TECHNICAL REQUIREMENTS

FOR

ON-SITE LOW TEMPERATURE THERMAL TREATMENT

OF

NON-HAZARDOUS SOILS CONTAMINATED WITH PETROLEUM/ COAL TAR/ GAS PLANT WASTES

- Final-

May 29, 1996

Prepared by

The Interstate Technology and Regulatory Cooperation

Low Temperature Thermal Desorption Task Group

Overview

Low Temperature Thermal Desorption (LTTD) is a treatment technology which removes contaminants from solid media (e.g., soils) by volatilizing them with heat, but without combustion of the media . LTTD has been widely used in treating petroleum contaminated wastes and is being used increasingly in the cleanup of manufactured gas plant (MGP) wastes and hazardous constituents, notably chlorinated solvents and pesticides.

Goals of the LTTD Task Group were:

to produce a standard set of technical requirements which could serve as a model to allow the LTTD technology to move from state to state, without unnecessary redevelopment of technical requirements;

to improve market conditions for LTTD technology providers by providing a degree of consistency and predictability in technical requirements for implementation of the technology for cleanup;

to develop a viable, repeatable process for interstate cooperation directed toward enhancing implementation of innovative technologies and innovative application of existing technologies to site cleanup;

to provide a framework for states which have no specific regulatory requirements for LTTD should they choose to develop those requirements and to provide a gauge for states which do have requirements to assess those requirements in light of the common requirements of other states;

to provide a template of technical requirements which could be used as a model for other technologies for all functions presented above.

Approach

The LTTD Task Group began the technical requirements development process by addressing treatment of non-hazardous soils because they felt the effort would be relatively straightforward. The task group intends for the next version of the LTTD technical requirements document to address treatment of hazardous waste, specifically soils contaminated with chlorinated constituents. They plan to use firsthand experience gained from the Rocky Flats LTTD DOIT Demonstration, as well as expertise of knowledgeable vendors who are beginning to deploy LTTD in the field for the cleanup of hazardous

waste.

Although agreement was reached for all of the technical issues presented in this document, the group found that, even for the "simple" case, achieving consensus on technical requirements was a painstaking and time consuming effort. It should be recognized that a certain level of effort is inherent to the stakeholder involvement process and additional effort was expended as part of the learning process as the group members moved forward in their pursuit of interstate cooperation.

As in the case of the other TSTG's, the LTTD task group was open to any ITRC member. Participants with expertise and ongoing LTTD projects in their states elected to join this task group and contributed consistently to the development of this work product. Most of the practical experience of these state regulators was in the realm of treating petroleum and MGP soil contamination. In addition, two individuals from the United States Environmental Protection Agency (US EPA) and one individual representing the public participated as often as they could in group conference calls and draft product review. An industry consultant was retained to provide the industry perspective during one ITRC meeting.

Although all members of the ITRC were invited and actively encouraged to provide input into the LTTD work products, the group found that active participants were primarily those regulators who saw a specific need for the technology in their respective states. A few technology vendors who saw a viable market for their technology were willing to comment on draft documents. This natural tendency for participants to focus almost exclusively in their areas of interest should be taken into account when initiating future efforts for interstate cooperation**.**

Product and Process Evaluation

It is useful at this point to make a distinction between the initial work product and the process used to develop the product when evaluating the success and lessons learned from the LTTD effort. The initial work product is a document which blends diverse state technical requirements for a proven technology used for treatment of non-hazardous soils. The LTTD task group considered requirements from nine states to develop their draft document and circulated the document for review and comment to all member states of the ITRC.

This document as a deliverable provides benefits at several levels:

This document provides a baseline of technical requirements for implementation of LTTD for cleanup of petroleum and MGP contaminated soils. While the use of LTTD for petroleum contamination is becoming more routine, the use of LTTD for gas plant sites is less well established.

This document will serve as a template for the group's development of technical requirements for the more challenging case of soils contaminated with chlorinated solvents and pesticides.

This document can serve as a template for technical requirements for promising new technologies still in the demonstration and testing phase.

The entire document outline is generally transferable to other "relatively mature" technologies. The following sections of the document may be directly transferrable to other technologies:

-Approach to established baseline requirements, allowing for flexibility to address site specific and technology specific variables

- Analytical Methods

- Sample QA/QC

- Water Discharge Requirements

- Operations Record Keeping

- General QA/QC

- Health and Safety

Strong lessons were learned in terms of process development. Members of the LTTD task group developed the draft document during weekly facilitated conference calls and during breakout sessions at ITRC meetings. They produced successively modified versions of the document based upon feedback and input from the entire ITRC. Group members were exceptionally successful in circulating the draft LTTD document within their respective states and obtaining comments from various divisions of their organizations. A few additional states provided valuable and thoughtful comments.

