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Safety Climate
An evaluation of the safety climate at AkzoNobel Site Stenungsund
Master of Science Thesis

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Preface

This master's thesis was carried out from January 2011 to June 2011. The work was performed in collaboration with AkzoNobel Site Stenungsund and the Department of Product and Production Development at Chalmers University of Technology. I would therefore first and foremost like to thank my supervisor at AkzoNobel Site Stenungsund, AnnCharlott Öberg, for her guidance and your great support. I would also like to thank my examiner at Chalmers University of Technology, Mohammad Shahriari, for his positive attitude, inspiring course and support.

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Göteborg, May 2011
Maria Bergh

Summary

Safety culture and safety climate are concepts that today attract much attention across a broad number of industries and sectors. A problem with safety culture and safety climate is though that no universal agreement on the definitions of these concepts exists. The aim of this master's thesis is to **evaluate the safety climate** at both Akzo Nobel Functional Chemicals AB (Akzo Nobel FC) and Akzo Nobel Surface Chemistry AB (Akzo Nobel SC) at AkzoNobel Site Stenungsund. The methods used for the evaluation are a questionnaire, entitled the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50), as well as interviews. The results of the evaluation reveal that the level of safety climate is relatively high at both Akzo Nobel FC and Akzo Nobel SC at AkzoNobel Site Stenungsund. When comparing the level of safety climate between the two companies there is only a significant difference on one of the seven dimensions of safety climate. Two sub-climates within Akzo Nobel FC are revealed, one including the shift workers and another including the daytime workers. Both of the sub-climates have a relatively high level of safety climate, but the level is higher for daytime workers compared to shift worker. No sub-climates between daytime worker and shift workers at Akzo Nobel SC are found. The level of safety climate is perceived higher among those who had not had any previous workplaces outside of AkzoNobel Site Stenungsund. The level of safety climate is also perceived higher among those who have heard the term safety culture before and among those who have an understanding of the term safety culture. There is, however, a lack of a shared, coherent understanding of the term safety culture among both workers and managers/supervisors at AkzoNobel Site Stenungsund. A recommendation to AkzoNobel is therefore to implement a shared and coherent understanding of what safety culture is in order to improve their safety climate.

It should be noticed that this is the non-confidential version of this master's thesis and therefore some data have been removed.

Keywords: safety culture, questionnaire, NOSACQ-50, interview.

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1. Introduction

Safety culture and safety climate are concepts that today attracts much attention across a broad number of industries and sectors. (Clarke, 2000) One of the reasons to this is that a good safety culture and a good safety climate are some of the most important factors in achieving safe workplaces. In an organization with a good safety culture and a good safety climate is safety everyone's primary goal. It is also understood that it is not enough to set up safety procedures. Everyone must understand why the procedures are necessary and everyone must use the procedures. It should also be understood that a good safety culture and safety climate will not only improve safety but also contribute to meeting business goals. (Engineering Safety Management Guidence, 2000) It should be noticed that every organization has a safety culture and safety climate, at some level. In order to improve the level of safety culture and safety climate it is important to: (AIChE)

1. determine the current level of safety culture and safety climate.
2. decide what level of safety culture and safety climate that is wanted.
3. create a plan to achieve the safety culture and safety climate that is wanted.

A problem with safety culture and safety climate is though that no universal agreement on the definitions of these concepts exists. The concept of safety culture was first truly introduced and defined after the Chernobyl accident. The lack of theoretical background to this definition resulted in a development of numerous definitions. (Cooper, 2000) There is also an ongoing academic debate about the differences and similarities between these two concepts. (Clarke, 2000) Attempts have though been made to find commonalities in the definitions of both safety culture and safety climate in order to find consensus regarding the concepts.

This master's thesis included a safety climate survey at AkzoNobel Site Stenungsund. AkzoNobel is a major producer of specialty chemicals and the largest global paint and coating company. As a part of AkzoNobel's continuous safety work is there a strong focus on improving and strengthening the safety culture at all business units and sub-business units in order to reduce accidents. To improve a safety culture it is important to clarify two things. Firstly, the concept of safety culture must be clarified and defined so that everyone understands what the company wants to improve. Secondly, the existing level of the safety culture and its "problem areas" also has to be identified in order to define the starting point for the improvement work. Identifying the level of a safety culture is difficult and takes a long time. It is therefore more common to evaluate safety climate which gives a "snap-shot" and an indication of the safety culture. (Canso, 2008) The focus of this master's thesis therefore mainly concerns the evaluation of the safety climate at AkzoNobel Site Stenungsund. Because of the variety of content in today's safety culture and safety climate definitions, there is a need for common definitions of the concepts that everyone at AkzoNobel Site Stenungsund is familiar with and can refer to.

In 2008, an external team performed a safety revision at AkzoNobel Site Stenungsund. The safety revision report concluded, among other things, that: (Jacobsson & Akselsson, 2008)

- safety is at focus at AkzoNobel Site Stenungsund.
- there is a high awareness among the employees.
- great resources are put aside for safety work.
- the management both in Stenungsund and further up in the organization has a strong focus on safety.
- sub-cultures exists at AkzoNobel Site Stenungsund.
- the cultures at Akzo Nobel Functional Chemicals AB and Akzo Nobel Surface Chemistry AB are different.
- sub-cultures within Akzo Nobel Functional Chemicals AB exists.
- sub-cultures between different shift teams at Akzo Nobel Functional Chemicals AB exist.

The safety revision did only conclude that sub-cultures exist but not the level of these. It is important to evaluate the level of the overall safety culture and the sub-cultures at AkzoNobel Site Stenungsund in order to improve them.

The problems that this master's thesis will focus on can be summarized into three parts as presented below:

1. There is a need for a safety culture and a safety climate definition that everyone at AkzoNobel is familiar with and can refer to.
2. There is a need for an evaluation of the level of safety culture at AkzoNobel.
3. There is a need of specific recommendation on what to do in order to improve the safety culture and the safety climate.

As mentioned before, this master's thesis will mainly focus on the evaluation of the safety climate and not directly evaluate the safety culture. The level of a safety climate will though give an indication and an indirect evaluation of the level of safety culture. (Canso, 2008)

1.1. Aim of this master's thesis

The aim of this master's thesis is to **evaluate the safety climate** at both Akzo Nobel Functional Chemicals AB and Akzo Nobel Surface Chemistry AB at AkzoNobel Site Stenungsund. After the evaluation, a comparison between the two companies will be made. Suggestions for improvement of the existing safety climate will be developed for both companies. The goal with this master's thesis is that its result will contribute to an improvement of the existing safety climate and an improved awareness around safety at both companies.

In order to fulfil the aim a set of research questions has been specified. The questions are:

- What level of safety climate do Akzo Nobel Functional Chemicals AB and Akzo Nobel Surface Chemistry AB at AkzoNobel Site Stenungsund have and are there any differences in the level of safety climate between the two companies?
- Do any sub-climates exist within the two companies and what level do they have?
- Does the level of safety climate vary with any factors that can be found in the background questions in the questionnaire used for the evaluation?
- What needs to be improved in ordered to increase the level of safety climate?

A definition of safety culture and safety climate will also be developed in order to clarify the concepts for the employees of AkzoNobel Site Stenungsund. The proposed definitions will be based on previous research and partly on the results from the evaluation. The definition will also be applicable for all of AkzoNobel's companies.

1.2. Delimitations

The scientific focus of this thesis will mainly concern safety climate. The study will be limited to only include employees of AkzoNobel that are working at AkzoNobel Site Stenungsund, all together including approximately 300 persons (the exact number is not presented due to confidentiality reasons). The evaluation of the safety climate will be made by using a questionnaire and interviews. The questionnaire will not be developed as a part of the work but will be chosen after a literature review. The software used to generate the results will not be developed as part of the work. Implementation of the recommended improvements will also not be included in the work.

1.3. Outline of the report

Introduction

This chapter presents background information about safety culture, safety climate and AkzoNobel. The problems that this master's thesis focuses on as well as the aim and the research questions of the thesis are also specified in this chapter. The delimitations and the outline of the report are also described.

Company descriptions

A brief description of AkzoNobel is presented in this chapter. The two companies which have been a part of this study, Akzo Nobel Functional Chemicals AB and Akzo Nobel Surface Chemistry AB, are also presented. Ethylene Amines, which is the sub-unit of Akzo Nobel Functional Chemicals AB operating at AkzoNobel Site Stenungsund, is also described.

Theory
This chapter describes and defines the concepts of organizational culture, safety culture and safety climate. The relationship between organizational culture and safety culture as well as between safety culture and safety climate are assessed. Methods for evaluating safety culture and safety climate and the benefits of a good safety culture and safety climate are also presented.

Methodology
The methodologies used for evaluating the safety climate at AkzoNobel Site Stenungsund are described in this chapter. The methodologies concern the data collection through a questionnaire (NOSACQ-50) and interviews but also the data analysis.

Results
The results from the survey and from the interviews are presented in this chapter. The level of safety climate within different groups at AkzoNobel Site Stenungsund, e.g. age, gender and tenure at AkzoNobel Site Stenungsund, are presented. The employees understanding of the term safety culture is also declared.

Discussion
This chapter begins with a discussion concering the methodology used for the evaluation of the safety climate at AkzoNobel Site Stenungsund. The results obtained from the evaluation and how they relate to previous research are also discussed in this chapter.

Conclusions
The conclusions of this master's thesis are presented in this chapter. The conclusions are based on the theory and the results presented in this master's thesis.

Recommendations
Recommendations and suggestions of how the safety culture and safety climate at AkzoNobel Site Stenungsund can be improved are presented in this chapter. Potential research areas are also suggested.

References
The references used in this master's thesis are listed in this chapter.

Appendix
Additional figures, tables and calculation examples are presented in appendix.

2. Company descriptions

AkzoNobel is the largest global paint and coating company and a major producer of specialty chemicals. They have approximately 55 000 employees working in more than 80 countries. About 3 600 of the employees are working in Sweden. AkzoNobel has three business units, Performance Coatings, Specialty Chemicals and Decorative Paintings. (AkzoNobel, 2011; AkzoNobel, 2011d) These business units have in turn sub-business units, see figure 1. The two companies that have been included in this study are Akzo Nobel Surface Chemistry AB and Ethylene Amines (a sub-unit of Akzo Nobel Functional Chemicals AB), both operating at AkzoNobel Site Stenungsund. These two companies have been coloured dark blue in figure 1.
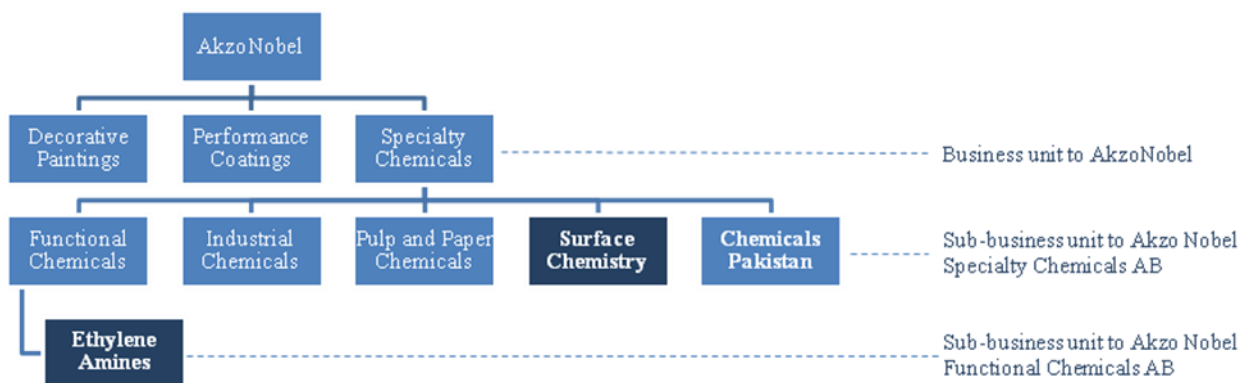

Figure 1. A simplified organizational chart of AkzoNobel.

2.1. Akzo Nobel Functional Chemicals AB

Akzo Nobel Functional Chemicals AB (Akzo Nobel FC) manufactures chemicals, intermediates and high-tech chemicals. Some of the chemicals produced are ethylene amines, chelating agents, cellulose derivates, salt products, sulfur products and polysulfides. The final products are used worldwide in everyday products such as bakery products and cosmetics. Akzo Nobel FC has eight sub-business units: Cellulosic Specialities, Chelates, Cross Linking Peroxides- Thermoset Chemicals & Polymer Additives (XTP), Elotex, Ethylene Amines, High Polymer, Salt Specialties and Sulphur Derivates. (AkzoNobel, 2011c)

2.1.1. Ethylene Amines

The sub-unit Ethylene Amines is a world leader in the production of ethylene amines and ethanolamines and also a producer of glycols. Ethylene amines are extremely reactive molecules. This makes them a versatile tool for building new molecules for a wide range of applications such as paints and asphalt adhesives. Ethanolamines are used extensively in the manufacture of detergents, in gas sweetening, textile additives, lubricants, cutting oil, surface coatings, in polyols for polyurethanes, in cyanide-free electroplating, pharmaceuticals and several other applications. The glycols produced are used in dying aids and explosives among other things. More details concerning some of the main applications for each product produced at Ethylene Amines can be found in appendix 1, figure 22, 23, 24, 25 and 26. (AkzoNobel, 2008a)

Ethylene oxide (EO) is a key raw material in many of the products produced at Ethylene Amines. At AkzoNobel Site Stenungsund, ethylene oxide is produced continuously in the ethylene oxide plant according to de schematic presented in appendix 2, figure 27. Ethylene oxide is then transported to for example the amine plant. The amine plant has mainly two continuous production processes, the ethanolamines process and the ethylene amines process. Ethanol amines are produced when ethylene oxide reacts with ammonia. Ethylene amines are then produced when some of the ethanol amines (mono-ethanol amine) reacts with ammonia. Appendix 2, figure 28, presents a schematic overview of the processes at the amines plant. (AkzoNobel, 2008b)

2.2.   Akzo Nobel Surface Chemistry AB

Akzo Nobel Surface Chemistry AB (Akzo Nobel SC) is one of the world's leading suppliers of specialty surfactants. Their products range from formulations for industrial and household cleaning to pelleting aids for animal feed, systems for road paving, flotation agents for the purification of minerals and personal care. (AkzoNobel, 2011b)

The Surface Chemistry plant at AkzoNobel Site Stenungsund produces surface active agents, surfactants, using two manufacturing and refinement units called EMU and STF. Some 150 different raw materials, largely consisting of renewable vegetable and animal fats and oils, are used to manufacture approximately 300 different end-products. These products are then used as functional ingredients in products ranging from biofules, detergents, asphalt and additives. (AkzoNobel, 2008b)

EMU has a reactor system for alkoxylation in which fatty amides, alcohols, amines and fatty acids react with ethylene oxide or propylene oxide in four parallel reactors. At STF, three separate lines are used in the production, the specialty line, the calcium line and the neutralization line. A large number of reactions are carried out batch-wise and often in several steps according to the schematic in appendix 3, figure 29. (AkzoNobel, 2008b)

3. Theory
This chapter describes and defines the concepts of organizational culture, safety culture and safety climate. The relationship between organizational culture and safety culture as well as between safety culture and safety climate are explained. Methods for evaluating safety culture and safety climate and the benefits of a good safety culture and safety climate are also presented.

3.1. Organizational culture
The concept of safety culture has it origin in the concept of organizational culture. (Nordén-Hägg, 2010) In order to understand what safety culture is it is therefore important to understand the concept of organizational culture. The concept of organizational culture was truly developed during the 1970s even though the ideas already existed. Unfortunately, no standard definition of organizational culture has yet been developed and accepted. In fact, there is a controversy among scientists today whether organizational culture is something an organization "is" or something an organization "has". The former view considers organizational culture as a way of describing the organization. This approach is often preferred by academics and social scientists. The latter view implies that culture is a variable that can be changed. This approached is often favoured by managers and management consultants. (Reason, 1997; Davies, Nutley, & Mannion, 2000; Nordén-Hägg, 2010)

Verbeke, Volgering and Hessels (1998) reviewed 54 definitions of organizational culture in order to compare common terms of the concept. Parts of their results are presented in table 1. As can be seen in table 1, the content of the investigated definitions vary significantly.

Table 1. Category frequencies of 54 organizational culture definitions.(The table is adapted from Verbeke et al., 1998, table 1)

Category	Frequency
Members	40
Shared	40
Values	30
Organization	28
Behaviour	27
Beliefs	23
Patterns	21
Norms	17
Learned	16
Way	15
Meanings	15
System	12
Assumptions	11
Social	1
Set	9
Practices	8
Understandings	7

The definition of safety culture proposed later in this master's thesis is partly based on previous research of Cooper (2000), Schein (2010), Guldenmund (2010) and Reason (1997). Their definitions of organizational culture are therefore presented below in order to give better understanding of their theories. The bold words are words that can be related to Verbeke et al. (1998) findings presented in table 1.

Cooper (2000) defines organizational culture as follows:

*"Organisational culture is a concept often used to describe **shared** corporate **values** that affect and influence **members**' attitudes and **behaviours**"* (p.111)

Guldenmund (2010) presents a framework for safety culture which he has based on Schein's research and therefore also partly on Schein's definition of organizational culture. Schein (2010) defines organizational culture as:

*"...a **pattern** of **shared** basic **assumptions** that the group **learned** as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new **members** as the correct way to perceive, think and feel in relation to those problems"* (p.18)

Reason (1997) defines organizational culture as:

*"**Shared values** (what is important) and **beliefs** (how things work) that interact with an **organization**'s structures and control systems to produce **behavioural norms** (the way we do things around here)"* (p. 192)

3.2.   Safety culture

The term safety culture was introduced by the International Nuclear Safety Group (INSAG) in a report (INSAG-1) concerning the Chernobyl accident, in 1986. The term safety culture was then further expanded in another INSAG report (INSAG-3) in 1988. INSAG-3 refers to safety culture as follows: (INSAG-12, 1999)

"The phrase safety culture refers to a very general matter, the personal dedication and accountability of all individuals engaged in any activity which has a bearing on the safety of nuclear power plants" (p.12)

The presented concept of safety culture was then left open for interpretation without any reference to literature. The lack of theoretical background together with the fact that the concept was not based on organizational culture theory has lead to a development of numerous definitions of safety culture. In fact, both the definition of safety culture and its relationship to organizational culture is something that is not yet agreed on. (Choudhry, Fang, & Mohamed, 2007; Guldenmund, 2010)

In 1991, the concept of safety culture was further developed and described in detail in yet another INSAG report (INSAG-4). Safety culture was then defined as follows: (INSAG-4, 1991)

"Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance" (p.1)

Choudhry et al. (2007) illuminates two conclusions that can be drawn from this definition. The first conclusion is that safety culture refers to both good safety attitudes as well as to a good safety management. The other conclusion is that safety has the highest priority in a good safety culture. (Choudhry et al., 2007) It can also be concluded that the definition only refers to nuclear plant safety issues. Whether this is suitable or not can be argued since there are far more organizations than nuclear plants dealing with safety issues.

As mentioned before, numerous definitions of safety culture exist today. Some of them are presented in table 2 in order to give an understanding of their variety. (Choudhry et al., 2007, table 2) As can be seen in table 2, there is significant variations when comparing these definitions. For instance, some of the definitions focus more on attitudes and behaviours while other refers to beliefs and norms.

Table 2. Examples of safety culture definitions and their original references. (The table is adapted from Choudry et al., 2007, table 2)

Original reference	Definition of safety culture
Hennedy and Kirwan (1998)	*"An abstract concept, which is underpinned by the amalgamation of individual and group perceptions, thought processes, feelings and behaviors, which in turn gives rise to the particular way of doing things in the organization. It is a sub-element of the overall organizational culture"*
Hale (2000)	*"the attitudes, beliefs and perceptions shared by natural groups as defining norms and values, which determine how they act and react in relation to risks and risk control systems"*

Glendon and Stanton (2000)	*"Comprises attitudes, behaviors, norms and values, personal responsibilities as well as human resources features such as training and development"*
Guldenmund (2000)	*"Those aspects of the organizational culture which will impact on attitudes and behavior related to increasing or decreasing risk"*
Cooper (2000)	*"Culture is 'the product of multiple goal-directed interactions between people (psychological), jobs (behavioral) and the organization (situational); while safety culture is 'that observable degree of effort by which all organizational members directs their attention and actions toward improving safety on a daily basis'"*
Mohamed (2003)	*"A sub-facet of organizational culture, which affects workers' attitudes and behavior in relation to an organization's on-going safety performance"*
Richter and Koch (2004)	*"Shared and learned meanings, experiences and interpretations of work and safety - expressed partially symbolically – which guide people's actions towards risk, accidents and prevention"*
Fang et al. (2006)	*"A set of prevailing indicators, beliefs and values that the organization owns in safety"*

Reason (1997) believes that a useful definition of safety culture is the one given by UK's Health and Safety Commission. This definition has also been adopted by the Advisory Committee for Safety in Nuclear Installations. This definition defines safety culture as follows: (Reason, 1997)

"The safety culture of an organization is the product of individual and group values, attitudes, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization's health and safety programmes. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficiency of preventive measure"(p.194)

Guldenmund (2010) redefines safety culture after his review of safety culture literature. He then defines safety culture as:

"...those aspects of the organizational culture which will impact on attitudes and behaviour related to increasing or decreasing risk." (p. 51)

One of the commonly used definitions and perhaps the shortest one is the one presented by the Confederation of British Industry (CBI) which summarizes safety culture as: (HSE, 2005 cited by CBI, 1991)

"the way we do things around here"

As a result of the lack of consistency in the definitions of safety culture has several studies been conducted in order to define and provide a better understanding of the concept. In a number of these studies, several definitions of safety culture were reviewed in the search for commonalities. In a study of this character, Wiegmann, Zhang, von Thaden, Sharma and Mitchell (2002a) found the following commonalities.

- *"Safety culture is a concept defined at the group level or higher, which refers to the shared values among all the group or organization members.*
- *Safety culture is concerned with formal safety issues in an organization, and closely related to, but not restricted to, the management and supervisory systems.*
- *Safety culture emphasizes the contribution from everyone at every level of an organization.*
- *The safety culture of an organization has an impact on its members' behavior at work.*
- *Safety culture is usually reflected in the contingency between reward system and safety performance.*
- *Safety culture is reflected in an organization's willingness to develop and learn from errors, incidents, and accidents.*
- *Safety culture is relatively enduring, stable and resistant to change."* (p. 5)

In the same study, a general definition of safety culture was defined based on the previously mentioned commonalities. This definition defines safety culture as follows: (Wiegmann et al., 2002a)

"Safety culture is the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values." (p. 8)

In a similar study performed by CANSO (the Civil Air Navigation Services Organisation) Safety Culture Workgroup (CSCWG) where a number of safety culture definitions reviewed. They identified the following elements as important for, what they believe is, a good definition of safety culture: (Canso, 2008)

- A safety culture definition should recognize that safety culture reflects <u>individual, group and organizational</u> attitude, norms and behaviours.
- A safety culture definition must recognize that safety culture is reflected in the value of safety, priority of safety and commitment to safety.
- A safety culture definition should also address the fact that a safety culture is demonstrated through attitudes, accepted norms <u>and</u> behaviours.

CSCWG also identified that a definition of safety culture should be related directly to the safe provision of air navigation. It should though be noticed that this is what CSCWG identified as important for a safety culture definition which is going to be used by CANSO. Based on these findings CANSO proposed a new definition as follows: (Canso, 2008)

"Safety culture refers to the enduring value, priority and commitment placed on safety by every individual and every group at every level of the organization. Safety culture reflects the individual, group and organizational attitudes, norms and behaviours related to the safe provision of air navigation services."
(p. 1)

As with the definition of safety culture presented in INSAG-4 (1991), this definition is also limited to one sector and can therefore not be used as a global and/or standard definition.

3.2.1. The components of a safety culture

The components of safety culture is also a topic that scientist has not yet agreed on. This master's thesis is based on the concepts of safety culture described by Cooper (2000), Guldenmund (2010) and Reason (1997). The report has been limited to only describe the models used in this master's thesis even though other models exist.

Cooper (2000) refers to Bandura's (1986)model of reciprocal determinism when he describes safety culture. The model consists of three interrelated aspects of safety culture, the psychological aspects, the behavioural aspects and the situational aspects. The psychological aspects of a safety culture refer to the safety climate or with other words "how people feel" about safety and safety management systems. According to Cooper (2000), this aspect concern individual and group values as well as attitudes and perceptions of safety. Safety climate has though been defined in several ways in literature and not all definitions include values, attitudes and perceptions. Safety climate and the definitions of it are discussed later in this master's thesis. The behavioural aspects of a safety culture are concerned with "what people do". This includes safety-related activities, actions and behaviours but also the managements' commitment to safety. The situational aspects refer to "what the organization has". This includes e.g. policies, procedures, regulations, organizational structures, management systems, control systems and communication systems. An overview of the concept can be found in figure 2. (Cooper, 2000; HSE, 2005; Canso, 2008) According to Cooper (2000) is Bandura's (1986) reciprocal model the perfect model to use when analyzing safety culture.

Safety Culture

Psychological Aspects

"How people feel"

Can be described as the "safety climate". This aspect concern individual and group values as well as attitudes and perceptions of safety.

Behavioural Aspects

"What people do"

This aspect concern safety-related activities, actions and behaviours but also the managements' commitment to safety.

