SITE INFORMATION

IDENTIFYING INFORMATION:

Site Name: Mound Site

Location: Rocky Flats Environmental Technology Site; Golden, Colorado

CERCLIS ID No.: CO7890010526

Regulatory Context:
Remediation of the Mound Site was authorized by the Proposed Action Memorandum (PAM) for the Source Removal at the Mound Site (IHSS 113) dated February 3, 1997. The Mound Site is designated as Individual Hazardous Substance Site (IHSS) 113. The Mound Site source removal and treatment project was conducted as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) Response Action.

TECHNOLOGY APPLICATION

Period of Operation:
Mobilization, setup, and commissioning of the treatment equipment was conducted from July 17, 1997 to August 4, 1997. Treatment operations were conducted from August 5, 1997 to August 21, 1997.

Quantity of Material Treated during Application:
724.5 cubic yards of contaminated soil were treated as determined by the number of batches of soil processed in the thermal desorption unit. The volume of the batch desorber was determined using the dimensions of the oven "trays" in which the soil was placed together with the number of batches treated.

BACKGROUND

Waste Management Practice That Contributed to Contamination:
Burial of approximately 1,400 drums of waste. All of the drums were removed in 1970. At the time of removal, approximately ten percent of the drums exhibited holes or breaches resulting from corrosion.

Site History:
The U.S. Department of Energy (DOE) used the Rocky Flats Site to fabricate components for nuclear weapons from 1951 to 1989. Hazardous mixed wastes generated from the associated machining operations were disposed at various locations at the site, including the Mound Site. Approximately 1,400 drums containing hazardous mixed waste were placed at the Mound Site between April 1954 and September 1958. These drums were covered with soil thus generating a "mound". The wastes contained in the drums originated from manufacturing operations in Buildings 444, 883, 771, and 776 at Rocky Flats Environmental Technology Site (RFETS). The drums were reported to contain uranium, beryllium, hydraulic oil, carbon tetrachloride and tetrachloroethylene (PCE). Over time, contamination leaked from these drums into the surrounding soils and groundwater.

Remedy Selection:
Low-temperature thermal desorption technology was selected to remove the volatile organic compound (VOC) contamination from soils excavated from the Mound Site. Thermal desorption technology was selected because of its demonstrated performance in removing VOCs from soil and sludge media. A batch process design was selected based on the relatively small volume of soil to be treated (less than 5,000 cubic yards) as well as the desire to minimize size reduction activities (i.e., feed preparation) because of the presence of radionuclide contamination.

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MATRIX DESCRIPTION

MATRIX IDENTIFICATION

Type of Matrix Processed Through Technology System:
Soil with cobbles and rocks

CONTAMINANT CHARACTERIZATION

Primary Contaminant Groups and Concentrations Measured During Site Investigation:
Figure 1 shows the location of the Mound Site at RFETS. Remedial investigation efforts indicated the presence of chlorinated organic and radionuclide contamination in Mound Site soils and groundwater. The locations of groundwater wells and soil borings at the Mound Site are shown on Figure 2. Chlorinated organic contaminants detected included PCE, trichloroethene (TCE), carbon tetrachloride, and methylene chloride. Radionuclides detected included uranium (U), plutonium (Pu), and americium (Am).

Groundwater Contamination
Groundwater samples from upgradient and downgradient monitoring wells are summarized in Tables 1a and 1b, respectively. These data show an increase in TCE and PCE concentrations in the groundwater passing through the Mound Site indicating that the site is a source of groundwater contamination. Groundwater contamination was addressed as a separate remediation project in 1998.

TABLE 1a*
Mound Site Upgradient Groundwater Sampling Results (mg/L)

Contaminant	Well 4386	Well 2387	Well 01791	Well 01891	Well 12091
PCE	0.0003	0.074	0.016	0.002	0.00059
TCE	<0.005	<0.005	0.001	<0.0002	0.0003

TABLE 1b*
Mound Site Downgradient Groundwater Sampling Results (mg/L)

Contaminant	Well 0174	Well 02191	Well 02291	Well 1987	Well 2087
PCE	528	0.98	3.4	0.88	0.091 J
TCE	18	0.067	0.41	0.07	0.005

J – estimated value
* Some of these well locations are not shown on Figure 2. Wells 4386, 2387, 01891, and 12091 are located to the South and West of IHSS 108 (Trench T-1).

Soil Contamination
Thirty-three samples of Mound Site soils were collected and analyzed for radionuclide content. The need for remedial action with respect to radionuclide contamination was assessed using the Sum-of-the-Ratios method to evaluate the total potential dose from all radionuclides present. In all cases, the Sum-of-the-Ratios was well below 1.0. As an example, calculation of the Sum-of-the-Ratios for the soil sample with the highest activities of radionuclides is summarized in Table 2.

