Management to Facilitate Compliance with Global Conventions During Hazardous and Toxic Waste Cleanup Projects in Asia

A thesis
submitted in partial fulfilment
of the requirements for the Degree
of
PhD at the University of Waikato

By

Ron Laurence McDowall

University of Waikato

2004

Abstract

Abstract

The management of hazardous and toxic waste projects in Asia (especially that related to intractable chemicals) has had a less than acceptable performance profile during the last 20 years. There have been numerous documented cases of management and systems failures in intractable chemical recovery projects, despite the establishment of global conventions designed to avoid such problems.

A research programme was undertaken with the aim of producing a management model for companies to help prevent such failures in the future. The research began in the field with an exploration of management culture and its impact on project management. This involved multiple visits to five Asian countries and interviewing people involved in intractable waste management at both strategic and operational levels and reviewing project records. Personnel in government departments, particularly the "competent authority", were interviewed to gain insights into the applied management culture within the five countries studied.

The various international conventions or regulations regarding hazardous waste and its management, were researched for their interdependence and effectiveness. The research concentrated on the "Management Plans" or "Environmental Management Systems" that reside within these conventions in order to establish a benchmark of expectation concerning standards of management and organisation that would be required of a member state to discharge its obligations under the conventions. This work involved the author attending several meetings and conferences of the parties to the UNEP Basel Convention, as well as attendance at many Technical Working Groups over several years.

Complexity theory and uncertainty theory, along with emergent theory and innovation adoption theory were researched. The outcome of this research clearly suggested that a multidimensional matrix-based approach could be successful in providing companies with a strategic management model that, if applied, could

enable them to manage large scale intractable projects effectively in compliance with the conventions. The hypothesis of this work is that Duncan's matrix model can be reverse applied to the external environmental elements and components, combined with the mutual adaptation model (i.e.: technology/organisational mutual adaptation), therefore establishing an integrated multidimensional model of adaptation.

The mutual adaptation approach was subsequently used to frame a series of questions that formed the basis of four field surveys. These surveys were applied at different times over a five year period, covering ten projects in China and Taiwan, and involving interviews with a total of 100 executives, who were asked a total of 96 questions across the four surveys, resulting in 9600 responses. The first two surveys were conducted close together in time with the third and fourth later in the process and thus could be considered retrospective. The respondents included project managers, engineers, technicians, company accountants, marketing managers and site leaders.

The data collected validated the hypothesis and established that complexity management was an element of those companies that successfully adopted external technology and systems and in fact were also engaged in reversing the technology back to the originators. The data also indicated that those companies not engaging in complexity management were not reversing technology adoption. An integrated mutual adaptation model was developed from the characterisation matrices and consequently a two-dimensional model of singularity. The final singularity model can be applied at an organisation's strategic level, so as to provide an organisational capacity for compliance with environmentally sound management practices as demanded by the international hazardous waste conventions.

Acknowledgements

During the course of the field surveys there was extensive overseas travel over some five years and I am indebted to Pierre Gaston, the French Consul for New Zealand, for his assistance and provision of funding for air travel. For the hours of editing I must thank Vicky Adin. For the many reviews of drafts I thank my supervisor Dr Frank Scrimgeour and also Dr Kate Kearins. My thanks are also due to my colleagues at The University of Auckland, in particular Dr Carol Boyle, who covered for my lectures many times while I was overseas researching this thesis.

Contents

List of Tables

List of Figures

List of Acronyms

ACP	Africa Carribean Pacific (Countries)
ANSI	American National Standards Institute
BS	British Standard
BSI	British Standards Institute
CNCCP	China National Centre for Cleaner Production
COP	Conference of the Parties
CP	Cleaner Production
DFE	Design for Environment
EARA	UK Environmental Auditors Registration Association
EEC	European Economic Commission
EFTA	European Free Trade Association
EMAS	Environmental Management Auditing Standard
EMS	Environmental Management Standard
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ESM	Environmentally Sound Management
EST	Environmentally Sound Technologies
EU	European Union
FAO	Food and Agriculture Organisation (UN)
ICC	International Chamber of Commerce
IETC	International Environment Technology Centre
IISD	International Institute of Sustainable Development
IMF	International Monetary Fund
IMNC	Mexican Institute of Standardisation and Certifications.
IMO	International Maritime Organisation
ISO	International Organisation for Standardisation
LCA	Life Cycle Analysis
MOU	Memorandum Of Understanding
NEPA	National Environmental Protection Agency (China)

NGO	Non Governmental Organisation
NTTTC	National Training and Technology Transfer Centre (China)
OECD	Organisation for Economic Co-operation and Development
PBRC	Pacific Basin Resource Centre
PCB	Polychlorobiphényles
PCT	Polychloroterphényles
PIC	Prior Informed Consent (Basel Convention)
PLA	Peoples Liberation Army
POPs	Persistent Organic Pollutants
RAB	Registrar Accreditation Board
SBC	Secretariat Basel Convention
SCC	Standards Council of Canada
SEPA	State Environmental Protection Agency (China)
SRP	Strategic Reference Point
TPC	Taiwan Power Company
TWG	Technical Working Groups
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organisation
USEPA	Environmental Protection Agency (USA)
WCED	World Commission on Environment and Development
WTO	World trade Organisation

1
Introduction

Waste, and hazardous and toxic waste in particular, is a growing[1] problem that is posing a serious threat to the "sustainability" of the global environment. Even with the advent of international conventions, few disposal options, and the high costs involved, drive an ever increasing demand for such wastes to be sent to inappropriate destinations with dangerous methods of management. The use, storage, handling, transportation, and disposal of hazardous waste, in both the developed and less-developed world, is characterised by inept, incompetent management that is continually compromising the biosecurity and biodiversity of the global environment.[2]

This thesis seeks to establish a multidimensional management model that deals with the issues of environmental protection demanded of Asian countries by global conventions. These countries have little experience or record of environmental protection capacity during hazardous or toxic waste projects, nor do they have an overt internal management structure that necessarily supports the principles of environmental protection.[3]

Objectives

This inquiry has two central objectives. The first is to examine the existing situation and background of hazardous waste management in Asia, and thus derive conclusions concerning how current management models address the global convention requirements. The second objective is to propose a multidimensional management model based on complexity theory and validated by field surveys.

---

[1] UN(FAO) Conference Baseline Study Paper, *Obsolete Pesticides Stocks,* M Davis, Pesticide Action Network,UK, Alexandria, Virginia, USA 13-15 September 2000.

[2] UNEP Sub Regional Workshop on Training and Management of Dioxins/Furans and PCBs, Seoul Korea 24-28 July 2000. See statement paper by Mr Heng Nareth Director, Department of Pollution Control Ministry of Environment, Cambodia.

[3] UNEP Sub Regional Workshop on Training and Management of Dioxins/Furans and PCBs, Seoul Korea 24-28 July 2000, See country reports from Brunei. Philippines, Nepal, Thailand, Bangladesh, Myanmar, Indonesia and China.

Specific objectives are as follows;

Chapter two reviews relevant global conventions for purpose, intent and definitions of environmentally sound management of hazardous waste projects.

Chapter three reviews currently used management models that are applied in order to achieve environmentally sound management of hazardous waste projects.

Chapter four reviews organisational science literature with respect to complexity and uncertainty models to provide a basis for field surveys.

Chapter five describes four "Complexity and Uncertainty" surveys involving ten large scale hazardous waste projects in Asia.

Chapter six analyses the survey results placing the information into complexity/uncertainty matrices in order to characterise the projects and develops a two dimensional model using the characterisation information from the surveys and proposes a practical working model.

Finally chapter seven proposes a three dimensional model and suggests areas for further research.

Thus the thesis provides a marriage of theory and practical application validated through fieldwork.

The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal was adopted unanimously on 22 March 1989 by the 116 States participating in the conference of Plenipotentiaries, which was convened by the Executive Director of the United Nations Environmental Programme (UNEP) and held in Basel at the invitation of the Government of Switzerland.[4]

[4] UNEP *Final Act of the Conference of Plenipotentiaries on the Global Convention on the Control of Transboundary Movements of Hazardous wastes,* 22 March 1989.

This convention was created in response to a growing recognition of the health and environmental risks associated with hazardous wastes. Various Governments brought into force a series of laws to control the generation, handling, storage, treatment, transport, disposal and recovery of these wastes.

The application of the Basel Convention uncovered a number of hazardous waste management problems that are still not well resolved. This is especially so with the trans frontier movements of intractable chemical waste.[5] Such waste occurs in large quantities in many Asian countries. Many of these countries are now attempting to handle their intractable waste situation within the guidelines and rules of the Basel Convention.

The problem with agreements such as the Basel Convention is the application of the conventions' requirements in countries that may not care all that much about the methodology of recovery, packaging and transportation of intractable waste. This is especially so in Asian countries with a poor record of environmental protection and some other agenda for not removing vast quantities of intractable and toxic waste.[6]

During recent years, it has become apparent within many Asian countries provisions of the Basel Convention are in the main ignored, or circumvented by local managers who often do not have the skills to properly manage hazardous waste projects.[7] It is also apparent that many shipments for disposal of hazardous wastes take place without notification, and involve movements between the developed world and the less-developed world, and do not comply with even basic international standards.[8]

Thus, the risk to the global environment from hazardous and toxic waste is not necessarily reduced by the ratification of the Basel Convention.

---

[5] Tolba and El-Kholy (1992) ch. 10, provides an overview of likely intractable waste scenarios in developing countries.

[6] Spitalink (1992), p.3, provides comparative studies of hazardous waste generation in Asian countries.

[7] Tolba and El-Kholy (1992) , p. 264.

[8] repetto (1994), p.4.

As with many "global" agreements, the Basel Convention, lacks specific detail concerning appropriate methods that should be applied so that the risk management of the hazardous waste is in compliance with the agreement.

There exists significant evidence (UNEP Basel Convention Conference - Stockholm, 1995) that the management culture of "environmentally emerging" countries can significantly reduce the intended effect of the management plans that are required by international conventions. There is a need for a strategic management plans to be developed that accommodate "local management culture" and strengthens its capacity when adopted within the host country infrastructure.[9]

Intractable waste contamination in Asia is a huge problem.[10] Containing and managing the problem presents major issues of complexity in developing the logistical and management framework, and execution thereof. The potential risk to the global environment due to failure of the management plan is extreme. In countries where there is little in the way of substantive consideration for the environment, maintenance of security, and integrity of the management system desired by global conventions, during intractable clearance, are at constant risk of defaulting.[11]

The scope of the global trade of hazardous wastes is difficult to ascertain. Estimates of the volume of hazardous wastes generated each year range from 300 to 500 million tonnes. It its generally accepted by the Basel Convention that about ten percent of this waste is shipped across international boundaries.[12]

The purpose of this thesis is to develop a management model that is more effective

[9] See Greenpeace "*Waste Trade Update*", Vol 2, Issue 2, 1 March 1989.

[10] For discussion of the hazardous waste situation in Asia refer to a conference paper by Qiao Zhiqi (1999).

[11] The Food and Agriculture Organisation of the UN (FAO) in their 1996 report estimate that developing countries are holding stocks of more than 100,000 tonnes of obsolete pesticides. Many of these chemicals are so toxic that a few grams could poison thousands of people or contaminate a large area. Leakage, seepage and various accidents related; to pesticides are quite common and widespread. Storage conditions rarely meet internationally accepted standards. Many pesticide containers deteriorate and leak their contents into the soil, contaminating ground water and the environment.

[12] The ten percent figure is suggested and compiled in the country reports of imports and exports contained in *World Resources Report 1990-91* p.325.

than current management models used in the extraction, management, transportation and disposal of intractable, toxic, and hazardous waste. The model has specific relevance to Asian companies involved in toxic and hazardous waste and is focussed on ensuring the intentions of the global conventions are not subverted.

This work attempts to bridge the gap between ratification of international conventions and the application of such conventions by the utilisation of a management structure that is aimed at facilitating compliance.

During the last thirty years there have been many field studies of systems failure and resultant severe environmental pollution caused by completely inadequate systematised management procedures. These field studies show that while a management plan was in place with a quality system and an environmental plan, the pollution still occurred before any element of the management system was aware of the possibility. Many of the current management models are too global in their applications, and they suffer from a lack of specificity. When dealing with highly dangerous intractable material being recovered from dangerous locations, management techniques, even when applied under an ISO standard, in the author's experience, are often simply found to be inadequate.[13]

The study of management models that are designed to deal with the issues involved with hazardous waste must inherently involve the field of organisational science. By understanding industries as complex systems, model design can be arranged so as to improve chances of adoption by decision makers. This thesis, therefore, concerns the design of models drawn from what in organisational science is referred to as "Complexity".[14]

Complexity theory deals with systems that show complex structures in time or space, often hiding simple deterministic rules. Complexity refers to the condition of the universe, which is integrated and yet too rich and varied for us to understand in simple, mechanistic or linear ways. Complexity deals with the nature of

[13] See McDowall project files 1987 - 1999. cf FAO reports 1996,1997,1998

[14] See Casti (1995), Coveney and Highfield (1995), Gell-Mann (1994), Horgan (1995), Kauffman (1993), Kelly (1994), Reeves (1996), Stacey (1995), Waldrop (1992).

emergence, innovation, learning and adaptation.[15] Traditional models for the management of hazardous waste projects tend to be linear or mechanistic in their response to the demands of global conventions such as the Basel Convention. Most traditional models are simplistic linear programmes of instructions that are not cognisant of the integrative elements that are a characteristic of such projects. Casti[16] suggests that "learning and adaptation" are essential elements of an organisation's management plan, yet these are not always part of the linear or mechanistic models that are applied today.

Without doubt, complexity research is not at the point of presenting an all embracing universal theory.[17] Despite the lack of empirical data, bold claims are being made about complexity being the next major breakthrough in management.[18] However, its norms are at a point where they can help to establish new models.[19] While empirical data is strangely absent from the literature, especially that related to models involving extreme degrees of "issues of complexity", there are those[20] that suggest with empirical studies such models can be described, and therefore that complexity theory adds much to organisational science. It is at this point that the thesis will begin its inquiry by attempting to provide the empirical data regarding issues of complexity and uncertainty that are involved with hazardous waste projects in Asia, and demonstrating how we may use the metaphors of complexity theory to shape management models.

If we define an organisation as "systems of co-ordinated actions among individuals and groups whose preferences, information, interests and knowledge differ" [21], then a central task of an organisational manager is "the delicate conversion of conflict into co-operation." It is this convergence of conflicting elements that will form the basis for investigating the Asian management culture and will shape the survey questions.

If we can provide an understanding of organisations as complex systems, and

[15] See Casti, 1995.
[16] repetto (1995).
[17] See Horgan (1995).
[18] See Phelan (1995).
[19] See Lissack (1996).
[20] See Begun (1994).
[21] March and Simon (1993).

develop the methodology as to how their systems interact, managers can improve decision making, and search for innovative solutions. Complexity theory is a promising framework that accounts for the dynamic evolution of organisations, and complex internal and external interactions.

By conceptualising organisations as complex systems, a number of managerial implications can be developed. Complexity theory also points to the importance of developing guidelines and decision rules to cope with complexity, and of searching for non obvious and indirect means to achieving goals.[22]

We have many instances in the organisational science literature where the application of complexity concepts is questioned. Johnson and Burden[23] have raised this question in their work. "Chaos theory and its close cousin, complexity theory, have recently made their appearance in the social science literature, including studies of organisations. The trend toward loosely applying non-linear dynamical theories to organisations troubles us...The essential problem remains: *How* should these concepts be applied?" The question 'how' is very important to this thesis. The answer will be crucial to the application of the models proposed.

James Begun[24] chides researchers for not looking at what confronts organisational science with respect to its practical application. Begun talks about the 95% of the organisational world, that complexity theory invites us to explore. It has been avoided because it is "too dark, murky, and intimidating, or, our theories and methods simply have not allowed us to see it". His suggestion is that we overcome the metaphors and approximate complex realities. On the other hand, Schein[25] is determined that "[t]he field of organisational science can only progress when we have a set of concepts that derive from concrete observations of real behaviours in real organisations, and therefore, provide some link to the concerns of practitioners who are solving problems here and now".

Within this thesis are four field surveys of companies engaged in ten large

[22] Levy (1994).
[23] Johnson and Burton (1994), p. 322.
[24] Begun (1994), p. 331.
[25] Schein (1996), p. 231.

hazardous waste projects. These surveys provide empirical data so that concrete observations can be made and the model, while based on complexity theory, will have substantial validity based on real data from real companies. The research will be based upon direct observation and interviews of the managers within companies in Asia directly involved in hazardous waste work.

2
Management of Hazardous Wastes under International Conventions.

This chapter examines the various international conventions or regulations regarding hazardous waste and its management, and summarises their interdependence and effectiveness. The research concentrated on the "Management Plans" or "Environmental Management Systems" that reside within these conventions, or international agreements, in order to establish a benchmark of expectation concerning standards of management and organisation that would be required of a member State to discharge its obligations under the conventions.

Introduction

The research in this section concentrates on "Environmental Management Systems" methodologies as they affect the delivery of global convention requirements. Each of the three major conventions are examined here (UNEP Basel Convention, OECD Convention and EU Directives) from the point of view of what the Convention's instruments demand in terms of "Environmental Management Systems", and how that is to be delivered.

During the first stage of research into the international conventions, it became quickly apparent that the Basel Convention (UNEP) has been adopted as the pseudo standard for many of the countries within the Asian region. Indeed, many of the other international conventions such as OECD, EU directives and the French Driere have completely adopted the Basel Convention to the mutual exclusivity of their own regulations. Within Asia, which is the primary region for this research, the adoption of the Basel Convention is complete. The most interesting development is the fact that the countries of Asia, and many other regions, have not only adopted the "Basel" for transboundary movements, but have extended its influence into the national scene by also adopting its requirements for management practices outside of the actual transboundary movement.

Therefore, this thesis concentrates on the Basel Convention, and refers to the other conventions only where they provide additional management standards that are generally applied. The complete adoption of the Basel Convention by many Asian countries to the exclusion of others was surprising, as the Convention lacks the detail that would enable its use as domestic internal regulation.[26]

Of note is the fact that the United States is not a signatory to the Basel Convention, and that the US EPA regulations regarding packaging and transportation do not figure in Asian projects involving hazardous waste management. The tendency is to use US Regulations such as the 40 CFR 760 series when nothing else is available. An example of this would be Korea asking for the 40CFR standards to apply for offshore incineration in France for PCBs.

It should also be noted that the Basel Convention Secretariat even though it is a subsection of the UNEP, is not funded by the United Nations. Its funding comes solely from the countries that are signatories to the convention. This is probably one of the main reasons for the convention's greater prominence than otherwise would be the case.

During the research period for this thesis, the Basel Convention secretariat held two Conference of the Parties (COP 4 & COP 5), several Technical Working Groups (TWG) and other meetings. These conferences were attended by representatives from 25 countries from the Asian region (including the author) and provided a valuable and relevant, insight into the current state of hazardous waste management and environmentally sound management practices in this region. The Basel Convention in the period 1995 to 1999, emerged as the truly global regulation for the management of hazardous wastes in an environmentally sound manner.

United Nations Environment Programme (UNEP) Basel Convention

The Montevideo Programme for Development and Periodic Review of Environmental Law identified the transport, handling, and disposal of toxic and dangerous wastes as one of the major areas that should be included in the

[26] See Lang, Nuehold and Zemanck (1991),p.150-152.

elaboration of international law involving regional co-operation.[27] The idea of regional co-operation for the management of hazardous waste gained momentum when the UNEP Governing Council (based on the Montevideo Programme) in 1982, convened a working group of experts to develop guidelines on the environmentally sound transport, management and disposal of hazardous wastes.[28] The principles that emanated from the working group of experts were affirmed at the Cairo conference, and are known as the Cairo principles or guidelines.[29] The Cairo guidelines contain the first relevant references and definitions to the transboundary movements of hazardous wastes and define the effects of such waste on the environment as pollution. The same guidelines also define the need for prior informed consent before transboundary movements of hazardous wastes can commence. The guidelines also refer to the need to establish specific measures to be taken by States to ensure the environmentally sound management of hazardous wastes within their boundaries. Finally, the Cairo Guidelines incorporate the need for cleaner production and sustainability with regard to the production of hazardous wastes.

In June 1987, the UNEP Governing Council adopted the Cairo Guidelines.[30] At the same time the Governing Council convened a new working group to formulate a global convention that would embody the Cairo Guidelines. Five sessions of this working group were held during the period February 1988 to March 1989.

At Basel, in Switzerland, the global convention that was conceived by the working group was adopted by the Conference of the Plenipotentiaries on 22 March 1989.[31] The Basel Convention was intended to facilitate the international community solving global environmental problems in a collective manner. Since its introduction in March of 1989, the Basel Convention has undergone several changes and

[27] UNEP, Montevideo Programme (Nairobi 1982); *Report of the Ad Hoc Meeting of Senior Government Officials Expert in Environmental Law to the Governing Council of UNEP*, 7 December 1981 (UNEP/GC.10/5/Add.2)

[28] See the reports of the Ad Hoc group of Experts on the Environmentally Sound management of Hazardous wastes in a total of three sessions, March 1984 (UNEP/WG.95/5); December 1984 (UNEP/WG.111/3); December 1985 (UNEP/WG.122/3).

[29] UNEP, Environmental Law Guidelines and Principles, *Environmentally Sound Management of hazardous Waste,* Nairobi 1987.

[30] UNEP Governing Council Decision 14/30 (17 June 1987).

[31] *Final Act of the Conference of Plenipotentiaries on the Global Convention on the Control of Transboundary Movements of Hazardous Wastes*, 22 March 1989.

amendments. These, and the original agreement, are discussed below. The ongoing purpose of the Basel Convention can be summarised as follows:

The Basel Convention represents new norms, rules and procedures in law governing the movement and disposal of hazardous wastes at international, as well as national levels. In this context, this instrument represents the intention of the international community to solve this global environmental problem in a collective manner. A regulatory system for the monitoring and control of hazardous wastes has been set up and is displayed in the full text of the Convention. Some of the key elements of the regulatory system of the Basel Convention are the so called "prior informed consent", the prohibition to export to a country which is not a contracting party to the convention, and the legal provisions for duty to re-import, and the responsibility of States involved in the transboundary movements.

Scope of the Convention

"Transboundary Movement" means any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one State to, or through, an area under the national jurisdiction of another State, provided that at least two States are involved in the movement (article 2 Para 3). Note that the full text of the Basel Convention appears in Appendix 1.

Provisions of the Convention are generally seen in two parts:

[A] Control of transboundary movements of hazardous wastes:

- Ban on import and export of hazardous wastes
- Illegal traffic detection and control
- Bilateral, multilateral and regional agreements
- The Control system of the Basel Convention

[B] Environmentally sound management of hazardous wastes and other wastes and their disposal :

- Technical guidelines
- Regional centres

The overall goal of the Secretariat of the Basel Convention (SBC) is "to protect human health and the environment against hazardous wastes".
To reach this goal the SBC sees its role to:

- Reduce transboundary movement
- Minimise generation
- Assist developing countries in environmentally sound management of hazardous wastes

The principles under which the SBC operates are:

- Minimise generation in terms of quantity and toxicity
- Disposal close to source of generation
- Guaranteed environmentally sound management
- Exportation only in the case of lacking technical capability

The original Basel Convention Article 4, was a provision for the signatory States to retain the right to prohibit the import of hazardous wastes. After the establishment of the Convention in 1989, there followed the fourth ACP/EEC Convention,[32] and the Bamako Convention,[33] banning imports into Africa from 30 January 1991. Both Conventions prohibit transboundary movement of hazardous wastes to developing countries, and the former, required ACP States to prohibit the direct or indirect import of hazardous wastes into their territory from the European Community or any other country. During the period leading up to the United Nations Conference on Environment and Development (UNCED) in 1992, many developing countries were calling for a comprehensive ban on hazardous wastes exports from industrialised to developing countries.[34]

The first meeting of the Basel Convention Conference [35] adopted a resolution (I/22)[36] that amended this article. The recommended amendment is as follows (within the Conference as a request); "the industrialised countries to prohibit

[32] Adopted at Lome (Togo) on 15 December 1989.
[33] OAU Council of Ministers resolution on Control of Transboundary Movements of Hazardous Wastes and their Disposal in Africa, July 1989. The Bamako Convention is available on ILM 30/3(1991).
[34] UNCED Rio Declaration (1992).
[35] Basel Convention Conference of The Parties, COP 1 (Uruguay 4 December 1992).
[36] Basel Convention Conference of The Parties, COP 1 Decision I/22, adopted 4 December 1992.

transboundary movements of hazardous wastes and other wastes for disposal to developing countries".[37]

The second meeting of the SBC[38] decided "to prohibit immediately all transboundary movements of hazardous wastes which are destined for final disposal from OECD to non OECD States".[39] It was during the second meeting of the Parties to the Basel Convention that the issue of environmentally sound management occurred as a result of the deliberations of a working party.[40]

At the third Convention meeting,[41] Article 4 was finally amended and reads: "each Party listed in Annex VII shall prohibit all transboundary movements of hazardous wastes which are destined for operations according to Annex IV A, to States not listed in Annex VII".[42] This means countries that are developing or are developed may send hazardous wastes for disposal so long as the disposal country is listed in Annex VII.

At the first Basel Convention meeting[43] decision I/15 was adopted where the Conference requested that the Parties urgently promulgate national laws making the illegal transboundary movements a criminal act, and further requested the SBC to present an analytical report on the results of the UNEP-ESCAP joint project to the second meeting of the Conference of the Parties to the Basel Convention. In addition, the Conference requested that an "open-ended Ad Hoc Committee to study ways and means of enhancing the monitoring and prevention of illegal traffic in hazardous wastes, and other wastes, and to report its findings to the Conference of the Parties at its second meeting".

At the second Basel Conference meeting,[44] Decision II/4 was proposed and recommended for adoption. This decision states: "[r]equests the Parties to

[37] Resolution I/22, COP 1 (Uruguay 4 December 1992).
[38] Basel Convention Conference of The Parties, COP 2 (Geneva 25 March 1994).
[39] Known as the Basel ban, See www.ban.org/
[40] *Draft International Strategy for the Environmentally Sound Management of Hazardous Wastes* December 1991, (UNEP/CHW/WG.2/1/3).
[41] Basel Convention Conference of The Parties, COP 3 (Geneva 18 September 1995).
[42] ibid.
[43] Basel Convention Conference of The Parties, COP 1 (Uruguay 4 December 1992).
[44] Basel Convention Conference of The Parties, COP 2 (Geneva 25 March 1994).

promulgate or develop stringent national legislation.... Further requests the Parties to incorporate in their legal systems, appropriate sanctions or penalties for the illegal traffic in hazardous wastes....[r]equests all Governments to promote the inter ministerial co-ordination within respective governments to prevent and penalise....[r]equests the SBC to assist Parties".

In practice, the SBC are required, at the regional level, to promote development of regional mechanisms and systems.

At the international level the SBC are required to:

1. co-operate with International Customs Co-operation Council and IMO[45] to train customs and Port Officers.

2. [cooperate with] Interpol for exchange of information.

"Parties may enter into bilateral, multilateral, or regional agreements or arrangements regarding transboundary movements of hazardous wastes, or other wastes, with Parties, or non Parties provided that such arrangements do not derogate from the environmentally sound management of hazardous wastes, and other wastes, as required by this Convention".[46]

A decision from the first meeting of the Conference[47] adopted the following request. "[r]equests the Parties to the Basel Convention notify the SBC expeditiously of any bilateral, multilateral and regional agreements or arrangements they conclude in accordance with para 2, of Article 11, of the Convention and further requests its open ended ad hoc committee to examine the bilateral, multilateral and regional agreements to arrangements communicated to the SBC and to present a report on their conformity with the stipulations of Article 11 of the Convention on the second meeting".

[45] IMO,Assembly Resolution, Transboundary Movement of hazardous wastes, 19 October 1989, (A16/Res.676)
[46] Article 11 of the Basel Convention (1989).
[47] Basel Convention Conference of The Parties, COP 1 (Uruguay 4 December 1992).

At the second meeting of the Conference,[48] Article 11 was again considered and the SBC report received. The Conference with decision II/10 "[r]equested that Parties which have entered, in accordance with Article 11, into bilateral, multilateral and regional agreements or arrangements to report, consistent with national laws and regulations, to the open ended ad hoc committee, through the SBC, on the conformity of such agreements or arrangements taking into consideration the list of questions annexed to this decision".[49]

Operational Procedure of the Convention

In general, the Basel Convention is actioned by means of formal notification procedures that the packaging, handling, transit notifications, and bilateral notifications have been actioned in accordance with the provisions of the Basel Convention. The most relevant section of this documentation is "[d]etermining whether to allow a transboundary Movement".[50]

States shall engage in the transboundary movement of hazardous waste, or other waste, only if there "does not exist a more environmentally sound alternative", and if it takes place between parties to the convention none of which has prohibited the import of such wastes. The Parties shall "require that hazardous wastes, or other wastes, to be exported, are managed in an environmentally sound manner in the State of import or elsewhere. "Any State has the sovereign right to ban the entry or disposal of foreign hazardous wastes and other wastes in its territory".[51]

Environmentally Sound Waste Management

The progression of the "Basel Convention" into the area of 'Environmentally Sound Management' has moved from this original Article (4) by Decision II/13 from the second meeting of the conference of the parties. "Each party shall prevent the import of hazardous wastes, and other wastes, if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner".[52] This decision states in part "confirms adoption of the Framework document (Decision I/19) on the preparation of technical guidelines for

[48] Basel Convention Conference of The Parties, COP 2 (Geneva 25 March 1994).
[49] See Conference Decisions, II/1-3, II/13-15,(1994)
[50] Section 7 of the Basel Convention (1989).
[51] Preamble, paragraph 6 of the Basel Convention (1989).
[52] Article 4 para 2(g) of the Basel Convention (1989).

the Environmentally Sound Management of Wastes subject to the Basel Convention. To date the 'Technical Working Group' (TWG) has held more than ten sessions and have established the compilation of lists of hazardous wastes. At TWG 15 initial progress has been made on the establishment of guidelines for "Environmentally Sound Management techniques".[53]

As far as the Basel Convention is concerned, the term "Environmentally Sound Management" means "taking all practicable steps to ensure that hazardous wastes, or other wastes, are managed in a manner which will, protect human health and the environment against the adverse effects which may result from such wastes". This generalised definition has been extensively criticised as being vague and insubstantial.[54] There are several provisions within the Basel Convention that attempt to give some guidance to the specific aims regarding "Environmentally Sound Management" of hazardous wastes.

"A Party shall not permit hazardous wastes, or other wastes, to be imported from a non party".[55] Notwithstanding that provision, "Parties may enter into a bilateral, multilateral, or regional agreements or arrangements regarding transboundary movements of hazardous wastes, and other wastes, provided that such agreements or arrangements do not derogate from the environmentally sound management of hazardous wastes, and other wastes, as required by this convention. These agreements or arrangements shall stipulate provisions which are not less environmentally sound than those provided for by this convention in particular taking into account the interests of developing countries".[56] "Each party is required to establish an authorisation system for persons handling hazardous waste,[57] and to ensure that every hazardous waste transport is accompanied from start to finish by a movement document containing the information specified in Annex VB of the Basel Convention, to be signed by each person who takes charge of the wastes".[58]

Parties must also establish requirements for packaging, labelling and transport in

---
[53] TWG 15, Environmental Sound Management, Geneva (2000).
[54] See Montgomery (1990),p.321; Rosencranz and Eldridge (1992),p.318; Schmidt (1992) ,p.70-76.
[55] Article 4 para 5, of the Basel Convention (1989).
[56] See Kummer (1995) ,p.57
[57] Article 4(7.a), of the Basel Convention (1989).
[58] See Kummer,(1995),p.57

conformity with relevant international rules, standards and practices. In accordance with Article 4(8) requiring technical guidelines, a TWG was set up in 1992 with the purpose of establishing guidelines for the "environmentally sound management" of hazardous wastes. This TWG now is part of the ongoing work that is conducted by the Convention. "The main purpose of the guidelines is to provide Governments and member States with elements, criteria and principles which applied together, constitute environmentally sound management of hazardous wastes".[59]

While providing the guidance (Article 4) for the conduct of member countries in the context of hazardous waste management, the Basel Convention does not contain absolute obligations.[60] Members are required to take appropriate measures to achieve the aims of Article 4; the exact nature and extent of such steps is left open. The provisions also leave open a number of important questions, such as the extent of the generating country's duty to ascertain the adequacy of disposal facilities in the prospective State of import, and the allocation of the burden of proof for the inclusion of a waste in the scope of the Convention and for the permissibility of export.

The 'Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal' was adopted on 22 March 1989 by the 116 States participating in the Conference of Plenipotentiaries on the Global Convention on the Control of Transboundary Movements of Hazardous Wastes. It was convened by the Executive Director of the United Nations Environment Programme (UNEP), and held in Basel at the invitation of the Government of Switzerland. The Basel Convention entered into force on 5 May 1992. The first of two meetings of the conference of the parties were held in December 1992 (Piriapolis, Uruguay), and the second in March 1994 (Geneva, Switzerland), respectively. As at 31 December 2003, 158 countries and the European Community are Parties to the Convention.

Since the introduction and application of the Basel Convention, the protocol of the convention has received substantial support from around the world. Such is the

[59] See Kummer (1995),p.58-59

[60] See Lang,Neuhold, and Zemanek (1991),p. 149-152

success of the convention that many nations no longer consider any transboundary movements unless it is in full compliance with this convention. In the area of environmentally sound management practices, the Basel Convention has been large on demands that such practices be incorporated but lacking in detail as to the definition of such practices, and the management techniques, that are to be employed. Many countries have expressed frustration at the lack of guidance in this area from the Basel Convention. The SBC has responded by creating a TWG to look into establishing technical guidelines for environmentally sound management practices, but so far have not produced satisfactory handling manuals. This activity represents a departure for the SBC in that, obviously, handling practices involving packaging, inland transport, container storage and safe handling techniques is beyond the transboundary area and into the 'on-land' practices. This trend will see a significant strengthening of the Basel Convention over the next few years into an all encompassing convention that will includes national activity for hazardous waste, as well as all international activity.

The strength of the Basel Convention clearly lies in its support from the Parties. So many countries are party to this convention that, as a protocol for the handling of wastes between countries, it cannot be avoided. The global model that the Basel Convention represents is so well constructed that there are no countries that it cannot be applied to. Despite any national or regional regulations or agreements that may apply within a country or within a bilateral agreement, nothing prevents its application. The Basel Convention is of such strength that green activist groups, such as Earth Watch and Greenpeace,[61] actively use the Basel Convention against any country that may be attempting to ship hazardous wastes without notification. Such an action was taken against Australia in 1992 when a container ship carrying four containers of PCB transited the port of Durban without processing the prior informed consent notification to the Durban Port Authorities. Greenpeace had monitored the shipment when it left Australia and checked with the Durban port authorities, and found that the notifications had not been made and therefore, the consignment was in clear breach of the Basel Convention. The outcome of this case was that the Australian Government found itself in an embarrassing situation, and immediately banned the export of PCB waste, a ban

[61] See www.ban.org

which is still in force today.

The main weakness of this Convention, is that fact that it is a global model and, as such, is lacking in detail as to the specific ways in which the articles of the Convention are carried out. Much of the weakness relates to the many imprecise and vague terminologies which are open to differing interpretations.[62] While the Convention clearly says that the packaging and transportation shall be carried out in a manner that is environmentally responsible, it does not provide any detail on how that should be performed or how it is judged and assessed. The Convention makes reference to "[i]nternationally accepted practices" in packaging, transportation, labelling, stowage etc., but does not attempt to place any specifications on those practices.[63] Another weakness is that the Basel Convention compliance is considered by many as being the only requirement when transhipping hazardous wastes, and local and national regulations are often overlooked. Many transport companies believe that a dangerous goods permit is not required when transporting hazardous cargo within one's own country because the transboundary paperwork is in compliance. So indeed, the success of the Basel Convention, in many cases is a weakness. Current activity by the TWG committee looking into environmentally sound management practices will eventually provide a significant amount of detail to enable nations to handle all their hazardous waste in a uniform manner under the Basel Convention, whether on land or sea.

The Basel Convention has a world-wide sphere of influence, although surprisingly as mentioned earlier the United States is not a Party to the Convention. Most Asian countries are Parties, and abide very closely to the terms and conditions of the Convention. The resulting effect is that any transboundary shipment outside of the Basel Convention notification procedures is generally regarded as illegal. The effect of the Basel Convention implementation, since 1992, has been to discipline the handling of hazardous waste projects as the effect of the articles of the Basel Convention has an influence on aspects of the project well beyond the actual shipping between countries. Indeed, when engaged in contractual negotiations with generators and disposers, most of the correspondence has to do with real or perceived compliance with the Convention.

[62] See Handl,(1990),p.6.

[63] See opinion in Lang,Nuehold and Zemanck (1991),p.150-152.

One of the interesting side effects of the Convention is the impact it has on States. Even though there are provisions within the Convention that can be used in certain circumstances most States seem to prefer using the articles of the Convention that are seen to be in full compliance. An example here would be the shipment of Wastes from Taiwan to France. Under the Convention, Taiwan could ship hazardous wastes to France under an instrument of Bilateral agreement. Under Article 11, Taiwan could simply arrange for France to accept its waste, and the only obligation is for France to advise the SBC that the shipment will be performed in accordance with the Convention. However while Taiwan is not a Party to the Convention, China is.[64] Taiwan, therefore, applied to the China NEPA for a Basel Convention notification to ship to France. China obliged, and provided the necessary transfrontier permit and the shipments proceeded under a full Basel Convention notification between contracting parties. Taiwan is also pursuing the idea of reforming its waste regulations so that its entire 'on-land' regulations are in full compliance, and indeed actually model the Basel Convention articles, even though the nation cannot be a member of Basel Convention. This is happening with several Asian countries, who have directly asked the SBC to provide comprehensive sets of regulations, so that they may be fully incorporated within their own waste laws.

Principally, the notifications procedures hold the key to the policing method but this mainly involves the formal notification procedures. It does not, in practice, cover such issues as "Environmentally Sound Management Practices". Many instances of poor management practices are unnoticed by the Basel Convention notification, especially in the Asian region, as Customs and inspectors are often poorly trained to notice the non compliance. Indeed, unless one has significant training in the safe handling of hazardous wastes, many instances of poor handling are often overlooked. The other problem is related to who defines what is an environmentally sound management practice. At what point is a practice unsound and how do you detect it? These issues the Basel Convention does not directly address but is planning to do so as it enters the next phase of 'on-land' regulations.

[64] As Taiwan is not recognised as a country by the UN it cannot be a member of the Basel Convention.

The Basel Convention goes through a normal amendments and updating phase on a cyclical basis. There have been six meetings of the Convention since enforcement and many changes to the Convention have been made. The process of amendment and adoption appears to be quite efficient in comparison with other United Nations Environment Programme ratifications. The TWG which has party representation, often instigates amendments or changes as well as provide the research required to place technical details and descriptions before the parties. It is the SBC's intention that the global model be provided with more definite detail as to how to package and transport and label and what is meant by environmentally sound management. In terms of notification of the Basel Convention Articles relating to transhipment between the parties, the application of management techniques is well established and the concepts of instruction, policy auditing etc., are well practised and carefully followed, and one could not really fault the Convention on this.

Kummer maintains that, "[t]he principle of environmentally sound management of hazardous waste provides that the wastes must be managed in such a way as not to endanger human health and the environment. Whereas it is embodied in most relevant international legal instruments in a fairly vague and unspecified form it is increasingly given concrete content by reference to standards established by non binding technical guidelines or codes of conduct in the field".[65]

The principle of non discrimination provides that the principle of environmentally sound management must be applied equally to wastes that remain within the territory of the generating State and wastes that are exported. This means that the same standards must be applied in both cases.

China and the Basel Convention

China was one of the founding member States of the Basel Convention and one of the first signatory countries.

Article 10 to 20 Chapter III of the Chinese permitting regulations[66] are an early attempt to mirror the Basel Convention. The Basel Convention is not referred to in

[65] Kummer,(1995),p.272.

[66] The permitting regulations were promulgated on January 29 1993 shortly after Basel enforcement

these permitting regulations but is obviously the model used.

Article 10, "[t]he hazardous Industrial waste is not allowed to be exported, unless it is agreed by written agreement by the importing government's authorised disposal organisation".

This regulation is a mirror reflection of Article 4, Para 1(c), of the Basel convention which reads, "Parties shall prohibit, or shall not permit, the export of hazardous waste, and other waste, if the State of import does not consent in writing to the specific import, in the case where that State of import has not prohibited the import of such wastes".

In practical terms the Chinese SEPA (State Environmental Protection Agency) prefer all permitting to be conducted under the Basel requirements.

Article 16 of the Chinese permitting regulations states " [i]f the exported hazardous Industrial waste were rejected, the exporter shall immediately submit rejection certifying documents to the central competent authority, and shall be responsible for removal".

This regulation (Article 16) is a mirror of Article 8, of the Basel Convention, which reads, "[w]hen a transboundary movement of hazardous waste, or other wastes, to which the consent of the States concerned has been given, subject to the provisions of this Convention, cannot be completed in accordance with the terms of the contract, the State of export shall ensure that the wastes in question are taken back into the State of export, by the exporter, if alternative arrangements cannot be made for their disposal in an environmentally sound manner, within 90 days from the time that the importing State informed the State of export and the Secretariat, or such other period of time as the States agree. To this end, the State of export and any party of transit shall nor oppose, hinder or prevent the return of those wastes to the State of export".

Again, in practical terms, China prefers the use of the Basel Convention articles but internally has great problems accepting the idea that wastes can come back if rejected. Taiwan companies (generators) are inclined to forbid any possibility of return and indeed, insist the the generators name does not appear on the wastes or the manifests. This is, of course, in complete contravention of the Basel and the China regulations (under which Taiwan is obliged to ship).

In 1993 China set up a body called the National Training and Technology Transfer Centre for Hazardous Waste Management and Disposal (NTTTC). This group is located at Tsinghua University, in Beijing, China and is based within the Environmental Engineering Design and Research Institute at that university. The Chinese authorities have outlined the following tasks for this group:

a) to undertake research on development and dissemination of information on cleaner production techniques, minimisation technologies, recycling technologies and treatment and disposal of hazardous wastes.

b) to provide training on hazardous waste management, including treatment and disposal technologies.

c) to introduce management and disposal technologies for hazardous waste from advanced countries and to spread the use of these technologies to the whole country.

d) to act as a technical support unit to the competent authority in the China National Environmental Protection Agency in the field of management of transboundary movement of hazardous wastes.

It is apparent that the responsibility for the management planning for hazardous waste management in China rests with NEPA[67] but the entire physical activity is carried out by NTTTC. It is within NTTTC that the China waste laws are taken well beyond their written intent in order to discharge their intent of spirit. NTTTC are responsible for developing the plans and methodologies, and the management

[67] Note that at the time of formation NEPA was the national environmental protection agency. Since the mid nineties the department has become a government ministry and is now called SEPA, State Environmental Protection Agency.

auditing plans that are put into practice around China. The management plans they produce tend to be modelled on international conventions (in many cases they are written by consultants from western countries), and in most cases the convention used is the Basel.

The objective of the centre is to train present and future managers, and engineers, responsible for hazardous waste management and disposal to enable them to deal with tomorrow's sophisticated technology and its training and education programme has three components: continuing education; undergraduate education and training; and graduate education training and research. The continuing education programme provides a comprehensive and practical curriculum of study in hazardous waste management designed for industrial engineers, managers from local environmental protection bureau and other regulatory agencies. The NTTTC has strong links with developed countries in the field of hazardous waste management and disposal with the help of the Basel Convention secretariat and they are regularly visited by overseas delegations.[68]

The importance of the Chinese regulations cannot be understated. Within the regulations the references to management systems, and packaging and transportation standards however, is of little relevance, due to the lack of such systems. The hazardous waste problems in China are vast (300 to 500 million tonnes of stored hazardous wastes awaiting final disposal), and therefore, their national regulations are extremely important as the country struggles with its huge waste problems and yearly industrial growth (in excess of 25% per annum).[69]

From an interview with the Centre Director of the Training and Education Branch, Associate Professor Qingzhong Bai, it is clear that there remains much work to do relating to the successful transfer of training and management systems to be able to get companies in China to understand how Environmental Management Systems

---

[68] See comments by Ma Hongchang (SEPA) in his paper *"Basel Convention and Implementation in Chinastate{sic} Environmental Protection Administration."*, at Conference, Second Asia-Pacific Regional training Workshop on hazardous waste management and practice, Beijing, Nov. 1999.

[69] See comments on status of hazardous waste quantities by Qiao Zhiqi, Director general, Department of Pollution Control, SEPA, China , *"Introduction to Environmental protection in China"* at conference Second Asia-Pacific Regional training Workshop on hazardous waste management and practice, Beijing, Nov. 1999.

need to be a management philosophy that permeates the business structure.[70] There appears to be little comprehension within NTTTC that this is a fundamental requirement.

Under the direction of SEPA of China, with financial assistance from Denmark, a plan has been developed to assist the implementation of the Basel Convention as the standard for hazardous waste management in China.[71] The main objectives of this action plan for hazardous waste management in China, and implementing the Basel Convention, is to strengthen the overall management of hazardous waste, including production, collection, storage, treatment, recycling, transportation, recovery and final disposal, management policy, organisation and method.

The reality is that the development of environmental management systems requires a infrastructure that has a long history of integration with corporate strategy. China needs to leapfrog the environmental awakening period and go straight into EMS for hazardous waste management. However, without a business infrastructure that has the background of strategic management as a planning process, this may prove to be an insurmountable obstacle. Perhaps the successful introduction and implementation of hazardous waste management plans will require going down a different path to that currently being proposed in the Western literature.[72]

China has the world's highest rate of economic development and has the highest rate of hazardous waste generation. More than 600 million tonnes of waste is produced per year, of which 5-7% is hazardous.[73] The accumulated amount of dumped waste exceeds 6 billion tonnes, of which 5-7% is hazardous. Because of the lack of hazardous waste regulations in China in recent years, the low level of treatment and recycling, lack of technical expertise and the lack of funding and experience, most of the hazardous wastes have simply been stockpiled. This situation has resulted in grossly contaminated soils, waterways and surface water,

[70] ibid.
[71] ibid.
[72] See discussion on Western methods and China's legislation impact in Hu Shouren's (SEPA) paper "China's Legislation on Hazardous Waste Management." at conference Second Asia-Pacific Regional training Workshop on hazardous waste management and practice, Beijing, Nov. 1999.
[73] ibid.

which is resulting in endangered health and damage to the environment. Severe pollution incidents occur frequently with more then 100 serious incidents per year.[74] Despite recent success in hazardous waste management in China, there still exists many problems that are similar to problems elsewhere in Asia. These problems include the lack of laws and regulations, low level management skills, lack of treatment and disposal facilities, shortage of funds, out of date technology, and inadequately qualified administrators and technicians.[75]

The weaknesses within the China regulations, as far as management of hazardous wastes is concerned, involves a lack of environmental management planning. The hazardous waste problem is now so vast, and is being added to on a scale that most western technicians cannot comprehend, that the Chinese regulations as such do not provide the guidance so that effective EMS systems can be put in place.[76] The strength of the Chinese regulations is simply that they are based on Basel and the NTTTC is applying itself to the implementation of the Basel Convention. While the Chinese regulations and the conventions they use will affect China, their effect or lack of effect will have a flow on affect on the rest of the Asian-Pacific region and, indeed, the rest of the world. The interview with NTTTC, however, indicated the people that manage these facilities are poorly equipped and funded to actively police hazardous waste regulations. Within China the ultimate authority for the implementation of the waste laws is SEPA and they are seriously underfunded for the task they are charged with.[77] The ability of the current structure of SEPA and NTTTC to deliver EMS and thus management systems to the management of hazardous waste is doubtful.

The regulations for hazardous waste management in China are at a primitive stage and the National Environmental Protection Agency is relying heavily on support from the Basel Convention to produce technical guidelines so that Environmentally

---

[74] ibid.

[75] See conference paper by Ms Lu Shu Ping, Director Shanghai Environmental protection Agency, "Actively promoting EMS Standards to Realise the General Objective of Shanghai's Environmental Protection." International Conference on ISO 14000 Environmental management and Sustainable Development, Beijing, China, 1996.

[76] See comments by Ma Hongchang (SEPA) in his paper *"Basel Convention and Implementation in Chinastate{sic} Environmental Protection Administration."*., at Conference, Second Asia-Pacific Regional training Workshop on hazardous waste management and practice, Beijing, Nov. 1999.

[77] ibid.

Sound Management Practices can be conducted. This is in spite of an impressive university based environmental engineering programme that is supported by SEPA. They have the will required but their management systems are so basic that they are unable to apply the techniques they already have knowledge of for the management and disposal of hazardous waste. China has broken new ground in that it has banned exports of hazardous wastes and will proceed to build the required treatment facilities on China soil. In order to begin to process that requirement their entire regulations for hazardous waste require an overhaul in the sense that the regulations need the practical guidelines added to them.

Organisation for Economic Co-operation and Development (OECD) Convention

The OECD (Organisation for Economic Co-operation and Development) was founded in 1961. Its primary purpose then was to stimulate economic progress and world trade. The Convention establishing the OECD was signed in December 1960, by 18 European countries, US and Canada and went into effect September 1961. The convention represented an extension of the "organisation for European Economic Co-operation (OECD) after this organisation had completed its original objective".[78] One of the basic objectives of the OECD was to achieve the highest possible economic growth, employment and living standards for its member countries. The OECD has attempted to reach this goal by liberalising international trade and the movement of capital between member countries and others.

The OECD does not have binding decision powers outside of its member States, and as such, does not enter into establishing International Conventions. The OECD is essentially a consultative assembly that pursues its objectives through persuasion of its member States. The organisation does this by the use of conferences, seminars and publication of papers. While the OECD has limited powers, it does have significant influence as an advisory body to the many international organisations involved with banking and trade. A decision of the OECD is binding on the members States. Decisions must be incorporated into national legislation. The existing acts of the Council in the field of waste management usually adopt the mixed form of 'Decision and Recommendation

[78] See Kiss and Sheldon (1991).pp 310-318

(D/R)'. The obligations are contained in the binding Decision part of the act and the non binding Recommendation part sets out the guidelines to members States for the implementation of these obligations.[79] Note that the full text of the OECD Convention appears in Appendix 2.

The main activity of the OECD is to operate as a clearing house for the masses of data and statistics collected about the world economy and other related matters. The purpose of the OECD is to boost prosperity by application of consistent policies and standardised practices across its member States, as well as non member States. The OECD collects a unique set of data and statistics that allows comparisons across countries. This work supports the discussions by member countries, who sent "experts" and policy makers to meet in specialised committees and groups for each of about 200 subject areas. Committee discussions can lead to formal agreements or rules to foster international fairness in economic areas, in various sections of the economy. Generally, the OECD produces discussion that is designed to contribute to better domestic policy making and more co-ordinated international practice.

In 1974, the 'Waste Management Group' (WMG) was established, and is now the principal group managing the Basel Convention interface. The main purpose of the WMG was to develop and promote international policies for waste management.[80] Other purposes of this group were to develop and promote policy instruments to minimise the generation of waste; promote reuse and recovery of materials and energy from waste streams; and ensure safe and environmentally responsible handling, storage and disposal of residual waste. Member States were expected to incorporate these policies into their own internal waste laws. Emphasis was placed on waste minimisation, reuse and disposal.

Environmentally sound management became an issue during the 1970s. In 1984, (5 years before the Basel Convention was established), the OECD adopted a decision to have member countries put in place measures to manage the transboundary

---

[79] Cf Article 5 of the OECD Convention.

[80] OECD Council Decision and Recommendation on Transfrontier Movements of hazardous wastes, 1 February 1984,(C(83)180(final).

movements of hazardous wastes.[81] This decision, which appears to be the first time the OECD had directly addressed the issue of transboundary movements of hazardous wastes, placed a binding code on the members States by the use of a set of principles.

For the first time, this set of principles included the issue of "environmentally sound management", the issue of "prior informed consent" (PIC), all country co-operation and return policy. Much of the material that emanated from decision 1984 D/R, was later incorporated into the Basel Convention. Much work was done in this period regarding the international transboundary movements between member States and it culminated after the OECD policy conference in 1985,[82] and the resulting international agreement on control of hazardous wastes between member countries.[83] While this agreement was in its draft stage, the UNEP sponsored work on the Basel Convention was gathering pace and coincided with the work by the OECD council in attempting to deal with transboundary movements of hazardous wastes to non OECD countries.

The UNEP activity caused the OECD to suspend further work on its draft agreement with its members countries on transboundary movements of hazardous Wastes.[84] After the adoption of the Basel Convention, the OECD ceased all work in the transboundary movement area and subsequently much of the provisions, especially that related to the hazardous waste classification lists, were incorporated in the Basel Convention. The OECD then instructed its member countries to give their support to the Basel Convention. It is important to note however, that most of the principles regarding environmental sound management relating to hazardous waste are still part of the OECD policy and remain in place.

The OECD then concentrated on the issue of international trade of recyclable wastes. There has been much criticism of the Basel Convention's management of recyclable waste, and the OECD has set up its own measures for member countries

[81] Council Resolution on International Co-operation Concerning Transfrontier Movements of Hazardous Wastes, 20- June 1985,(C(85)100,repr. in OECD,(1993a)). For a discussion see Kummer,(1995),p.160 et seq.
[82] OECD Policy Conference at Basel, Switzerland, March 1985.
[83] OECD Resolution International Co-operation transboundary Movements of Hazardous Wastes, October 1988.
[84] OECD Council Decision May 1988 (C89)1(final).

trading exclusively among themselves. A three tier list system is in place and is operated within the OECD block. The important interface points between the OECD and the Basel convention are :

- OECD control system implements Basel Convention within OECD[85]

- Memorandum of Understanding (MOU) between OECD Environment Directorate and Basel Convention Secretariat[86]

- OECD provides guidance to the Basel Convention in its work defining lists of Hazardous and Non Hazardous wastes

- Basel Convention List A and List B (Hazardous and Non Hazardous Waste) is based on OECD Green, Amber and Red lists

In international terms, OECD has an importance for the member States and States that need to deal with them. The OECD, however, does not deliver conventions or directorates. The work of the OECD directly effects only the States that are members (26 countries are members and none are in Asia). Within Asian country regulations there are no references made to OECD decisions or practices with respect to hazardous waste. Therefore, the relevance of the OECD to the Asian context, on the face of it, would appear to be insignificant. However, because of the memorandum of understanding (MOU) between the Basel Convention Secretariat and the OECD Environment Directorate and the support information and data provided by the OECD, its importance cannot be overlooked.

The significance of the OECD convention is the fact that its member States include most of the industrialised States in the world and, as such, represent the bulk of the worlds hazardous waste generators. The OECD continues to set regulations for the management of such wastes within these countries. This especially applies to the rules within the EU, and it is there that much OECD influence can be seen.

[85] OECD Council Resolution on Control of Transfrontier Movements of Hazardous Wastes, 30 January 1989.(C(89)1(final),repr. in OECD,(1993a)).
[86] See Kummer,(1995),p.161.

For the purpose of developing management tools for the environmentally responsible handling of hazardous waste, the OECD operates as a conduit for the opinions and policies of its member countries into the Basel Convention TWGs. The difference between the EU and the OECD is that the EU generally uses binding regulations or rules, whereas the OECD usually establishes policy for member countries to apply when making their own rules. Indeed, a member State can decide not to adopt an OECD rule but the EU rules are mandatory.

The strength of the OECD convention is that it has been around for nearly 40 years and its objectives and policies are well supported by its member States. The number of States that are members, 26, is a weakness, in that they tend to be Europe focussed. Because the organisation is a provider of policy and guidance, it serves as a useful information database for the other conventions that are more regulatory, such as the Basel Convention. The data and information it provides to the Basel Convention is very valuable indeed, and without it the Basel Convention ad hoc technical committees would have a very difficult assignment to complete.

The OECD decisions made at international committee meetings that are regularly attended by experts from the member States are binding on the States, and must be incorporated into their national legislation, unless they have abstained. States can arrange by themselves bilateral agreements to encompass those decisions but otherwise, there is no attempt by the OECD to police their decisions. They "police" their policies by persuasion. The OECD chemicals programme has a degree of influence around the world due to the quality of the work in this area. The OECD secretariat and the 26 member countries[87] work together to develop and co-ordinate environmental health and safety activities on an international basis. The OECD Convention is subject to the normal amendments for administration purposes. The Directorates continuously provide guidelines and decisions that are not considered convention amendments. They are merely the results of conducting the committee meetings.

The hazardous waste management techniques that the OECD prescribes to comply

[87] Now thirty countries as at December 2001.

with the Basel Convention is that they are required to be environmentally sound. In terms of 'on the ground' management systems and techniques, the OECD has yet to provide the Basel Convention with input that can be utilised in hazardous waste packaging and transportation management systems. Otherwise, the OECD concentrates on recyclable waste and national management policies and rules.

In summary, the OECD convention has a role to play in that it continuously supports the Basel Convention, and it is the latter convention that has a great influence in Asia. The OECD policies in the environmental area mirror the Basel Convention policies and the OECD input into the Basel Convention technical working groups will become progressively more important. The overall position of the OECD in the management of hazardous waste is that of technical support information and guidance via the Basel Convention. This will prove to be of great importance as the technical programmes are fully developed.

European Union (EU) Fifth Action Programme

The European Union consists of 15 member States[88] : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Since EU inception there have been five action programmes that have been adopted.[89]

The Fifth Action Programme[90] identified as one of the key tasks for the 1990s focussed on the need to halt and to reverse current trends in waste generation, in terms of both volume increase and in environmental hazard and damage. On the basis of the EU strategy for waste management, which was endorsed in the EU Council Resolution of 7 May 1990[91] , actions have focused on prevention/reuse, promotion of recovery, minimisation of final disposal, regulation of transport and remedial action. The fifth action programme covers the period 1993 to 2000, and was implemented[92] under the environmental provisions of the Maastricht Treaty

[88] As at December 1999.
[89] For Action Programmes 1-4 see Johnson and Corcelle (1989).
[90] Adopted 18 March 1992.
[91] Council Resolution on waste Policy, 7 May 1990, (OT No. C122/2,18 May 1990).
[92] Implemented 1 November 1993.

on European Union.[93]

There have been a number of other developments affecting the implementation of the waste strategy, including experience with the instruments adopted between 1990 and 1995, important judgements by the European Court of Justice, and important developments at international level, in particular the new EU Council regulation to implement the Basel Convention.[94]

Chapter 10 of the EU 1993 White Paper, has given an important incentive, in relation to the need for the creation of a new clean technology which should, inter alia, encompass longer product lifetime with more reuse and recycling. The objectives of Agenda 21's Chapter 20, on environmentally sound management of hazardous waste are followed under the EU waste strategy and related legislation.[95]

In order to facilitate the implementation of waste legislation, Council Decision 94/904 established a list of hazardous wastes, and Commission Decision 94/3 established a European Waste Catalogue. At the end of 1994, the Council adopted a directive on the incineration of hazardous waste. This directive sets, for the first time, standards for the incineration of hazardous waste in industrial plants, including emission limits for heavy metals and dioxins.

The existing directive on PCB/PCT disposal has become virtually obsolete due to the ban on marketing and use of PCB/PCT, and due to progress in PCB/PCT disposal techniques. A revision has been proposed, aiming at an approximation of Member States' legislation on the controlled disposal of PCBs/PCTs and equipment contaminated by them. The Council regulation on the supervision and control of shipments of waste within, into and out of the EU entered into force in May 1994. This Regulation transposes into EU law relevant international agreements that create obligations for the EU, such as the Lomé IV Convention, the Basel Convention, as well as the OECD Decision on the control of transfrontier movements of waste destined for recovery operations.

[93] For discussion see Wilkinson (1992),p. 221-226.
[94] Adopted by the EU February 1993.
[95] Commission Decision 94/3/EU, 20 December 1993.

The EU has played an active and important role to ensure international co-operation in the efforts to diminish the global problems caused by hazardous waste, and thus, respond to commitments undertaken under the Rio Declaration's Agenda 21. The regulation takes into account the objective to minimise waste movements destined for final disposal, on the basis of the principles of self-sufficiency and proximity and it regulates the control of shipments of waste destined for recovery operations in such a way that recovery is promoted while at the same time preventing such waste from being transported to recovery installations, which are unacceptable from an environmental point of view.

The target of not exporting waste destined for final disposal outside the EU by 2000, has in fact been implemented. Exports are permitted only to EFTA countries, which are also Party to the Basel Convention (Norway and Switzerland). Similar objectives are being pursued in the framework of the Basel Convention. Discussions are under way to ensure a total ban of exports of hazardous waste to non-OECD countries with immediate effect as far as export for final disposal is concerned, and to achieve a general ban of waste exports for recovery to non-OECD countries as of 1 January 1998. With a view to complying with this decision agreed at the international level, the Commission has made a proposal to amend Regulation 259/93, in order to extend the existing prohibition of exports of hazardous waste destined for recovery operations to ACP countries to all non-OECD countries as of 1 January 1998.

Exports of non hazardous waste for recovery to non-OECD countries are in principle not subject to any control procedures under Regulation 259/93. However, after consultation with these countries, here too control procedures will be introduced unless the Commission receives an indication to the contrary from the importing country. To this end, the Commission has adopted Commission decision 94/575/EEC. Complementary proposals to the Council have been made regarding cases not covered by that decision.

Considerable progress has been made in completing the Community legislative framework for waste management policy, but there are still a number of questions which create difficulties. Moreover, a substantive part of legislation recently adopted will not have practical effect before 1997, and therefore, targets for the year 2000 ande beyond may not be fulfilled. Furthermore, national legislation implementing EU rules is introduced slowly, and with considerable delay. The same applies for waste management plans. There are considerable lacunae in relation to reliable data on waste generation and disposal, at national and Community level which also reflects inconsistencies in the interpretation of definitions.

In relation to waste movements, international developments such as the Basel Convention have been an important trigger to the development of Community legislation; coherence of approaches and definitions needs to be followed up. In relation to international environmental issues the EU priorities include the intention "to reinforce the environmental component of co-operation with countries of Asia in line with Council Regulation (EEC) No.443/92".

The EU's role in the hazardous waste area, especially that involving the creation and implementation of management plans, cannot be underestimated. The EU has embraced the main criteria of Agenda 21, especially chapter 19 and 20, and its Fifth programme parallels the Agenda 21 programme. In December 1992, the Environmental Council agreed that the Fifth Programme provides "a comprehensive framework as well as a strategic approach and an important point of departure for the implementation of Agenda 21 by the Community and the members States" and called for the Community to Integrate the Rio Declaration. Three years after Rio, (1995) most of the initiative agreed at UNCED are under way at the Community level. Agenda 21 has been progressively incorporated into policy making.

In addition, the EU co-operates with the OECD and has great influence with the Basel Secretariat. In the next decade, the EU will gain more and more relevance in the Asian region as a result of its Asian policy. EU's role in the Lome Convention is also of some importance in that the delivery of environmentally sound management systems that are produced under that convention will also be used in the Asian context. The strength of the EU lies in its immense capacity to provide top level programmes for its member States and others. Not a single law has been passed by its European members without the EU's opinion being heard and generally applied. The member States have achieved major successes in promoting free trade throughout the world. In most bilateral, regional and global negotiations, the European Commission is given a mandate by the member States to conduct the negotiations on their behalf.

In the last twenty years, the EU has created a comprehensive network on international agreements and relationships, whose purpose extends well beyond the trade aspects. Included with these high level agreements on trade are many directives and agreements covering many aspects of protection of the environment and management plans for hazardous wastes. The EU's involvement with the Basel Convention, as well as its support for Agenda 21, must be seen as a very strong link to where, and how, the management planning for hazardous waste will continue. The many directives that are imposed on the member States directly affect the Asian region as it is with EU members States that the Asian economies have to deal with when disposing of their waste. The EU has regular meetings on environmental issues with its major industrialised partners (USA, Canada, Japan and Australia). The annual meetings cover areas of mutual interest, including hazardous waste management with the objectives of providing much greater standardisation.

While the United States in not a party to the Basel Convention or of the EU, it has formed a global partnership and the US influence in Chapter 20 of Agenda 21 will flow through to EU policy on hazardous waste management, and this will provide strength to the impact of the EU. The EU concept has been a powerful voice in the implementation of the Rio conventions and of other international agreements. In this area of implementation there are not that many industrialised countries that are active outside of their borders and the EU plainly sees its role is to be a leading player for developing countries and the economies that are in transition. The EU sees that it has a role in assisting these countries in complying with the various international conventions that are implied by Agenda 21. The EU considers that, due to its not inconsiderable experience at producing and developing legally binding regulations and directives, it can provide, and should take the lead in providing, the developmental processes required for the ongoing amendment and change of the conventions.

All policy decisions by the EU are issued, managed and policed by the use of Directives and these are controlled by political pressure at the highest level. The EU directives and Commission decisions are continuing and ongoing. The EU plans to have a significant role in the ongoing development and amendment of all international conventions that are linked to Agenda 21, including that related to hazardous waste management and disposal. Surprisingly, given the compliance with Agenda 21, Chapter 19 and 20, within the hazardous waste management area, the EU has yet to provide detailed methodologies or systems engineering. The current intention is that these matters are to be followed up.

Considering the position of the member States and the long history of production of directives and their binding nature, and the fact that the members States are in possession of the technology for the disposal of hazardous waste, the EU will play a large part in the ongoing development of management systems and will have a big impact on how the Basel Convention develops. The EU also provides a large contribution to the OECD in the Persistent Organic Pollutants programme, and the POPs Convention[96] which will also impinge on the Basel Convention.

Summary

While the Basel Convention is the protocol for transboundary movements of hazardous wastes and their environmentally sound management, the EU is a powerful motivating force for its application. While the EU has yet to provide any vast amounts of detail regarding the development of such systems, it remains the obvious candidate for doing so. Kummer insists that there is an argument that the conventions are moving towards a "[g]lobal, holistic and integrated regime of hazardous waste management by way of a global model".[97] Chapter 3 looks at existing "models" that are used in the field.

[96] The POPs convention was signed in Stockholm June 2001.

[97] See Kummer,(1995),p.261, et seq.

3
Emerging Global Waste Management Models

The principles of environmentally sound management embraced by the Basel Convention have received widespread support. They are embedded in the Basel Convention text and the Technical Guidelines and Strategy elaborated within its framework, and the legislation of the EU and the OECD. Since the principles of environmentally sound management are advocated by most relevant legal instruments, there is basis for the argument that they constitute emerging customary law obligations and thus constitutes an emerging global model for hazardous waste management.

Introduction

As Kummer demonstrates,[98] in the case of the "principles of waste minimisation and proximity", this view of an emerging global model can be supported by the argument that these principles are, in effect, an extension and clarification of the customary limitation of the 'freedom to pollute', and obligation to exercise due diligence, as an aspect of pollution control. With respect to the principle of non discrimination, this view is not generally accepted, however. As regards the Basel Convention's principle of environmentally sound management, a special problem emerges in the context of hazardous wastes subject to recycling recovery operations. The application, in principle, to hazardous wastes that have economic value and are destined for recycling or recovery, does appear to be accepted. The policy and legislation of the EU, and even more clearly the OECD, go one step further; they specifically advocate recycling and similar operations as a fundamental principle of waste management.

The relevant legal instruments consider recycling as a means of minimising waste disposal, as well as an environmentally sound management option. This is supported by Chapter 20 of Agenda 21, which endorses recycling as a part of the waste management hierarchy. It is also embodied in the framework document on the preparation of technical guidelines, elaborated by the Technical Working Group

[98] See Kummer (1995). p 264.

of the Basel Convention.

To assist the member States, the Basel Convention secretariat has developed guidelines and standardised or model national legislation on the management of hazardous waste for adoption by parties as their internal legislation.

The Basel Convention strikes a balance between between the so called framework treaty, (which lays down the fundamental principles only, and leaves the regulation of details to regional agreements) and a detailed global regime leaving no room for divergent regional regulation. While establishing a fairly detailed global standards, it allows for regional regulation taking into account the specific situations and needs of individual groups of countries. The balance between global and regional regulation is thus successfully achieved by the Basel Convention regime. Kummer, therefore, makes a substantial argument that, "[r]ules or principles embodied or advocated consistently in the above international legal instruments and supported by national policy, legislation and practice can now be considered customary law in the field of management and transboundary movements of hazardous wastes".[99] In addition, the concept of an integrated environmentally sound management regime is advocated in Chapter 20 of UNCED's Agenda 21.

In her analysis, Kummer concludes that a global regime is emerging for the management of hazardous wastes and, "undoubtedly, the emerging global waste management regime will not provide the ultimate solution to the complex problems posed by the hazardous waste cycle, but it can make an important contribution".[100]

Emergent global model

While an argument for the emerging global regime is strong, the practical acceptance and application of such a regime was questioned at the First Asian-Pacific Regional Meeting on the Establishment of the Regional Centre for Training and Technology Transfer on Environmentally Sound Management of Hazardous Waste. held in Beijing 9-11 July, 1996.[101] The conference report shows the direction Asian countries intended following as well as their apprehension as to how to get there

[99] See Kummer (1995), p. 263.
[100] See Kummer (1995), p. 287.
[101] UNEP Basel Convention sponsored conference.

and the lack of cohesive management structures required for the purpose. It also summarises the current status of the development of management structures for hazardous wastes in Asian countries. This conference was co-sponsored by the Secretariat of the Basel Convention SBC and China's National Environmental protection Agency (NEPA). The meeting was organised at the invitation of the Government of China and, in collaboration with the Basel Convention, as a follow up of the Decision III/19 of the third conference of the parties to the Basel Convention on Establishment of Regional centres for training and technology transfer for the environmentally sound management of Hazardous Waste and the minimisation of their generation. It was organised by the National Environmental Protection Agency (NEPA) in collaboration with Tsinghua University in Beijing.[102]

The conference was opened by Mr Wu Baozhong, Director General of Department of Pollution Control of National Environmental Protection Agency of China, as well as the head of the China delegation to the meeting Mr Zhang Kunmin, Deputy administrator of China. In his speech, Director General, NEPA said that to achieve the environmentally sound management of hazardous waste, not only were stringent domestic polices and regulations required but also close and effective international co-operation in this field should be called for, and that this meeting was a significant step for the countries of the Asia-pacific region to work together for future training and technology transfer for environmentally sound management of hazardous wastes.

United Nations Environment Programme International Environmental Technology Centre.

The representative of UNEP International Technology Centre (IETC) Mr C Strohmann suggested a number of opportunities on how to cooperate with the SBC and regional centres for training and technology transfers for environmentally sound management of hazardous waste. He emphasised the three main areas of opportunity to improve access to environmentally sound technologies (EST) and they are:

[102] Conference was held at Tsinghua University in Beijing between 7-12 July 1996. Taking an active part in the conference was the Chinese Government Department "National Training and Technology Transfer Centre for Hazardous Waste Management and Disposal" (NTTTC), as well as 25 countries and other interested parties.

- to improve access to information on environmentally sound technologies;
- to foster technology co-operation, partnerships and transfer; and
- to provide for capacity building.

As an example of collaboration, a source book on EST for management of hazardous wastes was mentioned and described.

United Nations Organisation of Industry and Development Cleaner Production Programme

Ms Yu Xiuling advised the meeting that China National Centre for Cleaner Production (CNCCP) has in past years undertaken a number of cleaner production projects in enterprises of various sectors in China with the support of UNEP and UNIDO. CNCCP concluded through doing CP auditing and CP projects that CP auditing is one way to achieve environmentally sound management of hazardous wastes and cleaner production is the best way to minimise the generation of hazardous wastes. They suggested that the following methods can be adopted to minimise the generation in the process of implementing cleaner production with different sectors being taken into account: improvement of product structure, raw material substitution, technical innovation, on site recycling, recovery and reuse, management strengthening and training.

China Non-Ferrous Metals Industry Corporation

Mr Jia Haibo, Director for Environment Division, China Non Ferrous, briefed the meeting of the situation in the non ferrous metals industry in China and the measures they have taken to improve environmental management in the sector. He informed the meeting that the main technologies for waste disposal and reuse in the non ferrous metals sector in China included dump, land fill, rehabilitation, reuse of mining waste for building materials, and recovering valuable metals from waste. Some slag and dust are treated in an environmentally sound manner, but such problems as low rate of waste reuse , lack of technology for waste management and insufficient funds for waste management still exists. So, international co-operation and assistance in this regard will be crucial to improvement of hazardous waste management in China.

"Activities and Progress for Implementing the Basel Convention in China" (Mr Wu Baozhong, Director General Department of Pollution Control, NEPA)

Mr Wu Baozhong first briefed the meeting about the current situation of waste generation and their causes. The main reasons for generation of large quantities of waste in China are the traditional patterns of production and consumption, inadequate technologies, low level of management, low rate of resource utilisation, inadequate capabilities and facilities for waste disposal treatment and disposal. Among the waste generated in China 3-5% is hazardous.

Mr Wu introduced recent progress in the legislation concerning solid waste management in China. In 1996 China began to enact the Law of Solid Waste Management, which provides a very strong legal basis for waste management in China. Mr Wu expressed China's full support for, and willingness to work with, the Secretariat of Basel Convention and the international community to achieve the goals and objectives of the convention through all possible means. He expressed the willingness of the Government of China to transform China's 'National Centre for Training and Technology Transfer for Hazardous Waste Management and Disposal' (NTTTC) existing in Beijing into an Asian - Pacific Regional Centre.

Relating to the question of priorities to be undertaken at the regional centres, it was recognised that there were two levels of such activities. The first level related to the type and clusters of activities to be undertaken, and the second level related to the more specific issues to be dealt with by the centres in order to address the needs of the region. As examples of clusters of activities, some of the following options were chosen; information exchange, training courses including seminars, demonstration projects, capacity building and preparation of training modules.

One of the main issues of concern for the delegates was the issue of technology transfer and how this should be dealt with by the centres. It was agreed that one of the main functions of the centre would be to serve as a clearing house for information on environmentally sound management practices and technologies. While it was accepted that the centres may not be able to financially gear up for this type of service, it was held that this would be an important requirement. Many of the delegates expressed urgent requirements for information, assistance and advice on technologies appropriate for the treatment and disposal of hazardous wastes.

It was emphasised by many of the delegates, that a great deal of research about environmentally sound technologies and practices was being done by a few countries but that this knowledge was not applied in practice, due to the high cost of application. There was a need to develop affordable technologies, and to operate facilities in an economic way, in order to create revenues. References were made to the need to provide improved management systems, legislation and regulations, which would result in better facilities, provided also that an economic incentive could be applied. This was a common theme with all delegates.

The role of the private sector and industry was also discussed by the meeting and it was considered that the involvement of these groups was crucial for the work of the centres. It was felt by many of the delegates that information on environmentally sound management and technologies would only be available from industry sources. It was considered that the collaboration of NGOs with the regional centres could be valuable particularly in information sharing on research done by NGOs on appropriate technologies such as the management of PCBs.

All country delegates expressed their frustration at the total lack of awareness within their countries regarding the environmentally sound management of hazardous waste and the harm that it causes. They also expressed serious concerns about funding for the training and technology transfer required to manage their hazardous waste problems in an environmentally sound manner. An emergent theme of the conference was the lack of understanding of what constituted 'Environmentally Sound Management' of hazardous wastes. Many of the delegates expressed their frustration with various conventions, especially that of the Basel Convention in that the regulations within the Conventions did not provide the detail of what it all meant in terms of environmentally sound management.

Existing Management Models in Use

Given the reality of the conventions and the dynamics of the evolving and emerging model of environmentally sound management, and accepting that the emergent model does not promulgate a particular management model, it is appropriate to examine how existing management "models" are able to cope with the demands of the conventions. The Basel Convention Secretariat in Geneva, provided information as to which management models were in current use for projects related to transboundary movements of hazardous wastes. Each of these were examined, both from the theory point of view and practical application. The purpose of this examination was to obtain a view of the veracity of the existing management "models" that are in current use by parties, to clearly discharge the requirements of the Conventions. In the main, the results and conclusions as to the veracity of the current management models is somewhat subjective and, in reality, an exercise in abductive reasoning.[103]

The process of abductive reasoning research involves the following:

- identification of a particular phenomenon and obtaining data which is descriptive of that finding;
- accounting for the finding by relating it to broader concepts and by inspecting our own experience, our stock of knowledge of similar, comparable findings, and the equivalent stock of ideas that can be included from within our disciplines and neighbouring fields;[104]
- going beyond that data by locating it within an interpretative framework; and
- iterating the above, such that there is a repeated interaction among existing ideas, former findings and observations, new observations and new ideas.[105]

[103] See Coffey and Atkinson (1996).
[104] ibid.
[105] repetto.

The management plans that are looked at here were obtained from several sources, including those loosely associated with conventions and regulations, and corporate manuals of companies engaged in the field of hazardous waste management. The plans researched are analysed for their capacity to provide comprehensive management methodologies to discharge, without compromise, the requirements of the emerging global convention on environmentally sound management of hazardous waste. The purpose of this section of the research (looking at the current management models that are used), was to obtain an insight into the strategic models, or sets of integrated plans that are currently employed in the workplace in Asian countries when engaged in the management of hazardous waste. For the purposes of this part of the research "Models" are interpreted as management plans, or sets of integrated plans that are intended to be used in the work place.

The "Country reports" from the Basel Convention Regional Centres conference in Beijing (July 1996)[106] clearly indicated, current management methodology would prove to be very difficult to research. Many countries had a common complaint that they could not access useful models or plans that were integrated in any sense of the word. As was also pointed out in the 'Country Reports', many States were trying to use the Basel Convention as the model fix, even though the analysis of the Convention above clearly shows that this could not be the case at this time. Not withstanding this governmental pessimism regarding the adequacy and veracity within the Asian region for the purposes of developing new management models, it is essential to research the area of existing management "models" that are employed in this region. To supplement this research interviews were undertaken with officials in the countries of Taiwan and China[107] to get an understanding of the effectiveness of management models in the hazardous waste area, going back about 15 years.

UNCED Rio Declaration (Agenda 21)

As was shown in 'Country Reports'[108] much of the emphasis within the global conventions has roots in Chapter 20, of the Rio Declaration,[109] as far as hazardous

[106] UNEP Basel Convention Conference, Tsinghau University, Beijing (1996).
[107] Competent Authority, SEPA, China.
[108] UNEP Basel Convention Conference, Tsinghau University, Beijing (1996).
[109] United Nations Conference on Environment and Development, Earth Summit, Rio de Janeiro, Brazil, June 1992.

waste is concerned. While it is accepted that Chapter 20 is merely a "statement", its management implications are inherent in the importance of the subject matter and it can be said that much of current literature and methodologies of hazardous waste management are based on the principles that have their roots in the Rio Declaration.[110] While the Rio Declaration can be viewed only as a policy document and, necessarily, does not attempt to provide tactical procedures, the "Rio model" is used by many Asian economies in a "defacto" manner as a management model.[111] The Rio Declaration, or Agenda 21, which is the road map for sustainable management of the future, is now slowly becoming an integrated part of business and government policies.

Chapter 20 of Rio Declaration

The full text of Agenda 21, Chapter 20, appears in the appendices and, therefore, for the text of individual clauses cited, reference should be made to the appendices. Reference to "integration" within clauses 20.1 to 20.3 suggests that the Chapter will provide detail on how integration will be achieved. The statement, that Hazardous Waste requires an integrated approach to its management, is certainly recognised by many governments and industry members but rarely detailed by any regulatory authorities. Within industry and, indeed, within many Government departments of Asian countries, there are difficulties in dealing with concepts such as that promulgated in this chapter of the Rio declaration, without attempting to incorporate the idea of an "integrated approach".

The Declaration has linked the integrated management of hazardous waste to sustainable management and natural resource management. There is no doubt that this concept of integration with the principles of sustainability is an important element of any management method or tools that are to be developed for the practical management of hazardous waste. The problem for many Asian countries as expressed in the Beijing "Countries Report",[112] is that they do not have the capacity to comprehend the implications of an integrated waste concept and paradoxically, those same countries also have the biggest hazardous waste

[110] ibid.

[111] See Discussion by Xie Zhenhua of Qinghua University as cited in Tremayne, China Review Autumn/Winter 1996.

[112] UNEP Basel Convention Conference, Tsinghau University, Beijing (1996).

problems.

Referring back to the Countries report above "It was emphasised by many of the delegates to the UNEP Beijing conference on hazardous waste in June 1996,[113] that significant research findings are not applied in practice due to the high cost of application and that limited technology transfer in the field of hazardous waste. There was an expressed need to develop affordable technologies and to operate facilities in an economic way in order to create revenues. References were made to the need to provide improved management systems, legislation and regulations, which would result in better facilities, provided also that an economic incentive could be applied. This was a common theme with all delegates. The role of the private sector and industry was also discussed by the Beijing conference delegates and it was considered that the involvement of these groups was crucial for the work of the centres. It was felt by many of the delegates that information on environmentally sound management and technologies would only be available from industry sources".[114]

This attitude is somewhat contrary to the statements expressed in the introduction phase of Chapter 20. The preference, indicated in the introduction, is for the Governments to adapt and integrate the philosophies of sound environmental management, but 7 years after Rio many Asian countries are declaring that such sentiments can only be delivered by industry sources. In COP 5,[115] the debate raged as to the meaning and implications of Environmentally Sound Management.[116] At the same conference the representative of the OECD stated in the plenary session that they (OECD) had recently agreed that waste management systems needed to be integrated with Environmentally Sound Management techniques and Sustainable Management principles but they had only just started this work and had yet to define the Integrated Concept.[117] "The fact that an acceptable set of guidelines on ESM does not yet exist is a matter of concern for industry. The lack of an ESM reference leaves open the question about meeting the obligations set out

[113] ibid.
[114] repetto., refer to page 68.
[115] Conference of the Parties 5, UNEP Basel Convention, Basel, Switzerland, 9 December 1999.
[116] UNEP Executive Director Klaus Topfer's speech at the Ministerial segment of the 5th Conference of the Parties to the Basel Convention, Basel, Switzerland, 9 December 1999.
[117] See Conference paper by André Bourassa presented at OECD ESM workshop, Cancun, Mexico, October 1999.

by the Basel Convention".[118]

Many country delegates[119] at COP 5 expressed their frustration at the total lack of awareness within their countries regarding the management of hazardous waste and the harm that it causes. They also expressed serious concerns about funding for the training and technology transfer required to management their hazardous waste problems in an environmentally sound manner.[120] This is possibly why the management of hazardous waste within Asian countries has not advanced much past public statements.[121] The adoption of a coherent management model that is government sponsored carefully utilising the Rio declaration is impossible given this is unavailable at this time.[122] The relevant clauses of the Rio declaration relating to environmentally sound management of hazardous wastes are discussed below. The clauses are examined in order to establish how they could be used in a practical sense as a management model.

Clause 20.4.[123]

In Asia the illegal international movement of hazardous waste is an enormous problem[124] and one that is considered, by some, as currently out of control.[125] There are many instances of hazardous waste movements that do not have permits or authorisation. In addition, many consignments are not properly packed nor handled. This situation has deteriorated since Rio and in some respects has served to enhance the gulf between theory and the practise of hazardous waste management.[126] To some extent some of this problem is due to the prevalence of waste being recycled and used by another industry after its generation. Rather than treating the waste as a hazardous commodity that is required to be managed and handled under the terms of the Basel Convention, it is often called a "raw material",

[118] ibid., p. 2.
[119] See Conference Report,Conference of the Parties 5, UNEP Basel Convention, Basel, Switzerland,9 December 1999
[120] repetto., See page 69
[121] See Tremayne, China Review, Autumn/Winter 1996.
[122] See UNEP COP4 Conference notes
[123] For full clause text see appendices.
[124] See Greenpeace report to POPs Convention, Stockholm, June, 2001.
[125] See Conference paper by André Bourassa presented at OECD ESM workshop, Cancun, Mexico, October 1999.
[126] See Greenpeace Case Histories of illegal traffic, POPs Convention submission, May 2001.

when clearly it is not, and the rules circumvented.[127]

Clause 20.5 & 20.6

Again, integrated life cycle management does not get past the statement of the obvious. Integrated management of hazardous waste is essential, but what is it? Many countries in the Asian region have difficulty with the idea of Life Cycle Analysis (LCA) and they certainly have a big problem with the cost of LCA.[128] When advised of the place of LCA within the concept of sustainable management, some industry chiefs in the Asian economies simply say that they will rely on the 'West' to tell them when a product should or should not be used. The idea that they should indulge in LCA is often foreign to Asian companies, as it is with much of the western world.[129] Within this part of the Rio declaration there is no attempt to assist governments in understanding not only their obligations but, more importantly, how to implement them. The inclusion of LCA as part of an integrated system of waste management that is directed at discharging the principles of sustainability makes the adaptation of management methodology very difficult to implement at either the policy level or the practical level.

Clause 20.7.

Transboundary movements are to be on environmentally sound management bases but these are not described or detailed. This is the same as the Basel Convention, which says that the management of hazardous waste shall be environmentally sound but does not describe what it means nor does it detail how to do it. Perceptions of what environmentally sound management is, often leads to the mishandling of hazardous materials. The shipping of full PCB transformers is a classic example of something that is permitted under the Basel Convention but it could be argued that it contravenes the concept of Environmentally Sound Management.[130] Again, the Rio Declaration does not attempt to provide the detail of how to achieve satisfactory compliance. The Basel Action Network[131] claims

[127] See Conference paper by André Bourassa presented at OECD ESM workshop, Cancun, Mexico, October 1999.

[128] See Chapter 21 for definition of Life Cycle Analysis, United Nations Conference on Environment and Development, Earth Summit, Rio de Janeiro, Brazil, June 1992.

[129] See Conference paper LCA activities in Asia by Ding-Quan Xiao, Sicuan University, China at Conference Life Cycle Assessment for Asia Pacific region held at University of Tsubuka, November 1998.

[130] See Kummer (1995), p. 278.

[131] See www.ban.org

that any movement of hazardous waste is not environmentally sound management and that the convention cannot produce a system that is.

It is from here (Chapter 20), that the Basel Convention gets its "instructions" to merge the onshore management with the offshore transboundary regulations. This is a large step up for the Basel Convention, as it now must deal with countries that are signatories to the Convention that have less than adequate laws and regulations regarding environmental sound management practices. The Basel Convention is poorly placed to achieve these "instructions" from the Rio Declaration as the Convention secretariat is underfunded for the purpose and is bogged down in technical detail because of its tendency to engage the policies and systems of the EU as a bench mark. For several years since 1992 the Basel Convention Secretariat has been working diligently on what waste constitutes hazardous waste and how should it be identified. For the purposes of providing environmental sound management systems the Secretariat has a huge logistics problem in providing a management model that is universal and timely. The UNEP defined the concept of Environmentally Sound Management in the Cairo Guidelines in 1987, but its use as a tool is still elusive.[132]

Clause 20.29.

Many Asian countries and in particular China, struggle with the idea of capacity building.[133] The intention is clear but the activity required to achieve it is not so clear. The National Environmental Protection Agency (NEPA) in China, has come to the conclusion that by itself it cannot produce the required capacity building and, indeed, recent statements would indicate that it is unable to even begin the process. Chinese authorities have embraced the ISO standards as a means for capacity building, especially the 14001 standard.[134] This, unfortunately, will take the focus away from the real issue of management of hazardous waste and place it into a "standard" solution that does not have the capacity to be used in that manner.[135]

[132] UNEP,Environmental Law Guidelines and principles no.8 :*Environmental Sound Management of Hazardous Wastes,* Nairobi 1987.

[133] *Study on Hazardous Waste Management and the Establishment of an Information Resource Centre - Final Report.* World Bank Project "SEPA Capacity Building", December 1995.

[134] See conference paper by Terada : "*EMS Trainers in Japan*" presented at International Conference on ISO 14000 and Sustainable Development, Beijing, November 1996.

[135] See argument and discussion by Conway in conference paper: "*ISO 14000 Standards and China : A trade and Sustainable Development Perspective*", presented at International Conference on ISO 14000 and Sustainable Development, Beijing, November 1996.

Clause 20.9.

This has long been a contention of the UN. Understand the economics and the people will follow. Again, it is a theory without the handbook on how to achieve it. For Asian countries that are still in the developmental phase, this presents a big challenge. How does the incentive mechanism work when the capital base is so low in the first place?[136]

Clause 20.10.

Interestingly enough, Asian countries do engage in many forms of reuse and recycling, nothing whatever to do with the management of hazardous waste, but merely a survival element. It also causes many of the out of compliance handling issues relating to dangerous goods shipments.

Clause 20.11.

This is a very hard concept (Integrated cleaner production) to achieve without vast input from life cycle studies and lots of management planning. This is where the whole issue gets into the "too hard" basket in Asia. The main problems here are the present state of corporate development. In order to progress into 'cleaner production' a company needs to fully develop corporate governance.[137]

Clause 20.12.

Asian countries do understand the processes involved to get these programmes on line. Cleaner production has improved significantly in several Asian economies but is usually put in place for economic reasons not for environmental sound management reasons.[138]

Clause 20.13.

How does an Asian economy develop this concept of environmentally sound non discrimination within a non regulated fractured economy with little in the way of

[136] See discussion by Hecq in conference paper: "*What is the future for ECO-auditing, Choices, Challenges and Constraints,*", presented at International Conference on ISO 14000 and Sustainable Development, Beijing, November 1996.
[137] Forester W S , et al "*Waste minimisation and clean technology.*" Waste Management Strategies for the future, Academic Press, 1993.
[138] Pearce D ,et al "*Market based approaches to solid waste management, resources conservation and recycling*", Vol 8 No 1,2, 1993.

guidelines? Again, the problems of definition here are very difficult to conceptualise, standardise, regulate, and then control. Unfortunately, this strategy means that Asian countries will read this to mean that exports of hazardous waste for disposal is to be avoided. This may be unhelpful for the countries that are trying to develop a management programme as they would be unable to export for destruction. Because many Asian countries see the Basel Convention as the "Regulation" they should comply with as it has an equivalent clause, they stockpile hazardous waste in the fond hope that one day some benign technology will be invented to cope with it. In the meantime, they do not intend to develop the domestic capability to handle such waste problems rather they simply bury the problem until technology catches up. This has led to a standstill policy in many countries and it is a problem not necessarily restricted to developing countries.[139]

"Countries should help develop the concept of technology transfer", unfortunately management structures are required to be in place before technology transfers occurs. There are many barriers to the application of such programmes especially that relayed to implementation of minimisation.[140] This is the first time technology assessment centres are mentioned in this chapter. There is no attempt to define what a technology assessment centre is or how it is structured and operated. As a policy it is a sensible statement but as a guide for environmentally emerging economies it is of little use and as a management model it lacks the necessary defining detail. The Regional Centre for Technology Transfer in Beijing that was formed in partnership with UN Basel Convention in 1997, had no idea how the technology centre was to function and three years after the initial establishment it still is not operating with a functional plan. Cleaner production does work in Asian economies not because of the environmental benefits but because of the economic benefits.

The Basel Convention, seven years after the Rio summit, is still trying to establish management plans that will be useful. So far the SBC have concentrated on hazard identification not on management structures. Seven years after Rio China's

[139] UNEP *Programmatic Document on the Draw up of the Guidelines for the Environment"* Harmless management techniques for waste under the Basel Convention. 1992.
[140] *The First Asia-Pacific Regional Meeting on Establishing Regional Centres for Training and Technology Transfer for Environmentally Sound Management of Hazardous Wastes*, Beijing July 7, 1996.

environmental regulation has only just been published and it is 8 A4 pages. Within it there is no management model of any kind. Implementation of cleaner production techniques however, has a longer time frame and some project were established under World Bank funding as early as 1993.[141]

Clause 20.14.
The most obvious database that should be established is that of Life Cycle Analysis (LCA) but this has not happened. In Asia there is a strong desire to utilise international organisations but the willingness of the western organisation is ambivalent to say the least.[142] The regional centre in Beijing has been established by the Basel Convention but is ineffective (2001).[143]

Clause 20.15.
Many countries in the Asian region are not members of the Basel or Bamako Conventions. The cleaner production network in Asia as a network is just gearing up but there is still many difficulties to overcome before the concept is a clearly defined management methodology of universal value. Following the Paris UNEP conference in 1992, the UNEP concentrated on the idea of increased co-ordination in the area of cleaner production education and training. Various modules were produced and are in use in the Asian region. Notwithstanding this activity, there are many barriers to the adoption of cleaner production within smaller industries.[144]

Clause 20.16.

Clause 20.17.
Many Asian countries do not have the resources for implementing the Chapter 20 policies. China, while currently being supported by over US$2 Billion worth of World Bank loans for environmental projects, are unable to deploy manpower or technical expertise or management models and programs. What laws relating to hazardous waste have been promulgated are weak and enforced inconsistently.[145] This gets back to the idea of integrated LCA studies and how to apply them to

[141] See Order of the President of the People's Republic of China, Regulation No.22 Environmental Protection Law, 1992.
[142] Ohno, T. Quoted in *Lean and Clean Management* Joseph Romm. Kodansha American 1994
[143] See regional centre reports COP 5 Geneva, December 1999.
[144] See Journal of Cleaner Production, 1999.
[145] For a discussion on funding and programs see China Review, B Tremayne, *China's Environmental Problem*, Issue 5, Autumn/Winter, 1996.

Asian economies. This clause has had States like China produce like policy and charge their Environmental Protection Agency with the task of converting the policies into action plans.

As the Rio Declaration is a policy document, no attempt is made to indicate how the States should execute such a plan. There are many instances in newspaper articles of many Asian governments having various plans and concepts but they are substantially window dressing and do not prevent pollution on a regular and vast scale.[146] In China, on the other hand, the State Environmental Protection Agency (SEPA) simply decided that in order to exercise responsible care the most effective way is to ban companies that produce less than a specified bench-mark of product.[147] For example, if a tannery produces less than 30,000 pieces of cow leather annually, then it is banned from operation. How this is supposed to encourage the larger companies to exercise responsible care is unclear.

Clause 20.18.

Clause 20.19.

As a policy (capacity building) the criteria mentioned here are valid, in that they have worked well for the more developed countries who have placed the management structures to create capacity building systems. For the environmentally emerging Asian economies, this policy by itself cannot be used as a management model. Asian governments are having severe difficulties establishing an effective interface with industry in order to establish co-operation programmes to record inventories and so on.[148]

Clause 20.20.

This is a statement of the obvious, and has been reiterated many times over the past twenty years. The basis for action has been in place for many years without implementation planning for environmentally emerging economies. What is required is a structure to permit the implementation of the basis for action. The

[146] See discussion paper *Considerations for simple and effective approaches to ESM*, OECD ESM Workshop, Cancun, Mexico, October ,1999.
[147] For analysis see the *Study on Hazardous Waste Management and the Establishment of an Information Resource Centre - Final Report.* World Bank Project "SEPA Capacity Building", December 1995.
[148] See conference paper by Terada : "*EMS Trainers in Japan*", presented at International Conference on ISO 14000 and Sustainable Development, Beijing, November 1996.

Brundtland commission has already established the basis for action several years before Rio.[149]

Clause 20.21.

What is the adoption process for a country that has been identified as incapable of doing it? Organisations such as NTTTC in China, have adopted the co-ordinating strategy but are unable to establish a management programme that reflects the strategy involved.[150]

The questions that emanate from this clause are; research into what and by whom and for whom and by what management process? As policy, this clause is sensible but as a management "model" it is inadequate.

Clause 20.22.

For the large Asian economies this is a formidable task. China alone has hundreds of millions on tonnes of hazardous waste. For it to be tabulated will take years.[151] Very few industry organisations or other countries are willing to involve themselves at the level suggested by this clause.[152] For some Asian countries, this is an impossible task.

Clause 20.23.

Clause 20.24.

This has not been achieved in New Zealand. Only recently has the Ministry for the Environment attempted to put this policy into action.[153] For Asian economies of large scale this is a big ask and one that is difficult to visualise, never mind implement.

Clause 20.25.

Clause 20.26.

This has been in place for years but major difficulties exist in translation to Asian

[149] See Brundtland Commission report *Our Common Future*

[150] See conference proceedings, NTTTC Conference Beijing, June 1996.

[151] See country reports of imports and exports contained in *World Resources Report 1990-91* p.325. cf UNEP FOA Inventory Systems manuals for waste pesticide stocks.

[152] For discussion on hazardous wastes in developing countries and the problems of inventory see workshop report from the OECD POP's workshop, Washington September, 2000.

[153] See MFE Hazardous Waste Policy Document, Wellington New Zealand,2000.

countries, and the real problem is the quality of the documentation and training systems for such handling technologies. Generally, the documentation is based on what you must do, not how oe why you must do it.[154]

Clause 20.27,28,29,30,31
Where is the management model for this? The UNIDO Organisation in Japan has the capacity to provide these services but are under-utilised by other Asian economies. Regional centres are available now, and 'out of region' centres for years, but the requirement here is to treat one's own, local countries are loath to establish a regional centre in their country and then accept hazardous waste from another. The provisions of these clauses is no guarantee that hazardous waste will be managed in an "environmentally sound manner" and, also tend to be policy driven and not implementation driven.

Clause 20.34
Clearly, there is a desire within the policies of the Rio declaration that governments develop environmentally sound management (ESM) policies and subsequent practices. As the primacy of part (f) of the clause would indicate, the development of ESM strategies should occur prior to classification, it is surprising that the Basel Convention secretariat chose to reverse the order and develop classification systems first. This has meant that the work to develop environmentally sound management of hazardous wastes has been delayed for several years. Only in July of 2001 has the Technical Working Group met to discuss ESM of hazardous wastes, in particular persistent organic pollutants (POPs).[155]

Clause 20.35.
Since Rio, only 5 countries have been added as parties to the Basel Convention.

Clause 20.38

> "(a) Elaborate or adopt policies for the environmentally sound management of hazardous wastes, taking into account existing

[154] See Countries report. UNEP Basel Convention Conference, Tsinghau University, Beijing,(1996)
[155] Technical Working Group 18, UNEP meeting report, Geneva, July 2001.

international instruments;"

In this clause there is a demand for environmentally sound management practices for the management of hazardous wastes. It is accepted that the Rio declaration is a non binding policy document, but there are many areas where the document attempts to formally tell nations what they must do and the targets expected. Despite the wording in the document, there is no attempt, however, to provide any management techniques or models that detail how nations are to achieve these objectives. Many nations simply do not have the infrastructure or the management skills to achieve the overall objectives of Chapter 20. There is no methodology inherent in this document as to the making of the structures requires to achieve these objectives.

As with many Conventions and global documents, Chapter 20 suffers from generalisation and the lack of specific direction. Management control is required for the achieving of these objectives and a carefully planned model is required to pull it off, none of which is residing within this document. The real problem that exists with Chapter 20, is that it is often accepted by some Asian countries as the actual management model that they must apply. What they appear not understand is that the provisions of the chapter are merely a guide to establishing a management structure and the guide does not include a road map of how to "do" the establishment. Because of its application as a management model, which does not have the required systems translation and subsequent infrastructure the overall effect is vague. This lack of a road map is the primary reason for the many out of compliance situations that are prevalent with hazardous waste projects in Asia. The Rio declaration does, however, point to the need to have environmentally sound management of hazardous wastes as a proactive mechanism that must be developed.

Weston International

Weston International is a US corporation involved in environmental management and consulting services and is involved with several Asian countries in providing project management for hazardous waste projects. In meetings with Dr Jing-Yea Yang (Vice President) in Taiwan during December 1996, discussions were held regarding management models and sustainable development. The analysis below is a summary of many hours of meetings and seminars held by the author with Dr Yea.

Dr Yea said that companies today are facing different and more complex environmental challenges than in any other period of history; challenges that affect every part of the enterprise and every decision that is made. In the past, the environmental challenges focused on compliance with specific regulations, e.g., laws that limit the amount of pollutants released into rivers and other waters of a country. These regulations will continue to be important; however, we are also seeing increased environmental pressures from cost containment, supplier/customer collaborator, international market dynamics, technology enhancements, and stakeholders (versus only resolutions) expectations. Additionally, international concerns with climate change and ozone depletion is illustrative of an environmental issue that transcends local or site-specific concerns and is one all companies, regardless of where they are located, can influence.

Stakeholders now include government, industry, citizens, investors, and international organisations. Those companies, according to Dr Yea, that integrate sustainable development into all aspects of their corporate operations will be winners. This illustrates the importance of integrating environmental improvement systems, strategies, and practices into the day-to-day decisions relevant to the operations of a company, including the design manufacture, distribution, use and ultimate disposal of products and services produced. The overall goal is to ensure that the company continues to grow and is prosperous over the long term, while respecting the environment and conserving human and natural resources. "For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the company and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future".

While many groups may argue whether the integration of environmental performance measures increases or decreases the competitive position of a company, the fundamental premise is that a company that can successfully accomplish this integration will have a long-term global competitive advantage. The Asia-Pacific region is uniquely positioned because of the commitment of the people, government, and industry to work together to integrate environmental protection with economic development. This commitment is greater than in many other regions of the world. The sustainable development approach incorporates life-cycle thinking (environment) and ISO 14000 (environment and economics). It goes one additional step to incorporate community, regional, and global issues (social).[156]

Recent surveys have suggested that organisations can make a decision as to whether, and to what degree, they want to be "green". (It is often clear that they must comply with environmental regulations in the country and location which they operate). The question that is more difficult to answer is, at what level should an organisation proceed beyond environmental compliance? Weston International has created five levels of environmental performance. These levels integrate environmental, economic, and social issues with business objectives to create a logical path for beyond compliance performance. The ultimate performance level is sustainability.

Once a strategy is selected, a framework for execution can be developed. An organisation's management can be divided into three general categories: overall management systems, product management, and operations management. Overall management systems include sustainability management. Product management includes systems such as design for the environment (DFE). Operations management includes both facility and remediation management systems. The product and operations orientation is consistent with the ISO EMS (Environmental Management System) systems, which focus on both of these elements. The tools that are required within an organisation, and where these tools apply, are dependent on which strategy is chosen.

Once the strategy is determined, an EMS is developed to maximise an organisations effectiveness in dealing with environmental matters. An EMS consists of

[156] See conference paper, Duan WENG, "*Life Cycle Assessment and Sustainable Development of Materials.*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

management commitment, policies and planning, implementation programmes, monitoring and measurement and management reviews. An EMS is then integrated across all relevant functions within a company, including: financial/accounting, engineering, manufacturing, human resources, purchasing, sales/marketing, and information management.

For each of these functions, decisions are made regularly that have some level of impact on minimising pollution, managing waste, energy efficiency, product safety (from human and environmental perspectives), employee welfare, risk management, and community relations. According to Dr Yea the only efficient method of integrating sustainable development decision criteria into all functions within a company is through a systematic and incremental process. An organisation must provide information, training, processes, and support systems that allow employees to make better decisions and take better action. Dr Yea's approach recognises the levels that the company moves through in order to achieve the ultimate goal of sustainability. Asked for his view on the ultimate corporate goal Dr Yea indicated that sustainable management was the only ultimate goal that is valid for any company.

As a company moves up in levels from compliant to sustained, the management systems elements change from environment only to environment, economic, and social combined. This is obviously most important for a management model application and tools necessary to comply with regulations, both at the facility and in remediation activities. Comprehensive environmental management systems and the design for environment systems and tools would not be necessary. The strategy drives the systems and tools needed.

If, on the other hand, an organisation has selected a market driven strategy, then additional systems and tools would be needed. A market driven strategy indicates that an organisation is responding to the needs of its customers (i.e., business-to-business drivers). The first system required would be an ESM to ensure that beyond compliance, environmental health and safety (EHS) aspects are appropriately defined and included. ISO 14001. Again the adherence to the idea that the qualifying system is ISO 14000. Dr Yea supports the idea that beyond compliance is best served by the ISO 14001 standard and provides one approach that has been developed and accepted worldwide. Additionally, systems and tools in product design (e.g., Life cycle thinking) and pollution prevention would be implemented. Most multinational companies are striving to implement a market-driven strategy today.

A sustained strategy focuses on integrating environmental, economic, and social principles by integrating tools such as full-cost accounting, stakeholder valuation analysis, life cycle assessment, and liability management. With a sustained strategy, the organisation effectively and efficiently optimises environmental, economic, and social aspects to identify and implement trends that will deliver prosperity over the long term.

Can integration be the end game for sustainable management and does all strategy therefore by definition come from this integration? Dr Yea says, "yes!". This strategy is not just an academic discussion that will not be considered by companies. It has been estimated that more that 50 companies (e.g., AMP, Honeywell, 3M, IBM, GE, Nippon Electric, and Volvo) have already publicly embraced sustainable development. These companies represent industrial sectors ranging from automotive, electronics, consumer, chemical, durable goods, and pulp and paper, to name a few.

Several examples demonstrate the application of sustainable development principles to decision making processes.

- It can be used in strategic planning. Rohm & Haas[157] developed a screening tool to evaluate the relative vulnerabilities of its products and compare those measures with the products' competitive advantage. Using the screening tool, the company was able to identify areas where additional changes would improve its environmental performance and reduce its vulnerabilities.

- To identify the life-cycle stages where the greatest burdens occur.

[157] See Fava et al. (1991).

> Pollution is often associated with a company's manufacturing operations, however, when one examines the percent contribution of life-cycle stages to total environmental burdens, one sees that it is the use stage, for many durable goods, where the greatest burdens occur.

According to Weston International, application of sustainable development principles results in revenue generation and competitive advantage. It is this optimisation among economic, environmental, and social considerations that provides opportunities for long term prosperity and revenue generation, which is why sustainable development does make good business sense.

Dr Yea's grand plan of all management strategy having its ultimate goal sustainability is a high risk gamble that all strategy has reached the end game. His integration of sustainable management into strategy at the exclusion of all else is ambitious, but adoption of the regime from a top down perspective is perhaps, unrealistic. However the model proposed by Dr Yea is worthwhile and its idea of integration could be utilised by the management model for hazardous waste management. There is some logic in looking at the third dimension of the model being some measure of sustainability or perhaps integration.

The International Institute of Sustainable Development (IISD)

The International Institute of Sustainable Management[158] is a non profit organisation based in Canada. It is very active in promoting sustainable development and management and has a very influential role with the UNEP. IISD staff regularly speak at environmental conferences and have an extensive range of documentation to assist nations manage their environment in a sound and sustainable manner.[159] The IISD is very active in promoting the theory of sustainable management around the world and its office in Canada produces very high quality documentation for companies and governments on the application of sustainable management. The information from IISD below, concentrates on the importance of the ISO 14001 model in its application as a management model and many of the comments follow on from the model by Dr Yea of Weston

[158] IISD, International Institute of Sustainable Management, Manitoba, Canada.
[159] See Conference paper, Conway. T, "*ISO 14000 Environmental Management and Sustainable Development*", Beijing, China, November 1996

International. Dr Yea's model was based on the idea of sustainable management being the ultimate objective of a strategy of integration, of which one element was ISO 14001 certification. Much of the material here was either presented by Stephan Barg of IISD or obtained from personal interviews with him.

Given the low numbers of Chinese companies certified to ISO 9001, one could be cautious in suggesting that the industry in general, in Asia, would adopt the ISO 14001 standard as a EMS model.[160] IISD, however, suggests that while the Chinese Government may not necessarily adopt the standard through regulation it will adopt the standard by association with style. This has ramifications for management models. If the ISO 14001 is to be a standard, by whatever means, in Asia, then management models will require incorporation of the same. Dr Yea's assertion is that the ISO 14001 is a prerequisite for integration, while IISD is saying that it is inevitable anyway.

With few exceptions, country delegations to TC 207[161] meetings have been dominated by industry from OECD countries, including some government officials, and only rarely involving public interest groups.[162] Consensus decision making has encouraged the ISO to avoid controversy and has tended to reinforce the relative homogeneity of participating groups. However, growing public recognition of the importance of ISO 14000 is contributing to pressure to diversify participation at the ISO. Countries and groups that have previously played a low key role or not participated at the ISO, are increasing their awareness and involvement.[163]

The Standards Committees (SCs) and Working Groups (WGs) of TC 207 are typically chaired by executives of large firms and transnational corporations headquartered in developed countries, such as KPMG Environmental Consulting, Merck and Company, Bayer, Du Pont and Scott Paper.[164] Representatives from developing countries generally participate far less because they often lack the

[160] For discussion on participation see conference paper, Liu-Jinsheng, "*Implementing ISO 14000 in China*", International Conference on ISO 14000 - Environmental Management and Sustainable Development, Beijing, China, November 1996.
[161] TC 207 is the ISO Technical Committee.
[162] For involvement analysis see Nash and Ehrenfeld, 1996.
[163] Knight and Wolfe (1995) state that more than 21 developing countries were represented at the TC 207 third annual plenary meeting but that most developing countries do not have a participatory membership and thus voting rights as they are unable to afford the costs involved in being a participatory member.
[164] See lists of leadership by Corporates as described by the European Environmental Bureau, 1995.

resources to devote to ISO activities or are not entirely aware of the relevance of ISO's work. China, for its part, appears to have become aware of the significance of the ISO's work only recently and is moving to increase its role in the international process and in domestic adoption of the standards.[165]

Public interest groups have been invited to meetings under TC207, but they typically lack the resources to attend meetings and follow proceedings consistently. As a result, large industry from developed countries has generally dominated much of the ISO TC207 process. For example, approximately 400 representatives of industry from the United States alone have actively participated in the development of ISO 14000 standards, whereas only 20 government and public interest groups have participated. The US delegation to the TC 207 meetings held in Oslo, Norway June 26 to July 1, 1995 involved approximately 120 people.[166] It is fair to say that the Chinese delegation has taken a much lower profile at TC 207 meetings. Similar participation patterns were witnessed at the TC 207 meeting held in Rio in June, 1996, although China had a more active delegation at those meetings.

These patterns of participation indicate the areas where ISO 14000 standards are expected to have their greatest benefits and potential impacts for businesses that compete in international markets. This is probably the best test of what sectors in China will benefit most from watching closely and participating in ISO 14000.

While the ISO 14001 EMS standard has largely been set, ISO discussions are ongoing regarding the more product oriented standards on life-cycle assessment, environmental labelling, and environmental aspects of product standards. As a result, China has an excellent opportunity to be actively involved.

There is growing experience internationally that systematic approaches to improve corporate environmental performance (increasing efficiency, reducing resource use and minimising wastes and polluting emissions) can improve government relations and public image in the market, reduce costs and expand market opportunities. However, because ISO 14001 does not establish performance standards on its own, the amount of environmental performance improvements will depend on the strength of a company's environmental policy and the domestic environmental policy regime.

[165] See Conference paper, Zhu Xing Xiang, "*The relationship between ISO 14000 and China's current Environmental Management System*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.
[166] See attendance listing for TC 207 meeting, Oslo, Norway, 1995.

The EMS standard is intended to help an organisation to:[167]

a) establish an environmental policy appropriate to itself;

b) identify the environmental aspects arising from the organisations past, existing or planned activities, products or services, to determine the environmental impacts of significance;

c) identify the relevant legislative and regulatory requirements;

d) identify priorities and set appropriate environmental objectives and targets;

e) establish a structure and programme(s) to implement the policy and achieve objectives and targets;

f) facilitate planning control, monitoring, corrective action, auditing and review activities to ensure both that the policy is complied with and that the environmental management system remains appropriate; and

g) be capable of adapting to changing circumstances.

ISO 14001 assigns great importance to senior management to provide leadership in defining the organisations environmental policy.[168] An environmental policy is essential for an EMS because the ISO 14001 standard does not establish environmental performance objectives and targets for the organisation (i.e. does not require that the organisation comply with a specified level of environmental performance that is not its own). Rather, the requirements of ISO 14001 are quite flexible requiring that an organisation:

- "consider" environmental impact when setting objectives and targets;
- commit to "continuous improvement" of environmental performance and pollution prevention (however defined); and

[167] See section A.4.0 in the draft standard ISO 14000.
[168] See Hunt & Johnson (1995). p. 69.

- comply with applicable legislative and regulatory requirements in the jurisdiction where the facility is located (if such requirements exist).

This flexibility is a necessary feature of ISO 14001, because of the wide range of companies that will want to participate in ISO 14001 who have different environmental and economic conditions.[169] It also allows organisations and countries to set environmental performance objectives and targets suitable to their needs. Finally, it avoids the trade implications of dictating specific environmental performance requirements across national boundaries in an extra territorial fashion.[170]

However, the flexibility of ISO 14001 means that environmental performance objectives and targets may not receive attention unless they are:

- "imported" into the EMS through the organisation's environmental policy; and/or

- supported by the existence of a domestic environmental policy and regulatory regime that establishes relevant environmental performance requirements and sets benchmarks for continuous improvement.

For this reason, ISO 14001 itself does not ensure environmental protection and sustainable patterns of development. However, in those instances where organisations are starting with negligible environmental awareness and no systems for addressing environmental issues, instituting an ISO 14001 programme is bound to be a significant step towards improving environmental performance.[171] This is true, even though a lot of work may need to be done to improve the environmental policies of organisations and the domestic environmental policy and regulatory regime.

Employee education and training is another key element of an EMS under ISO

---

[169] See Conference paper, Zhu Xing Xiang, "*The relationship between ISO 14000 and China's current Environmental Management System*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.
[170] Note that since this material on ISO 14000 was collected there has been a passing of time. However reference to the ISO web site in 2003 clearly shows that the adoption of the ISO 14000 standard has not reached a significant level. Total registrations in China as at 31 December 2002 was less that 150 and that of the US less than 350.
[171] ibid.

14001. Organisations are required to ensure that all personnel, whose work may create a significant impact upon the environment, are properly informed about the environmental significance of their work. Personnel must also be made aware of the importance of compliance with policies, procedures, and requirements of the EMS, their responsibilities under the EMS, and the potential impacts of their actions. ISO 14000 does not specify any requirements for rewards or penalties for worker performance, but simply states that employees will be made aware of the potential consequence of departures from specified operating procedures.

All organisations must perform self-auditing periodically in order to determine whether the environmental management system conforms to the ISO 14001 standard and to determine whether it is being properly implemented and maintained.[172] Organisations registered to ISO 14001 must have their compliance with the standard verified by a third party, registered with an accrediting agency.

Organisations can either be "registered" under ISO 14001, or "self-declare" their participation. Registered organisations will have third party verification that they have developed, documented, and are following an EMS according to the ISO 14001 standard. Most companies will seek to become registered to ISO 14000 by application to a "registrar". Once an application is filed, the registrar will perform a conformity assessment evaluating an applicant's EMS system against the ISO 14001 criteria. Registration can take from six months to a year, and once granted, will last for three years.

Each country adopting ISO 14000, is allowed to develop its own scheme for accreditation of registrars, certifiers and approval of training programs offered to auditors seeking certification. The accrediting body can be a governmental or non-governmental organisation. This approach has initiated a potential trade irritant that can arise from schemes that do not provide for domestic verification procedures or imply foreign verification of compliance with a voluntary standard, an issue that has garnered considerable attention in debates about eco-labeling schemes.

Many countries world-wide worked quickly to develop ISO 14000 accreditation and certification systems.[173] European countries, in particular, adopted the standard quickly as they had more experience with EMS standards developed by

[172] See Hunt & Johnson (1995). p. 210.
[173] Ibid.,p. 25 et seq.

the British Standards Institute (BS7750) and the EU's EMAS. Many European businesses registered their facilities under EMAS or BS 7750. Although similar to ISO 14001, both EMAS and BS 7750 are more stringent than ISO 14001. EMAS, in particular, is more prescriptive with a stronger emphasis on public reporting of environmental performance data.

The differences between ISO 14001 and EMAS requirements will likely become blurred over time.[174] There are three reasons for this. First, governments and corporations purchasing products and services from overseas suppliers will increasingly require that suppliers report on environmental performance because they need to respond to public pressures to show how they are minimising life-cycle environmental impacts downstream and up-stream of their facilities. Second, research conducted in OECD countries indicates that voluntary approaches are far more likely to be successful at achieving environmental performance objectives if they have clear environmental policy objectives and benchmarks, and public reporting requirements. Most OECD governments will undoubtedly be attempting to move voluntary approaches in this direction over time. Third, companies themselves will begin competing for the environmentally sensitive consumer through increasingly lofty reporting efforts that show how they are "greener" than the competitor. In time, therefore, public reporting on environmental performance may become a de facto requirement in important global export markets. China will need to monitor these pressures for stricter standards in the event that they begin to take hold.

Notable initiatives in North and South America and Asia to prepare for ISO 14001 include:

Two organisations in the US, the Registrar Accreditation Board (RAB) and the American National Standards Institute (ANSI), are preparing to share ISO accreditation responsibilities. The Standards Council of Canada (SCC) began an accreditation program in the late 1990s. Also, the SCC is establishing accreditation for certification of EMS auditors and for organisations that will provide training courses.

- Mexico's participation in TC 207 is coordinated by the Mexican Institute of Standardisation and Certification (IMNC). IMNC intends to establish a national certification system for 150 14001. It is

[174] See Willig (1995). p. 98.

expected that Mexico will follow the route it took for ISO 9000 certification, which would mean that IMNC would develop and publish environmental management-related Mexican standards that would closely resemble the ISO 14000 standards.

- Brazil has started to develop its national system for accreditation. The National Commission on Meteorology and technical advisory groups have established a working group, which is defining criteria for certification and accreditation.

- Venezuela has not yet decided how to handle accreditation and certification, however, the National Standards Institute (COVENIN) has established a subcommittee which, in a scheme very similar to 150 14000, is developing environmental standards for EMS, auditing, labelling, and life-cycle assessment.

- The Japan Audit and Certification Organisation is certified as a BS 7750 verifier and will also grant ISO 14000 certification once the standards are final and the Japanese Industrial Standards for environmental management are ready.

- By 2001 , Hong Kong completed a 14 month pilot EMS/ISO 14000 programme for companies interested in developing environmental management systems. In addition, the British Standards Institute, along with Inchcape Testing Services has created BSI Pacific, which provides training and certification services for ISO 14000. BSI Pacific has offices in Hong Kong and Taipei and is focusing its initial efforts on China, Taiwan, and Hong Kong.

- In Taiwan, the Bureau of Commodity Inspection and Quarantine (BCIQ) is interested in managing ISO 14000 accreditation and certification. This coming July a Body of Accreditation and Certification will be established. Its responsibilities will include ISO 14000 registration, ISO 9000 registration, auditor training courses and the registration of auditors.[175]

---

[175] Activity in these countries was reported by IISD at the Beijing ISO conference in 1996.

China's work on ISO 14000 is also proceeding in anticipation of the official release of ISO 14001. An ISO 14000 auditing centre was established under the National Environmental Protection Agency in the late 1990s. The centre plans to organise ISO 14000 training programs nationwide, and will probably serve as the certification agency for ISO 14000. Work has also been undertaken in Xiaman in the Fujian Province on the implementation of ISO 14000, according to a report on an ISO 14000 seminar held in Xiamen. About 20 environmental auditors from Tianjin have recently been trained in the EU-Singapore Regional Institute of Environmental Science and Technology, and will form the main force for ISO 14000 auditing.

There are unresolved questions about how viable it will be for developing countries, and small and medium size companies, to participate in ISO 14001. Registration fees for ISO 9000, a similar management system standard targeted at quality assurance, range between $25,000 and $100,000 for companies with between 50 and 1,500 employees, plus consultants' fees from $5,000 to $25,000, and the cost of staff time. Similar costs are likely to be incurred for ISO 14001.21 Substantial maintenance costs can also be expected given that registration to ISO 14001 must be renewed every 3 years.

ISO 14001 costs will often decrease on a per employee basis for large companies indicating that they will have a cost advantage over small and medium size companies. However, the number of employees is not the only indicator of costs. It is also likely that costs will be higher for companies that generally have more environmental issues to address, such as chemical plants, and companies that do not have experience with environmental or quality assurance management systems. For example, companies that have ISO 9000 registration could enjoy significant cost advantages.

Some concerns have been expressed that many small and medium size companies will find it difficult to assume the costs of ISO 14001. This is especially the case for those companies with large numbers of environmental issues to address and limited experience with rigourous management systems. Small and medium size firms in developing countries, in particular, fall into this category in disproportionate numbers and are the companies that often have the greatest impacts on human health and the environment within or close to communities.

If small and medium size companies are not able, or decide not to, participate in

ISO 14001 there will be a significant lost opportunity to improve their environmental performance and the performance of the economy as a whole. ISO 14001 would act to move these companies from a very low level of environmental awareness and management. In short, the incremental environmental performance improvements from ISO 14001 will likely be much higher for small and medium size companies than for large companies that already manage environmental issues and have management systems in place.

Another option that these companies might take is to lower their costs by 'self declaring' participation in ISO 14001 rather than becoming ISO 14001 "registered". This option may have negative consequences for market access if ISO 14001 becomes an important requirement for access to their markets or any future markets in the case of emerging sectors. China will need to acknowledge that many of its most severe environmental problems occur in small and medium size companies. Actions will need to be devised to bring these smaller companies along.

The ISO 14001 standard can be an important tool in China's environmental management regime. It can improve compliance with domestic environmental laws and policies and help Chinese export industries deal with environmental challenges in foreign markets. Environmental regimes and economic performance are critical because the environment increasingly influences competitiveness in important export markets.

Asian economies have experienced rapid economic growth in recent years. For example, between 1980 and 2002, annual growth in gross domestic product averaged more than 8% in China, South Korea, and Thailand, while the economies of Hong Kong Indonesia, Malaysia, and Singapore grew 5.5 to 8% per year. However, significant environmental degradation has accompanied this economic growth.[176] Environmental degradation will be an increasing problem for Asian countries and developing countries in other parts of the world.[177]

In recent years, China has attached increasing importance to the development and implementation of environmental legislation to address environmental problems.

---

[176] See opening speech remarks, Yin Gai, deputy General of Science, Technology and Standard Department, National Environment protection Agency, China at International conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

[177] Remarks from the opening address by David Runnalls, Co-Chair of the Trade and Environment Working group of the China Council for International Cooperation on Environment and Development at International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

China's laws are relatively comprehensive ranging from the basic environmental protection law to laws and regulations covering various aspects of the environment, including the marine environment, water, air, solid wastes, land, forests, grasslands, water, mineral resources, fisheries, and wildlife.

China's domestic regime is comprised of the so-called "eight systems" consisting of the "three old systems" (environmental impact assessment, pollutant discharge fees, and the three synchronisations), and the "five new systems" (a discharge permit system, the environmental responsibility system, an annual assessment of environmental quality in cities, limited time treatment, and centralised pollution control). The eight systems are implemented in conjunction with environmental quality and emission standards. The implementation systems and environmental standards rely heavily on direct government regulation, often making them prohibitive to actually enforce. Negotiation and dispute settlement processes figure far more prominently than the courts in resolving regulatory disputes.

Many developing countries lack environmental laws, have poorly crafted laws, and lack institutional capacity to enforce the laws. In countries where the domestic environmental protection regime is not developed, ISO 14001 appears, albeit incorrectly, to provide a complete solution on its own. First, the EMS standard holds out the promise that companies will come up with their own methods for protecting the environment. Second, the standard seems to suggest that over-committed government officials need not be directly involved since independent auditors will do most of the monitoring. However, as noted above, ISO 14001 itself does not stipulate environmental performance requirements. Rather, ISO 14001 must be linked with performance requirements in the form of an organisation environmental policy and/or domestic government laws and policies.

Many observers have only recently begun to consider the significance of international standards for domestic environmental law and policy. Implications for China's domestic environmental law and policy arising from the ISO 14001 standard mainly stem from the fact that the standard requires that companies comply with current environmental policies and regulations that apply to their industry. Countries are looking for ways to move away from traditional forms of environmental regulation that can be inflexible and costly towards voluntary frameworks with supportive regulation that reward innovation and foster continuous improvement. Much of this movement reflects new thinking about how to enhance environmental performance, but also accommodates industry's concerns about competitiveness in a global economy.[178]

ISO 14000 might affect Chinese domestic environmental law and policy in a number of ways. The legal authority for the development of ISO 14000 comes from the International Standards Organisation. As such, it will not necessarily be a formal part of Chinese law. However, regulators throughout the world can be expected to encourage ISO 14000 registration both for trade considerations and because of evidence that the adoption of environmental management systems can improve environmental performance, decrease the probability of an environmental incident, and improve a company's ability to respond to an accident.[179]

It is also conceivable that ISO 14001 could have a more direct legal impact. It might be possible, for example, for the Chinese government to develop regulations that incorporate ISO 14001 standards by reference. Even if they do not directly refer to ISO 14001, it is also possible that Chinese authorities will develop regulations in some areas which are heavily influenced by the ISO emphasis on management systems and reporting, rather than by developing more traditional command and control style regulations.

If registration becomes widespread, it is also foreseeable that the Chinese government could rely on ISO 14001 to interpret both statutory and non statutory duties of environmental care.

State Environmental Protection Agency (SEPA) China

In order to analyse how China "manages" its hazardous waste problems and to gain an insight into what might pass as a model that Chinese companies might use, several discussions and interviews with various Chinese SEPA officials were conducted. One person in particular had a very good understanding on the use of ISO 14001 in China and how it might effect corporations in their management plans. The discussion below is a result of interviews and statements made by Dr Ye Ruqiu, a senior environmental policy manager of SEPA, as well as attendance at

---

[178] See conference paper, Mr Cao Fengzhong Policy Research centre of Environment and Economy, *"ISO 14000 and the Green Trade Barrier."*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

[179] See conference paper,Tom Conway International institute for Sustainable development, canada, *"ISO 14000 Standards and China: The Trade and Sustainable Development."*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

the ISO 14001 conference in Beijing in 1996.[180]

With social and economic development, living standards in China have been improving steadily. However, the improper mode of development and the irrational use of resources have resulted in numerous environmental problems.[181] Depletion of natural resources and the continuing deterioration of the environment worsen the living conditions. "The ISO standards for environmental management (ISO 14000 Series) are the summary of the efforts of the International Organisation for Standardisation for the improvement of environmental management of different kinds of organisations and will play an important role in solving global environmental problems".

China is a developing country faced with the dual task of economic development and environmental protection. Environmental protection is considered an important strategy for attaining sustainable development of the country. The integration of EMS with sustainable management is a far sighted policy given the current state of environmental protection practices in China. When asked the question, "Did Mr Ye think that China could or should have a management plan based on integration, given the difficulty of educating China's enterprises?", he replied that he felt that the concept was valid in the international context but that the idea of integration would be very hard to achieve in China and this is where they have problems providing a plan that is simple to comply with. He also confirmed that he was unaware of any models or tactical plans that were in use within China's industry.

To carry out the policy of putting prevention first, the principle of simultaneous planning, implementation, and development of economic construction, urban and rural construction, and environmental protection was worked out. In recent years, unremitting efforts were made by the Chinese government in the field of environmental protection. At the same time, China participates actively in international co-operation to deal with global environmental problems and in

[180] Dr Ye Ruqiu is the Deputy Administrator of SEPA and Co-Chair of Trade and Environment Working Group of the China Council for International Cooperation on Environment and Development.

[181] For a discussion on the impact of growth on the environment in China see conference paper, Chen and Zhang, *New Environmental Management Standard to meet Economic Development*, Chinese Research Academy of Environmental Sciences, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

negotiation of multilateral environmental agreements".[182]

a. In 1991, China hosted the ministerial Meeting of Developing Countries on Environment and Development as a contribution to the preparation for the 1992 UN Conference on Environment and Development.

b. In June 1992, the Chinese Premier Li Peng put forward five points on international environmental co-operation at the UN Conference on Environment and Development.

c. After the UN Conference on Environment and Development, the Chinese government approved the Ten Policy Measures for Environment and Development and China's Agenda 21.

d. China has taken an active part in negotiations on international environmental agreements. So far, China has ratified the UN Framework Convention on Climate Change, the Biodiversity Convention, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Montreal Protocol on Substances That Deplete the Ozone Layer, and a number of other international environmental agreements.

e. In 1966, the 4th National Conference on Environmental Protection was held, which set the goals for environmental protection for the next five years and the year up to 2010. The decision on some issues of environmental protection was issued by the State Council, which stipulates that all industrial enterprises should meet the discharge standards set by the central and provincial governments by the year 2000. The Ninth Five Year Plan and Long Term Programme for 2010 for Environmental Protection was approved later, also by the State Council with two important attachments; the Plan for the Control of

[182] See conference paper, Dr Liu Shuqin, Law Department peking University, China, "*Impacts of Environmental Legislation and Environmental Management System on Industries Environmental Protection Behaviours*"., International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

Total Amount of Pollutants Discharge and the Transcentury Green Engineering Project Plan.

According to Mr Ye, "The effective solution of the global problems of environment and development, international co-operation is needed. The promulgation of the ISO 14000 Series is helpful in this respect through the standardisation of environmental management". Mr Ye was asked to explain why China needed international help to apply ISO 14001 when it was a simple EMS structure that could easily be applied by anyone. He replied by indicating that unless international organisations helped China to gain credibility the application of ISO 14001 would never occur within China. "The basic elements of the ISO standards are in line with China's sustainable development strategy and environmental policy of putting prevention first and combining prevention with control of pollution". This statement by Mr Ye at least provides an understanding that he does not see that ISO 14001 is a complete management plan in itself. He admitted however, during an interview, that many organisations in China and sections of Government believe that the standard can stand by itself without any further system additions.

Mr Ye confirmed that only the structure of ISO 14001 would be promoted as a global EMS within China and it would be up to industry to establish how the ISO 14001 EMS model would be applied. He knew of no applications systems that would be available. He stated that as each industry sector was different from all others that it would not be possible to establish a model structure that could be termed global in its application.

China takes an active attitude to the implementation of the ISO 14000 standard series and ISO14001, ISO14004, ISO14010, ISO14011, and ISO14012 standards of the series have been translated into Chinese. Moreover, the training materials for certifiers of environmental management systems approved by the British Registration Committee for Environmental Certifiers and the training materials for environmental management auditing edited by UNEP, ICC, and the International Consultation Engineers' Association have been also translated. Pilot activities in the implementation of ISO 14000 series have been carried out in Beijing, Shanghai, Tianjin, Nanjing, Guangzhou, Shenzhen and Liaoning province, and the General

Logistic Department of PLA, including 5 training courses for environmental certifiers and 4 training courses for environmental auditors from enterprises. These activities have caused great interest among governmental departments and enterprises in the country. For the effective implementation of ISO14000 series, the relevant laws, rules and measures for environmental management of the country, as well as the economic, technical and management conditions of the enterprises should be taken into account. In general, the solution to environmental problems of a country requires a clear fit with the specific conditions of that country.[183]

The ISO 14000 series of environmental management standards aims to standardise the environmental performance of enterprises and to reduce the environmental impacts caused by their production and service activities.[184] It also sets targets for saving resources, improving environmental quality, and promoting coordinated development of economy and environmental protection. When challenged on this point, Mr Ye admitted that the ISO standard could not be used in this fashion by itself. Industries need to use the ISO as a tool to produce specific EMS programmes and as such a standardised methodology does not apply. The implementation of the ISO 14000 series will help enterprises to improve their environmental performance and to integrate environmental protection into all management activities.

Mr Ye confirmed a previous comment that he had no idea how it would be possible for Chinese industry to integrate environmental performance into their strategic planning. He said that it should, and indeed, must happen but was not aware of how it could happen. He said "It will stimulate enterprises to change the mode of economic growth from extensive to intensive one. In the end, the ISO 14000 series will play an important role in improving the environmental quality and promoting sustainable development of the country". Mr Ye indicated that the real challenge for China is, the implementation of ISO 14001. The effect that is desired is an easy policy to establish, the actual application is much more difficult to apply if the ISO 14001 standard is to be used as a model.

[183]Conference opening remarks by Mr Yin Gai Director General of Science, Technology and Standard Development, National Environmental Protection Agency, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.
[184] See ISO 14001 Standard, Section 4.

The ISO 14000 series is a set of management standards, which are different from ordinary technical standards. There is no absolute target, but there is requirement of applying the best management experiences to the environmental management of the enterprises to realise the goal of pollution prevention and environmental protection in most effective ways. The ISO14000 series complements the environmental management system of China and might promote more effective environmental management in China.[185]

Here Mr Ye is much more realistic, and has begun to understand the difficulties involved. The words, "might promote", give warning of the real pitfalls in using this standard as an all embracing EMS standard across diverse industry. Mr Ye states further, "The implementation of the ISO 14000 series might help China to enhance the scientific level of its environmental management and make it more effective and operational and will certainly promote further the progress of the cleaner production in China. It may also be helpful in standardisation of the environmental management and make the management practices more internationally compatible". Again the model is getting bad press. Mr Ye is using words that indicate that he cannot see how the model will be applied and that its effects may be less that useful.

Mr Ye maintained that through the 23 years since 1973, a relatively comprehensive environmental administrative system has been set up including a series of laws, regulations, rules and standards and stated:

a. Up to now, five environmental protection laws and eight resource related laws have been promulgated, including the Environmental Protection Law, the Air Pollution Prevention and Control Law, the Water Pollution Prevention and Control Law, the Marine Environment Protection Law, and the Law on the Prevention and Control of Solid Waste Pollution. In addition, there are more than thirty administrative rules and regulations, including the Provisional Regulations on

[185] See conference paper, Zheng Yanan, "*An Assessment of ISO 14000's Impact on China's Enterprises and Response of China's Industries.*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

Prevention and Control of Water Pollution in the Iluaihe River Basin, the Rules on Prevention and Control of Noise Pollution, the Rules on the Management of Nature Reserves and others.

b. Over three hundred national environmental standards concerning environmental quality and discharge of pollutants have been promulgated. Moreover, there is a large number of local environmental laws and regulations issued by provincial and municipal authorities.

c. A system of environmental management measures has been worked out comprising mainly eight measures, which are environmental impact assessment, simultaneous design, construction, and putting into operation of pollution control facilities with the main construction project, collection fees for pollutant discharge, setting deadline for pollution control, environmental target and responsibility, quantitative examination of comprehensive urban environmental performance, licence for pollutant discharge, centralised treatment of pollutant discharges.

In May 1994, the Certification Committee for Environmental Labelling Products was established in China. So far, technical criteria for eleven eco-labelled products have been worked out, including, for example, refrigerating products, which are CFC-free or use substitutes for CFC, phosphorus-free detergent products, water-based paints, and others. Some sixty products manufactured by thirty enterprises have been awarded the Environmental Label. Cleaner production projects supported by the World Bank, UNIDO and IE/UNEP have been conducted. Cleaner production auditing was carried out in a number of enterprises with results of significant energy and resource saving and reduction of waste and pollutants generation. Over fifty enterprises in three provinces and three cities took part in the cleaner production project in the pilot phase.[186]

The ISO 9000 series has been widely practised in China. About 1000 enterprises

[186] See conference paper, Raymond Ermen, "*From Environmental Management to Sustainable Development*"., International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

have passed or applied for the certification of 1S0 9000 series of standards. These enterprises have developed certain knowledge about the ISO standards certification procedure. It can be seen from the above mentioned, that necessary conditions for the implementation of ISO 14000 series of standards have been created in China.[187]

China has been following the development of ISO TC207. In 1995, the National Technical Committee for Standardisation of Environmental Management was established, which consists of fifty members from governmental departments. The goal of the committee is to coordinate the efforts in setting up and standardising environmental management systems of enterprises and to improve their environmental performance. The committee will keep contact with ISO TC207, follow the development of the ISO14000 series of standards and transform the standard series into Chinese national standards taking into account of the country's specific conditions.

