OIL SPILL RESPONSE CAPACITY IN NUNAVUT AND THE BEAUFORT SEA

RESPONDING TO ARCTIC SHIPPING OIL SPILLS: RISKS AND CHALLENGES

As the Arctic warms and sea ice diminishes, the biggest threat to the Arctic marine environment from ships is from an oil spill. Less summer sea ice has already led to increases in ship traffic, yet significant legislative, capacity, information and funding gaps exist in the current spill response framework in both Nunavut, and in the Beaufort region.

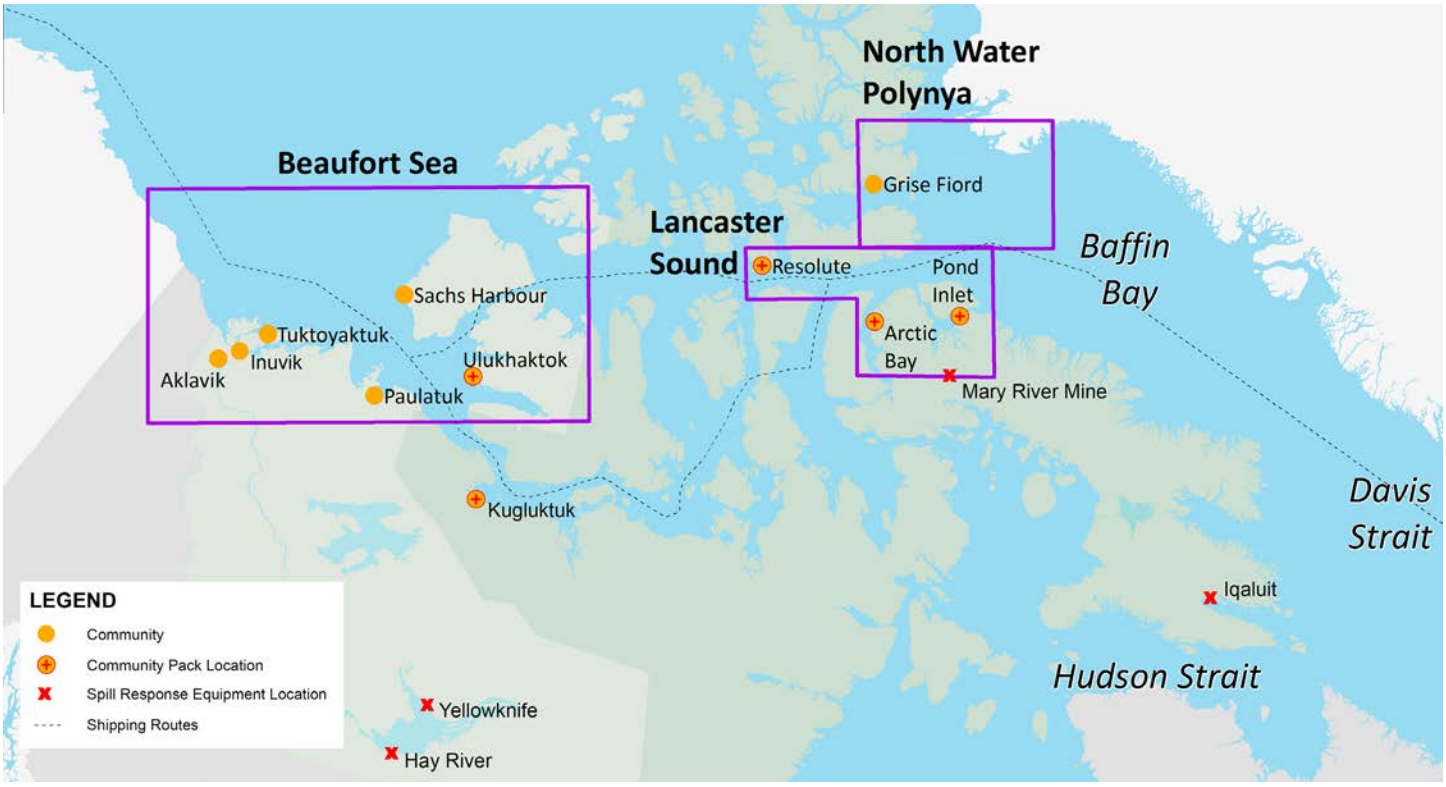
Although the Canadian Coast Guard has developed national, regional, and area response plans, these plans rely on capacities and methods that may not exist or cannot be adapted in remote communities to respond to a ship-based spill.

An Arctic shipping oil spill would devastate the surrounding marine environment, including the destruction of habitat for polar bears, seals, walrus, sea birds, as well as beluga, narwhal and bowhead whales. These consequences would be mainly borne by the communities, not the responsible parties. Arctic communities depend on healthy and clean waters for much of their food, and their cultural and spiritual well-being is tied to their environment.

WWF-Canada commissioned a series of reports to identify barriers that will prevent northern communities from effectively responding to a ship-based oil spill. Parallel reports for the western Beaufort region and Nunavut outline these barriers, and are summarized below. A third report provides a framework for developing realistic oil spill response plans for Nunavut communities. To effectively address the issues of oil spill response capacity in the North, engagement with communities is crucial to developing a framework that works within the Arctic context.

GEOGRAPHY AND POPULATION

The reports focus on remote regions above the Arctic Circle in Nunavut and the Northwest Territories, where communities generally rely on a mixed subsistence and market economy. Many people spend time harvesting land and sea mammals to supply a significant portion of their diet. Traditional knowledge is passed from generation to generation, and is an important element of northern Indigenous culture. When the environment is disrupted, it will undoubtedly have a significant impact on communities.



BEAUFORT REGION

The Beaufort region includes more than 7,500 kilometres of coastline. The area roughly corresponds with the Inuvialuit Settlement Region (ISR), one of the four Inuit regions of Canada. This region is also considered part of the southern route of the Northwest Passage.

In the Beaufort Region, the major communities are Inuvik, Tuktoyaktuk, Aklavik, Paulatuk, Kugluktuk, Sachs Harbour and Ulukhaktok. The total population of the communities is 5,767 people, of which more than half are Inuvialuit.

NUNAVUT

This report focuses on the four northernmost communities in Nunavut. Above the Arctic Circle, much of Nunavut's territory is a series of islands that make up the Arctic Archipelago. The largest of these is Baffin Island, which is home to the Mary River iron ore mine. All four communities are either on or close to the northern route of the Northwest Passage.

The total population of the four Nunavut communities is just over 2,800 people, with more than half of those living in Pond Inlet, the closest community to the Mary River mine. The vast majority of Nunavut residents are Inuit.

EXISTING ARCTIC SHIPPING OIL SPILL RESPONSE FRAMEWORK AND STANDARDS

The reports describe the framework that is in place to ensure that ships travelling through the Arctic have the capability to respond to an oil spill. It shows that while there are plans and standards in place, there are also gaps and uncertainties.

NATIONAL/INTERNATIONAL

- Canadian law requires ships to contract with a response organization that can provide equipment and personnel sufficient to clean up the amount of oil a ship is carrying, up to 10,000 tonnes. However, ships travelling north of 60 degrees' latitude are exempt from these provisions.
- Under Canadian and international law, all tankers over 150 tonnes and all other vessels over 400 tonnes must have a Ship Oil Pollution Emergency Plan (SOPEP), which includes reporting procedures, authorities to be contacted and actions to be taken. Currently, SOPEPs are not Arctic-specific and may not account for communications challenges that could arise in attempting to report a spill in the Arctic.
- Canada also has the National Marine Spills Contingency Plan, which includes a Central and Arctic Regional Plan that details the procedures, resources and strategies to be used in the event of spill.

BEAUFORT REGION

The **Canada/United States Joint Marine Pollution Contingency Plan** includes a **Joint Response Team** for both countries to co-ordinate when necessary. It also sets out procedures for Arctic nations to notify and request assistance from each other in the event of a spill, and includes commitments to maintain a national oil spill response plan.

The **Beaufort Sea and Amundsen Gulf Area Plan** identifies specific geographical priority areas and proposes tactics to protect these areas in the first 12 to 24 hours after a spill.

NUNAVUT

As part of the **Nunavut Agreement**, the **North Baffin Regional Land Use Plan** prohibits ships from coming within 10 kilometres of coastlines, and within 25 kilometres from the coastlines of Lancaster Sound, one of the most biologically productive areas of the Canadian Arctic.

The **Nunavut Land Use Plan** is expected to be completed by the end of 2017. The 2016 draft of the plan identifies several other protected areas with seasonal restrictions to protect wildlife habitat such as sea ice crossings and calving grounds.

GAPS IN OIL SPILL RESPONSE FRAMEWORK

PHYSICAL ENVIRONMENT

Arctic conditions limit the effectiveness of response equipment and often prevent any response at all. The Arctic climate is defined by major seasonal changes and sea ice for nine out of every 12 months. Cold air temperatures persist for much of the year, with most communities experiencing at least 250 days below freezing. Rain, blowing snow, fog, gale-force winds and prolonged periods of darkness limit visibility.

The presence of sea ice is the largest limiting factor in an adequate oil spill response.

During the small window when a response would be possible, several other environmental factors would impede an adequate oil spill response:

- High waves and strong winds common to Arctic waters make it impossible to contain oil using a boom, a critical tool used to prevent oil from reaching the shoreline.
- If visibility is less than one kilometre, it is extremely difficult to find and recover oil slicks.
- Recovery cannot take place during darkness, which persists through most of the winter months.
- Response ships can become unsafe to operate due to ice buildup.

The type of oil used by the majority of ships, heavy fuel oil (HFO), is also extremely difficult to remove from the environment, even in ideal conditions.

EQUIPMENT

What Exists

The Canadian Coast Guard (CCG) is the primary source of spill response in the Arctic. Community packs containing basic equipment designed for small near-shore spills (up to one tonne of oil) have been placed in Resolute, Arctic Bay and Pond Inlet in Nunavut, and in Kugluktuk and Ulukhaktok in the Beaufort region.

Both Iqaluit and Tuktoyaktuk have stockpiles of equipment, as does the Mary River Mine on Baffin Island. Additional oil spill resources are available from the CCG base in Hay River, south of Yellowknife.

Remnants of sea ice in late summer in Resolute Bay, Nunavut

© Ronny Frimann/Zine.No

WWF staff and volunteers practising the use of a boom to catch oil spills on water at the NordNorsk Beredskapssenter in Fiskebol, a training centre where people learn how to clean up oil and gas spills in water and along the coast. Lofoten Islands, Nordland, Norway.

Capacity Limits

Inadequate equipment

The largest equipment available in the Arctic can recover up to 1,000 tonnes of oil. However, tankers carrying fuel to the Mary River Mine can carry up to 4,500 tonnes of diesel, and community resupply vessels carry up to 18,000 tonnes of fuel oil.

Maintenance

Maintenance of community packs has been inconsistent. The Arctic environment renders mechanical equipment inoperable if it isn't properly maintained, so it is unknown whether the community packs are functional.

Access

Assuming the equipment is functional, accessing it would be another challenge. Some communities don't have a key for the locked storage containers because the CCG is concerned about maintaining responsibility for the equipment inside.

Transport to spill site

Even if the community can access the equipment, and it is functional, the small aluminum boats provided may not be sufficient to transport the equipment to the spill site in poor weather conditions. Larger boats better able to withstand harsh weather would then need to be located.

If the spill occurred in a community without a pack, the hamlet would need to arrange for an airplane to deliver the equipment from a nearby community and transport it from the airstrip to the spill site.

Storage and disposal

No hazardous waste facilities exist in the Arctic; all materials must be stored and transported south. Though response equipment in Iqaluit and Tuktoyaktuk is designed to recover up to 1,000 tonnes of oil, the containers in Tuktoyaktuk can only store up to 275 tonnes, with capacity in Hay River for an additional 240 tonnes. Oil cannot be removed from the environment if there is nowhere to store it.

People

The number of trained responders in northern communities is limited due to several factors. The communities are small, so there are only so many people to draw upon. In addition, people are often away from the community for long stretches, like during subsistence harvesting times, meaning a larger number would need to be trained to ensure there are always enough people available (anywhere from five to 16 community responders are necessary, depending on the equipment).

Government funding for training is currently well below what is necessary to recruit and train an appropriate number of community members. And even if enough people could be found and trained, there is little opportunity to practise or maintain skill levels.

Finally, in the event of a large spill, many responders would need to be flown in from larger centres. Small communities will likely not have the resources to house, feed and support the influx of people.

OTHER FACTORS THAT LIMIT RESPONSE

OIL SPILL BEHAVIOUR

Heavy fuel oil (HFO) is the fuel most often used by large shipping vessels. Of all the marine fuel options, it is also the most damaging in the event of a spill. The use of HFO is banned in the Antarctic, and several organizations (including WWF) are working with the International Maritime Organization to phase out the use of HFO in the Arctic.

The spreading and weathering of oil, and whether it comes in contact with ice, affects the way and the extent to which it can be recovered. Unfortunately, it is very difficult to conduct in-the-field research on how oil spills behave in the Arctic environment, so most of the information that exists is inferred from lab research.