Figure 1. Location of Mound Site at RFETS

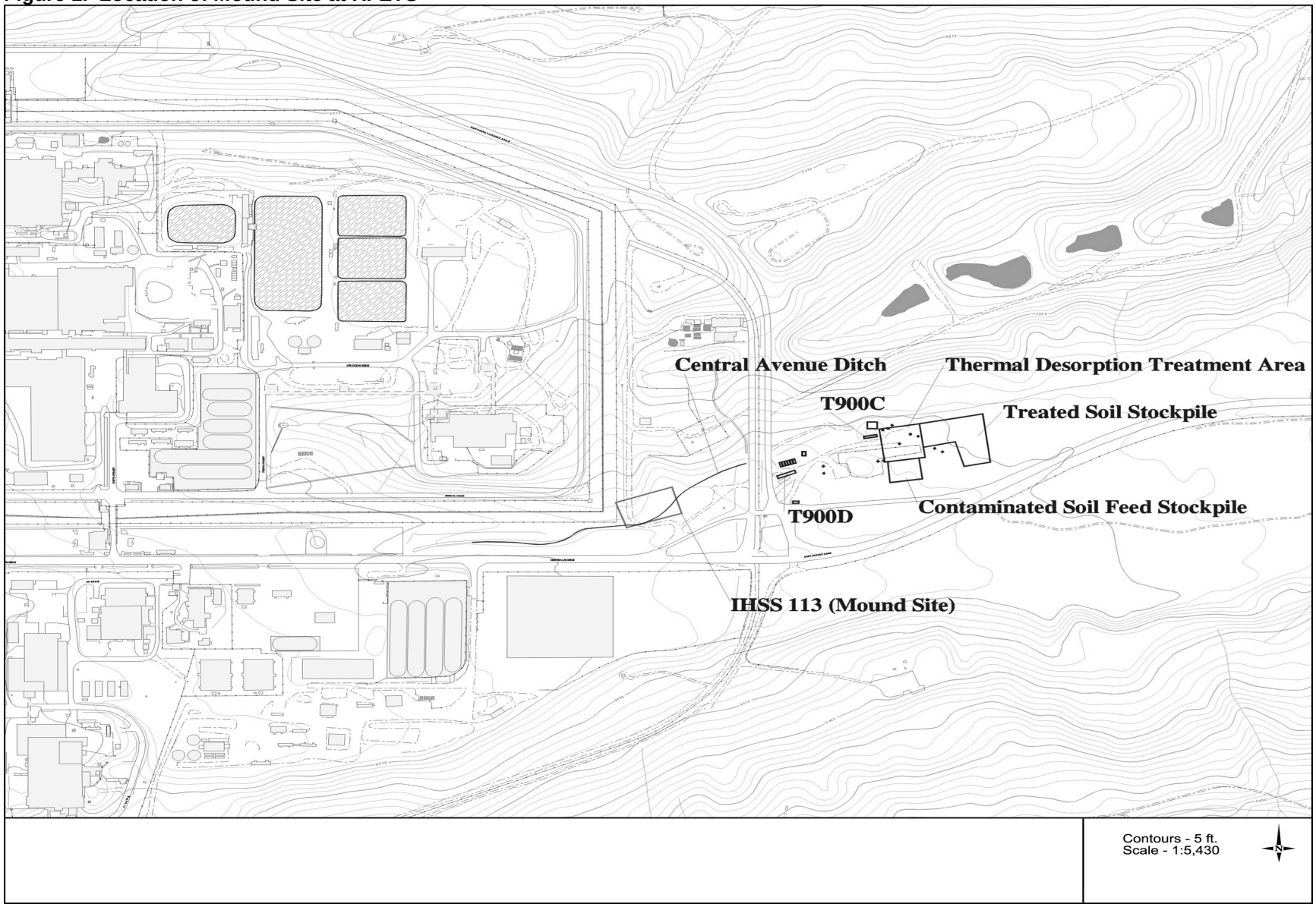


Figure 2. Location of Groundwater Wells and Soil Borings at Mound Site

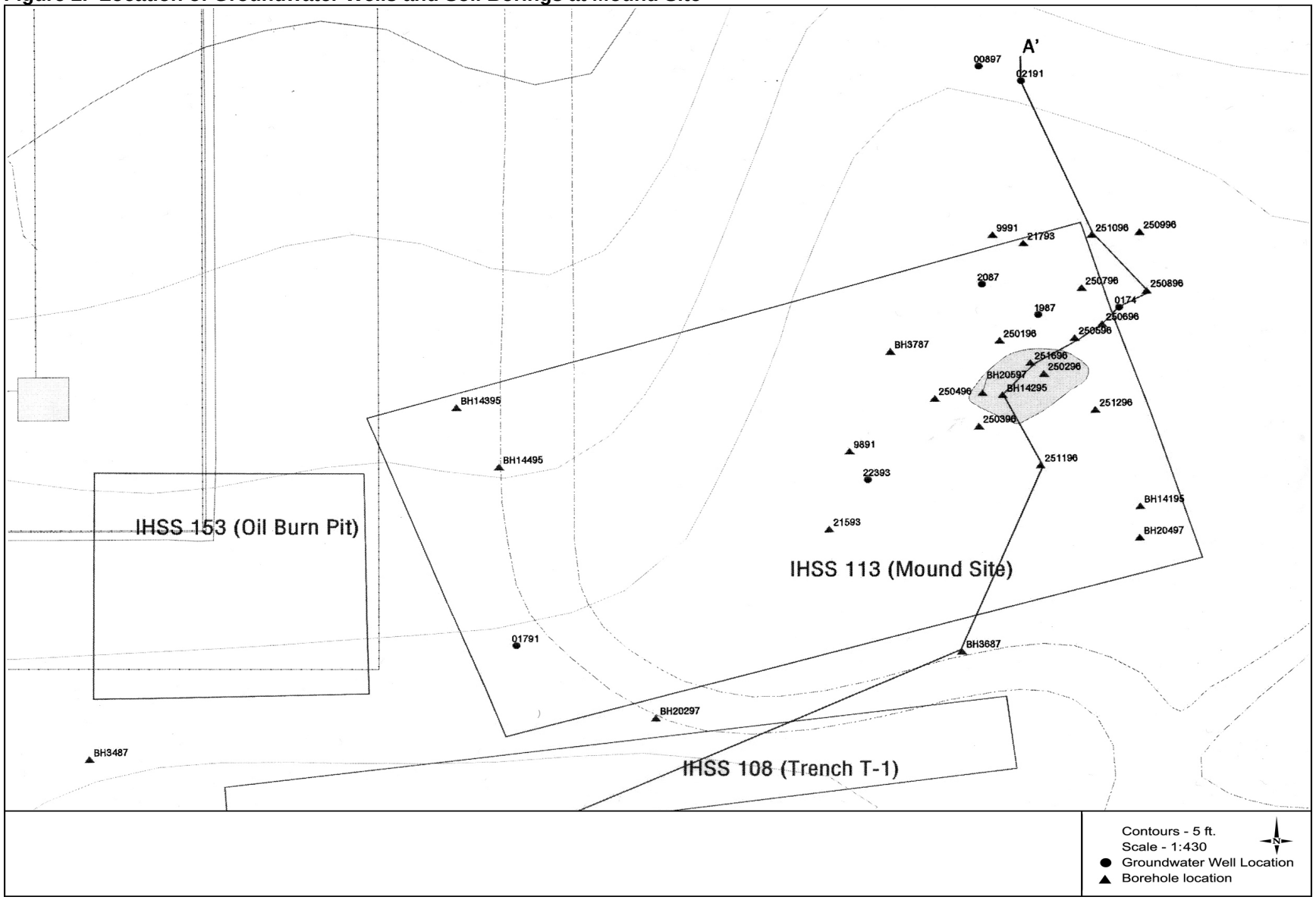


TABLE 2
Sum-of-the-Ratios Calculation for the Soil Sample Containing the Highest Activities of Radionuclides

Radioisotope	Concentration (pCi/g)	Tier I Action Levels (pCi/g)	Ratio
U-233/234	18.41	1,738	0.0106
U-235	1.376	135	0.0102
U-238	101.1	586	0.1725
Am-241	0.3572	215	0.0017
Pu-239/240	1.905	1,429	0.0013
		Sum-of-the Ratios	**0.1963**

Several subsurface soil samples exceeded the remedial action level for PCE of 11.5 mg/kg, with PCE concentrations of up to 760 mg/kg were observed in Mound Site soil samples. Twenty-four (24) boreholes were sampled at various depths from the surface to nearly 40 feet deep, depending on the borehole. The highest concentrations were in the boreholes clustered in the proposed (and actual) excavation area shown on Figure 2. The highest concentrations were at depths of 5-12 feet below ground. The highest concentrations were 160 mg/kg at 5.1-5.5 feet deep in Borehole (BH) 250296, 440 mg/kg at 7-8 feet in BH 251696, and 760 mg/kg at 5-8 feet and 550 mg/kg at 8-12 feet deep in BH 14295. Of all the samples analyzed, the majority had concentrations below 1 mg/kg, only 5 samples had concentrations between 1 and 100 mg/kg, and only 8 samples had concentrations greater than 100 mg/kg.

