A guide to oiled shoreline assessment (SCAT) surveys

Good practice guidelines for incident management and emergency response personnel



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Preface

This publication is part of the IPIECA-OGP Good Practice Guide Series which summarizes current views on good practice for a range of oil spill preparedness and response topics. The series aims to help align industry practices and activities, inform stakeholders, and serve as a communication tool to promote awareness and education.

The series updates and replaces the well-established IPIECA 'Oil Spill Report Series' published between 1990 and 2008. It covers topics that are broadly applicable both to exploration and production, as well as shipping and transportation activities.

The revisions are being undertaken by the OGP-IPIECA Oil Spill Response Joint Industry Project (JIP). The JIP was established in 2011 to implement learning opportunities in respect of oil spill preparedness and response following the April 2010 well control incident in the Gulf of Mexico.

The original IPIECA Report Series will be progressively withdrawn upon publication of the various titles in this new Good Practice Guide Series during 2014–2015.

Note on good practice

'Good practice' in the context of the JIP is a statement of internationally-recognized guidelines, practices and procedures that will enable the oil and gas industry to deliver acceptable health, safety and environmental performance.

Good practice for a particular subject will change over time in the light of advances in technology, practical experience and scientific understanding, as well as changes in the political and social environment.

Contents

How to use this guide

Oiled shoreline assessment surveys—also known as Shoreline Clean-up Assessment Technique (SCAT) surveys—are a critical component of a response operation. The information gathered by the survey teams is used by the response managers to set objectives, priorities, constraints and end points, all of which are essential in supporting the planning, decision making and implementation of an effective shoreline response programme.

This guide explains why an oiled shoreline assessment programme is an important element of a response, and outlines the benefits of systematic surveys. In addition, the guide explains why and how an effective shoreline assessment programme supports the planning, decision making and implementation process for a shoreline response, and how the key components of shoreline surveys are integrated into the data generation, decision making, and implementation and closure stages of a shoreline response programme.

The key elements of the survey process are also outlined with respect to the types of information that are collected and the purpose for which they are used by decision makers. The manner in which the data are collected is described, and a checklist is provided as a guide to the specific field and management activities within an oiled shoreline assessment programme. It should be noted, however, that this report is intended to be a guide rather than a field manual. The guide explains the important concept of shoreline segments and segmentation as a method for conducting systematic surveys and managing the data and information that is generated. Examples of the types of recommendations, maps and tables that are produced as part of the data management process illustrate how the field data are used in a shoreline response programme.

What is a shoreline assessment survey?

Despite the best intentions of an on-water response to an oil spill at sea or in a river, the likelihood is that at least some of the spilled oil will eventually reach the shoreline. When shoreline impact occurs, or is likely to occur, shoreline assessment is a critical component of the response programme and provides essential information for setting objectives, priorities, constraints and end points for an effective shoreline response.

Oiled shoreline assessment surveys are carried out to:

- define and document the scale and character of shoreline oiling;
- identify and document the shoreline type and coastal character within the affected area;
- develop recommendations for treatment end points and treatment techniques which provide a net environmental benefit (NEB, see box 5 on page 21) based on sound science;
- provide support throughout the treatment programme so that shoreline clean-up operations personnel understand the expectations and concerns of the response managers;
- provide a process for closure once treatment has been completed; and
- involve appropriate representatives to ensure consensus throughout the shoreline response programme.

Oiled shoreline assessment surveys may have different objectives as the phases of a response develop. During the initial or reactive phase the survey information defines the overall scale of the affected area and the character of the shoreline oiling, which enables clean-up teams to focus on higher priority locations. The planning phase is characterized by systematic surveys that provide detailed information and defensible recommendations on how to treat areas where clean-up is required, and by support for the clean-up teams so that they understand the objectives and strategies of the shoreline response programme. Typically, the survey teams include representatives from agencies or land owners/managers in the affected area so that they can be part of the evaluation process. The same survey teams inspect locations when treatment has been completed to ensure that the site-specific objectives have been met, so that the clean-up teams can be deployed to other areas.

Far left: shoreline oiling is typically discontinuous. Near left: shoreline assessment teams at work.

Why is an oiled shoreline assessment programme important?

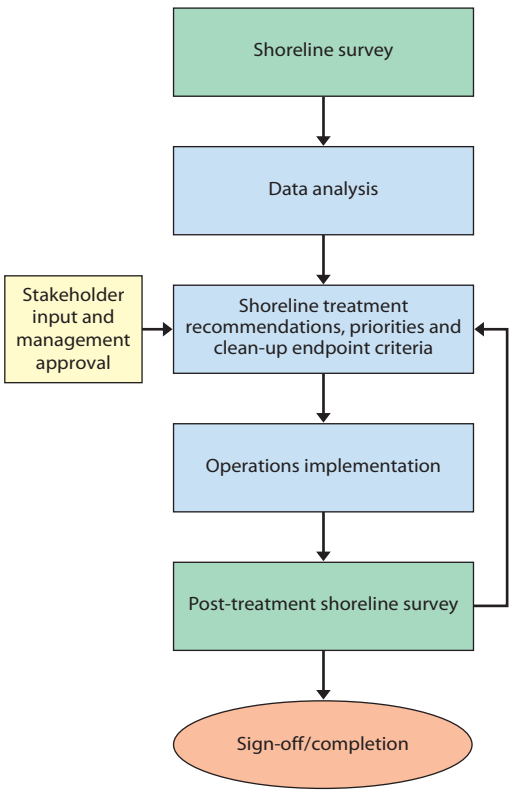
A well-managed oiled shoreline assessment (SCAT) programme generates systematic data while fully engaging stakeholders in the response management process. An oiled shoreline assessment programme provides:

- comprehensive documentation of oiling and shoreline conditions;
- objective and defensible scientific data and recommendations;
- standard measurements, terminology and descriptions;
- recommended treatment strategies;
- recommended end point criteria for segment sign-off;
- details of operational constraints, safety and security issues;
- data on ecological, cultural and socio-economic constraints;
- the use of good management practices;
- a management decision making process which includes stakeholder and regulatory input;
- monitoring of treatment progress;
- trained and calibrated inspection teams for completion surveys; and
- data that can be useful for a number of other purposes, including damage assessment or recovery studies.

Without this set of information, effective response planning and prioritization for a shoreline response programme would not be possible, and the operations teams would have to make spontaneous, on-site decisions regarding treatment. Instead, an oiled shoreline assessment programme utilizes expert personnel to survey shorelines ahead of operations; it assesses the need for treatment, and produces recommendations and objectives that, along with stakeholder input, allow for efficient and effective planning. In addition, an oiled shoreline assessment programme provides a strategy for completion (see Figure 1) which aims to assure an efficient process and an appropriate and sensible conclusion to spill response operations, while avoiding under- or over-utilization of resources and potential negative environmental impacts due to excessive treatment. Shoreline assessment surveys therefore provide valuable information and support for decision makers, planners and operations personnel to enable the *effective treatment or cleaning of oiled shorelines* by accelerating recovery *without causing additional harm to the environment*.

An oiled shoreline assessment programme provides a strategy for completion, without which a spill response would be unable to ensure an efficient process and an appropriate and sensible conclusion.

Figure 1 *Strategy for shoreline treatment completion*



Oil spill responders have been conducting shoreline surveys in one form or another for more than forty years. Prior to 1989, shoreline assessment historically involved relatively informal surveys, which often covered only the areas with the greatest oil concentrations,

and rarely involved a systematic or consistent recording or mapping process. The Shoreline Clean-up Assessment Technique (SCAT) survey programme created in 1989 during the response to the *Exxon Valdez* oil spill was designed to meet the challenge of documenting shoreline oiling, and evaluating treatment priorities and concerns in a remote area (Owens and Reimer, 2013). The SCAT concept involved a systematic survey of all shorelines in the affected area, with the data being managed using a geographic information system (GIS) database. This programme supported the planning and clean-up decisions that were the foundation for the 1989 shoreline response operation at both the strategic and tactical levels. The field procedures, the process of developing recommendations for shoreline treatment, and the data management tools have evolved since that first systematic survey, and the basic concept has stood the test of time in both large and small response operations worldwide.

Below: oiled shoreline assessment surveys being carried out in wetland environments

Source: ITOPF

What are the objectives of an oiled shoreline assessment programme?

The primary objectives of an oiled shoreline assessment programme are to:

- define the location, extent and character of the oiling;
- develop shoreline treatment recommendations;
- support operations during the treatment programme; and
- provide closure once the shoreline treatment objectives have been met.

This is achieved through:

- standardized procedures;
- good management practices;
- collection of data which are:
  - scientific;
  - systematic;
  - accurate;
  - consistent;
  - complete; and
  - defensible;
- provision of data, information and support to decision makers and operations personnel; and
- engagement of stakeholders.

In addition to these key strategic programme objectives, there may be other survey objectives during the different phases of a shoreline response programme, as described below.

Initial or reactive phase objectives

- Generate immediate information on the scale of the problem, by aerial reconnaissance and rapid ground or vessel assessment.
- In some cases, surveys can be conducted prior to oil reaching the shoreline to establish baseline conditions.
- Define the area(s) of affected shoreline and the degree and character of oiling.
- Establish immediate clean-up priorities and deploy operations to the right place(s) quickly. Prioritization is typically associated with the distribution of the heaviest oil concentrations and the oil's remobilization potential, and with the sensitivity of the affected shoreline.
- Treatment may primarily address bulk oil removal to minimize further impacts and enhance natural degradation.

