On-Site Incineration at the FMC Corporation - Yakima Pit Superfund Site Yakima, Washington

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Site Name: FMC Corporation - Yakima Pit Superfund Site	**Contaminants:** • DDD, DDE, DDT, dieldrin, endosulfan, ethion, malathion, parathion, cadmium, chromium, and zinc. • DDD concentrations of 76 mg/kg, DDE concentration of 210 mg/kg, and DDT concentrations of 210 mg/kg • The maximum concentrations of contaminants (mg/kg) detected in soil were DDD (76), DDE (28), DDT (210), dieldrin (40), endosulfan (7,000), ethion (180), malathion (170,000), parathion (3,300), cadmium (6), chromium (320), and zinc (1,020).	**Period of Operation:** January 1993 - May 1993
Location: Yakima, Washington		**Cleanup Type:** Remedial action
Vendor: VESTA Technology Ltd. 1670 West McNab Road Ft. Lauderdale, FL 33309	**Technology:** On Site Incineration • Solids crushed and mixed with soil • Incineration system consisting of co-concurrent rotary kiln and secondary combustion chamber (SCC) • Enclosed twin screw conveyor transported soil and debris to the unit • Soil had a through part rate of 60 kg/min with kiln temperature of 650 ^{o}C, the SCC temperature of 1,107 ^{o}C. • Ash discharged onto conveyers,sampled and analyzed, and then landfilled.	**Cleanup Authority:** CERCLA • ROD Date: 9/14/90 • EPA-lead
SIC Code: 2879 (Pesticides and Agricultural Chemicals)		**Point of Contact:** Lee Marshall U.S. EPA Region 10 1200 Sixth Avenue Seattle, Washington 98101 (206) 553-2723

Incineration at the FMC Corporation - Yakima Pit Superfund Site Yakima, Washington

(Continued)

Waste Source: Pesticide production wastes disposed of in an unlined pit	**Type/Quantity of Media Treated:** Soil and Debris • 5,600 cubic yards
Purpose/Significance of Application: Initially, was estimated in the ROD that between 900 and 4,000 cubic yards of material were contaminated. However, contamination extended deeper than previously anticipated and, as a result, over 5,600 cubic yards of material was excavated for incineration.	

Regulatory Requirements/Cleanup Goals:
- Destruction and Removal Efficiency (DRE) of 99.99 for all constituents of concern as required by Resource Conservation and Recovery Act (RCRA), 40 CFR Part 264 Subpart O.

Results:
- Monitoring and trial burn data indicate that all DRE and emission standards have been met.
- Analytical data of residuals indicate that cleanup goals have been met

Cost Factors:
- The actual cost for remediation using the incineration system was approximately $6,000,000.

Description:
Between 1952 and 1969, wastes contaminated with pesticides were disposed of on the site in an unlined waste disposal pit. It was estimated that 2,000 pounds of material was disposed of on the site in the pit contaminating soil with 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD), 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (DDE), 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane (DDT), and dieldrin.

A Record of Decision (ROD) signed in September 1990 specified on-site incineration as the remedial technology. Site cleanup goals and destruction and removal efficiency (DRE) standards were established for constituents of concern.

On-site incineration began in January 1993 and was completed in May 1993. The treatment system consisted of a rotary kiln and an SCC. Enclosed twin screws moved the soil to the kiln for treatment. Ash was collected and flue gas was completely incinerated. Incineration has achieved the soil cleanup goals specified in the ROD.

The actual cost for remediation using the incineration system was approximately $6,000,000.

EXECUTIVE SUMMARY

This report presents cost and performance data for the application of on-site incineration at the FMC Corporation - Yakima Pit (Yakima) Superfund site in Yakima, Washington. A rotary kiln incinerator was operated from January 1993 through May 1993 as part of a remedial action. Contaminants of concern at the site included pesticides and metals.

