RESEARCH/REVIEW ARTICLE

Regulatory policies for using oil dispersants in the Barents Sea

Natalia Belkina,[1] Olga Sarkova[2] & Ståle Jensen[3]

[1] Lundin Norway AS, Strandveien 50B, NO-1366 Lysaker, Norway
[2] IS-Systems, Portovyj proezd 31a, Murmansk 183038, Russia
[3] Ramboll Oil & Gas, Sjøhagen 6, P.O. Box 8058, NO-4068 Stavanger, Norway

Keywords
Oil spill; Arctic; Barents Sea; dispersants; Norway; Russia.

Correspondence
Natalia Belkina, Lundin Norway AS, Strandveien 50B, NO-1366 Lysaker, Norway. E-mail: natalia.belkina@lundin-norway.no

Abstract

Use of dispersants requires assessment of which environmental values are at stake. In the Barents Sea this issue is of high concern as large oil spills can cause transboundary pollution, affecting the interests of two neighbouring countries. The Joint Contingency Plan in the Barents Sea does not set any specific requirements for use of dispersants and lets Norway and Russia follow their national procedures. The Plan emphasizes that in case of transboundary pollution the decision to use dispersants shall only be undertaken upon common agreement. The paper presents a comparison of the national regulatory approaches of Norway and Russia to using dispersants. The research is based on the analysis of legislative documents and interviews with oil companies, oil spill responders and relevant national authorities. The research reveals that in both countries use of dispersants requires preliminary authorization of the national agencies. In Norway the pre-approval procedure and the algorithm of dispersants involvement in response to a real accident are clearly documented and are regularly tested. This has made the process of approval for using dispersants more efficient. In Russia the lack of practical experience in using dispersants and well-established approval procedures can result in a long and unclear permitting process for each oil spill case. This could seriously hinder the use of dispersants to combat transboundary pollution in the Barents Sea, even if it is considered to be beneficial. We conclude that the development of a harmonized approach for dispersants use in the Barents Sea should be thoroughly assessed.

Petroleum activities on the Norwegian continental shelf started in the North Sea and have gradually moved northwards to the Barents Sea (Knol & Arbo 2014; Tormodsgard 2014). The Norwegian–Russian agreement on delimitation of the Barents Sea entered into force in July 2011 (Government of Norway 2011; Moe et al. 2011). The agreement opened new opportunities for oil and gas activities in the previously disputed areas and joint development of petroleum resources in the Barents Sea and the Arctic Ocean. In June 2013, the Norwegian government declared the south-east Barents Sea opened for oil and gas activities (Norwegian Ministry of Petroleum and Energy 2013; Knol & Arbo 2014), while the Russian authorities assigned areas, located close to the Russian–Norwegian border, to Rosneft and partners Eni and Statoil (INTSOK 2014).

Development of the petroleum resources in the Arctic waters faces many operational and environmental challenges (Arctic Council 2009; Short & Murray 2011). The Barents Sea is an area with particularly demanding climatic conditions as well as considerations regarding its vulnerable environment (Harsem et al. 2011). The environmental risks of accidental oil spills associated with oil and gas activities, such as exploration, production and transportation, are of special concern (Pavlenko & Gluhareva 2008; Hasle et al. 2009; Jensen & Carroll 2010; Norwegian Ministry of the Environment 2011).

Few countries have sufficient resources for combating large oil spills on their own (Sarkova et al. 2010). Norway and Russia have mutually assisted one another in oil spill response (OSR) in the Barents Sea for more than

Citation: *Polar Research* 2015, *34*, 24326, http://dx.doi.org/10.3402/polar.v34.24326

20 years. Their cooperation is based on the Agreement for Oil Spill Combatment in the Barents Sea, signed by the governments of Norway and Russia in 1994 (Government of Russia 1994; Ly & Bjerkemo 2011). Under the Agreement the Joint Norwegian–Russian Contingency Plan for OSR in the Barents Sea was developed. These documents provide regulations for cooperation between the competent national authorities on oil spill combatment, joint exercises and regular meetings (Sydnes & Sydnes 2011; Knol & Arbo 2014; SMPC 2014).

Compared to more temperate areas, OSR in the Barents Sea could be challenged by the harsh climate, large distances, long periods of darkness and lack or absence of infrastructure in remote areas (Pietri et al. 2008; Harsem et al. 2011; Velez et al. 2011; Babenko 2013; Knol & Arbo 2014). It requires more time to deliver and deploy OSR equipment, ensure safety of personnel and provide them with the necessary supplies, especially in winter (Sarkova et al. 2010; Lampela & Jolma 2011; Ly & Bjerkemo 2011; Schmidt 2012). As a result timely response to oil spills and use of traditional mechanical recovery (booms and skimmers) in the Barents Sea could be significantly impeded (Lyons & Castaneda 2005; Guevarra 2011). This creates a need for adapting alternative tactics, such as using dispersants, which can be applied from ships or aircraft. Use of dispersants has the potential to treat larger and more remote spills quickly (Steen & Findlay 2008; Coelho et al. 2011; Knol & Arbo 2014).

The aim of the paper is to present the policies and procedures for using dispersants in the Barents Sea in Norway and Russia. Oil spill emergency systems in Norway and in the Russian Arctic were previously studied by Sarkova et al. (2010), Ivanova & Sydnes (2010), Ivanova (2011), Sydnes & Sydnes (2011, 2012) and Belkina (2013). Nevertheless, regulations for using dispersants in a transboundary context in the Barents Sea have not been subject to much academic research. This study is an initial research effort to compare the national regulations and procedures of Norway and Russia that govern the use of dispersants. The main question addressed in this paper is whether there is a harmonized approach for using dispersants in Norwegian–Russian OSR cooperation in the Barents Sea.

