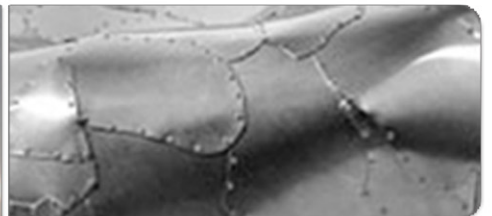
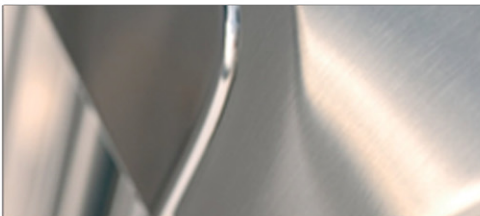




Steel MacTM
LIMITED

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Shoreline Response



Shoreline Oil Spill Response Strategy



Choosing the most appropriate techniques for cleaning up an oil spill is crucial and will depend upon the exact circumstances of an incident.

Contingency Planning

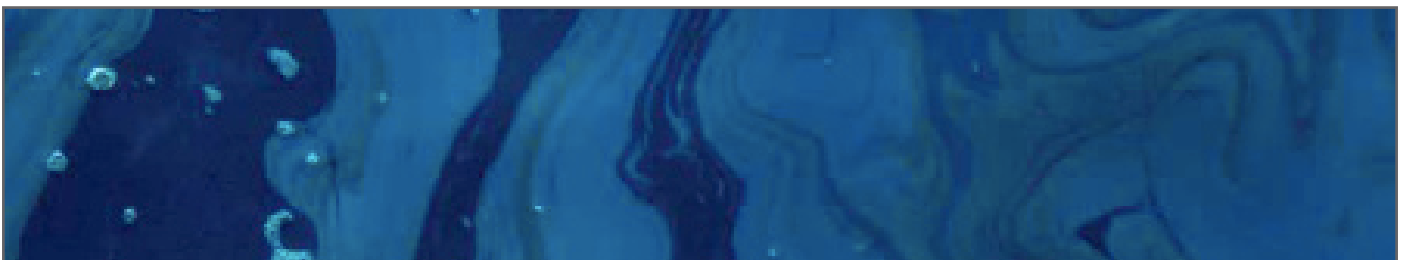
Careful planning is an essential preparation for any successful operation, especially an emergency one. Response to accidental spillage of oil is a typical example. Many people may be affected by an oil spill and many organisations have duties to perform apart from the task of physical clean-up. For example, an incident involving an oil tanker may entail search and rescue, lightering of cargo and salvage activities, all of which may impinge upon any spill response. There is often concern for the effects on the environment, fisheries, industry and recreation as well as considerations for public health and safety. There will inevitably be conflicting interests and the news media are always quick to expose any indecision, weakness or disagreement. Such situations are easier to resolve when a well prepared and tested contingency plan is available.

Contingency planning should follow the tiered response concept. Most oil spills are small and can be dealt with locally (Tier 1). Should the incident prove beyond the local capability or affect a larger area, an enhanced but compatible response will be required (Tier 2). The foundation of this tiered response is the local plan for a specific facility such as a port or oil terminal or for the length of coastline at risk from a spill. These local plans may form part of a larger district or national plan (Tier 3). National plans may in turn be integrated into regional response arrangements covering two or more countries.

Clean Up & Response

Aerial reconnaissance is an essential element of effective response to marine oil spills. It is used for assessing the location and extent of oil contamination and verifying predictions of the movement and fate of oil slicks at sea. Aerial surveillance provides information facilitating deployment and control of operations at sea, the timely protection of sites along threatened coastlines and the preparation of resources for shoreline clean-up. Observation can be undertaken visually or by use of remote sensing systems.

Initial clean up responses to a spill at sea are often based upon the use of dispersant chemicals or the containment and recovery of oil using booms and skimmers. Whilst these techniques can be of use in the right



circumstances, there are many difficulties associated with employing them effectively.

The type of oil and concerns over potential impacts of dispersed oil can preclude dispersant use. For example, they are not effective against many commonly transported oils which have a high viscosity, and soon become ineffective against lighter oils because natural weathering processes or the formation of water-in-oil emulsions greatly increases oil viscosity, often very quickly (a few hours to one to two days). The application of dispersant to treat large quantities of spilled oil also requires specialised equipment and extensive logistical support. Containment and recovery is limited by sea conditions and the relatively small oil encounter rate which the available systems can achieve.

