

12. WASTE MANAGEMENT GUIDELINES

12.1. Introduction

This section contains guidelines for the management of waste generated during an oil spill response operation. The guidelines presented in this section meet the objectives of appropriate guidelines established in the Project's Waste Management Plan, which is designed as a Project-wide reference in effective waste handling and disposal. The term "waste" is used throughout this section to refer to materials that are generated as the result of a spill and spill cleanup. The term is not used to define these materials for purposes of treaties, laws, decrees or regulations. In this document, "waste" refers to materials that are generated as a direct result (e.g., recovered crude oil) and/or indirect result (e.g., refuse and sewage) of an oil spill.

This GOSRP does not address management of wastes generated during the construction phase of the Project, nor waste from normal/routine operations. Waste management strategies and methods presented in this GOSRP are intended to be guidelines for use during a spill response. Other appropriate methods not discussed here may also be used provided they are acceptable.

Oil spill response operations will generate several different types of waste, and key considerations are the types, characteristics, and quantities of waste. These factors are largely dependent on the specific cleanup methods employed, which may change as the work progresses.

Appropriate government agencies in Chad or Cameroon will be notified of waste management/disposal activities as necessary. Waste generated in one country may not be transported across borders to another country.

Waste management programs implemented for an oil spill response will be based on the following principles:

- Provide safe working conditions and all necessary personnel protection
- Comply with all applicable laws and regulations
- Minimize the risks of pollution in all operations
- Cooperate with all local community and governmental agencies to limit impacts on local waste disposal facilities
- Handle, store, and transport oily waste in appropriate containers, tanks, and trucks
- Control the amount of waste generated by implementing waste reduction principles
- Segregate oily and non-oily waste to allow optimum reclamation and disposal
- Dispose of all waste in a safe manner and at Project-approved disposal sites

Several waste management facilities will be constructed as part of the Project to control, manage, and treat wastes generated from the Project. The types of facilities that will be available include:

- Landfill (including non-hazardous and hazardous waste cells)
- Incinerators
- Wastewater treatment
- Oily water treatment

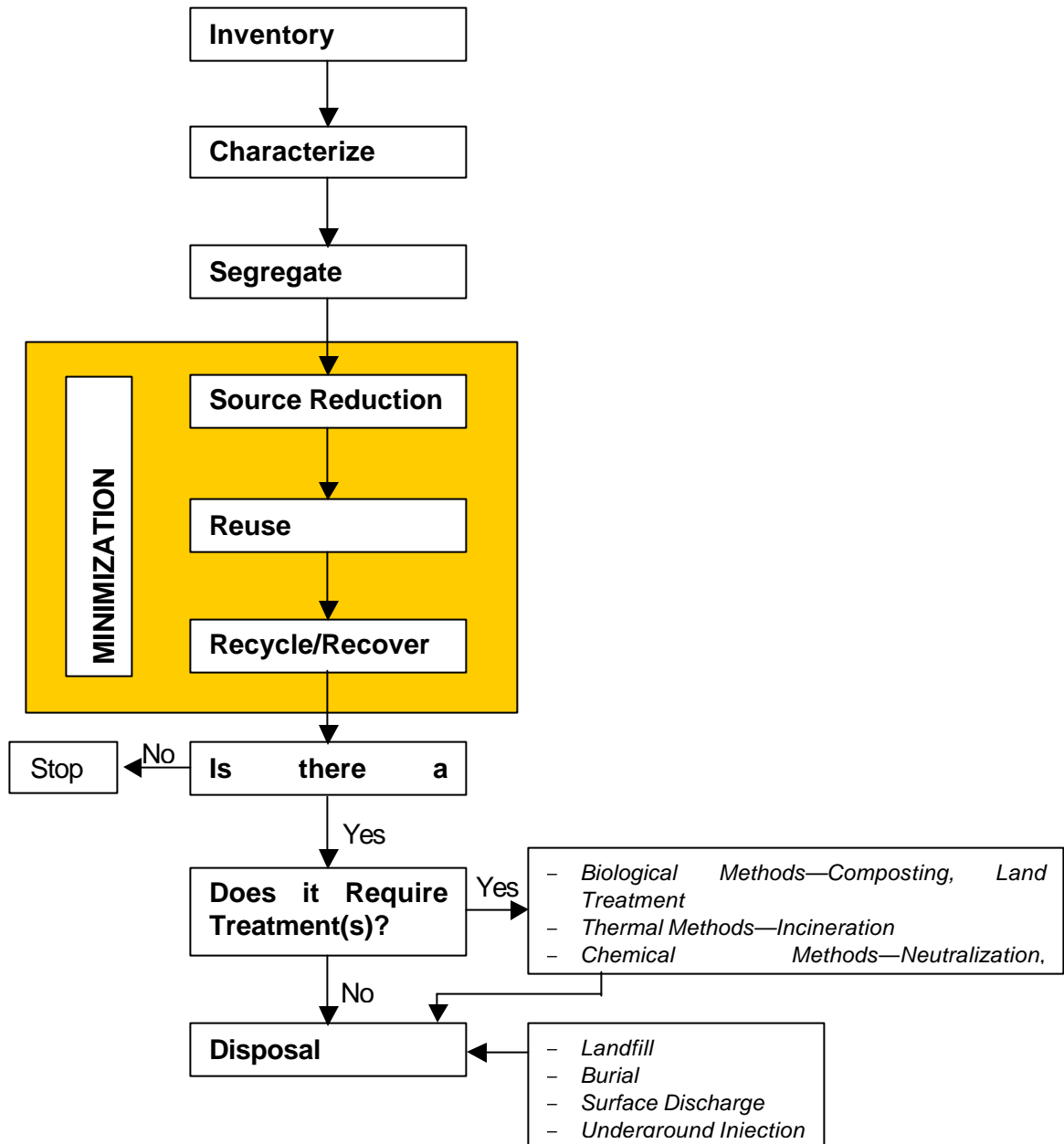
Specific locations of these facilities will be provided in the Area-specific OSRPs. Construction design parameters for the above facilities are provided in the Project Environmental Management Plan.