To guide the enforcement of the ISO14000 series of standards, the Chinese government will set up the National Steering Committee for Certification of Environmental Management System.[188] The procedures for the certification of environmental management systems of enterprises and for the qualification of certifiers and certifying institutions for environmental management systems will be conducted in accordance with international practices. This will ensure the fairness and effectiveness of the certification of the environmental management systems of the enterprises.

For the technical support of the implementation of the ISO 14000 series, the State Environmental Protection Agency (SEPA) established the Centre for Environmental Management Auditing. The Centre has a group of experts and scholars who have engaged in environmental management for a long time. There are also a number of experts at the Centre who have experiences in conducting certification. It takes part in important meetings organised by ISOTC207 and has set up working

[187] See conference paper, Mr Xia You Fu & Mr Di Chang Xing *"ISO 14000, Cleaner Production, and the Development of China's International trade"*. , International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.
[188] See conference paper, Mr Husayn Anwar, ERM Environomics, *"Implementation of China's Environmental Management Polices: Objectives, realities and an Opportunity for Coorperative capability Development."*., International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

contacts with a number of international organisations including UNEP, IMO, BSI, IISD, EARA. A series of publication, training, and consultation activities related to ISO 14000 series have been also done by the Centre.

Pilot work on the certification of environmental management system is going on now in China.[189] The work involves over twenty enterprises of different types and sizes in different cities. It is expected that through pilot work, the methods and procedures for conducting certification of environmental management systems of enterprises can be worked out. Mr Ye States; "At present, many enterprises in China are operating with low level technologies, poor management and weak environmental awareness. This situation will not only have negative effects on the economic efficiency of the enterprises, but also hinder the implementation of the ISO 14000 standard series". Efforts in changing the mode of production and measures taken for strengthening environmental management will help to improve this situation. Again, Mr Ye understood the problems of application using a universal model, but does not allude to the solutions.

Differences exist between the current environmental management in China and the ISO environmental management system standards. The life cycle analysis of the ISO14000 series finds some reflection in the cleaner production practices and environmental labelling scheme in China's environmental management measures.[190] The requirements of control of concentration of pollutants discharged should be combined with total amount control which is more in line with ISO 14000 series requirements. It is important to harmonise the current environmental management system with the ISO 14000 environmental management system standards in a systematic way. The implementation of ISO14000 standard series is an inevitable development trend in the world and will promote the environmental management in China. There is still a long way to go for the successful implementation of the ISO 14000 standard series.

---

[189] See conference paper, Mr Zhu Xing Xiang , "*The relationship between ISO 14000 and China's current Environmental Management System.*", International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

[190] See conference paper, Mr Xia You Fu and Mr Di Chang Xing, China Institute of Environmental and Trade, University of International Business and Economics., "*ISO 14000, Cleaner Production, and the Development of China's International Trade.*" International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

Summary

Some thirty models, ideas and concepts were investigated during this phase of this thesis. Of these, only two models are considered to be of value, in respect to the emerging global environmentally sound management model as proposed by the three major conventions. The so called soft models of non industrial organisations did not provide integration of management systems with organisational strategies and did not offer integration with quality systems. Most models in use around the world for the management of hazardous waste are based on a series of instructions, without any attempt to integrate these instructions with quality systems or the higher level instruments.

Clearly, the existing instruments are not codified for the various management cultures that exist within Asian companies. The emerging concept of Environmentally Sound Management as defined by the Basel Convention (or indeed the Rio declaration) has no credibility from the perspective of most Asian companies. In order to develop a model that provides "integration", as suggested by Weston International and IISD, the thesis examines the complexities and uncertainties of management culture within Asia.

4
Organisational Characteristics

In order to develop an integrated environmentally sound management model that can be effectively applied, it is necessary to research the local management culture and its implications for model adoption.[191] Several substantial toxic waste projects in China and Taiwan were researched and analysed to gain an insight into the mechanisms of local management behaviour so that the model development would be cognisant of these influences, thus facilitating their ultimate adoption. The projects and contracts researched cover a five year period from 1997 to 2001. The field research was informed by analysis of organisational literature and practical experience. This led to the development of four surveys which are signalled in this chapter as a response to the issues raised in the literature.

Introduction

To gain an insight into the effects of managerial culture on the model adoption mechanism, ten major projects and contracts were surveyed in China and Taiwan. In addition, documentation from many other smaller projects in Asia (including substantial periods of negotiations, pre contract and post contract), were reviewed. Many of these projects involved technology transfer and managerial model transfer. Much of the research performed in this chapter included projects, or contracts concerning the management, or disposal of intractable and hazardous wastes. In addition to these contracts, many interviews were conducted with colleagues, and other people who had extensive contractual dealings in China or Taiwan. Much of the hazardous waste work in these two countries is performed by a French Government-owned corporation, and the research work was performed in association with this company on many of its major contracts, thus gaining a significant insight into the workings of management systems within the relevant

[191] Kelly.S, Allison.M.A (1998). p. 41. See argument for self organisation and development of the complexity advantage. The authors argue that clearly, it is impossible to apply a process model effectively without understanding how and why individuals and groups performing the process act as they do.

culture setting.[192]

Negotiating in China or Taiwan is generally not easy. When entering into discussions, or contractual negotiations, the Chinese tend to maintain a rigid adherence to their plan or agenda, and indulge in blunt tactics to prevent the other party from achieving its goals. For example, for the China-Green[193] negotiations, which I was involved with as technical advisor, the Chinese side consisted of twenty-five people and the foreign company side only four. The Chinese team wrote comprehensive notes, and would hold nightly meeting among themselves in order to derive the next day's agenda. New "attacks" would be designed to prevent the foreign side from gaining the upper hand. The discussions and negotiations are usually characterised by fierce adversarial instructional sessions about the way things are done in China, and in complete contrast to the projected approach of harmony. In 1996, I attended an ISO 14000 conference[194] in Beijing, China. I was taken completely by surprise by the intense adversarial approach taken by the Chinese "negotiators" concerning the adoption process of ISO 14000.

In order to properly construct a research methodology into the adaptation criteria and associated behaviour of the Chinese negotiators, and hence derive some sort of "algorithm" of how to craft the model, so that the local management culture would be more likely to adopt rather than reject, there must be an in depth understanding of the Chinese negotiating style, and subsequently Chinese organisational culture.[195] For an understanding of Chinese organisational culture, it is necessary to understand the complexities and uncertainties,[196] and technology adaptation processes that underlie the organisational characteristics, and how that might effect the adoption process.[197]

---

[192] The company was Tredi SA of France. This company is a large multinational Government owned waste company with incineration facilities for intractable waste.
[193] China Green was a Joint venture arrangement between the Government of France and the State Environment Protection Agency set up in 1997 to manage large scale hazardous waste projects.
[194] International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.
[195] See keynote address by Tsoukas. H (1997) at Conference held in Hasselt, Belgian, Limburg University, November.
[196] See complexity research argument by Lissack (1996).
[197] See Lefebure.E, Letiche. H (1999), for a discussion of standard management mantra as "lets make things better; lets make things simple" As the authors indicate things are not so simple, and simplicity is a form of denial, that is, trying to avoid the dynamics of indeterminacy.

Adaptation Issues

For managers of corporations or organisations the prevailing models and structures arise from a few fundamental assumptions. The assumptions, according to McMaster,[198] are that the world's processes, like a machine, are both predictable and understandable. As the era of sustainability leads us to look at the idea of a second industrial revolution it must also lead us to look away from the mechanistic and reductionist paradigm to one that is directly dealing with issues of complexity. McMaster claims that this new visualisation of complexity resolution being at the heart of the matter, means that the concept of adaptation promoted by Leonard-Barton[199] may have to be considered as being too simplistic. Adjustments to such reorganisation may be on the way, but the conversion of such strategic, all pervading changes into tactical command and control is far from realised. While there have been countless transformations of ideas, the way of doing work within the institutional organisation has not altered greatly. Conceptual changes to existing industrial paradigms is accelerated as technology transfers increase, but there is little that has altered in the way an organisation does its work.[200]

In the new millennium there will continue to be an explosion in "our ability to access, move, create and process information".[201] As Leonard-Barton[202] states, adaptation of such process changes can only be effective if the adaptive process is multidimensional, and involves the organisational adaptation itself to technology as well as the adaptation of the technology to the organisation. Leonard-Barton calls this "mutual adaptation", and is shown graphically in Figure 4.1. McMaster insists that it is the former of these two activities that cannot be actioned by the existing management paradigm. As the depth of the "on line" development gets progressively more complex the current management theory cannot respond to the changes needed.[203]

---

[198] McMaster (1996), p. xvi. Here McMaster talks about "the emergence of a new era" and goes on to "Convergence of thinking into complexity" theory and discusses the application of complexity science.
[199] Leonard-Barton (1995). passim
[200] See McMaster (1996), p. 4. See the argument developed regarding learning and intelligence.
[201] ibid.
[202] Leonard-Barton (1995), p. 104. See the concept of mutual adaptation and the development of the idea of codevelopment of both the technology and the environment.
[203] Demming (1986). passim

While Leonard-Barton[204] portrays an organisation as being capable of self adaptation to the application of technology, McMaster argues that this cannot happen unless the organisation has a significant level of organisational intelligence and learning, thus making it possible to "transform the way in which we organise for work and organise for work itself".[205] The plethora of systems engineering and regulations that has been applied to hazardous waste management over recent years has not resulted in the creation of an all embracing systems approach, nor has it resulted in the creation of an organic intelligence organisation.[206]

While there is plenty of evidence to suggest that organisations react, and accept new ideas and technology, there is a universal reluctance to "create" an integrated intelligence and learning centre within organisations that constantly challenge the method of work. Companies and organisational entities continuously reject the issues of complexity that revolve around the "knowledge age", and tend to continue to apply the same management paradigm that prevailed prior to the second industrial revolution.[207]

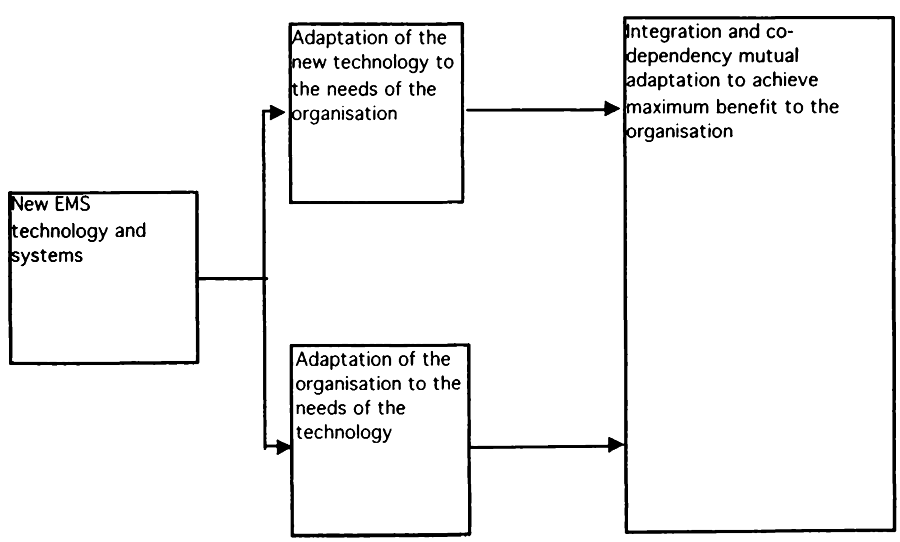


Figure 4.1 Mutual Adaptation Model as Adapted from Leonard-Barton.

[204] Leonard-Barton (1995), p. 104.
[205] McMaster (1996), p. 9.
[206] Peterson (2000), passim.
[207] Deiser (1994), p. 172. Deiser maintains that " The traditional technocratic planning approach, with its relatively static mechanistic view of the world, must be given up, at least to a certain extent, in favour of a paradigm better able to deal with the phenomena of dynamics and ongoing change".

Emergence of natural organisational intelligence must accompany the phenomenal changes within society, so that the accumulation of intelligence occurs through an integrated learning system. To generate a change in the adaptation of technology and systems into intelligence collection companies, a structural change is required. Where Leonard-Barton talks about the adaptation of an organisation to the technology she assumes that the organisation has to have the experiential where-with-all to alter its structural fabric for making changes. This is precisely the point at which many such ventures fail. The traditional planning approach (planning is not to be confused with strategy), with its mechanistic view should be replaced by systems theory complete with an interactionistic approach.[208]

For the adaptive, or interactionistic approach to work from an organisational point of view, there has to be structural change within the organisation, or within its training systems. Therefore, while Leonard-Barton is right, she has not emphasised the fundamental structural changes needed but by using the model of "mutual adaptation" she, along with McMaster and Deiser, have given us a clue that the issue of successful adaptation is multidimensional, and involves a structure that resolves the issues of complexity that are raised. Systems engineering have been doing that for years, by utilising Demming's "Operational Definitions".[209] The integration of adaptation, in a multidimensional sense, with the resolution of "issues of complexity and uncertainty", thus creating the learning structure required to successfully adapt technology, is the focus of this work.

Adaptation of the Organisation to the Technology

Uncertainty

External uncertainty arises due to the inability to control events external to the company.[210] Levels of uncertainty within a firm will vary according to the circumstances and the environment in which the business finds itself. Degrees of uncertainty are important to the development of the model, as the degree of uncertainty will surely effect the adoption process.

In early classical organisational theory, uncertainty was seen as mostly internal and

[208] Deiser (1994), p. 173.
[209] Demming (1986), passim
[210] See externality argument described by Burnes (1996), p. 60 et seq.

management science ignored human complexity in preference to a closed order.[211] By restricting uncertainty to internal systems, rational principles could be formulated that allowed for efficiency and order within the organisation. Over time internalised uncertainty was devolved by mechanist theory that favoured non rational dimensions to organisational behaviour.[212] As the old order of internalised uncertainty became less prevalent there was a new wave of organisational theory in the mid to late fifties, which saw the beginning of the realisation that organisations should be viewed as a system.[213] Presenting organisations as systems clearly moved the organisational theory to that of open systems.[214] In this "movement" it was seen that communication was the key to how the organisation related to external uncertainties. The open system philosophy held that instead of insulating against uncertainty (e.g. by sealing off the organisation's core competencies) it embraced uncertainty. As this model developed, much controversy raged as to the veracity of application and lack of empirical evidence. In order to establish sufficient evidence to suggest that adoption processes used by organisations towards uncertainty was a reality, multidimensional models were researched and utilised.[215]

Duncan used statistics in his modelling of organisational environments, and perceived uncertainty to measure the internalised characteristics of the perceived organisation environment. From his research he created a multidimensional matrix. One axis was "simple-complex" and the other "static-dynamic". By surveying twenty-two decision groups in six firms he was able to model the characteristics of perceived organisational environment and subsequent response. Figure 4.2 shows Duncan's matrix as adapted by Daft.[216]

Duncan found that the stable-unstable dimension of the environment is a more important contributor to uncertainty than that of the simple-complex dimension.

[211] Fayol (1949), p. 52-65. See his 14 principles of management for a closed order system and argument for a simplistic subordinate structure.
[212] Simon (1946), p. 53-67. An advocate of the Contingency theory of management which also laid the groundwork for the mechanist theory. His argument was opposed to Fayol's principles on the basis of oversimplification.
[213] Scott (1961), p. 7-26. cf. the distinctions between Contingency theory and the closed classical systems as proposed by Fayol again arguing that organisations are not closed systems.
[214] Katz and Khan (1978). The organisational subsystems include; boundary spanning, production, maintenance, adaptation and management.
[215] Duncan (1972), p. 89.
[216] Daft (1998), passim.

Duncan also found that uncertainty, and the degree of complexity and dynamics of the environment "should not be considered as constant factors in an organisation".

Duncan's theory says much about the nature of the external environment. What was not so obvious from his research were the implications regarding the characteristics of an organisation when confronted with dynamic uncertainty.

ENVIRONMENTAL CHANGE	Simple	Complex
Stable	Simple + Stable = **Low Uncertainly** Small number of external elements, and elements are similar Elements remain the same or change slowly	Complex + Stable = **Low-Moderate Uncertainty** Large number of external elements and elements are dissimilar Elements remain the same or change slowly
Unstable	Simple + Unstable = **High-Moderate Uncertainty** Small number of external elements, and elements are similar Elements change frequently and unpredictably	Complex + Unstable = **High Uncertainty** Large number of external elements and elements are dissimilar Elements change frequently and unpredictably

ENVIRONMENTAL COMPLEXITY

Figure 4.2 "Characteristics of Perceived Environments and Perceived Environmental Uncertainty" by Robert B. Duncan and adapted by Richard L. Daft

Duncan's work also concluded that "uncertainty" was influenced more by the static-dynamic dimension than the simple-complex dimension. In other words, he considered that the characteristic of the organisations environmental change had a higher influence within the organisation than the degree of complexity the organisation found itself in. Duncan's theory "emphasised that environmental uncertainty, and the dimensions of the environment are defined in terms of perceptions of the organisation's members".[217] These perceptions have manifested themselves in a series of factors, both internal and external, and the organisation's members (in Duncan's field survey) scaled these factors in degrees of influence and importance.

[217] Duncan (1972), p. 313.

Duncan maintained that up to around 1972, organisational theorists , had not clearly defined the organisational environment or its elements.[218] In his study, Duncan proposed a set of internal and external factors (See Figure 4.3) that he considered were the totality of physical and social factors that need to be taken directly into consideration in the decision making of individuals in the organisation. The internal environment consisted of those relevant "physical and social factors within the boundaries of the organisation that are taken directly into consideration in the decision making behaviours of that system." The external environment consists of those relevant "physical and social factors outside the boundaries of the organisation that are taken directly into consideration." The distinction between internal and external environments includes the interpersonal relationships of members, and their interactions with each other, and the external environment group including other individuals, groups and institutions.

Duncan cites several organisational theorists[219] when attempting to establish the

Internal Environment Components	External Environment Components
(1) Organisational personnel (2) Organisational functional and staff units (3) Organisational level	(4) Customer (5) Suppliers (6) Competitor (7) Socio-political (8) Technological

Figure 4. 3 Duncan's table of components comprising the organisation's internal and external environment

environmental dimensions of uncertainty and merely infers that there are two environmental dimensions. Daft[220] further cements the notion that there are two dimensions in his adaptation of Duncan's model. Duncan breaks down the simple notion of two basic environmental dimensions by "conceptualising" the simple-complex dimension and the static-dynamic dimension in the following way. "The simple part of the simple-complex dimension deals with the degree to which the

[218] As cited by Duncan (1972), Lawrence and Lorsch (1967), studied how organisations segment their environment into related sectors but have not clearly conceptualised the environment or its makeup.
[219] See Emery and Trist (1965), Thompson (1967) and Terreberry (1968).
[220] op cit.

factors in the decision unit's environment are few in number and are similar to one another in that they are located in a few components. The complex phase indicates that the factors in the decision unit's environment are large in number".[221]

Duncan's two dimensional model depends heavily on Dill's[222] work on boundary spanning as cited and extended by Terreberry. Duncan expressed his reduction of Terreberry's work into two simple dimensions, comprising a continuum of components (C) and factors (F). He contended that "an example of a decision unit, with a simple environment, is one with few factors and few components, like a lower level production unit that only interfaced with, say, a materials department, and a marketing department, all within one single component that of organisation function and staff unit".[223]

An example of a decision unit with a complex environment would be one located in, say, a programming and programme department. These decision unit members, when making a decision, may consider a wide variety of factors in both the internal and external environments. This decision unit example approaches the complex end of the simple-complex dimension as there are larger numbers of factors (F=6) that are dissimilar. This is due to the fact that they are located in several components (C=4). Duncan, thus, creates a simple-complex environmental index by multiplying F by C^2. Squaring the number of components is an indicator of similarity-dissimilarity in that the more components the factors are in the more dissimilar they are.[224]

Duncan's second dimension "indicates the degree to which factors of the decision units internal and external environment remain basically the same over time, or are in a continuous process of change".[225] This dimension which he calls "the static-Dynamic dimension has two sub dimensions. The first of these sub dimensions

[221] Duncan (1972), p 313.
[222] Dill (1958), p. 409., as cited by Terreberry (1968). Dill postulated that: organisation had "task" environment that is both homogeneous-heterogeneous and stable-dynamic. Terreberry postulated that the organisations boundary spanning to be functionally differentiated to correspond to segments of the task environment and each to operate on a decentralised basis to monitor and plan responses to fluctuations in its sector of the task environment.
[223] See Duncan (1972), p. 316.
[224] See Duncan's rationale for adopting C^2 where he discuses (p. 316.) the amount of variance between components is greater than the amount of variance between factors, and thus, should be weighted in the development of the index.
[225] See Duncan,(1972), p. 316.

"focuses on the degree to which the factors (F) identified by decision units members in the units internal and/or external environments are stable, that is remaining the same over time.[226] The second of the sub dimensions "focuses on the frequency with which the decision unit members take into consideration, new and different internal and/or external factors in the decision making process".[227]

In obtaining information from his subjects, Duncan was able to frame three components of uncertainty as follows;

1. lack of information regarding the environmental factors associated with a given decision making situation;
2. not knowing the outcome of a specific decision in terms of how much the organisation would lose if the decision was incorrect; and
3. inability to assign probabilities with any degree of confidence with regard to how environmental factors are going to affect the success or failure of the decision unit in performing its function.

The uncertainty dimensions 1 and 2 are measured with a simple Likert scale. Individuals receive an average score on each of the questions on the scores of the first and second dimensions by means of the formula;

$$\frac{\text{Total score on a given question (Sum of answers for each factor)}}{\text{number of factors taken into consideration}}$$

The third dimension of perceived environmental uncertainty deals with the respondent's ability to assign probabilities to the effect of a given factor on the success or failure of a decision unit in performing its function, and is expressed as a percentage function. The respondent's total score for this question is then averaged for the number of factors taken into consideration in decision making.

$$\frac{\text{Sum of degree of ability to assign probability for all factors identified}}{\text{Number of factors identified}}$$

[226] ibid., p. 317.
[227] ibid.

The scores are then added for a total uncertainty score.

Subsequent to Duncan's work, Milliken[228] developed a proposal of three types of organisational uncertainty. Milliken maintained that Duncan, and other organisational theorists[229] had focussed on the perceived environmental uncertainty as being a single entity and that there was confusion regarding inconsistent empirical data. Milliken cites several sources that indicated "problems range from findings of poor reliability and validity evidence for measurement instruments to a failure to find clear evidence of a relationship between "objective" characteristics of the organisational environment and perceptions of environmental uncertainty".[230] While Milliken confirmed that uncertainty was the fundamental element with which top level administrators must cope,[231] he was uncomfortable that the two simple dimensions, as proposed by Duncan and others, were sufficient, and in his paper sets about re-examining the terminology "Environmental Uncertainty". In unravelling the idea that environmental uncertainty was a multi packed construct, he established three types of uncertainty.

State uncertainty occurs when the organisation's managers perceive the organisational environment as unpredictable. When the environment deviates from perceived norms or expectations, the decision makers within the organisation will try to engage in knowledge acquisition to reduce their uncertainty.

Effect uncertainty involves the inability to predict the nature and impact of the future environment on the organisation. This suggests that organisations feeling effect uncertainty will try to alter their present behaviour when they perceive that a future possibility is most likely.

Response uncertainty is associated with attempts to understand what response options are available to the organisation and/or ability to predict the consequences of a response action.

[228] Milliken (1987), p. 133
[229] See Burns and Stalker (1961), Galbraith (1977), Lawrence & Lorsch (1967) and Thompson (1967).
[230] Milliken (1987). loc cit.
[231] Thompson (1967) as cited by Milliken (1987).

Researching these three types of uncertainty in terms of internal organisational management may lead us to an understanding the integrative nature of the firms response to external uncertainty. Survey A attempts to measure the degree that contracting organisations are affected by uncertainty, and to yield an understanding of the organisation's reactions to the external environment. By using the dimensions of uncertainty developed by Duncan, and elaborated by Daft and Milliken as a major construct within Survey A, we hope to see elements of state and effect uncertainty, leading to response uncertainty that may lead us onto establishing a definitive relationship between organisational characteristics and model adoption. In other words, the degree of the dimension of uncertainty, as seen through the eyes of the contracting organisations, may led us to how adoption mechanisms work and thus, how it can be influenced. By understanding the pressures and effects of external uncertainty on the firms responses to dynamic changes it should be possible to predict how uncertainty effects an internalising of an external model and its adoption process. The difference between Duncan's work is that his surveys were focussed on the corporation's perceived external environment, whereas this thesis surveys the external environmental elements about its perception of the corporate organisation.

Duncan's work defined for us the states of uncertainty, and how those dimensions interacted within an organisation, and its attempts to ratify the external environment, but we want to see if the same dimensional analysis (ie the uncertainty score) can be used to define the structures and elements of the adoption process of external management models. This was never shown by Duncan's work nor does it appear in his multidimensional matrix. When Daft integrated Duncan's work he also did not attempt to justify an adoption mechanism, which is quite surprising given the need for adaptation for "open system" organisations. Survey A on the other hand, by itself, will not address integration as defined by Duncan. This will be the result of combining surveys A and B. Survey B will be designed to examine the dimension of complexity. Survey A will attempt to look at the same components and factors proposed by Duncan but in a manner that is focussed on the externalities to the firm, and, in particular, the adoption and internalisation of external ideas, but not from the Chinese corporate point of view, rather from the external elements point of view. Duncan's work was focussed on the internal elements perception of uncertainty, and in that case, did not include adoption mechanisms.

Complexity

Model adoption often faces the conflict of internal complexities. Such complexities arise from many elements or issues, and the manner in which they interact within the internal framework of the organisation. For any firm, one expects such complexities, but when combined with the problems of adoption of foreign models such complexities become acute, and can provide blocks to change involving adaptation or adoption.[232] Internal complexities as they impinge on management's ability to adopt new processes the receiving organisation must be able to come to grips with the problem of complexity, or the adoption process is likely to fail.

The complexity of the political, regulatory, and technological changes confronting Asian companies today causes an urgency to adapt.[233] The increasing interconnectedness of people across the globe is helping to accelerate change, as diverse new customer demands are communicated faster and innovative organisational responses are enabled by collaboration through information technology. This is particularly acute given the fast moving Asian economies.

The business environment is becoming more complex and self structured or self-organising even in China.[234] Complexity theory views organisations as "complex adaptive systems" that coevolve with the environment through the "self-organising behaviour of agents navigating fitness landscapes" [235] of market opportunities and competitive dynamics. Changing external and internal "attractors" influence the process of adaptation by agents.[236] A definition for self organisation is useful at this stage and the definition of Cilliers (1998) is particularly useful.

[232] Barabba (1995)., p. 76.
[233] Greenwood and Hinings (1996). As cited by Coleman (1999).
[234] Miles et al. (1995). As cited by Coleman (1999). The suggestion by Coleman is that "self organisational behaviour will naturally occur without addressing what causes it". Miles asserts that the market attractors are a pull structure that provides internal innovation.
[235] Kauffman (1995). As cited by Coleman (1999). Cf the argument "that in today's business world, the variety of new opportunities is created by the emergence of new knowledge structures in scientific discoveries.
[236] Kauffman (1995) ; Morgan (1997) ; Stacey (1996).

The capacity for self-organisation is a property of complex systems which enables them to develop, or change internal structure spontaneously, and adaptively in order to cope with, or manipulate, their environment.[237]

Complexity theory suggests that self-organising behaviour will naturally occur without addressing what causes the processes that generate such behaviour.[238] Behaviour is self-organising when people are free to network with others and pursue their objectives, even if this involves crossing organisational boundaries created by formal structures. Complexity theory suggests that self-organisation is the natural "default" behaviour, while organisation studies recognise barriers to such freedom in bureaucratic structure. In terms of an economy that is used to central planning, this behaviour is hard to visualise, and a structured analysis is required to understand the processes that generate self organisation and behaviour especially as it relates to Asian business.

The increasing interconnectedness of people within Asian economies enables ideas to be translated into innovative offerings in response to rapidly communicated customer demands. A factor is the degree of connectivity between the people in a system: the variety in behaviour and predictability of response to the model adoption depends on the strength and number of internalised systemic connections, with few and strong interconnections producing stable behaviour too little variety for effective learning and many and weak interconnections producing unstable behaviour too much variety for effective learning.[239]

The organisation design/structure can facilitate adaptive changes like model adoption by being flexible. The concept is to design the organisation for the purpose of evolution with the changing environment and, to design for emergence by avoiding the rigidities of bureaucratic hierarchy. This means creating organisational arrangements that do not inhibit evolutionary change and that accept discontinuous change in the environment as entrepreneurial opportunity. The idea is to design the formal organisation such that structures, systems, and processes

[237] See Cilliers (1998), p. 90. Key aspects of self organising systems include; As a result of interaction between the system and its environment system structure can adapt dynamically to changes in the environment, Involves higher order non linear processes, emergent property of a system, involve an increase in complexity.

[238] cf. Stacey (1996). passim

[239] Stacey (1995)., p. 177.

"fit" the goals, rewards, and structures of the informal organisation.[240] Of course, this is where the main problems lies with Asian organisations, especially in China. Either the model has to have elements that encourage evolutionary change or the model has to have structures that force the organisation to change, and thus generate the self organisation required.

To extend this idea a little further, change is facilitated by a formal design structure within the model that exists only to validate informal behaviour. Alignment of members with the model's purpose is reinforced by both identity creating information about how each segment (and dimension) is contributing to the enterprise goals and extrinsic incentives of member ownership that support this identity. The intrinsic incentives are the challenge of the task, personal recognition, and freedom of activity in pursuit of entrepreneurial innovation.[241] So that the model is adopted and the organisation successfully adapts the complex process an understanding of the extrinsic and intrinsic incentives is essential, and the research of the companies will need to cover this issue.

The accelerating pace of change is often attributed to the advance of technology. What effects rapid change is what people do with the systems they have. Computers and telecommunications have dramatically increased the interconnectedness of people and the speed of sharing knowledge and information. This has fuelled an explosion of innovation, but it would not have been the case if people had not been motivated to use technology for new products and services.

Ultimately, the quality of self-organising behaviour and thus the success of the model adoption and adaptation depends on the organisation having people who respond to empowerment practices. Empowerment is defined as enabling feelings of meaning in work, autonomy, choice, and having an impact on outcomes.[242] Empowerment means releasing the self motivation of employees to take responsibility and initiative by trusting them to accept deep-seated psychological ownership of results and encouraging them to think, experiment, and improve.[243]

[240] Nadler (1998). passim
[241] Quinn (1996).
[242] Thomas and Velthouse (1990); Spreitzer (1995).
[243] Coleman (1999).

Empowerment will not work if employees do not have some intrinsic motivation to make a contribution. It would seem therefore that the model's algorithm must be flexible enough to establish empowerment where there is none or exploit it where it exists.

Complexity theory and organisation studies find some common ground in the concept of adaptation to new management processes. Increasing interconnectedness between people enables self-organising behaviour in response to new external management systems in contrast to the mechanistic models of bureaucracy, where "discontinuous change requires a complete overhaul of the organisation if it is to survive".[244] Adaptive change by organisations rarely needs to be radical, even when there is "discontinuous change in the environment, because the interface between the organisation and its environment is on the edge of chaos".[245] If the adaptive changes were to be radical, it would result in severe chaos internally at another level within the organisation. Given these small changes can cause large effects the mechanism for the adaptive model may well be subtle.

By understanding industries as complex systems, model design can be arranged so to improve their chances of adoption by decision makers. Complexity theory is a promising framework that accounts for the dynamic evolution of industries and the complex interactions among industry actors. By conceptualising industries as complex systems, a number of managerial implications can be developed. Complexity theory also points to the importance of developing guidelines and decision rules to cope with complexity, and of searching for non obvious and indirect means to achieving goals.[246] The degree of complexity and the internal interdependence within Asian companies is the focus of Survey B. Survey B was crafted so as to gain an insight into the complexities and interdependence within the firm so as to enable a further focussing of the adoption mechanism.

To ascertain the organisational characteristics, and thus obtain an insight into the internalised perceptions, we need to look at the very fabric of how Asian companies negotiate major contracts. By surveying the characteristics of Chinese

[244] Nadler (1998). As cited in Coleman (1996).
[245] Coleman (1999). passim
[246] As Levy (1994) phrased it: Cited by Lissack. (1999).

negotiators we can see how the degree of external uncertainty and internal complexity will affect the organisation and determine the kind of responses that are generated. The behaviour of the negotiators at the contract negotiations table provided a direct view of the effect that uncertainty can have on an organisation's capacity to adapt external models.

Methodology and mannerisms	negotiating norms motivations and attitudes expectations and assumptions
Prevailing environment	stage of economic development power and influence centers levels of bureaucracy government policy
Cross cultural complications	interpreting behaviour language cultural expectations

Figure 4.4 Blackman's Chinese Negotiating Norms

According to Blackman[247] there are three components of negotiating norms. These three features then characterise the Chinese negotiating style, and are displayed in Figure 4.4.

Blackman's three sets of norms can be further expanded using Duncan's matrix dimensions. Figure 4.5 is an adaptation of the table in Figure 4.4 and shows the integration with Duncan's matrix. When it comes to the Chinese accepting a management model, the adoption process can sometimes be influenced by strong counter argument. For example during a hazardous waste incineration project, the quality assurance system that the foreign company wanted to use was fiercely opposed by the Chinese negotiators on the basis that there was no legal requirement for it. A strong argument was made by the foreign team, that due to the lack of a legal requirement for a QA system, it could also be construed that there was no legal requirement not to have a QA system and the Chinese side eventually accepted the model standard.[248] Similarly during large project

[247] Blackman (1997). passim
[248] China-Green negotiations Hazardous Waste Incineration, Beijing (1997), Project Notes McDowall

negotiation in China, as well as a similar project in Taiwan, I observed that the negotiators were quite happy, and did not consider it unethical to call upon any regulation or practice, real or imagined, or distort any element of the negotiation in order to bring the other side around to that way of thinking. Blackman believes that this characteristic to be a carry over from the period where there was a lack of strong administrative and legal controls.[249]

Blackman's Norms	Duncan's Components	Blackman/Duncan factors
Prevailing environment Stage of economic development Power and influence centers Levels of bureaucracy Government policy	Customer Supplier Competitor Socio-Political Technological	Central Planning Open/closed system Core Competencies Organisational Flexibility Rigid Viewpoint Entreprenureship External elements Unpredictablility
Methodology and mannerisms Negotiating norms Motivations and attitudes Expectations and assumptions *Cross cultural complications* Interpreting behaviour Language Cultural expectations	Organisational personnel Organisational functional and staff units Organisational level	Adversarial Atmosphere repetitive Questioning Left field demands Pushing for bottom line Fixed positions Lack of coordination Renegotiating the contract Deadlock

Figure 4.5 Blackman's Norms integrated with Duncan's Components

The adoption or negotiation process is further complicated by the fact that the process is multilevel. Initially, broad acceptance will be achieved on the adoption of a management process, but further negotiation will be required on subsequent detail, and indeed decisions at this level can compromise the initial broad acceptance. Due to the lack of well established administration and managerial norms, and indeed legal structures, corruption of the process is a standard part of the process of adoption. Personal influence is a significant factor in the adoption of new management methodologies. The Chinese side will bring in powerful individuals to support their case.[250] In the Taiwan TPC,[251] project, when the contract negotiations commenced the work on the management and control

[249] ibid.
[250] Blackman (1997), p. 9.
[251] Taiwan Power Company (TPC) Project (1997) Project Notes, McDowall

methodology of the hazardous waste, the Taiwan side introduced even more people to protect their stand. When part of their requirements were demonstrated to be out of compliance with International Law they were able to assemble four eminent law practitioners who emphatically stated that in their opinion it did not matter.[252]

Adherence to specifications is something that Chinese negotiators hold to even when those specifications can be clearly shown to be inappropriate or out of date. Management models based on themes of practice are no exception. If there is an existing "Code of Management practice", even simply at a basic regional or local level, then the local Chinese bureaucrat will not accept a new foreign methodology that might be at variance to the existing standard. This can also manifest itself in the adoption process of standards. In discussions associated with the ISO 14000 conference in China 1996,[253] many of the delegates thought that the adoption of ISO 14000 was a complete methodology in itself that could be applied across all sectors. Their attitude was that if China adopts ISO 14000 standard then there is no need of additional methodologies of management as all would be provided for in the standard. That this is not so, was lost on the Chinese negotiators.

Using Blackman's[254] schedule (modified) of characteristics as the research criteria the surveys were constructed as the project and contract research material was obtained. By placing the observations across the matrix it would seem feasible that the response to the negotiating style, much modified, can result in an understanding of the forces of uncertainty, complexity and the effects on the contractor's organisation, and will provide a guidance solution that needs to be inherent in the development of the management model.

Integration of Uncertainty and Complexity

At this point it is useful to further examine Daft's[255] work of integration. Daft integrated Duncan's work and the work of others[256] into a unified and integrated theory as depicted in Figure 4.6.

---
252 op cit.
253 ISO Conference, Nov 1996, Beijing, China.
254 Blackman (1997), p. 12.
255 Daft (1998), p. 94. See discussion on "Integration is the quality of collaboration among departments." When the environment is highly uncertain, frequent changes require many information processes to achieve co-ordination so integration becomes a necessary addition to the organisational structure.
256 Burns and Stalker (1961). passim

Volatility	Simple	Complex
Stable	**Low Uncertainty** • Mechanistic structure; formal centralised • Few departments • No integrating Roles • Little imitation • Current operations orientation	**Low-Moderate Uncertainty** • Mechanist structure: formal, centralised • Many departments, some boundary spanning • Few integrating roles • Some imitation • Some planning
Unstable	**High-Moderate Uncertainty** • Organic stucture, teamwork: partcipative, decentralised • Few departments, much boundary spanning • Few integrating Roles • Quick to imitate • Planning orientation	**High Uncertainty** • Organic structure, teamwork participative, decentralised • Many departments differentiated, extensive boundary spanning • Extensive imitation • Extensive planning forecasting
	Complexity	

Figure 4.6 Dafts Integrated Matrix.

This integrated model has some simple explanations about the observations of the organisation's characteristics. The *low uncertainty* sector in which the external characteristics are simple and stable, the organisation acts in a mechanistic fashion. What is true today will be true tomorrow. In the *low-moderate* sector, where the external characteristics are complex but stable, what is true today has a chance of being true tomorrow. While the pace of change is the same, the increase in departments in order to keep track of the increased uncertainty makes predictability less certain. In the *moderate-high uncertainty* sector, where the external characteristics are simple and unstable, predictability and certainty about the future is now subject to a higher level of difficulty. In the *High uncertainty* sector, where the external characteristics are unstable and complex, predictability has no significant confidence level.

A simplified version of Daft's matrix can be described along similar lines to that used by Barbara [257] Here is clearly seen the relationship between uncertainty and

[257] Barabba (1995), p. 78. The model described here is similar to that of Duncan but is focussed on the effect of complexity on market segment but the theory is the same.

complexity on a simple two dimensional matrix as shown in Figure 4.7.

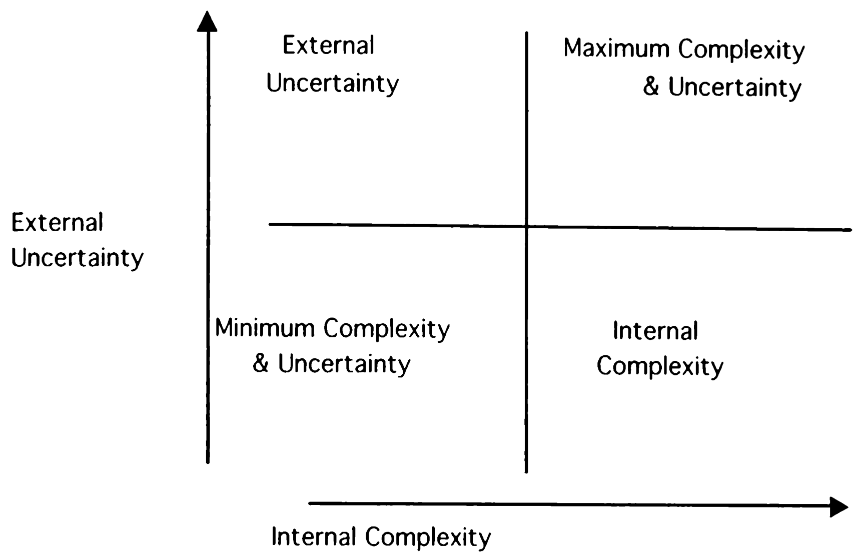


Figure 4.7 The Complexity/Uncertainty Matrix

Adaptation of the Technology to the Organisation

Know-Why

The transfer of technology to Asian countries, particularly from western countries, is an area where many companies have failed in recent years.[258] The management structures that have been applied have typically been driven by a multitude of motivations. However, the inability for some corporations to understand and manage complexity has often led to transfer failures.[259] In the context of management models for the Asian market, for the application of hazardous waste procedures, the transfer of capabilities to the Asian scene by Leonard-Barton,[260] presents a unique viewpoint that may have a significant application all the way to the work place. Leonard-Barton contends that companies have followed their markets, expanding into geographies relatively uncrowded by competitors. Leonard-Barton signals that often technology transfer occurs for the wrong reasons, and that there are other superior reasons involved.[261] It is this premise that makes her work all the more relevant, for the adaptation model development in that adaptation of models involving technology have other dimensions that have

[258] Xu Jianngping (1997), p. 82. See historical problems of technology transfer and its assimilation into the Chinese economy.
[259] Tang Shiguo (1997). passim
[260] Leonard-Barton (1995).
[261] ibid. p. 216.

characteristics that add to the issue of complexification. Drazin and Sandelands make a distinction between a complex system's observable structure, elemental structure, and deep structure.[262] This distinction is perhaps some indication that complexity models suffer from application veracity because of simplification.[263] By treating the elements of technology transfer as an elemental structure, as depicted by Drazin and Sandelands, it may be possible to incorporate a degree of credibility into the model.

When bringing new technologies to China, especially those related to management systems or systems engineering, the Chinese will often ask what is the point of using them as China does not need such systems. In general, in bringing such technologies to China, much time must be spent in providing the rationale behind the systems, and stating why it will be beneficial. This aspect can be very frustrating for foreigners negotiating in China. This aspect of "know why" proved to be a critical element in the development of the adaptation model, and thus an important part of the integrated adaptation process described by Leonard-Barton.[264] When questions about "know why" were introduced during the research period into the companies mentioned previously, the response was significant. Thus, <u>Survey C</u> concentrates on this part of technology adaptation. This part of the research started the thinking that technology transfer had many different dimensions that were in themselves complex, and that solving the riddle about adaptation during model transfer was linked to these additional attributes.

This realisation led to the formation of additional criteria that were introduced to the research and survey process. Whereas surveys A and B concentrated on uncertainty and complexity characteristics, and thus the integrated matrix as the

[262] As cited by Garud, Karnoe and Garcia in *Managing Complexity in Organisations*, edited by Lissack and Gunz,(1999). p 371. The argument by Drazin and Sandelands states that "observable structure represents perceived macrolevel, supraindividual patterns or structures generated by the interactions of the systems constituent agents, often manifesting emergent properties not evidenced at the individual level. Elemental structure consists of microlevel, individual social behaviours and interactions manifested in time and space. Deep structure consists of the generative grammar, rules, or logics that produce the social behaviours and interactions in the first place."
[263] Petzinger,(1999), p. 29.
[264] Leonard-Barton,(1995), p. 215. See her description of "Mutual Adaptation".

obvious model to go with the idea of "know why" was divergent,[265] and not something that simply grew out of the organisations ability to self organise coherently as a result of reacting to external uncertainty within the confines of the inherent complexity of its environment.[266]

While there are various stages within the technology transfer system that are usually referred to, and they tend to be technology or product related, it is useful to examine the stages of the transfer process to infer how the same process might effect the management model being developed here. Austin's[267] four level technological capability ladder is useful in this respect. He states that there are four levels of technology transfer that can lead to the creation of the reverse dynamic:[268]

1 assembly or turnkey operations;

2 adaptation and localisation of components;

3 product redesign; and

4 independent design of products.

The four levels tend to represent not only levels of transfer but also contrasting methodologies about entering an Asian nation. Managers in firms setting up factories in developing nations such as China, only to take advantage of an inexpensive labour source, "seem to assume that the knowledge will, at least for the foreseeable future, flow in one direction".[269] Technology transfer has often

[265] Deiser (1994), p.173. See the argument developed regarding "The Interacting Organisation". Deiser maintains that "In order to adapt the firm as closely as possible to different technologies, markets of functions, organisational design must provide an optimal differential of subsystems". He goes much further than Leonard-Barton and states " Interdisciplinary and interorganisational cooperation , carefully nurtured by top management, leads to integration of the fragmented perspectives of individuals and groups. It leads to a multicultural organisation, one that can act in a differentiated and in a coherent way at the same time".
[266] Given the simplicity of the Uncertainty / Complexity model such integration is not feasible.
[267] Austin (1990).
[268] Also as cited by Leonard-Barton (1995).
[269] Leonard-Barton (1995), p. 218. See discussion regarding the flow of technological capabilities across international boundaries and "the assumption that the technology transfer in fact desires to establish knowledge creating activities in a foreign location".

been referred to as "technology diffusion".[270]

Some companies ostensibly plan for a level 1 or 2 transfer. There are other companies that will assume from the outset that their divisions in Asia will become equal partners in the design and production of new technology, and therefore structure their agreements with an eye to eventually achieving levels 3 and 4. Some technology transfer agreements have achieved all four levels of transfer, the Asian companies exerted pressure to achieve innovation capabilities, or the source companies learned that the progression toward level 4 was predictable, if not totally inevitable. Leonard-Barton suggests that such progression is inevitable; however, within the hazardous waste business this does not appear to happen. The transfer process tends to end at level 1 or 2. On the other hand, current models show the opposite effect in that the diffusion of technology into Asia is neither automatic or instantaneous.[271] Surveys C and D were designed to uncover the dynamics of how companies blocked the progression pathways. For management processes, Austin's four levels are applicable and simply replace the idea of a physical product with a managerial product. Exploring the levels of technology diffusion or "technology absorbing capacity"[272] may well yield deeper dynamics that define how self organising adaptive characteristics can be applied to the recipient company.

The second level requires the technology exporting company to provide more time, money, and energy to ensure that the recipient can not only utilise the technology transferred but also fine-tune both it, and the local operations system into which it fits. "Not only must the recipient work force know how to operate, maintain, and repair the systems, but local professionals must also understand the principles on which the technology is based".[273] The most significant alteration in a technological product transfers is usually focussed on switching the sourcing of componentry to local firms. For management processes, this usually means a defaulting of the

[270] David (1997), p. 13. See discussion about technology transfer "usually being identified with one or another aspect of the process of technology diffusion, that being the subject area broadly concerned with the dissemination of knowledge about technological practices and consequent changes in the distribution of the population of potential users across the set of feasible techniques".
[271] See Grossman and Helpman (1991), p. 86-91 as cited by David (1997).
[272] David (1997), p. 24.
[273] op cit.

imported strategy to a local methodology that may, or may not equal or better the imported standard.

The concept of "know why"[274] is introduced into the third level of adaptation of the technology. "The third level, product redesign, moves the recipient organisation closer to an independent ability to innovate".[275] Rather than adapting components, the recipient now redesigns the whole product as a system. Recipients, however, are still dependent on the technology source for basic know-how and know why -i.e., for the scientific knowledge underlying the original product design. In my experience, working in Asia, the "know why" comes very late in the equation for management processes. Because there is no element of physical construction there is usually no analysis of management process flow, and therefore the desire to "know why" is not considered. Certainly it is not considered in a positive developmental way, rather it is dismissed as unimportant especially by the originator of the transfer.

Even if the two parties codevelop a product, major segments of the design activities are usually carried out by the technology source. The receiver may not yet be ready to conduct all the innovative activities itself. However, the receiver may still create products competitive with those of the source by layering its own expertise on top of licensed technology. In management processes this can involve the deliberate dismissal of the sender's concepts to be replaced by some local variant, often using standards that are unacceptable to the sender.

"In the fourth level, independent design of products, advanced technological knowledge possessed by both the original source and the original recipient flows bidirectional. The source has become a recipient, and the recipient has become a source. In these cases, the two are equivalent in technological capability; new product development may occur at either site".[276] This part of the model is the hardest to formulate. For the Asian economy to develop a managerial process in this manner is a difficult concept to visualise. The recipient seems to want

[274] Garud (1997). passim.
[275] Leonard-Barton (1998), p. 222.
[276] ibid.

managerial process change and redesigns because of an unwillingness to apply the discipline of the process, rather than to promote a new and higher level of capability of the process.

When transferring management models, complete with auditing features, the idea that both sides must understand the concept of pre-agreement diagnosis is a very difficult concept to get over. For many Asian business people this concept will have significant problems of application.[277] The four levels of capabilities transfer interact with the dimensions of a capability; each level is characterised by particular challenges in each of the four dimensions (physical systems, skills, managerial systems, and values), and therefore, much of the commentary on each transfer level is organised according to the dimensions. Critical success factors are suggested for achieving each of the four levels (assembly, localisation, product redesign, and product design).[278] As information from China would indicate,[279] the primary concern for Asian countries when indulging in technology transfer is the requirement for modernity. The lack of managerial experience can make the transfer happen for the wrong reasons.[280] The transfer of a management model follows a similar path to that of physical systems. Generally the model is simply "plonked down" and used.[281] Because of this, the local management culture will not accept the model, and will attempt to change its emphasis. Its acceptable use will only come about if the support systems are in place, and the models' interpretation is completed within the confines of the local culture. One of the most important factors when translating skills to the local management culture is the need for transfer of the "know-why". Asian management are quick to grasp the "know-how", but are insistent on obtaining the "know-why". Only then do they accept and apply the transfer.

In summary, a level 1 transfer of technology does not involve any "real conveyance

[277] David (1997), p. 32. See argument that "the adjustments and adaptations of existing cultural attitudes, social norms, organisational forms and institutional rules and procedures is neither necessarily automatic nor smooth. lack of plasticity in such social structures may retard and even block an otherwise technologically progressive economy's passage to the full exploitation of a particular emergent technology".
[278] Austin (1990).
[279] Xu Jianngping (1997), p. 82. See historical problems of technology transfer and its assimilation into the Chinese economy
[280] See David and Forey (1995). passim
[281] Jingping (1997). passim

of capability. If all the knowledge transferred is embodied in some physical form but is invisible to the users, those users develop little new capability because these essentially reactive activities create very little new knowledge".[282] Level 1 transfer for management models involves the transfer of capabilities as well as "know-how". Matching the local managerial infrastructure is much harder to apply, and there is some argument that one should not default the models strategy because of the perceived pervading culture. One should adapt the culture to the model in a creative way.

"Success at level 2 is defined as the ability to adapt product and to produce it using mostly local content. Both the technology source and the technology recipient stand to gain from product adaptation and localisation. The source gains in cost economies and the recipient in knowledge. Only if some knowledge of underlying engineering and scientific principles is transferred can local engineers alter the process or product to accommodate local needs and select local components. Therefore, achieving a level 2 transfer does involve more learning more transfer of actual development capability, than level 1".[283] Developmental capability transfer with a management model will come as a result of the transfer of the "know why". When the local management culture is presented with the "know why" then they can, and will develop alternative strategies within the model. In China, the government and the recipients of technology, have tried to force greater knowledge transfer by setting ambitious local content schedules.[284]

Training within model transfers is profoundly difficult. Combining the training with the transfer of "know-why", some training then becomes easier. However, to transfer quality transfer programmes on top of the model required a significant structure and control. Transferring an adaptive capability implies a commitment to releasing proprietary information or altering standard corporate tools, all requiring some degree of understanding of the underlying technology. The two values that continuously crop up in any discussion of localisation are discipline and quality - which are, of course, related. Generally in China, ISO 9000 certification and ISO 14001 certification is pursued for trading reasons rather that for quality

[282] Leonard-Barton (1995), p. 230.
[283] ibid.
[284] Xiaojuan (1997). passim

reasons. Once implemented, however, the spin off is an increase in quality. Quality programmes inherent in management models are somewhat harder to have incorporated within the recipient.

Inverse Transfer

"Success at level 3 is defined as the ability to redesign an entire product rather than just components. The intended result is not merely a product that can be locally produced but a superior product. The recipients of the equipment tools and operating procedures must not only thoroughly understand the equipment itself but also comprehend the underlying technology so that they can modify the entire product or process for local production, and/or for the local market. Therefore, at level 3, the knowledge transferred moves beyond "know-how" to "know why".[285] The concept of the recipient eventually being able to redefine the model and return it to the sender better than received is a process, that for management models, will be very difficult to include as part of the strategy of the transfer. It is desirable, but to actually include, within the model structure, a system of reverse transfer learning is a big ask. However, if it was included, then the idea would be very beneficial in that the local management would be less inclined to corrupt the model, rather they would have a mechanism to improve and modify the model, and the return it to the sender.

"People in China, who have held positions of responsibility, do not necessarily understand even the rudiments of management since they had little independent decision making power under the previous communist system, and almost no incentive to work hard at management".[286] However, they can readily dismiss or corrupt the management links of any transferred model due to their lack of training in managerial systems; therefore, companies engaged in technology transfer into China often need to build understanding of management practices, including basic problem solving skills, and the kind of appreciation for quality that has reawakened in the West over the last decade. This is a dilemma for adaptation models. Does one transfer the solving techniques as part of the "reverse transfer", and risk early modification, or is it left out for application at a later date depending on the success of application?

[285] Leonard-Barton (1995), p. 237.
[286] ibid., p. 240.

The idea of a "reverse transfer dynamic" is cemented by stating that success at level 4 is the independent design and production of a viable new product and the existence of potential for reverse transfer. "At level 4, the receiver has become the source - and the source can become the receiver".[287] When both parties have a real development capability, the challenge is to make the relationship synergistic. This part of the adaptation model (reverse transfer) is where the multidimensional aspect of the overall model could be delivered. The idea that the recipient will eventually become the sender for a management model transfer, is of great importance, and should be included in the overall adaptation model structure.

Training systems are often lacking in the sophistication required to transfer "know-why". Transferring technological capabilities requires an extremely important managerial skill not always associated with technically skilled people - the ability to coach. Good coaching requires an appreciation for how knowledge is conveyed: that knowledge is often tacit, held in the head, and cannot be transferred through blueprints or documentation; that lectures are not effective communication devices; that a lack of understanding, apparently due to inadequate skills, may in fact be caused by language differences and vice versa; that apparent language difficulties may actually signal more serious gaps in comprehension. The management model (in this work) transfer will require to impart the skill of coaching. As part of the "know why" transfer the model must have the capacity to transfer knowledge in a coaching sense.

Few manufacturing companies today can afford to be totally regional. The market is becoming truly global. Therefore, managers are increasingly confronted with the issues not of whether to transfer technological capabilities but of when, where, and to whom - a partner or a wholly owned subsidiary? Developing nations such as China influence the last decision by setting up disincentives to total ownership. China has greatly softened its initial position, which insisted that joint ventures be 50 % controlled by the local company. However, regulations still in place discourage 100 percent foreign ownership; in 1994, only 30 percent of a wholly

[287] Leonard-Barton (1995), p. 242.

owned subsidiary's output could be sold inside China, for instance. For their part, technology sources try to retain control over operations through majority ownership the more uneven in their favour, the better. Having a majority ownership in a joint venture does not guarantee control over management and the transfer of technological knowledge.[288]

Leonard-Barton looks at four different levels of capability or technology transfer, using the capability to create new products independently (level 4) to calibrate the position of recipient companies. Each of the four levels of capability transfer involves different proportions of the four dimensions of a technological capability. Leonard-Barton argues that a recipient company that reaches level 4 essentially duplicates the technological capabilities of the original technology source. Whereas technology flows mainly from source to receiver at the first three levels, at level 4 the flow is bidirectional. The relationship changes from parent-child to adult-adult. Not all companies will choose to transfer their technological capabilities to this extent. Those that do will need to be aware of the necessity for a long-term commitment and the development of some new management skills. Transferring capabilities requires an awareness of inherent design biases in equipment and products, the selection of personnel who are capable of coaching, and a sensitivity to multiple types of cultural influences on the interactions between personnel at the home technology source and at the receiver.

The idea that model transfers involve four levels and the concept of reverse transfer is of great importance to the multidimensional model development strategy. The idea that one should transfer not only the model but the "know-why", and the ability to problem solve, is an important concept that should be used in order to prevent local management culture corrupting the model's intentions. Most of the projects surveyed however, had a characteristic that was not immediately apparent until pointed out by several of the Chinese negotiators at a later date, post contract. This characteristic involved the very nature of the project in that they were all a linear one way technology transfer that expected a finite end point and no inherent developmental activity on the part of the receiving partner. The developmental capacity of the receiving partner is known as inverse or reverse technology transfer.

[288] Xiaojuan (1997). passim

It is something that does occur between developed economies but appears absent in undeveloped economies or economies in transition.

Within developed countries a new imperative may drive at least some innovative companies, and that is the quest to harness the skills of the target country. This is an inverse transfer idea. The idea is that when technology transfer occurs, the target country will eventually provide a return in the form of intellectual capital. This return while not overtly realised by the Chinese side observations indicate that such a concept is preferred. "New information technologies make this increasingly possible. Increasingly, managers transfer capabilities to developing nations not just to off-load capacity or to lower costs but to invest early in future sources of intellectual capital. Such investments, however, are neither cheap nor swift to mature".[289] The idea that the ultimate technology transfer is a challenge to the technology originator is something that I have found absent in Asia at the entry level of managerial systems. However, it must be said that the reopening of China to the outside world represents the latest entry-level opportunity for the transfer of technological capabilities.

Upon going back to the companies and Chinese and Taiwanese government departments that were involved in the projects surveyed, I found almost all indicated a preference for reverse transfer. Of the ten project partners, eight indicated that such a concept would have a significant impact not only on the acceptance of the requirements of foreign corporations in terms of managerial standards and quality control, aspects that often cause negotiation breakdown, but that if they had thought of it prior to contract negotiations the concept would have been included. Indeed, even with companies that have little technical expertise, and overtly require foreign partners for their technology and managerial systems expertise, they are enormously amenable to the idea of reverse transfer. Their capacity to understand the concept is somewhat surprising, and appears generic. Since realising that the idea has a substantial degree of support within China, I have used it with many contract negotiations since, and the resulting intense interest has been the basis on which subsequent negotiations have been easier to manage and less adversarial.

[289] Leonard-Barton (1995), p. 222.

Asia today presents an inclusive portrait of different levels of development.[290] The fifty-year history of the rise of Japan from the ashes of World War II to become partner with and competitor to the rest of the developed world demonstrates the ultimate potential for investment in transferring capabilities. The emergence of the "little tigers" (Taiwan, Hong Kong, Singapore, and Korea) over the past twenty-five years offers more recent testimony to developing nations' ability to absorb, build upon, and ultimately challenge foreign knowledge." This concept of the challenge to the "foreign knowledge" is intensely interesting, yet often ignored. Certainly, the prevailing attitude within corporate management in Europe and the US would be to provide technology and systems transfer that does not lead to the ultimate challenge to the foreign knowledge as that would be perceived to be a negative outcome. Perhaps the western world has been patronising in this regard. Certainly, Leonard-Barton seems to think so with her description of the emerging China:

> In fact, the decline of communism in China in the 1980s opened a whole new territory and set off a dash for markets reminiscent of the contest for land on the U.S. frontier. When communism gave way to capitalism in Eastern Europe and China, the view of all that unexploited and uncrowded market space jolted company executives into similar frenzied activity. They envisioned 1.2 billion customers in China alone, waiting with savings in hand, to buy. The vast country lacked power, transportation, and information infrastructure. Even a tiny portion of the market implied rivers of cash. If the opportunities in China seem more compelling than in other regions of the world, however, the realities of operating there are not unique. Operating in China is not that much different from some of the other developing countries I've been in," observed Landuyt of Shanghai Squibb.[291]

It is the managerial challenges of technology transfer that addresses the managerial issues of technology transfer in the Asian context by using the idea of inverse technology challenge as its foundation structure. The variations of the application of the issues inherent in technology transfer form the basis of the challenge.

[290] Ohmae (1989), p. 29.
[291] Leonard-Barton,(1995), p. 224.

> From the relatively unsophisticated and chaotic deals in China to the much more knowledge-laden relationships in Singapore to the equal partnerships ultimately achieved in Japan, examples of companies operating in the Asian region richly illustrate the transfer of technological capabilities. These [notes] therefore, concentrate on descriptions of company activities in this geographic region to illustrate the managerial challenges of transferring technological knowledge.[292]

The initial development of the adoption model in this thesis adhered to the "standard" concept of technology transfer, in that the process is fundamentally one way. Leonard-Barton insists that for generations, cross-border flows of knowledge were characterised as technological, transfers. "The term connoted a one-time, one-way expenditure of knowledge and hence denoted an uncomplicated transaction".[293] In the initial study in this area there is the linear one way approach. However as the research progressed it became clear that the issues of complexity involved caused the demise of management systems models were not solved by this process, and that the adoption process was not linear at all and involved a multidimensional approach to transfer acceptance and utilisation. "Although practitioners have grown increasingly sophisticated in understanding the enormous differences in commitment and behaviour implied within the range of activities encompassed by "technology transfer," misunderstandings continue".[294]

By concentrating on the transfer as being a transfer of capability rather than technology a fundamental shift in managerial thinking can be achieved. According to Leonard-Barton, "[c]onceiving of technology movement from one company to another and across international boundaries as the flow of technological capabilities rather than technology transfer helps to highlight the inadequacies of the old managerial mindset and to suggest the kinds of activities essential to success. However, implicit in this newer term is the assumption that the technology transfer in fact desires to establish knowledge creating activities in a foreign location".[295] In

[292] ibid.
[293] ibid.
[294] Leonard-Barton,(1995), p. 250.
[295] ibid., p. 229

countries around China this does not always hold. Knowledge gathering activities is often not on the minds of either party.[296] In China, however, there is a driving force in many of the corporate activities to harness just this benefit of knowledge gathering during technological capabilities transfers.[297]

One can debate the merits of individual ventures, and it is true that companies often create their own future competition by transferring capabilities overseas. However, many companies will choose to selectively transplant some portion of their knowledge needed to new markets or needed resources, and managers will have to manage that challenge without giving away critical core capabilities.[298] Their initial assumptions about what, and how much to transfer, obviously affect the entire transfer process. For management processes, this is somewhat harder to achieve as the technology being transferred needs to have the complete managerial picture transferred.

The issue of strategic partnerships has severe implications for the transfer of managerial processes in that in order to transfer a managerial concept and idea you must bare all for it to work, and in order to do that you must have an implicit trust in the strategic partner. Some managers consider even wholly owned subsidiaries as foreign entities, to be treated with caution, whereas others regard their joint venture partners as an extended arm of the corporation, to be fully informed. Obviously, the legal relationship reflects the motives and objectives of the two parties involved and sets some boundaries on the opportunities for transfer, but a wide range of transfer options can be embedded in any type of partnership. The chemical industry recently has indulged in a concept called chain management in order to avoid the problems of transfer of capabilities, and thus creating internal competition. The chain management idea is a management linking between all sectors of the chain from raw material supply to the product users. This linking is completely transparent with each of the sector elements having computer access to all parts of the other sectors whether wholly owned or not.

[296] Kao (1995), p. 31.

[297] Xu (1997), p. 92. See discussion future strategies for China's import of technology. Despite recent advances there is no doubt that China's technology is at a relatively low level. "By making great efforts during the past ten years, China has fulfilled its basic technological acquisition targets in the quantitative sense. What we have to do now is to produce a qualitative improvement."

[298] Jingping (1997), p. 102. See discussion on foreign investment and industrial transformation for China.

The idea that the one sees that technology transfer reverses to become a new flow of knowledge back to the originator is a concept that is hard to imagine for managerial processes in China.[299] A theoretical "continuum of transfer" situations stretches from the simple sale of equipment by source to receiver to, at the other extreme, the final absorbtion of so much knowledge that the receiver becomes product design source, capable of reversing the flow of knowledge. Leonard-Barton states that underlying this continuum is a conceptual learning model, with the relationship moving from that of teacher pupil to cocreators.[300] This is why this work is so useful in formulating a model for the adaptation of management processes in Asia - the idea that the model has a reverse dynamic dimension. It is this concept of a reverse dynamic that, while largely unrealised in Asia, for managerial models is a concept that has a strong application for the management of intractable wastes. From early work on waste sites it is apparent that the idea of the reverse dynamic could form the backbone of the third dimension of the management model. The question regarding the "continuum transverse" is, what would the effect on the management processes quality be? How does one keep to the original concept strategy when the transverse occurs?

For the "standard" technology transfer schemes the progression from dependence to the reversing dynamic is not necessarily ubiquitous or inevitable. Not all agreements between the original technology source and the originally designated receiver are set up with any intention to transverse this continuum, and even if they are, many agreements fade before the recipient has achieved a full product development capability. For the adoption process to be coherent when applying foreign management models in China or Taiwan, there must be institutionalised structures inherent in the recipient corporation that ensure collection, processing and utilisation of all relevant data and information. This is often overlooked when planning technology transfer given the idea that it is a one way process. By changing the idea to include a reverse dynamic will ensure that the transfer corporation demand that the recipient company have the capacity to deliver the institutionalised mechanisms to achieve this. In addition, the recipient corporation must be flexible in order to capitalise on external opportunities that the donor

[299] Kao (1995), p. 21. See discussion on the shaping power of Confucian tradition.
[300] Leonard-Barton (1995). passim.

country may not be aware of. The "how to" of this complexity must be placed within the adoption process itself in order for it to succeed and survive the local management culture. With the idea that technology transfer of managerial models involves much more that simply understanding the behaviour of the parties at negotiations, and the realisation that the process is bidirectional the survey schedules required some additional elements to investigate and survey the project parties capacity to assimilate such models. Survey D was designed to gain an insight into the idea of reverse transfer and the current level of adoption.

Given the idea that "inverse transfer" or the "reverse dynamic" is an integral part of the technology component of the adaptation model, the question becomes "was the "know-why or inverse transfer response emergent?". If so, what would the effect be, and how then could the "know why" dimension be integrated with the Duncan's uncertainty/complexity matrix, and thus lead onto a model that replicated the organisations' complete response as an adaptation model. Throughout the research world an intense search is now under way for characteristics and laws associated with emergent phenomena observed across different types of complex systems.[301] Emergence refers to emergence of new and coherent structures and elements that occur during organisational changes, particularly related to self-organisation of complex systems. Emergent phenomena defined as occurring on the macro level, in contrast to the micro-level components and processes out of which they arise. There are some generally accepted definitions that define the features of emergence:[302]

- radical novelty: emergence have features that are not previously observed in the complex system under observation.

- coherence or correlation: emergence appear as integrated wholes that tend to maintain some sense of identity over time. This coherence spans and correlates the separate lower-level components into a higher-level unity.

[301] Goldstein (1999), p. 49. See discussion on definition of commonality of properties of emergence between systems.
[302] ibid.

- global or macro level: since coherence represents a correlation that spans separate components, the locus of emergent phenomena occurs at a global or macro level, in contrast to the micro-level locus of their components. Observation of emergence, therefore, is of their behaviour on this macro level.

- dynamical: emergent phenomena are not pre-given wholes but arise as a complex system evolves over time. As a dynamical construct, emergence is associated with the arising of new attractors in dynamical systems (i.e., bifurcation).

- ostensive: emergence are recognised by showing themselves, i.e., they are ostensibly recognised.

Emergence, as an explanation, is often applied when the internal mechanisms of a system appear more logical by recognising an "across system organisation" rather than on the individual elements alone. Emergence can therefore be applied to the functioning of the parts of a system. "In fact, it is often the very interplay between the parts and the whole that has been emphasised in studies of complex, self-organising systems".[303] Lissack states that "complexity theory challenges the traditional management assumptions by noting that human activity allows for the possibility of emergent behaviour".[304] In this chapter, complexity and uncertainty understanding has been discussed, for stability and for survival, organisations must find ways to assimilate external events, so as to make their organisational strategies more predictable and preferred.

Organisation science is focussed on understanding how people, both inside and outside of the organisation, construct meaning and reality, and determine how that perceived reality provides a context for action. "In the process of sense making and reality construction, people in an organisation attempt to give meaning to the events and actions of the organisation. by definitive actions by constructing,

[303] See Lewin (1992).
[304] Lissack (1999), p. 110. Lissack provides an argument that emergent behaviours is allowed for by organisational science and complexity theory therefore it may exist and it may have a reality.

rearranging removing, integrating, leaving out unrandomising thus creating their own orderliness, and literally create their own constraints".[305] This process occurs across the organisation at two levels the 'intraindividual' and the 'intraorganisation'. Organisations often experience change as an "emergent" process. Emergence, as change, is defined as an overall system behaviour that comes out of the interaction of many participants behaviour that cannot be predicted or "even envisioned" from a knowledge of what each component of a system does in isolation.[306] The idea that integrating the micro emergent features so that they produce a macro emergent whole that exhibits an across the organisation behaviours or characteristic is not prevalent in the literature. The emergent nature of change, as experienced by other members of the organisation, is often overlooked. Change, instead, is treated as continuous, step like, or even chaotic, but with a definable scope and focus.[307] The experienced sense of change that the whole is bigger than the sum of the parts, and that the patterns observed and felt are unexpected is not captured. Survey D will be focussed on the reverse dynamic but in doing that it will look at micro emergent behaviours, and see if it can show us divergence that provides some structure for the adaptation model. In addition to an examination of embedded characteristics within the firms surveyed the survey questions will be structured in a way that allows insights of "knowledge management" (KM) and "organisational learning" (OL). The purpose of this is to find out if there are further integration's within these two management communities with complexity and uncertainty theory.

The Hypothesis

Duncan and subsequently Daft, have shown that both the simple-complex and static-dynamic dimensions are important in determining the state of the decisions unit's environment. By considering the interaction between these two dimensions, different states of the decision unit's environment can be identified. Once these are identified, predictions can then be made as to the degree of perceived environmental uncertainty expected to exist in these different types of environments.

The hypothesis here is that Duncan's matrix model, as adapted by Daft, can be

---
305 Weick (1995). As cited by Lissack (1999).
306 Casti (1997). As cited by Lissack (1999).
307 Stacey (1996).

reverse applied to the external environmental elements and components (as opposed to the internal decision making units), combined with the mutual adaptation model (ie technology/organisational mutual adaptation), therefore establishing an integrated multidimensional model of adaptation.

Summary

The analysis in this chapter looks at four organisational characteristics that of uncertainty and complexity along with know-why and reverse dynamic. These four characteristics form the basis for the field surveys that were conducted in China and Taiwan over five years (1997 to 2001). Results of these surveys are shown in Chapter five. The four surveys are:

Survey A	Uncertainty Characteristics (Organisational adaptation)
Survey B	Complexity Characteristics (Organisational adaptation)
Survey C	Know-Why (Technology adaptation)
Survey D	Reverse Dynamic (Technology adaptation)

The fours surveys and their relationship with the overall model are shown in Figure 4.8.

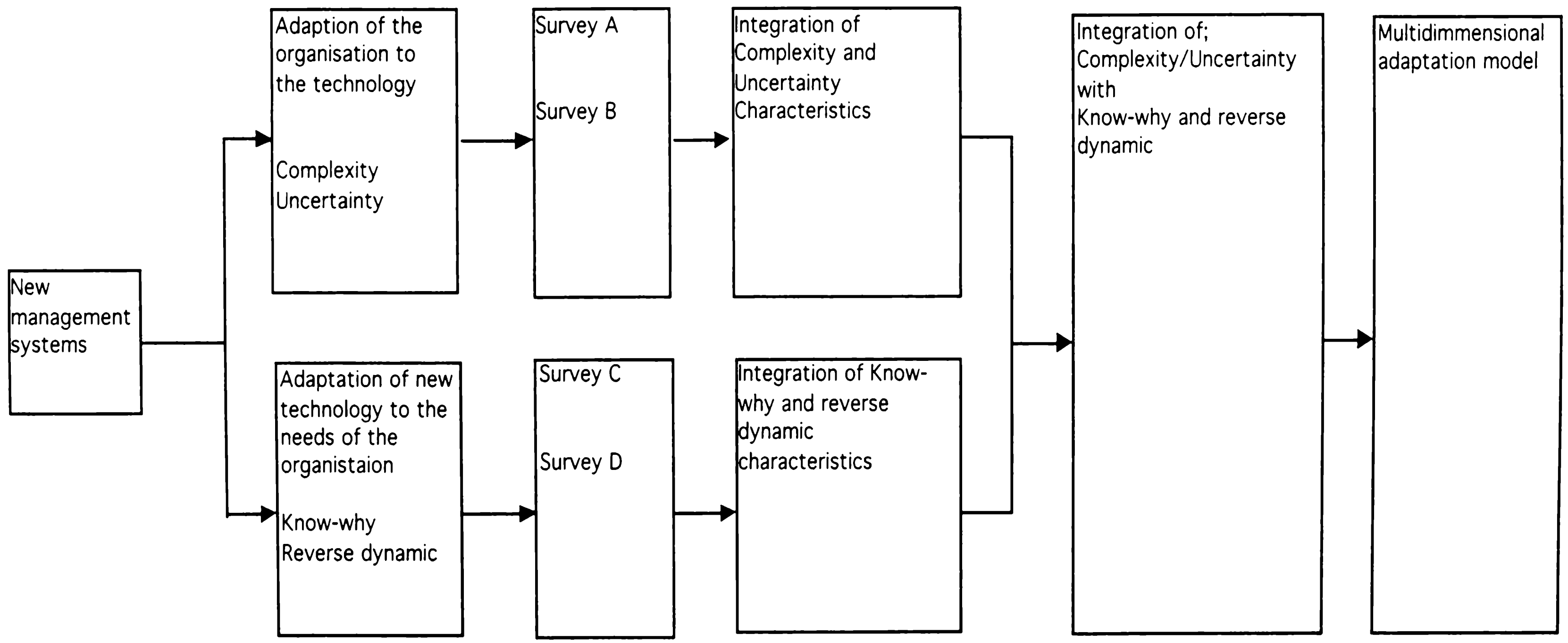


Figure 4.8 Adaptation Model Pathway

5
The Field Surveys

Introduction

The organisation characteristics discussed in Chapter 4 led to the formation of four field surveys. These surveys were applied at different times over a five year period, covering ten projects in China and Taiwan, and involved interviews with a total of 100 executives, who were asked 96 questions, resulting in 9600 responses. This chapter contains the details, and the results of the surveys. The field surveys conducted were as follows:

Survey A	Uncertainty Characteristics (Organisational adaptation);
Survey B	Complexity Characteristics (Organisational adaptation);
Survey C	Know-Why (Technology adaptation); and
Survey D	Reverse Dynamic (Technology adaptation).

Projects and Contracts Observed and Surveyed

Ten projects or contracts were surveyed (by the author) using the surveys (and observed) over five years, and each of the projects was multidisciplinary involving more than 30 staff as follows;

P1- Taiwan Power Company (TPC) - Taiwan.

This project involved the Government of Taiwan, through its Power Company, entering into a contract with a French company to remove and destroy the government's stock of intractable and hazardous chemicals. Project duration was three years.

P2 - Cleanaway Joint Venture TPC Contract -Taiwan.

This project involved the provision of large amounts of labour and services in the hazardous waste collection and packaging of the TPC project. The subcontract involved a contract between the Joint venture Taiwan/French consortium and Cleanaway Taiwan Ltd. This contract lasted five Years.

P3 - Project Shu Lin, Nan Tou, Taichung and Kaiochung warehouses extraction and removal - Taiwan

This project involved the removal of 10,000 tonnes of contaminated materials from hazardous waste storage warehouse in several urban centres throughout Taiwan. Project duration was one year.

P4 - Autoclaving Project in Kaiochung - Taiwan

This project involves the establishment of an Autoclave plant to dispose of 10,000 tonnes of PCB per year. It is a complex project with many establishment and operational problems. Some 50,000 tonnes of PCB contaminated materials were treated at this project over four years.

P5 - Shin Lin Electric Corporation, - Taiwan

This project involved the removal of 2000 tonnes of intractable chemicals over extended periods (three years). The project was characterised by very difficult site conditions and many non compliance with regulations and contract frustration.

P6 - Multi treatment of hazardous wastes plant - China

This project involved the establishment of multi platforms for hazardous waste disposal in China, and incorporates autoclaving, incineration and chemical reduction across ten provinces in China. The project negotiations lasted two years.

P7 - Hazardous waste storage and exchange facility - China

This project was initiated by SEPA of China and involved the establishment of a very large warehouse, storage and exchange facility for hazardous wastes for the city of Beijing. The project duration was two years.

P8 - Class one landfill for PCB and other intractables - China

This project involved the establishment of a Class One landfill operation near Beijing. The facility is now established after three years of construction and is one of the largest such landfills in the world.

P9 - Removal of large scale contaminated power structures - Taiwan.

This project involved the removal and disassembly of very large power units, and the subsequent transportation of contaminated components to Europe for incineration and autoclaving. The project duration was six months.

P10 - Mercury sulphide land contamination - Cambodia

A total of 5000 tonnes of contaminated soils and fixed incinerator ash was dumped in open grassland in Cambodia. The project involved three countries and a substantial extraction plan that took more than two years to complete. The project involved many departments of the Cambodian, Taiwanese, Chinese, USA and French governments.

Research Design and Methodology

The data used in this thesis to formulate management models came from an extended series of interviews and questionnaires (surveys A,B,C,D) relating to a diverse set of projects, contracts and companies during a five year period. Each of the projects focused on the adoption of technology and management systems for the management of toxic waste recovery. Specifically, the research was aimed at the adaptation processes adopted by organisations when introducing technology, and the adaptation of the technology to the organisation during such processes. An attempt was made in the four surveys to adhere to the comparison principles of Leonard-Barton,[308] as cited by Tyre and Orlikowski in their study of technology adaptation.[309] Tyre and Orlikowski framed their study so that they could examine "adaptation of new technologies at both group and individual levels". They deliberately sought "variety in the setting studied, the technologies introduced, and

[308] Leonard-Barton (1990). p. 248-266. The principles referred to by Tee and Orlikowski are 1. The technologies studied has passed the test of technical and organisational feasibility. 2. The technologies studied altered the work in obvious but not radical ways. 3. The technologies were open ended in the sense that uses had the capacity to make changes. 4. The focus of the research was consistent.

[309] Tyre and Orlikowski (1994). passim.

the type of users involved so as to enrich the range of insights and to enhance generalizability".[310] The four surveys here were conducted with ten very different companies and projects in three different countries and provided the diversity that was evident in the Tyre and Orlikowski study.

Overall, the questions within the surveys were framed from the point of view of observation from the client and non-client contracting parties. All four surveys involved in-depth field research so that the characteristics identified were well grounded in the experiences, terminology and outcomes of the users. The first two surveys were conducted close together in time with the third and fourth later in the process and could be considered retrospective. All data were obtained using two approaches, the first involved semistructured interviews with multi participant discussions and the second with one on one using questionnaires. All four surveys were conducted by the author with an interpreter. The first part was a qualitative approach but did not involve data collection. The second part involved the surveys (questionnaires) and was quantitative and the data collected and used in this thesis. The respondents included project, managers, engineers, technicians, company accountants, marketing managers and site leaders etc. In general, the contract value in each of the projects surveyed exceeded US$1 million. A total of ten projects were formally surveyed (although some 25 projects were observed in total) over five years. During the five year period the surveys were conducted there were only four executive personnel changes.

Survey A comprised a set of questions based on "uncertainty" and Survey B comprised a set of questions based on "complexities". Survey A was applied immediately after the completion of contract negotiations, and Survey B was applied approximately six months into each project. During all interviews an interpreter was present and the answers obtained were confirmed as to their accuracy and veracity. Results from the information gained in the first two field surveys was used to frame the next two surveys. Survey C was constructed to gain an understanding of the Know-how vs Know-why complexity, and Survey D was conducted to ascertain the inverse characteristic. All surveys were conducted personally by the author and involved over thirty visits to the two main countries.

[310] ibid., p. 101.

All questions are asked of individuals within the companies that were in negotiations or contracted with a Chinese or Taiwanese party. These companies are French, Taiwanese or Chinese contracting companies, either trying to get projects or are involved with current projects.

The surveys were a set of questions that required a ranked answer (standard simple Likert scale). Because of the problems of interpretation (French, Chinese and Mandarin), the ranking structure was kept simple and provided with large divisions in order to avoid confusion and vagueness in the answers. In some cases it was necessary to extract an overall impression and then assign a ranking that would fit.

The scale applied to all four surveys was as follows:

Scale 1-5:

1	very low extent
2	low extent
3	neutral
4	great extent
5	very great extent

Survey analysis

The survey analysis involved two stages and is presented in Chapter Six. The first involved a within-survey analysis and the second involved a cross-survey analysis. The first two surveys on uncertainty and complexity were searches for characteristics as patterns of the organisation and its reactions and responses to the external environment and the last two surveys involved the search for whether the characteristics discovered in the first two were resolved or embedded in the organisation's work environment with respect to the adoption of technology during the transfer stage. Both sets of surveys were designed to discover the characteristics of the work place environment, the degree and depth of the adaptation of the organisation to the technology transfer, and the adaptation of the technology transfer to the organisation. Throughout the four surveys, particular interest was placed on issues of knowledge management and organisational learning and its relationship with uncertainty and complexity theory.

Survey A

Uncertainty Characteristics

Survey A was designed to determine the elements of uncertainties that prevail within the project negotiation phase particularly those elements related to the adoption of new processes. The questionnaire that was formulated is shown in Table 5.1.

Question Development

The questions for Survey A were developed specifically to obtain insights into the issues of environmental uncertainty that affect Chinese organisations. In the main, the questions that were developed are formed against the uncertainty characteristics and cultural background as developed by Blackman.[311] The questions were placed in broad groupings specifically designed to examine knowledge management (KM) and organisational learning (OL) characteristics in then belief that some correlation may exist between complexity theories and other organisational models..

Questions A1-A3:

Group(OL)		State Uncertainty Environment
Sub Group(C)		Central Planning
Elements(F)	-	Historically risk averse
	-	Production demands centrally pronounced
	-	Decisions remote to organisations.

Survey Questions A-1 to A-3 were designed to determine the contribution of Blackman's characteristic "Central Planning" to uncertainty. Blackman indicates that "Central Planning" is a significant characteristic of the Chinese negotiating style. The questions in the survey are designed to get a measure of how much this characteristic features in organisational environment, and thus, to what extent it contributes to uncertainty. Despite liberalisation of the China labour market, there remains severe controls on the people in terms of the jobs they may take on. In general, most people cannot change jobs at will. The government decides what jobs they will perform, and where. Individuals are controlled in this way by the use of personnel files, which are held by the government, and contain political history of

[311] See Blackman (1997). p. xv.

the employee and immediate family members, work evaluations, criticisms, punishments, ideology, professional career assessments etc. One cannot move from one job to another unless the local personnel department releases the file to the next. Historically, China was a collective state management under a planned economic system. With this background as a cultural characteristic the dimension of uncertainly is easily influenced by the remnants of central planning, and its remaining intensity and extent will provide a driving factor into self organisation.

Question A1 - To what extent did the negotiators refer to another outside agenda?

Explanation: Before 1978 the economy in China was essentially a "planned" economy. This changed from 1981 as central planning devolved into deregulation.[312] Irrespective of the movement to independence of enterprises, there still remain centrally planned regulations that affect many organisations, and this question is designed to measure the degree to which the Chinese negotiators deferred to "outside agencies or agendas", whether or not they were real. The current trend permits organisational independence but has resulted in severe problems of "personal gain at the expense of state or the organisation".[313] The degree of uncertainty is measured as the higher the score, the greater the degree of uncertainty. Thus, the effect of a score of 5 would indicate that the negotiators were highly influenced by some outside agency that in fact could determine the organisation's future, and the organisation was affected by environmental uncertainty. A score of 1, on the other hand, would indicate an organisation that was truly independent and did not have any difficulty determining its own destiny, and therefore, the degree of environmental uncertainty was not contributed to by this characteristic.

Question A2 - To what extent is there an impression of outsider ethics?

Explanation: Outsider ethics are sometimes introduced into negotiations by the Chinese. "This is what the tax authorities want", or "This is how other westerners do it" etc.[314] The degree to which the Chinese negotiators appeal to "Outsider Ethics" is a measure of the uncertainty environment. The "ethics" Chinese

[312] See Brahm (1996). p. 110. Brahm provides a description of the transition from a centrally planned economy to one that has more independence for enterprises.
[313] ibid.
[314] See explanation by Blackman (1997). p. 12.

negotiator's depend "mainly on whether you are in the in group or the out group".[315] The higher the score on this scale the more intense the uncertainty characteristic. This question is designed to provide an indication of how the organisation uses outsider ethics to manage uncertainty and thus, the perception and role of "Central Planning".

<u>Question A3 - To what extent did the negotiators remove themselves from direct responsibility?</u>

Explanation: This question completes the "Central Planning" picture part of the uncertainty dimension. The more that negotiators removed themselves from direct responsibility for the decisions within the negotiation, the more the organisation cedes to central planning, and the more the organisations environmental is one of uncertainty. This question also provides an insight into the capacity of the organisation to adopt external models. The higher the score here, the higher the degree of uncertainty.

<u>Questions A4-A6:</u>

Group(OL)		State Uncertainty Environment
Sub Group(C)		Open/Closed System
Elements(F)	-	Mechanistic Structures
	-	Large Bureaucracy

The questions in this subgroup are designed to determine if Blackman's suggested organisational systems structure is influenced by uncertainty. Thus, the questions are designed to evaluate the degree to which the organisations are mechanistic and driven by open or closed systems. Elements of bureaucracy involve several rules regarding structure and effect.[316] The three questions are therefore designed to uncover the effect of uncertainty on the structural norms that shape the organisation. The questions were asked of the outside agency that was in

[315] ibid.,p. 77.

[316] Analysis as cited by Bond (1991). p. 73. The rules or constraints referred to include; (1) A well defined hierarchy of authority, (2) a division of labour based upon functional specialisation, (3) a system of rules covering the rights and duties of positional incumbents, (4) a system of procedures for dealing with work situations, (5) impersonality of interpersonal relationships, and (6) selection for employment and promotion based on technical competence.

negotiations with the Chinese party.

Question A4 - To what extent did the negotiation process follow an inflexible step by step procedure that appeared to be preordained and fixed?

Explanation: This question examines, from the outside negotiating party point of view, their level of perception that the Chinese organisation was a closed or open managerial system. The higher the score, the greater the level of the effect of closed systems on the level of uncertainty, and the higher the likelihood of mechanistic structures.

Question A5 - To what extent was there an impression that there was a large complex corporation involved with many sections and departments?

Explanation: The question looks at the degree to which the Chinese party is an open or closed organisation given the number of internal parties that are perceived by the outside contracting organisation. The higher the score, the higher the degree of mechanistic and closed systems.

Question A6 - To what extent did the departments have many different agendas?

Explanation: This question was designed to unmask the complexities within the organisation from a mechanistic and bureaucracy point of view. Multiple agendas increase uncertainty and the perception of a closed mechanistic system, and the degree to which the organisation is a large bureaucracy.

Questions A7-A9:

Group(OL)		Effect Uncertainty Environment
Sub Group(C)		Core competencies
Elements(F)	-	Hidden Structures
	-	Protected agencies
	-	Protected agendas
	-	Team Strategy

The questions in this subgroup are to do with Blackman's core competencies affecting Chinese negotiations and the questions are designed to determine to what extent the organisation defends its core competencies and thus, gains an idea of the degree to which uncertainty effects the organisational core competency. Many Chinese organisations are characterised by a relative lack of internal departments.[317] By examining the defending of core strategic competence a measure can be gained as to how deep the effect of uncertainty with respect to core competencies has on the organisation.

Question A7 - To what extent did the Chinese company exhibit protected core competency?

Explanation: The question looks at the degree to which the Chinese company adopts a team strategy approach in protecting its core competencies. Companies with strong core competencies are more likely to suffer less from external uncertainty and more susceptible to adoption of external plans and models. Innovation, and entrepreneurship is also a characteristic. The higher the score in this question, the less the effect on uncertainty. Therefore the score results have been inverted in the results.

Question A8 - To what extent did the core group defend its patch against difference?

Explanation: This question builds on the previous question, and firmly establishes the degree of competency within the Chinese firm. Again, the survey result is inverted.

Question A9 - To what extent did the characteristic of the core group display internalised and insular thinking in a protective manner?

Explanation: This question examines the inverse of the other two questions in this group in that it looks at the propensity of the firm to look inwardly and reject external ideas. Score result indicates degree of uncertainty from the perspective of rejection of external ideas.

[317] See Redding (1990) for an argument for the characteristics of the Chinese organisational structure. Redding concludes that: (1) A low level of specialisation, with fewer and/or less breaking up of the organisation into specialised departments, and with more people responsible for the spread of activities across a number of fields, (3) Less standardisation of activities and thus fewer routine procedures. (4) A relative lack of ancillary departments such as research and development, labour relations, public relations, market research, and a tendency instead for all employees to deal with the main product or service of the company.

Questions A10-12:

Group(OL)		Effect Uncertainty Environment
Sub Group(C)		Organisational Flexibility
Elements(F)	-	Historically Risk averse
	-	Rigid structures
	-	Protective internal Groups

The questions in this subgroup are designed to gain an insight into the effect of uncertainty on the structure of the chinese organisation. Redding has it that the consequence of traditional hierarchal allegiances and controls is the formation of cliques.[318] "Loyalties, being narrow, are rather more difficult to meld into an organisation-wide affiliation".[319]

Question A10 - To what extent did the company display a rigid approach to negotiations?

Explanation: This question examines the degree to which the Chinese party displayed a tendency to stick to its own agenda and not allow the flexibility of an outsider agency the capacity to change the order of the proceedings. The point of this question is to get an insight into the degree of organisational flexibility displayed by the company and thus, the degree to which flexibility contributes to uncertainty.

Question A11 - To what extent did the company display a protective stance against change to its internal systems?

Explanation: Similar question to the one above in that the degree to which the companies flexibility contributes to the effect the degree of uncertainty has on the firm.

Question A12 - To what extent did the company display an unwillingness to compromise?

[318] See Redding as cited by Bond (1991). Redding states that the strength of identity with group introduces the risk of apathy about or even hostility towards other groups, and the question of the organisations internal effectiveness may well rest on whether the group to which a person belongs has aims which are in line with those of the organisation.

[319] See Bond (1991). p. 84.

Explanation: A final question in the subgroup that emphasises the firm's degree of flexibility and thus, the degree to which uncertainty effects the firm.

Questions A13-A15:

Group(KM)		Response Uncertainty Environment
Sub Group(C)		Rigid Viewpoint
Elements(F)	-	Fixed Positions
	-	Outsider Influence
	-	Mechanistic defence

The questions in this subgroup are designed to obtain an understanding of the rigidity of the organisation to outside influence and, therefore, derive an understanding of the 'degree' to which the organisation is influenced by internal rigidities. Organisational flexibility is also an indication of an organisation's response to uncertainty. The more rigid the response, the more the organisation is influenced by uncertainty. Burns and Stalker[320] refer to two types of organisations, "mechanistic and organic" and the questions here are also looking at the differentiation that the two types of organisations display.

Question A13 - To what extent did the company display a fixed immovable position during the negotiation phase?

Explanation: This question examines the degree, to which the company negotiates from a fixed and immobile viewpoint. Internal rigidities are an indication of response to state uncertainty.

Question A14 - To what extent did the company indicate outsider influence in decisions?

Explanation: This question follows on from the previous in that an attempt is made to find out if the company is influenced in its rigidity by an outside influence.

Question A15 - To what extent did the company maintain its position even after it was shown to be illogical?

[320] Burns and Stalker (1961).

Explanation: The final question in the subgroup tests the degree to which rigidity is founded. Remaining fixed on a negotiation position is a clear internal response to external environmental uncertainty, and the degree to which this is the case effects the organisation's overall capacity to adopt.

Questions A16-A18:

Group(KM)		Response Uncertainty Environment
Sub Group(C)		Entrepreneurship
Elements(F)	-	Lack of individual initiative
	-	Historically risk averse
	-	Lack of personal responsibility

The questions in this subgroup are designed to "measure" the degree to which the organisation is "open" and responsive to uncertainty by the application of entrepreneurship and innovation. Again, the constructs of organisation response from a mechanistic or organic response are canvassed here. State uncertainty is examined here as opposed to Duncan's two dimensions.

Question A16 - To what extent did the company display a capacity to innovate?

Explanation: The company's capacity to innovate is clearly an indication of the organisational systems as to it being open or closed. The result here is inverted.

Question A17 - To what extent did the company display a capacity to accept new ideas and processes?

Explanation: Again, this is an indication of the firm's capacity to accept new ideas, and is a direct indication of how uncertainty effects the adoption process, and an indication of the state response. The result here is inverted.

Question A18 - To what extent did the company officers indicate personal responsibility?

Explanation: This question looks at the degree to which centralisation effects innovation and thus, is a check on the degree to which the organisation indulges in innovation as a result of management of uncertainty.

Questions A19-A21:

Group(KM)		Response Uncertainty Environment
Sub Group(C)		External elements
Elements(F)	-	Large numbers of external parties
	-	Slow change
	-	Internally protective to change

The questions in this subgroup are designed to cover the external environmental issues that affect the internal structure of the organisation. The degree to which the organisation responds to external elements is a measure of uncertainty that affects the organisation. The numbers of elements that are allowed to affect the organisation will be some "measure" of the flexibility of the organisation to cope with uncertainty. If the organisation is characterised by slow change, yet is affected by large numbers of external elements, then the uncertainty response is rigid and inflexible. These questions are also designed to look at Milliken's state uncertainty.

Question A19 - To what extent did the company indicate that they are impacted by large numbers of outside elements?

Explanation: The numbers of outside elements that are allowed to effect the organisation, are an indication of the degree to which uncertainty affects the management.

Question A20 - To what extent did the company indicate that they are affected by slow change?

Explanation: The speed to which organisations respond to environmental change is an indication of the state response to uncertainty, and an indication of adoption capacity.

Question A 21 How large in number were the external elements that affected the company?

Explanation: This question follows the two above in that it provides an indication of the numbers of outside elements and thus, the degree to which the firm is affected by uncertainty.

Questions A22-A24:

Group(KM)		Response Uncertainty Environment
Sub Group(C)		Unpredictability
Elements(F)	-	Slow predictable changes
	-	Risk averse

The questions in this subgroup are designed to define the level to which the organisation suffers from unpredictability and thus, the degree of uncertainty. This set of questions flows on from the previous set in that it is a check against the organisation's flexibility to cope with uncertainty. If, in fact, the organisation shows flexibility from the previous set of questions, then this set should show a configuration that supports that flexibility by the use of boundary spanning.

Question A22 - To what extent did the company display integration and boundary spanning?

Explanation: This question provides an indication of how the company organises itself internally and the degree to which self organisation is a reality.

Question A23 - To what extent did the company display external predictable changes?

Explanation: Again, this question provides an indication of organisational flexibility and thus, the degree to which uncertainty effects the company.

Question A24 - To what extent was there an indication that changes were infrequent?

Explanation: This question directly provides an indication that the company indulges in a slow predictable way to uncertainty.

The questions of Survey A are tabulated in Table 5.1.

Uncertainty Characteristics	Cultural Background	Survey A Question (Scale 1-5)
Central Planning	Historical Risk averse Production demands centrally planned Decisions remote to the organisation	A-1 To what extent did the negotiators refer to another outside agenda? A-2 To what extent was there an impression of outsider ethics? A-3 To what extent did the negotiators remove themselves from direct responsibility?
Open/Closed System	Mechanistic structure Large bureaucratic	A-4 To what extent did the process follow a step by step procedure that was preordained by outsiders? A-5 To what extent was there an impression that there was a large complex corporation involved with many sections and departments A-6 To what extent did the departments have different agendas?
Core competencies	Hidden structure Protected agencies within the company Team strategy Protective agenda	A-7 To what extent did the company exhibit protected core competency? A-8 To what extent did the core group defend their patch against difference? A-9 To what extent did the characteristic of the core group display internalized and insular thinking in a protective manner?
Organisational Flexibility	Historical risk averse Rigid Structures Protective internal groups	A-10 To what extent did the company display a rigid approach to negotiations? A11 To what extent did the company display a protective stance against change to its internal systems? A-12 To what extent did the company an unwillingness to compromise?
Rigid Viewpoint	Fixed Position Outsider influence Mechanistic defence against outside change	A-13 To what extent did the company display a fixed immovable position? A-14 To what extent did the company indicate outsider influence in decisions? A-15 To what extent did the company maintain its position even after it was shown to be illogical?
Entrepreneurship	Lack of individual initiative Historical risk averse Lack of personal responsibility taking	A-16 To what extent did the company a capacity to innovate? A-17 To what extent did the company display a capacity of accepting new ideas and processes? A-18 To what extent did the company officers indicate personal responsibility?
External Elements	Large numbers of external contacts Change is slow	A-19 To what extent did the companies indicate that they are impacted by large outside elements? A-20 To what extent did the companies indicate that the they are effected by slow change? A-21 How large were the external elements that affected the company?
Unpredictability	Slow predictable changes Risk averse	A-22 To what extent did the company display integration and boundary spanning? A-23 To what extent did the company display external predictable changes? A-24 To what extent was there an indication that changes were infrequent?

Table 5.1 Survey A Questionnaire

Survey A "Uncertainty Characteristics" Results

The results of the interviews conducted with companies involved with the ten projects are shown in Tables 5.2, 5.3,5.4 and 5.5 The references in these tables (A1-A24) refer to the questions numbers shown in Table 5.1. Analysis of these results and the results of surveys B, Cand D are discussed in Chapter Six.

Survey A Question A-1											f					
Q-A1	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	4	4	3	4	5	4	4	3	0	0	2	6	2	4
P2	1	2	2	2	1	1	2	2	2	1	3	5	1	1	0	2
P3	2	2	1	2	2	1	2	2	2	2	1	5	3	0	0	2
P4	3	5	5	5	4	5	5	5	5	5	0	0	1	1	8	4.7
P5	3	4	5	5	5	5	5	5	5	5	0	0	1	1	8	4.7
P6	1	1	2	2	1	1	2	3	2	2	4	5	1	0	0	1.7
P7	1	2	3	3	4	4	3	4	3	3	1	1	5	3	0	3
P8	5	5	5	5	4	5	5	5	5	5	0	0	0	1	9	4.9
P9	3	1	2	2	2	1	2	2	2	2	2	7	1	0	0	1.9
P10	5	4	5	5	4	5	4	5	5	5	0	0	0	3	7	4.7

Survey A Question A-2											f					
Q-A2	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	3	3	2	3	4	2	3	3	3	0	3	6	1	0	2.8
P2	1	1	1	2	2	3	2	2	3	3	3	4	3	0	0	2
P3	1	3	2	2	2	2	3	3	2	3	1	5	4	0	0	2.3
P4	1	1	3	2	4	2	2	2	2	2	2	6	1	1	0	2.1
P5	2	3	3	4	5	4	4	4	4	4	0	1	2	6	1	3.7
P6	2	2	4	4	4	3	3	3	4	4	0	2	3	5	0	3.3
P7	1	1	3	4	2	2	3	2	2	2	2	5	3	1	0	2.5
P8	2	3	3	2	3	3	3	3	3	3	0	2	8	0	0	2.8
P9	1	2	4	4	2	1	4	2	2	2	2	5	0	3	0	2.4
P10	4	5	3	4	5	3	5	5	5	5	0	0	2	2	6	4.4

Survey A Question A-3											f					
Q-A3	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	5	5	4	4	4	5	5	5	4	0	0	1	4	5	4.4
P2	1	1	1	2	2	2	1	2	2	2	4	6	0	0	0	1.6
P3	1	1	1	1	2	1	2	2	2	1	6	4	0	0	0	1.4
P4	4	5	5	5	4	5	5	5	5	5	0	0	0	2	8	4.8
P5	4	4	5	3	4	4	5	5	5	5	0	0	1	4	5	4.4
P6	1	1	2	2	2	1	1	2	2	2	4	5	1	0	0	1.7
P7	1	1	3	1	2	1	2	2	1	1	6	3	1	0	0	1.5
P8	4	5	5	5	4	5	5	5	5	5	0	0	0	2	8	4.8
P9	2	1	1	1	2	1	2	1	1	1	7	3	0	0	0	1.3
P10	3	4	3	4	4	5	5	4	4	4	0	0	2	6	2	4

Survey A Question A-4											f					
Q-A4	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	4	4	3	4	4	3	4	4	4	0	0	3	7	0	3.7
P2	1	1	2	2	1	2	2	2	2	2	3	7	0	0	0	1.7
P3	1	3	1	2	2	2	3	3	2	2	2	5	3	0	0	2.1
P4	1	4	4	4	3	3	4	4	4	4	1	0	2	7	0	3.5
P5	2	4	4	2	4	4	4	3	3	4	0	2	2	6	0	3.4
P6	2	2	2	1	2	2	2	2	2	2	3	8	0	0	0	1.9
P7	1	2	1	1	1	1	2	1	1	1	8	2	0	0	0	1.2
P8	3	5	5	5	4	4	5	5	5	5	0	0	1	2	7	4.6
P9	3	2	1	1	1	1	1	1	1	1	8	1	1	0	0	1.3
P10	3	3	5	5	5	4	4	4	5	5	0	0	2	3	5	4.3

Survey A Question A-5											f					
Q-A5	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	5	5	3	4	5	4	5	5	5	0	0	2	2	6	4.4
P2	2	2	2	1	2	1	2	1	2	1	4	6	0	0	0	1.6
P3	1	1	1	1	2	1	1	2	1	1	8	2	0	0	0	1.2
P4	4	4	4	3	4	4	4	3	4	4	0	0	2	8	0	3.8
P5	5	5	4	5	5	4	5	5	5	5	0	0	0	2	8	4.8
P6	3	3	1	4	3	2	2	3	3	3	1	2	6	1	0	2.7
P7	2	1	1	1	1	1	2	1	1	1	8	2	0	0	0	1.2
P8	1	2	1	2	3	4	3	3	3	3	2	2	5	1	0	2.5
P9	2	2	1	1	1	2	1	2	2	2	4	6	0	0	0	1.6
P10	2	1	2	1	3	3	3	3	3	3	2	2	6	0	0	2.4

Survey A Question A-6											f					
Q-A6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	5	5	3	5	5	4	4	5	5	0	0	2	2	6	4.4
P2	1	1	1	1	2	2	1	1	1	2	7	3	0	0	0	1.3
P3	1	1	1	2	2	1	1	1	1	1	6	4	0	0	0	1.4
P4	3	3	2	2	3	3	3	3	3	3	0	0	3	7	0	3.7
P5	4	4	1	4	4	4	4	4	4	4	1	0	0	9	0	3.7
P6	1	1	1	1	2	1	1	1	1	2	8	2	0	0	0	1.2
P7	2	2	2	1	1	3	3	2	2	2	2	6	2	0	0	2
P8	2	2	1	2	2	3	4	3	3	3	1	4	5	1	0	2.8
P9	2	2	1	2	1	1	1	2	1	2	5	5	0	0	0	1.5
P10	3	3	4	1	2	3	3	3	3	3	1	1	7	1	0	2.8

Table 5.2 Survey A Questions A1-6 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey A Question A-7											f					
Q-A7	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	2	4	4	3	3	3	3	3	3	0	2	6	2	0	3
P2	1	3	3	2	1	1	2	2	2	2	3	5	2	0	0	1.9
P3	1	2	1	1	2	1	2	1	2	2	5	5	0	0	0	1.5
P4	3	3	2	2	4	3	3	4	4	4	0	2	4	4	0	3.2
P5	1	2	2	1	2	2	3	3	2	2	2	6	2	0	0	2
P6	2	2	1	2	2	1	1	2	1	2	4	5	1	0	0	1.7
P7	1	2	1	1	1	1	2	2	3	3	5	3	2	0	0	1.7
P8	1	2	1	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P9	2	1	1	1	2	2	3	2	2	2	3	6	1	0	0	1.8
P10	1	1	1	2	1	1	1	1	2	2	7	3	0	0	0	1.3

Survey A Question A-8											f					
Q-A8	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	2	4	4	3	4	3	3	4	0	1	3	6	0	3.5
P2	2	1	2	1	3	3	2	2	3	3	2	4	4	0	0	2.2
P3	1	1	2	2	2	3	3	2	3	3	2	4	4	0	0	2.2
P4	3	4	4	3	3	5	4	4	4	4	0	0	3	6	1	3.8
P5	2	3	4	4	4	5	4	4	4	4	0	1	1	7	1	3.8
P6	2	3	2	3	3	3	4	4	4	4	0	2	4	4	0	3.2
P7	2	1	2	1	2	2	2	3	3	3	2	5	4	0	0	2.4
P8	4	4	2	4	4	3	4	4	3	5	0	1	2	6	1	3.7
P9	2	2	1	2	2	4	2	2	4	4	1	6	0	3	0	2.5
P10	3	3	4	5	4	5	5	5	4	4	0	0	2	3	5	4.3

Survey A Question A-9											f					
Q-A9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	3	4	5	4	5	4	5	5	0	0	1	5	4	4.3
P2	2	2	2	3	3	3	4	3	3	3	0	3	6	1	0	2.8
P3	1	2	2	1	1	1	1	2	2	1	6	4	0	0	0	1.4
P4	5	5	5	5	4	5	5	5	5	5	0	0	0	1	9	4.9
P5	5	5	4	3	4	5	5	4	4	4	0	0	1	5	4	4.3
P6	1	1	1	1	2	2	1	2	2	1	6	4	0	0	0	1.4
P7	3	3	2	2	3	3	2	3	4	3	0	3	6	1	0	2.8
P8	4	5	5	5	5	5	5	5	5	5	0	0	0	1	9	4.9
P9	1	1	1	1	2	1	1	2	2	2	6	4	0	0	0	1.4
P10	5	5	3	4	5	5	5	5	5	5	0	0	1	1	8	4.7

Survey A Question A-10											f					
Q-A10	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	4	4	3	4	3	4	4	4	0	0	2	8	0	3.8
P2	2	2	2	2	1	2	1	2	2	2	2	8	0	0	0	1.8
P3	1	3	3	3	3	2	2	3	3	3	1	2	7	0	0	2.6
P4	4	3	1	4	4	4	4	4	4	4	1	0	1	8	0	3.6
P5	5	5	5	5	3	5	4	5	5	5	0	0	1	1	8	4.7
P6	1	2	2	1	2	2	2	2	2	2	2	8	0	0	0	1.8
P7	1	1	1	1	1	2	1	1	1	1	9	1	0	0	0	1.1
P8	5	5	5	3	4	5	5	5	5	5	0	0	1	1	8	4.7
P9	2	2	1	2	3	1	1	1	1	1	6	3	1	0	0	1.5
P10	4	3	4	5	5	5	5	5	5	5	0	0	1	2	7	4.6

Survey A Question A-11											f					
Q-A11	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	3	4	5	5	5	5	4	5	0	0	1	2	7	4.6
P2	2	1	1	1	1	2	2	2	2	1	5	5	0	0	0	1.5
P3	1	2	1	1	1	1	1	2	1	1	8	2	0	0	0	1.2
P4	4	4	4	4	5	5	5	5	5	5	0	0	0	4	6	4.6
P5	4	4	5	5	4	5	5	5	5	5	0	0	0	3	7	4.7
P6	2	1	2	1	1	2	2	2	3	4	3	5	1	1	0	2
P7	1	2	2	1	1	1	1	2	1	1	7	3	1	0	0	1.6
P8	4	5	5	4	4	5	4	5	5	5	0	0	0	4	6	4.6
P9	1	1	2	2	1	2	2	2	2	2	3	7	0	0	0	1.7
P10	4	4	4	3	5	5	5	5	5	5	0	0	1	3	6	4.5

Survey A Question A-12											f					
Q-A12	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	3	5	4	4	4	5	5	0	0	1	3	6	4.5
P2	3	3	2	3	2	3	3	3	3	3	0	3	7	0	0	2.7
P3	2	1	1	3	3	2	3	3	3	3	2	2	6	0	0	2.4
P4	3	2	2	2	4	3	4	4	3	4	0	3	3	4	0	3.1
P5	4	2	4	3	4	4	4	4	4	4	0	1	1	8	0	3.7
P6	1	1	2	1	1	3	1	1	4	1	7	1	1	1	0	1.6
P7	2	1	2	2	2	3	3	2	2	2	1	7	2	0	0	2.1
P8	2	2	3	4	4	4	4	4	4	4	0	2	1	7	0	3.5
P9	1	1	1	2	1	1	2	2	3	1	6	3	1	0	0	1.5
P10	3	3	3	3	3	4	5	5	3	3	0	0	7	1	2	3.5

Table 5.3 Survey A Questions A7-12 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey A Question A-13											f					
Q-A13	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	2	4	4	3	3	4	4	4	0	1	2	7	0	3.6
P2	3	2	1	2	2	1	2	3	2	2	2	6	2	0	0	2
P3	2	2	2	3	1	1	1	2	1	1	5	4	1	0	0	1.6
P4	3	3	2	5	3	4	4	4	4	4	0	1	3	5	1	3.6
P5	5	4	5	3	5	5	5	5	5	5	0	0	1	1	8	4.7
P6	3	3	2	2	3	2	2	2	3	4	0	5	4	1	0	2.6
P7	1	1	1	3	2	2	2	1	1	1	6	3	1	0	0	1.5
P8	4	5	5	5	5	5	5	5	5	5	0	0	0	1	9	4.9
P9	3	1	1	2	2	2	2	2	2	2	2	7	1	0	0	1.9
P10	4	4	4	3	3	4	4	4	5	4	0	0	2	7	1	3.9

Survey A Question A-14											f					
Q-A14	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	3	3	3	3	3	4	3	4	0	0	4	6	0	3.6
P2	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P3	3	3	1	3	3	2	2	2	2	2	1	5	4	0	0	2.3
P4	3	4	4	2	4	3	3	3	4	4	0	1	4	5	0	3.4
P5	1	2	2	2	2	1	1	1	2	2	4	6	0	0	1	2.1
P6	1	1	2	2	1	1	3	1	1	1	7	2	1	0	0	1.4
P7	1	2	2	2	1	1	2	3	3	3	3	4	3	0	0	2
P8	1	1	2	1	1	1	3	3	1	1	6	1	2	0	1	1.9
P9	3	2	3	4	2	4	4	4	4	4	0	2	2	6	0	3.4
P10	3	5	5	4	4	4	5	5	5	4	0	0	1	4	5	4.4

Survey A Question A-15											f					
Q-A15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	3	4	3	4	5	4	5	5	0	0	2	5	3	4.1
P2	1	1	3	2	2	2	1	1	1	1	6	3	1	0	0	1.5
P3	1	2	1	2	1	1	1	2	3	1	6	3	1	0	0	1.5
P4	1	2	2	1	2	2	2	2	2	2	2	8	0	0	0	1.8
P5	4	5	4	3	4	3	4	4	5	5	0	0	2	5	3	4.1
P6	1	2	1	1	2	1	1	1	2	3	6	3	1	0	0	1.5
P7	3	2	2	3	3	4	2	3	3	2	0	4	5	1	0	2.7
P8	5	5	5	4	5	4	5	5	5	5	0	0	0	2	8	4.8
P9	2	1	1	1	1	1	1	1	2	2	7	3	0	0	0	1.3
P10	4	2	5	5	5	5	5	5	5	5	0	1	0	1	8	4.6

Survey A Question A-16											f					
Q-A16	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	1	2	2	2	2	2	2	2	2	2	8	0	0	0	1.8
P2	1	2	2	2	3	3	4	2	4	2	1	5	2	2	0	2.5
P3	1	1	2	1	3	1	1	1	1	1	7	1	1	0	0	1.2
P4	1	2	3	1	1	1	1	1	1	1	1	8	1	0	0	2
P5	1	2	1	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P6	1	2	3	1	1	1	1	1	1	1	8	1	1	0	0	1.3
P7	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P8	2	2	3	1	2	2	2	2	2	2	1	8	1	0	0	2
P9	4	4	4	3	4	4	3	4	4	4	0	0	2	8	0	3.8
P10	3	3	3	2	3	3	4	4	3	4	0	1	7	3	0	3.5

Survey A Question A-17											f					
Q-A17	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	2	2	2	2	2	2	1	3	2	1	8	1	0	0	2
P2	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P3	1	2	1	2	3	2	2	2	2	2	2	7	1	0	0	1.9
P4	1	1	2	2	1	1	2	2	2	3	4	5	1	0	0	1.7
P5	1	1	1	1	1	1	2	2	3	1	7	2	1	0	0	1.4
P6	1	2	2	1	1	1	1	3	1	1	7	2	1	0	0	1.4
P7	2	2	1	1	1	1	1	1	2	3	6	3	1	0	0	1.5
P8	2	1	1	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P9	1	1	2	2	2	3	1	1	1	1	0	3	6	1	0	2.8
P10	3	1	2	2	2	2	2	2	2	2	1	8	1	0	0	2

Survey A Question A-18											f					
Q-A18	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	1	3	2	3	3	3	3	3	3	1	1	8	0	0	2.7
P2	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P3	1	2	1	1	3	3	3	3	2	3	3	2	5	0	0	2.2
P4	3	2	4	4	3	2	3	4	4	4	0	2	3	5	0	3.3
P5	1	2	1	1	1	1	2	1	1	1	8	2	0	0	0	1.2
P6	3	2	2	1	1	2	1	1	1	1	6	3	1	0	0	1.5
P7	2	1	2	3	3	2	2	3	2	2	1	6	3	0	0	2.2
P8	1	3	3	1	3	2	2	2	2	2	2	5	3	0	0	2.1
P9	1	1	2	1	2	1	1	3	1	1	7	2	1	0	0	1.4
P10	1	1	1	2	1	2	1	3	1	1	2	7	1	0	0	1.9

Table 5.4 Survey A Questions A13-18 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey A Question A-19											f					
Q-A19	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	4	2	3	4	4	4	4	4	0	1	1	8	0	3.7
P2	1	1	2	3	2	1	1	3	1	1	6	2	2	0	0	1.6
P3	1	1	1	1	2	1	1	2	1	2	7	3	0	0	0	1.3
P4	4	4	4	4	2	5	4	3	5	3	0	1	2	5	2	3.8
P5	4	4	4	3	5	4	4	4	4	4	0	0	1	8	1	4
P6	4	3	3	3	3	2	2	2	3	2	0	4	5	1	0	2.7
P7	3	2	1	2	2	1	1	2	2	2	3	6	1	0	0	1.8
P8	4	4	4	4	4	4	5	4	4	4	0	0	0	9	1	4.1
P9	1	3	3	2	3	3	3	3	3	4	1	1	7	1	0	2.8
P10	3	4	4	4	4	4	4	4	4	5	0	0	1	8	1	4

Survey A Question A-20											f					
Q-A20	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	3	3	4	4	3	4	4	4	5	0	0	3	6	1	3.8
P2	1	2	2	1	2	2	2	2	2	2	2	8	0	0	0	1.8
P3	2	2	1	1	3	2	1	1	1	2	5	4	1	0	0	1.6
P4	2	1	2	2	2	2	3	3	3	3	1	5	4	0	0	2.3
P5	4	3	3	4	3	3	3	4	4	5	0	0	5	4	1	3.6
P6	4	4	4	4	3	5	4	4	4	5	0	0	1	7	2	4.1
P7	3	2	2	3	3	3	3	3	4	4	0	2	6	2	0	3
P8	2	4	4	3	3	4	4	4	4	5	0	1	2	6	1	3.7
P9	1	2	2	1	1	1	3	1	3	1	6	2	2	0	0	1.6
P10	4	4	3	5	5	5	3	4	4	5	0	0	2	3	5	4.3

Survey A Question A-21											f					
Q-A21	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	4	5	5	5	5	5	5	5	0	0	0	1	9	4.9
P2	1	1	2	1	2	1	1	1	2	2	6	4	0	0	0	1.4
P3	1	1	2	1	2	1	3	2	2	1	5	4	1	0	0	1.6
P4	5	5	5	5	5	5	5	5	5	5	0	0	0	0	10	5
P5	5	5	5	4	5	5	5	5	5	5	0	0	0	1	9	4.9
P6	3	2	4	2	2	4	4	4	4	4	0	3	1	6	0	3.3
P7	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P8	1	5	3	3	3	5	5	5	5	5	0	0	3	1	6	4.3
P9	2	3	3	1	2	2	3	1	1	1	4	3	3	0	0	1.9
P10	5	5	4	5	5	5	5	5	5	5	0	0	0	1	9	4.9

Survey A Question A-22											f					
Q-A22	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	2	2	4	4	4	3	4	4	0	2	1	7	0	3.5
P2	4	4	1	3	2	2	3	3	3	3	1	2	5	2	0	2.8
P3	1	2	3	2	2	2	2	2	2	3	1	7	2	0	0	2.1
P4	4	4	3	3	5	5	4	4	4	5	0	0	2	5	3	4.1
P5	4	4	5	5	5	3	4	4	4	4	0	0	1	6	3	4.2
P6	1	1	1	1	1	1	2	1	2	2	7	3	0	0	0	1.3
P7	2	2	2	2	2	1	2	2	2	2	1	9	0	0	0	1.9
P8	3	3	3	1	2	3	3	3	3	3	1	1	8	0	0	2.7
P9	2	2	2	1	2	3	3	2	2	2	1	7	2	0	0	2.1
P10	3	3	3	3	2	3	4	3	3	3	0	1	8	1	0	3

Survey A Question A-23											f					
Q-A23	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	2	1	3	3	2	2	2	2	2	1	7	2	0	0	2.1
P2	1	1	1	1	2	1	1	1	2	3	7	2	1	0	0	1.4
P3	1	1	1	1	1	1	2	3	1	1	8	1	1	0	0	1.3
P4	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P5	1	1	2	2	1	1	1	1	1	1	8	2	0	0	0	1.2
P6	1	2	1	1	1	1	1	2	3	3	6	2	2	0	0	1.6
P7	2	1	2	2	1	3	2	2	2	3	2	6	2	0	0	2
P8	2	2	2	2	1	2	2	2	2	2	1	9	0	0	0	1.9
P9	2	2	2	3	3	2	3	3	3	3	0	4	6	0	0	2.6
P10	1	1	1	1	3	2	1	1	1	1	8	1	1	0	0	1.3

Survey A Question A-24											f					
Q-A24	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	2	2	2	2	2	2	2	3	2	1	8	1	0	0	2
P2	2	2	2	3	2	2	2	2	2	2	0	9	1	0	0	2.1
P3	2	2	2	2	2	2	2	2	2	2	0	10	0	0	0	2
P4	1	1	1	2	1	1	1	1	1	1	9	1	0	0	0	1.1
P5	1	1	1	1	1	1	2	2	1	1	8	2	0	0	0	1.2
P6	2	2	1	1	1	1	2	1	1	1	7	3	0	0	0	1.3
P7	1	1	2	3	2	3	1	1	1	1	6	2	2	0	0	1.6
P8	1	3	3	3	2	2	2	2	2	2	1	6	3	0	0	2.2
P9	1	1	1	2	2	3	1	1	1	1	7	2	1	0	0	1.4
P10	1	1	1	2	2	2	1	1	1	1	7	3	0	0	0	1.3

Table 5.5 Survey A Questions A19-24 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey B

Complexity Characteristics

Survey B involved asking questions to provide an insight into the complexities associated with the various projects and their negotiating parties. Emphasis was placed on understanding the internal complexities of the contracting organisations from the perspective of the external elements and how these affected or shaped the characteristics of the firm. During the research phase, much effort was expended trying to understand the internal structure levels of management and responsibility, internal control systems, operations management and the like. This process was very difficult, but by using the simple survey (Survey B) it was possible to visualise, from the external point of view, the various levels of complexity, and resolve how this affected the organisational characteristics, and indeed the level or existence of complexity management.[321]

Question Development

The questions for Survey B were developed specifically to obtain insights into the issues of environmental complexity that affect Chinese organisations. In the main, the questions that were developed are formed against the complexity characteristics and cultural background as developed by Blackman. All questions are asked of the same companies and individuals as for Survey A, although conducted some six months after contract award.

<u>Questions B1-B3:</u>

Group(OL)		External Complexity Environment
Sub Group(C)		Central Control
Elements(F)	-	Traditional preference for generalities,
	-	Haggling tradition
	-	Distrust of foreign attitudes

[321] De Keijzer. A (1992). p. 212. "The Western mind is generally trained to think in cause and effect. If something is wrong, find the cause and fix it. The Chinese tend to think in terms of webs of thoughts and relationships. They try to unravel the pattern, wondering if it's too complex to be resolved"

Survey Questions B-1 to B-3 were designed to determine the contribution of Blackman's characteristic "Control of the Environment" to the external elements perceptions of complexity.[322] Blackman indicates that "Central Control" is a significant characteristic of the Chinese negotiating style. The questions in the survey are designed to get a measure of how much this characteristic features in organisational environment[323] and thus, to what extent it contributes to complexity, and, therefore, how are the issues of adaptation affected.[324] The idea that there is a relationship between the external environment and organisational structure (as depicted by Burns and Stalker[325]) provides us with a pathway for looking at how the same external environment influences the degree to which complexity is inherent in the firm, and effects the adaptation phase. They identified five different types of environments, based on the levels of uncertainty that was present, and they identified two basic or ideal forms of structure; mechanistic and organic. Their data showed that mechanistic structures were more effective in stable environments, while organic ones were better suited to less stable, less predictable environments.[326]

In the new millennium, there will continue to be an explosion in "our ability to access, move, create and process information".[327] As Leonard-Barton[328] tells us, adaptation of such process changes can only be effective if the adaptive process is multidimensional, and involves the organisational adaptation to technology itself, as well as the adaptation of the technology to the organisation. McMasters insists that it is the former of these two activities that cannot be actioned by the existing management paradigm. As the depth of the "on line" development gets progressively more complex, the current management theory cannot respond to the

[322] Leonard-Barton (1995). p. 31. In discussing the "pathology" of core rigidities Leonard-Barton speaks of "Insularity" as the "dark side" of core capabilities and states " these days it may seem impossible that many managers could be so inwardly focused as to believe that their company is insulated from change or that the skills and markets relevant to today's success will be identically relevant tomorrow".
[323] See Burns and Stalker (1961). p. 104-110 et seq
[324] See Lewin and Grabbe (1962). p. 272. The argument sponsored here is the need to "unfreeze" the organisational routine in order to envelope adaptation.
[325] Burns and Stalker, loc. cit.
[326] See discussion in Burnes (1996). p. 61.
[327] Leonard-Barton (1995).
[328] ibid.

changes needed.[329] The questions enumerated in Survey B are designed to get an idea of the client company dynamics, as it responds to external complexity, in the expectation that such insight will lead to an understanding of the blocks to the adoption processes.

Historically, China was a collective state management under a planned economic system. With this background as a cultural characteristic, central control forms an important feature of the Chinese management mantra. The questions here are designed to look at how the perception of complexity by the external elements affect the adoption or adaptation phase of technology. In particular, they are focused on the negotiation phase post contract award, using Blackman's characteristics.

<u>Question B1 - To what extent did the negotiators set the principles for negotiations without consultation?</u>

Explanation: The extent to which the negotiators for the client company attempted to set the environment for the negotiations has its roots set in traditional Chinese managerial culture, as previously discussed in Survey A. The idea that the degree of environmental control is an indication of the complexity effect within the firm is suggested by Kelly and Allison:[330] "the patterns amplified by closed behaviour loops generate the configuration relationship that in turn determine the essential characteristic of the firm".

<u>Question B2 - To what extent did the negotiators indulge in haggling and tradeoffs?</u>

Explanation: This question follows on from question B1 in that it examines closed loop behaviours, especially as it relates to tradeoffs.[331]

<u>Question B3 - To what extent did the negotiators create an adversarial atmosphere?</u>

Explanation: To some, the atmosphere generated at the negotiations may simply be a normal response to a tense negotiating situation, but in many cases it is part of the environment control, and its degree depends on the level of complexity effect

[329] Demming (1982).

[330] Kelly and Allison (1998). p. 61-64. See argument on vicious cycles and the command and control syndrome.

[331] Blackman (1997). p. 194.

within the firm. The negotiators on the Chinese side include more than the group evident in the negotiating place. There are other groups outside that influence the process and this characteristic can reinforce their propensity to be tough and unmoving. The larger the "inside and outside" team the greater the chances of an adversarial atmosphere.[332]

Questions B4-B6:

Group(OL)		External Complexity Environment
Sub Group(C)		Internal team Strategy
Elements(F)	-	Meticulous note taking
	-	Risk Averse
	-	Pressured persuasion
	-	Hidden agenda
	-	Paternalistic stance

Survey Questions B-4 to B-6 look at the activity of the negotiating team on the client side, and how that activity is affected by the external complexity environment. Activity such as comprehensive note taking, can be an indication of how the level of external complexity impacts on the internal organisation of the client company. The idea of team tactics, coupled with hidden agendas, is an indication of the impact the external environment has on the decision making process, and hence, the adoption process.[333] This group of questions takes a close look at the overt actions of the negotiating team and attempts to relate that to the effect the complexity in the external environment has on the internal processes.

Question B4 - To what extent did the negotiators exhibit excessive note taking and team tactics?

Explanation: The degree of complexity within the firm can be seen by the amount of file note taking during the negotiations and the subsequent nightly team meetings. The more the number of people in the team meetings, and the greater the

[332] Blackman (1997). p. 56.

[333] Kelly and Allison (1998). p. 21. See argument developed regarding the formation and establishment of Competitive Fitness. Firstly " looking within the entity, by its ability top self-organise internally quickly and effectively in the face of change." and secondly by " looking externally, by the adaptation an entity exhibits within its changing context".

amount of file note taking, the higher the perceived complexity by the external elements.[334]

Question B5 - To what extent did the negotiators indulge in false authority?

Explanation: During negotiations the Chinese have a tendency to appeal to supposed local regulations to push the foreign party to give them what they want.[335] When the Chinese involve foreigners in arguments with the bureaucracy as a result of such claims, they are unconcerned whether their behaviour is illegal or corrupt. The degree to which this behaviour is indulged in is a measure of the perceived complexity by the external elements.[336]

Question B6 - To what extent did the negotiators over emphasise the Chinese position?

Explanation: This China-Centredness, insisting that every thing be done the Chinese way and making the other side seem unreasonable if they object, shows through all stages of negotiations, and it is clearly the reason for many of the influence strategies that the Chinese use.[337] Their China-Centredness is reinforced by the fear that foreigners will cheat them. This fear prevents foreign technology adaptation or, at the very least, hinders it. The question here tests the degree to which China-Centeredness affects the negotiating process, and thus, is a measure of the degree to which complexity affects the adoption process.[338]

Questions B7-B9:

Group(OL)		External Complexity Environment
Sub Group(C)		Outsider Ethics
Elements(F)	-	Strong adherence to group goals
	-	Outsider ethics
	-	Team planning
	-	Muddy the water

[334] Blackman (1997). p. 77.
[335] Blackman, loc.cit. p. 76.
[336] See argument and discussion presented by Kreisberg (1994). The extent to which this type of negotiating behaviour is indulged in is quite surprising.
[337] Blackman, loc.cit, p. 76.
[338] See Zhang (1993) as cited by Blackman (1997). p. 68.

- Need to meet higher authorities

While it can be seen that outside influences effect internal decision making processes, it is much harder to place a degree on this characteristic and the affect it may have. The set of questions here is somewhat more oblique that the previous in that they infer the effect of outside agencies rather than by direct association. For instance, it can be argued that in the main the client negotiators were neutral about the contractors position but outsider ethics demand that they show no consideration of this. Thus, the question tries to look at the perception of the clients view of the contractor's position, and infer the degree to which there would some external influence not apparent in the client activity.

<u>Question B7 - To what extent did the negotiators not care about the contractor's position and had hidden agendas?</u>

Explanation: This question is designed to look at how outsider ethics impact the negotiations from the contractors point of view. In other words to what extent or degree the company protected itself from outsider influence.[339]

<u>Question B8 - To what extent did the negotiators produce left field and irrelevant demands?</u>

Explanation: This question tests the extent to which the company is influenced by outside effects, and is an extension of the previous question. Often left field demands are the result of protection against the requirements of the contractor.[340]

<u>Question B9 - To what extent did the negotiators push the need for a design based on perceived time pressure on the client side?</u>

Explanation: Time pressure is also a symptom of the problems of accepting outside demands, especially that related to adaptation of technology or methodology. The question here tests the degree to which the outside environmental demand is

[339] Biqiang. L (1998). See argument developed regarding the resolution of internal conflict.

[340] Blackman (1997). p. 78. "They will bring up a small matter or make an unexpected or ridiculous demand, and spend a lot of time arguing about it. This draws the opposite negotiator off the main path, puzzles him, and forces him to spend time and energy trying to deal with the issue."

changed according to internal needs for protection.[341]

Questions B10-B12:

Group(OL)		External Complexity Environment
Sub Group(C)		Exerted Pressure
Elements(F)	-	Haggling tradition
	-	Focus on price
	-	Fear of exploitation
	-	Distrust of foreigners

In the main, the questions in this subgroup are to do with "standard" negotiation activity. We are looking for the affect that these notional activities or characteristics have on the degree to which the impact on perceived complexity and thus, on the organisations internal adoption processes.[342]

Question B10 - To what extent did the negotiators use other bids to pressure the contractor's bid?

Explanation: This characteristic is not restricted to that of Asian companies but is a world-wide negotiating phenomena. The test here is to see to what degree the external environment effects the adoption processes.

Question B11 - To what extent did the negotiators display distrust and hold agreement to the end?

Explanation: Again, this question tests the degree to which the external environment affects the internal decision processes.[343]

Question B12 - To what extent did the negotiators go back and open closed and

[341] De Keijzer. A (1992). p. 213. The concept of time is presented here as "an elastic sense of time. because China has been around for so long there is no need to hurry." See p. 223 as to the use of time pressure against the foreign company during negotiations.

[342] Kelly and Allison (1998). p 22. The authors have developed a Complexity model based on Identifying and assessing the organisations "Co-evolutionary fitness". This model evaluates both the internal self organisation capability and the external selection status.

[343] Blackman (1997). p. 194.

completed issues?

Explanation: This question flows on from the previous, and tests the capacity for the company negotiating team to reopen previously closed issues. This tests the degree to which external complexity affects internal decision making.[344]

Questions B13-B15:

Group(KM)		External Complexity Environment
Sub Group(C)		Fixed positions
Elements(F)	-	Hidden agendas
	-	Strategy of higher authorities
	-	Distrust of foreign attitudes
	-	Money more important than time
	-	Risk averse
	-	Face

Complexification is often introduced into the negotiation phase by many different modes that can seem quite normal. The rest of the questions in the B survey are designed to look at the level of introduced complexification, and perhaps gain an insight into the challenge to the dominant management discourse that self organisation and adaptation is driven by systems and not by external stimulus.[345] The elements that make up this set of questions include the propensity for hidden agendas, which are often driven by higher authorities and a distrust of foreign attitudes.

Question B13 - To what extent did the negotiators become uncooperative during negotiations?

Explanation : During negotiations in China, an observable characteristic was that of uncooperative behaviour. There were, generally, underlying reasons for this that were often hard to ascertain. The disruption would add layers of complexity that were hard to separate into simple nodes. The level of disruption is surveyed,

[344] See Blackman (1997). p. 78. To some extent this characteristic is similar to that of left field demand and it sometimes occurs after signing of contracts.

[345] Stacey et al (1999). p. 8. See development of the challenge to the "dominant management discourse" and the shift away from thinking about an organisation as a system and advocating a way of thinking about an organisation as a process.

giving some indication to introduced complexity.

Question B14 - To what extent did the negotiators slow the process down deliberately?

Explanation: This is a variation on the theme of the previous question in that the delaying tactic was introduced to the negotiations and added complexity to the proceedings.

Question B15 - To what extent did the negotiators remain locked in a position that was dictated by a higher authority?

Explanation: This situation occurred without any logic being applied. The higher authority could be completely illogical, but still the locked position would be maintained. It introduces another layer of complexity and also challenges the idea that self organisation is the outcome or existence of coherent systems management.[346]

Questions B16-B18:

Group(KM)		External Complexity Environment
Sub Group(C)		Number of internal elements
Elements(F)	-	Team strategy
	-	Risk averse
	-	Strategy of higher authority
	-	Weak management

This set of questions builds on the previous section providing a view of how complexification effects the company's attitude and actions.

Question B16 - How many Chinese negotiators were there over the contracting party?

Explanation: This question continues the theme of complexification and its relation to systems management and the adaptation processes.

Question B17 - To what extent did the negotiators bring in new negotiators in order

[346] Stacey et al (2000). p. 8.

to bring on new pressures?

Explanation: Similar to the previous question but gives a view of rising complexification.

Question B18 - To what extent did the negotiators display a complete lack of coordination and weak management during the negotiations?

Explanation: This question was designed to provide an in-depth view of the systems management processes actually delivered during the negotiation phase. A high number here indicates a lack of coherent systems management.[347]

Questions B19-B21:

Group(KM)		External Complexity Environment
Sub Group(C)		Fixed positions
Elements(F)	-	Narrow specialism
	-	Different bureaux involved
	-	Unrealisable expectations
	-	Tradition of ongoing contract negotiations
	-	Tradition of lack of legal enforcement
	-	Limited authority
	-	Lack of knowledge

This set of questions tests the degree to which complexity permeates the organisation. By looking at "unrealisable expectations" and the tendency for contract negotiation to go past the contract signing phase gives us a view of the depth of complexity.

Question B19 - To what extent did the negotiators have to bring in new people as specialist needs required?

Explanation : Even when the situation did not require it, many specialist people are brought into the negotiations and added new levels of complexity.[348]

Question B20 - To what extent did the negotiators reopen discussions on closed

[347] Stacey et al (2000). p. 8.

[348] Blackman,(1997). p. 88.

contract issues?

Explanation: Of all the negotiation activities that are indulged in by the Chinese, this is the one that adds levels of complexity that are often unresolvable.[349]

Question B21 - To what extent did the negotiators display a lack of knowledge.