The Yakima site was the location of a former pesticide manufacturing plant which operated from 1951 until its closure in 1986. Between 1952 and 1969, wastes contaminated with pesticides were disposed of on the site in an unlined waste disposal pit. It was estimated that 2,000 pounds of material was disposed of on the site in the pit. Soil at Yakima was contaminated with 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD), 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (DDE), 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane (DDT), dieldrin, endosulfan, ethion, malathion, parathion, cadmium, chromium, and zinc. During the remedial investigation, the maximum concentrations of these contaminants in mg/kg detected in the soil were DDD (76), DDE (28), DDT (210), dieldrin (40), endosulfan (7,000), ethion (180), malathion (170,000), parathion (3,300), cadmium (6), chromium (320), and zinc (1,020).

A Record of Decision (ROD) signed in September 1990 established a Destruction and Removal Efficiency (DRE) of 99.99% for constituents of concern. In 1991, a Consent Decree was entered in the Eastern District of Washington in which the Responsible Party (RP) for the site agreed to implement the remedial action proposed in the ROD.

The RP conducted remedial activities including the operation of a rotary kiln incinerator to dispose of the contaminated soil. The incineration system at Yakima was comprised of a solid waste feed system; a co-current rotary kiln; a secondary combustion chamber (SCC); and an air pollution control system (APCS).

The incineration equipment was located on six flat bed trailers and several skids. Contaminated material was fed to the incinerator by a jacketed, twin-screw conveyor.

The incinerator volatilized and partially destroyed organic compounds from the contaminated material. Resulting ash from the incinerator was removed by a submerged drag conveyor while the off-gas was drawn into the SCC. The SCC was a down-fired steel shell that provided further combustion of contaminants in the gas.

Off-gas from the SCC was then drawn into the APCS, which was divided into three stages. The first stage, which consisted of a quench tank and two venturis, trapped and collected particulate matter. The second stage, which consisted of a packed bed adsorber and cooling tower, removed acid gases. The third stage, which consisted of an ionized wet scrubber, provided further removal of particulate matter. Ash collected from the incinerator and APCS was sampled and analyzed to determine if it was in compliance with site-specific land disposal requirements, at which time it was either re-incinerated or landfilled on the site.

During the five months of operation, the incinerator processed approximately 5,600 cubic yards of contaminated material. Treatment performance and emissions data collected during this application indicated that all performance standards and emissions requirements were achieved.

The actual cost for remediation using the incineration system was approximately $6,000,000.

SITE INFORMATION

Identifying Information

FMC Corporation - Yakima Pit Superfund Site
Yakima, Washington

CERCLIS #: WAD000643577

ROD Date: September 14, 1990

Treatment Application

Type of Action: Remedial (on-site rotary kiln incineration)

Period of operation: January 1993 - May 1993

Quantity of material treated during application: 5,600 cubic yards of soil and debris

Background

Historical Activity that Generated Contamination at the Site: Manufacture of pesticides

Corresponding SIC Code: 2879 (Pesticides and Agricultural Chemicals

Waste Management Practice That Contributed to Contamination: Waste disposal in an unlined pit

Site History:

- The site operated from 1951 until its closure in 1986. The site has remained vacant since its closure.
- From 1952 until 1969 wastes containing pesticides were disposed of in an on-site, unlined waste pit and covered with soil. The waste material included raw material containers, soil contaminated by leaks or spills from process equipment, broken bags, and off-specification materials [1].
- In the 1970s, liquid products were formulated on-site using solvents, emulsifiers, and stabilizers. Spills and leaks of these materials were believed to have been a source of concrete and soil contamination [1].
- Contamination at the site was found within a 58,000-square-foot area on the northeastern portion of the 10-acre site.
- Soil at Yakima was contaminated with pesticides and metals including DDD, DDE, DDT, dieldrin, endosulfan, ethion, malathion, parathion, cadmium, chromium, and zinc. A remedial investigation conducted in 1988 showed elevated concentrations of DDT and other pesticide constituents in the former disposal pit.
- Removal actions in 1988 and 1989 included excavation, removal, and disposal of 850 tons of contaminated soil from the waste pit [1].
- A ROD signed in 1990 addressed the contamination that remained in and around the waste pit. The ROD called for on-site incineration of contaminated soil and debris.

SITE INFORMATION (CONT.)

Background (Cont.)

- In April 1992, site mobilization began. By December 1992, incinerator shakedown had begun using contaminated soil. The trial burn scheduled for December 1992 was canceled due to delays in completing incinerator instrumentation installation and checkout. The trial burn was re-scheduled for January 1993.

