APPENDIX VI – WASTE MANAGEMENT AND DISPOSAL

This appendix contains guidelines for the management and disposal of wastes generated during a response to an oil spill. Tab A addresses the management of the various waste streams that may be generated during a spill response incident. Tab B identifies disposal options for these various types of waste streams. These guidelines are intended to minimize the on-site accumulation of wastes that could interfere with the containment and cleanup of an oil spill. Collection, storage, transportation, treatment and disposal of the wastes from a spill cleanup shall be conducted in a manner that minimizes environmental and public health impacts.

TAB A – WASTE MANAGEMENT

1. Waste Streams

The term "waste" is used throughout this appendix. It is used for the purpose of identifying the types of materials that are generated as the result of a spill and spill clean up, and is not used to define these materials for purposes of state and federal solid waste and hazardous waste statutes and regulations. To formally confirm that these materials are not considered wastes in the regulatory use of that term and to optimize the management of these materials in a safe and environmentally responsible manner (e.g., recycling of recovered crude oil), the following definition is used for purposes of this document: "waste" means materials that are generated as a direct result (e.g., recovered crude oil) and the indirect result (e.g., refuse, sewage, and hazardous wastes) of an oil spill; "waste" for these purposes does not mean "solid waste" as defined by Alaska (AS 46.03.900(5) and 18 AAC 60.910(53) and federal (42 U.S.C. § 6903(27)) laws.

The following wastes may be generated as a result of an oil spill:

- **Oily Solid Wastes**

- Sand/gravel/tarballs
- Asphalt patches
- Sludge
- Sorbent pads/booms/rags
- Pallets and other wood
- Shoreline debris
- Logs and driftwood
- Shoreline kelp and popweed
- Oily personnel gear and clothing
- Damaged response equipment and gear
- Empty drums/containers
- Animal carcasses

- **Non-Oily Solid Wastes**

- Domestic trash and garbage
- Bagged human waste
- Discarded equipment and construction materials

- **Oily Liquid Wastes**

- Recovered or skimmed oil and mixtures of oil and water
- Used engine oils, hydraulic fluids
- Fuels, contaminated with water and solids
- Engine room bilge/ballast waters from vessels
- Rainwater runoff from waste storage areas
- Washwaters from cleaning boats, equipment, gear
- Washwaters from cleaning oiled wildlife
- Other oily waters

- **Non-Oily Liquid Wastes**

- Sewage, liquid human wastes (gray and black waters)
- Lab wastes
- Chemicals, such as solvents

Wildlife carcasses and contaminated fish may be retained as evidence. Their ultimate disposal should comply with applicable regulations and the oily waste disposal procedures described in this section.

2. Waste Stream Identification Numbers

OILY WASTE	*WASTE STREAM *NUMBER*	*OTHER WASTES*	*WASTE STREAM *NUMBER*
Fresh Oil	101	Domestic Wastes	201
Weathered Oil	102	Debris	202
Emulsion	103		
Hydraulic Fluids	104	Pallets	203
Beach Debris	105	Paperboard	204
PPE	106	Drums	206
Sand/Soil	107		
Sorbents/rags	108		
Oily Wastewaters	109	HAZARDOUS WASTES	301
Carcasses	110		

*Note: The numbering system depicted here is one of several possible methods to categorize waste materials to facilitate tracking and eventual disposal.

3. Procedures for Transportation, Storage, and Disposal

Temporary waste storage areas will be strategically selected and located as points of accumulation and temporary storage for oil spill related wastes. These temporary storage areas can be located at recovery sites, or they make take the form of longer term storage at more permanent facilities. Waste generated by response efforts will be stored at these areas pending waste characterization, final identification of disposal options, and placement of contractual arrangements with approved disposal facilities. Temporary waste storage areas must be approved by ADEC and the land resource trustee. It will be the responsibility of the responsible party (RP) to provide manpower and equipment required to transfer the wastes from the arena of operations to the storage areas and to fully operate these areas.

At the storage areas, wastes will be segregated into waste streams and stored in appropriate containers. In general, waste streams will not be mixed unless specifically directed by the Environmental Unit Leader. Later in the response effort, wastes may be forwarded under manifest directly from the point of generation to the disposal facility without the need for temporary storage.

a. **Liquid wastes** recovered through skimming or washing operations will be accumulated in barges, portable tanks, bladders, drums, or other approved means and held pending waste classification and characterization. Each container must be labeled as to contents and provided with an identification number for tracking and accounting purposes. In most cases, water will be decanted (with State approval) to reduce the volumes of liquid wastes. Different classes of liquid wastes should not be mixed in the same containers without approval of the disposal officer.

