

14.1 Treatment, recycling and final disposal of recovered oil and oily waste

The objective of any oil spill clean-up operation is ultimately to treat, recycle or dispose of the oily waste in the most efficient and environmentally sound manner. The disposal option chosen will depend upon the amount and type of oil and contaminated debris, the location of the spill, environmental and legal considerations and the likely costs involved.

The table below identifies the different options available for the disposal of different categories of collected waste.

	Re-Processing	Oil-water separation	Emulsion breaking	Stabilization	Bio-remediation	Sediment-washing	Thermal treatment	Heavy fuel use	Landfill
Recovered oil alone	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Oil and water mixtures or emulsions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Oil and sediment mixtures	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Oil containing organic debris	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Oil and oil-contaminated PPE/ equipment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

= suitable technique = unsuitable technique

14.2 Re-processing

Oil is recovered with a low water and debris content and is then reprocessed through an oil refinery or recycling plant. Oil can then be reused—the preferred option in any waste treatment, but refineries cannot accept oil with a high salt content because it can cause irreversible corrosion damage to the pipe-work. Oil that is heavily contaminated with water, sediment and debris is also unacceptable.

14.3 Oil/water separation

Separation generally occurs by gravity i.e. oily water is put into a lined pit and allowed to separate out. A skimmer is then used to remove the oil from the surface. Special separation equipment, found at oil processing installations, is also often used. Oily water residue from separation techniques may then have to undergo further treatment through a system of weir separators, as the hydrocarbon content will still be too high for release into the environment.

14.4 Emulsion breaking

Heating of emulsions can be used to break them down to oil and water phases. In some cases, specialised emulsion breaking chemicals (demulsifiers) will have to be used. Once separated the recovered oil can be blended into refinery feedstock or reprocessed. Any chemicals used will remain in the water after separation so care will be needed when disposing of the water.

14.5 Stabilisation with binding agents

The oil can be stabilised using inorganic substances such as quicklime (calcium oxide), fly ash or cement. Stabilisation forms an inert mixture that reduces the risk of the oil leaching out and thus can be sent to landfill with fewer restrictions than free oil. The stabilised waste can also be used as a sub-base for light-duty car-parks. Contact with quicklime can cause irritation to eyes, skin, respiratory system, and gastrointestinal tract. The material reacts with water, releasing sufficient heat to ignite combustible materials.

Small quantities of oily waste from the Sea Empress incident were successfully mixed with quicklime. If the waste contains less than 5% oil it may be transported in lorries to the final disposal site and mixed there. If it contains 5 to 10% oil, mixing should be carried out before transportation. Road making milling machines may be used to incorporate the lime into a bed of waste 0.2 to 0.3 m deep. The proportion of lime must be determined by tests on site (from 5 to 20% according to the percentage of oil in the waste). Ordinary quicklime may be used with or without additives such as aluminium sulphate or phospho-gypsum. Suitable protective clothing and eye protection must be worn while spreading the lime and dust generation may cause an additional problem.

14.6 Landfarming

Bioremediation is used to accelerate the natural, microbial break-down of oil. One example of bioremediation was 'landfarming'. Oily debris, with relatively low oil content, was spread evenly over the land and thoroughly mixed into the soil promoting natural breakdown of oil by microorganisms. However, landfarming has been banned under the Landfill direction. Landfarming would need to be carried out within an engineered and lined cells, as a biological treatment of waste to reduce the hazardous content. These treatments, including composting, are long term and would require permits from the competent regulatory authority (EA/EHS/SEPA)

There are mobile plant licences for treatment of contaminated land that may have application in waste treatment. The detailed methodology will be dealt with through the application and permit process.

14.7 Incineration

Uncontrolled combustion of oil and oily wastes would not be satisfactory because of:

- The smoke and tar residues produced; and
- The risk of hot oils spreading due to reduced viscosity.

Uncontrolled combustion is now prohibited in the UK.

Incinerators in the UK are scarce and remote from many parts of the country. The use of authorised incinerator and heat treatment processes will need to be considered in relation to the other options available. Incineration can be a general method for tackling the products of a major incident. Emulsion should be treated with a demulsifier rather than burnt, as a high water content prevents combustion without additional fuel.

14.8 Landfill

Hazardous waste sites are scarce and remote from many parts of the country. The Environmental Regulator within the technical team sub-group will advise on the current situation with regard to licensed waste facilities available at the time of the incident. Sites may be used for solid material subject to the waste having been pre-treated in accordance with Article 6 of the Landfill Directive (STOp 1/2004).

14.9 Legislation issues

All hazardous waste in the European Community (EC) is strictly controlled by the European Council Directive 91/689/EEC on Hazardous Waste. The Special Waste Regulations 1996 implement this in the UK.

Oil spill waste is considered a hazardous waste under these regulations. A system of consignment notes and licensing, administered by the Environment Agency, ensures that wastes are tracked from the point of generation to the point of disposal. Both temporary storage and transport of all oil spill waste must, therefore, be carefully documented and licensed. Although this legislation does not necessarily apply to the rest of the world it can be seen as a system of good practice in any spill situation.

When dealing with small, local or regional spills, these regulations should not present a problem as there should be enough licensed hazardous waste carriers and storage/disposal routes to deal with the waste. Problems with this legislation may arise when large regional and international spills occur. The normal disposal routes will become overrun and new carriers and temporary storage sites must be identified. Licenses will have to be issued before they become operational which will almost certainly hinder the clean-up operation. It is up to the relevant authorities, the local authority and the Environment Agency to work together to resolve this issue.

14.10 Summary

It is essential that all long-term storage sites be set up as soon as possible after a spill in order to facilitate efficient transfer of waste from the spill site. Storage sites should be strategically placed at locations which are suitable for the final disposal of oil-contaminated waste. This needs to be thoroughly considered during contingency planning.

Effective management of these sites is also important in order to ensure that the waste is correctly handled, stored and prepared for final disposal. There are a number of possible disposal options for the different types of waste generated during a spill response. Each waste will require a different treatment method. This will be determined by a number of

factors including cost, local resources, legislation and environmental considerations. There may be conflict between the quickest, cheapest disposal option and sustainable waste management.