



Environmental Guidelines

Removal, Treatment & Disposal of Oily Sludge

2011

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Environmental Guidelines for Removal, Treatment and Disposal of Oily Sludge

1. Objective

The purpose of these Guidelines is to provide information to persons on the proper methods of Removal, Treatment and Disposal of Oily Sludge.

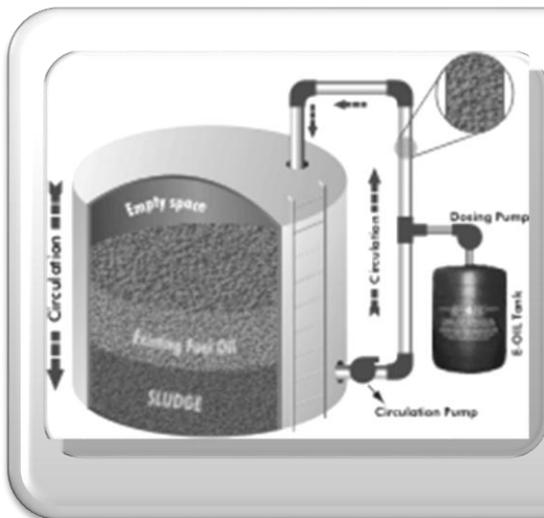
2. Scope and Contents

These guidelines are for persons who operate a business or facility that generates oily sludge. It can also be used as a tool to provide information to educators and interested persons. It contains information on various removal and treatment methods as well as guidelines for environmentally sound disposal that are applicable to Guyana.

3. Definition

Oily Sludge: the residual waste oil products such as those resulting from the purification of fuel or lubricating oil from main or auxiliary machinery or separated waste oil from bilge water separators, oil filtering equipment or oil collected in drip trays, and waste hydraulic and lubricating oils.

4. Overview



When using hydrocarbons, they have the tendency of separating into heavier and lighter hydrocarbons. The heavier hydrocarbons are known as 'sludge' or 'tank bottom'. This sludge is a major pollutant that consists of about 10-60% crude oil, 30-90% water and 5-40% solid particles.

If sludge gets into the environment it can result in contamination to soil and ground water. In addition, sludge contains substances such as hydrogen sulphide (H₂S), benzene and lead which when inhaled in high concentrations can have serious consequences to human health. As such, sludge is a major problem in the oil industry – it reduces the storage capacity of the storage tanks while at the same time has severe consequences on the environment if not controlled properly.

In order to have a successful environmentally friendly disposal system of the sludge, several steps must be followed, namely: removal and treatment.

Removal

There are several methods that can be used for the removal:



Manual Cleaning: This involves entering the tank and using manual labour to remove the sludge. It is usually done in teams because of the potentially hazardous chemicals that are found in sludge. Persons involved in manual cleaning of these oil tanks are also equipped with Personal Protective Equipment (PPE)

- **Chemical Cleaning:** This involves the use of surfactants, solvents or bacteria to break down complex molecules contained in the sludge and render them to their basic constituents.

- **Vacuum System:** This system can be used to remove sludge from its source to treatment area to an area where it can be treated for final disposal.

Treatment

Drying on Beds: These are specially prepared beds on which sludge is paced to dry before final disposal

Biological Methods: These involve the use of bacteria to remove the harmful components of sludge, rendering them to their basic components of sediment, waster and hydrocarbons.

Incineration/Thermal Treatment: This is the use of heat to treat the sludge. this method eliminates a variety of harmful substances while reducing the volume of waste.

5. Environmental Issues and Mitigation Measures

5.1. Issues Identified

Heavy hydrocarbons (Sludge) which settles at the bottom of tanks are major environmental pollutants. They are very toxic to human health and the physical environment. Some effects of oily sludge pollution include:

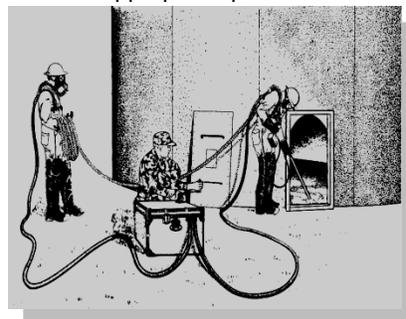
- Changes in aquatic ecosystems.
- Damage to lungs, kidneys, reproductive damage in birds, fish and reptiles.
- Loss in soil fertility including death to insects that live in the soil.
- Disruption in the entire food chain.