Practical considerations or “rules of thumb” for developing a waste management strategy are shown in Table 12-1. The key elements of the waste management hierarchy for the Project are shown in Figure 12-1. These elements are described in the sections that follow.

Table 12-1. Waste Management — “Rules Of Thumb”

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| <ul style="list-style-type: none">• Waste generation begins when the first person shows up on site; the waste stream should be organized before giving the go-ahead to start an activity.• Work with planning and operations to try to develop accurate estimates of waste generation from the different operational activities.• The waste stream is the most likely bottleneck for operations — for example, it may be necessary to have to turn off the skimmers if there is insufficient transfer and storage capacity.• Segregate wastes at source and label immediately.• In particular, separate wastes that:<ul style="list-style-type: none">(1) are oiled versus non-oiled;(2) are liquid versus solid;(3) can be incinerated;(4) are biodegradable; or(5) may be considered hazardous.• Waste volumes and types will change during the life of a response. |
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Figure 12-1. Waste Management Hierarchy



12.2. Inventory and Tracking

To document the amounts and disposal of waste generated during a spill response, the following principals will be implemented.

- Label all waste containers and identify the source of the waste.
- Clearly identify containers of special wastes. Use a label or other means to clearly identify the contents of containers holding wastes (e.g., reactive, corrosive, flammable, radioactive, etc.). This will communicate to others any potential hazards and help ensure that only appropriate wastes are deposited in them. Use only dedicated containers for hazardous waste and medical waste.
- Inventory the type and quantity of all wastes generated from a cleanup operation.
- Document quantities of restricted or hazardous waste using a waste manifest. Waste tracking can be essential in helping to manage environmental issues and costs.
- Document the transport, storage and final disposal of all wastes generated

Examples of waste manifest and tracking forms are provided in Appendix D, Forms. Documentation of waste inventories and disposal locations will be maintained at the appropriate operations sites.

12.3. Waste Characterization

Liquid wastes, including both oily and non-oily liquids, and solid wastes, including both oily and non-oily solid wastes, may potentially result from an oil spill. Different types of waste are generated by different cleanup methods.

Oily liquid waste:

- Recovered or skimmed oily mixtures
- Used engine oils and hydraulic fluids
- Fuels that are contaminated with water and/or solids
- Engine room bilge and ballast waters from vessels
- Contaminated rainwater runoff from waste storage areas
- Wash waters from cleaning boats, boom, and equipment
- Wash waters from decontamination procedures
- Other oily waters
- Wastes from a wildlife rehabilitation center

Non-oily liquid waste:

- Sewage and liquid human waste (gray and black waters)
- Lab wastes

Oily solid waste:

- Sand/gravel/tar balls
- Asphalt patches
- Sludge
- Sorbent pads/boom/rags/wood
- Shoreline debris
- Logs and driftwood
- Shoreline kelp
- Oily personnel gear and clothing
- Damaged response equipment and gear
- Empty drums and other containers
- Contaminated soil

Non-oily solid waste:

- Domestic trash and garbage
- Wastes from a wildlife rehabilitation center
- Discarded equipment and construction materials

Special waste: Oil spill cleanup may generate waste that requires special handling.

- Solvents and chemicals
- Batteries
- Wildlife carcasses
- Antifreeze

12.4. Segregation and Minimization of Waste Streams

The various types of waste have different optimal and alternative disposal methods. Therefore, it is important to:

- Segregate waste by type
- Minimize the quantity of each type of waste
- Avoid mixing hazardous and non-hazardous wastes together
- Label all waste containers and identify the source

One way to improve efficiency is to combine similar wastes and segregate dissimilar wastes if compatible with preferred disposal options. Always err on the conservative side by segregating waste whenever in doubt.

