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Occupational safety and health and skills in the oil and gas industry operating in polar and subarctic climate zones of the northern hemisphere

Report for discussion at the Tripartite Sectoral Meeting on Occupational Safety and Health and Skills in the Oil and Gas Industry Operating in Polar and Subarctic Climate Zones of the Northern Hemisphere
(Geneva, 26–29 January 2016)

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Abbreviations and acronyms

EU	European Union
GFA	global framework agreement
HSE	Health and Safety Executive (United Kingdom)
ILO	International Labour Organization/International Labour Office
ISO	International Organization for Standardization
IPIECA	International Petroleum Industry Environmental Conservation Association
IOGP	International Association of Oil & Gas Producers (formerly OGP)
NCS	Norwegian continental shelf
OSH	occupational safety and health
OGP	International Association of Oil & Gas Producers
PSA	Petroleum Safety Authority
UKCS	United Kingdom continental shelf

Introduction

This paper is intended to serve as a basis for discussion at the Tripartite Sectoral Meeting on Occupational Safety and Health and Skills in the Oil and Gas Industry Operating in Polar and Subarctic Climate Zones of the Northern Hemisphere. At the 320th Session of the ILO Governing Body (March 2014), it was decided that the purpose of the meeting would be to discuss occupational safety and health (OSH) and skills in the oil and gas operations that are being carried out in the polar and subarctic regions of the northern hemisphere. It was also decided that the discussion should cover workers engaged in the operation and maintenance of the oil and gas equipment and structures as well as the service activities ancillary to these operations. [1] At its 322nd Session (October–November 2014), the ILO Governing Body decided that the Meeting would be held from 22 to 25 September 2015; that it should be composed of eight Worker and eight Employer participants, selected after consultations with their respective groups of the Governing Body, and would be open to all interested governments; and that representatives of certain international non-governmental organizations would be invited to attend. [2] For administrative reasons, the Meeting was rescheduled to be held from 26 to 29 January 2016. The Governing Body also appointed its representative to chair the meeting. [3]

This report covers workers involved in the processes of exploration, extraction, and transport of oil and gas by air, rail, supply ship and crane, in polar and subarctic climate zones of the northern hemisphere, including operators and specialized service companies. This report does not cover the seafarers' "bill of rights", which is covered by the Maritime Labour Convention, 2006 (MLC, 2006).

[1] GB.320/POL/5, paras 12–13.

[2] GB.322/POL/4, para. 28.

[3] GB.324/INS/9.

1. Development of hydrocarbons in the polar and subarctic climate zones of the northern hemisphere

1. Fossil fuels are expected to remain an important part of the global energy mix in the coming decades. To meet the increasing demand, most future production growth will have to come from fields that are more technically challenging and expensive to extract from than previously, such as deep- and ultra-deep-water offshore sites, and the polar and subarctic climate zones of the northern hemisphere, particularly the Arctic Circle. The US Geological Survey has estimated the undiscovered, technically recoverable, conventional oil, natural gas and natural gas liquid resources north of the Arctic Circle to be approximately equivalent to 412 billion barrels of oil. The Arctic holds over 40 billion barrels of crude oil, 1,136 trillion cubic feet of natural gas and 8 billion barrels of natural gas liquids in about 400 oil and gas fields, and a further 90 billion barrels in estimated undiscovered reserves, of which 85 per cent is likely to be offshore. This accounts for approximately 13 per cent of the global undiscovered total. [1]

2. The Intergovernmental Panel on Climate Change warns that warming of the climate system is unequivocal; since the 1950s, many of the observed changes have been unprecedented. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished and the sea level has risen. [2] The warming of the Arctic is enabling oil and gas exploration that would have been impossible just a few decades ago. As a result, the region has experienced a development boom. [3] Rosneft has developed a new drilling platform called Berkut, which will develop the Arkutun-Dagi field in the Sea of Okhotsk. Berkut is the largest ice-resident production platform in the world. It can withstand up to force nine earthquakes, waves of up to 18 metres and temperatures as low as minus 44°C, while continuing to work. The drilling equipment can go to a depth of 14,000 metres. [4] Another example is the Alaska LNG (liquefied natural gas) project, which is expected to be completed in 2016. The proposed project facilities include a liquefaction plant and terminal in the Nikiski area on the Kenai Peninsula; a 42-inch pipeline of about 1,300 kilometres; as many as eight compression stations; at least five take-off points for in-state gas delivery; and a gas treatment plant on the North Slope. [5] In January 2015, Norway made available 57 blocks and part-blocks in the Barents Sea for petroleum development. [6]

[1] Roubini Global Economics: *Future oil supply (Part III): New oil, new fields* (New York, 2012).

[2] Intergovernmental Panel on Climate Change: *Climate change 2014: Synthesis report – Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva, 2014).

[3] N. Coleman: “Double nag at Norway offshore future”, in *Oilgram News* (2014, Vol. 92, No. 111), pp. 1 and 4.

[4] *Putin welcomes launch of drilling platform*, BBC Monitoring, Former Soviet Union, 27 June 2014.

[5] “Alaska LNG project partners file export application with DOE”, in *Oil & Gas Journal* (21 July 2014).

[6] “Norway opens new area of Barents Sea for license bids”, in *Offshore*, 22 Jan. 2015.

3. Some oil and gas production has resulted in serious accidents. The effects on the oil and gas companies of such accidents include both the direct economic costs and damage to company reputation. Reputational risk is likely to be particularly high in the Arctic since oil spills there will almost certainly attract greater attention than elsewhere – not only because of the fragility of Arctic ecosystems, the effects of oil in cold climates and the considerable challenges facing response actions, but also because of public perceptions of the Arctic as pristine wilderness. As the Exxon Valdez oil spill in Alaska in 1989 demonstrated, an oil spill in the Arctic could have enormous consequences for the Arctic's communities and ecosystems. During the winter months, the Arctic seas are covered with ice and are not navigable by oil-spill response ships. This means that if a spill started in the winter, the oil could continue to gush into the sea and under the ice until the spring, lasting for several months or even longer. Clean-up in the Arctic would be hampered by sea ice, extreme cold, hurricane-strength storms and pervasive fog; also, it might take longer or be ineffective because of fewer support vessels and less infrastructure than usual. [7] Some petroleum development plans are on hold because of environmental concerns. In 2013, Shell reported that the company had postponed drilling in Arctic waters using a drill ship when serious questions were raised concerning deficiencies in its safety and pollution control equipment; [8] and in 2015 the company abandoned Arctic oil and gas exploration. [9] Indigenous and tribal peoples in the Arctic could be adversely affected by the socio-economic and cultural consequences of accidents. Furthermore, work in extreme cold can impose severe working and living conditions on workers. [10] When accidents occur, fatalities can be higher than in any other region in the northern hemisphere because of more difficult evacuation, emergency response and rescue conditions.

1.1. Petroleum service companies

4. International competition has resulted in the development of a large service and supply industry for oil and gas exploration and production. In Norway, in 2012, the service and supply industry consisted of more than 1,300 companies across the entire supply chain, extending from seismic and drilling rig equipment, through valves, nuts and hoses for the shipbuilding industry, to advanced offshore supply and service vessels and subsea technology. The specialized and high-tech service and supply industry in Norway employs about 125,000 workers, of which 26,000 are permanently stationed offshore. About 186 billion Norwegian Krone (NOK) of the NOK461 billion of revenue (approximately 40 per cent) in the Norwegian service and supply industry originates from international markets. International revenue has grown by about 11 per cent annually since 2006. The rig and drilling services segment accounts for the largest share of international revenue. [11]

[7] A. Blanchard et al.: "Harmful routines? Uncertainty in science and conflicting views on routine petroleum operations in Norway", in *Marine Policy* (2014, Vol. 43), pp. 313−320.

[8] Shell Oil cancels offshore Alaska drilling for 2013, in *Environment News Service*, 27 Feb. 2013.

[9] B. Scheld: "Shell abandons Arctic oil, gas exploration", in *Oilgram News*, 29 Sep. 2015.

[10] International Petroleum Industry Environmental Conservation Association (IPIECA) and International Association of Oil & Gas Producers (OGP): *Health aspects of work in extreme climates* (OGP Report No. 398, 2008).

[11] Y. Tormodsgard (ed.): *FACTS 2014: The Norwegian petroleum sector*, Norwegian Ministry of Petroleum and Energy and Norwegian Petroleum Directorate.

2. Occupational safety and health challenges and best practices

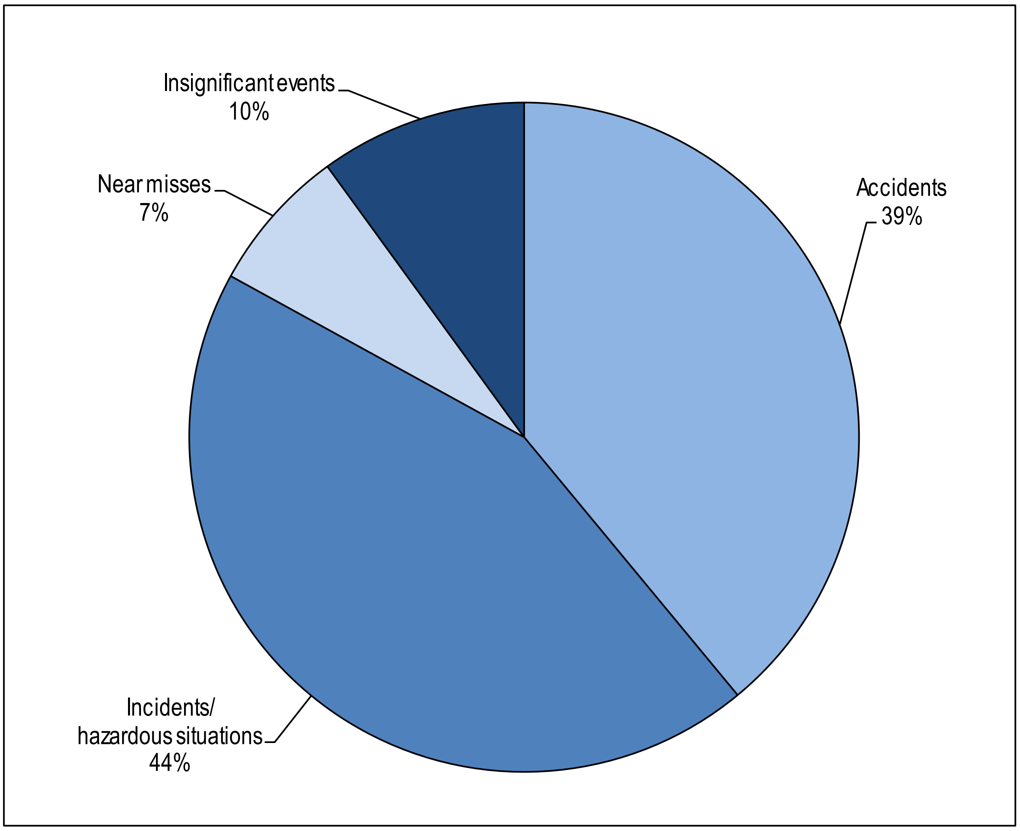
2.1. Offshore oil and gas accidents

5. The Worldwide Offshore Accident Database is one of the most comprehensive accident databases available. It contains 6,183 offshore accident reports from between 1975 and 2012, including accidents, incidents and near misses. Over 60 per cent of the data relates to incidents occurring in the northern hemisphere. The records are classified in four categories: insignificant events; near misses; incidents/hazardous situations; and accidents. The term “accidents” is defined as representing hazardous situations that have developed into accidents; this classification is used for all situations and events causing fatalities and severe injuries. The term “incidents” represents hazardous situations that have not developed into accidents; a low degree of damage has been recorded, and repairs or replacements are usually required. This category also includes events causing minor health injuries to personnel. “Near misses” represent events that might or could have developed into accidents, but where no damage has occurred and no repairs were required. “Insignificant events” represent hazardous situations with very minor consequences; in most of these cases no damages were registered and repairs were not required. Small spills of crude oil and chemicals are also included in this category, as are also very minor personnel injuries such as incidents leading to lost time.

6. Figures 1−3 show percentages for the different categories of event in the database. In figure 1, the more severe events are shown to be 83 per cent of the total collected data. With respect to type of unit, fixed facilities are more likely to experience accidents than mobile units: 50 and 38 per cent, respectively. Figure 2 shows the distribution of events by type of equipment-related cause for accidents in the database. In most cases, equipment malfunction was the main attributed cause for the event (34 per cent), followed by ignition (26 per cent). Causes related to safety systems are rarely recorded (0.18 per cent). Figure 3 shows the distribution of events for the different human-related causes in the database. Most events were attributed to unsafe procedures (37 per cent) or an absence of procedures that resulted in unsafe acts (44 per cent). [1] The figures indicate that in order to improve safety and health, the safety of equipment and facilities, and the elimination of human and organizational factors need to be addressed.

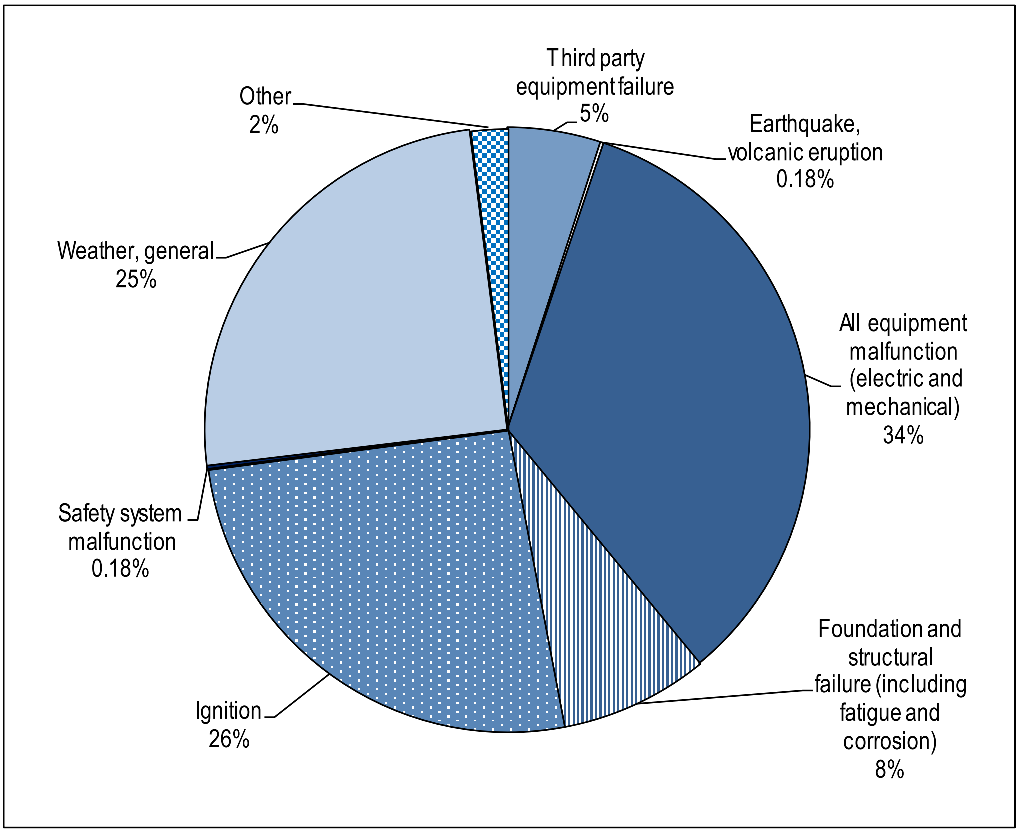
[1] M. Christou and M. Konstantinidou: *Safety of offshore oil and gas operations: Lessons from past accident analysis*: *Ensuring EU hydrocarbon supply through better control of major hazards* (Brussels, European Commission, JRC Scientific and Policy Reports, No. EUR 25646 EN, 2012).

