NEW IMO/EPPR GUIDES TO ARCTIC OIL SPILL RESPONSE – STRATEGIC AND OPERATIONAL

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ABSTRACT

In 2015 and 2016, two complementary projects produced both a new strategic guide (in two versions) and an updated operationally oriented guide to assist managers, regulators and responders in responding effectively to oil spills in snow and ice conditions. The objective of the first initiative, which began as a Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) project, a "Guide to Oil Spill Response in Snow and Ice Conditions", was to identify and describe the strategic aspects of planning and operations. This program gained a separate phase through the Emergency Prevention, Preparedness and Response (EPPR) working group of the Arctic Council to adapt the Guide specifically for Arctic waters. The second initiative by EPPR was to update the 1998 "Field Guide for Oil Spill Response in Arctic Waters" while retaining the original operational focus. The 2016 version of the Field Guide incorporates major revisions and updates to sections on strategies and countermeasures, for example the use of herders and burning, dispersants in ice and specialized brush skimmers as well as advances in remote sensing and tracking. In addition, new sections address important topics such as Health and Human Safety, Logistics and Wildlife Response.

The overall goal was to produce two complementary documents that provide a broad base of essential information to key decision-makers and responders at both the strategic planning level and at the field tactics and operations level.

These two projects bring together a wide range of new knowledge generated over the past two decades that make many previous manuals and documents out of date. With such a vast amount of recent literature, the new strategic guide and the operational field guide update can only provide a brief summary of the new material but are valuable tools to indicate where the more detailed documents can be found.

INTRODUCTION

The many different forms of Arctic ice and coastal environments present a wide range of challenging scenarios that must be understood for planning, preparing and implementing an effective oil spill response. A key element is to provide responders with the flexibility to use the full suite of potential countermeasures while they are still appropriate and effective. There is a strong need for a rigorous, scientifically defensible, streamlined process to rapidly assess the environmental trade-offs and to process the necessary approvals needed to use dispersants and *in situ* burning before changes in oil properties due to weathering limit the windows of opportunity.

In remote arctic regions, logistics limitations and sparse infrastructure favour offshore response strategies built around air support and shoreline response focused on *in situ* treatment options. Operational and safety challenges posed by long periods of darkness, variable ice conditions, and extreme temperatures require a continuous process of risk management linked to responder health and safety as part of contingency planning and exercising.

A goal of the joint program presented in this paper was to produce three complementary documents (two new and one update) that provide a broad base of essential information to key decision-makers and responders at both the strategic planning level and at the field tactics and operations level.

The common objective of the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) "Guide to Oil Spill Response in Snow and Ice Conditions" (IMO in press) and the Emergency Prevention, Preparedness and Response (EPPR) working group of the Arctic Council "Guide to Oil Spill Response in Snow and Ice Conditions in Arctic Waters" (EPPR 2015) is to identify and describe the strategic aspects of planning and operations. This guide consolidates the findings of many recent international research projects, such as the SINTEF JIP Oil in Ice and IOGP Arctic Response Technology Joint Industry Programs as well as the preparedness and planning tools produced over the last decade by IMO, IPIECA, the Arctic Council and other agencies.

The 2016 version of the 1998 EPPR "Field Guide for Oil Spill Response in Arctic Waters" (EPPR in press) incorporates major revisions and updates to sections on strategies and countermeasures, for example the use of herders and burning, dispersants in ice and specialized brush skimmers as well as advances in remote sensing and tracking. In addition, new sections address important topics such as Health and Human Safety, Logistics and Wildlife Response.

Each of the two new strategic planning guides (EPPR, 2015; and IMO in press) was reviewed by MEPC/IMO and EPPR member states and other relevant organizations, such as the International Tanker Owners Pollution Federation (ITOPF) and the World Wildlife Fund (WWF). As the IMO Guide was an original document, the first task in this project was to create a detailed annotated Table of Contents that was reviewed and approved prior to commencement of the report

preparation. It is significant to note that the review process resulted in a number of valuable improvements to the structure of the Guide.

