A SCAT Manual for Arctic Regions and Cold Climates

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Abstract

The *Shoreline Cleanup Assessment Technique* (SCAT) provides a systematic approach—based on standard terms and definitions—for describing and documenting oiled marine or lake shorelines and riverbanks. A new field guide has been developed that adapts the terminology and definitions for shorelines or riverbanks that are oiled in winter months and in arctic environments. The consideration of snow and ice conditions has involved some modification and adaptation of the standard approach to take into account shorelines that are ice and unique arctic shoreline types, such as tundra cliffs, inundated low-lying tundra, and peat shorelines. New materials that have been developed for this field guide include: a set of shoreline oiling forms for marine coasts, tidal flats, wetlands, lake shores, riverbanks, stream banks, and tar balls; shoreline and riverbank "short" forms for First Responders; text on cleanup methods for snow and ice, and for peat and tundra shores; an illustrated glossary of arctic shoreline types; and a job aid with colour photographs that illustrate the various forms of shoreline ice and snow conditions found in arctic regions and on cold-climate coasts and riverbanks.

1 Introduction

The *Shoreline Cleanup Assessment Technique* (SCAT) process is now a familiar part of oil spill response in many countries. SCAT teams play a key role in the assessment of the scale and scope of shoreline response programmes. The SCAT approach and documentation protocols were initially developed in 1989 during the *Nestucca* and *Exxon Valdez* spill response operations. Subsequently, Environment Canada developed generic second-generation SCAT protocols to standardize the documentation and description of oiled shorelines (Owens and Sergy, 1994).

Since its inception, the SCAT approach has been used on many spills, in a variety of ways, and has been modified by SCAT teams to meet a range of specific spill conditions. *The SCAT Manual: Second Edition* (Owens and Sergy, 2000) was produced to reflect updates and modifications derived from user experience and interagency adaptations. Neither this nor any other documents, however, fully address the seasonality issues in a SCAT programme, or the characteristics or implications of northern climates dominated by snow and ice conditions.

To address these issues, production of *The Arctic SCAT Manual* (Owens and Sergy, in press) was initiated by Environment Canada and the United States Coast Guard; an action supported by National Oceanographic and Atmospheric Administration in Alaska and by private spill response and advisory services. The

manual was produced under the auspices of the Emergency, Prevention, Preparedness, and Response (EPPR) Working Group of the Arctic Council.

The Arctic SCAT Manual is compatible and consistent with *The SCAT Manual: Second Edition.* The Arctic Edition, however, provides new material on:

- The unique shoreline types found in arctic regions;
- The character of the various forms of snow and shore-zone or nearshore ice forms in the Arctic or in other cold climate regions during winter months;
- The behaviour of oil;
- The activities of SCAT teams in these environments; and,
- A First Responders' Guide and short versions of two key shoreline oiling summary forms that can be used by local inhabitants during the initial phase of an assessment.

2 New Material in the Manual

2.1 The Documentation of the Character of Snow and Ice

The range of standard forms used to document oil on shorelines and riverbanks has been adapted for use in arctic regions and in any cold climate region during periods of snow and ice. The new forms presented in the manual are:

Arctic Shoreline Oiling Summary	(**ASOS**)
Short Arctic Shoreline Oiling Summary	(**SASOS**)
Winter Tidal Flat Oiling Summary	(**WTFOS**)
Winter Wetland Oiling Summary	(**WWOS**)
Winter Lake Shore Oiling Summary	(**WLSOS**)
Winter Riverbank Oiling Summary	(**WRBOS**)
Short Winter Riverbank Oiling Summary	(**SWRBOS**)
Winter Stream Bank Oiling Summary	(**WSBOS**)
Winter Tar Ball Summary	(**WTBS**)

For the most part, these forms are identical to the standard SCAT forms, with the addition of boxes in section 4 of each form to describe snow and ice conditions in the segment (Figure 1).

All of the forms can be downloaded in .pdf or MS Excel format from the Environment Canada (http://www.etc-cte.ec.gc.ca/estd_west/index_e.html) or the Polaris Applied Sciences, Inc. (http://www.polarisappliedsciences.com) websites.