If the recovered oil has not undergone significant weathering or emulsification and is free of foreign material, it can be transported to a refinery or oil terminal as a product rather than a waste. Oil that cannot be recovered in this way will be deemed a waste oil and subject to additional testing and handling requirements.

On vessels used for decontamination purposes, all oily wash water should be segregated from other wastes and stored on board the vessel for future transport to an identified disposal facility.

Oily water collected at boat cleaning stations should be segregated into the following four categories:

- Bilge waters
- Bottom liquids from cargo compartments or holds
- Oily deck and hull wash waters
- Oily hold wash waters

Oily wash waters from the cleaning of gear, boom, and equipment should also be segregated and stored separately. Used oil from gear and maintenance operations should not be mixed with any other liquids, but collected and stored in marked containers. Other liquid wastes, like hydraulic fluids, antifreeze and contaminated fuels, also should not be mixed, but stored in 55-gallon drums and marked as to their contents.

All unidentified liquid wastes should be labeled as such, segregated, and handled according to hazardous waste management standards (40 CFR 261) pending laboratory analysis for RCRA hazardous waste characteristics.

b. **Solid wastes** should be double bagged and placed in portable dumpsters or shipping vans and transported to the temporary storage areas. Basic separation of like wastes should take place at this level. Clear, color-coded plastic bags may be used to segregate solid wastes for different disposal options. Solid waste that is too large for plastic bags will be segregated into properly marked dumpsters or shipping vans. Large spills may require a dedicated solid waste storage barge.

All dumpsters, shipping vans, or other means for storage of oily solid wastes must be lined with plastic sheeting prior to use. To control free liquid accumulation within the containers, an inner lining of oil and water absorbing fabric will be used. Additional granular sorbent material should be added as required to eliminate free liquids. For responses where oily debris is extensive and likely to accumulate rapidly, debris may need to be piled in vacant storage yards with a drainage system to collect any runoff, or in lined earth pits.

Oily PVC waste materials should be bagged and tagged to show contents. These bags should be segregated from other waste streams and transported to a storage area

Bird and animal carcasses should be bagged, tagged, and segregated. Tags should include location of the recovery. Bird and animal carcasses will be handled as directed by the appropriate authority. Refer to Annex G, Wildlife Protection Guidelines.

c. **Non-oily waste** (scrap materials, construction materials, etc.) and domestic garbage and refuse should be collected and segregated (according to the particular requirements of municipal or private waste process and disposal facilities) to prevent oil contamination and transported to storage or final disposal site.

4. Waste Handling and Labeling

Proper waste handling, manifesting, custody transfer and labeling are important for the proper movement and documentation of all waste materials generated in an oil spill response. Wastes must be segregated according to the various types and must not be mixed. All segregated wastes will be properly labeled showing the type of waste in each container. For all unidentified wastes, they need to be labeled as such and segregated from the other wastes. All unidentified wastes/oils will be assumed to be hazardous until sample results are available. If a waste turns out to be hazardous, it will be handled and treated in accordance with current hazardous waste regulations.

5. Records

All waste oils, regardless of type, must be managed by a complete set of records. These records should show the following:

- where the waste was recovered,
- the type of waste,
- approximate volume,
- date collected,
- date transported to staging or disposal site,
- date received at temporary storage area or disposal site,
- the number of containers shipped,
- the number of containers received,
- the date, location and method of final disposal.

To aid in the implementation of the records requirements, the following procedures are recommended:

a. Waste management activities should be conducted as secure storage areas set up at strategic locations.

b. **Each load of waste departing the point of generation should be inspected and assigned to an internal waste stream matrix and inventory record.**

c. A waste tracking form should be completed for each load of waste. Information required on this form includes date and time, transporter name, vessel of truck number, description of waste and generating process, the assigned waste stream number, and destination of the waste.

d. Waste moved to off site treatment or disposal facilities are transported under the appropriate manifest with copies retained.

e. Once each day, a "waste management summary report" will be completed documenting the following daily and cumulative totals for each waste stream:

(1) waste received
(2) waste stored on site
(3) waste stored off site
(4) waste disposed by disposal facility

TAB B – DISPOSAL OPTIONS

Options for disposal of oily waste may include open burning, incineration, landfilling, bioremediation, and oil/water separation and recycling. See Table 1 of this appendix, below, for a list of disposal options that may be appropriate for different categories of waste streams. Table 2 lists contractors that may be available for waste disposal management.