Below left: aerial reconnaissance enables an initial assessment of the scale of the affected area.
Below right: video coverage with a descriptive commentary provides a rapid method of documenting shoreline oiling conditions.

Planning phase objectives

- Systematically document oiling conditions by detailed ground surveys for the development of a shoreline response plan (see Box 8 on page 25), taking into consideration the potential for oiling conditions to change over time.
- Recommend overall treatment objectives.
- Assess and recommend treatment strategies and tactics, and recommend clean-up end points and test methods.
- Define treatment constraints.

Operational phase objectives

- Provide a set of specific instructions (or 'work orders') to operations teams for the treatment of individual shoreline segments.
- Include environmental or other constraints and good management practices to prevent any additional impacts or damage that might otherwise result from treatment.
- Monitor and document the effectiveness of treatment and natural recovery.
- Track the status and progress of the treatment operations.

Completion phase objectives

- Compare treatment end points with oiling conditions during inspections so that all parties can agree that sufficient treatment has been completed on a segment-by-segment basis.
- Document the achievement of end points within segments designated for treatment, and enable sign-off or closure (see Box 2 on page 15 for an explanation of segments and segmentation).
- Identify possible locations for long-term monitoring where end points do not require removal of all of the oil, to ensure that natural weathering or self-cleaning takes place as anticipated.

Below: Shoreline surveys define the location and character of the oil: (left) oiled mangrove; (right) oiled marsh.

Source: ITOPF

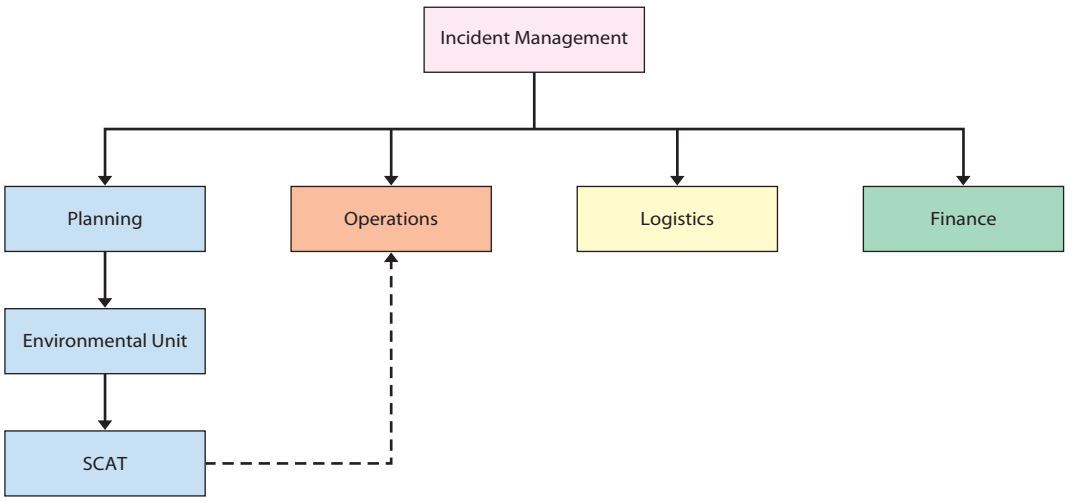
How does a shoreline assessment programme fit into a shoreline response programme?

An oiled shoreline assessment programme fits into the response management organization both vertically, under the Planning and Environment functions, and horizontally, with strong links and reciprocal communications with shoreline Operations (IPIECA-OGP, 2014b). See Figure 2, below.

A well-planned shoreline assessment programme systematically documents detailed shoreline character, oiling and logistics data for all of the affected area(s) on a segment-by-segment basis. The key objectives of a shoreline assessment programme are to:

- provide oiling data and treatment recommendations to decision makers and operations personnel in an efficient and timely manner to support the different phases of a response;
- enable rapid decision making and approval of the response plan, and to direct shoreline clean-up operations during all phases of a response;
- compile systematic, consistent and defensible documentation during all phases of a response;
- work closely with shoreline operations personnel to expedite and provide field support for the application of recommended treatment and end point criteria;
- provide accurate and informative data to stakeholders; and
- work with the spill management team to provide non-technical information to the general public.

Figure 2 *The SCAT programme's position in a typical response organization structure*



Who is involved in an oiled shoreline assessment programme?

A well-designed shoreline assessment programme involves experienced shoreline assessment field surveyors, key decision makers, planners and operations personnel, ensuring a comprehensive flow of information and data between all parties associated with the response. The programme also ensures that relevant stakeholders remain engaged, and keeps them involved with, and informed of, the decision making process.

Data management is a key component of the shoreline assessment programme, to ensure data integrity, storage and backup, and to provide a means of processing and analysing raw shoreline oiling data and presenting it in a format that can be easily communicated with decision makers and stakeholders.

Oiled shoreline assessment teams carry out the surveys ahead of the operations teams, and often recognize the hazards and constraints before anyone else; oiled shoreline assessment survey teams must therefore have a strong safety culture and should share their learnings with the rest of the response personnel.

Integration with the response management organization

The oiled shoreline assessment programme should be integrated within the function responsible for environmental decision making and recommendations. For example, within an Incident Management System (IMS) SCAT resides within the Environmental Unit, under the Planning Section. This ensures that agreement on the end points of the operation falls under one team, and that field data is passed back to those decision makers and response planners so that the response can be planned accordingly. The Planning Section is also responsible for ensuring that other relevant sections are kept informed via the Situation Unit.

A key role of the oiled shoreline assessment team is to support the response operations by communicating directly with the Operations personnel; this ensures that both teams understand each other's roles and requirements and enables each team to provide input to the other's decisions. For example, the field survey team can discuss with supervisors in the field how they can determine whether end points are reached, and the Operations personnel may provide an understanding of the practical benefits and limitations of available treatment methods.

Oiled shoreline assessment team participation

A fully functioning shoreline assessment team requires the joint participation of representatives of the responsible party and the agencies responsible for the affected area. This helps to maintain consistent reporting between the various regulators and stakeholders as well as preventing different interpretations about the location and degree of oiling. Agencies or land managers might be from the local, regional or national levels, or a combination of all three. The relevant national or local oil spill contingency plan may specify the membership of a shoreline assessment team. However, care must be taken to ensure that the membership of a shoreline assessment field team remains at a level that is easy to manage; it is not practical or efficient to have a large field team, and it may therefore be necessary to restrict field participation to selected key representatives. A

team of more than five people can become inefficient and difficult to manage from both a logistical and safety perspective. As mentioned above, the field survey teams must have appropriate safety training and a strong safety culture because they typically work remotely, often away from larger operational units and infrastructure. They should have the competence and authority to turn back where conditions or transportation may be deemed to be unsafe, and should pass safety reports and observations on to the Safety Officer in the response organization.

The role of a shoreline assessment survey Team Leader requires basic leadership skills. Leaders should be team players and listen to the views of each team member, with the aim of seeking a full team consensus on oiling conditions and recommendations for treatment.

Field team members who are new to shoreline assessment will require appropriate classroom and/or in-field training, and all team members require regular, spill-specific calibration to ensure consistency both between individual team members and between different teams. Consistency of data is improved by minimizing the turnover of field surveyors, and by ensuring that the same group of trained and calibrated personnel is used from the initial reconnaissance surveys through to completion. Training should include relevant safety issues and potential risks as well as shoreline assessment methods and shoreline processes specific to the geographic area to be surveyed.

The composition of an oiled shoreline assessment programme might include the following components:

- ***Oiled shoreline assessment programme management/coordination:*** responsible for designing and directing the programme, setting programme objectives, and liaising within the Environmental Unit and with other managers and decision makers within the response organization.
- ***Field survey teams:*** responsible for conducting aerial reconnaissance and ground/vessel surveys, gathering oiling (and other) data in the field, producing reports and recommendations for treatment, and inspecting segments where treatment is required to ensure end points are reached. Depending on site-specific needs, other data to be collected may include cultural resources, sensitive wildlife resources, environmental resources or operational, safety or logistical constraints.
- ***Data management:*** responsible for collecting and collating data, presenting data maps and summary tables and reports, and for coordinating with the response data management team to preserve shoreline assessment survey documentation on oil character and treatment or natural attenuation.

Below: an oiled shoreline survey team, including representatives from local agencies.

- ***GIS support:*** responsible for creating field maps for the survey teams and maps for survey reports.
- ***Logistics support:*** responsible for managing logistics and communications for the field teams, an important role when covering a large and/or remote area, and providing safety training and support (see Box 1 on *Safety and safety plans*, overleaf).
- ***SCAT Operations Liaison:*** responsible for direct communications between the shoreline assessment programme and Operations personnel, an important role when the field survey teams are unable to provide that function themselves, for example during a response when the field survey teams are spread over a wide area, away from operational zones.

Box 1 *Safety and safety plans*

As with any part of an oil spill response, safety is the number-one priority. For field survey teams there are many inherent risks to personnel, and safety plans should be produced at an early stage to ensure that teams are able to recognize, prevent and mitigate those risks.