Situational Aspects

"What the organisation has"

This aspect concern e.g. policies, procedures, regulations, organizational structures, management systems, control systems and communication systems.
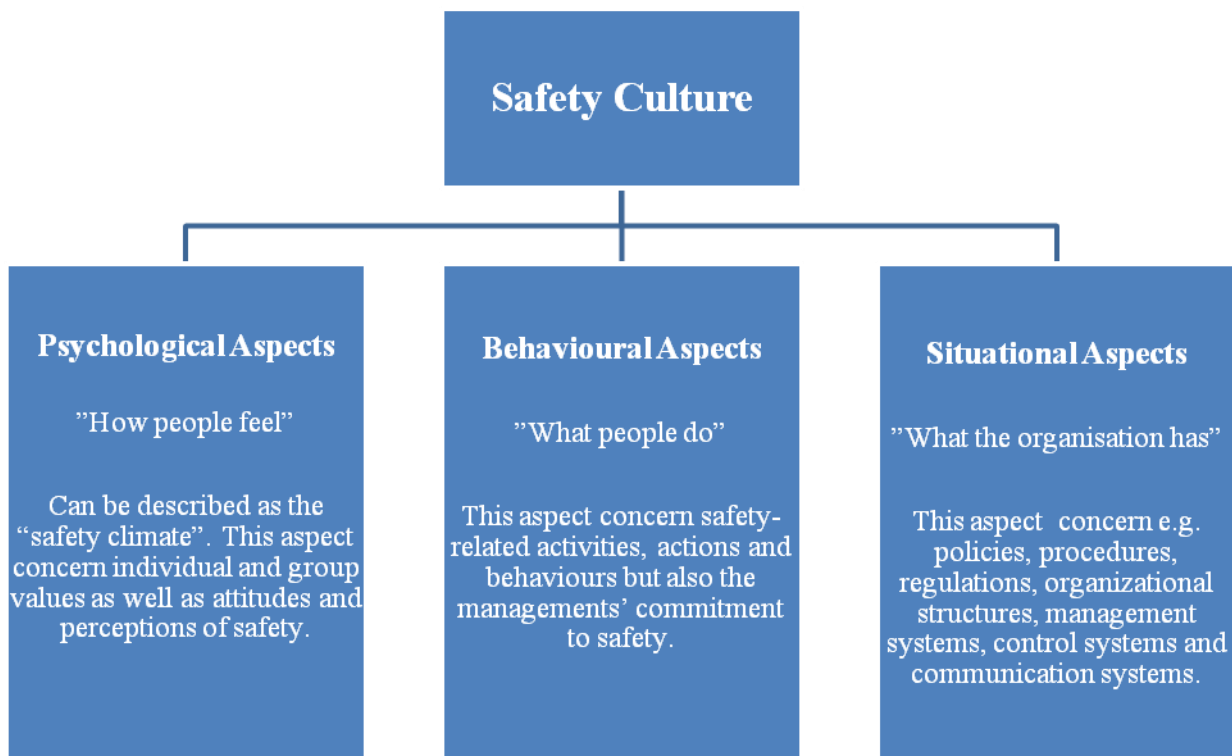
Figure 2. The three aspect of a safety culture presented by Cooper (2000). (The figure is adapted from Canso, 2008, figure 3)

Guldenmund (2010) proposed a framework for safety culture based on Schein's (1992) model of organizational culture. Guldenmund states that safety culture consists of a core of basic assumptions with surrounding layers of espoused values and artefacts. The surrounding layers are specific to safety and equated with the safety climate. Both the espoused values and the artefacts can be evaluated quantitatively and are considered less stable compared to the core of basic assumptions. This framework of safety culture is illustrated in figure 3. (Lardner, 2003; Guldenmund, 2010)
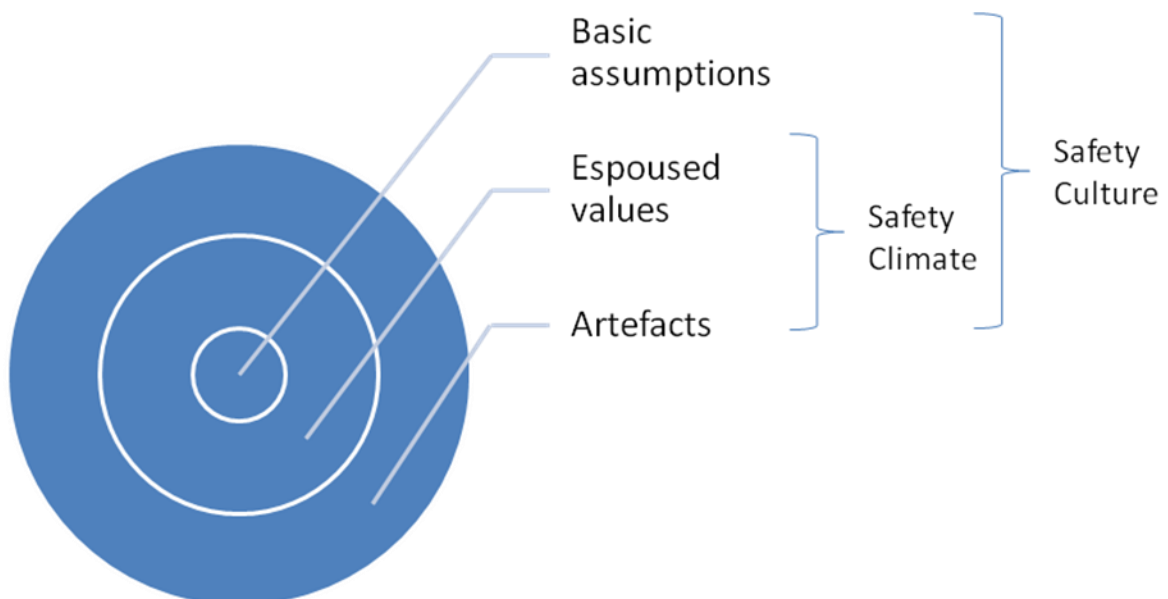

Basic assumptions

Espoused values

Artefacts

Safety Climate

Safety Culture

Figure 3. An illustration of Guldenmund's model of safety culture.

Schein (2010) defines basic assumptions as "the implicit assumptions that actually guide behaviour, that tell group members how to perceive, think about, and feel about things". He also states that such assumptions "have become so taken for granted that one finds little variation within a cultural unit".(Schein, 2010) The basic assumptions can have a more general character and does not have to be specifically related to safety. For example, if an organization's rules are considered futile then will also safety rules will be futile. (Lardner, 2003; Guldenmund, 2010)

In contrast to basic assumptions, espoused values of a safety culture are specifically related to safety. The espoused values refer to all values that are verbally propagated by the organization and in practice to the attitudes of the groups' members. Policies, manuals, formal statements, accident and incident reports as well as job descriptions are all examples of espoused values. (Lardner, 2003; Guldenmund, 2010; Schein, 2010) Artefacts of a safety culture are also specifically related to safety. Schein (2010) states that artefact:

"...includes all the phenomena that you would see, hear and feel when you encounter a new group with an unfamiliar culture. Artifacts include the visible products of the group, such as the architecture of its physical environment; its language; its technology and products; its artistic creations; its style, as embodied in clothing, manners of address, and emotional displays; its myths and stories told about the organization; its published lists of values; and its observable rituals and ceremonies" (p. 23)

Reason (1997) proposed another view of safety culture. He suggests that a safety culture is built up by four sub-cultures, a just culture, a reporting culture, a learning culture and a flexible culture. According to him these four sub-cultures create an informed culture which is equal to a safety culture. This is illustrated in figure 4. It should though be noticed that a safety culture is more than just the sum of its four sub-cultures. (Reason, 1997)

Figure 4. An illustration of the concept of safety culture suggested by Reason (1997).

A just culture is a culture based on trust and justice. The members of a just culture are both encouraged and rewarded for providing safety related information and they trust the organization enough to do so. It is also clearly understood and agreed on what an acceptable and unacceptable behaviour is. (Reason, 1997; Hudson, 1999; Canso, 2008) The organization and its employees all understand that all errors and unsafe acts cannot,

and will not, be punished regardless of their origins and circumstances. The punishment should be justified and based on the intention, action and consequence of the act. It should also be noticed that delayed punishment may give rise to a negative effect on behaviour. Close-in-time rewards are though the most powerful tool in order to change behaviours. (Reason, 1997)

A reporting culture is a culture where the members are willing to report their errors and near-misses. Such a culture is based on a just culture and the fact that the members trust the organization enough to report safety related issues. This trust has to be earned by showing the members that reporting is encouraged and rewarded and that blame and punishment is only used when it is justified. This is a very important issue since the members will not report their errors and near-misses if they know that they will only be blamed and/or punished for them. There are also other obstacles besides lack of trust and justice that might hinder the members from reporting. These include scepticism and extra work. (Reason, 1997). Five factors, influencing on the quality and quantity of the reports, have been pointed out by Reason (1997). The factors are:

- *"Indemnity against disciplinary proceedings – as far as it is practicable.*
- *Confidentially or de-identification.*
- *The separation of the agency or department collecting and analyzing the reports from those bodies with the authority to institute disciplinary proceedings and impose sanctions.*
- *Rapid, useful, accessible and intelligible feedback to the reporting community.*
- *Ease of making the report."* (p. 197)

The characteristics of a learning culture are that it has the willingness and competences to draw the right conclusions and to learn from the information concerning safety in the organization, e.g. reports of errors and near-misses. It has also the will to implement major reforms when they are needed. A learning culture and a reporting culture are strongly dependent of one another. A learning culture is dependent on a reporting culture in that sense that it is the reports that the organization should learn from. The reporting culture is also dependent on the learning culture because if the organization and the employees do not learn from the errors and near-misses that has been reported then will the reporting culture become very inefficient. (Reason, 1997; Hudson, 1999; Canso, 2008)

A flexible culture is a culture that can adapt effectively to different situations. Such adaptability is essential in order to be prepared in crises. (Reason, 1997) Organizational flexibility is also characterized by the possibility of changes in the decision-making processes depending on the urgency of the decision and the expertise that is needed. (Hudson, 1999; Canso, 2008)

An informed culture is based on a just culture, a reporting culture, a learning culture and a flexible culture. It is a culture in which there is enough knowledge about the factors influencing on the safety of the system, such as human, organizational, technical and environmental factors. (Reason, 1997; Hudson, 1999; Canso, 2008) According to Reason (1997), an informed culture is equal to a safety culture. The management of an organization with an informed culture promotes a culture where the employees understand the risks and hazards of their work. They also provide the proper knowledge, skills and job experience in order for their employees to perform their work safely. (Canso, 2008) According to Cooper (2000), can both Reason's (1997) model as well as Guldenmund's (2010) model be encapsulated by Bandura's (1986) reciprocal model. This is illustrated in figure 5.
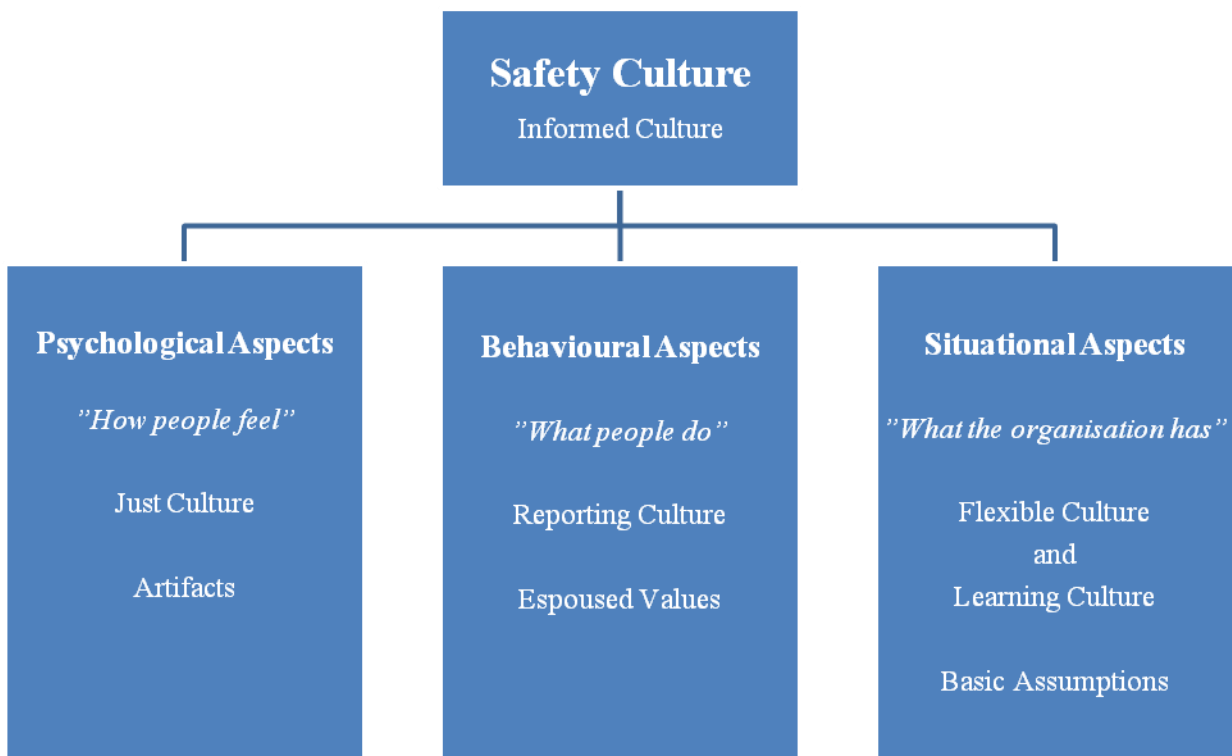
Figure 5. An illustration of the relationship between Reason's (1997) model and Guldenmund's (2010) model of safety culture and Bandura's (1986) reciprocal model.

3.2.2. Sub-cultures

Sub-culture is a term that is used to describe two different types of phenomena. The term sub-culture can refer to the sub-cultures which build up a safety culture. (Reason, 1997) In this case would a just culture, a reporting culture, a learning culture and a flexible culture be referred to as sub-cultures. The term sub-culture can also be used when referring to the different types of sub-cultures that may exist within an organization. (Schein, 2010) For example, if there is a different culture at department X than it is in the rest of the organization then it is possible to say that a sub-culture exists at department X. When the term sub-culture is used in the following parts of this master's thesis it will refer to the latter meaning if nothing else is stated.

It is common that an organization is built up by several sub-cultures. (Gadd, 2002; Lardner, 2003) The reason for this is that sub-cultures are likely to develop when employees are experiencing different working condition. The different working conditions may affect the way of viewing risks. Sub-cultures may have both a positive and a negative influence on the overall safety culture. The negative influence is that the presence of sub-cultures may lead to misunderstandings and conflicts between groups. The positive influence is that the sub-cultures may provide a greater insight and different perspectives of the risks and hazards within the organization. (Gadd, 2002)

3.3. Safety climate

As with organizational and safety culture no standard definition of safety climate exists. There is also confusion concerning the relationship and the differences between safety culture and safety climate. Consequently, the term safety climate is sometimes used interchangeably with the term safety culture. (Guldenmund, 2010) Perhaps one of the simplest explanations of safety climate is that it is not safety culture. (Denison, 1996) One of the more common descriptions of safety climate is that it is a "snapshot" of safety culture. (Wiegmann et al., 2002a; Wiegmann, Zhang, von Thaden, Sharma & Mitchell, 2002b; Canso, 2008) This means that safety climate reflects the safety culture at a given time and place. In contrast to safety culture, safety climate often refers to the features and not to the deeper context. (Denison, 1996) Nordén-Hägg (2010) concluded in her doctorial thesis that it can be considered that the organizational culture is expressing itself through the organizational climate.

Wiegman et al. (2002a) found that the majority of safety climate definitions differ from the definitions of safety culture in common ways. The commonalities of the safety climate definitions found were:

- *"Safety climate is a psychological phenomenon, which is usually defined as the perceptions of the state of safety at a particular time.*
- *Safety climate is closely concerned with intangible issues such as situational and environmental factors.*
- *Safety climate is a temporal phenomenon, a "snapshot" of safety culture, relatively unstable and subject to change."* (p. 8)

Based on these commonalities, Wiegman et al. (2002a) formulated a, what they call, global definition. The definition states that:

"Safety climate is the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on the features of the current environment or prevailing conditions." (p. 10)

3.4. The relationship between organizational culture and safety culture

The relationship between organizational culture and safety culture is not yet agreed on. Part of the reason for this is thought to be that there is a lack of theoretical background to the definition of safety culture presented by IAEA (INSAG-4). (Törner, 2010) While some researchers view safety culture as a part of the organizational culture others chooses to study the organizational culture's impact on safety. (Hopkins, 2006) Guldenmund (2010) is one of them who views safety culture as a part of the organizational culture which in turn is part of an industrial and a national culture. His framework for safety culture is though based on a framework of organizational culture that suggests that there is no need for a specific definition of safety culture. The basic assumptions of his framework are said to have an impact on safety, even if they are not explicitly related to safety, since they will permeate throughout the whole organization. (Guldenmund, 2010) Other researchers suggest the same approach where the organizational culture's impact on safety is studied rather than safety culture. (Hopkins, 2006; Törner, 2010)

According to Cooper (2000), safety culture is a sub-aspect of organizational culture which is thought to have an impact on members' attitudes and behaviours in relation to safety. Haukelid (2008) emphasizes this approach as well and states that it is important to stress that safety culture should not be viewed as separated from the organizational culture, but as a part of it. (Haukelid, 2008)

Researchers seem to have agreed on the fact that every organization has an organizational culture but there is still disagreement upon the fact if every organization has a safety culture or not. (Hudson, 1999) Some researchers emphasizes that every organization has a safety culture at some level which can be described as a strong, weak, positive or negative safety culture. Other states that only organizations for which safety is "an over-riding priority" have a safety culture. In the latter case, only few organizations have a safety culture. (Hudson, 1999; Hopkins, 2006) The former approach is the approach which this thesis is based on.

3.5.   The relationship between safety culture and safety climate

Unfortunately, there is still confusion between the concepts of safety culture and safety climate as well as the relationship between them. This has resulted in that the terms are sometimes used interchangeably. It should though be noticed that safety culture and safety climate is not the same thing.(Denison, 1996; Guldenmund, 2010)

Guldenmund (2010) compiled common characteristics for safety culture and safety climate which are presented below.

Safety culture and safety climate:
1. are a construct and an abstract phenomenon.
2. are relatively stable over time.
3. are multi-dimensional since they concern different dimensions of the organization for example, management commitment, workforce commitment, etc.
4. consists of something shared by a group.
5. consists of various aspects which means that they are common for the group but that sub-cultures and sub-climates may exist within the organization.
6. constitutes practices.
7. are functional.

Common characteristics of safety culture and safety climate have also been presented in a "tool-kit" developed by a research group at Gothenburg University. The common characteristics for safety culture and safety climate are that they are: (Törner, Pousette & Larsson, 2008b)

1. shared by the group.
2. constructed by the group.
3. relatively stable.
4. multi-dimensional.
5. expressed through values, symbols and actions.
6. functional and are not formed randomly.

When comparing these commonalties with the ones presented by Guldenmund (2010) it can be seen that each one of them has been identified by Guldenmund as well.

There is though disagreement among researchers upon the fact if safety climate is stabile over time or not. Some scientists state that safety climate is a temporal state (a "snap shot") of safety culture related to a particular time and location and therefore relatively unstable. (Cooper, 2000; Wiegmann et al., 2002b; Gadd, 2002; Lardner, 2003) Culture refers to the deeper structure of the organization which is related to the beliefs, values and assumptions among the members. Climate on the other hand typically refers to the members perceptions and therefore relates to the surface of the organizational life and culture. (Denison, 1996) Perceptions are influenced by for instance mood and climate can therefore be said to be more unstable that culture. (Canso, 2008) Safety culture is therefore considered as more enduring and underlying than safety climate which is considered more superficial. Safety climate may be considered as the psychological aspect of safety culture including how people perceive and feel about their safety culture. Safety climate can therefore be seen as an indicator of the organization's safety culture at a particular time and location. (Cooper, 2000; Gadd, 2002; Wiegmann et al., 2002b) According to this reasoning, the primary distinction between the two concepts is that climate refers to a situation (hence given time and location) while culture refers to an evolved context.

3.6. Benefits of a good safety culture and safety climate

Several studies have proven that a good safety culture and safety climate have a positive impact on safety and reduces accidents rates. (Törner, 2010)(SafeTracSolutions) It has also been proven that a good safety culture actually contributes to an increased productivity and reduced costs in the long run. (Hudson, 1999) The costs and causes of accidents can be illustrated with an iceberg, see figure 6. The direct costs and causes of an accident can be compared to the tip of an iceberg. The indirect costs and causes of accidents can be compared to the iceberg hiding under the surface. (Florczak, 2002; Li, 2006)
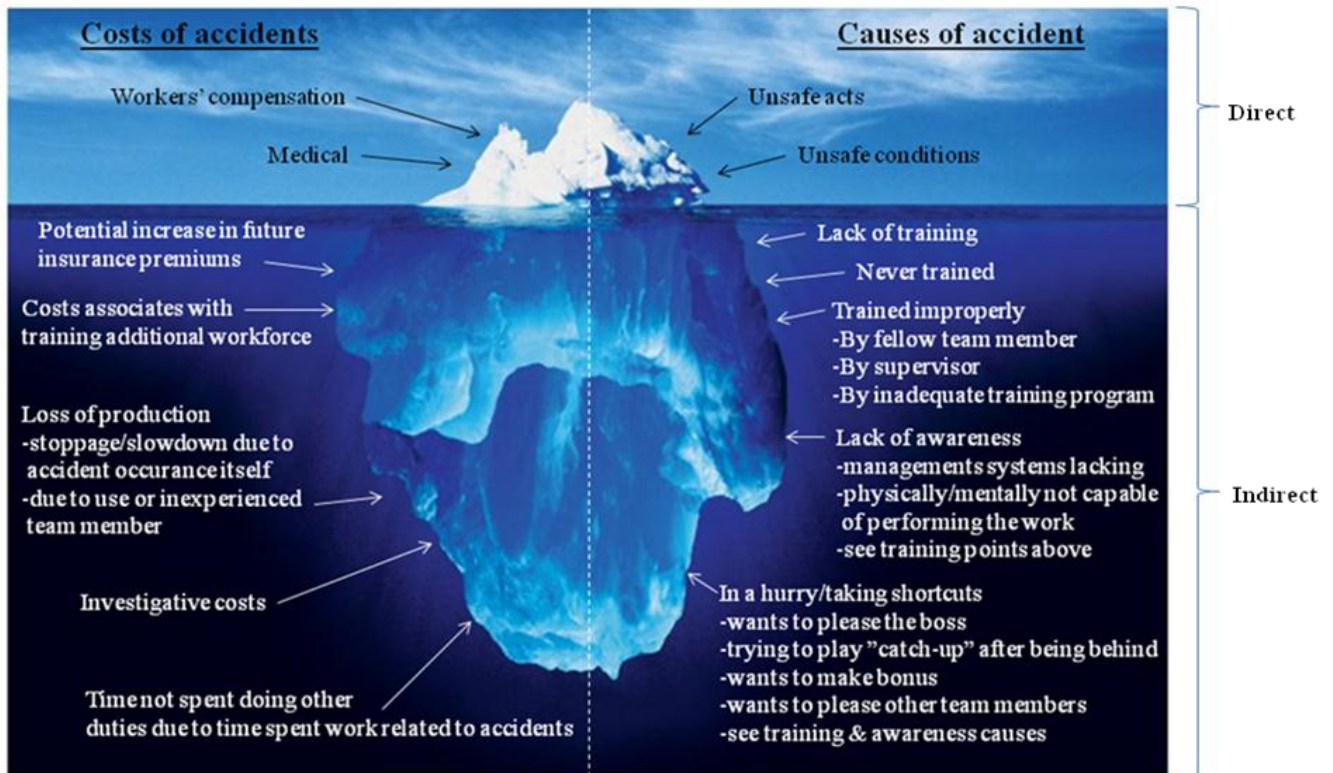

Figure 6. An illustration of direct and indirect costs and causes of accidents. (The figure is adapted from Florczak, 2002, figure 2-2)

There are also several more benefits with having a good safety culture and a good safety climate. (Taylor, 2005) In addition to reduced accidents rates, reduced costs and increased productivity, a good safety culture is a competitive advantage since it: (Railtrack, 2000; Taylor, 2005; Törner, 2010; Caterpillar, 2011)

- has a positive impact on safety.
- helps avoiding pain and suffering.
- generates substantial cost savings.
- demonstrates to the employees that the company care about them.
- helps to win bids for more jobs.
- reduces the downtime from injuries.
- allows to complete more jobs on time.
- builds a strong reputation for the company.

3.7. Methods for evaluating safety cultures and safety climates

Evaluating safety culture is complex, time consuming and requires the use of triangulated methods. This means that both quantitative and qualitative methods must be used when studying a safety culture. It should be noticed that no entirely satisfactory methodology for evaluating safety culture has yet been developed. As previously stated, safety climate is often used as an approximate evaluation of safety culture. Evaluating safety climate is much simpler than evaluating safety culture. The main reason for this is that it can be done by using only quantitative methods. (Denison, 1996; Lardner, 2003; Canso, 2008) Figure 7 present possible tools suitable for evaluating each aspect of safety culture and safety climate. (Canso, 2008)
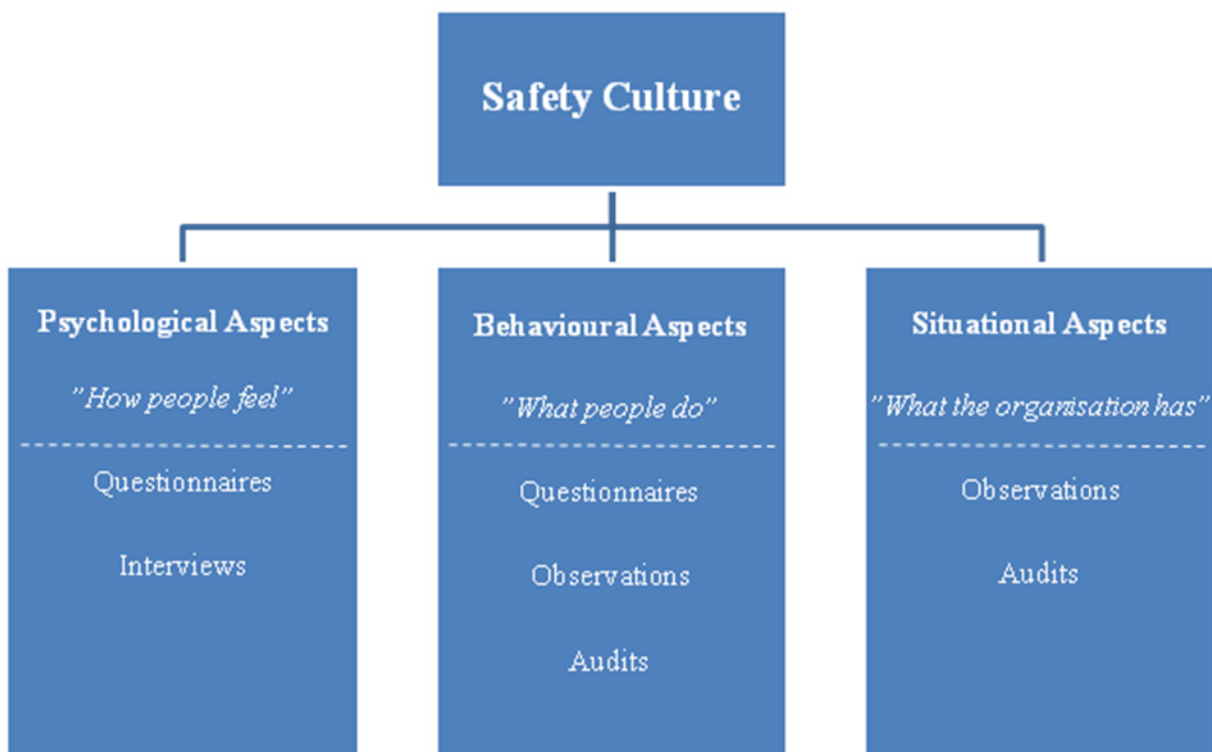
Figure 7. A brief presentation of possible tools for evaluating safety culture and safety climate. (The figure is adapted from Canso, 2008, figure 5)

The selection of the tool or tools to use depends on what is desired to evaluate as well as the time and resources available. It could also be considered too use an external resource when performing a survey of the level of safety culture or safety climate. An external resource may contribute to a feeling of trust and may also have access to databases available for benchmarking. (Reason, 1997; Weibull, 2008; Canso, 2008) Since this master's thesis focuses on evaluating safety climate will only the use of questionnaires and interviews be further described.

3.7.1. Questionnaires as a method

Some researchers claim to evaluate safety culture through questionnaires while other states that only safety climate can be evaluated through questionnaires. The latter view is supported by the theory presented in this master's thesis. A questionnaire would only evaluate how the safety culture is perceived at a given time and location and therefore it would evaluate safety climate and not safety culture. Since safety culture is expressed through safety climate it is thought possible to use an evaluation of safety climate as an approximate evaluation of safety culture. (Lardner, 2003)

The use of questionnaires is very common when evaluating safety climate. Surveys based on questionnaires can be performed by the organization or by an external resource. (Weibull, 2008) It is also possible to develop a new questionnaire or to choose to use an already existing one. If a new questionnaire is developed, then it has to be validated in order to assure that it evaluates what is desired in a reliable way. To develop such a questionnaire is a whole science in itself and out of the scope of this report. (Törner, 2010)

When choosing to use an already existing questionnaire is it important to ensure that the questionnaire has confirmed reliability and validity. There are two types of questionnaires to choose from, there is the kind which has been developed for/with a particular sector/industry and the kind with a generic character. Several questionnaires, which are said to evaluate safety culture or safety climate, have been reviewed in different studies. Unfortunately, several of the questionnaires do not evaluate what they state that they evaluate in a

reliable way. Some of the questionnaires are not based on theoretical background and previous research. There is also a large variety of dimensions studied through the questionnaires. A problem with the dimensions is that many of them have not confirmed reliability and validity. It should also be noticed that since most researchers work with their own dimensions or scales, it is not possible to refer to general norms or benchmarks. (Gadd, 2002; Guldenmund, 2010)

When evaluating safety climate it is important to evaluate it at a group level and not at an individual level since safety climate is by definition the *shared* perceptions of a group. It is therefore important that the questions are formulated as "we who work here…" rather than "I…". (Törner, 2010; Kinik, 2010) The structure of the questionnaire is also important. For instance, the questionnaire should not contain too many questions and the questions should be short and easy to understand. The response format also needs to be considered. A common response format is a five point Likert scale ranging from "strongly agree" to "strongly disagree". Unfortunately, the odd response number of options does not force the individual to make a stand. (Kinik, 2010)

Several researchers have tried to identify common features between the questionnaires, especially concerning the dimensions. Clarke (2000) reviewed 16 studies on safety climate and found a variation in the safety climate dimensions used. Five common themes among the dimensions where though identified, these are presented below in correct order:

1. Safety management systems
2. Individual responsibility and involvement
3. Work task/work environment
4. Management attitudes
5. Management actions

In a survey performed by Flin, Mearns, O'Connor and Bryden (2000), six common themes in safety climate questionnaires were identified. These themes are listed below in correct order.