The RP will be responsible for developing a waste disposal plan that provides the necessary logistical and procedural information for the transfer of wastes to disposal facilities. The disposal plan must be in compliance with existing laws and regulations. Oversight of the waste disposal plan will normally be the responsibility of the ADEC.

State regulation 18 AAC 75.130 requires that the final disposal of a hazardous substance including oil, be approved by ADEC. Oil spill reporting regulations 18 AAC 75.100 require that disposal information be provided within the oil spill report.

1. Short Term Management and Disposal Options for Liquid Wastes

If a spill occurs, both oil and non-oily liquid wastes will be generated or collected during cleanup. This section describes short-term management and disposal options for oil and non-oily liquid wastes, including domestic wastewaters.

a. Oily Liquids: Recovered oil and oily wastewater from spill-related activities will be stored on board tank vessels, in portable tanks, tank trucks, or in approved shore-side tanks where primary oil/water separation may occur. With State approval, on-site decanting may be allowed. After primary oil/water separation, one of the following disposal options will be used:

- Tender of recovered oil to the contracting vessel for offshore treatment;
- Transportation of recovered oil to a refinery or oil terminal for re-use as a product;
- Barging oily water to the continental U.S. for additional treatment or disposal, unless the spill fluid emanated from oil production facilities and can be recycled or disposed of at the original facility; or
- Barging heavily weathered and emulsified oils to the continental U.S. for treatment, additional oil recovery, and wastewater and solids disposal in a commercial waste management facility.

Treatment facilities for these options are described below.

(1) Onshore Treatment Facilities: Crude oil recovered soon after a spill will generally be suitable for reclamation by a production facility or refinery. Because the chemical make-up of spilled oil changes as it weathers, it is less likely that oil collected during a long-term cleanup operation can be reclaimed. Oil that is emulsified, weathered and mixed with debris from the sea or from beach cleaning operations is a mixture of liquids and solids and requires special handling and treatment prior to disposal. There are currently no appropriate disposal options in Alaska for these emulsified wastes. Therefore, they must be stored on barges and shipped to appropriate waste handling facilities in the continental U.S. for treatment.

Oily wastewater, if associated with oil production or terminal facilities, can be treated and disposed of at those facilities (such as the Ballast Water Treatment Plant at the Valdez Marine Terminal) with the approval of EPA and ADEC. Laboratory analysis of these wastewaters may be necessary so that contaminants do not interfere with the treatment process. If particular oily wastewaters cannot be treated because of incompatible contaminants or

inadequate plant capacity, those wastewaters will be taken to alternate treatment facilities (e.g., the tanker owner's refinery in the continental U.S. or a permitted bulk receiving facility). For certain wastewaters, physical chemical treatment methods (e.g., air stripping or granular activated carbon) may be preferred over biological treatment.

Contaminated wastewaters will require sampling, analysis, and possible pre-treatment before potential disposal in a municipal sewage treatment facility. EPA, ADEC, and municipal approval may be required. Any discharge into a municipal sewage system must meet EPA pre-treatment standards. If analysis indicates that wastewaters are hazardous, they will be shipped to a disposal facility in the continental U.S.

(2) Offshore Treatment Facilities: The objective of any onboard treatment will be to reduce the water content of the liquid wastes or recovered product collected and transported by the vessel, thereby increasing the vessel's storage capacity. It is reasonable to assume that some primary phase separation could take place in the vessels being loaded with oily wastewaters. The accumulated water could be extracted, treated and, after the appropriate permits are obtained, discharged overboard.

Treatment facilities to be considered include:

- Screw pumps (very suitable for low and highly viscous liquids)
- Centrifuges (operation not affected by vessel movement)
- Gravel filters (operation not significantly affected by vessel movement)
- Dissolved air flotation (DAF) unit (effective in removing low concentrations of oil, but its operation can be affected by vessel movement)

The performance of the onboard treatment facilities can be enhanced by the use of emulsion breakers and flocculation agents. Care should be exercised to ensure that they do not become a source of pollution. Unless the tanker or vessel is anchored in a sheltered area, treatment can be impacted by inclement weather.