Hazards might include, but are not limited to:

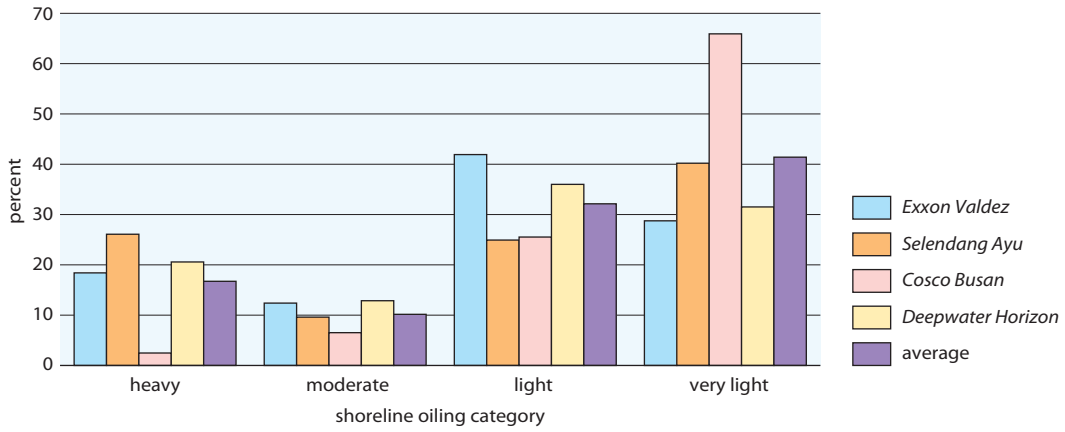
- weather:
  - cold/ice;
  - heat/sun;
  - rain/thunderstorms;
  - high winds;
  - fog;
- sea state;
- aviation operations;
- boat operations;
- working on/around water;
- driving/road conditions;
- working with heavy machinery (e.g. augers, excavators);
- slips, trips and falls;
- uneven and soft surfaces;
- wildlife;
- darkness;
- fatigue;
- dehydration;
- muscle strain;
- trash (e.g. sharps, glass, chemicals); and
- members of the public/security.

The field Team Leader should conduct daily briefings before beginning a survey to ensure that all members are aware of potential safety hazards and have the necessary knowledge and tools to minimize and mitigate risks. Because the oiled shoreline assessment survey team is often first on the scene, the team will also need to observe and identify new hazards daily and as conditions change. The safety briefing is also a means to ensure that all members understand the day's mission and objectives.

What are the key information requirements for decision makers?

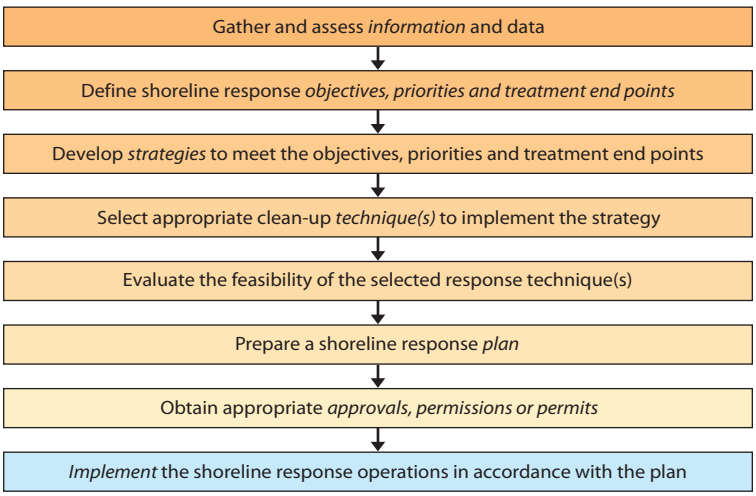
Following an oil spill, an effective and efficient response depends largely on rapid and informed decision making. A well-planned shoreline assessment programme provides critical information to enable decision makers to plan and execute a successful shoreline clean-up operation. In order to set objectives and priorities in the early stages of a response, spill managers require a full, non-technical overview of the situation as quickly as possible. Throughout the planning and operational stages, managers look to the shoreline survey team for defensible recommendations regarding objectives, priorities and clean-up end points, including appropriate clean-up techniques and operational constraints. In addition, they rely on reports regarding temporal changes in shoreline oiling and on treatment progress. It is important to establish agreed-upon metrics in terms of distances surveyed, oil impacts (for example, oiling category percentages—see Figure 3) and treatment in order to communicate consistent information to managers and the public. Finally, during the completion phase, managers rely on the opinions and recommendations of the experienced field teams to agree on and document segments for which the end points have been reached so that the response may be demobilized accordingly on a segment-by-segment basis.

Figure 3 *Percentage of total oiled shoreline by category for selected oil spills*



In Figure 3, the Deepwater Horizon *categories follow the 'Small tidal range' band width and 'Surface oil cover matrix' definition shown in Box 4 (pages 18–19); all other examples follow the 'Large tidal range' definition for oiled band width.*

Figure 4 *Information flow and the decision process*



An efficient shoreline assessment programme produces complete systematic data, ensuring that all shorelines in the affected area are surveyed. Well-calibrated shoreline assessment teams provide data which are consistent, both between different surveys and between different individual observers/teams. Quality is enhanced by maintaining a consistent team of oiled shoreline assessment field surveyors throughout the response. Reporting forms should generate quantitative data, thereby removing the need for qualitative descriptions or opinions.

Box 2 *Segments and segmentation*

At the very beginning of (or ideally before) a response, the shoreline or river bank(s) is divided into working units called segments. These segments are delineated to provide manageable areas of the shoreline for assessment, clean-up and subsequent inspection by the shoreline assessment survey teams. Each segment should have a relatively similar shoreline character in terms of physical features and sediment type. Segment boundaries are established based on:

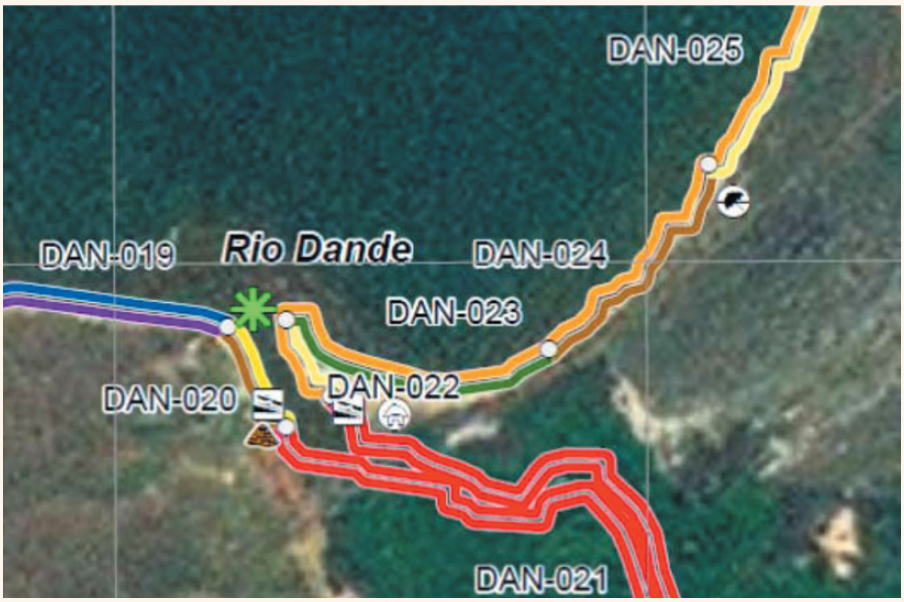
- prominent geological features, including inlets or stream/river mouths;
- changes in shoreline or substrate type;
- changes in oiling conditions;
- operational considerations, such as backshore character, access or staging factors; and
- jurisdictional or land ownership/management areas.

Each segment is given a unique identification number, which can then be used to cross-reference all documents and maps relating to shoreline surveys and operations. Segmentation breaks the shoreline down into manageable and practical portions for survey and operations teams, and simplifies the identification and location of different sections of shoreline (see map below). Segments where treatment is planned can correspond to operational areas or divisions.

Polygons may be used for segmentation on non-linear shorelines, such as wetlands, or in cases with highly irregular shorelines or terrestrial oiling (for an example see the oiled wetland status map on page 28).

Pre-SCAT mapping and segmentation avoids the need for reactive segmentation, or the use of multiple unconnected segmentation schemes created by different groups within a response; it can also be completed without the pressures and time constraints of a real incident. Where segmentation has been completed in advance, key shoreline sensitivity and logistical information such as shoreline type and backshore operational considerations (see map below) will be immediately available to the shoreline teams. The use of aerial videotape surveys has been found to provide a valuable source of data for shoreline segmentation, along with charts, maps and satellite imagery.

In the event of a spill, sub-segments can be created to account for variations in the degree and type of oiling. Pre-SCAT sensitivity and segmentation maps should be evaluated periodically in the field and revised as necessary to account for changes due to natural coastal processes and human activities, as well as to verify access points and staging areas.



Map courtesy of ACEPA, the Angola Ministry of Petroleum and Ministry of the Environment

Example of pre-SCAT shoreline segmentation that defines shore zone type (where oil could be deposited) and coastal character (the backshore where operations would be deployed and staged). In this example, the Environmental Sensitivity Index (ESI) shore type for segments DAN-022 through DAN-025 is the same (sand beach), but the backshore character changes significantly: dunes (22); man-made (23); cliff/bluff (24); and dunes (25).

