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Standard Guide for Surveys to Document and Assess Oiling Conditions[1]

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1. Scope

1.1 This guide covers field procedures by which data can be collected in a systematic manner to document and assess the oiling conditions on shorelines, river banks, and lake shores (shores and substrates) plus dry land habitats (terrain).

1.2 This guide does not address the terminology that is used to define and describe terrain oiling conditions, the ecological character of oiled terrain, or the cultural or other resources that can be present.

1.3 The guide is applicable to marine coasts (including estuaries) and to freshwater environments (rivers and lakes) and to dry land habitats. In alignment with Guide F2204:

1.3.1 For the purpose of this guide, marine and estuarine shorelines, river banks, and lake shores will be collectively referred to as shorelines, shores, or shore-zones.

1.3.2 Shore types include a range of impermeable (bedrock, ice, and manmade structures), permeable (flats, beaches, and manmade), and coastal wetland (marshes, mangroves) habitats.

1.4 Other non-shoreline, inland habitats include wetlands (pond, fen, bog, swamp, tundra, and shrub) and drier terrains (grassland, desert, forests), and will be collectively referred to as either wetlands or terrains, respectively.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1687 Guide for Terminology and Indices to Describe Oiling Conditions on Shorelines

F1779 Practice for Reporting Visual Observations of Oil on Water from Aircraft

F2204 Guide for Describing Shoreline and Inland Response Techniques

3. Significance and Use

3.1 Systematic surveys provide data on shoreline, lakeshore, river bank or other terrain's character and oiling conditions from which informed planning and operational decisions can be developed with respect to cleanup (**1-4**).[3] In particular, the data are used by decision makers to determine which oiled areas require treatment and to develop end-point criteria for use as targets for the field operations.

3.2 Surveys may include one or more of four components or phases, as listed below. The scale of an affected area plus quantity and availability of pre-spill information will influence the selection of survey components and its level of detail.

3.2.1 The **aerial reconnaissance survey phase** provides a perspective on the overall extent and general nature of the oiling conditions. This information is used in conjunction with environmental, resource, and cultural sensitivity data to guide shoreline protection, recovery of mobile oil, and to facilitate the more detailed response planning and priorities of the response operations.

3.2.2 The **aerial video survey(s) phase** provides systematic audio and video documentation of the extent and type of oiling conditions, physical character, and logistics information, such as access and staging data.

3.2.3 The **ground assessment survey(s) phase** provides the necessary information and data to develop appropriate response recommendations. A field team(s) collects detailed information on oil conditions, the physical and ecological

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The boldface numbers in parentheses refer to the list of references at the end of this standard.

character of oiled areas, and resources or cultural features that may affect or be affected by the timing or implementation of response activities.

3.2.4 The **post-treatment inspection ground survey** or monitoring phase provides the necessary information and data to ensure a segment, that is part of the response program, has been treated to the approved end-point criterion. **(5)**

3.3 In order to ensure data consistency, it is important to use standardized terminology and definitions in describing oiling conditions, as provided in Guide F1687. This terminology is described in more detail in guidelines on Best Practices and checklists for the implementation of a survey program **(1-4)**.

4. General Considerations

4.1 The specific survey procedures and the magnitude of the data sets will vary with the scale of the spill (the length and distribution of oiled terrain and quantity of oil), the nature or complexity of the terrain, and the needs of the response organization **(1)**.

4.2 Following a spill, in which only a few kilometers of coast and other terrain have been oiled, one ground survey team could accomplish all of the goals in an appropriate time frame.

4.3 As the scale of an oiled area increases, it could be necessary to conduct an aerial video survey, followed by a ground assessment using one or more survey teams.

4.4 Following spills which oil long sections of coast or other terrain (for example, more than 100 km), a sequence of initial aerial reconnaissance, aerial video survey, and ground assessment surveys may be necessary to provide appropriately-phased information to satisfy response planning and operational requirements in a timely manner.

4.5 Each of the four survey phases requires a separate survey design, assignment of duties to personnel, logistics planning, and establishment of survey and documentation procedures. A Shoreline Response (SRP) Plan which describes the work plan for this phased approach, and defines Best Management Practices, appropriate treatment methods, and the treatment end-point criteria should be developed, reviewed and approved as early as possible in the response. **(4)**

4.6 All field surveys in areas influenced by tides should be conducted during the lowest one-quarter to one-third of the tidal cycle to ensure maximum (viewing) exposure of the intertidal zone.

