

\*\*\*\*\*  
USACE / NAVFAC / AFCEC / NASA UFGS-02 53 16 (February 2010)  
-----  
Preparing Activity: USACE Superseding  
UFGS-02 53 16 (October 2007)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2019

\*\*\*\*\*

### SECTION TABLE OF CONTENTS

#### DIVISION 02 - EXISTING CONDITIONS

#### SECTION 02 53 16

#### REMEDIATION OF CONTAMINATED SOILS BY THERMAL DESORPTION

02/10

#### PART 1 GENERAL

- 1.1 UNIT PRICE
- 1.2 REFERENCES
- 1.3 SYSTEM DESCRIPTION
  - 1.3.1 Design Requirements
    - 1.3.1.1 Primary Desorption Chamber
    - 1.3.1.2 Air Pollution Control System Requirements
  - 1.3.2 Performance Requirements
    - 1.3.2.1 Treatment Criteria
    - 1.3.2.2 Emission Criteria
    - 1.3.2.3 Slagging Control
- 1.4 SITE SPECIFIC TREATABILITY STUDIES
- 1.5 SEQUENCING AND SCHEDULING
- 1.6 INSTRUMENTATION AND CONTROLS
  - 1.6.1 Control Room
  - 1.6.2 Redundancies
  - 1.6.3 Displays and Data
  - 1.6.4 Stack Emissions Monitoring and Sampling
  - 1.6.5 Sampling
  - 1.6.6 Interlocks and Alarms
    - 1.6.6.1 Visible Alarms
    - 1.6.6.2 Audible Alarms
    - 1.6.6.3 Remote Alarms
  - 1.6.7 Electrical Work
- 1.7 CONTAMINATED MATERIAL FEED SYSTEM
  - 1.7.1 Support Equipment
  - 1.7.2 Capacity
  - 1.7.3 Metering
  - 1.7.4 Rehydration
- 1.8 AIR SUPPLY AND POLLUTION CONTROL SYSTEMS
  - 1.8.1 Air Supply
  - 1.8.2 Induced Draft (ID) Fan
  - 1.8.3 Fugitive Emissions Control
  - 1.8.4 Quench
  - 1.8.5 Stack Emissions Control

- 1.8.6 Water and Liquid Waste
- 1.9 PROCESS RESIDUALS
  - 1.9.1 Liquid Wastes
  - 1.9.2 Solids
- 1.10 AUXILIARY FUEL SYSTEM
  - 1.10.1 Feed Capability
  - 1.10.2 Secondary Containment
- 1.11 OTHER SUBMITTAL REQUIREMENTS
- 1.12 SUBMITTALS
- 1.13 QUALITY ASSURANCE
  - 1.13.1 Ambient Air Emissions and Noise Control
  - 1.13.2 Hazardous Materials
  - 1.13.3 Proof of Performance
  - 1.13.4 Installation
  - 1.13.5 Detail Drawings
- 1.14 SITE CONDITIONS

## PART 2 PRODUCTS

- 2.1 EQUIPMENT, MATERIALS AND STORAGE
  - 2.1.1 Capacity
  - 2.1.2 Segregation of Materials
  - 2.1.3 Instrumentation, Sensors, Recorders, and Sampling
- 2.2 Conveyors

## PART 3 EXECUTION

- 3.1 LAYOUT
  - 3.1.1 Equipment
  - 3.1.2 Stockpiles
  - 3.1.3 Fuel System
- 3.2 INSTALLATION/ERECTION/REMOVAL
- 3.3 SAMPLING, MONITORING AND INSPECTIONS
  - 3.3.1 Minimum Sampling
  - 3.3.2 Stack Sampling
  - 3.3.3 Visual Inspections
  - 3.3.4 Interlocks, Automatic Cut-Offs and Alarms
- 3.4 LOGS
- 3.5 STARTUP
  - 3.5.1 Startup Plan
  - 3.5.2 Systems Demonstration
  - 3.5.3 Instrumentation Calibration
  - 3.5.4 Control Interlock Demonstration
  - 3.5.5 24 Hour Operation
  - 3.5.6 Reporting
- 3.6 PROOF OF PERFORMANCE PLAN
  - 3.6.1 Schedule
  - 3.6.2 Source of Material
  - 3.6.3 Operating Conditions
  - 3.6.4 Field Proof of Performance Report
    - 3.6.4.1 Quantitative Analysis of the Materials
    - 3.6.4.2 Quantitative Analysis of the Stack Gases
    - 3.6.4.3 Material and Energy Balances
    - 3.6.4.4 Fugitive Emissions
    - 3.6.4.5 Continuous Measurement and Recording
    - 3.6.4.6 Other Requirements
- 3.7 UTILITIES
  - 3.7.1 Electricity
  - 3.7.2 Water

3.7.3 Natural Gas  
3.8 DEMOBILIZATION PLAN

-- End of Section Table of Contents --

\*\*\*\*\*  
USACE / NAVFAC / AFCEC / NASA UFGS-02 53 16 (February 2010)  
-----  
Preparing Activity: USACE Superseding  
UFGS-02 53 16 (October 2007)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2019

\*\*\*\*\*

### SECTION 02 53 16

#### REMEDICATION OF CONTAMINATED SOILS BY THERMAL DESORPTION 02/10

\*\*\*\*\*

NOTE: This guide specification covers the requirements for onsite thermal desorption of non-radioactive materials contaminated by hazardous or toxic organic wastes and by petroleum, oil, or lubricants (POL).

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

\*\*\*\*\*

#### PART 1 GENERAL

##### 1.1 UNIT PRICE

\*\*\*\*\*

NOTE: The unit price for thermal desorption should be based on in-situ volume. For liquids and sludges the unit of measure should be mass. Materials requiring retreatment should be segregated from treated materials.

\*\*\*\*\*

The amount of material to be treated shall be verified by [in-place measurement] [mass]. The quantity of materials requiring retreatment shall be reported and subtracted from the daily production when calculating treatment costs.

