



DEPARTMENT of *TOURISM, ARTS,*  
and the ENVIRONMENT

ENVIRONMENT DIVISION

**INFORMATION BULLETIN No. 108**

**LANDFARMING PETROLEUM CONTAMINATED SOIL**

**August 2006**

## **1. Introduction**

This bulletin provides information and guidance on landfarming procedures and notification obligations for waste producers and environmental consultants. The information provided here is intended to apply to a 'one-off' landfarm and not for permanent or commercial landfarms. The latter will require further management and monitoring procedures to ensure the medium- to long-term landfarming activities do not impact on the environment.

Under suitable conditions, landfarming is an effective bioremediation technology for reducing concentrations of nearly all of the constituents of petroleum products typically found at petroleum storage sites. In the hierarchy of remedial options, this Division favours appropriately managed landfarming over the option of off-site soil disposal.

Landfarming is an above ground remediation technology for petroleum contaminated soil that reduces petroleum concentrations through biodegradation. This technology usually involves spreading excavated contaminated soil in a thin layer on the ground surface and stimulating aerobic microbial activity within the soils through aeration and/or the addition of minerals, nutrients and moisture. The optimal rate of application of each of these parameters to achieve efficient biodegradation will depend on a number of factors, including but not limited to: the type of petroleum hydrocarbons to be remediated; the level of hydrocarbon contamination; the hydrocarbon-degrading bacteria present; and the soil matrix.

## **2. Environmental Consultants**

It is recommended that an environmental consultant experienced in landfarming of hydrocarbon impacted soils supervise the works described herein. Further, it is recommended that the environmental consultant undertake the following:

- all sampling; and
- all reporting including the writing and submission of the environmental approval (see Section 3) and the final disposal or re-use approval applications (see Section 5.4) to the Division after the completion of the landfarming activity.

The Environment Division's Information Bulletin No. 107 *Environmental Consultants with Experience in Contaminated Site Assessment*, contains a list of consultants that may have experience in landfarming projects.

### **3. Notification & Approvals**

Notification of all landfarms must be given to both local government and the Environment Division.

Local government should also be asked for advice on whether they have any requirements for landfarm approvals.

The Environment Division issues approvals for landfarming operations under Part 4 of the *Environmental Management and Pollution Control (Waste Management) Regulations 2000* ('the Regulations'). The application for an environmental approval must be submitted to the Environment Division in the form of a Landfarm Environmental Management Plan. The information that must be included in the EMP to achieve approval to conduct the landfarming operation is detailed in Section 4 of this Bulletin.

For large landfarms or landfarms in environmentally sensitive areas, the proposed landfarm management as outlined in the EMP may be formalised in an Environment Protection Notice (EPN) issued by the Director of Environmental Management. The applicant will be notified prior to the drafting of the EPN and please note that the issuing of an EPN will incur a fee.

### **4. Landfarm Environmental Management Plan (EMP)**

The EMP must demonstrate planned, appropriate management of potential environmental harm that may arise from the emission of contaminated leachate, hydrocarbon vapours, dust and potential soil contamination from the landfarm operation. Specifically the EMP should, as a minimum, include the following information:

- The origin of the soil including:
  - the name and address of the impacted soil producer;
  - the address and description of where the contaminated soil originated; and
  - a brief description of the event that led to soil contamination
- A description of the soil.
- The volume of soil to be treated.
- Analysis for any contaminants that may reasonably be expected in the soil.
- Classification of the soil in accordance with the Environment Division's Information Bulletin No. 105 *Classification and Management of Contaminated Soil for Disposal*.
- Location and layout plans of the proposed landfarm showing its proximity to sensitive receptors (residences, business, water courses etc).
- Photographs of the proposed landfarm area.
- A suitability assessment of the proposed treatment location, with consideration given to physical characteristics and local hydrogeology (e.g. local depth to groundwater).
- Details of the stormwater, leachate and run-off management.
- Details of the proposed soil sampling and analysis program.
- Any other details of the design and management of the landfarm that meet those requirements outlined in Section 5 of this document.
- Air quality monitoring or an explanation for why monitoring is not required.
- Groundwater and/or surface water monitoring or an explanation for why monitoring is not required.

- Remediation target levels and predicted time frame for completion of the landfarm activity.
- Anticipated submission date for final disposal or re-use approval application to the Environment Division.

## 5. Landfarm Design and Management

The following information is provided as a guide for planning landfarm activities.

### 5.1 Soil Transport

- Dust generation should be prevented during transport of soil to and from the landfarm by ensuring adequate moisture levels are maintained in the soil.
- If soil classified as controlled waste (as defined in the Regulations) and is to be transported for fee or reward, a Waste Transport Business holding a current Environment Protection Notice issued under the *Environmental Management and Pollution Control Act 1994* is required.

Please note that soil and other material reasonably suspected to be a controlled waste must be sampled and analysed to determine whether it is a controlled waste before the waste can be removed from the site. Please see the Environment Division's Information Bulletin 105: *Classification and Management of Contaminated Soil for Disposal* for further details.

