IPIECA

International Association of Oil & Gas Producers

Contingency planning for oil spills on water

Good practice guidelines for the development of an effective spill response capability

IPIECA

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Preface

This publication is part of the IPIECA-IOGP 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 IOGP-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.

Note on good practice

'Good practice' in this context 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

Introduction

Oil spill contingency planning is the process of developing a suitable spill response capability that is in compliance with the regulatory framework and commensurate with the oil spill risks of an organization or facility. The intent of this guide is to provide guidance on the contingency planning process for potential oil spills in or on water. It is aimed at organizations with a risk of an accidental release of oil to a marine or aquatic environment, including those involved in the handling, transport, production or storage of oil products.

The degree of complexity involved in the planning process will greatly depend on the type of operation, local conditions, and environmental and socio-economic sensitivities. However, the overall objective is always to develop a capability to effectively react to a spill and sustain an ongoing response that is proportionate to the risk. This capability requires suitable equipment, sufficient logistics, and competent, trained responders supported by proven, exercised plans. A reliable system of review and maintenance will ensure the planning remains relevant and appropriate to changing levels of risk as an organization matures or evolves. This is a cyclical process that should remain active over the lifetime of an operation.

The guide consists of nine main sections:

- ***The contingency planning process*** provides an overview and starting point.
- ***The regulatory framework*** discusses the inclusion of international, regional and local agreements and regulatory requirements in an organization's contingency planning.
- ***Stakeholder engagement*** considers the involvement of stakeholders who share the risk and may be consulted in the planning process or in a response.
- ***Oil spill planning scenario development*** provides guidance on the analysis of risk and the identification of planning scenarios that cover the full range of risk and response challenges an organization may face.
- ***Response strategy development*** discusses the development of appropriate response strategies for the planning scenarios and the role of net environmental benefit analysis (NEBA) in agreeing the most appropriate response options.
- ***Determination of response capability*** explains the identification and provision of response resources, including consideration of supporting elements, in building an overall response capability.
- ***Contingency plan preparation*** outlines the compilation of the planning material into a clear and concise, actionable plan for use in a response, and supporting documents for supplemental material and justification of response capability.
- ***Implementation*** discusses the use of training and exercises to build responder competence and to test and verify that the capability and the plan meet the needs of the organization.
- ***Review and update*** explains the importance of a regular review and update of the planning material to maintain and improve capability over time.

IPIECA and IOGP have developed several subject-specific publications relating to the contingency planning effort. Numerous other documents and internet information portals have also been developed by industry and government for specific aspects of contingency planning. Such resources are referenced where appropriate throughout this guide and are listed in the *References and further reading* section on pages 49–51. The reader is encouraged to consult the various information sources.

The contingency planning process

The oil spill contingency planning process described in this guide is illustrated in Figure 1. To begin, planners must clearly define the assets and operations to be included within the planning scope. Industries such as shipping, pipelines, ports, oil handling facilities, and exploration and production differ widely in their scale of operational activities, environmental concerns, regulatory requirements and consequent oil spill risks. Each presents distinct challenges in planning.

Once planners have defined their scope, a thorough review of the regulatory framework is required to determine the applicable legislative and regulatory structure. This framework will have an influence throughout the entire process, and planners should always remain aware of the requirements and expectations. Stakeholder engagement should also be addressed at the outset by establishing who may be affected by the oil spill risk and a potential spill's consequences and who may need to be consulted or informed during the planning effort.

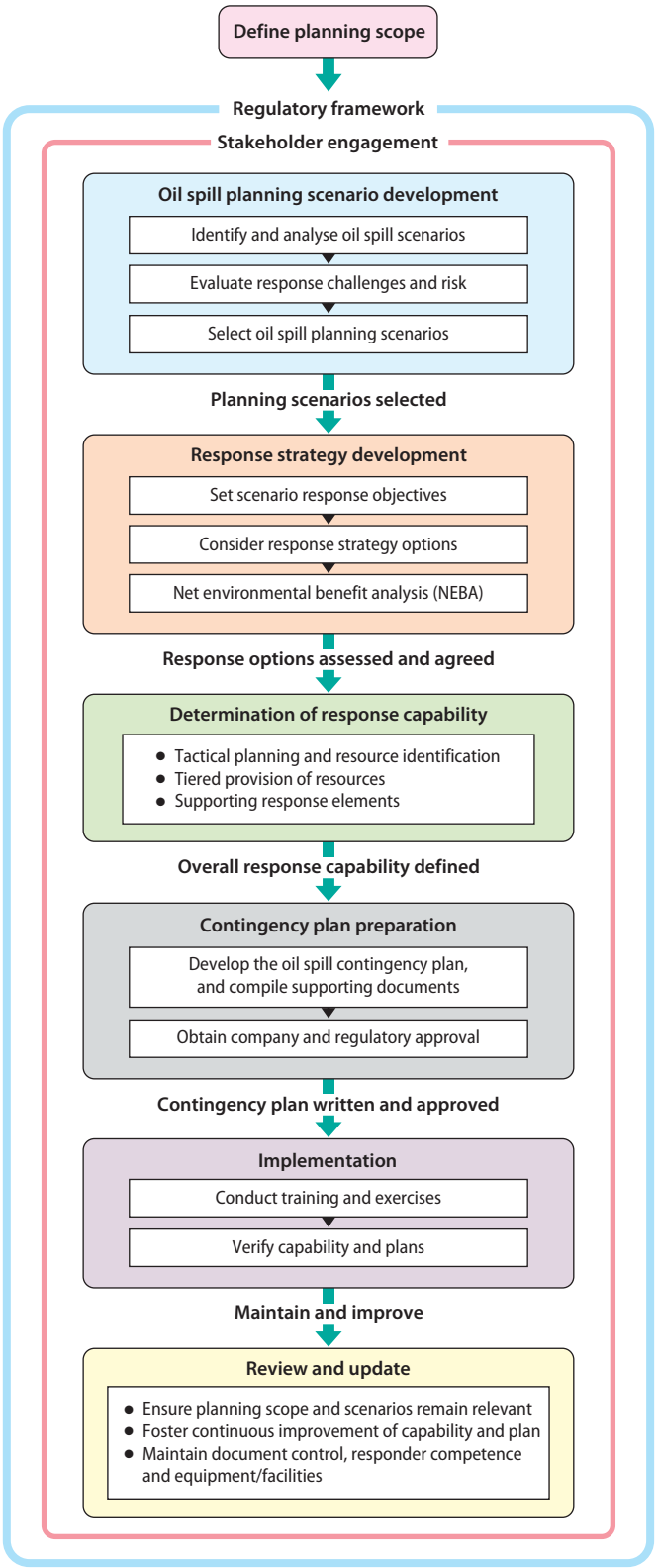
The process proceeds with a structured approach to developing spill response capability by:

- assessing risks and selecting oil spill planning scenarios that are representative of the risks;
- analysing the scenarios to determine an appropriately tiered oil spill response capability;
- compiling effective plans and thorough documentation; and
- implementing and verifying the desired level of preparedness.

Organizations are then responsible for regularly reviewing and updating all aspects of the contingency planning process and maintaining an appropriate state of preparedness over the life of the operation.

The various steps in the process draw on a wide range of disciplines, including crisis management, operations, environmental science, chemistry, logistics and supply chain management, health and safety, government relations, risk management, engineering, public affairs, and legal issues and

Figure 1 *The oil spill contingency planning process*



compliance. To adequately incorporate this diversity, organizations will benefit from engaging a range of internal and external expertise, and implementing the contingency planning process under the guidance of experienced oil spill response planners and responders. While subject matter expertise may be outsourced, it is important to ensure that the organization remains engaged in the planning process and takes ownership of its outcomes and implementation.

Tiered preparedness and response

The established three tiered structure allows those involved in contingency planning to describe how an effective response to any oil spill will be provided; from small operational spillages to a worst-case release at sea or on land. The structure provides a mechanism to identify how individual elements of capability will be cascaded. An organization's response capability and contingency plan should relate directly to the potential spill scenarios and cover each tier, as appropriate. It is important to note that the tiers are strictly for planning purposes and, in the event of a spill, whatever resources are necessary to adequately respond to the spill must be mobilized regardless of the tier. Planning according to the tiered approach ensures that an appropriate provision of resources is considered for a response of any magnitude as applies to an organization's risk. It enables responders with access to adequate resources to mobilize an effective and timely initial response using pre-planned strategies and Tier 1 capabilities and to cascade in additional resources as they adapt to any response as it unfolds.

Generally speaking, and unless national contingency plans or regulations define response levels otherwise, it is recognized internationally that tiers fall into three categories (see Box 1 on page 7).

The resources held at the three tiers work to complement and enhance the overall capability by enabling seamless escalation according to the requirements of the incident. An important concept is the cumulative nature of tiered response. The elements of a Tier 1 response are supplemented by higher tier capability and not superseded or replaced by it.

There are no rigid rules for categorizing scenarios in terms of a tiered response capability. A nearshore spill of persistent oil would require the cascading in of regional resources (Tier 2), compared to the same size offshore spill of a non-persistent oil which could be handled solely with local resources (Tier 1).

The challenge for planners as they proceed through the planning process is to consider the scenarios and their potential outcomes, the resources available to the organization, and the challenges of the geographical area of interest, in making a decision on the level of Tier 1 capability required and on the necessary arrangements at Tier 2 and Tier 3. For example, in remote locations, where significant time and effort is required to mobilize additional resources, local Tier 1 capability will need to be more sophisticated compared to the Tier 1 capability required at a project location near a well-developed area with available Tier 2 response support that can be quickly and easily mobilized and deployed.

For further details on the 'tiered response' approach see IPIECA-IOGP, 2015a.

Box 1 *Tiered preparedness and response: a three-tiered system*

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Tier 1

Tier 1 capabilities describe the operator's locally held resources used to mitigate spills that are typically operational in nature occurring on or near an operator's own facility. The resources also provide an initial response to spills that may potentially escalate beyond the scope of Tier 1 initial actions and capabilities.

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Tier 2

Tier 2 capabilities refer to additional, often shared, national or regional resources necessary to supplement a Tier 1 response or support an escalating response. Tier 2 capability includes a wider selection of equipment and expertise suited to a range of strategic response options.

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Tier 3

Tier 3 capabilities are globally available resources that further supplement Tiers 1 and 2. They comprise the international resources necessary for spills that require a substantial external response due to incident scale, complexity and/or impact potential.

The regulatory framework

The foundation for any oil spill contingency planning effort is an understanding of the regulatory framework in which the assets and operations are located. Organizations should assess how international, regional, national, and local regulations and agreements may apply to their situation, and how that may affect their particular oil spill contingency planning. Many international companies with spill risks also maintain internal guidelines and compliance standards, which planners must balance and integrate with government requirements.

International conventions and agreements

Many countries have ratified the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention), which provides a framework for international cooperation for combating major oil pollution incidents and sets requirements for national systems of preparedness and response. It requires countries to develop their own laws and procedures for preparing for, and responding to, oil spills ranging from local impact to international scale. These should be encompassed within a national oil spill contingency plan, under the auspices of a designated national authority.

The OPRC Convention calls for national authorities to work with oil and shipping industries, port authorities, and other relevant entities to unify response efforts. It is crucial that industry works with governments to develop a clear, common interpretation of national requirements. There needs to be clarity within both government and industry contingency plans as to who is responsible for specific actions under all foreseeable situations.

Other international agreements and conventions relevant to contingency planning include the:

- Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol); and the
- International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL).

Additional information on these and other international conventions, as well as a current list of signatories, can be found on the International Maritime Organization (IMO) website at www.imo.org.

International liability and compensation conventions relevant to contingency planning for ship-source spills include the:

- Civil Liability Convention (1992 CLC);
- Fund Convention (1992 Fund);
- Supplementary Fund Protocol (2003);
- Bunkers Convention (2008); and
- HNS (Hazardous and Noxious Substances) Convention (2010).

Organizations are advised to investigate the status of conventions as well as any relevant national legislation on compensation and liability for both ship and non-ship source spills. Some countries are not signatories to the international conventions and/or may have implemented their own laws instead. Examples include the United States Oil Pollution Act of 1990 (OPA 90) and the European Union Environmental Liability Directive (ELD).

For detailed information on these conventions and their considerations in developing procedures for claims and compensation see IPIECA-IOGP, 2015b.

Regional and binational agreements

There are a growing number of regional conventions and bilateral agreements that provide a formal framework for countries to respond jointly to spills. Where there is the potential for transboundary movement of spilled oil, or if personnel and equipment may need to be transported across borders, agreements can expedite response actions and sharing of resources. Prearranged procedures are vital for rapid resolution of issues such as liability concerns, emergency immigration and import provisions, and financial compensation processes. Organizations developing contingency plans should be aware of the current status of such agreements in their operating region.