(3) In-State Resources for Waste Treatment and Recycling: There are several facilities in the state that treat oily wastes or related materials. In general, however, operational or permit requirements limit the facilities' ability to handle recovered liquids.

Alaska Pollution Control is an oil recycling facility located in Palmer. The plant is currently accepting a variety of spilled and recycled refinery products, including lubricating oil, gasoline, diesel, and fuel oil. The products must be less than 1000 ppm total halogens and must not be hazardous waste by definition. Exact requirements must be verified prior to use of the facility, and the blended products must meet specifications for heating value. The products are processed and sold for use as industrial fuel. The plant does not accept crude oil for operational reasons, but does accept 10,000 to 20,000 gallons of water per week from spills and tank clean-outs. The water is processed and discharged to a Publicly Owned Treatment Works (POTW) under pre-treatment limits. Hydrocarbons recovered from the wastewater are processed in the same manner as the other products.

Various portable processes could be used to pre-treat waste before shipping to an oil recycling facility. In addition, it is possible to ship water that meets pre-treatment standards to a POTW. The acceptability of the waste will depend on its source and characteristics, as well as the volume. Each municipality has different requirements.

(4) Other Commercial Oil Recovery Methods: Other oil recovery methods are being used elsewhere in the U.S. These methods include the following:

- Oil is heated to a temperature below its flash point and injected into sludges to dissolve the waxy and gelatinous deposits to facilitate their recovery.
- Gravity separation, chemicals, heat, lighter oils and solvents, and emulsion-breaking chemicals are used to thin heavier fractions.
- Coker units are used at refineries to dispose of certain types of sludge.
- Mixing different oil types to enable their processing may make variable angle mixers more efficient.
- A rotary vacuum filter, consisting of a horizontal drum with a filter media on its outer surface, is partially submerged and rotated in a tank containing sludge. A vacuum pulls liquid inward while retaining solids on the outside, which are then scraped off.
- A scroll-type centrifuge rotating at 75-100 rpm forces solids against an inner bowl and on to discharge. High-feed rate and durability make this a popular item at refineries. The effluent still requires treatment and the solids produced might not be pumpable. Neither heat nor chemicals may be necessary to optimize the performance of two-stage centrifuges. Generally, centrifuges are operated only for 1-3 weeks at a time of 40-60% rated capacity.
- Gravity-belt filters press sludge between two moving belts and force out oil and water. These filters rely on the application of costly high molecular-weight polymers to coagulate sludge. Changes in the sludge, including pH and H_2S emissions, can result in problems. This method, however, has been used for many years on biosludges in Europe.

These technologies are not currently commercially available in Alaska, but they may be considered in the event of a spill.

b. Non-Oily Liquids: Oil spill cleanup operations produce large amounts of liquid sewage wastes that originate from domestic sources such as toilets, laundry and shower facilities, cooking, and gathering centers. The volume of such wastes is directly proportional to the number of cleanup workers involved.

Domestic wastewater may be collected and transported to a municipal sewage treatment system for disposal after approval from the municipal government. If the volume of sewage generated by cleanup workers exceeds the additional load handling capacity of the municipal sewage treatment plant, on-site land-based or barge-mounted wastewater treatment plants can be used to treat surplus waste volumes.

If additional wastewater treatment facilities (either land-based or barge-mounted) are to be used, the volume and concentration must be estimated for proper sizing of treatment systems. The RP should consult with the EPA and the ADEC for guidelines and standards for accomplishing this.

The sewage collected from remote areas may originate from non-flushing portable toilets that produce a concentrated waste stream high in BOD, suspended solids, and deodorant chemicals. Domestic wastewater treatment alternatives to municipal treatment facilities include:

- Physical-chemical package plants
- Extended aeration package plants
- Rotating biological contactor package plants

Packaged domestic wastewater treatment plants are recommended because they are portable and can be mobilized quickly, if available. These treatment facilities require plan review, an ADEC wastewater permit, and an EPA NPDES permit. A vessel with a U.S. Coast Guard- approved Type II Marine Sanitation Device (MSD) does not need an ADEC or EPA permit for discharges. (All vessels built after January 1980 are required to have a Type II or Type III MSD).

