300670-1108150001

BWX Technologies, Inc.
Babcock & Wilcox, a McDermott company

Babcock & Wilcox of Ohio, Inc.
1 Mound Road
Miamisburg, Ohio 45343-3030

P.O. Box 3030
Miamisburg, Ohio 45343-3030
(937) 865-4020
Fax: (937) 865-5445

BWO-013/98
January 22, 1998

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5493.1

98-AC/1-22

Mr. Nat Brown, Director
Miamisburg Environmental Management Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

SUBJECT: Contract No. DE-AC24-970H20044
SM/PP HILL PROJECT - BURN AREA CERTIFICATION OF CLOSURE AND FINAL AMENDED CLOSURE PLAN

Dear Mr. Brown:

Enclosed are four copies of the Burn Area Certification of the RCRA Closure and Final Amended Burn Area Closure Plan. Please forward to the appropriate DOE-MEMP staff and to the EPA for their review and approval.

If you have any questions or concerns about these documents, please call Felix Spittler, SM/PP Hill Project Manager, at 865-3981.

Sincerely,

Peter M. Hekman
President & General Manager

PMH/FS/nr

Enclosure

AMENDED BURN AREA CLOSURE PLAN

U.S. Department of Energy
Mound Plant
Miamisburg, Ohio
EPA I.D. No. OH6890008984
Ohio I.D. No. 05-57-0677
January 1998
Final

CLOSURE CERTIFICATION OF THE BURN AREA AT THE MOUND PLANT

US Department of Energy
Mound Plant
Miamisburg, Ohio

EPA ID No. OH6980008984
OHIO ID No. 05-57-0677

January 1998

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CLOSURE CERTIFICATION OF THE BURN AREA AT THE MOUND SITE

1.0 INTRODUCTION

This closure certification report has been prepared to document the closure of the Burn Area at the Mound Plant in Miamisburg, Ohio. This report provides the certifications by the Mound operator and the independent professional engineer that the Burn Area has been closed in accordance with the approved closure plan.

In this certification report, the Burn Area facilities are described, along with the various closure activities; facilities decontamination, dismantling and demolition, and debris and scrap disposal. The final site activities including soil sampling, and final site reclamation activities are also described. The deviations or modifications to the Closure Plan are also described.

The report includes the Ohio Administrative Code (OAC) required operator certification statement and signature and seal of the professional engineer registered in the State of Ohio.

The report appendices include certification related records for site visits; hazardous, debris, and scrap metal disposal and fate records.

2.0 BACKGROUND

2.1 Burn Area Description

The Burn Area of the Mound Plant was a fence enclosed area approximately 0.5 acre. There were six RCRA regulated units (two storage and four treatment) within the Burn Area that were used to manage and dispose of, through treatment, energetic materials including weapons components and powders.

The storage units were:

> Magazine 53, an above grade reinforced bunker with inside dimensions of approximately 15 feet long, 10 feet wide, and 10 feet high.
>
> Pyroshed, a roof covered, chain link fence enclosed area 15 feet long, 9 feet wide, and 7 feet high.

The treatment units were:

Open Burn Unit, a steel walled enclosure with a metal grating roof with inside dimensions of approximately 10 feet wide, 10 feet long, and 10 feet high.

Retort Unit, a rotary kiln approximately 10 feet long and 3 feet in diameter. The kiln is located in a concrete walled enclosure approximately 30 feet long, 15 feet wide, and 9 feet high. The Unit also included a pre-engineered sheet metal building (Building 90) adjacent to the retort enclosure, housing the retort controls and waste feed.

Energetic Materials Pretreatment Unit, a small (2 feet high, 1 foot in diameter) metal cylinder with base pan.

Thermal Treatment Unit, a small metal base that held a 55-gallon drum when operated. No drum was present at time of closure.

Complete descriptions of these units are included in the Amended Burn Area Closure Plan.

2.2 Closure Plan

All of the Burn Area Units except for Magazine 53 were cleaned and decontaminated and then dismantled or demolished. Magazine 53 was decontaminated and left in place.

As specified in the plan, rinseate samples were taken to confirm that the Burn Area units were acceptably clean or satisfactorily decontaminated prior to dismantling or demolition.

Decontamination wastes and dismantling and demolition materials were disposed of as specified in the plan as either hazardous waste, sanitary landfill waste, or as metal scrap for smelting.

After removal of all units, the Burn Area soils were sampled and analyzed to compare with action levels stated in the plan. If action levels were exceeded, further agreement will be reached for either removal of contaminated soils or closure based on risk assessment. Following soils testing and acceptance or additional work as agreed, the Burn Area will be back-filled as necessary, regraded, and reseeded with grass (check). Complete descriptions of the closure activities are included in the Amended Burn Area Closure Plan.

3.0 DOCUMENTATION OF CLOSURE ACTIVITIES BY INDEPENDENT PROFESSIONAL ENGINEER

This section provides the documentation by the independent professional engineer of closure activities witnessed by him or his representative. Notes for all site visits are presented in Appendix A. The following subsections discuss each phase of the closure.

3.1 Facilities Decontamination

Facilities decontamination activities were completed according to the closure plan over the period of 6-25-96 to 8-26-96. Except as noted in the site visit documentation, most decontamination activities were not witnessed. However, evidence of satisfactory decontamination is provided by the rinseate samples which were collected and analyzed for contaminates as specified in the closure plan.

The sampling and analysis methods are presented in the Amended Burn Area Closure Plan along with the results of all sample analyses are.

The rinseate analyses indicate all, except Building 90 floor (see 4.3), facilities were either satisfactorily decontaminated or clean enough without decontamination to allow dismantling and demolition to proceed.

3.2 Facilities Dismantling and Demolition

Dismantling and demolition for all above grade facilities (except for Magazine 53 which is being retained) occurred over the period 9-3-96 to 12-31-96). Most of these operations were observed as described in the site visit documentation (Appendix A). Track hoes equipped with either a shear, grapple or pneumatic hammer completed the demolition and dismantling and loaded the debris into containers for disposal.

The Energetic Materials Pretreatment Unit and the Thermal Treatment Unit were both crushed and made useless except as metal scrap. All retort appurtenances were removed and along with the retort barrel disposed of as scrap metal. Appendix B provides documentation of the retort fate as scrap metal for smelting.

There are no underground utilities associated with the Burn Area facilities. Only above ground electrical service was provided to the area and this service removal was one of the initial removal activities. Piping for propane (by temporary above ground tank) used for fuel at the retort was placed in the at grade slab at the retort area and was removed with the slab.

All at grade concrete slabs and below grade footings were removed over the period 9-3-96 to 12-31-96 following receipt of satisfactory rinseate analyses.

A site visit was made 12-31-96 after removal of all facilities, at grade slabs, and footings and prior to back-fill of the area to document completion of all planned removal activities (Appendix A).

3.3 Disposal of Hazardous Waste, Debris, and Scrap Metal

Disposal of closure generated waste has followed plan requirements. Additionally, all materials for disposal have been surveyed and have met normal Mound radiological release criteria as part of routine health physics requirements. Disposal of the following quantities of waste material has been completed:

Hazardous wastes - 36,267 lb.
To: Laidlaw Environmental Services
Pinewood, SC,
Rollins Environmental Services
Baton, LA,
Allworth of Tennessee,
Pleasant, TN.

Specific details as to types and quantities are presented in Appendix C.

Sanitary landfill (debris) waste - 110 cubic yards
To Koogler-Stony Hollow

Scrap metal for smelting - 63,440 lb.
To Franklin Iron & Metals Corp.

Appendices B, C, and D respectively include disposal related records for quantities and fate for the scrap metal, hazardous waste, and debris.

3.4 Other Site Cleanup Activity

See Amended Burn Area Closure Plan.

3.5 Soil Sampling

Post demolition Burn Area soils were sampled to identify any residual contamination. Analysis of these samples identified that only antimony exceeded the action level in the Amended Burn Area Closure Plan.

3.6 Final Site Reclamation

The site excavations will be back-filled with clean soil when approval of the risk-based closure is granted. The excavated areas have not been back-filled.

4.0 DEVIATIONS FROM OR MODIFICATIONS TO CLOSURE PLAN ACTIVITIES

4.1 Pyroshed raised wood floor pallets

The wood flooring covering the concrete slab at the Pyroshed was removed prior to demolition and decontamination verification and its whereabouts is not known.

4.2 Final burn in retort barrel

The final burn of the retort was completed through a series of flash burns instead of a steady burn.

4.3 Building 90 Slab Rinseate

The concentration of antimony in the final rinseate sample did not meet the remediation goal specified in the closure plan. Analysis of the floor paint confirmed that antimony was a constituent of the floor paint used in this structure. Both DOE and Ohio EPA were advised about the source of the antimony contamination prior to disposal as solid waste.

4.4 Risk-Based Closure

Because of the antimony residue found in the soil sampling, a Risk Assessment for Risk-Based Closure was prepared by Mound as an appendix to the Amended Burn Area Closure Plan.

5.0 CERTIFICATIONS

5.1 Professional Engineer

In accordance with OAC 3745-66-15, the undersigned independent professional engineer registered in the State of Ohio hereby certifies that the Burn Area has been closed in accordance with the closure procedures in the approved Burn Area Closure Plan and as described in Sections 3.0 and 4.0 above.

Carlton C. Schroeder

Parsons, Independent Registered Professional Engineer

STATE OF OHIO
CARLTON
C.
SCHROEDER
E-35145
PROFESSIONAL ENGINEER

Carlton C. Schroeder
1/21/98

5.2 Owner/Operator

In accordance with OAC 3745-50-42(D), the undersigned operator Certifies under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner/Operator of Facility

6.0 LIST OF APPENDICES

APPENDIX A	Notes from Site Visits
APPENDIX B	Documentation of Retort Fate as Scrape Metal for Smelting and Disposal Related Records for Quantities and Fate of Other Scrap Metal
APPENDIX C	Disposal Related Records for Quantities and Fate for Hazardous Waste
APPENDIX D	Disposal Related Records for Quantities and Fate for Debris

APPENDIX A

Notes from Site Visits

INTEROFFICE CORRESPONDENCE

TO: Carlton Schroeder

FROM: Ralph R. Jaeger RRJ

DATE: September 19, 1996

SUBJECT: Mound Burn Area Closure Plan

Tuesday, September 3, 1996:

I arrived at the Burn Area Site at 6:30 a.m.. It was still dark. The technician arrived at 7:10 a.m. to open the gate. The electrician arrived with the technician and started removing wires from Building 90. The trade foremen, J. V. Adams, Dawn Harden, and Dan Gorman, arrived at 7:30 a.m. followed shortly by the two heavy duty equipment operators and their equipment (track hoe with large shear mounted) (wheeled Tonka toy type with forks mounted). They needed to widen the gate for the track hoe. The shear easily solved that problem by cutting down a section of fence.

The first project was to take down the sheet metal part of the Open Burn Unit.

Open Burn Unit:

Item 1. Dawn said they did not do Item 1 as written. They did a series of flash burns instead. This was done earlier; I did not witness.

Item 4. The sand filling was not removed from the interior of the unit walls and placed in containers before the shear demolished the sheet metal wall. The sand flowed onto the ground as the walls were cut. Mound said they would collect the sand later.

Item 5. The roof and walls were cut into pieces and laid onto the ground. In the afternoon, heavy duty switched from the shear to the grapple and placed the sheet metal into a roll off dumpster.

Item 6. No work on the concrete footer was done this week. Dawn Harden emphasized to the H.D. operator to try not to disturb any concrete.

Note: The last operation of the day was to dump the dumpster back onto the ground so RCTs could survey the scrap.

The Pyroshed:

The roof and chain link fence were demolished after the open burn pit walls. The wood platform floor cover had been previously removed by Mound trades people. As of Tuesday afternoon, the roof material and chain-link fence were torn down by the shear and in a pile on the ground waiting to be put into a dumpster. The concrete pad remained in place.

The Retort Unit:

The sheet metal building was cut down and the metal roof removed in the late morning. Also, the shear was able to yank out the feed mechanism for the retort. The stack was also cut and removed by the shear. Per several Mound people, the retort barrel had been examined for classified material previously using an inserted video camera. The concrete walls were left in place. One of the concrete walls remains to be washed (decontaminated). The other walls were decontaminated previously.

4a) Was previously done.

Energetic Materials Pretreatment Unit:

The unit was previously removed and currently sits near the gate by the fence. It resides near other shelves and such that is designated for excess (reuse).

Thermal Treatment Unit:

Same as above.

Tuesday

A lot of work. The day ended with emptying roll-off dumpster onto the ground because H.P. had not surveyed.

Wednesday

Contest day between H.P. and Final Disposition. No work done. Big meeting with H.P.

Thursday

H.P. to survey scrap metal for release to offsite smelter. May plan to lift retort and set it off to the side so technicians can get into retort area and wash down the remaining wall. Dawn called late morning to say that the plan was canceled for Thursday afternoon. It was rescheduled for Monday.

Monday, September 9, 1996

They plan to lift retort and place onto "low-boy" for removal from the plant.

I asked Dawn what time they planned to lift retort out of Building 90. She informed me that contrary to her call to me on Thursday, they had lifted the retort out on Thursday afternoon and had decontaminated the remaining wall without telling her. She told me that Dave Glockler was going to take rinseate samples about 2:00 p.m.

I observed Dave's sampling. Dave sampled drum BA 010395 Dec. This is Mound's bar code number. Drum was in Magazine 53 (adjacent to the Burn Area). Dave then went to Building 90 and rinsed the floor. Then he mopped up (collected) rinseate. Three sample jars were filled with rinseate (1 liter jars). The mophead was then placed in the drum with other decon materials.

Wednesday, September 11, 1996

Sun Ngo had called late on Tuesday to say that the roll-off dumpster had been exchanged for the empty one and that the flatbed truck would be at the Mound tomorrow (Wednesday) at 7:30 a.m. to load and carry off retort. Dawn Harden stopped by to give me the same message.

On Wednesday, September 11, 1996 at 7:30 a.m., I arrived at the Burn Area. The technician arrived at 7:30 a.m. to open the gate. Heavy Duty was there when I arrived.

The flatbed had not arrived by 8:30 a.m. so H.D. began loading the remaining scrap metal from buildings into the roll-off. They specifically and individually crushed the Energetic Materials Pretreatment Unit and the Thermal Treatment Unit and then loaded the units into the roll-off along with the other building scrap metal. All parts of the retort except the barrel were loaded in this dumpster.

About 10:00 a.m., Franklin Salvage hauled the filled roll-off away and dropped off an empty. The empty may not be needed. H.D. was able to load almost everything into the previous dumpster. The flatbed truck for the retort arrived shortly after the roll-off dumpster truck. H.D. picked up the barrel (only part left) with grapple and placed the retort barrel on the truck. The retort barrel was chained and blocked onto the truck and the truck was weighed. Dawn followed the truck to observe the weighing of the loaded truck. The weighing was on the Mound scales.

November 13, 1996

Carlton Schroeder

On November 12, 1996, I witnessed the loading of 37 drums (18-55 gal. and 19-30 gal.) of soil and sand from the "burn area". These drums were staged in building 72 and loaded onto a Laidlaw Environmental Services' truck for transport to a South Carolina land fill. All drums contained Hazardous waste labels and all the DOT and EPA markings.

The drums were listed on EPA form 8700-22 "Uniform Hazardous Waste Manifest".

There are approximately 45 remaining drums of ash and debris, on site, that must be removed for completion of the "burn area" clean up.

Don F. Luthy
Sr. Tech. Consultant

attachment: Drum list

cc: Ralph Jaeger
Mike Usher

ste Description	Waste Profile	EPA Nos.	Weight (lbs)	Drum ID	Lab pack	ID
SO.., SAND CLEANUP WASTE (LES 749)	925	D006 D008	329.8	96 166	0	0
SOIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	347.0	96 167	0	0
SO ., SAND CLEANUP WASTE (LES 749)	925	D006 D008	332.5	96 168	0	0
SO ., SAND CLEANUP WASTE (LES 749)	925	D006 D008	330.3	96 169	0	0
SOIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	326.3	96 170	0	0
SO., SAND CLEANUP WASTE (LES 749)	925	D006 D008	328.4	96 171	0	0
SO , SAND CLEANUP WASTE (LES 749)	925	D006 D008	421.3	96 173	0	0
SOIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	426.3	96 174	0	0
SO , SAND CLEANUP WASTE (LES 749)	925	D006 D008	419.3	96 175	0	0
SO , SAND CLEANUP WASTE (LES 749)	925	D006 D008	326.7	96 176	0	0
SO., SAND CLEANUP WASTE (LES 749)	925	D006 D008	358.5	96 177	0	0
SOIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	326.7	96 178	0	0
SO , SAND CLEANUP WASTE (LES 749)	925	D006 D008	494.0	96 181	0	0
SO., SAND CLEANUP WASTE (LES 749)	925	D006 D008	542.8	96 182	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	707.0	96 183	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	557.7	96 184	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	545.4	96 185	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	554.1	96 186	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	697.5	96 187	0	0
O , SAND CLEANUP WASTE (LES 749)	925	D006 D008	707.6	96 188	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	373.8	96 189	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	469.8	96 190	0	0
O , [illegible] CLEANUP WASTE (LES 749)	925	D006 D008	420.5	96 200	0	0
O , [illegible] CLEANUP WASTE (LES 749)	925	D006 D008	398.4	96 201	0	0
OIL, [illegible] CLEANUP WASTE (LES 749)	925	D006 D008	399.1	96 202	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	375.3	96 203	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	387.4	96 204	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	393.8	96 205	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	408.0	96 206	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	360.4	96 216	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	424.1	96 217	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	346.9	96 218	0	0
O SAND CLEANUP WASTE (LES 749)	925	D006 D008	579.4	96 219	0	0
OIL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	601.8	96 220	0	0
IL, SAND CLEANUP WASTE (LES 749)	925	D006 D008	556.3	96 221	0	0
I SAND CLEANUP WASTE (LES 749)	925	D006 D008	487.2	96 222	0	0
I SAND CLEANUP WASTE (LES 749)	925	D006 D008	502.8	96 223	0	0
* Total ***			16564			

Form Approved. OMB No. 2050-0039. Expires 9-30-9

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH6890008984 Manifest Document No. 0334

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
U.S. DOE - MOUND PLANT
MOUND LAB FACILITY, 1 MOUND AVE P. O. BOX 66, MIAMISBURG, OH 45343-0987

4. Generator's Phone (513) 865-3078

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: LAIDLAW ENVIRONMENTAL SERVICES (TS), INC.

6. US EPA ID Number: MDD980554653

C. State Transporter's ID 185-NW

D. Transporter's Phone (615) 350-5400

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
LAIDLAW ENVIRONMENTAL SERVICES (TS), INC.
2815 OLD GREENBRIER PIKE
GREENBRIER, TN 37073-4514

10. US EPA ID Number: TND000645770

G. State Facility's ID

H. Facility's Phone (615) 643-4511

	11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	Hazardous Waste, solid, n.o.s., (Lead, ~~Mercury~~ Cadmium), 9, NA3077, P.G. III, R.Q. (~~D011, D005~~ D006, ~~D007~~, D008, ~~D007, D010, D011~~) BR	X	037	DM	16564	P	D006 ~~D004~~ BR
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
Additional EPA Waste Codes a. D008 b. c. d.

K. Handling Codes for Wastes Listed Above
a. S-01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Profile Numbers a. 96MTO-749, DOT ERG #171 b. c. d.
Emergency Contact: 800-535-5053 (597) INFOTRAC

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.
If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

GENERATOR

Printed/Typed Name: MICHAEL ISPER
Signature: Michael Isper
Month Day Year: 11 12 96

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: DONNIE LYONS
Signature: Donnie Lyons
Month Day Year: 11 12 96

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name
Signature
Month Day Year

PRINTED ON RECYCLED PAPER USING SOYBEAN INK

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

ORIGINAL - RETURN TO GENERATOR

ENVIRONMENTAL SERVICES

FORM A

Customer Notification And Certification

Generator Name/Location: U.S. DOE-Mound Plant / Miamisburg, OH

A I.D. Number: OH6 890 008 984

..aste Profile or ARF Designation: See Attached

Manifest Number: 00334

EPA Waste Number(s): See Attached

Waste Analysis Available? Yes (attached) _____ No X On file at receiving facility _____

Unrestricted Waste Notification (*Category 1*)

Mark the statement below if you generate a waste that is not a land disposal restricted waste (the waste has no applicable treatment standards).

☐ *I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is not restricted as specified in 40 CFR §268, Subpart D or any applicable prohibitions set forth in 40 CFR §268.32 or RCRA Section 3004(d).*

Restricted Waste/Debris Notification (*Category 2*)

Mark statement (2a) below if you generate a waste that is restricted from land disposal (the waste has applicable treatment standards). NOTE-1: A waste may pass one or more standards and require treatment or be varianced for others. In this case, all applicable categories must be checked. NOTE-2: D001, D002 and D012 - D043 wastes must be evaluated for underlying constituents found in 40 CFR §268. 48 (Table UTS), that are reasonably expected to be present. A list of these constituents must be included on FORM B, or attached to and accompany this notification with each waste shipment. Mark statement (2b) if you generate a debris waste that will be treated to the alternate debris standards located in 40 CFR §268.45.

☒ (2a) Restricted Waste Notification

I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is subject to the treatment standards specified in 40 CFR §268 Subpart D. The waste: (a) must be treated to the appropriate regulatory treatment standard, by the appropriate regulatory treatment method; (b) qualifies for a variance as described in category 3 below; or (c) meets some or all of the standards as described in Category 4 below.

☐ (2b) Alternate Debris Treatment Notification: This hazardous debris is subject to the alternate treatment standards of 40 CFR §268.45.

The waste contains the following contaminants subject to treatment [check all that apply]:

_____ §268.45(b)(1) - Toxicity characteristic debris;

_____ §268.45(b)(2) - Debris contaminated with listed waste;

_____ §268.45(b)(3) - Cyanide reactive debris.

Restricted Waste Variance Notification (*Category 3*)

Mark the statement below and list the applicable variance date on Form B, if you generate a waste which does not require treatment prior to land disposal because of a variance (including a case-by-case extension under 40 CFR §268.5, a nationwide variance under 40 CFR §268 Subpart C, a no migration petition under 40 CFR §268.6, or other applicable variance).

☐ *I notify pursuant to 40 CFR §268.7(a)(3) that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that this waste is subject to a national capacity variance under 40 CFR §268 Subpart C, or a case-by-case extension under 40 CFR §268.5, or an exemption under 40 CFR §268.6.*

Restricted Waste Certification (Treatment Standards Met) (*Category 4*)

Mark the certification statement below if you generate a waste that is restricted from land disposal (the waste has applicable treatment standards), and the waste meets the standards as generated. Note: All applicable constituent standards must be accounted for. A waste may pass one or more standards and require treatment or be variance for other constituents. In this case, all applicable categories must be checked.

☐ *I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D and all applicable prohibitions set forth in 40 CFR 268.32 or RCRA § 3004(d). I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.*

SIGNATURE: Michael Ispen DATE: 11-12-96

PRINT NAME: MICHAEL ISPEN TITLE: ENGINEER

Revised 10/94 585-7510-585003

FORM A

FORM B1 *(Must be accompanied by Form A*

Generator Name/Location U.S. DOE- Mound Plant / Miamisburg, OH Page 2 of 2

EPA I.D. Number : OH6 890 008 984 Manifest : 00334

Waste Profile or ARF	Category No.	EPA or State Waste Code	Variance Date	Description/Sub Category	Treatability Group (WW or NWW)	Waste Constituents or Legend #
8bMTO-749	2a	D008			NWW	
↓ ↓	↓	D006			NWW	

CONSTITUENTS IN SOLVENT, CALIFORNIA LIST AND CHARACTERISTIC WASTES.

F001 - F005 spent solvents

Legend #	Constituent Name
1	Acetone
2	Benzene
3	n-Butyl alcohol
*4	Carbon disulfide
5	Carbon tetrachloride
6	Chlorobenzene
7	Cresol (m-and p-isomers)
8	o-Cresol
*9	Cyclohexanone
10	1,2-Dichlorobenzene
11	Ethyl Acetate
12	Ethyl Benzene
13	Ethyl Ether
14	Isobutyl alcohol
*15	Methanol
16	Methylene Chloride
17	Methyl Ethyl Ketone
18	Methyl isobutyl ketone
19	Nitrobenzene
20	Pyridine
21	Tetrachloroethylene
22	Toluene
23	1,1,1-Trichloroethane
24	1,1,2-Trichloroethane
25	Trichlorothylene
26	1,1,2-Trichloro-1,2,2-trifluoroethane
27	Trichloromonofluoro-methane
28	Xylenes (total)

Legends 29-31 RESERVED

** If these constituents are present alone or in any combination of the three, then non waste water forms of these constituents must be treated to TCLP levels as indicated in §268.40.*

Technology-Based standards For F005 when the constituent is the only listed F00-F005 solvent

Legend #	Constituent Name
32	2-Ethoxyethanol
33	2-Nitropropane

Legends 34-43 RESERVED

CALIFORNIA LIST WASTES

Legend #	Constituent Name
44	Nickel
45	Thallium
46	Cyanide (Liquid)
47	Liquid Polychlorinated Biphenyls (PCB's)
48	Halogenated Organic compounds (HOC's)

SEE BACK FOR THE UNIVERSAL TREATMENT STANDARDS (UTS), Legends 49 - 264

Container Contents

☒ Bulk ☐ Lab Pack RQ _____

	Year Month Day	Code	Number	Chemist
Container Number:	961112	GBMTO	01-37	BR

Shipping	Hazardous Waste, solid, n.o.s.
Container Type:	* See Below
Size	
ID Number:	NA3077
NM	X
Absorbent	CVOX
Hazard Class:	9, III

Profile Number	MTO-749
Disposal Site	
Approval Code	
Reactive Wt.	

Line No.	Material Description	PS	Material Quantity	IC	EPA Waste Code Number
01	Soil 100%		18 ~~30~~ x 55 gal		~~D001~~
02			19 x 30 gal		~~D005~~
03					D006
04					~~D007~~
05					D008
06	QC L S SL pH		Appearance		~~D009~~
07	C1 0 36 0 N/A		Sand/Soil		~~D010~~
08	C2 0 36 0 ↓		↓		~~D011~~
09	C3 0 36 0 ↓		↓		
10	~~68~~# | Mand #				
11	01 - 220 17 - 222		33 - 205		
12	02 - 221 18 - 219		34 - 206		
	3 - 223 19 - 218		35 - 167		
	04 - 181 20 - 217		36 - 166		
15	05 - 182 21 - 216		37 - 201		
16	06 - 183 22 - 168				
17	07 - 184 23 - 169				
18	08 - 185 24 - 170		* C1 - 18, 17 H 55		
19	09 - 175 25 - 171		19 - 37, 17 H 30		
20	10 - 174 26 - 176				
21	11 - 173 27 - 177				
22	12 - 186 28 - 178				
23	13 - 187 29 - 200				
24	14 - 188 30 - ~~201~~ 202				
25	15 - 189 31 - 203				
26	16 - 190 32 - 204				
27					
28					

ABSORBENT
C - CORN COB
V - VERMICULITE
O - OIL DRY
X - OTHER

PS - PHYSICAL STATE
L - LIQUID/POURABLE
S - SOLID
SL - SLUDGE
D - POWDER OR DUST

IC - INTERNAL CONTAINER
G - GLASS M - METAL
P - PLASTIC F - FIBER
B - BAGGED

This Lab Pack list continues: Yes ☐ No ☒ This is page 1 of 1

ORIGINAL - FINAL T.S.D. • GREEN - TRANS/CERT • YELLOW - DISPOSER • PINK - 1ST T.S.D. • GOLD - GENERATOR

MATERIAL TRANSFER AND DISPOSAL TAG

PLEASE PRINT UNLESS SIGNATURE INDICATED

ITEM NO. FROM P/WRL
96-38-208

ITEM(S)
DRUMS OF ASH, SAND + SOIL

TRANSFER TO
LAIDLAW ENVIRONMENTAL
GREENBRIAR, TENN
Organization, Bldg. & Room — Extension

TRANSFER FROM
STEVEN L. KING
WM - BLDG 72 — 5117
Organization, Bldg. & Room — Extension

☑ EXEMPTED PROPERTY TRANSFER APPROVAL
The above described item(s) is exempt from radiological survey.

Bill [illegible] — [redacted] — 11-11-96
RCT/Area HP Signatrure — HP # — Date

☐ SURVEYED PROPERTY RELEASE APPROVAL
The above described item(s) has been surveyed in accordance with MD-80036 90014 and was approved for unrestricted release.

RCT Signatrure — HP # — Date

Item No. (from survey record) _____

☐ EVALUATED PROPERTY RELEASE APPROVAL
The above item(s) has been evaluated in accordance with MD-80036 10004 and was approved for unrestricted release.

RCT/Area HP Signatrure — HP # — Date

Full Signature of Sender
Steven L. King
HP # [redacted]

Extension	Building	Date
5117	72	11/7/96

ML-9588

8 Triangle Park Drive, Suite 304 • Cincinnati, OH 45246 • 513-326-7800 • Fax 513-326-7808

To: Carlton Schroeder

Date: 1-2-97

From: Ralph Jaeger RRJ

On Monday and Tuesday December 30 and 31, 1996, I was at the Mound Plant observing work in the Burn Area. The work in progress was the removal of all remaining concrete. This included the walls, floor slab, and footer of the retort building; the footer and floor of the open burn pit; the pyroshed floor slab; and various concrete walkways between buildings.

The concrete was, in almost all cases, reinforced with what looked like 3/8 inch diameter steel rod.

The work was performed by Heavy Duty Workers using track hoes mounted with hydraulic hammers. The concrete rubble was placed into large roll-off dumpsters. The rubble was separated into concrete that had been in contact with soil (foundations, floor slabs, and walkways) and that which had not (walls).

By noon on Tuesday, nine dumpsters were filled with rubble. Four were tagged by health physics as ready to be hauled off-site to be disposed of at a sanitary landfill. All others were to be held on-site pending additional analysis. By close of business on Tuesday, Koogler Suburban had hauled off 3 of the 4 dumpsters and returned them empty. The workers refilled them with material that had been in contact with soil. There still remains at lease two or three dumpsters worth of rubble primarily from the retort building's footer.

All workers were very conscientious about the segregation of the rubble.

bc: J. M. Usher

PARSONS

INTEROFFICE CORRESPONDENCE **PARSONS ID#** 00:000:002:0028-97

TO: Carlton Schroeder **DATE:** March 27, 1997

FROM: Ralph R. Jaeger **PHONE:** (513) 648-6780

SUBJECT: Soil Sampling Burn Area

On March 13, I attended a kick-off meeting for the soil sampling in the Burn Area at Mound as part of the RCRA Closure of this area. The sampling was scheduled to begin the next Monday or Tuesday (March 17 or 18) depending on the resolution of some health physic issues concerning the handling of samples to be sent off site for analysis. These issues were not immediately resolved and the sampling was rescheduled for Monday, March 24, 1997.

I visited the Burn Area that Monday afternoon to observe the soil sampling. A sketch of the sampling locations is attached. The core drilling was performed by Bowser Morner Construction. The samples were taken and handled by Roy F. Weston. Samples were taken at 0-6 inches, 1-2 feet and 2-3 feet.

I observed the sampling of locations #14, #20, #19, and #24. Sample location #24 was taken in the pit near the edge (below grade). One of the samples (0-6) from this location clearly showed a black band about an inch or so thick.

I observed the sampling of locations #15 and #16 on Tuesday morning. The Bowser Warner power hammer broke during the sampling of location #16 and sampling was halted until a new piece of equipment was brought to the site. Soon after the new drill rig arrived so did the rain.

On Wednesday, I observed the sampling of locations #13 and #12. As an example the Maronelle Sample for location #12 was taken from the 1-2 foot sample. A sample from this location was labeled sample 000052 bottle number 064402090, time 11:20, Analysis RNA + Explosives.

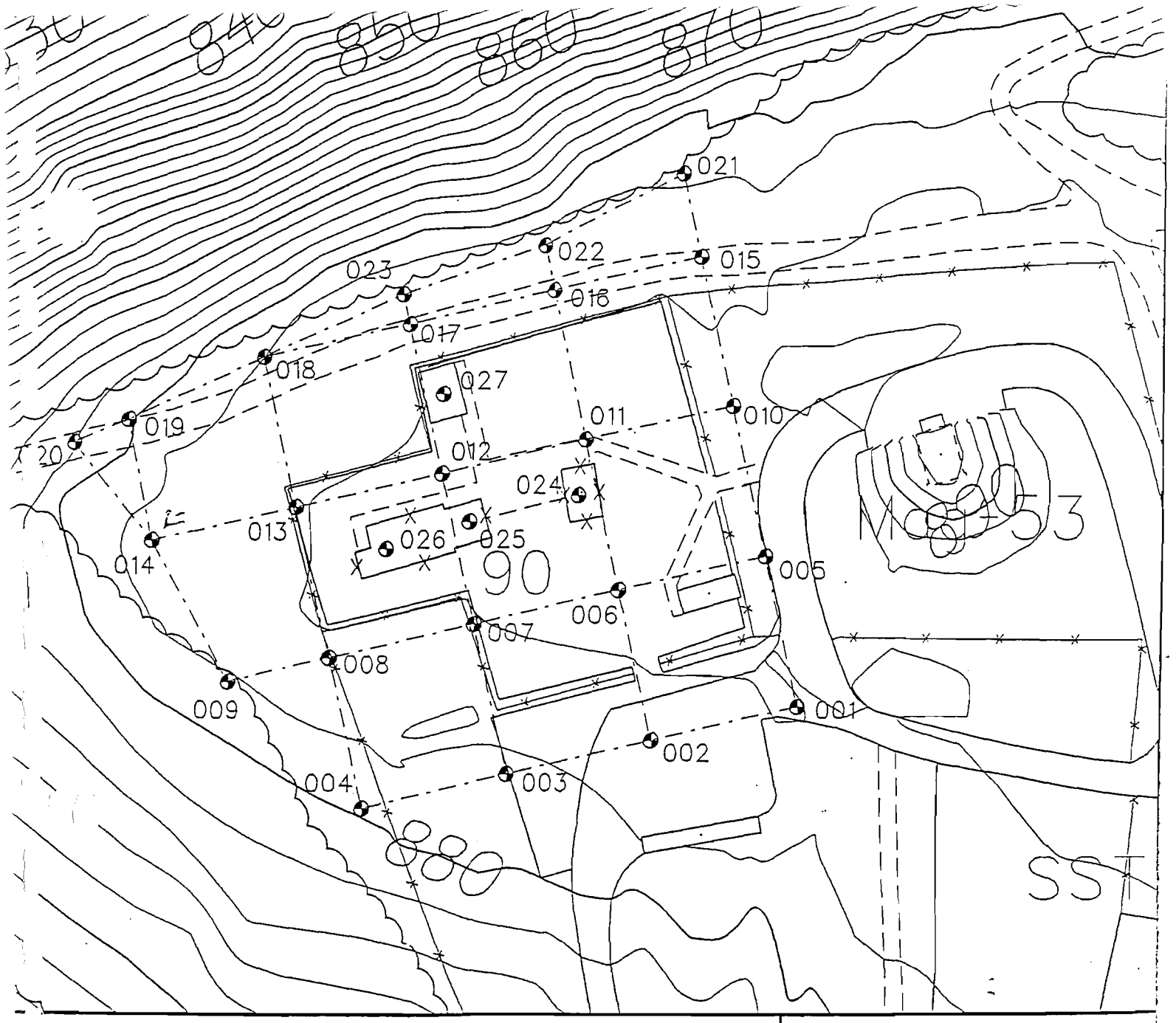
It should be noted that several locations took two drillings because of hitting rock on the first try. Both the Bowser Morner drillers and the Weston worker seemed very conscientious in the conduct of their work.

The location numbers are not shown on the sample bottles. All samples, location etc. are tied together on the "Field Entry Form". The Weston person places a Chain of Custody Seal on Each Sample and fills out a Chain of Custody Form. He copies this form, keeps the last 3 of 6 NCR type copies, and sends the top 3 copies with the sample to the lab via Federal Express.

