Societal threat landscapes of petroleum industry activity in the high north

E. Okstad, T.O. Grøtan & A. Øren
SINTEF Technology and Society, Safety and Mobility Research, Trondheim, Norway

ABSTRACT: Today, industrial and societal systems interact and become more complex than ever, and hidden, dynamic and emerging threats and vulnerabilities evolve. By observing the petroleum activity in the north (west Barents Sea) along with other developments and societal trends in the region, it is possible to sketch out a threat landscape of the high north. A threat landscape is formed from interconnected 'pictures' of threats and actors, given some external conditions. These conditions are 'on the move', and requires that the risk pictures as well as the landscapes must be maintained and revised. Examples of such are effects of declining oil prices, or a changing climate. It is important to assess the validity of any picture contributing to the landscape. Threats may lead to 'spillover effects' and unexpected events if pictures become saturated. Scenarios applicable for stress-tests may be derived from such threat landscapes. The severity and urgency of a scenario is strengthened by events occurring simultaneously, or as combined events. Risk mitigation should thus be handled more in collaborating teams of interconnected actors instead of by single entities themselves. Actors involved in the 'oil in high north' threat landscape either take part in, support, or are affected by the petroleum activity in some way. Each party should consider their situation and role in view of the evolving threat landscape, and look for alternative handling of emerging risks. As part of a case work in the New Strains of Society project, key actors have been interviewed. In addition to the interviews, associated workshops have been held. This paper summarizes the foundations of a preliminary threat landscape based on these interviews and workshops, with recommendations for further elaboration by researchers as well as practitioners. Main challenges associated with the aforementioned threat landscape are outlined. The concepts of robust organizations and resilience are reflected upon as alternatives to the prevalent failure-oriented safety approaches. Knowledge from the current study serve as input to the final New Strains of Society framework.

1 INTRODUCTION

A threat could be explained as a possible danger that might exploit vulnerability of a system and cause possible harm. Threat landscapes then cover threats and vulnerabilities of a thematic area that involve a network of agents and stakeholders, interacting normally or more randomly (Grøtan & Antonsen, 2016). The landscape metaphor involves an aggregate of the more prevalent notion 'threat pictures'. A 'threat picture' is confined and focused on a narrowed set of topics, either thematic-centric (e.g., oil spill) or actor-centric. A picture comprises a frame or a border that represents a clear demarcation of the relevant vs. non-relevant issues belonging to the threat, including the relevant vulnerability and presumptions on operational conditions. Such presumptions can, however, be turned the other way around. They can be recognized both as demarcation lines for the validity of a picture in relation to hidden, dynamic and emergent effects, but also as a key to understanding when a picture will become saturated with unaccounted or unprecedented conditions. The overall idea is that as threat pictures mature, scenarios for stress testing can be built.

The finalized project New Strains of Society (New Strains) dealt with these matters. Empirical studies of societal threats and vulnerabilities were focused on gradual developments of threat landscapes for thematic areas like the petroleum activity in the high north. Information was gathered from documentation reviews, followed up with guided interviews and workshops. By utilizing a joint interview guideline, the representatives from involved actors were incited to elaborate on threat pictures and scenarios that normally fall outside their normal belief of system behavior. Okstad et al. (2017) described a basis for the design of empirical case studies of which the results should support to the New Strains framework.

1.1 *Objective*

The main objective of this paper is to summarize generic findings gathered from interviews and workshops with involved actors concerning threat

landscapes arising from the thematic area 'oil in high north', and to organize the finding into a rudimentary threat landscape that can be subject for elaboration and extension at a later stage, involving more actors.

2 INFORMATION GATHERED

2.1 Description of case studies

The case 'oil in high north' is about possible implications of the offshore petroleum business in the high north (Barents Sea). In addition to this case, there are two other cases covered in the New Strains project; the 'Pandemic' and 'ICT infrastructure'. The latter is much about cyber safety, security and resilience and is as such, integrated in the other two thematic areas. In fact, it deals with vulnerability and risk handling of critical ICT infrastructures, of most importance in maintaining any societal function.

