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Standard Guide for Incinerating Oil Spill Wastes at Temporary Field Locations[1]

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1. Scope

1.1 This guide addresses incineration as a means of waste disposal and specifically discusses incinerating oil spill wastes at temporary field locations.

1.2 The purpose of this guide is to provide the user with general information on incineration as a means of disposal, not to define a rigid set of standards. It is intended as a reference to plan or execute disposal by incineration.

1.3 This guide outlines procedures and describes some equipment that can be applied to a land-based field incineration process. Included in the guide is a description of typical oil spill wastes that can be incinerated; an outline of procedures to select, prepare, operate, and restore a temporary site; and a summary of general site safety considerations.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary information is given in Section.7

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *field*—a location designed during an oil spill cleanup for incinerating oil spill waste material.

2.1.2 *incineration*—controlled burning of waste products or other combustible material.

2.1.3 *incinerator*—a device constructed for the purpose of containing a material for thermal oxidization.

2.1.4 *landfarming*—a controlled method of spreading a known amount of oil in a nominally uniform layer thickness onto a designated land area for the purpose of biological decomposition. This decomposition process is accelerated by mixing the oil layer with the top few inches of soil, aerating the soil by occasional plowing and adding fertilizers that include nitrogen and potassium to increase the oil decomposition rate.

2.1.5 *landfill*—a land disposal technique that uses excavated pits to contain the oil spill waste material. The waste is placed in the excavation, covered over, and left to degrade.

2.1.6 *oil spill*—An uncontrolled discharge of petroleum materials into the environment.

2.1.7 *on-scene coordinator*—the person in charge of oil spill countermeasures.

2.1.8 *open burning*—the process of burning a material without the aid of an incinerator.

2.1.9 *portable incinerator*—a device capable of being transported by some practical means to a field location for the purpose of burning combustible waste products.

2.1.10 *recycling*—any disposal method that uses oil spill waste material in some manner other than returning it to a marketed product. Examples are road oiling and direct use as fuel supplement.

2.1.11 *relative viscosity*—the measured viscosity of an emulsion (in any convenient unit) divided by the measured viscosity of the oil.

2.1.12 *reprocessing*—reclaimed spilled oil by some type of treatment technique that returns the oil into a product that can be sold.

3. Significance and Use

3.1 A series of five basic operations are generally required to control an oil spill. These operations are: containment, recovery, transfer, storage, and disposal. A deficiency in any one of these operations can cause the entire cleanup activity to slow down or even stop. For example, recovery operations must be terminated when temporary storage fills to capacity and skimmers are no longer able to offload picked-up oil. In order to minimize any adverse effect that the disposal process might have on the other four operations, proper planning and management of the waste disposal operation is essential.

3.2 One way to avoid a slowdown due to the disposal process is to select a disposal site near the cleanup activity. A convenient site reduces the time necessary to transport the picked-up material from storage to disposal, thus increasing the efficiency of the overall operation.

3.3 Unfortunately all oil spill cleanup locations may not be convenient to established oil waste disposal areas. In remote areas travel time to refineries, landfarms, or approved landfills may be hours or even days away from the spill. Therefore, it may be advantageous to establish a temporary field disposal site near the cleanup operation.

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3.4 An effective disposal method to use at temporary field locations is incineration. Incinerating oily waste does not require a large land surface area as does landfarming. Also, with an incineration process there is no need for long term subsurface monitoring as with the landfill method of disposal.

3.5 The incineration process can serve two functions. First, it can permanently destroy the oily waste to prevent recontamination by the oil, and second, it can reduce the volume of recovered materials that must be transported to other disposal facilities.

3.6 This guide may be applied where deemed suitable by the user. Because of the emergency nature of most spill cleanup situations, it is recognized that these guidelines cannot always be applied in every detail. Accepted industry practice is to do a safe and environmentally acceptable job with the available resources.

3.7 This guide is intended to be used by persons generally familiar with the practical aspects of oil spill cleanup operations. It is intended as a guide for the on-scene coordinator or personnel managing the spill waste disposal phase.

4. Classification of Oil Spill Waste Materials

4.1 The ability of an incinerator to burn oil and oily debris successfully depends on the nature of the recovered material. Of particular importance is the quantity of water associated with the recovered oil and debris, the size distribution of the debris, and the percentage of combustible, organic material in the mixture. This section describes the types of materials that can be incinerated in the field.

4.2 Recovered materials that can be incinerated are divided into several general categories based on their physical state, size, combustibility, transfer requirements, and components. Table 1 summarizes types of oil spill waste into the following categories.

