IPIECA REPORT SERIES

VOLUME ELEVEN

OIL SPILL RESPONDER SAFETY GUIDE

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International Petroleum Industry Environmental Conservation Association

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PREFACE

This report is one of a series commissioned by the International Petroleum Industry Environmental Conservation Association (IPIECA). The full series of reports will represent the IPIECA members' collective contribution to the global discussion on oil spill preparedness and response.

In preparing these reports—which represent a consensus of membership views—IPIECA has been guided by a set of principles which every organization associated with the transportation of oil products at sea should consider when managing operations related to the transportation, handling and storage of petroleum and petroleum products:

- it is of paramount importance to concentrate on preventing spills;
- safety of life is the highest priority in any incident;
- despite the best efforts of individual organizations, spills will continue to occur and will affect the local environment;
- response to spills should seek to minimize the severity of the environmental damage and to hasten the recovery of any damaged ecosystem;
- the response should always seek to complement and make use of natural forces to the fullest extent practicable.

Anyone charged with planning for oil spill response activities is faced with a vast array of tasks that must be analysed and prioritized. Often these tasks conflict, requiring difficult decisions to be made and compromises reached. Health and safety must never be compromised, regardless of the environmental imperative. Documented, safe systems of work should always be established and adhered to. This will often increase the complexity of operations and in many instances will require additional personnel. However, the temptation to get the job done at the expense of the health and safety of the responders should be resisted at all costs.

Health and safety should be the cornerstone of all oil spill preparatory measures. Responses to a variety of scenarios are best formulated away from the time-pressures that an actual crisis imposes. At each stage of the planning cycle, there must be a conscious check to ensure that no unwarranted increase in health and safety risk has occurred, or if it has, that additional control measures are put in place to counter it. These plans must then be practised in both tabletop and practical exercises, and refined as required by honest feedback.

The value of independent health and safety audits cannot be underestimated. A skilled and independent auditor will often unearth weaknesses in systems and plans that have previously remained hidden. This will allow remedial action to be taken to improve the quality and effectiveness of preparations.

SUMMARY AND INTRODUCTION

When an oil spill occurs, the issue of health and safety, both for the public and oil spill responders, is the most critical consideration. The purpose of this document is to investigate the safety aspects of oil spills and their response. It is recognized that safety is managed in many different ways around the world. The safety regimes in different countries vary enormously in the methods of achieving their objectives, from highly regulated prescriptive regimes which legislate actions, to risk-based systems which approach the problem from a totally different perspective. It would be foolhardy to try to develop a safety document that attempted to prescribe any particular approach to safety, as it would not succeed in meeting the expectations of at least some part of the community. Instead this document will concentrate on identifying the principal safety issues when an oil spill occurs, their degree of severity, and the practical steps that can be taken to minimize the impact of the spill.

Many spills have been cleaned up safely in the past. Because clean-up activities are usually conducted in the open air, the hazards from vapours and gases are relatively low, and simple protective clothing can reduce contact with oil and minimize any chance of harm. Nevertheless the oil and the working environment do introduce other hazards. The key to safety is to recognize the risks from all sources and to be prepared to act accordingly. The other major aspect when dealing with safety management is the issue of liability. Although safety management systems are used to manage the liabilities that may arise as a result of an accident, the document does not attempt to deal with this aspect of the problem. Rather, it focuses on the practical and technical safety considerations that need to be dealt with when responding to an oil spill. Those with well-developed safety regimes will have the procedures in place but should find value in the practical guidance. Those that do not have such advanced safety systems should find the guide useful in developing safety plans to deal with the issues that are raised.

This document is divided into six broad categories, each of which needs to be addressed. They are:

- management of safety;
- risk assessment;
- oil and response clean-up chemical safety issues;
- the working environment and safety during operations;
- personal protective equipment (PPE); and
- management of volunteers.

Each organization will need to establish its own strategy to ensure that health and safety is incorporated into its own spill response provisions. These strategies should be reviewed periodically, taking into account experience and lessons learned.

MANAGEMENT CONTROL OF SPILL SAFETY

The safety of the general public and responders is assigned the highest priority during spill response operations. A response management system, with safety as its core element, should start from the top and penetrate to all levels within the organizations participating in response activities.

To ensure that safety takes its proper place during response operations special actions need to be taken. The management team should appoint an individual and, if necessary, a supporting team, with a responsibility for safety management. Responders can often become too involved in operations and not be able to take an overall view of the situation. The safety manager needs to be able to step back from the operation and consider wider issues.

The safety manager should be responsible for monitoring and maintaining awareness of active and developing situations, assessing hazardous and unsafe situations and developing measures to assure personnel safety. These measures include:

- Site Assessment, during initial response, in order to: document the hazard analysis process; address hazard identification, personal protective equipment and control zones; and identify decontamination areas. Competent personnel, that is to say, those appropriately trained and experienced in the issues surrounding spill safety, should be used to manage and supervise response. Local labour can be used to support the clean-up effort provided that they are: given training in the safety issues that are relevant to the tasks they undertake; briefed on the risks that they will meet; and provided with the appropriate safety equipment.
- Developing and implementing a Site Safety and Health Plan (SSHP). Information to develop the plan can be obtained from sources such as specific site safety plans, hazard assessments and air monitoring data. The Plan should be reviewed regularly with regard to the safety implications of the activities proposed or in progress.
- Participating in planning meetings to identify health and safety concerns inherent in the operation's daily work plan.
- Correcting unsafe acts or conditions through the regular line of authority, although the safety manager should be authorized to exercise emergency authority to prevent or stop unsafe acts when immediate action is required. The safety manager should also investigate accidents that have occurred during operations.

- Establishing first-aid stations and medical facilities in accordance with the SSHP.