Attachment

c: Document Control

OUDATA\OU-2\MOUND\BURN.IOC



BURN AREA CLOSURE PLAN
SOIL SAMPLING LOCATIONS

LEGEND

● CORE SAMPLES

X EXCAVATION FACE SAMPLE

MOUND ERGIS

Environmental Restoration Geographic Information System

0 50 100

Scale in feet

Memorandum

DATE: December 11, 1997

TO: Carlton Schroeder

FROM: Ralph R. Jaeger RRJ

RE: RCRA Closure of Mound Burn Area - Site Visit

CC: File

On December 10, 1997, I visited the referenced area at approximately 9:00 am. After checking in with the project manager, Rich Bauer, I went to the Burn Area. All demolition activities are complete. There has not been much, if any, backfill. For example, the excavation of the Open Burn Unit has not been backfilled and currently is filled with rainwater. The sand from the inner walls of the Open Burn Unit remains in a nearby pile. This sand will be used to back fill the excavation when clearance is received.

The area is fenced with either six foot high chainlink or orange construction fence. The gate is not locked.

Also, I met with Phil Parker. He gave me a copy of their "Draft Risk Assessment for Risk-Based Closure Attachment to the Modified Amended Burn Area Closer Plan. I have made you a copy.

APPENDIX B

Documentation of Retort Fate as Scrap Metal for Smelting and Disposal Related Records for Quantities and Fate of Other Scrap Metal

Scrap metal was hauled off by Franklin Iron & Metal Corp. To their processing facilities to be processed for use as remelt for new steel production. Franklin Iron & Metal Corp. certifies that the material will not be resold for any other purposes, will not be disposed of as solid waste, or recycled in any other manner (See attached).

Total weight of scrape metal: 63,440 lb..

Franklin Iron & Metal Corp.

ISRI

STEEL
BRASS
COPPER
STAINLESS STEEL
ALUMINUM
MACHINERY
EQUIPMENT

Dealers and Processors of
SCRAP STEEL • NON-FERROUS METALS
MILL BROKERS

1939 EAST FIRST STREET
DAYTON, OHIO 45403
PHONE (513) 253-8184

September 11, 1996

EG&G Mound
Attn: Mr. W. David Glocker, Environmental Engineer

Dear Mr. Glockler,

Franklin Iron and Metal Corp. acknowledges the receipt of scrap steel from the EG&G Mound facility. In accordance with our standard procedures the scrap will be processed to mill specifications, then sold and used as remelt for new steel production. As Franklin Iron and Metal Corp. processes and sells over 15,000 tons of steel per month to several mills, we are unable to say at this time which mill would receive the scrap.

Franklin Iron and Metal Corp. certifies that the material will not be resold for any other purposes, will not be disposed of as solid waste, or recycled in any other manner.

Best Regards,

Greg Goble
Customer Relations

greg

FRANKLIN IRON & METAL CORPORATION

P 224676

(513) 253-8184

2015 EAST FIRST STREET
DAYTON OHIO 45403

RECEIVING REPORT

DATE 9-10 1996

CUSTOMER NAME: EG AMOUND

ADDRESS BUTLNATA

ORDER NO. | TRUCK NO. 1 + -30 | VIA TAM

WEIGHT	DESCRIPTION	PRICE	AMOUNT
	SHEET IRON		
	UNPREPARED STEEL MISC		
	STEEL TURNINGS		
	CAST IRON		
	UNCLEAN MOTORS		
	STEEL CLIPS		
	NON FERROUS		
	Truck = 51840 lbs		
	w/container		
	Truck only = 29000 lbs		
	Container only = 7360		
	∴ total steel wt = 15480 lbs		

OFFICE COPY

FRANKLIN IRON & METAL CORPORATION

P 224735

(513) 253-8184

2015 EAST FIRST STREET
DAYTON OHIO 45403

RECEIVING REPORT

DATE 9-11, 1996

CUSTOMER NAME: BIG MOUND

ADDRESS BURNS AREA

ORDER NO. | TRUCK NO. 4555 | VIA TRM

WEIGHT	DESCRIPTION	PRICE	AMOUNT
	SHEET IRON		
	UNPREPARED STEEL MISC.		
	STEEL TURNINGS		
	CAST IRON		
	UNCLEAN MOTORS		
	STEEL CLIPS		
	NON FERROUS		
	Total wt = 47900 lbs		

OFFICE COPY

APPENDIX C

Disposal Related Records for Quantities and Fate for Hazardous Waste

There were 34698.6 lb. of hazardous waste generated and disposed in 1996 and 1571 lb. in 1997. Details including the waste description, weight , manifest data, end disposal site, and disposal method are listed in the attached table.

194r

Burn Area Info

Waste Source	Waste Description		Weight (lbs)	Manifest	Manifested To:	End Disposal Site	Disposal Method
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	601.8	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	420.5	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	556.3	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	502.8	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	494.0	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	542.8	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	707.0	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	557.7	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	545.4	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	419.3	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	426.3	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	421.3	334	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS

BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	379.8	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	374.3	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	311.9	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	359.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	378.8	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	379.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	287.6	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	376.2	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	354.5	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	379.7	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	325.8	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	391.7	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	367.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	393.9	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS

BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	282.2	,5	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	(ABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	373.3	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	377.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	374.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	289.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	294.6	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	334.6	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	377.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	377.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	393.9	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	371.8	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	315.6	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	387.8	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	293.7	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATION POZZOLANIC MATERIALS

BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	372.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	342.2	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	368.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	396.5	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	355.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	307.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	379.1	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	380.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	386.2	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIC POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	392.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATI POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	411.4	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	SOIL, SAND CLEANUP WASTE (LES 749)	D006 D008	402.0	335	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	LAIDLAW ENVIRONMENTAL SERVICES, ROUTE 1, BOX 255, PINEWOOD, SC 29125	STABILIZATION, FIXATIO POZZOLANIC MATERIALS
BURN AREA	ASH WASTE	NONE	51.2	310	ROLLINS ENVIRONMENTAL SERVICES, 13351 SCENIC HIGHWAY, BATON ROUGE, LA 70807	XXX	
BURN AREA	ASH WASTE	D006	120.0	321	ROLLINS ENVIRONMENTAL SERVICES, 13351 SCENIC HIGHWAY, BATON ROUGE, LA 70807	XXX	

BURN AREA	ASH WASTE	D006 D008	47.9	21	ROLLINS ENVIRONMENTAL SERVICES, 13351 SCENIC HIGHWAY, BATON ROUGE, LA 70807	XXX
BURN AREA	ASH WASTE	D006 D008	151.3	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	267.4	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	373.8	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	373.5	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	464.5	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	302.6	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	384.8	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH WASTE, DEBRIS	D006 D008	112.2	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
BURN AREA	ASH, DEBRIS SCRAP WASTE	D006 D008	76.4	337	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	XXX
*** Total ***			34698.6			

Burn Area Info

Waste Source	Waste Description		Weight (lbs)	Manifest	Manifested To:	End Disposal Site	Disposal Method
BURN AREA	BURN AREA PPE, DEBRIS	NONE	99.0	353	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	XXX	
BURN AREA	RINSE WATER	NONE	217.6	353	LAIDLAW ENVIRONMENTAL SERVICES, 2815 OLD GREENBRIER PIKE, GREENBRIER, TN 37	XXX	
BURN AREA	OIL, FUEL OIL, ABSORBED, VERMICULITE CLEANUP	NONE	231.4	345	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	LAIDLAW ENVIRONMENTAL SERVICES, 2027 BATTLEGROUND RD., DEER PARK, TX 77536	
BURN AREA	OIL, FUEL OIL, ABSORBED, VERMICULITE CLEANUP	NONE	219.1	345	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	LAIDLAW ENVIRONMENTAL SERVICES, 2027 BATTLEGROUND RD., DEER PARK, TX 77536	
BURN AREA	OIL, FUEL OIL, ABSORBED, VERMICULITE CLEANUP	NONE	250.8	345	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	LAIDLAW ENVIRONMENTAL SERVICES, 2027 BATTLEGROUND RD., DEER PARK, TX 77536	
BURN AREA	OIL, FUEL OIL, ABSORBED, VERMICULITE CLEANUP	NONE	167.7	345	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	LAIDLAW ENVIRONMENTAL SERVICES, 2027 BATTLEGROUND RD., DEER PARK, TX 77536	
BURN AREA	RINSE WATER	NONE	385.9	345	ALLWORTH OF TENNESSEE, INC, 101 SOUTH PARK DR., MT. PLEASANT, TN 38474	LAIDLAW ENVIRONMENTAL SERVICES, 2027 BATTLEGROUND RD., DEER PARK, TX 77536	
*** Total ***			1571.5				

APPENDIX D

Disposal Related Records for Quantities and Fate for Debris

Debris, mostly in the form of concrete and concrete with rebar, was removed in roll off dumpsters.

Quantity:	110 cu yd
Destination:	Koogler-Stony Hollow

From: Oba Vincent at MOUND
To: MNDCONT.MNDPO(ZAHOJJ)
Date: 6/6/97 1:32pm
Subject: Re: Approval to Ship Roll Off's

Jim:

Based on the review of provided radiological data and the discussions with the OEPA and ODH. The referenced roll-offs may be released from the site. Please document the process utilized to complete this action.

Thanks

Oba

Date: 06/05/1997 03:53 pm (Thursday)
From: James Zahora
To: DOE_OH.MOUND.Vincent Oba
CC: DOE_OH.MOUND.Spesard Alan, TUNNRS, WARMEM, ANDRCA, DRAPDG
Subject: Request for Approval to Ship Roll Off's

Oba,

The attached describes 14 roll offs ready for off-site shipment. The projected ship dates are included. Please confirm the authorization to ship.

Jim

Date: 06/05/1997 03:31 pm (Thursday)
From: Carolyn Andrews
To: ZAHOJJ
CC: TUNNRS, WARMEM, ADKIDS
Subject: Roll-Offs Ready to Go Estimated Ship Dates

The following roll-offs are full and are awaiting final approval. The ship dates are based on conversations with Koogler-Suburban and Franklin Iron and are at best, estimated. Their schedules are arranged on a daily basis and cannot be guaranteed due to personnel, equipment, and other contract workload. They know that at least one per day can go at a minimum, and possibly up to three or four depending on workload.

1. LOCATION: Bldg. 21
SIZE: 30 Yd.
CONTENTS: Retaining Rods, I-Beams
SERIAL #333
SOURCE: RMMA
DESTINATION: Franklin Iron - Recycle
SHIP: 6/9/97

2. LOCATION: Bldg. 21
SIZE: 20 Yd.
CONTENTS: Construction Debris
SERIAL #K258
SOURCE: RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/10/97

3. LOCATION: Burn Area
SIZE: 20 Yd.
CONTENTS: Concrete
SERIAL #K149
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/10/97

4. LOCATION: Burn Area
SIZE: 30 Yd.
CONTENTS: Concrete
SERIAL #318
SOURCE: Non-RMMA
DESTINATION: Koogler -Stoney Hollow
SHIP: 6/11/97

5. LOCATION: Burn Area
SIZE: 30 Yd.
CONTENTS: Concrete
SERIAL # K200
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/11/97

6. LOCATION: Burn Area
SIZE: 30 Yd.
CONTENTS: Concrete
SERIAL #K302
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/12/97

7. LOCATION: Bldg. 19
SIZE: 30 Yd.
CONTENTS: Miscellaneous Construction Debris
SERIAL #K703
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/12/97

8. LOCATION: Bldg. 19
SIZE: 30 Yd..
CONTENTS: Miscellaneous Scrap Metal
SERIAL #H-013
SOURCE: Non-RMMA
DESTINATION: Franklin Iron - Recycle
SHIP: 6/10/97

9. LOCATION: Bldg. 19
SIZE: 10 Yd.
CONTENTS: Assorted Clear Glass
SERIAL #R268
SOURCE: Non-RMMA
DESTINATION: Koogler - Capitol Materials - Recycle
SHIP: 6/13/97

10. LOCATION: Spoils
SIZE: 20 Yd.
CONTENTS: Metal Carts
SERIAL #M222

SOURCE: Non-RMMA
DESTINATION: Franklin Iron - Recycle
SHIP: 6/11/97

11. LOCATION: Spoils
SIZE: 20 Yd.
CONTENTS: Metal Carts
SERIAL #M039
SOURCE: Non-RMMA
DESTINATION: Franklin Iron -Recycle
SHIP: 6/11/97

12. LOCATION: Spoils
SIZE: 30 Yd.
CONTENTS: Wood & Concrete
SERIAL #K571
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/13/97

13. LOCATON: Spoils
SIZE: 30 YD.
CONTENTS: Wood & Concrete
SERIAL #36202
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/14/97

14. LOCATION: Leachfield
SIZE: 30 YD.
CONTENTS: Fence Posts, Aluminum Wire, Plastic Pipe
SERIAL #K284
SOURCE: Non-RMMA
DESTINATION: Koogler - Stoney Hollow
SHIP: 6/9/97

CC: MNDCONT.MNDPO(ANDRCA,DRAPDG,TUNNRS,WARMEM),MNDCONT...

MNDCONT.MNDPO(ANDRCA,DRAPDG,TUNNRS,WARMEM),MNDCONT...

TOTAL P.004

AMENDED BURN AREA CLOSURE PLAN

U.S. Department of Energy
Mound Plant
Miamisburg, Ohio
EPA I.D. No. OH6890008984
Ohio I.D. No. 05-57-0677
January 1998
Final

1. FACILITY DESCRIPTION

1.1 General

This document identifies activities that will be necessary to permanently close the six Resource Conservation and Recovery Act (RCRA) regulated units in the area of the Mound Plant known as the Burn Area. The units were used to manage energetic materials, both weapons components and powders. No radioactive constituents were handled in these units. This document is submitted in accordance with the requirements of Ohio Administrative Code OAC 3745-66-10 through 66-15.

Mound was formerly an integrated research, development, and production facility performing work in support of U.S. Department of Energy (DOE) weapons and energy programs, with emphasis on explosives and nuclear technology. The weapons program missions included process development, production engineering, manufacturing and surveillance of explosive and nuclear components and specific testing equipment. Energy program missions included research, development, fabrication, and assembly of radioisotope-fueled heat sources for terrestrial and space applications. DOE has decided to consolidate its non-nuclear activities and move them to other DOE sites. As a result, Mound's current mission is to safely shut down operations, transfer the work to other DOE sites, and perform whatever clean up is necessary to release superfluous facilities to the City of Miamisburg for economic development. The site has 120 buildings on 1.24 square kilometers of land.

The U.S. Environmental Protection Agency (EPA) placed Mound on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on November 21, 1989 (54 *Federal Register* 48184). Pursuant to that status, the DOE and the EPA negotiated a CERCLA Section 120 Federal Facilities Agreement (FFA) and signed it on August 6, 1990. The Ohio Environmental Protection Agency (OEPA) and DOE renegotiated the FFA in 1993 and it now includes OEPA as a party. The DOE Environmental Restoration (ER) Program conducts activities covered by the FFA. The ER Program has been established to identify, assess, and remediate environmental contamination associated with release sites that resulted from spills or inadequate management of hazardous substances. There are over 400 potential release sites (PRS) that have been identified at Mound. The Burn Area encompasses four PRS's that are being investigated under the ER Program.

The general configuration of Mound and the location of the Burn Area units are illustrated in Drawing FSD920925 in Appendix A.

1.2 Topography

The major topographic feature in the region is the Great Miami River, which flows from north to south approximately 2,000 feet due west of the site. Mound is situated on two hills overlooking the river and the City of Miamisburg. The Burn Area is located on the southeastern hill. These hills consist of calcareous shales with thin interbedded limestones, covered by a thin veneer of unconsolidated glacial till deposits. A map illustrating the topography at Mound is provided in Drawing FSE920963 in Appendix A.

1.3 Other Hazardous Waste Management Units

There are currently two other hazardous waste management units in operation on-site, Building 72 (a hazardous waste storage unit) and Building 23 (a mixed waste storage unit). Mound has submitted a revised Part B permit application to permit these units. The expected year of closure of these units is 2002.

The Building 27 Filtration System, an inactive interim status unit, consisted of a filtration system through which solvent wastes were discharged. This unit is expected to be closed in 2002.

1.4 Hydrogeologic Information

To the northwest of the hill on which the Burn Area is situated is a tributary valley of the Great Miami River, referred to as the Mound Plant Valley. The valley contains the plant drainage ditch, which is underlain by fill material generated from plant grading, and interbedded glacial till and outwash deposits, the latter possibly comprising a small tongue of the Buried Valley Aquifer. The Buried Valley Aquifer, an important source of drinking water in the region, occupies a deep bedrock channel that roughly follows the course of the Great Miami River. The Burn Area does not overlie deposits contiguous with the Buried Valley Aquifer.

This RCRA closure plan does not include a ground water monitoring plan. If soil contamination is discovered to extend beyond the removed structures and soils, the potential for groundwater impacts will be reviewed with the OEPA. If ground water sampling becomes a requirement for closure, this plan will be amended to define the new monitoring criteria.

1.5 Unit Descriptions

The Burn Area includes two storage units, Magazine 53 and the Pyroshed. The Burn Area also includes four treatment units, the Open Burn Unit, the Retort Unit, the Energetic Materials Pretreatment Unit, and the Thermal Treatment Unit. A unit-by-unit description follows.

1.5.1 Magazine 53: Magazine 53 is an above grade reinforced bunker used for the temporary storage of containerized waste energetic materials (EM). The unit has been in service since around 1970. The internal structure of the unit consists of a concrete floor slab with a semi-circle of armored steel plate above it. These armored plate walls are tied to the end walls with anchor bolts and turned down plates cast integral with the end wall pour. Compacted fill surrounds the structure on three sides. The fill forms a 2:1 slope from surface elevation in a manner that provides a 3 foot thick cover at the unit's top. The uncovered front wall has a metal door for access. The unit interior is approximately 15 feet long, 10 feet wide, and 10 feet high. The capacity of the magazine is 1550 gallons (207 cubic feet). A photograph of Magazine 53 is provided in Figure 1. Appendix B contains a list of the wastes managed in Magazine 53.

1.5.2 Pyroshed: The Pyroshed is used for storage of waste energetic materials (EM). This unit consists of a reinforced concrete pad on a sub-base of gravel. A chain link fence forms the walls of the unit. A locked entry gate is located at the front of the unit. The roof is constructed of corrugated galvanized sheeting that shields the contents of the unit from direct sunlight and precipitation. Gravel surrounds the unit on all four sides. The approximate dimensions of the unit are 15 feet long by 9 feet wide by 7 feet high. The capacity of the Pyroshed is 1725 gallons (231 cubic feet). A photograph of the Pyroshed is provided in Figure 2. Appendix B contains a list of the wastes managed in the Pyroshed.

1.5.3 Open Burn Unit: The Open Burn Unit is an explosive burning facility. The unit has been in operation since approximately 1966. The unit was developed in native soil on a continuous concrete footing 18 inches wide and 30 inches deep. The enclosure's side walls consist of a layer of sand 10 inches thick sandwiched between two parallel steel plates each of which are 0.25 inches thick. All seams and joints are welded together. A 0.25 inch thick steel plate cap was welded along the top of the wall sections to close the sand filled space. The internal dimensions are approximately 10 feet wide, 10 feet long, and ten feet high. Two feet of sand form the base of the unit. The roof of the structure consists of metal grating. A photograph of the Open Burn Unit is provided in Figure 3. Appendix B contains a list of the wastes managed in the Open Burn Unit.

Figure 1: Photograph of Magazine 53

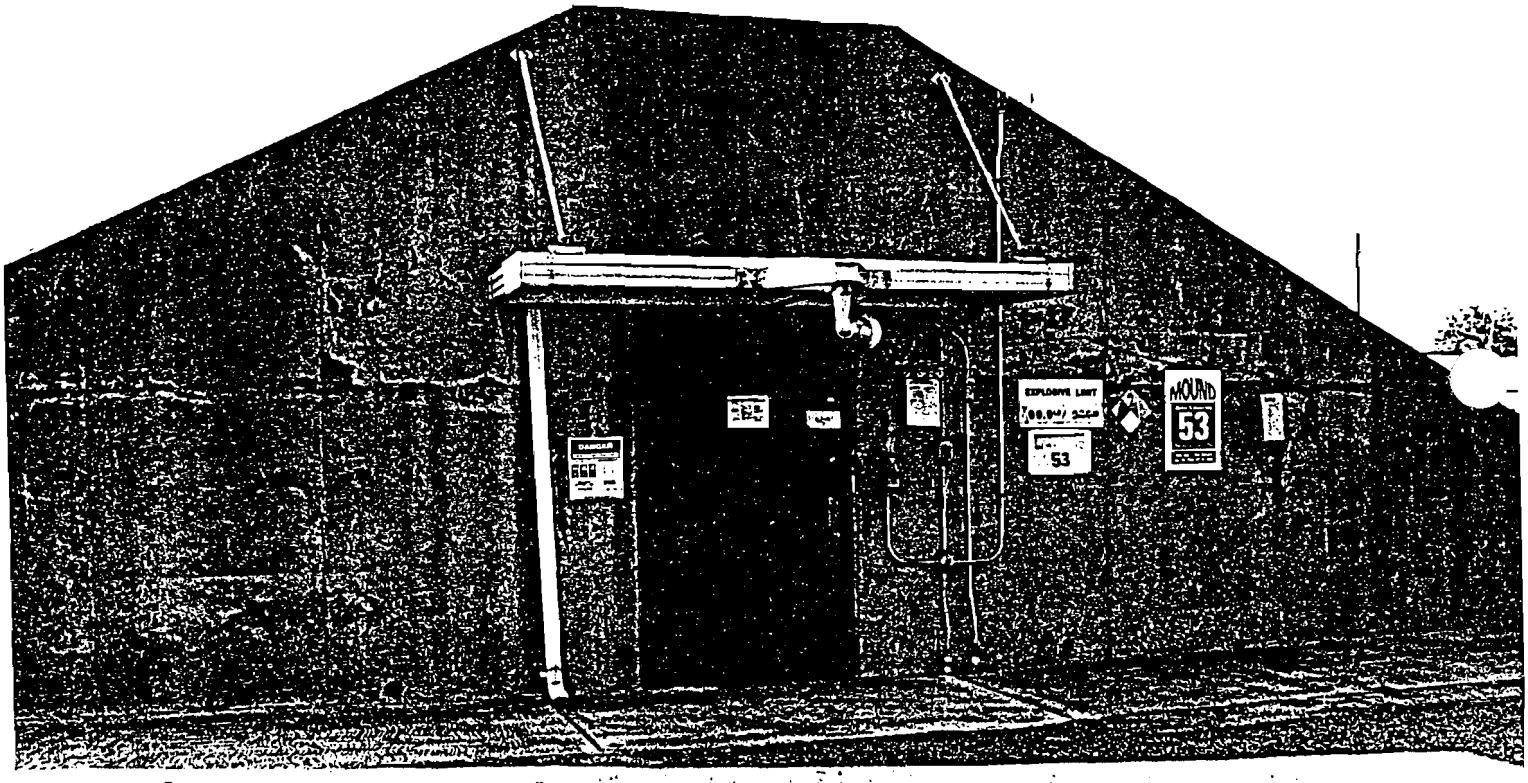


Figure 2: Photograph of the Pyroshed

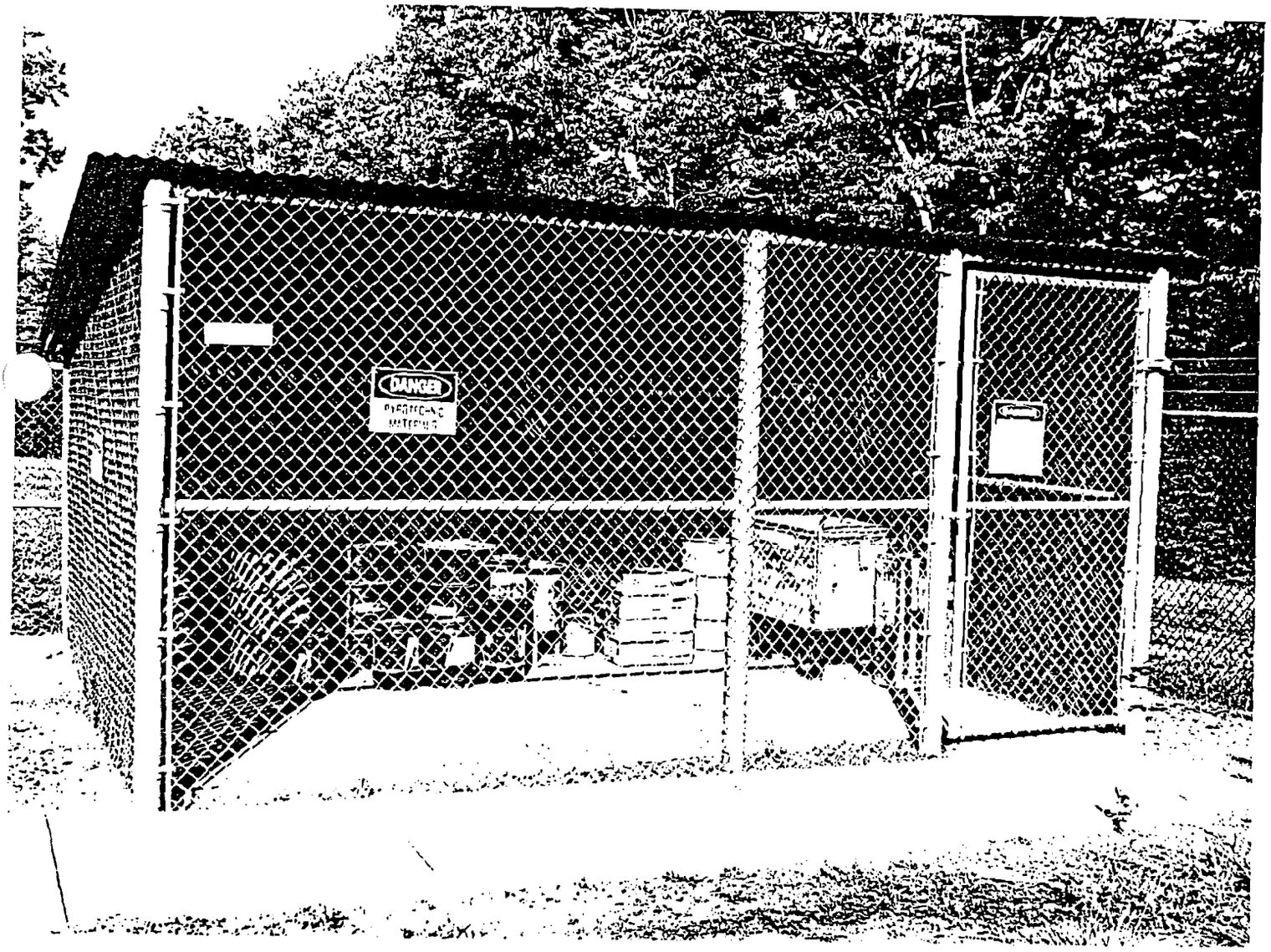
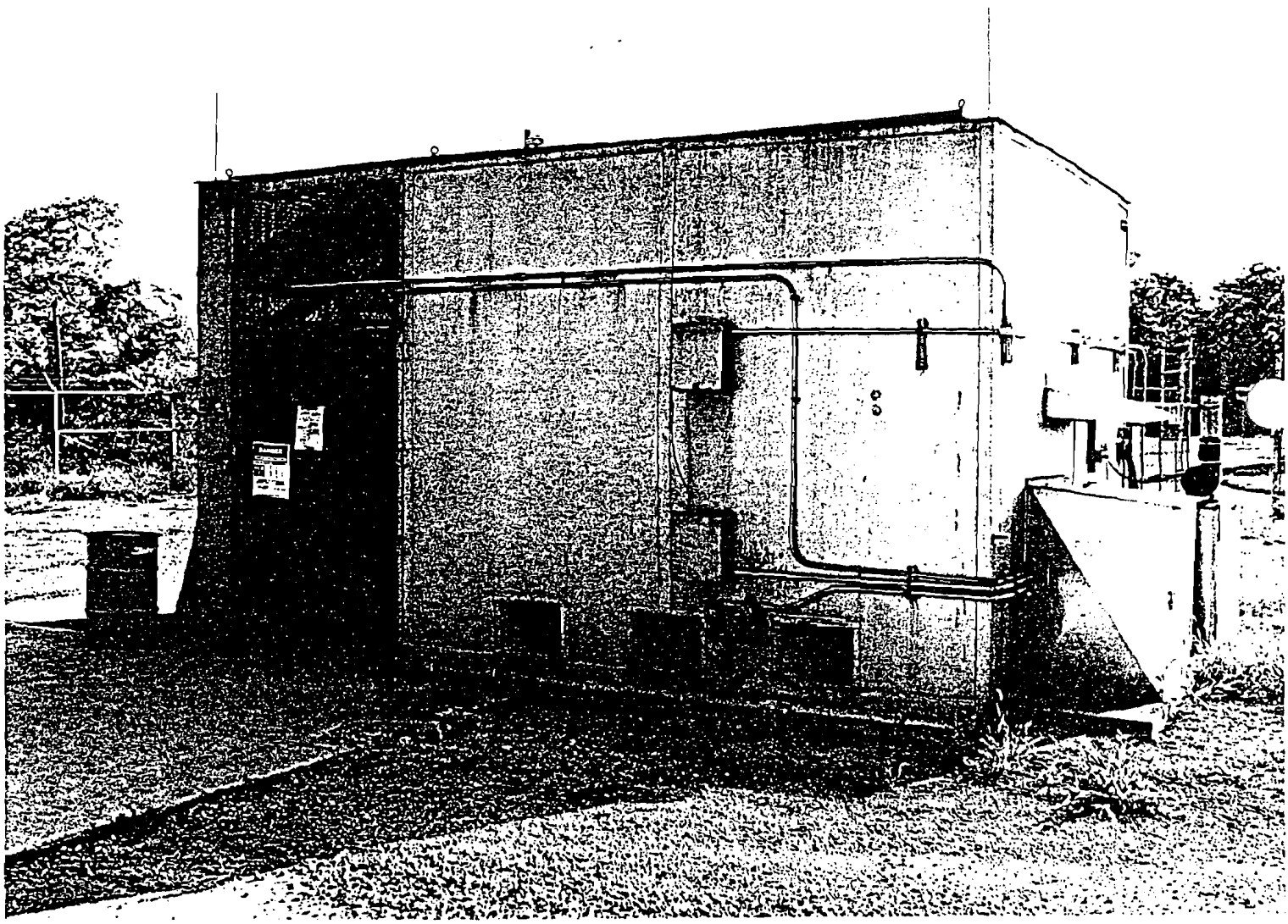


Figure 3: Photograph of the Open Burn Unit



1.5.4 Retort Unit: The Retort Unit is a rotary kiln thermal treatment unit used for detonating energetic material wastes. The primary components of the unit include the feed tube, exhaust stack, drive assembly, combustion chamber, and the burner assembly. The combustion chamber consists of two sections joined by a flanged bolted connection. Both barrel sections are constructed from steel 2.25 inches thick. The approximate dimensions of the unit are 3 feet diameter by 10 feet long.

The combustion chamber is mounted to two concrete piers 52 inches wide and 12 inches thick. The piers rest on foundations located 3 feet below grade. The foundations are 24 inches square reinforced concrete pads 12 inches thick. The mounting piers are keyed in and tied to the foundations. The combustion chamber base frame mounts to the piers. The base frame is a welded assembly constructed from structural steel shapes. The combustion chamber assembly is fixed to the base frame by bolted connections. The concrete base slab is penetrated by an embedded 1.5 inch diameter copper pipe for delivery of the propane supply.

The Retort Unit is located in the Burn Area at Building 90, which houses the unit controls and waste feed operations. This structure is a pre-engineered sheet-metal building constructed on a reinforced concrete slab 4 inches thick. The Retort Unit rotary kiln is located within a rectangular enclosure attached to the east side of Building 90 that is approximately 30 feet long and 15 feet wide with 9 foot high walls. Photographs of Building 90 and the rotary kiln are provided in Figures 4 and 5, respectively. Appendix B contains a list of the wastes managed in the Retort Unit.

1.5.5 Energetic Materials Pretreatment Unit: The Energetic Materials Pretreatment Unit is an inactive pretreatment unit where soapy water solutions generated in the cleaning of equipment and utensils in pyrotechnic and explosive operations were treated by evaporation and burning. The unit was taken out of service in the summer of 1991. The unit consists of a stainless-steel cylinder 2 feet high and 1 foot in diameter, mounted on three stainless-steel legs, and placed inside a stainless steel base pan 30 inches square and 6 inches high. Stainless-steel screens are attached to the top and bottom of the cylindrical component. A photograph of the Energetic Materials Pretreatment Unit is provided as Figure 6. Appendix B contains a list of the wastes managed in the Energetic Materials Pretreatment Unit.

1.5.6 Thermal Treatment Unit: The Thermal Treatment Unit is an inactive unit that was used for the burning of explosive wastes. The Thermal Treatment Unit was taken out of service in the summer 1991. The unit consisted of a 55 gallon

steel drum (no longer present) placed in a circular stainless-steel base. The lid of the drum was fitted with a blower. Sensors were fitted to the unit for monitoring process parameters during treatment. A photograph of the Thermal Treatment Unit is provided as Figure 7. Appendix B contains a list of the wastes managed in the Thermal Treatment Unit.