Explanation: This state often arises, and is an indication of complexity affecting the internal organisation.

Questions B22-B24:

Group(KM)		External Complexity Environment
Sub Group(C)		Deadlock
Elements(F)	-	Memories on recent poverty
	-	National goal to gain currency
	-	Short term focus
	-	Lack of business experience
	-	Misunderstandings
	-	China Centredness.

This set of questions, as for the previous set, is deigned to investigate the depth and nature of complexity within the organisation and how that effects adaptation.

Question B22 - To what extent did the negotiators fix on price at the exclusion of other attributes?

Explanation: This action is generally the result of the company trying to reduce the level of complexity, and thus, by keeping it simple, prevents complexification interfering with the adaptation processes.[350]

Question B23 - To what extent did the negotiators move to a deadlocked position?

Explanation: Sometimes called the end game, where the company negotiators are basically rejecting the contractor's offer. This offers an insight into the company's predisposition towards resolution of the contract and is often a holding position during the process.

[349] ibid.

[350] White, M. (1999). p. 284.

<u>Question B24 - To what extent did the negotiators ignore external advice?</u>

Explanation: This adds significant levels of complexification to the decision making process, and hence, the adaptation or structural coupling process. It is a technique used so that the company does not have to deal with the issues of complexity that arise.[351] The idea that structural coupling exists within organisations was also suggested by Terreberry when she hypothesised that organisational change is increasingly externally induced, and that organisational adaptability is a function of ability to learn and perform according to changes in the environment.[352]

The questions of Survey B are tabulated in Table 5.6.

[351] McElroy, M. (1999). p. 275. See the concept of autopoiesis (self making) and its relation to "structural coupling" citing Maturana and Varela.

[352] Terreberry, S (1968).

Complexity Characteristics	Cultural Background	Survey B Question (Scale 1-5)
Set Guiding principles without consultation	Traditional Preference for generalities before specifics	B-1 To what extent did the negotiators set the principles for negotiation without consultation?
Begin with ambit claim Step by step tradeoffs	Haggling tradition Fear of cheating Preservation of face	B-2 To what extent did the negotiators indulge in haggling and tradeoffs?
Adversarial Atmosphere	Anti Foreign attitudes Colonial and Communist legacy	B-3 To what extent did the negotiators create an adversarial atmosphere?
Repetitive questioning	Tradition of meticulous note taking Risk averse bureaucratic culture. Team strategy	B-4 To what extent did the negotiators exhibit extensive note taking and team tactics?
Using False authority	Tradition of pressured persuasion Outsider ethics Hidden agenda	B-5 To what extent did the negotiators indulge in false authority?
Psychological Pressure	Paternalistic stance exaggerating Chinese concession	B-6 To what extent did the negotiators over emphasis the Chinese position?
Lack of sympathy	strong adherence to group goals Outsider ethics Hidden agenda	B-7 To what extent did the negotiators not care about the contractors position and had hidden agendas?
Left field, illogical or ridiculous demands	Concern with face Team planning Muddy the water	B-8 To what extent did the negotiators produce left field and irrelevant demands?
Time pressure	Know westerners have decision making power Need to meet restraints of higher authorities	B-9 To what extent did the negotiators push the need for a design based on perceived time pressure on the contractors side?
Use of competitor offer to pressure for concessions	Haggling tradition Focus on price Gain technical know how Fear of exploitation	B-10 To what extent did the negotiators use other bids to pressure the contractors bid?
Pushing to find bottom line	Haggling tradition Distrust of foreigners Tradition of agreement, only at end	B-11 To what extent did the negotiators display distrust and hold agreement to the end?
Reopening previously closed issues	Team strategy Hidden agenda Perception of wealthy westerners	B-12 To what extent did the negotiators go back and open closed and completed issues?
Uncooperative in giving information	Hidden agendas contract negotiations Suspicion of foreigners	B-13 To what extent did the negotiators become uncooperative during negotiations?
Stalling. Slowness lack of progress	Problematic information gathering Money more important than time Risk averse. Face	B-14 To what extent did the negotiators slow the process down deliberately?
Fixed position	Strategy devised by higher authorities Limited authority. Lack of knowledge	B-15 To what extent did the negotiators remain locked in a position that was dictated by higher authority?
Number of Chinese Negotiators	Team Strategy Risk Averse Bureaucratic culture	B-16 How many Chinese negotiators were there over the contracting party?
Change of negotiators	Group Strategy Responsible to higher authorities	B-17 To what extent did the negotiators bring in new negotiators in order to bring on new pressures?
Lack of coordination	Multiple parties with internal tensions Insider-outsider orientation. Weak management control	B-18 To what extent did the negotiators display a complete lack of coordination and weak management during the negotiations?
Changing levels Specialist	Tradition of narrow specialism Different bureaus involved	B-19 To what extent did the negotiators have to bring in new people as specialist needs required?
Renegotiating the contract	Unrealizable expectations Tradition of ongoing contract negotiation Outsider ethics, expectation of short relationship	B-20 To what extent did the negotiators reopen discussions on closed contract issues?
Fixed position	Strategy devised by higher authorities. Limited authority	B-21 To what extent did the negotiators display a lack of knowledge?
Concentration on price	Strong memories of recent poverty National goal to gain foreign currency. Shortfocus on benefit to group	B-22 To what extent did the negotiators fix on price at the exclusion of other attributes?
	Haggling tradition Lack of business experience	B-23 To what extent did the negotiators move to a deadlocked position?
Deadlock	Incompatible goals Misunderstandings. China centredness	B-24 To what extent did the negotiators ignore external advice?

Table 5.6 Survey B Questionnaire

Summary of Survey B "Complexity Characteristics" Results

The results of the interviews conducted with companies involved with the ten projects are shown in Table 5.7, 5.8,5.9,5.10. The references in this table (B1-B24) refer to the questions numbers shown in Table 5.6. Analysis of these results are discussed in Chapter Six.

Survey B Question B-1											f					
Q-B1	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	5	4	5	4	4	5	5	0	0	0	3	7	4.7
P2	5	5	5	5	5	5	5	5	5	5	0	0	0	0	##	5
P3	5	5	5	5	4	5	5	5	5	5	0	0	0	1	9	4.9
P4	5	5	5	3	4	5	5	5	5	5	0	0	1	1	8	4.7
P5	5	5	5	4	4	5	5	5	5	5	0	0	0	2	8	4.8
P6	2	1	1	2	2	2	1	2	1	2	4	6	0	0	0	1.6
P7	2	1	1	1	2	2	1	2	3	2	4	5	1	0	0	1.7
P8	2	1	1	2	2	2	2	2	2	2	2	8	0	0	0	1.8
P9	2	1	2	3	2	4	2	2	2	2	1	7	1	1	0	2.2
P10	2	2	1	2	2	2	1	1	1	2	4	6	0	0	0	1.6

Survey B Question B-2											f					
Q-B2	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	4	3	4	3	3	4	4	3	0	0	4	6	0	3.6
P2	3	3	1	3	1	3	3	3	3	3	2	0	8	0	0	2.6
P3	4	4	3	5	5	5	5	5	5	5	0	0	1	2	7	4.6
P4	4	4	2	4	4	3	4	4	4	4	0	1	1	8	0	3.7
P5	4	4	3	4	3	4	3	3	3	3	0	0	6	4	0	3.4
P6	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P7	2	1	2	1	3	3	3	3	3	3	2	2	6	0	0	2.4
P8	1	1	1	3	2	2	2	2	2	2	3	6	1	0	0	1.8
P9	2	3	3	3	2	4	4	3	3	3	0	2	6	2	0	3
P10	2	1	2	2	1	2	2	3	3	2	2	6	2	0	0	2

Survey B Question B-3											f					
Q-B3	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	5	5	5	5	5	5	5	0	0	0	0	10	5
P2	5	5	4	5	4	4	4	5	5	5	0	0	0	4	6	4.6
P3	5	5	3	5	4	5	5	4	4	5	0	0	1	4	5	4.4
P4	5	5	5	5	4	5	5	4	5	5	0	0	0	2	8	4.8
P5	3	5	4	5	4	4	4	4	4	4	0	0	1	7	2	4.1
P6	4	3	4	2	4	2	4	4	4	4	0	2	1	7	0	3.5
P7	1	1	1	2	3	1	1	1	1	1	8	1	1	0	0	1.3
P8	1	1	1	1	1	1	2	1	1	1	9	1	0	0	0	1.1
P9	1	3	3	2	1	1	2	1	1	1	6	2	2	0	0	1.6
P10	1	1	1	1	3	1	1	1	1	4	8	0	1	1	0	1.5

Survey B Question B-4											f					
Q-B4	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	3	5	4	4	5	5	5	0	0	1	2	7	4.6
P2	5	5	5	4	5	5	5	5	5	5	0	0	0	1	9	4.9
P3	5	5	5	2	5	5	3	3	3	4	0	1	3	5	1	3.6
P4	5	4	2	4	4	3	4	3	3	4	0	1	3	5	1	3.6
P5	3	4	4	4	3	4	4	5	4	5	0	0	2	6	2	4
P6	2	1	1	1	1	1	1	3	1	1	8	1	1	0	0	1.3
P7	2	2	2	2	2	2	2	1	2	2	1	9	0	0	0	1.9
P8	1	2	3	1	1	3	3	3	3	4	3	1	5	1	0	2.4
P9	1	2	3	3	2	3	3	3	3	3	1	2	7	0	0	2.6
P10	1	1	1	2	4	1	1	1	1	1	8	1	0	1	0	1.4

Survey B Question B-5											f					
Q-B5	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	3	3	3	2	3	2	3	3	3	1	2	7	0	0	2.6
P2	2	3	4	4	2	4	4	4	4	4	0	2	1	7	0	3.5
P3	1	2	1	1	1	3	1	1	1	1	7	1	2	0	0	1.5
P4	2	2	2	3	2	2	2	2	2	2	0	9	1	0	0	2.1
P5	1	1	1	2	1	3	3	2	3	3	4	2	4	0	0	2
P6	1	2	2	2	3	2	2	3	2	2	1	7	2	0	0	2.1
P7	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P8	2	1	2	2	2	2	2	2	4	2	1	8	0	1	0	2.1
P9	3	3	2	3	2	2	3	2	3	4	0	4	5	1	0	2.7
P10	1	2	2	1	3	2	2	2	2	2	2	7	1	0	0	1.9

Survey B Question B-6											f					
Q-B6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	3	4	2	3	2	2	3	3	3	0	4	5	1	0	2.7
P2	2	2	2	2	3	2	2	2	4	2	0	8	1	1	0	2.3
P3	2	1	2	2	2	2	2	2	2	2	1	9	0	0	0	1.9
P4	2	4	5	4	4	4	4	4	4	4	0	1	0	8	1	3.9
P5	3	3	2	3	2	3	5	5	3	3	0	2	6	0	2	3.2
P6	1	2	1	1	2	1	3	1	1	1	7	2	1	0	0	1.4
P7	1	2	1	1	2	3	2	1	1	1	6	3	1	0	0	1.5
P8	1	2	1	2	2	2	2	3	2	3	2	6	2	0	0	2
P9	1	1	2	1	2	1	1	1	1	1	8	2	0	0	0	1.2
P10	2	1	3	2	1	1	2	2	2	2	3	6	1	0	0	1.8

Table 5.7 Survey B Questions B1-6 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey B Question B-7											f					
Q-B7	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	1	2	1	2	2	3	3	4	2	2	6	2	1	0	2.4
P2	2	1	4	1	1	1	2	2	3	2	4	4	1	1	0	1.9
P3	2	2	3	1	3	3	1	4	4	3	2	2	4	2	0	2.6
P4	4	2	5	3	4	3	4	4	4	4	0	1	2	6	1	3.7
P5	1	2	2	2	2	2	3	2	2	2	1	8	1	0	0	2
P6	2	1	2	2	2	3	1	1	1	2	4	5	1	0	0	1.7
P7	1	1	2	2	1	2	3	2	1	1	5	4	1	0	0	1.6
P8	2	1	2	1	2	2	2	2	2	3	2	7	1	0	0	1.9
P9	1	2	1	1	1	3	1	1	4	1	7	1	1	1	0	1.6
P10	2	1	1	2	2	2	1	1	1	2	5	5	0	0	0	1.5

Survey B Question B-8											f					
Q-B8	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	2	4	5	2	3	4	4	4	4	0	2	2	5	1	3.5
P2	2	1	2	2	2	3	3	2	2	2	1	7	2	0	0	2.1
P3	1	2	2	1	2	2	2	2	2	2	2	8	0	0	0	1.8
P4	4	4	4	4	2	4	3	4	4	4	0	1	1	8	0	3.7
P5	1	2	1	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P6	1	2	1	1	4	1	1	1	1	1	8	1	0	1	0	1.4
P7	2	1	2	3	1	3	3	4	3	3	2	2	5	1	0	2.5
P8	2	1	2	2	1	3	3	2	2	2	2	6	2	0	0	2
P9	3	1	2	2	2	2	4	4	2	2	1	6	1	2	0	2.4
P10	2	2	1	2	1	3	2	2	3	3	2	5	3	0	0	2.1

Survey B Question B-9											f					
Q-B9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	3	3	3	3	3	3	3	3	3	0	0	10	0	0	3
P2	2	3	3	3	2	3	3	4	3	4	0	2	6	2	0	3
P3	2	3	5	2	3	5	3	3	4	5	0	2	4	1	3	3.5
P4	1	3	3	2	2	4	3	3	3	4	1	2	5	2	0	2.8
P5	2	1	2	2	2	2	2	1	1	2	3	7	0	0	0	1.7
P6	2	2	1	3	1	1	1	2	2	2	4	5	1	0	0	1.7
P7	1	1	2	1	1	1	1	1	3	1	8	1	1	0	0	1.3
P8	2	1	2	2	2	2	2	2	2	2	1	9	0	0	0	1.9
P9	1	2	1	1	1	3	1	1	1	1	7	2	1	0	0	1.4
P10	3	1	3	3	2·	2	2	3	2	2	1	5	4	0	0	2.3

Survey B Question B-10											f					
Q-B10	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	2	3	2	3	2	4	5	2	2	0	6	2	1	1	2.7
P2	1	3	3	3	3	3	3	3	3	3	1	0	9	0	0	2.8
P3	3	3	2	3	2	5	4	4	4	4	0	2	3	4	1	3.4
P4	3	4	2	4	4	3	3	3	4	5	0	1	4	4	1	3.5
P5	1	2	2	3	1	2	2	2	1	1	4	5	1	0	0	1.7
P6	1	4	2	1	3	1	1	1	1	1	7	1	1	1	0	1.6
P7	2	2	2	2	2	2	2	2	2	2	0	10	0	0	0	2
P8	2	3	1	3	1	1	1	3	3	4	4	1	4	1	0	2.2
P9	2	1	2	2	2	3	2	2	2	2	1	8	1	0	0	2
P10	1	2	1	3	1	1	1	1	1	5	7	1	1	0	1	1.7

Survey B Question B-11											f					
Q-B11	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	5	4	5	4	4	5	5	5	0	0	0	5	5	4.5
P2	4	4	3	5	4	5	4	4	5	5	0	0	1	5	4	4.3
P3	5	3	5	5	5	3	5	5	5	5	0	0	2	0	8	4.6
P4	5	5	5	3	5	5	5	5	5	5	0	0	1	0	9	4.8
P5	2	3	1	2	1	1	3	3	3	3	3	2	5	0	0	2.2
P6	1	1	2	2	1	1	3	1	1	1	7	2	1	0	0	1.4
P7	1	1	1	1	1	1	2	1	1	1	9	1	0	0	0	1.1
P8	2	1	2	2	2	3	2	2	2	2	1	8	1	0	0	2
P9	1	1	1	1	2	1	2	1	1	1	8	2	0	0	0	1.2
P10	1	1	1	3	1	1	1	1	2	1	7	2	1	0	0	1.4

Survey B Question B-12											f					
Q-B12	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	3	3	2	3	3	2	4	3	3	0	3	6	1	0	2.8
P2	3	4	2	4	2	4	4	4	4	4	0	2	1	7	0	3.5
P3	3	2	3	2	3	4	4	3	3	4	0	2	5	3	0	3.1
P4	4	4	4	4	5	4	4	4	5	4	0	0	0	8	2	4.2
P5	4	4	5	3	5	4	4	5	5	5	0	0	1	4	5	4.4
P6	1	1	1	2	2	1	1	1	1	2	7	3	0	0	0	1.3
P7	2	2	1	2	3	2	2	2	5	2	1	7	1	0	1	2.3
P8	1	2	2	2	2	3	2	3	2	2	1	7	2	0	0	2.1
P9	1	2	1	2	3	1	1	1	3	1	6	2	2	0	0	1.6
P10	1	1	1	3	1	2	2	1	1	2	6	3	1	0	0	1.5

Table 5.8 Survey B Questions B7-12 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey B Question B-13											f					
Q-B13	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	4	3	4	3	4	4	5	4	4	0	0	2	6	2	4
P2	4	5	5	4	5	5	5	5	5	5	0	0	0	2	8	4.8
P3	2	3	3	3	3	3	3	4	3	3	0	1	8	1	0	3
P4	3	4	2	4	2	4	4	4	4	4	0	2	1	7	0	3.5
P5	5	5	5	4	5	5	5	5	5	5	0	0	0	1	9	4.9
P6	2	1	2	2	1	2	2	4	2	3	2	6	1	1	0	2.1
P7	1	1	1	1	2	1	2	3	2	2	5	4	1	0	0	1.6
P8	1	1	1	1	3	3	1	2	1	2	6	2	2	0	0	1.6
P9	2	1	2	2	2	2	1	2	2	4	2	7	0	1	0	2
P10	1	1	1	2	1	2	3	3	3	2	4	3	3	0	0	1.9

Survey B Question B-14											f					
Q-B14	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	4	5	5	3	5	4	5	5	0	0	1	3	6	4.5
P2	1	3	3	3	3	3	3	4	3	3	1	0	8	1	0	2.9
P3	4	5	5	3	5	5	5	5	5	5	0	0	1	1	7	4.2
P4	5	2	5	3	5	4	4	5	5	5	0	1	1	2	6	4.3
P5	2	2	1	3	1	4	2	3	2	1	3	4	2	1	0	2.1
P6	1	2	1	1	2	2	2	2	2	1	4	6	0	0	0	1.6
P7	3	1	1	2	2	1	1	3	1	1	6	2	2	0	0	1.6
P8	1	1	2	2	2	3	1	2	1	2	4	5	1	0	0	1.7
P9	1	1	1	3	3	1	2	2	3	3	4	2	4	0	0	2
P10	1	1	2	1	1	3	3	3	1	1	6	1	3	0	0	1.7

Survey B Question B-15											f					
Q-B15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	3	5	5	4	5	5	5	5	0	0	1	3	7	5
P2	3	3	3	4	1	3	2	2	2	3	1	3	5	1	0	2.6
P3	4	4	4	3	5	3	5	5	5	5	0	0	2	3	5	4.3
P4	4	4	5	3	5	3	5	5	5	5	0	0	2	2	6	4.4
P5	2	2	1	4	3	3	3	4	3	3	1	2	5	2	0	2.8
P6	2	1	2	1	1	1	2	2	3	2	4	5	1	0	0	1.7
P7	1	1	2	1	1	1	2	1	3	1	7	2	1	0	0	1.4
P8	3	1	2	2	2	3	1	4	1	1	4	3	2	1	0	2
P9	1	1	2	3	3	2	2	1	1	1	5	3	2	0	0	1.7
P10	1	1	2	1	1	1	2	1	1	4	7	2	0	1	0	1.5

Survey B Question B-16											f					
Q-B16	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	5	3	5	3	4	5	4	5	0	0	2	4	4	4.2
P2	5	5	5	3	5	3	5	5	4	5	0	0	2	1	7	4.5
P3	5	5	3	3	5	5	4	4	5	4	0	0	2	3	5	4.3
P4	4	4	2	4	3	3	3	4	4	4	0	1	3	6	0	3.5
P5	3	4	5	3	5	5	5	5	5	5	0	0	2	1	7	4.5
P6	1	1	2	1	2	2	2	1	1	3	5	4	1	0	0	1.6
P7	3	1	1	2	1	2	2	3	1	3	4	3	3	0	0	1.9
P8	1	2	1	2	1	1	1	3	3	2	5	3	2	0	0	1.7
P9	1	2	2	2	2	3	3	2	2	2	1	7	2	0	0	2.1
P10	2	2	2	1	2	2	1	4	3	3	2	5	2	1	0	2.2

Survey B Question B-17											f					
Q-B17	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	4	2	4	4	3	2	4	4	0	2	1	7	0	3.5
P2	5	5	2	3	5	5	5	5	5	5	0	1	2	0	7	4.3
P3	4	4	2	5	3	3	5	4	4	4	0	1	2	5	2	3.8
P4	5	5	2	5	3	5	5	5	4	4	0	1	1	2	6	4.3
P5	3	2	2	5	5	3	5	3	5	3	0	2	4	0	4	3.6
P6	2	2	2	1	3	1	1	2	3	2	3	5	2	0	0	1.9
P7	2	1	2	2	2	2	2	2	2	2	1	9	0	0	0	1.9
P8	1	1	2	1	1	1	4	1	1	1	8	1	0	1	0	1.4
P9	5	5	3	5	3	3	3	3	5	4	0	0	5	1	4	3.9
P10	2	2	2	1	2	2	1	1	2	3	3	6	1	0	0	1.8

Survey B Question B-18											f					
Q-B18	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	1	3	3	2	2	2	3	4	3	1	4	4	1	0	2.5
P2	4	4	5	2	4	5	2	2	3	5	0	3	1	3	3	3.6
P3	3	2	5	5	3	5	5	3	5	5	0	1	3	0	6	4.1
P4	4	4	4	2	4	5	5	4	4	5	0	1	0	6	3	4.1
P5	3	5	5	2	3	3	3	3	5	4	0	1	5	1	3	3.6
P6	1	1	2	3	2	1	1	1	1	4	6	2	1	1	0	1.7
P7	2	1	1	1	5	2	1	1	3	2	5	3	1	0	1	1.9
P8	1	2	2	1	2	5	5	3	5	3	2	3	2	0	3	2.9
P9	1	1	1	1	2	1	1	1	1	1	9	1	0	0	0	1.1
P10	1	2	2	2	2	3	1	1	1	2	4	5	1	0	0	1.7

Table 5.9 Survey B Questions B13-18 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey B Question B-19											f					
Q-B19	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	4	4	2	4	3	3	2	2	4	1	3	2	2	0	2.1
P2	3	3	1	2	2	1	1	1	3	1	5	2	3	0	0	1.8
P3	1	2	2	1	4	1	1	2	3	3	4	3	2	1	0	2
P4	1	2	3	1	3	4	3	3	3	4	2	1	5	2	0	2.7
P5	2	4	3	5	3	4	5	4	5	4	0	1	2	4	3	3.9
P6	1	1	3	2	1	2	1	3	2	2	4	4	2	0	0	1.8
P7	2	1	2	2	1	3	1	1	2	4	4	4	1	1	0	1.9
P8	2	1	1	2	3	2	4	1	2	2	3	5	1	1	0	2
P9	1	1	2	1	1	1	1	3	1	4	7	1	1	1	0	1.6
P10	1	1	2	1	3	2	2	1	1	2	5	4	1	0	0	1.6

Survey B Question B-20											f					
Q-B20	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	2	1	4	3	2	1	3	3	2	2	4	3	1	0	2.3
P2	5	3	1	5	1	3	1	1	3	3	4	0	4	0	2	2.6
P3	2	2	1	3	1	2	3	3	3	4	2	3	4	1	0	2.4
P4	4	4	2	2	4	4	4	3	4	4	0	2	1	6	0	3.1
P5	1	3	2	1	1	2	4	2	2	2	3	5	1	1	0	2
P6	1	1	1	1	2	1	2	2	2	3	5	4	1	0	0	1.6
P7	1	1	2	3	2	1	1	3	1	1	6	2	2	0	0	1.6
P8	1	1	2	2	2	1	1	3	2	2	4	5	1	0	0	1.7
P9	1	2	2	1	1	1	1	4	3	1	6	2	1	1	0	1.7
P10	1	1	2	2	1	1	1	1	3		7	2	1	0	0	1.4

Survey B Question B-21											f					
Q-B21	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	1	3	4	4	1	4	3	3	3	2	0	5	3	0	2.9
P2	1	2	1	2	2	1	4	3	1	3	4	3	2	1	0	2
P3	4	5	3	4	5	4	3	4	5	5	0	0	2	4	4	4.2
P4	1	3	1	2	1	2	2	1	1	3	5	3	2	0	0	1.7
P5	3	1	3	2	2	3	3	4	4	4	1	2	4	3	0	2.9
P6	3	2	1	2	2	1	2	1	1	1	5	4	1	0	0	1.6
P7	1	2	1	1	2	3	1	1	1	1	7	2	1	0	0	1.4
P8	2	2	2	1	1	1	2	1	1	3	5	4	1	0	0	1.6
P9	1	1	2	1	2	1	1	1	1	4	7	2	0	1	0	1.5
P10	1	2	1	1	1	1	1	1	1	1	9	1	0	0	0	1.1

Survey B Question B-22											f					
Q-B22	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	3	1	2	1	2	2	1	4	4	4	3	1	2	0	2.1
P2	1	2	4	2	1	1	1	2	2	1	5	4	0	1	0	1.7
P3	4	3	2	2	3	4	4	4	4	5	0	2	2	5	1	3.5
P4	3	4	2	2	3	3	4	4	4	3	0	2	4	4	0	3.2
P5	3	1	2	2	3	1	2	1	1	2	4	4	2	0	0	1.8
P6	1	2	1	3	2	1	1	1	1	1	7	2	1	0	0	1.4
P7	2	2	1	2	2	2	4	2	2	2	1	8	0	1	0	2.1
P8	1	2	1	1	3	3	4	1	3	3	4	1	4	1	0	2.2
P9	1	1	1	2	1	1	1	1	3	2	7	2	1	0	0	1.4
P10	1	1	2	1	2	1	1	1	1	1	8	2	0	0	0	1.2

Survey B Question B-23											f					
Q-B23	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	2	2	4	2	2	4	4	3	2	1	5	1	3	0	2.6
P2	1	1	2	1	1	2	2	2	1	3	5	4	1	0	0	1.6
P3	1	1	1	2	1	1	2	1	3	3	6	2	2	0	0	1.6
P4	1	1	2	2	3	3	4	3	3	3	2	2	5	1	0	2.5
P5	3	3	2	3	2	1	1	3	3	1	3	2	5	0	0	2.2
P6	1	1	2	1	3	1	1	1	3	1	7	1	2	0	0	1.5
P7	1	1	2	1	1	4	1	1	1	1	8	1	0	1	0	1.4
P8	2	2	2	1	2	2	1	1	2	2	3	7	0	0	0	1.7
P9	1	2	1	1	2	1	3	1	2	2	5	4	1	0	0	1.6
P10	1	1	2	1	1	1	1	3	1	2	7	2	1	0	0	1.4

Survey B Question B-24											f					
Q-B24	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	2	2	3	2	4	3	3	3	4	0	3	5	2	0	2.9
P2	1	2	2	1	3	4	2	2	3	2	2	5	2	1	0	2.2
P3	3	4	3	2	4	2	4	3	3	5	0	2	4	3	1	3.3
P4	2	4	1	2	3	4	4	4	5	4	1	2	1	5	1	3.3
P5	2	2	1	3	2	1	1	2	1	2	4	5	1	0	0	1.7
P6	1	1	2	2	2	3	2	2	1	1	4	5	1	0	0	1.7
P7	1	1	2	1	1	2	2	3	1	4	5	3	1	1	0	1.8
P8	3	1	1	1	2	1	2	1	3	1	6	2	2	0	0	1.6
P9	1	1	1	2	1	1	1	4	1	1	8	1	0	1	0	1.4
P10	2	1	2	1	1	3	3	1	1	3	5	2	3	0	0	1.8

Table 5.10 Survey B Questions B19-23 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey C
Know-Why Characteristics

Survey C was conducted during post contract reviews when contracting parties were asked "what element from the project could be improved?". Those companies involved in technology transfer had some serious concerns about the veracity of the transfer process and indicated, during the survey interviews,the tendency for the foreign partner to hold onto important data and methodology. It was felt that while there existed an integrated model developed from the uncertainty and the complexity surveys, the integrated model would not be complete unless this extra dimension was investigated. Therefore, Survey C was constructed in order to establish what additional environmental forces could affect the organisation and its reaction to the adoption of innovation and technology transfer. Survey C uses the same format that was applied for Survey A and B.

Question Development

The purpose of this survey (C) was to obtain an insight into the technology adaptation process and thus, characteristics by analysis of the adaptation of "know-how" and "know-why". The same projects that were surveyed for Surveys A and B were approached again and surveyed after contract award. The "know-how" and "know-why" concepts are as defined by Garud,[353] and elaborated by Leonard-Barton.[354] These definitions form the backbone of this survey.

Questions C1-C3:

Group(OL)		Know-why environment
Sub Group(C)		Central Planning & degree of know-how importation
Elements(F)	-	Historical risk averse
	-	Production demands centrally planned
	-	Decisions remote to the organisation

As for survey A and B, this group of questions is based on central planning but

[353] Garud (1997). p. 83.
[354] Leonard-Barton (1997).

with the degree of imported know-how included. The set of three questions is designed to obtain an initial insight into just how the company (being surveyed) views itself with respect to technology transfer.

Question C1 - To what extent does the company import new know-how?

Explanation: In the past, technology transfer was relatively scarce in China but since major reforms in the 80's and 90's the pace of such transfers has increased markedly.[355] This question is phrased so as to obtain the degree to which the company sees itself with respect to importation of know how.

Question C2 - To what extent does the company encourage imported technology?

Explanation: This follows question C1 and also tracks the suggestion proposed by Howe[356] and tests to what degree the company encourages imported technology.

Question C3 - To what extent does the company develop imported technology?

Explanation: This question is designed to see how far down the Austin[357] levels the company is. It is one thing to import know how but does the company look further to developing the imported technology from the point of importation to a higher state and, therefore, look at the importation of know why.

Questions C4-C6:

Group(OL)		Know-why environment
Sub Group(C)		Open/Closed systems &
		degree of adoption of new know-how
Elements(F)	-	Mechanistic structure
	-	large Bureaucratic

Having looked at the external environment of whether or not the company imports technology (questions C1-C3), or in fact say they do, we now test the managerial capacity of adoption of new know how. In particular, we look at the internal

[355] Xiaojuan (1997). passim.

[356] Howe (1997). p. 55. See discussion "Some lessons for China 3". "..part of the answer must lie with a continuing government role in searching and in the preliminary development and dissemination of new technology as well as in the provision of the basic skills necessary to enable codified knowledge to penetrate to the less modernised strata of the economy".

[357] Austin (1990).

capacity to plan and manage technology.[358]

Question C4 - To what extent does the company plan and manage the introduction of new technology?

Explanation: This is a direct question aimed at obtaining an insight into the degree of management and planning the company indulges in during the introduction phase.

Question C5 - At what level does the company prefer to adopt new technology?

Explanation: This question looks at the Austin[359] levels and attempt to get a firm fix on the level of adoption as an inference on "know-why".[360]

Question C6 - To what extent does the company negotiate with outsiders about adoption of new technology?

Explanation: In order to define the characteristics of the view of adoption, a look at their external interface provides some idea of structure. By negotiating with outside agencies shows that the organisation is not rigid nor internally focussed and, therefore, susceptible to adaptation.

Questions C7-C9:

Group(OL)		Know-why environment
Sub Group(C)		Core competencies & degree of management of new know-how
Elements(F)	-	Hidden structure
	-	Protective agencies within
	-	Team strategy

Management competency is very important to adaptation of new know-how. It is not enough for the company to simply indicate that they prefer to adopt new technologies at a certain level and that they communicate with outsiders. We must test their internal competency and ability to cope with the adaptation of

[358] Leonard-Barton (1997). p. 223. "success in transferring technology capabilities depend on, at a minimum, agreement between source and recipient about the level of development transfer to be achieved and also on both sides understanding of that goals managerial implications - i.e., the effort and resources necessary".

[359] op.cit.

[360] Garud (1997). passim.

technology.[361]

Question C7 - To what extent does the company develop its internal capacity with respect to innovation adoption?

Explanation: Know-how of technology transfer can only be assimilated if the company has internal capacity to manage and develop the technology. If the company has a capacity to develop adopted technologies the know-how and know-why becomes an important issue. This question determines that know-why can be adopted.[362]

Question C8 - To what extent does the company arrange its operations around new technology?

Explanation: This question extends question C7, in that it further clarifies the degree to which the company internal capacity is oriented to the new technology, and clearly tests the level of organisational reaction to the adoption of the technology.[363]

Question C9 - To what extent does the company develop plans and systems to cope with new technology adoption?

Explanation: It is one thing to arrange operations around the new technology but does the company have substantial plans and systems in place. The questions test the degree to which the company defines adaptation of the transferred technology.[364]

Questions C10-C12:

Group(OL)		Know-why environment
Sub Group(C)		Organisational flexibility & degree to which company develops know how
Elements(F)	-	Historical risk averse

[361] Jingping (1997). p. 97. See discussion on imported technology to China and organisational responses.

[362] Garud (1997). p. 83. See discussion on "Components of Knowledge". Garud argues that there are three components. Know-how, know-why and know-what and that often all are assumed to be know-how when clearly they are not. The relationship between these three elements is also an important dynamic.

[363] Leonard-Barton (1997). p. 104. cf model of mutual adaptation.

[364] Kreiner (1996). See discussion of creation of organisational management of intellectual capital.

- Rigid Structures
- Protective internal groups

Having looked at the degree of internal capacity the company has towards competent adoption of technology this group of questions further concentrates on the degree of development of the know how itself.

Question C10 - To what extent does the company develop capacity along the Austin levels?

Explanation: This question extends question C5 from adoption to development of know how and know why and aligns it to the Austin levels. By looking at the level of the development along the Austin levels we can see the degree, and characterise the company's capacity, to adopt and develop.

Question C11 - To what extent does the company go beyond the simple notion of adoption of new technology?

Explanation: This is a check question against question C10 and permits us to gain an understanding of the degree of commitment. If the result for question C10 is high but C11 is low the there is a conflict and the characteristic is exposed.[365]

Question C12 - To what extent does the company change its organisation to adopt?

Explanation: In the end if a company cannot change to the requirements of the technology then the idea of mutual adaptation fails and this question tests the degree to which the company self organises to the process.

Questions C13-C15:

Group(KM)		Know-why environment
Sub Group(C)		Rigid viewpoint & degree to which the company avoids new know how
Elements(F)	-	Fixed position
	-	Outsider influence

[365] Garud (1997). p. 93. See discussion about "knowledge is an important factor of the emerging era of intellectual capitalism understanding how to create knowledge, maintain it, and put it to strategies use is an issue that concerns both practitioners and academics". This really is an issue of trappings vs substance. Leonard-Barton's model of mutual adaptation must fail if the company cannot adapt to the technology. For the model to apply there must be organisational adaptation to the requirements of the technology.

- Mechanistic defence against outside change

Typically, and historically, Chinese industry has held rigid viewpoints and avoided new technology adoption.[366] This group of questions is focussed on determining if companies are in avoidance mode. Results are inverted in the result schedules.

<u>Question C13 - To what extent does the company avoid new concepts?</u>
Explanation: If the previous groups questions are in conflict with these questions then the characteristics will be confused but will reinforce the negative.[367]

<u>Question C14 - To what extent does the new company plan against outside change?</u>
Explanation: This is an inverted question to that of C5, and tests the company's preference for adaptation of new technology. If a company resists outside change, adaptation of the organisation to the requirements of new technology will be difficult.[368]

<u>Question C15 - To what extent does the company focus on adopting Know How?</u>
Explanation: This question provides the survey characteristic with a ranking of how important adopting know-how is. The company may be focussed on other matters and a low score here will reinforce C14 and show that the organisation does not adjust to the requirements of the technology.[369]

<u>Questions C16-C18:</u>

Group(KM)		Know-why environment
Sub Group(C)		Entrepreneurship & degree to which company is dependent on new Now How
Elements(F)	-	Lack of individual initiative

[366] Jingping (1997). p. 97. See discussion on "achievements and practices using imported technology in China".
[367] Daft (1998). p. 286. See discussion on "Innovate or perish: The strategic role of change. Powerful forces associated with advancing technology, integrated economic integration, the maturing of domestic markets, and the shift to capitalism in formally communist regions".
[368] ibid. p. 288. See discussion "Incremental vs Radical change"
[369] Leonard-Barton (1997). p. 104. Mutual adaptation model.

- Historical risk averse
- lack of personal responsibility taking

This subgroup is oriented around extending the adaptation principles into dependency. The organisational characteristics in terms of changing to the needs of the technology will be signalled by the degree of entrepreneurship and know how dependency.

<u>Question C16 - To what extent does the company avoid internal development and R&D?</u>
Explanation: This is an inverted question to test the degree to which internal development is inherent in the organisational culture.[370]

<u>Question C17 - To what extent does the company decide matters and design by group?</u>
Explanation: Again an inverted question showing the degree of entrepreneurship by looking at the opposite.

<u>Question C18 - To what extent does the company show entrepreneurship?</u>
Explanation: This question tests both C16 and C17 and looks directly at entrepreneurship as a measure of organisational adaptation of technology.[371]

<u>Questions C19-C21:</u>

Group(KM)		Know-why environment
Sub Group(C)		External elements &
		degree to which company enters know why
Elements(F)	-	large numbers of external contacts
	-	Change is slow

[370] Daft (1998). p. 291. See discussion on Organisational change vs organisational innovation. Organisational innovation is the adoption of an idea or behaviour that is new to the company's industry, market or general environment.
[371] ibid.,p. 376. See discussion on the "adaptability/Entrepreneurial Culture". "The management culture is characterised by the capacity of the organisation to detect, interpret, and translate signals from the environment into new behaviours responses. This type of company , however doesn't just react quickly to environmental changes-it actively creates change".

This subgroup transcends the know-how to the know-why. The elements of this subgroup are fixed on the numbers of contacts and the speed of change. Know why is indulged under an environment of fast change. These questions are designed to examine that dynamic.[372]

Question C19 - To what extent does the company deal with large numbers of contacts?

Explanation: This question is framed against the answers to previous questions and adaptation of the organisation to the requirements of the technology. If there are high degrees of adaptation and large numbers of contacts then the organisational adaptation index will be high.

Question C20 - To what extent does the company exhibit boundary spanning?

Explanation: This is also a measure of entrepreneurship and know-why characteristic.[373]

Question C21 - To what extent does the company react to change?

Explanation: High reaction to change will determine a positive characteristic of adaptation of the organisation to the requirement of the know-why technology.

Questions C22-C24:

Group(KM)		Know-why environment
Sub Group(C)		Unpredictability & degree of acceptance of know why
Elements(F)	-	Historical risk averse
	-	Slow predictable changes

The degree of acceptance of know-why is a measure of the firms flexibility and capacity to adapt to fast changing environments. This subgroup of questions looks directly at the company's capacity to accept a high level of know-why

[372] Garud (1997). passim.

[373] Leonard-Barton (1997). p.158. See discussion "the role technological gatekeepers play in a company's absorptive capacity is augmented by that of boundary spanners-people who understand the world of source and the world of receiver and translate as well as disseminate knowledge".

adaptation.[374]

Question C22 - To what extent does the company display a risk averse policy relating to external unpredictability?

Explanation: This is an inverted question in that if the company has a high risk averse indication then it is unlikely to indulge in know-why.[375]

Question C23 - How fast are new ideas and technology adapted?

Explanation: An indication here of the speed of know-why adaptation is a direct indicator of the organisation's capacity to adapt new technology.

Question C24 - To what extent is know-why an issue?

Explanation: This question reinforces the answers from C22 and C23 and hardens the characteristic as found.

Survey C questions are tabulated in Table 5.11.

[374] Garud (1997). passim

[375] Daft (1998). p. 373. See discussion Exhibit 10.4 "In unadaptive corporate structures, managers care mainly about themselves, their immediate work group or technology associated with that work group. They value the orderly and risk reducing management process much more high;ly than leadership initiatives".

Know-Why Characteristics	Cultural Background	Survey Question C (Scale 1-5)
Central Planning Degree of Know-how importation	Historical Risk averse Production demands centrally planned Decisions remote to the organisation	C1 To what extent does the company import new know-how? C2 To what extent does the company encourage imported technology? C3 To what extent does the company develop imported technology?
Open/Closed System Degree of adoption of new know-how	Mechanistic structure Large bureaucratic	C4 To what extent does the company plan and manage the introduction of new technology? C5 At what level does the company prefer to adopt new technology? (refer Austin's levels) C6 To what extent does the company negotiate with outsiders about adoption of new technology?
Core competencies Degree of management of new know-how	Hidden structure Protected agencies within the company Team strategy Protective agenda	C7 To what extent does the company develop its internal capacity with respect to innovation adoption? C8 To what extent does the company arrange its operations around new technology? C9 To what extent does the company develop plans and systems to cope with new technology adoption?
Organisational Flexibility Degree to which the company develops know-how	Historical risk averse Rigid Structures Protective internal groups	C10 To what extent does the company develop capacity along the Austin levels? C11 To what extent does the company go beyond the simple notion of adoption of new technology? C12 To what extent does the company change its organisation to adopt?
Rigid Viewpoint Degree to which the company avoids new know-how	Fixed Position Outsider influence Mechanistic defence against outside change	C13 To what extent does the company avoid new concepts? C14 To what extent does the company plan against outside change? C15 To what extent does the company focus on adopting know how??
Entrepreneurship Degree to which the company is dependent on new know how	Lack of individual initiative Historical risk averse Lack of personal responsibility taking	C16 To what extent does the company avoid internal development and R&D? C17 To what extend does the company decide matters and design by group? C18 To what extent does the company show entrepreneurship?
External Elements Degree to which the company adopts	Large numbers of external contacts Change is slow	C19 To what extent does the company deal with large numbers of contact? C20 To what extent does the company exhibit boundary spanning? C21 To what extent does the company react to change?
Unpredictability Degree of acceptance of know-why	Slow predictable changes Risk averse	C22 To what extent does the company display a risk averse policy relating to external unpredictability? C23 How fast are new ideas and technology adapted? C24 To what extent is Know why an issue?

Table 5.11 Survey C Questionnaire

Summary of Survey C "Know-why Characteristics" Results

The results of the interviews conducted with companies involved with the ten projects are shown in Tables 5.12, 5.13, 5.14, 5.15. The references in this table (C1-C24) refer to the questions numbers shown in Table 5.11. Analysis of these results are discussed in Chapter Six.

	Survey C Question C-1										f					
Q-C1	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	2	5	5	5	5	5	5	3	4	0	1	1	1	7	4.4
P2	5	5	5	5	5	5	5	5	5	4	0	0	0	1	9	4.9
P3	5	5	4	5	5	5	5	5	5	4	0	0	0	2	8	4.8
P4	5	5	2	5	5	5	5	5	5	4	0	1	0	1	8	4.6
P5	5	5	2	5	5	2	5	5	5	5	0	2	0	0	8	4.4
P6	4	4	2	2	5	5	4	5	5	4	0	2	0	4	4	4
P7	2	1	4	4	2	4	2	2	3	2	1	5	1	3	0	2.6
P8	2	1	2	2	2	2	2	3	2	2	1	8	1	0	0	2
P9	2	2	2	1	3	2	2	5	2	2	1	7	1	0	1	2.3
P10	2	2	2	1	2	2	1	1	2	3	3	6	1	0	0	1.8

	Survey C Question C-2										f					
Q-C2	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	3	4	4	5	3	5	4	0	0	2	3	5	4.3
P2	3	2	4	2	3	3	3	1	4	4	1	2	4	3	0	2.9
P3	5	5	3	5	4	5	4	5	5	5	0	0	1	2	8	5.1
P4	3	1	1	5	3	5	4	3	4	4	1	1	3	3	2	3.4
P5	3	2	2	4	3	4	3	3	4	4	0	2	4	4	0	3.2
P6	3	3	2	2	4	5	3	4	3	3	0	2	5	2	1	3.2
P7	2	2	1	5	3	4	3	3	3	3	1	2	5	1	1	2.9
P8	1	3	4	2	3	4	5	2	4	4	1	2	2	4	1	3.2
P9	5	4	2	5	3	4	3	3	3	3	0	1	5	2	2	3.5
P10	2	4	1	5	1	5	4	5	3	3	2	1	2	2	3	3.3

	Survey C Question C-3										f					
Q-C3	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	3	5	3	5	5	5	5	0	0	2	0	8	4.6
P2	4	4	2	2	5	4	5	3	4	5	0	2	1	4	3	3.8
P3	3	4	5	2	4	5	5	3	5	4	0	1	2	3	4	4
P4	5	5	5	5	4	5	5	5	4	5	0	0	0	2	8	4.8
P5	4	5	2	4	4	3	4	3	4	5	0	1	2	5	2	3.8
P6	4	4	2	5	4	3	3	5	4	4	0	1	2	5	2	3.8
P7	2	1	2	2	1	1	1	2	3	2	4	5	1	0	0	1.7
P8	1	1	2	3	1	1	2	2	1	1	6	3	1	0	0	1.5
P9	2	1	1	2	2	2	1	1	3	1	5	4	1	0	0	1.6
P10	5	2	2	4	1	4	4	5	4	3	1	2	1	4	2	3.4

	Survey C Question C-4										f					
Q-C4	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	5	4	4	3	4	5	5	5	0	0	1	4	5	4.4
P2	5	4	5	5	2	3	5	5	5	5	0	1	1	1	7	4.4
P3	3	4	4	2	4	4	3	3	5	5	0	1	3	4	2	3.7
P4	4	1	3	3	4	3	4	2	4	5	1	1	3	4	1	3.3
P5	5	2	5	4	4	5	4	3	4	4	0	1	1	5	3	4
P6	1	1	2	1	4	1	2	2	1	3	5	3	1	1	0	1.8
P7	3	4	2	5	2	5	3	3	2	2	0	4	3	1	2	3.1
P8	1	4	5	3	3	3	4	3	2	3	1	1	5	2	1	3.1
P9	3	4	4	2	3	5	3	5	4	5	0	1	3	3	3	3.8
P10	2	1	2	1	3	1	1	1	3	4	5	2	2	1	0	1.9

	Survey C Question C-5										f					
Q-C5	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	3	4	3	2	3	3	3	3	3	0	2	7	1	0	2.9
P2	3	1	4	1	4	4	2	5	4	2	2	2	1	4	1	3
P3	3	1	1	2	1	1	1	4	2	3	5	2	2	1	0	1.9
P4	5	2	1	2	2	3	2	2	2	3	1	5	2	1	1	2.6
P5	1	2	3	4	1	2	3	3	1	3	3	2	4	1	0	2.3
P6	1	2	3	4	5	1	3	4	2	4	2	2	2	3	1	2.9
P7	4	4	4	3	2	4	4	3	3	5	0	1	3	5	1	3.6
P8	2	3	4	1	3	2	2	2	1	1	3	4	2	1	0	2.1
P9	2	1	3	4	3	3	2	3	2	2	1	4	4	1	0	2.5
P10	4	2	2	4	1	2	3	3	2	4	1	4	2	3	0	2.7

	Survey C Question C-6										f					
Q-C6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	3	1	2	3	4	3	3	2	3	1	2	5	1	1	2.9
P2	3	2	2	2	1	4	2	2	1	2	2	6	1	1	0	2.1
P3	4	1	2	3	3	3	4	2	4	4	1	2	3	4	0	3
P4	3	5	4	2	4	3	3	5	4	3	0	1	4	3	2	3.6
P5	4	4	3	2	4	3	3	4	3	5	0	1	4	4	1	3.5
P6	5	1	4	3	5	2	2	5	1	2	2	3	1	1	3	3
P7	2	1	2	3	1	2	1	1	4	1	4	3	1	1	0	1.7
P8	1	3	3	2	1	4	2	2	2	1	3	4	2	1	0	2.1
P9	2	2	1	3	1	3	1	1	1	2	5	3	2	0	0	1.7
P10	1	2	3	4	1	2	2	1	1	2	4	4	1	1	0	1.9

Table 5.12 Survey C Questions C1-6 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey C Question C-7											f					
Q-C7	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	1	2	1	3	3	2	1	1	1	5	2	2	1	0	1.9
P2	2	2	1	3	1	2	3	2	2	1	3	5	2	0	0	1.9
P3	3	2	1	3	3	3	4	3	4	1	2	1	5	2	0	2.7
P4	5	4	5	2	5	5	2	3	4	5	0	2	1	2	5	4
P5	1	1	2	5	1	3	1	1	4	2	5	2	1	1	1	2.1
P6	4	5	3	4	5	4	5	4	5	5	0	0	1	4	5	4.4
P7	1	2	2	2	2	1	3	1	1	1	5	4	1	0	0	1.6
P8	1	3	2	3	2	1	2	2	2	2	2	6	2	0	0	2
P9	2	3	1	2	2	1	1	1	1	1	6	3	1	0	0	1.5
P10	2	3	3	1	1	2	3	1	1	1	5	2	3	0	0	1.8

Survey C Question C-8											f					
Q-C8	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	3	5	4	4	4	5	4	3	4	0	0	2	6	2	4
P2	3	3	1	3	3	1	3	5	3	4	2	0	6	1	1	2.9
P3	3	1	1	1	2	1	1	3	1	1	7	1	2	0	0	1.5
P4	4	1	3	2	3	3	2	4	4	3	1	2	4	3	0	2.9
P5	2	3	1	2	2	1	4	1	1	1	5	3	1	1	0	1.8
P6	2	2	2	1	2	3	2	1	1	3	3	5	2	0	0	1.9
P7	2	3	3	1	4	5	2	1	4	4	2	2	2	3	1	2.9
P8	1	3	4	2	1	2	2	2	2	2	2	6	1	1	0	2.1
P9	3	3	1	3	3	3	3	2	4	4	1	1	6	2	0	2.9
P10	1	2	1	1	2	2	2	3	1	1	3	6	1	0	0	1.8

Survey C Question C-9											f					
Q-C9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	1	2	3	1	3	3	3	4	2	2	3	4	1	0	2.4
P2	4	2	4	2	1	4	4	1	1	1	4	2	0	4	0	2.4
P3	1	1	1	4	2	2	4	1	2	2	3	4	1	2	0	2.2
P4	3	1	1	2	4	2	2	2	3	2	2	5	2	1	0	2.2
P5	1	2	1	3	3	1	1	1	1	1	7	1	2	0	0	1.5
P6	1	1	2	1	2	1	1	3	1	1	7	2	1	0	0	1.4
P7	1	2	4	3	4	3	1	3	3	3	2	1	5	2	0	2.7
P8	1	2	1	1	2	1	1	4	3	1	6	2	1	1	0	1.7
P9	2	3	1	2	1	1	1	1	1	1	7	2	1	0	0	1.4
P10	1	1	1	2	1	1	1	1	2	1	2	0	8	0	0	2.6

Survey C Question C-10											f					
Q-C10	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	5	4	1	5	4	1	1	1	1	5	0	1	2	2	2.6
P2	3	2	3	1	1	1	3	3	3	1	4	1	5	0	0	2.1
P3	2	3	1	2	3	3	3	4	4	4	1	2	3	3	1	3.1
P4	2	3	4	2	1	3	3	4	5	4	1	2	3	3	1	3.1
P5	3	1	1	3	1	1	3	3	3	3	4	0	6	0	0	2.2
P6	1	2	1	3	4	1	1	1	1	1	7	1	1	1	0	1.6
P7	1	3	3	1	4	3	3	3	3	3	1	1	7	1	0	2.8
P8	2	3	3	1	4	3	1	1	3	1	4	1	4	1	0	2.2
P9	3	1	3	1	3	3	2	3	2	3	2	2	6	0	0	2.4
P10	2	3	4	1	2	1	2	2	1	1	4	4	1	1	0	1.9

Survey C Question C-11											f					
Q-C11	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	3	4	5	4	4	5	5	5	3	0	0	2	3	5	4.3
P2	5	5	3	5	5	4	5	5	4	5	0	0	1	2	7	4.6
P3	5	4	5	5	5	5	5	5	5	5	0	0	0	1	9	4.9
P4	3	5	5	5	5	4	5	5	5	5	0	0	1	1	8	4.7
P5	1	2	3	1	3	4	1	3	2	3	3	2	4	1	0	2.3
P6	1	1	1	2	1	1	3	1	1	3	7	1	2	0	0	1.5
P7	4	4	4	2	4	4	3	4	4	3	0	1	2	7	0	3.6
P8	1	4	5	2	2	1	1	3	1	1	5	2	1	1	1	2.1
P9	1	1	2	1	1	3	4	1	1	1	7	1	1	1	0	1.6
P10	1	2	2	1	2	1	2	2	2	2	3	7	0	0	0	1.7

Survey C Question C-12											f					
Q-C12	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	1	2	2	3	4	3	2	3	3	1	4	4	1	0	2.5
P2	5	5	2	5	2	4	3	4	5	4	0	2	1	3	4	3.9
P3	1	2	4	5	1	5	5	3	2	3	2	2	2	1	3	3.1
P4	1	3	3	2	1	2	1	1	2	2	4	4	2	0	0	1.8
P5	5	5	2	5	4	3	5	5	5	5	0	1	1	1	7	4.4
P6	1	4	2	3	2	1	2	2	2	5	2	5	1	1	1	2.4
P7	2	4	2	1	5	1	4	2	4	3	2	3	1	3	1	2.8
P8	2	3	1	3	2	2	4	2	2	2	1	6	2	1	0	2.3
P9	1	3	2	1	2	3	1	1	1	1	6	2	0	2	0	1.8
P10	1	2	1	2	3	1	1	1	1	2	6	3	1	0	0	1.5

Table 5.13 Survey C Questions C7-12 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey C Question C-13											f					
Q-C13	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	3	4	3	4	5	5	5	4	0	0	2	3	5	4.3
P2	3	4	4	5	5	5	4	5	5	5	0	0	1	3	6	4.5
P3	3	3	5	4	2	4	5	5	5	5	0	1	2	2	5	4.1
P4	3	5	2	3	5	5	5	4	5	5	0	1	2	1	6	4.2
P5	5	5	4	3	5	5	5	5	4	5	0	0	1	2	7	4.6
P6	2	1	2	3	2	4	1	1	2	1	4	4	1	1	0	1.9
P7	2	1	1	2	1	2	3	1	4	2	4	4	1	1	0	1.9
P8	2	3	1	1	1	1	2	1	2	1	6	3	1	0	0	1.5
P9	1	3	2	4	2	2	2	1	2	2	2	6	1	1	0	2.1
P10	2	1	4	1	1	2	2	2	3	2	3	5	1	1	0	2

Survey C Question C-14											f					
Q-C14	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	5	3	5	5	4	5	5	5	0	0	1	2	7	4.6
P2	4	5	1	5	4	4	4	1	5	4	2	0	0	5	3	3.7
P3	5	5	2	5	5	3	4	5	5	5	0	1	1	1	7	4.4
P4	5	5	4	5	4	5	5	5	5	5	0	0	0	2	8	4.8
P5	2	2	1	2	2	2	2	2	2	2	1	9	0	0	0	1.9
P6	1	1	1	2	1	1	4	1	1	1	8	1	0	1	0	1.4
P7	2	4	4	2	1	4	4	5	4	4	1	2	0	6	1	3.4
P8	3	2	1	2	3	1	1	2	2	2	3	5	2	0	0	1.9
P9	3	1	1	2	3	3	3	2	3	3	2	2	6	0	0	2.4
P10	1	1	2	1	1	1	1	2	2	3	6	3	1	0	0	1.5

Survey C Question C-15											f					
Q-C15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	2	5	5	4	5	5	5	0	1	0	1	8	4.6
P2	4	2	4	2	3	4	2	4	4	4	0	3	1	6	0	3.3
P3	5	5	3	4	5	4	4	4	5	2	0	1	1	4	4	4.1
P4	5	5	5	5	4	5	5	5	5	5	0	0	0	1	9	4.9
P5	5	1	2	1	4	5	4	4	2	3	2	2	1	3	2	3.1
P6	1	1	2	1	3	2	1	1	1	1	7	2	1	0	0	1.4
P7	1	1	3	1	4	2	4	1	4	1	5	1	1	3	0	2.2
P8	4	4	4	2	4	4	4	4	4	4	0	1	0	9	0	3.8
P9	1	1	2	1	1	3	1	2	4	1	6	2	1	1	0	1.7
P10	1	1	2	1	1	1	1	3	1	1	8	1	1	0	0	1.3

Survey C Question C-16											f					
Q-C16	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	2	2	2	3	2	4	2	2	2	0	7	1	2	0	2.5
P2	2	2	2	2	2	2	2	4	2	2	0	9	0	1	0	2.2
P3	1	1	2	3	1	2	2	2	1	2	4	5	1	0	0	1.7
P4	2	3	3	2	1	3	1	3	1	2	3	3	4	0	0	2.1
P5	4	2	5	2	1	3	3	3	5	4	1	2	3	2	2	3.2
P6	4	1	4	2	1	4	4	4	4	4	2	1	0	7	0	3.2
P7	2	2	2	2	1	2	2	3	2	2	1	8	1	0	0	2
P8	1	3	3	1	2	4	3	4	3	3	2	1	5	2	0	2.7
P9	2	2	1	2	2	3	2	2	2	4	1	7	1	1	0	2.2
P10	5	3	1	2	1	3	3	3	4	3	2	1	5	1	1	2.8

Survey C Question C-17											f					
Q-C17	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	3	3	1	3	4	3	4	3	3	1	0	7	2	0	3
P2	4	1	2	2	3	2	4	1	2	2	2	5	1	2	0	2.3
P3	3	4	4	2	4	3	4	4	4	4	0	1	2	7	0	3.6
P4	2	2	2	1	2	2	1	3	1	1	4	5	1	0	0	1.7
P5	3	3	3	1	3	2	1	1	3	2	3	2	5	0	0	2.2
P6	4	4	4	3	4	4	3	4	5	4	0	0	2	7	1	3.9
P7	3	3	4	1	3	1	3	3	2	4	2	1	5	2	0	2.7
P8	1	1	1	2	1	1	1	1	1	2	8	2	0	0	0	1.2
P9	2	3	2	4	2	3	3	2	5	3	0	4	4	1	1	2.9
P10	1	1	2	1	1	1	2	3	1	1	7	2	1	0	0	1.4

Survey C Question C-18											f					
Q-C18	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	3	3	2	3	2	2	5	3	3	0	3	5	1	1	3
P2	2	3	4	1	2	1	4	4	4	4	2	2	1	5	0	2.9
P3	2	2	2	1	2	2	3	2	2	2	1	8	1	0	0	2
P4	4	4	4	1	4	2	4	5	4	4	1	1	0	7	1	3.6
P5	3	1	1	2	1	2	2	1	1	1	6	3	1	0	2	2.5
P6	3	1	2	2	2	1	2	2	3	2	2	6	2	0	0	2
P7	1	3	2	3	3	4	3	2	3	3	1	2	6	1	0	2.7
P8	4	2	4	3	3	4	3	3	3	3	0	1	6	3	0	3.2
P9	1	1	1	1	1	1	3	1	1	1	9	0	1	0	0	1.2
P10	1	1	2	1	2	2	2	1	2	1	5	5	0	0	0	1.5

Table 5.14 Survey C Questions C13-18 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey C Question C-19											f					
Q-C19	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	2	2	2	4	2	4	2	2	2	0	7	0	3	0	2.6
P2	2	2	1	2	2	2	4	2	2	2	1	8	0	1	0	2.1
P3	2	2	1	2	3	1	4	2	2	1	3	5	1	1	0	2
P4	1	1	1	1	1	1	3	1	1	1	9	0	1	0	0	1.2
P5	4	1	2	1	5	1	1	4	5	2	4	0	2	2	2	2.8
P6	4	1	1	1	2	1	1	2	1	1	7	2	0	1	0	1.5
P7	2	2	1	2	1	1	1	1	1	1	7	3	0	0	0	1.3
P8	2	2	2	1	2	2	2	2	1	2	2	8	0	0	0	1.8
P9	1	1	1	2	1	1	1	3	2	1	7	2	1	0	0	1.4
P10	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1

Survey C Question C-20											f					
Q-C20	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	2	3	2	2	3	3	2	2	2	0	6	4	0	0	2.4
P2	3	2	2	1	3	3	3	1	2	2	2	4	4	0	0	2.2
P3	2	4	4	2	3	2	2	2	2	2	0	7	1	2	0	2.5
P4	1	4	2	1	4	1	1	4	4	3	4	1	1	4	0	2.5
P5	1	2	4	1	5	1	2	1	2	1	5	3	0	1	1	2
P6	5	5	5	5	4	5	5	5	5	5	0	0	0	1	9	4.9
P7	1	3	2	1	4	1	1	1	1	2	6	2	1	1	0	1.7
P8	1	2	1	2	1	2	2	1	2	2	4	6	0	0	0	1.6
P9	1	1	1	3	1	1	1	1	1	1	9	0	1	0	0	1.2
P10	1	1	2	1	1	1	3	1	1	1	8	1	1	0	0	1.3

Survey C Question C-21											f					
Q-C21	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	3	2	3	3	5	3	3	3	3	0	1	8	0	1	3.1
P2	4	1	2	1	2	1	1	3	1	1	6	2	1	1	0	1.7
P3	3	3	4	2	4	3	5	4	4	5	0	1	3	4	2	3.7
P4	3	2	3	3	4	3	3	4	3	3	0	1	7	2	0	3.1
P5	4	4	5	2	3	5	2	4	2	2	0	4	1	3	2	3.3
P6	2	2	2	2	3	2	4	4	2	2	0	7	1	2	0	2.5
P7	3	1	1	2	3	3	4	3	1	1	4	1	4	1	0	2.2
P8	1	1	1	1	3	1	1	1	1	1	9	0	1	0	0	1.2
P9	1	1	2	1	2	1	3	1	1	1	7	2	1	0	0	1.4
P10	1	1	2	1	4	1	3	1	1	1	7	1	1	1	0	1.6

Survey C Question C-22											f					
Q-C22	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	4	4	2	3	2	2	2	2	2	0	7	1	2	0	2.5
P2	2	5	2	2	4	2	2	2	5	2	0	7	0	1	2	2.8
P3	2	3	1	4	4	3	3	4	4	4	1	1	3	5	0	3.2
P4	3	4	1	3	4	2	4	5	3	4	1	1	3	4	1	3.3
P5	1	1	2	1	1	2	2	1	1	1	7	3	0	0	2	2.3
P6	4	1	2	4	1	5	3	1	1	4	4	1	1	3	1	2.6
P7	5	3	4	3	4	5	4	4	4	4	0	0	2	6	2	4
P8	2	3	1	3	1	3	3	1	4	1	4	1	4	1	0	2.2
P9	1	1	2	2	1	1	1	1	1	1	8	2	0	0	0	1.2
P10	1	1	4	1	1	1	4	1	1	1	8	0	0	2	0	1.6

Survey C Question C-23											f					
Q-C23	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	2	4	3	1	3	2	3	3	4	1	2	5	2	0	2.8
P2	4	1	1	2	1	1	1	2	3	4	5	2	1	2	0	2
P3	4	1	1	2	1	1	1	2	1	1	7	2	0	1	0	1.5
P4	4	2	4	4	3	4	2	2	2	4	0	4	1	5	0	3.1
P5	1	2	3	1	1	4	3	3	3	1	4	1	4	1	0	2.2
P6	1	1	1	2	1	2	1	1	3	1	7	2	1	0	0	1.4
P7	1	1	2	1	1	4	1	1	1	1	8	1	0	1	0	1.4
P8	2	2	1	2	2	1	2	4	2	2	2	7	0	1	0	2
P9	4	1	2	1	1	1	2	2	1	2	5	4	0	1	0	1.7
P10	1	1	1	2	1	1	1	1	3	2	7	2	1	0	0	1.4

Survey C Question C-24											f					
Q-C24	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	4	2	5	5	2	3	3	5	5	0	2	3	1	4	3.7
P2	2	4	1	2	4	1	2	2	3	4	2	4	1	3	0	2.5
P3	2	4	4	1	4	4	4	2	4	4	1	2	0	7	0	3.3
P4	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P5	3	1	2	1	1	2	1	1	3	3	5	2	3	0	0	1.8
P6	1	3	1	4	1	1	1	3	1	1	7	1	1	1	0	1.6
P7	2	1	2	2	1	3	3	3	3	3	2	3	5	0	0	2.3
P8	3	2	1	4	3	4	1	5	4	4	2	1	2	4	1	3.1
P9	2	3	1	3	2	4	3	3	3	4	1	2	5	2	0	2.8
P10	4	2	2	3	2	5	2	4	2	2	0	6	1	2	1	2.8

Table 5.15 Survey C Questions C19-24 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey D
Inverse Transfer Characteristic

Survey D was conducted up to two years after a particular contract was issued. Technology transfer was looked at in Survey C in order to see how it affected the structure of the uncertainty complexity matrix. It was during the application of Survey C that a new emergent idea was apparent. This involved the reverse transfer or inversion idea, and survey D was constructed to examine the dynamics of this. Survey D, like Survey C, is oriented to examining the characteristics of the organisation's response to the requirements of the technology during adaptation of the technology transfer and thus, is part of the mutual adaptation model.[376]

Question Development

The purpose of this survey (D) was to obtain further insights into the organisational adaptation process, and thus, characteristics by analysis of the adaptation of "the reverse dynamic". The reverse dynamic is located in level four of the Austin levels.[377] It is the managerial challenges that addresses the issues of technology transfer by using the idea of inverse technology as its foundation structure. It is the variations of the application of the issues, management resolution and complexity management that is inherent in technology transfer.[378] The questions in this survey are constructed from the idea that the reverse dynamic is emergent[379] as far as adaptation models are concerned. The real challenge here is how the emergent characteristic is defined and thus, the definition of the attractor that will address it in any management model. The questions while in themselves are relatively simple they form a whole that provides an integrated picture of

[376] Leonard-Barton (1997). p. 104.
[377] Austin (1990). p. 237. passim
[378] See Chapter Four.
[379] Stacy, Griffin and Shaw,(2000). p. 108. See discussion on complex adaptation theory. The authors make the case that in complex adaptive systems the interaction rules are deterministic, a little like the if-then-else approach which are not fixed by evolve. Here they suggest "self-organisation and emergence lead to structural development and is spontaneous." This has to be viewed against the idea that complex adaptive systems are an assembly of agents each behaving constrained by its own rules of interaction and no individual thus then determines the behaviour of the whole organisation. This is often called micro diversity and is often a result of emergent behaviour. "In other words, the internal dynamic causes the emergent global pattern and simultaneously the emergent change in the mode of interaction, that is, the internal dynamic".

emergence.[380] The questions overall attempt to focus on the properties of emergence as defined in Chapter 4.[381]

Questions D1-D3:

Group(OL)		Reverse dynamic environment
Sub Group(C)		Central Planning & degree of inversion planning
Elements(F)	-	Historical risk averse,
	-	Production demands centrally planned
	-	Decisions remote to the organisation

This first group of questions attempts to look at the attitude of the company about reverse transfer and tries to determine if there is a conscious strategy in place before negotiations[382] involving technology transfer begin. It was conceivable that due to historical central planning that it was unlikely that such strategies were in place, and that these first questions were set up to determine that status.

Question D1 - To what extent does the company look at reverse transfer before contracts?

Explanation: This question was framed on the need to know immediately if the company had a preconceived idea of the reverse dynamic and that negotiations would be coloured by it.

Question D2 - To what extent does the company adopt transfer with a view of inverse?

Explanation: This question looks at whether or not the adoption strategy had an end game of reverse dynamic.

Question D3 - To what extent does the company develop imported technology for

[380] Goldstein (1999), p. 49. See discussion on definition of commonality of properties of emergence between systems.

[381] Lissack (1999), p. 110. Lissack provides an argument that emergent behaviours is allowed for by organisational science and complexity theory therefore it may exist and it may have a reality.

[382] Leonard-Barton (1997), p. 247. See discussion on long term commitment and the reference to the ned for technology managers to manage the process in a more sophisticated way. The inference here is that without the preconceived notion that reverse transfer will occur then it is unlikely that the company can assimilate such an idea.

the purpose of inverse transfer?

Explanation: This question looks at the Austin levels for evidence of a conscious development plan leading to the reverse dynamic.[383]

Questions D4-D6:

Group(OL)		Reverse dynamic environment
Sub Group(C)		Open/Closed Systems & degree of inversion management
Elements(F)	-	Mechanistic structure
	-	large bureaucratic

Having looked at the external environment of whether or not the company strategises reverse dynamic, and at what level it does (questions C1-C3), or in fact say they do, we now test the managerial capacity of development of the technology based on acquiring the reverse dynamic. In particular, we look at the internal capacity[384] to plan and manage the reverse dynamic. From an emergent[385] point of view, the capacity to develop technology (with the idea of reverse transfer) means that such capacity is an inherent part of the micro climate within the organisation.

Question D4 - To what extent does the company plan and manage the introduction of new technology from inverse point?

Explanation: This question looks directly at the imposition management applies regarding the reverse dynamic. This tests the degree to which the management team is willing and able to plan from the end game back to the introduction phase. Without this level of preplanning then it is unlikely that reverse transfer is really emergent.

[383] Lei and Slocum (1992). p. 81. See discussion on assimilation problems with adoption of technology. "Many firms do not understand the inherent complexities involved in formulating and implementing a strategic alliance and simply seek to cut costs and thereby reduce their commitment to investing in new product development and manufacturing technologies". The authors go on to discuss the difficulties in China of transfer adoption and internal company commitment.

[384] Leonard-Barton (1997). p. 216 et seq. See discussion on the perils and promise of transferring capabilities and the demands on internal capability.

[385] See White (1999). p. 286. cf discussion on corporations as classifier systems. "Corporates are complex systems with many features that interact non linearly to produce emergent outcomes".

Question D5 - At what level does the company prefer to adopt new technology for the purpose of inverse transfer?

Explanation: Again, following on from question D5, this tests the degree to which the company prefers to plan from the reverse dynamic point of view. The level of adoption is critical to the management of the reverse dynamic.

Question D6 - To what extent does the company negotiate with outsiders about adoption of new technology to transfer?

Explanation: This question is intended to look at the issue of mechanistic structures and the effect that has on the decision process of adaptation.

Questions D7-D9:

Group(OL)		Reverse dynamic environment
Sub Group(C)		Core competencies & degree of capacity building for inversion
Elements(F)	-	Hidden structure
	-	Protective agencies within
	-	Team strategy

Management competency is very important to adaptation of the reverse dynamic. It is not enough for the company to simply indicate that they prefer to adopt new technologies at a certain level and that they communicate with outsiders. It is important to test their internal competency and ability to cope with the adaptation of technology from the reverse dynamic perspective. James Utterback notes: "The idea of competency is critical to the survival of all firms as they encounter incremental and discontinuous technological change".[386] These questions required a high level of answer analysis in that it is easy to respond with positive responses but did they really mean it. Where there was doubt, additional people in the organisations involved were asked the same question.

Question D7 - To what extent does the company develop its internal capacity with respect to inverse adoption?

Explanation: Inverse technology transfer can only be assimilated if the company

[386] Utterback (1995). p. 130. As cited by White (1999).

has internal capacity to manage and develop the inverse technology. If the company has a capacity to develop adopted technologies and subsequently develop the inverse technology then this is an important characteristic. Mark White[387] notes: "[the] command and control legacy means existing corporate designs have a very difficult time generating the sequence of technological breakthroughs that sustainable adaptation in a supercritical economy requires".

Question D8 - To what extent does the company arrange its operations around inverse technology?

Explanation: This question extends question D7 in that it further clarifies the degree to which the company internal capacity is oriented to the inverse technology and clearly tests the level of organisational reaction to the adoption of the inverse technology.

Question D9 - To what extent does the company develop plans and systems to cope with looking at inverting from contract sign?

Explanation: It is one thing to arrange operations around the inverse technology, but does the company have substantial plans and systems in place? The questions tests the degree to which the company defines adaptation of the transferred technology from an inverse perspective.

Questions D10-D12:

Group(OL)		Reverse dynamic environment
Sub Group(C)		Organisational flexibility & degree of strategic adoption for inversion
Elements(F)	-	Historical risk averse
	-	Rigid Structures
	-	Protective internal groups

Having looked at the degree of internal capacity the company has towards competent adoption of technology for the purposes of inversion, this group of questions further concentrates on the degree of development of the inversion technology itself. In other words, does the company actually indulge in the

387 White (1999). p 283.

reverse technology development itself and to what depth is this characteristic performed?

Question D10 - To what extent does the company develop strategy along the Austin levels?

Explanation: This question extends question D5 from adoption to development of inversion technology and aligns it to the Austin levels. By looking at the level of the development along the Austin levels we can see the degree, and characterise the company's capacity to adopt and develop at the inversion level.[388]

Question D11 - To what extent does the company go beyond the simple adoption of new technology and into reverse dynamic?

Explanation: This is a check question against question D10, and permits us to gain an understanding of the degree of commitment. If the result for question D10 is high but D11 is low, then there is a conflict and the characteristic is exposed.

Question D12 - To what extent does the company change its organisation to adopt the reverse dynamic (inversion)?

Explanation: In the end, if a company cannot change to the requirements of the technology then the idea of mutual adaptation fails, and this question tests the degree to which the company self organises to the process.

Questions D13-D15:

Group(KM)		Reverse dynamic environment
Sub Group(C)		Rigid viewpoint & degree of inversion avoidance
Elements(F)	-	Fixed position
	-	Outsider influence
	-	Mechanistic defence against outside change

Typically, and historically, Chinese industry has held rigid viewpoints and avoided inversion technology adoption. This group of questions is focussed on

[388] See Rogers (1983). An argument is developed regarding the timing of adaptation and problems associated with rushing the introduction of innovation and a failure to correct subsequent problems. Thus development of the reverse technology by gradual and continuous adaptive efforts are hampered.

determining if companies are in inversion avoidance mode. Results are inverted in the result schedules.

Question D13 - To what extent does the company avoid new concepts involving inversion?

Explanation: If the previous groups questions are in conflict with these questions, then the characteristics will be confused, but will reinforce the negative.

Question D14 - To what extent does the company plan against outside change?

Explanation: This is an inverted question to that of D5, and test the company's preference for adaptation of new technology. If a company resists outside change, adaptation of the organisation to the requirements of new technology will be difficult.

Question D15 - To what extent does the company focus on adopting inversion?

Explanation: This question provides the survey characteristic with a ranking of how important adopting know-how is. The company may be focussed on other matters and a low score here will reinforce D14, and that the organisation does not adjust to the requirements of the technology.

Questions D16-D18:

Group(KM)		Reverse dynamic environment
Sub Group(C)		Entrepreneurship & degree of preference for inversion
Elements(F)	-	Lack of individual initiative
	-	Historical risk averse
	-	lack of personal responsibility taking

This subgroup is oriented around extending the adaptation principles into dependency. The organisational characteristics, in terms of changing to the needs of the technology, will be signalled by the degree of entrepreneurship and know-how dependency.[389]

<u>Question D16 - To what extent does the company avoid internal development for inversion?</u>

Explanation; This is an inverted question to test the degree to which internal development is inherent in the organisational culture.

<u>Question D17 - To what extent does the company decide inversion matters by group?</u>

Explanation: Again an inverted question showing the degree of entrepreneurship by looking at the opposite effect.

<u>Question D18 - To what extent does the company show inversion preference?</u>

Explanation: This question tests both D16 and D17 and looks directly at entrepreneurship as a measure of organisational adaptation of technology.

<u>Questions D19-D21:</u>

Group(KM)		Reverse dynamic environment
Sub Group(C)		External elements and degree of inversion integration
Elements(F)	-	large numbers of external contacts
	-	Change is slow

This subgroup transcends the know-how to the know-why. The elements of this subgroup are fixed on the numbers of contacts and the speed of change. Know-why is indulged under an environment of fast change. These questions are designed to examine that dynamic.[390]

<u>Question D19 - To what extent does the company deal with large numbers of</u>

[389] Daft (1998). p. 376. See discussion on adaptability/entrepreneurship culture. This cultural characteristic supports the notion that "the strategic focus is on external environment through flexibility and change. The culture encourages norms and beliefs that support the capacity of the organisation to detect, interpret, and translate signals from the environment into new behaviour responses. This type of company, however, doesn't just react quickly to environmental changes - it actively creates change".

[390] Garud (1997). p. 84. Distinctions are emphasised between know-how and know-why. While both are "important components of knowledge, it is only recently that attempts to make a distinction between them".

contact?

Explanation: This question is framed against the answers to previous questions and adaptation of the organisation to the requirements of the technology. If there are high degrees of adaptation and large numbers of contacts then the organisational adaptation index will be high.

Question D20 - To what extent does the company exhibit boundary spanning during inversion?

Explanation: This is also a measure of entrepreneurship and know-why characteristic

Question D21 - To what extent does the company react to change involving inversion?

Explanation: High reaction to change will determine a positive characteristic of adaptation of the organisation to the requirement of the inversion technology.

Questions D22-D24:

Group(KM)		Reverse dynamic environment
Sub Group(C)		Unpredictability and degree of adaptation of inversion
Elements(F)	-	Historical risk averse
	-	Slow predictable changes

The degree of acceptance of know-why is a measure of the firms flexibility and capacity to adapt to fast changing environments. This subgroup of questions looks directly at the company's capacity to accept a high level of know-why adaptation.[391]

Question D22 - To what extent does the company display a risk averse policy relating to inversion adoption?

Explanation: This is an inverted question in that if the company has a high risk averse indication then it is unlikely to indulge in know-why.

[391] Dutton and Thomas (1985). See discussion on the different learning style for know why, called "learning by studying". Also as cited by Garud (1997).

<u>Question D23 - How fast are new ideas and inversion adapted?</u>

Explanation: An indication here of the speed of know why adaptation is a direct indicator of the organisation's capacity to adapt new technology

<u>Question D24 - To what extent is inversion an issue?</u>

Explanation: This question reinforces the answers from C22 and C23 and seeks to confirm the characteristic.

Survey D questions are tabulated in Table 5.16.

Inverse Characteristics	Cultural Background	Survey D Question (Scale 1-5)
Central Planning Extent of inversion planning	Historical Risk averse Production demands centrally planned Decisions remote to the organisation	D1 To what extent does the company look at reverse transfer before contracts? D2 To what extent does the company adopt transfer with the view of inverse? D3 To what extent does the company develop imported technology for the purpose of inverse transfer?
Open/Closed System Extent of inversion management	Mechanistic structure Large bureaucratic	D4 To what extent does the company plan and manage the introduction of new technology from inverse point? D5 At what level does the company prefer to adopt new technology for the purpose of inverse transfer? D6 To what extent does the company negotiate with outsiders about adoption of new technology to transfer?
Core competencies extent of internal capacity building for inversion	Hidden structure Protected agencies within the company Team strategy Protective agenda	D7 To what extent does the company develop its internal capacity with respect to inverse adoption? D8 To what extent does the company arrange its operations around inverse technology? D9 To what extent does the company develop plans and systems to cope with look at inverting from contract sign?
Organisational Flexibility Extent of strategic adoption for inversion	Historical risk averse Rigid Structures Protective internal groups	D10 To what extent does the company develop strategy along the Austin levels? D11 To what extent does the company go beyond the simple adoption of new technology and into reverse dynamic? D12 To what extent does the company change its organisation to adopt inverse?
Rigid Viewpoint Extent of inversion avoidance	Fixed Position Outsider influence Mechanistic defence against outside change	D13 To what extent does the company avoid new concepts involving inversion? D14 To what extent does the company plan against outside change? D15 To what extent does the company focus on adopting inversion?
Entreprenureship Extent of preference for inversion	Lack of individual initiative Historical risk averse Lack of personal responsibility taking	D16 To what extent does the company avoid internal development for inversion? D17 To what extend does the company decide inversion matters by group? D18 To what extent does the company show inversion preference?
External Elements Extent of inversion integration	Large numbers of external contacts Change is slow	D19 To what extent does the company deal with large numbers of contact? D20 To what extent does the company exhibit boundary spanning during inversion? D21 To what extent does the company react to change involving inversion? D22 To what extent does the company
Unpredictability Adaptation of inversion	Slow predictable changes Risk averse	display a risk averse policy relating to inversion adoption? D23 How fast are new ideas and inversion adapted? D24 To what extent is inversion an issue?

Table 5.16 Survey D Questionnaire

Summary of Survey D "Reverse Dynamic Characteristics" Results

The results of the interviews conducted with companies involved with the ten projects are shown in Tables 5.17, 5.18, 5.19, 5.20. The references in this table (D1-D24) refer to the questions numbers shown in Table 5.16. Analysis of these results are discussed in Chapter Six.

Survey D Question D-1											f					
Q-D1	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	5	3	2	5	4	3	4	4	5	0	2	2	3	3	3.7
P2	3	2	5	5	5	3	3	3	5	5	0	1	4	0	5	3.9
P3	5	4	5	5	5	5	4	5	5	5	0	0	0	2	8	4.8
P4	5	4	5	5	5	2	4	5	5	5	0	1	0	2	7	4.5
P5	5	5	5	5	5	5	4	5	5	5	0	0	0	1	9	4.9
P6	3	4	2	5	4	3	2	3	3	4	0	2	4	3	1	3.3
P7	4	5	1	4	4	5	5	5	5	3	1	5	1	3	0	2.6
P8	1	1	1	1	3	1	1	4	1	1	8	0	1	1	0	1.5
P9	1	2	2	1	3	2	4	2	2	2	2	6	1	1	0	2.1
P10	1	2	1	1	4	2	4	2	2	1	4	4	0	2	0	2

Survey D Question D-2											f					
Q-D2	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	3	4	4	5	4	3	3	4	4	0	0	3	6	1	3.8
P2	3	1	3	3	3	4	3	3	3	3	1	0	8	1	0	2.9
P3	3	1	3	3	3	3	4	1	3	3	2	0	7	1	0	2.7
P4	4	2	4	3	4	4	4	5	5	4	0	1	1	6	2	3.9
P5	4	2	4	2	3	3	4	3	4	3	0	2	4	4	0	3.2
P6	4	2	3	5	4	4	3	3	3	3	0	1	5	3	1	3.4
P7	3	1	2	3	3	4	3	3	1	2	2	2	5	1	0	2.5
P8	4	3	2	5	3	3	5	3	3	3	0	1	6	1	2	3.4
P9	4	4	2	5	3	4	4	4	4	4	0	1	1	7	1	3.8
P10	4	2	5	4	3	5	4	4	4	3	0	1	2	5	2	3.8

Survey D Question D-3											f					
Q-D3	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	4	5	5	4	4	5	5	5	0	0	0	4	6	4.6
P2	3	4	5	5	4	3	5	3	3	5	0	0	4	2	4	4
P3	5	2	3	5	2	1	2	2	5	5	1	4	1	0	4	3.2
P4	3	5	4	3	3	3	3	4	3	3	0	0	7	2	1	3.4
P5	4	4	2	5	4	4	3	4	5	4	0	1	1	6	2	3.9
P6	4	4	2	4	3	4	4	5	4	4	0	1	1	7	1	3.8
P7	3	2	1	2	2	1	2	2	1	1	4	5	1	0	0	1.7
P8	3	1	2	1	1	3	1	1	1	1	7	1	2	0	0	1.5
P9	1	1	2	1	1	3	4	1	1	2	6	2	1	1	0	1.7
P10	1	1	2	1	1	3	1	1	1	1	0	1	8	1	0	3

Survey D Question D-4											f					
Q-D4	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	2	5	2	5	5	4	5	3	0	2	1	2	5	4
P2	5	5	3	5	5	5	5	5	5	5	0	0	1	0	9	4.8
P3	5	4	2	5	5	4	4	5	5	3	0	1	1	3	5	4.2
P4	4	2	1	4	3	5	3	4	4	3	1	1	3	4	1	3.3
P5	3	1	2	3	4	5	3	4	4	4	0	1	1	6	2	3.9
P6	4	2	2	3	4	5	2	4	3	5	0	3	2	3	2	3.4
P7	4	2	5	4	3	2	4	4	4	4	0	2	1	6	1	3.6
P8	3	1	3	3	2	5	4	4	3	3	1	1	5	2	1	3.1
P9	4	1	5	4	1	4	4	4	4	4	1	1	0	7	1	3.6
P10	1	2	1	1	1	1	1	3	1	1	8	1	1	0	0	1.3

Survey D Question D-5											f					
Q-D5	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	2	3	2	3	3	4	3	3	3	0	2	7	1	0	2.9
P2	4	4	3	4	3	4	4	5	4	4	0	0	2	7	1	3.9
P3	4	2	3	4	4	3	5	5	4	4	0	1	2	5	2	3.8
P4	5	2	4	1	4	1	4	1	1	3	4	1	1	3	1	2.6
P5	3	1	2	3	1	2	1	3	1	1	5	2	3	0	0	1.8
P6	1	2	2	2	2	2	2	1	4	2	2	7	0	1	0	2
P7	1	2	1	1	1	4	1	1	4	1	7	1	0	2	0	1.7
P8	3	2	1	2	1	2	2	2	2	2	2	7	1	0	0	1.9
P9	3	4	2	3	2	3	4	4	2	2	0	4	3	3	0	2.9
P10	2	1	3	4	1	3	4	2	4	4	2	2	2	4	0	2.8

Survey D Question D-6											f					
Q-D6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	2	4	1	5	3	3	2	3	3	1	2	5	1	1	2.9
P2	3	4	1	2	5	3	5	1	3	4	2	1	3	2	2	3.1
P3	2	1	4	2	4	2	2	2	4	4	1	5	0	4	0	2.7
P4	4	1	4	2	4	3	5	3	4	4	1	1	2	5	1	3.4
P5	3	1	3	2	5	3	5	3	3	3	1	1	6	0	2	3.1
P6	4	4	3	4	1	4	2	2	1	4	2	2	1	5	0	2.9
P7	1	1	2	1	3	1	2	4	1	1	6	2	1	1	0	1.7
P8	4	5	2	5	4	3	3	4	4	5	0	1	2	4	3	3.9
P9	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P10	2	1	2	2	1	1	3	2	2	2	3	5	1	1	0	2

Table 5.17 Survey D Questions D1-6 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey D Question D-7											f					
Q-D7	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	3	1	2	1	2	3	2	3	4	2	4	3	1	0	2.3
P2	4	5	4	5	3	4	4	5	5	5	0	0	1	4	5	4.4
P3	4	3	4	5	3	4	3	5	3	3	0	0	5	3	2	3.7
P4	3	5	3	3	4	3	5	3	3	3	0	0	7	1	2	3.5
P5	2	2	2	2	4	2	2	2	4	2	0	8	0	2	0	2.4
P6	2	1	3	4	1	3	3	2	4	4	2	2	3	3	0	2.7
P7	1	1	1	2	1	3	1	2	2	2	5	4	1	0	0	1.6
P8	3	2	1	2	2	1	1	2	3	2	3	5	2	0	0	1.9
P9	1	1	2	1	1	3	4	1	1	1	7	1	1	1	0	1.6
P10	2	1	3	1	1	2	1	2	2	2	4	5	1	0	0	1.7

Survey D Question D-8											f					
Q-D8	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	4	2	4	2	3	3	3	4	3	0	2	5	3	0	3.1
P2	3	5	2	3	5	4	3	4	4	3	0	1	4	3	2	3.6
P3	5	5	5	3	5	5	5	4	5	5	0	0	1	1	8	4.7
P4	4	5	1	5	4	2	4	4	3	4	1	1	1	5	2	3.6
P5	1	3	2	1	1	2	1	1	1	3	6	2	2	0	0	1.6
P6	1	1	1	2	2	1	1	2	2	2	5	5	0	0	0	1.5
P7	2	4	1	4	3	1	1	3	1	3	4	1	3	2	0	2.3
P8	2	4	2	4	3	4	2	2	2	2	0	6	1	3	0	2.7
P9	3	4	1	3	3	3	3	2	4	3	1	1	6	2	0	2.9
P10	2	2	1	2	3	2	1	2	4	2	2	6	1	1	0	2.1

Survey D Question D-9											f					
Q-D9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	1	3	5	2	4	3	3	3	4	1	1	5	1	1	2.7
P2	5	2	4	4	5	3	4	4	3	3	0	1	3	4	2	3.7
P3	3	2	3	3	5	3	4	3	4	4	0	1	5	3	1	3.4
P4	5	2	5	3	5	5	4	5	4	5	0	1	1	2	6	4.3
P5	1	1	1	1	3	1	5	1	1	5	7	0	1	0	2	2
P6	4	4	2	4	5	4	3	4	4	4	0	1	1	7	1	3.8
P7	3	1	3	3	2	3	3	4	3	3	1	1	7	1	0	2.8
P8	3	5	5	4	3	3	3	4	4	3	0	0	5	3	2	3.7
P9	1	1	2	1	1	3	1	1	3	4	6	1	2	1	0	1.8
P10	3	3	1	3	4	1	3	3	3	3	2	0	7	1	0	2.7

Survey D Question D-10											f					
Q-D10	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	2	2	3	2	2	2	4	2	2	0	7	1	2	0	2.5
P2	3	5	3	5	4	5	5	3	3	5	0	0	4	1	5	4.1
P3	4	5	2	5	3	4	4	3	4	3	0	1	3	4	2	3.7
P4	3	4	1	4	3	2	3	4	4	4	1	1	3	5	0	3.2
P5	2	4	1	3	2	3	4	2	2	2	1	5	2	2	0	2.5
P6	1	1	1	1	2	1	1	3	4	1	7	1	1	1	0	1.6
P7	4	2	3	1	2	4	3	3	3	3	1	2	5	2	0	2.8
P8	3	1	2	1	4	1	2	2	1	1	5	3	1	1	0	1.8
P9	2	1	2	2	3	2	2	2	2	3	1	7	2	0	0	2.1
P10	1	1	2	1	1	1	1	1	3	1	8	1	1	0	0	1.3

Survey D Question D-11											f					
Q-D11	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	2	3	1	3	3	3	1	3	3	2	2	2	6	0	0	2.4
P2	5	5	4	5	5	5	4	4	4	5	0	0	0	3	7	4.7
P3	5	5	5	5	3	5	4	5	5	4	0	0	1	2	7	4.6
P4	5	5	5	3	5	5	5	5	5	5	0	0	1	0	9	4.8
P5	3	2	1	1	2	1	3	3	1	1	5	2	3	0	0	1.8
P6	1	1	2	1	3	1	1	2	2	2	5	4	1	0	0	1.6
P7	4	3	4	5	4	3	3	5	3	4	0	0	4	4	2	3.8
P8	2	2	1	2	2	2	2	2	2	2	1	9	0	0	0	1.9
P9	2	3	1	2	1	1	1	2	2	1	5	4	1	0	0	1.6
P10	1	2	1	1	1	2	2	3	2	2	4	5	1	0	0	1.7

Survey D Question D-12											f					
Q-D12	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	4	1	3	2	3	3	3	2	2	1	3	5	1	0	2.6
P2	5	4	2	5	3	5	3	3	3	3	0	1	5	1	3	3.6
P3	3	3	1	3	3	4	3	3	3	3	1	0	8	1	0	2.9
P4	4	4	2	5	4	4	4	5	4	4	0	1	0	7	2	4
P5	5	5	5	5	3	5	5	4	5	4	0	0	1	2	7	4.6
P6	3	1	2	1	1	2	3	1	3	3	4	2	4	0	0	2
P7	4	2	4	4	3	4	2	2	4	4	0	3	1	6	0	3.3
P8	2	3	1	4	1	1	2	3	2	2	3	4	2	1	0	2.1
P9	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P10	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1

Table 5.18 Survey D Questions D7-12 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey D Question D-13											f					
Q-D13	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	3	5	5	3	5	5	5	5	0	0	2	1	7	4.5
P2	4	4	5	4	4	3	5	5	4	4	0	0	1	6	3	4.2
P3	4	1	3	5	2	5	2	3	2	3	1	3	3	1	2	3
P4	4	2	3	4	5	2	5	4	4	4	0	2	1	5	2	3.7
P5	5	5	5	5	5	5	5	5	5	5	0	0	0	0	##	5
P6	3	2	1	2	2	1	2	2	2	3	2	6	2	0	0	2
P7	1	1	2	1	3	1	2	2	2	1	5	4	1	0	0	1.6
P8	1	1	1	1	2	1	1	1	1	1	9	1	0	0	0	1.1
P9	2	2	2	2	4	2	2	2	2	2	1	8	0	1	0	2.1
P10	1	2	1	1	1	2	2	2	1	2	5	5	0	0	0	1.5

Survey D Question D-14											f					
Q-D14	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	2	1	1	1	3	3	1	1	1	7	1	2	0	0	1.5
P2	3	1	3	3	3	1	3	4	3	4	2	0	6	2	0	2.8
P3	3	3	4	3	5	4	3	5	3	4	0	0	5	3	2	3.7
P4	5	5	5	2	5	3	5	5	5	5	0	1	1	0	8	4.5
P5	4	5	3	5	4	5	5	3	5	5	0	0	2	2	6	4.4
P6	2	2	1	2	3	2	1	2	2	2	2	7	1	0	0	1.9
P7	3	1	2	1	1	3	2	1	1	1	6	2	2	0	0	1.6
P8	4	4	1	4	4	3	4	4	3	3	1	0	3	6	0	3.4
P9	1	1	2	1	4	3	4	1	2	3	4	2	2	2	0	2.2
P10	2	1	1	1	1	1	1	1	1	1	9	1	0	0	0	1.1

Survey D Question D-15											f					
Q-D15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	5	5	5	3	5	5	5	4	5	0	0	1	1	8	4.7
P2	5	4	4	3	5	4	3	3	5	4	0	0	3	4	3	4
P3	3	4	5	2	5	4	3	4	4	5	0	1	2	4	3	3.9
P4	5	5	5	4	5	5	5	5	5	5	0	0	0	1	9	4.9
P5	5	3	3	3	4	3	3	5	3	3	0	0	7	1	2	3.5
P6	1	1	2	1	1	1	3	1	1	1	8	1	1	0	0	1.3
P7	1	1	2	1	1	3	3	1	3	1	6	1	3	0	0	1.7
P8	3	4	2	4	4	4	5	4	3	4	0	1	2	6	1	3.7
P9	1	1	2	1	1	2	2	1	1	1	7	3	0	0	0	1.3
P10	1	1	2	1	1	1	4	1	1	1	8	1	0	1	0	1.4

Survey D Question D-16											f					
Q-D16	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	5	2	2	5	3	2	4	2	2	4	0	5	1	2	2	3.1
P2	5	5	5	3	4	5	5	3	3	3	0	0	4	1	5	4.1
P3	4	5	5	2	4	4	3	3	4	3	0	1	3	4	2	3.7
P4	1	1	1	2	1	3	1	1	1	1	8	1	1	0	0	1.3
P5	3	5	3	3	4	5	3	4	3	3	0	0	6	2	2	3.6
P6	4	4	4	3	4	2	4	2	4	4	0	2	1	7	0	3.5
P7	2	2	1	2	2	3	2	2	2	2	1	8	1	0	0	2
P8	3	3	2	3	3	4	2	4	4	3	0	2	5	3	0	3.1
P9	1	1	2	1	1	2	2	1	1	1	7	3	0	0	0	1.3
P10	1	4	2	4	4	4	1	4	4	4	2	1	0	7	0	3.2

Survey D Question D-17											f					
Q-D17	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	4	4	2	4	5	4	3	4	4	0	1	1	7	1	3.8
P2	4	4	2	2	4	5	3	4	4	4	0	2	1	6	1	3.6
P3	4	3	4	2	4	4	1	1	3	4	2	1	2	5	0	3
P4	2	2	2	3	2	2	4	2	2	2	0	8	1	1	0	2.3
P5	3	1	2	3	1	4	3	3	1	1	4	1	4	1	0	2.2
P6	4	2	3	4	4	5	3	5	4	4	0	1	2	5	2	3.8
P7	3	3	3	2	3	1	3	1	3	3	2	1	7	0	0	2.5
P8	1	1	1	2	1	1	4	1	1	1	8	1	0	1	0	1.4
P9	2	3	2	3	4	3	3	4	2	2	0	4	4	2	0	2.8
P10	1	1	1	1	2	1	3	1	1	1	7	1	1	0	0	1.2

Survey D Question D-18											f					
Q-D18	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	3	3	2	3	2	2	3	4	3	0	3	5	2	0	2.9
P2	4	2	2	2	3	2	4	2	4	4	0	5	1	4	0	2.9
P3	5	5	5	5	5	5	5	5	5	5	0	0	0	0	10	5
P4	4	4	2	4	3	4	4	5	4	4	0	1	1	7	1	3.8
P5	2	3	2	2	1	4	2	2	3	2	1	6	2	1	0	2.3
P6	2	2	2	1	2	2	2	1	3	2	2	7	1	0	0	1.9
P7	2	4	4	3	2	3	3	2	4	3	0	3	4	3	0	3
P8	2	3	2	1	3	2	3	1	2	2	2	5	3	0	0	2.1
P9	1	1	1	2	1	1	1	1	1	1	9	1	0	0	0	1.1
P10	1	1	2	1	1	2	2	2	1	1	6	4	0	0	0	1.4

Table 5.19 Survey D Questions D13-18 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Survey D Question D-19											f					
Q-D19	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	5	3	4	3	3	4	4	5	5	0	0	3	4	3	4
P2	4	4	3	4	4	4	4	4	4	4	0	0	1	9	0	3.9
P3	5	5	2	5	5	5	5	5	5	5	0	1	0	0	9	4.7
P4	4	4	3	4	4	5	4	5	4	4	0	0	1	7	2	4.1
P5	2	3	2	1	2	2	3	1	3	2	2	5	3	0	0	2.1
P6	1	1	2	1	1	1	2	2	1	2	6	4	0	0	0	1.4
P7	1	1	2	3	2	2	1	1	2	1	5	4	1	0	0	1.6
P8	1	1	2	1	1	2	2	1	1	1	7	3	0	0	0	1.3
P9	2	1	2	2	2	2	2	2	2	2	1	9	0	0	0	1.9
P10	1	1	2	1	2	5	4	4	3	4	3	2	1	3	1	2.7

Survey D Question D-20											f					
Q-D20	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	2	2	3	4	2	3	2	2	2	0	6	2	2	0	2.6
P2	5	5	5	4	5	4	5	4	5	4	0	0	0	4	6	4.6
P3	3	3	3	3	5	3	4	3	3	4	0	0	7	2	1	3.4
P4	4	3	4	2	3	5	4	4	4	4	0	1	2	6	1	3.7
P5	2	2	1	2	1	2	2	2	2	2	2	8	0	0	0	1.8
P6	5	5	5	4	5	5	5	5	5	5	0	0	0	1	9	4.9
P7	3	2	3	1	3	3	1	1	3	3	3	1	6	0	0	2.3
P8	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P9	1	1	2	1	2	1	1	1	1	1	8	2	0	0	0	1.2
P10	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1

Survey D Question D-21											f					
Q-D21	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	4	3	4	3	2	3	4	2	3	3	0	2	5	3	0	3.1
P2	4	4	4	3	4	4	3	4	5	5	0	0	2	6	2	4
P3	5	5	5	3	5	5	4	5	5	5	0	0	1	1	8	4.7
P4	2	1	2	2	2	1	2	2	2	2	2	8	0	0	0	1.8
P5	3	3	2	3	3	3	5	3	3	3	0	1	7	1	1	3.2
P6	2	2	2	1	2	1	2	2	2	2	2	8	0	0	0	1.8
P7	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P8	1	1	2	3	1	1	1	1	1	1	8	0	2	0	0	1.4
P9	1	1	1	1	3	2	1	1	2	2	6	3	1	0	0	1.5
P10	2	1	2	2	2	3	1	2	2	4	2	6	1	1	0	2.1

Survey D Question D-22											f					
Q-D22	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	1	1	1	3	1	4	1	1	4	7	0	1	2	0	1.8
P2	4	4	1	4	3	4	4	4	4	4	1	0	1	8	0	3.6
P3	4	4	4	4	2	4	3	4	3	3	0	1	3	6	0	3.5
P4	4	4	3	1	3	3	2	3	4	3	1	1	5	3	0	3
P5	5	2	2	3	5	2	3	2	2	2	0	6	2	0	2	2.8
P6	1	1	2	1	1	1	1	2	1	1	8	2	0	0	0	1.2
P7	4	1	1	4	4	4	4	4	4	4	1	1	0	8	0	3.5
P8	2	3	2	2	1	2	2	1	1	3	3	5	2	0	0	1.9
P9	2	2	2	2	1	2	3	1	2	2	2	7	1	0	0	1.9
P10	1	1	1	1	1	2	3	1	1	1	8	1	1	0	0	1.3

Survey D Question D-23											f					
Q-D23	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	1	2	3	3	1	3	2	1	3	3	3	2	5	0	0	2.2
P2	4	4	5	4	2	4	3	4	2	4	0	2	1	6	1	3.6
P3	4	4	5	4	2	5	3	4	4	3	0	1	2	5	2	3.8
P4	1	1	1	1	1	1	2	1	1	1	9	1	0	0	0	1.1
P5	3	1	3	2	1	1	1	2	3	1	5	2	3	0	0	1.8
P6	3	3	3	3	1	3	3	2	3	3	1	1	8	0	0	2.7
P7	4	4	5	4	2	4	4	3	5	5	0	1	1	5	3	4
P8	1	1	1	2	1	1	1	1	1	1	1	9	0	0	0	1.9
P9	1	3	2	2	1	4	3	2	3	2	2	4	3	1	0	2.3
P10	2	2	2	1	2	2	2	2	3	3	1	7	1	1	0	2.2

Survey D Question D-24											f					
Q-D24	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	1	2	3	4	5	Mean
P1	3	3	3	2	3	2	3	2	2	2	0	5	5	0	0	2.5
P2	4	3	4	4	2	4	4	4	2	4	0	2	1	7	0	3.5
P3	4	4	2	4	4	4	4	4	4	4	0	1	0	9	0	3.8
P4	3	4	2	3	4	5	4	4	3	4	0	1	3	5	1	3.6
P5	2	3	1	3	3	1	3	2	3	3	2	2	6	0	0	2.4
P6	1	2	1	3	1	3	1	1	1	1	7	1	2	0	0	1.5
P7	1	1	1	1	1	1	1	1	1	1	10	0	0	0	0	1
P8	1	1	2	1	1	1	1	1	1	1	9	1	0	0	0	1.1
P9	1	1	1	1	2	1	1	1	3	1	8	1	1	0	0	1.3
P10	1	1	2	1	2	2	1	1	3	1	6	3	1	0	0	1.5

Table 5.20 Survey D Questions D19-24 Results, Frequencies and Means.

Note: R - Respondents, P - Project Number

Summary

The data used in this thesis to formulate management models came from the questionnaires (surveys A,B,C,D) relating to a diverse set of projects, contracts and companies during a five year period. Each of the projects focused on the adoption of technology and management systems for the management of toxic waste recovery. The surveys were aimed at the adaptation processes adopted by organisations when introducing technology, and the adaptation of the technology to the organisation during such processes. The data collected from the surveys will be used in Chapter Six to establish the embedded characteristics of the organisations surveys in order to validate the multidimensional nature of the adaptation models.

6
Survey Analysis and Multidimensional Models

Introduction

Survey analysis involved two stages. The first involved a within-survey analysis and the second involved a cross-survey analysis. The first two surveys on uncertainty and complexity were searches for characteristics as patterns of the organisation and its reactions and responses to the external environment. The last two surveys involved the search for whether the characteristics discovered in the first two were resolved or embedded in the organisations work environment with respect to the adoption of technology during the transfer stage. From the survey analysis information the multidimensional models were formulated.

Within Survey Analysis - Survey A Total Uncertainty Scores

From the survey result tables (Tables 5.2,5.3,5.4,5.5) a summary table showing the means and a total "uncertainty score" is compiled. See Table 6.1. The range of the total "uncertainty scores for each project clearly show a varying effect within the organisations with respect to their responses to external uncertainty. The scores provide comparison between projects.

Survey A - Uncertainty	Projects and Contracts									
Uncertainty Characteristic	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
A-1	4.0	2.0	2.0	4.7	4.7	1.7	3.0	4.9	1.9	4.7
A-2	2.8	2.0	2.3	2.1	3.7	3.3	2.5	2.8	2.4	4.4
A-3	4.4	1.6	1.4	4.8	4.4	1.7	1.5	4.8	1.3	4.0
A-4	3.7	1.7	2.1	3.5	3.4	1.9	1.2	4.6	1.3	4.3
A-5	4.4	1.6	1.2	3.8	4.8	2.7	1.2	2.5	1.6	2.4
A-6	4.4	1.3	1.4	3.7	3.7	1.2	2.0	2.8	1.5	2.8
A-7	3.0	1.9	1.5	3.2	2.0	1.7	1.7	1.1	1.8	1.3
A-8	3.5	2.2	2.2	3.8	3.8	3.2	2.4	3.7	2.5	4.3
A-9	4.3	2.8	1.4	4.9	4.3	1.4	2.8	4.9	1.4	4.7
A-10	3.8	1.8	2.6	3.6	4.7	1.8	1.1	4.7	1.5	4.6
A-11	4.6	1.5	1.2	4.6	4.7	2.0	1.6	4.6	1.7	4.5
A-12	4.5	2.7	2.4	3.1	3.7	1.6	2.1	3.5	1.5	3.5
A-13	3.6	2.0	1.6	3.6	4.7	2.6	1.5	4.9	1.9	3.9
A-14	3.6	1.0	2.3	3.4	2.1	1.4	2.0	1.9	3.4	4.4
A-15	4.1	1.5	1.5	1.8	4.1	1.5	2.7	4.8	1.3	4.6
A-16	1.8	2.5	1.2	2.0	1.1	1.3	1.0	2.0	3.8	3.5
A-17	2.0	1.0	1.9	1.7	1.4	1.4	1.5	1.1	2.8	2.0
A-18	2.7	1.0	2.2	3.3	1.2	1.5	2.2	2.1	1.4	1.9
A-19	3.7	1.6	1.3	3.8	4.0	2.7	1.8	4.1	2.8	4.0
A-20	3.8	1.8	1.6	2.3	3.6	4.1	3.0	3.7	1.6	4.3
A-21	4.9	1.4	1.6	5.0	4.9	3.3	1.0	4.3	1.9	4.9
A-22	3.5	2.8	2.1	4.1	4.2	1.3	1.9	2.7	2.1	3.0
A-23	2.1	1.4	1.3	1.0	1.2	1.6	2.0	1.9	2.6	1.3
A-24	2.0	2.1	2.0	1.1	1.2	1.3	1.6	2.2	1.4	1.3
Total Uncertainty Scores	85.2	43.2	42.3	78.9	81.6	48.2	45.3	80.6	47.4	84.6

Table 6.1 Survey A - Summary of Means and Total Uncertainty Scores

Within Survey Analysis Survey B Total Complexity Scores

The total uncertainty scores from Table 6.1 and the total complexity scores from Table 6.2 are combined into Table 6.3 and graphed together in Figure 6.1. The graphing of the two sets of results allows us to see how the projects are grouped on the Duncan two dimensional matrix.[392]

[392] Duncan (1962). passim.

Survey B - Complexity	Projects and Contracts									
Complexity Characteristic	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
B-1	4.7	5.0	4.9	4.7	4.8	1.6	1.7	1.8	2.2	1.6
B-2	3.6	2.6	4.6	3.7	3.4	1.0	2.4	1.8	3.0	2.0
B-3	5.0	4.6	4.4	4.8	4.1	3.5	1.3	1.1	1.6	1.5
B-4	4.6	4.9	3.6	3.6	4.0	1.3	1.9	2.4	2.6	1.4
B-5	2.6	3.5	1.5	2.1	2.0	2.1	1.1	2.1	2.7	1.9
B-6	2.7	2.3	1.9	3.9	3.2	1.4	1.5	2.0	1.2	1.8
B-7	2.4	1.9	2.6	3.7	2.0	1.7	1.6	1.9	1.6	1.5
B-8	3.5	2.1	1.8	3.7	1.1	1.4	2.5	2.0	2.4	2.1
B-9	3.0	3.0	3.5	2.8	1.7	1.7	1.3	1.9	1.4	2.3
B-10	2.7	2.8	3.4	3.5	1.7	1.6	2.0	2.2	2.0	1.7
B-11	4.5	4.3	4.6	4.8	2.2	1.4	1.1	2.0	1.2	1.4
B-12	2.8	3.5	3.1	4.2	4.4	1.3	2.3	2.1	1.6	1.5
B-13	4.0	4.8	3.0	3.5	4.9	2.1	1.6	1.6	2.0	1.9
B-14	4.5	2.9	4.2	4.3	2.1	1.6	1.6	1.7	2.0	1.7
B-15	5.0	2.6	4.3	4.4	2.8	1.7	1.4	2.0	1.7	1.5
B-16	4.2	4.5	4.3	3.5	4.5	1.6	1.9	1.7	2.1	2.2
B-17	3.5	4.3	3.8	4.3	3.6	1.9	1.9	1.4	3.9	1.8
B-18	2.5	3.6	4.1	4.1	3.6	1.7	1.9	2.9	1.1	1.7
B-19	2.1	1.8	2.0	2.7	3.9	1.8	1.9	2.0	1.6	1.6
B-20	2.3	2.6	2.4	3.1	2.0	1.6	1.6	1.7	1.7	1.4
B-21	2.9	2.0	4.2	1.7	2.9	1.6	1.4	1.6	1.5	1.1
B-22	2.1	1.7	3.5	3.2	1.8	1.4	2.1	2.2	1.4	1.2
B-23	2.6	1.6	1.6	2.5	2.2	1.5	1.4	1.7	1.6	1.4
B-24	2.9	2.2	3.3	3.3	1.7	1.7	1.8	1.6	1.4	1.8
Total Uncertainty Scores	80.7	75.1	80.6	86.1	70.6	40.2	41.2	45.4	45.5	40.0

Table 6.2 Survey B - Summary of Means and Total Complexity Scores

	Projects and Contracts									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Total Complexity Scores	80.7	75.1	80.6	86.1	70.6	40.2	41.2	45.4	45.5	40.0
Total Uncertainty Scores	85.2	43.2	42.3	78.9	81.6	48.2	45.3	80.6	47.4	84.6

Table 6.3 Uncertainty and Complexity Rankings by Project

The two sets of scores from Table 6.3 are graphed on Duncan's two dimensional matrix as follows (Figure 6.1);

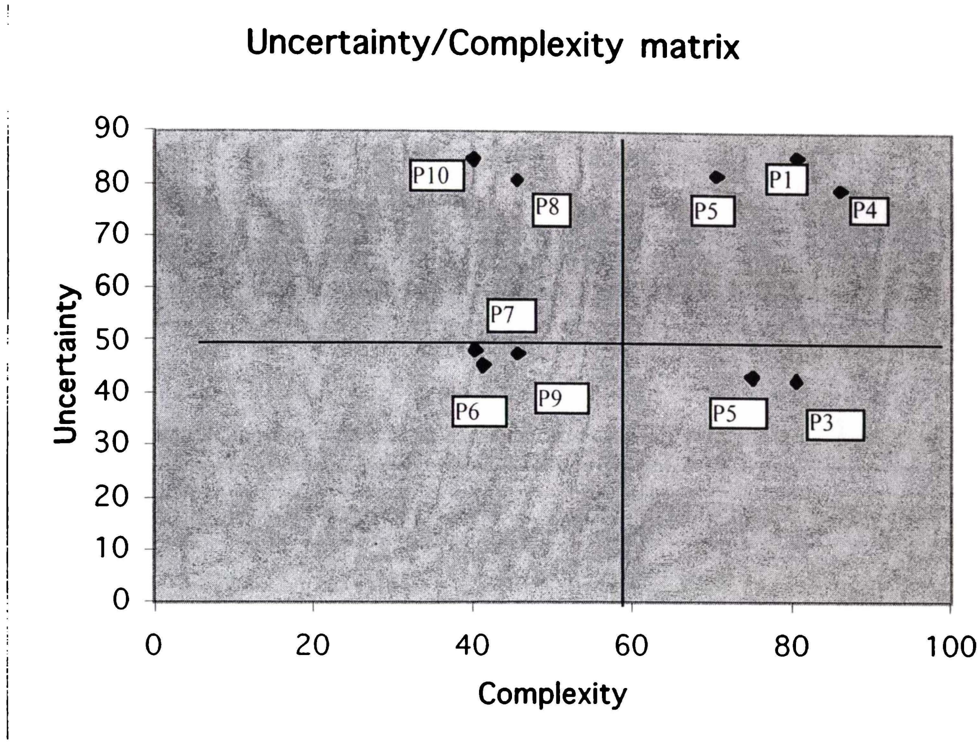


Figure 6.1 Uncertainty/Complexity Matrix, based on Surveys A & B Results

Project Groupings Surveys A & B

From Figure 6.1 it can be clearly seen that from a multidimensional viewpoint the projects are broadly grouped into the four segments shown in Table 6.4.

Quadrant	Characteristic Uncertainty	Complexity	Project
1	High	High	P1,P4,P5
2	Low	High	P2,P3
3	Low	Low	P6,P7,P9
4	High	Low	P8,P10

Table 6.4 Project groupings in Uncertainty/Complexity matrix segments

Using the groupings shown in Table 6.4 we look at the individual characteristics of each of the two first surveys. Within survey A the projects are grouped as shown in Table 6.4 and the question groups subgroup C. This is a similar comparison to that performed by Duncan in his study.[393] Table 6.5 below assembles the project

[393] Duncan (1962). passim.

groups and the question subgroups and delivers a scale for each of the surveyed characteristics on a comparative basis using the Difference of Means test. Using an arbitrary scale as shown in Figure 6.2 we can load a degree to each of the characteristics and compile Figure 6.3 which displays the compared characteristics on the Uncertainty/Complexity matrix. Table 6.6 shows the Survey B groupings and Figure 6.4 the element comparisons.

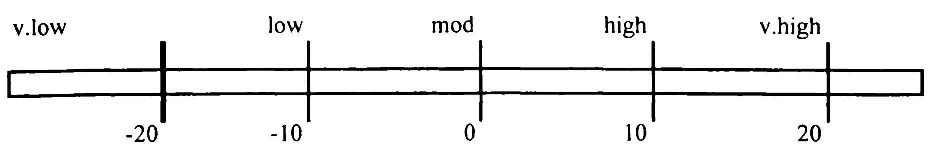


Figure 6.2 Arbitrary Scale for Matrix Element Comparison

Survey A - Uncertainty	Projects and Contracts									
Uncertainty Characteristic	P1	P4	P5	P8	P10	P6	P7	P9	P2	P3
A-1	4.0	4.7	4.7	4.9	4.7	1.7	3.0	1.9	2.0	2.0
A-2	2.8	2.1	3.7	2.8	4.4	3.3	2.5	2.4	2.0	2.3
A-3	4.4	4.8	4.4	4.8	4.0	1.7	1.5	1.3	1.6	1.4
Overall Mean	3.73	3.87	4.27	4.17	4.37	2.23	2.33	1.87	1.87	1.90
Project Group Mean	3.06	3.96		4.27			2.14		1.88	
(x-mn)SQD		0.1541		0.0200			0.1207		0.0006	
SD2		0.0414		0.0183			0.0366		0.0030	
SD1		1.0439		1.0439			1.0439		1.0439	
Z(Diff of Mns Test)		14.82		20.01			-15.16		-19.52	
A-4	3.7	3.5	3.4	4.6	4.3	1.9	1.2	1.3	1.7	2.1
A-5	4.4	3.8	4.8	2.5	2.4	2.7	1.2	1.6	1.6	1.2
A-6	4.4	3.7	3.7	2.8	2.8	1.2	2.0	1.5	1.3	1.4
Overall Mean	4.17	3.67	3.97	3.30	3.17	1.93	1.47	1.47	1.53	1.57
Project Group Mean	2.62	3.93		3.23			1.62		1.55	
(x-mn)SQD		0.1267		0.0089			0.1452		0.0006	
SD2		0.0375		0.0122			0.0402		0.0030	
SD1		1.0717		1.0717			1.0717		1.0717	
Z(Diff of Mns Test)		21.13		9.86			-16.14		-17.35	
A-7	3.0	3.2	2.0	1.1	1.3	1.7	1.7	1.8	1.9	1.5
A-8	3.5	3.8	3.8	3.7	4.3	3.2	2.4	2.5	2.2	2.2
A-9	4.3	4.9	4.3	4.9	4.7	1.4	2.8	1.4	2.8	1.4
Overall Mean	3.60	3.97	3.37	3.23	3.43	2.10	2.30	1.90	2.30	1.70
Project Group Mean	2.79	3.64		3.33			2.10		2.00	
(x-mn)SQD		0.1830		0.0200			0.0800		0.1800	
SD2		0.0451		0.0183			0.0298		0.0548	
SD1		0.7694		0.7694			0.7694		0.7694	
Z(Diff of Mns Test)		19.13		12.21			-15.49		-17.56	
A-10	3.8	3.6	4.7	4.7	4.6	1.8	1.1	1.5	1.8	2.6
A-11	4.6	4.6	4.7	4.6	4.5	2.0	1.6	1.7	1.5	1.2
A-12	4.5	3.1	3.7	3.5	3.5	1.6	2.1	1.5	2.7	2.4
Overall Mean	4.30	3.77	4.37	4.27	4.20	1.80	1.60	1.57	2.00	2.07
Project Group Mean	2.99	4.14		4.23			1.66		2.03	
(x-mn)SQD		0.2163		0.0022			0.0319		0.0022	
SD2		0.0490		0.0061			0.0188		0.0061	
SD1		1.2048		1.2048			1.2048		1.2048	
Z(Diff of Mns Test)		16.50		17.83			-19.22		-13.80	
A-13	3.6	3.6	4.7	4.9	3.9	2.6	1.5	1.9	2.0	1.6
A-14	3.6	3.4	2.1	1.9	4.4	1.4	2.0	3.4	1.0	2.3
A-15	4.1	1.8	4.1	4.8	4.6	1.5	2.7	1.3	1.5	1.5
Overall Mean	3.77	2.93	3.63	3.87	4.30	1.83	2.07	2.20	1.50	1.80
Project Group Mean	2.79	3.44		4.08			2.03		1.65	
(x-mn)SQD		0.4007		0.0939			0.0689		0.0450	
SD2		0.0667		0.0396			0.0277		0.0274	
SD1		0.9775		0.9775			0.9775		0.9775	
Z(Diff of Mns Test)		11.51		22.82			-13.39		-20.16	
A-16	1.8	2.0	1.1	2.0	3.5	1.3	1.0	3.8	2.5	1.2
A-17	2.0	1.7	1.4	1.1	2.0	1.4	1.5	2.8	1.0	1.9
A-18	2.7	3.3	1.2	2.1	1.9	1.5	2.2	1.4	1.0	2.2
Overall Mean	2.17	2.33	1.23	1.73	2.47	1.40	1.57	2.67	1.50	1.77
Project Group Mean	1.88	1.91		2.10			1.88		1.63	
(x-mn)SQD		0.7030		0.2689			0.9474		0.0356	
SD2		0.0884		0.0669			0.1026		0.0243	
SD1		0.4665		0.4665			0.4665		0.4665	
Z(Diff of Mns Test)		0.97		7.66			-0.19		-9.22	
A-19	3.7	3.8	4.0	4.1	4.0	2.7	1.8	2.8	1.6	1.3
A-20	3.8	2.3	3.6	3.7	4.3	4.1	3.0	1.6	1.8	1.6
A-21	4.9	5.0	4.9	4.3	4.9	3.3	1.0	1.9	1.4	1.6
Overall Mean	4.13	3.70	4.17	4.03	4.40	3.37	1.93	2.10	1.60	1.50
Project Group Mean	3.09	4.00		4.22			2.47		1.55	
(x-mn)SQD		0.1356		0.0672			1.2289		0.0050	
SD2		0.0388		0.0335			0.1169		0.0091	
SD1		1.1121		1.1121			1.1121		1.1121	
Z(Diff of Mns Test)		14.09		17.46			-9.59		-24.03	
A-22	3.5	4.1	4.2	2.7	3.0	1.3	1.9	2.1	2.8	2.1
A-23	2.1	1.0	1.2	1.9	1.3	1.6	2.0	2.6	1.4	1.3
A-24	2.0	1.1	1.2	2.2	1.3	1.3	1.6	1.4	2.1	2.0
Overall Mean	2.53	2.07	2.20	2.27	1.87	1.40	1.83	2.03	2.10	1.80
Project Group Mean	2.01	2.27		2.07			1.76		1.95	
(x-mn)SQD		0.1156		0.0800			0.2096		0.0450	
SD2		0.0358		0.0365			0.0483		0.0274	
SD1		0.2925		0.2925			0.2925		0.2925	
Z(Diff of Mns Test)		14.83		3.23			-14.43		-3.48	

Table 6.5 Project & Question Groups and Differences of Means: Survey A

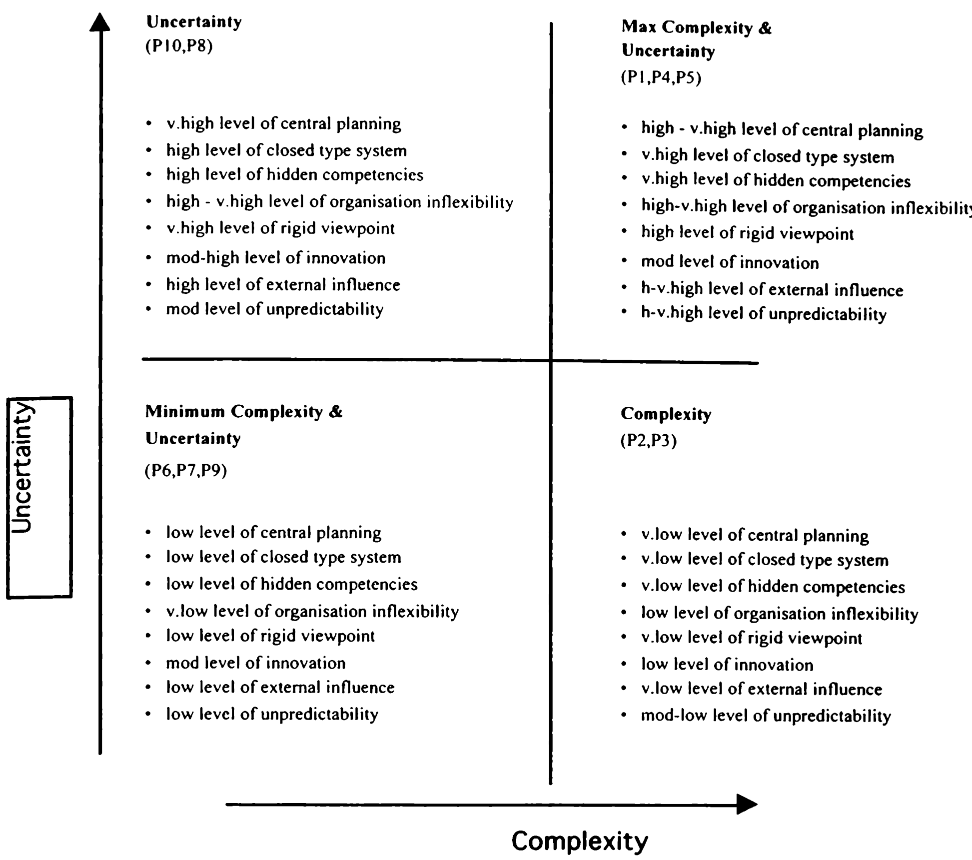


Figure 6.3 Complexity/Uncertainty Matrix with Survey A Elements

Element comparisons shown in Figure 6.3 are shown against the project groupings and using the Difference of Means test in a non standard way. The use of Difference of Means test has been used in a manner to achieve the same result that Duncan achieved by squaring the C component. The elements shown here clearly indicate organisational characteristics that are external environmental reactions and are formed sets of patterns. The elements of uncertainty in Figure 6.3 clearly demonstrate degrees of uncertainty associated with each of the quadrants of the matrix. Various patterns are easily discovered, for example, we can see patterns between the central planning elements and organisational flexibility and levels of innovation.. Table 6.6 below assembles the project groups and question subgroups and delivers a scale for each of the surveyed characteristics of Survey B on a comparative basis using the Difference of Means test. Using the arbitrary scale (Figure 6.2) we can load a degree to each of the characteristics and compile Figure 6.4 which displays the comparison characteristics on the Complexity/Uncertainty matrix.

Survey B - Complexity	Projects and Contracts									
Complexity Characteristic	P1	P4	P5	P8	P10	P6	P7	P9	P2	P3
B-1	4.7	4.7	4.8	1.8	1.6	1.6	1.7	2.2	5.0	4.9
B-2	3.6	3.7	3.4	1.8	2.0	1.0	2.4	3.0	2.6	4.6
B-3	5.0	4.8	4.1	1.1	1.5	3.5	1.3	1.6	4.6	4.4
Overall Mean	4.43	4.40	4.10	1.57	1.70	2.03	1.80	2.27	4.07	4.63
Project Group Mean	3.10	4.31		1.63			2.03		4.35	
(x-mn)SQD		0.0674		0.0089			0.1089		0.1606	
SD2		0.0274		0.0122			0.0348		0.0517	
SD1		1.2485		1.2485			1.2485		1.2485	
Z(Diff of Mns Test)		16.79		-20.34			-14.78		17.27	
B-4	4.6	3.6	4.0	2.4	1.4	1.3	1.9	2.6	4.9	3.6
B-5	2.6	2.1	2.0	2.1	1.9	2.1	1.1	2.7	3.5	1.5
B-6	2.7	3.9	3.2	2.0	1.8	1.4	1.5	1.2	2.3	1.9
Overall Mean	3.30	3.20	3.07	2.17	1.70	1.60	1.50	2.17	3.57	2.33
Project Group Mean	2.46	3.19		1.93			1.76		2.95	
(x-mn)SQD		0.0274		0.1089			0.2585		0.7606	
SD2		0.0175		0.0426			0.0536		0.1126	
SD1		0.7261		0.7261			0.7261		0.7261	
Z(Diff of Mns Test)		17.37		-12.46			-16.65		11.04	
B-7	2.4	3.7	2.0	1.9	1.5	1.7	1.6	1.6	1.9	2.6
B-8	3.5	3.7	1.1	2.0	2.1	1.4	2.5	2.4	2.1	1.8
B-9	3.0	2.8	1.7	1.9	2.3	1.7	1.3	1.4	3.0	3.5
Overall Mean	2.97	3.40	1.60	1.93	1.97	1.60	1.80	1.80	2.33	2.63
Project Group Mean	2.20	2.66		1.95			1.73		2.48	
(x-mn)SQD		1.7652		0.0006			0.0267		0.0450	
SD2		0.1400		0.0030			0.0172		0.0274	
SD1		0.5830		0.5830			0.5830		0.5830	
Z(Diff of Mns Test)		12.30		-7.53			-13.94		8.27	
B-10	2.7	3.5	1.7	2.2	1.7	1.6	2.0	2.0	2.8	3.4
B-11	4.5	4.8	2.2	2.0	1.4	1.4	1.1	1.2	4.3	4.6
B-12	2.8	4.2	4.4	2.1	1.5	1.3	2.3	1.6	3.5	3.1
Overall Mean	3.33	4.17	2.77	2.10	1.53	1.43	1.80	1.60	3.53	3.70
Project Group Mean	2.60	3.42		1.82			1.61		3.62	
(x-mn)SQD		0.9919		0.1606			0.0674		0.0139	
SD2		0.1050		0.0517			0.0274		0.0152	
SD1		0.9742		0.9742			0.9742		0.9742	
Z(Diff of Mns Test)		14.40		-13.77			-17.50		18.12	
B-13	4.0	3.5	4.9	1.6	1.9	2.1	1.6	2.0	4.8	3.0
B-14	4.5	4.3	2.1	1.7	1.7	1.6	1.6	2.0	2.9	4.2
B-15	5.0	4.4	2.8	2.0	1.5	1.7	1.4	1.7	2.6	4.3
Overall Mean	4.50	4.07	3.27	1.77	1.70	1.80	1.53	1.90	3.43	3.83
Project Group Mean	2.78	3.94		1.73			1.74		3.63	
(x-mn)SQD		0.7830		0.0022			0.0719		0.0800	
SD2		0.0933		0.0061			0.0283		0.0365	
SD1		1.0895		1.0895			1.0895		1.0895	
Z(Diff of Mns Test)		18.29		-16.64			-16.45		13.53	
B-16	4.2	3.5	4.5	1.7	2.2	1.6	1.9	2.1	4.5	4.3
B-17	3.5	4.3	3.6	1.4	1.8	1.9	1.9	3.9	4.3	3.8
B-18	2.5	4.1	3.6	2.9	1.7	1.7	1.9	1.1	3.6	4.1
Overall Mean	3.40	3.97	3.90	2.00	1.90	1.73	1.90	2.37	4.13	4.07
Project Group Mean	2.94	3.76		1.95			2.00		4.10	
(x-mn)SQD		0.1919		0.0050			0.2156		0.0022	
SD2		0.0462		0.0091			0.0489		0.0061	
SD1		0.9855		0.9855			0.9855		0.9855	
Z(Diff of Mns Test)		14.34		-17.34			-16.39		20.44	
B-19	2.1	2.7	3.9	2.0	1.6	1.8	1.9	1.6	1.8	2.0
B-20	2.3	3.1	2.0	1.7	1.4	1.6	1.6	1.7	2.6	2.4
B-21	2.9	1.7	2.9	1.6	1.1	1.6	1.4	1.5	2.0	4.2
Overall Mean	2.43	2.50	2.93	1.77	1.37	1.67	1.63	1.60	2.13	2.87
Project Group Mean	2.09	2.62		1.57			1.63		2.50	
(x-mn)SQD		0.1474		0.0800			0.0022		0.2689	
SD2		0.0405		0.0365			0.0050		0.0669	
SD1		0.5346		0.5346			0.5346		0.5346	
Z(Diff of Mns Test)		17.08		-16.76			-14.79		12.79	
B-22	2.1	3.2	1.8	2.2	1.2	1.4	2.1	1.4	1.7	3.5
B-23	2.6	2.5	2.2	1.7	1.4	1.5	1.4	1.6	1.6	1.6
B-24	2.9	3.3	1.7	1.6	1.8	1.7	1.8	1.4	2.2	3.3
Overall Mean	2.53	3.00	1.90	1.83	1.47	1.53	1.77	1.47	1.83	2.80
Project Group Mean	2.01	2.48		1.65			1.59		2.32	
(x-mn)SQD		0.6096		0.0672			0.0496		0.4672	
SD2		0.0823		0.0335			0.0235		0.0882	
SD1		0.5319		0.5319			0.5319		0.5319	
Z(Diff of Mns Test)		14.55		-11.72			-13.78		9.26	

Table 6.6 Project & Question Groups and Differences of Means; Survey B

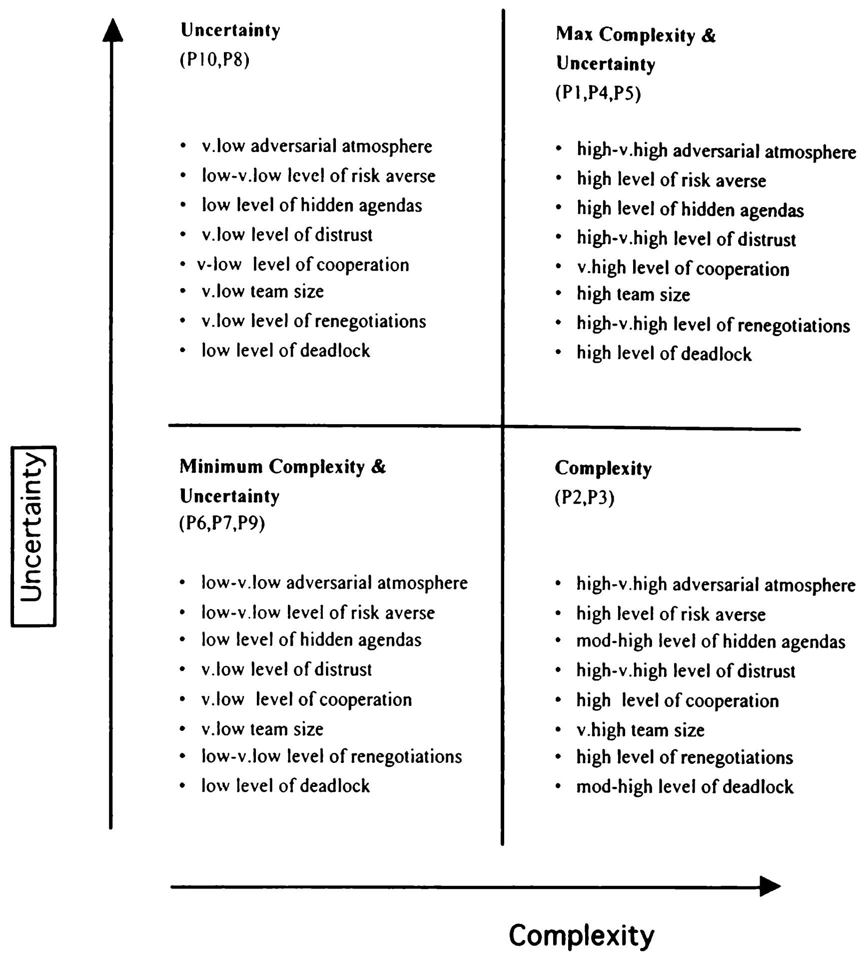


Figure 6.4 Complexity/uncertainty Matrix with Survey B Elements

Figure 6.4 is a similar output characteristics as for Survey A (Figure 6.3) Figure 6.4 are the elements assembled for complexity and clearly demonstrate degrees of association with each of the quadrants of the complexity/uncertainty matrix. Various patterns can be discovered from Figure 6.4 in a similar manner to that of Figure 6.3. For example we can see that "Team Size" is important to the organisation's location in the matrix and the combination with say "Deadlock" has a strong correlation with matrix position. Other elements show a correlation between levels of distrust and the risk averse elementand between adversarial atmosphere and levels of contract renegotiating.

Project Groupings Surveys C & D

Using the groupings shown in Table 6.4 we look at the individual characteristics of each of last two surveys (Survey C and Survey D). Within survey C the projects are grouped as shown in Table 6.4 and the question groups subgroup C. Table 6.7 is the Survey C Summary of Means and Table 6.8 presents Survey D Summary of Means. Table 6.9 below assembles the project groups and the question subgroups and delivers a scale for each of the surveyed characteristics (Survey C) on a comparative basis using the Difference of Means test. Using an arbitrary scale as shown in Figure 6.2 we can load a degree to each of the characteristics and compile Figure 6.5 which displays the compared characteristics on the Uncertainty/Complexity matrix. Table 6.10 shows the Survey B groupings and Figure 6.6 the element comparisons.

