



An explorative study of health, safety and environment culture in a Norwegian petroleum company

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ABSTRACT

This article reports a qualitative interview study of 31 employees, with and without leadership responsibility, employed in a Norwegian petroleum company. Health, safety and environment (HSE) culture was a new concept and the aim of this study was to gain insight into how the workers conceptualized the concept, different aspects of HSE culture and differences between the informants. The informants used the concept HSE culture in three ways. The most common way was descriptive, and the informants gave both positive and negative descriptions. Also a causal way of using the concept and a systemic way was used. Safety was the topic mentioned most, especially by informants from the operational units. However, occupational health and the working environment were also mentioned as important. Managers and employees differed little in the use of the concept of HSE culture and their opinions about the HSE challenges. Management was frequently mentioned as being important by all. Behaviour, competence, collaboration, procedures and the physical environment were found to be important in a sound HSE culture. These results are illustrated as an HSE culture umbrella in the discussion for further communication on the topic. This figure illustrates the important results of the study; managers and employees are partners in a system of interrelationships and they have different roles and actions in the HSE work.

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1. Introduction

Combining the term health, safety and environment (HSE) with the concept of culture has become common in the petroleum industry in Norway since 2002. Safety culture has been used since the 1980s and failings in safety culture have been attributed to a series of major disasters (INSAG, 1988). In the scientific field the safety culture concept is not yet established and its validity and content is still highly debated. However, a fuller and more comprehensive concept combining health, working environment and environment with safety was required to address the holistic mindset of companies striving to achieve a high level of social responsibility and show care and concern for “people”, “plant” and “the environment”. This article outlines the concept of HSE culture and focuses on how this concept is interpreted in a large petroleum company, with onshore and offshore process workers and office workers. It also discusses the relationship between safety culture and HSE culture.

The aims of the study are to explore the various ways the HSE concept is used and understood by managers and employees in one company and from this knowledge to build up an illustration useful for communication within the organisation. We believe this knowledge will be useful for other companies and industries as well and help to develop strategies, methods, and actions that will improve the HSE performance.

1.1. Background and industry context

The petroleum sector is the largest industry in Norway and employed in 2005 approximately 80,000 people in petroleum-based activities (Ministry of Petroleum and Energy, 2005). The Petroleum Safety Authority (PSA) Norway is an independent regulatory body under the Ministry of Labour and Government Administration. Its task is to stipulate premises and follow up to ensure that the participants in petroleum activities maintain high standards of health, environment, safety and emergency preparedness.

In 2001 the Government of Norway presented a white paper on HSE on the Continental Shelf (Stortingsmelding no. 7, 2001/2002) which stated that the authorities were concerned about a possible trend of declining improvement in safety performance. HSE culture in the industry was identified as a priority area. The Petroleum

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Safety Authority Norway underlined this priority in its further regulatory work. Norway's petroleum regulations of January 1st 2002, Framework for HSE, chapter 3, section 11, specifies that enterprises must have a sound health, environment and safety culture, saying: "The party responsible shall encourage and promote a sound health, environment and safety culture comprising all activity areas and which contributes to achieving that everyone who takes part in petroleum activities takes on responsibility in relation to health, environment and safety, including also systematic development and improvement of health, environment and safety". The guideline to this section states: "In order to make it clear that this section applies across the entire scope of application of the regulations, the expression "health, environment and safety culture" is used instead of the more established term "safety culture". Such a requirement had never before been expressed so specifically in Norwegian or international regulatory requirements. Safety culture had been used for a while as a concept; HSE culture was a new expression.

The regulatory requirement did not define HSE culture. The challenges for the companies were to give content to the concept HSE culture, determine how the HSE culture could be measured and outline how the companies could ensure further improvement of HSE.

2. Theoretical framework

The root of the word culture is the Latin word "colore", which means to cultivate. Culture has no fixed or broadly agreed meaning, even in anthropology. "Culture is as significant and complex as it is difficult to understand and 'use' in a thoughtful way" (Alvesson, 2002). Several definitions have been given, e.g. Schein, 1985; Reason, 1997; Alvesson, 2002. Edgard Schein's (1985) concept of culture is probably the most frequent definition used in organizational studies. Schein used three levels of culture: Artefacts; the most visible level of culture, visible, but often not decipherable; values; the sense of what ought to be in contrast to what is and basic assumptions; invisible, preconscious and taken for granted. According to Schein, the underlying basic assumptions are the ones that have worked repeatedly for a group of people and are therefore taken for granted.

Culture is shared between people and consists of shared elements like e.g. language and attitude held among the members of the group, and is transferred between people from one generation to another. Culture is complex and has to be analysed on different levels to be fully understood.

Both the concept of safety culture and the concept of HSE culture seem to be related to the concept of organizational culture as HSE are elements of an organization's culture. With a few exceptions conceptual arguments and models in the organizational culture literature have not played a central role in research on safety culture (Burke et al., 2007). One exception is Haukelid (2008) who stress that safety culture should not be something separate from or in addition to- an organizational culture, but constitute an integrated part of this culture. Following Richter and Koch (2004), he views safety culture as a focused aspect of the organizational culture.