1. Management/supervision
2. Safety system
3. Risk
4. Work pressure
5. Competence
6. Procedures/rules

In a similar study, Guldenmund (2010) identified the common themes listed below in correct order:

1. Management
2. Risk
3. Safety arrangements
4. Procedures
5. Training
6. Work pressure

It should be noticed that some of the questionnaires were included in both Flin et al. (2000) and Guldenmund's (2010) study. From these two studies, Flin et al. (2000) draws the conclusion that there are approximately three core themes; management, risk and safety arrangements.

A team of Nordic occupational safety researchers has developed a Nordic Safety Climate Questionnaire called NOSACQ-50. The questionnaire is based on organizational and safety climate theory, psychological theory, previous empirical research and results acquired through international studies. The reliability and validity of the questionnaire and its seven dimensions has been tested and confirmed. The seven dimensions concern shared perceptions of: (NOSACQ-50, 2010)

1. Management safety priority commitment, and competence
2. Management safety empowerment
3. Management safety justice
4. Workers' safety commitment
5. Workers' safety priority and risk non-acceptance
6. Safety communication, learning, and trust in co-workers safety competence
7. Workers' trust in the efficacy of safety systems.

These seven dimensions are the ones which this study will relate to since NOSACQ-50 is the questionnaire that was used in the evaluation of the safety climate at AkzoNobel Site Stenungsund. NOSACQ-50 is described in more detail later in the report as well as why these dimension has been chosen as a foundation for this study.

3.7.2. Interviews as a method

Interviews are a qualitative method which can be used when analyzing the results from a quantitative study. The interviews can be conducted personally or in focus groups. The benefit with individual interviews is that more personal and in depth questions can be asked. The benefits of interviewing focus groups are that the dynamics of the group and the "sharedness" of the culture can be obtained. (Kinik, 2010) The downside with interviews is that it may be hard to analyze and interpret the obtained data. It might also be difficult to compare results across sites or over time. (Lardner, 2003) It should also be noticed that the results may be biased if there is a low level of trust between the interviewer and the person being interviewed or within the focus group. (Lardner, 2003; Canso, 2008) The importance of a proper interview methodology should not be neglected. The methodology used for the interviews will have an impact on the results reliability and validity. (Lantz, 1993)

4. Methodology

A literature review was performed in the beginning of the project in order to learn more about AkzoNobel, safety culture, safety climate and the methods for evaluating safety climate. A meeting with three employees of AkzoNobel Site Stenungsund was also held in order to collect more information about the two companies. A survey was then performed in order evaluate the level of safety climate at AkzoNobel Site Stenungsund and to answer the research questions of this master's thesis. The survey used a questionnaire (NOSACQ-50) to collected data about the safety climate. Interviews were also performed as part of the survey. The aim with the interviews was to get a better understanding of the results from the questionnaires.

4.1. Meeting concerning the safety culture at AkzoNobel Site Stenungsund

A meeting between the author of this master's thesis, the supervisor of this thesis, a Safety Technician Representative from Akzo Nobel FC and an HSE-supervisor from Akzo Nobel SC was held for approximately one and a half hour. The aim with the meeting was to conclude differences between the two companies that might have an impact on the safety culture and/or the safety climate at AkzoNobel Site Stenungsund. The differences brought up at the meeting mainly concerned production, chemicals, organization, location, competence and experience.

4.2. Selection of questionnaire

After the literature review, a questionnaire was chosen for the survey. There are mainly two reasons to why a questionnaire has not been developed as a part of the work. The first reason is that it would take too much time to both construct a questionnaire and to evaluate and confirm its the reliability and validity. The other reason is that there would be no possibility to compare the results to other sectors.

There are many different questionnaires available which aim at evaluating the safety climate. The downside of this is that there is a large variety of dimensions and themes used in the different questionnaires. Another problem is that some questionnaires have not been evaluated with confirmed reliability and validity. (Kinik, 2010) Several aspects were included when a questionnaire, suitable for this survey, was chosen. The aspects with greatest importance for this survey are stated below.

- The questionnaire should evaluate safety climate.
- The questionnaire has to have confirmed reliability.
- The questionnaire has to have confirmed validity.
- The questionnaire has to be available in English.
- The questionnaire should be generic.
- The questionnaire should be relatively short (should take maximum 20 minutes to complete).
- The questions in the questionnaire should be easy to understand.

The questionnaire used for this evaluation was chosen after a comparison of several safety climate questionnaires commonly referred to in literature. A table containing the names of the questionnaires included in the literature review can be found in appendix 4, table 12. The questionnaire chosen for this evaluation is called the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50). It was chosen based on the fact that it complied well with the aspects previously mentioned above as well as with the benefits stated below.

- The questionnaire has been translated and validated to a number of languages including: Belgium (Dutch and French), Danish, English, Finnish, Icelandic, Norwegian and Swedish.
- The questionnaire has been translated and is in the process of being validated in other languages including: Chinese, Czech, Estonian, German, Hungarian, Indonesian, Italian, Japanese, Persian, Polish, Portuguese, Russian, Slovene, Spanish and Turkish.
- The questionnaire is based on contemporary research.
- The questionnaire uses a four point Likert scale.
- A database exists that can be used as a benchmarking tool.

4.2.1. The Nordic Safety Climate Questionnaire (NOSACQ-50)

The Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) is a diagnostic and intervention tool which can be used to evaluate the status and progress of safety climate in an organization. It is also a benchmarking tool at a group, company, sectoral, national and international level. (NOSACQ-50 database, 2010) The questionnaire was developed by a Nordic research network of occupational safety researchers with support from the Nordic Council of Ministers. (NOSACQ-50 Developers, 2010) It is based on organizational theory, safety climate theory, psychological theory, previous research, results acquired through studies and the continuous development process of the questionnaire. (NOSACQ-50, 2010) NOSACQ-50 consist of seven safety climate dimensions and additional background questions, see table 3. Each one of the seven dimensions consist of 6-9 items, altogether 50 items, hence the name NOSACQ-50. An English and a Swedish version of the questionnaire can be found in appendix 5 and appendix 6. (NOSACQ-50, 2010)

Table 3. The seven safety climate dimensions used in NOSACQ-50 and examples of aspects and items for each dimensions. (The table is adapted from Kinik, 2010, table 2)

Dimension	Aspects	Example of item
1. Management safety priority and ability (9 items)	Workers' perceptions of how management: - prioritize safety - actively promote safety and react to unsafe behaviour - show competence in handling safety - communicate safety issues	Item 1: Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight
2. Management safety empowerment (7 items)	Workers' perceptions of how management: - empower workers - supports participation	Item 13: Management never considers employees' suggestions regarding safety
3. Management safety justice (6 items)	Workers' perceptions of how management: - treat workers involved in accidents fairly	Item 20: Management looks for causes, not guilty persons, when an accident occurs
4. Workers' safety commitment (6 items)	Workers' perceptions of how they: - show commitment to safety - actively promote safety - care for each others' safety	Item 23: We who work here try hard together to achieve a high level of safety
5. Workers' safety priority and risk non-acceptance (7 items)	Workers' perceptions of how they: - prioritize safety before production - do not accept risk-taking or hazardous conditions	Item 33: We who work here never accept risk-taking even if the work schedule is tight
6. Peer safety communication learning and trust in safety ability (8 items)	Workers' perceptions of how they: - discuss safety issues whenever such emerge - learn from experience - help each other to work safely - treat safety suggestions from each other - trust each others' ability to ensure safety	Item 38: We who work here have great trust in each others' ability to ensure safety
7. Workers' trust in efficiency of safety systems (7 items)	Workers' perceptions of how they: - consider formal safety systems effective, e.g. safety representatives and safety rounds - experience benefit from early planning - experience benefit from safety training -experience benefit from clear safety goals and objectives	Item 46: We who work here consider that safety training is good for preventing accidents

The items can be divided into two groups depending on if they are positively or reversed (negatively) formulated items. The mixture of positive and reversed items enables the detection of acquiescence bias which is the tendency to respond in an indiscriminately positive way. (Altermatt, 2006) An example of such a bias could be if a person answers "strongly agree" to both item 1 and item 5 in table 4. All the items are answered in the same way (four point Likert scale) but have to be scored dependent on the formulation of the question, see table 4. Which items that are positively respectively reversed formulated, as well as which dimension they belong to, can be found in appendix 7, table 13.

Table 4. Example of a positive and a reversed item and the scoring of these. (The table is adapted from Analysing NOSACQ-50 data, 2010)

	Strongly disagree	Disagree	Agree	Strongly agree
Score for positive items	1	2	3	4
Score for reversed items	4	3	2	1
Example of a positively formulated item	Item 1: Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight			
Example of a reversed formulated item	Item 5: Management accepts employees here taking risks when the work schedule is tight			

When calculating the results from the questionnaire a mean score is calculated for each dimension and participant. These figures are then used to calculate the mean scores for each dimension, for the whole population as well as for sub-groups. The score in NOSACQ-50 ranges from 1-4, where 1 is the lowest score and 4 is the highest score. A mean score **over 2,5** is generally considered as a positive result since this is the mean value of the highest and lowest score. The mean scores of the NOSACQ-50 database are though slightly higher, see table 5. Notice that the figures in table 5 only concern the NOSACQ-50 database (which at the time included 4960 respondents) and not AkzoNobel's responses. Also notice that the mean scores only concern workers and not managers/supervisors. (Interpreting NOSACQ-50 results, 2011)

Table 5. Mean scores for each dimension of NOSACQ-50, from NOSACQ-50 database. (The table is adapted from Interpreting NOSACQ-50 results, 2011)

Dimension	Mean score[1]
1. Management safety priority and ability	2,96
2. Management safety justice	2,88
3. Management safety empowerment	2,97
4. Worker safety commitment	3,11
5. Workers safety priority and risk non-acceptance	2,87
6. Peer safety communication, learning, and trust in safety ability	3,03
7. Workers trust in the efficacy of safety systems	3,13
Total	2,99

[1] The mean scores only concern workers from NOSACQ-50 database.

It is though important to remember that the results from a survey should first and foremost be compared to the mean scores of the surveys result and not with the mean score from NOSACQ-50 database. A reason for this is that the current NOSACQ-50 database is not based on a representative sample. The sample is bias towards companies interested in evaluating their safety climate, of which many have a fairly high level of safety climate. It should also be noticed that the sectors represented in the current NOSACQ-50 database are construction, health care, manufacturing, shipping, aerospace and land transport of goods.

4.2.2. Modifications of NOSACQ-50

The only modification of NOSACQ-50 which was made is that questions concerning background information were added. These questions were added in order to verify if any dimension, or dimensions, of safety climate varies with the added background questions. An English and a Swedish version of NOSACQ-50, as well as the added background questions, are presented in appendix 5 and appendix 6. Some of the answers to the background were merged after the completion of the survey. This was done in order to generate larger groups. The minimum group size was chosen to 18 individuals in order to not disclose any ones identity. The revised background questions can be found in appendix 8 (English version) and appendix 9 (Swedish version).

4.3.   Selection of interview questions

The interviews were based on fourteen questions. Twelve of the interview questions were based on the 50 questions in NOSACQ-50. These interview questions asked the person to exemplify something in relation to the items which the question was based on. The other two interview questions concerned 1) which management that the employee referred to when answering the questionnaire and 2) the perceptions of the questionnaire. An English and a Swedish version of the interview questions as well as which items from NOSACQ-50 that they were based on can be found in appendix 10 and 11.

4.4.   The procedure

Every employee of AkzoNobel working at AkzoNobel Site Stenungsund at the time of the safety climate evaluation was asked to fill in a questionnaire. This included approximately 300 employees (the exact number is not presented due to confidentiality reasons). Information about the survey was sent out via an e-mail approximately one and a half month in advance. Posters with the same information as in the e-mail were put up at different locations at AkzoNobel Site Stenungsund.

The questionnaires were sent out via the inter-office mail to everyone working daytime and personally delivered to employees working shift time (one delivery per shift). Questionnaires were also left in the control rooms for those shift workers who did not work at the time of the delivery. The participation in the survey was voluntarily and it was possible to fill in the questionnaire anonymously. It was also stated in the questionnaire that the results would be presented in a way which assured that no individual would be identified. Both an English and a Swedish version of the questionnaire were used since there are employees at AkzoNobel Site Stenungsund who do not speak Swedish. The questionnaires could be returned via the inter-office mail, the regular mail (advanced postage) or by handing the questionnaire directly to the author of this master's thesis. The time for answering the questionnaire was altogether four weeks for day-time workers and 2-4 weeks for shift workers. After the first two weeks was a reminder sent out and the time to return the questionnaire was extended with one week. In total four weeks passed from the handing out of the first questionnaires before the results were conducted.

The return rate was 69,4% and the response rate was 60,0%. Every returned questionnaire was included when calculating the return rate. However, when calculating the response rate, only returned questionnaires with a filled in informed consent were included. All data collected through questionnaires (and interviews) were treated confidentially. This means that no person other than the author of this master's thesis were able to connect any answers or results to a specific person. The results have also been presented in such a way that no individual could be identified from the reporting of the results. All collected materials were kept locked up when the author was not working with it. After the publishing of this report, all raw data will be destroyed.

The aim with the interviews was to obtain a deeper understanding of the results from the questionnaires. A number of 35 randomly selected employees were asked via an e-mail, approximately two months in advance, if they wanted to participate in an interview. Nine employees choose to participate in an interview resulting in a response rate of 25,7% (9 out of 35). These people represented the mixture of employees at AkzoNobel Site Stenungsund fairly well. The interviews were performed over a period of three weeks. Each interview lasted for approximately half an hour to one and a half hour. Some of the interviews were recorded but this was voluntarily. The person being interviewed was informed that he/she had the right to refuse to answer any question. He/She was also informed that the results would be presented in such a way that no person would

be identified. The materials from the interviews were kept locked up when the author was not working with it. After the publishing of this report, all raw data will be destroyed.

4.5. Data analysis

Only questionnaires returned with a filled in informed consent were included in the compilation of the results. The data collected through the background questions and the 50 items of NOSACQ-50 were analysed by using IBM SPSS Statistics (version 9 and 18) and Microsoft Office Excel (2003 and 2007). The raw data from the items were used to calculate mean scores for each dimension and individual. Only answered items were used in the calculations. All answers for a dimension were excluded from the calculation if less than 50% of the items in that dimension were answered. The reason for this is that a mean score based on less than 50% of the items cannot be considered reliable. The mean scores for each dimension and individual were then used to calculate mean scores for each dimension and group. The minimum size of the studied groups was 18 individuals. The results presented in this master's thesis only concern workers if nothing else is stated. This is due to the fact that the minimum group size is 18 individuals. Exactly how the mean scores were calculated can be found in appendix 12, table 14 and table 15. The mean scores for the seven dimensions are displayed in radar charts in the results chapter. A radar chart is a 2-dimensional chart which can be used to present multivariate data for three or more quantitative variables. The statistical test used was an independent samples T-test (two-tailed). An independent samples T-test examines if there is any significant difference between two independent groups. A p-value (probability value) < 0.05 from the two-tailed T-test was considered statistically significant for all tests. Non-significant p-values are referred to as NS (non-significant) in the tables presented in the results. A significant relationship between tenure at AkzoNobel Site Stenungsund and number of workplaces outside of AkzoNobel Site Stenungsund was tested with a Spearman's rank correlation coefficient of $r= -0.24$ ($p= 0,01$). The internal consistency of the seven dimensions of NOSACQ-50 was tested by calculating Cronbach's alpha coefficients (coefficients of reliability). The internal consistency can be considered as good and the Cronbach's alpha coefficients from this study are presented in table 6.

Table 6. The Cronbach's alpha coefficients for each dimension from this study.

|	Cronbach's alpha coefficients for each dimension[1,2]						
	Dim1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
Workers	0,86	0,83	0,86	0,69	0,81	0,83	0,80
Managers/Supervisors	0,81	0,71	0,69	0,73	0,67	0,82	0,78

[1] Dim=Dimension

[2] A Cronbach's alpha coefficient $> 0,7$ is considered ideal.(Pallant, 2007)

Content analysis was used to analyse answers to the two open-ended questions (question L and Comments) in the questionnaire. The analytical approach in this thesis was guided by Graneheim and Lundman (2004). The analysis had low interpretation and focused on the manifest content of the open-ended question. The answers were summarized into meaning units, also referred to as categories in this master's thesis. A meaning unit is the constellation of words or statements which relate to the same central meaning. (Graneheim & Lundman, 2004) The meaning units from question L were ranged from most common to least common. Manifest content analysis with a low interpretation was also used when analysing the answers from the fourteen interviews questions. A summary of the answers were summarized in a table (table 10).

5. Results

5.1.   *Level of safety climate at AkzoNobel Site Stenungsund*

The evaluation of the safety climate at Akzo Nobel Functional Chemicals AB (Akzo Nobel FC) and Akzo Nobel Surface Chemistry AB (Akzo Nobel SC) indicates that the overall safety climate at AkzoNobel Site Stenungsund is relatively high. As previously described in the methodology section a mean score over 2,5 is considered as a positive result. The mean scores for the two companies ranged from 3,01 to 3,56 on the NOSACQ-50 scale (1 to 4). The lowest mean score was obtained in dimension 1 (3,01) for Akzo Nobel SC, see figure 8. Notice that the scale in all figures presented in this chapter has been broken and only ranges from 2,8 to 3,8. This has been done in order to elucidate the differences in figures. The mean scores for each dimension, for both AkzoNobel Site Stenungsund and the NOSACQ-50 database, can be found in figure 8. Also notice that the results only concern the workers when nothing else is stated. As can be seen in figure 8 are all mean scores, for both Akzo Nobel FC and Akzo Nobel SC, higher than the mean scores from NOSACQ-50 database. The results in figure 8 also shows that there only exist a significant difference in the level of safety climate between the two companies for dimension 1 (Management safety priority and ability), where Akzo Nobel FC has a slightly higher level of safety climate (see figure 8 for p-values).
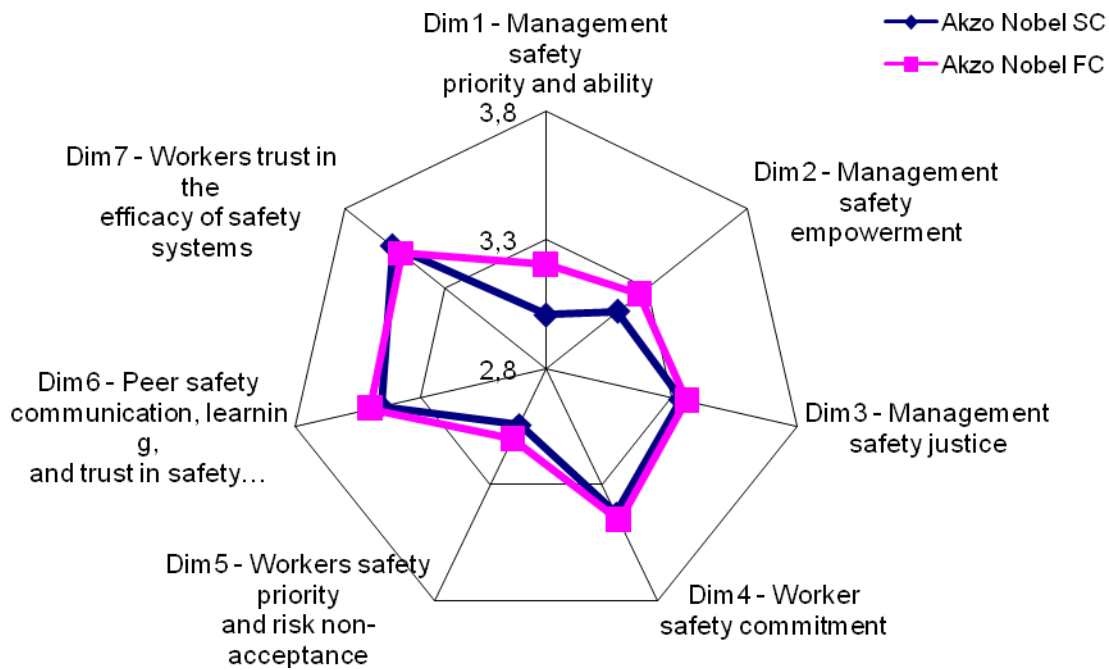
Company	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. Akzo Nobel SC	X	3,01	3,16	3,34	3,42	3,04	3,46	3,56
2. Akzo Nobel FC	X	3,20	3,26	3,36	3,46	3,10	3,50	3,52
Missing	X							
Total	**X**							
p-value: 1-2		0,049	NS	NS	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 8. The variation in the level of safety climate between Akzo Nobel FC and Akzo Nobel SC.

5.2. Sub-climates at AkzoNobel Site Stenungsund

When investigating potential sub-climates at AkzoNobel Site Stenungsund has the variations in the level of safety climate been studied between:

- shift workers and daytime workers at Akzo Nobel FC (figure 9)
- shift workers and daytime workers at Akzo Nobel SC (figure 10)
- shift workers and daytime workers at AkzoNobel Site Stenungsund (figure 11)
- shift workers at Akzo Nobel FC and shift workers at Akzo Nobel SC (figure 12)
- daytime workers at Akzo Nobel FC and daytime at Akzo Nobel SC (figure 13)

Figure 9 shows that there is a significant difference in the level of safety climate (for dimension 1, 2, 3, 4 and 5) between those who work daytime and those who work shift time at Akzo Nobel FC. The results illustrate that the shift workers' safety climate is significantly lower for dimension 1, 2, 3, 4 and 5 compared to the daytime workers', at Akzo Nobel FC (see figure 9 for p-values).
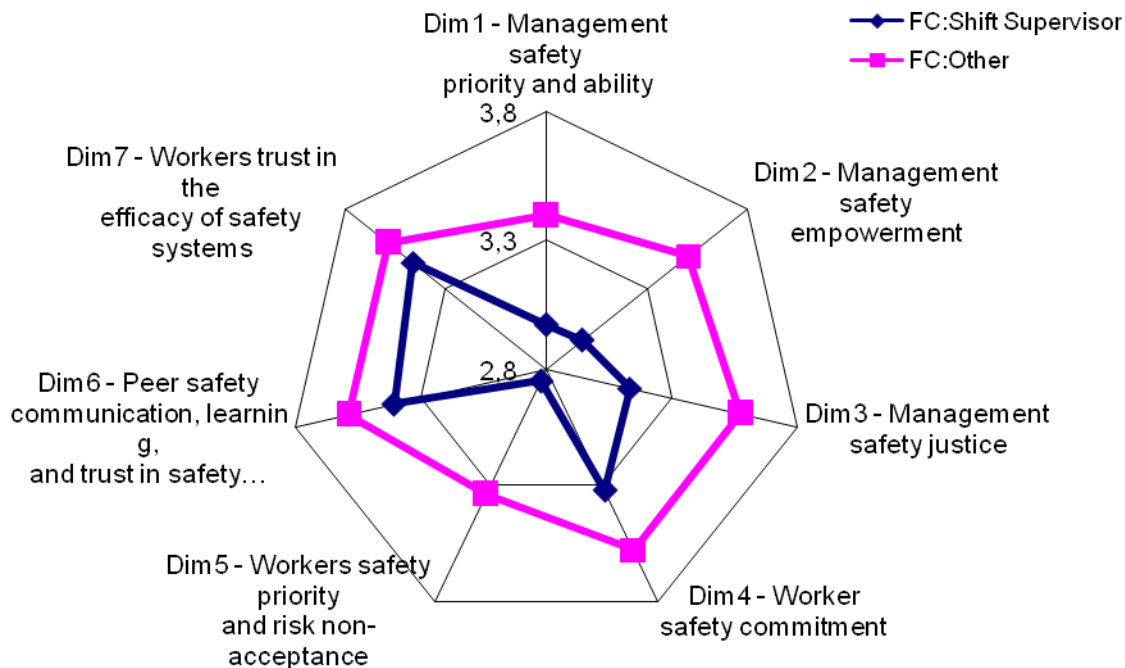
Closest manager/supervisor	n[4]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. FC: Shift Supervisor[1]	X	2,97	2,98	3,13	3,32	2,85	3,41	3,46
2. FC: Other[1]	X	3,40	3,50	3,58	3,58	3,34	3,59	3,59
3. SC: Supervisor[2]	X	3,04	3,05	3,27	3,32	2,95	3,42	3,55
4. SC: Other[2]	X	3,01	3,25	3,40	3,50	3,11	3,49	3,56
Missing	X							
Total	X							
p-value: 1-2		0,0004	0,000006	0,001	0,014	0,001	NS	NS
p-value: 1-3		NS	NS	NS	NS	NS	NS	NS
p-value: 1-4		NS	0,042	NS	NS	NS	NS	NS
p-value: 2-3		0,010	0,0002	0,022	0,022	0,017	NS	NS
p-value: 2-4		0,002	0,018	NS	NS	NS	NS	NS
p-value: 3-4		NS	NS	NS	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[3]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] FC=Akzo Nobel Functional Chemicals AB

[2] SC=Akzo Nobel Surface Chemistry AB

[3] Mean score for each dimension from the NOSACQ-50 database

[4] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 9. The variation in the level of safety climate within Akzo Nobel FC, between shift workers and day-time workers.

When comparing the level of safety climate for daytime workers and shift-workers at Akzo Nobel SC, no significant difference can be found for any of the dimensions. The results are presented in figure 10.
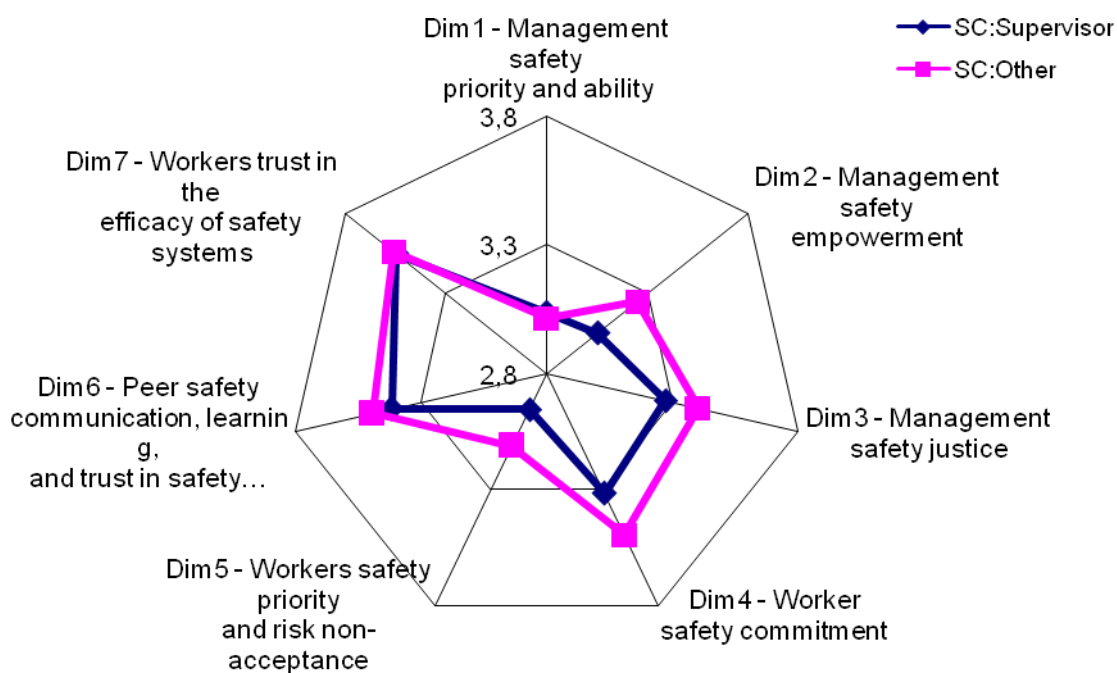

Figure 10. The variation in the level of safety climate between shift workers and day-time workers at Akzo Nobel SC.