Survey C	Projects and Contracts									
Know why Characteristic	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
C-1	4.4	4.9	4.8	4.6	4.4	4.0	2.6	2.0	2.3	1.8
C-2	4.3	2.9	5.1	3.4	3.2	3.2	2.9	3.2	3.5	3.3
C-3	4.6	3.8	4.0	4.8	3.8	3.8	1.7	1.5	1.6	3.4
C-4	4.4	4.4	3.7	3.3	4.0	1.8	3.1	3.1	3.8	1.9
C-5	2.9	3.0	1.9	2.6	2.3	2.9	3.6	2.1	2.5	2.7
C-6	2.9	2.1	3.0	3.6	3.5	3.0	1.7	2.1	1.7	1.9
C-7	1.9	1.9	2.7	4.0	2.1	4.4	1.6	2.0	1.5	1.8
C-8	4.0	2.9	1.5	2.9	1.8	1.9	2.9	2.1	2.9	1.8
C-9	2.4	2.4	2.2	2.2	1.5	1.4	2.7	1.7	1.4	2.6
C-10	2.6	2.1	3.1	3.1	2.2	1.6	2.8	2.2	2.4	1.9
C-11	4.3	4.6	4.9	4.7	2.3	1.5	3.6	2.1	1.6	1.7
C-12	2.5	3.9	3.1	1.8	4.4	2.4	2.8	2.3	1.8	1.5
C-13	4.3	4.5	4.1	4.2	4.6	1.9	1.9	1.5	2.1	2.0
C-14	4.6	3.7	4.4	4.8	1.9	1.4	3.4	1.9	2.4	1.5
C-15	4.6	3.3	4.1	4.9	3.1	1.4	2.2	3.8	1.7	1.3
C-16	2.5	2.2	1.7	2.1	3.2	3.2	2.0	2.7	2.2	2.8
C-17	3.0	2.3	3.6	1.7	2.2	3.9	2.7	1.2	2.9	1.4
C-18	3.0	2.9	2.0	3.6	2.5	2.0	2.7	3.2	1.2	1.5
C-19	2.6	2.1	2.0	1.2	2.8	1.5	1.3	1.8	1.4	1.1
C-20	2.4	2.2	2.5	2.5	2.0	4.9	1.7	1.6	1.2	1.3
C-21	3.1	1.7	3.7	3.1	3.3	2.5	2.2	1.2	1.4	1.6
C-22	2.5	2.8	3.2	3.3	2.3	2.6	4.0	2.2	1.2	1.6
C-23	2.8	2.0	1.5	3.1	2.2	1.4	1.4	2.0	1.7	1.4
C-24	3.7	2.5	3.3	1.1	1.8	1.6	2.3	3.1	2.8	2.8

Table 6.7 Survey C - Summary of Means

Survey D	Projects and Contracts									
Inverse Characteristic	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
D-1	3.7	3.9	4.8	4.5	4.9	3.3	2.6	1.5	2.1	2.0
D-2	3.8	2.9	2.7	3.9	3.2	3.4	2.5	3.4	3.8	3.8
D-3	4.6	4.0	3.2	3.4	3.9	3.8	1.7	1.5	1.7	3.0
D-4	4.0	4.8	4.2	3.3	3.9	3.4	3.6	3.1	3.6	1.3
D-5	2.9	3.9	3.8	2.6	1.8	2.0	1.7	1.9	2.9	2.8
D-6	2.9	3.1	2.7	3.4	3.1	2.9	1.7	3.9	1.1	2.0
D-7	2.3	4.4	3.7	3.5	2.4	2.7	1.6	1.9	1.6	1.7
D-8	3.1	3.6	4.7	3.6	1.6	1.5	2.3	2.7	2.9	2.1
D-9	2.7	3.7	3.4	4.3	2.0	3.8	2.8	3.7	1.8	2.7
D-10	2.5	4.1	3.7	3.2	2.5	1.6	2.8	1.8	2.1	1.3
D-11	2.4	4.7	4.6	4.8	1.8	1.6	3.8	1.9	1.6	1.7
D-12	2.6	3.6	2.9	4.0	4.6	2.0	3.3	2.1	1.1	1.0
D-13	4.5	4.2	3.0	3.7	5.0	2.0	1.6	1.1	2.1	1.5
D-14	1.5	2.8	3.7	4.5	4.4	1.9	1.6	3.4	2.2	1.1
D-15	4.7	4.0	3.9	4.9	3.5	1.3	1.7	3.7	1.3	1.4
D-16	3.1	4.1	3.7	1.3	3.6	3.5	2.0	3.1	1.3	3.2
D-17	3.8	3.6	3.0	2.3	2.2	3.8	2.5	1.4	2.8	1.2
D-18	2.9	2.9	5.0	3.8	2.3	1.9	3.0	2.1	1.1	1.4
D-19	4.0	3.9	4.7	4.1	2.1	1.4	1.6	1.3	1.9	2.7
D-20	2.6	4.6	3.4	3.7	1.8	4.9	2.3	1.1	1.2	1.0
D-21	3.1	4.0	4.7	1.8	3.2	1.8	1.1	1.4	1.5	2.1
D-22	1.8	3.6	3.5	3.0	2.8	1.2	3.5	1.9	1.9	1.3
D-23	2.2	3.6	3.8	1.1	1.8	2.7	4.0	1.9	2.3	2.2
D-24	2.5	3.5	3.8	3.6	2.4	1.5	1.0	1.1	1.3	1.5

Table 6.8 Survey D - Summary of Means

Survey C	Projects and Contracts									
Know why Characteristic	P1	P4	P5	P8	P10	P6	P7	P9	P2	P3
C-1	4.4	4.6	4.4	2.0	1.8	4.0	2.6	2.3	4.9	4.8
C-2	4.3	3.4	3.2	3.2	3.3	3.2	2.9	3.5	2.9	5.1
C-3	4.6	4.8	3.8	1.5	3.4	3.8	1.7	1.6	3.8	4.0
Overall Mean	4.43	4.27	3.80	2.23	2.83	3.67	2.40	2.47	3.87	4.63
Project Group Mean	3.46	4.17		2.53			2.84		4.25	
(x-mn)SQD		0.2156		0.1800			1.0163		0.2939	
SD2		0.0489		0.0548			0.1063		0.0700	
SD1		0.8548		0.8548			0.8548		0.8548	
Z(Diff of Mns Test)		14.24		-18.59			-12.16		15.75	
C-4	4.4	3.3	4.0	3.1	1.9	1.8	3.1	3.8	4.4	3.7
C-5	2.9	2.6	2.3	2.1	2.7	2.9	3.6	2.5	3.0	1.9
C-6	2.9	3.6	3.5	2.1	1.9	3.0	1.7	1.7	2.1	3.0
Overall Mean	3.40	3.17	3.27	2.43	2.17	2.57	2.80	2.67	3.17	2.87
Project Group Mean	2.85	3.28		2.30			2.68		3.02	
(x-mn)SQD		0.0274		0.0356			0.0274		0.0450	
SD2		0.0175		0.0243			0.0175		0.0274	
SD1		0.3787		0.3787			0.3787		0.3787	
Z(Diff of Mns Test)		19.50		-24.90			-7.85		7.53	
C-7	1.9	4.0	2.1	2.0	1.8	4.4	1.6	1.5	1.9	2.7
C-8	4.0	2.9	1.8	2.1	1.8	1.9	2.9	2.9	2.9	1.5
C-9	2.4	2.2	1.5	1.7	2.6	1.4	2.7	1.4	2.4	2.2
Overall Mean	2.77	3.03	1.80	1.93	2.07	2.57	2.40	1.93	2.40	2.13
Project Group Mean	2.30	2.53		2.00			2.30		2.27	
(x-mn)SQD		0.8422		0.0089			0.2156		0.0356	
SD2		0.0967		0.0122			0.0489		0.0243	
SD1		0.3805		0.3805			0.3805		0.3805	
Z(Diff of Mns Test)		9.50		-13.77			-0.15		-1.65	
C-10	2.6	3.1	2.2	2.2	1.9	1.6	2.8	2.4	2.1	3.1
C-11	4.3	4.7	2.3	2.1	1.7	1.5	3.6	1.6	4.6	4.9
C-12	2.5	1.8	4.4	2.3	1.5	2.4	2.8	1.8	3.9	3.1
Overall Mean	3.13	3.20	2.97	2.20	1.70	1.83	3.07	1.93	3.53	3.70
Project Group Mean	2.73	3.10		1.95			2.28		3.62	
(x-mn)SQD		0.0289		0.1250			0.9385		0.0139	
SD2		0.0179		0.0456			0.1021		0.0152	
SD1		0.7014		0.7014			0.7014		0.7014	
Z(Diff of Mns Test)		9.21		-18.98			-10.71		21.95	
C-13	4.3	4.2	4.6	1.5	2.0	1.9	1.9	2.1	4.5	4.1
C-14	4.6	4.8	1.9	1.9	1.5	1.4	3.4	2.4	3.7	4.4
C-15	4.6	4.9	3.1	3.8	1.3	1.4	2.2	1.7	3.3	4.1
Overall Mean	4.50	4.63	3.20	2.40	1.60	1.57	2.50	2.07	3.83	4.20
Project Group Mean	3.05	4.11		2.00			2.04		4.02	
(x-mn)SQD		1.2541		0.3200			0.4363		0.0672	
SD2		0.1180		0.0730			0.0696		0.0335	
SD1		1.1208		1.1208			1.1208		1.1208	
Z(Diff of Mns Test)		16.10		-16.06			-15.44		14.90	
C-16	2.5	2.1	3.2	2.7	2.8	3.2	2.0	2.2	2.2	1.7
C-17	3.0	1.7	2.2	1.2	1.4	3.9	2.7	2.9	2.3	3.6
C-18	3.0	3.6	2.5	3.2	1.5	2.0	2.7	1.2	2.9	2.0
Overall Mean	2.83	2.47	2.63	2.37	1.90	3.03	2.47	2.10	2.47	2.43
Project Group Mean	2.47	2.64		2.13			2.53		2.45	
(x-mn)SQD		0.0674		0.1089			0.4422		0.0006	
SD2		0.0274		0.0426			0.0701		0.0030	
SD1		0.3082		0.3082			0.3082		0.3082	
Z(Diff of Mns Test)		9.68		-18.08			3.29		-1.12	
C-19	2.6	1.2	2.8	1.8	1.1	1.5	1.3	1.4	2.1	2.0
C-20	2.4	2.5	2.0	1.6	1.3	4.9	1.7	1.2	2.2	2.5
C-21	3.1	3.1	3.3	1.2	1.6	2.5	2.2	1.4	1.7	3.7
Overall Mean	2.70	2.27	2.70	1.53	1.33	2.97	1.73	1.33	2.00	2.73
Project Group Mean	2.13	2.56		1.43			2.01		2.37	
(x-mn)SQD		0.1252		0.0200			1.4496		0.2689	
SD2		0.0373		0.0183			0.1269		0.0669	
SD1		0.5943		0.5943			0.5943		0.5943	
Z(Diff of Mns Test)		12.32		-20.26			-3.23		6.69	
C-22	2.5	3.3	2.3	2.2	1.6	2.6	4.0	1.2	2.8	3.2
C-23	2.8	3.1	2.2	2.0	1.4	1.4	1.4	1.7	2.0	1.5
C-24	3.7	1.1	1.8	3.1	2.8	1.6	2.3	2.8	2.5	3.3
Overall Mean	3.00	2.50	2.10	2.43	1.93	1.87	2.57	1.90	2.43	2.67
Project Group Mean	2.34	2.53		2.18			2.11		2.55	
(x-mn)SQD		0.4067		0.1250			0.3119		0.0272	
SD2		0.0672		0.0456			0.0589		0.0213	
SD1		0.3574		0.3574			0.3574		0.3574	
Z(Diff of Mns Test)		8.86		-7.30			-10.62		10.09	

Table 6.9 Project & Question Groups and Differences of Means Survey C

Uncertainty	
Uncertainty (P8,P10) • v.low level of importation of know-how • v.low level of adoption of know-how • low-v.low level of management of know-how • v.low level of development of know-how • low-v.low level of encouragement of know-how • v.low level of dependence on know-how • v.low level of adoption of know-why • mod-low level of acceptance of know-why	**Max Complexity & Uncertainty** (P1,P4,P5) • high-v.high level of importation of know-how • high level of adoption of know-how • high level of management of know-how • high level of development of know-how • high-v.high level of encouragement of know-how • high level of dependence on know-how • high level of adoption of know-why • mod-high level of acceptance of know-why
Minimum Complexity & Uncertainty (P6,P7,P9) • low level of importation of know-how • low level of adoption of know-how • mod level of management of know-how • low level of development of know-how • mod-low level of encouragement of know-how • mod level of dependence on know-how • mod level of adoption of know-why • low level of acceptance of know-why	**Complexity** (P2,P3) • high-v.high level of importation of know-how • mod-high level of adoption of know-how • mod-low level of management of know-how • v.high level of development of know-how • high-v.high level of encouragement of know-how • mod-low level of dependence on know-how • mod-high level of adoption of know-why • high level of acceptance of know-why

Complexity

Figure 6.5 Complexity/Uncertainty Matrix with Survey C Elements

Figure 6.5 are the elements assembled for technology adaptation (Know-why) and clearly demonstrate degrees of association with each of the quadrants of the complexity/uncertainty matrix. Various patterns can be discovered from Figure 6.5 in a similar manner to that of Figure 6.3 and Figure 6.4. For example we can see that "Adoption of know-how" is important to the organisations location in the matrix and the combination with say "dependence on know-how" has a strong correlation with matrix position. Other elements show a correlation within quadrants between acceptance of know-why and management of know-how and the differences between quadrants with respect to adoption of know-why.

Survey D	Projects and Contracts									
Inverse Characteristic	P1	P4	P5	P8	P10	P6	P7	P9	P2	P3
D-1	3.7	4.5	4.9	1.5	2.0	3.3	2.6	2.1	3.9	4.8
D-2	3.8	3.9	3.2	3.4	3.8	3.4	2.5	3.8	2.9	2.7
D-3	4.6	3.4	3.9	1.5	3.0	3.8	1.7	1.7	4.0	3.2
Overall Mean	4.03	3.93	4.00	2.13	2.93	3.50	2.27	2.53	3.60	3.57
Project Group Mean	3.25	3.99		2.53			2.77		3.58	
(x-mn)SQD		0.0052		0.3200			0.8422		0.0006	
SD2		0.0076		0.0730			0.0967		0.0030	
SD1		0.6896		0.6896			0.6896		0.6896	
Z(Diff of Mns Test)		18.55		-17.51			-11.76		8.37	
D-4	4.0	3.3	3.9	3.1	1.3	3.4	3.6	3.6	4.8	4.2
D-5	2.9	2.6	1.8	1.9	2.8	2.0	1.7	2.9	3.9	3.8
D-6	2.9	3.4	3.1	3.9	2.0	2.9	1.7	1.1	3.1	2.7
Overall Mean	3.27	3.10	2.93	2.97	2.03	2.77	2.33	2.53	3.93	3.57
Project Group Mean	2.94	3.10		2.50			2.54		3.75	
(x-mn)SQD		0.0556		0.4356			0.0941		0.0672	
SD2		0.0248		0.0852			0.0323		0.0335	
SD1		0.5383		0.5383			0.5383		0.5383	
Z(Diff of Mns Test)		5.02		-13.45			-12.76		25.71	
D-7	2.3	3.5	2.4	1.9	1.7	2.7	1.6	1.6	4.4	3.7
D-8	3.1	3.6	1.6	2.7	2.1	1.5	2.3	2.9	3.6	4.7
D-9	2.7	4.3	2.0	3.7	2.7	3.8	2.8	1.8	3.7	3.4
Overall Mean	2.70	3.80	2.00	2.77	2.17	2.67	2.23	2.10	3.90	3.93
Project Group Mean	2.83	2.83		2.47			2.33		3.92	
(x-mn)SQD		1.6467		0.1800			0.1756		0.0006	
SD2		0.1353		0.0548			0.0442		0.0030	
SD1		0.7327		0.7327			0.7327		0.7327	
Z(Diff of Mns Test)		0.15		-8.39			-11.59		25.77	
D-10	2.5	3.2	2.5	1.8	1.3	1.6	2.8	2.1	4.1	3.7
D-11	2.4	4.8	1.8	1.9	1.7	1.6	3.8	1.6	4.7	4.6
D-12	2.6	4.0	4.6	2.1	1.0	2.0	3.3	1.1	3.6	2.9
Overall Mean	2.50	4.00	2.97	1.93	1.33	1.73	3.30	1.60	4.13	3.73
Project Group Mean	2.72	3.16		1.63			2.21		3.93	
(x-mn)SQD		1.1785		0.1800			1.7874		0.0800	
SD2		0.1144		0.0548			0.1409		0.0365	
SD1		0.9939		0.9939			0.9939		0.9939	
Z(Diff of Mns Test)		7.37		-18.85			-8.64		21.02	
D-13	4.5	3.7	5.0	1.1	1.5	2.0	1.6	2.1	4.2	3.0
D-14	1.5	4.5	4.4	3.4	1.1	1.9	1.6	2.2	2.8	3.7
D-15	4.7	4.9	3.5	3.7	1.4	1.3	1.7	1.3	4.0	3.9
Overall Mean	3.57	4.37	4.30	2.73	1.33	1.73	1.63	1.87	3.67	3.53
Project Group Mean	2.87	4.08		2.03			1.74		3.60	
(x-mn)SQD		0.3941		0.9800			0.0274		0.0089	
SD2		0.0662		0.1278			0.0175		0.0122	
SD1		1.0979		1.0979			1.0979		1.0979	
Z(Diff of Mns Test)		18.89		-12.83			-17.80		11.46	
D-16	3.1	1.3	3.6	3.1	3.2	3.5	2.0	1.3	4.1	3.7
D-17	3.8	2.3	2.2	1.4	1.2	3.8	2.5	2.8	3.6	3.0
D-18	2.9	3.8	2.3	2.1	1.4	1.9	3.0	1.1	2.9	5.0
Overall Mean	3.27	2.47	2.70	2.20	1.93	3.07	2.50	1.73	3.53	3.90
Project Group Mean	2.73	2.81		2.07			2.43		3.72	
(x-mn)SQD		0.3385		0.0356			0.8956		0.0672	
SD2		0.0613		0.0243			0.0998		0.0335	
SD1		0.6669		0.6669			0.6669		0.6669	
Z(Diff of Mns Test)		2.08		-17.17			-7.43		25.47	
D-19	4.0	4.1	2.1	1.3	2.7	1.4	1.6	1.9	3.9	4.7
D-20	2.6	3.7	1.8	1.1	1.0	4.9	2.3	1.2	4.6	3.4
D-21	3.1	1.8	3.2	1.4	2.1	1.8	1.1	1.5	4.0	4.7
Overall Mean	3.23	3.20	2.37	1.27	1.93	2.70	1.67	1.53	4.17	4.27
Project Group Mean	2.63	2.93		1.60			1.97		4.22	
(x-mn)SQD		0.4822		0.2222			0.8156		0.0050	
SD2		0.0732		0.0609			0.0952		0.0091	
SD1		1.0138		1.0138			1.0138		1.0138	
Z(Diff of Mns Test)		5.08		-17.50			-11.23		27.05	
D-22	1.8	3.0	2.8	1.9	1.3	1.2	3.5	1.9	3.6	3.5
D-23	2.2	1.1	1.8	1.9	2.2	2.7	4.0	2.3	3.6	3.8
D-24	2.5	3.6	2.4	1.1	1.5	1.5	1.0	1.3	3.5	3.8
Overall Mean	2.17	2.57	2.33	1.63	1.67	1.80	2.83	1.83	3.57	3.70
Project Group Mean	2.41	2.36		1.65			2.16		3.63	
(x-mn)SQD		0.0807		0.0006			0.6896		0.0089	
SD2		0.0300		0.0030			0.0875		0.0122	
SD1		0.7163		0.7163			0.7163		0.7163	
Z(Diff of Mns Test)		-1.31		-18.38			-6.00		29.56	

Table 6.10 Project & Question Groups and Differences of Means Survey D

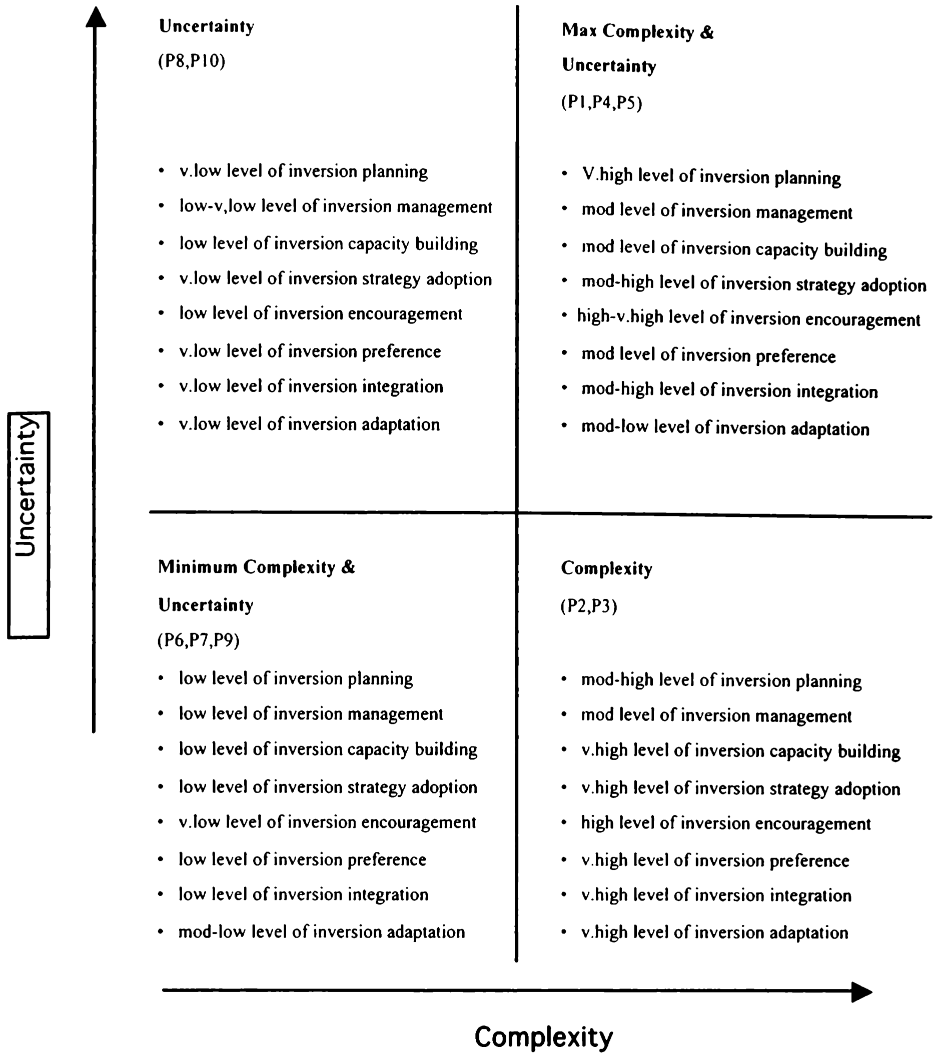


Figure 6.6 Complexity/Uncertainty Matrix with Survey D Elements

Figure 6.6 are the elements assembled for technology adaptation (inversion or reverse dynamic) and clearly demonstrate degrees of association with each of the quadrants of the complexity/uncertainty matrix. Various patterns can be discovered from Figure 6.6 in a similar manner to that of Figure 6.3 , Figure 6.4, and Figure 6.5 For example we can see that "inversion adaptation" is important to the organisations location in the matrix and the combination with say "inversion management" has a strong correlation with matrix position and other elements show a correlation between inversion integration and capacity building and the difference within quadrants with respect to inversion strategy adoption.

Within Survey Summary

The four surveys have been summarised as to their respective characteristics and patterns and are shown in Table 6.11. The results of the 'within survey' analysis (Figure 6.11) show that there are significant 'between survey' relationships and for a complete picture of the characteristics it is necessary to look at all the elements across the four surveys. The four sets of elements have been arranged together on the complexity/uncertainty matrix as shown in Figure 6.7. The purpose of this part of the analysis is to discover the degree to which the characteristics are embedded in the organisation's internal fabric and to the extent that the two sets of surveys can show the technology/organisational coupling.

Survey	Minimum Complexity & Uncertainty	Characteristic Uncertainty	Max Complexity & Uncertainty	Complexity
A	Decentralised, open organic flexible systems but low innovation	Centrally planned, closed mechanistic inflexible systems	Unpredictable, centrally planned mechanistic with organisational rigidities	Decentralised, with open networks, predictable environment
B	Small teams, trusting, straight forward negotiation style	Small team, trusting, not risk averse	Large adversarial teams, non trusting, aggressive negotiation style	large teams, adversarial
C	Low managerial capacity for know how adoption	Low internal capacity for innovation or know how adoption	Dependence on know how, high internal capacity for know how development	Very high dependence on know how development Moderate adoption of know why.
D	Low management inversion capacity building or planning	Low management inversion development capacity building	High level of inversion capacity building and inversion strategy adoption	High levels of inversion encouragement and adoption

Table 6.11 Within Survey Analysis Surveys A,B,C,D

Between Survey Summary

When the four survey results are placed together on a single matrix (Figure 6.7) it can be easily seen that the two right hand quadrants deliver both mutual adaptation model constructs that of the adoption of technology and organisational adaptation to that technology. The other two quadrants are usually lacking either one of the major mutual adaptation model constructs, whereas the right hand quadrants always have both sets. Organisations that occupy the two right hand quadrants exhibit the model characteristics and quite clearly have these characteristics embedded in their organisations. Reverse transfer only resides in the two right hand quadrants, the others not having managerial capacity building in order to generate reverse transfer subsequent to technology adoption. This is somewhat surprising given that the top right hand quadrant is maximum complexity and maximum uncertainty but it scored very high on adaptation of know how and know why and managerial adaptation of the required processes. The various relationships in the two right hand quadrants will be used when looking at a model of "singularity". The characteristics of "organisational learning" and "knowledge management" will be further examined to see if a convergence is apparent with complexity theory. It is from this 'convergence' that a unit model of 'singularity' may be formed.

Formulation of Multidimensional Models

From the research dealing with existing management plans[394] and the impact of management culture it is very apparent that a management plan needs to have a structure that is self checking, and has a dual output that can encourage the idea of quality assurance as being an integrated part of the plan rather than just a section of it. Leonard-Barton[395] emphasises the idea of integration as a way of getting the required activity level to conform to the job site needs. From the field surveys,[396] insights into the embedded characteristics of companies involved in the hazardous waste business show levels of interdependence within these characteristics that indicate mutual adaptation will be a major construct in achieving integration. These ideas provide the basis of a multi dimensional management system that could be effective in the delivery of true integration for intractable chemical recovery projects in Asia. The question is, can the interdependence shown in the embedded characteristics be the framework of a model of singularity.

Throughout the previous chapters reference has been constantly made to complexity theory and the belief that this holds much promise for emerging management models. Since the formulation of the studies, and resulting surveys, the science of organisational management has seen some movement in the "acceptance" that indeed complexity theory may well have a significant impact on organisational practice.[397] There is an apparent emergence of an idea that there are three "communities of management" namely; knowledge management,

[394] See Chapter Four
[395] See Leonard-Barton (1995)
[396] See Chapter Five
[397] See Karlenzig (1999).

Uncertainty

Uncertainty (P10,P8)

- v.low level of central planning
- v.low level of closed type system
- v.low level of hidden competencies
- low level of organisation inflexibility
- v.low level of rigid viewpoint
- low level of innovation
- v.low level of external influence
- mod-low level of unpredictability
- v.low adversarial atmosphere
- low-v.low level of risk averse
- low level of hidden agendas
- v.low level of distrust
- v-low level of cooperation
- v.low team size
- v.low level of renegotiations
- low level of deadlock

- v.low level of importation of know-how
- v.low level of adoption of know-how
- low-v.low level of management of know-how
- v.low level of development of know-how
- low-v.low level of encouragement of know-how
- v.low level of dependence on know-how
- v.low level of adoption of know-why
- mod-low level of acceptance of know-why
- v.low level of inversion planning
- low-v,low level of inversion management
- low level of inversion capacity building
- v.low level of inversion strategy adoption
- low level of inversion encouragement
- v.low level of inversion preference
- v.low level of inversion integration
- v.low level of inversion adaptation

Max Complexity & Uncertainty (P1,P4,P5)

- high - v.high level of central planning
- v.high level of closed type system
- v.high level of hidden competencies
- high-v.high level of organisation inflexibility
- high level of rigid viewpoint
- mod level of innovation
- h-v.high level of external influence
- h-v.high level of unpredictability
- high-v.high adversarial atmosphere
- high level of risk averse
- high level of hidden agendas
- high-v.high level of distrust
- v.high level of cooperation
- high team size
- high-v.high level of renegotiations
- high level of deadlock

- high-v.high level of importation of know-how
- high level of adoption of know-how
- high level of management of know-how
- high level of development of know-how
- high-v.high level of encouragement of know-how
- high level of dependence on know-how
- high level of adoption of know-why
- mod-high level of acceptance of know-why
- v.high level of inversion planning
- mod level of inversion management
- mod level of inversion capacity building
- mod-high level of inversion strategy adoption
- high-v.high level of inversion encouragement
- mod level of inversion preference
- mod-high level of inversion integration
- mod-low level of inversion adaptation

Minimum Complexity & Uncertainty (P6,P7,P9)

- low level of central planning
- low level of closed type system
- low level of hidden competencies
- v.low level of organisation inflexibility
- low level of rigid viewpoint
- mod level of innovation
- low level of external influence
- low-v.low adversarial atmosphere
- low-v.low level of risk averse
- low level of hidden agendas
- v.low level of distrust
- v.low level of cooperation
- v.low team size
- low-v.low level of renegotiations
- low level of deadlock

- low level of importation of know-how
- low level of adoption of know-how
- mod level of management of know-how
- low level of development of know-how
- mod-low level of encouragement of know-how
- mod level of dependence on know-how
- mod level of adoption of know-why
- low level of acceptance of know-why
- low level of inversion planning
- low level of inversion management
- low level of inversion capacity building
- low level of inversion strategy adoption
- v.low level of inversion encouragement
- low level of inversion preference
- low level of inversion integration
- mod-low level of inversion adaptation

Complexity (P2,P3)

- v.high level of central planning
- high level of closed type system
- high level of hidden competencies
- high - v.high level of organisation inflexibility
- v.high level of rigid viewpoint
- mod-high level of innovation
- high level of external influence
- mod level of unpredictability
- high-v.high adversarial atmosphere
- high level of risk averse
- mod-high level of hidden agendas
- high-v.high level of distrust
- high level of cooperation
- v.high team size
- high level of renegotiations
- mod-high level of deadlock

- high-v.high level of importation of know-how
- mod-high level of adoption of know-how
- mod-low level of management of know-how
- v.high level of development of know-how
- high-v.high level of encouragement of know-how
- mod-low level of dependence on know-how
- mod-high level of adoption of know-why
- high level of acceptance of know-why
- mod-high level of inversion planning
- mod level of inversion management
- v.high level of inversion capacity building
- v.high level of inversion strategy adoption
- high level of inversion encouragement
- v.high level of inversion preference
- v.high level of inversion integration
- v.high level of inversion adaptation

Complexity

Figure 6.7 Complexity/Uncertainty Matrix with Survey A & B and C & D Elements organisational learning and complexity theory that are converging to a single concept.[398] The idea that there might be a connection between these "communities" has been recently discussed.[399] Various aspects of the field studies were constructed in order to see if these relationships exist, as well as their interrelationships. McElroy argues that the OL issues Senge speaks of "are precisely those that scholars and researchers of complexity theory have been dealing with for the past 15 years". He goes on to state, "[c]omplex systems are by any other definition, learning organisations. Complexity theory is, therefore, on the verge of making a huge contribution to both KM and OL. But what in particular makes the impending merger of these three communities so compelling? What would account for the apparent synergy between them? The answer to both questions is that each of the three groups has something that the other two desperately need. There is an idea at stake here that is bigger than any one of them can defend alone, or even two of them together. It takes all three to make it work. KM and OL each lack a theory of how cognition happens in human social systems - complexity theory offers this missing piece".[400] This chapter will examine if such synergy exists in the field studies and in particular if there is an indication of the integration Senge speaks of and whether this provides us with the framework for a single integrated model or 'singularity'.[401]

Senge describes a learning organisation as an "[o]rganisation with an ingrained philosophy for anticipating, reacting and responding to change, complexity and uncertainty of the organisational environment".[402] The surveys in Chapter Five were designed with this definition in mind, in particular the surveys looked for embedded characteristics, or what Senge calls ingrained. The "between survey" have shown groupings between complexity and uncertainty and the organisational learning and knowledge management characteristics.

Embedded Characteristics

Looking at the questions and results that are based on organisational or

[398] McElroy (2000), actually states this as " [i]n what is shaping up to be an unusual and fascinating case of strange bedfellows, three otherwise separate communities of management practice are about to converge".
[399] See McElroy (2000).
[400] ibid.
[401] ibid.
[402] Senge (1990).

organisational learning characteristics, we can see that while the organisations in quadrant one of Figure 6.8, display characteristics of a high level of central planning, and inflexible and internal hidden agendas, the same organisations display a capacity for a high level of know-how adoption and implementation. In the second group, those based on knowledge management questions, we see the same pattern (albeit to a different degree). In this group, even though the organisational characteristics includes unpredictability, highly influenced by external forces and internal rigidity, the dependence on know-how and know-why adoption is high to very high, but inversion preference is lower. While the organisations in quadrant two of Figure 6.9, display characteristics of a very high level of central planning, inflexibility, internal hidden agendas, high levels of distrust etc., the same

Max Complexity & Uncertainty (Q1)

	OL
• high - v.high level of central planning	• high-v.high level of importation of know-how
• v.high level of closed type system	• high level of adoption of know-how
• v.high level of hidden competencies	• high level of management of know-how
• high-v.high level of organisation inflexibility	• high level of development of know-how
• high-v.high adversarial atmosphere	• v.high level of inversion planning
• high level of risk averse	• mod level of inversion management
• high level of hidden agendas	• mod level of inversion capacity building
• high-v.high level of distrust	• mod-high level of inversion strategy adoption

	KM
• high level of rigid viewpoint	• high-v.high level of encouragement of know-how
• mod level of innovation	• high level of dependence on know-how
• h-v.high level of external influence	• high level of adoption of know-why
• h-v.high level of unpredictability	• mod-high level of acceptance of know-why
• v.high level of cooperation	• high-v.high level of inversion encouragement
• high team size	• mod level of inversion preference
• high-v.high level of renegotiations	• mod-high level of inversion integration
• high level of deadlock	• mod-low level of inversion adaptation

Figure 6.8 Quadrant 1 of Figure 6.7 Rearranged for OL and KM

organisations display a capacity for a high level of know-how adoption and implementation. In the second group, those based on knowledge management questions, we see the same pattern. In this group, even though the organisational characteristics are large teams and a high degree of internal co-operation, influenced by external forces and some internal rigidity, the dependence on know-how and know-why adoption is also extremely high, especially with inversion preference.

Complexity
(Q2)

	OL
• v.high level of central planning	• high-v.high level of importation of know-how
• high level of closed type system	• mod-high level of adoption of know-how
• high level of hidden competencies	• mod-low level of management of know-how
• high - v.high level of organisation inflexibility	• v.high level of development of know-how
• high-v.high adversarial atmosphere	• mod-high level of inversion planning
• high level of risk averse	• mod level of inversion management
• mod-high level of hidden agendas	• v.high level of inversion capacity building
• high-v.high level of distrust	• v.high level of inversion strategy adoption

	KM
• v.high level of rigid viewpoint	• high-v.high level of encouragement of know-how
• mod-high level of innovation	• mod-low level of dependence on know-how
• high level of external influence	• mod-high level of adoption of know-why
• mod level of unpredictability	• high level of acceptance of know-why
• high level of cooperation	• high level of inversion encouragement
• v.high team size	• v.high level of inversion preference
• high level of renegotiations	• v.high level of inversion integration
• mod-high level of deadlock	• v.high level of inversion adaptation

Figure 6.9 Quadrant 2 of Figure 6.7 Rearranged for OL and KM

The organisations in quadrant three of Figure 6.10, display characteristics of a low level of central planning, inflexibility, internal hidden agendas, low levels of distrust etc. The same organisations display a capacity for only a moderate level of know-how adoption and implementation. In the second group, those based on knowledge management questions, we see the same pattern. In this group, even though the organisational characteristics are low team size and low degree of internal co-operation, low internal rigidity, the dependence on know-how and know-why adoption is very low. Inversion preference within quadrant three is also low.

The organisations in quadrant four of Figure 6.11. display characteristics of a very low level of central planning, inflexibility, internal hidden agendas, low levels of distrust etc., the same organisations display a very low capacity for know-how adoption and implementation. In the second group, those based on knowledge management questions, we see the same pattern. In this group, even though the organisational characteristics are low team size and low degree of internal co-operation, influenced by external forces and suffers some internal rigidity, the dependence on know-how and know-why adoption is extremely low. Inversion preference within quadrant four is very low.

Minimum Complexity & Uncertainty Q3

		OL
low level of central planning	low level of importation of know-how	
low level of closed type system	low level of adoption of know-how	
low level of hidden competencies	mod level of management of know-how	
v.low level of organisation inflexibility	low level of development of know-how	
low-v.low adversarial atmosphere	low level of inversion planning	
low-v.low level of risk averse	low level of inversion management	
low level of hidden agendas	low level of inversion capacity building	
v.low level of distrust	low level of inversion strategy adoption	

		KM
low level of rigid viewpoint	mod-low level of encouragement of know-how	
mod level of innovation	mod level of dependence on know-how	
low level of external influence	mod level of adoption of know-why	
mod level of unpredictability	low level of acceptance of know-why	
v.low level of cooperation	v.low level of inversion encouragement	
v.low team size	low level of inversion preference	
low-v.low level of renegotiations	low level of inversion integration	
low level of deadlock	mod-low level of inversion adaptation	

Figure 6.10 Quadrant 3 of Figure 6.7 Rearranged for OL and KM

Uncertainty
Q4

		OL
v.low level of central planning	v.low level of importation of know-how	
v.low level of closed type system	v.low level of adoption of know-how	
v.low level of hidden competencies	low-v.low level of management of know-how	
low level of organisation inflexibility	v.low level of development of know-how	
v.low adversarial atmosphere	v.low level of inversion planning	
low-v.low level of risk averse	low-v,low level of inversion management	
low level of hidden agendas	low level of inversion capacity building	
v.low level of distrust	v.low level of inversion strategy adoption	

		KM
v.low level of rigid viewpoint	low-v.low level of encouragement of know-how	
low level of innovation	v.low level of dependence on know-how	
v.low level of external influence	v.low level of adoption of know-why	
mod-low level of unpredictability	mod-low level of acceptance of know-why	
v-low level of cooperation	low level of inversion encouragement	
v.low team size	v.low level of inversion preference	
v.low level of renegotiations	v.low level of inversion integration	
low level of deadlock	v.low level of inversion adaptation	

Figure 6.11 Quadrant 4 of Figure 6.7 Rearranged for OL and KM

From Figure 6.12, we can see the correlations between the three communities that McElroy[403] alludes to. Where complexity is high, then so is organisational learning and internal knowledge management as it relates to adoption of technology and the preference of inversion. The table demonstrates a synergy between complexity and

[403] See McElroy (2000).

OL and KM. Where complexity is low, even if uncertainty is high, the adoption and the mutual adoption model is completely absent as in quadrant 3 and 4. What is of great interest is the degree of separation between the various elements across the quadrants. There appears to be no blurring between the four quadrants when it comes to the degree of OL or KM adaptation. It is either high to very high or low to very low across all questions as they are grouped in the four quadrants. One is able to say that the higher the degree of complexity and thus the higher the degree of application of complexity theory within the organisation, the more the company is likely to adopt new technology, and inversion along with the organisational learning aspects of that adoption, and the implementation of knowledge management that is required to successfully adopt the new processes (at least as far as the companies surveyed are concerned). While we can agree that there is some synergy to be seen in the convergence of complexity, organisational learning and knowledge management, what does it all mean? Can we use this synergy in a meaningful way and establish a model that is focussed on this synergy for management application purposes. The embedded characteristics of companies in quadrant two included clusters as depicted in Figure 6.13. In addition to the clusters and the synergy between organisational learning and knowledge

Q	Complexity	Uncertainty	OL	KM
1	Max	Max	V-high	Mod
2	High	Low	V-high	V-high
3	Low	Low	Low	Mod
4	Low	High	Low	Low

Figure 6.12 Matrix of Quadrants and OL and KM Comparisons

management, there can be seen a progression of innovation when the quadrants are viewed in their entirety. In looking back at Barton's innovation development levels, and the complexity uncertainty matrix, we can envisage a situation as shown in Figure 6.14. In this figure, it is possible to see the progression of innovation through each of the matrix quadrants and how each level relates to the Austin[404] levels.

[404] op cit

ORGANISATIONAL - centrally planned - closed systems - hidden competencies - inflexibility PERSONAL - adversarial - risk averse - hidden agendas - distrust	TEAMS - rigid viewpoint - innovative - predictable - cooperative - large team size	ADAPTATION - importation of know how - adoption of know how - management of know how INVERSION - planning - capacity - strategy adoption - inversion encouragement - inversion preference - inversion intregration - inversion adoption - Know-why
ORDINARY MANAGEMENT	EXTRAORDINARY MANAGEMENT	COMPLEXITY MANAGEMENT

Figure 6.13 Quadrant Two Clusters

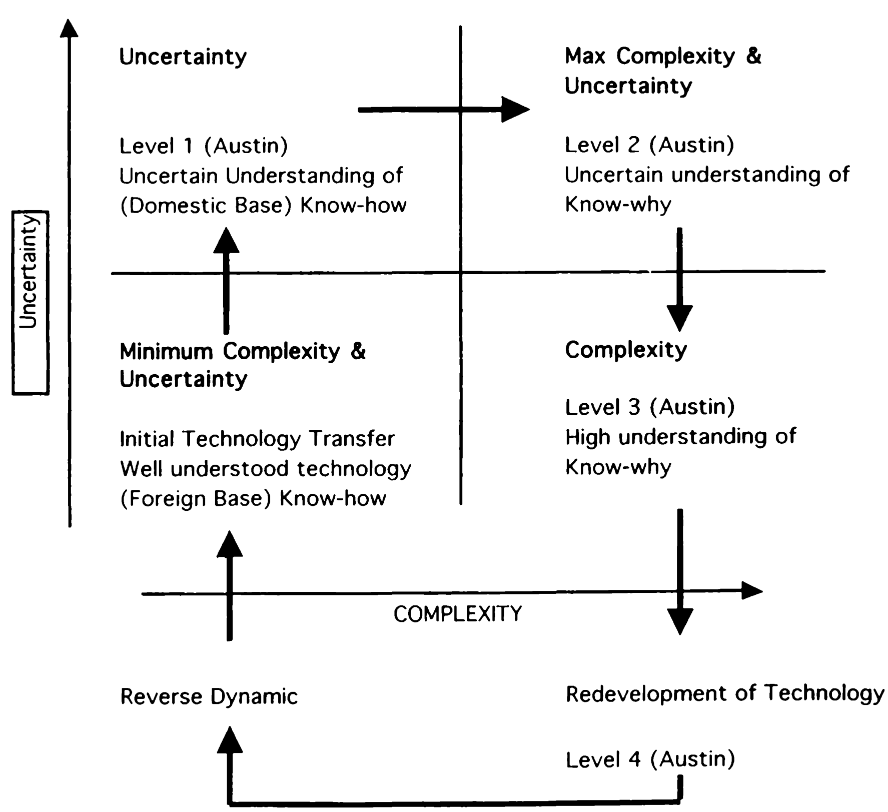


Figure 6.14 Daft's Matrix with the Reverse Dynamic

Mutual Adaptation Model

Quadrant two contains only companies that were successful in adopting innovation and adapting the organisation to that innovation, or new technology, to the extent that they were able to develop the technology to a new level and re-export the innovation back to the originators. Such companies were characterised by a high degree of complexity and a low degree of uncertainty. Within Figure 6.13 it will be noted that the clusters are grouped according to Stacey's idea of a company having ordinary management that co-exists with extraordinary management in order to generate complexity management. During the conducting of surveys it was clear that it was the "teams" that did the "complexity management" function rather than the run of the mill company management. Such departments appeared to have no set agendas or structured requirements or goals. Within themselves (the teams) they had rigid viewpoints but were internally very cooperative and innovative.

The companies that were successful in adopting innovation and new technology all exhibited the characteristics of independent large internal teams that were focused on adoption of new innovation and integration of the new technology in to the firm. All of this was achieved in an environment of very high complexity but low uncertainty. It could be postulated that the low uncertainty was a result of the teams' behaviour in controlling its own environment through complexity management, but that would be conjecture to be tested in later study. It is possible that the team's performed as they did as some form of defence against the rigid, centrally planned structure of the "ordinary management function", but it actually appeared[405] to be a deliberate process that may have evolved over time with success. It became possible during the survey interviews to predict if the interviewee was a team member outside of the mechanistic organisational structure or a functionary within it. The entire company on the other hand operated within an intensely complex environment but managed it producing startling results of innovation adaptation. The extent of the adaptation was in itself a revelation. The level of the adoption of the technology, and then its development and re-exporting back to the originators, was at a high level with these companies.

The output of the simple mutual adaptation model (Figure 6.15) represents a

[405] Personal observations by the author during the contract periods

fundamental integration block but on its own it cannot influence the organisation's internal intelligence systems and will may be useful for solving the issues of complexity that lie within. It is at this point that systems engineering can prove somewhat useful. Where the systems engineering approach may fail is the adoption and integration of the firm's strategic intention and other links back to the strategic management planning outputs of the organisation. Therefore the proposal here is to further integrate the models of co-dependency and systems thus creating

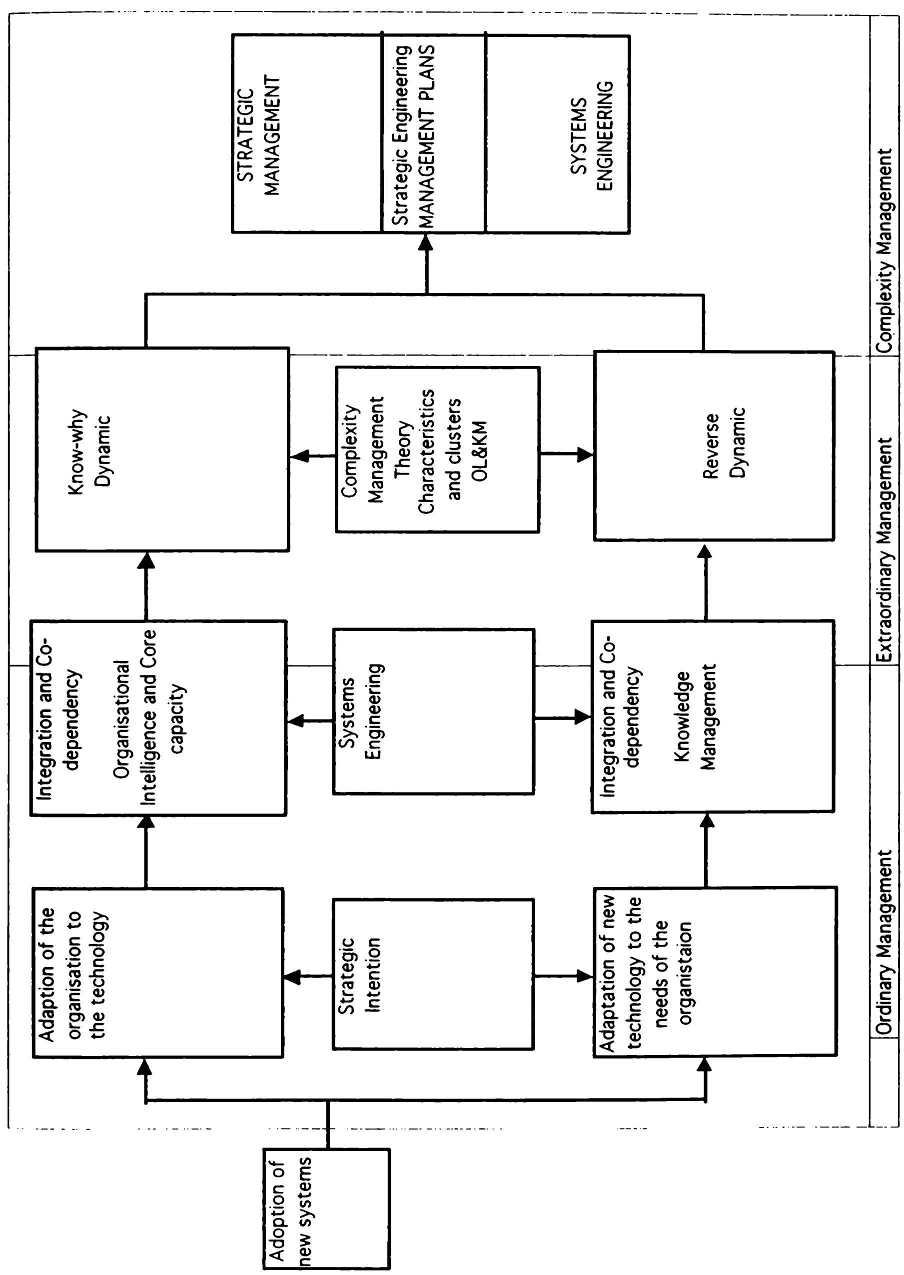


Figure 6.15 Mutual Adaptation Model with Stacey's Management Models

a multidimensional model that is capable of delivering strategic management integration across the border into operations management by using the systems engineering model as the vehicle. Unless this co dependency is addressed and systemised then the management model that is applied will always be at risk from failure during the application process. Thus Figure 6.15 is a block representation of the mutual adaptation model approach (incorporating the Barton model from Chapter Four) that results from the conclusions above and shows where the systems and adoption phases interact and integrate.

Integrated Two Dimensional Model

As a result of several years of observation of large-scale intractable chemical extraction and recovery projects in several Asian countries (during the field research phase of this work) in which the management systems were in the main singular or sequential the potential for a multi dimensional approach to management became clear. The problem then remained as to how a strategic intention that was multidimensional could be applied in the tactical sense. The quadrant two companies accept technology transfer but have random stand alone teams that investigate know-how and know-why and develop fully the reverse dynamic transfer and achieve market domination. These teams have no direct affiliation with the normal ordinary management process, they operate without agendas or structural hierarchy, nor are they affected by external pressures or control. For the Asian companies that were surveyed, given the history of central planning and control this is very significant. It is almost as if an underground design team has been working all along on reverse transfer and unknowingly using the characteristics and elements of complexity management. Companies in the west, in general, do not practise this kind of non agenda, no mission statement approach and could be blind sided if the approach by Asian companies is a general philosophy.

The integrated model evolves from the model in Figure 6.16 and using the information from the matrix in Figure 6.14 a two dimensional management model is established. The first dimension is described as the Vertical Integration Strategy and the second dimension is described as the Horizontal Integration Strategy as shown in Figure 6.16. Note that this model includes the feedback loop as developed in the Figure 6.14 matrix .

The model structure comprises a series of two dimensional matrices that are integrated horizontally and vertically into sub matrices and finally the matrices are integrated together in a final matrix or "singularity" as shown in Figure 6.17. The model in Figure 6.17 has the embedded characteristics from quadrant two.

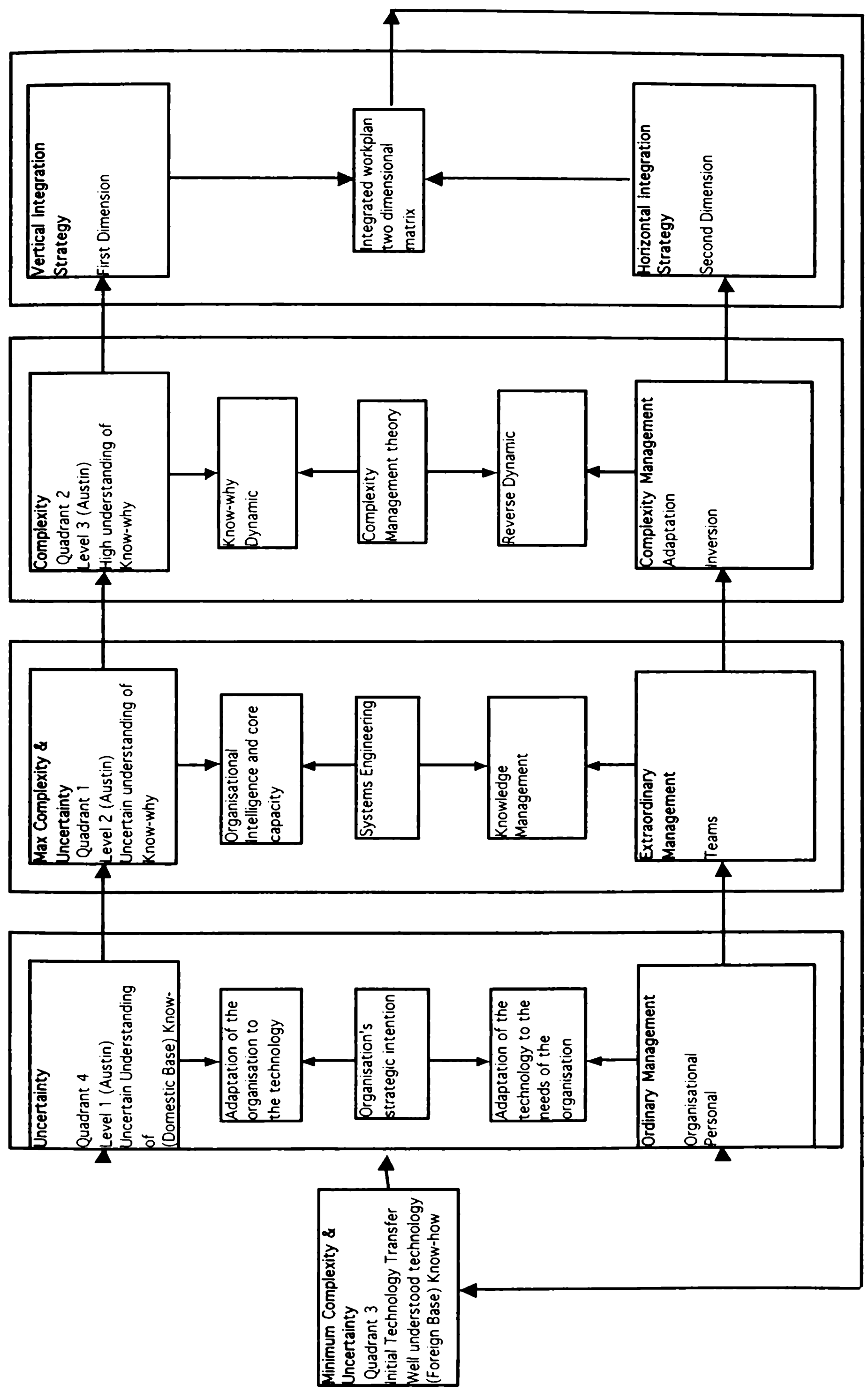


Figure 6.16 Integration and Adaptation Elements of Daft's Matrix Forming Integrated 2D Matrix

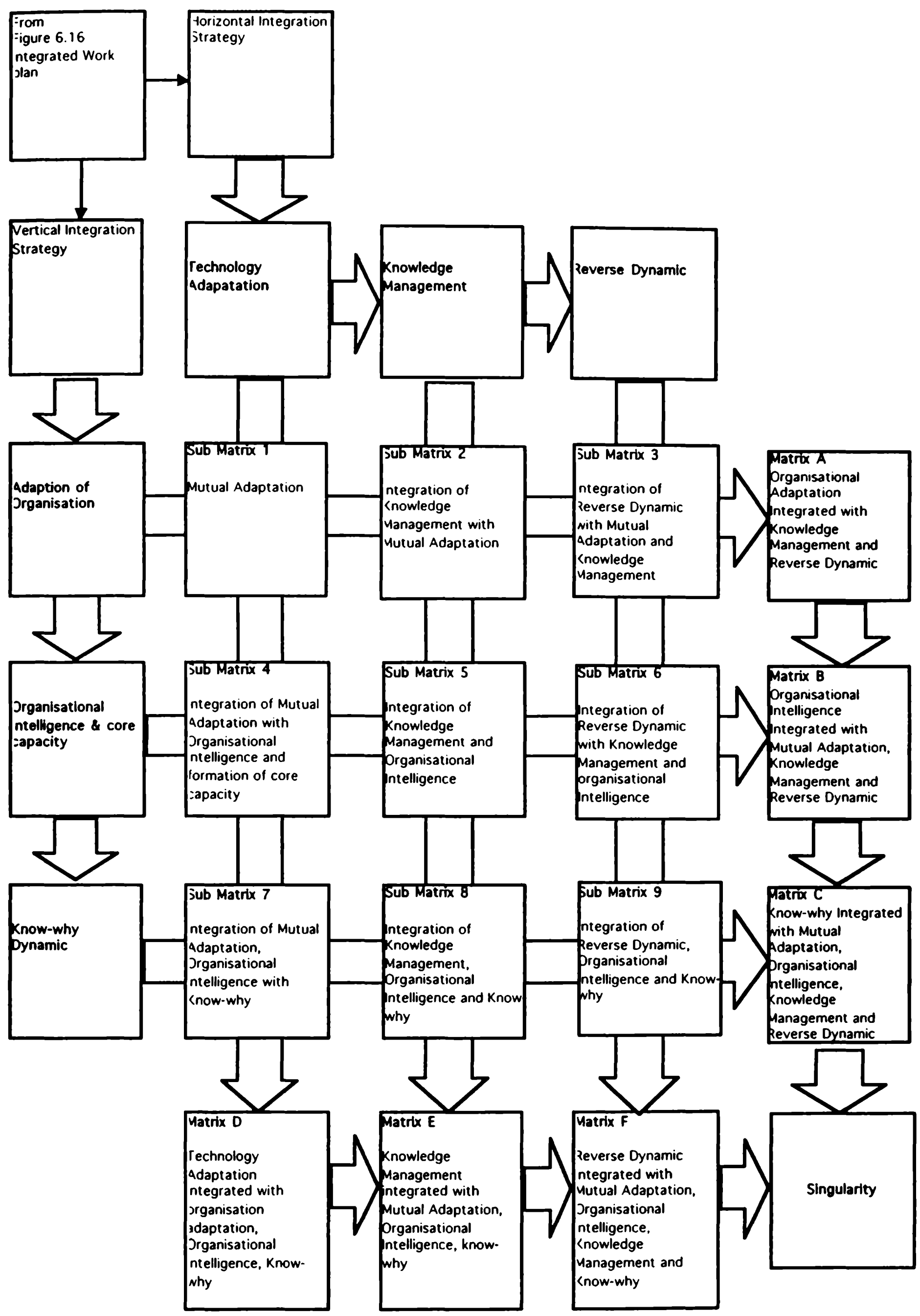


Figure 6.17 Multi Dimensional Matrix of Adaptation Forming a Model of Singularity

Model of Singularity

The output of the model (Figure 6.17) is described as a model of singularity and this is shown in Figure 6.18. The characteristics are singular, fully integrated and can be placed directly into a corporate strategy. It is this zone that has the "X factor". This is the zone where complexity management is practised by the successful Asian companies that were surveyed. The "Model of Singularity" while generated from the assembly of the integrated matrices can also be generated by the "plotting" of the matrices onto Daft's matrix quadrant two. Here we see the "broad plotting" on the uncertainty/complexity scale of the characteristics surveyed within quadrant two (zero to medium uncertainty vs medium to high complexity) that the matrices will intersect in a zone which is called the singularity zone. This is a zone where there is no further derivation or the 'bottom point' where there are no further matrices.

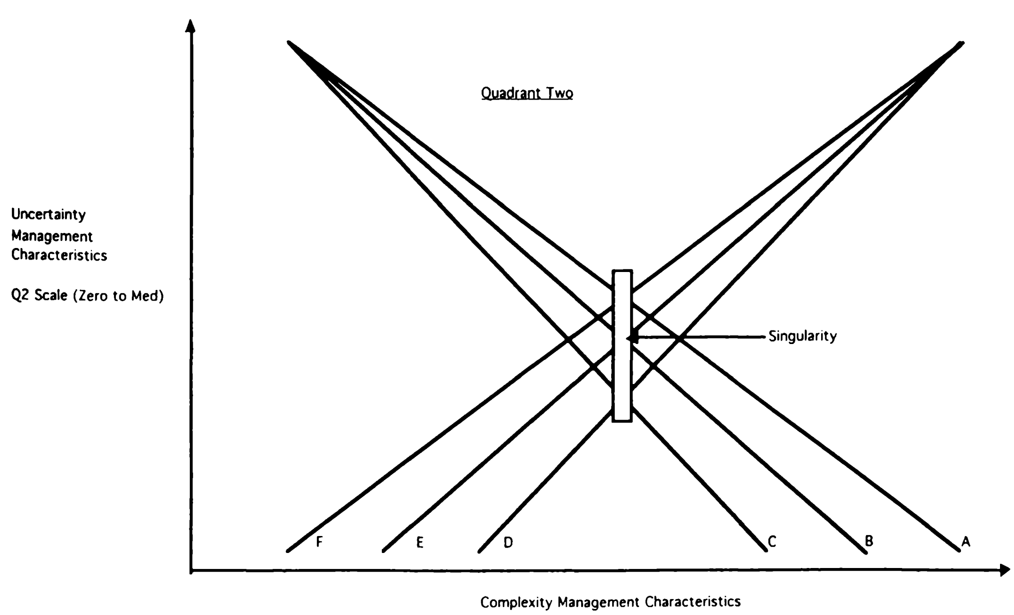


Figure 6.18 Model of Singularity from Daft's Matrix with Matrices A,B,C,D,E,F from Figure 6.17 on the Quadrant Two Scale

Summary

The thesis of this work states as a hypothesis "that Duncan's matrix model, as adapted by Daft, can be reverse applied to the external environmental elements and components (as opposed to the internal decision making units), combined with the mutual adaptation model (i.e.: technology/organisational mutual adaptation), therefore establishing an integrated multidimensional model of adaptation".[406] In this Chapter the data collected from the four field surveys was analysed for embedded characteristics. The data collected from ten Asian companies in hazardous waste management validated the hypothesis and established that complexity management was an element of those companies that successfully adopted external technology and systems and in fact were also engaged in reversing the technology back to the originators. The data also indicated that for those companies not engaging complexity management were not reversing technology adoption. From this analysis a multidimensional integrated adaptation model was generated and ultimately a model of singularity proposed.

[406] See last section Chapter Four

7

Conclusion

Introduction

This chapter first examines the various conflicts within complexity theory and its application to management theory and the associated pitfalls of attempting to conclude such linkages. Then given the results of the surveys in this thesis and the resulting mutual adaptation model presented in Chapter Six, an argument is established for such an association being more than "adduction". Implications for management within Asian companies of the application of the model are presented along with some ideas for future research.

Additional Aspects of Complexity Theory Which Inform the Conclusion

As noted in Chapter Four there is a growing field of management literature[407] that draws on complexity theory and adapts it to "management concerns and practices".[408] Rosenhead[409] cautions us to tread carefully when using so called scientific work in complexity, and reinterpreting that work for management application. His argument is based on the quality of the scientific studies and the applicability those results in management application. Rosenhead[410] cites Checkland[411] when he argues for an "objectivist stance that sees problems essentially as independent of individual participants' views and beliefs," and a "subjectivist stance that recognises the importance of participants' perceptions in defining or ever constituting a problem in the first place".[412] Using Schon's swamp

[407] See Stacey (1997)., McMaster (1996)., Wheatly (1992)., Merry (1995)., as cited by Rosenhead (1989).
[408] Rosenhead (1989)
[409] ibid.
[410] Rosenhead (2001).
[411] Checkland (1985)
[412] Checkland (1978) argues (as cited by Rosenhead (2001)), that "the world consists of systems that can be objectively modelled; that there are well specified and agreed objectives or goals; and that its[management] main task is to determine the most effective or efficient means to realise those goals." So called hard systems thinking. By contrast "soft systems thinking (Checkland (1985)), accepts that the rich complexity of the world cannot be assumed to consist of systems which can be modelled, let alone optimised. rather systems concepts can be helpful in structuring our thinking and learning about problematic situations and we should aim for debate and accommodation about the nature of the problem, rather than its solution".

analogy[413] Rosenhead argues, "that in the more demanding, and more important conditions of the swamp, some kind of appropriate, yet systematic approach is still more crucial. What is needed is a re-specification of rigour". Rosenhead further challenges the adoption of complexity theory by a series of questions;

- "What failings in current management theory or practice are claimed to be corrected?"
- "How novel are the management prescriptions which are derived from complexity theory?"
- "Does complexity theory provide scientific authority for these prescriptions?"[414]

Rosenhead examines the work of Stacey and others[415] as he pursues the questions above. He states that, "it is not enough for managers to adjust their behaviour in response to feedback on the success of their actions relative to pre-established targets; they also need to reflect on the appropriateness, in the light of unfolding events, of the assumptions used to set up those actions and targets". What Rosenhead is saying here is that the traditional internal 'common culture' of the 'group think' in which "the possible effects of divergence on promotion or even survival within the organisation are potent pressures for conformity"[416] prevents the organisation from producing strategies for dealing with the notion that the "future in principle is unknowable for systems of any complexity". Rosenhead provides us with a compact summary of the impact of complexity theory on management as follows:

"Given that the key finding claimed for complexity theory is the

[413] See Schon (1987), as cited Rosenhead (2001), p 5. "In the swampy lowland, messy, confusing problems defy technical solution. The irony of this situation is that the problems of the high ground tend to be relatively unimportant to individuals or society at large, however great their technical interest may be, while in the swamp lie the problems of greatest human concern. The practitioner must choose. Shall he remain on the high ground where he can solve relatively unimportant problems according to prevailing standards of rigour, or shall he descend to the swamp of important problems and non-rigorous inquiry?".
[414] Rosenhead (1998).
[415] See Stacey (1995), Wheatley (1992).
[416] Rosenhead (1998). p 5. Rosenhead goes on to argue "This is not an atmosphere in which searching re-examination of cherished assumptions can thrive - rather the reverse. Yet agility of thought bases on the fostering of diversity is a prerequisite for the organisation's longer term success".

> effective unknowability of the future, the common assumption among managers that part of their job is to decide where the organisation is going, and to take decisions designed to get it there is seen as a dangerous delusion. Management afflicted by increasing complexity and information overload, can react by becoming quite intolerant of ambiguity. Factors, targets, organisational structures all need to be nailed down. Uncertainty is ignored or denied. The management task is seen to be the enunciation of mission, the determination of strategy, and the elimination of deviation. Stability is sought as the ultimate bulwark against anxiety, which might otherwise become overwhelming. All of these managerial reflexes, many of them unassailably commonsensical, are quite counterproductive when viewed from a complexity theory perspective".[417]

Stacey (1995) tells us, via Rosenhead's analysis, that "overrationalist thinking" has dominated management theory for too long and that the "organisation, like the universe, is conceptualised as a giant piece of clockwork machinery. [This was thought] to be, in principle, entirely predictable; and good management should be able to get similarly reliable performance from the universe. Discoveries by the theorists of complexity and chaos show that even the natural world does not operate this way - and this revelation of the role of creative disorder in the universe needs to be taken to heart by managers. The consequences, according to Stacey, are to turn management orthodoxy on its head".[418]

Rosenhead, while accepting the premise of orthodoxy requiring, being 'ripe for', reassessment maintains that such theory is rooted in generalities and non specificity, "their sense of being unchallengable within the offered framework of ideas. If you accept the relevance of complexity theory to the managerial condition, then you must also accept the package of systemic categorical imperatives which are embedded in it".[419] Stacey's concept of 'extraordinary' management as opposed

[417] Rosenhead (1998). p 4.

[418] Stacey (1995). The consequences include; (1) Analysis loses its primacy, (2) Contingency (cause and effect) loses its meaning, (3) long term planning becomes impossible, (4) visions become illusions, (5) consensus and strong cultures become dangerous, (6) statistical relationships become dubious. etc. As cited by Rosenhead (1998).

[419] Rosenhead (1998). p 6. Rosenhead refers to this adoption of complexity theory as 'motherhood' statements in their sense of non specific adaptation.

to 'ordinary' management[420] is expressed by Rosenhead as innovatory, encourages the formation of "informal structures involving for example specific workshops around issues or processes with multidimensional membership from many functional areas of the business".[421] Stacey argues that in order that workshop teams can work, top management should not "espouse a unique vision or long term plan, but should rather promote the conditions for the emergence of an evolving agenda of strategic issues, and aspirations. In effect, management needs to *combine* permissive style with abrasive challenge. [Rosenhead's emphasis]. As Rosenhead points out, the role of analysis is "extraordinarily limited" in Stacey's "extraordinary management". While its long term purpose of obviously long term survival, 'there is no long-term plan and precious little long-term planning." The strategic role of senior management is largely to facilitate processes of dialogue which can lead to innovation, rather than to preside over an elaborate analytic process".[422] Stacey, according to Rosenhead, relegates even those "tools which might be considered consistent with 'extraordinary management' (eg simulation, scenario analysis) to a marginal role, if any".[423]

In a similar way, but for different reasons, Stacey maintains credibility for complexity theory citing convergence by other management researchers to the same

[420] Stacey (1993). Complexity theory by defining two levels of management, ordinary and extraordinary, cited by Rosenhead. "*Ordinary management* is required in order to carry out day to day problem solving to achieve the organisation's established objectives. It employs a logical analytical process involving data analysis, goal setting, evaluating options against goals, rational choice, implementation through the hierarchy and monitoring. This is planning and management based on a shared ideological consensus, with control at its centre. Competent management is necessary if the organisation is to deliver cost effective performance. *Extraordinary management*, by contrast is what is required if the organisation is to be able to transform itself in situations of open ended change. Here rationalistic forms of decision making are largely inoperative, since these require as their starting point precisely those givens which must now be disputed."

[421] Rosenhead (1998). p 6. "Formation of these groups should be essentially spontaneous, provoked by paradoxes, anomalies and conflicts thrown up in the process of normal management. They need to be self organising, capable of redefining or extending their remit rather than being bound by fixed terms of reference. Under these conditions group learning can occur, and its results inputed as arguments to the broader management procession the necessary absence of hard evidence, arguments in favour of new assumptions and directions will be analogical and intuitive, and the process of decision making will be political as champions attempt to persuade others to their point of view." Stacy argues that both management systems are needed.

[422] ibid. p 8

[423] ibid. p 7. Rosenhead argues that the "downplaying of analysis is asserted rather than argued. Never the less it clearly stems from the very firm distinction which Stacey draws between rationality and creativity. For him rationality is fine, and necessary, for handling routine business, but is not up the job of sense making in poorly structured situations."

conclusions.[424] While McElroy[425] predicts a convergence of 'strange bedfellows' towards a single union of organisational learning, knowledge management and complexity theory as a joining of models that each have a missing link, Stacey sees the convergence as a confirmation that complexity theory must be cogent. The convergence Stacey talks about and cited by Rosenhead includes:

- [T]hat organisations do not only adapt to their environments, but help create them.
- [T]hat organisational success can come from contradiction as well as consistency
- [T]hat success may stem from being part of a self-reinforcing cycle, rather than explicit vision.
- [T]hat revolutionary as well as incremental changes may lie on the route to organisational success.

Rosenhead criticises this attempt at justification of a theory by association. In arriving at the point of convergence, Stacey has burned the bridges of construction and logic in the sense that the complexity theory can give no place for the management structures that helped create it in the first place, with the notable exception of system dynamics. Thus, systems engineering or systems thinking contributions are "irredeemably trapped", as Rosenhead puts it, in the pre-complexity history.[426]

Rosenhead argues that Stacey and others rely on the authority of science given that they have relegated pre-complexity theory to history.[427] This is a confusing conclusion in that the 'science' of extraordinary management explicitly does not rely on science or analysis and yet the authority of science is required (by Rosenhead) to authorise complexity theory. Rosenhead further maintains that,

[424] Stacey (2001). p 193 et seq. A convergent argument is presented regarding systems thinking.
[425] See McElroy (2000).
[426] Rosenhead (1998) p 8.
[427] ibid. p 8. Rosenhead actually is quite clear on this point, he states that Stacey and others "rest explicitly on the authority of science".

"there is no formally validated evidence demonstrating that complexity theory-based prescriptions for management style, structure and process do produce the results claimed for them. These results are generally to do with long-term survival, a phenomenon not susceptible to study using short term experimental methods. Such evidence as is adduced is almost exclusively anecdotal in nature."

Theoretical Results and Implications

What the surveys in this thesis did not uncover is whether the process management or indeed systems engineering of adaptation and inversion was handed back to "Ordinary Management". It appeared to be the case, but this was outside the scope of the investigation. There did not appear to be any evidence that the "Complexity Management Teams" actually managed the production processes once the innovation had been adopted and integrated. Team size was an important factor in the adoption process and thus, complexity management. Importantly, what the survey data is telling us is that the "Austin" pathway is only through quadrant two. Thus the teams' contribution to redevelopment of technology must be via complexity management in the sense Stacey defines it. High understanding of 'know-why' only occurs in quadrant two. Convergence is absent in the other quadrants but clearly visible in quadrant two as the driver of redevelopment of technology and reverse dynamic.

Notwithstanding Rosenhead's challenge to complexity theorists and Stacey's extraordinary management concept (as the delivery vehicle for complexity theory) we have the situation where, at least for the Asian companies surveyed, there is a strong link between the implementation of complexity theory and adaptation of innovation, product development and inversion or reverse dynamic. While Rosenhead maintains a credibility divide between complexity theory and Stacey's lack of scientific backing, for the Asian companies surveyed there is a convergence of complexity theory, knowledge management and organisational learning and an association between companies that have successfully engaged offshore innovations and complexity management theory. Indeed, the reverse is also true in that the companies that were not successful in engaging adaptation of new innovation did not indulge in complexity management. Rosenhead would prefer to say that this association of complexity management theory is adducted (to offer as a reason of proof) rather than scientific. In the light of the evidence in quadrant two of the survey analysis, it must be said that the scientific nature of the result is somewhat more than adduction. The interesting outcome of the multidimensional model is seen by backcasting. Backcasting is looking at the output phase of the adoption process, that which results in innovation and redevelopment of technology, and then looking back to the process the generated it. One can then see that complexity management had a role to play.

Deiser[428] warns of the problems of matching external needs of technology adaptation with differentiation and integration. An overemphasis on integration leads to reduced capacity of differential adaptability. Balance of differentiation adaptation strategies along with the relevant integration will ensure a robust management model. Traditional algorithms of the strategy management process involve steps of analysis, formulation and implementation. Inserting this divided approach into a management process is dynamic and constantly subject to external shock changes causing the conceptual strategic intention to be lost. In order to assimilate the management model into a rapidly changing environment strategic competence and corporate intelligence need to be integrated. Deiser also states that "corporate competence is defined as an organisation's ability to interact, at any given time and under changing circumstances, with and within the relevant environmental context, in an efficient and effective way, leaving all players in a win-win situation".[429]

Inherent in this definition is the construct of corporate intelligence and the development of strategic interactive skills. For a firm to collect and process information and data in a collective intelligence system a systemized and formal structure is required. For firms engaged in hazardous waste management this is where the systems engineering approach is useful. The barriers that exist in a traditional management paradigm are overlapped by the application of systems engineering methodology. Using a systems engineering approach the management function can produce interdisciplinary co-operation that can lead to integration of the corporate strategic intention with competence and organisational intelligence and thus deliver a cogent operational management model. Within engineering

[428] Deiser (1994).
[429] Deiser (1994).

"system engineering" has not reached the status of a discipline but it is the structural architecture by which large scale projects of complexity can be controlled. Integration forms a large part of the systems engineering profile where smaller units are combined together into large sub units and are managed in a combined manner.

Hart suggests that such a strategic intention should motivate organisational change by setting high broad aspirations.[430] He further suggests that when setting such objectives the firm is establishing a "strategic reference point" (SRP) and that the model is multidimensional.

The surveys do show, however, an overall weakness in the complexity management concept in that top management have no pathway in which to develop integrated leadership. Nor do the "issues of complexity" find a comfortable home in the 2 D model. The challenge of applying the 2D model to the workplace environment has been in matching demands of external requirements to that of internal capabilities. Organisational performance has always been based on reference points that determine strategic choice.[431] The strategic reference point theory gives us an opportunity to see if adding the third dimension will improve the usefulness of the 2D model and lead onto establishing a higher level of singularity.[432]

Strategic management has traditionally been based on the matching of external demands with internal capability and being able to move to meet new challenges when the externalities change. New capabilities have to be built when changes occur and a constant gap appears that is required to be bridged in order for the organisation to be successful.[433] Benchmarking or reference points appear to be a central theme and this is no different for Asian organisations. The three-dimensional model proposed by Fiegenbaum, Hart, Schiendel is based around three axes of externalities, internalities, and time base.[434]

[430] Hart (1997).
[431] Porter (1980).
[432] Fiegenbaum, Hart, Schendel (1994).
[433] Prahalad and Hamel (1990).
[434] Fiegenbaum, Hart, Schiendel (1994).

Practical Implications for Hazardous Waste Management in Asia

Notwithstanding Rosenhead's challenge to complexity theorists and Stacey's extraordinary management concept (as the delivery vehicle for complexity theory) we have the situation where, at least for the Asian companies surveyed, there is a strong link between the implementation of complexity theory and adaptation of innovation, product development and inversion or reverse dynamic. While Rosenhead maintains a credibility divide between complexity theory and Stacey's lack of scientific backing, for the Asian companies surveyed there is a convergence of complexity theory, knowledge management and organisational learning and an association between companies that have successfully engaged offshore innovations and complexity management theory. Indeed, the reverse is also true in that the companies that were not successful in engaging adaptation of new innovation did not indulge in complexity management. Rosenhead say that this association of complexity management theory is adducted (to offer as a reason of proof) rather than by a scientific proof.

In the light of the evidence in quadrant two of the survey analysis, it must be said that the scientific nature of the result is somewhat more than adduction. The practical implications for management in the Asian companies involved in hazardous waste management is that complexity management is essential for the technology and systems adoption that is required. The quadrant two (and thus successful) companies accept technology transfer as a normal function but have random stand alone teams that investigate know-how and know-why and develop full the reverse dynamic transfer and achieve market domination. These teams have no direct affiliation with the normal ordinary management process, they operate without agendas or structural hierarchy, nor are they affected by external pressures or control. For the Asian companies that were surveyed, given the history of central planning and control this is very significant. This means that corporate strategy for such organizations could benefit by being structured on the following integrated two-dimensional strategy:

- Vertical strategy comprising:
  - Adaptation of the organisation to the technology;
  - Organisational Intelligence and core capacity; and

- Know-why dynamic.

- Horizontal strategy comprising:
  - Adaptation of the technology to the organisation;
  - Knowledge management; and
  - Reverse dynamic.

Further Research

The three dimensional model (Fiegenbaum, Hart, Schiendel) attempts to examine the role of the leaders and why some companies have a leadership system that is clearly focused on the elephants in the living room and integrates its style accordingly and those that do not.[435] The three dimensions (internal, external and time)[436] are the reference points for the operationalisation of the strategic intention as it is defined in the mission and vision statements. Operationalisation of strategic intentions is often the missing link when attempting to deliver a methodology that involves a difficult subject matter such as hazardous waste management systems. The three dimensional approach where the time base is added is an attempt to overcome this problem.

As discussed previously some scholars have traditionally seen the end game for strategic management as a match up between external demands and internal capacity. The problem with many strategic management models, especially those associated with severe changes in risk assessment during the operational phase, are that the swings in the external demands are not compensated for within the body of the model. In the main the traditional strategic management model is static and cannot provide the basis for a cogent system that dynamically tracks the real world situation.

To provide a basis for dynamic change[437] Hart proposes adding a time base, thus turning the two dimensional model into a three-dimensional model. The model is then presented as a "Strategic Reference Point Matrix". In this manner the issues of strategic intention are treated with time in an integrated way. While the matrix can be seen to embrace the corporate strategic intention, that adaptation to a time base

[435] Frankel (1998).
[436] Hart (1997)
[437] Hart (1994)

(past, present, future) does not provide a structure to deal with the issues of complexity that arise during a complex engineering based project.

To replace the time base in the Strategic Point Reference Matrix model thus converting it from two dimensions to three, one has to look at the very dynamics that effect the purpose of the management plan the organisation wants to use. If the model has to cope with balancing opposing and contradictory elements both external and internal to the organisation and this is to be done in the third dimension then we must analyse the multiple impacts and influences have on the overall performance of the project. This of course will be specific to the actual organisational activity involved.

If the activity is simply one of effective competition and delivery of products then the third dimension will look at the impacts of the company's strategy on the external environment over time. For a hazardous waste management project it is much more complex and the SRP Matrix model needs a third element that can cope with the issues of complexity involved.

As a major hazardous waste project develops over time, the risk assessment of the project changes and has a direct impact on the strategic intention of the organisation handling the project. The two-dimensional model developed so far has adapted the technology of the project to the organisation and the organisation to the technology and managed the strategic intention by means of systems engineering. This approach provides a robust management model by the integration of strategic management and systems engineering but it does not automatically protect the project from risk.

The third dimension of the model must therefore take into account the changing circumstances beyond the organisation. To simply base this on time (Past, Present, Future) is inadequate for projects of this kind. In order to regulate the management desired strategic intention for the project it is necessary to step outside the confines of the project execution and view it from a new strategic reference point. What has been observed in the more successful companies surveyed during the research phase of this thesis is the 'use' of backcasting. Generally this was expressed as an "aim or objective". In reality 'aims and objectives' are not part of the complexity teams' agenda. Certainly the success when achieved did not necessarily relate back to a specific and agreed objective. What was apparent was not objective setting but a desired 'end game'.

There are two ramifications of this. Firstly an acknowledgement by team members that reverse dynamic and exported technology could not be achieved by incremental improvements, and secondly that in fact 'path breaking' design was required and that design of such technologies at the 'Austin 4' level was achieved by "backcasting".[438] Not only did complexity management separate out the successful Asian corporates but there was another dimension of activity going on that at first was somewhat invisible. As time went on what was seen as a highly sophisticated management regime was shown to be something different, The practice was complexity teams who operated without agenda, and applied the activity in a rigid manner. This autonomy manifests itself as a practical breakdown into systems and project management. To accept that 'path breaking' and 'backcasting' is a legitimate systems approach it must be accepted that multiple variables in the global context can act as individual but integratable systems. This will involve making inferences about the likely interfaces by the use of general principles.[439]

It is therefore proposed that the third dimension to the model of singularity is that of backcasting. It is left to others to examine how backcasting works in the strategic sense and if it can only be applied in a firm that practices complexity management and integrated adaptation. Of further interest is the question if western managerial practices also include complexity management at the level the Asian companies surveyed in this thesis were achieving.

Field Application Manuals (FAM)

This thesis establishes the theory that innovation adaptation, redevelopment and dynamic reversal is derived from organisations that use "complexity management

[438] See Robinson (1998). p 325-338. See argument for why modelling and forecasting techniques fail when applied to issues of sustainable resource management. Proposal is that alternative methodology involves backcasting and design. Backcasting involves working backwards from a particular desired future to the present. The idea is to allow technical and social feasibility assessments of alternative place-based designs for a time that is at least twenty-five to fifty years in the future.

[439] Clayton & Radcliffe (1996).

teams" within normal organisational structures and can be represented by a multidimensional matrix or a singularity. The multidimensional matrix (mutual adaptation model) can be applied at several levels within an organisation. It can form the basis of structural policy that drives strategy; particularly innovation adaptation and it can also be applied at the operations management level. The model has been adopted by the UNEP Basel Convention and presented as Field Application Manual (FAM). The FAM appears as a UNEP document: McDowall, R.L "Destruction and Decontamination of PCBs and POPs as Waste" Geneva, UNEP, 2002, ISBN 92/1/158611/9 Volume A&B. Ed 1. There are currently over 100 countries using the FAM for their intractable management and there is anecdotal evidence that many companies within these countries are also using the FAM as a strategic document. The FAM is complete with a computer based 'Expert" system that allows users to apply the matrix and generate the operational plans and Work Procedure Instructions. (WPI's) Consultants are also using it to generate contract documents and specifications. In many parts of the UN structure the FAM is a standard document for the management of intractable wastes. The author has prepared some 50 site, country or company specific FAMs for POPs management using the complete multidimensional matrix as presented in this thesis. There is evidence that the elements of the matrix work in all countries not just Asian countries.

-ooOoo-

References

Austin, J. (1990). *Managing in developing nations strategic analysis and operating techniques*. New York: Free Press.

Anwar, H. (1996). *"Implementation of China's Environmental Management Polices: Objectives, realities and an Opportunity for Coorperative capability Development.* International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Barabba, V. (1995). *Meeting of the Minds.* Boston, Mass: Havard Business School Press.

Beder, S. (1996). *The Nature of Sustainable Development* Newham, Australia: Scribe.

Begun, J. (1994). Chaos and Complexity: Frontiers of Organization Science. *Journal of Management Inquiry*, Vol. 3, No. 4, 329-335.

Biqiang, Li. (1998). *Motivation and Management Innovation and its Correlation with Technological Innovation*, Paper presented at the Second International Symposium on Management of Technology Nov. 26-28, Hangzhou, China : International Academic Publishers.

Blackman, C. (1997). *Negotiating China.* St. Leonards, NSW, Australia: Allen & Unwin.

Boal, K., & Bryson, J. (1987). Charismatic leadership : A phenomenological and structural approach. *Emerging Leadership Vistas*. Boston: Heath.

Bollard, A., & Mayes, D. (1993, Feburary). Lessons for Europe from New Zealand's Liberalisation experience. *National Institute Economic Review* 1/93 Vol.43, 81-97.

Bond, M. (1991). *Beyond the Chinese face : Insights from Psychology*. NewYork: Oxford University Press.

Bourassa, A. Paper presented at OECD ESM workshop, Cancun, Mexico, October 1999.

Brahm, L. (1996). *China as No.1: The New Superpower takes Centre Stage*, Singapore : Butterworth-Heinemann.

Brown, R. (1997, October). *Waitakere Print Project.* Proceedings International Solid Waste Association Conference, Wellington, New Zealand. 269-276

Brundtland, G. (1987). *Our Common Future.* New York : Oxford University Press.

Burns, T. & Stalker, G.M. (1961). *The Management of Innovation*, London: Tavistock.

Burnes, B. (1996). *Managing Change : A strategic approach to organisational dynamics*. London: Pitman.

Casti, J. L. (1997). *Would-be Worlds.* New York: John Wiley.

Casti, J. (1995). *Complexification*. New York: Harper.

Checkland, P. (1985). From Optimizing to learning: a Development of Systems Thinking for the 1990s, *Journal Operational Research Society* Vol 36, 757-767.

Chen. & Zhang. (1996). *New Environmental Management Standard to meet Economic Development*, Chinese Research Academy of Environmental Sciences, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Cillers, P. (1998). *Complexity and Postmodernism.* London: Routledge.

Clayton,A.M.H., & Radcliffe, N.J., (1996). *Sustainability A Systems Approach.* London: Earthscan.

Coffey, A., & Atkinson, P. (1996). *Making Sense of Qualitative Data.* Thousand Oaks, CA.: Sage.

Coleman, H. (1999). What enables Self- Organizing behaviours in Business. *Journal of Emergence* Vol 1, No.1, 33-48.

Coleman, H. J. (1998). Why employee empowerment is not just a fad. *Leadership and Organisational Development Journal, 17 July,* 29-36.

Conway, T. (1996). *ISO 14000 Standards and China: A trade and sustainable Development Perspective.* Paper presented at Intenational Conference on ISO 14000 and Sustainable Development, Beijing, China.

COP 1, (1992). Basel Convention Conference of The Parties, COP 1, (Uruguay 4 December).

COP 2, (1994). Basel Convention Conference of The Parties, COP 2 (Geneva 25 March).

COP 3, (1995). Basel Convention Conference of The Parties, COP 3, (Geneva 18 September).

Coveney, P. V., & Highfield, R. R. (1995). *Frontiers of Complexity*, London: Faber & Faber.

Daft, R.L. (1998). *Organization Theory and Design*, 6th Edition, Cincinnati, Ohio: South Western College.

David, P. A. (1997). Rethinking Technology Transfers : incentives, institutions and knowledge based industrial development' in Feinstein and Howe (Eds), *Chinese Technology Transfer in the 1990s*. UK: Edward Elgar, 13-37.

David,P., & Forey, D. (1995). Accessing and expanding the science and technology knowledge base. *STI Review-Science, Technology and Industry*, No. 16,14-68.

David, P., & Olsen, T.E. (1992). Technology adoption, learning spillovers, and the optimal duration of patent based monopolies. *International Journal of Industrial Organisation.* Vol. 10, 517-43.

De Keijzer. A. (1992). *China Business Strategies for the '90s*. Berkeley, California : Pacific View Press.

Deiser, R. (1994). Post-Conventional Strategic Management Criteria for the Postmodern Organisation. Paper in *Building the Strategically Responsive Organisation*. Eds., Thomas, O'Neal, White, Hurst. New York: Wiley.

Demming, W. E. (1986). *Crisis.* MIT Centre for Advanced Engineering, Cambridge, MA.

Dill, W.R. (1958). Environment as an Influence on Managerial Activity. *Administrative Science Quarterly*, 2 , 409- 43.

Duncan, R.B. (1972, September). Characteristics of Organizational Environments and Perceived Environmental Uncertainty. *Administrative Science Quarterly*, 17, 3, 313-27.

Dutton , J.M., & Thomas, A. (1985). Relating technological change and learning by doing, in Rosenbloom (Ed.), *Research on Technological Innovation, Management and Policy,* Vol. 2, Greenwich, CT:JAI Press.

Earle, V. (1997, November). Green Image Under Fire. *NZ Business Journal*, 38 -42.

Eisner, H. (1997). *Essentials of Project and Systems Engineering Management.* New York: Wiley

Emery, F.E., & Trist, E. (1965). The causal texture of organisational environments. Journal : *Human Relations*, 18:21-31.

Ermen, R. (1996). *From Environmental Management to Sustainable Development.* International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Fava, J.A., & B. Jones, & R. Denison, & M. A. Curran, & B. Vigon, & S. Selke (Editors), *Technical Framework for Life-Cycle Assessment*, SETAC Foundation for Environmental Education, Incorporation, 1991.

Fayol, H. (1949). (First printed in 1916). *General Principles of Management Classics of Organisational Theory.* 4th edition, J. Shafrite & J. S. Ott (Ed's.), 1996, Melbourne: Wadsworth.

Fiegenbaum, A., & Hart, S., & Schiendel, D. (1994). Strategic Reference Point Theory' in *Building the Strategically Responsive Organisation.* New York: Wiley.

Feinstein, C., & Howe, C. (1997). *Chinese Technology Transfer in the 1990s*, Cheltenham, UK.: Edward Elgar.

Fengzhong, C. (1996). *ISO 14000 and the Green Trade Barrier.* International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Forester, W. S., & Skinner, J.H. (1993). *Waste Management Strategies for the Future.* New York: Academic Press.

Frankel, C. (1998). *In Earth's Company*, Grabriola Island BC: CanadaNew Society Publishers.

Galbraith, J. (1977). *Organization Design*. Reading, MA: Addison-Wesley

Galbraith, J. (1962). *Designing Complex Organisations.* Reading, MA: Addison-Wesley.

Garud, R. (1997). On the Distinction between Knowhow, Knowwhy and Knowwhat in Technological Systems. in J. Walsh and A. Huff (Eds.) *Advances in Strategic Management*, Stamford CT: JAI Press.

Gell-Mann, M. (1994). *The Quark and the Jaguar.* New York: W H Freeman and Co.

Gibbs, D., & Hooper, P. (1996, October). Sustainable Development and Corporate Environmental Strategy in NW England. *Greener Management International*, Issue 16, 77-86.

Goldstein, J. (1999). Emergence as a Construct: History and issues. *Journal of Emergence*, Vol. 1 No.1, 49-71.

Greenpeace Organisation. (1998). *Waste Trade Update,* Vol 2, Issue 2, 1.

Greenpeace Organisation. (2001) *Submission to POPs Convention*, Stockholm, June.

Greenpeace Organisation. (2001) *Case Histories of Illegal Traffic*, POPs Convention submission, May.

Greenwood, R., & Hinings C. R. (1996, October). Understanding radical organisational change: Bringing together the old and the new Institutionalism. *Academy of Management Review,* 21,1022-54.

Grossman, G., & Helpman, E. (1991). Trade, Innovation and Growth. *American Economic Review,* 80(2),86.

Grundy, T. (1994). *Strategic Learning in Action.* The Henly Management Series. New York : McGraw Hill.

Hale, D. (1996). 6th International Cleaner Production Conference, Bali, Conference Proceedings.

Handl, G. (1990). Environmental Security and Global Change: The Challenge to International Law. *Year Book of International Environmental Law*, 3-33.

Hart, S. (1997). Strategies for a Sustainable World. *Harvard Business Review,* Jan.-Feb., 68-76.

Hecq, W. (1996). *What is the Future of ECO-Auditing, Choices, Challenges and Constraints?.* Paper presented at Intenational Conference on ISO 14000 and Sustainable Development, Beijing, China.

Hemming, C. (1995). Business Success From Seizing the Environmental Initiative. *Business and the Environmental Practitioner Series*, UK.: Technical Communications Ltd.

Horgan, J. (1995). From Complexity to Perplexity. *Scientific American*, Vol. 272, 74-79.

Howe, C. (1997). 'Technology and Competitiveness in Asia', Feinstein and Howe (Ed's), *Chinese Technology Transfer in the 1990's*. UK: Edward Elgar, 38-58.

Hu, Shouren. (1999). *China's Legislation on Hazardous Waste Management.* Paper presented at Second Asia-Pacific Regional Training Workshop on Hazardous Waste Management and Practice, Beijing, China.

Hunt, D., & Johnson, C. (1995). *Environmental Management Systems: Principles and Practice.* New York: McGraw.

IMO, Assembly Resolution, Transboundary Movement of hazardous wastes, 19 October 1989, (A16/Res.676).

International Institute for Sustainable Development (IISD). *Business Strategy for Sustainable Development: Leadership and Accountability for the 90's*, Manitoba Canada: IISD.

ISO Conference China (1996). Intenational Conference on ISO 14000 and Sustainable Development, Beijing, China.

Jackson, S. (1995). Profiting from Pollution Prevention. *Environmental Protection Bulletin No.44.*

Jaques, E., & Clement, S. (1991). *Executive Leadership: A Practical Guide to Managing Complexity.* Falls Church, VA: Basil Blackwell, Cason Hall & Co.

Jingping, D. (1997). Using Imported technology to transform existing enterprises in China. in Feinstein and Howe, *Chinese technology Transfer in the 1990s.* UK: Edward Elgar.

Johnson, S., & Corcelle, G. (1989). *The Environmental Policy of the European Communities. London:* Graham & Trotman.

Johnson, J., & Burton, B. (1994). Chaos and Complexity Theory for Management: Caveat Emptor. *Journal of Managment Inquiry* 3(4), 320-328

Kao, K. (1995). The World-Wide Web of Chinese Business. *The Evolving Global Economy.* (Ed.), Kenichi Ohmae. Boston, MA: Harvard Business Review book.

Karlenzig, W. (1999). Senge on Knowledge. *Knowledge Management Magazine* July , 22-4.

Katz, D., & Kahn, R. (1978). *The Social Psychology of Organisations.* New York: Wiley.

Kauffman, S.A. (1995). *At Home in the Universe. The Search for Laws of Complexity. New York:* Oxford. University Press.

Kauffman, S. A. (1993). *The Origins of Order: Self-Organization and Selection in Evolution.* New York: Oxford University Press.

Keasey, K., & Wright, M. (1997). *Corporate Governance.* New York: Wiley.

Kelly, K. (1994). *Out of Control: The New Biology of Machines, Social Systems, and the Economic World.* Reading, Mass.: Addison-Wesley

Kelly, S., & Allison, M.A. (1998). *The Complexity Advantage. New York:* McGraw Hill.

Kiss, A., & Sheldon D. (1991). *International Environmental Law.* New York: Transational Publishers.

Knight, A., & Wolfe, J. (1995). Performing to a higher standard. *CA Magazine*, Vol.128, No.9, 39-40.

Kreiner, K. (1996). *Knowledge and Mind.* Paper presented at Annual Academy of Management Meeting, Cincinnati.

Kreisberg, P. H. (1994). China's negotiating behaviour. TW Robinson and Scambaugh (Eds), *Chinese Foriegn Policy: Theory and Practice*, Oxford : Clarendon Press.

Kuhre, W. (1995) *ISO 14001 Certification : A Practical Guide for preparing effective Environmental Management Systems.* Upper Saddle River, NJ: Prentice Hall PTR.

Kummer, K. (1995). *International Management of Hazardous Wastes: The Basel Convention and Related Legal Rules*, Oxford University Press, New York.

Lang,W., & Nuehold. H., & Zemanek. K. (Eds),(1991). *Environmental Protection and International Law,* Graham and Trotman, London.

Lawrence, P., & Lorsch, J. (1967). *Organisation and Environment,* Boston: Harvard University, Graduate School of Business Administration.

Lefebure, E., & Letiche, H. (1999). Managing Complexity from Chaos : Uncertainty, Knowledge, Skills. *Journal of Emergence*, Vol. 1, Issue 3, p 7-15]

Lei, D., & Slocum, J. (1992). Global strategy Competence Building and Strategic Alliances. *California Management Review* 35(2) University of California, Berkeley.

Leonard-Barton, D. (1990). A dual methodology for case studies: synergistic use of a longitudinal single site with replicated multiple sites. *Organisation Science* 1,3, 240-266.

Leonard-Barton, D., (1995). *Wellsprings of Knowledge*, Boston, Mass: Harvard Business School Press.

Levy, D. (1994). Chaos Theory and Strategy: Theory, Application, Management Implications, *Strategic Management Journal*, Vol. 15.

Lewin, K., & Grabbe, P. (1961). Principles of re-education. *The Planning of Change: Readings in the Applied Behavioural Sciences*, edited by Warren Bennis, Kenneth Benne and Richard Chin, 503-509. New York: Holt Rinehart and Winston. Fourth Edition.

Lewin, R. (1992). *Complexity: Life at the Edge of Chaos*, New York: Macmillan.

Lissack, M.R. (1996). Chaos and Complexity "What does this have to do with knowledge management?. *Knowledge Management: Organisation, Competence, and Methodology*, ed. J.F. Schreinmakers, Wurzburg, Germany, Ergon Velog I: 62081.

Lissack, M.R. (1999). Complexity ; The Science, its Vocabulary and its relation to Organisations. *Journal of Emergence,* Vol., Issue 1.

Lissack, M.R., & Gunz, H.P. (eds),(1999), *Managing Complexity in Organizations*. Westport, CT: Quorum Books.

Liu-Jinsheng. (1996). *Implementing ISO 14000 in China.* Paper presented at Intenational Conference on ISO 14000 and Sustainable Development, Beijing, China.

Liu, Shuqin. (1996). *Impacts of Environmental Legislation and Environmental Management System on Industries Environmental Protection Behaviours.* International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

Lu, Shu Ping. (1996). *Actively Promoting EMS Standards to Realise the General Objective of Shanghai's Environmental Protection,* Paper presented at the International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Ma, Hongchang. (1999). *Basel Convention and Implementation in Chinastate Environmental Protection Administration,* Paper presented at 'Second Asia-Pacific Regional Training Workshop on Hazardous Waste Management and Practice', Beijing, China.

March, J., & Simon, H. (1993). *Organizations,* 2nd edition, London: Blackwell Press.

Marcie, J., & Orlikowski, W. (1994) Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organisations. *Organisation Science* Vol. 5, No.1.

McDowall, R.L (1996). Interview with : *Director of the Training and Education Branch Associate professor Qingzhong Bai NTTTC China July 96 "Role of Basel Convention in making regulations for waste management in China"*

McElroy, M. (1999). Complexity, IT and the Interprise. Paper in *Managing Complexity in Organisations,* edited by M. Lissack, and H Gunz, London : Quorum Books.

McElroy, M. (2000). Integrating Complexity theory, knowledge management and organizational learning. *Journal of Knowledge Management* Vol.4. No.3, 195-203.

McMaster, M. (1996). *The Intelligence Advantage. Organising for Complexity.* Newton, MA: Butterworth-Heineman.

Merry, U. (1995). *Coping with Uncertainty: insights from the new sciences of chaos, self-organization and complexity*, Praeger, Westport Conn.

Miles, R.E., Coleman, H.J., & Douglas Creed, W.E. (1995, Spring). Keys to success in corporate redesign. *California Management Review*, 128-145.

Milliken, F. (1987). Three types of perceived uncertainty about the environment state effect and response uncertainty. *Academy of Management Review* 12, 133-43.

Ministry for the Environment (NZ), (1997, October). *State of Environment Report* Launch meeting Auckland.

Mitchell, G., A.D. May and A.T. McDonald. 1995. PICABUE: A methodological framework for the development of indicators of sustainable development. *International Journal of Sustainable Development and World Ecology* 2, 2:104-123.

Montgomery, M. A. (1990). Travelling Toxic Trash: An Analysis of the 1989 Basel Convention in *The Fletcher Forum of World Affairs.* Medford, MA: The Fletcher School of Law and Diplomacy.

Morgan, G. (1997). *Images of Organization.* Thousand Oaks, Calif.: Sage Publications.

Nadler, D. A. (1998). *Champions of Change.* San fransisco CA: Jossey-Bass.

Nash, J., & Ehrenfeld, J. (1996). Code Green: Business Adopts Voluntary Environmental Standards. *Environment* January/February: 16-45

Nie Yongfeng et al, (1995). *Study on Hazardous Waste management and Establishment of an Information Centre - China* World Bank Report No.94-JGF-04 December 1995

OAU Council of Ministers resolution on Control of Transboundary Movements of Hazardous Wastes and their Disposal in Africa, July 1989. The Bamako Convention is available on ILM 30/3(1991).

OECD Council Decision and Recommendation on Transfrontier Movements of hazardous wastes, 1 February 1984,(C(83)180(final).

OECD Policy Conference at Basel, Switzerland, March 1985.

OECD Resolution International Co-operation transboundary Movements of Hazardous Wastes, October 1988.

OECD Council Decision May 1988 (C89)1(final).

OECD Council Resolution on Control of Transfrontier Movements of Hazardous Wastes, 30 January 1989.(C(89)1(final),repr. in OECD,(1993a)).

Ohmae, K. (1989, January-Feburary). Companyism and Do More Better. *Harvard Business Review.*

Palmer, P., & Cooper,I., & Vorst, R. (1996). *Mapping out Fuzzy Buzzwords* Conference proceedings : International Sustainable Development Research Conference Vol 5, 87-93 Manchester Conference Centre, UK.

Pennings, J. (1992). Structural contingency theory; a reappraisal. *Research in Organisational Behaviours* 14, 584-602.

Penace, D., & Turner, R. (1993). Market Based Approaches to Solid Waste Management. *Resources Conservation and Recycling,* Vol. 8, No. 1,2.

Peterson, D. (2000, May). *Evolution of Firms Using Blind Strategies: The Emergence of Observed Patterns of Bureaucracy, Innovation, and Economic Growth.* Paper presented at the International Conference on Complex Systems, Nashua, NH.

Petzinger, T. (1999). Complexity More than a Fad, in *Managing Complexity in Organisations* (Ed's.), Lissack and Gunz, Connecticut: Quorum Books.

Phelan, S. (1995). *From Chaos to Complexity in Strategic Planning.* Paper Presented at the 55th Annual Meeting of the Academy of Management Vancouver, British Columbia, Canada.

Porter, M.E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors.* New York: Free Press.

Prahalad, C.K., & Hamel, G. (1990, May). The Core Competence of the Corporation. *Harvard Business Review,* 79-91.

Primozic, K., & Primozic, E., & Leben, J. (1995). *Strategic Choices.* New York: McGraw Hill.

Punte, P. (1997, September). Cleaner Production in New Zealand Hospitals. *Opus International. ISWA Conference proceedings*, Wellington, New Zealand.

Quinn, R. E. (1991). *Beyond Rational Management : mastering the paradoxes and competing demands of high performance.* San Francisco: Jossey-Bass.

Quinn, R.E. (1996). *Deep Change: Discovering the Leader Within.* San Francisco: Jossey-Bass.

Qiao, Zhiqi. (1999). *Introduction to Environmental Protection in China,* Paper presented at 'Second Asia-Pacific Regional Training Workshop on Hazardous Waste Management and Practice', Beijing, China.

Quan Xiao, D. (1998). *LCA activities in Asia* , Sicuan University, China at Conference Life Cycle Assessment for Asia Pacific region held at University of Tsubuka.

Redding, S. (1990). *The spirit of Chinese Capitalism.* Berlin: de Gruyter.

Reeves, W. (1996). *Cognition and Complexity: The Cognitive Science of Managing Complexity.* Lanham, Maryland: Scarecrow Press.

Robinson, J. (1998). Unlearning and backcasting: rethinking some of the questions we ask about the future. *Technological and Social Change* 33.325-338.

Rogers, E.M. (1983). *Diffusion of Innovations.* 3rd edition, New York: The Free Press.

Romm, J. (1994). *Lean and Clean Management.* New York: Kodansha American.

Rosencranz, A., & Eldridge, C. (1992). Hazardous Wastes: Basel after Rio, in *Environmental Policy and Law* 22/5/6, 381.

Rosenhead, J. (1989). Complexity Theory and Management Practice. *The human Nature Daily review. http://human-nature.com/scienmce-as-culture/rosenhead.html. 7 August 02.*

Rosenhead, J. (2001). *Rational Analysis for a Problematic World Revisted.* Second Edition, Chichester: John Wiley & Sons Ltd.

Schein, E. (1996). Three Cultures of Management: The Key to Organisational learning. *MIT Sloan Management Review,* Vol 38, No.1.

Schon, D. (1987). *Educating the Reflective Praticioner: Toward a New Design for Teaching and Learning in the professions,* San Francisco, Jossey-Bass.

Schmidt, A. (1992). Transboundary Movements of Waste under EU Law: The Emerging Regulatory framework. *Journal of Environmental Law* 4/1: 57.

Scott, W. G. (1961, April). Organisational Theory: An overview and an appraisal. *Academy of Management* Journal, 26.

Senge, P. (1990). *The Fifth Discipline.* New York: Currency Doubleday.

SEPA, (1995). *Study on Hazardous Waste Management and the Establishment of an Information Resource Centre - Final Report.* World Bank Project "SEPA Capacity Building", December.

Simon, H. A. (1946). The Proverbs of Administration. *Public Administration Review* 6: 53-67.

Simon, H.A. (1957). *Administrative Behaviour: A study of Decsion-making Processes in Administrative Organizations. New York: Macmillian.*

Spitalink, E.R. (1992, November). *Hazardous Waste Management Legislation in Asia,* Briefing paper presented at the 'International Chemical Regulation Briefing', Washington DC..

Spreitzer, G. M. (1995, October) Individual Empowerment in the Workplace: Dimensions, Measurement and Validation. *Academy of Management Journal* 38: 1442-65.

Spreitzer, G.M. (1996). Social Structural Characteristics of Psychological Empowerment. *Academy of Management Journal*, 39 (April), 483-504.

Stacey, R.D. (1992). *Managing the Unknowable: strategic boundaries between order and chaos in organisations.* Jossey-Bass, San Francisco.

Stacey, R.D. (1993).*Strategic Management and Organisational Dynamics.* Pitman, London.

Stacey, R. D. (1995). The science of complexity An alternative perspective for strategic change process. *Strategic Management Journal* 16 : 477-495.

Stacey, R. D. (1996). *Complexity and Creativity in Organizations*. San Francisco, Berrett-Koehler.

Stacey, R D. (2001). *Complex Responsive Processes in Organizations*. New York, Routledge.

Stacey, R. D., & Griffin, D., & Shaw, P. (2000). *Complexity and Management.* New York: Routledge.

Stead, W.E., & Stead, J.G. (1992). *Management for a Small Planet : Strategic Decision Making and the Environment.* Newbury Park, CA: SAGE.

Taiichi Ohno., (1988). *Toyota Production Systems.* Tokyo: Productivity Press Inc.

Tang, Shiguo. (1997). Sino-Japanese Technolgy transfer and its effects. by regarding technology transfer problems. *Chinese Technology transfer in the 1990's* (Ed's.) Feinstein and Howe, UK: Edward Elgar.

Terada, S. (1996). *EMS Trainers in Japan.* Paper presented at Intenational Conference on ISO 14000 and Sustainable development, Beijing, China.

Terreberry, S. (1968). The evolution of organisational environments. *Administrative Science quarterly.* 12: 311-396.

Thomas, K. W. & Velthouse, B. A. (1990, October). Cognitive elements of empowerment: An interpretative model of Intrinsic task motivation. *Academy of management review* 15: 666-81.

Thompson, J.D. (1967). *Organisation in action.* New York: McGraw-Hill.

Tolba, M., & El-Kholy, O.A. (1992). *The World Environment 1972-1992.* London: Chapman and Hall.

Tremayne, B. (1996, Autumn/Winter). China's Environmental Problem. *China Review.* Issue 5.

Tsoukas, H. (1997, November). *Reading organisations: uncertainty, complexity, narativity.* Paper delivered at Uncertainty, Knowledge and Skill Conference, Limburg University, Hasselt, Belgium.

Tyre, M.,& Orlikowski, W. (1994). Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations. *Organization Science*, 5, 1, 98-118.

Ulrich, S., & Winter, M. (1996, July). Environmentally -Driven market Changes. *Greener Management International.* Issue 15, Wiltshire, UK.: Greenleaf, 31-52.

UNEP, (1981). Montevideo Programme (Nairobi 1982); *Report of the Ad Hoc Meeting of Senior Government Officials Expert in Environmental Law to the Governing Council of UNEP*, 7 December (UNEP/GC.10/5/Add.2)

UNEP, (1984). Reports of the Ad Hoc group of Experts on the Environmentally Sound management of Hazardous wastes in a total of three sessions, March 1984 (UNEP/WG.95/5); December 1984 (UNEP/WG.111/3); December 1985 (UNEP/WG.122/3).

UNEP, (1987). Environmental Law Guidelines and Principles, *Environmentally Sound Management of hazardous Waste,* Nairobi.

UNEP, (1989). *Final Act of the Conference of Plenipotentiaries on the Global Convention on the Control of transboundary Movements of Hazardous wastes*, 22 March.

UNEP, (1991). Basel Convention. *Draft International Strategy for the Environmentally Sound Management of Hazardous Wastes* December, (UNEP/CHW/WG.2/1/3).

UNEP, (1994). Basel Convention on the *Control of Transboundary Movement of Hazardous Wastes and their Disposal.* Basel Convention Series / SBC No.94/008 Geneva, June.

UNEP, (1995). Basel Convention. *Third Meeting of the Conference of the Parties Decision III/19* Geneva, December.

UNEP, (1995). *Study on Hazardous Waste Management and the establishment of an information resource centre - Final Report.* World Bank Project "NEPA Capacity Building". December.

UNEP, (1996). Basel Convention Conference . *The First Asia-Pacific Regional Meeting on Establishing Regional Centres for Training and Technology Transfer for Environmentally Sound Management of Hazardous wastes.* Beijing, July.

UNEP, (2000). Workshop proceedings, *Sub Regional Workshop on Training and Management of Dioxins/Furans and PCB's,* Seoul, Korea, 24-28 July.

United Nations Conference on Environment and Development, Earth Summit, Rio de Janeiro, Brazil, June 1992.

UN(FAO), (2000). Conference proceedings, *Obsolete pesticides Stocks* Alexandra, Virginia, USA 13-15 September.

Utterback, J. (1995, January). Developing Technologies: the Eastman Kodak Story. *McKinsey Quarterly*. 130.

Waldrop, W.M. (1992). *Complexity: The Emerging Science at the Edge of Order and Chaos.* New York: Simon & Schuster.

Weng, D. (1996). *Life Cycle Assessment and Sustainable Devlopment of Materials.* Paper presented at Intenational Conference on ISO 14000 and Sustainable Development, Beijing, China.

Wentz, C. A. (1995). *Hazardous Waste Management.* Second Edition, New York: McGraw-Hill.

Weick, K.E. (1995). *Sensemaking in Organizations*. Thousand Oaks, Calif: Sage Publications.

Wheatley, M.J. (1992). *Leadership and the New Science: Learning about Organisation from an Orderely Universe.* Berrett-Koehler, San Francisco.

White, M. (1999). Adaptive Corporations. Paper in *Managing Complexity in Organisations* edited by M Lissack, and H Gunz, London: Quorum Books.

Wilkinson, D. (1992). Maastricht and The Environment: The implications for the EC's Environment Policy of the Treaty of European Union, *Journal of Environmental Law* 4/2.221.

Willig, J. (1995) *Auditing for Environmental Quality Leadership.* New York: Wiley.

World Resources Report 1990-91.

Wymore, A. (1993). *Model based Systems Engineering.* Boca Raton: CRC Press.

Xiaojuan, Jiang. (1997). Chinese Government policy towards science and technology and its influence on the technical development of industrial enterprises, in Feinstein and Howe, *Chinese technology Transfer in the 1990's.* UK: Edward Elgar.

Xu, Jianngping. (1997). China's International Technology Transfer ; the current situation, problems and future prospects, in Feinstein and Howe, *Chinese Technology Transfer in the 1990's.* UK: Edward Elgar.

Zairi, M. (1996). *Benchmarking Supplier Partnerships for Best Practice* Oxford: Butterworth Hienmann.

Zhang, Jiashen., (Ed.). (1993). *Waishang touziqiye shiwu shouce* (A Practical Guide to Joint Ventures), Jingji Guanli Chubanshe, Fuzhou.

Zheng, Yanan. (1996). *"An Assessment of ISO 14000's Impact on China's Enterprises and Response of China's Industries.*, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Zhu, Xing Xiang. (1996). *The Relationship between ISO 14000 and China's current Environmental Managment System.* Paper presented at Intenational Conference on ISO 14000 and Sustainable Development, Beijing, China.

Xia, You Fu, & Di, Chang Xing. (1996). *ISO 14000, Cleaner Production, and the Development of China's International trade.* International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China.

Yin, Gai. (1996) Conference opening remarks (Director General of Science, Technology and Standard Development), National Environmental Protection Agency, International Conference on ISO 14000 Environmental Management and Sustainable Development, Beijing, China, 1996.

Appendices

APPENDIX 1 United Nations Environment Programme Basel Convention

BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL ADOPTED BY THE CONFERENCE OF THE PLENIPOTENTIARIES ON 22 MARCH 1989

ENTRY INTO FORCE

5 MAY 1992

130 PARTIES

AS OF JULY 1999

PREAMBLE

The Parties to this Convention,

Aware of the risk of damage to human health and the environment caused by hazardous wastes and other wastes and the transboundary movement thereof,

Mindful of the growing threat to human health and the environment posed by the increased generation and complexity, and transboundary movement of hazardous wastes and other wastes,

Mindful also that the most effective way of protecting human health and the environment from the dangers posed by such wastes is the reduction of their generation to a minimum in terms of quantity and/or hazard potential,

Convinced that States should take necessary measures to ensure that the management of hazardous wastes and other wastes including their transboundary movement and disposal is consistent with the protection of human health and the environment whatever the place of disposal, Noting that States should ensure that the generator should carry out duties with regards to the transport and disposal of hazardous wastes and other wastes in a manner that is consistent with the protection of the environment, whatever the place of disposal.

Fully recognizing that any State has the sovereign right to ban the entry or disposal of foreign hazardous wastes and other wastes in its territory,

Recognizing also the increasing desire for the prohibition of transboundary movements of hazardous wastes and their disposal in other States, especially developing countries,

Convinced that hazardous wastes and other wastes should, as far as is compatible with environmentally sound and efficient management, be disposed of in the State where they were generated,

Aware also that transboundary movements of such wastes from the State of their generation to any other State should be permitted only when conducted under conditions which do not endanger human health and the environment, and under conditions in conformity with the provisions of this Convention,

Considering that enhanced control of transboundary movement of hazardous wastes and other wastes will act as an incentive for their environmentally sound management and for the reduction of the volume of such transboundary movement,

Convinced that States should take measures for the proper exchange of information on and control of the transboundary movement of hazardous wastes and other wastes from and to those States,

Noting that a number of international and regional agreements have addressed the issue of protection and preservation of the environment with regard to the transit of dangerous goods,

Taking into account the Declaration of the United Nations Conference on the Human Environment (Stockholm, 1972), the Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes adopted by the Governing Council of the United Nations Environment Programme (UNEP) by decision 14/30 of 17 June 1987, the Recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods (formulated in 1957 and updated biennially), relevant recommendations, declarations, instruments and regulations adopted within the United Nations system and the work and studies done within other international and regional organizations,

Mindful of the spirit, principles, aims and functions of the World Charter for

Nature adopted by the General Assembly of the United Nations at its thirty-seventh session (1982) as the rule of ethics in respect of the protection of the human environment and the conservation of natural resources,

Affirming that States are responsible for the fulfilment of their international obligations concerning the protection of human health and protection and preservation of the environment, and are liable in accordance with international law,

Recognizing that in the case of a material breach of the provisions of this Convention or any protocol thereto the relevant international law of treaties shall apply,

Aware of the need to continue the development and implementation of environmentally sound low-waste technologies, recycling options, good house-keeping and management systems with a view to reducing to a minimum the generation of hazardous wastes and other wastes,

Aware also of the growing international concern about the need for stringent control of transboundary movement of hazardous wastes and other wastes, and of the need as far as possible to reduce such movement to a minimum,

Concerned about the problem of illegal transboundary traffic in hazardous wastes and other wastes,

Taking into account also the limited capabilities of the developing countries to manage hazardous wastes and other wastes,

Recognizing the need to promote the transfer of technology for the sound management of hazardous wastes and other wastes produced locally, particularly to the developing countries in accordance with the spirit of the Cairo Guidelines and decision 14/16 of the Governing Council of UNEP on Promotion of the transfer of environmental protection technology,

Recognizing also that hazardous wastes and other wastes should be transported in accordance with relevant international conventions and recommendations,

Convinced also that the transboundary movement of hazardous wastes and other wastes should be permitted only when the transport and the ultimate disposal of such wastes is environmentally sound, and

Determined to protect, by strict control, human health and the environment against the adverse effects which may result from the generation and management of hazardous wastes and other wastes,

HAVE AGREED AS FOLLOWS:

Article 1

Scope of the Convention

1. The following wastes that are subject to transboundary movement shall be "hazardous wastes" for the purposes of this Convention:

(a) Wastes that belong to any category contained in Annex I, unless they do not possess any of the characteristics contained in Annex III; and

(b) Wastes that are not covered under paragraph (a) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the Party of export, import or transit.

2. Wastes that belong to any category contained in Annex II that are subject to transboundary movement shall be "other wastes" for the purposes of this Convention.

3. Wastes which, as a result of being radioactive, are subject to other international control systems, including international instruments, applying specifically to radioactive materials, are excluded from the scope of this Convention.

4. Wastes which derive from the normal operations of a ship, the discharge of which is covered by another international instrument, are excluded from the scope of this Convention.

Article 2

Definitions

For the purposes of this Convention:

1. "Wastes" are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law;

2. "Management" means the collection, transport and disposal of hazardous wastes or other wastes, including after-care of disposal sites;

3. "Transboundary movement" means any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one State to or through an area under the national jurisdiction of another State or to or through an area not under the national jurisdiction of any State, provided at least two States are

involved in the movement;

4. "Disposal" means any operation specified in Annex IV to this Convention;

5. "Approved site or facility" means a site or facility for the disposal of hazardous wastes or other wastes which is authorized or permitted to operate for this purpose by a relevant authority of the State where the site or facility is located;

6. "Competent authority" means one governmental authority designated by a Party to be responsible, within such geographical areas as the Party may think fit, for receiving the notification of a transboundary movement of hazardous wastes or other wastes, and any information related to it, and for responding to such a notification, as provided in Article 6;

7. "Focal point" means the entity of a Party referred to in Article 5 responsible for receiving and submitting information as provided for in Articles 13 and 16;

8. "Environmentally sound management of hazardous wastes or other wastes" means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes;

9. "Area under the national jurisdiction of a State" means any land, marine area or air space within which a State exercises administrative and regulatory responsibility in accordance with international law in regard to the protection of human health or the environment;

10. "State of export" means a Party from which a transboundary movement of hazardous wastes or other wastes is planned to be initiated or is initiated;

11. "State of import" means a Party to which a transboundary movement of hazardous wastes or other wastes is planned or takes place for the purpose of disposal therein or for the purpose of loading prior to disposal in an area not under the national jurisdiction of any State;

12. "State of transit" means any State, other than the State of export or import, through which a movement of hazardous wastes or other wastes is planned or takes place;

13. "States concerned" means Parties which are States of export or import, or transit States, whether or not Parties;

14. "Person" means any natural or legal person;

15. "Exporter" means any person under the jurisdiction of the State of export who arranges for hazardous wastes or other wastes to be exported;

16. "Importer" means any person under the jurisdiction of the State of import who arranges for hazardous wastes or other wastes to be imported;

17. "Carrier" means any person who carries out the transport of hazardous wastes or other wastes;

18. "Generator" means any person whose activity produces hazardous wastes or other wastes or, if that person is not known, the person who is in possession and/or control of those wastes;

19. "Disposer" means any person to whom hazardous wastes or other wastes are shipped and who carries out the disposal of such wastes;

20. "Political and/or economic integration organization" means an organization constituted by sovereign States to which its member States have transferred competence in respect of matters governed by this Convention and which has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve, formally confirm or accede to it;

21. "Illegal traffic" means any transboundary movement of hazardous wastes or other wastes as specified in Article 9.

Article 3

National Definitions of Hazardous Wastes

1. Each Party shall, within six months of becoming a Party to this Convention, inform the Secretariat of the Convention of the wastes, other than those listed in Annexes I and II, considered or defined as hazardous under its national legislation and of any requirements concerning transboundary movement procedures applicable to such wastes.

2. Each Party shall subsequently inform the Secretariat of any significant changes to the information it has provided pursuant to paragraph 1.

3. The Secretariat shall forthwith inform all Parties of the information it has received pursuant to paragraphs 1 and 2.

4. Parties shall be responsible for making the information transmitted to them by the Secretariat under paragraph 3 available to their exporters.

Article 4

General Obligations

1. (a) Parties exercising their right to prohibit the import of hazardous wastes or other wastes for disposal shall inform the other Parties of their decision pursuant to Article 13.

(b) Parties shall prohibit or shall not permit the export of hazardous wastes and other wastes to the Parties which have prohibited the import of such wastes, when notified pursuant to subparagraph (a) above.

(c) Parties shall prohibit or shall not permit the export of hazardous wastes and other wastes if the State of import does not consent in writing to the specific import, in the case where that State of import has not prohibited the import of such wastes.

2. Each Party shall take the appropriate measures to:

(a) Ensure that the generation of hazardous wastes and other wastes within it is reduced to a minimum, taking into account social, technological and economic aspects;

(b) Ensure the availability of adequate disposal facilities, for the environmentally sound management of hazardous wastes and other wastes, that shall be located, to the extent possible, within it, whatever the place of their disposal;

(c) Ensure that persons involved in the management of hazardous wastes or other wastes within it take such steps as are necessary to prevent pollution due to hazardous wastes and other wastes arising from such management and, if such pollution occurs, to minimize the consequences thereof for human health and the environment;

(d) Ensure that the transboundary movement of hazardous wastes and other wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes, and is conducted in a manner which will protect human health and the environment against the adverse effects which may result from such movement;

(e) Not allow the export of hazardous wastes or other wastes to a State or group of States belonging to an economic and/or political integration organization that are Parties, particularly developing countries, which have prohibited by their legislation all imports, or if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner, according to criteria to be decided on by the Parties at their first meeting.

(f) Require that information about a proposed transboundary movement of hazardous wastes and other wastes be provided to the States concerned, according to Annex V A, to state clearly the effects of the proposed movement on human health and the environment;

(g) Prevent the import of hazardous wastes and other wastes if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner;

(h) Co-operate in activities with other Parties and interested organizations, directly and through the Secretariat, including the dissemination of information on the transboundary movement of hazardous wastes and other wastes, in order to improve the environmentally sound management of such wastes and to achieve the prevention of illegal traffic.

3. The Parties consider that illegal traffic in hazardous wastes or other wastes is criminal.

4. Each Party shall take appropriate legal, administrative and other measures to implement and enforce the provisions of this Convention, including measures to prevent and punish conduct in contravention of the Convention.

5. A Party shall not permit hazardous wastes or other wastes to be exported to a non-Party or to be imported from a non-Party.

6. The Parties agree not to allow the export of hazardous wastes or other wastes for disposal within the area south of 60° South latitude, whether or not such wastes are subject to transboundary movement.

7. Furthermore, each Party shall:

(a) Prohibit all persons under its national jurisdiction from transporting or disposing of hazardous wastes or other wastes unless such persons are authorized or allowed to perform such types of operations;

(b) Require that hazardous wastes and other wastes that are to be the subject of a transboundary movement be packaged, labelled, and transported in conformity with generally accepted and recognized international rules and standards in the field of packaging, labelling, and transport, and that due account is taken of relevant internationally recognized practices;

(c) Require that hazardous wastes and other wastes be accompanied by a movement document from the point at which a transboundary movement commences to the point of disposal.

8. Each Party shall require that hazardous wastes or other wastes, to be exported, are managed in an environmentally sound manner in the State of import or elsewhere. Technical guidelines for the environmentally sound management of wastes subject to this Convention shall be decided by the Parties at their first meeting.

9. Parties shall take the appropriate measures to ensure that the transboundary movement of hazardous wastes and other wastes only be allowed if:

(a) The State of export does not have the technical capacity and the necessary facilities, capacity or suitable disposal sites in order to dispose of the wastes in question in an environmentally sound and efficient manner; or

(b) The wastes in question are required as a raw material for recycling or recovery industries in the State of import; or

(c) The transboundary movement in question is in accordance with other criteria to be decided by the Parties, provided those criteria do not differ from the objectives of this Convention.

10. The obligation under this Convention of States in which hazardous wastes and other wastes are generated to require that those wastes are managed in an environmentally sound manner may not under any circumstances be transferred to the States of import or transit.

11. Nothing in this Convention shall prevent a Party from imposing additional requirements that are consistent with the provisions of this Convention, and are in accordance with the rules of international law, in order better to protect human health and the environment.

12. Nothing in this Convention shall affect in any way the sovereignty of States over their territorial sea established in accordance with international law, and the sovereign rights and the jurisdiction which States have in their exclusive economic zones and their continental shelves in accordance with international law, and the exercise by ships and aircraft of all States of navigational rights and freedoms as provided for in international law and as reflected in relevant international instruments.

13. Parties shall undertake to review periodically the possibilities for the reduction of the amount and/or the pollution potential of hazardous wastes and other wastes which are exported to other States, in particular to developing countries.

Article 5

Designation of Competent Authorities and Focal Point

To facilitate the implementation of this Convention, the Parties shall:

1. Designate or establish one or more competent authorities and one focal point. One competent authority shall be designated to receive the notification in case of a State of transit.

2. Inform the Secretariat, within three months of the date of the entry into force of this Convention for them, which agencies they have designated as their focal point and their competent authorities.

3. Inform the Secretariat, within one month of the date of decision, of any changes regarding the designation made by them under paragraph 2 above.

Article 6

Transboundary Movement between Parties

1. The State of export shall notify, or shall require the generator or exporter to notify, in writing, through the channel of the competent authority of the State of export, the competent authority of the States concerned of any proposed transboundary movement of hazardous wastes or other wastes. Such notification shall contain the declarations and information specified in Annex V A, written in a language acceptable to the State of import. Only one notification needs to be sent to each State concerned.

2. The State of import shall respond to the notifier in writing, consenting to the movement with or without conditions, denying permission for the movement, or requesting additional information. A copy of the final response of the State of import shall be sent to the competent authorities of the States concerned which are Parties.

3. The State of export shall not allow the generator or exporter to commence the transboundary movement until it has received written confirmation that:

(a) The notifier has received the written consent of the State of import; and

(b) The notifier has received from the State of import confirmation of the existence of a contract between the exporter and the disposer specifying environmentally sound management of the wastes in question.

4. Each State of transit which is a Party shall promptly acknowledge to the notifier receipt of the notification. It may subsequently respond to the notifier in writing, within 60 days, consenting to the movement with or without conditions, denying permission for the movement, or requesting additional information. The State of export shall not allow the transboundary movement to commence until it has received the written consent of the State of transit. However, if at any time a Party decides not to require prior written consent, either generally or under specific conditions, for transit transboundary movements of hazardous wastes or other wastes, or modifies its requirements in this respect, it shall forthwith inform the other Parties of its decision pursuant to Article 13. In this latter case, if no response is received by the State of export within 60 days of the receipt of a given notification by the State of transit, the State of export may allow the export to proceed through the State of transit.

5. In the case of a transboundary movement of wastes where the wastes are legally defined as or considered to be hazardous wastes only:

(a) By the State of export, the requirements of paragraph 9 of this Article that apply to the importer or disposer and the State of import shall apply mutatis mutandis to the exporter and State of export, respectively;

(b) By the State of import, or by the States of import and transit which are Parties, the requirements of paragraphs 1, 3, 4 and 6 of this Article that apply to the exporter and State of export shall apply mutatis mutandis to the importer or disposer and State of import, respectively; or

(c) By any State of transit which is a Party, the provisions of paragraph 4 shall apply to such State.

6. The State of export may, subject to the written consent of the States concerned, allow the generator or the exporter to use a general notification where hazardous wastes or other wastes having the same physical and chemical characteristics are shipped regularly to the same disposer via the same customs office of exit of the State of export via the same customs office of entry of the State of import, and, in the case of transit, via the same customs office of entry and exit of the State or States of transit.

7. The States concerned may make their written consent to the use of the general notification referred to in paragraph 6 subject to the supply of certain information, such as the exact quantities or periodical lists of hazardous wastes or other wastes to be shipped.

8. The general notification and written consent referred to in paragraphs 6 and 7

may cover multiple shipments of hazardous wastes or other wastes during a maximum period of 12 months.

9. The Parties shall require that each person who takes charge of a transboundary movement of hazardous wastes or other wastes sign the movement document either upon delivery or receipt of the wastes in question. They shall also require that the disposer inform both the exporter and the competent authority of the State of export of receipt by the disposer of the wastes in question and, in due course, of the completion of disposal as specified in the notification. If no such information is received within the State of export, the competent authority of the State of export or the exporter shall so notify the State of import.

10. The notification and response required by this Article shall be transmitted to the competent authority of the Parties concerned or to such governmental authority as may be appropriate in the case of non-Parties.

11. Any transboundary movement of hazardous wastes or other wastes shall be covered by insurance, bond or other guarantee as may be required by the State of import or any State of transit which is a Party.

Article 7

Transboundary Movement from a Party through

States which are not Parties

Paragraph 1 of Article 6 of the Convention shall apply mutatis mutandis to transboundary movement of hazardous wastes or other wastes from a Party through a State or States which are not Parties.

Article 8

Duty to Re-import

When a transboundary movement of hazardous wastes or other wastes to which the consent of the States concerned has been given, subject to the provisions of this Convention, cannot be completed in accordance with the terms of the contract, the State of export shall ensure that the wastes in question are taken back into the State of export, by the exporter, if alternative arrangements cannot be made for their disposal in an environmentally sound manner, within 90 days from the time that the importing State informed the State of export and the Secretariat, or such other period of time as the States concerned agree. To this end, the State of export and any Party of transit shall not oppose, hinder or prevent the return of those wastes to the State of export.

Article 9

Illegal Traffic

1. For the purpose of this Convention, any transboundary movement of hazardous wastes or other wastes:

(a) without notification pursuant to the provisions of this Convention to all States concerned; or

(b) without the consent pursuant to the provisions of this Convention of a State concerned; or

(c) with consent obtained from States concerned through falsification, misrepresentation or fraud; or

(d) that does not conform in a material way with the documents; or

(e) that results in deliberate disposal (e.g. dumping) of hazardous wastes or other wastes in contravention of this Convention and of general principles of international law,

shall be deemed to be illegal traffic.

2. In case of a transboundary movement of hazardous wastes or other wastes deemed to be illegal traffic as the result of conduct on the part of the exporter or generator, the State of export shall ensure that the wastes in question are:

(a) taken back by the exporter or the generator or, if necessary, by itself into the State of export, or, if impracticable,

(b) are otherwise disposed of in accordance with the provisions of this Convention,

within 30 days from the time the State of export has been informed about the illegal traffic or such other period of time as States concerned may agree. To this end the Parties concerned shall not oppose, hinder or prevent the return of those wastes to the State of export.

3. In the case of a transboundary movement of hazardous wastes or other wastes deemed to be illegal traffic as the result of conduct on the part of the importer or disposer, the State of import shall ensure that the wastes in question are disposed of in an environmentally sound manner by the importer or disposer or, if necessary, by itself within 30 days from the time the illegal traffic has come to the

attention of the State of import or such other period of time as the States concerned may agree. To this end, the Parties concerned shall co-operate, as necessary, in the disposal of the wastes in an environmentally sound manner.

4. In cases where the responsibility for the illegal traffic cannot be assigned either to the exporter or generator or to the importer or disposer, the Parties concerned or other Parties, as appropriate, shall ensure, through co-operation, that the wastes in question are disposed of as soon as possible in an environmentally sound manner either in the State of export or the State of import or elsewhere as appropriate.

5. Each Party shall introduce appropriate national/domestic legislation to prevent and punish illegal traffic. The Parties shall co-operate with a view to achieving the objects of this Article.

Article 10

International Co-operation

1. The Parties shall co-operate with each other in order to improve and achieve environmentally sound management of hazardous wastes and other wastes.

2. To this end, the Parties shall:

(a) Upon request, make available information, whether on a bilateral or multilateral basis, with a view to promoting the environmentally sound management of hazardous wastes and other wastes, including harmonization of technical standards and practices for the adequate management of hazardous wastes and other wastes;

(b) Co-operate in monitoring the effects of the management of hazardous wastes on human health and the environment;

(c) Co-operate, subject to their national laws, regulations and policies, in the development and implementation of new environmentally sound low-waste technologies and the improvement of existing technologies with a view to eliminating, as far as practicable, the generation of hazardous wastes and other wastes and achieving more effective and efficient methods of ensuring their management in an environmentally sound manner, including the study of the economic, social and environmental effects of the adoption of such new or improved technologies;

(d) Co-operate actively, subject to their national laws, regulations and policies, in the transfer of technology and management systems related to the environmentally sound management of hazardous wastes and other wastes. They shall also co-operate in developing the technical capacity among Parties, especially those which may need and request technical assistance in this field;

(e) Co-operate in developing appropriate technical guidelines and/or codes of practice.