COMMUNICATIONS INFRASTRUCTURE

Reliable communications infrasrtucture capable of providing information on weather and sea conditions, maintaining contact with on-the-ground and incoming responders, as well as being able to monitor the spill are all essential to an effective response.

The community nearest to the spill would serve as an important communications hub. However, in the Arctic, cellphone and Internet networks are quickly overwhelmed, slowing Internet speeds, preventing phone calls, and potentially leading to a complete breakdown in emergency response protocol.

It is also critical for incoming responders to have information about safe maritime routes, including the presence of sea ice and inclement weather. If communications systems are inoperable, area surveys may be needed before vessels can assist, leading to more response delays.

RESPONSE TIME

Canadian law provides response times for different levels of spills, which must be adhered to by regional response organizations. However, these standards are not in line with current response capabilities in the Arctic:

Response Equipment Type	Response Standard South of 60	Estimated Response Time North of 60
Oil spill up to 150 t	Six hours	48 hours
Oil spill up to 1,000 t	12 hours	One week

If a CCG icebreaker was in the region, it could provide additional assistance, but there are only three ships responsible for the whole of the Northwest Passage.

In 2008, the Baffin Regional Area Plan identified specific geographical priority areas (including Lancaster Sound) and proposed tactics to protect these areas in the first 12 to 24 hours after a spill. However, there are very few details or recommendations in the plan, and the CCG cautions that the strategies it outlines are untested and require an on-site assessment to confirm their validity.

A Canadian coast guard ship and a Russian converted research vessel carrying tourists in Resolute Bay, Qikiqtaaluk Region, Nunavut

CONCLUSIONS AND RECOMMENDATIONS

Shipping in the Canadian Arctic is a dangerous and precarious endeavour. Navigation is challenging, weather and visibility are often poor, sea ice is difficult to detect and the waters are inadequately charted. Yet, as sea ice melts, shipping is only increasing in the region, along with the risk of oil spills that threaten the sensitive Arctic ecosystem and the wildlife and communities that depend on it.

The extreme Arctic climate makes a successful oil spill response enormously challenging, even with unlimited personnel and equipment. However, there are several measures that could provide added safety and reduce the risk of spills, as well as increasing response capabilities:

1. Incorporate Inuit organizations into the Northern Marine Transportation Corridors Initiative

Inuit and Inuvialuit should have a greater role in decision-making that shapes the future of Arctic shipping. The Northern Marine Transportation Corridors Initiative is a CCG and Transport Canada program tasked with identifying specific shipping routes through the Arctic to improve safety. Arctic Indigenous peoples should be fully incorporated into this process.

2. Increase preventative measures

Shipping lanes should be identified using information on subsistence use and environmentally sensitive habitats. Transport Canada should then designate preferred routes, as well as areas to be avoided, and take these routes and areas to the International Maritime Organization.

3. Eliminate the use of heavy fuel oil in the Arctic

The Government of Canada, under the jurisdiction of Transport Canada, should implement a ban on HFO through national legislation, with a phase-out period to allow industry and re-supply vessels time to build new ships and integrate lighter fuels into their business models.

4. Strengthen oil spill response plans

Response plans should be made Arctic-specific and address the logistical challenges of a spill response. Ships should be required by international and Canadian law to carry equipment for an initial response to a spill, and should have effective damage control measures in place to help mitigate the longer response times often encountered in the Arctic due to extreme weather.

5. Implement southern response standards in the North

Indigenous communities in the North should not receive a lower level of protection from spills simply because there are fewer ships in the region and communities are less populated. Standards for contracting with response organizations south of 60 degrees' latitude should also be implemented in the North.

6. Develop local capacity to respond to spills

The CCG should develop a list of trained individuals in each community, and incorporate training for oil spill response in schools and community organizations. Funding is also required to develop local training organizations and advisory boards, and to ensure Indigenous voices are heard in the decision-making process. Additional resources are also needed for oil recovery storage, response boats, harbours, boat ramps and on-shore response equipment.

7. Integrate Arctic-specific measures into Canada's Oceans Protection Plan

Canada's Oceans Protection Plan commits to improving Canada's oil spill preparedness. The Government of Canada should commit to making the Arctic a top priority, and should be held accountable.

FOR MORE INFORMATION:

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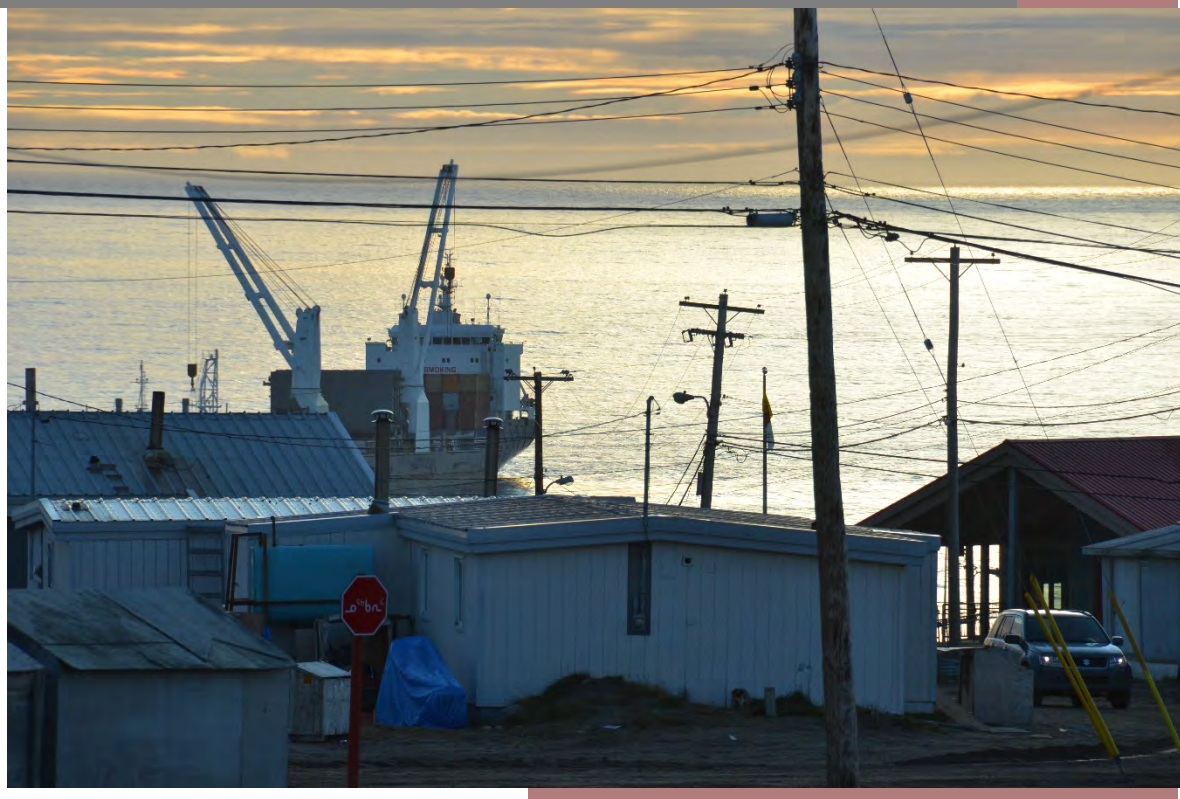
Background Information for Community Oil Spill Response Planning in Pond Inlet, Resolute, Grise Fiord, and Arctic Bay



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Report to WWF-Canada

Prepared by Layla Hughes

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BACKGROUND INFORMATION FOR COMMUNITY OIL SPILL RESPONSE PLANNING IN POND INLET, RESOLUTE, GRISE FIORD, AND ARCTIC BAY

Report to WWF Canada
November 2016

Prepared by Layla Hughes

I. Introduction: the need for local response planning

The purpose of this report is to provide background information to support a process for community oil spill response planning in Pond Inlet, Arctic Bay, Resolute, and Grise Fiord.

Diminishing sea ice in the Arctic has led to increased shipping, which in turn leads to an increase in the risk of spills from ships.[1] The biggest threat to the Arctic marine environment from ships is from an oil spill.[2] Yet, significant legislative, capacity, information and funding gaps exist in the current spill response framework in Nunavut. Although the Canadian Coast Guard (CCG) has developed national, regional, and area response plans, the plans rely on capacities and methods that may not adequately protect the hamlets in Nunavut from a ship based spill.

The impacts of a spill would be borne by the communities in the region, who depend on healthy and clean marine waters for the majority of their food and whose cultural and spiritual well-being are tied to their environment. Despite the severe consequences of a spill to local communities, the people in the Nunavut region have had insufficient input into oil spill response planning in their waters.

A meaningful role in oil spill response planning by Nunavut communities is important, because it is likely that in many cases, they would be the first responders on scene to respond to oil spill, and they have the deepest understanding of the environmental conditions and the sensitive resources that would influence response

[1] Ellis, B. and Brigham, L., co-editors, *Arctic Marine Shipping Assessment 2009 Report* (Arctic Council, 2009), p. 168.
[2] *Id.*, p. 5.

operations. Thus, oil spill response can be strengthened through better coordination with local communities.[3] Such participation would also support the constitutional right of Aboriginal engagement in decision-making for issues that could significantly impact their land, culture, and health.

Not every community has response equipment for a marine spill. In the communities that do, the equipment is limited and could be used to respond to only a very small spill. This equipment is not regularly checked and there is a strong possibility that some of it will not be functional unless it is repaired and replaced on a regular basis. Furthermore, the local plans do not provide much detail on priority places or describe how the response equipment can be used to protect those places. The response plans identify equipment that could be brought in from outside these communities, but the plans do not identify or address the logistical challenges that would be involved in cascading additional people and equipment and thus do not acknowledge the low likelihood that more resources could be brought in to effectively limit the impacts of a spill.

Ships oil spill response plans provide no guidance for cleaning up a spill in the water and ships carry no response equipment for marine spills. Although the Mary River Mine has spill response plans, these plans are designed only for a small spill in the immediate area of the Milne Point port.

Response planning standards are requirements that determine how much oil a response plan should be designed to recover and how quickly that recovery should take place. In the south, these standards apply to private Response Organizations, which ships must contract with to provide response capacity. However, the standards are not based on an assessment of the amount of oil that could spill in a worst-case discharge. In the Arctic, there are no Response Organizations and equipment and capacity is thus developed on an ad hoc basis, again without any reference to the amount of fuel that could actually be spilled

Thus, there is little response equipment throughout the Arctic. The great distances between equipment depots, the sparse infrastructure, and the challenging weather conditions would make it very difficult to transport equipment and people from one location to another, and these challenges would be compounded when trying to use equipment and people from the south to respond to a spill in the Arctic.

Even if a community has sufficient equipment and trained personnel, there are a number of factors that can limit an effective spill response. For example, the spreading and weathering of oil and whether it comes into contact with ice will

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[3] *See, e.g., A Review of Canada's Ship-Source Spill Preparedness and Response: Setting the Course for the Future, Phase II*, Tanker Safety Expert Panel (2014); LOOKNorth, *Oil Spill Detection and Modeling in the Hudson and Davis Straits* (May 2014).

significantly affect recovery success. The equipment that is used to recover oil or protect the shoreline will not work as well in certain situations, such as where there are high winds, short period or high waves, limited visibility, or icy waters. The ability for people to communicate between the spill sites, the staging area where equipment is located, the nearest hamlet, and boats and aircraft in the area is also important, as is the ability for people and equipment to get to the spill site. All of these things can affect the time it takes to respond to a spill, and the more time that passes, the more difficult it becomes to recover oil or protect important resources before the oil encounters them.

The existing state of preparedness in the Arctic strongly points to the need for and fundamental importance of developing a local response capacity. The development of this capacity can build on the regulatory framework relating to land and water use, the protection of environmental and cultural resources, and oil spill preparedness and response. This framework involves a range of individuals, companies, and government entities that can be engaged to support community-based response planning and the development of stronger legal standards.

Most importantly, however, a community response plan can identify local priorities and provide leadership and direction for all entities engaged in developing Arctic oil spill response capacity.

II. Background

The location, physical environment, infrastructure, and population of a community are important initial considerations in identifying options for strengthening a community's capacity for oil spill response. These underlying factors create constraints that community response planning must take into account.

Pond Inlet, Arctic Bay, Resolute, and Grise Fiord are the four northern-most communities in Canada and are part of the territory of Nunavut, in the Canadian Arctic Archipelago. Grise Fiord, the northern-most community, is on Ellesmere Island, which is part of the Canada's far north Queen Elizabeth Islands. Resolute, the second most northern hamlet, is on Cornwallis Island, west of Ellesmere Island and also part of the Queen Elizabeth Islands. To the south, Lancaster Sound separates the Queen Elizabeth Islands from Baffin Island, which is home to Pond Inlet and Arctic Bay. Lancaster Sound leads from Baffin Bay west into Parry Channel, forming the eastern portion of the Northwest Passage. Thus, each of these communities is on or near the emerging shipping routes connecting the Atlantic and Pacific Oceans through the Canadian Arctic Archipelago.