2. Short Term Management and Disposal Options for Solid Wastes

If a spill occurs, oily and non-oily solid wastes will be collected, segregated, and stored at interim temporary storage areas and, if necessary, at the sites of cleanup operations on beaches. Most solid wastes will be stored in plastic bags after collection. Hazardous wastes will be handled in accordance with RCRA regulations and transported to the continental U.S. for disposal. Non-hazardous wastes will be handled in the most economic manner. Solid waste will be incinerated, if capacity allows; a secondary option is transport to landfills in Alaska or the continental U.S.

a. Hazardous Oily Solid Wastes: RCRA hazardous solid wastes may be generated from oil spill response activities. Potential sources of RCRA hazardous wastes are:

- Spill-related materials that exhibit hazardous characteristics
- Maintenance wastes generated by vessels and vehicles used in response and clean up.
- Laboratory wastes and residues from testing and disposal of spill-related material.

A hazardous waste storage area will be established if hazardous wastes are generated. If necessary, satellite accumulation areas will also be established. Proper container storage and labeling practices will be followed. Assigned personnel will monitor operations throughout the spill area to prevent improper waste disposal and to minimize the creation of hazardous waste through "mixing" (the disposal of small quantities of hazardous waste into solid waste containers, such as used oil tanks or boat washing slop tanks).

Hazardous waste management procedures include the following: ascertaining that response contractors are aware of regulatory requirements, including handling practices; obtaining generator I.D. numbers; proper labeling; storage; and monitoring of operational areas by personnel trained in hazardous waste management.

Hazardous wastes will be disposed of in a permitted hazardous waste facility in the continental U.S. since no permitted waste disposal site exists in Alaska at this time.

b. Non-Hazardous Oily Solid Wastes

(1) Incineration: Waste incineration can be an economical means of destroying organic compounds. Ash generated as a result of incineration will be tested for hazardous characteristics and properly transported for disposal at appropriately permitted facilities.

With approval from the North Slope Borough, up to 15 tons per day of non-hazardous oily solid waste, except sand and gravel, may be shipped to the North Slope Borough incinerator facility at Deadhorse. For spills in Prince William Sound, the Valdez Marine Terminal's incinerator can handle non-hazardous oily and non-oily solid waste, as capacity allows.

Several other state-approved facilities for incineration of response waste exist in Alaska. In Southeast Alaska, municipal incinerators are available in Juneau and Sitka, and one is proposed for Ketchikan. Use of these facilities for incineration of response wastes requires written approval from ADEC. Consult with the local ADEC Office on the status of approved landfills and incineration facilities.

(2) Disposal at Facilities in the Continental U.S.: Some solid waste is not suitable for incineration (e.g., rain suits and some kinds of boom). These wastes will be shipped to landfill disposal sites in the continental U.S.

(3) Burial: On-site burial may be used at remote locations where oily debris will otherwise have to be transported large distances for centralized disposal. The operation will consist of excavating an on-site disposal pit and burying the oily waste. The advantages of this disposal method are reduced costs for transporting, packaging, storage, and ultimate disposal fees.

Disadvantages of this method include the logistics of transporting excavation equipment and personnel to remote sites and possible future leakage from the uncontained disposal pits.

On-site burial of oily waste requires a solid waste disposal permit from ADEC. Although on-site burial may be permitted in remote locations, the likelihood of it occurring without engineering controls is minimal. On-site burial is not a preferred waste management option because of the technical difficulties involved and public and agency concerns over such disposal.

(4) Waste Sludge Disposal: The sludge resulting from certain treatment facilities will require further treatment or disposal. Sludge treatment may include:

- Fluidized bed incineration
- Steam stripping
- Digestion, dewatering, vacuum filtration, centrifugation
- Controlled land disposal

The quantity of sludge generated by the treatment process will depend on the solid content of the oily wastewaters treated. Steam-stripping can recover oil adhering to the solids and the process can produce a sludge possibly suitable for disposal at a permitted facility.

Depending on the organic content of the sludge, aerobic or anaerobic sludge digestion may be feasible. Heating the contents of the sludge digester will accelerate the rate of biological decomposition of the sludge and reduce the residence time required for sludge stabilization. The water resulting from the sludge dewatering operation may be returned to the wastewater treatment system ahead of the biological oxidation process. The stabilized sludge may be suitable for land disposal at a permitted landfill site.

c. Non-Hazardous, Non-Oily Solid Wastes: Non-oily solid wastes (refuse) are generated from a variety of sources during oil spill cleanup operations. Care must be taken to separate non-oily solids wastes from oily wastes and to maintain separation until ultimate disposal.