3. The Parties shall employ appropriate means to co-operate in order to assist developing countries in the implementation of subparagraphs a, b, c and d of paragraph 2 of Article 4.

4. Taking into account the needs of developing countries, co-operation between Parties and the competent international organizations is encouraged to promote, inter alia, public awareness, the development of sound management of hazardous wastes and other wastes and the adoption of new low-waste technologies.

Article 11

Bilateral, Multilateral and Regional Agreements

1. Notwithstanding the provisions of Article 4 paragraph 5, Parties may enter into bilateral, multilateral, or regional agreements or arrangements regarding transboundary movement of hazardous wastes or other wastes with Parties or non-Parties provided that such agreements or arrangements do not derogate from the environmentally sound management of hazardous wastes and other wastes as required by this Convention. These agreements or arrangements shall stipulate provisions which are not less environmentally sound than those provided for by this Convention in particular taking into account the interests of developing countries.

2. Parties shall notify the Secretariat of any bilateral, multilateral or regional agreements or arrangements referred to in paragraph 1 and those which they have entered into prior to the entry into force of this Convention for them, for the purpose of controlling transboundary movements of hazardous wastes and other wastes which take place entirely among the Parties to such agreements. The provisions of this Convention shall not affect transboundary movements which take place pursuant to such agreements provided that such agreements are compatible with the environmentally sound management of hazardous wastes and other wastes as required by this Convention.

Article 12

Consultations on Liability

The Parties shall co-operate with a view to adopting, as soon as practicable, a protocol setting out appropriate rules and procedures in the field of liability and compensation for damage resulting from the transboundary movement and disposal of hazardous wastes and other wastes.

Article 13

Transmission of Information

1. The Parties shall, whenever it comes to their knowledge, ensure that, in the case of an accident occurring during the transboundary movement of hazardous wastes or other wastes or their disposal, which are likely to present risks to human health and the environment in other States, those states are immediately informed.

2. The Parties shall inform each other, through the Secretariat, of:

(a) Changes regarding the designation of competent authorities and/or focal points, pursuant to Article 5;

(b) Changes in their national definition of hazardous wastes, pursuant to Article 3;

and, as soon as possible,

(c) Decisions made by them not to consent totally or partially to the import of hazardous wastes or other wastes for disposal within the area under their national jurisdiction;

(d) Decisions taken by them to limit or ban the export of hazardous wastes or other wastes;

(e) Any other information required pursuant to paragraph 4 of this Article.

3. The Parties, consistent with national laws and regulations, shall transmit, through the Secretariat, to the Conference of the Parties established under Article 15, before the end of each calendar year, a report on the previous calendar year, containing the following information:

(a) Competent authorities and focal points that have been designated by them pursuant to Article 5;

(b) Information regarding transboundary movements of hazardous wastes or other wastes in which they have been involved, including:

(i) The amount of hazardous wastes and other wastes exported, their category, characteristics, destination, any transit country and disposal method as stated on the response to notification;

(ii) The amount of hazardous wastes and other wastes imported, their category, characteristics, origin, and disposal methods;

(iii) Disposals which did not proceed as intended;

(iv) Efforts to achieve a reduction of the amount of hazardous wastes or other wastes subject to transboundary movement;

(c) Information on the measures adopted by them in implementation of this Convention;

(d) Information on available qualified statistics which have been compiled by them on the effects on human health and the environment of the generation, transportation and disposal of hazardous wastes or other wastes;

(e) Information concerning bilateral, multilateral and regional agreements and arrangements entered into pursuant to Article 11 of this Convention;

(f) Information on accidents occurring during the transboundary movement and disposal of hazardous wastes and other wastes and on the measures undertaken to deal with them;

(g) Information on disposal options operated within the area of their national jurisdiction;

(h) Information on measures undertaken for development of technologies for the reduction and/or elimination of production of hazardous wastes and other wastes; and

(i) Such other matters as the Conference of the Parties shall deem relevant.

4. The Parties, consistent with national laws and regulations, shall ensure that copies of each notification concerning any given transboundary movement of hazardous wastes or other wastes, and the response to it, are sent to the Secretariat when a Party considers that its environment may be affected by that transboundary movement has requested that this should be done.

Article 14

Financial Aspects

1. The Parties agree that, according to the specific needs of different regions and subregions, regional or sub-regional centres for training and technology transfers

regarding the management of hazardous wastes and other wastes and the minimization of their generation should be established. The Parties shall decide on the establishment of appropriate funding mechanisms of a voluntary nature.

2. The Parties shall consider the establishment of a revolving fund to assist on an interim basis in case of emergency situations to minimize damage from accidents arising from transboundary movements of hazardous wastes and other wastes or during the disposal of those wastes.

Article 15

Conference of the Parties

1. A Conference of the Parties is hereby established. The first meeting of the Conference of the Parties shall be convened by the Executive Director of UNEP not later than one year after the entry into force of this Convention. Thereafter, ordinary meetings of the Conference of the Parties shall be held at regular intervals to be determined by the Conference at its first meeting.

2. Extraordinary meetings of the Conference of the Parties shall be held at such other times as may be deemed necessary by the Conference, or at the written request of any Party, provided that, within six months of the request being communicated to them by the Secretariat, it is supported by at least one third of the Parties.

3. The Conference of the Parties shall by consensus agree upon and adopt rules of procedure for itself and for any subsidiary body it may establish, as well as financial rules to determine in particular the financial participation of the Parties under this Convention.

4. The Parties at their first meeting shall consider any additional measures needed to assist them in fulfilling their responsibilities with respect to the protection and the preservation of the marine environment in the context of this Convention.

5. The Conference of the Parties shall keep under continuous review and evaluation the effective implementation of this Convention, and, in addition, shall:

(a) Promote the harmonization of appropriate policies, strategies and measures for minimizing harm to human health and the environment by hazardous wastes and other wastes;

(b) Consider and adopt, as required, amendments to this Convention and its annexes, taking into consideration, inter alia, available scientific, technical, economic and environmental information;

(c) Consider and undertake any additional action that may be required for the achievement of the purposes of this Convention in the light of experience gained in its operation and in the operation of the agreements and arrangements envisaged in Article 11;

(d) Consider and adopt protocols as required; and

(e) Establish such subsidiary bodies as are deemed necessary for the implementation of this Convention.

6. The United Nations, its specialized agencies, as well as any State not Party to this Convention, may be represented as observers at meetings of the Conference of the Parties. Any other body or agency, whether national or international, governmental or non-governmental, qualified in fields relating to hazardous wastes or other wastes which has informed the Secretariat of its wish to be represented as an observer at a meeting of the Conference of Parties, may be admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Conference of the Parties.

7. The Conference of the Parties shall undertake three years after the entry into force of this Convention, and at least every six years thereafter, an evaluation of its effectiveness and, if deemed necessary, to consider the adoption of a complete or partial ban of transboundary movements of hazardous wastes and other wastes in light of the latest scientific, environmental, technical and economic information.

Article 16

Secretariat

1. The functions of the Secretariat shall be:

(a) To arrange for and service meetings provided for in Articles 15 and 17;

(b) To prepare and transmit reports based upon information received in accordance with Articles 3, 4, 6, 11 and 13 as well as upon information derived from meetings of subsidiary bodies established under Article 15 as well as upon, as appropriate, information provided by relevant intergovernmental and non-governmental entities;

(c) To prepare reports on its activities carried out in implementation of its functions under this Convention and present them to the Conference of the Parties;

(d) To ensure the necessary coordination with relevant international bodies, and in particular to enter into such administrative and contractual arrangements as may be required for the effective discharge of its function;

(e) To communicate with Focal Points and Competent Authorities established by the Parties in accordance with Article 5 of this Convention;

(f) To compile information concerning authorized national sites and facilities of Parties available for the disposal of their hazardous wastes and other wastes and to circulate this information among Parties;

(g) To receive and convey information from and to Parties on:

- sources of technical assistance and training;

- available technical and scientific know-how;

- sources of advice and expertise; and

- availability of resources

with a view to assisting them, upon request, in such areas as:

- the handling of the notification system of this Convention;

- the management of hazardous wastes and other wastes;

- environmentally sound technologies relating to hazardous wastes and other wastes; such as low- and non-waste technology;

- the assessment of disposal capabilities and sites;

- the monitoring of hazardous wastes and other wastes; and

- emergency responses;

(h) To provide Parties, upon request, with information on consultants or consulting firms having the necessary technical competence in the field, which can assist them to examine a notification for a transboundary movement, the concurrence of a shipment of hazardous wastes or other wastes with the relevant notification, and/or the fact that the proposed disposal facilities for hazardous wastes or other wastes are environmentally sound, when they have reason to believe that the wastes in question will not be managed in an environmentally sound manner. Any such examination would not be at the expense of the Secretariat;

(i) To assist Parties upon request in their identification of cases of illegal traffic and to circulate immediately to the Parties concerned any information it has received regarding illegal traffic;

(j) To co-operate with Parties and with relevant and competent international organizations and agencies in the provision of experts and equipment for the purpose of rapid assistance to States in the event of an emergency situation; and

(k) To perform such other functions relevant to the purposes of this Convention as may be determined by the Conference of the Parties.

2. The Secretariat functions will be carried out on an interim basis by UNEP until the completion of the first meeting of the Conference of the Parties held pursuant to Article 15.

3. At its first meeting, the Conference of the Parties shall designate the Secretariat from among those existing competent intergovernmental organizations which have signified their willingness to carry out the Secretariat functions under this Convention. At this meeting, the Conference of the Parties shall also evaluate the implementation by the interim Secretariat of the functions assigned to it, in particular under paragraph 1 above, and decide upon the structures appropriate for those functions.

Article 17

Amendment of the Convention

1. Any Party may propose amendments to this Convention and any Party to a protocol may propose amendments to that protocol. Such amendments shall take due account, inter alia, of relevant scientific and technical considerations.

2. Amendments to this Convention shall be adopted at a meeting of the Conference of the Parties. Amendments to any protocol shall be adopted at a meeting of the Parties to the protocol in question. The text of any proposed amendment to this Convention or to any protocol, except as may otherwise be provided in such protocol, shall be communicated to the Parties by the Secretariat at least six months before the meeting at which it is proposed for adoption. The Secretariat shall also communicate proposed amendments to the Signatories to this Convention for information.

3. The Parties shall make every effort to reach agreement on any proposed amendment to this Convention by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority of the Parties present and voting at the

meeting, and shall be submitted by the Depositary to all Parties for ratification, approval, formal confirmation or acceptance.

4. The procedure mentioned in paragraph 3 above shall apply to amendments to any protocol, except that a two-thirds majority of the Parties to that protocol present and voting at the meeting shall suffice for their adoption.

5. Instruments of ratification, approval, formal confirmation or acceptance of amendments shall be deposited with the Depositary. Amendments adopted in accordance with paragraphs 3 or 4 above shall enter into force between Parties having accepted them on the ninetieth day after the receipt by the Depositary of their instrument of ratification, approval, formal confirmation or acceptance by at least three-fourths of the Parties who accepted them or by at least two thirds of the Parties to the protocol concerned who accepted them, except as may otherwise be provided in such protocol. The amendments shall enter into force for any other Party on the ninetieth day after that Party deposits its instrument of ratification, approval, formal confirmation or acceptance of the amendments.

6. For the purpose of this Article, "Parties present and voting" means Parties present and casting an affirmative or negative vote.

Article 18

Adoption and Amendment of Annexes

1. The annexes to this Convention or to any protocol shall form an integral part of this Convention or of such protocol, as the case may be and, unless expressly provided otherwise, a reference to this Convention or its protocols constitutes at the same time a reference to any annexes thereto. Such annexes shall be restricted to scientific, technical and administrative matters.

2. Except as may be otherwise provided in any protocol with respect to its annexes, the following procedure shall apply to the proposal, adoption and entry into force of additional annexes to this Convention or of annexes to a protocol:

(a) Annexes to this Convention and its protocols shall be proposed and adopted according to the procedure laid down in Article 17, paragraphs 2, 3 and 4;

(b) Any Party that is unable to accept an additional annex to this Convention or an annex to any protocol to which it is party shall so notify the Depositary, in writing, within six months from the date of the communication of the adoption by the Depositary. The Depositary shall without delay notify all Parties of any such notification received. A Party may at any time substitute an acceptance for a previous declaration of objection and the annexes shall thereupon enter into force for that Party;

(c) On the expiry of six months from the date of the circulation of the communication by the Depositary, the annex shall become effective for all Parties to this Convention or to any protocol concerned, which have not submitted a notification in accordance with the provision of subparagraph (b) above.

3. The proposal, adoption and entry into force of amendments to annexes to this Convention or to any protocol shall be subject to the same procedure as for the proposal, adoption and entry into force of annexes to the Convention or annexes to a protocol. Annexes and amendments thereto shall take due account, inter alia, of relevant scientific and technical considerations.

4. If an additional annex or an amendment to an annex involves an amendment to this Convention or to any protocol, the additional annex or amended annex shall not enter into force until such time the amendment to this Convention or to the protocol enters into force.

Article 19

Verification

Any Party which has reason to believe that another Party is acting or has acted in breach of its obligations under this Convention may inform the Secretariat thereof, and in such an event, shall simultaneously and immediately inform, directly or through the Secretariat, the Party against whom the allegations are made. All relevant information should be submitted by the Secretariat to the Parties.

Article 20

Settlement of Disputes

1. In case of a dispute between Parties as to the interpretation or application of, or compliance with, this Convention or any protocol thereto, they shall seek a settlement of the dispute through negotiation or any other peaceful means of their own choice.

2. If the Parties concerned cannot settle their dispute through the means mentioned in the preceding paragraph, the dispute, if the Parties to the dispute agree, shall be submitted to the International Court of Justice or to arbitration under the conditions set out in Annex VI on Arbitration. However, failure to reach common agreement on submission of the dispute to the International Court of Justice or to arbitration shall not absolve the Parties from the responsibility of continuing to seek to resolve it by the means referred to in paragraph 1.

3. When ratifying, accepting, approving, formally confirming or acceding to this Convention, or at any time thereafter, a State or political and/or economic integration organization may declare that it recognizes as compulsory ipso facto and without special agreement, in relation to any Party accepting the same obligation:

(a) submission of the dispute to the International Court of Justice; and/or

(b) arbitration in accordance with the procedures set out in Annex VI.

Such declaration shall be notified in writing to the Secretariat which shall communicate it to the Parties.

Article 21

Signature

This Convention shall be open for signature by States, by Namibia, represented by the United Nations Council for Namibia, and by political and/or economic integration organizations, in Basel on 22 March 1989, at the Federal Department of Foreign Affairs of Switzerland in Berne from 23 March 1989 to 30 June 1989 and at United Nations Headquarters in New York from 1 July 1989 to 22 March 1990.

Article 22

Ratification, Acceptance, Formal Confirmation or Approval

1. This Convention shall be subject to ratification, acceptance or approval by States and by Namibia, represented by the United Nations Council for Namibia, and to formal confirmation or approval by political and/or economic integration organizations. Instruments of ratification, acceptance, formal confirmation, or approval shall be deposited with the Depositary.

2. Any organization referred to in paragraph 1 above which becomes a Party to this Convention without any of its members States being a Party shall be bound by all the obligations under the Convention. In the case of such organizations, one or more of whose member States is a Party to the Convention, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under the Convention. In such cases, the organization and the member States shall not be entitled to exercise rights under the Convention concurrently.

3. In their instruments of formal confirmation or approval, the organizations

referred to in paragraph 1 above shall declare the extent of their competence with respect to the matters governed by the Convention. These organizations shall also inform the Depositary, who will inform the Parties of any substantial modification in the extent of their competence.

Article 23

Accession

1. This Convention shall be open for accession by States, by Namibia, represented by the United Nations Council for Namibia, and by political and/or economic integration organizations from the day after the date on which the Convention is closed for signature. The instruments of accession shall be deposited with the Depositary.

2. In their instruments of accession, the organizations referred to in paragraph 1 above shall declare the extent of their competence with respect to the matters governed by the Convention. These organizations shall also inform the Depositary of any substantial modification in the extent of their competence.

3. The provisions of Article 22, paragraph 2, shall apply to political and/or economic integration organizations which accede to this Convention.

Article 24

Right to Vote

1. Except as provided for in paragraph 2 below, each Contracting Party to this Convention shall have one vote.

2. Political and/or economic integration organizations, in matters within their competence, in accordance with Article 22, paragraph 3, and Article 23, paragraph 2, shall exercise their right to vote with a number of votes equal to the number of their member States which are Parties to the Convention or the relevant protocol. Such organizations shall not exercise their right to vote if their member States exercise theirs, and vice versa.

Article 25

Entry into Force

1. This Convention shall enter into force on the ninetieth day after the day of deposit of the twentieth instrument of ratification, acceptance, formal confirmation, approval or accession.

2. For each State or political and/or economic integration organization which ratifies, accepts, approves or formally confirms this Convention or accedes thereto after the date of the deposit of the twentieth instrument of ratification, acceptance, approval, formal confirmation or accession, it shall enter into force on the ninetieth day after the date of deposit by such State or political and/or economic integration organization of its instrument of ratification, acceptance, approval, formal confirmation or accession.

3. For the purpose of paragraphs 1 and 2 above, any instrument deposited by a political and/or economic integration organization shall not be counted as additional to those deposited by member States of such organization.

Article 26

Reservations and Declarations

1. No reservation or exception may be made to this Convention.

2. Paragraph 1 of this Article does not preclude a State or political and/or economic integration organization, when signing, ratifying, accepting, approving, formally confirming or acceding to this Convention, from making declarations or statements, however phrased or named, with a view, inter alia, to the harmonization of its laws and regulations with the provisions of this Convention, provided that such declarations or statements do not purport to exclude or to modify the legal effects of the provisions of the Convention in their application to that State.

Article 27

Withdrawal

1. At any time after three years from the date on which this Convention has entered into force for a Party, that Party may withdraw from the Convention by giving written notification to the Depositary.

2. Withdrawal shall be effective one year from receipt of notification by the Depositary, or on such later date as may be specified in the notification.

Article 28

Depository

The Secretary-General of the United Nations shall be the Depository of this Convention and of any protocol thereto.

Article 29

Authentic texts

The original Arabic, Chinese, English, French, Russian and Spanish texts of this Convention are equally authentic.

IN WITNESS WHEREOF the undersigned, being duly authorized to that effect, have signed this Convention.

Done at..................................on the.............day of...................................1989

Footnotes

1. Characterization of wastes: ....

2. Corresponds to the hazard classification system included in the United Nations Recommendations on the Transport of Dangerous Goods (ST/SG/AC.10/1Rev.5, United Nations, New York, 1988)

3. Decision III/1 (AMENDMENT TO THE BASEL CONVENTION)
The Conference,
Decides to adopt the following amendment to the Convention:
"Insert new preambular paragraph 7 bis:
Recognizing that transboundary movements of hazardous wastes, especially to developing countries, have a high risk of not constituting an environmentally sound management of hazardous wastes as required by this Convention;
Insert new Article 4A:
1. Each Party listed in Annex VII shall prohibit all transboundary movements of hazardous wastes which are destined for operations according to Annex IV A, to States not listed in Annex VII.
2. Each Party listed in Annex VII shall phase out by 31 December 1997, and prohibit as of that date, all transboundary movements of hazardous wastes under Article 1(I)(a) of the Convention which are destined for operations according to Annex IV B to States not listed in Annex VII. Such transboundary movement shall not be prohibited unless the wastes in question are characterised as hazardous under the Convention.

APPENDIX 2 Convention on the Organisation for Economic Co-operation and Development

PARIS 14th December 1960

THE GOVERNMENTS of the Republic of Austria, the Kingdom of Belgium, Canada, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Kingdom of Greece, the Republic of Iceland, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Kingdom of Norway, the Portuguese Republic, Spain, the Kingdom of Sweden, the Swiss Confederation, the Turkish Republic, the United Kingdom of Great Britain and Northern Ireland, and the United States of America;

CONSIDERING that economic strength and prosperity are essentiel for the attainment of the purposes of the United Nations, the preservation of individuel liberty and the increase of general well-being;

BELIEVING that they can further these aims most effectively by strengthening the tradition of co-operation which has evolved among them;

RECOGNISING that the economic recovery and progress of Europe to which their participation in the Organisation for European Economic Co-operation has made a major contribution, have opened new perspectives for strengthening that tradition and applying it to new tasks and broader objectives;

CONVINCED that broader co-operation will make a vital contribution to peaceful and harmonious relations among the peoples of the world;

RECOGNISING the increasing interdependence of their economies;

DETERMINED by consultation and co-operation to use more effectively their capacities and potentialities so as to promote the highest sustainable growth of their economies and improve the economic and social well-being of their peoples;

BELIEVING that the economically more advanced nations should co-operate in assisting to the best of their ability the countries in process of economic development;

RECOGNISING that the further expansion of world trade is one of the most important factors favouring the economic development of countries and the improvement of international economic relations; and

DETERMINED to pursue these purposes in a manner consistent with their obligations in other international organisations or institutions in which they participate or under agreements to which they are a party;

HAVE THEREFORE AGREED on the following provisions for the reconstitution of the Organisation for European Economic Co-operation as the Organisation for Economic Co-operation and Development:

Article 1

The aims of the Organisation for Economic Co-operation and Development (hereinafter called the "Organisation") shall be to promote policies designed:

(a) to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;

(b) to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and

(c) to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

Article 2

In the pursuit of these aims, the Members agree that they will, both individually and jointly:

(a) promote the efficient use of their economic resources;

(b) in the scientific and technological field, promote the development of their resources, encourage research and promote vocational training;

(c) pursue policies designed to achieve economic growth and internal and external financial stability and to avoid developments which might endanger their economies or those of other countries;

(d) pursue their efforts to reduce or abolish obstacles to the exchange of goods and services and current payments and maintain and extend the liberalisation of capital movements; and

(e) contribute to the economic development of both Member and non-member countries in the process of economic development by appropriate means and, in particular, by the flow of capital to those countries, having regard to the importance to their economies of receiving technical assistance and of securing expanding export markets.

Article 3

With a view to achieving the aims set out in Article 1 and to fulfilling the undertakings contained in Article 2, the Members agree that they will:

(a) keep each other informed and furnish the Organisation with the information necessary for the accomplishment of its tasks;

(b) consult together on a continuing basis, carry out studies and participate in agreed projects; and

(c) co-operate closely and where appropriate take co-ordinated action.

Article 4

The Contracting Parties to this Convention shall be Members of the Organisation.

Article 5

In order to achieve its aims, the Organisation may:

(a) take decisions which, except as otherwise provided, shall be binding on all the Members;

(b) make recommendations to Members; and

(c) enter into agreements with Members, non-member States and international organisations.

Article 6

1. Unless the Organisation otherwise agrees unanimously for special cases, decisions shall be taken and recommendations shall be made by mutual agreement of all the Members.

2. Each Member shall have one vote. If a Member abstains from voting on a decision or recommendation, such abstention shall not invalidate the decision or recommendation, which shall be applicable to the other Members but not to the abstaining Member.

3. No decision shall be binding on any Member until it has complied with the requirements of its own constitutional procedures. The other Members may agree that such a decision shall apply provisionally to them.

Article 7

A Council composed of all the Members shall be the body from which all acts of the Organisation derive. The Council may meet in sessions of Ministers or of Permanent Representatives.

Article 8

The Council shall designate each year a Chairman, who shall preside at its ministerial sessions, and two Vice-Chairmen. The Chairman may be designated to serve one additional consecutive term.

Article 9

The Council may establish an Executive Committee and such subsidiary bodies as may be required for the achievement of the aims of the Organisation.

Article 10

1. A Secretary-General responsible to the Council shall be appointed by the Council for a term of five years. He shall be assisted by one or more Deputy Secretaries-General or Assistant Secretaries-General appointed by the Council on the recommendation of the Secretary-General.

2. The Secretary-General shall serve as Chairman of the Council meeting at sessions of Permanent Representatives. He shall assist the Council in all appropriate ways and may submit proposals to the Council or to any other body of the Organisation.

Article 11

1. The Secretary-General shall appoint such staff as the Organisation may require in accordance with plans of organisation approved by the Council. Staff regulations shall be subject to approval by the Council.

2. Having regard to the international character of the Organisation, the Secretary-General, the Deputy or Assistant Secretaries-General and the staff shall neither seek nor receive instructions from any of the Members or from any Government or authority external to the Organisation.

Article 12

Upon such terms and conditions as the Council may determine, the Organisation may:

(a) address communications to non-member States or organisations;

(b) establish and maintain relations with non-member States or organisations; and

(c) invite non-member Governments or organisations to participate in activities of the Organisation.

Article 13

Representation in the Organisation of the European Communities established by the Treaties of Paris and Rome of 18th April, 1951, and 25th March, 1957, shall be as defined in Supplementary Protocol No. 1 to this Convention.

Article 14

1. This Convention shall be ratified or accepted by the Signatories in accordance with their respective constitutional requirements.

2. Instruments of ratification or acceptance shall be deposited with the Government of the French Republic, hereby designated as depositary Government.

3. This Convention shall come into force:

a) before 30th September, 1961, upon the deposit of instruments of ratification or acceptance by all the Signatories; or

(b) on 30th September, 1961, if by that date fifteen Signatories or more have deposited such instruments as regards those Signatories; and thereafter as regards any other Signatory upon the deposit of its instrument of ratification or acceptance;

(c) after 30th September, 1961, but not later than two years from the signature of this Convention, upon the deposit of such instruments by fifteen Signatories, as regards those Signatories; and thereafter as regards any other Signatory upon the deposit of its instrument of ratification or acceptance.

4. Any Signatory which has not deposited its instrument of ratification or acceptance when the Convention comes into force may take part in the activities of the Organisation upon conditions to be determined by agreement between the Organisation and such Signatory.

Article 15

When this Convention comes into force the reconstitution of the Organisation for European Economic Co-operation shall take effect, and its aims, organs, powers and name shall thereupon be as provided herein. The legal personality possessed by the Organisation for European Economic Co-operation shall continue in the Organisation, but decisions, recommendations and resolutions of the Organisation for European Economic Co-operation shall require approval of the Council to be effective after the coming into force of this Convention.

Article 16

The Council may decide to invite any Government prepared to assume the obligations of membership to accede to this Convention. Such decisions shall be unanimous, provided that for any particular case the Council may unanimously decide to permit abstention, in which case, notwithstanding the provisions of Article 6, the decision shall be applicable to all the Members. Accession shall take effect upon the deposit of an instrument of accession with the depositary Government.

Article 17

Any Contracting Party may terminate the application of this Convention to itself by giving twelve months' notice to that effect to the depositary Government.

Article 18

The Headquarters of the Organisation shall be in Paris, unless the Council agrees otherwise.

Article 19

The legal capacity of the Organisation and the privileges, exemptions, and immunities of the Organisation, its officials and representatives to it of the Members shall be as provided in Supplementary Protocol No. 2 to this Convention.

Article 20

1. Each year, in accordance with Financial Regulations adopted by the Council, the Secretary-General shall present to the Council for approval an annual budget, accounts, and such subsidiary budgets as the Council shall request.

2. General expenses of the Organisation, as agreed by the Council, shall be apportioned in accordance with a scale to be decided upon by the Council. Other expenditure shall be financed on such basis as the Council may decide.

Article 21

Upon the receipt of any instrument of ratification, acceptance or accession, or of any notice of termination, the depositary Government shall give notice thereof to all the Contracting Parties and to the Secretary-General of the Organisation.

IN WITNESS WHEREOF, the undersigned Plenipotentiaries, duly empowered, have appended their signatures to this Convention.

DONE in Paris, this fourteenth day of December, Nineteen Hundred and Sixty, in the English and French languages, both texts being equally authentic, in a single copy which shall be deposited with the depositary Government, by whom certified copies will be communicated to all the Signatories.

Decision of the Council concerning the Document for Transfrontier Movements of Wastes

---

ENVIRONMENT

28 July 1994 - C(94)154/FINAL

THE COUNCIL,

Having regard to Article 5 a) of the Convention on the Organisation for Economic Co-operation and Development of 14 December 1960;

Having regard to the Decision-Recommendation of the Council of 1 February 1984 on Transfrontier Movements of Hazardous Waste [C(83)180(Final)] which requires Member countries to control transfrontier movements of hazardous waste;

Having regard to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, adopted on 22 March 1989, and noting that most Member countries and the European Community have become parties of this Convention;

Having regard to the Decision of the Council of 30 March 1992 concerning the Control of Transfrontier Movements of Wastes destined for Recovery Operations [C(92)39/FINAL] as amended on 23 July 1993 [C(93)74/FINAL] and on 28 and 29 July 1994 [C(94)153/FINAL];

Having regard to the European Community Regulation on the Supervision and Control of Shipments of Waste within, into and out of the European Community;

Considering that the implementation of the control system established by Council Decision C(92)39/FINAL calls for the development of a uniform document to provide the information required for notification and tracking of transfrontier movements of wastes destined for recovery operations within the OECD area;

Considering that member countries have expressed the wish that the document for transfrontier movement of wastes called for by Council Decision C(92)39/FINAL be developed in such a way that it could be used not only for movements to be controlled by this Decision but also for those to be controlled by the Basel Convention and the EC Regulation and that, therefore, its use should not be made mandatory as orginally envisaged by Council Decision C(92)39/FINAL;

Noting that the Commission of the European Communities is proposing to use the document developed by the OECD for transfrontier movements to be controlled by the EC Regulation;

On the proposal of the Environment Policy Committee;

I. **DECIDES** that paragraph C of Appendix 2 of Annex I to Council Decision C(92)39/FINAL be amended as follows:

"C. It is recommended that Member countries use the Document hereunder for Transfrontier Movement of Wastes, comprising a Notification Form and a Movement/tracking Form, to provide the information required to control transfrontier movements of wastes destined for recovery operations within the OECD area."

II. **REQUESTS** the Secretary-General to pursue discussions with the Secretariat of the Basel Convention to assess whether the Document for Transfrontier Movement of Wastes could also be used for transfrontier movements to be controlled by the Basel Convention.

APPENDIX 3 UNCED Rio Declaration

20.1. Effective control of the generation, storage, treatment, recycling and reuse, transport, recovery and disposal of hazardous wastes is of paramount importance for proper health, environmental protection and natural resource management, and sustainable development. This will require the active cooperation and participation of the international community, Governments and industry. Industry, as referred to in this paper, shall include large industrial enterprises, including trans national corporations and domestic industry.

20.2. Prevention of the generation of hazardous wastes and the rehabilitation of contaminated sites are the key elements, and both require knowledge, experienced people, facilities, financial resources and technical and scientific capacities.

20.3. The activities outlined in the present chapter are very closely related to, and have implications for, many of the programme areas described in other chapters, so that an overall integrated approach to hazardous waste management is necessary.

20.4. There is international concern that part of the international movement of hazardous wastes is being carried out in contravention of existing national legislation and international instruments to the detriment of the environment and public health of all countries, particularly developing countries.

20.5. In section I of resolution 44/226 of 22 December 1989, the General Assembly requested each regional commission, within existing resources, to contribute to the prevention of the illegal traffic in toxic and dangerous products and wastes by monitoring and making regional assessments of that illegal traffic and its environmental and health implications. The Assembly also requested the regional commissions to interact among themselves and cooperate with the United Nations Environment Programme (UNEP), with a view to maintaining efficient and coordinated monitoring and assessment of the illegal traffic in toxic and dangerous products and wastes.

Overall objective

20.6. Within the framework of integrated life-cycle management, the overall objective is to prevent to the extent possible, and

minimise, the generation of hazardous wastes, as well as to manage those wastes in such a way that they do not cause harm to health and the environment.
Overall targets

20.7. The overall targets are:

(a) Preventing or minimising the generation of hazardous wastes as part of an overall integrated cleaner production approach; eliminating or reducing to a minimum trans boundary movements of hazardous wastes, consistent with the environmentally sound and efficient management of those wastes; and ensuring that environmentally sound hazardous waste management options are pursued to the maximum extent possible within the country of origin (the self-sufficiency principle). The trans boundary movements that take place should be on environmental and economic grounds and based upon agreements between the States concerned;

(b) Ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the expeditious elaboration of related protocols, such as the protocol on liability and compensation, mechanisms and guidelines to facilitate the implementation of the Basel Convention;

(c) Ratification and full implementation by the countries concerned of the Bamako Convention on the Ban on the Import into Africa and the Control of Transboundary Movement of Hazardous Wastes within Africa and the expeditious elaboration of a protocol on liability and compensation;

(d) Elimination of the export of hazardous wastes to countries that, individually or through international agreements, prohibits the import of such wastes, such as, the contracting parties to the Bamako Convention, the fourth LomÇ Convention or other relevant conventions, where such prohibition is provided for.

20.8. The following programme areas are included in this chapter:

(a) Promoting the prevention and minimisation of hazardous waste;

(b) Promoting and strengthening institutional capacities in hazardous
waste management;

(c) Promoting and strengthening international cooperation in the management of trans boundary movements of hazardous wastes;

(d) Preventing illegal international traffic in hazardous wastes.

PROGRAMME AREAS

A. Promoting the prevention and minimisation of hazardous waste

Basis for action

20.9. Human health and environmental quality are undergoing continuous degradation by the increasing amount of hazardous wastes being produced. There are increasing direct and indirect costs to society and to individual citizens in connection with the generation, handling and disposal of such wastes. It is therefore crucial to enhance knowledge and information on the economics of prevention and management of hazardous wastes, including the impact in relation to the employment and environmental benefits, in order to ensure that the necessary capital investment is made available in development programmes through economic incentives. One of the first priorities in hazardous waste management is minimisation, as part of a broader approach to changing industrial processes and consumer patterns through pollution prevention and cleaner production strategies.

20.10. Among the most important factors in these strategies is the recovery of hazardous wastes and their transformation into useful material. Technology application, modification and development of new low-waste technologies are therefore currently a central focus of hazardous waste minimisation.

Objectives

20.11. The objectives of this programme area are:

(a) To reduce the generation of hazardous wastes, to the extent feasible, as part of an integrated cleaner production approach;

(b) To optimise the use of materials by utilising, where practicable and environmentally sound, the residues from production processes;

(c) To enhance knowledge and information on the economics of prevention and management of hazardous wastes.

20.12. To achieve those objectives, and thereby reduce the impact and cost of industrial development, countries that can afford to adopt the requisite technologies without detriment to their development should establish policies that include:

(a) Integration of cleaner production approaches and hazardous waste
minimisation in all planning, and the adoption of specific goals;

(b) Promotion of the use of regulatory and market mechanisms;

(c) Establishment of an intermediate goal for the stabilisation of the quantity of hazardous waste generated;

(d) Establishment of long-term programmes and policies including targets where appropriate for reducing the amount of hazardous waste produced per unit of manufacture;

(e) Achievement of a qualitative improvement of waste streams, mainly
through activities aimed at reducing their hazardous characteristics;

(f) Facilitation of the establishment of cost-effective policies and approaches to hazardous waste prevention and management, taking into consideration the state of development of each country.

Activities

(a) Management-related activities

20.13. The following activities should be undertaken:

(a) Governments should establish or modify standards or purchasing
specifications to avoid discrimination against recycled materials, provided that those materials are environmentally sound;

(b) Governments, according to their possibilities and with the help of multilateral cooperation, should provide economic or regulatory incentives, where appropriate, to stimulate industrial innovation towards cleaner production methods, to encourage industry to invest in preventive and/or recycling technologies so as to ensure environmentally sound management of all hazardous wastes, including recyclable wastes, and to encourage waste minimisation investments;

(c) Governments should intensify research and development activities on cost-effective alternatives for processes and substances that currently result in the generation of hazardous wastes that pose particular problems for environmentally sound disposal or treatment, the possibility of ultimate phase-out of those substances that present an unreasonable or otherwise unmanageable risk and are toxic, persistent and bio-accumulative to be considered as soon as practicable. Emphasis should be given to alternatives that could be economically accessible to developing countries;

(d) Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations and industries, as appropriate, should support the establishment of domestic facilities to handle hazardous wastes of domestic origin;

(e) Governments of developed countries should promote the transfer of environmentally sound technologies and know-how on clean technologies and low-waste production to developing countries in conformity with chapter 34, which will bring about changes to sustain innovation. Governments should cooperate with industry to develop guidelines and codes of conduct, where appropriate, leading to cleaner production through sector trade industry associations;

(f) Governments should encourage industry to treat, recycle, reuse and dispose of wastes at the source of generation, or as close as possible thereto, whenever hazardous waste generation is unavoidable and when it is both economically and environmentally efficient for industry to do so;

(g) Governments should encourage technology assessments, for example through the use of technology assessment centres;

(h) Governments should promote cleaner production through the establishment of centres providing training and information on environmentally sound technologies;

(i) Industry should establish environmental management systems, including environmental auditing of its production or distribution sites, in order to identify where the installation of cleaner production methods is needed;

(j) A relevant and competent United Nations organisation should take the lead, in cooperation with other organisations, to develop guidelines for estimating the costs and benefits of various approaches to the adoption of cleaner production and waste minimisation and environmentally sound management of hazardous wastes, including rehabilitation of contaminated sites, taking into account, where appropriate, the report of the 1991 Nairobi meeting of government-designated experts on an international strategy and an action programme, including technical guidelines for the environmentally sound management of hazardous wastes; in particular in the context of the work of the Basel Convention, being developed under the UNEP secretariat;

(k) Governments should establish regulations that lay down the ultimate responsibility of industries for environmentally sound disposal of the hazardous wastes their activities generate.

(b) Data and information

20.14. The following activities should be undertaken:

(a) Governments, assisted by international organisations, should establish mechanisms for assessing the value of existing information systems;

(b) Governments should establish nationwide and regional information collection and dissemination clearing-houses and networks that are easy for Government institutions and industry and other non-governmental organisations to access and use;

(c) International organisations, through the UNEP Cleaner Production programme and ICPIC, should extend and strengthen existing systems for collection of cleaner production information;

(d) All United Nations organs and organisations should promote the use and dissemination of information collected through the Cleaner Production network;

(e) OECD should, in cooperation with other organisations, undertake a comprehensive survey of, and disseminate information on, experiences of member countries in adopting economic regulatory schemes and incentive mechanisms for hazardous waste management and for the use of clean technologies that prevent such waste from being generated;

(f) Governments should encourage industries to be transparent in their operations and provide relevant information to the communities that might be affected by the generation, management and disposal of hazardous wastes.

(c) International and regional cooperation and coordination

20.15. International/regional cooperation should encourage the ratification by States of the Basel and Bamako Conventions and promote the implementation of those Conventions. Regional cooperation will be necessary for the development of similar conventions in regions other than Africa, if so required. In addition there is a need for effective coordination of international regional and national policies and instruments. Another activity proposed is cooperating in monitoring the effects of the management of hazardous wastes.

Means of implementation

(a) Financing and cost evaluation

20.16. The Conference secretariat has estimated the average total annual cost (1993-2000) of implementing the activities of this programme to be about $750 million from the international community on grant or concessional terms. These are indicative and order-of-magnitude estimates only and have not been reviewed by Governments. Actual costs and financial terms, including any that are non-concessional, will depend upon, inter alia, the specific strategies and programmes Governments decide upon for implementation.

(b) Scientific and technological means

20.17. The following activities related to technology development and
research should be undertaken:

(a) Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations, and industries, as appropriate, should significantly increase financial support for cleaner technology research and development programmes, including the use of biotechnologies;

(b) States, with the cooperation of international organisations where appropriate, should encourage industry to promote and undertake research into the phase-out of the processes that pose the greatest environmental risk based on hazardous wastes generated;

(c) States should encourage industry to develop schemes to integrate the cleaner production approach into design of products and management practices;

(d) States should encourage industry to exercise environmentally responsible care through hazardous waste reduction and by ensuring the
environmentally sound reuse, recycling and recovery of hazardous wastes, as well as their final disposal.

(c) Human resource development

20.18. The following activities should be undertaken:

(a) Governments, international organisations and industry should encourage industrial training programmes, incorporating hazardous waste prevention and minimisation techniques and launching demonstration projects at the local level to develop "success stories" in cleaner production;

(b) Industry should integrate cleaner production principles and case examples into training programmes and establish demonstration projects/networks by sector/country;

(c) All sectors of society should develop cleaner production awareness campaigns and promote dialogue and partnership with industry and other actors.

(d) Capacity-building

20.19. The following activities should be undertaken:

(a) Governments of developing countries, in cooperation with industry and with the cooperation of appropriate international organisations, should develop inventories of hazardous waste production, in order to identify their needs with respect to technology transfer and implementation of measures for the sound management of hazardous wastes and their disposal;

(b) Governments should include in national planning and legislation an integrated approach to environmental protection, driven by prevention and source reduction criteria, taking into account the "polluter pays" principle, and adopt programmes for hazardous waste reduction, including targets and adequate environmental control;

(c) Governments should work with industry on sector-by-sector cleaner
production and hazardous waste minimisation campaigns, as well as on the reduction of such wastes and other emissions;

(d) Governments should take the lead in establishing and strengthening,
as appropriate, national procedures for environmental impact assessment, taking into account the cradle-to-grave approach to the management of hazardous wastes, in order to identify options for minimising the generation of hazardous wastes, through safer handling, storage, disposal and destruction;

(e) Governments, in collaboration with industry and appropriate international organisations, should develop procedures for monitoring the application of the cradle to grave approach, including environmental audits;

(f) Bilateral and multilateral development assistance agencies should substantially increase funding for cleaner technology transfer to developing countries, including small- and medium-sized enterprises.

B. Promoting and strengthening institutional capacities in hazardous waste management

Basis for action

20.20. Many countries lack the national capacity to handle and manage hazardous wastes. This is primarily due to inadequate infrastructure, deficiencies in regulatory frameworks, insufficient education and training programmes and lack of coordination between the different ministries and institutions involved in various aspects of waste management. In addition, there is a lack of knowledge about environmental contamination and pollution and the associated health risk from the exposure of populations, especially women and children, and ecosystems to hazardous wastes; assessment of risks; and the characteristics of wastes. Steps need to be taken immediately to identify populations at high risk and to take remedial measures, where necessary.

One of the main priorities in ensuring environmentally sound management of hazardous wastes is to provide awareness, education and training programmes covering all levels of society. There is also a need to undertake research programmes to understand the nature of hazardous wastes, to identify their potential environmental effects and to develop technologies to safely handle those wastes. Finally, there is a need to strengthen the capacities of institutions that are responsible for the management of hazardous wastes.

Objectives

20.21. The objectives in this programme area are:

(a) To adopt appropriate coordinating, legislative and regulatory measures at the national level for the environmentally sound management of hazardous wastes, including the implementation of international and regional conventions;

(b) To establish public awareness and information programmes on
hazardous waste issues and to ensure that basic education and training
programmes are provided for industry and government workers in all countries;

(c) To establish comprehensive research programmes on hazardous wastes in countries;

(d) To strengthen service industries to enable them to handle hazardous wastes, and to build up international networking;

(e) To develop endogenous capacities in all developing countries to educate and train staff at all levels in environmentally sound hazardous waste handling and monitoring and in environmentally sound management;

(f) To promote human exposure assessment with respect to hazardous waste sites and identify the remedial measures required;

(g) To facilitate the assessment of impacts and risks of hazardous wastes on human health and the environment by establishing appropriate procedures, methodologies, criteria and/or effluent-related guidelines and standards;

(h) To improve knowledge regarding the effects of hazardous wastes on human health and the environment;

(i) To make information available to Governments and to the general public on the effects of hazardous wastes, including infectious wastes, on human health and the environment.

Activities

(a) Management-related activities

20.22. The following activities should be undertaken:

(a) Governments should establish and maintain inventories, including computerised inventories, of hazardous wastes and their treatment/disposal sites, as well as of contaminated sites that require rehabilitation, and assess exposure and risk to human health and the environment; they should also identify the measures required to clean up the disposal sites. Industry should make the necessary information available;

(b) Governments, industry and international organisations should collaborate in developing guidelines and easy-to-implement methods for the characterisation and classification of hazardous wastes;

(c) Governments should carry out exposure and health assessments of
populations residing near uncontrolled hazardous waste sites and initiate
remedial measures;

(d) International organisations should develop improved health-based
criteria, taking into account national decision-making processes, and assist in the preparation of practical technical guidelines for the prevention, minimisation and safe handling and disposal of hazardous wastes;

(e) Governments of developing countries should encourage interdisciplinary and intersectoral groups, in cooperation with international organisations and agencies, to implement training and research activities related to evaluation, prevention and control of hazardous waste health risks. Such groups should serve as models to develop similar regional programmes;

(f) Governments, according to their capacities and available resources
and with the cooperation of the United Nations and other relevant organisations as appropriate, should encourage as far as possible the establishment of combined treatment/disposal facilities for hazardous wastes in small- and medium-sized industries;

(g) Governments should promote identification and clean-up of sites of
hazardous wastes in collaboration with industry and international organisations. Technologies, expertise and financing should be available for this purpose, as far as possible and when appropriate with the application of the "polluter pays" principle;

(h) Governments should ascertain that their military establishments conform to their nationally applicable environmental norms in the treatment and disposal of hazardous wastes.

(b) Data and information

20.23. The following activities should be undertaken:

(a) Governments, international and regional organisations and industry should facilitate and expand the dissemination of technical and scientific nformation dealing with the various health aspects of hazardous wastes, and promote its application;

(b) Governments should establish notification systems and registries of exposed populations and of adverse health effects and databases on risk assessments of hazardous wastes;

(c) Governments should endeavour to collect information on those who enerate or dispose/recycle hazardous wastes and provide such information to the individuals and institutions concerned.

(c) International and regional cooperation and coordination

20.24. Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations, as appropriate, should:

(a) Promote and support the integration and operation, at the regional and local levels as appropriate, of institutional and interdisciplinary groups that collaborate, according to their capabilities, in activities oriented towards strengthening risk assessment, risk management and risk reduction with respect to hazardous wastes;

(b) Support capacity-building and technological development and research in developing countries in connection with human resource development, with particular support to be given to consolidating networks;

(c) Encourage self-sufficiency in hazardous waste disposal in the country of origin to the extent environmentally sound and feasible. The trans boundary movements that take place should be on environmental and economic grounds and based upon agreements between all States concerned.

Means of implementation

(a) Financing and cost evaluation

20.25. The Conference secretariat has estimated the average total annual cost (1993-2000) of implementing the activities of this programme to be about $18.5 billion on a global basis with about $3.5 billion related to developing countries, including about $500 million from the international community on grant or concessional terms. These are indicative and order-of-magnitude estimates only and have not been reviewed by Governments. Actual costs and financial terms, including any that are non-concessional, will depend upon, inter alia, the specific strategies and programmes Governments decide upon for implementation.

(b) Scientific and technological means

20.26. The following activities should be undertaken:

(a) Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations and industry as appropriate, should increase support for hazardous waste research management in developing countries;

(b) Governments, in collaboration with international organisations, should conduct research on the health effects of hazardous wastes in developing countries, including the long-term effects on children and women;

(c) Governments should conduct research aimed at the needs of small and medium-sized industries;

(d) Governments and international organisations in cooperation with industry should expand technological research on environmentally sound hazardous waste handling, storage, transport, treatment and disposal and on hazardous waste assessment, management and remediation;

[But again the Asian countries ask how and who, refer above to the lack of infrastructure and also to Report One "Conference Report Basel etc"[36]

(e) International organisations should identify relevant and improved technologies for handling, storage, treatment and disposal of hazardous wastes.

(c) Human resource development

20.27. Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations and industry as appropriate, should:

(a) Increase public awareness and information on hazardous waste issues and promote the development and dissemination of hazardous wastes information that the general public can understand;

(b) Increase participation in hazardous waste management programmes by the general public, particularly women, including participation at grass-roots levels;

(c) Develop training and education programmes for men and women in industry and Government aimed at specific real-life problems, for example, planning and implementing hazardous waste minimisation programmes, conducting hazardous materials audits and establishing appropriate regulatory programmes;

(d) Promote the training of labour, industrial management and government regulatory staff in developing countries on technologies to minimise and manage hazardous wastes in an environmentally sound manner.

20.28. The following activities should also be undertaken:

(a) Governments, according to their capacities and available resources and with the cooperation of the United Nations, other organisations and non-governmental organisations, should collaborate in developing and disseminating educational materials concerning hazardous wastes and their effects on environment and human health, for use in schools, by women's groups and by the general public;

(b) Governments, according to their capacities and available resources and with the cooperation of the United Nations and other organisations, should establish or strengthen programmes for the environmentally sound management of hazardous wastes in accordance with, as appropriate, health and environmental standards, and extend surveillance systems for the purpose of identifying adverse effects on populations and the environment of exposure to hazardous wastes;

(c) International organisations should provide assistance to member States in assessing the health and environmental risks resulting from exposure to hazardous wastes, and in identifying their priorities for controlling the various categories or classes of wastes;

(d) Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations, should promote centres of excellence for training in hazardous waste management, building on appropriate national institutions and encouraging international cooperation, inter alia, through institutional links between developed and developing countries.

(d) Capacity-building

20.29. Wherever they operate, trans national corporations and other large-scale enterprises should be encouraged to introduce policies and make commitments to adopt standards of operation with reference to hazardous waste generation and disposal that are equivalent to or no less stringent than standards in the country of origin, and Governments are invited to make efforts to establish regulations requiring environmentally sound management of hazardous wastes.

20.30. International organisations should provide assistance to member States in assessing the health and environmental risks resulting from exposure to hazardous wastes and in identifying their priorities for controlling the various categories or classes of wastes.

20.31. Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations and industries, should:

(a) Support national institutions in dealing with hazardous wastes from the regulatory monitoring and enforcement perspectives, with such support including enabling of those institutions to implement international conventions;

(b) Develop industry-based institutions for dealing with hazardous wastes and service industries for handling hazardous wastes;

(c) Adopt technical guidelines for the environmentally sound management of hazardous wastes and support the implementation of regional and international conventions;

(d) Develop and expand international networking among professionals working in the area of hazardous wastes and maintain an information flow among countries;

(e) Assess the feasibility of establishing and operating national, subregional and regional hazardous wastes treatment centres. Such centres could be used for education and training, as well as for facilitation and promotion of the transfer of technologies for the environmentally sound management of hazardous wastes;

(f) Identify and strengthen relevant academic/research institutions or centres for excellence to enable them to carry out education and training activities in the environmentally sound management of hazardous wastes;

(g) Develop a programme for the establishment of national capacities and capabilities to educate and train staff at various levels in hazardous wastes management;

(h) Conduct environmental audits of existing industries to improve in-plant regimes for the management of hazardous wastes.

C. Promoting and strengthening international cooperation in the management of trans boundary movements of hazardous wastes

Basis for action

20.32. In order to promote and strengthen international cooperation in the management, including control and monitoring, of trans boundary movements of hazardous wastes, a precautionary approach should be applied. There is a need to harmonise the procedures and criteria used in various international and legal instruments. There is also a need to develop or harmonise existing criteria for identifying wastes dangerous to the environment and to build monitoring capacities.

Objectives

20.33. The objectives of this programme area are:

(a) To facilitate and strengthen international cooperation in the environmentally sound management of hazardous wastes, including control and monitoring of trans boundary movements of such wastes, including wastes for recovery, by using internationally adopted criteria to identify and classify hazardous wastes and to harmonise relevant international legal instruments;

(b) To adopt a ban on or prohibit, as appropriate, the export of hazardous wastes to countries that do not have the capacity to deal with those wastes in an environmentally sound way or that have banned the import of such wastes;

(c) To promote the development of control procedures for the trans boundary movement of hazardous wastes destined for recovery operations under the Basel Convention that encourage environmentally and economically sound recycling options.

Activities

(a) Management-related activities

Strengthening and harmonising criteria and regulations

20.34. Governments, according to their capacities and available resources and with the cooperation of United Nations and other relevant organisations, as appropriate, should:

(a) Incorporate the notification procedure called for in the Basel Convention and relevant regional conventions, as well as in their annexes, into national legislation;

(b) Formulate, where appropriate, regional agreements such as the Bamako Convention regulating the trans boundary movement of hazardous wastes;

(c) Help promote the compatibility and complementarity of such regional agreements with international conventions and protocols;

(d) Strengthen national and regional capacities and capabilities to monitor and control the trans boundary movement of hazardous wastes;

(e) Promote the development of clear criteria and guidelines, within the framework of the Basel Convention and regional conventions, as appropriate, for environmentally and economically sound operation in resource recovery, recycling reclamation, direct use or alternative uses and for determination of acceptable recovery practices, including recovery levels where feasible and appropriate, with a view to preventing abuses and false presentation in the above operations;

(f) Consider setting up, at national and regional levels, as appropriate, systems for monitoring and surveillance of the trans boundary movements of hazardous wastes;

(g) Develop guidelines for the assessment of environmentally sound
treatment of hazardous wastes;

(h) Develop guidelines for the identification of hazardous wastes at the national level, taking into account existing internationally - and, where appropriate, regionally - agreed criteria and prepare a list of hazard profiles for the hazardous wastes listed in national legislation;

(i) Develop and use appropriate methods for testing, characterising and classifying hazardous wastes and adopt or adapt safety standards and principles for managing hazardous wastes in an environmentally sound way.

Implementing existing agreements

20.35. Governments are urged to ratify the Basel Convention and the Bamako Convention, as applicable, and to pursue the expeditious elaboration of related protocols, such as protocols on liability and compensation, and of mechanisms and guidelines to facilitate the implementation of the Conventions.

Means of implementation

(a) Financing and cost evaluation

20.36. Because this programme area covers a relatively new field of operation and because of the lack so far of adequate studies on costing of activities under this programme, no cost estimate is available at present. However, the costs for some of the activities related to capacity-building that are presented under this programme could be considered to have been covered under the costing of programme area B above.

20.37. The interim secretariat for the Basel Convention should undertake studies in order to arrive at a reasonable cost estimate for activities to be undertaken initially until the year 2000.

(b) Capacity-building

20.38. Governments, according to their capacities and available resources and with the cooperation of United Nations and other relevant organisations, as appropriate, should:

(a) Elaborate or adopt policies for the environmentally sound management of hazardous wastes, taking into account existing international instruments;

(b) Make recommendations to the appropriate forums or establish or adapt norms, including the equitable implementation of the polluter pays principle, and regulatory measures to comply with obligations and principles of the Basel Convention, the Bamako Convention and other relevant existing or future agreements, including protocols, as appropriate, for setting appropriate rules and procedures in the field of liability and compensation for damage resulting from the trans boundary movement and disposal of hazardous wastes;

(c) Implement policies for the implementation of a ban or prohibition, as appropriate, of exports of hazardous wastes to countries that do not have the capacity to deal with those wastes in an environmentally sound way or that have banned the import of such wastes;

(d) Study, in the context of the Basel Convention and relevant regional conventions, the feasibility of providing temporary financial assistance in the case of an emergency situation, in order to minimise damage from accidents arising from trans boundary movements of hazardous wastes or during the disposal of those wastes.

D. Preventing illegal international traffic in hazardous wastes

Basis for action

20.39. The prevention of illegal traffic in hazardous wastes will benefit the environment and public health in all countries, particularly developing countries. It will also help to make the Basel Convention and regional international instruments, such as the Bamako Convention and the fourth LomÇ Convention, more effective by promoting compliance with the controls established in those agreements. Article IX of the Basel Convention specifically addresses the issue of illegal shipments of hazardous wastes. Illegal traffic of hazardous wastes may cause serious threats to human health and the environment and impose a special and abnormal burden on the countries that receive such shipments.

20.40. Effective prevention requires action through effective monitoring and the enforcement and imposition of appropriate penalties.

Objectives

20.41. The objectives of this programme area are:

(a) To reinforce national capacities to detect and halt any illegal attempt to introduce hazardous wastes into the territory of any State in contravention of national legislation and relevant international legal instruments;

(b) To assist all countries, particularly developing countries, in obtaining all appropriate information concerning illegal traffic in hazardous wastes;

(c) To cooperate, within the framework of the Basel Convention, in assisting countries that suffer the consequences of illegal traffic.

Activities

(a) Management-related activities

20.42. Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organisations, as appropriate, should:

(a) Adopt, where necessary, and implement legislation to prevent the illegal import and export of hazardous wastes;

(b) Develop appropriate national enforcement programmes to monitor compliance with such legislation, detect and deter violations through appropriate penalties and give special attention to those who are known to have conducted illegal traffic in hazardous wastes and to hazardous wastes that are particularly susceptible to illegal traffic.

(b) Data and information

20.43. Governments should develop as appropriate, an information network and alert system to assist in detecting illegal traffic in hazardous wastes. Local communities and others could be involved in the operation of such a network and system.

20.44. Governments should cooperate in the exchange of information on illegal trans boundary movements of hazardous wastes and should make such information available to appropriate United Nations bodies such as UNEP and the regional commissions.

(c) International and regional cooperation

20.45. The regional commissions, in cooperation with and relying upon expert support and advice from UNEP and other relevant bodies of the United Nations system, taking full account of the Basel Convention, shall continue to monitor and assess the illegal traffic in hazardous wastes, including its environmental, economic and health implications, on a continuing basis, drawing upon the results and experience gained in the joint UNEP/ESCAP preliminary assessment of illegal traffic.

20.46. Countries and international organisations, as appropriate, should cooperate to strengthen the institutional and regulatory capacities, in particular of developing countries, in order to prevent the illegal import and export of hazardous wastes.

APPENDIX 4 BASEL Declaration on Environmentally Sound management

We, the Ministers and other heads of delegation from .... States ,

Having met in Basel, Switzerland, from 6 to 10 December 1999, on the occasion of the fifth meeting of the Conference of the Parties to the Basel Convention and the tenth anniversary of the adoption of the Basel Convention,

Concerned about the continuing risk of damage to the environment and of harmful effects on human health caused by the environmentally unsound management of hazardous wastes,

Recognizing that, notwithstanding the concerted efforts made during the first decade of the Basel Convention, hazardous waste generation has continued to grow at the global level and transboundary movements of hazardous wastes are still a matter for concern,

Further recognizing the importance of partnership with the private sector and non-governmental organizations,

Building on the achievements of the first decade of the Convention,

1. Assert a vision that the environmentally sound management of hazardous and other wastes is accessible to all Parties, emphasizing the minimization of such wastes and the strengthening of capacity-building;

2. Conclude that, having reviewed progress in the implementation and further development of the Basel Convention during its first decade, significant achievements have been made, such as the development and adoption of the control system for transboundary movements; the waste lists and model legislation; the adoption of the ban amendment; and the establishment of regional and subregional centres for training and technology transfer and also note with satisfaction that the number of Parties has greatly increased since the entry into force of the Convention;

3. Reaffirm the fundamental aims of the Basel Convention, namely, the reduction of transboundary movements of hazardous and other

wastes subject to the Basel Convention, the prevention and minimization of their generation, the environmentally sound management of such wastes and the active promotion of the transfer and use of cleaner technologies;

4. Reiterate our commitmen to sustainable development and full support for the implementation of the Rio Declaration, Agenda 21 and the programme for its further implementation adopted by the United Nations General Assembly at its nineteenth special session in 1997;

5. Undertake to make all possible efforts to ensure the universality of the Convention by promoting the ratification of or accession to the Convention and its amendments and by ensuring effective implementation of and compliance with its obligations;

6. Recognize the need to focus our activities within the next decade on specific actions to promote the implementation of the Convention and its amendments worldwide, at all levels, and, to this end, agree to enhance and strengthen our efforts and cooperation to achieve environmentally sound management in the following fields:

(a) Prevention, minimization, recycling, recovery and disposal of hazardous and other wastes subject to the Basel Convention, taking into account social, technological and economic concerns;

(b) Active promotion and use of cleaner technologies and production, with the aim of the prevention and minimization of hazardous and other wastes subject to the Basel Convention;

(c) Further reduction of transboundary movements of hazardous and other wastes subject to the Basel Convention, taking into account the need for efficient management, the principles of self-sufficiency and proximity and the priority requirement of recovery and recycling;

(d) Prevention and monitoring of illegal traffic;

(e) Improvement and promotion of institutional and technical capacity-building, as well as the development and transfer of environmentally sound technologies, especially for developing countries and countries with economies in transition;

(f) Further development of regional and subregional centres for training and technology transfer;

(g) Enhancement of information exchange, education and awareness-raising in all sectors of society;

(h) Cooperation and partnership at all levels between countries, public authorities, international organizations, the industry sector, non-governmental organizations and academic institutions;

(i) Development of mechanisms for compliance with and for the monitoring and effective implementation of the Convention and its amendments;

7. Support the development of pilot projects on state-of-the-art or best available technologies to demonstrate the environmentally sound management of hazardous wastes and their minimization, including those financed by public or private partnership, in selected countries or regions, taking into account the needs of small and medium-sized enterprises, and agree that these pilot projects will take into consideration issues related to the environmentally sound disposal of stockpiles of hazardous wastes;

8. Recognize the need for a sound financial basis for the effective implementation of these activities and for increased efforts to gain access to all sources of funding, including international financial institutions, and recognize, in addition, the need to develop strategies that will harness market forces to promote waste minimization and environmentally sound management and to provide opportunities for investment in this field;

9. Agree that decision V/33 of the Conference of the Parties constitutes our agenda for the next decade on environmentally sound management.

ENVIRONMENTALLY SOUND MANAGEMENT

The Conference, Welcoming the Basel Declaration on Environmentally Sound Management and reaffirming the objectives set out therein,

1. Decides that, for the next decade of the Basel Convention, the following activities should be undertaken to achieve the objectives

of environmentally sound management in the following fields:

(a) Prevention, minimization, recycling, recovery and disposal of hazardous and other wastes subject to the Basel Convention, taking into account social, technological and economic concerns :

Elaboration of a concept and a programme for the environmentally sound management of hazardous and other wastes, with an emphasis on waste prevention and minimization, taking into account the different regional and sectoral capabilities or specificities; promotion of initiatives in all States and at all levels to encourage environmentally sound waste management, in partnership with government authorities at all levels and with stakeholders, including capacity-building, awareness-raising and education;

Promotion of financial and other economic instruments or concepts, with a view to identifying sustainable and self-sufficient solutions for the minimization and environmentally sound and efficient management of hazardous and other wastes subject to the Basel Convention, bearing in mind that such instruments should be affordable and socially acceptable, as well as economically viable; and the exchange of information on such instruments and their application;

(b) Active promotion and use of cleaner technologies with the aim of the prevention and minimization of hazardous and other wastes subject to the Basel Convention :

Cooperation of the regional and subregional centres for training and technology transfer with cleaner production centres and similar institutions having experience and expertise in areas related to the minimization and management of hazardous and other wastes subject to the Basel Convention, for the purpose of sharing information and knowledge and streamlining activities;

(c) Further reduction of the transboundary movements of hazardous and other wastes subject to the Basel Convention, taking into account the need for efficient management, the principles of self-sufficiency and proximity and the priority requirements for recovery and recycling :

Consistent with the technological needs of the Parties, promotion of initiatives aimed at reducing transboundary movements to the minimum, taking into account the environmentally sound management of the wastes, the protection of human health, the principles of proximity and self-sufficiency and the priority requirement of recovery and recycling;

(d) Prevention and monitoring of illegal traffic :

Continued cooperation with the International Criminal Police Organization and the World Customs Organization, in particular, in the training of customs and enforcement officers in order to identify, monitor and prevent illegal traffic in hazardous and other wastes subject to the Basel Convention;

Adoption of procedures to address alleged cases of illegal traffic and to assist Parties in preventing, identifying, monitoring and resolving illegal traffic;

Institutional strengthening of the regional and subregional centres for training and technology transfer, to enable Parties to prevent and monitor illegal traffic;

(e) Improvement and promotion of institutional and technical capacity-building, and development,and of the transfer of environmentally sound technologies, especially for developing countries and countries with economies in transition :

With regard to capacity-building and assistance in legal and institutional matters, the development and effective implementation of legal instruments, building and strengthening of institutional infrastructures for the environmentally sound management of hazardous and other wastes subject to the Basel Convention and their minimization and the control of their transboundary movements;

With regard to capacity-building and assistance in technical matters, assisting in building and improving installations for the treatment of hazardous and other wastes subject to the Basel Convention and the transfer of know-how and technology; and the advancement and improvement of strategies for the practical implementation of the minimization and environmentally sound management of both domestically generated wastes and wastes subject to transboundary movements that would include appropriatetools, measures and incentives especially for use by developing countries and countries with economies in transition, taking into account the needs of small and medium-sized enterprises;

(f) Further development of regional and subregional centres for training and technology transfer :

Establishment or strengthening of the activities of regional and subregional centres for training and technology transfer, to ensure their important role in the implementation of the Basel Convention and of minimization methods and the environmentally sound management of hazardous and other wastes subject to the Basel Convention, aiming at financial self-sufficiency, bearing in mind that the role and activities of different regional centres in information exchange are to be consolidated and made available to all stakeholders and that regional centres should progressively become involved in activities related to training, public awareness and the exchange of information on waste minimization and environmentally sound technology and expertise;

Collection and dissemination of information on existing examples, in particular in developing countries and countries with economies in transition, of best practices in waste management;

Facilitation of different partnerships where so required, including partnerships with industry, for the development of minimization methods and environmentally sound waste-management solutions;

(g) Enhancement of information exchange, education and awareness-raising in all sectors of society :

Enhancement of the existing information system developed by the secretariat, including improved access, in order to disseminate the knowledge and experience gained in the implementation of the Basel Convention;

Development and operation of a worldwide information system to provide information on available expertise and solutions for waste-related problems and to strengthen the role of the regional centres in these efforts;

Training of the staff of competent authorities, enforcement officers and other key actors (e.g., generators, transporters, disposers, recyclers), where needed, bearing in mind that such training is required to implement the environmentally sound management of hazardous wastes, in particular, controls for transboundary movements, and the monitoring and prevention of illegal traffic in hazardous and other wastes and that it could include, inter alia , in-house training in partnership between government authorities and industry, as well as practice-oriented seminars and workshops, and that the capacities and experience of the regional centres for training and technology transfer should be fully utilized and enhanced;

Promotion of public education and awareness on waste-related issues, in particular at the regional, subregional and local levels, involving all stakeholders, as well as educational institutions, bearing in mind that such efforts may include information campaigns related to waste minimization and the environmentally sound management of hazardous and other wastes subject to the Basel Convention;

(h) Cooperation and partnership at all levels between countries, public authorities, international organizations, the industry sector, non-governmental organizations and academic institutions :

Enhancement of partnership with all stakeholders, to include the various experiences, needs and interests of different regions and sectors for the implementation of the Basel Convention; encouragement of and provision of incentives to the private and public sectors to cooperate with other stakeholders and to contribute experience and expertise in the management of hazardous and other wastes subject to the Basel Convention, including the application of cleaner technologies;

Enhancement of cooperation between the secretariat and international organizations active in areas relevant to the implementation of the Basel Convention and its amendments, bearing in mind that this is to include cooperation with United Nations bodies active in the field of sustainable development, to encourage the incorporation of policies on the environmentally sound management of hazardous wastes in Parties' national environmental management and sustainable development plans and cooperation with the relevant programmes on cleaner production, such as with the joint programme on cleaner production of the United Nations Environment Programme and the United Nations Industrial Development Organization; launching of joint activities and projects in cooperation with organizations such as the United Nations Environment Programme and the Food and Agriculture Organization of the United Nations in areas of common interest, in particular, on persistent organic pollutants, waste pesticides and other chemical wastes;

(i) Development of mechanisms for compliance with and the monitoring and effective implementation of the Convention and its amendments : Promotion of the effective implementation of and compliance with the obligations of the Convention and its amendments and the provision of assistance to the Parties as required;

Completion of work on mechanisms designed to facilitate and monitor compliance and implementation of the Convention, bearing in mind that this is to include a mechanism for compliance monitoring, procedures for dispute settlement and guidelines to assist States to prevent, identify and resolve cases of illegal traffic, for consideration by the Conference of the Parties at its sixth meeting;

2. Requests the Technical Working Group to work on the selection of waste streams in countries or regions, for the purpose of developing pilot projects on the state of the art in the field of cleaner production and the environmentally sound management of hazardous and other wastes, including the development of contingency emergency plans;

3. Further decides that, in order to implement these activities, access to financial resources and mechanisms is essential and that, accordingly, the following activities should be undertaken:

(a) Development of projects in cooperation with the United Nations Environment Programme for funding by international entities such as the Global Environment Facility and the facilitation of access to other international financial mechanisms;

(b) Encouragement of the development of financial strategies that will harness market forces to promote environmentally sound management and waste minimization and provide opportunities for investment in this field;

(c) Development of a financial strategy for the operations and activities of the Convention, including innovative methods of fund-raising;

4. Requests the subsidiary bodies of the Conference of the Parties, under the guidance of the Expanded Bureau, further to elaborate and to prioritize the activities for the years 2000-2002 listed in the annex to the present decision and to start working towards implementing the above objectives as soon as feasible,

pending the elaboration and adoption of the work programme;

5. Also requests the subsidiary bodies to prepare a strategic plan, including an indicative work programme, for the period to the year 2010, to address the objectives set forth in the present decision, and to develop a work programme by areas of work based on the present decision for the years 2003-2004, for consideration and adoption by the Conference of the Parties at its sixth meeting;

6. Requests the subsidiary bodies to provide periodic information to the Conference of the Parties on the progress of implementation of the agenda for the next decade on environmentally sound management;

7. Requests the secretariat to collect and disseminate the information needed for the tasks set out above and to coordinate the contacts with the partners involved.

APPENDIX 5 UNEP Guide

Destruction and Decontamination of PCBs and POPs as waste.

Volume A and B

This guide was produced for UNEP by the writer and includes the two dimensional matrix in Part IV of the document. The matrix shown is for a simple site situation but is the same one that is used at the company strategic level.

DESTRUCTION AND DECONTAMINATION TECHNOLOGIES FOR PCBs AND OTHER POPs WASTES UNDER THE BASEL CONVENTION

A Training Manual for Hazardous Waste Project Managers

Volume A

Secretariat of the Basel Convention

DESTRUCTION AND DECONTAMINATION TECHNOLOGIES FOR PCBs AND OTHER POPs WASTES UNDER THE BASEL CONVENTION – VOLUME A

Published in October 2002

Sales No. E.02.III.D.211

ISBN : 92-1-158611-9

ISSN : 1020-8364

Printed in chlorine-free cyclus paper

This Publication is available from:

Secretariat of the Basel Convention
International Environment House
15 chemin des Anémones,
CH-1219 Châtelaine, Switzerland

Tel. : (4122) 9178218 Fax : (4122) 797 34 54

E-mail : sbc@unep.ch

Web : www.basel.int

Destruction and Decontamination Technologies for PCBs and Other POPs Wastes

A Training Manual for Hazardous Waste Project Managers

Volume A

CONTENTS

Foreword

This Training Manual has been prepared by the University of Auckland, New Zealand in the context of the convening of the First Continental Conference for Africa on the Environmentally Sound Management of Unwanted Stocks of Hazardous Wastes and their Prevention, Rabat, Morocco, 8-12 January 2001.

It has been designed to assist those governments or organisations, not only in Africa, charged with the task of managing the destruction or decontamination of POPs (Persistent Organic Pollutants) with procedures that assist with the planning and selection of appropriate technologies that suit the particular circumstances whilst complying with the need for environmentally sound management principles and the principles of sustainability. In that context special consideration should be given to the local national frameworks and the responsibilities of the relevant competent authority.

New ideas and technologies are emerging rapidly and good practices are still evolving. The Training Manual however will remain useful in providing a selection process allowing new technologies to be evaluated under the provisions of the Training Manual and enabling organisations to continue to adopt new technologies as they become available. There are four parts to this Training Manual. Part Four is a detailed Field Application Training Manual to the handling and environmentally sound management of POPs as wastes covering obsolete pesticides and PCB's in particular.

The Training Manual should be considered in conjunction with other technical guidelines adopted by the Conference of the Parties to the basel Convention and governing the environmentally sound management of hazardous wastes, in particular the Technical Guidelines on Wastes Comprising or Containing PCB's, PCTs, and PBB's (Y10), Technical Guidelines for Incineration on Land,(D10), Technical Guidelines for Specially Engineered Landfill (D5), and Technical Guidelines on Wastes collected from Households (Y46). The document should be considered in conjunction with other important guidelines such as the FAO Pesticide series.

The writer refers in particular to the Draft Technical Guidelines on the environmentally sound management of POPs wastes which, at the time of printing of this document, are being negotiated under the Basel Convention. Furthermore, this Training Manual aimed at providing practical training for waste managers should not be interpreted as preempting any of the principles, guidance and recommendations that will form part of the Technical Guidelines on the ESM of POPs wastes mentioned hereabove.

Ron McDowall
International Centre for Sustainability Engineering and Research
Faculty of Engineering
University of Auckland
New Zealand

Secretariat of the Basel Convention (SBC)
International Environment House
11-13 chemin des anemones
Building D
1219 Chatelaine (Geneva)
Switzerland
Tel.: (+41 22) 917 8281
Fax.: (+41 22) 797 3454
E-mail: sbc@unep.ch

How to use this Guide

This guide is designed as a desk top manual for planners, project managers and government department staff. Its style aims to provide for ease of reference and absorption of complex ideas and areas of uncertainty. The guide has been designed as a complete technical guide for the management of POPs as waste in an Environmentally Sound Manner. This guide not only covers the basic principles of hazardous waste such as POPs but seeks to provide a step by step guide as to how such wastes are to be managed, packages, stored, transported, decontaminated and disposed of. The step by step strategy culminates in a set of Work Procedure Instructions that will allow and party to establish and manage a POPs waste project. At the end of Part IV there is a sample set of Tender and Contract documents that a party can use to create a contract for the management and handling of a POPs project. This technical guide is based on the integrated matrix system of waste management and no part of the project can be initiated without the preceding parts being carried out. The reader must understand that all parts of this guide are integrated as a management programme.

The guide is designed to be used in several complementary ways:

- In creating a project strategy for disposal or decontamination
- In establishing the appropriate technology to use
- In establishing a set of rules and methods to actually perform a destruction of decontamination project.
- In providing the principles for site establishment and the basis for an operational manual.

The guide can help with

Planning
- understanding background and principles
- correct inventory collation
- inventory analysis

Writing project Plans
- produce an overall plan for disposal or decontamination

Technology Decision making
- appraisal of appropriate technology
- selection of technology for destruction or decontamination

Writing tender documents
- produce tender documents for destruction or decontamination

Hazardous waste project Implementation
- produce implementation plans

Project manual
- produce comprehensive destruction or decontamination manual

The guide is organised into four basic parts

I BASIC PRINCIPLES AND BACKGROUND

This section covers the background to the POP's problem and the actions of international organisations to deal with the toxic waste problems.

II POPs PROJECT STRATEGIES

The formulation of strategies for destruction and decontamination depends on the inventory analysis. When the information Is available then the strategy selection process commences.

III TECHNOLOGY SELECTION PROCESS

When the destruction and Decontamination strategy is in place then the specific technology decisions can be made and the appropriate technology selected. several destruction and decontamination technologies are presented in this section

IV IMPLEMENTATION PROCESS

Tendering and project management documentation and plans. This section provides design guidance for site appraisals, packaging of hazardous wastes, storage, transportation as well as guidance for the destruction and decontamination processes.

Scope of the guide

- The guide can be used to prepare plans and strategies for the project management of hazardous waste projects involving Intractable chemicals such as PCBs and other POP's
- The scope is such that any organisation can use it to prepare simple plans for a small scale waste problem involving less than 5 tonnes of material or for a large scale operation involving say 5000 tonnes of material.
- In the final Part of the guide there are planning guides so that large projects that demand a high standard of quality assurance are available.

CONTENTS

Background

- Persistent Organic Pollutants (POPs) are chemical substances which are extremely stable, and are known to accumulate in biological tissue thereby posing a risk of adverse effects to human health and the environment. With the evidence of long-range transport of these substances to regions where they have never been used or produced and the consequent threats they pose to the global environment, the international community has on several occasions called for urgent global actions to reduce and eliminate releases of these chemicals.

- POPs, wastes fall under the scope of the Basel Convention which calls for the environmentally sound management of hazardous wastes and the control of their transboundary movements. The environmentally Sound management conceptual framework as agreed and defined by the 5th meeting of the parties (Basel Convention, December 1999) is as follows; "Within the framework of integrated life-cycle management, prevention to the extent possible and minimise the generation of hazardous wastes, treat and dispose in such a way as they do not cause harm to health and the environment, and eliminate or reduce transboundary movements of hazardous wastes".

- In its decision 19/13C of February 7, 1997 the Governing Council (GC) requested that the Executive Director of the United Nations Programme (UNEP), together with relevant international organisations, convene an intergovernmental negotiating committee (INC). The INC was asked to prepare an internationally legally binding instrument for action on twelve specified POPs. The GC also requested that UNEP develop and share information on the following topics: alternatives to POPs, inventories of PCBs and available destruction capacity, and sources of and management strategies for PCDD/PCDF. The negotiations under the INC led to the adoption of the Stockholm Convention in 2001.

Legislative Authority

- UNECE LRTAP POPs Protocol (Long Range Transboundary Pollution)
- Olso-Paris Convention (NE Atlantic)
- Barcelona Resolution (Mediterranean)
- Arctic Environmental protection
- NAFTA/NACEC Resolution
- UNEP Global Programme of Action
- Stockholm Convention (2001)

- *The twelve specified POPs covered by the Stockholm Convention are :*
  Pesticides: aldrinchlordane, dieldrin,DDT, endrin,heptachlor,hexachlorobenzene, mirex,toxaphene.
  Industrial Chemicals: PCB,
  By-Products: Dioxins and Furans
  Pesticides and PCB are covered by this Technical Guide.

- This guide will attempt to provide the practical application of these sentiments while maintaining a realistic approach to destruction and decontamination. There are real issues involved with the treatment, decontamination and disposal of hazardous wastes particularly POPs and PCBs. This guide will concentrate on POPs as waste and in particular PCBs and unwanted pesticides and will provide practical guidance to solving the issues of complexity that surround the Basel Convention statement on Environmentally sound management of POPs and PCBs. In parts of this guide POPs are treated separately from PCBs as their situations and dispositions are different and require different approaches.

Key References

UNEP Basel Convention, 1989, Technical Guidelines for the Environmentally Sound management of PCB's
FAO Pesticide Disposal series
UNEP Chemicals Toolkit for Dioxins and Furans, 2000
UNEP Stockholm Convention, 2001

Unwanted and Obsolete Pesticides

- Obsolete pesticides are stored and unused pesticides that can no longer be used for their original intended use and there require disposal. There are many reasons for the existence of stocks of unwanted pesticides. These can range from the pesticide being banned and therefore unsold stocks have remained in storage, deterioration of the pesticides due to the length of time in storage or improper storage, the products suitable is unsatisfactory and can no longer be used for the original intended use, or other reasons such as chemical changes that render the product unusable. It is difficult to ascertain whether or not the pesticides product has become unusable. Generally it is not so difficult to ascertain if the product is unwanted. It may be however that the product while unwanted in one situation is capable of being used in another.

- Unwanted pesticides are a major problem in many countries. For decades obsolete and unwanted pesticide stockpiles have been building and accumulating in developing countries so that now it is estimated that there are more then 200,000 tonnes of such material located at thousands of sites all around the planet. Many of these chemicals (POPs) have long been banned or are unusable for other reasons. Today there are often found in dangerous storage conditions, leaking from rusted containers, contaminating ground water and soils and poisoning the health and environment of people everywhere.

POPs (PCBs)

- Polychlorinated Biphenyls are a class of chlorinated hydrocarbons that have been used extensively since 1930 for a variety of industrial uses. They consist of two benzene rings joined by a carbon-carbon bond with chlorine atoms substituted on any or all of the remaining carbon atoms. PCBs include mobile oily liquids and hard transparent resins, depending on the degree of substitution. PCBs are generally found either as stored liquid with contaminated equipment or still operating in the field. This technical guide also covers PCB in either case.

- The value of PCBs derive from their chemical inertness, resistance to heart, non flammability, low vapour pressure and high dielectric constant. As electricity came into widespread use during the first half of the 20th century, equipment suppliers became major users of PCBs. The major application involved PCB being used as a coolant and dielectric fluid in power transformers and capacitors.

- The uses of PCBs can be classified as either closed or open. In closed applications it was the intention to prevent any loss of PCB by containment within the sealed unit.

Declaration : New Zealand Government 1988

"Disposal of PCB wastes"

The Government's policy is that ALL PCBs shall be withdrawn from service in five years time All owners of PCBs therefore need to prepare to replace existing equipment and to remove it to storage and ultimate disposal. Disposal of PCB oil and contaminated equipment shall be by high temperature incineration or by other approved method. Owners of PCB shall pay for all costs involved with the disposal of PCBs

Contamination of the environment was then consequent of a equipment leak. In open applications the PCB's were exposed to the environment, and some loss to the environment was *inevitable*. The major closed applications were as coolants in transformers and dielectrics in capacitors.

- Between 1929 and 1989, total world production of PCBs was 1.5 million tonnes. After the US banned the manufacture or sale of PCB except in Closed systems in 1976 production continued at a rate of 16000 tonnes per year from 1980 to 1984 and some 10,000 tonnes per year from 1984 to 1989.

- Many of the characteristics that make PCBs ideal for industrial applications create problems when they are released into the environment. The effects on humans and the environment primarily follow chronic exposure. Like many other chlorinated hydrocarbons, PCBs associate with the organic components of soils, sediments, and biological tissues, or with dissolved organic carbon in aquatic systems. PCB's volatize from water surfaces in spite of their low vapour pressure, partly because of their hydrophobicity. The chemical properties of PCBs vapours their long range transport, and PCBs have been detected in Arctic air, water and organisms.

- Despite the cessation of production in many countries from the mid 70s, PCBs continue to be a pollutant of major concern on an international scale. There is still a substantial amount of PCB still in use. This results from the long lifetimes of power equipment such as transformers, and the exemption given in many countries for contained use for the lifetime. There are relatively high quantities in storage awaiting disposal.

- Part of the world production has been destroyed, part remains in use or awaits destruction, whilst a substantial proportion has been released to the environment. **Depending on the type and concentration levels there are several destruction and disposal options available.**

Sustainability

Sustainable engineering and technology focusses on pollution and the adaptation of cleaner production. Pollution prevention minimises effluents and waste streams from products and eliminates the need for treatment and control. Sustainable technologies are those that reduce pollution through significant technical advances. For communities to be sustainable they must be free from pollution in all its forms. This guide attempts to integrate the elements of recovery and management of PCBs and POPs and dispose of them in a manner that is Sustainable. The guide

has detailed descriptions of example operating manuals for such activity and has descriptions of various destruction and decontamination technologies, including High Temperature Incineration. It is the authors opinion that the plans and methodologies contained in this guide provide for sustainable destruction and decontamination technologies for POPs and PCBs.

As the export of POPs as waste is not banned completely the concept of environmentally sound management of POPs whatever the place of disposal is valid. The principle of environmentally sound management of POPs provides that the wastes must be managed in such a way as not to endanger human health and then environment. Whereas it is embodied in most relevant international legal instruments in a fairly vague and unspecified form it is given concrete content by reference to standards established by non binding technical guidelines or codes of conduct in the field. This document is written as a field application manual and provides a means by which environmentally sound management of POPs as waste is delivered.

Chemicals including pesticides are widely distributed in the environment. Therefore there are many possible sources of exposure to these chemicals for humans. Substances which are in ambient or indoor air may be inhaled while those in water or food may be ingested or inhaled. Direct contact with the chemical is the most prevalent way environmental chemicals can penetrate the skin, but exposure through the skin may also occur as a result of contact with chemical contaminants in air and water.

A single agrochemical can enter the body through all three routes of exposure, inhalation, ingestion and skin penetration (dermal exposure). A pesticide can involve more than one route of exposure if precautions are not taken. A pesticide can be inhaled during use or repacking, penetrate the skin during handling and be ingested through food if not washed off hands etc.

Once a agrochemical enters the body, it is often absorbed into the bloodstream and can move throughout the body. The amount of absorbed and the rate of absorption depends on the chemical involved and the route of exposure. This movement of the agrochemical through the bloodstream is called distribution. Through distribution a chemical can come into contact with all parts of the body, not only the original site of entry. In some cases, such contact distant from the point of entry can lead to adverse health effects. For example the ingestion of the pesticide parathion into the stomach can lead to substantial damage to the lungs.

Once a agrochemical is absorbed into the bloodstream, it can have several different fates. In many cases, it is rapidly removed from the body. In other situations it may be stored in various parts of the body, such as fat or bone and remain in the individual for many years. A compound may also lead to a toxic effect through interaction with certain organs or tissues in the individual or with other compounds in the body.

Often a agrochemical which is absorbed into the body interacts with particular body chemicals and is changed into one or more other chemicals. This process is called metabolism.

The particular properties of the absorbed chemical are quite critical to its fate in the body. Certain Agrochemical are very resistant to metabolism and readily dissolve into fat and are then stored. Dieldrin is a good example of this type of compound. Other chemicals are more rapidly metabolised and excreted before they can cause adverse effects. The organophosphate pesticides tend to behave this way at low doses.

In the case of a single event exposure it is the total amount of agrochemical to which are person is exposed that determines the severity of the toxic effect if any. The greater the amount of exposure the greater the potential for adverse health effects. In some cases this is due to the inherent toxicity of the agrochemical and in others to the inability for the body to defend itself. In the latter case the body may not be able to metabolise the chemical rapidly enough to prevent an increase in concentration to toxic levels. In such a situation there is a clear threshold above which toxic signs and symptoms appear.

In the case of repeated multiple exposures to an agrochemical it is not only the total amount of exposure but also the rate or timing of exposure that is quite important. All processes in the body normally proceed at specific rates so that metabolism excretion and storage occur during a particular period of time after a chemical is absorbed. For one occurrence exposure the time needed for the various processes that breakdown the compound to be completed will determine the length of time that a toxic response if any persists.

However if there are repeated exposures to the same chemical the situation is more complicated. If there is enough time between so that all of the chemical from the initial exposure is excreted and no effects persist then each exposure is essentially independent of the previous one and can be treated as a single exposure. However if the time between exposures is so short that some of the chemical remains from the first exposure then a build-up can occur. Over time this build up can lead to levels that are toxic.

The total amount of exposure can have different results depending on whether the exposure occurred all at once or repeatedly over time. A high dose given once may have the same toxic effect while the same total given in small doses over time will not.

The possible toxic effects of exposure to a particular agrochemical depends on many factors. These include characterisation of the chemical and the individual exposed, the route of exposure, the total dose and the time course exposure. Unfortunately scientists have not been able to determine exactly how each of these factors will affect any specific individual so that present understanding of agrochemical exposures only provides general guidance.

The procedures specified in this manual are designed to minimise exposure and this minimise the potential for adverse health effects.

Polychlorinated Biphenyls (PCBs) are a mixture of chemicals and may be clear to yellow oily liquids or solids, vapour is invisible, and PCBs are heavier than water.

PCBs are a group of Chlorinated Hydrocarbons. Up to 209 different compounds exist in the PCB group. PCBs have the chemical composition C12 H10-nC1n. Specific chemical properties vary with the amount of chlorine.

PCBs are generally stable chemically and resistant to heat. They are fire-resistant, have a strong odour, are insoluble in water, and can be mixed with oils used in transformers and capacitors as insulating fluids ("Dielectrics"). Other uses included heat transfer fluids, hydraulic fluids, in brake linings, paints, sealants, varnishes, carbonless copy paper, cosmetics, etc.

PCBs do not break down readily. They persist in the environment and are absorbed by animals, being stored in fatty tissues. Once in the food chain they increase in concentration the further up the chain one goes ("Bioaccumulate").

As well as the risk from PCBs themselves, there is a risk from fires involving equipment containing PCBs. Such fires can produce toxic by-products including dioxin (Polychlorinated Dibenzoparadioxins, Poly Chlorinated Dibenzofurans and Hydrogen Chloride).

PCBs are thought to be hazardous to human health. The path of PCBs entering to the human body is by breathing, ingesting and passing through the skins.

No matter what, PCBs must be handled with extreme caution. Most commonly, inhalation of PCBs may lead to nausea and eye, nose and throat irritation. PCBs may also damage the liver.

High exposure of PCBs may damage the nervous system, causing numbness, weakness and tingling (pins and needles) in the arms and legs. Also high exposure to the skin may cause itching, sweating and burning sensations. Long-term high skin exposure may result in ridges in finger and toe-nails, acne and skin pigmentation.

High exposure through inhalation may irritate lungs and cause gastro-intestinal problems such as a reduced bowel capacity. Also the nervous system and skin problems mentioned above may be caused through inhalation in high exposure sites.

Research results do not confirm or conclusively show a causal relationship for the following effects :

1. PCBs may be teratogens (can cause fetal malformation in the first three months of pregnancy)

2. They may damage an adult's reproductive system.

   The symptoms of high PCB levels in the body, as listed above, are often (and possibly erroneously) directly related to the concentration of PCBs in the blood.

Destruction and Decontamination Technologies for PCBs and POPs

PART II - PROJECT STRATEGIES

UNEP

Basel

Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal

Convention

ISCER

PART II PROJECT STRATEGIES

Steps for the Environmentally Sound Management of POPs as waste

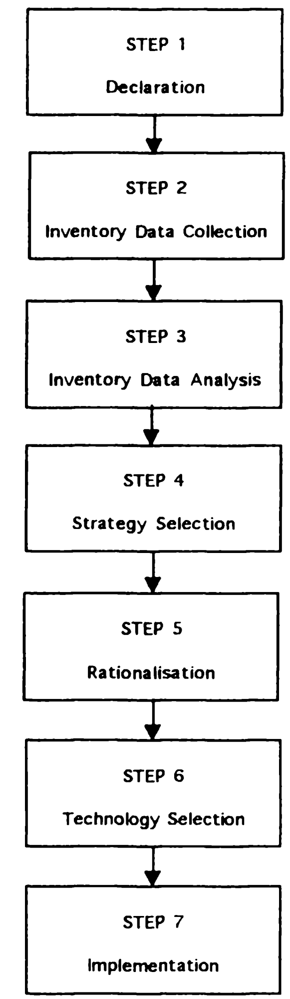
The process to developing an Environmentally Sound Management Project strategy for destruction *and decontamination* is essentially the same for all POPs, PCBs and unwanted and obsolete *pesticides. There are seven steps involved and these steps are the same for all.* The guide deals with each separately but follows the same seven steps.

Step one	Declaration to dispose PCBs and POPs

The decision to dispose is where the whole process starts. When a country or organisation decides that a POP or PCBs will be collected and disposed of and this is declared the entire process commences at the point of declaration. The important key issues at the point of declaration are also to state the boundaries of the disposal. Will it be only government agencies that have stock of PCBs or POPs or will it also cover private or public companies. Will stocks without owners be included and who will pay for the disposal. At the point of declaration the rules about end of service life for equipment contaminated with PCBs will need to be stated. The declaration of disposal needs to be short, clear and concise as to the boundaries of the project. Without a clear declaration it will be difficult to determine which stocks are to be disposed of and which are not. Once the declaration has been published then the project follows specific steps.

Step two	Inventory data collection POPs(PCBs)

The process involved with determining and selecting an appropriate destruction or decontamination technique begins with the inventory stage. It is important to understand that the whole process of selecting the destruction or decontamination stage is entirely dependent on the quality and quantity of the information obtained during the inventory phase. It is not possible to correctly select an appropriate technology unless the inventory stage is rigourous and detailed. The range of concentration and disposition of PCB for instance is so vast that is is unacceptable to determine the destruction or decontamination technology without the inventory analysis being in place.



When the inventory analysis is complete **and the stock's size, concentration and disposition is known then and only then can the process begin in order to establish the appropriate technology or combination of technologies that will deal with the waste in a sustainable manner.**

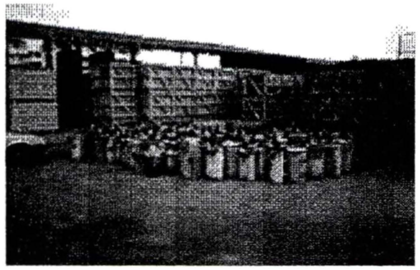
Depending on the inventory analysis there are many options available and this guide will provide a method for working out the best technology and management plan as well as provide details of the available technologies.

The inventory data collection must be detailed enough to provide the following information. When collecting data for PCB inventory there are four fundamental questions to be asked.

What is it?
Where is it?
How much is there?
Who owns it?

These questions are answered by the provision of the following data against the following segments:

In service transformers
Out of service transformers
Inservice capacitors
out of service capacitors
Bulk storage tanks, drums and containers



Compiling a National PCB inventory

Scope

- determine the regions to be inventoried
- locate areas where PCBs are likely to be found
- divide areas into logical units to be inventoried

Selection of facilities to inventory

- select those facilities that are likely; to have significant quantities of PCBs
- also consider facilities that may have disposed of PCBs inadequately

Facilities that may have PCBs

- electric utilities
- industrial facilities
- railroad systems
- military installations
- research labs
- manufacturing plants
- mining operations
- landfills

Priority facilities

- electric utilities, power companies
- electronics manufacturing
- petrochemical plants
- railroad systems
- transformer repair
- mining operations

Step Six - Inventory Data Collection POPs(PCBs) Continued

For each of the segments there are several data required as follows.

In service transformers

KVA rating	Brand name
Fluid qty	location
number (EPA)	PCB concentration
Year of manufacture	Scheduled year of replacement
weight	status/owner

Out of service transformers

KVA rating	Brand name
Fluid qty	location
number (EPA)	PCB Concentration
Year of manufacture	weight
status/owner	

In service capacitors

KVAr Rating	Brand name
Weight	number (EPA)
location	status/owner

Out of service capacitors

KVAr rating	Brand by name
weight	number (EPA)
location	status/owner

Bulk storage, drums, tanks etc.

Type	location
weight	fluid qty
PCB Concentration	status/owner

The data entry for status can includes codes for leaking, stable, packed etc.

Which Inventory system to use

Self reporting or physical inventory

Considerations:-

- Scale of inventory
- how many facilities
- where are they located
- complexity of facilities
- responsiveness of industry

Self reporting management

- notifications
- education
- transmission of information
- handling of responses
- performing spot checks

Self reporting Notification/Education

- send forms and instructions to identified facilities
- use advertising
- contact p[professional and trade associations
- specify places to call for assistance

Transmission of PCB survey information

- to whom should you send forms?
- how long to wait for a response?
- how should you follow up?

Handling of Responses

- check form for completeness
- enter the information into the database
- devise a process to ensure quality of data

Selecting the equipment to be inventoried

- must do
  - transformers
  - capacitors
- ought to do
  - hydraulic fluids
  - oil filled cables
- get information on
  - PCB containing wastes
  - Soil contamination

Determining if the equipment contains PCB.

•look for manufacturers label
•locate other records or information about the equipment
apply assumption rules

Assumption rules

Transformers and capacitors with no information	Assume PCB
Transformers with mineral oil dielectric fluids and no other information	Assume PCB contaminated
Circuit breakers, voltage regulators, Fluorescent light ballasts with no information	Assume PCB contaminated.

Inspect service records

•determine if the equipment has been retrofilled
• if retrofilled obtain records ppm levels

Sampling and analysis

•direct sampling of dielectric fluids
-from equipment drains etc.

Testing for PCBs

•simple screening tests (done on site using kits)
-density
-chlorine content

Laboratory testing
-gas chromatography

Communicating with facility management

•obtain co-operation of facility managers before conducting the inventory
•explain the purpose of the inventory
• schedule the inventory visit
•discuss equipment locations, if possible
•learn plant safety procedures

Conducting the inventory

• facility entry
•preinventory meeting with facility managers
•selecting the equipment to be inventoried
•working with facility managers to conduct the inventory
•inventoring
•sampling and analysis
•completing the inventory form
•post inventory meeting

In many respects the inventory data collection for POPs other than PCBs including; unwanted and obsolete pesticides is very similar to that of PCBs. The four questions are the same;

What is it?
Where is it?
How much is there?
Who owns it?

Whereas the testing and sampling of PCB is a relatively straight forward exercise, in the field for pesticides and POPs as waste in general it is a different matter. In many cases of long term storage of POPs and unwanted and obsolete pesticides the question "What is it?" becomes very difficult However it is very important that during the inventory process the "what is it?" question is answered fully. There are many experts available that can readily identify the class of pesticides and agri-chemicals in general and at the very least the class must be identified. This is because unlike PCB the segregation of the various unwanted agri-chemicals classes is very important when the material is to be transported.

During the process of repackaging of POPs, waste streams must be kept separate and hence the inventory data collection process must identify the streams. A waste steam can be made up of separate types of waste so long as they are compatible with each other. The first step is to keep liquids and solids separated from the very beginning. The.inventory data collection must therefore contain information that permits the construction of a segregation strategy which will eventually impact on the transportation strategies.

Pesticides are categorised into groups of pesticides, such as organic chlorine pesticides, organic phosphorus pesticides and pyrethroide pesticides. Pyrethroide pesticides have a low toxicity level, chlorinated pesticides are toxic, but not acute, phosphorus pesticides are acute toxic.

Class segregation rules

(a)Formulations. All powder, liquid and aerosol formulations of agri-chemicals shall be kept segregated.

(b)Herbicides. All herbicides should be stored in a segregated area of the store, and on their own, to prevent cross contamination.

(c)Sodium Chlorate/Potassium Chlorate. These are scheduled class oxidising agents and must be segregated in storage so that they do not come into contact and react with any combustible materials, or acids.

(d)Pool chemicals. Calcium hypochlorite shall not be stored with any agri-chemicals (or any other chemical) as contamination can cause spontaneous explosion.

(e)Soil Fumigants. Methyl bromide, chloropicrin, dichloropropane,dichloropropene and other soil fumigants shall be segregated in storage so that they cannot come into contact with any other chemical at any time.

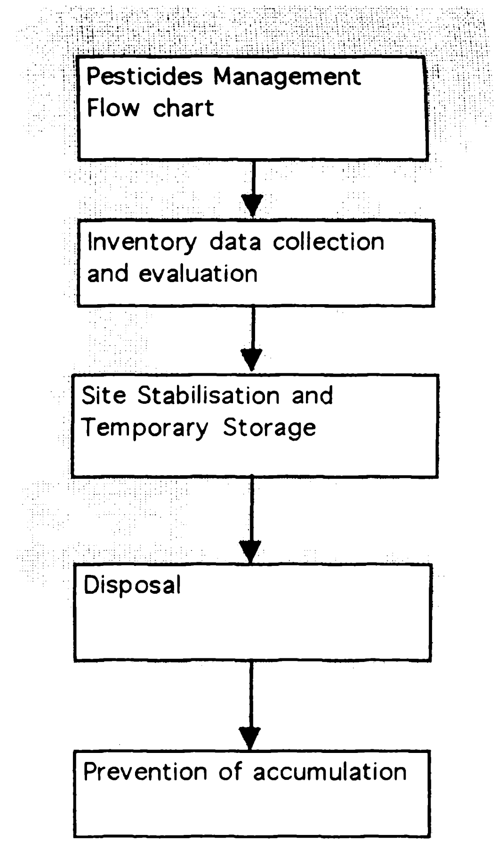
(f) Lubricants, Brake fluids Under no circumstances shall these be stored with any agri-chemicals.

(g) Potassium, calcium and ammonia nitrate fertilisers. Under no circumstances shall these fertilisers be stored with agri-chemicals.

Inventory data for unwanted and obsolete pesticides should include:

location
classes and type of material
weight and volumes of each material
Owner information
storage situation
leakage and contamination information
product information - active ingredient, formulation, concentration
product age and condition

As for PCBs the inventory data collection for other POPs is the starting point for the formulation of a project plan to deal with the unwanted and obsolete pesticides. An additional factor for a pesticides project is site stabilisation. During the inventory data collection information is collected that provides details of the site situation and disposition of the chemicals o that during the project activity a stabilisation of the site can be applied. Within the project plans outlined in this guide this is covered in the site clearance and site preparation plans.



FAO STANDARD INVENTORY FORMS FOR RECORDING OBSOLETE PESTICIDES

Product Form
A product sheet needs to be completed for each product (if one product is kept in different types of containers, one sheet should be completed for each type of container)

SHEET NUMBER: .... DATE: ....
OWNER OF PRODUCT: .... STORAGE SITE: ....
LABELS ON CONTAINERS:
TRADE NAME: .... ACTIVE INGREDIENT(S): ....
FORMULATION TYPE: .... CONCENTRATION: .... g/litre or g/kg
MANUFACTURER: .... BATCH NUMBER:.....................................
MANUFACTURE DATE: .... ARRIVAL DATE: ....
CONTAINER TYPE: .... UNIT SIZE: ....
NUMBER OF CONTAINERS: .... QUANTITY: ....
ORIGIN: purchased by Government / received as donation (name donor): ....
imported by private company (name company): ....
CONDITION OF PESTICIDE: usable / unknown / deteriorated
CONDITION OF CONTAINERS: good/ minor damage / serious damage
transportable / not transportable
description of damage: ....
HAVE CONTAINERS BEEN OPENED? yes / some / no / not certain
REASON FOR NOT USING THE PRODUCT:
expired / deteriorated / banned / wrong formulation
no need / stock too large / no longer recommended
Other: ....
REMARKS: ....

Step three | Inventory Analysis POPs (PCBs)

The information contained in the inventory analysis allows us to commence the planning required to derive a destruction and decontamination strategy. There are several steps to this phase.

Inventory Analysis Step 2 - Data Breakdown

With the data collected during the inventory phase a breakdown of the information is required. This breakdown is designed to discover the size and nature of the waste material so that groupings can be assigned so that the appropriate technology selection process can be applied. Ultimately there are two overall categories. The first is material that is to be decontaminated and the second is material for destruction. It is very important to get the waste PCB properly assigned so that the appropriate technology can be selected. While the inventory data may refer to simply PCB transformer it is necessary to know the amounts and the concentrations of PCB as this will have a material effect on the technology selected to either decontaminate the transformer or to export it for destruction.

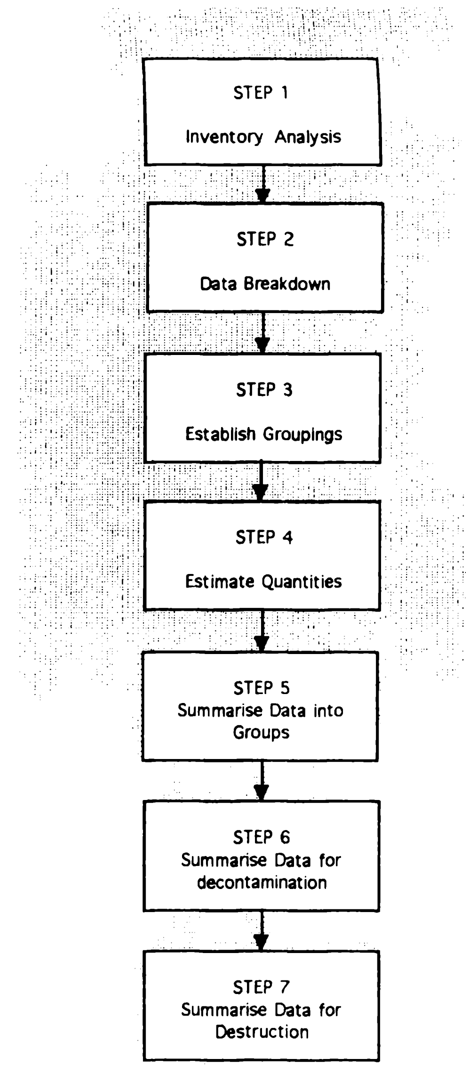
Inventory Analysis Step 3 - Establish groupings

For PCB contaminated equipment it is necessary to establish groupings for the waste to be categorized into. The groupings below are a suggestion for likely groupings that are based on appropriate technology for the decontamination of destruction of the PCB. The groupings should be laid out on a matrix so that amounts can be entered into and then the summarising can be done.

Likely PCB groupings

Gp 1 In service transformers (all sizes) with less than 50ppm PCB
Gp 2 In service transformers (less than 500KVA) with 50-5,000 ppm
Gp 3 In service transformers (less than 500KVA) with 5,000-50,000 ppm
Gp 4 In service transformers (More than 500KVA) with 50-5,000 ppm
Gp 5 In service transformers (more than 500KVA) with 5,000-50,000ppm
Gp 6 In service transformers (more than 500KVA with 50,000-900,000ppm

Inventory Analysis process for POPs (PCBs)



Gp 7 Out of Service transformers (all sizes) with less than 50ppm
Gp 8 Out of service transformers (less than 500KVA) with 50-5,000ppm
Gp 9 Out of service transformers (less than 500KVA) with 5,000-50,000ppm
Gp 10 Out of service transformers (less than 500KVA) with 50,000-900,000ppm
Gp 11 Out of service transformers (more than 500KVA) with less than 50ppm
Gp 12 Out of service transformers (more than 500KVA) with 50-5,000ppm
Gp 13 Out of service transformers (more than 500KVA) with 5,000-50,000ppm
Gp 14 Out of service transformers (more than 500KVA) with 50,000-900,000ppm
GP 15 Empty out of service transformers
Gp 16 In service Capacitors
Gp 17 Out of Service capacitors
Gp 18 Storage tanks with oil less than 50ppm
Gp 19 Storage tanks with oil greater than 50ppm

Photo : Type 7 storage

This grouping breakdown is placed on a matrix with the quantities from the inventory analysis and then the matrix is passed to the next step in the process which is the strategy selection.

Step 2 Data Breakdown involves the organising of the inventory data types and quantities into the grouping.

PCB Inventory Analysis - Step 2 Data Breakdown

PCB Type	Manu	Type No.	Service No.	Owner	KVA/r	Total Weight Kg	Oil Wt Kg	Oil Qty Litres	PCB ppm	Gp
T/F	ABB	TM	134	TPC	250	450	185	250	<50	1
T/F	Tyree	OB	145	TPC	5000	12500	2500	4000	>50000	6
Caps	T&J	TYY	1485	PDC	125	60	25	35	5000	16

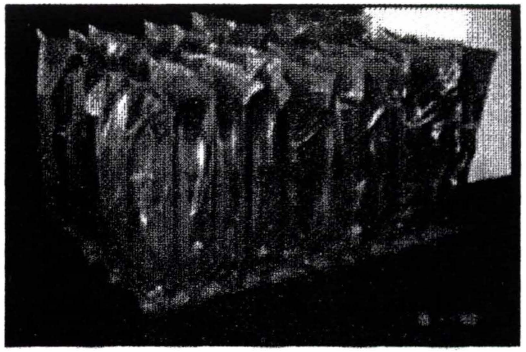


Photo : Type 10 Storage

PCB Inventory Analysis - Step 4 Estimate quanitites

Oil Wt Kg	Oil Qty Litres	PCB ppm	Gp	Qty Decon Oil Kg	Qty Decon Mat Kg	Qty Destr PCB Kg
185	250	<50	1	185	265	0
2500	4000	>50000	6	2500	10000	2500
25	35	5000	16	25	55	55

Step 4 Inventory analysis involves estimating the quantities of PCB oil and PCB contaminated materials

PCB Inventory Analysis - Step 5 Summarise data

Gp	Qty Decon Oil Kg	Qty Decon Mat Kg	Qty Destr PCB Kg
1	2560	9562	0
2	3540	10000	3540
3	2687	55	55
4	15000	28000	15000
5	29500	48900	29500
6	16500	29500	16500

Step 5 Inventory analysis involves reordering the data into the group total quantities and summarised across decontamination and destruction.

Photo : Type 6 Storage

PCB Inventory Analysis - Step 6 Decontamination

Gp	Qty Decon Oil Kg	Qty Decon Mat Kg	Total Decxon Kg
1	2560	9562	12122
2	0	10000	10000
3	2687	55	2742
4	0	28000	28000
5	0	48900	48900
6	0	29500	29500
		TOTAL	131,264

Step 6 Inventory analysis involves summarizing the total amount to be decontaminated

Step 7 Inventory Analysis involves summarising the amount to be destroyed

PCB Inventory Analysis - Step 7 Destruction

Gp	Qty Decon Oil Kg	Qty Dest Mat Kg	Total Destr Kg
1	0	0	0
2	3540	0	3540
3	0	0	0
4	15000	0	15000
5	29500	0	29500
6	16500	0	16500
		TOTAL	64,540

Step 3	Inventory Analysis
	POPs (Unwanted and Obsolete pesticides)

The analysis for unwanted pesticides and POPs is somewhat simpler than for PCBs. Generally the waste falls into the broad classes of segregation and in the main these products must be exported for destruction rather than local decontamination. Decontamination procedures may be required for soil and water clean up and this in the main involves extraction of the contaminated soil rather than treatment of it. There are some technologies however that can be used in situ for soil contaminated with pesticides and involve bioremediation or phytoremediation.

The analysis must provide detailed summaries of the quantities of stored waste and the location and disposition of it. Whereas the inventory analysis for PCBs generally falls into two categories, decontamination or destruction, the analysis of inventory for pesticides should be broadly placed into the four categories as follows;

Obsolete products requiring disposal

Products requiring further identification and testing

Usable products

Usable after reformulation

Obsolete products requiring disposal

- products that are banned
- Products that are deteriorated beyond usability
- Products that testing has show to beyond usability
- Contaminated products rendering them unusable

Products requiring further identification

- Unidentified products
- Older products passed useby dates

Usable products

- Use is still permitted and not unusable

Usable after reformulation

- Products in good condition but need reformulating so they can be reused.

The quality of the inventory analysis becomes important at this stage. So that the correct technology is selected that data contained in the matrix from stages 1,2 and 3 must be accurate.

The actual grouping make up will also have a bearing on the combination of technology selection. If there is much more of one grouping over another then a single technology may be chosen to cover all the stock.

The possible technology selections for PCBs that can be made against each of the groupings above are as follows:

<u>Gp1</u> <u>In service transformers (all sizes) with less than 50ppm PCB</u>

In general in service transformers with less than 50ppm may be left in service and not touched. Retrofilling is possible but this creates stocks of lightly contaminated oil. In the main most countries prefer to treat below 50ppm as not PCB. From an environmentally sound management point of view with retrofilling producing stocks of contaminated oil the best option is to leave the less than 50ppm as it is.

<u>Gp2</u> <u>In service transformers (less than 500KVA) with 50-5,000 ppm</u>

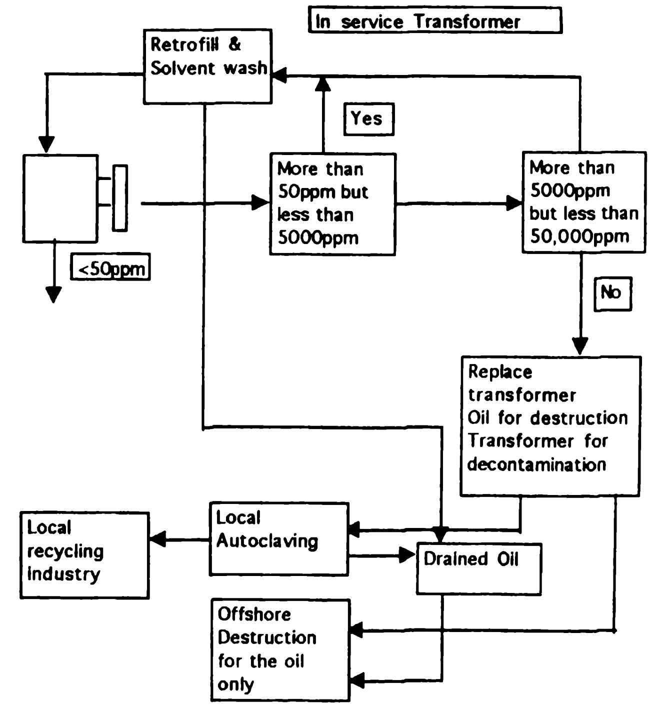
For transformers in service with less than 5000ppm retrofilling is cost effective and valid with in situ treatment not cost effective for transformers of this size.

<u>Gp 3</u> <u>In service transformers (less than 500KVA) with 5,000-50,000 ppm</u>

Retrofilling with in situ treatment of solvent washing or bio reaction and circulating polishing with Perchloroethylene. Also replacement option is valid

<u>Gp 4</u> <u>In service transformers (More than 500KVA) with 50-5,000 ppm</u>

Retrofilling with in situ treatment uis required due to the size of the transformers and the capacity for long term leaching. Removed oil which may be up two two times the transformer capacity will require to be destroyed. Replacement option not valid due to high capital cost and destruction costs.



Note : Only Oil, Internal Transformer cardboard, wood and ceramics etc is ever destroyed. All other transformer components, steel, copper, aluminium are recovered and recycled.

Gp 5 In service transformers (more than 500KVA) with 5,000-50,000ppm

Retrofilling with in situ treatment for residual leaching. Recovered contaminated oil must go for destruction.

Gp 6 In service transformers (more than 500KVA) with 50,000-900,000ppm

Oil for destruction and transformer for decontamination and recycling after autoclaving.

Gp 7 Out of Service transformers (all sizes) with less than 50ppm

Oil for destruction, transformer may be reused or recycled

Gp 8 Out of service transformers (less than 500KVA) with 50-5,000ppm

Oil for destruction, transformer for solvent washing and reused or recycled

Gp 9 Out of service transformers (less than 500KVA) with 5,000-50,000ppm

Drain Oil for destruction, transformer to autoclaving, solvent washing and recycling

Gp 10 Out of service transformers (less than 500KVA) with 50,000-900,000ppm

Drain Oil for destruction, transformer for autoclaving, solvent washing and recycling

Gp 11 Out of service transformers (more than 500KVA) with less than 50ppm

Drain oil for destruction, transformer for autoclaving, solvent washing and recycling

Gp 12 Out of service transformers (more than 500KVA) with 50-5,000ppm

Drain oil for destruction, transformer for autoclaving, solvent washing and recycling

Gp 13 Out of service transformers (more than 500KVA) with 5,000-50,000ppm

Drain oil for destruction, transformer to solvent washing, autoclaving and recycling

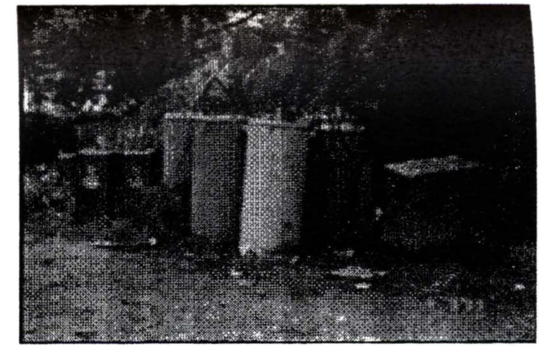


Photo:Type 1 Storage

Gp 14 Out of service transformers (more than 500KVA) with 50,000-900,000ppm

Drain oil for destruction, transformer for autoclaving and recycling

GP 15 Empty out of service transformers

Autoclaving and/or solvent washing and recycling

Gp 16 In service Capacitors

Remove and send for shredding and destruction or autoclaving

Gp 17 Out of Service capacitors

Shredding and autoclaving or destruction

Gp 18 Storage tanks with oil less than 50ppm

No action

Gp 19 Storage tanks with oil greater than 50ppm

Drain oil for destruction, solvent wash tank.

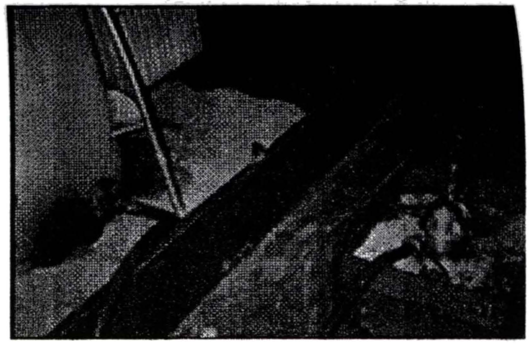


Photo : Temporary bunding for transformer decanting

Step 4 | Strategy selection POPs Unwanted Pesticides

Compared to management of PCBs unwanted and obsolete pesticides have another step that must be applied before the disposal strategy is selected. This involves site stabilisation. Generally is is helpful if this process is done with the inventory and data collection phase but in reality it is done at a later date. Stabilisation of sites in necessary to reduce further loss to the environment and increasing risks to the local population and site workers. Site stabilisation involves repackaging of the unwanted chemicals that are leaking from unstable and deteriorated containers. Site stabilisation also involved segregation of classes and separation of dangerous combinations. It is during this phase along with the information from the inventory analysis that the strategy selection for destruction and decontamination can commence.

In the main for unwanted and obsolete pesticides and POPs in general decontamination is not an option apart for contaminated soils. Destruction is required for those products that cannot be reused as they are, or reused after reformulation. The disposal or destruction method chosen will depend on the type and quality of product involved and local circumstances. While a destruction technology may be suitable for one situation it may be unsuitable for another. This means that the process of formulating a strategy will have to consider the combination of the technology and the chemicals involved at the particular site.

The five main alternatives for strategy selection are :

high temperature incineration
landfill
chemical treatment
long term storage
ball milling

These alternatives are discussed in PART III of the guide.

Given the amount of PCB oil to be disposed of, should the country import the technology to incinerate the oil using a mobile incinerator or due to the low quantities should it be exported to another country that is set up with incineration facilities. Would it be feasible to import Plasma Arc technology and dispose within the country. What are the issues of dioxins and furans that impinge on this decision and are they managed by the chosen technology. Is storage long term a feasible option so that when a cheaper more friendly option is available then disposal can occur. Should the country import dechlorination, solvent washing, autoclaving technology or biotech technologies to decontaminate the PCB equipment? Can the recycling business cope with the materials from the autoclaving process. All of these decisions depend on the quantity of the material, the concentration (PCBs) of the material, the infrastructure available within the country and the logistical framework necessary to handle the project. The steps in volved in the rationalisation activity are as follows:

- After the basic strategy selection has been performed the matrix is updated to show the reality of the chosen strategies and thus the quantities of materials that will be available to each part of the chosen strategies.
- It is then appropriate to rationalise the process by examining the matrix to see where the bulk of the material lies and determine where a particular group may be combined with another group as far as treatment is concerned.
- Major decisions are made at this point based on the reality of the country situation and the disposition and size of the waste to be disposed. It is during this stage that the requirements of environmentally sound management are delivered. Decisions in this step include;
- export all or part of the PCBs

Extracts from the Basel Convention

(d) Ensure that the Transboundary movement of hazardous wastes and other wastes is reduced to a minimum consistent with the environmentally sound and efficient management of such wastes , and is conducted in a manner that will protect human health and the environment against the adverse effects which may result from such movement:

(e) Not allow the the export of hazardous waste or other wastes to a State or group of States belonging to an economic and/or political integration organisation that are Parties , particularly developing countries, which have prohibited by their legislation all imports, or if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner, according to criteria to be decided on by the Parties at their first meeting.

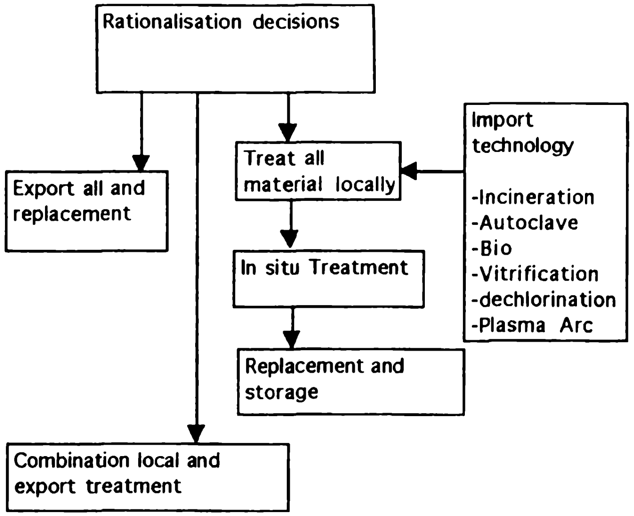
(f) Require that information about proposed Transboundary movement of hazardous wastes and other wastes be provided to the States concerned according to annex V.A to State clearly the effects of the proposed movement on human health and environment:

(g) Prevent the import of hazardous wastes and other wastes if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner:

Step 5 - Rationalisation - PCBs (Cont)

- *Construct or import PCBs destruction or decontamination technology*
- remove PCB contaminated equipment from service or leave in situ and treat

All of these questions and decisions must be framed within the concept of environmentally sound management, minimisation of transboundary movements, sustainability and sound management practice as well as economic considerations. A balance must be achieved here that provides a solution that is best for all the elements described. It will not be possible to satisfy all of the requirements. It may be that the best environmentally sound management solution involves total export because the rationalisation analysis has indicated that it is not technically feasible nor economically feasible to develop an indigenous technology or import a technology to dispose of small amounts of highly contaminated PCB oil. On the other hand it may be feasible to import autoclaving systems to take care of decontamination of empty transformers with the concentrated PCB oil being exported for destruction. These are the decision that can only be made after the rationalisation procedure is complete and that procedure is dependent on an accurate inventory analysis.



In a similar manner to that of rationalisation for PCBs, POPs and unwanted or obsolete pesticides must go through rationalisation. Because unwanted or obsolete pesticides are generally sent for destruction the rationalisation involves the feasibility of the various options open to the country involved. If high temperature incineration is chosen should it be a mobile machine imported to the country or should the waste travel overseas to a developed country that provides a service of destruction using a HTI. It is usually not an option for a developing country to consider constructing its own high temperature incinerator as a fixed plant. The cost for this is prohibitive and there are issues related to operational safety and training etc. It is feasible to import a mobile High temperature incinerator that can be transported from site to site should there be sufficient material available to make it economic. Quantities at each site would need to be in the order of 7000 tonnes for this option to be successful.

Cement kilns can provide a useful alternative for purpose built HTI but it needs to be a rotary kiln with appropriate gas treatment systems such as an electrostatic precipitator. Often the owner of the cement kiln will not allow its use for pesticide destruction. The time taken to evaluate and determine such kilns can be used usually exceeds that required for other options.

Export to a HTI incinerator in a developed country is a valid option for all quantities from one tonne to 10,000 tonnes and more. These days the cost of HTI incineration for pesticides is very competitive and is the preferred technology at this time.

In situ chemical treatment is an option but there are many problems associated with performing treatment within developing countries. Generally it is often not cost effective when compared to incineration and difficult to ensure environmental protection during treatment. Chemical treatment is generally viewed as simply preparing the product for further treatment such as landfilling or incineration rather than an end in itself.

Ball milling is an emerging technology that has huge promise for on site treatment and destruction of obsolete pesticides - details in Part III

Step 5 Rationalization Project Strategy Management

For hazardous waste projects of some size there needs to be a project management strategy for the implementation of the strategies chosen. While PART IV has a full set of implementation plans there needs to be an understanding of basic project management and that is defined here, There are five distinct areas that are required to be "managed" so that the waste project is successfully completed. These five areas of the waste project areas that must be managed by the project team and they are described as management functions.

Managing Scope

Managing Project Organisation

Managing Quality

Managing Cost

Managing Time

Each of these elements is delivered within the Implementation plans in PART IV.

Within each of these five elements is the element of risk management and this is discussed separately.

Before these elements are considered the project definition must be formulated. The project definition initiates the project and therefore relates the work to projects objectives.

Managing the Scope

Scope management is often the most overlooked aspect of project management. It is within this element that the project objectives are set and generally where the biggest failure component occurs. It is within the definition of scope and its subsequent management that the true direction of the boards intentions can be lost. The purpose of scope management can be summarised as follows:

The management of the project scope shall be defined so that the activity engaged ensures that enough, but only enough, work is undertaken to deliver the project's purpose.

Within this definition are three key elements (J Turner) :

- an adequate, or sufficient, amount of work is done
- unnecessary work is not done
- the work that is done delivers the stated business purpose

There are four steps to make this definition a reality for this project and they are:

1) Develop the concept through the projects objectives

2) Define the scope through the work breakdown structure

3) Authorise and execute the work, and monitor and control progress

4) Commission the facility to produce the system and obtain the benefits.

The main emphasis is at the start of this process, as the mistakes made here are rarely corrected. Item 3 above is the purpose behind the "Ownership" of the project. The development of the Project Concept (1) is a critical issue and this must be properly completed after the project leader has had the opportunity to evaluate the site situation .

Work Breakdown structure (2) is a process by which during the first stage of formulating the management of the project the work of the project is divided and subdivided for management and control purposes. In preference to breaking the project into a low level of detailed in a single step the idea is to devolve through increasing levels of detail. Therefore the work breakdown structure is developed by breaking the project into intermediate and sub project steps and the work required to execute that sub group is identified.

There are three fundamental levels of work breakdown:

- Integrated
- Strategic
- Detail

For this project due to its nature of involving the entire Business the Work breakdown must start at the first Breakdown level and progress down. As it devolves downwards then the detail level breaks down into project phase, task, activity etc and there will be probably about seven levels that are finally listed. This process as mentioned devolves as the project unfolds and the detail of the project becomes clearer as a result of the business purpose clarification.

The advantages of the Work Breakdown concept are:

- It provides better control of work definitions
- It allows work to be delegated in coherent packages
- It allows work to be defined at an appropriate level for estimating and control of the current stage
- It allows risk to be contained within the work breakdown structure

The use of work breakdown structures will satisfy the principles of good management:

1 Manage through a structured breakdown of the project
2 Focus on results: what to achieve and how to achieve it
3 Balance results through the work breakdown, between areas of technology, people, systems and organisation
4 Organise a contract between all the parties involved, by defining their role, responsibilities and working relationships
5 Adopt a clear and simple reporting structure

In order to create the work breakdown the process of defining the project must be carried out :

Defining Projects

The project definition always has the role of initiating the project and therefore as previously mentioned relates the work of the project to management's requirements. The following three requirements should be defined:

- the purpose
- the scope
- the objectives

The purpose statement should be clear and concise and once the project is underway it will become the mission of all those involved in the project, both as team members and as resource providers.

The scope is an initial high level description of the way in which the purpose will be commissioned. The Statement of Scope should include two elements:

- The work that falls within the remit of the project and is required to achieve the benefits
- the work that falls outside of the remit of the project

The objectives should be quantitative and qualitative measures by which the completion of the project will be judged. In effect they define the outcome that will be produced. The objectives should address:

- address all the work within the scope of the project
- not address work outside of the scope of the project
- begin to set the parameters for managing quality, cost and time.

Summary of Managing Scope

The purpose of scope of management methodology is to ensure that :

- adequate work is done
- unnecessary work is not done
- the project's purpose is achieved

There are four steps of scope management:

- develop the concept through the projects objectives
- define the scope through the work breakdown structure
- authorise and execute the work, and monitor and control progress
- commission the project and produce the benefit

Work breakdown is a process by which the work is subdivided for management,control purposes and logical arrangement purposes.

The project is defined at the strategic level through;

- the purpose
- the Scope inclusions and exclusions
- the objectives

At the strategic level the Milestones plan:

- shows how the deliverables build towards the final objectives
- sets a stable framework
- controls the unfolding and devolution of the management of the scope

A good milestone plan

- is clear, simple and concise
- focusses on necessary sections
- gives an overview of the project

There are seven steps in milestone planning

- agree the final milestone
- brainstorm milestones
- review the list
- experiment with result paths
- draw the logical dependencies
- make the final plan

Plans at the lower level include:

- subsidiary milestones plans
- work package scope statements
- activity plans developed on a rolling wave basis.

Managing Project Organisation

The next major project management objective is that related to managing the project Organisation. Through this process the project Manager defines the type and level of resources inputs, and how they are to be managed in order to achieve the purpose of the project that has been stated in the management of scope.

When the Scope and the Organisation have been fully defined they represent the Project Contract that then exists between the project team and the Corporate Management.

The purposes, principles and processes of project organisation are defined as below;
Project Organisation Purpose is defined for this project as follows:

to assemble sufficient resources (human, material and financial) of the appropriate type and quality to undertake the work of the project and to deliver the strategic intention of the project.

Three of the principles of good project management are discharged by the management of the project organisation:

- negotiate a contract between all parties
- assign roles and responsibilities at all levels of work breakdown
- adopt a clear and simple reporting structure

Negotiating Contracts

The Project must establish an organisational structure and the project manager must establish a contract between all parties involved at all levels as follows:

- between Management and the Project Manager Level
- between the parties making up the PCG at the Strategic Level
- between the members of the project team at the tactical level

The project manager is responsible for negotiating the "Contracts" by building a clear vision of the project and devolving that mission or vision down to objectives at each level of the organisational structure.

Defining Roles and responsibilities

The "Contract" is defined by the process of defining roles and responsibilities of the parties involved for the work elements at each level of the breakdown. This can take the following format:;

For work	Who is to undertake the task
For management	Who is to make decisions Who is to manage progress Who guides new resources
For Communication	Who must provide information and opinions Who may provide information and knowledge Who must be informed of outcomes

The responsibility chart should be kept simple and clear. It should be a single page defining resources and inputs. It defines the "Contracts" at all levels of breakdown and is the document against which the "contracts" are negotiated and agreed. The responsibility chart is the document that is used to foster cooperation and ensure that the project operation is brought on quickly and effectively.

The use of a responsibility chart is now widespread in project management of the project type that water is engaged in. Typically the chart is a matrix with work elements shown as rows and organisational elements as columns Symbols placed in the body of the matrix show the level of involvement of a particular organisational unit. Communications assisted by the use of identification letters as shown on the sample responsibility chart attached with the report.

Use of the Responsibility chart

This chart can be used at all levels within the Work Breakdown Structure. Specifically it can be used in three fundamental levels.

Project level : Procedural Responsibility Chart

This level is used for defining procedures to be employed on the project and include:

- procedures for monitoring and control
- change control procedures
- quality control procedures

Strategic Level : Milestone responsibility chart

This level is used for defining roles and responsibilities for achieving milestones. Sometimes both milestones and procedures can be used on the same page and the two levels are then merged into one management level.

Tactical Level Activity schedule

At this level the responsibility chart defines the roles and responsibilities of named people and resources to do the work to achieve a milestone. Because these activity schedules are to be planned on a rolling wave basis during implementation planning, the people involved can now be named. As previously described the Milestone plan is developed during the initial stages by group negotiation and agreement The same principle applies to the responsibility chart. By using the group principle all inputs from all members can be integrated into the responsibility chart result and then the end product is bought by all. The responsibility chart is built up after the Milestones chart which is after the Work Breakdown Structure.

Summary of Managing project Organisation

The purpose of project organisation is:

- assemble adequate resources
- to execute the work of the project
- the ensure successful outcome

The principle elements of Organisational management are;

- the contract between the parties involved
- organisational breakdown structure which matches the work breakdown
- responsibility charts

There are two critical elements when choosing an organisational structure:

- type of organisational structure
- location of resources

The Contract requires recording estimates of work content, so that resource providers can commit themselves to the release of their people.

Drawings, materials, plant and equipment are managed using registers and lists against the activities in which they are required.

Managing Quality

Quality is the first project constraint. The scope and organisation sections mentioned above are the primary project objectives and the methodology required to achieve them. The next three sections refer to the constraints on the project and the methodology required to manage them. The first constraint on the project is that related to quality.

There are two aspects of quality that must be managed. The first is that quality aspect that involves the work, materials, drawings, equipment etc of the project. The second aspect is that related to the management of the project itself. The quality management of the project management structure, the quality maintenance of the responsibility chart and the work Breakdown structures etc. The second aspect of quality involves all aspects of the internal documentation, communications and reporting systems and the on line tracking of the project against the corporate strategy etc.

Project Quality

Project quality has traditionally been a difficult concept to define within the concepts of the project itself. Obviously a definition of project quality is required for this project if it is to have any use at all. J Turner defines quality as a concept that has three essential elements:

- good quality vs High quality
- fitness for purpose
- conforming to the project requirement

Good Quality Vs High quality

Good quality does not imply High quality. It means supplying a product or service to a standard or a specification and thus supplying what the end user wants, with a predictable degree of reliability an uniformity at a price that is acceptable.

Fitness of Purpose

The concept is often adopted as a measure of good quality and it can be applied equally well whether the facility produced is an organisational change, an information system or an engineering product. The project that is the subject of this methodology is an integrated example of all of these.

Conforming to the project requirement

Saying something is fit for the purpose begs the question of who makes the judgement. The answer to this of course is management and this implies that quality means meeting management's requirement or specification. This is the definition of quality that is now normally applied. In order to set the measure of quality is is therefore necessary to set out management's requirement in advance in a formal document or specification. This usually takes the form of a Statement of User requirement and is part of the project definition report.

In order to assure the quality of the project it is essential to have the following:

- a clear specification
- use of defined standards
- historical experience
- qualified resources
- impartial design reviews
- change control

Assuring the quality of the management processes

This is similar to that applied to the project output itself and it means having a set of defined procedures for managing projects. Procedures clearly specify how projects are to be managed by qualified resources. This can be own experience or standard practice.

In this type of project it would be beneficial to apply the ISO 9001 standards for quality assurance on the management processes. This will mean automatically many of the project quality issues will be covered by the ISO approach as the management has total responsibility for all aspects of the project including such matters as quality control over drawings and design decisions etc

Summary of management of Quality

There are five quality elements to total quality management on projects

- quality of the design
- quality of the management processes
- quality assurance
- quality control
- the right attitude

Assuring the quality of the project requires

- a clear specification
- use of defined standards
- historical experience
- qualified resources
- impartial design reviews
- change control

Controlling the quality of the project must be:

- planned
- tested
- recorded
- analysed
- independent

Assuring the quality of the management processes requires defined procedures for managing projects, which are fully implemented. These procedures can then be used to conduct audits to control the quality of the management processes.

The Standard to be used for this project should be ISO 9001 Quality Management Systems.

Managing Cost

This is the fourth project objective managing cost by which the project manager ensure that the project cost is financially viable, worthwhile and within the project budget constraints.

Normally this process would start at the estimating of the project costs but this has already been performed for the approval stage. While a budget approval has been received it is the project managers responsibility to control all aspects of the total budget so that costs do not run out of control.

The activity that is performed during the setting of the Work Breakdown Structure leans itself to applying the cost estimates so that the monitoring system can be applied. In addition to this the business unit runs its own counter cost system and this will be run in parallel to the managing cost regime.

Controlling Costs : Obtaining Value for Money

The common mistake that many project managers make and a mistake that often gets management support is to control cost by using as the measure the rate of monthly expenditure and compare this with the monthly estimate rate. The cost estimate is to be prepared against the Work breakdown structure. This is then scheduled in time by scheduling the work elements to produce an expenditure profile. This profile is what is normally referred to in Water as the predicted cash flow of the project.

