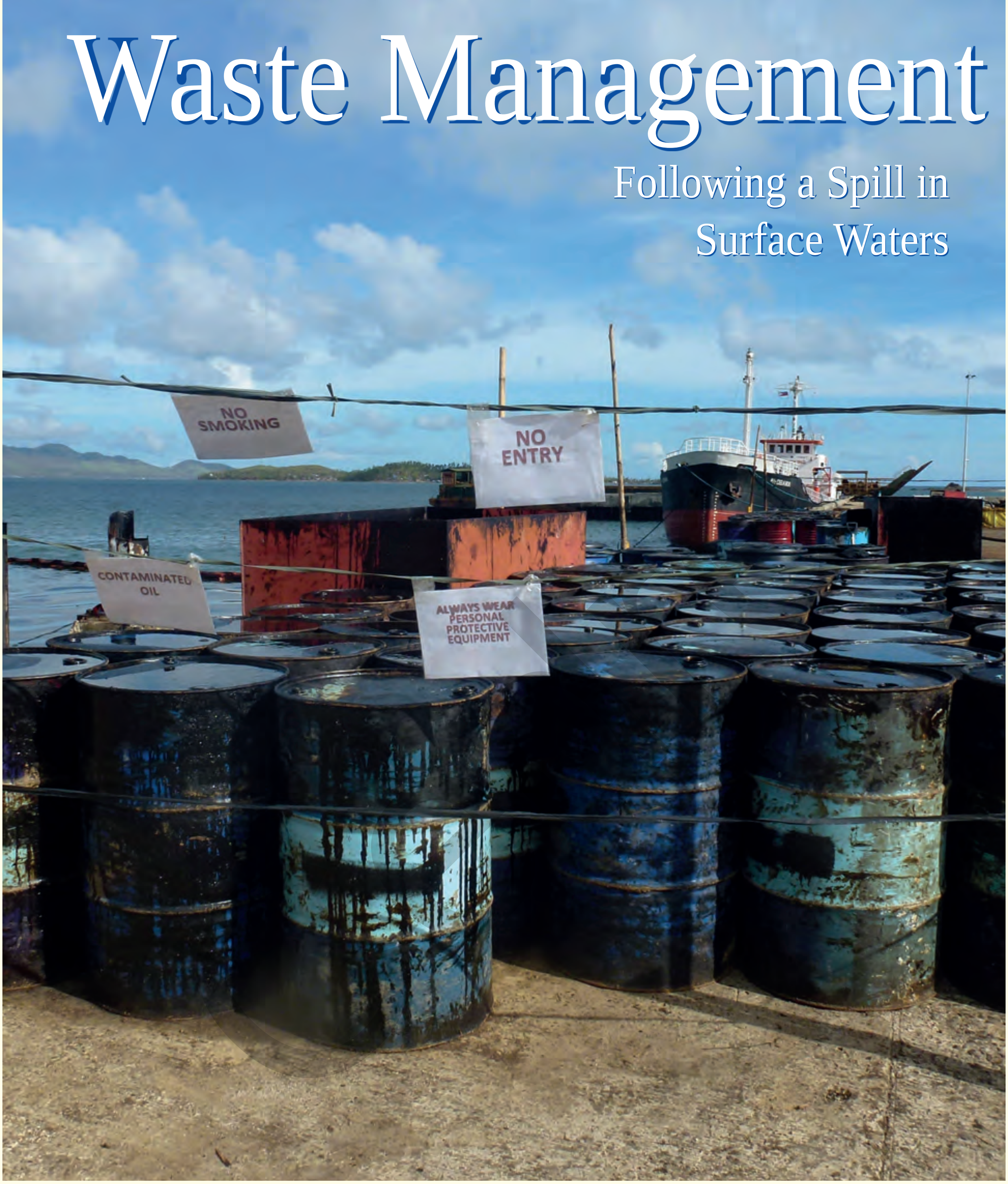
Waste Management

Following a Spill in Surface Waters



OPERATIONAL GUIDE

Cedre

Waste Management

Following a Spill in Surface Waters

OPERATIONAL GUIDE

Information
Decision-making
Response

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Purpose and limits of this guide

When a spill occurs, there is often a high risk of having to manage large quantities of often very heterogeneous waste. Depending on the type of substance released into the environment, the contaminated waste may be considered hazardous and should be handled as such. This is the case of waste generated by oil and chemical spills.

The management of such waste, from its collection to its ultimate disposal, including its transfer and the restoration of all temporary storage sites involved, can raise certain difficulties for response managers. Appropriate decisions, made at as early a stage as possible, possibly prior to any spill, will help to control the situation and prevent bottlenecks during clean-up operations.

This facilitates both the work in progress and the crisis recovery phase, both in terms of image and cost. Waste management is often the longest and most costly operation after a major oil or chemical spill.

This guide reviews the different stages of waste management following a spill in surface waters (marine and inland waters), and identifies the constraints to be considered for each of them. Although it is largely based on past experience of oil spills, it nevertheless includes a number of specific sections devoted to chemical spills.

The words and expressions followed by a • in the text are defined in the glossary on page 104.

Contents

Regulatory aspects

Different regulations exist at international, European and national levels. Their purpose is to protect human health and the environment against the adverse effects caused by waste collection•, storage, transportation, treatment and disposal•.

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A1

International and European regulations

Basel Convention

The Basel Convention, adopted in 1989 and which entered into force in 1992, is an international treaty on the Control of Transboundary Movements of Hazardous Wastes and their Disposal• (available at www.basel.int). Currently, there are 188 Parties to the Convention. This worldwide convention is the most comprehensive agreement on hazardous waste in relation to the environment and aims to:

- minimise hazardous waste generation in terms of quantity and hazard level;
- dispose of waste as close as possible to the source of generation;
- restrict movements of hazard waste.

This applies to toxic, explosive, corrosive, flammable, ecotoxic and infectious waste.

European Waste Framework Directive 2008/98/EC

The European Waste Framework Directive (Directive 2008/98/EC) of 19 November 2008, amended by Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 as part of a circular economy• package, is the cornerstone of European legislation on waste. It aims to protect the environment and human health, its objectives being "as a matter of priority, to prevent and reduce the production and harmfulness of waste, in particular by acting on the design, manufacture and distribution of substances and products and by promoting reuse, as well as to reduce the overall impact of the use of resources and improve the efficiency of their use". Waste prevention, which limits the use of resources, is therefore an important component of the circular economy•. The Directive also highlights the responsibility of the waste producer and the public's right to information.

This Directive must be transposed into national legislation to be applicable.

National regulations

It is necessary to consult and comply with the regulations relating to waste management in force in the country affected by the spill.

Generalities on spill waste management

Definitions

B1

Waste

Basel Convention: "substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law".

European Waste Framework Directive 2008/98/EC: "any substance or object which the holder discards or intends or is required to discard".

A substance or object is considered waste until it is fully recovered and treated and no longer poses a potential threat to the environment or human health.

Hazardous waste

Basel Convention: wastes that belong to any category contained in Annex I (Categories of wastes), unless they do not possess any of the characteristics contained in Annex III of the Convention.

The Secretariat of the Convention may also be informed by the Parties (member States) of any requirements concerning transboundary movement procedures applicable to additional wastes, other than those listed in Annexes I and II of the Convention, which are considered or defined as hazardous under its national legislation.

Examples of hazardous waste:

- *waste oils/water, hydrocarbons/water mixtures, emulsions•;*
- *waste mineral oils unfit for their originally intended use;*
- *residues arising from industrial waste disposal operations;*
- *wastes having as constituents acidic/basic solutions or acids/bases in solid form, organic phosphorus compounds, organic solvents.*

European Waste Framework Directive 2008/98/EC: "waste which displays one or more of the hazardous properties listed in Annex III" (hazardous properties H1 to H15).

The properties of waste which render it hazardous have recently been updated to take into account scientific progress, by European Commission Regulation (EU) 1357/2014 of 18/12/2014, in force since 1 June 2015, and Council Regulation (EU) 2017/997 of 08/06/2017, in force since 5 July 2018.

Examples of properties which render waste hazardous (see Annex III of the European Framework Directive): explosive, oxidizing, flammable, irritant, carcinogenic, corrosive, infectious, ecotoxic...

Code	Waste from...
05 01	petroleum refining
05 01 05*	oil spills
(...)	
13 04	bilge oils
13 04 01*	bilge oils from inland navigation
13 04 02*	bilge oils from jetty sewers
13 04 03*	bilge oils from other navigation
(...)	
16 07	transport tank, storage tank and barrel cleaning (except 05 and 13)
16 07 08*	wastes containing oil
16 07 09*	wastes containing other hazardous substances
(...)	
16 10	aqueous liquid wastes for off-site treatment
16 10 01*	aqueous liquid wastes containing hazardous substances
16 10 02	aqueous liquid wastes other than those mentioned in 16 10 01

Table 1: Excerpts of Annex III of the European Waste Framework Directive 2008/98/EC

Waste management

A series of phases, defined in the European Waste Framework Directive 2008/98/EC as “collection, transport, recovery• and disposal• of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker”.

Waste management is often a long process and frequently the most costly component of a spill response. Hazardous waste requires specific treatment in appropriate facilities and must not be treated in the same way as household waste (unless exempted). It is subject to reinforced administrative control with regard to storage, transport, pre-treatment and disposal•.

In the context of spill clean-up operations, the polluted materials collected, as well as all materials resulting from the restoration of storage sites, are thus considered as "waste". Depending on the nature of the waste and the presence or absence of hazard criteria, waste may be classified as hazardous or non-hazardous.

Waste origin and categories

The composition of the waste generated by oil and chemical spills is variable and depends on a number of factors.

The quality and quantity of waste will evolve over time, according to the response phase in progress. It can be divided into two main categories: liquid waste and solid waste.

- **liquid waste** is collected during recovery operations on the water (in the open sea or inland waters), near the shore or bank, in port areas, in drainage ditches or in onshore settling• pits, during decontamination of responders and equipment, during contaminated wildlife cleaning operations as well as after extinguishing a fire (water mixed with emulsifiers for example). It generally contains pollutant, to a varying degree according to the extent of oil-water separation and water removal conducted during recovery and storage operations;
- **solid waste** (with a consistency ranging from pastes to solids) is collected during offshore trawling• operations (pollutants, contaminated sorbents•...), shoreline clean-up operations (sediment, vegetation, seaweed, wildlife, litter...) and dismantling of temporary waste storage sites. It also includes consumables required for response operations (PPE•, geotextile•, sorbents•...).

▶ **Practical fact sheet C2**: Waste characterisation/categorisation

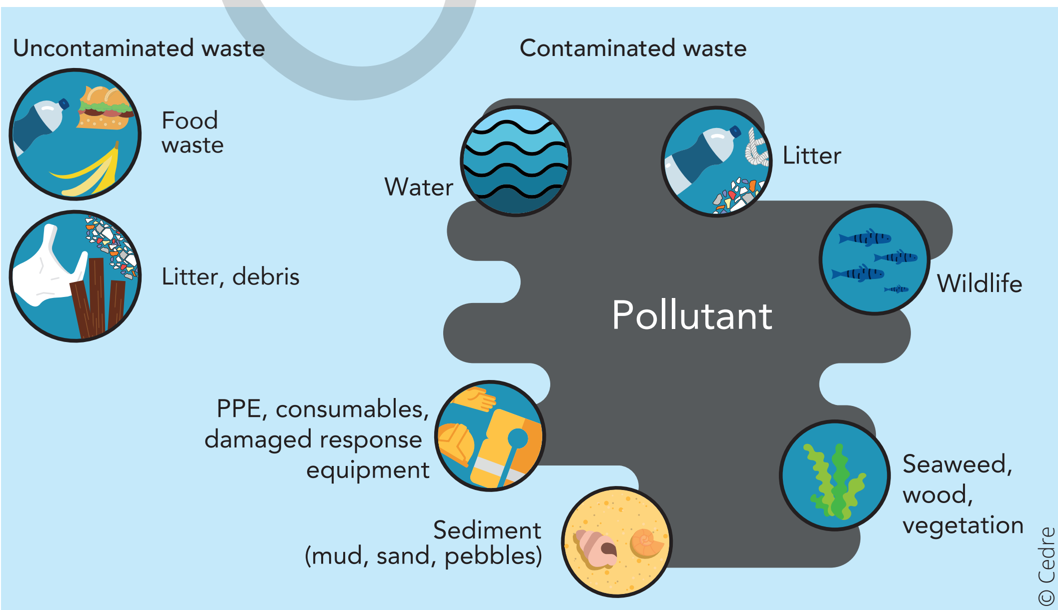


Figure 1: Different types of waste generated by the response to spills in surface waters

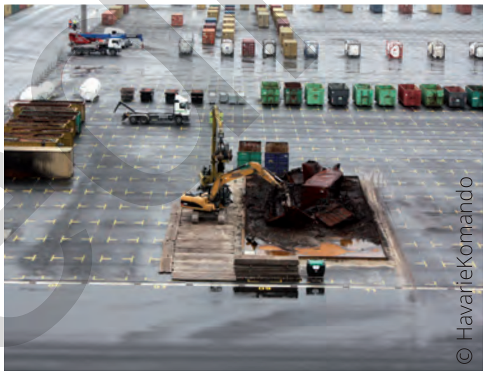
Specificities of chemical spills

Chemical spills can sometimes generate large volumes of contaminated biological waste (animal carcasses, seaweed, etc.).

Example: in 2018, following a lorry accident, around 10 m³ of sodium chlorite was spilled into the Gave d'Aspe river, resulting in the death of hundreds of fish and the disappearance of vegetation along several kilometres of banks downstream.

In the event of packages being lost overboard or damage to a container ship, the containers and their contents (not necessarily hazardous) may become hazardous waste due to contamination or damage. It may be necessary to wash down the packages/containers or even destroy them and dispose of them as waste. In addition, in the event of a fire, the extinguishing water will be contaminated with various toxic substances and must be treated.

An oiled container in a washing area



Dismantling containers following a fire onboard a container ship

Similarly, the grounding of a ship can lead to its dismantling and therefore the management of all chemicals carried (wide variety).

Primary storage site for chemicals from the dismantling of a grounded ship

Past experience

Past experience has shown that oil spills generate a highly variable volume of waste which is not directly proportional to the volume spilled but rather depends on a combination of factors such as:

- the composition of the spilled oil, which determines the evolution of the product in the environment (weathering) and in particular:
  - reduction of the volume spilled through evaporation• (loss of light fractions), natural dispersion• in water or biodegradation•;
  - increase, sometimes drastic (up to 5-fold), in the volume due to emulsification• (incorporation of water and increase in viscosity•);
- the time spent in the water (distance from coast), the metocean or hydrodynamic conditions (water and air temperature, agitation...) which will influence the kinetics• of the above-described processes;
- the presence of debris, seaweed, vegetation or suspended matter with which the oil can amalgamate;
- the offshore response techniques implemented and their effectiveness (more selective than on land);
- the type of sediment on the shoreline which, together with the oil's viscosity•, will determine the extent to which the oil and sediment will mix (infiltration);
- the response techniques used on land and their implementation (selectivity), which can have a very significant impact on the volumes of waste collected (mixing of oil and sediments in particular);

Year	Incident name	Oil spilled (tonnes)	Liquid waste (tonnes)	Solid waste (tonnes)	Total waste collected (tonnes)	Ratio of waste/spilled oil
Crude oil spills						
1978	*Amoco Cadiz*	227,000	100,000	100,000	200,000	0.9
1993	*Braer*	86,200	-	2,000	2,000	0.02
1996	*Sea Empress*	73,370	25,000	11,000	36,000	0.5
2010	*Deepwater Horizon*	780,000	162,260	89,200	251,460	0.3
Heavy fuel oil spills						
1980	*Tanio*	13,500		28,000	28,000	2.1
1999	*Erika*	19,800	1,100	200,000	201,000	10.2
2002	*Prestige*	63,000	50,000	159,300	209,300	3.3
2007	*Volgoneft 139*	2,000	200	79,400	79,400	40.0

Table 2: Examples of volumes of waste generated by selected oil spills (after ITOPF 2014)

- finally, the duration of the response and the number of operators, whose equipment and consumables will be included in the waste to be treated; use of disposable or reusable consumables.

Past crude oil spills have generated lower ratios than those involving heavy fuel oil, for which evaporation• processes are limited and natural dispersion• almost nil (see Table 2).

Among the crude oil spills presented in Table 2, we note that no liquid waste was produced during the *Braer* incident. This can be explained by the prevailing storm conditions which prevented response operations at sea and by the nature of the crude oil, which was light with a low concentration of asphaltenes• (compounds that promote emulsification•), which naturally dispersed at sea, drastically reducing the quantities of oil that reached the shore and therefore the volume of waste.

In the case of the *Deepwater Horizon* oil spill, recovered liquids represented 20% of the quantity spilled, with 60% of the oil having evaporated, naturally dispersed or been chemically dispersed or burned in situ. The quantity of oil that reached the coast, and therefore the volume of solid waste, were therefore limited with respect to the volume spilled. Shoreline clean-up was selective (major sediment flushing and in situ sieving operations); a very significant share of the solid waste collected was made up of booms, sorbents•, which were very widely used, and PPE•.

In the case of heavy fuel oil spills, storm conditions prevented or greatly restricted recovery at sea during the *Tanio*, *Erika* and *Volgoneft 139* spills. Shoreline strandings therefore accounted for a high proportion of the waste associated with these spills. In contrast, during the *Prestige* spill, the oil remained at sea for a long time, allowing the fleet of specialised oil spill response vessels, supported by more than a thousand fishing vessels, to recover a significant share of the volume spilled at sea. The very large volumes of solid waste collected during the *Erika* and *Volgoneft 139* spills can be explained, firstly, by the fact that the oil was mixed with seaweed and other debris and, secondly, by the collection• of large volumes of sand with the oil (poor selectivity of collection• operations at certain sites).

These examples show that, although some of the factors influencing the volume of waste are beyond human control, the choice of response techniques, such as in situ clean-up, selective collection• and limited use of disposable consumables, can significantly reduce the volume of waste generated.

Small-scale spills: the management of small-scale orphan spills is a recurring issue that can sometimes have major organisational and financial implications for municipalities. After the emergency phase, which may be managed by emergency response teams (usually fire fighters), the municipality will then often be responsible for the waste management chain.

▶ **Practical fact sheet C10**: Specificities of small-scale spills

Specificities of chemical spills

The quantity of waste generated by chemical spills varies according to the type and behaviour of the product. It is generally rare for pollutants to be collected following a response to a chemical spill, except in the case of persistent floating or sinking pollutants (transported in bulk) or packages.

The majority of chemicals become rapidly diluted in water and/or in the atmosphere and it is not possible for them to be recovered by responders. Dilution is also a solution that can be applied to manage chemicals remaining inside a wreck, as it is often less risky (explosion, corrosion, etc.) with respect to the substance's characteristics.

Finally, it is not uncommon for chemical spills in inland waters to cause significant mortality among fish populations, requiring the collection• and treatment of the dead fish.

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Example of the* Allegra *(1997): *The Liberian tanker* Allegra *released 900 tonnes of palm kernel oil (a persistent floating pollutant) following a collision in the Channel off Guernsey. The oil quickly solidified, forming a 800 m by 400 m slick, which expanded to become 20 km long and 4 km wide. It drifted towards the shores of the Channel Islands and Cotentin on the French coast, where it washed up along the strandline. The oil was in the form of balls that were 5 to 50 cm in diameter, yellowish inside with a sponge-like appearance and covered with a whitish crust.*

Balls of palm kernel oil washing up on the shore during the Allegra *spill*

In total, 27 tonnes of palm kernel oil was manually recovered from the English and French shores. No bunker oil was recovered on the French coast. In the affected areas where the oil was not collected, it broke down naturally.

Example of the* Bahamas *(1988): *the chemical tanker entered the port of Rio Grande in Brazil carrying 19,000 tonnes of 95% concentrated sulphuric acid (completely soluble in water). Due to technical errors and an onboard crisis situation, the machine room was flooded with a mixture of water and acid, causing the vessel to list heavily. The acid/water mixture was too corrosive and made it impossible to pump out the cargo. In view of the risks related to response operations (explosion, lack of suitable equipment to recover the corrosive mixture), the chosen strategy was to gradually release the vessel's cargo into the port waters at ebb tide, while constantly monitoring the pH.*

Challenges and strategies

Following small or large-scale spills, managers can face numerous difficulties related to the quantity and variety of waste collected during clean-up operations. The main challenges of proper waste management are:

- **logistical challenges:** to prevent overflows, bottlenecks or blockages because of a weak link in the chain (storage, transport, treatment unit capacity, etc.) curbing the overall response capability and usually requiring operations to be suspended;
- **environmental challenges:** not to generate additional pollution, to limit resource and energy consumption, and to minimise the quantity of waste generated;
- **economic challenges:** to optimise and control waste management costs.

