# Phase III Excerpts

TABLE OF CONTENTS



Sections omitted to expedite review.

## I. INTRODUCTION & BACKGROUND

### A. Introduction

LSPCO is pleased to provide this Phase III Remedial Action Plan Report (Phase III) as required under the Massachusetts Contingency Plan (MCP) for a release of petroleum product to soil, groundwater, and surface water at ACME.

The ACME facility and land where the facility is located is hereafter referred to as the "Property." The portion of land where the release is present is hereafter referred to as the "Disposal Site." The Property is located at the corner of West and South Streets (See Figure 1). A site plan and the boundary of the Disposal Site are shown in Figure 2.

This Phase III Report considers that media defined in Phase II, which poses a Significant Risk as defined in the MCP, to evaluate and select a comprehensive remedial action plan for the Disposal Site. An Immediate Response Action (IRA), which includes in-situ bioremediation of groundwater and saturated aquifer soil located down gradient of the source is currently operating at the Disposal Site. No other portion of the Disposal Site has been remediated under an IRA or Release Abatement Measure. LSPCO determined that the bioremediation system meet requirements of 310 CMR 40.0857(2) such that detailed evaluation of remedial action alternatives are <u>not</u> necessary because the alternative is:

- Proven to be effective in remediating petroleum at the Disposal Site based on experience at other disposal sites.
- Results in the reuse, recycling, destruction, detoxification, treatment, or combination thereof of the subject contaminants;

- Has been implemented in a manner that will not pose significant risk of harm to health, safety, public welfare or the environment; and
- Is likely to reduce and/or control the contamination to fulfill the requirements of a Class A Response Action Outcome.

This Phase III Report focuses on that portion of the Disposal Site that poses a Significant Risk as defined in the MCP that has not yet been remediated. Specifically, contaminated soil located around a 3,000-gallon underground petroleum storage tank (UST), the source of the release, poses a Significant Risk. The UST was closed in-place in 1991 in accordance with 527 CMR 9.00. The UST and contaminated soil is located beneath the ACME facility.

B. Background

The Massachusetts Department of Environmental Protection (MADEP) advised ACME of a release of petroleum product to the Brook Underground culvert on October 1, 1998 based on findings reported by The local Department of Public Health (DPH) & Code Enforcement. DPH observed light non-aqueous phase liquid (LNAPL) petroleum seeping into the underground culvert through a 4-inch diameter weep hole in the culvert's wall. Weep holes are evenly spaces along the culvert's wall. The underground culvert is located in an easement, which passes through the east end of the ACME property (See Figure 2). It is a twin box underground culvert with each box about 12-feet wide and 7-feet high. Surface water from Big Lake flows south

through the underground culvert to Two Small Pond. Two Small Pond is located about 500-feet down stream to the south. The underground culvert also receives storm water run off throughout this portion of the town via catch basins that discharge directly to the underground culvert and via tributary storm water drain lines. The release resulted in a petroleum sheen on water in the culvert. LNAPL did not accumulate on water in the underground culvert. The release to the underground culvert was temporarily abated by the DPH at the time of their inspection.

LSPCO determined that a 2-hour reporting condition [310 CMR 40.0311(8)] was present at the Disposal Site where petroleum product had been released, or could potentially release to a storm drain. A Condition of Substantial Release Migration [310 CMR 40.0413(2)(a)] was also met. The MCP requires Immediate Response Actions (IRA) in both cases.

Release conditions were verbally reported by LSPCO to MADEP on March 19, 1999. Assessment-only IRA activities were verbally approved at the time of reporting. The following documents were submitted to MADEP since release reporting:

- Release Notification Form, April 5, 1999;
- IRA Plan, May 18, 1999;
- IRA 120-Day Status Report, August 20, 1999;
- IRA First 6-Month Status Report, January 20, 2000;
- Revised MADEP transmittal forms, February 11, 2000;
- Phase I Report & Tier II Classification, March 2000;
- IRA Second 6-Month Status Report, July 21, 2000;
- Modified IRA Plan, November 3, 2000;
- IRA Third 6-Mondth Status Report, January 25, 2001;
- IRA Fourth 6-Month Status Report, July 19, 2002;
- IRA Fifth 6-Month Status Report, January 23, 2002; and
- Phase II Report and Completion Statement, May 2002.

