Oil spill preparedness and response: an introduction
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Oil spill preparedness and response: an introduction
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.

The original IPIECA Report Series will be progressively withdrawn upon publication of the various titles in this new Good Practice Guide Series during 2014–2015.

Note on good practice

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

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

Background

The oil and gas industry recognizes that oil spills may have serious ecological and socio-economic consequences and are potentially hazardous to workers and the wider community. Significant effort is dedicated to designing operations and employing procedures that prevent spills from occurring in the first instance and improving the efficacy and speed of clean-up operations should an incident occur. The industry constantly incorporates new research, understanding and lessons learned to improve spill prevention, and as a result the number of large spill incidents (commonly defined as oil spills greater than 700 tonnes) from shipping and allied activities has reduced more than ten-fold from the 1970s through to the present day (Figure 1).

In the unlikely event that an oil spill does occur, the industry’s primary goal is to minimize the impact of the spill on people, the environment and communities. This is achieved by ensuring a well-planned, rapid and effective response. While response objectives will vary depending on the specific circumstances of the spill, there are certain basic objectives that will guide any response which may be summarized as:

- safeguarding the safety and health of people—both of responders and communities;
- stopping the source of the spill as quickly as possible;
- minimizing environmental and community impact;
- minimizing the risk of oil reaching the shore in offshore scenarios; and
- minimizing the risk of oil entering watercourses or groundwater in onshore scenarios.

Figure 1: The number of large spills (>700 tonnes) from oil tankers, 1970 to 2014

Source: International Tanker Owners Pollution Federation (ITOPF), 2015 (www.itopf.com)
Purpose

This document provides a synopsis of the essential components of an effective oil spill preparedness, response and restoration framework. It describes the core principles that are used by the industry to underpin the framework and which run through the IPIECA-IOGP series of ‘Good Practice Guides’ (GPGs) on oil spill preparedness and response. Hyperlinks are provided throughout the document, highlighted in blue, which will take you to each respective GPG, as well as to other relevant sources, for more detailed information.

The IPIECA-IOGP Good Practice Guide Series 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.

This material is also available on the IPIECA and IOGP websites at www.ipieca.org and www.iogp.org, respectively.
Organization

This document is organized into the following four primary components:

- Keys to a successful response;
- Preparedness;
- Response; and
- Restoration.

Keys to a successful response

Prior to discussing different preparedness, response and restoration strategies and activities, it is important to understand the building blocks that are critical to a successful response. These building blocks include having an effective incident management system (IMS) in place along with a robust stakeholder engagement programme to ensure that the oil spill community is supportive of the strategies and tactics that the industry plans to implement should a spill occur. A good understanding by the oil spill community of the tiered preparedness and response concept along with the net environmental benefit assessment (NEBA) process and the need for good decision making are also key building blocks for a successful response.

Preparedness

In addition to the building blocks mentioned above, an effective spill preparedness programme must be put in place to ensure that companies are adequately prepared to respond to potential oil spill scenarios including a worst credible case discharge. Preparedness programmes generally include, but are not limited to, a comprehensive oil spill contingency plan (OSCP) and an effective training and exercise programme, along with the implementation of the tiered response concept.

Response

The next step in the framework is responding to an oil spill should one occur. First and foremost is the protection of the health and safety of responders but this component also covers the various response options for assessing and addressing oil spills on water and land as well as waste management, environmental protection, oiled wildlife and others.

Restoration

Once the emergency phase of a spill response is completed, actions will generally need to be taken to assess potential impacts on the environment and conduct the associated restoration activities or provide compensation for the impacts.
Keys to a successful response

A successful oil spill response has a set of core good practices at its heart. These are the building blocks of an effective oil spill preparedness framework; they are advocated by industry and are fundamental to minimizing the potential for environmental and community damage. These core good practices begin with the understanding that, even with a strong focus on prevention, there is still a possibility that oil spill incidents may occur. Operators must therefore have effective, deliverable contingency plans, capable of mounting a response up to and including the worst credible case release or discharge.