TCE, carbon tetrachloride, and methylene chloride were not detected above their remedial action levels (see Cleanup Goals/Standards) in any of the soil samples. Based on these data, PCE was the only contaminant of concern driving remediation. The areal extent and depth of soil excavation was therefore based on the presence of PCE above its remedial action level of 11.5 mg/kg.

Contaminant Properties:

Contaminant	Normal Boiling Point (°C)	Solubility @ 25 °C (mg/l)	Soil-Water Partition Coefficient (cm^3/g)
PCE	121	150	0.15 to 0.36
Carbon tetrachloride	77	1,160	0.115 to 0.44
Methylene chloride	40	16,700	
TCE	87	1,100	0.05 to 0.15

MATRIX CHARACTERISTICS AFFECTING TECHNOLOGY COST OR PERFORMANCE

For purposes of thermal treatment, soils excavated from the Mound Site may be viewed as falling into one of the following two groups: 1) soils excavated from above a weathered claystone/sandstone layer, and 2) weathered claystone/sandstone material.

Soils in the first group include silty clays, sandy clays, sandy silts, clayey gravels, and sandy gravels of the Rocky Flats Alluvium. Collectively, the makeup of these soils is as follows:

TABLE 3a
Soils Above Claystone/Sandstone Layer

Component	Range
Clay Content	15 to 50%
Silt	10 to 40%
Sand	20 to 30%
Gravel	10 to 40%

The size of the gravel in the clayey gravels and sandy gravels was up to three inches in diameter. Similarly, the sandy and silty clays included gravel/cobbles three inches in diameter or larger. In addition to the gravel, rock fragments and cobbles were present in the gravels and clays. Rocks greater than three inches in size were encountered.

Based on observations made by field geologists while taking soil borings in the vicinity of the Mound Site, the sandy and silty clays have moderate to high plasticities while the sandy silts have low plasticities. Atterburg limit data on these soils are not available. The moisture content of the soils located above the weathered claystone/sandstone ranged from 8 to 18 weight percent, depending on weather conditions during excavation activities.

The Mound Site project also required the thermal treatment of weathered claystone/sandstone material. The composition of the weathered claystone/sandstone in the Mound Site area is as follows:

TABLE 3b
Weathered Claystone/Sandstone

Component	Range
Clay Content	45 to 90%
Silt	40 to 85%
Sand	5 to 55%
Gravel	0

Field characterization of various claystone/sandstone samples from the Mound Site indicates a wide range in plasticity. Some claystone samples exhibited high plasticities while others exhibited moderate and low plasticities. Atterburg limit data for the claystone/sandstone samples are not available. The moisture content of the weathered claystone/sandstone material ranged from 10 to 18 weight percent.

TECHNOLOGY SYSTEM DESCRIPTION

PRIMARY TECHNOLOGY

Low-temperature thermal desorption technology implemented with the McLaren Hart IRV-150 Batch Thermal Desorption Unit.

SUPPLEMENTAL TECHNOLOGY TYPES

Offgas from the thermal desorber was treated with the following unit operations prior to atmospheric discharge: HEPA (high efficiency particulate air) filtration, condensation, and vapor-phase granular activated carbon (GAC) adsorption.

Condensate from chilling the offgas from the thermal desorber was treated at the RFETS Consolidated Water Treatment Facility (CWTF). The CWTF includes the following unit operations: chemical precipitation, microfiltration, neutralization, dewatering, ultraviolet/peroxide oxidation, ion exchange, and liquid-phase GAC adsorption.

SYSTEM DESCRIPTION AND OPERATION

System Description
A McLaren Hart IRV-150 thermal desorption system was used to treat the Mound Site soils. The system included four ovens, configured with two-ovens per treatment train. Figure 3 illustrates the unit operations included in each two-oven treatment train.