The new IMO and EPPR Guides were managed through the Norwegian Coastal Administration and the EPPR Field Guide update was managed through the Prince William Sound Science Centre in Alaska.

This paper describes the driving forces behind this double initiative and the scope and content of the reports.

IMO - EPPR "GUIDE TO OIL SPILL RESPONSE IN SNOW AND ICE CONDITIONS"

The purpose of this Guide is to provide a better understanding to assist managers and decision makers in recognising and addressing key issues and potential response options at the strategic planning level. The Guide is:

- Generic (while pointing out key differences in regional ice regimes and marine activities),
- Strategic (focusing on what response managers and decision makers need to know),
- Relevant for all areas with ice and snow that have a risk for oil spills, and
- Focuses on:
  (a) ice and snow oiled from potential marine sources, as well as
  (b) ice and snow in the coastal/marine environment oiled from potential terrestrial sources.

This Guide is not intended to serve as a stand-alone "how to" manual. Its purpose is to complement existing field manuals that provide more technical step-by-step advice for managers and responders at the operations and tactics levels (for example: Alaska Clean Seas, 2013; EPPR, 1998 and EPPR, in press). The major topics covered in this strategic guide are listed in Table 1.

In general, the EPPR document is similar in approach and layout to the IMO Guide but without material that relates to Antarctic or lower latitude environments with annual ice cover, such as the Great Lakes, St. Lawrence River Estuary, Labrador Coast and the Caspian Sea. Notably, the new "Arctic" version does include the Baltic Sea and Sakhalin Island region.

The objective of the Guide is to identify and describe those aspects of strategic planning and operations that are directly associated with a response to an oil spill in ice and snow conditions. Response strategies to deal with oil spills in summer open water conditions are not specifically considered.

The Guide encompasses a wide range of concepts and information that fall into the two very different, but closely linked, strategic components of: 1) Planning and Preparation for an incident, and 2) the Implementation of Response Strategies. The summary points from the Guide on the following pages are not presented in an order of importance: in fact, for the most part they are all important, as one component cannot be considered in isolation for strategic planning, preparedness, and implementation.

One summary point deserves special attention for remote polar regions especially: the need to have a rigorous, scientifically defensible, streamlined process in place to rapidly assess the environmental trade-offs and process the necessary approvals needed to use the most beneficial response strategy or mix of strategies. The goal is to maximise access to all the available options in an emergency, where they are appropriate and effective. Giving responders this flexibility is crucial to ensuring success of any spill response; linked with the need for thorough contingency planning and drills in advance.