IRA activities are summarized in Section II of this report. A Phase I and Tier Classification was submitted to MADEP, which based on a numerical ranking score of 242 points, classified the Disposal Site as Tier II under the MCP.

## II. IMMEDIATE RESPONSE ACTION

### A. Background and Summary

The initial IRA Plan summarized findings from the assessment, which identified a small volume of light non-aqueous phase petroleum liquid (LNAPL) located adjacent to the exterior wall of the underground culvert. The petroleum product was determined to have been released from a 3,000-gallon underground storage tank located about 45-feet up gradient of the underground culvert. According to City construction drawings for the underground culvert, a 12-inch thick bed of screened gravel is located beneath the culvert and 18-inches of screened gravel was back-filled along the culvert's wall.

The IRA plan proposed 1) removal of LNAPL located next to the underground culvert's wall. Collection would occur from inside the underground culvert at the weep hole where LNAPL was observed and 2) groundwater and petroleum product layer monitoring. The plan was presumptively approved by MADEP in 21-days in accordance with the MCP. Because work was to be conducted inside the underground culvert and could affect Two Small Pond, a determination of applicability under wetland regulations was sought from the Conservation Commission. In September 1999, the Commission determined that the regulations did not apply, but required notice of field activities to their department and to the DPH.

Oil recovery was conducted using a vacuum truck. About 150-gallons of oily water was collected via the weep hole in September 1999. After observation of activities by the DPH, their department believed that petroleum product recovery inside the underground culvert posed an unacceptable risk to surface water quality and required future remedial activities to occur outside the

underground culvert. No further petroleum product recovery was conducted since the initial effort.

A Modified IRA Plan was submitted to MADEP in November 2000. The Modified IRA Plan proposed construction and operation of an in-situ bioremediation system. The system's layout is shown in Figure 3. The bioremediation system includes a groundwater recovery trench, recovery well, nutrient treatment shed, and a groundwater recharge trench. Its hydraulic flow schematic is shown in Figure 4. Construction, operation, and maintenance of the bioremediation system were performed by the subcontractor (the Sub) as a subcontractor to LSPCO . The system was constructed in April and May 2001. Continuous operation of the system began on May 23, 2001. Weekly to bi-weekly operation and maintenance of the system has been conducted by the Sub to manually remove LNAPL from oil/water separator drums, maintain nutrient and microbe levels, and check and maintain system hydraulic equipment as necessary.

Environmental monitoring under the IRA includes quarterly groundwater monitoring for depth to water, LNAPL thickness, dissolved petroleum product by MADEP Extractable Petroleum Hydrocarbon (EPH) and Volatile Petroleum Hydrocarbon analyses, and nutrient analysis that includes nitrogen-ammonia, nitrogen-nitrate, and total phosphorus. Water in the underground culvert is monitored quarterly for nutrients and visually inspected for a petroleum sheen on the water's surface. ACME continues to operate the bioremediation system.

MADEP audited the IRA, which included an inspection of the Disposal Site, on February 14, 2002. Only one violation was identified by MADEP where the nutrient treatment shed should have a monitoring logbook for operation and maintenance of the bioremediation system.

B. Performance of the Bioremediation System

During the IRA Status Report period from July 5, 2001 to January 2, 2002, the bioremediation system had removed 23-gallons of LNAPL. LNAPL was recovered from oil/water separator drums located in the treatment shed. About an 80/20 mixture of LNAPL and biomass is decanted weekly from the drums and stored in DOT-approved 55-gallon drum and labeled as hazardous waste. The drum is a designated RCRA satellite accumulation container and is pumped along with other waste oil streams for bulk transport from the facility 48-gallons of LNAPL had been removed since system startup on May 23, 2001. The drum was emptied once since system startup with disposal of the waste oil reflected in a November 5, 2001 bulk shipment from the facility.

168,258 gallons of contaminated groundwater has been treated since system startup.

The next 6-month IRA Status Report will be submitted to MADEP by July 19, 2002.