Stranded oil distribution

A shoreline assessment survey should be designed to evaluate and document several important factors related to oiling in order to facilitate the decision making process for a response programme. Surveys should identify and report the following information on a segment-by-segment basis:

- ***Location:*** maps, GPS coordinates and descriptions of where shoreline oiling is observed, noting which segments are oiled and in which tidal zone the oil has been stranded. Segments in which there is no observed oil (NOO) should be documented.
- ***Shoreline type:*** descriptions of the primary and secondary shoreline types surveyed, ideally using standard descriptors and coding such as the Environmental Sensitivity Index (ESI) (see IPIECA/IMO/OGP, 2012) or Environment Canada's shoreline classification system (see Box 3 on page 17).
- ***Coastal character:*** description of the backshore, specifically noting access and staging factors for operations.
- ***Oil concentration:*** quantitative descriptions of the distribution (length, width and percentage cover) and thickness of surface oil, and the location, thickness, depth and percentage cover of subsurface oil, using standard and consistent measurements and definitions (see Box 4 on pages 18–19).
- ***Character of the oil:*** standard descriptions of the character of the oil and the degree of weathering, for example, fresh oil, emulsification, oil residue, or sheen (see Box 4 on pages 18–19).
- ***Potential behaviour of the oil:*** an indication of the likely persistence (days to weeks, weeks to months, months to years) of the oil and its remobilization potential, based on the characteristics of the oil, the change of oiling with time (weathering), and the water and weather conditions.

Layer of subsurface (buried) oil residue in a hand-dug pit on a sandy beach.

This information set is initially used to develop immediate clean-up priorities, which are typically those segments with the heaviest oil concentrations and the greatest potential for remobilization of the oil.

During the subsequent planning stage, shoreline oiling data is combined with information on sensitivity and resources at risk in order to set long-term objectives and priorities. Oiling data includes the following segment-specific information:

- oiled shoreline assessment forms and associated maps, sketches, diagrams and photos;
- safety and logistical issues, such as access and constraints;
- observed resources at risk; and
- beach profile data (see *What types of data are generated?* on page 27)

Such information can be collated to produce area or regional overviews of the shoreline oiling and of the response progress, in the form of oiling and status tables and maps and time series diagrams (see pages 27–28).

Appendix 1 on pages 32–33 provides an example of an oiled shoreline assessment form. Standard forms can be modified to reflect the specific shoreline character (e.g. wetlands) or oiling conditions of a particular region or spill.

Far left: a pebble/cobble beach with oil deposited primarily above the intertidal zone.
Near left: an oiled river bank during a period with a falling water level.

Box 3 *Environment Canada's shoreline classification (for temperate and arctic environments)*

Marine shoreline types

- Bedrock—cliff/vertical
- Bedrock—sloping/ramp
- Bedrock or beach rock—platform
- Glacier/ice shelf
- Man-made solid
- Man-made permeable
- Sand beach
- Mixed sediment beach
- Pebble/cobble beach
- Boulder beach
- Mud flat
- Sand flat
- Mixed sediment flat
- Pebble/cobble/boulder flat
- Wetland
- Mangrove
- Peat shoreline
- Tundra cliff—ice rich
- Tundra cliff—ice poor
- Inundated low-lying tundra

Winter shorelines—marine and freshwater
(usually temporary)

- Ice foot
- Snow
- Frozen swash
- Frozen spray/splash
- Grounded ice floes

Marine and lake coastal character

- Cliff/hill
- Sloped
- Flat/lowland
- Beach
- Delta
- Dune
- Lagoon
- River inlet/channel
- Wetland
- Man-made

Freshwater shoreline types (lake, river, stream)

- Bedrock cliff/ramp
- Bedrock platform/shelf
- Man-made solid
- Man-made permeable
- Sediment cliff
- Mud/clay bank
- Sand beach or bank
- Mixed sediment beach or bank
- Pebble/cobble beach or bank
- Boulder beach or bank
- Peat/organic beach or bank
- Mud flat
- Sand flat
- Mixed sediment flat
- Vegetated bank
- Marsh
- Swamp
- Bog/fen
- Wooded upland

River or stream valley character

- Cliff
- Sloped
- Canyon
- Straight
- Confined or leveed
- Meander
- Flood plain valley
- Braided
- Oxbow
- Man-made

River or stream channel character

- Shoals
- Point bars
- Cascade
- Rapids
- Riffle
- Pool
- Gide
- Log jams
- Undercut banks

Box 4 *Standard terms and definitions*

A key element of shoreline assessment is the use of agreed standard terms and definitions, without which comparison between different survey forms and reports would be difficult. By using the same words or phrases to describe oiling, everyone in the response understands their meanings and there is no misinterpretation. Examples of accepted terms and their definitions to describe surface oiling character include:

Oil band width can be categorized depending on tidal range or shoreline environment:

	Small tidal range (< 2 m), lake or river shoreline	Large tidal range (> 2 m)
Wide	> 2 m	> 6 m
Medium	1–2 m	3–6 m
Narrow	0.3–1 m	0.5–3 m
Very narrow	< 0.3 m	< 0.5 m

Oil character

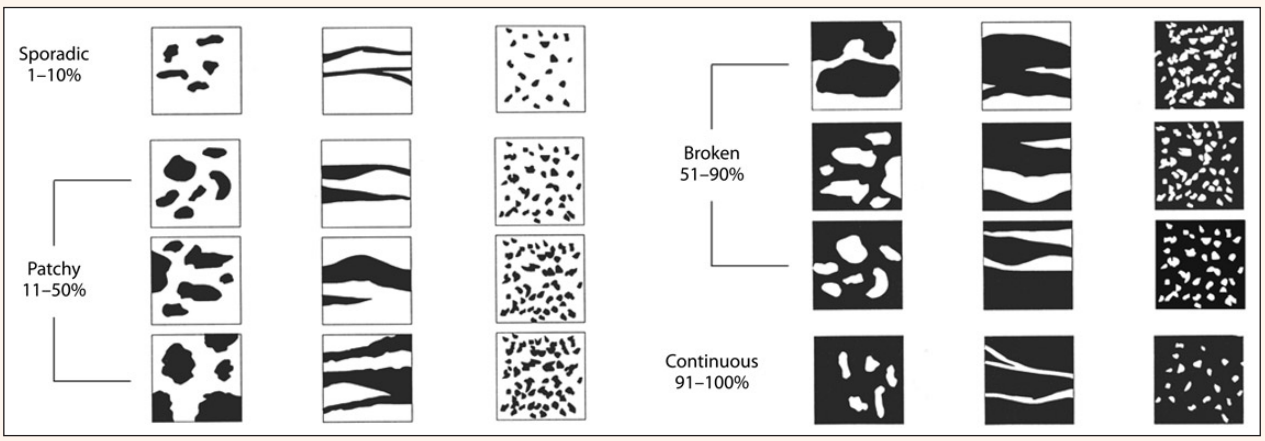
- Fresh: un-weathered, low viscosity oil
- Mousse: emulsified oil (a mixture of oil and water)
- Tar balls: discrete oil balls on a beach or adhered to the substrate (< 10 cm diameter)
- Tar patties: discrete oil patties on a beach or adhered to the substrate (> 10 cm diameter)
- Tar: weathered coat or cover of tarry, almost solid, consistency
- Surface oil residue: non-cohesive oiled surface sediments
- Asphalt pavements: cohesive mixture of oil and sediments
- No oil observed (NOO)

Oil distribution is grouped into the following categories (see Figure 5):

- Trace: < 1%
- Sporadic: 1–10%
- Patchy: 11–50%
- Broken: 51–90%
- Continuous: 91–100%

Note: Tar balls can be counted for a fixed area, also noting average and largest sizes.

Figure 5 *Percentage distribution examples*



Source: Owens Coastal Consultants

Oil thickness is described according to the following categories:

- Thick oil: > 1 cm
- Cover: > 0.1 cm to ≤ 1 cm
- Coat: > 0.01 cm to ≤ 0.1cm (can be scratched off with a fingernail)
- Stain: ≤ 0.01cm (cannot be scratched off easily with a fingernail)
- Film: transparent or translucent film or sheen

Terms such as 'light', 'moderate' and 'heavy' are given specific definitions so that their use is consistent and comparable. Matrices (see examples in Figures 6 and 7 below) can be used to categorize oiling to provide a simple, yet standardized, description.