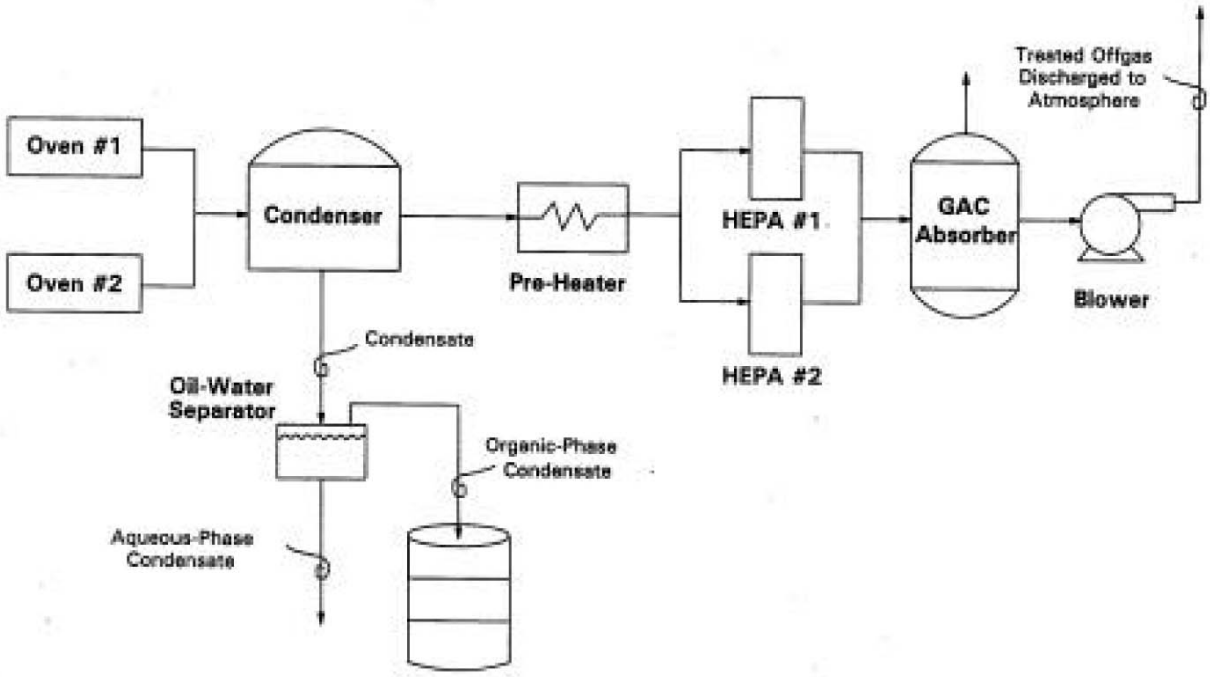
The IRV-150 is an indirect-heated thermal desorption unit. Specifically, hot combustion gases from burning propane are passed through metal tubes (i.e., "heaters") located in the cover of each oven. Heat is transferred from the hot gases to the soil primarily through radiation, but also through forced convection as ambient air is drawn over the heater tubes into the oven. The combustion gases are not commingled with the sweep air and do not contact the soil. Instead, the combustion gases are discharged directly to the atmosphere after passing through the heater tubes.

The offgas leaving the oven is treated prior to atmospheric discharge as indicated in Figure 3. The unit operations employed to treat the offgas from the ovens included condensation, HEPA filtration, and GAC adsorption. A preheater is placed between the condenser and the HEPA filters to prevent condensation from occurring on the filter media. Two HEPA filters, configured in parallel are employed to ensure continued operation in the event that the "in-service" filter becomes plugged. The filtered gas stream is polished with GAC prior to atmospheric discharge.

Each oven is approximately 8-feet wide by 18-feet long by 1.5-feet high. Each oven includes two removable trays into which the soil is placed (see System Operation below). Each tray has a capacity of approximately 2.25 cubic yards.

The design of thermal desorption systems, including the IRV-150, is based on two primary operating parameters: soil temperature and residence time. Specifically, the temperature to which the soils are heated and the time at which they are maintained at that temperature are the two operating parameters that most influence the performance of the desorber (i.e., contaminant removal efficiencies).

Figure 3. Thermal Desorption Process Flowsheet



System Operation

A front-end loader is used to load contaminated soil into IRV-150 oven trays. Clumps of soil greater than six inches are broken apart with a shovel as the trays are loaded. A forklift is employed to place two of the loaded oven trays into each IRV-150 oven. The oven covers are moved into place and the blowers are started to induce an air flow through the oven covers and beds of contaminated soil. The propane heaters are then fired to begin heating the ovens.

The bulk soil temperature reached the minimum target temperature of 180 °F after 2.5 to 3.5 hours. Soil bed temperatures are measured with thermocouples that are installed through the bottom of the trays and extend into the soil. The minimum target temperature is maintained for at least 30 minutes after it is reached prior to turning off the propane heaters.