Oil dispersants

Oil dispersants are chemicals, similar in properties to common dishwashing soaps, which are applied to oil spills to accelerate the natural degradation of the oil (Stoermer et al. 2001; Lyons & Castaneda 2005). Once applied, dispersants help to break down oil into small droplets which mix vertically and horizontally into the water column, where they are rapidly diluted. Naturally occurring microorganisms are then able to act more quickly and degrade the oil (Clark et al. 2005; Guevarra 2011; Joeckel et al. 2011).

As proven in numerous field and laboratory trials, dispersants are most effective when applied before oils have weathered to become too viscous or too emulsified (Chandrasekar et al. 2003; Mullin et al. 2008; Potter et al. 2012). Because spilled oil can dramatically change its properties during the weathering processes, dispersant use has a distinct "window of opportunity" when it is most effective (Trudel et al. 2003). The window of opportunity can vary significantly depending on both the properties of the oil and local conditions (Sørstrøm et al. 2010). Generally for heavier oils, the window of opportunity is not more than two or three days. Hence, it is crucial to start application of dispersant as soon as practicable (SEA Consulting Group 2013). Substantial testing and research, including field experiments in the Barents Sea (Chandrasekar et al. 2003; Sørstrøm et al. 2010), have demonstrated that dispersants can be effective in cold waters (Owens & Belore 2004; Mullin et al. 2008; Belore et al. 2009). Moreover, icy conditions slow down weathering processes, lengthening the window of opportunity for applying dispersants (Bjerkemo 2011; Velez et al. 2011).

Applying dispersants as an OSR strategy has been gaining an increasing level of acceptance from worldwide authorities (Lunel 2001; Steen & Findlay 2008). The change in attitude is largely due to the reduction in toxicity of commercially available dispersants, and in part because conventional mechanical methods have definite limitations (Lyons & Castaneda 2005; Guevarra 2011). Currently available dispersants are generally less toxic than the crude oils they are used to disperse. Potential negative environmental impacts of the use of dispersants result from potentially toxic chemical components in the dispersed oil, not from the chemical compounds in the dispersants themselves (Fuller & Bonner 2001; Lewis 2013).

The overall aim of applying dispersants is to remove oil from the sea surface and prevent it from entering bays and estuaries or stranding on sensitive shorelines, which are considered to be more vulnerable than offshore areas (Stoermer et al. 2001; Lin & Mendelssohn 2005; Coelho et al. 2011). However, saving coastal habitats from oil pollution means exposing organisms in the water column to the high concentrations of the dispersed oil: one location, habitat or group of species benefit at the expense of another. Getting the correct balance is difficult, and conflicts inevitably arise which need to be resolved in the

Citation: *Polar Research* 2015, *34*, 24326, http://dx.doi.org/10.3402/polar.v34.24326

best practicable manner (Lunel 2001; Belkina 2013). Trade-offs must be thoroughly considered in each single case through a process known as net environmental benefit analysis (NEBA). The process requires taking into account the circumstances of the spill, the practicalities of OSR operation, scientific understanding of the relative impacts of oil and clean-up options, and some kind of value judgment of the relative importance of socio-economic and environmental factors (IPIECA 2000; Whelan et al. 2005). A decision on the use of dispersants should be based on what is believed to result in the greatest net environmental benefit, i.e., the least environmental damage (Clark et al. 2005; DeMicco et al. 2011; Guevarra 2011). Based on the NEBA results, the relevant national authorities can take a political decision to allow the use of dispersants in waters under their jurisdiction (Vik 2003; Joeckel et al. 2011).

When dispersants are considered to be applied in seas bordering several countries, the decision should be taken in consultation with all appropriate national governmental agencies (Stoermer et al. 2001; Clark et al. 2005). For instance, countries adjacent to the Baltic Sea, which are the contracted parties to the Helsinki Convention, have agreed to HELCOM Recommendation 22/2, which states that "mechanical means are the preferred response measures in the Baltic Sea, and that chemical agents may only be used in exceptional cases, after authorisation has been granted in each individual case" (Helsinki Commission 2001: 154). The Helsinki Convention allows the use of dispersants only with very strict limitations due to the shallow water depths and limited water exchange in the Baltic Sea (Steen & Findlay 2008; Lampela & Jolma 2011). There are no comparable Russian or Norwegian recommendations relating to the use of dispersants in the Barents Sea (Belkina 2013). The Joint Contingency Plan stipulates that "the existing national decision making process of each Party will be followed to determine whether dispersants or other chemicals will be used to respond to an oil pollution incident. The use of dispersants or other chemicals in situations which can affect the interests of both Parties shall only be undertaken upon agreement" (SMPC 2014: 7).

Method of data collection

This study is based on the analysis of publicly available documents combined with a series of semi-structured interviews with Norwegian and Russian experts (Table 1). The formal functions of the organizations that the interviewees represented were a general criterion for selecting them. The interviewees included representatives of oil companies involved in joint Norwegian–Russian offshore projects in the Barents Sea, oil spill responders and national authorities with responsibilities pertaining to OSR. The interviews were carried out in the framework of the project Russian–Norwegian Oil and Gas Industry Cooperation in the High North (Ru-No Barents Project) coordinated by the Norwegian Oil and Gas Partners (INTSOK). INTSOK is a network-based organization that was established by the Norwegian petroleum industry and the Norwegian Government to exchange experience and knowledge of oil and gas industry developments internationally (INTSOK 2014). The main purpose of the interviews was to find out how national procedures for using dispersants are performed in practice.

The study area is geographically limited to the Barents Sea since Norwegian–Russian cooperation activities are primarily in this area.

Regulating dispersants use in Norway and in Russia

This section presents an overview of the central OSR regulations and policies on dispersants use in Norway and Russia. The interviewees comment on how the dispersants regulations are implemented in practice.

Table 1 Interviews on regulatory approaches to oil spill response (OSR) in Norway and Russia.