An optimal waste management strategy must therefore be defined in advance, based on the following recommendations:

- apply the waste hierarchy* principle as strictly as possible;
- ensure transparency and traceability of waste management;
- rapidly restore all waste storage sites.

These different challenges must be identified during the preparedness phase.

▶ **Practical fact sheet C1**: Contingency planning

*The waste hierarchy concept

The overall objective of the waste hierarchy• concept is to limit the use of resources, environmental impacts and costs, by promoting waste management/treatment methods that tend towards sustainable material management and achieving a circular economy•. This concept, integrated in the 2008 European Waste Framework Directive, should be systematically applied when developing a waste management strategy.

However, in the event of a spill situation, it may not always be possible to implement it fully, depending on the location of the incident, the locally available treatment options and the extent of mixing of the oil or chemicals with other materials.

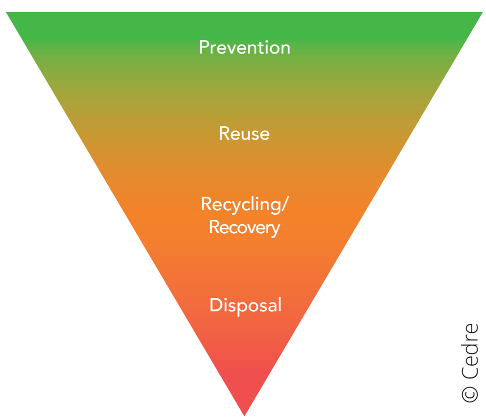

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Figure 2: The waste hierarchy concept

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Prevention = avoiding/reducing waste production
Have an up-to-date contingency plan which, in the event of a spill, reduces the time required to implement waste management and provides immediately operational solutions.
Characterise and sort waste, then organise segregation starting from waste collection• and primary storage.
Minimise waste production by using the best available response techniques, prioritising in situ clean-up, while preventing further spreading of the pollution in the environment (across the clean-up site, on roads, at primary, intermediate and long-term storage sites) and quickly restoring all storage sites used.
Reuse
Prioritise the reuse of response and protective equipment (clean it rather than dispose of it, wherever possible).
Recover pollutants in the industrial cycle if possible.
Recycling•/Recovery•
Make best use of waste by choosing recovery• or treatment streams where they exist, for example to convert waste contaminated by oil or chemicals to a reusable product, recover its calorific value as an alternative fuel or recover its energy (electricity production or heat generation).
Disposal•
As a last resort, if the above reuse/recycling•/recovery• options are not possible, implement final disposal• at a landfill site or by incineration without energy recovery•. This is the case in particular for highly mixed waste that cannot be segregated and for residual waste after recycling•/recovery. Landfill is the least desirable option as it occupies large surface areas and poses long-term risks of environmental contamination (groundwater or surface water).

The transparency and traceability of waste management must be ensured throughout the process.

Phases/stages (from onshore and offshore collection up to treatment)

Collection

The basic rules of collection• are as follows:

- limit the volume of waste, primarily by choosing the most selective and efficient recovery techniques or shoreline response techniques (for example, prioritising in situ washing over collection•);
- avoid spreading and burying the pollutant due to trampling (so-called "secondary" or "indirect" contamination), by working methodically (traffic system, machinery suited to the terrain, specific decontamination facilities);
- sort waste as far upstream as possible to facilitate subsequent channelling into specific streams, using appropriate containers for each type of waste that are clearly labelled to avoid confusion and mixing downstream (classification according to physical state, proportion of pollutant, sediment, seaweed or other matter);
- follow the technical instructions issued by the experts, complying with the previously defined clean-up areas and techniques;
- raise awareness and train staff at all levels of the recovery chain, in relation not only to the operational procedure but also to the use of consumables.

▶ **Practical fact sheet C3**: Waste minimisation
▶ **Practical fact sheet C4**: Segregation at source and appropriate containers

Temporary storage

In the case of major spills, temporary waste storage can involve three successive stages: primary (backshore, bankside or dockside for port sites), intermediate (waste pooling) and long-term storage.

With the exception of primary storage sites on the backshore or bankside whose location is determined at the time of the spill, the other sites (primary dockside site, intermediate and long-term sites) should be pre-identified and listed, as far as possible, in a contingency plan, making best use of local opportunities and in cooperation with the local authorities/users/owners.

In addition, the following operations can be implemented at all these sites: waste segregation or simple gravity separation (e.g. settling• after recovery) or particle size separation. No physico-chemical or biological treatment should be carried out at these sites.

Primary storage sites

Primary storage sites should be located as close as possible to the polluted area to facilitate waste collection• and transfer.

These sites receive waste directly from the clean-up sites:

- waste transit area at **port sites** ("dockside" sites): these are ports where specialised vessels and fishing vessels involved in the response will unload liquid and solid (viscous/congealed) waste collected at sea. As part of the planning process, sites with the necessary surface area and suitable lifting and storage facilities should be identified;

  ▶ **Practical fact sheet C5**: Unloading waste recovered at sea at "dockside" sites;

- **"backshore" or "bankside"** waste transit area: this is an emergency platform for the immediate deposit, sorting and pooling of pollutants from clean-up sites located in the immediate vicinity. These temporary storage sites are transloading points between vehicles operating on the clean-up site (foreshore, riverbanks) and road vehicles for evacuation, if possible on a daily basis, to treatment facilities or intermediate sites. In case of difficult access, waste evacuation from the site by boat or helicopter can be considered;

  ▶ **Practical fact sheet C6**: Primary storage sites on the backshore or bankside.

Intermediate storage sites

Intermediate storage sites receive waste from multiple primary storage sites. These are "buffer" sites that should be set up quickly to prevent primary sites from become overloaded. Here the waste may be pooled, repackaged or pre-treated (simple operations). These sites must not be located in sensitive areas.

The waste is then channelled into treatment, recovery• or disposal• streams or to a long-term storage site.

Long-term storage sites

Long-term storage sites receive waste from intermediate storage sites to be prepared for treatment.

Such sites are necessary when the quantities of waste collected or expected exceed the treatment capacities of the available streams managed on a just-in-time basis. They also allow time to examine the waste treatment, recovery• or disposal• options, to organise its evacuation and sometimes to build a specific treatment facility.

They are located outside of sensitive areas and are designed for large volumes and for medium/long-term use (major constraints); the operator• should use existing infrastructure, such as existing waste storage or treatment facilities, wherever possible.

▶ **Practical fact sheet C7**: Intermediate and long-term storage sites

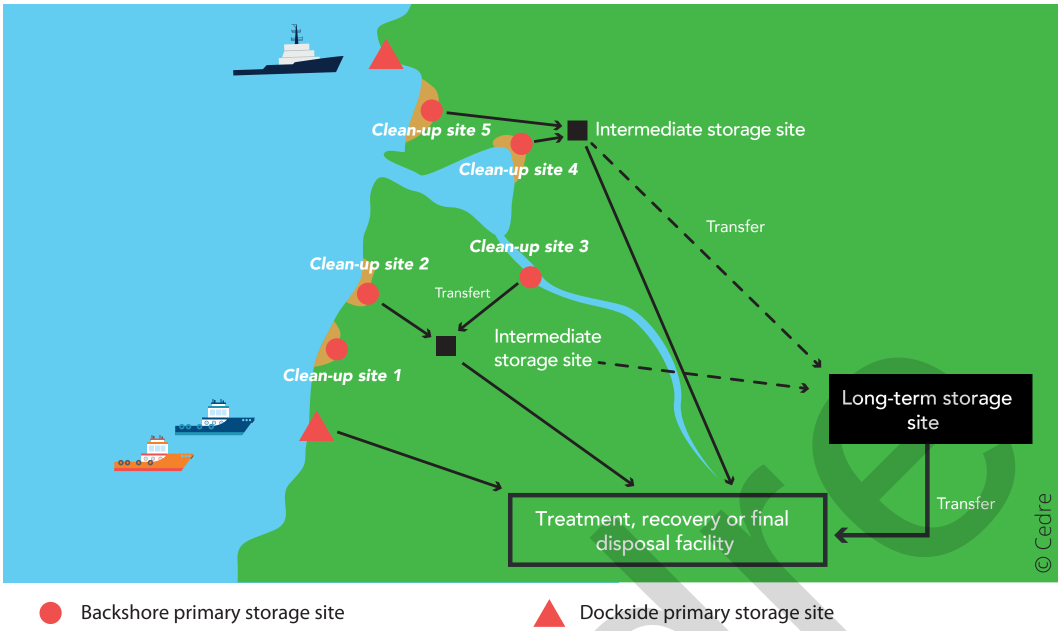

Figure 3: Stages of waste storage following a spill

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Transportation and tracking

Various means can be used to transport waste from the polluted area (marine or inland waters, shoreline or riverbanks) to the primary storage site, then on to other storage sites (intermediate, long-term) or to the chosen recovery•/treatment or disposal• streams: manual means, light machinery, by road, boat and aircraft (helicopter...)

These transfers must always comply with the regulations in force in the country. Most countries have national regulations for the transport of dangerous goods (TDG•), including the tracking and tracing of waste, often based on United Nations recommendations. There exist international regulations for example for:

- road transport: ADR•;
- inland waterway transport: ADN•;
- rail transport: RID•;
- maritime transport: maritime codes for TDG• in packaged form (IMDG Code•) and in bulk (IGC Code• for gases, IBC Code• for liquids and IMSBC Code• for solids).

These different regulations govern aspects including packaging and labelling, characteristics of the vehicle and safety equipment, the conditions and restrictions on traffic, movement and traceability.

These international regulations apply to dangerous goods transported from one signatory State to another. In Europe, the European Framework Directive 2008/68/EC on the inland transport of dangerous goods also renders mandatory the application of the ADR (road), RID• (rail) and ADN• (inland waterways) agreements within member States.

According to these regulations, all dangerous goods transported must be accompanied by a transport document, drawn up on the basis of the information provided by the shipper. The primary purpose of waste tracking documents is to ensure traceability.

If there is no suitable waste management stream available in the country, the waste may be transported to another country under the Basel Convention.

In the absence of TDG• regulations in the country, or if the emergency situation created by a moderate or major spill requires adaptations, the authorities can issue derogations to resolve the situation and define the minimum safety and traceability requirements.

▶ **Practical fact sheet C8**: Transportation and tracking

Treatment, recovery or disposal

Following the collection• phase, a number of options are available to recover, treat or dispose of the different types of waste. Today the emphasis is on prioritising streams that tend towards sustainable development and the circular economy• (waste hierarchy•). Many solutions exist to recycle or recover all or part of the waste (materials recovery•, energy recovery•, thermal, biological and physico-chemical treatments) and, as a last resort or for residual waste, landfill or incineration without energy recovery• may be considered.

In practice, the choice of waste stream is based on a multi-criteria analysis that takes into account the characteristics of the waste (nature, consistency, volume), the existing facilities (location, throughput, acceptance thresholds and capacity), timeframes, as well as environmental considerations and regulatory restrictions.

In addition, waste often requires successive techniques to be applied. Certain pretreatments can be implemented directly at sea/in inland waters or on land and can reduce the volumes of polluted waste to be treated and/or render the waste eligible for certain treatment facilities.

▶ **Practical fact sheet C9**: Pre-treatments and treatments

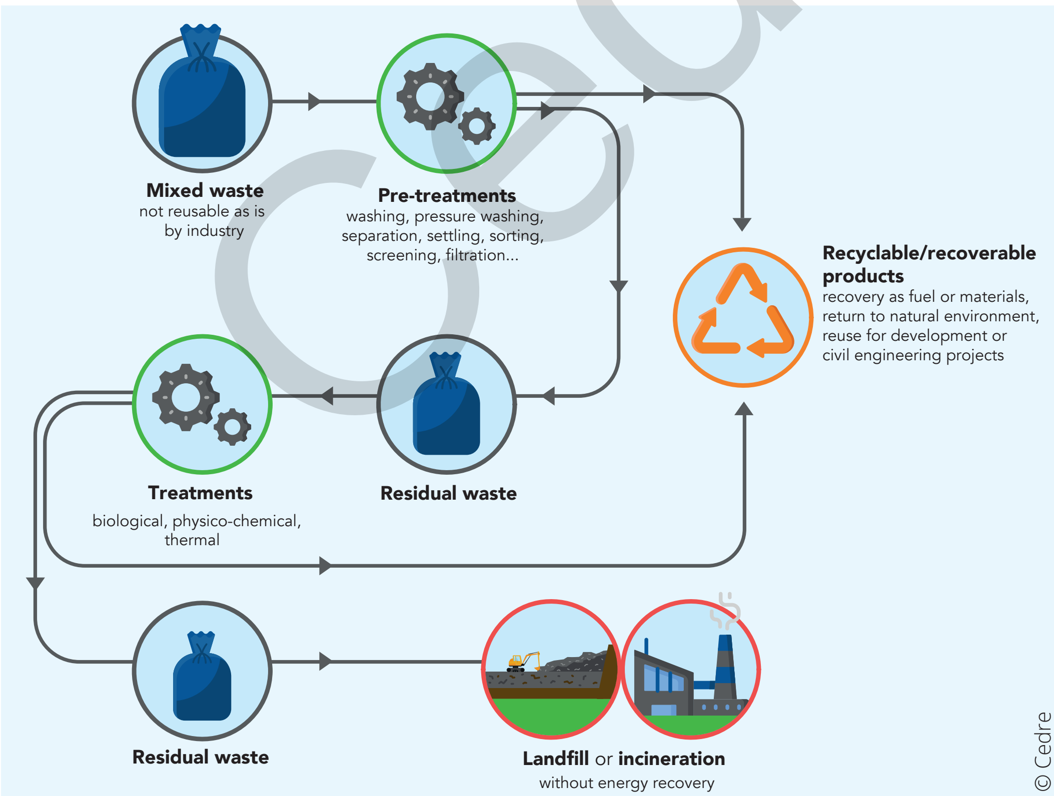

Figure 4: Flow chart of waste treatment operations

The volume of waste generated by a large-scale spill and the complexity of the resulting mixtures (mixture of oil, sand, litter, etc.) may be high enough to justify the construction of a specific high-capacity facility. In addition, if such a facility is built close to the clean-up sites, it reduces the environmental impact and economic implications of transport.

In this case, the (pre-)treatment techniques must be tested before setting up a large-scale system (major undertaking requiring studies, laboratory testing or pilot-scale testing). The results of these tests should enable the authorities to confirm the technical feasibility of the treatment options as well as their environmental performance. The waste must be analysed prior to the application of any treatment.

Waste treatment centre built during the Erika *disaster: sediment washing station (Brézillon).*

Funding

The question of funding systematically arises in the wake of a spill, especially in relation to waste management which is generally the most costly part of the response. In the case of a spill, the "polluter pays" principle applies; the cost of waste management (from storage to treatment) is therefore the responsibility of the polluter through their insurer (up to a certain liability limit).

According to the situation, the polluter (the insurer) can either directly handle waste management (technically and financially) or subsequently reimburse the entities (municipalities or states) that implemented the necessary actions.

In the case of shipping incidents, the direct covering of costs and/or compensation processes will depend on the legal regime in place, the type of ship and the pollutant involved. There are several international conventions to guarantee and speed up the compensation process even in the case of an unidentified or uncooperative polluter:

- CLC 92, 1992 Fund, 2003 Supplementary Fund (for oil tankers and their cargoes);
- the 2001 Bunker Convention, which covers oil used for the propulsion of all ships over 1,000 gross tonnage;
- the 1996 Hazardous and Noxious Substances Convention (HNS) adopted in 2010 but not yet in force.

In all cases, waste management claims must be supported by data, duly recorded and retained, on the quantity, type and final destination of the waste, in addition to the various relevant invoices. Compensation will only be provided for expenses related to waste• storage, transport, handling and treatment operations deemed "reasonable" (see box on next page).

For further information, the International Oil Pollution Compensation Funds (IOPC Funds•) document "Guidelines for presenting claims for clean-up and preventive measures" (2018 Edition) provides details on waste management costs (clean-up techniques used, deduction of waste sold where appropriate, choice of the most economical treatment facilities) and examples of lists of supporting documents to be provided when filing a compensation claim.

Cover of the "Guidelines for presenting claims for clean-up and preventive measures", 2018 Edition, IOPC Funds

Example of waste management deemed unreasonable by insurers (extract from the IOPC Funds• document shown on the left):

"Clean-up operations following a spill of some 2 000 tonnes of heavy fuel oil generates almost 80 000 tonnes of oily waste. Whereas it might have been anticipated that the spill would generate approximately 20 000 tonnes of waste, in fact, the quantity of waste collected was some 40 times the amount of oil spilled. There was little doubt that this amount of waste had been collected since the quantity was verified against weigh bridge tickets and from estimates of volumes piled up at storage sites. In assessing the claim for disposal and associated transport and storage costs the 1992 Fund took the view that in some places the inappropriate use of heavy machinery to remove oil from shorelines had resulted in excessive quantities of oily waste being collected. After detailed investigations it was concluded that adverse weather conditions and the types of shoreline to be cleaned had led to exceptional circumstances and the costs of dealing with some 40 000 tonnes of waste were accepted as reasonable."

If the polluter is not identified and recourse to the above-mentioned compensation funds is not possible (e.g. pollution of inland waters), the waste management costs fall to the polluted party and therefore, in general, to the relevant local authority.

Practical fact sheets

Contingency planning

Waste management is often the longest and most costly operation after a major oil or chemical spill. The main difficulty in planning this phase is that it consists in drawing up a management plan for an unpredictable volume of waste of an unknown nature, while taking into account the different possible types of waste generated, the available facilities and the necessary treatment techniques. Legal, financial, environmental, operational and logistical aspects must be covered during this planning phase.

Aims

To design an operational document to enable the operator• of an industrial facility and/or the authorities to effectively respond to a spill of pollutant. This document must be clear, precise, concise and known to all stakeholders;

To identify all logistical constraints in order to reduce the time needed to implement waste management (collection•, transportation, storage, treatment) in the event of a spill and to have immediately implementable solutions.

Precautions

The plan must:

comply with international and national regulatory requirements and, where applicable, the operator's Health, Safety and Environment policy•;

meet the specificities of the given geographical region and be appropriate to the region's work culture (regulations, vocabulary, etc.);

be regularly tested through exercises in order to ensure it is relevant and fully understood by the personnel liable to be mobilised for its implementation. It should be regularly updated, particularly after an incident, a change in organisation or the introduction of new protection or response measures.

Regular updating is crucial and should cover:

- **developments in legislation and technology;**
- **the inventory of authorised transport companies and treatment and disposal• facilities.**

Key points to include in the waste management plan

Regulatory framework in force in the country for waste/hazardous waste, including storage, treatment, disposal•, transboundary movements, transport requirements (traceability, packaging, labelling);

where available, contact details of administrations, experts, or other services that can provide support for waste management;

roles and responsibilities of authorities in charge of waste management and decision chain;

strategies/objectives and recommendations for each stage of the waste management process in order to optimise efficiency and costs, tailored to the specific context of the country concerned and the types of processes and facilities available;

types of waste generated by a spill to ensure response teams bear in mind the need to sort waste at source. This categorisation should be tailored to the specific context of the country concerned and the types of processes and facilities available;

emergency mobilisation procedures for the resources required for waste management, ideally through agreements already signed with owners, industrial operators• and/or specialised companies (carriers, dockside/intermediate/long-term storage sites, etc.);

list of storage sites (dockside primary, intermediate and long-term), that are safe both for the environment and the general public, making best use of local opportunities (large car park, household waste recycling centre/civic amenity site, industrial platform, brownfield land, etc.) and in consultation with the local authorities; if no such opportunities are feasible, a list of the main criteria for selecting and developing storage sites (see box on next page);

contact details of specialised waste management service providers (laboratories, approved public works and transport companies, suppliers of protective equipment, containment and recovery equipment, etc.) to provide quick access to this information in an emergency, including ready-to-use templates for transport tracking;

list of existing treatment facilities (biological treatment centres, industrial incinerators, cement plants, waste storage facilities, etc.) and industrial firms that could provide support in the event of an emergency (refineries, cement plants, etc.), with their contact details, waste eligibility criteria and the annual capacity (volume and throughput);

monitoring and restoration procedures for temporary storage sites (primary/ intermediate/long-term);

file structure for record-keeping for legal or claims purposes (e.g. waste quantities and types, transport documents...).