The 'oil in high north' case defines threat landscapes much as societal impact of the petroleum activity and its presence in the region. Examples are environmental concerns, access to limited services in emergencies (e.g., SAR), like public hospitals and air-borne ambulance, as well as the dependability of shared infrastructures. The latter could be communication infrastructure, energy supply, transportation systems for goods and/or services to offshore installations as well as to local communities.

'Pandemic' is about dealing with a global epidemy that crosses national borders, affecting the public widely and thus, indirectly threatening important societal functions and infrastructures, herein questioning the deliberations of saturation points and interdependencies of the preliminary threat landscape presented in this paper.

2.2 General aspects; method and interview guide

In this paper, we try to delineate a preliminary threat landscape, based on tentative threat pictures, interviews and available public information. The key activity is to encircle and 'carve out' possible 'pictures' and their saturation characteristics. What external events could 'shake' or interrupt them? Possible spillover effects are here those effects that carry the potential to influence other (external or overlapping) pictures, and ultimately the whole 'landscape'. The strategy for doing this is based on the landscape representation of Grøtan and Antonsen (2016). Separate interviews were carried out and pragmatically used for this purpose, providing crucial grounds for the New Strains framework development aiming for stress-testing as the ultimate objective. Each interview was aligned to contribute in an optimal matter to the framework, and based on a joint interview guide (Grøtan and Antonsen 2016). Key players were interviewed at both a general level, and on specific topics related to their presumed or self-declared 'picture'. The initial aim was to identify the interviewees' home ground with respect to risk pictures and the risk management been implemented. What kind of events were covered by the risk analysis normally, and what have been the criteria for establishing emergency- and contingency plans?

By going through past events and how the organization responded, characteristics of how they were surprised are revealed, in addition to information about situation handling. By going through these experiences, one should touch upon the outer edge of what (situations) are possible to handle by the organization. This could be explained as the thickness of the threat pictures' frame. Next, the aim was to challenge actors to look for the bigger picture given the situations experienced, how could the situations possible escalate? What may have happened if the initial event occurred slightly different, or conditions were some otherwise for the scenario? At this stage, it was expected that actors used their imagination and took the opportunity to respond actively on both thinkable, and less thinkable scenario escalations. Important questions in this phase were:

– What has been done after the incident to be better prepared (learned by experience)?
– What kind of effects in sense of improved interaction between actors are seen?
– What kind of overlap with other threats are seen in the hypothetical crisis?
– How could such kinds of interactions and overlap be handled in practice?

Threat landscapes for 'oil in high north' have been formulated on basis of adapted interviews and meetings. The strategy was to pursue initiating events further and challenge operators and actors with respect to possible ways of escalations. By exerting pressure on a given threat landscape, one or more threat pictures were approaching a saturated state which triggered thinkable events. These events escalated from some defined 'overlaps' between the set of threat pictures and/or actors in the landscape.

One possible escalation relates to the production installation's dependence of electric power supply from shore in normal operation. A scenario, with overlapping threat pictures, e.g. challenging weather, or vulnerable power supply, could initiate from a winter storm caused by a polar low pressure. The storm knocks out the power supply to the offshore production facility, while at the same time hampers evacuation of personnel from installation by helicopter.

Then, we ask what could be done to avoid similar experiences, or to be better prepared. The risk management should be updated accordingly. Finally, taking as a premise that surprises anyhow might occur in the future—what could be done, or should happen to successfully deal with these surprises? Here, we identify some resilience capabilities. The interviews were structured according to the predefined sequence of issues starting with the interviewee's home ground, i.e. a description of the risk management- and emergency preparedness system in service.

2.3 Actors involved in 'oil in high north'

A list of potential interviewees was established based on a predefined actor landscape, shown in Figure 1.