The level of safety climate for all shift workers and all daytime workers at AkzoNobel Site Stenungsund has also been investigated. The results in figure 11 show that there is a significant difference in the level of safety climate for all dimensions where the level is lower for shift workers (see figure 11 for p-values).
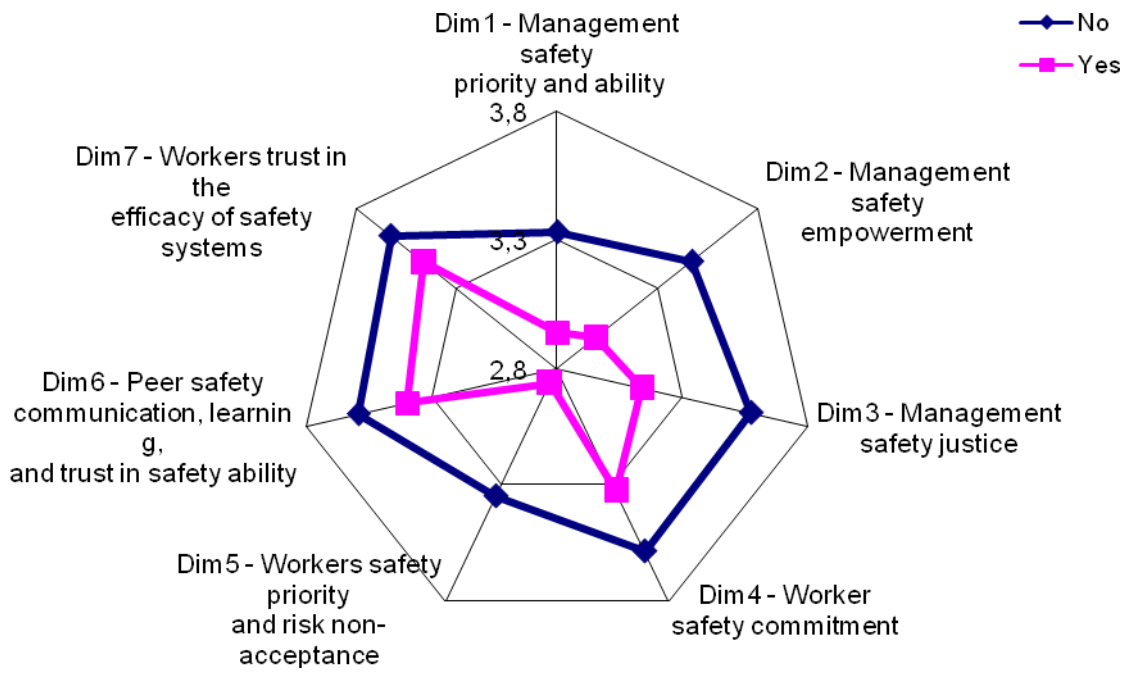
Shift work	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. No	X	3,33	3,47	3,57	3,59	3,35	3,59	3,63
2. Yes	X	2,94	2,99	3,14	3,33	2,86	3,40	3,46
Missing	X							
Total	X							
p-value: 1-2		0,00003	0,0000000	0,00003	0,0004	0,000001	0,012	0,040
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 11. The variation in the level of safety climate between shift workers and day-time workers at AkzoNobel Site Stenungsund.

Figure 12 illustrates the level of safety climate for the shift workers at Akzo Nobel FC and the shift workers at Akzo Nobel SC. The results show that there is no significant difference in the level of safety climate between the shift workers at Akzo Nobel FC and the shift workers at Akzo Nobel SC (see figure 9 for p-values).
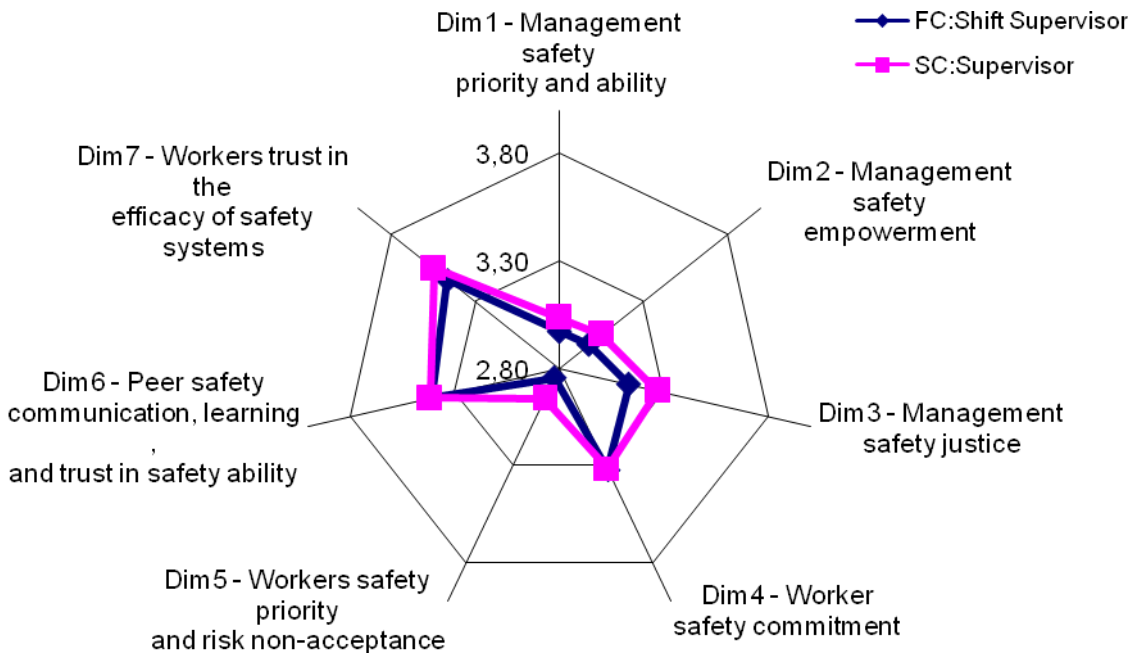
Figure 12. The variation in the level of safety climate between shift workers at Akzo Nobel FC and Akzo Nobel SC at AkzoNobel Site Stenungsund.

Figure 13 shows the level of safety climate between daytime workers at Akzo Nobel FC and daytime workers at Akzo Nobel SC. The results illustrate that there is a significant difference in level of safety climate (dimension 1 and 2) between the daytime workers at both Akzo Nobel FC and Akzo Nobel SC (see figure 9 for p-values).
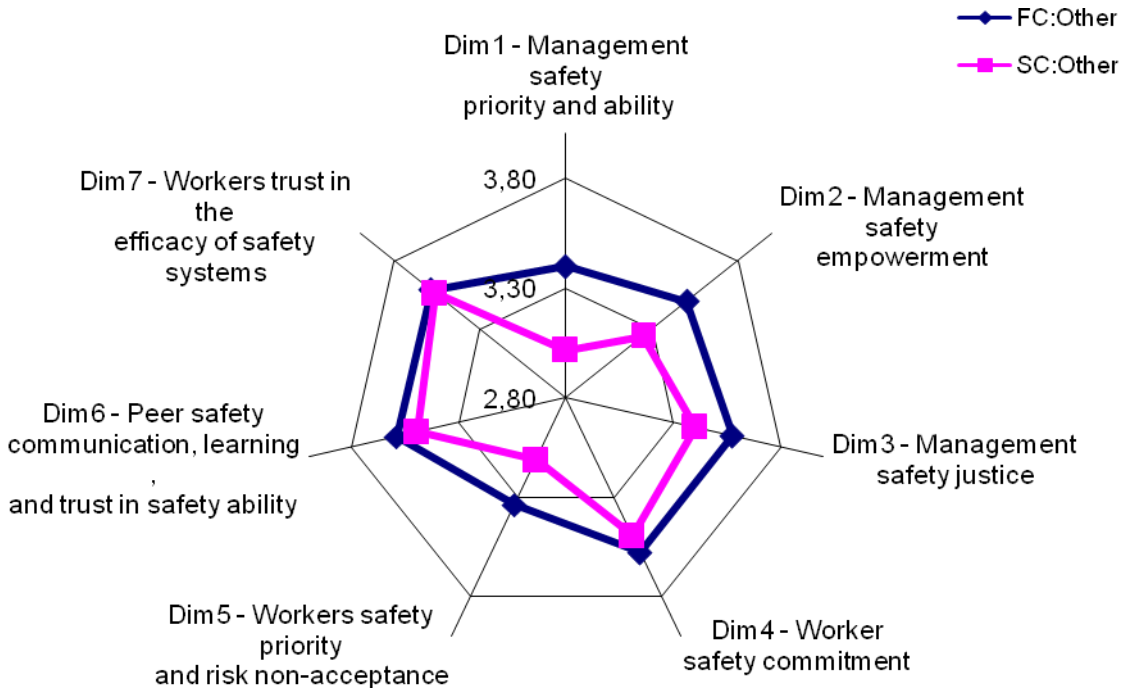

Figure 13. The variation in the level of safety climate between daytime workers at Akzo Nobel FC and Akzo Nobel SC at AkzoNobel Site Stenungsund.

5.3. Additional factors influencing the level of safety climate

The results showed that the level of safety climate varies significantly (for some dimensions) depending on:

- year of birth.
- if the employee is a manager/supervisor or a worker.
- tenure at AkzoNobel Site Stenungsund.
- tenure in the current position.
- if the employee had worked outside of AkzoNobel Site Stenungsund.
- if the employee had heard the term safety culture before.
- if the employee knew what safety culture is.

Figure 14 illustrates the variation in the level of safety climate depending on year of birth. There is only a significant difference between the youngest (orange) and the oldest (blue) group for dimension 5 (Workers safety priority and risk non-acceptance) (see figure 14 for p-values).

Figure 14. The variation in the level of safety climate depending on the year of birth.
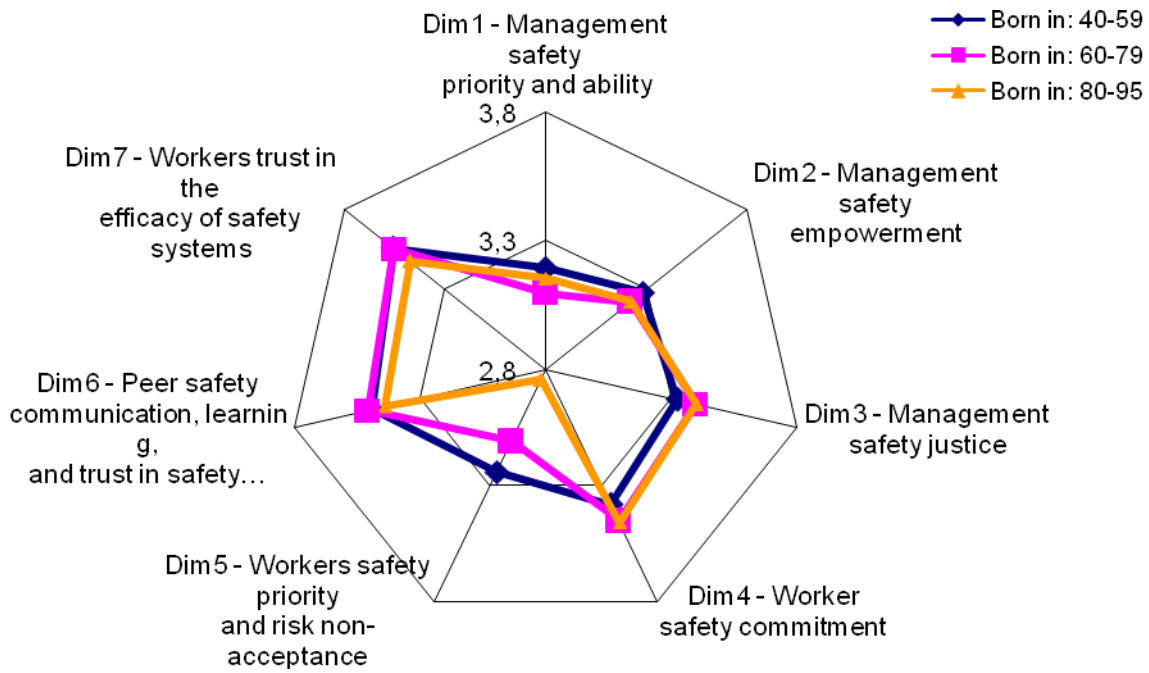
Year of birth	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. Born in: 40-59	X	3,19	3,28	3,32	3,38	3,24	3,50	3,56
2. Born in: 60-79	X	3,10	3,22	3,40	3,45	3,11	3,51	3,55
3. Born in: 80-95	X	3,15	3,22	3,40	3,46	2,84	3,44	3,48
Missing	X							
Total	X							
p-value: 1-2		NS	NS	NS	NS	NS	NS	NS
p-value: 1-3		NS	NS	NS	NS	0,01	NS	NS
p-value: 2-3		NS	NS	NS	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 14. The variation in the level of safety climate depending on the year of birth.

Figure 15 illustrates that there is a significant difference in the level of safety climate between managers/supervisors (pink) and workers (blue) for dimension 1-3 (see figure 15 for p-values). It should be noticed that managers/supervisors has scored a significantly higher level of safety climate for the first three dimensions which are the dimensions that concern management.
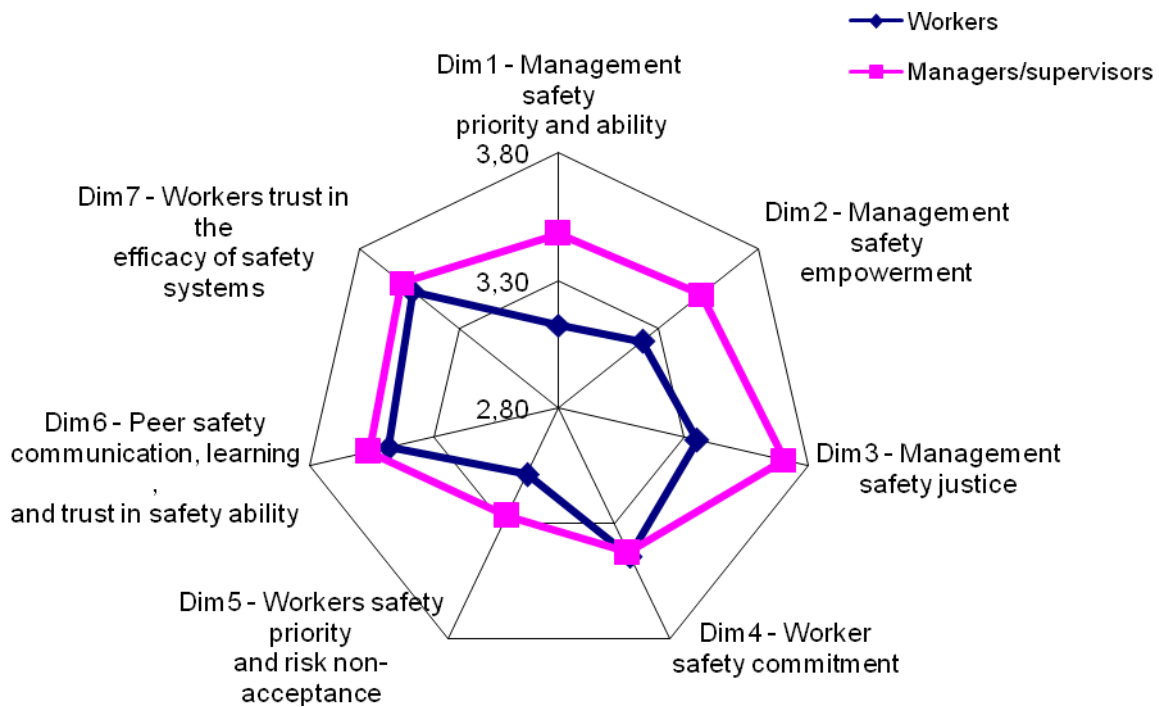
Workers and Managers/Supervisors	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. Workers	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
2. Managers/Supervisors	X	3,48	3,51	3,70	3,42	3,26	3,56	3,59
Missing	X	2,90	3,24	3,25	3,00	3,07	3,34	3,43
Total	X							
p-value: 1-2		0,001	0,004	0,003	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 15. The variation in the level of safety climate between managers/supervisors and workers.

Figure 16 illustrates the variations in the level of safety climate depending on tenure at AkzoNobel Site Stenungsund. As can be seen in this figure, there is a significant difference for dimension 5 (Workers safety priority and risk non-acceptance) for those who have been working at AkzoNobel Site Stenungsund for more than 16 years (orange) compared to the rest (see figure 16 for p-values). According to these results is the level of safety climate (in dimension 5) higher among those who have been working at AkzoNobel Site Stenungsund for more than 16 years.
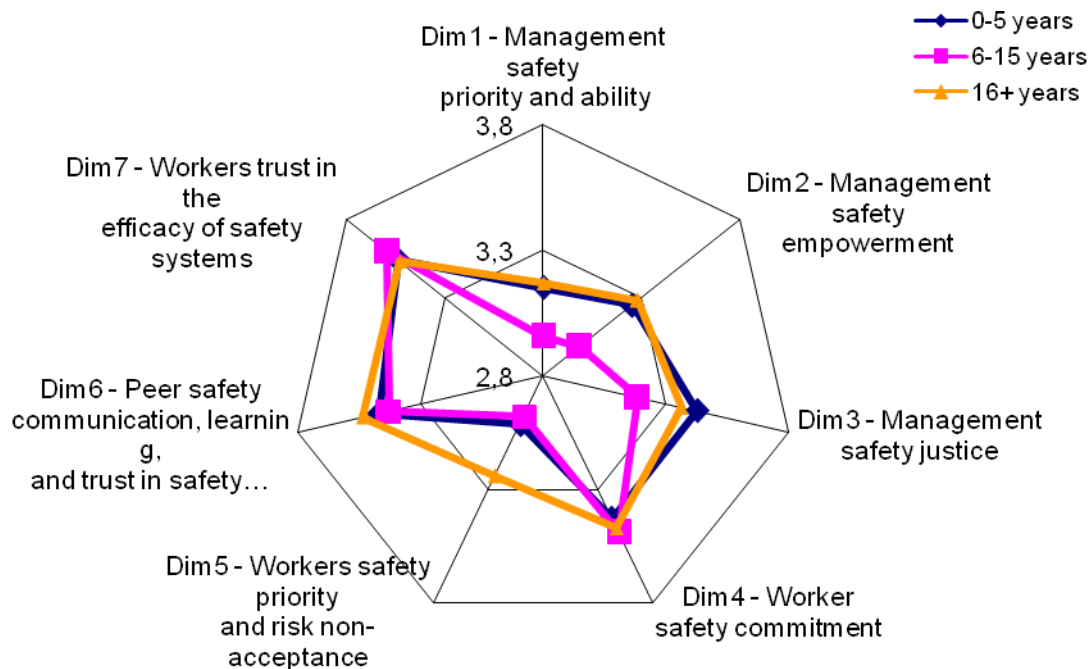
Tenure at AkzoNobel Site Stenungsund	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. 0-5 years	X	3,15	3,25	3,43	3,43	3,01	3,47	3,54
2. 6-15 years	X	2,96	2,99	3,19	3,49	2,98	3,43	3,59
3. 16+ years	X	3,17	3,28	3,36	3,47	3,24	3,54	3,53
Missing	X							
Total	X							
p-value: 1-2		NS	NS	NS	NS	NS	NS	NS
p-value: 1-3		NS	NS	NS	NS	NS	NS	NS
p-value: 2-3		NS	0,033	NS	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database
[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X
n=number of participants
Dim=Dimension
NS=Non-significant

Figure 16.The variation in the level of safety climate depending on how long the employee has been working at AkzoNobel Site Stenungsund.

The variations in the level of safety climate depending on tenure in the current position have been illustrated in figure 17. There is a significantly higher level of safety climate, for dimension 7 (Workers trust in the efficacy of safety systems), for those who have been working in their current position for 6-10 years (orange) compared to the others. There is also a significantly higher level of safety climate for dimension 3 (Management safety justice) for those who have been working in their current position for 1-5 years compared to those who have been working in their current position for more than 10 years (see figure 17 for p-values).
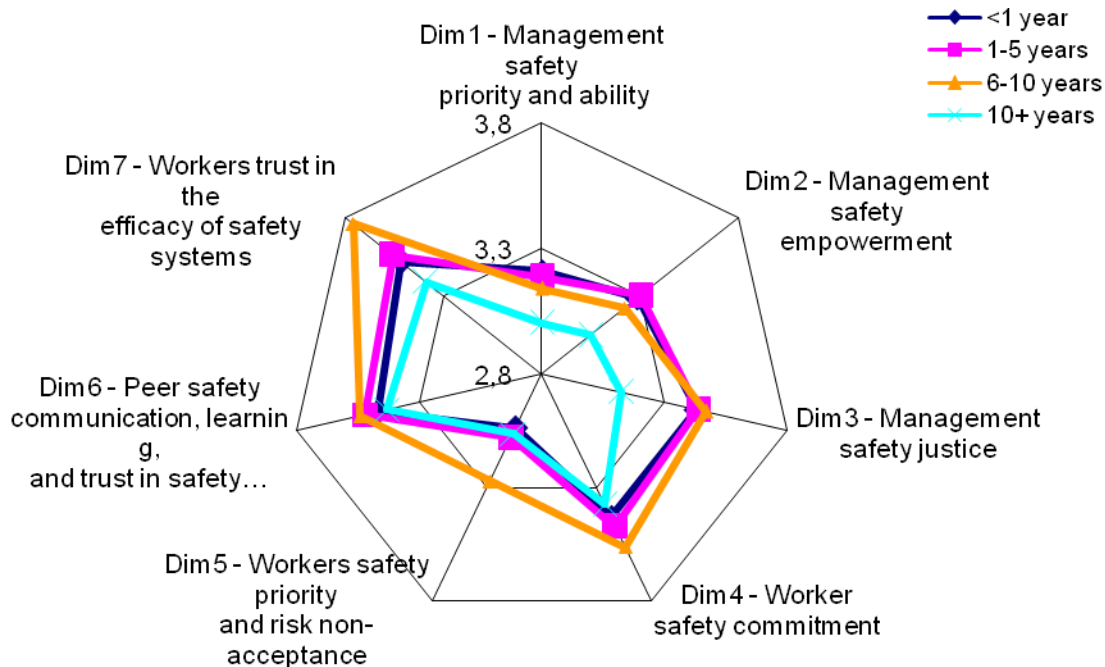
Tenure in position	n^2	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. <1 year	X	3,21	3,29	3,43	3,43	3,04	3,47	3,52
2. 1-5 years	X	3,19	3,30	3,44	3,47	3,08	3,52	3,56
3. 6-10 years	X	3,14	3,22	3,47	3,56	3,27	3,54	3,76
4. 10+ years	X	3,00	3,05	3,12	3,38	3,06	3,43	3,39
Missing	X							
Total	X							
p-value: 1-2		NS	NS	NS	NS	NS	NS	NS
p-value: 1-3		NS	NS	NS	NS	NS	NS	0,029
p-value: 1-4		NS	NS	NS	NS	NS	NS	NS
p-value: 2-3		NS	NS	NS	NS	NS	NS	0,029
p-value: 2-4		NS	0,053*	0,034	NS	NS	NS	NS
p-value: 3-4		NS	NS	NS	NS	NS	NS	0,006
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

*Almost significant

Figure 17. The variation in the level of safety climate depending on how long the employee has been working in their current position at AkzoNobel Site Stenungsund.

Figure 18 illustrates that there is a significantly higher level of safety climate among those who have not had any workplaces outside of AkzoNobel Site Stenungsund (blue) compared to those who have (see figure 18 for p-values). Notice that those who have not had any workplaces outside AkzoNobel Site Stenungsund scored a higher level of safety climate for all dimensions. A negative relationship (r=-0.24; p=0,01) was found between tenure at AkzoNobel Site Stenungsund and number of workplaces outside of AkzoNobel Site Stenungsund (not shown in figure).
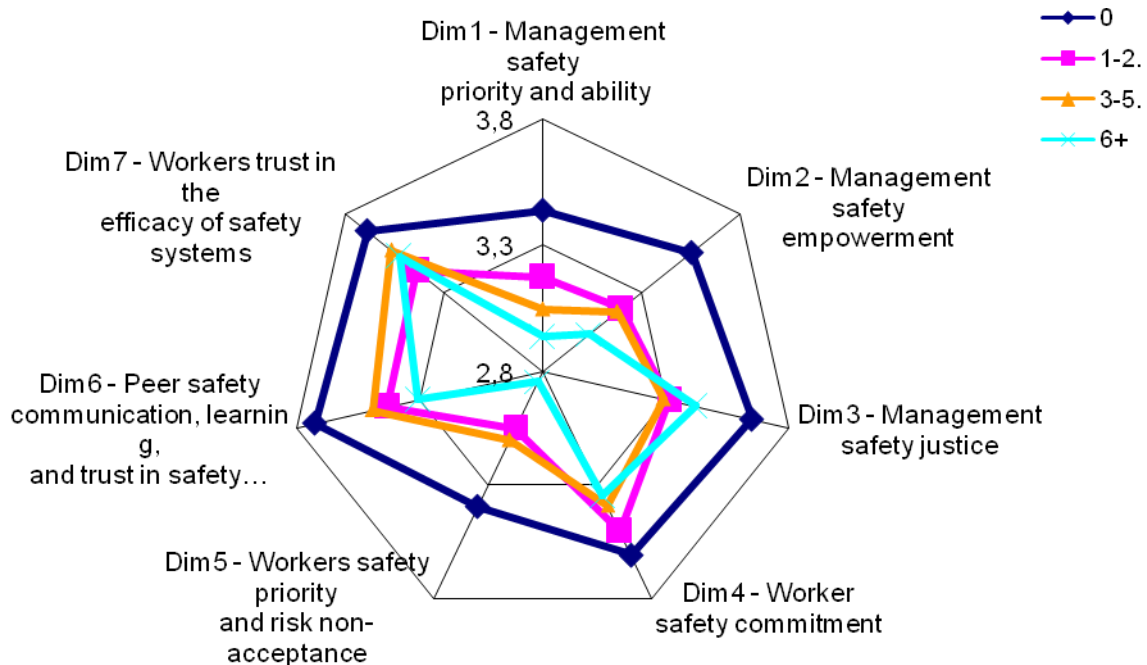
Other workplaces	n^2	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. 0	X	3,44	3,55	3,65	3,61	3,39	3,73	3,69
2. 1-2	X	3,17	3,20	3,31	3,50	3,05	3,43	3,44
3. 3-5	X	3,05	3,18	3,29	3,39	3,10	3,49	3,57
4. 6+	X	2,94	3,04	3,42	3,35	2,85	3,31	3,53
Missing	X							
Total	**X**							
p-value: 1-2		NS	0,008	0,048	NS	0,030	0,021	0,068
p-value: 1-3		0,003	0,007	0,017	0,056*	NS	0,024	0,286
p-value: 1-4		0,006	0,002	NS	0,050*	0,001	0,002	0,191
p-value: 2-3		NS	NS	NS	NS	NS	NS	NS
p-value: 2-4		NS	NS	NS	NS	NS	NS	NS
p-value: 3-4		NS	NS	NS	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

*Almost significant

Figure 18. The variation in the level of safety climate depending on how many other workplaces the employee has had outside of AkzoNobel Site Stenungsund.