The ovens are allowed to cool for approximately 30 minutes after the heat is turned off. The trays are then removed from the ovens with a forklift, placed in a staging area away from the immediate work area, and allowed to cool overnight. "Spare" (additional) trays loaded with feedstock soil are immediately placed into the empty ovens and the process is repeated.

After cooling, trays of treated soil were "re-hydrated" with water (i.e., spray) and transferred to a treated soil staging area adjacent to the treatment area. Re-hydration served to minimize the generation of dust when transferring the treated soil out of the trays. Stockpiled treated soils were covered with ConCover Remediation Cover material, a soil binder, to minimize erosion and windblown dispersion from the stockpile.

Secondary waste streams from the thermal desorption operation include condensate, spent HEAF (high efficiency air filter) and HEPA media, spent GAC media, and miscellaneous project-generated trash. Condensate was transferred, via tanker truck, to the CWTF and treated prior to discharge. Spent HEAF and HEPA media was land disposed as LDR-compliant mixed waste and spent GAC was incinerated at an offsite permitted facility. The miscellaneous project-generated trash (e.g., tarps, lumber, sand bags, etc.) were disposed in the onsite landfill.

OPERATING PARAMETERS AFFECTING TECHNOLOGY COST OR PERFORMANCE

Parameter	Value
Temperature	180 °F
Residence Time	2.5 to 3.5 Hours (Active Heating Time)
Ambient Air Flow*	1,000 to 3,000 cubic feet per minute
Pressure	700 mmHg
Energy Input*	1.5 million BTU per hour

*Parameter value listed in table is on a per treatment unit (i.e., oven) basis.

TIMELINE

Start Date	End Date	Activity
	02/03/97	Draft Proposed Action Memorandum for Mound Site Source Removal
03/05/97	04/10/97	Mound Site Excavation
05/20/97	06/23/97	Delivery and Installation of Propane Tanks
07/17/97	**09/29/97**	**SOIL TREATMENT ACTIVITIES**
07/07/97	07/31/97	Subcontractor Training
07/17/97	08/04/97	Mobilization of Thermal Desorption Equipment
07/26/97	07/27/97	Hookup and Final Pressure Test of Propane Lines
07/30/97	08/04/97	Shakedown Test
08/05/97	08/21/97	Soil Treatment
08/05/97	08/23/97	Off-Site Laboratory Analysis
Milestone	08/23/97	Soil Treatment Complete
08/22/97	08/29/97	Decontamination of Thermal Desorption Unit
08/11/97	08/29/97	Sampling and Analysis of Waste (i.e., Treatment-Generated Secondary Waste Streams)
08/25/97	08/27/97	Waste Packing and Interim Storage
09/03/97	09/27/97	Return Treated Soil to Mound Site (i.e., Backfill)
09/17/97	09/29/97	Waste Shipment for Off-site Disposal
Milestone	09/29/97	Waste Disposal Complete

TECHNOLOGY SYSTEM PERFORMANCE

CLEANUP GOALS/STANDARDS

The cleanup target levels used for the excavation activities are the Final Rocky Flats Cleanup Agreement (RFCA) Tier I Subsurface Action Levels for VOCs. These action levels were incorporated to prevent any further degradation of groundwater above the RFCA Tier I Groundwater Action Levels. The VOC cleanup target levels for the excavation are listed below in Table 4.

TABLE 4
VOC Cleanup Target Levels for Excavation

Contaminant	Concentration (mg/kg)
Carbon Tetrachloride	11.0
Methylene Chloride	5.77
PCE	11.5
TCE	9.27

The performance or treatment goals for the thermal desorption of Mound Site soils were established at levels that meet or are below: 1) RCRA Treatment Standards For Hazardous Waste (6 Colorado Code of Regulations [CCR] 1007-3, 268.40) and 2) Tier I Subsurface Soil Action Levels for the VOCs found in the Mound Site soils. The treatment goals for the contaminants of concern are listed below in Table 5.

TABLE 5
Soil Treatment Goals

Contaminant	Concentration (mg/kg)
Carbon Tetrachloride	2.0
Methylene Chloride	5.77
PCE	6.0
TCE	4.0

The only chemical-specific applicable standard for the Mound Site soil treatment project was the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for radionuclides. The 40 CFR 61.92 is applicable and requires that no member of the public receive more than 10 mrem per year above background from airborne sources of radiation. Demonstration of compliance with 40 CFR 61.92 is performed on a sitewide basis taking into consideration all RFETS sources. Stack monitoring is required for all release points which could contribute greater than 0.1 mrem/year. Based upon air dispersion modeling results, stack monitoring for radionuclides was not required.