5.2 Removal of Oily Sludge

5.2.1 The first step in the removal of sludge is the development and implementation of appropriate procedures and a written plan for tank entry and cleaning works. It should include:

- The scope of work to be performed; this will include information on tanks to be cleaned, their structure and conditions, the products contained, the specific work to be done and when each phase of the work is expected to start and completed.
- The responsibility of each member of the team. Each person should be able to carry out his task safely and follow procedures throughout the tank cleaning operation
- Hazard assessment - involves identifying and evaluating the elements, hazard and conditions of the tank to be entered.
- Establishment of safe practices (e.g. exposure levels) - involves having procedures and controls in place to minimize exposure and hazards.
- An emergency plan - involves a plan to cover notification procedures, equipment requirement, tank specific rescue procedures and incident reporting requirements.
- Obtain the required permits (see section six (6)).



5.2.2 Operators should ensure that all instruments are properly calibrated. Equipment that could be used in the tank - cleaning operation includes but is not limited to vacuum equipment, pumps, approved explosive-proof electrical equipment, transfer hose, disposal containers, shovels, brushes, sponge and rags. Materials may include water, steam, fuel oil, soap solvents and approved chemicals.

5.2.3 Before entering the tank, a visual inspection should be carried out to ensure the stability of the tank. All internally combustible powered equipment (automobiles, trucks, etc.) should be away from the source of flammable vapours. Signs and barricades should be placed around the site.

5.2.4 All vapour from tanks must be released before cleaning can commence. The vapour can be freed by the use of mechanical and natural ventilation. Vapour can be displaced through the use of inert gases or steam, water or fuel oil. The method used however should be determined by the nature of the gases, the potential hazard of gases area type, size and construction and location of the tank.

5.2.5 Internal cleaning of the tank will only occur when the oxygen level in the tank is less the 23.5% (standard set by most Petroleum industries). There should also be a log on site of all persons that enter the tank and the amount of time each individual spends in the tank.

5.2.6 Sludge can be removed either by fixed connection (there is no initial entry into tanks) and by entry into tanks. In most cases fixed connection would facilitate the use of chemicals or vacuum system to remove sludge while entry into tank would facilitate manual cleaning of the tanks.



5.2.7 All persons entering the tank shall wear approved Person Protective Equipment (PPE) throughout the entire cleaning operation.

5.2.8 Sludge can be washed, brushed or swept into buckets, bins or removed by hand. An absorbent can be used to remove small amounts of material on the floor or wall of the tank.

5.2.9 The tank can then be washed and sprayed down with a water hose and the waste water removed by a pump or vacuum.

5.2.10. If chemical method is being applied, diluted concentrations of hyper chlorites or permanganate may be used to loosen sludge from the tank. This mixture can then be removed by pump or vacuum.

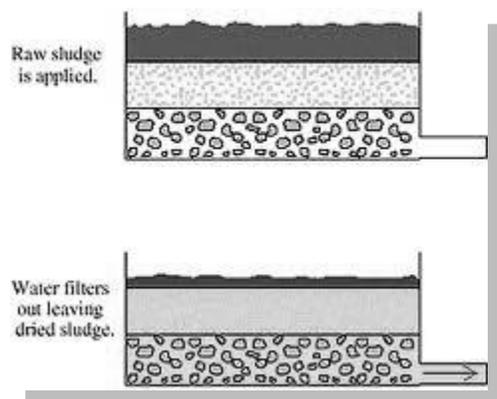
5.2.11. It is important that an attendant monitor the person that is inside the tank. If fumes exceed expected levels, all operations should be stopped.

5.2.12. While in the tank, workers should inspect for any leaks and report immediately to persons at the top.

5.2.13. The tank should be given a final wash down with water or with an approved chemical or solvent. When the tank is finished cleaning, all cleaning material must be removed.

5.3 Mitigation Measures

5.3.1 *Drying on beds*



5.3.1.1 Sludge that is removed from the tanks is usually pumped/dumped onto this bed.

5.3.1.2 This bed allows for the evaporation of water while allowing the hydrocarbons to percolate a drain at the bottom of the bed where it can be collected and reused. The sediment is collected from the bed and disposed of.

5.3.1.3 The bed can be constructed with 15-30 cm (5.91-11.81 inches) of coarse sand, underlined by 7.5 cm (2.95 inches) of fine sand and 22.5 cm (8.86 inches) of graded gravel of size ranging

from 5 cm (1.97 inches) to 150 cm (59.1 inches) at the bottom. At the top, are open joined tiled drains 10 cm (3.94 inches) in diameter. The side wall should project 1.6 m above the sand surface.

5.3.1.4 The size of the drying bed may be 1200 to 1800 cm (472.4 -708.7 inches) wide and 3000 to 3750 m (1181.1-1476.4 inches) long.