Physical Environment

The extreme climate of Nunavut includes major seasonal changes and sea ice for much of the year. Baffin Bay is frozen from October until June, with landfast ice in all the fjords and pack ice offshore persisting late into the summer. Even during the open water season, icebergs, calving from tidewater glaciers in Greenland and Canada, are frequent along the entire coast. Much of the shoreline along Baffin Bay consists of cliffs 1000 metres high. The many fjords and inlets in the region are deep water, between 200 and 500 metres, and the tidal range is generally less than a metre.[4]

Lancaster Sound is also chocked with pack ice and landfast ice for nine months of the year. The coast has cliffs reaching 400 metres high interspersed with coastal plains and many fjords and inlets. The tidal range is around two metres and there is a moderate current through the Sound.

Arctic Bay, Grise Fiord, and Pond Inlet are adjacent to polynyas, which are nutrient-rich areas of open water throughout the year that provide important habitat for many species of marine mammals. The largest is the North Water Polynya in northern Baffin Bay.

In addition to the sea ice, cold air temperatures also characterize the area for much of the year. From December until April, the average daily temperature is 22 degrees Celsius below zero. Temperatures go above freezing only during June, July, and August, but even during this warmer period daily averages are only slightly above freezing. Clouds, fog, blowing snow and darkness often limit visibility in the region.

Infrastructure and population[5]

The Nunavut region is sparsely populated and difficult to reach. The communities of Pond Inlet, Arctic Bay, Resolute, and Grise Fiord are predominately Inuit (Nunavummiut) who rely on a mixed subsistence and market economy. Many people hunt and fish for a significant portion of their diet. The environmental knowledge and survival skills required by these activities are important elements of Nunavummiut culture, passed down from generation to generation.

The communication and transportation infrastructure in the Nunavut region is minimal. No roads lead into or out of the communities. Small planes using gravel airstrips and small docks or boat ramps serve as the primary mode of transportation for the communities. Local travel is mostly by snow machines and ATVs on dirt roads. Travel beyond the local roads on the tundra is difficult in the summer but possible on the snow and ice during the winter. Internet and telephone

[4] Canadian Coast Guard, Baffin Region, Nunavut Area Plan (2008).
[5] Demographics and infrastructure information from Government of Nunavut website.

bandwidth, which is offered through satellite connections, is low and inconsistent, and there is limited VHF coverage offshore.

Large vessels bring supplies to the hamlets during the summer and must remain offshore, transferring the goods to shallow draft barges and landing craft that land on the beach. No hazardous waste facilities exist in the entire region. This means that ships must keep any hazardous materials onboard until they reach a facility in the south. In addition, when oil is recovered from a spill, it cannot be disposed of locally but must be stored and shipped to the south.

Climate Change

As part of the region where multi-year ice is expected to persist the longest, the communities of Pond Inlet, Arctic Bay, Resolute, and Grise Fiord are experiencing fewer effects of climate change than many other Arctic communities. However, even in this "Last Ice Area," Inuit hunters have experienced changes in freeze-up and break-up timing, less stable sea ice, and changes to ocean currents and temperatures. Although the open water season is extending, large pieces of glacier are breaking off and traveling through the waterways.[6] All of Canada's northern coasts have warmed more than the Canadian average. [7] Annual precipitation has increased, and is projected to continue to increase during all seasons, especially winter.[8] Winds are increasing as well.

The changes in the climate are altering ecosystems that have supported traditional Inuit activities and life for centuries.[9] Ice-based travel routes and hunting grounds are becoming unsafe and inaccessible during shoulder seasons and animal migration times and locations are changing, making subsistence hunting more difficult.[10]

The North Water Polynya has been breaking up earlier and occurring less frequently over the last four decades. Changes to this and associated polynyas will also affect subsistence hunters, particularly those in Grise Fiord, who rely heavily on the polynyas to hunt for whales and other marine mammals that concentrate there.[11] Conversely, some environmental resources are increasing. For example, a projected

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[6] Petrasek MacDonald Consulting, Impacts of Current and Projected Climate Change on Key Features of the Last Ice Area, p. 9 (July 2016) [hereinafter Impacts on LIA].
[7] Lemmen, D., et al, editors, *Canada's Marine Coasts in a Changing Climate*, p.166 (Government of Canada, 2016).
[8] Impacts on LIA, p. 6; *Canada's Marine Coasts in a Changing Climate*, p. 166.
[9] *Unikkaaqatigiit: Putting The Human Face On Climate Change*, p. 4(Tapiriit Kanatami, Université Laval, and National Aboriginal Health Organization, 2005).
[10] Impacts on LIA, p. 28.
[11] *Id.*, p. 16.

growth in Arctic cod will likely bring benefits to subsistence and the economy, especially for Arctic Bay and Resolute.[12]

III. Regulatory framework and entities responsible for marine activities, oil spill preparedness and response, and environmental protection in Nunavut

Community-based oil spill response can involve the participation and input of a range of individuals, companies, and government entities. The regulatory framework relating to land and water use, the protection of environmental and cultural resources, and oil spill preparedness and response identifies the legal requirements that are related to preparedness and response and the entities that can be engaged to support community-based response planning.

Governance of land and water use

The Nunavut Land Claims Agreement (NLCA) was negotiated by the Nunavut Tunngavik Incorporated (NTI) and the federal government of Canada and created the public government of Nunavut, a territory of Canada. The NLCA identifies the geographical and governing jurisdiction of the territorial government, which includes all lands and waters within the Nunavut Settlement Area.[13]

The NLCA provides the overarching policy direction for the development and review of land use plans in Nunavut, which guide development in Nunavut, including in marine areas.[14] Land use plans are relevant to community oil spill response because they identify priority uses and important areas, and they govern activities, including shipping, that entail oil spill risks in marine waters. Conditions imposed by the plan can help to address existing oil spill risks as preventative measures. In addition, should specific projects in the future entail addition risks, the approval of those proposals can be conditioned on actions that may support the necessary increase in response planning capabilities.

The North Baffin Regional Land Use Plan, approved in 2000, includes the communities of Resolute, Arctic Bay, Grise Fiord, and Pond Inlet.[15] The plan requires regular meetings between the CCG and the communities to discuss shipping-related concerns, prohibits ships from coming within 10 kilometres from coastlines generally and within 20-25 kilometres from the coastline of Lancaster Sound unless they are approaching or leaving a port, and calls for the minimization of ships

[12] *Id.*, p. 19-20.
[13] Nunavut Land Claims Agreement (NLCA) Section 3.2.1.
[14] *Id.,* Section 11.5.1 & 15.2.2.
[15] Nunavut Planning Commission, North Baffin Regional Land Use Plan (2000).

traveling through and around ice floe edges.[16] It is unclear whether ship traffic is actively monitored to ensure compliance with these setbacks.

The Nunavut Planning Commission (NPC) is in the process of creating the Nunavut Land Use Plan (NLUP), which is scheduled to be complete in 2017. The NLUP applies to all activities within Nunavut, including the Outer Land Fast Ice Zone (along Baffin Bay), surface and subsurface lands, freshwater, marine areas and the beds of these bodies of water. The NLUP does not apply within established National Parks, National Marine Conservation Areas, Territorial Parks, and National Historic Sites administered by Parks Canada. Although none of these areas are within the communities discussed in this report, some are adjacent to or near them, and Parks Canada may therefore be a valuable partner in developing community response plans.

The 2016 draft NLUP sets out broad goals, which include protecting and sustaining the environment, encouraging conservation planning, building healthier communities, and encouraging sustainable economic development. In support of these goals, the draft plan identifies options and recommendations for restricting or prohibiting specific uses of land and water. The draft plan also provides one of three land use designations for all areas covered by the plan: protected areas, special management areas, and mixed use areas. Some protected areas and special management areas, especially in marine waters, have seasonal restrictions. For example, shipping is restricted in certain times and places to allow caribou crossing on the ice and to protect beluga calving grounds. Subject to these seasonal restrictions, shipping is allowed in most areas although there are some set backs to protect important ecological resources. In addition, communities have listed two areas as being essential for a variety of ecological purposes, and have asked that these locations be closed to all non-Inuit vessels.[17]

The NPC implements land use plans by conducting Conformity Determinations for projects, and conditions accompanying those determinations are implemented through the issuance of permits, licenses, and authorizations. Under Article 11 of the NLCA, the Minister of Indian Affairs and Northern Development (INAC) can grant an exemption from a decision by the NPC that a project is not in conformity with the NLUP.[18] For example, the Minister of INAC granted an exemption for the Mary River Mine Project, an iron ore mine that has recently begun production. However,

[16] *Id.* Terms 3.5.3 to 3.5.5.
[17] The two areas are Moffatt Inlet (near Arctic Bay) and Foxe Basin (south of the communities discussed in this report).
[18] NLCA Section 11.5.11.

whether the exemption still applies under the new federal administration, and whether the exemption applies to the mine's recently revised plans, is unclear.[19]

After the Conformity Determination, the NPC forwards the project proposal to the Nunavut Impact Review Board (NIRB), which reviews project proposals and determines whether projects should proceed, and if so, under what terms and conditions.[20] Thus, for specific projects, the NIRB may also impose terms and conditions that support community response planning. For example, the NIRB imposed specific conditions regarding fuel storage for the Crystal Serenity cruise ship.[21]

Certain activities are exempt from review by the NIRB, including shipping for community resupply, unless the NPC has concerns about cumulative impacts.[22] However, shipping activity for other projects are not exempt from review by the NIRB.[23] Projects that have been exempted from the NLUP by a Minister (e.g., of INAC) must still undergo review by the NIRB.

The Arctic Waters Pollution Prevention Act is one of the primary federal laws governing shipping activity in Canada. The Act prohibits pollution from ships and creates shipping safety control zones that limit entry based on the polar class of the vessel, according to ice conditions in the zone. Under the Canada Shipping Act, ships that are more than 300 gross tonnes (GT) must report their geographic position under the Northern Canada Vessel Traffic Services Zone (NORDREG) before entering Canada's northern waters.

Protection of wildlife and Aboriginal interests

Various Aboriginal and public government institutions play a role in the governance of wildlife and Aboriginal interests.

This section will first discuss Aboriginal institutions. NTI represents Inuit under the NLCA, acting as a watchdog to ensure provisions under the agreement are carried out. Under the umbrella of NTI, the three regions of Nunavut are represented by different Regional Inuit Associations. Pond Inlet, Resolute, Grise Fiord and Arctic Bay are part of the Qikiqtani Inuit Association (QIA). As a "Designated Inuit Organization" under Article 39 of the NLCA, QIA is responsible for managing Inuit Owned Lands (which are solely terrestrial) in the Qikiqtani Region. There are Inuit Owned Lands near the communities of Pond Inlet, Resolute, Grise Fiord and Arctic

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[19] "Nunavut regulator: we can't assess Baffinland's new railway proposal," Nunatsiaq Online, July 26, 2016.
[20] NLCA Section 12.2.2; 12.3.1.
[21] Nunavut Impact Review Board, Screening Decision Report File No.: 16TN039 (Aug. 23, 2016).
[22] NLCA Section 12.3.3.
[23] *Id.,* Section 12.12.2.

Bay.[24] QIA's Department of Major Projects serves as a source of information about major projects and advocates on behalf of Inuit, including through Impact Benefit Agreements with project proponents such as Baffinland Iron Mines Corporation.[25] The national umbrella group for Inuit Organizations is Inuit Tapiriit Kanatami (ITK).

The NLCA also created Inuit wildlife organizations.[26] The Nunavut Inuit Wildlife Secretariat represents territorial wildlife issues and supports the Regional Wildlife Organizations (RWO) and Hunters and Trappers Organizations (HTOs).[27] Qikiqtaaluk Wildlife Board is the RWO for Grise Fiord, Pond Inlet, Arctic Bay, and Resolute. Each community has its own HTO. These organizations can help identify priority areas for community protection, contribute information about logistical concerns, play a role in the protection of wildlife during a spill, and advocate for additional support to protect Inuit wildlife resources in response planning.

Turning to public government, within the Government of Nunavut, the Department of Environment's Divisions of Wildlife Management, Fisheries and Sealing, and Parks and Special Places manage and protect important wildlife and habitat. Each of these divisions may have valuable expertise to contribute to the development of local response plans.

The Nunavut Wildlife Management Board (NWMB) was created as an institution of public government under the NLCA, and is the main instrument of wildlife management and the main regulator of access to wildlife in the Nunavut Settlement Area. The Board's mandate is to help ensure the protection and wise use of wildlife and wildlife habitat for the long-term benefit of Inuit and the rest of the public of Nunavut and Canada.[28] The federal government's Department of Fisheries and Oceans co-manages these resources through its participation on the NWMB.