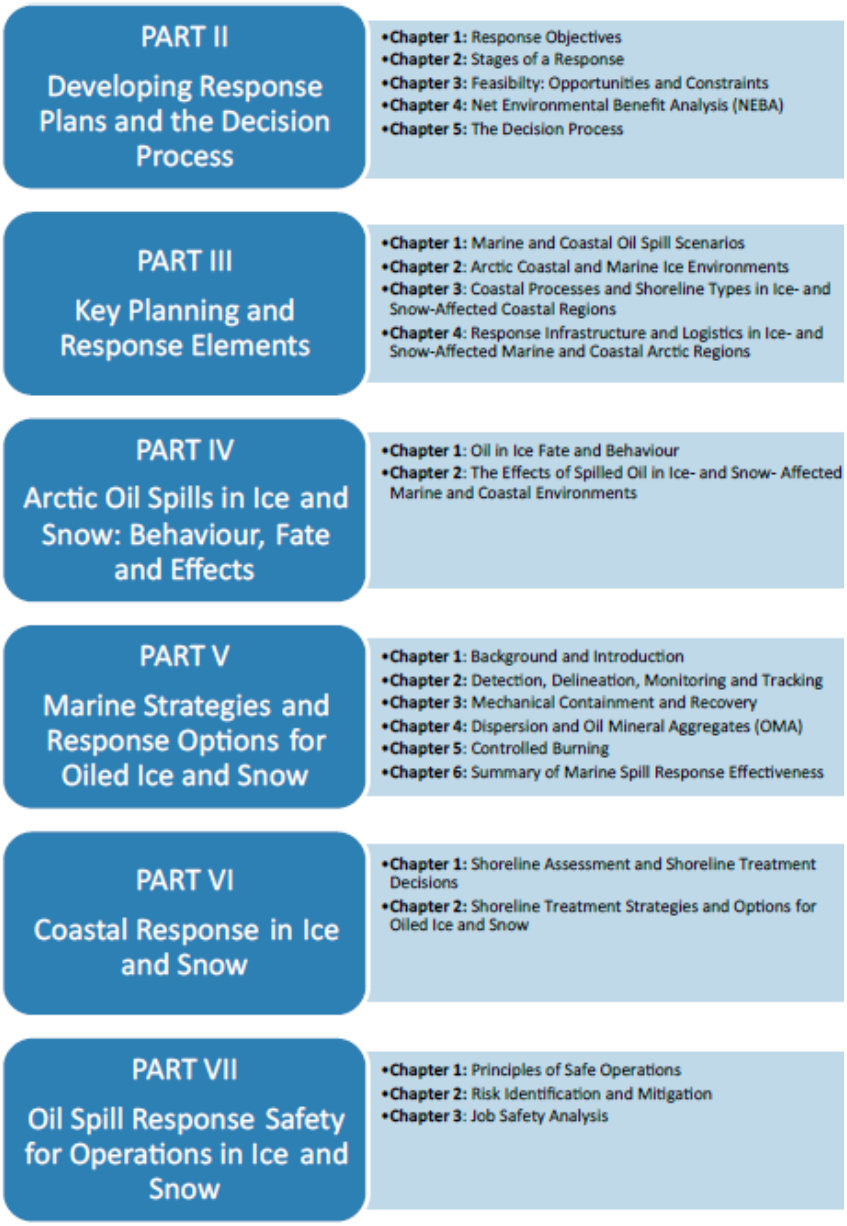

Figure 1 Structure of the IMO/EPPR "Guide to Oil Spill Response in Snow and Ice Conditions" (from EPPR 2015)

Summary Points from the EPPR Guide: Planning and Preparation

1. Oil spill response management, organisation, planning, decision-making and notification procedures are not uniform worldwide, but frequently follow best practice. Planning, preparation and training for a response to oil spills in ice and snow typically have different goals and objectives depending on (a) the ice regime and ice cycle in a given area, and (b) the extent of supporting infrastructure (IPIECA/OGP 2014).
2. Many polar areas have challenging weather conditions and low populations with limited infrastructure.
3. Multiple sources of oil spills in ice-affected areas include marine activities connected with oil and gas exploration/production, cargo vessels, research vessels, cruise ships, drilling operations and pipelines. Although still small in absolute numbers compared with other world trade routes (Suez, Panama, Straits of Malacca, etc.), the gradual increase in vessel traffic along the Northern Sea Route (NSR) and other ice-covered areas, generates an associated increase in spill risk. Assuming that the potential for spills from vessel accidents is directly related to traffic intensity, the Baltic Sea stands out with the highest risk region covered in this Guide in terms of the numbers of vessels engaged in regular operations in ice.
4. Planning for the credible worst-case discharge is a primary requirement for new drilling applications but the frequency of such events is extremely remote compared to smaller Tier 1 or 2 spills. In 40 years of offshore drilling in Arctic waters, there has never been a Tier 3 incident. Areas in this Guide with the highest current concentration of offshore year-round oil production with seasonal ice include: Sakhalin Island, Alaska North Slope, Cook Inlet, Bohai Bay and the Pechora Sea. Most of the presently planned oil exploration programmes in areas affected by ice are designed and permitted for completion during the summer open water period. Spills from those activities are unlikely to occur with ice present under normal circumstances but contingency plans must take this possibility into account.
5. Sea ice structure, morphology and properties span a wide range of conditions, including ice formed in brackish low salinity water ice such as found off major river deltas and in estuaries (e.g., Lena, Colville, Mackenzie, Gulf of St. Lawrence, Caspian Sea), freshwater ice in rivers, freshwater Great Lakes ice and ice formed from very low salinity waters in the Baltic Sea. Differences in behaviour of oil in ice at different times in the ice cycle and in different areas affect every aspect of response planning and preparation. These include key characteristics such as: ice concentration or coverage, stability, drift rate, roughness, and timing of the spill relative to freeze-up or break-up. Planning response objectives, strategies, and tactics must reflect the timing of a response within the regional and local seasonal ice/snow cycle.
6. Ice often extends the time available to plan and execute an offshore response by containing, concentrating, and trapping the oil for long periods in a close to fresh state. At the same time, low temperatures, snow cover, and increased oil thickness can reduce the rate of evaporation and lead to longer persistence. Although ice in sufficient concentrations may reduce the oil spreading and weathering rate, it will also greatly complicate the detection and

