Getting It Crystal Clear

Reviewing the occupational health Risk Management System to ensure and improve Crystalline Silica health and safety at a cement manufacturing plant: the case of Blue Circle Southern Cement, Berrima

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TITLE:

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REVIEWING THE OCCUPATIONAL HEALTH RISK MANAGEMENT SYSTEM TO ENSURE AND IMPROVE CRYSTALLINE SILICA HEALTH AND SAFETY AT A CEMENT MANUFACTURING PLANT: THE CASE OF BLUE CIRCLE SOUTHERN CEMENT, BERRIMA

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Management summary

Research Question

The management of Blue Circle Southern Cement (BCSC) was wondering whether the Risk Management System (RMS) of Crystalline Silica (CS) at their plant in Berrima was still up to date and whether there are best practices from which they can learn. Therefore the following main research question was determined for this research:

> *Does the current RMS at BCSC ensure CS health and safety of their stakeholders and can their RMS be improved?*

Conclusions

As important stakeholders were determined the New South Wales-government and the Community Liaison Committee. The analysis showed no legal gaps in the policies and procedures at BCSC for the management of CS hazard. The Cement Sustainability Initiative (CSI) and the European network for Silica (NEPSI) were analysed for possible RMS improvement suggestions.

For the stakeholder Community Liaison Committee no scientific evidence was found that the community is indeed at risk for the CS hazard. There was evidence found which states that within a community inappropriate concern may rise concerning health issues.

Recommendations

NEPSI provides some improvement suggestions in their Good Practices Guide. As a result cleaning, dust monitoring and supervision are suggested as areas for improvement. Also a risk management model is suggested to improve the structure of the Occupational Health & Safety (OH&S) management at BCSC.

The next recommendation is to involve the Community Liaison Committee in the CS issue. At this moment they are not aware of the CS hazard. From a risk communication point of view, it might be a good idea to involve them in the decision making regarding CS management.

Other recommendations are for further research. According to the literature review, risk management should be a continuous process. For the management of BCSC this means that the risks associated with CS should be assessed on a regular basis and certainly when new legislation is introduced. This RMS model can also be used for other hazards and risks at BCSC.

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List of abbreviations

BCSC	Blue Circle Southern Cement, Berrima, NSW, Australia
CFMEU	Construction Foresting Mining Energy Union
COPD	Chronic Obstructive Pulmonary Disease
CS	Crystalline Silica
CSI	Cement Sustainability Initiative
ES-TWA	Exposure Standard- Time Weighted Average
KPI	Key Performance Indicators
MSDS	Material Safety Data Sheet
NEPSI	European Network for Silica
NOHSC	National Occupational Health and Safety Commission
NO_x	Nitrogen Oxides
NSW	New South Wales
OHS Act	NSW Occupational Health & Safety Act was revised in 2000
OH&S	Occupational Health and Safety
PPE	Personal Protective Equipment
RAC	Risk Assessment Code
RMS	Risk Management System
RPE	Respiratory Protective Equipment
SO_x	Sulphur Compounds
TLV	Threshold Limit Values
UWS	University of Western Sydney
VOC	Volatile Organic Compound
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization

Preface

This thesis is the result of the final course of my bachelor study: Industrial Engineering and Management at the University of Twente in the Netherlands. In order to write this thesis I have visited the Blue Circle Southern Cement plant in Berrima, NSW, Australia. It has been quite an experience to be abroad for more than eleven weeks.

This thesis could not have been realized without the help of the following persons. First I would like to thank Dr. Anneke Fitzgerald for arranging this opportunity for me and for the supervision in Australia. I would like to thank John Presbury for giving me the opportunity to do my research at BCSC and for the time he put in helping me retrieving the right information.

Then I would like to thank Professor Koos Krabbendam for introducing me to Dr. Anneke Fitzgerald, and together with Ir. Frank van den Berg for the supervision of my research.

Outside of the supervision, I would also like to thank Anneke and her husband John for providing a place to stay during my visit to Australia and the trips they have taken me on. Also I would like to thank Kathy Eljiz, Dorothea Zakrzewski and Warwick Wearing for their input during the writing circle and their dedication into making me feel at home.

Finally I would like to thank my parents for making this trip financially possible and Coen for the support during the writing and rewriting of this thesis.

I hope you will enjoy reading this thesis.

Relinde de Beer

Haarlem, March 2008

1 Introduction

When studying the history of Occupational Health and Safety (OH&S), it becomes clear that this is an issue that can be traced back into antiquity (Gochfeld, 2005). Although there is a tendency to believe that all major occupational diseases have been conquered these days, exposures and diseases still exist (Gochfeld, 2005). Therefore OH&S is an area is of great importance to companies worldwide.

In New South Wales, Australia, the NSW Occupational Health & Safety Act was revised in 2000 (OHS Act) and imposes a general "duty of care" to ensure the safety of persons at or near a workplace (NSW Occupational Health and Safety Act, 2000). A key objective of the OHS Act is that employers are required to "protect people against workplace health and safety risks" (NSW Occupational Health and Safety Act, 2000). The introduction of the OHS Act emphasizes the need for OH&S policies and procedures within companies.

In this report Blue Circle Southern Cement (BCSC) is advised about the effects the revision of the OHS Act has on the occupational health and safety policies for the substance Crystalline Silica (CS) at the BCSC plant.

Reading guide

This report is structured as follows. In chapter 2 the research questions and the methodology for finding an answer to the research questions is described. In chapter 3 the literature review is presented. This chapter gives a description of the substance of Crystalline Silica and its effect on OH&S, defines what risk is and what a Risk Management System (RMS) is, described the national guidelines, and describes two best practices with regard to CS management. Finally it will describe a method for determining the stakeholders for this research. In chapter 4 the stakeholders for this research are identified, using the method described in the literature review. In chapter 5 one finds the current RMS for the different stakeholders and in chapter 6 some improvement options for the RMS at BCSC are described. Finally in chapter 7 the conclusions and recommendations are presented.

2 Research design

In this chapter the research questions will be defined and the methodology to answer the research questions will be described. In the last paragraph the use of a case study research design is justified.

2.1 Problem statement

At Blue Circle Southern Cement (BCSC) in Berrima, Australia the OH&S adviser and the Human Resources Manager wonder whether their company still complies with all the rules concerning health and safety issues, stated by the government of New South Wales in the renewed OHS Act. They are especially interested in their performance on Crystalline Silica (CS) safety management. At BCSC a Risk Management System (RMS) for CS is in place. BCSC is now wondering whether their RMS is adequate when used to reassure stakeholders of their health and safety. In particular, BCSC is committed to provide the safest possible work place by reviewing and revising their policies and procedures in regard to CS.

2.2 Research Questions

The main research question for this study is based on the problem statement and has been defined as follows:

> *Does the current RMS at BCSC ensure CS health and safety of their stakeholders and can their RMS be improved?*

Development of sub questions and methods

To be able to give an answer to the main research question, it will be divided into sub questions. The sub questions and the methods used to obtain an answer will be described next.

- *What is CS?*
- *Which health risks are associated with the use of CS?*

To be able to analyse the OH&S risks regarding CS at BCSC, more insight in the substance CS must be obtained. Therefore a literature study was undertaken to gain more insight in the history of CS in OH&S, the physical aspects of CS, the importance of particle size and the health risks associated with inhaling CS.

- *What is a RMS?*

At BCSC a RMS is in place, as they have to comply with NSW laws and regulations regarding employee health and safety. The question that remains is whether BCSC is doing everything within their power to ensure that the risks associated with CS are as low as reasonably attainable. To find an answer to this question, a literature research will be conducted to determine what a RMS is and how it is used in companies.

- *What are the national guidelines for CS?*

To be able to analyse whether or not BCSC complies with NSW laws and regulations regarding employee health and safety, the national guidelines for OH&S risk management will be described.

- *What framework can be used for the identification of stakeholders?*

BCSC has different stakeholders both inside and outside the company. It is important to determine which of these stakeholders are important for this specific research, as they will define the scope of the research. Therefore stakeholder identification needs to be conducted. In the literature review a framework for stakeholder identification will be described.

- *Who are the stakeholders for BCSC?*

The potential stakeholders will be defined based on the literature, a conversation with the OH&S manager at BCSC, and a review of the BORAL Induction Manual.

- *What are the current international best practices for managing CS safety?*

An internet research was conducted to find international best practices on OH&S initiatives, and focused especially on OH&S initiatives based on the management of the CS risk.

- *What is the current RMS for CS at BCSC?*

Next to the information obtained by the literature review, semi structured interviews were held with the OH&S adviser to be able to give a description of the RMS used at BCSC and to find out whether or not BCSC is complying with all legal requirements. Also internal documents were analysed. Next to this the BCSC environmental manager was interviewed and information regarding community communication was collected.

- *What is the gap between the national guidelines for CS and the current policy and procedures at BCSC?*

After all information was analysed, conclusions were drawn. These were discussed in a meeting at BCSC, with among others the OH&S adviser, the HRM manager and the environmental manager present.

- *What are the changes required to improve the RMS system at BCSC?*

Recommendations for the management of CS at BCSC were formulated.

2.3 Methodology

Thus far the problem statement and the research questions have been described. In this paragraph a case study research approach is justified and explained.

2.3.1 Case study research design

According to McMurray et al. (2004), this research is deemed a case research because it is about one cement manufacturing plant and therefore the research findings and implications will only be applicable for this one plant at this moment in time.

Case research requires a careful research design. According to Yin "a research design is an action plan for getting from here to there" (1994, p.19). This means that a research design is a method of transforming the initial research questions into a set of conclusions (Yin, 1994). It is a well known phenomenon in case research that the researcher ends up collecting data that does not give an answer to the research questions formulated in the initial stage of the research. The purpose of a research design is to prevent this from happening.

In Figure 1 the research design for this study is depicted. This research starts from a qualitative research paradigm, and then in particular the case study. The case study determines the rest of the research design as described by Yin (1994). Yin (1994) describes five components of a case research design: a) the research questions; b) the unit of analysis; c) the theoretical framework; d) the methods used to collect data and e) the context of the research. These components are shown in Figure 1. The components of a case research, presented in Figure 1, will be described in this chapter, providing a research design.

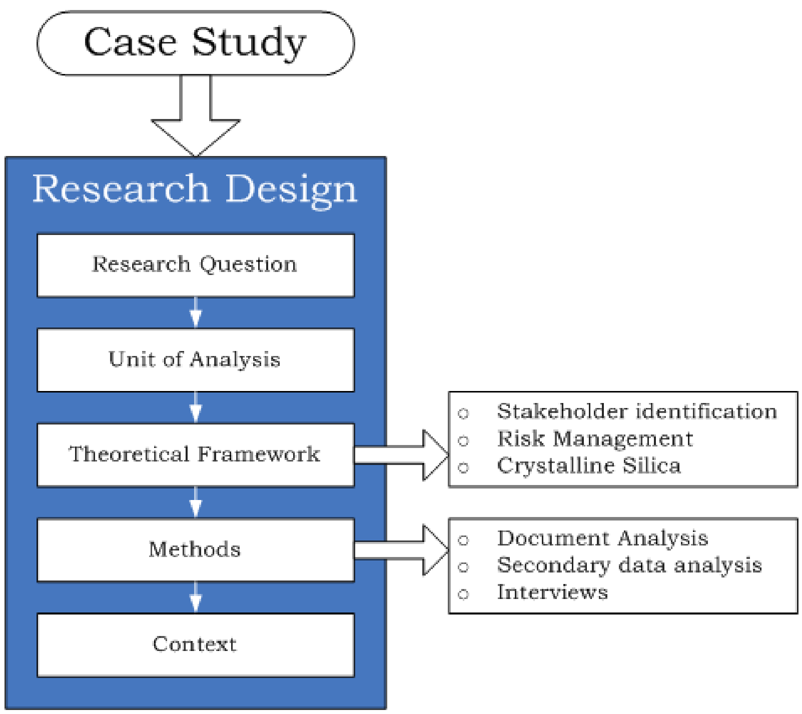

Figure 1: Methodology framework (Adapted from Yin, 1994)

2.3.2 Research Question

In the introduction of this report the research question has been formulated as follows:

> *Does the current RMS at BCSC ensure CS health and safety of their stakeholders and can their RMS be improved?*

2.3.3 Unit of Analysis

In classic case research, the unit of analysis was often an individual (Yin, 1994). Nowadays a "case" can also be an event or an entity that is less clearly defined as a single individual (Yin, 1994). Therefore it is important for all case research to give a clear and bounded definition of the unit of analysis for the case researched. For this case study the unit of analysis is the cement manufacturing plant of Blue Circle Southern Cement at Berrima, NSW, Australia.