The Nunavut Marine Council (NMC), also established under the NLCA, is comprised of the NIRB, the Nunavut Water Board, the NPC and the NWMB and advises and makes recommendations to other government agencies regarding the marine areas of the Nunavut Settlement Area.[29]

At the federal level, Environment and Climate Change Canada (ECCC) oversees resource conservation, protection of water resources, and weather forecasting. The ECCC's National Environmental Emergencies Centre (NEEC) coordinates ECCC's role

[24] Nunavut Tunngavik Incorporated, Inuit Owned Lands in Nunavut (2000).
[25] Qikiqtani Inuit Association, Department of Major Projects.
[26] NLCA Sections 5.2.1, 5.7.1.
[27] Nunavut Inuit Wildlife Secretariat.
[28] NLCA Section 5.2.33.
[29] Nunavut Marine Council Business Case (Feb. 2012).

in environmental emergency preparedness and response for both land and marine incidents. NEEC provides scientific advice, including contaminant dispersion and trajectory modeling, fate and behavior of hazardous substances, oil sensitivity mapping data, and the establishment of cleanup priorities and techniques. The Centre also oversees the protection of sensitive ecosystems and wildlife such as migratory birds and fish. Thus, NEEC provides environmental information to inform the CCG's planning for and response to a spill.

The Canadian Wildlife Service, which is part of NEEC, provides advice on wildlife protection, rescue and rehabilitation. In the event of a spill, the agency would also issue permits for wildlife hazing and capture, if necessary. The agency has issued response plan guidance for oiled birds but has no wildlife treatment capabilities.[30] These are typically provided by a third-party contractor hired at the time of a spill.

Governance of oil spill preparedness and response

The regulatory framework for oil spill preparedness and response includes jurisdiction by various government agencies at the territorial and federal level. The Government of Nunavut is responsible for ensuring preparedness and response for land-based spills and spills that occur along Nunavut's coastlines. The Department of Environment's (DOE) Environmental Protection Division enforces Canada's Spill Contingency Planning and Reporting Regulations, which require spill contingency plans for fuel handling and storage facilities.[31] The regulations require an inventory and the location of response and clean up equipment available to implement the spill contingency plan but they do not specify how much or what kinds of equipment must be included in the plan, nor whether marine or shoreline protection and clean up equipment must be on hand. Nunavut's Petroleum Products Division (PPD) has recently updated oil spill response and environmental emergency plans for all of the communities in Nunavut. These plans outline response techniques, including for the containment of fuel in water and in ice.[32] The plans also provide an inventory of dedicated facility spill response equipment. For each of the communities, the equipment list is as follows:[33]

[30] Canadian Wildlife Service, Birds and Oil - Response Plan Guidance (Draft June 2012).
[31] Environmental Protection Act, Consolidation Of Spill Contingency Planning and Reporting Regulations R-068-93 (July 22, 1993).
[32] *See, e.g.,* Petroleum Products Division, Grise Fiord Environmental Emergency Plan, pp. 101 – 104 (plan effective from September 28, 2015).
[33] *See, e.g.,* Grise Fiord Oil Pollution Emergency Plan, p. 29 (plan effective from September 1, 2015).

CATEGORY	PURPOSE	TYPICAL EQUIPMENT
Containment	Contain/control in 1 hour	150ft. of Floating Boom, 200ft. of Rope, 2 bales of absorbent pads(40 ft.), shovels
Recovery	Initiate recovery in 6 hours	gas-powered pump
Storage	Storage/disposal	At least 4 Empty 205 litre drums
Support	Support Operations	Pumps, lighting, shovels, rakes and/or consumables (sorbent).
Safety	Support Operations	Communication equipment, Personal Protective Equipment, First Aid kits.

The DOE has a conservation officer in every hamlet and a Regional Environmental Protection Officer in Pond Inlet, and they receive a 4-day spill response course that focused on land-based spills but touches on marine spills.[34]

At the federal level, Transport Canada (TC) is the lead agency regulating Canada's Marine Oil Spill Preparedness and Response regime. TC sets the guidelines and regulatory structure for the preparedness and response to marine oil spills and is responsible for ensuring that the appropriate level of preparedness is available to respond to marine oil pollution incidents in Canada.

Pursuant to the Emergency Management Act, the CCG develops and maintains the national, regional, and area oil spill response plans, which must conform to the guidelines and regulations set out by TC. The National Marine Spills Contingency Plan (National Response Plan) outlines the responsibilities of various entities. South of 60 degrees, the operators of a ship are responsible for responding to a spill and are required to contract with a Response Organization that supplies the equipment and personnel to conduct the response.[35] In the Arctic, there are no Response Organizations and the CCG is the primary entity responsible for managing and carrying out a spill response.[36] The CCG and the Government of Nunavut have overlapping responsibilities regarding the protection and cleanup of shorelines.

While TC and CCG are primarily responsible for oil spill preparedness and response, other entities also provide input into policy or assistance with preparedness and response. For example, the Arctic Regional Advisory Council is comprised of representatives from local government, Aboriginal interests, the fishing industry, commercial shipping, conservation groups, and others. The Advisory Council has the mandate to make recommendations to the Ministry of Transport on policy issues

[34]Nunavut Department of Environment, comments on Phase II of Tanker Safety Expert Panel (May 16, 2014).
[35] Canada Shipping Act, 2001, section 171.
[36] Oceans Act, 1996, section 41(1).

affecting regional preparedness and response.[37] Although the Advisory Council could provide future guidance for local oil spill response planning, it is unclear how active or authoritative the Advisory Council is at this point.[38] The Northwest Territories/Nunavut Spills Working Group is an inter-agency group that provides coordination for spill reporting and response. Finally, The Royal Canadian Mounted Police (RCMP) has detachments in all four communities and has provided initial reconnaissance about marine spill locations in advance of the arrival of responders. The RCMP may also have the keys to access to the CCG's response equipment that is stored in the communities.[39]

Oil spill response plans

The CCG has developed a series of response plans that are designed to work together, going from a national, to regional, to local level. At the highest level, the National Response Plan sets out overarching policies, guidelines, and responsibilities for oil spill response operations and it requires each CCG response region to detail the procedures, resources, and strategies that will be used to respond to a spill.[40]

More detailed Regional Plans identify the inventories of response equipment and provide additional explanation of how response will take place. The Central and Arctic Regional Plan covers all Canadian waters from the Alaska-Yukon boundary east to the Nunavut-Greenland boundary, as well as Hudson and James Bays, the Great Lakes, the St. Lawrence River, and the internal waters of Northwest Territories, Nunavut, Alberta, Saskatchewan, Manitoba, and Ontario.[41] This plan details the procedures, resources, and strategies that will be used for a response in the region. However, there is no process in place that assures that the equipment requirements of these plans are in place or that the CCG is prepared to respond effectively.[42] Thus, certain aspects of the plan are aspirational and do not reflect the existing state of planning and preparedness. For example, the Area Response Plan provides an inventory of equipment, but there are no processes or procedures in place to ensure that the equipment is in working order. The plan also provides for cascading of additional equipment from other locations in the event of a spill that exceeds the capacity of the equipment in the community, but there is no

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[37] Canada Shipping Act, 2001, section 172.
[38] Although the Tanker Safety Panel's second report, which addresses Arctic shipping, did not reference Regional Advisory Councils, the first report recommended that they be disbanded.
[39] *Oil Spill Detection and Modeling in the Hudson and Davis Straits*, p. 65.
[40] Canadian Coast Guard, *Marine Spills Contingency Plan – National Chapter* (2011), pp. 1-6 to 1-7.
[41] Canadian Coast Guard, *Central and Arctic Regional Response Plan* (2008), p. 1-1.
[42] *Report of the Commissioner of the Environment and Sustainable Development to the House of Commons, Chapter 1, Oil Spills from Ships* (Office of the Auditor General, 2010), p. 2 [*CESD Oil Spills from Ships*].

requirement to ensure that this equipment could actually be transferred to the site within a useful period of time.

At a more local level, the Area Plans, which are annexes to the Regional Plans, are to be based on risk analysis (determining which communities or areas are most likely to be endangered by a potential oil spill and why, their associated environmental sensitivities, and the typical type of spill that could be expected), the identification of response priorities, and the development of response strategies and tactics.[43] These plans are supposed to be reviewed and updated annually.[44]

The Baffin Region Area Plan, drafted in 2008 (and not updated since then), covers Foxe Basin, Hudson Strait, Davis Strait, Baffin Bay, Parry Channel, and Lancaster Sound.[45] The Plan identifies specific geographical priority areas and proposes tactics to protect these areas in the first 12-24 hours of a spill. The Plan provides very few details or recommendations for protecting the communities of Pond Inlet, Arctic Bay, Resolute, and Grise Fiord from an oil spill. The CCG cautions that the strategies identified in the plan are untested and require site visits and deployment exercises to confirm their viability.[46] It is unclear whether the CCG has made any site visit or conducted any deployment exercises.

The CCG has recently initiated an Area Response Planning Initiative, which aims to adopt a regional, risk-based preparedness and response system for ship-source oil pollution spills across Canada. The initiative is starting with pilot projects in four non-Arctic areas, seeking to identify how the oil response regime can be strengthened.[47] Community based response plans in Nunavut could inform this process.

Ships also have oil spill emergency plans. Under Canadian and international law, all tanker ships that are at least 150 GT and all other vessels that are at least 400 GT must have a Ship Oil Pollution Emergency Plan (SOPEP).[48] A SOPEP outlines steps that must be taken if a ship-based spill occurs, including reporting procedures, authorities to be contacted, and actions to be taken by crew. Currently, SOPEPs are not Arctic-specific and therefore a SOPEP may not account for communications challenges that could arise in attempting to report a spill in the Arctic.[49] The degree

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[43] Central and Arctic Regional Response Plan, p. 4-4.
[44] Id.
[45] Separate Area Plans have been created for the Kitikmeot and Keewatin Regions.
[46] Baffin Region, Nunavut Area Plan, p. 7.
[47] The pilot areas are the southern portion of British Columbia (BC);the St. Lawrence (Montréal to Anticosti Island) (QC); Port Hawkesbury and the Strait of Canso (NS); and Saint John and the Bay of Fundy (NB).
[48] Vessel Pollution and Dangerous Chemicals Regulations, SOR/2012-69, subsection 27(1); MARPOL annex 1. These requirements are codified in regulations under the Canada Shipping Act.
[49] However, the Polar Code now requires, "Operation in polar waters shall be taken into account, as appropriate, in the Oil Record Books, manuals and the shipboard oil pollution emergency plan or the

of planning outlined in a SOPEP is rudimentary, as it does not require the identification of where response equipment in or outside the region might come from, nor does it require planning for the response-related logistical issues that arise after the authorities are notified.

Finally, oil handling facilities in the area have spill response plans.[50] For example, the Mary River Mine has an Emergency and Spill Response Plan (ERP) and a Milne Port Oil Pollution and Emergency Plan (OPEP). The ERP addresses spills in areas outside the Milne Inlet Fuel Storage Facility and identifies on-site response training, including in marine spill response and shoreline recovery.[51] The Milne Port OPEP addresses the specifics of response for the fuel storage facility and the bulk transfer of fuel, and describes shoreline and marine characteristics, spill scenarios and response strategies, planned training and spill exercises, and response equipment available at the port.[52] These plans are based on a worst-case spill scenario that assumes a very small volume of fuel will spill during fuel transfer. Thus, the plans do not address response for higher amounts of fuel that could spill in the event of a breach of bunker or fuel carriage tanks. As a result, the on-site equipment is adequate for response only for a small spill. Although these plans provide detailed information about the coastline, the environmental resources, and priority areas, the information covers only the immediate Milne Inlet area and would not be helpful for a spill that took place elsewhere, such as near Pond Inlet, or that migrated from the source to other areas.

Response standards

Response standards establish concrete requirements for cleaning up a spill. In southern waters, to ensure the appropriate level of response equipment and personnel exist in the event of a spill, Canadian law requires ships to contract with a Response Organization that can provide equipment and personnel sufficient to clean up the amount of oil that a ship is carrying, up to 10,000 tonnes (t), within a

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shipboard marine pollution emergency plan as required by MARPOL Annex I." Part IIA, section 1.1.4. Thus, Canadian regulations may be updated to implement this provision.

[50] Canada Shipping Act, Regulations for Oil Handling Facility Standards, TP12402.

[51] Baffinland Iron Mines Corporation - Mary River Project Emergency Response and Spill Contingency Plan (Mar. 2013).

[52] Baffinland Iron Mines Corporation, Preliminary Oil Pollution Emergency Plan Marine Spills Appendix B.2, Milne Inlet Fuel Storage Facility.

certain amount of time.[53] However, ships traveling north of 60 degrees latitude are exempt from these provisions.[54]

The rationale for an absence of response standards in the Arctic is based on the lack of adequate funding, due to an insufficient number of ships that could contribute to the formation of an Arctic Response Organization. Perceptions about the relative risk of ship-based oils spills in the Arctic may also be limiting support for Arctic response standards. A TC commissioned risk assessment asserts that "the risk of oil spills in Canadian Arctic waters is significantly lower than in the rest of Canada as a result of low probability of spills, as determined by the lower level of traffic and low volumes of oil transported over the last 10 years."[55] Although the study incorporates an Environmental Sensitivity Index and a Human-Use Resource Index (HRI), the particular importance of subsistence in the health and wellbeing of northern communities was not considered. Instead, the HRI accounted only for commercial losses that would be caused by a spill.[56] A Coastal Population Index was used as a proxy for subsistence values based on the assumption that non-commercial hunting and fishing activities would increase commensurate with increased population densities.[57] Yet this approach devalues the risks to individuals, especially those living in small communities who are heavily dependent on subsistence hunting.

