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**THE PHYSICAL WORK ENVIRONMENT IN RELATION TO  
THE PHYSICAL AND PSYCHOLOGICAL SYMPTOMS OF SICK  
BUILDING SYNDROME**

A thesis

submitted in partial fulfillment

of the requirements for the degree

of

**Master of Applied Psychology**

at

**The University of Waikato**

by

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The University of Waikato

2011

## **Abstract**

This study investigated the relationship between perceptions of a poor physical work environment (PWE) and sick building syndrome (SBS), and with various psychological variables that impact organizational productivity.

164 employees working in medium to large office buildings in New Zealand completed an online questionnaire. Overall, the results supported the relationships that were predicted. Ratings of a poor PWE were strongly and positively related to SBS symptoms. Both ratings of a poor PWE and SBS symptoms were positively related to absenteeism, turnover intentions, and continuance commitment; and were negatively related to affective commitment, perceived organizational support, and job satisfaction. SBS mediated the relationship between PWE and most of these variables, except for continuance commitment. Contrary to prior research self-rated job performance was not found to be related to PWE or SBS.

The major implications of this research are that it is important for researchers and managers alike to consider the physical aspects of the work environment as well as managerial and interpersonal aspects. This research also showed that New Zealand employees are experiencing SBS symptoms, indicating SBS is just as important for New Zealand organizations as it is for organizations overseas. Further implications of this study, and directions for future research are discussed in the final chapter.

## **Acknowledgements**

Firstly, I would like to thank my supervisors Dr Donald Cable and Professor Mike O’Driscoll. Your continued advice and support throughout this process has been invaluable.

I would like to thank everyone who completed the online survey for this project. Recruiting participants was more challenging than I expected and I appreciate the time that people put in to responding to the survey. I would especially like to thank those HR managers who sent the invitation to participate out to their staff; your help has been very important to the success of this research.

I would like to thank everyone who has supported me on this journey. My parents for continuously believing in my abilities and for encouraging me to pursue academic achievement. My sisters and friends for giving me ongoing encouragement and comic relief in stressful times. In particular, I would like to thank the girls at Pacific Ave for providing such a fun and stress-free environment to live while completing this project.

I would like to acknowledge support from the Department of Labour in the form of a graduate research grant. This grant made it possible for me to conduct the research required for this thesis.

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## **Chapter 1**

### **Introduction**

The labour market in New Zealand has traditionally been based on primary industries such as agriculture and mining, and secondary industries such as manufacturing and construction. In the last few generations this has been changing with more of the workforce employed in the tertiary sector, which consists of service based industries such as banking and communication services (2001). With the shift in the type of work, the setting of work has also changed from outdoor and industrial settings to indoor office environments. More than half of the workforce in North America now work in an office setting (Klitzman & Stellman, 1989). Following this trend, workers who can roughly be described as “blue collar” now comprise less than 40% of the total work force in New Zealand, having dropped 9% from 1987 to 2000 (Department of Labour, 2001). It is likely that this trend will continue in the near future as there is an ongoing shift in the labour market from primary and secondary jobs, such as agriculture and manufacturing, to service based jobs in the tertiary sector. The Department of Labour predicts that with the changing nature of work from industrial to service based jobs the health and safety concerns in New Zealand workplaces will also change (Department of Labour, 2008).

Office settings have traditionally been viewed as a work environment with low physical risks (Hedge, Burge, Robertson, Wilson, & Harris-Bass, 1989). This is true when compared to other work environments where industrial or accidental toxic exposures can have disastrous consequences. However, Redlich, Sparer and Cullen

(1997) stated that “unlike industrial or accidental exposures, such low level indoor exposures are very common” (p. 1013). Even though these indoor exposures occur at a low level, such exposure occurs far more frequently than large scale accidental exposure. Redlich et al. went so far as to say that “problems with the indoor environment are one of the most common environmental health issues that clinicians face” (1997, p. 1013). Due to the numerous and frequently used nature of office workplaces any risks involved with the office work environment are important to understand because these risks have the potential to affect a large proportion of the workforce (Klitzman & Stellman, 1989).

One potential risk for office workers that has been identified in previous research is *Sick Building Syndrome* (SBS), a term that was originally coined in the 1970s to describe a range of physical symptoms that individuals were experiencing in modern, air conditioned buildings (World Health Organization, 1983). Individuals suffering from SBS experience a range of nonspecific symptoms while in their place of work which alleviate when away from the office environment. Such physical symptoms can include complaints of headache, mental fatigue, eye, nose and throat irritations, nausea, dizziness, dry skin, dry mucous membranes, wheeze, and cold/flu like symptoms (Hedge et al., 1989). Other symptoms reported in previous research have included musculoskeletal problems, confusion and irritability (Kinman & Griffin, 2008), as well as odour and taste complaints (Rostron, 2008).

In a report issued by the World Health Organization in 1983, SBS was described as an emerging environmental health problem, with symptoms resulting

from a poor physical work environment (PWE). The report distinguished between temporary cases, such as newly built or renovated office buildings, where symptoms disappear as the indoor pollutants related to construction diminish, and permanent cases, where symptoms persist for years and often no obvious cause is evident even after investigation (World Health Organization, 1983). Various causes of SBS have been identified in the literature, including indoor air quality, lighting, sound, indoor pollutants, volatile organic compounds (VOC), computers and printers (Rostron, 2008). In permanent “sick” buildings, symptoms cannot be contributed to any specific air contaminant and symptoms persist over time (Hedge, Erickson, & Rubin, 1996). If symptoms are due to a measured toxin in the work environment that exceeds recommended standards this is then classified as a building related illness (BRI) rather than SBS. These distinctions will be explained further in the following section. The most common aspect of the PWE that has been linked with SBS is indoor air quality; this is often associated with mechanical ventilation systems and centrally controlled air conditioning (World Health Organization, 1983).

Employee illness presents huge costs to organizations, individuals and the economy as a whole. A recent report released by the New Zealand Treasury estimates the annual cost of lost hours due to employee illness in New Zealand could be up to \$11.5 billion, which is 7.6% of gross domestic product (GDP) (Holt, 2010). This estimate includes the costs of absenteeism, where the employee is physically absent from work, and also costs associated with when the employee is not physically absent from work but their performance is impaired due to illness. While this number does not separate different forms of illness, or provide an estimate of costs associated with

SBS alone, it does give an indication of the serious impact of employee sickness on organizational productivity. Any form of illness will also have negative consequences for the individual employee. If the illness is seen to be caused by the environment they work in, this is likely to affect the employee's perception of their organization and the commitment they have towards the organization (Baldry, Bain, & Taylor, 1997). Negative perceptions of the PWE and SBS symptoms have been linked to turnover, lowered productivity and negative employee attitudes as well as absenteeism (Rostron, 2008; Ryan & Morrow, 1992). All of these factors affect overall organizational productivity and are therefore relevant and important to research.

Within Organizational Psychology and Human Resources fields the physical aspects of the work environment are not widely discussed. Baldry et al. (1997) argued that because of phenomena like SBS it is no longer justifiable to conduct research on workplace variables, such as employee commitment and satisfaction, as if they take place in a neutral shell. Instead the built office environment must be included in analysis of "white collar" work (Baldry et al., 1997). The purpose of the present study is to investigate how the PWE and SBS symptoms relate to various outcomes that affect organizational productivity.

While no one aetiology of SBS has been clearly established in the literature, there is one component common to all theories of SBS; this is the physical work environment (PWE). The PWE has been linked not only to physical symptoms of SBS, but also to employee wellbeing and behaviour (Klitzman & Stellman, 1989).

For this reason the current study is based around a mediating relationship between the physical work environment, sick building syndrome symptoms and the outcome variables. Most of the previous research reviewed has focussed on the causes of SBS rather than the effects SBS might have on individual and organizational outcomes. While research on potential psychological outcomes is relatively sparse, there is enough in the literature linking both SBS and PWE to employee attitudes, beliefs and behaviours to begin to construct a theoretical model. The purpose of this study is to build on previous research linking the PWE and SBS symptoms. In addition, the current study tested the hypothesised relationships between PWE and SBS with several outcome measures, including absenteeism, job performance, job satisfaction, intention to quit, organizational commitment, affective and continuance organizational commitment, and perceived organizational support. A model of these relationships is presented in Figure 1.1.

### Theoretical Framework

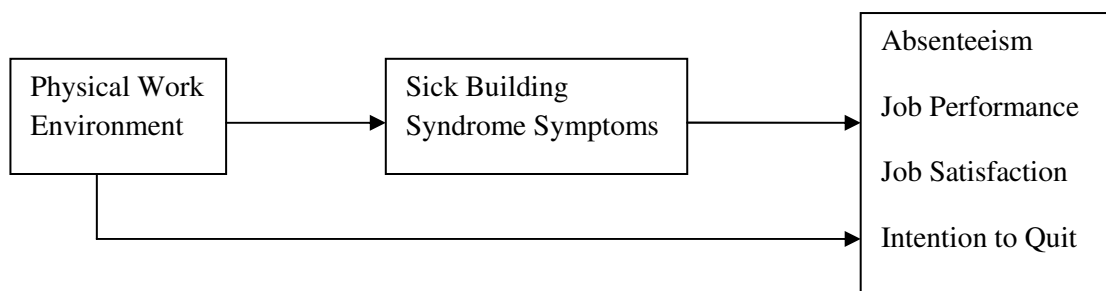


Figure 1.1 Model of the Theoretical Framework

## **Sick Building Syndrome and the Physical Work Environment**

Early industrial psychologists focused largely on organizational productivity, often with the aim to improve physical aspects of the work environment and work systems in order to increase efficiency (Spector, 2008). In the early 20<sup>th</sup> Century management theory was hugely influenced by Frederick Taylor and his principles of scientific management, resulting in the idea that people could be more efficient with the right motivation and the right environmental and work design (Spector, 2008). It was these principles that guided the well known Hawthorne Studies at the Western Electric Company, the best known of which aimed to determine the lighting level that would produce the optimal performance in a factory task. In this experiment employees were relocated to a separate work room where the lighting level was varied to see the effects of lighting on productivity. Contrary to expectations, productivity continued to rise regardless of the level of lighting (Roethlisberger & Dickson, 1939). It was concluded that social aspects of work had more of an impact on productivity than the physical aspects. Baldry et al. (1997) argued that it was this finding that heralded the end of interest in the physical environment in the social sciences. The increased emphasis on the social context of work resulted in the belief that the PWE was not worth studying (Baldry et al., 1997). Indeed, textbooks in the field promote this inference from the Hawthorne studies, with one author concluding that “whatever the reason [for the increased productivity], it seems clear that social factors can be more important than physical factors in people’s job performance” (Spector, 2008, p. 12). Baldry et al. (1997) contended that if the PWE is not at an acceptable level of quality, employee attitudes and behaviour would be adversely

affected regardless of the management practices that are in place. They argued that to be able to draw complete conclusions the PWE must be included in organizational research as well as behavioural and psychological factors (Baldry et al., 1997).

The first reports of the symptoms associated with SBS emerged as early as the 1950s. These cases were associated with post-war buildings designed to be energy efficient, air tight, and low-cost to build (Rostron, 2008). As large scale office buildings became more common, reports of cases of SBS increased over the following decades. In the 1970s a greater emphasis was placed on energy conservation and efficiency. Buildings that would previously have been ventilated naturally through open air windows were made “tight” by eliminating open windows and converting to mechanical ventilation (Baldry et al., 1997). Where previously employees could regulate the temperature and air flow in their environment by opening or closing a window, regulation now occurred through building-wide centrally controlled air conditioning systems. The symptoms that began to emerge in employees working in these closed off office environments have sometimes been called “tight” building syndrome because of the enveloped nature of the work environment (Ryan & Morrow, 1992), but will be referred to as SBS. The phenomenon of SBS gained increased recognition from the early 1980s onward as more cases began to be reported, largely in North America and Scandinavian countries (World Health Organization, 1983).

Research in to SBS has aimed to establish a clear aetiology of the syndrome, because if specific causes are identified these can then be eliminated. Early on, SBS

was linked with environmental working conditions (Hedge et al., 1989), but identifying the specific factors leading to the development of the syndrome remained elusive. SBS is commonly defined as a cluster of nonspecific physical symptoms occurring in occupants of particular buildings at a greater prevalence than what you would expect to see in the general population (e.g. Rostron, 2008). As previously noted, SBS symptoms as defined by the World Health Organization include: eye, nose and throat irritation; sensation of dry mucous membranes and skin; erythema (redness of the skin); mental fatigue; headaches, high frequency of airway infections and cough; hoarseness, wheezing, itching and unspecific hypersensitivity; and nausea and dizziness (World Health Organization, 1983). In a view point that is often reiterated, Bauer et al. (1992) defined SBS as occurring when occupants of a building complain of physical symptoms that cause discomfort but where no consistent aetiology has been identified. Thorn (1998) stipulated that SBS is usually diagnosed when one or more of the common, nonspecific symptoms are present at a prevalence that exceeds that normally expected in the population of a building. Symptoms are experienced while in the work environment and dissipate when away from the work environment such as during holidays or weekends. This second point differentiates SBS from other building related illnesses where symptoms persist away from the building (Hedge et al., 1996).

In a review of the literature Ryan and Morrow (1992) distinguished SBS from other workplace disorders. They identified four major workplace disorders that all present along a continuum of nonspecific symptoms: SBS, building related illness, neurotoxic disorders and mass psychogenic illness. SBS is characterised by the fact it



does not have a single identifiable cause, it is most severe a few hours after arriving at the place of work and abates after spending some time away from work. Building related illnesses, in contrast, have a known aetiology and specific symptoms.

Examples of building related illnesses include legionnaires disease and Pontiac fever. These differ from SBS because they are caused by a known bacterium that sufferers are exposed to while in a particular building. Infection from this bacteria remains even after leaving the infected building. Legionnaires disease is the more severe of the two and can result in pneumonia, while Pontiac fever is caused by the same bacteria but results in mild respiratory illness. According to Ryan and Morrow (1992) neurotoxic disorders, that are the result of indoor environmental exposure, differ from SBS in that there is a specific acute exposure to dangerously high levels of an identifiable neurotoxin, or documented chronic exposure of low levels. Once again, SBS differs from this because SBS does not have a single identifiable cause.

In the past some authors have claimed SBS to be just another form of mass psychogenic illness, this occurs when a group of people experience acute physical symptoms at the same time for which there is no apparent cause (Bauer et al., 1992). There are similarities between the two as mass psychogenic illness also occurs without a known aetiology; however, it can be distinguished from SBS in several ways including the way each disorder spreads. Symptom reports of SBS cluster in certain areas of a building, where a pollution source might be present, whereas mass psychogenic illness spreads rapidly through social groups within a building with no relation to any potential cause. SBS symptoms develop over months or years whereas mass psychogenic illness occurs within hours or days of a triggering event

(Mendelson, Catano, & Kelloway, 2000). Bauer et al. (1992) investigated the similarities between SBS and mass psychogenic illness in an office environment, and concluded that “there is no apparent justification for attributing SBS complaints to contagious psychogenic factors or mass hysteria” (p.218). Mendelson et al. add that while SBS may not have a clear aetiology, environmental factors have been empirically linked to physical symptoms, but this is not the case with mass psychogenic illness.

As mentioned earlier, the aetiology of SBS is a complicated one. Although the PWE is understood to be the cause, no one risk factor or toxin can explain the phenomenon. While several building characteristics have been investigated, Hedge et al. (1996) stated that there has not been a consensus in the literature about what constitutes a “sick” building. This sentiment has been repeated throughout SBS research (e.g. Lahtinen, Huuhtanen, & Reijula, 1998; Passarelli, 2009). In a review of SBS literature presented from a medical standpoint, Redlich, Sparer and Cullen (1997) stated that there is no universally accepted clinical definition of SBS and no adequate theory for its occurrence. However, although no one cause has become apparent, several environmental risk factors for SBS recur throughout the research. Common building risk factors include air conditioning systems, inadequate ventilation, volatile organic compounds (VOC), illumination, dust, noise (Rashid & Zimring, 2008; Thörn, 1998), higher air temperature, and moisture problems in buildings (Seppanen & Fisk, 2006). Other risk factors have been suggested to contribute including car exhaust fumes from indoor garages, outdoor pollution, heat

and chemicals released by laser printers, computers and photocopiers (Mendelson et al., 2000; Ryan & Morrow, 1992).