Incident management system

Effective incident management requires the ability to establish command and control of the response activities—i.e. to move the management of the response from the initial reactive mode to one where the scope of the incident is understood, appropriate response actions are being taken in alignment with response strategies, and where the outcome of the incident is being driven by a clear set of objectives to protect people and the environment. The incident management system (IMS) defines and standardizes the management organizational structure and processes to enable seamless integration of various involved organizations while promoting successful incident management and coordination.

Figure 2 illustrates a typical incident management structure. However, variations are found from country to country.

IMS principles were developed in the 1970s by the fire-fighting services as a management method to clarify command relationships and to make effective use of mutual aid and cooperation for large-scale incidents involving multiple authorities. Although originally developed to address fires, the IMS concept is now applied to many other types of emergency events or incidents, including oil spill response.

Experience has shown the value of unifying and integrating incident response functions into a single organization, managed and supported by one command structure and supporting processes, and with clear ‘line of sight’ between command and field. The incident response organization is most successful when the following key principles are applied:

- use of a single, integrated organization to manage the response;
- organization by function, e.g. command, operations, planning, logistics, finance;
establishment of clear, hierarchical reporting relationships; and
keeping the organization modular, scalable and appropriately sized.

The incident management system GPG introduces the common elements of an IMS to stakeholders who may be called upon to work together to provide specific expertise, assistance or response resources during an emergency incident.

Tiered preparedness and response

The principle of tiered preparedness and response is recognized as the basis on which to establish a robust oil spill preparedness and response framework. It establishes the capability that can be escalated and cascaded to the scene. This reduces the unnecessary global stockpiling of large quantities of response resources, yet can still provide for a robust response through the integration of local, regional and global capabilities. The established three-tiered structure allows the planner to describe how an effective response to any oil spill will be provided, i.e. from small operational spillages to a worst credible case release at sea or on land.

Developed in the 1980s, the tiered preparedness and response approach categorizes response capabilities and ensures that the appropriate resources are accessible to a facility or region in the event of a spill. These principles enable responders to plan for the escalation of both regional and global response resources in the unlikely event of a major spill.

The tier classifications are broadly defined as follows:

Tier 1: Capability necessary to handle a local spill and/or provide an initial response.
Tier 2: Regional capability necessary to supplement a Tier 1 response, including general equipment and specialized tools and services.
Tier 3: Global resources necessary for spills that require a substantial additional response due to incident scale, complexity and/or impact potential.

It is important to recognize that while the extent and size of the spill is relevant to the tier classification, other factors such as environmental resources at risk, seasonal accessibility and geographical remoteness also play a part. For this reason, the tiers should not be defined quantitatively as there are too many variables in a spill (e.g. oil type, location, environmental setting, weather, local governance, etc.) to calculate the amount and quantity of resources required by a given volume of oil spilled.

The tiered preparedness and response GPG presents an updated view of tiered preparedness and response, from a simple scale-based (resource requirement) model to a more detailed approach where expertise and specific tools are accessed and utilized where beneficial. Using a newly-developed system which identifies fifteen response planning categories, the structure provides a mechanism for the planner to identify how individual elements of capability can be cascaded into the theatre of response operations. This is a reflection of advances in technology, communications, logistics and the expertise required to rapidly deploy the appropriate response toolkit to the location of an incident.
Stakeholder engagement—alignment, integration and decision making

Critical to the success of a response effort is the need to ensure that the expectations and priorities of all stakeholders are aligned at the outset. This encourages all the various parties to work together effectively, towards a common goal. Stakeholders may include the oil companies, shipping interests, government agencies and local communities.

The priorities for spill response will inevitably vary according to the unique individual circumstances of the spill but, in general, the aim will be to prevent damage to sensitive ecosystems, and to the health, safety and property of people, as well as maintaining the vitality and sustainability of tourism and other key business and community industries, such as fishing.

