ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

Landfarming at Sites in Alaska

Technical Memorandum **Date: January 2018**

Purpose and Applicability

The purpose of this Technical Memorandum is to outline conditions under which landfarming will be considered an appropriate remedial technology for petroleum contaminated soil. When implemented correctly, landfarming can be a cost-effective and efficient means of reducing petroleum contaminant concentrations in soil, especially in locations where other means of remediation are not feasible due to cost or availability. This guidance applies only to soil contaminated with petroleum. If other contaminants are present, consultation with DEC is required.

Background

Landfarming has been used for many years as a means of reducing petroleum contaminant concentrations in soil. Landfarming is distinct from other soil remediation alternatives and from temporary storage, as summarized below:

- Landspreading- Landspreading consists of spreading contaminated soil in a layer without a liner, typically 4-6 inches in depth or less and then allowing the contaminants in soil to naturally degrade and/or volatilize without tilling.

- Biopiles or biocells- A biopile is a contained soil cell on a liner where nutrients or other additives are added to the soil to increase the degradation of contaminants. It may also incorporate active or passive aeration through a network of perforated piping installed throughout the cell. Typically 4-6 feet thick, biopiles can be of any thickness, and are sometimes turned over periodically to enhance contaminant degradation.

- Stockpiling- Stockpiles are simply piles of contaminated soil of any thickness placed on a liner and covered without regard to contaminant reduction. Stockpiling soil is typically only acceptable to ADEC for up to two years at which time remediation or disposal must take place.

For the purposes of this Tech Memo, landfarming is defined as the spreading of contaminated soil, with or without the use of a liner, typically in a layer no thicker than 18 inches, followed by routine tilling, monitoring, and sampling that is conducted until the soil reaches the site target levels for applicable contaminants of concern. In some situations, soil may be landfarmed to a depth greater than 18 inches so long as the tilling equipment can reach the bottom of the landfarmed soil.

Previous landfarms used various amendments to enhance natural degradation, but it has been demonstrated that with adequate soil moisture content, tilling the landfarm on a frequent basis (every 3-5 days) is sufficient to reduce petroleum contaminant concentrations without the use of

amendments[i]. This Tech Memo will not address the efficacy of the various soil amendments available on the market, but acknowledges that amendments may be appropriate based on site-specific conditions. If it is determined that nutrient amendment, typically in the form of commercially available fertilizer, is necessary to achieve the desired results, soil samples should be collected and nutrient demands calculated so that the appropriate amendment may be selected. The actual time it takes to treat soil to the site target levels will vary based on climate and weather conditions, soil type, contaminant concentrations and other factors. Soil that is too wet or dry may limit the rate of contaminant degradation. Similarly, low nutrient soil may need to be amended to achieve sufficient rates of contaminant degradation.

Applicability

Once landfarming has been selected as the preferred remedial alternative, the characterization data must be reviewed and used to evaluate the controls that will be necessary to insure the integrity of the landfarming operation. If contaminant concentrations exceed the Maximum Allowable Concentrations (MACs)[1], additional evaluation or site controls may be necessary, including but not limited to:

1. Analysis of soils using the Synthetic Precipitation Leaching Procedure (SPLP).[2] This analysis may be requested by the ADEC Project Manager if contaminant concentrations are above the MACs and the responsible party is proposing to landfarm without a liner. SPLP results will be compared to Table C groundwater cleanup levels and if exceeded, the ADEC Project Manager may require a bottom liner as described in (3) below. This method should be run using a neutral water extraction unless otherwise approved by ADEC.