5.3.1.5 The sludge is usually applied at a depth of 20 to 30 cm (7.9- 11.8 inches) thick and can be removed within 7-10 days.

5.3.1.6 The sediment can then be disposed.

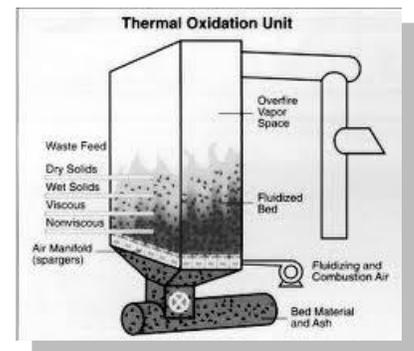
5.3.2 **Incineration**

5.3.2.1 The sludge must be dehydrated before it can be incinerated.

5.3.2.2 The sludge shall burn for 30 minutes at a temperature of 800 -- 850°C.

5.3.2.3 At the end of the incineration process the ash produced can be used in the production of cement. Additionally, the ash can be taken to a landfill site for final disposal.

5.3.2.4 The incinerator can be square box type, fixed bed type or fluidized bed type.



5.3.3 **Biological Method**

5.3.3.1 Before treating oil sludge with bacteria, a sample of the sludge should be tested to identify any possible pollutants.

5.3.3.2 The sludge must then be cleaned of any material that does not constitute oily sludge. This should be done especially if the sludge was stored in an open area.

5.3.3.3 The oily sludge is then mixed with dry soil (exclusive of any rocky material). The amount of dry soil used will be determined by the moisture of the sludge. If the sludge has very low moisture content, the addition of dry soil might not be necessary.

5.3.3.4 The sludge –soil mixture is then placed in a prepared location (most likely a concrete area). A plastic, of size equal to the prepared location, should be spread before the sludge mixture is poured out. A sufficient amount of oil eating bacteria (e.g. *Alcanivorax borkumensis*) and growing agent is then added to the mixture. The new mixture should be covered with plastic to allow for anaerobic remediation.

5.3.3.5 The mixture is then monitored to ensure that the remediation process is taking place. At times, mixing will be necessary to achieve required results. The remediation process usually takes about eight (8) weeks.

5.3.3.6 The bio sludge can then be further mixed with additional soil and be used as a fertilizer or placed in a landfill site.

5.4 Disposal method

When disposing oily sludge the main principle should be to minimise the quantity of waste requiring disposal with regards to:

- The environmental considerations/ circumstances.
- The best available practical technology.
- The quantity of sludge to be disposed.
- The local circumstances.
- Sustainability.
- An acceptable cost benefit ratio.

As such, one practical technique is to use the sediments from oily sludge as a fertilizer. Studies have shown that the sediments are rich in Nitrogen, Phosphorous and Potassium (N, P, K), which are vital for the proper growth of plants.

The sludge can also be utilised in cement manufacturing due to its Iron and Aluminium contents and in clay brick manufacturing.

The oil which is collected from the drying beds process can be reused as normal crude oil.

If the sludge cannot be used for any of the suggestions mentioned above, the sediments from the sludge can be mixed with soil or another other adsorbent and placed in plastic bags where it can then be disposed of at the hazardous waste landfill site.

The method of disposal at the landfill site can be utilised by persons who do not have to apply for an Environmental Authorisation (see section 6) but are still generating oily sludge.

6. EPA Authorisation Process

The first step is to apply to the **Environmental Protection Agency (EPA)** for Environmental Authorisation. The developer must submit to the Agency a completed Application Form and all the required information:



New Projects	Existing Projects
<ul style="list-style-type: none"> ☛ Identification of the Permit Applicant (National ID Card, Passport). ☛ Proof of Land Ownership ☛ A 'No-Objection' Letter for the operation from the relevant Local Authority – NDC/RDC/Town Council. Note the Approved Site Plan by the NDC/RDC/Town Council would be accepted as “no-objection”. ☛ 'No Objection' from the Village Council <u>and</u> Ministry of Amerindian Affairs if project falls within Amerindian titled lands. ☛ Land use suitability letter/Outline Planning Permission from the Central Planning & Housing Authority ☛ Map showing surrounding land uses, identification of receiving water(s) and the location of any existing or proposed intake and discharge structures and the location of any discharge. ☛ Draft Site Plan (approved by the NDC/RDC/Town Council, as applicable to project site) showing the layout of the Operation (submit a final version after all necessary adjustments have been made). ☛ Project Description (summary). ☛ Business Registration/Certificate of Incorporation (if applicable). ☛ Indication whether or not a Permit or Licence from any other Government entity is required or have been obtained. Submit Permit, Licence, or Proof of Application from relevant sector Agency. 	<ul style="list-style-type: none"> ☛ Identification of the Permit Applicant (National ID Card, Passport). ☛ Proof of Land Ownership ☛ Map showing surrounding land uses, identification of receiving water(s) and the location of any existing discharge structures and the location of any discharge. ☛ Site Plan showing the layout of the Operation. ☛ Project Description (summary). ☛ Business Registration/Certificate of Incorporation (if applicable). ☛ Indication whether or not a Permit or Licence from any other Government entity is required or have been obtained. Submit Permit, Licence, or Proof of Application from relevant sector Agency.