## III. NATURE AND EXTENT OF CONTAMINATION

The nature and extent of petroleum contamination at the Disposal Site is discussed below. Soil and groundwater analytical data, which were presented in the Phase II Report for the Disposal Site are included in Tables 1 through 4. Figure 5 illustrates a conceptual model of the petroleum release from the 3,000-gallon UST and the impact to down gradient environmental media and receptors.

### A. Source Area

The 3,000-gallon UST was determined to be the source of the release based on the following conditions:

- LNAPL is present at well MW-4 located about 5-feet directly down gradient of the 3,000-gallon UST. Measurable LNAPL has not been present at well MW-1 which is located about 5-feet directly down gradient of the 8,000-gallon UST.
- Dissolved petroleum concentrations in groundwater located immediately down gradient of the USTs were 22 times lower at the 8,000-gallon UST (MW-1) compared to concentrations at the 3,000-gallon UST (MW-4) when tested before startup of the bioremediation system in 1999. The concentrations at MW-1 were below groundwater quality standards. LNAPL at MW-4 was purged prior to sampling groundwater for dissolved petroleum analysis.
- Petroleum measured on soil collected from the capillary zone (8-10 feet below the ground surface) revealed concentrations about 15 times lower immediately down gradient of the 8,000-gallon UST (MW-1, 8-10' ) compared to capillary soil located immediately down gradient of the 3,000-gallon UST (MW-4, 8-10').
- Geoprobe soil sample collected at borings GP-2 and GP-3 which were located within 3-feet of the 3,000-gallon UST revealed elevated petroleum concentrations in soil to concentrations that exceeded MCP Upper Concentration Limits (UCLs). Boring GP-1,

which was located between the USTs, had petroleum concentrations in soil below Method 1 S-1 soil standards.

The nature and extent of contaminated soil and groundwater located beneath the 3,000-gallon UST was determined by field investigation. Drilling refusal by what is believed to be a concrete slab was encountered from 4-6 feet below the top of the floor slab. Drilling through this subsurface obstruction would require a large rotary drill rig inside the operating facility. Drilling at the UST inside the facility was not feasible using such equipment because it was not physically accessible and drilling activities would substantially disrupt manufacturing operations.

Because petroleum concentrations in soil decrease with depth at borings GP-2 and GP-3, the release appears to have occurred from overfilling the UST and/or leaking pipes connecting to the top of the UST. The release appears to have migrated down to the subsurface concrete obstruction immediately beneath the UST, traveled over the obstruction and continued to migrate downward to groundwater below. Petroleum product that reached the groundwater table migrated eastward via groundwater flow and discharged to the underground culvert located approximately 45-feet to the east. Severest petroleum concentrations in soil are believed to be present in soil located above the subsurface concrete obstruction. Contaminated soil and groundwater may be present beneath the UST but LNAPL is not believed to be located beneath the tank, because the subsurface concrete obstruction is believed to have diverted the majority of the release to the east end of the UST toward well MW-4. Because planned response actions at the Disposal Site to achieve a Condition of No Significant Risk include bioremediation of the petroleum plume located down gradient of the UST and implementation of an Activity and Use Limitation for contaminated soil located around the UST, and where restrictive physical access to the UST prevented additional investigation, LSPCO concluded

that collecting data to validate subsurface conditions beneath the 3,000-gallon UST was not critical to the response action outcome.

B. Down Gradient Plume

A plume of petroleum product contamination is present at the Disposal Site and extents from the 3,000-gallon UST to the Brook underground culvert. The plume consists of LNAPL as measured at well MW-4 and along the underground culvert's wall, dissolved petroleum in groundwater, and contaminated soil in the capillary zone. The petroleum plume has not migrated beyond the underground culvert because 1) the underground culvert had been a discharge point for groundwater flowing from the Disposal Site. and 2) The underground culvert is located at the bottom of a steep hill located to the east where groundwater beneath this area flows west also discharging to the underground culvert.

LSPCO was concerned that the petroleum plume would migrate along the west side of the underground culvert's wall in the down gradient direction and therefore installed well MW-2 to monitor groundwater quality for this purpose. Dissolved petroleum concentrations have decreased at this well indicating that migration of the plume in this direction has not occurred. LSPCO also visually inspected weep holes located in the underground culvert's wall about 25-feet down stream (south) of the Disposal Site and did not identify petroleum migrating into the culvert at these locations.