The iterative process worked well for the LTTD group for their first revisions, because the individual group members were willing and able to invest the effort needed to follow-up with their colleagues.

The LTTD group realized greatest efficiency in having a core group of five to seven experienced people from different states produce the draft product.

A facilitator helped to keep their discussions focused and handled the actual document revision and production work.

Public stakeholder comment was solicited from stakeholder representatives of the ITRC. In concert with the full ITRC, the LTTD group adopted the recommended "A Guide to Tribal and Community Involvement in Innovative Technology Assessment". This guide clearly points out the desire and need for "meaningful community involvement" at the site implementation level .

The members of the group recognized the need for stakeholder involvement but had difficulty with determining the appropriate approach to stakeholder involvement. Their struggle centered around trying to incorporate site-specific stakeholder needs into their generic technical requirements document. The group feels this is a cross cutting issue and recommends that the full ITRC pursue a viable approach.

Additional stakeholder feedback was solicited by sending out the document for full ITRC review and comment, presenting the document at ITRC meetings and asking for feedback during facilitated breakout and full group sessions, and finally by asking for feedback directly from technology vendors. Overall, state representatives who did not respond to the LTTD group's original written request for comments also did not offer much feedback during ITRC meetings. Twelve vendors verbally committed to providing evaluation and feedback, but only a limited number actually provided comments.

In this case, a great deal of effort was expended to generate a marginal amount of feedback. An inherent limitation of the process is the lack of time for participants to provide thorough consideration to the other subgroups' work products, while trying to produce work products of their own. Thus, thoughtful consideration needed to understand all of the implications of these work products, in some cases, apparently has been deferred until individual state "sign off" for the documents is requested.

It is possible that the efficiency of the feedback/revision loop could be improved by taking more time up front to identify stakeholders who are likely to provide the needed feedback and concentrate efforts there. However, the group must still genuinely attempt to give all stakeholders an opportunity to voice their concerns.

Communication between the LTTD Task Group and the Full ITRC

The chair of the LTTD Task Group, as well as the chairs of the other TSTG's, also served as members of the ITRC Steering Committee. As a result, ITRC overarching requirements and expectations were clearly communicated to the LTTD Task Group. The group was allowed and encouraged to develop the LTTD work product autonomously, while keeping the ITRC mission in mind. Requests from the LTTD group for ITRC support were fully accommodated in the form of facilitation, full group sessions and breakout sessions on LTTD. **The cross-linked structure between the LTTD Task Group and the ITRC enhanced the flow of information and fostered communication in both directions.**

ITRC Acceptance of the LTTD Work Product

The LTTD group members began and will continue to follow steps of the November 1, 1995 "ITRC Decision Making Process" as they seek to gain acceptance by the ITRC members of their work product. States have been asked to indicate their level of acceptance and commitment to implementation (full acceptance, acceptance of indicated sections of the document, acceptance with reservations or noted exceptions, non-acceptance). ITRC members are working within their respective state agencies to obtain letters describing level of acceptance at the appropriate level within their organizations.

Even though existing laws/regulations may make it impossible for some states to accept and implement provisions of the LTTD document in its entirety, the process is providing value in that:

Acceptance to the extent possible is being documented, bringing a level of consistency and predictability to implementation LTTD in the field

Specific impediments to acceptance and implementation are being identified for future resolution

The initial effort to ascertain ITRC states level of acceptance occurred during the March through May 1996 time frame. A summary of state concurrence efforts to date, along with copies of concurrence letters received to date, are provided in Appendix B. Table B-1 shows that ten states already have submitted letters to indicate their level of acceptance and commitment to use of this document.

The LTTD subgroup plans to continue to work with the remaining ITRC states to document their level of acceptance of this work product. In order to maximize response, the members of the LTTD TSTG recommend that the governors of the ITRC states ask their environmental health agencies to designate an appropriate individual to carefully and thoughtfully consider the work product produced by this group and to report back to their respective governors on the level of acceptance and implementation they can recommend.

Outstanding Issues

Initial efforts of the LTTD group involved taking a diverse set of existing requirements from several states, attempting to resolve differences and identifying those areas which could not be reconciled. In several instances, the group found that existing federal or state statutes/regulations conflict with one another. As a result, the full ITRC was not able to reach consensus on certain issues. The interim solution was either to pass the overarching issues on the full ITRC or to relegate these issues to a state by state (or case by case) resolution. As yet, several technology specific and overarching issues remain unresolved. Major concerns include:

How to effectively involve the public in this process

Whether an LTTD unit and/or its afterburner is classified as an incinerator

The number and nature (discrete vs. composite) of verification samples to be collected

Whether field analytical methods can be used in place of offsite laboratory sample analysis

How to deal with time delays and costs associated with permitting requirements for Resource Conservation and Recovery Act (RCRA) hazardous waste sites

PREFACE

The Interstate Technology and Regulatory Cooperation Work Group (ITRC) is exploring mechanisms for interstate cooperation which may decrease the amount of time it takes for new technologies to become widely accepted and integrated into the site cleanup process. ITRC Technology Specific Task Groups (TSTG's) are focusing on several technologies, one of which is Low Temperature Thermal Desorption (LTTD). In preparing this document, the LTTD Task Group used the following "basic assumptions" :

For purposes of this document, the term "non-hazardous" takes the federal definition as defined in 40 CFR.