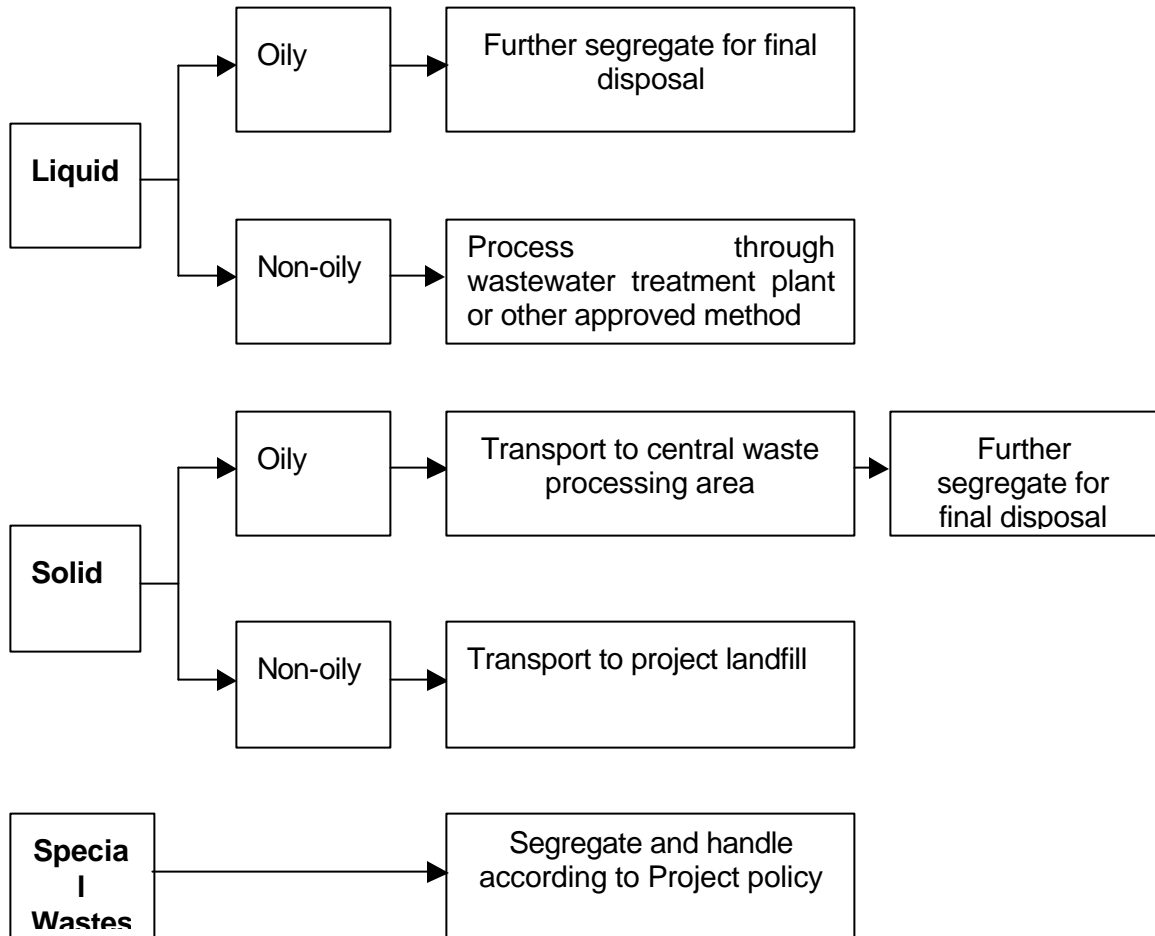
12.4.1. Segregation

Segregate waste at the point of generation to facilitate subsequent handling and disposal:

- Segregate all oily waste from non-oily wastes.
- Dispose of non-oily waste (domestic refuse and trash) in accordance with the project Waste Management Plan.
- Transport all oily solid waste to a central waste processing area.
- Further segregate oily waste as required to facilitate final disposal.

Figure 12-2 is a flowchart for the segregation of waste of different types.

Figure 12-2. General Guidelines for Waste Segregation



12.4.2. Waste Minimization

Waste minimization is essential during spill response operations. To the maximum extent feasible, minimization should be achieved through prevention and reduction of waste generated during cleanup. Waste management and operations personnel are responsible for making use of their field experience to identify other practical ways of minimizing waste generation by recycling, reusing materials, or employing different cleanup methods.

- Waste prevention involves the attempt to remove materials and debris from areas that have not yet been oiled prior to oil impact.
- Minimization of waste generated during cleanup includes the conservative use and reuse of contaminated equipment. Unnecessary use or overuse of disposable equipment and cleanup products should be discouraged to the extent safely feasible.

In-situ treatment and natural recovery should be considered during response planning and used when and where applicable. The purpose of *in-situ* treatment is to accelerate the natural recovery of the areas by selecting options that involve on-site activities without a requirement for off-site waste disposal. A number of techniques are available for treating oiled sediments and other materials in place with little or no waste generation including:

- Natural Recovery (Section 10.3.1),
- Sediment Tilling/Aeration (Sections 8.5.2 and 10.3.13),
- Surf Washing (Section 10.3.14),
- Burning (Sections 8.5.3 and 10.3.15),
- Chemical/Biological Treatment (bioremediation) (Sections 8.5.1, 10.3.16/10.3.17)

In-situ treatment is the preferred option in terms of waste minimization. All of the waste minimization techniques have significant advantages over wholesale waste removal, especially in treating sediments. *In-situ* treatment is also the preferred option in terms of cost minimization. Cost is a common concern in spill response and costs increase if oily waste is disposed using an elaborate process or at a great distance from the spill site. Clearly, *in-situ* treatment and waste minimization help decrease transportation and disposal costs.

Guidelines for Reducing Waste Generation

The following are guidelines for reducing the amounts of waste generated during operations.