Figure 4: Photograph of Building 90

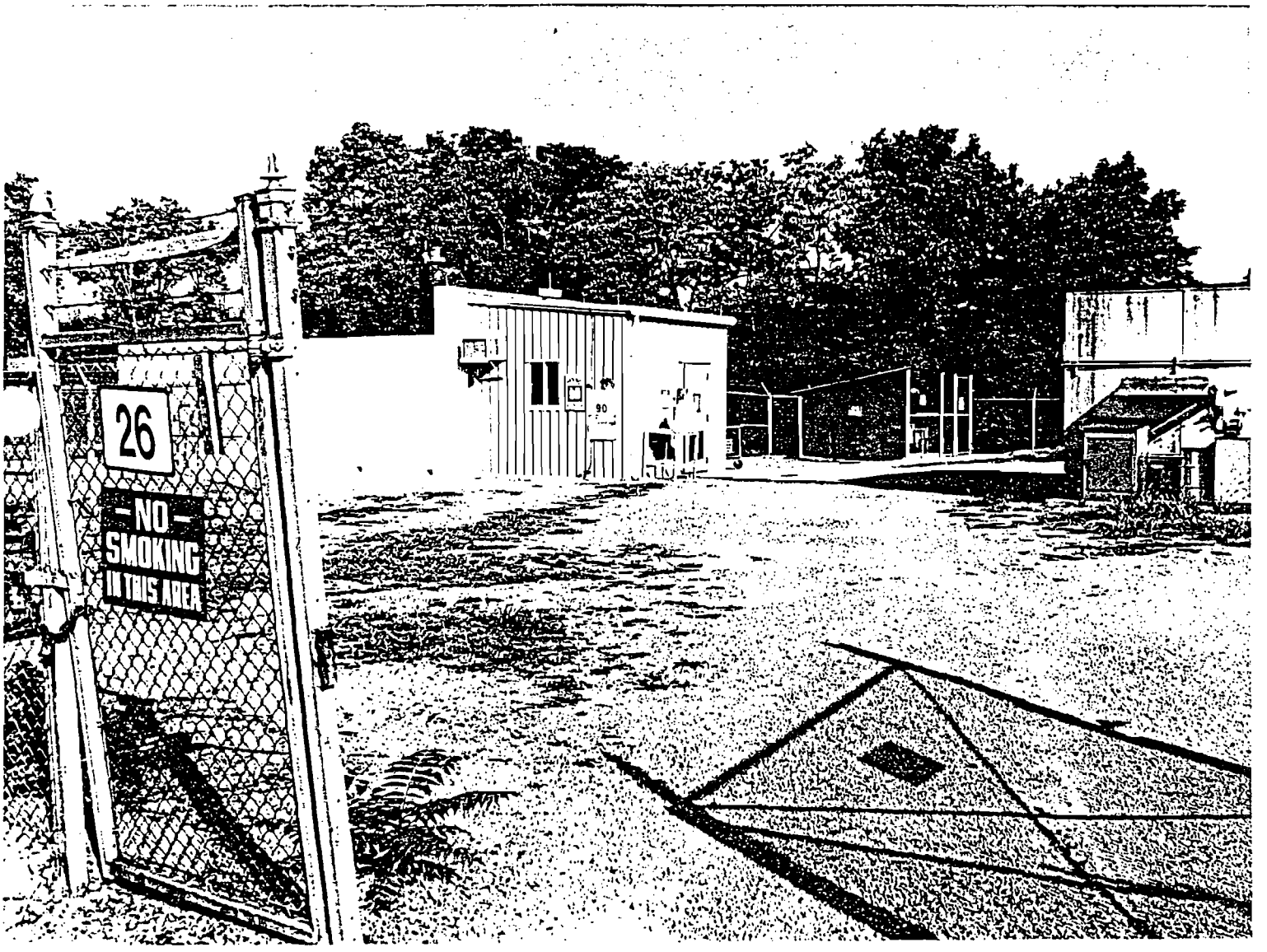


Figure 5: Photograph of the Rotary Kiln

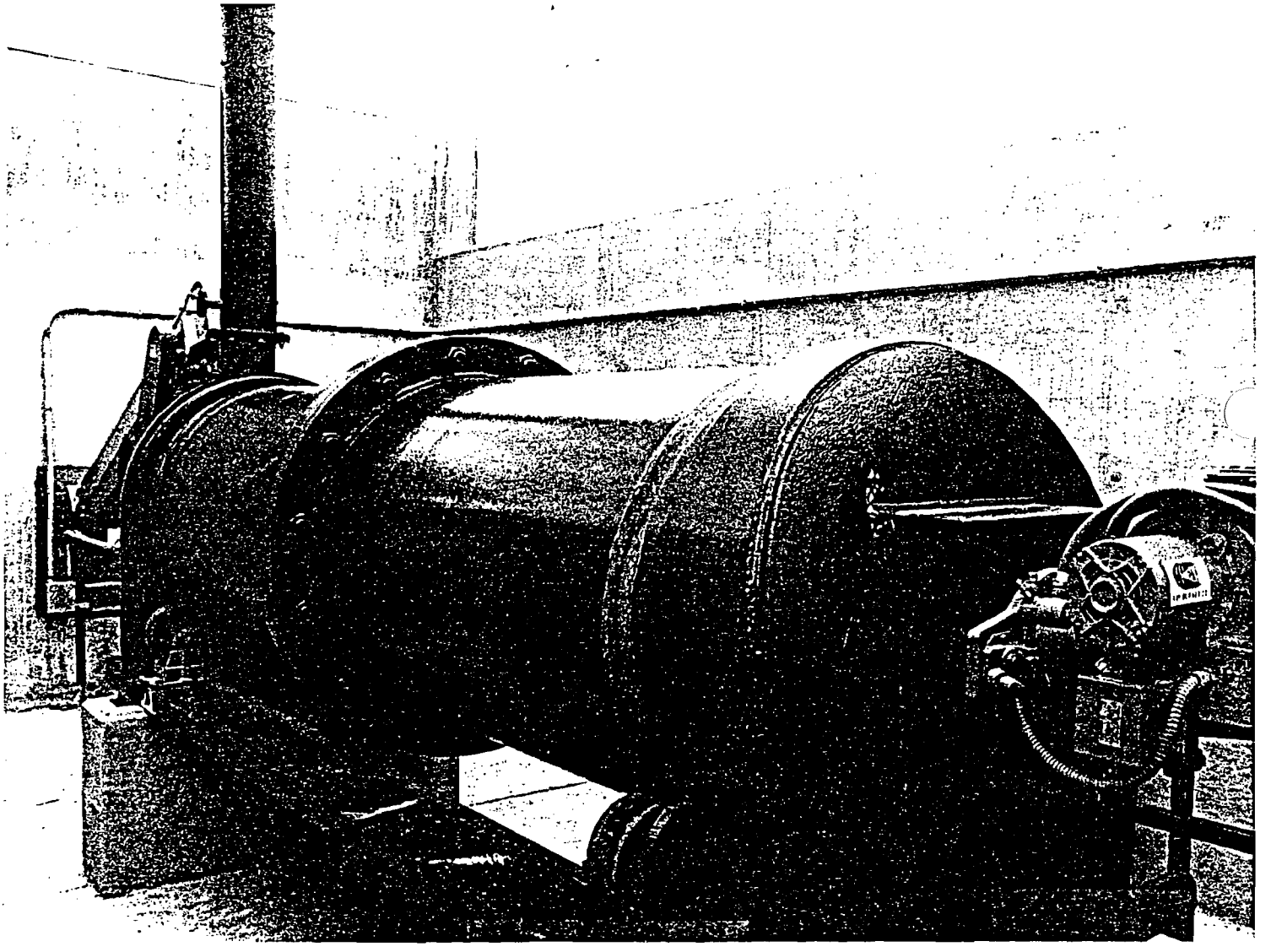


Figure 6: Photograph of the Energetic Materials Pretreatment Unit

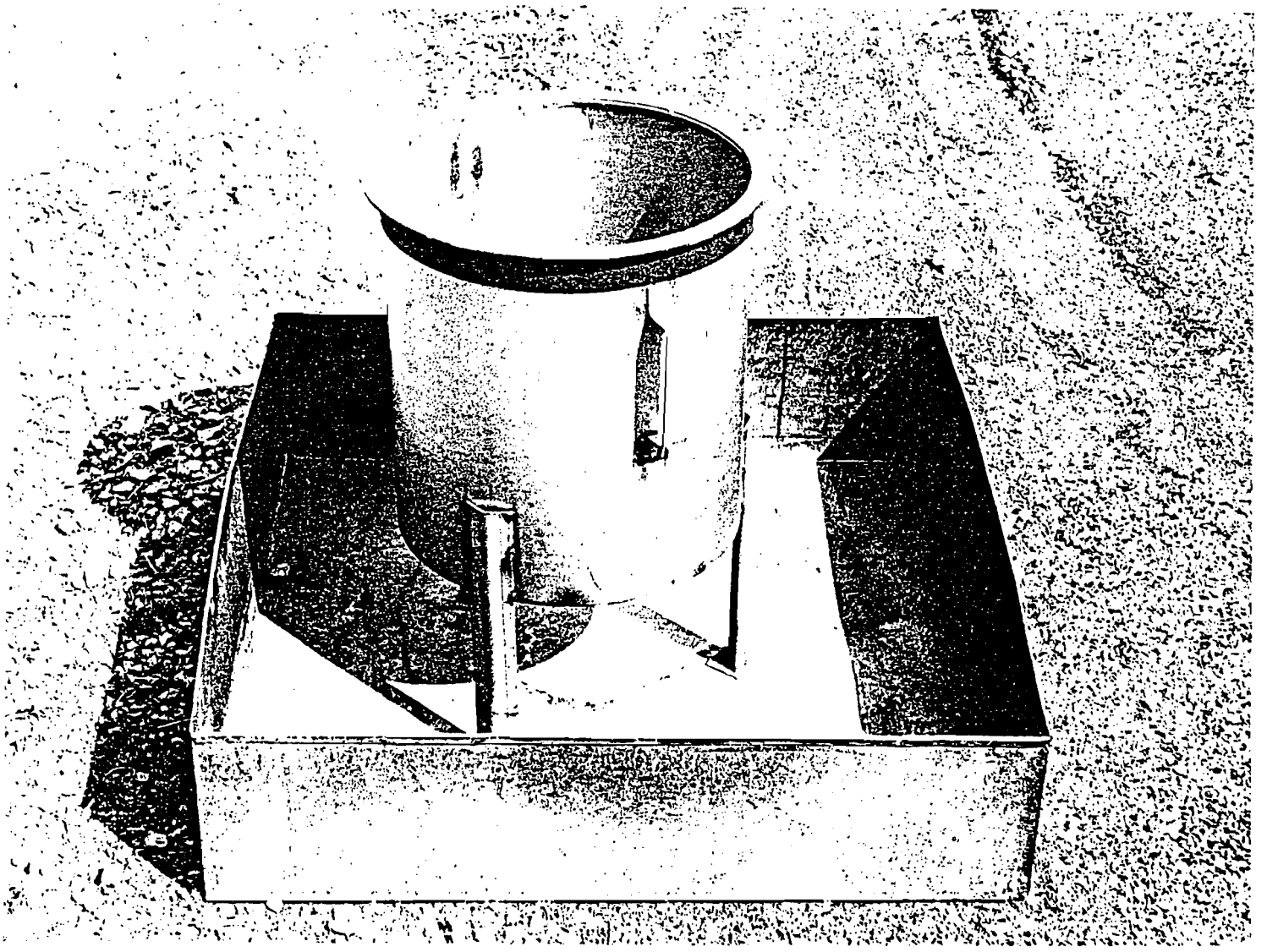
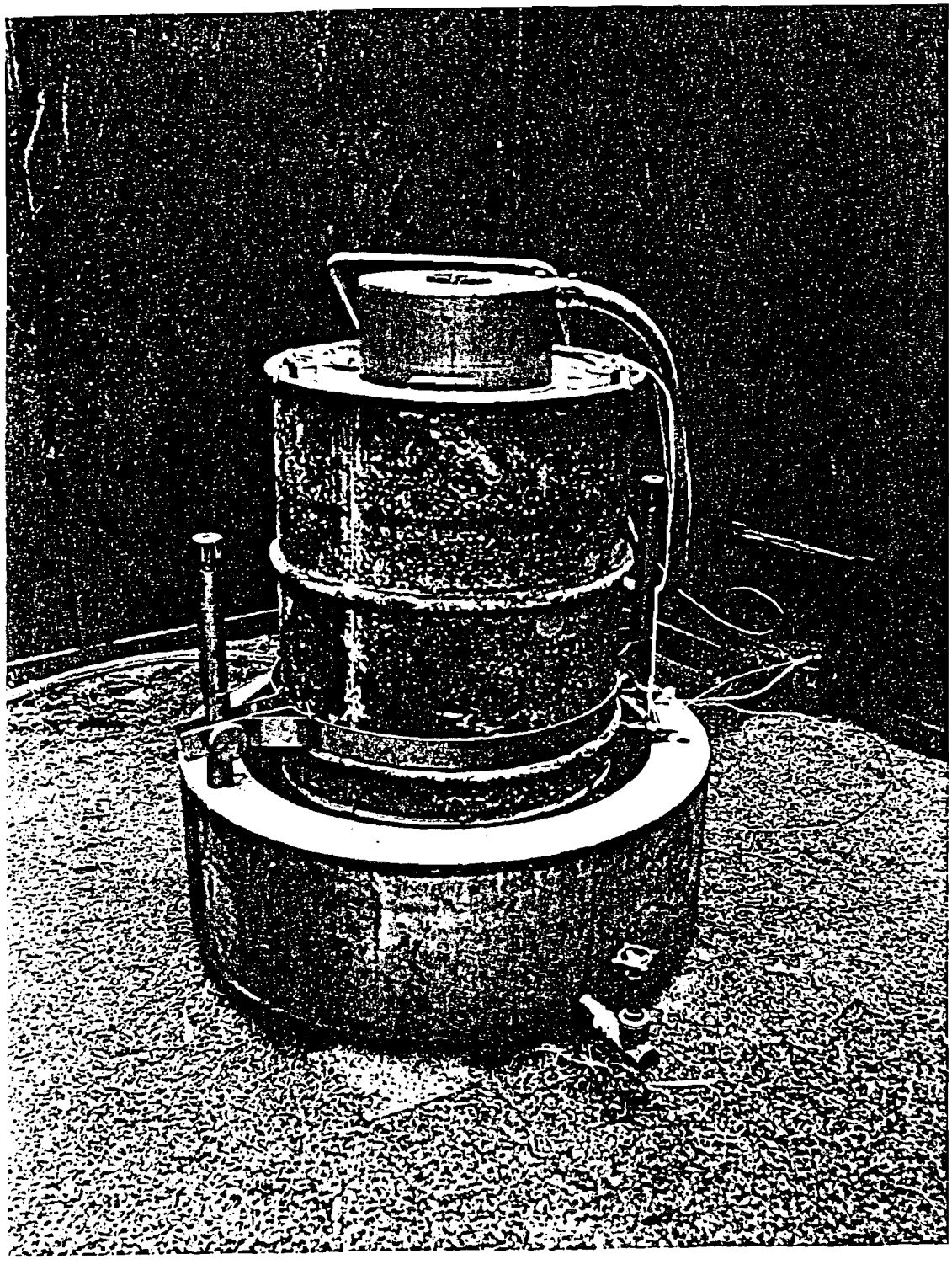


Figure 7: Photograph of the Thermal Treatment Unit



1.6 Other Environmental Permits

Description	Permit Number
NPDES permit (water)	1IO00005**D
Ohio Hazardous Waste permit	05-57-0677
Building 90 retort (air)	857091196N002
Open Burn Unit for explosives waste (air)	Letter permit

NOTE: The Mound Plant has other permits in force. However, these are not listed because they are not relevant to Burn Area operations.

2. CLOSURE PROCEDURES

2.1 Disposal or Decontamination of Equipment, Structures, and Soils

2.1.1 Magazine 53: Any remaining containers of waste will be removed from the structure and sent to a RCRA commercial facility for treatment and disposal. Waste shipments will be accompanied by appropriate manifests and land disposal restriction notifications. Any necessary storage of the waste will be provided in accordance with the existing on-site waste management system. Magazine 53 will be visually characterized to see if any visible contamination is present. If visible contamination is present and greater than 5% of total surface area then decontamination of the structure will be required. If visible contamination is less than 5% of the total surface area then decontamination will not take place. The structure will not be dismantled. If decontamination of the structure is necessary, it will proceed as described below:

1. The floor of the structure will be swept with a floor broom. The sweepings and the broom head will be collected in appropriate DOT containers and managed as hazardous waste unless samples indicate otherwise. All interior surfaces of Magazine 53 will then be decontaminated.

2. The method for decontamination will be chemical extraction by water washing or spraying. A detergent such as Alconox, Liquinox, or similar product may be used, as well as, cloths, rags or mops, as necessary. High-pressure water washing may also be used if appropriate measures are taken to confine the water.

3. Mound shall ensure that all run-off water from the decontamination procedure is contained, collected and packaged according to Hazardous Waste requirements. Collected water will be stored in Building 72 awaiting receipt of analyses.

4. A rinseate sample will be collected and evaluated against the following criteria to determine if successful decontamination has been achieved:

Compound	mg/l
Antimony	0.09
Barium	2.0
Beryllium	0.06
Cadmium	0.075
Chromium	1.0
Dibutylphthalate	1.0
Diphenylamine	1.0
Lead	0.6
Nickel	1.0
Nitroglycerin	1.0
Silver	1.0

5. The decontamination procedures described above will be repeated, as necessary, until the rinseate standard is met.

6. An independent, registered professional engineer will certify the work described above has been performed in accordance with this plan.

2.1.2 Pyroshed: Any remaining containers of waste will be removed from the structure and sent to a RCRA commercial facility for treatment and disposal. Waste shipments will be accompanied by appropriate manifests and land disposal restriction notifications. Any necessary storage of the waste will be provided in accordance with the existing on-site waste management system. The Pyroshed will be visually characterized to see if any visible contamination is present. If visible contamination is present and greater than 5% of total surface area then decontamination of the structure will be required. If visible contamination is less than 5% of the total surface area then decontamination will not take place. If decontamination is not necessary the Pyroshed will be dismantled/demolished and the debris disposed of as discussed in items 6 through 11 below. If decontamination of the structure is necessary, it will proceed as follows:

1. The floor of the structure will be swept with a floor broom. The sweepings and the broom head will be collected in appropriate DOT containers and managed as hazardous waste unless samples indicate otherwise. All interior surfaces of the Pyroshed will then be decontaminated.

2. The method for decontamination will be chemical extraction by water washing or spraying. A detergent such as Alconox, Liquinox, or similar product may be used, as well as, cloths, rags or mops, as necessary. High-pressure water washing may also be used if appropriate measures are taken to confine the water.

3. Mound shall ensure that all run-off water from the decontamination procedure is contained, collected and packaged according to Hazardous Waste requirements. Collected water will be stored in Building 72 awaiting receipt of analyses.

4. A rinseate sample will be collected and evaluated against the following criteria to determine if successful decontamination has been achieved:

Compound	mg/l
Antimony	0.09
Barium	2.0
Beryllium	0.06
Cadmium	0.075
Chromium	1.0
Dibutylphthalate	1.0
Diphenylamine	1.0
Lead	0.6
Nickel	1.0
Nitroglycerin	1.0
Silver	1.0

5. The decontamination procedures described above will be repeated, as necessary, until the rinseate standard is met. NOTE: If this criteria cannot be met, all materials from the dismantling/demolishing of the Pyroshed will be handled and disposed of as hazardous waste.

6. The corrugated roof and chain-link fence will be sent to a secondary smelter as scrap.

7. The wood platform covering the concrete pad will be demolished and sent to a sanitary landfill for disposal.

8. The concrete pad will be demolished.

9. The demolition debris will be sent to a sanitary landfill for disposal.

10. The site of the structure will be back-filled to grade level with clean soil.

11. An independent, registered professional engineer will certify the work described above has been performed in accordance with this plan.

2.1.3 Open Burn Unit: Mound will demolish the metal walls of the unit and send the pieces to a secondary smelter. The smelting process will treat all potential contaminants that may be on the surface of the wall. Potential contaminants include all of the constituents listed in the Appendix to OAC 3745-51-11 that are present in wastes treated in the unit and are listed in Table 1 below. Any excessive contamination will be removed prior to demolition and shipment off-site. The sand filling of the metal walls of the unit is not expected to be contaminated because the sand did not come into contact with the wastes being treated (the walls completely enclosed the sand filling).

Since the wastes were treated by open burning on the sand covering of the unit floor, it is assumed that the sand and the soil beneath the sand are contaminated by treatment residues. Floor material will be removed to a depth of 2 feet. Removed sand/soil will be placed in appropriate DOT containers and managed as hazardous waste unless analytical results indicate otherwise. Mound will demolish and dispose of the concrete footer as hazardous debris unless analytical results indicate otherwise.

The specific closure procedure is as follows:

1. The unit will be operated empty to destroy any potential energetic material contamination. This will be accomplished by performing a burn, in the normal burn zone of the unit, with three to six inches of wood chips. The unit will be allowed to cool before proceeding further. Any excessive contamination will be removed prior to demolition and disposed of as hazardous waste unless analytical results prove otherwise.

2. The first two feet of floor material will be removed by hand and placed into appropriate DOT containers. The sieved floor material will be managed as hazardous waste unless analytical results indicate otherwise. The material remaining in the sieve will be reviewed regarding its security classification and managed as hazardous waste unless analytical results indicate otherwise.

3. The entryway color video camera is completely enclosed in a protective case. It will be removed from the case and decontaminated, as necessary.

4. The sand filling will be removed from the interior of the unit walls, placed in containers, and disposed of at a sanitary landfill.

5. The roof and walls of the unit will be demolished, cut into pieces, and sent to a secondary smelter as scrap. Appropriate documentation will be completed and records of the fate of the scrap will be kept on file for review by OEPA.

6. The concrete footer will be demolished, collected in appropriate DOT containers and managed as hazardous debris unless analytical results indicate otherwise.

7. Soil samples will be analyzed for the hazardous waste constituents listed in Table 1 (Section 2.1.7) after the removal of the soil and sand under the Open Burn unit. The plan is to remove the soil to a depth of two feet which is known to have surface contamination. The results of the analyses will be compared to the action levels shown in Table 1. If the action levels are not exceeded, no further removal of floor soil will be performed. Refer to Appendix C for additional details on sampling and analysis.

8. Soil sampling and removal equipment will be decontaminated by washing with Alconox, Liquinox, or similar product and water and then triple rinsed. The wash water and rinseate will be managed as hazardous waste unless analytical results indicate otherwise.

9. The site of the structure will be back-filled to grade level with clean soil.

10. An independent, registered professional engineer will certify the work described above has been performed.

2.1.4 Retort Unit: The retort enclosure, in general, did not come into contact with the waste being treated because the treatment occurred inside the rotary kiln. The only contamination possible in the enclosure is from spillage of the treatment residues. However, Building 90 may have come into contact with the wastes being treated because that is where the waste containers were opened and the waste handling occurred.

Mound will decontaminate the interior of Building 90 and the floor and walls of the retort enclosure. Mound will disassemble Building 90 and the retort, cut them up, and send the pieces to a secondary smelter. After decontamination, Mound will demolish the concrete floor of Building 90 and the concrete retort enclosure (floor and walls) and dispose of the debris at a sanitary landfill upon analytical verification that the decontamination rinseate is not hazardous.

The specific closure procedure is as follows:

1. The retort will be run empty, at 700^0 F, +/- 50^0 F, for two hours to assure combustion of any residual energetic materials (EM). The unit will be allowed to cool before proceeding further.

2. Any remaining waste residues will be collected in appropriate DOT containers and managed as hazardous waste unless analytical results indicate otherwise.

3. The roof, conveyor assembly, retort barrel, stack components, and metal supports of the unit will be demolished, cut into pieces, and sent to a secondary smelter as scrap. During demolition, the retort barrel will be examined for classified material. (Release of the retort from the site is contingent on it being declared unclassified because the Atomic Energy Act requires the protection of classified information.) Appropriate documentation will be completed and records of the fate of the scrap will be kept on file for review by OEPA.

4. The balance of Building 90 will be decontaminated, as discussed below:

    a. The floor of the structure will be swept with a floor broom. The sweepings and the broom head will be collected in appropriate DOT containers and managed as hazardous waste unless samples indicate otherwise. All interior surfaces of Building 90, along with the floor and walls of the retort enclosure, will then be decontaminated.

    b. The method for decontamination will be chemical extraction by water washing or spraying. A detergent such as Alconox, Liquinox, or similar product may be used, as well as, clothes, rags or mops, as necessary. High-pressure water washing may also be used if appropriate measures are taken to confine the water.

    c. Mound shall ensure that all run-off water from the decontamination procedure is contained, collected and packaged according to Hazardous Waste requirements. Collected water will be stored in Building 72 awaiting receipt of analyses.

d. A rinseate sample will be collected and evaluated against the following criteria to determine if successful decontamination has been achieved:

Compound	mg/l
Antimony	0.09
Barium	2.0
Beryllium	0.06
Cadmium	0.075
Chromium	1.0
Dibutylphthalate	1.0
Diphenylamine	1.0
Lead	0.6
Nickel	1.0
Nitroglycerin	1.0
Silver	1.0

5. The decontamination procedures described above will be repeated, as necessary, until the rinseate standard is met. NOTE: If these criteria cannot be met, all materials from the concrete floor of Building 90 and the concrete retort enclosure (floor and walls) will be handled and disposed of as hazardous waste.

6. The metal walls of Building 90 will be demolished, cut into pieces, and sent to a secondary smelter as scrap. Appropriate documentation will be completed and records of the fate of the scrap will be kept on file for review by OEPA.

7. The concrete walls and floor of the retort enclosure and the concrete floor of Building 90 will be demolished and disposed of at a sanitary landfill.

8. The site of the structure will be back-filled to grade level with clean soil.

9. An independent, registered professional engineer will certify the work described above has been performed in accordance with this plan.

2.1.5 Energetic Materials Pretreatment Unit: The unit will be decontaminated with tap water. The unit will be cut up for sale as scrap to a secondary smelter. Appropriate documentation will be completed and records of the fate of the scrap will be kept on file for review by the OEPA.

2.1.6 Thermal Treatment Unit: The unit will be decontaminated with tap water. The metal parts of the unit will be dismantled or cut up for sale as scrap to a secondary smelter. Appropriate documentation will be completed and records of the fate of the scrap will be kept on file for review by the OEPA.

2.1.7 Burn Area Soils: The full extent of vertical and horizontal soil contamination in the Burn Area is not well defined. The primary location for suspected soil contamination involves the Open Burn Unit. As previously discussed in section 2.1.3, this closure plan will remove the soil with known surface contamination from the floor area within this unit. The potential for the other units to be a source for soil contamination is less likely. There are no historic records of leaks or spills from the storage units or the Retort Unit. Additionally, Mound's operational procedures for the storage units did not permit the opening of waste containers, therefore, minimizing the potential for releases.

Soil sampling of the Burn Area soils will be performed as discussed in the Sampling and Analysis Plan (Appendix C). If contamination extends beyond the planned removal of soils from the Open Burn Unit, this closure plan will be amended to pursue clean closure by removal based on background (Table 1 action levels) or clean closure based on risk assessment. Sampling of the Burn Area soils will be performed after completion of the closure activities itemized in sections 2.1 through 2.6. Details on sampling and analysis can be found in Appendix C.

The DOE Environmental Restoration (ER) program has taken soil samples from off-site to determine background levels for various on-site contaminants. This work is documented in "OU 9, Background Soil Investigation: Soil Chemistry Report" (September 1994). This off-site sampling and analysis data were used to generate the RCRA action levels in Table 1 for the contaminants of concern. The methodology for arriving at the action levels is documented in "Determination of Action Levels for Closure of Burn Area Using Off Site Background Sample Data" (September 14, 1995, J. C. Miles, EG&G Mound Applied Technologies) and amended in a memorandum dated December 4, 1995, by J.C. Miles.

ER has also performed soil sampling in the Burn Area as a part of their field investigations. This work is documented in "OU 3 Limited Field Investigation Report" (March 1993). Surface and subsurface soil samples were taken at 20 locations in the Burn Area and analyzed for target compound list of volatile organic compounds, semivolatile organic compounds, pesticides/PCBs, target analyte list inorganics, and explosives. This data will be used in conjunction with the new soil sampling data to make a decision as to proceed with a clean closure based on background or a clean closure based on risk assessment.

Table 1. Constituents of Burn Area Wastes

Waste Constituent	CAS Number	Action Level (mg/kg)
Antimony	7440-36-0	0.44
Barium	7440-39-3	208.
Beryllium	7440-41-7	1.45
Cadmium	7440-43-9	1.25
Chromium	7440-47-3	22.0
Dibutylphthalate	84-74-2	Any detectable (PQL)
Diphenylamine	122-39-4	Any detectable (PQL)
Lead	7439-92-1	61.5
Nickel	7440-02-0	30.9
Nitroglycerin	55-63-0	Any detectable (PQL)
Silver	7440-22-4	1.22

PQL = Practical Quantitation Limit

2.2 Description of Security Systems

In addition to the general provisions of fencing, gates, secured buildings, and guards, as discussed in this section, other features contribute to the security of the Burn Area. This area is a fenced facility that is located within a DOE weapons research, development, and production installation with military-type security. The majority of employees working at Mound are required to have access authorization clearances granted by DOE based on investigation conducted by the Office of Personnel Management, the Federal Bureau of Investigation (FBI), or other U.S. government agencies. All employees and contractors are required to show their clearance badge or other authorized photograph identification badge at any access gate prior to entry into the facility. This clearance photo ID badge must remain on their person at all times while at the facility. Visitors must sign in and out, carry a visitor's badge, and be escorted at all times by a cleared employee while within a security area. Only authorized persons may enter Mound.

The primary function of Mound has been to perform integrated research, development, and production work in support of DOE weapons and energy programs, with emphasis on explosives and nuclear technology. The general nature of these programs requires constant [24-hour (hr)] surveillance by on-site, armed security guards who continuously monitor and control entry onto Mound. Traffic access to Mound is provided by Benner Road along the southwest boundary and Mound Road along the southeast boundary. Entrances to the facility from these roads are staffed by armed guards or are locked and patrolled.

In addition to these surveillance measures, the Burn Area is monitored during normal working hours (6:00 AM to 6:30 PM) when in operation by on-site personnel. During working and non-working hours, the fence surrounding the area is locked. The storage unit doors remain locked except during loading, unloading, or inspection operations. Overhead lights illuminate the entrance to Magazine 53 throughout the night. On-site security personnel patrol Mound around the clock and Burn Area at least once each night. Two-way radios allow security officers to report upset conditions immediately. These practices ensure 24 hour surveillance to the storage facility.

The entire perimeter of Mound is surrounded by a chain link security fence with barbed wire or barbed tape coil topping. The height of the fence varies from 7 to 10 feet. Each plant entrance that has access to the Burn Area is staffed by armed security guards 24 hours per day or is locked and patrolled.

The Burn Area itself is encircled by a chain link security fence 7 feet high topped with three strands of barbed wire. This fence contains one vehicle gate that remains locked at all times during working and non-working hours.

Warning signs that indicate the controlled access nature of Mound are posted on the perimeter fence and at each entry point warning that the area is restricted and that unauthorized entry is illegal. The entrances to the Burn Area are posted with the following signs:

"Danger - Unauthorized Personnel Keep Out."
"Danger - Explosives - Keep Out."

The signs are legible at distances of at least 25 feet. The signs are written in English and are sufficient in number to be visible from any approach direction.

Following completion of closure, the Burn Area will not be required to meet the security restriction imposed by RCRA.

2.3 Closure Certification

Once closure and decontamination of the Burn Area have been completed, the area will be inspected by the owner/operator and an independent professional engineer registered in the State of Ohio. Within 60 days of closure, the owner/operator and the independent professional engineer will both submit by registered mail a certification report to the State of Ohio. The wording of the certification statement and signatures will meet the requirements of OAC 3745-50-42. The report will include a summary of the closure activities performed and analytical sample results. Records of the fate of the scrap metal will be submitted with the closure certification. The report will also include the results of visual inspections completed during closure and after closure completion. Following closure, the area will be used for other industrial operations.

3. CLOSURE SCHEDULE

3.1 Expected Year of Closure

The closure of the Burn Area is expected to be completed in 1998.

3.2 Frequency of Partial Closures

There will be three other partial closures (Building 27 Filtration System, Building 72 and Building 23). Final closure of all RCRA units is not expected until 2002.

3.3 Closure Milestones

1. The waste inventory has been removed as of April 23, 1996.

2. Decontamination will begin by June 25, 1996.

3. Closure will be completed by 180 days after approval of this plan unless an extension is approved by OEPA.

4. The Closure Certification Report will be submitted to the OEPA within 60 days from the completion of closure.

5. A detailed closure schedule is included in Figure 8.

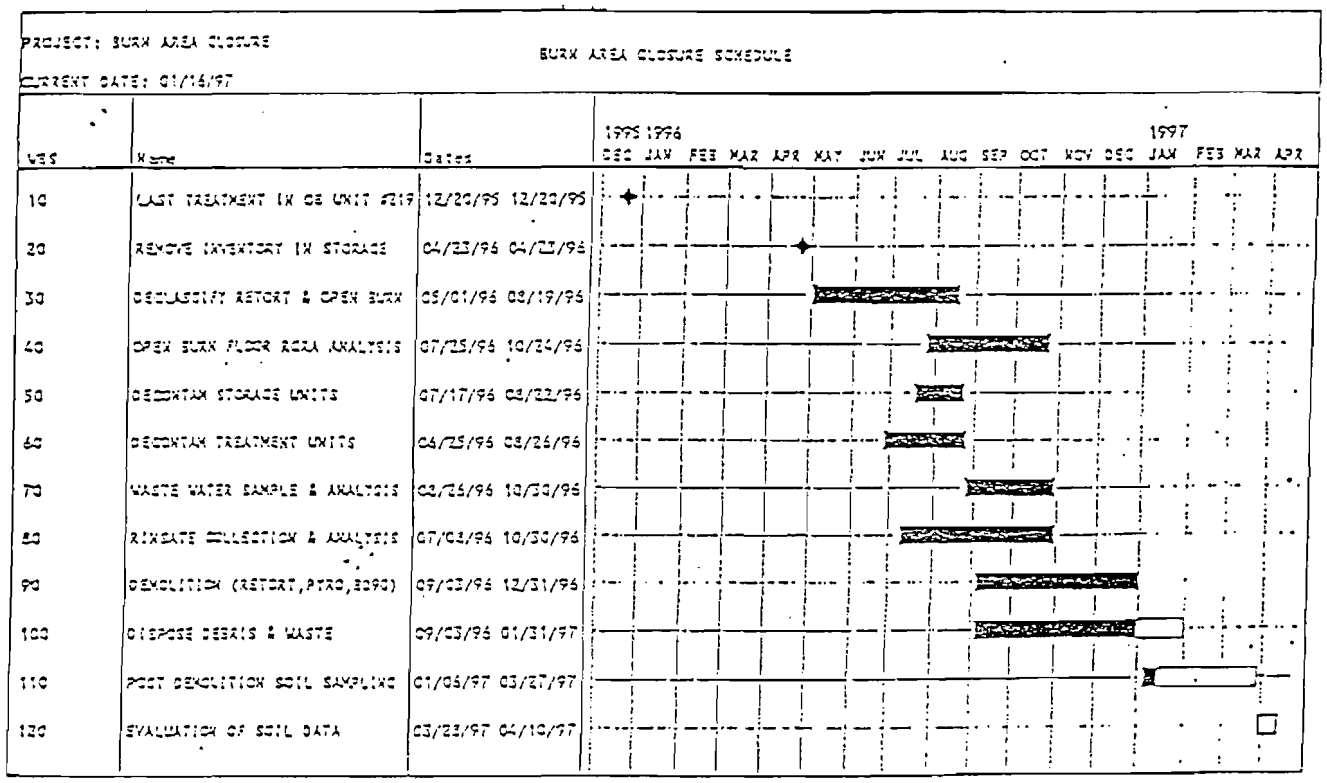
Figure 8: Closure Schedule

PROJECT: BURN AREA CLOSURE

BURN AREA CLOSURE SCHEDULE

CURRENT DATE: 01/16/97

WBS	Name	Dates
10	LAST TREATMENT IN OB UNIT #219	12/20/95 12/20/95
20	REMOVE INVENTORY IN STORAGE	04/23/96 04/23/96
30	DECLASSIFY RETORT & OPEN BURN	05/01/96 08/19/96
40	OPEN BURN FLOOR RCRA ANALYSIS	07/25/96 10/24/96
50	DECONTAM STORAGE UNITS	07/17/96 08/22/96
60	DECONTAM TREATMENT UNITS	06/25/96 08/26/96
70	WASTE WATER SAMPLE & ANALYSIS	08/26/96 10/30/96
80	RINSATE COLLECTION & ANALYSIS	07/03/96 10/30/96
90	DEMOLITION (RETORT,PTRO,EOPO)	09/03/96 12/31/96
100	DISPOSE DEBRIS & WASTE	09/03/96 01/31/97
110	POST DEMOLITION SOIL SAMPLING	01/06/97 03/27/97
120	EVALUATION OF SOIL DATA	03/28/97 04/10/97



critical | completed | total float | delay
noncritical | milestone | free float | conflict
baseline

4.0 CLOSURE PLAN AMENDMENT

4.1 Preface

This amendment to the approved May 16, 1996, Burn Area Closure Plan proposes to perform a risk-based clean closure of the Burn Area.

During the implementation of closure activities, low concentrations of metals were detected in the post demolition soil samples. A risk-based assessment was performed to determine whether the contamination levels remaining in the Burn Area soil pose a health risk in excess of risk-based closure standards. Final closure of the Burn Area units is expected in January 1998 upon completion of the risk assessment. The amendment to the closure schedule is shown in Figure 9.

4.2 Background

Burn Area Closure activities began in April 1996. Post demolition soil sampling activities required by this closure were completed by the end of March 1997. Sampling methods, equipment, and laboratory analytical methods used were in compliance with the US EPA's SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition."

Twenty-seven core samples and eight excavation face samples of soil were collected to assess the contamination in the Burn Area. The core samples were characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. The Sampling Plan Map (Figure 10) locates the grid where core and excavation face samples were collected.

Table 2 summarizes the analytical results for the soil testing.