## 1.2 REFERENCES

\*\*\*\*\*

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

\*\*\*\*\*

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

### AMERICAN WELDING SOCIETY (AWS)

AWS B2.1/B2.1M (2014; Errata 2015) Specification for Welding Procedure and Performance Qualification

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

### ASME INTERNATIONAL (ASME)

ASME B40.100 (2013) Pressure Gauges and Gauge Attachments

ASME BPVC SEC IX (2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

ASME PTC 19.3 TW (2016) Thermowells Performance Test Codes

### ASTM INTERNATIONAL (ASTM)

ASTM E122 (2017) Standard Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

ASTM E953/E953M (2016) Standard Practice for Fusibility of Refuse-Derived Fuel (RDF) Ash

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ISA MC96.1 (1982) Temperature Measurement  
Thermocouples

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (2019) Standard for Chimneys, Fireplaces,  
Vents, and Solid Fuel-Burning Appliances

NFPA 30 (2018) Flammable and Combustible Liquids  
Code

NFPA 31 (2016) Standard for the Installation of  
Oil-Burning Equipment

NFPA 54 (2018) National Fuel Gas Code

NFPA 58 (2017; ERTA 17-1) Liquefied Petroleum Gas  
Code

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;  
TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6;  
TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;  
TIA 17-11; TIA 17-12; TIA 17-13; TIA  
17-14; TIA 17-15; TIA 17-16; TIA 17-17 )  
National Electrical Code

NFPA 82 (2019) Standard on Incinerators and Waste  
and Linen Handling Systems and Equipment

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 250 (1991) Calibration Services Users Guide

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 450/4-80/023R (1985) Guideline for Determination of Good  
Engineering Practice Stack Height  
(Technical Support Document for the Stack  
Height Regulations)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 264 Standards for Owners and Operators of  
Hazardous Waste Treatment, Storage, and  
Disposal Facilities

1.3 SYSTEM DESCRIPTION

The thermal desorption system shall be provided and operated by the Contractor to transfer organic compounds from contaminated materials to a gaseous stream drawn through the system. The system shall consist of a process or series of processes designed to remove organic contaminants from the contaminated materials by heating the soil or sludge matrix. Removal/treatment of organic vapors shall be completed in one or more air pollution control systems.

### 1.3.1 Design Requirements

\*\*\*\*\*  
**NOTE: The first option is preferred. It is more difficult to enforce schedule constraints with the second option.**  
\*\*\*\*\*

The capacity of the system shall be [consistent with the remedial action schedule] [a minimum of [\_\_\_\_\_] kg/hour tons/hour]. Modifications to the system shall be the Contractor's responsibility; however, no modifications shall be performed without the Contracting Officer's approval.

#### 1.3.1.1 Primary Desorption Chamber

\*\*\*\*\*  
**NOTE: This paragraph is applicable to rotary kiln technology only. If batch processes are used, remove this paragraph.**  
\*\*\*\*\*

The primary desorption chamber volatilizes the compounds of concern. The primary chamber shall be [directly fired with the primary chamber operated at a pressure lower than atmospheric.] [indirectly fired.] [An inert carrier gas shall be recycled through the desorber and stack emissions treatment system.]

#### 1.3.1.2 Air Pollution Control System Requirements

\*\*\*\*\*  
**NOTE: If site materials contain PCBs, consider eliminating the use of an afterburner to alleviate permitting problems during construction.**  
\*\*\*\*\*

The air pollution control system shall contain [an afterburner. The temperature of the afterburner shall be greater than the temperature of the primary chamber] [a quench followed by an adsorption type treatment system] [a condenser followed by an adsorption type treatment system] [\_\_\_\_].

### 1.3.2 Performance Requirements

#### 1.3.2.1 Treatment Criteria

Maximum contaminant concentrations allowed in thermally treated materials shall be as follows:

ORGANIC CONTAMINANT	TREATMENT CRITERIA (mg/kg)
[Trichloroethylene]	[10]
[_____]	[_____]

Materials that do not meet the treatment criteria shall be retreated until the treatment criteria are met.

#### 1.3.2.2 Emission Criteria

\*\*\*\*\*

**NOTE: Current federal regulations are not directly applicable to thermal desorption. The designer should perform an air pathway analysis per ETL 1110-1-174 and obtain the State or air quality regional requirements. Include mass or concentration limits, as appropriate.**

\*\*\*\*\*

The system shall be designed to prevent exceeding ambient air quality standards as established by the State, and to minimize health risks associated with thermal desorption system emissions, as shown in TABLE 1.

TABLE 1 EXHAUST GAS CRITERIA		
COMPONENT	FEDERAL	STATE
Organic removal efficiency (minimum percent)	[_____]	[_____]
Total hydrocarbons	[_____]	[_____]
O <sub>2</sub> (minimum)	[_____]	[_____]
CO	[_____]	[_____]
HCl	[_____]	[_____]
Metals	[_____]	[_____]
Particulates	[_____]	[_____]

#### 1.3.2.3 Slagging Control

\*\*\*\*\*

**NOTE: The treatability study should determine the ash fusion temperature of the feed materials in accordance with ASTM E953/E953M.**

\*\*\*\*\*

Slagging shall be minimized by operating at [\_\_\_\_\_] degrees C degrees F less than the ash fusion temperature of the feed materials, as determined by ASTM E953/E953M.

#### 1.4 SITE SPECIFIC TREATABILITY STUDIES

\*\*\*\*\*

**NOTE: Coordinate list of applicable treatability studies. Treatability studies performed on the site materials should be documented in this paragraph or furnished as an attachment to this section of the specifications. Summarize the results in this paragraph.**

\*\*\*\*\*

[\_\_\_\_\_]



## 1.5 SEQUENCING AND SCHEDULING

\*\*\*\*\*  
**NOTE: Verify that objectives have been identified  
in PART 3.**  
\*\*\*\*\*

Documentation of successful accomplishment of the objectives of each phase of operation is required prior to approval to begin the next phase of operations. Mobilization shall include transportation of the equipment to the site, equipment erection and installation, but not operation. Mobilization shall not commence until approval of the mobilization plan is received from the Contracting Officer.