These actors, or organizational units, were assumed to play active roles in the threat landscape. Hence, they will also be prime candidates for being actors in a future 'resilience landscape' (Grøtan & Antonsen 2016). Founded on the New Strains principles of building such landscapes (Grøtan & Bergström, 2016), Grøtan (2018) utilizes a New Strains discursive-support structure that enables such a polycentric resilience landscape to evolve over time. Based on this, a preliminary threat landscape may be elaborated and evolving further.

2.4 Interviews and workshops accomplished

During the project work, we managed to get in touch with an oil company, the council of county emergency preparedness in Finnmark, the regional health company and a local health company. We also planned to interview representatives from the police, the national electric power net agency, telecommunication companies and the local electric power company. This turned out to be difficult, inter alia because we easily run into asking for classified information that we cannot receive. There

Figure 1. Actor landscape: 'Oil in High North'.

have been three workshops held in 2016–2017 on the topic cyber safety, security and resilience of critical infrastructure. Information from these workshops is elaborated on in the discussion part of the paper.

In addition to the obstacles of classified information, we also come into or derive information and knowledge that is obviously sensitive (but unclassified), and therefore is omitted.

However, it is emphasized here that the conception of 'sensitive' is based own judgements.

2.5 Findings from narrative-structured interviews

The 'narrative structure' is based on Grøtan and Antonsen (2016).

2.5.1 General issues

General characteristics of the high north involving the petroleum industry activity and maritime traffic in the area were i.a. as follows:

- A situation with limited 'resources' in the high north put constraints on crisis mitigation.
- Actors have experienced limited information provided by externals in early phases of situations, combined with bad communication.
- The region is known for rough weather conditions and large distances between parties and service providers in reaching the necessary resources.
- There are still conflicting interests between nations in the Barents region.
- Societal events, and/or global changes to society seem to have effect on business as usual.
- Cyber-security, hidden, dynamic and emerging (h/d/e) risks are evolving. These issues are incorporated in emergency exercises, initiated by the county administration, that involve actors and stakeholders starting to learn by collaboration.

2.5.2 Actors 'state of the art' in risk management

Oil companies give lower priority to security issues than pure (physical) safety. The petroleum business in Norway is not defined as a CI and thus, not subject to the Security Act like other critical infrastructures.

Misleading, cyber-related actions, or events with purposes others than what seems to be the case at first place are challenging tasks for the industry. It is generally difficult to improvise on such ICT-problems when lacking overview or knowledge to problem origin in the early phases of a scenario/event. Achieving a delayed overview of the situation, or late awareness of the main purpose of an attack is normal, not exceptional. Generally, there are limited roles, or dedicated activities in strengthening the security field in the petroleum business. Measures are prescribed for physical protection mainly, e.g.
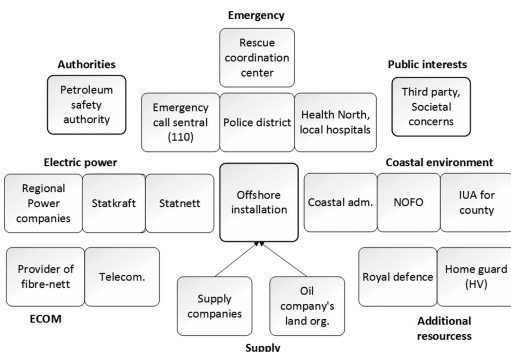
like to secure persons from becoming violent offshore, implement 100% check of personal luggage before offshore flights, etc. However, the industry is aware of cyber threats like the 'denial of service'.

From the authority's point of view, cyber security is part of the overall emergency preparedness in society. Finnmark county has included these issues in their emergency-preparedness plans, and constitute an important part of their training program.

Geographical coverage of the health emergency-preparedness is defined in dialogue with national authorities. Focus is on robust systems for alerting, assessing and managing unexpected situations. The regional health company (Finnmark) is set for handling of major accidents with many injuries. It incorporates plans for the critical infrastructures. Emergency plans, that includes infrastructures, are aligned with the relevant actors, like oil companies, hospitals, police, coast guard, national defense, etc. The ambulance services are also crossing national borders to Russia and Finland.