Speed is a key element in an effective oil spill response as oil spills are often rapidly evolving events and spread quickly on the water’s surface. An hour lost early in the response equates to days lost later in the process, and the impacts of a spill can increase exponentially due to delays that occur early in a response. For this reason, it is in everybody’s interests to promote a fast and effective response through effective cooperation between government, industry and stakeholders. This translates into practical actions which may include:

- clear emergency response organization and procedures;
- ensuring the flow of objective information from the site of the spill;
- availability of pre-authorized techniques in the response toolkit;
- apolitical decision-making; and
- the ability to mobilize and deploy response capabilities.

Cooperation and quick decision making by the incident management team using the recognized IMS will dictate the effectiveness of the response and is a necessity for these practical actions to be implemented, and all parties need to adhere to the mantra of ‘inform, consult and listen’. The involvement of stakeholders in the contingency planning process provides the foundation for successful decision-making. A NEBA driven approach identifies suitable response tools, the use of which will preferably have been pre-approved by the stakeholders and reflected in plans which have been properly exercised.
The International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC Convention) is an international instrument that has been signed by numerous governments. This establishes a commitment to work cooperatively with other countries, and with the oil, shipping and ports industries, in ensuring a suitable national oil spill response system. It also stipulates reporting and planning requirements and encourages the development of both bilateral and multilateral agreements. The requirements set by the OPRC Convention are aligned with the principles of effective response described in this document.

The current document embraces the concept of stakeholder engagement and provides supplemental information to the above discussion; other GPGs on NEBA and Oil spill contingency planning also incorporate aspects of stakeholder engagement.

**Net environmental benefit analysis**

Net environmental benefit analysis (NEBA) is a process used to ensure that the impacts of oil spills on people and the environment are minimized. It involves consideration and judgment to compare the likely outcomes of using different oil spill response techniques. The process may be led by experienced planners but encourages inputs from government, industry and local communities. NEBA provides a solid scientific basis for understanding and confirming value judgements between differing ecological and socio-economic resources. The advantages and disadvantages of different response techniques need to be compared with each other and with natural clean-up, to determine which approach will result in the least overall harm to the environment and local community. It typically involves the steps shown in Table 1 and should ideally be carried out prior to an oil spill as a fundamental part of contingency planning.

**Table 1** Example of the key steps typically carried out as part of the NEBA process

<table>
<thead>
<tr>
<th>NEBA step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate data</td>
<td>Consideration of where the spilled oil may occur and where it is likely to drift under the influence of currents and wind; various oil spill trajectory models exist to support this. It is also useful to know how an oil will ‘weather’ as it drifts.</td>
</tr>
<tr>
<td>Predict outcomes</td>
<td>Assessment of what is likely to be affected by the spilled oil if no response is undertaken. This may include both ecological and socio-economic resources, and areas with cultural or historical value. Seasonal variations may need to be taken into account.</td>
</tr>
<tr>
<td>Balance trade-offs</td>
<td>The efficiency and feasibility of the response toolkit should be reviewed in the context of representative scenarios. This covers the response techniques, the practicalities of their utilization and how much oil they can recover or treat. If areas under threat include oil-sensitive coastal habitats, the role of oil spill response at sea is to either prevent or limit the spilled oil from reaching these habitats. Previous experience can help to assess which oil spill response techniques are likely to be effective. Pragmatic considerations should form an important part of the NEBA process as applied to all feasible response techniques.</td>
</tr>
<tr>
<td>Select best options</td>
<td>The NEBA process output is the selection of response technique(s) that minimize the overall impacts of a potential spill on the environment, and promote the most rapid recovery and restoration of the affected area. Tiered capability is then established based on the identified needs.</td>
</tr>
</tbody>
</table>
NEBA can also be used after an oil spill to facilitate urgent decisions on how to minimize environmental and socio-economic impacts.

The NEBA GPG explains how the process takes into account the circumstances of the spill, the practicalities of clean-up response, the relative impacts of response and clean-up options, and the process by which judgements are made on the relative importance of social, economic and environmental factors.