Interview no.	Position	Country	Interview language	Date of interview (all 2013)
1	General director, private OSR company	Russia	Russian	13 Jun.
2	Environmental team lead, oil company	Norway	Norwegian	14 Jun.
3	Senior environmental impact assessment specialist, environmental consulting company	Russia	Russian	1 Aug.
4	Lead of OSR department, oil company	Norway	Norwegian	12 Aug.
5	Environmental advisor, Norwegian Clean Seas Association for Operating Companies	Norway	Norwegian	15 Aug.
6	Health, safety and environment manager, oil company	Russia	Russian	21 Aug.
7	Deputy director of health, safety and environment manager department, oil company	Russia	Russian	14 Nov.
8	OSR authorities representative	Russia	Russian	15 Nov.
9	OSR authorities representative	Norway	Norwegian	18 Nov.
10	Senior specialist at the health, safety and environment department, oil company	Russia	Russian	10 Dec.

The central OSR regulations in Norway

A number of legislative documents cover oil spill preparedness and response in Norway. The most important legislative documents that cover oil spill preparedness in Norway include the Pollution Control Act (1981), which addresses general pollution, the Petroleum Act (1996), which governs Norwegian petroleum resources and development of these (Ly 2001), the Health, Safety and Environment Regulations (PSA 2010a, b, c), which stipulate central OSR requirements, and the Pollution Regulations (Norwegian Environment Agency 2012), which, among other things, address the composition and use of dispersants to combat oil pollution.

Policy on use of dispersants in Norway

In Norway OSR is mainly based on mechanical containment and recovery using booms and skimmers (Sarkova et al. 2010; Ly & Bjerkemo 2011; Sydnes & Sydnes 2011). Dispersants are considered to be supplemental to mechanical recovery (Knol & Arbo 2014). The overall principle is that dispersants should be chosen when their application results in less overall environmental damage than conventional mechanical recovery or no response (Vik 2003). Selection of dispersants as a response strategy must be based upon NEBA. Under the Pollution Control Act the environmental authorities may oblige companies in charge of oil operations (hereafter called operators) to use different OSR techniques. This may include a direct order to establish a contingency system based on dispersants if this is thought to reduce damage caused by an oil spill (Interviews 2, 9).

Use of dispersants requires pre-approval of competent national agencies and must be included in operators' OSR plans (Pollution Regulations §19-4). There is no "approved list of dispersants" in Norway to which authorities can refer when taking a decision on dispersants use (Interviews 2, 9). However, dispersants should be tested for their effectiveness, natural degradation and algae toxicity and can be allowed for use only by passing these tests (Vik 2003; Pollution Regulations §19-4). The tests results are documented in any OSR plan containing use of dispersants (EMSA 2010).

Operators on the Norwegian continental shelf are obliged to prove the effectiveness of the chosen dispersant on their own crude oils (PSA 2010b, §42). Operators must also test the oil dispersibility in different degrees of weathering of the relevant crude oil in order to assess a window of opportunity for effective use of dispersants under various sea conditions (Lunel 2001; PSA 2010a, §59).

The Norwegian Environment Agency (NEA), under the Ministry of Climate and Environment, is in charge of pollution preparedness requirements and regulations concerning using and testing dispersants (EMSA 2010). The operator submits the OSR analysis involving the use of dispersants as a part of the application for a discharge permit to the NEA for pre-approval (Hasle et al. 2009; PSA 2010c, §34). The Norwegian Coastal Administration (NCA) will receive applications for dispersants use during a real accident and will in cooperation with the NEA be the final authority for decision-making (Pollution Regulations §19-4).

The NEA and the NCA have developed support templates—the Decision Matrix and the Control Form—to clarify information which must be included in the application for using dispersants in case of a real accident (EMSA 2010). The Control Form is a one-page template containing general information on oil spill parameters, location, weather forecast, type of dispersants and application method. The Decision Matrix shall include detailed information on natural dispersion, vulnerable natural resources, depth and distance to shore, possible stranding of oil, chemical dispersibility of the oil spill, wind conditions, strategy for applying dispersants, criteria for operating in darkness, dispersant application capacity, salinity of the surface water, monitoring of the spill and how to quantify the amount of oil remaining after an operation has been completed. Both forms are available on the NCA's website (Norwegian Coastal Administration 2010).

When use of dispersants is included in the OSR plan and pre-approved by the NEA, only the one-page Control Form should be sent to the NCA before commencing to use dispersants (the Decision Matrix can be sent subsequently). The NCA is on duty on a 24-hour basis and can assess the application and issue permission for dispersants use within 30 minutes of receiving the application (Interview 5). No further official authorization is required prior to commencing the use of dispersants (Pollution Regulations §19-4).

If dispersants are not included in the OSR plan, the operator has to submit both forms to the NCA for their approval. The decision-making in such a case may take much longer as there may be a need for decision support from the NEA, the Institute of Marine Research and others (Interviews 2, 9).

Using dispersants and the approval process are important parts of regular OSR exercises organized by the NCA, the Norwegian Clean Seas Association for Operating Companies (NOFO) and other parties of interest (Ly 2001; Jensen et al. 2011). This results in a quick decision-making process and effective response (Interview 4). In recent years dispersants have been used in Norway in

Citation: *Polar Research* 2015, *34*, 24326, http://dx.doi.org/10.3402/polar.v34.24326

two incidents, one in 2006 and a minor one in 2010 (SEA Consulting Group 2013). Dispersant stockpiles are available in Norway and contain Dasic SLICKGONE NS and minor amounts of Corexit 9527 (EMSA 2010).

The central OSR regulations in Russia

The Russian Federation regulates offshore oil and gas activity in the Arctic through a complex system of rules derived from the Constitution, multiple statutes and decrees, orders, regulations and other sources of law (Prozorovsky 2011; Arctic Offshore Oil and Gas Guidelines Paper 2012). The licensing procedure and requirements for environmental protection, including emergency preparedness, are outlined in the Federal Law on the Continental Shelf of the Russian Federation (Government of Russia 1995; Vodyannik 2012). Russian regulations stress that the right to conduct exploration drilling and produce hydrocarbons, transport and store oil using the associated pipelines and infrastructure on the Russian Continental Shelf can be granted only if the operator has an approved OSR plan (Government of Russia 1998, 2012; Venchikova 2012). The operator shall also provide information on OSR technologies suitable for the ice conditions if petroleum activities take place in ice-covered waters (Government of Russia 2012; Donskoy 2014). In Russia approximately 50 legislative documents can be applied to oil spill prevention and response (Zagvozdkin 2008; Sarkova et al. 2010; Ivanova 2011).