- Solid waste:
 - do not mix any oil, fuel, or oily waste with trash and garbage
 - prevent oily waste from contaminating soil; use liners beneath drums, tanks, or cleaning operation sites
 - use sorbent pads and booms until they become moderately oiled
 - when collecting mousse patties and oiled sand and gravel, minimize the collection of underlying or nearby clean sand or gravel
 - completely use up all of the chemical or fertilizer in drums; to the extent practical, wash the drums clean at the areas where they are used

- challenge the source of improperly labeled waste or whenever there is a suspicion that waste did not come from the current spill cleanup effort
- Liquid waste:
 - cover areas used for storage of fuel, chemicals, and waste to minimize the accumulation of rainwater
 - do not order more chemicals/solvents than are reasonably needed; finish using one container prior to opening a new one
 - take precautions not to contaminate fuels, lube oils, and waste with water or solid contaminants; keep tops and bungs on drums, tanks, and other containers
 - examine disposal implications before using chemical additives (e.g. demulsifiers in recovered oil)
 - use cleaners sparingly, even if they are biodegradable; do not use excessive amounts or flush with large amounts of water
 - use wash water sparingly; ensure that hoses, valves, and faucets do not leak and are closed when not in use
 - if there is any question about the source or content of a waste oil, keep it separate from other waste oils until its source can be identified or it can be sampled and tested

12.5. Waste Collection, Packaging and Storage

Procedures for waste collection and storage differ for different types of wastes.

A number of readily available materials can be used to package materials recovered during spill response. Techniques available for packaging and storage of oil spill wastes include:

- tank vessels (liquids),
- barges (liquids or solids),
- flexible towable tanks/pillow tanks (liquids),
- lined earthen pits (solid),
- lined earthen dikes (solid),
- prefabricated kits (liquids),
- sealed-top drums (liquids or solids),
- livestock tanks (liquid),
- “oilfield” tanks (liquid),
- unused above-ground tanks (liquids),
- unused under-ground tanks (liquids),
- dumpsters (solid),
- “supersacks” (solid), and
- plastic trash bags (solids).

12.5.1. Recovered Oil and Oil/Water Mixtures

Oil and oil/water mixtures recovered from oil spill cleanup operations may be contained on skimmers, portable tanks, tank trucks, or in barges at the cleanup site. In a large-scale cleanup on water, skimming vessels must be able to offload waste onto larger capacity barges or ocean vessels. A dedicated collection barge could also visit cleanup sites and provide a collection service. Work boats or deck barges may be outfitted with deck tanks for the collection and transportation of recovered oil. Alternately, bladders can be used for collection (and also storage) of the recovered liquids.

For shoreside recovery operations, recovered liquids may be collected in vacuum trucks or tank trucks for transportation to a central waste storage area. Portable tanks can also be used at shoreside collection points, with truck transportation to the storage facility.

An effective and efficient oil recovery operation relies on the ability to decant water separated from an oil/water mixture and dispose of it. Decanting water from liquid waste will usually occur within the oil collection area at the containment and recovery site to allow recovery of additional oil.

Personnel working with skimmers and recovered oil transfers will to the extent possible:

- Separate the oil to reduce the water content and minimize the formation of emulsions.
- Decant the water
- Remove foreign objects (e.g., solids, debris, plastics, and seaweed) caught and collected during the oil cleanup operation.

At a minimum, treated water must be free of visible solids, floating objects, discoloration, and oil and grease. Oil/water mixtures should not be mixed with other oily liquid materials, such as lube oil or contaminated fuels.

Recovered liquid waste can be temporarily stored in leased collection vessels, barges, large bladders, portable tanks, or tank trucks. The recovered liquid will then be transferred to a central waste storage facility for longer-term storage. The central storage facility can be large shoreside portable tanks that are accessible by truck, or they may be a fixed tank facility, such as a terminal.

The percentage of oil in the recovered liquids determines how they will be handled at the storage area. Liquids with a low oil content may be transported to a project wastewater treatment or produced water treatment facility. Liquids with a high oil content, however, may be processed at the produced water treatment facility, or incinerated. Some treatment of the recovered liquids may also be required at the storage facility to produce "water-free" oil and "oil-free" water for final disposal.

12.5.2. Other Waste Oils

This category includes waste crank-case oil, hydraulic oil, and contaminated fuel. These will typically be collected in small containers (4-20 liters, 1-5 gallons) and transported to a central waste storage facility, where they will be stored in small portable tanks or in drums until final disposal outlets are determined. The central waste storage facility will be located near the spill where flat land is available (see Figure 12-3).

12.5.3. Oil-Contaminated Water

Oily waters will be generated in both offshore and onshore operations. Offshore oily waters may consist of water from oil recovery operations, ballast water, bilge water, and wash water. These waters should be segregated and may either be retained on a vessel for temporary storage or transferred to shoreside tankage. Bladders can also be used for on-water storage of oily water. Portable or fixed tanks at a shore-based marine facility are best for longer term storage of these waters; however, water can also be transferred by tank truck to the central waste storage facility or directly to the disposal outlet.

Onshore oily water may consist of water from oil recovery operations, wash water, or contaminated rainwater. These waters should be segregated and stored at the central waste storage facility in portable or fixed tankage. Personnel will, to the extent possible, decant the water at shoreside recovery locations.