In a World Health Organization working group report (World Health Organization, 1983) several potential causes of SBS were noted. The report highlights the importance of thermal factors including temperature and humidity. While airborne pollutants may impact physical symptoms it must be established that no known toxins, such as formaldehyde, are present at elevated levels. Ryan and Morrow (1992) add that SBS symptoms cannot be attributed to elevated levels of known toxins or by obvious bacterial or viral diseases, although these factors must be investigated if symptoms do occur. As mentioned above, if symptoms can be linked to elevated levels of known toxins or bacterial infection this is then defined as a building related illness, or neurotoxic disorder, depending on the identified cause, not SBS (Ryan & Morrow, 1992). As previously mentioned, common features of buildings in which participants report SBS symptoms include; forced ventilation systems that often use re-circulated air, poor design and maintenance of such systems, large areas are covered with textiles (e.g. carpets) that may contain toxins (World Health Organization, 1983). Symptomatic office spaces are often airtight building envelopes, where windows cannot be opened. The factor most commonly linked with SBS symptoms is indoor air quality and air conditioning systems (Hedge et al., 1996).

In one of the early comprehensive studies of SBS Hedge et al. (1989) propose a model of SBS that looks beyond a simple physical framework asserting that SBS is not the result of inadequate indoor air quality alone. The model incorporates both

environmental and situational conditions as well as individual characteristics of people that report physical symptoms of SBS. In order to test this model, Hedge et al. surveyed 4373 office workers in 47 different locations. They found that fewer symptoms were reported in offices that used natural ventilation or mechanically ventilated air. The highest rate of reported symptoms was found in offices with air-conditioning ventilated through water-based systems with slightly less symptoms in those with all-air systems. However, it is important to note that there was large variation between buildings using the same type of ventilation. Hedge et al. (1989) measured several individual factors and found that significantly more women than men reported symptoms. It was also found that older workers, those in more responsible positions, and workers that used visual display units (VDUs) for long periods of time each day reported higher levels of job stress, which in turn is associated with increased symptom reports.

In a later study Hedge et al. (1996) investigated 27 office buildings with various types of layout and ventilation system using a questionnaire method. Their questionnaire included measures of perceptions of ambient environmental conditions, occupational factors, work-related health and SBS symptoms, and personal information. They found that 76% of workers in air-conditioned buildings reported at least one SBS symptom. Women reported more symptoms than men but it is unclear whether this is a direct relationship, or confounded by other factors such as the use of eye-wear, and nickel allergies. If these factors had have been controlled for, Hedge et al. (1996) suggest the gender difference may not have been apparent. More symptoms were reported by people that used their computers full-time. Workers reporting higher

job stress also reported more symptoms. This study emphasised that objective measures of the physical work environment are not enough on their own to explain SBS symptoms. This was supported when, contrary to expectations, more symptoms were reported in five of the buildings with outdoor airflow than many of the mechanically ventilated buildings. It may be that employee perceptions of their physical work environment are a better predictor of SBS than objective measures. Hedge et al. found a strong causal path from satisfaction with the work environment and perceptions of the PWE to SBS symptoms. Findings suggested that workers who report dissatisfaction with their work environment also experience more symptoms of SBS (Hedge et al., 1996).

Phipps, Sisk, and Wall (1999) conducted a study to assess the prevalence of SBS symptoms in New Zealand. They surveyed a cross-section of 252 office workers in Palmerston North, and found that 88% of the sample experienced at least one symptom that they associate with their work environment. This was compared by Phipps et al. (1999) to a U.K. sample where 81% of respondents experienced at least one symptom, and can be compared to the U.K. study described above that found a prevalence rate of 76% for one or more symptoms (Hedge et al., 1996). Phipps et al. (1999) argue that because a similar prevalence was found in the New Zealand sample to the European sample it was compared to, it is likely that other SBS research from overseas can be applied to a New Zealand context. This study shows that SBS is just as much, or more, of an issue in New Zealand as it is elsewhere.

Once incurred the impact of SBS on individuals and organizations can be huge. Rostron (2008) identified possible implications of SBS to be reduced productivity, reduced overtime, and increased turnover. Other potential outcomes include worker morbidity, job dissatisfaction (Bauer et al., 1992), reduced employee commitment, and increased absenteeism (Baldry et al., 1997; Seppanen & Fisk, 2006). These outcomes all relate to overall organizational productivity. As well as these individual responses to SBS there may also be collective responses. This is particularly pertinent in unionised workplaces where organised action is likely to take place once a problem with the PWE has been identified. This could be in the form of negotiation for improvements to the work environment, or more serious collective industrial action such as strikes (Baldry et al., 1997). Only individual outcomes are included in the present study but it is important to note that there are potential collective outcomes that have the potential to cost an organization a great deal of money.

Employee perceptions of the PWE have not only been implicated as a cause of SBS but have also been linked directly to several organizational outcomes. As McGuire and McLaren (2009) argue, almost every moment of the working day is spent within the PWE. As such it stands to reason that dissatisfaction with the work environment has the potential to influence organizational outcomes in a significant way. Previous research has linked the PWE with employee health, wellbeing and behaviour as well as SBS symptoms (Seppanen & Fisk, 2006). Therefore it is expected that employee perceptions of a poor PWE will be related to the physical symptoms of SBS as well as the outcome variables

While there has been debate in the literature about the specific causes of SBS, one factor has remained constant, the physical work environment. SBS cannot be attributed to any single aspect of the work environment but results from the combination of multiple environmental and individual features (Ryan & Morrow, 1992). With SBS it is the workers who present the symptoms, but the building that they occupy which is the cause (Burge, 2004). In this study both SBS symptoms and the PWE are assessed using a questionnaire measure commonly used in SBS research (Hedge et al., 1996). It is expected that reports of a poor PWE will be positively related to SBS symptoms.

*Hypothesis 1:* Reports of a poor physical work environment will be positively related to sick building syndrome symptoms.

## **Outcome Variables**

### **Absenteeism**

Because SBS is a syndrome based largely on physical symptoms, one of the most likely outcomes of SBS is a high rate of employee absenteeism. Absenteeism occurs when an employee takes time off work because of ill health. Absenteeism can be hugely costly to an organization. The New Zealand Treasury recently released a research article establishing the cost of ill health, including absenteeism, on the New Zealand economy. It was estimated that the total cost of employee illness, including where employees are at work but their productivity is reduced because of illness, is \$11.5 billion per year. Of this, it was estimated that the cost of absenteeism due to ill health is \$202 million in lost working hours each year in New Zealand (Holt, 2010). Although only a proportion of those lost hours will be due to SBS, these numbers

give an indication of the scope of the costs involved with absenteeism for New Zealand organizations. In a review of the literature on SBS Rostron (2008) cites absenteeism as one of the major outcomes of SBS. Seppanen and Fisk (2003) developed a conceptual model to estimate the impact of improving the indoor environment on SBS symptoms and various outcomes linked with organizational productivity. They concluded that one of the major benefits of any interventions that reduce SBS symptoms will be reduced employee sick leave (Seppanen & Fisk, 2003).

As well as the mediating relationship of SBS between the PWE and absenteeism, some aspects of the PWE have been found to directly impact absenteeism. In particular several studies have linked Indoor Air Quality (IAQ) with absenteeism (Milton, Glencross, & Walters, 2000; Niemelä, Seppänen, Korhonen, & Reijula, 2006). As mentioned earlier, IAQ is considered to be one of the major contributors to SBS symptoms (Hedge et al., 1996). Milton et al. (2000) conducted a study to assess the effects of outdoor air supply on absenteeism at 115 different work sites of a manufacturing company in Massachusetts with different levels of ventilation. Sick leave records for 3720 employees were used and analysed against the type of ventilation in each office area. It was found that levels of sick leave were significantly higher at sites with lower levels of ventilated air. Sick leave was also more common at sites with higher humidification. Milton et al. (2000) suggest the reduced sick leave at sites with better ventilation could be due to a reduction in the spread of airborne viruses and a reduction in building related symptoms. It is important to note that this was a field study and many variables that could have influenced sick leave were not measured, and there may have been other variables



that caused the increased sick leave in certain work sites. Although these findings must be treated with some caution it does indicate that IAQ has a direct and significant impact on absenteeism. This premise was supported by Seppanen and Fisk (2006) in a review of the literature reporting quantitative relationships between indoor environment quality and work performance and health. Through meta-analysis, data from several studies that investigated ventilation and absenteeism were combined, Seppanen and Fisk (2006) found that rates of short term sick leave were higher in office settings with lower ventilation rates.

In order to assess the impact of IAQ and SBS symptoms on absenteeism, Niemela et al. (2006) conducted a case study intervention in one department of an insurance company occupying a large office building in Finland. The intervention consisted of cleaning and recalibrating the air conditioning system. A questionnaire assessing SBS symptoms was distributed to employees before the intervention and again one year later. Absenteeism was measured using sick days recorded by the organization for the 12 months leading up to the intervention and for the 12 months following it. The prevalence of SBS symptoms reduced by 8.8% from the time of the first survey to the second survey following the intervention. Absenteeism reduced from a department wide rate of 1.2% in the 12 months before the intervention to 0.9% after. The rate of absenteeism did not reduce in the rest of the insurance company nor in the general banking and insurance sector. Niemela et al. (2006) concluded from this that the intervention increased IAQ and reduced SBS symptoms which led to reduced absenteeism rates.

Previous research, as mentioned above, has shown that improvements in the PWE can lead to a reduction in absenteeism. In addition, reduced SBS symptoms have been related to reduced absenteeism. I expect that in this study participants who rate the quality of their work environment as better, and report less symptoms of SBS will also report less sick days due to SBS symptoms.

*Hypothesis 2a:* Reports of a poor physical work environment will be positively related to absenteeism

*Hypothesis 2b:* Sick building syndrome symptoms will be positively related to absenteeism

### **Job Performance**

One of the key outcomes of concern for organizations is individual job performance. If an employee is experiencing physical symptoms they will not necessarily take time off work, either because of pressure to remain at work, or because symptoms do not seem severe enough to warrant sick leave. Instead, they may continue to work but at reduced productivity (Baldry et al., 1997). This is one aspect of “presenteeism”, where employees are at work but, because of ill health, are not as productive as they could be (Holt, 2010). Several authors have reported links between the PWE and SBS with individual employee performance (e.g. Kaczmarczyk, Melikov, & Fanger, 2004; Wargocki, Wyon, Sundell, Clausen, & Fanger, 2000).

There are two main pathways in the SBS literature through which employee performance is studied. The first is the effect of IAQ, and other environmental factors, on performance. This is particularly relevant for SBS as poor IAQ has been

shown to be a strong predictor of SBS symptoms (e.g. Wargocki et al., 2000). The other strand links physical SBS symptoms directly to performance outcomes (Niemelä et al., 2006). Performance is measured in two ways in the literature, either by assessing employees perceptions of their own performance or by taking objective measures of productivity (Wargocki, Wyon, Baik, Clausen, & Fanger, 1999). While on first glance the latter method may seem preferable as it provides ‘objective’ results, the former is likely to be just as useful. If workers view their own productivity as being affected by their environment this is likely to influence their attitudes toward the organization (Baldry et al., 1997).

Wargocki et al. (1999) conducted an experiment to assess the relationship between SBS symptoms and individual job performance. Participants were students that spent several hours in an office setting completing tasks designed to simulate office work, such as typing. During the tasks the participants were exposed to varying levels of air pollution. Participants were asked to rate their perceptions of the physical environment, and their experience of SBS symptoms. Performance was determined by the speed and accuracy with which each task was completed. Participants were more dissatisfied with the quality of the environment when the pollution source was present. They also reported more symptoms, reported a reduced effort and scored lower on objective measures of performance when the pollution source was present (Wargocki et al., 1999). It is important to note that because this study used student participants in a controlled laboratory setting, the results may not be generalisable to a real world context where workers are employed in a range of jobs.

Following on from this Wargocki et al. (2000) conducted a study in a normally furnished office space where all factors remained constant except level of outdoor airflow. The aim of this research was to investigate the effect of increasing the rate of airflow on perceived air quality, SBS symptoms and performance. To measure performance objectively 30 student participants performed tasks designed to simulate office work during three separate five hour periods in a controlled setting. As well as measuring objective performance, a questionnaire was used to measure the other relevant variables. It was found that increased ventilation rates resulted in decreased dissatisfaction with air quality, increased productivity, and reduced reports of SBS symptoms. Wargocki et al. (2000) concluded that supplying ventilation rates well above a normal standard can decrease prevalence of physical SBS symptoms and improve employee performance. It is important to note however, that this experiment took place in a controlled setting with student participants. It is unclear how well these findings would generalise to a normal office setting.

Kaczmarczyk et al. (2004) hypothesised that in addition to increased air flow, personalised control over the level and temperature of the air flow would reduce SBS symptoms and increase productivity. They investigated the impact of ventilation control using a personalised ventilation system (PVS) on participant's ratings of perceived air quality, thermal comfort, SBS symptoms and performance. It was expected that less SBS symptoms would be reported when participants had control over ventilation and when they had access to outdoor air. Participants completed tasks in a controlled office setting with both mixed and personalised ventilation, a controllable pollution source was used to decrease air quality. Perceived air quality

was highest when outdoor air was supplied through a PVS at a lower temperature than air in the room. This also reduced perceived SBS symptoms such as headache and inability to think clearly. PVS use increased self estimated performance with participants reporting that they expended less effort on tasks when they had access to a PVS. Kaczmarczyk et al. (2004) conclude that this would lead to increased productivity in an office setting, however, there was no difference in objective measures of performance. The authors conclude that this was possibly because participants were not practiced at using the PVS and therefore spent more time adjusting it than necessary, but that in a real life scenario the use of PVS's would lead to increased productivity (Kaczmarczyk et al., 2004). However, this experiment was also conducted in a controlled laboratory environment so the generalisability of the findings is unclear.

From a review and meta-analysis of the relevant literature Seppanen and Fisk (2006) provide a summary of quantitative relationships relating the PWE and SBS symptoms to employee productivity. They summarised studies that researched ventilation rates and performance, perceived air quality and performance, temperature and performance, SBS symptoms and performance, and temperature and SBS symptoms. From these studies Seppanen and Fisk (2006) conducted a meta-analysis in order to estimate the effect of the work environment on work performance and worker health. Through statistically combining data from several studies conducted both in the field and in laboratory settings using call centre workers, Seppanen and Fisk (2006) conclude that increased ventilation rates are related to increased employee performance. It was also found that employee perceptions of air quality

positively relate to employee performance but the nature of the research prevented Seppanen and Fisk from drawing causal conclusions about this relationship.

Seppanen and Fisk theorise that temperature affects productivity directly, as well as indirectly through increasing prevalence of SBS symptoms. Investigating the direct relationship reported in previous research, they found that employee performance increases with a temperature up to 20°C-23°C but decreases once the temperature rises above 23°C-24°C. Fifteen field studies were found that linked increased SBS symptoms to decreased self assessed productivity in the workplace. In addition five laboratory studies linked SBS symptoms to decreased objectively measured performance. The findings from studies linking temperature and SBS symptoms were then used to establish a formula to summarise the relationship between the two. It was found that, on average, for every 1°C increase in workplace temperature above 22.5°C, SBS symptoms increase by 12%.

In a previously mentioned study, Hedge et al. (1996) investigated 27 office buildings in the UK of various types of layout and ventilation system using a survey questionnaire which included measures of perceived performance. Although worker productivity was not directly or objectively assessed, workers were asked how much each environmental condition and each SBS symptom disrupted their work. The greatest disruptions were found to be from uncomfortable thermal conditions, distracting noise and poor lighting. The SBS symptoms that workers found to be most disruptive were eye symptoms, mental fatigue and headache.

Previous research has established clear connections between several aspects of the indoor environment and employee productivity, in particular perceived air quality, temperature (Seppanen & Fisk, 2006), and ventilation rates (Kaczmarczyk et al., 2004). In addition SBS symptoms have been linked to objective measures of employee productivity and self-rated performance (Niemelä et al., 2006; Seppanen & Fisk, 2006). It is expected that in the current study employees who rate the quality of the PWE as lower will also rate their own performance as lower, and employees that report more SBS symptoms will rate their own performance as lower.