PERFORMANCE DATA

A sample of treated soil from each oven was collected and analyzed for VOCs. Except for two ovens (TDU-1 and TDU-3 of Batch 9), all treated soil sample results met the soil treatment goals presented above in Table 5. The soil processed in TDU-1 and TDU-3 of Batch 9 did not meet the treatment goal for PCE (i.e., 6 mg/kg) and was therefore re-treated in the thermal desorption unit. All soil treatment goals were met upon re-treatment. Table 6 presents a summary of the post-treatment range of treated soil VOC concentrations. The data in Table 6 include the re-treatment of TDU-1 and TDU-3 of Batch 9. The data in Table 6 indicates that PCE, TCE, and carbon tetrachloride were not detected in any of the post-treatment soil samples. Methylene chloride is considered to be below detection levels, and thus below its treatment goal, in the treated soil samples because the compound was detected in trip blanks associated with soil samples where methylene chloride was detected.

TABLE 6
Soil Treatment Goals

Contaminant	Soil Treatment Goal	Low Concentration (mg/kg)	High Concentration (mg/kg)
PCE	6	0.625U	0.630U
TCE	4	0.625U	0.630U
Methylene Chloride*	5.77	300J,B	3,000
Carbon Tetrachloride	2	0.625U	0.630U

U = Detection limit. Contaminant was not detected at or above this level.
J = Estimated concentration.
B = Contaminant was detected in laboratory blank.
* = Methylene chloride detected in associated trip blank and is therefore considered undetected in all treated soil samples.

PERFORMANCE DATA ASSESSMENT

Table 6 presents a comparison of the range of treated soil VOC data with the associated treatment goals. As this table shows, the system met the cleanup goals for PCE, TCE, methylene chloride, and carbon tetrachloride.

PERFORMANCE DATA QUALITY

The quality of the data used in the Mound Site Source Removal was assessed in terms of the five data-quality parameters: precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. The PARCC parameter evaluation was performed in accordance with the guidance established by the Rocky Flats Administrative Procedure 2-G32-ER-ADM-08.02, *Evaluation of ERM Data for Usability in Final Reports,* and with guidance provided by EPA.

Since the Mound Site cleanup project committed large personnel and equipment resources, field decisions were based on data faxed directly from the laboratory to support timely field decisions. This allowed for the timely use of analytical results. Data validation was performed after the data were used for its intended purpose. Analytical laboratories supporting this project have all passed regular laboratory audits by the Rocky Flats Analytical Projects Office.

QC samples were collected from the excavation boundary, and during the initial TDU baselining investigation. QC samples were collected at the rate of 1 per 20 samples during process verification VOC soil sampling. The types of QC samples collected included duplicates, equipment rinse blanks, and trip blanks.

COST OF THE TECHNOLOGY SYSTEM

PROCUREMENT PROCESS

The services of McLaren Hart and the IRV-150 low-temperature thermal desorption technology were procured for the Mound Site project on a non-competitive, sole source basis. The sole source award was the culmination of a three-step market survey/evaluation effort (i.e., literature review, vendor presentation, and field inspection) to identify potentially applicable thermal desorption technologies and subcontractors for the project. The evaluations indicated that the McLaren Hart IRV-150 thermal desorption unit was the only technically-suited process for treating Mound Site soils for two reasons.

First, the McLaren Hart IRV-150 thermal desorber unit was able to directly treat VOC-contaminated materials (i.e., soil and rock) up to approximately eight inches in size. This capability eliminates the need for material separation and size reduction processes that are required by the continuous-processing units evaluated. In addition, material separation and size reduction processes such as screening and crushing generate significant amounts of dust. Because the Mound Site soils are contaminated with low levels of radionuclides, The As Low as Reasonably Achievable (ALARA) policy precludes the use of systems that generate dust when systems that minimize dust are available.

The second reason the McLaren Hart IRV-150 unit was uniquely qualified to meet the requirements of the Mound Site Source Removal project is because it is comprised of simple equipment that is easily decontaminated and surveyed (radiological). At the completion of the Mound Site soil treatment operations, all thermal desorption equipment must be shown to be below specific levels of radionuclide contamination through radiological survey before equipment can be released from RFETS. All equipment surfaces on the IRV-150, both internal and external, are exposed and easily accessible. This is in contrast to all of the other thermal desorption units evaluated. Specifically, the internal surfaces of all other units would not allow a complete and confident radiological survey.

COST DATA

Costs for cleanup of the Mound Site, presented in Table 7, were provided by the Kaiser-Hill Company, L.L.C. The costs were estimated from actual total project costs (i.e., excavation and treatment). The costs include RFETS infrastructure costs (e.g., site security) in effect at the time the Mound Site project was conducted. These infrastructure costs change from year to year as the accounting structure is modified and may or may not be representative of similar costs at other project sites.