Figure 1. Distribution of events by category, World Offshore Accident Database



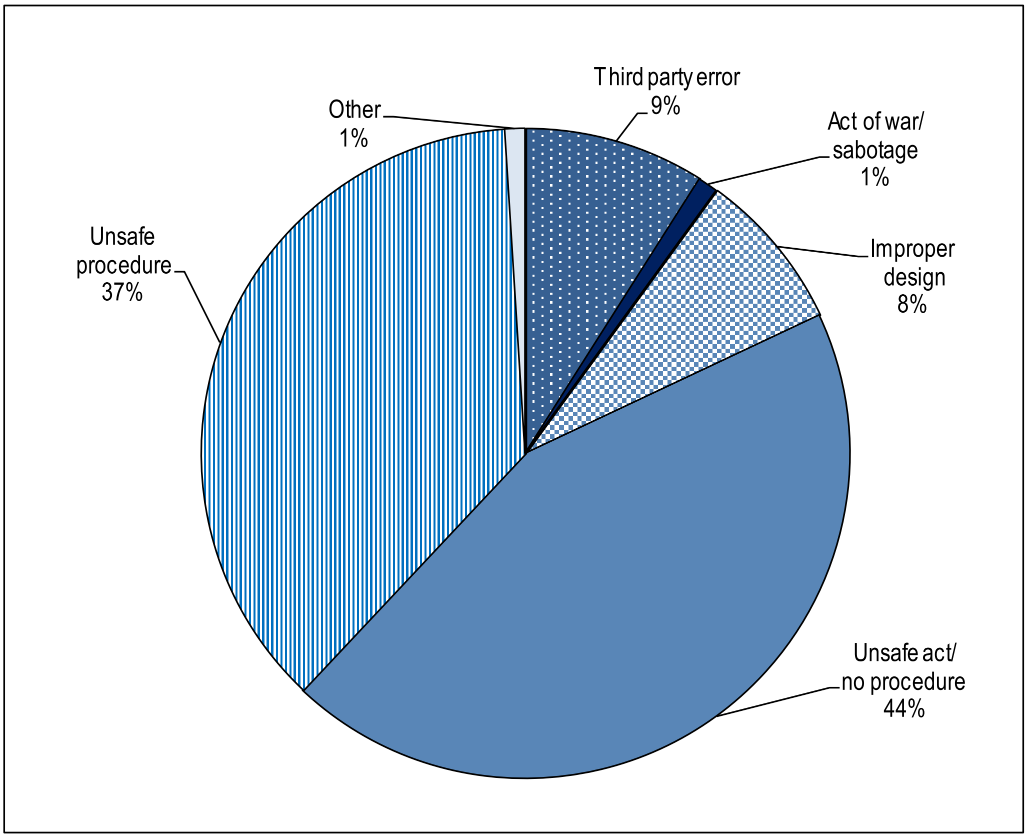
Source: M. Christou and M. Konstantinidou: *Safety of offshore oil and gas operations: Lessons from past accident analysis*, European Commission, 2012, p. 31.

Figure 2. Distribution of events by type of equipment-related or natural cause, World Offshore Accident Database



Source: M. Christou and M. Konstantinidou: *Safety of offshore oil and gas operations: Lessons from past accident analysis*, European Commission, 2012, p. 36.

Figure 3. Distribution of events by type of human-related cause, World Offshore Accident Database



Source: M. Christou and M. Konstantinidou: *Safety of offshore oil and gas operations: Lessons from past accident analysis*, European Commission, 2012, p. 35.

2.2. Ageing installations

7. In the oil and gas industry, one of the key safety challenges relating to equipment and installations is asset integrity. When offshore installations continue to work beyond their design life, they begin to raise safety concerns. A broad study of the industry found a statistically significant correlation: a 1 per cent increase in platform age leads to a 0.3632 per cent increase in the rate of accidents. [2] It is reported that many of the existing assets are nearing obsolescence. Shortages of new offshore rigs accelerate the safety risk. A shortage of new rig capacities in the coming years might make it necessary to use old installations longer. [3]

8. Workers have frequently expressed concern that maintenance is left to pile up on ageing platforms, and that the level of accidents has routinely been under-reported. Early in 2004, the Offshore Industry Liaison Committee – the United Kingdom's offshore workers' union – reported that many of the offshore installations were literally falling apart. Some of them

[2] As reported in B. Casselman: "Aging oil rigs, pipelines expose Gulf to accidents: Deep-sea-drilling debate has largely ignored troubled state of offshore infrastructure", in *The Wall Street Journal,* Asian edition, 16 Dec. 2010, p. 14.

[3] P. Dittrick: "Industry seeks new offshore rigs, longer onshore laterals in shale", in *Oil & Gas Journal* (14 Feb. 2011), pp.16–17.

were over 30 years old, while the original design use was for 15–20 years.[4] In 2007, poor maintenance conditions of some North Sea platforms were reported. The UK Health and Safety Executive (HSE) discovered the backlog of non-routine maintenance to be as high as 26,000 hours – and only half the deluge firefighting equipment passed a required test. The plant in more than half of the 100 installations inspected was considered to be in poor condition. The HSE's report states that "[c]ompanies often justified the situation with the claim that the plant, fabric and systems were non-safety-critical and a lower level of integrity was justified. This illustrates a lack of understanding in many parts of the industry that degraded non-safety-critical plant and utility systems can impact on safety critical elements in the event of a major accident reducing their performance."[5]

9. Furthermore, changes of installation ownership make it difficult to provide proper maintenance over time. When BP sold the Forties Oil Field − the single largest North Sea discovery − to Apache Corporation in 2003, it said that its cost-cutting had never been done to the detriment of safety. Soon after the sale, Apache shut down one rig for 28 days of repairs, 30 per cent longer than originally scheduled. Canadian Natural Resources had a similar experience in a North Sea field with a fixed platform which was originally built for Chevron. The field had changed hands several times before Canadian Natural Resources took it over in 2002, and all the platforms and the pipelines that serve them needed repair work.[6]

2.3. International labour standards on OSH

10. The ILO's international labour standards provide the minimum legal framework for promoting OSH. The ILO Constitution sets forth the principle that workers should be protected from sickness, disease and injury arising from their employment. The ILO's instruments on OSH promote tripartite collective efforts by governments, employers and workers to build, implement and continuously strengthen a preventative safety and health culture. Tripartism is a key component for effective OSH regimes in the oil and gas industry. A hydrocarbon development project – the trends in risk level in the petroleum activity (RNNP) process – serves to illustrate how tripartism works in the Norwegian oil and gas industry.

11. This process has developed considerably since its inception in 1999–2000 as a result of tripartite cooperation.[7] The national policy approach to OSH promoted by the ILO emphasizes the role of national governments in OSH management. From a governmental perspective, OSH management is a combination of related parts organized into a related whole or system. A systems approach to OSH means that emphasis is on the interdependence and interactive nature of its different components and on the overall outcome of efforts to improve it.

[4] "Cost cutting jeopardizes North Sea rigs: Union hits at oil and gas industries over under reporting of offshore accidents" (interview with K. Scott), in *The Guardian*, 26 Apr. 2004, p. 11.

[5] HSE: *Key Programme 3: Asset Integrity Programme*, report by the Offshore Division of HSE's Hazardous Installations Directorate (London, 2007), p. 7.

[6] H. Timmons: "Aging oil rigs raise safety issues", in *The New York Times*, 30 Dec. 2003.

[7] See K. Mearns and S. Yule: "The role of national culture in determining safety performance: Challenges for the global oil and gas industry", in *Safety Science* (2009, Vol. 47, Issue 6), pp. 777−785.

12. ILO standards on OSH provide essential tools for governments, employers and workers to establish such practices and to provide for maximum safety and health at work. The driving force behind ILO work in the area of OSH is the instruments that specifically regulate the main principles for managing or preventing exposure to occupational hazards and the associated means and methods for achieving this. These are laid down in 15 ILO Conventions, one Protocol and 17 Recommendations, as well as in the ILO codes of practice relating to OSH. Conventions are legally binding international treaties that may be ratified by member States, while Recommendations serve as non-binding guidelines. In many cases, a Convention lays down the basic principles to be implemented by ratifying countries, while a related Recommendation supplements the Convention by providing more detailed guidelines on how it could be applied. Recommendations can also be autonomous, that is to say not linked to any Convention. ILO Conventions and Recommendations are drawn up by representatives of governments, employers and workers and are adopted at the International Labour Conference. Once a standard is adopted, member States are required under the ILO Constitution to submit it to their competent authority (normally the Parliament) for consideration. In the case of Conventions, this means consideration for ratification. If it is ratified, a Convention generally comes into force for that country one year after the date of ratification. Ratifying countries commit themselves to applying the Convention in national law and practice and reporting on its application at regular intervals. [8]

13. A code of practice provides technical guidance without creating legal obligations. [9] In addition, a number of guides serve as companion publications to some codes of practice, providing information on implementation. While not formally approved by meetings of experts, nor submitted to the Governing Body, they might, however, be considered by a meeting of experts or a panel of consultants for general comment prior to final publication. “Guidelines” are not clearly defined, but fall somewhere between codes of practice and guides. For all intents and purposes, however, guidelines, when adopted by a meeting of experts and reported to the Governing Body, are analogous to a code of practice. They often address an issue that does not require global attention, or is less technical than it would be in a code. [10]

14. In the oil and gas industry, the code of practice *Safety and health in the construction of fixed offshore installations in the petroleum industry* was published by the ILO in 1981. The code does not specifically address Arctic operations or OSH in cold or low temperature working and living conditions. Only two codes of practice refer to OSH in cold working environments. First, *Safety and health in the non-ferrous metals industries*, published in 2003, requests employers to provide workers with extra care when they are required to move from a very hot working environment to a much colder one, especially when exposed to strong wind. It states: “Workers should be protected against the severest forms of cold stress, hypothermia and cold injury. … The core body temperature should not be allowed to fall below 36ºC (96.8ºF). Suitable protection should be provided to prevent injury to bodily extremities.” Second, the code of practice *Ambient factors in the workplace*, published in 2001, has a few provisions on the protection of workers from cold. This code does apply to the oil and gas industry, but it does not provide specifically for the protection of workers in extreme cold working and living conditions. It places emphasis on the role and obligations of competent authorities, the responsibilities of employers, and the

[8] See http://ilo.org/global/standards/subjects-covered-by-international-labour-standards/occupational-safety-and-health/lang--en/index.htm.

[9] GB.289/STM/2, para. 4.

[10] GB.289/STM/2, paras 6 and 7.

duties and rights of workers and others with regard to the prevention of illness and injury to health resulting from hazardous ambient factors in the working environment. It deals, in particular, with the setting up of legal, administrative and practical procedures and frameworks for the assessment of hazards, risks and of control measures; the aims of and mechanisms for identifying and eliminating or controlling the hazard or risk from hazardous ambient factors; the surveillance of workers' health and of the working environment; and the provision of information and training to workers, including regarding specific factors such as cold and low temperature working environments. However, the provisions of this code do not apply to other ambient factors, such as shift work, to ergonomic factors, or to psychosocial factors, such as work intensification, repetitive work and stress. The code is not a legally binding document and is not intended to replace national laws, regulations or accepted standards. Its provisions are considered as the basic requirements for the protection of workers' health against hazardous ambient factors and are not intended to discourage competent authorities from adopting higher standards. More stringent national or international regulations have priority over the recommendations in this code. [11] The relevant excerpts from *Ambient factors in the workplace* are found in the appendix.

2.4. Arctic standards

15. While there are some international and/or industry standards that may be applicable generally to operations in the Arctic, there are few standards that apply specifically to Arctic operations. Systematic reviews of globally applicable standards for suitability in the Arctic have only been done for a few of the available standards, such as ISO 19906:2010 *Petroleum and natural gas industries – Arctic offshore structures*. International organizations in the Arctic focus on cooperative activities for the protection of the general population, environmental protection and biosystem protections. There is no single authority or organization to comprehensively address specific OSH standards in the Arctic.

2.4.1. International Organization for Standardization (ISO) standards

16. The International Organization for Standardization (ISO) provides universal voluntary industrial standards. It is currently developing ISO 45001 "Occupational health and safety management systems – Requirements". [12] The ILO has been participating in the process of formalizing ISO 45001 on the basis of a Memorandum of Understanding signed by the two organizations in August 2013. [13] ISO 45001 is expected to be adopted in late 2016; it is now at the stage of the preparatory technical work. The standard will set requirements for OSH management systems and is designed to help companies and organizations around the world ensure the health and safety of workers. [14]

[11] ILO: *Ambient factors in the workplace: An ILO code of practice* (Geneva, 2001).

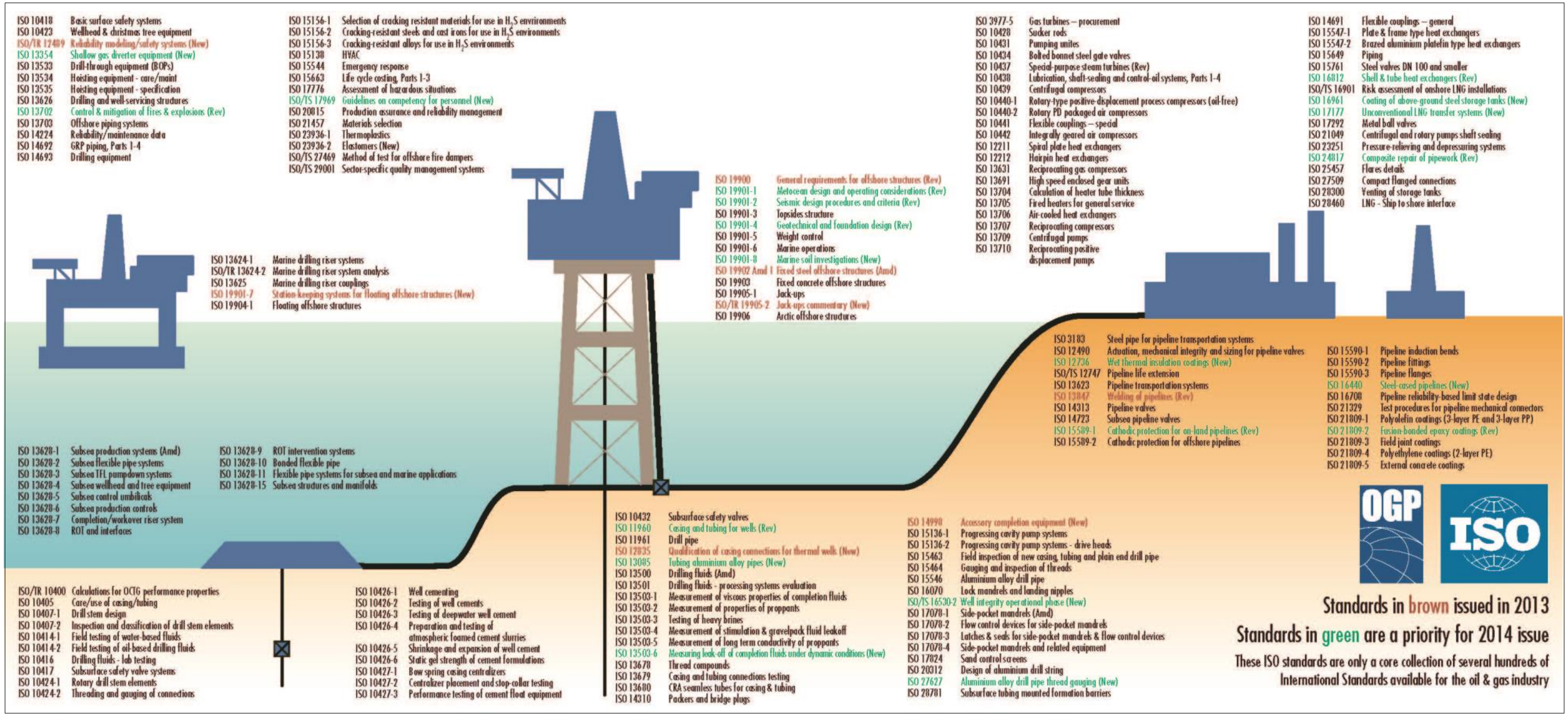
[12] Available at http://www.iso.org/iso/catalogue_detail?csnumber=63787.

[13] GB.319/INS/INF/1 and GB.320/INS/14/4.

[14] Letter from the International Trade Union Confederation entitled: "ISO standard for occupational health and safety management systems", dated 7 Oct. 2014.

17. The ISO also provides universal voluntary industrial standards for the oil and gas industry. A number of core ISO standards for use in the oil and gas industry are shown in figure 4. Since ISO 19906 was issued in 2010, some 130 offshore standards have been adapted or modified for common use in the Barents Sea. This is because the Arctic is not one homogenous region, and operational situations differ vastly, depending on the ice conditions, water depth, and proximity to existing support infrastructure in the area, as well as on season and region.

Figure 4. ISO standards for use in the oil and gas industry



Source: ISO and OGP. For a full size, colour version of this graphic, see http://www.iogp.org/Portals/0/Standards/standardsposter.pdf.