*Hypothesis 3a:* Reports of a poor physical work environment will be negatively related to self-rated performance

*Hypothesis 3b:* Sick building syndrome symptoms will be negatively related to self-rated performance

### **Job Satisfaction**

Job satisfaction has been defined as a “pleasurable or positive emotional state, resulting from the appraisal of one’s job experiences” (Locke, 1976, p. 1300). Job satisfaction can be thought of as the extent to which people like or dislike their jobs (Spector, 2008). Job satisfaction is an important organizational variable because it has consistently been linked with turnover intentions, as well as organizational commitment (Tett & Meyer, 1993). In an early meta-analysis of the research, job satisfaction was found to be a significant predictor of individual performance (Petty, McGee, & Cavender, 1984). It is expected that if an employee is satisfied with their job they will be more motivated to be productive. Job satisfaction was included in the present study because of its relation to turnover intentions, turnover and organizational commitment (Spector, 2008). If SBS symptoms or the PWE are related

to reduced job satisfaction, it indicates that both SBS and the PWE will have significant impacts on overall organizational productivity.

Several studies have mentioned a relationship between physical SBS symptoms and job satisfaction (e.g. Hedge et al., 1996; Redlich et al., 1997) but the association has not been well researched. In a study outlined earlier, Hedge et al. (1996) investigated several variables related to SBS. It was found that workers who reported more physical SBS symptoms also reported lower levels of job satisfaction. As this study used a cross-sectional survey method, conclusions cannot be drawn about the causality of this relationship. Kinman and Griffin (2008) report similar findings from a survey distributed to 346 office workers in five different locations. Job satisfaction was found to be lower for female participants who reported more SBS symptoms, although this was not the same for male participants. Danielsson and Bodin (2008), in a survey of 469 employees in seven different types of offices, found that job satisfaction of employees is related to environmental aspects of the office they occupy. Employees that perceived the PWE as worse had lower job satisfaction. While not conclusive, the difference found in self-reported job satisfaction suggests that the PWE can influence individual employee attitudes such as job satisfaction. Along a similar line, Carlapio (1996) used a questionnaire method to investigate the relationship between satisfaction with the PWE and various employee attitudes and behaviours, including job satisfaction. It was found that greater satisfaction with the work environment was related to greater job satisfaction. Both of these were then related to greater organizational commitment and reduced intention to turnover amongst employees (Carlapio, 1996).



To date the research on the PWE, SBS symptoms and job satisfaction has not been extensive. Job satisfaction has been strongly related to turnover intentions, organizational commitment and employee performance (Petty et al., 1984; Tett & Meyer, 1993). Because of this it is included in the current study. Based on previous research (Danielsson & Bodin, 2008) it is expected that employees report a poor PWE will have lower levels of job satisfaction. In line with findings of Hedge et al. (1996) it is expected that higher reports of SBS symptoms will be related to lower job satisfaction.

*Hypothesis 4a:* Reports of a poor physical work environment will be negatively related to job satisfaction

*Hypothesis 4b:* Sick building syndrome symptoms will be negatively related to job satisfaction

### **Organizational Commitment**

Meyer and Allen (1991) defined organizational commitment as an attitude that characterises the employee's relationship with their organization, and has implications for the decision to continue or discontinue membership in that organization. Meyer and Allen (1991) conceptualise organizational commitment as having three dimensions, affective commitment, continuance commitment, and normative commitment. Affective commitment arises from the employee's emotional attachment to and identification with the organization, whereas continuance commitment occurs when the employee is aware of high costs associated with leaving the organization. Contrary to this normative commitment is thought to be the extent to which an employee feels obliged to stay with the organization for moral or other reasons (Meyer, Allen, & Smith, 1993). Each type of commitment translates to

different motivations for behaviour. Myer et al. (1993) state that employees with high affective commitment will remain with the organization because they want to, those with high continuance commitment will remain because they need to, and those with high normative commitment will remain because they feel they ought to. Normative commitment was not included in the present study, based on previous research (Cooper-Hakim & Viswesvaran, 2005; Meyer et al., 1993) which has found a strong correlation between the normative and affective commitment scales, indicating some overlap between normative and affective commitment. Affective and continuance commitment have been shown to have well established relationships with other variables of interest, including turnover, job performance and job satisfaction (Cooper-Hakim & Viswesvaran, 2005). Because of the strong links of organizational commitment to influences on organizational productivity (Meyer et al., 1993), it is important to establish how the PWE and SBS symptoms might impact employee commitment.

Baldry et al. (1997) argued that failure on the part of management to do anything about a disliked and unhealthy environment, especially one resulting in SBS symptoms, is likely to result in reduced organizational commitment. McGuire and McLaren (2009) investigated the relationship between the physical work environment, employee well-being and employee commitment. They defined employee commitment as “an employee’s identification with, and adoption of, an organization’s values, norms and traditions” (p. 35). This relates to Meyer and Allen’s (1991) construct of affective commitment. They hypothesised that perceptions of a better physical work environment would result in greater employee

commitment, and that employee well-being would mediate the relationship between the physical work environment and employee commitment. McGuire and McLaren argue that in order to facilitate employee productivity and commitment, the physical work environment must be sufficient for individual and organizational needs. McGuire and McLaren (2009) conducted a field study in a call centre in Scotland. Sixty five front-line employees completed a survey designed to assess their satisfaction with the work environment as well as stress, wellbeing and their commitment to the organization. It was found that employee wellbeing mediated the relationship between employee satisfaction with the physical work environment and employee commitment. The aspects of the physical work environment measured by McGuire and McLaren were somewhat different to the measure used in the current study which is based on Hedge et al. (1996). However, the study by McGuire and McLaren highlights the importance of taking in to account how physical aspects of the work environment impact on organizational commitment.

Carlapio (1996) constructed a questionnaire designed to provide a comprehensive assessment of employee satisfaction with aspects of their physical work environment. It was hypothesised that job satisfaction and satisfaction with the PWE would combine to form an overall work satisfaction construct which would predict organizational commitment and intentions to turnover. Organizational commitment was assessed using the Organizational Commitment Questionnaire (OCQ) (Carlapio, 1996) which relates to the construct of affective commitment in the three component theory of organizational commitment (Meyer & Allen, 1991). Carlapio (1996) found that reduced satisfaction with the physical work environment

was related to reduced organizational commitment of employees. Combined with job satisfaction, satisfaction with the work environment explained 63% of the variance in organizational commitment. Organizational commitment in turn was strongly negatively related to turnover intentions, accounting for 80% of the variation (Carlapio, 1996, p. 341).

Both McGuire and McClaren (2009) and Carlapio (1996) link the physical work environment with organizational commitment. Both studies found that improvements in the physical work environment related to increases in the equivalent of affective commitment. Therefore it was expected that better perceptions of the PWE and fewer SBS symptoms would be related to increased affective commitment.

*Hypothesis 5a:* Reports of a poor physical work environment will be negatively related to affective organizational commitment

*Hypothesis 5b:* Sick building syndrome symptoms will be negatively related to affective organizational commitment

Continuance commitment was not included in the preceding studies, however, it has been shown in previous research that if employees feel that they cannot leave their current organization because of financial restrictions or limited options elsewhere, they will stay even when they have no emotional attachment to their current organization (Cooper-Hakim & Viswesvaran, 2005). Employees that might otherwise have left the organization because of SBS symptoms could stay on because they feel that it would be too costly to leave or they have no opportunities elsewhere.

In an extensive literature review and meta-analysis, Meyer, Stanley, Herscovitch, and Topolnytsky (2002) investigated the antecedents, correlates and consequences of Meyer and Allen's (1991) three component theory of organizational commitment. They established correlations for each type of commitment with work experience variables, such as role ambiguity, or procedural justice. They found that for these work experience variables "in all cases, the sign of the correlation involving continuance commitment was opposite to that for affective and normative commitment" (p. 32). Because continuance commitment has found to relate differently than affective commitment to other variables in past research, it is expected that it will relate differently to other variables in this research too.

While it is expected that a poor PWE and SBS symptoms will relate negatively to affective commitment, it is not expected that they will relate the same way to continuance commitment. Therefore it is expected in this study that a worse PWE and more SBS symptoms will relate to increased continuance commitment.

*Hypothesis 6a:* Reports of a poor physical work environment will be positively related to continuance organizational commitment

*Hypothesis 6b:* Sick building syndrome symptoms will be positively related to continuance organizational commitment

### **Turnover Intentions**

Turnover occurs when employees voluntarily, or involuntarily, leave their job. While a certain amount of turnover is unavoidable, excessive turnover can leave an organization with an inexperienced and untrained workforce which leads to reduced organizational efficiency and productivity (Spector, 2008). High rates of turnover are

also undesirable because of the high cost of recruiting and training new staff, and the competitive edge gained over other organizations by retaining high performing staff (Spector). Turnover intentions can be conceived as the deliberate wilfulness to leave the organization (Tett & Meyer, 1993). Turnover intentions are often used in organizational research instead of objective measures of turnover. Tett and Meyer (1993) argue that because of the strong relationship between turnover intentions and actual turnover in previous research, it is reasonable to assume turnover intentions can predict future turnover with some accuracy. Although not largely studied in the SBS literature it is logical that SBS symptoms could lead to higher levels of turnover and intention to quit among employees of an affected building (Rostron, 2008). A person who is being made ill from their environment is likely to seek out a new environment to work in. They may do this by requesting changes in their current environment, or by seeking out a new organization and therefore a new physical environment to work in. It is likely that if an employee experiences ongoing uncomfortable physical symptoms while at their place of work, and encounters relief from these symptoms when away from the work environment, they will start to consider leaving that work environment completely. In their review article Seppanen and Fisk (2003) developed a conceptual model in order to estimate the costs associated with SBS and its outcomes, and the cost effectiveness of making improvements to the indoor environment. As well as sick leave, high employee turnover features as one of the likely outcomes associated with SBS. Turnover can be incredibly costly for organizations because of lost productivity and the costs

associated with hiring and training new staff. SBS is likely to increase employee's intention to turnover as well as actual turnover.

Carlopio (1996) developed the physical work environment satisfaction questionnaire (PWESQ) to assess employee perceptions of their physical work environment. The survey contains 5 subscales, the first of which assesses ambient environmental conditions similar to that used in this study (Hedge et al., 1996). In order to investigate the influence of the physical work environment on employee attitudes and behaviours, the PWESQ was administered to 641 employees at 8 different organizations, as well as measures of job satisfaction, organizational commitment and intention to turnover. It was found that reduced satisfaction with the physical work environment related to reduced job satisfaction, reduced organizational commitment, and increased intention to turnover.

Turnover intentions are viewed in the literature as the strongest cognitive precursor to the employee leaving the organization (Tett & Meyer, 1993), and can therefore be expected to predict future turnover with some accuracy. Increased turnover is often cited as one of the major outcomes of a poor PWE and SBS symptoms (Baldry et al., 1997; Rostron, 2008). Therefore, it is expected that poor ratings of the PWE will be related to higher turnover intentions, while SBS symptoms will also relate to higher turnover intentions.

*Hypothesis 7a:* Reports of a poor physical work environment will be positively related to turnover intentions

*Hypothesis 7b:* Sick building syndrome symptoms will be positively related to turnover intentions

### **Perceived Organizational Support**

Perceived Organizational Support (POS) can be defined as the extent to which the employee feels that the organization values their contribution and cares about their wellbeing (Eisenberger, Huntington, Hutchison, & Sowa, 1984). It is theorised that employees with high POS expect that any extra effort on their part will be recognised by their employer and will therefore be more likely to align their behaviour with the goals of the organization. Eisenberger, Armeli, Rexwinkle, Lynch and Rhoades (2001) theorised that high POS would result in the desire on the part of employees to reciprocate the advantageous treatment they feel that they get from their employer. If this is the case, employees with high POS will feel obliged to act in a way that benefits the organization. POS is expected to be higher when the organization has been seen to show a caring and positive regard to its employees (Eisenberger et al., 2001). It then follows that if an employee is experiencing SBS symptoms that they view as being caused by the PWE they will not view their organization as caring about their wellbeing. It is logical to expect that a poor PWE and increased SBS symptoms will be related to reduced POS. While POS has made an appearance in the SBS literature, research on the subject has not been extensive. In one literature review Lahtinen et al. (1998) identified that employees that reported high levels of SBS symptoms also reported low supervisor support, and less satisfaction with the human resource situation in their organization.

In an investigation in to employees working in known SBS settings and relatively SBS free workplaces Mendelson et al. (2000) investigated the relationship of POS with the incidence of SBS symptoms, perceptions of the PWE, role overload



and family support. It was found that POS was higher in SBS locations than in unaffected areas. This is possibly because the organization at the SBS locations had been actively involved in trying to solve the problem so was seen to be caring about the employees. However, further investigation revealed that high role overload and high family support, but low organizational support were related to higher reports of physical symptoms. This suggests that those employees who were more likely to perceive their health as negatively affected by work and report poor air quality also saw the organization to be less supportive. Because of the nature of the study the direction of the relationship between perceptions of the PWE, SBS symptoms and POS was unclear (Mendelson et al., 2000).

In a case study of the development of SBS in one building Thorn (2000) observed an ongoing development of mistrust between parties as time went on. Through ineffective and indecisive actions taken by management, employees stopped believing that the organization cared about their well-being or could deliver what the employees needed. This appeared to contribute to the ongoing development and maintenance of SBS above and beyond the effect of environmental factors alone. While information obtained through case study cannot be considered statistically generalisable to other situations, case studies can be used to obtain a deeper understanding of a certain phenomenon. This case study suggests that while reduced POS may be an outcome for SBS, it may also contribute to its maintenance (Thorn, 2000).

POS is a belief held by employees that their organization acts with their best interests in mind. Employees that strongly believe this are more likely to act in ways that are congruent with the organizations goals (Eisenberger et al., 2001) which makes POS an important variable for assessing the impact SBS might have on overall organizational productivity. Although POS is not well researched in the SBS literature, past evidence does suggest a directional relationship where high ratings of the PWE and low incidence of SBS symptoms will be related to high POS.

*Hypothesis 8a:* Reports of a poor physical work environment will be negatively related to perceived organizational support

*Hypothesis 8b:* Sick building syndrome symptoms will be negatively related to perceived organizational support

### **Mediated relationship**

Previous research has established the physical environment as the main contributor to SBS symptoms. Research has also linked both the PWE and SBS symptoms to the outcome measures investigated in this study. Based on the literature it is theoretically expected that SBS will account for some of the variance in the outcome measures caused by PWE. It is therefore expected that SBS symptoms will mediate the relationships between the PWE and the outcome measures in this study.

Seppanen and Fisk (2006) concluded from their review of the literature that a link exists between SBS symptoms and performance, and aspects of the PWE and performance. They suggest that the linkage between building factors and SBS symptoms, and further to performance and health outcomes, would be a successful theoretical model for future research on SBS. In previously mentioned research,

McGuire and McLaren (2009) conducted a field study in a call centre in Scotland. 65 front-line employees completed a survey designed to assess their satisfaction with the work environment as well as stress, wellbeing and their commitment to the organization. It was found that employee well-being, both physical and emotional, mediates the relationship between employee satisfaction with the physical work environment and employee commitment. It is therefore expected that in the current study SBS symptoms will mediate the relationship between the PWE and the outcome measures of absenteeism, job performance, job satisfaction, turnover intentions, affective and continuance commitment, and perceived organizational support.