2.3.4 Theoretical framework

As already mentioned in the development of the sub questions, the theoretical framework will consist of the following parts:

- Theory on CS
- Theory on risk, RMS, and risk communication
- National guidelines for CS
- Best practices for CS risk management
- Stakeholder theory

The literature review can be found in chapter 3.

2.3.5 Methods

For this research three methods of data gathering have been used. These are document analysis, secondary date analysis and interviewing.

Document Analysis

Various hardcopy brochures and Manuals from BCSC were used for data collection on cement making, safety culture, organization of BCSC and community communication.

- Online documents on the following subjects were also analysed:
- OH&S legislation from the NSW government
- CS substance, CS adverse effects, CS related diseases and CS exposure standards
- Best practices regarding CS management

Secondary data analysis

To be able to compare the exposure standards set by the NSW government and the CS exposure at BCSC, the CS monitoring data from the Occupational Hygiene Professional were analysed.

Interviews

Two semi-structured interviews were held with John Presbury, the OH&S adviser at BCSC, one of these interviews was held by telephone. One semi-structured interview by telephone was held with Grant Williams, the environmental manager of BCSC. During the two other visits of the BCSC plant information was gathered, but not in the form of an interview.

2.3.6 Context

This study is performed for the cement manufacturing plant Blue Circle Southern Cement in Berrima.

History Blue Circle Southern Cement

In 1974 Blue Circle Southern Cement was formed out of a partnership of Associated Portland Cement Manufacturers and Southern Portland Cement PLC., owned by BHP. In 1987 BCSC was taken over by BORAL. Because BORAL moved into the cement business, internal frictions emerged. BORAL was as from then, selling cement to independent distributors. "BORAL had been able to introduce its name into most of its acquisitions quite easily. But to offer BORAL concrete as well as BORAL cement, and to have green and gold trucks entering competitors' yards, was virtually unthinkable" (BORAL (6), n.d.). This is the main reason that BCSC still operates under its own name.

Cement making

The primary process at BCSC is the fabrication of Portland cement. To gain insight in the primary process at BCSC this will be described.

Cement consists of an accurately controlled mixture of calcium (found in limestone), silica, aluminium and iron (found in shale and iron ore) that is blended together and ground into a fine powder. It is the CS found in sand (70% CS) and shale (22% CS) that is of importance for this research.

The limestone needed for the making of cement comes from a quarry, owned by BCSC. The shale is quarried on the worksite itself. Iron ore and gypsum are acquired from outside resources (The story of Cement, n.d.).

The fine powder is then heated up to a temperature of 1400°C in a rotary kiln. The material that comes out of this kiln is called clinker. The clinker is then cooled and ground together with gypsum. The combination of ground clinker and gypsum is called Portland cement (The story of Cement, n.d.). Finally the cement is put in bags and transported to the customers.

3 Literature review

In this chapter the three important terms from the main research question: CS, RMS, and stakeholders will be described in a literature review. First we will discuss the history and substance of CS and the health risks associated with CS. Then we will give a definition for risk and describe a general RMS and theory regarding risk communication will be discussed. Further the National Guidelines for managing CS will be explained and best practices for the management of the CS risk will be described. Finally we will describe what stakeholders are and a model for stakeholder identification will be discussed.

3.1 Crystalline Silica

This paragraph will provide a better understanding of the history of CS in OH&S, the substance CS and the hazards and risks involved with the respiration of CS. Furthermore this paragraph will provide more insight in the health effects it can have on humans.

3.1.1 History of Crystalline Silica in OH&S

Since the early 1920's the cement industry is concerned with the CS containing dust that they produce and the effects it may have on their workers (Rosner & Markowitz, 2002). By the 1930's, the first measures to reduce the risks of CS related diseases were introduced. Examples of these measures are the installation of ventilation equipment and the reorganizations of practices at the factories (Rosner & Markowitz, 2002). In the 1940's Threshold Limit Values (TLV) were introduced for CS, although these standards were not yet scientifically studied and analysed (Rosner & Markowitz, 2002). Rosner and Markowitz (2002) even state that the first TLV's had been set at about the lowest level engineering methods then would have been able to achieve.

In 1991 CS was added to the "reasonably anticipated to be a human carcinogen" list by the Unites States National Institute of Health in their Sixth Annual Report on Carcinogens (1997). In the Ninth Annual Report on Carcinogens from 2000, CS was revised to "known to be a human carcinogen" (National Toxicology Program, 2005).

3.1.2 The substance Crystalline Silica

Silica occurs naturally in one of three different states; crystalline, amorphous or glassy (ACOEM, 2007). For this research, only silica in the crystalline state will be taken into account as this is the form in which CS is used at cement manufacturing plants. According to the American College of Occupational and Environmental Medicine (ACOEM, 2007) and the WHO (WHO, 2000) the three major industrial types of CS are quartz, cristobalite and tridymite. Quartz is the second most common mineral in the earth's crust (ACOEM, 2007). Quartz is the most common from in ambient temperatures. Tridymite is formed at 870°C and cristobalite is formed at 1470°C (IMA, n.d.). Furthermore quartz is colourless and insoluble in water and acids (U.S. Department of Health and Human Services, 1998).

The most common form in which we know CS is sand (U.S. Department of Health and Human Services, 1998). Sand is a material whose grain size distribution falls between 0.06 and 2.00 millimetres (IMA, n.d.) and has been used by humans throughout history for all kinds of purposes such as glass making, ceramics making, filtration and the petroleum industry (U.S. Department of Health and Human Services, 1998).

3.1.3 Crystalline Silica as a health risk

Before the diseases associated with the respiration of CS, first the importance of the particle size will be explained. Then the diseases silicosis, lung cancer and other CS related diseases are described.

Particle size

As CS most common form is sand, humans are exposed to CS every day. Therefore the respirable size of the particles is of great importance for determining the risks of CS. These particles have been divided in four sizes: non-inhalable, inhalable, thoracic and respirable (NEPSI, 2006), see Figure 2. According to the European Standards (EN 481, 1993) approximately 50% of dust particles with a size between 50 and 100 µm can be inhaled by humans and is therefore named inhalable dust. Dust particles larger than 50 µm can be filtered out by the body through the hairs in the nose and mucus in the throat. Thoracic dust particles are smaller than 50 µm and can pass the nose and mouth, but will be filtered out by the mucus in the larynx.

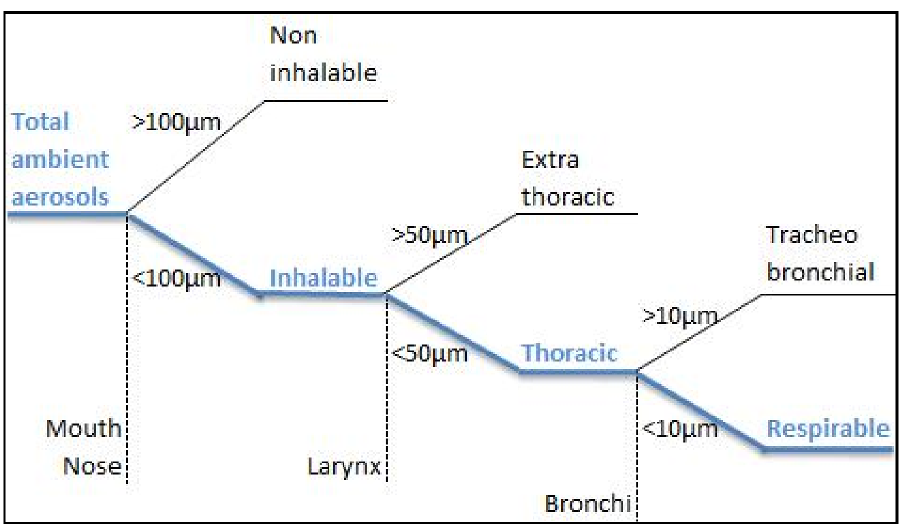

Figure 2: Dichotomous model of aerosol fractionation (NEPSI (2), n.d.)

Respirable particles smaller than 10 µm are harder to be filtered by the lungs. These particles can penetrate to the pulmonary alveolar (gas exchange) region of the lungs, which can form multiple nodular lesions in the lung parenchyma, which can develop by conglomeration in larger lesions, which can cause silicosis (American Thoracic Society, 1997). Therefore it is this small fraction of CS particles that forms a health risk. In Figure 3 the percentage of dust particles ending up in the alveolar region of the lungs is depicted.

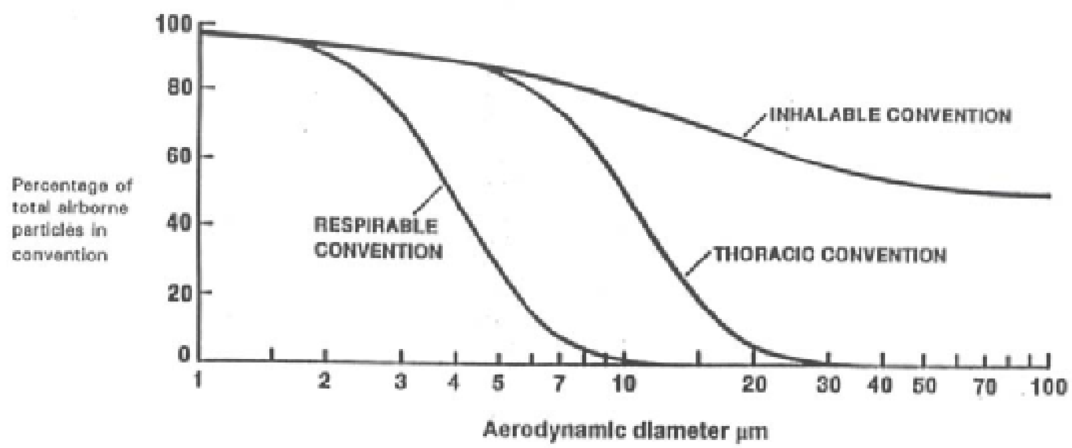

Figure 3: Percentage of dust particles not filtered by the lungs (NEPSI, 2006)

In Figure 3 it can be seen that the respirable convention consists of particles smaller than 10 µm, this was also shown in figure 6. This respirable convention line shows that with a particle size smaller than 2 µm, 100% of the airborne particles are respirable, while with particle size 5 µm, only 20% of the airborne particles are respirable and when the particle size reaches 10 µm, the particles will not reach the pulmonary alveolar region of the lungs. This figure shows that the smaller the particles are, the easier they penetrate deep into the lungs of humans. The other lines show the thoracic convention line and the inhalable convention line, but particles in these regions are not small enough to penetrate into the pulmonary alveolar region of the lungs and therefore do not form a risk for the development of silicosis.

Silicosis

As already mentioned, the respiration of small CS dust particles contains a health risk. The main disease caused by the inhaling of free CS dust is silicosis (Steenland & Sanderson, 2001; Yassin, Yebesi, & Tingle, 2005; Colllin, Salmon, Brown, Marty, & Alexeeff, 2005; Hardy & Weill, 1995). Silicosis is one of the oldest occupational diseases and is incurable as to this moment (Yassin, Yebesi, & Tingle, 2005).

Silicosis is caused by inhalation of free CS respirable dust particles (Colllin, Salmon, Brown, Marty, & Alexeeff, 2005; World Health Organisation, 2000; Yassin, Yebesi, & Tingle, 2005). The disease is progressive, even when the exposure to free CS dust stops (Collin et al., 2005).

Silicosis can manifest itself in three different types: chronic, accelerated and acute silicosis (World Health Organisation, 2000). Chronic silicosis occurs after more than ten years of exposure to low levels of free CS (Yassin, Yebesi, & Tingle, 2005). Symptoms may feature breathlessness and can resemble chronic obstructive pulmonary disease (COPD) (Kaufman, 2007). Accelerated Silicosis usually develops within 5 to 10 years after exposure to high levels of free CS. Accelerated Silicosis shows the same symptoms as chronic silicosis, but the symptoms progress much faster (Kaufman, 2007). Acute silicosis can develop within five weeks after exposure to very high levels of free CS (Yassin, Yebesi, & Tingle, 2005). Extra symptoms for acute silicosis are very inflamed lungs, filled with fluid and low blood oxygen levels (Kaufman, 2007). General symptoms for all types are chronic cough, shortness of breath, fever and weight loss. Accelerated and acute silicosis can be fatal, chronic silicosis has a good prognosis (Kaufman, 2007).

Lung Cancer

Another issue that needs to be addresses is the question whether or not CS exposure is related to the development of lung cancer. There are multiple studies that claim that the development of lung cancer is indeed related to the existence of silicosis in the patient. There is though no scientific evidence for a direct relation between lung cancer and exposure to free CS without the prior existence of silicosis (Klerk & Musk, 1998; Ward, 1995; Fine, 1995).