mechanical recovery of spilled oil. Intermediate drift ice concentrations often referred "broken ice" may prove particularly challenging.

7. Landfast ice in many areas can act as an impenetrable barrier and protect the shoreline from direct oiling following an offshore spill for much of the year.
8. Some shore processes and shore types are unique to the presence of ice and snow. Seasonal or year-round shore ice can be a dynamic process or a stable feature and the presence of ice and snow can completely alter the shore zone character.
9. In terms of fate and behaviour, spills in ice are fundamentally different from spills in open water. Understanding this difference is critical for detection, trajectory analyses and strategic planning. Response techniques that work in open water and temperate regions may be ineffective or provide much reduced effectiveness in cold, snow, and ice.
10. The sensitivity and vulnerability of potential resources at risk vary significantly in time and space in areas with seasonal ice cover and snow. Many species adopted to life in polar regions or areas with a seasonal ice cover are highly mobile or only present during the spring, summer, and fall: such as migratory waterfowl, and bowhead and beluga whales. Fewer resources may be at risk when ice and snow are present through the winter.
11. The coastal environment is the breeding and nursery ground for many species upon which subsistence coastal inhabitants depend. From a human perspective, this coastal/nearshore zone is generally the most sensitive and vulnerable environment in the Arctic. Two primary objectives of regional and local response strategies are to prevent oil from reaching the coast and to protect those resources at risk. Responders should be aware that pelagic ecosystems and resources are critical throughout the polar regions and that response priorities and objectives should be developed using up- to-date "resource at risk" information, and in consultation with local experts.

Summary Points from the EPPR Guide: Response and Implementation

1. Although, in theory, there are several strategic tools in the responder toolkit, using these effectively in a real incident could be extremely challenging depending on many factors, such as: coping with the dynamic nature and unpredictability of ice; the remoteness and great distances that are often involved in responding in areas like the Arctic and Antarctica; the impacts of cold temperatures, ice and a harsh operating environment on response personnel and equipment; and the frequent lack of shore-side infrastructure and communications to support and sustain a major response effort such as waste disposal.
2. Any significant ice concentrations can severely limit the effectiveness of mechanical containment and recovery in dealing with large spills. At the same time, the presence of ice can potentially increase the window of opportunity for successful burning and/or dispersant applications (that period when the oil remains unemulsified, thick and relatively fresh).
3. The availability of a scientifically defensible, streamlined process to rapidly assess the environmental trade-offs and process the necessary approvals related to the use of dispersants and *in situ* burning can provide the key to response success, especially in remote polar

regions. Maximizing the utilization of potentially limited operational windows, when the oil is still in a form amenable to recovery or removal, is an important objective of strategic and contingency planning.