Figure 19 presents the variations in the level of safety climate depending on if the employee has or has not heard the term safety culture before. As can be seen in figure 19, there is a significantly lower level of safety climate, for dimension 3 and 6, among those who have not heard the term safety culture (blue) compared to those who have (pink) (see figure 19 for p-values). Notice that 14% states that they have not heard the term safety culture before.
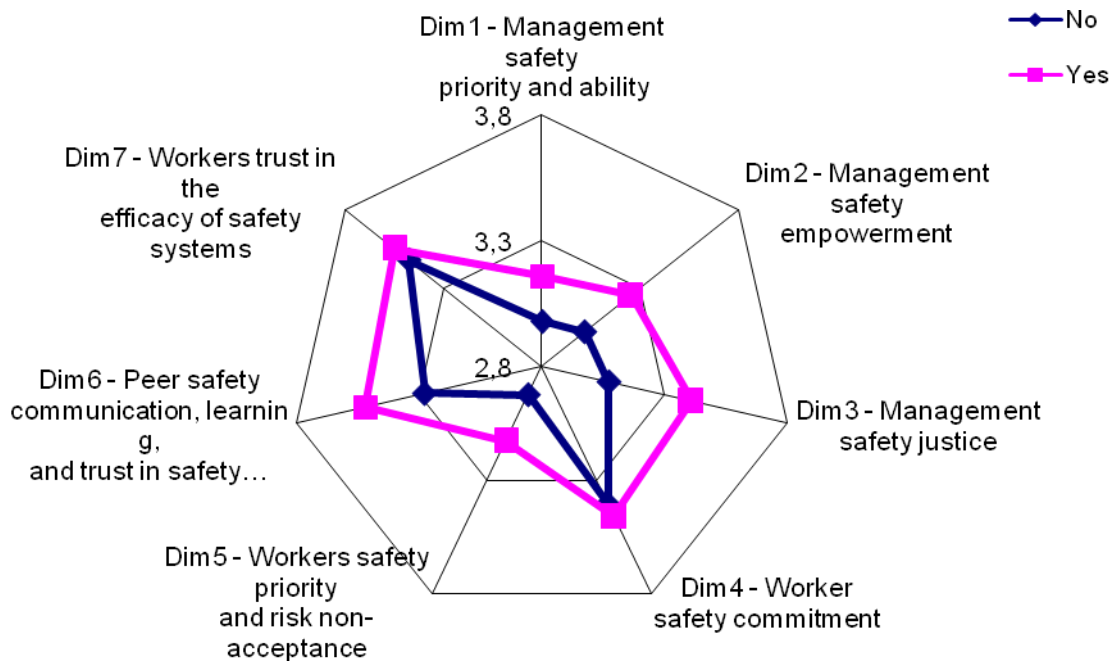
Safety culture - heard	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. No	X	2,98	3,02	3,07	3,41	2,92	3,28	3,48
2. Yes	X	3,16	3,25	3,41	3,46	3,13	3,52	3,55
Missing	X							
Total	X							
p-value: 1-2		NS	NS	0,026	NS	NS	0,026	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 19. The variation in the level of safety climate depending on if the employee has heard the term "safety culture" before.

The results in figure 19 only illustrate the level of safety climate for workers depending on if the employee has or has not heard the term safety culture before. In table 7 data can be found on how many workers and managers/supervisors at both Akzo Nobel FC and Akzo Nobel SC that has and has not heard the term safety culture before. As can be seen there are only workers that have not heard the term before. Notice that the percentages presented in table 7 only concern those who have answered the question.

Table 7. A presentation of how many workers and managers/supervisors at the two companies that has and has not heard the term safety culture before.

Company	Have heard the term safety culture	No. of Workers[1]	No. of Managers/ Supervisors[1]	Percentage of workers[2]	Percentage of managers/ supervisors[2]
Akzo Nobel SC	No	X	X	17%	0%
Akzo Nobel SC	Yes	X	X	83%	100%
Akzo Nobel SC	Total	X	X		
Akzo Nobel FC	No	X	X	12%	0%
Akzo Nobel FC	Yes	X	X	88%	100%
Akzo Nobel FC	Total	X	X		
Akzo Nobel FC and SC	Missing	X			

[1] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

[2] Notice that the percentages only concern those who have answered the question.

Figure 20 illustrates the variations in the level of safety climate depending on if the employee knows or not knows what safety culture is. There is a significant difference in the level of safety climate for dimension 1, 2, 3, 6 and 7 when comparing the group who states that they do know what safety culture is (pink) with the group who states that they do not know what safety culture is (blue) (see figure 20 for p-values). Notice that there is almost a significant difference for dimension 5 as well. Those who state that they do know what safety culture is, have a higher level of safety climate. Notice that 22% have stated that they do not know the meaning of the term safety culture.

Figure 20. The variation in the level of safety climate depending on if the employee knows what safety culture is or not.
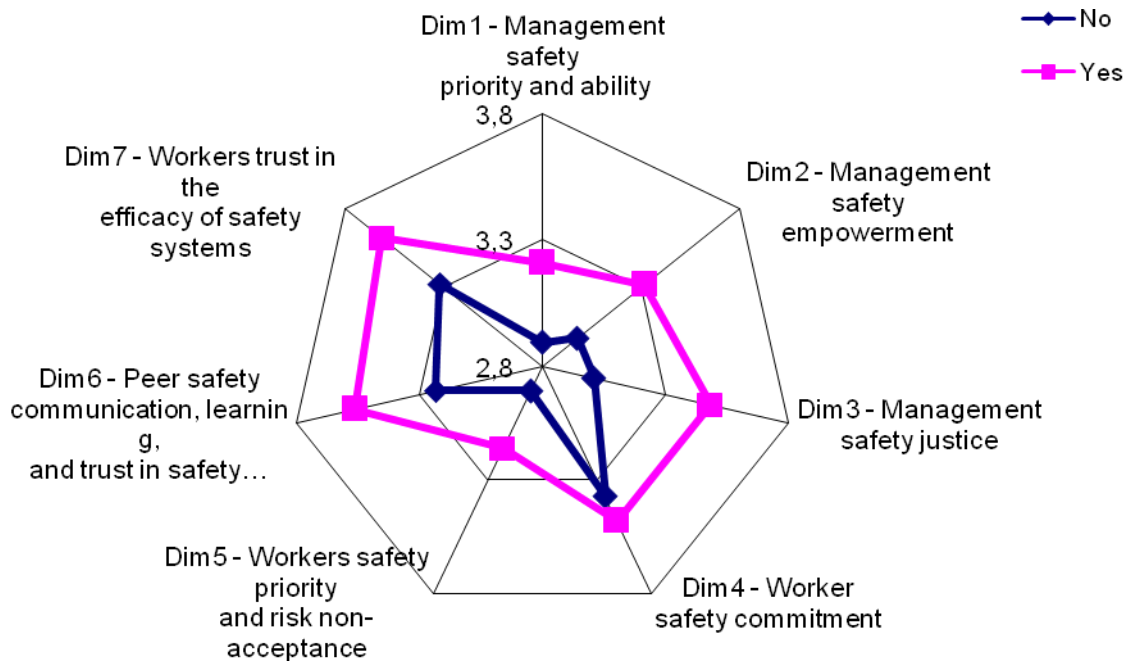
Safety culture - know	n^2	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. No	X	2,89	2,98	3,01	3,37	2,91	3,24	3,32
2. Yes	X	3,21	3,32	3,48	3,48	3,16	3,56	3,61
Missing	X							
Total	X							
p-value: 1-2		0,007	0,002	0,0002	NS	0,053*	0,0004	0,003
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[1] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

*Almost significant

Figure 20. The variation in the level of safety climate depending on if the employee knows what safety culture is or not.

The results in figure 20 illustrate the level of safety climate for workers depending on if the employee know what safety culture is. In table 8 data can be found on how many workers and managers/supervisors at both Akzo Nobel FC and Akzo Nobel SC that do and do not know what safety culture is. As can be seen in this table, a noteworthy part of both managers/supervisors and workers do not know what safety culture is. Notice that the percentages presented in table 8 only concern those who have answered the question.

Table 8. A presentation of how many workers and managers/supervisors at the two companies that do and do not know what safety culture is.

Company	Know what safety culture is	No. of Workers[1]	No. of Managers/ Supervisors[1]	Percentage of workers[2]	Percentage of managers/ supervisors[2]
Akzo Nobel SC	No	X	X	23%	29%
Akzo Nobel SC	Yes	X	X	77%	78%
Akzo Nobel SC	Total	X	X		
Akzo Nobel FC	No	X	X	23%	8%
Akzo Nobel FC	Yes	X	X	77%	92%
Akzo Nobel FC	Total	X	X		
Akzo Nobel FC and SC	Missing	X			

[1] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

[2] Notice that the percentages only concern those who have answered the question.

Figure 21 presents the variation in the level of safety climate depending on gender. As can be seen in this figure, there is no significant difference for any of the dimensions depending on if the employee is a male (blue) or a female (orange) (see figure 21 for p-values).
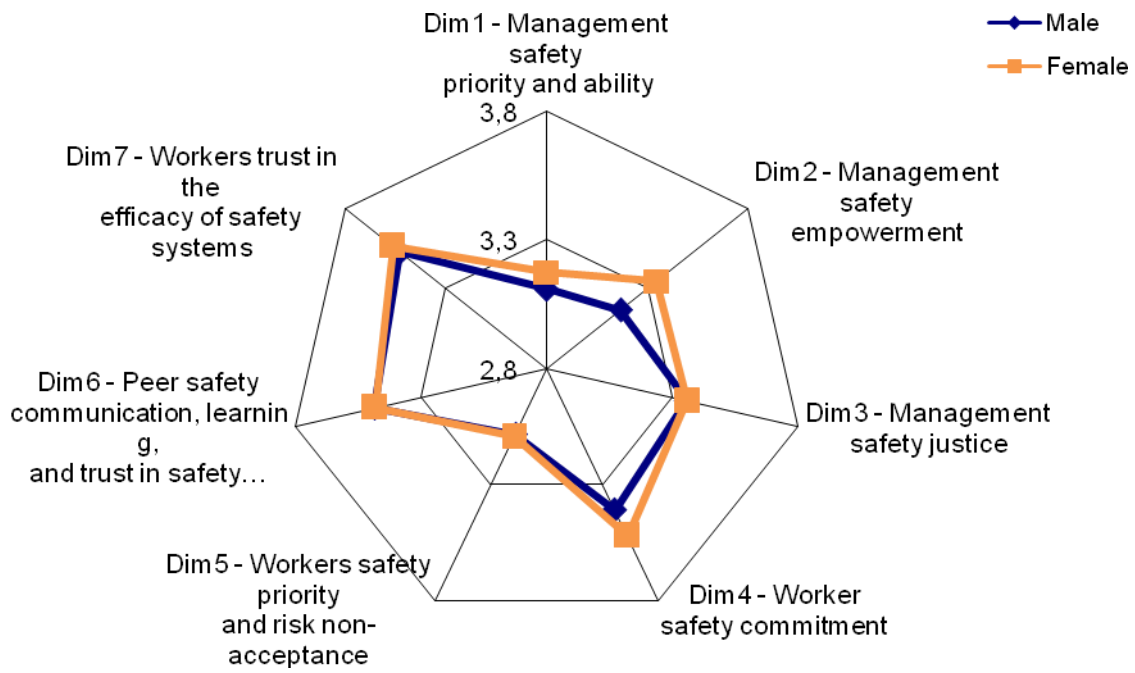
Gender	n[2]	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7
1. Male	X	3,11	3,17	3,36	3,41	3,08	3,49	3,53
2. Female	X	3,17	3,35	3,36	3,52	3,09	3,48	3,56
Missing	X							
Total	X							
p-value: 1-2		NS	NS	NS	NS	NS	NS	NS
AkzoNobel (workers and managers/supervisors)	X	3,17	3,32	3,44	3,29	3,14	3,46	3,52
AkzoNobel (workers)	X	3,13	3,22	3,35	3,44	3,09	3,48	3,53
NOSACQ-50[1]	3702	2,92	2,86	2,97	3,08	2,85	3,02	3,11

[1] Mean score for each dimension from the NOSACQ-50 database

[2] The exact number of participants is not presented due to confidentiality reasons, instead the number is marked with an X

n=number of participants

Dim=Dimension

NS=Non-significant

Figure 21. The variation in the level of safety climate depending on gender

5.4. Evaluation of NOSACQ-50

As can be seen in appendix 5 and appendix 6, it was possible for the employees to write comments in the end of the questionnaire. Approximately 25 persons wrote a comment (the exact number is not presented due to confidentiality reasons). The comments concerned different topic but most of them had a connection to the questionnaire. The general comments related to NOSACQ-50, both them obtained through the questionnaires, interviews, phone-calls and conversations, have been summarized in table 9.

Table 9. General comments related to NOSACQ-50.

No.	Comments
1.	Some perceive that it is hard to answer "we-questions" explaining that they can only answer for themselves.
2.	Some would like to have an "I-do-not-know"-option since they feel that they do not have the knowledge or experience to answer certain questions.
3.	Some items are formulated in a way so that they contain the words never and always. It was pointed out that such questions are yes/no-question.
4.	Some questioned the anonymity. They thought that it would be easy to identify them if they had answered the background questions.
5.	There were also personal comments concerning what is good and not good at AkzoNobel. These will not be published in order to not reveal anyone's identity.
6.	Some pointed out that they think that this survey is very important.
7.	Some referred to item 29 ("We who work here regard risks as unavoidable") and pointed out that there is a risk with working at a chemical plant and that it is positive to realize this in order to be able to work as safe as possible.
8.	Some also referred to question 34 ("We who work here consider that our work is unsuitable for cowards") and pointed out that it is important to have respect for the chemicals and the processes but one should not be afraid of them.

5.5. Results from the interviews

A number of 9 employees out of 35 choose to participate in an interview which generated a response rate of 25,7%. Some of those who turned down the invitation to an interview said that they did not have the time to participate. Table 10 present a summary of the results from the interviews. The exact answers from the interviews are not presented in the report in order to assure that no individual may be identified. Instead, a short summary of the answers to each question is presented. Some of the answers were very coherent while other were of a varying character. The answers from those working further away from the production were almost always of a positive character. When all answers tended to be of a positive character then were the answers from persons working further away from the production often even more positive. The focus on time in relation to safety was also brought up at several of the interviews. It was mentioned that too much focus on time might have a negative impact on safety since it might draw the attention away from safety.

Table 10. A summary of the answers from the interviews.

Dimension	Interview questions	Summary of the answers
1. **Management safety priority and ability (9 items)**	Which management did you refer to when you answered the questionnaire?	There was a great variation in the answers. The variation ranged from "the closest managers and supervisors" all the way up to "the highest management in Holland". The most frequent answer were though "the Site Management" and the closest management for respective company.
	Can you give examples of how the management balances between production and safety?	There was a great variation in the answers. Some experienced that there is no balance between safety and production and states that safety always comes first. Other stated that there is always a balance which often favours production. The latter view seems to be shared by people working closer to the production. Several also mentioned that there is a strong focus on time and economy.
	Can you give examples of management's ability to manage safety?	Most of the people interviewed experienced that the management has the ability to manage safety. The answers often referred to that management talks a lot about safety and "points with their whole hand". Some pointed out that there perhaps needs to be more action in relation to the safety talks and that it sometimes feels like the safety talk does not come from the heart.
2. **Management safety empowerment (7 items)**	Can you give examples of employee participation in safety-related decisions?	Most of the persons interviewed related their answers to safety representatives, risk assessments, meetings, incidents reporting and BBS. Some of the persons pointed out that there is a need of improvements of the incidents reporting system in order to improve the feedback and learning from the reports.
	Can you give examples of how management enables the employees to work safely?	The answers were often related to safety equipment, rules and laws, instructions and policies. Several of those who work relatively close to the production also brought up the focus on time as something that might have a negative impact on safety.
3. **Management safety justice (6 items)**	Can you give examples of how management collects information after an accident?	There was a varying character of the answers to this question. Everyone seemed to have a fairly good understanding of how the procedure is, or should be, done. The answers did tend to have a more positive character among those working further away from the production.
	Can you give examples of management consequences after an accident?	There seemed to be a relatively shared agreement that the consequences often have a more technical focus. There also seemed to be a shared understanding that blame and/or punishment is something that is not a part of the consequences.
Supplement: management		There seemed to be a shared understanding that there is a strong focus on safety. Some pointed out that there also is a strong focus on time and economy. It was also pointed out that the system for incident reporting needs to be improved. Some mentioned that the system and communication for reporting LTI (Lost Time Injury) needs improvement in order to clarify the system.
4. **Workers' safety commitment (6 items)**	Can you give examples of your colleagues' safety commitment?	The safety commitment seems to be of a varying kind. Some stated that it is very high while other state that safety is perhaps not everybody's interest but that everybody sees it as a part of their job. The answers often referred to the fact that people report incidents, discuss safety, use safety equipment and are not afraid to ask questions.

5.	Workers' safety priority and risk non-acceptance (7 items)	Can you give examples of how your colleagues balance between production and safety?	The answers were very similar to the answers to the question on "how management balances between production and safety". Consequently, there was a great variation also in these answers. Some experienced that there is no balance between safety and production and stated that safety always comes first. Other stated that there is always a balance which often favors production. Also in this matter seemed the latter view to be shared by people closer to the production. Once again were the focus on time and economy brought up.
6.	Peer safety communication learning and trust in safety ability (8 items)	Can you give examples of how your colleagues try to learn more about safety?	The answers often contained the following examples: they ask questions spontaneously, apply for courses, questions, some works with safety when they are off work, they report incidents, the perform BBS observations. Some also stated that safety is not everyone's interest but that everyone sees it as part of their job.
		Can you give examples of your colleagues' ability to work safety?	The answers often related to competence and experience. Some also referred to the ability to say "No" to perform a job when experiencing a risk.
		Can you give examples of how your colleagues communicate safety?	Some stated that they talk a lot about safety, sometimes even so much that it becomes ironic. Some of those working closer to production stated that the amount of communication could vary depending on who they worked with.
7.	Workers' trust in efficiency of safety systems (7 items)	Can you give examples of the following alternatives affect safety?:	
		• Safety representatives	There was a great diversity of answers. Some experienced that safety representatives have a great impact on safety. Others stated that safety representatives do not have an impact. Some also stated that they do not really know what they do.
		• Safety rounds	Generally positive answers to this question but many referred to safety rounds as "cleaning rounds".
		• Safety training	Generally positive answers to this question.
		• Safety considerations in the early stages of planning	Very positive answers to this question.
		• Clear-cut goals of safety	The answers pointed out that it is important to have clear-cut safety goals. Some stated that some of today's goals are not very clear-cut but that it is hard to precise the goals on a more detailed level. It was also pointed out that even though it is important with clear-cut goals is it even more important that one stands up for them and follows them.
Supplement: workers			Some pointed out that there is a strong focus on time. Some also pointed out that it can be hard to say "No" and that it sometimes feels like it is not okay to say "No". The manning of the shifts was also brought up during the interviews.

5.6. How the employees at AkzoNobel Site Stenungsund define safety culture

As can be seen in appendix 5 and appendix 6, question L, it was possible for the employees to write what their understanding of the term safety culture is. Approximately 100 persons wrote something about their understanding of safety culture (the exact number is not presented due to confidentiality reasons). Common words and expressions from question L have been summarized in table 11. Notice that there is a great variation in what the employees refer to when they refer to safety culture. For instance, 25 out of 52 categories were only mentioned one time. Another difference in the answers was that some wrote what they believe is a good safety culture while other wrote that a safety culture can be both good and bad.

Table 11. A summary of the comment on NOSACQ-50.

No.	Category	Frequency
1	To think safety	18
2	How the work is performed/to work safe/how the work should be performed	18
3	"Safety first"/Prioritize safety	15
4	Behaviour	6
5	The view of safety	6
6	Attitude	5
7	The "way"	4
8	Discuss/talk about	4
9	Awareness	4
10	Shared	3
11	Permeate	3
12	It is ingrained in the walls/It is naturally	3
13	How one relate to safety	3
14	To know/knowledge	3
15	Norms	3
16	Manage	3
17	Approach	3
18	Nobody shall get hurt	2
19	Compliance of/how one relate to various precepts	2
20	Continuous	2
21	Education	2
22	Think through	2
23	Improve	2
24	Rules/Safety rules	2
25	To see risks	2
26	Acting	2
27	The basic idea of safety	2
28	Values	2
29	"Zero by Choice"/"Safe by Choice"	2
30	Incorporated	1
31	Way of acting	1
32	How one view risks	1
33	The level of safety	1
34	To strive after safety	1
35	Responsibility	1
36	Wholeness	1
37	To use protective clothing	1
38	To follow precepts	1
39	The human comes first	1
40	Planning	1
41	Responsive	1
42	Active	1
43	BBS (Behaviour Based Safety)	1
44	Open accounting	1

45	Encourage	1
46	Not take risks	1
47	Routines	1
48	Ambition	1
49	Inform	1
50	Preventative	1
51	Focus	1
52	Safety maturity	1

5.7. *Proposed safety culture and safety climate definitions*

Based on the definitions and the commonalities between the definitions presented in this master's thesis as well as Verbeke et al. (1998) findings, a new definition of safety culture has been proposed. The proposed definition defines safety culture as follows:

"Safety culture is a concept defined by the values, beliefs, assumptions and norms concerning safety which are shared by the members of the group. The safety culture influence the members' attitudes and behaviour related to safety performance. The safety culture is created by the group and is relatively enduring, stable and resistant to change. A good safety culture is when safety comes first."

This definition includes both what safety culture is and what a good safety culture is in order to clarify the concept even further. This is due to the fact that the answers to question L in the questionnaire included both what safety culture is as well as what a good safety culture is. As with all mentioned definitions of safety culture this is not a standard definition. It is a definition that AkzoNobel can use in their future work when improving their safety culture and safety climate.

A new definition of safety climate has also been proposed based on the theory presented in this master's thesis. The proposed definition of safety climate is:

"Safety climate is a psychological and temporal phenomenon, "a snap-shot", of the perceived state of safety culture at a particular time and place."

Nor is this a standard definition of the concept but it is a relatively simple definition that AkzoNobel can use and refer to in their future work on safety culture and safety climate improvements.

6. Discussion

6.1. Method

In order to answer the aim and the research questions was the questionnaire called NOSACQ-50 used. The evaluation of NOSACQ-50 has mainly been based on comments obtained through the questionnaires, interviews, phone-calls and conversations. The first comment, in table 9, concerned that it was hard to answer "we-questions". Some stated that they were only able to answer for themselves. In order to evaluate safety climate it is though important to evaluate the shared perceptions which is related to what the group perceive, hence the "we-questions". Perhaps it needs to be clarified that it is "my perceptions of what the group perceive". The second comment concerned the outline of the questionnaire, referring to the four point Likert scale. Perhaps is should have been specified even more that a questions should be passed if it could not be answered for any reason. It has consciously been chosen to exclude an "I-do-not-know" column in order to force the employees to really think about the questions and to answer them. The third comment in table 9 concerned the language. It is possible that the questions containing the words "always" and "never" have to be reviewed and reformulated not to cause confusion and unreliable results. The anonymity was also questioned which can be seen in table 9, comment 4. It was though voluntarily to answer every question in the questionnaire, including the background questions. Perhaps it should have been specified more clearly that if the person answered several background questions then there was a possibility that the author of this thesis might have been able to identify them. It was though stated in the questionnaire that the results would be presented in such a way that no individual would be identified. Comment 7 and 8 in table 9 were related to specific items in NOSACQ-50. There will not be any analysis of these comments since such an analysis is considered out of the scope of this thesis. Additionally to this evaluation was the internal consistency of the seven dimensions of the questionnaire tested. Based on this test, the internal consistency can be considered as good. All together, NOSACQ-50 can be considered as a good and reliable instrument for measuring safety climate. First of all, NOSACQ-50 has been tested with confirmed reliability and validity as previously mentioned in this master's thesis. Secondly, the comments from the evaluation of NOSACQ-50 mainly concern minor improvement areas, which could easily be improved.

As mentioned in the methodology chapter, only questionnaires returned with a filled in informed consent were included in the compilation of the results. This resulted in a lowered response rate in comparison to the return rate. There could be several reasons to why the response rate was lower than the return rate. First of all, it is possible that some missed to fill in the informed consent. Secondly, some might not have wanted to participate in a survey of this character (for different reasons) but felt a group pressure to hand in the questionnaire. It should though be noticed that both the return rate and the response rate have been recognized as a fairly high rates. According to IaR (2010) can a response rate over 50% be considered as adequate, over 60% as good and over 70% as very good, when the survey has been administrated via mail. It has also been concluded that the response rate and return rate is fairly high compared to other response rates from other surveys, both within AkzoNobel Site Stenungsund and within other organizations were NOSACQ-50 have been used. (Krogh-Pedersen & Bjerg, 2009; Kinik, 2010; Öberg, 2011) In order to increase the response rate it might be necessary to be emphasize even more that only questionnaires that with a filled in informed consent will be included in the results. The questionnaires could also be handed out personally in connection to e.g. a meeting. In this case it could be possible to set aside some time for completing the questionnaire. By doing so, the drop-off linked to lack of time or lack of interest to complete a questionnaire might be reduced. It must though be remembered that in order to obtain reliable results, must the participation in the survey be voluntarily and there must also be a possibility to be anonymous.

The interviews can be considered as a good methodology to obtain a deeper understanding of the results from a survey based on NOSACQ-50. I could be considered to send out the interview questions in advanced. This would give the person in question more time to think about his/her answers. A drawback with this could though be that the spontaneity in the answers would be decreased.

As mentioned before, the response rate related to participation in an interview was fairly low (25,7%). A risk with a low response rate is that the participants might not represent the whole population, in this case every AkzoNobel employee at AkzoNobel Site Stenungsund. Although, in this study did the participant represent a fairly good mixture of the employees at AkzoNobel Site Stenungsund. The number of interviews also seemed high enough to mirror the perceptions of a large part of the employees at AkzoNobel Site Stenungsund. It should though be noticed that statistically, these results should be viewed with caution. The

low response rate for the participation in an interview could depend on several reasons. One reason could be that the employee did not receive the information concerning that he/she had been invited to a voluntarily interview. Secondly, there is no possibility to be completely anonymous in an interview which might reduce the participation in an interview. Another reason, which was mentioned by some who turned down the invitation, was that they did not have the time to participate.

6.2. *Results*

The overall level of safety climate at AkzoNobel Site Stenungsund can be considered as relatively high. The mean scores from the survey are all higher than 2,5 (which is the mean of the scale) and are therefore considered as positive results. Most of the mean scores from the survey are also higher than the mean scores of NOSACQ-50 database. It is though important to remember that the results from a survey should first and foremost be compared to the mean score of the surveys result and not with the mean score from NOSACQ-50 database. One of the reasons for this is that the current NOSACQ-50 database is not based on a representative sample. The sample is bias towards companies interested in evaluating their safety climate, of which many have a fairly high level of safety climate. Another reason is that no chemical industry is yet represented in the NOSACQ-50 database.

The mean scores in most of the figures in the result only concern workers and not managers/supervisors. The reason for this is that the number of managers/supervisors that participated in the survey is too small to divide them into smaller groups without risking that any ones identity might be revealed. Even though figure 8 indicate that the level of safety climate is fairly the same for both Akzo Nobel FC and Akzo Nobel SC this is not completely true.

When investigating the two companies separately it has been concluded that there is a greater variance in the level of safety climate for Akzo Nobel FC compared to Akzo Nobel SC, compare figure 9 and figure 10. Figure 9 reveals a significant difference in the level of safety climate between the shift workers and the daytime workers at Akzo Nobel FC. It can therefore be concluded that at least two sub-climates exists at Akzo Nobel FC, one including shift workers and another including daytime workers. These findings were also concluded by Jacobsson and Akselsson (2008). Figure 10 do not reveal any differences in the level of safety climate between the shift workers and the daytime workers at Akzo Nobel SC. It can therefore be concluded that these results do not reveal any sub-climates within Akzo Nobel SC. Since there is no difference in the level of safety climate between the shift workers and the daytime workers at Akzo Nobel SC the difference at Akzo Nobel FC seems not to have to do with the fact that the workers work shift time. When investigating the level of safety climate for all shift workers at AkzoNobel Site Stenungsund the results reveal that they seem to share the same perceptions about the safety climate. Jacobsson and Akselsson (2008) also pointed out that sub-cultures exist between different shift teams at Akzo Nobel FC. This has not been investigated in this survey since it would not be possible to present such results without jeopardizing that anyone's identity was exposed, hence the size of the shift teams is smaller than the minimum group size (of 18 individuals). Since there was a rotation of personnel between the shift teams at the time of the survey is it also possible that results concerning possible sub-climate between different shift teams would not be accurate.