## 1.6 INSTRUMENTATION AND CONTROLS

Continuous emission monitors shall be in accordance with the appropriate Performance Specifications and EPA 450/4-80/023R. Systems shall be adequately protected from damage from onsite activity.

### 1.6.1 Control Room

\*\*\*\*\*  
**NOTE: The designer should consult the military  
installation regarding the usage of radio  
communications. Closed circuit TV requirements  
should be deleted if specified in Section 28 10 05  
ELETRONIC SECURITY SYSTEMS (ESS).**  
\*\*\*\*\*

A fully enclosed control room provided with system controls, instrument readouts, and data recording devices shall be maintained. The control room shall be heated and air conditioned, permitting year round occupancy, and shall meet instrumentation and control equipment manufacturer's operating specifications. If the control room is located in the exclusion zone, provision shall be made for personnel using protective clothing and equipment. If the control room is located in the support zone, a [hard wired] [or radio] intercommunication system with two communication channels between the control room and thermal desorption system operating area shall be provided to allow control room operators to communicate with system operators. Closed circuit television monitoring of operations shall be provided in the control room.

### 1.6.2 Redundancies

Fully redundant backup capability within each subsystem to safely terminate system operations at the control room and at the thermal desorption system shall be provided. Duplexing or redundancies within the instrumentation and control systems shall be adequate to provide uninterrupted continuous monitoring of the emissions and to demonstrate operation in accordance with the approved operating conditions.

### 1.6.3 Displays and Data

Monitored parameters and excursion alarms shall be displayed locally and displayed and recorded in the control room. Process and emissions data shall be maintained in the control room and recorded on magnetic media in the approved microcomputer compatible digital format. Flow information shall include rate monitoring, integration and totalizing. Hard copies of

recorded data and summaries of recorded data shall be maintained in the control room. The copies shall be available upon request.

#### 1.6.4 Stack Emissions Monitoring and Sampling

Continuous monitoring with calibration/verification sampling shall be provided as shown in TABLE 2. Process parameters shall be recorded at intervals not exceeding one minute. Calibration of sensors shall be with standards traceable to NIST and in conformance with NIST SP 250.

TABLE 2 STACK EMISSIONS MONITORING AND SAMPLING SCHEDULE		
Operating Period	Parameter	Frequency
[Proof of Performance]	Oxygen	[continuous] [_____]
[interim operations]		[_____] [not required]
[operations]		[_____] [not required]
[Proof of Performance]	Carbon Monoxide	[continuous] [_____]
[interim operations]		[_____] [not required]
[operations]		[_____] [not required]
[Proof of Performance]	Carbon Dioxide	[continuous] [_____]
[interim operations]		[_____] [not required]
[operations]		[_____] [not required]
[Proof of Performance]	Total Hydrocarbon (HC)	[continuous] [_____]
[interim operations]		[_____] [not required]
[operation]		[_____] [not required]
[Proof of Performance]	Principal Organic	[in accordance with Proof of Performance Plan] [_____]
[interim operations]		[_____] [not required]
[operation]		[_____] [not required]

TABLE 2 STACK EMISSIONS MONITORING AND SAMPLING SCHEDULE		
Operating Period	Parameter	Frequency
[Proof of Performance]	[Products of Incomplete Combustion (PICs)]	[in accordance with Proof of Performance Plan] [_____]
[interim operations]		[_____] [not required]
[operation]		[_____] [not required]
[Proof of Performance]	Opacity	[weekly] [daily] [_____]
[interim operations]		[_____] [not required]
[operation]		[_____] [not required]
[Proof of Performance]	Particulates	[in accordance with Proof of Performance Plan] [_____]
[interim operations]		[_____] [not required]
[operations]		[_____] [not required]
[Proof of Performance]	Metals	[in accordance with Proof of Performance Plan] [_____]
[interim operations]		[_____] [not required]
[operations]		[_____] [not required]

#### 1.6.5 Sampling

Stack sampling port and equipment for collecting discrete and composite samples shall be provided with adequate access for personnel and equipment.

#### 1.6.6 Interlocks and Alarms

##### 1.6.6.1 Visible Alarms

Visible alarms shall consist of lights on the main control panel, flashing symbols on the screen of the microprocessor controller in the control room and, for each interlock that stops the contaminated material feed system, lights at the equipment location.

##### 1.6.6.2 Audible Alarms

Audible alarm activation shall be provided for each interlock that stops the feed to the thermal processing unit.

#### 1.6.6.3 Remote Alarms

\*\*\*\*\*  
NOTE: In cases in which remote alarms are not required, this paragraph should be deleted. In cases in which it will be desirable to have immediate notification of off-site persons this paragraph should be included. Persons to be called and the order of calling should be specified. The Contracting Officer or a designated representative should always be included in the calling sequence.  
\*\*\*\*\*

Auto dialing to the indicated remote locations shall be provided for each interlock that stops the contaminated material feed to the thermal processing unit. The calling sequence is [\_\_\_\_], [\_\_\_\_] then [\_\_\_\_] in priority order.

#### 1.6.7 Electrical Work

All electrical work, wiring, and controls shall conform to the applicable requirements of NFPA 70.

### 1.7 CONTAMINATED MATERIAL FEED SYSTEM

#### 1.7.1 Support Equipment

\*\*\*\*\*  
NOTE: Address rocks, construction debris, trees, stumps, drums, barrels, etc. and oversize materials. Oversize materials are any materials too large to be compatible with the thermal desorber. Materials may be required to be shredded and treated or separated from the feed material, decontaminated and disposed on or offsite. Maximum allowable sizes to be treated in the thermal desorber should be specified.  
\*\*\*\*\*

Material handling and contaminated material feed systems provided shall be capable of [shredding], [conveying], [pumping], [and] [screw feeding] of contaminated materials, separately or in combination, to the primary chamber. Pre-treatment shall include crushing or grinding and screening as required to produce material no larger than [\_\_\_\_] mm inch in diameter and which is otherwise compatible with the thermal desorber.