The United Nations Environment Programme (UNEP) Regional Seas Programme has been instrumental in driving regional cooperation to protect common bodies of water. Most of the Regional Seas Programmes function through Action Plans that are often underpinned by a legally-binding regional convention (www.unep.org/regionalseas/programmes). Several other independent, intergovernmental programmes, for example the Arctic Council and Helsinki Commission (HELCOM), were formed as a result of regional conventions and work cooperatively with UNEP.

Arctic Council

The Arctic Council consists of the eight Arctic States: Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russia, Sweden and the United States. Six international organizations representing Arctic Indigenous Peoples have permanent participant status. www.arctic-council.org

Neighbouring countries may be party to bilateral or multilateral agreements to facilitate cooperation in responding to spills in adjacent waters. This can include conducting joint exercises, developing joint contingency plans, sharing information, or establishing expedited customs and immigration procedures for equipment and trained personnel. For example, the Canada-United States Joint Marine Pollution Contingency Plan has provided a framework for cooperation since 1974; and the Manche Plan, a bilateral agreement between France and the UK, has been in place since 1978.

National and local legislation and regulations

Many countries and their provinces have well-established laws and regulations for contingency planning. These may include compliance standards, such as response time frames and incident reporting, tier definitions, approvals systems and various other aspects. Regulations can be specific and prescriptive in their conditions and processes. In these cases, the regulatory system will drive the planning process and set the requirements for overall oil spill preparedness and response capability as well as integration with the national and local oil spill contingency planning frameworks.

In the absence of specific national or local guidance, organizations should adhere to the international and regional protocols and conventions applicable to their operational area, as well

as to international good practice. Efforts should be made to achieve a common understanding of response management and capability with the relevant government regulatory bodies.

ITOPF maintains a series of Country Profiles focused on ship-source spills. The Profiles provide a summary of the oil spill response arrangements and clean-up resources in many maritime nations (www.itopf.com).

Environmental and cultural conventions and agreements

Planners should also consider conventions, agreements and international guidance on cultural and environmental protection, particularly when developing sensitivity maps and establishing priority protection areas. Box 2 provides examples of treaties and conventions that provide a legal basis for the protection of critical habitats, species and cultural heritage. The World Database on Protected Areas administered by the UNEP World Conservation Monitoring Centre holds a vast amount of information on protected areas (www.protectedplanet.net).

Box 2 *Environmental and cultural conventions and agreements*

International examples

- Convention on Wetlands of International Importance (Ramsar Convention)
- United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Convention
- Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention)

Regional examples

- Protocol Concerning Specially Protected Areas and Wildlife (SPAW) under the Cartagena Convention
- Japan Australia Migratory Bird Agreement (JAMBA)

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Near right: Ha Long Bay, Vietnam—a UNESCO World Heritage Site. Far right: Otago Peninsula, New Zealand—a habitat for yellow-eyed penguins, an IUCN (International Union for Conservation of Nature) Red List species with endangered conservation status.

Stakeholder engagement

Fostering open communication between industry, government and the community ensures that stakeholder priorities and expectations are understood. Early identification of stakeholders and consistent engagement throughout the contingency planning process allows for meaningful discussion and resolution of conflicting interests and opinions while in a non-emergency situation. It also provides planners with the opportunity to identify important environmental resources and socio-economic features and their value to the community.

Potential stakeholders may involve parties from many different backgrounds and with diverse interests (Box 3). A stakeholder can be a person or an organization with an interest or concern in response preparedness or their potential consultation or participation in a response to an oil spill. It can also be a local community or indigenous group that could potentially be impacted by a spill in their area. The participation of certain stakeholders during the contingency planning process may be mandated by regulation, such as public consultation requirements or approvals by government agencies.

Box 3 *Potential stakeholders*

- Government agencies
- Indigenous groups
- Universities and research institutes
- Non-governmental organizations
- Local communities
- Local business
- Volunteer organizations
- Ports/harbours
- Neighbouring facilities and industries
- Local emergency responders
- Labour organizations
- Political parties

Trellis Environmental, LLC

Contingencies need to be considered wherever an oil spill could disrupt local communities, for example those relying on subsistence fishing.

Planners will need to identify stakeholders that have a valid contribution to the contingency planning process, as well as those who may be engaged in sharing information. For example, the contact details for local landowners are important data for inclusion in the contingency plan. Sensitivity mapping (see pages 20–21) and net environmental benefit analysis (NEBA) (see page 26) are important parts of the contingency planning process where involvement of local constituents and the benefit of traditional and local knowledge can improve the quality of planning. A stakeholder mapping exercise carried out in consultation with an organization's external affairs group is one potential method planners might use to identify the relevant parties.

More detailed information on stakeholder engagement and community consultation can be found in IPIECA-IOGP, 2015c and IPIECA-IOGP, 2015d.

ITOPF

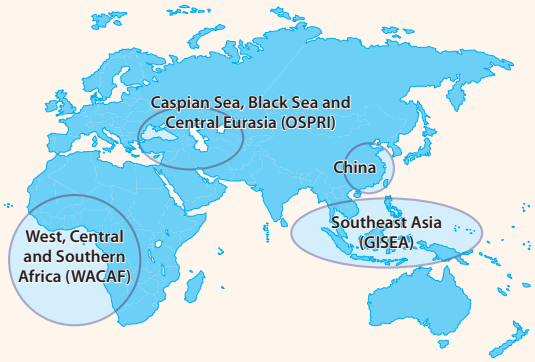
OSRL

Forums held to facilitate stakeholder engagement during planning and exercises contribute to more effective and efficient communication and relationships.

Industry efforts are also being made on regional and global scales to promote cooperation between stakeholders. Programmes, such as the Global Initiative (GI) (see Box 4), complement government and industry in regional efforts to enhance the capacity of countries to prepare for, and respond to, marine oil spills (www.ipieca.org/topic/oil-spill-preparedness/global-initiative).

Box 4 *Global Initiative regional groups*

- Caspian Sea, Black Sea and Central Eurasia Region—Oil Spill Preparedness Regional Initiative (OSPRI)
- West, Central and Southern Africa Region (WACAF)
- Southeast Asia Region (GISEA)
- China Programme



In addition to the Global Initiative programme, a growing number of other groups, such as ARPEL (the Regional Association of Oil, Gas and Biofuels Sector Companies in Latin America and the Caribbean), are also involved in promoting constructive dialogue, information sharing and capacity building in their regions. Planners will benefit from an understanding of these efforts in their region and how they affect their contingency planning.

Oil spill planning scenario development

A suitable selection of oil spill planning scenarios serves as the basis for defining an effective response capability that is commensurate with an organization's level of risk. In accordance with the tiered response approach, planners should aim to define a balanced set of scenarios that collectively represent the range of spill risks and response challenges within the planning scope. A number of details are determined and analysed in making an appropriate selection (see Box 5).

Box 5 *Spill scenario information, and questions that may need to be considered in its analysis*

Scenario information to be determined

- Event
- Likelihood (frequency/probability)
- Oil type
- Volume
- Duration of release
- Behaviour of spilled oil
- Location of event
- Prevailing hydrodynamic and environmental conditions
- Trajectory and fate
- Geographic zone of potential spill impact
- Environmental and socio-economic sensitive resources at risk and potential consequences if impacted.

Analysis

- What can go wrong?
- What is the chance that it could happen?
- What type of oil and how much of it could be released?
- Where could it happen and what are the local conditions?
- Where could the spilled oil go and how might it behave in the environment?
- What impacts could it have and how severe could the consequences be?

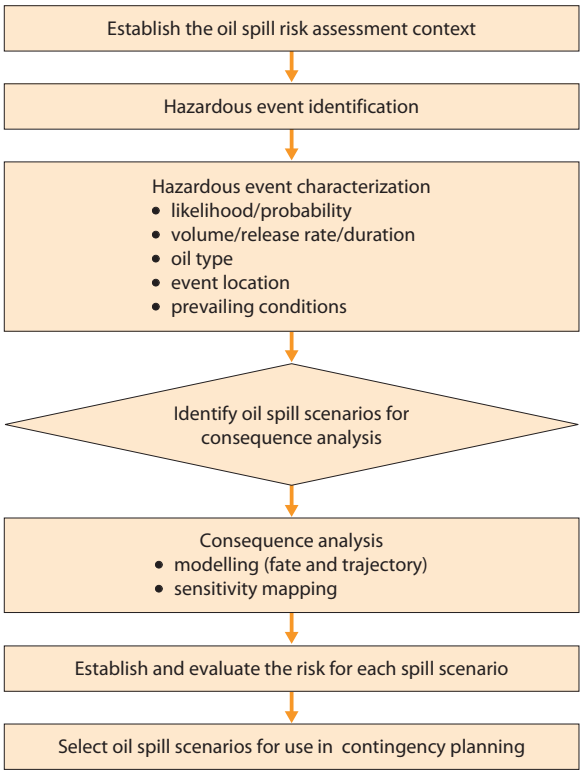
This data compilation and its analysis will continue to inform decision making throughout the contingency planning process and should be included in the contingency planning documentation for use during a response as well as for justification of response capability.

Figure 2 outlines the general process for developing oil spill scenarios for contingency planning. It uses the principles of oil spill risk assessment to facilitate an informed selection of scenarios. An oil spill risk assessment is a systematic method to:

- identify hazardous events that could result in spills;
- analyse the characteristics and likelihood of the hazardous events;
- define associated oil spill scenarios and identify a selection suitable for consequence analysis;
- analyse the potential consequences of each selected spill scenario if they were to occur; and
- establish and evaluate the subsequent risks to the environmental and socio-economic resources.

A number of risk assessment methodologies exist, ranging from prescriptive and comprehensive quantitative processes to simplified qualitative approaches. Planners will need to

Figure 2 *The general process for oil spill scenario development*



establish a risk assessment context (degree of complexity) that is appropriate for the planning scope. This will depend on a variety of considerations, including the scope and type of operations, availability and reliability of data, risk criteria and corporate practices. Ultimately, organizations should employ a risk assessment technique appropriate for their situation, in compliance with both their internal standards and the regulatory framework, and which provides results suitable for making reliable decisions regarding risk.

Detailed guidance on risk assessment and the selection of scenarios can be found in IPIECA-IOGP, 2013a and IMO, 2010.

Hazardous event identification and characterization

Planners should begin with a hazard identification analysis to determine all of the operational hazards that could result in a release of oil product. IPIECA-IOGP, 2013a outlines a number of tools that may be used to facilitate hazard identification. A characterization of the hazardous events should then be undertaken to define oil spill scenarios that are representative of those hazardous events (Box 6). For fixed facilities, it is possible to identify and describe specific hazardous events and release scenarios. For transient operations, such as shipping, the use of applicable generic scenarios can be appropriate. For ports or operations with a mix of shipping and fixed facilities, planners may find that a combination approach is most suitable.

Box 6 *Examples of potential spill scenarios based on hazardous events*

- Small operational/maintenance spills due to minor incidents
- Loss of well control leading to a blowout
- Ruptured flow lines, pipelines, risers, subsea equipment due to earthquake
- Loss of containment due to tank storage failure
- Loss of containment during offloading/transfers/bunkering
- Loss of containment from ship collision
- Loss of containment from ship grounding
- Loss of containment due to explosion

Planners should be aware of the inherent differences in industries when describing scenarios for operations that are fixed, transient or a combination of the two.

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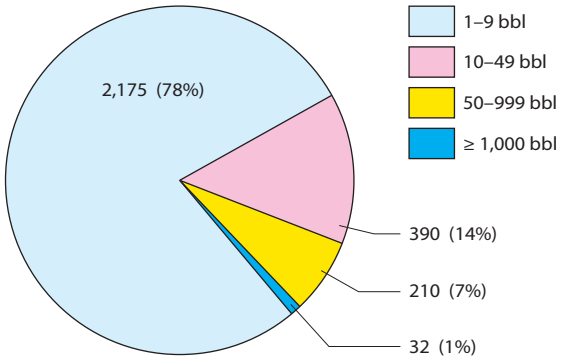
The identified hazardous events are characterized in terms of the likelihood of the event, the potential volume and duration of the release, the type of oil, and the location.

Likelihood

Likelihood refers to the chance an event might occur. It can be determined in general terms or mathematically, depending on the oil spill risk assessment context. Historical data (e.g. see Figure 3) can provide useful information on the causes of spills and statistics on spill frequency. This can aid in determining likelihood as well as informing the selection of spill planning scenarios. Analysis of shipping-related data has shown that most spills from ships occur in or close to ports; they tend to be small in size and are generally the result of routine operations such as off-loading, discharging and bunkering (ITOPF, 2011a). Conversely, the occurrence of large spills is relatively rare; however, their impact can be severe. When analysing operations of any type, planners should be mindful of distinguishing not only the low probability, high-consequence releases associated with worst credible case discharge scenarios, but also the more likely low-volume releases related to small, local incidents.

Figure 3 *Petroleum spills from US Outer Continental Shelf oil and gas activities—number of spills in each size category, 1964–2009*



Data from Anderson *et al.*, 2012

Updated shipping statistics are produced by ITOPF every year. The IOGP Risk Assessment Data Directory report series contains useful information for the oil and gas production and process industries (www.iogp.org.uk). Many national agencies also compile data on spills within their jurisdiction.