5. Segmentation

5.1 The shore, substrate or terrain to be surveyed is divided into working units, called either segments, within which the terrain's character is relatively homogeneous in terms of physical features and sediment type or called polygons, for water features. **(1)**

5.2 Each segment is assigned a unique location identifier (for example, an alpha-numeric code).

5.3 Segment boundaries can be set using prominent geological features (headlands, streams, etc.), changes in shore/substrate/soil types, jurisdictional or ownership boundaries, fencing, windrows, roadways or changes in oil conditions.

5.4 Segment lengths are to be short enough to yield adequate resolution and detail on the distribution of oil for response planning and operational decisions. Most segments would be in the range of 0.2 to 2.0 km in length.

5.5 If segments already exist as part of a pre-spill planning exercise or sensitivity mapping database, then segment boundaries might need to be adapted, segments subdivided, or the segment codes revised, or some combination thereof, to reflect the oiling conditions from a spill.

6. Aerial Reconnaissance Survey(s)

6.1 An initial aerial survey(s) is conducted along coastlines, banks, shores, or other terrain within the spill path. The objective is to determine which locations have been oiled to provide an overall perspective and scale of the spill event and from which to plan for a more systematic documentation or assessment survey.

6.2 Findings from this survey can be augmented with information from a high-altitude surveillance and tracking program.

6.3 Fixed-wing or rotary-wing aircraft fly the spill path at slow-speeds and at altitudes in the range of 75 m to 150 m. Unmanned Aerial Vehicles (UAV) may be used to fly the spill path at slow speeds and at altitudes in the range of 10 m to 150 m. Local regulations may restrict altitude. Repeat surveys could be beneficial for spill circumstances when slick movement continues to oil new segments.

6.4 Helicopters are preferred over fixed-wing aircraft, as they allow easier landings to confirm observations made from the air. Among fixed-wing aircraft, those with wings mounted above the fuselage (high-wing aircraft) are essential to allow visibility of terrain features.

6.5 If possible, in manned aircraft, the survey team should consist of an oil observer and a navigator/recorder. The observer should be an oil spill specialist familiar with oil on shorelines, coasts, banks, and other terrain and able to distinguish between natural materials on water and shores versus oil (for example, stranded kelp, black lichen, heavy mineral bands, etc.) and distinguish various liquids on dry terrain features versus oil (rainwater, dark soils, exposed peat). The oil observer operates the video camera and provides a continuous audio commentary. The navigator logs the flight lines, locates segments being observed on maps or charts, and records oil observations.

6.6 If possible, for unmanned aircraft (UAV), the survey team should consist of a pilot, oil observer and spotter/recorder. The observer should be an oil spill specialist familiar with oil on shorelines, coasts, banks, and other terrain and able to distinguish between natural materials on water and shores versus oil (for example, stranded kelp, black lichen, heavy mineral bands, etc.) and distinguish various liquids on dry terrain features versus oil (rainwater, dark soils, exposed peat). The pilot operates the UAV and video camera. The observer locates segments being observed on maps or charts, and

records oil observations. The spotter maintains visual sight lines with the UAV and provides safety feedback to the pilot.

6.7 Records of observations can be made on maps and notebooks. Video and still photography can be used to add a visual record of examples of oiling conditions and terrain or shoreline character for immediate use by response planners and decision makers.

6.8 Aerial reconnaissance is generally not needed where the presence of oil has been defined clearly from other means or where the affected terrain is short enough in length that an aerial video survey can be completed in one-half day or for tidally influenced areas, during one low-tide cycle.

7. Aerial Video and Mapping Survey(s)

7.1 The aerial video recording and mapping survey(s) are conducted where there is known or potential oiling. The survey is used to provide detailed and systematic documentation on the extent and type of shoreline oiling and other shoreline conditions.