12.5.4. Non-Oily Liquid Wastes

Most non-oily liquid waste will consist of sanitary waste from either offshore or onshore operations. Offshore-generated waste should be retained in holding tanks on board vessels. The holding tanks can either be emptied at shoreside facilities or onto sewage barges or vessels, or they could be discharged as allowed by permit. Once onshore, sanitary sewage should be moved directly to a treatment facility via a dedicated sewage tank truck. Sanitary waste should not be mixed with other wastewater or wastes. Sanitary waste from onshore operations should likewise be transported directly to treatment facilities from the generation point, if possible. If necessary, sanitary waste can be stored for several days in dedicated portable tanks before being transported to treatment facilities.

12.5.5. Solid Waste

Different types of solid waste may be generated as the result of oil spill response activities. Oily and non-oily solid waste occur. Collectively, solid waste resulting from oil spill response operations is generated offshore, on the beach, and onshore. Every effort should be made to properly segregate the solid of each type, because collection and storage procedures may be different for each.

Large amounts of manual labor are required for the collection, segregation, and storage of solid waste. Most solid waste from an oil spill will be collected by cleanup workers on land, shorelines, and beaches. These wastes will initially be separated into two categories, oily and non-oily solid waste. This separation will determine how the waste will be packaged, transported, stored, and disposed. Special care must be taken at all times not to mix oily and non-oily wastes.

Waste will be picked up or piled up by type (e.g., sorbent, beach materials, debris), bagged, and placed in a lined temporary storage area. All but large-sized waste will be placed in sealed plastic bags. Waste that is too large to be placed in bags will be placed in dumpster-type containers. Previous experience with successful oil spill response activities has indicated the value of using color-coded bags to segregate oily and non-oily solid wastes, specifically clear plastic bags for oily solid waste (which allow easy visual identification) and colored bags (usually blue) for non-oily solid wastes.

Solid waste will be transported as needed by trucks and/or vessels to the storage location. Before loading bags of oily solid waste, an impermeable liner and/or absorbent material and absorbent boom will be laid down on the cargo area. If the carrier collects

bags of both oily and non-oily waste, the bags should be segregated and care taken to ensure that the bags containing non-oily waste are not contaminated by leaking bags of oily waste.

If the waste is initially transported by boat, the bags will be unloaded at dockside facilities into lined dump trucks and transported to the central waste facility. If possible, separate vessels and trucks will be used to transport oily and non-oily wastes. A central waste storage facility will be located at a site easily accessible by truck and/or train. Figure 12-3 is a schematic of a central waste storage facility.

For some remote beach areas, temporary storage areas in the form of lined shallow excavations can be established. These temporary storage areas will be used primarily for storage of waste such as soils, debris, vegetation, driftwood, and refuse. Where roads are available, bagged solid waste can be picked up by dump truck and transported directly to the central waste facility. The bags will be unloaded and segregated by bag color (i.e., oily or non-oily). Clear bags containing oily waste will be stored in a lined area; blue bags containing non-oily waste may be stored in an unlined area.

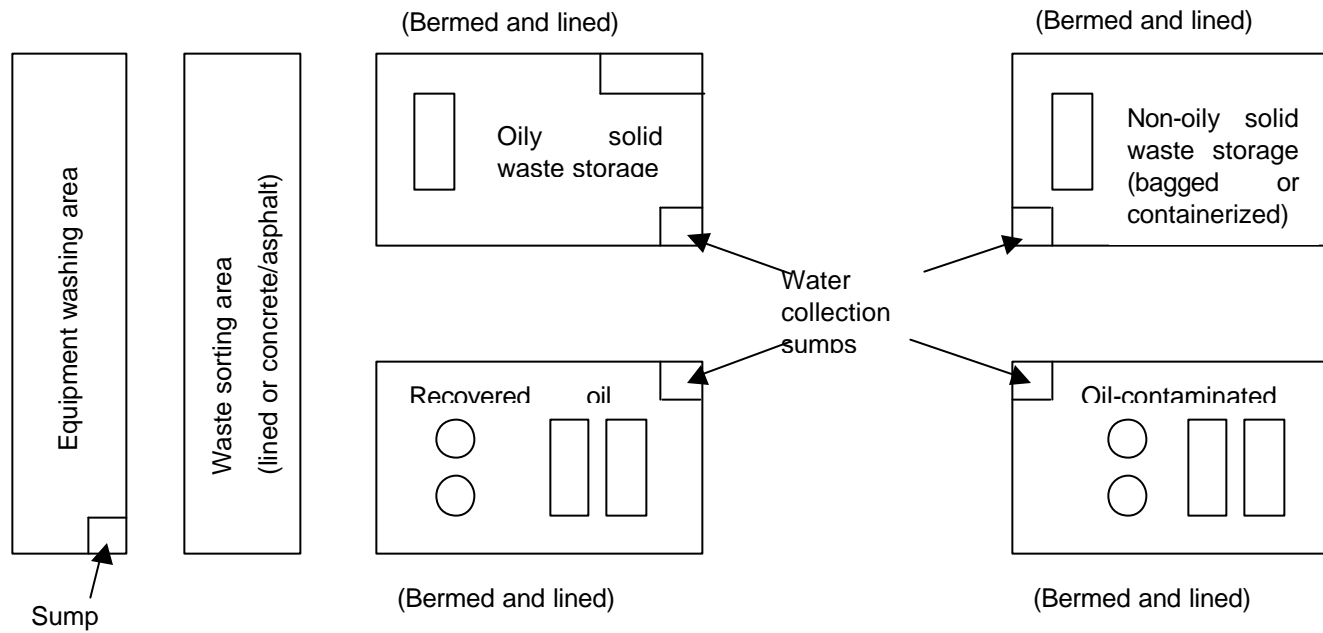
Although most materials will be pre-sorted before arriving in the central waste facility, some separation of bulk-delivered solid waste may be required at the storage facility. Size-reducing equipment such as crushers may be used on oiled wood and rock. Materials may be washed to prevent clogging of equipment. Wash water will be collected on-site for removal and treatment with other oily liquid streams.