ARCTIC SHORELINE OILING SUMMARY (ASOS) FORM Page _____ of _____

4B SNOW and ICE CONDITIONS		*circle all tidal zone locations as necessary - Lower : Middle : Upper : Supratidal*			
snow:	cover _____%	**frozen spray:**	width _____m	**ice foot:**	width _____m
	thickness _____cm		thickness ____cm		thickness _____cm
	fresh Y / N	**frozen swash:**	width _____m		location L M U S
	compacted Y / N		thickness ____cm	**ice push ridge**	width _____m
	location L M U S		location L M U S		thickness _____cm
glacier ice:	height of ice front: _____m	**grounded floes:**	ave. length _____m		location L M U S
	floating front: Y / N		ave. thickness _____cm		
			location L M U S		

4C NEARSHORE ICE CONDITONS	*circle one in each of the three categories*	
CONCENTRATION: 0/10	***FORM: (m)***	***AGE and thickness (cm):***
open drift < 1/10	pancake 0.3 -3	small floes 20-100	new = frazil-grease-slush		
very open drift 1/10 - 3/10	brash < 2	medium floe 100-500	nilas or ice rind	< 10	age unknown ___
open drift 4/10 - 6/10	ice cakes < 20	big floe 500-2000	young: grey-white	10-30	
close pack 7/10 - 8/10	none Y	vast-giant floe > 2000	first year	> 30	
very close pack 9/10	**Fast ice: Y /N**		second year	> 250	
compact ice 10/10	**Tidal Cracks: Y / N**		multi year	> 300	

Figure 1 Format for the description of (4B) shore-zone Snow and Ice Conditions and (4C) Nearshore Ice Conditions in the ASOS form

Seven snow and ice categories are used to summarize the shore-zone conditions (Table 1). The nearshore ice terminology follows that of NOAA (2000). A new Job Aid (Section 3, below) provides colour examples of these seven categories.

Table 1 Terms and Acronyms to Describe Shoreline Ice and Snow Conditions

Snow	**SNW**
Frozen swash	**FSW**
Frozen spray	**FSP**
Ice foot	**IFT**
Ice-push ridge	**IPR**
Grounded floes	**GFL**
Glacier ice	**GLC**

2.2 Arctic Coasts, Shoreline Types, and Oil

Three shoreline types are common in the Arctic as a result of the presence of permafrost and tundra in the coastal zone regions: tundra cliffs, peat shorelines, and inundated low-lying tundra (Owens and Michel, 2003). The “shoreline type” box of the new Arctic Shoreline Oil Summary (ASOS) form contains check-off information for these three shore types, in addition to that for the standard mid-latitude shore types that are also found in the arctic or cold-climate regions.

The support materials in the manual include text on the physical shore-zone character and coastal processes of Arctic Canada and Alaska. Text on oil behaviour on snow and ice and on the three “arctic” shoreline types provides information that typically is not found in standard mid-latitude field guides or response manuals. The text also identifies key considerations that should be taken into account in reviewing the treatment options (Table 2). A new Job Aid provides colour photographic examples of these three shore types (see Section 3 below).