4. Detection of oil in ice and under snow is challenging and may require a mix of sensors and platforms including satellite, airborne, surface and subsea.
5. Logistics limitations and sparse infrastructure in many remote areas with ice may favour response strategies built around air support.
6. Operational and safety challenges posed by long periods of darkness and extreme temperatures that are typical in marine and coastal environments with ice and snow, require a continuous process of risk assessment: safety of personnel is always paramount.
7. The selection of response strategies should be based on scientific principles embodied within the process of Net Environmental Benefit Analysis (NEBA - now known as Spill Impact Mitigation Assessment or SIMA): including the option of natural recovery. Responders also should be mindful that spills and response strategies can have significant effects on local and indigenous communities and subsistence users and that these concerns need to be considered in parallel with the NEBA/SIMA.
8. Decisions on strategies for remote area oiled shoreline operations should focus on the use of *in situ* treatment options to minimise manpower requirements and waste generation.
9. Shoreline processes and shoreline character change with the seasons so that different strategies and tactics are necessary at times and in places where ice and/or snow are present.
10. The application of proven response decision-making through some form of Unified Command and spill management structure is no different for a spill in ice than in more temperate waters: the fundamental precepts and priorities remain the same. Subsistence issues may have a higher priority than in temperate zones.

EPPR FIELD GUIDE FOR OIL SPILL RESPONSE IN ARCTIC WATERS

This Guide originally developed in 1998 is intended to serve as a stand-alone “how to” manual and to summarize and complement existing field manuals that provide more technical step-by-step advice for managers and responders at the operations and tactics levels (for example: ADEC 2010, Alaska Clean Seas, 2013). This second edition incorporates major revisions and updates to sections on strategies and countermeasures, for example: the use of herders and burning, dispersants in ice and specialized brush skimmers as well as advances in remote sensing and tracking.

The revision of the EPPR Field Guide for Oil Spill Response in Arctic Waters was based on:

- Initial development of an extended Table of Contents (TOC) for review and comment by the EPPR working group to ensure that the scope, format and content are agreed upon and that the project is on track before writing is initiated.

- Restructuring and reorganization of the first edition to be more user friendly (primarily by removal of duplications).
- Incorporation of new knowledge and information into a revised text.
- Addition of an introductory "Initial Response Guide" for first responders (Figure 2)
- New sections on "Health and Human Safety in the Arctic", "Wildlife Response in the Arctic", and "Logistics and Response Strategies in the Arctic".