In addition, the study did not account for the heightened risks from navigation nor the heightened costs of spill response in the Arctic.[58] Arctic conditions increase the probability of certain accidents. For example, capsizing and groundings are more probable due to topside icing and the lack of good charts and navigational aids. In addition, Arctic conditions increase the consequences of a spill because of the difficulty of response.[59]

The CCG aims to maintain a national capacity to respond to a spill of 10,000 t through a collection of spill response equipment depots throughout the country. Although TC certifies that regional Response Organizations maintain the capacity to respond to ship-source oil spills of up to 10,000 t, similar procedures and criteria for

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[53] Canada Shipping Act, 2001, section 167(1); Environmental Response Arrangements Regulations, SOR/2008-275. For example, Response Organizations operating south of the Arctic must be able to deploy response equipment capable of responding to up to 1,000 tonnes of oil within 12 hours. Marine Safety Directorate, Transport Canada, Response Organization Standards, TP 12401 E, Section 3(2) (1995).

[54] Environmental Response Arrangements Regulations, SOR/2008-275, section 3.

[55] Risk Assessment for Marine Spills in Canadian Waters, Phase 2, Part B: Spills of Oil and Select Hazardous and Noxious Substances Transported in Bulk North of the 60th Parallel (WSP Canada Inc., 2014), p. iii.

[56] Id., p. 11.

[57] Id., p. 16.

[58] Id., pp. 9, 60.

[59] Vard Marine Inc., Protection of Critically Sensitive Nunavut Marine Habitats, p. 74 (August 2016).

ensuring readiness are not in place for the CCG, and the federal government's response capacity has not been estimated.[60] The CCG is still building a national response capacity, and equipment requirements and placement are determined on an ad hoc regional basis.[61]

The role of communities in response planning

The importance of and need for Nunavut communities to be involved in response planning has been voiced from many corners. The NCLA emphasizes the importance of Inuit participation in decision-making, specifically noting, "there is a need for Inuit involvement in aspects of Arctic marine management . . ."[62] Notably, a top priority of the current government of Canada is to consult and cooperate with Indigenous peoples in accordance with the UN Declaration on the Rights of Indigenous Peoples.[63]

The Tanker Safety Expert Panel recommended community engagement in the planning process, exercises, training, and other opportunities related to spill response.[64] A report prepared for the NPC also recommended increased community input into spill response and preparedness, through, for example, local instruction in the operation and maintenance of response equipment and regular spill exercises.[65]

Additionally, a recent report by the PEW Charitable Trusts and proceedings from meetings about the Northern Marine Transportation Corridors placed a priority emphasis on the importance of involving Aboriginal input in the planning of the Transportation Corridors.[66] Thus, there is a strong mandate for communities to become more involved in oil spill response planning and protection of their shorelines and resources.

IV. Oil Spill Response Equipment, Personnel, Infrastructure, and Logistics

A baseline assessment of the oil spill response equipment, infrastructure, logistics, and limitations to spill response in the region and within each community is

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[60] CESD Oil Spills from Ships, p. 22.
[61] Audit of The Canadian Coast Guard Environmental Response Services (Department of Fisheries and Oceans, 2010).
[62] NLCA Section 15.1.1.
[63] Prime Minister Justin Trudeau, "Statement by Prime Minister on release of the Final Report of the Truth and Reconciliation Commission," (Dec. 15, 2015).
[64] A Review of Canada's Ship-Source Spill Preparedness and Response: Setting the Course for the Future, Phase II, p. 29.
[65] Oil Spill Detection and Modeling in the Hudson and Davis Straits, p. 69.
[66] Dawson, J., et al., Proceedings of the Northern Marine Transportation Corridors Workshop (December 8, 2015).

essential for assessing existing capacity and identifying practical steps for improving local preparedness.

Oil spill response equipment in the region

The CCG is the primary source of spill response equipment in Nunavut, although community fuel storage facilities and the Mary River Mine also have some response equipment.

The CCG has placed community packs in Resolute, Arctic Bay, and Pond Inlet, but not in Grise Fiord. These packs contain basic spill control equipment designed for use in near-shore areas and they can be used to clean up 1 t of oil during ice-free times.[67] The packs include 1350-3650 feet of boom, an Elastec TDS-118 skimmer, a 16-foot aluminum boat, and an open top storage tank. The packs also include shoreline kits, which are comprised of rakes, shovels, pitch forks, sorbents, and tarps.[68]

A fourth, and larger, equipment depot is in Iqaluit. Because of the size of this equipment, it cannot be transported by plane. Therefore, the equipment would be transported by barge or ship.[69]

The condition of the equipment within the community packs and Iqaluit depot is unclear. Although the National Response Plan aims to maintain "a proper state of readiness through a pro-active approach using work orders and preventative maintenance,"[70] the system for assuring the upkeep and maintenance of the equipment has not been consistent.[71] For example, years after the Community Pack was placed in Iqaluit, the CCG had not conducted any critical maintenance.[72] The Arctic environment renders mechanical equipment inoperable if it is not maintained, and therefore some of the equipment in the Community Packs may no longer be functional. In addition, essential ancillary equipment such as power packs, generators, and lights must be functional.

Outside of Nunavut, additional oil spill resources are staged in Hay River, NWT.[73] This equipment could be transported by air to the community nearest to the spill site if conditions were favorable. Together with the equipment in a community pack

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[67] Canadian Coast Guard, Arctic Response Strategy, Presentation to Arctic Council Emergency Prevention, Preparedness, and Response Working Group (November 2009).
[68] *Oil Spill Detection and Modeling in the Hudson and Davis Straits*, p. 65.
[69] *Central and Arctic Regional Response Plan*, p. 5-13.
[70] *Marine Spills Contingency Plan – National Chapter,* p. 3-4.
[71] *CESD Oil Spills from Ships*, p. 21.
[72] Benoit, L., *Perspectives on Emergency Response in the Canadian Arctic, Part C: Findings of the Hypothetical Scenario*, p. 11.
[73] *Central and Arctic Regional Response Plan*, p. 5-12.

and the additional equipment in Iqaluit, this equipment is designed to recover a total of 1000 t of oil.

The storage and disposal capacity of the equipment can also be a limiting factor. The equipment from Hay River can store a total of 240 t of fluids, which means that even if 1000 t or more of oil was recovered, there would be no place to store it. Additionally, some of this storage capacity will be used by water, because the liquid that is recovered is rarely 100% oil.

If a CCG boat were in the region, it may be able to provide additional response equipment. Five to six CCG icebreakers are spread across the Arctic during the summer, with two or three typically covering the region outside of Quebec. Thus, only three icebreakers are responsible for the entire Northwest Passage. The CCG predicts that its icebreakers can be available to vessels needing icebreaking services in the Canadian Arctic within 10 hours.[74] However, this time frame varies depending on ice conditions. Marine support can take multiple days if the weather and location of resources are unfavorable.[75] In addition, because space on a vessel is at a premium, ships will not necessarily have oil spill response equipment on board.[76]

The Eastern Canada Response Corporation is the certified Response Organization responsible for oil spill response in eastern Canada, south of 60 degrees. The Response Organization maintains response equipment in six locations along eastern Canada, the northern-most of which is St. John's. Because there is no preexisting agreement for the equipment to be used for an out of region spill, the CCG and the corporation would have to reach an agreement before it could be used for response efforts in Nunavut.

Trained personnel

Another consideration for a marine oil spill response in Nunavut is the level of training and number of people who can use response equipment. Deployment of the equipment from Hay River requires 11 CCG and 16 community responders.[77] To operate the equipment stored in Iqaluit, it would take 14 CCG employees, 13 contractors, and 13 community responders.[78] Yet, most communities have only one or two people who are trained to use oil spill response equipment. "This training is

[74] CESD Marine Navigation, p. 15.
[75] Emergency Management in the Arctic, p. 10.
[76] CCG EPPR Presentation.
[77] Central and Arctic Regional Response Plan, p. 5-13.
[78] Id., p. 5-14.

often at a relatively basic level and with little opportunity for practice or maintaining the skills learned."[79]

The limited number of trained responders in Nunavut is due to a number of factors. First, because the communities are small, there are a limited number of people to draw upon. In addition, these people are not always available. If a spill occurred during subsistence harvesting times, for example, many people from the community would be absent. Second, people are reluctant to take spill response training courses without being compensated, but the government has limited funds to provide compensation and training.[80] Third, when spills and training do not occur regularly, it is difficult to maintain skill levels.[81] Communication and cultural barriers may also impede the successful implementation of training programs for local people.[82]

The CCG anticipates that some community members could be trained on the spot,[83] but especially in small communities, it is unclear whether the CCG would be able to find enough people to train, how much time it would take, and whether response would be effective and safe if training occurred in this manner. As one federal employee living in the Arctic observed, "I think the question is how is this equipment going to be used and who is going to use it and how long will it take to use it."[84]

Depending on the number of people who were available in the community for ad hoc training, somewhere between 30-40 people with more expertise, including contractors and CCG employees, would still have to be flown in from outside the region and transported to the spill site to respond to a spill of 1000 t.

The arrival of these responders would have a major impact on the community. Most ccommunities can only support 10-15 additional people at a time,[85] although the ability of the community to support the responders would depend on the needs of the responders (such as accommodation, food, fuel, medical services, specialized or heavy equipment, local transportation, etc.).[86] However, even providing sufficient food for the responders would be difficult because food supply is "just in time." One Arctic resident explains, "You add a number of people into the community, you've

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[79] Beaufort Regional Environmental Assessment, Report on the Status of the Recommendations in the Study on Inuvialuit Community Spill Response Training in the Beaufort Region, p. 3-6 (2013).
[80] *Id.,* p. 3-7.
[81] *Id.,* p. 3-2.
[82] *Perspectives on Emergency Response*, p.12.
[83] *Central and Arctic Regional Response Plan*, p. 5-12.
[84] *Perspectives on Emergency Response*, p. 12.
[85] *Central and Arctic Regional Response Plan*, p. 5-12.
[86] Funston, B., *Emergency Preparedness In Canada's North: An Examination Of Community Capacity*, p. 21.

overwhelmed their ability to supply themselves with basic items . . . If we miss flights for two days, we're on bread and water."[87]

Cascading resources for a spill of more than 1000 t

As discussed in more detail below, a number of ships in the region have more than 1000 t of fuel on board. However, there are no resources in the region to address spills greater than 1000 t. For larger spills, the National Response Plan relies on equipment that would be cascaded from other regional and national inventories. All of that equipment, along with the additional personnel needed to operate it, would have to be brought in from outside the region, either by air or by sea. The distance of Nunavut communities from larger population centers and the lack of infrastructure would make the cascading of people and equipment extremely challenging.

Response and logistical concerns specific to each community

The weather, population, infrastructure, coastline geography, and other logistical concerns for each community are also important constraints that must be considered in community response planning efforts.

Pond Inlet[88]

Pond Inlet is at the northern tip of Baffin Island on Eclipse Sound, around 60 kilometres from the open water of Baffin Bay and adjacent to Bylot Island. Pond Inlet is the most populated of the four communities with 1668 inhabitants and a 1200 metre gravel runway. Around 113 kilometres southwest of Pond Inlet, a deep-water berth at Milne Inlet serves as the dock for the Mary River Mine.

In the summer and fall, storms travel through Baffin Bay, bringing higher precipitation to Baffin Island. These storms also bring heavy winds offshore, although Pond Inlet is relatively protected from high winds. September and October also bring snow, which often restrict visibility. In Pond Inlet visibility is significantly impaired (less than 3 miles/5 kilometres or a ceiling under 1000 feet/300 metres) for nearly 20 percent of each day in fall.[89] From mid-November to mid-January, visibility is further impaired by lack of any daylight, as the sun stays below the horizon.

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[87] *Perspectives on Emergency Response*, p. 14.
[88] Climate data from Nunavut Petroleum Products Division Pond Inlet Environmental Emergency and Oil Pollution Emergency Plans (2015).
[89] Nav Canada, The Weather of Nunavut and the Arctic, p. 151 (2001).

The area has 3 – 4.5 metre tides and a continuous southward current of 1-2 knots, which carries ice floes into the inlet from Baffin Bay. Ice begins to form along the coast in September and does not melt until July.

For Pond Inlet, the CCG Area Response Plan notes that the exposed, unprotected coast will challenge shoreline booming techniques for the sandy beach and tidal flats near the community, but recommends deploying 3000 feet (around 1000 metres) of boom. The plan also notes the risk that southwest currents will carry ice and oil onto the shore. The plan explicitly states that shore-based operations are not to take place without consulting local residents. The plan identifies Sirmilik National Park and Bylot Island as areas that are important for wildlife, and recommends hazing by local hunters and helicopters to protect the wildlife from oil. The plan also notes that archaeological and historical sites are in the area, but does not identify their specific locations.

Over a hundred kilometres to the southwest, the Baffinland Mine has oil spill response equipment, including an aluminum skiff boom, a skimmer, and storage drums.[90] The ships carrying fuel to the mine also have spill response equipment on board, including boom and a skimmer.[91]

Arctic Bay[92]

Around 250 kilometres to the west of Pond Inlet, and also on Baffin Island, Arctic Bay is on a gravel beach in a protected area along Adams Sound, which feeds into Admiralty Inlet and then northwards to Lancaster Sound. Arctic Bay has a population of 817 and also has a 1220-metre gravel runway.