Safety culture has been used in the literature since 1986, such as in the report on the Chernobyl nuclear accident from the International Atomic Energy Agency (1988). Cox and Flin (1998) and Guldenmund (2000) reviewed the literature on safety culture and showed that safety culture developed as a concept because explaining a linear connection between one causal factor and various major accidents in the industry in the early 1980s was difficult. Lack of a positive safety culture was used as a broad factor in explaining these accidents and catastrophes. Safety culture

and the theory related to it started later in the offshore and shipping industry (Cooper, 2000). The aircraft and transport industries have also focused on safety culture. In the Norwegian petroleum company referred to in this article, safety culture was first used in the late 1980s in drilling operations (Haukelid, 1989).

Even though the expression 'safety culture' has been a popular concept in discussing the underlying cause of major accidents, there has been no consensus on the content of safety culture or its effects, and there are no satisfactory models of safety culture (Guldenmund, 2000). Safety culture is defined in many different ways (Wiegmann et al., 1997; Cox and Flin, 1998; Cooper, 2000), although Haukelid (2008) suggested that describing the phenomenon is sometimes more useful than defining it.

Richter and Koch (2004) analysed safety culture in light of Martin's three cultural perspectives: integration, differentiation and fragmentation (Martin, 1992). Within the integration perspective, culture is perceived as the shared understandings in a given organization and these studies identify a consistency across cultural manifestations. Schein is mentioned as probably the most significant scholar within this perspective. The differentiation perspective emphasizes the lack of consensus between interpretations and meanings in an organization and the focus is usually on sub-cultures. Richter and Koch understand the fragmentation perspective as ambiguity: Cultural manifestations are ambiguous and there is a lack of clarity when it comes to interpretations and meanings. Alvesson (2002) adopts a critical stance towards Martin's concept of fragmentation. He prefers the concept of "bounded ambiguity": "We can thus talk about bounded ambiguity, in which cultures do not necessarily establish clarity, shared orientations and consensus among broad groups of people, but still offer guidelines for coping with instances of ambiguity without too much anarchy or confusion" (Alvesson, 2002). Bounded ambiguity implies that there are at least some broadly shared rules, which is a necessity if the concept of culture is going to have any meaning at all. Both Alvesson and Martin are skeptical to the integration perspective represented by Schein.

Safety culture and safety climate has often been used interchangeably, although climate has been described as reflecting attitudes, perceptions and beliefs, while culture is more complex, reflecting values and norms (Mearns and Flin, 1999). Safety climate may be seen as a "snapshot" of the safety culture, and reflects the perception of an organization shared by those participating, and is more superficial and transient than culture (Flin et al., 2000). Safety climate is usually explored through questionnaires, often composed of thematic questions relevant for safety and has resulted in many different scales (Flin et al., 2000; Guldenmund, 2000, 2007). In a study analyzing safety climate scales used, Flin et al. (2000) identified main themes important for safety climate in 19 studies in nuclear industry, oil and gas industry, chemical sites, factories, manufacturing plants, aircraft, transport and construction. These themes included management, safety system, risk, work pressure, competence and procedures/rules. The factor 'management' emerged in 72% of the studies (Flin et al., 2000). Guldenmund (2007) labelled the themes within safety climate research into organizational level (the processes taking place at higher organizational level e.g. manager teams deciding policies, strategies, goals), group level (processes within groups or teams the respondent works in) and individual level (the particulate process to the respondent, or the attitude level). Safety culture researchers tend to focus on the values and assumptions of the organizational members with respect to safety and emphasize the role of organizational norms and socialization influences on safety behaviour and safety outcomes usually studied via qualitative methodologies as observation and interviews.

The expansion of the safety culture concept to include health, working environment and environment introduced factors other

than major accidents and catastrophes which was the background for the safety culture concept. Occupational health and working environment are closely related to the workers' everyday work situation and include individual health, well-being and psychosocial working environment as well as ergonomics and human factors, chemical working environment, noise, and physical work conditions. The HSE work concerning the environment; preserving biological diversity and keeping emissions and discharges low, has until now not been a part of the "safety culture" concept. The word "culture" has not been commonly used together with occupational health and working environment or environment in the literature. Only safety has been combined with culture, when discussing the underlying causes of major accidents.

Preventing occupational diseases and controlling adverse effects on the health of workers are other important aspects of HSE work in socially-responsible companies. The incidence of work-related diseases and work-related sickness absence can be indicators of the quality of the working environment and seen as a part of the company's HSE culture. Work-related diseases are usually developed over a period of time and diagnosed outside the companies. Occupational accidents are acute and immediately visible at the work place and perceived as more dramatic than occupational diseases. This difference between injuries and diseases could be one reason for the focus on safety culture and climate as precursors that can address to prevent major accidents and injuries. Mearns and Hope (2005) note that: "Interestingly, the rapidly growing literature on safety culture makes little, if any, reference to the concept of health or to the environment, although many organizations have HSE or HSEQ (health, safety, environment and quality) departments". If HSE is central to the business of the organization then the nature of HSE culture and how it is understood by personnel requires further investigation. As far as we know, no study has yet addressed this in the published literature.

2.1. Aims of the study

The aims of the study were to gain insight into the various ways the HSE concept was understood and defined in a Norwegian petroleum industry organization. The study was designed as a case study to explore this concept among workers with and without leadership responsibility and their opinion of the major challenges to HSE.

We wanted answers to the following questions:

- How do workers conceptualize HSE culture and which aspects are important in describing HSE culture?
- Do workers with and without leadership responsibility differ in how they conceptualize HSE culture?