According to the Environmental Protection (Hazardous Wastes Management) Regulations 2000 Part II (Power to Issue Environmental Authorisation):

3. (1) Any person who, at the time of the commencement of these Regulations, is in operation of a facility that generates, treats, stores, disposes or transports hazardous waste shall submit a duly completed notice in the form set out in Schedule III to the Agency.

(2) The Agency shall publish the notification mentioned in paragraph (1) at least twice in a daily newspaper having wide circulation in Guyana and members of the public shall have at least sixty days from the date of the last publication to make objections to the operations of the facility to the Agency.

(3) The Agency shall, in deciding to grant an environmental authorisation in accordance with regulation 18 of the *Environmental Protection (Authorisation) Regulations 2000*, take into account the submissions that have been made to it under paragraph (2).

(4) The Agency shall send a copy of the objections to the person who has given notice of activity and thereupon such person shall make application to the Agency under regulation 4.

4. (1) Any person who at the time of the commencement of these Regulations is in operation of a facility that generates, transports, treats, stores or disposes of hazardous waste, shall, subject to paragraph (3), before commencing any action related thereto, submit an application to the Agency for an environmental authorisation within three years of the commencement of these Regulations or such other time as the Agency may determine.

(2) Any person who proposes to operate a facility that generates, transports, treats, stores or disposes of hazardous waste, shall, subject to paragraph (3), before commencing any action related thereto, submit an application to the Agency for an environmental authorisation within three years of the commencement of these Regulations or such other time as the Agency may determine.

(3) The fee prescribed in regulation 8 of the *Environmental Protection (Authorisations) Regulations 2000* shall accompany the application.

(4) The Agency may at any time request a person who engages in any of the activities specified in paragraph (1) to submit a notification of activity and an application to the Agency for an environmental authorisation.

(5) An application for an environmental authorisation shall be in accordance with the provisions of regulation 17 of the *Environmental Protection (Authorisations) Regulations 2000*.

(6) In addition to the information that is required for a grant of an environmental authorisation prescribed in regulation 17 of the *Environmental Protection (Authorisations) Regulations 2000*, the applicant shall provide written evidence of financial capability.

(7) The requirement in paragraph (1) for an environmental authorisation shall not apply to –

(a) Facilities that generate or store hazardous wastes in quantities less than one hundred kilograms per month;

(b) Facilities that generate less than one kilogram of acutely hazardous wastes per month;

(c) Facilities that accumulates up to one thousand kilograms of hazardous wastes onsite at any time.

(8) Any person who contravenes this regulation shall be guilty of an offence and shall be liable on summary conviction to a fine of not less than seventy-five thousand dollars nor more than five hundred thousand dollars and to imprisonment for six months.



6.2. The Environmental Protection Agency (EPA) shall, within six (6) weeks of receipt of a completed application, grant an environmental authorization to the applicant or refuse a grant.

6.3. The Agency may refuse to grant an Environmental Authorization where there is reason to believe that the application contains or is based on false or misleading information, if an applicant is under the age of eighteen or is an undischarged bankrupt.

6.4. When an Environmental Authorization is granted, it shall be in effect until a fixed date specified in the authorization. The date shall not be beyond five (5) years from the date on which the Environmental Authorizations was granted.

6.5. When an Environmental Authorization is in force, it shall be the duty of the EPA to ensure that the activities authorized by the Environmental Authorization do not cause pollution of the environment or harm human health and to ensure that the conditions of the Authorization are complied with.

6.6. The EPA may, at any time by written notice to the holder of a permit, cancel, suspend or modify an Environmental Authorization. Reasons can include misrepresentation or willfully omission in obtaining the Environmental Authorization, violation of any condition of the Environmental Authorization, or the establishment of new or revised standards in respect of the operations of the facility.

6.7. Any person who is aggrieved by a decision of the Agency may, at any time within twenty-eight (28) days of decision by notice in writing appeal against any decision by the Agency.