Visibility is significantly impaired (less than 3 miles/5 kilometres or a ceiling under 1000 feet/300 metres) during the summer and fall 30-45 percent of the time, and 20-30 percent of the time during spring.[93] Visibility is limited by the lack of any daylight between mid-November and mid-January. The sun is up continuously from the beginning of May until the beginning of August.

Tides and currents in Arctic Bay are minimal. Sea-ice forms in September and doesn't break up until July.

For Arctic Bay, the CCG Area Response Plan notes that the mouth of the bay is too wide to use boom, but it recommends deploying the 3500 feet (1067 metres) of boom that is available there. The plan notes that there are archaeological sites at

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[90] Baffinland Iron Mines Corporation, Preliminary Oil Pollution Emergency Plan Marine Spills Appendix B.2, Milne Inlet Fuel Storage Facility, Annex 4.
[91] *Id.* Annex 6.
[92] Climate data from Nunavut Petroleum Products Division Arctic Bay Environmental Emergency and Oil Pollution Emergency Plans (2015).
[93] Nav Canada, The Weather of Nunavut, p. 148.

Uluksan Point, but it does not otherwise identify important areas near the community.

A deep-water berth exists near Arctic Bay at the Nanisivik Naval Facility, which is connected to the village by a gravel road. The dock from this decommissioned mine is now being refurbished as a Naval refueling station.

The Nanisivik Naval Facility Spill Contingency Plan does not identify what spill response equipment will be available at the site, although the plan references the use of boom and skimmers.[94] With respect to a vessel grounding or collision, the Emergency Response Plan states only that, "Individual ships will have their own emergency plan and standard operating procedures in the case of ship grounding or collision."[95]

Resolute[96]

Across Lancaster Sound and nearly 400 kilometres northwest of Arctic Bay is Resolute, on the south coast of Cornwallis Island. The population is around 250. The town has a gravel runway that is around 2000 metres long, although the Royal Canadian Air Force is considering an expansion that would include a paved, 3000-metre runway, hangars, and other infrastructure to serve as a base for search and rescue operations. The decommissioned Polaris mine, 100 kilometres northwest of Resolute, has a deep-water dock.

Wind gusts in Resolute on most days are more than 30 kilometres per hour and often reach above 60 kilometres per hour. Most of the annual precipitation is snow in August, September, and October. The snow often restricts visibility. During the summer, low cloud and fog are the routine across ice-covered waterways and open water areas. Visibility is significantly impaired (less than 3 miles/5 kilometres or a ceiling under 1000 feet/300 metres) during the summer and fall 30-40 percent of the time, and 20-30 percent of the time during spring and winter.[97] In Resolute, the sun goes down in the beginning of November and does not come up again until the beginning of February.

For the community of Resolute, the CCG Area Response Plan notes that protection of the shoreline, which is extremely sensitive, could be affected by ice, depending on the direction of the wind. The plan also notes that the bay is too wide to protect with boom, but recommends deploying the 1500 metres of available boom. The

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[94] Nanisivik Naval Facility Spill Contingency Plan, Appendix F (July 2013).
[95] *Id.,* Appendix G.
[96] Climate data from Nunavut Petroleum Products Division Resolute Environmental Emergency and Oil Pollution Emergency Plans (2015).
[97] Nav Canada, The Weather of Nunavut, p. 157.

plan also notes the historical importance of Beechey Island, 80 kilometres east of Resolute, but does not otherwise identify important areas near the community.[98]

Grise Fiord[99]

Grise Fiord, one of the coldest and most isolated inhabited places in the world, is around 400 kilometres northeast of Resolute and around the same distance north of Arctic Bay, on Ellesmere Island. The community is situated on Jones Sound, more than 100 kilometres from Baffin Bay.

The population is 150. The community has a short gravel airstrip that is 500 metres. The airstrip is very difficult to approach and only experienced pilots flying small planes such as the DHC-6 Twin Otters are recommended.[100] The CCG equipment from Hay River is not available due to the length of the runway.

While the winds in Grise Fiord are generally light, they are very erratic and can include strong gusts, making conditions difficult to predict. Visibility is limited for 10-15 percent of the time during the summer and is generally good through the rest of the year.[101] The sun goes down in the beginning of November and does not come up again until mid February.

Grise Fiord is surrounded by tidewater glaciers and loose ice or icebergs in the water throughout the open water season. A moderate current flows out of Jones Sound into Baffin Bay.

For the community of Grise Fiord, the CCG Area Response Plan notes only that protection of the sand and gravel shore may be limited due to the presence of ice at any time and that the fjord is too deep and wide for booming techniques. The plan also notes the importance of Coburg Island, 100 kilometres southeast of Grise Fiord, to seabirds and recommends that local hunters and helicopters be used to haze the birds away from the oil. No other important areas are identified and no other available response tactics (besides shoreline clean up) are recommended.

V. Factors that can limit response

Even if a community has sufficient equipment and trained personnel, there are a number of factors that can limit an effective spill response, including how the oil changes and where it goes after it spills, the response methods and equipment that

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[98] As discussed in more detail, below, Environment and Climate Change Canada is in the process of documenting and categorizing shoreline sensitivity and mapping this information for purposes of strengthening oil spill response plans. However, this process has not been completed for the communities addressed by this report.
[99] Climate data from Nunavut Petroleum Products Division Grise Fiord Environmental Emergency Plan (2015).
[100] Grise Fiord Environmental Emergency Plan, p. 24 ; NavCanada, The Weather of Nunavut, p. 197.
[101] Nav Canada, The Weather of Nunavut, p. 199.

is used, the available communications and transportation infrastructure, the time it takes to begin recovering oil after it has spilled, and weather conditions that may limit a response altogether.

Oil spill behavior and oil spill response mechanisms

The behavior of oil spilled in water influences how and whether the oil can be cleaned up. For example, the spreading and weathering of oil and whether it comes into contact with ice will significantly affect how and the extent to which it can be recovered. Most of the information about the behavior of oil spills in the Arctic is inferred from research in the lab, rather than field studies or actual oil spills. Thus, response planning is limited to some degree by a lack of information about the behavior of oil spilled in the Arctic.

In addition, the equipment that is used to recover oil or protect the shoreline will not work as well in certain situations, such as where there are high winds, short period or high waves, limited visibility, or icy waters.

A more in-depth discussion about what happens to oil when it spills in Arctic conditions, various options for removing spilled oil and minimizing its impacts, and trade-offs of different response methods are discussed in more detail in a second report, authored by Nuka Research, that is part of this WWF project.

Transportation and communication infrastructure

Transportation infrastructure can also limit the effectiveness of response efforts. In the event of a spill, response resources would need to be transported from storage depots to staging areas near the spill or the coastal resources to be protected. The lack of transportation infrastructure in Nunavut makes this a challenge. Bringing additional people and equipment into the community could be difficult, especially during the summer and fall when flights are often cancelled. Weather and sea ice could also limit the ability to transfer equipment and personnel by water from the nearest community to the spill site. Boats such as the 16-foot skiff accompanying the response equipment in Resolute, Pond Inlet, and Arctic Bay cannot travel in high winds or waves, nor can they travel for extended distances. During the fall, the sea can freeze quickly, making a response effort by boats that are not ice-capable very challenging. Extreme storms are also common during the fall, which would make response efforts dangerous or impossible.

In addition, the ability for people to communicate between the spill site, the staging area where equipment is located, the nearest hamlet, and boats and aircraft in the area is also important. Reliable communications, sea and weather information, and

the ability to monitor the spill are essential components of oil spill response.[102] "Communications infrastructure of Canada's Arctic communities is fragile and is heavily dependent on only a few centralized points, which decreases stability."[103] Communication challenges could be a significant impediment to mounting and sustaining a response in any of the communities.[104]

The nearest community to the spill location would serve as an important hub for the transfer of equipment and people, and the ability to communicate with that community would therefore be crucial.[105] Yet, cellphone and internet networks can be quickly overwhelmed, slowing the speed of the internet, preventing phone calls, and potentially leading to a breakdown in proper emergency response protocol. For example, during an emergency exercise in Iqaluit in 2009, the influx of people in the community overloaded the local cellphone and internet networks, making it impossible to carry out the emergency protocol.[106]

To access and recover the oil, it is necessary for responders to have information about safe maritime routes and conditions, including information regarding the presence of ice and weather conditions. This information must be transmitted by the limited communications infrastructure, and the "lack of access to bandwidth that permits timely downloading of live information aboard vessels is one of the issues currently facing navigators in the North."[107]

Once oil comes in contact with water, it will travel with currents and wind, and tracking the spill is therefore essential to being able to find the oil and recover it. The National Aerial Surveillance Program has one Dash 7 airplane, based in Ottawa, which could be used to monitor the spill as long as it is floating on the water surface.[108] Other methods for monitoring a spill may also be available but would require additional planning and resources.

Response time

Response time is a critical factor in an oil spill response. As discussed above, Canadian law provides response times for different levels of spills that regional Response Organizations must be able to meet. However, these standards are fairly weak and do not apply to response capabilities in the Arctic. The CCG estimates

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[102] Kravitz, M. and Gastaldo, V., *Emergency Management in the Arctic: The context explained*, p. 6 (Munk-Gordon Arctic Security Program).
[103] *Id.*
[104] Fournier, S. and Caron-Vuotair, M., *Changing Tides: Economic Development in Canada's Northern Marine Waters*, p. 12 (Conference Board of Canada, 2013).
[105] An Assessment of the Socioeconomic Impact of Internet Connectivity in Nunavut, p. 30. (Strategic Networks Group, 2012).
[106]Emergency Management in The Arctic, p. 6.
[107] Tanker Safety Expert Panel, Phase II, p. 12.
[108] Id., p. 18.

that it would take 48 hours to have equipment from Hay River on scene.[109] By comparison, Response Organizations operating south of 60 degrees must be able to deploy the same level of response equipment (capable of responding to up to 150 t of oil) within six hours (although only at designated ports). Additionally, because more time could be necessary to fly the 27 or so people needed to operate the Hay River equipment into the region, and because delays due to weather are a very real possibility, the first response could be delayed even longer.

It would likely take even longer for the equipment from Iqaluit to arrive. The CCG estimates a general timeframe of one week for deployment of the barge in Iqaluit to a spill site. However, this response time is a very general estimate provided for any of the 1000 t storage depots to any place in the Arctic.[110] More specific estimates for how long it would take have not been made for each community, and this should be done for local response plans. By comparison, Response Organizations operating south of the Arctic must be able to deploy the same level of response equipment (capable of responding to up to 1000 t of oil) within 12 hours (although again, only at designated ports).[111] Depending on where CCG boats were at the time of the spill, it could take days for the boat to reach the spill site. For example, during the grounding of the *Clipper Adventurer* in Coronation Gulf, it took four days for the first oil pollution response assistance to arrive.[112]

Additional delays could occur once the people and equipment are staged in the nearest community. One resident explained that a response to an emergency can be jeopardized by the lack of snowmobiles, ATVs, boats and motors, gas and oil, which "greatly hampers our response time. We spend the time trying to find people to volunteer their equipment."[113]

Response time is critical because the more time that passes, the more the oil travels and spreads. This makes shoreline protection and recovery more difficult because there is a larger area that is covered in oil and the patches that are thick enough to be picked up by skimmers become smaller. As the spreading increases, weathering will also increase, making the oil more difficult to contain and recover. High winds and rough seas would make matters worse. In addition, the longer the response time, the greater chances of the oil stranding onshore or mixing with or migrating under ice.

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[109] Central and Arctic Regional Response Plan, p. 5-12.
[110] Central and Arctic Regional Response Plan, p. 5-13.
[111] Marine Safety Directorate, Transport Canada, Response Organization Standards, TP 12401 E, Section 3(2) (1995). Response times for larger spills are also defined, and although these are not limited to responses within designated reports, they allow for longer time limits.
[112] Stewart, E. and Dawson, J., A Matter of Good Fortune? The Grounding of the Clipper Adventurer in the Northwest Passage, Arctic Canada. Arctic, Vol. 64, No. 2, p. 9 (June 2011).
[113] Emergency Management in the Arctic, p. 17.

Response gap

Arctic conditions can make the recovery of oil spilled from a ship in the Arctic much more difficult but they can also completely preclude any response efforts at all. A "response gap" exists when activities that may cause an oil spill are conducted during times when an effective response cannot be achieved, either because technologies available will not be effective or because their deployment is precluded due to environmental conditions or other safety issues.[114]

Environmental conditions that can prevent an attempted response include wave height, wind speed, air temperature, visibility, cloud ceiling, daylight, vessel superstructure icing, and ice coverage. For example, boom will only work in waves up to one metre high, or two metres if the waves are sufficiently spread out. Wind more than 15 metres per second will also make it impossible to contain the oil with boom. If visibility is less than one kilometre, it is extremely difficult to find and recover oil slicks, and no recovery can take place during darkness. If too much ice builds up on the boats or equipment, they will not be safe to operate.[115]

A study commissioned by Canada's National Energy Board assessed the response gap in West Central Canadian Davis Strait. The study found that during periods of open water, mechanical recovery would not be possible for 36 percent of the time in August, 48 percent of the time in September, 67 percent of the time in October, and 95 percent of the time in November.[116] The response gap assessment does not account for sea ice. Because there are many days throughout the season when ice coverage would preclude response, the response gap may actually be much greater.[117]

Although the study examines the response gap in a location to the east of Lancaster Sound, the analysis provides a general picture of the difficultly responding to a spill in the region. Additional, location-specific response gap analyses should be performed for each community engaged in local response planning, because it may point to the need for additional mitigation measures, such as tugs or closed areas.