**Situational awareness, aligned objectives and response strategy**

Three-way communication is critical to a successful response and includes the development of pre-established points of contact for industry, government, and the community as part of the preparedness process. A shared view of the situation (‘situational awareness’) using surveillance, modelling and visualization tools as inputs to a ‘common operating picture’ will ensure that all parties are operating from the same perspective. This, coupled with a good understanding of each party’s primary concerns, ultimate objectives and priorities, will facilitate alignment and transparency of decision-making during the response so that all parties are privy to the choices being made and are able to support them. Although a GPG has not been prepared specifically to describe this aspect of spill response, situational awareness is largely addressed through the remote sensing and aerial observation GPGs discussed in the Response section on pages 14–19.
Contingency planning

Oil spill contingency planning is the process of developing a suitable spill response capability that is in compliance with the local regulatory framework and commensurate with the oil spill risks of an organization or facility. The oil spill risk assessment and response planning processes allow the identification of, and adequate planning and provisioning for, scenarios of all scales and complexities. Incorporated within these processes are the principles of tiered preparedness and response discussed on page 8 of this document.

A full explanation of contingency planning and preparedness processes is given in the relevant GPGs, however, the following critical elements should always be considered:

- The basis of response preparedness is the capability to respond; this is not measured solely by equipment stockpiles, but also encompasses personnel, equipment, organization, procedures, logistics, training, exercising and review.
- Understanding the level of risk, including identifying oil fate and trajectory and the key ecological and socio-economic sensitivities which may be threatened under realistic planning scenarios is vital.
- Developing robust, detailed, contingency plans for scenarios up to and including the credible worst case, with the ability to cascade identified capability through the tiers as needed and without barriers.
- Working with regulators and the community to secure pre-authorizations for the preferred response techniques, whether that be the use of dispersant, the potential for controlled (in-situ) burning, shoreline protection sites, etc.
- Ensuring communications strategies are in place and that key community, regulatory and other stakeholder contacts are identified and are consulted in the contingency planning process.
- Planning to manage and integrate external offers of assistance which may involve additional capability that is not central to contingency plans.

Ultimately, contingency plans should be prepared that embody the above concepts and which also include detailed executable components that can be translated into a physical spill response capability. However, no matter how good the plan, if it is to ensure optimum capability it should also incorporate:

- training;
- exercising;
- a continuous review process;
- access to both trained people and suitable equipment; and
- the logistical means to deploy, support and maintain a response.

The contingency planning GPG provides guidance on the contingency planning process for potential oil spills in or on water following an accidental release of oil to a marine or aquatic environment, whether that be during the handling, transport, production or storage of oil products.
Sensitivity mapping for oil spill response

Sensitivity maps should be prepared as part of the contingency planning or preparedness process. They should be designed to convey essential information to those responding to oil spills by identifying the sites of coastal resources and environmentally-sensitive areas. Producing these maps involves assembling information on resources and deciding what guidelines for spill response should be included. Uses range from planning practical site-specific shore protection and clean-up to strategic planning for large remote areas.

The sensitivity mapping GPG explains the processes for compiling these maps, and the differences between strategic and tactical sensitivity maps, and provides guidance on running a sensitivity mapping project.

Oil spill response training

Responder training is an essential precondition for effective oil spill response, which requires personnel who understand, and can perform, a variety of emergency response and incident management functions. The purpose of oil spill training is to ensure that these personnel are identified and given appropriate opportunities to learn and maintain relevant knowledge and skills. The oil spill training GPG presents a stepwise process, known as the ‘training cycle’, to assist organizations and individuals in achieving this aim. This document is linked and cross-referenced to the companion GPG on oil spill exercises (see below).

Oil spill exercises

The oil spill exercises GPG provides guidance on constructing an exercise programme that is suitable for meeting an organization’s or facility’s requirements in training for spills associated with oil exploration and production, oil transportation via land or water, or the operation of oil storage facilities and marine terminals. This guidance is aimed at those persons responsible for ensuring that oil spill contingency plans are practised and verified, and is linked and cross-referenced to the companion GPG on oil spill training.
The oil spill response process usually proceeds along the following lines:

- **Initial deployment:** following a verification of a spill and initial safety assessment, responders immediately deploy all necessary local capability and assess the event’s scale and impact potential.