Figure 6 *Initial surface oil cover matrix*

		Width of oiled area			
		Wide (> 2 m)	Medium (1–2 m)	Narrow (0.5–1 m)	Very narrow (< 0.5 m)
Oil distribution	Continuous 91–100%	heavy	heavy	moderate	light
	Broken 51–90%	heavy	heavy	moderate	light
	Patchy 11–50%	moderate	moderate	light	very light
	Sporadic 1–10%	light	light	very light	very light
	Trace < 1%	very light	very light	very light	very light

Oiled area width *(in this case for a location with a small tidal range) and* ***oil distribution*** *are combined in this 'Initial surface oil cover matrix'.*

Figure 7 *Final surface oil categorization matrix*

		Surface oil cover			
		Heavy	Moderate	Light	Very light
Average thickness	Thick oil > 1cm	heavy	heavy	moderate	light
	Cover 0.1–1.0 cm	heavy	heavy	light	light
	Coat 0.01–0.1 cm	moderate	moderate	light	very light
	Stain/Film < 0.01 cm	light	light	very light	very light

The ***initial categorization of the surface oil*** *from the 'Initial surface oil cover matrix' (Figure 6) is combined with the* ***average oil thickness*** *in this 'Surface oil categorization matrix.*

Treatment options and constraints

Treatment end points

Treatment end points provide measureable objectives for a shoreline response, ensuring that everyone involved, from the management level to the response operators in the field, understands which segments require clean-up and what level of residual oiling is considered acceptable in those segments. When those mutually-agreed end points are achieved, this means that no further treatment (NFT) is required and that a segment can be removed from the response, and clean-up teams redeployed elsewhere as required. The involvement of the appropriate environmental agencies in the development of end points ensures that their requirements and concerns can be fully taken into account in the decision making process.

In recommending end points to the spill management team, the shoreline assessment programme team must understand the degree of oiling, the rate of weathering, the potential for remobilization and the potential for natural recovery, as well as the shoreline type and sensitivity, and the potential for exposure to wildlife and the public. Typically, end points are defined for each of the affected shoreline types and uses. An understanding of the capabilities and limitations of the available treatment techniques is essential; in particular, the team should be aware of any negative impact that each treatment option may have on the shoreline habitat. It is important to note that it is rarely technically or economically practical to attempt to clean to pre-spill conditions or to the NOO standard, and that some treatment activities may have a negative net environmental benefit (NEB), particularly on sensitive shorelines (see Box 5 on page 21 for the principles of ALARP and NEB). Technical Working Groups may be established to determine NFT end points and treatment options for different shoreline types (see Box 7 on page 24).

Ideally, end points should be quantitative, reducing any ambiguity from the process, for example: '*surface oiling less than 10% distribution and less than 1 cm thick*'. However, end points may also be qualitative, providing they are objective and measureable, for example: '*no oil which produces a rainbow sheen on disturbance*'. Analytical measurements could also be used to define end points, however it is likely to be difficult to agree on anything but an arbitrary concentration, so an in-situ quantitative or qualitative assessment is generally preferable. In situations where the shoreline type is particularly sensitive to physical impacts from treatment, an operational end point may be preferable, for example: '*this segment reaches 'no further treatment' (NFT) status when the recommended treatment has been completed*' (see Box 6 on page 22 for more examples of shoreline treatment end points).

Shoreline treatment recommendations (STRs)

Where a segment does not meet the end point criteria, the spill management team needs to know where the oiling is, why it does not meet end points, and how the operations personnel can clean the segment. With good data and an understanding of the shoreline oiling, characteristics and required end points, as well as a sound knowledge of available treatment techniques, the shoreline assessment programme team can make recommendations for shoreline treatment for each segment using an STR form (See NWACP 2014 for an example STR form). Where non-standard techniques, or new equipment is used, field trials or tests may be required

to determine their effectiveness. In some cases, where a shoreline is particularly sensitive to physical or other impacts from treatment, recommendations of 'no treatment' and/or 'monitor recovery' may be appropriate. The STR should identify and define the oiled area(s) within the segment (see page 27) and highlight the most appropriate treatment technique(s) for the oiling and shoreline type. The STR should also include clear instructions regarding any safety, logistical and ecological issues and constraints. STR forms are reviewed and approved by the spill management team, so that they can be incorporated into the shoreline response programme, essentially becoming 'work orders' for the shoreline operations teams.

STRs should include:

- segment number(s), coordinates, maps and photos;
- description of the oiled location(s), including shoreline characteristics;
- types and degree of oiling;
- recommended treatment techniques;
- a list of the different stages/steps of treatment;
- end point criteria for the segment(s);
- environmental, cultural and social restrictions and issues; and
- safety and logistical issues.

Treatment constraints—good management practices

In order to limit negative impacts from the recommended treatment options, the STR should refer to good management practices. These should explain the measures required to avoid or minimize additional harm, such as reducing physical impact to sensitive shorelines, avoiding vegetation disturbance, and minimizing disturbance of wildlife, cultural or historical resources.

Box 5 *NEB and ALARP*

The primary purpose of shoreline treatment is to *accelerate the natural recovery processes*, such as weathering and biodegradation. There typically comes a point in the treatment process when either no benefit is gained from any further treatment or the effort may result in undesired effects (such as root disturbance in wetlands), and therefore that treatment activity should either be modified or should cease. Two key principles for determining end points and treatment options are the principles of ALARP and NEB.

ALARP considers that a risk should be '*as low as reasonably practicable*', where the risk is greater than zero, but is tolerable and cannot be reduced further without incurring *disproportionate cost and effort*.

NEB involves the assessment of the '*net environmental benefit*' of potential treatment alternatives, *including natural recovery*, by comparing the negative and positive impacts of each treatment option and defining when a particular treatment activity should cease. Different treatment options have different impacts on the environment; generally the more aggressive the technique, the greater the physical shoreline impact. The assessment of NEB is therefore used to determine which option provides the greatest overall benefit to the environment. This assessment might include the options of 'no treatment' or 'monitor the recovery' where the shoreline is particularly sensitive to physical or other impacts from treatment operations. In addition to environmental impacts, NEB can also include the consideration of cultural and socio-economic issues. For further information on NEB and NEBA (net environmental benefit analysis) see IPIECA-OGP (2014a), *Net environmental benefit analysis for oil spill preparedness and response*.

Box 6 *Examples of shoreline treatment end points*

- No more than 1% tar balls which are less than 2 cm in diameter.
- No oil or tar balls greater than background deposition rates (where there is good documentation of background oiling data).
- No oiling on hard substrates greater than coat (0.1 mm), and no greater than 20% distribution.
- No oil on pooled water greater than a silver sheen in a marsh or in a pit or trench.
- No surface oiling more than 10% distribution and more than 1 cm thick.
- No oil which produces rainbow sheen on disturbance.
- No oil which rubs off on contact.
- No subsurface oiling greater than oil residue which is 4 cm thick and patchy (50% distribution).
- This segment reaches NFT status when the recommended treatment has been completed.

Example end points: near right: < 1% tar balls; far right: < 10% stain

How is an oiled shoreline assessment programme implemented?

Survey planning and strategies

Scope of the project

The first step in a response is to establish the potential size of the affected oiled area and to scale the shoreline survey programme accordingly. As with response operations, shoreline assessment resources need to be flexible and can always be scaled up or down as the situation changes. As long as oil is still migrating, daily overflights with reports are necessary to plan both strategy (scale of the response programme) and tactics (where to send ground survey teams and operations crews).

Segmentation

Dividing the shoreline into manageable segments at the beginning of a response, or as part of pre-spill planning, provides a database foundation within which survey documents, photographs and maps can be easily cross-referenced, and oiled areas can be easily located (see Box 2 on page 15). The same segmentation should be used throughout the response by all responders so as to avoid confusion.

Coordination with operations personnel

Although the shoreline assessment programme resides within the Planning function, it is vital that the shoreline assessment programme is able to establish direct communications with the shoreline operations personnel. This allows for an efficient process by ensuring that the operations teams understand what is required and that they are aware of any environmental concerns. At the same time, the shoreline assessment survey teams will become aware of any practicality, feasibility and timing issues that may arise during treatment. A SCAT Operations Liaison role, either within the field teams or as a separate function, can help to facilitate two-way discussions of:

- treatment guidelines;
- techniques and strategies;
- operational limitations and good practice guidelines;
- environmental, cultural and socio-economic limitations;
- prioritization of treatment;
- the understanding and application of STRs; and
- the identification of logistical assets and liabilities (such as access points, staging areas, boat docks and launches, quality of roads and infrastructure).

Coordination with stakeholders

Relevant stakeholders, such as the responsible party and key government agencies, typically have representation within the shoreline assessment programme, either in the management team and/or in the field. This ensures good coordination and communications as well as mutually-agreed decisions relating to shoreline oiling and treatment. For large incidents with multiple stakeholders, the formation of Technical Working Groups may be appropriate to ensure that the requirements and concerns are addressed during the decision making process (see Box 7 overleaf).

Box 7 *Technical Working Groups*

The end point criteria and treatment techniques recommended by shoreline assessment teams are approved by the key decision makers at the management level. Technical Working Groups (TWGs) may be formed to ensure that key agencies representing environmental, cultural and socio-economic interests at the local to national levels, and relevant stakeholders such as the responsible party, operations and planning personnel, all have the opportunity to present their requirements and concerns during the decision making process. Where several shoreline environments have been oiled, TWGs may be established for each shoreline type (e.g. for sand beaches, wetlands and man-made shorelines). Data, information and recommendations from the shoreline assessment programme are provided for discussion within the TWG(s) and are used to provide outputs required by the response management, for example:

- definition of shoreline segments that need treatment;
- establishment of treatment priorities;
- development of end point criteria by shoreline type;
- development of shoreline treatment recommendations by habitat type;
- recommendation of field trials to evaluate and compare different treatment techniques; and
- evaluation of shoreline assessment data throughout the operational process to determine the effectiveness and effects of treatment.