18. ISO 19906 specifies requirements and provides recommendations and guidance for the design, construction, transportation, installation and removal of offshore structures related to the activities of the petroleum and natural gas industries in Arctic and cold regions. Its objective is to ensure that offshore structures in these regions provide an appropriate level of reliability with respect to personnel safety, environmental protection and asset value to the owner, as well as to the industry and society in general. ISO 19906 does not contain requirements for the operation, maintenance, service-life inspection or repair of these structures except where the design strategy imposes specific requirements. The standard does not apply specifically to mobile offshore drilling units, or to mechanical, process and electrical equipment or any specialized process equipment associated with Arctic and cold region offshore operations except in so far as is necessary for the structure to sustain safely the actions imposed by the installation, housing and operation of such equipment. [15] In 2011, a subcommittee was created at the ISO to work further on standards development for Arctic offshore structures, with seven working groups established to address the following areas: working environment; escape, evacuation and rescue; environmental monitoring; ice management; Arctic materials; physical environment for Arctic operations; and man-made islands and land extension. [16]

2.4.2. Other Arctic standards and best practices

19. Some ILO member States are members of international organizations that are collaborating on protecting the population, the environment, and the biodiversity systems in the polar and subarctic climate zones of the northern hemisphere. These include the European Union (EU); the International Regulators' Forum; the North Sea Offshore Authorities Forum; and the Arctic Council. These organizations are the international forums for improving safety and health in the oil and gas industry. The EU regulates safety and health in the oil and gas industry. The International Regulators' Forum is a group of 11 regulators of health and safety in the offshore upstream oil and gas industry, which is active in the area of international standards development. The North Sea Offshore Authorities Forum is a forum for cooperation between the authorities of the North Sea countries. The work of the Forum is carried out through working groups; it holds an annual plenary assembly in one of its member countries, to hear the presentation of reports and decide the future mandates of the working groups. The Arctic Council is a high-level international forum which was established to promote cooperation, coordination and interaction among the Arctic States, with the involvement of Arctic indigenous communities and other Arctic inhabitants, on issues of common interest, and in particular sustainable development and environmental protection issues. The Arctic Council has been involved in activities relating to offshore oil and gas exploration and development. In May 2015, the Arctic Offshore Regulators Forum (AORF) was established. The AORF is a forum of technical and operational offshore petroleum safety regulators. Its primary scope, of work is the exchange of information, best practices and relevant experiences learned from regulatory efforts related to developing petroleum resources in the Arctic region. [17]

[15] See http://www.iso.org/iso/catalogue_detail.htm?csnumber=33690.

[16] See http://www.iogp.org/arctic-committee.

[17] "BSEE participates in Arctic offshore regulators forum meeting in Washington", 1 May 2015, available at: http://www.bsee.gov/BSEE-Newsroom/BSEE-News-Briefs/2015/BSEE-Participates-in-Arctic-Offshore-Regulators-Forum-Meeting-in-Washington/.

20. These international organizations produce standards that apply to Arctic operations. In 2013, the EU enacted an offshore oil and gas operations Directive [18] that requires operators to prove their ability to cover potential liabilities and to submit major hazard reports and emergency response plans before operations start. Under the Directive, all operators must ensure that they have sufficient physical, human and financial resources to minimize the impact of a major accident. No licence will be granted unless the applicant provides evidence that adequate provision has been, or will be, made to cover liabilities potentially deriving from its offshore oil and gas operations. Operators also have to provide an internal emergency plan, giving a full description of the equipment and resources at their disposal, action to be taken in case of an incident, and all arrangements made to limit risks and give the authorities as much warning as possible. In addition, EU Member States must prepare external emergency response plans covering offshore installations within their jurisdictions. The Directive clearly states that it does not affect EU law concerning safety and health of workers at work, in particular Directive 89/391/EEC – OSH "Framework Directive", or Directive 92/91/EEC on mineral-extracting industries and drilling. The Directive calls on the European Commission to promote high safety standards for offshore oil and gas operations at the international level through relevant global and regional forums, including the Arctic Council.

21. The Arctic Council has produced guidance for member States with existing or potential Arctic oil and gas developments. In 2009, it published the *Arctic offshore oil and gas guidelines*, and it has also issued specific guidance on dealing with emergencies in its *Field guide for oil spill response in Arctic waters*. In March 2014, the Council produced a guidance document: *Arctic offshore oil and gas guidelines: Systems safety management and safety culture – Avoiding major disasters in Arctic offshore oil and gas operations* to enhance and supplement the 2009 Guidelines by providing tools and approaches for reducing the potentially catastrophic effects of major oil and gas accidents. This document provides guidance to Arctic States on how they can promote an improved safety culture and robust safety management systems in the Arctic offshore oil and gas industry. It attempts to establish common goals in relation to safety, and processes for managing major risk factors, and it outlines targeted actions or approaches that can guide Arctic regional and national authorities in regulating or influencing critical human and organizational safety systems. However, the document deals only with "systems safety", sometimes called "process safety", not OSH.

22. In addition, international oil and gas industry associations compile their member companies' best safety and health practices and publish safety and health reports, studies and guidelines, some of which focus on Arctic safety operations. In March 2014, the International Association of Oil & Gas Producers (IOGP) created an Arctic Committee, two of whose primary objectives are to: "act as the E&P [exploration and production] industry's technical and advocacy focal point on issues related to upstream activities in the Arctic and cold region environments more generally" and "develop a long-term strategy to address the key Arctic issues for the upstream industry". [19]

2.4.3. International Code for Ships Operating in Polar Waters (Polar Code)

23. In November 2014, the International Maritime Organization adopted the International Code for Ships Operating in Polar Waters (Polar Code), and related amendments to the

[18] Directive 2013/30/EU of the European Parliament and of the Council of 12 June 2013 on safety of offshore oil and gas operations and amending Directive 2004/35/EC.

[19] See http://www.iogp.org/Newsroom/News/PostId/18/new-committee-to-address-arctic-issues.

International Convention for the Safety of Life at Sea (SOLAS). The Polar Code highlights the potential hazards of operating in polar regions, including ice, remoteness and rapidly changing and severe weather conditions, and provides goals and functional requirements in relation to ship design, construction, equipment, operations, training, and search and rescue, which are relevant to ships operating in Arctic and Antarctic waters. The SOLAS amendments are expected to enter into force on 1 January 2017. They will apply to new ships constructed after that date. “Ships constructed before 1 January 2017 will be required to meet the relevant requirements of the Polar Code by the first intermediate or renewal survey, whichever occurs first, after 1 January 2018”. [20]

2.5. Regulatory regimes

24. The oil and gas industry is regulated by national authorities. Safety and health are governed by the competent authority in the country in which the oil and gas company is operating. Each country has its own regulatory approach, legal regime, institutional arrangements and capacities, and management systems, and all of these vary from country to country. One of the often referenced differences between national safety and health governance schemes relates to whether countries have prescriptive or performance-based approaches to regulation. For example, the United States has employed a prescriptive regime. The regulator is responsible for ensuring that operators meet clearly defined requirements. In contrast, Norway is viewed as a model for using a performance-based regime. Under this approach, the operators have greater responsibility and are encouraged to innovate. While the regulator remains responsible for setting quantifiable goals, the performance-based approach leaves the means of reaching those goals up to operators. These different regulatory approaches are summarized in table 1.

Table 1. Comparison of two major regulatory regimes in the oil and gas industry

Prescriptive regime	Performance-based regime
Gives the competent authorities possibility to specify exact requirements	Depends on dialogue and trust between the competent authorities and the industry
Requires comprehensive and detailed inspection	The companies need to aim for good safety culture
Reduces operators’ responsibility to evaluate and manage risk	Tripartite cooperation and tripartite involvement
Depends on the industry’s willingness to give access to and share information	Transparency and openness with regard to reporting of failures and non-compliance
Can lag behind with regard to technological and social development	Requires a high degree of knowledge and competence

Source: Fridtjof Nansen Institute and Det Norske Veritas: *Arctic resource development: Risks and responsible management* (Norway, Lysaker/Høvik, 2012), p. 24.

25. Some challenges for prescriptive regimes include the following:

- Prescriptive regulations for operations can limit the approaches and technologies best available to do the work safely in any given situation.
- Prescriptive regulations take time to develop and implement and often lag behind advances in operating technology and practices.

[20] http://www.imo.org/MediaCentre/PressBriefings/Pages/38-nmsc94polar.aspx#.VMPAFq2PLL9.

- Relying solely on prescriptive regulations might cause the operator to meet only minimum requirements and not advance the level of safety through continuous improvement initiatives.

- Prescriptive regulations may lead to an “affirmative defence” by the operator or company in the event of an accident – whereby the operator assumes no liability by claiming they followed the rules or their safety plan was approved. This can have the effect of placing responsibility for safety and environmental protection back on the regulator.[21]

26. While neither approach can be said to be better than the other, countries are increasingly moving towards performance-based regimes. In addition, these approaches are not necessarily independent of each other. A combination of prescriptive and performance-based standards is a viable regulatory option that might allow a certain degree of flexibility. This so-called hybrid approach is often used when prescriptive regulatory systems are revised or adapted to incorporate performance-based standards. Canada takes this approach. In 2014, the Government of Canada enacted the Offshore Health and Safety Act. The Act ensures the safety of offshore workers, clarifies roles and responsibilities, increases transparency, covers workers in transit to offshore platforms, and gives OSH officers the power to enforce regulations.[22] Given the complex and wide-ranging nature of safety and health in the Arctic, there is a need for greater reliance on goal-setting and performance management for regulating offshore operations.

27. One challenge that arises when comparing safety and health data from different countries is the fact that they have a variety of regimes, contexts, cultures and histories of regulation. Incident and accident data are often taken as the single defining measure of the industry’s safety and health status. It is reported that, globally, the number of incidents has declined in recent years. Although the oil and gas industry collects its member companies’ safety performance information, using indicators, and annually publishes performance data, this annual report is not necessarily comprehensive – the IOGP’s safety statistics for 2013 were based on data provided by 50 oil and gas companies, for example. The number of companies reporting has gradually increased, however, with 39 companies reporting in 2008, 43 in 2009 and 49 in 2012. It seems that safety data as measured by safety performance indicators are not systematically gathered and used to improve OSH. This may be true at the company level. The Russian Federation’s oil and gas companies report on their safety and health performance in annual reports,[23] but each company communicates a different set of safety data to the public: their reporting methods must be standardized if a comparative analysis is to be conducted of the Russian oil and gas industry. In order to improve overall OSH in the oil and gas industry safety reporting also needs to include information about, and analysis of, near misses, and information on accidents involving contractors.

[21] Arctic Council: *Arctic offshore oil and gas guidelines: Systems safety management and safety culture* (Tromsø, Norway, 2014), p. 12.

[22] Offshore Health and Safety Act 2014. Available at: http://laws-lois.justice.gc.ca/eng/annual statutes/2014_13/FullText.html.

[23] Bashneft: *2013 sustainability report: Art of creating value* (Ufa, Russian Federation, 2014); Gazprom Neft: *Annual report 2013: New horizons* (St. Petersburg, 2014), available at http://ar2013.gazprom-neft.com/upload/GPN_AR_2013_eng_web.pdf; Gazprom: *Gazprom sustainability report 2010−2011* (Moscow, 2012); Tatneft: *Annual report 2013: Exploring new horizons* (Tatarstan, Russian Federation, 2014).

2.6. OSH management systems

28. Standardized processes for the oil and gas industry are designed to support an organization's ability to operate safely in any conditions and to deal effectively with any contingencies. Standardization has the potential to increase the predictability of normal operations by facilitating the transfer of lessons learned across organizational contexts. A process safety management system is used in the oil and gas industry throughout the lifecycle of oil and gas wells to ensure that safety, health and environmental protection measures are in place. [24] However, standard procedures are, by definition, strategies for dealing with known hazards and accident scenarios.

29. Standardization may:

> in some instances be counterproductive for safety, since it can reduce the ability to deal with unexpected events. The company's efforts to reduce variation in the performance of work processes seem to be based upon an assumption that human error is the prime cause of accidents, and that the goal of safety management is to reduce variation in worker behaviour. However, this view runs the risk of overlooking that human behaviour is a key *resource* for safety. Safety is dependent on the situated actions of human beings, in order to deal with the operational anomalies which are inevitable aspects of high risk environments. [25]

30. Studies [26] show that management systems are effective when worker participation and leadership are in place, and that, in the oil and gas industry, ILO–OSH 2001 [27] approaches can achieve the best results. ILO–OSH 2001 suggests a "plan/do/check/act" system, which fully supports worker participation and leadership. The value of mechanisms that ensure that workers participate in OSH management systems (including workers' representatives and safety and health committees) must be understood. In line with international labour standards, employers must recognize workers' representatives whenever these are legitimately chosen by workers, not only when it seems appropriate to them. A preventative safety and health culture is a prerequisite for safety and health at work. A preventative safety and health culture "refers to a culture in which the right to a safe and healthy working environment is respected at all levels, where government, employers and workers actively participate in securing a safe and healthy working environment through a system of defined rights, responsibilities and duties, and where the principle of prevention is accorded the highest priority". [28]

[24] IOGP: *Standards and guidelines for well construction and well operations*, May 2015, London.

[25] S. Antonsen et al.: "The role of standardization in safety management: A case study of a major oil & gas company", in *Safety Science* (2012, Vol. 50, Issue 10), pp. 2001−2009.

[26] J. Bennet and P. Foster: "Developing an industry-specific approach to a safety management system", in *Policy and Practice in Health and Safety* (2007, Vol. 5, No. 1), pp. 37–59; S. Bornstein and S. Hart: "Evaluating Occupational Safety and Health Management Systems", in *Policy and Practice in Health and Safety* (2010, Vol. 8, No. 1), pp. 61–76.

[27] ILO: *Guidelines on occupational safety and health management systems, ILO–OSH 2001*, 2nd edition (Geneva, 2009).

[28] The Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187), Art. 1(d).

2.6.1. The role of worker participation

31. Extensive worker participation and influence are key components of effective management systems.[29] Workers are stakeholders in the ILO's international labour standards, and worker protection and participation are at the core of safety and health at work. International labour standards request employers to ensure a safe and healthy working environment, and to identify hazards in order to eliminate them or reduce the risks involved. Worker participation plays a critical role in OSH management systems, and must be systematically built into systems. This point should be emphasized to the many companies in the oil and gas industry with management systems that take a management-driven approach and limit worker involvement. Workers should be able to participate through safety representatives.

2.6.2. The role of safety representatives

32. Studies on the Norwegian oil and gas industry have found that when management systems are dominated by managers, the influence of safety representatives tends to be reduced.[30] Another study found that worker participation in safety and health committees is more protected when there are elected representatives with sufficient rights than when representatives are not elected, and that union support for safety representatives and worker participation can achieve the best results. The study emphasizes the importance of safety representatives not being excessively dependent on managerial attitudes for effective worker representation. Effective worker influence on OSH must instead be based on the rights of trade unions to elect safety representatives, and on the rights of these representatives that enable them to perform their duties, such as rights to paid time to conduct work related to their role, and to access to all relevant information.[31]

33. Research indicates that the role of trade unions in relation to safety representatives is respected only to an extent in the oil and gas industry. The perceived scarcity of resources and the lack of significance accorded to the role of safety representatives undermine their balanced participation. Workers' perceptions of safety representatives having low social status in the workplace, a minimal role in workplace planning and too little influence contribute to a weakening of the strategic position of safety representatives and put them under pressure. In order to empower them, dialogue between safety representatives and management must be strengthened. The competence of safety representatives must be updated to allow them to support arguments with facts. Instead of being a hindrance to their career development, their position as safety representatives should be promoted and rewarded.[32]

[29] C. Gallagher: *Health and safety management systems: An analysis of system types and effectiveness* (Melbourne, National Key Centre in Industrial Relations, Manash University, 2007).

[30] For example, J. Hovden et al.: "The safety representative under pressure: A study of occupational health and safety management in the Norwegian oil and gas industry", in *Safety Science* (2008, Vol. 46), pp. 493−509.

[31] D. Walters and T. Nichols: *Worker representation and workplace health and safety* (Basingstoke, Palgrave Macmillan, 2007).

[32] Hovden et al., op. cit.

2.6.3. The role of senior management

34. The commitment of senior management to OSH management systems is important because communication between employers and workers is critical, and the attitudes of senior management strongly affect the nature of such communication – and thus workers' opportunities to influence management systems. [33] Management commitment to safety is recognized as a fundamental component of an organization's management system. While experience is not the dominant factor in determining leadership style or attitudes to safety, less experienced offshore installation managers and those with more authoritative styles of leadership tend to overestimate their ability to influence and motivate the workforce. It seems that although offshore installation managers are aware of best practices in safety leadership, they do not always act accordingly. They report having considerable difficulty in motivating their workforce and in controlling some workforce behaviour that is crucial to safety, such as encouraging workers to take responsibility for safety and to report near misses. [34]

35. In the oil and gas industry, with its typically diverse workforce, the climate of communication is of paramount importance: communication errors can lead to accidents. [35] The communication climate of an organization may either encourage or hinder horizontal, upward or downward communication among workers. In organizations with defensive climates, workers tend to abstain from communicating their needs, as they become very cautious about making statements and may have a low level of motivation. On the other hand, organizations with supportive environments encourage active worker participation, a healthy exchange of information and constructive conflict resolution. Instilling a collaborative communication climate in an organization, however, requires effective conflict management. [36]

2.7. Gender perspective in OSH policies

36. In general, the oil and gas industry has a low share of women workers. However, women workers represent a vital, available talent pool to help meet the demand of the projected growth and expansion of the industry in the coming years. Concerns have been expressed over the various effects of exposure to hazardous substances and biological agents on women's reproductive health, as well as the physical demands of heavy work, the ergonomic design of workplaces and the length of the working day. Long working hours also raise issues of work–life balance and potentially pose problems for workers with family responsibilities. If health promotion policies in the field of OSH are to be effective for both women and men, they must be based on accurate information about the relationship between health and gender roles. A broad strategy for the improvement of women workers' safety and health should be designed within an OSH policy. A coherent

[33] S. Bhattacharya: *The impact of the ISM Code on the management of occupational safety and health in the maritime industry*, PhD thesis (School of Social Science, Cardiff University, 2009).

