Applying International Standards in Response to Oil Spills in Remote Areas

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ABSTRACT (300190)

It is accepted international practice that the level of effort invested in oil spill contingency planning and preparedness should be related to the best available, location-specific risk evaluations. Accordingly, high risk and/or highly sensitive areas often see greater degrees of planning and pre-incident resource allocation than low risk areas. High risk areas typically include navigational 'choke points' for shipping or approaches to ports; highly sensitive areas would include areas of intense coastal tourism, mari-culture, or natural resources (e.g. coral reefs or mangroves). Naturally, levels of preparedness vary between countries for a variety of reasons including availability of resources (i.e. funding) or priorities. Whilst logical, this approach to contingency planning leaves open a gap in response capacity in so far as incidents do still occur from time to time in what are normally thought of as extremely low risk areas. Good examples are the infrequent, yet still important, incidents that occur from passing vessel traffic on long-distance, inter-continental routes. Other examples are incidents from scheduled shipping routes servicing remote areas or even passenger vessels visiting remote locations such as the Arctic or the Antarctic.

Because remote areas are often characterised by a general lack of infrastructure and because local authorities in remote locations typically do not have appropriate funds, training and manpower to deal with unexpected oil spill incidents, the intensity and quality of emergency response and post-incident follow-up tends to depend on the involvement of outside parties. The question arises, what is appropriate "international practice" in response

operations in terms of the types/methods of work undertaken, the termination standards applied, health and safety issues, and post-incident follow-up, such as monitoring studies. The intent of this paper is to discuss the meaning of “international standards” for oil spill response in the context of remote operations. Practical examples will be drawn from remote spills world-wide, including incidents in Tristan da Cunha (in South Atlantic), Madagascar, and Papua New Guinea.

INTRODUCTION

Since its establishment in 1968, ITOPF has attended over 700 incidents in 97 countries. Based on data collected over the last 40 years it is possible to identify trends or ‘hot spots’ in ITOPF’s attendance at incidents, with Asia and Europe being ‘hot spots’ in the last ten years. These trends reflect the presence of busy shipping lanes such as the Straits of Malacca and the English Channel, and the large numbers of ports and vessel movements in these regions. However, incidents do still occur in locations that are considered remote; but the term remote is quite subjective. Although ITOPF has attended incidents in geographically remote areas, such as the French Overseas Territory of Wallis and Futuna Islands in the South Pacific, this and other such remote locations do support regular shipping activity and therefore have associated infrastructure such as a harbour and/or port. Incidents in these sort of locations do not therefore present the same set of challenges as incidents occurring in areas that are not only geographically remote but also characterised by low population density and very limited infrastructure. As could be expected, such areas do not typically have a developed contingency plan for responding to shipping incidents, an identified competent national lead authority, or any arrangements for accessing response equipment. Consequently, the response to such incidents tends to be led by the ship owner who usually looks to contract in international resources to manage the response. From ITOPF's perspective, it is cases such as these that are remote cases.

In addition to the remote cases discussed in this paper, ITOPF has attended two incidents in Antarctica, but the nature of the non-persistent oil involved (in Antarctica, vessels are prohibited from using Heavy Fuel Oils as bunkers) and the circumstances of the incidents meant that other than monitoring the situation, no further response was recommended. However, the act of simply getting on site and identifying resources suitable for surveillance activities highlighted the challenges of responding to shipping incidents in such environments. In response to the gradual increase in the volume of Arctic shipping and a growing awareness of the potential for an oil spill in remote Arctic areas, as an organisation, one of ITOPF's current focus areas is Arctic oil spill preparedness and response capability.

ITOPF's aim is to promote effective spill response and, like any other international organisation brought in to assist with a remote incident, strives to apply the same standards to all spill responses regardless of where they occur. But what do we mean by 'standards', because in relation to oil spill response, there are not many actual 'international standards'. The word 'standard' is popularly defined as 'a required or agreed level of quality or attainment' and therefore implies that a prescribed criteria has to be met. In the context of oil spill response, international standards are more commonly expressed as internationally accepted best practice. For example, there is no international standard for how clean a sandy beach should be following clean-up; instead there are many manuals/ guidelines detailing factors to consider when determining whether a suitable level of cleanliness has been achieved, with the final result decided on a case by case basis. Effective spill response is not necessarily simply about reaching a quantitative endpoint, but more about implementing a logical and reasonable decision making process through the application of internationally accepted best practice. Therefore, the general principles and the overall approach taken to responding to an incident should be the same regardless of where it has occurred.