- **Confirm response techniques:** responders then match the actual spill to the closest planning scenario. Once matched, the accompanying pre-planned response techniques are confirmed as appropriate and implemented.

- **Organize the response:** organizing the response entails procuring the appropriate resources to allow for the industry standard of prudent overreaction. This also includes the stand-up and implementation of an incident management system, at a scale meeting the potential incident needs.

- **Cascade resources:** capability is deployed in a cascading manner, with escalation from appropriate external pre-identified resources, as the spill evolves and responders understand what is required.

- **Adjust for realities:** effectiveness of techniques and incident conditions are assessed and adjusted throughout the response.

- **Ongoing response:** the response will continue until an agreed-upon end point is reached, at which time restoration will commence.

Note that, after the initial deployment, the process is often cyclical. Based on an operational period (typically 24 hours), there may be a repeating process of ‘plan, do, re-evaluate and adapt’.

**Oil spill responder health and safety**

When an oil spill occurs, the issue of health and safety, both for the public and oil spill responders, is a serious consideration. It is recognized that health and safety are managed in many different ways around the world, with highly regulated prescriptive regimes which legislate actions in some countries and risk-based systems in others. The responder health and safety GPG focuses on identifying the principal issues when an oil spill occurs, their degree of severity, and on the practical steps that can be taken to minimize the impact of the spill on the health and safety of those involved in responding to it. Although this document is primarily intended to address oil spills on water, it may also be of use in the event of an inland spill.

**Source control**

An important part of any response to an oil spill incident is to safely control the source of the spill and stop further flow as soon as possible. While source control features in plans for vessel operations, pipelines, terminals etc., it is important to recognize the substantial investment by industry in the development and global provision of source control capability for capping offshore wells. Capping is the act of putting a device on a well to stem an uncontrolled flow of hydrocarbons. The device has the ability to close in a well assuming that the cap itself, the downhole equipment and the well bore have the integrity to withstand the resulting shut-in pressures. The cap would typically be placed on the existing wellhead, through which hydrocarbons are escaping. If required, the cap can also be used as a containment solution to
channel hydrocarbons to the surface for collection while the well is being shut in. While this is outside the scope of the current GPG series, more information on this subject can be obtained from various websites including the Subsea Well Intervention Service (offered by Oil Spill Response Limited), the Helix Well Containment Group (HWCG), OSPRAG, the Marine Well Containment Company (MWCC) and others.

**Surveillance, modelling and visualization**

It is important for responders, government agencies and communities to have a clear understanding of the pollution situation, response actions under way, and progress being made to prevent or mitigate potential impacts. This ‘situational awareness’ is provided by a combination of surveillance operations, predictive modelling and the depiction and reporting of a variety of response features and data.

The IPIECA-IOGP Good Practice Guide on the aerial observation of oil pollution provides guidance on the identification and observation of spilled oil at sea. The document explains the principles of aerial reconnaissance, as well as developing a mission profile and estimating oil types, thicknesses and quantities from the air. Guidance is provided on calculating drift and preparing pollution reports, as well as guiding response vessels from an observing aircraft.

Satellite remote sensing is one of several technologies that form the surveillance strategy required for effective response to oil spills. The capabilities of the technology have developed significantly over the past two decades to the point where the technology is now meeting useful industry needs in terms of spatial and temporal sampling and timely response. Satellites can operate independently of weather, logistics, political or other ground or airspace conditions, and are particularly useful and cost-effective for wide area synoptic coverage.

The IPIECA-IOGP Good Practice Guide on satellite remote sensing provides guidance on the strategic and operational role and application of satellite remote sensing for oil spill response. The guide covers how to set up a satellite remote sensing response team, the technology involved, the process of taking a satellite image request through to providing decision-making information, and the challenges and future opportunities for satellite remote sensing within the oil spill response framework.
Response techniques

Types of equipment and techniques to be employed

The techniques which are considered and identified in the scenario planning stage are drawn from the response toolkit. These tools include natural processes (i.e. biodegradation), the use of at-sea containment and recovery, chemical dispersants and controlled (in-situ) burning, as well as shoreline protection and clean-up. These tools are summarized below with additional information provided on each one in subsequent subsections. Table 2 summarizes the benefits and potential drawbacks of each technique.