Basic requirements for offshore oil spill preparedness and response are stipulated in numerous decrees issued by the Russian government and various ministries (Chernoplekov 2002; Prozorovsky 2011). The most central ones are the following: decree no. 1188 (On amendments to the decree no. 613 dated 21 August 2000 and decree no. 240 dated 15 April 2002) by the Government of the Russian Federation, dated 14 November 2014 (Government of Russia 2014a); decree no. 1189 (On organization of prevention and response to spills of oil and oil products on the continental shelf of the Russian Federation, in inland sea waters, territorial sea and adjacent zone of the Russian Federation) by the Government of the Russian Federation, dated 14 November 2014 (Government of Russia 2014b); decree no. 53 (On approval of regulations of a functional subsystem for operational actions on prevention and response to oil spill at sea from vessels or facilities regardless their ownership or national affiliation) by the Ministry of Transport of the Russian Federation, dated 6 April 2009 (Ministry of Transport 2009); and decree no. 156 (On approval of instructions on the definition of the lower level of oil and oil product spills for the classification of oil spill to an emergency situation) by the Ministry of Natural Resources of the Russian Federation, dated 3 March 2003 (MNR 2003).

Policy on use of dispersants in Russia

Russian oil spill preparedness at sea is based on mechanical containment and recovery (Chernoplekov & Kram 2005). Dispersants are considered to be supplemental to mechanical methods depending on the spill scenario (Belkina 2013). Policy for dispersants use in Russia is outlined in the Regulations on Oil Spill Dispersants Application as of October 2005 (CNIIMF 2005). According to the regulations, use of dispersants must be included in OSR plans and pre-approved by the relevant authorities. The preliminary approval of dispersants means that they have in principle been authorized for use in the inland and territorial seas and the exclusive economic zone of the Russian Federation, and may be applied in OSR operations at a particular site (Interview 8). The preliminary approval also means that a dispersant's toxicity is tested by the Russian specialized research centres, which have established maximum permissible concentrations (MPC) or tentative safe exposure level (temporary norm) for marine areas (Interviews 1, 3).

Previously the list of the pre-approved dispersants contained OM-6, OM-84, DN-75, dispersants 124v and 124d, Corexit 7664 and Corexit 9527, according to the Order of the Russian State Fishery Committee (Goskomrybolovstvo)—On fishery norms—dated 28 April 1999 (Russian State Fishery Committee 1999). This document is no longer in effect and has been replaced by the Order of the Russian Federal Agency of Fishery Resources (Rosrybolovstvo, former Goskomrybolovstvo)—On approval of water quality norms for fishery water bodies including MPC of harmful substances in fishery water bodies—dated 18 January 2010 (Russian Federal Agency of Fishery Resources 2010). The latter provides MPC only for Corexit 7664. There is no other legal document in force which provides MPCs or temporary norms for using dispersants in Russian Arctic marine waters (Interviews 6, 7).

The environmental advantages and disadvantages of using dispersants shall be assessed at the stage of emergency preparedness planning in the preliminary NEBA. In accordance with the dispersants regulations (CNIIMF 2005), in an actual oil spill situation authorization to use the pre-approved dispersants is also needed. The decision on dispersant use shall be taken in agreement with the territorial bodies of the Environmental Protection Agency (Rosprirodnadzor) and the Russian State Fishery Committee (Rosrybolovstvo) on the basis of NEBA which is undertaken at the time of a real oil spill, that is, NEBA of

the actual situation. If a preliminary NEBA has been performed, the NEBA of the actual situation is done in an abbreviated form to evaluate whether the actual situation corresponds to the scenarios given in the OSR plan. If the actual and preliminary scenarios are similar, the authorized representatives of the territorial branches of Rosprirodnadzor and Rosrybolovstvo should endorse the use of dispersant in the given situation. If the actual situation deviates significantly from a preliminary one, a new NEBA must be conducted.

The dispersants regulations (CNIIMF 2005) contain general information on testing and certifying dispersants in Russia, NEBA procedure, dispersants application techniques, etc. However, these regulations, like any other relevant document in Russia, do not stipulate the algorithm for involvement of the pre-approved dispersants into the actual OSR operations (Interviews 6, 10). The lack of a well-established approval procedure could result in a long and unclear permitting process in each oil spill case. While time is spent getting the authorities' approval, the window of opportunity for applying dispersants can be lost (Chernoplekov & Kram 2005; Belkina 2013).

Another factor which can make it less attractive to use dispersants in Russia compared to mechanical recovery is that using pre-approved dispersants may be considered as "discharge of pollutants into water environment," which must be paid for in accordance with the Russian environmental protection policy (Sarkova et al. 2010; Donskoy 2014). However, it should be noted that dispersants have not been used yet in real OSR operations in Russia. At least, there are no reliable records (SEA Consulting Group 2013). Thus, there is an absence of practical administration of the fee for discharge of dispersants. The legal side of this issue is controversial and requires additional coordination with environmental authorities, namely Rosprirodnadzor (Interviews 6, 10).

Dispersants use and the approval process are not included into regular national OSR exercises (Interviews 6, 10). This could lead to a total avoidance of dispersants even if their use can be beneficial.