#### 1.7.2 Capacity

Capacity of the contaminated material feed system shall be consistent with the capacity of the thermal desorption system.

#### 1.7.3 Metering

The contaminated material feed system shall be capable of weighing the contaminated materials (liquid and solid) introduced into the thermal desorption system with an accuracy of plus or minus [2] [2.5] [5] percent of actual weight.

#### 1.7.4 Rehydration

\*\*\*\*\*  
**NOTE: Final moisture content may be specified here,  
if appropriate.**  
\*\*\*\*\*

Treated material handling systems shall include provisions for rehydration, prior to storage, of material leaving the thermal desorption system in order to reduce the fugitive emissions and to confine the materials to the proper storage area.  
Text

#### 1.8 AIR SUPPLY AND POLLUTION CONTROL SYSTEMS

##### 1.8.1 Air Supply

A forced draft (FD) blower/fan or fans shall be used to provide combustion air for the burners.

##### 1.8.2 Induced Draft (ID) Fan

The induced draft (ID) blower/fan or fans shall be used to maintain negative pressure throughout the system.

##### 1.8.3 Fugitive Emissions Control

\*\*\*\*\*  
**NOTE: Select the second option for indirectly fired  
units.**  
\*\*\*\*\*

[Emissions from the combustion zone shall be controlled by keeping the combustion zone sealed and maintaining a combustion zone pressure lower than atmospheric pressure.] [ Means that have been demonstrated to provide fugitive emissions control shall be implemented with the approval of the Contracting Officer.]

##### 1.8.4 Quench

Off-gases from the primary soil treatment zone shall be cooled to temperatures protective of downstream units and equipment.

##### 1.8.5 Stack Emissions Control

\*\*\*\*\*  
**NOTE: Indicate design wind force the stack will  
have to withstand. Structural design should also  
include seismic resistance in accordance with UFC  
3-310-04, when appropriate.**  
\*\*\*\*\*

The air pollution control system shall be capable of controlling gaseous, solid and aerosol type emissions to meet the performance requirements. Stack support shall be in accordance with NFPA 82 and NFPA 211, as applicable. Vertical and lateral supports for exterior chimneys shall withstand wind forces of [\_\_\_\_\_] km/hour mph.

#### 1.8.6 Water and Liquid Waste

The air pollution control system shall be designed to minimize water consumption and liquid waste generation. Liquids in the air pollution control system shall be recirculated to the maximum extent practicable prior to wasting to the liquid waste system.

#### 1.9 PROCESS RESIDUALS

\*\*\*\*\*  
**NOTE: Verify that all process residual streams are covered.**  
\*\*\*\*\*

##### 1.9.1 Liquid Wastes

Residual liquid wastes from the air pollution control system and liquids collected from the [air pollution control system] [stockpile] [\_\_\_\_\_] shall be sampled, treated and disposed of in accordance with regulatory and contract requirements.

##### 1.9.2 Solids

Residual solid materials from the [air pollution control system] [liquid waste treatment system] [\_\_\_\_\_] shall be sampled, treated, and disposed of in accordance with regulatory and contract requirements.

#### 1.10 AUXILIARY FUEL SYSTEM

##### 1.10.1 Feed Capability

The auxiliary fuel system shall have direct feed capability to the thermal destruction system. Meters, pressure gages and controls shall be provided to maintain proper operating conditions. Design shall be in conformance with the applicable requirements of NFPA 30 and NFPA 31, NFPA 54 or NFPA 58, as appropriate to the fuel type.

##### 1.10.2 Secondary Containment

Auxiliary fuel storage tanks shall be provided with secondary containment as required by paragraph 2-3.4 Control of Spillage from Aboveground Tanks of NFPA 30.

#### 1.11 OTHER SUBMITTAL REQUIREMENTS

The following shall be submitted:

- a. Flow diagram for process equipment associated with the thermal desorption system and data, including but not limited to: contaminated material stream flows; direction of material flow, including range of flow rate and range of composition, identified by lines and arrows denoting the direction and destination of the flow; material, mass and energy balances for the entire thermal desorption system. Piping and instrumentation diagram indicating: process equipment; instrumentation; piping and valves; stacks, vents and dampers; control equipment (including sensors, process controllers, control operators, valves, interlocks, alarms, and contaminated material feed cut-off systems); labels and other necessary information to correlate to the process flow diagram.