Separate trucks for onshore operations should be maintained for the transportation of non-oily solid wastes. The non-oily waste material may be sent to an appropriate municipal landfill or municipal incinerator with capacity to handle the wastes for disposal, if approved by local officials. Since most towns and cities have municipal landfills, disposal will likely occur at local population centers. The RP should coordinate with municipal officials.

The refuse produced by a large-scale oil spill cleanup operation may have a significant impact on the local landfill. For example, the Exxon Valdez oil spill cleanup operations in Prince William Sound increased local refuse disposal as much as 500%, with a corresponding increase in personnel and equipment at the local landfill operations to meet the higher demand. In such situations, it is important to coordinate with the community to assure that personnel and equipment requirements are met.

Disposal of wastes in solid waste sites must conform with the facilities' permit requirements.

3. Long-Term Management and Disposal Options

a. Open Burning: On-site burning is a potential disposal method for non-hazardous oil-stained rock and sand mixtures, tar balls, logs, driftwood, and miscellaneous solid wastes.

(1) Remote Stockpile Burning: Open burning may be a feasible method for large quantities of combustible oily wastes that are stockpiled in remote areas, but this method generally requires weather suited for smoke dispersal. Burn residue produced from open burning needs to be collected, tested for hazardous characteristics, and properly transported to disposal sites. Open burn pits designed to facilitate efficient removal of residues can facilitate a smoother cleanup operation.

Open burning in Alaska is regulated by ADEC, and before proceeding with an open burning operation, written approval must be obtained from ADEC. Approval is contingent upon submission of an open burning plan that addresses concerns outlined in the Alaska Air Quality Control Regulations (18 AAC 50). These concerns include the following: air contaminants, location of sensitive population centers, weather considerations, visibility impacts, overall coordination, public information, and other project specifications. In addition, the plan for open burning must include an evaluation of feasible alternatives with a demonstration that open burning is the most feasible choice.

(2) *In Situ* Open Burning: Combustible materials, such as oiled logs, branches, and other natural materials found along beaches, can be burned in piles where they have been collected. A propane torch can be used to initiate combustion or a burn promoter, such as fuels, can be added to the oiled materials.

Open burning can also be applied to any oily wastewater collected for off-site disposal. However, this disposal method would require a site-specific ADEC Open Burning Permit and an ADEC Wastewater Disposal Permit. Burn residue will have to be contained and collected at each site and tested for hazardous characteristics, thus leading to possible logistical problems.

Sustained burns of logs and other large items can penetrate some substrates to a depth of about one foot, thus removing the underlying oil. Oil that has migrated downward into beach materials beyond that depth likely would not be burned.

Other disadvantages or constraints to *in situ* open burning can include:

- Public concerns.
- Threat of spreading (e.g., grass or forest fire)
- Burn residue might be hazardous or otherwise present a pollution problem
- Direct biological impacts from heat may be a concern where an extensive area is fired.
- Smoke plume may not meet regulatory requirements.

b. Incineration: Incineration can be used to dispose of oily waste materials at the source or at temporary collection and storage areas. The incineration process must be combined with appropriate flue gas cleaning and residue handling in order to complete the overall waste management process. A variety of wet, semi-dry, and dry acid-gas scrubbing processes are available with extensive, successful experience in application to incineration systems. The applicability of a specific process is determined through evaluation of flue gas characteristics, reagent and residue handling costs, need for plume suppression, and other factors. Sensitive

instrumentation for detecting pollutant levels within the system is also vital, as is the ability of the equipment to adjust to changing conditions. Two technologies currently dominate the waste incineration industry: rotary kiln incineration and fluidized bed incineration. The advantages and disadvantages of both systems are well known and documented since both technologies are established incineration techniques with several commercial plants currently in existence.

Rotary kiln incineration appears to be the better overall option for necessary permanent incineration capacity. If on-going operations justify use of a permanent incineration system, the following system appears preferable:

- One or more medium-sized, modularized rotary kiln systems on the same site with good access by water and land.
- Necessary feed storage, feed preparation, ash-handling facilities, and other support services as needed for all units, making these common to all incineration units to the extent possible and practical.
- Operation of one unit at a time on locally-generated wastes at reduced capacity to maintain the facilities in ready condition and to maintain the skills of the operating crew.
- Delivery of spill wastes and containerized materials to the site by barge for processing. Storage of the wastes most amenable to storage will stretch the processing period and reduce the size, number, and cost of the facilities.