To actually control the costs some measure of the actual work done must be determined so that accurate comparisons can be made. The Work Breakdown Structure provides the means to do this. As an element of work is complete, you can compare how much it actually cost against what it was estimated to cost. Within the Counter Cost method this is usually referred to as the earned value.

The earned value for a work package or the whole project is the sum of the estimate of the completed activities which constitute it. Cost is controlled by comparing the earned value to the actual expenditure, and calculating a cost variance.

A bias is introduced if the work in progress is ignored. To allow for this a subjective estimate of the percentage for activities started but not yet finished. J Turner suggests that it best to simply use an average (50%) which becomes self discharging as time goes along. We therefore have

- for activities

  % completion = 0%, 50% or 100%

- for the project and work packages

  % completion = earned value/Original estimate

The next problem that comes up for cost control is when to actually make the Comparisons. Many systems do the analysis only based on monies paid. This is still a valid approach but when the sums are done it is too late to change anything. Usually the way to overcome this is to use the committed funds approach where the entry is made to the cost control system when the money is committed but not necessarily paid. This way the costs can be controlled as the variances can be calculated well before the project cost overruns have occurred and something can then be done about it.

Summary of Managing Costs

A cost estimate is prepared:

- as a basis for control
- to estimate durations
- to prepare tenders

generally the cost estimates structure is:

- Proposal estimate
- budget estimate
- sanction estimate
- the control estimate

For this project the proposal and budget estimates have already been prepared and the approval reached. The sanction estimate will be left out but the control estimate will be prepared as part of the implementation process and so that cost control can be conducted on the basis of a sanction estimate.

The control estimate is prepared as a function of the Work Breakdown Structure where the allocation of costs is coordinated with the WBS.

Cost is controlled by comparing the earned value, a measure of the amount of work performed to date, to the actual expenditure to date.

Managing Time

This is the last of the project objective strategies. This is an objective of the project manager which ensures that the project is delivered on time to achieve the project objectives.

The Time schedule

The time schedule is set against the work breakdown structure. This schedule is constructed with forecast record of the time expected or when the work will occur and when the work actually does occur.

Purpose of the schedule.

The purpose of recording these dates and times within the work breakdown structure is as follow;

- to ensure that the project benefits are obtained on a time scale that justifies the project costs
- to coordinate the resource effort
- **to enable the availability of the resources when actually required**
- to allow the assignment of resources and priorities
- to meet the end date

The fits element mentioned above is the main reason for generating the time schedule. Overall the benefits of the projects must be understood and the time frame that is required to achieve those benefits should be recognised and formally entered into the schedule.

The second element is the mechanism for the project activity and sets the tasks in motion. The last item is of course what sets the team on the target and focusses all the activity. On a basic level, the schedule which is based on the work breakdown structure sets the planned and actual start date, finish date and the duration of each work element. Flexibility or float can also be recorded so that any adjustments that are made can be readily accommodated without the end date compromise.

Durations

This is the amount of time allocated for each work activity or task procedure to complete its work schedule. For this Integrated project there will be many work activities that are dependent on outside resources and operational constraints. Some of these elements may be outside of the control of the project team. For the purpose of the time schedule however they should be treated as fixed As part for the time schedule therefore the project team must estimate the relevant durations for each and every activity and logically understand how they all fit together with prioritisation etc.

After the commencement of a work activity we can estimate the time remaining or the remaining duration. This may be equal to the planned duration less the time since the activity started, or we may have to estimate the remaining duration based on knowledge of the work performed to date. Once the work activity is completed we can record the actual duration and compare that with the overall critical path to ensure that the end date is not compromised.

For this project we should use early dates, late dates, float, planned, baseline and scheduled dates which are all standard time management concepts and can easily be introduced to the work breakdown structure without a large network system.

There are the following tome schedule components that the system will require and these are normally presented on gnantt charts.

Early start	Duration	Early finish
Late Start	Float	Late Finish
Baseline start	Baseline float	Baseline finish
Schedule Start	Remaining Float	Schedule finish
Actual Start	Remaining duration	Actual Finish

If the work breakdown structure is carefully constructed in the first place it is possible for the time schedule to place itself manually over the top of it and little use required of a computerised project scheduling system. Only when gnantt charts were required would a computer be used. This approach is preferred so that the time schedule does not become a large unwieldy system that takes many hours of effort simply to keep up to date. To communicate the time schedule in its basic form involves generally two simple structures. Firstly activity schedules which are the product of the Work Breakdown structure. These lists produce the activities with the relevant durations, start date end dates and so on, and are produced as a simple schedule. See format samples. The second presentation is that of gnantt charts.

Identifying the critical path

This is a series of non float activities with the longest durations. It is important to determine the critical path and not lose sight of it. An overall milestone chart showing the critical path is most useful and is best hand drawn (using CAD) rather than a computer project package.

Controlling time

The schedule is used to control the projects duration, which is the main reason for using the schedule. There are four steps in this process

- set a measure
- record progress
- calculate the variance
- take remedial action

Set the measure

The most common mistake is to measure the project time against the most recent update of the time schedule. If this happens the project manager will lose sight of where the time schedule is against the original time scale and will lose control of the project delivery. It is essential that the project time always be measured against the baseline so that updates are compared against the original time frame not the updated one.

Progress

By noting in the schedule the actual start and the actual end dates of each breakdown activity then progress can be properly measured.
For this project is will be appropriate to only measure actual start and end dates rather than attempt to estimate percentage complete. So long as the frequency of reporting is enough then control will be adequate. A frequency of about two weeks progress is measured against activities of two weeks duration.

Summary

The purpose of scheduling time on a project is to

- to obtain timely benefits that justify the expenditure
- to coordinate resource management
- to schedule resource availability
- to assign priorities
- to meet end dates

The schedule specifies the duration, start and finish dates and float of the activities in the project. each activity has the following dates recorded.

- early date
- late date and float
- baseline date
- actual date and remaining duration

The schedule can be communicated and used as;

- an activity listing
- gnantt chart

The duration is calculated by comparing work content to the number of resources available and comparing and allowing for;

- lost time
- interference
- communication
- lead times
- sequencing

The early and late dates can be calculated from the durations and logical sequence of the activities using a critical path network. There are two types of network that can be used;

- precedence network
- activity on arrow

Progress can be monitored on the schedule by

- recording progress on the critical path

PART III TECHNOLOGY SELECTION PROCESS

Step 6 | Technology Selection POPs, PCBs, Unwanted and Obsolete Pesticides

After the rationalisation strategy (Step 5) is complete and the basic areas of destruction and decontamination are known then the technology selection can commence. When the amount and nature of the contaminated material to be decontaminated on shore is known then the work can begin to look at what technologies are available and then select the appropriate technology from an environmental and economic point of view. There are many decontamination technologies to choose from either, on shore or off shore. The decision to go offshore is of course dependent on the rationalisation strategy (Step 5) and this decision is based on the best environmentally sound management approach which best meets the amount and nature of the POPs involved.
For destruction of POPs there are also many options and the selection must be made on similar grounds to the decontamination requirements.

Following the rationalisation process the technology selection is applied.
The summary section of the rationalisation part will determine which of the various technologies are appropriate and will be most efficient to use. There are decisions to be made regarding appropriateness of the technology, environmentally sound management principles, economics and ability of the technology to be applied.

Several technologies are described here and there are many more that are not. We have attempted to provide descriptions of the most commonly used technologies but also include emerging technologies.

Technology Types

Established

- Incineration (HTI)
- Thermal desorption
- Dechlorination
- Solvent Extraction

Emerging

- Solidification
- Stabilisation
- Bioremediation
- Vitrification
- Ball Milling

Technology Type	DESTRUCTION
	HIGH TEMPERATURE INCINERATION

Description of process

Hazardous waste incinerators have a main chamber (also called the primary chamber) for burning PCBs and POPs such as unwanted and obsolete pesticides and a secondary chamber. The secondary chamber is used for extending the residence time for maximum destruction of the material and its thermal oxidation into gases and unburnable solids. Well managed incineration can destroy POPs with a destruction and removal efficiency greater than 99.99 per cent. Removal efficiencies at this level (and higher levels of 99.99995 percent) require carefully controlled conditional and management of the incinerator to achieve these efficiencies. The effectiveness depends on the type of waste, turbulence, temperature and the residence time being maintained.

Downstream of the secondary chamber is the gas treatment system. This often comprises a quench system (to reduce dioxin formation) packed tower absorbers, precipitators and other reactive absorbers. The chemistry of incineration is the controlled high temperature oxidation of primarily organic compounds to produce carbon dioxide and water. Inorganic substances such as salts, acids and metallic compounds may also be produced from these wastes. Incineration processes for management of hazardous wastes are highly complex and require control of the kinetics of chemical reactions under non steady state conditions.

Sustainability factors

Inappropriate use of incinerators and poor management procedures can cause incineration to produce hazardous by-products that pose severe threats to the environment and to human and animal health. Sometimes the by-product can be more toxic than the original incinerated product. Of major concern are the formation during the incineration process of polychlorinated dibenzodioxins and polychlorinated dibenzofurans (dioxins and furans). Dioxins and furans are

Benefits

Total destruction in proven system. Generally accepted technology by many nations. Long history of experience with management of HTI. Problem of hazardous chemicals with attendant liability problems is ended. No ongoing storage or contamination problems.

Disadvantages

Dangerous air emissions if incinerator operation or design inadequate. Transboundary movement across oceans. Overall high cost.

Key Points

- large capacity
- located in developed countries
- total destruction
- high DRE
- medium cost

extremely ecotoxic and persist in the environment for long periods of time. Dioxins and furans are formed during the cooling of the gasses after the secondary chamber. It is a formation reaction that is effected by the gas temperature, the occurrence of chlorine or other halogenated compounds and the presence of a catalyst. Modern HTI are now built with rapid quenching systems that quickly cool the gas to safe temperatures at which reformation does not occur and the use of wet scrubbers. In addition incinerators are now being fitted with dioxin removal facilities such as catalytic reduction. From a sustainability point of view there are many who say that high temperature incineration is unsustainable in that the pollution to the air is unacceptable due to the emissions of dioxins and furans as well as greenhouse gases such as CO2. In the past this view was correct. However modern incinerators that are designed for high temperature and are equipped with reformation prevention and dedicated dioxin removal facility have removed the problem of dangerous emissions. Dioxins and furans is one of the most controversial issues surrounding HTI. Dioxins are a family of organic chemical compounds known as polychlorinated dibenzodioxins (PCDDs) with 75 different forms that are characterised by the placement of 1-8 chlorine atoms and their aromatic rings. Tetrachlorodibenzo-p-dioxin (TCDD) is the most widely known and is found as an unwanted contaminant in pesticides. Furans (polychlorinated dibenzofurans or PCDFs) are a family of 135 organic compounds. Of the 210 compounds, seventeen are considered to be harmful to the environment. Dioxin is a natural by product of most combustion processes and is created by forest fires, woodstoves, automobiles, power plantsand smelters. Although incineration has been often been cited as the major cause of dioxins, recent USEPA data suggests that hazardous waste incinerators produce less than 0.2% of the dioxin that is produced by wood stoves and indeed are not a major cause of dioxin in the environment.

Cost effectiveness factors

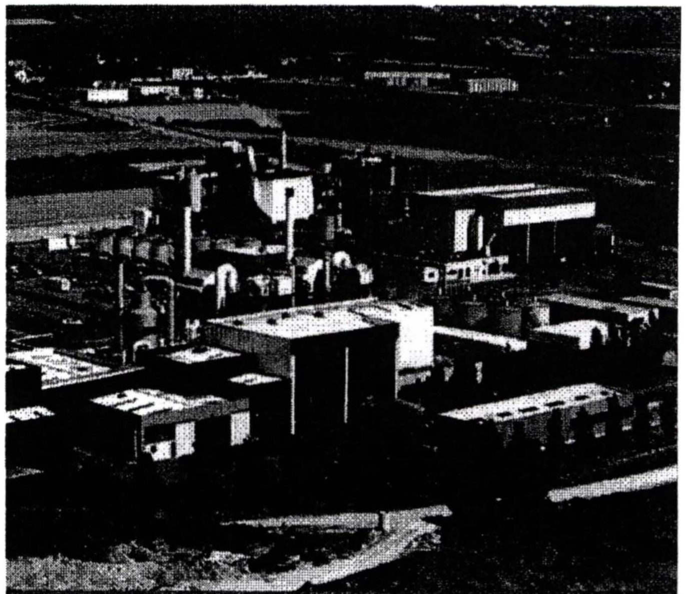
It is not possible to simply consider the cost of the incineration process in isolation when comparing with other technologies. Given that it is likely that an incineration process will be unavailable in a developed country the costs of packaging, containerisation and shipping of the waste must also be considered. The cost of the incineration (which is anywhere between US$200 to US$5000 per tonne) is often the lower component of the costs compared to the recovery, stabilisation, repackaging, separation and transport of the waste. As rule of thumb for the on shore activity and the transboundary movement of the waste, this cost will be up to five times the cost of incineration.

Selection of pesticides for destruction by incineration

Selection of incineration depends on the type of pesticide, the type of incinerator and its associated gas treatment system. Inorganic pesticides cannot be incinerated.

Organic pesticides must be burned in HTI at over 1100 degrees centigrade for more than 2 seconds.

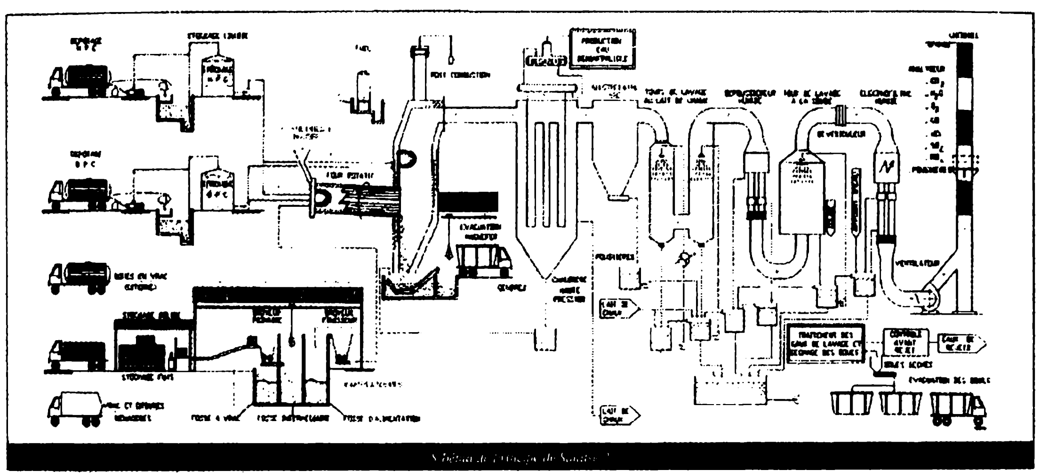
Organic products with heavy metals content can only be incinerated in special facilities.


TREDI SALAISE incineration plant

PCBs and POPs HTI in Europe

Country	*Facility Operator*	Contact
Denmark	Kommunekeimi a/s	Fax 45 65 30 27 63
Finland	Ekochem Oy Ab	Fax 35 8 19 715 300
France	Tredi	Fax 00 33 4 74 61 52 44
Germany	Entsorggungsbetrieb (GSB)	Fax 49 8453 91-151
Germany	Bayer	Fax 49 2133 515893
Netherlands	AVR-Chemie	Fax 31 181 242 502
Netherlands	Akzo Nobel Chemicals	Fax 31 10 4389295
Norway	Norcem AS	Fax 47 35 57 1400
Sweden	SAKAB	Fax46 19 577027
Switzerland	ETI	Tel 41 81 253 54 54
Switzerland	EMS-Dottikon AG	Fax 41 56 616 8120
Switzerland	Novartis Services AG	Fax 41 61 468 3348
UK	Cleanaway Ltd	Fax 44 151 357 3313
UK	Reychem International	Fax 44 1495 759 019

Not all of these operators will import PCB or POPs



Incinerator types

Rotary kiln incinerators

Rotary kilns consist of an inclined rotating tube so that the waste moves horizontally as well as radially through the cylinder. Rotation speeds are low at 0.5 to 2 rpm in order to encourage turbulence. Waste is fed into the high end and ash is discharged at the low end. Combustion gases pass from the kiln into the secondary combustion chamber.

Liquid injection incinerators

Liquid injection incinerators are refractory lined cylinders, either horizontal or vertical and are quipped with a primary burner for waste and additional fuel to atomise the waste into the combustion chamber. Mainly used for highly mobile liquid waste.

Static kiln incinerators

Static kilns use a two stage combustion process on a horizontal grate in the primary chamber. In large units a ram constantly charges the unit and removes the ash at the same time.

Fluidised bed incinerators

Fluidised bed incinerators employ a bed of sand held in suspension by air in which the waste is injected.

Cement kilns

Wastes with a suitable calorific value is used as fuel and solid materials can be fed in part way down the kiln. For chlorinated wastes the residues are contained within the clinker.

Technology Type	DECONTAMINATION	PCBS
	AUTOCLAVE	

Description of process

Autoclaving is a technology that has been around for many years now and is well proven. In general for PCBs, only the oil and transformer components such as ceramics, cardboard and wood are incinerated. The rest of the transformer is autoclaved and after decontamination the various metals such as copper , steel and aluminium are sent to the metals recycling industry. Autoclaving is a solvent decontamination process that extracts PCBs from contaminated material. The process can only be used for PCBs not for any of the other POPs. It is most often used in projects in conjunction with HTI. For capacitors the process involves shredding and placing all the material into the autoclaving chamber and by vacuum extraction with solvent remove the PCB. The resulting decontaminated capacitor materials can then be landfilled with the extracted oil and PCBs being sent for HTI incineration. Transformers on the other hand are drained, completely disassembled including the core and windings and the casing and all components are placed in the autoclave chamber and decontaminated.

Autoclaves may either be fixed or mobile. If sufficient quantities exist in the country then a mobile autoclave can be considered. Obviously the unit can be moved about according to location of PCB stock. It is also possible to build a fixed autoclave plant in the origin country. When looking at Autoclaving as a fixed plant in origin country consideration must be given to utility supplies such as energy, Compressed air, water, trade waste etc.

Sustainability factors

Autoclaving is a very good option when quantities of transformers and capacitors are large. Only the oil is sent overseas for destruction thus reducing the amount of material, weight, space and

Benefits

Excellent decontamination standard (to NDT) and recovery of metals often contributes to reducing the overall cost of autoclaving. In some cases the recycling revenue exceeds the autoclaving costs. If done onshore vast cost reduction to disposal costs for PCBs. Low emissions.

Disadvantages

Complex plant requiring expertise to run in origin country Need large amounts of waste to justify location in origin country (in excess of 2000 tonnes). large amounts of solvent used initially although solvent is recovered during the process.

Key Points

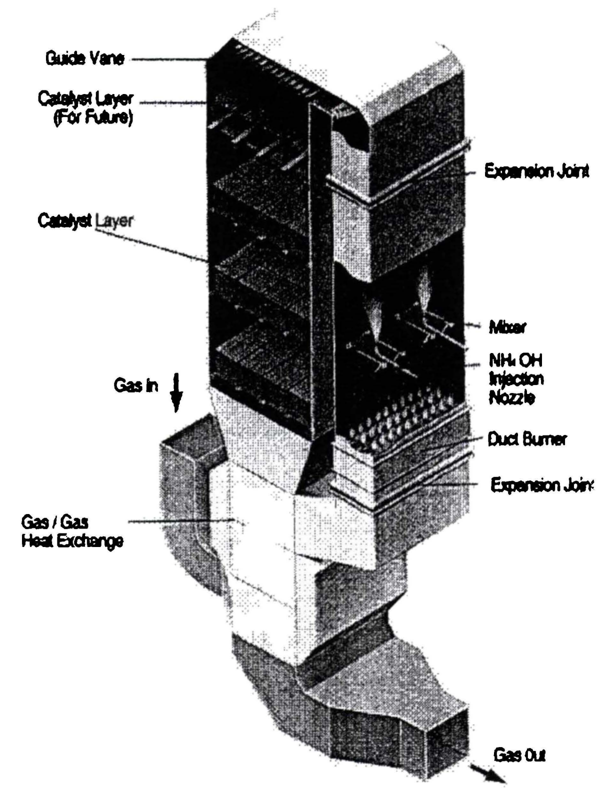
- Transformers and capacitors decontaminated
- Need large quantities for origin country Installation
- expertise of operators
- mobility of plant
- utilities availability

danger in the shipment. The copper, steel and aluminium is recycled in origin country. For PCBs and PCB contaminated equipment decontamination of the equipment is to be preferred over complete incineration. It is unsustainable to incinerate transformer coils, windings and tanks.

Cost effectiveness factors

Autoclaving is very cost effective given the correct circumstances. For large onshore origin country stocks of contaminated equipment then mobile or fixed autoclave plant can offer excellent opportunities for cost reduction compared to sending all the material offshore. The costs are comparable with incineration but has none of the attendant cost of packaging and transportation. Indeed the recycling of the materials will often produce a positive cost result.

Dioxin Removal Facility



Step 6 – Technology selection

Technology Type	DESTRUCTION	PCBs
	PLASMA ARC	POPs

Description of process

Plasma systems technology use a plasma arc device (often called a plasma torch) to create extremely high temperatures up 10,000 degrees centigrade for destruction of highly toxic wastes such as PCBs and POPs. Plasma arc destruction has only recently moved from the pilot stage to full scale production stage for hazardous wastes but shows promise for liquid PCB and POPs. Emissions are gaseous and slag and are treated in a gas treatment system similar to that of HTI but on a much reduced scale. The most common form of plasma arc generation is via an electrical discharge via a gas. In passing through the gas, electrical energy is converted to thermal energy and is absorbed by gas molecules which are activated into ionised states. Plasma Arc is a pyrolysis process. It does not need energy to heat excess air like conventional incinerators. Because of this the downstream gas treatment systems are very small as there is no excess air. Plasma Arc systems use electrical energy as their energy source and as such is expensive. Plasma arc installations are easily set up in origin countries and occupy a small footprint.

Sustainability factor

For significant quantities of liquids in country of origin Plasma Arc technology represents a good option from a sustainability point of view. There is no shipping offshore for PCB oil or pesticide liquids. This means that coupled with autoclaving this technology can be very effective providing the quantities are are adequate.

Benefits

Very small footprint. low emission simple gas treatment systems. Portable and mobile easily set up in origin country.

Disadvantages

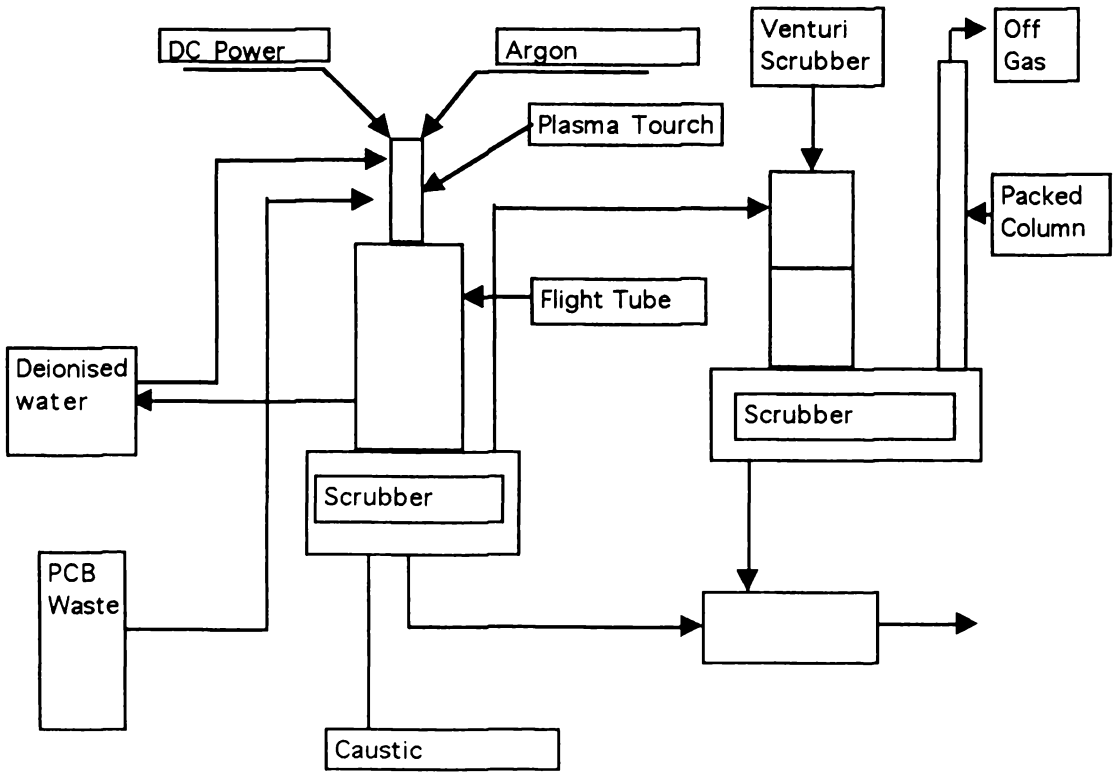
Generally restricted to liquids and for PCBs must be located with autoclave or solvent washing plant. Expensive in comparison to incineration.

Key Points

- **Portability**
- **small footprint**
- **liquids**
- **expensive**
- **simple operation**
- **high DRE**
- **best in origin**

Cost Effectiveness factor

This type of technology is best used in the country of origin and should involve significant amounts of liquid PCBs or POPs. Cost is about $US1200 per tonne with set up costs of up to $US 1 million.



Plasma Arc process

Technology Type	DECONTAMINATION	PCBs
	DECHLORINATION	POPs

Description of process

Chemical Dechlorination is based on reactions with either an organically bound alkali metal or an alkali metal oxide or hydroxide.

Dechlorination processes are well developed for the treatment of liquid PCBs and PCB contaminated oil. The chlorine content is converted to inorganic salts, which can be removed from the organic fraction by filtration. Reactions take place under inert atmosphere and can be used on an operating transformer in the field.

The Base Catalysed Dechlorination process (BCD) is a batch process operated in a series of stages and can treat wastes up to 10 % PCB. The key to the BCD process is the hydrogen donor with anoxidation potential low enough to produce nucleophilic hydrogen in the presence of base NAOH at low temperatures. Capacitors cannot be treated with this process and solvent washing is required for the transformer components. The Base Catalysed Dechlorination (BCD) process, was developed to treat halogenated organic compounds. The process was developed from work by the USEPA on earlier forms of dechlorination (in particular the "KPEG" process). This work was undertaken at the Cincinnati Risk Reduction Research Laboratory. The proponents claim BCD is suitable for treatment of wastes which contain up to 100000 mg/kg of halogenated aliphatic or aromatic organic compounds such as PCBs. In practice, the formation of salt within the treated mixture can limit the concentration of halogenated material able to be treated. Reduction of chlorinated organics to less than 2 mg/kg is achievable.

The BCD process can involve direct dehalogenation or decomposition of the waste material, or can be linked with a pre-treatment step such as thermal desorption which yields a relatively small

BCD Process Performance

The process has been shown to reduce contaminated soils from 10,000ppm to below detectable with two hours.

For PCBs and contaminated transformer oils the BCD treatment process will typically reduce the contamination to below detection.

Direct treatment of capacitors by the BCD process is not possible and solvent extraction is required Although some facilities shred the capacitors and treat the material with sodium hydoxide The shredded material can then be treated with the BCD process.

Benefits

- PCB and POPs destroyed in one step.
- Simple process with very small emissions
- Proven technology
- Small facility foot print.

Disadvantages

Must use solvent extraction with transformers and capacitors or other pre-treatment *quantity of a condensed volatile phase for* separate treatment by the BCD process. The BCD process involves the addition of an alkali or alkaline earth metal carbonate, bicarbonate or hydroxide to the contaminated medium containing one or more halogenated or non-halogenated organic contaminant compounds. Alkali is added to the contaminated medium in proportions ranging from 1 to about 20 percent by weight. The amount of alkali required is dependent on the concentration of the halogenated or non-halogenated organic contaminant contained in the medium.

A hydrogen donor compound is added to the mixture to provide hydrogen ions for reaction with the halogenated and non-halogenated contaminants, if these ions are not already present in the contaminated material. The hydrogen donor compound may comprise the high boiling point solvent in which the alkali or alkaline earth metal compound is added, or it may include fatty acids, aliphatic alcohols or hydrocarbons, amines or other similar compounds. In order to activate these compounds to produce hydrogen ions a source of carbon must be added, either in solution or in suspension. An inexpensive carbon source which is water soluble and suitable for use, is a carbohydrate such as sucrose.

The mixture is heated at a temperature and for a time sufficient to totally dehydrate the medium. This may be performed at atmospheric or at reduced or elevated pressure. The water which is included in the aqueous solution allows homogeneous distribution of the alkali throughout the mixture and acts as a wetting agent and penetrant. When the water is removed from the medium during the dehydration step, the alkali is concentrated to a reactive state.

After dehydration, the medium is further heated at a temperature between 200oC and 400oC for a time sufficient to effect reductive decomposition of the halogenated and non-halogenated organic contaminant compounds, typically 0.5 to 2 hours. At this temperature the carbon source (eg the carbohydrate) acts as a catalyst for the formation of a reactive hydrogen ion from the hydrogen donor compound. Finally, the mixture is neutralised by the addition of an acid, preferably to a pH of 7 to 9. Depending on the nature of the feed material, the reagent additions and the site use, it may be possible for the treated material to be returned to the site if desired, although this may not be possible if the treated material is oily or has a high salt content.

Cost Effectiveness

Up to USD1000 per tonne PCB contaminated oils and up to USD 250 for contaminated soils

Safety and Environmental Considerations

Potential to form dioxins and furans is very small and if formed then the BCD process will Dechlorinate. Emissions low. Low operating temperatures

Eco Logic Process

A gas reduction process uses high temperature hydrogen as a reducing agent to destroy chlorinated organic compounds. Eco Logic International Inc. (Eco Logic), Canada has developed a hydrogenation process known as Gas-Phase Chemical reduction (GPCR). The process is based on gas-phase thermo-chemical reaction of hydrogen with organic compounds. At 850^{O}C or higher, hydrogen combines with organic compounds in a reaction known as reduction to form smaller, lighter hydrocarbons, primarily methane. For chlorinated organic compounds, such as PCBs, the reduction products include methane and hydrogen chloride. This reaction is enhanced by the presence of water, which acts as a reducing agent and a hydrogen source.

Organics such as PCBs, PAHs, chlorophenols, dioxins, chlorobenzenes, pesticides, herbicides and insecticides are quantitatively converted to methane. Approximately 40% of the methane produced can be subsequently converted to hydrogen via the water shift reaction and the remaining methane converted to hydrogen in the catalytic steam reformer. Thus, the process can operate without an external supply of hydrogen.

The mixture of gases and vaporised liquids are heated as they pass electric heating elements situated around the central ceramic-coated steel tube of the reactor. Gases and any entrained fine particulates proceed up the central tube providing in excess of 2 seconds retention time at 900^{O}C. The reactions come to completion before the gases reach the scrubber where the water, heat, acid and carbon dioxide are removed. A caustic scrubbing agent is added, if required, to maintain the scrubber water pH at between 6 and 9. The temperature of the exit gas is maintained near 35^{O}C by cooling the scrubber water using dual plate heat exchangers and cold water from an evaporative cooler.

Eco Logic Process Performance

As the Process is a hydrogenation process and thus will add hydrogen molecules to any incomplete hydrogenated organic molecule the process will Dechlorination molecules and break down chlorine rings and will therefore treat PCP, PCP and other POPs and dioxins ina similar manner and achieve very high destruction rates.

Benefits

•low emissions

•treats all chlorinated molecules

•complete destruction

•converts chlorinated compounds into fuel

Disadvantages

•large fixed plant (Mobile and portable units available)

•use of hydrogen

Contaminated equipment processed in the pretreatment desorber unit (TRBP) constitutes a relatively small organic load to the reactor and high strength organic wastes such as Askarel fluids can be processed simultaneously. The TRBP is also suitable for processing high-strength organic wastes such as obsolete pesticides which are sufficiently volatile to evaporate directly from drums. The advantages of this approach are that handling is reduced, drums are cleaned in place and inorganic solids remain behind in the drums. Fugitive emissions are minimised due to the reduced handling requirements and the elimination of transfer operations.

Cost Effectiveness Eco Logic

Up to USD2500 per tonne PCB and USD5000 for capacitors. Contaminated soils etc. USD3000 per tonne (If treated using TRBP). Relatively expensive option. If contaminated soils are treated using the TORBED system then costs reduce to US$200-700 per tonne depending on soil characteristics, volumes etc.

PCB Gone

In service treatment of transformers is possible using dechlorination processes. A process developed by S D Myers called PCB Gone involves circulating the transformer fluid through a filtration system until the PCB concentrations are below the reclassification level. The PCB Gone process is very specific in the scheduled wastes it is able to treat, as it is designed to treat PCB contaminated transformer oils without the need to remove the transformer or take the transformer out of service. The fluid is recirculated through the treatment system until the residual PCB concentrations are below those required (< 2 ppm in the USA). The continued recirculation of the fluid through the transformer largely flushes the PCBs from the transformer windings and other internal components. The treated oil is then suitable for continued use.

PCB Gone Process performance

With concentrations within transformer below 50,000 ppm the PCB gone process is quite effective and will reduce the PCB concentration to below 5ppm. Leaching can occur and the transformer may continue to require polishing for some time Easy to set up and operate.

Benefits

- For low contamination cost effective
- Portable process
- minimal air emissions
- low temperature system
- treats in service transformers

Disadvantages

- gaining approval for portable systems
- not appropriate for pure PCB transformers
- not applicable for capacitors
- collected PCB must still be destroyed.

In addition to removing PCBs, the PCB Gone treatment system also regenerates the used fluid by **filtration through Fullers Earth as with other conventional transformer fluid reclamation systems.** This treatment removes acids, sludges and other oxidation by-products by a mechanical filtration process, that in effect reclaims the contaminated transformer fluid. As the treated oil is reused and the transformer decontaminated without the need to remove it from service, significant cost savings could be expected from this treatment approach. The process uses a proprietary Dechlorination reagent that provides for safe operation and is non-destructive to the transformer oil's dielectric properties.

PPM Process

The process operates at ambient temperature and does not use flammable solvents, The process uses a complex organo-sodium reagent. The reagent is air and water sensitive and during reduction the process must be blanketed with nitrogen. When introduced to the reaction tank, the reagent reacts immediately with the PCBs and chlorinated hydrocarbons to form sodium chloride and a polyphenylene polymer. The reagent reacts with inhibiters, acids, thiols, and chlorides to form the appropriate sodium salts, which are then present in the oil as a insoluble sludge. After decontamination small quantities of water are added to destroy and excess reagent.

The process consists of three parts. Pre-treatment, decontamination and Clarification. In the pre-treatment part water is reduced to acceptable levels by draining the water and other impurities off the bottom of the reception tank holding the contaminated transformer oil.

After pre-treatment the oil is decontaminated The sodium reagent is added directly to the oil after *the application of a nitrogen blanket.* ***The amount of reagent added is determined before the*** *cleanup to determine the PCB,* chlorinated hydrocarbon, sulphur and other impurity levels. As the PCBs react to the sodium they are monitored on site with a gas chromatograph.

After decontamination the oil is cleaned of salts and solids through filtration. During this stage, small;l amounts of water are introduced to destroy excess amounts of reagent. The solids, salts and small amounts of water solution of sodium hydroxide are removes at this stage. All wastes removed at this stage is small and non PCB.The process consists of three parts. Pre-treatment, decontamination and Clarification. In the pre-treatment part water is reduced to acceptable levels by draining the water and other impurities off the bottom of the reception tank holding the contaminated transformer oil.

Step 2 - Technology selection

Technology Type		
	DECONTAMINATION	PCBs
	DESORPTION	POPs

Description of process

Thermal desorbers are used to vaporise hazardous organic contaminants so that they can be separated from the solid materials to which they adhere or are adsorbed. Other systems are then required to treat the desorbed organics. Elements of a desorber unit are waste handling and feed systems, thermal Desorption chamber, off gas condensation and separation and treatment systems for the separated organic compounds. Thermal desorption separates contaminants from soil. Soil is heated in a chamber where water, organic contaminants and certain metals are vaporised. A gas or vacuum system transports vaporised water and contaminants to an off-gas (i.e., air emission) treatment system. The design of a system aims to volatize contaminants, while attempting not to oxidise them. Based on the operating temperature of the desorber, thermal desorption processes can be categorised into two groups: high temperature thermal desorption (HTTD) and low temperature thermal desorption (LTTD). It is important to note that thermal desorption does not to destroy organics.

High Temperature Thermal Desorption (HTTD). In HTTD, wastes are heated to 320 to 560 °C (600 to 1,000 °F). HTTD is frequently used in combination with incineration, solidification/stabilisation, or dechlorination, depending upon site-specific conditions. Low Temperature Thermal Desorption (LTTD). In LTTD, wastes are heated to between 90 and 320 °C (200 to 600 °F). LTTD is most often used for remediating fuels in soil.

Thermal Desorption Performance

Generally low emissions and the process needs careful control to be effective. DRE's for PCB contaminated soils and dioxins is 6 nines. Does not use large amounts of excess air and operates under reduced pressure.

Benefits

Indirect heating

For soils very effective

can handle full range of chlorinated hydrocarbons, PCBs , POPs etc.

Disadvantages

Fixed large plant

Metal hydroxides from plant may need disposal.

Off gas requires treatment

Unless being heated to the higher end of the LTTD temperature range, organic components in the *soil are not damaged, which enables treated* soil to *retain* the ability to support future biological activity.

Treatment of the off-gas must remove particulates and contaminants. Particulates are removed by conventional particulate removal equipment, such as fabric filters. Contaminants are removed through condensation followed by carbon adsorption, or they are destroyed in a secondary combustion chamber or a catalytic oxidiser.

Treatment and control of air emissions from thermal desorption operations is an extremely important consideration. It is important that there are no emissions problems concerning metals, certain PAHs and dioxins/furans. Mercury emissions are very difficult to control, and using an afterburner is unacceptable.

Thermal desorption systems are somewhat effective in removing VOCs, SVOCs, fuels, pesticides and some metals from soil. High temperature units are more effective removing volatile metals and SVOCs.

Cost Effectiveness

Cost vary across different facility operators but generally for contaminated soils about USD250 per tonne.

Technology Type	DESTRUCTION	PCBs
	IN SITU VITRIFICATION	POPs

In situ Vitrification (ISV) is a commercially available technology used for contaminated site remediation and waste treatment. It is a mobile, thermal treatment process that uses electricity to heat and melt contaminated soils, sludges and other earthen materials. The treatment results in the permanent destruction of organic contaminants and the permanent immobilisation of inorganic contaminants within the high integrity vitreous product.

ISV has been demonstrated to be effective in the treatment of all classes of contaminants including organics, heavy metals, radioactive material, and explosive compounds. The ISV process has been successfully used at full scale to treat a wide range of soils and wastes including contaminants such as pesticides, herbicides, dioxin, PCB's, arsenic, mercury, lead etc.

The ISV process is distinguished by its ability to accommodate a wide range of wastes and debris. This eliminates the need for handling, sorting and size reduction activities. Virtually all types of debris can be accommodated by the process including drums, scrap metal, concrete, boulders wood and plastic. Using the process a destruction efficiency of 99.9999% can be achieved.

In Situ vitrification involves the electric melting of earthen materials at high temperature for purposes of destroying organic contaminants and permanently immobilising non-volatile inorganic contaminants in a glassy, rock-like vitrified product, thereby rendering the treated product non hazardous. The process employs joule heating and typically operates in the range of 1,600 to 2,000 degrees C for most earthen materials.

In Situ Vitrification (ISV) is a commercially available mobile, thermal treatment process that involves the electric melting of contaminated soils, sludges, or other earthen materials, wastes and debris for the purposes of permanently destroying, removing, and/or immobilising hazardous and radioactive contaminants. The process is widely applicable to all soil types and all classes of contaminants including organics, heavy metals and radionuclides.

The ISV process is a batch process that involves forming a pool of molten soil at the surface of a treatment zone between an array of four electrodes. The molten soil serves as the heating element of the process wherein electrical energy is converted to heat *via joule heating as it passes through the molten soil. ISV melt temperatures typically range between 1,500-2,000°C. Continued application of energy results in the melt pool growing deeper and wider until the desired volume has been treated.* When electrical power is shut off, the molten mass solidifies into a vitreous monolith with unequalled physical, chemical, and weathering properties compared to alternative solidification/stabilisation technologies.

Extrapolating established US costs results in a cost of $500 to $750 per tonne for contaminated soil,

PROS

- The process is widely applicable to all soil types and all classes of contaminants including organics, heavy metals and radionuclides.
- The process is operated on an around the clock basis and can achieve treatment rates of up to 150 tonnes per day.
- High concentrations of organic contaminants, 10-20 wt%, can be treated by the process with existing equipment. Organic concentrations in excess of 20 wt% can be treated with modified equipment.
- The ISV process equipment is all trailer mounted except for the off-gas hood, which is transported to the site and then assembled. Only two personnel are required to operate the equipment.
- ISV is relatively safe and represents a low risk to the environment as demonstrated by successful commercial operations in the US and in Japan.
- a very high percentage of organic contaminants are destroyed in the ground (typically >99.9%);
- most heavy metals and all radionuclides are largely retained in the melt so the emissions of these species from the melt to the off-gas treatment system are minimal;
- the treatment process is relatively slow; the melt grows at a rate of only a few cm per hour resulting in only a small fraction of the waste material being treated at any one time;
- the off-gas treatment system is robust and has been demonstrated to be effective on a wide range of contaminant types; provision of a back up system in case of primary system failure covers the contingency of breakdown and discharge of untreated waste gases.
- for the in situ mode of treatment, the process does not require excavation and handling of contaminated soils so the risk to workers, the public, and the environment are minimised;
- since the process treats wastes on-site, there is no requirement for, or risk from, the off-site transport of wastes;
- no organic contaminants remain in the vitrified product;
- the vitrified product is extremely effective at immobilising heavy metals and radionuclides and the product far surpasses TCLP requirements;
- the process equipment includes back-up safety systems and an alternate power supply in case of equipment or power failure.
- Liquids and non-soil wastes would be mixed with soil. Treatment costs for liquid and non-soil wastes would depend on the soil mixture ratios.

CONS

- Off-gas treatment required to treat volatile organics.

- *Other major components include the process control station, a back-up off-gas treatment system and a diesel powered generator.*
- 11 kV three phase electrical power which can be supplied either from the utility grid or from diesel powered generators.
- The thermal oxidiser, if used, typically requires 3 Mbtu/hr of fuel.
- A source of potable water is also required to support process operations.
- For the in situ mode of treatment, sites must be characterised to ensure that there are no high integrity sealed containers, such as drums, and that there are no other structures present where liquids can accumulate and become trapped. Sealed containers and other trapped liquids become pressurised upon heating and can result in sudden gas releases through the melt.
- Establishment costs are expected to be significant for the ISV process and therefore it is likely to be relatively expensive for smaller projects.
- ISV requires either soil or some other earthen material to serve as the treatment media (melt).

The process works by melting soil in place using electricity applied between pairs of graphite electrodes. A highly conductive starter path is placed between the electrodes to allow initiation of melting. As electricity flows through the starter path, the path heats up and causes the surrounding media to melt. Once the media is molten, it too becomes electrically conductive. Continued application of electricity results in joule heating within the molten media between the electrodes. After the melt is fully established, the melt zone grows steadily downward and outward through the contaminated volume.

The media being treated must be capable of forming a melt with adequate electrical conductivity. Most natural soils and other earthen materials meet this criterion and can be processed without modification. If necessary, additives can be used to allow treatment of otherwise unacceptable media.

Organic constituents are thermally desorbed and then destroyed by thermal decomposition (pyrolysis) within the oxygen-depleted media being treated. Non-volatile inorganics are typically incorporated into the melt and the resulting vitrified product. Such incorporation occurs within the framework of the glassy product itself, as opposed to simple encapsulation (being surrounded) by the glass. A large volume reduction (25-50% for soils) occurs due to elimination of void volume and vaporisable materials during processing.

Step 6 - Technology selection

Technology Type	DECONTAMINATION & DESTRUCTION	PCBs
	EMERGING	POPs

BIOREMEDIATION

Bioremediation refers to the use of micro-organisms to break down organic chemical compounds that contaminate soil. The key to the process is the identification of an appropriate organism to perform the bioremediation process. The effects of moisture content, temperature, oxygen levels, food sources are required to be understood so that successful application can be achieved. In situ bioremediation treats the soil in place and eliminates the need to transfer the soil elsewhere for treatment. In situ remediation usually uses the indigenous bacteria and supplements with nutrient water to increase microbial rates. Ex situ technologies treat excavated soils under controlled conditions where temperature and moisture is managed. For sites without owners that have low levels of contamination this process can be very cost effective and after time very effective in cleaning contaminated sites. Generally unsuitable for heavily contaminated pesticide sites but will work on low levels of POPs and PCBs.

SOLIDIFICATION AND STABILISATION

These technologies rely on limiting the solubility or mobility of the toxic component in hazardous waste generally by physical containment. Five containment methods are used. Solidification by pozzolan reactions, possolan-portland cement reactions, thermoplastic micro encapsulation, and macro encapsulation. The sorption process requires additional solid materials to take up free liquids.

SOIL WASHING

PCB and POPs and other particles that are adsorbed into the surface of particles can be leached from soil by caustic agents such as sodium hydroxide.

SUPERCRITICAL WATER OXIDATION

This technology is a high temperature and pressure system that uses the properties of supercritical water in the destruction of organic compounds. The process is applicable to the treatment of a range of contaminants including acrolonitrile wastewater, pesticide waste water, PCBs, halogenated aliphatics and aromatics. The process is established with a totally enclosed ina reactor. The oxidant is injected as required on a heat based transfer, thermal and kinetic considerations. The process results in the formation of disposable ash and releasable gases.

GASIFICATION

This process uses a low pressure steam at high temperatures and a thermochemical reaction to vaporise and separate waste into their elemental components. A reduction process takes place in a reaction vessel which is directly heated. A reductive process rather than combustion takes place. There is no reactor stack gas.

CHEMICAL OXIDATION

Hydrogen peroxide, potassium permanganate, Oxone (DuPont chemical), peroxydisulfate, ultraviolet activated hydrogen peroxide and ozone oxidation are all viable oxidants for the treatment of nonstockpile neutralents. Under appropriate operating conditions and with sufficient reagent, the organic compounds present in the neutralents can be expected to be mineralized with any of these oxidants.

For chemical oxidation not activated by UV light, conventional process equipment and procedures are used. The reactions are carried out at 80-100C at Atmospheric pressure in aqueous solutions. When an organic phase is present, vigorous agitation is necessary to suspend and disperse the organic materials in the aqueous phase.

PROS

- Relatively mild conditions (low temp and press)
- Only gas evolved is CO_2.
- Inorganic salts precipitate when water is evaporated and are sent to landfill.
- Dioxins and furans are not formed
- Low cost
- Robust
- Good pollution prevention
- No large gas streams

CONS

- Reagent cost high.
- May not fully mineralize the compounds in the neutralents, or reaction may be prohibitively slow.
- Technology not yet mature.
- Capital and operating costs are expected to be moderate.
- Large equipment

ELECTROCHEMICAL OXIDATION

At low temperature and atmospheric pressure, electrochemically-generated oxidants react with organochlorines to form carbon dioxide, water and inorganic ions. High destruction efficiencies. All emissions and residues can be captured for assay and reprocessing, if needed. An electrochemical cell is used to generate oxidizing species at the anode in an acid solution, typically nitric acid. These oxidizers and the acid then attack any organic compounds, converting most of them to carbon dioxide, water and inorganic ions at low temperature (< 80 °C) and atmospheric pressure.

PROS

- The organic content of the feed, which can be soluble or insoluble organic liquids or solids, can vary between 5 and 100 percent without affecting the process unduly.
- Likewise, the water content of the waste can vary over a wide range.
- overall costs are estimated to be some 30 percent of the current estimate of demilitarization through incineration
- Materials can be fed by gravity or by pumping, and can be solid (such as PCB-laced wooden pallets) or liquid.
- The SILVER II TM process operates at relatively low temperature and pressure (up to 90 o C and nominally atmospheric pressure).
- AEA reports that there are low volumes of by-product streams (gaseous, liquid, and solid), and that dioxins and dibenzofurans are not produced by the process.
- when organics react with SILVER II TM , they are completely mineralized
- Positive characteristics include low temperature, low off-gas, and an apparent ability to treat diverse waste streams.

CONS

- off gases passed through a scrubber and potentially through an activated carbon filter before being
  discharged to the atmosphere
- By-products of the process include salts (referred to on Figure 2.1.1 as miscellaneous inert solids), nitric acid, spent scrubbing solutions, and off gases.
- AEA indicated that a key factor affecting cost is electrochemical efficiency
- reactions are strongly surface area dependent, solids and some liquids require significant size reduction and/or mixing for adequate oxidation to occur, whereas soluble organics are more easily oxidized
- Because the reactions take place at low temperature and in a liquid state, the times required for the reactions are much longer than for thermal systems, and typically, more secondary waste is generated by the oxidizing agents.

ELECTROCHEMICAL OXIDATION - CERIUM

The CerOx process is similar to the Ag(II) process except that it uses 0.8M Ce(IV) solution in 3M nitric acid at 100C to oxidize and destroy organic compounds. Unlike Ag(II), Ce(IV) is stable. The Ce is produced and regenerated by the electrolysis of Ce (III) in a bipolar electrochemical cell (T-cell). Carbon is converted to CO_2; chlorine compounds are converted to elemental chlorine, which is scrubbed and converted to hypochlorite. CerOx uses few reactants, principally nitrate (recycled), nitric acid, and sodium hydroxide to treat off-gases. Biggest cost is for electricity to operate the electrolysis T-cells.

PROS

- Cerium is much cheaper than Ag and much less toxic
- Low temperature and low pressure.

CONS

- High chlorine content in feed would result in lots of chlorine gas which would have to be treated.
- Uses large quantities of nitric acid
- Inorganic salt concentration builds up in anolyte solution and solution must be replaced periodically.
- Less developed than Ag(II) technology

STEAM REFORMING

The Steam Detoxification process involves very high temperature steam reforming (ie. 1100 to 15000C) to destroy hazardous wastes. Vent gases are carbon dioxide and water. Steam Detoxification consists of a two step process, and is carried out in a Pyrolysis Detoxifier. The hydrocarbon component of the waste is first evaporated in a first-stage waste feed evaporator unit and the vaporised gases are then mixed with superheated steam and fed into a "pyrolysis reactor" where they are further electrically heated under a slight vacuum. A carbon monoxide converter oxidises the detoxified gases and an activated carbon adsorber removes the last of the trace organics and metals.

PROS

- As the reactor is heated electrically the gases are free of the fuel combustion particulates common to incinerator systems.
- is small enough to readily fit into existing buildings;
  provide acceptable installation costs;
  destroy liquid solvents and their contaminants;
  destroy organic contaminants adsorbed onto activated carbon;
  destroy organics in the vapour phase;
  process continuous liquid feed streams;
  process drummed wastes without removal of drums;
  operate with a high temperature waste feed evaporator for solid organics;
  serve as part of a process to purify ground water; and reactivate vapour and liquid phase activated carbon canisters.
- Costs are estimated by the proponent at approximately half the average cost of incineration or landfill in the US.
- Most promising technology according to DOE (DOE/SEAB)

CONS

- The process requires potentially elaborate gas treatment systems, and the overall system can be expected to be of similar complexity to the Eco Logic system
- Some pretreatment required for solid wastes (shredding, grinding, desorption).
- Some of the solid residues left over after the evaporation stage may require solidification and fixation before landfill disposal.
- The high temperatures used in the process require specialised equipment and reactor materials. The process requires containment of potentially hazardous gases at high temperatures and therefore will require careful design and operation.
- Mainly suitable to liquid and aqueous wastes.

WET AIR OXIDATION

The WAO process oxidizes and hydrolyzes organic contaminants in water at temperatures of 150-315C and pressures of 150 to 3150psi, below the critical temperature of water and pressure (374C and 3,204psia). If pure oxygen is used instead of air as the oxidizing agent, the gas volumes that must be managed are greatly reduced.

Organic compounds containing carbon, hydrogen and oxygen are converted to CO_2, H_2O and short chain biodegradable compounds such as acetic acid and formaldehyde. Depending on reaction conditions, further biotreatment of residues may be necessary. Toxic heavy metals in the neutralent would have to be precipitated and filtered out prior to biotreatment. Sulphur containing organics are mineralized to sulfate ions in solution, Phosphorous to phosphate ions, chlorine to chloride ions, nitrogen to ammonium and nitrate ions and nitrogen and nitrous oxide gas, cyanides are converted to CO_2 and ammonium ions.

PROS

- Mature technology, Zimpro has installed more than 300 units worldwide
- Requires only the addition of air/oxygen and water
- No dioxins formed, proponent claims they are destroyed.
- Titanium liner prevents corrosion
- Costs lower than for incineration.

CONS

- Most effective on dilute aqueous solutions
- May not be effective against PCBs and HCB.
- Effluent needs to be treated biologically.

BALL MILLING

The Ball Milling process is a mechano/chemical process, relying on the energy released at the point *of collision between balls in a ball mill* to activate a reaction between the waste and CaO (lime), breaking down the organochlorine compounds. By-products of the destruction of organochlorine compounds using CaO are generally of low toxicity and may include graphite, calcium chloride and calcium hydroxide. The process may be applied to concentrated forms of halogenated hydrocarbons such as PCBs and DDT. In the case of contaminated electrical components, the possibility exists to destroy the encapsulating container in the same process.

Disperse wastes (eg contaminated soil) would preferably be concentrated by solvent extraction or a similar process prior to destruction within the ball mill treatment system.

PROS

- treated materials are expected to be suitable for disposal to landfill in the case of solid wastes, or other normal disposal methods in the case of liquid wastes
- In the case of contaminated electrical components, the possibility exists to destroy the encapsulating container in the same process.
- the low energy potential of the system in relation to the surrounding environment means that the potential for release of contaminants is reduced. Also, the process can be readily shutdown in a short period of time, further reducing the potential for release in case of an emergency or power failure;
- the process operates at low temperatures increasing safety, reducing energy consumption and reducing the potential for formation of dioxins;
- items of electrical equipment, contaminated with PCB or damaged or corroded waste containers may be fed directly into the ball mill system for destruction;
- the process largely uses well established mineral processing equipment and principles;
- the process by its nature will result in a high degree of mixing of wastes and would tend to break up agglomerated material;
- no gaseous emissions are produced;
- the process is likely to readily treat wastes containing a range of organic contaminants, or mixtures of organic contaminants in one step, reducing waste handling and the associated risk.

CONS

- Disperse wastes (eg contaminated soil) would preferably be concentrated by solvent extraction or a similar process prior to destruction within the ball mill treatment system.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal was adopted in 1989 and entered into force in 1992. Presently, there are more than 150 Parties to the Basel Convention. Its objective is to protect human health and the environment from the adverse effects caused by the generation, management and transboundary movements of hazardous wastes.

The fundamental aims of the Basel Convention are the reduction of the transboundary movements of hazardous wastes, the prevention and minimization of their generation, the environmentally sound management of such wastes and the active promotion of the transfer and use of cleaner technologies.

In December 1999, the Parties to the Basel Convention adopted the Basel Protocol on Liability and Compensation for Damage resulting from the Transboundary Movements of Hazardous Wastes and Their Disposal.

www.basel.int

Secretariat of the Basel Convention
International Environment House
15 chemin des Anémones,
CH-1219 Châtelaine, Switzerland

Sales No. E.02.III.D.211
ISBN 92-1-158611-9
ISSN 1020-8364

UNEP

DESTRUCTION AND DECONTAMINATION TECHNOLOGIES FOR PCBs AND OTHER POPs WASTES UNDER THE BASEL CONVENTION

A Training Manual for Hazardous Waste Project Managers

Volume B

Secretariat of the Basel Convention

UNEP

DESTRUCTION AND DECONTAMINATION TECHNOLOGIES FOR PCBs AND OTHER POPs WASTES UNDER THE BASEL CONVENTION – VOLUME B

Published in October 2002

Sales No. E.02.III.D.211

ISBN : 92-1-158611-9

ISSN : 1020-8364

Printed in chlorine-free cyclus paper

This Publication is available from:

Secretariat of the Basel Convention
International Environment House
15 chemin des Anémones,
CH-1219 Châtelaine, Switzerland

Tel. : (4122) 9178218 Fax : (4122) 797 34 54

E-mail : sbc@unep.ch

Web : www.basel.int

Destruction and Decontamination Technologies for PCBs and Other POPs Wastes

A Training Manual for Hazardous Waste Project Managers

Volume B

Part IV – Implementation Process

Foreword

This Training Manual has been prepared by the University of Auckland, New Zealand in the context of the convening of the First Continental Conference for Africa on the Environmentally Sound Management of Unwanted Stocks of Hazardous Wastes and their Prevention, Rabat, Morocco, 8-12 January 2001.

It has been designed to assist those governments or organisations, not only in Africa, charged with the task of managing the destruction or decontamination of POPs (Persistent Organic Pollutants) with procedures that assist with the planning and selection of appropriate technologies that suit the particular circumstances whilst complying with the need for environmentally sound management principles and the principles of sustainability. In that context special consideration should be given to the local national frameworks and the responsibilities of the relevant competent authority.

New ideas and technologies are emerging rapidly and good practices are still evolving. The Training Manual however will remain useful in providing a selection process allowing new technologies to be evaluated under the provisions of the Training Manual and enabling organisations to continue to adopt new technologies as they become available. There are four parts to this Training Manual. Part Four is a detailed Field Application Training Manual to the handling and environmentally sound management of POPs as wastes covering obsolete pesticides and PCB's in particular.

The Training Manual should be considered in conjunction with other technical guidelines adopted by the Conference of the Parties to the basel Convention and governing the environmentally sound management of hazardous wastes, in particular the Technical Guidelines on Wastes. **Comprising or Containing PCB's, PCTs, and PBB's (Y10), Technical Guidelines for Incineration on Land,(D10), Technical Guidelines for Specially Engineered Landfill (D5), and Technical Guidelines on Wastes collected from Households (Y46).** The document should be considered in conjunction with other important guidelines such as the FAO Pesticide series.

The writer refers in particular to the Draft Technical Guidelines on the environmentally sound management of POPs wastes which, at the time of printing of this document, are being negotiated under the Basel Convention. Furthermore, this Training Manual aimed at providing practical training for waste managers should not be interpreted as preempting any of the principles, guidance and recommendations that will form part of the Technical Guidelines on the ESM of POPs wastes mentioned hereabove.

Ron McDowall
International Centre for Sustainability Engineering and Research
Faculty of Engineering
University of Auckland
New Zealand

Secretariat of the Basel Convention (SBC)
International Environment House
11-13 chemin des anemones
Building D
1219 Chatelaine (Geneva)
Switzerland
Tel.: (+41 22) 917 8281
Fax.: (+41 22) 797 3454
E-mail: sbc@unep.ch

Step 7 Implementation

Introduction

After the technology selection (Part III) is complete then the process of implementation commences. This involves writing specifications and tenders for the various parts of the project. There should be separate tenders for the various parts of the project especially if there are off shore and on shore components and separate destruction and decontamination parts.

A project team will need to be established and when the tenders are sent out on the world market the project can commence. The Implementation plans and tender documentation are shown in detail in PART IV.

Implementation of a Hazardous waste project appears to be complicated but in reality there are a few rules to follow and the process becomes quite manageable.

The important key to implementation and in order to ensure that all the other steps of the project are completed first and in the correct order. Also each of the preceding steps are to be complete with no parts missing. When this is done the process of implementation becomes very straight forward.

Implementation Part IV comprises three main sections

Section One - Operating Document

Section Two - Tender document

Section Three - Contract Document

Because the dimensions and nature of the project are known (from the previous parts of this guide) as well as the selected technology it is appropriate to write the project operational manual before the tender document. This means that the international companies that will tender against the document will be able to refer to the Operating manual and indeed the manual can be included in the tender document so that the tender when received is compliant with the main operating manual. The operating manual will have several parts depending on what component of the waste is to be treated locally, which component will be sent offshore etc. It may be that there will be two or three tender documents that the operating manual is used in conjunction with and it may be that only some parts of the operating manual are used with any one tender document.

The field manual detailed here in this Part is designed to discharge the hazardous waste work in an environmentally sound manner in accordance with the principles detailed in part I of this guide.

Introduction

The purpose of this manual is to provide legislators, consultants, contractors and other interested bodies with sufficient practical and technical information for the safe and effective handling, packaging, transportation and disposal of POPs as waste in an accepted Environmentally Sound Management manner.

The **Primary Aim** of this manual is to provide the regulatory Authorities, within which the Toxic waste resides, with the highest level of confidence that the project of clearance and disposal will be performed to a high technical level that recognises all environmental safeguards inherent in the resident Country's Waste Laws, in an operationally efficient manner.

The **Primary Goal** of this manual is to ensure that the Clearance and Disposal of POPs Waste is performed without endangering the public or environment of any country or persons. This goal of ensuring there are no accidents or spillage, leaks or escapes to the environment of any kind is to be achieved by rigid enforcement of the plans and programmes described.

The Structure of this manual to achieve the aim and the goal is a Management Plan based on the following parts.

Part 1	Project Plan
Part 2	Safety and Environmental Plan
Part 3	Quality Assurance Plan
Part 4	Work Procedure Instructions

Each part is made up of nine sections as depicted by the POPs Manual Structural Diagram shown on page 5.

The overriding Philosophy behind the Management Plan is ***"Plan the work and work the plan"***

Potential Environmental Impact of the Project.

Strategy Statement

In order that the management plan is constructed properly for any project involving risk to the environment an Environmental Impact Report must be prepared and the results of that study are imprinted onto the management plan and the QA work procedures and the Project Plan. The material in this section provides an overview of the Environmental Impact of the Clearance and Disposal project and the effect it has on the Management Plan is shown in Part 1. The Quality Assurance effect on the Management Plan is shown in Part 3. The impact of the Environmental Impact Report on the Management Plan is strictly in accordance with the Aims and Goals as indicated in the introduction.

During the course of activities associated with the application of this manual potential for environmental impact relates to the spillage or leakage of POPs waste.

A spill or leak in itself does not represent a high risk to nearby human populations, because direct contact by ingestion, through the skin or by breathing airborne material for a long period is required before a health hazard is likely. As POP's waste does not give off high levels of vapour at normal temperatures exposure to airborne vapours is substantially restricted to the site of the spill. In the case of direct skin contact, the required treatment consists only of thorough washing and proper disposal of contaminated water.

Manual Format

The procedures and strategies that are adopted in this manual are designed to :

1. Minimise the chances of spills or leaks of POPs waste occurring.

2. Contain and control any leaks or spills that may occur to prevent their escape into the wider environment or their coming into contact with the public.

3. Divide the wastes into individual lots of a size that reduces the volume of a spill or leak to a manageable quantity.

4. Provide a shipping strategy that centres on the movement of relatively small consignments of wastes in any one shipments.

5. Provide Management and audit trail procedures that ensures full accountability and traceability of all waste handled.

6. Ensure all personnel involved in the implementation of the proposal are fully aware of the nature of the materials to be handled and are fully trained in appropriate emergency response procedures.

7. Provide the waste owner with a high level of confidence that the waste clearance and disposal will be conducted at the highest safety level possible.

Operating manual Design

The manual has been designed on a matrix basis so that the various elements of the management plan and operational procedures are fully integrated and that the objectives of the project from a safety and environmental point of view are fully discharged. The structure means that only the Work Procedure Instructions need to be on site as these instructions completely integrate all the information in Parts 1 to 3.

POPs Handling Manual Structure

	PART - 1 PROJECT PLAN	PART - 2 SAFETY & ENVIRONMENTAL PLAN	PART - 3 QUALITY ASSURANCE PLAN	PART - 4 WORK PROCEDURE INSTRUCTIONS
Section One	Management Plan	Management S&E Plan	QA Management Plan	WPI 4.1 Management Instructions
Section Two	Site Inspection Plan	Site Inspection S&E Plan	QA Site Inspection Plan	WPI 4.2 Site Inspection Instructions
Section Three	Clearance Plan	Clearance S&E Plan	QA Clearance Plan	WPI 4.3 Clearance Instructions
Section Four	Site Preparation Plan	Site Preparation S&E Plan	QA Site Preparation Plan	WPI 4.4 Site Preparation Instructions
Section Five	Packaging Plan	Packaging S&E Plan	QA Packaging Plan	WPI 4.5 Packaging Instructions
Section Six	Transportation Plan	Transportation S&E Plan	QA Transportation Plan	WPI 4.6 Transportation Instructions
Section Seven	Disposal Plan	Disposal S&E Plan	QA Disposal Plan	WPI 4.7 Disposal Instructions
Section Eight	Insurance Plan	Insurance S&E Plan	QA Insurance Plan	WPI 4.8 Insurance Instructions
Section Nine	Emergency Plan	Emergency S&E Plan	QA Emergency Plan	WPI 4.9 Emergency Instructions

WPI 4 10 Project Documentation

PART 1 | SECTION 1 - Management Plan

1.0 Strategy Statement

The methodology of the Project Plan is to design a set of Plans and Programmes that are specifically directed at achieving the aims and Goals as mentioned in Part 1. These plans are then enumerated within a set of of work procedure instructions (WPI's) and are managed, controlled and audited by the management team. The detail included in this section forms the overall Project Plan that is implemented by the management team.

Each of the elements in this manual is presented through each part so that in Part four they are finally integrated into the Work Procedure Instructions. Therefore Parts 1-3 can be viewed as the detail of the hazard and the procedural elements required and Part four presents the working documents that are used on site for the actual project. Within WPI 4.10 are all the working check sheets and QA audit check lists. WPI 4.10 presents all the documentation for the all the recording that is necessary.

1.1 Management Team

In order that a coherent Project Plan is written and then implemented a management structure is required. At the outset of a Hazardous Waste project that involves POPs there must be an overall Project Manager. This person must be charged with the entire responsibility for the Goals and Objectives being entirely met. He must be a dedicated and determined manager who while able and willing to delegate the work effort but not to default the responsibilities to the end client and the environment. The first action the Project Manager is to assemble his team set the Project Plan priorities and construct the elements of the Plan. There is a tendency for such teams to immediately make a start on the project without the necessary planning being put in place.

It is essential that the Plan be developed and enumerated and put in place before any site works are undertaken.

The **Project Plan** is constructed from the following sub sections:

Section 1	Management Plan
Section 2	Site Inspection Plan
Section 3	Clearance Plan
Section 4	Site Preparation Plan
Section 5	Packaging Plan
Section 6	Transportation Plan
Section 7	Shipping and Disposal Plan
Section 8	Insurance Plan
Section 9	Emergency Plan

In some cases it will be necessary to modify these plans to suit the end client who may have specific requirements for contractual reasons. However these plans should not be ignored in deference to Contractual requirements, at the very least they should form part of the Contract as to the methodology of the Project.

The Management Plan is represented by the compilation of all the Plans from Part 1 of this manual. As the specific site conditions and the material to be removed become known the management plan reflects these elements and the management plan then becomes specific.

2.0 Strategy Statement

Before the Project Plan can be fully developed a Site Inspection must be undertaken. In many instances this may already have been performed for Contractual reasons prior to the operational aspects of the Project being put into place. However it is necessary to perform the exercise again due to the fact that the Project manager needs to be doing the site examination from a different viewpoint to that of the personnel that may have been involved in putting together a Tender or Contractual Document.

The Project Manager needs to have a fresh look at the Sites in order that they can begin to plan the project from the point of view of the Goals and objectives stated in the introduction part of this manual.

2.1 Elements of the Site Inspection Plan

- Reasons for Site Inspection
- Site name
- Storage Type
- Type & Quantity
- Goals & Objectives
- Fire Protection
- Residents
- Access

2.2 Reasons for Site Inspection

A clearance Plan cannot be developed if there is no knowledge of the POP sites. POPs sites can come in various forms eg.

* warehouses with POP material and fluids Properly contained
* warehouse with POP material and Fluids improperly contained
* POP material Dumped on open ground without environmental protection
* POP Still located in original positions (PCBs) within industry but not working
* POP (PCB) still located in original positions within industry and still in working operation.

Until the sites that come under the control of the Project Plan are surveyed by the Project manager and his team the subsequent plans cannot be developed.

The Sections that follow comprise the Site Inspection Plan and is presented as a step by step procedure for analysing the various sites and the implications to subsequent plans and environmental protections and the fulfilment of the goals and objectives of the project plan.

The Site Inspection Plan is presented in the Work Procedure Instructions. Its function is to provide a structured schedule that permits the Project Manager to quickly assess the site conditions and presents the necessary data into the other plans. A Site Inspection Sheet should be filled out for each and every site and each and every version of stored material.

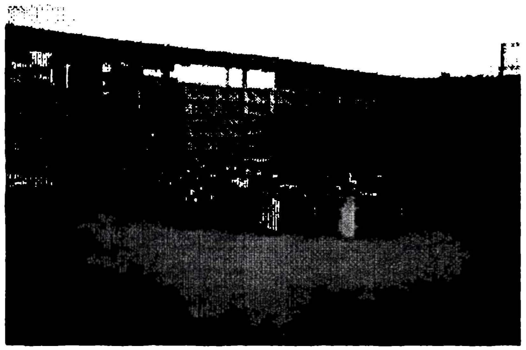


Photo : Hard Surface storage (PCBs) without environmental protection

The site inspection plan lays down the foundation of the Project and the sections of the plan are discussed below.

2.3 Site Inspection Data Gathering

Site name
The name and location of the site are recorded
Storage Type
This item is where the site observation of the stored material is noted.

The storage type factor that is assigned to the material is intended to indicate a risk factor associated with that type of storage. If the pops material is safely stored in an approved warehouse sitting in a plastic bag inside a bin then the risk factor assigned to this option would be 1. This factor would be loaded into the clearance plan in terms of site prioritisation. If the material is located on open ground and is not contained then the assignment factor could be as high as 8 and therefore the Clearance plan would be receive a higher priority than the previous example. In other words the material stored outside on ground would be cleared before the material stored inside a secure warehouse.

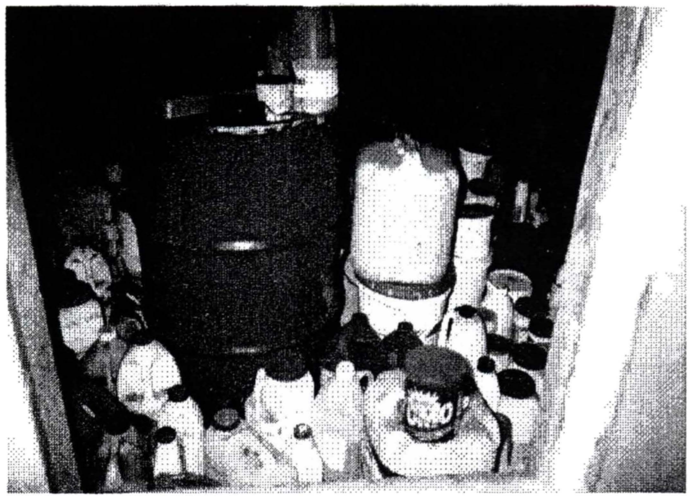


Photo : Pesticides storage in tank with some environmental protection but leaking.

Type and Quantity

This item is where the type of material is recorded. It will be necessary to perform sample testing to determine the level of POPs contamination as this has a significant effect on the techniques adopted to clear the site.

Goals/Objectives
After looking at the storage and material type the Project Manager must revisit the Goals and Objectives and provide and assessment as to the probability of achieving the set goals with the site situation. If a low assessment factor is allocated then the computerised version will generate a secondary report indicating that a Clearance Plan cannot be written. In this situation the Project Plan goes into an emergency plan with subsequent plan of action.

Power/Lighting &
Fire Protection
Again the information gained provide options and schedules for filling out with the calculations and decisions slotted into the correct parts of the clearance plans.

Lifts & Hoists
Details of lifts and hoists is applicable are added to the file and the results are sent to the appropriate Parts of the Site Preparation Plans.

Space
This item is critical to the Clearance plan and several details are requested within the WPI's. When all the details are completed the relevant items are transmitted to the Site Preparation Plan and the Clearance Plan.

Residents
This item covers the possibility of nearby residents or housing and several items of information are also to be collected and the implications placed in the Clearance Plan.

Access
This item covers the access to the storage area and notes such things as road condition, accessibility for emergency services and evacuation routes etc.

The resultant output of the application of all the relevant parts of Section 2 within in Parts 1,2,3, are the Work Instructions WPI 4.2. If these instructions are applied as shown in WPI 4.2 then the balance of this manuals Project Plans are then oriented correctly to the nature of the operation. If the provisions of WPI 4.2 are ignored or incomplete then the entire set of plans is rendered ineffective.

The provisions of Section 2 as detailed in WPI 4.2 is to do with planning the work whereas WPI 4.3 to WPI 4.9 are to do with working the plan.

Section Summary

Site Inspection Plan

- Site Inspection Plan designed to obtain critical site information
- Storage type information requirements
- POPs Type and Quantities information requirements
- Site drawing requirements
- Residential access information requirements

PART 1 | Section 3 - Clearance Plan

3.0 Strategy Statement

The Clearance Plan is an output of the Site Inspection Plan. When all the observations and calculations and risk factors are known the Clearance Plan can be prepared. The Clearance Plan sets down the prioritised clearance schedule based on the risk factors. The Clearance Plan also, by virtue of the prioritised schedule, sets up the relevant parts of the Site Preparation Plan. This activity then allows the allocation and location of the Projects' resources to be applied in a manner that addresses the identified risk factors.

3.1 Elements of the Clearance Plan

- Warehouse or storage clearance priority schedule
- Type and Quantity clearance priority schedule
- Area defence lines
- Resource Positioning
- Impact on Packaging Plan
- Warehouse or site decontamination

3.2 Warehouse or storage facility Clearance Priority.

In order to discharge responsibilities as described under the introduction section of the manual the priority of clearance is to be scheduled according to risk factor obtained during the Site Inspection plan. Therefore the order of Storage clearance shall be:

Type 1 Storage : POPs materials, Solids and free liquids dumped on open ground with no spill protection and major leaking.

Type 2 Storage : POPs materials, Solids and free liquids located in original equipment location still working but with no spill protection and leaking.

Type 3 Storage : POPs materials, Solids and free liquids dumped on open ground with no spill protection and minor leaking.

Type 4 Storage : POPs materials, Solids and free liquids located in original equipment location but not working but with no spill protection and leaking.

Type 5 Storage : Warehouse with POPs materials, Solids and free liquids that are incorrectly stored or contained and are leaking within warehouse structure and onto ground surface.

Type 6 Storage : POPs materials, Solids and free liquids located in original equipment location but not working but with spill protection and not leaking.

Type 7 Storage : Warehouse with POPs materials, Solids and free liquids that are incorrectly stored or contained and are leaking within warehouse structure but not onto ground surface.

Type 8 Storage : POPs materials, Solids and free liquids dumped on open ground with spill protection and no leaking.

Type 9 Storage : Warehouse with POPs materials, Solids and free liquids that are incorrectly stored or contained and would be threat to the environment if leaking were to occur.

Type 10 Storage : Warehouse with POPs materials, Solids and free liquids that are correctly stored in containment, tagged and registered and provided with full spill containment within warehouse structure and public access is prohibited.

Photo : Warehouse Storage Type 10

3.3 Clearance Priority Schedule PCB's only

Type 1 Type : PCB free liquids with 500,000 to 900,000 ppm Askeral

Type 2 Type : PCB free liquids with 100,000 to 500,000 ppm Askeral

Type 3 Type : PCB free liquids with 50,000 to 100,000 ppm Askeral

Type 4 Type : PCB free liquids with 50 to 50,000 ppm Askeral

Type 5 Type : PCB free liquids with less than 50 ppm Askeral

Type 6 Type : PCB Sealed capacitors with 500,000 to 900,000 ppm Askeral

Type 7 Type : PCB Sealed capacitors with 50-500,000 ppm Askeral

Type 8 Type : PCB Sealed capacitors with 0 to 50 ppm Askeral

Type 9 Type : PCB Transformers with 500,000 to 900,000 ppm Askeral

Type 10 Type : PCB Transformers with 50 to 500,000 ppm Askeral

3.4 PCB Quantity Priority Schedule

Type 1 Quantity : Sealed capacitors Exceeding 500 Tonnes

Type 2 Quantity : Sealed capacitors 100-500 Tonnes

Type 3 Quantity : Sealed capacitors 50-100 Tonnes

Type 4 Quantity : Sealed capacitors 25-50 Tonnes

Type 5 Quantity : Sealed capacitors 0-25 Tonnes

Type 6 Quantity : Transformers exceeding 500 tonnes

Type 7 Quantity : Transformers 100-500 tonnes

Type 8 Quantity : Transformers 50-100 tonnes

Type 9 Quantity : Transformers 25-50 tonnes

Type 10 Quantity : Transformers 0-25 tonnes

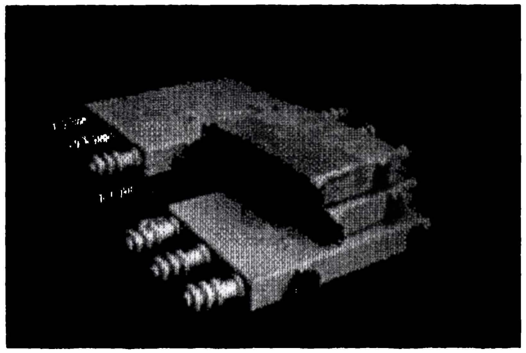


Photo : PCB Capacitors with more than 500,000ppm

3.5 Position Allocations

Depending on the information gathered during the site inspection the next area to be decided is the location of the defended area containing the amenities, clean up materials and emergency vehicle etc. Other spatial considerations are packing and containerisation areas etc. Depending on the output of the Site Inspection plan the Clearance plan will have variations of the following spatial considerations.

- Location of Decontamination Facility
- Location of Staff amenities
- Location of emergency Vehicle
- Location of Decanting/Packaging Area
- Location of dispatch area
- Overall Defence Zone.

3.6 Location of Decontamination Facility

This facility which is supplied by the Clearance Company under the management of the Project Manager is normally constructed within a shipping container and is purpose built. The design should allow easy loading and unloading so that it can be efficiently moved from site to site. This facility should be located in such a manner that it impedes the progress from the site entry to the site works. This facility should be sited so that any personnel entering the warehouse or storage area must enter the unit and any personnel leaving the work area must exit from the facility. It should not be positioned to one side of the entry to the work site, it must be in line. Facilities required within this structure are fully described within Section 4.

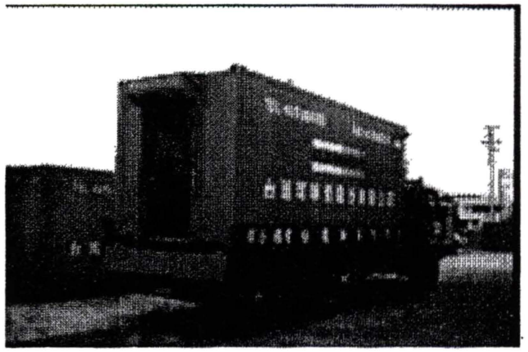


Photo : Decontamination facility mounted on its transport

3.7 Location of Staff amenities

The staff amenities which is also normally a purpose built shipping container or similar must be located outside of the work area and beyond the decontamination unit so that in order for the workers to attend the amenities they must pass through the decontamination facility. There must be no positioning of the amenities that would facilitate the avoidance of the decontamination unit.

3.8 Location of the Emergency vehicle

This should be located outside of the work area and be accessible without passing through the decontamination facility.

3.9 Location of Decanting/Packaging area

This area should be located as close to the work area as possible. If the project involves transformers they should be decanted in situ. In the case of PCB only under extreme conditions should full transformers be moved. The only justification for moving full transformers before decanting may be for reasons of accessibility and even then all possibilities must be exhausted before the decision is made to move the transformer. See section 4 for further details.

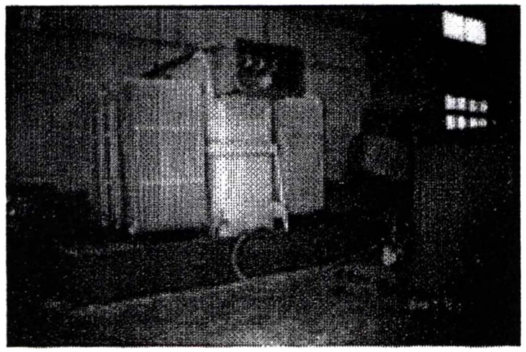


Photo : Decanting Power Transformer with temporary bund

3.10 Location of Dispatch Area

This area is to be decided after careful consideration of the location. There must be separation from the decanting and bulk fluid handling area and general packaging and dispatch. The two areas must have their own bunded zones as different risks are attached to each activity.

3.11 Overall Defence Zone

After the site drawing has been completed during the Site Inspection Plan a defence line must be drawn. This line represents the work area defended area and is to be a physical barrier. For some sites it may be sufficient to have a plastic tape declaring the defended area. For other larger more at risk sites it may be necessary to put up a temporary security fence.

3.12 Impact on Packaging Plan

The Clearance plan has an impact on the packaging plan in the sense that details of the product to be cleared will effect the packaging plan. If the site to be cleared consists of small capacitors then the packaging requirements will be quite simple. If on the other hand the site consists of a multitude of transformers, drums of PCB, capacitors and other miscellaneous materials then the packaging requirements are complicated. Therefore one of the outputs of the Clearance Plan is the Packaging plan and this is so indicated within the Work Procedure Plans in Part four of this manual.

3.13 Warehouse Decontamination

Once all capacitors, pallets, racking, etc. have been removed from the warehouse the walls must be washed down. It is recommended to use an aqueous non ionic detergent blended with some sodium polyphosphate. A combination brush/washer will be used. Water will be picked up with a wet vacuum cleaner or absorbed with solid absorbent.

The stair ways and the hoist in the building will also be washed down. When the floor is dry, rubber covering should be packed up into smaller pieces and stacked into transport boxes. Areas of potentially high contamination will be identified prior to surface stripping. These will be targeted as "worst case" for confirmation of the efficiency of the cleaning process.

Section Summary

Clearance Plan

- warehouse or storage clearance is prioritised by Risk factor
- Resources are located according to defence requirements
- Clearance plan effects Packaging Plan
- Warehouse to be decontaminated at the end of clearance

4.0 Strategy Statement

To achieve the objectives as stated in Part 1, an important part of the project plan is the site preparation plan. Section 4 is concerned with the detail of site preparation. It should be noted that the sites will be worked on in a prioritised manner that recognises the comparative risks associated with each site. The sequence of events planned for each site as the "Site Preparation Proposal" is a direct result of the risk factor assessment and is a product of the strategy of **Minimisation of Risk Policy** that is inherent in the Aims and Goals of this manual. In order that the Clearance plan is correctly applied a Site preparation plan must be put in place.

4.1 Elements of the Site Preparation plan

- Site Preparation
- Containment barriers and spill protection
- Location of Decontamination and Amenities Units
- Working Areas
- Working Area equipment requirements
- Defence Areas
- Emergency Access
- Fire Protection
- Intruder Alarms
- Telephone and other communications
- Records
- Emergency vehicle

4.2 Site Preparation

Each warehouse or storage site will have been prioritised as a result of the Clearance Plan. In addition the Clearance Plan would have provided details of the location of the decontamination and amenities units. The Site Preparation Plan deals with the specific organisational aspects that are required for the various sites.

The site drawing as generated by the Site Inspection Plan now needs to be properly drawn up with the various areas indicated. This drawing must show the following work areas.

- Primary Zone decanting/pumping area
- Primary Zone Unloading/Breakdown area
- Primary Zone Packaging Area
- Primary Zone Transit Bin loading area
- Secondary Zone Transit bin storage area
- Secondary Zone Transit bin consolidation area
- Tertiary Zone Containerisation area

The location of facilities and services must also be shown on this drawing, namely;

- Location of defence zone
- Location of Decontamination unit
- Location of Amenities unit
- Location of emergency vehicle
- Location of public zone
- Location of all emergency materials
- Location of all First Aid equipment
- Location of Fire fighting equipment
- Location of WPI Notice Board

When all the facilities and services are defined and annotated on the site drawing then the Project Manager can proceed to construct the barriers etc. The required barriers and containment systems are discussed below.

During the project it is anticipated that there will be many visitors to view the work. These visitors must be controlled. The work area, which may be potentially contaminated must be clearly defined, eg. with a barrier of flags, plastic tape, etc. and entry restricted to only those who are correctly attired. Those inspecting the work must wear disposable overalls, disposable boot covers, half face respirators fitted with OV/AG/Particulated filters and safety glasses or goggles.

After inspecting the works visitors must pass through the decontamination unit to remove the overalls and boot covers. A system will need to be established to ensure visitor respirators and glasses are kept clean and the filters changed weekly.

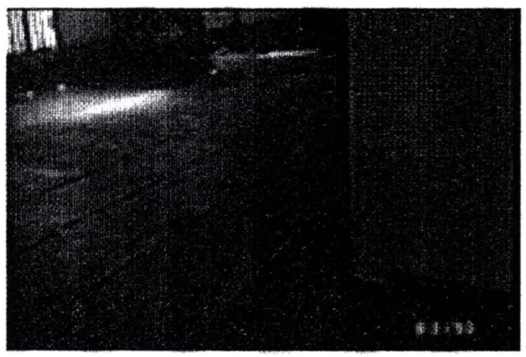


Photo : Floor Sealing in Containment area

4.3 Containment barriers and spill protection (Warehouse type Storage facility)

All areas of operation during the Clearance of the POPs from the site require environmental protection. That is to say all areas must have some form of physical protection to prevent POPs entering the environment. This normally takes the form of bunding (temporary or permanent) or surface preparation prevent egress. The type and level of the bunding protection relies on the operations expected within the secure area and the level of risk involved. If the operation involves the packing of sealed PCB capacitors into containers and the maximum single capacitor fluid quantity is relatively small then a temporary bund using polythene sheets on top of a sawdust bund is sufficient. On the other hand decanting large power transformers (PCBS) would justify the construction of a block wall around the intended operational area of sufficient depth to hold all the fluid resident in the largest transformer.

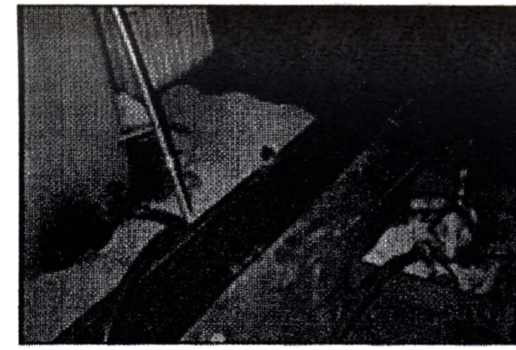


Photo : Temporary bunding for transformer decanting

The following containment barrier structural requirements are designed to be applied against the total Risk factor that the site inspection derives from the addition of the three factors for site, type, quantity.

Type 1 : Containment - Risk factor =

This involves large quantities of high concentration POPs which is poorly stored and leaking with little or no environmental protection.

Three bunded areas will be required as follows:

Primary Zone

This area will require a block wall bunding and sealed floors. All surface defects and cracks in the nominated primary area shall be cleaned and sealed and the entire floor is to be sealed with a two pot epoxy paint designed to prevent POPs escape. The bund shall be sized to allow the handling of the largest container and it must cope with the greatest amount of fluid loss from any one incident. All access into this bund area shall be over the top of the bund. Primary bund areas must not have removable sections.

Secondary Zone

The purpose of this zone is for the storage of filled transit bins. The bund size should be designed to cope with storage of sufficient bins to fill at least one 20 foot shipping container. If it is anticipated that shipping out of the POP will be irregular then more storage space will be required. In the event that the POPs is to be trucked to another warehouse for further consolidation then the Secondary zone will only require an area sufficient to handle a single truck load. The height of the bund wall is a calculation based on the complete loss of a single transit bin filled with free POPs.

Tertiary Zone

The purpose of this zone is the containerisation of the transit bins. The area must be bunded but due to the area involved by the use of containers a single block height or hump bund will be sufficient. The surface must also be sealed and all drains provided with pump out interceptor or blocking.

Type 2 : Containment - Risk factor =

This involves large quantities of high concentration POPs in containers which are correctly stored and not leaking.

Two bunded areas will be required as follows:

Secondary Zone

The purpose of this zone is for the packaging and storage of transit bins. The bund size should be designed to cope with storage of sufficient bins to fill at least one 20 foot shipping container. If it is anticipated that shipping out of the POPs will be irregular then more storage space will be required. In the event that the POPs is to be trucked to another warehouse for further consolidation then the Secondary zone will only require an area sufficient to handle a single truck load. The height of the bund wall is a calculation based on the complete loss of a single transit bin

Tertiary Zone

The purpose of this zone is the containerisation of the transit bins. The area must be bunded but due to the area involved by the use of containers a single block height or hump bund will be sufficient. The surface must also be sealed and all drains provided with pump out interceptor or blocking.

Type 3 : Containment - Risk factor =

This involves large quantities of high concentration POPs in containers which are incorrectly stored and are leaking.

Three bunded areas will be required as follows:

Primary Zone

This area will require a block wall bunding and sealed floors. All surface defects and cracks in the nominated primary area shall be cleaned and sealed and the entire floor is to be sealed with a two pot epoxy paint designed to prevent POPs escape. The bund shall be sized to allow the handling of the largest unit capacity and it must cope with the greatest amount of fluid loss from any one incident. All access into this bund area shall be over the top of the bund. Primary bund areas must not have removable sections.

Secondary Zone

The purpose of this zone is for the storage of filled transit bins. The bund size should be designed to cope with storage of sufficient bins to fill at least one 20 foot shipping container. If it is anticipated that shipping out of the POPs will be irregular then more storage space will be required. In the event that the POP is to be trucked to another warehouse for further consolidation then the Secondary zone will only require an area sufficient to handle a single truck load. The height of the bund wall is a calculation based on the complete loss of a single transit bin filled with free POPs. In the case of solid Pesticides superbags may be used within this zone.

Tertiary Zone

The purpose of this zone is the containerisation of the transit bins. The area must be bunded but due to the area involved by the use of containers a single block height or hump bund will be sufficient. The surface must also be sealed and all drains provided with pump out interceptor or blocking.

Type 4 : Containment - Risk factor =

This involves low quantities of low concentration PCB or POPs in containers which are correctly stored and not leaking.

One bunded area will be required as follows:

Tertiary Zone

The purpose of this zone is the packing of transit bins and containerisation of the transit bins. The area must be bunded but due to the area involved by the use of containers a single block height or hump bund will be sufficient. The surface must also be sealed and all drains provided with pump out interceptor or blocking.

Type 5 : Containment - Risk factor =

This involves low quantities of low concentration PCB or POPs in containers which are incorrectly stored and leaking.

One bunded area will be required as follows:

Tertiary Zone

The purpose of this zone is the packing of transit bins and containerisation of the transit bins. The area must be bunded but due to the area involved by the use of containers a single block height or hump bund will be sufficient. The surface must also be sealed and all drains provided with pump out interceptor or blocking.

4.4 Containment barriers and spill protection (In service equipment) PCB

PCB contaminated equipment in service equipment generally falls into two groups.

- Power Transformers
- Power factor Correction capacitors

Power Transformers

The containment procedures required for in service equipment is very dependent on the individual locations. Power transformers used for local power distribution is usually quite easy to defend with containment barriers. On the other hand power transformers "buried" inside an old Pulp & Paper mill may involve a significant effort to protect the environment during decanting and extraction.

In all cases involving power transformers they must be decanted in situ. There is no justification for moving PCB contaminated Transformers before they have been decanted. This means that careful planning will be required to protect the environment during the decanting procedure. A temporary bund must be erected around the transformer to be decanted, and this must be sized to cope with the entire amount of fluid held by the transformer. All the decanting equipment, piping, pumps and drums must be located within the bunded area. All pumping equipment must be positioned on separate drip trays and all equipment to handled as PCB contaminated equipment.

Any floor cracks and splits must be cleaned and sealed within the bund area and all drains blocked off so that any spill of any size is fully contained. If there are overhead sprinklers (Fire protection) these must be isolated and drained before decanting commences. Large extract fans must also be positioned so as to draft away accumulated fumes from the decanting area. The entire work place is then provided with plastic barrier tape signage placed and the area defended.

Power factor capacitors

These units are much easier to handle and can be moved while still containing the PCB. If only a small number of capacitors are to be removed then a very small protected area can be created around the transit bin immediately beside the site and hand loading can be affected. If a large capacitor bank is involved with more than 20 individual capacitors then a complete area bund will be required with floor protection drains interceptors etc. Bunding in these circumstances can involve the use of sawdust humps with heavy gauge polythene sheets with welded joints. Note that after the extraction the polythene should be regarded as contaminated and sent for disposal.

4.6 Location of the Decontamination and amenities units.

Transportable decontamination and amenities units supplied by the subcontractor will be used in the conduct of the Clearance activity. The location of these units is as described previously in this section.
The decontamination unit must be designed with "dirty" and "clean" sections separated by the shower facilities. Clean clothes and towels are located in the "clean end" of the unit, and at the start of each period of work, personnel will go through the following procedure:

- Onto the "clean" side of the decontamination unit.
- Change into work clothes and put on protective clothing and equipment.
- Exit from the "dirty" side of the unit.
- At the end of each period of work, personnel will go through the following procedure :
- Remove and discard protective clothing into receptacle provided.
- Enter the "dirty" side of the decontamination unit.
- Remove clothing and temporarily store (during the work shift) or discard into receptacle provided (at end of shift or if obvious contamination has occurred).
- Shower with soap to ensure complete decontamination.
- Enter the "Clean" side of the decontamination unit.
- Towel down and change into clean clothing.

In the normal course of events, the protective clothing and equipment should ensure that the personnel do not become contaminated. Therefore, the waste water from the shower should not be contaminated and disposal to the sewerage or septic system would be allowable. However, if obvious contamination has occurred, the waste water will be collected, drummed and disposed of along with the other waste.

The amenities unit is considered to be a "clean" area and will therefore be located on the "clean" side of the decontamination unit. The amenities unit consists of lunch room facilities and will be used by personnel during breaks only after going through the decontamination procedures discussed above.

4.7 Working Areas

Within the Primary, Secondary and Tertiary zones various work activities is to take place. As a normal rule of thumb the various work activities that are assigned to each zone should not be undertaken within another zone. It is possible to elevate a work activity up the scale of zone primacy but not downwards. In other words while it is acceptable to perform storage in the Primary zone it is not acceptable to perform Decanting functions in the tertiary zone. In detail the work activities per zone is assigned as follows:

Primary Zone

Placement of loose capacitors, transformer carcasses, miscellaneous contaminated materials into bunded area by forklift onto a receiving platform above the bund height. Lifting onto the work surface within the primary zone bund area by overhead monorail and placed ready for packing into transit bins or UN rated drums. Transit bins and drums lifted into this bund and arranged for the packing of drums, miscellaneous materials etc. Placing into transit bins along with packing materials. Lifting out of primary bund with monorail and placing into the Secondary Bund area. Within this zone other activity such as transformer disassembly and solvent washing can also be performed. Pumping activity associated with PCB drum consolidation into transit bulk containers is performed in this area.

Secondary Zone

This area is simply for the storage of the transit bins awaiting arrival of a 20 foot shipping container or shipment by truck to a central warehouse for cargo consolidation. No work activity of any kind is allowed in this area other then the loading and unloading and storage of full transit bins.

Tertiary Zone

This area is reserved for the loading of transit bins onto trucks or into containers. It is possible to use this area for storage of transit bins but it is not recommended practice due to the amount of loading activity in the area. All the timber packing equipment required for the containerisation will be stored in this area ready for the final in container bracing.

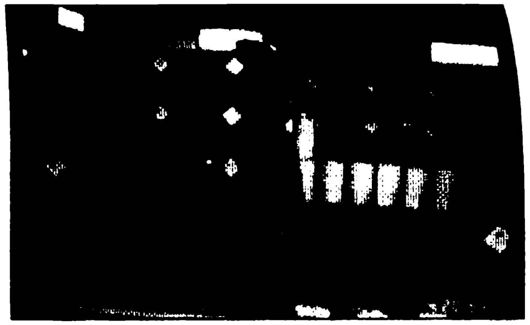


Photo : Tertiary Zone - Note barriers at floor level

4.8 Working Area equipment requirements

In general equipment is assigned per working zone and this equipment should not travel between zones. Pumping equipment for the transfer of POPs from partially filled drums to consolidation drums of transit containers should not be moved out of the Primary zone. This equipment should stay there for the duration of the project. Pumps, hoses, spanners and all tools should have a specified place of occupation within the bund and when not in use are to be located in that place. Emergency spill containment materials are to be located outside the primary zone but within easy reach. The emergency shower, fire fighting equipment and first aid equipment is also to be installed immediately adjacent to the primary zone.

4.9 Defence Areas

A defence line should be drawn around both the primary and secondary Zones. Generally the tertiary zone does allow access to authorised personnel such as container truck drivers who are not required to dress in the personnel protection equipment. Such people are not permitted to enter the secondary or primary zones. For major operations the defence line should be a security type fence, for temporary operations then plastic warning tape may be used.

4.10 Emergency Access

The defence system shall be so designed that in the event of a full scale emergency the emergency services can have full access to the working platforms without having to go through the defence lines. In other words the defence line must be able to be readily removable by emergency services. During such emergencies that are attended by the fire service a position for a Command vehicle both upwind and down wind must be provided.

If a worker is injured within the primary zone and cannot be readily moved for fear of severe personal injury then members of the emergency services must go through the decontamination facility and place the correct attire before attending the victim. If the injured person is likely to lose his life before emergency personnel can be correctly attired then the emergency personnel must be immediately informed of this possibility, informed as to the danger of the primary zone and then asked to enter the zone without PPE. As soon as the victim is stabilised then the emergency personnel must exit the zone and proceed to full decontamination within the decontamination facility including full body showers and removal and disposal of all clothing. If significant amounts of free POPs are on the working platform during the emergency the personnel entering the zone must be provided with BA sets and after the event blood tests must be organised for those exposed.

4.11 Fire Protection

The worst case PCB or POPs scenario involves a fire in the facility. If the fire is collateral then it can be fought using conventional techniques. If the fire however involves the PCB or POPs materials itself then it can only be fought using full body chemical suits with integral breathing apparatus. The fire must be fought with dry agent and must be fought aggressively with short rosters arranged for those at the front. Full body showers and full chemical decontamination kits will be required. If the local fire service does not have this equipment or provide the training for same then it must be arranged by the Project Manager.

The storage site and workplace areas must be provided with a comprehensive fire fighting capacity so that a substantial fire can be controlled for at least 30 minutes before Fire service help could be expected. For any fires of any size within the storage facility or workplace zones the Fire service must be called immediately for a full scale turn out. Even a small fire in a storage facility can get out of hand within minutes and the threat to humans and the environment is enormous and it is better to have a full scale support team on its way before it gets out of hand.

4.12 Intruder Alarms

The warehouse should be fitted with an intruder alarm. This can be a stand alone unit but should be connected to the telephone system and monitored by a security company and should also include 24 hour fire alarms.

4.13 Telephone and other communications

Secure telephone and fax is required. If these services are not readily available within the country of activity then a stand alone satellite unit should be purchased.

4.14 Records

A complete record system is required for the project and the format of this will depend on the client or POPs owner requirement. The system should be computer based with off site disc holdings and sequence back up copies.

4.15 Emergency Response Vehicle

For all POPs projects of a size exceeding 20 tonnes of POPs a comprehensively equipped Emergency Vehicle must be maintained for the duration of the project. This vehicle attends all spills and doubles as the escort vehicle during transhipment of shipping containers or transit bins within the country of the project. The vehicle also attends the final transfer to the ship loading company.

Section Summary

Site Preparation Plan

- All POPs extraction require a Site Preparation plan no matter how small
- All POPs extraction requires containment protection
- Warehouse storage sites require decontamination and amenity units
- Primary, Secondary and Tertiary Protection Zones are required
- Working platforms and areas to be defended
- Full emergency access required
- Fire fighting capacity for 30 minutes required
- Emergency vehicle requirements

PART 1 | Section 5 - Packaging Plan

5.0 Strategy Statement

The packaging plan described in this section and the relevant parts of the WPI in part four has been developed using the standards and techniques built up over time and many projects in different countries. In order that the project aims and gaols are fully discharged the packaging plan must reflect physically the environmental implications of POPs spillage. The techniques discussed here have been proven over many years to provide the safest methodology of packaging that ensures the POPs arrives in the disposal country or organisation in the same manner in which it was discharged from the country of origin. In all aspects the strategy of packaging is designed to ensure that the transportation of POPs is fully defended against any possibility of leakage, spillage or contamination of any kind. These instructions as enumerated within the WPI's must be carefully adhered to and involves that such packaging be Quality Assured by an independent assessor. The QA requirements are included in Part 3 and also appear in Part 4 WPI's.

5.1 Elements of the Packaging Plan

- Waste Packing
- Container Packing
- Weighing
- Labelling
- Container Marine Survey

5.2 Waste Packing

All waste from the job site including drummed liquids, drummed containers, solid and liquid pesticides contaminated solid residue from floor treatment or other materials (signs, shelving, fire extinguishers, timber, plastic pallets, plastic tubs, rubber floor coverings, disposable overalls, clothing, boot covers, used respirators filters, used wipes,etc.) will be packed into either UN rated drums on pallets or UN rated big bags or transit Bins or IBCs or other special containers.

All non UN approved drums containing solid waste material, as well as other solid waste, will be placed into (oversized) drums or UN-approved Big Bags.

Non UN-approved drums containing liquid will be pumped into either ISO-tank containers (18.000l.), UN-approved PE liquid drums or 1.000l. IBC's. The repacked drums will be UN/Y-s approved and will be transported in a dedicated 20ft box container or ISO tank containers, by road and by sea. Transportation will be according to IMDG / ADR regulations.

5.2.1 Solid Pesticides and related material

The drums containing solids will be repacked in 200l. PE open head drums, 280 ltr. (oversized) drums or Big Bags. Solids packed in bales, jute sacks or bags and other solid material (like wood) can be loaded manually into UN-approved Big Bags, with inner lining, each up to a maximum weight of 1000 kg. each. However, the average weight per Big Bag will be approximately 750 - 800 kgs. The empty Big Bag will be placed on a sound pallet, prior to be loaded with solid material, to facilitate handling of the loaded Big Bag.

Empty bottles, boxes and aerosols will be first packed in an airtight sealed plastic bag, to prevent any leakage and then placed manually into an open head UN-approved drum (1A2).

5.2.2 T-drums

Drums that have been repacked in non UN-tested T-drums will have to be over packed into UN-approved oversized (280ltr.) drums. The content of all T-drums will be visually inspected by opening the lid manually. In the case the T-drum will contain liquids, these liquids will be pumped out of the drum as far as possible (see procedure for Liquid Pesticides). When the liquids have been taken out of the drum in manner the drum will be crushed.

T-drums containing drums with solids will be repacked into oversized drums. As at most POPs sites these drums packed in T-drums are most likely to be in very poor condition and therefore the following procedure will be applied:

The PE T-drum containing the old 200 ltr. drum will be turned upside-down into a special designed drip tray, capable of containing 125% of the original content of the drum. The drum will be released by turning the T-drum off the lid and take it off. Directly after this handling, an steel UN-approved oversized (280 ltr.) will be placed over the old drum and the oversized drum will be then turned back, with the opening upwards. Finally the drum will be closed and directly properly labelled. The drum will be sealed to assure that the drum will not contain any other material than the label indicates.

5.2.3 Liquid Pesticides

Drums that contains liquids will be pumped over into ISO tank containers, UN-approved drums or 1.000 ltr. IBC's (Intermediate Bulk Container). The liquids will be pumped out of the old drums by using an air driven pump equipped with Viton membranes or an explosion proof pump, or use will be made of a vacuum-truck, and pumped directly into an UN-approved packaging (either ISO tank container, 200 ltr. closed head drum (type 1A1) or 1000 ltr. IBC. Liquid products in bottles and cans can be emptied manually, using a big funnel into UN-approved 1A1 drums

5.2.4 Crushing of old drums

Drums that are mostly empty, heavily corroded and containing remaining residues of pesticides will be crushed by means of a drum crusher. First the emptied drums will be filled with absorbent, prior to the crushing. The drum crusher t should be equipped with a drip tray to avoid leaking of remaining liquid and small solid components. The liquid residue of a crushed drum will be pumped out of the drip tray immediately into a closed head drum (Type 1A1). Solid residue will be packed in Big Bags or open head drums, with a PE-liner (sack) of 200 micron.

Drum Crusher requires a specification such that the maximum pressure is 32 tonnes with a cyclustime of 40 sec. The maximum drum size that can be crushed is 200ltr., the minimum drum size is 50 ltr. The crusher will be placed on a plastic foil of sufficient quality to avoid contamination of the soil during crushing. The crushed drums will be packed in UN-approved Big Bags with inner lining of 200 micron. Some 10 crushed drums will be packed per Big Bag, placed on a pallet and banded with steel bandage.

Each open and closed head drum and Big Bag with repacked material and the drums with the disposed safety clothing, filters, PE-lining, etc. will be labelled in accordance to the relevant IMDG transport legislation as well as with a waste stream number , together with description of the content, the name of the storage place of origin and with the reference from the Inventory List.

- Liquids will be drummed in 205 litre steel drums and handled as discussed above.
- Contaminated soil and residue from floor treatments will be placed in 205 litre steel drums.
- All other soft material(disposable overalls, clothing, boot covers, used respirator filters, used wipes etc.) will be double wrapped in polythene and packed into 205 litre steel drums or big bags handled as discussed above.
- Other hard materials (signs, shelving, fire extinguishers, plastic pallets, remaining tubs, rubber floor coverings etc.) will either be placed directly into big bags or packed into 205 litre steel drums and handled as discussed below.
- All drums of liquids are to be placed within a steel transit bin as discussed below.

Transit Bins

Standard bins will be approximately 1100 mm wide, 1310 mm long, and 1000mm high.

The steel transit bins will have all joints welded and will be leak tested by filling with water. The lids will be bolted and/or strapped in position.

The standard bin will be able to accept the majority of the Waste as follows:

- The bins will be lined with a layer of polythene sheet for its full height to further prevent against leakage and to assist in removal of the absorbent material during unpacking.
- A 15mm deep layer of absorbent material will be placed inside each box prior to packing to allow absorption of any fluid which may leak during transport.
- POPs containers or drums of liquids will be placed in the boxes inside plastic tubs where available in an upright position.

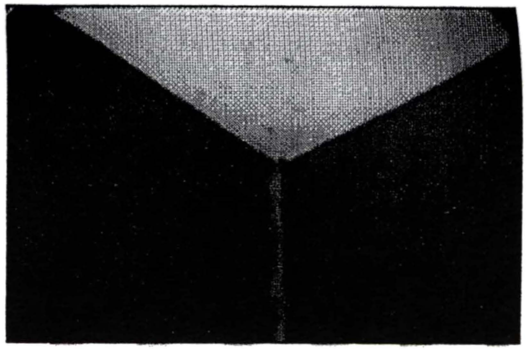


Photo : Welded Joints of Transit bins

- Smaller containers will be placed in the bins in two layers separated with a sheet of plywood placed on the terminals of the first layer.
- Small Containers identified as being in a leaking condition, will be wrapped in a further two layers of polythene sheets before being loaded into the bins.
- PCB Transformers will be drained of liquid and the liquid handled as discussed below. The transformer carcasses will be placed in bins inside plastic tubs where available and lateral movement will be prevented by chocking with timber chocks.
- Liquids will be drummed in 205 litre steel drums and handled as discussed below.

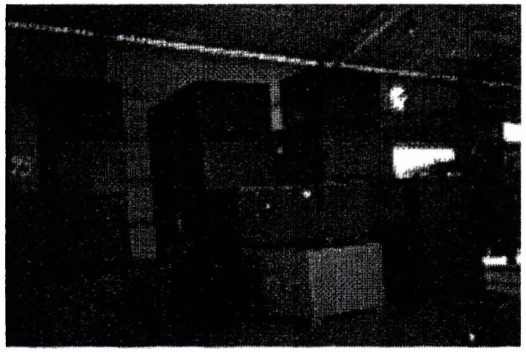


Photo : Transit Bins in storage before use, note forklift stackability

- Contaminated soil and residue from floor treatments will be placed in 205 litre steel drums and these will again be placed three to a bin with lateral movement prevented by using timber chocks.

- All other soft material(disposable overalls, clothing, boot covers, used respirator filters, used wipes etc) will be double wrapped in polythene and packed into 205 litre steel drums handled as discussed below.

- Other hard materials (signs, shelving, fire extinguishers, plastic pallets, remaining tubs, rubber floor coverings etc) will either be placed directly into the boxes or packed into 205 litre steel drums and handled as discussed below.

- All steel drums of waste will be placed three to a transit bin. The boxes will be fitted with a floor of 4mm plywood. Lateral movements of the drums will be prevented by chocking with timber chocks.

Items which will not be accommodated in the standard transport boxes are as follows:

- Capacitors and transformers of a size too large for the standard boxes will require special transport boxes to be built. These special boxes will be purpose designed at the time required, but the design will be similar to that of the standard size box.

- Liquids which are already drummed in 205 litre steel drums will require re-drumming. See above for procedure. This will be done by lifting the existing drums and placing each one into an oversized (256 litre) drum. The oversized drums will be placed, in a manner similar to that discussed above, into special transport bins which will be purpose designed and built at the time required. The design will be similar to that of the standard transport box.

5.3 Container Packing

The standard transport units (transit Bins) discussed in the previous section are designed to fit into a shipping container. Care is to be taken to ensure that the containers are not overloaded or unbalanced. A standard shipping container (20ft) will take 16 Transit bins stacked.

The drums with the liquid waste, solid waste and disposed safety clothing, filters, PE-lining, etc. will be placed per 4 in a single transit bin. The Big Bags will also be placed on pallets. (one Big Bag per pallet). Then the pallets will be placed in the 20ft. box container, using a 1,5 tonnes forklift and a ramp, and properly stuffed.

Big Bags on pallets will be loaded in one layer into the container. (12 Big Bags per container is max. 12 tonnes net weight. Drums with dry material only will be loaded on pallets in two layers, separated with plywood, with a maximum of 72 drums per container (up to 25 tonnes net weight.).

The material inside the container will be lashed, secured and properly labelled in accordance with the IMDG-code. The containers will also be labelled on each of the 4 sides of the container and transported at soonest to the harbour, according to a transport scheme to be communicated and subject to approval for the export given by the competent authorities.

- The contents of each shipping container will be recorded.
- Liquids and solids are to be placed in separate containers.

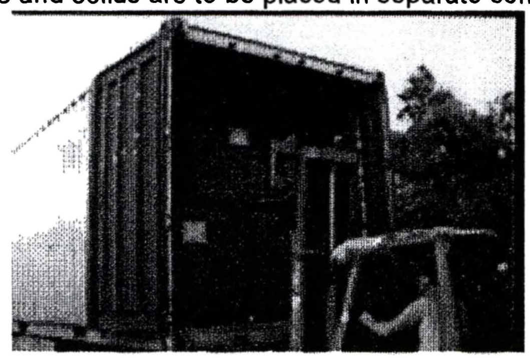


Photo : Transport Unit Loading into shipping containers

- Timber dunnage will be used to restrict movement of the transport units during transport and where transport boxes are stacked two high, a sheet of plywood will be placed between the bins.

The requirements of the Port of Entry are that drummed POPs (PCBs) liquid and transformer carcasses cannot be added in the same shipping containers. To comply with these requirements, drummed liquids will be transported in individual shipping containers in which no other wastes are shipped. In addition, the other requirements of the Port of Entry for the packing of PCB wastes will be complied with if wastes are packed as indicated within this Plan and the shipping containers are packed as discussed above.

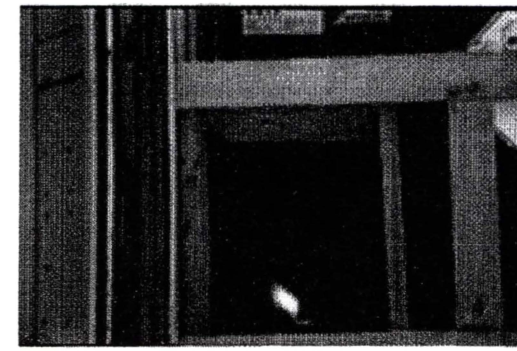


Photo : Container bracing, interior view

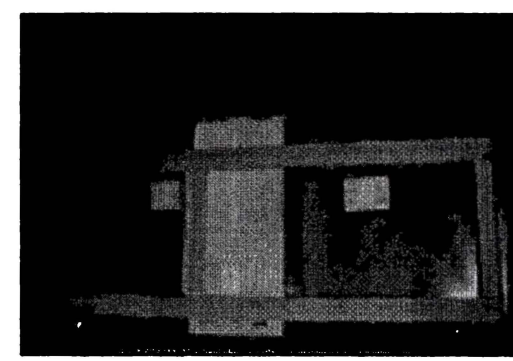


Photo : Transport unit bracing

5.4 Weighing

Most contracts require that the POPs waste without the packaging waste be weighed for payment purposes. It is essential that this process be carefully constructed so that the client is completely satisfied that his requirements will be met. The weighing process must be efficient and accurate with all parties happy with the system.

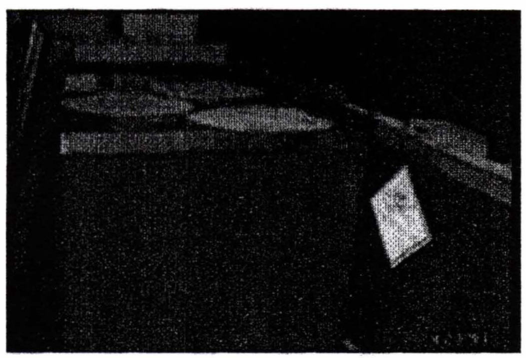


Photo : Drum Loading in Transit bin

5.6 Transport Units

Each transport unit will have a self adhesive label attached which will include the following :

- The IMDG (International Maritime Dangerous Goods) placard of a size whereby dimension "D" is 100 mm.
- The IMDG marine pollutant mark of a size whereby dimension "D" is 100 mm.
- The words "POLYCHLORINATED BIPHENYLS" or

- The name of the Holder.
- The full name and address of the Clearance Organisation.
- The full name and address of the Consignee
- A short description of the waste.

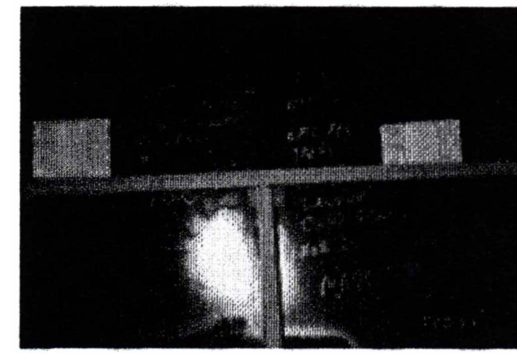


Photo : Labelling of Transport units

- The transport unit number.
- The weight of the transport unit.
- The date the unit was packed.
- The shipping container load number.

Shipping Containers
Each shipping container will be labelled as follows :

- The IMDG placard of a size whereby dimension "D" is 250 mm.
- The IMDG marine polluted mark of a size whereby dimension "D" is 250 mm.

Photo: Container Labelling

- When travelling on freeways in the country of origin, the label will be attached to both sides of the container. In addition, a sign with a white background and red lettering showing the following will be placed in a conspicuous position;

    - category
    - name of the substance
    - quantity
    - properties
    - important points in relation to handling
    - emergency contact;
        . name
        . telephone number
        . other details.

5.7 Transport Vehicles

The shipping container transport vehicles will be fitted with a sign showing the following;

- **Clearance Company's full name and address**
- Clearance Company's telephone number

This sign will be removed from the vehicle when the container is handed into the control of the Port Authorities.

5.8 Container Marine Survey

The services of a marine surveyor must be employed to survey the packing and final disposition of the cargo within the container. The Marine surveyor must be registered and produce a certified report of the packing accompanied with photos showing the various stages of container loading and bracing details etc.

<u>Section Summary</u>

Packaging Plan

- All POPs waste material must be packed in a standard manner using transit bins and drums for full transit protection.

- All POPs Transit bins must be properly packed into 20 foot Shipping containers that have been certified for shipment of POPs and all transit bins to be properly braced within the container to prevent any movement.

- All POPs Materials are to be correctly weighed

- All containers are to be Marine surveyed before transport to Port

- All containers to be correctly labelled

6.0 Strategy Statement

The detailing and control strategy for Transportation of the packed POPs to storage or ports requires the same level of attention as the other elements of the Clearance project. The Transportation must be carefully planned so that there are no possibilities of surprises during road transportation and that such details such as road works, hours of travel, routes, driver training etc. are fully taken care of in the Transport plan and applied by these WPI's. As for the other sections of this plan all the necessary details are contained within the WPI's including the required Safety and Environmental considerations along with QA implications.

During the transport from the warehouse to the docks the escort vehicle will accompany the containers on every journey. Permission may need to be sought to move more than one container at a time. The crew in the escort vehicle are to be fully trained in all emergency procedures and will be in radio/phone contact with the Clearance Company and the shipping container truck/s. As part of the Management plan there are agreed routes that are traversed and regular 'check ins' to the Clearance Company. Local police, emergency authorities, etc. will be notified of the routes, procedure and precautions as required by local regulations. Consideration will be given to off-peak time for movement in order to minimise the risk of accidents. Because of the attentiveness required of driver and crew a log will be kept of the hours worked and suitable rest periods inserted in the schedule.

6.1 Elements of the Transport Plan

- Marine Survey
- EPD Approvals
- Movement Timing
- Driver Briefing
- Escort Vehicle
- Communications

6.2 Marine Survey

Before any containers can leave site they must have been prechecked before loading, marine surveyed before final transit bin bracing and final inspection after bracing. When the Marine Survey has been released then the container can be made available for road transport to the port.

6.3 EPD approvals

Application for approval to transport the POPs waste on all roads must be made to the local Environmental Protection Department (EPD) for the locality of the waste. This application must include a statement of Quantity, Type, Route, Date and time of day. Approval to transport on ordinary roads will be in the form of a letter. Without this letter of approval the Waste cannot be moved. This is a general requirement for most countries, however where the requirement does not exist for EPD notification them route approval and timing should be made to the District Fire service.

6.4 Route Planning

The quality of the delivery of the shipping container is very dependent on the route chosen and the time of day. The various route options should be surveyed and the following items should be examined and thus the routes should be shortlisted to provide the most efficient an safest route selection.

* Examine the route options and detail restrictions (One way roads, Traffic densities etc)
* Research likely road works and traffic disruption possibilities
* Research population densities in selected routes
* Examine the access routes for the emergency services likely to take in the event of call out and ensure that the route will always allow for them to get to the site of the emergency as soon as possible without delay.
* Examine the various waterways on the routes and ensure that minimum number waterways are traversed.
* Avoid routes that have long traffic delays

6.5 Movement Timing

The transport of the POps waste must be done in daylight hours and during such business hours that will ensure that the Delivery will be complete well before the end of the day shift of the local emergency services. The timing however should be planned to avoid rush hour traffic.
The route shall be travelled by the escort vehicle as a dummy run at the timing planned to ensure that the conditions at that hour of the day will not unduly impede the transport.

6.6 Driver Briefing

The transport driver is to be selected on the basis of driving experience and record and must have basis Hazardous Substances transport experience and knowledge of emergency procedures. All transports to the port will be accompanied by the Escort vehicle with trained personnel attending who will deal with any emergencies but the driver must be able to handle the situation should the emergency vehicle be separated. The driver is to be fully briefed on the route, timing and emergency procedures and documentation. A kit bag of Driver Personal Protection equipment is to be placed in the cab of the transport vehicle before it leaves the site and the driver is to be fully briefed on its contents and how to use the equipment.

A complete set of transportation documentation as well as the emergency procedures and notifications is also to be placed in the cab. Under most circumstances these emergency procedures would not be used as emergencies will be handled by the escort vehicle and its personnel. But in the event that the Escort vehicle is disabled or involved in an accident the transport driver needs to be able to contain any situation until the back up crews arrive.

6.7 Escort Vehicle

The project emergency escort vehicle is to accompany all transport of POPs waste to storage or site. Under no circumstances is a delivery of POPs waste to be performed without the escort vehicle. The escort vehicle is also not allowed to perform the escort duties if its inventory is incomplete or that personnel are missing. details of the escort vehicle design and equipment it carries are shown in Section nine.

6.8 Communication

Complete communications systems are to be maintained between the transport vehicle, emergency response escort vehicle and the project control room. This communication is to be a combination radio/cell phone system. A regular check system is to be employed to keep the control room abreast with the delivery progress and any incidents along the route. The control room is to monitor and log the progress and warn of any new information occurring that could impede the progress.

Section Summary

Transport Plan

- Marine Survey completed
- Route, Timing and official approvals received
- Driver Briefing completed
- Escort vehicle and communications checked

PART 1 Section 7 - Shipping & Disposal Plan

7.0 Strategy

Shipping POPs waste to an offshore disposal facility must be conducted by a recognised shipping company and full cognizance made of all international laws (in particular the Basel convention) regulating the trans shipment of toxic waste.

7.1 Elements of the Shipping and Disposal Plan

- Labelling
- Lloyds Survey
- Port Acceptance
- Trans Frontier Documentation
- Basel Convention

7.2 Labelling

Before the shipping company can accept the container for loading at the port the following labels must be affixed and in order.

Four labels Marked Class 9 "Marine Pollutant"
Correct technical name
IMDG Classification
United Nations Number

In the case of pesticides waste the proper shipping name shall be mentioned on all shipping instructions, according to the IMDG-regulations for the several UN-numbers indicated in the Inventory Report.

The remaining 'unknown' pesticides after further analyses of the inventory report, during the progress will be labelled as follows :

Liquid waste material:

PESTICIDES, LIQUID, TOXIC, N.O.S.
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.

Solid waste material:

PESTICIDES, SOLID, TOXIC.
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.

7.3 Lloyds Survey

No container can be accepted for shipping unless the marine Survey is available and included as part of the shipping documentation.

7.4 Port of Entry Acceptance

Port acceptance at country of destination may have the following conditions.

(a) Transformers (PCBs) shall be drained and placed in leak proof trays (steel, all joints welded and leak tested). Trays are to be sized to contain all PCB's assuming the transformer was full. All container contents ate to be effectively secured within fright containers.

(b) 205 ltr approved steel drums (of new condition) UN Rated containing waste POPs are to be placed in leak proof transit bins of such size to contain all the POPs plus one third. A maximum of four by drums must be stood on plywood (4 mm) within the bin. All container contents are to be effectively secured within freight containers. If a second level of stow is required then it must be separated by 15 mm thick plywood.

(c) POPs contaminated wipes, clothing etc are to be retained in double wrapped polythene bags and placed in steel bins with closed lids.

It is permissible for items defined in (a) and (c), and (b) and (c), to be shipped in the same container. However, under no circumstances is it acceptable for containers holding items defined in (a) and (b) together.

(d) The Port safety Officer must be notified prior to shipment of the following before approval for entry is given:

-Source of the waste
-Packing certificate showing compliance with (a)-(c) above and details of the items packed
-Trans frontier shipment documents
-Estimated time of arrival and arrival berth

(e) Upon discharge, the ships agent must notify the Port Safety Officer in writing the date, time and destination of the transport of the waste. The ships agent will need to have prearranged customs clearance and transportation.

(g) The Port safety Officer also requires notification of the importers ability to supply a competent emergency response team to deal with any spillages, and needs a 24 hour contact number for the emergency response team and for the importers local agent.

7.5 Trans frontier Documentation

Correct and valid for the importation period trans frontier documentation (TFS) is required to be in place before the shipment leaves the country of origin. This documentation is to be obtained by the importers shipping agent and includes all certificates and documents as detailed below:

•All transport documents for road and sea transport (IMDG/ADR)
•Dangerous goods declaration
•Container packing certificates
•Bills of lading
•IMO labels, UN labels, Marine Pollutant labels, Waste ID labels for each drum.
•Complete script for each load and all shipment related activities.

7.6 Basel Convention

All shipment of POps waste shall be conducted under the auspices of the Basel Convention. In particular Article 6, 7,8 and 10.

Section Summary

Shipping & Disposal Plan

- Labelling completed and correct
- Lloyds Survey completed and sighted
- Port Acceptance standards complied with and attested
- Trans Frontier Documentation valid and in place
- Basel Convention fully complied with

8.0 Strategy

The project should be fully covered for all risks. The policy should obviously protect all those involved including the client but it must also be seen to be a provision that protects the environment from harm. A large accident involving a large spill will be very costly to clean up and a comprehensive insurance policy should be in place to cater for this type of event. When obtaining offers of insurance the Project manager should obtain the policy that while protecting himself and his client full protection is offered for environmental protection that will ensure that the funds are available to clean up a substantial problem.

8.1 Elements of the Insurance Plan

- Types of insurance
- Who and what should be covered
- Actions by the clearance company to hold harmless

8.2 Types of insurance

Depending on the extent of the POPs clearance operations, type and quantity of the POP the insurance packages required are as follows:

Complete "Pollution" Insurance cover for all accidents and incidents involving the removal, packaging and transportation of POP's. In addition complete protection of all contractors, agents, clients, engineers etc is required as well as cover for workers, employers liability insurance where required, machinery insurance, public liability insurance, motor vehicle insurance and professional liability.

8.3 Who and What should be covered

Main policy should cover for " Protect the main contractor, his
subcontractors, the client, his engineers and agents against their third party bodily injury property damage including any pollution clean up expense arising from the contract for the packaging, removal and transportation to the contractor for disposal of Persistent Organic Pollutants. (POPs). The amount of cover of the policy should be substantial and be at least US$10 Million.

8.4 Actions by clearance company to hold harmless.

Insurance policies of this nature require that the policy holder take all reasonable steps to ensure that:

There is compliance with regulations concerning transportation, storing and packaging of POP's.

The cargo is to be shipped in containers and loaded under professional supervision, and

The master of the carrying vessel is to be fully aware of the substance to be shipped.

<u>Section Summary</u>

Insurance Plan

- Types of insurance appropriate to protect the environment

- Actions required by the clearance company to hold harmless

9.0 Strategy Statement

The Emergency Plan is concerned with the detail of the equipment, services and methodology during and emergency situation. The system and equipment shown in this WPI is designed to allow a full emergency response to be available during all POPs operations and transport. The emergency plan is to be available at all times in the form of an Emergency Response Unit (ERU). This facility is always to be available during all stages of packaging as well as transportation. During transportation of the POPs waste to the export port the ERU is to act as the escort vehicle. The Emergency plan is discharged by means of Flip charts and these are to be activated during the emergency.

9.1 Elements of the Emergency Response Plan

- ERU Vehicle
- ERU Equipment Inventory
- Escort Duties
- Emergency Response during escort
- Emergency Response for other
- Emergency Response for fire
- Emergency Response for protest

9.2 ERU Vehicle

Due to the substantial amount of equipment to be carried by the ERU and the recovered waste it may also be called upon to transport this vehicle must be substantial. It is recommended that the ERU be housed in modular containers that is easily loaded onto the back of a flat bed truck with a capacity of about 10 Tonnes and the ERU truck should be fitted with a crane with half tonne lifting capacity. The ERU vehicle must be fitted with a communication system with at least two methods of communication. (EG radio and mobile telephone). The ERU must be capable of maintaining communications with the "Control Room" and the POPs Container truck.

9.3 ERU Equipment Inventory

The equipment to be carried by the ERU is extensive and a continuous inventory list must be maintained for the unit. Whenever the ERU is required for escort duties the inventory list must be checked for any shortages and the delivery of POPs containers to the Export Port must not proceed if the ERU is lacking equipment within its inventory. The schedule of equipment required for the ERU is as shown later in this section of the WPI. Within the check sheets WPI 4.90 is a check indication by the site supervisor that the ERU is properly equipped and its inventory is complete.

9.4 Escort Duties

The ERU is to operate as the primary escort vehicle and is to attend all transport deliveries of POPs waste to the Export Port. During such escort duties the vehicle is to travel behind the waste transport vehicle and its personnel to assume complete control during any kind of on the road incident. The escort vehicle personnel are to regulate the rest and safety stops and authorise the changing of any planned routes. During such escort duties if there are any possibilities of spillage or damage to the POPs cargo then the ERU and its personnel are to begin the notifications procedures and commence the Emergency Response procedures.

9.5 Emergency Response During Escort

In the case of accident, spill or leak during transport, emergency response measures as follows are to be taken immediately. All such incidents require that "An emergency be declared". The words "Emergency" must be used in communications regarding the incident.

* Immediately following the incident the POPs waste container driver is to notify the ERU escort vehicle.

* The ERU crew will respond immediately to the initial notification from the Container truck driver and follow the Flip sheets system as outlined in WPI 4.9.

* If the waste discharge is a major spill (ie the spill exceeds 4
litres) then the formal notifications procedure must commence as per the Notification procedure in WPI 4.9

9.6 Emergency Response for other

In the case of accident, spill or leak at the storage facility or packaging area, emergency response measures as follows are to be taken immediately. All such incidents require that "An emergency be declared". The words "Emergency" must be used in communications regarding the incident.

* Immediately following the incident the site supervisor is to inform the ERU and then to immediately follow the flip sheet system shown in WPI 4.9.

* The ERU crew will respond immediately to the initial notification from the Supervisor and be available at the site if required.

* If the waste discharge is a major spill (ie the spill exceeds 4 litres) then the formal notifications procedure must commence as per the Notification procedure in WPI 4.9.

9.7 Emergency Response to fire

Fire in the storage facility is extremely serious and all fires must be treated with utmost caution and an emergency declared immediately and the Flip sheet system applied immediately.

9.8 Residential Protest

If local residents set up a protect at the storage facility this must be treated as an emergency and operations shut down immediately and all actions taken to protect the stored POPs.

Section Summary

Emergency Plan

- ERU Vehicle to be fully stocked and available
- Escort Duties to be fully understood by personnel as well as the flip sheets system
- Emergency Response to follow preset procedure as laid down in flip sheets system

PART TWO

Safety and Environmental Plan

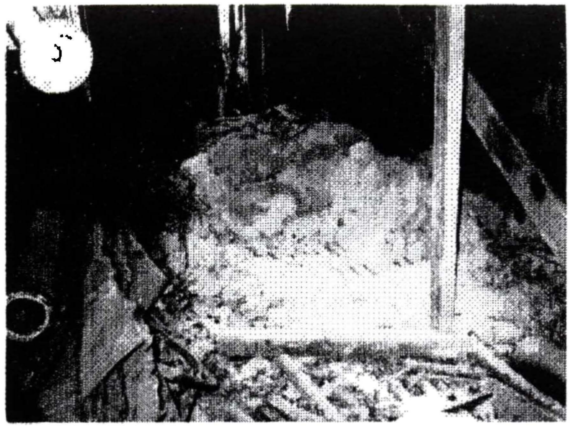


Photo: Old DDT store showing free form storage and leaking into environment

Photo : Pesticides store

Introduction

Part 2 presents the Management Plan implications of the Environmental Impact Report and the support structure for the methodology of the Project Plan as shown in Part 1.

As indicated within the introduction of this manual the sections of the Safety and Environmental Plan are to be read in parallel with the Sections of Part 1 of the Project Plan.

The meaning of Safety, as used within this Part of the manual, means personnel safety as well as Environmental safeguards. Throughout the application of the Work Procedure Instructions (WPI's) a common theme of safety is prescribed. At no stage is this aspect to be left out or overlooked. The design of this documentation ensures that all aspects of personnel and environmental safety are an integral part of the operating procedures. This is why the sections of Part 2 of the Project plan are written to coincide directly with the operational plans as enumerated in Part 1. The application of the safety and Environmental Protection plans are regulated, monitored and audited by the QA plan in Part 3.

The plans as finally set down in Part 4 of this manual as Work Procedure Instructions cannot be applied if all aspects of Part 2 regarding safety and Environmental are not complied with. If the Part 2 plans are in part or in full are not adhered to then the QA reporting structures will indicate that the Project is being conducted out of compliance.

The Safety and Environmental Plans as discussed in this Part of the POPs manual have been constructed using a mass of information derived from many years of POPs extraction operations in many countries over a period of 20 years. The rules of safety that are derived here generally cover those regulations that exist in many countries and in fact enhance the laws and regulations in that they are more specific and accurately deal with the practical reality of POPs recovery operations. The sections of part 2 are as follows:

Section 1	Management S & E Plan
Section 2	Site Inspection S & E Plan
Section 3	Clearance S & E Plan
Section 4	Site Preparation S & E Plan
Section 5	Packaging S & E Plan
Section 6	Transportation S & E Plan
Section 7	Shipping & Disposal S & E Plan
Section 8	Insurance S & E Plan
Section 9	S &E Check List

PART 2 Section 1 - Management Safety and Environmental Plan

1.0 Strategy statement

The management team that administers the Project via the WPI's must understand that the principles of operation that are inherent in the WPI's emanate from work safety principles and environmental safeguards. Within the work procedures there will be detailed instructions relating to safety and emergency instructions.

To discharge the Project managers responsibilities for the application of the Safety and Environmental Plan a training programme must be undertaken that reflects the operational standards annotated in the WPI's.

1.1 Elements of the Management Safety and Environmental plan

- Management Focus
- Training Programmes
- WPI's audit function

1.2 Management Focus

The management plan and team focus throughout the project has to be conducted from a strong Safety and environmental protection platform. The QA part of the management plan has a series of questions relating to the provision of the management plan and it's capacity to cope with the safety and Environmental protection required.

The emphasis and focus of the entire project plan and all of it's sections must come from the management plan and be based squarely on safety and Environmental Protection. There must be no compromises during operational procedures that will circumvent the requirements of safety and Environmental Protection.

1.2 Hazardous evaluation

1.2.1 Safety procedures

During the activities on site, whenever this is required by the opinion of the project manager, suitable protective clothes will be used and other protective gear in order to prevent direct exposure with hazardous substances.

If a confined space must be entered, an oxygen test will be taken before entering and subject to the opinion of the Project Manager, either a full face mask or a full breathing air protection mask will be worn.

Special care will be applied in case of potential hazards following from poor or dangerous conditions of drums (e.g. over pressure in drums) and other type of packaging.

1.2.2 The main hazard facing the workers at the site is exposure to various types of toxic elements. The concentrations of the toxic elements in the waste materials will be determined. Based on the information from the available MSDS, the S&E manager advises all potential hazards related to the formulated products. From the unidentified products the S&E manager will not know which (agro-) chemicals or POPs they contain but protection of personnel against exposure will be based on working procedures for the most toxic elements.