4.3 Data Evaluation and Selection of Contaminants of Potential Concern

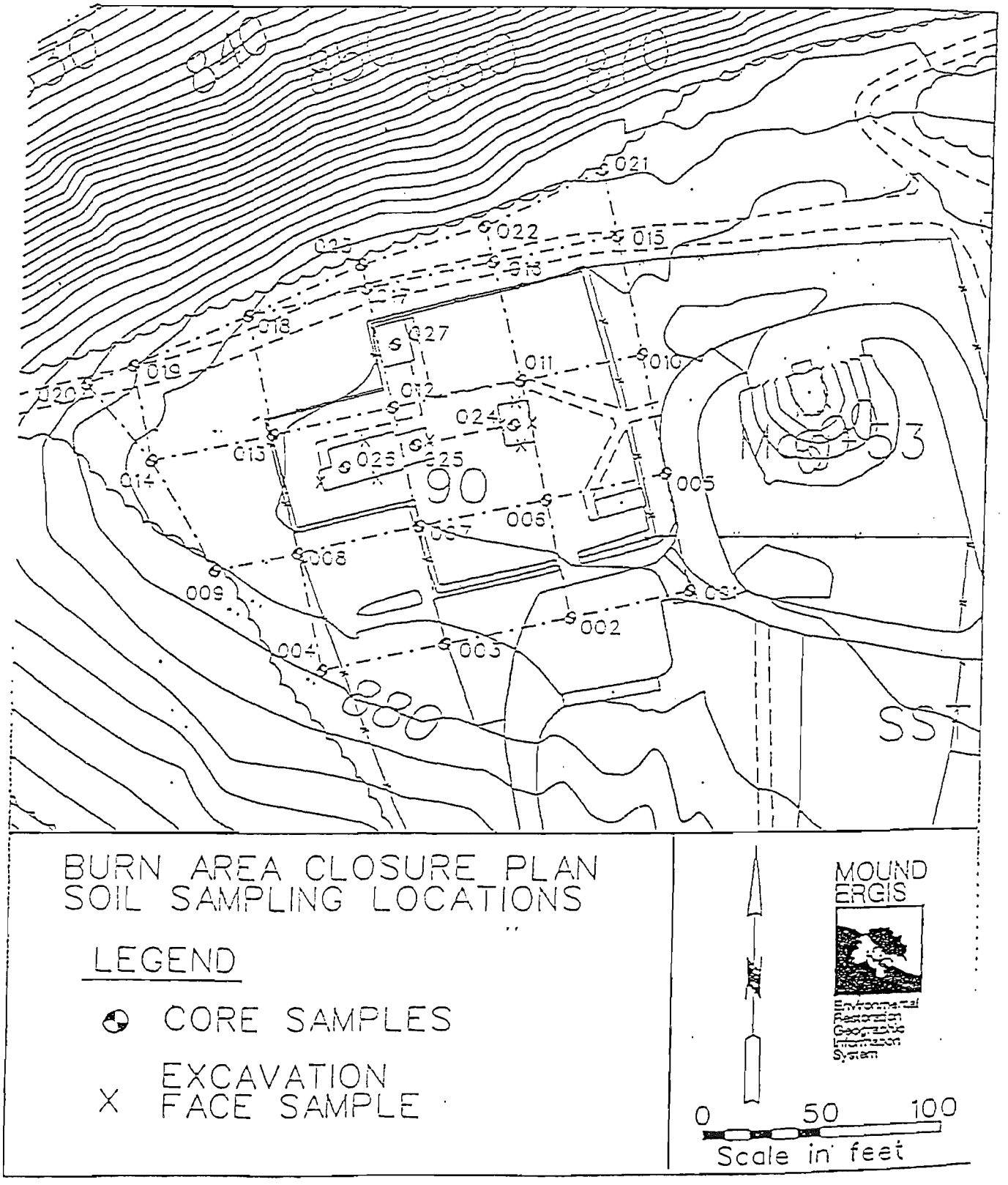
RCRA closure constituents detected within the demolition area were evaluated against background soil data in an effort to determine which constituents were present at concentrations exceeding naturally occurring background levels. The 95 percent upper confidence limit (UCL) of the mean concentration was calculated for each analyte and compared to Burn Area action levels. The specific action levels or clean up goals are presented in Table 1 (Section 2.1.7). The action levels for naturally occurring constituents is the 95% upper

Figure 9: Amendment to Closure Schedule

GANTT CHART REPORT

WBS	Name	Dates	1997 Dec	1998 Jan	Feb	March	April
10	Amend Closure Plan	12/01/97 1/21/98					
20	Submit Final Amended Closure Plan	12/01/97 1/22/98					
30	Perform Risk Assessment	12/01/97 1/21/98					
40	Prepare Closure Documentation	12/01/97 3/16/98					
50	Submit Closure Certification	12/01/97 3/17/98					

Figure 10: Sampling Plan Map



tolerance limit which is calculated as the mean of the background population plus two times the standard deviation of the background population. The action level for contamination originating from non-naturally occurring chemicals is equal to the practical quantitation limit (PQL) for the testing method.

The initial evaluation of soil data for contaminants of concern involved the calculation of the 95% UCL concentrations for eight metals for comparison to its corresponding action level. Only antimony had a 95% UCL concentration level greater than the action level and is therefore assumed to be a constituent of possible concern. No explosive compounds or diphenylamine were detected in any sample that exceeded its corresponding action level. Dibutylphthalate was detected in one sample at a concentration of 700 ug/kg. Dibutylphthalate is not considered a contaminant of concern due to its presence in the laboratory blanks. See Table 2 for a comparison of the results.

4.4 Risk Based Closure

The Mound plant is currently undergoing transition from a former Nuclear Weapons Complex Facility to a non-DOE owned commercial facility. In pursuit of this goal, the ultimate end state is "restoration to land use standards" and "transition to the surrounding community." Current planning by DOE and the City of Miamisburg is to redevelop the Mound site for industrial land use with deed restrictions to prohibit any construction within the site's historic disposal areas. Mound pursued a residential scenario risk assessment for antimony as preferred in the RCRA risk-based closure guidance. However, because residential standards could not be met, an industrial scenario was pursued and deed restrictions will be put in place to include the Burn Area (See Appendix D).

The risk assessment, protective of human health and the environment, was conducted in accordance with EPA guidance (U.S. EPA 1987a and Ohio EPA 1993).

Table 2

Post Demolition Soil Sampling Results for RCRA Constituents at the Burn Area

Analyte	Maximum Concentration Detected	95% UCL of the Mean Concentration	Action Limit (AL) Conc.	Detects above the AL (Frequency)
INORGANICS				
Antimony	6.4 mg/kg	0.58 mg/kg	0.44 mg/kg	Yes (32/98)
Barium	255 mg/kg	86 mg/kg	208 mg/kg	Yes (2/98)
Beryllium	4.7 mg/kg	0.98 mg/kg	1.45 mg/kg	Yes (11/98)
Cadmium	1.4 mg/kg	0.19 mg/kg	1.25 mg/kg	Yes (1/98)
Chromium	34.5 mg/kg	13.9 mg/kg	22 mg/kg	Yes (5/98)
Lead	113 mg/kg	11.3 mg/kg	61.5 mg/kg	Yes (2/98)
Nickel	55.1 mg/kg	20.2 mg/kg	30.9 mg/kg	Yes (6/98)
Silver	2.4 mg/kg	0.54 mg/kg	1.22 mg/kg	Yes (5/98)
ORGANICS				
Dibutylphthalate	700 ug/kg	195 ug/kg	~ 400 ug/kg	Yes (1/98)
Diphenylamine	ND	< 400 ug/kg	~ 400 ug/kg	No (0/98)
EXPLOSIVES				
Nitroglycerin	ND	< 1000 ug/kg	~1000 ug/kg	No (0/98)
PETN	ND	< 1000 ug/kg	~1000 ug/kg	No (0/98)

ND = not detected.
UCL = 95% Upper Confidence Limit of a Mean..

APPENDIX A

APPENDIX B

Magazine 53

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
2,4,6-Trinitrotoluene	None	D003
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D007
Cadmium	Cadmium compounds, N.O.S.	D006
Cyclo-1,3,5-trimethylene-2,4,6-trinitramine	None	D003
Cyclotetramethylene tetranitramine	None	D003
Hexanitroazobenzene	None	D003
Hexanitrostilbene	None	D003
Lead	Lead compounds, N.O.S.	D008
Lead Azide	Lead compounds, N.O.S.	D008
Lead Styphnate	Lead compounds, N.O.S.	D008
Pentaerythritol tetranitrate	None	D003
Tetracene	None	D003
Triaminotrinitrobenzol	None	D003
Trinitro-2,4,6-phenylmethylnitramine	None	D003
	Beryllium	
	Nickel	
	Silver	D011

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
Al/Cu2O	None	D003
Al/CuO	None	D003
Al/CuO/SiC	None	D003
Al/Fe2O3	None	D003
Al/Fe3O4	None	D003
Al/KClO4	None	D003
Al/KClO4/NiO2	Nickel compounds, N.O.S.	D003
Al/Ni	Nickel compounds, N.O.S.	D003
Al/Ni/NiO	Nickel compounds, N.O.S.	D003
Al·Si/Fe3O4	None	D003
Antimony sulfide	Antimony compounds, N.O.S.	
Arcite 373D	None	D003
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4 (BCTK)	Chromic acid H2CrO4, calcium salt	D003, D007

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
B/CuO	None	D003
B/KNO3	None	D003
Barium nitrate	Barium compounds, N.O.S.	D003, D005
Barium Styphnate	Barium compounds, N.O.S.	D003, D005
Fe/KClO4	None	D003
Hexanitroazobenzene	None	D003
Lead Styphnate	Lead compounds, N.O.S.	D003, D008
Mg/Pb3O4	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
Pb3O4/B/KClO4/CaSi	Lead compounds, N.O.S.	D003, D008
Ti/B	None	D003
Ti/B/Al2O3	None	D003
Ti/KClO4	None	D003
Ti0.65/2B	None	D003
Ti0.65/3B	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
TiHX/KClO4	None	D003
TiKClO4	None	D003

Open Burn Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
2,4,6-Trinitrotoluene	None	D003
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
Al/Cu2O	None	D003
Al/CuO	None	D003
Al/CuO/SiC	None	D003
Al/Fe2O3	None	D003
Al/Fe3O4	None	D003
Al/KClO4	None	D003
Al/KClO4/NiO2	Nickel compounds, N.O.S.	D003
Al/Ni	Nickel compounds, N.O.S.	D003
Al/Ni/NiO	Nickel compounds, N.O.S.	D003
Al·Si/Fe3O4	None	D003
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CuO	None	D003
B/KNO3	None	D003
Cadmium	Cadmium	D006

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Cyclo-1,3,5-trimethylene-2,4,6-trinitramine	None	D003
Cyclotetramethylene tetranitramine	None	D003
Fe/KClO4	None	D003
Hexanitroazobenzene	None	D003
Hexanitrostilbene	None	D003
Lead	Lead	D008
Mg/Pb3O4	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
Pb3O4/B/KClO4/CaSi	Lead compounds, N.O.S.	D003, D008
Pentaerythritol tetranitrate	None	D003
Ti/B/Al2O3	None	D003
Ti/KClO4	None	D003
Ti0.65/2B	None	D003
Ti0.65/3B	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
Triaminotrinitrobenzol	None	D003
Trinitro-2,4,6-phenylmethylnitramine	None	D003
Zr/KClO4	None	D003
	Beryllium	

Retort Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
2,4,6-Trinitrotoluene	None	D003
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
Antimony sulfide	Antimony compounds, N.O.S.	
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4 (BCTK)	Chromic acid H2CrO4, calcium salt	D003, D007
B/KNO3	None	D003
Barium nitrate	Barium compounds, N.O.S.	D003, D005
Barium Styphnate	Barium compounds, N.O.S.	D005
Cadmium	Cadmium	D006
Cyclo-1,3,5-trimethylene-2,4,6-trinitramine	None	D003
Cyclotetramethylene tetranitramine	None	D003
Fe/KClO4	None	D003
Hexanitroazobenzene	None	D003
Hexanitrostilbene	None	D003
Lead Azide	Lead compounds, N.O.S.	D003, D008

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Lead Styphnate	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
Pentaerythritol tetranitrate	None	D003
Tetracene		D003
Ti/B	None	D003
Ti/KClO4	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
TiHX/KClO4	None	D003
TiKClO4	None	D003
Triaminotrinitrobenzol	None	D003
Trinitro-2,4,6-phenylmethylnitramine	None	D003
Zr/Fe2O3	None	D003
	Diphenylamine	
	Nitroglycerine	
	Dibutylphthalate	
	Beryllium	
	Nickel	
	Silver	

Energetic Materials Pretreatment Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Al/Cu2O	None	D003
Al/CuO	None	D003
Al/CuO/SiC	None	D003
Al/Fe2O3	None	D003
Al/Fe3O4	None	D003
Al/KCIO4	None	D003
Al/KClO4/NiO2	Nickel compounds, N.O.S.	D003
Al/Ni	Nickel compounds, N.O.S.	D003
Al/Ni/NiO		D003
Al·Si/Fe3O4	None	D003
B/CaCrO4		D003, D007
B/CaCrO4/Ti/KClO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CuO	None	D003
B/KNO3	None	D003
Fe/KClO4	None	D003
Fluorel/Pb3O4		D003, D008
Mg/Halon/	None	D003

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Mg/Pb3O4	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
NH4ClO4/polysulfide monomer	None	D003
Pb3O4/B/KClO4/CaSi	Lead compounds, N.O.S.	D003, D008
Pb3O4/B/KClO4/CaSi/DAP		D003, D008
Pd/Al	None	D003
Ti/B/Al2O3	None	D003
Ti/KClO4	None	D003
Ti0.65/2B	None	D003
Ti0.65/3B	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
Zr/KClO4	None	D003

Thermal Treatment Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Triaminotrinitrobenzol	None	D003

APPENDIX C

APPENDIX C

SAMPLING AND ANALYSIS PLAN FOR THE RCRA CLOSURE OF THE BURN AREA

Summary

The Burn Area sampling and analysis plan will evaluate the following media: the decontamination waste water, the final rinseate samples of surfaces and demolition materials, the removed soil from the Open Burn unit, and multiple core samples of soil from the Burn Area. The sampling methods and equipment, as well as laboratory analytical methods will comply with the USEPA's SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition."

Decontamination Waste Water and Rinseate Testing

MAGAZINE 53 and the PYROSHED: If decontamination is necessary, sampling will proceed as follows: The storage units will be cleaned by sweeping the floors. The dust and dirt will be placed in a drum. This drum will be sampled and stored with other soil drums from the Burn Area closure. To minimize the generation of waste water, both the floor and wall surfaces will be detergent washed with mops and sponges. The wash water will be collected using standard janitorial buckets with a squeegee. The floors and walls will then be washed a second time with tap water. Both the waste detergent and tap water will transferred to a drum. The bucket, mops, and sponges will be triple rinsed with tap water which will be transferred to the drum prior to washing the storage unit walls and floors with tap water a third time. This final wash water will be collected and sampled as the "final rinseate". Excess rinseate water will also be transferred to the storage unit waste water drum. One sample will be collected from each storage unit. The waste water and rinse water from both storage units will be combined into a single drum which will be managed as potentially hazardous waste. One sample will be drawn from this drum and analyzed. The mops, sponges, and bucket will be reused on decontamination of treatment unit surfaces or will be placed in a separate drum and also managed as potentially hazardous waste pending the "final rinseate" analyses.

THERMAL TREATMENT & ENERGETIC MATERIALS PRETREATMENT UNITS: These two units are small and appear to be free of visible contamination. Since the need for decontamination of these units is unlikely, both of these treatment units will be cleaned with tap water only. Mound will generate a "rinseate sample" via a similar procedure used on the storage units. These units will be placed on a plastic liner to contain the rinse water. These units be will be cleaned with a minimum rinse water using a sponge. The waste rinse water will be squeezed into the bucket from the sponge. All waste water from both units will transferred to a single drum. A separate "final rinseate" sample for each unit and one drum sample will be analyzed to determine disposal options.

RETORT UNIT: The concrete floor and wall surfaces from Building 90 and Retort enclosure will be cleaned and rinseate tested. A minimum of two rinseate samples will be generated and sampled. Waste detergent and rise water will be transferred into a drum.

SOIL SAMPLING EQUIPMENT: Rinse water from decontaminating soil sampling equipment will be consolidated in a single waste container. Upon completion of the Burn Area sampling activities, a sample will be removed and analyzed to determine disposal requirements.

Open Burn (OB) Unit Soil Testing

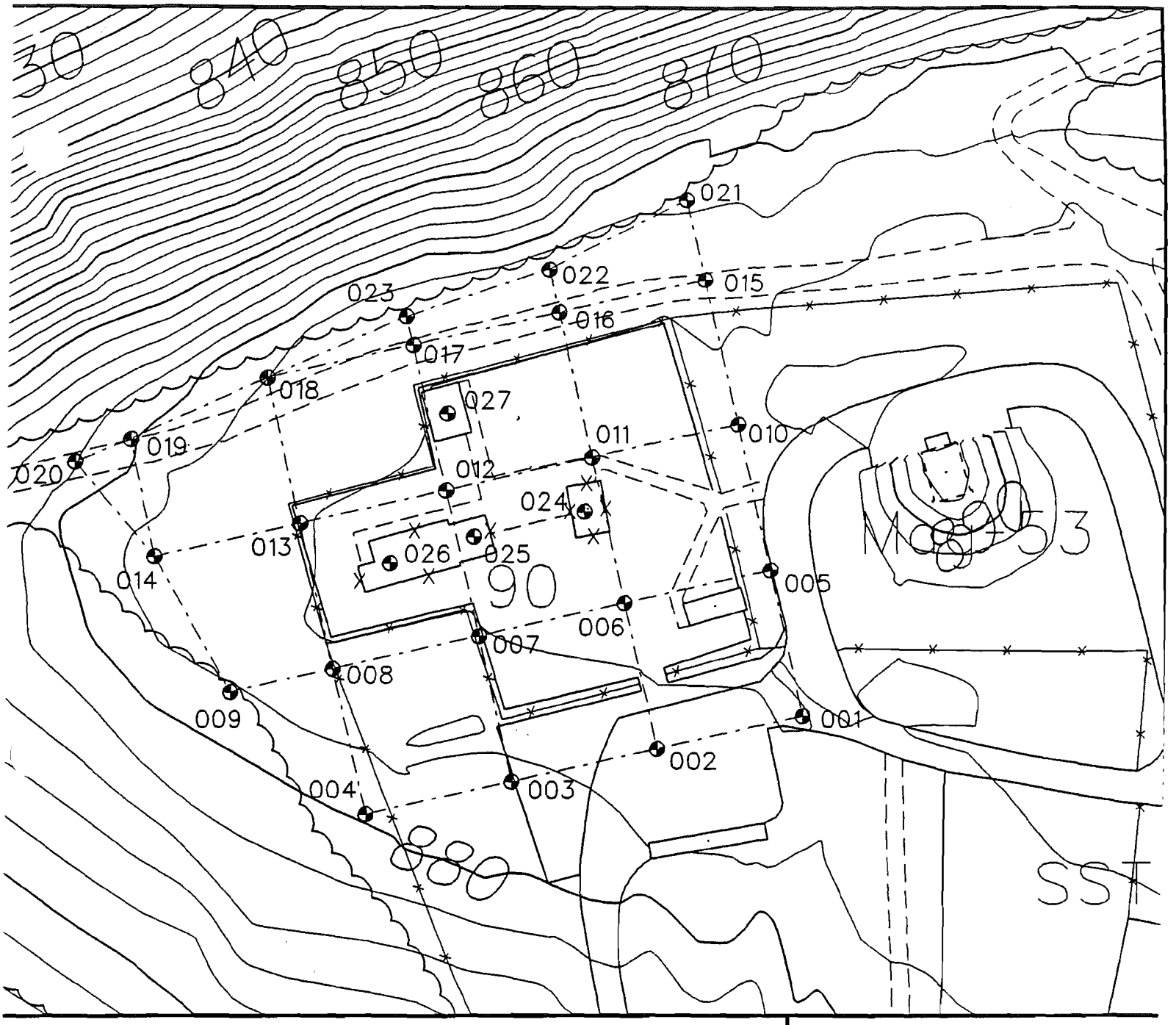
The sand and soil floor in the OB Unit will be removed and placed into approximately 80 drums. After removal of sand/soil, two soil samples will be collected from the surface (0-1 ft.) of the floor.

Burn Area - Post-Demolition Soil Testing

Twenty five core samples of soil will be collected from a 50 feet grid interval (5x5) to assess the contamination in the Burn Area. The soil samples will be characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. Therefore a total of 75 soil samples will be characterized from this grid.

Four additional core samples will be collected from the removed unit locations: the pyroshed, the open burn cubicle, Building 90, and the retort enclosure. The soil samples will be characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. Therefore a total of 12 soil samples will be characterized.

Eight additional soil samples will be collected from each of the excavation faces of the two treatment units.



BURN AREA CLOSURE PLAN
SOIL SAMPLING LOCATIONS

LEGEND

- ⊕ CORE SAMPLES
- X EXCAVATION FACE SAMPLE

MOUND ERGIS

Environmental Restoration Geographic Information System

0 50 100

Scale in feet

Antimony UCL Calculations

Note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.76		0.76	-0.274436846
2	0.34	u	0.17	-1.771956842
3	0.31	u	0.155	-1.864330162
4	0.36	u	0.18	-1.714798428
5	0.33	u	0.165	-1.801809805
6	0.32	u	0.16	-1.832581464
7	0.32	u	0.16	-1.832581464
8	0.33	u	0.165	-1.801809805
9	0.32	u	0.16	-1.832581464
10	0.35	u	0.175	-1.742969305
11	0.34	u	0.17	-1.771956842
12	0.33	u	0.165	-1.801809805
13	0.33	u	0.165	-1.801809805
14	0.35	u	0.175	-1.742969305
15	0.34	u	0.17	-1.771956842
16	0.3	u	0.15	-1.897119985
17	0.36		0.36	-1.021651248
18	0.32	u	0.16	-1.832581464
19	0.32	u	0.16	-1.832581464
20	5		5	1.609437912
21	0.47		0.47	-0.755022584
22	0.33	u	0.165	-1.801809805
24	1.1		1.1	0.09531018
25	0.34	u	0.17	-1.771956842
26	0.34	u	0.17	-1.771956842
27	0.3	u	0.15	-1.897119985
28	0.49		0.49	-0.713349888
29	0.28		0.28	-1.272965676
30	0.31	u	0.155	-1.864330162
31	0.34	u	0.17	-1.771956842
32	0.32	u	0.16	-1.832581464
33	0.32	u	0.16	-1.832581464
34	0.32	u	0.16	-1.832581464
35	0.36	u	0.18	-1.714798428
36	0.34	u	0.17	-1.771956842
37	0.33		0.33	-1.108662625
38	0.8		0.8	-0.223143551
39	0.31	u	0.155	-1.864330162
40	0.29	u	0.145	-1.931021537
41	0.33	u	0.165	-1.801809805
42	0.28	u	0.14	-1.966112856
43	0.3	u	0.15	-1.897119985
44	0.33	u	0.165	-1.801809805
45	0.34		0.34	-1.078809661
47	0.29	u	0.145	-1.931021537
48	0.33	u	0.165	-1.801809805
49	0.62		0.62	-0.478035801
50	0.3	u	0.15	-1.897119985
51	0.29	u	0.145	-1.931021537
52	0.48		0.48	-0.733969175
53	0.33	u	0.165	-1.801809805
54	0.29	u	0.145	-1.931021537
55	0.59		0.59	-0.527632742

56	0.3 u	0.15	-1.897119985
57	0.26 u	0.13	-2.040220829
58	0.67	0.67	-0.400477567
59	1.5	1.5	0.405465108
60	0.37	0.37	-0.994252273
61	0.24 u	0.12	-2.120263536
62	0.38	0.38	-0.967584026
63	0.32 u	0.16	-1.832581464
64	0.32 u	0.16	-1.832581464
65	2.1	2.1	0.741937345
66	0.75	0.75	-0.287682072
67	0.24 u	0.12	-2.120263536
68	0.28 u	0.14	-1.966112856
70	0.53	0.53	-0.634878272
71	1	1	0
72	0.55	0.55	-0.597837001
73	3.5	3.5	1.252762968
74	0.38	0.38	-0.967584026
75	0.39	0.39	-0.94160854
76	1.7	1.7	0.530628251
77	1	1	0
78	0.37	0.37	-0.994252273
79	0.42	0.42	-0.867500568
80	0.34 u	0.17	-1.771956842
81	0.51	0.51	-0.673344553
82	0.58	0.58	-0.544727175
83	0.34	0.34	-1.078809661
84	0.47	0.47	-0.755022584
85	0.29 u	0.145	-1.931021537
86	0.94	0.94	-0.061875404
87	0.57	0.57	-0.562118918
88	0.29 u	0.145	-1.931021537
89	0.27 u	0.135	-2.002480501
90	0.42	0.42	-0.867500568
91	0.55	0.55	-0.597837001
93	0.4	0.4	-0.916290732
118	6.4	6.4	1.85629799
119	1.7	1.7	0.530628251
121	0.97	0.97	-0.030459207
122	1.4	1.4	0.336472237
123	0.91	0.91	-0.094310679
124	0.58	0.58	-0.544727175
125	0.96	0.96	-0.040821995
126	0.56	0.56	-0.579818495
127	0.37	0.37	-0.994252273

	GM
mean(x)	**mean(ln x)**
0.549846939	-1.13609979
std dev (x)	**std dev (ln x)**
0.904065404	0.898271767
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.701262789	0.58299814

Barium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	73.9		73.9	4.302712828
2	35.3		35.3	3.563882964
3	48.2		48.2	3.875359021
4	101		101	4.615120517
5	33.3		33.3	3.505557397
6	25.3		25.3	3.230804396
7	62.1		62.1	4.128745989
8	48.6		48.6	3.883623531
9	50.5		50.5	3.921973336
10	104		104	4.644390899
11	104		104	4.644390899
12	61.7		61.7	4.122283931
13	40.2		40.2	3.693866996
14	98.2		98.2	4.587006215
15	38		38	3.63758616
16	31.4		31.4	3.446807893
17	101		101	4.615120517
18	31.3		31.3	3.443618098
19	28.3		28.3	3.342861805
20	87.9		87.9	4.476199805
21	100		100	4.605170186
22	99.3		99.3	4.598145571
24	84.8		84.8	4.440295543
25	96.7		96.7	4.571613402
26	96.9		96.9	4.573679519
27	47.9		47.9	3.869115504
28	198		198	5.288267031
29	51.9		51.9	3.94931879
30	37.5		37.5	3.624340933
31	86.3		86.3	4.457829598
32	58.6		58.6	4.070734697
33	47.5		47.5	3.860729711
34	59.3		59.3	4.082609306
35	72.9		72.9	4.289088639
36	51		51	3.931825633
37	41.9		41.9	3.735285827
38	106		106	4.663439094
39	82.4		82.4	4.411585437
40	34.6		34.6	3.543853682
41	114		114	4:736198448
42	58.9		58.9	4.075841091
43	54		54	3.988984047
44	88.4		88.4	4.48187197
45	86.4		86.4	4.458987676
47	105		105	4.65396035
48	51.4		51.4	3.939638172
49	203		203	5.313205979
50	43.3		43.3	3.768152635
51	77.1		77.1	4.345103281
52	116		116	4.753590191
53	81.3		81.3	4.398146017
54	36.8		36.8	3.605497845
55	111		111	4.709530201

56	26.7	26.7	3.284663565
57	45.1	45.1	3.808882247
58	97.4	97.4	4.578826211
59	89.8	89.8	4.497584975
60	90.8	90.8	4.508659286
61	33.9	33.9	3.523415014
62	26.9	26.9	3.292126287
63	34.9	34.9	3.552486829
64	44.3	44.3	3.790984677
65	87.5	87.5	4.471638793
66	183	183	5.209486153
67	38.5	38.5	3.650658241
68	34.1	34.1	3.529297384
70	27.1	27.1	3.299533728
71	80.3	80.3	4.385769621
72	163	163	5.093750201
73	75.7	75.7	4.32677816
74	72.8	72.8	4.287715955
75	146	146	4.983606622
76	72.9	72.9	4.289088639
77	87.6	87.6	4.472780998
78	135	135	4.905274778
79	74.5	74.5	4.310799125
80	73.4	73.4	4.295923936
81	129	129	4.859812404
82	56.6	56.6	4.036008985
83	58.2	58.2	4.063885355
84	211	211	5.351858133
85	51.8	51.8	3.947390149
86	73.9	73.9	4.302712828
87	66.1	66.1	4.191168747
88	28.7	28.7	3.356897123
89	34.6	34.6	3.543853682
90	152	152	5.023880521
91	137	137	4.919980926
93	64	64	4.158883083
118	71	71	4.262679877
119	81.5	81.5	4.40060302
121	69.1	69.1	4.235554731
122	76.2	76.2	4.333361463
123	103	103	4.634728988
124	255	255	5.541263545
125	75.3	75.3	4.321480135
126	65.8	65.8	4.186619838
127	56.8	56.8	4.039536326

mean(x)	**mean(ln x)**
77.98061224	4.219790209
std dev (x)	**std dev (ln x)**
43.75432034	0.522193436
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
85.30872985	86.17631436

Beryllium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.55		0.55	-0.597837001
2	0.32		0.32	-1.139434283
3	0.46		0.46	-0.776528789
4	0.66		0.66	-0.415515444
5	0.3		0.3	-1.203972804
6	0.3		0.3	-1.203972804
7	0.56		0.56	-0.579818495
8	0.44		0.44	-0.820980552
9	0.43		0.43	-0.84397007
10	1		1	0
11	1		1	0
12	0.56		0.56	-0.579818495
13	0.44		0.44	-0.820980552
14	0.92		0.92	-0.083381609
15	0.49		0.49	-0.713349888
16	0.4		0.4	-0.916290732
17	0.87		0.87	-0.139262067
18	0.51		0.51	-0.673344553
19	0.43		0.43	-0.84397007
20	1.1		1.1	0.09531018
21	0.94		0.94	-0.061875404
22	0.91		0.91	-0.094310679
24	1		1	0
25	0.77		0.77	-0.261364764
26	0.87		0.87	-0.139262067
27	0.51		0.51	-0.673344553
28	1.5		1.5	0.405465108
29	0.52		0.52	-0.653926467
30	0.33		0.33	-1.108662625
31	0.75		0.75	-0.287682072
32	0.46		0.46	-0.776528789
33	0.46		0.46	-0.776528789
34	0.46		0.46	-0.776528789
35	0.73		0.73	-0.314710745
36	0.59		0.59	-0.527632742
37	0.47		0.47	-0.755022584
38	1.2		1.2	0.182321557
39	1.1		1.1	0.09531018
40	0.57		0.57	-0.562118918
41	1.2		1.2	0.182321557
42	0.82		0.82	-0.198450939
43	0.75		0.75	-0.287682072
44	0.94		0.94	-0.061875404
45	1		1	0
47	1		1	0
48	0.68		0.68	-0.385662481
49	2.9		2.9	1.064710737
50	0.55		0.55	-0.597837001
51	0.84		0.84	-0.174353387
52	1.4		1.4	0.336472237
53	0.81		0.81	-0.210721031
54	0.6		0.6	-0.510825624
55	1.1		1.1	0.09531018

56	0.42	0.42	-0.867500568
57	0.71	0.71	-0.342490309
58	0.8	0.8	-0.223143551
59	0.96	0.96	-0.040821995
60	0.67	0.67	-0.400477567
61	0.37	0.37	-0.994252273
62	0.32	0.32	-1.139434283
63	0.44	0.44	-0.820980552
64	0.54	0.54	-0.616186139
65	3.6	3.6	1.280933845
66	2	2	0.693147181
67	0.34	0.34	-1.078809661
68	0.26	0.26	-1.347073648
70	0.5	0.5	-0.693147181
71	0.79	0.79	-0.235722334
72	1.1	1.1	0.09531018
73	1.2	1.2	0.182321557
74	1.7	1.7	0.530628251
75	0.91	0.91	-0.094310679
76	0.74	0.74	-0.301105093
77	0.99	0.99	-0.010050336
78	1.1	1.1	0.09531018
79	0.56	0.56	-0.579818495
80	0.6	0.6	-0.510825624
81	1.7	1.7	0.530628251
82	0.5	0.5	-0.693147181
83	0.28	0.28	-1.272965676
84	1.9	1.9	0.641853886
85	0.49	0.49	-0.713349888
86	1.6	1.6	0.470003629
87	1.2	1.2	0.182321557
88	0.37	0.37	-0.994252273
89	0.34	0.34	-1.078809661
90	1.2	1.2	0.182321557
91	1.4	1.4	0.336472237
93	0.46	0.46	-0.776528789
118	0.92	0.92	-0.083381609
119	4.3	4.3	1.458615023
121	0.95	0.95	-0.051293294
122	4.7	4.7	1.547562509
123	0.84	0.84	-0.174353387
124	1.8	1.8	0.587786665
125	0.5	0.5	-0.693147181
126	0.51	0.51	-0.673344553
127	0.47	0.47	-0.755022584

mean(x)	**mean(ln x)**
0.903265306	-0.301353513
std dev (x)	**std dev (ln x)**
0.740111131	0.587685996
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
1.027221555	0.984295389

Cadmium CL Calclations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.25	u	0.125	-2.079441542
2	0.27	u	0.135	-2.002480501
3	0.25	u	0.125	-2.079441542
4	0.28	u	0.14	-1.966112856
5	0.26	u	0.13	-2.040220829
6	0.25	u	0.125	-2.079441542
7	0.25	u	0.125	-2.079441542
8	0.26	u	0.13	-2.040220829
9	0.25	u	0.125	-2.079441542
10	0.27	u	0.135	-2.002480501
11	0.27	u	0.135	-2.002480501
12	0.3		0.3	-1.203972804
13	0.26	u	0.13	-2.040220829
14	0.27	u	0.135	-2.002480501
15	0.27	u	0.135	-2.002480501
16	0.24	u	0.12	-2.120263536
17	0.26	u	0.13	-2.040220829
18	0.25	u	0.125	-2.079441542
19	0.25	u	0.125	-2.079441542
20	0.29	u	0.145	-1.931021537
21	0.27	u	0.135	-2.002480501
22	0.26	u	0.13	-2.040220829
24	0.45		0.45	-0.798507696
25	0.27	u	0.135	-2.002480501
26	0.26	u	0.13	-2.040220829
27	0.23	u	0.115	-2.162823151
28	0.61		0.61	-0.494296322
29	0.22	u	0.11	-2.207274913
30	0.25	u	0.125	-2.079441542
31	0.27	u	0.135	-2.002480501
32	0.27		0.27	-1.30933332
33	0.25	u	0.125	-2.079441542
34	0.25	u	0.125	-2.079441542
35	0.28	u	0.14	-1.966112856
36	0.27	u	0.135	-2.002480501
37	0.26	u	0.13	-2.040220829
38	0.24	u	0.12	-2.120263536
39	0.24	u	0.12	-2.120263536
40	0.23	u	0.115	-2.162823151
41	0.26	u	0.13	-2.040220829
42	0.22	u	0.11	-2.207274913
43	0.24	u	0.12	-2.120263536
44	0.26	u	0.13	-2.040220829
45	0.25	u	0.125	-2.079441542
47	0.23	u	0.115	-2.162823151
48	0.26	u	0.13	-2.040220829
49	0.26	u	0.13	-2.040220829
50	0.24	u	0.12	-2.120263536
51	0.23	u	0.115	-2.162823151
52	0.25	u	0.125	-2.079441542
53	0.26	u	0.13	-2.040220829
54	0.23	u	0.115	-2.162823151
55	0.24	u	0.12	-2.120263536

56	0.24 u	0.12	-2.120263536
57	0.2 u	0.1	-2.302585093
58	0.24 u	0.12	-2.120263536
59	0.35	0.35	-1.049822124
60	0.24 u	0.12	-2.120263536
61	0.19 u	0.095	-2.353878387
62	0.26 u	0.13	-2.040220829
63	0.25 u	0.125	-2.079441542
64	0.25 u	0.125	-2.079441542
65	0.28 u	0.14	-1.966112856
66	0.28 u	0.14	-1.966112856
67	0.19 u	0.095	-2.353878387
68	0.22 u	0.11	-2.207274913
70	0.22 u	0.11	-2.207274913
71	0.25 u	0.125	-2.079441542
72	0.19 u	0.095	-2.353878387
73	0.25 u	0.125	-2.079441542
74	0.26 u	0.13	-2.040220829
75	0.24 u	0.12	-2.120263536
76	0.27 u	0.135	-2.002480501
77	0.17 u	0.085	-2.465104022
78	0.26	0.26	-1.347073648
79	0.25	0.25	-1.386294361
80	0.27	0.27	-1.30933332
81	0.27	0.27	-1.30933332
82	1.4	1.4	0.336472237
83	0.23 u	0.115	-2.162823151
84	0.58 u	0.29	-1.237874356
85	0.23 u	0.115	-2.162823151
86	0.26 u	0.13	-2.040220829
87	0.25 u	0.125	-2.079441542
88	0.23 u	0.115	-2.162823151
89	0.21 u	0.105	-2.253794929
90	0.24 u	0.12	-2.120263536
91	0.24 u	0.12	-2.120263536
93	1.1	1.1	0.09531018
118	0.87	0.87	-0.139262067
119	0.29 u	0.145	-1.931021537
121	0.29 u	0.145	-1.931021537
122	0.35	0.35	-1.049822124
123	0.27 u	0.135	-2.002480501
124	0.56	0.56	-0.579818495
125	0.4	0.4	-0.916290732
126	0.25 u	0.125	-2.079441542
127	0.21 u	0.105	-2.253794929

mean(x)	**mean(ln x)**
0.185306122	-1.891113015
std dev (x)	**std dev (ln x)**
0.193925557	0.516059512
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.217785413	0.192621542