Whilst the overall approach to dealing with an incident remains the same, spills in remote locations can pose considerable logistical challenges which can have a significant bearing on the overall response. For example, a lack of infrastructure and resources can mean that responders are unable to get on site as quickly as desired, that not all of the preferred equipment may be mobilised and consequently some response options may not be feasible. However, just because the clean-up techniques used and the end result achieved may be different for a spill in a remote area compared to a non-remote area, it does not mean that best practice has not been applied, or that the overall aim of the response has not been achieved.

APPLYING NET ENVIRONMENTAL BENEFIT ANALYSIS TO REMOTE SPILLS

The ultimate aim of any oil spill response is to minimise environmental and socio economic impacts and aid the natural recovery process. For remote spills, responders still go through the same process of Net Environmental Benefit Analysis (NEBA) to determine how this aim is best achieved. NEBA has been described by IPIECA (2000) as the process of weighing up and comparing the advantages and disadvantages of different response options with the advantages and disadvantages of natural cleaning. However, there are certain aspects to remote spills that impact on the practicalities of actually going through the NEBA process and its outcome.

The very nature of the remoteness can make it difficult to gather adequate information in order to fully evaluate the situation prior to actually arriving on site. The logistics associated with responding to the grounding of the bulk carrier MS OLIVA, introduced below, were such that an evaluation had to be done remotely in order to make important decisions on the mobilisation of response equipment.

On 16th March 2011, bulk carrier MS OLIVA (built 2009; 40,170 GT) laden with a cargo of 65,000 tons of soya beans grounded on Nightingale Island; a small uninhabited island which is part of the Tristan da Cunha group of four islands in the South Atlantic. Tristan da Cunha (TdC) Island is the only inhabited island (home to around 260 inhabitants), making this the most remote inhabited archipelago in the world, with South Africa being the nearest point of land some 2,816 kilometres away. Of the remaining three islands, Nightingale Island is a seabird sanctuary hosting many endemic and endangered species in large numbers (more than 2 million pairs of birds) including the northern rock hopper penguin, whilst Inaccessible and Gough Islands are both wildlife reserves. At the time of the incident, the vessel was carrying 1,420 tonnes of Heavy Fuel Oil (HFO) 380 and 74 tonnes of Marine Diesel Oil (MDO). Two days after the grounding the vessel split in two, spilling significant quantities of oil.

Members of the response team assembled in South Africa soon after the incident occurred and, based largely on information received from the TdC authorities and others already on site about the extent of shoreline contamination and the number of birds impacted, made important decisions on priorities and equipment mobilisation. The TdC group of Islands are home to a significant proportion of the estimated world breeding population of Northern Rockhopper penguins. Initial figures of oiled birds were estimated at 20,000 to 30,000 penguins and therefore the response was to mount a bird rehabilitation operation and a shoreline clean-up operation aimed at removing the threat to the wildlife of the island by removing the bulk oil from the rocky foreshore. Space on board the vessels chartered to take response equipment from South Africa to TdC was limited and therefore priority was given to bird rehabilitation equipment over clean-up equipment. Remote spills such as this, where response equipment has to be mobilised over considerable distances, add an additional complexity to the NEBA process and highlight the need to identify clear priorities and the importance of decisions made in the early stages of the response.

Often, it is the appointed spill manager who is responsible for working with the relevant local stakeholders to identify priorities and develop an appropriate response plan for remote spills. However, because oil pollution response preparedness is usually not a high priority for governments in remote areas thought to typically be at very low risk, this role is usually being undertaken in the context of no contingency plan in place, no clear lead authority or existing working relationships established, and no information on sensitivities i.e. none of the internationally accepted best practices with regard to preparedness have been implemented. These factors, combined with the fact that the spill manager usually has a lack of local knowledge, all result in what can be a significant period of time before any clean-up activity actually begins, which can be frustrating for all involved. In the MS OLIVA case, although all interested parties worked co-operatively and very efficiently (within ten days the first suitable vessel had been sourced (this involved searching southern Africa and approaching the UK and South African governments for assistance) and loaded with specialist bird cleaning equipment), the time required to evaluate the situation and develop a response plan, combined with the time it took to charter vessels and sail the equipment, meant that clean-up using the equipment mobilised from South Africa started on 13th April i.e. nearly a month after the incident first happened.