Together, these factors usually mean that only a small fraction of a major spill can be dealt with at sea, and it is almost inevitable that oil will threaten coastal resources. Protective strategies are seldom employed to the extent possible and it will usually be necessary to mount a shoreline response operation. Priorities for protection and clean-up will need to be agreed and care must be taken to ensure that the techniques selected do not do more damage than the oil alone.

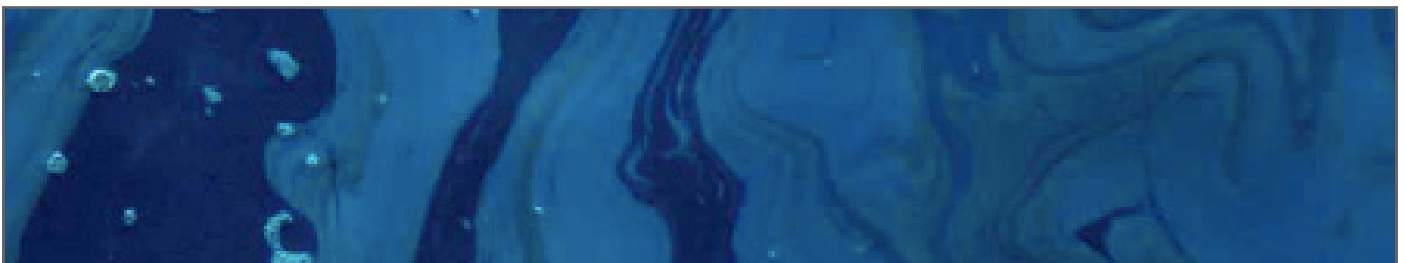
Protecting Sensitive Resources

Given the difficulties of cleaning oil at sea, spilled oil will often threaten coastal resources. It may be possible to protect some of these resources by the strategic deployment of booms. Highest priority should be given to protecting coastal resources which are particularly sensitive to oil pollution and which can be boomed effectively. These can include industrial water intakes, leisure facilities such as marinas & beaches and environmentally sensitive areas, such as bird colonies. It is important to act quickly and prioritising sites is essential. This is predetermined on the local contingency plan.

Shoreline Clean Up

Given the difficulties of cleaning up oil at sea, many oil spills result in contamination of shorelines. The oil which reaches the coast generally has the greatest environmental and economic impact. It also determines to a large extent the political and public perception of the scale of the incident, as well as the costs. It is important to start removing oil promptly from contaminated shorelines because as time passes and the oil weathers, it will stick more and more firmly to rocks and sea walls, and may become mixed with or buried in sediments. Shoreline clean-up is usually straightforward, however, and does not normally require specialised equipment - it is not a 'high tech' business. Reliance is frequently placed on locally-available equipment and manpower, rather than specialised equipment. Good organisation and management are the key to effective clean-up. Poorly thought out and uncoordinated clean-up efforts usually result in inefficient use of resources and excessive quantities of waste for disposal.

Shoreline clean-up needs to be carried out in accordance with a clear strategy that takes account of the characteristics of the oil, the level of contamination and the relative environmental, economic and amenity sensitivities of different locations. Many of these issues are best addressed during the preparation of an oil spill contingency plan. Because equipment availability and manpower may be limited in the early stages of a spill, it is often necessary to prioritise sensitive areas, which can result in conflicts between, for example, economic and environmental interests.



The concept of balancing environmental sensitivities against socio-economic factors (e.g. fisheries, tourism) in order to determine the most appropriate techniques and level of cleanliness (sometimes referred to as “net environmental and economic benefit analysis”, or NEEBA) is well known and widely accepted. Such issues, however, are frequently not adequately addressed in contingency plans or are ignored by those in charge of actual operations. As a result, shoreline clean-up is often not carried out with the degree of care and control that is warranted. This can mean that operations are unnecessarily prolonged, that excessive amounts of oily material are generated for disposal, that additional environmental and economic damage is caused, and that the cost of clean-up and third party damages is higher than it should be.

Strategy .