Other CS related diseases

However, silicosis is not the only disease caused by the inhalation of free CS dust. According to Hardy and Weill (1994) there is also scientific evidence for the contribution or cause of respirable CS on pulmonary tuberculosis, COPD, lung cancer and several extrapulmonary diseases. Examples of these extrapulmonary diseases are autoimmune diseases such as scleroderma, rheumatoid arthritis and systemic lupus (Parks, Conrad, & Cooper, 1999).

3.2 Risk management

According to Sadgrove (1996) “a RMS ensures that the organization manages its treats in proactive, coordinated, cost-effective and prioritized way” (Sadgrove, 1996, p.2). How we can define these threats and how these threats can be managed will be described in this paragraph.

3.2.1 Risk

When defining risk for the area of OH&S, it is important to keep in mind the difference between hazard and risk. A hazard is defined as “a substance, agent or physical situation with a potential for harm in terms of injury or ill health, damage to property, damage to the environment or a combination of these” Sadhra (2005). This definition points out that a hazard already exists when the potential for harm is identified, no matter how large or small this potential is. Risk is defined as “the likelihood of the harm or undesired event occurring and the consequences of its occurrence” (Sadhra, 2005). A similar definition comes from Donoghue who describes the risk of a hazard as “the probability that [the hazard] will result in an undesired event and the consequences that such an event would have” (Donoghue, 2001). This relationship between probability and consequences can be described in an equation: *risk = probability x consequences* (Donoghue, 2001; Joy, 2004). This definition of risk will be used in the risk management process described in the next paragraph.

The difference between hazard and risk is important when determining the risks an organization is exposed to, because an organization might be exposed to a hazard but does not have a significant risk associated with it, when either probability or consequences are very low.

3.2.2 Managing risk

Risk management is important because it helps a company avoid costs, disruptions and general unhappiness. Sadgrove (1996) mentions five factors that have put an increasing pressure on the risk management of an organization. The five factors mentioned by Sadgrove (1996) are: legislation, insurance, customers, management itself and the public. The factor legislation has become more important because governments increasingly put more emphasis on health and safety and environmental topics. Insurance has become more expensive and is now more difficult to obtain. Customers have become more demanding on the subject of product quality and management has discovered that preventing problems is better than solving them. Finally, the public now expects a higher standard of corporate behaviour, especially on the subjects of pollution, disturbance and bad ethical behaviour (Sadgrove, 1996). These factors put more emphasis on creating a solid RMS for an organization.

According to Sadgrove a "RMS ensures that the organization manages its treats in a proactive, coordinated, cost-effective and prioritized way” (Sadgrove, 1996, p.2). The WHO defines risk management as “the process of weighing policy alternatives to accept, minimize or reduce assessed risks and to select and implement appropriate options” (WHO, 2008). In this definition it is stated that risk management is a process.

3.2.3 Risk management process

Managing risk can be divided into a five-stage risk-management process based on the literature of Joy (2004) and Sadgrove (1996), which will be described next. A graphical representation of the five-phase model is depicted in Figure 4.

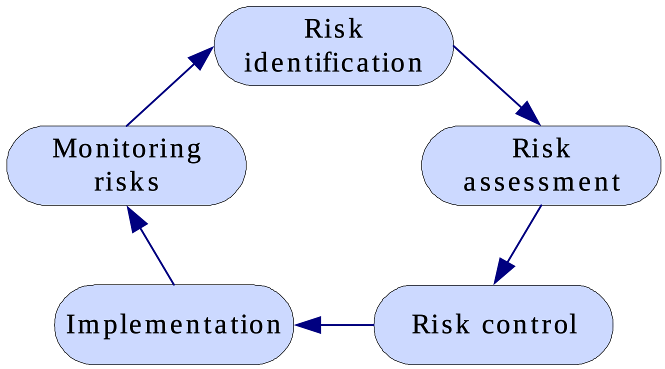

Figure 4: Risk management process

Risk identification

The first stage is *risk identification*, in which all potential hazards to employees as well as to others affected by the organizations activities are identified (Joy, 2004). To identify these hazards, Sadgrove (1996) mentions five methods: 1) ask the staff for their opinion on what are the hazards and risks, 2) review the purchases of the companies, as these could contain hazardous substances, 3) audit the workplace for hazardous substances, 4) check a government list of hazardous substances and 5) read publications related to health and safety subjects in the same line of work.

Risk assessment

When a hazard has been identified, the gravity of the risk involved with this hazard should be evaluated, which is done in the *risk assessment* phase (Sadgrove, 1996). In this phase the magnitude of the risk is determined in terms of the two variables probability and consequences.

According to the WHO (2008) risk assessment is "the qualitative or quantitative estimation of the likelihood of adverse effects that may result from exposure to specified health hazards or from the absence of beneficial influences". Like the WHO, Donogue (2001) also makes a distinction between qualitative terms and quantitative values to describe probability and consequences, which he uses in the hazard risk assessment matrix. In the qualitative hazard risk assessment matrix the probability of the risk, also called likelihood of occurrence, is described in the rows, and the consequences of the hazard are described in the columns of the matrix. Donoghue (2001) classifies the probability with the following terms:

- *Frequent* (likely to occur frequently)
- *Probable* (likely to occur several times in the life of the operation)
- *Occasional* (likely to occur sometime in the life of the operation)
- *Remote* (unlikely but possible to occur sometime in the life of the operation)
- *Improbable* (so unlikely that it can be assumed that it may never occur)

Consequences are classified with the following terms (Donoghue, 2001):

- *Catastrophic* (death)
- *Critical* (permanent major disability)
- *Marginal* (permanent minor disability)
- *Negligible* (temporary disability)

In Table 1 the qualitative hazard risk assessment matrix is depicted. The numbers in Table 1 are the risk assessment codes (RAC) and determine the relative importance of each issue and their need for control. According to Donoghue (2001) the typical acceptability criteria are:

- RAC 1-5: Unacceptable: risk must be reduced (black cells)
- RAC 6-9: Undesirable: all practicable controls must be used – with documented acceptance of residual risk (dark grey cells)
- RAC 10-16: Acceptable: with documented acceptance of residual risk (light grey cells)
- RAC 17-20: Acceptable (white cells)

Table 1: Qualitative hazard risk assessment matrix

	Consequences			
Probability	*Catastrophic*	*Critical*	*Marginal*	*Negligible*
Frequent	1	3	7	13
Probable	2	5	9	16
Occasional	4	6	11	18
Remote	8	10	14	19
Improbable	12	15	17	20

Risk control

The third phase of the risk management process is *risk control*. In this phase a decision is made for suitable control measures that will eliminate or reduce the unacceptable or undesirable risk determined in the risk assessment phase (Joy, 2004).

Control measures should be implemented in accordance with the Hierarchy of Control. The Hierarchy of Control model is "a list of control measures, in priority order that can be used to eliminate or minimise exposure to hazardous substances" (NOHSC 2007, 1994, p. 49). In priority order means that higher control measures in the hierarchy should be considered first before going down in the hierarchy (Gately & Bromwich, 2007). This does not mean that control measures are mutually exclusive; multiple measures can be used at the same time, when this is necessary to reduce risk to as low a level as possible (NOHSC 2007, 1994). The Hierarchy of Control model as used by Gately & Bromwich (2007, p.77) is depicted in Figure 5 and will be described next.

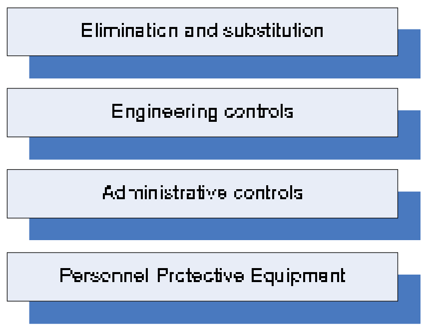

Figure 5: Hierarch of Control (Adapted from Gately and Bromwich, 2007, p. 77)

The first step in the hierarchy of control is *elimination or substitution*. Elimination means that the process or substance is removed from the process. In practice elimination is often not possible (Gately & Bromwich, 2007). Substitution means that a process or substance is replaced with another, non hazardous, process or substance that has more or less the same characteristics as the previous (Gately & Bromwich, 2007).

The second step in the hierarchy of control is the use of *engineering controls*. There are three main engineering controls possible to engineer the hazard out of the current system. These three controls are isolation, containment and ventilation. Isolation can be a physical or distance barrier that isolates the worker completely from the hazard to prevent exposure. Containment is a measure to prevent the hazardous substance to escape from the source. Further, industrial ventilation is the "engineering control of contaminations by dilution or local exhaust ventilation" (Gately & Bromwich, 2007).

The third step is the use of *administrative controls*. The use of administrative controls is in fact changing the systems and methods of work to reduce the risk (Gately & Bromwich, 2007). Various ways of changing systems and methods of work are education and training, work schedule and work practice changes and worker rotation and removal from exposure.

The use of *Personnel Protective Equipment (PPE)* is the last resort to minimize exposure to hazardous substances (Gately & Bromwich, 2007). Although PPE is at the bottom of the hierarchy of control, it is still widely used, often as back-up supplement for other control measures.

Implementation

In the fourth phase the control measures decided upon in phase three are implemented. It is important to determine who is responsible for the implementation and communicate this throughout the organization.

Monitoring risks

In the last phase, monitoring risks, the effectiveness of the implemented control measures should be ensured.

3.2.4 Health risk communication

In the area of public health and safety and environmental issues, there has been an increasing need for health risk communication, particularly since the media and the general public have become increasingly hazard conscious (Nicholson, 1999).

In order to be able to communicate effectively, it is important to know who the audience is for ones message (Schwarzkopf, 2006). Who the audience is, can be determined by doing a careful stakeholder analysis as discussed in paragraph 3.1.

It should be taken into account that stakeholder concern can both be underestimated as well as exceed the concern that the experts feel to be appropriate (Nicholson, 1999). Schwarzkopf (2006) adds to this that those stakeholders with the least understanding of certain processes are the most vulnerable to possible risky outcomes of those processes. It can therefore be concluded that it is important to remember that risk communication can always lead to inappropriate reactions by the stakeholders involved, especially when they do not understand the process involved, which implies urgency for clear communication with the stakeholders involved, regarding these issues.

According to Nicholson the aims of health risk communication should be to “present information in such a way that it is understood and usable”, to ensure that “the audience is informed so as to be able to make judgements on risks” and “to engage the active support of the people affected” (Nicholson, 1999, p.253).

When health risks need to be communicated to stakeholders, it is best that this is done by occupational heath personnel or health professionals. The study of Erickson (1990) shows that occupational heath personnel or health professionals have the highest credibility with the general public and that the government has the lowest credibility with the general public (Nicholson, 1999). It is also important that risk information is disclosed sooner rather than later (Nicholson, 1999).

3.3 NSW Occupational health and safety RMS requirements

In the previous paragraph a general health and safety RMS has been described. It was also mentioned that legislation concerning health and safety issues has become stricter. This paragraph will give more insight in the extensive legal requirements and recommended practices for OH&S RMS requirements the New South Wales (NSW) Government subscribes for organizations operating in NSW.

3.3.1 The OH&S Act 2000

The most important law for OH&S is the New South Wales Occupational Health and Safety Act 2000. According to this Act "an employer must ensure the health, safety and welfare at work of all the employees of the employer" (NSW Occupational Health and Safety Act, 2000).

This OHS Act describes "the general requirements necessary to ensure a safe and healthy workplace, and is designed to reduce the number of injuries in the workplace by imposing responsibilities on individuals and corporations" (WorkCover (1), 2003).

To support the requirements as stated by the Act, regulations have been made (WorkCover (2), 2003). These regulations support the general requirements described in the Act and provide more detail. Chapter 6 of these regulations describes the obligations of an employer with respect to hazardous substances. As CS is considered a hazardous substance (NOHSC 10005, 1999), BCSC has to fulfil these legal obligations. The Australian National Occupational health and Safety Commission (NOHSC) published these regulations in their *National Model Regulations for the Control of Workplace Hazardous Substances* (NOHSC 1005, 1994).

The National Code of Practice for the Control of Workplace Hazardous Substances provides a practical guide on how to comply with the regulations in the *National Model Regulations for the Control of Workplace Hazardous Substances* (NOHSC 2007, 1994). A Code of Practice is not a law but a recommended practice. Nonetheless it should be followed unless there is an alternative course of action that achieves the same or better standards (WorkCover, 2006).

3.3.2 WorkCover Code of Practice

For this research the Code of Practice for the Control of Hazardous Substances (WorkCover, 2006) is of importance. WorkCover (2006) has written their *Code of Practice for the Control of Workplace hazardous Substances* based on *The National Code of Practice for the Control of Workplace Hazardous Substances* (NOHSC 2007, 1994). WorkCover made some minor changes that reflect recent changes in the legislation. Therefore the WorkCover Code of Practice (WorkCover, 2006) will be used for this study.