Pesticides are categorised into groups of pesticides, such as organic chlorine pesticides, organic phosphorus pesticides and pyrethroide pesticides. Pyrethroide pesticides have a low toxicity level, chlorinated pesticides are toxic, but not acute, phosphorus pesticides are acute toxic.

1.2.3 A second hazard is related to the occurrence of 'normal ' work accidents leading to injury. Where several manual jobs are carried out simultaneously a close supervision will be maintained in order to ensure adherence to safe working practices.

A third hazard is the outbreak of fire. Even when remote, this danger is fully taken into consideration as part of the Emergency Plan (Section 9).

1.2.4 A fourth hazard is the influence of climatic conditions (heat in combination with high humidity) on the team member, wearing personnel protective equipment. Fatigue resulting from heavy physical labour under poor climatic conditions is a factor to be aware of.

Due to the potential hazards, different types of protective gear are required. Where necessary, extra PPE has to be used.

1.) Face masks with P3 filter.
2.) Disposable coveralls and anti-static, fire-proof overalls.
3.) PVC gloves.
4.) Boots.
5.) Helmets.

The spent personal protective equipment will be disposed of.

1.2.5 Employee sign off

The project members will be medical checked before the start of the project and after returning from the project. The health check-up will at least consist of a liver function test, a longest, and an overall health check (blood pressure etc.). Further a blood sample will be taken in which the amount of possible toxic elements will be measured.

1.3 Training Programmes

The work instructions are in addition to and part of the training sessions. The training activity is part of the Site Preparation requirement and are to be implemented well before the site works actually start. If the team to be employed on the site is already well trained and experienced in the handling of POPs then only the safety issues relating to the particular site need be reviewed. It should be noted, however, that the WPI's contain an audit feature that tests by the use of personnel questionnaire the current status of knowledge and reviews the individual training.

If an individual fails the questionnaire tests as applied by the QA Audit then he/She must be cycled through additional training. Training as applied by this manual is an ongoing audited feature of the operational aspects of this manual.

The training must be performed by a recognised and experienced POPs recovery operator. If such an organisation or person does not exist within the project team then outside resources have to be selected, and if necessary someone from outside the country may need to be contracted to perform the training required.

1.4 WPI's Audit Function

The management plan focus is to be discharged via the Quality Assurance of the Site Preparation Plan (Section 4 of Part 3). The QA audit questions that are raised in this section appear in point format within the WPI and provide the means by which the management team ensure that all the plans adhere to the principles that are inherent in the management focus. If there is non compliance in this section then the focussing principles have been compromised and the Primary aims and goals of this project manual have been circumvented.

<u>Section Summary</u>

Management Safety and Environmental Plan

- Management Plan is Safety and Environmental Focussed
- To achieve this focus Training programmes are implemented
- To monitor the effectiveness a QA audit procedure is used in the WPI's

PART 2 | Section 2 - Site Inspection Safety and Environmental Plan

2.0 Strategy statement

The quality of the Project Plan is very dependent of how well the Site Inspection Plan is executed. In order to determine the correct information is obtained, the Site Inspection Plan is crafted from the safety and Environmental protection aspect.

The very first site attendance must be done using full personal safety precautions. The number of people attending the site inspection must be kept to a minim and be issued with a minimum personnel Protection equipment (PPE) standard.

The Site inspection Plan documentation shown in the WPI's must be adhered to in the order shown so that the correct documentation is gathered.

2.1 Elements of the Site Inspection Safety and Environmental plan

- Personal safety
- Environmental Safety
- Storage Type
- Type and Quantity
- Fire Protection

2.2 Personal safety

When planning to visit site for the first time it is necessary to obtain site information from the client regarding the likely conditions on site. The information provided, however, should only be regarded as a guide. In many circumstances client representatives may wish to "play down" the nature of site conditions and the situation may easily be misrepresented.

For your own personal safety you must plan to visit the site

with a level of personal protection that will allow you and other members of your team to attend the site under most contaminant conditions. For the protection of others and the protection of the environment

you must severely limit the numbers of extra people during the visit. All other members of the site inspection team must be supplied with the minimum protection equipment level.

If other people are required at the site but not on the contaminated area then these people are to be restrained back at a nominated barrier point.

2.3 Environmental safety

When attending site for the initial project assessment the Project Manager must be in a position to act immediately if there are conditions that violate environmental waste laws or best practice regulations. Often site have been left to degenerate and the storage situation becomes outside of the Waste Laws of the origin country. The client may not be aware of the nature of the problem and have accepted it for years. This does not absolve the Project Manager from the responsibilities that are inherent in this manual.

If there is a problem on site then it must be dealt with. If the situation constitutes an emergency then the construction of the site inspection must be suspended and the WPI4.9 emergency instructions are to be acted on immediately. It is insufficient to merely advise the client you must act.

In taking responsibility for this project you take responsibility for the protection of the environment. If you arrive on site and find that are large quantities of POPs leaking to ground surface you must call out a full scale emergency and go through the notification procedure as laid down in WPI 4.9. The Project Manager is then required to control and manage the Situation until relieved by the authorities or the emergency is over.

2.4 Storage Type

The primary aim of the Site Inspection Plan is to ascertain the risk factors associated with the type of storage encountered at the site. The various types of storage discovered at the site are assigned a Risk Factor for safety and another for environmental protection. The overall risk factor is then loaded into the Clearance Plan to provide the clearance priorities. Risk factors are numbered 1-10 where RF=1 indicates storage in full compliance with containment requirements, safety and full environmental protection is afforded. RF=10 is where there is no environmental protection and the POPs is in free form and leaking into the ground. The risk factors that are associated to the various methods of storage are discussed as follows:

Type 1 Storage : POPs materials, Solids and free liquids dumped on open ground with no spill protection and major leaking.

Risk factor Safety	10
Risk factor Environment	10
Overall Risk factor	20

Type 2 Storage : POPs materials, Solids and free liquids located in original equipment location still working but with no spill protection and leaking.

Risk factor Safety	:	8
Risk factor Environment	:	9
Overall Risk factor		17

Type 3 Storage : POPs materials, Solids and free liquids dumped on open ground with no spill protection and minor leaking.

Risk factor Safety	8
Risk factor Environment	8
Overall Risk factor	16

Type 4 Storage : POPs materials, Solids and free liquids located in original equipment location not working but with no spill protection and leaking.

Risk factor Safety	6
Risk factor Environment	8
Overall Risk factor	14

Type 5 Storage : Warehouse with PCB materials, Solids and free liquids that are incorrectly stored or contained and are leaking within warehouse structure and onto ground surface.

Risk factor Safety	2
Risk factor Environment	9
Overall Risk factor	11

Type 6 Storage : PCB materials, Solids and free liquids located in original equipment location but not working but with spill protection and not leaking.

Risk factor Safety	2
Risk factor Environment	4
Overall Risk factor	6

Type 7 Storage : Warehouse with PCB materials, Solids and free liquids that are incorrectly stored or contained and are leaking within warehouse structure but not onto ground surface.

Risk factor Safety	2
Risk factor Environment	6
Overall Risk factor	8

Type 8 Storage : PCB materials, Solids and free liquids dumped on open ground with spill protection and no leaking.

Risk factor Safety	4
Risk factor Environment	4
Overall Risk factor	8

Type 9 Storage : Warehouse with PCB materials, Solids and free liquids that are incorrectly stored or contained and would be threat to the environment if leaking were to occur.

Risk factor Safety	:	2
Risk factor Environment	:	4
Overall Risk factor	:	6

Type 10 Storage : Warehouse with PCB materials, Solids and free liquids that are correctly stored in containment, tagged and registered and provided with full spill containment within warehouse structure and public access is prohibited.

Risk factor Safety	1
Risk factor Environment	1
Overall Risk factor	2

If the storage method is not described within these ten options then the project manager is to assume the nearest equivalent risk factors.

2.5 Type and Quantity

As for the Storage type, the POP type and its quantities involve a safety and Environmental risk factor. The various POP types and quantities are graded with a risk factor which are also entered into the Clearance plan as a prioritising factor.

Material Type

Type 1 Type : POPs free liquids with 500,000 to 900,000 ppm Concentrations

Risk factor Safety	10
Risk factor Environment	10
Overall Risk factor	20

Type 2 Type : POP free liquids with 100,000 to 500,000 ppm Concentrations

Risk factor Safety	8
Risk factor Environment	8
Overall Risk factor	16

Type 3 Type : POP free liquids with 50,000 to 100,000 ppm Concentrations

Risk factor Safety	6
Risk factor Environment	6
Overall Risk factor	12

PART 2 | Section 2 - Site Inspection Safety and Environmental Plan (Cont)

Type 4 Type : POP free liquids with 50 to 50,000 ppm Concentrations
Risk factor Safety 4
Risk factor Environment 4
Overall Risk factor 8

Type 5 Type : POP free liquids with less than 50 ppm Concentration
Risk factor Safety 2
Risk factor Environment 2
Overall Risk factor 4

<u>Quantity Type</u>

Type 1 Quantity : Solids POPs more than 100 tonnes
Risk factor Safety : 8
Risk factor Environment : 8
Overall Risk factor : 16

Type 2 Quantity : Solids POps 50-100 Tonnes
Risk factor Safety : 6
Risk factor Environment : 6
Overall Risk factor : 12

Type 3 Quantity : Solids POPs 25-50 Tonnes
Risk factor Safety : 4
Risk factor Environment : 4
Overall Risk factor : 8

Type 4 Quantity : Solids POPs 10-25 Tonnes
Risk factor Safety : 2
Risk factor Environment : 2

Type 5 Quantity : Solids POPs 5-10 Tonnes
Risk factor Safety : 2
Risk factor Environment : 2
Overall Risk factor : 4

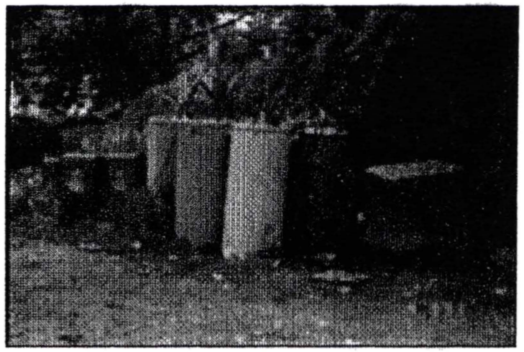


Photo : Type 1 Storage

Photo : Type 6 Storage

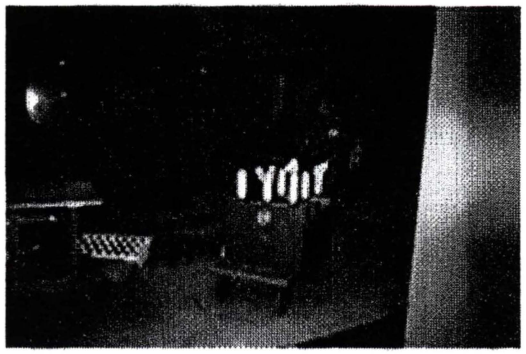


Photo : Type 2 Storage

Photo : Type 7 storage

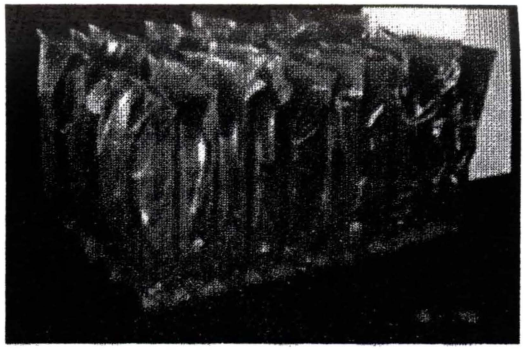


Photo : Type 10 Storage

If the storage method is not described within these ten options then the project manager is to assume the nearest equivalent risk factors.

2.6 Fire Protection

In keeping with international practice, water cannot be used for fire fighting when stored PCB or POPs is involved. Therefore the fire fighting capacity at the site becomes very important.

Dry agent extinguishers must be available and the quantity of these must be sufficient to control a large fire until the arrival of the fire service.

The type and quantity of fire fighting equipment is dependent on the storage type and the type and quantity of the POPs stored. The higher the risk factor the greater the amount of fire fighting equipment required.

Fire in a POPs storage facility is a very serious dangerous event and a full scale emergency call out to all emergency services is warranted during a facility fire. The danger from a fire involving POPs involved the formation of dioxin and furans during combustion of POPs products. These fire byproducts of POPs are extremely hazardous to human health.

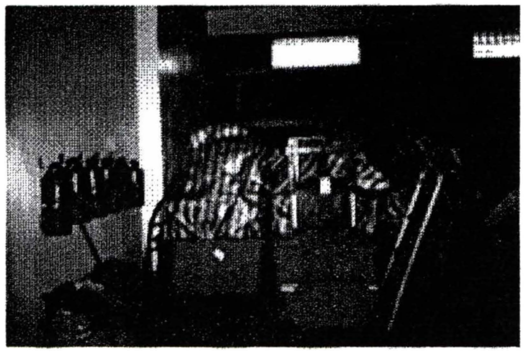


Photo : Fire Fighting Equipment

A collateral fire adjacent to the stored POPs can be fought with hand held extinguishers with minimum personnel protection equipment. However if the fire has involved POPs materials then it can only be fought with full BA sets and then only by professional fire fighters. If the fire is out of control then the immediate area is to be evacuated and all nearby residents evacuated. The only member of the site team to remain after evacuation is the site supervisor who must be wearing a full BA set so that he can assist the Fire service with the location of stored POPs and any other information they may require. All other members of the team should be evacuated.

At the outbreak of fire the Site supervisor is to activate WPI 4.9 emergency procedures and follow the notification procedures to the letter.

As part of the Site Preparation plan a site evacuation plan is to be designed and Command sites for the emergency services are to be determined.

<u>Section Summary</u>

Site Inspection Safety and Environmental Plan

- Number of site inspection personnel kept to minimum.
- Full personnel protective equipment required.
- Site inspection plan to be suspended if emergency situation is present.
- Project Manager must assume full Environmental Protection responsibility.
- Storage types must be fully analysed so that Risk factors can be assigned.

PART 2 Section 3 - Clearance Safety and Environmental Plan (Cont)

3.0 Strategy Statement

In order to discharge the Safety requirements and provide full environmental protection the clearance plan must be prioritised. This means that the type of storage or warehouse must be cleared by degree of danger. The higher the danger the higher up the priority list the clearance and the earlier the clearance.

3.1 Elements of the Clearance Safety and Environmental plan

- Storage and Type prioritisation
- Waste Packaging prioritisation

3.2 Storage and Type Prioritisation

In order to clear the site in a safe and orderly manner plus maintain the management focus of safety and environmental protection the clearance plan must be prioritised according to the risk factor.

The clearance priority is determined by the site inspection plan and the clearance safety and environment plan simply follows this schedule.

3.3 Waste Packing Prioritisation

In general, wastes will be packed in the following order (where the items exist)
POPs

- leaking containers
- non leaking non UN containers
- drummed liquids non UN containers
- bulked liquids non UN containers
- non leaking brand pesticide containers
- contaminated soil
- other movable items
- residue from floor treatment

In addition, soft materials (overalls, clothes, wipes, etc.) will be packaged as used.

Items which are unable to fit into standard transport units will packed last so that sufficient time is available to design and manufacture the special transport units.

PCBs

- drummed liquids
- leaking capacitors (when encountered)
- non-leaking capacitors
- transformers (and drained oil)
- contaminated soil
- other movable items
- rubber floor covering
- residue from floor treatment

In addition, soft materials (overalls, clothes, wipes, etc.) will be packaged as used.

Items which are unable to fit into standard transport bins will packed last so that sufficient time is available to design and manufacture the special transport bins.

Section Summary

Clearance Safety and Environmental Plan

- Clearance is performed to management focus on safety
- Clearance is prioritised according to risk factor
- Waste Packaging is prioritised

PART 2 | Section 4 - Site Preparation Safety and Environmental plan

4.0 Strategy Statement

When setting up the site, particular attention must be made to safety and Environment issues. During the design of the various structures required consideration must take into account the reality of each site and the ramifications of the work procedures and POPs types involved. Site preparation in addition to the work platform structures must include training of staff, personal occupational hygiene and safe working practices. Therefore as apart of the site preparation plan a safety and environmental plan is required to be produced which can be QA audited by the safety and Environmental QA plan.

4.1 Elements of the Site Preparation Safety and Environmental plan

- Personnel safety Procedures
- Medical Testing Procedures
- Personnel Protection Equipment (PPE)
- Emergency Response vehicle
- Training
- International Labour safety laws
- Environmental protection and work practices

4.2 Personnel Safety Procedures

<u>Occupational Hygiene Principles</u>

POPs enter the body by inhalation of vapours or dust containing POPs, by absorption through the skin or by ingestion through eating or smoking with contaminated hands and transferring to the mouth.

The ways to reduce exposure are :

1. Have a controlled area where POPs may be handled. Sign and restrict access.

2. Wear full body protective work clothing.

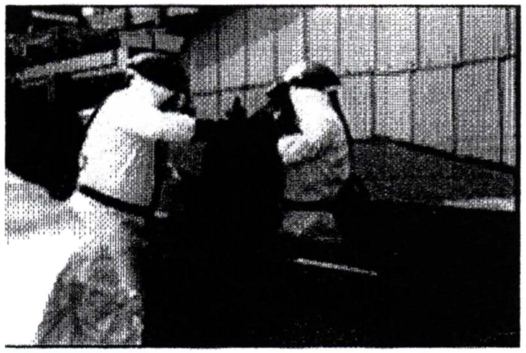


Photo : Full Body Protective Work Clothing

3. Wash thoroughly immediately after exposure to POPs and on exiting from the work area.

4. Training all workers in the hazards, correct use of PPE and correct work practices.

5. Make every effort to keep the POPs contained and enclosed.

6. Use good work practices at all times.

Good work practices would be described as follows :

* Workers whose clothing has been contaminated by POPs should change into clean clothing promptly.

* Do not take contaminated work clothes home. Family members could be exposed.

* If there is the possibility of skin exposure, emergency shower facilities should be provided.

* On skin contact with Polychlorinated Biphenyls, immediately wash (using soap) or shower to remove the chemical. At the end of the

workshift, wash any areas of the body that may have contacted POPs , whether or not known skin contact has occurred.

* Do not eat, smoke, or drink where POPs are handled, processed, or stored, since the chemicals can be swallowed, Wash hands carefully before eating or smoking.
* If Solid, when vacuuming, a high efficiency particulate absolute (HEPA) filter should be used, not a standard domestic or commercial vacuum.

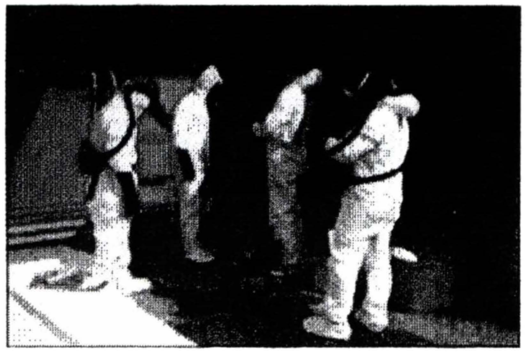


Photo : Personal Protection Equipment

Medical Testing Procedure

Medical testing for any personnel involved with the on site work prior to employment is considered desirable to ensure that work will not aggravate any preexisting condition. The requirements of international law are :

* Physical examination
* Chest X-Ray
* Blood Pressure
* Urine Sugar and protein
* White blood cell count
* Haemoglobin count
* Blood ALT or SGPT and creatinine

Further tests appropriate to planned tasks associated with PCB's are :

* Liver function tests
* Serium triglycerides level
* skin examination
* Lung function test

The cardiac/pulmonary tests are considered necessary because of the potential heat stress from working in TYVEK suits in the subtropical & tropical environment. The physical examination should also determine if the workers are able to cope with the physical demands of lifting or moving the capacitors. Complete records of all personnel involved with the Project are to be kept and if the project lasts beyond twelve months then the testing regime is to be repeated.

Personal Protective Equipment

In addition to good work practices it is necessary for workers to use personal protective equipment. As mentioned above the major routes of exposure are by inhalation and skin absorption.

Gloves

The gloves should be impermeable to POP's and unaffected by contact. The most suitable types are :

* Butyl rubber
* Neoprene rubber
* Nitrile rubber

The final selection criteria should be on fit, dexterity, snag resistance and price. From our experience the Edmont Solvex gloves (nitrile) have reasonably good dexterity and good snag resistance. The gloves should be worn outside the overall sleeves. If there is a tendency for the gloves and sleeves to separate and there is risk of skin contact, then they can be held together with masking tape.

Gloves should be removed carefully to avoid contamination of the unprotected hand. If there is excessive sweating in the glove than a cotton underglove can be used. Gloves (both inner and outer) should be disposed of each day or if they are damaged.

Overalls

TYVEK overalls are the primary means of skin protection. The overalls to be used when packing capacitors into boxes and other activities associated with handling capacitors is Type 55427. These overalls have reasonable snag and tear resistance, however if they become torn when lifting capacitors then a cheap protective apron should be worn. It is not expected that this will be a problem during the planned work.

The overalls should be disposed of if they become damaged or contaminated and at the end of the each day.

Undergarments

It is recommended that undergarments are worn by workers, primarily for comfort. These should be inexpensive light weight loose fitting shorts, shirts and socks.

Respirators

The task being undertaken and the likely hazard determine the type of respiratory equipment to be used. Workers engaged in packing capacitors into shipping boxes will use SURVIVAIR PAPR units fitted with belt mounted organic vapour, acid gas, HEPA filter cartridges. These units are fitted with flow and battery sensors and training needs to cover these aspects. Filters should be changed every two days. Face pieces require cleaning at the end of each day's work. This should be done using sterile wipes and/or soap and water washing. The SURVIVAIR units have the disadvantage of a close fitting face piece which can prove uncomfortable, particularly, if spectacles are worn. It is recommended to obtain RACAL PAPR's fitted with similar OV, AG/HEPAfilters to offer as an alternative. It must be stressed that the RACAL and SURVIVAIR filters are not interchangeable and stocks and training must take this into account.

Training in the use of the respirators must include cleaning, fit testing, changing filters, checking battery condition, charging instructions, and general care and inspection.

The self contained breathing equipment (air line and bottled air) are used on the emergency vehicle. These units have finite time limits and additional supplies of bottled air must be known.

The emergency vehicle equipment is supplemented by full face SURVIVAIR filter respirators.

Foot Covering

Since there is a combined risk of physical injury and chemical contamination it is necessary to use steel cap safety boots and chemical protection. The latter being TYVEK 417. If the type 417 prove to have insufficient durability due to scuffing then type 77017 should be used. Boot covers should be disposed of when damaged or alternatively daily.

Eye Protection

The workers engaged in removing the capacitors will have eye protection integrated into their respiratory protection.

Visitors to the work must have eye protection in the form of wrap around safety glasses (UVEX) or goggles.

Consumables

The anticipated consumables for the project are estimated for both workers and visitors :

Workers :

Tyvek Overalls	2-3 /person/day	(allow for tears)
Tyvek boot covers	2/person/day	
Respiratory cartridges	change/2 days	(2 or 3 cartridges/blower depending on brand)
Racal respirator facelets	1/day	
Gloves	1 1/2 pair/person/day	
Underclothes	complete change/person/day	
Respiratory decontamination wipes	1 pack/person/week	

Visitors :

Tyvek overalls	1 pair/visitor
Tyveh boot covers	1 pair/visitor
Visitor respirators	1 set filters/week
Eye protection	reusable - maintain approx. 20 in stock

4.3 Emergency Response Vehicle

An emergency response vehicle has been prepared which will escort each road movement. This vehicle is fitted out with a crane and a covered shipping container for storing the comprehensive range of equipment which may be needed in the event of an incident.

4.4 Decontamination Unit

A decontamination unit has been built in a converted shipping container. This is well fitted out with a gas hot water system, two showers, storage lockers for protective equipment, clean clothes, dirty clothes and is designed for isolation between the "Clean " and "dirty" sections.

4.5 Training

The correct training of all personnel involved in the POPs removal process in one of the key factors.

The training "packages"required will include :

Toxic Hazard : - This should cover the human toxic effects balanced by indications of dose required. should emphasis the relative importance of inhalation and skin absorption.

Personal Hygiene : - This should cover the necessity to wash before eating, drinking or smoking, the care needed when removing dirty clothing so as not introduce additional skin contamination, not removing any equipment or clothing from the site, showering (using soap) before going home.

Respiratory Protection : - How to check the equipment is assembled and operating correctly, checking for low battery or low flow, correct fitting using fit test equipment, eg. saccharin or banana oil, changing filters, charging battery packs.

Personal Protective Equipment : - How to use the overalls boot covers gloves, etc., how to remove contaminated equipment, importance of PPE.

Heat Stress : - What is heat stress and how to recognise the symptoms, the importance of maintaining fluid intake, importance of "working smart" to use mechanical aids, not rushing, interspersing heavy work with light work, doing heavy work in the cooler part of the day, the role of acclimatisation.

Emergency Procedures : - Site emergency procedures if there is a liquid spillage, clean up procedures, personal decontamination if splashed (use of eye wash), isolation of areas and containment, transport emergency, eg. vehicle accident, vehicle fire, deployment of containment booms, cleanup procedure, selection of suitable protective equipment, emergency communication procedures, notification of authorities, crowd control.

Safe Work Practices : - Not to take personal risks when working, working within personal capabilities, not reaching too far, ensuring footing is secure before lifting/reaching, etc.

4.6 International Labour Safety and Health Law in Relation to POPs

The floor and walls of POPs working areas must be constructed from impervious materials washable with water.

A rest room must be provided outside of the POPs working area. The working area must have facilities for bathing, flushing of the eyes and mouth and changing and washing clothes.

The working area must be marked with the words "Non Operating Staff Prohibited" both in English and Country of POP origin.

All storage containers used in storage and transport of POP's must be clearly marked with the contents and items to be noted in handling.

Contaminated rags and scrap paper must be placed in an impervious container and sealed.

When not in use, storage containers must be kept in a specified area.

Whenever operations are being conducted with POPs a supervisor must be appointed. The supervisor must:

* Ensure that workers are not contaminated by the POPs
* Direct the operations of the workers.
* Examine the exhaust facilities once per month. Records of such inspections must be kept for at least three years.
* Ensure that workers wear necessary protective clothing.

The employer must prohibit the workers from smoking or eating in the POPs work area, and mark the area accordingly.

All items which have come into contact with POPs must be marked accordingly.

When POP's are being transferred between containers the outlets of the two containers must be such as to create a seal when transferring.

The condition of the storage vessels must be examined every day prior to commencing operations with POP's and other surrounding areas examined for leakage. If any leaks are found, the storage vessel must be repaired and leaked POPs cleared.

The employer must examine the density of all materials in the air of the work place every six months, record the results of such examination and keep the results for at least three years.

4.7 Environmental Protection and Work Practice

All construction activity must be designed with one purpose in mind and that is environmental protection. At all times during the design phase of the site preparation the question is to be asked about the veracity of the design to protect the environment. The question should be in the format "what happens if the worst case scenario occurs, will the environment be protected?

The design of the working platforms should be crafted so that it facilitates the use of good working practices that will ensure that accidents are kept to a minimum and this will adhere to the minimisation of risk policy.

Section Summary

Site Preparation Safety and Environmental Plan

- Rigid personnel safety procedures required
- Medical testing of all workers mandatory
- Personal Protective Equipment required to be worn at all times by all personnel during work activities
- All workers to undergo regular and updated training

PART 2 | Section 5 - Packaging Safety & Environmental Plan

5.0 Strategy Statement

The PCB wastes to be handled during the implementation of this proposal are potentially hazardous, creating the need to plan for and put in place, workable emergency response procedures at all phases of the project. These procedures need to cover responses to emergencies involving threats to the environment and the public, as well as those that may threaten the health and safety of personnel involved in the operations.

The handling and storage procedures to be followed in this proposal (as outlined in previous sections of this document) have been developed over time and through considerable experience with actual operations. The procedures therefore are designed specifically to minimise the risks of emergencies arising.

The packaging of wastes to international standards prior to transport is designed to provide at least double containment of the materials. This will substantially limit the volume of wastes likely to be split or to leak in any one incident.

However, it is inappropriate to rely solely on set procedures to achieve a high level of safety. There remains the need to be able to respond in a positive and rapid manner to unforeseen circumstances.

5.1 Elements of the Site Inspection Safety and Environmental plan

- Emergency Response
- Emergency Response Procedures

The following description outlines relevant emergency procedures.

5.2 **Emergency response**

As described, all personnel involved with the proposal will be properly trained and fully informed of the nature of the materials being handled and the appropriate emergency response procedures.

All trucks will be accompanied by an escort vehicle, which will function as an emergency response vehicle to provide an effective response in the unlikely event of a leak or spillage during the transport phase.

In the case of an accident, spill or leak during transport, emergency response measures will be taken immediately.

1 The spill area will be isolated and barricaded. Personnel not involved with the cleanup will be excluded from the secured area.

2 Under the EPA Regulations a crew will respond immediately upon notification that a waste spill has occurred.

3 All cleanup personnel will wear personal protective clothing and equipment.

4 Every reasonable effort will be made to stop or retard the flow of wastes and contain that which has been discharged.

5 If the waste spill does reach flowing water, storm sewers or any inaccessible area, timely notification procedures will be initiated immediately the escort crew is aware of a spill. Measures will also be initiated to prevent any additional spill material from reaching water or wetlands.

6 Contaminated absorptive material and soils will be placed in steel containers.

7 All surfaces exposed to the spilled fluid will be decontaminated.

8 At spills in densely populated areas, the spill area will be continuously supervised until the spilled waste and all cleanup materials have been removed from the site, secured in drums, or otherwise neutralised.

The periods of highest risk of a spill or leak developing is during loading and unloading of wastes. To minimise potential environmental impact, loading area will have adequate spill response materials and spill prevention measures. When loading or unloading waste equipment at the ship or in the field, spill prevention measures will be taken and spill control and cleanup materials will be readily available.

5.3 Emergency Response Procedures

Staff Training and Supervision

i Medical assessment and certification of fitness for each employee before work commencement. This would establish baseline health status of each staff member for comparison with subsequent examinations.

ii Continued medical assessment on a monthly basis and on exit of employment within 72 hours of cessation of work.

iii At request of employer, employee or authorised medical personnel where excessive absorption of wastes is suspected.

iv Periodic random checks at the discretion of authorised medical personnel.

In addition to medical surveillance, the repackaging and site facilities will be provided with a first aid post, including an ablutions block specifically designed to provide for decontamination and disposal of clothing, towels and other materials as required.

The following items of protective equipment will be available and used as appropriate :

i. One piece chemical resistant suit with internal zip, external buttons and a hood;

ii goggles (unless the respirator provides eye protection);

iii chemical resistant (ie Viton) gauntlet type gloves (note : natural rubber, neoprene or polyethylene are not suitable);

iv chemical resistant disposable protective overshoes, and

v. respiratory protection.

A properly fitted full facepiece canister respirator will provide adequate respiratory protection for dealing with waste spillage or releases which are at ambient temperatures. For dealing with such fluids at elevated liquid temperatures, or in general, for work in any confined space, self-contained or compressed air line breathing apparatus will be worn.

The occupational health and safety precautions will include the following :

i. All personnel should avoid all body contact with wastes.

ii. Personnel must always wear company approved protective clothing (as described previously).

iii. Any normal clothing which accidentally comes into contact with wastes must be removed for disposal with other contaminated materials.

iv. Any cuts or small abrasions must be protected with waterproof dressings beneath the protective clothing.

vii. On completion of work involving the wastes each person must wash hands and face before eating, drinking or using any toilet facilities.

First aid procedures are :

i. Eyes - immediately irrigate with water for at least fifteen minutes and obtain medical attention.

ii. Skin - immediately remove any contaminated clothing and wash affected skin with soap and water, or an industrial cleanser.

iii. If swallowed - wash out mouth several times with clean water, give water to drink and obtain medical attention.

iv. If inhaled - remove to fresh air and obtain medical attention.

Small Spillage

1. The area should be isolated and untrained personnel not involved with the cleanup excluded from the secured area.

2. Barricades should be placed as required around the contaminated areas to prevent pedestrians and vehicles from entering until the spill material is cleaned up and removed.

3. A crew will respond immediately upon notification that a waste spill has occurred. Trained officers will remain on-site until the emergency has passed.

4. All cleanup personnel handling wastes and/or engaged in the actual cleanup are to wear personal protective clothing and equipment to prevent contamination of clothing or skin, as detailed in Section E1 above.

5. Every reasonable effort should be made to stop or retard the flow of wastes spill and contain that which has been discharged, using personnel,equipment and materials on-site and immediately available.

6. If the waste spill does reach flowing water, storm sewers or any inaccessible area, the first employee to the spill area will immediately initiate notification procedures and also initiate measures to prevent any additional spill material from reaching water or lands.

7. In most cases, an oil absorptive material is a useful cleanup tool. If used, it should be spread on the contaminated area and should be left in place for at least one hour, or as long as necessary to ensure that all available fluids have been absorbed.

8. After spilled fluids have been absorbed, the absorptive material, along with any contaminated soils, are to be placed in the steel containers provided for that specific disposal purpose. If conditions are such that waste penetration cannot be determined, then at least 15cm of soil depth should be removed.

9. All surfaces exposed to the spilled fluid should be decontaminated with swabs containing an efficient solvent, such as trichloroethane.

10. Any contaminated steel structures, wood racks or cable trays (all types) should also be washed down with solvent. All equipment on these structures that may be contaminated by a waste spill, but will not be removed, must also be similarly cleaned. Use caution with the solvent to prevent further contamination of equipment and vehicles in the spill area.

11. All types of structures, buildings, private vehicles that may be contaminated are to be washed down with solvents. (Use caution with solvent on privately owned vehicles to prevent damage to vehicle finish). On each private vehicle involved, fill out a written record. Again, take all necessary measures to prevent solvent and wastes from entering into any sewer or drainage system and treat as other contaminated wastes.

12. All contaminated items, including tools, clothing, boots and any other equipment, must either be thoroughly cleaned with solvent where practical, or disposed of in the steel containers provided specifically for disposal purposes.

13. All drums should be clearly identified, loaded on a vehicle and carefully secured to minimise the chance of another spill.

14. The vehicle carrying the drum(s) must also be labelled in accordance with Dangerous Good (Road Transport) Regulations.

15. The containers are to be taken directly to the central receival point for subsequent shipment for disposal.

16. At spills in densely populated areas, the spill areas will be continuously manned until the spilled waste and all cleanup materials have been removed from the site, secured in drums, or otherwise neutralised.

17. If skin contact with wastes does occur, remove with waterless hand cleaner, wipe with towels and dispose of these towels in the containers provided for that purpose. If eye contact occurs, flush eye thoroughly with water for at least 15 minutes.

18. Spills water require special treatment, as follows :

(i) The water will be bailed and pumped into secure 205 litre drums and sealed. The sediments and sludge from the bottom of the puddle should then be cleaned up to a depth of at least 7.5 - 15.0 cm, depending on the percolation, and placed in drums. All containers will then be sent to the central receival point for appropriate disposal.

(ii) Residual contaminated water will be soaked up in dry sand, ash, sawdust or commercial absorbents. The saturated material will be placed in "open Head" 205 litre drums and sealed. The sediment and sludge from the bottom of the puddle should then be removed to a depth of at least 7.5-15.0 cm, depending on the percolation, and placed in drums.

<u>Section Summary</u>

Packaging Safety & Environmental Plan

- Emergency repose during packaging failures
- standard clean up systems

PART 2 Section 6 - Transportation Safety and Environmental Plan

6.0 Strategy Statement

In order to discharge the Safety requirements and provide full environmental protection and to maintain the policy of risk minimisation the Transport Plan must be not only carefully adhered to but must be continuously monitored for any non compliance.

6.1 Elements of the Transport Safety & Environmental Plan

- Driver Briefing
- Route adherence
- Communication
- Vehicle Inspection
- Load Security
- Emergency Procedure

6.2 Driver Briefing and PPE

The driver is to be fully briefed as to his duties of care during the transportation of the POPs to site. This briefing should be over and above the specific driver training and should be delivered on the day of dispatch of each and every container. This briefing shall include the following point by point schedule.

* Is the driver of good health and sobriety
* Is the driver fully aware of the route
* Brief the driver of any changes to route, timing, destination, road hazards.
* Brief the driver as to communication check times to escort and control
* Brief the driver as to rest stops (one per hour)
* Brief the driver to load check stops (one per hour)
* **Check driver has loaded PPE Kit Bag and knows how to use it.**
* Check driver is aware of his duties if escort vehicle delayed
* Check emergency procedures and notification schedule is in drivers cab
* Check driver is aware of how to cope initially with emergency

6.3 Route and adherence

The planned route shall be shown on a road map and placed in the cab after driver briefing. The points of radio progress reports are to be indicated on the map. Should it become necessary to change the route during the course of the delivery the driver shall advise the escort vehicle and pull over when safe to do so and await authorisation to alter the route.

6.4 Communication

The safety of the POPs delivery is dependent on good communication. No delivery of POPs shall commence until a full communication check with the escort vehicle at the control room has been effected. No containers shall be delivered until the communication check has been carried out and proved effective. The control room is to be located at the Clearance Contractors main offices and it to be manned continuously during container delivery. The person in charge of the control room shall be fully conversant with the route and all its particulars. He shall be capable of accepting full control responsibility during any incidents.

6.5 Vehicle

Inspect the vehicle for tyre or suspension damage and look for obvious mechanical reasons for the vehicle to be unfit for duty. Also inspect the COF.

6.6 Load Security

The supervisor and the driver must together inspect the load and determine that the load is correctly fastened onto the container truck by its locking turrets. No container is to be dispatched unless thecontainer is locked in position and that the locking has been witnessed by the supervisor and the driver. The load security is to be checked at least once per hour or 100Km.

6.7 Emergency Procedure and Escort vehicle

All trans shipment of containers of POPs Waste to the port shall be escorted the entire route up to receipt and acceptance by the Port Authority. The escort vehicle personnel are to be fully trained in all aspects of spill control and are to assume full responsibility for the cargo during all aspects of the delivery. Any route changes must be authorised by the Escort vehicle personnel only after clearance from control room.

Section Summary

- Driver briefing and Route planning
- Emergency procedures
- Communication
- Vehicle stops

PART 2 Section 7 - Shipping and Disposal Safety & Environmental Plan

7.0 Strategy Statement

All the previous plans and strategies of this manual if applied properly will ensure that the shipping of the containers of waste is safe. The adherence to the IMDG code ensures that the cargo is placed on the correct area of the ship away from foodstuffs etc. Provided that all of the packaging codes and plans and QA have been followed then the complete safety of the public and the environment during shipment to the country of disposal will be achieved.

7.1 Elements of the Shipping and Disposal Safety and Environmental plan

- Labelling
- Lloyds Survey
- Basel Convention

7.2 Labelling

Part of the safety to the environment is the proper placement of the hazardous goods labels on the containers. It is most important for environmental protection that the correct action is taken during an incident involving the POPs waste container and if the labelling is incorrect then inadvertent damage to the environment will occur if the incident is mishandled.

7.2 Lloyds Survey

The standard of the container packing will determine the amount of damage the waste will incur during incidents or accidents. The Lloyds Survey is the method by which final environmental protection is achieved. It is most important that the Lloyds Survey is properly done and certified. The method of packing will ensure that only the most severe of accident will cause a leakage. The Lloyds survey is the final QA for this procedure.

7.3 Basel Convention

The Basel convention governs the packing, and movement of POPs Waste from export country to country of disposal. This manual supports all the articles of the Basel convention and all its provisions regarding notifications and compliance. The entire shipping and disposal of the POPs must follow the declarations of the Basel convention. This will apply even if the country of waste origin is not a signatory to the convention.

<u>Section Summary</u>

Shipping and Disposal Safety and Environmental Plan

- Correct Labelling ensures safety and environmental protection during incidents
- Lloyds Survey ensures that environmental protection for almost all incidents
- Basel Convention compliance ensures environmental protection

PART 2 Section 8 - Insurance Safety and Environmental Plan

8 0 Strategy Statement

While the need for insurance cover is obvious in order to protect the participants of the POPs clearance operation, the main purpose of the insurance policy is to provide a high degree of environmental protection. By having a comprehensive package in place that is the ultimate pollution policy means that clean is assured in the unlikely event that a POPs escape occurs. This is not t say that the packaging and transportation can therefore be of a lessor standard because at the end of the day the policy will do the clean up. The policy is only to be the absolute back stop environmental protection should all the other plans and strategies fail.

There fore the primary aim of the insurance policy is to provide funds for environmental protection should all the other procedures fail in the event of a catastrophic loss.

8.1 Elements of Insurance Safety and Environmental Plan

- Appropriate Insurance policy

8.2 Appropriate Insurance Policy

In the event of a catastrophic event where uncontrolled POPs enters the environment the only final capacity to protect the environment lies in the strength of the insurance policy to provide the finds for the cleanup. This means that the insurance policy chosen for the project must be designed with the protection of the environment firmly in mind.

<u>Section Summary</u>

Insurance safety and Environmental Plan

- The environmental protection in the end relies on an appropriate insurance policy in place.

PART 2 Section 9 - Emergency Safety & Environmental Plan

9.0 Strategy Statement

During an emergency where POPs has spilled or is threatening the environment or the safety of personnel the only strategy that can exist for the emergency procedures is the the procedural process of the emergency be strictly followed as shown by the Flip sheets in the WPI's. If the procedures are carefully adhered to then the damage to the environment will be minimised.

9.1 Elements of the Emergency safety and Environmental Plan

- ERU
- Flip Sheets

9.2 ERU

Discharge of environmental protection and safety of public and personnel can only be achieved with the use of a fully equipped ERU and the provision of trained staff and procedures.

9.3 Flip Sheets

The entire emergency procedures are to be discharged via the flip sheets as indicated in WPI 4.9.

<u>Section Summary</u>

Emergency safety and Environmental Plan

- A fully equipped ERU is required to effectively provide an emergency service
- The emergency procedures is discharged via flip sheets

PART THREE
QUALITY ASSURANCE PLAN

PART 3 Section 1 - QA Management Policies

1.0 Strategy Statement

This section sets out the Management Plan Quality Control and assurance for the project. The QA policies and objectives are a direct result of the Environmental Impact Report and the Aims and Objectives as shown in Part 1. It is proposed within this manual that a full QA schedule be applied to this project to ensure that the aims and objectives as shown in Part 1 are fully met and complied with and conforms with ISO 14000.

The basis of the ISO system is the application of a detailed Quality Manual. This Quality Manual is a broad description of the elements of the Quality system, setting out Policy, Organisation, Standards and Objectives and describing what is to be achieved. Part 3 of this manual forms the Quality manual for the Project.

1.2 Elements of QA Management Polices

- Policy
- Standards
- Objectives

1.3 Policy

The Quality Manual must have as its basis a policy statement the carefully states the Contractors Quality Policy. This policy by its very definition must be aligned to the aims and goals that have been set for the project work to be undertaken. Therefore the policy for the QA manual is an expanded version of the aims and goals as shown under Part 1.

The **primary Aim** of this POPs Manual is to provide the Client with a level of confidence that the project will be performed to a high technical level that fully recognises all environmental safeguards inherent in the country's Waste laws, in an operationally efficient manner. This aim is achieved by the presentation of the plans and programmes within this manual.

The **primary Goal** of this Technical Proposal is to ensure that the Clearance and Disposal of the POPs Waste is performed without endangering the public or environment of any other country or persons. This goal of ensuring there are no accidents or spillage, leaks or escapes to the environment of any kind is to be achieved by rigid enforcement of the plans and programmes by utilising a Quality Assurance programme.

Thus the aim and goal of this POPs manual can be expressed as follows:

It is the aim to put in place efficient, audited plans and programmes that ensure the discharge of all obligations under law and in so doing, achieve the goal of no endangerment to the environment or people.

The majority of the community, accept wholeheartedly that the long-term quality of life we enjoy depends on the quality of our environment. We firmly believe we have a responsibility to operate in a manner that conserves resources, minimises waste and pollution and safeguards the environment for future generations.

1.4 Objectives

Quality Assurance in the management of intractable wastes is often a requirement of tenders or contracts. It is also a necessary segment of the Management Plan for any project involving the Clearance and Disposal of Intractable Waste such as POPs in order that the stated Aims and Goals can be achieved.

Analysis of the task of managing intractable wastes leads to identification of the following areas as critical to the assuring the quality of the process:

1. Selection & Training of Personnel
2. Use & Maintenance of Personal Protective Equipment
3. Identification and Labelling of Consignment
4. Packaging of Consignment
5. Transport of Consignment by Road

6. Transport of Consignment by Ship
7. Emergency Management
8. Assessment and Decontamination of Warehouse
9. Quality Control
10. Document Control
11. Internal Audits & Corrective Action

In each of these areas there will be numerous Procedures and Work Instructions required to fully describe and manage the system. These basic components of any Quality system are identified below in point form and are fully described in the Work procedure instructions in part four of this operations manual.

Selection & Training of Personnel

Principal objectives are to ;

* Have adequately educated and trained personnel to conduct the task.
* Have sufficient personnel selected and trained to avoid any interruption to the project due to staff shortage.
* Give complete training in the specifics of the task and routinely reinforce this training.
* Know the complete health background of all employees ensuring avoidance of health issues arising from the particular disposal programme.

Selection, Use & Maintenance of Personal Protective Equipment (PPE)

Principal objectives are to ;

* Select correct PPE for the task with full understanding of all Occupational Hygiene and Safety aspects of the particular task.
* Train all personnel in the correct use of the PPE
* Maintain all PPE in optimum operating condition

Identification & labelling of Consignment

Principal objectives are to ;

* Identify each item of a consignment uniquely
* identify the location and its status of each item to be disposed of,
* Label all containers, both primary and external with all necessary local, national and international required shipping codes, dangerous goods labels, identity and contact for consignor and emergency information.

Packaging of Consignment

Principal objectives are to;

* Package the consignment such that minimum risk is posed to operators, transporters, the public and environment in ongoing handling, transport of the consignment.
* Meet all local, national and international regulatory requirements and maritime agreements/conventions on the transport of dangerous or environmentally hazardous material.
* Contain the packing area ensuring avoidance of any contamination of the local environment.

Transport of Consignment by Road

Principal objectives are to ;

* Transport the consignment with the full knowledge of risks posed by the transport route and method, and to minimise those risks.
* Fully comply with all regulatory requirements concerning transport of dangerous or environmentally hazardous materials
* Avoid or minimise disruption to normal traffic

Transport of Consignment by Ship

Principal objectives are to ;

* Transport the consignment with the full knowledge of risks posed by the transport route and method, and to minimise those risks.
* Fully comply with all local. national and international regulatory requirements and maritime agreements/conventions concerning transport of dangerous and environmentally hazardous waste.

Emergency Management

Principal objectives are to ;

* Avoid or minimise risk posed to the public and environment by emergencies involving the consignment
* Respond to defined levels and types of emergencies with appropriate levels of action
* Ensure adequately trained and drilled personnel are available whenever and wherever required for the handling of any emergency involving the consignment
* Supply and manage emergency equipment specific to likely incidents involving the consignment.

Assessment and Decontamination of Warehouse

Principal objectives are to;

* Accurately and thoroughly assess the level of contamination of storage areas and surrounding land in a scientifically valid and repeatable manner
* Decontaminate storage areas and surrounding land to levels of contamination agreed to by contract.
* Conduct the assessment and decontamination at minimum risk to the personnel involved and the public at large

Quality Control

Principal objectives are to ;

* Ensure the quality of critical steps of the process is controlled in a defined manner and records are kept of that control
* Meet all Quality Control requirements defined by contract.

PART 3 Section 1 - QA Management Policies(Cont)

Document Control

Principal objectives are to ;

* Ensure all required documents/records are fully defined, available, completed and accurate

* Ensure all documents (Contracts, reports, procedures, instructions etc.) to be uniquely identified

* Ensure responsibility for generation, transmittance, security, confidentiality and archiving of documents is defined.

* Ensure alteration of any issued document can only be performed by authorised personnel, leaving a record of the alteration.

Internal Audits & Corrective Action

Principal objectives are to ;

* Audit all aspects of the process at least once every 6 months.

* Ensure the audit system is maintained by defined Manager

* Ensure that audits are conducted by suitably trained and experienced auditors.

* Ensure a corrective action system accurately records all non-conformance and manages implementation of root cause elimination.

* Ensure line management is responsible for correction of non-conformance.

Section Summary

QA Management Polices

- **ISO 9001 and ISO 14001 standards apply**

PART 3 Section 2 - QA Site Inspection Plan

2.0 Strategy Statement

This section provides the Quality Assurance detail for the Site Inspection plan. This section should be read in conjunction with Part 1 Section 2. The QA of the site inspection plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.2 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Site Inspection Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.

2.1 Elements of the QA Site Inspection Plan

- Site Name
- Storage Type
- Type and Quantity
- Goals & Objectives
- Power/Lighting & Fire Protection
- Lifts & Hoists
- Space
- Residents
- Access

2.2 Site name

QA-Audit

<u>Question: Is the name for the site clearly stated and includes sufficient information to accurately identify the site?</u>

Compliance: No Action

Noncompliance: Action

Establish name and include sufficient detail to clearly identify site. It is not enough to simply call the site "Number Five". The site name must include an area name that is instantly recognised by all associated with the project as well as the emergency services. During the establishment of the site name a check with the local Fire service should be made in order to see if the site name that is intended to be used is adequate for their purposes.

<u>Question: Is the name in keeping with the Client register of sites and is the name readily recognised by the local EPA.?</u>

Compliance: No Action

Noncompliance : Action

After checking with the emergency services and the client a final check should be done with the local EPA to ensure that the site name agrees with their Hazardous waste register and that no confusion will be caused by the use of the chosen name.

2.3 Storage Type

QA-Audit

<u>Question: Are all the site storage types listed in the schedule ?</u>

Compliance : No Action

Noncompliance: Action

Audit check the site until the total schedule is completed and that all individual items are clearly identified and accounted for on the schedule. The total number of items should be counted as a total and this total should be made up of subtotals of individual storage types.

Question: Are there any items in storage that are an immediate threat to the environment.?

Compliance : No Action

Noncompliance: Action

If during the site inspection some or all of the POPs stored are an immediate threat to the environment, then the site inspection process is to be immediately suspended and the emergency plan put into operation. This means that WPI 4.9 Emergency instruction is drawn up the emergency vehicle is called out and the cleanup operation is put in motion. During the formulation of the WPI 4.9 the entire site is checked for other items that are an immediate threat to the environment.

Question : Are there any items on storage that are structurally unstable?

Compliance: No Action

Noncompliance : Action

Make immediate arrangements to have the stacked storage items restacked so that the stacked structure is no longer unstable. This can be achieved by the use of WPI 4.3.

Question : Are any of the items of storage that are leaking?

Compliance : No Action

Noncompliance : Action

The same action as for "Threat to the environment" is required.

Question : Is there any free Liquid POPs on storage surface.?

Compliance : No Action

Noncompliance : Action

The same action as for "Threat to the environment" is required.

Question : Are there any items that are an earthquake risk?

Compliance : No Action

Noncompliance : Action

Isolate those items at risk from the surrounding equipment and stabilise against earthquake. This activity should receive urgent priority in the clearance plan.

Question : Is the storage area protected from the elements?

Compliance : No Action

Noncompliance : Action

Urgent action is required to provide protection even if this has to be a temporary cover. This activity should receive urgent priority in the clearance plan.

PART 3 Section 2 - QA Site Inspection Plan(Cont)

Question : Are there any items of building configurations that are a fire risk?

Compliance : No Action

Noncompliance : Action

Either the PCB material must be urgently removed to a safe location or the building configuration changed. This is an urgent activity in the clearance plan

Question : Is there a public access risk to the storage?

Compliance : No Action

Noncompliance :Action

Urgent steps are to be taken to prevent further public access. This may mean the immediate installation of a security fence or security guard until more permanent arrangements can be made.

Question : Is the storage area lockable?

Compliance : No Action

Noncompliance :Action

Immediate arrangements to made to secure storage area.

Question : Is the PCB in storage correctly registered and tagged with identifiers?

Compliance : No Action

Noncompliance :Action

Review the methodology that was used to store the material in the first place and see if a suitable system is available that can be extended to this project. If this is not feasible and the client is unable to advise the system used then the Clearance plan will need to establish a tagging system and method of recording as depicted in the clearance plans.

Question : Are there any items in storage that should not be stored with POPs.?

Compliance : No Action

Noncompliance :Action

Make immediate arrangements to remove these items. If there is any machinery or vehicles or other equipment that is not contaminated then they must be removed immediately.

Question : Is there any aspect of the storage that should be immediately notified to local EPA ?

Compliance : No Action

Noncompliance :Action

Issue a report and immediately notify the EPA citing the noncompliance. This must not be neglected.

2.4 Type and Quantity

QA -Audit

Question : Are all the POps types listed and quantities noted?

Compliance : No Action

Noncompliance :Action

Proceed to compete the entire register of POPs types and quantities. The clearance plan cannot be completed without the completion of this register. If a client generated register has been supplied then its contents must be site audited for accuracy.

Question : Are all risk assessments noted in the schedule.?

Compliance : No Action

Noncompliance :Action

Provide all risk assessment information so that the risk assessment factors can be noted.

Question : Are there any items that cannot be handled safely with the standard POPs handling techniques that will require a specialist approach?

Compliance : No Action

Noncompliance :Action

Issue Report "Special Handling Requirement" as per the instructions WPI 4.3

2.5 Goals/Objectives

QA Audit

Question : In reviewing the Goals and Objectives of the project are there any aspects of the site, storage, type and quantities that are not in strict accordance with achieving the Goals and objectives.?

Compliance : No Action

Noncompliance :Action

Issue Report "Primary Aim Noncompliance" as per WPI 4.2

2.6 Power/Lighting and Fire Protection

QA-Audit

Question : Is the site provided with sufficient Power and lighting for the efficient project execution.?

Compliance : No Action

Noncompliance :Action

Issue Specification for additional Power and lighting resources as per WPI 4.2

Question : Are the site electrical services safe and of a good standard and are there overhead power conductors interfering with operations?

Compliance : No Action

Noncompliance :Action

Issue Specification for additional work as per WPI 4.2

Question : Is there sufficient fire protection for the fighting of substantial fires for 30 minutes before the fire service arrives?

Compliance : No Action
Noncompliance :Action
Issue Report "Fire Fighting Resources" as per WPI 4.2

PART 3 Section 2 - QA Site Inspection Plan(Cont)

2.7 Lifts & Hoists

QA -Audit

Question : Does the site have sufficient lifts and hoists in working order if the storage is multilevel?

Compliance : No Action

Noncompliance :Action

Issue report "Lifts & Hoists" as per WPI 4.2

2.8 Space

QA-Audit

Question : Is there sufficient space within the storage area to layout the packaging system?

Compliance : Action

Produce preliminary sketch of the layout area to assist the Site Preparation Plan

Noncompliance :Action

Issue Report " Spatial Requirements Noncompliance" as per WPI 4.2

Question : Is there sufficient appropriate space for the location of Decontamination and amenities facility?

Compliance : Action

Produce preliminary sketch of the layout area to assist the Site Preparation Plan

Noncompliance :Action

Issue Report " Spatial Requirements Noncompliance" as per WPI 4.2

Question : Is there sufficient space to locate the Fire service command vehicle and other emergency services during an emergency?

Compliance : Action

Produce preliminary sketch of the layout area to assist the Site Preparation Plan

Noncompliance :Action

Issue Report " Spatial Requirements Noncompliance" as per WPI 4.2

Question : Can the working areas be completely defended against the intrusion of public and unauthorised access?

Compliance : Action

Produce sketch showing defended boundaries

Noncompliance : Action

Issue Report "Unauthorised Access noncompliance" as per WPI 4.2

Question : Can the working areas be defended against burglars and arsonists or environmental activists?

Compliance : Action
Produce sketch showing defended boundaries

Noncompliance : Action

Issue Report "Unauthorised Access noncompliance" as per WPI 4.2

2.9 Residents

QA-Audit

Question : Are there nearby residential accommodations?

Compliance : No Action

Noncompliance : Action

Produce sketch showing proximity of residential dwellings for clearance plan

Question : Are these accommodations at risk of fire in storage items?

Compliance : No Action

Noncompliance : Action

Issue Report "Fire Risks" as per WPI 4.2

Question : With the proximity of residential accommodations are the Aims and goals of the project compromised ?

Compliance : No Action

Noncompliance : Action

Issue Report "Primary Aims and Goals noncompliance" as per WPI 4.2

Question : Are the nearby residents appraised of evacuation criteria if fire breaks out in storage area?

Compliance : No Action

Noncompliance : Action

Provide to Client for distribution to the residents the Fire evacuation instructions.

2.10 Access

QA-Audit

Question : Are the roads and streets up to the Storage area adequate for the planned activity.?

Compliance : No Action

Noncompliance : Action

Issue Report "Access Roads" as per WPI 4.2

Question : Will there be easy access to the storage area for all emergency vehicles?

Compliance : No Action

Noncompliance : Action

Issue report "Storage Area Access for Emergency vehicles" and in addition visit with the emergency authorities to ascertain options.

Question : Are the roads and streets adequate for a full scale evacuation should it be required.?

PART 3 Section 3 - QA Clearance Plan

3.0 Strategy Statement

This section provides the Quality Assurance detail for the Clearance plan. This section should be read in conjunction with Part 1 & 2 Section 3. The QA of the Clearance plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.3 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Clearance Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.

3.1 Elements of the QA Clearance Plan

- Ware house or storage facility Clearance priority
- Type and Quantity clearance priority schedule
- Position Allocations
- Location of Emergency vehicle
- Location of the Decanting/Packaging area
- Location of the Dispatch area
- Location of the Overall Defence Zone

3.2 Warehouse or Storage facility Clearance Priority

Question : Are all the types of storage correctly indicated on the Schedule?

Compliance : No Action

Noncompliance : Action

Complete the schedule as required under the WPI 4.3 filling out the entire details as to Storage types.

3.3 Type and Quantity clearance priority schedule

Question : Are all the POPs types and quantities entered into the schedules?

Compliance : No Action

Noncompliance : Action

Complete the schedule as required under the WPI 4.3 filling out the entire details as to POPs types and quantities.

3.4 Position Allocations

Question : Are the locations of the Decontamination and amenities units drawn on the site plan?

Compliance : No Action

Noncompliance : Action

Complete the drawing of the site showing the location of the decontamination and amenities units and indicating the flow of personnel.

3.5 Location of Emergency vehicle

Question : Is the location of The emergency Vehicle indicated on the site drawing?

Compliance : No Action

Noncompliance : Action

Complete the drawing of the site showing the location of the emergency Vehicle.

PART 3 Section 3 - QA Clearance Plan(Cont)

3.6 Location of the Decanting/Packaging area

Question : Are the locations of the decanting/packaging areas indicated on the site drawing?

Compliance : No Action

Noncompliance : Action

Complete the drawing of the site showing the location of the decanting and packaging areas.

3.7 Location of the Dispatch area

Question : Is the location of the Dispatch area indicated on the site drawing?

Compliance : No Action

Noncompliance : Action

Complete the drawing of the site showing the location of the dispatch area.

3.8 Location of the Overall Defence Zone

Question : Is the location of the Defence Zone indicated on the site drawing?

Compliance : No Action

Noncompliance : Action

Complete the drawing of the site showing the location of the defence area.

PART 3 Section 4 - QA Site Preparation Plan

4.0 Strategy Statement

This section provides the Quality Assurance detail for the Site Preparation plan. This section should be read in conjunction with Part 1 & 2 Section 4. The QA of the Site Preparation plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.4 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Site Preparation Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.

4.1 Elements of the QA Sire Preparation Plan

- Site Preparation
- Containment barriers and spill protection(Warehouse)
- Location of Decontamination and Amenities Units
- Working Areas
- Working Area equipment requirements
- Defence Areas
- Emergency Access
- Fire Protection
- Intruder Alarms
- Telephone and other communications
- Records
- Emergency vehicle

4.2 Site Preparation

Question : Are the Primary, Secondary and Tertiary Zones shown on the Site drawing?

Compliance : No Action

Noncompliance : Action

Design the Primary, secondary and tertiary zones and show their outlines on the site drawings.

Question : Is the Public Zone indicated on the Site drawings?

Compliance : No Action

Noncompliance : Action

Design the Public Zone area that should be accessible for members of the public that will not require PPE. This area should include the main office for the project.

Question : Are the Emergency and First Aid material locations indicated on the Site drawings?

Compliance : No Action

Noncompliance : Action

Draw the locations of the emergency spill containment materials and the first aid stations on the site drawing.

Question : Is the Fire Fighting equipment indicated on the Site drawings?

Compliance : No Action

Noncompliance : Action

Calculate the fire fighting systems require and indicate on the site drawing.

Question : Is the Work Procedure Instruction Notice Board indicated on the site drawing?

Compliance : No Action

Noncompliance : Action

Position the WPI notice board and indicate on the site drawing.

4.3 Containment barriers and spill protection(Warehouse)

Question : Have the correct bunding requirements been applied to each operating zone?

Compliance : No Action

Noncompliance : Action

Design each bunding requirements in accordance with the local waste laws and the requirements of this manual.

Question : Has the schedule been correctly filled out with the total risk factor calculations?

Compliance : No Action

Noncompliance : Action

From the Site Inspection Plan and the Clearance Plan calculate the Total Risk Factors and determine the minimum methods of containment.

Question : Do the calculated Total risk factors conform with the policy of minimum risk policy.

Compliance · No Action

Noncompliance : Action

Reassess the calculated Total Risk factor and elevate to the next level if it appears that the minimum Risk Policy is not complied with.

Question : Have the "In service" POPs (PCBs) types and quantities been entered into the schedule

Compliance : No Action

Noncompliance : Action

Correctly assess the types and quantities of the "In service" equipment and place results onto the schedule.

4.4 Location of Decontamination and Amenities Units

Question : Have both the decontamination unit and the amenities units been clearly shown on the site plan and all access routes clearly shown and defended.

Compliance : No Action

Noncompliance : Action

Assess the site for the location of the Decontamination and amenities units and clearly show these on the site plan along with the ingress and egress paths, indicating how the routes are defended.

4.5 Working Areas

Question : Are the working areas clearly indicated showing exactly which part of the operations are to be performed within the designated zones including storage of tools and equipment etc.

Compliance : No Action

on the site plan to show how the work activity is to be executed and how each area is autonomous in that work activity does not spill out into the other areas.

4.6 Working Area equipment requirements

Question : Has the equipment required for each work activity been assessed and list generated.

Compliance : No Action

Noncompliance : Action

Assess the work activity requirements and create a listing of area tool and equipment requirements.

4.7 Defence Areas

Question : Are all areas adequately defended against incorrect work activity and are these areas properly fenced and defended against unauthorised access.

Compliance : No Action

Noncompliance : Action

Design the defence areas and methods to prevent the intrusion of the areas by unauthorised personnel and inappropriate work activities.

4.8 Emergency Access

Question : Can the emergency services gain unrestricted access during an emergency of any kind.

Compliance : No Action
Noncompliance : Action

Assess the access under emergency conditions and ensure that all emergency services can access the site without undue restriction.

4.9 Fire Protection

Question : Is there adequate fire fighting equipment to handle a fire for at least 30 minutes.

Compliance : No Action

Noncompliance : Action

Provide a minimum equipment level to allow the fire fighting capacity on site to be at least 30 minutes.

4.10 Intruder Alarms

Question : Does the site have sufficient monitored intruder alarms system

Compliance : No Action

Noncompliance : Action

Install a 24 hr. monitored fire and intruder alarm system

4.11 Telephone and other communications

Question : Is the site provided with adequate telephone and communications systems

Compliance : No Action

Noncompliance : Action

Provide a secure telephone line for phone (toll free) and fax. Also provide Cell phone where possible, Pager and radio telephone

4.12 Records

Question : Is the site provided with an adequate record keeping facility

Compliance : No Action

Noncompliance : Action

Purchase a computer based record keeping facility complete with printing capability and organise off site storage of data.

4.13 Emergency vehicle

Question : Is there are comprehensively equipped Emergency vehicle available on call.

Compliance : No Action

Noncompliance : Action

Provide a fully equipped vehicle for emergency call out and escort duties.

5.0 Strategy Statement

This section provides the Quality Assurance detail for the Packaging plan. This section should be read in conjunction with Part 1 & 2 Section 5. The QA of the Packaging plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.5 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Packaging Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.

5.1 Elements of the QA Packaging

- Waste Packaging
- Container Packing
- Weighing
- Labelling
- Container Marine Survey

5.2 Waste Packaging

<u>Question : Have purpose built transit bins been provided</u>

Compliance : No Action

Noncompliance : Action

Organise the construction or purchase or obtain from the Disposal company purpose built transit bins in sufficient quantity to keep up with the proposed clearance rate.

<u>Question : Are the dimensions of the transit bins approximately 1100 x 1310 x 1000mm</u>

Compliance : No Action

Noncompliance : Action

Bins of other sizes are unlikely to fir correctly into the shipping container and therefore should be reordered.

<u>Question : Have the transit bins been leak tested and certified</u>

Compliance : No Action

Noncompliance : Action

Organise leak testing before use.

<u>Question : Are all the joints fully welded</u>

Compliance : No Action

Noncompliance : Action

Organise additional welding to ensure liquid tightness.

<u>Question : During the packaging process is each stage of packing provided with the full protection elements as demanded by the packaging Plan Part 1 section 5</u>

Compliance : No Action

Noncompliance : Action

Repack in accordance with the Packaging Plan. No transit bins are to be exported without all the integral packaging protection elements.

5.3 Container Packing

Question : Are the Transit bins packed in the 20 foot shipping container two wide and two high

Compliance : No Action

Noncompliance : Action

Repack so that a total of 16 bins can be packed into the standard 20 foot container.

Question : During the loading of the shipping container were total weights recorded and checked against the total loading capacity of the container.

Compliance : No Action

Noncompliance : Action

Arrange for weighing of transit bins during loading and record compliance with weight restrictions.

5.4 Weighing

Question : During the packing process has the POPs minus packing material been weighed for payment purposes.

Compliance : No Action

Noncompliance · Action

Provide accurate and efficient weighing process for the weighing of the POPs.

5.5 Labelling

Question : Has all the correct labelling been applied to the transit bins using self adhesive labels

Compliance : No Action

Noncompliance : Action

No transit bin or transport unit is to leave the site without the correct labelling. Provide a complete stock of labels as required by the packaging plan.

5.6 Container Marine Survey

Question : Have the shipping containers been marine surveyed by a registered marine Surveyor.

Compliance : No Action

Noncompliance : Action

Arrange for Marine surveyor to survey the shipping containers and their packing.

PART 3 Section 6 - QA Transportation Plan

6.0 Strategy Statement

This section provides the Quality Assurance detail for the Transportation plan. This section should be read in conjunction with Part 1 & 2 Section 6. The QA of the Transportation plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.6 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Transportation Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.
This QA schedule is based on a single shipment and this QA schedule should used as a general document with compliance noted on the individual check sheets for each container.

6.1 Elements of the QA Transportation Plan

- Marine Survey
- EPD Approval
- Route Planning
- Escort vehicle
- Driver Briefing
- Load Security

6.2 Marine Survey

QA-Audit

Question : Have all containers been prechecked and marine surveyed and has the MS report been sighted?

Compliance : No Action

Noncompliance : Action

No containers are permitted to travel to the export port if they have not been Marine Surveyed. If they have not been surveyed and a certificate not sighted then the supervisor is to make arrangements form the containers to be surveyed. If this does not happen then a NCR report is to be urgently generated for the attention of the project manager.

6.3 EPD Approval

Question : Has the application for EPD approval been filed and the approval letter received?

Compliance : No Action

Noncompliance : Action

Unless the letter of approval is received then the containers must not leave for the port. Most countries have a requirement by the local EPD that requires a permit for the road delivery of hazardous waste. Without it there is no permission to leave. If the approval is not obtained an urgent NCR is to be generated for the project managers attention.

6.4 Route Planning

Question : Has the route been carefully planned, inspected and travelled to ensure that the cargo will be safe at all times?

Compliance : No Action

Noncompliance : Action

Unless the route has been carefully checked, travelled and all obstructions, overhead wires etc have been investigated the dispatch cannot go ahead. No delivery to port is allowed to be effected unless a full route investigation has been carried and properly documented.

Question : Has the route been surveyed for traffic delays?

Compliance : No Action

Noncompliance : Action

During the route investigation careful note should be made of the traffic densities and possible delays and the route planned to go around these.

Question : Have the routes times been carefully worked out to avoid rush hour traffic conditions?

Compliance : No Action

Noncompliance : Action

The route must avoid rush hour times. It is unacceptable to have the container truck stranded for long periods of time in stalled traffic.

6.5 Escort Vehicle

Question : Is the Escort vehicle fully stocked and available for the escorting of the container truck to the Port and the check lists checked off?

Compliance : No Action

Noncompliance · Action

No delivery to port or anywhere else may take place unless the escort vehicle is fully stocked and fully manned and its communications channels are functioning. If a delivery is effected without the escort vehicle then an urgent NCR is to be faxed to the Project manager.

6.6 Communications

Question : Has the entire communication system been checked out between the container truck, escort vehicle and the control room?

Compliance : No Action

Noncompliance : Action

Unless there is substantial and well connected communication links between the container truck, the escort vehicle and the control room then no deliveries are allowed to be effected. If a delivery is effected and the communications are defective then an urgent NCR is to be faxed to the Project Manager.

6.7 Driver Briefing

Question : Have all the driver briefing statements been complied with?

Compliance : No Action

Noncompliance : Action

Unless ALL the driver briefing statements have been made and checked off the Transport check list then no delivery of containers can be effected. POPs cargo must not be transported by drivers that have no training or comprehension of the transport of hazardous waste. If the driver arrives at the site and is unsuitable he must be rejected.

6.8 Load Security

Question : Has the supervisor and the driver performed the load security check?

Compliance : No Action

Noncompliance : Action

Unless both the driver and the supervisor personally check the load security the delivery must not be effected. If either the driver or the supervisor have not checked the load security then a NCR must be filed.

Question : Has the Container truck a current COF ?

Compliance : No Action

Noncompliance : Action

No truck is to be used if it does not have a current Certificate if Fitness. There are no exceptions. If a delivery is effected using a truck without a current COF then an urgent NCR is to be faxed to the project manager.

PART 3 Section 7 - QA Shipping & Disposal Plan

7.0 Strategy Statement

This section provides the Quality Assurance detail for the Shipping & disposal plan. This section should be read in conjunction with Part 1 & 2 Section 7. The QA of the Shipping & Disposal plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.7 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Shipping & Disposal Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.

7.1 Elements of the QA Shipping & Disposal Plan Audit Questions

Question : Have all the labelling been correctly applied and affixed to the container?

Compliance : No Action

Noncompliance : Action

Ensure that the correct labelling of the container is placed as failure will result in non acceptance by the Port.

Question : Has the Lloyds survey certificate been sighed and is it part of the shipping documentation?

Compliance : No Action

Noncompliance : Action

The Lloyds certificate must be sighted. No container is to be presented for shipping unless this document is included with the shipping documents.

Question : Has all the packaging been done in accordance with the port of the acceptance country and a certificate attesting to this?

Compliance : No Action

Noncompliance : Action

If this certificate is not presented with the shipping document attesting to packaging standards then the container is not to be presented to the export port.

Question : Is the shipping documentation complete with the inclusion of the completed and valid Trans Frontier document?

Compliance : No Action

Noncompliance : Action

Without the Trans frontier documentation the container cannot be presented to the export port.

Question : Are all aspects of the Basel convention been checked and complied with?

Compliance : No Action

Noncompliance : Action

If the Basel conventions cannot be complied with then the container cannot be presented to the export port.

8.0 Strategy Statement

This section provides the Quality Assurance detail for the Insurance plan. This section should be read in conjunction with Part 1 & 2 Section 8. The QA of the Insurance plan follows the sections as shown in Part 1. The Work Procedure Instructions in Part 4 include in point format the QA issues raised in this section. As the Site specific details are filled in WPI 4.8 the QA part of the Instruction covers those aspects as discussed below. The QA-Audit comprises a series of questions against each part of the Insurance Plan and are complete with instructions for compliance and noncompliance. Most of the noncompliance responses will initiate a noncompliance report. This Report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the noncompliance reports.

8.1 Elements of the QA Insurance Plan

Question : Does the proposed insurance policy provide the necessary funds to protect the environment for any conceivable accident ?

Compliance : No Action

Noncompliance : Action

Unless the policy covers all incidents to protect the environment then it should be renegotiated.

PART 3 Section 9 - QA Emergency Plan

9.0 Strategy Statement

The QA procedure of the emergency plan is embedded in the flip sheets. Unless the flip sheets system is followed there is no QA. If the flip sheet system is correctly applied during the emergency then the QA aspect of the emergency plan is correctly applied.

9.1 Elements of Quality Assurance

- Flip Sheets
- Incident reports

9.2 Flip Sheets

Question: Are all the emergency procedures correctly applied as per the flip sheets?

Compliance : No Action

Noncompliance : Action

Provide the complete Flip Sheets system as outlined in the WPI 4.9. Ensure that all personnel are familiar with the Flip system

Incidents Reports

Question: Have the appropriate incidents reports been produced after incident.?

Compliance : No Action

Noncompliance : Action

Ensure that after all incidents a report is generated.

PART FOUR
WORK PROCEDURE INSTRUCTIONS

WORK PROCEDURE INSTRUCTIONS

WPI 4.1 Management instructions

Operational Instructions
Safety and Environmental Instructions

Reports

Instruction Number	Procedural Instruction [name] Project	Page 1

WPI 4.1.1 Goals & Objectives

The Primary Aim of these Procedural Instruction is to provide the authorities with the highest level of confidence that the project of clearance and disposal will be performed to a high technical level that recognises all environmental safeguards in an operationally efficient manner.

The Primary Goal of these procedural Instructions is to ensure that the Clearance and Disposal of the Pesticide Waste is performed without endangering the public or environment of any country or persons. This goal of ensuring there are no accidents or spillage, leaks or escapes to the environment of any kind is to be achieved by rigid enforcement of the plans and programs described in these Work Procedure Instructions.

WPI 4.1.2 Procedures and Strategies

The procedures and strategies that form the principles of operation include the following:

- Minimise the chances of spills of contaminated waste occurring.
- Contain and Control any leaks or spills that may occur to prevent their escape into the wider environment or their coming into contact with the public.
- Divide the wastes into individual lots of a size that reduces the volume of a spill or leak to a manageable quantity.
- Provide a transport strategy that centers on the movement of relatively small consignments of wastes in any one convoy.
- Provide Management and audit trail procedures that ensures full accountability and traceability of all waste handled.
- Ensure that all personnel involved in the implementation of the proposal are fully aware of the nature of the materials to be handled and are fully trained in appropriate emergency response procedures.

WPI 4.1.3 Project Plan

The methodology of the Project Plan is to design a set of plans and programmes that are specifically directed at achieving the aims and goals indicated above. These plans are them enumerated within a set of Work Procedure Instructions (WPI's) and are managed, controlled and audited by the management team.

The Project Plan is constructed from the following sub sections:

Section 1 Management Plan

Section 2 Site Inspection Plan

Section 3 Clearance Plan

Section 4 Site Preparation Plan

Section 5 Packaging Plan

Section 6 Transportation Plan

Section 7 Shipping & Disposal Plan

Section 8 Insurance Plan

Section 9 Emergency Plan

Each of these sections culminates in a set of Work Procedure Instructions.

WPI4.1.4 Management Plan

The Management Plan is based around the concept of the QA auditing the work procedure Instructions (WPI's). All the necessary project controlling detail are enumerated within these WPI's and the QA section provides the audit function. Should a section of the works be out of compliance then the appropriate report would be generated. To set up and monitor this set of plans the Project Director must first create a Management Team.

Instruction Number	Procedural Instruction [Name] Project	Page 2

WPI 4.1.5 Management Team Structure

The management team is to be set up around the Main Contractor Subcontractor concept based on the Client contract Document. The main Contractor is XYZ International who are entirely responsible to the Client and the Environment for the safe and efficient discharge of the obligations under contract.
The Subcontractor is the nominated Clearance company on site.
At all times the Main Contractor is responsible for the complete Contract of clearance and the Management Team Structure is to be structured in recognition of this responsibility.
Members of the team are to be appointed as follows:

WPI 4.1.6 Project Director [ ]

Overall Project Director with top level access to Client, Government, Disposal services etc. Maintains a constant monitoring of the discharge of the contractual responsibilities as well as ensuring safety and environmental protection. All decisions regarding Safety, environmental, economic etc are referred to this office.

WPI 4.1.7 Project Manager [ ]

All day to day management of the entire project from site inspections to shipping and disposal are responsibility of this officer. He has direct in line management responsibility to ensure the total discharge of all obligations under contract and to ensure that the operation is rigidly performed according to the safety and Environmental instructions and the that all work is supervised using the Work Procedure Instructions. All project communications and instructions are to be issued by this office. All QA auditing and Reporting to be the responsibility of this office.

WPI 4.1.8 Subcontract Project manager

This position is filled by an experienced manager from the Clearance Company and reports directly to the Project Manager. Responsibilities include the supervision of the WPI's, training and emergency management. All site clearance, packaging and local transport are included in this office.
Directly responsible for the discharge of all safety and environmental requirements and the completion of all QA requirements.

WPI 4.1.9 QA Inspectors

This position reporting Directly to both the Project manager and the Client is to be an independent Engineering Auditor experienced with Hazardous waste management.

WPI 4.1.10 Clearance and Packaging Manager

Reports to Subcontract Project Manager and is responsible for the day to day site management of the Clearance Plan and the discharge of all the obligations of the Clearance Plan. All matters of safety and environmental protection relative to the clearance plan are the direct responsibility of this office. All emergency situations are initially under the management of this officer until relieved by the Subcontract manager. This officer is responsible for the veracity of the check sheets by the application of his signature daily.

WPI 4.1.11 Documentation & Regulations manager

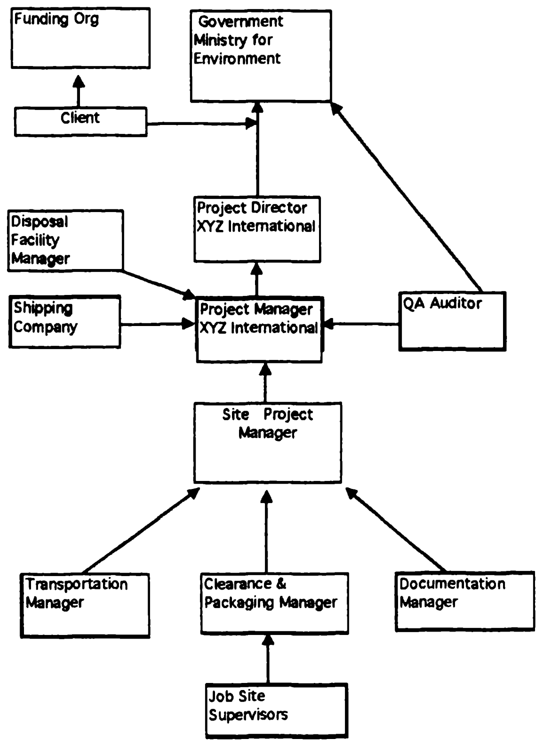
This position handles the day to day documentation between the client and regulatory authorities. The position does not handle the contractual communication but it handles the advice communication regarding shipments, weighing, permits etc.

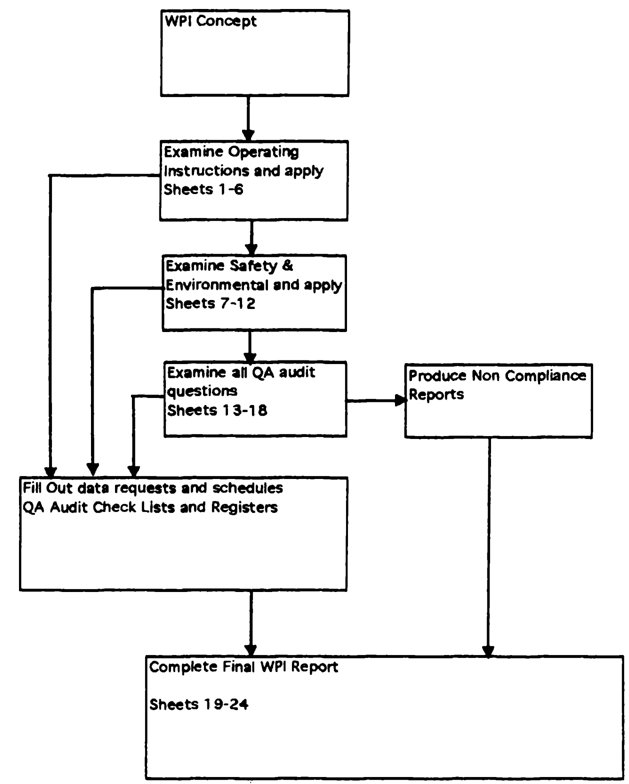
WPI 4.1.12 WPI Structure

Each set of Work Procedure Instructions is set up as a 6 x 4 mosaic of 24 sheets.

Sheets 1-6	Operational Instructions
Sheets 7-12	Safety and Environmental Instructions
Sheets 13-18	QA Audit Check Lists and registers
Sheets 19-24	Reports

WPI 4.1.12 **Management Structure**





Instruction Number	Procedural Instruction [name] - Project Page 5
S&E 4.1.1	**Strategy** The Management Team must understand that the principles of operation that are inherent in the WPI's emanate from work safety principles and environmental safeguards. Throughout these WPI's there will be detailed instructions relating to safety and emergency instructions. The management team is charged with the responsibility for the application of the Safety and Environmental Plan and personnel training programmes must be undertaken to reflect these standards and ensure that the WPI's are correctly enforced.
S&E 4.1.2	**Job Descriptions** Before the appointments of the Management Team are confirmed the Job Descriptions must be completed. Within each of the Job Descriptions a restatement of the Safety and Environmental Aims and Objectives thus indicating the managerial principles. Each of the Job Descriptions must have a full description as follows; - Primary Aims and Goals - Managerial Plan Strategy - Safety and Environmental responsibilities - QA Auditing Function These functions are to be embodied in the following structures: - Management Focus - Training Programmes - WPI Audit function
S&E 4.1.3	**Environmental Impact** For any managerial plan that involves handling a hazardous chemical the plan must be cognizance of the risk to the environment. In order that the plans are entirely consistent with the risk an Environmental Impact Report must be generated that outlines the environmental risks and the results of this study are imprinted on the management plan. The environmental Impact Report for this specific project appears in the report section of WPI 4.1.

Item	Instruction Number	Procedural Instruction [Name] - Project Page 13
1	QA 4.1.1	It is the aim this Plan to put in place efficient, audited plans and programmes that ensure the discharge of all obligations under International law and in so doing, achieve the goal of no endangerment to the environment or people of any other country.
2	QA 4.1.2	**QA Standards** The Quality Assurance standard to which this project will be conducted will be ISO 14001. All the plans and QA documentation that accompanies this plan are designed with this standard in mind. The Management plan must therefore be designed to meet the following:
3	QA 4.1.3	**Management Responsibility** Establish the responsibility, authority and the interrelation of all personnel who manage, perform and verify work affecting quality and the discharge of contractual responsibilities. Verification resources shall be resourced and conducted and a management system established to implement and maintain the quality system.
4	QA 4.1.4	**Quality System** Establish and maintain a documented Quality System.
5	QA 4.1.5	**Contract Review** Establish and maintain procedures for contract review to ensure all requirements are adequately and clearly defined and that resources are available to meet those requirements.
6	QA 4.1.6	**Document Control** Establish and maintain procedures which ensure current issues of all documents critical to quality are available where and when needed, and that obsolete documents are promptly removed.
7	QA 4.1.7	**Purchasing** Ensure purchased products and services conform to specified requirements.,
8	QA 4.1.8	**Purchaser Supplied Product** Establish and maintain procedures for verification, storage and maintenance of purchaser supplied product provided for incorporation in supplies necessary for delivery of the service.
9	QU 4.1.9	**Product Identification and Traceability** Establish and maintain procedures for identifying and tracing individual products and services through all stages of the project.
10	QA 4.1.10	**Inspection and Testing** Implement a plan and quality procedures ensuring that all materials and equipment used in delivering the clearance service conform to the requirements, and that all services and goods provided conform to the client needs.

Item	Instruction Number	Procedural Instruction [Name] - Project Page 14
11	QA 4.1.11	**Corrective Action** Establish and maintain document procedures which investigate the cause of nonconforming service and initiates corrective action needed to prevent recurrence, analyse all processes and systems to eliminate potential causes of non conforming services and implement and record changes in p[Procedures resulting from corrective action.
12	QA 4.1.12	**Internal Quality Audits** Maintain and carry out a comprehensive system of planned and documented internal quality audits to verify whether all activities complied with procedures and to determine effectiveness of the quality system.
13	QA 4.1.13	**Training** Establish and maintain procedures for identifying the training needs and provide for the training of all individuals affecting quality. Establish the responsibility, authority and the interrelation of all personnel who manage, perform and verify work affecting quality and the discharge of contractual responsibilities. Verification resources shall be resourced and conducted and a management system established to implement and maintain the quality system.

Item	Audit Number	Quality System Audit Check Page 15	Non Compliance Report
1	QA 4.1-A	Question: Have the Job descriptions been prepared for each of the management team using the information contained in WPI 4.1.5?	
		Compliance Signature:	See Rpt 4.1-A
2	QA 4.1-B	Question: Do the managers understand the Goals and Objectives and are capable of discharging their responsibilities	
		Compliance Signature:	See Rpt 4.1-B
3	QA 4.1-C	Question : Do all managers understand the structure of the project plan and how that fits into achieving the goals and objectives.?	
		Compliance Signature:	See Rpt 4.1-C
4	QA 4.1-D	Question: Do all managers understand the level of activity that they are responsible for and the lines of communication.?	
		Compliance Signature:	See Rpt 4.2-D
5	QA 4.1-E	Question: Are all managers aware of the Flow chart requirements for each area of activity and have studied the relevant sections of the project plan?	
		Compliance Signature:	See Rpt 4.1-E
6	QA 4.1-F	Question: Are all managers experienced with hazardous waste management and have received recent training and briefing on this project?	
		Compliance Signature:	See Rpt 4.1-F

Rpt 4.1.1 **Environmental Impact Report**

In order that the management plans can be effective a clear understanding of the Environmental Impact of the hazardous substances involved is required. Waste Pesticides is a well understood waste type with regards to its impact on the environment and a less understood chemical with regards to its impact on human health. It is necessary however to assume that the effects on the human health are likely to be serious and therefore this attitude is taken by this Impact report.

Toxicology

Chemicals including pesticides are widely distributed in the environmnet. Therefore there are many possible sources of exposure to these chemicals for humans. Sustances which are ambient in indoor air may be inhaled while those in water or food may be ingested or inhaled. Direct contact with the chemical is the most prevalent way environmental chemicals can penetrate the skin, but exposure through the skin may also occur as a result of contact with chemical contaminants in air and water.

A single agrochemical can enter the body through all three routes of exposure, inhalation, ingestion and skin penetration. A pesticide can involve more thann one route of exposure if precautions are not taken.
A pesticide can be inhaled during use or repackaging, pentrate the skin during handling and be ingested in food if not washed off hands etc.

Once a agrochemical enters the body, it is often absorbed into the bloodstream and can move about the body. The amount of absorbed chemical and the rate of absortion depends on the chemical involved.

The possible toxic effects of exposure to a particular agrochemical depends on many factors. These include characterisation of the chemical and the individual exposed, the route of exposure, the total dose and the time course exposure.

Rpt 4.1.2 **Potential Environmental Impacts for this Project.**

During the course of the operational aspects of this project the potential for environmental impact therefore relates to the spillage or leakage of the waste.

A spill or leak in itself does not represent a high risk to nearby human populations, because direct contact by ingestion, through the skin or by breathing airborne material for a long period is required before the health hazard is likely. As the waste does not give off high levels of vapour at normal temperatures exposure to airborne vapours is substantially restricted to the site of the spill. In the case of direct skin contact, the required treatment consists of only a thorough washing and disposal of contaminated water.

Rpt 4.1.3 **Conclusion**

The impact on the environment of spilled pesticides chemicals is to be considered a high risk and risk to human health of spills to be moderate risk.
The Project plan must be constructed to assume the responsibility to protect the environment from the high risk of contamination.

Rpt 4.1-B

Daily Site Diary - [Name] Project

	Date:
	Supervisor:
Site Name:	**Contract #**
Employees on Site	
Function	**Name:**
Delays and Lost time eg. Access, weather, accidents, abseenteeism, Material Shortages.	
Variation, Day works, non conformances etc	
Planned Work	
Completed work/Progress: Work done, location, ahead/behind schedule.	
General remarks : details of meetings, correspondence etc:	
Sub Contractors on site:	
Equipment on Site:	
Supervisors signature	Date
Contract Managers Signature	Date

WPI 4.2 Site Inspection instructions

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 5
		Management Plan
1	S&E 4.1.1	**Strategy** The Management Team must understand that the principles of operation that are inherent in the WPI's emanate from work safety principles and environmental safeguards. Throughout these WPI's there will be detailed instructions relating to safety and emergency instructions. The management team is charged with the responsibility for the application of the Safety and Environmental Plan and personnel training programmes must be undertaken to reflect these standards and ensure that the WPI's are correctly enforced.
2	S&E 4.1.2	**Job Descriptions** Before the appointments of the Management Team are confirmed the Job Descriptions must be completed. Within each of the Job Descriptions a restatement of the Safety and Environmental Aims and Objectives thus indicating the managerial principles. Each of the Job Descriptions must have a full description as follows; - Primary Aims and Goals - Managerial Plan Strategy - Safety and Environmental responsibilities - QA Auditing Function These functions are to be embodied in the following structures: - Management Focus - Training Programmes - WPI Audit function
3	S&E 4.1.3	**Environmental Impact** For any managerial plan that involves handling a hazardous chemical the plan must be cognizance of the risk to the environment. In order that the plans are entirely consistent with the risk an Environmental Impact Report must be generated that outlines the environmental risks and the results of this study are imprinted on the management plan. The environmental Impact Report for this specific project appears in the report section of WPI 4.1.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 13
		Management Plan
1	QA 4.1.1	It is the aim this Plan to put in place efficient, audited plans and programmes that ensure the discharge of all obligations under International law and in so doing, achieve the goal of no endangerment to the environment or people of Mozambique or of any other country.
2	QA 4.1.2	**QA Standards** The Quality Assurance standard to which this project will be conducted will be ISO 14001. All the plans and QA documentation that accompanies this plan are designed with this standard in mind. The Management plan must therefore be designed to meet the following:
3	QA 4.1.3	**Management Responsibility** Establish the responsibility, authority and the interrelation of all personnel who manage, perform and verify work affecting quality and the discharge of contractual responsibilities. Verification resources shall be resourced and conducted and a management system established to implement and maintain the quality system.
4	QA 4.1.4	**Quality System** Establish and maintain a documented Quality System.
5	QA 4.1.5	**Contract Review** Establish and maintain procedures for contract review to ensure all requirements are adequately and clearly defined and that resources are available to meet those requirements.
6	QA 4.1.6	**Document Control** Establish and maintain procedures which ensure current issues of all documents critical to quality are available where and when needed, and that obsolete documents are promptly removed.
7	QA 4.1.7	**Purchasing** Ensure purchased products and services conform to specified requirements..
8	QA 4.1.8	**Purchaser Supplied Product.** Establish and maintain procedures for verification, storage and maintenance of purchaser supplied product provided for incorporation in supplies necessary for delivery of the service.
9	QU 4.1.9	**Product Identification and Traceability** Establish and maintain procedures for identifying and tracing individual products and services through all stages of the project.
10	QA 4.1.10	**Inspection and Testing** Implement a plan and quality procedures ensuring that all materials and equipment used in delivering the clearance service conform to the requirements, and that all services and goods provided conform to the client needs.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 19
		Management Plan
1	Rpt 4.1.1	**Environmental Impact Report** In order that the management plans can be effective a clear understanding of the Environmental Impact of the hazardous substances involved is required. Waste Pesticides is a well understood waste type with regards to its impact on the environment and a less understood chemical with regards to its impact on human health. It is necessary however to assume that the effects on the human health are likely to be serious and therefore this attitude is taken by this impact report. **Toxicology** Chemicals including pesticides are widely distributed in the environmnet. Therefore there are many possible sources of exposure to these chemicals for humans. Sustances which are ambient in indoor air may be inhaled while those in water or food may be ingested or inhaled. Direct contact with the chemical is the most prevalent way environmental chemicals can penetrate the skin, but exposure through the skin may also occur as a result of contact with chemical contaminants in air and water. A single agrochemical can enter the body through all three routes of exposure, inhalation, ingestion and skin penetration. A pesticide can involve more thann one route of exposure if precautions are not taken. A pesticide can be inhaled during use or repackaging, pentrate the skin during handling and be ingested in food if not washed off hands etc. Once a agrochemical enters the body, it is often absorbed into the bloodstream and can move about the body. The amount of absorbed chemical and the rate of absortion depends on the chemical involved. The possible toxic effects of exposure to a particular agrochemical depends on many factors. These include characterisation of the chemical and the individual exposed, the route of exposure, the total dose and the time course exposure.
2	Rpt 4.1.2	**Potential Environmental Impacts for this Project.** During the course of the operational aspects of this project the potential for environmental impact therefore relates to the spillage or leakage of the waste. A spill or leak in itself does not represent a high risk to nearby human populations, because direct contact by ingestion, through the skin or by breathing airborne material for a long period is required before the health hazard is likely. As the waste does not give off high levels of vapour at normal temperatures exposure to airborne vapours is substantially restricted to the site of the spill. In the case of direct skin contact, the required treatment consists of only a thorough washing and disposal of contaminated water.
3	Rpt 4.1.3	**Conclusion** The impact on the environment of spilled pesticides chemicals is to be considered a high risk and risk to human health of spills to be moderate risk. The Project plan must be constructed to assume the responsibility to protect the environment from the high risk of contamination.

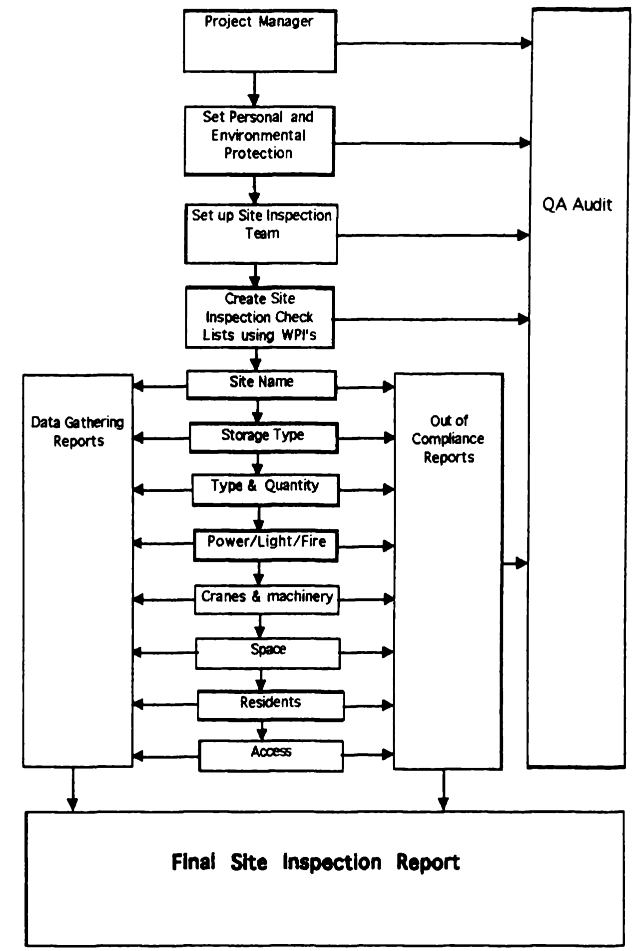
Item	Instruction Number	Procedural Instruction Mozambique - Project Page 20
		Management Plan
1	Rpt 4.1-B	**Daily Site Diary-Mozambique Project**

Site Name:	Date: Supervisor: Contract #
Employees on Site Function	Name:
Delays and Lost time eg. Access, weather, accidents, absenteeism, Material Shortages.	
Variation, Day works, non conformances etc	
Planned Work	
Completed work/Progress: Work done, location, ahead/behind schedule.	
General remarks : details of meetings, correspondence etc:	
Sub Contractors on site:	
Equipment on Site:	
Supervisors signature	Date
Contract Managers Signature	Date

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 1
		Site Inspection Plan
1	WPI 4.2.1	**Strategy Statement** Notwithstanding any previous Site Inspection prior to the formation of the Clearance Contract the Project Manager must perform a full site inspection and evaluation and present the findings in detailed Site Inspection Report. For this project in Mozambique the initial site inspection was performed by representatives from AVR International and Tredi NZ. The site report appears at the end of this section. These Work Procedure Instructions detail the activities that are required to complete the required information gathering and include a reporting structure to assist the output reports. The specific instructions for risk assessment factors are contained within the Safety & Environmental Section pages 5-8. **Elements of the Site Inspection Plan** **Site Name** Record the name and location of the site in the report section of the site **Storage Type** Investigate and record all the various types of storage. This item is where the site observations of the stored material is noted. The storage type factor that is assigned to the material is intended to indicate a risk factor associated with that type of storage. This information is required so that the clearance plan can be prioritized. (See assigning factors in pages 5-8) **Type and Quantity** The waste type and quantity are required to be investigated and recorded. **Dimensions** Details of the site dimensions as well as any storage facilities or units used are to be noted. Waste weight estimates and special requirements are to be noted.
2	WPI 4.2.2	**Lighting and Power** Investigate all power and lighting systems for safety of wiring and fire. Lighting levels should be measured to ascertain if they are adequate for the work areas from an operational and a safety point of view. Power supplies should be checked to ensure that sufficient capacity is available for the loads that will be imposed during the clearance. Details from this examination should be included in the Final Site Inspection Report.
3	WPI 4.2.3	**Cranes and other Machinery** Availability and capacity of available cranage and support machinery to be investigated and noted
4	WPI 4.2.4	**Space** A preliminary examination of the space available around the storage area is required to ensure that it will be possible to establish the necessary facilities to handle the works. If there is insufficient space then the Final report should indicate alternatives.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 2
		Site Inspection Plan
6	WPI 4.2.6	**Residents** The location and density of nearby accommodation should be examined and reported. There should be no attempt to contact residents at this stage, merely ascertain the proximity and density by casual observation.
7	WPI 4.2.7	**Access** Full survey of the existing road or street access to the site is required with the report highlighting any areas that will cause problems for emergency services and container trucks etc. Information required includes building access, accessibility for emergency services, evacuation routes, road condition. The details of this examination should be included within the Final Site Inspection Report.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 4
		Site Inspection Plan Flow Chart



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 7

Site Inspection Plan

1 S&E4 2 1 **Strategy Statement**

For the Project Plan to proceed smoothly the correct set of information must be collated and recorded by the Site Inspection plan and this activity must be regulated from the Safety & Environment viewpoint.

When planning to visit site for the first time after contract award it is necessary to obtain site information from the client as to the likely conditions on site. For your own personal safety the personnel attending the site inspection must plan to visit with a level of personal protection that will allow the project manager and other members of the team to attend site under most contaminated conditions.

For the protection of others and the protection of the environment the project manager must severely limit the numbers of extra people during the site inspection visits. All other members of the site inspection team must be provided with a minimum level of PP.

All other people required at the site but not in the contaminated area are to be restrained at a nominated barrier point.

When attending site for the initial project assessment the Project Manager must be in a position to act immediately if there are conditions that violate environmental waste laws or best practice regulations.

If there is a problem on the site then it must be dealt with. If the situation constitutes an emergency then the construction of the Site Inspection plan must be suspended and the emergency instructions are to be acted on immediately.

S&E Elements of the Site Inspection Plan

2 S&E 4.2 2 **Site name**

Establish the site name and location clearly and without confusion. Check with Fire service and other emergency services that the name is instantly recognizable. The name must be fully described in the Report and all plans and instructions must adhere to that site name.

3 S&E 4.2 3 **Storage Type**

The primary aim of the Site Inspection Plan is to ascertain the risk factors associated with the type of storage encountered at the site.

The various types of storage discovered at the site are to be assigned a Risk factor for safety and a risk factor for environmental protection.

The overall risk factors are then loaded into the Site Inspection Reports to be integrated into the site Clearance plan.

The risk factors that are associated with the storage types are as follows

Type 1 Storage
Pesticides Contaminated Materials, Solids dumped on open ground with no protection and major loss capacity

Risk factor Safety 10
Risk factor environment 10
Overall Risk factor 20

Type 2 Storage
Pesticides Contaminated Materials, Solids dumped on open ground with no protection and minor loss capacity

Risk factor Safety 8
Risk factor environment 9
Overall Risk factor 17

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 8

Site Inspection Plan

Type 3 Storage
Pesticides Contaminated Materials, Solids dumped on open ground with no protection and no loss capacity

Risk factor Safety 8
Risk factor environment 8
Overall Risk factor 16

Type 4 Storage
Warehouse with Pesticides Contaminated Materials, Solids and liquids that are incorrectly stored or contained and are leaking within structure and onto ground

Risk factor Safety 8
Risk factor environment 8
Overall Risk factor 16

Type 5 Storage
Warehouse with Pesticides Contaminated Materials, Solids and liquids that are incorrectly stored or contained and are leaking within structure but not onto ground

Risk factor Safety 8
Risk factor environment 8
Overall Risk factor 16

Type 6 Storage
Warehouse with Pesticides Contaminated Materials, Solids and liquids that are incorrectly stored or contained and would be a trteat to the environmnet if leaking occurred.

Risk factor Safety 7
Risk factor environment 7
Overall Risk factor 14

Type 7 Storage
Warehouse with Pesticides Contaminated Materials, Solids and liquids that are correctly stored or contained, tagged and registered and provided with full spill containment.

Risk factor Safety 3
Risk factor environment 4
Overall Risk factor 7

Type & Quantity

A for the storage type information is to be collected regarding the type and quantity. The various waste types and quantities must be graded as to risk factor. This information is also used in the clearance plan

Type and Quantity of Waste material

The type, nature, composition and the estimated quantity of the waste information is required for the Final site inspection report

Item	Audit Number	Procedural Instruction Mozambique - Project	Page 13
		Site Inspection Plan	Non Compliance Report
		Site name/Storage	
1	QA 4.2-A	Question: Is the name for the site clearly stated and includes sufficient information to accurately identify the site?	
		Compliance Signature :	See Rpt 4.2-A
2	QA 4.2-B	Question: Are all the site storage types listed in the schedule ?	
		Compliance Signature :	See Rpt 4.2-B
3	QA 4.2-C	Question : Are there any items in storage that are an immediate threat to the environment.?	
		Compliance Signature :	See Rpt 4.2-C
4	QA 4.2-D	Question : Are there any items on storage that are structurally unstable.?	
		Compliance Signature :	See Rpt 4.2-D
5	QA 4.2-E	Question : Are any of the items of storage that are leaking?	
		Compliance Signature:	See Rpt 4.2-E
6	QA 4.2-F	Question : Is there any free waste on storage surface?	
		Compliance Signature:	See Rpt 4.2-F
7	QA 4.2-G	Question : Are there any items that are an earthquake risk?	
		Compliance Signature :	See Rpt 4.2-G
8	QA 4.2-H	Question Is the storage area protected from the elements?	
		Compliance Signature :	See Rpt 4.2-H
9	QA 4.2-J	Question : Are there any items of building configurations that are a fire risk?	
		Compliance Signature :	See Rpt 4.2-J
10	QA 4.2-K	Question : Is there public access to the storage?	
		Compliance Signature :	See Rpt 4.2-K
11	QA 4.2-L	Question : Is the storage area lockable?	
		Compliance Signature	See Rpt 4.2-L
12	QA 4.2-M	Question : Is the Waste in storage correctly registered and tagged with identifiers?	
		Compliance Signature:	See Rpt 4.2-M
13	QA 4.2-N	Question : Are there any items in storage that should not be stored with waste?	
		Compliance Signature	See Rpt 4.2-N
14	QA 4.2-O	Question : Is there any aspect of the storage that should be immediately notified to theMozambique Govt?	
		Compliance Signature:	See Rpt 4.2-O
15	QA 4.2-P	**Type & Quantity** Question : Are all the Waste Types listed and quantities noted?	
		Compliance Signature :	See Rpt 4.2-P
16	QA 4.2-Q	Question : Are all risk assessment noted in the schedule:	
		Compliance Signature :	See Rpt 4.2-Q
17	QA 4.2-R	Question : Are there any items that cannot be handled safely with the standard waste handling techniques that will require a specialist approach?	
		Compliance Signature :	See Rpt 4.2-R

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 14
		Site Inspection Plan	Non Compliance Report
		Goals/Objectives	
18	QA 4.2-S	Question : In reviewing the Goals and objectives of the project are there any aspects of the site, storage, type, and quantities that are not in strict accordance with achieving the Goals and Objectives?	
		Compliance Signature	See Rpt 4.2-S
19	QA 4.2-T	**Power/Lighting and Fire Protection** Question : Is the site provided with sufficient power and lighting for efficient project execution?	
		Compliance Signature :	See Rpt 4.2-T
20	QA 4.2-U	Question : Are the site electrical services safe and of a good standard?	
		Compliance Signature:	See Rpt 4.2-U
21	QA 4.2-V	Question : Is there sufficient fire protection equipment for the fighting of substantial fires for 30 minutes before the fire service arrives?	
		Compliance Signature :	See Rpt 4.2-V
22	QA 4.2-W	**Cranes and Machinery** Question : Does the site have sufficient cranes and hoists in working order	
		Compliance Signature :	See Rpt 4.2-W
23	QA 4.2-X	**Space** Question : Is there sufficient room within the storage area to layout the packaging system?	
		Compliance Signature :	See Rpt 4.2-X
24	QA 4.2-Y	Question : Is there sufficient appropriate space for the location of the decontamination and amenities facilities?	
		Compliance Signature :	See Rpt 4.2-Y
25	QA 4.2-Z	Question : Is there sufficient space to locate the Fire service command vehicle and other emergency services during an emergency.	
		Compliance Signature :	See Rpt 4.2-Z
26	QA 4.2-AA	Question: Can the working areas be completely defended against the intrusion of public and unauthorised access?	
		Compliance Signature :	See Rpt 4.2-AA
27	QA 4.2-AB	Question : Can the working areas be defended against burglars and arsonists or environmental activists?	
		Compliance Signature :	See Rpt 4.2-AB
28	QA 4.2-AC	**Residents** Question: Are there nearby residential accommodations?	
		Compliance Signature :	See Rpt 4.2-AC
29	QA 4.2-AD	Question : Are these accommodations at risk of fire in storage items?	
		Compliance Signature :	See Rpt 4.2-AD
30	QA 4.2-AE	Question : With the proximity of residential accommodations are the Aims and goals of the project compromised?	
		Compliance Signature:	See Rpt 4.2-AE

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 15
		Site Inspection Plan	**Non Compliance Report**
31	QA 4.2-AF	Question :Are the nearby residents appraised of evacuation criteria if fire breaks out in the storage area?	
		Compliance Signature :	See Rpt 4.2-AF
		Access	
32	QA 4.2-AG	Question : Are the roads and streets up to the storage area adequate for the planned activity?	
		Compliance Signature :	See Rpt 4.2-AG
33	QA 4.2-AH	Question : Will there be easy access to the storage area for all emergency vehicles?	
		Compliance Signature:	See Rpt 4.2-AH
34	QA 4.2-AI	Question : Are the roads and streets adequate for a full scale evacuation should it be required?	
		Compliance Signature :	See Rpt 4.2-AI
35	QA 4.2-AJ	Question : Is the report schedule for the waste completed completed?	
		Compliance Signature	See Rpt 4.2-AJ
		Hazards	
36	QA 4.2-AK	Question: Are there any overhead transmission lines or power cables above the Storage site that will impede loading operations?	
		Compliance Signature:	See Rpt 4.2-AK

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 19

Site Inspection Data Report

Site Name:

Storage Type

Put Proportion Decimal here

Type 1 Storage [ ] x Risk Factor [20] = This Project [ ]
Type 2 Storage [ ] x Risk Factor [17] = This Project [ ]
Type 3 Storage [ ] x Risk Factor [17] = This Project [ ]

Type

Put Proportion Decimal here

Type 1 Type [ ] x Risk Factor [ ] = This Project [ ]

Quantity

Put Qty here in tonnes

Type 1 Quantity [1000] x Risk Factor [ ] = This Project [ ]

Storage Total (Sum Subtotals) Risk factor =
Type Total (Sum Subtotals) Risk factor =
Quantity Total (Sum Subtotals) /500 =

Waste Quantities

Storage containers

Storage Drums

Item	Report Number	Procedural Instruction Mozambique - Project Page 20
		Site Inspection Non Compliance Report
1	Rpt 4.2-A	Establish name and include sufficient detail to clearly identify site. It is not enough to simply call the site "Number Five". The site name must include an area name that is instantly recognised by all associated with the project as well as the emergency services. During the establishment of the site name a check with the local fire service should be made in order to see if the site name that is intended to be used is adequate for their purposes.
2	Rpt 4.2-B	Audit check the site until the total schedule is completed and that all individual items are clearly identified and accounted for on the schedule. The total number of items should be counted as a total and this total should be made up of subtotals of individual storage types.
3	Rpt 4.2-C	If during the site inspection some or all of the waste stored are an immediate threat to the environment, then the site inspection process is to be immediately suspended and the emergency plan put into operation. This means that WPI 4.9 Emergency Instruction is drawn up, the emergency vehicle called out and the clean-up operation put in motion. During the formulation of WPI 4.9 the entire site is checked for other items that are an immediate threat to the environment.
4	Rpt 4.2-D	Make immediate arrangements to have the stacked storage items restacked so that the stacked structure is no longer unstable. This can be achieved by the use of WPI 4.3.
5	Rpt 4.2-E	Same action as for Rpt 4.2-C
6	Rpt 4.2-F	Same action as for Rpt 4.2-C
7	Rpt 4.2-G	Isolate those items at risk from the surrounding equipment and stabilise against earthquake. This activity should receive priority in the Clearance Plan.
8	Rpt 4.2-H	Urgent action is required to provide protection even if this has to be temporary cover. This activity should receive urgent priority in the clearance plan.
9	Rpt 4.2-J	Either the waste material must be urgently removed to a safe location or the building configuration changed. This is an urgent activity in the Clearance plan.
10	Rpt 4.2-K	Urgent steps are to be taken to prevent further public access. This may mean the immediate installation of a security fence or security guard until more permanent arrangements are made.
11	Rpt 4.2-L	Immediate arrangements to be made to secure storage area.
12	Rpt 4.2-M	Review the methodology that was used to store the material in the first place and see if a suitable system is available that can be extended to this project. If this is not feasible and the client is unable to advise the system used then the clearance plan will need to establish a tagging system and method of recording as depicted in the Clearance Plans.
13	Rpt 4.2-N	make immediate arrangements to remove these items. If there is any machinery or vehicles or other equipment that is not contaminated then they must be removed immediately.
14	Rpt 4.2-O	Issue a report and immediately notify the EPA citing the non compliance. This must not be neglected.
15	Rpt 4.2-P	Proceed to complete the entire register of waste types and quantities. The clearance plan cannot be completed without the completion of this register. If a client generated register has been supplied then its contents must be site audited for accuracy.
16	Rpt 4.2-Q	Provide all risk assessment information so that the risk assessment factors can be noted.
17	Rpt 4.2-R	Issue report " Special Handling Requirement" as per the instructions WPI 4.3
18	Rpt 4.2-S	Issue Report "Primary Aim Non Compliance as per Final Reports.
19	Rpt 4.2-T	Issue Specification for additional Lighting and Power.
20	Rpt 4.2-U	Issue Specification for additional work
21	Rpt 4.2-V	Issue Report "Fire Fighting Resources" as per Final Report
22	Rpt 4.2-W	Issue Report "Lifts & Hoists" as per Final Report
23	Rpt 4.2-X	Issue Report "Spatial Requirements Non Compliance" as per Final report
24	Rpt 4.2-Y	Issue Report "Spatial Requirements Non Compliance" as per Final Report
25	Rpt 4.2-Z	Issue Report "Spatial Requirements Non Compliance" as per Final Report
26	Rpt 4.2-AA	Issue Report "Unauthorized Access non-compliance" as per Final Report
27	Rpt 4.2-AB	Issue Report "Unauthorized Access non-compliance" as per Final Report
28	Rpt 4.2-AC	Produce Sketch showing proximity of residential accommodations for Clearance Plan.
29	Rpt 4.2-AD	Issue Report "Fire Risks" as per Final Report
30	Rpt 4.2-AE	Issue Report " Primary Aims and Goals non-compliance"
31	Rpt 4.2-AF	Provide to client for distribution to residents the Fire evacuation instructions.
32	Rpt 4.2-AG	Issue Report " Access Roads" as per Final Report
33	Rpt 4.2-AH	Issue Report "Storage Area Access for Emergency Vehicles" and in addition visit with the emergency authorities to ascertain options.
34	Rpt 4.2-AI	Issue Report "Evacuation Difficulties" as per Final Report.
35	Rpt 4.2-AJ	Examine the storage and count the waste capacitors and transformers. If the storage is such that it is impossible to count the material then calculate the nearest estimates.
36	Rpt 4.2-AK	Detail the hazard and report on method to avoid the problem. If serious then detail approach to adapt the packing process another way.

Item		Procedural Instruction Mozambique - Project Page 21

Site Inspection Final Report

"Use the format here to produce the Final Site Inspection Report"

FINAL REPORT FORMAT

Introduction

This report for [ ] storage is the result of the application of the Site Inspection Plan and covers aspects of storage type, Waste type and quantity. Information provided by the Final Site Inspection report is to be used within the Site Clearance and preparations plans.

Site Inspection Data

Site Name

The confirmed site name that has been verified by the emergency services, the client and is [ ].

Storage Types

The types of storage that are present at the named site are as per the following list.

Waste Types

The waste type is constant throughout the site quantity;

Waste Quantity

The quantities of Stored waste that are present at the named site are included in the following list.

Light, Power and Fire Fighting Equipment

There are minimum power available and no lighting. There are no fire fighting facilities available onsite

Lifts and Hoists

Space

Residents

Access

Waste Material

WPI 4.3 Clearance instructions

Item		Procedural Instruction Mozambique - Project Page 22
		Site Inspection Final Report Format FINAL REPORT FORMAT Continued. Non Compliance Reports Special Handling Requirement (Rpt 4.2-R) Primary Aim and Goals Non Compliance (Rpt 4.2-S,AE) Fire Fighting Resources (Rpt 4.2-V) Lifts and Hoists (Rpt 4.2-W) Spatial Requirements (Rpt 4.2-X,Y,Z) Unauthorized Access Non Compliance (Rpt 4.2-AA,AB) Fire Risks (Rpt 4.2-AD)

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 1

Clearance Plan

1 WPI 4.3.1

Strategy Statement

The clearance Plan is an output of the site inspection plan. When all the observations and calculations and risk factors are formulated within the Final Site Inspection Report then the Clearance Plan can be written. The Clearance Plan sets down the prioritized clearance schedule based on risk factors. The Clearance plan also, by virtue of the prioritized schedule, sets up the relevant parts of the Site Preparation Plan. This activity then allows the allocation and location of the Project resources to be applied in a manner that addresses the identified risk factors.

Elements of the Clearance Plan

Storage clearance priority schedule

Within the final site inspection report there is a completed schedule of the observed storage area types. These listed Types are numbered 1-10. Under the stated policy of minimization of risk those storage types that have the highest risk factors are to be cleared first. If there an outside influence that requires a different order to that of risk minimization then a non compliance report is to be completed.

The order of clearance is therefore to be based on the following order and those storage types that appear in the Site Inspection Plan are to appear in the order shown in the Clearance Plan Final report.

Prioritized order of Storage Clearance

Within each storage type there are further risk considerations. These considerations include waste Type and quantity. In order that the policy of risk minimization is fully carried out the Clearance plan must indicate the correct clearance priorities for waste Type and quantity. The Site Inspection Final report reports on the various types and quantities. The priority schedule for these types and quantities is as follows:

When the details of the Site Inspection Plan are known then the prioritized clearance schedule can be completed within the Clearance Final report.

Time table

Details of the expected clearance of the site are required. Note in the report the start date and the end date for clearance of all waste for this [site name].

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 3

Clearance Plan

2 WPI 4.3.2

Location of Services and amenities

The Clearance Plan includes final details of the locations of the various services and amenities. careful planning is required to correctly locate these services and facilities so that the worker safety and site protection is guaranteed. As part of the Site Inspection plan a site drawing indicating the various boundary restraints and limitations is to be produced. This drawing shall under the Clearance Plan be annotated with the allocations of the positions of the various services and facilities.
The type and disposition of these services and facilities is described below and their characteristics are to be taken into account when deciding where to place them on the site drawing.

The various locations and positions that require positional decisions within the Clearance Plan are as follows.
Location of Decontamination Facility
Location of Staff amenities
Location of Emergency vehicle
Location of Packaging Area
Location of Dispatch area
Overall Defence zone

Location of Decontamination Facility
The location of this facility within the site drawing must take into consideration the access to the work areas. The positioning of this facility must impede normal site access so that all workers and site visitors are required to pass through this facility. Consideration shall also be given to ensure that if the site is required to be attended by emergency services that their access is not impeded by the Decontamination facility.
This facility is to be sited so that any personnel entering the warehouse or storage area must enter the unit and any personnel leaving the work area must exit from the facility. It must not be positioned to one side of the entry to the work site, it must be in line. There must be a method however that allows the unit to be by-passed in the event that rapid entry is required by emergency services.

Location of Staff amenities
This unit must be located outside of the work area beyond the decontamination facility. The positioning of this unit must not impede access to the work site and it must be installed at a reasonable distance away from the work site. There must be no positioning of the amenities unit that would facilitate the avoidance of the decontamination unit.

Location of Emergency vehicle
The emergency vehicle shall be located outside of the working area and shall be accessible without passing through the decontamination facility.

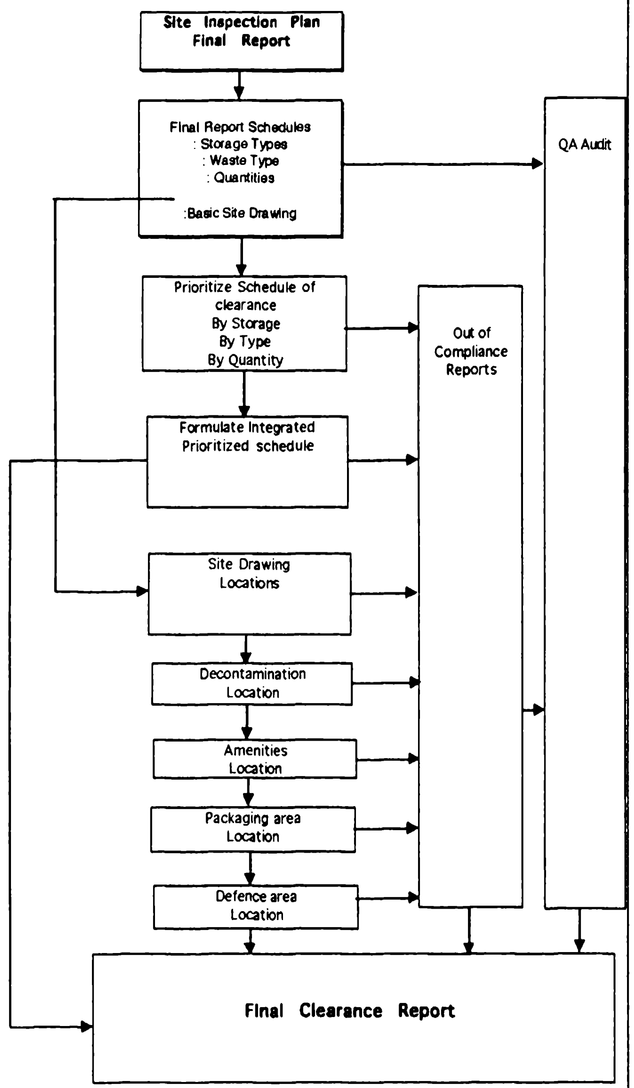
Location of the Packaging area.
This area should be located as close to the work area as possible.

The packaging area is to be clearly shown on the site drawing. The location should clearly indicate the position of all the equipment, tools and storage items as well as forklift movement plan and shipping container positions. The overall bunding protection should also be shown as it interlocks with the movement plan.

Location of Dispatch Area
This area is to be accessible by members of the public. (Truck drivers and the like). This area must be completely separate from the packing areas. The location of the container dispatch and how the separation is to be achieved is to be shown.

Overall defense zone
If the warehouse or storage site is not already provided with a fenced boundary then the site drawing must indicate the site fence requirements and the Final Clearance report includes a section to be completed regarding the site fencing.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 4
		Clearance Plan Flow Chart



Item	Instruction Number	Procedural Instruction Mozambique - Project Page 7
		Clearance Plan
1	S&E 4 3 1	**Strategy Statement**

Strategy Statement

In order to discharge the Safety requirements and provide full environmental protection and to maintain the policy of risk minimization the Clearance plan must be prioritized. This means that the Clearance Plan must constructed so that the warehouse or storage areas must be cleared by degree of danger. The higher the danger the higher up the priority list the clearance and the earlier the clearance. The integration of the clearance schedule as contained within the Final report of the clearance plan is designed to adhere to this policy.

Elements of the Clearance Safety and Environmental Plan

Storage and type prioritization

In order to clear the site in a safe and orderly manner plus maintain management focus of safety and environmental protection the clearance plan must be prioritized according to the risk factor.
The clearance priority is determined by the site inspection plan and the clearance safety and environment plan simply follows the schedule.

Waste packing Prioritization

In general, wastes will be packed in the following order (where items exist)

Waste material exposed to environment where there is no protection
Waste material exposed to environment but with protection
Waste drummed but exposed to the open
waste material contained protected and not in the open.
In addition, soft materials (overall, clothes, wipes etc.) will be packaged as used.

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 13
		Clearance Plan	**Non Compliance Report**
		Warehouse or Storage facility Clearance Priority	
1	QA 4.3-A	Question: Are all the types of storage correctly indicated on the schedules from WPI 4.2 ?	
		Compliance Signature	See Rpt 4.3-A
		Type and Quantity clearance priority schedule	
2	QA 4.3-B	Question : Are all the Waste types and quantities entered into the schedules from WPI 4.2 ?	
		Compliance Signature	See Rpt 4.3-B
		Position allocations	
3	QA 4.3-C	Question: Within the Final Report for the Site Inspection plan is there a site drawing?	
		Compliance Signature	See Rpt 4.3-C
4	QA 4.3-D	Question: Are the locations of the Decontamination and amenities units drawn up on the site plan?	
		Compliance Signature	See Rpt 4.3-D
5	QA 4.3-E	Question: Is the location of the Emergency vehicle indicated on the site drawing?	
		Compliance Signature	See Rpt 4.3-E
6	QA 4.3-F	Question: Are the locations of the Packaging areas indicated on the site drawing?	
		Compliance Signature	See Rpt 4.3-F
7	QA 4.3-G	Question: Is the location of the dispatch area shown on the site drawing?	
		Compliance Signature	See Rpt 4.3-G
8	QA 4.3-H	Question: Is the location of the defence zone indicated on the site drawing?	
		Compliance Signature	See Rpt 4.3-H
9	QA 4.3-I	Question : Are the details of clearance start date and end date noted?	
		Compliance signature	See Rpt 4.3-I

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 20
		Clearance Non Compliance Report
1	Rpt 4.3-A	Complete the schedule as required under the WPI 4.2 filling out the entire details as to storage types
2	Rpt 4.3-B	Complete the Schedule as required under WI 4.2 filling out the entire details as to Waste types and quantities.
3	Rpt 4.3-C	Complete the site drawing as required by WPI 4.2
4	Rpt 4.3-D	Complete the drawing of the site and display as a separate drawing showing the location of the decontamination and amenities units and indicating the flow of personnel.
5	Rpt 4.3-E	Complete the site drawing showing the location of the emergency vehicle.
6	Rpt 4.3-F	Complete the drawing of the site showing the location of the decanting/packaging areas.
7	Rpt 4.3-G	Complete the site drawing showing the location of the dispatch area with movement indications.
8	Rpt 4.3-H	Complete the site drawing showing the location of the defence area.
9	Rpt 4.3-I	Complete the schedule of start and end dates

FINAL REPORT FORMAT

Introduction

This report for [ ] Waste storage facility is the result of the application of the Clearance Plan and covers aspects of waste Clearance prioritizing by storage type, Waste type and quantity. Information provided for within this report and the conclusions are to be used for the Site Preparation plan.

Clearance Data

Storage Type priority

The types of storage that exist at the [Site name] are listed in order of priority in descending danger.

Waste Type Priority

The types of waste that exist at the [Site name] are listed in order of priority in descending danger

Waste Quantity priority

The quantities of Waste that exist at the [site name] are listed in order of priority in descending danger

Integrated Clearance priority

In considering the above individual priority allocation to the three categories above the final recommendation as to prioritized clearance is as per the following list in order of clearance.

Time table

Clearance dates required include:

Start date ....

Clearance of waste by date...............................

Decontamination of site date...........................

Site finished date..

FINAL REPORT FORMAT Continued.

Insufficient Data from Site Inspection Plan (Rpt 4.3-A-C)

Primary Aims and Goals Non Compliance

Unacceptable Locations (Rpt D-H)

Conclusions

At the [site name] there are the following storage types, waste types and quantities that have scheduled as follows in accordance with the required safety and environmental standards
This schedule indicates the exact method of clearance that is to be undertaken
to minimize the risk and maximize the protection.

The locations of the decontamination and amenities as well as the decanting/packaging area and defence zones is shown on the attached site drawings and these indicate that the works can proceed.

Non Compliance Reports are summarized as follows:

The overall conclusion of the Clearance report is that the works may proceed with the following criteria:

Full zone protection required.

Information for the Site Preparation Plans

"Include the QA check schedules, Clearance Data Reports, Non Compliance reports and any other matters that will require attention from within the Site Preparation plan."

Appendices

"Appendices to the final report should include the following"

Clearance Data reports, Site drawings

WORK PROCEDURE INSTRUCTIONS

WPI 4.4 Site Preparation Instructions

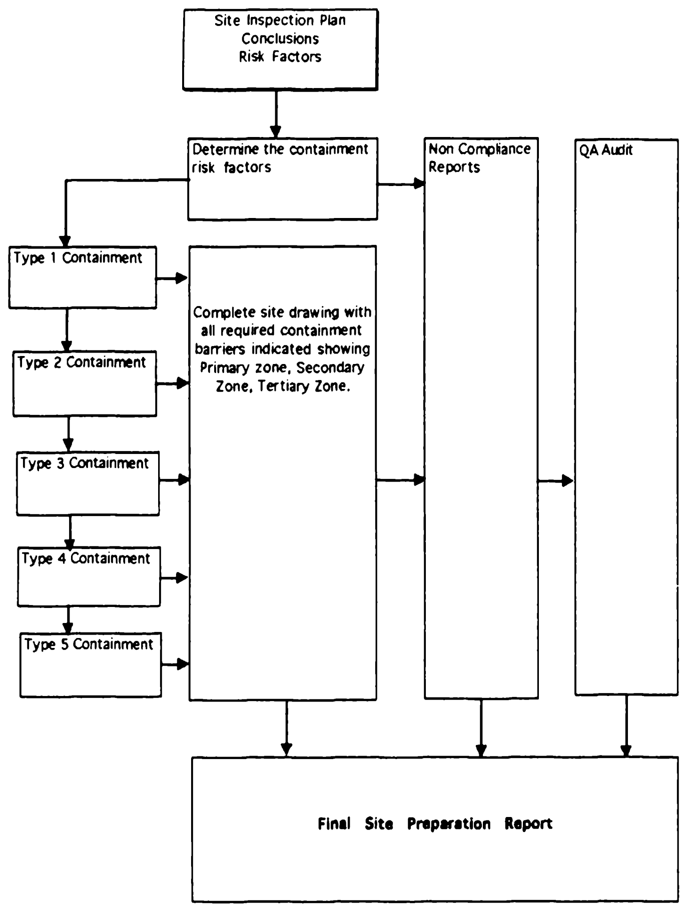
Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 1
		Site Preparation Plan	
1	WPI 4 4	**Strategy Statement** The Site Preparation Plan is concerned with the detail of site preparation. The sequence of events planned for each site is a direct result of the risk factor assessment and is a product of the Strategy of Minimisation of Risk policy that is inherent in the Aims and Goals of this plan. The Site preparation Plan is the means by which the Clearance plan is implemented. **Elements of the Site Preparation Plan** **Site Preparation** Each storage area will have been prioritised as a result of the Clearance Plan. In addition the Clearance Plan would have provided details of the location of the Decontamination and amenities units. The Site preparation plan deals with the specific organizational elements that are required for the various sites. The site drawings and sketches now need to be properly drawn up with the various areas indicated. This drawing must show the following work areas. - Primary Zone unloading/Breakdown area - Primary Zone packaging area - Secondary Zone Transit storage area - Secondary Zone Transit consolidation area - Tertiary Zone containerization area Each site will require some or all of these areas. The actual requirement will depend on the Clearance plan conclusions. The locations of services and facilities must also be shown on these drawings, namely, - Location of Defence Zone - Location of Decontamination Unit - Location of Amenities unit - Location of emergency vehicle - Location of Public Zone - Location of all emergency materials - Location of all First Aid equipment - Location of all fire fighting equipment - Location of WPI notice board When all these facilities and services are fully annotated and defined within the working site drawings then construction of the barriers can proceed. **Visitors** During the clearance of the Waste material there will be may be some visitors wanting to inspect the operation. Visitors must be controlled. The work area, which may be potentially contaminated, must be clearly defined e.g. with a barrier of flags, plastic tape, etc. and entry restricted to only those who are correctly attired. Those inspecting the work must wear disposable overalls, disposable boot covers, half face respirators fitted with OV/AG/Particulated filters and safety glasses THERE ARE TO BE NO EXCEPTIONS TO THESE PROTECTION REQUIREMENTS REGARDING VISITORS After inspecting the works visitors must pass through the decontamination unit to remove the overalls and boot covers. The site supervisor is to ensure that visitor respirators and glasses are kept clean and the filters changed weekly No visitors are permitted onto the site unless they are authorised by the client project engineer and the project manager	

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 2
		Site Preparation Plan	
		Containment Barriers and spill protection All areas of operation during the clearance of pesticide waste from the site require environmental protection. That is to say all areas must have some form of physical protection to prevent the waste from entering the environment. This normally takes the form of bunding (temporary or permanent) or surface preparation. The type and level of the bunding protection relies on the operations expected within the secure area and the level of risk involved. The following containment barrier structural requirements are designed to be applied against the total risk factor that the Site inspection plan and the clearance plan derives from the addition of the three factors of Storage, type and quantity. **Type 1 Containment - Risk factor = (55-60)** **Three protected areas will be required as follows:** **Primary Zone** Full PPE is required in this zone **Secondary Zone** **Tertiary Zone** This zone has the amenities and decontamination units as per the layout drawing. No PPE is required apart from the in the dirty area of the decontamination unit. **Equipment required** Emergency shower Fire fighting equipment (5 x 5Kg) First aid equipment decontamination container Amenities unit Office unit Air-conditioning plant	

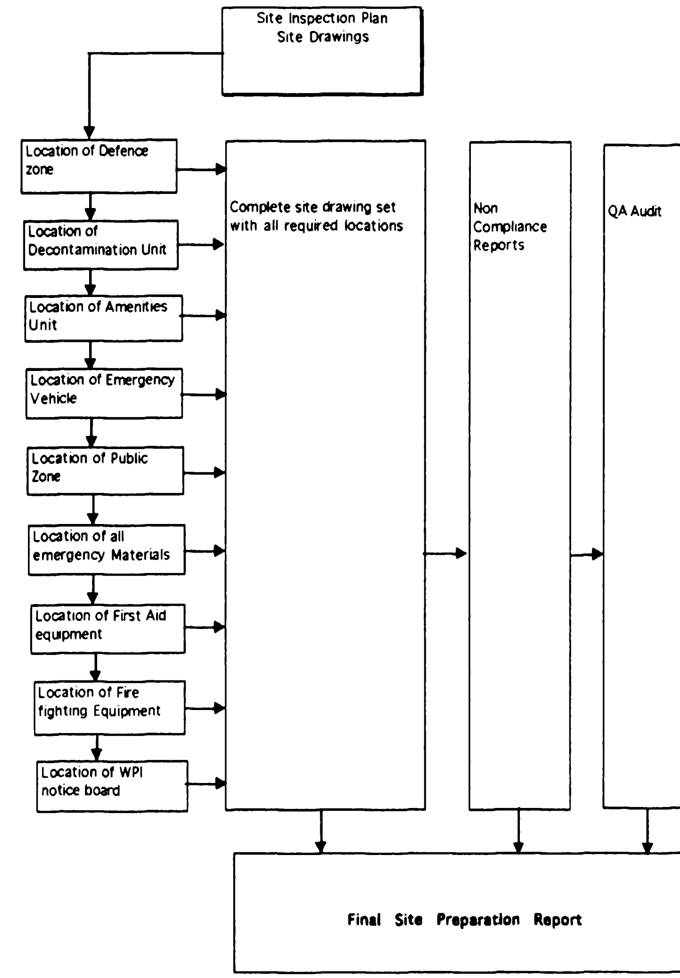
Item	Instruction Number	Procedural Instruction Mozambique - Project Page 3
		Site Preparation Plan
3	WPI 4.4-3	**Location of the Decontamination and Amenities units** Provisional location of these units should have been provided during the site inspection stage and after the drawings have been updated to show the level of bunding required they are further annotated with the locations of the decontamination facility and the amenities units. The decontamination unit must be designed with "Dirty" and "Clean" sections separated by shower facilities. Clean clothes and towels are located in the "Clean" End of the unit, and at the start of each period of work, personnel will go through the procedure as shown on the flow sheet. In the normal course of events, the protective clothing and equipment should ensure that personnel do not become contaminated. Therefore waste water will be collected, drummed and disposed of along with the other waste. The amenities unit is considered a "clean" area and is therefore to be located on the "clean" side of the decontamination unit. Under no circumstances is this unit to be located in the "Dirty" area or work areas. The amenities unit is to consist of lunch room facilities and is to be used by personnel during breaks only after going through the decontamination procedures as shown on the flow chart.
4	WPI 4.4.4	**Work Areas** After the correct zones have been allocated it is necessary to plan and develop the working activity in each zone. Within the Primary, secondary and tertiary zones various work activities are to take place. As a normal rule of thumb the various work activities that are assigned to each zone should not be undertaken in another zone. It is possible to elevate a work activity up the scale of zone primacy but not downwards. In detail the work activities that are to be assigned per zone are as follows: **Primary Zone** **Secondary Zone** Unloading and loading of full and empty containers. Stacker operation. **Tertiary Zone** Visitors access to this area only and personnel. Amenities and decontamination unit as well as the ERU are located in this area. Office, telephones fax etc as well as computer records etc.
5	WPI 4.4.5	**Working Area equipment Requirements.** In general equipment is assigned per working zone and this equipment should not travel between zones. This equipment should stay there for the duration of the project. Pumps, hoses, spanners and all tools should have a specific place of occupation within the bund and when not in use are to be located in that place. Emergency spill containment materials are to be located outside the primary zone but within easy reach. The emergency shower, fire fighting equipment and first aid equipment is also to be installed immediately adjacent to the primary zone.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 4
		Site Preparation Plan
6	WPI 4.4.6	**Defence Areas** A defence line should be drawn around both the primary and secondary zones. Generally the tertiary zone does not allow access to authorised personnel such as container truck drivers who are not required to dress in the personnel protection equipment. Such people are not permitted to enter the secondary or primary zones. For major operations the defence line should be a security type fence, for temporary operations then a plastic warning tape can be used.
7	WPI 4.4.7	**Emergency access** The defence system shall be so designed that in the event of a full scale emergency the emergency services can have full access to the working platforms without having to go through the defence lines. In other words the defence line must be able to be readily removable by emergency services. During such emergencies that are attended by the fire service a position for a command vehicle both upwind and down wind must be provided.
8	WPI 4.4.8	**Fire protection** The worst case scenario involves a fire in the facility. If the fire is collateral then it can be fought using conventional techniques. If the fire however involves the waste itself then it can only be fought using fullbody chemical suits with integral breathing apparatus. The fire must be fought with dry agent and must be fought aggressively with short rosters arranged for those at the front. Full body showers and full chemical decontamination kits will be required. If the local fire service does not have this equipment then it must be provided by the Project manager.
9	WPI 4.4.9	**Intruder alarms**
10	WPI 4.4.10	**Telephone and Fax** Secure telephone and fax service is required. No site activity is to commence unless the telephone service is connected and available.
11	WPI 4.4.11	**Records** A complete record system is required for each site and the format of this will depend on the client needs. The system should be computer based with off site disc holdings etc. All the daily records, QA schedules should be recorded in a hard copy format as well as on the site computer. If it is not possible to have a computer on site then the forms shown in this WPI are to be adhered to.
12	WPI 4.4.12	**Emergency Response vehicle** For all waste projects exceeding 200 Tonnes of waste a comprehensively equipped emergency vehicle must be maintained for the duration of the project. This vehicle attends all spills and doubles as the escort vehicle during transshipment of containers or transit bins within the country of the project. The vehicle also attends the final transfer to the ship loading company. details of this vehicle are contained in WPI 4.9.