- b. System schedule including dates and durations for system mobilization, start-up, proof of performance, interim operation, production burn, and demobilization prior to beginning site activities.
- c. Specific procedures and requirements for onsite placement of the thermal desorption system and its subsystems.
- d. Plan identifying instruments requiring calibration and describing the required calibration procedure and tolerances.
- e. List of the proposed operating conditions for process parameters to be continuously monitored and recorded. Detailed descriptions of the proof of performance schedule, operating conditions and parameters, material sources, and required sampling and analyses shall be included.
- f. Specific detailed procedures for continued operation of the system, based on the proof of performance results; adjustments for variation in the contaminated material feed shall be included. Schedule of inspection and maintenance procedures and activities shall be included.
- g. Demobilization plan detailing specific procedures to be used for decontamination of system components, test methods for verification of decontamination, and the schedule for equipment decontamination and removal from the site.
- h. Information on function, design capacity, and expected operational capacity for the following equipment in the thermal desorption system: feed preparation equipment, feed/treated materials conveying equipment, thermal treatment equipment (primary chamber, blowers, air pollution control equipment). Equipment specifications identifying manufacturer and model number, materials of construction, interior and exterior dimensions, design limitations, and normal operating conditions. Operating capacity and operating conditions for subsystem equipment; pumps, valves and other in-line devices; sizes of conveying and/or feeding devices; size and number of parallel components or lines.
- i. Detailed manufacturer's data on the overall controls, sequence of control, description of components, wiring diagrams, logic diagrams, control panel layouts, legends and standard symbols, sensors, process controllers, control operators, valves, alarms, interlocks and contaminated material feed cut-off systems. Data describing in detail the equipment used to monitor stack emissions, including the stack sampling probe, filters, gas transport tubing, sampling pump, moisture removal system, analyzer's calibration system, and data recorder.
- j. An analysis demonstrating that the amount of noise generated at a distance of 30 meters 100 feet for the following octave band frequencies: 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 hertz will not exceed the approved noise levels.
- k. Backup and redundancy analysis containing a failure mode analysis and an emergency manual that indicates responses to be taken under the following circumstances: (1) sudden loss of integrity of refractory lining, (2) puffing or sudden occurrence of fugitive emissions, (3) failure of temperature monitoring control mechanism, (4) primary burner and/or air port clogging or failure, (5) electrical power failure (primary or secondary), (6) scrubber water flow or scrubber water makeup flow out of range, (7) excessive solids deposition in the air

pollution control system, (8) loss of quench water, (9) increase in gas temperature after quench zone and (10) demister operation failure.

- l. An operating record as described in this specification. Inspection and maintenance checklists and records of preventive maintenance and repairs.
- m. Instructions for use of software packages necessary to evaluate the operating data from the control system and daily operating data on magnetic media.
- n. Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.
- o. Reports containing the results of startup and proof of performance. The reports shall contain the information necessary for making application for an operating permit.

#### 1.12 SUBMITTALS

\*\*\*\*\*

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. Locate the "S" submittal under the SD number that best describes the submittal item.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed



**item for Army projects.**

\*\*\*\*\*

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Layout; G[, [\_\_\_\_]]  
Thermal Desorption System; G[, [\_\_\_\_]]

SD-03 Product Data

Sequencing and Scheduling; G[, [\_\_\_\_]]  
Mobilization Plan  
Startup Plan; G[, [\_\_\_\_]]  
Proof of Performance; G[, [\_\_\_\_]]  
Operating Plan; G[, [\_\_\_\_]]  
Demobilization Plan  
Utilities  
Equipment; G[, [\_\_\_\_]]  
Instrumentation and Controls; G[, [\_\_\_\_]]  
Ambient Air Emissions and Noise Control  
Redundancies  
Logs  
Control System

SD-06 Test Reports

Logs  
Startup

1.13 QUALITY ASSURANCE

\*\*\*\*\*

**NOTE: The designer should determine State, regional, or local noise abatement requirements. Requirements may vary on 24-hour or weekly cycles.**

\*\*\*\*\*

1.13.1 Ambient Air Emissions and Noise Control

The thermal desorption system shall conform to applicable state, regional, and local regulations regarding ambient air emissions and noise pollution control. A noise analysis predicting the amount of noise generated by the system shall be furnished prior to mobilization. Maximum noise levels approved for site operations shall not be exceeded.

1.13.2 Hazardous Materials

If any process residuals are found to contain hazardous materials, they shall be [transported and disposed of in accordance with Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.] [treated in accordance

with Section 02 55 00 SOLIDIFICATION/STABILIZATION (S/S) OF CONTAMINATED MATERIAL and backfilled on site.]

#### 1.13.3 Proof of Performance

Proof of performance shall be in accordance with the approved Proof of Performance Plan.

#### 1.13.4 Installation

Installation shall be performed with minimal damage to the existing site environment. Welding shall be performed in accordance with AWS D1.1/D1.1M by welders certified to have passed qualification tests using procedures covered in AWS B2.1/B2.1M or ASME BPVC SEC IX. Require any welder to retake the test when, in the opinion of the Contracting Officer, the work creates reasonable doubt as to the welder's proficiency.

#### 1.13.5 Detail Drawings

Submit detail drawings showing dimensions of the equipment, layout of the thermal desorption system and subsystems, including location of components and onsite improvements. Drawings showing dimensions, layout, location of barriers, capacities, and placement of the stockpiles. Drawings shall be to the approved scale.

### 1.14 SITE CONDITIONS

\*\*\*\*\*  
**NOTE: Include site and soil characterization data and reference other sections that contain the data. To utilize SpecsIntact automation, insert Section Reference tags on the section numbers referenced in this paragraph.**  
\*\*\*\*\*

Generalized characteristics and location of the contaminated materials are as indicated on the drawings and described in Sections [\_\_\_\_\_] [\_\_\_\_\_].

## PART 2 PRODUCTS

### 2.1 EQUIPMENT, MATERIALS AND STORAGE

Equipment and storage facilities shall be provided for removing, handling and storing residues resulting from thermal treatment, including treated material and solids captured by the pollution control system.

#### 2.1.1 Capacity

Capacity for treated material and solids captured by the pollution control system removal, handling, and storage systems shall be consistent with the capacity of the thermal desorption system.

#### 2.1.2 Segregation of Materials

\*\*\*\*\*  
**NOTE: Thermal desorption is a separation process. Combining the air pollution control residuals with the treated materials may make the treated material fail backfill requirements for metals leachability.**

Regulations generally allow combining prior to testing.

\*\*\*\*\*

Separate storage for treated material and solids captured by the pollution control system handling systems shall be adequate for segregating a minimum of [72] [\_\_\_\_\_] hours production to allow for results from sampling and analyses prior to additional treatment or disposal.

#### 2.1.3 Instrumentation, Sensors, Recorders, and Sampling

\*\*\*\*\*

NOTE: 40 CFR 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions applies when the contaminated material to be treated contains polychlorinated biphenyls (PCBs) in excess of 50 mg/kg. Emissions monitoring and rates from 40 CFR 264, Subpart O may apply in the absence of state regulations. Contact the appropriate Federal and state regulatory agencies to determine the extent of monitoring required.