7.2 Small high-wing, rotary-wing, aircraft, or UAVs fly at very slow speeds at altitudes in the range of 25 to 75 m.

7.3 The primary survey team consists of an oil observer and a navigator. The navigator records and maps relevant flight information. The oil observer operates the video camera and provides a continuous audio commentary, for which the color video image provides a visual frame of reference. In some cases, a video technician might be desirable for operation and quality control of audio and video recordings

7.4 Duties of the oil observer are as follows:

7.4.1 To identify or create segment boundaries and verbally describe their location on one of the audio channels. These descriptions are also recorded by the navigator on a set of digital or hard-copy flight-line maps or charts.

7.4.2 To video continuously through an open aircraft door or window with the camera angled down (30 to 45°) and slightly ahead of the aircraft (15 to 30°), so the area being described comes into focus and is in the visual foreground during commentary. Video resolution is best when a flight line has the sun is behind the aircraft.

7.4.3 To provide a continuous descriptive commentary on oiling conditions, including the *(1)* length and width of the oiled areas and the oil distribution (percent surface oil cover), *(2)* physical substrate or terrain character, and *(3)* other pertinent features such as access locations or constraints.

7.5 Video recording equipment requires either a camera/recorder/color monitor system or a camcorder system. The system needs an on-screen date/time marker plus audio recording, and lowlight recording capabilities. Other system requirements include: *(1)* an independent, stabilized power supply or converter, and *(2)* a voice-activated two-channel audio recording and communications system between all crew members, including the pilot. Also desirable is the capability for location (geographical positioning system; GPS) records with the imagery, a stabilized camera mount, and small inboard color monitor(s).

8. Ground Assessment Survey(s) Phase

8.1 Systematic ground assessment surveys are conducted on oiled and unoiled segments within affected areas to provide detailed and complete documentation to guide development of appropriate response priorities, endpoints, constraints, and segment treatment tactics (**1 and 4**).

8.2 The scale of the ground assessment survey is dependent on the size and character of the area affected and the intended use of the survey data.

8.3 Where more than one survey team is deployed, measures are needed to ensure calibration across teams used for consistency in procedures, terminology, reporting and interpretation of observations.

8.4 Typically, a ground assessment survey team contains an oil spill specialist, at the minimum. Teams can include an ecologist, cultural resources specialist, and government agency representatives, depending on available personnel and the complexity of the spill.

8.4.1 In the simplest form, the survey is conducted by an oil-spill shoreline specialist who has a basic understanding of marine coastal or inland water geomorphology and processes, soils and upland geomorphology and processes, oil behavior, and cleanup. Using standardized terms, definitions, and procedures, this specialist documents the oiling conditions and physical character of each oiled segment.

8.4.2 A specialist in ecology can identify and assess communities and evaluate the effect of the oil and/or the potential effect of treatment options. The ecologist can also *(1)* verify the occurrence of sensitive habitats or species (in a segment) which were identified previously in sensitivity maps or databases, *(2)* identify and document human use activities in a segment, and *(3)* identify procedures or constraints on response operations to minimize effects on the biota.

8.4.3 Ground assessment surveys are designed in accordance with Best Management Practices, as defined by a specialist or designated team.[4]

8.4.4 Inclusion of a cultural resources archaeological specialist, and/or a land manager/owner-representative can be helpful to identify unknown sites, confirm the current condition of known sites, and to ensure team activities do not disturb such sites (**4**). These specialists or representatives can also help: *(1)* evaluate potential effects of various treatment options, *(2)* if authorized, collect artifacts for preservation, and *(3)* identify procedures or constraints on response operations to avoid potential impacts on sites in or adjacent to oiled segment(s).

8.5 Representatives of government agencies, land owners or managers, the potential responsible party, and the operations team can participate as observers to assist in subsequent development of response option preferences and constraints.

[4] In the US, team members can be assigned by a State or Federal On-Scene Coordinator (OSC) to ensure compliance with Section 7 of the Endangered Species Act (ESA) (**4**). Similarly, ground surveys are designed in consultation with OSC-designated specialist(s), State Historical Preservation Offices (SHPOs) and other stakeholders participate, as appropriate under the US National Historic Preservation Act (NHPA).

8.6 Results from a ground assessment survey will document and assess surface and, where applicable, subsurface oiling conditions. On shores where the materials are mobile or where the oil can permeate into the substrate, it could be necessary to dig pits or trenches to locate and describe buried or has penetrated oil (**6**). Trials have shown that trained detection dogs can locate and delineate subsurface oil under a range of conditions. They can be used as part of a SCAT program to clear large areas with no surface or subsurface oil (No Detectable Oil) very rapidly (**7**).