4.2.1 *Liquids*—Oil recovered from a spill usually has water associated with it. The percentage of water collected with the oil varies widely. The water can be present with the oil either as free water or mixed into the oil to form a water-in-oil emulsion. It is often necessary to decant the free water from the oil prior to incineration. In order to decrease the water content in the emulsion, chemicals or heat can be added to break the emulsion into free water and oil. After separation of the free water, the remaining liquids will be uncontaminated oil and emulsions. Both are pumpable by conventional means, contain little or no debris, and have relatively high heating values. According to Table 1, liquids are designated as uncontaminated oil and emulsion.

TABLE 1 Types of Oil Spill Waste

Waste Material	Physical State		
Categories	Liquid	Semi-solid	Solid
Oils			
Uncontaminated (Crudes, refined products)	X	X	
Emulsions (Crudes, some refined products)	X	X	
Weathered (Tarballs, burned oil residue)		X	X
Oily Debris			
Small combustible (Sticks, cups, sorbent pads)		X	X
Large combustible (Logs, seaweed mats, pilings)			X
Small noncombustible (Sand, rocks, metal, soil)		X	X

4.2.1.1 *Uncontaminated Oil*—Liquid, uncontaminated oil is pumpable by conventional means and contains little or no debris. The major component is crude oil or a refined product such as fuel oil, diesel oil, or lubricating oil. These materials normally have high heating values and burn efficiently. Although relatively uncontaminated, this category of liquid may contain small amounts (for example, up to about 5 %) of other non-hydrocarbon.

4.2.1.2 *Emulsions*—Liquid emulsions are pumpable by conventional means and contain little or no debris. The major components are oil, either crude or certain refined products, and water. Generally, the more water in a water-in-oil emulsion, the higher the viscosity. For example, the relative viscosity of a water-in-oil emulsion with 50 % water is 10, whereas the viscosity with 80 % water is 10 000. Viscosity can affect the type of transfer system, incinerator system and pretreatment required to lower the heating value.

4.2.2 *Semi-solids*—Semi-solid waste material may result from oil weathering, debris mixing into oil, or low temperature. Most oil spill cleanup operations must dispose of semi-solid materials. The major components of semi-solids can be either oil or debris. For example, uncontaminated No. 6 fuel oil can become a semi-solid at low temperatures depending on its pour point. Oil-saturated pine needles or straw can also be considered semi-solid type materials. Semi-solids without treatment can generally be transferred by some types of positive displacement pumps, conveyor systems, vacuum systems, or screw augers. They can also be pre-treated prior to incinerating. For example, debris can be separated from the oil or the oil can be heated to make it a liquid in order to be pumped by conventional means. According to Table 1, semi-solids are designated by five categories as follows: uncontaminated oil, emulsions, weathered oil, small combustible debris, and small noncombustible debris.

4.2.2.1 *Uncontaminated Oil*—Semi-solid uncontaminated oil can occur naturally or can be formed as a result of low temperatures. Some crude oils exist in nature as semi-solid materials due to paraffinic constituents and must be heated in order to be easily transferred. In the Arctic, temperatures are low enough to cause some crude oils to become semi-solids.

4.2.2.2 *Emulsions*—Semi-solid emulsions can solidify at low temperatures when the water phase begins to freeze. The greater the water phase the more solid the material becomes.

4.2.2.3 *Weathered Oil*—Semi-solid weathered oils are highly viscous materials composed mainly of oil with components C_{10} and greater. Weathered oil is formed in many ways including exposure to sunlight, heat and long-term mixing in water. Exposure to these conditions causes a reduction in the light ends of the oil and a resultant increase in the viscosity. Tarballs are an example of highly-weathered oil.

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4.2.2.4 *Small Combustible Debris*—Semi-solid small combustible debris refers to a mixture of oil, either liquid or semi-solid, and debris. The debris in the mixture is not bulky and any one piece can easily be picked up in one hand. Examples of such debris are oil-coated sorbent pads, leaves and wood cuttings.

4.2.2.5 *Small Noncombustible Debris*—Semi-solid noncombustible debris refers to those oily debris mixtures that contain components that will not burn at the same temperatures as the oil. Oils containing soils and metal may be included in this category.