2.5.3 *Experiences from h/d/e events in own business*

The following draws an overview of some threat pictures that are relevant for the 'oil in high north'. These pictures mainly are derived from the interviews.

Offshore installations may become vulnerable to electrical-power shut down from shore, given the new Norwegian policy that requires electrical power supply from shore. The tense political climate, with environmental activists and Russian collaboration makes operations challenging to a certain extent. The public society in the northern part of Norway, including the petroleum industry, have been surprised by several big events lately. Three examples were:

– The refugee situation in 2015 with large groups of people crossing Norwegian border at Storskog.
– The big avalanche at Svalbard in 2016 came as a surprise and challenged the health company's preparedness, including transportation of personnel.
– The ash cloud came from the Iceland volcano in 2010 led to major ambulance-flight restrictions.

Oil companies typically expect only minor, or none surprising events from own business. As mentioned, cyber security of critical infrastructures and lack of overview/delayed knowledge about emerging problems are general issues given implementation of new/innovated technology in society.

Finnmark as a large county with resources geographically spread is also a challenge. There is limited capacity of the local hospitals to handle big events with lots of injuries. Anyway, unforeseen events happen all the time in the north, often related to the challenging weather conditions and long distances.

The time factor in an acute situation often become critical, and the required resources in an emergency may be far away, and take 2–3 hours to mobilize. An example of such is the fire-fighting service.

There are periods of the year with less access to back-up health personnel, e.g. during the Easter with people spending their holiday time out in the terrain. Personnel resources to solve ICT-problems may also be scarce locally, and it becomes a critical aspect if communication gets down during handling of a crisis.

Finally, the electric power situation depends on a power distribution grid crossing borders to both Finland and Russia, which makes it even more vulnerable. The electrical power net covering the northern parts of Norway is operated by 7 companies. Although, Norway, Russia and Finland have agreed on training the emergency preparedness against events (including power supply) that involve all three countries, the handling of crises near the borders to each country with utilization of the common resources is a critical issue.

2.5.4 *Pandemic as a threat*

The national preparedness plan for pandemic flu describes how to prevent and reduce the spread of infection, morbidity and death, and to provide good treatment and care for people affected by the flu pandemic. Municipalities in Norway are obligated through the Civil Protection Act, to actively work with emergency preparedness, such as e.g. to have a plan for how to handle possible pandemics. Some of our project group members were allowed to observe and challenge participants in the crisis response team during one specific manoeuvre, 'exercise Virus', in one municipality during the autumn 2017. The type of virus was in this case a seasonal influenza virus. In this exercise, all municipal offices were involved.

A pandemic is a complicated situation to handle for a municipality. It involves the administrative and operative management, and several different professionals such as general practitioners, hospitals, nursing homes, transportation, schools, day-care, groceries, to mention some. Moreover, a pandemic flu situation is highly different than an emergency event as e.g. a major explosion, that leaves an unexpected complex situation with a high degree of uncertainty. While many emergencies occur suddenly, a pandemic flu spreads and escalates in a slower manner. It is possible, to a certain degree, to be prepared and prevent the severity of the outbreak. However, it should be mentioned that the lethality of a flu pandemic could be abnormally high, in which could leave the situation even more complex and difficult to solve. Ebola pandemic, with the high degree of lethality, is another example of complex pandemic.

During the 'exercise Virus' it was observed that the organisation involved in handling the crisis is complex, the distance between the members in the

crisis management, the crisis response team, the administrative and operative management, as well as the many other actors involved, could lead to a non-optimal communication dialogue between professional institutions, external actors and decision makers. At some offices, the person of contact could have changed, without notifying in the emergency preparedness plan or in the digital crisis management tool, in which led to further communication problems. Misunderstandings could easily take place; degree of severity, underestimation of time consumption, and which resources are available. Moreover, since also neighbouring municipalities are affected in case of a pandemic, competition for the same resources as e.g. beds for a temporary emergency room/hospital, could occur. Other important issues are the complex logistics for handling sick persons, to continue with safe operation of critical societal functions and to have enough qualified personnel to run daily operations.