The LTTD group has elected to produce baseline technical requirements which should be followed for all LTTD applications. Because of the wide diversity of thermal treatment technologies, the group feels it is not feasible to establish a detailed test plan appropriate for all sites.

These technical requirements were developed to provide stakeholders (including vendors) with some degree of predictability and consistency of requirements from state to state. However, states reserve the right to go beyond these requirements, but should have a rationale for doing so.

Alternatives to these requirements may also be acceptable, on a case specific basis, but there should be a technical basis for the alternative.

Because of the wide variability among states, the technical requirements do not include any emission criteria for air, or cleanup criteria for soil or water.

ACKNOWLEDGMENTS

The members of the Interstate Technology and Regulatory Cooperation (ITRC) Low Temperature Thermal Desorption (LTTD) Task Group wish to acknowledge the individuals, organizations and agencies that contributed to this technical requirements document.

The LTTD affords, as part of the broader ITRC effort, is funded primarily by the US Department of Energy and US Department of Defense. The US Environmental Protection Agency and Association of State and Territorial Solid Waste Management Officials are providing technical support and the Western Governors Association is staffing the working group.

The Task Group also wishes to recognize the efforts of its participating members. State regulatory representatives who developed this document included Mr. Brian Sogorka (NJ) who chaired the group, Mr. Tom Conrardy (FL), Mr. Tom Douglas (FL), Mr. Ted Dragovich (IL), Mr. Jim Harrington (NY), Mr. Bal Lee (CA), and Mr. Matt Turner (NJ). Representatives from EPA, Mr. Jim Cummings and Mr. Paul dePercin, provided a valuable federal perspective. Stakeholder participation and review was provided by Ms. Anne Callison of Lowry AFB RAB. Ongoing group facilitation and technical support was provided to the group by Ms. Chris Renda of Environmental Services Network. A beneficial industry perspective was provided by Mr. Jim Cudahy of Focus Environmental, Inc.

In addition the group would like to thank representatives of ITRC member states and federal agencies who provided thoughtful comments on the various draft documents. Written responses were received from the states of California, Colorado, Florida, Illinois, Louisiana, Massachusetts, New Jersey, New York, Pennsylvania, Texas, and U.S. Department of Energy Headquarters (EM-50). The LTTD group also wishes to thank the technology vendors whose comments provided a needed industry perspective: Electric Power Research Institute (EPRI), Maxymillian Technologies, Midwest Soil Remediation, Inc., Valmont Industries, RUST Geotech of the DOE Grand Junction Project Office and Kaiser-Hill - Integrating contractor of the Rocky Flats Environmental Technology Site.

Special appreciation is extended to Mr. Chris McKinnon of the Western Governors' Association and Ms. Ginger Swartz of Swartz and Associates for their guidance throughout the writing of this document.

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1.0 INTRODUCTION

1.1 Background

The legal and regulatory uncertainties surrounding the cleanup of waste sites discourages the testing and use of innovative technologies and innovative applications of accepted technologies. Technology developers have difficulty gaining regulatory approval for the use of new technologies. Their difficulties are compounded by the requirement for developers to demonstrate a technology's performance in each state targeted for technology deployment.

In response to this concern, the Western Governors' Association convened a meeting of western regional regulators during the summer of 1994 to discuss ways to increase cooperation among states on the review, permitting, and evaluation of promising new remediation technologies. This group, now called the Interstate Technology and Regulatory Cooperation (ITRC) Working Group, has been expanded to states outside the region and includes federal, industry, tribal and public advisors as well.

Under direction from western governors, participating regulatory agencies which are cooperating with the ITRC will report to those governors in June 1996. The agencies will recommend mechanisms to be incorporated into state policy to facilitate interstate cooperation in order to shorten the time it takes technologies to go from demonstration to widespread application. One of the mechanisms under review is the development of baseline regulatory requirements and standardized protocols for verifying a technology's cost and performance.

During subsequent meetings of the ITRC Working Group, initial areas of technical focus were chosen and subgroups began work on establishing reporting and demonstration protocols for specific technologies. The Low Temperature Thermal Desorption (LTTD) Task Group (regulators from California, Florida, Illinois, New Jersey, New York and EPA) developed a preliminary plan to provide a set of composite LTTD regulatory requirements for all participating states. However, early work confirmed a suspected limitation --- most states have not yet established generic regulatory requirements but rather have established requirements on a site specific basis. The objective of the LTTD Task Group therefore became the development of a baseline of technical requirements which might be acceptable to several state regulatory agencies. If successful, this reduction of regulatory impediments should help to lower the cost of permanent remedies for contaminated sites.