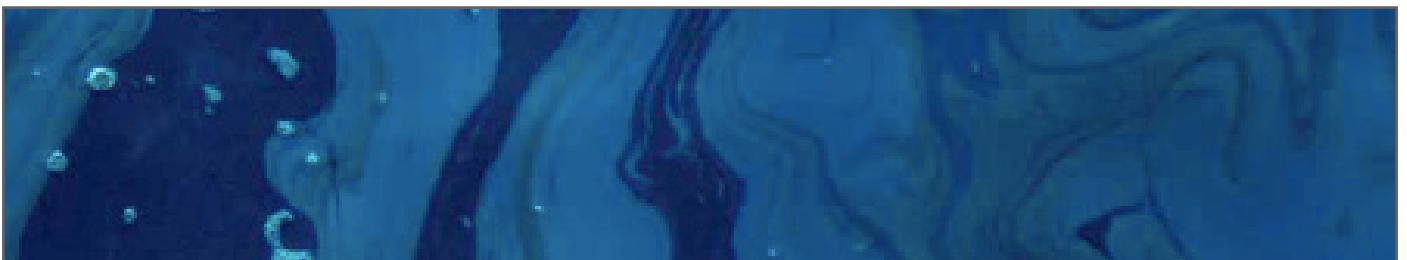
Shoreline clean-up is usually carried out in stages, starting with the removal of the heaviest accumulations of oil. Secondary clean-up ideally should not begin until heavy accumulations have been removed and the risk of recontamination by floating oil has receded. The need for secondary cleaning and the degree to which it is carried out must be judged against the use of the shoreline and economic and environmental sensitivities. The final traces of oil are often difficult and time consuming to remove. In many instances natural degradation processes deal with them quickly and effectively, especially where wave action and tidal water movements are strong. In special circumstances, for example where beaches are heavily used by the public, final ‘polishing’ to a very high standard may be justified, although some of the techniques which may be required, like high-pressure hot water washing, can cause environmental impacts.

Wherever clean-up is carried out, arrangements will need to be made for temporary storage of recovered oil before it is moved for disposal. This can be organised at the beach head, in car parks or open land close to the beach. It is important to keep different kinds of waste (pure oil, oily sand, oily debris, plastic and PPE) segregated as this considerably simplifies final disposal. The different wastes can be sent through different final disposal routes. In particular, pure liquid oil can be recycled.

Mobile Oil

Clean-up effort should first be directed to areas which have the heaviest concentrations of mobile oil, which might otherwise move under the influence of changing winds and currents, leading to a greater length of coastline becoming contaminated. The removal of floating oil from harbours and other accessible areas where it becomes concentrated against shorelines or sea walls can be relatively straightforward, using a combination of booms and skimmers and locally-available resources such as vacuum trucks and similar suction devices and manpower. However, oil trapped along inaccessible parts of a coastline can pose considerable problems in this regard. If it is persistent and therefore resistant to natural breakdown and dissipation, it will act as a reservoir for contaminating additional stretches of the coast or for the re-oiling of previously cleaned areas.

Mobile oil residues may pick up sediment in inshore waters, in the surf zone or after temporarily stranding on beaches and then washing off. Such residues may become heavier than water if they accumulate sufficient sediment, which will result in sunken oil on the sea bed. Such sunken oil can be re-mobilised by storms, thereby re-contaminating previously cleaned areas.



Sand Beaches

Bulk oil can usually be removed without difficulty from hard-packed sand beaches, using a combination of well-organised teams of manual labourers assisted by front-end loaders and other mechanical equipment to transport recovered wastes. Care needs to be taken not to remove excessive quantities of sand or to mix the oil deeply into the beach substrate, and in this respect manual collection of the oil is far preferable to attempts at mechanical removal with machinery.

Final cleaning options can include manual removal or sieving of tarballs or oil fragments or the use of specialist beach cleaning machinery. In some circumstances techniques such as flushing with sea water to remove buried oil or ploughing to encourage the breakdown or degradation of final traces may be appropriate.