On the positive hand, since the pandemic situation often escalates in a slow matter, the management can reallocate human resources. E.g., personnel working at the municipal cultural school could be reallocated to work at vaccination posts or nursing homes, as there most likely would be shortage of health personnel in a pandemic situation. Still, because of the high numbers of persons involved in a pandemic, even a pandemic with low lethality could have the potential to paralyse—to a certain degree, a whole society.

From this, we hypothesize that a pandemic component in 'The High North', could affect the capability and function of persons directly involved at offshore installations as well as the support network on-shore from the Finnmark county. This could again threaten the safety for the work and the environment in 'The High North'. Although we presume that 'pandemic' aspects already have been considered by the 'Oil in High North' actors, we find reason to issue a warning that the 'crippling' effect of a pandemic is likely to jeopardize any assessment of saturation effects related to almost any risk picture. This is probably even more relevant for scarcely populated areas, where competent people probably have several roles, related to e.g., authorities, companies, NGOs and the civic society. The latter is especially important for reliance on community resilience, despite the assumption that the population is more robust compared to rural areas (see later discussion on resilience).

2.5.5 *Emergence, escalation into 'bigger pictures'*
The following gives some examples of possible escalation routes into 'bigger pictures'. Terror, where the health services can be targets themselves (physical/cyber), is thought of as a possible scenario. Sensitive patient information may get lost, although health companies are subjects to the Security Act.

A refugee situation could escalate with people disappearing after crossing the national border, with a pandemic coming up. At the same time, some might bring forward violent attitudes and crime.

With changing traffic patterns in the north, mainly enforced by increased tourisms, etc. the health companies are challenged on capacity and logistics in case of simultaneous events. There is limited capacity in local hospitals to handle big events with lots of injuries. These situations may as well effect on the health preparedness served to the petroleum business.

2.5.6 *Expectations and revised risk governance*
Of the most important learning from incidents by the oil companies is:

– Risk governance being updated based on learning from incidents.
– Outsourcing of ICT services requires improved focus on contracts.
– Improved (risk) knowledge is achieved among actors involved in the (oil) business.
– Hospitals, police, etc. are more aware of possible new scenarios offshore.

From a Finnmark county perspective, the new 'cyber scenarios' are to be included in the 'national risk picture', but the emergency preparedness should be made Finnmark-specific. The council of county emergency preparedness plays an important role in improving the society's risk awareness by maintaining an open dialog, and arranging training exercises.

For the health companies, review of emergency plans is expected to adapt at new events and developments of the society. New emergency plans should also cover 'hybrid-war' scenarios. Here, the rescue function of the armed forces need close cooperation with the civilian health service to handle crises. Interaction competence will thus be more important. The 22. July terror attack gave us new views in that respect (Johnsen & Øren, 2015).

2.5.7 *Recognizing the usefulness of resilience*
When it comes to specific resilience capabilities the county emergency preparedness is used as an example. The county expresses they adapt to situations, and the degree of improvisation often occurs there and then. It is however, more difficult to improvise on ICT-problems due to lack of overview/knowledge in early phases of a situation. Each sector/actor carry out resilience, or resilient behavior in different ways, either as an organization or individuals. Early sharing of information to society (e.g. the municipalities) is one of the county governor's main responsibilities and should support such a behavior.

Safety and emergency events offshore are handled by the Norwegian rescue coordination center (RCC) in first instance. The oil business itself may

contribute by its own transportation resources to assist the health companies in specific rescue operations, etc. The Seeking helicopter squadron has become an important resource for the health companies as well.