1.2 Status of LTTD Use for Petroleum and MGP Waste Contaminated Soils

The use of LTTD has advanced to the point where many states have approved/permitted multiple LTTD units for petroleum contaminated soil. LTTD treatment costs appear to be decreasing as a result of competition among LTTD technologies and other types of treatment. Some states are in the process or have recently permitted LTTD units to treat MGP wastes. This trend is expected to continue as regulators and the public become more comfortable with LTTD treatment of MGP wastes.

The recent trend for low temperature thermal treatment facilities is towards larger fixed facilities as opposed to mobile facilities. This trend is likely due to economies of scale, public acceptance issues, and site size restriction. Fixed facilities have the cost advantage of going through the public acceptance process once. Mobile facilities may face time constraints and economic difficulties when public acceptance must be obtained each time their unit is moved to a new site.

1.3 Scope of Document

The LTTD Subgroup elected to begin with the relatively "straightforward" case of requirements for non-hazardous soils contaminated with petroleum hydrocarbon contaminants, coal tar, and other manufactured gas plant (MGP) contaminants and defer discussion on more problematic contaminants such as chlorinated compounds. This document deals with contaminants including gasoline, mineral spirits, kerosene, jet fuel, fuel oil, crude oil and cutting oil, coal tars, tar soils, purifier box waste, purifier box waste contaminated soil and a combination of all of these contaminants. A future version is planned which will also address soils contaminated with hazardous wastes such as polychlorinated biphenyls (PCB's), chlorinated solvents, and pesticides.

Because of the wide range of variations from state to state, this document does not address media cleanup criteria (soil, water, air) or waste classification sampling requirements. This document does not attempt to address whether any particular LTTD unit or afterburner is classified as an incinerator. That determination, along with associated requirements, will be made by individual states.

In addressing areas of agreement among states, the LTTD Task Group has chosen to lay out technical requirements, as opposed to guidance or recommendations, for implementation of LTTD because it is a fairly well developed technology. In keeping with the objective of providing requirements, the word "shall" is used throughout this document, rather than softer words such as "should."

1.4 The Need for Flexibility and Variances

The LTTD subgroup recognizes that on some sites, states may choose to go beyond this set of requirements. It is incumbent upon operators to find out from regulators whether there are additional or alternate requirements applicable; and it is in the states' best interest to allow variances from these technical requirements based on specific technology applications. Variances also should be provided to allow for the use of appropriate alternative sampling or analytical methods.

In order to provide flexibility in the technical requirements, variances for alternate sampling, analytical, waste processing or monitoring methods may be used if:

1. The method has previously been used successfully under similar site conditions, as documented by a regulatory agency; or

2. The method has been tested successfully by independent, non-regulatory verification entity; or

3. The method is approved by the agency, based upon site specific conditions or technology modifications; the following criteria should be considered:

a. waste stream homogeneity (e.g., verification sample frequency could be decreased or a highly homogeneous waste stream, and increased for a heterogenous waste stream);

b. contaminant concentration in waste stream (e.g., verification sample frequency could be decreased for a waste stream that is only moderately contaminated, and increased for a heavily contaminated waste stream);

c. automatic shut-down conditions (e.g., shut-down condition based on soil exit temperature could be eliminated based on a higher verification sample frequency);

d. receptor proximity (e.g., fugitive dust control requirements could be relaxed based on receptor proximity).

1.5 The Need for Public Involvement

The LTTD Task Group recognizes the need for stakeholder involvement when selecting new technologies for the cleanup of contaminated sites. In keeping with the full ITRC, they have adopted the concepts in principal put forward in "A Guide to Tribal and Community Involvement in Innovative Technology Assessment". This guide clearly points out the desire and need for "meaningful community involvement" at the site implementation level.

Although emphasis is placed on public and tribal involvement at the site specific level, technology developers need to be aware of the types of information the community will require for their decision making process. The guide can be used as a "checklist" by technology developers and regulators Examples of concerns which can be considered in a generic sense include noise levels, air emissions, risk to the public, permanence of the remedy and cost.

1.6 Cost and Performance Reporting Requirements

The ITRC has adopted the "Guide to Documenting Cost and Performance for Remediation Projects" as a model to standardize cost and performance reporting. The LTTD group further recommends that the data and information found in the Cost and Performance Report for the T H Agriculture & Nutrition Company Superfund Site (TH Ag Report) is appropriate for use in documenting applications of LTTD. Routine applications of LTTD may not need to be documented using the cost and performance format. The EPA Technology Innovation Office (TIO) has agreed to determine which LTTD applications need to be documented using the cost and performance format.. A standardized outline of a cost and performance report for LTTD is provided in Appendix A of this report.