On basis of the results, we wanted to test if the findings in this company about HSE culture were in line with themes in the scientific literature on safety climate and safety culture, as there is almost no literature about HSE culture, and build up an illustration useful for communication within the company studied.

3. Approach and methods

Since the petroleum industry started its activities on the Norwegian continental shelf about 1970, huge sums have been investigated in offshore exploration and field development, transport infrastructure and onshore process plants. The petroleum industry can be divided in upstream and downstream segments. Upstream refers to exploration, extraction and production of crude oil and natural gas. Downstream consists of refinery operations, distribution and retail of the petroleum fractions, mainly land based activ-

ities. In Norway the upstream petroleum industry is confined to the Norwegian continental shelf, and is henceforth denoted Norway's offshore petroleum industry.

The company selected for this study was a large international integrated oil and gas company based in Norway. It was the largest operator on Norway's continental shelf, and the oil fields operated by the group accounted for about 60% of total oil and gas production in Norway in 2003. More than 13,000 people were employed in the company in Norway, and about 3500 employees worked offshore. The company operated more than 20 on-stream oil and gas fields, which comprised 20 platforms or production ships with crew, four unstaffed installations and 23 subsea facilities. The offshore production installations generally consist of a drilling unit, a processing unit and living accommodation. Offshore platforms are isolated, the workforce travel to work by helicopter and stay on the platforms for 14 days with 12-h shifts day or night, followed by a 4-week off period at home. Onshore the company operated 4 process sites in Norway and Denmark were the production workers normally worked 8-h shifts day and night following a rotation schedule. Most of them lived nearby their workplace.

Typically in a Norwegian oil and gas company, administration personnel and staff were located onshore together with specialists who support the offshore installations and the onshore process sites. The company's overall objective for HSE was zero harm. HSE was defined as an abbreviation for "health, safety and the environment" and embraced the categories of occupational health and the working environment, the environment, safety, security and emergency response.

A qualitative research design was used because interviews are a good method for studying a concept (Kvale, 1996; Denzin and Lincoln, 2000) and to explore subjective experiences and understandings. To identify themes in the data, Giorgi's (1985) phenomenological analysis in four stages was used. The focus initially is on unravelling the elements of experience (Glaser and Strauss, 1967). These types of data collection methods permit the researcher to understand the world as seen by the target audience rather than pre-determining it by using an a priori framework developed by the researcher. The research team consisted of four persons.

3.1. Sample

This article is based on interview data from 31 workers; senior managers and non-management employees (Table 1). It is necessary to have opinions from different levels in the organization as common opinions about HSE culture are important for systematic and focused HSE work. Participatory occupational health and safety management has been common in Norway since the

Table 1

Participants and methods used for data collection in a study of HSE culture in a petroleum company.

Type of participants	Number	Gender	Methods	Comments
HSE managers	8	5 Men 3 Women	Individual interviews	Two interviews not transcribed. Notes taken
Managers	6	5 Men 1 Woman	Individual interviews	Three interviews not transcribed. Notes taken
Safety deputies	8	6 Men 2 Woman	Individual interviews	All transcribed
Employees	9	7 Men 2 Women	Individual interviews: 5 Two persons in each interview: 4	All transcribed
Total	31	23 Men 8 Women		

1960s (Hale and Hovden, 1998) and the workers are important in defining and finding solutions for health and safety problems and well being at the workplace. The informants varied in gender, age, background and experience. Except for two informants in Denmark (one Norwegian and one Danish), they were all Norwegians working in Norway. About 18 different business units within the group were represented from different fields of operations like drilling, catering, process, maintenance, different geographical regions; from different offshore platforms, onshore process sites and onshore office locations, and different kinds of jobs like blue collar workers as production operators, catering personnel, maintenance personnel, electricians, crane operators, and white collar office workers managing HSE and operational units. We had a good selection of participants as managers and employees represented both office work and operating work at onshore and offshore plants.

All the HSE managers at the upper level of the organization (eight persons) were interviewed. These managers were identified as experts in the field and considered information-rich people who would probably provide us with a great deal of information about the HSE culture in the company. The safety representatives, elected by other workers, were seen as important informants for this study and represented the company employees on issues regarding occupational health, safety and welfare (eight persons). Nine employees with long experience in the company known to represent the opinions of other workers in addition to their own were chosen to ensure information from different organizations, geographical locations and gender. In addition six managers (drilling, platform and plant managers) were asked about their opinions of HSE culture. All agreed to participate in an interview as part of the research.

3.2. Data collection

Individual semi-structured interviews, based on Kvale's (1996) principles, were used. An exploratory interview guide (added in this article as an Appendix A) was developed and used during the interviews to ensure that relevant questions were raised and to maintain some extent of scope and direction. The interview guide was based exploring the new health, safety and environment concept and was divided into four main topics to ensure that all elements of the HSE concept were discussed with the informants; HSE culture in general, health and working environment, environment and safety. The interviewers wanted to get the informers own understanding of the expression HSE culture and of important elements and descriptions of HSE culture in the company. The questions were formed to explore the informers experience in their workplaces and to investigate work-related issues which could explain the HSE culture in the company. The general HSE culture items were phrased as: "What do you mean by the concept HSE culture?", "What are the characteristics of a company with a strong HSE culture?", "Which elements are important to create a good HSE culture?" In the specific occupational health and working environment, safety and environment items, the questions were formed as "What do you mean by safety culture?" The interview guide was pre-tested on a few persons in the company before the main study. The test persons provided answers to the research questions in the study. Data were collected from February to April 2003. There were four interviewers. In two of the interviews two persons were interviewed at the same time, due to practical reasons.