This rotary kiln incineration system can be developed and implemented in a reasonably short time and in compliance with regulatory requirements. Some oil spill cleanup specialists have indicated that there are portable incinerators on the market that provide good backup in an emergency because they can be quickly dispatched to remote sites.

c. Bioremediation:

(1) *In Situ* Biodegradation: Bioremediation involves adding nutrients (nitrogen and phosphorus) to enhance indigenous microbial activity. Successful bioremediation can accelerate the clean up of a spill and reduce the amount of oily wastes requiring disposal.

Bioremediation of *in situ* spilled oil is still in the research phase, but holds promise for use under favorable conditions. on oiled sand, pebbles, cobble, driftwood, and other natural beach materials. The shoreline configuration must be amenable to this method, but smaller debris does not have to be transported to a remote site for ultimate disposal. Larger items of debris must be dealt with separately and the technique might require several seasons for significant degradation to occur.

(2) Landfarming: Some oil spill specialists in other parts of the country consider landfarming a feasible alternative to oily waste disposal. In Alaska, however, due to the low temperatures, short summers, high precipitation, and the scarcity of flat soily areas, further research must be done before the plausibility of this method can be determined. In landfarming, oily sludges are spread on a selected site and then combined with soil, moisture, and nutrients in the presence of oxygen to promote bacterial degradation of the hydrocarbon components. This requires an even application of flowing oily wastes. Smaller items, such as sand, pebbles, short seaweed (less than 6 inches long), sludges, and contaminated soils can also be processed this way. The most suitable sites are large fields with deep, tillable soil and a constant supply of water. Some sites might require the placement of a liner. The soil is prepared, the nutrients and wastes are applied, and then the field is tilled periodically. The soil pH must be controlled and the field must not have a greater than 1% or 2% grade.

Necessary equipment includes backhoes, tractors, rototillers, disc harrow or plows, fencing, pumps, and sprinkler systems. This method requires a permit and monitoring. If a liner is used, it must be removed when the hydrocarbons reach approved levels.

d. Landfilling: Approximately five permitted landfills that can accept oily wastes are currently in use in Alaska. These landfills are associated with oil fields on the North Slope and are typically reserved exclusively for the company operating the landfill.

At this time, no landfill facility in Alaska will accept significant amounts of oily solid wastes. In the event of a large spill, landfill disposal will be feasible only if ADEC permits disposal of significant amounts of oily waste at existing sites and/or expedites permitting of proposed sites. The advantages of having an in-state oily waste landfill include immediate availability and accessibility, as well as reduced logistical requirements for transportation, packaging and disposal.

An ADEC solid waste permit is required to site an oily waste landfill in Alaska. Discussions with regulatory solid waste management personnel indicate that successful state approval of a permit will be contingent on site-specific engineering designs. To be effective, a facility must be fully constructed and permitted before a spill.

TABLE 1: WASTE DISPOSAL OPTIONS

WASTE STREAM	PRIMARY OPTION	FIRST ALTERNATIVE	SECOND ALTERNATIVE
Fresh Oil (101)	Refining	Fuel Blending	Ex Situ Burning
Weathered Oil (102)	Fuel Blending	Land Treatment	Solidify & Landfill
Emulsions (103)	Fuel Blending	Land Treatment	Solidify & Landfill
Hydraulic Fluids (104)	Refining		
Oil Debris (105)	Incineration	Open Burning	Landfill
Oily PPE(106)	Incineration	Landfill	
Oily Sand/Gravel (107)	Ex-Situ Burning	Land Treatment	Landfill
Oily Sorbents (108)	Fuel Blending	Incineration	Landfill
Oily Wastewater (109)	Electrocoagulation Treatment		
Animal Carcasses (110)	Offer for Research	Incineration	

WASTE STREAM	PRIMARY OPTION	FIRST ALTERNATIVE	SECOND ALTERNATIVE
Domestic Wastes (201)	Incineration	Landfill	
Non-Oily debris (202)	Incineration	Landfill	
Pallets (203)	Recycle/Reuse	Open Burn	Landfill
Paperboard (204)	Recycle/Reuse	Open Burn	Landfill
Drums (206)	Recycle/Reuse	Landfill	
Hazardous (301) Wastes	Special Handling, Storage, Treatment		