- In January 1993, the re-scheduled trial burn was canceled due to mechanical difficulties with the incinerator. After extensive incinerator modifications, the shakedown period was extended. Later in the month an EPA-mandated 72-hour demonstration test of the incinerator using clean soil was completed. Incineration of contaminated soil resumed under operational guidelines and limits established in an extended shakedown plan.

- In March 1993, the extended shakedown activities were completed. The trial burn was conducted and successfully completed later in the month.

- Between January 1993 and May 1993, approximately 5,600 cubic yards of contaminated material were incinerated. This amount included the material which was incinerated during the shakedown period.

- Incinerator ash was disposed of on the site. Backfilling of the ash was completed in June 1993. Site demobilization activities were completed in July 1993.

Regulatory Context:

- In 1983 the Yakima site was placed on the National Priorities List (NPL).

- The selected remedy was implemented under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (NCP) in 40 CFR part 300 [6].

- The DREs were set in accordance with Resource Conservation and Recovery Act (RCRA) incinerator regulations in 40 CFR part 264, subpart O.

Remedy Selection: On-site incineration was selected as the remedy for contaminated soil and debris at the Yakima Pit Superfund site based on treatability study results, its ability to be protective of human health and the environment, and its ability to comply with Applicable or Relevant and Appropriate Requirements (ARARs).

SITE INFORMATION (CONT.)

Timeline

Table 1. Timeline [1, 2]

Date	Activity
1951 - 1986	Pesticides were manufactured at the Yakima site
1952 - 1969	Wastes from pesticide manufacturing were disposed of in an on-site unlined pit
1983	Yakima site placed on NPL
1988	Remedial Investigation
1988	First Removal Action
1989	Second Removal Action
September 1990	ROD signed specifying on-site incineration
April 1992	Site mobilization begins
January 1993	72-hour demonstration test completed
March 1993	Incineration Performance Test completed
May 1993	Incineration completed
June 1993	On-site backfilling of ash completed
July 1993	Site was demobilized
August 1993	Remedial Completion Inspection of the site

Site Logistics/Contacts

Site Management: RP-lead

Oversight: EPA

Remedial Project Manager:
Lee Marshall
U.S. EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-2723

Treatment System Vendor:
VESTA Technology Ltd.
1670 West McNab Road
Ft. Lauderdale, FL 33309

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix Processed Through the Treatment System:

- Soil and debris from an unlined waste disposal pit
- Contaminated concrete from the manufacturing plant

Contaminant Characterization

Primary Contaminant Groups: Pesticides and Metals

- The contaminants of greatest concern were: DDD, DDE, DDT, dieldrin, endosulfan, ethion, malathion, parathion, cadmium, chromium, and zinc.
- The maximum concentrations of contaminants (mg/kg) detected in soil were DDD (76), DDE (28), DDT (210), dieldrin (40), endosulfan (7,000), ethion (180), malathion (170,000), parathion (3,300), cadmium (6), chromium (320), and zinc (1,020).

Matrix Characteristics Affecting Treatment Costs or Performance

Information on matrix characteristics, such as soil classification, moisture content, and density, was not available.

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

VESTA Technology, Ltd. Model 200 Transportable Hazardous Waste Incinerator (incineration system) including:

- Solid waste feed system
- Co-current, rotary kiln
- Secondary combustion chamber

Supplemental Treatment Technology

Pretreatment (solids):

- Crushing
- Mixing

Post-Treatment (air):

- Quench tank
- Venturi scrubber
- Cooling tower
- Packed bed absorber
- Ionized wet scrubber

Post-Treatment (water):

- Surge tank
- Particulate filters
- Carbon filter

TREATMENT SYSTEM DESCRIPTION (CONT.)

System Description and Operation

- In addition to the soil, approximately 10 cubic yards of concrete and a limited amount of decontamination fluid was incinerated. The concrete was crushed to 1 inch pieces and mixed with the soil for incineration. Decontamination fluid, generated from cleaning concrete and personal protective equipment was collected and also mixed with soil for incineration.

- The main components of the incineration system included the rotary kiln, the SCC, and the APCS. The equipment was located on flat bed trailers and skids. The final system consisted of six trailers in a 100-foot by 120-foot work area [3].