12.5.6. Special Waste

Oil-spill response activities in Chad or Cameroon may generate small quantities of special wastes. Whenever appropriate, efforts should be made to collect, store, and dispose of the special waste in a fashion that is consistent with the project Waste Management Plan.

- Solvents and chemicals: These will be collected in labeled 220 liter (55-gallon) drums and stored in the central waste storage facility awaiting final disposal.
- Batteries: Large, lead-acid batteries are to be stored on pallets at the central waste storage facility. Dry-cell batteries can be stored in open-top drums.
- Wildlife carcasses: If it is necessary to store wildlife carcasses for more than one or two days for later analysis, a refrigerated facility (such as a refrigerator tractor trailer) should be provided. If wildlife carcasses do not require analysis, they will be stored in clear bags (as oily solid waste) and transported to the designated wildlife recovery area for prompt disposal.
- Antifreeze: Antifreeze will be stored in labeled drums and placed in the central waste storage area.

Figure 12-3. Schematic of a Central Waste Storage Facility



12.6. Transportation

Waste transportation options include:

- freight boats
- tank trucks or railroad tank cars
- freight trucks or railroad freight cars
- light trucks
- aircraft
- dump trucks

Transportation options will be selected based on the type and quantity of waste to be moved. If possible, separate vessels and trucks will be used to transport oily and non-oily wastes.

12.7. Disposal Options for Liquid Waste

After initial collection and packaging and temporary (interim) storage of oiled wastes, final disposal and treatment options will be evaluated. Techniques available for disposal include:

- Reprocessing/Recycling
- Landfarming/Bioremediation
- Open Pit Burning
- Incineration

Disposal options will be selected based on whether the waste is solid or liquid and whether it is oily or non-oily. To the extent practical, waste generated during oil spill cleanup activities should be recycled or disposed of at the existing Project disposal facilities in Chad or Cameroon that routinely handle similar materials during non-spill conditions. These facilities might include the crude oil pipeline, tankage, incinerators, produced water treatment plants, wastewater treatment plants, and landfills.

12.7.1. Disposal of Recovered Oil

Considerations for the choice of a disposal method include:

- How clean the material is; whether it is primarily free of debris and not highly emulsified
- Availability of local disposal and recycling resources
- Cost of disposal processes
- Environmental factors
- Local regulatory issues

Reprocessing

Reprocessing is an excellent means of disposal for recovered oil, especially when the liquids contain little debris. Typical sites that can accept oil for reprocessing include refineries, pipeline pump stations, terminals, and production facilities.

Depending on the reprocessing facility used, the disposal of several hundred bbl/hour is typically achievable. An advantage of this method is that oil is salvaged and reused;

however, transportation costs can be high, depending on the distance between the reprocessing facility and the storage site. No auxiliary equipment is needed other than for transportation.

Supplemental Fuel/Reuse

Waste material, such as recovered oil and lube oil, may be used as fuel if appropriate facilities such as cement kilns are available to handle wastes as fuel.

Bio-treatment

Bio-treatment includes land farming and composting.

Land Farming

Land farming is an option for the disposal of recovered liquids. In land farming, recovered liquids are spread on selected sites and combined with the soil, moisture, and nutrients in the presence of oxygen to promote bacterial degradation of the hydrocarbon components. This requires uniform applications of oily waste over the selected land parcel.

The most suitable sites are large fields with deep, tillable soil with adequate moisture. Some sites might require the placement of a liner. At the site, the soil is prepared, nutrients and waste are applied, and the field is tilled periodically. The soil pH must be controlled, and the field must have less than 1 to 2% grade. Runoff is collected for reapplication during dry periods or treated (separation) before discharge.

This is a proven method that can be implemented quickly. Furthermore, the oil degrades rapidly. Applications can be made every 6 to 8 weeks during warm weather. The method requires a large surface area and periodic maintenance to fertilize, till, and spread oil. Required equipment typically includes a tractor, plow, fertilizer, and a tank truck with a spray bar. After several years, the site can be replanted with grass or other vegetation.

Composting

Composting is similar to land farming in that the hydrocarbons are biologically degraded. Usually composting is done in a pile, using wood chips or other similar material as a bulking agent. Recovered liquids are sprayed on the pile, with moisture and nutrients added. The pile is periodically mixed for aeration. Forced aeration using a blower and perforated piping enhances the degradation rate. Composting can be done at a lined site or on an asphalt/concrete pad. Required equipment typically includes a front-end loader/backhoe, aeration system, fertilizer, wood chips, and mixing equipment.