2.0 PRE-TREATMENT SOIL SAMPLING

2.1 Parameters Sample

For purposes of this document, the objective of pretreatment sampling is to identify the range of soil types and contaminant concentrations expected on the site. This information is necessary in order to select the appropriate soil for the thermal treatment test runs and to insure that the most heavily contaminated samples are selected for the test run. It is assumed that the site has been adequately characterized during a remedial investigation. Therefore, sample frequency requirements are not addressed in this document.

Pre-treatment soil sampling for petroleum contaminated or coal tar/MGP wastes and contaminated soils shall include the parameters for the contaminant source outlined in Tables 1 and 2, respectively. Pre-treatment soil sampling parameters shall also include any additional contaminants of concern associated with the soil. (See Section 3. Feed Soil Limitations). Recommended methods for the various sampling parameters are presented in Section 2.2. Sample data collected during an investigation of the site may be substituted for the following requirements, as appropriate.

TABLE 1. Soil Sampling Parameters for LTTD Treatment of

Petroleum Contaminated Soils

PETROLEUM CONTAMINANT	ANALYTICAL PARAMETERS
Gasoline, Mineral Spirits	VO+10 [1], Lead [2]
Kerosene, Jet Fuel	VO+10, Naphthalenes [3]
Fuel Oil No. 2, Diesel Fuel	TPHC, PAH [4]
Fuel Oil Nos. 4 & 6, Hydraulic Oils, Cutting Oil,	

Crude Oil, Lubricating Oil	TPHC, PAH [4]

Table Footnotes

1. Environmental Protection Agency (EPA) target compound list volatile organic (VO) or priority pollutant VO scans including xylene with a gas chromatograph/ mass spectrometer (GC/MS) library search for the ten highest peaks.

2. Lead analysis required for leaded gasoline sources. Soil may have elevated metals prior to petroleum spills occurring. However, metals other than lead, are not typically parameters of concern for petroleum spills. Operating temperatures are usually low enough to prevent significant volatilization of metals.

3. Naphthalenes, including naphthalene, methyl naphthalenes, di-methyl naphthalenes; may be analyzed in base/neutral+15 (B/N+15) fraction or in VO fractions; if analyzed in VO fraction, instrument shall be calibrated for these analytes. Quantitation of all isomers found shall be performed against at least one methyl naphthalene standard and at least one di-methyl naphthalene standard.

4. Polynuclear Aromatic Hydrocarbons (PAH) as per EPA Priority Pollutant List.

TABLE 2. Soil Sampling Parameters for LTTD Treatment

of Coal Tar/Gas Plant Wastes and Contaminated Soils

CONTAMINANT	**ANALYTICAL PARAMETERS**
Coal Tar and Coal Tar Contaminated Soils	BTEX[1], PAH, TPHC[2] , Metals[3], BNA[4]
Purifier Box Waste and Box Waste Contaminated Soils	Metals[3], Total Cyanide, Total and Reduced Sulfur
Combined Coal Tar and Box Wastes or Contaminated Soils	BTEX[1], PAH, TPHC[2,], Metals[3], BNA[4], Total Cyanide, Total and Reduced Sulfur

Table Footnotes

1. BTEX compounds consist of benzenes, toluenes, ethyl benzenes and xylenes.

2. TPHC - Total petroleum hydrocarbons.

3. Metals - At MGP sites, certain metals (e.g. arsenic, cadmium, chromium, copper, lead and nickel) could be present at elevated levels, typically up to several hundred parts per million. However, operating temperatures are usually low enough to prevent significant volatilization of metals.

4. BNA compounds are base/neutral/acid extractables. This includes PAH compounds.

2.2 Analytical Methods

EPA/ASTM methodologies shall be utilized for all parameters. The specific methodologies are presented in Table 3.

TABLE 3. Methods of Analysis for LTTD sites

Parameter	Method of Analysis
BTEX, VO+10	SW846 8240 (Packed Column) or 8260 (Capillary Column)
PAH	SW846 8270
TPHC	SW846 8015B
Metals	SW846 6010
BNA	SW846 8270
Total Cyanide	SW846 9010 (manual) or 9012 (automated)
Sulfur	ASTM 3176, 3177 methods 427C, 428A

2.3 Sample Quality Assurance/Quality Control (QA/QC)

All QA/QC required by the analytical method shall be completed. Lab QA/QC summary documentation (including non-conformance summary report and chain of custody) shall be submitted with analytical results. Full QA/QC deliverables as specified by the analytical method shall be maintained and shall be available upon request for at least three years. Ultimate responsibility for QA/QC documentation belongs with the responsible party of a site or the vendor conducting a demonstration. However, the responsible party may contract with another entity, such as an analytical laboratory, to house the actual QA/QC data.