Release volume and discharge rate

Release volume can be established using either known fixed volumes and discharge rates or estimated volumes based on calculations and assumptions. This can be as simple as presuming an instantaneous release of 100% of a fixed volume due to failure of containment, or it can involve complex engineering and mathematical calculations, such as estimating rates for a pipeline rupture or well blowout. Government regulations or international industry standards should always be consulted on this subject as calculations for determining volumes and release rates for contingency planning are often prescribed. Planners should also include an estimation of worst credible case discharge and ensure that the associated scenario is carried forward for consequence analysis.

Oil type and the behaviour of spilled oil

Planners need to understand how the anticipated oil type will behave in the environment into which it may be spilled, including how it will weather or change over time. The base properties of a particular oil will drive the physical and chemical changes that occur when it may be spilled onto water. Oil characterization is the process used for describing the unique properties of a particular oil and its weathering profile under certain environmental conditions. Understanding how the oil behaves provides key information for planners because it:

- can be used to predict persistence in the environment and toxicity;
- is a required input to spill trajectory and fate modelling for consequence analyses;
- contributes to response strategy development and the choice of appropriate response techniques and equipment (for example understanding an oil's propensity to evaporate or emulsify can aid in establishing the efficacy and windows of opportunity for certain techniques, such as dispersant application and controlled in-situ burning);
- informs waste management decisions; and
- provides health and safety planners with indicators of potentially hazardous conditions, such as noxious fumes or dangerous flash points.

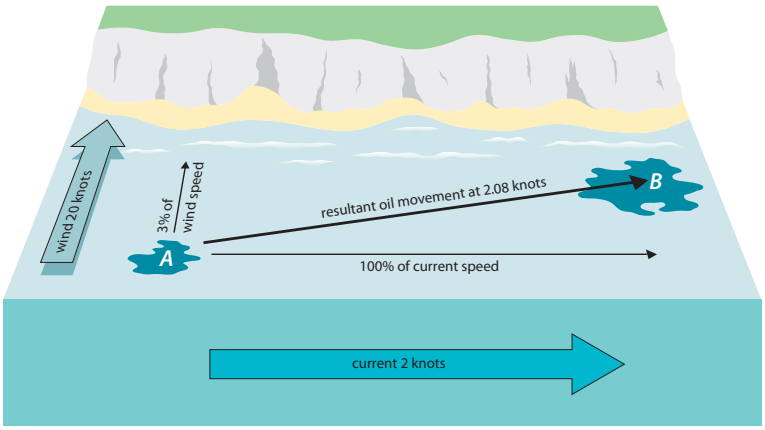
The base properties and weathering behaviour of many oils have been studied and documented. If sufficient data are not available or applicable to the organization's operating environment, laboratory and bench-scale experiments can be conducted on samples of the product to obtain the necessary data. Exploration projects face a particular challenge in that the oil properties may not yet be known. In this case, planners should choose an analogue oil based on their best available data. A range of possible oil types can also be used to capture a variety of potential outcomes. Planners should be aware of the uncertainty involved with this and the potential pitfalls when determining response measures.

For more detail on weathering, oil characterization and examples of applications in contingency planning, see also IPIECA-IOGP, 2013b; ITOPF, 2011b; and ITOPF, 2014.

Event location and prevailing conditions

The event location together with an understanding of local prevailing conditions give planners a preliminary view of the areas that could potentially be affected by a spill and the response challenges associated with the characteristics of a particular area. Although detailed environmental and socio-economic sensitivities will not have been considered at this stage, local knowledge, environmental/social impact assessments, and existing sensitivity maps can provide a basis for spill response experts to highlight events with the potential for severe consequences and which may therefore be given priority for further analysis.

Figure 4 *The effects of wind and current on the movement of an oil slick*



An oil slick moves at approximately the same speed as the surface current and at about three percent of the wind speed—the resultant movement being a vector sum of the two.

Alaska Clean Seas

Unique planning factors, such as ice flow or break-up periods, can affect the distribution, behaviour and fate of spilled oil and choice of response method.

'Prevailing conditions' refers to the typical weather and hydrodynamic conditions experienced in an area. Local meteorological and oceanographic, or metocean, data is a fundamental input to predicting oil behaviour and movement (Figure 4). It is also an important consideration for planners and responders when evaluating the appropriateness of response techniques and site health and safety considerations.

Relevant data for use in oil spill scenario definition and spill modelling include wind/current direction and speed, sea state, tides, sea and air temperature, and possibly ice. Three-dimensional current data together with temperature and salinity profiles of the water column are also of particular interest for modelling subsea release plumes and dispersant efficacy in deep water environments.

Seasonality should always be considered, along with data from a time frame sufficient to include variations throughout the year. Any extreme conditions and unique planning factors that pose particular threats should also be noted, such as:

- hurricane, typhoon and monsoon seasons;
- ice flows or break-up periods;
- areas of high current or sea state; and
- temperature extremes (hot or cold).

Data for use in computer modelling of oil spills should be based on historical records and/or modelled metocean data fields. The availability and reliability of data will vary depending on the data collection history of the region of interest. Some areas of the world's oceans have extensive databases compiled over years of sophisticated monitoring, whereas remote or less-developed areas may not have such detailed information to draw on. Data can be obtained from official agencies, academic institutions and commercial organizations. In addition, experience has proven that information from local fishermen and watermen can be invaluable, particularly during a response.

Identify spill scenarios for consequence analysis

Planners should use the hazardous event characterization information to define representative oil spill scenarios and identify a selection suitable for consequence analysis. For a large operation with hundreds of potential events, this can be complex and will require a rigorous approach. Sound judgment based on data obtained during the characterization must be used to choose a manageable and meaningful number of scenarios for detailed consequence analysis, which can be time consuming and costly. It is recommended that the chosen scenarios be limited to a practical number and be representative of the tiered response approach. Regulatory requirements may also define specific scenarios that will need to be addressed.

Spill scenario consequence analysis

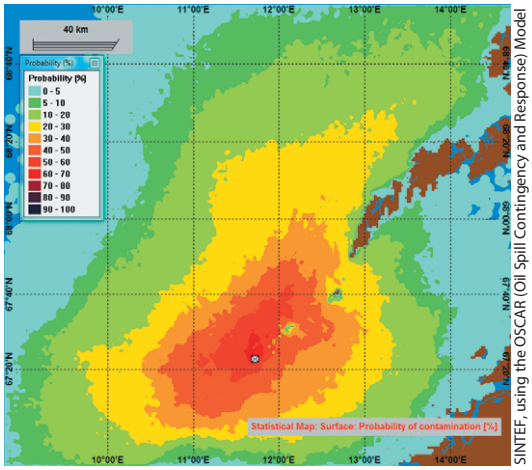
For each identified scenario, the potential environmental and socio-economic consequences should be determined. Predictions of oil trajectory and fate, together with an evaluation of the potential sensitive resources at risk of impact from oiling, combine to provide an estimate of the severity of an oil spill scenario. This value is critical in establishing and evaluating the risks associated with a spill scenario.

Computer modelling of oil spills

Oil spill modelling provides a forecast of oil trajectory and fate based on known or estimated oil properties and local prevailing conditions. Two main types of transport modelling outputs are used by planners to evaluate spill scenarios. A stochastic model (Figure 5) provides a statistical analysis of multiple trajectories of the same scenario simulated over a defined period of time, such as a season, using a database of historic or modelled hydrodynamic and wind data. The stochastic modelling output predicts the geographical zone of potential impact for a spill scenario (i.e. where oil might go) and the probability of impact for areas within that zone, along with associated timescales and potential concentrations or volume.

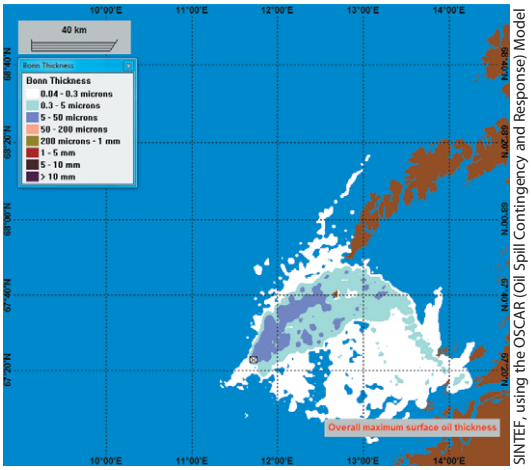
A deterministic model provides a simulation of the fate and transport of a single trajectory for a specific spill scenario and one set of hydrodynamic and wind conditions (Figure 6). The output predicts the projected oil movement, timeline and volume or concentration, including estimates

Figure 5 *An example of stochastic modelling output*



This image of a statistical analysis of multiple trajectories predicts the probability of where water surface oiling might occur based on a 10-day simulation using a dataset of historical hydrodynamic and wind conditions. It does not define the exact footprint of a spill scenario, but rather illustrates the zone of potential impact within which oiling might occur and the probability that oil might be present within that zone.

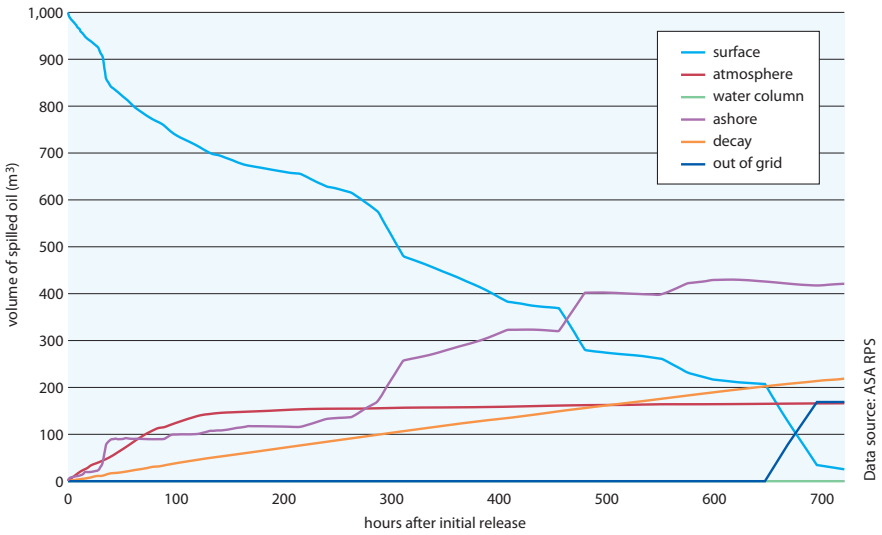
Figure 6 *An example of deterministic modelling output*



This image shows a single trajectory from the multiple trajectory statistical analysis in Figure 5. It predicts the maximum thickness of oil emulsion occurring on the water surface over a 10-day simulation using one input set of hydrodynamic and wind conditions.

of beached oil. Deterministic models can also be used to generate a mass balance analysis, which depicts the fate of the spilled oil over time, e.g. evaporation, biodegradation, dispersion, shoreline stranding, etc. (Figure 7).

Figure 7 *Example mass balance analysis*



This example of an oil mass balance graph is based on water surface area exposed to surface oil with an average thickness greater than 0.01 mm (dark brown sheen) for a 1,000 m^3 release of IFO-180 (intermediate fuel oil with a maximum viscosity of 180 centistokes).

Combining stochastic results with any number of deterministic outputs produces valuable information that can influence decisions concerning response strategy development and the identification of necessary response capability. The information is also an essential input to the sensitivity mapping and evaluation of environmental and socio-economic risk. Correct interpretation of the data generated from modelling is a specialist task, and care should be taken to ensure the material is interpreted and presented appropriately for the intended audience.

Various organizations and companies have developed oil spill computer models ranging from basic to the very sophisticated. Planners should use a model that is suitable for the spill scenarios they are analysing. It should be mentioned that certain spill scenarios may not need a sophisticated model when the spill volume is very small or if spill movement and fate predictions can be made based on previous modelling results, the experience of specialists coupled with local knowledge, or the use of the vector addition method shown in Figure 4.

Deep water drilling programmes, for which one or more scenarios may be a subsea release of oil, are advised to use models that are capable of performing multifaceted subsurface and surface fate and trajectory analyses. These complex models may also be used to simulate the application of spill response techniques, such as the use of subsea dispersants and their potential effectiveness, which can be useful during strategy development.

It is important to note that these models are only capable of making predictive estimates of fate and trajectory, and the quality of the input data will influence the quality of the model output. Users of the modelling data should understand the model limitations and the inherent difficulties in predicting oil fate processes (e.g. evaporation, emulsification, etc.).

Modelling is a predictive tool and cannot readily replace the need for real-time surveillance during an actual incident.

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Sensitivity mapping

Once planners have defined what incidents could occur, where the oil might go and how it could behave and weather in the environment, it is then necessary to determine which environmental and socio-economic resources could be affected and the degree of sensitivity of those resources to accidental oiling. Three sensitivity themes are considered:

- shoreline type and its general environmental sensitivity to oil spills;
- sensitive ecosystems, habitat, species and key natural resources; and
- sensitive socio-economic (including cultural heritage) features.