Chromium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	11.1		11.1	2.406945108
2	6.6		6.6	1.887069649
3	8.6		8.6	2.151762203
4	12.6		12.6	2.533696814
5	5.3		5.3	1.667706821
6	4.2		4.2	1.435084525
7	9.3		9.3	2.2300144
8	7.6		7.6	2.028148247
9	6.9		6.9	1.931521412
10	16.1		16.1	2.778819272
11	15.5		15.5	2.740840024
12	10.2		10.2	2.32238772
13	6.8		6.8	1.916922612
14	16.1		16.1	2.778819272
15	10.6		10.6	2.360854001
16	8.4		8.4	2.128231706
17	15.1		15.1	2.714694744
18	8.3		8.3	2.116255515
19	9.5		9.5	2.251291799
20	14.7		14.7	2.687847494
21	17		17	2.833213344
22	16.4		16.4	2.797281335
24	14.8		14.8	2.694627181
25	15.8		15.8	2.76000994
26	16.5		16.5	2.803360381
27	9.5		9.5	2.251291799
28	24.9		24.9	3.214867803
29	9.3		9.3	2.2300144
30	6.5		6.5	1.871802177
31	13		13	2.564949357
32	9.5		9.5	2.251291799
33	8.5		8.5	2.140066163
34	9.8		9.8	2.282382386
35	12.4		12.4	2.517696473
36	10.2		10.2	2.32238772
37	8.9		8.9	2.186051277
38	20.1		20.1	3.000719815
39	16.7		16.7	2.815408719
40	8.1		8.1	2.091864062
41	18		18	2.890371758
42	14.1		14.1	2.646174797
43	12.4		12.4	2.517696473
44	16.5		16.5	2.803360381
45	18.1		18.1	2.895911938
47	16		16	2.772588722
48	9.9		9.9	2.292534757
49	33.3		33.3	3.505557397
50	7.4		7.4	2.00148
51	13.9		13.9	2.63188884
52	20		20	2.995732274
53	12.1		12.1	2.493205453
54	7.7		7.7	2.041220329
55	13.8		13.8	2.624668592

56	5.2	5.2	1.648658626
57	9.9	9.9	2.292534757
58	13.8	13.8	2.624668592
59	21.6	21.6	3.072693315
60	12.4	12.4	2.517696473
61	5.5	5.5	1.704748092
62	5.5	5.5	1.704748092
63	6.3	6.3	1.840549633
64	8.9	8.9	2.186051277
65	11.2	11.2	2.415913778
66	23.5	23.5	3.157000421
67	5.7	5.7	1.740466175
68	5	5	1.609437912
70	7.8	7.8	2.054123734
71	21.4	21.4	3.063390922
72	20.1	20.1	3.000719815
73	11	11	2.397895273
74	22.1	22.1	3.095577609
75	14.9	14.9	2.701361213
76	13.8	13.8	2.624668592
77	18.8	18.8	2.93385687
78	18.1	18.1	2.895911938
79	10.6	10.6	2.360854001
80	10.4	10.4	2.341805806
81	19.5	19.5	2.970414466
82	7.6	7.6	2.028148247
83	8.5	8.5	2.140066163
84	34.5	34.5	3.540959324
85	8.3	8.3	2.116255515
86	6	6	1.791759469
87	10.9	10.9	2.388762789
88	4.6	4.6	1.526056303
89	5.2	5.2	1.648658626
90	17.9	17.9	2.884800713
91	20.6	20.6	3.025291076
93	8.4	8.4	2.128231706
118	18.9	18.9	2.939161922
119	9.4	9.4	2.240709689
121	17.6	17.6	2.867898902
122	10.9	10.9	2.388762789
123	18.2	18.2	2.901421594
124	24.4	24.4	3.194583132
125	12.1	12.1	2.493205453
126	9.6	9.6	2.261763098
127	8.6	8.6	2.151762203

mean(x)	**mean(ln x)**
12.75306122	2.443108135
std dev (x)	**std dev (ln x)**
5.942546299	0.458192662
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.83
UCL normal	**UCL lognormal**
13.74833844	13.91843771

Lead UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	10.6		10.6	2.360854001
2	2.9	u	1.45	0.371563556
3	4.2		4.2	1.435084525
4	5.8		5.8	1.757857918
5	2.8	u	1.4	0.336472237
6	2.7	u	1.35	0.300104592
7	6.9		6.9	1.931521412
8	2.8	u	1.4	0.336472237
9	4.5		4.5	1.504077397
10	18.5		18.5	2.917770732
11	15.5		15.5	2.740840024
12	5.8		5.8	1.757857918
13	5.3		5.3	1.667706821
14	18.2		18.2	2.901421594
15	4.6		4.6	1.526056303
16	8.9		8.9	2.186051277
17	19.9		19.9	2.990719732
18	2.9		2.9	1.064710737
19	4.4		4.4	1.481604541
20	24.2		24.2	3.186352633
21	7.6		7.6	2.028148247
22	7		7	1.945910149
24	13.2		13.2	2.58021683
25	14.8		14.8	2.694627181
26	9.2		9.2	2.219203484
27	4.4		4.4	1.481604541
28	21.2		21.2	3.054001182
29	2.5		2.5	0.916290732
30	2.7	u	1.35	0.300104592
31	14.8		14.8	2.694627181
32	2.7	u	1.35	0.300104592
33	4.8		4.8	1.568615918
34	2.7	u	1.35	0.300104592
35	6		6	1.791759469
36	5.2		5.2	1.648658626
37	3.5		3.5	1.252762968
38	13.9		13.9	2.63188884
39	4.1		4.1	1.410986974
40	4.3		4.3	1.458615023
41	15		15	2.708050201
42	3.1		3.1	1.131402111
43	2.6	u	1.3	0.262364264
44	14.6		14.6	2.681021529
45	16.8		16.8	2.821378886
47	8.1		8.1	2.091864062
48	3.2		3.2	1.16315081
49	15.1		15.1	2.714694744
50	4.5		4.5	1.504077397
51	5.8		5.8	1.757857918
52	10.1		10.1	2.312535424
53	5.1		5.1	1.62924054
54	3.5		3.5	1.252762968
55	9.2		9.2	2.219203484

56	2.6 u	1.3	0.262364264
57	4.9	4.9	1.589235205
58	6.4	6.4	1.85629799
59	11.5	11.5	2.442347035
60	7.9	7.9	2.066862759
61	3.1	3.1	1.131402111
62	5	5	1.609437912
63	2.8	2.8	1.029619417
64	3.5	3.5	1.252762968
65	17.1	17.1	2.839078464
66	10.4	10.4	2.341805806
67	3.4	3.4	1.223775432
68	4.2	4.2	1.435084525
70	13.1	13.1	2.57261223
71	13	13	2.564949357
72	9.6	9.6	2.261763098
73	73.8	73.8	4.301358732
74	10.9	10.9	2.388762789
75	8.6	8.6	2.151762203
76	14.1	14.1	2.646174797
77	11.5	11.5	2.442347035
78	7.1	7.1	1.960094784
79	11.9	11.9	2.4765384
80	12.6	12.6	2.533696814
81	8.4	8.4	2.128231706
82	6	6	1.791759469
83	7.5	7.5	2.014903021
84	6.3 u	3.15	1.147402453
85	2.5	2.5	0.916290732
86	9.8	9.8	2.282382386
87	13.1	13.1	2.57261223
88	2.5 u	1.25	0.223143551
89	8.1	8.1	2.091864062
90	11	11	2.397895273
91	9.1	9.1	2.208274414
93	5	5	1.609437912
118	113	113	4.727387819
119	3.1 u	1.55	0.438254931
121	11.2	11.2	2.415913778
122	3 u	1.5	0.405465108
123	7.8	7.8	2.054123734
124	13	13	2.564949357
125	15.9	15.9	2.766319109
126	6.9	6.9	1.931521412
127	4.1	4.1	1.410986974

mean(x)	**mean(ln x)**
9.686734694	1.864920298
std dev (x)	**std dev (ln x)**
13.52462922	0.868293527
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
11.95188412	11.34214869

Nickel UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	15.3		15.3	2.727852828
2	18.7		18.7	2.928523524
3	16.1		16.1	2.778819272
4	21		21	3.044522438
5	8.6		8.6	2.151762203
6	7.5		7.5	2.014903021
7	19.6		19.6	2.975529566
8	14.4		14.4	2.667228207
9	12.9		12.9	2.557227311
10	21.3		21.3	3.058707073
11	22.8		22.8	3.126760536
12	16		16	2.772588722
13	13.7		13.7	2.617395833
14	22.1		22.1	3.095577609
15	16.5		16.5	2.803360381
16	13.8		13.8	2.624668592
17	19.7		19.7	2.980618636
18	13.2		13.2	2.58021683
19	17.7		17.7	2.87356464
20	16.8		16.8	2.821378886
21	25.9		25.9	3.254242969
22	29.8		29.8	3.394508394
24	20.5		20.5	3.020424886
25	16.5		16.5	2.803360381
26	20.2		20.2	3.005682604
27	13.8		13.8	2.624668592
28	34		34	3.526360525
29	12.1		12.1	2.493205453
30	9.1		9.1	2.208274414
31	16.6		16.6	2.809402695
32	17.2		17.2	2.844909384
33	11.5		11.5	2.442347035
34	14.3		14.3	2.660259537
35	19.1		19.1	2.949688335
36	15.8		15.8	2.76000994
37	15.6		15.6	2.747270914
38	19.8		19.8	2.985681938
39	22.3		22.3	3.104586678
40	10.8		10.8	2.379546134
41	21.5		21.5	3.068052935
42	15.2		15.2	2.721295428
43	16.5		16.5	2.803360381
44	17.6		17.6	2.867898902
45	16.9		16.9	2.827313622
47	21.9		21.9	3.086486637
48	13.7		13.7	2.617395833
49	47.2		47.2	3.854393893
50	9.5		9.5	2.251291799
51	19.5		19.5	2.970414466
52	29.5		29.5	3.384390263
53	17.4		17.4	2.856470206
54	11.4		11.4	2.433613355
55	25.5		25.5	3.238678452

56	8.2	8.2	2.104134154
57	14.6	14.6	2.681021529
58	17.5	17.5	2.862200881
59	17.7	17.7	2.87356464
60	18.8	18.8	2.93385687
61	10.6	10.6	2.360854001
62	5.7	5.7	1.740466175
63	9.1	9.1	2.208274414
64	13.6	13.6	2.610069793
65	33.1	33.1	3.499533282
66	28.2	28.2	3.339321978
67	8.5	8.5	2.140066163
68	8.2	8.2	2.104134154
70	2.8	2.8	1.029619417
71	19.5	19.5	2.970414466
72	28.6	28.6	3.353406718
73	8.7	8.7	2.163323026
74	21.9	21.9	3.086486637
75	22.9	22.9	3.131136911
76	11.4	11.4	2.433613355
77	17.9	17.9	2.884800713
78	25.2	25.2	3.226843995
79	8.6	8.6	2.151762203
80	9.5	9.5	2.251291799
81	37.1	37.1	3.61361697
82	17.2	17.2	2.844909384
83	5.2	5.2	1.648658626
84	55.1	55.1	4.009149716
85	15.5	15.5	2.740840024
86	7.8	7.8	2.054123734
87	12	12	2.48490665
88	8.9	8.9	2.186051277
89	4.6	4.6	1.526056303
90	38.1	38.1	3.640214282
91	33.9	33.9	3.523415014
93	14.2	14.2	2.653241965
118	27.9	27.9	3.328626689
119	12.8	12.8	2.549445171
121	15.2	15.2	2.721295428
122	14.8	14.8	2.694627181
123	16.6	16.6	2.809402695
124	89.8	89.8	4.497584975
125	15.9	15.9	2.766319109
126	13.3	13.3	2.587764035
127	12.4	12.4	2.517696473

mean(x)	**mean(ln x)**
18.31632653	2.77280445
std dev (x)	**std dev (ln x)**
11.27792017	0.51552559
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
20.20518973	20.1795495

Silver UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.46	u	0.23	-1.46967597
2	0.49	u	0.245	-1.406497068
3	0.45	u	0.225	-1.491654877
4	0.52	u	0.26	-1.347073648
5	0.46	u	0.23	-1.46967597
6	0.45	u	0.225	-1.491654877
7	0.46	u	0.23	-1.46967597
8	0.47	u	0.235	-1.448169765
9	0.46	u	0.23	-1.46967597
10	0.49	u	0.245	-1.406497068
11	0.49	u	0.245	-1.406497068
12	0.47	u	0.235	-1.448169765
13	0.47	u	0.235	-1.448169765
14	0.5	u	0.25	-1.386294361
15	0.48	u	0.24	-1.427116356
16	0.43	u	0.215	-1.537117251
17	0.47	u	0.235	-1.448169765
18	0.46	u	0.23	-1.46967597
19	0.46	u	0.23	-1.46967597
20	0.52	u	0.26	-1.347073648
21	0.49	u	0.245	-1.406497068
22	0.47	u	0.235	-1.448169765
24	0.49	u	0.245	-1.406497068
25	0.48	u	0.24	-1.427116356
26	0.48	u	0.24	-1.427116356
27	0.42	u	0.21	-1.560647748
28	0.52		0.52	-0.653926467
29	0.41	u	0.205	-1.5847453
30	0.45	u	0.225	-1.491654877
31	0.49	u	0.245	-1.406497068
32	0.45	u	0.225	-1.491654877
33	0.45	u	0.225	-1.491654877
34	0.46	u	0.23	-1.46967597
35	0.5	u	0.25	-1.386294361
36	0.49	u	0.245	-1.406497068
37	0.47	u	0.235	-1.448169765
38	0.81		0.81	-0.210721031
39	0.75		0.75	-0.287682072
40	0.5		0.5	-0.693147181
41	0.93		0.93	-0.072570693
42	0.41	u	0.205	-1.5847453
43	0.51		0.51	-0.673344553
44	0.74		0.74	-0.301105093
45	0.69		0.69	-0.371063681
47	0.53		0.53	-0.634878272
48	0.47	u	0.235	-1.448169765
49	1.5		1.5	0.405465108
50	0.43	u	0.215	-1.537117251
51	0.59		0.59	-0.527632742
52	0.98		0.98	-0.020202707
53	0.47	u	0.235	-1.448169765
54	0.41	u	0.205	-1.5847453
55	0.82		0.82	-0.198450939

56	0.43 u	0.215	-1.537117251
57	0.44	0.44	-0.820980552
58	0.45 u	0.225	-1.491654877
59	0.65	0.65	-0.430782916
60	0.44 u	0.22	-1.514127733
61	0.35 u	0.175	-1.742969305
62	0.48 u	0.24	-1.427116356
63	0.46 u	0.23	-1.46967597
64	0.46 u	0.23	-1.46967597
65	1	1	0
66	1	1	0
67	0.35 u	0.175	-1.742969305
68	0.39 u	0.195	-1.63475572
70	0.41 u	0.205	-1.5847453
71	0.71	0.71	-0.342490309
72	0.77	0.77	-0.261364764
73	1.4	1.4	0.336472237
74	0.91	0.91	-0.094310679
75	0.47	0.47	-0.755022584
76	0.59	0.59	-0.527632742
77	0.77	0.77	-0.261364764
78	0.89	0.89	-0.116533816
79	0.63	0.63	-0.46203546
80	0.74	0.74	-0.301105093
81	1.2	1.2	0.182321557
82	0.47 u	0.235	-1.448169765
83	0.42 u	0.21	-1.560647748
84	1.5	1.5	0.405465108
85	0.41 u	0.205	-1.5847453
86	0.47 u	0.235	-1.448169765
87	0.61	0.61	-0.494296322
88	0.41 u	0.205	-1.5847453
89	0.39 u	0.195	-1.63475572
90	2.4	2.4	0.875468737
91	1.2	1.2	0.182321557
93	0.43	0.43	-0.84397007
118	2.4	2.4	0.875468737
119	1.2	1.2	0.182321557
121	0.95	0.95	-0.051293294
122	0.84	0.84	-0.174353387
123	0.49 u	0.245	-1.406497068
124	0.95	0.95	-0.051293294
125	0.43 u	0.215	-1.537117251
126	0.46 u	0.23	-1.46967597
127	0.39 u	0.195	-1.63475572

mean(x)	**mean(ln x)**
0.491071429	-0.983942707
std dev (x)	**std dev (ln x)**
0.43587526	0.68912283
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.96
UCL normal	**UCL lognormal**
0.564073252	0.54370051

Dibutylphthalate UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg) u = MDL	CONC.(x)	ln(x)
1	380 u	190	5.247024072
2	21 jb	21	3.044522438
3	22 jb	22	3.091042453
4	23 jb	23	3.135494216
5	390 u	195	5.272999559
6	390 u	195	5.272999559
7	420 u	210	5.347107531
8	400 u	200	5.298317367
9	22 jb	22	3.091042453
10	420 u	210	5.347107531
11	420 u	210	5.347107531
12	390 u	195	5.272999559
13	410 u	205	5.323009979
14	410 u	205	5.323009979
15	400 u	200	5.298317367
16	380 u	190	5.247024072
17	22 jb	22	3.091042453
18	390 u	195	5.272999559
19	25 jb	25	3.218875825
20	47 jb	47	3.850147602
21	33 jb	33	3.496507561
22	410 u	205	5.323009979
24	410 u	205	5.323009979
25	410 u	205	5.323009979
26	400 u	200	5.298317367
27	400 u	200	5.298317367
28	26 jb	26	3.258096538
29	400 u	200	5.298317367
30	380 u	190	5.247024072
31	410 u	205	5.323009979
32	380 u	190	5.247024072
33	380 u	190	5.247024072
34	390 u	195	5.272999559
35	430 u	215	5.370638028
36	420 u	210	5.347107531
37	400 u	200	5.298317367
38	410 u	205	5.323009979
39	390 u	195	5.272999559
40	400 u	200	5.298317367
41	410 u	205	5.323009979
42	390 u	195	5.272999559
43	390 u	195	5.272999559
44	420 u	210	5.347107531
45	400 u	200	5.298317367
47	410 u	205	5.323009979
48	21 j	21	3.044522438
49	420 u	210	5.347107531
50	380 u	190	5.247024072
51	390 u	195	5.272999559
52	400 u	200	5.298317367
53	420 u	210	5.347107531
54	380 u	190	5.247024072
55	420 u	210	5.347107531
56	33 j	33	3.496507561
57	29 j	29	3.36729583
58	330 u	165	5.105945474

59	330 u	165	5.105945474
60	23 j	23	3.135494216
61	330 u	165	5.105945474
62	330 u	165	5.105945474
63	330 u	165	5.105945474
64	330 u	165	5.105945474
65	21 j	21	3.044522438
66	330 u	165	5.105945474
67	330 u	165	5.105945474
68	330 u	165	5.105945474
70	330 u	165	5.105945474
71	330 u	165	5.105945474
72	19 j	19	2.944438979
73	330 u	165	5.105945474
74	330 u	165	5.105945474
75	22 j	22	3.091042453
76	330 u	165	5.105945474
77	330 u	165	5.105945474
78	33 jb	33	3.496507561
79	38 jb	38	3.63758616
80	28 jb	28	3.33220451
81	25 jb	25	3.218875825
82	24 jb	24	3.17805383
83	41 jb	41	3.713572067
84	65 jb	65	4.17438727
85	28 jb	28	3.33220451
86	36 jb	36	3.583518938
87	27 jb	27	3.295836866
88	43 jb	43	3.761200116
89	39 jb	39	3.663561646
90	40 jb	40	3.688879454
91	36 jb	36	3.583518938
93	21 jb	21	3.044522438
118	49 jb	49	3.891820298
119	700 b	700	6.551080335
121	28 jb	28	3.33220451
122	26 j	26	3.258096538
123	440 u	220	5.393627546
124	470 u	235	5.459585514
125	410 u	205	5.323009979
126	410 u	205	5.323009979
127	230 j	230	5.438079309

mean(x)	**mean(ln x)**
142.1530612	4.61826868
std dev (x)	**std dev (ln x)**
97.69501797	0.943092078
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.205
UCL normal	**UCL lognormal**
158.5153444	195.2192096

j = estimated concentration (below MDL)
b = blank contaminant
u = not detected (MDL)

APPENDIX D

RISK ASSESSMENT FOR THE RISK-BASED CLOSURE MOUND PLANT BURN AREA SOIL

Mound Plant
Miamisburg, Ohio

January 22, 1998

Prepared for
U.S. DEPARTMENT OF ENERGY
Ohio Field Office
Miamisburg Environmental Management Project
P. O. Box 66
Miamisburg, Ohio 45343-0066

PREFACE

This report presents a risk assessment of the residual contamination detected at the Burn Area following post demolition soil sampling activities. Acceptance of this attachment by the regulatory agencies will allow the unit to be considered risk-based closed.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABS	Absorption Factor
CDI	Chronic Daily Intake
CFR	Code of Federal Regulations
COPC	Contaminant of Potential Concern
DOE	United States Department of Energy
E	Exposure level
FR	Federal Register
g	Gram
HEAST	Health Effects Assessment Summary Table
HI	Hazard Index
IRIS	Integrated Risk Information System
Kg	Kilogram
Mg	Milligram
Ohio EPA	Ohio Environmental Protection Agency
OSWER	Office of Solid Waste and Emergency Response
PCBs	Polychlorinated biphenyls
PEF	Particulate Emissions Factor
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RME	Reasonable Maximum Exposure
SF	Slope Factor
TCLP	Toxicity Characteristic Leaching Procedure
TICs	Tentatively Identified Compounds
UCL	Upper Confidence Limit
U.S. EPA	United States Environmental Protection Agency
VF	Volatilization Factor

EXECUTIVE SUMMARY

Mound is situated on two hills overlooking the river and the city of Miamisburg. The Burn Area is located on the southeastern hill and includes two storage units, Magazine 53 and the Pyroshed; and four treatment units, the Open Burn Unit, the Retort Unit, the Energetic Materials Pretreatment Unit, and the Thermal Treatment Unit. From September 1996 through July 1997, the storage and treatment units were removed and/or demolished as part of the closure activities for the Burn Area. Following these activities, post demolition soils were sampled to identify any residual contamination. Analysis of these samples revealed minimal levels of antimony present; these detections prevented the area from being clean closed.

The purpose of this Appendix to the Amended Burn Area Closure Plan is to determine whether the residual contaminant, antimony, is present at levels in compliance with Resource Conservation and Recovery Act (RCRA) risk-based closure standards. Compliance with these standards will allow the Burn Area to be considered risk-based closed.

In an effort to demonstrate compliance, a human health risk assessment was conducted in accordance with Environmental Protection Agency (EPA) guidance for RCRA risk-based closures (U.S. EPA 1987a and Ohio EPA 1993b). Soil samples were taken in areas were the highest amount of antimony was excepted per Ohio EPA based on previous sampling efforts. The samples were analyzed for TCLP. The current and planned land use of the site is industrial; however both a residential land use and industrial land use scenario were evaluated in the risk assessment.

Risks were then characterized for each exposure pathway for antimony. The risk based standards were not achieved for the residential land use scenario due to the groundwater pathway. Based on the industrial land use scenario risk assessment performed, human health risks from residual contamination do not exceed EPA target values. The Burn Area is considered risk-based closed under the industrial land use scenario; however since both the residential land use and the industrial land use scenario risk assessments indicated that the drinking water pathway is the critical pathway, deed restrictions will be imposed.

1.0 BACKGROUND

The Burn Area, located on the southeastern hill, includes two storage units, Magazine 53 and the Pyroshed; and four treatment units, the Open Burn Unit, the Retort Unit, the Energetic Pretreatment Unit, and the Thermal Treatment Unit. Figure 1-1 shows the location of the Burn Area at Mound. By July 1997, all storage units and treatment units except for Magazine 53 were demolished and/or removed from the project site. Magazine 53 was washed and rinsate tested. Rinsate test results passed RCRA closure standards.

The purpose of this closure risk assessment is to determine whether constituents remaining in soil at the Burn Area are present at levels in compliance with RCRA health-based closure standards. In order to demonstrate risk-based closure of the Burn Area, a human health risk assessment was conducted in accordance with EPA guidance (U.S. EPA 1987a and Ohio EPA 1993). The human health risk assessment includes four steps:

(1) Data Evaluation and Selection of Contaminants of Potential Concern;
(2) Exposure Assessment;
(3) Toxicity Assessment; and
(4) Risk Characterization.

2.0 DATA EVALUATION/SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN

The Burn Area site comprises an area of about 40,000 square feet. Twenty-seven core samples and eight excavation face samples (from the Treatment Units) were collected to confirm the removal of gross contamination. The core samples were characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. The sampling plan map (Figure 2-1) locates the grid where confirmatory samples, referred to as post-demolition samples, hereinafter, were collected.

Samples were collected and analyzed per the Burn Area Closure Plan. Samples were analyzed for organic and inorganic constituents using U.S. EPA's SW-846 Publication, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. Constituents of Burn Area Wastes are presented in Table 1. Complete analytical results are presented in Appendix A.

2.1 Comparison to Action Levels - Background and Practical Quantitation Limit

Distribution testing using the tests in SAS, a statistics analysis software, was performed on the Burn Area Data and the applicable Mound Background data. These data were shown to be lognormally distributed using descriptive statistics (see Appendix B).

Background soil data were considered to be those data for similar soils as extracted from the OU9, Background Soils Investigation: Soil Chemistry Report. Burn Area soil types were believed to be most similar to the Fairmont silty clay loams and Ritchey silt loams described in this Report.

The initial evaluation of Burn Area soil data for contaminants of concern involved the calculation of the 95% upper confidence limit (UCL) point of the data distribution for each RCRA contaminant for comparison to its corresponding action level. The action level for a naturally occurring constituent that is lognormally distributed (as with the Burn Area data and the applicable Mound Background data) is the 95% UCL point of the distribution. For lognormal data, this is calculated from the geometric mean of the background population and the standard deviation of the background population. The action level for contamination originating from non-naturally occurring or non-detectable chemicals is equal to the practical quantitation limit (PQL) for the testing method. Specific action levels or clean up goals are presented and compared with the respective 95% UCL point of the RCRA potential contaminants of concern data distribution in Table 2.

2.2 Selection of Contaminants of Potential Concern

Antimony was the only inorganic closure constituent detected in post-demolition samples with a 95% UCL point of the distribution greater than its PQL or action level; therefore, it was assumed to be related to the Burn Area. No explosive compounds or organics were detected in any sample that exceeded its corresponding action level. Antimony is considered the only Burn Area contaminant of potential concern.

3.0 EXPOSURE ASSESSMENT

The current and planned land use of the site is industrial with restricted access; however, a residential land use scenario was evaluated in the risk assessment in order to establish whether the Burn Area meets the most restrictive standards for risk-based closure. Demonstrating compliance with risk-based closure standards under a residential scenario will allow unrestricted land use of the Burn Area. The residential land use scenario evaluation assumptions, calculations, and results are found in Appendix C. The risk assessment evaluated under the residential land use scenario did not meet risk-based closure standards. Therefore, the industrial land use scenario was evaluated in the risk assessment to determine whether risk-based standards could be met. The industrial land use scenario evaluation assumptions, calculations, and results are found in Appendix D. Results are summarized in Section 5.2.

3.1 Point of Exposure

U.S. EPA (1989) specifies that the potential point of exposure to hazardous waste constituents is assumed to be directly within the unit boundary. Therefore, post-demolition samples taken directly in the Burn Area boundary were used to determine exposure intakes. Due to the close proximity of the soil sample locations to the former units, the samples are likely to contain the highest residual contaminant levels. Using the analytical data from these samples will result in conservative estimates of residual risks.

3.2 Exposure Pathways

Table C-1 lists the exposure pathways evaluated for the Burn Area residential land use scenario risk assessment, and Figure 3-1a depicts the related conceptual unit exposure model. These pathways represent all feasible pathways based on a residential land-use scenario. Table D-1 lists the exposure pathways evaluated for the Burn Area industrial land use risk assessment, and Figure 3-1b depicts the corresponding conceptual unit exposure model. Soil is the only contaminated media identified at the Burn Area. The Burn Area Closure Plan did not require groundwater testing for closure. However, the RCRA Risk Assessment Guidance (Ohio EPA, 1993b) does address groundwater impacts via calculations.

As stated earlier, the residential land use scenario was initially evaluated for the Burn Area. In order to evaluate a residential land use scenario, the groundwater pathway must be included in the Risk Assessment or excluded based on specific exceptions noted in Ohio EPA 1993b. Upon examination, it was determined the exclusionary exceptions do not apply to the Burn Area; therefore, the groundwater pathway was addressed.

To evaluate the impact of residual soil contamination on groundwater, either a published or site-specific chemical dependent partition coefficient (Kd) for antimony had to be used to predict attenuation of the contaminant or toxicity characteristic leaching procedure (TCLP) testing (55 FR 11798, 40 CFR 261.24) for antimony had to be performed. After the post-demolition samples were taken and analyzed, it was determined that there is no published or site-specific chemical dependent partition coefficient for antimony. It was then decided that additional Burn Area soil samples for TCLP antimony testing would be taken.

Four TCLP soil samples were taken. These samples were selected to avoid areas where previous results indicated antimony non-detects. Post-demolition total antimony soil results were overall relatively low (many non-detects) with a few spots at relatively higher levels.

TCLP soil leachate concentrations for antimony were determined using SW-846 methodology. The TCLP soil leachate data, extraction efficiencies, and their means and standard deviations are presented on Table 4. The 95% UCL of the mean antimony TCLP concentration data is also

shown on Table 4. Note, the average concentration of the antimony in the Leachate is at the drinking water standard of 6 ppb. The TCLP probably overestimates the concentration in the groundwater because the site is not a landfill and the TCLP soil samples were biased samples. Nevertheless, the 95% confidence level of the mean antimony leachate concentration was used to estimate the amount of antimony that would potentially contaminate the future hypothetical drinking water supply.

3.3 Exposure Parameters

Exposure equations and parameters for a residential land use scenario for soils are listed in Tables C-2 through C-4. These equations and parameters are consistent with those listed in Ohio EPA's Closure Plan Review Guidance for RCRA Facilities, Appendix E, Tables 1 through 5 (Ohio EPA, 1993a).

Exposure equations and parameters for residential use of groundwater are listed in Tables C-5 and C-6. As noted, groundwater is not used as a potable water supply on-site. Future use of groundwater is not expected based on the planned use of the property as an industrial facility. However, in order to evaluate the impact of residual soil contaminants on groundwater, the ingestion and dermal contact pathways were evaluated for residential receptors based on TCLP leachate results.

Exposure equations and parameters for an industrial land use scenario for soils are listed in Tables D-2 through D-4. These equations and parameters are consistent with those listed in Ohio EPA's Closure Plan Review Guidance for RCRA Facilities, Appendix E, Tables 6 through 10 (Ohio EPA, 1993a). Exposure equations and parameters for industrial use of groundwater are listed in Tables D-5 and D-6. The ingestion and dermal contact pathways were also evaluated for the adult industrial worker receptor based on TCLP leachate results.

3.4 Intake Equations

The intake calculations for each residential land use exposure route are presented in Tables C-7 through C-16. The intake calculations for each industrial land use exposure route are presented in Tables D-7 through D-11. Intakes were estimated using the standard intake equations provided in Ohio EPA (Ohio EPA, 1993 a). Chemical specific intakes were estimated for receptors and are expressed as the amount of chemical at the exposure boundary (e.g., skin, lungs, gut) that is available for absorption. Intakes from dermal contact with soils and groundwater are expressed in terms of absorbed dose.

Air intakes were assessed because individuals may be exposed to the chemical in the vapor phase (volatiles) or adsorbed to particulates (dust) generated from contaminated soils. Airborne emissions may result from the volatilization of organic constituents from soils. Risk from

inhalation of volatiles is assumed to be relevant only for chemicals that easily volatilize. Therefore, intakes from volatile emissions are only calculated for those constituents with a Henry's Law Constant of greater than 1×10^{-5} atm-m^3/mole and a molecular weight of less than 200 g/mole. Antimony is not easily volatilized.

Intakes from inhalation of particulate phase chemicals were derived using a particulate emission factor (PEF). The PEF is used to relate the contaminant concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from surface soils. This relationship is derived by Cowhead (1985) and provides an assessment procedure for hazardous waste sites where the surface contamination is assumed to provide a continuous and constant potential for emission over an extended period of time. The PEF of 4.63 E+09 m^3/kg was used for antimony as defined in the OSWER Directive 9285.7-01B (U.S. EPA 1991).

4.0 TOXICITY ASSESSMENT

Toxicological data used to evaluate risk were obtained from the U.S. EPA's Integrated Risk Information System (IRIS). IRIS is an electronic database containing the most current descriptive and quantitative U.S. EPA regulatory information on chemical and radiological constituents. Chemical files maintained in IRIS contain information relating to noncarcinogenic and carcinogenic health effects. The antimony reference dose (RfD) and antimony trioxide reference concentration (RfC) obtained from IRIS are listed in Table C-17 and D-12.

5.0 RISK CHARACTERIZATION

Risks were characterized by integrating the toxicity and exposure assessments into quantitative and qualitative expressions of risk. To characterize carcinogenic risks, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical specific dose-response information. To characterize potential noncarcinogenic effects, comparisons are made between the projected intakes of substances and approved toxicity values.

5.1 Quantification of Carcinogenic Risks

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., incremental or excess individual lifetime cancer risk). The EPA does not consider antimony a potential carcinogen (IRIS, 1997a and b). As a result, quantification of carcinogenic risks are not applicable.

5.2 Quantification of Noncarcinogenic Risks

For noncarcinogens, the potential for toxic effects is measured by comparing an exposure level over a specific time period with a chemical-specific reference dose derived for a similar exposure period. This ratio of exposure is called a hazard quotient. The noncancer hazard quotient assumes that there is a level of exposure below which it is unlikely that adverse health effects will occur, even to sensitive sub-populations. The threshold level is determined through animal and human epidemiological studies and is called the reference dose or RfD. The equation for determining the hazard quotient is described below:

Noncancer Hazard Quotient = E/RfD

Where:

E = exposure level (or intake) (mg/Kg-day);

RfD or RfC = chemical-specific reference dose or chemical-specific reference concentration (mg/Kg-day)

If the exposure level exceeds unity (1), there may be a potential noncancer effect. The ratio of E/RfD does not represent a statistical probability; therefore, the level of concern does not increase linearly as the RfD or RfC is approached or exceeded.

To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach is used. This approach assumes that simultaneous subthreshold exposures to several chemicals could result in an adverse health effect.

The HI is equal to the sum of the hazard quotients, as shown below:

Noncancer Hazard Index = $E_1/RfD_1 + E_2/RfD_2 + \ldots E_i/RfD_i$*

Where:

E_i = exposure level (or intake) for the ith toxicant;

RfD_i = chemical-specific reference dose for the ith toxicant

Note* use RfC_i, as applicable

The HI assumes that the magnitude of the effect will be proportional to the sum of the hazard quotients. Since there is only one contaminant of potential concern, antimony, the noncancer

hazard index equals the exposure level for antimony divided by the chemical-specific reference dose (or the reference concentration, as applicable) for antimony for each exposure pathway.

Risks were specifically evaluated and characterized for each residential land use exposure pathway for the adult and child resident. Risks were specifically evaluated and characterized for each industrial land use exposure pathway for the adult industrial worker.

A summary of the risk evaluations is presented in Table C-17 for the residential land use scenario. For the future adult resident, the total noncarcinogenic HI is 0.7 (rounded to one significant figure) which is less than the EPA target value of 1. For the future child resident, the total noncarcinogenic HI is 3.0, which is more than the EPA target value of 1. The groundwater pathway is the critical pathway because HI value for the ingestion groundwater pathway exceeds the EPA target value of 1. Therefore, human health risks from residual contamination are not acceptable under the residential land use scenario.

Summaries of risk evaluations are presented in Table D-12 for the industrial land use scenario. For the future adult industrial worker, the total noncarcinogenic HI is 0.7 (rounded up to one significant figure) which is less than the EPA target value of 1. Therefore, human health risks from residual contamination do not exceed EPA target values under an industrial land use scenario.

6.0 UNCERTAINTY ASSESSMENT

The risk values calculated in the risk assessment are not fully probabilistic estimates of risk, but conditional estimates given a considerable number of assumptions about exposure and toxicity. Therefore, there are many uncertainties inherent in the risk assessment evaluations. Perhaps the greatest number of assumptions made to assess risk are made in the exposure assessment.