2. Groundwater Evaluation- If the depth to groundwater is not known and a responsible party is proposing to landfarm soil with concentrations above the MACs without a liner, the depth to groundwater must be determined. If the depth to groundwater is 6 feet below ground surface or less, a bottom liner may be required as described in (3.) below. Baseline groundwater sampling may also be requested especially in areas with shallow groundwater (< 6 feet bgs). The monitoring well(s) should be placed downgradient of the landfarm and be sampled before and after the landfarming is conducted.
3. Bottom Liner- If a responsible party is proposing to landfarm soil with: contaminant concentrations above the MACs; with SPLP results above Table C groundwater cleanup levels; with seasonal groundwater within 6 feet of the surface; with free phase or mobile product in the soil; or if there are other migration concerns, a bottom liner with a minimum thickness of 10 mil plus 6 inches of fine grained sacrificial material to protect the liner may be required.

4. Leachate collection- If a bottom liner is required, a leachate collection system will also be required to minimize the amount of water that collects within the landfarm, as saturated

[1] 18 AAC 75.341, Table B1 Migration to Groundwater and B2 Maximum Allowable Concentrations

[2] Note: If volatile organic compounds (VOCs) are contaminants of concern to be evaluated, SPLP by zero headspace extraction (ZHE) must be performed. Refer to EPA SW-846 Method 1312 for additional information on SPLP extraction or volatile and semi-volatile organics.

conditions will limit the effectiveness of the landfarm. The leachate collection system must be located such that accumulated water drains towards the collection system and does not saturate the soil when the collection sump is full.

All landfarm operations must be conducted in accordance with an ADEC-approved site specific work plan, and depending on the scope of the landfarming activities, may have to comply with the Treatment Facility regulations found in 18 AAC 75.365, and also the Operation Requirements for Soil Treatment Facilities, March 15, 2013, adopted by reference[3]. Landfarming Work Plans submitted to ADEC for review should reference and include as an Appendix the Landfarming Checklist found as Attachment A to this document.

Landfarm Construction

Landfarm construction will differ based on the contaminant concentrations as noted above, however some information will be required for all landfarming work plans regardless of design including:

a. A figure showing the proposed landfarm location, distance to surface water and potential receptors including all drinking water wells within 200 yards of the edges of the landfarm.
b. The completed Landfarming Checklist in Attachment A.
c. Provisions for site security such as fencing, signage, or other controls.
d. A tilling and sampling schedule.
e. Provisions for maintaining the landfarm over winter, if anticipated.

Depending on the soil type, screening of oversize material greater than two inches may be preferred to reduce treatment volume, but also to facilitate tilling. Oversized material must be handled in accordance with the 2005 *Petroleum Hydrocarbon Cleanup for Oversize Material* technical memorandum.[4]

Landfarm Construction-Lined Operation

If a lined landfarm is warranted, the objective of landfarm construction is to contain the contaminated soil and any leachate created by rainfall or snowmelt and to protect the underlying soil and groundwater from secondary contamination. Site preparation should begin with clearing the area of any protrusions that may damage the liner. After the site is prepared, berms must be constructed around the entire perimeter of the landfarm. The height of the berm must be sufficient to contain any water that may collect and the bottom liner must overlap the berm by at least two feet. Berms may be constructed of clean fill, timbers, straw waddles or other materials. It is recommended that a space of at least two feet be left between the edge of landfarmed soil and the berm.

The liner should be selected based on the anticipated duration of the landfarming effort. If the landfarm cell is to be used only one season, a 10-mil bottom liner is acceptable. If the landfarm cell is intended to be used for more than one season, a 20-mil liner is required. Regardless of liner thickness, fine grained sacrificial material must be placed on top of the liner to a depth of no less than

[3] Available at: http://dec.alaska.gov/spar/csp/guidance-forms
[4] A copy of this technical memorandum is available at: http://dec.alaska.gov/spar/csp/guidance-forms

6 inches to protect the liner during cell loading, tilling, and unloading. If the liner is damaged during landfarming operations, it must be repaired so that any leachate is contained.