\*\*\*\*\*

- a. Instrumentation and equipment including sensors, local indicators, connecting devices, recorders, analyzers and components necessary to monitor and control the safe and efficient operation of the system shall be provided.
- b. Thermometers shall conform to ASME PTC 19.3 TW, with wells and temperature range suitable for the use encountered.
- c. Draft Gauges shall conform to ASME B40.100 with a diaphragm or bellows actuating system and a circular scale. The gauges shall have a zero adjustment screw. Suitable shutoff cocks shall be provided.
- d. Pressure Gauges shall conform to ASME B40.100 and be of pressure detecting class, single Bourdon tube style, and suitable for detecting air pressure.
- e. Sensors shall conform to ISA MC96.1, Type [E] [J] [K] [T], and shall be provided in the combustion chamber or as otherwise directed. The thermocouple shall be suitable for continuous operation and control at temperatures up to [1540] [\_\_\_\_\_] degrees C [2800] [\_\_\_\_\_] degrees F, accurate to 0.75 percent, and shall be long enough to be inserted 150 mm 6 inches into the furnace. The thermocouple shall be provided with an adjustable flange and with a high-temperature metal alloy, closed-end, protecting tube suitable for insertion into the furnace without support of the projecting end. Compensating lead wire 1.52 mm 16 gauge in diameter and 30 m 100 feet long with a weatherproof braid shall be supplied for connecting the thermocouple to the instrument. The installed unit shall indicate gas passage temperatures and shall control burner operation.

#### 2.2 Conveyors

\*\*\*\*\*

NOTE: Make a determination of the maximum contaminated material feed rate which could be

sustained without releasing volatile organic compounds to the air in violation of air quality regulations. This determination should be made using feed rates and contaminant concentrations typical of full scale production. If the potential does not exist for the release of unacceptable amounts of volatile organic chemicals, this paragraph may be deleted. Calculations supporting this determination should be included in the Design Analysis.

\*\*\*\*\*

Contaminated material feed conveyors shall be covered and vented to the air pollution control system.

### PART 3 EXECUTION

#### 3.1 LAYOUT

\*\*\*\*\*

**NOTE: Coordinate the drawings to allow the best access possible to the work area.**

\*\*\*\*\*

Do not increase the size of the process area without approval of the Contracting Officer. Costs associated with any area increase are borne by the Contractor, including costs of construction, demolition and site restoration.

##### 3.1.1 Equipment

Use the area indicated for equipment such as an auxiliary generator; dewatering equipment; pre-treatment equipment such as shredders, screens, etc.; air emission controls and monitoring equipment; contaminated material conveyance, preparation and loading equipment; and fuel tanks.

##### 3.1.2 Stockpiles

\*\*\*\*\*

**NOTE: Complete segregation of stockpiles is recommended for highly contaminated materials.**

\*\*\*\*\*

The area provided for stockpiling shall be used for segregated temporary storage of untreated contaminated materials, treated materials, and solids captured by the pollution control system. Contaminated materials, treated materials and solids captured by the pollution control system shall not be mixed. Facilities for treated materials and solids captured by the pollution control system shall maintain segregation of treated materials and solids captured by the pollution control system until each has been characterized for additional treatment and/or disposal. Stockpiles shall be constructed to include:

- a. A chemical resistant impermeable geomembrane liner with a minimum thickness of 1.0 mm 40 mils. Subgrade preparation; and installation, testing, inspection and protection of the liner shall be in accordance with SECTION 02 56 13 WASTE CONTAINMENT GEOMEMBRANE.
- b. An impermeable geomembrane cover with a minimum thickness of 0.25 mm 10

mils to prevent precipitation from entering the stockpile.

- c. Berms surrounding the stockpile which are a minimum of 0.9 m 1 foot in height.
- d. Slope the liner to a low point to allow leachate to be collected. Handle leachate collected from the stockpile in accordance with paragraph LIQUID WASTES. Leachate collected from the stockpile may be used in the thermal desorption process provided the treated material meets the physical and chemical post-treatment test criteria.

### 3.1.3 Fuel System

Fuel system installation and testing shall comply with the applicable requirements of NFPA 30 and NFPA 31, NFPA 54 or NFPA 58, as appropriate to the type of fuel.

### 3.2 INSTALLATION/ERECTION/REMOVAL

The installation/erection of the thermal desorption system shall be performed to allow removal of the system from the site and site restoration.

### 3.3 SAMPLING, MONITORING AND INSPECTIONS

\*\*\*\*\*

NOTE: Verify that the contract documents cover the sample preservation and analytical method for contaminated and treated materials, stack emissions for parameters required in paragraph Stack Emissions Monitoring and Sampling, and solids captured by the pollution control system. Reference should be made to 40 CFR 266 for the analysis for TCLP metals.

Sampling requirements are project specific. Sampling frequency requirements and composite sampling techniques are negotiated with the regulatory agency.

Typically, treated materials from each day are stockpiled separately. Therefore, testing is normally done on a daily basis with varying composite sampling requirements.

\*\*\*\*\*

Contaminated material feed, treated material and solids captured by the air pollution control system shall be sampled and analyzed as allowed by the permits and as specified. The sampling of treated soils and solids captured by the air pollution control system shall be in accordance with ASTM E122.

#### 3.3.1 Minimum Sampling

Sampling and analyses shall be performed in accordance with the schedule as shown in TABLE 3.

TABLE 3 - MATERIAL SAMPLING FREQUENCY REQUIREMENTS			
COMPONENT	MATERIAL		
	CONTAMINATED	TREATED	SOLIDS CAPTURED BY THE POLLUTION CONTROL SYSTEM
volatile organics	[_____]	[_____]	[_____]
semi-volatile organics	[_____]	[_____]	[_____]
polychlorinated biphenyls (PCBs)	[_____]	[_____]	[_____]
TCLP metals	[NA]	[daily]	[_____]
metals	[NA]	[daily]	[_____]

### 3.3.2 Stack Sampling

Stack samples shall be taken in accordance with State regulation.