3.0 FEED SOIL LIMITATIONS

The generator of the soil shall certify, based upon site history or previous sampling/characterization, that halogenated organic compounds (including PCB's) are not contained in the soil to be treated. As an added precaution, to prevent inadvertent treatment of chlorinated contaminants, soil shall be pre-tested for total organic halogen (TOX), using EPA SW846 Method 9020. TOX analysis is not required if site soils have been analyzed for chlorinated volatile organics, pesticides and PCB's. (The LTTD Task Group is drafting a separate document which specifies requirements for treating soils contaminated with chlorinated constituents.) If there is any doubt as to the nature of constituents, sampling is required.

Soil contaminated with elevated levels of heavy metals shall not be treated unless the air permit specifically allows treatment of the material.

The following soil conditions require pre-treatment or a test run to ensure the technology will be effective:

1. soil moisture >35%

2. material > 2" diameter

3. soil has high plasticity

4. soil has high humus content [2]

5. for petroleum contaminated media only - either soil TPHC >20,000 ppm

or greater than 25% LEL in gas in desorption chamber

6. for coal tar contaminated media only - coal tar product > 2%

4. SOIL TREATMENT VERIFICATION SAMPLING

4.1 Sample Parameters

Soil treatment verification sampling for petroleum or coal tar/MGP contaminated soils shall include the parameters outlined in Table 1 and Table 2. BTEX may be eliminated from verification sampling of coal tar contaminated soils because PAH compounds are surrogate for BTEX. In addition, any other site specific

contaminants of concern for the treated soil shall be included in the parameter list. Verification sampling is not required for any contaminants which will be unaffected by thermal treatment, including metals.

4.2 Sample Frequency

Post-treatment soil sampling will require one (1) composite sample for each one hundred (100) cubic yards or one hundred and forty (140) tons of treated soil, using method ASTMC702-87. Each composite shall be comprised of five (5) discrete samples.

As an alternative to composite samples, five (5) **discrete** samples for each one hundred (100) cubic yards or one hundred and forty (140) tons of treated soil may be collected. On a case by case basis, based upon documented efficiency of the treatment system, the post-treatment sample frequency may be reduced. This situation may be particularly applicable to high throughput units.

Special consideration is required for volatile organics sampling. Samples for volatiles shall be collected using specialized sampling techniques to minimize loss of volatile contaminants.

4.3 Analytical Methods

EPA/ASTM methodologies presented in Table 3 shall be used. For verification sampling, gas chromatography methods with a mass spectrometer detector system are required for analysis of volatile/semi-volatile contaminants. Mass spectrometer methods are not required if:

1. Contaminant identity is known;

2. The contaminant chromatographic peak is adequately resolved from any other peak; and

3. At least 10% of the sample analyses (minimum of one sample) are confirmed using the appropriate gas chromatograph/mass spectrometer detection system.

4.4 Sample QA/QC

All QA/QC required by the analytical method shall be completed. Lab QA/QC summary documentation (including non-conformance summary report and chain of custody) shall be submitted with analytical results. Full QA/QC deliverables as specified by the analytical method shall be maintained and shall be available upon request for at least three years. Ultimate responsibility for QA/QC documentation belongs with the responsible party of a site or the vendor conducting a demonstration. However, the responsible party may contract with another entity, such as an analytical laboratory, to house the actual QA/QC data.

5.0 SOIL HANDLING AND STOCKPILING

Pre-treatment soil stockpiles shall be stored on a surface such as concrete or an impermeable liner of appropriate thickness. The stockpile shall be covered by a secured plastic cover of appropriate thickness or stored within the confines of a building. At a minimum, the staging area for the stockpiles shall be constructed to prevent surface water and precipitation from entering the area and to collect leachate. All soil stockpiles shall remain covered to prevent the generation of dust. Water spray or equivalent shall be utilized as necessary to prevent dust generation. Monitoring shall be provided to ensure that unacceptable levels of dust generated from the movement and handling of soil do not migrate from the site.

Post-treatment soil shall be stored in the same manner as pre-treated soil until analytical testing has confirmed that the soil has successfully been treated. A physical barrier, such as a curb or a wall, shall be maintained to separate the pre-treatment from the post-treatment stockpiles. All areas shall be restored, to the extent practicable, to pre-remediation conditions with respect to topography, hydrology and vegetation, unless an alternate restoration plan is approved by the governing agency.

6.0 SYSTEM OPERATING REQUIREMENTS

6.1 Primary Unit Operations

Unit shall be operated within the operating envelope created during site specific test runs, conducted to optimize system performance. Operating conditions such as minimum temperature range, residence time and airflow in primary units and afterburners shall be determined during the test runs .