The combined modelling output of all the spill scenarios defines the overall zone of potential spill impact and outlines the geographic area of interest for sensitivity mapping. Potentially vulnerable sensitivities within this area of interest should be identified and characterized, and the probability of the spilled oil having an impact on these resources should be considered. This is best accomplished by developing a sensitivity map or analysing existing maps of the area, which may already be established and regularly maintained, usually by government programmes, regional cooperative efforts, or industry.

The sensitivity data is used in the risk assessment process to determine the potential consequences of a spill scenario and the probable impacts on key habitats and species as well as socio-economic features. The evaluation will provide planners with information on the location of high-risk areas and the resources and data to support their prioritization for protection, for example for optimum shoreline exclusion booming. Strategic sensitivity maps are developed to identify protection priorities and their ranking of importance, which is vital for setting response objectives and supporting decision making during a response. This can be a complex process and is closely tied to net environmental benefit analysis (NEBA) (see page 26).

Sensitivity maps also contribute vital information during a response. They can be used to convey essential information to on-site spill responders by illustrating the location of sensitive areas and resources, such as bird and turtle nesting areas and mariculture facilities. The maps can also be expanded to contain a wide range of operational planning information such as logistics data, site-specific tactics for priority protection areas, trajectory modelling, equipment stockpiles, staging areas, emergency medical facilities, potential command centres, etc.

Sensitive environmental and socio-economic areas and resources at risk should be illustrated in sensitivity maps.

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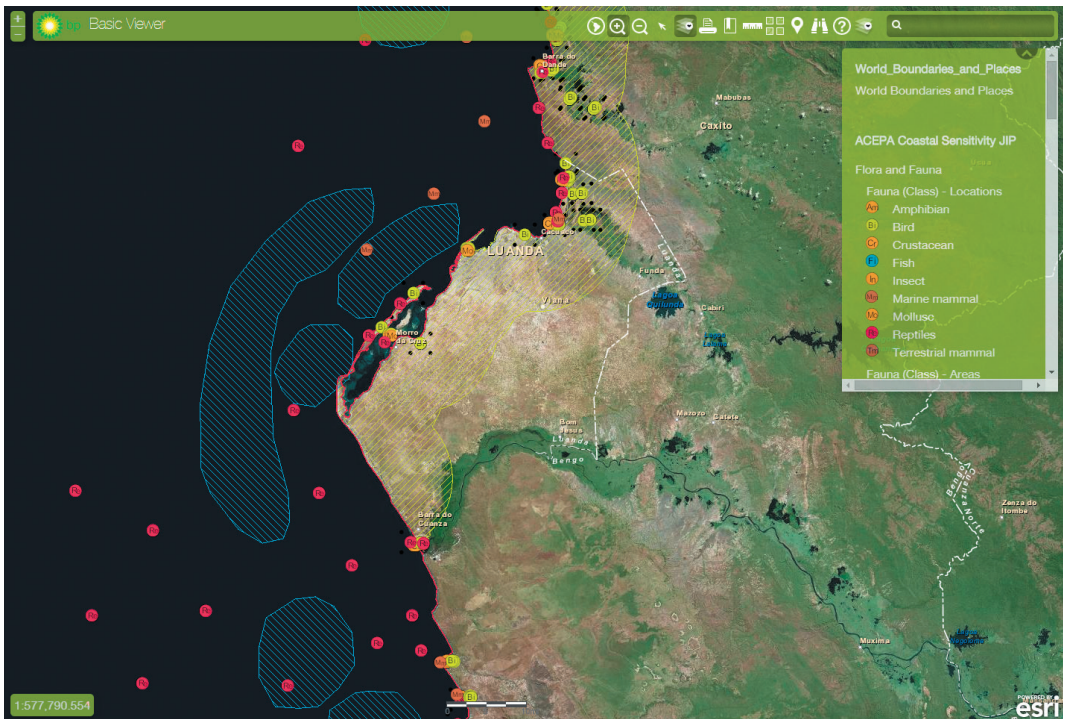
Figure 8 *Coastal sensitivity viewer—webGIS interface tool*



BP Angola

Sensitivity mapping can be presented as a simple hard-copy map with tables listing resource details, or integrated into a geographic information system (commonly referred to as GIS) capable of containing large volumes of data. Maps developed in GIS may be accessed either by printing hard copies or by viewing the information electronically, including via internet access (see Figure 8). Sensitivity maps developed in GIS can also be integrated into electronic emergency management systems, and linked to other databases for enhanced command and control and a depiction of response activities, resources and status. This is referred to as a common operating picture (COP). Although GIS is becoming widely used in local and national administrations and by industry, it is not always necessary and basic printed maps may be suitable for smaller operations.

It is recommended that hard-copy versions of maps are generated for use by on-site responders, as the use of electronic devices may not always be feasible or reliable in remote or extreme locations, and the maps may serve as a record for later reference during incident investigations and claims preparation. Care must be taken to avoid printed maps becoming too cluttered and difficult to interpret.

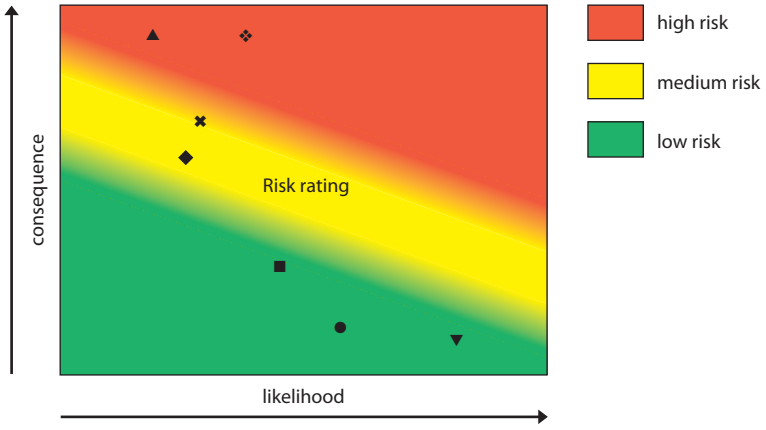
Detailed guidance on sensitivity mapping for oil spill response can be found in IPIECA/IMO/IOGP, 2012.

Evaluate risk and select oil spill planning scenarios

After the spill scenarios are defined and analysed, planners should make a final selection that represents the full range of response challenges and risks against which response strategies and a tiered capability can be defined. This should reflect the tiered response approach and result in a range of scenarios covering small operational spills up to and including a worst credible case discharge scenario. Worst credible case represents the scenario with the most severe consequences and which is considered plausible. Regulatory requirements should also be consulted as they may dictate specific scenarios that must be included in contingency planning.

A common method used to facilitate and refine the final selection of planning scenarios is a risk assessment matrix (RAM). It is used to plot the likelihood and consequence outcomes from each of the spill scenarios and can be presented in a variety of formats. An example of a RAM is shown in Figure 9. The matrix provides a view of the overall risk profile and a comparison of the risk associated with each potential spill scenario. Overall risk reduction is achieved with effective prevention and mitigation measures. Reducing the likelihood of a spill occurring through prevention is the primary aim, yet despite best intentions a residual risk always remains. The risk comparison, together with a review of each scenario's unique influences (e.g. oil type, prevailing conditions, local sensitivities), informs the choice of an appropriate set of oil spill planning scenarios to formulate mitigation measures. For smaller operations only a few scenarios may be identified, one of which may provide the information needed to plan the most effective response strategies to mitigate risks. For larger and/or complex operations, numerous scenarios may be identified, in which case a well-rounded, representative set covering a range of risks will need to be selected.

Figure 9 *Example of an oil spill scenario risk assessment matrix (RAM)*



Assess the risks: likelihood x consequence = risk rating

● = Loss of containment during fuel transfer quayside; 10 tonnes; diesel fuel
▼ = Small maintenance leak; 10 litres; hydraulic fluid
✖ = Pipeline rupture near shore; 1,000 tonnes; light crude
■ = Offloading at sea; 400 tonnes; diesel fuel
◆ = Subsea leak; 1,500 tonnes; crude
▲ = Subsea well blowout; 1,500 tonnes/day for 30 days; crude oil
❖ = Vessel grounding—loaded ultra-large crude carrier

Response strategy development

After a range of oil spill planning scenarios are selected, consideration shifts to the development of appropriate response strategies, which are comprised of available and viable response techniques and which adequately mitigate the impact and consequences of each scenario. Planners should consider how the response for a scenario might develop over time and how the response strategy may need to adjust as the spill evolves. The realities of the situation and the limitations of techniques and equipment must be well understood. Extreme weather conditions, the presence of ice, highly volatile or heavy viscous oils, remote/inaccessible locations, and proximity to highly-sensitive areas can all heavily influence and restrict or dictate the selection of suitable response techniques. In all cases, the response strategy should be established in consultation with the relevant authorities and stakeholders, with consideration given to the greatest net environmental benefit (see page 26).

It is important to consider all the response techniques that are appropriate for the conditions.

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The response strategy should be focused on clear, attainable goals by first establishing a set of response objectives for the planning scenarios. Objectives are based on a number of inputs (Box 7), however, those that are largely common to all spill scenarios are to:

- protect the health and safety of responders and the public;
- control the source;
- contain and recover spilled material;
- maximize protection of sensitive areas; and
- minimize damage to environmental and socio-economic resources.

Below: the presence of ice pack may preclude the use of containment booms. Oil contained by the ice itself may be recovered with appropriate skimmers, other equipment and relevant expertise.

Health, safety and, in certain circumstances, security considerations are a significant part of a response and are always the top priority. Detailed information on establishing strategies for the health and safety of responders can be found in IPIECA-IOGP, 2012a. Information on source control can be

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Box 7 *Important aspects to consider when defining scenario response objectives*

- Health, safety and security
- Regulatory requirements, such as response timelines and priorities
- Proximity of priority protection sites and resources at risk
- Stakeholder and public expectations and priorities
- Corporate philosophy and priorities

obtained from various websites including the Subsea Well Intervention Service offered by Oil Spill Response Limited, OSPRAG, the Marine Well Containment Company, and others (see page 51).

The identification of sensitive resources and priority protection sites, as determined by the sensitivity mapping, provides the site-specific information to inform the NEBA discussions and develop response strategies that best meet the objectives of sensitive area protection and the minimization of damage.

A response strategy can consist of a single response technique or a combination of techniques (Box 8). Response techniques are also commonly referred to as response options or methods.

Box 8 *Examples of response techniques*

- Surveillance modelling and visualization
- At-sea containment and recovery
- Offshore surface dispersant application
- Controlled in-situ burning
- Alternative technologies (e.g. bioremediation, herding agents, etc.)
- Monitoring and evaluation
- Protection of sensitive resources
- Shoreline and inland assessment (SCAT)
- Shoreline clean-up

An appropriate response strategy for a minor scenario may consist of one or two techniques, such as surveillance and vessel-based offshore surface dispersant application.

Scenarios that are more complex may require one or multiple strategies consisting of various combinations of techniques at different tier levels, possibly in different locations or for varying seasonality. For example, a scenario with the potential to occur both in winter when ice is present and in summer when open water conditions exist will likely require multiple strategies, since the preferred techniques will change due to the seasonal conditions. A scenario with the potential for impact on offshore, near-shore and shoreline areas will require a strategy with a variety of techniques suitable for use in those unique environments.

Topics to be considered when establishing response strategies are summarized in Box 9.

All response techniques have advantages and disadvantages. Numerous technical papers and guidance documents detailing the various options for offshore and shoreline response, as well as real spill experiences, are available from a variety of sources, including:

- IPIECA-IOGP Oil Spill Response Joint Industry Project (www.oilspillresponseproject.org)
- ITOPF Technical Information Papers (www.itopf.com)
- API Technical Reports (www.oilspillprevention.org)
- Arctic Oil Spill Response Technology Joint Industry Programme (www.arcticresponsetechnology.org).

Box 9 *Response strategy considerations*

- Health, safety and security of responders and the public
- Oil spill planning scenario(s) information:
  - Spill volume
  - Oil properties and weathering characteristics
  - Prevailing and limiting conditions
  - Predicted trajectory, fate and transport from the oil spill modelling data
  - Distribution and sensitivity of environmental and socio-economic resources at risk, and their prioritization for protection
- Response technique effectiveness and limitations, including:
  - Effectiveness given the oil properties and weathering profile
  - Time window of opportunity for the use of certain response techniques
  - Limitations on performance and feasibility of techniques given local prevailing conditions
  - Volume of waste material generated
- Regulatory framework, such as:
  - Mandated response times
  - Defined equipment capacity calculations
  - Government oil spill contingency plan restrictions or preferences for certain response techniques
  - International compensation schemes and funding
- Existing response resources and their availability and capability, such as:
  - Specialized oil spill response equipment
  - Adequately trained and experienced oil spill response personnel
  - Supporting equipment (vessels, cranes, etc.) and services (catering, housing, waste removal and disposal, etc.)
- Net environmental benefit analysis (NEBA):
  - Stakeholder and community considerations
  - Analysis of the response options to inform the choice of best techniques to minimize the impacts on people and the environment
  - Selection of the most effective response strategy based upon priorities and trade-offs

Net environmental benefit analysis

Once the most effective and feasible response techniques are identified for each scenario, a net environmental benefit analysis (NEBA) should be carried out to determine which of those technique(s) will have the greatest net environmental benefit. The NEBA process provides a structured approach for selecting the best response actions to minimize potential impacts on people and the environment. It presents a useful framework to achieve science-based planning and stakeholder consensus prior to, and away from, the emotive atmosphere prevalent at the time of a spill.