Site Safety and Health Plan (SSHP)

The safety manager should ensure the preparation and implementation of the SSHP in accordance with local and national plans and regulations. The SSHP should, ideally, address the following elements:

- health and safety hazard analysis for each site, task or operation;
- comprehensive operations work plan;
- personnel training requirements;
- personal protective equipment (PPE) selection criteria;
- site-specific occupational medical monitoring requirements;
- individual and area air monitoring plan;
- site control measures;
- confined space entry procedures, if needed;
- pre-entry briefings (initial/daily/pre-shift);
- pre-operations health and safety conference for all incident participants;
- quality assurance of SSHP effectiveness; and
- decontamination.

Site layout plans may help with making people aware of the risks and the location of key safety elements. These should be prepared and displayed at the site command post. A copy should be returned to the incident command centre and should be revised as conditions at the site change.

Safety briefing and communication

One of the key methods of managing safety is by the use of safety briefings (Appendix 2). Ideally, briefings should be held before the start of each shift to pass along all information necessary to ensure safety on the site. All contractor supervisory personnel should attend these safety meetings in order to pass information to their own teams. A method of rapid communications with all field sites should be included in the safety briefings. The information passed should be pitched at the correct level to suit the audience; for example clean-up crews will require a different content and style of briefing to the personnel in the command centre. The briefings should address:

Briefing the response team prior to a day's operations

- work zone characteristics;
- hazard information on the spilled product;
- evacuation routes;
- assembly points;
- first-aid post locations;
- location of staging areas;
- command post locations; and
- how to respond to other emergencies that may arise.

RISK ASSESSMENT

An overall risk assessment should be conducted at the start of a spill.

Introduction

The first task that should be undertaken when preparing to conduct oil spill response operations is a comprehensive risk assessment and hazard analysis. When an oil spill occurs the management team will need to carry out a high-level risk assessment of the overall situation as soon as possible to ensure that oil spill responders or the wider population are not in danger. The initial approach should be to answer such questions as:

- Is there a potential gas cloud and therefore an explosion risk?
- Should people be evacuated or excluded?
- Is the environment safe for people?
- Will oil enter water systems that may affect people?

This initial safety assessment may lead to the establishment of safety or exclusion zones whilst the area is monitored in more detail. This may include the use of monitoring equipment to detect flammable or toxic gases and materials. The persistence of these sorts of hazards is not usually great, but this issue is more significant with the more volatile oil types and in calm weather conditions. Monitoring should continue until it can be established that the risk has reduced to acceptable levels. Once the overall situation has been stabilized from a safety point of view then the work of responding to the oil spill can begin. In normal circumstances responders are not likely to be exposed to areas in which there is an explosion or toxic vapour risk. Specialist source control teams, who are trained and equipped to work within these high-risk areas, are the ones most likely to enter these environments.

When responding to a spill, the risks posed by particular operations or locations should be assessed on a case-by-case basis. One way of dealing with this situation is through the use of a Site Safety Survey Form (Appendix 1). This form, when completed by a competent individual from the response team, can be used to identify the various hazards and determine if they present a risk. Once identified, appropriate control measures can be taken to mitigate the risks. Those personnel involved in carrying out risk assessments must have sufficient training and knowledge to understand the potential hazards presented by the operations. The process of risk assessment is intended to identify all of the potential hazards. Once this has been completed, the probability and the severity of any potential

incident should be predictable. Those incidents most likely to occur frequently, or those most likely to cause the greatest harm, should be dealt with first. Account must be taken of who might be harmed, and how. There are a number of techniques in common use for the assessment of risk. Some rely on descriptive ranking, while others employ a numerical scoring system to produce an order of priority. Whatever system is employed, it is important that all the assessments are carried out in a consistent manner.

Once the likelihood and severity of risks have been considered, the precautions available should then be examined to determine their effectiveness. If the hazard continues to present a risk then additional measures should be put in place. There is an accepted hierarchy of approach that may be summarized as follows:

1. Prevent access to the hazard
2. Organize the work in a way that exposure to the hazard is reduced
3. Use PPE

The risk assessment should be fully documented and filed. During the conduct of operations the risk from the spilled oil will inevitably change but many of the physical risk factors in the environment will remain constant. As a matter of course, the workplace hazards should be periodically reassessed and the suitability of previously selected hazard controls re-evaluated. The possibility of reviewing previous risk assessments will assist in getting consistency of approach. The Site Safety Survey Form (Appendix 1) is a means of documenting the particular hazards at any particular site or those arising from particular operations. In the main, hazards can be seen to arise from a number of specific areas:

- the spilled product itself and response chemicals;
- the working environment;
- risks during response operations;
- risks from machinery used in the clean-up operation; and
- risks from external factors.

SPILLED PRODUCT AND RESPONSE CLEAN-UP: CHEMICAL SAFETY

Some spills present specific safety risks

Responses to oil spills inevitably put responders and chemicals together in the same environment. Potential exposure of personnel should be assessed, monitored, and controlled if health effects are to be avoided. Each type of product, when spilled into the environment, will have its own set of chemical characteristics that will determine the most effective response strategy and, indeed, which strategies are safe to use. It should be borne in mind that the chemical characteristics of the spilled product will usually change over a period of time as a result of what is known as 'the weathering process', i.e. the action of the elements on the product and its reaction with the surroundings.

In order to assess the measures needed to protect responders from the spilled product, its chemical constituents and characteristics must be known. By convention, this information is presented in a document called a material safety data sheet (MSDS). Each MSDS contains all the information required to complete a risk assessment of the chemical.

Oils, whether in the crude state or as refined products, represent a safety hazard. The main hazards that can arise are as a result of the following properties:

- flammability;
- explosive vapours;
- toxicity;
- hydrogen sulphide;
- exclusion of oxygen; and
- the slippery nature of oil.