The risk assessment evaluated a residential land use scenario and industrial land use scenario for all RCRA contaminants associated with the Burn Area that were above specific action limits. A multi-route, multi-constituent evaluation of all exposure routes associated with a residential scenario was evaluated in order to determine the risks associated with these pathways. For each exposure pathway evaluated under the each scenario, standard default parameters that represent reasonable worst case were used. Values were taken from Ohio EPA (Ohio EPA 1993b). Many of the exposure parameters represent 90th to 95th percentile values. When several upper bound values are combined in estimating exposure for any one pathway, resulting risk estimates may be in excess of the 99th percentile exposure and thereby be outside the range of exposures that might reasonably be expected to occur at the site. Therefore, the risks calculated are conservative and most likely overestimate the actual exposures that may be associated with the site.

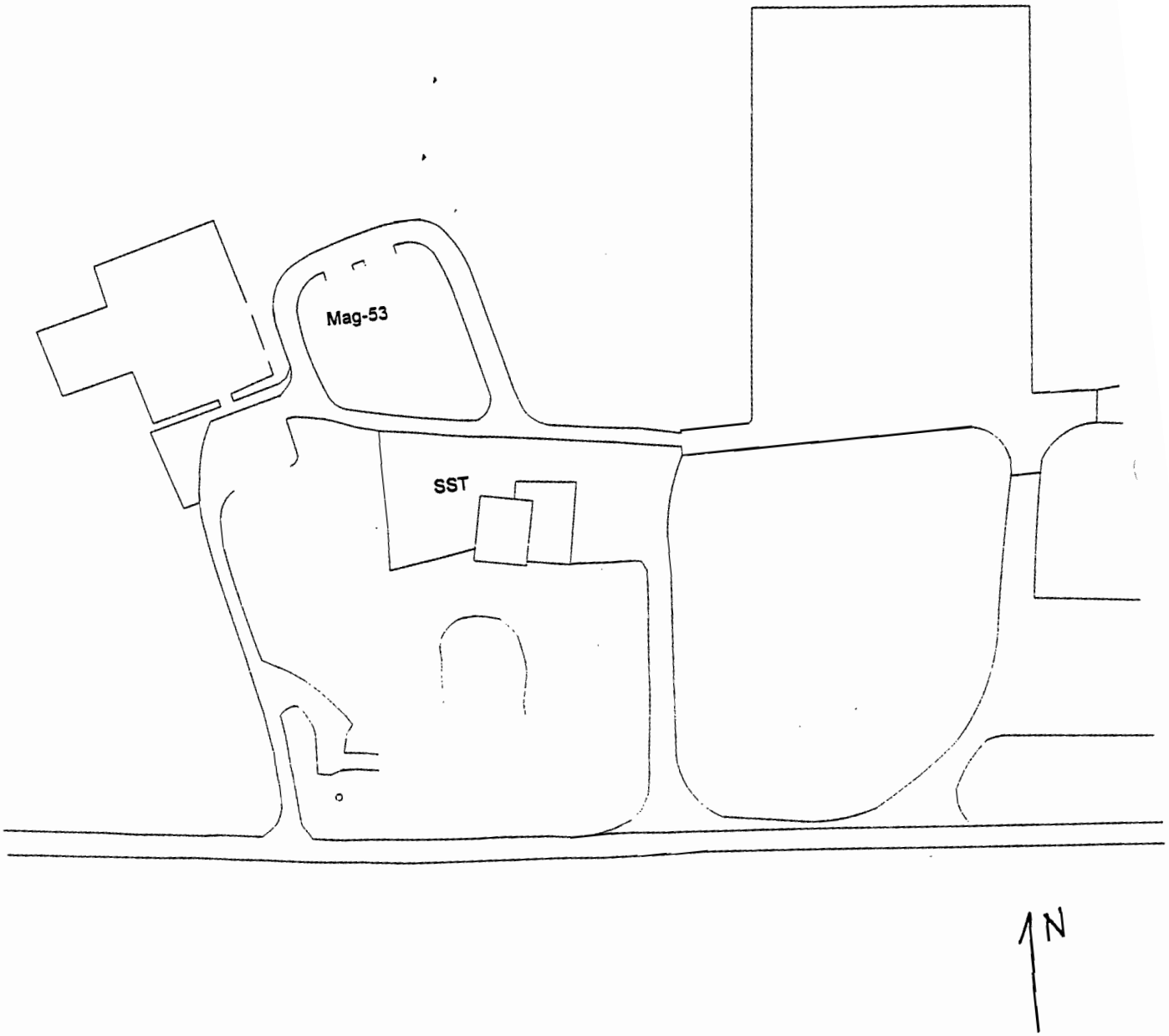

Figure 1-1, Location of the Burn Area

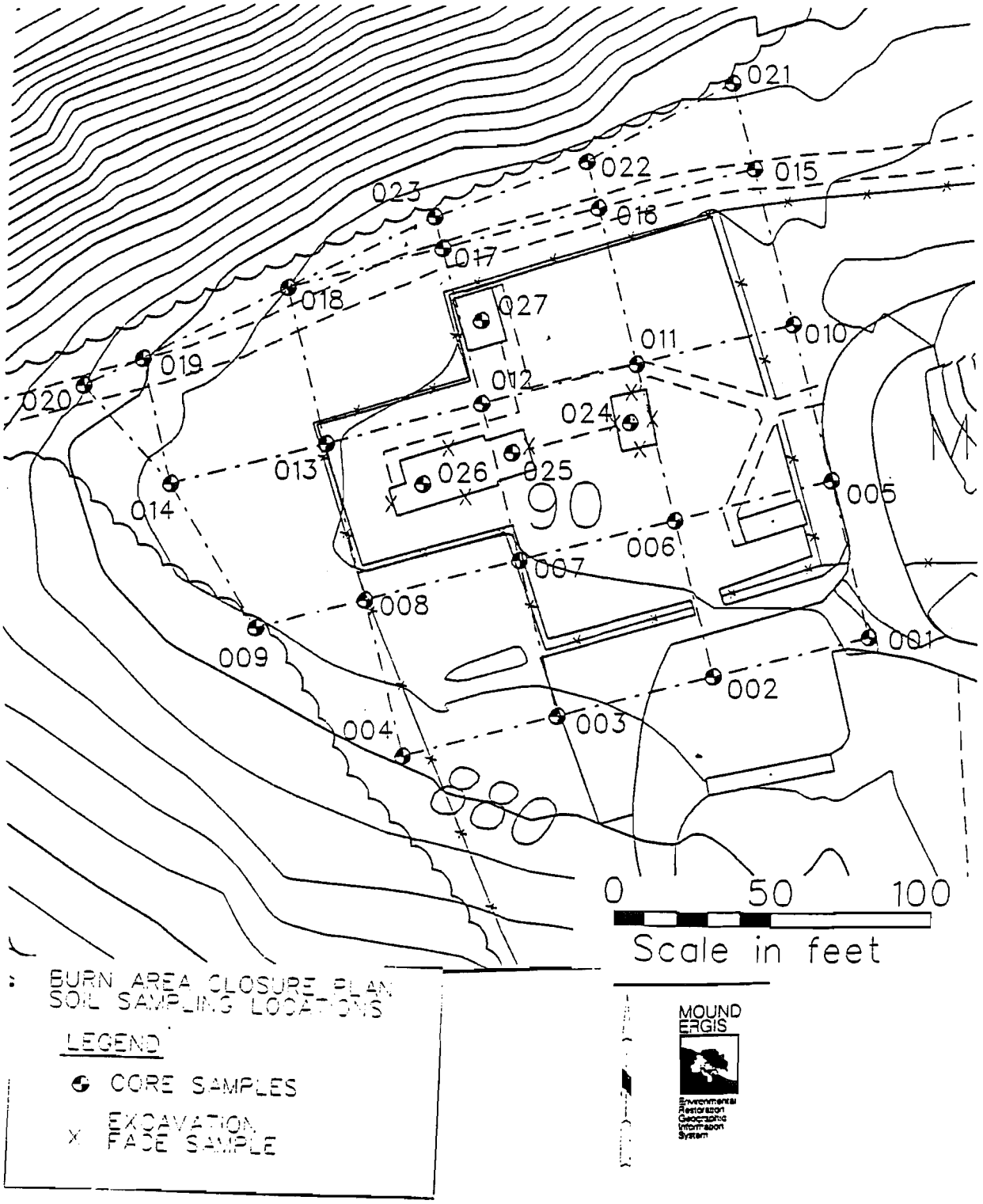

Figure 2-1, Location of Burn Area Post-Demolition Soil Samples

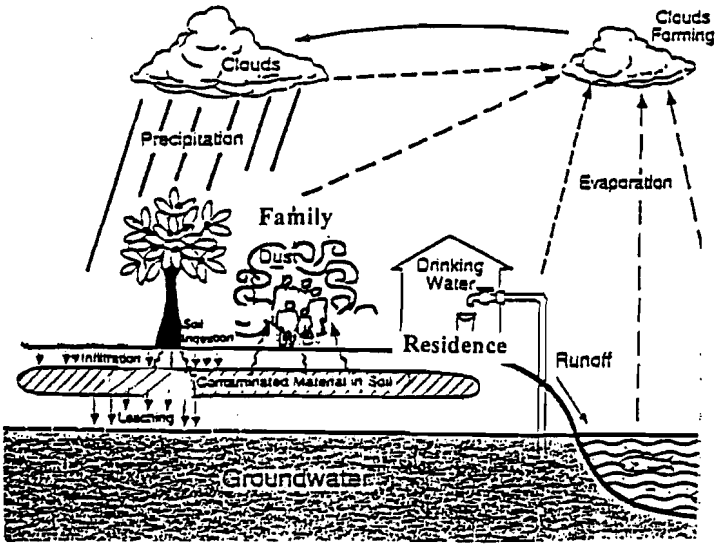

Figure 3.1a, Conceptual Unit Exposure Model - Residential Land Use Scenario

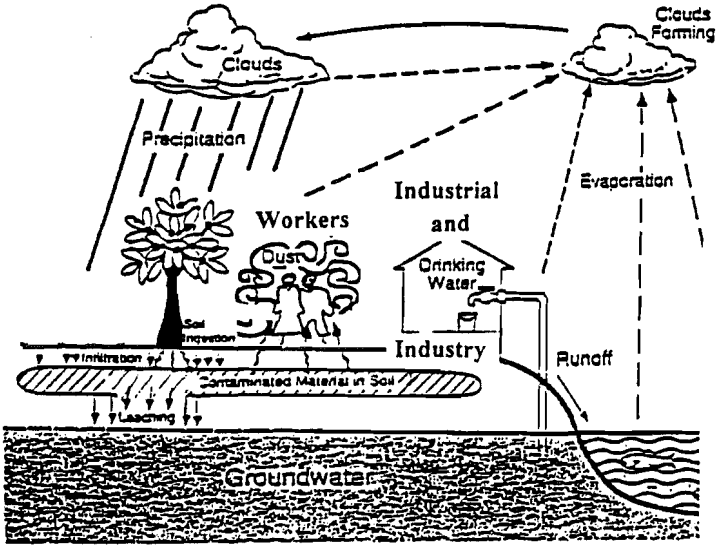

Figure 3.1b, Conceptual Unit Exposure Model - Industrial Land Use Scenario

Table 1

Constituents of Burn Area Wastes

Waste Constituent	CAS Number	Action Level (mg/kg)
Antimony	7440-36-0	0.44
Barium	7440-39-3	208.0
Beryllium	7440-41-7	1.45
Cadmium	7440-43-9	1.25
Chromium	7440-47-3	22.0
Dibutylphthalate	84-74-2	Any detectable (PQL)
Diphenylamine	122-39-4	Any detectable (PQL)
Lead	7439-92-1	61.5
Nickel	7440-02-0	30.9
Nitroglycerin	55-63-0	Any detectable (PQL)
Silver	7440-22-4	1.22

PQL = Practical Quantitation Limit

Table 2

Post Demolition Soil Sampling Results for Hazardous Constituents Burn Area Waste

Analyte	Maximum Concentration Detected	95% UCL of the Mean Concentration	Action Limit (AL) Conc.	Detects above the AL (Frequency)
INORGANICS				
Antimony	6.4 mg/kg	0.58 mg/kg	0.44 mg/kg	Yes (32/98)
Barium	255 mg/kg	86 mg/kg	208 mg/kg	Yes (2/98)
Beryllium	4.7 mg/kg	0.98 mg/kg	1.45 mg/kg	Yes (11/98)
Cadmium	1.4 mg/kg	0.19 mg/kg	1.25 mg/kg	Yes (1/98)
Chromium	34.5 mg/kg	13.9 mg/kg	22 mg/kg	Yes (5/98)
Lead	113 mg/kg	11.3 mg/kg	61.5 mg/kg	Yes (2/98)
Nickel	55.1 mg/kg	20.2 mg/kg	30.9 mg/kg	Yes (6/98)
Silver	2.4 mg/kg	0.54 mg/kg	1.22 mg/kg	Yes (5/98)
ORGANICS				
Dibutylphthalate	700 µg/kg	195 µg/kg	~ 400 µg/kg	Yes (1/98)
Diphenylamine	ND	< 400 µg/kg	~ 400 µg/kg	No (0/98)
EXPLOSIVES				
Nitroglycerin	ND	< 1000 µg/kg	~1000 µg/kg	No (0/98)
PETN	ND	< 1000 µg/kg	~1000 µg/kg	No (0/98)

ND = not detected.
UCL = 95% Upper Confidence Limit of a Mean.

Appendix A

Soil Analytical Results and TCLP Leachate Concentrations

Antimony UCL Calculations

Note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.76		0.76	-0.274436846
2	0.34	u	0.17	-1.771956842
3	0.31	u	0.155	-1.864330162
4	0.36	u	0.18	-1.714798428
5	0.33	u	0.165	-1.801809805
6	0.32	u	0.16	-1.832581464
7	0.32	u	0.16	-1.832581464
8	0.33	u	0.165	-1.801809805
9	0.32	u	0.16	-1.832581464
10	0.35	u	0.175	-1.742969305
11	0.34	u	0.17	-1.771956842
12	0.33	u	0.165	-1.801809805
13	0.33	u	0.165	-1.801809805
14	0.35	u	0.175	-1.742969305
15	0.34	u	0.17	-1.771956842
16	0.3	u	0.15	-1.897119985
17	0.36		0.36	-1.021651248
18	0.32	u	0.16	-1.832581464
19	0.32	u	0.16	-1.832581464
20	5		5	1.609437912
21	0.47		0.47	-0.755022584
22	0.33	u	0.165	-1.801809805
24	1.1		1.1	0.09531018
25	0.34	u	0.17	-1.771956842
26	0.34	u	0.17	-1.771956842
27	0.3	u	0.15	-1.897119985
28	0.49		0.49	-0.713349888
29	0.28		0.28	-1.272965676
30	0.31	u	0.155	-1.864330162
31	0.34	u	0.17	-1.771956842
32	0.32	u	0.16	-1.832581464
33	0.32	u	0.16	-1.832581464
34	0.32	u	0.16	-1.832581464
35	0.36	u	0.18	-1.714798428
36	0.34	u	0.17	-1.771956842
37	0.33		0.33	-1.108662625
38	0.8		0.8	-0.223143551
39	0.31	u	0.155	-1.864330162
40	0.29	u	0.145	-1.931021537
41	0.33	u	0.165	-1.801809805
42	0.28	u	0.14	-1.966112856
43	0.3	u	0.15	-1.897119985
44	0.33	u	0.165	-1.801809805
45	0.34		0.34	-1.078809661
47	0.29	u	0.145	-1.931021537
48	0.33	u	0.165	-1.801809805
49	0.62		0.62	-0.478035801
50	0.3	u	0.15	-1.897119985
51	0.29	u	0.145	-1.931021537
52	0.48		0.48	-0.733969175
53	0.33	u	0.165	-1.801809805
54	0.29	u	0.145	-1.931021537
55	0.59		0.59	-0.527632742

56	0.3 u	0.15	-1.897119985
57	0.26 u	0.13	-2.040220829
58	0.67	0.67	-0.400477567
59	1.5	1.5	0.405465108
60	0.37	0.37	-0.994252273
61	0.24 u	0.12	-2.120263536
62	0.38	0.38	-0.967584026
63	0.32 u	0.16	-1.832581464
64	0.32 u	0.16	-1.832581464
65	2.1	2.1	0.741937345
66	0.75	0.75	-0.287682072
67	0.24 u	0.12	-2.120263536
68	0.28 u	0.14	-1.966112856
70	0.53	0.53	-0.634878272
71	1	1	0
72	0.55	0.55	-0.597837001
73	3.5	3.5	1.252762968
74	0.38	0.38	-0.967584026
75	0.39	0.39	-0.94160854
76	1.7	1.7	0.530628251
77	1	1	0
78	0.37	0.37	-0.994252273
79	0.42	0.42	-0.867500568
80	0.34 u	0.17	-1.771956842
81	0.51	0.51	-0.673344553
82	0.58	0.58	-0.544727175
83	0.34	0.34	-1.078809661
84	0.47	0.47	-0.755022584
85	0.29 u	0.145	-1.931021537
86	0.94	0.94	-0.061875404
87	0.57	0.57	-0.562118918
88	0.29 u	0.145	-1.931021537
89	0.27 u	0.135	-2.002480501
90	0.42	0.42	-0.867500568
91	0.55	0.55	-0.597837001
93	0.4	0.4	-0.916290732
118	6.4	6.4	1.85629799
119	1.7	1.7	0.530628251
121	0.97	0.97	-0.030459207
122	1.4	1.4	0.336472237
123	0.91	0.91	-0.094310679
124	0.58	0.58	-0.544727175
125	0.96	0.96	-0.040821995
126	0.56	0.56	-0.579818495
127	0.37	0.37	-0.994252273

GM

mean(x)	**mean(ln x)**
0.549846939	-1.13609979
std dev (x)	**std dev (ln x)**
0.904065404	0.898271767
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.701262789	0.58299814

Barium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	73.9		73.9	4.302712828
2	35.3		35.3	3.563882964
3	48.2		48.2	3.875359021
4	101		101	4.615120517
5	33.3		33.3	3.505557397
6	25.3		25.3	3.230804396
7	62.1		62.1	4.128745989
8	48.6		48.6	3.883623531
9	50.5		50.5	3.921973336
10	104		104	4.644390899
11	104		104	4.644390899
12	61.7		61.7	4.122283931
13	40.2		40.2	3.693866996
14	98.2		98.2	4.587006215
15	38		38	3.63758616
16	31.4		31.4	3.446807893
17	101		101	4.615120517
18	31.3		31.3	3.443618098
19	28.3		28.3	3.342861805
20	87.9		87.9	4.476199805
21	100		100	4.605170186
22	99.3		99.3	4.598145571
24	84.8		84.8	4.440295543
25	96.7		96.7	4.571613402
26	96.9		96.9	4.573679519
27	47.9		47.9	3.869115504
28	198		198	5.288267031
29	51.9		51.9	3.94931879
30	37.5		37.5	3.624340933
31	86.3		86.3	4.457829598
32	58.6		58.6	4.070734697
33	47.5		47.5	3.860729711
34	59.3		59.3	4.082609306
35	72.9		72.9	4.289088639
36	51		51	3.931825633
37	41.9		41.9	3.735285827
38	106		106	4.663439094
39	82.4		82.4	4.411585437
40	34.6		34.6	3.543853682
41	114		114	4.736198448
42	58.9		58.9	4.075841091
43	54		54	3.988984047
44	88.4		88.4	4.48187197
45	86.4		86.4	4.458987676
47	105		105	4.65396035
48	51.4		51.4	3.939638172
49	203		203	5.313205979
50	43.3		43.3	3.768152635
51	77.1		77.1	4.345103281
52	116		116	4.753590191
53	81.3		81.3	4.398146017
54	36.8		36.8	3.605497845
55	111		111	4.709530201

56	26.7	26.7	3.284663565
57	45.1	45.1	3.808882247
58	97.4	97.4	4.578826211
59	89.8	89.8	4.497584975
60	90.8	90.8	4.508659286
61	33.9	33.9	3.523415014
62	26.9	26.9	3.292126287
63	34.9	34.9	3.552486829
64	44.3	44.3	3.790984677
65	87.5	87.5	4.471638793
66	183	183	5.209486153
67	38.5	38.5	3.650658241
68	34.1	34.1	3.529297384
70	27.1	27.1	3.299533728
71	80.3	80.3	4.385769621
72	163	163	5.093750201
73	75.7	75.7	4.32677816
74	72.8	72.8	4.287715955
75	146	146	4.983606622
76	72.9	72.9	4.289088639
77	87.6	87.6	4.472780998
78	135	135	4.905274778
79	74.5	74.5	4.310799125
80	73.4	73.4	4.295923936
81	129	129	4.859812404
82	56.6	56.6	4.036008985
83	58.2	58.2	4.063885355
84	211	211	5.351858133
85	51.8	51.8	3.947390149
86	73.9	73.9	4.302712828
87	66.1	66.1	4.191168747
88	28.7	28.7	3.356897123
89	34.6	34.6	3.543853682
90	152	152	5.023880521
91	137	137	4.919980926
93	64	64	4.158883083
118	71	71	4.262679877
119	81.5	81.5	4.40060302
121	69.1	69.1	4.235554731
122	76.2	76.2	4.333361463
123	103	103	4.634728988
124	255	255	5.541263545
125	75.3	75.3	4.321480135
126	65.8	65.8	4.186619838
127	56.8	56.8	4.039536326

mean(x)	**mean(ln x)**
77.98061224	4.219790209
std dev (x)	**std dev (ln x)**
43.75432034	0.522193436
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
85.30872985	86.17631436

Beryllium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.55		0.55	-0.597837001
2	0.32		0.32	-1.139434283
3	0.46		0.46	-0.776528789
4	0.66		0.66	-0.415515444
5	0.3		0.3	-1.203972804
6	0.3		0.3	-1.203972804
7	0.56		0.56	-0.579818495
8	0.44		0.44	-0.820980552
9	0.43		0.43	-0.84397007
10	1		1	0
11	1		1	0
12	0.56		0.56	-0.579818495
13	0.44		0.44	-0.820980552
14	0.92		0.92	-0.083381609
15	0.49		0.49	-0.713349888
16	0.4		0.4	-0.916290732
17	0.87		0.87	-0.139262067
18	0.51		0.51	-0.673344553
19	0.43		0.43	-0.84397007
20	1.1		1.1	0.09531018
21	0.94		0.94	-0.061875404
22	0.91		0.91	-0.094310679
24	1		1	0
25	0.77		0.77	-0.261364764
26	0.87		0.87	-0.139262067
27	0.51		0.51	-0.673344553
28	1.5		1.5	0.405465108
29	0.52		0.52	-0.653926467
30	0.33		0.33	-1.108662625
31	0.75		0.75	-0.287682072
32	0.46		0.46	-0.776528789
33	0.46		0.46	-0.776528789
34	0.46		0.46	-0.776528789
35	0.73		0.73	-0.314710745
36	0.59		0.59	-0.527632742
37	0.47		0.47	-0.755022584
38	1.2		1.2	0.182321557
39	1.1		1.1	0.09531018
40	0.57		0.57	-0.562118918
41	1.2		1.2	0.182321557
42	0.82		0.82	-0.198450939
43	0.75		0.75	-0.287682072
44	0.94		0.94	-0.061875404
45	1		1	0
47	1		1	0
48	0.68		0.68	-0.385662481
49	2.9		2.9	1.064710737
50	0.55		0.55	-0.597837001
51	0.84		0.84	-0.174353387
52	1.4		1.4	0.336472237
53	0.81		0.81	-0.210721031
54	0.6		0.6	-0.510825624
55	1.1		1.1	0.09531018

56	0.42	0.42	-0.867500568
57	0.71	0.71	-0.342490309
58	0.8	0.8	-0.223143551
59	0.96	0.96	-0.040821995
60	0.67	0.67	-0.400477567
61	0.37	0.37	-0.994252273
62	0.32	0.32	-1.139434283
63	0.44	0.44	-0.820980552
64	0.54	0.54	-0.616186139
65	3.6	3.6	1.280933845
66	2	2	0.693147181
67	0.34	0.34	-1.078809661
68	0.26	0.26	-1.347073648
70	0.5	0.5	-0.693147181
71	0.79	0.79	-0.235722334
72	1.1	1.1	0.09531018
73	1.2	1.2	0.182321557
74	1.7	1.7	0.530628251
75	0.91	0.91	-0.094310679
76	0.74	0.74	-0.301105093
77	0.99	0.99	-0.010050336
78	1.1	1.1	0.09531018
79	0.56	0.56	-0.579818495
80	0.6	0.6	-0.510825624
81	1.7	1.7	0.530628251
82	0.5	0.5	-0.693147181
83	0.28	0.28	-1.272965676
84	1.9	1.9	0.641853886
85	0.49	0.49	-0.713349888
86	1.6	1.6	0.470003629
87	1.2	1.2	0.182321557
88	0.37	0.37	-0.994252273
89	0.34	0.34	-1.078809661
90	1.2	1.2	0.182321557
91	1.4	1.4	0.336472237
93	0.46	0.46	-0.776528789
118	0.92	0.92	-0.083381609
119	4.3	4.3	1.458615023
121	0.95	0.95	-0.051293294
122	4.7	4.7	1.547562509
123	0.84	0.84	-0.174353387
124	1.8	1.8	0.587786665
125	0.5	0.5	-0.693147181
126	0.51	0.51	-0.673344553
127	0.47	0.47	-0.755022584

mean(x)	**mean(ln x)**
0.903265306	-0.301353513
std dev (x)	**std dev (ln x)**
0.740111131	0.587685996
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
1.027221555	0.984295389

Cadmium CL Calclations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.25	u	0.125	-2.079441542
2	0.27	u	0.135	-2.002480501
3	0.25	u	0.125	-2.079441542
4	0.28	u	0.14	-1.966112856
5	0.26	u	0.13	-2.040220829
6	0.25	u	0.125	-2.079441542
7	0.25	u	0.125	-2.079441542
8	0.26	u	0.13	-2.040220829
9	0.25	u	0.125	-2.079441542
10	0.27	u	0.135	-2.002480501
11	0.27	u	0.135	-2.002480501
12	0.3		0.3	-1.203972804
13	0.26	u	0.13	-2.040220829
14	0.27	u	0.135	-2.002480501
15	0.27	u	0.135	-2.002480501
16	0.24	u	0.12	-2.120263536
17	0.26	u	0.13	-2.040220829
18	0.25	u	0.125	-2.079441542
19	0.25	u	0.125	-2.079441542
20	0.29	u	0.145	-1.931021537
21	0.27	u	0.135	-2.002480501
22	0.26	u	0.13	-2.040220829
24	0.45		0.45	-0.798507696
25	0.27	u	0.135	-2.002480501
26	0.26	u	0.13	-2.040220829
27	0.23	u	0.115	-2.162823151
28	0.61		0.61	-0.494296322
29	0.22	u	0.11	-2.207274913
30	0.25	u	0.125	-2.079441542
31	0.27	u	0.135	-2.002480501
32	0.27		0.27	-1.30933332
33	0.25	u	0.125	-2.079441542
34	0.25	u	0.125	-2.079441542
35	0.28	u	0.14	-1.966112856
36	0.27	u	0.135	-2.002480501
37	0.26	u	0.13	-2.040220829
38	0.24	u	0.12	-2.120263536
39	0.24	u	0.12	-2.120263536
40	0.23	u	0.115	-2.162823151
41	0.26	u	0.13	-2.040220829
42	0.22	u	0.11	-2.207274913
43	0.24	u	0.12	-2.120263536
44	0.26	u	0.13	-2.040220829
45	0.25	u	0.125	-2.079441542
47	0.23	u	0.115	-2.162823151
48	0.26	u	0.13	-2.040220829
49	0.26	u	0.13	-2.040220829
50	0.24	u	0.12	-2.120263536
51	0.23	u	0.115	-2.162823151
52	0.25	u	0.125	-2.079441542
53	0.26	u	0.13	-2.040220829
54	0.23	u	0.115	-2.162823151
55	0.24	u	0.12	-2.120263536

56	0.24 u	0.12	-2.120263536
57	0.2 u	0.1	-2.302585093
58	0.24 u	0.12	-2.120263536
59	0.35	0.35	-1.049822124
60	0.24 u	0.12	-2.120263536
61	0.19 u	0.095	-2.353878387
62	0.26 u	0.13	-2.040220829
63	0.25 u	0.125	-2.079441542
64	0.25 u	0.125	-2.079441542
65	0.28 u	0.14	-1.966112856
66	0.28 u	0.14	-1.966112856
67	0.19 u	0.095	-2.353878387
68	0.22 u	0.11	-2.207274913
70	0.22 u	0.11	-2.207274913
71	0.25 u	0.125	-2.079441542
72	0.19 u	0.095	-2.353878387
73	0.25 u	0.125	-2.079441542
74	0.26 u	0.13	-2.040220829
75	0.24 u	0.12	-2.120263536
76	0.27 u	0.135	-2.002480501
77	0.17 u	0.085	-2.465104022
78	0.26	0.26	-1.347073648
79	0.25	0.25	-1.386294361
80	0.27	0.27	-1.30933332
81	0.27	0.27	-1.30933332
82	1.4	1.4	0.336472237
83	0.23 u	0.115	-2.162823151
84	0.58 u	0.29	-1.237874356
85	0.23 u	0.115	-2.162823151
86	0.26 u	0.13	-2.040220829
87	0.25 u	0.125	-2.079441542
88	0.23 u	0.115	-2.162823151
89	0.21 u	0.105	-2.253794929
90	0.24 u	0.12	-2.120263536
91	0.24 u	0.12	-2.120263536
93	1.1	1.1	0.09531018
118	0.87	0.87	-0.139262067
119	0.29 u	0.145	-1.931021537
121	0.29 u	0.145	-1.931021537
122	0.35	0.35	-1.049822124
123	0.27 u	0.135	-2.002480501
124	0.56	0.56	-0.579818495
125	0.4	0.4	-0.916290732
126	0.25 u	0.125	-2.079441542
127	0.21 u	0.105	-2.253794929

mean(x)	**mean(ln x)**
0.185306122	-1.891113015
std dev (x)	**std dev (ln x)**
0.193925557	0.516059512
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.217785413	0.192621542

Chromium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	11.1		11.1	2.406945108
2	6.6		6.6	1.887069649
3	8.6		8.6	2.151762203
4	12.6		12.6	2.533696814
5	5.3		5.3	1.667706821
6	4.2		4.2	1.435084525
7	9.3		9.3	2.2300144
8	7.6		7.6	2.028148247
9	6.9		6.9	1.931521412
10	16.1		16.1	2.778819272
11	15.5		15.5	2.740840024
12	10.2		10.2	2.32238772
13	6.8		6.8	1.916922612
14	16.1		16.1	2.778819272
15	10.6		10.6	2.360854001
16	8.4		8.4	2.128231706
17	15.1		15.1	2.714694744
18	8.3		8.3	2.116255515
19	9.5		9.5	2.251291799
20	14.7		14.7	2.687847494
21	17		17	2.833213344
22	16.4		16.4	2.797281335
24	14.8		14.8	2.694627181
25	15.8		15.8	2.76000994
26	16.5		16.5	2.803360381
27	9.5		9.5	2.251291799
28	24.9		24.9	3.214867803
29	9.3		9.3	2.2300144
30	6.5		6.5	1.871802177
31	13		13	2.564949357
32	9.5		9.5	2.251291799
33	8.5		8.5	2.140066163
34	9.8		9.8	2.282382386
35	12.4		12.4	2.517696473
36	10.2		10.2	2.32238772
37	8.9		8.9	2.186051277
38	20.1		20.1	3.000719815
39	16.7		16.7	2.815408719
40	8.1		8.1	2.091864062
41	18		18	2.890371758
42	14.1		14.1	2.646174797
43	12.4		12.4	2.517696473
44	16.5		16.5	2.803360381
45	18.1		18.1	2.895911938
47	16		16	2.772588722
48	9.9		9.9	2.292534757
49	33.3		33.3	3.505557397
50	7.4		7.4	2.00148
51	13.9		13.9	2.63188884
52	20		20	2.995732274
53	12.1		12.1	2.493205453
54	7.7		7.7	2.041220329
55	13.8		13.8	2.624668592

56	5.2	5.2	1.648658626
57	9.9	9.9	2.292534757
58	13.8	13.8	2.624668592
59	21.6	21.6	3.072693315
60	12.4	12.4	2.517696473
61	5.5	5.5	1.704748092
62	5.5	5.5	1.704748092
63	6.3	6.3	1.840549633
64	8.9	8.9	2.186051277
65	11.2	11.2	2.415913778
66	23.5	23.5	3.157000421
67	5.7	5.7	1.740466175
68	5	5	1.609437912
70	7.8	7.8	2.054123734
71	21.4	21.4	3.063390922
72	20.1	20.1	3.000719815
73	11	11	2.397895273
74	22.1	22.1	3.095577609
75	14.9	14.9	2.701361213
76	13.8	13.8	2.624668592
77	18.8	18.8	2.93385687
78	18.1	18.1	2.895911938
79	10.6	10.6	2.360854001
80	10.4	10.4	2.341805806
81	19.5	19.5	2.970414466
82	7.6	7.6	2.028148247
83	8.5	8.5	2.140066163
84	34.5	34.5	3.540959324
85	8.3	8.3	2.116255515
86	6	6	1.791759469
87	10.9	10.9	2.388762789
88	4.6	4.6	1.526056303
89	5.2	5.2	1.648658626
90	17.9	17.9	2.884800713
91	20.6	20.6	3.025291076
93	8.4	8.4	2.128231706
118	18.9	18.9	2.939161922
119	9.4	9.4	2.240709689
121	17.6	17.6	2.867898902
122	10.9	10.9	2.388762789
123	18.2	18.2	2.901421594
124	24.4	24.4	3.194583132
125	12.1	12.1	2.493205453
126	9.6	9.6	2.261763098
127	8.6	8.6	2.151762203

mean(x)	**mean(ln x)**
12.75306122	2.443108135
std dev (x)	**std dev (ln x)**
5.942546299	0.458192662
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.83
UCL normal	**UCL lognormal**
13.74833844	13.91843771

Lead UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	10.6		10.6	2.360854001
2	2.9	u	1.45	0.371563556
3	4.2		4.2	1.435084525
4	5.8		5.8	1.757857918
5	2.8	u	1.4	0.336472237
6	2.7	u	1.35	0.300104592
7	6.9		6.9	1.931521412
8	2.8	u	1.4	0.336472237
9	4.5		4.5	1.504077397
10	18.5		18.5	2.917770732
11	15.5		15.5	2.740840024
12	5.8		5.8	1.757857918
13	5.3		5.3	1.667706821
14	18.2		18.2	2.901421594
15	4.6		4.6	1.526056303
16	8.9		8.9	2.186051277
17	19.9		19.9	2.990719732
18	2.9		2.9	1.064710737
19	4.4		4.4	1.481604541
20	24.2		24.2	3.186352633
21	7.6		7.6	2.028148247
22	7		7	1.945910149
24	13.2		13.2	2.58021683
25	14.8		14.8	2.694627181
26	9.2		9.2	2.219203484
27	4.4		4.4	1.481604541
28	21.2		21.2	3.054001182
29	2.5		2.5	0.916290732
30	2.7	u	1.35	0.300104592
31	14.8		14.8	2.694627181
32	2.7	u	1.35	0.300104592
33	4.8		4.8	1.568615918
34	2.7	u	1.35	0.300104592
35	6		6	1.791759469
36	5.2		5.2	1.648658626
37	3.5		3.5	1.252762968
38	13.9		13.9	2.63188884
39	4.1		4.1	1.410986974
40	4.3		4.3	1.458615023
41	15		15	2.708050201
42	3.1		3.1	1.131402111
43	2.6	u	1.3	0.262364264
44	14.6		14.6	2.681021529
45	16.8		16.8	2.821378886
47	8.1		8.1	2.091864062
48	3.2		3.2	1.16315081
49	15.1		15.1	2.714694744
50	4.5		4.5	1.504077397
51	5.8		5.8	1.757857918
52	10.1		10.1	2.312535424
53	5.1		5.1	1.62924054
54	3.5		3.5	1.252762968
55	9.2		9.2	2.219203484