NEBA uses the planning scenario information—including data on the environmental and socio-economic resources identified in the sensitivity mapping process—experience from previous spills, and scientific expertise to inform an assessment of the environmental and social impacts that could potentially result from the use of certain response techniques at specific locations. The NEBA process weighs the advantages and disadvantages, or trade-offs, of the available techniques so that an effective response may be formulated to achieve the maximum overall benefit for the environment. Finding consensus is an important part of the process; conflicts do occur, and an informed discussion should take account of the various stakeholder priorities and concerns that may be raised at each location.

Natural recovery (i.e. no human intervention) is used as the benchmark against which to evaluate response actions. Past experiences have shown that, for some habitats, certain clean-up techniques bring little ecological benefit and may worsen damage if they are too invasive. For example, if the use of intensive clean-up techniques on remote shorelines is not going to bring meaningful socio-economic benefits, or if it has the potential to exacerbate the ecological damage, its validity should be questioned. Such considerations should take account of the recreational, economic and wildlife uses of the shorelines, the safety of the public and responders, and the possibility of bulk oil remobilizing and spreading the contamination further afield.

Through the use of NEBA, the relevant stakeholders in contingency planning should be able to understand the reasons why certain response options are included in the response strategy. If regulatory approval for a particular technique, such as offshore dispersant application, is required, the NEBA discussion provides an opportunity for that technique to be evaluated and pre-approved for spill situations matching the planning scenarios. Should a spill occur, stakeholders only need to verify that the assumptions considered in the NEBA and the pre-approval are still applicable. If the actual spill situation deviates significantly from the planning scenarios, the NEBA-based approval process will still be expedited since many of the assumptions established during planning will still apply.

Guidance on conducting a net environmental benefit analysis can be found in IOGP-IPIECA, 2013a; IPIECA-IOGP, 2015d; and Aurand *et al.*, 2000.

Determination of response capability

Once suitable response strategies are assessed and agreed for the planning scenarios, focus turns to identifying the appropriate equipment, personnel and logistics resources needed to implement the strategies and ensuring their availability within the necessary time frame. Using the tiered response approach, the provision of resources should be flexible and adaptable enough to handle not only the smaller, low-impact spill scenarios but also the integration of additional regional and global resources to address more complex spills, such as worst credible case discharge scenarios or an escalating response. Ultimately, the goal of planners is to determine an adequate capability to mount and sustain an effective response to a spill of any magnitude as applies to an organization's unique risk profile.

Determination of response capability consists of:

- defining tactics and their logistics to implement the chosen response strategies;
- identifying the resources (equipment, personnel) to support the tactics;
- evaluating the availability of those resources and ensuring their timely provision; and
- ensuring all necessary supporting response elements (e.g. communications, waste management, etc.) are included in the overall response capability.

Tactical planning and resource identification

Planners should consider how to execute the selected strategy for each planning scenario, and what equipment, personnel, logistics and supporting elements will be necessary in each case. A combination of resources is needed to successfully implement and sustain a response (see Box 10 on page 29). Logistics, in particular, covers a vast array of equipment and services. The amount of logistics and waste management support required to adequately maintain even a small spill is often underestimated. Planners should ensure that these aspects are not overlooked.

Determining appropriate tactical methods and the various resources necessary to support them requires input from multiple sources and can be complex (see Box 11 on page 30). Planners should consider their zone of potential impact, and the various conditions in which they might need to operate and for how long. Offshore, near-shore, shoreline and riverine settings, and even seasonal variations, will require different considerations for the type of equipment, deployment conditions, quantity and skills of required personnel, and support for maintaining operations over time. Certain techniques, such as the use of dispersants, will have important windows of opportunity for effective use.

Below: equipment must be suitable for the oil properties and local operating conditions if it is to function effectively.

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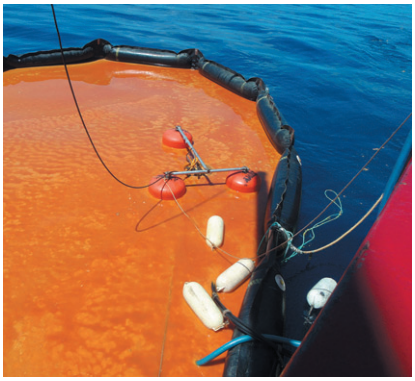

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For each response technique, planners must determine what resources they will need, how much of those resources are required, how quickly those resources are needed and for how long. For example, when examining an offshore containment and recovery scenario, planners need to consider: the type and amount of boom and skimmer combinations that are best suited for the local offshore conditions and anticipated oil properties; specifications for vessels suitable for deploying and operating the equipment; distances and travel times from staging areas for re-supply and waste off-loading; limiting weather and sea conditions; recovery rates and waste storage requirements; and numbers of personnel and their support requirements. If the spill scenario anticipates that the slick will move toward shore, planners then address similar issues for the near-shore techniques of the response strategy. If protected species are known to inhabit the area, there may be special considerations for operating parameters (e.g. vessel speeds) and personnel requirements (e.g. wildlife observers).

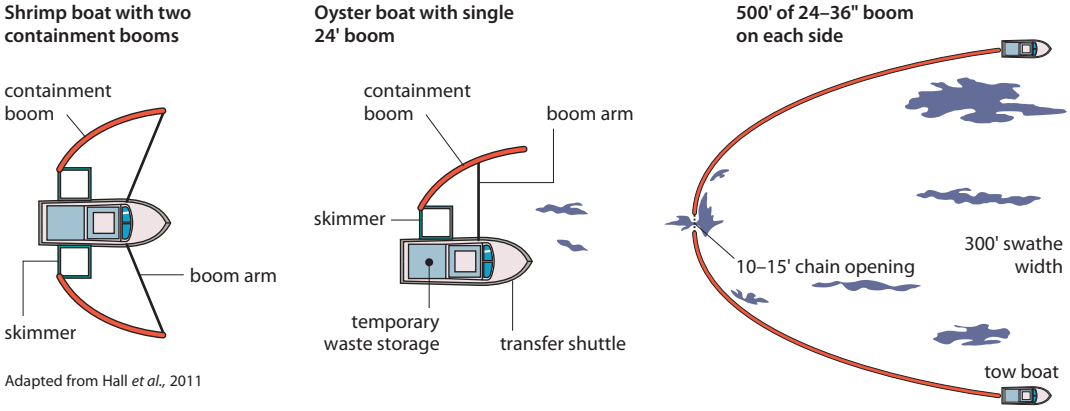
Regulatory requirements such as recovery or containment capacity, storage capacity, or response timelines may also heavily influence the arrangements and resource needs, and compliance with these requirements may need to be demonstrated within the contingency plan.

Organizations are encouraged to maximize the use of local resources when considering tactical arrangements (Figure 10). In many locations, the majority of non-specialist resource requirements can be sourced locally. This reduces costs, provides opportunities for local vendors, vessel operators and labourers, and decreases mobilization times. Local knowledge of conditions and navigational hazards can also be invaluable.

Consider the use of specialized containment, recovery and temporary waste storage equipment which is compatible with the specifications of locally available vessels of opportunity. In this example, local fishing vessels are incorporated into the containment and recovery capability.

Figure 10 *Local non-specialized resources can be combined with specialized resources to maximize efficiency and the use of resident services*

Consider viable tactical options to maximize the safe and effective use of local resources



Adapted from Hall *et al.*, 2011

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Hall *et al.*, 2011

Whitewater Rescue Institute

Use of local businesses can provide valuable knowledge of terrain and prevailing conditions as well as community involvement.

Box 10 *Examples of response resource categories*

Specialized oil spill resources

- Equipment:
  - Boom
  - Dispersant spray equipment
  - Wildlife response equipment
  - Skimmers and pumps
  - Oil spill response vessels
  - Computer modelling
  - Temporary oil storage facilities (fastanks, dracones, inflatable barges, etc.)
  - Aircraft for remote sensing observation and dispersant spraying
  - Communications equipment (satellite phones, air-to-ground radio, etc.)
- Personnel:
  - Subject matter experts
  - Spill response contractors
  - Trained field responders
  - Government agencies
  - Trained vessel captains and crew
  - Trained pilots and crew
- Logistics and supply:
  - Dispersants
  - Computer modelling
  - Satellite imagery
  - Sorbent materials
  - Spare parts
  - Personal protective equipment

Non-specialist resources

- Equipment:
  - Light equipment (pressure washers, lighting, generators, shovels, buckets, etc.)
  - Vessels of opportunity (VOO)
  - Heavy equipment (excavators, cranes, etc.)
  - General communication and computer equipment (phones, radios, etc.)
- Personnel:
  - Vessel captains and crew (VOO)
  - Labourers
  - Administrative staff
  - Security
  - Volunteers
- Logistics and supply:
  - Temporary storage facilities
  - Staging areas
  - Medical aid
  - Land transport services
  - Catering and housekeeping
  - Accommodation
  - Sanitary facilities
  - Command centres
  - Aircraft for visual observation and transport of resources
  - Waste transport, treatment and disposal services
  - IT (information technology) services

Box 11 *Examples of topics typically addressed when determining tactics and response resource requirements*

- Health, safety and security issues
- Likely effectiveness and limitations of techniques, such as windows of opportunity, seasonal variations, regulatory requirements and prevailing or limiting conditions
- Recommended or required response times, recovery rates and storage capacity
- Recommended equipment configurations
- Suitable equipment and vessel support to safely and efficiently support the tactics
- Identification of specialist service providers to support implementation of the tactics, if required
- Quantities of equipment and personnel needed to implement the tactics for the anticipated operational periods
- Logistics support required to implement and sustain response levels
- Waste management requirements to support the tactics
- Types of specialized and non-specialized resources that can be maintained or sourced locally
- Proposed location and condition of staging and launch sites
- Shoreline access, terrain and anticipated degree of oiling
- Consideration for cascading additional resources into the response if the tier level escalates, and integration of those resources into the response
- Planning scenario worst credible case discharge or regulatory-mandated spill planning volume
- Government approvals processes and requirements for the anticipated tactics
- Mutual aid or cooperative arrangements for sharing regional resources
- Experience and lessons learned from previous responses
- Cultural heritage sites and the concerns of Indigenous Peoples
- Impacts on commercial and tourist areas
- Seasonality (fishing, nesting, tourism, etc.)
- Wildlife protection and response
- Endangered or protected species that may be encountered

Logistics covers a wide array of support and services for a response, from maintaining personnel in the field to procurement, mobilization and integration of additional resources.

Trellis Environmental, LLC

ITOPF

A significant spill may require a large number of workers. These individuals will require accommodation, transportation, meals, sanitation, medical support, decontamination, etc. This may involve an intensive logistics operation, particularly for a remote location. Possible service providers and locations, e.g. barracks, schools, hotels, halls, etc., or providers of mobile facilities that could be used for these purposes, should be identified for inclusion in the contingency plan. Large amounts of protective clothing and other equipment may also be required. Local vendors potentially able to provide the projected type and amounts quickly should be noted.

Shoreline clean-up can involve a substantial workforce, which is often supplied by local labour. Organizations may consider training pre-identified local labour or services for oil spill response activities. Local community organizations, cultural factors, and labour laws can influence training requirements, working hours, logistics needs and manpower numbers, all of which will affect estimations of personnel resource requirements. In some jurisdictions, large numbers of volunteers may arrive on site. If volunteers are anticipated, procedures for their integration into the response should be considered. For further information on the management of volunteers see IPIECA-IOGP, 2015e.

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Time and effort must be dedicated to training local labour to function safely and properly in an oil spill response environment, and care must be taken to provide suitable personal protective equipment for the conditions.

Tiered provision of resources

As planners refine their list of required equipment, personnel and logistics, they should evaluate whether the resources currently available to the organization are sufficient to meet tactical needs within the required time frame. The scale of tiered capability for each response technique will be contingent on how many resources are needed, how quickly they will be needed, and how rapidly they can be accessed and deployed. This, in turn, will greatly depend on the availability of local and regional resources and the distance, time and logistical challenges associated with mobilization and deployment.

Considerations for ensuring an adequate provision of resources are listed in Box 12 on page 32. For additional information on tiered provision of resources see page 6 and refer to IPIECA-IOGP, 2015a.