*Hypothesis 9:* Sick building syndrome symptoms will mediate the relationship between the physical work environment and:

- a) Absenteeism
- b) Job performance
- c) Job satisfaction
- d) Intention to quit
- e) Affective organizational commitment
- f) Continuance organizational commitment
- g) Perceived organizational support

## Summary of Hypotheses

- H1:* Reports of a poor physical work environment will be positively related to sick building syndrome symptoms.
- H2a:* Reports of a poor physical work environment will be positively related to absenteeism
- H2b:* Sick building syndrome symptoms will be positively related to absenteeism
- H3a:* Reports of a poor physical work environment will be negatively related to employee performance
- H3b:* Sick building syndrome symptoms will be negatively related to employee performance
- H4a:* Reports of a poor physical work environment will be negatively related to job satisfaction
- H 4b:* Sick building syndrome symptoms will be negatively related to job satisfaction
- H5a:* Reports of a poor physical work environment will be negatively related to affective organizational commitment
- H5b:* Sick building syndrome symptoms will be negatively related to affective organizational commitment
- H6a:* Reports of a poor physical work environment will be positively related to continuance commitment
- H6b:* Sick building syndrome symptoms will be positively related to continuance commitment
- H7a:* Reports of a poor physical work environment will be positively related to turnover intentions
- H7b:* Sick building syndrome symptoms will be positively related to turnover intentions
- H8a:* Reports of a poor physical work environment will be negatively related to perceived organizational support

*H8b:* Sick building syndrome symptoms will be negatively related to perceived organizational support

*Hypothesis 9:* Sick building syndrome symptoms will mediate the relationship between the physical work environment and:

- a) Absenteeism
- b) Job performance
- c) Job satisfaction
- d) Turnover intentions
- e) Affective organizational commitment
- f) Continuance organizational commitment
- g) Perceived organizational support

## **Chapter 2**

### **Method**

A survey was conducted of employees of several organizations occupying a range of medium to large office buildings in New Zealand. A total of 38 were approached and 9 took part in the study. These office buildings were situated in Auckland, Mount Maunganui, Hamilton, and Rotorua.

#### **Participants**

Overall, 634 invitations to participate were distributed. From this 168 people completed the online questionnaire representing a response rate of 26.5%. The criterion for inclusion in this study was that the employees' work was conducted in an office setting. To ensure this criterion was met, participants and organizations were only approached if they were based in an office building. In addition, a question was included in the survey designed to screen out any respondents who did not work in an office environment. This was: "Please describe your working environment" with the response options of "office" or "other (please explain)". Of the 168 respondents four responded as working in a non-office environment. These people were excluded from subsequent analysis which left a sample of 164. Demographic details of the sample (N=164) are presented in Table 1.

#### **Measures**

Data in this study were collected using an anonymous online questionnaire, developed using validated scales from previous research. The questionnaire contained

Table 1.

*Demographics*

		Frequency		Percent		
Gender	Female	95		58.3		
	Male	68		41.7		
	Total N	163				
Ethnicity	NZ European	121		76.1		
	Maori	10		6.3		
	Pacific Peoples	0		0		
	Asian	4		2.5		
	Other	24		15.1		
	Total N	159				
		N	Min.	Max.	Mean	Std Dev.
Age		145	19	72	41.63	11.83

quantitative measures of employee perceptions of the physical work environment, sick building syndrome symptoms, absenteeism, intention to turnover, perceived organizational support, self rated job performance, job satisfaction and organizational commitment (affective and continuance). In the last section respondents were asked to give some information about themselves, including age, gender, and ethnicity. A sample of the cover letter and questionnaire are presented in Appendix A.

All scale scores were computed by taking the mean response to items in the scale. In order to avoid losing large amounts of data, missing data imputation was employed according to the suggestions of Roth, Switzer and Switzer (1999). For any cases where respondents had not answered a particular question within a scale, the value for the item was estimated using within-participant mean data imputation. In this technique, the likely value of the missing item is calculated using the rest of the responses by the individual respondent on that scale. Roth et al (1999) suggested this technique as it acknowledges individual differences in responding. In total 44 separate items were replaced in this way. This represents .36% of the total data.

**Physical Work Environment.** Employee perceptions of the physical work environment (PWE) were measured using a 14 item scale developed by Hedge et al. (1996). Respondents were asked to rate how many times in the previous month they had experienced each of the conditions in their place of work, for example, "insufficient ventilation" or "unpleasant odours". Each item was scored on a response scale consisting of 'never' (1), '1-3 times a month' (2), '1-3 times a week' (3) and 'every day' (4).

In previous research, a distinction has been made between effect indicators, in which the latent variable causes the observed variable, and formative indicators, in which the construct is caused by the components being used to assess it (Diamantopoulos & Winklhofer, 2001; Spector & Jex, 1998). In the case of formative indicators each item is thought to measure a separate but related construct rather than one latent variable (Spector & Jex, 1998). The items in the measure are summed to



give a total index score. In this study it was decided that it was more appropriate to treat the PWE measure as a formative indicator of environmental factors in the workplace, rather than the observable variance of the work environment as a latent variable. This can be seen by taking in to account example items from the PWE measure such as “problems with glare” and “uncomfortable drafts” (sic). Both of these items measure a physical aspect of the work environment, however they would not be interchangeable in the scale, and they do not measure the same underlying construct. A person that scores highly on an item related to glare would not necessarily score highly on an item related to uncomfortable drafts. Exploratory Factor Analysis (EFA) was conducted with multi-item scales to establish the underlying structure. An underlying structure is not expected with variables that are considered to be formative indicators (Spector & Jex, 1998); therefore it is not appropriate to conduct EFA with the PWE measure.

The PWE scale had a Cronbach's Alpha coefficient of .80 and was positively skewed (.71). To decide whether skew values were significant enough to conduct transformations, the skew was compared to the standard error of skew. If the skew value exceeded this by more than a ratio of 2:1 it was considered to be skewed. The skew value of PWE exceeded this ratio, so transformations were conducted according to the recommendations of Tabachnick and Fidell (2007). Scales with moderate positive skew were transformed by taking the square root. For scales with a strong positive skew the logarithm was taken. For negatively skewed scales, the scales were first inverted and then the appropriate transformation was applied depending on the extent of the skew. For the PWE scale, the square root transformation was applied

and the newly transformed variable was correlated with all other variables in the study. However, transformation did not change the correlations between the PWE scale and the other variables so the untransformed data were used for subsequent analysis.

**Sick Building Syndrome.** The physical symptoms of SBS were measured using a 16 item scale developed by Hedge et al. (1996). Symptoms included in this scale are congruent with those put forward by the World Health Organization (1983) and are similar to those used in other SBS research (Bachmann & Myers, 1995; Kinman & Griffin, 2008). Example items include "irritated, sore eyes" and "stuffy, congested nose". Other items covered symptoms such as dry skin, nausea, and headaches. Respondents were asked to indicate how many times in the previous month they experienced each symptom that they associated with work. The response options were: 'never' (1), '1-3 times a month' (2), '1-3 times a week' (3), and 'every day' (4).

Exploratory Factor Analysis (EFA) was conducted on the SBS scale using the principle axis factoring method. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .87 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to continue. Four factors with Eigenvalues greater than one were extracted; however after examining the scree plot (Appendix B) it was decided that a one factor solution was appropriate. This factor explained 40% of the total variance.

The SBS scale had a coefficient alpha of .89 which shows good internal consistency. The SBS scale had a moderate positive skew of .84. This exceeded the standard error of skew by more than a ratio of 2:1. The SBS scale was transformed using the square root transformation according to the recommendations of Tabachnick and Fidell (2007) and then correlated with all other variables. Transformation did not increase the correlation of SBS with other variables and so the untransformed data was used for subsequent analysis.

**Absenteeism.** Absenteeism was measured using one item; “How many days in the last 12 months were you absent from work because of any of these symptoms?” Respondents were asked to enter the exact number of days they had been absent from work. Absenteeism had a strong positive skew of 2.14, which exceeded the standard error of skew by more than a ratio of 2:1. The logarithm of absenteeism was calculated to transform this variable according to the recommendations of Tabachnick and Fidell (2007) for a strong positive skew. However, the transformed absenteeism variable did not correlate any differently with any of the other variables so the untransformed variable was used in all further analysis.

**Job Performance.** A self rated measure of job performance was obtained using the 'professional efficacy' scale from the Maslach Burnout Inventory (Maslach, Jackson, & Leiter, 1996). The scale consists of six items, for example, “In my opinion I am good at my job” and “at my work, I feel confident that I am effective at getting things done”. These items were scored on a 5 point scale ranging from 'never' to 'always'.

When EFA was conducted using the principal axis factoring method, the KMO measure of sampling adequacy was .74 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to continue. As expected, one factor with an Eigenvalue over one was extracted (Appendix B). This factor explained 50.00% of the variance. The Cronbach's alpha in this study was .75. The job performance scale had a slight negative skew of -.04. This skew value does not exceed the standard error of skew and did not need to be transformed (Tabachnick & Fidell, 2007).

**Job Satisfaction.** Job satisfaction was measured using a three item scale from the Michigan Organizational Assessment Questionnaire (Cook, Hepworth, Wall, & Warr, 1981). The items were “In general, I don't like my job”, “All in all, I am satisfied with my job” and “In general, I like working here”. Responses were recorded on a 7-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

When EFA was conducted using the principal axis factoring method, the KMO measure of sampling adequacy was .73 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to continue. As expected, one factor with an Eigenvalue over one was extracted (Appendix B). This factor explained 83.33% of the variance. The Cronbach's alpha in this study was .90. The job satisfaction scale had a strong negative skew (-1.50). This scale was transformed by first inverting the values to convert it in to a positive distribution before the logarithm was taken as recommended by Tabachnick and Fidell (2007) for variables with a strong negative skew. The transformed job satisfaction scale did not correlate

differently with other variables than the un-transformed scale. The un-transformed scale was used in all subsequent analysis.

**Turnover Intentions.** Turnover intentions were measured using a three item scale developed by Colarelli (1984). These items are: “If I have my own way, I will be working for my current employer one year from now” (Reverse scored); “I frequently think of quitting my job”; and “I am planning to search for a new job during the next 12 months”. These items were scored on a seven point response scale ranging from 'strongly disagree' to 'strongly agree'.

When EFA was conducted using the principal axis factoring method the KMO measure of sampling adequacy was .74 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to continue. As expected, one factor with an Eigenvalue over one was extracted (Appendix B). This factor explained 79.36% of the variance. Cronbach's alpha of .87 in this study. Turnover scale was positively skewed (.71). This was transformed using the square root method in accordance with the recommendations of Tabachnick and Fidell (2007) for moderate positively skewed distributions. The transformed variable of intention to turnover did not correlate any differently with the other variables than the untransformed data. Therefore, the untransformed variable was retained for further analysis.

**Organizational Commitment.** Meyer and Allen (1984) developed a measure of organizational commitment with two separate scales to measure affective commitment and continuance commitment. The affective commitment scale was designed to measure the employee's emotional attachment to and identification with

the organization. The affective commitment scale consists of 8 items, for example “This organization has a great deal of personal meaning for me.” Items were scored on a 7-point Likert type scale with responses ranging from 'strongly agree' to 'strongly disagree'.

EFA was conducted on the affective commitment scale using the principal axis factoring method. The KMO measure of sampling adequacy was .87 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to continue. As expected, one factor with an Eigenvalue over one was extracted (Appendix B). This factor explained 54.17% of the variance. The Cronbach's alpha in this study was .87, suggesting good internal consistency. The affective commitment scale had a skew value of .01. As this does not exceed the standard error of skew the scale was not considered to be skewed, therefore no transformation was necessary (Tabachnick & Fidell, 2007).

The continuance commitment scale measures the extent to which the employee feels there are high costs associated with leaving the organization. The continuance commitment scale consists of 8 items, for example, “right now, staying with my organization is a matter of necessity as much as desire”. Items were scored on a 7-point Likert type scale with responses ranging from 'strongly agree' to 'strongly disagree'.

EFA was conducted on the continuance commitment scale using the principal axis factoring method. The KMO measure of sampling adequacy was .82 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to

continue with EFA. Two factors with an Eigenvalue over one were extracted, however after inspecting the scree plot (Appendix B) a one factor model was decided upon. This factor explained 45.70% of the variance. The Cronbach's alpha in this study was .81, suggesting good internal consistency. The continuance commitment scale was found to have a slight negative skew of -.13. This skew value does not exceed the standard error of skew and as such no transformation is required (Tabachnick & Fidell, 2007).

**Perceived Organizational Support.** The survey of perceived organizational support (SPOS) was developed by Eisenberger et al. (1984). The original version of the survey contains 32 items. In order to reduce completion time in the current study, the short version of the SPOS was used. The short version of the SPOS consists of 16 items with a reliability coefficient (alpha) of .93 (Eisenberger et al., 1984). The survey is designed to measure the extent to which the respondent feels that the organization values their contributions and cares about their wellbeing. For example, items in the short version of the SPOS include “The organization really cares about my well-being” and “The organization shows very little concern for me” (reverse scored). Responses were recorded on a 7-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

When EFA was conducted using the principal axis factoring method, the KMO measure of sampling adequacy was .94 and Bartlett's test of sphericity was significant, suggesting that it was appropriate to continue. As expected, one factor with an Eigenvalue over one was extracted (Appendix B). This factor explained

57.67% of the variance. The Cronbach's alpha in this study was .95. The POS scale had a moderate negative skew of  $-.48$ . As this value exceeded a 2:1 ratio with the standard error of skew the POS scale was transformed according to the recommendations of Tabachnick and Fidell (2007). The scale was first inverted to convert it to a positively skewed distribution, and then the square root was taken. The transformation did not improve the correlations between POS and any other variables. Therefore, the un-transformed scale was used in all further analysis.

### **Procedure**

The research and ethics committee for the School of Psychology at the University of Waikato granted ethical approval for this research. Participants were recruited using two methods. In the first method HR managers within target organizations were contacted to determine if the organization would be interested in participating in the study. If the HR manager agreed to consider participation they were then sent information via email explaining the scope of the study (Appendix C), what would be required of the organization and the respondents, and outlining participants' rights including privacy. This email also contained a copy of the survey questions so that the HR manager could make an informed decision about participation. If permission was given for the organization to become involved, an email invitation to participate (Appendix D) was then circulated amongst employees by the HR manager through the internal email system. The invitation informed employees about the study and their rights if they chose to participate and contained a link to the online version of the questionnaire. Six buildings participated that were originally approached using this method.



The second method of participant recruitment targeted potential participants directly. This was done by selecting medium to large office buildings, and distributing flyers (Appendix E) to people who worked in the building as they entered or left. The flyer was similar to the email invitation described earlier. It contained information on the study and participant rights as well as the web address of the online survey. If people consented to participate they were given instructions to type the address in to the address bar of their web browser in order to access the online questionnaire. Three buildings were sampled from that were originally approached using this method. Unfortunately, because of the nature of the online survey method, it was not possible to compute how many individual respondents were recruited using each of the methods.

## Chapter 3

### Results

This chapter presents the outcomes of the statistical analyses, which are separated into three main sections: descriptive statistics, correlations and regressions, and mediated regression analyses.

#### Descriptive Statistics

Descriptive statistics were calculated for all variables including means, standard deviations, skew and Cronbach's alpha. These are presented in Table 2. The PWE and SBS were scored on a four point scale ranging from 'never' (1) to 'every day' (4). Turnover, perceived organizational support, organizational commitment, and job satisfaction were scored on 7 point scales ranging from *strongly disagree* (1) to *strongly agree* (7). Self rated performance was scored on a 5 point scale ranging from *never* (1) to *always* (5). Absenteeism was measured with one item asking respondents to state how many days they had been absent in the previous 12 months. On average participants reported moderate to low levels of PWE (1.78), SBS symptoms (1.59), intention to turnover (2.91) and absenteeism (1.45). Participants reported moderate to high levels of perceived organizational support (4.86), affective organizational commitment (4.37), and continuance organizational commitment (4.27). Participants reported high levels of job satisfaction (5.66) and self rated performance (4.04).

Six variables had levels of skew that were greater than a 2/1 ratio with the standard error of skew. As mentioned in Chapter two transformations were conducted on these variables according to the recommendations of Tabachnick and Fidel (2007). However, as this did not change the correlation with other variables the non-transformed data was retained for further analysis. Cronbach's alpha for all of the variables was above Nunnally's (1978) recommended internal consistency threshold of .70. This suggests the scale scores are reliable for respondents in this study.

Table 2.

*Descriptive Statistics*

	Mean	Std Dev.	Skew	Alpha
PWE (a)	1.75	.50	.71	.80
SBS (a)	1.59	.44	.84	.89
Absenteeism (b)	1.45	2.36	2.14	N/A
Intention to Turnover (c)	2.91	1.75	.71	.87
Perceived Organizational Support (c)	4.86	1.13	-.48	.95
Job Satisfaction (c)	5.66	1.26	-1.50	.90
Performance (d)	4.04	.50	-.04	.75
Affective Organizational Commitment (c)	4.37	1.14	.01	.87
Continuance Organizational commitment (c)	4.27	1.17	-.13	.81

(a) 4 point scale, (1 = never, 4 = every day).