A third legislative device is standard setting. According to Standards Australia a standard is "a published document which sets out specifications and procedures designed to ensure that a material, product, method or service is fit for its purpose and consistently performs in the way it was intended" (What is a Standard?, n.d.). As described in the previous paragraph, this research focuses on the substance CS. Therefore the most important standard for this research is the exposure standard for CS which is 0.1 mg/m³ ES-TWA (Exposure Standard-Time Weighted Average) for Australia anno 2007. Other important standards have been taken into account by WorkCover and will therefore not be explained individually.

In Figure 6 the connections between the different forms of legal requirements, recommended practices and their reflection on BCSC policies and procedures are depicted.

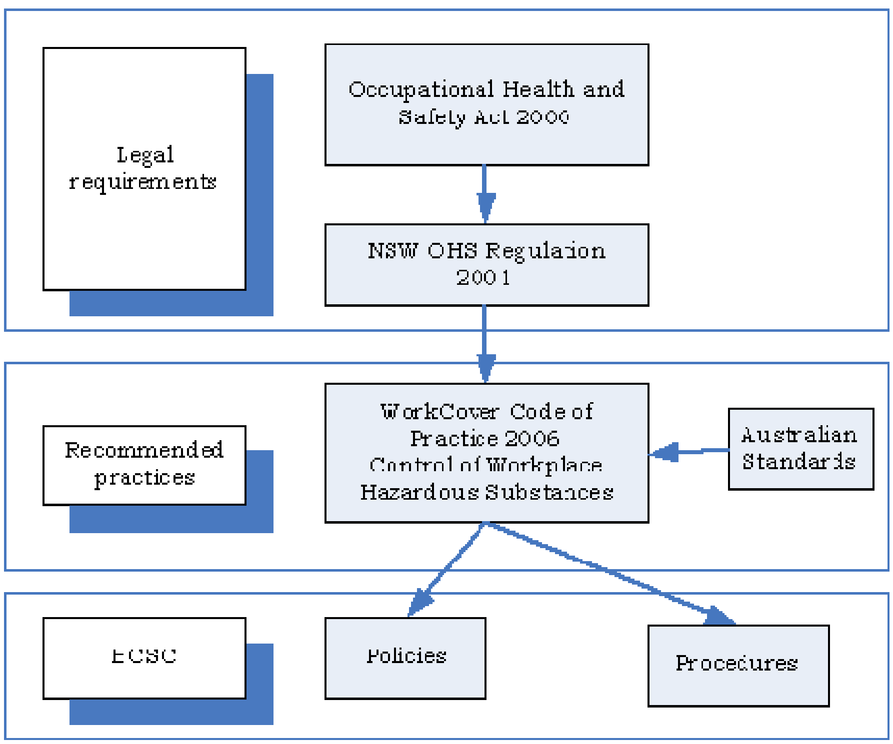

Figure 6: legal requirements and recommended practices and their reflection on BCSC

The WorkCover Code of Practice is used to develop policies and procedures at BCSC. There are eight requirement listed by the *Code of Practice for the Control of Workplace hazardous Substances* (WorkCover, 2006) that BCSC has to comply with. These requirements are a) consultation; b) provision of information; c) induction and training; d) control measures; e) monitoring; f) risk assessment; g) health surveillance; and h) record keeping and reporting (WorkCover, 2006). The next section will give a short summary of these requirements. These requirements will be used to determine whether or not BCSC complies with the current national guidelines.

Consultation

Employers are required to share information with their employees about issues that could have an effect on their health and giving them an opportunity to express their views (WorkCover, 2006). Consultation of employees is required in many cases; therefore WorkCover recommends that the employees are consulted every time there is a change or review of the OH&S system.

Provision of information

There are two ways in which information about the hazardous substance can be provided, either by a Material Safety Data Sheet (MSDS) or by labelling. Companies are required to prepare MSDS for all the hazardous substances that they supply (WorkCover, 2006). Labelling ensures the correct content of a container with the purpose of readily identifying its contents and therefore attending the person who is handling the container on the hazards involved with the substance and the suitable precautions that should be undertaken (WorkCover, 2006). The *National Code of Practice for the preparation of Material Safety Data Sheets* (NOHSC 2011, 2003) provides more detailed information on the requirements of an MSDS. It is the duty of the employer to make sure that all MSDS are available for employees, customers and other stakeholders (WorkCover, 2006).

Induction and training

Employees have to be inducted and trained in workplace procedures such as managing OH&S, reporting hazards, OH&S procedures and how to access information on OH&S (WorkCover, 2006). Induction and training should be repeated when there has been a change in workplace procedures (WorkCover, 2006).

Control measures

Employers are required to prevent their employees from exposure to hazardous substances (WorkCover, 2006). Where prevention is not an option, adequate control measures should be taken to minimise the risk to health (WorkCover, 2006). Control measures should be implemented in accordance with the Hierarchy of Control as discussed in the previous paragraph.

Monitoring

According to WorkCover (2006) monitoring is “the use of valid and suitable techniques to derive an estimate of the exposure of employees to hazardous substances" (p. 40). For airborne contaminants, such as dust, monitoring involves continuous and periodic sampling of the workplace atmosphere and comparing the results to the relevant exposure standards (WorkCover, 2006). Monitoring should be done by competent and skilled persons only (WorkCover, 2006). The current exposure standard for CS is 0.1 mg/m³ Exposure Standard- Time Weighted Average (ES-TWA) (NOHSC, 2007).

Health surveillance

Health surveillance is "the periodic physiological or clinical examination of exposed workers to detect early reversible health effects, so that measures can be taken to prevent occupational disease" (Aw, 2005). According to the *National Model Regulations for the Control of Workplace Hazardous Substances* (NOHSC 1005, 1994), health surveillance is required for employees exposed to CS.

Risk assessment

Risk Assessment is the procedure that enables decision making about providing appropriate induction and training, control measures, monitoring and health surveillance (WorkCover, 2006). The three steps involved in risk assessment are: 1) identification of hazardous substances used and present in the workplace; 2) review of information about each hazardous substance; 3) identification of risks.

Record keeping and reporting

The employer has to keep records of risk assessments which indicate a need for monitoring and/or health surveillance in a suitable form for at least 30 years (WorkCover, 2006).

3.4 Risk management best practices

In this paragraph two 'best practices' around the world for CS related risk management are discussed. The initiatives discussed will be the Cement Sustainability Initiative (CSI) and the European Network for Silica (NEPSI). For these initiatives their goal and methods and possible impact on BCSC will be discussed.

3.4.1 Cement Sustainability Initiative

History of the Cement Sustainability Initiative

Cement Sustainability Initiative (CSI) is a sector project of the World Business Council for Sustainable Development (WBCSD). The mission of the WBCSD is to provide "a platform for companies to explore sustainable development, share knowledge, experiences and best practices, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organizations" (About the WBCSD, n.d.). The CSI is one of their six sustainability initiatives (Sector Projects, n.d.). The CSI exists since 1999, when ten large cement manufacturers started working together (About CSI, n.d.), the CSI now has sixteen members.

In 2002 the CSI issued an Agenda for Action. The six critical issues reported in this Agenda for Action are (About CSI, n.d.):

- Climate protection and CO2 reduction
- Responsible use of fuels and materials
- Employee health and safety (OH&S)
- Emission monitoring and reduction
- Local impacts on land and communities
- Reporting and communications

CS is not an issue discussed directly by the CSI but the CSI covers problems regarding employee health and safety (OH&S), emission monitoring and reduction, and local impacts on land and communities that are valuable for this research and will be described in more detail in the next paragraph (CSI, 2002).

OH&S, emission reduction and local impacts

In June 2005, a report was published in which the results on the agenda for Action of the last three years are presented. In this report it can be seen that for Employee Health and Safety, the focus has been on Safety more than on Health of the employees. The identified Key Performance Indicators (KPI) for Employees Health and safety are Lost Time Injuries and Fatalities (Timberlake, 2005). Both these KPI's measure the safety at the plant and do not take into account the long term health effects for the employees.

The KPI's for Emission Monitoring and Reduction are the emission of NO_x (nitrogen oxides), SO_x (sulphur compounds) and dust (Timberlake, 2005). CS is not mentioned as a separate part of the dust emission and there is little attention given to the dust emission. More attention is given to the emission of Dioxins, VOC's (Volatile Organic Compounds) and Trace metals.

The last issues analysed was Local Impacts on Land and Communities. This research mainly focused on the impact on the community. For this issue the KPI of importance is the "Percentage of sites with community engagement plans in place" (Timberlake, 2005). No information is known on what information should be taken up in these community engagement plans.

The aims of the discussed critical issues are described in appendix 3. In this table the aim developed for the joint projects, as well as the aims for the individual partners are described.

3.4.2 European Network for Silica

History of the European Network for Silica'

NEPSI is the acronym for the 'European Network for Silica' formed by the Employee and Employer European sectoral associations having signed the Social Dialogue Agreement "Agreement on Workers' Health Protection Through the Good Handling and Use of Crystalline Silica and Products Containing it" on 25 April 2006, representing 14 industry sectors (NEPSI, n.d.).

There are seventeen organisations that have signed the agreement, but the Agreement remains open for further signatures (NEPSI, n.d.). The NEPSI industry sector organisations and their counterpart trade union federations negotiated a multi-sectoral social dialogue Agreement (NEPSI, n.d.). The European Commission supported this project and qualified it as innovative as it is the first multi-sectoral agreement (NEPSI, n.d.).

NEPSI has two important documents, the agreement itself (NEPSI, 2006) and the Good Practice Guide on Workers Health Protection through the Good Handling and Use of Crystalline Silica and Products containing it" (NEPSI (2), n.d.).

In the agreement the objectives and the scope of the agreement are explained. The objective is to protect the health of employees against the risks of CS by minimising exposure to prevent, eliminate or reduce CS related health risks and by increasing knowledge regarding the health effects of CS (NEPSI, 2006). The scope of the agreement addresses all handling of CS, including production, storage, transport and mobile workplaces (NEPSI, 2006).

More important for BCSC is the Good Practices Guide. This report consists of two parts. The first part gives an explanation on what CS is and what the involved hazards and risks are. The second part consists of a number of Task Guidance Sheets that explain activities that are common in companies working with CS. The activities are described and the recommended practices and discourage practices are explained. In appendix 4 a list of the Task Guidance Sheets useful for Cement factories.

3.5 Stakeholder identification

In the last decade, stakeholder thinking has become more and more an issue when talking about the success of firms (Donaldson, 2002). In management literature the idea that corporations have stakeholders is now widely accepted, both in academic and professional literature (Donaldson & Preston, 1995). The identification of stakeholders is an issue addressed by Mitchell, Agle and Wood (1997). They describe a model that identifies the saliency of different stakeholders of firms. This idea of stakeholders not being equal is reinforced by Barringer and Harrison (2000). They state that one of the starting points of effective stakeholder management is "determining which stakeholder matters most" (Barringer & Harrison, 2000).

3.5.1 Stakeholder identification model

To determine which stakeholders matter most, first a definition of a stakeholder will be given. According to Freeman a stakeholder is "any group or individual who can affect or is affected by the achievement of the organizations objectives" (Mitchell et al., 1997). This is a very broad definition, which prevents stakeholders from being excluded a priori. When all potential stakeholders are listed, Mitchell et al. provide a framework consisting of three stakeholder attributes: power, legitimacy and urgency to be able to identify the stakeholders that matter most. Stakeholders who possess the attribute power are "those [stakeholders that are] able to bring about the outcomes they desire, even despite resistance" (Mitchell et al., 1997). Legitimacy is defined as "a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed systems of norms, values beliefs and definitions" (Mitchell et al., 1997). This broad definition refers to socially excepted and expected structures and behaviour. The third attribute, urgency, is defined as "the degree to which stakeholder claims call for immediate attention" (Mitchell et al., 1997). In this definition the words 'immediate attention' show that urgency has a time constraint and that it is critically important to pay attention to the stakeholders claim. With these attributes a typology of stakeholders can be made, which then can be used to determine which stakeholders matter most for this research. In Figure 7 the model used to identify stakeholder is depicted.