Discussion

In neighbouring Norway and Russia dispersants are recognized as an effective technique to combat offshore oil spills and protect sensitive coastlines. In both countries use of dispersants requires preliminary authorization of appropriate national agencies. NEBA is essential to the procedures in both countries and is used to assess what is at stake, whether or not dispersants are used. In contrast to Russian practice, there is no list of approved dispersants in Norway. However, dispersants can be authorized for use in Norway only if they pass specialized tests. It means that any dispersant can be used if the test criteria are met. In Russia only Corexit 7664 is currently approved for application in Russian marine waters.

Norwegian regulations oblige operators to test the chosen dispersant on their own crude oils at the oils' varying degrees of weathering in order to assess the window of opportunity for using the dispersant effectively. In Russia there is no such requirement, and the implementation of weathering tests depends only on the willingness of a particular operator.

In Norway the pre-approval procedure and the algorithm of dispersants involvement in response to a real accident are clearly documented and are regularly tested at OSR exercises. There is only one governmental body responsible for the decision-making process in a real spill situation, which reduces to a minimum the time required to process the permit (in practice less than 1 h). In Russian marine waters, dispersants have never been used on a large scale. Lack of practical experience and a well-established pre-approval procedure is likely to result in a long and unclear permitting process in each oil spill case.

The Barents Sea has already become an arena for solid OSR cooperation between the governments of Norway and Russia (Sarkova et al. 2010). Why dispersants have still not been incorporated in joint OSR planning and exercises in the Barents Sea can probably be explained by the fact that the responsible national governmental agencies do not have their own dispersants stockpiles in the Arctic region and, as a result, are mainly focused on mechanical containment and recovery (Chernoplekov & Kram 2005). The existing decision-making process stipulated by the Joint Contingency Plan in the Barents Sea does not set any specific requirements for dispersants use and lets both parties follow their own national procedures. In situations which can affect the interests of both countries the decision to use dispersants shall only be undertaken upon agreement (SMPC 2014: 7). However, a well-established and agreed algorithm determining this process in joint OSR operations, where there is a risk of transboundary pollution, does not exist.

Lack of a proper regulatory mechanism for dispersants involvement in real OSR operations in Russia and not testing the decision-making process for using dispersants in Russian national OSR exercises will hinder rather than help to achieve concordance with the Norwegian counterpart and could lead to a total avoidance of dispersants even if their use could be beneficial (Interviews 6, 10).

The unclear situation regarding the application of dispersants in joint OSR operations today will most probably remain without significant changes until the

Citation: *Polar Research* 2015, *34*, 24326, http://dx.doi.org/10.3402/polar.v34.24326

Norwegian petroleum industry comes closer to the Norwegian–Russian maritime border in the Barents Sea. At that stage, NOFO will come on the scene (Interview 5). NOFO is a non-governmental organization, which, on behalf of the operators in Norway, administrates and maintains OSR, including personnel, vessels, equipment and dispersants stockpiles (Ly 2001). If using dispersants is considered to be beneficial by operators and NOFO, a concordance with the Russian side, whose interests could be affected, should be achieved (Interviews 5, 10).

In light of increasing petroleum activities and associated risks of transboundary oil pollution, a possibility to develop a common Norwegian–Russian strategy for using dispersants in the Barents Sea should be thoroughly assessed. If adopted, it would benefit both the Russian national OSR system and the Norwegian–Russian OSR cooperation in the Barents Sea. A harmonized approach would ensure that dispersants are a viable option in cross-border areas in the Barents Sea.

While assessing the possibility of harmonizing the strategy for dispersants use in the Barents Sea, the following key points should be addressed: the need to standardize dispersant testing and (pre)approval methods in Norway and Russia; the need to pre-define areas, seasons and criteria for dispersants use in the Barents Sea; the efficiency of commercially-available dispersants in the Barents Sea with regard to temperature, salinity and the most common oil types; wildlife sensitivity to oil spills and dispersed oil in the Barents Sea; transboundary customs procedures when dispersants need to be imported quickly into the affected country; the need to harmonize a system of claims management for damage compensation for oil spills from offshore installations and vessels in case of transboundary pollution in the Barents Sea.

Acknowledgements

At the time of the paper submission, BN was employed at Ramboll Oil & Gas in Stavanger, Norway.

References

Arctic Council. 2009. *Arctic marine shipping assessment 2009 report*. Tromsø, Norway: Arctic Council.

Arctic Offshore Oil and Gas Guidelines. 2012. *The Arctic offshore oil and gas guidelines in Greenland and the Russian Federation*. Royalton: Vermont Law School Institute for Energy and Environment.

Babenko M. 2013. Osvoenie Arktiki—ugroza dlya ekologii regiona? (Is the development of the Arctic a threat to the environment of the region?) *Bezopasnost' Toplivno-Ėnergetičeskogo Kompleksa 2 (Safety of Fuel and Energy Complex 2)*, 114–115.

Belkina N.S. 2013. Choosing oil spill response method to protect sensitive coastal areas in the Russian Arctic. In: *SPE Arctic and Extreme Environments Conference and Exhibition. Moscow, Russia, 15–18 October 2013. Vol. 2*. Pp. 985–999. Red Hook, NY: Curran Associates.

Belore R.C., Trudel J.V. & Guarino A. 2009. Large-scale cold water dispersant effectiveness experiments with Alaskan crude oils and Corexit 9500 and 9527 dispersants. *Marine Pollution Bulletin 58*, 118–128.

Bjerkemo O.K. 2011. Behaviour of oil and HNS spilled in Arctic waters—an Arctic Council project. *International Oil Spill Conference Proceedings 2011(1)*, abs229.

Chandrasekar S., Dorial G. & Weaver J.W. 2003. Determining dispersant effectiveness data for a suite of environmental conditions. *International Oil Spill Conference Proceedings 2003(1)*, 331–334.

Chernoplekov A. & Kram A. 2005. Development of the regulatory base for unconventional OSR technologies in Russia. *International Oil Spill Conference Proceedings 2005(1)*, 399–401.

Chernoplekov A.N. 2002. Struktura i sostav planov likvidacii avarijnih razlivov nefti. (The structure and content of oil spill response plans.) *Bezopasnost'Žiznedejatel'nosti 4 (Life Safety 4)*, 28–36.