Table 2 The benefits and potential drawbacks of the various oil spill response techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Benefits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersant</td>
<td>Removes surface oil that could harm wildlife and keeps oil from spreading to the shoreline; enhances natural biodegradation of oil and reduces vapours on the water surface.</td>
<td>Dispersed oil has the potential to initially affect local water column-dwelling wildlife and vegetation.</td>
</tr>
<tr>
<td>Mechanical recovery</td>
<td>Removes oil with minimal environmental impact.</td>
<td>Mechanical recovery can be inefficient, resource-intensive, and restricted by water conditions, with typically no more than 10–20 per cent oil recovery.</td>
</tr>
<tr>
<td>Controlled (in-situ) burning</td>
<td>Removes large amounts of oil rapidly via controlled (in-situ) burning.</td>
<td>Burning presents a potential safety risk and localized reduction in air quality; burn residue can be difficult to recover.</td>
</tr>
<tr>
<td>Physical removal</td>
<td>Selectively restores environmental and social value at specific locations using a variety of tools.</td>
<td>Aggressive or inappropriate removal methods may impact ecosystems and individual organisms.</td>
</tr>
<tr>
<td>Natural processes</td>
<td>Takes advantage of natural processes for oil removal, including biodegradation, and avoids intrusive clean-up techniques that may further damage the environment.</td>
<td>Natural removal can take more time to return the environment to pre-spill use than other response techniques.</td>
</tr>
</tbody>
</table>

The advantages and disadvantages of each oil spill response technique

In addition to the benefits and drawbacks associated with each technique, not all tools and techniques will necessarily be appropriate for use in a given environment or scenario. Table 3 outlines the potential limitations, although it should be noted that these are not hard and fast rules and will vary according to the circumstances, for example, although most tanker spills would be amenable to the use of dispersant, there may be some cargos (e.g. heavy fuel oil) that would not be responsive to dispersant application, particularly in cold seas.

This information provides a starting point for considering response options and evaluating the trade-offs using the NEBA process that inevitably have to be made during every major response.
Table 3  General guidance on the suitability of the different response techniques under a variety of circumstances

<table>
<thead>
<tr>
<th>Example Scenarios</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dispersants</td>
</tr>
<tr>
<td><strong>Offshore release</strong></td>
<td></td>
</tr>
<tr>
<td>Tanker spill</td>
<td>✓</td>
</tr>
<tr>
<td>Subsea spill</td>
<td>✓</td>
</tr>
<tr>
<td>Spill flowing towards populated area</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Near Shore Release</strong></td>
<td></td>
</tr>
<tr>
<td>Spawning season</td>
<td>x</td>
</tr>
<tr>
<td><strong>Onshore or near-shore release</strong></td>
<td></td>
</tr>
<tr>
<td>Near marsh or sand beach</td>
<td>x</td>
</tr>
</tbody>
</table>

Dispersants: surface application

Dispersant use can be an effective way of minimizing the overall ecological and socio-economic damage by preventing oil from reaching coastal habitats and shorelines and enhancing the natural biodegradation processes that ultimately assimilate oil into the environment. What dispersants are, and how they work when applied to oil slicks on the sea’s surface, are described in the IPIECA-IOGP Good Practice Guide on the surface application of dispersants. Details on the capabilities and limitations of dispersants are presented, together with highlights on the need for regulation, the advantages of preplanning and advance authorization, operational procedures and monitoring during their use.

Dispersants: subsea application

The recent evolution of subsea dispersant injection (SSDI) as a response tool for possible deeper water well releases is described in the Good Practice Guide on the subsea application of dispersants. This includes the operational capabilities that have been developed, and how the decision to plan for SSDI may be justified by NEBA approaches. Particular features described include the ability to mount continuous operations in a wide range of sea conditions, as well as approaches to monitoring the effectiveness and effects of its application.