- The waste feed system consisted of a variable speed J.C. Steele Feeder, a weigh belt conveyor, an inclined drag conveyor and a twin 6-inch screw feeder. The J.C. Steele Model 88C Even Clay Feeder was a multi-shafted conveyor which included a hopper and hopper extension to hold soil fed to it by a mechanical loader. The rate of discharge from the feeder was controlled by adjusting the rate at which the screws turned [3].

- Solids from the Steele feeder fell onto a Model MD-24T Thayer weigh belt conveyor. The belt passed over an isolated frame connected to a load cell, which measured the deflection caused by the weight of the soil. It then transmitted a signal to a controller which governed the rate at which the Steele feeder discharge soil to the feed system [3].

- Solids fell from the weigh belt to a bottom carry drag conveyor manufactured by Taunton Engineering. The drag conveyor was 25 feet long and had a 12 foot high discharge flange. The conveyor was driven by a 2 horsepower (hp) motor [3].

- Soils fell from the drag conveyor onto a water-jacketed twin screw conveyor, which fed the soils into the kiln. The conveyor was driven by a 6.7-hp drive motor. Water was circulated in the jacket to protect the conveyor components from the high temperatures generated by the kiln.

- The co-current kiln was 25 feet in length, had an inside diameter of 5.9 feet, and was lined with high-temperature refractory. The kiln was designed to operate with excess air or oxygen and to handle a maximum throughput rate of 10,000 pounds per hour.

- The average throughput of waste feed was 60.6 kg/min. The kiln was rated at 10.5 million BTU/hr and operated at 650°C.

- Residual ash from the kiln fell from the discharge end of the conveyor into the ash drag conveyor. The bottom end of the conveyor was completely submerged in water to cool the hot ash. The conveyor discharged the ash into a hopper. The ash was then sampled and analyzed to determine if it met requirements for on-site land disposal. The TCLP analyses of the ash confirmed that it was not a RCRA characteristic waste, and therefore could be landfilled on site.

- Flue gas from the kiln was routed to the SCC to ensure complete combustion of volatilized contaminants. The SCC operated at approximately 1,107°C and was equipped with an excess air burner. Air flow in the SCC was co-current to the flue gas flow. The burner was rated at 12.5 million BTU/hr. The SCC was 30 feet long and had an inside diameter of 6.5 feet.

TREATMENT SYSTEM DESCRIPTION (CONT.)

- The exhaust gas from the SCC was then routed to the system's APCS. The APCS contained three distinct units. The first stage consisted of a quench tank and a venturi scrubber to reduce flue gas temperature and remove particulates. Acid gas was neutralized by a pH-controlled spray in the venturi. Solids were removed from the process water by a clarifier. The clarifier used a filter press to remove solids, and the treated water was recycled to the venturi.

- The second stage of the APCS consisted of a packed bed absorber and a cooling tower to subcool the off-gas. The process water for the absorber was pH controlled to ensure sufficient removal efficiency of acid gas. The subcooling of the off-gas was in a closed loop through a heat exchanger to reduce heavy metal emissions. Blowdown from the second stage was treated and then used as makeup water for the first stage [3].

- The third step consisted of a two-stage ionized wet scrubber to remove particulates. The scrubber used high voltage ionization to electrostatically charge particulates in the gas stream before they entered the scrubber section. Particles greater than 3 microns were collected by inertial impaction. Smaller particles were attracted to the neutral surfaces of the scrubber due to the electrostatic charge which had been imparted on them. Blowdown from the scrubber was treated and then used as makeup water for the first stage [3].

- The blowdown from the second and third stages was treated in a system which consisted of a 1,000 gallon surge tank, a three-stage particulate filter, an activated carbon filter, and a particulate post filter. The surge tank acted as a primary settling tank for particulate removal and provided capacity to handle excess flow conditions. The three-stage particulate filter was designed to remove particulates larger than 1 micron. The carbon filter was designed to remove organic compounds that were present. The post filter removed any particulate larger than 0.5 microns. The solids collected by the filters were collected and sampled prior to disposal [3].