Readily available Tier 1 capability is an essential component of an effective contingency plan. The ability to react rapidly and contain a minor oil spill in the vicinity of an organization's operating area requires immediate access to equipment, either on-site or from immediately-available local sources. Personnel must be appropriately trained and aware of the capabilities of the equipment and how it should be deployed and operated. This will enable a response to be mobilized within minutes of a spill being detected.

Box 12 *Considerations for ensuring adequate resource provision (based on IPIECA-IOGP, 2013a)*

- Verification that existing resources, including mobilization times, are adequate
- Procurement of additional resources at Tier 1 or Tier 2
- Repositioning of existing Tier 1 or Tier 2 resources to improve response times
- Taking up membership with existing Tier 2 facilities or developing new Tier 2 facilities
- Ensuring access to a Tier 3 cooperative through membership
- Improving the facilitation and integration of Tier 3
- Identification of adequate logistic capacity (aircraft, vessels, road transport, support services), including the potential need to procure, contract or retain services
- Minimizing the impact of barriers to the cascading of resources in from other countries or regions
- Waste management resources availability for handling, transport and disposal
- Supply chain management reliability for consumables, such as personal protective equipment (PPE) and sorbent
- Availability of non-specialized labour and equipment supply
- Refining training and exercise programmes to improve and expand local capacity
- Availability of resources from government agencies, e.g. coastguard, military

Developed regions with established oil spill response facilities and expertise may have ample access to existing Tier 2 resources via contracted providers, mutual aid agreements or industry cooperatives. Areas without a regional support system, or with difficult or prolonged travel required for the mobilization of supplementary resources, should explore the options of either maintaining a larger Tier 1 capability or streamlining cross-border equipment movement and upgrading logistics and infrastructure access to improve mobilization times for Tier 3 providers.

It is essential for organizations to consider the complexities of cascading large numbers of resources into their response. Planning documentation should include an escalation process and resource integration procedures for the activation and mobilization of the identified Tier 2 and Tier 3 resources, if a spill exceeds the response capability at Tier 1. This includes procedures for immigration and customs, and any emergency dispensation information for cross-border movement of personnel, equipment and material. Transport of certain goods within a country may require special transportation licences and paperwork that may delay delivery if not considered beforehand.

Below: Alaska Clean Seas base in Deadhorse, Alaska

Alaska Clean Seas

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Alaska Clean Seas

Substantial oil spill response resources are available from the oil industry's global stockpiles and commercial service providers, and through regional and international agreements.

In actual incidents, spills do not always fall into convenient categories and the boundaries between tiers will inevitably be blurred. It is, therefore, important to be prepared to involve the next highest tier from the earliest moments. It is easier to stand down mobilized resources than to try to escalate a response by calling up unprepared reserves at a late stage.

Planners may need to re-evaluate strategy decisions if, upon analysis of tactics and resources, it is determined that the necessary capability required to implement the initial strategy choices is not feasible or realistic. This can be a cyclical process until the most efficient and logical arrangement for provision of resources is achieved. Planners should keep in mind that under international compensation regimes, the cost of strategies and resources should be realistic and reasonable.

Supporting response elements

There are a number of supporting elements that are essential to an overall response capability. The degree of need will be contingent on the regulatory framework, planning scenarios, operating location and the spill risks of the organization. They are, however, common to almost every oil spill response and should not be overlooked when determining capability requirements.

Waste management

Recovered oil, oily debris, and contaminated sediment and water can be generated well in excess of the original spill volume, and waste streams must be properly managed in accordance with the local laws and regulations for hazardous waste storage, handling and disposal. This can have major implications for an oil spill clean-up operation and can cause bottlenecks and delays unless suitable arrangements are made. All too often, oil containment and recovery or shoreline clean-up operations are slowed or discontinued temporarily for lack of adequate waste storage and/or handling capabilities. For this reason, response techniques that result in reduced volumes of waste are preferable.

Oiled waste management can be a major logistics challenge that can also raise serious legal and cost issues in some countries. It must always be coordinated with the relevant authorities, and care must be taken not to create another environmental problem. Suitable equipment, vehicles,


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The treatment and disposal of waste is simplified if waste types (e.g. liquid and solid waste, and oiled and non-oiled waste) are segregated at the clean-up site.

temporary storage sites, and final disposal methods and locations should be identified and their availability agreed with the local authorities during contingency planning; they should also be identified in the contingency plan or a supporting waste management plan along with licensed waste transport and disposal contractors.

For detailed guidance see: IPIECA-IOGP, 2014a; ITOPF, 2011c; and IPIECA-IOGP, 2013c.

Response communications

Reliable and secure communications are of paramount importance in ensuring a safe and effective response operation. Field teams must be able to communicate with each other and with the response management team. The level of equipment and technology, and the need for subject matter experts required to operate a communications network, are often underestimated, particularly with today's prevalent use of complex technology. Large volumes of incoming calls can quickly overcome phone lines and delay or disrupt communications. Operations in remote areas may require additional satellite and radio capability, or there may be military or national security restrictions on the type of communication equipment, frequencies and channels that may be used. If there is the potential for hazardous environments, intrinsically-safe radios and mobile phones must be used.

A template response communications plan can be pre-populated with the known details established during planning, including any operational limitations, requirements for permits, or restricted frequencies or devices. The types of devices available for communications and IT should be listed along with radio frequencies and telephone and fax numbers. Contact information for information technology (IT) assistance, software management, GIS operators and other technology specialists should also be included in the contingency plan.

Wildlife protection and response

If there is the potential for oiled wildlife or the presence of endangered or legally-protected species, a wildlife response strategy should be agreed with government authorities, trustee agencies and stakeholders during the planning process. The care and treatment of oiled wildlife can be contentious and may attract a high level of attention and scrutiny. A swift and efficient

response is more likely to be achieved if discussion and consensus are dealt with during the contingency planning process. Oiled wildlife response requires specialized planning, personnel, equipment and facilities. Details of the arrangements for wildlife protection and the response to oiled wildlife should be included in the contingency plan or a supporting wildlife response plan. Information specific to this subject is available in IPIECA, 2014b. Additional reports, guidance documents, and country profiles are also available from Sea Alarm (www.sea-alarm.org).

Andrew Milanes, Environmental Science Services, Inc.

Above: the presence of nesting or endangered species may influence the choice of allowable response activities and logistics.

Sampling and monitoring

With the possible exception of small spills that are quickly cleaned up, a sampling and monitoring programme will likely be required or prudent, particularly if surface/subsea dispersants or controlled in-situ burning are used. A monitoring programme may be implemented to aid in decision making, to monitor technique effectiveness, or to determine the extent of pollution or the impact of the spill on the environment. Subject matter experts, qualified sampling organizations and laboratories, and the equipment and logistics required to execute a monitoring programme should be noted in the contingency plan. Guidance on establishing the objectives of the monitoring programme and how to accomplish them should also be included, along with any data and protocols that can be predetermined, such as handling and storage requirements, local compliance requirements, available laboratory methodology and capability, and preliminary costs.

Conducting sampling and laboratory analyses in remote or less-developed regions may present logistical and technological challenges. Local, in-country laboratories may not be able to perform all desired analyses. Solutions should be considered during planning while there is time to explore cost-effective alternatives. Refer to ITOPF, 2012a for more detailed information.

OSRL

Sampling and monitoring procedures and resources should be considered during contingency planning, and should be described in the plan documentation.

Crisis (external) communications

Oil spill incidents often attract significant interest from the media and public. The power of internet communication should not be underestimated, and the instant posting of pictures and opinions from the public and media should be expected. To alleviate the spread of misinformation, external communication procedures—for example media and public information management procedures—with oil spill-specific considerations should be developed or added to an organization's overall crisis communications system. Templates and guidance for responding to the news media, social media and internet information portals should be included in the contingency planning documentation as a tool for response personnel involved in external communications.

Oil spill incidents often attract significant interest from the media and the public; those directly affected by a spill should be promptly and properly informed.

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ITOPF

Funding and compensation

Organizations will need to consider adequate budget resources to support preparedness, including costs for purchasing Tier 1 resources, accessing Tier 2 and Tier 3 capability, training and exercising. Spill response can also be costly, and a means of, or process for, funding the identified response strategies should be considered. Workers may require payment at regular intervals, and invoices for purchased items and services may have strict payment terms. For spills in remote locations, the logistics required to securely transport funds to pay for wages and services should be considered. Ensuring that suitable funding is in place may require the use of insurance and external sources of money. Regulations may require proof of funding to be included within the contingency plan.

If the spill risks of an organization indicate that there may be environmental or socio-economic damage or loss, there should be consideration for assessing impacts, and managing claims and compensation. A process for mobilizing additional personnel and resources to intake, evaluate and process claims could be included either in the contingency plan or in a supporting claims and compensation plan. The process will depend upon the organization providing compensation and the country affected by the oil spill, and whether countries are signatories to international compensation regimes or have their own legislation.

Local businesses and individuals who are placed at a disadvantage due to the presence of pollution or response activities may be eligible for compensation.

Trellis Environmental, LLC

Record keeping is essential for claims and compensation processes. Planners should ensure that document preservation processes and any associated legal requirements, including the collection of vital records and data, are noted in the contingency plan.

For more detailed information on claims and compensation, see ITOPF, 2012b and IPIECA-IOGP, 2015b.

Contingency plan preparation

An oil spill contingency plan (OSCP) is a document, or suite of documents, that provides guidance on how to respond to an oil spill of any tier as applies to the risks of an organization. A successful contingency plan will facilitate an effective and efficient initial response to incidents and will provide the decision making tools and information needed to organize and support an ongoing or escalating response while adjusting to the realities of changing conditions. It is important that the contingency plan provides the instruction and information needed in a response. Additional background information or material not directly required in a response, such as planning justification and preparedness details (e.g. risk assessment documentation, training and exercise programmes), should be available for the regulatory review process, planning assessments and later contingency plan review and update, and should be included in supporting documents or appendices. The contingency plan and supporting documentation together should demonstrate that a rigorous planning process was undertaken in building response capability.

Internal management-level approval of the contingency plan is essential as it confirms an organization's commitment to meet and maintain the planned level of capability. External regulatory approval is often a mandated and controlled process ensuring that legislative requirements are met. It also confirms support and agreement from government agencies for the preparedness levels and response management cooperation outlined in the contingency plan.

Depending on the complexity of an organization's operations, one OSCP may be sufficient, or a suite of documents may be more appropriate. For example, a number of offshore platforms in one field may each have their own Tier 1 resources and site-specific OSCP, but may share Tier 2 and 3 capabilities coordinated under a wider OSCP. A port or terminal will likely require only one document covering all applicable tiers. An OSCP with numerous response options or sensitive areas may benefit from supplementary tools for responders, such as response tactics handbooks or operational sensitivity maps for site-specific tactical instruction. Supporting elements, such as wildlife response and sampling and monitoring, can be included within the OSCP but are also often arranged as standalone supporting plans to avoid complicating and overcrowding the main body of the OSCP with too much detail. Planners should scale the content appropriately according to the type of operation, the level of risk, and the needs of the end-user personnel.

It is important to keep in mind that there is no standard format for a contingency plan that meets the needs of all operations. Many organizations have contingency plan standards and practices that have been tested and proven suitable for their activities. Some regulators prescribe a format that is dictated by government regulations or national oil spill contingency plan frameworks. If a regulatory-mandated layout of a contingency plan is cumbersome for responders to navigate, the use of a standalone handbook (sometimes referred to as a Spill Emergency Field Guide, Checklist, or Quick Guide), particularly for the initial response, may prove useful.

Some regulators do not prescribe a format, or their suggested format may be optional. In the absence of specific guidance, organizations are encouraged to develop plans that are appropriate for their end user and formatted in a manner that is effective for use in an emergency situation. Actionable versus general background information should be included in the main body of the plan to better inform responders on what specific actions they should be taking. The plan organization should be logical; information is best provided in the same sequence as it is needed during a response. This will aid in accessing key information and in the retention of where in the

plan the information is located. Diagrams and flow charts that clearly and concisely communicate the direction needed during a response are particularly helpful.

The sections below describe the core areas that any OSCP should address. This is followed by a description of potential appendices and supporting documents. A corresponding outline is provided in Annex 1 on pages 52–55, however planners should recognize that no standard template is applicable for all operations.

Specific guidance is available for shipping in ITOPF, 2011a and for offshore oil and gas exploration, production and pipeline facility operators in API, 2013.

OSCP introduction

The OSCP introduction should:

- list the overall response aims, priorities and objectives;
- outline the scope (including a summary description of operations and spill risks) and geographical coverage of the plan; and
- provide instructions for document control with respect to updates, amendments and plan distribution.

The introductory section also provides the opportunity to state corporate philosophy and describe any integration with national response systems, government contingency plans or other applicable plan coordination.

Integration with other plans

Illustrations of the contingency plan integration with other plans and the national response framework, if any or as previously agreed with the authorities, will help to avoid confusion during a response (Box 13). If external organizations and third parties are involved, the interface with their plans should be clearly stated in bridging documents. For example, a response to an incident involving a ship may include the shipowner and/or the ship's insurer or salvor. It is also commonplace for third-party service companies (e.g. drilling contractors) to be involved in implementing oil and gas projects; their participation in a response to an incident should be integrated. Misunderstandings and an unorganized response may result if clear lines of cooperation and communication between the various parties are not defined.