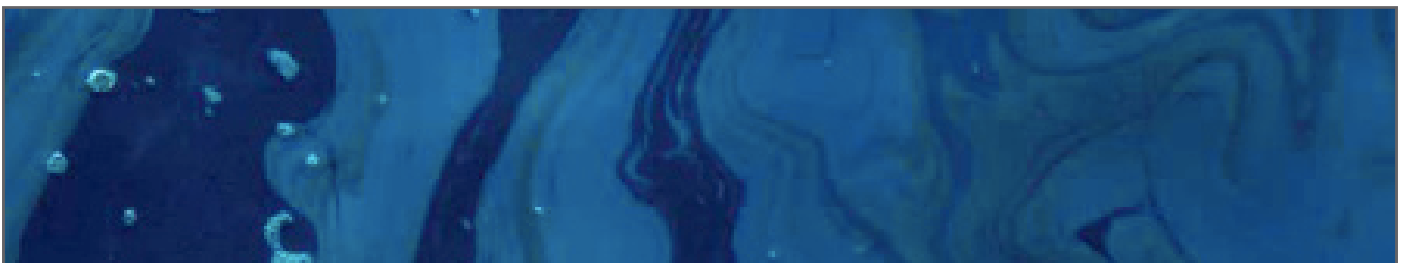
Rocky Shores

Cleaning of rocky shores close to amenity beaches or sea walls and slipways is normally straightforward. Bulk oil can be recovered manually or by using vacuum units or other skimmers on pooled oil. Low pressure flushing with sea water may also be employed to wash oil residues to collection points. Final cleaning usually requires high pressure flushing, the pressure needed depending on how firmly the oil is adhering to the rock. If the residual oil is stuck very firmly to the rock, or if a very high degree of cleanliness is required, then it may be necessary to resort to high pressure hot water washing or even sand blasting. Such “aggressive” techniques will cause damage to the natural fauna and flora living on the rocks, and so they should be used with caution. In many cases it will be most appropriate and least damaging to leave natural processes, such as wave action and scouring, to deal with any residual oil over time.

Greater problems are caused where oil penetrates deeply into boulders, cobbles or gravel since it is rarely practical to do more than remove surface accumulations. If amenity or wildlife concerns dictate a more thorough clean-up, the most effective technique is likely to be sea water flushing, with the containment and collection of any oil that is released using booms and skimmers. On cobble or gravel beaches it may be appropriate to bulldoze the contaminated beach material into the surf zone to take benefit of natural cleaning processes. In circumstances where residual oil on shorelines might pose a threat to breeding colonies of marine mammals or birds, such as seals or penguins, and where other techniques might cause damage through greater disturbance, it may be appropriate to cloak oily haul out areas and access routes with some form of natural sorbent, such as peat.

The use of Sorbent materials and Bioremediation on Shorelines.

Sorbent materials may have a useful role in shoreline clean-up. For example they may assist with the recovery of liquid oil where the use of skimmers or vacuum units is not feasible, or they may be effective for retaining oil being flushed or pressure washed from rocks. They may also be used to control floating oil residues being released from rip-rap sea walls where other techniques are impractical or imprudent. However, there have been many instances of sorbent misuse. For example, the widespread scattering of particulate sorbents or sorbent pads on oil has been seen on many occasions when simpler techniques such as manual collection or the use of vacuum units would be more appropriate.



The recovery of sorbent/oil mixtures may also be more difficult than simply recovering the oil itself. For example, the presence of sorbents may clog pumps and suction devices. In addition, they increase the volume of waste and some sorbent materials require specialised and costly disposal. These factors are important in determining the overall benefit which might accrue from the use of sorbents.

Bioremediation, the application of oil-degrading bacteria and/or nutrients to enhance the natural biological breakdown of oil, has generated considerable interest for more than two decades. It is not suitable for use on bulk oil, but has been promoted as an aid to the breakdown of final traces after clean-up by other methods. Research and trials during oil spills have shown that the addition of cultured, specialist bacteria is ineffective because they are rapidly out-competed by naturally occurring oil degrading bacteria which are adapted to local conditions.

The addition of nutrients (nitrogen and phosphorus, which are necessary for microbial degradation to occur) has some potential in certain circumstances, but has so far not been demonstrated to be beneficial for large scale restoration projects.

Organisation

Whilst the technical aspects of dealing with the oil in inshore waters and on shorelines are clearly important, the effectiveness of the response will ultimately depend upon the quality of pre-spill contingency planning and the organisation and management of the clean-up operations. This is especially the case with shoreline clean-up because of the probable involvement in a major spill of a large number of different parties, including separate central, regional and local government authorities, various agencies, port and harbour authorities, terminal operators, other private companies, commercial clean-up contractors and special interest groups.

Termination of Clean-up

All clean-up activities should be constantly evaluated to ensure that they remain appropriate as circumstances change. Once any operation has been shown to be ineffective, likely to cause unacceptable additional damage to environmental or economic resources, or if the costs far exceed any possible benefits, it should be stopped. There are frequently strong pressures on those in charge of response operations, however, to adopt other non-technical criteria to decide when to terminate a response measure.

Thus, on many occasions, the inappropriateness of cleaning certain types of shorelines will be ignored and as many resources as possible will be deployed in an attempt to persuade politicians, the media and public that everything possible is being done to deal with the problem. In this regard it is important to note that the technical justification of response measures (“reasonableness”) is fundamental to the recovery of clean-up costs under the 1992 Civil Liability and Fund Conventions.