The interviews lasted for 1 h. Most interviews were performed at the informant's workplace; the interviews with informants from offshore plants were performed onshore. The interviews started with information about the purpose of the study and how the results from the interview would be used. All participants were in-

formed of the confidentiality of the interviews and the fact that they were being used for research purposes.

3.3. Analyses

Twenty six of the 31 interviews were taped and then transcribed in full text. In five of the interviews thorough notes were taken due to technical problems with the tape recorder. Time pressure made it impossible for there to be two interviewers for every interview situation. There were two interviewers at 26 of the 31 interviews and one interviewer at five interviews. In the interview situations where notes were taken, there were two interviewers.

To obtain reliable and valid results, the four researchers began with standard methods of data analysis such as coding and categorizing, looking for emerging themes and patterns according to Giorgi's (1985) phenomenological analysis in four stages: (a) reading the material to get a sense of the whole; (b) read the same descriptions more slowly and identify different meaning representing different aspects of HSE culture and coding these; (c) abstracting the meanings within each of the coded groups; and (d) summarizing the contents of each code group to generalize descriptions reflecting the most important elements in the informants opinion of HSE culture and HSE challenges. The four researchers did their own coding and then discussed the code categories and the meaning. The analysis was based on the joint interpretations of these researchers. The informants and the part of the organization where the informants worked remained anonymous.

The researchers followed the methods and procedures of qualitative research. When the four researchers categorized the various statements, the aspects that seemed important to the informants emerged. Confidentiality was ensured, as only the researchers and the two people who transcribed the interviews had access to the interviews.

4. Results

The results of the data from the 31 people interviewed are presented under each of the questions the researchers stated. All citations have been translated from Norwegian. The informants were selected into four groups; managers, HSE managers, safety deputies and employees (Table 1). However, the results are presented referring to informants with and without leader responsibility (employees and managers) as there were small differences within the two manager groups and the two employee groups. An "employee" means a person without leadership responsibility if nothing else is specified. The expression "informants" are used about all.

4.1. How do the informants conceptualize health, safety and environment culture?

4.1.1. Three ways to use the concept HSE culture

The informants used and understood the expression HSE culture in three different ways. The most common was descriptive. Both positive and negative statements were made, such as

The company takes care of the workers.

We have everything on paper, we have most of it in our head, but we have just about nothing in our heart.

They used the concept to describe the cultural expressions that could be linked to HSE and they told stories about "typical company". The informants described the general characteristics of HSE challenges in the company. They tended to tell normative stories about health and safety, and most related what was not good or what should be done to improve HSE in the organization.

The second way to use the concept was the causal way. Culture was used as a causal term when treated as one of many factors that influences HSE. Culture then becomes synonymous with such concepts as attitudes and behaviours. One informant claimed:

HSE culture means that everybody has the right attitude and does their work tasks properly.

Culture was reduced to something that individuals possess. Changing culture became a quest of educating and changing the behaviour and qualities of the individuals.

Just a few informants used the concept of HSE culture in a third way. This was the systemic way to signify the holistic interrelationship in a defined system. Some said that HSE culture would differ from workplace to workplace: for example, office workers would face different problems than the offshore-based organization. One HSE manager said:

HSE culture is almost everything. It ranges from managers executing their role to the individual's task performance; it is also quality and requirements in our procedures. The managers must feel obligated to be role models, must care and follow up employees and must be engaged in the employees' performance at work and in how the working conditions are arranged in a good, proper HSE way.

This informant tried to show that culture became an abstraction of the entire whole to explain conditions that cannot be reduced to one singular factor. The workplace, the tasks and the organization had to be considered.

4.1.2. HSE was mainly safety

Safety was the topic interviewees mentioned most frequently. In fact, many informants, especially from the production units, only addressed safety and not occupational health and the environment when we asked for their opinions about HSE culture. Topics discussed included procedures, safe work processes, protective equipment, protecting the installation, management, communication and taking care of each other, like

In the company HSE culture is safety offshore.

The informants regarded safety as a problem in relation to HSE culture. They had stories about everyday episodes and incidents: people who do not follow regulations and procedures, employees taking shortcuts, managers not responding to unsafe behaviour, not using the right personal protective equipment, confidential documents not being locked up and others. To avoid occupational injuries and accidents, attitude and behaviour were mentioned. One informant said:

We have too many "silent deviations"; no one dares to do anything about it. It is something we have always done, and it is accepted.

The interviewees had to ask many informants specifically about health, the working environment and the environment to get them to respond about these parts of HSE culture. The office informants used the concept of HSE differently from the informants working on plants onshore and offshore. The office informants talked about their own working environment conditions, such as the presence of a manager, work pressure, stress and coping, job satisfaction, challenges related to balancing job demands and home life and a heavy travel load. They also claimed that they learn a lot about safety because the company continuously focused on safety in the production units.