Down gradient contaminant plume conditions reported to MADEP in the last IRA Status Report dated January 23, 2002 are summarized here. The bioremediation system had been operating about 8-months at the time the status report was submitted to MADEP. Except for well MW-5, dissolved concentrations of petroleum spiked since the system began operating on May 23, 2001.

Concentrations showed a significant increase when sampled on July 23, 2001 and then showed a significant decrease when sampled on October 11, 2001. Concentrations at MW-5 did not spike, but have gradually increased since the system began operation. The concentration spike was expected and reflects mobilization of petroleum in groundwater and on soil from enhanced groundwater movement and microbial action caused by the treatment system. Mobilization of petroleum in the subsurface is also evident at well MW-1, which is located cross-gradient of the 3,000-gallon UST. The subsequent decrease of petroleum reflects the consumption of petroleum by the oil-eating microbes. Further evidence of effective treatment is the increase in nutrient levels (See Table 3) in groundwater introduced by the system and a spike in petroleum concentrations measured in groundwater influent to the treatment system. The petroleum spike in the influent occurred in the monitoring round after the spike occurred in groundwater, and reflects the lag in travel time for liberated petroleum to reach the recovery trench.

Virtually no dissolved petroleum was present at well MW-2. This well was monitored to determine if petroleum was migrating off-site along the underground culvert wall. Results continue to show that no significant petroleum has migrated along this pathway prior to operation of the remediation system. Overall, the treatment system is operating as designed.

## IV. PHASE II CONLUSIONS

The following conclusions were made after completion of Phase II:

- Contamination at the Disposal Site has been characterized as No. 2 fuel oil, which originated from the 3,000-gallon UST located beneath the eastern end of the facility.

- The petroleum release resulted in contamination to soil located around the UST, and contamination to groundwater and soil in the capillary zone down gradient of the UST extending from the UST to the Brook underground culvert.

- LNAPL is present immediately down gradient of the UST at well MW-4 and along the west wall to underground culvert. LNAPL has discharged to surface water in the underground culvert. The culvert discharges to Two Small Pond located about 500-feet from the Disposal Site.

A Method 1 risk characterization has determined a Condition of Significant Risk at the Disposal Site where comprehensive response actions are required as follows:

- The discharge of LNAPL to water in the underground culvert would occur in absence of the bioremediation system currently operating at the Disposal Site and in absence of the plugs placed in the weep holes to the culvert.

- The presence of LNAPL at well MW-4 at a thickness exceeding the threshold thickness to implement an IRA would exist at the Disposal Site in absence of the bioremediation system currently operating at the Disposal Site.

- The EPC of EPH C19-C36 Aliphatics in soil around the 3,000-gallon UST located beneath the facility exceed Method 1 S-3 soil standards. UCLs are not exceeded.

- The EPC of EPH C19-C36 Aliphatics in soil across the entire Disposal Site exceed Method 1 S-3 soil standards. UCLs are not exceeded.

## V. REMEDIAL OBJECTIVES:

The MCP requires that a permanent Response Action Outcome (RAO) is achieved when 1) contaminant sources are eliminated or controlled, 2) Substantial Hazards as defined in the MCP, are eliminated, 3) contaminants are reduced to concentrations that do not pose a Significant Risk as defined in the MCP, and 4) contaminants are reduced to concentrations approaching background as defined in the MCP, if feasible. The objective of the clean up at the ACME Disposal Site is to achieve a Class A-3 RAO where remedial actions have permanently achieved a level of no significant risk, the level of contaminants have not been reduced to background, and an Activity and Use Limitation is required.

In-place closure of the 3,000-gallon UST in 1991 in accordance with 527 CMR 9.00 has eliminated the source of petroleum. Substantial Hazards, as defined in the MCP, are not present at the property.

The bioremediation system currently operating at the Disposal Site is partially fulfilling the objective of achieving a permanent solution. The bioremediation system is removing LNAPL and biologically reducing petroleum levels in aquifer down gradient of the 3,000-gallon UST.