Flammability

Crude oils, condensates and refined products may be ignited if they are exposed to a source of ignition. The period for which oil remains easily ignitable is usually short because of evaporation of the more volatile components and the inclusion of water in the oil if it emulsifies. Whilst the oil is fresh care must be taken to exclude any potential sources of ignition from an area to minimize the risk of fire. Responders should exercise care in the selection of equipment that is used in response operations if it may cause ignition of the spilled product. Additionally, smoking, sparking tools, vehicles or any other potential source of ignition should be kept out of the spill area. Access to the spill operations areas

should be controlled whilst any danger of ignition persists. Light products such as gasoline or kerosene represent a particular hazard and special care should be taken when approaching these spills.

Explosive vapours

When a refined product or volatile crude is spilled, there will be a release of hydrocarbon vapours during the initial stages of the incident. There is potential for this vapour cloud to drift, under the effects of the prevailing winds, into a centre of population or to a location where there is a possibility of the vapours being ignited. Safety exclusion zones and air monitoring stations may need to be established to determine the vapour levels to monitor whether or not they are within explosive limits. The release of vapours may present a specific hazard to internal combustion engines causing them to over-speed uncontrollably if the vapour is inducted into the engine. Internal combustion engines should not be operated in areas where a risk of explosion exists. As a precaution, engines that could be exposed to environments where vapours are present should be protected by the fitting of an air inlet shut-off device that will operate if the engine speed exceeds maximum rated limits.

Toxicity

Fears of the toxicity of oil are widespread but the risk is low because, although oils contain potentially harmful components, it is relatively easy to prevent them entering the body to cause harm. The spilled product's toxic properties may follow a variety of routes of entry into the body other than breathing the gases or vapours. It may be absorbed through the skin or eyes, ingested (swallowed) or injected. The potentially most serious exposure exists during the initial stages of a spill, particularly when volatile crude oils, condensates or light refined products are involved. These products can have carcinogenic components. For example, benzene is a confirmed human carcinogen for which the risks and safe exposure limits have been defined. If the potential exposure exceeds the prescribed limits, then suitable PPE must be worn, such as chemical-protective clothing and respirators. Whilst these aromatic products usually only persist for a short period of time and will rapidly disperse in the air, they do pose a specific safety risk. Care must be taken to monitor the levels of benzene in the environment and protect both responders and the public from exposure. The level of aromatics released will be a function of the specific oil type, the surface area of the spill, temperature and the wind conditions at the time of the release. The risks must be assessed by specialists and controls implemented to reduce their impact to an acceptable level.

Reference to the occupational exposure limits (OELs) of any chemicals should be made and a proper monitoring regime adopted. OELs may be either short-term (for chemicals with acute effects) or long-term (for chemicals with chronic effects).

Hydrogen sulphide

The presence of toxic vapours must also be monitored. 'Sour crudes' give off hydrogen sulphide gas (H_2S). Even though it can be smelled at low concentrations, at lethal concentrations H_2S is impossible to detect without specialist equipment. There can be particular concern for the public if there is a possibility that a gas cloud from an incident could drift into residential or populated areas. If the levels are extremely high due to a 'blow out' of a sour crude well or release of a large quantity of sour crude oil, evacuation may have to be considered as a sensible precaution. Responders should not normally be operating in an environment where the risk of poisoning from gasses such as H_2S exist, unless they are involved in source control. If the gas is suspected, based on information usually gained from the producer or the shipper of the oil, a monitoring system should be established to determine the levels. Once the level of gas present has reduced to acceptable levels, responders should be provided with personal monitoring equipment to monitor their personal exposure and their working time limited so as not to exceed any occupational exposure limits that are set in respect of the gas.

Exclusion of oxygen

The gases from hydrocarbons can displace the oxygen in an environment, particularly when they collect in confined spaces or trenches that are not adequately ventilated. Oxygen content readings should be taken prior to entering any confined space, trench or area where reduced ventilation may lead to an accumulation of hydrocarbon vapours. Entry should not be permitted unless readings in excess of 19.5% O_2 are confirmed. Such areas should be monitored continually; entry by responders controlled using a permit to work system; and the appropriate tank entry procedures implemented.

Conducting air monitoring in the vicinity of the spill site.

Slipperiness

The most common form of accident encountered during spill operations results from slips, trips or falls. Many of the products encountered are, by their very nature, slippery. Slips, trips and falls on oiled surfaces are one of the main causes of injury and awareness of these hazards should be raised. Responders can also find it difficult to handle equipment when wearing oily gloves, which can increase the time taken to complete familiar tasks and may make some more complicated tasks impossible without decontaminating the equipment first.

Air monitoring equipment and record keeping

Air and exposure monitoring can be conducted through the use of electronic monitors, draeger tubes, personal monitors or passive diffusion monitors. The type, level and frequency of monitoring should be based on the particular circumstances. An example of an air monitoring record is shown in Appendix 3.

Protective clothing should be suited to the oil type and the working environment.

Skin contact with oil

Oil and some of the chemical compounds used in clean up operations can have a degreasing effect on skin tissue and can cause problems if ingested. When responders are working on a clean-up operation suitable PPE should be worn to prevent oil contact with the skin which may cause dermatitis, an inflammation of the skin. The type of PPE used must be suited to the climatic conditions at the site as problems of heat exhaustion may arise if workers are required to wear impermeable PPE for long periods in very hot conditions. Work periods must be managed to ensure that adequate rest periods are given.

Protective gloves, suits and boots should be provided to protect the responder, and moisturizing barrier creams should be provided to protect the skin. Decontamination facilities should be established which permit responders to remove oiled clothing in a controlled environment, and which provide them with access to suitable washing facilities. Another ailment sometimes experienced by responders is sickness and diahorrea caused by the accidental ingestion of contaminated food due to inadequate hygiene. Personal hygiene and decontamination facilities should be provided to permit workers to wash prior to taking meal breaks, in order to guard against this type of illness.