Table 7 shows that $2,316,000 were expended for cleanup of this site, however no additional information is available on the portion of the total cost that was due to treatment of contaminated soil. Therefore, a unit cost for treatment of contaminated soil was not calculated. Information about the amount expended for treatment alone is considered confidential business information by the DOE.

There were no capital equipment costs incurred in treating Mound Site soils. The IRV-150 thermal desorption equipment was provided by McLaren Hart as part of a performance-based contract to treat the Mound Site soils. The equipment was successfully decontaminated, free released, and returned to McLaren Hart following Mound Site soil treatment operations.

TABLE 7
Site Cleanup Costs

Item	Cost (FY 1997)
Planning and Site Preparation	$580,000
Project Management	$210,000
Excavation, Treatment, Waste Disposition, Site Restoration	$1,526,000
Total Soil Treatment Cost	**$2,316,000**

REGULATORY/INSTITUTIONAL ISSUES

The authorizing document for this removal action is the Final Proposed Action Memorandum (PAM). The PAM outlined the approach that was taken and the applicable requirements for the excavation and subsequent removal of VOCs from the soil at the Mound Site. The PAM was submitted in February 1997, and was approved by EPA and the Colorado Department of Public Health and Environment (CDPHE) in March 1997.

The source removal was conducted in accordance with the Rocky Flats Compliance Agreement, and Federal, State, and local laws, as well as DOE's orders and RFETS policies and procedures. The VOCs addressed in this action are CERCLA hazardous substances and Resource Conservation and Recovery Act (RCRA) hazardous waste constituents contained in an environmental media (soil). All substantive requirements under CERCLA were met.

The only permit required on at the Mound Site Project was an Excavation Permit. Prior to any excavation activity at the RFETS, a Request for a Soil Disturbance Evaluation must be submitted. Once approved, the Excavation Permit was issued and excavation activities began in March, 1997 and were completed in April, 1997.

The Kaiser-Hill Company, L.L.C., filed an Air Pollution Emissions Notification (APEN) to CDPHE for TDU operation. The APEN included engineering estimates of total mass of various pollutants that would be discharged to the atmosphere during the course of the treatment project.

OBSERVATIONS AND LESSONS LEARNED

COST OBSERVATIONS AND LESSONS LEARNED

Several cost and productivity enhancements associated with design enhancements to the thermal treatment system are discussed below.

PERFORMANCE OBSERVATIONS AND LESSONS LEARNED

The Mound Site soil treatment project was the first time three design enhancements of the IRV-150 were implemented. The first includes the use of trays to hold the soil instead of placing the soil directly into the ovens. This enhancement proved extremely beneficial in practice resulting in a significant decrease in the generation of dust and an increase in overall productivity/throughput. Specifically, at the completion of a batch, the trays containing treated soils were removed from the ovens without the need to wait for the soil to completely cool. The ovens were immediately loaded with previously charged trays and the next treatment cycle was started. Also, by allowing a much longer cool down period (outside of the treatment operation), the tray design resulted in a significant reduction in steam generation and particulate entrainment when the treated soils were sprayed with water for the purpose of hydration and dust control.

The second and third design enhancements are related to the HEPA filter units. A preheater was installed in the offgas treatment train between the condenser and the HEPA filters to raise the temperature of the offgas leaving the condenser above its dew point. This design change successfully prevented condensation on the HEPA media, which had caused a dramatic decrease in filtration efficiencies in previous projects. Also, two HEPA filters, configured in parallel, were included in each offgas treatment train. This allowed continued operation in the event that one of the filters plugged.

The installation of soil bed thermocouples noted earlier did not withstand the repeated loading and unloading of the trays. The thermocouples were installed through the bottom of the trays and into the soil bed. A detachable signal line was installed from the end of the thermocouple lead (i.e., bottom of tray) through the side of the oven and to an indicator display. These connections were detached every time a tray was placed into and removed from an oven. Several of the thermocouple leads were damaged during tray placement and removal operations.

REFERENCES

RMRS, 1997, *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113,* RF/RMRS-96-0059, Rev. 0, February.

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RMRS, 1997, *Closeout Report for the Source Removal at the Mound Site IHSS 113,* RF/RMRS-97-041.UN, Rev. 0, October.

Verschueren, K., 1983. Handbook of Environmental Data on Organic Chemicals, Second Edition.

ACKNOWLEDGMENTS

This case study report was prepared for DOE by:

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