(b) number of days reported absent.

(c) 7 point scale (1=strongly disagree, 7 = strongly agree).

(d) 5 point scale (1 = never, 5 = always).

## Hypothesis Testing

Correlations between all variables were calculated and are presented in table 3. The level of significance used to determine whether or not a hypothesis was supported was  $p < 0.05$ . Both the  $p < 0.05$  and  $p < 0.01$  levels are identified in table 3. Missing data was excluded pairwise.

As expected PWE was strongly and positively related to SBS symptoms ( $r = .55, p < .01$ ). This supports Hypothesis 1 and suggests that as people report more issues with their work environment they also experience more SBS symptoms.

Absenteeism was positively correlated with PWE ( $r = .22, p < .05$ ) and SBS ( $r = .33, p < .05$ ). Therefore, hypotheses 2a and 2b were supported. This suggests that as people report more issues with their work environment, and report experiencing more SBS symptoms, they are also absent from work for more days.

Hypotheses 3a and 3b predicted that job performance would be negatively correlated with PWE and SBS. However, job performance was not significantly related to PWE or SBS symptoms so hypotheses 3a and 3b were not supported.

As predicted job satisfaction was negatively related to PWE ( $r = -.17, p < .05$ ) and SBS symptoms ( $r = -.33, p < .01$ ). Therefore hypotheses 4a and 4b were supported. This suggests that as people rate their PWE as poor, and report high levels of SBS symptoms, they also report low levels of job satisfaction.

Affective commitment was negatively related to general PWE ( $r = -.19, p < .05$ ) and SBS symptoms ( $r = -.27, p < .01$ ). Therefore hypotheses 5a and 5b were

supported. As people report a poor PWE and high levels of SBS symptoms, they also report low affective commitment.

Hypotheses 6a and 6b predicted that continuance commitment would be positively related to PWE and SBS. This was supported as a positive correlation was found between continuance organizational commitment and PWE ( $r = .17, p < .05$ ) and SBS ( $r = .21, p < .01$ ). This suggests that as people rate the PWE as poor and experience high levels of SBS symptoms, they also report high levels of continuance commitment.

As expected, turnover intentions were positively related to PWE ( $r = .24, p < .01$ ) and SBS symptoms ( $r = .31, p < .01$ ). Therefore, hypotheses 7a and 7b were supported. This suggests that high ratings of a poor PWE and SBS symptoms are related to high levels of turnover intentions.

Perceived organizational support was negatively related to PWE ( $r = -.38, p < .01$ ) and SBS symptoms ( $r = -.44, p < .01$ ). Therefore, hypotheses 8a and 8b were supported. As people reported high levels of a poor PWE and SBS symptoms, they also reported low perceived organizational support.

Table 3.

*Correlations*

	PWE	SBS	Absent	Turnover	POS	JobSat	Perform	AffCom	ContCom
PWE	1								
SBS	.56**	1							
Absent	.21*	.33**	1						
Turnover	.29**	.31**	.24*	1					
POS	-.41**	-.44**	.02	-.50**	1				
JobSat	-.21*	-.33**	-.08	-.74**	.58**	1			
Perform	.02	.03	.06	-.22**	.21**	.28**	1		
AffCom	-.23**	-.27**	-.12	-.61**	.69**	.63**	.39**	1	
ContCom	.20*	.21**	-.05	.18*	-.38**	-.21**	-.07	-.32**	1

Note: PWE = Physical work environment, SBS = Sick building syndrome, Absent = Absenteeism, Turnover = Turnover intentions, POS = Perceived organizational support, JobSat = Job satisfaction, Perform = Job Performance, AffCom = Affective commitment, ContCom = Continuance commitment.

N = 153 – 164.

Absenteeism had several missing values. Absenteeism N = 104

\*= significant at the  $p < 0.05$  level

\*\* = significant at the  $p < 0.01$  level

### **Mediated Regression**

Mediation analysis was conducted to test Hypotheses 9a – 9g according to the guidelines established by Baron and Kenny (1986). This approach consists of three stages, first the mediator variable is regressed on the predictor variable. In the second step the criterion variable is regressed on the predictor variable. In the third stage the criterion variable is regressed on both the predictor and mediator variable simultaneously.

In order for mediation to occur, four requirements must be met. First, the predictor variable must be significantly related to the mediator variable. Second, the predictor variable must be significantly related to the criterion variable. Third, the mediator variable must be significantly related to the criterion variable in stage 3. The fourth requirement is that the relationship between the predictor and criterion variables is smaller in stage three, when the mediator is included, than in stage two. If the relationship between the predictor and criterion variables is significant in stage two and non-significant in stage three this is regarded as full mediation. If the relationship between the predictor and criterion variable is reduced from stage two to stage three, but is still significant, this is partial mediation. Mediation regression analysis was conducted to assess the mediation relationships predicted in Hypotheses 9a – 9g. Sobel tests were then used to test the significance of any mediation relationships found using the regression analysis outlined by Baron and Kenny (1986). Results of these analyses are presented in Table's 4 – 9. The level of significance used to confirm hypotheses was  $p < 0.05$ , significance at the  $p < 0.01$  level was also indicated in these tables.

**Absenteeism.** Hypothesis 9a stated that SBS symptoms would mediate the relationship between the PWE and absenteeism. Table 4 presents the three regression equations estimated to establish a mediating relationship. In the first equation, SBS (the mediator) was regressed on PWE (the predictor) and this was significant. In the second equation absenteeism (the criterion) was regression on PWE, this was significant. In the third equation absenteeism was regressed on both PWE and SBS. The relationship between job satisfaction and SBS was significant. The relationship between job satisfaction and PWE was not significant when SBS was controlled for in equation three. All four of Baron and Kenny's (1984) conditions were satisfied and full mediation occurred. A Sobel test was conducted which indicated a significant mediation effect

Table 4.

*Mediated regression testing hypothesis 9a*

Equation	Criterion	Predictor	Beta	t	R Square
1	SBS	PWE	.56	8.26**	.31
2	Absenteeism	PWE	.21	2.21*	.05
3	Absenteeism	PWE	.04	.37	
		SBS	.28	2.35*	.10
		Sobel Test		z = 2.29, p < .05	

\*p&lt;.05

\*\*p&lt;.01



**Job Performance.** Hypothesis 9b was that SBS would mediate the relationship between PWE and self-rated job performance. However, job performance was not significantly related to either PWE or SBS so was not included in the mediation analysis. Hypothesis 9b was not supported.

**Job Satisfaction.** Hypothesis 9c stated that SBS symptoms would mediate the relationship between PWE and job satisfaction. Table 5 contains the three regression equations performed to test this hypothesis. In the first equation, SBS (the mediator) was regressed on PWE (the predictor) and this was significant. In the second equation, job satisfaction (the criterion) was regression on PWE, and was significant. In the third equation, job satisfaction was regressed on both PWE and SBS. The relationship between job satisfaction and SBS was significant. The relationship between job satisfaction and PWE was not significant when SBS was controlled for. All four of Baron and Kenny's (1984) conditions were satisfied and full mediation occurred. The Sobel test indicated a significant mediation effect.

Table 5.

*Mediated regression testing hypothesis 9c*

Equation	Criterion	Predictor	Beta	t	R Square
1	SBS	PWE	.56	8.26**	.31
2	Job Satisfaction	PWE	-.21	-2.59*	.04
3	Job Satisfaction	PWE	.02	.25	
		SBS	-.32	-3.47**	.11
		Sobel Test		z = -3.20, p < .01	

\*p<.05

\*\*p<.01

**Turnover intentions.** Hypothesis 9d stated that SBS symptoms would mediate the relationship between the PWE and turnover intentions. Results of the three regression equations are presented in table 6. In the first equation, SBS (the mediator) was regressed on PWE (the predictor) and was significant. In the second equation, turnover intentions (the criterion) was regressed on PWE and was significant. In the third equation, the relationship between PWE (the predictor) and turnover intentions (the criterion) was not significant when SBS (the mediator) was included. The relationship between turnover intentions and SBS was significant in the third equation. All four of Baron and Kenny's (1984) requirements were met indicating full mediation. The Sobel test confirmed significant mediation.

Table 6.

*Mediated regression testing hypothesis 9d*

Equation	Criterion	Predictor	Beta	t	R Square
1	SBS	PWE	.56	8.26**	.31
2	Turnover Intentions	PWE	.29	3.69**	.08
3	Turnover Intentions	PWE	.18	1.89	
		SBS	.20	2.18*	.10
			Sobel Test	z = 2.11, p < .05	

\*p&lt;.05

\*\*p&lt;.01

**Affective Commitment.** Hypothesis 9e stated that SBS symptoms would mediate the relationship between the PWE and affective commitment. Results of the three regression equations conducted to test this hypothesis are presented in Table 7. In the first equation, SBS (the mediator) was regressed on PWE (the predictor) and was significant. In the second equation, affective commitment (the criterion) was regression on PWE, and this was significant. In the third equation the relationship between PWE (the predictor) and affective commitment (the criterion) was not significant when SBS (the mediator) was included. The relationship between affective commitment and SBS was significant in the third equation. All four of Baron and Kenny's (1984) requirements were met indicating full mediation. The Sobel test confirmed significant mediation.

Table 7.

*Mediated regression testing hypothesis 9e*

Equation	Criterion	Predictor	Beta	t	R Square
1	SBS	PWE	.56	8.26**	.31
2	Affective Commitment	PWE	-.23	-2.92**	.05
3	Affective Commitment	PWE	-.12	-1.22	
		SBS	-.20	-2.10*	.08
		Sobel Test		z = -2.04, p < .05	

\*p<.05

\*\*p<.01

**Continuance Commitment.** Hypothesis 9f predicted that SBS symptoms would mediate the relationship between the PWE and continuance commitment. Three regression equations were conducted to test this hypothesis and are presented in Table 8. In the first equation, SBS (the mediator) was regressed on PWE (the predictor) and was significant. In the second equation, continuance organizational commitment (the criterion) was regression on PWE, and was significant. In the third equation, both PWE and SBS were not significantly related to continuance commitment. The first two requirements established by Baron and Kenny (1986) were met but the third and fourth requirements were not. Therefore hypothesis 9f was not supported indicating that SBS did not mediate the relationship between PWE and continuance commitment. The non-significant Sobel value confirmed the lack of mediation effects for continuance commitment.

Table 8.

*Mediated regression testing hypothesis 9f*

Equation	Criterion	Predictor	Beta	t	R Square
1	SBS	PWE	.56	8.26**	.31
2	Continuance Commitment	PWE	.20	2.46*	.04
3	Continuance Commitment	PWE	.12	1.28	
		SBS	.14	1.41	.05
				Sobel Test	z = 1.39, n.s.

\*p&lt;.05

\*\*p&lt;.01

**Perceived Organizational Support.** Hypothesis 9g stated that SBS would mediate the relationship between PWE and perceived organizational support. Three regression equations were conducted to test this hypothesis, the results of which are presented in table 9. In the first equation, SBS (the mediator) was regressed on PWE (the predictor) and was significant. In the second equation, perceived organizational support (the criterion) was regression on PWE, and was significant. In the third equation, the relationship between SBS and perceived organizational support was significant. The relationship between PWE and perceived organizational support was reduced when SBS was controlled for, but was still significant. According to the requirements of Baron and Kenny (1986) SBS partially mediates the relationship between PWE and perceived organizational support. The Sobel test confirmed a significant mediation.

Table 9.

*Mediated regression testing hypothesis 9g*

Equation	Criterion	Predictor	Beta	t	R Square
1	SBS	PWE	.56	8.26**	.31
2	POS	PWE	-.41	-5.49**	.16
3	POS	PWE	-.23	-2.73**	
		SBS	-.30	-3.51**	.22
				Sobel Test	z = -3.23, p < .001

\*p&lt;.05

\*\*p&lt;.01

## **Summary**

Ratings of a poor PWE and SBS symptoms were negatively related to job satisfaction, affective commitment, and perceived organizational support. Ratings of a poor PWE and SBS symptoms were positively related to absenteeism, turnover intentions, and continuance commitment. The PWE and SBS symptoms were not significantly related to self-reported job performance. SBS symptoms mediated the relationship between a poor PWE and absenteeism, job satisfaction, affective commitment, perceived organizational support, and turnover intentions. There was not a mediating relationship found between the PWE, SBS symptoms and continuance commitment. Implications of these findings are discussed in the following chapter.

## Chapter 4

### Discussion

The aim of this research was to investigate the relationship between the physical work environment (PWE) and sick building syndrome (SBS), and with various outcomes that are relevant to overall organizational productivity. New Zealand is currently experiencing an economic recession, and in this economic climate it is more important than ever for organizations to retain high performance employees and ensure that the work environment is conducive to high levels of individual performance. The physical aspects of the work environment do not always receive as much attention as the managerial and interpersonal aspects, even though the PWE has been shown to influence organizational-relevant outcomes (Baldry et al., 1997). People who are actively involved in the work force will spend a large proportion of their lives in their place of work. It is important that, as well as the impact on organizational productivity, any potential harm from the physical aspects of the workplace is considered.

Overall, the results supported the relationships that were predicted. Ratings of a poor PWE were strongly related to SBS symptoms. Both PWE and SBS were related to absenteeism, job satisfaction, turnover intentions, affective and continuance commitment, and perceived organizational support (POS). SBS mediated the relationship between PWE and most of these variables, except for continuance commitment. Contrary to much prior research self-rated job performance was not found to be related to PWE or SBS. The implications of these findings are discussed.

This chapter is divided into six sections. First a complete overview of findings will be given, followed by a review of the strengths and limitations of the current study. The implications of the research will then be outlined and discussed. Based on the findings, possible directions for future research will be offered. Finally, conclusions from this research will be drawn.

### **Relationships between Variables**

**The Physical Work Environment and Sick Building Syndrome.** It was expected that ratings of a poor PWE would have a strong positive relationship with SBS symptoms. This is in line with previous research (Hedge et al., 1996) identifying physical aspects of the work environment as the main predictor of SBS symptoms. A working group report by the World Health Organization identified poor working conditions as the main contributing factor to SBS (1983). Burge et al. (2004) described SBS as a phenomenon in which the inhabitants of a building present the symptoms, but the building they inhabit that is the cause. While SBS has been consistently linked to the PWE, no one specific aspect of the environment is the sole cause (Ryan & Morrow, 1992). It is for this reason that Hedge et al. (1996) designed a scale to assess various physical aspects of the work environment thought to contribute to SBS. This measure was used in the current study to assess employee perceptions of the PWE. Based on this previous research hypothesis one stated that complaints about the PWE would be positively correlated with reports of SBS symptoms. The relationship in this study was a strong one which supported this hypothesis and also the previous research linking the PWE and SBS symptoms. These findings suggest that employees who rate the PWE as poor also experience



more SBS symptoms. This finding is not unique, but it is important for organizations to take notice. According to Baldry et al. (1997), both organizations and organizational behaviour research often ignore the physical aspects of the work environment, even when it has clearly been linked to the experience of SBS and other outcomes important to organizations.

**Absenteeism.** Absenteeism in this study was measured as self-reported days taken off work due to SBS symptoms. Because SBS is a syndrome that results in physical symptoms it makes conceptual sense that SBS would be related to absenteeism. It was further expected that a poor PWE would also be positively related to absenteeism, and the results supported this hypothesis. This is congruent with a statistical model developed by Seppanen and Fisk (2003) to estimate the impact of improvements to the quality of the work environment. They established that one of the major benefits of work environment improvements would be reduced employee sick leave. This finding supports previous research that has linked various aspects of a poor PWE to increased absenteeism (Milton et al., 2000; Niemelä et al., 2006). It was expected that SBS would have a positive relationship with absenteeism and the evidence found in the current study supported this hypothesis. This confirms the findings of Rostron (2008) who established absenteeism as one of the major outcomes of SBS in a review of the literature.