Incineration

Incineration methods include open burning, local process incineration, and the use of portable incinerators.

Open Burning

Recovered liquids are burned along with oily solid waste in open areas or pits. Typically, this is conducted by excavating several ditches and alternately loading and burning in each one.

Open burning of recovered liquids and solid waste will help dispose of both types of waste at the same time. The waste is eliminated permanently, and the method is very useful in remote areas. Some of the drawbacks of this method are the potential difficulty of operation, smoke emissions, and possible safety concerns.

Local Process Incineration

Incineration of recovered oil spill materials can be accomplished at facilities with stationary process incinerators. Incinerators will be located at each pump station and at the Chad production field. Other incinerators may be located in refineries, waste-disposal sites, reclamation plants, and wood processing plants.

Local process incinerators can dispose of waste at the rate of several hundred barrels per hour. The main advantage of this method is that it uses existing local facilities. This can result in rapid implementation, especially if a local process incinerator is close to the cleanup site. Furthermore, the process is safe, and emissions are controlled. It may, however, be more costly than other methods. An efficient storage and transportation system is important. Some incinerators may be able to burn liquids as supplemented fuel. Discussions with the managers of local facilities should identify the range of products that their incinerators can handle.

Portable Incineration

Portable incinerators are designed primarily to burn solid wastes. However, rotary kiln incinerators and air curtain incinerators are capable of burning both solids and liquids, such as recovered oil and oil/water mixtures. Rotary kiln incinerators burn liquids through special liquid injection ports. They are capable of burning at a relatively high rate, but require time to mobilize and construct. Air curtain incinerators are relatively simple, burn up to 600 barrels per day of emulsion, and are suited for field locations. For both types of incinerators, the liquid waste must be free of large solids that might plug the liquid feed nozzles

Disposal of Waste Oil

Oily waste in this category includes crank-case oil, hydraulic oil, and contaminated fuel. Such waste will be typically cleaner (primarily free of debris and not highly emulsified) than other liquid wastes. Therefore, the waste will be amenable for disposal by reprocessing, use as supplemental fuel, or incineration. All three disposal options were discussed in the previous section.

12.7.2. Disposal of Oil-Contaminated Water

Factors affecting the selection of disposal options for this type of waste are:

- The amount of free oil present
- The level of dissolved hydrocarbon present
- Whether the waste contains surfactants or other chemicals
- Discharge location

The disposal option will therefore depend primarily on the source of the oil-contaminated water. The following is a list of possible treatment options according to the wastewater source. The degree of treatment required also depends on the discharge location and sensitivity.

To the degree possible, oily wastewater should be processed (treated) at existing wastewater treatment facilities. Wastewater treatment facilities or septic systems will be constructed for the treatment of domestic wastewater during project construction and operations. Design parameters for these systems are described in the Project Environmental Management Plan.

Disposal of Recovered Oily Water

General

This type of waste typically contains free oil without surfactants. An oil/water separator is used to remove the free oil. Recovered free oil is transported to an appropriate facility for disposal, and the treated water is discharged.

For oil spills, gravity separators are simple devices that rely on residence time to provide sufficient oil/water separation. Typically, 30 to 45 minutes residence time is sufficient for good separation. Vertical or horizontal portable tanks with sufficient residence time can be used as separation vessels. Earthen basins with oil retention baffles and overflow weirs can also be constructed in the field. Prefabricated separators with and without plate packs are also available, but require significant time to mobilize.

Disposal of Wash Water

This waste results from washing oiled equipment, boats, booms, gear, etc. If the waste contains no surfactant, then oil-water separation should be sufficient.

If surfactants were used for the washing process, then the oil would typically be emulsified in the wash water. In this case, emulsion breakers should be added before oil-water separation.

Disposal of Ballast/Bilge Water

This type of waste is typically free of surfactants, and oil-water separation is sufficient prior to discharge. Discharge is to comply with international and national laws.

Disposal of Rainwater

Rainwater runoff from storage areas for oil and oily waste would typically be lightly contaminated with oil and be surfactant-free. Oil-water separation is normally sufficient prior to discharge.

12.7.3. Disposal of Non-Oily Wastewater

Oil spill cleanup operations can generate large amounts of liquid sewage wastes, both onshore and offshore, that originate strictly from domestic sources such as toilets, laundry, showers, and kitchens. The volume of this waste is proportional to the number of cleanup workers involved. Some small amount of non-oily wastewater may also originate from laboratory facilities as wash water or sample water.

Project wastewater treatment facilities or septic systems would be used for the treatment of domestic wastewater during an oil spill cleanup to the extent practical. Design requirements would include treatment of biological, physical, and chemical constituents, including oil and grease, pathogens, dissolved solids, metals, etc. Treated wastewater would be discharged to surface waters or natural drainages or to septic systems. Effluents would meet World Bank Guidelines for Onshore Oil and Gas Development for wastewater, domestic sewage, and contaminated storm water prior to discharge to surface waters or natural drainages. If septic systems would be utilized during a cleanup operation, the systems would be designed and located based on knowledge of local hydrological conditions. Regular maintenance and periodic monitoring would be conducted to keep systems operating as planned.