At-sea containment and recovery

At-sea containment and recovery is the controlled encounter and collection of oil from the water’s surface. Equipment is used to corral and concentrate the spilled oil (using floating barriers or booms) on the sea surface into a suitable surface thickness, allowing for mechanical removal. The
IPIECA-IOGP Good Practice Guide on at-sea containment and recovery explains how effective containment and recovery can: reduce the impact on on-water sensitivities such as seabirds, fish and mammals; reduce the impact on shoreline sensitivities by removing floating oil at sea; reduce the complexity and duration of a shoreline response; and reduce the volume of waste generated by a response by preventing or minimizing shoreline impacts. The document explores the reasons why at-sea containment and recovery sometimes fails, and the circumstances under which it should, and should not, be considered.

In-situ burning

In-situ burning (ISB) is the controlled ignition and burning of spilled oil at, or close to, the spill site. ISB is recognized as a viable response tool for cleaning up oil spills on water, land and ice. ISB can rapidly reduce the volume of spilled oil, thereby greatly reducing the need to collect, store, transport and dispose of recovered oil. ISB can also shorten the overall response time to an oil spill, thus aiding in environmental protection. The in-situ burning GPG contains a compilation of information regarding the in-situ burning of oil spills. It includes the scientific aspects of the burning process and its effects, and practical information about the procedures to be followed and equipment required for carrying out in-situ burns.

Shoreline assessment (SCAT)

Despite the best intentions of an on-water response to an oil spill at sea or in a river, the likelihood is that at least some of the spilled oil will eventually reach the shoreline. When shoreline impact occurs, or is likely to occur, shoreline assessment is a critical component of the response programme, and provides essential information for setting objectives, priorities, constraints and end points for an effective shoreline response. The shoreline assessment GPG explains how an effective shoreline assessment programme supports the planning, decision making and implementation process for a shoreline response, and how the key components of shoreline surveys are integrated into the data generation, decision making and implementation/closure stages of a shoreline response programme.

Shoreline clean-up

The IPIECA-IOGP Good Practice Guide on shoreline clean-up techniques sets out the important factors to be considered when contemplating the clean-up of an oiled shoreline, including the steps to be taken in managing shoreline clean-up operations. The advantages and disadvantages of some of the most frequently used techniques are discussed, as well as identifying at what stage in the overall operation a particular technique is likely to be most useful. In addition, the document examines the interaction between stranded oil and different shoreline types, and suggests some possible approaches to addressing the challenges this interaction can present.
Inland responses

The **inland response GPG** presents an overview of inland oil spill response in aquatic environments (freshwater rivers and streams, lakes and ponds, wetlands and estuarine water bodies and their associated shores and banksides) identifying similarities to marine response and highlighting unique issues pertinent to inland spills. The document addresses the response phase of inland incidents, where actions are undertaken to ensure safety, minimize the immediate spread and threat of a spill and deploy techniques to clean up spilled oil in aquatic environments. It does not address spills to terrestrial environments and the possible remediation actions which may be considered where oil has contaminated the underlying soil or ground water.

Waste management

The response to an oil spill often results in the rapid generation and accumulation of large quantities of oily waste. Emulsified oil and oiled sand, gravel and entrained debris can increase the volume of waste to many times the volume of oil originally spilt. This waste often exceeds the capacity of the locally available waste management infrastructure which can slow or temporarily discontinue oil recovery and clean-up operations. As a result, the management of response-related wastes can become the most time-demanding and costly aspect of an oil spill. The **oil spill waste GPG** sets out the principles involved in identifying and planning for management and minimization of the various waste streams listed above. Wastes from a variety of sources (offshore and onshore spills worldwide, and upstream and downstream operations from oil exploration and production, processing, refining, transport and storage activities) are considered.