Clark J., Abbasova A., Bagirova K., Campbell G., Gallagher R., Garajayeva N., Huseynova L. & Nielson D. 2005. Evaluation of dispersants use in the Azerbaijan region of the Caspian Sea. *International Oil Spill Conference Proceedings 2005(1)*, 247–252.

CNIIMF (Russian Maritime Institute) 2005. *Pravila primeneniya dispergentov dlja likvidacii razlivov nefti. (Regulations on oil spill dispersants application.) Report number STO 318.4.02-2005*. Moscow: Russian Maritime Institute.

Coelho G., Aurand D., Slaughter A., Robinson L. & Jones B.C. 2011. Rapid toxicity evaluations of several dispersants: a comparison of results. *International Oil Spill Conference Proceedings 2011(1)*, abs416.

DeMicco E., Schuler P.A., Omer T. & Baca B. 2011. Net environmental benefit analysis of dispersed oil on nearshore tropical ecosystems. *International Oil Spill Conference Proceedings 2011(1)*, abs282.

Donskoy S. 2014. Nedropolzovanie i ekologicheskya bezopasnost. (Use of subsoil resources and environmental safety.) *Bezopasnost' Toplivno-Energetičeskogo Kompleksa 1 (Safety of Fuel and Energy Complex 1)*, 78–82.

EMSA (European Maritime Safety Agency) 2010. *Inventory of national policies regarding the use of oil spill dispersants in the EU member states*. Lisbon: European Maritime Safety Agency.

Fuller C. & Bonner J. S. 2001. Comparative toxicity of oil, dispersant, and dispersed oil to Texas marine species. *International Oil Spill Conference Proceedings 2001(2)*, 1243–1248.

Government of Norway 2011. Treaty between the Kingdom of Norway and the Russian Federation concerning maritime delimitation and cooperation in the Barents Sea and the Arctic Ocean. Accessed on the internet at https://www.regjeringen.no/globalassets/upload/ud/vedlegg/folkerett/avtale_engelsk.pdf on 15 March 2015

Government of Russia 1994. *Soglashenie meždu Pravitel'stvom RF i Pravitel'stvom Korolevstva Norvegja o sotrudničestve v bor'be s zagryazneniem neftju v Barencevom more. (The agreement between the Government of the Russian Federation and the Government of the Kingdom of Norway on cooperation in combating emergency spills in the Barents Sea.) Order no. 545, 24 May 1994*. Moscow: Government of Russia.

Government of Russia 1995. *O kontinentalnom shelfe Rossijskoj Federacii. (On the Continental Shelf of the Russian Federation.) Federal Law no. 187-FZ, 30 November 1995*. Moscow: Government of Russia.

Government of Russia 1998. *O vnutrennih morskih vodah, territorialnom more i priležaščei zone Rossijskoj Federacii. (On inland sea waters, territorial sea and adjacent zone of the Russian Federation.) Federal law no. 155-FZ, 31 July 1998*. Moscow: Government of Russia.

Government of Russia 2012. *Ob izmeneniyah v federalnih zakonah 'O kontinentalnom shelfe Rossijskoj Federacii' i 'O vnutrennih morskih vodah, territorialnom more i priležaschei zone Rossijskoj Federacii'. (On amendments to the Federal Laws 'On the continental shelf of the Russian Federation' and 'On inland sea waters, territorial sea and adjacent zone of the Russian Federation'.) Federal law no. 287-FZ, 30 December 2012*. Moscow: Government of Russia.

Government of Russia 2014a. *O vnesenii izmenenij v postanovlenija pravitel'stva Rossijskoi Federacii ot 21 avgusta 2000 no. 613 i ot 15 aprelja 2002 no. 240. (On amendments to the Russian Federation governmental decree as of August 21, 2000 no. 613 and decree as of April 15, 2002 no. 240.) Decree no. 1188, 14 November 2014*. Moscow: Government of Russia.

Government of Russia 2014b. *Ob organizacii predupreždenija i likvidacii razlivov nefti i nefteproduktov na kontinental'nom shel'fe Rossijskoj Federacii, vo vnutrennih morskih vodah, v territorial'nom more i priležaščej zone Rossijskoj Federacii. (On organization of prevention and response to spills of oil and oil products on the continental shelf of the Russian Federation, in inland sea waters, territorial sea and adjacent zone of the Russian Federation.) Decree no. 1189, 14 November 2014*. Moscow: Government of Russia.

Guevarra J.L. 2011. The nationalization of dispersants accreditation and approval protocols in Asia: implications for response. *International Oil Spill Conference Proceedings 2011(1)*, abs144.

Harsem Ø., Eide A. & Heen K. 2011. Factors influencing future oil and gas prospects in the Arctic. *Energy Policy 39*, 8037–8045.

Hasle J.R., Kjellen U. & Haugerud O. 2009. Decision on oil and gas exploration in an Arctic area: case study from the Norwegian Barents Sea. *Safety Science 47*, 832–842.

Helsinki Commission 2001. *HELCOM manual on co-operation in response to marine pollution within the framework of the convention on the protection of the marine environment of the Baltic Sea Area, (Helsinki Convention). P. 154*. Helsinki: Helsinki Commission. Accessed on the internet at http://helcom.fi/action-areas/response-to-spills/manuals-and-guidelines/ on 5 March 2014

INTSOK (Norwegian Oil and Gas Partners) 2014. *Russian–Norwegian oil & gas industry cooperation in the High North. Logistics and transport—report*. Accessed on the internet at http://www.intsok.ru/index.php?id=2526 on 3 March 2014

IPIECA (International Petroleum Industry Environmental Conservation Association) 2000. *Choosing spill response options to minimize damage: net environmental benefit analysis. IPIECA Report Series 10*. London: IPIECA.