4.2.3 *Solids*—Solid waste material recovered at oil spills exhibits no fluid characteristics. The major component of the material is the solid matter and not the oil. Solids range in size from oil-coated sand grains to logs. Solids are normally transferred with material handling equipment and cannot be pumped by conventional means. Large oil-coated materials that cannot be handled by one person are in this category and usually require power equipment, such as cranes or conveyor systems to move them. Sometimes it is easier to incinerate large solids by first reducing their size by cutting, shredding or grinding. Solid materials in this guide are designated in Table 1 by the following categories: weathered oil, small combustible debris, large combustible debris, and small non-combustible debris.

4.2.3.1 *Weathered Oil*—Solid weathered oils are found mainly on shorelines and are formed as a result of long-time exposure to sunlight, water and, often, mixing with debris. Normally weathered solid materials are not harmful to the environment but are a nuisance on recreational beaches.

4.2.3.2 *Small Combustible Debris*—Solid small, combustible debris is material that can be picked up and moved by one person. Oil-coated sticks, paper cups, and lightly-oiled sorbent pads are examples.

4.2.3.3 *Large Combustible Debris*—Solid large, combustible debris is material too large to be moved by one person. Normally these materials must be handled by cranes, trucks, bulldozers, etc. These materials are normally reduced in size by cutting, shredding or grinding if they are to be incinerated. Size reduction not only makes it easier to handle the material, but also improves the combustibility of the material.

4.2.3.4 *Small Non-Combustible Debris*—Solid small, noncombustible debris includes oil-coated soils and metals which do not exhibit fluid characteristics. These are normally handled by front-end loaders, shovels, trucks, etc. depending on the amount of material. Incinerating these wastes usually results in residues that must eventually be disposed of following the incineration process.

5. Incineration Equipment

5.1 A variety of incinerators are used to incinerate oil and oily debris in the field. The incinerator used depends on several factors, including the location of the oil spill and incinerator site, the material to be disposed of, size of the oil cleanup operation, and government regulations. Any incinerator system is acceptable to use as long as it is designed to burn oil waste material, is safe to operate in the field, meets the requirements of officials, and is approved (if necessary) to use.

5.2 Some incinerator systems require auxiliary equipment to operate. This equipment includes feed systems for loading the waste, water for cooling the flame, and fuel to ignite the waste or heat the incinerator chamber. Other systems are self-contained and do not require auxiliary equipment.

5.3 *Categories of Incinerators*—Incinerator systems used to burn oil spill waste products can be placed into one of the following categories: factory assembled, user assembled, or user fabricated.

5.3.1 *Factory Assembled*—Factory assembled incinerators are complete commercially available devices. They require no assembly or fabrication by user in order to implement their use in the field.

5.3.2 *User Assembled*—User assembled incinerators are made from commercially available component parts; for example, a fan, a motor, and a refractory lined chamber. They require assembly of the components by the user, but parts do not need to be fabricated.

5.3.3 *User Fabricated*—User fabricated incinerators are those not commercially available that require design and fabrication. These units are generally one of a kind systems.

5.3.4 These guidelines will only describe factory assembled and user assembled systems. User fabricated systems are useful in the field, but are too numerous to include in these guidelines.

5.4 *Requirements of a Field Incinerator*—In order for an incinerator to be a practical tool for field incineration, it must satisfy the following general requirements.

5.4.1 *Burns Oily Materials*—The incinerator must be a proven system, capable of burning oil liquids or semi-solids, or both.

5.4.2 *Transportable*—The incinerator shall be transportable to the oil cleanup location by air, land, or water vehicles.

5.4.3 *Safe*—The incinerator shall be a device proven safe to use, and when operated correctly will not endanger persons, equipment, or the environment.

5.4.4 *Auxiliary Equipment*—The incinerator system shall include all the equipment necessary to incinerate the waste materials, or the auxiliary equipment shall be standard equipment readily available from suppliers. Examples of auxiliary equipment include pumps, supplemental fuel, safety shields, loading systems, portable tankage (bladders or truck tankers), and electrical generator systems.

5.4.5 *Field Repairable*—The incinerator shall be designed so that minor repairs can be made at the temporary incineration site.

5.5 *Types of Field Incinerators*—There are three types of incinerator systems that are most commonly used for on-site incineration. They are commercially available either as complete units or can be assembled from component parts. The three types of systems are the rotary kiln, the air curtain incinerator, and the open flame oil burner.

5.5.1 *Rotary Kiln*—The rotary kiln is an incinerator that uses a rotating inclined cylinder as a combustion chamber to process and contain the waste material. It is designed to tumble the material being fed into it to provide agitation for complete combustion. Residence time in the incinerator is controlled by the combusion chamber angle, speed of rotation, and length. Most of these units are designed to burn fairly small batches and

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