Spill response chemicals and cleaning agents

A number of chemical materials, such as dispersant materials and solvent cleaners are used when responding to oil spills and special care must be taken when handling these materials. Most products are provided with guidance notes on the risks, use and handling of the material, and this information should be made available to all those handling the product. When handling dispersant chemicals, gloves, goggles and protective clothing should be worn and prolonged contact with the skin avoided, as many of the materials are hydrocarbon based and can cause oil contact dermatitis. Similar precautions should be taken when handling solvent cleaner chemicals, as these can contain more aromatic components. Special care should be taken in the use of respiratory protection with the appropriate filter cartridges. A full discussion of the safety implications of dispersant use is provided under ‘Dispersant Response Operations’ in the following section (see pages 18–19).

THE WORKING ENVIRONMENT AND SAFETY DURING RESPONSE OPERATIONS

Oil spills invariably bring out the worst in the weather.

The working environment

Oil spills can occur in practically any type of environment and under all climatic and meteorological conditions. This poses a number of challenges to responders and has an overriding influence on the response options available. Some aspects of the working environment (such as site layout, security, working shifts) may be controlled by the responders themselves. Others, including the weather and the terrain, must be given consideration and accommodated when response targets are set. In every working environment, safety must remain the top priority, and measures to control any risks put in place.

Weather

Extremes of temperature, humidity and precipitation all place considerable strain on human performance. Symptoms range from heat stroke, sunburn and dehydration at one end of the scale to frostbite and hypothermia at the other. These conditions are, by their nature, hazardous and must be assessed accordingly. Suitable and sufficient control measures need to be provided and might include:

- specialized clothing;
- shelter;
- survival training;
- adjustments to work patterns to provide rest/respite for workers; and
- provision of communications equipment and accurate weather forecasting.

The natural environment

The environment in which a spill can occur can range from exposed shorelines to rugged and remote mountains in the case of pipeline spills. Safe access and egress must be arranged for vehicles and pedestrians with account being taken of shoreline type (mud, cliffs, mangroves etc.) and tidal patterns and ranges. Care must be taken that workers and equipment are not cut off by rising tides when working on shorelines. In the case of inland spills, each locality will present its own unique set of challenges that must be overcome, including accessibility, gradients, watercourse flow rate and depth, and water table characteristics.

The natural environment can present a significant risk.

Although indigenous flora and fauna are often an important ecological and environmental resource, they can present a very real safety issue. Poisonous plants and dangerous animals need to be identified, and their appearance publicized to the responders along with information on how to deal with the threat they present. Of greater concern are those creatures that may actually attack humans both in the sea and on dry land. Where these possibilities exist, expert advice must be obtained and adequate protection provided.

Night operations

Night operations present particular risks for workers. Unless adequate lighting can be guaranteed to ensure that responders can have safe and secure access to the worksite, and that an acceptable level of operational efficiency can be guaranteed, night clean-up operations should be avoided. It is difficult to see oil in low light conditions and the risk of slips, trips or falls increases dramatically. Worker fatigue will increase through night working and the operational benefits of this work need to be assessed. Application of dispersants, particularly from aircraft is not recommended during night time conditions as there are inherent safety and operational efficiency issues.

Providing safe access to the worksite is critical to reducing the risk of accidents.

Slips, trips and falls

As mentioned previously, the most common hazard to responders is the danger from slips, trips or falls. Oil spills can occur in locations where the access to the work site is difficult. The problem is compounded when the surface is coated with oil, but rocky shorelines can be naturally slippery due to seaweed, wet rocks or mud. Safe and secure access must be provided for the workforce to prevent the possibility of injury. When working on the shoreline, it is advisable for responders to keep clear of cliffs or rocky shorelines until a safe means of access has been provided, either in the form of access bridges or guide ropes. Clean-up crews should be warned of the hazards of any particular site access and be given

information on the safest access routes. Slips, trips and falls are also an issue when working on vessels involved in offshore operations. Responders should beware of falling into the water and must wear lifejackets at all times. Decks can become extremely slippery when coated in oil. Towing lines and equipment hoses add to the potential trip hazards. Good seamanship to maintain clean and tidy decks is an important factor in reducing the hazard.

Manual handling and equipment lifting

Care must be taken by responders when lifting equipment or recovered waste bags. Where possible lifting equipment should be used. If manual handling is required, the loads should be restricted to manageable proportions and persons instructed in the proper lifting techniques. When using lifting equipment, responders should be provided with safety helmets and only those trained in the operation of the equipment permitted to use it.

Transport of materials/waste disposal

When oil is recovered it is often stored in temporary pits on the shoreline. These pits should be cordoned off from the public. Safe and secure access should be provided to them for vehicles delivering or removing material. The pits should be well marked with suitable signage to warn any person against accidentally falling into them.

Temporary storage tanks must be clearly marked and secondary pollution should be avoided.

There are potential risks from the use of heavy machinery in public places (near right).

Vehicle cleaning stations should be provided at shoreline access points (far right).

Oil spills require significant logistics support with regard to the transportation of equipment, and the use of specialist vehicles and personnel transport. To prevent degradation of local road safety, care must be taken to avoid secondary contamination beyond the initially oiled areas. Transport cleaning stations will need to be established to prevent oil being transferred into public areas and causing potential safety hazards.

Clean-up operations generate large quantities of waste that must be stored, sorted and disposed of through an approved process or procedure. The transport of materials will often require specialized vehicles. In most cases, licences will need to be obtained from the local authorities to allow storage, transportation and disposal of oily waste.

First aid

The arduous nature of response activities increases the risk of illness and injury to responders. Often they are undertaking difficult tasks, under pressure and in unfamiliar surroundings. Preventative measures need to be taken to protect responders from infectious diseases and from other health effects of the oil-contaminated environment. Water and food quality must be of a suitable standard to avoid illness. Responders should be trained in first aid and also have an awareness of:

- medical facilities available locally and how to access them;
- vaccinations which may be required; and
- medevac arrangements which should be available in the case of serious injury.