OSRL

A response can involve the participation of a variety of organizations.

If other internal emergency response plans are to be implemented concurrently, the oil spill contingency plan should demonstrate how the spill response will be managed and coordinated with additional response operations. For example, a simultaneous draw on personnel and logistics

Box 13 *Integration with other plans (example list)*

Internal emergency response plans

- Medical evacuation plan
- Facility emergency response plan
- Crisis management plan
- Business continuity plan
- Source control plan
- Well capping and containment plan
- Relief well plan
- Contractor bridging documents
- Firefighting response plan
- Salvage plan
- Towing plan

External emergency response plans

- Contractor emergency response plans
- Local authority crisis management and emergency response plans
- Regional oil spill contingency plans
- Local and regional tactical plans
- National oil spill contingency plans

to support both source control and spill response efforts can create gaps and a lapse in response time if not planned appropriately.

Initial actions

Initial response information is critical in guiding responders through the first hours or days of an incident. This information should be located near the front of the plan for quick access, and should provide the direction and information necessary for responding individuals to:

- make required notifications;
- assess an incident and mitigate hazards, usually based on incomplete and rapidly evolving information;
- activate an informed, immediate response;
- activate additional response resources including the management team, as needed; and
- review sensitive areas at risk.

Notifications and reporting

Timely notification of key internal and external personnel and organizations is instrumental in mounting an effective response. A summary of typical notifications is provided in Box 14 on page 40. Notification procedures, responsibilities and regulatory requirements (including forms, timelines and instructions) should be provided along with a directory of contact information. Flow charts and diagrams are effective ways of displaying the flow of notifications that are often required. The provision of a checklist and log will assist in the documentation and evidence of timely reporting and alerts. It is important to specify the management role responsible for ensuring that notification and reporting requirements are met.

Box 14 *Typical notifications to be included in the plan**

- Company personnel
- Primary response team (internal or contractor)
- Government agencies (required and supplemental)
- Incident or response management team
- Community contacts and media press releases
- Key stakeholders and land managers
- Nearby industry or facilities
- OPRC (Article 4) and MARPOL requirements

* *Contact information for contractors, suppliers and other response resource providers should be included in the resources section or in a separate resource directory where information is actively kept up to date.*

Assessment

Contingencies should be considered for locating and tracking spills when conditions of low visibility, darkness, safety or security prevent visual surveillance from being deployed.

Information on the oil type/characteristics, spill size, location and trajectory path is crucial in determining the health and safety hazards posed by the spill, the appropriate response strategies, and the identification of potentially threatened environmental and socio-economic sensitivities. Under certain circumstances, security assessments may be needed before workers can be deployed. Guidelines and information should be provided for:

- evaluating site health, safety and security;
- implementing surveillance;
- observing, tracking and assessing the spill, initially and over time;
- determining current and forecasted meteorological and hydrodynamic conditions;
- activating modelling support for predicting oil trajectory; and
- evaluating the potential scale, tier level, and impact of the incident.

Alaska Clean Seas

Detailed information on site safety and health assessments can be found in IPIECA-IOGP, 2012a. For information on oil spill surveillance, tracking and observation see IPIECA-IOGP, 2015f.

Organizations are encouraged to take a proactive approach to the potential need for escalation, with a conservatively high estimate of the potential scale and impact of the incident. It is generally easier to stand down additional resources than attempt to mobilize them reactively in last-minute haste.

Response resources

Rapid mobilization of resources is critical for mounting an effective response. Essential response resources should be listed in the plan or a resource directory, along with their sources and associated contact/activation information. The process for activating and mobilizing the primary response organizations should be referenced, including designation of the management roles with financing and mobilization signature authority. Procedures for a controlled cascading of resources into a response should also be included to allow adjustments to be made as the needs of the response are better understood.

The types of response resources that should be described (refer to Box 10 on page 29) include, but are not limited to:

- spill response equipment (booms, skimmers, barges, skimming vessels, etc.);
- logistics support service providers and equipment/supplies;
- vessels of opportunity (required vessel specifications, lists of locally available vessels, etc.);
- local labour sources and volunteers; and
- subject matter experts.

An inventory of locally available Tier 1 response equipment should always be maintained directly in the plan. For plans covering wide geographical areas and spill risks, a complete resource list can become extensive and be subject to frequent review and update. Maintaining an up-to-date list can be particularly challenging in less developed areas where the availability of resources and services can fluctuate. A standalone resource directory or electronic database may be more efficient under these circumstances. The use of an electronic database allows for rapid and easy identification of resources and updating of information. It can also be linked to GIS and response management software for real-time inventory updates and status reports.

For each key resource or response contractor, it is recommended that the information required for their identification, activation and mobilization be included (Box 15). The International Offers of Assistance (IOA) Guidelines developed by the IMO (Parker *et al.*, 2014) provide a common set of terminology for significant equipment and personnel types typically offered or requested from

Box 15 *Suggested relevant Information for inclusion in the response resource list*

- Category of capability or response technique
- Equipment type
- Quantity
- Size/capacity
- Owner/source
- Contact information
- Location
- Mobilization and deployment time
- Special logistics requirements
- Activation protocol, e.g. contractual arrangements or mutual aid agreement

international sources during Tier 3 responses. When confronted with large or complex oil spill incidents, common use of terms will assist in managing requests for spill response resources and offers of assistance from other countries and organizations. The resource data should be verified and updated regularly with strict document control to ensure a current version is always available with correct and relevant information.

Response management

It is imperative that a system is in place for managing oil spill incidents, with a functional incident management organization that can expand and contract in size to operate effectively at all tier levels. An oil spill is one of many crises an organization may face, and a well-exercised incident management organization and framework should already be in place with established processes and procedures. This section of the contingency plan should describe the organization's incident management system as it applies to an oil spill response. This includes information such as:

- the response organization;
- roles and responsibilities;
- management and planning processes and procedures; and
- response management facility location and activation procedure.

ITOPF

A clear understanding of roles and responsibilities promotes a cooperative atmosphere.

An understanding of the expected participation of both internal and external parties is critical for the management structure to function cohesively. Role-specific checklists of responsibilities and tasks can be excellent reference guides for those who are assigned positions within the response organization.

A documentation system is an essential management process for an oil spill response. It should be defined in the contingency plan, or in an appendix, recognizing that there may be a government mandated approach to documentation and document preservation.

The IPIECA-IOGP Good Practice Guide on incident management (IPIECA-IOGP, 2016) provides additional detail on this subject. Further information is also available in the IMO guidelines on incident management systems (IMO, 2012), the United States Federal Emergency Management Agency ICS Resource Center (http://training.fema.gov/EMIWeb/IS/ICSResource/index.htm) and the ITOPF Technical Information Paper on leadership, command and management (ITOPF, 2012c).

Sensitive areas

The immediate identification of environmental and socio-economic sensitivities potentially at risk from an oil spill, together with any pre-designed protection tactics, is vital in ensuring the most appropriate allocation of equipment and personnel.

Responders need clear procedures and tools for the immediate identification of potentially threatened sensitivities, as well as the protection priorities and tactical measures developed and agreed during planning. This section of the plan should include topics such as:

- identification of environmental and socio-economic resources at risk and sensitive areas;
- protection priorities;
- sensitivity maps; and
- operational sensitivity maps/site-specific tactical plans/geographical response plans.

The pre-identified sensitivities and high-risk areas within the potential geographic response area should be listed and their locations shown on a map. Associated stakeholder contact information and pre-determined protection strategies and tactics should also be referenced together with any limiting factors or operations that should be avoided. The tactical and strategic sensitivity maps must be accessible to facilitate decisions on priority areas for protection and the choice of techniques and strategies.

Operational sensitivity maps, also commonly referred to as geographic response plans, site-specific tactical plans or action plans, could also be developed for the most sensitive sites during contingency planning. They are effective tools for informing response teams about high-risk areas and can consist of:

- details of the site-specific environmental and socio-economic sensitivities;
- pictures, topographic maps and satellite imagery;
- protection and clean-up techniques;
- deployment schematics and instructions;
- technique constraints and limitations;
- operational features;
- prevailing and limiting conditions, including hazardous landscape forms;
- seasonal weather restrictions;
- logistics information, including predetermined locations for staging areas and temporary waste storage sites;
- stakeholder and land owner/manager contacts; and
- regulatory reporting and approvals requirements.

These maps are often compiled as an atlas and included as an appendix, with an index of sites listed within the plan for reference. Depending on the size and scope of the contingency plan, they could alternatively be included directly within the *Response strategy* or *Sensitive area* sections of the contingency plan.

The sensitivity mapping information should be arranged in a printable format for hard-copy use by on-site personnel and linked into the GIS mapping database, if one is used. More information on developing sensitivity maps can be found in IPIECA/IMO/IOGP, 2012. An example of a geographical response plan atlas can be found on the website of the Region 10 Regional Response Team and Northwest Area Committee at www.rrt10nwac.com.

Response strategy

The response management team must be able to quickly gain an understanding of the strategic guidance developed and agreed during planning, as well as of the techniques available to them. During a response, the planned response strategies are confirmed or adapted as the situation progresses and evolves. Over time, certain techniques may become ineffective and new response options should be evaluated and employed as needed. The planning process cannot predict all the potential outcomes or conditions that may be encountered. A clear explanation of the available techniques, tools and guidance for making decisions will assist management in adjusting the response in accordance with the actual trajectory, conditions and time to impact encountered on the day.

Flow charts, decision trees or comparable graphical approaches are common and effective methods for providing guidance on decisions relating to the response strategy and suitability of techniques. Summaries of the response techniques applicable to the planning scenarios should be provided. Any techniques that were pre-identified using NEBA (see page 26) should be clearly noted. Documentation of the NEBA should be included or referenced such that it may provide a foundation for re-evaluation of techniques using real-time conditions, if they deviate from those considered in the planning scenarios.

A quick reference tool, such as a scenario matrix, can provide responders with critical planning scenario information in a compact, user-friendly format. Table 1 presents some suggested headings for a scenario matrix. Direction should also be included for conditions that warrant no active response other than surveillance, and for situations where a response is not feasible due to safety, weather or other restrictions. An instruction to justify and document any deviations from the planned strategies should be included.

Table 1 *Scenario matrix headings*

Scenario	Oil character	Objectives	Tier level	Strategy	Techniques	Required resources	Limitations	NEBA	Approval requirements	Subject matter experts

It is important to know whether the use of certain techniques has been pre-approved. If pre-approval has not been obtained, guidance on the process for obtaining approval should be provided. Pre-approval for techniques such as dispersant application or controlled in-situ burning is strongly recommended, as the windows of opportunity can be time-sensitive and any delay in the mobilization of resources may compromise effectiveness.

Tactical plans or handbooks to support the provision and implementation of a specific technique or capability are helpful tools for responders and management. This level of detail is not always required, but can provide an efficient means of compiling the multiple features involved in successfully implementing response techniques from start to finish. Depending on the scope of the contingency plan, planners should decide whether this information is more effectively included within the main contingency plan or as supporting documentation. Annex 2 on page 56 highlights the topics typically covered in tactical response plans/handbooks.

Waste management

It is essential that planners do not lose sight of the need to pre-plan for waste management. The lack of proper waste handling, temporary storage, transport and disposal can lead to hold-ups, disruption of clean-up operations and potential violations of regulatory requirements. Details and guidance for implementing the waste management strategy and recycling, treatment or disposal arrangements should be included within the oil spill contingency plan or as a separate waste management plan.

Decontamination

OSRL

Pre-identified secure areas for cleaning equipment and vessels, in particular to prevent secondary contamination due to run-off, should be listed in the plan, or guidance on establishing decontamination sites should be included.

Decontamination requires unique consideration with respect to health, safety and waste management, as well as supporting logistics. It must be implemented from the outset of a response and be capable of handling the decontamination of personnel and the gross decontamination of equipment on a daily basis. As resources are demobilized from the response, more comprehensive decontamination will be required. Pre-identified locations and approved cleaning agents for decontamination should be listed in the plan. Large response vessels may require dedicated berths or dry docks for cleaning. Arrangements for cleaning third-party property, such as the hulls of fishing boats or other vessels, may also be considered, if applicable. Guidance for compiling a spill-specific decontamination plan is a helpful tool for inclusion.

Demobilization and termination of the response

Management are responsible for ensuring that the scale of the response remains appropriate. As the needs of the response change, or as objectives are met, resources will need to be withdrawn from the response. Over time, the organization will be downsized as the response requirements diminish. This requires procedures for executing an orderly, well-documented process of demobilization. Guidance should be provided on the prioritization of resources for demobilization, keeping in mind cost-effectiveness and the most efficient utilization of resources.