TWGs add an additional layer of confidence to the decision making process so that upper level management and stakeholders can be assured that the relevant participants and experts, whose opinions or concerns have been considered throughout the process, have also been involved in making recommendations on treatment and end points. TWGs therefore help to make the approval of these recommendations a smooth process, particularly when multiple agencies are involved.

Field survey requirements

Planning for shoreline assessment surveys should include the mobilization and provision of a variety of resources, including:

- trained and calibrated multi-agency teams;
- equipment (e.g. notebook, GPS, camera, shovel, profile stakes, PPE);
- transportation (e.g. road, off-road, water, air);
- a safety plan and job safety analysis process to identify and remove or mitigate new hazards;
- communications (e.g. mobile phones, radio, satellite phones); and
- training tools (job aids, manuals, calibration presentations).

A selection of typical shoreline assessment survey resources: (near right) personal equipment including PPE, first-aid kit, foul-weather gear, GPS, camera and notebook; (far right) paperwork and information, including maps, plans, job aids and oiled shoreline assessment forms.

Plans and resources should be in place to provide the following data:

- oiled shoreline assessment forms (paper or electronic—see Appendix 1);
- sketches/maps;
- photos/videos;
- GPS positional data;
- beach profile data (see Box 9 on page 29); and
- monitoring site data (see Box 9 on page 29).

Data management

Shoreline surveys can generate large amounts of data which must be collected, reviewed, organized and preserved. Agreed-upon performance metrics must be established at the start of the response. Shoreline oiling data (see *What types of data are generated?* on page 27) should be rapidly made available to the response organization so that once the field teams have completed a survey that data may be processed quickly by the data management team. This processing includes quality assurance/quality control (QA/QC) of raw data, entry into a database within a geographic information system (GIS) function, and data analysis, through to final data presentation and preservation.

The objectives and strategies of the shoreline survey and response programme can be summarized in a shoreline response plan (see Box 8). This plan, when approved by the spill management team, defines what will be surveyed, who participates, the survey protocols, the approved treatment objectives, priorities and end points, shoreline treatment options, and the inspection process.

Box 8 *The shoreline response plan*

A shoreline response plan sets out the specific objectives, priorities and activities of a shoreline assessment programme and describes the treatment options and end points for the shoreline response programme, as agreed by the relevant stakeholders. The plan is beneficial to the shoreline assessment team and the Planning and Operations Sections as it helps each to understand the process, and the cooperation and communications that are required between the different parties.

Key components of a shoreline response plan are:

- health and safety;
- programme objectives;
- programme management;
- field team participants;
- field methods and forms:
  - aerial reconnaissance during initial stages;
  - shoreline inspections;
- shoreline treatment process;
- data management and reporting;
- logistics;
- spill management support;
- liaison with the Operations Section;
- treatment end points;
- shoreline treatment options;
- prioritization of treatment by segments; and
- the sign-off and completion process.

Time and space considerations

Shoreline assessment surveys are conducted as early as possible when oil spills affect, or are likely to affect, coastal resources. No matter what the size of the incident or where it happens, oiling location and conditions should be documented for planning, operational, legal and liability purposes. The scale of the shoreline assessment programme varies for each incident. A small, localized spill might only require one or two field teams with oversight, data and logistics coordinated by a single person in the command post; whereas a spill that affects tens or hundreds of kilometres might require multiple field teams with a large support group to provide data management, GIS support, logistics support and a liaison with the Operations Section. An important function of the shoreline assessment survey teams during the initial response phase is to debrief the Planning and Operations Sections on key information generated during the day's surveys. This information transfer has to take place in time for response personnel to incorporate that information into planning for the next day's activities. Survey teams only need to stay ahead of the operations teams by approximately two or three days during the initial stages of the response; any longer presents the risk that shoreline data may become out of date due to changes in oiling conditions, especially in the early stages of a response when the oil is still relatively fresh and mobile.

Below: mechanical trenching to determine the presence of subsurface oil on a mixed sand-pebble beach; and (bottom) inspecting a hand-dug pit for subsurface oil.

Teams should be prepared to look for subsurface oil in case the oil has penetrated beach sediments, or has been reworked or buried by sediments due to wave action. A range of detection and delineation options can be considered (API, 2013) and in some cases extensive systematic surveys may be required, for example if there are widespread and variable deposits of subsurface oil (Owens *et al.*, 1995).

When mobilizing field survey personnel it is important to consider the amount of time a person can commit to the response. A large incident might require a shoreline assessment programme to continue for several months or even years; in order to maintain consistent and accurate data, it is preferable to use the same calibrated personnel throughout the programme.

Teams should be prepared for a variety of spill environments and regional adaptations, which might require an understanding of different shoreline processes, different survey types and forms, and different transportation requirements, safety issues and clothing/PPE requirements. In tidal locations, survey planning must take into account the tidal range and tide heights so that field teams can observe the entire intertidal zone during their surveys. The range of field environments include:

- marine coasts;
- river and stream banks;
- lake shores;
- terrestrial environments; and
- regional variation, e.g.:
  - temperate;
  - tropics; and
  - arctic/ice or winter.

What types of data are generated?

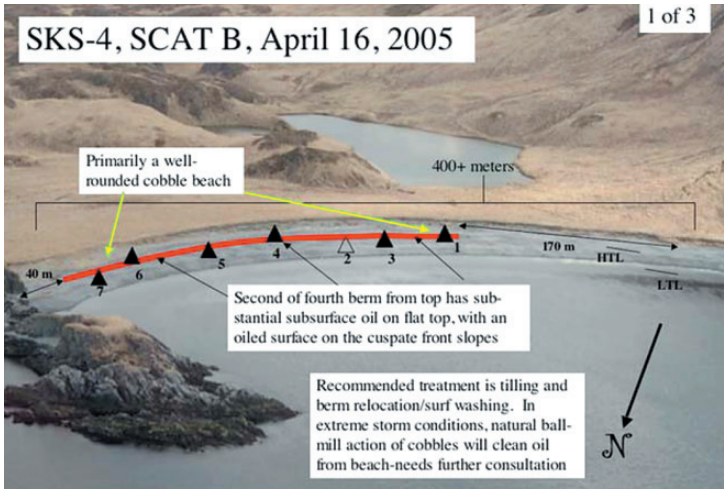
Data output from the field surveys includes tables, graphs, maps, photographs and reports. The field data are scientific and the summary outputs are designed to be easily understood by non-technical personnel and the general public.

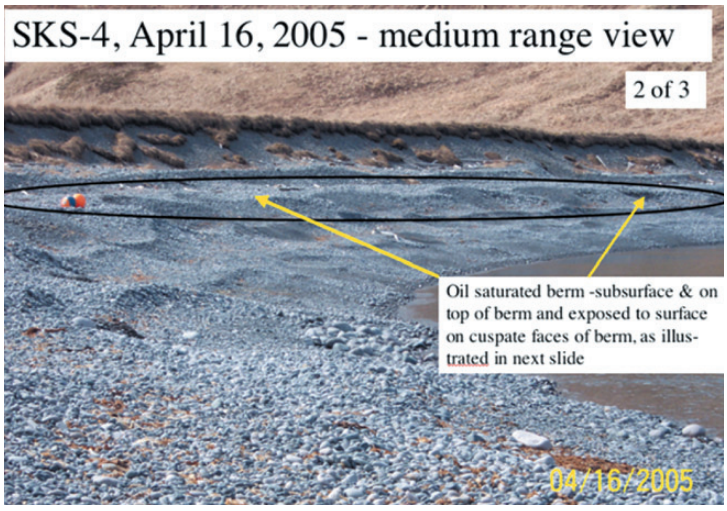
Field data, which include oiled shoreline assessment forms, sketches, photographs (see right), videos, and GPS track lines and waypoints, are collated by the data manager or data team to provide maps and other visual presentations related to segment-specific or area/regional summaries (see photographs overleaf).

Summary tables and graphs are also useful to provide situational information (see Table 1).

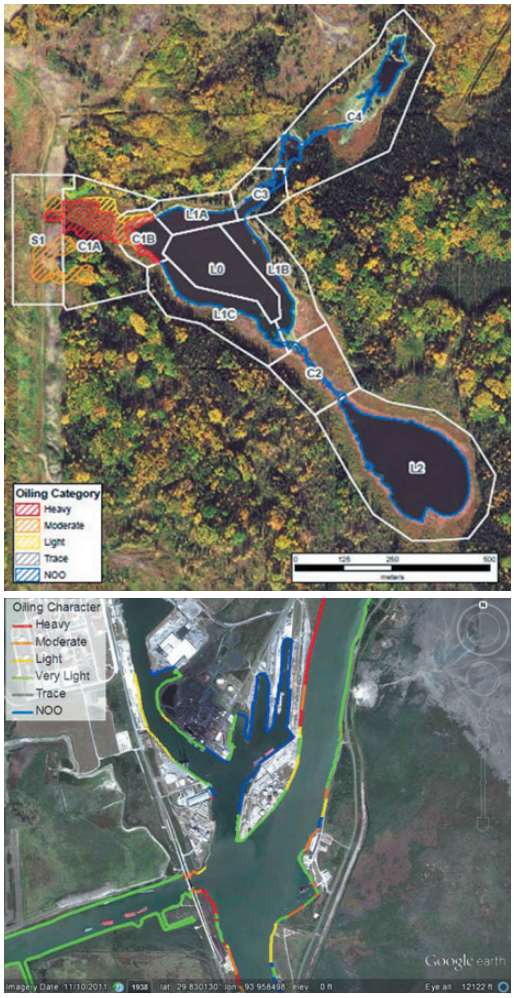
Compilations of shoreline oiling data document the past and current distribution and character of oiling conditions, representing changes through time, and hence the progress of natural recovery and/or treatment of the shoreline.