Experience from a gas-leak event on an installation in the north lately tells that health companies nowadays are notified earlier without occurrence of a serious event with injuries, or having a real evacuation situation. The threshold level to establish preparedness is maintained as before, but notification to the health company comes earlier than before. The main reason is that the crisis management at health companies is more able to judge, or assess the seriousness of situations during the early stages than operators at the alarm receiving center.

Another aspect of resilience is that inhabitants of Finnmark tend to try out their premises extensively in crisis situations. The northern communities are characterized by their robust populations. Due to the region of small, often isolated communities, the ability to handle unforeseen situations is spelled out when events occur. There is, however, a variety of such skills. Living in the north involves some risks and the inhabitants are more used to stand-in the situation when required. Next, there is also a reliance of our neighbor countries on Norwegian assistance in crises, e.g. in north Finland and Russia. An accident near the border to Russia can also be supported by resources from Russia. There is no experience from real events on such, but the countries exercise together regularly.

3 THREAT LANDSCAPES OVERVIEW

Generally, emergency preparedness in oil companies is mainly designed to handle single accident events at a time only, e.g. a hydro carbon-leak or fire. However, problems may escalate if e.g. a production upset and a hydro carbon leak occur at the same time and in combination with outfall of critical infrastructures. An example of the latter is loss of electric power from onshore, or technical failures on critical communication systems. The following summarizes input to threat landscapes derived from the interviews:

– Long distances in the north between critical (emergency preparedness) resources may induce logistic challenges when facing emergency situations, e.g. easy/in time access to onshore equipment in case of an unexpected oil spill.
– The petroleum industry is not subject to the 'security act', which makes the involved actors less accountable to cyber-attacks than other domains, e.g., 'denial of service' types of viruses.
– Possible 'Spillover effects' from externals during a crisis, e.g. environment activists, political interests may interrupt a proper handling of situations.

– Critical operations at the same time of an infection disease spread among key offshore personnel may reduce the problem-solving capacity dramatically.
– Terror attacks in combination with bad weather makes it difficult with respect to accessing accurate information, and handle multiple demands to limited resources for normalization.
– 'Oil in high north' is currently a Vest-Finnmark domain. A major accident offshore may however, require the whole capacity of the regional health company. That means the capacity of single health companies might be too scarce in those situations.
– Extraordinary events (e.g. the refugee situation at Storskog) combined with a major offshore accident could cause trouble for the emergency assistance from the health companies due to limited resources.
– Ambulance services by air is a critical function in emergency situations offshore, and may easily be interrupted by bad weather or natural disasters, like the ash cloud in 2010.
– The avalanche at Svalbard in 2016 came as a surprise and challenged the health preparedness of health companies, especially with respect to transportation of personnel. An offshore accident at the same time would have been difficult to handle locally.
– Health companies are always challenged on capacity and logistics by simulations events. The companies are decentralized, often small units with focus on the 'acute' functions during events.
– Experience from an exercise at a hospital with a CBR-incident (Chemical, Biological, Radiological), and at the same time a real failure in the communication system did occur. Then there was a need to put the exercise on 'hold' to solve it.
– Resources to solve ICT-problems become scarce with communication difficulties. Access to troubleshooting capacity also becomes a scarcity resource by constantly introducing new technology.

The above aggregate to three major treat landscapes that could be elaborated on further (see):

– Production upsets
– Cyber security
– Emergency preparedness at sea

A further elaboration of these landscapes is conceivable, drawing on a discursive support scheme (Grøtan, 2018) that supports development of polycentric resilience landscape, including cyber vulnerability issues.

3.1 External conditions

In addition to threat landscapes, the following issues were registered through the interviews as

major external conditions, i.e. kinds of 'labyrinths or moving horizons' (Grøtan & Antonsen, 2016):

– Changing conditions for the offshore petroleum industry in general, mainly due to lower oil prices, a continuous need for cost cutting with structural and organizational consequences.
– Hidden vulnerabilities in the 'system' for electrical power supply from shore.
– Development strategies for the electrical power grid are not fully predictable for the industrial actors. Uncertainty relates to further development, of which, is partly geographically conditioned.
– Uncertainty relates to the resilience capabilities and degree of informal collaboration between actors involved in a potential (offshore) crises.
– The degree of information and communication constraints occurring between governmental levels and actors in crisis situations that evolve.