The French geological survey BRGM• has a methodology, which it first began developing in the 2000s, for the identification of intermediate storage sites, based on GIS• software and a multi-criteria analysis. This methodology has been used at both departmental and regional scale and has been adapted by private service providers:

Site name:	
Location on 1:50,000 scale map:	Photographs
GPS coordinates:	
Available surface area:	
Geology/hydrogeology:	
Hydrology:	*E.g. distance from nearest surface waters*
Topography:	
Neighbouring area:	*E.g. distance from nearest homes*
Current use:	
Land ownership:	*E.g. private or public land*
Accessibility:	*E.g. for light vehicles, trucks, etc.* *type of site access road*
Foreseeable constraints:	
Other:	

Figure 5: Example of a description sheet template for identifying a waste storage site

Waste characterisation/ categorisation

The waste generated by an oil or chemical spill is very diverse and depends on numerous factors (product spilled, weathering of the product, presence of plastic litter or vegetation, geographical location, response techniques used, etc.). It can be divided into two main categories: liquid waste and solid waste.

Objectives

To identify the product spilled and therefore the types of waste generated in order to define the necessary safety measures, the level of responder protection and the waste management strategies to be implemented.

To optimise segregation to ensure the most appropriate treatment for each type of waste and reduce the volume of non-recovered waste.

Precautions

All products spilt or washed up on the shore or banks should be considered potentially hazardous, pending more detailed analysis;

it is important to set up a data collection network in advance, so that reliable, accurate information is available quickly at the beginning of an incident.

Hazard level characterisation

All materials will be mixed, to a varying extent, with the oil or chemical spilled. The characteristics and hazard level of the initial product must be assessed:

based on information from the literature or technical data: shipping document, dangerous goods manifest (for container ships only), any information displayed on the container, the product's Safety Data Sheet (SDS•) provided by the manufacturer, importer or seller, etc.;

visually (type, colour, odour, water/pollutant content, labelling if packaged...). Beware, making a visual estimation of the pollutant content is no easy task and pollution can be invisible (gas, colourless liquid...);

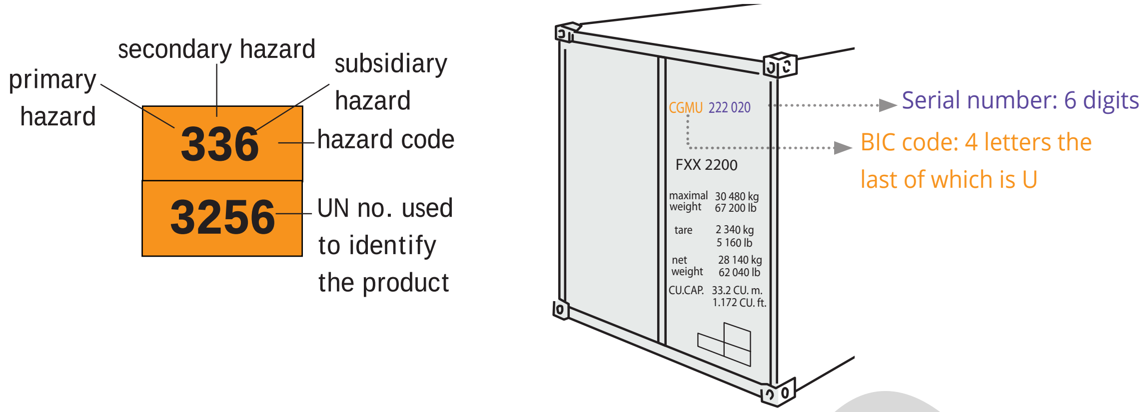

Figure 6: Examples of product identification from truck/package labelling (UN number/owner code (BIC) and container serial number)

with support from experts;

by conducting analyses in situ (volatile compound measurements, colorimetric analysis, gravimetric analysis, etc.) or in the laboratory, for precise characterisation (Cedre, public or private laboratories, etc.) or to identify the appropriate treatment/disposal• stream (industrial laboratories), but also for legal purposes (source identification).

Hazard warning plates on a vehicle

Pollutant sampling: use compatible, non-contaminating materials (glass, metal, Teflon, etc.) and store samples below 10°C wherever possible.

Specificities of chemical spills (in bulk or packaged form)

Recovery operations can produce different types of waste, with a wide range of categories and hazard levels, and a risk of violent reactions.

Certain products that are not normally hazardous can form hazardous products upon contact with water, air, another product or simply due to degradation over time.

Example of the* Fénès *incident in 1996 (Corsica, France): *marine spill of 2,500 tonnes of wheat; fermentation of the wheat and production of toxic gases: hydrogen sulphide, methanol and ethanol, generating health risks for responders involved in clean-up operations.*

Once the pollutant has been identified, it is important to determine how hazardous the waste is. The definition of hazardous waste is generally set out in national regulations, as well as in the Basel Convention and the European Waste Framework Directive 2008/98/EC.

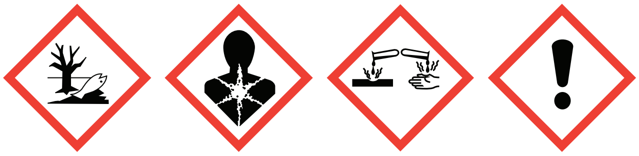

Figure 7: Examples of hazard pictograms

At European level, the classification of certain waste as hazardous or non-hazardous depends on the hazardous properties of the substances present but also on the concentrations of certain persistent pollutants above a certain limit (set by Regulation (EU) No 2019/636 of 23/04/19).

Examples:

Pollutant	Limit above which waste is considered hazardous	Justification
Oil	250,000 ppm (25%)	Calculation based on hazard statements (source: FNADE•ADR Guide 2019)
PCB	50 ppm (0.005 %)	Persistent pollutant – POPs Regulation

Table 3: Examples of pollutant levels characteristic of hazardous waste

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Different waste categories

The table below lists the different categories of waste generated by a spill, each of which has its own distinct management and treatment processes.

This table does not include any bulk cargoes and packages that are recovered intact during response operations and may be returned to the manufacturer or forwarded to the consignee for normal use, after having followed the relevant legal procedures.

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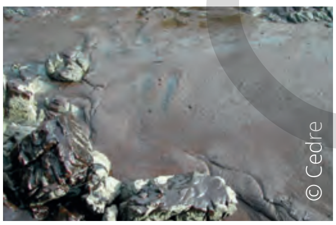
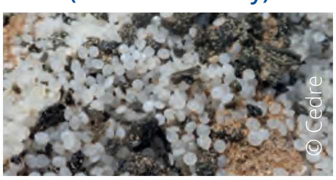
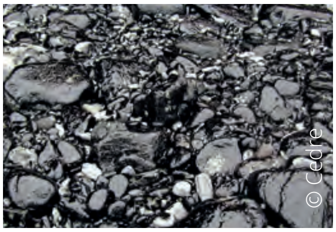
Category	Origin	Characteristics and/or operational constraints
Liquids  *Oil*  *Vegetable oil*	Pumping operations at sea, in watercourses, along the shoreline or riverbanks, in port areas. On-land washing operations (pressure washing, flushing, flooding, etc.). Decontamination of responders and spill response equipment. Water collection• at storage sites. Recovery of fire extinguishing water.	Oil or chemical waste mixed with water, composed of up to 90% water and possibly containing low levels of suspended solids and organic matter. Choose appropriate storage containers (watertight, resistant to the pollutant) that allow for settling•...
Solids (paste-like consistency)  *Emulsified substance*	Offshore trawling• operations. On-land manual or mechanical collection•.	Tarballs, patties, slicks, emulsified to a varying extent, recovered by selective collection•. Waste with a high proportion of pollutant and a low sediment content.
Solids (hard consistency)  *Industrial Plastic Pellets (IPP)*  *Tarballs*	Offshore trawling• operations On-land manual or mechanical collection•.	Waste with a high proportion of pollutant and a low sediment content.

Category	Origin	Characteristics and/or operational constraints
Polluted soil/sediment 	At sea or in inland waters: dredging•, manual or mechanical recovery on the bottom. On-land manual or mechanical collection•.	Waste with a high proportion of sediment, containing infiltrated pollutant. May be the result of non-selective collection (sand + pellets). Visual or analytical characterisation to determine the pollutant content, establish whether the waste is hazardous or non-hazardous and adapt segregation (degree of contamination) to meet the eligibility criteria of the treatment streams.
Pebbles and stones mixed with pollutant 	On-land manual or mechanical collection•.	Waste coated with pollutant (small amount of pollutant compared to the volume of the waste). Waste collected if in situ washing is not feasible.
Clean-up site consumables 	Sorbents• used during response operations to recover pollutants from the water surface. PPE•, geotextile•, plastic tarpaulins used during riverbank or shoreline clean-up operations.	Variable pollutant content, depending on the viscosity• and type of sorbent• (sorption capacity). Washing and reuse of certain consumables, in particular PPE•, for as long as possible (to reduce resource consumption).
Contaminated seaweed and vegetation 	Contaminated aquatic vegetation (seaweed, seagrass) either in the water or deposited along the strandline. On-land vegetation contaminated by pollutant washed up on the upper foreshore or the riverbanks. Contaminated (natural) driftwood. Natural raw material used as a sorbent• or for filtration (straw, peat, etc.).	Risks (health, safety) related to fermentation.
Contaminated litter/debris 	Floating debris or waste contaminated by pollution in the water or on land (machined wood, plastics, etc.).	According to the degree of contamination, segregation by type of waste (metal, plastic, wood) for channelling into the different treatment streams.

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Category	Origin	Characteristics and/or operational constraints
Contaminated dead wildlife 	Dead birds, fish, molluscs, mammals, reptiles (turtles), etc.	Dead animals should be counted by species prior to disposal•. Some may be retained for scientific studies. As far as possible, they should be placed in plastic bags to prevent contamination (difficult to implement in the case of large numbers of animals).
Contaminated, damaged, hazardous or non-hazardous packages 	Packages (drums, containers), contaminated by the pollutant or containing pollutants, transhipped from the vessel or collected at sea or on land.	The contents should be identified from the label, if legible, and/or from the ship's manifest, if identified. Repackaging into suitable containers if necessary.
Uncontaminated vegetation 	Preventive collection on land before the pollution reaches the shore: seaweed, seagrasses, natural wood. Caution: certain species are protected, even when stranded. *E.g. In France, a derogation is required before posidonia can be removed.*	Compostable materials. Possible to move them (subject to obtaining a derogation in the case of protected species) to an area that is not liable to be affected by the spill.
Uncontaminated litter 	Preventive collection on land before the pollution reaches the shore: plastics, metal, etc.	Apply the sorting, recycling• or disposal• policy in force in the area/country concerned.
Uncontaminated household waste 	Waste generated by the clean-up site.	Plastic bottles, cans, food waste, paper, etc. Apply the sorting, recycling• or disposal• policy in force in the area/country concerned.

Table 4: Waste categories

Waste minimisation/ limitation

Experience has shown that even in the case of moderate spills, large quantities of waste can be generated, as a result of the characteristics and behaviour of the spilled product, but also of the clean-up techniques implemented and response management choices.

Large number of big bags of waste stored for several weeks which have begun to leak, increasing the volume of contaminated sediment

Objectives

To reduce the quantity of waste in order to facilitate its emergency management, mitigate environmental impacts and reduce costs.

Precautions

- Raise awareness and train responders from the outset and throughout clean-up and waste handling operations;
- seek expert advice in particular on the choice of clean-up techniques;
- ensure you have the appropriate equipment to reduce waste volumes (e.g. settling •).

Minimising waste by preventive removal

Additional volumes of waste may be generated if large amounts of debris, litter or vegetation are present on land before the pollution is washed up.

Recommendation: remove vegetation, seaweed, natural wood, debris and litter from sites identified as being at risk of strandings, before the pollution reaches the shore.

Vegetation and litter stranded on the shoreline

Minimising waste by preventing secondary contamination

Secondary contamination can affect clean-up sites, storage sites or transport areas. It can take various forms:

spread of the pollution;

- *e.g. pedestrian/vehicle traffic in polluted areas → pollutant deeply buried or spread to a clean area on shoes/wheels*

creation of new pollution in an initially unpolluted area;

Storage of waste in an unlined area: additional pollution due to overflow or mishandling

Golden rule to prevent secondary contamination → Work methodically

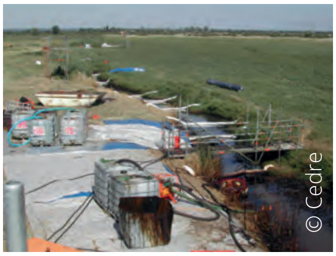
	Control access to clean-up sites (keep out onlookers and non-essential and untrained people).
	Organise and mark out the clean-up site and the different zones using stakes, barricade tape, signs, etc. Organise and mark out the pedestrian and vehicle traffic system and line the traffic lanes (if necessary, with washable linings or geotextile•, polythene sheeting).
	Protect uncontaminated ground and surrounding rocks during in situ pressure washing operations (avoid splashing).
	Protect the ground at temporary storage sites (polythene sheeting, geomembrane•, etc.) and in high-risk areas (unloading•, pipe connections, etc.), and collect contaminated run-off water. Use a waterproof cover on containers to prevent rainwater infiltration, which would increase the volume of waste and could result in overflow.
	Set up watertight decontamination areas for personnel, equipment and/or vehicles before they are allowed to leave the clean-up site: • marking out of "clean" zones, "decontamination" zones and "contaminated" zones; • flat or slightly sloping platform; • ground linings (e.g. polythene sheeting); • recovery of washing water via a pit positioned downhill and pumping/recovery. The purpose of the decontamination areas is to prevent secondary pollution but also to ensure adequate comfort for personnel after each work session and thereby ensure they continue to work efficiently.

Table 5: Recommendations to reduce the risk of secondary contamination

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Minimising waste through economical use of consumables and, if possible, the reuse of consumables and equipment

Use consumables (e.g. sorbents•, geotextile•) sparingly and efficiently; choose reusable consumables wherever feasible (e.g. PPE•);

Counter-example: excessive use of sorbent pads

reuse rather than throw away: clean reusable PPE (e.g. boots and helmets) and recovery equipment (e.g. buckets, bins, shovels) at the end of each day with sorbent pads or cloths, possibly with a tested and approved, non-toxic cleaning agent; rinse and dry.

C3

Example: sorbent mops (or "pom poms") drying on site for reuse

Example: PPE• drying

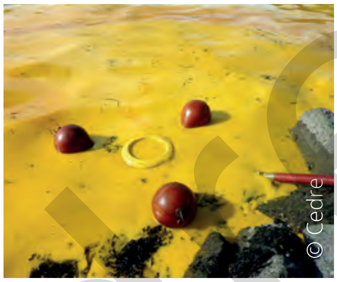
Tip: a film-forming agent can be sprayed onto recovery equipment (e.g. buckets, bins, etc.) prior to collection• operations to facilitate emptying and cleaning with a view to their reuse.

Minimising waste by selective collection

Choosing the most selective and efficient recovery techniques helps to minimise the volume of waste → Seek expert advice to make these choices.

Encourage selective recovery techniques at sea/in inland waters to minimise the amount of uncontaminated water collected;

Avoid collecting excessive quantities of water



Use of flat suction heads, skimmers, etc.

implement settling• of liquid waste systematically in the case of floating pollutants to separate the water from the pollutant;

Release of water into a containment area after settling in a vacuum truck

Mobile settling tank that can be set up on site

ensure all techniques are meticulously applied;

prioritise manual recovery over mechanical techniques, especially in the case of light or scattered contamination;
e.g. sand sieves useful for tarballs, mechanical sifting or raking beach cleaners adjusted according to the sediment particle size•, oleophilic rollers...

Recovering pollutant from the sediment surface using a hand shovel

Avoid collecting uncontaminated sediment

Collection by adhesion of oil to an oleophilic roller

Materials collected in a beach cleaner hopper (tarballs)

prioritise the use of in situ clean-up techniques whenever possible (particularly for oil spills): flushing, surfwashing, pressure washing, etc.

Remobilising pollutant trapped in the sediment using a low pressure water jet (flushing technique)

Pressure washing stones•

See Cedre Operational Guide on oiled shoreline clean-up.

Segregation at source and appropriate containers

Waste segregation is a key step in the waste hierarchy• concept: it enables the use of waste management methods that tend towards sustainable development and the circular economy•.

Unsorted waste with a high environmental and economic impact

Objectives

To reduce the need for pre-treatment operations;

to facilitate the use of precise, appropriate recovery•/ treatment streams;

to reduce the environmental impacts and economic implications.

Precautions

Use suitable, clearly labelled containers, and be careful when handling chemicals (beware of potential reactions between the pollutant and the container) → see box on chemical spills on p. 46;

raise awareness and train responders, from the outset and throughout operations, on the importance of waste segregation and the consequences (including economic implications) of inappropriately mixing waste contaminated by oil or chemicals;

seek expert advice.

Tips for optimised sorting

Appoint a person to regularly monitor segregation and manage temporary storage;

adjust segregation requirements based on:

→ the waste classification (▶ **Practical fact sheet C2**: Waste characterisation/ categorisation): by type, nature, degree of contamination;

→ the expected quantity of waste;

→ pre-identified recovery•/treatment streams and final disposal• options available: it is pointless to sort waste “for the sake of it", segregation must be consistent with existing streams;

segregate waste from the beginning of clean-up operation to reduce the need for pre-treatment;

assign the collection• of different categories of waste to different teams;

C4

use appropriate storage containers (water-resistant, wind-resistant, UV-resistant) from the beginning of clean-up operations, chosen from a variety of materials not necessarily originally designed for waste collection• (buckets, plastic bags, big bags•, which may be watertight or not, bins, metal drums, skips, tanks, etc.). Consult the list of equipment and suppliers, if available, in the contingency plan;

for each type of waste, clearly label each container, and display the hazard symbol where appropriate, to avoid confusion and subsequent mixing (classification according to physical state, proportion of pollutant, sediment, fermentable organic matter);

implement daily monitoring of the waste collected and stored at primary storage sites to establish as accurate a material balance as possible.

Clearly labelled containers (separation of contaminated and clean waste)

Container selection criteria

Take into account the viscosity• of the waste in the choice of container so that it can subsequently be pumped/recovered;

capacity: dependent on the weight and nature of the waste, and compatible with manual handling where relevant;

Examples:

→ *for manual handling, use small containers as the weight will rapidly become a limiting factor,*

→ *the volume of the containers should be known and possibly displayed on a label to help on-site supervisors estimate the volume of waste collected.*

materials:

→ watertight;

→ durable (for instance resistant to solar radiation in hot regions);

→ compatible with the waste transported, in particular for chemicals: consult SDS•;

→ compatible with treatment or disposal• options;

For example, plastic bags may be incompatible with final disposal• options and may be very difficult or impossible to separate from sticky polluted materials, which can cause the waste to be refused by the waste stream.

stability and ease of handling (containers without handles often lead to unexpected difficulties and secondary contamination). Use containers with retractable handles or that can be crane-lifted, whatever the case they should be transferable;

a closing system (cover, lid, stopper) to protect against rainwater infiltration and to reduce odours, a level monitoring system (or container with sufficiently transparent sides to allow visual monitoring) to prevent overflow and anticipate the replacement of the container, and a drainage system to remove water after settling•.