Other risks

There are other risks that need to be considered, especially when dispatching responders internationally. Some parts of the world have their own inherent dangers and these must be assessed on a case-by-case basis. Professional advice from embassies and government departments, or from specialist security companies, will need to be sought in order to make an informed judgement on how to proceed. Support and advice should be sought from the in-country staff as to the actual risk conditions on the ground at the spill location. Issues to be considered include:

- travel arrangements (routes, visas, couriers);
- airline safety;
- accommodation;
- language; interpreters, translation of documents;
- risk of hijack or kidnap;
- any country-specific risks such as terrorism, civil war, unexploded ordnance; and
- evacuation.

The extent and potential threat of these hazards must be taken into account before committing responders to any particular activity. If there is a risk, suitable and appropriate countermeasures and plans should be established, communicated and tested.

Shoreline deployments require extensive management (see box below).

Safety during response operations

Shoreline response operations

The majority of response activities occur on shorelines. The proximity to water presents its own set of hazards which give rise to increased risks, particularly among inexperienced or unfamiliar responders. Notably, tides, currents and waves contribute to creating a dynamic environment that can catch out the unwary and needs constant monitoring and reassessment.

The nature of shoreline deployments often poses problems in terms of communications, access and movement of heavy equipment, together with the provision of adequate first-aid and evacuation resources. Cliffs, mud and treacherous terrain increase the difficulties in providing these arrangements.

Unless access to spill sites and contaminated areas is properly controlled, the local population can be exposed to risks from which they are not protected. Additionally, vehicles and persons entering the spill area may generate secondary contamination and possibly cause unnecessary damage to sensitive environmental resources.

Shoreline response safety tips

- Test for poisonous or explosive gases
- Create safe access—slips and falls on large boulder fields are a significant cause of injuries
- Ensure adequate manpower to achieve the task safely
- Ensure adequate safety briefings (Appendix 2) and supervision
- Be aware of tidal conditions
- Provide shelter, rest periods and nourishment for responders
- Employ a buddy system to avoid lone working
- Never permit entry into excavations, always clearly mark storage pits on shorelines
- Reassess operations if weather deteriorates, especially if a heavy sea is running
- Ensure adequate first aid, safety briefings and medevac facilities
- Risks can be minimized by having good communications

Shoreline clean-up operations need to be managed carefully to prevent accidents.

It is essential that shoreline responders are trained to recognize the hazards present in their working environment, and are provided with adequate means to control the risks.

Offshore response operations

Offshore working can take place either on fixed installations or on vessels. These environments have their own special practices and procedures that should be followed in order to remain safe. Inexperienced or uninitiated responders are at

Offshore response safety tips

- Test for poisonous or explosive gases before approaching spill
- Lines and chains used for lashing and towing have the potential to cause serious injuries and must be checked periodically, especially in high seas
- Keep the decks as clean as possible—hazards faced in the offshore environment multiply as a result of poor weather, oiled decks and equipment, and congested work areas
- Ensure that all responders are familiar with the equipment to be used
- Ensure that all responders are familiar with the vessel emergency procedures
- Deck operations always carry the hazard of drowning so a lifejacket must be worn
- Ensure a full briefing is conducted before commencing operations
- Secure equipment with tag lines when lifting using deck cranes
- Risks can be minimized by having good communications between the bridge and the deck

High seas conditions can make vessel operation hazardous.

increased risk when operating offshore and, where possible, regular local workers acting as safety escorts should accompany them. A personal floatation device must be worn by all responders working offshore and in vessels, because swimming ability is impaired by clothing such as boots and helmets. Vessels engaged in offshore response work should be suitably sized and equipped to deal with the environment. Adequate and suitable safety and communications equipment should be installed on the vessels. Crews should be trained and competent in the operation of the vessels and responders should be trained and fully briefed on their responsibilities.

It cannot be overstressed that the hazards faced in the offshore environment multiply as a result of poor weather, oiled decks and equipment, and congested work areas. Lines and chains used for lashing and towing have the potential to cause serious injuries and must be checked periodically, especially in high seas. A communications system should be established to permit all vessels working offshore to be able to report any emergencies and provide operations status reports. A system of notifying craft of any adverse weather reports should be established as a precaution and is particularly important when small craft are engaged in nearshore response operations.

Dispersant response operations

The use of dispersant chemicals to treat spilled oil brings with it a number of health and safety issues that must be addressed. Specifically, the chemicals can pose a hazard to health and the methods of application can leave unprotected responders open to various modes of exposure. These include:

- **Breathing aerosol droplets mists.** When operations present this risk, personal issue respirators must be worn by all responders during spraying operations, whether shoreline spraying, spraying from vessels or operating aircraft systems. The respirators must be fitted with a particle filter, providing

Appropriate PPE must be used when using dispersants.

protection against particles such as dust, oil mist, smoke and chemical aerosol spray. On vessels, all normal doors and windows should remain closed during spraying operations, to protect crew members located within the accommodation, inside the engine room or on the bridge. On larger vessels, there is the potential of dispersant mist entering the forced air engine room ventilation. In this case, it is advisable for engine room personnel to use deck operations PPE during spraying operations. Dispersant mist may also have a detrimental effect on engines if ingested into air inlets. Special care should be taken to protect all personnel when spraying is conducted in windy conditions.

- **Ingestion.** Respirators should be used to prevent swallowing of any dispersant mist. Personal hygiene practices must be rigorously applied to prevent the possibility of dispersant ingestion during meal breaks.
- **Absorption through the skin.** Dispersant is readily absorbed by the skin and can cause irritation or organ damage. One-piece PVC suits and nitrile-rubber gloves are required to be worn during loading and transfer operations and for boat and shoreline spraying. Nitrile-rubber gloves are also required when coupling/disconnecting dispersant hoses during the operation of fixed wing aircraft systems.
- **Splashes to the eyes.** Chemical goggles are required where splash risk exists, e.g. during loading and transfer operations, for boat and shoreline spraying and for fixed wing aircraft operations. Medical attention should always be sought if dispersant is splashed into the eyes.