The current study did not measure overall absenteeism, but absenteeism that the employee felt was due to SBS symptoms. Absenteeism due to injury or that the respondent attributed to other things was not included. As mentioned previously, overall absenteeism can cost New Zealand organizations up to \$202 million each year

(Holt, 2010). Costs of absenteeism include lost productivity, the cost of replacement staff, and the costs of healthcare where this is funded by the organization. The regular absenteeism of an employee, say due to SBS symptoms, would also place strain on other employees who would then have to 'pick up the slack'. If absenteeism is due to a poor PWE or SBS, it could be preventable by addressing aspects of the work environment; therefore the costs associated with such absenteeism may also be preventable. This was found in a case study intervention conducted by Niemela et al. (2006) where the recalibration and cleaning of the air conditioning system resulted in reduced reports of SBS symptoms and reduced absenteeism in an office building. The link in the current study of both poor PWE and SBS symptoms to absenteeism clearly shows the impact that both of these can have on overall organizational productivity as well as individual employee health and well-being.

**Job Performance.** One of the outcomes that has been consistently reported in the literature as a result of SBS and a poor PWE is reduced job performance (e.g. Kaczmarczyk et al., 2004; Wargoeki et al., 2000). This finding has been confirmed through various methods of measuring the PWE, such as self-report measures (Hedge et al., 1996), measures of toxin levels (Wargoeki et al., 1999), and rate of airflow (Wargoeki et al., 2000). As well as various methods of measuring individual performance, such as speed and accuracy on office tasks (Wargoeki et al., 1999) and self rated performance (Kaczmarczyk et al., 2004). The experience of SBS symptoms has usually been measured using self-report methods (e.g. Hedge et al., 1996). Wargoeki (1999; Wargoeki et al., 2000) found that in a manipulated lab setting designed to represent an office environment, poor physical conditions led to increased

SBS symptoms and reduced objectively measured productivity. Kaczmarczyk et al. (2004) found that a manipulated work environment in a lab setting led to increased reports of SBS symptoms, reduced self-reported job performance, but did not affect objectively measured performance. In a statistical model designed to assess the impact of the physical work environment on productivity, Seppanen and Fisk (2006) concluded that various aspects of the work environment, such as indoor air flow and temperature, directly impacted employee performance. Furthermore, in a study conducted by Hedge et al. (1996), employee ratings of poor environmental conditions in the workplace and the experience of SBS symptoms were reported to disrupt self-rated individual employee performance.

Following the trends found in previous research, it was hypothesised that ratings of a poor PWE and SBS symptoms would be negatively related to job performance. That is, when reports of SBS symptoms and reports of poor working conditions are high, self rated job performance would be low. This relationship was not found in the current study. Neither SBS symptoms nor ratings of a poor PWE had a significant relationship with job performance. This does not support previous findings that improved indoor work environment and reduced SBS symptoms would improve individual job performance (Kaczmarczyk et al., 2004; Wargocki et al., 1999; Wargocki et al., 2000).

This unexpected outcome could be due to the measure used in the current study to assess job performance. This was the 'professional efficacy' scale from the Maslach Burnout Inventory (Maslach, Jackson & Leiter, 1996). The psychometric

properties of this measure were examined in chapter two. EFA confirmed the scale to have a one factor model with a Cronbach's Alpha of .75, which indicates an acceptable level of internal consistency (Nunnally, 1978), and the scale was not skewed. The measure is psychometrically sound so the absence of expected correlations cannot be due to the psychometric properties of the scale. The measure itself was designed to assess an individual's opinion of their overall performance at work. The items are quite general such as "In my opinion I am good at my job" and "at my work, I feel confident that I am effective at getting things done". This subjective measure of performance differs greatly from some of the objective measures used in previous research, such as direct measures of productivity (Wargocki et al., 1999).

One reason that the expected correlations with the PWE and SBS were not found could be the fact that the items within the measure used in the current study were about general indicators of overall job performance rather than specific tasks. Previous research focused much more on specific tasks, often doing so with objectively measured indicators of job performance (Kaczmarczyk et al., 2004; Wargocki et al., 1999). Due to the nature of self-report measures, a self-report measure of job performance is open to bias because it is hard for respondents to have an objective view of their own performance. It is quite possible that someone would rate themselves as a high performer but may not actually have high levels of productivity, or objectively measured output, when compared to other employees. Objective measures of performance or supervisor ratings of performance might provide more accurate indicators of employee performance than self ratings. One

meta-analysis comparing different types of ratings of performance found that self ratings of job performance had a low (.22) correlation with supervisor ratings (Conway & Huffcutt, 1997). Conway and Huffcutt suggested that supervisor ratings of performance are more likely to be accurate than other ratings because it is part of a supervisor's job to be attentive to and to evaluate the behaviour of subordinates.

As mentioned earlier, much of the previous research presented in the literature review linking the PWE, SBS and performance was conducted in controlled laboratory settings with students completing tasks designed to replicate office work (Wargocki et al., 1999). The norm in these studies is for office work to be simulated with tasks such as typing in a laboratory set up to represent an office, where various aspects of the work environment (such as air flow) are manipulated. It might be that these controlled laboratory studies are not generalisable to real life organizational situations with actual employees. This could explain the contrary findings of the current study with previous findings linking the PWE, and SBS with job performance in laboratory research. It would be important for future research to investigate the relationship between SBS, PWE and job performance in real world settings using objective measures, or supervisor reports, to establish if there is a direct relationship here. This was outside of the scope of the current study.

**Job Satisfaction.** As mentioned earlier, job satisfaction is the extent to which people like or dislike their job (Spector, 2008). It was expected that ratings of a poor PWE, and SBS symptoms would have a negative relationship with job satisfaction. In this study it was found that both a poor PWE and SBS symptoms were related to

lower levels of job satisfaction. This supports the findings that job satisfaction of employees is influenced by environmental aspects of the office they occupy (Danielsson & Bodin, 2008). This also provides empirical support for other publications that have theorised about a negative relationship between SBS and job satisfaction (e.g. Hedge et al., 1996; Redlich et al., 1997). People who report a poor work environment and who experience physical symptoms of SBS also have lower levels of job satisfaction. This is important because previous research has linked levels of job satisfaction with organizational commitment, turnover intentions, as well as actual turnover (Tett & Meyer, 1993). In an early meta-analysis of the research, job satisfaction was found to be a significant predictor of individual performance (Petty et al., 1984). Petty et al. argued that if an employee is satisfied with their job they will be more motivated to be productive. The findings of the current study suggest that employees who rate the PWE as poor and experience SBS symptoms have lower job satisfaction. Reduced employee satisfaction could in turn influence overall organizational productivity. This research suggests that managers would benefit from considering PWE factors as well as job design factors if they are aiming to foster high levels of job satisfaction in their employees.

**Organizational Commitment.** Meyer and Allen's (1991) model of organizational commitment was used in the current study. Scales were used to measure affective commitment, where employees are committed because they feel emotionally attached to the organization, and continuance commitment, where employees are committed because they are aware of the high costs associated with leaving. Hypothesis five predicted that complaints about the PWE, and that reports of

SBS symptoms would be negatively related to affective commitment. These hypotheses were supported in the current study. This corroborates the findings of McGuire and McLaren (2009) that reduced satisfaction with the physical work environment and reduced employee wellbeing are both related to reduced organizational commitment. Carlapio (1996) also found that reduced satisfaction with the physical work environment was related to reduced organizational commitment of employees. The organizational commitment measure used in both of these studies related to Meyer and Allen's (1991) construct of affective commitment used in the current study. Because affective commitment is an employee's emotional attachment to and identification with the organization, it makes intuitive sense that the experience of a poor PWE or SBS could lead to reduced levels of affective commitment towards the organization. Affective commitment is an important factor because it has been shown in previous research to impact organization-relevant outcomes. In a meta-analysis of organizational commitment research, affective commitment was found to be negatively related to turnover, turnover intentions, absenteeism, and positively related to performance, and organizational citizenship behaviours (Meyer et al., 2002). Because affective commitment is linked to so many organization-relevant outcomes, it is in the best interests of organizations to foster high levels of affective commitment. The current study suggests that addressing issues with the PWE and SBS may be one way to increase levels of affective organizational commitment amongst employees.

The studies referred to in the above, did not include a measure that was equivalent to Meyer and Allen's (1991) construct of continuance commitment.

Previous research has shown that employees with high levels of continuance commitment are likely to behave in different ways than employees with high levels of affective commitment (Meyer et al., 2002). Continuance commitment was included in this study because it has not been well researched in previous SBS literature. In a meta-analysis Myer et al. (2002) found that continuance commitment related to variables in a different way than affective commitment did. In fact, for each relationship continuance commitment had with variables of work experience, such as procedural justice, the relationship with affective commitment was in the opposite direction. It was therefore expected that the PWE and SBS symptoms would have a different relationship to organizational commitment than they would for affective commitment.

A possible explanation for the positive correlations between a poor PWE, SBS symptoms and continuance commitment is the 'limited options' aspect of continuance commitment. Previous research has established that if employees feel that they cannot leave their current organization because of financial considerations or limited options elsewhere, they will stay even when they may not have any emotional attachment for their current organization (Cooper-Hakim & Viswesvaran, 2005). It could be that employees who might otherwise have left the organization, because of poor work conditions and SBS symptoms, might be staying because they feel that they have no other options. These employees might then have high levels of continuance commitment, in that they are committed to staying with the organization purely because they feel there are no other options available to them elsewhere, or they would experience a negative financial impact if they left. This can be contrasted



with affective commitment where employees stay with the organization because they want to (Meyer & Allen, 1991).

If a poor PWE and SBS symptoms do somehow influence continuance commitment, this has implications for organizations. In a previously mentioned meta-analysis on organizational commitment, it was found that while continuance commitment was negatively related to turnover and turnover intentions, it was also negatively related to job performance (Meyer et al., 2002). This was supported by another meta-analysis in which continuance commitment was also found to have a negative relationship with performance (Cooper-Hakim & Viswesvaran, 2005). In the current study ratings of a poor PWE and SBS symptoms were both associated with high levels of continuance commitment. Although continuance commitment may lead to lower levels of turnover, it has a negative relationship with other organization-relevant outcomes including job performance. High levels of continuance commitment are not necessarily a positive thing for organizations. It is therefore important for organizations to foster affective rather than continuance commitment. Affective commitment is more likely to be associated with desirable occupational and organization-relevant behavior than continuance commitment (Meyer et al., 1993). The results of the current study suggest that improving the PWE, thereby reducing SBS symptoms, may be one way of fostering affective commitment. However, because of the cross-sectional nature of the research it is not possible to determine the causal direction of these relationships. The finding of the current study that continuance commitment is positively related to PWE and SBS is interesting. This could be explored further in future research in order to understand the nature of

continuance commitment, perceptions of the PWE and SBS and the underlying mechanics of these relationships.

**Turnover intentions.** Hypothesis seven predicted that a poor PWE and SBS symptoms would be positively related to turnover intentions, and this hypothesis was supported in the current study. This provides empirical support for the theoretical link made by Rostron (2008) that SBS would lead to higher levels of intention to turnover. This also supports the findings of Carlopio (1996) that higher satisfaction with the physical work environment is related to reduced intention to turnover. Intentions to turnover are an important organizational variable because they have been found to relate strongly to actual turnover (Colarelli, 1984). Employee turnover costs organizations in time to recruit and train new employees, as well as the loss of knowledge and skills within the organization when employees leave. The findings of this study suggest that improvements in the quality of the PWE and lower levels of SBS could reduce the levels of turnover intentions, and subsequently actual turnover in an organization.

**Perceived Organizational Support.** The relationship between PWE, SBS and POS has not been clear in previous research. Some findings have related poor PWE and SBS symptoms to lower levels of POS (Lahtinen et al., 1998) while other research has related these two variables to higher levels (Mendelson et al., 2000). It was expected in the current research that the former would be true. The one study that found higher levels of POS in a building that reported SBS was based on one organization with management that was very involved with employees and committed to openly addressing the SBS problem (Mendelson et al., 2000). This led

to higher levels of POS in this case because the employees were very aware of management's efforts to tackle the problem. However, in most cases where employees are experiencing SBS symptoms or issues with the PWE, management may not be so committed and so POS would be lower. For this reason it was predicted that poor PWE and SBS symptoms would be negatively related to POS and the data supported both of these relationships in the current study.

This supports findings from a literature review by Lahtinen et al. (1998) that identified that employees who reported high levels of SBS symptoms also reported low supervisor support and less satisfaction with the human resource processes in their organization. This adds to current understanding of the relationship between PWE, SBS and POS which has previously not been well researched. POS is an important variable because employees with high POS are more likely to care about the organization's welfare and help the organization achieve its objectives (Eisenberger et al., 2001). This is believed to occur through a reciprocation process; the more employees believe the organization supports them the more they will act in ways to ensure the success of the organization. Applied to the current study, the findings suggest that if the employee experiences a poor PWE and SBS symptoms they are less likely to think that their organization supports them or cares about their welfare. According to Eisenberger et al. (2001), these employees will be less likely to engage in behaviours that are conducive to the organization's success.

### **Mediated Relationships**

As discussed earlier, a poor PWE is the most prominent predictor of SBS throughout the SBS literature. SBS has also been linked with the outcome variables of absenteeism, job performance, job satisfaction, turnover intentions, affective and continuance commitment, and perceived organizational support in the current study. The PWE has a direct relationship with each of these variables, and it was expected that SBS symptoms would mediate the relationships between the PWE and the outcome variables in this study. The rationale was that individuals who rated the PWE as poorer would report more SBS symptoms, and would be more likely to have high absenteeism, low job performance, low job satisfaction, high turnover intentions, low affective commitment, and high continuance commitment.

It was found that SBS did mediate the positive relationships between a poor PWE and absenteeism and turnover intentions. This suggests that SBS explains why increased ratings of a poor PWE would be related to higher levels of absenteeism and turnover intentions. It could be concluded from these findings that a poor PWE could lead to an individual employee experiencing more SBS symptoms which would cause that employee to take more days off work due to sick leave, and also to consider leaving the organization.

It was found that SBS also mediated the negative relationships between a poor PWE and job satisfaction and affective commitment. This suggests that SBS explains why a poor PWE would be related to lower levels of job satisfaction and affective commitment. In each of these cases a full mediation effect was apparent.

From these findings it can be concluded that a poor PWE could lead to SBS symptoms which could then lead an employee to experience reduced job satisfaction and reduced affective commitment towards their organization.

When the three mediation equations were calculated for PWE, SBS and POS the relationship between PWE (the predictor) and POS (the outcome) remained significant even when SBS (the mediator) was included in the third equation. According to the rules outlined by Baron and Kenny (1986) this is a partially mediated relationship. This suggests SBS accounts for some of the variance in POS because of the poor PWE.

It was expected that SBS would mediate the positive relationship between a poor PWE and continuance commitment. The rationale was that a poor PWE would impact the experience of SBS symptoms which would then be related to high levels of continuance commitment for employees who remained with the organization because they felt they had limited options to leave. Although both a poor PWE and SBS symptoms were positively related to continuance commitment, it was found that SBS did not mediate the relationship between a poor PWE and continuance commitment. One explanation for this is that another, unmeasured, variable accounts for the association of both PWE and SBS to continuance commitment, and that neither of these variables influence continuance commitment directly. As mentioned earlier, continuance commitment arises when employees feel that they have to stay with the organization because they feel they have no other options, or it would be financially damaging to them to try and leave (Meyer & Allen, 1991).

At the time that this survey was conducted, New Zealand was experiencing an economic recession. Because of this, many organizations had been making some staff redundant and/or had stopped hiring new staff to reduce operating costs. It could be that in this situation continuance commitment was high among employees in general because they were conscious of the recession and of the limited employment opportunities elsewhere. At other times people who reported a poor PWE and reported high levels of SBS might have left their organizations to move to a better work environment. However, because of the limited options in the current job market these people might be staying with their organization because they feel they have no other options. Because of the cross sectional nature of this research, and the limited range of variables that were measured, it is impossible to ascertain the causal directions of these relationships, and if there were any other confounding variables that influenced the PWE, SBS and continuance commitment.

### **Strengths of the Research**

The major strength of this study is that, based on a review of the literature, it appears to be one of the few studies to link the physical causes and symptoms of SBS with a range of psychological and behavioural outcomes. Previous research has largely focussed on the causes of SBS, with the most prevalent cause being a poor PWE, rather than the outcomes of SBS within organizations. The findings of the current study corroborate previous research that has repeatedly found a relationship between a poor PWE and SBS symptoms (Burge, 2004; Hedge et al., 1996). Some previous research has linked the PWE with various organization-relevant outcomes e.g. job satisfaction (Danielsson & Bodin, 2008) and organizational commitment

(McGuire & McLaren, 2009); other research has linked SBS with these and additional organizational outcomes such as turnover intentions (Carlapio, 1996). However, in the literature review conducted for the current study no previous research was found that empirically links the PWE and SBS to such a range of employee attitudes, beliefs and behaviours that are important to organizational functioning. This research adds to our understanding of how the PWE and SBS interact with individual employee attitudes, beliefs and behaviours in the workplace.