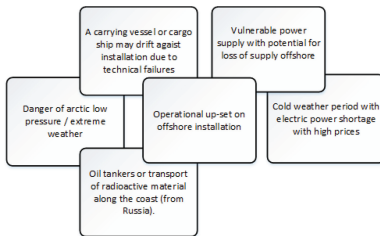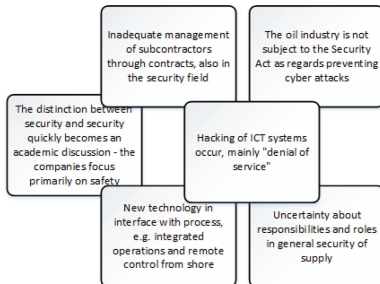Figure 2. Threat landscape: Production upset.

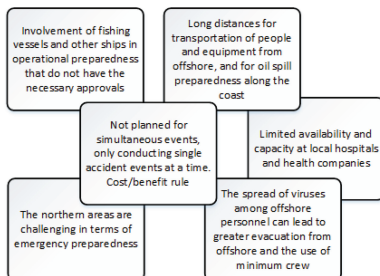Figure 3. Threat landscape: Cyber security.

Figure 4. Threat landscape: Emergency preparedness at sea.

– The availability of personnel varies over time in the regional health companies depending on changing regional policies that may have effect on the quality of the health preparedness.
– The degree of shared information and communication between the actors in the petroleum business and health companies, has developed into new levels lately.
– The development of the expected 'total-defense' concept is uncertain. To what degree (and when) can actors rely on sufficient and steady interaction between actors according to such a concept?
– The technology change and degree of innovation in the hospital sector imply varying dependency on the Internet in rescue and health preparedness.
– Access to troubleshooting capacity (ICT related) may become scarce for the health companies in times of new implementations.
– Required manning in the northern health companies, and accessibility to personnel vary during the year due to individual work- and shift schemes.

4 DISCUSSION AND FURTHER WORK

Threat scenarios are elaborated on basis of threat landscapes with 'saturated' threat pictures and 'moving horizons' in Section 3 and 3.1. Scenarios may initiate from the offshore installation itself, from a passing ship in the area, enforced by bad weather conditions, or loss of critical infrastructures like electric power from shore. In combination with other events, scenarios may escalate into severe accidental events.

The important aim of scenario framing/delimitating in New Strains was to establish an appropriate foundation and discussion basis for the actors and stakeholders involved (Okstad, 2016). Any actor should take the opportunity to respond on knowable escalation factors of the identified scenarios, if they were involved or affected according to the given threat landscape.

The scenario should neither be too specific, nor to general. In case of the first it probably requires too detailed knowledge and extensive verification of its implications for the final acceptance as a scenario among actors. If scenarios become too general and vague, they will be counterproductive and of minor value in clarifying possible escalation factors and effects of such within a given threat landscape.

Another challenge was how far one should go to look for interconnections between contemporary threats and adverse circumstances as reinforcements to possible threat escalations. The right balance was found to be just making illustrations of possible spill-over effects, or the added effects of several overlapping events or vulnerabilities in the given threat landscape.