[34] A. O'Dea and R. Flin: "Site managers and safety leadership in the offshore oil and gas industry", in *Safety Science* (2001, Vol. 37), pp. 39−57.

[35] S. Nordin, et al.: "Organizational communication climate and conflict management: communications management in an oil and gas company", in *Procedia: Social and Behavioural Sciences* (2014, Vol. 109), pp. 1046−1058.

[36] M. B. Hannevik et al.: "Organizational climate in large-scale projects in the oil and gas industry: A competing values perspective", in *International Journal of Project Management* (2014, Vol. 32), pp. 687−697.

framework should be developed to ensure a coordinated national approach. A national policy on OSH should include specific protection for the safety and health of women workers. It should provide guidance to enable employers, trade unions and national authorities to identify problems, make the appropriate links with general safety and health activities for all workers, and develop specific programmes to ensure that the needs of women workers are taken into account in occupational and industrial restructuring processes at the national level, particularly in the areas of legislation, information and training, workers' participation, and applied research. It has been suggested that a gender mainstreaming approach should be taken when reviewing and developing OSH laws and practices. [37]

[37] ILO: *10 keys for gender sensitive OSH practice – Guidelines for gender mainstreaming in occupational safety and health* (Geneva, 2013).

3. Health and well-being of workers

37. Arctic offshore operation exposes workers to extremely cold, windy and wet conditions. Workers are at risk of temperature shock because of differences between indoor and outdoor temperatures, wind, fog, dust, ice, freezing rain, snow and violent storms, which can result in difficult working and living conditions. Extreme cold can impact physical work capacity (see table 2).

Table 2. Effects of cold on manual performance

Hand skin temperature		Effect on performance
°C	°F	
32–36	89–97	Optimal hand and finger function
27–32	81–89	Effects on finger dexterity, precision and speed
20–27	68–81	Impaired performance in work with small details, reduced endurance
15–20	59–68	Impaired performance of gross finger work
10–15	50–59	Reduced gross muscle strength and coordination, pain sensation
<10	<50	Numbness, manual performance reduced to simple gripping, pushing, etc.

Source: IPIECA and OGP: *Health aspects of work in extreme climates* (2009), p. 4.

38. In addition, more oil and gas workers become ill as a result of their work than are killed or injured in industrial accidents. [1] Most diseases caused by work do not kill, but they can involve years of pain and suffering for those affected and their family members. As well as the human cost, there are potential production costs from sickness-related absences, staff turnover and, in extreme cases, dealing with medical emergencies and compensation claims.

3.1. Health challenges to oil and gas workers

39. The International Petroleum Industry Environmental Conservation Association (IPIECA), the global oil and gas industry association for environmental and social issues, uses a percentage tool to indicate how well oil and gas companies manage eight elements of their health management system. The percentage is based on a self-assessment performed by each company to gauge the extent of their compliance with the requirements of each element. The percentage of the company that complies with each level from 1 to 4 is entered into the tool. The total must add up to 100 per cent.

- Level 1 – Process under development.
- Level 2 – Process in place but not fully implemented and embedded.
- Level 3 – Process in place and implemented; system functioning; system procedures documented and results being measured.
- Level 4 – Process in place and implemented; system sustained and supported by an ongoing improvement process.

[1] Oil & Gas Agenda: *The health monitor: Occupational health*, 2015, http://www.growthmarkets-oil.com/features/featurethe-health-monitor-occupational-health-4622752/ [accessed 9 Oct. 2015].

40. The results from the percentage tool are displayed as a radar chart representing levels 1–4. Figure 5 represents the consolidated results from the participating companies in the percentage tool data collection for recent years (six companies in 2009, 17 in 2011 and 29 in 2013 – names of oil and gas companies are not published). The figure shows that over these years companies have gradually improved their health and safety performance indicators. In particular, companies should increase their efforts to improve:

- health impact assessment;
- health risk assessment and planning;
- public health interference and promotion of good health;
- industrial hygiene and control of workforce exposure; and
- health reporting and record management.

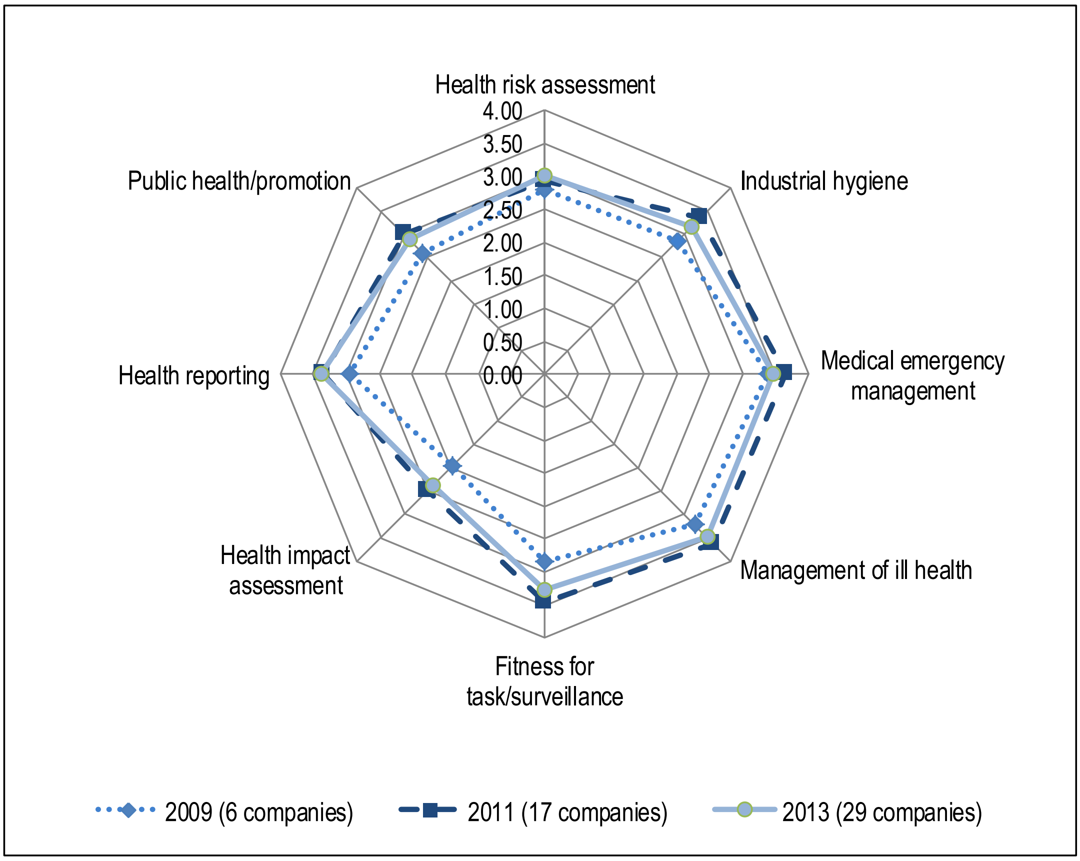
41. Some of the challenges most relevant to the health and well-being of workers are discussed below.

42. Many harmful effects of lifestyle behaviours, such as smoking, alcohol and drug abuse, nutritional deficiencies and physical inactivity, can interact with workplace hazards and their combined effects increase health risks to workers. However, the early detection and appropriate treatment of incident diseases will reduce mortality and lower the frequency and extent of residual disability from many occupational and work-related diseases. The elimination or limiting of such health risks can also prevent or delay the onset of life-threatening diseases such as strokes, coronary artery diseases and cancer. [2] The work location is often the first place where health risk factors are identified and where steps can be implemented to take preventative measures or provide treatment. Much work in the oil and gas industry is carried out at remote locations, which have limited medical care facilities and which are far from specialist treatment centres. Given this unique situation, regular health assessments can help identify and reduce risk factors, define individual action plans to promote healthy lifestyles, improve quality of life, and reduce medical costs. [3]

[2] V. Forastieri: *SOLVE: Integrating health promotion into workplace OSH policies* (Geneva, ILO, 2012), p. 3.

[3] IPIECA: *Prevention of heart attacks and other cardiovascular diseases: A guide for managers, employees and company health professionals* (London, 2013).

Figure 5. Assessment of health management by major oil and gas companies, 2009, 2011 and 2013



Source: IPIECA and OGP: *Health and safety performance indicators*: 2011 data and 2013 data, Report No. 2011h of Oct. 2012 and Report No. 2013h of June 2014.

3.1.1. Communicable diseases

43. Working and living in a confined environment on offshore rigs in the Arctic raises the risk of infectious diseases among workers. In March 2010, during its 307th Session, the ILO Governing Body approved a new list of occupational diseases. [4] This new list replaced the preceding one in the Annex of the List of Occupational Diseases Recommendation, 2002 (No. 194). The new list includes a range of internationally recognized occupational diseases, from illnesses caused by chemical, physical and biological agents to respiratory and skin diseases, musculoskeletal disorders and occupational cancer. This list also has open items in all the sections dealing with these diseases. The open items allow for the occupational origin of diseases not specified in the list to be recognized where a link is established between exposure to risk factors arising from work activities and the disorders contracted by the worker. In addition, the International Labour Conference in June 2010 adopted the HIV and AIDS Recommendation, 2010 (No. 200), following the formulation of the ILO code of practice *HIV/AIDS and the World of Work*.

3.1.2. Non-communicable diseases

44. The United Nations General Assembly at its 66th session in May 2011 warned that non-communicable diseases represent a new frontier in the fight to improve global health. The

[4] ILO: *ILO List of occupational diseases* (revised 2010) (Geneva).

United Nations focused on the four groups of diseases covered by the World Health Organization Global strategy for the prevention and control of noncommunicable diseases, [5] namely cardiovascular diseases, cancer, diabetes and chronic respiratory diseases. The rise in these diseases is fuelled by a combination of risk factors, including tobacco use, an unhealthy diet, lack of physical activity and harmful alcohol use. These four main diseases cause almost 80 per cent of all deaths from non-communicable diseases. [6]

3.1.2.1. Cardiovascular diseases

45. Cardiovascular diseases are currently among the most common health concerns for oil and gas workers in polar and subarctic areas. Comprehensive data for death or serious events due to medical causes are difficult to obtain. However, according to research conducted by Oil & Gas UK in the northern sector of the UK North Sea in 2011 and 2012, nine deaths of offshore workers due to medical causes were reported. Of these, eight were due to cardiovascular diseases and one to suicide. The deaths from cardiovascular diseases all occurred in persons over the age of 40, and five of these eight deaths were in people over the age of 50.

46. Serious medical events among offshore workers may result in the medical evacuation (medevac) of the worker concerned for medical care ashore. No precise figures are available on the number and causes of medical evacuations of offshore workers. However, according to Oil & Gas UK, reports from doctors providing medical services to the oil and gas industry suggest that a major cause of serious medical illness leading to evacuation is cardiovascular disease and, increasingly, strokes.

47. The oil and gas industry's future workforce may be particularly susceptible to lifestyle choices that can increase the incidence of cardiovascular disease. Health concerns were raised in the media about the difficulties of evacuating oil and gas workers by helicopter after Oil & Gas UK reported that the average weight of men working in the offshore oil and gas industry increased by 19 per cent between 1985 and 2009. [7] For this reason, the oil and gas industry is putting in place risk-based health promotion programmes aimed at addressing lifestyle problems, as well as initiatives to promote the well-being of workers in the long term. This is a proactive approach involving the families of workers in the reduction of cardiovascular disease risk, such as family fitness days, and the promotion of healthy diets and lifestyles. [8]

3.1.2.2. Stress, depression and bullying

48. Scientific evidence shows that, in the long term, work-related stress can contribute to musculoskeletal disorders and ill health, including hypertension and cardiovascular diseases. It may also alter immune functions, which in turn can facilitate the development

[5] See http://www.who.int/nmh/publications/wha_resolution53_14/en/.

[6] United Nations General Assembly Report of the Secretary-General: *Prevention and control of non-communicable diseases* (A/66/83), 2011, http://www.un.org/en/ga/search/view_doc.asp?symbol=A/66/83&Lang=E [accessed 12 October 2015].

[7] ibid. p. 24.

[8] J. Turner: "The big issue: Tackling the health risks faced by offshore employees," in *offshore technology.com*, 18 Nov. 2014, available at http://www.offshore-technology.com/features/featurethe-big-issue-tackling-the-health-risks-faced-by-offshore-employees-4423096/.

of cancer. Moreover, work-related stress also contributes to an inability to cope with work as well as to poorer career opportunities and employment prospects.

49. A study of office and production workers' health in the oil and gas industry in Siberia (Russian Federation) found that oil and gas production workers experience higher levels of stress than office workers. [9] Extreme cold weather is a dangerous situation that can trigger health emergencies in susceptible people. Workers who are exposed to extreme cold or who work in cold environments may be at risk of cold stress. However, what constitutes cold stress and its effects can vary across different areas of the Arctic. Whenever temperatures drop decidedly below normal, and as wind speed increases, heat more rapidly leaves workers' bodies. These weather-related conditions may lead to serious health problems. Some known cold stresses include hypothermia, frostbite, trench foot and chilblains. To prevent cold stress, workers should wear appropriate protective clothing and be aware of how their bodies are reacting to the cold. Avoiding alcohol, certain medications and smoking can also help minimize the risk. [10]

50. A study published in 2014 examined the prevalence of clinical depression in the workforce and found that oil and gas workers had reported high overall levels of depression compared to other industries. [11] The researchers found that physical inactivity and stress in the workplace are the main factors affecting the rate of depression. In the Arctic, weather conditions can have a significant impact on health and performance as exposure to cold can decrease awareness, and dark, damp or severe weather conditions can contribute to depression. Seasonal affective disorder is a mood disorder associated with depressive episodes, which is related to seasonal variations of light and it increases during the dark winter months. Another study from 2011 investigates the links between individual and psychosocial work factors and mental distress among offshore shift workers in Norway. [12] The result of the study indicates that the level of mental distress is higher among men than women. In 2013, at a conference commemorating the 25th anniversary of the Piper Alpha disaster in the North Sea, Professor Neil Greenberg, an occupational and academic psychiatrist and leading expert in the United Kingdom in operational stress, including post-traumatic stress disorder, compared the situation of oil and gas workers deployed to far-flung, isolated and sometimes dangerous locations to the military and the risk of exposure to traumatic incidents. He "urged companies to take more preventative action to protect their workers". [13]

51. A study involving more than 1,000 Norwegian offshore oil and gas workers found that workplace bullying is a stronger predictor of mental health problems than risk perception. According to the study, workers in organizations operating in environments with a high potential for risks and hazards report higher levels of stress and health problems than workers in general. The study implies that a considerable challenge for the oil and gas

[9] L. Korkina et al.: "Coenzyme Q10-containing composition (Immugen®) protects against occupational and environmental stress in workers of gas and oil industry", in *BioFactors* (2003, Vol. 18, Nos. 1–4), pp. 245−254.

[10] US Centers for Disease Control and Prevention: *Cold stress*, 2015.

[11] L.Wulsin et al.: "Prevalence rates for depression by industry: A claims database analysis", in *Social Psychiatry and Psychiatric Epidemiology* (2014, Vol. 49, No. 11), pp. 1805−1821.

[12] C.H Ljoså et al.: "Mental distress among shift workers in Norwegian offshore petroleum industry: Relative influence of individual and psychosocial work factors", in *Scandinavian Journal of Work, Environment and Health*, (2011, Vol. 37, No. 6,), pp. 551−555.