Dispersant response operation safety tips

- Assess the routes of possible exposure to dispersant chemical
- Provide PPE to guard against each and every route, ensuring that all PPE is compatible and fits the wearer
- Keep decks clear and dispersant free by regular washing
- Head spray vessels into wind where possible
- Make sure that the PPE is resistant to the dispersant in use
- Avoid uncontrolled releases of dispersant
- Always refer to the Material Safety Data Sheets

Aviation operations

Response strategies often include the use of aircraft. This may be for reconnaissance, transport or for dispersant spraying. Aircraft operations, airfields, and indeed aircraft themselves, present numerous hazards that must be identified and controlled. Briefings should be provided to passengers by the aircrew on the safety aspects of the specific aircraft type and the location and use of safety equipment. Care must be taken by personnel whilst on the airport not to enter areas in which aircraft are operating without first gaining the necessary permission from the airport staff or aircrew.

Aircraft can play a significant role in response operations.

Aviation safety tips

- Never walk across airfield aprons without an escort.
- When approaching or leaving aircraft, care must be taken to avoid the intakes, exhausts, propellers and rotor blades.
- A rotating helicopter blade may pass near to the ground particularly when idling: personnel should always crouch when approaching or departing from a helicopter with turning rotors and in the direction advised by the aircraft crew.
- Approach to an aircraft should only be made when directed by the pilot or crew, and the route should remain in the pilot's field of view.
- Briefings must be provided to passengers by the aircrew on the safety aspects of the aircraft and the location and use of the exits and life saving equipment provided.
- Particular attention should be paid to hearing protection and the wearing of high visibility garments when working on airfields.
- Loose objects pose a threat to aircraft safety and should be controlled. This includes litter, nuts and bolts, packing cases and hats.

Personnel responsibility

Whatever the working environment, safety can be considerably improved if personnel watch out for each other as well as themselves. The working environment in a spill situation changes constantly, and responders need to be able to adjust to the changing conditions to mitigate any potential injury or loss.

Along with physical and chemical factors, other factors also affect the working environment. Working long hours under hot and dry, or cold, damp and windy conditions along with extended periods away from home can quickly lead to fatigue. As fatigue sets in the ability to exercise good judgement and decision making decreases rapidly. Equipment operation and working on deck becomes more dangerous as fatigue becomes more pronounced. Personnel injuries, unexpected environmental discharges, and property damage potentially can all result from equipment failure. Safe working is dependent upon the experience and training of the involved personnel and the continued close attention to safety procedures.

PERSONAL PROTECTIVE EQUIPMENT SELECTION AND SITE FACILITIES

PPE selection

Personal protective equipment (PPE) is an essential element in ensuring responders are able to work in a safe manner. The proper selection and use of PPE requires skill and experience. The following points should be taken into consideration when selecting the appropriate PPE:

- the expected working conditions and hazards;
- the activities to be performed;
- the person(s) being exposed; and
- the compatibility of the equipment—each piece of PPE should be capable of performing effectively without hindering the proper operation of other pieces.

Consideration should also be given to the nature of the task and the demands placed on the worker, including:

- the physical effort required to do the job;
- the methods of work involved;
- how long the PPE will need to be worn;
- the need for adequate vision and communications whilst wearing the items;
- whether high cost, durable equipment or lower cost disposable items be selected; and
- whether the task is critical to the overall clean-up.

Consultation with the safety manager and experienced responders is advantageous in determining the most suitable type of PPE. These personnel are best placed to provide first hand knowledge of the task, environment and any other unique factors.

The working environment will often dictate the PPE selection criteria. For example, cold weather environments require the use of thermally insulating clothing. This type of clothing can be rendered unusable if it comes into contact with liquid oils, hence a robust and well-sealed impermeable layer should be worn above the cold weather clothing. Conversely, in hot climates, impermeable clothing will exacerbate the problem of heat stroke. Workers should therefore be given adequate rest breaks and liquids to ensure their welfare, or an acceptable compromise should be reached in the type of PPE that they wear.

A properly equipped, well motivated team is a major asset

The selection of the correct type of personal protective equipment is critical.

PPE should not be issued without information and training in its use and maintenance. Without this, its effectiveness will be severely reduced. Proper decontamination and cleaning facilities should be provided so that the equipment remains in a good condition for as long as possible. Without these facilities PPE supplies will be wasted, straining supply lines and reducing cost-effectiveness. Where possible, systems should be established to ensure that workers remain responsible for the condition of their own PPE. Simple systems which require workers to hand in used PPE before new stocks are issued will assist in the control of waste. Separate disposal facilities for used PPE should be established to segregate the waste.

By taking an activity-based approach to PPE selection, a response organization is able to set some working parameters. These should include mechanical protection, the elements/climate, and hazardous substances. It is vital to emphasise that PPE is not, in itself, the only risk control method but in most circumstances it is inevitable that personnel will come into close contact with the oil and PPE will be a necessity.

A guide to PPE selection is included opposite.

Safety and welfare facilities on site

Sanitation and personal hygiene facilities

Potable water, non-potable water, toilets and personal hygiene facilities should be readily available. Details of the location of hygiene facilities should be contained on the Site Safety Map.