56	2.6 u	1.3	0.262364264
57	4.9	4.9	1.589235205
58	6.4	6.4	1.85629799
59	11.5	11.5	2.442347035
60	7.9	7.9	2.066862759
61	3.1	3.1	1.131402111
62	5	5	1.609437912
63	2.8	2.8	1.029619417
64	3.5	3.5	1.252762968
65	17.1	17.1	2.839078464
66	10.4	10.4	2.341805806
67	3.4	3.4	1.223775432
68	4.2	4.2	1.435084525
70	13.1	13.1	2.57261223
71	13	13	2.564949357
72	9.6	9.6	2.261763098
73	73.8	73.8	4.301358732
74	10.9	10.9	2.388762789
75	8.6	8.6	2.151762203
76	14.1	14.1	2.646174797
77	11.5	11.5	2.442347035
78	7.1	7.1	1.960094784
79	11.9	11.9	2.4765384
80	12.6	12.6	2.533696814
81	8.4	8.4	2.128231706
82	6	6	1.791759469
83	7.5	7.5	2.014903021
84	6.3 u	3.15	1.147402453
85	2.5	2.5	0.916290732
86	9.8	9.8	2.282382386
87	13.1	13.1	2.57261223
88	2.5 u	1.25	0.223143551
89	8.1	8.1	2.091864062
90	11	11	2.397895273
91	9.1	9.1	2.208274414
93	5	5	1.609437912
118	113	113	4.727387819
119	3.1 u	1.55	0.438254931
121	11.2	11.2	2.415913778
122	3 u	1.5	0.405465108
123	7.8	7.8	2.054123734
124	13	13	2.564949357
125	15.9	15.9	2.766319109
126	6.9	6.9	1.931521412
127	4.1	4.1	1.410986974

mean(x)	**mean(ln x)**
9.686734694	1.864920298
std dev (x)	**std dev (ln x)**
13.52462922	0.868293527
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
11.95188412	11.34214869

Nickel UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	15.3		15.3	2.727852828
2	18.7		18.7	2.928523524
3	16.1		16.1	2.778819272
4	21		21	3.044522438
5	8.6		8.6	2.151762203
6	7.5		7.5	2.014903021
7	19.6		19.6	2.975529566
8	14.4		14.4	2.667228207
9	12.9		12.9	2.557227311
10	21.3		21.3	3.058707073
11	22.8		22.8	3.126760536
12	16		16	2.772588722
13	13.7		13.7	2.617395833
14	22.1		22.1	3.095577609
15	16.5		16.5	2.803360381
16	13.8		13.8	2.624668592
17	19.7		19.7	2.980618636
18	13.2		13.2	2.58021683
19	17.7		17.7	2.87356464
20	16.8		16.8	2.821378886
21	25.9		25.9	3.254242969
22	29.8		29.8	3.394508394
24	20.5		20.5	3.020424886
25	16.5		16.5	2.803360381
26	20.2		20.2	3.005682604
27	13.8		13.8	2.624668592
28	34		34	3.526360525
29	12.1		12.1	2.493205453
30	9.1		9.1	2.208274414
31	16.6		16.6	2.809402695
32	17.2		17.2	2.844909384
33	11.5		11.5	2.442347035
34	14.3		14.3	2.660259537
35	19.1		19.1	2.949688335
36	15.8		15.8	2.76000994
37	15.6		15.6	2.747270914
38	19.8		19.8	2.985681938
39	22.3		22.3	3.104586678
40	10.8		10.8	2.379546134
41	21.5		21.5	3.068052935
42	15.2		15.2	2.721295428
43	16.5		16.5	2.803360381
44	17.6		17.6	2.867898902
45	16.9		16.9	2.827313622
47	21.9		21.9	3.086486637
48	13.7		13.7	2.617395833
49	47.2		47.2	3.854393893
50	9.5		9.5	2.251291799
51	19.5		19.5	2.970414466
52	29.5		29.5	3.384390263
53	17.4		17.4	2.856470206
54	11.4		11.4	2.433613355
55	25.5		25.5	3.238678452

56	8.2	8.2	2.104134154
57	14.6	14.6	2.681021529
58	17.5	17.5	2.862200881
59	17.7	17.7	2.87356464
60	18.8	18.8	2.93385687
61	10.6	10.6	2.360854001
62	5.7	5.7	1.740466175
63	9.1	9.1	2.208274414
64	13.6	13.6	2.610069793
65	33.1	33.1	3.499533282
66	28.2	28.2	3.339321978
67	8.5	8.5	2.140066163
68	8.2	8.2	2.104134154
70	2.8	2.8	1.029619417
71	19.5	19.5	2.970414466
72	28.6	28.6	3.353406718
73	8.7	8.7	2.163323026
74	21.9	21.9	3.086486637
75	22.9	22.9	3.131136911
76	11.4	11.4	2.433613355
77	17.9	17.9	2.884800713
78	25.2	25.2	3.226843995
79	8.6	8.6	2.151762203
80	9.5	9.5	2.251291799
81	37.1	37.1	3.61361697
82	17.2	17.2	2.844909384
83	5.2	5.2	1.648658626
84	55.1	55.1	4.009149716
85	15.5	15.5	2.740840024
86	7.8	7.8	2.054123734
87	12	12	2.48490665
88	8.9	8.9	2.186051277
89	4.6	4.6	1.526056303
90	38.1	38.1	3.640214282
91	33.9	33.9	3.523415014
93	14.2	14.2	2.653241965
118	27.9	27.9	3.328626689
119	12.8	12.8	2.549445171
121	15.2	15.2	2.721295428
122	14.8	14.8	2.694627181
123	16.6	16.6	2.809402695
124	89.8	89.8	4.497584975
125	15.9	15.9	2.766319109
126	13.3	13.3	2.587764035
127	12.4	12.4	2.517696473

mean(x)	**mean(ln x)**
18.31632653	2.77280445
std dev (x)	**std dev (ln x)**
11.27792017	0.51552559
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
20.20518973	20.1795495

Silver UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.46	u	0.23	-1.46967597
2	0.49	u	0.245	-1.406497068
3	0.45	u	0.225	-1.491654877
4	0.52	u	0.26	-1.347073648
5	0.46	u	0.23	-1.46967597
6	0.45	u	0.225	-1.491654877
7	0.46	u	0.23	-1.46967597
8	0.47	u	0.235	-1.448169765
9	0.46	u	0.23	-1.46967597
10	0.49	u	0.245	-1.406497068
11	0.49	u	0.245	-1.406497068
12	0.47	u	0.235	-1.448169765
13	0.47	u	0.235	-1.448169765
14	0.5	u	0.25	-1.386294361
15	0.48	u	0.24	-1.427116356
16	0.43	u	0.215	-1.537117251
17	0.47	u	0.235	-1.448169765
18	0.46	u	0.23	-1.46967597
19	0.46	u	0.23	-1.46967597
20	0.52	u	0.26	-1.347073648
21	0.49	u	0.245	-1.406497068
22	0.47	u	0.235	-1.448169765
24	0.49	u	0.245	-1.406497068
25	0.48	u	0.24	-1.427116356
26	0.48	u	0.24	-1.427116356
27	0.42	u	0.21	-1.560647748
28	0.52		0.52	-0.653926467
29	0.41	u	0.205	-1.5847453
30	0.45	u	0.225	-1.491654877
31	0.49	u	0.245	-1.406497068
32	0.45	u	0.225	-1.491654877
33	0.45	u	0.225	-1.491654877
34	0.46	u	0.23	-1.46967597
35	0.5	u	0.25	-1.386294361
36	0.49	u	0.245	-1.406497068
37	0.47	u	0.235	-1.448169765
38	0.81		0.81	-0.210721031
39	0.75		0.75	-0.287682072
40	0.5		0.5	-0.693147181
41	0.93		0.93	-0.072570693
42	0.41	u	0.205	-1.5847453
43	0.51		0.51	-0.673344553
44	0.74		0.74	-0.301105093
45	0.69		0.69	-0.371063681
47	0.53		0.53	-0.634878272
48	0.47	u	0.235	-1.448169765
49	1.5		1.5	0.405465108
50	0.43	u	0.215	-1.537117251
51	0.59		0.59	-0.527632742
52	0.98		0.98	-0.020202707
53	0.47	u	0.235	-1.448169765
54	0.41	u	0.205	-1.5847453
55	0.82		0.82	-0.198450939

56	0.43 u	0.215	-1.537117251
57	0.44	0.44	-0.820980552
58	0.45 u	0.225	-1.491654877
59	0.65	0.65	-0.430782916
60	0.44 u	0.22	-1.514127733
61	0.35 u	0.175	-1.742969305
62	0.48 u	0.24	-1.427116356
63	0.46 u	0.23	-1.46967597
64	0.46 u	0.23	-1.46967597
65	1	1	0
66	1	1	0
67	0.35 u	0.175	-1.742969305
68	0.39 u	0.195	-1.63475572
70	0.41 u	0.205	-1.5847453
71	0.71	0.71	-0.342490309
72	0.77	0.77	-0.261364764
73	1.4	1.4	0.336472237
74	0.91	0.91	-0.094310679
75	0.47	0.47	-0.755022584
76	0.59	0.59	-0.527632742
77	0.77	0.77	-0.261364764
78	0.89	0.89	-0.116533816
79	0.63	0.63	-0.46203546
80	0.74	0.74	-0.301105093
81	1.2	1.2	0.182321557
82	0.47 u	0.235	-1.448169765
83	0.42 u	0.21	-1.560647748
84	1.5	1.5	0.405465108
85	0.41 u	0.205	-1.5847453
86	0.47 u	0.235	-1.448169765
87	0.61	0.61	-0.494296322
88	0.41 u	0.205	-1.5847453
89	0.39 u	0.195	-1.63475572
90	2.4	2.4	0.875468737
91	1.2	1.2	0.182321557
93	0.43	0.43	-0.84397007
118	2.4	2.4	0.875468737
119	1.2	1.2	0.182321557
121	0.95	0.95	-0.051293294
122	0.84	0.84	-0.174353387
123	0.49 u	0.245	-1.406497068
124	0.95	0.95	-0.051293294
125	0.43 u	0.215	-1.537117251
126	0.46 u	0.23	-1.46967597
127	0.39 u	0.195	-1.63475572

mean(x)	**mean(ln x)**
0.491071429	-0.983942707
std dev (x)	**std dev (ln x)**
0.43587526	0.68912283
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.96
UCL normal	**UCL lognormal**
0.564073252	0.54370051

Dibutylphthalate UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	380	u	190	5.247024072
2	21	jb	21	3.044522438
3	22	jb	22	3.091042453
4	23	jb	23	3.135494216
5	390	u	195	5.272999559
6	390	u	195	5.272999559
7	420	u	210	5.347107531
8	400	u	200	5.298317367
9	22	jb	22	3.091042453
10	420	u	210	5.347107531
11	420	u	210	5.347107531
12	390	u	195	5.272999559
13	410	u	205	5.323009979
14	410	u	205	5.323009979
15	400	u	200	5.298317367
16	380	u	190	5.247024072
17	22	jb	22	3.091042453
18	390	u	195	5.272999559
19	25	jb	25	3.218875825
20	47	jb	47	3.850147602
21	33	jb	33	3.496507561
22	410	u	205	5.323009979
24	410	u	205	5.323009979
25	410	u	205	5.323009979
26	400	u	200	5.298317367
27	400	u	200	5.298317367
28	26	jb	26	3.258096538
29	400	u	200	5.298317367
30	380	u	190	5.247024072
31	410	u	205	5.323009979
32	380	u	190	5.247024072
33	380	u	190	5.247024072
34	390	u	195	5.272999559
35	430	u	215	5.370638028
36	420	u	210	5.347107531
37	400	u	200	5.298317367
38	410	u	205	5.323009979
39	390	u	195	5.272999559
40	400	u	200	5.298317367
41	410	u	205	5.323009979
42	390	u	195	5.272999559
43	390	u	195	5.272999559
44	420	u	210	5.347107531
45	400	u	200	5.298317367
47	410	u	205	5.323009979
48	21	j	21	3.044522438
49	420	u	210	5.347107531
50	380	u	190	5.247024072
51	390	u	195	5.272999559
52	400	u	200	5.298317367
53	420	u	210	5.347107531
54	380	u	190	5.247024072
55	420	u	210	5.347107531
56	33	j	33	3.496507561
57	29	j	29	3.36729583
58	330	u	165	5.105945474

59	330 u	165	5.105945474
60	23 j	23	3.135494216
61	330 u	165	5.105945474
62	330 u	165	5.105945474
63	330 u	165	5.105945474
64	330 u	165	5.105945474
65	21 j	21	3.044522438
66	330 u	165	5.105945474
67	330 u	165	5.105945474
68	330 u	165	5.105945474
70	330 u	165	5.105945474
71	330 u	165	5.105945474
72	19 j	19	2.944438979
73	330 u	165	5.105945474
74	330 u	165	5.105945474
75	22 j	22	3.091042453
76	330 u	165	5.105945474
77	330 u	165	5.105945474
78	33 jb	33	3.496507561
79	38 jb	38	3.63758616
80	28 jb	28	3.33220451
81	25 jb	25	3.218875825
82	24 jb	24	3.17805383
83	41 jb	41	3.713572067
84	65 jb	65	4.17438727
85	28 jb	28	3.33220451
86	36 jb	36	3.583518938
87	27 jb	27	3.295836866
88	43 jb	43	3.761200116
89	39 jb	39	3.663561646
90	40 jb	40	3.688879454
91	36 jb	36	3.583518938
93	21 jb	21	3.044522438
118	49 jb	49	3.891820298
119	700 b	700	6.551080335
121	28 jb	28	3.33220451
122	26 j	26	3.258096538
123	440 u	220	5.393627546
124	470 u	235	5.459585514
125	410 u	205	5.323009979
126	410 u	205	5.323009979
127	230 j	230	5.438079309

mean(x)	**mean(ln x)**
142.1530612	4.61826868
std dev (x)	**std dev (ln x)**
97.69501797	0.943092078
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.205
UCL normal	**UCL lognormal**
158.5153444	195.2192096

j = estimated concentration (below MDL)
b = blank contaminant
u = not detected (MDL)

	A	B	C	D	E	F
1				Cadmium CL Calculations		
2						
3						
4						
5						
6						
7						
8	Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)		ln(x)
9						
10	1	0.25	u	=IF(C10="u", B10/2,B10)		=LN(D10)
11	2	0.27	u	=IF(C11="u", B11/2,B11)		=LN(D11)
12	3	0.25	u	=IF(C12="u", B12/2,B12)		=LN(D12)
13	4	0.28	u	=IF(C13="u", B13/2,B13)		=LN(D13)
14	5	0.26	u	=IF(C14="u", B14/2,B14)		=LN(D14)
15	6	0.25	u	=IF(C15="u", B15/2,B15)		=LN(D15)
16	7	0.25	u	=IF(C16="u", B16/2,B16)		=LN(D16)
17	8	0.26	u	=IF(C17="u", B17/2,B17)		=LN(D17)
18	9	0.25	u	=IF(C18="u", B18/2,B18)		=LN(D18)
19	10	0.27	u	=IF(C19="u", B19/2,B19)		=LN(D19)
20	11	0.27	u	=IF(C20="u", B20/2,B20)		=LN(D20)
21	12	0.3		=IF(C21="u", B21/2,B21)		=LN(D21)
22	13	0.26	u	=IF(C22="u", B22/2,B22)		=LN(D22)
23	14	0.27	u	=IF(C23="u", B23/2,B23)		=LN(D23)
24	15	0.27	u	=IF(C24="u", B24/2,B24)		=LN(D24)
25	16	0.24	u	=IF(C25="u", B25/2,B25)		=LN(D25)
26	17	0.26	u	=IF(C26="u", B26/2,B26)		=LN(D26)
27	18	0.25	u	=IF(C27="u", B27/2,B27)		=LN(D27)
28	19	0.25	u	=IF(C28="u", B28/2,B28)		=LN(D28)
29	20	0.29	u	=IF(C29="u", B29/2,B29)		=LN(D29)
30	21	0.27	u	=IF(C30="u", B30/2,B30)		=LN(D30)
31	22	0.26	u	=IF(C31="u", B31/2,B31)		=LN(D31)
32	24	0.45		=IF(C32="u", B32/2,B32)		=LN(D32)
33	25	0.27	u	=IF(C33="u", B33/2,B33)		=LN(D33)
34	26	0.26	u	=IF(C34="u", B34/2,B34)		=LN(D34)
35	27	0.23	u	=IF(C35="u", B35/2,B35)		=LN(D35)
36	28	0.61		=IF(C36="u", B36/2,B36)		=LN(D36)
37	29	0.22	u	=IF(C37="u", B37/2,B37)		=LN(D37)
38	30	0.25	u	=IF(C38="u", B38/2,B38)		=LN(D38)
39	31	0.27	u	=IF(C39="u", B39/2,B39)		=LN(D39)
40	32	0.27		=IF(C40="u", B40/2,B40)		=LN(D40)
41	33	0.25	u	=IF(C41="u", B41/2,B41)		=LN(D41)
42	34	0.25	u	=IF(C42="u", B42/2,B42)		=LN(D42)
43	35	0.28	u	=IF(C43="u", B43/2,B43)		=LN(D43)
44	36	0.27	u	=IF(C44="u", B44/2,B44)		=LN(D44)
45	37	0.26	u	=IF(C45="u", B45/2,B45)		=LN(D45)
46	38	0.24	u	=IF(C46="u", B46/2,B46)		=LN(D46)
47	39	0.24	u	=IF(C47="u", B47/2,B47)		=LN(D47)
48	40	0.23	u	=IF(C48="u", B48/2,B48)		=LN(D48)
49	41	0.26	u	=IF(C49="u", B49/2,B49)		=LN(D49)
50	42	0.22	u	=IF(C50="u", B50/2,B50)		=LN(D50)
51	43	0.24	u	=IF(C51="u", B51/2,B51)		=LN(D51)
52	44	0.26	u	=IF(C52="u", B52/2,B52)		=LN(D52)
53	45	0.25	u	=IF(C53="u", B53/2,B53)		=LN(D53)
54	47	0.23	u	=IF(C54="u", B54/2,B54)		=LN(D54)
55	48	0.26	u	=IF(C55="u", B55/2,B55)		=LN(D55)
56	49	0.26	u	=IF(C56="u", B56/2,B56)		=LN(D56)
57	50	0.24	u	=IF(C57="u", B57/2,B57)		=LN(D57)
58	51	0.23	u	=IF(C58="u", B58/2,B58)		=LN(D58)
59	52	0.25	u	=IF(C59="u", B59/2,B59)		=LN(D59)
60	53	0.26	u	=IF(C60="u", B60/2,B60)		=LN(D60)
61	54	0.23	u	=IF(C61="u", B61/2,B61)		=LN(D61)
62	55	0.24	u	=IF(C62="u", B62/2,B62)		=LN(D62)
63	56	0.24	u	=IF(C63="u", B63/2,B63)		=LN(D63)
64	57	0.2	u	=IF(C64="u", B64/2,B64)		=LN(D64)
65	58	0.24	u	=IF(C65="u", B65/2,B65)		=LN(D65)
66	59	0.35		=IF(C66="u", B66/2,B66)		=LN(D66)
67	60	0.24	u	=IF(C67="u", B67/2,B67)		=LN(D67)
68	61	0.19	u	=IF(C68="u", B68/2,B68)		=LN(D68)
69	62	0.26	u	=IF(C69="u", B69/2,B69)		=LN(D69)
70	63	0.25	u	=IF(C70="u", B70/2,B70)		=LN(D70)
71	64	0.25	u	=IF(C71="u", B71/2,B71)		=LN(D71)
72	65	0.28	u	=IF(C72="u", B72/2,B72)		=LN(D72)
73	66	0.28	u	=IF(C73="u", B73/2,B73)		=LN(D73)
74	67	0.19	u	=IF(C74="u", B74/2,B74)		=LN(D74)
75	68	0.22	u	=IF(C75="u", B75/2,B75)		=LN(D75)

	A	B	C	D	E	F
76	70	0.22	u	=IF(C76="u", B76/2,B76)		=LN(D76)
77	71	0.25	u	=IF(C77="u", B77/2,B77)		=LN(D77)
78	72	0.19	u	=IF(C78="u", B78/2,B78)		=LN(D78)
79	73	0.25	u	=IF(C79="u", B79/2,B79)		=LN(D79)
80	74	0.26	u	=IF(C80="u", B80/2,B80)		=LN(D80)
81	75	0.24	u	=IF(C81="u", B81/2,B81)		=LN(D81)
82	76	0.27	u	=IF(C82="u", B82/2,B82)		=LN(D82)
83	77	0.17	u	=IF(C83="u", B83/2,B83)		=LN(D83)
84	78	0.26		=IF(C84="u", B84/2,B84)		=LN(D84)
85	79	0.25		=IF(C85="u", B85/2,B85)		=LN(D85)
86	80	0.27		=IF(C86="u", B86/2,B86)		=LN(D86)
87	81	0.27		=IF(C87="u", B87/2,B87)		=LN(D87)
88	82	1.4		=IF(C88="u", B88/2,B88)		=LN(D88)
89	83	0.23	u	=IF(C89="u", B89/2,B89)		=LN(D89)
90	84	0.58	u	=IF(C90="u", B90/2,B90)		=LN(D90)
91	85	0.23	u	=IF(C91="u", B91/2,B91)		=LN(D91)
92	86	0.26	u	=IF(C92="u", B92/2,B92)		=LN(D92)
93	87	0.25	u	=IF(C93="u", B93/2,B93)		=LN(D93)
94	88	0.23	u	=IF(C94="u", B94/2,B94)		=LN(D94)
95	89	0.21	u	=IF(C95="u", B95/2,B95)		=LN(D95)
96	90	0.24	u	=IF(C96="u", B96/2,B96)		=LN(D96)
97	91	0.24	u	=IF(C97="u", B97/2,B97)		=LN(D97)
98	93	1.1		=IF(C98="u", B98/2,B98)		=LN(D98)
99	118	0.87		=IF(C99="u", B99/2,B99)		=LN(D99)
100	119	0.29	u	=IF(C100="u", B100/2,B100)		=LN(D100)
101	121	0.29	u	=IF(C101="u", B101/2,B101)		=LN(D101)
102	122	0.35		=IF(C102="u", B102/2,B102)		=LN(D102)
103	123	0.27	u	=IF(C103="u", B103/2,B103)		=LN(D103)
104	124	0.56		=IF(C104="u", B104/2,B104)		=LN(D104)
105	125	0.4		=IF(C105="u", B105/2,B105)		=LN(D105)
106	126	0.25	u	=IF(C106="u", B106/2,B106)		=LN(D106)
107	127	0.21	u	=IF(C107="u", B107/2,B107)		=LN(D107)
108						
109						
110						
111				**mean(x)**		**mean(ln x)**
112				=AVERAGE(D10:D107)		=AVERAGE(F10:F107)
113						
114				**std dev (x)**		**std dev (ln x)**
115				=STDEV(D10:D107)		=STDEV(F10:F107)
116						
117				**count (n)**		**count (n)**
118				=COUNT(D10:D107)		=COUNT(F10:F107)
119						
120				**Student-t**		**H-statistic**
121				1.658		2.117
122						
123				**UCL normal**		**UCL lognormal**
124				=D112+D121*(D115/SQRT(D118))		=EXP(F112+(0.5*F115*F115)+(F115*F121/(SQRT(F118-1))))

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RECRA LabNet
a division of Recra Environmental, Inc.

208 Welsh Pool Road
Lionville, PA 19341-1313
Phone: (610) 280-3000
Fax: (610) 280-3041

DATE: 9/8/97

TIME:

NO. PAGES: (including cover sheet)

TO: Trisha Beckelin

OF: DOE

FAX #: 937-865-4489

FROM: Judy Stone

COPY TO: Dave Gloebler / mound
937-865-3835
Gordon Horn

Send Original? ☐ No ☐ Regular Mail ☐ Overnight Express

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MESSAGE:

Preliminary Sb. data — analyzed SW846. Being rerun — CLP — later today (totals) Results not likely to change much at-all. TCLP are fine.

Recra LabNet - Lionville

INORGANICS DATA SUMMARY REPORT 09/08/97

CLIENT: SOLG MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05276-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT	DILUTION FACTOR
-001	000150	Antimony, Total	3.6	MG/KG	0.11	1.0
-002	000151	Antimony, Total	1.9	MG/KG	0.1	1.0
-003	000152	Antimony, Total	1.3	MG/KG	0.09	1.0
-004	000153	Antimony, Total	1.5	MG/KG	0.09	1.0
-005	000150	Antimony, TCLP Leachate	30.2 u	UG/L	30.2	1.0
-006	000151	Antimony, TCLP Leachate	30.2 u	UG/L	30.2	1.0
-007	000152	Antimony, TCLP Leachate	30.9	UG/L	30.2	1.0
-008	000153	Antimony, TCLP Leachate	30.2 u	UG/L	30.2	1.0

150: $\frac{.0044 \text{ mg/l}}{3.6 \text{ mg/kg}} = .0012$

151: $\frac{.0096}{1.9} = .0051$

152: $\frac{.0075}{1.3} = .0058$

153: $\frac{.0038}{1.5} = .0025$

avg. TCLP = .0063

= avg. ratio = .0037

$= \frac{x}{0.58 \text{ mg/kg}}$

* $x = .0021$ mg/l

Recra LabNet - Lionville

INORGANICS METHOD BLANK DATA SUMMARY PAGE 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT	DILUTION FACTOR
BLANK1	97L1746-MB1	Antimony, Total	0.09 u	MG/KG	0.09	1.0
BLANK1	97L1754-MB1	Antimony, TCLP Leachate	30.2 u	UG/L	30.2	1.0
BLANK2	97L1754-MB2	Antimony, TCLP Leachate	30.2 u	UG/L	30.2	1.0

Recra LabNet - Lionville

INORGANICS ACCURACY REPORT 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	DILUTION FACTOR(SPK)
-001	000150	Antimony, Total	125	3.6	61.8	196.8	20.0
-005	000150	Antimony, TCLP Leachat	4970	30.2 u	5000	99.4	1.0

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INORGANICS PRECISION REPORT 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	RPD	DILUTION FACTOR(REP)
-001REP	000150	Antimony, Total	3.6	3.2	11.5	1.0

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INORGANICS LABORATORY CONTROL STANDARDS REPORT 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	97L1746-LC1	Antimony, LCS	324	300	MG/KG	108.0
LCS1	97L1754-LC1	Antimony, LCS	2930	3000	UG/L	97.7

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RECRA LabNet
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208 Welsh Pool Road
Lionville, PA 19341-1313
Phone: (610) 280-3000
Fax: (610) 280-3041

DATE: 9/13/97

TIME:

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TO: Trudy Bechlin / Dave Hoechlin
OF: DOE / Mound
FAX #: 937-865-4489 937-865-3835

FROM: Judy Stone

COPY TO:
Gordon Horn / Craig Stoll
of R.G.

SPECIAL INSTRUCTIONS:
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MESSAGE:
Here is revised matrix spike recovery – LIMS had calculated as a water sample instead of TCLP originally – recovery is much more acceptable. Sorry for the confusion.

Recra LabNet - Lionville

INORGANICS ACCURACY REPORT 09/13/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	DILUTION FACTOR(SPK)
-001	000150	Antimony, TCLP Leachat	5680	4.4	5000	113.5	200

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RECRA LabNet
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208 Welsh Pool Road
Lionville, PA 19341-1313
Phone: (610) 280-3000
Fax: (610) 280-3041

DATE: 9/12/97

TIME:

NO. PAGES: (including cover sheet)

TO: Trisha Beckler

OF: DOE

FAX #: 937-865-4489

FROM: Judy Thom

COPY TO: Dave Gloechler / Mound
937-865-3835

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MESSAGE:

TCLP Sb by furnace method

Recra LabNet - Lionville

INORGANICS DATA SUMMARY REPORT 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT	DILUTION FACTOR
-001	000150	Antimony, TCLP Leachate	4.4	UG/L	0.90	1.0
-002	000151	Antimony, TCLP Leachate	9.6	UG/L	0.90	1.0
-003	000152	Antimony, TCLP Leachate	7.5	UG/L	0.90	1.0
-004	000153	Antimony, TCLP Leachate	3.8	UG/L	0.90	1.0

Recra LabNet - Lionville

INORGANICS METHOD BLANK DATA SUMMARY PAGE 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT	DILUTION FACTOR
BLANK1	97L1754-MB1	Antimony, TCLP Leachate	0.90 u	UG/L	0.90	1.0
BLANK2	97L1754-MB2	Antimony, TCLP Leachate	0.90 u	UG/L	0.90	1.0

Recra LabNet - Lionville

INORGANICS ACCURACY REPORT 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	DILUTION FACTOR(SPK)
-001	000150	Antimony, TCLP Leachat	5680	4.4	500	1135	200

Recra LabNet - Lionville

INORGANICS LABORATORY CONTROL STANDARDS REPORT 09/12/97

CLIENT: RG&G MOUND-BURN AREA RECRA LOT #: 9709L305

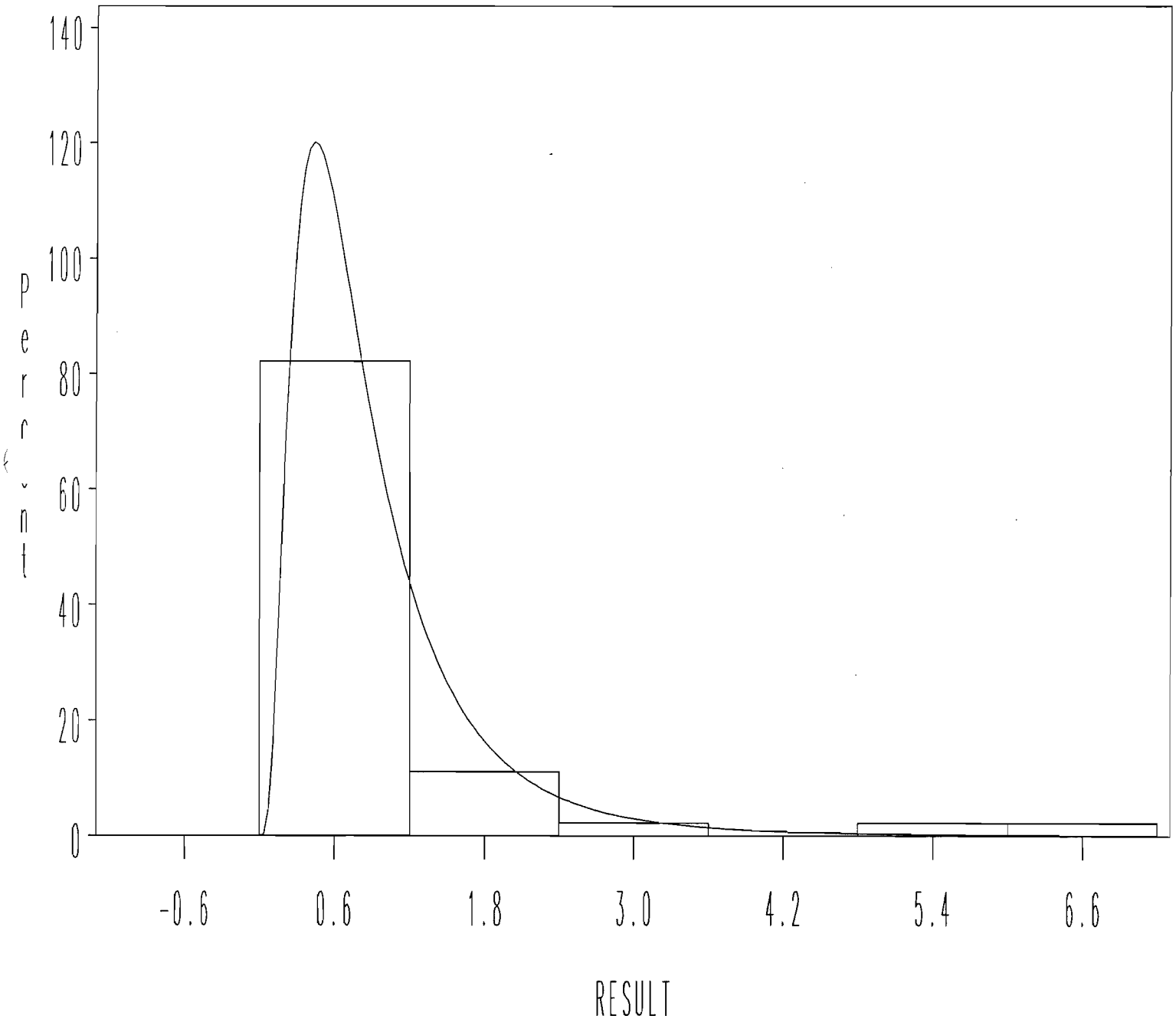
WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	97L1754-LC1	Antimony, LCS	3060	3000	UG/L	102.0

Appendix B

Antimony Data Evaluation

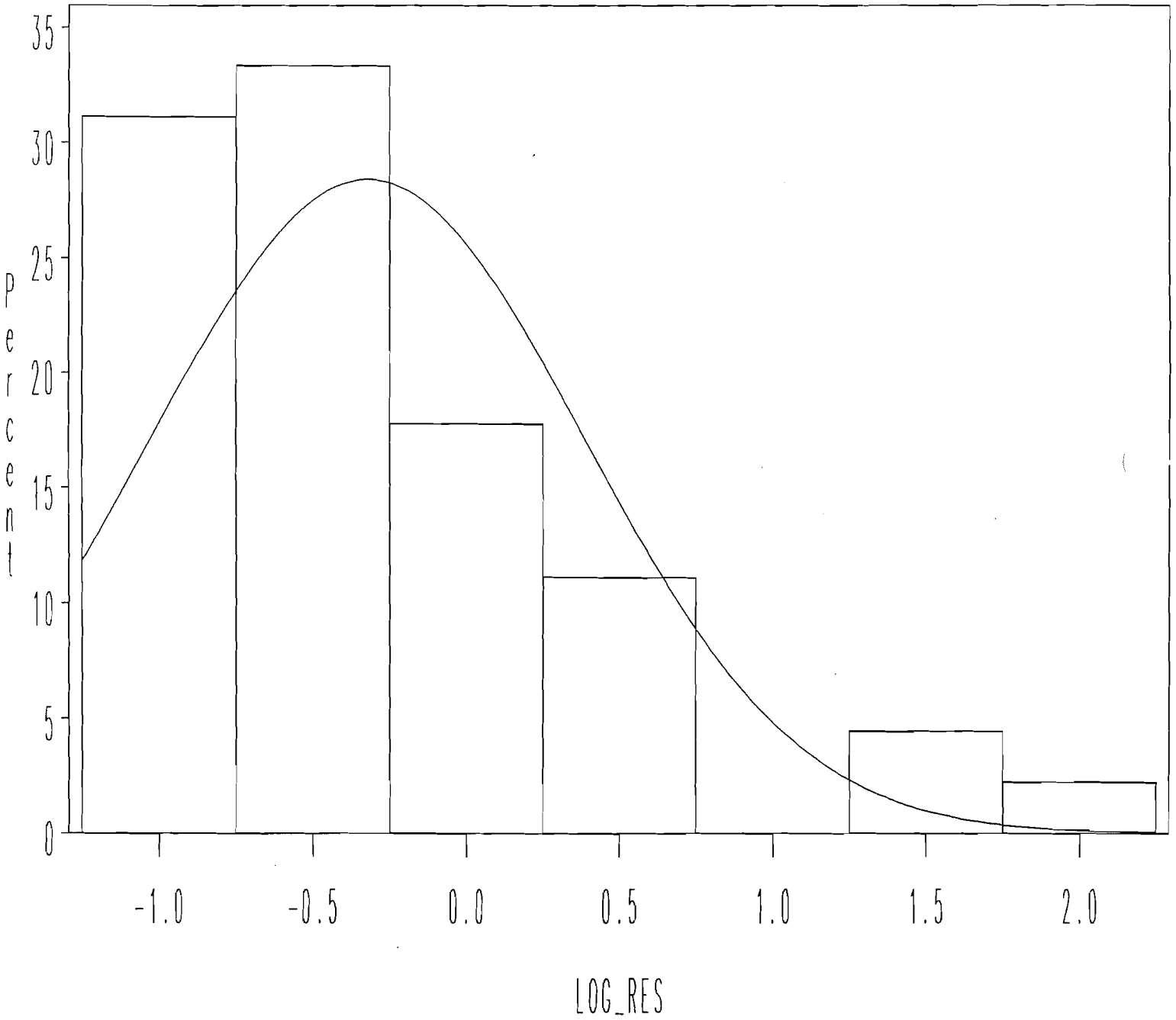
Histogram Of Burn Area Sample Results
With Lognormal Distribution Superimposed
(Only Results Above MDAs Are Utilized)
NAME=Antimony