[13] P. Murray: "Work offshore 'like being in a war zone'", in *the Express*, 7 July 2013.

industry lies in finding ways to prevent and handle bullying. In addition, given that risk perception was found to be a significant predictor of mental health problems, the industry needs to reduce its impact on workers. In this context, the oil and gas industry must give high priority to the prevention and management of stressors. As for how to protect workers, the study suggested that one way to prevent and handle workplace bullying and unhealthy risk perception may be to develop and strengthen the psychological safety climates in the organizations.[14]

3.2. Substance abuse

52. Drugs and alcohol are generally forbidden in the workplace due to the safety implications inherent in their use. Cases demonstrate that the costs of not having a substance abuse screening programme are high. The accident report of the Exxon Valdez oil spill stated: "The Safety Board concludes that the master of the Exxon Valdez was impaired by alcohol at the time the vessel grounded on Bligh Reef and that impairment of his judgment owing to alcohol consumption caused him to leave the bridge at a critical time." [15]

53. The oil and gas industry has established guidelines for eliminating substance abuse in the workplace. Among these are giving workers and employers mutual responsibility to identify co-workers showing signs of substance abuse and to offer help. In Norway, the Advisory centre for issues related to alcohol, drugs and addictive gambling in the workplace (AKAN) plays a critical role. The Norwegian Oil and Gas Association's guidelines suggest that member companies establish their own AKAN committees and report to the company's working environment committee. In addition to dealing in general with issues related to alcohol and drugs, the committee should assist in relocating and rehabilitating affected workers at the earliest possible stage. The committee consists of representatives from management, the workforce and the company health service. [16]

3.3. Health of indigenous and tribal peoples

54. Promoting health for indigenous and tribal peoples is an important agenda for the oil and gas industry in the Arctic, where approximately 4 million people live. The Arctic population includes approximately 320,000 indigenous persons. The proportion of indigenous peoples varies significantly among the Arctic States, from zero in Iceland to the vast majority in Greenland. In Canada, around half the Arctic population is indigenous.[17] There is debate about whether offshore drilling could harm the traditional livelihoods, health and well-being of the Alaskan natives. The Inupiat people, for instance, hunt bowhead whales and other marine species in Arctic waters, and half their caloric intake comes from subsistence sources of meat. A study of the native population found that the oil and gas industry's expansion in Alaska's North Slope has disrupted the traditional subsistence lifestyle, contributing to rising rates of diabetes and related metabolic

[14] M. Birkeland Nielsen et al.: "Bullying and risk-perception as health hazards on oil rigs", in *Journal of Managerial Psychology* (2013, Vol. 28, No. 4), pp. 367−383.

[15] R. Flin and G. Slaven: *Managing the offshore installation workforce* (Tulsa, OK, PennWell, 1996), p. 35.

[16] Norwegian Oil and Gas Association: *Recommended guidelines for handling alcohol and substance abuse* (Oslo, 2007).

[17] Fridtjof Nansen Institute (FNI) and Det Norske Veritas (DNV): *Arctic resource development: Risks and responsible management* (Norway, Lysaker/Høvik, 2012).

conditions as a result of dietary change; rising rates of substance abuse, domestic violence, and suicide; more frequent asthma exacerbations; and increased exposure to organic pollutants, including carcinogens and endocrine disruptors. [18]

55. The cultures, ways of life, traditions and customary laws of indigenous and tribal peoples are valuable and need to be respected and protected, and the peoples should participate in decision-making processes in the countries in which they live. The Indigenous and Tribal Peoples Convention, 1989 (No. 169), is based on respect for the cultures and ways of life of indigenous peoples and recognizes their right to land and natural resources, and their right to define their own priorities for development. The Convention covers a wide range of issues pertaining to indigenous peoples, including safety and health. Article 20(3)(b) states that indigenous people are not to be "subjected to working conditions hazardous to their health, in particular through exposure to pesticides or other toxic substances".

[18] A. Wernham: "Inupiat health and proposed Alaskan oil development: Results of the first integrated health impact assessment/environmental impact statement for proposed oil development on Alaska's North Slope", in *EcoHealth* (2007, Vol. 4), pp. 500−513.

4. Working-time arrangements

56. Offshore working-time arrangements are subject to constraints and demands that do not apply in onshore work settings. Twelve-hour shift work schedules and long rotation patterns are a common feature of working on offshore oil and gas installations. Offshore work also takes place in the remote locations of many drilling and oil and gas development sites. The limitations of accommodation facilities in these remote locations make it necessary for offshore workers to stay for long periods of time. The duration of offshore tours seems to be getting longer in recent years. Escape is literally impossible for those who work 12-hour shifts over two weeks on board the offshore rigs. A study involving a large contractor company providing well services for platform drilling on the Norwegian (NCS) and the United Kingdom (UKCS) continental shelves found that different installations and work teams have different exposure to accidents, and structural work factors matter significantly. Somewhat counter-intuitively, workers who have a nomadic status and who hold the least regular shift rotations appear to have a lower risk of being involved in incidents. [1]

4.1. Health impacts

57. Psychosocial risks have been widely reported as having a significant impact on the health and safety of workers in the oil and gas industry. The need for psychosocial risk management and the promotion of workers' health and well-being are now being recognized as important issues.

58. Psychosocial risks are risks associated with the way work is organized, designed and managed. They concern interactions among job content, work organization and management, and other environmental and organizational conditions, on the one hand; and workers' competences and needs on the other. These risks may have a harmful impact on workers' safety and health through their perceptions and experience.

59. Research indicates that there is an increased likelihood of illness and injury among workers working long-hour schedules and schedules involving unconventional shift work, such as night and evening shifts. A recent study reports that shift work is linked to a heightened risk of developing Type 2 diabetes, with the risk seemingly greatest among men and those working rotating shift patterns. This heightened risk rose to 37 per cent for men. [2] In addition, fatigue-related errors made by workers working these kinds of demanding schedules can have serious and adverse repercussions for safety and health. [3] The number of hours worked per day, and number of consecutive days worked without more than 24 hours off, are considered the primary factors influencing worker fatigue. Considered less influential are total hours worked in a week, rotating shifts, and night shift work.

[1] J.E. Tharaldsen et al.: "Perspectives on safety: The impact of group membership, work factors and trust on safety performance in UK and Norwegian drilling company employees", in *Safety Science* (2010, Vol. 48, No. 8), pp. 1062–1072.

[2] Y. Gan et al.: "Shift work and diabetes mellitus: A meta-analysis of observational studies", in *Occupational and Environmental Medicine* (2014, Vol. 72, No. 1, July), pp. 72−78.

[3] A.E. Dembe: "Ethical issues relating to the health effects of long working hours", in *Journal of Business Ethics* (2009, Vol. 84, No. 2, Jan.), pp. 195−208.

60. Oil and gas employers are aware of worker fatigue and protective schemes have been put in place. Most oil and gas companies, however, lack the processes needed to effectively monitor and manage worker fatigue. [4] Organizations that do have internal controls and/or proactive monitoring systems estimate their fatigue-related cost per worker to be lower. [5]

4.2. Overtime work

61. An ILO study on compressed working weeks found that negative health outcomes are most likely to be associated with extended shifts in combination with either high workloads or regular overtime. [6] Overtime varies from installation to installation. On the UKCS, on some installations there is little or no overtime work, whereas on others frequent overtime is needed to maintain normal operations. On UKCS installations, more than half the day workers, and almost a quarter of day/night shift workers, reported working hours longer than the regular 84 hours per week. In Norway, 18 per cent of workers reported more than 20 hours overtime on their most recent offshore tour.

62. A system is in place to track workers' trip histories, competences and training, and to log offshore work-hours, with a warning flagged if excessive hours are recorded. Offshore workers who work for specialized service companies, for example those involved in well services and related activities, routinely move from one installation to another to provide specific tasks that cannot be covered by the regular employees. These workers tend to have no fixed work/leave cycle; rather, they undertake successive jobs as assigned by the companies. Some of these workers have excessively long working hours.

63. Within the EU, the EU Working Time Regulation regulates working time in the oil and gas industry. However, on the UKCS it does not regulate the maximum duration of offshore work. The HSE suggested that no overtime should be worked without a risk assessment, that there should be an absolute limit of 14 hours' work in any one shift or any period of 24 hours, and that the normal operation of the installation should not rely on overtime. On the UKCS the maximum period that an individual can work offshore is normally 21 days; a shore break of at least one third of the time spent offshore must then be taken. However, many managers offshore work very long hours: about 60 per cent of senior managers and about 29 per cent of supervisors reported working more than 100 hours per week.

4.3. Fly-in-fly-out

64. Working time schemes in remote areas rely on rotational work in order to keep workers in these areas longer. In Siberia (Russian Federation), two forms of rotational work are frequently used. The first is trans-regional rotations, which are connected by shuttle shifts of specialist teams from other regions of the country at distances of 2,000–3,000 kilometres or more. This method includes the flight from a place of permanent residence to base points in the north, followed by delivery of workers to the workplace by ground or by air. Work is managed in different shift systems for 12–30 days or more. After this, workers return to their places of permanent residence for a certain period of time. In the second

[4] M. Chan: "Fatigue: The most critical accident risk in oil and gas construction", in *Construction Management and Economics* (2011, Vol. 29, No. 4, Apr.), pp. 341−353.

[5] PennEnergy: *The effects of employee fatigue and its management in the energy industry* (2014).

[6] P. Tucker: *Compressed working weeks* (Geneva, ILO, Conditions of Work and Employment Series No. 12, 2006).

type of rotation, workers are delivered by different types of transport to workplaces and are accommodated in field towns. Usually, shifts of eight to 12 hours are applied, and the duration of a rotation period is up to three months.[7]

65. A survey of fly-in-fly-out workers in the energy industry reported that a majority of workers (75 per cent) have overall good or very good levels of physical and mental health. However, 60 per cent agreed that the demands of long-distance commute work arrangements interfered with their work–life balance; 40 per cent reported feeling lonely or socially isolated to some degree; and 5 per cent reported moderate to severe stress levels. One of the most important findings from the survey is the extent to which workers value their privacy and personal space. The desire for a private room where they can use the internet, phone family and friends, or watch television at a time of their choosing, and without other people nearby, was clearly expressed. The ability to connect with family and friends is important for the psychological health of fly-in-fly-out workers – a sense of belonging reduces stress and loneliness.[8]

4.4. Offshore shift working arrangements

66. A literature review in 2013 examined, among other things, six cross-sectional studies on the relationship between shift work and offshore oil workers' health. [9] It found that, overall, few studies have investigated this relationship, and their findings are inconclusive. The findings regarding body mass index are also inconsistent. [10] The studies found that shift work is a predictor for gastric problems; [11] however, there is no evidence for more subjective health complaints among offshore shift workers compared to offshore day workers, except in the group of shift workers fulfilling the criteria for shift work disorder. [12]

[7] A. Gudkov: "Physiological aspects of rotational work forms in the oil and gas sector of the High North", in *Barents Newsletter on Occupational Health and Safety* (2009, Vol. 12, No. 1), pp.18−20.

[8] M. A. Barclay et al.: *Factors linked to the well-being of fly-in-fly-out (FIFO) workers*, Research Report (Brisbane, CSRM and MISHC, Sustainable Minerals Institute, University of Queensland 2013).

[9] I. N. Fossum et al.: "Effects of shift and night work in the offshore petroleum industry: A systematic review", in *Industrial Health* (2013, Vol. 51, No. 5), pp. 530−544. The six studies cited (on pp. 534–535) are: K. R. Parkes: "Mental health in the oil industry: A comparative study of onshore and offshore employees", in *Psychological Medicine* (1992, Vol. 22, No. 4, Nov.), pp. 997–1009; K. R. Parkes: "Shiftwork, job type, and the work environment as joint predictors of health-related outcomes", in *Journal of Occupational Health Psychology* (1999, Vol. 4, No. 3, July), pp. 256–268; K. R. Parkes: "Shift work and age as interactive predictors of body mass index among offshore workers", in *Scandinavian Journal of Work, Environment and Health* (2002, Vol. 28, No. 1, Feb.), pp. 64–71; S. Waage et al.: "Shift work disorder among oil rig workers in the North Sea", in *Sleep*, (2009, Vol. 32, No. 4, Apr.), pp. 558–565; S. Waage et al.: "Shift work and age in petroleum offshore industry", in *International Maritime Health* (2010, Vol. 62, No.4), pp. 251–257; and C. H. Ljoså et al.: "Mental distress among shift workers in Norwegian offshore petroleum industry: Relative influence of individual and psychosocial work factors", in *Scandinavian Journal of Work, Environment and Health* (2011, Vol. 37, No. 6, Nov.), pp. 551−555.

[10] Fossum et al., op. cit., p. 538.

[11] ibid., p. 539.

[12] ibid., p. 539.

4.4.1. Quality of sleep

67. The demands and constraints of the offshore working environment can have adverse effects on health, particularly the quality of sleep. Perceived risk and safety are significant psychological stress factors which may interfere with and deteriorate the sleep quality of offshore workers. A study on the NCS examined the relationship between risk perception, safety climate and sleep quality. A total of 9,601 offshore workers from 52 offshore installations on the NCS participated in the study. Overall, the study results indicate that both perceived risk and perceived safety climate are significant predictors for poor subjective sleep quality among offshore workers. These findings hold even after controlling for gender, age, installation, work area and shift arrangements. [13]

68. The study found day workers to have significantly lower distress scores than day/night workers. Sleep quality was highest for workers on day shifts, lowest for those on fixed-shift rotation. The impact of day/night shifts versus day work had different impacts on health to the impact of job. Day/night rotation was a risk factor only for sleep problems. Job type predicted other health risks, and work-related injury. [14] Day/night shift work (as compared with day work) and job type are associated with different patterns of health-related outcomes. The study found that shift work effects gave rise to significantly higher levels of gastric problems and psychological distress. However, there is a degree of confusion between shift work and job type in predicting psychosomatic and mental health outcomes. The study found that offshore oil and gas shift work directly predicted gastric problems and sleep disturbance.

4.4.2. Shift work, adaptation and re-adaptation

69. Studies regarding the adaptation of circadian rhythms show that most workers were fully adapted to night work after one,[15] two or three weeks.[16] Full adaptation to night work offshore may be more common and easier to achieve than adaptation to night work

[13] S. Hope et al.: "Associations between sleep, risk and safety climate: A study of offshore personnel on the Norwegian continental shelf", in *Safety Science* (2010, Vol. 48, No. 4, Apr.), pp. 469−477.

[14] See also Parkes, 1999, op. cit.

[15] A. Harris et al.: "Cortisol, reaction time test and health among offshore shift workers", in *Psychoneuroendocrinology* (2010, Vol. 35, No. 9, Oct.), pp. 1339–1347; S. Waage et al.: "Subjective and objective sleepiness among oil rig workers during three different shift schedules", in *Sleep Medicine* (2012, Vol. 13, No. 1, Jan.), pp. 64–72; R. G. Barnes et al.: "Adaptation of the 6-sulphatoxymelatonin rhythm in shiftworkers on offshore oil installations during a 2-week 12-h night shift", in *Neuroscience Letters* (1998, Vol. 241, No. 1, 23 Jan.), pp. 9−12; M. Gibbs et al.: "Adaptation of the circadian rhythm of 6-sulphatoxymelatonin to a shift schedule of seven nights followed by seven days in offshore oil installation workers", in *Neuroscience Letters* (2002, Vol. 325, No. 2, 7 June), pp. 91–94; M. Gibbs et al.: "Predicting circadian response to abrupt phase shift: 6-sulphatoxymelatonin rhythms in rotating shift workers offshore", in *Journal of Biological Rhythms* (2007, Vol. 22, No. 4, Aug.), pp. 368–370; B. Bjorvatn et al.: "Rapid adaptation to night work at an oil platform, but slow readaptation after returning home", in *Journal of Occupational and Environmental Medicine* (1998, Vol. 40, No. 7, July), pp. 601–608; and B. Bjorvatn et al.: "Subjective and objective measures of adaptation and readaptation to night work on an oil rig in the North Sea", in *Sleep* (2006, Vol. 29, No. 6, June), pp. 821−829.

[16] H. Thorne et al.: "Differences in sleep, light, and circadian phase in offshore 18:00–06:00 h and 19:00–07:00 h shift workers", in *Chronobiology International* (2008, Vol. 25, No. 2, Apr.), pp. 225–235.

onshore. This may be related to the fact that the offshore environment is better adapted to 24-hour operations, with similar routines for day and night shift workers, making it easier to align the circadian rhythm to the working environment. Morning exposure to light may prevent a phase delay. With respect to re-adaptation, several of these studies showed that re-adaptation from night work back to a daytime schedule offshore or at home was slower than adaptation to night work. [17]

70. In addition, three offshore intervention studies regarding sleep, adaptation and re-adaptation indicated that bright light treatment and melatonin administration, aiming to improve adaptation to shift work offshore, may give significant positive effects. The interventions seemed to be more effective in improving re-adaptation following night work. [18]

[17] Harris et al., 2010, op cit.; Gibbs et al., 2002, op. cit.; Bjorvatn et al., 1998, op. cit.