Examples of containers used (non-exhaustive)

Type of container	Illustration	Waste type	Advantages	Drawbacks
At sea				
Floating storage tank. Flexible bladder or towed barge (various capacities available)		Liquids	Recovery at sea; Towable	Limited capacity; Restricted usage according to sea and weather conditions; Difficult to recover viscous oil
Vessel's integral tank. Variable capacity, up to 5,000 m³		Liquids	Recovery at sea; Continuous settling•; Heating coils to maintain the product's fluidity until its removal	Unloading• time in dock
On land				
Plastic drum with lid (approx. 60 L)		Liquids	Airtight lid; Handles suitable for manual handling; Easy to fill (wide opening);	Flat surface (sloping surfaces problematic); No drainage valve (settling• not possible); Should not be filled to the brim, according to the weight of the waste
Metal drum (200 L)		Liquids	Lid; Crane-liftable (holes pierced at the top of the barrels to thread a chain through); Readily available	Flat surface (sloped surfaces problematic); No drainage valve (settling• not possible); No handles
Self-supporting flexible tanks (2 to 20 m³)		Liquids	Specifically designed for oil spills, but suitable for all types of non-corrosive liquids, especially for floating pollutants; Fitted with a drainage valve•	Not suitable for viscous products; Not transportable once filled; Smooth, flat surface (sensitive to perforation, sloping surfaces problematic)

Type of container	Illustration	Waste type	Advantages	Drawbacks
IBC• container (600 L to 1 m³)		Liquids	Stable; Can be handled by forklift; Can be fitted with a drainage valve•	Flat surface (sloping surfaces problematic)
Folding frame tank (5 to 35 m³)		Liquids	Suitable for all types of non-corrosive liquids, especially for floating pollutants; Fitted with a drainage valve•; Some models can be connected in series, with a continuous settling• system (overflow• and drainage valves); Folding	Assembly time for large volumes; Smooth, flat surface (sensitive to perforation, sloping surfaces problematic)
Specialised tanker truck (15 to 30 m³)		Liquids	Enables direct transfer to a storage site or treatment facility (reducing risks of secondary contamination).	Limited capacity; Availability; Certified companies; Downtime to be factored in for settling•
Separation tank with heating coils 70 m³		Liquids	On-site settling•; Heating coils to maintain the product's temperature until its removal; Temporary solution pending transfer to trucks	Low availability; Specialised personnel required; Must be transported empty
Plastic bag (100 L max)		Solids: pastes• or hard solids (sediment, litter...)	Manual handling possible; Low cost; Readily available	Low resistance to oil and most chemicals, UV rays, impact (risk of puncture/leakage); Should not be filled to the brim, according to the weight of the waste; Short-term storage (daily transfer required); May cause difficulties in terms of eligibility criteria for waste treatment or disposal•

Type of container	Illustration	Waste type	Advantages	Drawbacks
Open bucket (10 L)/bin (30 to 75 L)/ wheelie bin (150 L to 1 m³)		Solids (pastes or hard solids): pastes•, sediment, litter, plastic pellets...	Low cost and readily available; Handles suitable for manual handling	Should not be filled to the brim, according to the weight of the waste; Flat surface; Short-term storage
Big bag• (0.5 to 1 m³)		Solids (pastes or hard solids): pastes•, sediment, litter	Strong; Some are plastic-lined to improve waterproofing; Handles; Can be lifted by crane or helicopter	Flat surface; Ensure the bag remains fully open during filling and ensure stability; Avoid big bags• with an open bottom or discharge spout
Skip (10 to 30 m³)		Solids (pastes or hard solids): pastes, sediment, litter	Watertight or line with a plastic liner; Crane-liftable; Transportable by truck or barge; Coverable	Flat surface; Truck collecting the skip must be compatible with the bearing capacity of the ground (weight, number of drive wheels...)
Lined pit (50 to 200 m³, 1 to 2 m deep max.)		Liquids or pastes	To deal with a large-scale spill; Large storage capacity	High risk of environmental impact: line carefully and fully restore site after use; Access and oil evacuation: dig a pit that is longer than it is wide (width determined according to site machinery), remove oil by pumping or shovelling; Site sensitivity (especially backshore sites)

Table 6: Examples of containers for storing spill waste

Reminder: in all cases, the ground must be fairly flat, have a sufficient bearing capacity and be protected (lined with geotextile•/polythene sheeting) and if necessary have an effluent• collection• system

▶ **Practical fact sheet C3**: Waste minimisation/limitation, see section entitled "Minimising waste by preventing secondary contamination".

C4

Specificities of chemical spills (in bulk or packaged form):

Incidents involving incompatible mixtures are not only caused by newly manufactured chemicals. Their end-of-life can also cause accidents. Mixing of incompatible substances most often occurs during hazardous waste pooling/unloading• operations or during the storage of such waste. While the kinetics• of reactions between incompatible waste materials are generally very fast, they may be slow enough not to be noticed or reported at the time of occurrence, resulting in delayed incidents.

Particular vigilance is required when handling chemicals: mixing incompatible waste can cause a violent reaction (explosion, fire, release of flammable/toxic/asphyxiating/corrosive gases, formation of unstable materials) → social, environmental, human consequences...

Recommendations

Consult the SDS• of the spilled product(s) to obtain information such as their toxicity and ecotoxicity, hazards, protective measures and safety precautions for handling, storage and transport. For waste segregation and repackaging, "Section 7" provides information on product handling and storage:

Section 7	Handling and storage	1. Precautions for safe handling 2. Conditions for safe storage, including any incompatibilities

mobilise personnel trained in chemical risks, comply with procedures and ensure all personnel wear PPE•;

be vigilant about how temporary storage is organised:

- → separation of incompatible waste materials (e.g. acids and bases, oxidising and reducing agents, fuel and combustive agents);
- → suitable container material; e.g. steel specifically suited to corrosive chemicals or high density polyethylene, presence of a pressure relief valve...
- → appropriate environmental conditions (temperature, light, humidity, etc.), and provide suitable premises if necessary;
- → restrict the quantities stored;

Organised temporary storage of chemicals onboard a vessel

be vigilant about pooling/unloading operations•:

- → check that containers are clean;
- → define the order of unloading• to avoid mixing incompatible materials;
- → ensure operations are supervised by qualified personnel;
- → clearly label containers to prevent mistakes;

implement appropriate monitoring/control measures: infrared detection/video surveillance, sprinklers, gas collection/treatment devices, with regular tests to ensure that they are operating correctly;

define the measures to be implemented in case of emergency: stop transfers, neutralisation protocol.

Unloading waste recovered at sea at “dockside” sites

Effective coordination of human and material resources must be implemented to ensure the continuity of the waste management chain. Onshore operators must therefore be prepared and organised for boats to unload waste quickly and safely. Experience has shown how sensitive such operations, at the land/sea interface, are; misunderstandings very often arise between stakeholders (maritime and land authorities, consular chambers, ports, P&I club). The efficiency of response operations at sea will depend on the smooth coordination of this logistics chain. The aim is also to facilitate the reception of waste and transfer to intermediate or long-term storage sites, or even treatment sites.

Objectives

To anticipate this phase of pollution response at the land/sea interface;

to unload the pollutant recovered at sea as quickly as possible, in order to immediately return to the polluted areas at sea to avoid creating bottlenecks in the logistics chain.

Precautions

Identify in advance (contingency planning) ports or facilities that could receive waste, based on the information provided by experts and field officers;

define the equipment required on land for unloading (lifting, trucks, etc.);

dialogue with stakeholders (authorities, operators•, ports, etc.) from the outset and throughout recovery operations at sea, and in particular estimate the quantities of pollutant liable to be collected, identify existing storage capacities to meet the needs;

restrict the number of unloading ports to reduce the risk of secondary contamination and avoid sensitive sites.

Onshore-offshore interface:
Coordination = efficiency

Important points to discuss

The type of waste to be unloaded (liquid or solid, quantities being collected, quantities likely to arrive, evolution of the product, packaging, etc.);

where the vessels have come from, the clean-up sites, route details, etc.;

possible unloading sites (docks);

onboard storage and transfer conditions: number and type of tanks, heating, transfer pump (flow rate);

unloading method (pumping, crane-lifting);

the conditions in which the waste is stored on the dockside and transferred to an intermediate storage site or a recovery•, treatment or disposal• stream.

Operational constraints to be anticipated

Good preparation will save time and mean that the vessel can return to the clean-up area sooner:

mooring constraints:

→ depth of the harbour basin must be compatible with the vessels' draught (check tidal constraints where relevant and the presence of any shallows);

→ sufficient length of dock, without completely interrupting existing activities;

onshore equipment:

→ enough space on the dockside to create:

- a work area (at least 30 m by 50 m) that should be lined (protective tarpaulin placed on the dockside and along the wall of the unloading dock) and fenced off (dock closed to the public or marked out);
- a temporary storage area for waste skips (trawls, PPE•, tarpaulins, sorbents•, etc.), liquid waste recovery tanks and/or a parking area for vacuum trucks;
- an equipment storage area where a mobile crane can be set up;
- a decontamination area for tools and personnel;

→ a containment area with response booms deployed along the port infrastructures to prevent contamination of the port area (polluted vessels, risk of pollution during trawl lifting, unloading, rough cleaning of vessels, etc.), together with the use of sorbents•. If pollution occurs, deploy a skimmer and a storage tank for the recovered waste;

→ appropriate unloading/lifting equipment according to requirements and the maximum weight the dock can carry: loader with telescopic arm and lifting arm with winch, road crane, etc;

Appropriate lifting equipment for the weight to be lifted: forklift to transport an IBC

→ waste reception/storage solutions:

- with a heating system if necessary according to the product;
- of sufficient capacity: in the case of recovery at sea by specialised spill response vessels, if feasible waste should be transshipped to a large-capacity (several hundred or thousand cubic metres) buffer storage facility (refinery, deballasting station•). The use of tankers (very limited capacity: 15 to 30 m^3) is a secondary option because of its low efficiency (time, rotations, handling);

→ an appropriate connection with an assembly comprising a flange, valve, connection and plug, as well as a retention tank under the connection assembly, to which flexible and semi-rigid hoses can be attached (without a suitable connection, it can take a long time to transfer the product which can affect response operations at sea);

→ a flow rate adapted to the height of the quay, the distance between the quay and the unloading site, the reception facility (e.g. deballasting station•) and the viscosity• of the pollutant;

→ suitable access for heavy goods vehicles (turning, one-way traffic) transferring waste from the quay to an intermediate storage or treatment facility;

→ electricity supply, fresh water supply, lighting;

sufficient, available personnel to conduct operations, guide handling, moor the boats, supervise transfer operations, order the containers required for the dockside and/or on board (bin, skips, big bags•), sort the waste, provide site security, etc.

C5

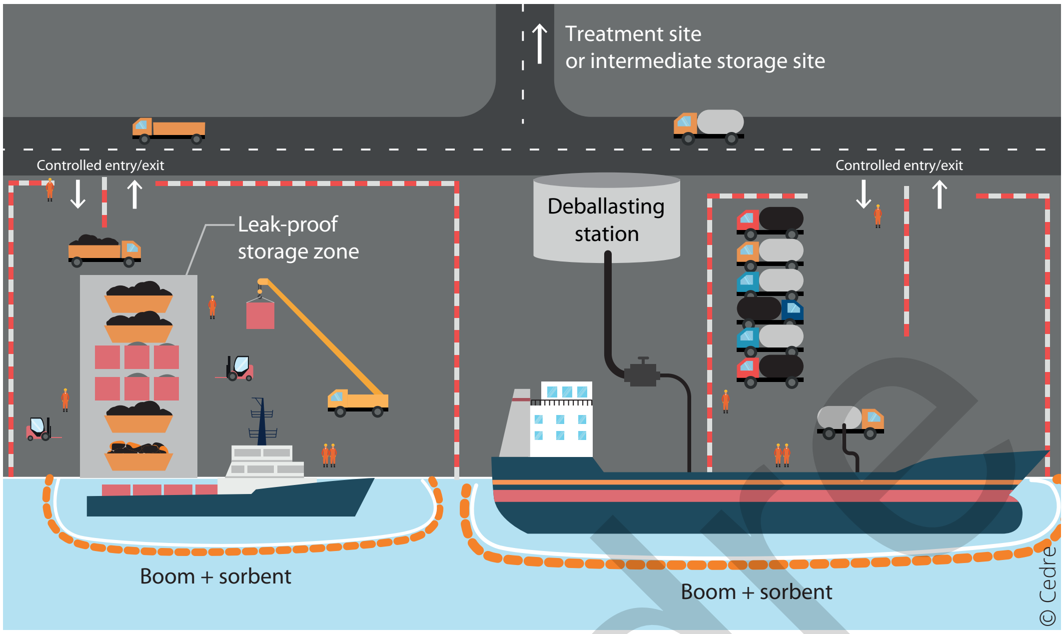


Figure 8: Diagram showing the logistics of unloading a fishing vessel and a specialised spill response vessel

Unloading a trawl from a vessel to a lined temporary storage area on the dockside

Primary storage sites on the backshore or bankside

A primary storage site is an emergency platform located in the immediate vicinity of the clean-up site, where waste can be deposited, sorted, pooled and transferred on a near daily basis.

Lifetime: a few days to a few weeks (duration of clean-up operations).

Primary storage site on the backshore

Primary storage site in a car park

Objectives

To optimise the work of the clean-up teams;

To provide greater flexibility in the management of flows from clean-up sites and in the evacuation to intermediate storage sites, by acting as a buffer facility.

Precautions

Avoid congestion of the site, which could lead to its closure and put a stop to clean-up operations;

protect the ground;

ensure site safety to prevent it becoming a dumping ground.

Site selection criteria

(on a case by case basis, compromise based on a multi-criteria analysis):

proximity to clean-up site;

location outside floodable areas (tides and storm surge);

distance from sensitive areas (habitats and vulnerable species);

topography: flat area if possible or slightly sloping, and load-bearing ground;

surface type: artificial area such as a car park, if possible;

surface area available (usually between 100 and 500 m²), requirements determined according to:

→ size of clean-up site;

→ type of waste, sorting and expected daily volume;

→ space required for different zones: waste storage, pre-treatment (settling•, draining, screening) where applicable;

accessibility via the road network (including for machinery and trucks) or waterways (otherwise consider air transport);

permission from the landowner and/or local authority;

suitable conditions for container handling.

Specificities of chemical spills

Given the potential risks of violent reactions, drums or other packaged forms of hazardous substances collected must be stored at specific, isolated sites far from any homes; wherever possible, the waste should be evacuated at the end of each day to an approved treatment facility.

Isolated temporary storage site for containers of chemicals recovered at sea and on land

General preparation

Appoint one or more persons to ensure coordination and compliance, particularly for pre-treatment operations;

organisation into zones: contaminated zone (clean-up site to temporary storage site), clean zone (temporary storage site to road), pre-treatment zone (settling•, screening);

marking out (rope, tape, chains) and traffic system (pedestrians, machinery), to avoid spreading the pollution to uncontaminated areas;

defined and controlled access points (display signs prohibiting entry outside of operating hours);

reinforced tracks for machinery.

Specific preparation

Protection of the ground surface and subsoil: use of geotextile•, waterproof liners, etc., to prevent surface contamination and deep infiltration;

run-off management: protection of storage capacities against rain (lids, tarpaulins, etc.), diversion of rainwater (peripheral trenches) and recovery of contaminated water;

organisation of the temporary storage site according to the volume of waste to be recovered, segregation requirements and available containers:

- → use watertight containers that are suited to the waste collected (possibly repackaged to facilitate transport)
  ▶ **Practical fact sheet C4**: Segregation at source and appropriate containers;
- → create watertight platforms with a simple ground liner for solids and liquids already packaged in bags, big bags•, drums, etc;
- → create a watertight platform with a peripheral bund• or concrete blocks for bulk waste (sediment, debris, etc.);
- → if necessary, prepare a lined pit in the case of large volumes of pastes•;

implementation of simple pre-treatment operations to improve waste selectivity: settling•, screening, etc.
▶ **Practical fact sheet C3**: Waste minimisation by selective collection•

Primary storage of contaminated waste on a riverbank

Primary storage in big bags on top of a custom-made retention system

C6

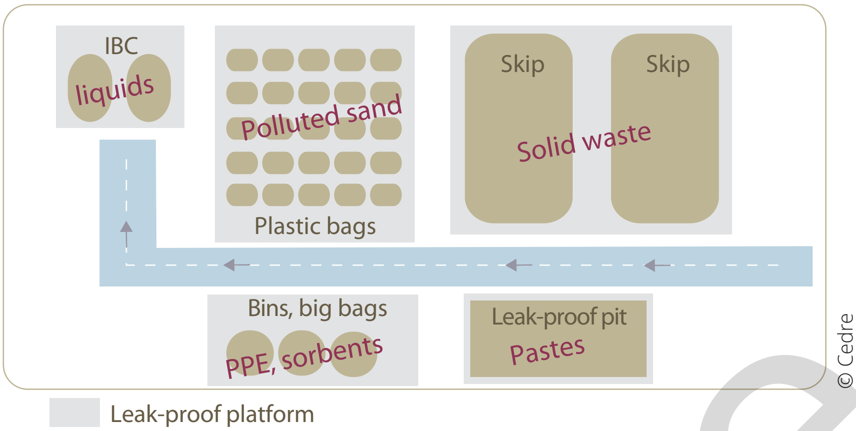


Figure 9: Diagram showing the layout of a primary storage site (bird's-eye view)

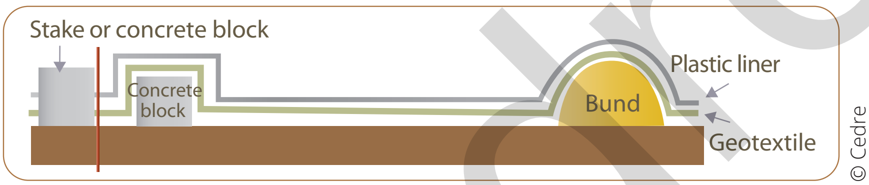


Figure 10: Diagram of a watertight platform for bulk waste (cross-sectional view)

C6

Waste tracking and evacuation

Regular waste evacuation (daily in case of large-scale pollution);

evacuation to an approved treatment/recovery•/disposal• facility or to an intermediate storage site, depending on availability;

preparation of a transport document for tracking purposes before the waste leaves the site; this document should be given to the carrier ▶ **Practical fact sheet C8**: Transportation and tracking;

daily quantification of waste volumes and creation of a log of incoming and outgoing waste (kept on site): first identify the capacity of the containers, then count the number of containers.

Municipality		**Identification of clean-up or storage site:**		
Date:	**Person in charge:**			
Waste type	**Number and type of containers**	**Estimated volume of waste**	**% or degree of contamination**	**Estimated volume of pollutant**
Oil with some sand	*80 partially filled plastic bags*	*50 l x 80 ≈ 4,000 L*	*Heavily oiled ≈ 80 %*	*= 4,000 x 0.8 ≈ 3,200 L*
Liquid oil	*2 IBCs•*	*2 m³*	*Nearly pure (settled) ≈ 95 %*	*= 2 x 0.95 ≈ 1.9 m³*
Oiled seaweed	*1 partially filled skip*	*≈ 5 m³*	*Heavily oiled ≈ 90 %*	*= 5 x 0.9 ≈ 4.5 m³*
...	...	...	...	...
Total volume of waste:				

Table 7: Example of a daily waste estimation log

Discharge control/health and safety

Clean the site regularly;

limit dust emissions (covered storage containers) and be particularly careful during loading/unloading and transport operations;

manage effluent (runoff and settling water): check the quality of the water complies with regulations or thresholds established in agreement with the authorities prior to discharge into the natural environment or pumping and disposal at a certified facility.

Site closure/restoration

Clean the storage site as soon as the clean-up sites serviced have closed to prevent it becoming a dumping ground;

dismantle, clean and decontaminate equipment if necessary and remove all structures and materials installed on the site;

rehabilitate, ideally within one to a few weeks, the soil, subsoil, access roads, surrounding vegetation and any installations existing prior to the response operations, ensuring that no hazards remain and the site is restored to its pre-spill condition:

- → assess the background contamination in the surrounding area (reference value) to allow comparison with the final condition of the site;
- → conduct initial clean-up (sediment withdrawal, extraction, if necessary) to remove all polluted layers and pockets of pollution;
- → if necessary, have an environmental diagnosis (soil, groundwater) carried out by a third party including:
  - mapping of any pollution on the site (extent, depth, concentrations);
  - where relevant, a proposal of clean-up operations to be implemented and levels to be obtained.

Decisions concerning the implementation of clean-up operations should be made in consultation with the authorities.

Intermediate and long-term storage sites

An **intermediate storage site** is a facility used to pool waste from several primary storage sites and is accessible to heavy duty trucks. Here, the waste is sorted and repackaged to facilitate handling and to meet the eligibility criteria of waste streams. Pre-treatment operations can also be carried out here to reduce the volume of waste. The waste is then evacuated to recovery•, treatment or disposal• facilities or, where not immediately feasible, to long-term storage sites.

A **long-term storage site** is a facility used to pool waste from several intermediate storage sites. This type of site is necessary when the expected quantities of waste exceed the treatment capacities of the available streams managed on a just-in-time basis or when a dedicated treatment facility needs to be built (as in the case of the *Erika* spill in France and the *Prestige* in Spain). It is a temporary transit area and by no means a permanent storage site.