### 5.2 Landfarm Design and Operation

- The landfarming site should be adequately demarcated and include appropriate signage to prevent unauthorised access and to indicate that the soil in the landfarm area is undergoing remediation. Additionally signs relating to site safety should be erected as necessary.
- The landfarm must be bunded on all sides<sup>1</sup> with a berm at least 0.8 metres high and 0.5 metres thick and constructed of compacted clay, or some other impermeable material, to a permeability equal to or less than  $10^{-9}$  m/s.
- The base of the landfarm must be of a minimum thickness of 0.3 metres and constructed of compacted clay, or some other impermeable material, to a permeability of equal to or less than  $10^{-9}$  m/s.
- The base should be constructed with a gentle slope (between approximately 2 and 10°) towards a leachate collection point.
- The soil within the landfarm should be arranged into windrows of not more than 0.5 metres height. Ideally, the width of each windrow and distance between windrows

---

<sup>1</sup> In some cases it may only be necessary to bund three sides allowing easy access of machinery to the landfarming area. However, measures must be taken to prevent contaminated leachate from discharging out, and prevent stormwater entering the landfarm from the un-bunded side.

would be sufficient to allow easy access of machinery for the purpose of aeration of the soil contained within the windrows.

- All soil in the landfarm should be turned over on a regular basis in order to aerate the soil and promote microbial activity.
- Stormwater should be prevented from coming into contact with the contaminated soil and should be diverted away from the landfarm area using earthen berms or interceptor trenches.
- Overflow of leachate from the landfarm must be prevented and thus all leachate collected must be either recycled onto the material being treated in the landfarm area or directed to, and contained within, an impermeable leachate collection system of adequate capacity.
- Should any leachate contained within the leachate collection system require disposal, a licensed waste contractor should be engaged to remove and dispose of the leachate appropriately. The waste transport officer can be contacted on 03 6233 6273 for information on licensed waste transporters.
- The use of water sprinklers may be required from time to time to ensure that the soil remains damp (but it should not be saturated with water).
- Nutrients and/or minerals may need to be added to enhance the efficiency of microbial activity.
- Lighter (more volatile) petroleum products (*e.g.* petrol) may evaporate during landfarm aeration processes. Emission of volatile organic compounds (VOCs) may need to be controlled and/or captured and treated.
- In order to minimise volatile emissions, it is recommended that the soil in a landfarm is covered with a heavy duty plastic liner that is adequately secured. This liner can be temporarily removed for the purpose of turning over the soil for aeration. Covering the soil may also prevent excessive rain infiltration and assist in maintaining optimum moisture levels and/or would assist in preventing erosion and dust emissions from the landfarm.

### 5.3 Monitoring

- Sampling and analysis of the soil should occur on a regular basis to ensure that biodegradation is occurring. Samples should be analysed for:
  - Contaminant levels (*e.g.* typical contaminants in petroleum-contaminated soil may be total petroleum hydrocarbons, benzene, toluene, ethyl-benzene, xylenes);
  - Nutrient levels;
  - Moisture levels; and
  - pH levels.
- Air monitoring may be required if houses or other occupied buildings are located in the vicinity of the landfarm. Air monitoring should assess the atmospheric ground

level concentrations of all volatile contaminants that may be emitted from the landfarm soil.

- The landfarm should be inspected on a regular basis to ensure that environmental controls (*e.g.* plastic covers, odour controls, dust controls, drainage, leachate and run-off management systems) are operating correctly.
- Additional monitoring events may also be necessary in response to adverse weather such as high rainfall events (*e.g.* monitoring of drainage and leachate collection) or strong winds (*e.g.* monitoring of plastic covers, odour controls) to ensure that environmental controls are operating properly when subject to the adverse conditions.
- Depending on the volume of the contaminated soil, the location of the landfarm, the degree of contamination, and the hydrological and hydrogeological settings, additional environmental sampling may be required. This sampling may include surface water, groundwater and/ or soil sampling.

#### **5.4 Completion**

- Treatment of the petroleum contaminated soil will be deemed complete when the results of compound-specific testing demonstrates that based on the classification of soil from the Environment Division's Information Bulletin 105: *Classification and Management of Contaminated Soil for Disposal*:
  - the levels for contaminants of concern will not pose a risk to human health or the environment for the future re-use of the soil; or
  - levels of contaminants of concern allow the disposal of the material (as Level 1- fill material, Level 2- low level contaminated soil, or Level 3- contaminated soil).
- An application for the approval of re-use or disposal of the soil must be submitted to the Environment Division. Approval to re-use or dispose of the soil must be obtained prior to the treated soil's removal from the approved landfarming area.
- After removal of the treated (landfarmed) soil, the site should be validated by taking samples from the material underlying the landfarm to confirm that contamination has not migrated vertically through the sub-surface.
- Failure of the landfarming operation to remediate the soil to acceptable levels after 24 months may result in an Environment Protection Notice being served to require further treatment and/or removal of the soil to a more suitable site for further treatment and then disposal.

## 6. Further Information

For further information relating to this bulletin contact:

Contaminated Sites Unit  
Waste Management Section  
Environment Division  
Department of Tourism, Arts, and Environment  
GPO Box 1751, Hobart TASMANIA 7001

<b>Waste Management Officer</b> .....	Environment Division
<b>Contaminated Sites Officer</b> .....	Telephone: (03) 6233 6518
<b>Controlled Waste Transport Officer</b> .....	Facsimile: (03) 6233 3800

Legislation may be viewed on the Internet at <http://www.thelaw.tas.gov.au>.  
General information can be viewed at <http://www.environment.tas.gov.au>.

## 7. Currency of this Bulletin

This bulletin may be subject to amendment and persons relying on this bulletin should check with the Environment Division to ensure that it is current at any given time.

### *Disclaimer*

*This document has been prepared to assist those involved in the bioremediation of contaminated soil by landfarming. The contents are based on the best information available to the Environment Division at the time of publication and are subject to revision based upon further advice received by the Division. No warranty is given as to the correctness of this information and no liability is accepted for any statement or opinion or for any error or omission.*