The MS OLIVA incident highlights the difficulties of carrying out a rapid, but accurate, evaluation of the situation to inform and start the NEBA process. ITOPF would envisage that the same could also be true for ship sourced spills in remote Arctic areas, and could be further compounded by the potential difficulties associated with detecting and tracking oil in ice.

As part of the NEBA process undertaken for any spill response, during the development of the response plan the spill manager will use information gathered during the evaluation phase and draw on past experience to predict the likely outcome of different response options. However, the logistics surrounding remote spills may mean that there are fewer response options available for consideration. In ITOPF's experience of remote cases, response activity has mainly focused on shoreline clean-up, since logistical difficulties often preclude any form of at-sea response. Generally, as a result of not having readily available specialist equipment, initial shoreline clean-up usually involves low technology/ manual techniques to remove bulk contamination and, where necessary, further cleaning of secondary contamination may also be carried out using specialist equipment that is typically mobilised from national or international stockpiles of equipment.

In the MS OLIVA case, initial reports indicated that three of the four islands had been oiled, but once on site, surveys showed that Nightingale Island and its neighbouring Middle Island received the heaviest impact. Furthermore, although initial reports estimated that 20,000-30,000 penguins had been impacted, the number turned out to be a lot lower; less than 4,000 oiled birds were captured for cleaning. The logistical and safety challenges of mounting a shoreline clean-up operation at Inaccessible Island and along the exposed northern and western shores of Nightingale Island meant that no clean-up response was undertaken in these areas. Since the response objective was to remove the threat to wildlife by recovering the bulk oil, recognising the natural cleaning potential, the porous nature of the volcanic rock and the environmental sensitivities of the island, aggressive cleaning techniques were discounted as the response objective was not to remove all traces of oil. The initial approach used in all areas was to manually scrape and recover the thick bulk oil from on and around the pebbles, boulders and bedrock. More specialist equipment was then used to conduct medium pressure flushing and high pressure washing, during which time sorbent materials were used to recover the released oil. Operations were carried out by a response team comprising response specialists, salvage personnel and islanders.

Using a limited number of specialist, trained personnel to lead the response and train members of the local community, who then make up the majority of the workforce, is a common approach to shoreline clean-up during remote spills. Another example of where this approach was taken was during the response to the GULSER ANA incident.

On 26th of August 2009, the bulk carrier GULSER ANA (built 1985; 23,802 GT) ran aground on the southern coast of Madagascar near Faux Cap. The vessel was carrying 39,250 tonnes of rock phosphate as well as 568 tonnes of HFO. The integrity of the vessel quickly deteriorated, resulting in a significant oil spill and loss of cargo, with further decreasing losses over the following months. As noted by Laruelle (2012), by the end of 2009, all the cargo and oil had been lost causing approximately 47 km of sandy beaches to be contaminated with oil within a 70km stretch of shoreline. Although cargo was observed dissipating into the sea, none was ever observed to have washed ashore. Faux Cap consists of a basic settlement on the coast with multiple small farming villages inland interlinked by sandy tracks. It is home to a few thousand inhabitants and is characterised by a lack of infrastructure, vehicles and supplies.

The nearest airport is located in Fort Dauphin, a 7 hour drive away. The capital of Madagascar, Antananarivo, is 1,200 km to the north and approximately 3 days by road.

ITOPF arrived on site four days after the incident occurred and immediately started to survey the situation and establish contact with the relevant authorities. Within a relatively short space of time a clean-up plan had been agreed and, due largely to the fact that initial cleaning only required equipment that could be sourced locally, clean-up work was able to begin on 3rd September (i.e. just over a week after the incident occurred). Fisheries form an important part of the subsistence-level existence of the inhabitants living near the coast, with activity focusing on hand gathering from intertidal reef areas. There is also a limited amount of boat based fishing (from dug-out, out-rigger canoes) and commercial gathering of lobster. This dependency on the foreshore for fishing activity was therefore the main driver for the clean-up operation.

The majority of the coastline affected was sand beaches and therefore the techniques used in these areas consisted mainly of manual labour using basic tools to recover the light to moderate oiling, including buried oil and submerged oil in shallow lagoons. Spill managers trained local villagers on the clean-up techniques, emphasising the need to remove only oil and oily material, resulting in a very selective and effective technique that produced as little waste as possible. There was one heavily oiled rocky area, which although would have cleaned naturally, it was felt that the time required for this, and the likelihood of oil contaminating neighbouring, heavily utilised beaches in that time, meant that an additional phase of clean-up work was recommended in this one area. A combination of flushing and high pressure washing was utilised using specialist equipment mobilised from France.