Decontamination procedures

Contaminated personnel, equipment and vehicles or vessels should be decontaminated in accordance with a decontamination plan which should include:

Typical minimum PPE requirements

	Supervisor	Plant driver	Manual cleaner	Chemical spray	Chemical brush	H.P. washing	L.P. washing	Visitor decon.	Visitor hot/warm zone	Cold zone	Lifting	Boat crew	Water	Cold	Heat	Noise	Gas sampler	H_2S	Benzene
Dayglo vest	●																		
Coveralls	●	●									●		●		●				
Oil skin suit			●		●	●	●	●	●										
Safety boots	●	●		●							●	●	●						
Safety wellingtons			●		●	●	●	●	●										
Chest waders														●					
Rigger gloves	●	●																	
PVC gloves			●		●	●	●	●	●										
Tape seals			●		●			●	●										
Ear defenders																●			
Safety glasses	●						●		●										
Goggles			●	●		●		●											
Bump hat			●	●	●	●	●	●	●								●		
Safety helmet											●								
Personal floatation device													●	●					
Tyvek® suit															●				
Thermal suit														●					
Immersion suit														●					
Air monitor patch			●	●	●													●	●
Respirator [1]					●												●	●	●
TECPS [2]				●													●		

[1] Chemical cartridge respirator with full facepiece & organic vapour cartridge filter with an assigned protection factor (APF) of 50
[2] Totally encapsulating chemical protective suit

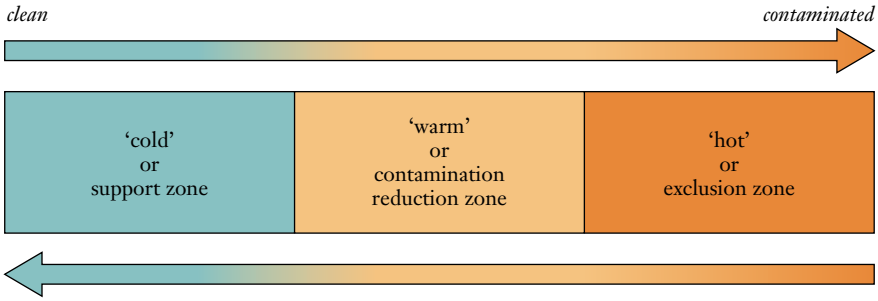
- a description of the location and layout of decontamination stations for the facility;
- a list of the decontamination equipment needed;
- the appropriate PPE for persons carrying out the decontamination;
- appropriate procedures for specific materials that may be encountered;
- methods and procedures for preventing secondary contamination of clean areas;
- methods and procedures for minimizing worker contact with contaminants during removal of PPE;
- safe disposal methods for clothing and equipment which are not completely decontaminated; and
- revisions whenever the site conditions change, or the facility hazards are re-assessed based on the new information.

Decontamination facilities

Decontamination is best performed in a specific sequence to reduce levels of contamination on personnel, PPE, equipment or transport until no contaminant remains. Facilities should be established to deal with the waste from cleaning stations so it can be disposed of in an approved manner in order to prevent secondary pollution.

Decontamination stations should take personnel and equipment from the 'hot' contaminated zone through a 'warm' cleaning zone to the 'cold' exit point from the operations area. Movement through these zones should be coordinated to reduce the possibility of cross contamination.

Contamination zones



MANAGEMENT OF VOLUNTEERS

Volunteers will frequently offer their services to assist, either as part of the clean-up team or to assist with wildlife rescue. Volunteers are often inexperienced and untrained in spill response activity, so this resource can be both an asset and a liability if their use is not controlled and insufficient care is given to safety and welfare. For this reason, safe use of volunteers needs careful thought and planning.

In some areas of the world, volunteers are prohibited from becoming involved in the response activity unless they can demonstrate that they have undertaken formal safety training. In other countries it has proved impossible to prevent the public from becoming involved in the clean-up, and certain countries positively encourage such assistance. Whichever philosophical approach prevails, the key is to ensure safety, adequate communication and, where possible, control of the effort.

If volunteers are used in a response activity, it should be in such a way that their safety is assured. A specific training programme should be provided, identifying the risk and hazards and how to avoid injury. Volunteers should also be provided with appropriate PPE and integrated in to the overall command structure to ensure that they have the benefit of safety information briefings.

Volunteer coordination

Management of volunteers can be difficult as they can be focused on either their own local environment or their own specific issues. To get the best out of a volunteer workforce a volunteer coordinator can be included as part of the response management team. The volunteer coordinator should be responsible for managing and overseeing all aspects of volunteer participation, including recruitment, induction and assignment.

A volunteer coordinator would:

- coordinate with the response organization to determine where volunteers are needed;
- identify the local skills that are available that can be usefully employed;
- identify any necessary skills and training needs;
- verify minimum training required, as necessary, with safety manager or units requesting volunteers (if special skill is required);

Volunteer activities must be coordinated and the safety aspects managed.

- activate, as necessary, standby contractors for supplementary training needs;
- coordinate nearby or on-site training as part of the deployment process;
- identify and secure other equipment, materials and supplies;
- provide induction safety training for volunteers;
- activate pre-registered volunteers if needed;
- assess, train and assign volunteers to specific tasks;
- coordinate with the logistics section for volunteer housing and meal arrangements; and
- assist volunteers with other special needs.

Volunteer responders

If volunteers are to be used during the clean-up, they will need to have attained an acceptable level of competence in clean-up techniques and safety. Training and supervision will be needed from experienced personnel that can be drawn from either the response team or from local organizations.

Wildlife volunteers

Often, members of the public are distressed by the reports and sights of oiled wildlife, and volunteer to assist. In order to minimize distress to the animals concerned, oiled wildlife often needs special handling by trained personnel. In some parts of the world professional organizations are available to treat and clean oiled wildlife. In an ideal world, before volunteers are included in the response, they should receive professional training and should be supervised during animal collection or subsequent cleaning operations.

Logistics volunteers

Some volunteers may offer to become involved in the logistics operation supporting the spill response. Their training needs will depend upon the role in which the volunteer is engaged. Some support activities would not expose the volunteer to the risks associated with clean up and therefore only basic training in the management structure of the response organization will be required. These types of activities include:

- logistics (e.g. procurement, purchasing, inventory control);
- transportation (e.g. carpools, trucking);
- food preparation and distribution;
- first-aid squads; and
- personnel services (e.g. lodging, laundry).