Some intermediate sites will need to be set up within 48 hours to relieve the strain on the first primary storage sites. It takes longer to set up long-term storage sites (around a fortnight).

Lifetime:

- intermediate: a few weeks to a few months,
- long-term: several years.

Preparation of a long-term storage site

Objectives

To allow time, in the event of a major spill, to prepare the waste treatment/recovery•/disposal• phase by:

- → conducting further characterisation, either qualitative (visual, olfactory, field analysis kit) or quantitative (laboratory analysis);
- → providing extra time to negotiate contracts for waste treatment or export;
- → building, if necessary, a specific facility for waste pre-treatment and sometimes treatment•;

to pool, repackage and further segregate waste (quantify, characterise, divide);

to closely manage the outgoing waste flow (monitoring, traceability);

to supply the selected streams to their exact reception and treatment capacity.

Precautions

Compliance with current regulatory procedures relating to waste storage;

environmental protection by lining the ground and managing run-off and percolation•;

permanent control of aspects relating to safety (high risk operations, e.g. unloading•, site security), logistics, the environment (watertightness, cleanliness), traceability;

support from the authorities relating to the procedures applicable to waste.

Intermediate/long-term storage site selection criteria

Generally speaking, the same criteria apply for both types of sites. However, they will be more stringent for a long-term storage site, in particular given the length of time the site will be in operation and the volumes of waste to be considered. A multi-criteria assessment should be conducted to select the most suitable site, taking into account the following aspects:

preparation time (compatible with the emergency situation);

proximity to sites serviced to reduce travel time for trucks and transport costs (based on past experience: an intermediate site should ideally be 10 to 30 km from the clean-up sites; a long-term storage site should be < 100 km or a 1-hour drive);

proximity to an existing treatment/disposal• facility;

location outside sensitive areas and more specifically away from water bodies that are particularly sensitive to pollution; for long-term storage sites, outside of protected natural areas (e.g. Natura 2000) and drinking water source protection zones or floodable/submersible areas;

location at least 50 m (intermediate site) to 100 m (long-term site) from homes;

- ground with good bearing capacity (trucks, large volumes of waste);
- accessible to heavy duty trucks;
- geology/hydrogeology: preferably semi-permeable or even impermeable layer for a long-term site (natural passive barrier) above the aquifer and remote from groundwater;
- available surface area (generally 1,500 to 3,000 m^2 for an intermediate site and 20,000 to 100,000 m^2 for a long-term site), to be determined according to the type of waste, the expected daily volume and the space required for the different zones;
- site suitability in terms of land ownership and tenancy (authorisation from landowner, availability for several months or even years), health conditions and regulations (compatibility with local planning documents) → establishment of an agreement specifying the characteristics of the facility, the operating conditions, financial conditions, duration, responsibilities, and rehabilitation requirements;
- acceptance by local councillors, associations, users and the general public.

To select sites, it is recommended to work together with the local authorities and with local experts. It should be noted that industrial sites, such as refineries for example, often have facilities that can offer emergency solutions: liquid effluent• reception capacity (storage tanks, deballasting station•, API oil-water separators), platforms that can be adapted to store solid waste, rainwater management systems, etc.

Sites should be pre-identified as far as possible.
▶ **Practical fact sheet C1**: Contingency planning

A fenced off intermediate storage site

Preparing and managing an intermediate or long-term storage site

General preparation:

Access control post, safety instructions and waste transfers: appoint one or more people to be in charge and provide written instructions at the control post;

mobile fencing (intermediate site) or permanent fencing with continuous surveillance (long-term site) around the site to prohibit unauthorised access, and display of safety signs (mandatory PPE•, no unauthorised entry) and signs indicating the waste handled by the facility;

organisation of the site into zones, according to the type of waste to be stored, as well as a decontamination zone for machinery, a pre-treatment zone (settling•, draining, sieving/screening), a traffic system for heavy duty trucks, etc., with marking out of the different zones (rope, tape, chains);

traffic management: traffic system (pedestrians, machinery), ideally one-way to facilitate operations and prevention collisions, visible signage to avoid contaminating "clean" zones, speed limit;

specificity for long-term sites: weigh bridge for weighing trucks (incoming/outgoing).

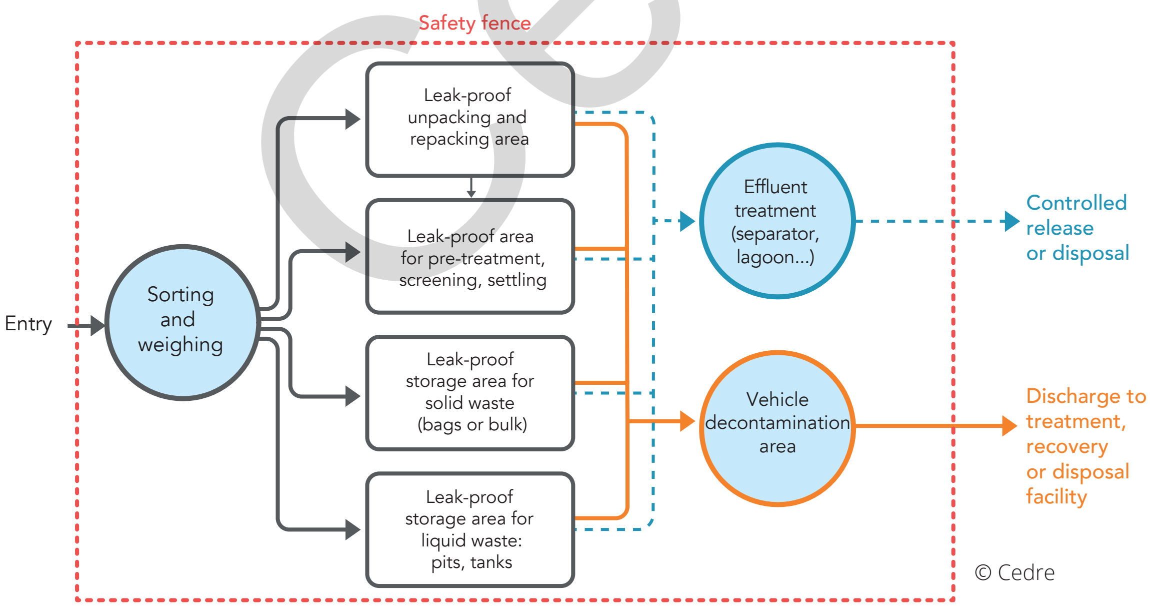


Figure 11: Diagram showing the layout of an intermediate or long-term storage site

Specific preparation:

organisation of storage according to the waste to be stored:

▶ **Practical fact sheet C4**: Segregation at source and appropriate containers:

→ if necessary, repackage or even re-sort the bags, big bags•, skips and containers to be fed into the appropriate streams;

→ create watertight platforms with a simple ground liner for solids and liquids already packaged in bags, big bags•, drums, etc;

→ create a watertight platform with a peripheral bund• or concrete blocks for bulk waste (sediment, debris, etc.);

→ creation of lined pits for large volumes of pastes• (a few 100 to 200 m^3 pits for an intermediate site and 1,000 to 10,000 m^3 pits for long-term sites).

Additional platforms may be prepared as and when they are needed.

protection of the ground and subsoil:

Temporary storage of packaged dry solid waste	Temporary storage of liquid or solid waste in bulk
Objective: to create a contamination barrier below temporary storage facilities	**Objective**: to reinforce waterproofing to protect the subsoil
Watertight surface or surface that has been rendered watertight in reception, storage and handling areas for hazardous substances and waste: use of plastic sheeting laid over a puncture-resistant geotextile• to prevent the sheeting from being punctured, on a prepared surface.	A layer of naturally occurring or added clay (permeability < 10^{-9} m/s) at least 1 m thick, overlaid with a 1.5 mm HDPE• geomembrane•(permeability < 10^{-14} m/s), including overlying and underlying puncture-resistant geotextiles•, with a drainage layer for run-off water. → Contract a specialised company to check the thicknesses, permeability of the clay and/or the laying of the geomembrane• (welded by certified installers).

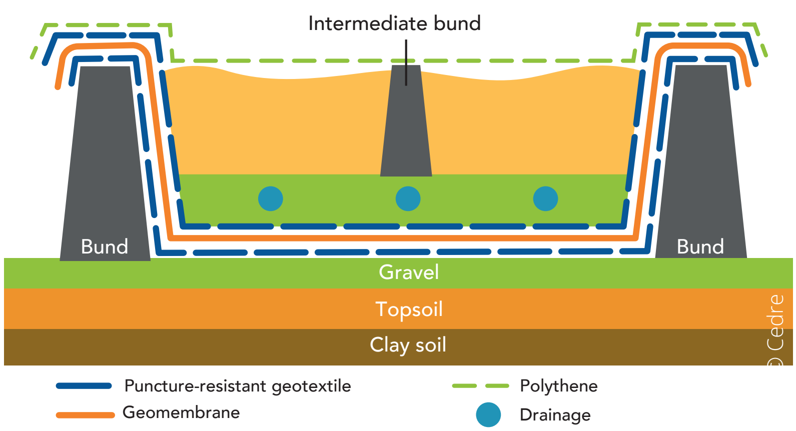


Figure 12: Cross-sectional view of a typical long-term storage site

C7

percolation• and run-off management: protection of storage capacities against rain (lids on containers, tarpaulins on bulk storage capacities if technically feasible, etc.), diversion of rainwater (peripheral trenches) and recovery of contaminated water (percolation• water, decontamination area for machinery, etc.) and evacuation to a treatment station (oil-water separator, lagoon, etc.) prior to discharge or disposal•;

implementation of simple pre-treatment operations to improve selectivity: settling•, screening, washing, etc;

preparation of decontamination areas for vehicles (wheel bath at site exit) and responders;

specificities of a long-term site:

- → reception facilities operational 24/7;
- → provision of a sufficient number of platforms/cells and assessment of their operational duration in order to plan for the opening of new capacities;
- → biogas management: provide vents in the cells for venting.

Waste tracking and evacuation

Keep a daily log (kept on site) recording all movements (incoming/outgoing flows) (computerised if possible to facilitate transmission to the command post).

Incoming waste log				
Storage site identity and address:			Person in charge:	
Date and time	Waste type	Tonnage (estimated or weighed – specify)	Origin	Carrier (name and registration of truck and trailer)
08/10/2021	Liquids	5 tonnes (estimated)	Primary site no.1	
09/10/2021	Heavily polluted sediment	12.8 tonnes (weighed)	Primary site no.2	
...				

Outgoing waste log (waste tracking forms must be compiled						
Date and time	Waste type	Tonnage (estimated or weighed – specify)	Consignee	Waste tracking form no.	Carrier (name and registration of truck and trailer)	Operation scheduled
10/10/2021	Liquids: oil	15 tonnes (weighed)	Refinery xxx	1		R3 (recycling/ reclamation of organic substances)
11/10/2021	Heavily polluted sediment	24.8 tonnes (weighed)	Treatment centre xxx	2		D9 (physico-chemical treatments)
...				3		

Table 8: Example of incoming and outgoing waste logs

** to be completed with the selected waste stream. In Europe, use the codes for disposal or recovery operations (see Annex I of the European Waste Framework Directive 2008/98/EC).*

organisation of transfer to the relevant treatment, recovery• or disposal• streams, once contracts have been signed or the units are up and running, or to a long-term storage site if necessary;

waste monitoring and tracking by completing and checking the transport document.

Discharge control/health and safety

Regularly clean the site (premises, traffic lanes and parking areas), to remove any deposits of hazardous, polluting or combustive materials or dust;

limit dust emissions (covered storage containers) and be particularly careful during loading/unloading and transport operations;

check compliance of wastewater and effluent• discharges with regulations or thresholds established in agreement with the authorities prior to discharge into the natural environment and after any treatment (oil-water separators/sludge traps, run-off lagoon, etc.). Caution: direct or indirect discharge into groundwater and spraying on land prohibited;

conduct regular monitoring (during and after waste input) to ensure there is no impact on the ground (and groundwater). For example, for a long-term site, by placing several piezometers around the outside of the site (at least one upstream, serving as a reference, and two downstream); this should be carried out by an independent organisation.

Site closure/restoration

Clean the site as soon as it is closed down;

dismantle, clean and decontaminate equipment if necessary and remove all structures and materials installed on the site. The waterproofing materials, surfacing and bunds• installed when preparing the site will also be added to the waste to be treated at the end of operations; they can increase the volume of waste by 15 to 30%.

Dismantling of a long-term storage site, removal of tarpaulins lining the base and sides of a pit rehabilitate, ideally within a few months of the end of waste treatment•, the soil, subsoil, access roads, surrounding vegetation and any installations existing prior to the response operations, ensuring that no hazards remain and the site is restored to its prior condition (the costs of any modifications or improvements to the site with respect to its original situation will not be covered by the pollution management budget):

→ ideally, have a survey conducted prior to the use of the site to establish a baseline for comparison with the final condition; if this is not feasible, assess the background contamination in the surrounding area (reference value);

→ conduct initial clean-up (sediment withdrawal, extraction, if necessary) to remove all polluted layers and pockets of pollution, based on visual observation;

→ environmental diagnosis (soil, groundwater) by a third party including:

- mapping of any pollution on the site (extent, depth, concentrations);
- where relevant, a pollution management plan including a cost-benefit analysis and a proposal of clean-up operations to be carried out with the levels to be reached;

→ if necessary, have decontamination operations conducted by a company other than the company that carried out the diagnosis and checks performed by an independent organisation (both diagnosis and control may however be carried out by the same company).

Decisions concerning the implementation of clean-up operations should be made in consultation with the authorities.

Transportation and tracking

Objectives

To ensure the continuity of the logistics chain;

to prevent secondary contamination;

to ensure waste traceability;

to promote the use of local treatment streams.

Precautions

Take into account the characteristics of the category of waste transported (hazardous or not) ► **Practical fact sheet C2**: Waste characterisation/categorisation;

comply with the TDG• regulations in force (see B.5 section Transportation and tracking);

identify certified companies with appropriate vehicles and trained staff ► **Practical fact sheet C1**: Contingency planning;

source the appropriate equipment for loading vehicles, e.g. skip height of up to 4.5 m;

request exemptions from restrictions on weekend and night-time driving if necessary, depending on applicable regulations;

seek expert advice on TDG• regulations.

Transfer from clean-up sites to primary storage sites

Possible means of transport, to be selected according to the site's accessibility and sensitivity, to prevent additional impacts on the environment:

Motor vehicles:

- → light all-terrain vehicles (e.g. quadbikes, rubber tracked wheelbarrows or dumper trucks) which limit the impact in case of soft substrates or sensitive vegetation (dune, heath...);
- → earthmoving equipment, loaders for easily accessible sites with load-bearing soil;

in the case of difficult access or sensitive sites, consider the use of:

→ manual methods or animals (human chain, pack animals...);

→ nautical transport, e.g. barges, pirogues, etc.;

→ air transport, e.g. helicopter.

Transferring big bags by helicopter

Avoid spreading the pollution (secondary contamination):

Organise and mark out pedestrian and vehicle traffic lanes;

protect traffic zones: washable linings or geotextile•, polythene sheeting...

Transfer from storage sites to treatment sites

Responsibilities of the waste shipper:

When dispatching waste from a primary site, the shipper should:

check the category of waste transported with regard to regulations;

ensure that loading personnel are trained and that loading instructions are followed;

check the carrier has the necessary training, authorisations and certification;

use approved containers suitable for transporting the type of waste in question;

hand over the transport document (+ waste tracking form required for hazardous waste) to the carrier;

in addition when transporting several containers (chemical products):

→ check the compatibility of the transported waste;

→ ensure containers are properly wedged and lashed;

in addition when transporting tanks:

→ ensure the tank has been properly cleaned and/or vented before filling;

→ check the tank is properly closed and sealed after loading.

Specificities of chemical spills

do not mix waste that is contained by chemicals:

- → organise loading according to chemical incompatibilities among the waste and use appropriate vehicles;
- → after unloading, clean the tank if the waste in the next load is liable to be incompatible or to affect the waste treatment process;

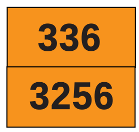
comply with safety instructions: wear PPE•, no smoking, stop engine during loading/unloading operations, implement good handling practices, etc.

Possible means of transport, to be selected according to:

the nature of the waste (liquid, solid), its packaging and its hazardousness;

the TDG• regulations in force, with the necessary signage:

- → packaging, labelling, identification of each container in compliance with TDG regulations;
- → hazard labels, at least 100 mm × 100 mm, for tank vehicles and small containers of less than 3 m^3;
- → orange plates with the product hazard identification number and the UN number• to identify the type of product concerned: for full tank containers, empty tank containers, bulk containers, general purpose containers, tank vehicles, bulk vehicles and all other vehicles involved in the transport of dangerous goods;



the volume to be transported. River/sea and rail transport can be good options for very large volumes (a whole train can carry up to 2,000 tonnes of waste, a ship up to 5,000 tonnes, compared to a maximum of 40 tonnes for a truck);

site contraints: access, bearing capacity, sensitivity;

distances to be covered.

Avoid spreading the pollution (secondary contamination):

Make sure vehicles using public roads are clean: vehicle decontamination area to be set up at the storage site exit (wheel bath/do not overlook the importance of cleaning truck tyres);

for solid waste, use leak-proof, lined capacities, approved for transporting waste: this ensures that no leakage will occur during transport and that there are no safety hazards (check the integrity of the vehicle

Decontaminating a vehicle before it leaves the storage site and check it is leak-proof if a fault is identified).

In an emergency, non-specialised vehicles may be used if an exemption is granted by the authorities.

Oil leakage from a non-watertight truck

Traffic system

In the event of a major spill, a vehicle traffic system must be set up to minimise impacts on road safety and disturbance for local residents, due to the traffic and the hazardous nature of the waste (odour, flammability, toxicity): marking out of traffic lanes to avoid inconvenience, a one-way system in the case of narrow roads, etc.

If necessary, roadworks may be undertaken to allow for the traffic (taking into account the width of the vehicles, the bearing capacity of the roadways, spaces required for waiting and manoeuvring).

Queue of lorries for waste evacuation, near homes

Traceability

A waste transport document should be systematically present in every vehicle transporting waste from a temporary storage site to the treatment or disposal• facility, for traceability. This document is also an effective tool for establishing a material balance.

Every person involved (producer, collector, treatment site) completes and signs a section of the document and keeps a copy. Once this document has been fully completed (waste treated), it is returned to the waste producer and must be kept for at least 5 years (or more if there is a risk of litigation).

This transport document includes:

- information about the issuer of the document: identification of the clean-up site, the waste producer, name of the storage site supervisor in charge of managing the operation, destination and type of treatment envisaged;
- the characteristics of the waste: code/name based on the waste nomenclature if available (applicable regulations), volume and type of waste;
- information about the carrier: name of the company and driver, type of vehicle, licence number if legally required;
- information on the destination facility: name, contact and certificate of receipt (type and volume of waste).

C8

WASTE TRACKING FORM	**Incident:**	**Form number:**
PRODUCER		
Contact		
Company name: Address:	Tel.: Fax: Email:	Person in charge: Tel.:
Waste delivered		
Type of waste (oil•, oil & sand, etc.) Quantity of waste (tonnes or m³)	Consistency: □ Liquid □ Paste □ Solid	Type of packaging: Packaging/registration number:
Destination		
Facility name: Address of facility:	Facility manager: Tel.:	Type of operation by facility: □ Storage □ Pre-treatment □ Final disposal
Notes:	I hereby certify that the above information is correct, and that the material is accepted for transport in accordance with national transport regulations.	Date of shipment: Name: Signature:
CARRIER		
Contact		
Company name: Address:	Tel.: Fax: Email:	Type of vehicle: □ Rigid truck □ Articulated truck □ Other Registration number:
Waste transported		
Type of waste (oil•, oil & sand, etc.) Quantity of waste (tonnes or m³)	I hereby certify that the above information is correct, and that the material is accepted for transport in accordance with national transport regulations.	Removal date: Delivery date: Name: Signature:
CONSIGNEE		
Contact		
Company name: Address:	Tel.: Fax: Email:	Person in charge: Tel.:
Waste received		
Type of waste (oil•, oil & sand, etc.) Quantity of waste (tonnes or m³)	Consistency: □ Liquid □ Paste □ Solid	Type of packaging: Packaging/registration number:
Operations implemented		
□ Sorting □ Pooling	□ Pre-treatment Specify:	□ Final disposal Specify:
□ Waste rejected. Specify reason(s):	I hereby certify that the above information is correct and that the waste has been received	Date: Name: Signature:

Table 9: Waste tracking form template

Pre-treatments and treatments

C9.1 Generalities

Definitions

Many options exist for waste pre-treatment, treatment, recovery• and disposal•.