If conditions warrant (e.g. wide variation in soil type on site), this test shall include separate runs for treatment of coarse and fine soil contaminated with specific petroleum products or coal tar/MGP wastes. For example, if treating diesel contamination, two runs would be required: one with coarse soil and one with fine soil. If any adverse feed soil conditions as listed in Section 3.0 (e.g. high TPHC, high plasticity, humus) exist, soils exhibiting these conditions shall be treated during an appropriate number of test runs. The maximum soil processing rate shall be based on amount of contaminant treated per unit time (contaminant concentration **x** soil feed rate) as demonstrated during the test.

Soil test runs at each new site are generally expected, unless a previous site with similar soil characteristics and contaminant levels has been successfully remediated. See Section 7.1 for stack testing requirements.

6.2 Air Emission Control Unit Operations

An afterburner or equally effective air pollution control device is required in order to insure adequate hydrocarbon control. To insure adequate particulate control, a baghouse or equally effective air pollution control device is required. Operating conditions (temperature and duration) will be determined during the test run, subject to individual state approval.

6.3 Monitoring Parameters

The following parameters shall be monitored and recorded during operation of the unit:

1. exit soil temperature
2. baghouse pressure drop
3. soil processing rate
4. afterburner temperature (if applicable)
5. exit air temperature from the desorption chamber

6.4 Automatic Shutdown Provisions

The following shall trigger automatic shutdown of contaminated soil feed:

	Conditions	Shutdown
1.	Primary burner failure	Instantaneous shutdown
2.	Outlet soil temperature below set point which is based on type and amount of contamination, soil type, and test run.	10 minute delay
3.	Afterburner temperature (if applicable) below set point used in test run.	30 second to 2 minute delay
4.	Blower failure or positive pressure at the desorber.	Instantaneous shutdown
5.	Bag house pressure drop (if applicable) outside the operating envelope determined during test run.	Instantaneous shutdown

6.5 Fugitive Emissions Control

Fugitive emissions control is required. Fugitive emissions control shall be accomplished by maintaining negative pressure in equipment designed to operate at negative pressure. Controls to

limit fugitive dust emissions at the treated soil outlet shall be in place. Treated soil shall be moisturized within the enclosed soil discharge conveyor to minimize dust generation.

7.0 AIR EMISSIONS MONITORING REQUIREMENTS

From a state's point of view, air emissions levels are a major factor in determining whether a process can be permitted. This section will focus on emission monitoring requirements, frequency of monitoring and parameters. Air emissions criteria are not addressed because these are determined by individual states.

7.1 Emission Monitoring - Stack Testing

Stack testing is required for a new unit or if new equipment is added to a previously tested unit;

it is not needed each time an approved unit is set up and operated in a manner which is shown to be similar to previous test runs. Stack testing is required each time a new type of soil contamination is being treated.

Initial stack testing parameters shall include:

total hydrocarbons

particulates

carbon monoxide (CO)

oxygen

sulfur oxides (SOx) - if box waste is treated

PAH's as sampled with EPA Modified Method 5 (coal tar only)

applicable metals

Sites with soils having elevated background or metals from other sources shall undergo risk screening for metals emission. In this case, samples representing the highest concentration of metals shall be collected from the site for the screening.

7.2 Emission Monitoring - Continuous Emission Monitors (CEM)

CEM's shall include oxygen and carbon monoxide (CO).

7.3 Sampling and Analytical Methods

EPA methodologies shall be as specified in 40 CFR Part 60, Appendix B.

7.4 Sample QA/QC

All QA/QC required by the analytical method shall be completed. Lab QA/QC summary documentation (including chain of custody and summary of any deviation from the QA/QC specified by the method) shall be submitted with analytical results. Ultimate responsibility for QA/QC documentation belongs with the responsible party. However, the responsible party may contract with another entity, such as an analytical laboratory, to house the actual QA/QC data.

8.0 WATER DISCHARGE REQUIREMENTS

The operation of some treatment equipment may generate various types of water. Possible sources of water generation include, condensate from the treatment system, storm water runoff, non-contact cooling water, soil stockpile leachate. All such water shall be collected; such water shall be treated, recycled or discharged in accordance with applicable regulations. If process water is used to re-moisturize soil, treatment verification sampling shall occur after re-moisturization. Any excess water which is generated shall be disposed in accordance with individual state requirements. In general, water can be disposed at a permitted off-site commercial facility, a publicly owned treatment works (POTW) or on-site in accordance with a National Pollution Discharge Elimination System (NPDES) permit.

9.0 OPERATIONS RECORD KEEPING

The following records shall be maintained on site or at other approved location:

Summary of soil treatment verification sample results

Operating logs, including

CEM records or logs

Shutdown events included in Section 6.4

Monitoring parameters included in Section 6.3

Documentation on the retreatment or disposal of failed batches

10.0 GENERAL QA/QC

An independent certified laboratory is required for all analytical testing for environmental media including air, soil and water. An in-house certified laboratory may be used if at least 10% of the samples are verified by an independent certified laboratory. These provisions apply to both mobile and fixed laboratories.