- Combustion gases were drawn through the kiln system and APCS by an induced draft fan and were exhausted through a 30-foot fiberglass reinforced plastic stack. Typical flue gas velocity was 85 m^3/min.

<u>Operating Parameters Affecting Treatment Cost or Performance</u>

Table 2. Summary of Operating Parameters

Parameter	Value
Residence Time	NA
System Throughput	60.6 kg/min
Kiln Temperature	650°C

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

- The cleanup goals and standards were specified in the ROD. The DRE standards were set based on RCRA incinerator regulations in 40 CFR part 264, subpart O.
- A DRE of 99.99% was required for each constituent of concern.
- Ash residuals were tested using the Toxicity Characteristic Leaching Procedure (TCLP) prior to on-site disposal.
- Cleanup standards in mg/kg were set for the following constituents in soil: DDD (5.1), DDE (3.6), DDT (3.6), Dieldrin (0.076), cadmium (8.0), hexavalent chromium (1.0), endosulfan (4.2), ethion (42.4), malathion (1,695), parathion (11.0), zinc (500).
- Cleanup standards in mg/100 cm^2 were set for the following constituents in concrete and other surfaces: DDD (0.0065), DDE (0.0046), DDT (0.0046), dieldrin (0.0001), endosulfan (0.010), ethion (0.270), malathion (8.2), and parathion (2.4).
- The soil cleanup criteria were established according to a risk assessment which allowed a 5 x 10^{-6} excess lifetime cancer occurrence.
- A cumulative hazard index was set at less than or equal to 1 for all noncarcinogenic substances.

Treatment Performance and Compliance

- A trial burn conducted at Yakima was designed to operate the incineration system at conditions that would reflect worst-case destruction and removal of all constituents of concern. Hexachlorobenzene was selected as the POHC. The reported DRE for this POHC is included in Table 3.
- The incinerator at Yakima operated within the operating limits established during the trial burn, signifying that all cleanup requirements established in the ROD were met. The AWFCOs limits used during the operation of the incinerator are shown in Table 4. Information about the frequency of AWFCOs was not available. Available trial burn and typical operating parameters are shown in Table 5.
- The residual ash was sampled and analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it was in compliance with on-site disposal requirements. These data are presented in Table 6.

Table 3. Average Destruction and Removal Efficiencies from Trial Burn [4]

Contaminant	Average Contaminant Feed Rate in Soil (lb/hr)	Average Contaminant Rate in Stack Gas Emissions (lb/hr)	Average Contaminant Concentration in Residual (µg/kg)	DRE (%)
Hexachlorobenzene	3.0	2.46 x 10^{-7}	0.130	99.999992

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 4. Automatic Waste Feed Cutoffs

Parameter	Cutoff Limit
Maximum contaminated soil feed rate[1]	67 kg/min
Maximum kiln temperature	1,000°C
Minimum kiln temperature	600°C
Minimum SCC outlet temperature	1,093°C
Maximum quench outlet temperature	100°C
Minimum recycle to venturi	150 Lpm
Minimum venturi differential pressure	750 mm w.c.
Minimum absorber recycle flow	1,000 Lpm
Minimum absorber flow water pH	6
Maximum cooling tower inlet temperature	80°C
Minimum ionized wet scrubber #1 recycle water flow	1,000 Lpm
Minimum ionized wet scrubber #2 recycle water flow	1,000 Lpm
Minimum ionized wet scrubber #1 voltage	12 kV
Minimum ionized wet scrubber #2 voltage	12 kV
Maximum exhaust stack CO concentration	500 ppm
Maximum exhaust stack average CO concentration[1]	100 ppm
Maximum exhaust stack O_2	4%
Maximum exhaust stack flow	175 m^3/min
Minimum kiln O_2 level	6%
Minimum SCC outlet O_2 level	3%
Maximum kiln pressure	-1.3 mm w.c.
Bypass stack not closed	Open

[1]One hour rolling average

TREATMENT SYSTEM PERFORMANCE (CONT.)