Pre-treatment operations facilitate overall waste management:

- minimisation of volumes;
- preparation for treatment (wider range of options in terms of waste streams);
- reduction of volumes incinerated or sent to landfill and increase in volumes recovered.

In addition to being carried out at specific treatment sites, these operations can also be carried out at the collection• site or at storage sites (primary, intermediate or long-term).

Certain waste items/products collected then become immediately recoverable for:

- direct industrial use;
- recycling• by industry: liquid waste sent to a refinery, distillation and refining of solvents, energy production for certain types of flammable waste, recovery of metals (destroyed containers).

Other types of waste can be recovered after being treated. In accordance with the waste hierarchy•, treatment solutions that lead to recovery• (materials, energy) should be prioritised over landfill or incineration without energy recovery•.

The main options for pre-treatment, recovery•, treatment and disposal• are presented in the following figure.

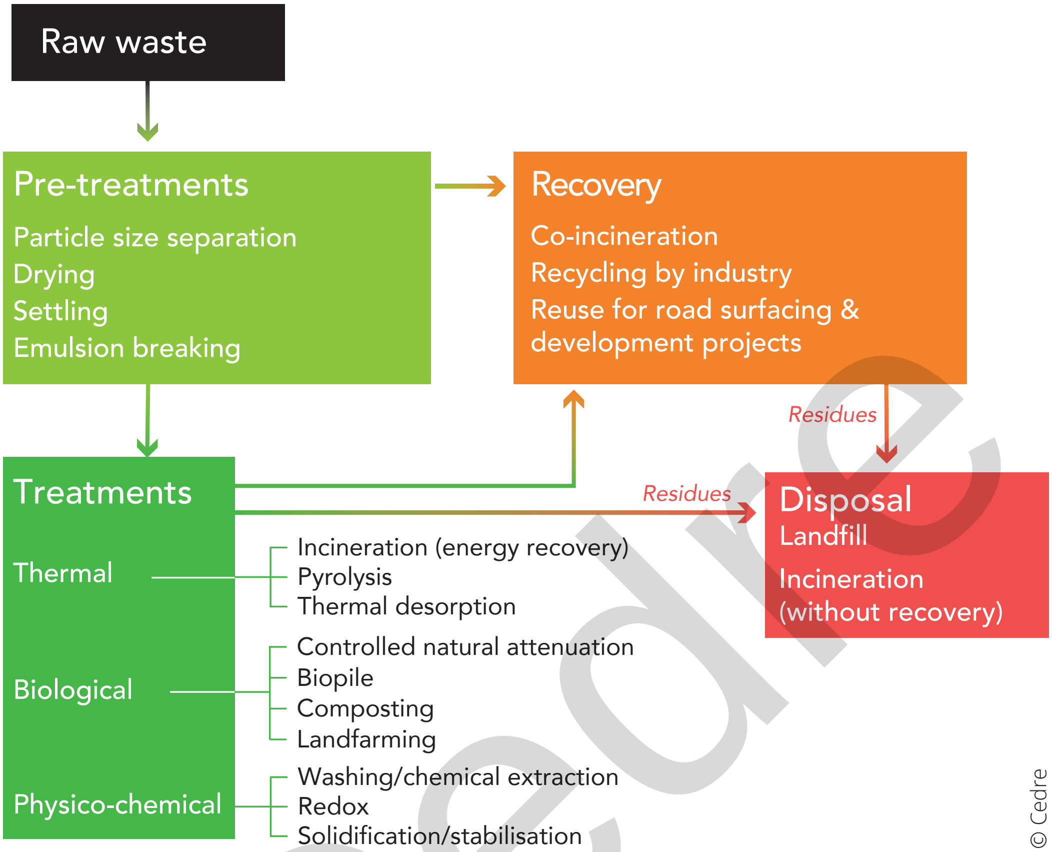


Figure 13: Summary of waste pre-treatment, recovery, treatment and disposal options

Choice of techniques

The choice of technique or successive techniques will be based on a multi-criteria analysis that takes into account the characteristics of the waste (nature, consistency, volume), the existing facilities (location, throughput and capacity), timeframes, as well as environmental considerations and regulatory restrictions. The following table shows the possible streams for each waste type; the techniques are described in more detail on the following pages to provide insight into the complexity and cost of the processes and to emphasise once again the importance of minimising the volume of waste.

Waste category			Mixtures		Liquid waste		Solid waste								
			Pollutants/solids	Water/pollutant	Mainly pollutant	Mainly water	Pastes*	Mainly pollutant (little sand)	Vegetation	Litter*	Heavily polluted sediment	Lightly polluted sediment	Stones, pebbles	Damaged or used response equipment	Animal carcasses
Pre-treatment		Particle size separation*	✓					✓	✓	✓	✓	✓	✓		
Pre-treatment		Drying							✓						
Pre-treatment		Settling* (on site or at a deballasting station*)	✓	✓	✓	✓									
Pre-treatment		Emulsion breaking*		✓	✓		✓								
Energy recovery		Co-incineration* as fuel			✓		✓	✓	✓	✓				✓	
Energy recovery		Co-incineration* as matter										✓			
Energy recovery		Recovery* by industry			✓										
Treatment	Thermal	Incineration (facility for hazardous waste)			✓		✓	✓	✓	✓	✓			✓	✓
Treatment	Thermal	Incineration in a household waste incineration plant					✓	✓	✓	✓				✓	✓
Treatment	Thermal	Pyrolysis					✓	✓	✓		✓				
Treatment	Thermal	Thermal desorption*									✓				
Treatment	Biological	Controlled natural attenuation										✓			
Treatment	Biological	Biopile										✓			
Treatment	Biological	Landfarming										✓			
Treatment	Biological	Composting										✓			
Treatment	Physico-chemical	Washing								✓	✓	✓	✓	✓	
Treatment	Physico-chemical	Chemical extraction									✓				
Treatment	Physico-chemical	Redox (chemical pollution only)									✓	✓			
Treatment	Physico-chemical	Solidification/stabilisation					✓	✓			✓				

* for small quantities and subject to acceptance

Table 10: Overview of possible streams by waste category

Residual waste remaining after recovery* or treatment operations will be disposed at landfill sites or by incineration without energy recovery*.

Procedure

To find existing waste streams, up-to-date documentation is not always available. It is therefore recommended to contact the authorities in charge of waste management.

In some cases, treatment operations may be carried out in situ or on site, subject to compliance with the relevant regulations and after obtaining the necessary authorisations.

Ideally, streams should be pre-selected during the contingency planning phase (advance contracts). In the case of off-site treatment, a pre-acceptance request should be submitted to the chosen facility: a document, and if possible a sample, should be sent to characterise the waste. Generally, an acceptance certificate will be sent in return, confirming that the facility accepts the waste. A valid acceptance certificate number should be indicated on the transport document to facilitate processing at the treatment centre.

The practical fact sheets on the following pages describe the different pre-treatment, treatment, recovery and disposal techniques in more detail.

The costs indicated are based on past experience of treatment operations carried out in France (excluding collection•, prior sorting and transport costs) and are given per tonne (t) excluding tax.

C9.2 Pre-treatments

Particle size separation

With particle size separation•, the different fractions are sorted according to their size, density or surface properties, mainly by mechanical action but water can also be added. Several potential successive operations can be performed (depending on the particle size distribution and the required fineness of separation): pre-screening or calibration, magnetic separation, disaggregation unit or decompactor, screening, sieving, centrifugation, gravity separation by settling, filtration and dehydration of fine particles, etc.

Examples of applications: solid/liquid separation, sediment/pebble separation, sorbent• wringing, separation of liquids from litter, separation of clean sediment from tarballs, draining of vegetation...

⊕ minimisation of the volume of polluted materials, thereby reducing costs and facilitating recovery•.

⊖ collection• and treatment of effluent•.

Possibility of mobile unit on site: feasible with available resources (custom-made).

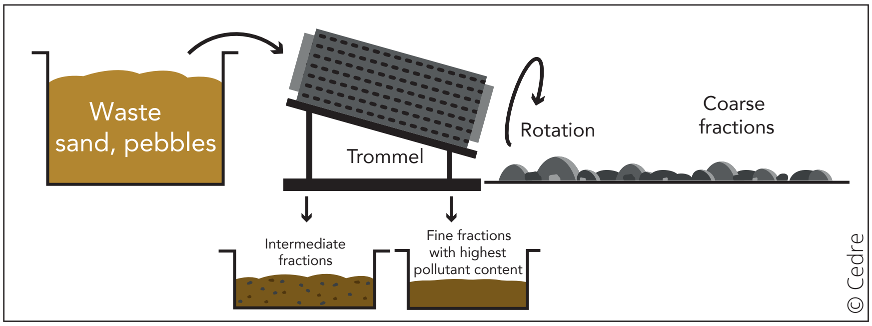
Improvised separation system: screened funnel and separation of oil and litter

Custom-made sediment/oil separation system using the flushing technique

Cost (SelecDEPOL, 2020): €8/t (custom-made installation) to €80/t (industrial facility), according to the quantity of materials to be treated.

Final destination:

Solids → treatment or recovery• option appropriate to each fraction;
Water (if water is added or from separation operations) → recycling• (closed loop) or natural environment (controlled release, possibly after treatment).



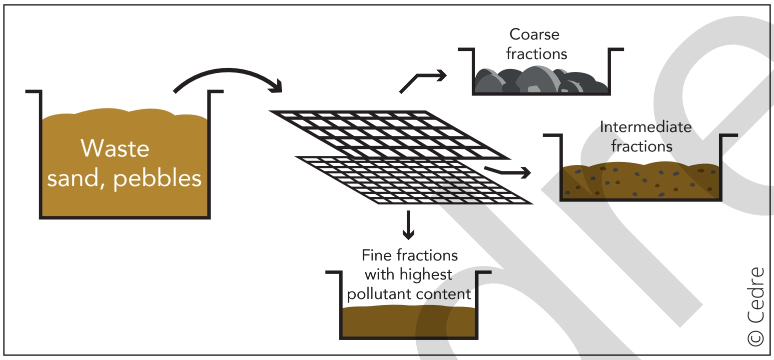


Figure 14: Diagrams showing different types of particle size separation

C9.2

Drying

Natural drying (evaporation• of water) of vegetation may be necessary prior to incineration. The vegetation is piled in layers with a maximum height of 20 cm, for example in 2 m by 2 m piles. It may dry very quickly according to the climate (a few days).

⊕ up to 50% weight reduction, thereby reducing processing costs.
⊖ odours, risk of fermentation.

Possibility of mobile unit on site: custom-made structure.

Cost: €0, excluding site preparation (especially waterproofing).

Final destination: incineration, co-incineration•, pyrolysis.

Custom-made drying/draining system: plant debris placed on a grid over an IBC

Settling

Settling• is a technique used to separate a floating phase (pollutant) from water, and sometimes also sediment (that sinks). In the case of large volumes, this operation can be implemented at a deballasting station• provided the sediment content is low.

⊕ waste minimisation, can break an unstable emulsion•.
⊖ controlled decanting of free water.

Possibility of mobile unit on site (appropriate containers with drainage valve).

Cost (REMPEC, 2011): €50/t.

Final destination:
Pollutant → treatment or recovery• (nearly pure liquids),
Water → natural environment (controlled decanting, possibly after treatment).

On-site settling

Emulsion breaking

Emulsion breaking• is a technique used to separate water from a pollutant either by a thermal process followed by settling• or by the use of demulsifying agents.

⊕ waste minimisation (an emulsion• can contain up to 50-80 % water).
⊖ feasibility dependent on the product's flash point (as the emulsion must be heated to between 60 and 66 °C) and the toxicity of the demulsifying agent.

Use of a mobile unit on site not possible

Cost (REMPEC, 2011): < €50/t.

Final destination:
Pollutant → treatment or recovery• (nearly pure liquids);
Water → natural environment (controlled release, possibly after treatment).

In practice, over and above screening and static settling• operations which can easily be implemented at primary or intermediate storage sites, the final treatment of liquid waste by phase separation is generally not feasible on site; it should be carried out by deballasting stations or appropriate treatment facilities.

C9.3 Recovery

Co-incineration (recovery as fuel)

Incorporation of contaminated waste as a fuel source:

recovered liquid waste is mixed with clean fuel;

solid contaminated waste (wood, plastic, litter) can be used as an alternative fuel in furnaces.

Several cement plants are capable of disposing of hazardous waste.

⊕ recovery•.
⊖ treatment of atmospheric releases (strict rules, in particular refusal of PVC, chlorine if >1%), the presence of salts causes corrosion of the system (refusal of liquids with more than 0.1 to 0.5% salt).

Cost: for soil, average costs of €45-55/t (SelecDEPOL, 2020); for sludge, €80-160/t (DUNOD, 2016); for other waste, around €90/t (DUNOD, 2016 data).

Co-incineration (recovery as material)

Use of lightly contaminated sand as an alternative raw material.

Some cement plants have been specially adapted to use waste from large spills.

⊕ recovery• and resource savings.
⊖ pollutant content must not exceed 5,000 ppm•.

Cost (REMPEC, 2011): €30 to 150/t according to the condition of the waste.

Recycling by industry

Incorporation of recovered oil or chemicals (nearly pure) as a product (e.g. in a refinery).

⊕ recovery•.
⊖ very low level of impurity or mixture with water required, reluctance by industrial firms.

Cost: no data.

Reuse for road surfacing or development projects

Most treatments leave residues• (clinker•, ash, sludge, etc.) and/or treated soil that may be very lightly contaminated.

These materials, or part of them, may be reused for road surfacing or as backfill for development projects, depending on their physico-chemical characteristics and according to the regulations in force.

C9.4 Thermal treatments

The majority of thermal treatments are applicable to any type of waste resulting from a spill and in particular for high concentrations of pollutants. Pre-treatment will often be necessary (grinding, drying, etc.).

⊕ energy recovery• (heat, electricity), minimisation of the volume of residual waste (up to 90% depending on the techniques used), mitigation of risks related to the hazardous nature of the substances involved.
⊖ cost and reinforced treatment of atmospheric emissions, unavailability and restrictive eligibility criteria (quantity per day, size of waste items, etc.) of facilities in certain regions or countries.

Incineration

Incineration consists in aerobic combustion (in the presence of air) in a furnace at very high temperatures (870 to 1,200°C) at which organic pollutants are destroyed and converted to water vapour, carbon dioxide and combustion residues• (ash). Several solutions exist:

- industrial incinerator specialised in the treatment of hazardous waste;
- power station;
- lime kiln (tighter acceptance criteria);
- household waste incineration unit (according to regulations and authorised waste, possible derogation for small volumes or lightly contaminated waste such as litter, PPE•...).

⊕ energy recovery• (heat, electricity), applicable to all types of pollutants with the exception of radioactive compounds, provided that the system for treating atmospheric emissions is suited to the waste to be treated (refusal of PVC, chlorine).

⊖ the presence of sea salt causes corrosion of the system.

Note: an incineration unit with insufficient energy efficiency is considered to be a disposal• technique and not a treatment option.

Possibility of mobile unit on site: within a specific facility and for specific situations (difficult access site remote from all sensitive areas).

Note: open-air burning is not recommended because of the atmospheric emissions generated (tar residues•, toxic fumes) and is prohibited in many countries. It may be considered in an area that is difficult to access and remote from all uses, for waste such as vegetation or lightly contaminated debris, after obtaining permission from the authorities. For example, in the case of the *Prestige* spill, only certain local authorities issued a derogation for the open-air burning of lightly contaminated driftwood.

Mobile incineration unit

C9.4

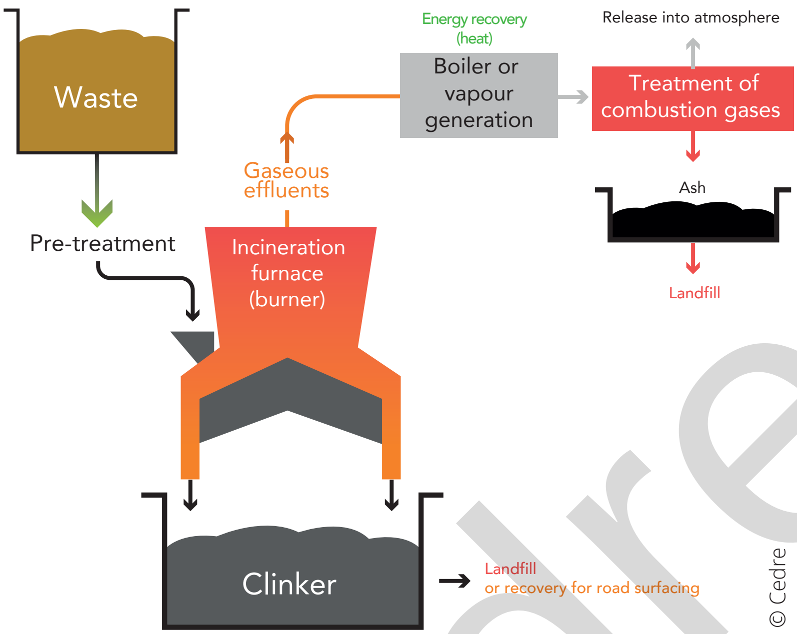


Figure 15: Diagram showing the principle of incineration

Costs (SelecDEPOL, 2020): average cost of €250 to 450/t off-site for polluted soil; €80 to 110/t at a household waste plant (DUNOD, 2016).

Final destination of residues•:

Clinker•, residues from the purification of incineration fumes from household waste• (ash, soot) → Stabilisation followed by burial in a certified landfill site (recovery• not possible),

Effluent• (drainage of clinker, leachate from waste during storage...) → Wastewater treatment plant.

Derived process for liquid waste: evapo-incineration. This is a thermal cracking process in which the water phase of a water/oil mixture is evaporated. Following the evaporation• of the water, a hydrocarbon condensate can be collected and can be easily incinerated. Water in the vapour phase undergoes a high temperature thermal treatment to remove the residual organic phase.

Cost (DUNOD, 2016): €80 to 160/t off site.

Pyrolysis

The pyrolysis process consists in extracting pollutants (desorption• and then conversion of the pollutants to the gas phase) by heating to temperatures ranging from 150 to 540°C (low pyrolysis) to 1,200 to 2,000°C (high pyrolysis), in the absence of oxygen.

This technique is suitable for treating organic waste, but also soil/sediment rich in organic matter that is highly contaminated with semi-volatile or low-volatility compounds: heavy oil fractions, oils, pesticides, PCBs•, dioxins, furans, PAHs•, refinery residues•, etc.

⊕ applicable on waste with high concentrations of salts, chlorine, nitrogen, sulphur; less advanced treatment of atmospheric emissions than incineration; more recovery• possibilities than with incineration.

⊖ few existing facilities (recent technology); pre-treatment required to reduce input waste size (additional cost of €25-75/t – DUNOD, 2016).

Possibility of a mobile unit on site.

Cost (SelecDEPOL, 2020): €75 to 150/t for an off-site pyrolysis process for soil treatment.

Final destination of residues•:

Solid residues• → material recovery• or, failing that, disposal• by burial at a certified landfill site (the type of facility will depend on the degree of residual contamination);

Liquid residues• (viscous water/oil mixture) → oil industry or co-incineration• (fuel);

Gas residues• → recycling• by burning for the thermal requirements of the facility.

Thermal desorption

Thermal desorption• consists in extracting volatile and semi-volatile pollutants (desorption• and then conversion of the pollutants to the gas phase) by heating the soil/sediment to temperatures ranging between 90 and 560°C:

LTTD (Low Temperature Thermal Desorption): at low temperatures (90 to 320°C) for organic pollutants,

HTTD (High Temperature Thermal Desorption): at high temperatures (320-560°C), usually combined with other treatment techniques (stabilisation, incineration).

This treatment applies to soil/sediment or sludge heavily contaminated with volatile and semi-volatile organic compounds, which may or may not be halogenated.

⊕ conservation of physical and even biological soil properties (LTTD), recovery• possible.

⊖ the hydrocarbon content must be less than 50,000 ppm•.