In both the MS OLIVA and GULSER ANA cases, the NEBA process was applied to determine the most appropriate response strategy and, although logistically demanding, the necessary equipment was mobilised from various stockpiles of equipment to the general incident location and then air lifted via helicopter in order to reach the clean-up site. However, for some remote spills it is not always appropriate or possible to carry out such operations, and therefore the response options available for consideration are more limited. For example, there has been much research into the various response options for oil in ice, and specialist equipment developed accordingly. However, during a remote shipping incident in the Arctic the circumstances may be such that although equipment to support various response options is available, sourcing and mobilising suitable vessels to actually carry out the response within a reasonable timeframe could be a significant challenge.

On 24th December 2012, the (un-laden) refrigerated cargo ship ASIAN LILY (built 1998; 7,355 GT) ran aground on Kwaiawata Island in the Milne Bay Province of Papua New Guinea. Kwaiawata Island is part of the Marshall Bennett Islands, a group of six inhabited (and one uninhabited) islands in Milne Bay. The nearest island to Kwaiawata with an airstrip is Kiriwina Island, approximately 100km away. Kwaiawata Island is nearly circular (almost 2.8km in diameter north to south) and supports an indigenous community of around 300 people. The island has no modern infrastructure such as docks, airstrips, roads, power lines, or modern buildings. There are many basic dwellings and some small clearings and farmed plots amongst the dense wooded area, but subsistence fisheries play a central role in the socio-economic existence of the people of the island. The shoreline is narrow and characterised by either trees overhanging the water or rocky cliffs.

At the time of the incident the vessel was carrying approximately 450 tonnes of HFO. As a result of the grounding, about 120m of limestone bedrock, covered with tumbled coral, shell cobble and pebble was thinly coated with fuel oil. There were also limited accumulations of oiled natural debris. Access to the island to carry out surveys was via the casualty that had grounded on the foreshore (the bow reached the trees that backed the narrow beach). During the salvage operations minor sheens were seen emanating from the vessel, but no further substantial loses of oil were observed. The vessel was successfully re-floated on 11th January 2013.

The dense tree coverage and the characteristics of the shoreline meant there was no helicopter landing site near the area of contamination, nor were there any tracks or pathways appropriate for transporting equipment across the island. Furthermore, there were no landing sites on the island suitable for any substantial sized motorised vessel. As per the NEBA process, the advantages and disadvantages of different response methods were considered and compared with what was likely to be achieved if left to natural cleaning alone. Given the importance of the area for subsistence fishing and the proximity of the contaminated area to the only area of foreshore on the island used by the locals for recreational purposes (500m away), it was determined that the natural cleaning potential of the site should be assisted through removal of the bulk contamination. The possible options of flushing and high pressure washing were not recommended since it would have been an extremely challenging logistical operation to bring any specialist equipment ashore. The use of chemical cleaning agents was also not recommended as this could have led to a marked increase in oil concentrations in the water column (as opposed to sheens on the water surface) that could have come into contact with sessile reef organisms, reef fish, locals using the area for swimming, and nearby intertidal water wells.

Taking all factors into account, and given the relatively limited area of contamination, it was recommended that wiping the bedrock in conjunction with removal of oiled debris was the way forward. This approach meant that the clean-up utilised resources that could be manually carried onto the island via the casualty. After training and being equipped with PPE, a small team of islanders carried out six days of rock wiping. Rags (that had been mobilised as part of the salvage response) were used to wipe the relatively smooth bedrock (almost half the contaminated area) of the oil coating, with the sharper stone in the intertidal zone left to clean naturally. Ten days after the incident occurred, as a result of natural cleaning promoted by the rag wiping, the coating of oil had largely been reduced to a transparent, greasy film which, given the exposed nature of the shoreline, was expected to clean naturally quite rapidly. During a return visit five months after the incident, no traces of oil could be found.

An important consideration during any incident is to establish clear criteria for terminating the response. As highlighted by Baker (1997) there is no single or 'best' definition of clean, and as noted by Dicks et al (2002), three key questions from a technical perspective to ask when considering termination of shoreline clean-up are 1) is the remaining oil likely to harm environmentally sensitive resources, 2) does it interfere with the aesthetic appeal and/or amenity value; and 3) is the oil detrimental to economic resources or disrupting economic activities? The other key factor is the cost of further clean-up operations. Just because the logistics of an operation mean it is expensive, does not necessarily mean it should not be done, but the question needs to be asked whether the operation is required to achieve the overall goal.