[18] B. Bjorvatn et al.: "Bright light treatment used for adaptation to night work and re-adaptation back to day life: A field study at an oil platform in the North Sea", in *Journal of Sleep Research* (1999, Vol. 8, No. 2, June), pp. 105–112; B. Bjorvatn et al.: "Randomized placebo-controlled field study of the effects of bright light and melatonin in adaptation to night work", in *Scandinavian Journal of Work, Environment and Health* (2007, Vol. 33, No. 3, June), pp. 204–214; and H. C. Thorne et al.: "Returning from night shift to day life: Beneficial effects of light on sleep", in *Sleep and Biological Rhythms* (2010, Vol. 8, No. 3, July), pp. 212–221.

5. Accidents in transportation

71. Data show that, in areas including the Arctic Circle, accidents are more likely to occur in transportation than in work on exploration and development of hydrocarbons. According to an analysis by the US Centers for Disease Control and Prevention of 128 fatalities in activities related to offshore oil and gas operations in the United States for the period 2003−10, transportation events were the leading cause of death (65 fatalities, or 51 per cent), most of which involved aircraft (49 fatalities, or 75 per cent). Two-thirds of the fatalities involved workers employed in specialized and service companies in the oil and gas extraction industry (87 fatalities, or 68 per cent). Of those, almost half were employed by well servicing companies (43), followed by drilling contractors (26) and oil and gas operators (18) – 49, 30 and 21 per cent, respectively. The remainder involved workers who were classified as employees in other industries, including transportation and warehousing (23), construction (10) and all other industries (eight) − 18, 8 and 6 per cent, respectively. Nearly a quarter (31, or 24 per cent) of the fatalities occurred among workers whose occupations were classified as "transportation and material moving", transporting workers and their equipment to and from offshore drilling platforms. [1]

5.1. Transportation by air

5.1.1. Helicopter accidents

72. The journey to and from work within the offshore installations can be more hazardous than the job itself. For those working offshore and for some working onshore, the round trip is often made by helicopter. Table 2 summarizes accident data and traffic volumes in the Norwegian and UK sectors and the North Sea in total for the periods 1990–98, 1999–2009 and the merged period 1990–2009. The main finding is that the number of fatalities in accidents per million person flight hours in the UK sector in the period 1990–98 was 2.3, but the corresponding number for the period 1999–2009 in the Norwegian sector was zero. For the North Sea, there were a total of 2.4 fatalities per million person flight hours during the period 1999–2009. This is an increase from the previous period (1990–98) where 1.8 fatalities per million person flight hours were reported. In the UK sector there were 5.6 fatalities per million person flight hours during the period 1999–2009.

[1] US Centers for Disease Control and Prevention: "Fatal injuries in offshore oil and gas operations: United States, 2003−2010", in *Morbidity and Mortality Weekly Report (MMWR)* (2013, Vol. 62, No. 16, 26 Apr.), pp. 301−304.

Table 3. Offshore helicopter accidents and fatal accidents, Norway, United Kingdom and North Sea, 1990–2009

	1990–98			1999–2009			1990–2009		
	Norway	UK	North Sea	Norway	UK	North Sea	Norway	UK	North Sea
Million person flight hours	5.2	10.5	15.7	7.8	6.1	13.9	13.1	16.6	29.7
Number of accidents	4	11	15	1	11	12	5	22	27
Number of fatal accidents	1	2	3	0	3	3	1	5	6
Percentage fatal accidents	0.25	0.18	0.2	0	0.27	0.25	0.2	0.23	0.22
Number of fatalities	12	17	29	0	34	34	12	51	63
Accidents per million person flight hours (accident rate)	0.76	1.05	0.95	0.13	1.81	0.86	0.38	1.33	0.91
Number of fatalities per accident	3	1.5	1.9	0	3.1	2.8	2.4	2.3	2.3
Number of fatalities per million	2.3	1.6	1.8	0	5.6	2.4	0.9	3.1	2.1
Fatal accident rate (FAR)	230	160	180	0	560	240	90	310	210

Source: A. Herrera et al.: *Helicopter safety study* (HSS-3), Main Report, No. SINTEF A15753 (Trondheim, SINTEF, 2010), p. 67.

73. Trade unions have repeatedly raised concerns about the fatal helicopter accidents, reiterating to the oil and gas industry the hazardous nature of offshore oil and gas exploration and production. These accidents serve to remind everyone that the industry safety record should be, in the first instance, measured in human terms and not just as a set of statistics. Improving the safety of all operating helicopters simultaneously is no easy task; however, safety cannot be compromised for any reason.

74. Some aviation accidents result from faulty equipment. In Canada, when 17 workers died in March 2009 (see section 6.2.3 below), an analysis of this fatal crash by the Transportation Safety Board of Canada indicated that the Sikorsky helicopter S-92A gearbox failed ten minutes into a test designed to show that it could run half an hour without oil, a failure rate judged to be 267 times worse than the standard. [2] Ill-fitting survival suits may have been one factor in the deaths, the crash inquiry heard. In a letter, the Canadian Association of Petroleum Producers said that concerns about the E-452 suits, issued to offshore workers in 2007, had been raised during a 2008 survey by the manufacturer, Helly Hansen. The suits were said to be bulky and stiff, the zippers were difficult to close and the wrist seals were uncomfortably tight. Also, some of the suits leaked during training and only a limited range of sizes was available. Another concern raised by the sole survivor of the crash was that the gloves attached to the survival suits were difficult to put on and that his hands had been too numb to do so. In the meantime, the gloves had been redesigned and retested with offshore workers to ensure that the suits fitted properly. Randell Earle, a lawyer for unionized Canadian offshore workers, suggested that the inquiry should examine how long it takes the oil industry to introduce safety improvements and criticized delays in equipping offshore workers with helicopter underwater emergency breathing apparatus (HUEBA). “When somebody wants something done in this industry,” he commented, “they set a very

[2] Transportation Safety Board of Canada: *Aviation investigation report A09A0016*, http://www.tsb.gc.ca/eng/rapports-reports/aviation/2009/a09a0016/a09a0016.asp.

clear mandate and they set timelines for things to be done within that mandate. With the HUEBA, it was all fuzzy.” [3]

75. In May 2014, recommendations were issued by the UK Civil Aviation Authority following several accidents between 2009 and 2014 involving Airbus Helicopters’ Super Puma EC225. The recommendations advised that all existing models should be fitted with redesigned gear shafts as soon as possible, and that life-saving new breathing equipment should be rolled out across offshore helicopters 15 months earlier than planned, in January 2015 rather than April 2016. In the meantime, a seating restriction was introduced, allowing passengers to fly only if they were seated next to a push-out window exit that would allow them to escape in the event of an emergency. However, replacing the gear shafts would require taking a number of helicopters out of service, which would add pressure on transport if seating restrictions were introduced simultaneously, so the UK Civil Aviation Authority pushed back these restrictions by three months, from 1 June to 1 September 2014, to allow offshore repairs to be carried out over the summer. [4]

76. These accidents reinforce the need for the oil and gas industry to continue to work with the helicopter operations and safety equipment manufacturers, as well as with regulators and trade unions to further reduce the risks. Risk reduction will only be achieved by collectively and vigorously pursuing current and future offshore helicopter safety initiatives and research projects and ensuring that recommendations arising from various inquiries and reviews are implemented expeditiously.

5.1.2. Transportation by rail

77. The surge in hydrocarbon shipments poses environmental risks to the population and safety and health risks to workers from accidents that may occur from rail lines, pipelines, waterways and at trans-shipment sites. From 2010 to 2013, the demand for rail cars in North America increased by 1,300 per cent because a pipeline system to transport oil to refineries does not yet exist in many parts of Canada and the United States. In July 2014, in response to a series of train crashes involving crude oil, regulations to phase out thousands of older rail tank cars within two years were proposed. Accident investigators had complained for decades that cars were too easily punctured or ruptured, spilling their contents, when derailed. The proposed regulations would apply to the transport not only of oil, but also of ethanol and other hazardous liquids. They would apply only to trains of 20 or more cars, which would include most oil shipments and would also make the 40 miles per hour speed limit in urban areas (that freight railroads have voluntarily agreed to) mandatory, as tank cars have ruptured in several accidents at speeds as low as 24 miles per hour. [5] Similarly, the US Department of Transportation proposed upgrading existing legislation on tank cars to require thicker, more puncture-resistant shells, enhanced braking systems, and rollover protection. The proposed law would apply to freight trains carrying 20 or more tank cars loaded with flammable fuels. Crude-carrying tank cars would need to

[3] I. Graham: *Working conditions of contract workers in the oil and gas industries*, (Geneva, ILO Sectoral Activities Programme, Working Paper No. 276, 2010), pp. 50−51, citing M. Baird: “Offshore workers had long complained about ill-fitting survival suits, crash inquiry hears”, in *The Telegram*, 17 Nov. 2009. See also M. Baird: “Offshore breathing devices a long time coming”, in *The Telegram*, 17 Nov. 2009.

[4] UK Civil Aviation Authority: “CAA announces changes to timescales for offshore helicopter safety measures”, in *CAA Newsroom*, 7 May 2014.

[5] Associated Press: *New safety rules proposed to curb oil train fires*, 23 July 2014.

be strengthened by 2017. [6] Similarly, pipelines raise safety and health concerns. In August 2015, the Polarled gas pipeline became the first pipeline to take the Norwegian gas infrastructure across the Arctic Circle. [7] The National Energy Board of Canada produces pipeline safety incident reports. It has also developed a pipeline safety map to communicate information related to the pipeline to the public. [8]

5.1.3. Transportation by supply ship and by crane

78. Offshore workboats carry supplies, equipment and people to and from offshore projects. The past few years have produced one of the most dramatic improvements in safety in this area. In the 1980s, the US offshore workboat industry had an unacceptable number of injuries and incidents, however nowadays they are relatively rare. Every year, the Offshore Marine Service Association has surveyed the US-flagged workboat companies on their safety records and has consistently found the personal injury rate to be one tenth of the national average for all shore-side jobs. The Association has commented that this good safety record is the result of hard work, a commitment to running a drug- and alcohol-free industry and ongoing training. The message that every crew member, from the captain down to an entry-level deckhand, is responsible for halting any operation that does not appear safe must be constantly reinforced. [9]

79. The oil and gas industry uses various types of crane-assisted devices to transfer workers from crew supply boats. Some of the latest models have seats or quick-release clips for riders. In 2009 it was reported that these devices have improved safety, due to industry initiatives such as training, videos about operational procedures, preflight safety briefs, and transfer device inspections. However, since 2000 there have still been 72 crane-transfer incidents, with 11 fatalities and 59 injuries; 49 per cent involved falling, 38 per cent involved lateral impact (swinging), and 32 per cent involved vertical impact (heavy landing). The report concluded that careful attention needs to be paid to vessel choice, crane operation, training and the transfer device itself, but that ultimately the human factor still figures prominently. [10]

[6] G. Hess: “U.S. seeks tighter rail safety rules”, in *Chemical and Engineering News* (2014, Vol. 92, No. 33, 18 Aug.), p. 22.

[7] OGH editors: “Statoil: Polarled gas pipeline crosses Arctic Circle”, in *Oil & Gas Journal*, (21 Aug. 2015).

[8] See http://www.cbc.ca/news2/interactives/pipeline-incidents/ [accessed on 15 Oct. 2015].

[9] K. Wells: “Offshore workboats have good safety record: Letter to the editor”, in *The Times−Picayune*, 21 July 2010.

[10] P. Dittrick: “Marine transfer safety evolves”, in *Oil & Gas Journal* (16 Feb. 2009).

6. OSH skills and training

80. Accidents are often attributed to a lack of workers' skills. Indeed, it is often reported that a particular accident could have been prevented if the workers concerned had been better trained to resolve the situation swiftly. [1] In order for workers to be more aware of their roles in the workplace, it is necessary to build OSH skills. Efficient skills management can prevent repeated errors, [2] and operational competence is important. [3] The Occupational Safety and Health Convention, 1981 (No. 155), provides for the adoption of a coherent national OSH policy, as well as action to be taken by governments and within enterprises to promote OSH to improve working conditions. The Convention encourages employers and workers to cooperate in improving OSH. For example, Article 19 of the Convention states: "(a) workers, in the course of performing their work, co-operate in the fulfilment by their employer of the obligations placed upon him; … (d) workers and their representatives in the undertaking are given appropriate training in occupational safety and health; …". It is particularly important in Arctic operations to have well-trained, competent and reliable workers. Cross-training is also necessary for workers who, due to constraints and limitations, may be required to fill in for or assist a primary worker in critical operations. All workers in the extreme cold working environment will need specialized competences on equipment and installations for extreme cold weather, firefighting, emergency preparedness, and an understanding of gender equality and diversity.

6.1. OSH skills

81. Oil and gas workers require certain skills and expertise within a particular organization; these include technical qualifications, competences, experience and understanding of process safety risks, together with a range of personal and interpersonal qualities that promote safety capability. Generally, attention has focused on skills such as compliance, vigilance and perseverance as determinants of individual safety behaviour. These behaviours, in turn, support overall safety in an organization, and thus contribute to organizational capability under routine operating conditions. There is, however, increasing awareness that individual safety behaviour does not necessarily ensure that the safety of the overall system is maintained. When the capacity of an organization to adapt and change in response to internal and external pressures and to maximize operational safety is considered, other personal attributes are required. This broader set of attributes must encompass the ability to detect early signs of potential system malfunctions, and the knowledge and skills to forestall them before they escalate into operating emergencies. With respect to a range of worker characteristics that drive effective performance in high-reliability organizations, it is anticipated that workers are able to communicate extensively with co-workers; to respond rapidly and appropriately to problems and unexpected events, switching tasks and roles flexibly to deal with changing situations; to respond to novel or complex problems with coordinated and effective actions; and have the motivation to gain a better understanding of operating processes and procedures and to share such information openly.

[1] See for example R. Gold and B. Casselman: "Far offshore, a rash of close calls", in *The Wall Street Journal*, Eastern edition, 8 Dec. 2010.

[2] L. J. Gressgård: "Knowledge management and safety compliance in a high-risk distributed organizational system", in *Safety and Health at Work* (2014, Vol. 5, No. 2, June), pp.53–59.

[3] A. Sasson and A. Blombren: *Knowledge based oil and gas industry* (BI Norwegian Business School Research Report, No. 3/2011, Oslo), p. 60.

82. These suggest that training should include individual skills to anticipate and adapt to operational changes, to maintain situational awareness, to communicate effectively with co-workers, and to make timely and appropriate decisions, not only under normal operating conditions but also in unexpected and rapidly changing situations. The oil and gas industry could learn from situation-awareness training provided in other industries, such as the aviation industry. Safety training should not only include hazard awareness and perception, which is currently focused on heavily, but should also incorporate an element of projection training to allow workers to practice evaluating possible outcomes. In essence, this is a form of dynamic risk assessment, allowing for control measures to be taken and the necessary levels of safety assured. [4]

83. The world's oil and gas industry is in the midst of a talent crisis. In the United States alone, many oil and gas companies risk losing up to 80 per cent of their retirement-eligible population in the next five years. The industry-wide survey produced by the Bank of Scotland in April 2014 reveals that seven in ten Scottish oil and gas companies are predicting that they will grow in the coming years. But concerns are raised over a skills shortage, with 40 per cent of firms describing a lack of available staff as a major challenge. Companies report a particular lack of well drilling and operating engineers, subsea specialists, project engineers, health and safety specialists and geoscientists. Many engineering companies in the oil and gas industry said the lack of skilled workers was causing problems. [5] The shortage of skilled workers makes it harder than ever to attract and recruit qualified and Arctic-experienced workers.

6.1.1. Competencies of the inspectors

84. Inspection is one of the most effective methods of bringing workplace practices into line with labour legislation, labour standards, OSH standards and human rights. It is a way of enforcing legal provisions relating to conditions of work and the protection of workers while engaged in their work, and plays an important role in ensuring that labour law is applied equally to all employers and workers. The roles of inspectors are critical for improving safety and health in the oil and gas industry. Many debates have taken place following the BP Deepwater Horizon accident, focusing on the roles of inspectors and their competencies.

85. Norway applies performance-based supervision. It builds on the view that a regulator cannot perform a quality inspection of the Norwegian oil and gas industry. Regulations and the supervisory system (labour inspectors) must be designed to help enhance the awareness of the oil and gas companies that they bear total responsibility for operating acceptably. The Norwegian Ministry of Labour and Social Affairs specifies the following guidance on how to discharge the Petroleum Safety Authority's (PSA) duties:

- PSA supervision should be system-oriented and risk-based;
- it should be a supplement to and not a replacement for internal control by the oil and gas industry;
- the PSA must strike a balance between its role as a high-risk/technology regulator and a labour inspection authority; and

[4] A. Sneddon, K. Mearns and R. Flin: "Situation awareness and safety in offshore drill crews," in *Cognition, Technology and Work* (2006, Vol. 8, July), pp. 255−267.