11.0 HEALTH AND SAFETY

A written Health and Safety Plan shall be developed and implemented in accordance with Occupation Safety and Health Administration (OSHA) regulations 20 CFR 1910.120, the Hazardous Waste Operations and Emergency Response Rule. The plan shall address the following elements:

Key Personnel Air Monitoring

Health and Safety Risks Site Control

Training Decontamination

Protective Equipment Emergency Response

Medical Surveillance Confined Space Entry

Spill Containment System Operation Safety

System Maintenance Safety

12.0 REFERENCES

1. Federal Remediation Technologies Roundtable, March 1995. Guide to Documenting Cost and Performance for Remediation Projects: EPA-542-B-95-002.

2 Participants of the *DOIT Tribal and Public Forum on Technology and Public Acceptance,* May 1995. A Guide to Tribal and Community Involvement in Innovative Technology Assessment.

3 U.S. Environmental Protection Agency, November 1993. Innovative Site Remediation Technology, Thermal Desorption, Volume 6: EPA 542-B-93-001.

4. U.S. Environmental Protection Agency, October 1994. How to Evaluate Alternative Clean-up Technologies for Underground Storage Tank Sites (A Guide for Corrective Action Plan Reviewers.): EPA 510-B-94-003.

5. U.S. Environmental Protection Agency, January 27, 1995. Cost and Performance Report, Thermal Desorption at the T H Agriculture and Nutrition Company Superfund Site, Albany, Georgia..

6. Lee, Bal, 1991. Draft Engineering Bulletin: Treatment of Manufactured Gas Plant (MGP) Soils, California Environmental Protection Agency Department of Toxic Substances Control, Alternative Technology Division.

APPENDIX A

Outline of

Cost and Performance Report

for LTTD

OUTLINE of

COST and PERFORMANCE REPORT

for LTTD

1. Executive summary

2. Site information

3. Background

a. Contaminant Location and Geologic Profile

b. Contaminant Characterization

c. Soil/waste characteristics affecting treatment cost or performance

4. Treatment System Description

a. Thermal desorption system description and operation

- Detailed Description

- Automatic Feed-Cutoff Conditions

b. Operating parameters affecting treatment cost or performance

c. Project timeline

5. Treatment System Performance

a. - Cleanup Goals/Standards

b. - Treatment Performance Data

- Test Run Data Summary

- Full-scale Sustained Run Data Summary

c. - Performance Data Assessment

d. - Performance Data Completeness

e. - Performance Data Quality

6. Treatment System Costs

a. - Procurement Process

b. - Cost Data Quality

c. - Treatment Cost Elements

d. - Before Treatment Cost Elements

e. - Post Treatment Cost Element

7. Observations and Lessons Learned

a. Cost Observations and Lessons Learned

b. Performance Observations and Lessons Learned

8. References

9. Appendix

A. Treatability Study Results (if applicable)

- Objectives

- Test Description

- Performance Data

- Lessons Learned

- Full Scale Treatment Activity (soil data)

B. Test Run Data

C. Full Scale Treatment Activity Soil Data

APPENDIX B

Summary of

State Acceptance of

LTTD Work Product

TABLE B-1

Summary of Verbal/Written Indications of State Concurrence

as of May 29, 1996

(a) We agree that the requirements are appropriate and commit to using them to the maximum extent feasible;

(b) We agree that the requirements are appropriate; however, have an organizational, regulatory, policy, or statutory conflict. (Please indicate what the conflict is).

(c) We agree conceptually with the requirements and will use and evaluate them in a test mode; or

(d) We do not believe the requirements are appropriate. (Please indicate the reasons why.)

STATE	Total Document "Level A"	Air Quality "Level B" All Others - "Level A"	Mixed for specified sections	Total Document "Level B"	Total Document "Level C"	Nonconcurrence for one or more sections "Level D"	Status of concurrence process
AZ			X	X			**Letter Submitted**
CA		X		X			**Letters Submitted**
CO	X		X				**Letter Submitted**

DE							Just starting
FL		X		X			**Letter Submitted**
ID							
IL			X	X			**Letter Submitted**
KS							Just starting
KY			X		X		**Letter Submitted**
LA		X		X			**Letter Submitted**
MA				X			Near completion
NE							In mid-process
NJ			X	X			**Letter Submitted**
NM							In mid-process
NV							
NY			X			X	**Letter Submitted**
OH							
OR					X		In mid-process

PA			X	X		X	**Letter Submitted**
SD							
TN							Just starting
TX							In mid-process
UT (UST)	X						**Letter Submitted**
UT (AIR)			X	X			**Letter Submitted**
WA							Just starting
WI							

Related Links:

- For Further Information on a Variety of Thermal Treatment Technologies click here for an EPA Summary Report of Demonstrations.