8.7 The inclusion of ecological or archaeological observations in a survey would depend on the purpose of the survey.

8.8 Shallow water observations can be appropriate to determine if oil or oiled sediments are present in the nearshore, river channel lakes or wetlands. These observations can be done using underwater viewing tubes, video, or be carried out by certified divers.

8.9 Standard information/observations forms are recommended in order to ensure that all necessary data are recorded or considered in a consistent manner. These forms are typically designed to suit a spill situation. An example of a generic shoreline oiling summary (SOS) form is provided in Fig. 1. Simpler forms can be used where appropriate to the intended purpose of the spill survey. Similar forms have been developed for use in freshwater or riverine environments and on a regional basis applicable to non-temperate (arctic/winter) (**8**) or tropical shore-zone conditions. These forms can be used as templates and modified for a particular shore, substrate or terrain.

8.10 GPS waypoints plus a field sketch (Fig. 2) are recommended to locate oiled zones within a segment, where oil is not distributed uniformly, or to identify special features. A field sketch or annotated aerial or detailed satellite imagery, rather than a perspective drawing, is interpreted more easily and can include oiling, substrate character, photographic, and scale information.

8.11 Still-color photographs or video recordings can supplement a completed form and sketch (Fig. 3). Videos and still photographs must be geo-referenced for data management and retrieval. This typically is achieved either by having a built-in GPS capability within a camera or by using commercial software to match GPS time/positioning data with the time of a digital image. More information can be recorded on an audio channel of a video recorder than in a field note book with sketches and photographs. The video recording system has an advantage over just notes or tape recorders because visual images of the location under discussion are provided. This technique (audio and video recording) is particularly recommended for surveys of segments where shore, substrate, terrain or oiling conditions are particularly complex, unusual, or spatially variable.

8.12 There are several optional post-survey activities.

8.12.1 Prior to departing a survey site, a team can quickly review individual assessments and discuss findings to ensure nothing significant has been overlooked.

8.12.2 At the completion of each day, it is typical for a team to review, recopy, and finish, as necessary, all forms, maps, notes, etc. Completed survey track and waypoint logs, photographs, and documentation should be downloaded, filed, and archived, as appropriate.

8.12.3 Survey findings can be entered into a database and used to calculate or assess the degree or relative severity of oiling (see Practice F1779) and facilitate the setting of cleanup priorities.

8.12.4 Reports on findings or recommendations can be submitted to the response command center or presented to planners and decision-makers, as required, to provide an up-to-date and accurate perspective on the extent and degree of oiling and to assist in setting cleanup priorities and in selecting response techniques.

8.13 For sections of shore, substrate or terrain, which do not meet its cleanup end point criteria, then a Shoreline Treatment Recommendation (STR) form is prepared (Fig. 4) and submitted to response command. Review can involve consideration of suitability of Best Management Practices, endangered and threatened species, cultural or archeological resources, etc. The approved STR is incorporated into the response planning cycle through, for example, the Incident Command System (ICS) 204 form (**10**) and becomes the de facto "Operational Permit to Work" for cleanup of that segment(s) (**4**).

9. Post-Treatment Assessment Survey(s) Phase

9.1 Monitoring or inspection surveys are done as response operations completes cleanup of affected segments and requests a clean-up confirmation inspection by SCAT teams and land owner/managers.

9.2 An initial inspection with the field response Operations supervisor(s) may be appropriate prior to a formal inspection with government and/or other land/owner manager representatives to evaluate if the cleanup endpoint criteria have been met.

9.3 The purpose of inspection surveys is to determine and document post-treatment oiling conditions. The inspection surveys can have one of three outcomes: *(1)* no observed oil (NOO), *(2)* no further treatment (NFT) is required, as the segment(s) meet endpoint criteria or that NFT is recommended given specific considerations (for example, ALARP achieved, NEBA, Safety), or *(3)* further treatment is necessary to meet endpoint criteria. It is advisable to use a Segment Inspection Report (SIR) form (for example, Fig. 5) to record results of an inspection survey. SIRs are used to transmit recommendation(s) to the response decision-makers (**4**).