12.8. Disposal Options for Solid Waste

12.8.1. Disposal of Oily Solid Waste

Oily solid waste will be collected, segregated, and stored either at the centralized waste storage area or at the sites of cleanup operations. Most oily waste will be stored in plastic bags after collection. Vegetation debris will most likely be piled (not bagged) on location.

Landfilling, incineration (including open burning) and land farming are the key disposal options available for oily solid waste.

Landfilling

A landfill is an excavated area of land that serves as a disposal site for solid waste. Waste is deposited in a landfill and is periodically (usually daily) covered with soil to control vapors, odors, and littering.

The key concern with landfilling of oily solid waste is protection of underlying drinking water aquifers, if any. This concern influences the location and design of landfills. If the hydrogeology is suitable, a liner may not be required. If not suitable, a means of controlling leachate, such as a membrane liner or clay liner, may be required. Landfilling of liquid waste should be avoided.

Design parameters for constructing solid waste (non-hazardous and hazardous) landfills are provided in the Project Environmental Management Plan.

Fixation, also known as stabilization, makes certain types of waste more amenable to disposal in landfills. The method can augment landfill disposal of oily solid wastes that include free liquid. It can also be used for sludge residuals from storage tanks and water treatment facilities, as well as for oil-contaminated sand and soil. Solidification prior to landfilling can reduce the leachability of oil and metals from the waste.

The fixation/stabilization (F/S) process involves the addition of various stabilizing agents or solidifying binders (singularly or in combination), such as lime, cement, fly ash, silicates, or organic polymers, to a waste to physically and chemically immobilize contaminants. F/S treatment results in improved handling and physical characteristics and decreased solubility (decreased leaching) of contaminants. Mixing of the reagents with the waste can be done using a mechanical mixer, backhoe, or front end loader.

Incineration

Incineration can be used to dispose of oily solid waste at the source, at temporary collection areas, or at offsite facilities. Design parameters for constructing incinerators are provided in the Project Environmental Management Plan. Incineration of oily solid waste can occur at the incinerators constructed for the Project or in portable incinerators as described below:

Portable incinerators:

Portable incinerators can be used to efficiently burn recovered oil or oily solid waste in the field. Several incinerators can be used for this purpose, including rotary kiln and air curtain incinerators. Rotary kiln incinerators have no moving internal parts, are simple in concept, and have been successfully used in similar applications. They can incinerate the widest variety of waste materials, have low maintenance requirements, and operate effectively within a wide range of temperatures. Several portable units have been built by

contractors for use in oil fields; however, they take considerable time to mobilize. Rotary kilns also typically need feed-size reduction equipment, such as chippers or shredders.

Air curtain incinerators are another portable system for waste disposal in the field. They accept up to two tons per hour of oily debris and up to 600 bbl per day of oil emulsions. The advantage of this type of incinerator is that it accepts both liquid and solid waste, has high disposal rates, and results in a permanent disposal of the waste. Air curtain incinerators are easy to operate and are transportable. However, they require considerable time to mobilize to remote locations. Also, no emissions controls exist, but clean burning is promoted by air injection and controlled feed rates.

Open Burning

Burning in open areas or pits is a method primarily used for disposal of combustible oily waste and debris such as sorbents, vegetation, tar balls, logs, and other large bulky items. Readily combustible materials, such as oiled logs, branches, and other natural materials often can be burned in piles where they have been collected. A propane torch can be used to initiate combustion, and a burn promoter, such as fuel, can be added to the oiled materials.

Large quantities of stockpiled materials are often burned in several ditches or trenches, with each ditch being alternately loaded and burned. The use of a burning grate or air blower to promote good combustion reduces smoke emissions and increases capacity. The burn residue can either be buried when the pit is closed or collected and transported to a project landfill. Implementation of this method will require earth-moving equipment and appropriate fire safety precautions.

Land Farming/Composting

Land farming and composting are options for the disposal of oily solid waste. The processes are also applicable to oily sludges, oiled sand, seaweed, water treatment sludges, and contaminated soil. These options are discussed in Section 12.7.1

12.8.2. Disposal Options for Non-Oily Solid Waste

Non-oily solid waste such as garbage and trash are generated from a variety of sources during oil spill cleanup operations. Care will be taken to separate non-oily solid waste from oily waste and to maintain separation until ultimate disposal. Separate trucks for onshore operations will be maintained for the transportation of non-oily solid waste, which may be disposed of by incinerator, or may be sent to an appropriate landfill with capacity to handle the waste for disposal.

The refuse produced by a large-scale oil spill cleanup operation may exceed the capacity of existing project landfills and incinerators. It may be necessary to expand the capacity of the available facilities, or to construct new facilities.

12.9. Disposal Options for Special Waste

The selected disposal method will depend on the type of special waste as follows:

- **Solvents and chemicals:** Solvents and chemicals may be recycled or recovered in a reprocessing facility. If this is not an option, incineration is the preferred disposal method.
- **Batteries:** Lead-acid batteries may be disposed of in a project landfill or recovery facility, if available. Dry cell and other batteries will be overpacked and placed in a

Project landfill.

- Wildlife carcasses: Wildlife carcasses may be disposed of by incineration or landfill with other oily solid waste.
- Antifreeze: Antifreeze may be recycled/reclaimed, incinerated, or sent to a Project landfill.