### 3.3.3 Visual Inspections

The thermal desorber and associated equipment (pumps, valves, conveyors, pipes, etc.) shall be subjected to thorough visual inspections for leaks, spills, fugitive emissions, and signs of tampering or mechanical failure as indicated in TABLE 4.

TABLE 4 - VISUAL INSPECTION SCHEDULE	
Phase of Operation	Minimum Inspection Frequency
Proof of Performance	[Once per 8-hour shift][Daily]
Interim operations	[Once per 8-hour shift][Daily]
Operations	[Daily][Weekly]

### 3.3.4 Interlocks, Automatic Cut-Offs and Alarms

Interlocks, automatic contaminated material feed cut-off and associated alarms shall be tested at least [weekly] [\_\_\_\_\_].

## 3.4 LOGS

Data from sampling, inspections and tests shall be recorded and the records placed in the operating log. The field log book shall describe calibration procedures conducted and results obtained. Logs shall be maintained

throughout the duration of operations and shall be made available for inspection upon request by the Contracting Officer.

### 3.5 STARTUP

Startup shall include material handling systems demonstration, instrumentation calibration, control interlock demonstration and 24 hour operation. Startup operations shall demonstrate that the system is capable of processing material at the proposed feed rate and that the air pollution control system is capable of attaining the required throughput rates. Perform startup activities using uncontaminated material.

#### 3.5.1 Startup Plan

Submit a startup plan. The plan shall describe control system functions and specific procedures proposed to demonstrate each function and for testing the system with uncontaminated materials; formats and procedures for reporting the material handling demonstration and hot check results; proposed operating procedures for the proof of performance with detailed descriptions of the sampling and analysis to be performed.

#### 3.5.2 Systems Demonstration

Demonstrate the contaminated material preparation and feed systems and the treated material and solids captured by the pollution control system handling systems. The systems demonstration shall not commence until written approval is received from the Contracting Officer. The systems and the treated material and solids captured by the pollution control system handling systems shall operate continuously at the proposed maximum feed rate for 4 hours without a malfunction or shutdown related to the systems. The systems demonstration shall be conducted using uncontaminated material. There shall be no fugitive emissions, or "dusting".

#### 3.5.3 Instrumentation Calibration

Instrumentation calibration shall ensure that compliance-related instrumentation functions will be performed reliably and accurately. Test instruments shall be calibrated by a recognized standards laboratory 30 days prior to testing with standards traceable to NIST SP 250. Instrumentation and control system calibrations will be witnessed by the Contracting Officer.

#### 3.5.4 Control Interlock Demonstration

Following instrumentation calibration, it shall be demonstrated that control system interlocks and alarms are programmed correctly and are fully functional. Each alarm point shall be tested for proper response. Alarms, interlocks, and emergency responses (activation of combustion gas by-pass system or an emergency system shut down) shall be demonstrated. Operating conditions which trigger system alarms may be artificially induced in the field, or the control set points may be altered to invoke the desired response alarm. Appropriate control system responses (including interlocks, alarms, by-pass activation and/or emergency shutdowns) to each of the specified stimuli shall be demonstrated.

#### 3.5.5 24 Hour Operation

The system shall be placed in operation under conditions proposed in the Proof of Performance Plan for 24 hours or the treatment of one batch (if a

batch system) without a malfunction or shutdown related to the contaminated material feed or the treated material and solids captured by the pollution control system handling systems with all continuous emissions monitoring systems functional throughout the 24 hour operations. Shakedown shall begin after the 24 hour prove-out period and may be performed on contaminated materials.

### 3.5.6 Reporting

An interim letter-report will be acceptable with the results formally reported in the startup report.

### 3.6 PROOF OF PERFORMANCE PLAN

\*\*\*\*\*

NOTE: Delete this paragraph when treating POL contaminated soils (non-hazardous waste).

The system should not be approved for operation until acceptable removal and other operating parameters are successfully achieved during the Proof of Performance. Production operating conditions should be established from the Proof of Performance results.

Approved production operating conditions should become contract requirements.

If acceptable removal and other operating parameters are not achieved, production operations should not be approved. Results of the Proof of Performance should be analyzed and the causes of deficiencies evaluated. The Contractor should be required to make physical and operational changes to the thermal desorption system to bring it into compliance with the required operating parameters and removal efficiencies.

If the first attempt at performing a Proof of Performance fails, each subsequent attempt should include a separate Proof of Performance report. Second and third proof of performances, if needed, should be performed at no extra cost to the Government.

Upon completion of a successful Proof of Performance, the thermal desorption system should be approved for production operations contingent on the specified operating conditions established from the successful Proof of Performance test results.

After failure of the third Proof of Performance attempt and/or expiration of 1 calendar year from the initiation of Proof of Performance operations, the Contractor may be considered in default in accordance with the Contract Clauses.

A complete Proof of Performance, regardless of similarities between treatment trains, should be



conducted on each treatment train of multiple secondary treatment trains or air pollution control trains that are used with a single thermal desorption unit. Each train should be tested simultaneously to the maximum practical extent. For multiple treatment trains that will be operated under different operating conditions or different contaminated material feed rates, each proposed set of conditions should be demonstrated during the Proof of Performance.

The designer should ensure that regulators define permitting process and time delays associated with the review and approval process. Interim conditions should be adamantly sought as the permit process could delay construction operations greatly increase cost of project.