4.1.3. Health and working environment and environment culture

The informants were satisfied with the health service and the organization's focus on the organizational working environment conditions, the regular health and working environment pro-

grammes, the stress management programmes offered, exercises at work and working environment surveys. Many talked about presence at work (as the converse of absence): the way workers are followed up by the company when their lives are difficult or when they have health problems or are on sick leave. A manager and a safety representative said:

One takes care of the workers in different phases of their life, so from my place and with my experience in my own organization, I think the company does a very good job concerning people's health and working environment.

... I am quite sure that, if I could not manage to do my job for some reason, I would be given some other work: that I believe. I have seen others that have got jobs elsewhere when they have got [health] problems. It is about HSE culture, isn't it; it is about taking care.

Many stories were about changing the ergonomic or physical working environment; some were concerned about physical work conditions and aging. As one employee from an offshore platform said:

... [There are] problems with accessibility to many workplaces, we have ladders instead of stairs. This is difficult to change because it costs money. Because we are walking around at the plant and usually we have tools and log-forms, and then it is hard to climb ladders with all the tools and everything else. And I am growing older, and for a 60-year-old person it is better to climb stairs than climb ladders. If nothing is done now, I think people have to stop working before they retire.

The informants said that the company handled the environment well. However, most HSE managers mentioned sustainable development: a better quality of life for everyone, now and for generations to come. Reaching this technical level of development and following the strict international regulations were considered important. The employees were involved in minimizing the risk of oil and gas spills and in waste management. The focus was also on minimizing the use of chemicals. None of the informants mentioned security.

4.1.4. Themes describing HSE culture

Six themes were frequently brought up as important conditions to HSE culture in the company: management, collaboration, procedures, behaviour, physical work condition and competence.

4.1.4.1. Management and behaviour. Management was frequently mentioned as a theme. The focus was the manager's visibility, clarity and ability to communicate, to be consistent and to be a good role model. The employees wanted a visible manager who spoke to people and showed interest in motivating for HSE, understanding HSE challenges and giving HSE credibility. The employees wished to have managers who illustrated good HSE practice through their own actions as role models. They also had to be clear in their instructions, such as about requirements and what was acceptable. Having a distinct and precise management was mentioned as important. Consistent management meant that managers should react to undesirable operations. Many employees were concerned about how instructions and corrections were given. They claimed it was important to have an open, questioning attitude and not to act as a police authority. Neither the managers nor the employees were completely satisfied with the present practice in this area.

Some managers were concerned about employees not following procedures and regulations, shown in this statement:

I think that behaviour cannot be changed, at least not where we are now; we have to manage through consequences. People must

understand that if you do something wrong, it will have consequences. If not, this is wrong. We have been too kind.

The employees also considered this to be a problem, and one of them stated:

The things you do must have consequences, it could be either-or consequences. [Today] it is similar no matter what, if you do your job it is all right, if you don't do your job it is all right. If you do more than your job, it is also all right. It should be...if you do wrong things it ought to have a consequence, at least a talk or a warning and to be told how to do it.

4.1.4.2. Procedures. The interview guide had no questions about procedures, but almost every informant talked about procedures when talking about HSE culture. They strictly underlined that the group had too many and too difficult procedures and that many employees did not know the procedures necessary to perform their job. Some said that the procedures were good, but not always followed. Others found the procedures difficult to read. Some meant that the huge number of procedures and the detailed procedures did not give any possibility for critical thinking and took away people's personal responsibility and drive in critical situations.

4.1.4.3. Collaboration and competence. Most informants said that HSE culture had to do with the daily work practice, in collaboration with others. They broadly agreed that working with people's attitudes is necessary. Many informants stated that attitudes are the basis for behaviour and practice. Communication and collaboration between managers and employees and between colleagues was frequently mentioned. Open, honest communication was mentioned as a condition for being careful and for daily practice, as stated here:

It is the simple things: we have a lot of facilities, but the most important is to use our head and discuss work situations before you start the job. Maybe you see no problem, but another can see the problems. This is what we are not clever enough to do, to talk through what we are going to do.

The informants used HSE culture in three different ways. The most common way of using HSE culture was descriptive but also a causal and systemic way was used. Safety was the topic mentioned most, especially by the operational units. However, occupational health, the working environment and the natural environment were also seen as important. Management, behaviour, competence, collaboration and procedures were found to be important in a sound HSE culture.

4.2. Do managers and employees differ in how they conceptualize HSE culture?

The descriptive use of the concept of HSE culture was quite similar among managers, HSE managers and non-management employees with few exceptions. HSE culture was mainly used to describe "the typical company". Both managers and employees emphasized the themes mentioned frequently as relevant to HSE culture: management, collaboration, procedures, behaviour, competence and physical work conditions. Business units did not seem to vary here.

Employees tended to be more critical about managers' commitment to HSE than the managers themselves, and the managers very strongly focused on employees' HSE attitude and behaviour.

HSE cultureit is attitude- creating work.

One other important difference was about the difficult balance between the priorities of financial results and HSE. No manager or HSE manager mentioned this dilemma, but almost all non-man-

agement employees did. The interview guide had no questions about financial results or reputation. One safety representative from an onshore plant said:

It is said with two tongues: take your time to do your job, but also, we need to earn so and so much money per day selling gas.