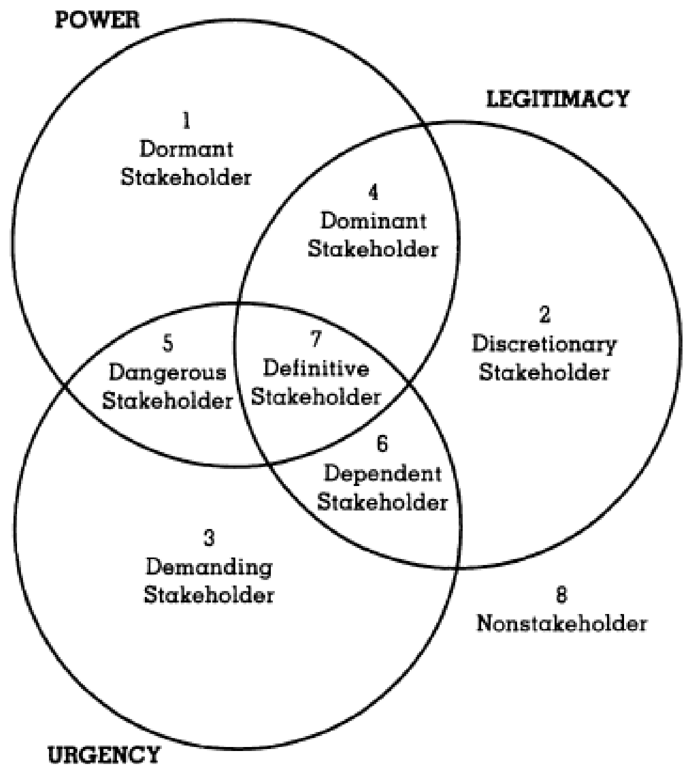

Figure 7: Stakeholder typology (Mitchell, Agle and Wood, 1997, p. 874)

3.5.2 Classes of stakeholders

As can be seen in Figure 7, the three attributes power, legitimacy and urgency form eight different classes of stakeholders. Stakeholders which posses only one of the attributes are called 'latent' stakeholders. It is not likely that latent stakeholders will receive much attention from the organizations managers. Stakeholders that posses two attributes are called 'expectant' stakeholders and these stakeholders are much more likely to require a higher engagement from the organizations managers. The stakeholders that possess all three attributes are definitive stakeholders and therefore require the most attention from the organizations management.

For this research Mitchell's model for stakeholder identification is used. This framework was chosen because it is an often use framework for stakeholder identification and because this model gives suggestions for the way in which BCSCs' management should address the different types of stakeholders.

3.6 Conclusions literature review

In this chapter three terms from the main research question have been described in a literature review.

Stakeholder theory

We started with the description of a theory for stakeholder identification. Mitchell et al. (1995) describes a framework for stakeholder identification that consists of three stakeholder attributes: power, legitimacy and urgency. These attributes make it possible to identify the stakeholders that matter most for this research in a structured way. In the next chapter we will use this framework to determine the most important stakeholders for this research.

Risk management theory

We defined risk as probability x consequences and described a five-phase risk management process model consisting of the phases: risk identification; risk assessment; risk control; implementation and monitoring risk, which give us a guideline for structuring the analysis of the RMS at BCSC. Because of the importance of the factor legislation, the NSW OH&S regulations have been described. The five-phase process model and the NSW OH&S regulations will be applied on BCSC in chapter 5.

Crystalline Silica Theory

The last subject discussed was CS. It was determined that CS dust is only an OH&S risk when the particle size is smaller than 10 µm. The health risk associated with respirable CS is preliminary silicosis, but a connection with the development of lung cancer and other diseases cannot be rejected.

Crystalline Silica best practices

Two best practices around the world for CS management were described. The initiatives discussed were the Cement Sustainability Initiative (CSI) and the European Network for Silica (NEPSI).

At this moment the CSI is not very helpful for BCSC as do not mention the CS hazard separately. The NESPI is helpful for BCSC as it describes Good Practice Guides for the handling of CS. These Goods Practice Guides will be described in chapter 6.

4 Stakeholder identification

In this chapter BCSC's stakeholders and their influence on CS health and safety management at BCSC will be described. This process is known as stakeholder identification and has been described in paragraph 3.1.

4.1 Potential stakeholders

To be able to determine which stakeholders matter most, first a list of potential stakeholders has been drawn up. This list of potential stakeholders was drawn up from the article of Nicholson (1999), a discussion with the OHS manager of BCSC and from the BORAL induction Manual.

Nicholson (1999) names employees, the public who perceives they are at risk (community), union representatives, and special interest groups as the audience for risk communication. These stakeholders can therefore be seen as potential stakeholders for this research. To this list the government, the cement industry, BORAL management, suppliers and customers (grouped as visitors) were added based on the BORAL induction Manual and the Community Liaisons Committee was added after a discussion with the OH&S manager.

These potential stakeholders are depicted in Figure 8. The inner layer are internal stakeholders, the outer layer are external stakeholders. For each of these potential stakeholders their stakeholder attributes: power, legitimacy and urgency as described in the literature review, are determined.

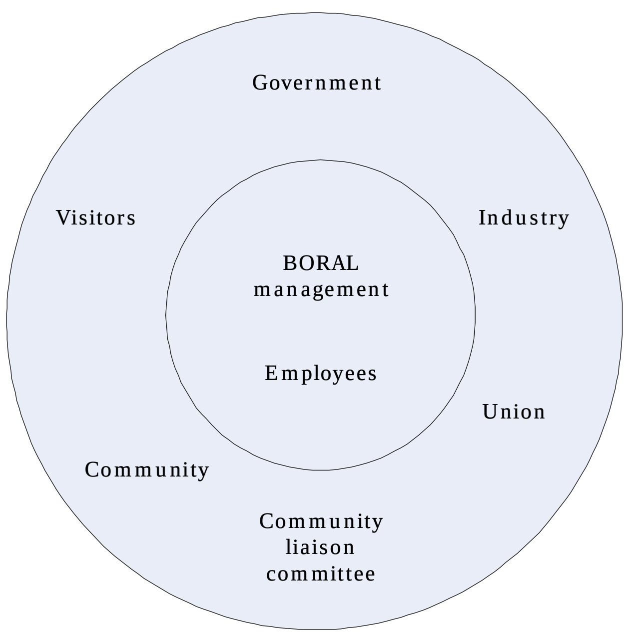

Figure 8: Stakeholders BCSC

4.2 Stakeholder identification

In this paragraph we will describe the attributes for the potential stakeholder defined in paragraph 4.1. Then we will give a description of the five different stakeholder typologies present for BCSC management.

4.2.1 Determine stakeholder type

BORAL management

Power: BORAL is the mother company of BCSC and therefore BORAL management has the power to induce outcomes they desire which would mean that BORAL management has the attribute power. But when it comes to power related to the management of the CS hazard, they will first of all have to comply with the government legislation and only then can they enforce their own measurements upon BCSC. Therefore with respect to the management of the CS hazard, they have limited power compared to the power of the government.

Legitimacy: BORAL management is a legitimate stakeholder as the in organization structure of BORAL, BORAL management is above BCSC management and with this connection the legitimacy of the stakeholder relation between BORAL management and BCSC management is confirmed.

Urgency: At this moment BORAL management does not have an urgent claim on BCSC management to solve problems regarding CS safety at the Berrima plant.

Given these attributes BORAL management is a dependant stakeholder.

Employees

Power: A single employee does not have the power to bring about the outcome he or she desires with regard to the CS hazard. The only power an employee has is resignation, although the resignation of a single employee would not harm the organization very much.

Legitimacy: The employee is a legitimate stakeholder, as its claims are appropriate given his place in the organization. The organization has a corporate responsibility to make sure its employees are not exposed to health risks, which makes it a legitimate stakeholder.

Urgency: An employee of BCSC has received training in CS safety and is therefore aware of the risk involve with working with CS. It can therefore be presumed that employees find it critically important that BCSC management does all it can to make sure that they are not exposed to the CS hazard. Therefore the employees do have the attribute urgency.

Given the attributes legitimacy and urgency of the stakeholder employee, it can be determined that an employee is a dependant stakeholder.

Union

Power: Because the union can be seen as a collection of all employees, the power increases when compared to that of a single employee. When all employees put down their work, for example during a strike, this would have a negative impact of BCSC. So they have more power to bring about the outcomes they desire than a single employee.

Legitimacy: The Australian Construction Foresting Mining Energy Union (CFMEU) has the following mission statement on its website: "[…] to campaign for improvements in occupational health and safety standards […]" (CFMEU, n.d.). There is also a document on their website warning for the dangers of inhaling silica dust (CFMEU (2), n.d.). Therefore the Union is a legitimate stakeholder.

Urgency: As there are no employees of BCSC asking for assistance in the CS matter from the union, the union does not have the attribute urgency.

Given these attributes the union is a dormant stakeholder for BCSC management.

Visitors *(visitors are both customers and suppliers that visit the BCSC plant)*

Power: Visitors do not have to power to bring about the outcome they desire with regard to the CS hazard, as they are not part of the OH&S management process at BCSC.

Legitimacy: Visitors are legitimate stakeholders as they want safe products from BCSC and they want to know when they have to use their products with precautions.

Urgency: When determining whether or not visitors have the attribute urgency, depends on the fact whether or not they know if the CS hazard is present at the BCSC plant. As it is obligatory to inform the visitors of the appropriate measures that should be taken on the plant, it can be assumed that visitors are aware of the CS hazard at the plant and can therefore be seen as urgent stakeholders.

Given these attributes visitors can be either a discretionary or a dependant stakeholder. Taking the worst-case scenario visitors is a dependant stakeholder for BCSC management.

Community

Power: The community itself lacks power, as the community has not one voice. There are though different stakeholders within the community that do have a voice.

Legitimacy: The community is a legitimate stakeholder as they can appeal on BCSC community involvement program and refer to the company's environmental and social responsibility reports.

Urgency: There is no urgency, because as far as BCSC knows at this moment, the community is not aware of the possible CS hazard at the BCSC plant. Therefore they do not have a claim for immediate attention on CS hazard management.

Therefore the community can be described as a discretionary stakeholder.

Community liaisons committee

Power: The Community Liaisons Committee does have the attribute power, as "power is held by those [...] who can command the attention of the news media" (Mitchell et al., 19997, p.876). This potential stakeholder has somewhat more power than the community itself, as the community healthcare worker will be one of the first to identify possible community health problems that could relate to free CS and can then command the attention of the news media.

Legitimacy: The Community Liaisons Committee is a legitimate stakeholder as it was BCSC itself who started this committee.

Urgency: There is no urgency, because as far as BCSC knows at this moment, Community Liaisons Committee is not aware of the possible CS hazard at the BCSC plant. Therefore they do not have a claim for immediate attention on CS hazard management.

Therefore the Community Liaisons Committee can be described as a dominant stakeholder.

Government

Power: The government has the attribute power, as they can bring about outcomes they desire through legislation and regulation.

Legitimacy: The government is a legitimate stakeholder, as they are responsible for public health and therefore have to ensure protection from hazardous substances for employees, and communities throughout the country.

Urgency: While it was the NWS government that induced the new ES-TWA for CS, it is also the NSW government that needs to make sure that companies comply to this ES-TWA. Therefore they do have a certain amount of urgency, as the implementation of these new limits has a time constraint.

Given these attributes the government of NSW is a definitive stakeholder.

Industry

Power: The cement industry federation does not make its own rules. It merely translates government rules for their members. Next to this companies are not obligated to join the cement industry federation. Therefore the cement industry federation does not have the attribute power.

Legitimacy: The cement industry federation does own the attribute legitimacy, as it has a legit relationship with its members.

Urgency: It is not the cement industry federation that is knocking on BCSC door for CS safety attention. This is the government, maybe translated by the cement industry federation, but not initiated by the cement industry federation itself. Therefore they do not own the attribute urgency.

The cement industry federation is a discretionary stakeholder.

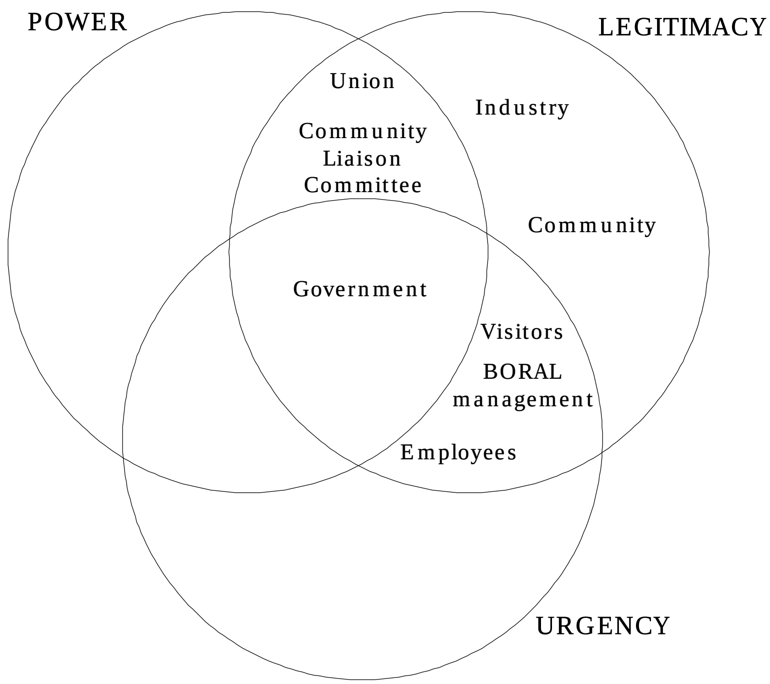

Figure 9: Stakeholders in Mitchell's model.