Table 5. Operating Parameters [4, 7]

Parameter	Actual Value[1]	Trial Burn Value
Contaminated Soil Feed Rate	60.6 kg/min	81.8 kg/min
Fuel Fired Feed Rate	10.5 million BTU/hr	10.5 million BTU/hr
Emission Rate		
Particulate	NA	0.0014 gr/dscf
HCl	NA	0.004 kg/hr
Cl_2	NA	<0.001 kg/hr
SO_2	NA	6.18 ppm
NO_x (@ 7% O_2)	NA	1,123.83 ppm
Operating Conditions		
CO concentration in gas	10 ppm	18.44 ppm
Exhaust stack O_2 concentration	10%	12.97%
Kiln temperature	650°C	NA
SCC outlet temperature	1,107°C	NA
Stack gas flow rate	85 m^3/min	NA
Quench outlet temperature	85°C	NA

[1]Anticipated values as reported in the Incineration Work Plan.

Table 6. TCLP Comparison for Residual

Constituent	Regulatory Threshold Concentration (mg/L)[a]	Average TCLP Concentration (mg/L)[b]
Metals		
Arsenic	5	0.016
Barium	100	0.19
Cadmium	1	0.0028
Chromium	5	0.011
Lead	5	0.020
Mercury	0.2	0.00012
Selenium	1	0.0099
Silver	5	0.0046
Organochlorine Pesticides		
Chlordane	0.03	0.00037
Endrin	0.02	0.000082
Heptachlor (and epoxide)	0.008	0.00018
Lindane	0.4	0.000037
Methoxychlor	10	0.00011
Toxaphene	0.5	0.0012

Note: Only pollutants that were detected are included in this table.
[a]Excerpted from 40 CFR § 261.24 Table 1.
[b]Geometric mean value of reported ash samples.

TREATMENT SYSTEM PERFORMANCE (CONT.)

Performance Data Completeness

- Data are available for concentrations of contaminants in the soil before treatment.
- Data are also available for concentrations of contaminants in the incinerator residue. These data were periodically collected prior to on-site land disposal.

Performance Data Quality

- According to site personnel, the QA/QC program used throughout the remedial action met the EPA and the State of Washington requirements. All monitoring was performed using EPA-approved methods, and the vendor did not note any exceptions to the QA/QC protocols.

TREATMENT SYSTEM COST

Procurement Process

- The RP contracted with VESTA Technology Ltd. to provide and operate the incinerator at the site.

Cost Data

- The estimated treatment cost of $6,000,000 was reported by Bechtel Environmental, Inc. A total of 7,840 tons of soil were incinerated. This corresponds to a total unit cost of $770 per ton. A detailed breakdown of these costs was not available.

Cost Data Quality

- Actual capital and operations and maintenance cost data are available from the treatment vendor for this application.

OBSERVATIONS AND LESSONS LEARNED

Observations and Lessons Learned

- It was estimated in the ROD that between 900 and 4,000 cubic yards of material were contaminated. However, contamination extended deeper than previously anticipated and, as a result, over 5,600 cubic yards of material was excavated for incineration.

- Samples from 7 feet below ground surface taken during excavation contained contaminant concentrations above the cleanup goals. EPA determined that excavation below 7 feet was technically impracticable, and that the material did not pose an exposure risk because soil at this depth was constantly submerged below water. Additionally, EPA felt that the groundwater was not at risk due to the excavation of material which had already taken place. Groundwater monitoring was scheduled to take place for five years following the completion of the incineration project [5].

- Many problems occurred while trying to get the incinerator operational. Shakedown activities were scheduled for the winter months with average temperatures around 25°F. The cold weather caused many delays in setting up the incinerator. Additionally, the incinerator contractor did not anticipate the amount of monitoring that would occur on-site, which caused further delays [6].

- Excavation of contaminated soil at the site was complicated by environmental factors. The water table at the site is at its seasonal low of 7 feet below ground surface during the winter months. Excavation of soil with the water table at this level is preferred but harsh winter conditions in Washington introduced other problems. During the warmer summer months, the water table at the site is at its seasonal high of 6 inches to 1 foot below ground surface. While the warmer temperatures make outdoor operations easier, the high water table hampers soil excavation.

REFERENCES

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1) Incineration Work Plan - Revision 3, Addendum 2, VESTA Technology, Ltd., January 1993.

1) Cleanup Summary for Incinerator Ash and Waste, Beehtel Environmental, Inc., June 1993.