When comparing figure 9, 10, 11, 12 and 13, it can be seen that the actual difference in the level of safety climate lies between the daytime workers at Akzo Nobel FC compared to the rest (the daytime workers at Akzo Nobel SC and all shift workers at AkzoNobel Site Stenungsund). It is hard to say why the daytime workers at Akzo Nobel FC perceive the level of safety climate higher than the rest. The answers from the interviews supported these findings in that sense that the answers tended to be of a more positive character the further away from production the employee worked. As mentioned before, sub-climates and sub-cultures are though likely to develop when employees are experiencing different working conditions. (Gadd, 2002) Milczarek and Najmiec (2004) investigated the relationship between the level of safety climate and if the employee had experienced dangerous situations or an accident at work. They found that people who had experienced dangerous situations, or an accident, at work had a lower level of safety climate compared to those who had not experienced any of this. Wu, Liu and Lu (2007) also found a relationship between accident experience and safety climate. When reviewing the statistics of accidents at AkzoNobel Site Stenungsund it can be concluded that employees working closer to the production and in laboratories seem to experience more accidents at work compared to other workers. (Flexite, 2011) The reason for this could be that the shift workers are those who work closest to the production at AkzoNobel Site Stenungsund. This

could explain why the level of safety climate is lower for shift workers than it is for daytime workers at Akzo Nobel FC.

The variation in the level of safety climate between the daytime workers at Akzo Nobel FC and Akzo Nobel SC, as well as why there is no variation within Akzo Nobel SC, is harder to explain. One theory is that a large part of the daytime workers at Akzo Nobel SC are located closer to the production compared to the daytime workers at Akzo Nobel FC. If that is the case then is it also possible that the daytime workers at Akzo Nobel SC have experienced dangerous situations or an accident at work which would lower the perceived level of safety climate. Unfortunately, it is not as simple as locating employees further away from the production in order for them to experience less accidents and/or dangerous situations at work, and in turn also perceive a higher level of safety climate. What is not to forget is that safety culture and safety climate are both complex systems dependent on for instance trust, shared learning and not at least communication. (Reason, 1997) It should therefore be noticed that moving personal further away from the production might also have a negative impact on at least shared learning and communication and in turn the safety culture and the safety climate. It should also be remembered that sub-cultures and sub-climates may have both a positive and a negative influence on the overall safety culture and safety climate. As described before, the negative influence can be misunderstandings and conflicts between groups. The number of misunderstandings can though be decreased with a well functioning communication within the organization. The positive influence with sub-cultures and sub-climates is that they may provide a greater insight and different perspectives to the risks and hazards within the organization. In order for this to be a positive aspect it is important that the organization uses these insights and perspective. (Gadd, 2002) The importance of the organizational structure and location was also emphasized during the meeting described in the methodology chapter.

Out of the background questions, which did not relate to which company the employee worked for, the level of safety climate mainly varied with 1) if the employee was a manager/supervisor or a worker; 2) if the employee had worked outside of AkzoNobel Site Stenungsund; 3) if the employee had heard the term safety culture before and 4) if the employee knew what safety culture is.

As can be seen in figure 15, the managers at AkzoNobel Site Stenungsund perceive a higher level of safety climate for those dimensions that concern management. One hypothesis to why these differences exist is that there might be a lack of communication between the management and the workers. It is possible that the management work on safety related issues is not effectively communicated to the workers. This could perhaps generate a lower perception of management's safety climate among the workers.

A very interesting finding was that there is a significantly higher level of safety climate among those who have not had any workplaces outside of AkzoNobel Site Stenungsund compared to those who have. One hypothesis could be that those who have only worked at AkzoNobel Site Stenungsund perhaps have less experience of other safety cultures and safety climates. A relationship between tenure at the workplace and safety climate has though been discovered in other studies. (Wu, Shiau, Lee & Shu, 2009; Beus, Bergman & Payne, 2010) It was revealed in this master's thesis that there is a significant relationship between tenure at AkzoNobel Site Stenungsund and zero number of workplaces outside of AkzoNobel Site Stenungsund. It would be interesting to investigate which of the two factors (tenure at workplace and number of workplaces) that had the most significant impact on the level of safety climate.

Opposed to the findings in this report, Wu et al. (2007) found a significant relationship between year of birth and safety climate as well as for gender and safety climate. It should though be noticed that their study was performed in Taiwan where another national culture exist compared to the Swedish culture. The influence of the national culture on the safety culture might explain why there is a difference in the two results but in order to conclude this more research is needed.

The level of safety climate seems to be lower among those who have not heard the term safety culture before. What is interesting is that 14% states that they have never heard the term safety culture before. This is interesting since AkzoNobel strongly promotes that their safety culture must be improved. The results therefore indicate that 14% do not know that the company want to improve their safety culture. The level of safety climate also seems to be lower among those who do not have an understanding of the meaning of the term safety culture. Table 7 also reveals that there are only workers at AkzoNobel Site Stenungsund who has not heard the term safety culture before.

It is also interesting that 22% stated that they do not know the meaning of the term safety culture. This means that 22% do not know what the company want to improve when they say that they want to improve their safety culture. Table 8 revealed that there are both managers/supervisors and workers that do not know what safety culture is. A hypothesis to why a total of 22% do not have an understanding of the term safety culture is that there might be a lack of communication alternatively education within the company. The reason for this hypothesis is that AkzoNobel uses the term safety culture frequently when they talk about safety improvements. It should therefore be natural that every employee had heard about safety culture before and had a shared understanding of what safety culture is. The results also reveal that the level of safety climate is higher among those who know what safety culture is. One hypothesis to why this is the case is that AkzoNobel strongly promotes that safety culture improvements are a part of their safety improvements. It is therefore possible that those who know what safety culture is, are more involved in work related to safety improvements and therefore have a higher level of safety climate.

There was a great variation in what the employees referred to when they were asked to write down their understanding of the term safety culture. Another difference in the answers was that some wrote what they believe is a good safety culture while other wrote that a safety culture can be both good and bad. When comparing the content of these understanding (table 11) with the content of the definitions of safety culture reviewed in this master's thesis it can be concluded that there are both similarities and dissimilarities between them. The definitions from the employees of AkzoNobel mainly focus on three aspects, namely:

1. to think safe
2. to act/work safe
3. to prioritize safety

The values, beliefs, assumptions and norms concerning safety are common terms in safety culture definitions which could, in a layman language, be interpreted into "to think safe". The safety culture influence the members' attitudes and behaviour related to safety performance and the attitudes and behaviours could be interpreted into "to act/work safe". Even if these understandings comports fairly well with the definitions reviewed it should not be forgotten that there is a great variance in the answers.

Returning to the fact that 22% of the employees do not know what the company want to improve when they say that they want to improve their safety culture. Then adding the fact that a large part of the other 71% has relatively different understandings of the meaning of the term safety culture (the remaining 7% chose to not answer this question). This means that when the company states that they want to improve their safety culture there is a great variance in what the employees believes is going to be improved. Researchers have emphasized the importance of an effective communication in order to obtain commonly understood goals. (Clarke, Mckenna & Ian, 2006; Misnan & Mohammed, 2007) In order to illustrate the importance of communicating the safety goals and visions Roughton and Mercurio (2002) compared this with if an airline pilot taking off from an airport without having a written flight plan. If not succeeding to communicate a shared and coherent understanding of what the goal is, e.g. what it is that the company wants to improve, then this may have a negative impact on the effectiveness of the safety culture improvements. (HSC, 2001; Roughton & Mercurio, 2002) In order to effectively improve a safety culture it is therefore important that everyone refers to the same definition when talking about safety culture and also that they have the same goal in mind. (HSC, 2001) This is also why the new definitions of safety culture and safety climate have been proposed as a part of this master's thesis. As mentioned before are these definitions not standard definitions. Since communication plays an important part in the work on safety culture and safety climate improvements, it could be considered to review the communication paths within an organization.

7. Conclusions

The results from the evaluation revealed that the level of safety climate is relatively high at both Akzo Nobel FC and Akzo Nobel SC at AkzoNobel Site Stenungsund. After a comparison of the level of safety climate of the two companies a significant difference for one dimension (Dimension 1 – Management safety priority and ability) was found. Two sub-climates within Akzo Nobel FC were revealed, one including shift workers and another including daytime workers. Both sub-climates had a relatively high level of safety climate but the level was higher for daytime workers compared to shift worker. No sub-climates between daytime worker and shift workers at Akzo Nobel SC were found. It was also discovered that the level of safety climate is higher among those who had not had any other workplaces outside of AkzoNobel Site Stenungsund. Another finding was that the level of safety climate is higher among those who have heard the term safety culture before. It was also found that the level of safety climate was higher among those who had an understanding of what safety culture is. Yet another finding was that there is a lack of a coherent understanding of the term safety culture among both workers and managers/supervisors.

8. Recommendations

8.1. AkzoNobel

The positive results from the survey as well as the high response rate indicate that a will to improve the safety culture and safety climate exist at AkzoNobel Site Stenungsund. It is important to implement a **shared coherent understanding** of what safety culture is, among both management and workers, in order to increase the level of safety culture and safety climate. Today, no shared understanding of what safety culture is exist and a total of 22% do not have an understanding of the concept.

The first recommendation is therefore for management to decide and define what safety culture is for AkzoNobel. The theoretical background and the safety culture and safety climate definitions proposed in this master's thesis could be used as a starting point in a decision process of that character. Management also has to decide and specify what level of safety culture and safety climate that is wanted.

The second recommendation is to create a plan for how to reach the set up goals on safety culture improvements. This is recommended since it is important to communicate and make sure that everyone understands **how** they can improve their safety culture and what the benefits of such improvements are.

It is also recommended to communicate what safety culture is for AkzoNobel in order to create a shared coherent understanding of the concept. What level of safety culture and safety climate that is wanted should also be specified and communicated to the employees as the **shared goal** with the safety culture improvements.

A plan for reaching the goals on safety culture improvements should be developed in such a way which makes it possible for every employee to participate in the safety culture and safety climate improvements. The plan should also focus on **how** every employee can be involved in the work on improvements. One way to involve every employee could be to run workshops in workgroups with guidance from a trained HSE-coach or safety-culture-coach. A workshop could both be used as a method to **communicate** the **shared goal** with the safety culture improvements but also to discuss **how** each individual and each group could improve their safety culture. In the end of a workshop could everyone assign, and write down, an "I-will-statement" connected to their safety culture improvements. Such a statement should be developed by the employee him-/herself and not be a forced statement. It would also be possible to place the statements into the P&D Dialogs if one wishes. Not to forget is the importance of feedback related to both the workshop and the "I-will-statements".

Feedback is also important in relation to a safety climate evaluation. It is therefore strongly recommended to distribute this master's thesis among the employees who participated in this safety climate evaluation. It could be considered to translate the master's thesis into Swedish. It is also recommended to have some sort of oral feedback as well. It has been decided that such a feedback session will be held during the autumn of 2011 at Site Stenungsund by the author of this master's thesis.

It is important to follow up the improvements on safety culture and safety climate. It is therefore recommended to evaluate the safety climate every two or three years. It is of great importance to use the same evaluation tool (NOSACQ-50) in future evaluations in order to be able to compare the results from such surveys with the results obtained in this master's thesis. It would also be a good idea to evaluate the level of safety climate at other AkzoNobel sites in Sweden and in other parts of the world. Doing so would not only result in an evaluation of the level of safety climate at other sites but also improve the possibilities of learning from other sites work on safety culture improvements.

It could be considered to add two background questions to the questionnaire (see appendix 8 and 9) if using it again. The two background questions are "Have you experienced a dangerous situation at work?" and "Have you experienced an accident at work?". By adding these background questions could Milczarek and Najmiec (2004) findings be further investigated.

The lack of feedback from the incident reporting system was an additional matter which was brought up at several occasions during the work. It is therefore recommended to review the incident reporting system to investigate if the system for feedback from the reporting needs improvement. It is important to remember that a well functioning reporting system is an essential part of a safety culture. The reason for this is that a reporting culture and a learning culture, both dependent on a well functioning reporting system, are parts of a safety culture.

8.2. *Future research*

As have been emphasized in previous research as well as in this master's thesis, there is a need for a coherent understanding of the two concepts safety culture and safety climate. Differences in the level of safety climate between shift workers and daytime workers, as well as what it is that affects these differences, are possible research areas for the future. It would also be interesting to further investigate the relationship between shift workers and experience rate of accidents and/or hazardous situations at work. The relationship between the level of safety climate and the number of workplace outside of the current workplace is another possible research area. I would also be interesting to further investigate the relationship between the level of safety climate and if the employees have or have not an understanding of the term safety culture.

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Appendix 1 - Applications for the products produced at Ethylene Amines

Glycols
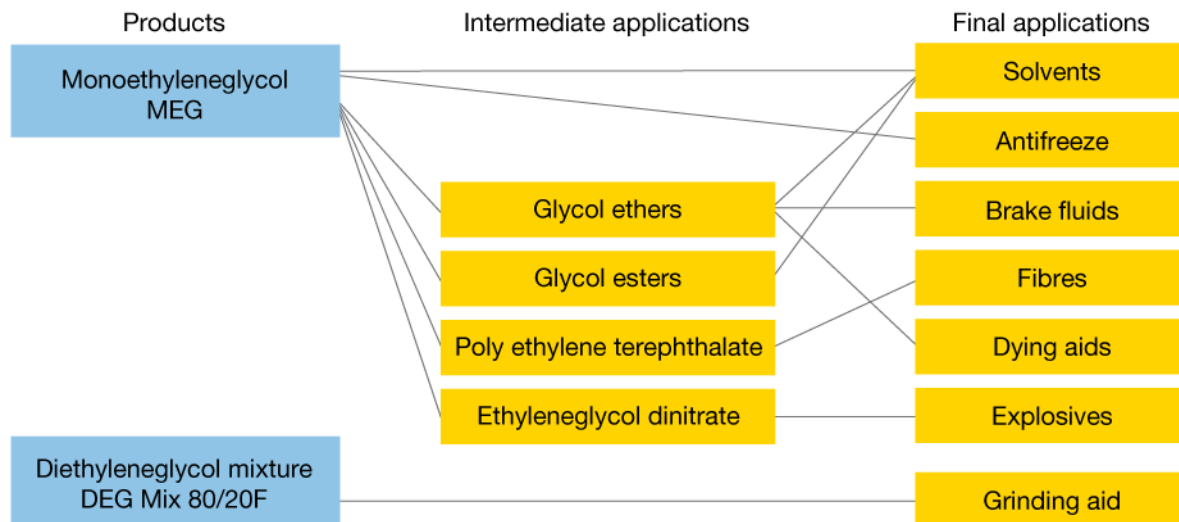
Figure 22.Intermediate and final applications of the glycols produced at AkzoNobel Site Stenungsund. (The figure is adapted from AkzoNobel, 2008a)

Ethanolamines - Industrial Applications
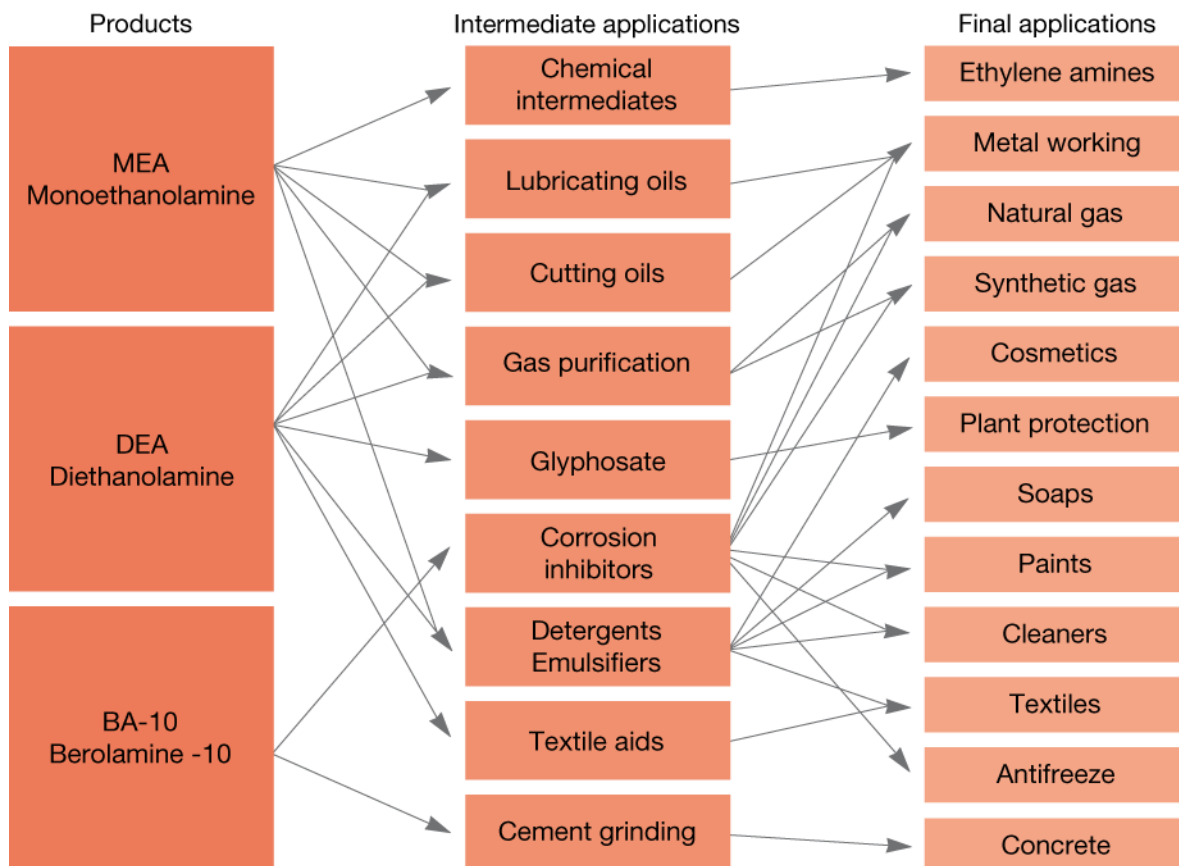
Figure 23. Intermediate and final applications of the ethanolamines produced at AkzoNobel Site Stenungsund. (The figure is adapted from AkzoNobel, 2008a)

Ethylene Amines - Industrial Applications

Products	Intermediate applications	Final applications
EDA Ethylenediamine	Dithio-carbamates	Fungicides
AEEA Aminoethyl Ethanolamine	Stearamide	Plastics lubricants
DETA Diethylenetriamine	Perborate activator	Detergents
	Chelating agents	Pulp and Paper
	Surfactant/Imidazoline	Textile auxiliaries
	Softeners/Antistats	Paints/Adhesives
	Wet strength resins	
	Polyamides	
	Epoxy hardeners	
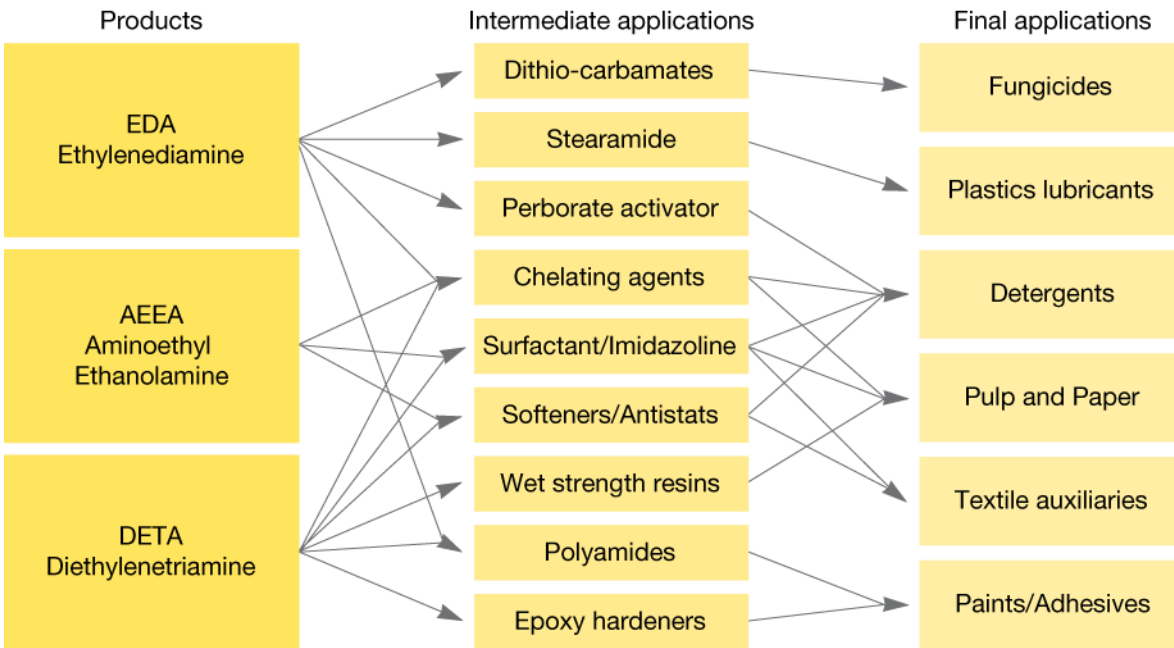
Figure 24. Intermediate and final applications of the ethylene amines (EDA, AEEA and DETA) produced at AkzoNobel Site Stenungsund. (The figure is adapted from AkzoNobel, 2008a)

Ethylene Amines - Industrial Applications

Products	Intermediate applications	Final applications
AEP Aminoethyl Piperazine	Chelating agents	Detergents
NMP N-methyl Piperazine	Surfactant/Imidazoline	Pulp and Paper
HEP Hydroxyethyl Piperazine	Softeners/Antistats	Textile auxiliaries
PIP Piperazine	Wet strength resins	Paints/Adhesives
	Polyamides	Polyurethane foam
	Epoxy hardeners	Drugs/Vet.drugs
	Polyurethane catalyst	
	Pharmaceuticals	
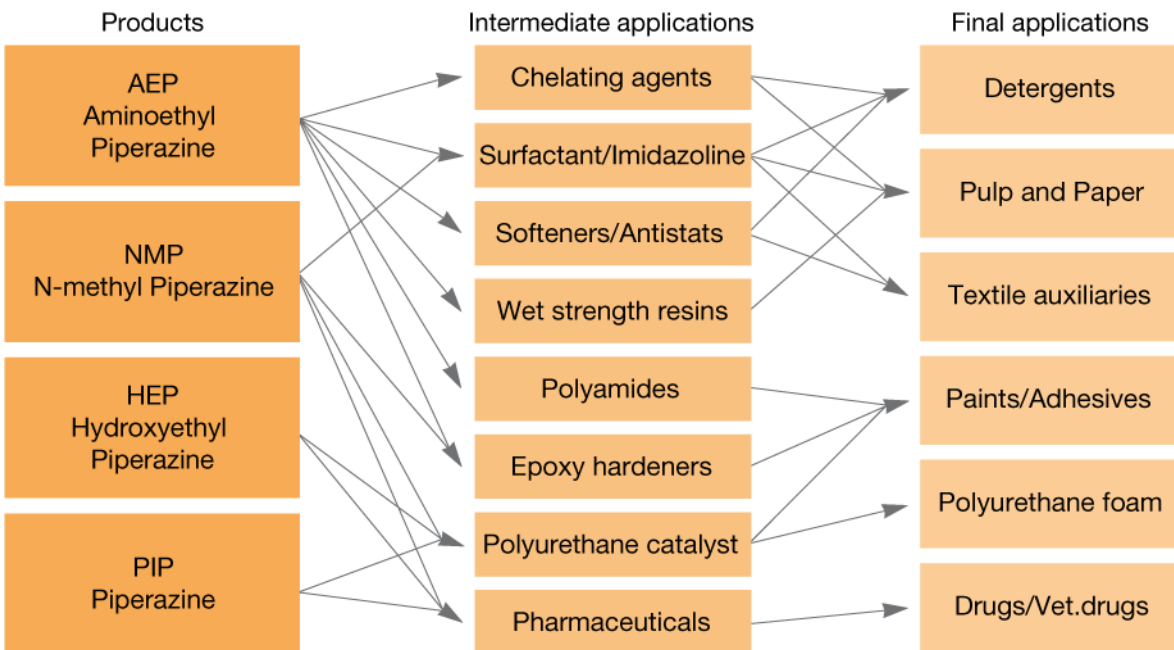
Figure 25. Intermediate and final applications of the ethylene amines (AEP, NMP, HEP and PIP) produced at AkzoNobel Site Stenungsund. (The figure is adapted from AkzoNobel, 2008a)
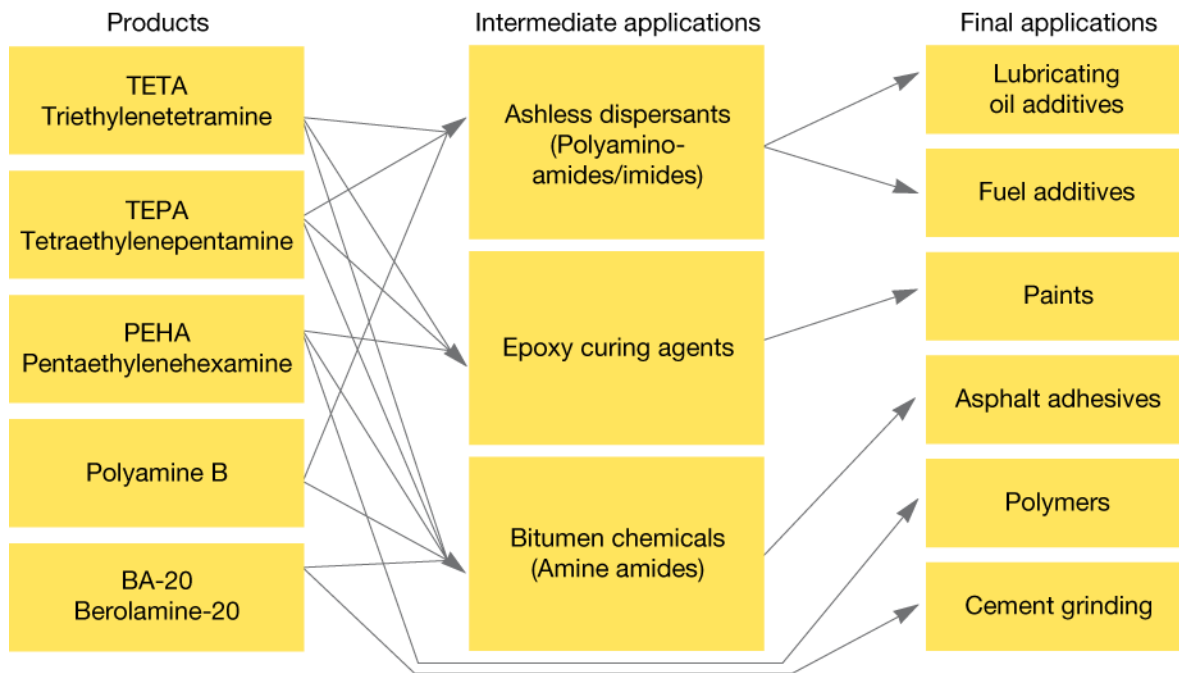
Figure 26. Intermediate and final applications of the ethylene amines (TETA, TEPA, PEHA, polyamine B and BA-20) produced at AkzoNobel Site Stenungsund. (The figure is adapted from AkzoNobel, 2008a)