The offshore and onshore plant employees claimed that safety is usually given higher priority than financial results, but not always. Many related the difficult role for middle managers in choosing between financial results and HSE results as they felt the pressure from both sides. Some employees thought that the middle managers were not sufficiently involved in safety. They explained that they had too much to do or lacked interest. Some of the participants told about participation in decisions for improving the working environment. They understood that one could not always wish for the most expensive solutions:

When we propose decisions, we cannot be too ambitious. It is of no use always suggesting a Rolls Royce. We must have a possibility to get it through.

However, informants with and without leadership responsibility, felt privileged to have the company as a place of employment. Good HSE results were considered to be important for reputation and for good financial results. Showing the company as a good company to work for and being proud of the HSE results was important to the employees. These two statements show that the informants believed that financial results and HSE did not have to be contradictory:

I believe that the company will have good financial results if we have a good HSE culture. Accidents cost money, and it is poor motivation for people; they will be depressed and the company will get a poor reputation and maybe the workers will get victimized in their private social acquaintances. Maybe people don't want to work here any more then.

A company with a good HSE culture will give the staff a feeling of job satisfaction, and this will provide a good reputation in the surroundings.

Managers and employees differed little in the use of the concept of HSE culture and their opinions about the HSE challenges, but employees tended to be more critical about managers' commitment to HSE than the managers themselves. The managers focused on employees' HSE attitude and behaviour.

5. Discussion

This section discusses the concept of HSE culture among informants and the theories on this of various experts. An illustration useful for communication from this knowledge is described to communicate the findings within the industry.

5.1. The use of HSE culture in the company and experts' theories

The expression was used to signify three different concepts. The most common was descriptive: outlining specific characteristics of the organization as HSE culture they regarded as relevant to HSE. People described surface phenomena they had seen and experienced through their own work. Secondly, the term was also used more or less synonymously with concepts such as behaviour and attitudes. HSE culture was conceptualized as a factor with a causal effect on the HSE results of the organization. The third use of the term is a systemic one: HSE culture is the holistic relationship between various phenomena influencing HSE in the organization.

The informants' different use of culture and HSE culture seemed to correspond with the lack of agreement about how to use terms

(Cooper, 2000; Cox and Flin, 1998; Wiegmann et al., 1997). HSE culture is most commonly used in the company descriptively. This corresponds with Schein's (1985) upper level of culture: artefacts or visual phenomena that may be described.

When informants in this study used culture synonymously with behaviour and attitudes, culture became a factor that could be influenced, thereby changing the premises for HSE performance. In this understanding, HSE culture was understood as HSE behaviour or HSE attitudes. Culture was reduced to something individuals possessed, and changing the culture meant educating and changing the behaviour and qualities of the individuals. This approach that can be seen in debates in the media and in research that a majority of workplace accidents and injuries are attributed to unsafe work practices of employees rather than unsafe working conditions. Many investigations seem to focus on attributing blame to an individual proximal to an accident, rather than investigating the underlying factors that may have contributed to the situation. Both Schein (1985) and Alvesson (2002) indicated that direct concepts such as attitudes, behaviour and social patterns should be used instead of culture for these surface phenomena. Guldenmund (2007) argued that safety climate research has basically been attitude research. Culture is best understood by referring to deep-level, partly non-conscious sets of meaning, ideas and symbols in groups.

Few informants used HSE culture in a holistic manner. This view may be partly related to Schein's (1985) underlying basic assumptions, the ones that have worked repeatedly and are taken for granted, or what Geertz (1973) called a cultural system: the same meaningful patterns being reflected in different phenomena. In a systemic model, attention is turned towards the interplay between the various aspects of a system. The task is to understand how one phenomenon reflects other phenomena. This may enable other aspects of the organization that may influence HSE to be discovered.

When asked about HSE culture, most of the informants focused on safety. The stories were about everyday episodes and incidents; none talked about serious accidents. This is interesting as the word safety culture was developed as an explanation for major catastrophes (Cox and Flin, 1998; Guldenmund, 2000). The environment was not a major topic even though the informants were asked several questions about it. The environment seemed to be considered as a task for dedicated experts in the company. Nobody talked about security. This may reflect the fact that workers in Norway feel safe at work and do not consider their personal safety, such as kidnapping and terrorism, to be a problem. One should be aware that this is probably different from the situation in some other countries. The company has regulations for access to buildings and plants and for data security, and the company's definition of HSE included security and emergency response. However, this did not seem to be an issue for the workers in our study at all.

Informants working on plants on and offshore differed in the use of the concept from office informants onshore. Office informants talked mainly about the working environment, work pressure, stress, job satisfaction and similar topics, more related to occupational health and working environment than to safety. A number of studies in offshore environments, in both the UK and the Norwegian offshore sectors, have considered employee perceptions and elements of health and safety (Mearns et al., 1998, 2003; Cox and Cheyne, 2000; Tharaldsen et al., 2008). Issues have included stress, strain, risk perception, accidents and safety management. The importance of management's commitment to HSE has been highlighted. Also individual factors and organizational culture have been identified as important.

The informants seemed to generally agree that the company performed well concerning the working environment, occupational health and care of employees. This may be different in other petroleum companies with other economical and working environ-

ment conditions and different company-, industrial- and government requirements. In the Norwegian petroleum industry there has been a very high standard and strict regulations on all HSE risks and a close follow up by the authorities. Still there is confusion in this company about the HSE culture concept. This will probably be the same in other companies even if HSE is not as strongly focused. The different companies will have deviating HSE challenges based on the HSE risks in the company.