A further strength of this research is its use of a New Zealand sample. Most previous research on SBS has been conducted in Northern America (Bauer et al., 1992; Mendelson et al., 2000) and Europe (Hedge et al., 1996; Kaczmarczyk et al., 2004). In the literature review for the current study, only one article was found that investigated SBS in a New Zealand sample (Phipps et al., 1999). Phipps et al. investigated the prevalence of SBS in New Zealand in comparison to a sample in England. They found that the two samples reported similar levels of SBS symptoms, and conclude that SBS is just as much an issue in New Zealand as it is elsewhere (Phipps et al., 1999). The current study extends on this research because it includes measures of organizational-relevant variables as well as measures of a poor PWE and SBS symptoms. This research then contains important information about employee attitudes towards the PWE and experiences of SBS in a New Zealand context.

### **Limitations of the Research**

One of the major limitations of this study was its cross-sectional design, which prevents any conclusions from being drawn about the causal relationships between variables (Spector, 1994). Another limitation is that self-report scales were

used to assess all of the variables. This can lead to common method bias where correlations between variables are inflated because each variable is measured using the same method (Spector & Jex, 1998). This is encountered in much of organizational psychology research. For many of the variables measured in this study, self-report scales are the only viable method available, for example, organizational commitment, and perceived organizational support. The only way to measure such variables is to ask the respondents themselves. For some variables there are available alternatives. For example, organizations records of absenteeism and supervisor ratings of job performance could be used instead of self-report measures. As mentioned earlier, poor PWE and SBS symptoms were not negatively related to job performance in this sample as was expected. One of the reasons for this could have been that self-report measures of job performance were used instead of objective measures or supervisor ratings. Given the scope of this study, neither of these options could be used. Spector (1994) recommended self-report methods as an easy first step to study phenomena of interest and provide insights in to the relationships between variables. Future research on the relationships between PWE, SBS and organizational behaviours could use various means of collecting data to avoid common method bias and establish strong causal links between variables.

There were also limitations with data collection because of several organizations reluctance to take part in the research. In the data collection phase 38 buildings or organizations were approached and only 9 agreed to take part. The contact person (usually the HR manager) within several organizations openly admitted that they were having issues with the PWE at their workplace and because



they knew that this was causing problems they did not want to take part in the study in case it caused further problems for management. One of these cases was even relocating because of issues with the PWE and didn't want to take part because, in the words of the HR manager, "it might stir up a hornet's nest". This may have led to an underestimation of the prevalence of poor PWE and SBS symptoms in the New Zealand context, and an underestimation of the strength of the relationships between the PWE, SBS and the other variables.

### **Implications of the Research**

The results of this research have several practical implications. The aim of this research was to investigate the relationship of the PWE and SBS on various behavioural and psychological outcomes in an organizational context. This study provides some insight into these relationships, many of which have not been well researched in the past.

The first important finding of this research is that ratings of a poor PWE were strongly and positively correlated with SBS symptoms. Much research has previously confirmed this link (Burge, 2004; Hedge et al., 1996). However, this is the first of its kind conducted with a New Zealand sample. While Phipps et al. (1999) investigated the prevalence of SBS in a New Zealand context, the current study is the first to assess SBS along with potential causes and outcomes. This is important because it provides empirical evidence for the expectation that a poor PWE could be associated with employees experiencing SBS, and its potential consequences, in a New Zealand context.

Both the poor PWE and SBS symptoms were positively related to self-reported absenteeism. This is an important finding because absenteeism costs New Zealand organizations up to \$202 million each year (Holt, 2010). It was also found that SBS mediated the relationship between PWE and absenteeism. This implies that while the PWE has a relationship with absenteeism, it is the experience of SBS symptoms that would be more likely to lead employees to actually taking time off. Because absenteeism is so costly the present findings should encourage organizations to assess their employees' perceptions of the work environment. Organizations should also take any complaints of physical symptoms associated with SBS seriously.

Ratings of a poor PWE and SBS symptoms were negatively related to job satisfaction. This implies that a poor PWE and an employee's experience of SBS symptoms could lead to reduced job satisfaction for that employee. Job satisfaction has been linked to overall organizational productivity through several pathways including turnover, organizational commitment and job performance (Petty et al., 1984; Tett & Meyer, 1993). In addition a poor PWE and SBS symptoms were both negatively related to affective organizational commitment and positively related to intentions to turnover, and continuance commitment. These variables all contribute to overall organizational productivity (Spector, 2008).

Ratings of a poor PWE and SBS symptoms were both negatively related to POS. This suggests that ultimately, if people see problems with physical aspects of their work environment, and if they experience uncomfortable physical symptoms, they will view their employer as less supportive. This is interesting when compared to the findings of Mendelson et al. (2000) who investigated SBS in various buildings.

They found that POS was actually higher in buildings affected by SBS than in those that weren't. They concluded that this is likely because management in the buildings affected by SBS in their sample were actively trying to address the issues with the PWE and SBS. The current study did not address whether management had any active considerations for the PWE and SBS, and this could be an interesting consideration for future research. The findings of the current study, in light of the findings of Mendelson et al. (2000), suggest that the negative outcome of reduced POS could be avoided if organizations actively address any issues that employees have with their work environment, including SBS.

It was found that SBS symptoms fully mediated the relationships between the PWE and absenteeism, turnover intentions, job satisfaction and affective commitment. SBS also partially mediated the relationship between the PWE and perceived organizational support. These are relevant findings because they imply that SBS accounts for the effect that the PWE has on all of these outcomes. This emphasises how important SBS is in the organizational setting. SBS could result in a work force with high levels of absenteeism and turnover, and reduced job satisfaction, affective commitment and perceived organizational support.

A poor PWE and SBS symptoms were linked with several important organization-relevant outcomes. These findings confirm that the effects of SBS are not limited to health costs alone. Organizations should not ignore the physical aspects of the work environment because their employees certainly aren't ignoring them. This research shows how important it is for organizations to consider every aspect of the work environment to enhance employee attitudes and behaviour. Carlapio argues that

“disregarding the well-documented effects of the physical work environment on people's behavior leaves behavioral variance unexplained and the relationships between environmental variables and measures of interest to researchers and practitioners (e.g., staff turnover, satisfaction, and commitment) unexplored.” (Carlapio, 1996, p. 330). The findings of the current study suggest that by focussing only on interpersonal, or managerial aspects of the work environment, other important factors such as the impact of the PWE, and the potential of SBS, are ignored. Therefore, this research gives the opportunity for future research to expand on the relationships presented in this study that may not have been well researched in the past.

### **Future Research**

This study has revealed several significant relationships between the PWE, SBS and several variables that affect overall productivity. Unfortunately because this study was cross sectional in design, no conclusions can be drawn about any causal relationships between variables. It would be valuable for future research to investigate these significant relationships with a longitudinal study design. This way more conclusive results could be obtained about the true effects of the PWE and SBS on organizational productivity.

As mentioned earlier, job performance was not related to the PWE or SBS symptoms in this study. A potential reason for this finding that was discussed earlier is that a self-report measure was used rather than objective measures or supervisor ratings of performance. In addition, the job performance measure was based on indication of overall performance rather than performance on specific job-related

tasks. Much of the previous research was based on the latter. Future research could use different methods of assessing individual job performance, in order to establish if the PWE and SBS influences individual job performance in organizational situations. In addition, this study was limited to the central North Island of New Zealand. In order to establish a better understanding of the extent to which SBS occurs in New Zealand office buildings in a greater geographical area could be covered by future research.

### **Conclusions**

Most of the previous SBS research has been conducted in Europe and Northern America, however, the current study shows that office buildings, and those that inhabit them, in New Zealand are also at risk. This means that poor physical working conditions and SBS symptoms should be important and relevant to management and organizational psychology professionals in New Zealand. In the current sample ratings of a poor PWE and SBS symptoms were linked with high levels of absenteeism, turnover and continuance commitment, and low job satisfaction, affective commitment and perceived organizational support. SBS was also found to mediate the relationship between the PWE and absenteeism, turnover, job satisfaction, affective commitment and perceived organizational support. This suggests that the experience of SBS symptoms accounts for much of the effect that the PWE has on these organization-relevant variables. All of the factors investigated in this study contribute to overall organizational productivity. It is therefore important for organizations and future researchers to acknowledge the physical aspects of the work place as well as social and management aspects.

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## Appendices

### Appendix A - Survey



Thank you for taking the time to complete this survey. There are four sections in total. The first two sections will ask you questions about the environment in which you work and physical symptoms. The third section covers attitudes, beliefs and behaviours associated with your workplace. The final section asks a few brief questions about you. It should take you about 15 minutes to answer all of the questions. There will be a progress bar at the bottom of each page to indicate how far through you are. You are able to exit this questionnaire at any stage if you wish to do so. If you would like to access the findings from this study, you will find instructions on how to do so at the end.

#### A. The environment in which you work.

This section contains questions about your physical work environment. Please answer each item by selecting the most appropriate response for you.

How many times in the last month have you experienced the following conditions in your place of work?

	Never	1 -3 times per month	1 - 3 times per week	Every day
Temperature too warm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Temperature too cold	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lighting too dim	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problems with	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

glare				
Insufficient ventilation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uncomfortable Drafts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Too little air movement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Air is too dry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Air is too humid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distracting ambient noise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stale air	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dusty air	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electrostatic shocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unpleasant odours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**B. Physical Symptoms** This section contains questions regarding physical symptoms that you may experience while at work. Report symptoms that you attribute to your place of work. Please answer each item by selecting the most appropriate response for you.

How many times in the last month you have experienced the following symptoms that you associate with your work?

	Never	1-3 times per month	1-3 times per week	Every day
Excessive mental fatigue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Headache	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dry eyes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Irritated, sore eyes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Tired strained eyes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nervousness, irritability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unusual tiredness, lethargy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stuffy congested nose	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sore, irritated throat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Runny nose	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hoarseness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dry skin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dizziness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wheezing, chest tightness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nausea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skin irritation, rashes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How many days in the last 12 months were you absent from work because of any of these symptoms?

#### B. Attitudes, beliefs and behaviours associated with your workplace

This section contains questions about various attitudes and behaviours that relate to your job and organization. Please answer using the following scale. Answer each item by selecting the most appropriate response for you.

Please indicate to what extent you agree with each of the following statements by selecting the appropriate response.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
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If I have my own way, I will be working for my current employer one year from now	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I frequently think of quitting my job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am planning to search for a new job during the next 12 months	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please indicate to what extent you agree with each of the following statements by selecting the appropriate response.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
The organization values my contribution to its well-being.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If the organization could hire someone to replace me at a lower salary it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>









<p>my organization with people outside it.</p> <p>I really feel as if this organization's problems are my own.</p> <p>I think I could easily become as attached to another organization as I am to this one.</p> <p>Right now, staying with my organization is a matter of necessity as much as desire.</p> <p>One of the major reasons I continue to work for this organization is that leaving would require considerable personal sacrifice—another organization may not match the overall benefits I</p>	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○



I am not afraid of what might happen if I quit my job without having another one lined up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Please indicate to what extent you agree with each of the following statements by selecting the appropriate response.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
In general, I don't like my job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All in all, I am satisfied with my job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, I like working here	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For the following items please answer by selecting the most appropriate response for you.

	Never	Infrequently	Sometimes	Frequently	Always
I can effectively solve the problems that arise at work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel I am making an effective contribution to what the organization does.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion I am good at my job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel exhilarated when I accomplish something at work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have accomplished many worthwhile things in this job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At my work, I feel confident that I am effective at getting things done.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

D. Now tell me a little about yourself

What is your age?

What is your gender?

- Female
- Male

How would you describe your ethnicity?

- NZ European
- Maori
- Asian
- Pacific peoples
- Other \_\_\_\_\_

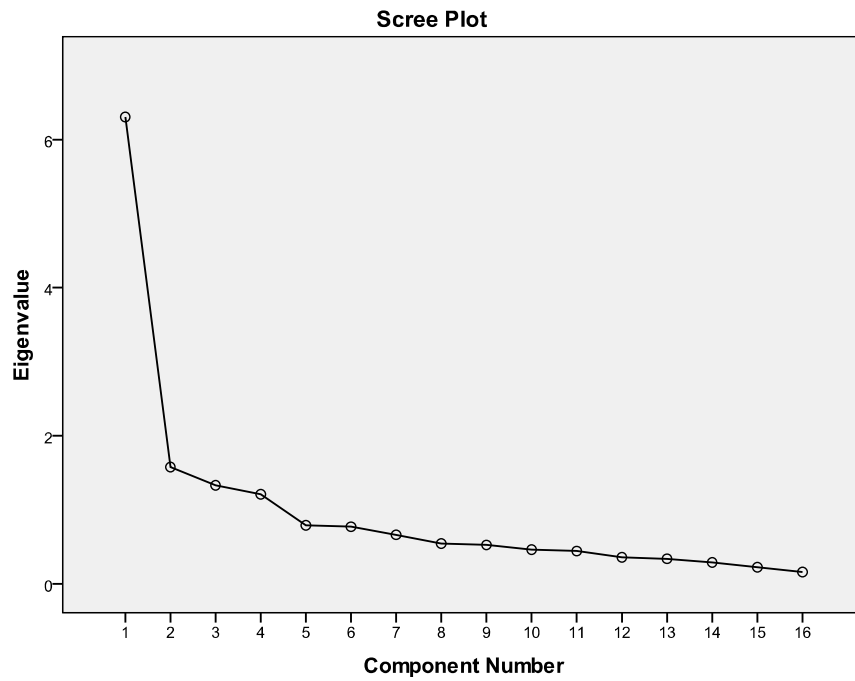
How would you describe the environment in which you work?

- Office Building
- Other (please explain) \_\_\_\_\_

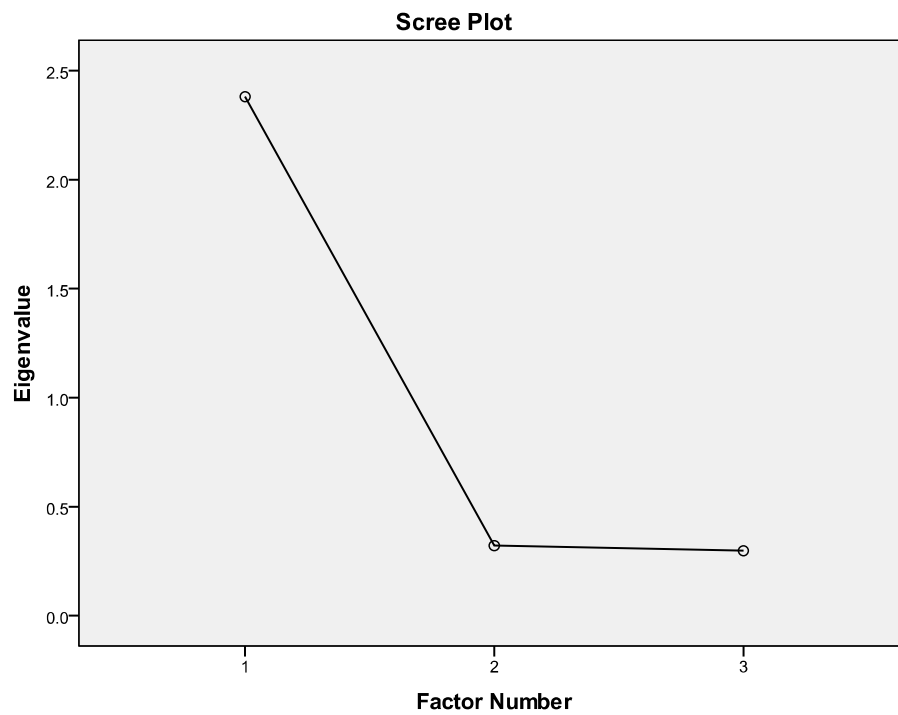
What is the street address of the building that you work in (or building name if it is well known)?