Ivanova M. 2011. Oil spill emergency preparedness in the Russian Arctic: a study of the Murmansk region. *Polar Research 30*, article no. 7285, doi: 10.3402/polar.v30i0.7285.

Ivanova M. & Sydnes A.K. 2010. Interorganizational coordination in oil spill emergency response: a case study of the Murmansk region of northwest Russia. *Polar Geography 33*, 139–164.

Jensen H.V., Andersen J.H. & Gyltnes S.L. 2011. Oil spill response technology development through industry commitments—the Norwegian way. *International Oil Spill Conference Proceedings 2011(1)*, abs344.

Jensen L.K. & Carroll J. 2010. Experimental studies of reproduction and feeding for two Arctic-dwelling *Calanus* species exposed to crude oil. *Aquatic Biology 10*, 261–271.

Joeckel J., Walker A. H., Scholz D. & Huber C. 2011. Dispersant use approval: before, during and after Deepwater Horizon. *International Oil Spill Conference Proceedings 2011(1)*, abs329.

Knol M. & Arbo P. 2014. Oil spill response in the Arctic: Norwegian experiences and future perspectives. *Marine Policy 50 Part A*, 171–177.

Lampela K. & Jolma K. 2011. Mechanical oil spill recovery in ice; Finnish approach. *International Oil Spill Conference Proceedings 2011(1)*, abs189.

Lewis A. 2013. *Dispersant testing under realistic conditions. Final report 2.1. Report from Joint Industry Programme to identify and summarise the state-of-the-art on research conducted to date on the effectiveness of dispersant and mineral fines in ice*. London: Arctic Oil Spill Response Technology Joint Industry Programme.

Lin Q. & Mendelssohn I.A 2005. Dispersants as countermeasures in neashore oil spills for coastal habitat protection. *International Oil Spill Conference Proceedings 2005(1)*, 447–451.

Lunel T. 2001. Dispersants pre-approvals—best practice. *International Oil Spill Conference Proceedings 2011(1)*, 441–444.

Ly J.M. 2001. Oil spill response training and exercises in Norway: are we prepared? In *International Oil Spill Conference Proceedings 2001*. Tampa, FL, 26–29 March 2001. Pp. 617–622. Washington, DC: American Petroleum Institute.

Ly J.M. & Bjerkemo O.K. 2011. Prevention, preparedness, and response to shipping incidents in the Barents Sea. *International Oil Spill Conference Proceedings 2011(1)*, abs228.

Lyons Z. & Castaneda X. 2005. History of dispersant development: a dispersant timeline. *International Oil Spill Conference Proceedings 2005(1)*, 643–645.

Ministry of Transport 2009. *Prikaz ob utverždenii položenijiya o funkcionalnoj podsisteme organizacii rabot po predupreždeniju i likvidacii razlivov nefti i nefteproduktov v more s sudov i ob'ektov nezavisimo ot ih vedomstvennoi i nacionalnoi prinadležnosti. (On approval of regulations of a functional subsystem for operational actions on prevention and response to oil spill at sea from vessels*

Citation: *Polar Research* 2015, *34*, 24326, http://dx.doi.org/10.3402/polar.v34.24326

or facilities regardless their ownership or nationality.) Decree no. 53, 6 April 2009. Moscow: Ministry of Transport.

MNR (Ministry of Natural Resources of the Russian Federation) 2003. *Prikaz ob utverždenii ukazanij po opredeleniju nižnego urovnya razliva nefti i nefteproduktov dlya otneseniya avarijnogo razliva k chrezvichajnoj situacii. (On approval of instructions on the definition of the lower level of oil and oil product spills for the classification of oil spill as an emergency situation.) Decree no. 156, 3 March 2003*. Moscow: Ministry of Natural Resources of the Russian Federation.

Moe A., Fjærtoft D. & Øverland I. 2011. Space and timing: why was the Barents Sea delimitation dispute resolved in 2010? *Polar Geography 34*, 145–162.

Mullin J., Belore R. & Trudel K. 2008. Cold water dispersant effectiveness experiments conducted at Ohmsett with Alaskan crude oils using Corexit 9500 and 9527 dispersants. *International Oil Spill Conference Proceedings 2008(1)*, 817–822.

Norwegian Coastal Administration 2010. Kontrollskjema for bruk av dispergeringsmidler på sjø. Beslutningsskjema for bruk av dispergeringsmidler. (The control form for use of dispersants at sea. The decision matrix for use of dispersants at sea.) Accessed on the internet at http://www.kystverket.no/Documents/Beredskap/Skjemaer/Kontroll- og beslutningsskjema for bruk av dispergeringsmidler (inkl veiledning).doc on 1 March 2014

Norwegian Environment Agency 2012. *Regulations relating to pollution control*. Accessed on the internet at http://www.miljodirektoratet.no/no/Regelverk/Forskrifter/Regulations-relating-to-pollution-control-Pollution-Regulations/ on 17 July 2014

Norwegian Ministry of Petroleum and Energy 2013. Tilleggsmelding til Meld. St. 36 (2012–2013). *Nye muligheter for Nord-Norge—åpning av Barentshavet sørøst for petroleumsvirksomhet. (Supplement to White Paper 36 [2012–2013]. New opportunities for the northern Norway—opening of the south-east Barents Sea.)* Oslo: Norwegian Ministry of Petroleum and Energy.

Norwegian Ministry of the Environment 2011. *First update of the integrated management plan for the marine environment of the Barents Sea–Lofoten area. Report to the Norwegian Storting (white paper)*. Oslo: Norwegian Ministry of the Environment.

Owens C.K. & Belore R.C. 2004. Dispersant effectiveness testing in cold water and brash ice. In: *Proceedings of the 27th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*. Pp. 12–14. Ottawa: Environment Canada.

Pavlenko V.I. & Gluhareva E.K. 2008. Problems of the cooperation between the Arctic states in oil spill response in the Arctic. In: *Oil and Gas of the Arctic Shelf Proceedings. Vol. 1*. Pp. 25–27. Murmansk: Gelion.