VI. Existing environmental and subsistence information and maps

Maps that show details about important environmental resources, what the shoreline is made of, and how the shore can be accessed are important tools for a

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[114] Robertson, T., Response Gap Estimated for Two Operating Areas in Prince William Sound (Prince William Sound Regional Citizens Advisory Council, 2007).
[115] Ross, S., Spill Response Gap Study for the Canadian Beaufort Sea and the Canadian Davis Strait (2011), pp. 8-10. [Spill Response Gap Study].
[116] Id., p. 26.
[117] WWF-Canada, Letter of Comment, S.L. Ross Spill Response Gap Study for the Canadian Beaufort Sea and the Canadian Davis Straight, submitted to NEB, Arctic Offshore Drilling Review, NEB File: OF-EP-Gen-AODR 01, p.2 (September 7, 2011).

community in deciding how and where it will focus its response efforts if there is an oil spill. Certain shoreline types are more sensitive to oil pollution, and in some areas in the Arctic these areas have been mapped. In addition, the physical features of the shoreline and surrounding area will affect how and whether a shore can be protected.

There are various sources of information about the environmental resources in Grise Fiord, Pond Inlet, Resolute, and Arctic Bay, including maps identifying important areas. Although detailed coastal mapping for the Canadian Arctic is in progress, most maps are on a smaller scale (covering a large area) and identify only general areas of importance within and near each community. Many are not detailed or recent enough for community oil spill response planning purposes. The degree of community input in the creation of these maps varies, and is not always clearly stated.

An ECCC project used video and satellite images of the coastline in six different Canadian Arctic areas to identify baseline coastal information from 2010-2012. Known as the Emergency Spatial Pre-SCAT for Arctic Coastal Ecosystems (eSPACE) project, it is intended to provide baseline mapping to support a range of coastal planning activities, including oil spill response and cleanup efforts. This information was used to create the Beaufort Regional Coastal Sensitivity Atlas. The atlas uses shoreline classifications, including the use of an Environmental Sensitivity Index, and provides clean up strategies for shoreline types.[118] One of the other coastlines mapped by the eSPACE project includes Resolute Bay.[119] However, this information has not yet been used to create an atlas. Because of the extensive length of the Canadian coastline, the eSPACE project is investigating methods to create an automated system that can general baseline maps without intensive human input and manipulation.

The Government of Nunavut's DOE conducted the Nunavut Coastal Resources Inventory (NCRI). Inventories of Arctic Bay (2010) and Grise Fiord (2014) were completed. According to a review of these coastal inventories, the NCRI maps provide detail on locations, timing, distribution, diversity, abundance, and migration routes for many specific species, as well as specific travel routes, archaeological sites, campsites, and hunting and fishing areas used by local Inuit.[120]

Twenty-five years ago, the Nunavut Atlas was created to assist the Inuit in selecting the lands they would retain with the settlement of the Nunavut claim. Each section

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[118] Environment Canada, Beaufort Regional Coastal Sensitivity Analysis (2015).
[119] Wynja, V.et al, Mapping coastal information across Canada's northern regions based on low-altitude helicopter videography in support of environmental emergency preparedness efforts. Journal of Coastal Research, 31(2), 276–290 (2015).
[120] Impacts on LIA, p. 30. I was unable to location the Nunavut Coastal Resources Inventories on the internet.

contains an indexed map of the settlement area, maps illustrating and text describing land use and critical wildlife areas.[121] However, this atlas does not appear to be available electronically. Because of the time that has passed since these maps were created, they may not be as relevant today.

The NLUP process includes a variety of maps, some of which are on a large scale (close up) and include detailed community-specific information.[122] For example, the summary of community meetings for each community include maps identifying environmental, cultural, and historical resources and areas with potential for sustainable economic development. Schedule A of the Draft NLUP is a map of the entire region identifying land use designations. Schedule B is a map of the entire region identifying valued ecosystem and socio-economic components. The options and recommendations include a set of large scale maps identifying, among other things, key birds habitat, caribou use areas, polar bear use areas, beluga calving grounds, sea ice features, existing and proposed protected areas, and historical areas. [123] These maps could help communities identify spill response priorities.

The Pan Inuit Trails Atlas is a website-based map providing place names and trails throughout the Canadian Arctic. Place-names are linked to places of significance, and often denote important fishing and hunting areas and camps. The source maps can also be viewed through the atlas.[124]

A partnership between Nunavut Youth Consulting, the Geomatics and Cartographic Research Centre at Carleton University, and Nunavut Arctic College has created an online atlas called the Cybercartographic Atlas of Arctic Bay. The atlas includes an interactive spoken map of Inuktitut place names in the Arctic Bay Region.[125]

Project assessments for the Mary River Mine, developed by the project proponent, include fuel spill models with shoreline maps and information, but the detailed information is limited to Milne Inlet and does not extend as far as Eclipse Sound or Pond Inlet.[126] The coastal sensitivity mapping for the project focuses on the proposed southern shipping route and relies on Environment Canada's Arctic Environmental Sensitivity Atlas System (AESAS) for information about the northern

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[121] Riewe, R. Nunavut Atlas. Canadian Circumpolar Institute and the Tungavik Federation of Nunavut (1992).
[122] Nunavut Planning Commission, 2016 Draft Nunavut Land Use Plan.
[123] The original data sources for those maps may also contain detailed information. Nunavut Land Use Plan, 2016 Draft, Table 6.
[124] Pan Inuit Trails Atlas.
[125] Cybercartographic Atlas of Arctic Bay.
[126] Mary River Mine Final Environmental Impact Statement Appendix 9A, Milne Port Fuel Spill Modelling (Feb. 2012).

route.[127] The AESAS includes shoreline sensitivity mapping in Lancaster Sound and was last updated by Environment Canada in 2000 or 2004.[128]

On a smaller scale (covering a larger area), Fisheries and Oceans Canada compiled maps of ecologically and biologically significant areas in the eastern Arctic.[129] Pond Inlet, Arctic Bay, and Resolute are all within and adjacent to Ecologically or Biologically Significant Marine Areas (EBSAs), and Grise Fiord is flanked by EBSAs as well. Fisheries and Oceans Canada also mapped important ecological and biological marine features based on local knowledge.[130] These maps are helpful for a general overview but are not detailed enough for local response planning purposes.

WWF recently commissioned a report by Vard Marine Incorporated to support the NLUP process, and this report identifies some important marine and coastal resources on a small scale.[131] Because these maps cover a large area, they are also not very helpful for local response planning purposes.

In addition, planning documents for the Nanisivik Naval Facility Project include maps identifying, on a smaller scale that spans all four communities, wildlife areas of special interest, polar bear, walrus, ringed seal, bearded seal and harp seal range, important bird areas, key marine habitat, narwhal, beluga whale, killer whale, and bowhead whale range, subsistence and commercial fish and shellfish harvest locations, and protected areas.[132] Again, the large areas that these maps cover make them less helpful for community response planning.

VII. Shipping in Nunavut

Navigating in Nunavut waters is particularly risky due to the presence of sea ice, the low visibility from fog and from short daylight hours in the fall, and the lack of information and communication support for ships. Despite these risks, shipping activity in the Nunavut region is increasing. Most ship traffic is from adventure tourism, resource development, and community resupply, although some large vessels are now transiting the area in transarctic shipping. As the number and size of ships using Nunavut waters increases, the potential for spills and the

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[127] Mary River Mine Final Environmental Impact Statement Appendix 9C, Coastal Environmental Sensitivity Mapping (Feb. 2012).
[128] The atlas is referenced in the Beaufort Sea Atlas. However, the AESAS and information about its coverage is not easily found on the internet.
[129] Oceans and Fisheries Canada, Ecologically And Biologically Significant Areas In Canada's Eastern Arctic Biogeographic Region (2015).
130 Brown and Fast, An Overview Of Important Ecological And Biological Marine Features In Nunavut Based on Local Knowledge (2012).
[131] *Protection of Critically Sensitive Nunavut Marine Habitats*.
[132] Nanisivik Naval Facility Project Specific Information 4.48 to 4.67 (July 2013).

consequences of these spills also increases. During the NLUP meetings, Arctic Bay, Grise Fiord, Resolute, and Pond Inlet all expressed concerns about shipping.[133]

Information and communication support for ships

Safe navigation in Nunavut is challenging due to a number of factors. As described above, sea ice is present in Nunavut waters for most of the year. Even during periods of open water, sea ice, bergybits, growlers and icebergs are present, can be difficult to spot and can cause significant damage to a ship's hull.

Also, navigation is difficult because of the poor quality of charts. The Canadian Hydrographic Service (CHS) produces navigational charts for the region, which provide essential information to ships such as water depths and hazards. The CHS has incomplete hydrographic data for the Arctic, including the eastern part of the Northwest Passage and access to each of the four communities.134 The charts for the region are therefore not very detailed or accurate.135

Information for ships about sea ice and weather is also limited, making navigation more difficult. The CCG Marine Communications and Traffic Services (MCTS) is based in Iqaluit, 1000 kilometres from Pond Inlet and 1500 kilometres from Resolute and Grise Fiord. A base in Resolute, which operates from mid-July to late October, provides ship to shore communications, radiofacsimile weather and ice charts, and information on wind and ice conditions in specific areas.[136] In addition, ECCC's Meteorological Service provides, on a seasonal basis, daily weather and ice information based on imagery from satellites.

The Automatic Identification System (AIS) is an automatic tracking system used on ships and by vessel traffic services for identifying and locating vessels. AIS is an important tool for preventing ship-based spills because ships that are unexpectedly too close to shore or that appear to have lost power can be seen and a response can be activated to assist the ship before it runs aground. Information about a ship's location can be transmitted to satellites or to shore-based stations. Where AIS shore-based coverage is incomplete or satellite coverage is spotty, ships cannot be tracked in real time, limiting the effectiveness of this tool.

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[133] Nunavut Planning Commission, 2016 Draft Land Use Plan, p. 84.
[134] Report of the Commissioner of the Environment and Sustainable Development to the House of Commons, Chapter 3, Marine Navigation in the Canadian Arctic, p. 6 (Office of the Auditor General, 2014)[CESD Marine Navigation].
[135] Tanker Safety Expert Panel, Phase II, p. 24.
[136] Canadian Coast Guard, Radio Aids to Marine Navigation, Pacific and Arctic, part 2, pp. 7-12. (2015).

Shipping trends in Nunavut

Current shipping in the region consists mostly of passenger vessels (both entering and exiting the Canadian Arctic as part of a Northwest Passage, and larger cruise ships visiting the hamlets in the region), community resupply ships, tankers and general cargo vessels supporting the development of the Mary River mine, and government icebreakers.[137]

Grise Fiord and Arctic Bay gets the fewest number of ships, with community resupply and small adventure ships being the main source of traffic. Ships traveling the Northwest Passage travel past Resolute, and may call on that community and/or Pond Inlet. Pond Inlet, with the additional ships from the Mary River Mine, gets the most ship traffic.

During the 2013 open water season, there were 27 adventure and tourism voyages in the region, 12 of which were by passenger vessels (as opposed to smaller vessels such as yachts).[138] In the fall of 2016, the first full-sized cruise ship transited the Northwest Passage through Lancaster Sound. Eight tankers and 14 cargo vessel voyages also traveled in Lancaster Sound in 2013.[139] Also during the summer of 2013, the Nordic Orion, a ship carrying coal from western Canada to Finland, became the first bulk carrier to transit the Northwest Passage.[140]

The Mary River iron ore mine on Baffin Island, 155 kilometres south of Pond Inlet, is the only operating mine in the region. Ore is trucked from the mine to Milne Inlet, and then shipped through Eclipse Sound, passing Pond Inlet. The mine is operating year-round and stockpiling at Milne Inlet for shipping during the open water season. During the 2015 season, 13 voyages carried ore from Milne Inlet.[141] Additional vessels carried fuel for the mine.

Although Lancaster Sound has been identified as an area of high oil and gas potential, there is no exploration or production of hydrocarbons in the region. Until recently, Shell Oil held 30 exploration permits in the Sound, but has since relinquished them.

