Cost and Performance Summary Report
Thermal Desorption at the Reilly Industries Superfund Site, O. U. 3
Indianapolis, Indiana

Summary Information [1, 3, 4, 5, 6, 7, 8]

The 120-acre Reilly Industries Superfund site (Reilly), previously known as Reilly Tar & Chemical (Indianapolis Plant), is a former coal tar refinery and creosote wood treatment plant located in Indianapolis, Indiana. The site, which operated from 1921 to 1972, includes the 40-acre Oak Park property, which contains the majority of the operating facilities, including storage tanks, distillation towers, and utilities. The site also includes the 80-acre Maywood property, which contains additional operating facilities.

The site includes the following five waste disposal areas: the Lime Pond area; the Abandoned Railway Trench; the Former Sludge Treatment Pit; the Former Drainage Ditch; and the South Landfill and Fire Pond. The Reilly site was added to the National Priorities List (NPL) in 1984. Contaminants of concern in the soil included polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, and pyridine, including its derivatives.

In September 1993, a record of decision (ROD) was signed for operable unit (OU) 2 to address the contaminated soil and sludge in the disposal areas. The ROD required treatment of 11,000 tons of soil on site using thermal desorption. An explanation of significant differences (ESD) was signed in October 1997 to modify the remedy for OU 2, reducing the quantity of soil to be treated to 3,700 tons (see discussion below under System Operation). Between November 1996 and January 1997, a total of 3,700 tons of contaminated soil were treated.

Tables 1 and 2 show average and maximum contaminant concentrations in the four areas covered by O.U. 3, respectively. The lime pond had the highest levels of pyridine derivatives. The drainage ditch and railroad trench had the highest levels of carcinogenic PAHs.

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Type of Action:	Remedial
Lead:	PRP Lead

Table 1. Average Contaminant Concentrations Measured During Site Investigations (mg/kg) [1]

Waste Disposal Area	Total Carcinogenic PAHs	Total Pyridine Derivatives	Total Benzene
Lime Pond	350	5,673	191
Drainage Ditch	2,265	1	<1
Railroad Trench	3,794	19	1
Sludge Treatment Pit	836	6	<1

Table 2. Maximum Contaminant Concentrations Measured During Site Investigations (mg/kg) [6]

Waste Disposal Area	Total Volatile Organic Compounds	Total Semivolatile Organic Compounds
Lime Pond	5,522	9,870
Drainage Ditch	199.9	117,120
Railroad Trench	656	126,020
Sludge Treatment Pit	202.9	53,710

Timeline [1, 5]

1984	Reilly added to NPL
September 1993	ROD signed for O.U. 3
October 1997	ESD signed for O.U. 3
November 1996 to January 1997	Thermal desorption operations conducted
November 1, 1996	Performance test conducted

Factors That Affected Cost or Performance of Treatment

Listed below are the key matrix characteristics for this technology and the values measured for each during site characterization.

Matrix Characteristics [1, 7]

Parameter	Value
Soil Classification:	Sandy gravelly fill material to clay-rich soils
Clay Content and/or Particle Size Distribution:	Not available
Moisture Content:	15 - 30%
Organic Content:	2 - 56% carbon
pH:	Not available
Bulk Density:	Not available

Treatment Technology Description [1,7]

The thermal treatment system used for this application was a low temperature thermal desorption (LTTD) system owned by Williams Environmental Services, Inc. The system included a direct-heated rotary kiln, feed metering unit, baghouse, thermal oxidizer, and control unit that housed the controls, data logger, and analyzers. The desorber was a countercurrent rotary dryer fired by a 49 million BTU/hour burner. The unit was approximately 40 feet long and 8.5 feet in diameter, and was fabricated from 304 stainless steel. Contaminated soil was screened to remove cobbles and rocks greater than 2 inches in diameter prior to being fed to the desorber. Treated soil was disposed on site.

System Operation

After a startup period, performance testing was conducted which showed that the desorber met the cleanup standards for soil and emission limits for stack gases. During initial full-scale operations, the vendor has difficulty maintaining the desired soil temperature and throughput for the system and temperature spikes were obderved. Analysis of the soil indicated that the BTU level was higher than expected for some of the soil (800 BTU/pound) and that the moisture content of the soil was elevated (greater than 20 percent). Temperature spikes were observed when soils with levels greater than 800 BTU/pound were processed.

To address these concerns, the vendor made several modifications including blending soil containing high BTU levels with soils containing lower BTU levels, modifiying the configuration inside the desorber to provide for additional showering of the soil through the hot gas stream and promote more efficient heat transfer, and decreasing the soil screening cutoff from 2 inch to 1 inch. However, BTU levels remained elevated and throughput during a performance test conducted on November 1 was limited to 22 tons/hour. Operations were temporarily suspended. Because of the change in site conditions, an ESD was issued that modified the amount of soil to be treated to 3,700 tons (the amount of soil that could be blended to less than 800 BTU/pound), rather than the 11,000 tons originally identified. Treated soils were backfilled on-site. The remaining contaminated soil that could not be blended to less than 800 BTU/pound was required to be transported off site and treated in an industrial boiler or cement kiln.

Treatability Study

Prior to performing full-scale operation, a treatability study was conducted using a static tray method to determine the operating parameters needed to meet soil cleanup standards. Testing of soil from the four disposal areas was conducted at 650, 750, 850, and 950 ^{o}F, with samples collected after 10, 20, and 30 minutes of operation.