Shoreline assessment data and the derived summary information are important, not only to spill management and stakeholders to aid decision making and planning, but also to the general public to understand the evolving situation.





The photographs on the right show the different levels of detail of shoreline oiling conditions in the same segment (Owens et al.*, 2008).*



Shoreline oiling status maps: (top) an oiled wetland environment (polygon segments) and lake shoreline environment (linear segments); and (bottom) linear shoreline segments in a commercial waterway.

Data sets might include:

- aerial survey forms/reports;
- oiled shoreline assessment forms;
- photographs and videos;
- GPS track lines and waypoints;
- field sketches and maps;
- shoreline treatment recommendations (STRs);
- oiling and status tables;
- oiling and status maps;
- operational maps, showing current treatment areas;
- diagrams (e.g. time series showing progress);
- history tracking (chronological segment-specific actions throughout the response);
- beach profiles and reports (Box 9, opposite);
- photomonitoring and time series data (Box 9);
- cultural/historical data; and
- incidental wildlife information collected during shoreline assessment surveys.

Table 1 *Oiling summary table from an assessment survey of an oiled lake shore*

Shoreline type	Oiled length (m)	% of total oiled length	Length by oiling category (m)			
			heavy	moderate	Light/very light	No observed oil
Bulrush/reed	23,315	71.3	14,464	4,669	4,182	6,512
Wetland fringe	4,545	13.9	2,525	786	1,234	10,555
Cobble-pebble	1,392	4.3	1,268	39	85	1,668
Boulder-cobble	952	2.9	54	323	575	7
Mixed sediment	806	2.5	0	260	546	5,343
Vegetated bank	676	2.1	138	53	485	4,134
Sand	295	0.9	78	30	187	940
Peat/soil	286	0.9	150	74	62	0
Man-made permeable	227	0.7	0	0	227	410
Mud	194	0.6	0	194	0	493
TOTALS	**32,688**	**100.0**	**18,677**	**6,428**	**7,583**	**30,062**

Box 9 *Supplementary field data*

In addition to oiled shoreline assessment forms, sketches and photographs, the shoreline assessment field teams can produce other data which might be useful for a response. These might include aerial and shoreline videos, beach profiles, and photomonitoring data, as well as information about ecological, cultural, socio-economic, logistical and safety issues. The field survey teams, being the 'eyes on the ground', can also locate and report stranded operational equipment, such as boom and anchors washed up on the shoreline, and oiled wildlife.

Beach profile data

Where oil has been, or is likely to become, buried by sediment due to dynamic shoreline processes, or penetrates into coarse sediments, beach profile data are essential to help response personnel understand where oil might be buried and to what depths. Data can be collected by periodically surveying regular, calibrated beach profiles to show changes in beach elevation with time. By combining beach profile data with initial oiling data, the data team can recommend to the field teams where to look for buried oil.

Photomonitoring and time-series data

Photomonitoring sites at specific locations (identified by coastal features or stakes) and camera viewpoints produce useful time-series data through forms and photographs, showing the changes in oiling conditions, vegetative cover, erosion and profile changes over time. These are very useful for illustrating the progress of natural recovery and treatment of the affected shoreline to response personnel, external parties and the public.

Time-series photographs from photomonitoring surveys of an oiled wetland showing the change of oiling over time: (top) shortly after initial oiling; (bottom) several months after initial oiling.

How are shoreline treatment programmes completed?

Calibrated and experienced shoreline assessment teams can provide a process that enables a smooth and efficient closure of shoreline treatment operations. The response is completed when all responsible parties agree that sufficient appropriate treatment has been completed and that further activities may cease to provide a net environmental benefit (NEB) or are no longer practicable (ALARP) (see Box 5 on page 21). An integrated, inter-agency shoreline assessment programme delivers 'consensual satisfaction' between the various parties and stakeholders, and each is kept engaged from the initial shoreline assessment surveys through to the segment inspection sign-off recommendations.

Shoreline assessment surveys and reports

The key objective during shoreline assessment surveys is to reach full team consensus regarding oiling observations and treatment recommendations in order to ensure consistent and accurate reporting. Agreement amongst the team members should be attained for each segment in the field so that important details are not missed or forgotten when producing formal paperwork after the surveys are completed. Field data, including oiled shoreline assessment forms, maps, photographs and sketches are collated for each segment. Oiled shoreline assessment forms include a descriptive summary of the oiling conditions for the segment and recommendations for treatment if the oiling is above the agreed end point criteria, together with guidance on whether treatment would provide an NEB.

Shoreline treatment recommendations (STRs)

Where the field teams recommend treatment, STRs are generated for approval by the decision makers, and then provided to the Operations Section to guide the shoreline clean-up activities. (See *Treatment options and constraints*, on page 20.)

Sign-off and completion

When the oiled shoreline assessment survey team agrees that a segment requires no further treatment (NFT) because:

(a) the segment meets the agreed end point criteria;
(b) the survey team considers the oiling to be ALARP; or
(c) they evaluate that there would be no NEB in further treatment,

they report their recommendation on a shoreline inspection report (SIR). See NWACP 2014 for an example SIR form.

In addition:

(d) the Safety Officer may determine that risks which cannot be mitigated preclude the continuation of field activities.

The final 'approval' for segment completion is made by the response management personnel (for example, the Incident Manager) based on the recommendations from the field teams.

Figure 8 *Segment completion process*

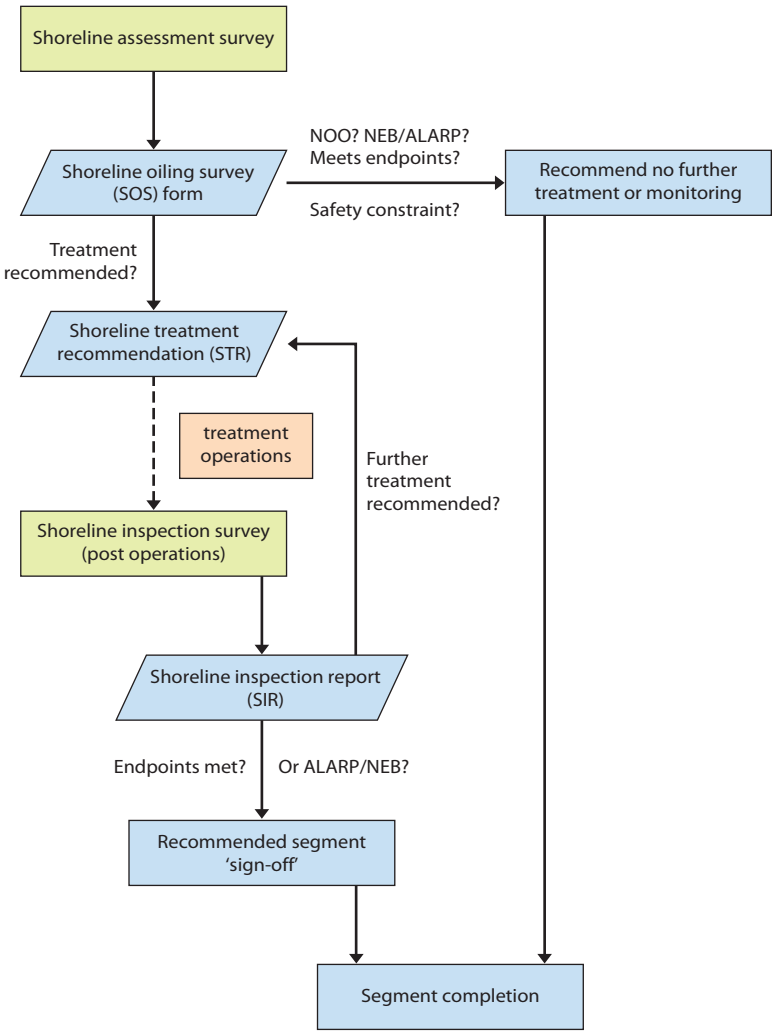


Figure 8 highlights the basic steps from initial shoreline surveys to completion on a segment-by-segment basis.

A successful shoreline assessment programme includes:

- the generation of timely information and data at the start of a response to scale the shoreline response programme;
- support for the Operations personnel to provide them with a clear understanding of what is expected in terms of treatment objectives, and what concerns or constraints apply to their actions and activities;
- the integration of parties who, through legislation, land management or other reasons, should be included in the development of treatment objectives and criteria, and the inspection/closure process; and
- the production of a formal record of oil conditions and treatment during the response.

Appendix 1:
Example of an oiled shoreline assessment form

The example form below (POSOW, 2013) is designed for marine shorelines and was developed for non-technical surveyors. More technically-oriented forms are provided by MCA (2007), NOAA (2013) and Owens and Sergy (2004).