This study shows that there is a need to better relate occupational health, working environment and environment issues into safety issues. The concept safety culture, originally used to explain major accidents and catastrophes, need to be widening to HSE culture, were the daily working environment and the individual health, well-being and psychosocial working environment, physical and chemical work conditions as well as the environment; preserving biological diversity and keeping emissions and discharges low are being highlighted. By underlining the HSE culture in the regulative work, The Petroleum Safety Authority Norway expected the petroleum companies HSE planning and performance to include all HSE risk to be controlled, measured and improved. One of the benefits of using HSE culture instead of safety culture is that it reminds the evaluator and the managers about all HSE issues instead of only one (safety). This is in line with the priority of European Agency for Safety and Health at work which is to create and maintain a culture of prevention in Europe's workplaces; "People have the right to a safe and healthy work environment" (European Agency for Safety and Health at work, 2008).

The HSE culture concept was used in relation to the workers' everyday work situation and their reflections on occupational health and safety issues. In the modern working life, a close dialogue between the parties, the employees in general and safety representatives in special and the management on different levels, are important. A study by Hovden et al. (2008), showed a huge gap between the safety representatives and their managers in the Norwegian Petroleum Industry regarding perceptions of their own rights, duties and obligations. This was in line with our finding that employees claimed there were problems of priority of costs versus safety and difficulties in influencing decisions. However, there were small differences between employees with and without leadership responsibilities regarding other factors in our study. Also, we did not find differences among offshore workers and employees working at onshore plants. This may reflect that there is a common HSE culture in the company. This will be according to the integration perspective (Schein, 1985) where culture is perceived as the shared understandings in a given organization. However, since there are several ways of understanding the concept in the organization the differentiation perspective introduced by Martin (1992) is more likely to fit with our findings. The differentiation perspective emphasizes the lack of consensus between interpretations and meanings in an organization and the focus is usually on sub-cultures. There are at least some broadly shared rules, which is a necessity if the concept of culture is going to have any meaning at all.

5.2. From theory and interviews to an illustration useful for communication

As the interviews showed, the categories management, behaviour, competence, collaboration, procedure and physical conditions seemed to be important elements in informants' opinions of HSE culture. This corresponds with the safety climate literature (Flin et al., 2000; Guldenmund, 2000, 2007).

The researchers decided to introduce an illustration to communicate the systemic way to understand HSE culture for this company based on study results and the literature. Cox and Flin (1998) argued that the safety culture concept had the potential

to provide an umbrella for both individual and safety issues and could be used as a vehicle for framing further improvements. Therefore we suggest using the umbrella analogy to build up a pragmatic illustration of a complex concept useful for communication within the company studied. The decision was taken to attempt to make the illustration compatible with the language being used within the company (Fig. 1). The spokes of the umbrella signified the interrelated phenomena; behaviour, competence, collaboration, procedures and physical work conditions. Behaviour addressed the variety of daily activities performed by workers in the organization on an individual level, competence and procedures were important elements to shape skill-, rule- and knowledge-based activities/decision (Guldenmund, 2007). Collaboration was the relationships between workers, as the formal organizational structure and the group level phenomenon as described by Guldenmund (2007). Physical conditions were used about the physical facilities of the workplace. This included design, architecture and technology in use. The fabric was divided into two sections: managers and employees. This illustrated that managers and employees were partners in a system of interrelationships and that they had different roles in this system as figured by the two colour fabric. Financial results and reputation in the present study, was regarded as a category under management. The categories represented a broad approach to the HSE field.

The company has later developed the illustration further and named the umbrella handle values to underline that the values is what we base our decisions on. However, values were not discussed with the informants in this study. The illustration is useful to communicate the interplay between the different aspects affecting HSE culture and HSE results. It illustrates the relationship between categories that should be analyzed for systemic relationships. These categories correspond with expert models by Schein (1985) and Alvesson (2002). Due to this illustration it may be necessary to implement different parallel actions for improving HSE.

5.3. Strengths and limitations

No specific guidelines govern sample size in qualitative research; the purpose is to understand a phenomenon and not to



Fig. 1. Health, safety and environment culture umbrella as a framework for communication developed from a study of workers in a petroleum company in Norway.

determine statistically significant differences. Patton (1990) suggests that the validity, meaningfulness and insight generated from qualitative inquiry have more to do with the information-richness of the cases selected and the capability of the researchers than with the sample size. In our case, 31 informants from various parts of the organization and managers, specialists and ordinary employees provided information about HSE culture from important parts of the whole organization. We found differences among managers and employees and also differences among office informants and process informants. Another approach would have been to select more workers from specific units or groups, but as this was an explorative study, this wide selection was chosen. The study was done in one company and in two countries (Norway and Denmark) although there were many different units with different kind of operations and tasks. More studies are needed to generalize the results across other industries and countries.

There were differences in how the interviews were done. In five of the interviews only one person interviewed, while there were two in the others. In two of the interviews two persons were interviewed at the same time. Five of the interviews were not taped, only notes were not taken from. The quality of the study would probably have been better if these conditions were better controlled, but we do not think this has influenced the results to any major extent.

The anonymity is a challenge with this type of research. The citations were chosen because they underlined expressions from many employees and/or underlined important points in a good manner. No informants should be recognised, and this was also underlined for them before the interviews started. However, there might have been some underreporting of negative information, as this study was not performed giving anonymous information, but information in a face-to-face interview.