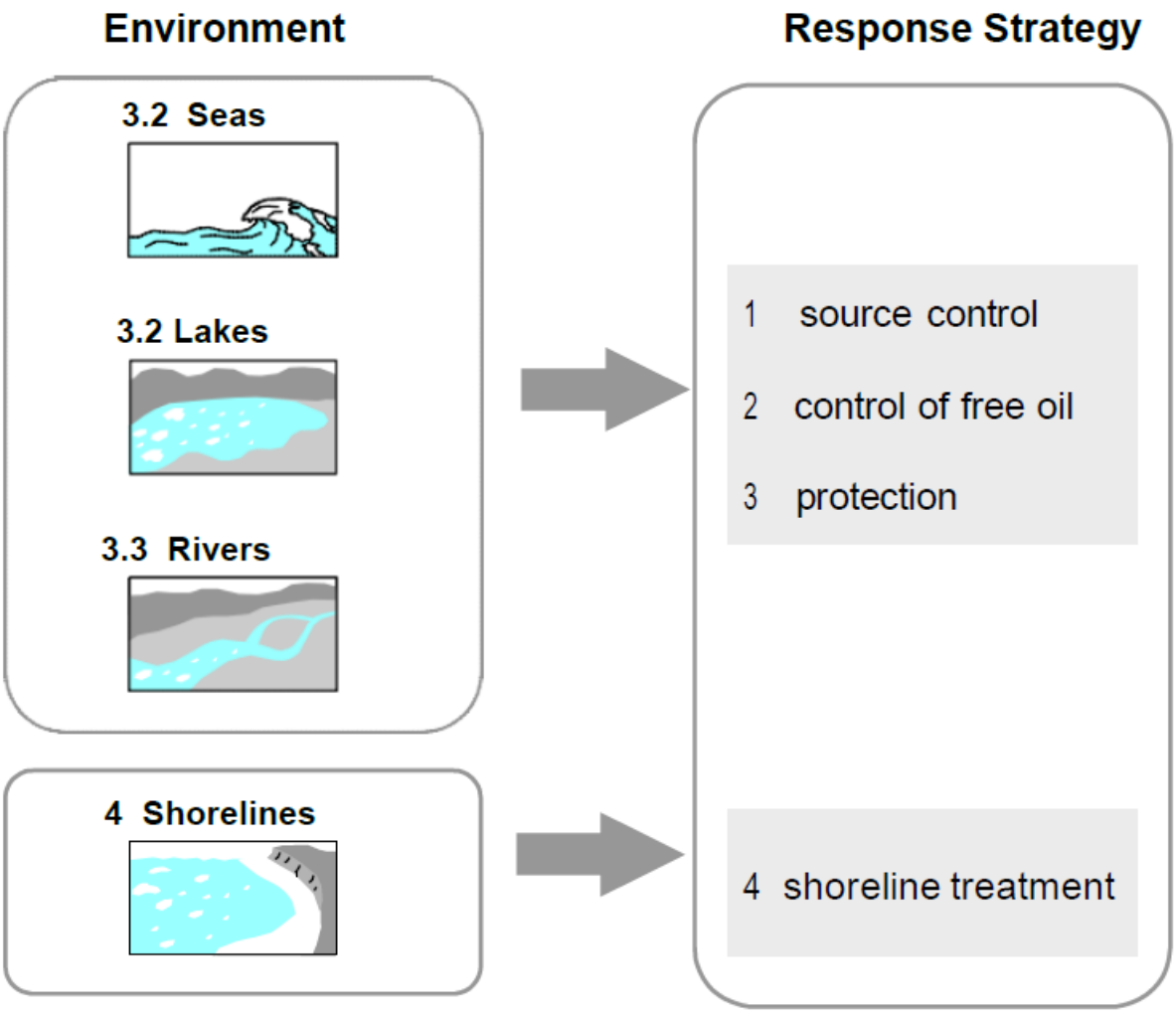

Figure 2 EPPR Field Guide new Initial Response Guide format

A series of figures were relocated into the Initial Response Guide (Section 3) to provide a "quick look" first responder summary of response techniques for seasonal water/ice conditions. The figures follow the first edition pictorial-style form presentation with a set of icons to present the countermeasure options (Figure 3).

Environment			Response				
Season	Water/Ice Conditions	Oil Location	Countermeasures			Feasibility	Waste Management
			contain/recover	burn	disperse		
	• no ice • open water		F B	A		○	• barge • tanker • workboat • towable tank
			G			●	
	• open water • ice floes • broken ice • frazil/grease ice • slush • pancake ice		E F B	A C		○	• barge • tanker • workboat
			G			●	
			E B	C		◒	
	• solid ice • multi-year ice • ice floes • broken ice • brash ice • ice hummocks		D E B C	B		○	• drums • tanker truck • workboat • porta-tank
			E B C			●	
			E B C	B		◒	
	• open water • ice floes • broken ice • melt pools • leads		E F B	A C		○	• barge • tanker • workboat
			G			●	
			E B	C		◒	

Table 3 Example of Initial Response Guide for Control on Rivers: with and without ice

Knowledge and information from major recent contributions to oil spill response in the Arctic in the revised EPPR Field Guide included, among others:

- multiple Arctic Council projects (2005 "Arctic SCAT Manual", 2009 "Oil Spill Waste Management Guidelines", 2012 "Health, Safety, and Environmental Management Systems", 2014 "Arctic Offshore Oil and Gas Guidelines -Systems Safety Management and Safety Culture"),
- projects associated with the 2006-2009 SINTEF Oil in Ice JIP and the 2012-2017 IOGP Arctic Response Technology-JIP, and the 2012 API publication "Spill Response in the Arctic Offshore", and
- US National Academy of Sciences "Responding to Oil Spills in Arctic Marine Environments" (NRC 2014).

CONCLUSIONS

These two projects are based on significant recent improvements in knowledge and understanding based largely on newly acquired field experience. The reports bring together a wide range of new materials generated over the past two decades that had make many previous manuals and documents out of date. With such a vast amount of recent literature, the strategic

Guide and the operational Field Guide only provide a brief summary of the new material but are valuable references to where the more detailed documents can be found.

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