Table 2 Summary of Key Features of Peat and Tundra Shorelines

TUNDRA CLIFF: ICE RICH	TUNDRA CLIFF: ICE POOR
Physical Character • usually a tundra vegetation mat overlies a peat layer and exposed ground ice (permafrost) • unstable: erosion rates often >1m/month in the open-water season • produce either slumped tundra-peat blocks or mud slurries in the intertidal zone	***Physical Character*** • eroding, unconsolidated sediment cliffs with a surface tundra mat • usually have a sand or sand-gravel beach at the base that is supplied by the products of cliff-face erosion • more stable than ice-rich tundra cliffs
Oil Behaviour • persistence would be short due to natural high erosion rates but could be extended if oil is buried by block falls or incorporated in a peat slurry • oil would be absorbed by peat and may pool between blocks • oil would not stick to wet mud slurries but could mix with them	***Oil Behaviour*** • same as a sand or sand-gravel beach • penetration would occur only for light oils • medium, heavy or weathered oils would remain on the surface but could be buried by wave action
Treatment Considerations • unstable, so safety is a key issue • options include natural recovery, manual or mechanical removal, low-pressure wash, and sorbents • avoid damage to the tundra surface	***Treatment Considerations*** • manual or mechanical removal; surf washing • avoid sediment removal at cliff base
INUNDATED LOW-LYING TUNDRA	**PEAT SHORELINE**
Physical Character • complex and convoluted shoreline of interconnected ridges and shallow ponds • produced by the drowning of low-land tundra and by polygon breaching • combination of vegetated flats, peat mats, and salt or brackish lagoons	***Physical Character*** • spongy cohesive or granular material produced from tundra erosion • may be an un-cohesive wet or dry beach deposit with a low bearing capacity or a mobile slurry mat
Oil Behaviour • vegetation often is water-saturated, which would limit penetration • oil may be on the water surface in ponds • oil may be deposited some distance inland during a storm surge	***Oil Behaviour*** • crude or heavy oils would not penetrate: medium and light oils would be absorbed by dry peat • peat slurry is similar to a loose granular sorbent and would reduce the spreading of oil
Treatment Considerations • avoid trampling and disturbance of tundra surface and minimize vegetation removal: the tundra is a living plant community • typically low bearing capacity, may need planks or snowshoes for access • options include low-pressure washing and vacuums or skimmers	***Treatment Considerations*** • avoid trampling and mixing oil into dry or wet peat mats • low bearing capacity, may need planks or snowshoes for access • options include manual removal, flushing, and vacuums

2.3 SCAT Team Activities

The manual provides guidelines for winter or arctic SCAT and field activities. The process of shoreline segmentation for snow and ice conditions is basically the same as used elsewhere. The primary differences for field surveys during winter months, or when snow and ice are present in an arctic or sub-arctic environment, are the possibilities that:

- Surface oil can be covered by blowing snow;
- Oil can penetrate fresh snow;
- Oil can enter ice cracks and leads; and
- Oil beneath or within ice cannot be detected except by drilling holes through the ice.

Other points that should be considered for winter or arctic surveys include:

- Boat-based ground surveys may be more efficient than land-based surveys when ice is present at the shoreline, as the oil may be seen more easily from the water;
- Daylight hours are typically short during winter months in mid- and northern latitudes so that the window of opportunity for surveys during the low-tide may be limited in situations where tidal water-level changes are a factor; and,
- Similarly, days are long during the arctic or sub-arctic summer so that it may be possible to survey during both low-tide windows in areas with semi-diurnal tides.

2.4 First Responders' Guide

In many cases, the First Responders to spills in arctic or remote regions will be regional inhabitants. They will be in the best position to conduct a rapid initial assessment on the nature of the shoreline oiling. Most likely, they will continue with the assessment survey teams as additional support personnel arrive on scene.

The field survey techniques for the First Responders are described as a series of steps along with instructions for completion of either the shoreline or the riverbank form. The intent for the First Responders is that observations are recorded on "short" forms rather than on the more complicated standard forms. The field survey techniques are described as a series of steps and instructions for completion of the forms, and copies of the forms themselves are presented as a separate section of the field guide so that it can be used as a stand-alone document. Cross references to the main body of the field guide indicate where more detailed or additional information can be obtained.

The format and content of the "short" shoreline and "short" riverbank oiling summary forms is consistent and compatible with the standard forms so that the same data sets can be created from either one.

3 New Job Aids

The manual contains new two new Job Aids: an illustrated glossary of arctic shoreline types and colour photographs that illustrate the various forms of shoreline ice and snow conditions found in arctic regions and on cold-climate coasts and riverbanks.

The photographs in the Job Aid for the three common arctic shore types are interspersed with the tables that have been consolidated as Table 2 above.

The Job Aid for shoreline snow and ice conditions is presented below.

4 Conclusions

As the SCAT process becomes more widely accepted and used during spill response operations, so the need for flexibility and variations has become apparent. *The Arctic SCAT Manual* responds to the need for guidelines, standardized definitions, standardized terminology, and forms that can be used for oiled shorelines or riverbanks in arctic environments and other cold climates in winter months. For the first time, a First Responders' Guide has been included to assist local inhabitants during the initial phase of an oiled shoreline assessment.

5 References

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