The researchers were both from within the organization and from a research institute and had different backgrounds such as anthropology, sociology, geography and ergonomics/occupational health and working environment. The internal researcher, having insight into the organization, helped in understanding the internal language of the company and was helpful when listening to and analyzing the text. The external researchers were able to maintain adequate distance from the study setting as they had little former experience within the company. The different ways of approaching the same subject probably resulted in increased understanding of the results (Malterud, 2001).

A theoretical and empirical study would be difficult for exploring the understanding of the concept HSE culture in the company. There are not enough empirical and theoretical knowledge in this field to make good quantitative research methods for the aim of this study and therefore qualitative methods were chosen. As it was an open interview guide, it was not possible to directly compare the answers from the informants or to count how many informants who answered the same. The interview guide seemed to be open and precise enough to give the informants the opportunity to reflect on the concept of HSE culture and to reflect on the HSE challenges facing the company. A methodological triangulation, e.g. fieldwork and participant observation could have mapped "tacit knowledge", basic assumptions and "webs of significants" – in short the deeper levels of any given culture. This would probably have improved the study and should be considered for further studies of this type.

Data in this study is from 2002. However, we think the data is still valid today. Other studies have been performed in this industry (Tharaldsen et al., 2008) and also in this company (Høivik et al., 2007, 2008) after 2002. All these studies show the importance of the same categories for HSE indicating stability in the petroleum industry concerning these factors in 2002–2005. We have no reason to believe that the information has changed substantially from

2005 until today, as there have been no large changes in the HSE system in this period. Changing culture takes time and therefore it reason to believe that the categories in this study are still value in the company. Also HSE facts from the Petroleum Safety Authorities Norway, 2008, show that within some areas the HSE performance has declined and in other areas improved. The same picture is seen in the company in our study.

This is the first published study of the HSE culture concept, and it differ from safety culture studies because we widening the concept from safety to HSE were the daily working environment and the individual health, well-being and psychosocial working environment, ergonomics and human factors, chemical working environment, noise, and physical work conditions as well as the environment; preserving biological diversity and keeping emissions and discharges low are being highlighted.

6. Conclusion

The main findings from this study were that informants have different opinions about the concept and content of HSE culture. The informants used HSE culture in different ways; the concept meant different things within the organization. Another important finding is that the expression HSE was mainly used as safety in the operational plants on and offshore whether the office workers used the concept of HSE differently. This may be problematic in discussing how to improve the HSE work and what actions are needed. It is important to clarify both the use of the concept HSE culture and HSE in the communication in the company to be sure that it is a common understanding. It is a prerequisite for the companies to know how HSE and HSE culture is used and understood by employees at different levels in the organization to work systematic to improve HSE. This is important knowledge to other industries and nations as well.

Managers and employees focused mostly on the same themes as important for HSE; management, behaviour, competence, procedures, collaboration and physical conditions; reflecting that there is a common HSE culture in the company, or at least some broadly shared rules. However, since there are several ways of understanding the concept in the organization the differentiation perspective fit with our findings, focusing on sub-cultures within the organization. The themes as important prerequisites for the HSE culture in the company were in line with the safety climate literature. However, working with HSE culture will widen the approach and make occupational health and working environment, environment and security just as important as safety issues.

The interpretation of the expression HSE culture is important as it affects how the workers, both with and without leadership responsibility, deal with occupational health, safety and work environment issues. It is proposed that the HSE culture is investigated in more detail and the interplay of occupational health, safety and environmental issues and how they are prioritized in relation to each other and in relation to other organizational goals, e.g. productivity, finance, could be an important development of our understanding of how socially-responsible organizations define and articulate their values and conduct their business.

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Appendix A

Interview guide in a study of HSE culture in a petroleum company.

Interview guide – HSE culture

Name:

Position/area of responsibility:

Previous experience/what have you done earlier

HSE culture

1. What do you mean by the concept of HSE culture?

2. What are the characteristics of a company with a strong HSE culture?

3. Which elements are important to create a good HSE culture?

4. Why do we have focus on HSE? Is there a reason for the Petroleum Safety Authority Norway to focus on HSE culture?

5. Do you suppose it is possible to achieve better health, safety and environment results when we use the concept of HSE culture?

6. Will a culture program help to get better HSE results?

7. Do the concepts of health, safety and environment have anything in common?

8. What do you think about the HSE culture in the company? What are the company's challenges or problems? The strong aspects or elements?

9. What attitudes does the company have towards HSE?

10. Do you have any examples that describe HSE culture in your part of the organization?

11. Is it possible to change the HSE culture? What efforts must be made?

12. What part do the managers play in promoting HSE culture?

13. What do you think of the statement: “The things to which the managers pay systematic attention will be culture?”

14. How do you think the managers should react when critical events arise?

15. Do you know any tools for measuring HSE culture? What tools does your part of the organization use?

Health and working environment

1. How do you think health is taken into account in your part of the organization?

2. How do you think the working environment is taken into account in your part of the organization?

3. Stories and examples.

Environment

1. How do you think the environment is taken into account in your part of the organization?

2. Stories and examples.

Safety

1. What do you mean by safety culture?

2. How do you think safety is taken into account in your part of the organization?

3. What characterizes safety culture in the company?

4. Stories and examples.

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