MARINE TEMPERATE (SOS) FORM (EML ver. 31Mar16) **Incident:**_____ **Page**_____ **of** ____

1.GENERAL INFORMATION	**Date** (dd/mmm/yyyy)	**Time** (24h standard/daylight) _____:_____ to _____:_____	Tide Height (m) Low:_____ High:_____
Segment ID:	Segment Name:		(H / M / L) - (R / F /LS / HS)
Ops Zone:	Survey Type:	STR:	

Survey By: Foot __ ATV__ Boat __ Overlook __ Helicopter__ Drone __ Other _____	**Weather:** Sun / Clouds / Fog / Rain / Snow Windy / Calm	**Exposure:** Very Exposed / Exposed Semi-Protected / Protected / Very Protected

2. SURVEY TEAM	Name	Organization	Name	Organization
Team Number				

3. SEGMENT	Total Length: (m)	Length Surveyed: (m)	Maximum Intertidal Width: (m)

Survey Start GPS:	WP:	LAT: -	LONG: -		Datum:
Survey End GPS:	WP:	LAT: -	LONG: -		

4a. SHORELINE TYPE *Indicate only ONE Primary (P) (dominant) type and ALL Secondary(S) types.*

BEDROCK: Cliff_____ Ramp_____ Platform_____	Sediment BEACH: Sand____ Mixed____ *(F / C)* Pebble/Cobble____ Boulder_____
MAN-MADE: Solid _____ Permeable_____	Sediment FLAT: Mud____ Sand____ Mixed____ *(F / C)* Pebble/Cobble/Boulder____
Description: _____	Wetland:____ *type:* _____
ESI Shoreline Type (primary) ____ (secondary) ____	Other:_____ *if snow and ice use Winter SOS*

4b. COASTAL/BACKSHORE CHARACTER *Indicate only ONE Primary (P) and ANY Secondary (S) types.*

Cliff/Hill: ____ ht._____ m. Sloped: > (5°) (15°) (30°)	Primary Substrates: _____ Forested / Vegetated: _____	Flat/Lowland: ___ Beach:___ Dune:___ Inlet/Channel:___ Delta:___ Lagoon:___ Wetland:___ Man-Made:___ *type:*_____

5. OPERATIONAL FEATURES	Debris: Types_____	Oiled: Yes / No	Amount: (bags/trucks)
Direct backshore access? Yes / No	Alongshore access adjacent segment? Left / Right / Both / No	Suitable for backshore staging? Yes / No	
Access Description / Restrictions:			Strong Currents? Yes / No

6. OILING DESCRIPTION: *Use letters A-Z, Indicate 100% overlapping oil zones in different tidal zones by numbering them (e.g. A1, A2)*

Zone ID	WP Zone Start	WP Zone End	Substrate Type(s) or ESI Code	Tidal Zone				Oil Cover						Oil Thickness					Oil Character							
								Area		Distribution		Size														
				LI	MI	UI	SU	Length (m)	Width (m)	Dist % (> 1) or	Number per unit area	Avg Size (cm)	Large Size (cm)	TO	CV	CT	ST	FL	FR	MS	TB	PT	TC	SR	AP	NO

7. SUBSURFACE OILING CONDITIONS: *Format: Indicate Zone ID in Pit #, e.g., A-1, B-2, B-3, (use only number if not in zone e.g. 4, 5)*

Pit #	WP #	Substrate Type Surface/Subsurface	Tidal Zone				Pit Depth (cm)	Oiled Interval (cm-cm)	Subsurface Oil Character								Water Table (cm)	Sheen Color B,R,S,N	Clean Below Yes / No
			LI	MI	UI	SU			AP	OP	PP	OR	OF	TR	NO	%			
		/						-											
		/						-											
		/						-											
		/						-											
		/						-											
		/						-											

8. COMMENTS: Cleanup Recommendations; Ecological/Recreational/Cultural/Economic Issues; Wildlife Observations; Other Descriptions

**Use supplemental marine SOS form for additional oiling zones, pits, and comments/sketches.*

MAP: Yes / No	SKETCH: Yes / No	PHOTOS / VIDEO: Yes / No (-)	TRACKLINE: Yes / No	WAYPOINTS: Yes / No
Form Completed By:		Photographer(s):	GPS Person / Unit:	

FIG. 1 Example Survey Information Form: a Shoreline Oiling Summary (SOS) (1)