The plan should include guidance for response termination. A response operation is usually considered for termination when:

- response objectives are met;
- treatment end points are met;
- no net environmental benefit can be achieved through a continuation of response efforts; or
- it is determined that a longer-term project of restoration will be required to achieve end-point criteria.

The criteria to be considered when making the decision to terminate the operation should be specified in the Incident Action Plan along with a process of consultation with appropriate stakeholders. The plan should also identify the decision maker who has the authority to sign off completed areas and approve the termination of response operations. For additional information on treatment end points and the completion of a response see IPIECA-IOGP, 2014c.

Response debrief

A process for post-incident critique, with feedback of lessons learned and follow-up actions, is important for continued improvement of the contingency plan and response preparedness. Post-response reviews should include the management team, field response supervisors and external organizations (e.g. government, contractors), as appropriate.

Appendices or supporting documents

Detailed information relevant to the needs of responders may not fit neatly into the main body of the contingency plan but should be easily accessible when needed. Planning information which does not contribute directly to a response should be documented separately such that it does not interfere with the guidance provided in the OSCP. Appendices and supporting documents provide a means for compartmentalizing material in an organized and accessible manner. This might include:

- overall response information—health and safety, in-field communications and documentation forms;
- background information—facility descriptions, baseline environmental and socio-economic information, and the risk assessment;
- frequently updated material or large volumes of information—site-specific tactical plans and contact and resource directories may benefit from being tracked under a document control process separate from that used for the main body of the plan, especially if they are to be updated frequently; sensitivity maps and general tactical plans can be large documents that may easily overwhelm the main body of the plan;
- specialized subject-specific guidance and plans, such as shoreline assessment, wildlife protection and response, sampling and monitoring, claims and compensation, external communications and waste management; and
- plan justification and other preparedness material—scenario planning justification, plan and equipment maintenance/audit schedules, and training and exercise programmes.

It should be noted that critical response information typically required in the first 12 to 24 hours of a response should be contained in the plan and not referenced in external documents, to avoid using valuable time accessing those documents and the information.

Implementation

Training

The successful implementation of a response is not only a function of appropriate response capability and capacity, but is also contingent upon the competence of the individuals involved. Training should include an appropriate level of theory and practical elements as well as equipment deployment, depending on the role. Familiarization with relevant contingency plans and procedures should also form part of the training package.

It is vital that those with an identified role in a response organization receive appropriate training.

Training should provide managers with an understanding of response management processes, and with a foundation for educated decision making. Field managers and responders must fully understand the technical aspects of equipment use, its limitations and safe operating requirements. For detailed guidance on oil spill training see IPIECA-IOGP, 2014d.

Exercises and equipment deployments

Tabletops, drills and functional exercises are an excellent way for personnel to practice in their pre-assigned emergency roles, and to test and verify contingency plans and procedures. Joint exercises provide the opportunity to test the roles and expectations of the various parties involved. Exercises carried out during the initial implementation of a contingency plan will test the developed response system and ensure that it meets the objectives of the plan, as well as assure compliance with regulatory requirements. Practical deployment of the response equipment in the operating environment will verify that the tactical arrangements and resource specifications are appropriate, and will highlight any adjustments that need to be made. Valuable lessons can be learned from such exercises, and these should be used to improve contingency plans. Personnel will not only feel more comfortable after constructive exercising, they will also benefit from strengthened connections with other response team members. Important relationships with external organizations, government entities and contractors are also fostered during full-scale exercises or joint simulations.

Lamor

Practical equipment deployments ensure that field responders are trained and competent in activating and implementing tactical plans.

For guidance on planning and implementing exercises see IPIECA-IOGP, 2014e.

Review and update

Contingency planning and competence building are not one-time events. Contingency plans should be dynamic, and the information they contain needs to be regularly reviewed to ensure that its validity is maintained. At the basic level, this may involve ensuring that contact details and equipment lists are current, or it could involve more fundamental updates in light of feedback from exercises or actual spill response activities. Should operations and the risk change, for example if new assets are introduced or additional oil types are identified, planning changes may be introduced which, in turn, means that new strategies and capabilities will need to be devised. Spill response technology and scientific data are constantly evolving due to ongoing research and development as well as feedback from exercises and actual responses. The strategies and tactics in the plan should be periodically reviewed and updated in line with advancements and improvements in equipment and techniques, and to reflect any improved knowledge of the potential response area and sensitivities.

In many cases, regulation will dictate a system of review and evaluation for approved plans. In the absence of regulatory guidance, organizations will need to implement their own programme of review and audit for ensuring sustained readiness and competency.

All plan holders need to be made aware of updates that are made, and plans that have been issued should be subject to document control procedures to prevent confusion and the misuse of outdated versions. New personnel within the organization, as well as government agencies and contractors, will require training and exercising to ensure they are familiar with the processes and procedures in the contingency plan. Individuals who have previously received training will need to attend refresher courses to make sure their competence remains valid. In addition, equipment and facilities will require maintenance and care to assure sustained readiness.

OSRL

A schedule of maintenance and audit for response equipment, consumables, warehouses and command post facilities should be defined in the plan.

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For information on source control see the following websites:

Oil Spill Response Limited, Subsea Well Intervention Service
www.oilspillresponse.com/services-landing/subsea-well-intervention-service

Oil and Gas UK, Oil Spill Prevention and Response Advisory Group (OSPRAG)
www.oilandgasuk.co.uk/knowledgecentre/OSPRAG.cfm

Marine Well Containment Company www.marinewellcontainment.com

Subsea Well Response Project http://subseawellresponse.com

Annex 1: Preparing a contingency plan

The format of a contingency plan should be in compliance with existing:

- local legislation and regulations;
- company policy and standards; and the
- national contingency plan.

In the absence of prescriptive content defined by government regulations or company standards, the format presented in this Annex may be used as a guideline. The content of an OSCP is intended to provide instructional actions specific to initiating and conducting a response. If a large volume of material creates difficulties in navigating the core procedures and information in the main body of the plan, it may be better to include some material as appendices or as separate plans (supporting documents). Examples of such material include sensitivity maps, tactical plans, directories and supporting elements. Material requiring frequent updates and redistribution (e.g. contact and resource directories, operational sensitivity maps, site-specific tactical plans) may benefit from separate document control and tracking. In some locations this may not be an issue; however in developing regions, contact information, local supply services and logistics details will often need regular updating. Background information and capability justification, which has been compiled over the course of the planning effort, should be included as appendices or separate supporting documents.

There is no standard format for a contingency plan that meets the needs of all organizations; the format will vary depending on the scope of the plan and should be scaled accordingly, i.e. sections may be added or removed based on the level of risk and the need for the listed contingency plan components. Planners should arrange the format in the most effective manner for the particular operation, and in accordance with the local and national regulatory framework.

Simple techniques, such as the use of tabs, arranging pages into sections, and creation of a well-organized table of contents will help users to navigate to key information in the contingency plan, and will also simplify the plan update process. Tables, flow charts and decision trees should be used as much as possible to simplify the presentation of material and facilitate the most efficient use of the contingency plan in an emergency situation.

A suggested format for a contingency plan is summarized below.

Introduction

- Overall response priorities and objectives
- Plan scope (including a summary description of operations and risks)
- Geographical area of coverage
- Integration with other plans
- Document control (plan custodian, distribution, review and update records)

Initial actions

- Initial actions and strategy decision guide
- Initial site safety and spill assessment
- Initial response priorities and objectives
- Initial action checklists for key personnel
- Immediate notifications and reporting
- Activation of response management team

- Identification of environmental and socio-economic sensitivities
- Immediately available Tier 1 resources and contacts
- Activation and deployment of Tier 1 resources
- Response escalation procedures
- Key facility information

Notifications and reporting

- Internal requirements and procedures
- External requirements and procedures
- Supplemental notifications, if any
- Contact details and forms (included either within the main body of the plan or as a separate directory for ease of frequent updating)

Assessments

- Site health, safety and security assessments
- Spill surveillance techniques (aerial surveillance, tracking buoys, etc.)
- Spill observation and assessment guidance
- Meteorological and hydrodynamic forecasting
- Spill trajectory and modelling
- Tier level assessment and escalation potential

Response resources

- Resource inventories and services list including required logistics support, contact information and mobilization times (included either within the main body of the contingency plan, or as a separate directory if lists are extensive and/or frequent updates are anticipated)
- Resourcing procedures
- Vessels of opportunity (required vessel specifications, lists of locally available vessels, etc.)
- Local labour sources and volunteers
- Subject matter experts or speciality expertise

Response management

- Response organization
- Roles and responsibilities
- Management processes and procedures
- Response management facility activation and location

Sensitive areas

- Identification of sensitivities
- Protection priorities
- Sensitivity maps (include either a full set of maps within the main body of the contingency plan, or a reference list of maps that are supplied in a separate document or GIS; the best arrangement will depend on the volume, size and type of maps)
- Operational sensitivity maps/site-specific tactical plans/geographical response plans (include a full set within the main body of the contingency plan, or a reference list of maps/plans that are supplied in a separate document; the best arrangement will depend on the volume and size of the material)

Response strategy

- Strategy decision guidance (flow charts, scenario matrix, NEBA decision guidance, etc.)
- Scenario-specific response strategy summaries
- Offshore, near-shore, shoreline and inland waterway response capabilities, as applicable
- Regulatory pre-approvals and/or approval application procedures
- General tactical plans, if any (included either within the main body of plan or as separate documents) see Annex 2 for detail

Waste management

- Regulatory requirements
- Procedures (including segregation, minimization, site removal, etc.)
- Guidance for developing spill-specific waste management plan
- Pre-designated temporary storage sites
- Treatment and final disposal arrangements or options

Decontamination

- Health and safety guidance
- Procedures and approved cleaning agents
- Pre-designated decontamination sites
- Guidance for developing a spill-specific decontamination plan

Demobilization

- Procedures (final equipment and vessel inspections, personnel checkout, resupply of consumables, claims for repairs, return of hired gear, etc.)
- Guidance for developing a spill-specific demobilization plan

Termination of response

- Guidance on establishing treatment end points and response termination criteria
- Designation of the roles with authority to sign off on completed areas and approve termination of the response

Response debrief

- Responsibilities and guidelines for conducting a post-spill analysis

Potential appendices or supporting documentation

General response information

- Health and safety guidelines
- In-field communications
- Documentation requirements and forms

Frequently updated information or large volumes of material

- Resource and contact directories
- Site-specific plans
- Sensitivity maps and general tactical plans

Background information

- Description of the facility and/or operations (including facility information, oil types and volumes handled, oil properties and weathering data, etc.)
- Baseline environmental and socio-economic information
- Meteorological and hydrodynamic information (including both prevailing and limiting/extreme conditions)
- Risk assessment

Specialized subject-specific plans

- Shoreline assessment
- Claims and compensation
- Sampling and monitoring
- Crisis (external) communications—public information, media, stakeholder engagement
- Wildlife protection and response
- Waste management

Finance and administration

- Human resources procedures (hiring, managing and compensating local labour)
- Financial responsibility and sources of funding
- Contractual agreements

Plan justification and other preparedness material

- Risk assessment and scenario planning
- Spill prevention and detection
- Training and exercise programme
- Plan and equipment review and audit schedule

Annex 2: Tactical response plan / handbook topics

Tactical plans or handbooks to support the provision and implementation of a specific capability are helpful tools for responders and management. This level of detail is not always required, but can provide an efficient means of compiling the multiple features involved in successfully delivering response techniques at planned tiers from start to finish.

Response capability overview (e.g. at-sea containment and recovery, controlled in-situ burning, etc.)

Safety and security protocols

Regulatory requirements

- Parameters of existing pre-approval, or procedure for applying for approval
- Reporting requirements
- Relevant government agencies

Inventory and mobilization of resources at each tier

- Resource inventory (type, use, equipment capacity or recovery rates, personnel/shift)
  - Specialist resources
  - Non-specialist resources
  - Logistics support
  - Service providers
  - Subject matter expertise
  - Relevant mutual aid agreements or industry cooperative support
- Mobilization of resources
  - Location of resources
  - Procedures for activation and mobilization
  - Cross-border movement requirements (visas, import papers)
  - Delivery and deployment times
  - Appropriate staging areas and launch points
  - Supply chain for consumables

Deployment and operations

- Deployment methods and schematics
- Constraints and limitations of use
- Environmental considerations
- Waste management support
- Monitoring for effectiveness
- Transport requirements (vessels, aircraft, specialized ground transport, etc.)

Personnel requirements

- Management team roles and responsibilities
- Field supervisors
- Labourers

Communications

Decontamination and demobilization

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IPIECA

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.

www.ipieca.org

International Association of Oil & Gas Producers

IOGP represents the upstream oil and gas industry before international organizations including the International Maritime Organization, the United Nations Environment Programme (UNEP) Regional Seas Conventions and other groups under the UN umbrella. At the regional level, OGP is the industry representative to the European Commission and Parliament and the OSPAR Commission for the North East Atlantic. Equally important is OGP's role in promulgating best practices, particularly in the areas of health, safety, the environment and social responsibility.

www.iogp.org