CONCLUSIONS

The clean up of spilled oil is important, but not as important as ensuring the safety of those who are involved or may be affected by the spill. The health and safety of the public and the responders is a critical aspect of a successful operation. The problem is not a particularly complex one, but one that requires management, planning and common sense to minimize the risk of accidents.

The risks are well known, and arise for the most part from the natural environment in which the operations are conducted rather than from the product itself, particularly as the oil weathers and the lighter fractions evaporate.

Conducting a risk assessment is essential in preparing for safe oil spill clean up from various operations and working environments. Response managers and supervisors should be trained in the use of risk assessments and have the necessary safety training to be able to determine the hazards and put in place control measures.

Responders should be provided with appropriate training and briefings to ensure that they are aware of the risks and how to deal with them. Communication of safety issues is vitally important, as is the provision of appropriate Personal Protective Equipment to workers.

This report identifies the key issues surrounding responder safety, and is intended to provide guidance regarding the options available for carrying out safe clean-up operations. Hopefully it will provoke thoughts to assist in the establishment of a safety regime to prevent accidents during spill incidents.

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Further reading

US Department of Labor and the US Occupational Safety and Health Administration (2001). *Training Marine Oil Spill Response Workers Under OSHA's Hazardous Waste Operations and Emergency Response Standard.*

APPENDIX 1
EXAMPLE SITE SAFETY SURVEY FORM

1. SITE:

2. DATE: **3. TIME:** **4. INCIDENT:**

5. PRODUCT(S): (Attach MSDS)

6. Site Characterization (tick all relevant boxes):

6a. Area: ☐ Ocean ☐ Bay ☐ River ☐ Saltmarsh ☐ Mudflats
☐ Shoreline ☐ Sandy ☐ Rocky ☐ Cliffs ☐ Docks

6b. Use: ☐ Commercial ☐ Industrial ☐ Farming ☐ Public ☐ Government
☐ Recreational ☐ Residential ☐ Other

7. Weather: ☐ Ice/frost ☐ Snow ☐ Rain ☐ Wind ☐ Sun

Temperature _____

8. Site Hazards:

☐ Bird handling	☐ Fire, explosion, *in-situ* burn	☐ Slips, trips and falls
☐ Boat safety	☐ Heat stress	☐ Steam and hot water
☐ Chemical hazards	☐ Helicopter operations	☐ Tides
☐ Cold stress	☐ Lifting	☐ Trenches, excavations
☐ Drum handling	☐ Motor vehicles	☐ UV radiation
☐ Equipment operations	☐ Noise	☐ Visibility
☐ Electrical hazards	☐ Overhead/buried utilities	☐ Weather
☐ Fatigue	☐ Pumps and hoses	☐ Work near water
☐ Other	☐ Other	☐ Other

9. Air Monitoring:

☐ O_2 ☐ LEL ☐ Benzene ☐ H_2S ☐ Other (specify)

10. Personal Protective Equipment:

☐ Foot protection	☐ Coveralls	☐ Head protection
☐ Impervious suits	☐ Eye protection	☐ Personal floatation
☐ Ear protection	☐ Respirators	☐ Hand protection
☐ Other		

11. Site Facilities Required:

☐ Sanitation ☐ First Aid ☐ Decontamination

12. Emergency Plan Requirements:

☐ Alarm system ☐ Evacuation plan

13. Contact Details Required:

☐ Fire ☐ Doctor ☐ Ambulance ☐ Police ☐ Hospital ☐ Other

14. Date Plan Completed: _____ **15. Plan Completed by:** _____

continued overleaf

EXAMPLE SITE SAFETY SURVEY FORM (continued)

Site Name:
Location/Map Reference:

Include work zones, first-aid locations, primary and secondary escape routes, assembly points, staging area and command post locations.

APPENDIX 2
EXAMPLE SITE SAFETY BRIEFING SHEET

Incident: _____ **Project Code:** _____

Site Name: _____ **Location/Map Ref.:** _____

Date: _____ **Time:** _____

Briefing Conducted by: _____

Topics Covered:

- Weather conditions ☐
- Injuries and illnesses ☐
- Corrective actions/precautions ☐
- First aid ☐
- Site emergency plan ☐
- Site hazards ☐
- Oil/chemical hazards ☐
- PPE to be worn ☐
- Decontamination procedures ☐
- Other topics (list below) ☐

Comments:

APPENDIX 3
EXAMPLE GAS TESTING RECORD SHEET

	Acceptable Limits	Initial Test		Follow-up Tests					
		Results	Date/ time	Results	Date/ time	Results	Date/ time	Results	Date/ time
Gas Test % O_2	Limits >19.5%< 22%								
% LEL	<10%								
H_2S	Refer to current industry practice								
Benzene	Refer to current industry practice								
#1									
#2									
#3									
#4									
#5									

O_2 = Oxygen, LEL = Lower explosive limit, H_2S = Hydrogen sulphide, STEL = Short-term exposure limit, TWA = Time weighted average

Tests completed by	Initial Test	1st Follow up	2nd Follow up	3rd Follow up
Name				
Signature				

The International Petroleum Industry Environmental Conservation Association (IPIECA) is comprised of oil and gas companies and associations from around the world. Founded in 1974 following the establishment of the United Nations Environment Programme (UNEP), IPIECA provides the oil and gas industry's principal channel of communication with the United Nations. IPIECA is the single global association representing the industry on key environmental issues including oil spill preparedness and response, global climate change, operational issues and biodiversity.

Through a Strategic Issues Assessment Forum, IPIECA also helps its members identify new global environmental issues and evaluates their potential impact on the oil and gas industry. IPIECA's programme takes full account of international developments in these global issues, serving as a forum for discussion and cooperation involving industry and international organizations.

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Oil Companies International Marine Forum (OCIMF)

Petroleum Association of Japan (PAJ)

Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean (ARPEL)

Regional Clean Sea Organisation (RECSO)

South African Petroleum Industry Association (SAPIA)

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