Potential future growth in shipping

As marine activity continues to expand in the Arctic, the potential risk of vessel accidents and oil spills also increases. Changing sea-ice conditions due to climate change, including calving of ice islands (from ice shelves) and more abundant small

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[137] Protection of Critically Sensitive Nunavut Marine Habitats, p. 20.
[138] *Id*., p. 21.
[139] Id.
[140] O'Rourke, R., Changes in the Arctic: Background and Issues for Congress p. 21(Congressional Research Service, 2016).
[141] Id., p. 5.

icebergs, also make the region increasingly hazardous to navigate.[142] Increased activity from passenger and re-supply vessels and natural resource projects is likely. The populations of Arctic Bay and Pond Inlet are projected to grow, which may lead to additional community resupply vessels.

Shipping from the Mary River Mine is also likely to increase. The company has applied for an amendment to triple the amount of iron ore currently permitted (from 4.2 to 12 million tonnes a year) and to extend the shipping season to 10 months a year.[143] The company proposes to use two ice breaking Post Panamax ore carriers to extend the shipping season from June to March. These carriers will transfer the ore to other carriers in Nuuk during the winter and in Eclipse Sound, near Pond Inlet, during open water periods.[144] "During the trans-shipment operation, up to five vessels will be active at the trans-shipment area in Eclipse Sound (one Cape size ore carrier, two purpose built self-discharging ore carriers, and two tugs). In addition, floating storage of fuel will be anchored nearby for refueling of the tugs."[145] The company anticipates 150 ore carrier voyages a year.[146] As of October 2016, the environmental review process for the amendment had yet to begin. The increase in Mary River Mine ship traffic will result in increased traffic traveling past Pond Inlet.

Although no other mines are operating in the area, there is ongoing exploration for diamonds and base metals.

In addition, the Canadian government has started construction to refurbish a deep-water dock and refueling facility in Nanisivik, 33 kilometres northeast of Arctic Bay, for use as a government refueling station from July to October. Two Arctic Offshore Patrol Ships are expected to use the station four to ten times per season. The facility may also be used to receive and distribute cargo from other government or commercial vessels. The facility is likely to result in some increase in ship traffic in Admiralty Inlet, near Arctic Bay, though how much this increase is remains to be seen.

As information and response services are further developed along the corridor, the use of Lancaster Sound is likely to increase. For example, in the spring of 2016, the Chinese government published Northwest Passage shipping operating manual to support Chinese cargo vessels traveling from China to the Northeast coast of North

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142 Canada's Marine Coasts in a Changing Climate, p. 181.
143 Indigenous and Northern Affairs Canada, Nunavut: mineral exploration, mining and geoscience overview, p. 46 (2015).
144 Baffinland Iron Mines Corporation, Mary River Project Phase 2, Second Amendment to Project Certificate No 005 Project Description, p. 12 (Oct. 2014).
145 *Id.* at 14.
146 *Id.*

America.[147] The CCG has begun the process of designating shipping corridors through the Northwest Passage. The initiative will identify routes within which key navigational information services will be prioritized, such as hydrography, icebreaking, and aids to navigation. The initiative identifies the route through Lancaster Sound as a primary corridor.[148] The establishment of the corridors may lead to increased traffic, as part of the objective of establishing the corridors is to incentivize their use.[149]

Potential spill volumes from ships near Pond Inlet, Arctic Bay, Resolute, and Grise Fiord

Oil can spill from a vessel's cargo (in the case of a tanker or barge) or its fuel tanks. Ships currently transporting hydrocarbons through the area carry refined petroleum products such as diesel, gasoline, and jet fuel.[150] Currently, no ships carry crude oil through the region, although this could change if offshore hydrocarbon development takes place.

The ships transiting Nunavut waters use a variety of fuel types for their own propulsion, with many of the larger commercial ships typically using heavy fuel oils (HFOs), which pose the greatest risk. HFOs are 50 times more toxic than medium and light crude oil spills and evaporate more slowly in cold environments such as the Arctic.[151] Intermediate Fuel Oils (IFOs) are a blend of marine gas oil and heavy fuel oil and are also more toxic and evaporate more slowly than lighter oils. Chemical or product tankers, passenger vessels, bulk carriers, container vessels, and refrigerator container ships typically use HFOs and IFOs.[152] Barring international agreement to ban HFO use in the Arctic, ship traffic fueled by HFOs and IFOs is likely to increase in Nunavut. In 2013, 23 ships made one or more voyage through Lancaster Sound using IFOs or HFOs.[153]

Other vessels use arctic diesel fuel.[154] Diesel is a more refined product than fuel oils, making it more likely to spread, evaporate, and dissolve. Diesel is a non-persistent fuel, meaning that it tends to degrade more quickly than persistent oils

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147 The People's Republic of China, China Daily, *China charting a new course for maritime transportation* (April 20, 2016).
148 *Northern Marine Transportation Corridors Initiative* (Canadian Coast Guard, 2015).
149 *Proceedings of the Northern Marine Transportation Corridors Workshop*, p. 4.
150 Tanker Safety Expert Panel, Phase II, p. 2.
151 Bornstein, J., et al, "Effects-driven chemical fractionation of heavy fuel oil to isolate compounds toxic to trout embryos." 33.4 *Environmental toxicology and chemistry* 814-824 (2014).
152 *Id.,* figure 5-12, p. 32.
153 *Protection of Critically Sensitive Nunavut Marine Habitats,* pp. 116-125.
154 Arctic diesel fuel is formulated to work at lower temperatures than regular diesel and has a somewhat lower viscosity.

(fuel oils or crude oils). However, diesel has a higher acute toxicity to animals, plants, and people when it is first released.

The size of an oil spill could range from a few liters spilled by a small boat to thousands of tonnes of fuel spilled by tanker or a large commercial vessel.

Fuel capacity for typical ships using Nunavut waters

Bulk carriers and cruise ships are vessels currently operating in Nunavut waters using HFO/IFO, and they carry from 2000 to 3000 t of fuel. For example, the bulk carrier Nordic Orion, notable as the first bulk carrier transit of the Northwest Passage in 2014, carried around 2500 t of fuel.[155] The Nordic Oshima, which serves the Mary River Mine and is similar to the other ore carriers serving the mine, is slightly larger with a fuel capacity of more than 2800 t.[156] In 2014, the Nunavik, an ice-strengthened ore carrier, made the first unsupported trip from near Deception Bay, in Quebec's Nunavik region, to northeastern China. The ship carried around 2020 t of IFO.[157] It is unclear how closely the ships transiting Lancaster Sound come to the coastline or to Nunavut villages.

Typical dry cargo vessels (providing community resupply) currently in the Eastern Canadian Arctic probably carry less than 1000 t of fuel,[158] but the average general cargo vessels carry around 2000 t of fuel.[159] Thus, if larger vessels are used in the future to meet the demands of growing communities, the amount of fuel used by these vessels will be greater.

The Crystal Serenity is a 68,870 GT cruise ship that travelled through Lancaster Sound and stopped in Pond Inlet during its cruise through the Northwest Passage in 2016. The fuel capacity for this vessel is approximately 3085 t. The ship voluntarily ran on low sulfur fuel, although most large passenger ships do not, and can hold thousands of tonnes of HFOs.[160]

Tankers carrying fuel to the Mary River Mine carry up to around 4500 t of diesel,[161] while community re-supply vessels carry up to around 18,000 t of fuel oil.[162]

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[155] Based on worst-case discharge as reported to U.S. Coast Guard in Vessel Response Plan.
[156] Based on worst-case discharge as reported to U.S. Coast Guard in Vessel Response Plan.
[157] Fednav: Nunavik. http://www.fednav.com/en/nunavik.
[158] Typical dry cargo vessels today are around 12,000 DWT. Wright, C., *Navigability Of The Canadian Arctic* (2012), p. 8. These ships are likely to have tank capacities that are less than 1000 tonnes.
[159] *Aleutian Island Risk Assessment, Task 2A: Marine Spill Frequency and Size Report* (DNV and ERM-West, 2010), p. 9. [*AIRA Spill Frequency and Size*].
[160] The average fuel capacity for passenger ships transiting the Aleutian Islands, for example, is 1,750 tonnes. *AIRA Spill Frequency and Size,* p. 9.
[161] See Baffinland Iron Mine Corporation, Final EIS, Appendix 9A, Milne Port Fuel Spill Modelling, p. 2 (Feb 2012) (assuming 5 million liter cargo).
[162] *See, e.g.,* Grise Fiord Environmental Emergency Plan at 94 (10-20 million liter cargo capacity); Resolute Bay Environmental Emergency Plan at 96 (13 million liter cargo capacity); Pond Inlet

However, the risk that these vessels will spill oil is reduced as a result of double hulls for tankers.

In addition to increasing traffic, ships are using and will continue to use Nunavut waters for longer periods each year because the sea freezes over later each season. Ships are therefore in Nunavut in the fall, when daylight hours are quickly diminishing and reduced visibility becomes an additional risk factor.

VIII. Conclusions

A framework for local spill response planning should include a process for inventorying locally and regionally available resources and evaluating the capabilities and limits for responding to potential spills. The framework should evaluate equipment along with infrastructure and logistics, and should recommend options for filling gaps in preparedness.

The communities of Pond Inlet, Resolute, Arctic Bay, and Grise Fiord are not prepared for a ship-based spill. As this report notes, Grise Fiord has no CCG-stockpiled oil spill response equipment and the other three communities have equipment that could clean up only a very small amount of oil. Furthermore, the condition of this equipment is uncertain and not checked regularly. Although additional response equipment is stored in Hay River and Iqaluit, it is unclear how or whether that equipment could be used in the Nunavut communities. The distance of these communities from larger population centers and the lack of infrastructure would make the cascading of people and equipment extremely challenging. In addition, the weather could prevent the transport of equipment and people to the spill site.

With only a few ships outfitted with minimal response equipment and spread out over a large area of the Canadian Arctic, the CCG is unlikely to reach a spill quickly or be able to clean up significant amount of oil. Moreover, there is no CCG process in place to ensure that sufficient equipment will ever exist in any of the villages to clean up the amount of oil that could spill from ships currently traveling in the region. The ships themselves are not required under Canadian law to carry their own spill response equipment or to have contracted response capacity in the Arctic.

As a result, community response planning should begin with an assessment of the worst case discharge that is possible and the resulting equipment and people that would be needed to respond to this worst case scenario. Based on this understanding, the communities should also assess how and to what degree outside resources might assist in meeting these response needs by determining

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Environmental Emergency Plan at 93 (19-20 million liter cargo capacity); Arctic Bay Environmental Emergency Plan at 96 (19-20 million liter cargo capacity).

how people and equipment could be brought into the area and how long the process would take. Because weather can limit the transport of equipment and people into town, weather limitations should be factored into the logistical analysis, such as by determining how likely it is that flights might be cancelled.

Because of the significant limits of weather, communities should also conduct response gap analyses to get a better understanding of when and how long the periods are when no response would be possible. The limits to response are based not only on the operational constraint of equipment, but also on personnel health and safety. Air and water temperatures, combined with wind speed, determine whether it is safe for people to response to a spill and local response plans should incorporate this information.

These analyses would help to provide a clearer picture of the limitations to response and could point to the need for strengthened prevention measures to address risks that cannot otherwise be addressed.

The communities can also identify existing resources that could be developed and strengthened. For example, Nunavut's PPD has some equipment and trained personnel, as does the Mary River Mine and possibly the Naval facility will as well. Communities can explore opportunities to work with the Nunavut PPD and project proponents to stockpile additional equipment and increase response training.

In addition to a lack of response equipment, Nunavut communities do not have adequate response plans. The CCG area response plans for the communities provide very little information about how important resources should be protected and how fuel should be recovered. Therefore, communities can also support the development of local response plans by identifying priority areas for protection and ensuring that adequate maps and site specific strategies exist that can be used during an oil spill response.

Local response plans can also assess the communications systems that would be available for response operations and be designed accordingly.

A framework for local spill response planning should provide a mechanism for communities to work in partnership with other levels of government to assess and improve the existing regime. The framework should identify priorities and consider implementation pathways – which may include the need for legislative change – in order to achieve the goal of enhanced, community-based preparedness.

Engagement by the communities in government permitting and planning processes may help the communities to gain support for local response planning efforts. The hamlets of Nunavut can consider priorities for protecting their resources from the impacts of a spill and identify the ways in which they'd like to be more involved in

federal response planning regime. These efforts can lead to support for community-based response plans, which hamlets can seek to incorporate into existing and updated area plans.

In addition, communities can seek support for stronger response capacity by advocating for changes to the regulatory regime, such as for provisions that would ensure each community has equipment to respond to a spill of a certain size (greater than the 1 t currently available in the community packs).

A framework for local spill response planning should inventory available information and data and include a mechanism to incorporate local and traditional knowledge from risk assessment and planning through response and recovery. It should also include policy recommendations as they relate to community priorities for risk evaluation and spill response.

The communities of Pond Inlet, Resolute, Arctic Bay, and Grise Fiord have community members with unique and critical knowledge of natural resources, local navigational conditions, and infrastructure/logistics that are valuable to oil spill contingency planning and response. This information should be incorporated into local response plans and inform policy recommendations related to federal planning efforts.

In sum, by assessing existing resources, logistical considerations, community priorities, and response limits, Nunavut hamlets can identify how to increase their local response capabilities. This information can inform the development of local response plans, be incorporated into federal response planning efforts, and support advocacy for increased government support and improved response planning regulations.

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