4.2.2 Managerial implications for stakeholder types at BCSC

In the previous paragraph five different stakeholders types were identified for BCSC management. Each of these stakeholder types has their own managerial implications. These implications will be described in this paragraph.

Discretionary stakeholders: Community, Industry

Discretionary stakeholders are "a particularly interesting group for scholars of corporate social responsibility and performance" (Mitchell et al., 1995). There is no pressure on management to engage in an active relationship with these stakeholders, but management can choose to do so, based on corporate social responsibility factors.

In the case of the community, BCSC management is indeed involved in a 'corporate social responsibility' relationship with the community, via the Community Liaison Committee.

Dominant stakeholder: Community Liaison Committee, Union

As the Community Liaison Committee and the Union are dominant stakeholders, they deserve attention from BCSC management as they have the power to induce outcomes they desire.

The Community Liaison Committee has symbolic power, as they are able to get the attention of the news media.

Dependant stakeholders: Employees, Visitors, BORAL management

Dependant stakeholders depend upon others for the power necessary to be able to carry out their will. Employees, visitors and BORAL management are dependent on the decisions of the government regarding CS management regulation. When stakeholders with power adopt an urgent claim of these dependant stakeholders, these stakeholders can become definitive stakeholders. The possible adoption of the attribute urgency is further discussed in paragraph 4.2.3.

Definitive stakeholder: Government

The definitive stakeholder government is the stakeholder with the most salience to the BCSC management. Although the government legislation comes to the BCSC management indirectly, it is this stakeholder that can influence CS management the most.

4.2.3 Attribute urgency obtained

Mitchell et al. states in his article that stakeholder attributes are not static, stakeholders can obtain their missing attributes over time. As became clear in the stakeholder attribute description in paragraph 4.2.1, at this moment in time, the stakeholders Community and Community Liaison Committee do not have the attribute urgency because they are not aware of the presence of CS in their environment. For the future it should be taken into account that information regarding the presence of CS near cement manufacturing plants can be disclosed in the media, which would make these stakeholders aware of the presence of CS in their environment. Such a change in presence of information could induce a change in the stakeholder typologies. In Figure 10 Mitchell's stakeholder model with the shifts that such information could induce is depicted.

As discussed in paragraph 3.2.4 the availability of such information could raise concerns within the community, especially when they do not understand the process that is at the core of this problem. With these concerns the Community Liaison Committee can become a definitive stakeholder, with the community dependent on them for the attribute power.

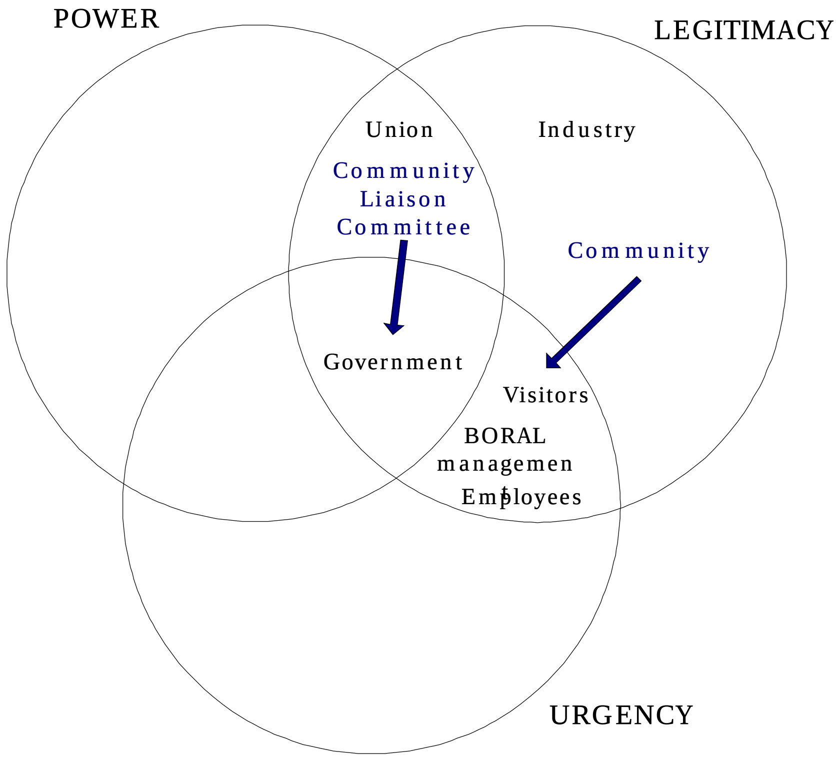

Figure 10: Stakeholders with urgency shift in Mitchell's model

4.3 Conclusion stakeholders

This paragraph has pointed out that the government is the most salient stakeholder for this research. This paragraph has also pointed out that the dominant stakeholder, Community Liaison Committee, can obtain its missing attribute urgency by media attention for CS safety issues. Both these stakeholders have dependant stakeholders connected to them.

The stakeholder government has the stakeholders employees, visitors and Boral management connected to them as dependant stakeholders. The Community Liaison Committee has the Community as a dependant stakeholder. Therefore, for the rest of this research the stakeholders Government and Community Liaison Committee will be the main focus of analysis.

5 Risk management at BCSC

In the previous chapter the government was identified as the most important stakeholders for the management of CS at BCSC. In this chapter we will compare the legislation induced upon BCSC and the corresponding Code of Practice by WorkCover with the policies and procedures at BCSC. Further the application of a risk management process model will be described.

The community liaisons committee was also identified as an important stakeholder for this research. Therefore we will also describe how BCSC should manage risk for its community.

5.1 Compliance to NSW legislation

The RMS at BCSC should comply with the current national guidelines as described in chapter 3. To be able to analyse whether or not BCSC is complying with these national OH&S guidelines with regard to CS, a description of each of the requirements from the NSW government for the management of hazardous substances for BCSC is needed. This description is predominantly based on personal communication with the BCSC OH&S adviser. The fact that this information is based solely on one information source limits the validity of this comparison. Consequences of this limited validity will be discussed in paragraph 7.3. When other documents have been used, these will be referenced in the text.

Consultation

At BCSC a variety of OH&S safety committees are in place, each of them occupied by employees. Employees are consulted when major changes in OH&S policies or procedures are changed.

Provision of information

At BCSC Material Safety Data Sheets (MSDS) provide information concerning the CS hazard of their products. There are MSDS available for all products and semi-products manufactured by BCSC and they are easily obtainable via their website. An example of an MSDS can be seen in appendix 1.

Induction and training

At BCSC employees receive a general OH&S training at the beginning of their job, this training is the same for employees as it is for other visitors. BCSC employees are also trained in the use of hazardous substances via on the job training. An exam has to be taken at the end of the training to show that you have been paying attention. Next to this, employees are also trained in the proper use of PPE.

Control measures

As already mentioned in chapter 3 for this section the Hierarchy of Control model of Gately and Bromwich (2007) is used. In Figure 11 the Hierarchy of Control model and the BCSC measures are depicted. The rest of this section will describe the measures undertaken by BCSC to control the CS risk.

Elimination or substitution

As CS is an important ingredient of cement and there is no substitution known for the raw materials containing CS, at this moment BCSC is not able to eliminate or substitute CS from the cement making process.

Engineering controls

As described, there are three main engineering controls possible to engineer the hazard out of the current system: isolation, containment and ventilation. At BCSC isolation is used in the form of filters, storage facilities and control rooms, containment is used in the form of seal systems and ventilation systems are used in the form of suction systems. At this moment BCSC focuses on the isolation of raw materials treating systems; the use of enclosed raw material transportation systems, and the possibilities of the enclosure of the entire plant within a building.

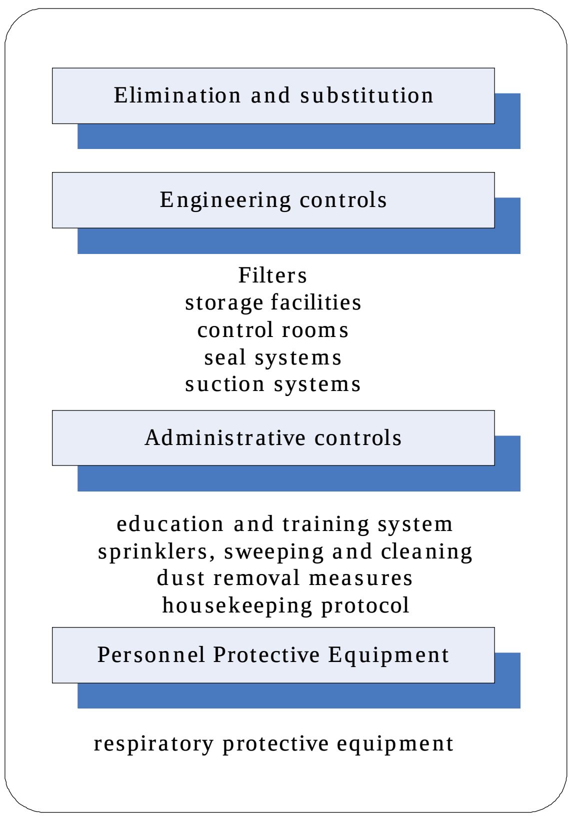

Figure 11: Hierarch of Control at BCSC
(Adapted from Gately and Bromwich, 2007, p. 77)

Administrative controls

At BCSC various administrative control measures are in place. First of all, BCSC has an education and training system that will keep employees and other visitors up to date on the hazard controls measures in place. Also sprinklers, sweeping and cleaning and other dust removal measures are taken by BCSC employees. BCSC tries to minimize the amount of time employees' work in known dust areas and they have a housekeeping protocol to keep dust out of the buildings.

Personnel Protective Equipment

At BCSC a variety of PPE is used, such as hearing protection, goggles and protective boots. Though for the control of CS risk, mainly respiratory protective equipment is used. BCSC uses dust masks that meet the Australian Standards requirements for the particular respiratory risk concerned and the protection level required.

Monitoring

The CS monitoring system at BCSC is the 'Occupational Hygiene Survey Silica Dust Exposure', executed by an independent occupational hygiene professional. This monitoring process assesses whether or not the dust exposure levels at the plant site exceed maximum levels. This monitoring system exists of multiple dust measuring devices placed at both static places throughout the plant as well as dynamic with employees. During a period of time multiple measurements are performed and repeated throughout the years. The dust measuring devices are run for a certain time and afterwards the dust contained is analysed on the amount of inspirable dust, respirable dust and the amount of free CS. The Exposure Standard-Time Weighted Average (ES-TWA) for these substances is depicted in Table 1.

Table 1: Exposure Standards (Hermann, 2007)		
Respirable Dust Total	5	mg/m^3 ES-TWA
Respirable Free Silica	0.2*	mg/m^3 ES-TWA
Inspirable Dust Total	10	mg/m^3 ES-TWA

*In a report from 2004 the new standard of 0.1 is mentioned, but is not yet adjusted in the Sampling Results sheet from 2007

From 1991 to 2004, an ES-TWA of more than 0.1 was measured four times. In all cases the employee involved was wearing a respirator.

In one of these cases in 2001, a CS ES-TWA of 0.22 was measured. According to the occupational hygiene professional this was due to a measurement failure and needed to be retested. The second time this was tested, the result was below the ES-TWA.

According to the analysed test results, there is evidence that at BCSC the ES/TWA for CS is sometimes over 0.1 mg/m³. This has though only occurred three times in the last 16 years and at all times a respirator was worn by the employees involved.

Health surveillance

Health surveillance at BCSC consists of an occupational and medical history of the employee and collecting of demographic data at the moment of employment. Next to that every five years employees have to complete a standardized respiratory questionnaire, have standardized respiratory function tests such as FEVI, FVC and FEVI/FVC and have a chest X-ray (full size PA view). This is health surveillance as it is prescribed by the NOHSC (NOHSC 1005, 1994).

Risk assessment

Risk assessment is an overarching requirement which enables decision making regarding the requirements mentioned above. This research is a form of risk assessment, as it contains all the steps of a risk assessment. First, a hazardous substance, namely CS, was identified. Second, information regarding this hazardous substance was evaluated in a literature review and third, the risk related to the hazard of CS was identified. A more detailed description of the third step, risk identification will be given in paragraph 5.2.