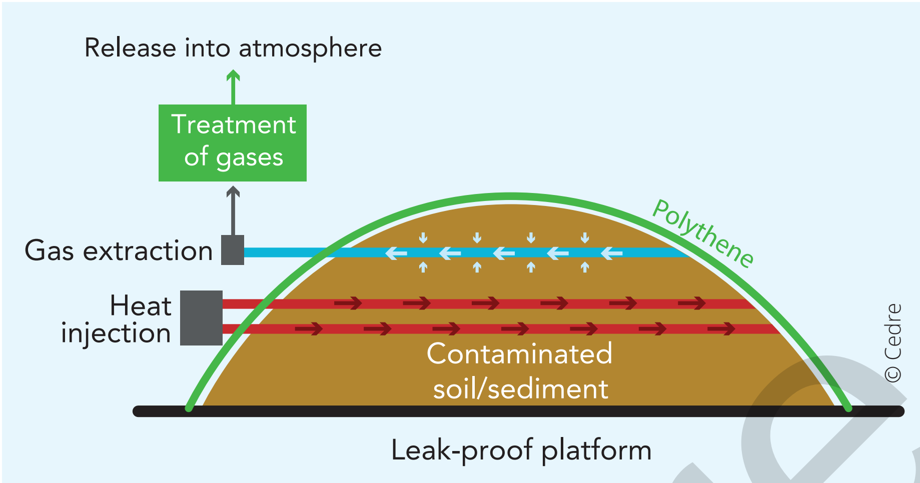


Figure 16: Diagram showing the principle of thermal desorption

Treatment of polluted soil by thermal desorption - Pile in the process of being treated

C9.4

Possibility of a unit on site.

Cost (SelecDEPOL, 2020): average of €80 to 100/t excluding on-site electricity consumption (profitable on site for volumes exceeding 25,000 tonnes); €80 to 125/t off-site.

Final destination: possible return to the natural environment or recovery• (backfill) and, failing that, disposal• by burial at a certified landfill site (the type of facility will depend on the degree of residual contamination).

C9.5 Biological treatments

Biological treatments are tried and tested techniques that are well known to many spill response operators.

⊕ cost, works effectively on a large number of organic pollutants.

⊖ the oil content must generally be below 20,000 ppm•, treatment time particularly if carried out on site (a few months to years), effectiveness dependant on the biodegradability of the pollutant.

Controlled natural attenuation

Natural process, without human intervention, which reduces the mass, toxicity, mobility, volume or concentration of pollutants. This technique is only acceptable for residual and biodegradable pollution and is sometimes preferable when response operations are liable to have a greater environmental impact than the pollution itself. The natural processes considered include:

destructive processes: biodegradation•, photo-oxidation, hydrolysis,

non-destructive processes: dispersion•, dilution, evaporation, adsorption•.

⊕ can be implemented in situ.

⊖ can be difficult to accept from public and environmental points of view and needs to be explained and monitored in the long term.

Cost (SelecDEPOL, 2020): €12 to 65/m² (study, monitoring).

Biopile

The biopile involves building windrows with polluted soil/sediment, to perform biological treatment (bioremediation) by amendment (structuring agents such as compost which promotes aeration and biostimulation) under controlled conditions (aeration, humidification, nutrient addition, collection• of leachates• and gases).

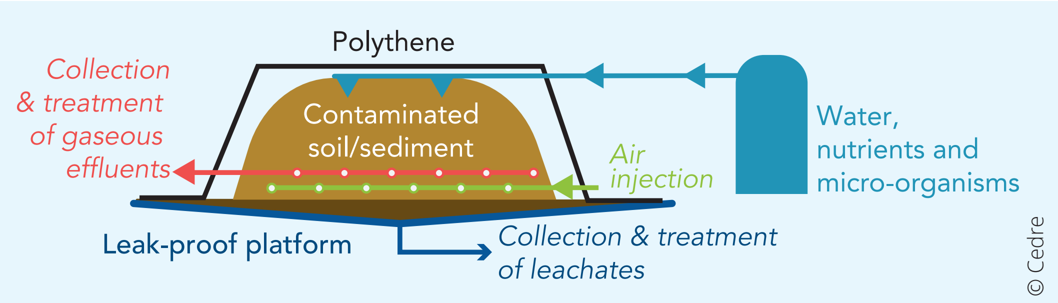


Figure 17: Diagram showing the principle of a biopile

⊕ suitable for oil products such as diesel, light crudes, light fuel oils, kerosene.

⊖ resistance of substances such as halogenated VOCs•, pesticides, heavy oil fractions (PAHs•, organic mineral oils, resins and asphaltenes•), pre-treatment required to homogenise the soil.

Possibility of on-site treatment.

Cost (SelecDEPOL, 2020): average of €36 to 50/t on site, €45 to 55/t off site.

Final destination: possible return to the natural environment or recovery• (backfill) and, failing that, disposal• by burial at a certified landfill site (the type of facility will depend on the degree of residual contamination).

Landfarming

This technique consists in spreading polluted soil/sediment in a thin layer (ideally 2 to 10 cm, maximum 30 cm) over large areas, to stimulate interaction between the polluted matrix and the atmosphere. The aim is to promote aeration and therefore aerobic degradation. The pollutants are degraded by oxidation (regular ploughing to ensure aeration) and biologically through the addition of nutritional supplements (minerals and fertilisers).

⊕ suitable for light pollutants (BTEX•, phenols, light PAHs• such as naphthalene and phenanthrene, petroleum products: petrol, diesel, light lubricants, biodegradable mineral oils).

⊖ large surface area required, resistance of resins and asphaltenes•, management of leachate• and/or percolation• water.

Possibility of on-site treatment.

Cost (SelecDEPOL, 2020): €13 to 25/t on site, €13 to 35/t off site.

Final destination: possible return to the natural environment or recovery• (backfill) and, failing that, disposal• by burial at a certified landfill site (the type of facility will depend on the degree of residual contamination).

Composting

Composting consists in mixing solid organic waste (vegetation, etc.) with organic amendments (known as compost) and arranging them in windrows to promote biodegradation•. Composting is carried out in the open air or in a shed, with mechanical turning, forced aeration and the addition of organic amendments and nutrients.

⊕ suitable for light pollutants (BTEX•, phenols, light PAHs• such as naphthalene and phenanthrene, petroleum products: petrol, diesel, light lubricants, biodegradable mineral oils).

⊖ increased volume of waste, resistance of resins and asphaltenes•.

Possibility of on-site treatment.

Cost (SelecDEPOL, 2020): €15 to 40/t for soil, €8 to 35/t for green waste (DUNOD, 2016).

Final destination: possible return to the natural environment by spreading or other recovery• and, failing that, disposal• by burial at a certified landfill site (the type of facility will depend on the degree of residual contamination).

C9.6 Physico-chemical treatments

Physico-chemical treatments have the advantage of being applicable to different types of pollutants and may be of particular interest in the case of chemical spills.

⊕ suitable for chemical spills or pollutants that are resistant to other techniques.
⊖ potential difficulties for the recovery• of the treated materials.

Washing/chemical extraction

Washing with water is a common process after particle size separation•. The contaminants adsorbed on fine particles, previously separated from the coarse particles, are transferred to the aqueous phase (or extracting solution). This contaminated solution is then treated. In order to increase the transfer of pollutants from the fine particles to the water, it is common practice to add chelating agents•, adjust the pH and add surfactants (solution formation and chemical extraction). In the case of chemical extraction, there are two different techniques:

chemical extraction, through which metal pollutants are dissolved in water;

solvent extraction, which is more specifically suited to organic pollutants.

⊕ suitable for substances for which other techniques are ineffective (PAHs, PCBs•, dioxins and furans, pesticides).
⊖ difficulties related to the recovery• of treated materials due to the change in texture and moisture content of the materials, potential need for further treatment to remove traces of solvents.

Possibility of a mobile unit on site.

Cost (SelecDEPOL, 2020): €80 to 285/t, costly for small quantities (chemical extraction profitable on site for volumes exceeding 10,000 tonnes).

Final destination:

Pollutants (sludge) → treatment followed by recovery• or disposal• by burial at a certified landfill site,

Polluants (oil) → recycling• by oil industry;

Treated soil/sediment: return to the natural environment possible or recovery• (backfill) and, failing that, disposal• by burial at a certified landfill site (type of facility will depend on the degree of residual contamination);

Wash water/extractants → recycling• (closed loop) or treatment.

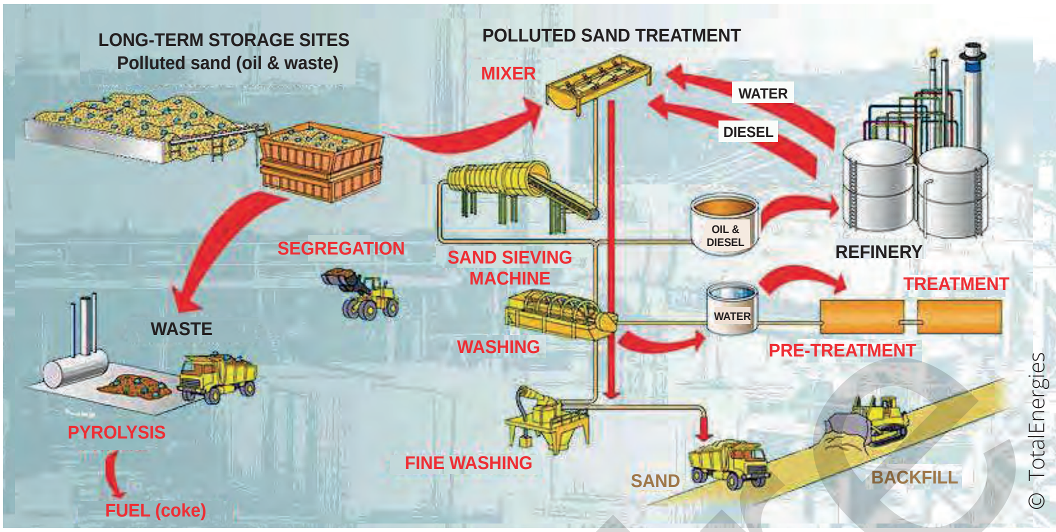


Figure 18: Simplified diagram of the washing process applied during the Erika *spill*

C9.6

Application: the *Erika* spill

The equipment needed to treat the 272,000 tonnes of waste from the *Erika* spill in December 1999 (waste collected including materials from storage sites) was installed on land belonging to the Donges refinery (TotalEnergies).

The diesel and water used for fluidisation and washing processes were supplied directly by the refinery.

At the end of the treatment process, the sand and gravel, separated by sand screening, were washed then recovered by use at public works sites. Litter and debris recovered after mechanical and manual sorting was washed and ground, then incinerated as ordinary industrial waste.

After filtering in a filter press, the sludge was recovered to be used as backfill after thermal treatment or treatment in a cement works. Petroleum products (fuel oil and diesel) were recycled at the Donges refinery. The process water was also sent to the refinery, to the wastewater treatment station.

Redox (mainly for chemical pollution)

Oxidation-reduction processes convert pollutants to more stable, less mobile or inert substances. The process involves creating an intimate mixture of oxidants/reducers and homogenised soil. The first steps are similar to those of washing (separation) followed by oxidation-reduction of the pollutants in stirred tanks in order to promote contact between the polluted soil/sediment, the water and reagents (oxidants or reducers).

⊕ suitable for inorganic pollutants, particularly cyanide and chromium.

⊖ difficulties related to the recovery• of treated materials due to the change in texture and moisture content of the soil; potential need for further treatment to remove traces of solvents; not suitable for grease or mineral oils.

Possibility of a unit on site.

Cost (SelecDEPOL, 2020): average of €60 to 90/t, cost proportional to pollutant content.

Final destination:

Treated soil → return to the natural environment possible or recovery• (backfill) and, failing that, disposal• by burial at a certified landfill site (type of facility will depend on the degree of residual contamination);

Reagents → recycling• (closed loop) or treatment.

Solidification/stabilisation

This process aims to trap pollutants in order to reduce their mobility. The pollutants are either physically bound, included in a stabilised matrix or chemically bound. There are two stages:

solidification: consists in physically binding or trapping pollutants within a stable, hard, inert mass. The aim is to reduce contact between water and the pollutants mainly by reducing the porosity (reduction in permeability);

stabilisation: consists in reducing the solubility or increasing the chemical fixation of a pollutant to make it less mobile.

Various additives can be used:

cementitious materials: cement, pozzolan•, hydraulic slag•, lime;

organophilic clay substrate;

thermoplastic material.

⊕ easy to implement in the absence of other treatment infrastructure; greatly reduced environmental impact thanks to leachate stabilisation; can be coupled with geotechnical requirements for reuse.

⊖ pollutant still present; increased volume of waste; reduced efficiency in the case of significant amounts of soluble salts (chlorides, sulphates, etc.); treatment accompanied by an exothermic reaction (risk of fire in the presence of highly concentrated pollutant).

Possibility of a unit on site.

Cost (SelecDEPOL, 2020): average of €45 to 75/t on site, €180 to 250/t off site (including final disposal• by burial at a certified landfill site) for soil.

Final destination: recovery• (backfill) in compliance with national regulations and, failing that, disposal• by burial at a certified landfill site (the type of facility will depend on the degree of residual contamination).

Lime treatment by mechanical mixing

C9.7 Disposal

The disposal• option should only be used as a last resort, mainly for residues• from treatment, for collected waste for which no treatment is feasible, or where there is no existing facility.

Waste is disposed of in landfills according to its degree of pollution and leaching potential:

- landfill site for hazardous industrial waste (with or without prior stabilisation-solidification);
- landfill site for non-hazardous waste, for instance household waste and other assimilated waste;
- landfill site for inert waste.

⊕ suitable for mixed waste.

⊖ pollutant content acceptance thresholds (for raw waste and leachates•) to be respected for each waste stream as well as the water content < 30%.

Average cost (SelecDEPOL, 2020): €105 to 140/t at hazardous waste landfill site; €52 to 85/t at non-hazardous waste landfill site; €10 to 20/t at inert waste landfill site (costs will vary according to the supply/demand context).

Specificities of small-scale spills

It is not uncommon for municipalities to be faced with small-scale pollution of unknown origin: balls of oil, paraffin or vegetable oils that have weathered at sea washing up on the shoreline following operational discharges, dumping of waste oil in a watercourse, etc.

As the polluter is unidentified, the organisation and cost of clean-up operations are often borne by the municipalities. In terms of resources, they may be able to call upon the fire brigade, intermunicipal bodies (which may be responsible for household waste management), a higher authority (e.g. county council) or even private resources. They can also seek advice from the relevant national bodies and expert organisations (e.g. Cedre).

Small-scale strandings on the shoreline: palm oil/paraffin

Objectives

To help the competent authorities to anticipate the challenges associated with the management of collected waste, in terms of organisation and cost.

Precautions

Assess whether it is indeed a small-scale incident: feedback has shown that in the majority of cases, these "small-scale strandings" affect a single municipality, and that the deposits occur on a single occasion. In rarer cases, several municipalities may be affected simultaneously.

Where they exist, local emergency plans should be consulted;

refer to the MRCC• and the authorities which, if necessary, will consolidate the different reports;

characterise the product and assess the associated risks in order to implement the appropriate management measures;

be selective during collection• operations and avoid secondary contamination

▶ **Practical fact sheet C3**: Waste minimisation

Who is in charge of managing the response?

The local authority is generally in charge of emergency operations, in as far as they have sufficient response resources and as long as the incident does not extend beyond the boundaries or exceed the capacities of the municipality.

In the case of larger-scale incidents that may affect several municipalities, the local authority may seek support from other entities (e.g. higher authority, intermunicipal body, fire brigade, protected area managers, government services, etc.) to overcome difficulties in mobilising the resources required to manage the incident and subsequently the waste, and, in particular, to reduce the associated costs (sharing of human and material resources, and/or joint waste management).

See the Cedre Operational Guide entitled "Local Authorities' Guide: What to do in the event of a spill"

Product identification

▶ **Practical fact sheet C2**: Waste characterisation/categorisation

visual analysis (may be sufficient) and surveys by trained operators;

consultation of labels in the case of packages (containers, drums, etc.);

sending of photos and/or samples to a specialised laboratory for confirmation or to obtain more detailed information on the product/waste (SDS•, risks...).

Assessment of product behaviour and risks

Examples:

- *Heavy fuel oils: impact due to adhesion and coating (plumage of seabirds), low risk of significant contamination of water, sediment and fauna (low solubility and small quantities).*
- *Paraffin and vegetable oils: transported in liquid state, they congeal when released. Non-hazardous products but possible risks for children and animals in case of ingestion when washed up on beaches.*

Assessment of specific measures to be taken for waste management (techniques and means of transport/storage, PPE•, disposal• option, etc.).

C10

Health and safety

Objective: to prevent health risks

protection of the population: closure of the areas affected by the strandings until collection operations are complete, and information of the population (information boards);

protection of operators: provision of personal protective equipment suited to the type of operations, including at least boots and gloves, with additional equipment according to the risk assessment of the product to prevent exposure through skin contact, inhalation or ingestion (overalls, oil- or chemical-resistant gloves).

Mobilisation of personnel and spill response equipment

Mobilisation of resources (equipment and personnel) belonging to the municipality, inter-municipality, regional authority, fire brigade or private companies;

depending on the scale of the incident, a request for equipment managed at national level (PPE•, consumables, containers, etc.) may be made by the local authority, particularly if there is an agreement in place with a national stockpile, while the costs will remain the responsibility of the local authority;

particular vigilance is necessary in relation to the selectivity of the recovery equipment mobilised (e.g. do not pump up a mixture consisting mainly of water, do not collect too much sand) in order to reduce the transport and treatment costs which will be invoiced to the local authority if the polluter has not been identified.

Waste storage/transport

Packaging in appropriate containers, based on the recommendations set out in the SDS• if available and/or according to appearance (e.g. leak-proof if fluid) → plastic bags (balls of vegetable oil) or woven bags (paraffin), buckets, bins, watertight big bags• (oil, mineral oils) or watertight skips;

identification of a temporary storage area for waste pending evacuation: choose a safe area (often a municipal area) and, for oil pollution, a watertight area (concrete surface, car park, lined with tarpaulin or geomembrane•, etc.) or a retention area, with collection• of polluted effluents• (e.g. civic amenity site, household waste transfer centre, technical services, etc.);

use of appropriate means of transport that comply with TDG• regulations (e.g. lined, leak-proof dump trucks, ADR• signage if necessary).

Disposal

pre-select disposal facilities during the contingency planning phase if available;

contact government services for advice;

apply the sorting, recycling• or disposal• policy in force in the area/country concerned;

contact the usual hazardous waste management contractors and/or local disposal facilities (via intermunicipal bodies for example) and enquire about their eligibility criteria.

Derogations can be requested, for example, for acceptance by a household waste incineration plant: some incinerators have the technical capabilities required to handle small quantities of polluted waste and/or low to medium levels of contamination (pastes• to solids, sorbents and litter).

For small volumes (< 10 m^3), the ideal solution from a financial and technical point of view is disposal• at a civic amenity site. In the event of strandings across several municipalities, the waste may be pooled prior to evacuation to the appropriate facility.

Examples of past experience:

- *oiled waste: specialised channels for hazardous industrial waste or household waste facilities subject to derogation;*
- *vegetable oil: composting or household waste incineration plant;*
- *paraffin: household waste incineration plant;*
- *birds: management by a rendering plant (in the case of no or low contamination) or an industrial waste or household waste incineration plant subject to derogation.*

Cost/funding

The cost of waste management and disposal is generally borne by the local authority affected.

Exceptions:

The polluter has been identified → the "polluter pays" principle applies (remember to keep evidence of all expenses relating to waste management);

in some exceptional cases (large-scale spills), the local authority may, in certain countries and subject to conditions, request the reimbursement of exceptional personnel and external costs from a higher authority or national fund.

Pollution in rivers:

The principles outlined above remain valid for spills in rivers. After the containment phase managed by emergency response teams (usually fire fighters), the municipality will then often be responsible for the recovery and treatment phase. The municipality must be particularly vigilant about the selectivity of the pumping equipment used (avoid pumping up water) in order to reduce the transport and treatment costs which will be invoiced to the local authority if the polluter has not been identified.

Example: **Anetz*****, 2008 – Small-scale pollution in inland waters:*** *a 150- to 200-litre spill of domestic fuel oil polluted several hundred metres of ditch upstream of a NATURA 2000 classified marsh. The first emergency containment measures were implemented by the fire brigade, followed by a private contractor commissioned by the mayor of Anetz, as representative of the State, to carry out clean-up operations to prevent the pollution from spreading downstream. The operations consisted in cleaning the ditches and implementing temporary storage and treatment of the polluted soil. This first phase of operations was estimated at €270K and was authorised by the mayor. The mayor indicated that the costs would be covered by the polluter or their insurer and that in the event of payment difficulties, State intervention may be requested.*

In the end, the work undertaken could not be paid for by the local authority and no state funding was possible. The final cost was high in relation to the volume of pollutant released, probably due to overscaled operations.