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 6
13	WPI 4 4 13	Site Preparation Plan Flow Chart 1	



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 7
14	WPI 4 4 14	Site Preparation Plan Flow Chart 2	



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 8

Site Preparation Plan

1 S&E 4.4.1 **Strategy Statement**

During the process of setting up the site ready for packing operations, particular attention must be paid to Safety and environmental issues. During the design of the various structures required on the site the Project Manager and site supervisor must take into account the reality of each site and the ramifications of the work procedures and the waste types involved. Site preparation in addition to the work platform structures must include training of staff, personal occupational hygiene and safe working practices.

These WPI's include below details and instructions to ensure that the site preparation includes those necessary elements for the Safety and Environmental Plan are carried out.

Elements of the Site Preparation Safety and Environmental Plan

Personnel Safety Procedures & Occupational Hygiene Principles

All staff working on the site are to be trained in and adhere to the following procedures.

Pesticides waste enters the body by inhalation of vapours or dust , by absorption through the skin or by ingesting through eating or smoking with contaminated hands and transferring to the mouth.
To protect staff the project manager and the site supervisor must adopt and carefully control the following.

Have a controlled area where wastes are handled. Sign and restrict access. This relates to the definition of the containment zones. These must be policed rigidly.

- Wear full body protective work clothing. The project Manager and site supervisor is responsible for assuring that all workers in the waste zone are correctly attired. There are to be no exceptions. If any staff members do not adhere to this ruling they must be removed from the site

-Wash thoroughly immediately after exposure to HgS and on exiting from the work area. This includes for all daily breaks.

- The project manager and the site supervisor are responsible for the training of all staff in the operational hazards, correct use of the PPE and correct work practices and the application of the WPI's and the QA standards therein.

-The site supervisor and the staff are responsible for ensuring that the HsG is always kept contained and safe.

- All staff are responsible in applying good working practices.

GOOD WORKING PRACTICES ARE DEFINED AS FOLLOWS

* Workers whose clothing has been contaminated by waste should change into clean clothing promptly.

* Workers must not take contaminated work clothes home.

* If there is any possibility of skin exposure, emergency shower facilities should be provided and used.

* On skin contact with waste immediately wash (using Soap) or shower to removes the chemical. At the end of the worksift, wash any areas of the body that may have contacted waste, whether or not known skin contact has occurred.

* Do not eat, smoke or drink where waste is handled, processed, or stored, ad always wash hands before eating and smoking.

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 9

Site Preparation Plan

2 S&E 4.4.2 **Medical testing**

All potential workers must be prepared for the site not only in the work practices but also all must have a medical examination and testing before they can be admitted to the site.

Such medical examination and testing must include the following.

* An examination to ensure the fitness of the person to undertake heavy lifting work while attired in chemical suits and perhaps under extreme heat conditions. It is essential that the medical examiner determine the workers state oh health to ensure that the planned work activity will not aggravate a pre-existing condition.
The examination must include:

* Physical Examination
* Chest X-ray
* Blood Pressure
* Urine Sugar and protein
* White blood cell count
* Haemoglobin count
* Blood ALT or SGPT and Cretine

In addition the following tests are to undertaken:

* Liver Function Tests
* Serium triglycerides level
* skin examination
* Lung function test

Complete records of all these tests are to be kept by the Project manager and if the project extends past 12 months then the tests are to be repeated.

THESE TESTS ARE TO BE PERFORMED ON ALL PERSONNEL EXPECTED TO WORK ON THE SITE BEFORE WORK COMMENCES ON THE SITE PREPARATION

3 **Personal Protective Equipment (PPE)**

In addition to the good working practices described above it is necessary for workers to use personal protective equipment (PPE). During the site preparation all this equipment should be sourced.

Gloves
These should be a quality similar to Edmont Solex(Nitrile) and are to be worn during all work activity in the Primary and secondary zones. The gloves should be worn outside of the overall sleeves. If there is a tendency for the glove and sleeve then use masking tape to hold them together.
Gloves should be removed carefully to avoid contamination of the unprotected hand. Gloves are to be disposed of daily at the end of the workshift therefore qualities are required to be calculated during the site preparation process.

Overalls
TYVEK overalls are the primary means of skin protection.
Type 55427 overalls are to be used
The overalls are to be disposed of if they become damaged or contaminated during the workshift and at the end of each day. Overalls must not be used for more than one full day.

Undergarments
It is recommended that the workers wear light undergarments under the overalls for comfort.

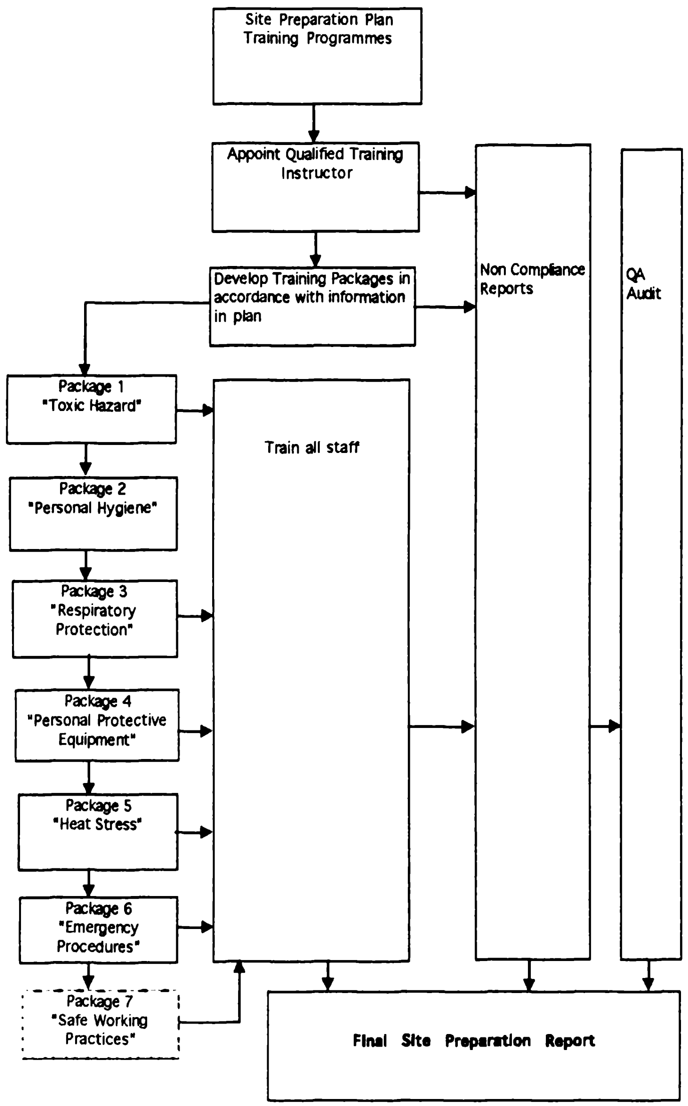
Respirators
The task being undertaken and the likely hazard determine the type of respiratory system equipment to be used. When dust laden HgS exists then the workers are to be equipped with SURVIVAIR PAPR units fitted with belt mounted organic vapour, acid gas, HEPA filters cartridges.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 10
		Site Preparation Plan
		These units are fitted with flow and battery sensors and training needs to be conducted to cover these aspects. When used the filters need to be changed every two days. Face pieces required cleaning at the end of each day's work. This should be done using sterile wipes and/or soap and water washing.
		Training in the use of the respirators must include cleaning, fit testing, changing filters, checking battery condition, charging instructions and general care and inspection.
		Foot Covering Since there is a combined risk of physical injury and chemical contamination it is necessary to use steel capped safety boots and chemical protection. The latter being TYVEK 417. Boot covers should be disposed of daily or when damaged. Consumables
		daily consumption of safety equipment per person per day is expected to be as follows and the site preparation should allow for the purchase and storage.
		Workers Thyme Overalls 2-3 per person per day Tyvek boot covers 2 per person per day Gloves 2 pair per person per day Undergarments one complete change per person per day Respiratory Decontamination wipes 1 pack per person per week. If Free HgS then Racal respirator facets 1 per person per day Respirator cartridges 2 per day per person. Eye protection 1 pair per week
		Visitors Tyvek Overalls 1 per visitor Tyvek Book covers 1 pair per visitor Visitor respirator 1 set filters per week Eye protection reusable 20 in stock.
4	S&E 4.4.4	**Training**
		For successful and safe operations the aspect of training is a key element.
		As part of the site preparation a comprehensive training package is to be assembled and all potential staff are to e passed through the scheme.
		The "training" packages required must include the following:
		Toxic hazard:- This training should cover the human toxic effects balances by the indications of dose required. The training of Toxic hazard should include the environmental impact information and the relative importance of inhalation and skin absorption.
		Personal Hygiene:- This should cover the necessity to wash before eating, drinking or smoking, the care needed when removing dirty clothing so as not to introduce additional skin contamination, not removing any equipment or clothing from site, showering (using soap) before going home.
		Respiratory Protection:- Training should include how to check the equipment is assembled and operating correctly, checking for low battery or low flow, correct fitting using fit test equipment, changing filters and battery packs.
		Personal Protective Equipment:- How to use the overalls, boot covers, gloves and just as important how to remove contaminated clothing so that the contamination does not get onto unprotected skin.
		Heat Stress:- Training should detail what is heat stress and how to recognise the symptoms, the importance of fluid intake, importance of working "smart" to use mechanical aids, not rushing, interspersing heavy work with light work, doing heavy work in the cooler parts of the day, and the role of acclimatisation.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 11
		Site Preparation Plan
		Emergency procedures:- Training is to include instruction of site emergencies procedures if there is a liquid spillage, clean up procedures, personal decontamination if splashed (use of eye wash), isolation of areas and containment, transport emergency, e.g.. vehicle accident, vehicle fire, deployment of containment booms, clean-up procedure, selection of suitable protective equipment, emergency communication procedures, notification of authorities, crowd control. Details of the actual activity involved for emergency can be found in WPI 4.9.
		Safe working practices:- Training should clearly demonstrate the need to avoid risk taking activity, working within personal capability, not reaching too far, ensuring footing is secure before lifting etc.
5	S&E 4.4.5	**Responsibility of Supervisor**
		After work has commenced on the site and all training is complete the supervisor is responsible for the ongoing application of the standards and techniques that were taught in the training programmes. he is particularly responsible for the following:
		* Ensure that the workers continue good working practices that ensure they are not exposed to contamination * Completely direct the workers in all activities thus ensuring they are always properly prepared for the work at hand. * Ensure that all workers wear PPE at all times. * Ensure that personal hygiene rules are followed.

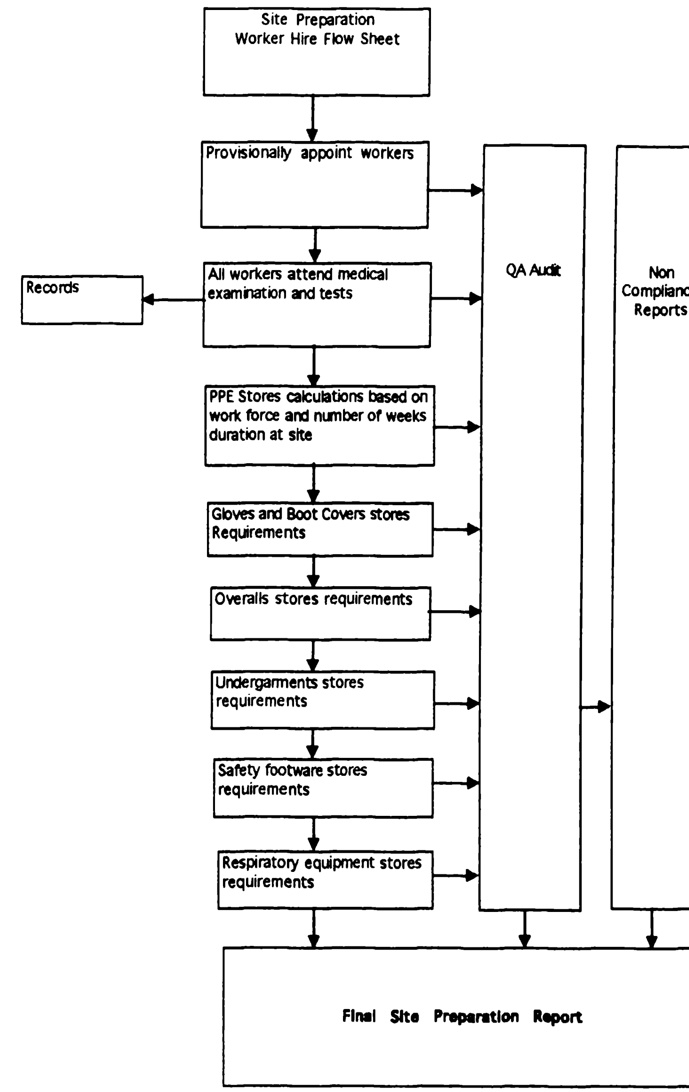
Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 12

Site Preparation Training Flow Sheet



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 13

Site Preparation Worker Hire Flow Sheet



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 14
		Site Preparation Plan	Non Compliance Report
		Site Preparation	
1	QA 4 4-A	Question Are the primary. Secondary and tertiary Zones shown on the site drawing?	
		Compliance Signature	See Rpt 4.4-A
2	QA 4.4-B	Question Is the public Zone indicated on the drawings?	
		Compliance Signature	See Rpt 4.4-B
3	QA 4.4-C	Question. Are the emergency and first aid material locations indicated on the site drawings?	
		Compliance Signature	See Rpt 4.4-C
4	QA 4.4-D	Question : Is the fire fighting equipment location shown on the drawings?	
		Compliance Signature	See Rpt 4.4-D
5	QA 4.4-E	Question: Is the work procedure Instruction Notice Board Indicated on the site drawing?	
		Compliance Signature	See Rpt 4.4-E
6	QA 4.4-F	Question : Have the correct bunding requirements been applied to each operating area?	
		Compliance Signature	See Rpt 4.4-F
7	QA 4.4-G	Question : Has the schedule been correctly filled out with the total risk factor?	
		Compliance Signature	See Rpt 4.4-G
8	QA 4.4-H	Question : Do the calculated total risk factors conform with the policy of minimum risk policy?	
		Compliance Signature:	See Rpt 4.4-H
		Locations of Decontamination and amenities Units	
9	QA 4.4-I	Question: Have both the decontamination unit and the amenities units locations been shown on the site drawing with all access routes shown and defence lines?	
		Compliance Signature	See Rpt 4.4-I
		Working Areas	
10	QA 4.4-J	Question Are the working areas clearly indicated showing exactly which part of the operations are to be performed within the designated zones Including storage of tools and equipment etc?	
		Compliance Signature	See Rpt 4.4-J
11	QA 4.4-K	Question Has the equipment required for each work activity been assessed and list generated.	
		Compliance Signature	See Rpt 4.4-K
		Defence areas	
12	QA 4.4-L	Question Are all areas adequately defended against incorrect work activity and are these areas properly fenced and defended against unauthorised access?	
		Compliance Signature	See Rpt 4.4-L
		Emergency Access	
13	QA 4.4-M	Question Can the emergency Services gain unrestricted access during and emergency of any kind?	
		Compliance Signature	See Rpt 4.4-M
		Fire Protection	
14	QA 4.4-N	Question Is there adequate fire fighting equipment to handle a fire for at least 30 minutes?	
		Compliance Signature	See Rpt 4.4-N

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 15
		Site Preparation Plan	Non Compliance Report
		Intruder Alarms	
15	QA 4.4-O	Question: Does the site have sufficient monitored intruder alarms fitted?	
		Compliance Signature	See Rpt 4.4-O
		Telephone and other communications	
16	QA 4.4-P	Question: Is the site provided with adequate telephone and communications systems?	
		Compliance Signature	See Rpt 4.4-P
		Records	
17	QA 4.4-Q	Question: Is the site provided with adequate record keeping facility?	
		Compliance Signature	See Rpt 4.4-Q
		Emergency Vehicle	
18	QA 4.4-R	Question: Is there a comprehensively equipped Emergency vehicle available on call?	
		Compliance Signature	See Rpt 4.4-R
		Training	
19	QA 4.4-S	Question: Is the person assigned to perform the training adequately qualified to do the task?	
		Compliance Signature	See Rpt 4.4-S
20	QA 4.4-T	Question: Does the Training Package 1 conform to the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-T
21	QA 4.4-U	Question: Does the training package 2 comply with the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-U
22	QA 4.4-V	Question: Does the training package 3 comply with the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-V
23	QA 4.4-W	Question: Does the training package 4 comply with the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-W
24	QA 4.4-X	Question: Does the training package 5 comply with the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-X
25	QA 4.4-Y	Question: Does the training package 6 comply with the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-Y
26	QA 4.4-Z	Question: Does the training package 7 comply with the requirements of the plan?	
		Compliance Signature	See Rpt 4.4-Z
		QA Audit Check sheets	
27	QA 4.4-AA	Question: Are the QA check lists and registers approved by the Mozambique Govt?	
		Compliance Signature	See Rpt 4.4-A

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 16
		Site Preparation Plan

Quality Assurance Check Lists and registers.

The check lists and registers attached to this section are the day to day QA audit sheets which record all the QA check points and list the modifications and adjustments to the work activity. These check sheets also include the Waste registers and worker movement etc.

As part of the Site Preparation activity these check sheets are to be copied off into a central register for each storage site.

These check sheets are in addition to the Quality assurance questions and the non compliance reports. The check sheets and registers are to be used on a daily basis whereas the quality assurance questions are on a reporting basis.

The check sheets and registers include the following standard forms.

Register of Personnel Movement (Site Workers)

Register of Personnel Movement (Others-Drivers etc)

Register of waste

QA Check list (Control of Personnel/Vehicles)

QA Check list (Clearance)

QA Check list (Documentation)

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 17
		Site Preparation Plan
1	Rpt 4.4-A	Design the Primary, Secondary and tertiary Zones and show their outlines on the site drawings.
2	Rpt 4.4-B	Design the public zone area that should be accessible for members of the public that will not require PPE. This area should include the main office for the project.
3	Rpt 4.4-C	Draw the locations of the emergency spill containment materials and the fist aid stations on the site drawing.
4	Rpt 4.4-D	Calculate the fire fighting equipment level required and indicate location on the site drawing.
5	Rpt 4.4-E	Position the WPI board and indicate on the site drawing.
6	Rpt 4.4-F	Design each bunding requirement in accordance with local waste laws and the requirements of this manual
7	Rpt 4.4-G	From the site inspection plan and the clearance plan calculate the total risk factors and determine the minimum methods of containment.
8	Rpt 4.4-H	Reassess the calculated Total Risk factor and elevate to the next level if it appears that the Minimum risk policy is not complied with.
9	Rpt 4.4-I	Assess the site for the location of the Decontamination and amenities units and clearly show these along with the site plan along with the egress and ingress paths, indicating how the routes are defended.
10	Rpt 4.4-J	Assess the work activity in each area and place this information on the site plan to show how the work activity is to be executed and how each area is autonomous in that work activity does not spill out to other areas.
11	Rpt 4.4-K	Assess the work activity requirements and create a listing of area tool and equipment requirements.
12	Rpt 4.4-L	Design the defence areas and methods to prevent the intrusion of areas by unauthorised personnel and inappropriate work activities.
13	Rpt 4.4-M	Assess the access under emergency conditions and ensure that all emergency services can access the site without undue restriction.
14	Rpt 4.4-N	Provide a minimum equipment level to allow the fire fighting capacity on site to be at least 30 minutes.
15	Rpt 4.4-O	Install 24 hour monitored alarm system
16	Rpt 4.4-P	Provide a secure telephone line for phone (toll free) and fax. Also provide cell phone where possible, pager and radio telephone where appropriate.
17	Rpt 4.4-Q	Purchase a computer based record keeping facility complete with printing capability and organise off site data storage.
18	Rpt 4.4-R	Provide a fully equipped emergency vehicle for call out and escort duties.
19	Rpt 4.4-S	Hire or appoint a training officer that fully understands the training systems needed for Toxic waste handling and clean-up. Ensure that this person is fully qualified.
20	Rpt 4.4-T-Z	Reassess the programmes to ensure that they comply with the plan standards and the Waste laws of Mozambique.
21	Rpt 4.4-AA	Obtain client approval for QA check list or obtain from client preferred lists.

Instruction Number	Procedural Instruction Mozambique - Project	Page 18

Site Preparation Plan

"Use the format here to construct the Final Site Inspection Report"

FINAL REPORT FORMAT

Introduction
This report for [Site name] storage facility is the result of application of the site inspection plan and covers the details that are required to be constructed at the site to allow for the removal of the waste.
After all the constructional elements of this report have been complied with can the packing operation commence.

Working Zones

Primary Zone

The site drawing attached to the appendices of this report show the location and extent of the primary zone.

"Attach the drawing showing the design of the primary zone if applicable"

Secondary Zone

The site drawing attached to the appendices of this report show the location and extent of the Secondary Zone.

"Attach the drawing showing the design of the primary zone if applicable"

Tertiary Zone

The site drawing attached to the appendices of this report show the location and extent of the tertiary zone.
"Attach the drawing showing the design of the primary zone if applicable"

Locations

Decontamination and Amenities units

The drawings attached show the location of the decontamination, amenities units and the method by which the workers must enter the unit.

Defence Zone

The site drawing attached shows the overall defence zones and how the emergency services can easily enter the building or storage area.

Emergency materials, First aid equipment and fire fighting systems

The site drawing attached shows the locations and methods of access to the emergency spill materials, First aid equipment and the fire fighting equipment.

WPI Notice Board

The location of the notice board on which the WPI instructions are placed is shown on the site drawings.

Containment Risk factore

The summarised containment risk factors are shown below:-

"Indicate the Containment Risk Factor summary from the Site Preparation data"

Instruction Number	Procedural Instruction Mozambique - Project	Page 19

Site Preparation Plan

FINAL REPORT FORMAT Continued

Working Area Equipment requirement

"Insert list of equipment required to be placed in each of the working zones as identified in the allocated zones."

Insufficient Data from the Clearance Plan

"This report to be completed if any part of the schedules and drawings is missing or incomplete from the Clearance Plan Final Report."

Primary Alms and Goals Non Compliance

"This report by its nature invoke a serious review of the situation. For any situation that the Project Manager feels violates the spirit or intent of the Project's Aims and Goals, must generate this report. Within it the Project Manager must clearly state what part of the Aims and Goals are violated and why he thinks that such conditions will prevent the Main Contractor from discharging its responsibilities to the client. Included with this statement must be a suggested solution that will bring the project back on strategy."

Non Compliance Reports

"Insert all Non compliance Reports that remain unattended or corrected."

Conclusions

At the [site name] storage facility the following working zones have been designed and constructed and these are indicated on the attached drawings.

"Insert the working zone schedule as created from the Clearance plan information"

At the [site name] the final positions for the decontamination facility and the amenities emergency materials first aid and fire fighting equipment is as shown on the attached drawings.

The Registers and the QA audit sheets have been placed in folders for the continuous recording on site and are ready to receive data. These QA check lists and registers have been approved by the client.

All workers personal protection equipment has been specified ordered and delivered.

Intruder alarms are fitted, tested and the telephone/fax lines are operational.

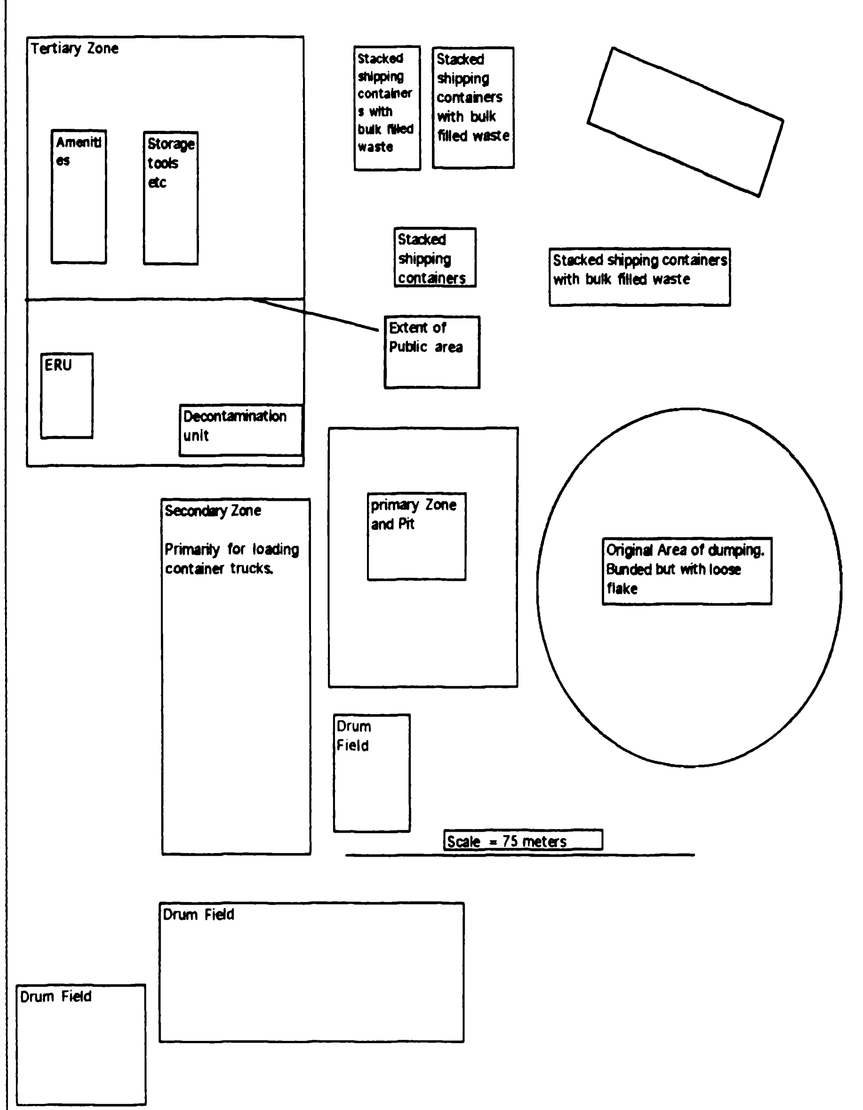
The site records computer is established as has an off site data storage system.

Appendices

"Include all site drawings and schedules"

Item	Instruction Number	Procedural Instruction Cambodian - Project	Page 20

Site Preparation Plan



WORK PROCEDURE INSTRUCTIONS

WPI 4.5 Packaging Instructions

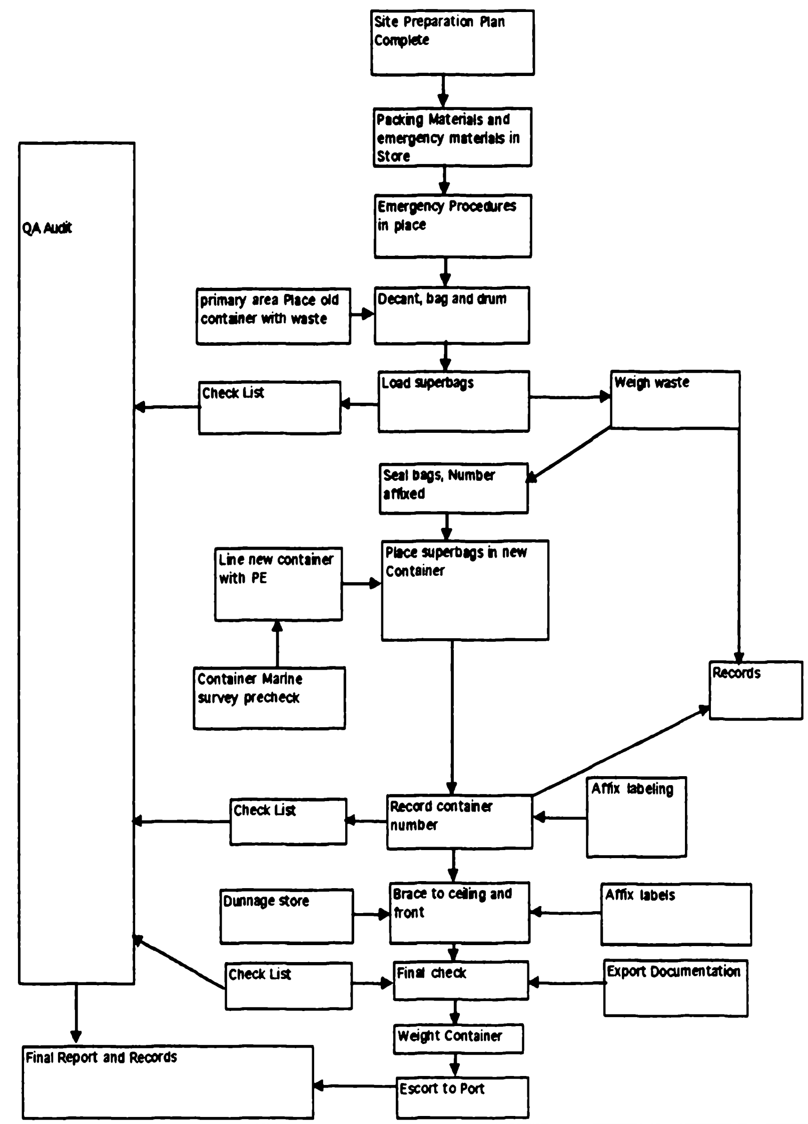
Item	Instruction Number	Procedural Instruction Mozambique - Project Page 1
		Packaging Plan
1	WPI 4.5.1	**Strategy Statement** In order that the project aims and goals are fully discharged the packaging plan must reflect physically the environmental implications of spillage. The techniques discussed here have been proven over many years to provide the safest methodology of packaging that ensures the waste arrives in the disposal country in the same manner in which it was discharged from the country of origin. In all aspects the strategy of packaging is designed to ensure that the transportation of the waste is fully defended against any possibility of leakage, spillage or contamination of any kind. These Instructions as enumerated within this WPI must be carefully adhered to and includes that such packaging be Quality Assured by an independent assessor.
2	WPI 4.5.2	**Elements of the Packaging Plan** 1. Waste Packing 2. Container Packing 3. Weighing 4. Labeling 5. Container Marine Survey 6. Decontamination
3	WPI 4.5.3	**Waste Packing** Drums containing solids will be repacked in UN 200 ltr PE open head drums, 280 ltr oversize drums or big bags. Solids packed in jute sacks or bags and other solid material like wood cam be loaded manually into big bags, with inner lining, each up to max 1000 Kg each. The big bags will be placed on pallets. Empty bottles, boxes and aerosols will be first packed into airtight sealed plastic bags and then placed into open head drums. Drums that have been repacked into non UN T drums will have to be placed into UN overdrums. The contents of all T drums can be checked by lid removal. For drums of liquids the contents are to be redrummed by pumping out the contents into a UN drum. T drums with solids to be repacked into oversize drums. Drums containing liquids will be pumped into ISO tank containers or 1000 ltr IBC's. All old druims are to be crushed and packed into big bags for transport.
4	WPI 4.5.4	**The standard container will be able to accept the majority of the Waste as follows:** The drums with the liquid waste, solid waste and disposed safety clothing, filters, PE Lining etc will be placed per 4 on one pallet. The drums on pallets will be banded. The big nags will alos be placed on pallets (one big nag per pallet) Then the pallets will be loaded into the box containers and properly stuffed. Big bags on pallets will be loaded in one layer intyo the container. 12 Big bags per contrainer. Drums will be loaded on pallets intwo layers, separated with plywood with max 72 drums per container.
5	WPI 4.5.5	**Weighing**
6	WPI 4.5.6	**Labeling** The following labeling satisfied all regulations governing the labeling of wastes for transport in most countries, transport by ocean going vessels. Packaging without clear labelling are to be relabelled.

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 2
		Packaging Plan
8	WPI 4.5.8	**Transport Units** Each transport unit will have a self adhesive label attached which will include the following: 1. The IMDG (International Maritime Dangerous Goods) placard of a size whereby dimension "D" is 100 mm. 2. The words "Unidentified Pesticide " where necessary 3. The name of the Holder. 4. The full name and address of the Clearance Organisation. 5. The full name and address of the Consignee. 6. A short description of the waste. 7. The transport Unit number. 8. The weight of the transport unit. 9. The date the unit was packed. 10. The shipping container load number.
9	WPI 4.5.9	**Shipping Containers** Each shipping container will be labeled as follows: 1. The IMDG placard of a size whereby dimension "D" is 250 mm. (Mounted one in each corner of the shipping container & 4 "Marine Pollutant") 2. When travelling on freeways in the country of origin, the label will be attached to both sides of the container. In addition, a sign with a white background and red lettering showing the following will be placed in a conspicuous position: a. Category (Class 6.1) b. name of the substance c. quantity d. properties e. important points in relation to handling f. emergency contact, i. name ii. telephone number iii. other details
	WPI 4.5.6	**Decontamination**

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 3
		Packaging Plan	
10	WPI 4.5.10	**Transport Vehicles** The shipping container transport vehicles will be fitted with a sign showing the following: 1. Clearance Company's full name and address. 2. Clearance Company's telephone number. This sign will be removed from the vehicle when the container is handed into the control of the Port Authorities.	
11	WPI 4.5.11	**Container Marine Survey** A prepacking survey must be carried out ion each container. This comprises an inspection of the door seal, Close door test, sound floor inspection and plate date inspection. The services of a marine surveyor must be employed to survey the packing and final disposition of the cargo within the container. The Marine surveyor must be registered and produce a certified report of the packing accompanied with photos showing the various stages of container loading and bracing details etc. After approval then the surveyor must affix the box seal and note the number on the BOL.	

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 4

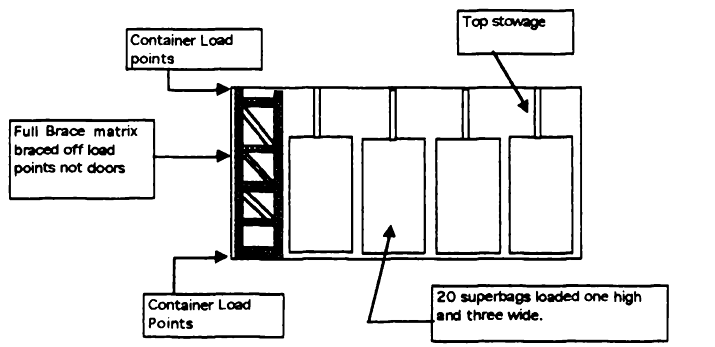
Packaging Plan

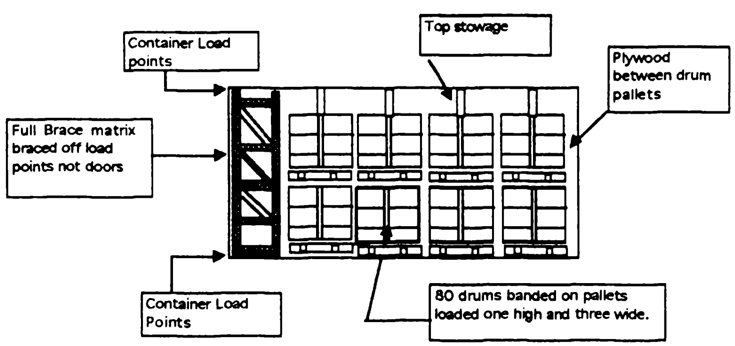


Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 5

Packaging Plan

Container Bracing Plan

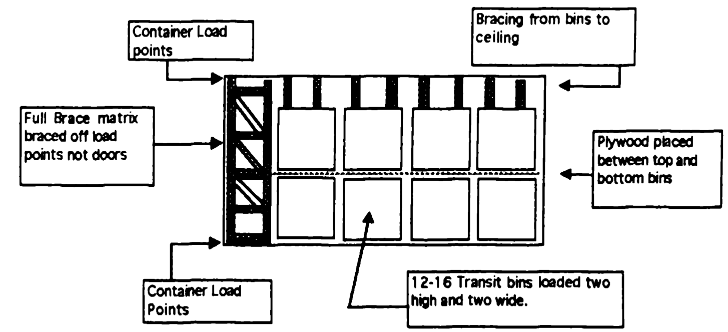




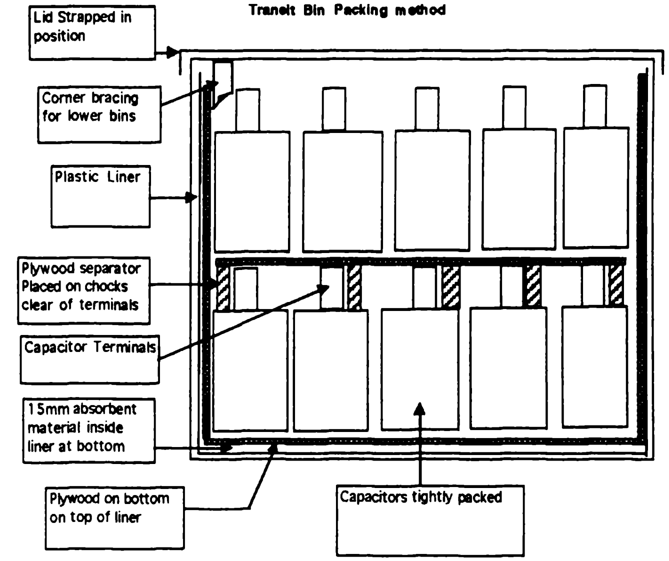
Item	Instruction Number	Procedural Instruction	Page 5

Packaging Plan

Container Bracing Plan



Transit Bin Packing method



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 8

Packaging Plan

1 S&E4 5 1 **Strategy Statement**

The wastes to be handled during the implementation of this proposal are potentially hazardous, creating the need to plan for and put in place, workable emergency response procedures at all phases of the project. These procedures need to cover responses to emergencies involving threats to the environment and the public, as well as those that may threaten the health and safety of personnel involved in the operations. The Emergency response procedures are detailed in WPI 4.9. When there is spillage of any kind then WPI 4.9 is to be uplifted and put into action immediately. The handling, packing and storage procedures to be followed in this proposal (as outlined in previous sections of this document) have been developed over time and through considerable experience with actual operations. The procedures therefore are designed specifically to minimise the risks of emergencies arising.

The packaging of wastes to international standards prior to transport is designed to provide at least double containment of the materials. This will substantially limit the volume of wastes likely to be spilt or to leak in any one incident.

However, it is inappropriate to rely solely on set procedures to achieve a high level of safety. There remains the need to be able to respond in a positive and rapid manner to unforeseen circumstances.

2 S&E4.5.2 **Elements of the Site Inspection Safety and Environmental plan.**

1. Emergency Response
2. Emergency Response Procedures

The following description outlines relevant emergency procedures.

3 S&E4.5.3 **Emergency response**

As described, all personnel involved with the proposal will be properly trained and fully informed of the nature of the materials being handled and the appropriate emergency response procedures.

All waste Transport trucks will be accompanied by an escort vehicle, which will function as an emergency response vehicle to provide an effective response in the unlikely event of a leak or spillage during the transport phase.

In the case of an accident, spill or leak during transport, emergency response measures will be taken immediately and the WPI 4.9 uplifted and placed into action.

The periods of highest risk of a spill or leak developing is during loading and unloading of wastes. To minimise potential environmental impact, loading area must have adequate spill response materials and spill response materials and spill prevention measures. When loading or unloading waste equipment at the ship or in the field, spill prevention measures must be undertaken and spill control and clean-up materials are to be readily available.

4 S&E4.5.4 **Staff Health and Supervision Requirements**

i. Medical assessment and certification of fitness for each employee before work commencement. This would establish baseline health status of each staff member for comparison with subsequent examinations.

ii. Continued medical assessment on a monthly basis and on exit of employment within 72 hours of cessation of work.

iii. At request of employer, employee or authorised medical personnel where excessive absorption of wastes is suspected.

iv. Periodic random checks at the discretion of authorised medical personnel.

In addition to medical surveillance, the repacking and site facilities will be provided with a first aid post, including an ablutions block specifically designed to provide for decontamination and disposal of clothing, towels and other materials as required.

Instruction Number	Procedural Instruction Mozambique - Project	Page 9

Packaging Plan

The following items of protective equipment will be available and used as appropriate.

i. One piece chemical resistant suit with internal zip, external buttons and a hood.

ii. goggle (unless the respirator provides eye protection).

iii. Any normal clothing which accidentally comes into contract with wastes must be removed for disposal with other contaminated materials.

iv. Any normal clothing which accidentally comes into contact with wastes must be removed for disposal with other contaminated materials.

v. On completion of work involving the wastes each person must wash hands and face before eating, drinking or using any toilet facilities.

First aid procedures are:

i. Eyes - immediately irrigate with water for at least fifteen minutes and obtain medical attention.

ii. Skin - immediately remove any contaminated clothing and wash affected skin with soap and water, or an industrial cleanser.

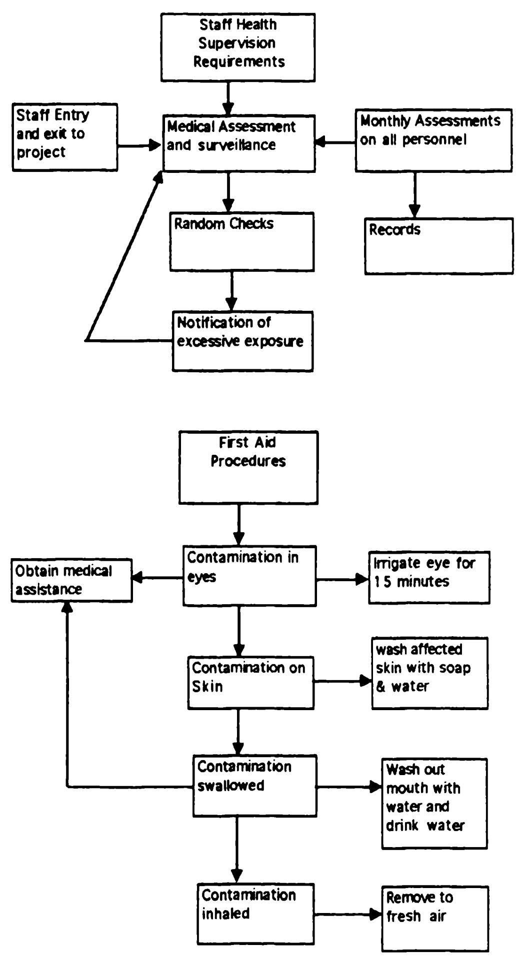
iii. If swallowed - wash out mouth several times with clean water, give water to drink and obtain medical attention.

iv. If inhaled - remove to fresh air and obtain medical attention.

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 12

Packaging Plan

Emergency Response Procedures



Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 15
		Packaging Plan The QA - Audit comprises a series of questions against each part of the Packaging plan and are complete with instructions for compliance and non compliance. Most of the non compliance responses will initiate a non compliance report. This report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the non compliance reports. **Elements of the QA Packaging** - Waste Packaging - Container Packing - Weighing - Labeling **Waste Packaging**	
1	QA 4.5-A	Question: Are the superbags filled correctly with no overfilling?	
		Compliance Signature:	See Rpt 4.5-A
2	QA 4.5-B	Question : Are the supoerbags correctly tied?	
		Compliance Signature	See Rpt 4.5-B
3	QA 4.5-C	Question : Are the super bags provided with a recorded number?	
		Compliance Signature:	See Rpt 4.5-C
4	QA 4.5-D	Question : Have the drums been banded and provided onto pallets?	
		Compliance Signature	See Rpt 4.5-D
5	QA 4.5-E	Question : Have the bags and drums been weighed and recorded ?	
		Compliance Signature:	See Rpt 4.5-E
6	QA 4.5-F	Question:	
		Compliance Signature:	See Rpt 4.5-F
7	QA 4.5-G	Question : Are the correct labelling been applied?	
		Compliance Signature:	See Rpt 4.5-G
		Container Packing	
8	QA 4.5-H	Question : Are the superbags packed in the 20 foot shipping container three wide and one high	
		Compliance Signature:	See Rpt 4.5-H
9	QA4.5-I	Question: Have the containers been inspected for suitability of purpose and have no damage?	
		Compliance signature:	See Rpt 4.5-I
10	QA 4.5-J	Question: During loading of the containers were total weights recorded and checked against the total loading capacity of the containers.?	
		Compliance Signature:	See Rpt 4.5-J
11	QA 4.5-K	Question: During the waste packing and container loading are all check sheets as shown in WPI 4.4 been correctly filled out?	
		Compliance Signature:	See Rpt 4.5-K
12	QA 4.5-L	Question: Have the superbags been packed within the container with dunnage to restrict movement during shipment?	
		Compliance Signature	See Rpt 4.5-L
13	QA 4.5-M	Question: Is the construction of the container door dunnage matrix fully braced diagonally to prevent the possibility of transit boxes falling against the door of the container and is that matrix braced against the container load points and not the door?	
		Compliance Signature:	See Rpt 4.5-M

Item	Instruction Number	Procedural Instruction Mozambique - Project	Page 16
		Packaging Plan	
13	QA 4.5-O	Question:	
		Compliance Signature:	See Rpt 4.5-O
14	QA 4.5-P	Question:	
		Compliance Signature:	See Rpt 4.5-P
		Weighing	
15	QA 4.5-Q	Question:	
		Compliance Signature:	See Rpt 4.5-Q
		Labeling	
16	QA 4.5-R	Question: Have the containers been provided with the correct labeling standards and have the check lists for labels been filled out as per WPI 4.4?	
		Compliance Signature:	See Rpt 4.5-R
17	QA 4.5-S	Question: Does each transport unit, bin etc have a self adhesive labels per page 3 of the Operational instructions of this WPI?	
		Compliance Signature:	See Rpt 4.5-S
		Marine Survey	
18	QA 4.5-T	Question : Have all the filled containers been Marine Surveyed by a registered Marine Surveyor?	
		Compliance Signature:	See Rpt 4.5-T
19	QA 4.5-U	Question : Has each shipping container been prechecked before loading for WOF, Door Seals, Door test etc?	
		Compliance Signature:	See Rpt 4.5-U

Item	Instruction Number	Procedural Instruction Mozambique - Project Page 22
		Packaging Non Compliance Action Instructions
1	Rpt 4.5-A	Do not overfill bags
2	Rpt 4.5-B	Ensure that the bags are correctly tied off
3	Rpt 4.5-C	All bags are to be provided with a number that relates to the weighed amount
4	Rpt 4.5-D	Ensure pallets are provided and all drums groups are banded
5	Rpt 4.5-E	Ensure that all weighing procedures are followed
6	Rpt 4.5-F	
7	Rpt 4.5-G	
8	Rpt 4.5-H	For stability and efficiency the superbags should be restacked so that they fit one high and three wide.
9	Rpt 4.5-I	Any damaged containers should be rejected and returned to the shipper. There should be no door damage or load point damage. The floors must be integral and still sealed.
10	Rpt 4.5-J	Ensure that all check sheets as depicted in WPI 4.4 are fully completed for each shipment.
11	Rpt 4.5-K	Ensure that all check sheets as depicted in WPI 4.4 are fully completed for each shipment.
12	Rpt 4.5-L	Ensure that the packing process correctly schedules the weighing and that the clients check sheets are correctly filled out.
13	Rpt 4.5-O	
14	Rpt 4.5-P	
15	Rpt 4.5-Q	Ensure that the correct weighing and documentation procedure is applied.
16	Rpt 4.5-R	Ensure that correct labeling is applied. The transit bins and containers must not leave the storage unless the correct labeling is affixed.
17	Rpt 4.5-S	
18	Rpt 4.5-T	All containers must be Marine surveyed by a registered surveyor and a report generated.
19	Rpt 4.5-U	All containers must undergo a precheck to ensure suitability of use.

Packaging Plan Quality Assurance Audit

QA AUDIT REPORT FOR PACKAGING

Introduction

This Report for [ ] has been generated during the QA Audit Site Inspection of packaging operations. The QA Site Inspection is intended to confirm that the packaging plan has been adhered to and that all the provisions of safety have been complied with.

Handling Methodology

The QA Audit procedure confirmed that the handling procedures during the extraction packaging and container loading is in accordance with the Project manual. The handling methodology as detailed in the Clearance plan and the order of clearance is confirmed as complying with all aspects of the Project Manual.

Packaging Methodology

The QA Audit procedure confirmed that the packaging procedure fully complies with all aspects of WPI 4.5.

Spatial layouts and facility locations.

Materials

Project manuals and WPI Documentation

Comment on site availability

Non Compliance Report

Refer to NCR's in QA Audit report

Primary Aims and Goals non compliance

Conclusions

At the [ ] storage facility all the working zones and equipment necessary to carry out the Packaging plan are in place and packaging is in compliance. The correct check sheets are been correctly filled out. The site now has its first QA inspection.

Signed QA Audit Engineer

WORK PROCEDURE INSTRUCTIONS

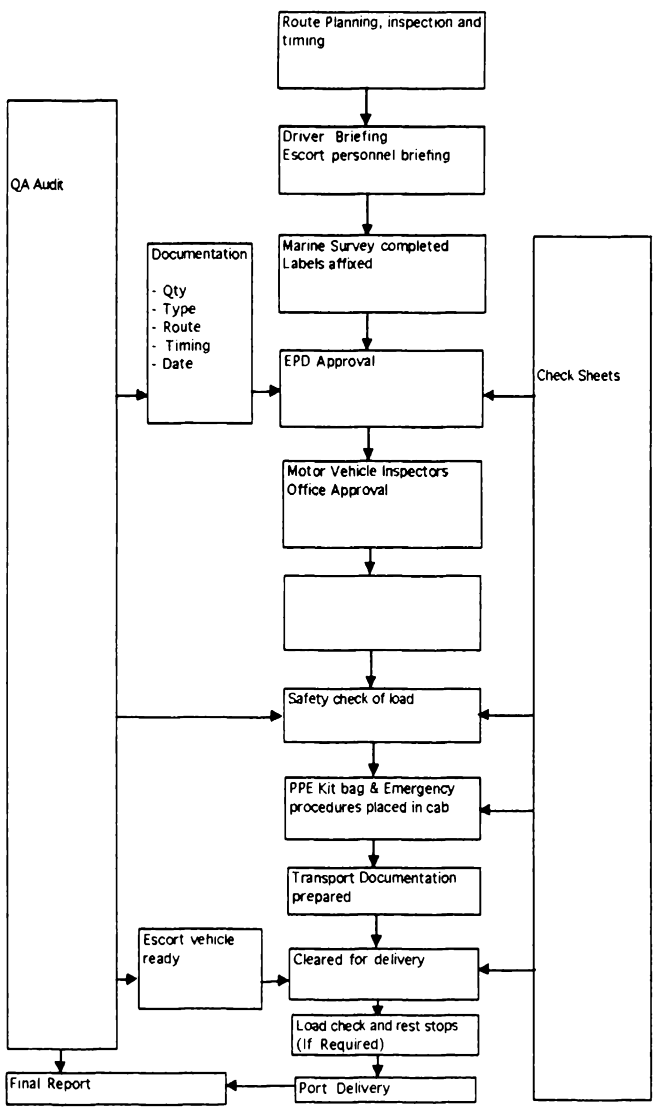
WPI 4.6 Transport Instructions

Item	Instruction Number	Procedural Instruction - Mozambique Project Page 1
		Transport Plan
1	WPI 4.6.1	**Strategy Statement** The detailing and control strategy for Transportation of the packed waste to the ports requires the same level of attention as the other elements of the Clearance project. The Transportation must be carefully planned so that there are no possibilities of surprises during road transportation and that such details such as road works, hours of travel, routes, driver training etc. are fully taken care of in the Transport plan and applied by these WPI's. **Elements of the Transport Plan**
2	WPI 4.6.2	**Marine Survey** Before any containers can leave site they must have been prechecked before loading, marine surveyed before final transit bin bracing and final inspection after bracing. When the Marine Survey has been released then the container can be made available for road transport to the port.
3	WPI 4.6.3	**MFE approvals** Application for approval to transport the waste on all roads must be made to the local Environmental Protection Department (EPD) for the locality of the waste. This application must include a statement of Quantity, Type, Route, Date and time of day. Approval to transport on ordinary roads will be in the form of a letter. Without this letter of approval the Waste cannot be moved.
4	WPI 4.6.4	
5	WPI 4.6.5	
6	WPI 4.6.6	**Route Planning** The quality of the delivery of the shipping container is very dependent on the route chosen and the time of day. The various route options should be surveyed and the following items should be examined and thus the routes should be sortlisted to provide the most efficient an safest route selection. * Examine the route options and detail restrictions (One way roads, Traffic densities etc) * Research likely road works and traffic disruption possibilities * Research overhead cable and wire obstructions in selected routes * Examine the access routes for the emergency services likely to take in the event of call out and ensure that the route will always allow for them to get to the site of the emergency as soon as possible without delay. * Examine the various waterways the routes and ensure that minimum waterways are traversed. * Avoid routes that have long traffic delays
7	WPI 4.6.7	**Movement Timing** The transport of the waste must be done in daylight hours and during such business hours that will ensure that the Delivery will be complete well before the end of the day shift of the local emergency services. The timing however should be planned to avoid rush hour traffic. The route shall be travelled by the escort vehicle as a dummy run at the timing planned to ensure that the conditions at that hour of the day will not unduly impede the transport.
8	WPI 4.6.8	**Driver Briefing** The transport driver is to be selected on the basis of driving experience and record. All transports to the port will be accompanied by the Escort vehicle with trained personnel attending who will deal with any emergencies. The driver is to be fully briefed on the route, timing and emergency procedures and documentation.

Item	Instruction Number	Procedural Instruction - Mozambique Project Page 2
		Transport Plan
9	WPI 4.6.9	**Driver Briefing Continued** A kit bag of Driver Personal Protection equipment is to be placed in the cab of the transport vehicle before it leaves the site and the driver is to be fully briefed on its contents and how to use the equipment. A complete set of transportation documentation as well as the emergency procedures and notifications is also to be placed in the cab. Under most circumstances these emergency procedures would not be used as emergencies will be handled by the escort vehicle and its personnel. But in the event that the Escort vehicle is disabled or involved in an accident the transport driver needs to be able to contain any situation until the back up crews arrive.
10	WPI 4.6.10	**Escort Vehicle** The project emergency escort vehicle is to accompany all transport of waste to the port or site. Under no circumstances is a delivery of waste to be performed without the escort vehicle. The escort vehicle is also not allowed to perform the escort duties if its inventory is inadequate or that personnel are missing.
11	WPI 4.6.11	**Communication** Complete communications systems are to be maintained between the transport vehicle, emergency response escort vehicle. This communication is to be a combination radio/mobile phone system.

Item	Instruction Number	Procedural Instruction - Mozambique Project	Page 3

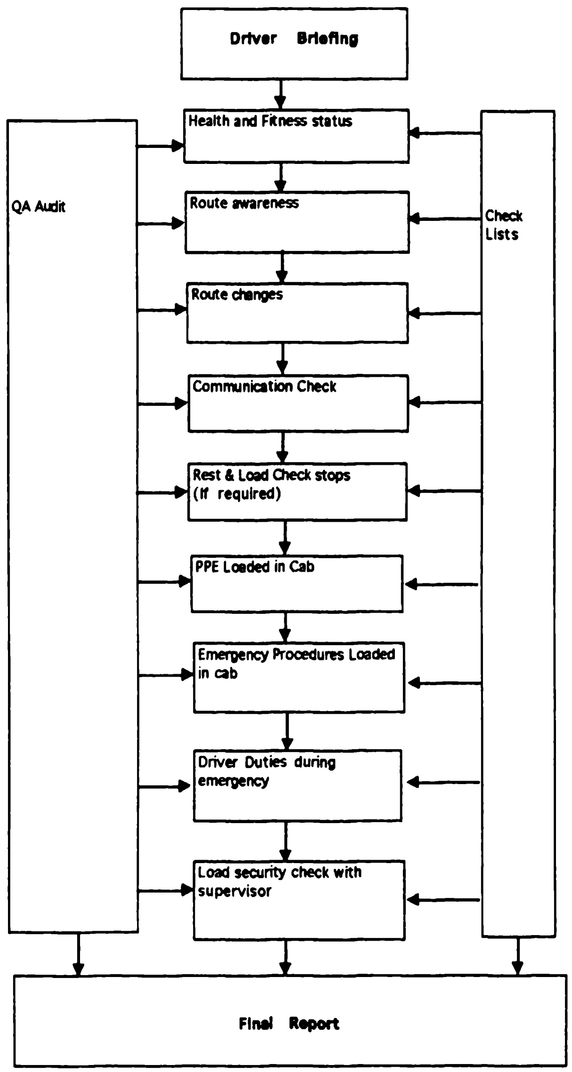
Transport Plan Flow Drawing



Item	Instruction Number	Procedural Instruction - Mozambique Project — Page 8
		Transport Plan
1	S&E 4 6 1	**Strategy Statement** In order to discharge the Safety requirements and provide full environmental protection and to maintain the policy of risk minimisation the Transport Plan must be not only carefully adhered to but must be continuously monitored for any non compliance. **Elements of the Transport Safety & Environmental Plan**
2	S&E 4 6 2	**Driver Briefing and PPE** The driver is to be fully briefed as to his duties of care during the transportation of the waste. This briefing should be over and above the specific driver training and should be delivered on the day of despatch of each and every container. This briefing shall include the following point by point schedule * Is the driver of good health and fitness * Is the driver fully aware of the route *Brief the driver of any changes to route, timing, destination, road hazards * Brief the driver as to communication check times to escort and Contractor control * Brief the driver as to rest stops (one per hour if required) * Brief the driver to load check stops (one per hour if required) * Check driver has loaded PPE Kit Bag and knows how to use it * Check driver is aware of his duties if escort vehicle delayed * Check emergency procedures and notification schedule is in drivers cab *Check driver is aware of how to cope initially with emergency
3	S&E 4 6 3	**Route and adherence** The planned route shall be shown on a road map and placed in the cab after driver briefing. The points of radio progress reports are to be indicated on the map. Should it become necessary to change the route during the course of the delivery the driver shall advise the escort vehicle and pull over when safe to do so and await authorisation to alter the route.
4	S&E 4 6 4	**Communication** The safety of the waste delivery is dependent on good communication. No delivery of waste shall commence until a full communication check with the escort vehicle has been effected. No containers shall be delivered until the communication check has been carried out and proved effective
5	S&E 4 6 5	**Vehicle** Inspect the vehicle for tyre or suspension damage and look for obvious mechanical reasons for the vehicle to be unfit for duty. Also inspect the COF.
6	S&E 4 6 6	**Load Security** The supervisor and the driver must together inspect the load and determine that the load is correctly fastened onto the container truck by its locking turrets. No container is to be despatched unless the container is locked in position and that the locking has been witnessed by the supervisor and the driver..
7	S&E 4 6 7	**Emergency Procedure and Escort vehicle** All trans shipment of containers of Waste to the port shall be escorted the entire route up to receipt and acceptance by the Port Authority. The escort vehicle personnel are to be fully trained in all aspects of spill control and are to assume full responsibility for the cargo during all aspects of the delivery. Any route changes must be authorised by the Escort vehicle personnel only after clearance from Contractor control room.

Instruction Number	Procedural Instruction - Mozambique Project	Page 9

Transport Plan S&E Flow Chart



Item	Instruction Number	Procedural Instruction - Mozambique Project	Page 15
		Transport Plan The QA - Audit comprises a series of questions against each part of the Transport plan and are complete with instructions for compliance and non compliance. Most of the non compliance responses will initiate a non compliance report. This report then becomes part of the management reporting to the client who is then required to provide an ongoing direction to the conclusions of the non compliance reports. This QA schedule is based on a single shipment and this QA schedule should used as a general document with compliance noted on the individual check sheets for each container. **Elements of QA Transport** - EPD Approval - MVI Approval - Freeways Approval - Route Planning - Escort vehicle - Driver Briefing - Load Security	**Non Compliance Report #**
1	QA 4.6-A		
		Compliance signature:	See Rpt 4.6-A
		EPD Approval	
2	QA 4.6-B	Question: Has the application for EPD approval been filed and the approval letter received?	
		Compliance Signature:	See Rpt 4.6-B
3	QA 4.6-C	Question:	
		Compliance Signature:	See Rpt 4.6-C
		Route Planning	
4	QA 4.6-D	Question: Has the route been carefully planned, inspected and travelled to ensure that the cargo will be safe at all times?	
		Compliance Signature:	See Rpt 4.6-D
5	QA 4.6-E	Question: Have all road works on the route been taken into account and all overhead obstructions?	
		Compliance Signature:	See Rpt 4.6-E
6	QA 4.6-F	Question: Has the route been surveyed for traffic delays?	
		Compliance Signature	See Rpt 4.6-F
7	QA 4.6-G	Question: Have the routes times been carefully worked out to avoid rush hour traffic conditions?	
		Compliance signature:	See Rpt 4.6-G
		Escort vehicle	
8	QA 4.6-H	Question : Is the Escort vehicle fully stocked and available for the escorting of the container truck to the Port and the check lists checked off?	
		Compliance Signature:	See Rpt 4.6-H
		Communication	
9	QA 4.6-I	Question: has the entire communication system been checked out between the container truck, escort vehicle and Contractor control room? Compliance Signature:	
			See Rpt 4.6-I
		S&E Driver Briefing	
10	QA 4.6-J	Question: Have all the driver briefing statements been complied with?	
		Compliance Signature:	See Rpt 4.6-J

Item	Instruction Number	Procedural Instruction - Mozambique Project Page 18	
		Transport Plan Load Security	Non Compliance Report #
11	QA 4.6-K	Question: Has the supervisor and the Driver performed the load security check?	
		Compliance Signature:	See Rpt 4.6-K
12	QA 4.6-L	Question: Has the Container Truck a current COF?	
		Compliance Signature:	See Rpt 4.6-L
13	QA 4.6-M	Question: Has the supervisor checked the vehicle for any obvious mechanical faults?	
		Compliance Signature:	See Rpt 4.6-M

Item	Instruction Number	Procedural Instruction - Mozambique Project Page 22
		Transport Non Compliance Action Instructions
1	Rpt 4.6-A	
2	Rpt 4.6-B	Containers with waste may not leave the storage site unless written approval from EPD has been received for that particular shipment. If this approval is not obtained then a NCR must be produced.
3	Rpt 4.6-C	Containers with waste may not leave the storage site unless written approval from MVIO has been received for that particular shipment. If this approval is not obtained then a NCR must be produced.
4	Rpt 4.6-D	Ensure that the route is carefully planned and travelled. If this has not been performed of the supervisor believes that it has not been done properly then a NCR must be filled out.
5	Rpt 4.6-E	All road works must be inspected to ascertain if they are a hazard or not. If this has not been done then write NCR.
6	Rpt 4.6-F	All routes must be surveyed for traffic delays during the planned travel time. If this has not been performed then write NCR.
7	Rpt 4.6-G	All routes must be surveyed for rush hour traffic congestion. If this has not been done then write out NCR.
8	Rpt 4.6-H	Unless the escort vehicle is completely stocked with all required equipment and is available for duty no container must leave the site name. If the container truck leaves without the Escort vehicle it must be recalled. If this is not done then write NCR and urgently advise Contractor.
9	Rpt 4.6-I	Unless all communication checks are completed and OK the delivery must not happen. If it does then write out NCR and immediately advise Contractor control room.
10	Rpt 4.6-J	Complete all driver briefings. If this is not done write out NCR and advise Contractor control Room
11	Rpt 4.6-K	Ensure that the supervisor and the driver inspects the load for security. If this is not done then write NCR.
12	Rpt 4.6-L	No container trucks are to be used if it does not have a current COF.
13	Rpt 4.6-M	The supervisor must check the container truck for any obvious signs of damage etc. If this is not done then write NCR

Instruction Number	Procedural Instruction - Mozambique Project	Page 23

Transport Plan

"Use the format provided here to construct the final Transport Report. This report is required to be filed during the first week of container despatch from the site name"
"This report is to be produced at the time of first delivery"

FINAL REPORT FORMAT

Introduction
This Report for [Site name] has been generated during the first of the Transport operations. This report is intended to confirm that the Transport plan has been adhered to and that all the provisions of safety have been complied with. Information provided for in this report is to be used by the Quality Assurance Engineer during site inspections of the Transport process to ensure compliance.

Route Planning
The planning of the route and all of its implications of traffic, road works, population densities, waterways and time of day have been carefully investigated and the selected routes will maximise the safety and delivery.
"If the Route planning investigation reveals any safety issue or hazard whatsoever then that is to discussed here"

Driver Briefing
Compete driver briefing has been carried out as detailed in the WPI.

"If the Driver briefing has raised problems then this needs to be stated here"

Communications
The complete communication system between the escort vehicle, the container truck and Contractor has been properly checked out and approved.

"If the Communication system is less than adequate then this must be discussed here"

Non Compliance Report

"All non compliance reports that remain unattended or corrected are to be clearly stated"

Primary Aims and Goals non compliance
"This report by its nature invokes a serious review of the situation. For any situation that the site supervisor feels violates the spirit or intent of the projects Aims and Goals, must generate this report. Within it the site supervisor must clearly state what part of the Aims and goals are violated and why he thinks that such conditions will prevent the Main Contractor from discharging its responsibilities to the client. Included with this statement must be a suggested solution that will bring the project back on strategy"

Conclusions

At the [Site name] storage facility all the Transport requirements have been adhered to and the delivery process commenced. The correct check sheets are being filled out and Non compliance reports generated as required.

Signed Site Supervisor & Project Manager

WORK PROCEDURE INSTRUCTIONS

WPI 4.9 Emergency Instructions

Item	Instruction Number	Procedural Instruction - Mozambique project Page 1
		Emergency Plan
1	WPI 4.9.1	**Strategy Statement** The Emergency Plan is concerned with the detail of the equipment, services and methodology during and emergency situation. The system and equipment shown in this WPI is designed to allow a full emergency response to be available during all waste operations and transport. The emergency plan is to be available at all times in the form of an Emergency Response Unit (ERU). This facility is always to be available during all stages of packaging as well as transportation. During transportation of the waste waste to the export port the ERU is to act as the escort vehicle. The Emergency plan is discharged by means of Flip charts and these are to be activated during the emergency. **Elements of the Emergency Response Plan**
2	WPI 4.9.2	**ERU Vehicle** Due to the substantial amount of equipment to be carried by the ERU and the recovered waste it may also be called upon to transport this vehicle must be substantial. It is recommended that the ERU be housed in modular containers that is easily loaded onto the back of a flat bed truck with a capacity of about 1 Tonnes . The ERU vehicle must be fitted with a communication system with at least two methods of communication. (EG radio and mobile telephone). The ERU must be capable of maintaining communications with the "Control Room" and the waste Container truck.
3	WPI 4.9.3	**ERU Equipment Inventory** The equipment to be carried by the ERU is extensive and a continuous inventory list must be maintained for the unit. Whenever the ERU is required for escort duties the inventory list must be checked for any shortages and the delivery of waste containers to the Export Port must not proceed if the ERU is lacking equipment within its inventory. The schedule of equipment required for the ERU is as shown later in this section of the WPI. Within the check sheets WPI 4.90 is a check indication by the site supervisor that the ERU is properly equipped and its inventory is complete.
4	WPI 4.9.4	**Escort Duties** The ERU is to operate as the primary escort vehicle and is to attend all transport deliveries of waste waste to the Export Port. During such escort duties the vehicle is to travel behind the waste transport vehicle and its personnel to assume complete control during any kind of on the road incident. The escort vehicle personnel are to regulate the rest and safety stops and authorise the changing of any planned routes. During such escort duties if there are any possibilities of spillage or damage to the cargo then the ERU and its personnel are to begin the notifications procedures and commence the Emergency Response procedures.
5	WPI 4.9.5	**Emergency Response During Escort** In the case of accident, spill or leak during transport, emergency response measures as follows are to be taken immediately. All such incidents require that "An emergency be declared". The words "Emergency" must be used in communications regarding the incident. * Immediately following the incident the waste container driver is to notify the ERU escort vehicle. * The ERU crew will respond immediately to the initial notification from the Container truck driver * If the waste discharge is a major spill then the formal notifications procedure must commence as per the Notification procedure.

Item	Instruction Number	Procedural Instruction - Mozambique project Page 2
		Emergency Plan
6	WPI 4.9.6	**EMERGENCY PROCEDURE FOR A MAJOR SPILL DURING ESCORT OF PESTICIDE WASTE** *General* Because of the known persistent nature of POPs in the environment and their tendency to bioaccumulate, it is important to prevent entry into the environment. Therefore: 1 - It is essential to prevent waste leaking into drains or natural waterways. 2 - All wastes and residues containing POPs shall be collected for disposal 3 - Carry out necessary recording and notifications. *Emergency Procedure priority Steps* 1 - Don Protective Clothing 2 - Stop the flow of pesticides waste 3 - Contain POPs 4 - Report Incident 5 - Keep non essential people and staff away 6 - Recover all POPs Contaminated material
	Step 1	***Don Protective Clothing*** Personnel from the ERU must wear PPE before entering the leak or spill area. If the waste Container truck driver is required to assist then he must also wear PPE.
	Step 2	***Stop the Flow of waste*** *Reposition the drum to stop the flow *Reposition the transit bin or tray within container * If possible stop the leakage with temporary seals within containers *If Shipping container has fallen off truck deck then reposition level urgently * If necessary transfer fluid to spare drum
	Step 3	***Contain the waste*** * Dyke major spills with soils, fullers earth or other materials. This action may involve the use of front end loaders creating emergency dam * If at all possible prevent waste entering drains, waterways or spilling to ground. Place bund bags on nearby drains. * Use sand or sawdust to absorb and recover the waste, all of this to be recovered in a wide mouth drum * Recover all contaminated soils by digging down at least 100 mm more if soil is loose. *If leaking from truck tray then drive truck onto prepared sheet of plastic to contain the waste.
	Step 4	***Notifications and reports*** If a major spill or accident has occurred during the escort of waste to the export port then the following services are to be notified immediately in order as shown: - Supervisors - Project Manager - Control room - Client Project Engineer - Local EPD

Item	Instruction Number	Procedural Instruction - Mozambique project Page 3

Emergency Plan

- Provincial EP
- Central EPA
- Road and traffic Authority
- Local Police bureau
- Fire Service Department

Step 5 ***Protect Personnel and the public***

* All non- essential personnel and publics shall be kept out of the immediate leak or spill area. The area should be roped off to prevent any spread of waste material by vehicle or pedestrian traffic.
* Only personnel familiar with waste safety procedures will be used to shut off the source of the waste spill, contain the spilt waste, and carry out recovery and clean up work.
*The repair of equipment or the clean-up of spillages and leaks containing waste should be carried out by competent staff only. PPE must be worn.
* Where a significant area of waste slurry is exposed to the air in an indoor situation or within a container then breathing apparatus must be worn.
* Contaminated clothing must be placed in waste waste materials drums.

Step 6 ***Recover the waste***

Once the waste flow has been stopped and the waste contained then the waste must be recovered. This can be performed using absorbent materials, buckets, brooms rags, sawdust, booms etc. All such recovered waste must be placed in wide mouth drums

Step 7 ***Decontaminate the area***

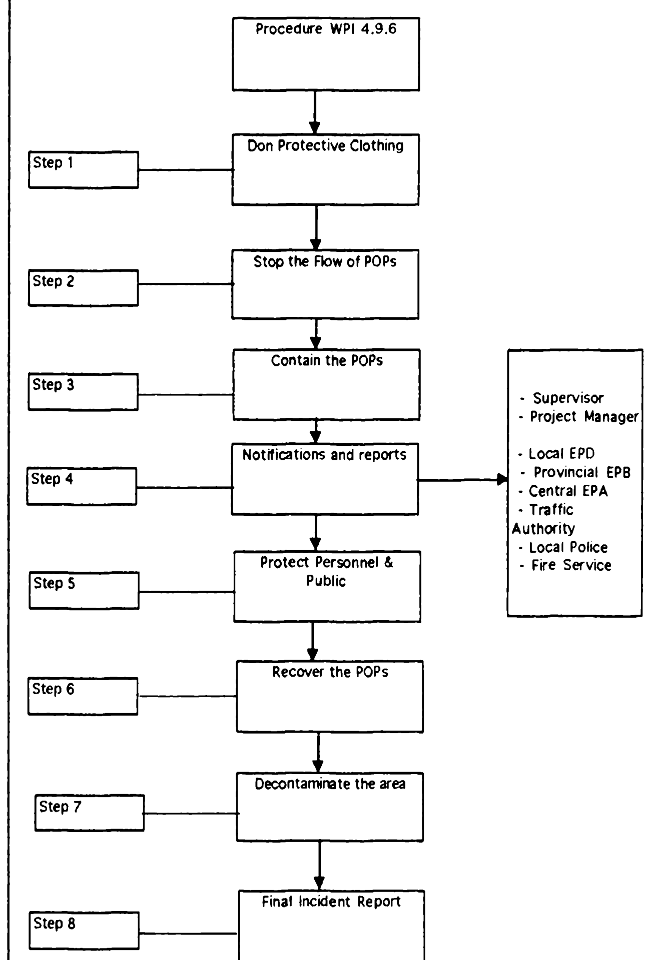
All surface subject to the waste slurry must be decontaminated with solvent. Any spill on cars etc must be wiped down in situ with absorbent cloth.

Step 8 ***Final incident report***

This report should be generated within 24 hours of the incident and cover matters of spill type and quantity and methods used to clean up

Item	Instruction Number	Procedural Instruction - Mozambique project Page 4

Emergency Plan



Item	Instruction Number	Procedural Instruction - Mozambique project	Page 5

Emergency Plan

QA CHECK SHEETS
To be checked off during Emergency

Don Protective equipment

STEP 1

Specify the Names of personnel involved in the area of emergency risk	Wearing Correct PPE	BA Sets required	Time In	Time Out
Name: Position:				
Name: Position:				
Name: Position:				
Name: Position:				
Name: Position:				

STEP 2

Stop the Flow of POPs

No | Is the POps still flowing out from containment | Yes → Take immediate and urgent steps to block the flow

No | Is the compromised load upended within container and drum penetrated | Yes → Immediately reposition drum and or transit bin to stop flow

No | Is the compromised load simply a leaking drum with no shifting of containment | Yes → Block flow immediately with absorbent material and decant the drum into another if slurry

No | Is the compromised load a result of a major traffic accident | Yes → Block flow as well as ascertain injury. Assume control of accident site until taken over. Make sure emergency services aware of POPs. Prevent access by unprotected public if POPs leaking

No | Are there people lying inured with the compromised load | Yes → Provide First aid until arrival paramedics. Prevent POPs contaminating victims. Make sure Paramedics aware of POPs, provide them with PPE if needed.

To Step 3

WPI EMERGENCY RESPONSE DURING ESCORT OF POPs TRANSPORT FLIP SHEETS WPI 4.4

Item	Instruction Number	Procedural Instruction - Mozambique project	Page 6

Emergency Plan

Contain the POPs

STEP 3

Yes | Is the leak or spill contained and cannot further contaminate the environment | No → Take immediate and urgent steps to contain the leaked POPs

No | Are there drains in the immediate area of the POPs spill or leakage | Yes → Immediately position drain bund bags over drain exits. Block all access to waterways and drains immediately

No | Is the POPs leaking on the ground directly from the truck tray | Yes → Immediately place plastic sheeting on the ground and drive truck onto the sheet

No | Is the POPs slurry flooding out from the containment directly onto ground surface | Yes → Urgently provide dykes using fullers earth, soil, sawdust and plastic sheeting to contain POps from further expansion of surface area

No | Is the POps now contained | Yes → Use sand, sawdust, rags absorbent materials to recover the POPs and place in wide mouth drums. Dig contaminated soils down to 100mm and place in plastic lined transit bins.

To Step 4

Item	Instruction Number	Procedural Instruction - Mozambique project	Page 7

Emergency Plan

Notifications

STEP 4

No | Is the leak or spill contained and cannot further contaminate the environment | Yes

No → Go Back to Steps 1-3

Yes → Take immediate and urgent steps to Notify all the appropriate authorities and services

Notifications to be performed in the order shown by telephone, radio & Fax

Contact Name	Organisation Name	Telephone Number	Fax Number	Time Done	Date	Acknowledged
	Supervisor					
	Project Manager					
	Control Room					
	Project Engineer					
	Local EPD					
	Provincial EPB					
	Central EPA					
	Road & Traffic Authority					
	Local Police Bureau					
	Fire service department					

No | Are all the Notifications complete and acknowledged | Yes

Yes → To Step 5

Item	Instruction Number	Procedural Instruction - Mozambique project	Page 8

Emergency Plan

Protect Personnel & Public

STEP 5

Yes | Is the leak or spill contained and cannot further contaminate the environment and is no further danger to the public or the environment | No

No → Take immediate and urgent steps to protect the public and personnel

No | Are there public about in the immediate area | Yes

Yes → Immediately Block access to the general public and any non essential personnel including emergency services that are not directly required. Place "Chemical Spill" Signs and rope area off with danger tape

No | Are all clean up personnel trained in dealing with POPs spills safety procedures involved with the recovery and clean up | Yes

No → Remove untrained personnel

Yes → Ensure all clean up crew are provided and are wearing PPE

No | Is there a significant exposed area of POPs in a semi enclosed situation | Yes

Yes → Urgently provide immediate area personnel with BA sets as required

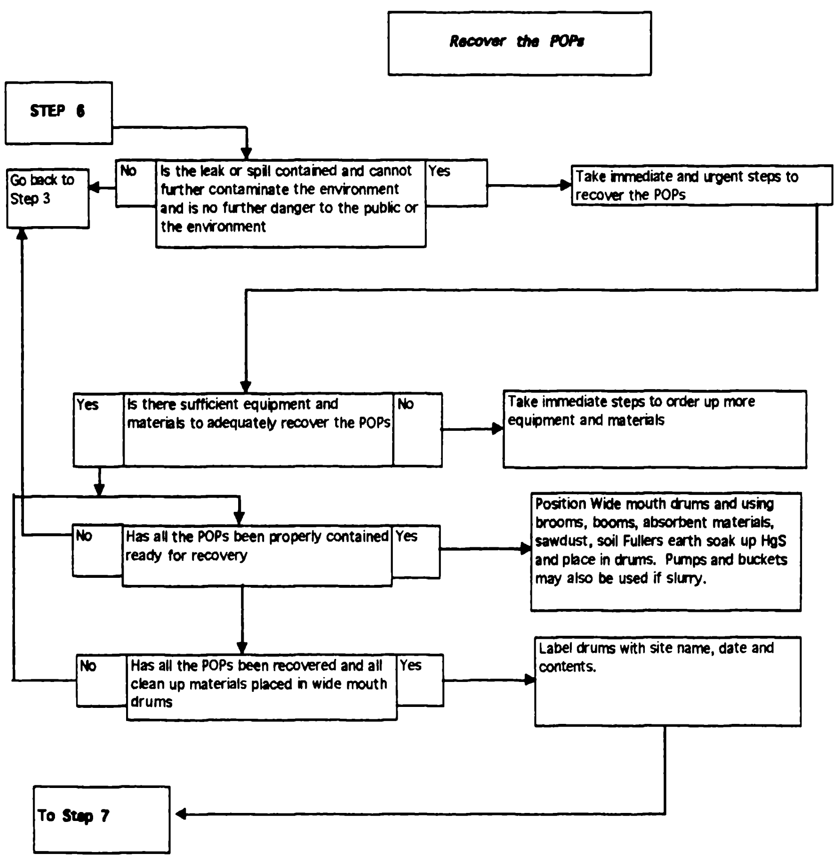
No | Have any public has their clothing contaminated | Yes

Yes → All contaminated clothing of POPs personnel and public are to be collected and placed in waste drums.

To Step 6

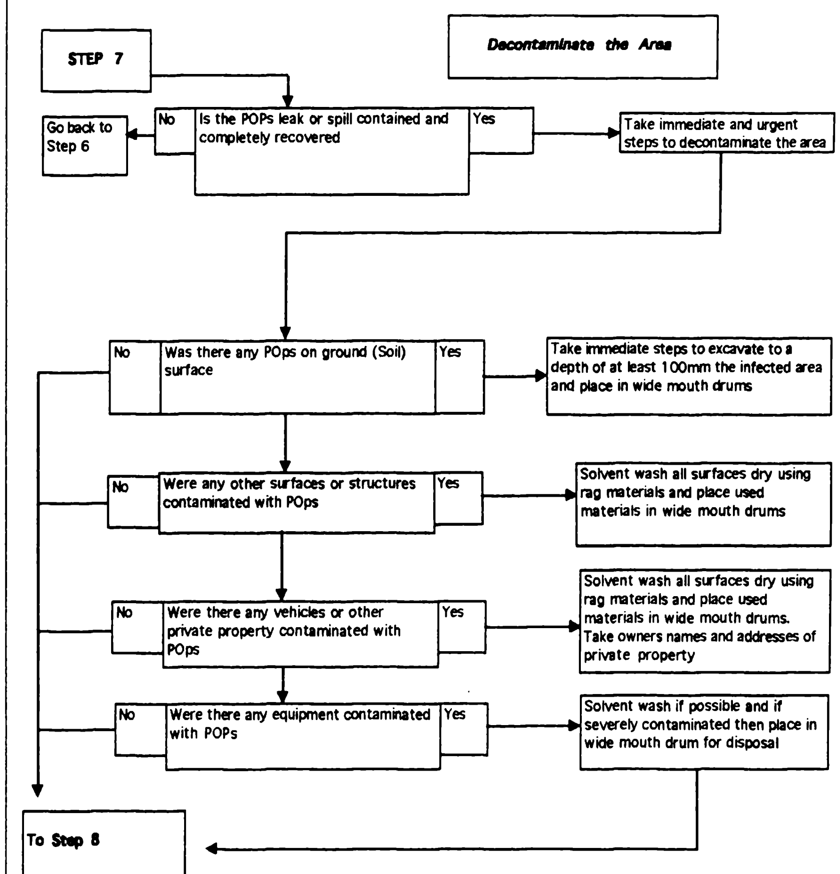
Item	Instruction Number	Procedural Instruction - Mozambique project	Page 9

Emergency Plan



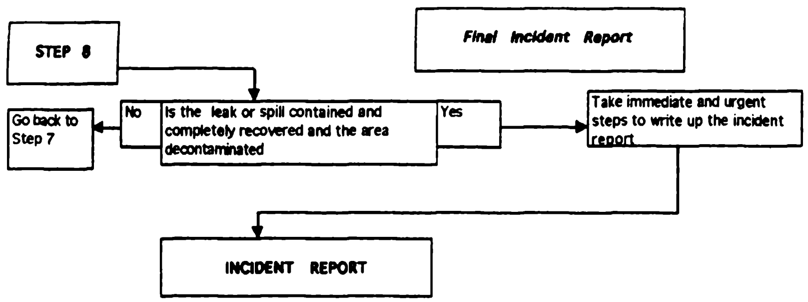
Item	Instruction Number	Procedural Instruction - Mozambique project	Page 10

Emergency Plan



Item	Instruction Number	Procedural Instruction - Mozambique project	Page 11

Emergency Plan



Details of Location	Date of Incident	Duration	Date of report
Details of the accident or spill incident			
Description of the Spill site			
Description of Spill, Amount of Spill, Type of POPs			
Description of recovery operations			

Incident supervisor signature Attesting all POPs cleaned up and removed

WORK PROCEDURE INSTRUCTIONS

WPI 4.10 Documentation

Site Name : Date: Form WPI 4.10-A

Register of Personnel Movement (Site Workers)

Organisation	Name	Position	Time In	Time Out	PPE Attired	Comments

QA Inspector Compliance Signature	
Job Site Supervisor Signature	

Site Name : Date: Form WPI 4.10-B

Register of Personnel Movement (Drivers and off site personnel)

Organisation	Drivers Name	Authorised by	Time In	Time Out	Payload Weight	Comments

QA Inspector Compliance Signature	
Job Site Supervisor Signature:	

Site Name : Date: Form WPI 4.10-C

Register of Personnel Movement (Visitors)

Organisation	Name	Authorised By	Time		PPE Attired	Comments
			In	Out		

QA Inspector Compliance Signature

Job Site Supervisor Signature

WPI Check Sheets WPI 4.10

Ware House Name : Date: Form WPI 4.10-D

Register of Incoming Materials

Supplier	Superbags	Containers	Other	Chkd BOL	Qty	Comments

QA Inspector Compliance Signature.

Job Site Supervisor Signature

WPI Check Sheets WPI 4.10

Ware House Name : **Date:** **Form WPI 4.10-E**

QA Check List (Site Workers)

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
Training Programme Completed				
Medical Examinations completed				
Site briefing completed				
Protective Clothing for clearance workers				
Uniform for other workers				
Decontamination procedures correct				
Defence Lines in place				
Clothing changes				
Register of Staff Movements completed				

QA Inspector Compliance Signature:	
Job Site Supervisor Signature:	

WPI Check Sheets WPI 4.10

Ware House Name : **Date:** **Form WPI 4.10-F**

QA Check List (Drivers)

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
Register of vehicle movements completed				
Transport vehicle labelling correct				
Weights of tare for Transport vehicles recorded				
ERU Vehicle available for escort duties				
Drivers briefed				

QA Inspector Compliance Signature:	
Job Site Supervisor Signature:	

Ware House Name : **Date:** **Form WPI 4.10-G**

QA Check List (Visitors)

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
Valid Authorisations				
Correct Attire				
Correct PPE				
Register for Visitors completed.				
Visitor briefing completed				
Visitor guide provided				

QA Inspector Compliance Signature:	
Job Site Supervisor Signature:	

Site Name : **Date:** **Form WPI 4.10-H**

QA Check List (Equipment)

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
Primary Zone equipment in place				
Secondary Zone equipment in place				
Tertiary Zone equipment in place				
Fire fighting equipment in place and all present				
Telephone and fax available				
First Aid equipment in place				
Spill clean-up materials in place				
Decontamination Facility in place				

QA Inspector Compliance Signature:
Job Site Supervisor Signature:

WPI Check Sheet WPI 5.10

Ware House Name : **Date:** **Form WPI 4.10-I**

QA Check List **[Emergency Systems]**

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
ERU Unit Available				
Packaged Spill Systems in place during operations				
Fire fighting systems in place during operations				
First aid systems in place during operations				

QA Inspector Compliance Signature:
Job Site Supervisor Signature:

WPI Check Sheets WPI 5.10

Site Name : **Date:** **Form WPI 4.10-J**

QA Check List **[Waste Labelling & Recording]**

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
Labelling of Capacitors/Transf				
Classification sticker				
Recording of Waste information and Waste name on Form WPI 4.10-M				
Recording of Individual Big bags and drums on WPI 4.10-M				
Placement of all transit units labels as per the Packaging Plan WPI 4.5				
Labelling of Containers				
Correct Naming of Waste				
UN Classification Number				
Waste Type labels				
Toxic Chemical Ref 4 x				
Consignee name and address				
Emergency Contact Numbers				
Labelling of Transport Vehicle				
Name of Clearance Company				
Telephone Number				
Waste stickers				
Emergency procedures handbook				

QA Inspector Compliance Signature:
Job Site Supervisor Signature:

Ware House Name : **Date:** **Form WPI 4.10-K**

QA Check List (Container Survey)

Description	Compliance Record Y	N	Improvement/Remedy	Comments
Container Precheck				
Container Survey check Door Seal inspection				
Close Door Test Sound Floor inspection				
Plate date inspection Recording of tare and number				
Marine Survey				
No required				

QA Inspector Compliance Signature:	
Job Site Supervisor Signature:	

Site Name : **Date:** **Form WPI 4.10-L**

QA Check List (Packaging)

Description	Compliance Record Y	N	Improvement/Remedy	Comments
Packaging Standards				
Packing of Transit units according to WPI 4.5				
Correct internal big bag liners and Drum PE Liners				
Correct internal corner and layer bracing				
Inspection of transit unit before close				
Correct recording of Transit units				
per container				

QA Inspector Compliance Signature:	
Job Site Supervisor Signature:	

Site Name : Date: Form WPI 4.10-T

QA Check List [TRANSPORT]

Description	Compliance Record			Comments
	Y	N	Improvement/Remedy	
Marine Survey Are all MS checks complete				
Route Planning Has the route been carefully planned				
Escort Vehicle Is the Escort vehicle available and ready				
Health & Sobriety Is the driver sober and healthy				
Communication Are all communication checks complete Radio,Cell Phone working				
Rest & Load Check Stops Are the load and Rest stops planned				
PPE in Cab Is the PPE loaded into Drivers cab				
Emergency procedures Are the Emergency procedures in Cab				
Driver Briefing Is the driver briefed				
Container Labels Are the correct container labels affixed				
Vehicle Labels Are the correct vehicle labels affixed				
Vehicle COF Is the vehicles COF current				
Vehicle Condition Is the vehicle mechanically safe				
Load Delivery documentation Are the correct papers with the driver				

Departure Time	
Departure date	
Arrival Time	

Destination Place	

Record Rest and Load Check Stops

Rest Stop #1 Time	
Rest Stop #2 Time	
Rest Stop #3 Time	
Rest Stop #4 Time	
Rest Stop #5 Time	

Load Check Time #1	
Load Check Time #2	
Load Check Time #3	
Load Check Time #4	
Load Check Time #5	

QA Inspector Compliance Signature:

Job Site Supervisor Signature:

Site Name : Date: Form WPI 4.10-M

Transit Unit #

Register of Waste For Super bag

BOX Container Number

Item #				MFG Number	Date of Manufacture	Manufacturer	Weight (KG)	Comments
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
						Total Weight=		

QA Inspector Compliance Signature:

Job Site Supervisor Signature:

Site Name : Date: Form WPI 4.10-N

Container #

Register of Waste Per Container

Transit Unit #	Weight	Truck Tare	Truck & Container Tare	Container Weight	Transhipped by	Comments

QA Inspector Compliance Signature:
Job Site Supervisor Signature:

Ware House Name : Date: Form WPI 4.10-O

Register of Waste - Container Despatch

Container #	Weight	Marine Survey Date	Labels and BOL Date	Despatch Date	Export Permits MOTC	Current Location

QA Inspector Compliance Signature:
Job Site Supervisor Signature:

Site Name : Date: Form WPI 4.10-R

NCR No

Non Compliance Report

Part 1 Non Conformance
Relevant WPI Number:

Reported By: Date

Part 2 Disposition
Relevant WPI Number.

Use as is [ ] Rework [ ] Repair [ ] Reject [ ]

Describe action taken

Reinspection Required Y [ ] N [ ] Date

Part 3 Close Out

Disposition Completed by ________ Date ________

Resinspected by ________ Date ________

NCR Closed out By ________ Date ________

QA Inspector Compliance Signature	
Job Site Supervisor Signature	

Site Name : Date: Form WPI 4.10-Q

Report No

Accident and Injury Report

Part 1 - Victim Details

Name of Worker		Date of Accident or Injury	
Address of Worker		Next of Kin advised	
Employed by :			
Home Phone Number			
Accident or Injury Reported by:			
Immediate worker supervisor			
Location and time of accident or injury			

Part 2 - Nature of Accident or Injury

Describe accident or injury

Describe Injuries received

Part 3 - Action Report

	Action and or Name of Institution
On site First Aid applied	
Transfer to Medical centre	
Transfer to Hospital	
Fatality	

	Authority name and notification method.
Notifications to Authorities	

Witness to accident - Report (Witness Name)	
Supervisors Accident Report (Immediate Supervisor name)	

QA Inspector Compliance Signature.	
Job Site Supervisor Signature	
Report Author Name and Signature	

SECTION TWO - TENDER DOCUMENTATION

Introduction

The information that appears on the following pages is a sample tender and contract document. This document is constructed on the basis of the operating manual being established and thus this documentation uses the information contained in the above manual.

Tender

Contract : A-Chem 1

Handling, Packaging, Transportation and Destruction of Unwanted Agri-chemicals

For

XXXXXXXXXX

Contents

SECTION ONE

INSTRUCTIONS TO TENDERER

1.1 Introduction
This Contract is for the removal of hazardous agri-chemicals as per Appendix A from their current store in ...., their repacking and transportation to a disposal site and the ultimate disposal in an environmentally sustainable manner.

1.2 Principal
The Principal is ...

1.3 Superintendent
The Principal is represented by his Superintendent;

1.4 Delivery of Tenders
Two copies of the Tender offer and response shall be delivered to

Attention
By the end of business : **Friday XXXXXX**

1.5 Copy of Specification

One copy of the Tender document is made available free of charge. Additional copies will be available for $50 each. This sum is to cover the reproduction costs and is not refundable

1.6 Alternatives

Should the Tenderer consider that it can offer any advantages to the Principal by a modification to the Specification, it may set this out in a covering letter a description of the modification and the reduction in price if such modification is accepted by the Principal. Notwithstanding the description, drawings or literature which may be submitted with the Tender, all details will be assumed to be in accordance with this Tender document.

1.7 Interpretation

If the Tenderer has any doubt as to the meaning of any part of the Conditions of Contract or of the specification, it shall set out in his covering letter the interpretation on which it relies.

1.8 Additional Information

Additional information the Tenderer may require during their Tender document compilation may be obtained from;

1.9 Validity

All Tenders shall remain open to acceptance by the Principal for a period of not less than 60 business days after Tender closing.

1.10 Scope of Tender

Tenders shall be for the complete supply of all equipment and services covered by the specification. Part Tenders will not be considered.

1.11 Information with Tenders

Tenders shall be submitted with all information requested in the specification. The tenderer shall provide details of current staff and a reference list of similar completed projects of this nature with telephone numbers of clients for reference purposes. All schedules in Section 5 shall be completed as part of the Tender response.

1.12 Scope of project

This specification covers the total management of the agri-chemicals stockpile from initial handling right through to the ultimate disposal. The stockpile is currently stored in transit bins in a storage facility in ......

1.13 Drawings

The drawings as listed in the appendices have been provided in order to show the scope of the works.

1.14 Local information

The Agri-chemicals are stored in a hazardous goods storage facility in xxxxxxx and in the main are held in UN rated drums within transit bins. The schedule of bins, drums and contents are as shown in Appendix A

1.15 Regulations and bylaws

The whole of the Contract shall be carried out in accordance with local and international regulations which include but are not limited to the following:

Resource Management Act 1991
Toxic Substances Act 1979
HSNO 1996
Hazardous Substances Storage Regulations
Dangerous Goods Act
Code of Practice for The transport of hazardous Substances on Land S5433 1988
UNEP Basel Convention
IMO
IMDG

1.16 Project Description

The project consists of extraction from an existing warehouse of Agri-chemical waste as per the Appendix A attached, their unpacking from their existing bins and their repacking into new bins, transportation, interim storage containerisation and then ultimate destruction. The project includes all documentation and safety issues associated with such a project.

1.17 Project timing

Refer to the attached Project Time scales

SECTION TWO

CONDITIONS OF CONTRACT

2.1 Conditions of Contract

The Conditions of Contract shall be the Australian Standard Conditions of Contract AS2124. 1992

2.2 Amendments to the General Conditions of Contract

The following clauses have been deleted or amended in the General Conditions of Contract.

For additions to the General Conditions of Contract refer to the Special Conditions of Contract.

Clause 1 Construction of Contract

In the first paragraph delete "the State or Territory named in the annexure" and insert ....

Clause 2 Interpretation

Page 6 Delete from this clause the section entitled "practical Completion" Part (c) of the following:

".....which in the opinion of the Superintendent, are essential for the use, operation and maintenance of the works......."

Clause 8.4 Supply of Documents

Delete the last paragraph of this clause and insert the following:

All documentation prepared under this Contract shall be the property of the Principal. The Principal shall be entitled to use these documents for any purpose other than for resale.

The Contractor shall at the time stated in the Contract deliver the Principal copies of all documents.

The Principal's Superintendent has the right to inspect, check and verify all detailed design and construction documents, planning and scheduling documentation, trans frontier documentation and any other documentation pertinent to this Contract and at the Principal options may make this documentation available to an independent auditor appointed by the Principal.

Clause 10.6 **Direct Payment of Designated or Nominated Sub Contractors**

Page 17 Delete this clause in its entirety.

Clause 13 **Patents, Copyright and other intellectual property rights.**

Page 19 Delete the last paragraph of this clause and insert the following:

The Contractor warrants and guarantees that all designs, drawings, specifications, programming, methodology and planning systems, methods of operation and working provided for or prepared by the Contractor under this Contract do not infringe any valid patent, registered design, trademark or name, copyright or other protected right. The Contractor agrees to indemnify and hold harmless the Principal against all actions, proceedings, claims, demands, liabilities either expressed or implied and all costs, losses, damages and expenses whatsoever resulting or arising from any claim or infringement of any patent, registered design, trademark, copyright or any other property interest of a third party resulting from the designs, drawings, specifications and other documentation provided or prepared by the Contractor under this Contract. The Contractor shall at his expense take all necessary action to ensure the Principal's use of such documentation, material and equipment during any such proceedings or actions referred to in this clause.

Clause 14.2 Payment where there is no variation

Page 20 Delete this clause in its entirety

Clause 14.3 Notice and fees

Page 20 Delete this clause in its entirety

Clause 17.1 Indemnity by the Contractor

Page 22 ***Delete sub-points (d) and (e)***

Clause 17.2 ***Indemnity by the Principal***

Page 23 Delete this clause in its entirety

Clause 27.1 **Possession of Site**

Page 27 The following additional paragraph is to be inserted:

"Should any delay take place in giving the Contractor such possession of the site the delay shall be deemed not to constitute a breach of Contract on the part of the Principal but shall be a ground for an extension of time for Practical Completion"

Clause 29 **Materials, Labour and Construction plant**

Page 29 Add new subclause 29.4 as follows:

Clause 29.4 **Liens and charges**

The Contractor warrants that all equipment and material supplied by him under the Contract are free from all claims and encumbrances whatsoever and the Contractor shall hold the Principal free and harmless against any and all claimants furnishing labour, equipment, services and material in connection with the performance of the Contract.

Clause 35.5 **Extensions of time for practical completion**

Page 35 Amend this clause as follows:

(i) In the second paragraph, after "to an extension of time for practical completion" insert "for that delay which the Contractor has clearly demonstrated delayed the critical path of the works."

Clause 38 **Clean up**

Page 38 Amend this clause as follows:

(i) **Add a new paragraph below the first paragraph as follows:**

"in the event that the Contractor fails to keep the site in an environmentally clean, and tidy condition and does not remedy such default within 24 hours of receipt of a written instruction from the Superintendent, the Superintendent may then, without giving further notice to the Contractor, have the work of cleaning and tidying up carried out by other persons. In this event the Contractor shall pay the Principal for the incurred and reasonable cost of cleaning arranged by the Superintendent . Any amounts due the Principal pursuant to this clause may be deducted from moneys otherwise due to the Contractor or may be recovered by the Principal as a debt due to the Principal by the Contractor.

Clause 48.5 **Arbitration**

Page 53 Delete reference to "Australia" and insert "....................".

SECTION THREE

SPECIAL CONDITIONS OF CONTRACT

SC1 INDEPENDENT CONTRACTOR

The Contractor warrants to the Principal as at the date of the Contract and at all times during the performance of the work under the Contract that it shall act as an independent Contractor and shall not act as an agent of the Principal or the Superintendent in executing the work under the Contract and maintaining control over his employees and sub Contractors and shall execute all the work under the Contract in accordance with his own methods, subject to complying with the Contract, and nothing contained in the Contract or any sub Contract ordered by the Contractor shall create any Contractual relationship between any sub Contractor and either the Principal or Superintendent.

Where the Contract provides for the Contractor to design or develop systems equipment and methodology the Contractor hereby acknowledges that the Principal is relying on the Contractors knowledge, skill and judgement to produce a completed product that is fit for the purpose.

SC2 APPROVAL BY THE SUPERINTENDENT

Whenever the words "or equal" or "equivalent" appear in the Contract, they shall mean "or approved equal" or " approved equivalent" as the case may be.

Unless expressly stated to the contrary, or unless the context does not permit, whenever the word "approved" or approval appears in the Contract, then such words shall mean "approved by the Superintendent" and "approval by the Superintendent" as the case requires.

All documentation prepared by the Contractor shall be provided to the Superintendent for review in the period specified in the Contract or where there is no period specified at a reasonable time prior to their issue for use for the purposes of the works. The Contractor shall not perform any change to the works which affects the functional quality of the works or any part thereof including the substitution of any alternative or equivalent material or systems or methods for the materials, systems or methods described in the Contract and specifications and/or included in any documentation previously approved by the Superintendent without first obtaining the further review of the Superintendent of the documents indicating such changes. The Superintendents view shall not relieve the Contractor from responsibility for any errors or omissions contained in the documentation prepared by the Contractor or from his obligations to comply with the requirements of this Contract.

SC3 CO-ORDINATION WITH THE PRINCIPAL AND OTHERS

The Contractor shall be solely responsible for the direction, coordination and co-operation of all persons employed by him including all nominated sub Contractors and suppliers.

The Contractor acknowledges that during the execution of the work under this Contract that there may be other Contract work proceeding on the same site. The Contractor shall fully cooperate with and take all necessary steps, and comply with all directions issued by the Superintendent where those steps or directions are necessary to avoid impeding the work of others. The Contractor shall also cooperate fully with any other persons engaged by the Principal in coordinating the provision of emergency services and security services and any other mater relating to the project as a whole.

In the event of differences arising with regard to priorities on Site between the Contractor and other parties, the Superintendent shall decide the issue and his decision shall be binding on all parties.

SC4 DATA AND INFORMATION

Comprehensive information and data capture is required as part of this Contract and such information and data shall be submitted to the Superintendent during the progress of the project in accordance with the schedules in the annexure.

SC5 CONTRACTOR'S INVOICE AND REPORTING DOCUMENTS

The Contractors Payment claim shall be completed in an acceptable manner and shall comprise the following documents.

- Progress Payment Claim
- Network programme update
- Updated cash flow payments forecast

Other reports to be provided at regular intervals are;

- On a daily basis
- Site Injury report
- Daily Site report
- On a weekly basis

- *All QA Documentation as per performance specification*
- *Summary activity reports*

Failure or lack of co-operation of the Contractor to prepare the payment claim as required with all the supplementary documents shall be cause for withholding all or part of the progress payment then pending until such time as the Contractor has met the requirements to the satisfaction of the Superintendent.

SC6 OFF SITE INSPECTIONS

The Superintendent shall have the right to inspect the Contract at any point in the life of the Contract including the premises of the ultimate disposal facility that is to be used under this Contract. Any such inspections,checking or approvals or acceptance given by the Superintendent shall not relieve the Contractor of his obligations under this Contract.

SC7 POWER OR PRINCIPAL TO TERMINATE

The Principal may, at any time and at his absolute discretion, terminate the Contract in whole or from time to time in part by giving the Contractor 7 days written notice thereof whether or not the Contractor is in default.

SC8 ACKNOWLEDGEMENT BY THE CONTRACTOR

The Principal, Superintendent and/or their agents, employees, consultants and representatives shall not be liable whether in Contract, tort (including negligence) or to the extent legally possible pursuant to any other principle of law for any information provided to the Contractor for any errors therein or arising therefrom;

The Contractor acknowledges that it did not in any way rely upon information whether contained in the Contract or not which may have been provided to him by the Principal or the Superintendent or any other party referred to in the proceeding paragraph for the purposes of entering into the Contract and further acknowledges that all such information was furnished for the convenience of the Contractor only;

The Contractor further acknowledges that it enters into this Contract based on his own investigations and determinations.

SC9 REGULATORY AUTHORITIES

The Contractor shall comply with that all laws and regulations and valid directions of governmental authorities and other relevant Regulatory Authorities (e.g. Basel Convention).

SC10 INVOICES AND RECORDS

During the term of this agreement and for a period of three months after the final certificate of destruction;

The Principal may question any invoice presented by the Contractor and may require correction of any error therein whether or not the invoice relates to a payment which has already been made; and

The Contractor shall keep and maintain books, receipts, vouchers, dockets, certificates and other documents relating to items of expense for which the Principal is required to make reimbursement to the Contractor and if required by the Principal shall allow an audit thereof by the auditor appointed by the Principal.

SC11 SUPERVISORY PERSONNEL

The Contractor shall assign adequate supervisory personnel to the Contract to ensure that the works are performed in accordance with the Contract and Contract programme. If the Superintendent, having given the Contractor reasonable notice to rectify the situation is not satisfied that this is being achieved, it may instruct the Contractor to supply additional personnel to the Contract at no additional cost.

SC12 COMMUNICATIONS

Formal communication between the Contractor and the Superintendent, including notification of claims for variations and extensions of time for practical completion, safety issues, design and method changes, Non compliance reports, substitutions and site and transport issues, shall be in writing and signed by the Contractors representative.

SC13 CONSEQUENTIAL DAMAGES

Except as otherwise expressly provided , neither party to the Contract shall be liable to the other party by way of consequential dangers including loss of production, loss of use, loss of revenue, loss of profit, business interruption, or any indirect loss whatsoever.

SC14 INSURANCE SPECIAL CONDITIONS

In addition to the General Conditions of Contract the following shall apply:

Insurance to be maintained by the Contractor (See section 8).

SECTION FOUR

SCOPE OF WORK

4.1 Introduction

This section of the Contract covers the detail of the overall Scope of Works. This document does not attempt to describe and specify the entire schedule of works. The Contractor is responsible for placing before the Superintendent for his approval a comprehensive written project plan as part of his contractual duties that fully describes how the project will be conducted. The descriptions here are simply to assist the tenderer understand the overall scope of the project.

4.2 Current storage

The Agri-chemicals that are the subject of this Contract are currently safely and correctly stored at a hazardous goods storage facility in xxxxxxx.

4.3 Scope of works

This Contract involves the removal of approximately XXX steel bins that contain approx XXX UN rated drums (205lt). The bins are to be unpacked and returned to the hazardous storage facility. The removal and transportation of the bins from the hazardous storage facility must be performed under the technical specifications noted in section seven of this Contract (ie with full escort etc.).

When the bins have arrived in an approved facility for repackaging (this facility must be in compliance with the XX storage code) they must be repacked into new containers prior to packing into shipping containers. Rules of segregation apply.

After the containers are marine surveyed they are to be transported to the port of departure (if disposal offshore) and the Transboundary documentation prepared and executed. All transportation to be escorted within xxxxxxxxx and overseas if required by regulation.

Upon arrival the shipment is to be taken to the site of disposal and disposed of.

The execution of this Contract also involves an extensive documentation system to ensure compliance with the procedures as written in the Contractor **project plan. This plan will be extensive and require substantial time to compile and manage during all aspects of the project.**

The primary Aim of the project methodology within this project is to provide the highest level of confidence that the disposal of the agri-chemicals will be performed to a high technical level that recognizes all environmental safeguards inherent in the laws and regulations of xxxxxxx , the Basel Convention and the Country of destination. The primary Goal of the methodology contained within this document is to ensure that the clearance, transportation and ultimate destruction is performed without endangering the public or environment. This goal of ensuring there are no accidents or spillage. leaks or escapes to the environment of any kind to be achieved by rigid enforcement of the plans and procedures that are proposed to be utilized by the contractor.

It should be noted that within the drums of waste are the original containers. There are several thousands of these containers from plastic cans, to glass bottles. This project covers the safe destruction of all of these containers.

SECTION FIVE

TENDER RESPONSE DOCUMENTATION

5.1 Preliminary

All parts of section five are required to be completed in every detail for the Tender to be considered valid.

Tenders may photocopy the forms that make up this section and type the data required on them.

5.2 Tender Procedure

Tenders shall be submitted in two sealed envelopes contained in a single larger envelope, also sealed. The second envelope shall contain the price offered. No disclosure of price shall be made in the first envelope. The envelopes shall be clearly labeled **"Envelope No.1 (Proposal, excluding price)"** and **"Envelope No.2 (Price)"**.

The tenders will be evaluated from a technical proposal first and ranked. The prices will then be assessed and the Principal will then hold negotiations with the preferred contractor.

FORM OF TENDER (FORM 1)

PROJECT :
AGRI-CHEMICALS DESTRUCTION

TENDER FORM

**Name of person,
firm or company
tendering
USE BLOCK
LETTERS..**

address of...
hereby Tender(s) to perform the work for

Description
of works
(Contract No. A-Chem 1) in accordance with
the following document ....
List Documents
....

If the Tenderer is a firm the
1. For the lump sum of (A-H).....................................
full names of the individual ....
members of the firm must
be stated here.
2. At the rates (I) in the Price Schedule............................
....
Dated this.......................day of....................1998

....
Signature of Tenderer

PRICE SCHEDULE (FORM 2)

PROJECT :
AGRI-CHEMICALS DESTRUCTION

Name of tenderer ....
Part Description
Amount ($)
(Scope and Quantity as per Appendix A Schedules)

A	Project Management and documentation systems
B	Receiving transit bins and unpacking
C	transport to interim storage site
D	Repacking into new transport media
E	Containerisation and Port transport
F	Shipping and offshore transport
G	Receiving, handling and disposal
H	Other (Specify)

TOTAL FIXED PRICE OFFER AS PER APPENDIX A

$............................

Signed by Duly Authorised Officer of the Company............................

Name:.................................

Title:.................................

Company name and stamp:.......

Date:.................................

PREVIOUS EXPERIENCE AND HISTORY (FORM 3)

PROJECT :
AGRI-CHEMICALS DESTRUCTION

The Tenderer is to list his entire experience with the management, handling and disposal of hazardous Agri-chemicals as described in the Scope of Works. The detail here should include CV's of personnel that are proposed, the Company's overall experience, the total tonnages last five years. All countries that the Tenderer has operated in shall be listed along with a project listing in those countries

TIME AND ACTIVITY PROGRAMME (FORM 4)

PROJECT : REGIONAL COUNCIL CONSORTIUM
AGRI-CHEMICALS DESTRUCTION

The Tenderer is to provide his expected time and activity schedule that will provide sufficient detail to see that deadlines can be met and the logical sequence of activity required.

The deadlines are as follows:

Removal of all Agri-chemicals from xxxx storage by xxxxx.

Destruction certificates by xxxxxxx.

QUALITY ASSURANCE AND CERTIFICATIONS (FORM 5)

PROJECT :
AGRI-CHEMICALS DESTRUCTION

The Tenderer is to provide a detailed description of the Quality Assurance system it uses and the certifications it holds. The preference is for ISO 9001 and ISO 14000 but if the Tenderer has a different system then full details are required. In addition copies of the certificates and the citations are required along with the name of the certifying authorities.

TRANSBOUNDARY DOCUMENTATION (FORM 6)
PROJECT :
AGRI-CHEMICALS DESTRUCTION

If the Tenderer intends to ship the waste offshore for disposal then they are to provide evidence of previous CERFA documentation and evidence that the offshore disposal facility will accept the waste and if necessary copies of bilateral letters between xxxxxx and the receiving Government

INSURANCE CERTIFICATIONS (FORM 7)
PROJECT :
AGRI-CHEMICALS DESTRUCTION

The Tenderer is to provide copies of statements from its insurance company that confirm that cover is held as required by the specifications and the amounts provided for and the type of policy involved.
The contractor is also required to comply (for offshore disposal) with the EU requirement Art 27 (2.5.9-93) with respect to return of shipments. A bank bond will be required to provide at least $ 50,000 to cover for the possibility of the waste return to xxxx. The Bond cover confirmation availability will be required.

DISPOSAL FACILITY AND LICENCES (FORM 8)
PROJECT :
AGRI-CHEMICALS DESTRUCTION

Onshore facility
If the tenderer intends to use an on shore facility then it must provide comprehensive details on the facility, method of operation, emissions, licences, owners, history etc.

Offshore Facility
If the tenderer intends to use an offshore facility for disposal then it must supply complete details of the facility including mode of operation of the destruction process, all relevant details regarding emissions, owner, location, years in business, capacity, etc. In addition a copy of all current operating licences are required as well as trial burn data. A letter from the administering EPA of the off shore company is required indicating that the plant has the appropriate licences and warrants to operate the facility for the destruction of waste Agri-chemicals.

METHODOLOGY AND SYSTEMS SECTIONS 1-9 (FORM 9)
PROJECT :
AGRI-CHEMICALS DESTRUCTION

The Tenderer shall provide comprehensive examples and evidence of his project plan and the methodology that will be engaged to perform the scope of works in the manner as described in Section seven of this document. The tenderer must provide sufficient information to allow the Principal to ascertain the Tenderers ability to perform the works in the manner described.

SECTION SIX

SPECIFICATION - PRELIMINARY AND GENERAL

6.1 Preliminary

The work is to be carried out in accordance with the accompanying specification and the General and special conditions of Contract.

6.2 Intent

The intent of the specification is to show the Contractor the minimum standards that are required to complete the scope of works. The tenderer is required as part of the tendering procedure to clearly demonstrate that it has the experience and history to undertake a project of this nature. This demonstration of his ability to undertake the works will include detailed documentation standards, Quality Assurance standards and a photographic history of previous similar works.

6.3 Tender Documentation

The documentation required as part of the Tender response is detailed in section five of this document. All sections of section five are required to be completed to ensure that a valid Tender is submitted. If any part of section five is not provided then the Tender is likely to be rejected.

6.4 Contractor to satisfy themselves

The Contractor shall be deemed to have satisfied themselves by personal inspection of the current storage site and the interim repacking site and the interim storage site that the works planned are feasible and that his organisation can perform the works prior to commencing the works.

6.5 Sub-contractors

If the Contractor proposes to sublet any part of the Contract or works specified in this Contract then they shall first obtain the Superintendent's approval of the firms to whom proposes such work shall be sublet.

6.6 Other Contractors or Service authorities

Where necessary, the Contractor shall coordinate the activities of other contractors or service authorities in association with his own programme of work. The Contractor shall be deemed to have made sufficient allowance in his Contract price for such coordination.

6.7 The Contract

The Contract shall be a lump sum Contract based on the price quoted provided in the Schedules enclosed in this specification (section 5), and subject to authorised extras, or deductions from, the Contract and to variations of final costs of provisional sums allowed.

Where extra items of work, which is not covered under this Contract has been requested by the Superintendent then these items must be covered by an authorised variation order issued by the Superintendent.

6.8 Variations to the Contract

The Superintendent may order variations to the Contract as set out in the Conditions of Contract.

6.9 Possession

The Principal shall have the right to take possession of, and use any completed or partially completed portion of the work, notwithstanding the time for completion of the whole work or portions of the work that may not have expired.

6.10 Project Plan

The entire project shall be conducted from a written set of procedures that are produced by the Contractor and approved by the Superintendent. The project plan is to be completely integrated across all facets of the project and cover all detail for the entire project. No part of the project is to be performed without a written procedure that is part of an overall QA system that is to be regularly audited (with copies of the audits being sent to the superintendent) during the project.

6.11 Materials and workmanship

All materials and workmanship shall be of the best quality throughout and subject to the approval of the Superintendent and generally in accordance with the requirements of the UN packaging codes and the Basel convention standards.

6.12 Transboundary Documentation

All offshore shipments of hazardous waste are to be provided with the correct documentation as required by the Basel Convention. If the destination country is not a Basel member then the Tenderer will be required to demonstrate that it has a bilateral letter from the two Governments involved that the shipment will be accepted by both parties. Under no circumstances is the shipment allowed to go to a non OECD country for disposal.

6.13 Reporting Requirements

The Contractor is required to present a project programme on a continuous basis. This programme will be drafted on a time scaled network, showing the logical progression of the all activities necessary for the orderly completion of the works in sufficient detail to enable the Superintendent to evaluate progress and to order additional activity should the programme be behind schedule. To that end the Contractor shall be required to furnish progress information in report format on a weekly basis and shall be based on activity points in each area of work.

6.14 Project Management & Planning

This project requires a full project management approach involving a hierarchy of activity compiled within a project manual as follows:

The structure of the manual is to have at least four parts;

Part 1	Project Plan
Part 2	Safety and Environmental Plan
Part 3	Quality Assurance Plan
Part 4	Work Procedure Instruction

Within each of those parts are to be sections covering the following;

Section One	:	Management Plan
Section two	:	Site Inspection Plan
Section three	:	Clearance plan
Section four	:	Site Preparation plan
Section five	:	Packaging plan
Section six	:	Transportation plan
Section Seven	:	Shipping and Disposal plan
Section eight	:	Insurance Plan
Section nine	:	Emergency plan

The Contractor will be required to compile a similar project plan and the Tenderer is required to describe in detail the type of plan it proposes. It is in the Tenderers interest to provide as much detail as possible of his management system. The sections one to nine form the basis of the technical specification and are described in section seven.

6.15 Quality Assurance

This project is to be driven completely by a comprehensive QA system. The Contractor must have in place a recognised QA system and is required to indicate within the Tender response how the QA system is integrated with the actual activity. Throughout the project it is expected that all documentation generated will be part of this QA system and will form the reporting information required. Tenderers are to provide detailed information as to the certifications they hold and examples of the documentation systems that are employed by that certification. Copies of the certifications are required. Throughout the Contract substantial documentation is required as detailed in the specification. All such documentation is to be managed in a manner that ensures the correct documentation and procedures are being applied.

As a minimum the QA system shall have a documentation structure that includes:

1. Registers
   - Staff
   - Drivers
   - Visitors
   - Transit Bins etc.
2. QA Check Lists
   - Staff
   - Drivers
   - Visitors
3. QA Check Lists
   - Equipment
   - Emergency Systems
   - Labeling
   - Container Survey
   - Packaging
4. Chemical Waste Registers
   - Waste
   - Containers
   - Dispatch
5. Daily Diary
   - Diary
   - Accident & Injury
6. Non Compliance Reports

6.16 Ownership of the waste

The owner of the waste at all times up to destruction shall be the principal.

SECTION SEVEN

TECHNICAL REQUIREMENTS

Introduction

The technical specification outlines the basic management structure that is required to perform the works as described in the Scope of works. This technical specification does not provide the detail of how the work should proceed it concentrates on the elements of what should be achieved. The Contractor is required to integrate these criteria into a fully detailed tactical plan. For Tender purposes a comprehensive demonstration of his plan is required in the Tender response documentation. It is felt that if a Tenderer cannot provide substantial evidence of a plan using the structure described here then it will not be suitable for this project.

Part one	Management Plan
Part two	Site Inspection Plan
Part three	Clearance plan
Part four	Site Preparation plan
Part five	Packaging plan
Part six	Transportation plan
Part Seven	Shipping and Disposal plan
Part eight	Insurance Plan
Part nine	Emergency plan

Part One : Management Plan

The methodology of the Management Plan is to design a set of Plans and Programmes that are specifically directed at achieving the aims and Goals as mentioned in the scope of works (section 4.3). These plans are then enumerated within a set of of work procedure instructions and are managed, controlled and audited by the management team.

In order that a coherent Project Plan is written and then implemented a management structure is required. At the outset of a Hazardous Waste **project that involves hazardous Agri-chemicals there must be an overall** Project Manager provided by the Contractor. This person must be charged with the entire responsibility for the Goals and Objectives being entirely met. they must be a dedicated and determined manager who while able and willing to delegate the work effort but not to default the responsibilities to the end client and the environment. The first action the Project Manager is to assemble his team set the Project Plan priorities and construct the elements of the Plan. There is a tendency for such teams to immediately make a start on the project without the necessary planning being put in place.

It is essential that the Plan be developed and enumerated and put in place before any site works are undertaken. Prior to any activity taking place the Contractor will be required to submit to the Superintendent a completed copy of the management plan for approval.

Part two : Site Inspection Plan

Before the Project Plan can be fully developed a Site Inspection must be undertaken. There are two sites to be considered and planned for. The first is the existing storage facility and the other is the site where the repacking is to take place. For the second area the following plans are required.

Elements of the Site Inspection Plan includes;

- Reasons for Site Inspection
- Site name
- Storage Type
- Type & Quantity
- Goals & Objectives
- Fire Protection
- Residents
- Access

The quality of the Project Plan is very dependent of how well the Site Inspection Plan is executed. In order to determine the correct information is obtained the Site Inspection Plan is crafted from the safety and Environmental protection aspect.

Elements of the Site Inspection Safety and Environmental plan includes;

- *Personal safety*
- *Environmental Safety*
- *Storage Type*
- *Type and Quantity*
- *Fire Protection*

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Part three : Clearance plan

The Clearance Plan is an output of the Site Inspection Plan. When all the observations and calculations and risk factors are known the Clearance Plan can be prepared. The Clearance Plan sets down the prioritised clearance schedule based on the risk factors. The Clearance Plan also, by virtue of the prioritised schedule, sets up the relevant parts of the Site Preparation Plan. This activity then allows the allocation and location of the Projects' resources to be applied in a manner that addresses the identified risk factors.

Elements of the Clearance Plan includes;

- Warehouse or storage clearance priority schedule
- Type and Quantity clearance priority schedule
- Area defence lines
- Resource Positioning
- Impact on Packaging Plan
- Warehouse or site decontamination

In order to discharge the Safety requirements and provide full environmental protection the clearance plan must be prioritised. This means that the type of storage or warehouse must be cleared by degree of danger. The higher the danger the higher up the priority list the clearance and the earlier the clearance.

Elements of the Clearance Safety and Environmental plan

- Storage and Type prioritisation
- Waste Packaging prioritisation

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Part four : Site Preparation plan

To achieve the objectives as stated in the scope of works, an important part of the project plan is the site preparation plan. Section 4 is concerned with the detail of site preparation. The sequence of events planned for each site as the "Site Preparation Proposal" is a direct result of the risk factor assessment and is a product of the strategy of Minimisation of Risk Policy that is inherent in the Aims and Goals of this Contract. In order that the Clearance plan is correctly applied a Site preparation plan must be put in place.

Elements of the Site Preparation plan includes;

- Site Preparation
- Containment barriers and spill protection
- Location of Decontamination and Amenities Units
- Working Areas
- Working Area equipment requirements
- Defence Areas
- Emergency Access
- Fire Protection
- Intruder Alarms
- Telephone and other communications
- Records
- Emergency vehicle

When setting up the site, particular attention must be made to safety and Environment issues. During the design of the various structures required consideration must take into account the reality of each site and the ramifications of the work procedures and Agri-chemicals types involved. Site preparation in addition to the work platform structures must include training of staff, personal occupational hygiene and safe working practices. Therefore as apart of the site preparation plan a safety and environmental plan is required to be produced which can be QA audited by the safety and Environmental QA plan.

Elements of the Site Preparation Safety and Environmental plan

- Personnel safety Procedures
- Medical Testing Procedures
- Personnel Protection Equipment (PPE)
- Emergency Response vehicle

- *Training*
- International Labour safety laws
- Environmental protection and work practices

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Part five : Packaging plan

In order that the project aims and goals are fully discharged the packaging plan must reflect physically the environmental implications of spillage. The techniques and methodologies that are to be placed here must been proven over many years to provide the safest methodology of packaging that ensures the waste arrives in the disposal location or country in the same manner in which it was discharged from the storage facility. The Tenderer is required to describe in detail how it intends to achieve that.

In all aspects the strategy of packaging must be designed to ensure that the transportation of waste is fully defended against any possibility of leakage, spillage or contamination of any kind.

Elements of the Packaging Plan include;

- Waste Packing
- Container Packing
- Weighing of container
- Labeling
- Container Marine Survey (for offshore disposal)

The Agri-chemicals wastes to be handled during the implementation of this proposal are potentially hazardous, creating the need to plan for and put in place, workable emergency response procedures at all phases of the project. These procedures need to cover responses to emergencies involving threats to the environment and the public, as well as those that may threaten the health and safety of personnel involved in the operations.

The packaging procedures to be followed in this proposal must have been developed over time and through considerable experience with actual operations. The procedures therefore are to be designed specifically to minimise the risks of emergencies arising.

The packaging of wastes to international standards (UN II or better) prior to **transport is designed to provide at least double containment of the materials.** This will substantially limit the volume of wastes likely to be spilt or to leak in any one incident.

However, it is inappropriate to rely solely on set procedures to achieve a high level of safety. There remains the need to be able to respond in a positive and rapid manner to unforeseen circumstances.

Elements of the packaging Safety and Environmental plan include;

- Emergency Response
- Emergency Response Procedures

Segregation

The following segregation strategy is to apply with the Contractor providing the methodology to achieve the segregation within the project plan.

All waste material to be segregated into separate steel bins according to their hazard classes. No bin to contain Waste materials of different hazard classes.

Segregation for the agri-chemicals shall follow the following rules:

These segregation rules are based on primary risk as defined in S 5433 Table 5. In practice the rules are:

All waste materials within each hazard class to be segregated into compatible families of chemicals and the families segregated into separate 205 litre drums or other suitable UN rated containers. Segregation will be into the following families for Class 6 chemicals;

Herbicides
Fungicides
Insecticides
Fertilisers/Mineral supplements
Animal remedies
Vertebrate Remedies
Laboratory Chemicals

All solid and liquid chemicals whether or not of the same hazard class to be segregated into separate steel bins. No bin to contain drums of solid and liquid chemicals whether or not of the same hazard class.

Liquid chemical of the same hazard class and compatible family has been *aggregated within one drum.*

205 litre FOH drums are used for solids and 205 litre bung top drums are to be used for liquids. All drums should be heavy duty (1.6mm wall) triple seam, UN rated 1A1 and new or as in new condition. All drums are to be lined with 100 micron HD plastic liner.

Class 3 and Class 8 chemicals to be subject to special isolation and/or packing arrangements, wood or other corrosion resistant primary packing and polypropylene cubic storage bins.

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Part six : Transportation plan

The detailing and control strategy for Transportation of the packed waste to storage or ports requires the same level of attention as the other elements of the destruction project. The Transportation must be carefully planned so that there are no possibilities of surprises during road transportation and that such details such as road works, hours of travel, routes, driver training etc. As for the other sections of this plan all the necessary details are to be contained within the Work Procedure Instructions (WPI's) including the required Safety and Environmental considerations along with QA implications.

During the transport from the warehouse to the docks the escort vehicle will accompany the containers on every journey. Permission may need to be sought to move more than one container at a time. The crew in the escort vehicle are to be fully trained in all emergency procedures and will be in radio/phone contact with the Contractor project manager and the shipping container trucks. As part of the Management plan there are agreed routes that are traversed and regular 'check ins' to the Clearance Company. Local police, emergency authorities, etc. will be notified of the routes, procedure and precautions as required by local regulations. Consideration will be given to off-peak time for movement in order to minimise the risk of accidents.

Elements of the Transport Plan include;

- Marine Survey
- Movement Timing
- Driver Briefing
- Escort Vehicle
- Communications

In order to discharge the Safety requirements and provide full environmental protection and to maintain the policy of risk minimisation the Transport Plan must be not only carefully adhered to but must be continuously monitored for any non compliance.

Elements of the Transport Safety & Environmental Plan includes;

- Driver Briefing
- Route adherence
- Communication
- Vehicle Inspection
- Load Security
- Emergency Procedure

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Part Seven : Shipping and Destruction plan

Shipping Chemical waste to an offshore destruction facility must be conducted by a recognised shipping company and full cognizance made of all international laws (in particular the Basel convention) regulating the trans shipment of toxic waste.

Elements of the Shipping and Destruction Plan includes;

- Labeling
- Lloyds Survey
- Port Acceptance
- Trans Frontier Documentation
- Basel Convention

All the plans and strategies of this project if applied properly will ensure that the shipping of the containers of waste is safe. The adherence to the IMDG code ensures that the cargo is placed on the correct area of the ship away from foodstuffs etc. Provided that all of the packaging codes and plans and QA have been followed then the complete safety of the public and the environment during shipment to the country of disposal will be achieved. The Tenderer is to demonstrate how this is to be achieved and also note which shipping lines will be used if the disposal facility is offshore.

***Elements of the Shipping and Destruction* Safety and Environmental plan** includes;

- Labeling
- Lloyds Survey
- Basel Convention

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Elements of the Destruction plan includes;

The disposal plan must be completely integrated with the overall project plan even if the disposal company is a different company. The complete detail of how the disposal company handles the waste, by what methods it is destroyed of and under what licence conditions does the plant operate. The plan is to include the transportation arrangements in the destination country and all relevant details of destruction and the method by which a final certificate is produced. Within the Tender document response is a comprehensive requirement for details of the proposed disposal facility.

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

Part eight : Insurance Plan

The project should be fully covered for all risks. The policy should obviously protect all those involved including the client but it must also be seen to be a provision that protects the environment from harm. A large accident involving a large spill will be very costly to clean up and a comprehensive insurance policy should be in place to cater for this type of event. When obtaining offers of insurance the Project manager should obtain the policy that while protecting himself and his client full protection is offered for environmental protection that will ensure that the funds are available to clean up a substantial problem.

Elements of the Insurance Plan include;

- Types of insurance
- Who and what should be covered
- Actions by the clearance company to hold harmless

Complete "Pollution" Insurance cover for all accidents and incidents involving the removal, packaging and transportation of waste Agri-chemicals. In addition complete protection of all contractors, agents, clients, engineers etc. is required as well as cover for workers, employers liability insurance where required, machinery insurance, public liability insurance, motor vehicle insurance and professional liability.

Main policy should cover for " Protect the main Contractor, his subcontractors, the Principal , his engineers and agents against their third party bodily injury property damage including any pollution clean up expense arising from the Contract for the packaging, removal and transportation to the Contractor for disposal of Agri-chemicals. The amount of cover of the policy should be substantial and be at least US$5 Million.

The contractor is also required to comply (for offshore disposal) with the EU requirement Art 27 (2.5.9-93) with respect to return of shipments. A bank bond will be required to provide at least $ 50,000 to cover for the possibility of the waste return to xxxxxx .

Insurance policies of this nature require that the policy holder take all reasonable steps to ensure that:

There is compliance with regulations concerning transportation, storing and packaging of Agri-chemicals wastes.

The cargo is to be shipped in containers and loaded under professional supervision, and

The master of the carrying vessel is to be fully aware of the substance to be shipped.

While the need for insurance cover is obvious in order to protect the participants of the waste clearance operation, the main purpose of the insurance policy is to provide a high degree of environmental protection. By having a comprehensive package in place that is the ultimate pollution policy means that clean is assured in the unlikely event that an escape occurs. This is not to say that the packaging and transportation can therefore be of a lessor standard because at the end of the day the policy will do the clean up. The policy is only to be the absolute back stop environmental protection should all the other plans and strategies fail.

Therefore the primary aim of the insurance policy is to provide funds for environmental protection should all the other procedures fail in the event of a catastrophic loss.

In the event of a catastrophic event where uncontrolled waste enters the environment the only final capacity to protect the environment lies in the *strength of the insurance policy to provide the funds for the cleanup. This means that the insurance policy chosen for the project must be designed with the protection of the environment firmly in mind.*

Part nine : Emergency plan

The Emergency Plan is concerned with the detail of the equipment, services and methodology during and emergency situation. The system and equipment detailed in this plan must be designed to allow a full emergency response to be available during all operations and transport. The emergency plan is to be available at all times in the form of an Emergency Response Unit (ERU). This facility is always to be available during all stages of packaging as well as transportation. During transportation of the waste to the export port the ERU is to act as the escort vehicle. The Emergency plan is discharged by means of Flip charts and these are to be activated during the emergency.

Elements of the Emergency Response Plan includes;

- ERU Vehicle
- ERU Equipment Inventory
- Escort Duties
- Emergency Response during escort
- Emergency Response for other
- Emergency Response for fire
- Emergency Response for protest

During an emergency where waste has spilled or is threatening the environment or the safety of personnel the only strategy that can exist for the emergency procedures is the the procedural process of the emergency be strictly followed as shown by the Flip sheets in the WPI's. If the procedures are carefully adhered to then the damage to the environment will be minimised.

Elements of the Emergency safety and Environmental Plan include;

- ERU
- Flip Sheets

ERU

Discharge of environmental protection and safety of public and personnel can only be achieved with the use of a fully equipped ERU and the provision of trained staff and procedures.

Flip Sheets

The entire emergency procedures are to be discharged via the flip sheets.

This element of the project plan must be fully configured by the Contractor and examples of this must be submitted with the Tender document.

APPENDICES

Appendix A - Schedule of Agri-chemicals

Appendix B - Layout of existing stor