Record keeping and reporting

At BCSC the records of risk assessments, health surveillances and monitoring are kept for at least 30 years, which means that BCSC complies too the WorkCover claim of 30 years.

5.2 Risk management process model

To describe the risk management process, the model described in paragraph 3.2 will be used. The five phases of this model are:

1. Risk identification
2. Risk assessment
3. Risk control
4. Implementation
5. Monitoring risk

5.2.1 Risk identification

For this research the hazard of CS had already been identified by the BCSC management. It was then determined that CS was indeed on the list of hazardous substances from the NSW government and there are publications that show a relationship between CS and silicosis and other health problems. For this research we therefore only took two of the possible risk identification steps suggested by Sadgrove (1996), namely:

- Check a government list of hazardous substances

- Read publications related to health and safety subjects in the same line of work.

When a hazard or risk has been identified, the gravity of the risk should be evaluated by doing a risk assessment. This is done in the next paragraph.

5.2.2 Risk assessment

Risk assessment is an overarching requirement which enables decision making regarding the control measures mentioned above. Risk assessment is the second step in the risk management process depicted in Figure 4. The WorkCover Code of Practice describes three steps in risks assessment, the third being risk identification.

When we identify the risk related to free CS, we will describe the magnitude of the risk by using the two variables probability and consequences. Donoghue defines in his article the place the 'hazard – disease combinations' for CS takes in the qualitative hazard risk assessment matrix for underground metalliferous mining. As for this research employees are not working underground, we have adjusted the probability by one point; to make them fit the circumstances at the BCSC plant.

Table 2 : Risk assessment CS disease

Disease	Probability	Consequences	RAC	Acceptability
Silicosis	Occasional	Marginal (permanent minor disability)	11	Acceptable (with documented acceptance of residual risk)
Lung cancer	Remote	Catastrophic (death)	8	Undesirable (all practicable controls must be used – with documented acceptance of residual risk)

From Table 2 it becomes clear that all practical controls must be used to reduce the risk of lung cancer. Although for the risk of silicosis this is not the case, it was said that lung cancer is related to silicosis. Therefore to reduce the risk of lung cancer, also the risk of silicosis must be reduced. These arguments underline the need for control measures at BCSC regarding CS safety.

5.2.3 Control risk

Risk control is also an important subject in the WorkCover code of Practice; the necessary comments on this subject have already been given in paragraph 5.1.

5.2.4 Implement control measures and monitor risks

As the model described in paragraph 3.2 already mentioned, risk management is a continuous process. CS risk management does not finish after this research. BCSC will still need to keep monitoring the CS safety as the hazard is still present at the BCSC plant and forms a potential health risk for employees.

5.3 Risk management for the community

In the previous chapter the stakeholder government was analysed. In this chapter the stakeholders 'community liaison committee' and its dependant stakeholder, the community, will be analysed.

5.3.1 Crystalline Silica in the media

Desk research was performed to find information regarding the health risk of CS for the community. It became evident that risk management in OH&S has been described frequently, but little has been written about risk management in the community. Although there is research available that indicates an increased public concern with respect to the CS hazard (Nicholson, 1999), this concern is usually disregarded by arguing that there is not enough scientific evidence to proof that this kind of low exposure to CS is indeed a health risk (Hardy & Weill, 1994; American Thoracic Society, 1997).

As described in paragraph 3.2, the problem with community concern is that it could lead to inappropriate reactions, which can mean that the community's concern exceeds the concern that experts feel to be appropriate. So the statement that there is not enough evidence to proof that a low exposure to CS is indeed a health risk, is not enough for BCSC to ensure the absence of concern in the community.

An example can be given from a newspaper article, titled '*Cancer scare: how sand on a beach came to be defined as a human carcinogen*' (Stipp, 1993). In this article the decision of the American Government to add CS to the 'Known to be a Human Carcinogen' list and therefore a warning on bags of sand is discussed. This article shows an inappropriate reaction of the stakeholders involved, because these stakeholders do not fully understand the implications of this decision by the government. The complete article can be read in appendix 3. These kinds of articles could raise concerns within the community regarding their health and safety.

5.3.2 Communicating risks

It is important for BCSC to reduce any inappropriate concerns within the community. It is for this purpose that BCSC has the Community Liaisons Committee, with whom it can discuss these concerns. But this committee is only one of the forms in which BCSC provides its community with adequate information. The other ways in which BCSC is providing the community with information are:

- The community news

- The environmental news
- The community bulletin
- Notes on the Community Liaison Meetings
- The brochure: the Berrima Works environment

This information is available online, although there is a threshold for retrieving this information. Before this information can be downloaded, the website asks for personal information. It suffices to only fill out state and zipcode, but as this is not immediately clear, this could form a threshold for people searching for information.

Little information on dust issues and no information on the risks of CS for people living in close environment of the plant have been found in this online source. Also no information has been found to reassure the community that they are not at risk for CS respiration. There was though very extensive information on noise and dioxin issues, these issues were discussed almost every Community Liaison Meeting.

5.4 Conclusion Risk Management at BCSC

5.4.1 Conclusion government

No gaps between the NSW guidelines and the policies and procedures at BCSC were found, which means that BCSC complies with the current national guidelines. Therefore no action will be taken in this phase of the model.

A risk management model for BCSC was described with which BCSC can implement based on the existing CS management methods already present. In chapter 6 a tool will be provided that will help BCSC manage the risks involved with the CS hazard.

5.4.2 Conclusion community

Regarding the stakeholder Community Liaison Committee no scientific evidence was found that would reinforce that the community is at risk for the CS hazard. There has though been found evidence that CS ended up in the media where it raised concern. This evidence reinforces the assumption made in paragraph 4.2.3 that the Community Liaison Committee and the community could obtain the attribute urgency somewhere in the future and a policy for community risk communication could therefore be valuable.

6 Improvement options for BCSC

In the previous chapter the current RMS for BCSC and its community was described. In this chapter some improvement option for BCSC will be described. First improvement options based on the two best practices discussed in chapter 3 are discussed; finally improvement actions based on the suggested risk management model are discussed.

6.1 Cement Sustainability Initiative

As to this moment, BCSC is not a member of the CSI. The Australian Cement Federation is a project partner, but is not involved in data gathering (About CSI, n.d.).

It becomes evident the CSI initiative is still in its first phase and that there is as for this moment no focus on CS risk management. The issues that are discussed could in a later stage become of influence on the management of CS and should therefore be monitored by BCSC. In 2007 a full progress report should have been issued, but up to this moment (February, 2008) this full progress report has not been made available. BSCS should take notice of this full progress report when it is issued and see whether or not there is already information available in this report that is important for the management of the CS risk.

BSCS could also ask the Cement Industry Federation in Australia to make the CS management a separate issue for the CSI. As all cement manufacturing companies are involved in CS management, BCSC could take a leading role in gathering more specific information among the CSI members on how they manage the CS OH&S risk. Becoming a member might be a requirement to do this, but no information on how to become a member was found on the CSI website.

6.2 European Network for Silica

Although NESPI is a European organisation and BCSC therefore does not have to comply with the Agreement, issues they address are also of importance for BCSC. Especially the “Good Practice Guide on Workers Health Protection through the Good Handling and Use of Crystalline Silica and Products containing it” (NEPSI (2), n.d.) might give BCSC some handles to improve their own CS RMS. In Appendix 4 a list of all Good Practice Guides that are of influence on cement manufacturing companies can be found. Some practical suggestion will be given to improve the RMS at BCSC.

Cleaning

In paragraph 5.1 the control measures for CS are described. BCSC indicates that they have protocols to keep dust out of the buildings. The Good Practice Sheet of NEPSI on Cleaning indicates that this building cleaning should not be done with a brush or compressed air, but that vacuum or wet cleaning methods should be used to clear the building of dust.

Dust Monitoring

The Good Practice Sheet on dust monitoring prescribes a full documentation on the dust monitoring campaigns. At BCSC these documents were not always easy to find and not filled in the same way, which makes at hard to retrieve exact data from these documents. Record information that should be included according to the Good Practice Sheet on dust monitoring is: data, job function, workers name, shift length, sample flow rate and duration, work activities and working practices, weather conditions, PPE worn, comments on dust control measures, production process, tonnage rate, etc. In the analysed monitoring sheet of BCSC the job function, shift length and weather conditions were not included in the data.

Training

The Task Guidance Sheet on Training from NEPSI describes a number of issues that should be included in the training of employees working with free CS. These issues are:

- Give your workers information on employer's and employee's duties under Health and Safety law.
- Give your workers information on the health effects associated with respirable crystalline silica dust.
- Provide them with training on factors affecting dust exposure and on dust exposure prevention.
- Provide them with training on good practices to use in the workplace and on safe working procedures.
- Provide them with training on protective measures and how to check that those controls are working.
- Provide them with training on when and how to use any respiratory protective equipment (RPE) or other PPE provided.
- Provide them with training on how to maintain RPE/PPE, where to store it when not in use, how to obtain replacements and how to report defects.
- Provide them with training on what to do if something goes wrong.
- Give your workers information on dust monitoring programmes and the importance of their co-operation.
- Employees should also be informed of the conclusions of any personal exposure monitoring campaign.
- In the event that an employee's measured personal exposure to respirable crystalline silica exceeds the relevant occupational exposure limit value, that employee must be provided with details of his own personal exposure monitoring result.
- Employees should be informed about health surveillance procedures

According to BCSC all of these issues are incorporated into the training of BCSC employees.

Supervision

NESPI has also developed a Good Practice sheet on supervision. This sheet indicates that an OH&S manager or supervisor should have the following skills:

- Knowledge of the health hazard of CS dust
- Understanding of processes likely to cause problems
- Understanding of control measures and their applications
- Knowledge and understanding of the Good Practice guides and their application on relevant tasks

In the case of BCSC the first three skills are indeed present at the OH&S adviser. The last skill is not, as these Good Practices Guides are not obligatory in Australia. It could though improve the understanding of the CS hazard and ways in which this hazard could be managed better.

6.3 Risk management tool for BCSC

The risk management model in Figure 12 has been described in chapter 3 and was used to discuss the RMS at BCSC. As this risk management model includes the most important requirements of the NSW government regarding OH&S management of hazardous substances (WorkCover, 2006).

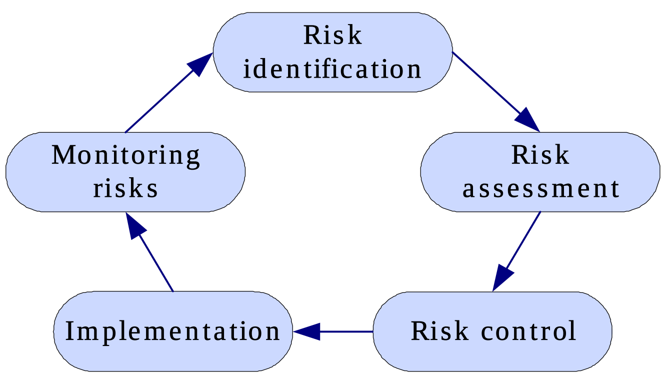

Figure 12: Risk management model for BCSC

In the *risk identification* phase the requirements *consultation* and *provision of information* are important, as these requirements involve the employees of BCSC in the identification of hazards and the risks involved with these hazards.

In the *risk assessment* phase the requirement risk assessment are important. The provided risk hazard assessment matrix provides an extra tool for BCSC to assess the risks associated with CS dust.

In the *risk control* phase the requirement control measures is important. The Hierarchy of Control is the most important tool in this phase. BCSC can use this Hierarchy of Control to establish a more precise description of all measures taken to reduce the CS risk.

In the *implementation* phase the requirement induction and training is important as all new CS risk management measures would need employees to learn how to take these measures and what precautions they should take. This would probably mean that they need additional training.

In the *monitoring risks* phase the requirements monitoring, health surveillance, and record keeping and reporting are important as these monitor the actual risk of CS at the plant (monitoring), the effects this risk has on the employees (health surveillance) and it gives a handle for long term monitoring (record keeping) which is important given the long term effect CS can have on humans.

6.4 Conclusion improvement options

The CSI is at this moment not a source for improvement options. When the full progress report is published, some improvement actions might come to light. The NEPSI does provide some improvement actions in their Good Practices Guide. Improvements are suggested in cleaning, dust monitoring and supervision. Finally a risk management model for BCSC is suggested to improve the structure of the OH&S management at BCSC.

7 Conclusions, recommendations and discussion

Based on the research questions and the analysis in the previous chapters conclusions will be drawn and recommendations will be made. The sub questions will be repeated and an answer will be given based on the findings described in this report.

7.1 Conclusions

What are the stakeholders for the potential problems of inhaling CS?

For this research the framework from Mitchell et al. (1995) was used to identify the stakeholders that matter most. For each potential stakeholder their stakeholder attributes were determined. Application of this framework identified two central stakeholders, the NSW government and the Community Liaison Committee.