Threat scenarios that have been discussed related to 'oil in high north' are:

- Critical exploration drilling activities goes on in the North Barents Sea, and at the same time, a major ICT-system failure occurs. There is limited ICT infrastructure in the area. A well control situation escalates into a critical situation that require shutdown and immediate evacuation of personnel from the rig.
- A large passenger boat gets into fire at open sea, at the same time an ICT-problem strikes the health company. Combined with large discharges of oil/chemicals at a site of damage (CBR), situations quickly get out of control. Viewed from the health company's point of view, the size of the accident in sense of the number of injured people becomes the biggest stress factor.
- Simultaneous energy-power cut to an offshore installation and an oil spill, or operational problem at site. Challenges then occur related to fast and effective mitigation of consequences. Finnmark county is large, with the onshore recourses geographically spread. Then it takes time to move, e.g. by helicopter between west and east.
- Offshore event, international cyber-attack, critical failure in communication systems/infrastructure (random failure/out-fall, or a deliberated action, e.g. cut of cables).
- Ship collision with an installation, and at the same time an outfall of electric power from shore occurs. Finally, an escalating pandemic flu strikes the area. With a trend of increasing ship transportation with new production- and exploration drilling taking place in the north-east Barents Sea. In addition, system vulnerabilities exist connected to ICT and Internet of Things incorporated in every critical infrastructure and logistic function.

Our experience from the interviews is generally positive with respect to the interviewees willingness and engagement to share their opinions and thoughts on these aspects. However, we faced a challenge regarding confidentiality and security clearance at a degree that limited our contact with some actors.

Regarding the workshops, the participating people were motivated to contribute there and then. Discussions in interdisciplinary work groups was a success. People from authorities, research units and practitioners worked very well and the impression was that it was valuable spending of time. However, the discussions regarding threat pictures, and especially related to cyber security, quickly became technical. In some discussion groups, therefore, the discussion was raised a level and used more to elaborate around possible effects or consequences of the cyber threats. One drawback was the tendency of pulling out the consequences completely (to wide, or thinking 'worst case') instead of thinking possible event chains or sequences leading to such. Maybe we should have emphasized to concentrate on a limited set of consequences, i.e. linked to the given organization.

5 CONCLUSION

In line with the suggested approach to encircling and building threat landscapes, a preliminary threat landscape for 'Oil in High North' has been developed. Results from a study of pandemic handling in a municipality has also been included in the landscape. This threat picture sensitizes the 'oil in high north' scenario to be further scrutinized concerning operational presumptions and considerations of saturation effects.

For a further development to take place, crucial issues about not only classified information, but also sharing of obviously 'delicate' information on (e.g., cyber) vulnerabilities would have to be addressed. The authors judgement is that this should be possible, laying the foundations for stress-testing according to the New-Strains objective (Okstad et al. 2016).

REFERENCES

Grøtan, T.O. 2018. Building Cyber Resilience through a discursive approach to 'Big Cyber' Threat Landscapes. Paper submitted to ESREL 2018.

Grøtan, T.O., Antonsen, S. 2016. Take it to the limits. An empirical strategy for exploring the new strains of society in terms of hidden, dynamic and emergent vulnerabilities. ESREL 2016, Glasgow, Scotland.

Grøtan, T.O., Bergstrøm, J. 2016. Calibrated resilience landscapes of composite protection: Theoretical grounding of an empirical approach. ESREL 2016, Glasgow, Scotland.

Johnsen S.O., Øren, A. 2015. Is complacency creating a reactive regulatory regime? ESREL 2015, Zürich, Switzerland.

Okstad, E. 2016. Scenario approaches as a means of handling emerging risks in society. ESREL 2016, Glasgow, Scotland.

Okstad, E., Dahl, Ø. 2017. Horizon scanning approaches for early sensing of cyber-physical threats to water utilities. 53rd ESReDA Seminar: Enhancing Safety: The Challenge of Foresight.

Okstad, E., Grøtan, T.O., Paltrinieri, N. 2017. An empirical case design and stress test addressing hidden, dynamic and emergent vulnerabilities of society. ESREL 2017, Portorz, Slovenia.

Øren, A., Grøtan, T.O., Dahl, Ø. Pandemic landscape of new strains of society. ESREL 2016, Glasgow, Scotland.

Weick, K.E. & Sutcliffe, K.M. 2007. Managing the unexpected, resilient performance in an age of uncertainty. Second edition, John Wiley & Sons, Inc.