Appendix 2 - The ethylene oxide plant and the amines plant
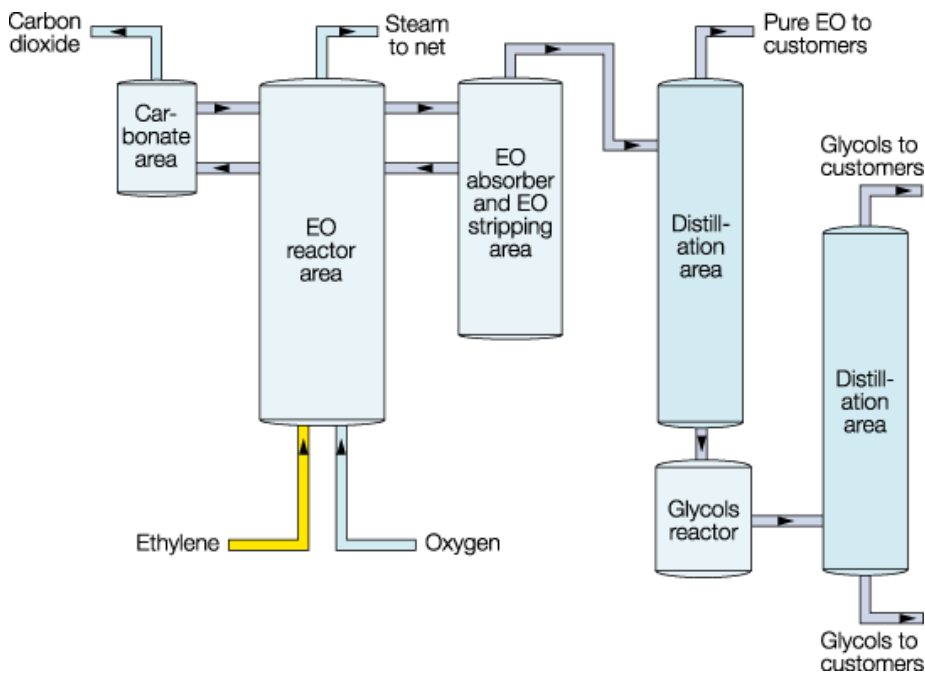
Figure 27. A schematic view of the ethylene oxide plant. (The figure is adapted from AkzoNobel, 2008b)
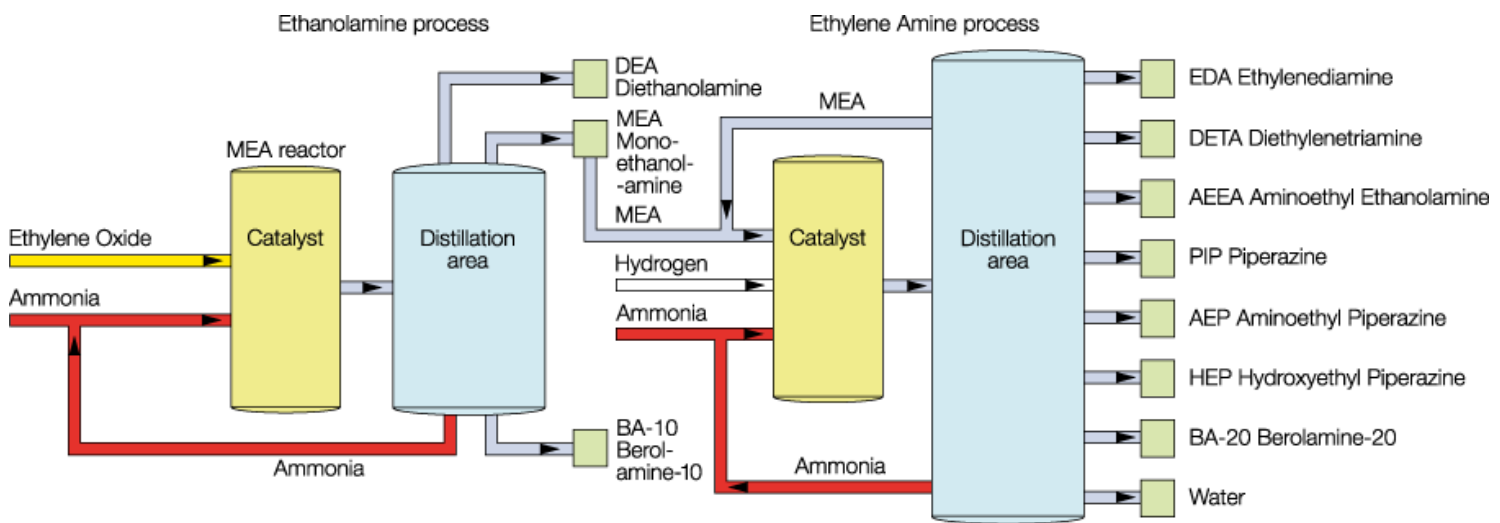
Figure 28. A schematic view of the amines plant. (The figure is adapted from AkzoNobel, 2008b)

Appendix 3 – The Surface Chemistry plant
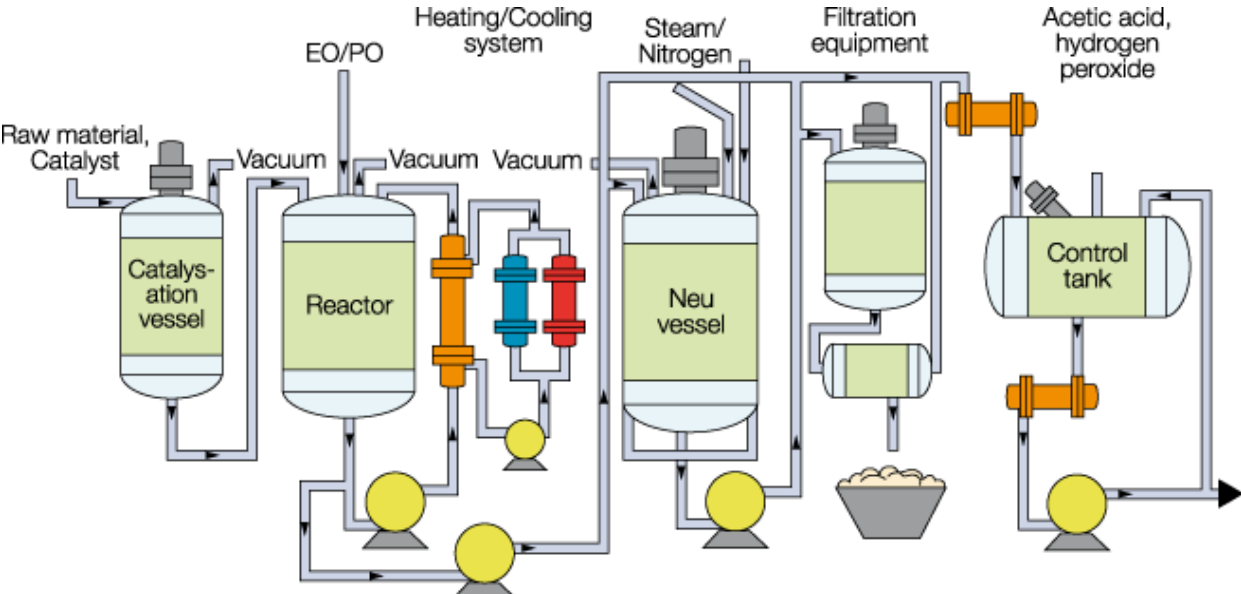
Figure 29. A schematic view of the Surface Chemistry plant. (The figure is adapted from AkzoNobel, 2008b)

Appendix 4 – Questionnaires

Table 12. List over the questionnaires that were reviewed as a part of the literature review.

Questionnaire	Reference
NOSACQ-50	(NOSACQ-50, 2010)
LINS questionnaire	(LINS, 2011)
ARAMIS questionnaire	(ARAMIS)
Aberdeen University Offshore Safety Questionnaire (OSQ99)	(HSE, 2005, table 3)
HSE Health and Safety Climate Survey Tool (CST)	(HSE, 2005, table 3)
Occupational Psychology Centre Safety Culture Questionnaire (SafeCQ)	(HSE, 2005, table 3)
Quest Evaluations and Databases Ltd Safety Climate Questionnaire (QSCQ)	(HSE, 2005, table 3)
Rail Safety and Standards Board (RSSB) Safety Culture Tool	(HSE, 2005, table 3)
Robert Gordon University Computerised Safety Climate Questionnaire (CSCQ)	(HSE, 2005, table 3)
The Loughborough University Safety Climate Assessment Toolkit (LSCAT)	(HSE, 2005, table 3)
Serco Assurance Safety Culture Assessment Tool	(HSE, 2005, table 3)
Zohar (1980) - 40, questionnaire is administered during interview	(Zohar, 1980)
Glennon (1982a,b) - 68, self-administered questionnaire (SAQ)	(Guldenmund, 2010, table 4)
Brown and Holmes (1986) - 40, SAQ	(Guldenmund, 2010, table 4)
Cox and Cox (1991) - 18 (+ 4), SAQ	(Guldenmund, 2010, table 4)
DeDobbeleer and BeÂland (1991) - 9, SAQ	(Guldenmund, 2010, table 4)
Ostrom et al. (1993) - 88, SAQ	(Guldenmund, 2010, table 4)
Safety Research Unit (1993) - 65, SAQ	(Guldenmund, 2010, table 4)
Cooper and Philips (1994) - 50, SAQ	(Guldenmund, 2010, table 4)
Niskanen (1994) - 22 (workers) and 21 (supervisors), SAQ	(Guldenmund, 2010, table 4)
Geller (1994)	(Guldenmund, 2010, table 4)
Coyle et al. (1995) - 30 (organisation 1) and 32 (organisation 2)	(Guldenmund, 2010, table 4)
Berends (1996) - 34, SAQ	(Guldenmund, 2010, table 4)
Lee (1996) - 172, SAQ	(Guldenmund, 2010, table 4)
Cabrera et al. (1997) - 69, SAQ	(Guldenmund, 2010, table 4)
Williamson et al. (1997) - 67, SAQ	(Guldenmund, 2010, table 4)

Appendix 5 – English version of NOSACQ-50

Nordic occupational safety climate questionnaire

Project leader and contact person: Maria Bergh
Chalmers University of Technology, Gothenburg

Phone number: 0303-85305/076-XXXXXXX

The purpose of this questionnaire is to get your view on safety at this workplace. Your answers will be processed on a computer and will be handled confidentially. No individual results will be presented in any way. Although I want you to answer each and every question, you have the right to refrain from answering any particular question, a group of questions, or the entire questionnaire.

I have read the above introduction to the questionnaire and agree to complete the questionnaire under the stated conditions.	☐ Yes

Information

Please read the information before filling in the questionnaire.

My name is Maria Bergh and I am a student from Chalmers University of Technology in Gothenburg. I am doing my master thesis at the HSE&S department at Site Stenungsund. The purpose of this work is to identify the level of safety climate that exists at AkzoNobel Site Stenungsund. 'Safety Climate' is a measure of your and your colleagues shared perceptions of how safety at your workplace is dealt with on a daily basis - both by the management and by you and your colleagues. This study aims at identifying similarities and differences in the safety climate in different parts of the organisation. The goal with this work is that its results will contribute to an improved safety climate and an increased awareness of safety at Site Stenungsund.

Everyone working for AkzoNobel at Site Stenungsund is being asked to fill in the questionnaire. The participation is voluntary, but the higher participation rates, the more accurate will the results be. All participants will fill in the questionnaire anonymously. The results will be presented in such a way that no single employee can be identified. The report will be produced in two versions, one confidential for AkzoNobel employees only and one public report for Chalmers University of Technology.

Below you can find information on how to register your answers. Keep in mind that some items are asked in a positive, respectively negative way so please read the questions carefully before answering them. Although some questions may appear very similar, please answer each one of them. If you have any questions please contact me at phone number: 0303-85305 or 076-XXXXXXX.

Please return the questionnaire to me in a sealed envelope, <u>before</u> **18/3.** You can return it to me personally, send it through the inter-office mail or to the following address:

AkzoNobel, Functional Chemicals AB
Entréhuset Site, Maria Bergh
Uddevallavägen 17
SE-44485 Stenungsund

Examples of how to register your answers

		Strongly disagree	Disagree	Agree	Strongly agree	
		Put only one X for each question				
i	Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight	☐	☐	☒	☐	Correctly marked
ii	We who work here break safety rules in order to complete work on time	▓	☐	☐	☒	Corrected marking

If you put an X in a wrong box, fill in the whole box and put a new X in the correct box

Background information

A   **Year of birth?** 19 __ __

B   **Are you:**   [ ] Male   [ ] Female

C   **Do you have a managerial position, e.g. manager, supervisor?**
[ ] No   [ ] Yes

D   **Which of the companies below do you work for?**
[ ] Surface Chemistry   [ ] Functional Chemicals

E   **Who is your closest manager/supervisor?**

Functional Chemicals

[ ] Manufacturing Manager

[ ] Site Manager

[ ] Site Plant Manager

[ ] Process Manager

[ ] Loading Manager

[ ] Maintenance Leader

[ ] Project & Technology Manager

[ ] Purchasing Manager

[ ] HSE Manager

[ ] Quality & Env. Lab. Manager

[ ] Facility Manager

[ ] Production Manager

[ ] Shift supervisor: A-shift

[ ] Shift supervisor: B-shift

[ ] Shift supervisor: C-shift

[ ] Shift supervisor: D-shift

[ ] Shift supervisor: E-shift

[ ] Other manager/supervisor

Surface Chemistry

[ ] Plant Manager

[ ] PQC Manager

[ ] Project & Technology Manager

[ ] Logistics Manager

[ ] HSE Manager

[ ] Production Manager

[ ] Supervisors Production

[ ] Other manager/supervisor

F   **Where at the site are you located?**
[ ] Amine building   [ ] ”Derivaten”

[ ] Entrance building/Fire station   [ ] “Gula villan”

[ ] Maintenance building   [ ] Other building at the site

[ ] ”Piloten”   [ ] I am not located at the site.

[ ] Amine/EO Control room

[ ] EMU/STF/Loading department belonging to Surface Chemistry

G   **Do you work on a shift?**
[ ] No   [ ] Yes, B-shift   [ ] Yes, D-shift

[ ] Yes, A-shift   [ ] Yes, C-shift   [ ] Yes, E-shift

H   **How long have you been working at AkzoNobel Site Stenungsund?**
[ ] Less than 1 year   [ ] 6-10 years   [ ] 16-20 years

[ ] 1-5 years [ ] 11-15 years   [ ] More than 20 years

I   **How long have you been working in your current position?**
[ ] Less than 1 year   [ ] 6-10 years   [ ] 16-20 years

[ ] 1-5 years [ ] 11-15 years   [ ] More than 20 years

J   **How many other workplaces have you had other than the ones at AkzoNobel Site Stenungsund?**
[ ] 0   [ ] 1-2   [ ] 3-5   [ ] 6-10   [ ] More than 10

K   **Have you heard of the term ”safety culture” before?**
[ ] No   [ ] Yes

L   **Do you know what ”safety culture” is?**
[ ] No   [ ] Yes

If 'Yes', please describe your understanding of what safety culture is here:

_____

_____

_____

_____

In the following section please describe how you perceive that the managers and supervisors at this workplace handle safety. Although some questions may appear very similar, please answer each one of them.

	Strongly disagree	Disagree	Agree	Strongly agree
	Put only one X for each question			
1. Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight	☐	☐	☐	☐
2. Management ensures that everyone receives the necessary information on safety	☐	☐	☐	☐
3. Management looks the other way when someone is careless with safety	☐	☐	☐	☐
4. Management places safety before production	☐	☐	☐	☐
5. Management accepts employees here taking risks when the work schedule is tight	☐	☐	☐	☐
6. We who work here have confidence in the management's ability to handle safety	☐	☐	☐	☐
7. Management ensures that safety problems discovered during safety rounds/evaluations are corrected immediately	☐	☐	☐	☐
8. When a risk is detected, management ignores it without action	☐	☐	☐	☐
9. Management lacks the ability to handle safety properly	☐	☐	☐	☐

Although some questions may appear very similar, please answer each one of them

	Strongly disagree	Disagree	Agree	Strongly agree
	Put only one X for each question			
10. Management strives to design safety routines that are meaningful and actually work	☐	☐	☐	☐
11. Management makes sure that each and everyone can influence safety in their work	☐	☐	☐	☐
12. Management encourages employees here to participate in decisions which affect their safety	☐	☐	☐	☐
13. Management never considers employees' suggestions regarding safety	☐	☐	☐	☐
14. Management strives for everybody at the worksite to have high competence concerning safety and risks	☐	☐	☐	☐
15. Management never asks employees for their opinions before making decisions regarding safety	☐	☐	☐	☐
16. Management involves employees in decisions regarding safety	☐	☐	☐	☐
17. Management collects accurate information in accident investigations	☐	☐	☐	☐
18. Fear of sanctions (negative consequences) from management discourages employees here from reporting near-miss accidents	☐	☐	☐	☐
19. Management listens carefully to all who have been involved in an accident event	☐	☐	☐	☐

Although some questions may appear very similar, please answer each one of them

		Strongly disagree	Disagree	Agree	Strongly agree
		Put only one X for each question			
20.	Management looks for causes, not guilty persons, when an accident occurs	☐	☐	☐	☐
21.	Management always blames employees for accidents	☐	☐	☐	☐
22.	Management treats employees involved in an accident fairly	☐	☐	☐	☐

In the following section please describe how you perceive that employees at this workplace handle safety

		Strongly disagree	Disagree	Agree	Strongly agree
23.	We who work here try hard together to achieve a high level of safety	☐	☐	☐	☐
24.	We who work here take joint responsibility to ensure that the workplace is always kept tidy	☐	☐	☐	☐
25.	We who work here do not care about each others' safety	☐	☐	☐	☐
26.	We who work here avoid tackling risks that are discovered	☐	☐	☐	☐
27.	We who work here help each other to work safely	☐	☐	☐	☐
28.	We who work here take no responsibility for each others' safety	☐	☐	☐	☐

Although some questions may appear very similar, please answer each one of them

	Strongly disagree	Disagree	Agree	Strongly agree
	Put only one X for each question			
29. We who work here regard risks as unavoidable	☐	☐	☐	☐
30. We who work here consider minor accidents as a normal part of our daily work	☐	☐	☐	☐
31. We who work here accept dangerous behaviour as long as there are no accidents	☐	☐	☐	☐
32. We who work here break safety rules in order to complete work on time	☐	☐	☐	☐
33. We who work here never accept risk-taking even if the work schedule is tight	☐	☐	☐	☐
34. We who work here consider that our work is unsuitable for cowards	☐	☐	☐	☐
35. We who work here accept risk-taking at work	☐	☐	☐	☐
36. We who work here try to find a solution if someone points out a safety problem	☐	☐	☐	☐
37. We who work here feel safe when working together	☐	☐	☐	☐
38. We who work here have great trust in each others' ability to ensure safety	☐	☐	☐	☐

Although some questions may appear very similar, please answer each one of them

	Strongly disagree	Disagree	Agree	Strongly agree
	Put only one X for each question			
39. We who work here learn from our experiences to prevent accidents	☐	☐	☐	☐
40. We who work here take each others' opinions and suggestions concerning safety seriously	☐	☐	☐	☐
41. We who work here seldom talk about safety	☐	☐	☐	☐
42. We who work here always discuss safety issues when such issues come up	☐	☐	☐	☐
43. We who work here can talk freely and openly about safety	☐	☐	☐	☐
44. We who work here consider that a good safety representative plays an important role in preventing accidents	☐	☐	☐	☐
45. We who work here consider that safety rounds/evaluations have no effect on safety	☐	☐	☐	☐
46. We who work here consider that safety training is good for preventing accidents	☐	☐	☐	☐
47. We who work here consider early planning for safety as meaningless	☐	☐	☐	☐
48. We who work here consider that safety rounds/evaluations help find serious hazards	☐	☐	☐	☐
49. We who work here consider that safety training is meaningless	☐	☐	☐	☐
50. We who work here consider that it is important that there are clear-cut goals for safety	☐	☐	☐	☐

If you wish to elaborate on some of your answers, or if you have any comments regarding the study, you are welcome to write them here.

Comments:

_____

_____

_____

_____

_____

_____

_____

Thank you for filling in the questionnaire. Please ensure you have checked off the box on the front page showing that you have given your informed consent to participate in the study.

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IRIS

International Research Institute of Stavanger

Työterveyslaitos

Nordic Council of Ministers

Appendix 6 – Swedish version of NOSACQ-50

NOSACQ-50
Swedish

Frågeformulär om säkerhetsklimat på arbetsplatsen

Projektledare och kontaktperson: Maria Bergh
Chalmers tekniska högskola, Göteborg

Telefonnummer: 0303-85305/076-XXXXXXX

Syftet med detta frågeformulär är att få din uppfattning om säkerheten på den här arbetsplatsen. Dina svar kommer att bearbetas med hjälp av dator och kommer att behandlas konfidentiellt. Inga resultat avseende enskilda personer kommer att presenteras. Även om jag önskar att du besvarar varje fråga så har du rätt att avstå från att besvara såväl vissa frågor som grupper av frågor eller hela frågeformuläret.

| Jag har läst inledningen till frågeformuläret och samtycker till att fylla i formuläret enligt de förutsättningar som beskrivs. | ☐ Ja |

Frågeformuläret är utvecklat av en nordisk arbetsgrupp av arbetsmiljöforskare, med finansiellt stöd från Nordiska Ministerrådet.

Var god läs informationen innan du fyller i frågeformuläret.

Jag heter Maria Bergh och studerar vid Chalmers tekniska högskola i Göteborg. Jag gör mitt examensarbete för HSE&S avdelningen på Site Stenungsund. Syftet med arbetet är att identifiera vilken nivå av säkerhetsklimat som existerar på AkzoNobel Site Stenungsund. 'Säkerhetsklimat' är ett mått på din och dina kollegors gemensamma uppfattning av hur säkerheten på er arbetsplats behandlas dagligen - både av ledning och av dig och dina kollegor. Arbetet syftar även till att identifiera likheter och skillnader i säkerhetsklimatet i olika delar av företaget. Målet med arbetet är att dess resultat kommer att bidra till ett förbättrat säkerhetsklimat och en ökad medvetenhet kring säkerhet inom Site stenungsund.

Alla som är anställda av AkzoNobel och arbetar inom Site Stenungsund ombeds att svara på frågefomuläret. Alla deltagare kommer att fylla i frågeformuläret anonymnt. Resultatet kommer att presenteras så att inga enskilda personer kan komma att identifieras. Rapporten kommer att produceras i två versioner, en konfidentiell för enbart anställda inom AkzoNobel och en publik för Chalmers tekniska högskola.

Nedan hittar du information om hur du anger dina svar. Kom ihåg att vissa frågor är av positiv, respektive negativ karaktär så var noga med att läsa frågorna noggrant innan du svarar på dem. Var god att svara på var och en av frågorna även om några av dem kan verka mycket lika. Om du har några frågor är du välkommen att kontakta mig på telefonnummer: 0303-85305 eller 076-XXXXXXX.

Var god returnera frågeformuläret i förslutet kuvert till mig innan den **18/3**. Du kan lämna det till mig personligen, skicka det via internposten eller till följande adress:

AkzoNobel, Functional Chemicals AB
Entréhuset Site, Maria Bergh
Uddevallavägen 17
SE-44485 Stenungsund

Exempel på hur du anger dina svar

Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt	
Sätt endast ett X för varje fråga				

i   Ledningen uppmuntrar medarbetarna här att arbeta enligt säkerhetsreglerna - också när tidsschemat är pressat
☐ ☐ ☒ ☐   Korrekt ifylld

ii   Vi som arbetar här överträder säkerhetsregler för att få arbetet färdigt i tid
▓ ☐ ☐ ☒   Korrigerad markering

Om du satt ett X i fel ruta, fyll hela rutan och sätt ett nytt X i rätt ruta

Bakgrundsinformation

A   **Födesleår?** 19 __ __

B   **Är du:**   [ ] Man   [ ] Kvinna

C   **Har du en arbetsledande befattning, t. ex. chef, arbetsledare?**
[ ] Nej   [ ] Ja

D   **Vilket av nedanstående företag arbetar du för?**
[ ] Surface Chemistry   [ ] Functional Chemicals

E   **Vem är din närmsta chef av förljande alternativ?**

Functional Chemicals

[ ] Manufacturing Manager	[ ] Quality & Env. Lab. Manager
[ ] Site Manager	[ ] Facility Manager
[ ] Site Plant Manager	[ ] Production Manager
[ ] Process Manager	[ ] Shift supervisor: A-shift
[ ] Loading Manager	[ ] Shift supervisor: B-shift
[ ] Maintenance Leader	[ ] Shift supervisor: C-shift
[ ] Project & Technology Manager	[ ] Shift supervisor: D-shift
[ ] Purchasing Manager	[ ] Shift supervisor: E-shift
[ ] HSE Manager	[ ] Annan chef

Surface Chemistry

[ ] Plant Manager	[ ] HSE Manager
[ ] PQC Manager	[ ] Production Manager
[ ] Project & Technology Manager	[ ] Supervisors Production
[ ] Logistics Manager	[ ] Annan chef

F   **I vilken byggnad på siten har du din arbetsplats?**
[ ] Entrehuset/Bradstation   [ ] Derivaten

[ ] Underhållsbyggnaden   [ ] Gula villan

[ ] Piloten   [ ] Annan byggnad på siten

[ ] Amin/EO Kontrollrum   [ ] Jag har inte min
                                               arbetsplats på siten

[ ] Aminhuset

[ ] EMU/STF/Utlastningen tillhörande Surface Chemistry

G   **Arbetar du skift?**
[ ] Nej   [ ] Ja, B-skiftet   [ ] Ja, D-skiftet

[ ] Ja, A-skiftet   [ ] Ja, C-skiftet   [ ] Ja, E-skiftet

H   **Hur länge har du arbetat för AkzoNobel Site Stenungsund?**
[ ] Mindre än 1 år   [ ] 6-10 år   [ ] 16-20 år

[ ] 1-5 år   [ ] 11-15 år   [ ] Mer än 20 år

I   **Hur länge har du haft din nuvarande tjänst?**
[ ] Mindre än 1 år   [ ] 6-10 år   [ ] 16-20 år

[ ] 1-5 år   [ ] 11-15 år   [ ] Mer än 20 år

J   **Hur många andra arbetsplatser har du haft förutom de på AkzoNobel Site Stenungsund?**
[ ] 0   [ ] 1-2   [ ] 3-5   [ ] 6-10   [ ] fler än 10

K   **Har du hört uttrycket "säkerhetskultur" tidigare?**

[ ] Nej   [ ] Ja

L   **Vet du vad "säkerhetskultur" är?**

[ ] Nej   [ ] Ja

Om 'Ja', beskriva vad säkerhetskultur är för dig:

_____

_____

_____

_____

I följande avsnitt anger du hur du uppfattar att chefer och arbetsledare på den här arbetsplatsen hanterar säkerhet. Var god att svara på var och en av frågorna även om några av dem kan verka mycket lika.

	Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt
	Sätt endast ett X för varje fråga			
1. Ledningen uppmuntrar medarbetarna här att arbeta enligt säkerhetsreglerna - också när tidsschemat är pressat	☐	☐	☐	☐
2. Ledningen ser till att alla får den nödvändiga informationen om säkerhet	☐	☐	☐	☐
3. Ledningen ser åt ett annat håll när någon slarvar med säkerheten	☐	☐	☐	☐
4. Ledningen sätter säkerhet före produktion	☐	☐	☐	☐
5. Ledningen accepterar att medarbetarna här tar risker i arbetet när tidsschemat är pressat	☐	☐	☐	☐
6. Vi som arbetar här har förtroende för ledningens förmåga att hantera säkerhet	☐	☐	☐	☐
7. Ledningen ser till att säkerhetsproblem som upptäcks vid inspektioner korrigeras omedelbart	☐	☐	☐	☐
8. När en risk upptäcks ignoreras den av ledningen	☐	☐	☐	☐
9. Ledningen saknar förmåga att hantera säkerheten på ett bra sätt	☐	☐	☐	☐

Var god att svara på var och en av frågorna även om några av dem kan verka mycket lika

	Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt
	Sätt endast ett X för varje fråga			

10. Ledningen försöker utforma säkerhetsrutiner som är meningsfulla och som verkligen fungerar ☐ ☐ ☐ ☐

11. Ledningen ser till att var och en kan påverka säkerheten i sitt arbete ☐ ☐ ☐ ☐

12. Ledningen uppmuntrar medarbetarna här att delta i beslut som påverkar deras säkerhet ☐ ☐ ☐ ☐

13. Ledningen tar aldrig hänsyn till medarbetarnas förslag rörande säkerhet här ☐ ☐ ☐ ☐

14. Ledningen eftersträvar att alla på arbetsplatsen ska ha hög kompetens om säkerhet och risker ☐ ☐ ☐ ☐

15. Ledningen frågar aldrig efter medarbetarnas åsikter innan den fattar beslut som rör säkerhet ☐ ☐ ☐ ☐

16. Ledningen gör medarbetarna här delaktiga i beslut som rör säkerhet ☐ ☐ ☐ ☐

17. Ledningen samlar in tillförlitlig information vid utredning av olyckor ☐ ☐ ☐ ☐

18. Rädsla för negativa konsekvenser från ledningen avskräcker medarbetarna här från att rapportera olyckstillbud ☐ ☐ ☐ ☐

19. Ledningen lyssnar noga på alla som har varit inblandade i en olyckshändelse ☐ ☐ ☐ ☐

Var god att svara på var och en av frågorna även om några av dem kan verka mycket lika

	Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt
	Sätt endast ett X för varje fråga			
20. Ledningen söker orsaker, inte skyldiga personer, när en olycka inträffar	☐	☐	☐	☐
21. Ledningen lägger alltid skulden för olyckor på de anställda	☐	☐	☐	☐
22. Ledningen behandlar medarbetare som är inblandade i en olycka här rättvist	☐	☐	☐	☐

I följande avsnitt anger du hur du uppfattar att personalen på den här arbetsplatsen hanterar säkerhet

	Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt
23. Vi som arbetar här anstränger oss verkligen tillsammans för att uppnå en hög säkerhetsnivå	☐	☐	☐	☐
24. Vi som arbetar här tar gemensamt ansvar för att det alltid är ordning och reda på arbetsplatsen	☐	☐	☐	☐
25. Vi som arbetar här bryr oss inte om varandras säkerhet	☐	☐	☐	☐
26. Vi som arbetar här undviker att ta itu med risker som upptäcks	☐	☐	☐	☐
27. Vi som arbetar här hjälper varandra att arbeta säkert	☐	☐	☐	☐
28. Vi som arbetar här tar inget ansvar för varandras säkerhet	☐	☐	☐	☐

Var god att svara på var och en av frågorna även om några av dem kan verka mycket lika

	Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt
	Sätt endast ett X för varje fråga			
29. Vi som arbetar här ser risker som oundvikliga	☐	☐	☐	☐
30. Vi som arbetar här anser att mindre olyckor är en normal del av det dagliga arbetet	☐	☐	☐	☐
31. Vi som arbetar här accepterar riskfyllt beteende, så länge inga olyckor sker	☐	☐	☐	☐
32. Vi som arbetar här överträder säkerhetsregler för att få arbetet färdigt i tid	☐	☐	☐	☐
33. Vi som arbetar här accepterar aldrig risktagande ens när tidsschemat är pressat	☐	☐	☐	☐
34. Vi som arbetar här anser att vårt arbete är olämpligt för "fegisar"	☐	☐	☐	☐
35. Vi som arbetar här accepterar att våra arbetskamrater tar risker i arbetet	☐	☐	☐	☐
36. Vi som arbetar här försöker finna en lösning om någon påpekar ett säkerhetsproblem	☐	☐	☐	☐
37. Vi som arbetar här känner oss säkra när vi arbetar tillsammans	☐	☐	☐	☐
38. Vi som arbetar här har stor tilltro till varandras förmåga att tillförsäkra säkerhet	☐	☐	☐	☐

Var god att svara på var och en av frågorna även om några av dem kan verka mycket lika

	Stämmer inte alls	Stämmer inte så bra	Stämmer delvis	Stämmer helt
	Sätt endast ett X för varje fråga			
39. Vi som arbetar här lär av våra erfarenheter för att förebygga olyckor	☐	☐	☐	☐
40. Vi som arbetar här tar varandras synpunkter och förslag rörande säkerhet på allvar	☐	☐	☐	☐
41. Vi som arbetar här talar sällan om säkerhet	☐	☐	☐	☐
42. Vi som arbetar här diskuterar alltid säkerhetsfrågor när sådana frågor dyker upp	☐	☐	☐	☐
43. Vi som arbetar här kan tala fritt och öppet om säkerhet	☐	☐	☐	☐
44. Vi som arbetar här anser att ett bra skyddsombud spelar en viktig roll för att förebygga olyckor	☐	☐	☐	☐
45. Vi som arbetar här anser att skyddsronder inte påverkar säkerheten	☐	☐	☐	☐
46. Vi som arbetar här anser att säkerhetsutbildning är bra för att förebygga olyckor	☐	☐	☐	☐
47. Vi som arbetar här anser att säkerhetshänsyn på ett tidigt stadium i planeringen är meningslös	☐	☐	☐	☐
48. Vi som arbetar här anser att skyddsronder hjälper till att upptäcka allvarliga risker	☐	☐	☐	☐
49. Vi som arbetar här anser att säkerhetsutbildning är meningslös	☐	☐	☐	☐
50. Vi som arbetar här anser det viktigt att det finns tydliga säkerhetsmål	☐	☐	☐	☐

Om du önskar utveckla några av dina svar, eller om du har kommentarer beträffande studien, ber jag dig skriva dem här.

Kommentarer:

_____

_____

_____

_____

_____

_____

_____

**Tack för att du fyllt i formuläret.
Var vänlig kontrollera att du kryssat i rutan på första sidan som anger att du mottagit informationen och accepterar att delta i studien.**

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Nordiska ministerrådet

Appendix 7 – Items from NOSACQ-50

Table 13. The positively and reversed formulated items of NOSACQ-50. (The table is adapted from Analysing NOSACQ-50 data, 2010)

Dimension	Positively formulated items[1]	Reversed formulated items[1]
1. Management safety priority and ability (9 items)	A1, A2, A4, A6, A7	A3, A5, A8, A9
2. Management safety empowerment (7 items)	A10, A11, A12, A14, A16	A13, A15
3. Management safety justice (6 items)	A17, A19, A20, A22	A18, A21
4. Workers' safety commitment (6 items)	A23, A24, A27	A25, A26, A28
5. Workers' safety priority and risk non-acceptance (7 items)	A33	A29, A30, A31, A32, A34, A35
6. Peer safety communication learning and trust in safety ability (8 items)	A36, A37, A38, A39, A40, A42, A43	A41
7. Workers' trust in efficiency of safety systems (7 items)	A44, A46, A48, A50	A45, A47, A49

[1] A=answer to an item, e.g. A10 is the answer to item 10.

Appendix 8 – An English version of the revised background questions

A **Year of birth?** *(Question A has been modified.)*

[ ] 1940-59   [ ] 1960-79   [ ] 1980-95

B **Are you:**

[ ] Male   [ ] Female

C **Do you have a managerial position, e.g. manager, supervisor?**

[ ] No   [ ] Yes

D **Which of the companies below do you work for?**

[ ] Surface Chemistry   [ ] Functional Chemicals

E **Who is your closest manager/supervisor?** *(Question E has been modified.)*

Functional Chemicals
[ ] Shift Supervisor   [ ] Other manager/supervisor

Surface Chemistry
[ ] Supervisors Production   [ ] Other manager/supervisor

F ***Question F has been excluded.***

G **Do you work on a shift?** *(Question G has been modified.)*

[ ] No   [ ] Yes

H **How long have you been working at AkzoNobel Site Stenungsund?**
(Question H has been modified.)

[ ] 0-5 years   [ ] 6-15 years   [ ] More than 16 years

I **How long have you been working in your current position?**
(Question I has been modified.)

[ ] Less than 1 year   [ ] 6-10 years

[ ] 1-5 years   [ ] More than 10 years

J   **How many other workplaces have you had other than the ones at AkzoNobel Site Stenungsund?** *(Question J has been modified.)*

[ ] 0   [ ] 1-2   [ ] 3-5   [ ] More than 6

K   **Have you heard of the term "safety culture" before?**

[ ] No   [ ] Yes

L   **Do you know what "safety culture" is?**

[ ] No   [ ] Yes

If 'Yes', please describe your understanding of what safety culture is here:

_____

_____

_____

_____

_____

_____

_____

Appendix 9 – A Swedish version of the revised background questions

A   **Födelseår?** *(Fråga A har modifierats.)*

[ ] 1940-59 [ ] 1960-79 [ ] 1980-95

B   **Är du:**

[ ] Man   [ ] Kvinna

C   **Har du du en arbetsledande befattning, t. ex. chef, arbetsledare?**

[ ] Nej   [ ] Ja

D   **Vilket av nedanstående företag arbetar du för?**

[ ] Surface Chemistry   [ ] Functional Chemicals

E   **Vem är din närmsta chef av förljande alternativ?** *(Fråga E har modifierats.)*

Functional Chemicals
[ ] Shift Supervisor   [ ] Annan manager/supervisor

Surface Chemistry
[ ] Supervisors Production   [ ] Annan manager/supervisor

F   ***Fråga F har exkluderats.***

G   **Arbetar du skift?** *(Fråga G har modifierats.)*

[ ] Nej   [ ] Ja

H   **Hur länge har du arbetat för AkzoNobel Site Stenungsund?**
           (Fråga H har modifierats.)

[ ] 0-5 år   [ ] 6-15 år   [ ] Mer än 16 år

I   **Hur länge har du haft din nuvarande tjänst?**
           (Question I has been modified.)

[ ] Mindre än 1år   [ ] 6-10 år

[ ] 1-5 år   [ ] Mer än 10 år

J   **Hur många andra arbetsplatser har du haft förutom de på AkzoNobel Site Stenungsund?** *(Fråga J har modifierats.)*

[ ] 0   [ ] 1-2   [ ] 3-5   [ ] Fler än 6

K   **Har du hört uttrycket "säkerhetskultur" tidigare?**

[ ] Nej   [ ] Ja

L   **Vet du vad "säkerhetskultur" är?**

[ ] Nej   [ ] Ja

Om 'Ja', beskriva vad säkerhetskultur är för dig:

_____

_____

_____

_____

_____

_____

_____

Appendix 10 – English version of the interview questions

Introduction

- The aim with the interview is to get a deeper understanding of the results from the questionnaire survey.

- The questions will concern your and your colleagues' common perceptions.

- The questions will concern the following topics:

  1. **Management safety priority and ability**

  2. **Management safety empowerment**

  3. **Management safety justice**

  4. **Workers' safety commitment**

  5. **Workers' safety priority and risk non-acceptance**

  6. **Peer safety communication learning and trust in safety ability**

  7. **Workers' trust in efficiency of safety systems**

  8. **How the questionnaire was perceived**

- You can reject to answer all questions.

- The results will be presented in such a way that no individual may be identified.

- All material that has been collected through interviews, questionnaires or in any other way will be kept locked up until the report has been published.

- All material that has been collected through interviews, questionnaires or in any other way will be destroyed when the report has been published.

Interview questions
Questions on a management level:

Question 1: Which management did you refer to when you answered the questionnaire?

2. **Management safety priority and ability**
   Question 2: Safety priority (based on item: 1.1, 1.4, 1.5)
   Can you give examples of how the management balances between production and safety?

Question 3: Safety ability (based on item:1.2, 1.3, 1.6, 1.7, 1.8, 1.9)
Can you give examples of management's ability to manage safety?

1.1. Management encourages employees here to work in accordance with safety rules – even when the work schedule is tight
1.2. Management ensures that everyone receives the necessary information on safety
1.3. Management looks the other way when someone is careless with safety
1.4. Management places safety before production
1.5. Management accepts employees here taking risks when the work schedule is tight
1.6. We who work here have confidence in the management's ability to handle safety
1.7. Management ensures that safety problems discovered during safety rounds/evaluations are corrected immediately
1.8. When a risk is detected, management ignores it without action
1.9. Management lacks the ability to handle safety properly

3. **Management safety empowerment**
   Question 4: Participation in decisions (based on item: 2.3, 2.4, 2.6, 2,7)
   Can you give examples of employee participation in safety-related decisions?

   Question 5: Managements enabling (based on item: 2.1, 2.2, 2.5)
   Can you give examples of how management enables the employees to work safely?

3.1. Management strives to design safety routines that are meaningful and actually work
3.2. Management makes sure that each and everyone can influence safety in their work
3.3. Management encourages employees here to participate in decisions which affect their safety
3.4. Management never consider employees' suggestions regarding safety
3.5. Management strives for everybody at the worksite to have high competence concerning safety and risks
3.6. Management never asks employees for their opinions before making decisions regarding safety
3.7. Management involves employees in decisions regarding safety

4. Management safety justice
   Question 6: Collection of information (based on item: 3.1, 3.3)
   Can you give examples of how management collects information after an accident?

   Question 7: Justice and consequences (based on item: 3.2, 3.4, 3.5, 3.6)
   Can you give examples of management consequences after an accident?

4.1. Management collects accurate information in accident investigations
4.2. Fear of sanctions (negative consequences) from management discourages employees here from reporting near-miss accidents
4.3. Management listens carefully to all who have been involved in an accident event
4.4. Management looks for causes, not guilty persons, when an accident occurs
4.5. Management always blames employees for accidents
4.6. Management treats employees involved in an accident fairly

Questions on a workers level:

5. Workers' safety commitment
Question 8: Safety commitment (based on item: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6)
Can you give examples of your colleagues' safety commitment?

5.1. We who work here try hard together to achieve a high level of safety
5.2. We who work here take joint responsibility to ensure that the workplace is always kept tidy
5.3. We who work here do not care about each others'
5.4. We who work here avoid tackling risks that are discovered
5.5. We who work here help each other to work safely
5.6. We who work here take no responsibility for each others' safety

6. Workers' safety priority and risk non-acceptance
   Question 9: Safety priority (based on item: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)
   Can you give examples of how your colleagues balance between production and safety?

6.1. We who work here regard risks as unavoidable
6.2. We who work here consider minor accidents as a normal part of our daily work
6.3. We who work here accept dangerous behaviour as long as there are no accidents
6.4. We who work here break safety rules in order to complete work on time
6.5. We who work here never accept risk-taking even if the work schedule is tight
6.6. We who work here consider that our work is unsuitable for cowards
6.7. We who work here accept risk-taking at work

7. **Peer safety communication learning and trust in safety ability**
   Question 10: Safety learning (based on item: 6.1, 6.4, 6.5)
   Can you give examples of how your colleagues try to learn more about safety?

   Question 11: Trust in safety ability (based on item: 6.2, 6.3)
   Can you give examples of your colleagues' ability to work safety?

   Question 12: Safety communication (based on item: 6.6, 6.7, 6.8)
   Can you give examples of how your colleagues communicate safety?

7.1. We who work here try to find a solution if someone points out a safety problem
7.2. We who work here feel safe when working together
7.3. We who work here have great trust in each others' ability to ensure safety
7.4. We who work here learn from our experiences to prevent accidents
7.5. We who work here take each others' opinions and suggestions concerning safety seriously
7.6. We who work here seldom talk about safety
7.7. We who work here always discuss safety issues when such issues come up
7.8. We who work here can talk freely and openly about safety

8. Workers' trust in efficiency of safety systems
   Question 13: Trust in safety systems (based on item: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7)
   Can you give examples of the following alternatives affect safety?:

   • Safety representatives

   • Safety rounds

   • Safety training

   • Safety considerations in the early stages of planning

   • Clear-cut goals of safety

8.1. We who work here consider that a good safety representative plays an important role in preventing accidents
8.2. We who work here consider that safety rounds/evaluations have no effect on safety
8.3. We who work here consider that safety training is good for preventing accidents
8.4. We who work here consider early planning for safety as meaningless
8.5. We who work here consider that safety rounds/evaluations help find serious hazards
8.6. We who work here consider that safety training is meaningless
8.7. We who work here consider that it is important that there are clear-cut goals for safety

- Safety representatives

- Safety rounds

- Safety training

- Safety considerations in the early stages of planning

- Clear-cut goals of safety

9. How the questionnaire was perceived
   Question 14: How was the questionnaire perceived by you and your colleagues?

Appendix 11 – Swedish version of the interview questions

Introduktion

- Syfte med intervjun är att få en djupare förståelse av resultaten från enkätundersökningen.

- Frågorna kommer att beröra dina och dina kollegors gemensamma uppfattningar.

- Frågorna kommer att beröra följande områden:

1. **Ledningens säkerhetsprioritering, säkerhetsledningsförmåga och säkerhetskompetens**

2. **Ledningens säkerhetsbemyndigande**

3. **Ledningens rättvisa i säkerhetsledningen**

4. **Säkerhetsenganemang**

5. **Säkerhetspriotitering och icke-acceptans av risker**

6. **Säkerhetskommunikation, - lärande, och tillit till varandras förmåga**

7. **Tilltro till säkerhetssystem**

8. **Hur enkäten uppfattats**

- Du kan avböja att svara på alla frågor.

- Resultaten kommer att framställas så att ingen enskild person kan komma att identifieras.

- Allt material som samlas in via intervjuer, frågeformulär eller på övriga sätt kommer att förvaras inlåsta fram tills dess att rapporten är färdigställd.

- Allt material som samlas in via intervjuer, frågeformulär eller på övriga sätt kommer att förstöras när rapporten är färdigställd.

Intervjufrågor
Frågor på ledningsnivå (management level):

Fråga 1: Vilken ledning refererade du till när du svarade på frågeformuläret

1. **Ledningens säkerhetsprioritering, säkerhetsledningsförmåga och säkerhetskompetens**
   Fråga 2: Säkerhetsprioritering (baserad på fråga:1.1, 1.4, 1.5)
   Kan du ge exempel på hur ledningen balancerar mellan produktions- och säkerhetsmål?

   Fråga 3: Säkerhetsledningsförmåga (baserad på fråga: 1.2, 1.3, 1.6, 1.7, 1.8, 1.9)
   Kan du ge exempel på ledningens förmåga att hantera säkerhet?

1.1. Ledningen uppmuntrar medarbetarna här att arbeta enligt säkerhetsreglerna- också när tidsschemat är pressat
1.2. Ledningen ser till att alla får den nödvändiga informationen om säkerhet
1.3. Ledningen ser åt ett annat håll när någon slarvar med säkerheten
1.4. Ledningen sätter säkerhet före produktion
1.5. Ledningen accepterar att medarbetarna här tar risker i arbetet när tidsschemat är pressat
1.6. Vi som arbetar här har förtroende för ledningens förmåga att hantera säkerhet
1.7. Ledningen ser till att säkerhetsproblem som upptäcks vid inspektioner korrigeras omedelbart
1.8. När en risk upptäcks ignoreras den av ledningen
1.9. Ledningen saknar förmåga att hantera säkerheten på ett bra sätt

2. **Ledningens säkerhetsbemyndigande (empowerment)**
   Fråga 4: Delaktighet i beslut (baserad på fråga: 2.3, 2.4, 2.6, 2,7)
   Kan du ge exempel på de anställdas delaktighet i säkerhetsrelaterade beslut?

Fråga 5: Ledningens möjliggörande av säkert arbete (baserad på fråga: 2.1, 2.2, 2.5)
Kan du ge exempel på hur ledningen gör det möjligt för anställda att arbeta säkert?

- Ledningen försöker utforma säkerhetsrutiner som är meningsfulla och som verkligen fungerar
- Ledningen ser till att var och en kan påverka säkerheten i sitt arbete
- Ledningen uppmuntrar medarbetarna här att delta i beslut som påverkar deras säkerhet
- Ledningen tar aldrig hänsyn till medarbetarnas förslag rörande säkerhet här
- Ledningen eftersträvar att alla på arbetsplatsen ska ha hög kompetens om säkerhet och risker
- Ledningen frågar aldrig efter medarbetarnas åsikt innan den fattar beslut rörande säkerhet
- Ledningen gör medarbetarna här delaktiga i beslut som rör säkerhet

3. Ledningens rättvisa i säkerhetsledningen

Fråga 6: Insamling av information (baserad på fråga: 3.1, 3.3)
Kan du ge exempel på hur ledningen samlar in information efter en olycka?

Fråga 7: Rättvisa och konsekvenser (baserad på fråga: 3.2, 3.4, 3.5, 3.6)
Kan du ge exempel på ledningens konsekvenser efter en olycka?

- Ledningen samlar in tillförlitlig information vid utredning av olyckor
- Rädsla för negativa konsekvenser från ledningen avskräcker medarbetare här från att rapportera olyckstillbud
- Ledningen lyssnar noga på alla som har varit inblandade i en olyckshändelse.
- Ledningen söker orsaker, inte skyldiga personer, när en olycka inträffar
- Ledningen lägger alltid skulden för olyckor på de anställda
- Ledningen behandlar medarbetare som är inblandade i en olycka här rättvist

Frågor på arbetsgruppsnivå (workers level):

4. Säkerhetsenganemang

Fråga 8: Säkerhetsengangemang (baserad på fråga: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6)
Kan du ge exempel på dina kollegors säkerhetsengagemang?

- Vi som arbetar här anstränger oss verkligen tillsammans för att uppnå en hög säkerhetsnivå.
- Vi som arbetar här tar gemensamt ansvar för att det alltid är ordning och reda på arbetsplatsen
- Vi som arbetar här bryr oss inte om varandras säkerhet
- Vi som arbetar här undviker att ta itu med risker som upptäcks
- Vi som arbetar här hjälper varandra att arbeta säkert
- Vi som arbetar här tar inget ansvar för varandras säkerhet

5. **Säkerhetspriotitering och icke-acceptans av risker**

   Fråga 9: Säkerhetsprioritering (baserad på fråga: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)
   Kan du ge exempel på hur dina kollegor balanserar mellan produktions- och säkerhetsmål?

- Vi som arbetar här ser risker som oundvikliga
- Vi som arbetar här anser att mindre olyckor är en normal del av det dagliga arbetet
- Vi som arbetar här accepterar riskfyllt beteende, så länge inga olyckor sker
- Vi som arbetar här överträder säkerhetsreglerna för att få arbetet färdigt i tid
- Vi som arbetar här accepterar aldrig risktagande ens när tidsschemat är pressat
- Vi som arbetar här anser att vårt arbete är olämpligt för "fegisar"
- Vi som arbetar här accepterar att våra arbetskamrater tar risker i arbetet

6. Säkerhetskommunikation, - lärande, och tillit till varandras förmåga

Fråga 10: Säkerhetslärnade (baserad på fråga: 6.1, 6.4, 6.5)
Kan du ge exempel på hur dina kollegor försöker lära sig mer om säkerhet?

Fråga 11: Tillit till varandras förmåga (baserad på fråga: 6.2, 6.3)
Kan du ge exempel på dina kollegors förmåga att arbeta säkert?

Fråga 12: Säkerhetskommunikation (baserad på fråga: 6.6, 6.7, 6.8)
Kan du ge exempel på hur dina kollegor pratar om säkerhet?

- Vi som arbetar här försöker finna en lösning om någon påpekar ett säkerhetsproblem
- Vi som arbetar här känner oss säkra när vi arbetar tillsammans
- Vi som arbetar här har stor tilltro till varandras förmåga att tillförsäkra säkerhet
- Vi som arbetar här lär av våra erfarenheter för att förebygga olyckor
- Vi som arbetar här tar varandras synpunkter och förslag rörande säkerhet på allvar
- Vi som arbetar här talar sällan om säkerhet
- Vi som arbetar här diskterar alltid säkerhetsfrågor när sådana frågor dyker upp
- Vi som arbetar här kan tala fritt och öppet om säkerhet

Tilltro till säkerhetssystem

Fråga 13: Tilltro till säkerhetssystem (baserad på fråga: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7)
Kan du ge exempel på hur följande alternativ inverkar på säkerheten?:

- Skyddsombud

- Skyddsronder

- Säkerhetsutbildning

- Säkerhetshänsyn i ett tidigt stadium av planering

- Tydliga säkerhetsmål

- Vi som arbetar här anser att ett bra skyddsombud spelar en viktig roll för att förebygga olyckor
- Vi som arbetar här anser att skyddsronder inte påverkar säkerheten
- Vi som arbetar här anser att säkerhetsutbildning är bra för att förebygga olyckor
- Vi som arbetar här anser att säkerhetshänsyn på ett tidigt stadium i planeringen är meningslös
- Vi som arbetar här anser att skyddsronder hjälper till att upptäcka allvarliga risker
- Vi som arbetar här anser att säkerhetsutbildningen är meningslös
Vi som arbetar här anser det viktigt att det finns tydliga säkerhetsmål

- Skyddsombud

- Skyddsronder

- Säkerhetsutbildning

- Säkerhetshänsyn i ett tidigt stadium av planering

- Tydliga säkerhetsmål

8. **Hur enkäten uppfattades**
    Fråga 14: Hur uppfattades enkäten av dig och dina kollegor?

Appendix 12 – Instructions for mean score calculations

Table 14 present how the mean scores for each indivudual are calculated. The letter A stands for answer and the number is the number if the item, hence A10 is the answer to item 10.

Table 14. A presentation of how the mean scores are calculated for each dimension of NOSACQ-50. (The table is adapted from Analysing NOSACQ-50 data, 2010)

Dimension	Mean score calculation[1]
1	$$\frac{(A1 + A2 + (5 - A3) + A4 + (5 - A5) + A6 + A7 + (5 - A8) + (5 - A9))}{\text{Number of answered items}}$$
2	$$\frac{(A10 + A11 + A12 + (5 - A13) + A14 + (5 - A15) + A16)}{\text{Number of answered items}}$$
3	$$\frac{(A17 + (5 - A18) + A19 + A20 + (5 - A21) + A22)}{\text{Number of answered items}}$$
4	$$\frac{(A23 + A24 + (5 - A25) + (5 - A26) + A27 + (5 - A28))}{\text{Number of answered items}}$$
5	$$\frac{((5 - A29) + (5 - A30) + (5 - A31) + (5 - A32) + A33 + (5 - A34) + (5 - A35))}{\text{Number of answered items}}$$
6	$$\frac{(A36 + A37 + A38 + A39 + A40 + (5 - A41) + A42 + A43)}{\text{Number of answered items}}$$
7	$$\frac{(A44 + (5 - A45) + A46 + (5 - A47) + A48 + (5 - A49) + A50)}{\text{Number of answered items}}$$

[1] If the number of answered items is less than 50% of the total number of items for that dimension then should all answers in that dimension be excluded from the total mean score for each dimension and group (see the example in table 15).

When the mean score for each dimension and indivudual has been calculated then should the total mean score for each dimension and group. This is illustarted in the example in table 15 where the total mean score has been calculated for dimension 1 (group size=20 individuals).

Table 15. An example of how the mean scores are calculated for each individual and for a group of 20 individuals, for dimension 1.

Individual	A1	A2	A3r	A4	A5r	A6	A7	A8r	A9r	Calculation	Mean per individual
1	4	3	4	4	3	4	4	4	4	34/9=	3,78
2	3	4	3	3	3	4	3	4	4	31/9=	3,44
3	4	3	3	3	3	3	4		4	27/8=	3,38
4	4	3	3			4	4	4	3	25/7=	3,57
5	3		3		4			4		-	No Mean[1]
6	3	3	4	3	3	3	4	4	4	31/9=	3,44
7	4	4	3	4	3	3	3	3	3	30/9=	3,33
8	4	4	4	4	4	4	4	4	4	36/9=	4,00
9	4	3	3	3	3	4	4	4	4	32/9=	3,56
10	4	3	3	3	4	4	3	3	4	31/9=	3,44
11	3	4	3	4	4	3	3	3	4	31/9=	3,44
12	4	3	3	3	3	3	3	3	4	29/9=	3,22
13	4	3	3	3	3	3	3	3	3	28/9=	3,11
14	3	4	4	3	3	3	4	3	3	30/9=	3,33
15	3	3	3	3	3	4	4	4	3	30/9=	3,33
16	3	4	3	3	4	4	4	4	3	32/9=	3,56
17	4	3	4	3	4	3	3	4	3	31/9=	3,44
18	3	3	4	4	3	3	3	3	3	29/9=	3,22
19	4	3	4	4	3	4	3	3	3	31/9=	3,44
20	3	4	3	4	3	3	3	3	3	29/9=	3,22
Total mean score for this group, dimension 1										65,28/19=	3,44

[1] No mean score is calculated since the number of answered items is less than 50% of the total number of items for the dimension.

r=reversed item