What is the name of the organization that you work for?

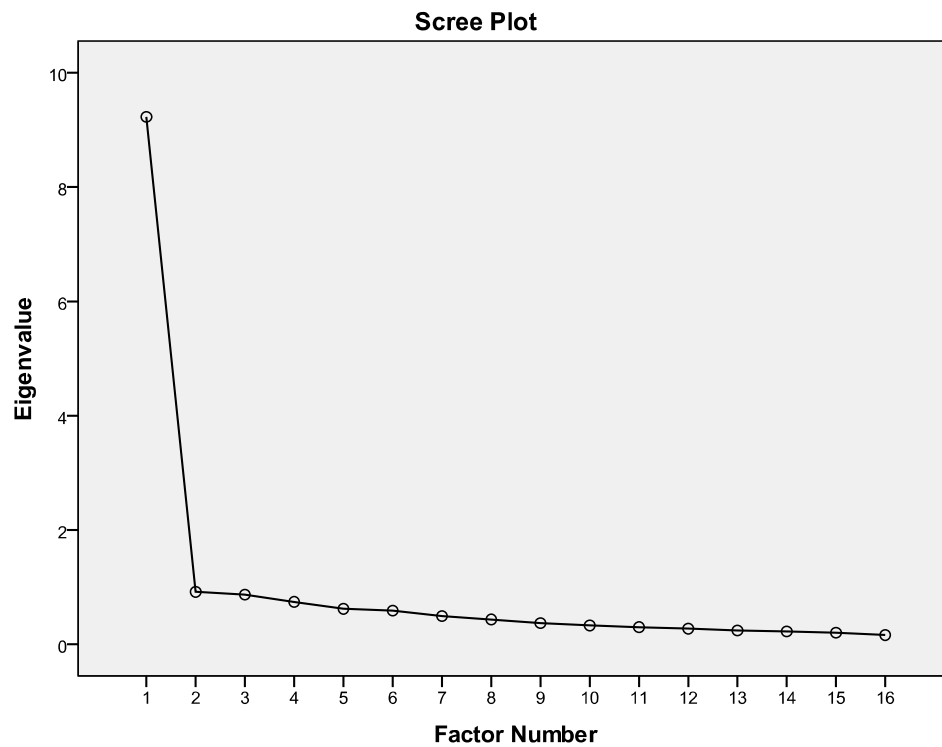
## Appendix B – Scree Plots



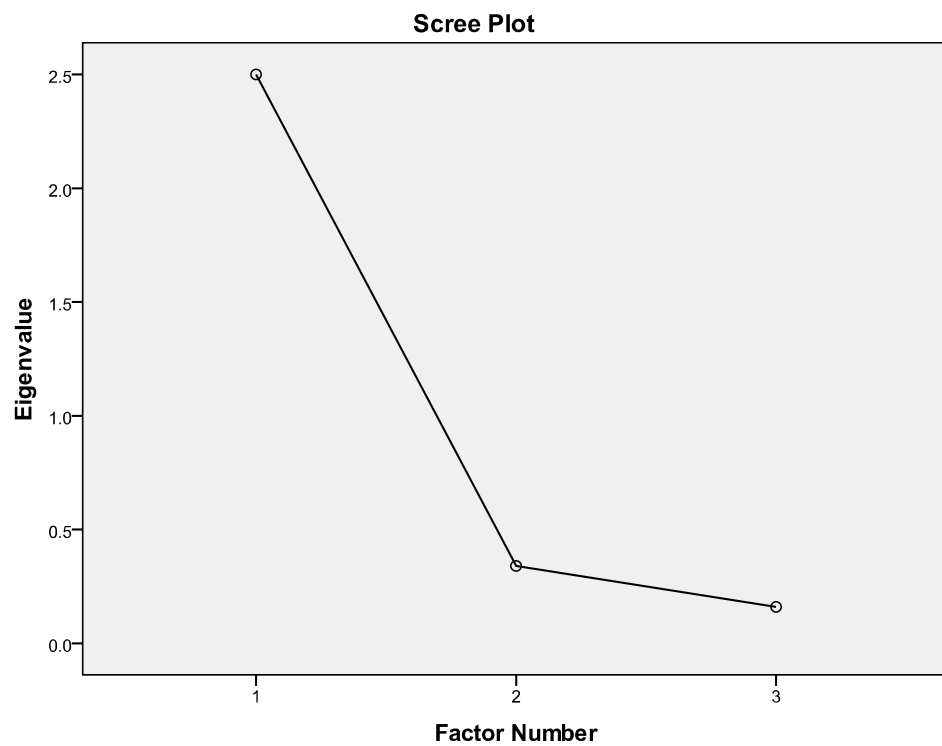
*Figure B.1.* Scree plot for the Sick Building Syndrome Symptoms scale.



*Figure B.2.* Scree plot for the intention to turnover scale.

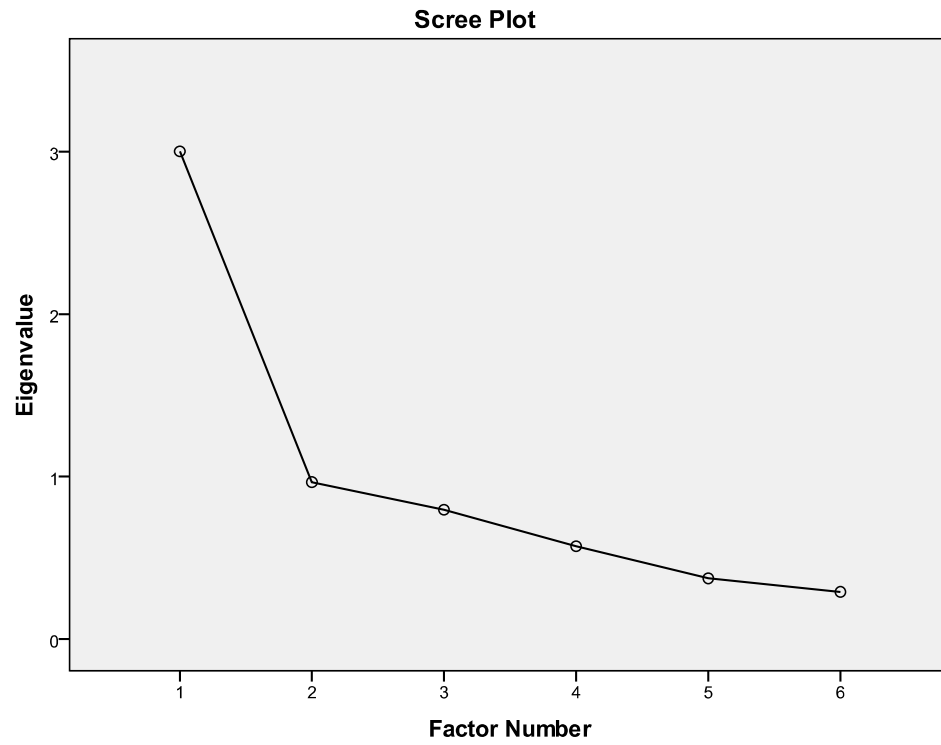


*Figure B.3.* Scree plot for the perceived organizational support scale.

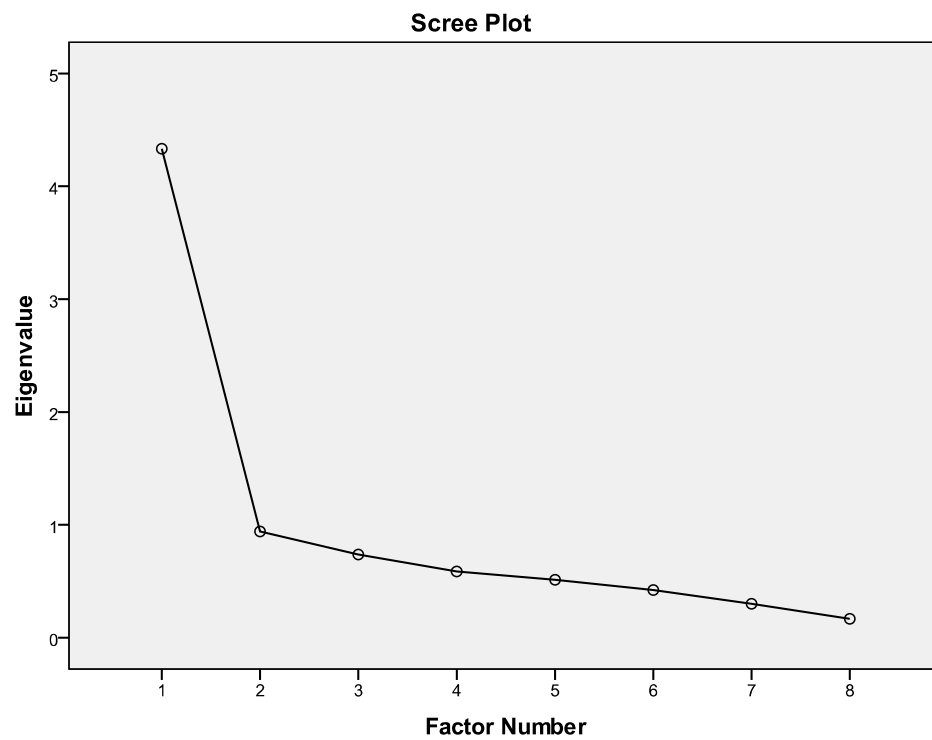


*Figure B.4.* Scree plot for the job satisfaction scale.

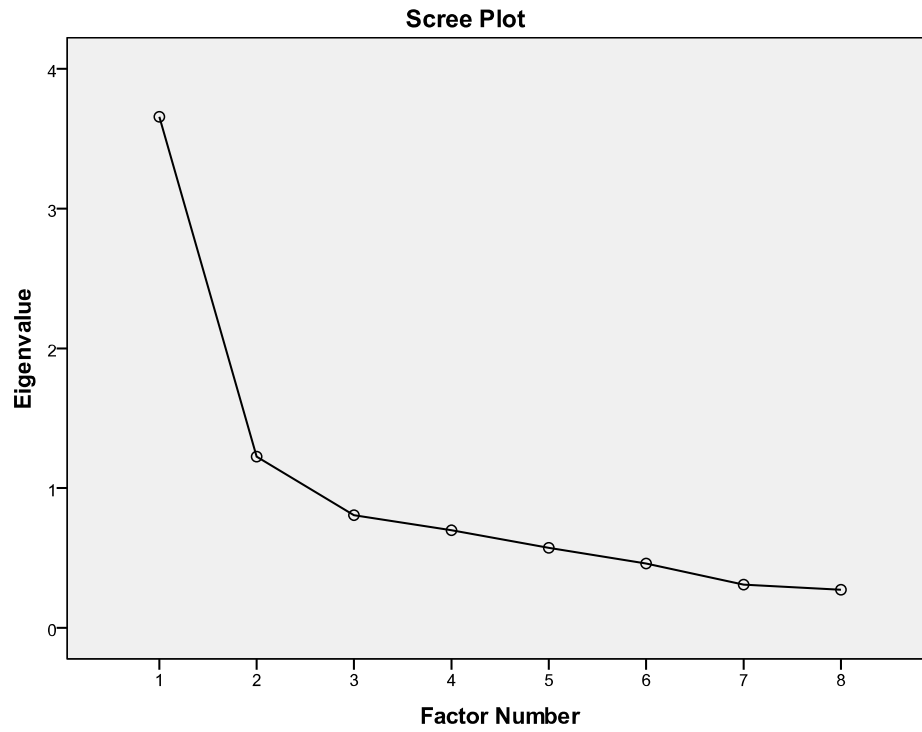




*Figure B.5.* Scree plot for the job performance scale.



*Figure B.6.* Scree plot for the affective commitment scale.



*Figure B.7.* Scree plot for the continuance commitment scale.

## Appendix C - Letter to Organizations

Dear...,

My name is Sarah Meikle and I am currently completing a Masters of Applied Psychology at the University of Waikato. I am researching the effect of the physical work environment on employee performance and wellbeing.

In order to research this topic I am distributing a short questionnaire to employees that work in various medium to large office buildings. As your organization occupies one such building I would like to be able to ask if your employees would be willing to complete the questionnaire. The questionnaire can be administered online and will take about 20 minutes to complete. The questions cover perceptions of the physical work environment, physical symptoms the employee may experience, and questions on various attitudes and behaviours related to work.

Through your participation I hope to understand how the physical work environment influences any physical symptoms employees may experience, and also various psychological outcomes. I hope that the results of the survey will be useful for informing organizations about the aspects of the physical work environment that may influence employee wellbeing and performance.

You are entitled to request a summary of the research findings. In order to respect confidentiality of the participants, anything I give you will be in summary form. I will not pass on any information on individual responses, or anything that may be used to identify any of the participants.

If you have any questions or concerns about the questionnaire or about being in this study, you may contact me by email: [s.m.meikle@windowslive.com](mailto:s.m.meikle@windowslive.com). The Ethics Committee at the University of Waikato has approved this study. If you have any concerns about the ethics of this study you may contact Dr Robert Isler, phone 07-838 4466 ext. 8401, email: [r.isler@waikato.ac.nz](mailto:r.isler@waikato.ac.nz).

Sincerely,

Sarah Meikle

## Appendix D - Email to Participants within Organizations

Dear Respondent,

I am inviting you to participate in a research project investigating the effects of the physical work environment on employee wellbeing and performance. **A link is provided to a short questionnaire that asks a variety of questions about your physical work environment and your experiences at work.**

Through your participation I hope to understand how the physical work environment influences physical symptoms of employees and also various psychological outcomes. I hope that the findings of this research will contribute to knowledge in this area and will be useful for organizations. If organizations are aware of what effects different work environments can have, they can implement changes to improve the work environment for their employees.

There will be no risks to you if you decide to participate in this survey and I guarantee that your responses will be kept completely confidential. No information will be collected that can connect you with your responses. Any information I share with your organization, or with other people, will be in a summary form and it will not be possible for individual responses to be identified.

**The questionnaire is online and will take you only about 15 minutes to complete. By submitting the questionnaire you have confirmed your consent to participate. To access the survey please click on the following link:**

<http://psychology.waikato.ac.nz/surveys/sarahm>

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me by email: [s.m.meikle@windowslive.com](mailto:s.m.meikle@windowslive.com), or phone: 0273614427. The School of Psychology Ethics Committee at the University of Waikato has approved this study. This research is being conducted as a requirement for my Masters of Applied Psychology under the supervision of Donald Cable who can be contacted by email: [dcable@waikato.ac.nz](mailto:dcable@waikato.ac.nz), or phone (07) 838 4032 ext 8296.

Thank you for taking the time to consider participating in this research, I greatly appreciate it. Details on how to access a summary of the results of this research are provided at the end of the questionnaire.

Kind Regards,

Sarah Meikle

## Appendix E - Flyer



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

### Do you work in this building?

Be part of exciting research about the physical work environment.

I am inviting you to participate in a research project investigating the effects of the physical work environment on employee wellbeing and performance. This involves filling out a short questionnaire that asks a variety of questions about your physical work environment and your experiences at work. **The questionnaire will only take you 10 to 15 minutes to complete.**

There will be no risks to you if you do decide to participate and your participation is greatly appreciated. No information will be collected that can connect you to your answers. Any information I share with anyone else will be in summary form.

I hope that the findings of this research will contribute to knowledge in this area and will be useful for organizations. If organizations are aware of what effects different work environments can have, they can implement changes to improve the work environment for their employees.

**If you choose to be part of this research**, please type the following URL in the address bar of your internet browser:

<http://psychology.waikato.ac.nz/surveys/sarahm>. This will take you to an online version of the questionnaire. By completing and submitting the questionnaire you will be giving your consent to be part of the research.

Details on how to access a summary of the results of this research are provided at the end of the questionnaire. This study is being conducted as a requirement for a Masters of Applied Psychology and has been approved by the School of Psychology Ethics Committee at the University of Waikato. If you have any questions or concerns feel free to contact me, Sarah Meikle, (email [s.m.meikle@windowslive.com](mailto:s.m.meikle@windowslive.com); phone 0273614427) or my supervisor Donald Cable (email [dcable@waikato.ac.nz](mailto:dcable@waikato.ac.nz); phone (07) 838 4032 ext 8296)