Oiled wildlife

The **oiled wildlife GPG** provides an overview of the key concepts and practices in oiled wildlife response preparedness, and explains how a higher level of integrated preparedness can be achieved. This document also distils the knowledge and experience gained over many years of responding to spills of crude and fuel oils over several decades, and provides sound guidance for managing the capture, triage, cleaning and rehabilitation of oiled wildlife following a spill. Many of the same techniques, policies and operating procedures can be applied to spills of other chemicals that are transported by ship, train or pipeline and that may affect wild animals. This document will therefore also be of value to planners tasked with preparing for events involving those products, and may also be used as a primer for personnel whose job it is to develop the oiled wildlife preparedness plans of their company or country and who have only a passing knowledge of wildlife response.
While distinct and separate from the preparedness and response processes, and inevitably taking place over longer timescales, impact assessment and restoration play a key role following a spill. In many cases, an impact assessment should be initiated immediately following discovery of a spill to collect ephemeral data, and will often continue well after the emergency response phase is complete. Components of assessment and restoration may include:

- **Environmental impacts**: oil spill impacts on marine ecology and on shorelines can be significant, particularly in the early stages of a spill. It is therefore important to understand what the potential impacts are, so that adequate pre-planning can be conducted to quickly initiate an impact assessment programme.

- **Remediation**: the remediation of oil spills typically involves the removal or treatment of residual oil on shorelines or terrestrial areas after the emergency response phase has been completed and transitions to the project phase. Typically, remediation is only required if there are ongoing environmental impacts from the residual oil.

- **Environmental restoration**: the goal of environmental restoration is to restore the environment to pre-spill conditions through natural recovery or restoration activities, such as marsh vegetation planting, sediment replacement, habitat enhancement, etc.

- **Community restoration**: compensation of financial impacts is one form of community restoration, along with advertising campaigns to promote local businesses, tourism and recreation, and enhanced access to recreational shorelines.
Marine environmental impacts

The IPIECA-IOGP Good Practice Guide on the impacts of oil spills on marine ecology provides an overview of how oil spills can impact on marine ecological resources and functions and how quickly those resources and functions can take to recover. It describes the properties of mineral oils and physical processes that spilled oils go through that are relevant to marine ecological impacts, provides a general description of the mechanisms and factors that typically affect the impacts of oil spills on marine resources and their rates of recovery, and describes some of the more common impacts that oil spills have had on different ecosystems, with reference to particular case studies. The document summarizes current good practice in spill response and how it is designed to maximize net environmental benefit.

Shoreline environmental impacts

The GPG on the impacts of oil spills on shorelines provides an overview of how oil spills can impact on marine and estuarine shorelines and how quickly they can recover. The document describes the fate of oil on different shorelines and the characteristics that are relevant to impacts and recovery, together with the ecological impacts of oil on shorelines. It outlines current best practice in shoreline clean-up, and summarizes some of the fundamental approaches and requirements of impact assessment.

Economic assessment and compensation

Despite the best efforts of those involved in a response, a release of oil has the potential to affect property and impair commercial activity, resulting in economic loss. The IPIECA-IOGP Good Practice Guide on economic assessment and compensation considers the effects of oil on the fisheries and tourism sectors, as well as on other commercial activities, and identifies the sources of money that may be available to compensate for such damages. The legislation and compensation schemes that enable payments are explained, and the methods by which the various types of economic damage can be quantified and calculated under the schemes and the procedures necessary for submitting claims for losses are outlined, including claims for the costs of a response, as well as for property damage and for economic loss.
IPIECA is the global oil and gas industry association for environmental and social issues. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance; and is the industry’s principal channel of communication with the United Nations. Through its member led working groups and executive leadership, IPIECA brings together the collective expertise of oil and gas companies and associations. Its unique position within the industry enables its members to respond effectively to key environmental and social issues.

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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, IOGP is the industry representative to the European Commission and Parliament and the OSPAR Commission for the North East Atlantic. Equally important is IOGP’s role in promulgating best practices, particularly in the areas of health, safety, the environment and social responsibility.

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