[5] Bank of Scotland: *Rising fortunes 3: Examining growth in the oil and gas industry*, Edinburgh, Apr. 2014, p. 13.

- it should collaborate with companies and unions representing crucial requirements in PSA activities.

86. Norway maintains a risk-based inspection approach, as it considers it neither possible nor desirable to supervise all activities, facilities and equipment. Risk-based supervision means that areas with the highest risk are given priority. This does not mean that because the PSA has conducted an inspection of a selected area, the oil and gas company is freed from its duty to ensure that facilities, plants and equipment comply with regulatory requirements at all times. PSA inspection supplements the company's internal inspection and control systems. Inspectors' competencies and industry knowledge are critical for proper inspection. [6]

87. In 2010, the Asian edition of *The Wall Street Journal* reported that inspectors in the Gulf of Mexico had been overruled by industry, undermined by their own managers and outmatched by the sheer number of offshore installations they were responsible for overseeing. Due to resource constraints, inspectors largely inspected hardware, barely checking for system safety issues. While offshore drilling technologies had advanced substantially, inspection had not kept pace. Inspectors were mostly former oilfield workers without professional academic degrees and had little formal training. They were not required to pass any certification tests but were expected to learn their craft from on-the-job training only. They had almost no direct experience in the specified field of deep water drilling, and, during offshore inspections, had no access to advanced technologies. Inspectors could shut down operations for safety reasons, but to do so they needed to obtain permission from their managers and they were sometimes overruled. Much of the inspectors' time offshore was spent reviewing paperwork and copying data by hand from printouts and logs, such as on how much oil was being pumped or the dates on which equipment had been tested. They made sure first-aid kits were on board and that any open holes on deck had railings to prevent falls. [7]

88. Adequate resources are needed for inspection. In 2007 it was reported that around 85 per cent of major workplace accidents in the United Kingdom were not investigated by the HSE. Its inspectors cited lack of resources as a reason for failing to investigate incidents on 307 occasions – up from 255 occasions in 2005–06, and 188 in 2004–05. [8]

6.2. OSH training

89. Training in the oil and gas industry must contribute to a preventative safety and health culture. The ILO global strategy on occupational safety and health, adopted at the 91st Session of the International Labour Conference in 2003, states: "[OSH] training should focus on supporting preventative action and on finding practical solutions." [9] Accidents are more prevalent in specialized and service companies than regular companies. According to an IOGP report in 2013, the fatal accident rate was 2.20 among contractors

[6] http://www.psa.no/how-we-work/category991.html [accessed on 15 Oct. 2015].

[7] L. Eaton et al.: "Inspectors adrift in rig-safety push", in *The Wall Street Journal*, Asian edition, 6 Dec. 2010, p. 16.

[8] "HSE faces the fact of dwindling resources", in *The Safety and Health Practitioner* (2007, Vol. 25, No. 9, Sept.), p. 7.

[9] ILO: *Global strategy on occupational safety and health: Conclusions adopted by the International Labour Conference at its 91st Session, 2003*, Geneva, 2004, para. 20.

compared with 1.83 among company employees. [10] Thus, OSH training must be inclusive, covering all workers.

90. Typically, oil and gas companies or operators outsource the majority of jobs related to the exploration and production of hydrocarbons. Operators are essentially project managers. It is believed that large oil and gas companies benefit from thousands of specialized and service companies globally. Thus, it is critically important to establish responsibility for ensuring that OSH rules and regulations are implemented along the contracting chains. Safety and health should feature prominently in contracts between operators and contractors, and contractors and subcontractors. The level of preparedness of workers is one of the criteria used by contractors and subcontractors in professional selection processes. Levels of OSH education and training and the equipment used to conduct such training depend on the level of preparedness of workers.

91. Examples of best practice have shown that operators can effectively support OSH and provide OSH training for contractors and subcontractors. Many oil and gas companies have safety programmes to help their contractors improve OSH. For example, under ExxonMobil's safety programme called "Nobody gets hurt", the workforce lost-time incident rate was reduced by more than 12 per cent per year from 2000 to 2009. ExxonMobil's employees and contractors receive rigorous training before commencing work in its facilities. They participate in safety teams, conduct safety observations and help improve safety procedures. In 2008, more than 1,600 of the company's contractor supervisors and managers participated in leadership workshops, over 20 per cent more than in 2007. By using specially tailored tools and techniques, including ergonomics, the number of accidents and cases of illness at work can be reduced. [11]

92. Capacity building of local enterprises and workers is a priority in terms of local schemes that contribute to the promotion of decent work in host countries. The oil and gas industry has invested in building the capacities of the local workforce and local enterprises where the necessary expertise is in short supply. Norwegian companies, for example, have built local capacity in the Murmansk region of the Russian Federation. Statoil Hydro got involved before it knew whether or not they would win a share of the Stokmann project. Likewise, other large oil and gas companies and major contractors have long been observing developments in the Barents Sea. The Norwegian Oil and Gas Partners and Statoil Hydro have been working with Murmanshelf, the Murmansk Association of Contractors and Suppliers to the Oil and Gas Industry, to raise awareness about international standards. Training seminars cover issues related to OSH, tendering, business management and quality standards. [12]

93. A culture of coercion and fear prevents workers from addressing significant OSH challenges. An incident report released in 2013 by the US Bureau of Safety and Environmental Enforcement following a fire on the Black Elk production platform in the Gulf of Mexico in late 2012 found that an oil and gas company had failed to provide their contractors with adequate training. The Filipino migrant workers told the investigators that

[10] IOGP: *Safety performance indicators: 2013 Data*, Report No. 2013s, London, July 2014, p.1–2.

[11] L. Koottungal: "Industry safety record improving", in *Oil & Gas Journal*, 24 Aug. 2009.

[12] A. Knizhnikov and E. Wilson: *Responsible contracting in the Russian oil and gas industry* (Moscow, WWF–Russia, 2010).

they were worried they would lose their jobs and be sent home if they raised safety concerns. [13]

94. Incentive schemes can have a considerable impact on safety and health. The oil and gas industry has introduced such schemes in order to meet specific objectives. However, safety cannot be compromised to meet operational objectives. Some schemes take the traditional approach of everyone losing part or all of their bonuses if an accident occurs. This does not encourage people to work more safely. Instead, workers feel pressured into not reporting accidents. It is also inherently unfair to workers who are not in any position to prevent or mitigate the accident, such as those who are off shift or working on a different part of the rig. By taking away the earned bonus, workers have no incentive to perform well. [14]

6.2.1. Role of bilateral agreements

95. Bilateral relations play a significant role in OSH and OSH training. Collective agreements improve OSH for a large group of workers within an enterprise. The Gazprom International Trade Union and its units have collective agreements with business units of Gazprom and Gazprom's subsidiaries responsible for OSH compliance and control with the aim of improving OSH. [15] In the same context, global framework agreements (GFAs) serve mutual interests of employers and workers, promoting a preventative safety and health culture. GFAs can protect the interests of workers across a multinational company's operations and at the same time enhance the corporation's interest and reputation. The IndustriALL Global Union has concluded GFAs with energy and energy-related multinational companies, including GDF Suez, Lukoil, Norsk Hydro, Petrobras, Statoil, and Total. OSH training is one of the most important provisions in these bilateral agreements. All GFAs in the energy industry stress the important role of training in promoting safety and health at work for all workers and protecting them from any harm. For example, Norsk Hydro's GFA states: "Hydro is committed to providing both permanent and temporary workers with training on occupational hazards and their prevention. Through this commitment, Hydro aspires to eliminate accidents and injuries throughout its operations." [16] Statoil and Lukoil's GFAs clearly state that it is the company's responsibility to implement training programmes. [17]

96. In addition, the GFAs in the energy sector appear to follow a best practice approach so as to improve health and safety at work (Statoil, Lukoil). GDF Suez's GFA provides one of the most comprehensive and inclusive approaches to OSH. It adopts eight principles for

[13] Bureau of Safety and Environmental Enforcement: *Investigation of November 16, 2012, Explosion, fire, and fatalities at West Delta Block 32 Platform E, Gulf of Mexico Region, New Orleans District*, BSEE Panel Report 2013-002, 4 Nov. 2013. See also D. Gilbert: "U.S. Regulator finds safety lapses in fatal oil-rig fire; Investigative report cites violations in offshore accident", in *The Wall Street Journal*, 4 Nov. 2013.

[14] S. Devereux: *Drilling technology in nontechnical language* (Tulsa, PenWell Corporation, 2012), pp.291−292.

[15] Gazprom: *Gazprom sustainability report 2010−2011*, Moscow, 2011, p. 90.

[16] Art. 2(e) of the *Global Framework Agreement between Norsk Hydro ASA and IMF/ICEM Fellesforbundet and IndustriEnergi for the development of good working relations in Norsk Hydro ASA operations worldwide*.

[17] The full texts of the GFAs are available at: www.industriall-union.org [accessed on 15 Oct. 2015].

"the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations". The eight principles are: (1) taking risks into account in any decision-making process; (2) a participatory approach to the prevention of hazardous situations; (3) the promotion of a climate of trust and dialogue; (4) classification of prevention; (5) inter-comparison, sharing and feedback provision; (6) a prevention and protection level of our service providers equivalent to that of our employees; (7) compliance with regulations and internal rules; and (8) crisis management preparation. [18] Some GFAs also include provisions concerning the prevention of HIV and AIDS (Lukoil, Norsk Hydro).

6.2.2. Emergency preparedness training

97. Emergency preparedness training is critical for saving lives. [19] Whether a worker is "fit to work" is likely to be determined through a medical examination, however it is also important to have emergency response training. On Norwegian offshore oil and gas installations, workers must pass a number of courses and training sessions to acquire safety certificates. In early 2014, four Norwegian offshore oil and gas trade unions, including Industri Energi, Fellesforbundet, Lederne and SAFE, announced that they had suspended their membership in the Norwegian Oil and Gas Association's Network for Safety and Emergency Response Training. They contested the employer's decision instituting a number of changes in safety and emergency training on the NCS because they were concerned that training on putting out fires, evacuations, saving lives and various rescue procedures had been weakened under the new curriculum. Training in lifeboats, man overboard procedures and search and rescue teams had been cut by approximately 50 per cent under the new rules, and there were further plans to transfer exercises that had been carried out on land to offshore. This meant that vital exercises and training had to be done offshore during an 84-hour work week on the platforms. [20]

98. To prevent industrial accidents, Lukoil carried out exercises in 2013 for the prevention of and preparation for emergency situations at the Vysotsk marine export terminal in the Gulf of Finland. The exercises rehearsed procedures in extinguishing a fire on the petroleum product loading jetty, guiding a tanker to the port roads, and finding and collecting petroleum products from the water surface, as well as rescue measures by sea and land. The exercise involved 47 fire and rescue equipment units, a K-52 helicopter, and 137 workers from the Vyborg Fire Service as well as the mobile command post of the Russian Emergency Ministry for the Saint Petersburg region, the Vyborg Rescue Service and relevant workers at the Vysotsk Terminal. [21]

99. The challenge for the oil and gas industry is to be able to quickly and effectively respond to potential vast and serious incidents. The industry has developed mutual aid arrangements to best address at the local, regional or basin levels where resources are more likely to be accessible and where operators are likely to share common technical, logistical, legal and regulatory environments. Based on this arrangement, the oil and gas industry has developed a framework for the offshore industry to inform and assist operators and

[18] *Global agreement on health & safety of the GDF Suez Group*, May 2014.

[19] Industri Energi: *Deepwater Horizon and Macondo,* Report by the Norwegian trade union, Industri Energi, on the oil disaster in the Gulf of Mexico in April 2010 (Stavanger and Oslo, 2011).

[20] "Norwegian unions pull out of offshore safety training program", in *Middle East and North Africa Business (MENA) Report*, 30 Jan. 2014.

[21] Lukoil: *Annual report 2013,* Moscow, 2013, p.73.

industry associations in initiating and conducting mutual aid arrangement discussions within their local or regional basins. It lays out a process for identifying and developing mutual aid arrangements tailored to local circumstances, and identifies the issues and challenges that may be encountered. The framework suggests that the operator assesses the health, safety or security of people; the environment; and the safety, security or integrity of property. The framework also suggests that operators and industry associations work with the authority in a new area that may be restricted by local laws and regulations, including requirements regarding nationality or collective bargaining. [22]

6.2.3. Civil aviation training

100. Lessons learned from air accidents must be fully reflected in civil aviation training. The crash of Cougar flight 491 in Newfoundland and Labrador, Canada, demonstrates this point. In March 2009, a Sikorsky S-92A helicopter travelling to the SeaRose and Hibernia offshore oil installations, carrying 16 workers and two pilots, crashed into the sea, resulting in the loss of 17 lives. There was one survivor. The investigation revealed that the incident was due to both human and technical errors (see section 5.1.1 above). Although offshore safety had improved since the Ocean Ranger accident in 1982, research indicates that in practice, the oil and gas industry’s attention to helicopter safety did not always reflect their espoused commitment, safety culture or safety management systems. Moreover, the industry ignored lessons learned from prior incidents, such as the Ocean Ranger disaster. Among other things, adequate survival and pilot training was lacking. The authority called for improved pilot training, especially in emergency procedure, and highlighted areas of ambiguity, omission or inconsistency in the manufacturer’s and Cougar’s flight manuals.

101. A lack of operational and emergency training in general, along with the absence of manuals for the ballast control system and no emergency training on how to operate it manually, were all identified by the Ocean Ranger inquiry commissioners as major causes of the accident. The commissioners made four recommendations for improved operational, safety and emergency training, including establishing uniform standards. They also called for the establishment of a stakeholder industry training board, which included workers. Twenty-four years later, in 2009, the Atlantic Canada Offshore Petroleum Training and Qualifications Committee was setting training standards, with the Canadian Association of Petroleum Producers acting as the secretariat. The Training and Qualifications Committee was an industry-dominated body, and there were no worker representatives. As a result, the inquiry into the Cougar flight accident recommended a more participatory training body, to include suppliers of protective equipment and worker representatives. [23]

102. Helicopter Safety Study 3 (HSS-3) – a study on the NCS – provides a wide range of other considerations for civil aviation training in the North Sea. On the NCS, many pilots are satisfied with the increase in the number of simulator hours, but this study provides further elements for consideration regarding civil aviation training and air safety on the NCS.

103. Towards the end of 2009, one company increased the number of hours in a simulator from six to eight hours per year. It is important that the number of hours is viewed in relation to practising special situations, for example landing on floating helicopter decks in the dark. Operational simulator training is now conducted according to requirements from the

[22] OGP: *Mutual aid in large-scale offshore incidents – A framework for the offshore oil and gas industry* (London, OGP Report No. 487, 2013).

[23] S. Hart: “The crash of Cougar Flight 491: A case study of offshore safety and corporate social responsibility”, in *Journal of Business Ethics* (2013, Vol. 113, No. 3), pp. 519−541.

authorities, and there is little room for special training. Many pilots want more time so that they can repeat and train for unexpected situations. Some pilots point out that flying to a rig is demanding, and there is a need for more training on these types of operations in the dark, fog and wind, as well as on other customer-related topics.

104. For technical and operative workers, training has become more IT-based than before. In some areas, IT-based training contributes to improving safety. However, this type of training does not enable pilots to consult with experienced pilots to learn from their experience.

105. With respect to the technicians' skills, there is a concern that technical experience will be scaled down, and that there is a move towards less expensive technical experts. New regulations provide for the hiring of workers with less experience to carry out the work, while qualified technicians are responsible for overall approval and signing off.

106. Another concern relates to the future recruitment of both technicians and pilots, because these occupations have become less attractive. [24]

[24] I.A. Herrera et al.: *Helicopter safety study 3* (HSS-3): Main report, No. SINTEF A15753 (Trondheim, SINTEF, 2010).

7. Summary

107. Crude oil and natural gas will remain important to the energy industry, and the industry needs to operate safely at all costs. To meet an expected increasing demand for hydrocarbons, the oil and gas industry is investing in the development of new reservoirs, which are often found in technically challenging geographic locations, including the Arctic. Reservoirs in the Arctic have the potential to produce hydrocarbons to fill a substantial gap in the hydrocarbon supply shortage in the coming decades. However, the Arctic operations face many difficult challenges. Fatalities could be higher because of very difficult evacuation, emergency response and rescue conditions, particularly in winter. Clean-up would be extremely challenging because of fewer supporting vessels and infrastructure. Ice and extreme low temperatures may interfere with clean-up operations. Environmental damage could be more severe, more extensive and longer lasting than in any other region in the northern hemisphere because of the fragile and sensitive nature of the environment and the persistence of oil in cold temperatures. Indigenous and tribal peoples in the Arctic could suffer serious socio-economic and cultural consequences as a result of accidents. Oil spills would impact their health and well-being because they depend on the Arctic Ocean for subsistence foods as well as for their cultural and traditional ways of life.