An interim operating period should commence within 7 calendar days after receipt of the Proof of Performance test results and the issuance of interim operating conditions. The interim operating period should continue for the total number of calendar days remaining in the period of time allowed for preparation and submittal of the Proof of Performance report and the number of calendar days allowed for review and approval. Loss of potential interim operating time resulting from delays in submittal of an acceptable Proof of Performance report should be the responsibility of the Contractor. The interim operating approval should expire at the end of the period described above and operation should cease until a final production operation approval is issued. Operating conditions during the interim operating period should be determined based upon performance data obtained during Proof of Performance operations. At a minimum, these conditions should include:

- a. Total mass feed should be based on the feed rate demonstrated to meet treated material quality standards during preproduction operations.
- b. Desorber operating conditions should demonstrate the ability to meet treatment standards during preproduction operations.
- c. Air pollution control system operating conditions should be demonstrated during the Proof of Performance to ensure compliance with all emissions standards.
- d. Sampling and analysis requirements of treated materials should be in accordance with the Sampling and Analysis Plan.

\*\*\*\*\*

Submit a Proof of Performance Plan. Conduct proof of performance in accordance with the approved Proof of Performance Plan.

### 3.6.1 Schedule

Written notification of the anticipated date of the full proof of performance shall be received at least 7 days prior to the projected start date. Proof of performance operations may begin upon receipt of written approval of the Proof of Performance Plan and written notification that final shake down activities have been completed and that all systems are ready to conduct a full proof of performance.

### 3.6.2 Source of Material

\*\*\*\*\*

**NOTE: Specify the locations and depths at which samples for the field demonstration will be obtained. Chemical testing should be performed to verify that the materials to be used for the field demonstration contain the contaminants of concern at high enough concentrations to test the process. Additional testing may be warranted to verify that the physical properties of the materials are appropriate for backfilling.**

\*\*\*\*\*

Contaminated material used for the field demonstration shall be obtained from [\_\_\_\_]. Prior to performing the field demonstration, contaminated material to be used for the field demonstration shall be tested to verify it contains the following minimum levels of contamination: [\_\_\_\_].

### 3.6.3 Operating Conditions

All systems shall be operated at the conditions specified in the Proof of Performance Plan for the duration of the proof of performance.

### 3.6.4 Field Proof of Performance Report

The proof of performance report shall include results of the proof of performance, including sample analysis data, calculations, and conclusions within [7] [14] [\_\_\_\_] days of the completion of a proof of performance. At a minimum, data collected during each proof of performance shall be sufficient to make the following determinations:

#### 3.6.4.1 Quantitative Analysis of the Materials

A quantitative analysis of each contaminated feed, treated material, and pollution control system stream for each individual run for each parameter stated in the Proof of Performance Plan. From each feed stream, analysis of composites made from grab samples taken at 15 minute intervals for each individual test run during the proof of performance. The quantitative analysis shall include analyses for any surrogate or spiking compounds.

#### 3.6.4.2 Quantitative Analysis of the Stack Gases

Perform a quantitative analysis of the stack exhaust gases for the concentration and mass emissions of O<sub>2</sub>, [CO<sub>2</sub>,] CO, [HCl,] [NO<sub>x</sub>,] [SO<sub>2</sub>,] [THC,] [metals] and particulates for the proof of performance. Continuously measure and record the stack gas velocity and the concentration of O<sub>2</sub>, [CO<sub>2</sub>,] CO, HCl, [NO<sub>x</sub>,] [SO<sub>2</sub>,] [and] [THC] in the stack exhaust gases.

#### 3.6.4.3 Material and Energy Balances

\*\*\*\*\*  
NOTE: If the contaminated material characterization data showed negligible chloride content, delete the HCl requirement.  
\*\*\*\*\*

A computation of the mass emission rate of particulates, in accordance with 40 CFR 264, Subpart O. If the HCl emission rate exceeds 1.8 kg 4 pounds of HCl per hour, a computation of the HCl removal efficiency in accordance with 40 CFR 264, Subpart O shall be performed.

#### 3.6.4.4 Fugitive Emissions

Identification of sources of fugitive emissions and means of control of the emissions.

#### 3.6.4.5 Continuous Measurement and Recording

Continuous measurement and recording of operating parameters as required in the approved Proof of Performance Plan.

#### 3.6.4.6 Other Requirements

Other monitoring, sampling, and/or analyses required by the approved Proof of Performance Plan. Submit an Operating Plan based on the Proof of Performance results.

### 3.7 UTILITIES

\*\*\*\*\*  
NOTE: The system utilities requirements should be identified in the Contractor's design. The following information may be used as a check: the amount required for a 12,000 - 18,000 kg 15 - 20 ton per hour unit is 5 - 35 L per second 75 - 600 gpm of water, 1200 - 2500 kw of electricity and 30 - 60 cubic meters per minute 1000 - 2000 scfm of natural gas. The Contractor should verify the adequacy of the existing utilities and be responsible for the required agreements with the utility companies for usage and any required changes.

Points of connection are normally shown on the drawings. Occasionally names, addresses, and telephone numbers of the utility companies are shown on the drawings. Delete the following paragraphs if the information is shown elsewhere.

\*\*\*\*\*

Fuel and utilities shall be provided at locations indicated. Verify availability and locations of utilities and compensate the utility company for connection and usage.

#### 3.7.1 Electricity

The power [utility] [company] is [\_\_\_\_], phone number [\_\_\_\_].

### 3.7.2 Water

The water [utility] [company] is [\_\_\_\_], phone number [\_\_\_\_].

### 3.7.3 Natural Gas

The natural gas [utility] [company] is [\_\_\_\_], phone number [\_\_\_\_].

## 3.8 DEMOBILIZATION PLAN

Complete demobilization in accordance with the approved demobilization plan. Begin demobilization after the contaminated materials have been treated to the requirements of this section. Demobilization includes disconnection of utilities, decontamination, disassembly, and removal of thermal desorption system equipment, materials handling equipment, structures, and concrete pads related to the thermal desorption system. Demobilization is complete when the thermal desorption equipment and related equipment have left the site and the equipment and stockpile areas have been restored.

-- End of Section --