When using a liner, it may be preferable to select a site with a slight grade toward one corner of the treatment area, otherwise the site will need to be prepared in a manner that creates a slight grade for the liner. This will allow for drainage of rainwater or snowmelt from the landfarm that would otherwise collect in the cell and impede the natural degradation of contaminants in the soil. Leachate from lined landfarms must be collected and treated appropriately and may not be discharged without approval from the ADEC Project Manager.

Landfarm Construction-Unlined Operation

If the soil is suitable for landfarming without a liner, the objective of landfarm construction is to ensure the soil remains within the landfarm and is not transported beyond the berms by run-off, wind, or tilling operations. Berms must be constructed around the entire perimeter of the landfarm and be of sufficient height and construction to withstand the amount of precipitation and sheet flow anticipated without eroding or allowing the landfarmed soil and contaminants to be transported outside of the berms.

Top Covers

To prevent water saturated conditions, run-off, or fugitive dust or to limit exposure to sensitive receptors, it may be desirable at times to employ a top cover. A minimum of 6-mil reinforced polyethylene cover is recommended. The cover should overlap the berm and the bottom liner by at least 4 feet and be secured. The top cover should only be employed for as long as necessary to allow for maximum aeration of the landfarmed soil.

Baseline Site Sampling, Tilling, and Post-Treatment Sampling

Baseline soil sampling of the proposed landfarm area is recommended to document the presence of any existing contamination prior to construction of the landfarm. Regardless of whether the landfarm is constructed on a liner or not, post-treatment sampling will be required to determine if the landfarm impacted the underlying or adjacent soil. Tilling the landfarm on a frequent basis is required. The more frequently the landfarm is tilled, the more rapidly the contaminant concentrations will be reduced. It is recommended that landfarms be tilled every 3-5 days, but this rate may be adjusted based on contaminant concentrations and the duration the landfarm is anticipated to be in use.

Tilling may be conducted using a variety of implements including a tractor with a tow-behind tiller attachment, a backhoe or grader, an ATV with a tow-behind tiller attachment, or any other implement that can adequately till to the base of the impacted soil.

Sampling of the landfarm may be conducted after the soil is first spread to evaluate the initial contaminant concentrations, during the tilling phase to evaluate the rate of contaminant reduction, or at the end of the proposed landfarming period to determine if landfarmed soils have met the target cleanup goals. If adequate characterization data is already available, Responsible Parties may choose forego the initial sampling. Similarly, they may choose to wait until the landfarm has been sufficiently tilled such that the first time it is sampled, it is anticipated that the target cleanup goals have been met.

To confirm cleanup goals have been met, the landfarm should be divided into a grid; field screening should be conducted across the grid and discrete confirmation samples collected from the areas with the highest field screening results. Alternative sampling, such as multi-incremental sampling may be appropriate, especially at large landfarms and may be proposed and approved on a site-specific basis.

Once landfarming activities have ceased, soil samples must be collected from beneath the former landfarm and any other potentially impacted areas to determine if contaminants migrated from the landfarm into underlying or adjacent soil. Multi-incremental sampling may also be appropriate for this purpose, depending on the size of the landfarm.

Storm Water Pollution Prevention

Many of the design specifications noted above are intended to control the flow of water into and out of the landfarm cell. If the landfarm preparation or the landfarm itself covers an area of one acre or more and there is the possibility of a discharge to storm water a Notice of Intent to operate under the Construction General Permit must be filed with the Alaska Pollutant Discharge Elimination System (APDES) program and a Storm Water Pollution Prevention Plan (SWPPP) will be required.

Landfarm Closure

After sampling has confirmed that landfarming has successfully reduced contaminant concentrations to target levels, the soil may be reused or disposed of offsite with prior approval from the ADEC Project Manager. Post-treated soils may not be used in contact with surface water or in any sensitive environments.

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[i] *Final Corrective Action Report, Service City Pad Prudhoe Bay, Alaska*. Prepared by BNC International and SLR Alaska for BP Exploration (Alaska) Inc. March, 2003