108. Between 1975 and 2012, at least 6,183 offshore accidents were reported, the majority in the northern hemisphere. Fixed facilities are more likely to experience accidents than mobile units. The most common contributing causes relate to procedures − either unsafe or absent − which result in unsafe acts. Some installations are used beyond their design life, which raises serious safety concerns. Much equipment is neither properly maintained nor tested on a regular basis. The shortage of new rig capacities in the coming years might add to the risk of using the old unsafe installations. Changes in installation and pipeline ownership also cause difficulties in maintaining safe conditions over time.

109. While there are some international and/or industry standards that may be applicable in general to petroleum operations in the Arctic, few standards apply specifically to Arctic operations. In the oil and gas industry, ISO standards, which are voluntary, are widely used. Exclusively for Arctic operations, ISO 19906: *Petroleum and natural gas industries – Arctic offshore structures*, was issued in 2010. The EU and the Arctic Council have also produced laws and guidelines concerning safety operations in the Arctic, however these do not address OSH challenges and issues in the region.

110. No ILO Conventions or Recommendations specifically refer to OSH in the Arctic, nor are there any ILO OSH instruments specifically for the oil and gas industry. In 2001, the ILO published the code of practice *Ambient factors in the workplace*, which includes a section on the protection of workers from cold and low temperatures. Although this code applies to the oil and gas industry, it lacks adequate references and specific information regarding protecting workers who are subjected to extreme cold working and living conditions in the Arctic and other cold regions.

111. In November 2014 the International Maritime Organization adopted the Polar Code, and related amendments to the SOLAS, for the protection of seafarers and to ensure the safety of ship operations in Arctic waters.

112. A challenge is that there is no single instrument that comprehensively or systematically addresses OSH issues in the extreme cold working and living conditions in the oil and gas industry in the Arctic. Varied operating conditions in different areas could hinder the application of specific technical standards across the Arctic offshore. In addition, there may be an overlap in the different standards and best practices developed by governments, employers' and workers' organizations, and other organizations.

113. Several ILO member States in the Arctic are members of international organizations operating in the region. However, the oil and gas industry is regulated by national authorities. Each country has a special regulatory regime that oversees safety and health, with its own regulatory approach, legal framework, institutional agreements, capacities and management systems. These regimes can be categorized as performance-based or prescriptive. Purely prescriptive regulations and rules are not sufficiently detailed or specific to prevent systems failure accidents and to maintain the highest levels of safety. Given the complex and wide-ranging nature of safety management systems in the Arctic, there is a need for greater reliance on performance to regulate operations. A hybrid approach consisting of components of both regimes would be more appropriate in Arctic operations.

114. There are also differences in accident data collection and data comparison methods among member States. Accidents and incidents are reported to national authorities in accordance with national legislation. Also, safety indicators used for accidents and incident reporting vary from country to country, making it very difficult to accurately compare the safety status of oil and gas industries in different countries. Accident rates may be lower in some countries due to less reporting, possibly related to differences in interpretation of what constitutes reportable injuries, or due to fear of losing livelihoods. The sanctions and consequences of being signed off work as sick or injured are much more severe in some countries than in others. Safety reporting also needs to include information and analysis on wider OSH indicators, such as near misses and accidents involving service and supply companies. There is a need for common data pooling and exchange of information on best practices. In this connection, coordination among regulators is essential.

115. In Arctic operations, stringent governance systems and mechanisms must be in place to ensure the highest level of safety and health at work. A preventative safety and health culture is a prerequisite, and such a culture can be created by encouraging communication between management and workers, as well as between internal and external actors, particularly specialized and service companies and their workers. A preventative safety and health culture can also be promoted by the ILO's international labour standards on OSH in the oil and gas industry. Both workers and top management should be involved. To this end, the roles of safety representatives and safety and health committees must be clear and must serve their intended purposes. Employers should collaborate with safety representatives and trade unions to meet and consult on OSH matters.

116. There are some areas of North Sea operations where oil and gas workers' health and well-being should be improved. Risks of both communicable and non-communicable diseases exist, and the oil and gas industry is encouraged to take the measures and initiatives adopted and promoted by the United Nations to cope with these diseases. Special attention should be given to offshore workers, for whom cardiovascular disease is one of the greatest concerns. Together with stroke, it is a major cause of serious medical illness and can require medical evacuation. Work-related stress, depression and bullying are reported in Arctic offshore sites, increasing risks to mental health. Substance abuse not only harms workers but can also cause accidents. Eliminating or limiting these health risks could prevent or delay the onset of life-threatening diseases. To detect such risks and improve health and well-being in the workplace, the roles of workplace safety and health committees must be respected. In the long term, the oil and gas industry needs to implement the best risk-based health promotion possible, using a holistic approach to address lifestyle problems. It also needs to develop and sustain health management programmes that address the well-being of workers' families and workers' psychosocial risks, depression and stress. Psychosocial risks have an impact on organizations through workers' health and behaviours. Consequently, it is essential to provide a psychosocially safe environment in Arctic operations.

117. Workers in the oil and gas industry are exposed to OSH risks because of exposure to hazardous substances and biological agents. Special attention to health and safety must be paid to women of reproductive age. For health promotion policies to be effective for both women and men, a broad strategy for the improvement of women workers' safety and health must be built into an OSH policy.

118. Indigenous peoples often live in areas where hydrocarbons are being developed. Convention No. 169 requests the oil and gas industry to fully respect the cultures and ways of life of indigenous peoples, recognizing their rights to land and natural resources, and giving them the right to decide their own priorities for the process of development. It is reported that oil and gas developments have disrupted traditional subsistence lifestyles, harming the health of indigenous peoples.

119. There is an increased likelihood of illness and injury among workers working long-hour schedules and schedules involving unconventional shift work, such as night and evening shifts. One concern in relation to working time is the excessive overtime work reported on offshore installations. Long working hours often result in adverse effects on the work–life balance. On some UK North Sea installations more than half the day workers and almost a quarter of day/night shift workers reported working longer than the regular 84 hours per week. In Norway, about 18 per cent of offshore workers work more than 20 hours overtime. Other categories of workers also work long hours, for instance those working for specialized and service companies. These workers routinely move from one installation to another to provide specific services. They do not tend to have a fixed work pattern that includes leave. It is also reported that about 60 per cent of senior offshore managers and about 30 per cent of supervisors are working more than 100 hours per week.

120. Many fatalities occurred when managers and workers were travelling by road, rail, water or air, or were struck by a vehicle. Travel to and from work at both offshore and onshore installations can be more dangerous than the job itself because aviation accidents are often fatal. A number of schemes and technologies seek to prevent such accidents, but there is a perception that cost prevails over safety, and aviation contracting practices jeopardize air safety even further. All safety requirements related to aviation activities must be cleared before take-off by qualified aviation advisors. Emergency escape systems, survival equipment, survival suits and rescue response must be updated with the latest available technology and equipment, and they must be available to pilots, crews and all managers and workers on board. All workers must participate in comprehensive emergency preparedness and emergency response training. As a result of serious past accidents, the laws and regulations on transportation by rail have been amended in some countries. Although safety in supply ships has improved in the past two decades, employers and trade unions are required to work closely together to reduce accidents and incidents. This also applies to other human transportation equipment, both onshore and offshore.

121. Insufficient OSH skills and training are often identified as contributing factors to major industrial accidents. Convention No. 155 provides that employers and workers should cooperate in promoting OSH and that workers and their representatives should be given appropriate training in OSH in the workplace. In Arctic operations, it is important to have well-trained, skilled and self-reliant workers because it is possible that they will have to stay offshore longer than expected, with longer crew rotations and sometimes unpredictable transportation schedules due to ice, wind or conditions of extreme cold. The oil and gas industry is currently suffering from an acute shortage of skilled workers, and such shortages are likely to become a more serious challenge as a large number of workers are due to retire in the coming years. The industry could potentially lose its institutional memory regarding safety and good practices. Qualified and Arctic-experienced workers, and operational workers who are experts in more than one subject area and who perform well in conditions of extreme cold and isolation with limited supervision, communication and transport capability are difficult to find. Recruiting and retaining trained and competent oil and gas inspectors is another challenge. Inspectors need to be trained and have experience in effectively handling a wide range of OSH and technical issues in Arctic operations.

122. Other OSH training challenges include a culture of coercion or fear, and the fact that production incentive agreements often prevent workers from addressing OSH issues in the workplace. OSH training must be provided to all workers, including contractors and subcontractors. Safety training for specialized and service companies that have limited resources and expertise in safety and health must be provided by large oil and gas companies or operators at their own expense, thus contributing to an overall improvement in OSH. Bilateral agreements, such as collective bargaining and GFAs, can provide a good model for safety training and good safety practices.

123. In the North Sea, helicopter pilots and on-board crew must receive adequate professional, survival and emergency training. The number of hours and the content of civil aviation training should be expanded to meet more than minimum requirements, and training should include special operations and refresher courses. Retraining should take place on a regular basis. The recruitment of qualified pilots and technicians is the main issue: the oil and gas industry is encouraged to collaborate more with other agencies, such as civil aviation authorities, training institutes, helicopter manufacturers, and the industry associations and trade unions concerned.

Appendix

Excerpts from Chapter 8 of the code of practice *Ambient factors in the workplace* (2001) [1]

8. Heat and cold

8.1. Scope

8.1.1. This chapter gives additional and specific information to help employers, workers and competent authorities apply the general principles in Chapters 2 and 3. It applies to conditions in which:

…

(d) temperatures are unusually low (e.g. in outdoor work during winter season, in cold storage work);

(e) high wind speeds (>5 m/s) prevail with unusually low temperatures;

(f) work with bare hands is carried out for extended periods of time at temperatures below 15 °C.

8.1.2. Workers should be allowed sufficient time to acclimatize to an extremely … cold environment, including major changes in climatic conditions.

8.1.3. This chapter does not deal with:

(a) risk of injury from contact with very … cold surfaces, but where these exist the employer should take this risk into account in assessing control measures that are appropriate;

(b) special measures required to protect against the effect of immersion in cold water, by diving or by accident.

8.2. Assessment

8.2.1. If workers are exposed for all or part of their tasks to any conditions listed in paragraph 8.1.1 above and the hazards and risks cannot be eliminated, employers should assess the hazard or risk to safety and health from the thermal conditions, and determine the controls necessary to remove such hazards or risks or to reduce them to the lowest practicable level.

…

8.2.3. In assessing the hazard and risk, employers should:

(a) make comparisons with other similar workplaces where measurements have been made;

(b) where this is not practicable, arrange for measurements to be performed by a technically competent person, using appropriate and properly calibrated equipment;

(c) seek the advice of the occupational health service or a competent body about exposure standards …;

(d) bear in mind that the quality of fine work done by hand is adversely affected by cold temperatures.

8.2.4. Measurements of thermal conditions should take account of:

(a) all stages of work cycles and the range of temperature and humidity under which the tasks are performed;

(b) the range of clothing worn during the tasks;

(c) major changes in physical activity level (metabolic heat production);

[1] ILO: *Ambient factors in the workplace: An ILO code of practice*, Geneva, 2001.

(d) occasional tasks such as cleaning and maintenance of hot equipment and cold areas, and renewal of … cold insulation.

8.2.5. The measurement survey should be structured so as to identify the sources of any problem, and the tasks in which it occurs. If the risk assessment shows that thermal conditions are outside the ranges recommended by the standards referred to in section 8 […], the employer should assess control options and take effective control measures.

…

8.4. Prevention and control in cold environments

8.4.1. Where the assessment shows that the workers may be at risk from exposure to cold, the employers should, if practicable, eliminate the need for work in cold conditions (for example by rescheduling work to be performed in a warmer season, or by moving the work from outdoors to indoors, or separating the cold parts of a process from the workers, as far as practicable). If elimination of such work is impracticable, employers should introduce other control measures to reduce risk from cold conditions.

8.4.2. Where the work is done outdoors, or the temperature at the workplace depends on outdoor temperature, employers should take into account present and forecast weather conditions in scheduling work, and monitor conditions while long duration work is in progress.

8.4.3. Employers should ensure that workers are not positioned near very cold surfaces or, if this cannot be avoided, that the workers are protected by radiation shields. For standing tasks, the floor should, where practicable, have an insulating surface.

8.4.4. Where work is conducted at low air temperatures, employers should ensure that the velocity of air movement around the workers is minimized (to the extent consistent with providing the workers with sufficient fresh air).

8.4.5. Protection should take into account the air movement experienced when riding on an open vehicle (such as a fork-lift truck in a cold store). For outdoor work, employers should, as far as practicable, provide a workplace protected from wind, rain and snow. When high wind speed is prevailing, the special cooling risk (wind chill) should be considered and appropriate protective clothing, headgear and face masks should be made available.

8.4.6. Where work is carried out at unusually low temperatures:

(a) employers should implement work-rest cycles with warm shelters for recovery when:

  (i) work is likely to last for some time;

  (ii) the temperature and wind speed are likely to vary;

  (iii) workers are experiencing or showing symptoms of discomfort;

(b) work scheduling should allow for the extra time taken by tasks in the cold, and the need for adequate drink and food;

(c) where practicable, work rates should be designed to avoid heavy sweating, but if this does occur, employers should ensure that dry replacement clothing is available with warm changing facilities.

8.4.7. Where it is not practicable to eliminate the need for work in cold environments, employers should ensure the provision of:

(a) adequate protective clothing properly designed and fitted for protection against cold;

(b) adequate facilities for changing;

(c) arrangements for cleaning such clothing and drying clothing and footwear between shifts;

(d) headgear which is comfortable to wear, wind-proof (if appropriate), with adequate protection for ears and neck, and compatible with safety equipment.

8.4.8. Workers in the cold will often need to urinate more frequently, and employers should ensure that suitable arrangements are available, where feasible, and that the design of protective clothing allows easy urination.

8.4.9. Workers should be consulted and should cooperate in the choice, fitting and wearing of the protective clothing.

8.4.10. Suitable protection should be given to the hands and fingers, particularly where dexterity is needed, as well as other exposed parts of the body. Employers should provide:

(a) facilities for warming the hands, for example by warm air, where appropriate;

(b) tools with insulated handles, especially in temperatures below freezing point;

(c) measures to ensure that the bare hand does not touch surfaces below –7 °C (workplace design or protective clothing);

(d) measures to ensure that bare skin does not touch liquids below 4 °C;

(e) appropriate measures to be taken in the event of insulating clothing getting wet;

(f) face and eye protection, as appropriate, for outdoor work and working in snow (e.g. safety goggles against glare).

8.4.11. As there is danger of dehydration in cold environments, particularly when these are also dry, employers should make water or dilute flavoured drinks readily available to workers, and should encourage them to drink, by providing a close source or arranging for drinks to be brought to the workers. Alcohol, caffeine, carbonated drinks or drinks with a high salt or sugar content are unsuitable, as are drinking fountains because they are too difficult to drink from in sufficient volume.

8.4.12. Where a residual risk of hypothermia is unavoidable, even after all the control measures have been taken, and particularly below –12 °C, workers should be adequately supervised so that they can be withdrawn from the cold if symptoms occur, bearing in mind that confusion is a symptom of hypothermia and therefore workers in an emergency may not rescue themselves. Workers at risk should not be left on their own long enough for a dangerous condition to develop. Particular care should be taken to design tasks and workplaces in cold environments to minimize the risk of accident. Employers should ensure that first-aid facilities as well as staff trained in the use of such facilities are available.

8.5. Health surveillance

8.5.1. In cases where control is provided by work-rest systems (see paragraph … 8.4.6 above) or protective clothing, workers should be examined by qualified occupational health personnel who should determine:

(a) their fitness for the conditions of work;

(b) any limitations that should be applied to their work;

(c) the programme of training and information of workers;

(d) the measures for providing such training and information;

(e) any pre-existing conditions which might affect their tolerance to heat or cold (such as heart disease, overweight or some skin diseases); and

(f) measures to minimize risks among vulnerable groups (such as older workers).

8.6. Training and information

8.6.1. Workers exposed to … cold and their supervisors should be trained:

(a) to recognize symptoms which may lead to heat stress or hypothermia, in themselves or others, and the steps to be taken to prevent onset and/or emergencies;

(b) in the use of rescue and first-aid measures; and

(c) about action to be taken in the event of increased risks of accidents because of high and low temperatures.

8.6.2. Workers should be advised of:

(a) the importance of physical fitness for work in … cold environments;

(b) the importance of drinking sufficient quantities of liquid and the dietary requirements providing intake of salt and potassium and other elements that are depleted due to sweating;

(c) effects of drugs which can reduce their tolerance to thermal extremes.

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