What is a RMS and what are the national guidelines for CS?

Risk was defined as probability x consequences. A general RMS was introduced based on the following phases: risk identification, risk assessment, risk control, implementation and monitoring risk. The NSW legislation requirements for the management of hazardous substances were described based on the WorkCover Code of Practice. These requirements include consultation; provision of information; induction and training; control measures; monitoring; risk assessment; health surveillance; and record keeping and reporting. Finally some comments were made on health risk communication.

What is CS and what are the risks associated with the use of CS?

As Crystalline Silica is the second most common mineral in the earth's crust, people are exposed to it almost every day. This is why it is important to notice that only respirable CS, with a diameter of <10 µm, forms a health risk. CS with a respirable size is almost only found in occupational settings. The main disease caused by the respiration of CS is silicosis. A progressive disease for which there is no cure. Lung cancer is related to silicosis, but there is not enough scientific evidence to say that CS directly causes lung cancer. For other diseases there is no indisputable evidence that there is a relationship with respiring CS, but circumstantial evidence has been found.

What are the current international best practices for managing CS safety?

Two international initiatives on the managing of CS are evaluated. The Cement Sustainability Initiative is a collaboration between different cement manufacturers that focus on sustainability. At this moment their Agenda for Action does not include CS management tools, but this initiative has just started and their first results are yet to be presented.

NEPSI is a European Association between fourteen industry sectors working with CS. They publicized a Good Practice Guide on the Handling of CS. This Practice

Guide contains Task Guidance Sheets on different tasks executed by cement manufacturers. These Guidance Sheets contain information on how to address these tasks that could be of interest for BCSC.

What is the current RMS for CS at BCSC?

There was no RMS model that was used by BCSC other than the NSW regulations in the WorkCover Code of practice. Therefore these requirements were used to determine whether or not the policies and procedures at BCSC comply with the legal requirements.

No scientific evidence was found that would reinforce that the community is at risk for the CS hazard. There was evidence found that the Community Liaison Committee and the community are at risk for concern raising information regarding free CS. As they are not aware of the processes involved with cement making and the CS hazard, it is important to keep an eye on the community.

What is the gap between the current national guidelines on CS and the current policy and procedures at BCSC?

No gap was found between the NSW legislation and the RMS at BCSC. For the community there was no RMS, so no gap could be determined.

What are the changes required to improve the RMS system at BCSC?

From the Good Practice guide of the NEPSI some improvement actions were determined. These improvement actions suggest that for cleaning no dust brush or compressed air should be used, that the monitoring sheets should include job function, shift length and weather conditions and that for good supervision more information can be found in the different Good Practice Sheets.

Also a risk management model for BCSC is suggested to improve the structure of the OH&S management at BCSC. This is a continuous process model and it can also be used for other health management issues that CS management.

7.2 Recommendations

In chapter 6 some improvement suggestions for BCSC have already been described. These improvement suggestions will not be repeated in this paragraph. This paragraph will address the involvement of the Community Liaison Committee and will give some recommendations for further research.

7.2.1 Involvement of the community

As discussed in chapter 5, the Community Liaison Committee is at this moment not aware of the CS hazard at BCSC. But when we look back to the statement of Sadgrove (1996) that the public nowadays expects a higher standard of corporate behaviour, especially on the subjects of pollution, disturbance and bad ethical behaviour, it could be an opportunity to engage in an active relationship with the community and make information regarding the CS hazard available to them. It is then important to remember that risk communication can always lead to inappropriate reactions by the stakeholders involved and therefore information should be presented in such a way that it is understood and usable for the stakeholders, and that the audience is informed in such a way that they are able to make their own judgements on risks. When BCSC decides to inform the Community Liaison Committee on the CS hazard at the plant, it is best that this is done by occupational heath personnel or health professionals.

7.2.2 Recommendations for further research

The RMS model described is a continuous process. After the 'monitoring risks' phase the 'risk identification' phase is re-entered. This should also be the case for the risk of respirable CS.

This risk management cycle can also be used for other OH&S issues at BCSC, such as fire hazards for the employees and the dioxin and noise levels for the community. It is important that the management of BCSC reviews these risks on a regular basis.

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Appendices

APPENDIX 1: Example Material Safety Data Sheet

APPENDIX 2: Wall Street Journal: Cancer Scare

APPENDIX 3: CSI Agenda for action

CSI Agenda for action *(CSI, 2002)*		
	Joint projects	*Individual partners*
Employee health and safety	The Health and Safety Task Force will develop an information exchange including information on the rates, origins and types of accidents and incidents that occur; share company experience and develop recommendations for prevention	Each company will respond to the recommendations of the Health and Safety Task Force by: • Improving existing systems, procedures and training for tracking, following up and preventing accidents and incidents. • Measuring and reporting publicly on performance in a common format.
Emission monitoring and reduction	The CSI will develop an industry protocol for measurement, monitoring and reporting of emissions such as: • NOx • SOx • Dust /particulates They will also find solutions to better assess emissions of other substances such as dioxins and VOCs and consult with external stakeholders on both projects, and subject the protocol to external validation.	Each company will apply the industry protocol for measurement, monitoring and reporting of emissions once it has been developed and validated. Each company will make emissions data publicly available and accessible to stakeholders. By 2006 each company will set emissions targets on relevant materials and report publicly on progress relative to those targets.
Local impacts on land and community	The SCI will work with interested stakeholders to develop guidelines on an Environmental and Social Impact Assessment (ESIA) process which can be used at all cement plant sites and associated quarries, and for all new projects, site acquisition and development, and closures. The guidelines will be subject to external validation.	Each company will apply the ESIA guidelines once they are developed and validated, and will develop tools to integrate them into their decision making processes for site development and management. By 2006, each company will have rehabilitation plans for its existing operating quarries. Where operating quarries are newly acquired, plans will be developed within 3 years of acquisition. The plans will be communicated to local stakeholders, and will be regularly reviewed and updated. Each company will draw up rehabilitation plans for specific cement plant sites once closure timing is known. These will be communicated to local stakeholders.

APPENDIX 4: Task Guidance Sheets for Cement

Table 2: Task Guidance Sheets for	
2.1.1.	Cleaning
2.1.2	Design of buildings
2.1.3	Design of control rooms
2.1.4	Design of ducting
2.1.5	Design of dust extraction units
2.1.6	Dust monitoring
2.1.7	General indoor storage
2.1.8	General outdoor storage
2.1.9	General ventilation
2.1.10	Good hygiene
2.1.11	Handling and transport systems
2.1.12	Laboratory work
2.1.13	Local exhaust ventilation
2.1.14	Maintenance, service & repair
2.1.15	Personal protective equipment
2.1.16	Removing dust or sludge from an
2.1.17	Supervision
2.1.18	Systems of packaging
2.1.19	Training
2.1.20	Working with contractors
2.2.1a	Bag emptying – small bags
2.2.1b	Bag emptying – bulk bags
2.2.3b	Bulk loading
2.2.4b	Bulk unloading
2.2.6	Crushing of minerals
2.2.8	Drying minerals
2.2.16Grin	Grinding of minerals
2.2.19	Grinding of minerals
2.2.22	Mixing of materials
2.2.28	Quarry mobile plant – excavation
2.2.29	Screening
2.2.31b	Small bag filling - flours
2.2.35	Use of a drilling rig
2.2.36	Water assisted dust suppression

APPENDIX 5: List of Interviews

For the data collection of this research, four interviews were conducted of which two were done by telephone and a final presentation was given, during which some information was gathered.

May 7, 2007: Introduction Blue Circle Southern Cement

During this first visit of the plant, a tour of the plant was organised by John Presbury. During this tour the making of cement was explained. During the meeting with John Presbury and Bob Strode (HRM manager), the problem of BCSC was discussed and a planning was made.

May 24, 2007: Interview John Presbury

During this interview the eight measures described in the WorkCover Code of Practice were discussed and John Presbury explained how BCSC complies with these measures. Also the reports of Dieter Herman, the occupational hygienist, were discussed.

June 5, 2007: Interview John Presbury by telephone

A first draft of the analysis part of the report was discussed with John Presbury and some changes were made in this chapter. Also the planning for the remaining time in Australia was discussed and a date was planned for the final presentation.

June 18, 2007: Interview Grant Williams by telephone

Grant Williams is the environmental manager of BCSC. With Grant Williams the different forms of communication with the community were discussed.

July 10, 2007: Presentation

At this final presentation the following people were present:

- Ian Unsworth: General Manager BCSC
- Bob Strode: HRM Manager BCSC
- John Presbury: Health and Safety adviser BCSC
- Grant Williams: Environmental Manager BCSC
- Dieter Herman: Occupation Hygienist
- Anneke Fitzgerald: Supervisor UWS
- Terry Sloan: Professor at UWS
- Ross Chapman: Professor at UWS
- Dorothea Zakrzewski: PhD student UWS
- Kathy Eljiz: PhD student UWS

During the final presentation the findings were presented to these persons and there was a discussion about the community involvement. Main topic of this discussion was whether or not BCSC should inform the community on the CS issues. No straightforward answer came out of this discussion.

APPENDIX 6: Self assessment Relinde

During this study some validity problems arose. In this appendix these problems will be named and a possible solution will be given. These solutions cannot be incorporated in this research anymore, but can help both BCSC as researchers with future research projects. Also some personal reflection on this project and learning goals will be discussed.

Location of the researcher

For this project I was located at the University of Western Sydney (UWS) and not at the cement manufacturing plant of BCSC in Berrima for two reasons:

1. It was determined that an outside researcher present at the plant could raise concerns with the employees regarding their health and safety. It was therefore decided that the research should be as invisible as possible during the course of the research and was therefore not located at the BCSC plant but at the University of Western Sydney.
2. Because this is the norm in Australia for research students.

The consequence of this distance from the company was that there was no time for me to build a trust relationship with the company. For me this resulted in a hesitation to ask them anything I wanted to know, also because I was aware of the great pressure of ethical considerations for students to talk to other stakeholders than the actual supervisor.

For example: I have spoken to a student who was already three months busy to get approval for the interviewing of employees at a hospital in Sydney.

I think this problem could have been solved in two ways:

1. Rent a room in the Berrima Inn and stay there for the first two weeks to get to know the company and the supervisor somewhat better and then I could have been somewhat bolder and just ask my supervisor at BCSC I would want to talk to some stakeholders; with the chance I would get a negative answer.
2. Build my research in such a way that it was a pure literature based research with no empirical data. This would though not have fit very well with the goals of my study.

When I could start the project over, I would choose the first option, because I think that this approach might have given me more insight in the companies' culture and it would therefore have been easier to estimate what I could and could not ask regarding the subject.

Concerns with the stakeholders

A second consideration was the somewhat sensitive subject which CS management is. As I have explained in the report it does not take much to raise concerns with the stakeholders of this research, but it is not up to me to decide whether or not BCSC should inform the community in this matter. The more people know of my research the bigger the chance information might end up where BCSC does not want it (yet). This was also a consideration I have made not to talk to too many stakeholders. Afterwards I think this presumption of my role in this issue was a bit exaggerated.

What I would have done different

Most important I would have prepared the research better at home. I would have already looked up more information regarding CS and RMS and have a global idea of what I was going to do. I would also have contacted a second supervisor before I left and discussed with him also what his expectations of such a project are.

Second I would have paid less attention to the methodology theory. This was very important for my supervisor in Australia, but it was much less important for my supervisors in The Netherlands. This could have saved me a week time in Australia which I could have used for analysing the NESPI Good Practice Guides.

Last but not least I would have been bolder in the data collection. I have been too careful which left me with very little empirical evidence and a problem with the validity of my research.

What I have learned during this project

Being on the other side of the world for three months has been quite an experience. I have learned a lot about myself both professional and private. The second one I will keep out of the scope of this discussion.

First I have learned to be more critical and sometimes bolder. I was too afraid I would do something wrong that would either mess up the relationship of my supervisor in Australia with my supervisor in The Netherlands or the relationship between my two supervisors in Australia. They both would like to be able to send more students over there to do a project. I now think that a little more critical view from my side would not have ruined these relationships.

Second I have learned to structure a report better. If I look at the first version and then at this third version, I think I have come a long way. In my Master thesis I have know all this from the start, which has made it easier for me to develop a good proposal and structure a report.

Finally I have learned that I cannot do two projects at the same time and that the only option then is to stop one and finish the first. Knowing what I know now I would not have started my Master thesis yet, but I would have first finished this.

Conclusion

I have learned that the closer you are to a problem, the better you will be able to solve it. I have learned to be more critical and that this does not immediately ruin relations. I have seen the benefits of a good preparation, know how to structure a large report and that you cannot do everything at the same time.