The fact that what is a feasible, effective and reasonable response may be different for a spill in a remote location compared to a non-remote location, does not mean that internationally accepted best practice has not been applied. The clean-up in all three cases had clear termination criteria to reflect that the goal was to aid natural cleaning processes (and in the MS OLIVA case to remove the threat to local wildlife). In the ASIAN LILY case, when considering the overall goal of the response, the fact that, due to logistical constraints, rag wiping was used as opposed to other more equipment focused techniques such as flushing, is not actually that significant. Flushing may have resulted in less of a greasy film being present at the end of the designated cleaning period, but the fact that the bulk of the oil was removed to allow natural cleaning to occur in a reasonable time period, meant that the overall aim of the response was achieved.

HEALTH AND SAFETY DURING RESPONSE TO REMOTE SPILLS

Generally speaking, there are enormous variations in how health and safety is approached around the world. However, in terms of oil spill response, the goal is simply to ensure that health and safety remains the priority throughout response operations, regardless of where they are being conducted. Since the majority of the workforce engaged in remote shoreline clean-up work are commonly members of the local community, as opposed to trained spill responders, these individuals are unlikely to be familiar with what is regarded as international best practice for health and safety during oil spill response. It is important therefore that those managing the response utilise their experience to ensure that the relevant health and safety best practice is applied, and those carrying out the work are sufficiently trained and briefed for the task. Whilst the general principles of assessing risks and taking mitigating actions are likely to be practiced by the local community on a regular basis, in

ITOPF's experience, they are not familiar with the concept of wearing protective personal equipment (PPE) and can be reluctant to wear the recommended protection, particularly in warm climates (as is also true for spills in non-remote locations). In such cases, the key is communicating risk, and every effort should be made to ensure that best practice is followed.

Whilst the overall approach to health and safety at a spill site should not differ between non-remote and remote incidents, in the later, factors such as very difficult to access foreshore and limited immediate access to emergency healthcare can have a significant bearing on the overall response. Furthermore, in remote cold weather spills issues such as 24 hour darkness, extreme cold, potentially dangerous wildlife and the presence of ice and snow would all need to be considered as part of the risk assessment process and addressed during the training of response personnel. It needs to be recognised that the hazards and the limited options for mitigating consequences may combine to a degree where the working method is significantly modified, or a particular activity is deemed too risky to undertake. Although this can have implications for the overall level of clean-up activity undertaken and the level of cleanliness achieved in remote areas, it is only right that such decisions are made. For example, during the MS OLIVA response, the risk assessment determined that measures such as having a helicopter available for emergency evacuation and a dedicated medic on-site, were necessary in order for the clean-up operations to take place, all of which had obvious implications for the cost of the response. However, despite taking these steps, the shoreline topography and prevailing rough sea conditions combined to mean that clean-up was simply not an option in some areas.

WASTE MANAGEMENT DURING REMOTE SPILL RESPONSE

Internationally accepted best practice for waste management would be to consider during the contingency planning phase how any waste generated during a spill may be dealt with (i.e. options for storage, transport, processing and disposal are investigated). However, by the nature of spills in remote locations, this level of preparedness does not typically exist. Therefore, for those managing an incident, the international concept of the waste hierarchy, where the amount of waste generated is reduced, reused and recycled so that the volume requiring final disposal is as low as possible, becomes even more important. In the absence of local legislation driving requirements, finding feasible solutions that are fit for purpose becomes the key consideration. Often, the practical nature of the situation will ensure that, despite a legislative requirement, it is in everyone's interest to pursue best practice. For example, to ensure that waste is temporarily stored in an appropriate way in order to avoid secondary contamination and onward handling problems.