Pietri D., Soule A.B., Kershner J., Soles P. & Sullivan M. 2008. The Arctic shipping and environmental management agreement: a regime for marine pollution. *Coastal Management 36*, 508–523.

Potter S., Buist I., Trudel K., Dickins D. & Owens E. 2012. *Spill response in the Arctic offshore*. Washington, DC: American Petroleum Institute.

Prozorovsky V. 2011. The shelf needs protection. *Oil of Russia 1*. Accessed on the internet at http://www.oilru.com/or/46/966/ on 21 May 2014

PSA (Petroleum Safety Authority Norway) 2010a. *Regulations relating to conducting petroleum activities (the activities regulations)*. Accessed on the internet at http://www.psa.no/activities/category399.html on 17 July 2014

PSA (Petroleum Safety Authority Norway) 2010b. *Regulations relating to design and outfitting of facilities, etc. in the petroleum activities (the facilities regulations)*. Accessed on the internet at http://www.psa.no/facilities/category400.html on 17 July 2014

PSA (Petroleum Safety Authority Norway) 2010c. Regulations relating to management and the duty to provide information in the petroleum activities and at certain onshore facilities (the management regulations). Accessed on the internet at http://www.psa.no/management/category401.html on 17 July 2014

Russian Federal Agency of Fishery Resources 2010. *Ob utverždenii normativov kačestva vod vodnih obektov rybohozjajstvennogo znaceniya, v tom čisle normativov predel'no dopustimih koncentrcij vrednih vecščestv v vodah vodnih ob'ektov rybohozjajstvennogo značeniya. (On approval of water quality norms for fishery water bodies including maximum permissible concentrations of harmful substances in fishery water bodies.) Order no. 20, 18 January 2010*. Moscow: Russian Federal Agency of Fishery Resources.

Russian State Fishery Committee 1999. *O rybohozjajstvennih normativah. (On fishery norms.) Order no. 96, 28 April 1999*. Moscow: Russian State Fishery Committee.

Sarkova O.M., Belkina N.S., Kovalenko K.V. & O'Connell K. 2010. *Improvement of the emergency oil spill response system under Arctic conditions for protection of sensitive coastal areas (case study: the Barents Sea)*. Murmansk: UNEP/GEF Project Russian Federation, Support to the National Programme of Action for the Protection of the Arctic Marine Environment/Nefco.

Schmidt C.W. 2012. Offshore exploration in the Arctic: can Shell's oil-spill response plans keep up? *Environmental Health Perspectives 120*(5), a194–a199.

Sea Consulting Group 2013. *Dispersant use in ice-affected waters: status of regulations and outreach opportunities. Final report 2.8. Report from Joint Industry Programme to summarize the current technical/policy obstacles on use of dispersants for each Arctic nation*. London: Arctic Oil Spill Response Technology Joint Industry Programme.

Short J. & Murray S. 2011. A frozen hell. *Nature Publishing Group 472*(7342), 162.

SMPC (State Marine Pollution Control, Salvage and Rescue Administration) 2014. *Joint Norwegian–Russian plan for oil spill response in the Barents Sea*. Moscow: State Marine Pollution Control, Salvage and Rescue Administration.

Sørstrøm S.E., Brandvik P.J., Buist I., Daling P.S., Dickins D., Faksness L.-G., Potter S., Rasmussen J.F. & Singsaas I. 2010. *Joint industry programme. Oil spill response in the Arctic and ice-covered waters. Summary report. SINTEF Report A14181*. Trondheim: SINTEF.

Steen A. & Findlay A. 2008. Frequency of dispersant use worldwide. *International Oil Spill Conference Proceedings 2008(1)*, 645–649.

Stoermer S., Butler G. & Henry C. 2001. Application of dispersants to mitigate oil spills in the Gulf of Mexico: the Poseidon pipeline spill case study. *International Oil Spill Conference Proceedings 2001(2)*, 1227–1229.

Sydnes A.K. & Sydnes M. 2011. Oil spill emergency response in Norway: coordinating interorganizational complexity. *Polar Geography 34*, 299–329.

Sydnes A.K. & Sydnes M. 2012. Norwegian–Russian cooperation on oil spill response in the Barents Sea. *Marine Policy 39*, 257–264.

Tormodsgard Y. (ed.) 2014. *Facts 2014. The Norwegian petroleum sector.* Oslo: Ministry of Petroleum and Energy.

Trudel K., Ross S., Belore R., Buffington S., Rainey G., Ogawa C. & Panzer D. 2003. Technical assessment of using dispersants in the U.S. Gulf of Mexico and California. *International Oil Spill Conference Proceedings 2003(1)*, 515–522.

Velez P., Johnsen H.G., Steen A. & Osikilo Y. 2011. Advancing oil spill preparedness and response techniques for Arctic conditions. *International Oil Spill Conference Proceedings 2011(1)*, abs105.

Venchikova V. 2012. Priroda v zakone. (Nature in law.) *Toplivno- Ėnergetičeskij Kompleks Rossii. Strategii Razvitija 3 (The Fuel and Energy Complex of Russia. Development Strategies 3)*, 39–42.

Vik A.M. 2003. New Norwegian policy on use of dispersants. *International Oil Spill Conference Proceedings 2003(1)*, 273–274.

Vodyannik I. 2012. Neobhodimii instrument. (The necessary tool.). *Toplivno- Ėnergetičeskij Kompleks Rossii. Strategii Razvitija 3 (The Fuel and Energy Complex of Russia. Development Strategies 3) 3*, 43–44.

Whelan A., Rayburn T. & Jaster M. 2005. Conceptual model applied: planning for oil spills on a remote island. *International Oil Spill Conference Proceedings 2005(1)*, 353–354.

Zagvozdkin V. 2008. Environmental safety comes first. *Oil of Russia 1*. Accessed on the internet at http://www.oilru.com/or/34/655/ on 15 May 2014