Results from the study showed that the desorber would achieve the revised cleanup standards with operation in the range of 650 to 950 ^{o}F and a 20 minute residence time. The study also indicated that soils had elevated BTU, VOC, and moisture contents.

Operating Parameters [1,7]

Listed below are the key operating parameters for this technology and the values measured for each.

Operating Parameter	Value
Residence Time	15 - 20 minutes
System Throughput	20 - 22 tons/hour
Soil Exit Temperature	800 - 1000°F
Thermal Desorber Exit Gas Temperature	350 - 450°F
Thermal Oxidizer Exit Gas Temperature	>1400°F
Baghouse Differential Pressure	>1 in. w.c.

Performance Information

Table 3 presents the soil cleanup standards for the Reilly site. These cleanup standards for cPAHs and pyridine derivatives are for subsurface soil based on an industrial/commercial site use. cPAHs are carcinogenic PAHs, identified in the ROD as benzo(a)pyrene equivalents.

Table 3. Soil Cleanup Standards for Reilly Industries

Parameter	Total Concentration (mg/kg)
cPAHs	20
Pyridine Derivatives	510
Pyridine	0.7
Benzene	0.1
Toluene	20

The ROD required that soil be treated with thermal desorption to meet cleanup standards for carcinogenic PAHs and pyridine derivatives, and the TCLP criteria for volatile and semi-volatile organic compounds. However, the treatability study results showed that the analytical detection limits for the TCLP data were very close to the TCLP cleanup standards. Therefore, the TCLP standards were replaced with equivalent total waste cleanup standards, shown in Table 3. Stack gas emissions limits were specified for VOCs of 15 pounds per day.

The 3,700 tons of soil was treated in 33 batches. All but five batches met the cleanup goals after initial treatment in the desorber. Five batches (about 925 tons of soil) that did not meet the cleanup goal for pyridine were retreated to meet these standards.

Air emissions were monitored during the one run performance test conducted on November 1. Results from this test were VOCs – 0.59 lbs/day; cPAHs – 6.11×10^{-7} lb/hr; particulate matter – 0.0152 gr/dscf (corrected to 7% O_2); CO – 1.07 lb/hr; and non-methane hydrocarbons – 0.046 lb/hr. The vendor reported that these results met applicable emission limits.

Performance Data Quality

Limited information was provided about the procedures and methods used to analyze untreated and treated soil. Information was provided identifying the protocols used for stack sampling for particulate matter, volatile organics, carcinogenic PAHs, CO, and non-methane hydrocarbons. The vendor did not report any deviations from established quality assurance or quality control procedures.

Cost Information [1]

Cost information was provided by the treatment vendor, and reflects actual costs for the project.

Table 4. Actual Project Costs

Cost Category/Element	Cost (1996 $ Basis)
1. Capital Cost for Technology	
Technology mobilization, setup, and demobilization	270,000
Planning and preparation	
Site work - preparation/restoration	
Equipment and appurtenances	
Startup and testing	
Other	
TOTAL CAPITAL COSTS	270,000
2. O&M for Technology	
Labor	659,130
Materials	Included with labor
Utilities and fuel	Included with labor
Equipment ownership, rental, or lease	Included with labor
Performance testing and analysis	
Other (includes nonprocess equipment overhead and health and safety)	
TOTAL OPERATION AND MAINTENANCE COSTS	659,130
3. Other Technology-Specific Costs	
Compliance testing and analysis	80,880
Soil, sludge, and debris excavation, collection, and control	26,070
Disposal of residues	Not provided
4. Other Project Costs	51,652
Total cost	1,087,732
Total cost for calculating unit cost	929,130
Quantity treated	3,700 Tons
Calculated unit cost	251/Ton
Basis for quantity treated	Soil treated

Observations and Lessons Learned [6,7]

The LTTD treated 3,700 tons of soil contaminated with carcinogenic PAHs and pyridine derivatives to below cleanup goals in about three months at a unit cost of $251 per ton. Seventy-five percent of the soil was treated to below the cleanup goals after initial treatment; the remaining soil was treated to below cleanup goals after re-treatment.

The elevated BTU and moisture content of the soil limited the amount of material that could be processed through the desorber. Engineering modifications, including blending soil, modifying the desorber to promote heat transfer, and reducing the soil screening cutoff size, did not increase the throughput rate. The vendor was able to treat only about one-third of the contaminated soil originally intended to be treated on site with thermal desorption because of this change in site conditions. The remaining contaminated soil was shipped off site for treatment using a boiler or industrial furnace.

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References

The following references were used in the preparation of this report.

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2. EPA. Region 5 NPL Fact Sheet. November 2000.

3. EPA. Source Site Description. <www.epareachit.org>. February 26, 2001.

4. Treated Soil Tracking Form. January 6, 1997.

5. EPA. Record of Decision for Reilly Tar & Chemical Corp. (Indianapolis Plant). Operable Unit 3. September 30, 1993.

6. EPA. Explanation of Significant Differences for Reilly Tar & Chemical Corp. (Indianapolis Plant). Operable Unit 3. October 6, 1997.

7. Mark Fleri, Williams Environmental. Comments on Draft Cost and Performance Summary Report. Fax to Richard Weisman, Tetra Tech EM Inc. October 9, 2001.

8. Dion Novak, EPA Region 5. Comments on Draft Cost and Performance Summary Report. Telephone conversation and Confirmation E-mail with Richard Weisman, Tetra Tech EM Inc. November 4, 2001.

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