LSPCO believes that it will not be feasible to achieve background levels at all locations at the Disposal Site. The MCP defined "Background", in part, as levels of oil that would exist in the absence of the Disposal Site which are either 1) ubiquitous and consistently present in the environment and attributable to geologic and ecologic conditions, or from atmospheric deposition; and 2) petroleum residues incidental to the normal operation of motor vehicles. The bioremediation system is expected to reduce concentrations of petroleum on soil and in groundwater located down gradient of the 3,000-gallon UST to levels that approach

background concentrations. However, it is not readily feasible to reduce petroleum concentrations in soil located at the UST, which is located beneath the ACME facility, to levels that approach background.

## VI. AVAILABLE REMEDIAL ACTION ALTERNATIVES AND INITIAL SCREENING:

As mentioned earlier in this report, the bioremediation system installed as an IRA and currently operating at the Disposal Site is successfully remediating the down gradient portion of the Disposal Site. This remediation system is not subject the Phase III evaluation. Review of available remedial action alternatives and initial screening is limited to contaminated soil located at the 3,000-gallon UST, which is the remaining portion of the Disposal Site that poses a Significant Risk and has not yet been remediated.

### A. General

Remedial Action Alternatives (RAAs) for the site were determined by identifying technologies available to remove contaminants from unsaturated soils, and technologies available to reduce contaminant concentrations to a level of No Significant Risk. There are numerous readily available alternatives to remediate soil contaminated with Extractable Petroleum Hydrocarbons and include:

1. Excavation;
2. In-situ bioremediation;
3. Natural attenuation; and
4. Land use restrictions.

PORTIONS OMITTED

## VIII. SELECTED REMEDIAL ALTERNATIVE AND REMEDIAL ACTION PLAN:

### A. Selected Remedial Action Alternative

Remedial Action Alternative (RAA) # 4 - Land use restriction was selected as the most appropriate method to achieve a level of No Significant Risk from contaminated soil located around the 3,000-gallon UST. The estimated cost to implement this RAA is $9,000. The AUL RAA was selected because 1) the probability of exposure to contaminated soil located around the 3,000-gallon UST is low given current and foreseeable land use, 2) there is virtually no health risk to workers to implement this RAA. Implementation of the excavation and in-situ bioremediation RAAs pose a risk to workers and/or a risk to the structural integrity of the facility that is not warranted compared to the health risk posed by the contaminated soil itself. and 3) the incremental increase in cost for excavation or bioremediation compared to the incremental environmental/health benefit provided by these alternatives is not justified. The Excavation and bioremediation RAAs cost three and one-half times more than the AUL RAA, but offer no greater reduction in health risk than that provided by an AUL because the material is located beneath a building.

Excavation and off-site disposal of contaminated soil and the UST would be a suitable RAA if the material were not located beneath the facility. If this portion of the facility were to be significantly renovated or demolished at some time beyond the foreseeable future, the effectiveness of the AUL will be evaluated and excavation of the material will be performed, if appropriate to maintain a condition of No Significant Risk under the MCP.

### B. Remedial Action Plan

The remedial action plan would be implemented as follows:

Define limits of area subject to AUL. The area of contaminated soil located around the 3,000-gallon UST will be subject to the AUL at a minimum. The AUL may include land area equal to the limit of the Disposal Site, depending on the concentration of residual petroleum not treated by the currently operating bioremediation system.

Implementation of the AUL would occur after remediation of soil and groundwater currently being treated down gradient of the 3,000-gallon UST is considered complete. If remediation of soil and groundwater down gradient of the 3,000-gallon UST is required beyond the Tier II Classification expiration date of April 15, 2005, a Class C RAO will be submitted to MADEP. The AUL will be implemented in support of a Class A-3 RAO for the Disposal Site when in-situ bioremediation of the down gradient plume is complete.

C. Implementation

A Phase IV - Remedial Implementation Plan (RIP) is required by April 15, 2003 in accordance with the MCP. It is LSPCO's professional opinion that a Phase IV RIP is not required to implement an AUL at the Disposal Site. RIPs apply to RAAs that involve construction, treatment, removal, and operation and maintenance of remedial systems. An AUL involves none of these aspects. Nor is a Phase IV RIP required for the in-situ bioremediation system currently operating at the Disposal Site. A plan to construct, operate, and maintain the system was approved by MADEP as IRAs.

Figures, tables of Phase III Omitted (see Phase II)