Surface and subsurface oiling conditions are recorded on the example below in boxes 6 and 7, respectively. Subsurface oil detection and delineation methods are described in API (2013).

box 1

GENERAL INFORMATION	Incident:	Date:
Commune/Region	Survey time: .....to.....	Tide:

box 2

SURVEY TEAM	Organisation:	Telephone number:

box 3

SEGMENT	Segment ID: Name of site:	
Total Length: .....m	Length surveyed: ..... m	
Start GPS: Lat	Long:	Other ref:
End GPS: Lat	Long:	Other ref:
Exposure: high / medium / sheltered / very sheltered / don't know		
Coastline type description (i.e estuary, boulder beach, marsh, cliff coastline, port.....):		

box 4

TOOL BOX: SHORELINE SUBSTRATE TYPE DESCRIPTION (NOT TO BE FILLED IN)

Man-made structures [solid (quay...) / permeable (rip-rap...)

Cliff [rocky / soft

Bedrock platform

Boulder (> 25 cm)

Cobble (6 cm to 25 cm)

Pebble (2 cm to 6 cm)

Granule (2 mm to 2 cm)

Sand (60 µm to 2 mm)

Mud (<60 µm) (grains not visible)

Mixed sediments

Sand with vegetation (dune)

Mud with vegetation (saltmarsh)

box 5

OPERATIONAL FEATURES		
Direct backshore access? yes/ no	Suitable: pedestrian / trucks	
Accessible from the neighbouring segment? yes / no	Suitable: pedestrian / trucks	
Debris ? yes / no	Not much / a lot / don't know /approx. volume:	Oiled? yes / no
Algae/posidonia deposit? yes / no	Not much / a lot / don't know /approx. volume:	Oiled? yes / no
Oiled fauna? yes / no	Type	Nbr: .....
Uses: tourism / fishing / other:	Conservation: yes/no. If yes, specify: historical / archaeological /nature	

boxes 6 & 7

SURFACE OIL

SUBSURFACE OIL

If the segment has relatively uniform oiling conditions along or across shore, complete one section: zone A. If not, subdivide the segment into as many zones as necessary and complete as many sections : B, C, D....

ZONE A Level: upper beach / middle beach / lower beach (circle option). If necessary: Long:..... Lat:.....

Substrate	6. Surface oil? yes / no					7. Subsurface oil: yes / no / don't know				
(choose type from Box 4)	Length (m)	Width (m)	Distr*	Thick**	Charact***	Pit ID	Penetration depth (cm)	Buried		
								depth (cm)	thickness (cm)	water (cm)

* **Distr**ibution: **Tr**ace < 1%; **SP**oradic (1-10%); **PA**tchy (11- 50%); **BR**oken (51-90%); **CO**ntinuous (91-100%)

** **Thick**ness: **TO** = **T**hick **O**il >1 cm; **CV** = **Co**a**V**er 1 mm to 1 cm; **CT** = **Co**a**T** <1 mm; **FL** = **Fi**L**m** = transparent sheen

*** **Charact**eristics: **FR** = **FR**esh; **MS** = **Mo**u**S**se; **TB** = **T**ar **B**alls <10 cm; **PT** = Tar **P**atties: 10 cm to 1 m; **PA** = **PA**tches:1 to 30 m; **SR** = **S**urface oil **R**esidue: non cohesive oiled sediment; **AP** = **A**sphalt **P**avement: cohesive mixture; **TA** = **TA**rry: almost solid weathered oil.

boxes 6 & 7

ZONE B Level: upper beach / middle beach / low beach (circle option). If necessary: Long:..... Lat:.....

Substrate	6. Surface oil? yes / no					7. Subsurface oil: yes / no / don't know				
(choose type from Box 4)	Length (m)	Width (m)	Distr*	Thick**	Charact***	Pit ID	Penetration depth (cm)	Buried		
								depth (cm)	thickness (cm)	water (cm)

ZONE C Level: upper beach / middle beach / lower beach (circle option). If necessary: Long:..... Lat:.....

Substrate	6. Surface oil? yes / no					7. Subsurface oil: yes / no / don't know				
(choose type from Box 4)	Length (m)	Width (m)	Distr*	Thick**	Charact***	Pit ID	Penetration depth (cm)	Buried		
								depth (cm)	thickness (cm)	water (cm)

ZONE D Level: upper beach / middle beach / lower beach (circle option). If necessary: Long:..... Lat:.....

Substrate	6. Surface oil? yes / no					7. Subsurface oil: yes / no / don't know				
(choose type from Box 4)	Length (m)	Width (m)	Distr*	Thick**	Charact***	Pit ID	Penetration depth (cm)	Buried		
								depth (cm)	thickness (cm)	water (cm)

BACK TO BOX N° 3 TO FILL IN THE LENGTH SURVEYED!

box 8

GENERAL COMMENTS / SKETCH

* **Distr**ibution: **Tr**ace < 1%; **SP**oradic (1-10%); **PA**tchy (11- 50%); **BR**oken (51-90%); **CO**ntinuous (91-100%)
** **Thick**ness**: TO** = **T**hick **O**il >1 cm; **CV** = **C**o**V**er 1 mm to 1 cm; **CT** = **C**oa**T** <1 mm; **FL** = **Fi**e**L**m = transparent sheen
*** **Charact**eristics**: FR** = **FR**esh; **MS** = **M**ou**S**se; **TB** = **T**ar **B**alls <10 cm; **PT** = Tar **P**atties: 10 cm to 1 m; **PA** = **PA**tches:1 to 30 m; **SR** = **S**urface oil **R**esidue: non cohesive oiled sediment; **AP** = **A**sphalt **P**avement: cohesive mixture; **TA** = **TA**rry: almost solid weathered oil.

Appendix 2: Oiled shoreline assessment programme checklist

This checklist is adapted from NWACP, 2014.

Initial reactive phase

- Deploy aerial reconnaissance and/or rapid ground response teams to gather preliminary information on the oiled shoreline.
- Establish communications and coordination with Operations and Safety personnel.
- Establish a shoreline assessment programme coordinator.
- Establish the objectives of the shoreline assessment programme, using the overall response objectives as guidance.
- Determine the scope and scale of the initial area to be surveyed by shoreline assessment field teams.
- Determine who will participate in the field survey (that is, who is represented on the field teams).
- Determine the number of field survey teams and appropriate level of support personnel.
- Segment the survey area (if the area is pre-segmented, check the need for any revisions and make any necessary amendments).
- Establish a data management system and, if possible, access an appropriate digitized shoreline.
- Select, and if necessary modify, the appropriate shoreline assessment forms to be used by the field teams and coordinate with the data manager to ensure compatibility.
- Establish and develop shoreline assessment reporting metrics.
- Develop a survey and reporting schedule to introduce key survey information in time for incorporation into the planning schedule for shoreline operations.
- Identify incident-specific health and safety considerations for shoreline assessment operations.
- Identify and assemble the essential logistics and survey equipment for the field teams.
- Begin drafting a shoreline response programme plan.

Planning phase

- Finalize the shoreline response programme plan.
- Determine which areas are to be surveyed, and prioritize segments (may require overflight data).
- Prepare, deploy and manage field survey teams.
- Establish a process for summarizing field data and communicating data as appropriate to response managers and planners, using agreed-upon metrics.
- Develop procedures for translating field oiling data into shoreline treatment recommendations, which must include stakeholder input, regulatory compliance (site specific), and management approval.
- Determine how treatment end points are selected (for example, through Technical Working Groups, if needed).
- Develop and submit initial clean-up guidelines and end points to the response management for approval.

Operational phase

- Ensure that all elements of the shoreline response programme plan are being addressed and documented.
- Monitor the effectiveness of the clean-up.
- Monitor and document changes in oiling locations, character and extent.
- Develop periodic summary and progress reports (initially these may be daily data reports but would transition into weekly summaries).

Completion phase

- Determine the formal completion inspection and approval process/procedures.
- Establish a communications protocol with the Operations Section that notifies the programme coordinator when clean-up treatments have been completed on a given segment.
- Evaluate the need for establishing a post-treatment assessment survey as a dress rehearsal for final sign-off and closure inspections with the land-owners/managers.
- Deploy shoreline assessment teams to conduct post-clean-up inspections to confirm that the end points have been achieved.
- Ensure that all of the documents are collected and archived.
- Document and disseminate lessons learned from shoreline assessment and treatment.

Acronyms

ALARP	As Low As Reasonably Practicable
GIS	Geographic Information Systems
GPS	Global Positioning System
IMS	Incident Management System
IMO	International Maritime Organization
IPIECA	The Global Oil and Gas Industry Association for Environmental and Social Issues
NEB	Net Environmental Benefit
NEBA	Net Environmental Benefit Analysis
NFT	No Further Treatment
NOO	No Oil Observed
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
SCAT	Shoreline Clean-up Assessment Technique
SIR	Shoreline/Segment Inspection Report
SOS	Shoreline Oiling Summary
STR	Shoreline Treatment Recommendation
TWG	Technical Working Group

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Further reading

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IPIECA is the global oil and gas industry association for environmental and social issues. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance; and is the industry's principal channel of communication with the United Nations. Through its member led working groups and executive leadership, IPIECA brings together the collective expertise of oil and gas companies and associations. Its unique position within the industry enables its members to respond effectively to key environmental and social issues.

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