This case was taken to court and acts as a reminder that the local authority must be particularly vigilant about the clean-up operations implemented (selectivity) and waste management costs proposed by private contractors chosen to take over from emergency response teams, bearing in mind that the local authority will have to cover these costs if no polluter is identified.

Case studies

D

Ulysse/*CSL Virginia*, 2018 Marine pollution

Following a collision on 7 October 2018 between the ro-ro vessel *Ulysse* and the container ship *CSL Virginia*, approximately 550 m^3 of bunker fuel was spilled into international waters north of Corsica.

The spill reached the coast on 16 October and the Var authorities activated the POLMAR marine pollution shoreline contingency plan the same day. Small quantities of tarballs were found in the Bouches-du-Rhône department and sporadically as far as the Spanish border.

In Var, the most affected department, the pollution spread, to very variable degrees, along the coastline across 16 municipalities, of particular socio-economic importance in particular related to tourism (Gulf of Saint-Tropez, Ramatuelle...) and to the quality of the landscapes and the environment (especially the Corniche varnoise marine protected area and Port-Cros national park). The affected coastline is a succession of sandy beaches and very rugged low rocky coasts interspersed with shingle beaches and steep cliffs with poor accessibility.

The clean-up operations were carried out by a specialised private contractor, Le Floch Dépollution, commissioned by the P&I clubs of the vessels involved.

Access for machinery was impossible along a large portion of the affected coastline, the pollutant was therefore largely collected manually. Thanks to major efforts to implement selective recovery and the use of in situ clean-up techniques (remobilisation of the oil on the lower foreshore and underwater by sediment agitation with low-pressure impact hoses, pressure washing of oiled pebbles and wood), the collection of sand, stranded seagrass and wood was limited, thus reducing the volume of waste collected.

Selective manual collection of tarballs from stranded seagrass

Remobilisation of oil buried in the sand on the lower foreshore

In total, 576 m³ of waste was collected. The different categories of waste and their management are detailed in the table below:

Waste collected (data from 07/06/2019)	Pre-treatment/treatment	Waste management streams
193 m³ of oiled wood	Incineration of hazardous materials	Energy recovery
171 m³ of oiled posidonia	Incineration of hazardous materials	Energy recovery
106 m³ of emulsified oil	Incineration of hazardous materials	Energy recovery
53 m³ of oiled sand/sediment	Sorting/separation/physico-chemical treatment	Recovery of sand for public works
53 m³ of oiled litter	Incineration of hazardous materials	Energy recovery

Table 11: Overview of the waste collected and the associated treatment streams Ulysse *and* CSL Virginia *collision, 2018*

The figures in the table above show that, apart from the polluted sand, the rest of the highly contaminated waste collected could only be incinerated, which at least allowed for energy recovery•.

After separating oiled and unoiled stranded wood, pressure washing with a view to leaving the wood on site

Depositing a big bag directly into a truck, thus avoiding the need for a secondary storage site in this sensitive area

Loire estuary, 2008 Shoreline and estuarine pollution

In March 2008, a leak occurred from a 4.5 km-long pipe between a bunker fuel storage tank and a vessel loading dock. Nearly 500 tonnes of oil was released within the site, along the banks, and part of this oil, estimated at 180 tonnes, flowed into a tributary of the Loire, contaminating the banks to varying degrees discontinuously from the mouth of the estuary to around 30 km upstream.

The industrial operator responsible for the pollution took charge of the clean-up operations and contracted numerous specialised private companies.

The onshore response involved clean-up operations on a wide variety of polluted substrates (riprap, quays and structures, sand and shingle beaches, salt meadows, mudflats and reedbeds, etc.), which required the use of appropriate response techniques. At the leak point, shore-sealing booms and sorbent• booms were deployed for containment, then the heavily oiled mud on the banks was excavated using a high-powered extractor truck. Over the first few days, the oil that had accumulated at the edge of the bank or was still floating was collected manually or using vacuum trucks where the banks were accessible. Numerous washing operations (flushing, pressure washing) were carried out to clean up riprap, port structures, etc., sometimes requiring specialist rope access technicians. Heavily oiled boulders, cobbles and pebbles were washed off-site near the banks of the estuary or at the industrial site before being returned. On a long stretch of bank, the vegetation and surface soil were oiled (reedbeds, meadows, salt meadows): depending on the case, the vegetation was cut/mown and the soil surface scraped or else, where there were low levels of contamination, natural cleaning was prioritised to mitigate the potential impact of the response.

The waste was stored on the industrial site (surface area of around 2 hectares), in separate units and pre-treatments were applied.

Aerial view showing the contamination of the banks of the estuary after the spill

D2

In total, 4,963 tonnes of oil and oiled materials were collected, sorted and then treated at an appropriate treatment facility according to the nature of the waste and its degree of contamination:

Waste type	Treatment	Tonnage
Liquid fuel oil	Distillation	9
	Preparation/use as fuel	18
Heavily contaminated soil	Preparation/use as fuel in cement works	20
Oiled soil	Hazardous industrial waste facility	3,199
	Thermal desorption• (landfill cell cover)	25
	Biological treatment	118
Oiled reeds/seaweed	Incineration (energy recovery)	961
Oiled wood	Incineration (energy recovery)	357
Fuel oil in paste• form in plastic bags	Co-incineration	46
Geotextile•	Co-incineration	185
	Hazardous industrial waste facility	26
TOTAL		4,963 t

Table 12: Overview of the tonnages for each waste category and the associated treatment streams

Sorting/preparation platform for collected waste: boulders, soil, oiled vegetation

Temporary storage of sorted waste in skips

Waste preparation: removal of plastic bags containing oiled vegetation (separation of different types of waste)

Pre-treatment operations carried out on the industrial site: settling/separation of oil and water collected in the estuary for oil recycling

Deepwater Horizon, 2010 Very large-scale marine pollution

The explosion of the *Deepwater Horizon* drilling rig on 20 April 2010 triggered the release of a continuous stream of crude oil at a depth of 1,500 m. The total volume spilled was estimated at between 700,000 and 860,000 m^3.

Impressive response capacities were mobilised (equipment and expertise) at sea, in the air and on land. Large quantities of various types of waste were generated, although they remained moderate with regard to the volume of oil spilled (ratio of 0.4 to 0.5):

Category	Nature	Origin	Quantity recovered
Oily liquids	Crude oil-water mixtures and emulsions•	Recovery on the water or on the shoreline	73,200 m^3
Liquids	Effluents with very low oil content (sheen, droplets)	Decontamination, settling, process, run-off...	150,000 m^3
Oiled solids	Booms, sorbents, PPE•, various debris, vegetation...	Clean-up operations	95,550 tonnes
Uncontaminated solid waste	Various debris and household waste	Clean-up operations and logistics	14,000 tonnes
Reusable and recyclable	Plastics, metal, etc.		4,760 tonnes
Total waste collected			Around 340,000 tonnes

Table 13: Overview of the tonnages of waste collected

Following formal notice from the authorities (with technical support from the US EPA•), the oil company drew up a waste management plan which defined in detail the entire waste management chain according to the type of waste (liquids/solids); in particular, it outlined waste storage (limited number of sites), sorting and pre-treatment operations to reduce volumes, and possible treatment methods within the states concerned (reduced transport).

Key points that helped to reduce the volume of waste:

- large-scale at-sea response techniques (surface and subsea dispersion operations at the leak source, in situ burning) in addition to natural dispersal processes: over 50% reduction of the volume of oil; selective clean-up on the shoreline (rinsing, in situ sieving) also helped to limit the quantities of sediment collected; on the other hand, containment and sorbent booms, sorbents, which were massively used, and PPE• accounted for a very significant share of the solid waste collected.
- strict clean-up site organisation with restricted access to the site (check point + personnel entry/exit register), division into "clean" and "dirty" zones, with flexible

barrier system and appropriate signage, a decontamination zone, all supervised by site managers → Limitation of secondary contamination;

Worksite organised into zones with an access corridor before entering the "operations" zone and a decontamination area

Decontamination area for oiled equipment

- proper preparation of onshore staging areas: leak-proofing (levelling, sandy sub-layer, geotextile film, retention tanks, etc.), waste sorting and pre-treatment• (settling, separation, etc.), equipment decontamination area (boom washing prior to reuse, effluent collection), equipment storage and repair area, storage areas for waste packed in plastic bags; unloading onto the dockside of the waste recovered by oil spill response vessels was also organised.

Waste management:

Due to a lack of data, it is not possible to give precise figures, however the different waste streams used are outlined below:

Pre-treatment = strategy to reduce waste and promote recycling• and recovery• options

- washing of polluted sediment in mobile units either in situ or returned to the beach after cleaning;

- wringing out of sorbents with a view to recycling• them, to avoid conventional disposal by incineration: particular attention was paid to the disposal of polluted sorbent materials, given the large quantities used. Recovered mixtures of oil and water were sent to an emulsion• recycling facility•; wrung-out booms were sent to a sorbent recycling• facility.

Mi-SWACO sand cleaning station, installed on a wooden platform on Grand Isle beach, Louisiana

When placed under pressure, sorbents can be reduced to about a quarter of their original volume. An initial volume of 120 m³ can be reduced to 30 m³, with the production of approximately 120 litres of very lightly contaminated effluent.

D3

Recovery•

- Re-injection of liquid oil into wells;
- recycling• (commercial sale) of oil recovered from settling operations and emulsion• breaking;
- incineration or co-incineration (waste used as fuel) in household waste incinerators with energy recovery: e.g. booms after their recyclable materials have been removed.

As well as some innovative research projects:

- recycling• of waste in the form of pastes• (contaminated sand, tarballs, patties) into road asphalt: screening to remove debris, then incorporation of 2% of the pollutant in the asphalt manufacturing process. Limitations: long time required to obtained authorisations (more than 6 months), profitability proportional to waste flow;
- recycling• of used sorbents (composed of polypropylene) in the automotive industry: pre-treatment (wringing out, cutting up, removal of non-recyclable elements) then incorporation in the manufacture of plastic objects.

Treatment

- Incineration in mobile units, subject to authorisation and air and odour control, used for certain oiled or unoiled materials: diverse debris, chlorine-free plastics, animal carcasses, etc;
- biological treatment, such as biopile or landfarming, for sediments: little used because of the long treatment times.

Disposal in landfills

In the early stages, this was the main option used for solid waste. Finally, thanks to the oil company's Green Alternatives Program, the use of this stream was reduced.

Key takeaway: the concept of the "Green Alternatives Program", developed by the oil company, which aimed to optimise the waste recycling•, reuse and recovery• strategy, boosted research and innovation into pre-treatment and recovery• techniques. It is indisputably a step forward in terms of waste treatment, and deserves to be systematically developed and included in the response plan.

MSC Napoli, 2007 Marine pollution by oil and containers

On 18 January 2007, the British container ship *MSC Napoli* was en route to Lisbon when it was caught in a storm and suffered hull failure, causing it to take on water through a 1.5 m-long crack in the starboard side hull. The vessel was intentionally beached on 20 January 2007 at the entrance to the English Channel, in Lyme Bay, England.

It was transporting 2,318 containers with a cargo comprising 1,684 tonnes of hazardous goods (167 kg of explosives, 177 tonnes of gases, 462 tonnes of flammable liquids, 107 tonnes of flammable solids, 61 tonnes of oxidants, 143 tonnes of toxic materials and over 200 tonnes of corrosive materials).

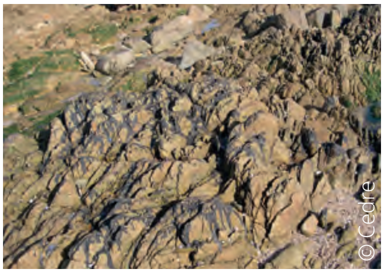
In total, 119 containers of general cargo and 302 tonnes of oil were released at sea (50 tonnes of heavy fuel oil (IFO 380), 150 tonnes of marine diesel and a combination of used oils during container recovery and ship dismantling operations).

Given the scale of the spill, the “Manche Plan" was activated on the UK side, and British and French resources were mobilised. Oil but also containers began to reach the English coast: in total 76 containers were recovered from the shoreline. In addition, the UK was responsible for recovering the containers remaining onboard the ship and the dismantling of the vessel. A total of 45,660 tonnes of cargo was removed from the ship and transferred to shore to a specially prepared area for washing, dismantling and disposal operations. The management of this incident lasted 924 days.

On the French coast, the first strandings were observed 10 days after the incident, in the form of tarballs and patties amalgamated with seaweed, oiled packets of biscuits (from burst containers), and oiled birds, found sporadically over a distance of about 100 km.

Oiled packets of biscuits washed up on the Breton coast

Strandline comprising a mixture of oiled biscuit and seaweed



Oiled rocky shoreline

Oiled bird

The POLMAR• contingency plan was not activated given the small volumes involved (around 100 m^3 and approximately 600 oiled birds) but the State services in charge of the POLMAR• contingency plan were strongly mobilised to support the mayors of the affected municipalities who were heavily involved in organising manual clean-up operations.

The authorities advised and participated in:

- providing recommendations on optimising the sorting of polluted materials to ensure simpler and less costly disposal;
- the choice of the most suitable treatment option for the different types of waste;
- the identification of suitable sites for the disposal of polluted materials;
- the identification of available modes of transport.

In total, 65 tonnes of waste was collected in Finistère and 102 tonnes in Côtes-d'Armor.

In a second phase, in order to minimise the volume of waste, the shipowner's P&I club commissioned a clean-up contractor to sort and repackage the waste already collected. In the end, a total volume of 51 tonnes of waste was managed, and a large proportion of the sand collected was returned to the sites.

For example, in Finistère, only 4 tonnes were disposed of in a specialised incineration plant for hazardous waste located in the Yvelines department. The rest of the waste collected was treated locally: 40 tonnes of sieved sand was returned to the beaches while the rest of the waste (birds, driftwood, litter, biscuits with lightly oiled packaging, seaweed) was disposed of at the nearest household waste incineration plant.

Primary waste storage pending collection by a dump truck

Further information

Glossary and acronyms

The words and expressions followed by a • in the text are defined below.

Absorption: penetration of a pollutant (fluid or viscous) into the matter of which the sorbent is composed and its subsequent retention

ADN agreement: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways

ADR agreement: European Agreement concerning the International Carriage of Dangerous Goods by Road

Adsorption: adherence of a pollutant to the surface of a solid such as sediment or other matter in suspension in the water

API oil-water separator: tank designed to separate supernatant oil and settled solids. It owes its name to the American Petroleum Institute, which standardised its design in the 1950s for the treatment of refinery effluents

Asphaltenes: heavy fraction of crude oils, large share of oil distillation residues in refining

BARPI: *Bureau d'Analyse des Risques et Pollutions Industriels* (French Bureau for Analysis of Industrial Risks and Pollutions)

BIC number: number attributed by the *Bureau International des Containers et du transport intermodal* used to identify the owner of a container. It is composed of a 4-letter code, the last of which is U

Big bag: flexible woven bag with a large capacity, about 1 m^3, equipped with straps

Biodegradation: decomposition of organic matter by micro-organisms

BRGM: *Bureau de Recherches Géologiques et Minières* (French Geological Survey)

BTEX: Benzene, Toluene, Ethylbenzene, Xylenes (Monocyclic Aromatic Hydrocarbons)

Bund: construction or earthen dyke, possibly held by a stone supporting structure

Cargo manifest: transport document which lists all the cargo (including dangerous goods)

Chelating agent: organic substance that combines with a metal ion to form a soluble complex

Chemical incompatibility: substances (in this context, waste substances) that may react violently with each other because of their chemical characteristics.

Circular economy: economic system of trade and production that minimises resource consumption and waste production

Clinker: solid residues from waste incineration

Co-incineration: incineration of waste in industrial incinerators or furnaces as an alternative or complementary source and/or as a material source

Collection: removal of waste from the environment, including preliminary sorting and storage, in preparation for transport to a waste treatment facility

Deballasting station: facility for the reception and recycling of oily residues in ports from ships' tanks/bilges

Desorption: transformation through which a pollutant is detached from a substrate

Dispersion: formation, due to wave action and turbulence at the sea surface, of oil droplets of various sizes, which become suspended in the water column. According to the product's viscosity, and on the geographical location and bathymetric situation, this natural phenomenon may be accelerated by the use of dispersants

Disposal: any operation to get rid of waste without recovery

Dredging: cleaning/collecting sediment underwater using a dredger

Effluent: potentially contaminated water generated by spill response clean-up operations

Emulsification: process of producing and stabilising an emulsion

Emulsion: incorporation of water into oil creating a heterogeneous mixture due to agitation or the addition of active agents

Evaporation: transformation of a liquid into a gas

Geomembrane: synthetic membrane liner with very low permeability

Geotextile: synthetic textile used as a filter in the public works sector (drainage, etc.).

GIS: Geographic Information System

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HDPE: High Density Polyethylene

HSE: Health, Safety, Environment

HWIP: Household Waste Incineration Plant

IBC: International Bulk Container, a flexible or rigid container with a capacity of approximately 1 m^3 designed for mechanical handling

IBC Code: International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk

IGC Code: International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk

IMDG Code: International Maritime Dangerous Goods Code

IMSBC Code: International Maritime Solid Bulk Cargoes Code

INERIS: *Institut National de l'Environnement industriel et des RISques* (French National Institute for Industrial Environment and Risks)

IOPC Fund: International Oil Pollution Compensation Funds

Kinetics: speed of a process

LDPE: Low Density Polyethylene

Leachate: water that has passed through a pile of waste (rainwater, liquid produced by waste fermentation)

Litter: solid materials of all kinds, in diverse forms, deliberately discarded or accidentally lost on the shoreline or at sea, waste from land that is carried into the marine environment by rivers, drainage and sewage systems or carried by the wind

MRCC: Maritime Rescue Coordination Centre

OFB: *Office français de la biodiversité* (French Biodiversity Agency)

Oleophilic: which has an affinity for fats

Operator: person or company that operates a facility

Overflow: discharge through the upper part of a device

PAH: Polycyclic Aromatic Hydrocarbon

Particle size separation: sorting of different fractions of materials according to either their size, density or surface properties, and recovery of a reduced volume of pollutant

Paste: waste that has a paste-like consistency; very thick, emulsified liquid that lacks fluidity

PCB: Polychlorinated biphenyl

Percolation: slow passage of a liquid through a medium such as sediment. It is mainly due to the effect of gravity, therefore moving in a downward direction

POLMAR: French system for responding to marine oil pollution on the coastline. It is organised into two parts: the maritime response and the shoreline response.

POP: Persistent Organic Pollutant. The POP Regulation prohibits the production, placing on the market and use of substances identified as POPs

Pouzzolan: porous volcanic rock, varying in colour from grey to reddish, used as a secondary constituent of cements and mortars

PPE: Personal Protective Equipment

Ppm: parts per million

Recovery: any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy

Recycling: any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. This includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations

Residue: material remaining after a physical or chemical operation, industrial processing or manufacturing, in particular after extraction of the most valuable products

RID: Regulations concerning the International Carriage of Dangerous Goods by Rail

SDS: Safety Data Sheet

Settling: separation by use of the difference in gravity of immiscible products (which do not mix), at least one of which is liquid

Slag: solid residue from the smelting of metal ores or coal combustion

Sorbent: solid product capable of trapping and retaining a liquid pollutant in the environment in order to facilitate its recovery.

Specialised vessel: vessel specially adapted for spill response operations and is not transporting goods or passengers

TDG: Transportation of Dangerous Goods

Trawling: operation aimed at increasing the concentration and thickness of a slick of pollutant spread out over a water surface using a boom towed by two boats at a speed of less than 1 knot

UN number: 4-digit identification number for goods whose transportation is regulated

Unloading: action of removing the contents of a vehicle carrying substances in liquid, gas or powder form

US EPA: United States Environmental Protection Agency

Viscosity: resistance to flow

VOC: Volatile Organic Compound

Waste holder: the producer of the waste or the natural or legal person who is in possession of it (even temporarily)

Waste treatment: begins after collection, transport and pre-treatment operations. This step occurs prior to recovery or disposal and is aimed at reducing the volume of pollutants and facilitating recovery and avoiding disposal, in accordance with the waste hierarchy.

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