In reviewing the options available for the management of waste, when no legislation exists, consideration should be given to common practices in the area. For example in the ASIAN LILY case, although oiled rags and PPE were collected and taken off the island on-board the casualty as she was re-floated, ITOPF recommended that the relatively limited quantities of lightly contaminated natural debris (such as wood, palm fronds, coconuts) be collected and burned. This was made in the context that the local population live by open fires. In other areas of the world, this solution would have been in contravention of national legislation and therefore not appropriate. As described by Laruelle (2012), during the MS OLIVA incident, all of the oily waste collected was initially placed into heavy duty plastic bags which were then placed into 1m^3 capacity bulk bags. A helicopter was used to transfer the bulk bags from the clean-up sites to the vessel chartered to mobilise response equipment that had remained on station for the duration of the response. A purpose-built ‘bunded’ area was constructed on board the vessel to prevent any secondary contamination whilst sailing back to South Africa, where the waste was then disposed of.

During the GULSER ANA incident, waste was collected in heavy duty plastic bags which were taken from the clean-up site to intermediate storage sites via quad bikes, 4x4 picks ups or manpower. Waste was then transported to a site near to the capital (approximately a 3 day drive) for either incineration or treatment with quicklime to neutralise the waste prior to being used as raw material for construction purposes. Whilst the options available for final treatment/ disposal of waste may be more limited in remote spills and the logistics involved with the transport of waste may result in higher than average costs, it should be recognised that it is in the interest of those responsible for the response to ensure that a suitable solution is found whereby there are no long term implications arising from how the waste is managed.

MONITORING AND IMPACT ASSESSMENT STUDIES IN REMOTE SPILLS

The consequences of an incident occurring in a remote location as opposed to in a busy shipping lane for example are different, but are not necessarily less significant. A vessel grounded and losing oil in a busy port may cause significant disruption to shipping activity in the area, but the same vessel grounded and spilling oil in a remote location may cause significant disruption to local subsistence fishermen. In ITOPF’s experience, those impacted in remote locations can often rely heavily on the natural resources that may have been impacted.

All three cases mentioned in this paper involved some form of monitoring and or impact assessment was conducted. After the re-float of the ASIAN LILY, an impact assessment was carried out to determine the overall area of reef impacted as a result of the grounding (including the presence of any paint scrapings) and to provide information on the likelihood of, and timescales for, natural recovery. The rationale for conducting the monitoring and impact assessment studies in the MS OLIVA was in relation to seafood safety and potential impacts on stock levels and for the GULSER ANA for fears over seafood safety and contamination of drinking water in beach-side water wells. Sampling and monitoring is probably the main area in oil spill response where actual international standards are applicable. To be of most value, it is important that the results of any sampling are related to any relevant standards (for example, how measured concentrations of heavy metals in biota samples compare with maximum allowable concentrations detailed in seafood safety guidelines). Whilst the country in question may not have a national standard, ITOPF would always recommend that appropriate international or national guidelines/ standards, such as those set by the World Health Organisation, European Union etc. are used.

The application of best practice dictates that if the relevant drivers for studies are present, and so long as the logistics still allow for the work to be carried out in a meaningful time scale, then such work should be conducted. Although post spill monitoring was conducted in the three cases mentioned in this paper, the feasibility and cost effectiveness of deploying and maintaining resources in a timely manner means that often it is not possible to carry out such activities. As with any monitoring or impact assessment study, planning is essential, but this is emphasised even more when working on remote cases.

CONCLUSIONS

Although every case is different and presents a new set of challenges, the same overall approach to how the situation is dealt with can be applied even when responding to incidents in remote locations. However, whilst the thought process behind the incident response is the same, it needs to be recognised that the degree of logistical difficulty will significantly influence the response options available, and the cost of any operation conducted. The cost benefit of remote spill response therefore means that applying international best practice to how the incident is assessed and responded to in terms of identifying priorities, planning and applying termination criteria etc., becomes even more important to help ensure that there is a clear rationale for the response, and that what is done is effective and reasonable.

The fact that the logistics, and sometimes the associated health and safety issues, may dictate that certain response activities are not possible and the level of cleanliness achieved may therefore be different for spills in remote locations as opposed to non-remote locations, does not necessarily mean that all that is feasible, effective and reasonable has not been done. If the overall aim of the response is to minimise environmental and socio-economic impacts and assist natural recovery, then low technology responses can still achieve this.

In terms of looking forward and learning from past experience of spills response in remote locations, the Arctic is certainly a region where both governments and industry are working to increase preparedness and response capabilities. Any future ship sourced spills in remote Arctic locations would not only be characterised by issues discussed in this paper (primarily logistical and health and safety issues) but also other unique challenges. For example the fact that many areas have been preserved in a relatively pristine state and the already heighted media awareness generally associated with this region, would add to the importance of the NEBA process.

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