Curve: —— Lognormal(Theta=0 Shape=0.7 Scale=-.3)

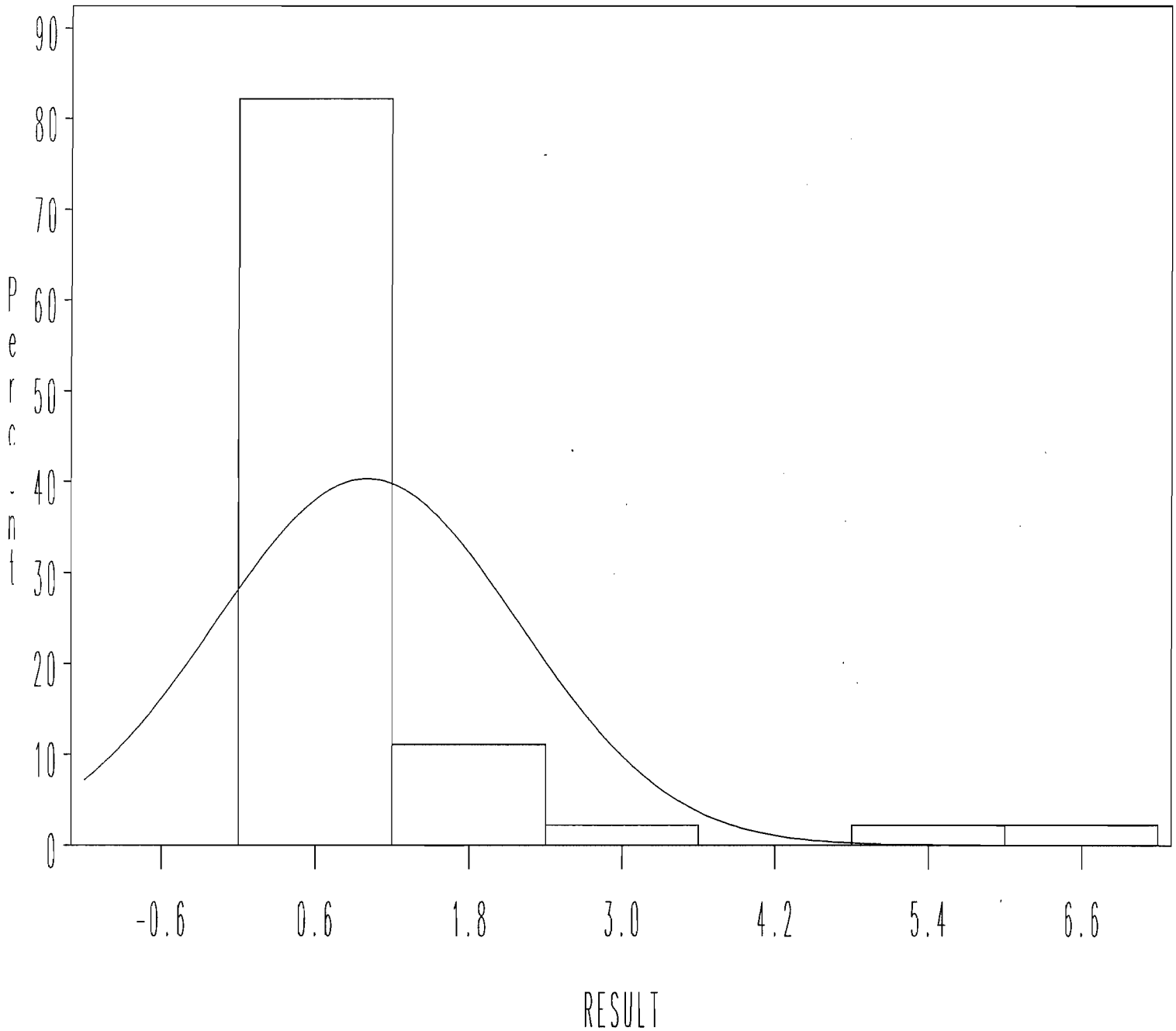
Histogram Of Burn Area Sample Results
With Normal Distribution Superimposed
(Only Results Above MDAs Are Utilized)

NAME=Antimony



Curve: —— Normal(Mu=-0.321 Sigma=0.7024)

Histogram Of Burn Area Sample Results
With Normal Distribution Superimposed
(Only Results Above MDAs Are Utilized)
NAME=Antimony



Curve: —— Normal(Mu=1.0056 Sigma=1.1866)

Appendix C

Residential Land Use Scenario Evaluation

Table C-1

Residential Land Use Scenario
Exposure Routes/Pathways
Burn Area

Medium	Route of Exposure	Exposure Activity	Potential Receptors	Exposure Source
Soils	Ingestion	Incidental Contact	Adult and Child Residents	Soils
	Dermal	Direct Contact	Adult and Child Residents	Soils
	Inhalation	Fugitive Dust (outdoor)	Adult and Child Residents	Soils
Groundwater	Ingestion	Direct Contact	Adult and Child Residents	Potential Potable Water Supply
	Dermal	Direct Contact (showering)	Adult and Child Residents	Groundwater
	Inhalation of mist	Direct Contact (showering)	Adult and Child Residents	Groundwater

Table C-2

TCLP Leachate Results for the Burn Area

Sample ID	Sb(TCLP) mg/L	Total Sb mg/kg	Extraction Efficiency kg/L
000150	4.4	3600	1.22E-03
000151	9.6	1900	5.05E-03
000152	7.5	1300	5.77E-03
000153	3.8	1500	2.53E-03
	Mean	Mean	Mean
	6.3	2075	3.64E-03
n= 4	std dev =2.7	t-value = 2.35	95%UCL of mean = 9.5 mg/L = 9.5E-03 mg/L

Table C-3

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SOILS AND DUST

Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

Parameter	Resident
CS = Concentration in Soil (mg/kg)	95% UCL
IR = Ingestion Rate (mg/day)	100 (adult), 200 (child)
CF = Conversion Factor (kg/mg)	1.00E-06
FI = Fraction Ingested (unitless)	1
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10,950 (adult), 2,190 (child)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table C-4

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SOIL AND DUST

Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

Parameter	Resident
CS = Concentration in Soil (mg/kg)	95% UCL
CF = Conversion Factor (kg/mg)	1.00E-06
SA = Skin Surface Area Available for contact (cm^2/day)	5000 (adult), 2000 (child)
AF = Soil to Skin Adherence Factor (mg/cm^2)	1
ABS = Absorption Factor (unitless)	Chemical Specific (a)
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10,950 (adult), 2,190 (child)

(a) 1% for metals recommended by OEPA (Ohio EPA Interim Final RCRA Closure Guidance, September 1993)

Table C-5

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF AIRBORNE CHEMICALS IN FUGITIVE DUST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Resident
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL
IR = Inhalation Rate (m^3/hour)[a]	0.83
ET = Exposure Time (hours/day)	24
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10950 (adult), 2190 (child)

References: Ohio EPA Interim Final RCRA Closure Guidance, September 1993
[a] - 20 m^3/day = 0.83 m^3/hour

Table C-6

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN GROUNDWATER

Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

Parameter	Resident
CW = Concentration in water (mg/L)	95% UCL of mean TCLP leachate concentration
IR = Ingestion Rate (L/day)	2
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10,950 (adult), 2,190 (child)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table C-6a

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN GROUNDWATER

Absorbed Dose (mg/kg-day) = (CW x SA x PC x ET x EF x ED x CF) / (BW x AT)

Parameter	Resident
CW = Absorbed Dose (mg/cm^2)	95% UCL of mean TCLP leachate concentration
SA = Skin Surface Area Available for contact (cm^2)	20000 (adult), 7000 (child)
PC = Dermal Permeability Constant (cm/hr)	1.0E-03[a]
ET = Exposure Time (hrs./day)	0.2 [b]
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days) Noncarcinogens (ED x 365 days/yr.)	10950 (adult), 2190 (child)
CF = Conversion Factor (L/cm^3)	1/1000

[a] - From Risk-Base Guideline Values Report - Appendix A, Table P2, Parameters for Chemical of Concern, March 1997, page 127

[b] - Based on the 90th percentile shower time of 12 minutes (12min/day x 1hr/60min= 0.2 hr/day)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table C-6b

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF CHEMICALS IN WATER MIST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Resident
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL
IR = Inhalation Rate (m^3/hour)	0.60
ET = Exposure Time (hours/day)	0.2
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days) Noncarcinogens (ED x 365 days/yr.)	10950 (adult), 2190 (child)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

TABLE C-7 INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
SOIL INGESTION INTAKE
Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	IR (mg/day)	CF (kg/mg)	FI (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Intake (mg/kg-day) Noncarcinogens
Antimony	0.58	100	1.00E-06	1	350	30	70	10950	7.95E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 100 mg/day x 1E-06 kg/mg x 1 x 350 days/yr x 30 yrs / (70 kg x 10950 days)
Intake = 7.95E-07 mg/kg-day

TABLE C-8. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
SOIL INGESTION INTAKE
Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	IR (mg/day)	CF (kg/mg)	FI (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Intake (mg/kg-day) Noncarcinogens
Antimony	0.58	200	1.00E-06	1	350	6	15	2190	7.42E-06

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 200 mg/day x 1E-06 kg/mg x 1 x 350 days/yr x 6 yrs / (15 kg x 2190 days)
Intake = 7.42E-06 mg/kg-day

TABLE C-9. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
DERMAL CONTACT WITH CHEMICALS IN SOILS AND DUST
Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CF (kg/mg)	SA (cm^2/day)	AF (mg/cm^2)	ABS (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Abs. Dose (mg/kg-day) Noncarcinogens
Antimony	0.58	1.00E-06	5000	1	0.01	350	30	70	10950	3.97E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 1 E-06 kg/mg x 5000 cm^2/day x 1mg/cm^2 x 0.01 x 350 days/yr x 30 yrs / (70 kg x 10950 days)
Intake = 3.97E-07 mg/kg-day

ABS (Absorption Factor) is chemical specific

TABLE C-10. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
DERMAL CONTACT WITH CHEMICALS IN SOILS AND DUST
Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CF (kg/mg)	SA (cm^2/day)	AF (mg/cm^2)	ABS (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Abs. Dose (mg/kg-day) Noncarcinogens
Antimony	0.58	1.00E-06	2000	1	0.01	350	6	15	2190	7.42E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 1 E-06 kg/mg x 2000 cm^2/day x 1 mg/cm^2 x 0.01 x 350 days/yr x 6 yrs / (15 kg x 2190 days)
Intake = 7.42E-07 mg/kg-day

ABS (Absorption Factor) is chemical specific

TABLE C-11. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
INHALATION OF CHEMICALS IN FUGITIVE DUST
Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) OUTDOOR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.83	24	350	30	70	10950	3.41E-11

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10mg/m^3 x 0.83 m^3/hr x 24 hr/day x 350 days/yr x 30 yrs / (70 kg x 10950 days)
OUTDOOR Intake = 3.41E-11 mg/kg-day

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) SHOWERING	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.6	0.2	350	30	70	10950	2.05E-13

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25 E-10 mg/m^3 x 0.60 m^3/hr x 0.2 hr/day x 350 days/yr x 30 yrs / (70 kg x 10950 days)
SHOWERING Intake = 2.05E-13 mg/kg-day

TABLE C-12. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
INHALATION OF CHEMICALS IN FUGITIVE DUST AND WATER MIST
Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) OUTDOOR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.83	24	350	6	15	2190	1.59E-10

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = default value = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10 mg/m^3 x 0.83 m^3/hr x 24 hr/day x 350 days/yr x 6 yrs / (15 kg x 2190 days)
OUTDOOR Intake = 1.59E-10 mg/kg-day

WATER MIST WHILE SHOWERING

CONTAMINANT	CS (mg/kg)	CA (mg/m3)	IR (m3/hr)	ET (hrs/day) SHOWERING	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.6	0.2	350	6	15	2190	9.59E-13

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = default value = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10 mg/m^3 x 0.83 m^3/hr x 0.2 hr/day x 350 days/yr x 6 yrs / (15 kg x 2190 days)
SHOWERING Intake = 9.59E-13 mg/kg-day

TABLE C-13. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
GROUNDWATER INGESTION INTAKE
Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	IR (L/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	INTAKE (mg/kg-day)
Antimony	0.0095	2	350	30	70	10950	2.60E-04

CW= Concentration in water (mg/L) 95% UCL of mean TCLP leachate concentration

Calculations

Noncarcinogen
Intake (mg/kg-day) = 9.5E-03 mg/L x 2 L/day x 350 days/yr x 30 yrs / (70 kg x 10950 days)
Intake = 2.60 E-04 mg/kg-day

TABLE C-14. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
GROUNDWATER INGESTION INTAKE
Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	IR (L/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	INTAKE (mg/kg-day)
Antimony	0.0095	2	350	6	15	2190	1.21E-03

CW= Concentration in water (mg/L) 95% UCL of mean TCLP leachate concentration

Calculations

Noncarcinogen
Intake (mg/kg-day) = 9.5E-03 mg/L x 2 L/day x 350 days/yr x 6 yrs / (15 kg x 2190 days)
Intake = 1.21 E-03 mg/kg-day

TABLE C-15. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
GROUNDWATER DERMAL ABSORBED DOSE (SHOWERING)
INTAKE (mg/kg-day) = (CW x CF x SA x PC x ET x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	CF (L/cm^3)	SA (cm^2)	PC (cm/hr)	ET (hrs/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.0095	1.00E-03	20000	1.00E-03	0.2	350	30	70	10950	5.21E-07

CALCULATION

Noncarcinogen

Intake (mg/kg-day) = 9.5 E-03 mg/L x 1.0E-03 L/cm^3 x 20,000 cm^2 x 1.0E-03 cm/hr x 0.2 hrs/day x 350 days/yr x 30yrs/ (70 kg x 10950 days)
Intake = 5.21 E-07 mg/kg-day

TABLE C-16. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
GROUNDWATER DERMAL ABSORBED DOSE (SHOWERING)
INTAKE (mg/kg-day) = (CW x CF x SA x PC x ET x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	CF (L/cm^3)	SA (cm^2)	PC (cm/hr)	ET (hrs/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.0095	1.00E-03	7000	1.00E-03	0.2	350	6	15	2190	8.50E-07

CALCULATION

Noncarcinogen

Intake (mg/kg-day) = 9.5E-03 mg/L x 1.0E-03 L/cm^3 x 7,000 cm^2 x 0.2 hrs/day x 1.0E-03 cm/hr x 350 days/yr x 6 yrs/ (15 kg x 2190 days)
Intake = 8.50 E-07 mg/kg-day

TABLE C-17. Summary of Total Risk
All Pathways
Burn Area

cenario and Recepto	Media	Pathway	onCarcinogen Risk (Dose)	RfD***	HQ = HI	
Future Scenario: Adult Resident	Soil	Ingestion	7.95E-07	4.00E-04	1.99E-03	B
		Dermal	3.97E-07	4.00E-04	9.93E-04	B
		Inhalation of Dust* (outdoor exposur	3.41E-11	6.00E-05	5.68E-07	B
		SUBTOTAL	1.19E-06		2.98E-03	B
	Groundwater	Ingestion	2.60E-04	4.00E-04	6.50E-01	B
		Dermal	5.21E-07	4.00E-04	1.30E-03	B
		Inhalation of mist (showering)	2.05E-13	6.00E-05	3.42E-09	B
		SUBTOTAL	2.61E-04		6.51E-01	B
		TOTAL	2.62E-04		**6.54E-01**	B
Future Scenario: Child Resident	Soil	Ingestion	7.42E-06	4.00E-04	1.86E-02	B
		Dermal	7.42E-07	4.00E-04	1.86E-03	B
		Inhalation of Dust* (outdoor exposur	1.59E-10	6.00E-05	2.65E-06	B
		SUBTOTAL	8.16E-06		2.04E-02	B
	Groundwater	Ingestion	1.21E-03	4.00E-04	3.03E+00	
		Dermal	8.50E-07	4.00E-04	2.13E-03	B
		Inhalation of mist (showering)	9.59E-13	6.00E-05	1.60E-08	B
		SUBTOTAL	1.21E-03		3.03E+00	
		TOTAL	1.22E-03		**3.05E+00**	

* exposure time = 24 hours
** exposure time = 0.2 hours
***equals RfC (antimony trioxide) for airborne intake
HI = Hazard Index

B = Below EPA target risk levels (HI<1)

Appendix D

Industrial Land Use Scenario Evaluation

Table D-1

Industrial Land Use Scenario
Exposure Routes/Pathways
Burn Area

Medium	Route of Exposure	Exposure Activity	Potential Receptors	Exposure Source
Soils	Ingestion	Incidental Contact	Adult Industrial Worker	Soils
	Dermal	Direct Contact	Adult Industrial Worker	Soils
	Inhalation	Fugitive Dust	Adult Industrial Worker	Soils
Groundwater	Ingestion	Direct Contact	Adult Industrial Worker	Potential Potable Water Supply
	Dermal	Direct Contact	Adult Industrial Worker	Groundwater
	Inhalation of mist	Direct Contact (showering)	Adult Industrial Worker	Groundwater

Table D-2

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SOILS AND DUST

Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CS = Concentration in Soil (mg/kg)	95% UCL
IR = Ingestion Rate (mg/day)	50
CF = Conversion Factor (kg/mg)	1.00E-06
FI = Fraction Ingested (unitless)	1
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-3

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SOIL AND DUST

Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

Parameter	Adult Industrial Worker
CS = Concentration in Soil (mg/kg)	95% UCL
CF = Conversion Factor (kg/mg)	1.00E-06
SA = Skin Surface Area Available for contact (cm^2/day)	5000
AF = Soil to Skin Adherence Factor (mg/cm^2)	1
ABS = Absorption Factor (unitless)	Chemical Specific [a]
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

[a] 1% for metals recommended by OEPA
Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-4

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF AIRBORNE CHEMICALS IN FUGITIVE DUST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL soil concentration
IR = Inhalation Rate (m^3/hour)	0.83 [a](outdoor)
ET = Exposure Time (hours/day)	8 (outdoor)
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days) Noncarcinogens (ED x 365 days/yr.)	9,125

[a] - 20 m^3/day = 0.83 m^3/hour
References: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-5

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN GROUNDWATER

Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CW = Concentration in water (mg/L)	95% UCL of mean TCLP antimony leachate concentration
IR = Ingestion Rate (L/day)	2
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-6

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN GROUNDWATER

Absorbed Dose (mg/kg-day)=(CW x SA x PC x ET x EF x ED x CF)/(BW x AT)

Parameter	Adult Industrial Worker
CW = Chemical Concentration in Water (mg/L)	95% UCL of mean TCLP antimony leachate concentration
SA = Skin Surface Area Available for contact (cm^2)	20,000
PC = Dermal Permeability Constant (cm/hr)	1.0E-03[a]
ET = Exposure Time (hrs./day)	0.2[b]
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
CF = Conversion Factor (L/cm^3)	1/1000
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

[a] - From Risk-Base Guideline Values Report - Appendix A, Table P2, Parameters for Chemical of Concern, March 1997, page 127

[b] - Based on the 90th percentile shower time of 12 minutes (12min/day x 1hr/60min= 0.2 hr/day)
Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-6a

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF CHEMICALS IN WATER MIST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL soil concentration
IR = Inhalation Rate (m^3/hour)	0.6 (showering)
ET = Exposure Time (hours/day)	0.2 (showering)
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

References: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

TABLE D-7 INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
SOIL INGESTION INTAKE
Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	IR (mg/day)	CF (kg/mg)	FI (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Intake (mg/kg-day) Noncarcinogens
Antimony	0.58	50	1.00E-06	1	250	25	70	9125	2.84E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 50 mg/day x 1E-06 kg/mg x 1 x 250 days/yr x 25 yrs / (70 kg x 9125 days)
Intake = 2.84E-07 mg/kg-day

TABLE D-8. INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
DERMAL CONTACT WITH CHEMICALS IN SOILS AND DUST
Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CF (kg/mg)	SA (cm^2/day)	AF (mg/cm^2)	ABS (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.58	1.00E-06	5000	1	**0.01**	250	25	70	9125	2.84E-07

Calculation (Antimony)

Noncarcinogen

Intake (mg/kg-day) = 0.58 mg/kg x 1 E-06 kg/mg x 5000 cm^2/day x 1 mg/cm^2 x 0.01 x 250 days/yr x 25 yrs / (70 kg x 9125 days)
Intake = 2.84E-07 mg/kg-day

ABS (Absorption Factor) is chemical specific

TABLE D-9. INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
INHALATION OF CHEMICALS IN FUGITIVE DUST
Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) OUTDOOR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.83	8	250	25	70	9125	8.12E-12

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10mg/m^3 x 0.83 m^3/hr x 8 hr/day x 250 days/yr x 20 yrs / (70 kg x 9125 days)
OUTDOOR Intake = 8.12E-12 mg/kg-day

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) SHOWERIN	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.6	0.2	250	25	70	9125	1.47E-13

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10 mg/m^3 x 0.6 m^3/hr x 0.2 hr/day x 250 days/yr x 25 yrs / (70 kg x 9125 days)
SHOWERING Intake = 1.47E-13 mg/kg-day

TABLE D-10 INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
GROUNDWATER INGESTION INTAKE
Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	IR (L/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	INTAKE (mg/kg-day)
Antimony	0.0095	2	250	25	70	9125	1.86E-04

CW= Concentration in water (mg/L) 95% UCL of mean TCLP leachate concentration

Noncarcinogen
Intake (mg/kg-day) = 9.5E-03 mg/L x 2 L/day x 250 days/yr x 25 yrs / (70 kg x 9125 days)
Intake = 1.86E-04 mg/kg-day

TABLE D-11. INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
GROUNDWATER DERMAL ABSORBED DOSE (SHOWERING)
INTAKE (mg/kg-day) = (CW x CF x SA x PC x ET x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	CF (L/cm^3)	SA (cm^2)	PC (cm/hr)	ET (hrs/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.0095	1.00E-03	20000	1.00E-03	0.2	250	25	70	9125	3.72E-07

CALCULATION

Noncarcinogen

Intake (mg/kg-day) = 9.5E-03 mg/L x 1.0E-03 L/cm^3 x 20,000 cm^2 x 1.0E-03 cm/hr x 0.2 hrs/day x 250 days/yr x 25 yrs/ (70 kg x 9125 days)
Intake = 3.72E-07 mg/kg-day

TABLE D-12. Summary of Total Risk
All Pathways
Burn Area

Scenario and Receptor	Media	Pathway	onCarcinogen Risk (Dose)	RfD***	HQ = HI	
Future Scenario	Soil	Ingestion	2.84E-07	4.0E-04	7.10E-04	B
Industrial Land Use		Dermal	2.84E-07	4.0E-04	7.10E-04	B
		Inhalation of Dust* (outdoor exposure)	8.12E-12	6.0E-05	1.35E-07	B
		SUBTOTAL	5.68E-07		1.42E-03	B
	Groundwater	Ingestion	1.86E-04	4.0E-04	4.65E-01	B
		Dermal	3.72E-07	4.0E-04	9.30E-04	B
		Inhalation (showering)	1.47E-13	6.0E-05	2.45E-09	B
		SUBTOTAL	1.86E-04		4.66E-01	B
		TOTAL	1.87E-04		**4.67E-01**	B

* exposure time = 8 hours
** exposure time =0.2 hours
***equals RfC (antimony trioxide) for airborne intake
HI = Hazard Index

B = Below EPA target risk levels (HI<1)

Appendix E

References

References

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APPENDIX B

Magazine 53

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
2,4,6-Trinitrotoluene	None	D003
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D007
Cadmium	Cadmium compounds, N.O.S.	D006
Cyclo-1,3,5-trimethylene-2,4,6-trinitramine	None	D003
Cyclotetramethylene tetranitramine	None	D003
Hexanitroazobenzene	None	D003
Hexanitrostilbene	None	D003
Lead	Lead compounds, N.O.S.	D008
Lead Azide	Lead compounds, N.O.S.	D008
Lead Styphnate	Lead compounds, N.O.S.	D008
Pentaerythritol tetranitrate	None	D003
Tetracene	None	D003
Triaminotrinitrobenzol	None	D003
Trinitro-2,4,6-phenylmethylnitramine	None	D003
	Beryllium	
	Nickel	
	Silver	D011

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
Al/Cu2O	None	D003
Al/CuO	None	D003
Al/CuO/SiC	None	D003
Al/Fe2O3	None	D003
Al/Fe3O4	None	D003
Al/KClO4	None	D003
Al/KClO4/NiO2	Nickel compounds, N.O.S.	D003
Al/Ni	Nickel compounds, N.O.S.	D003
Al/Ni/NiO	Nickel compounds, N.O.S.	D003
Al·Si/Fe3O4	None	D003
Antimony sulfide	Antimony compounds, N.O.S.	
Arcite 373D	None	D003
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4 (BCTK)	Chromic acid H2CrO4, calcium salt	D003, D007

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
B/CuO	None	D003
B/KNO3	None	D003
Barium nitrate	Barium compounds, N.O.S.	D003, D005
Barium Styphnate	Barium compounds, N.O.S.	D003, D005
Fe/KClO4	None	D003
Hexanitroazobenzene	None	D003
Lead Styphnate	Lead compounds, N.O.S.	D003, D008
Mg/Pb3O4	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
Pb3O4/B/KClO4/CaSi	Lead compounds, N.O.S.	D003, D008
Ti/B	None	D003
Ti/B/Al2O3	None	D003
Ti/KClO4	None	D003
Ti0.65/2B	None	D003
Ti0.65/3B	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
TiHX/KClO4	None	D003
TiKClO4	None	D003

Open Burn Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
2,4,6-Trinitrotoluene	None	D003
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
Al/Cu2O	None	D003
Al/CuO	None	D003
Al/CuO/SiC	None	D003
Al/Fe2O3	None	D003
Al/Fe3O4	None	D003
Al/KClO4	None	D003
Al/KClO4/NiO2	Nickel compounds, N.O.S.	D003
Al/Ni	Nickel compounds, N.O.S.	D003
Al/Ni/NiO	Nickel compounds, N.O.S.	D003
Al·Si/Fe3O4	None	D003
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CuO	None	D003
B/KNO3	None	D003
Cadmium	Cadmium	D006

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Cyclo-1,3,5-trimethylene-2,4,6-trinitramine	None	D003
Cyclotetramethylene tetranitramine	None	D003
Fe/KClO4	None	D003
Hexanitroazobenzene	None	D003
Hexanitrostilbene	None	D003
Lead	Lead	D008
Mg/Pb3O4	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
Pb3O4/B/KClO4/CaSi	Lead compounds, N.O.S.	D003, D008
Pentaerythritol tetranitrate	None	D003
Ti/B/Al2O3	None	D003
Ti/KClO4	None	D003
Ti0.65/2B	None	D003
Ti0.65/3B	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
Triaminotrinitrobenzol	None	D003
Trinitro-2,4,6-phenylmethylnitramine	None	D003
Zr/KClO4	None	D003
	Beryllium	

Retort Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
2,4,6-Trinitrotoluene	None	D003
5-Cyanotetrazolatopentaammine Cobalt (III) Perchlorate	None	D003
Antimony sulfide	Antimony compounds, N.O.S.	
B/CaCrO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CaCrO4/Ti/KClO4 (BCTK)	Chromic acid H2CrO4, calcium salt	D003, D007
B/KNO3	None	D003
Barium nitrate	Barium compounds, N.O.S.	D003, D005
Barium Styphnate	Barium compounds, N.O.S.	D005
Cadmium	Cadmium	D006
Cyclo-1,3,5-trimethylene-2,4,6-trinitramine	None	D003
Cyclotetramethylene tetranitramine	None	D003
Fe/KClO4	None	D003
Hexanitroazobenzene	None	D003
Hexanitrostilbene	None	D003
Lead Azide	Lead compounds, N.O.S.	D003, D008

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Lead Styphnate	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
Pentaerythritol tetranitrate	None	D003
Tetracene		D003
Ti/B	None	D003
Ti/KClO4	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
TiHX/KClO4	None	D003
TiKClO4	None	D003
Triaminotrinitrobenzol	None	D003
Trinitro-2,4,6-phenylmethylnitramine	None	D003
Zr/Fe2O3	None	D003
	Diphenylamine	
	Nitroglycerine	
	Dibutylphthalate	
	Beryllium	
	Nickel	
	Silver	

Energetic Materials Pretreatment Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Al/Cu2O	None	D003
Al/CuO	None	D003
Al/CuO/SiC	None	D003
Al/Fe2O3	None	D003
Al/Fe3O4	None	D003
Al/KCIO4	None	D003
Al/KClO4/NiO2	Nickel compounds, N.O.S.	D003
Al/Ni	Nickel compounds, N.O.S.	D003
Al/Ni/NiO		D003
Al·Si/Fe3O4	None	D003
B/CaCrO4		D003, D007
B/CaCrO4/Ti/KClO4	Chromic acid H2CrO4, calcium salt	D003, D007
B/CuO	None	D003
B/KNO3	None	D003
Fe/KClO4	None	D003
Fluorel/Pb3O4		D003, D008
Mg/Halon/	None	D003

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Mg/Pb3O4	Lead compounds, N.O.S.	D003, D008
NH4ClO4	None	D003
NH4ClO4/polysulfide monomer	None	D003
Pb3O4/B/KClO4/CaSi	Lead compounds, N.O.S.	D003, D008
Pb3O4/B/KClO4/CaSi/DAP		D003, D008
Pd/Al	None	D003
Ti/B/Al2O3	None	D003
Ti/KClO4	None	D003
Ti0.65/2B	None	D003
Ti0.65/3B	None	D003
TiH0.65/KClO4	None	D003
TiH1.65/KClO4	None	D003
Zr/KClO4	None	D003

Thermal Treatment Unit

Chemical Name	Appendix VIII Constituent(s)	Waste Code(s)
Triaminotrinitrobenzol	None	D003

APPENDIX C

APPENDIX C

SAMPLING AND ANALYSIS PLAN FOR THE RCRA CLOSURE OF THE BURN AREA

Summary

The Burn Area sampling and analysis plan will evaluate the following media: the decontamination waste water, the final rinseate samples of surfaces and demolition materials, the removed soil from the Open Burn unit, and multiple core samples of soil from the Burn Area. The sampling methods and equipment, as well as laboratory analytical methods will comply with the USEPA's SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition."

Decontamination Waste Water and Rinseate Testing

MAGAZINE 53 and the PYROSHED: If decontamination is necessary, sampling will proceed as follows: The storage units will be cleaned by sweeping the floors. The dust and dirt will be placed in a drum. This drum will be sampled and stored with other soil drums from the Burn Area closure. To minimize the generation of waste water, both the floor and wall surfaces will be detergent washed with mops and sponges. The wash water will be collected using standard janitorial buckets with a squeegee. The floors and walls will then be washed a second time with tap water. Both the waste detergent and tap water will transferred to a drum. The bucket, mops, and sponges will be triple rinsed with tap water which will be transferred to the drum prior to washing the storage unit walls and floors with tap water a third time. This final wash water will be collected and sampled as the "final rinseate". Excess rinseate water will also be transferred to the storage unit waste water drum. One sample will be collected from each storage unit. The waste water and rinse water from both storage units will be combined into a single drum which will be managed as potentially hazardous waste. One sample will be drawn from this drum and analyzed. The mops, sponges, and bucket will be reused on decontamination of treatment unit surfaces or will be placed in a separate drum and also managed as potentially hazardous waste pending the "final rinseate" analyses.

THERMAL TREATMENT & ENERGETIC MATERIALS PRETREATMENT UNITS: These two units are small and appear to be free of visible contamination. Since the need for decontamination of these units is unlikely, both of these treatment units will be cleaned with tap water only. Mound will generate a "rinseate sample" via a similar procedure used on the storage units. These units will be placed on a plastic liner to contain the rinse water. These units be will be cleaned with a minimum rinse water using a sponge. The waste rinse water will be squeezed into the bucket from the sponge. All waste water from both units will transferred to a single drum. A separate "final rinseate" sample for each unit and one drum sample will be analyzed to determine disposal options.

RETORT UNIT: The concrete floor and wall surfaces from Building 90 and Retort enclosure will be cleaned and rinseate tested. A minimum of two rinseate samples will be generated and sampled. Waste detergent and rise water will be transferred into a drum.

SOIL SAMPLING EQUIPMENT: Rinse water from decontaminating soil sampling equipment will be consolidated in a single waste container. Upon completion of the Burn Area sampling activities, a sample will be removed and analyzed to determine disposal requirements.

Open Burn (OB) Unit Soil Testing

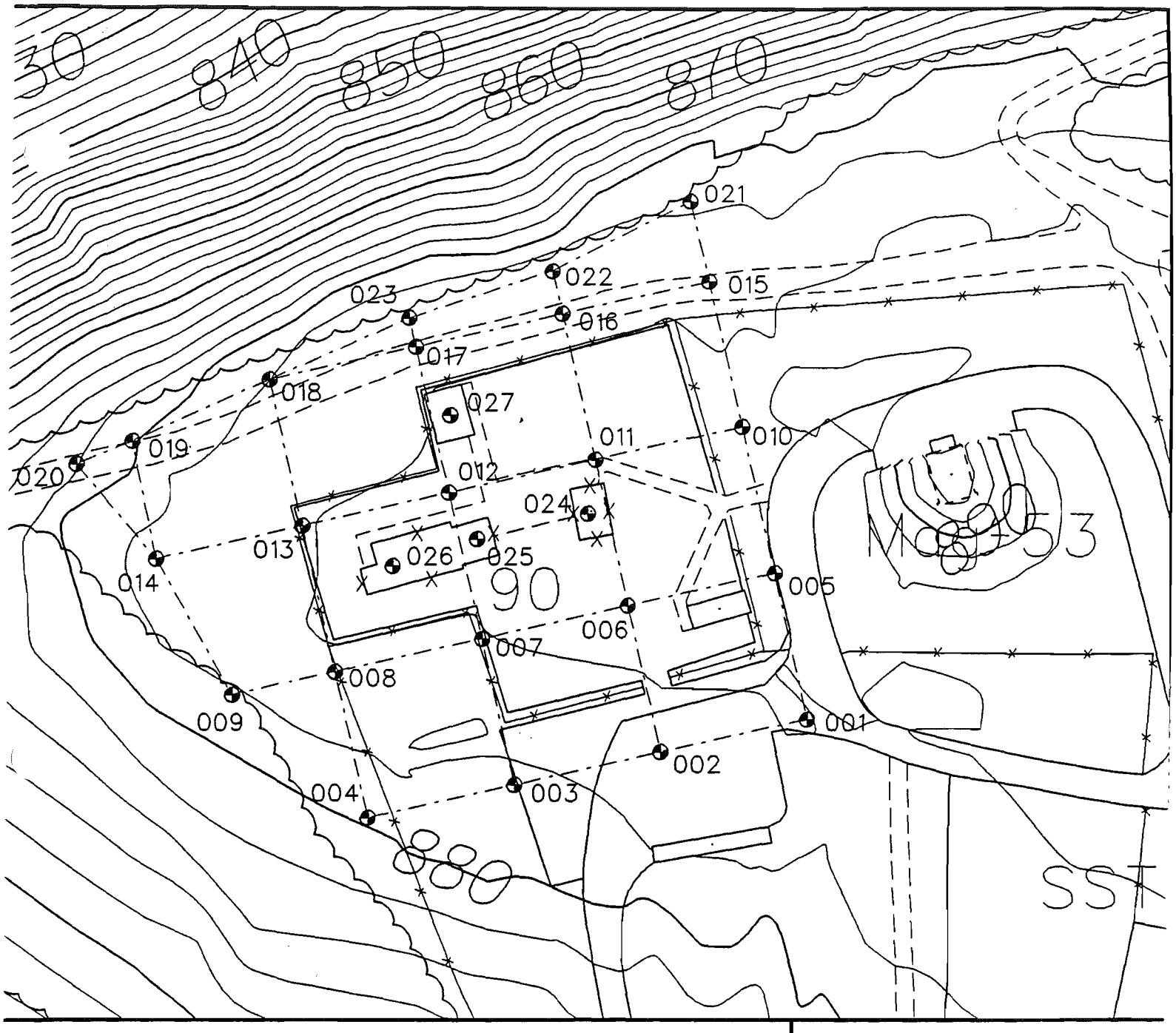
The sand and soil floor in the OB Unit will be removed and placed into approximately 80 drums. After removal of sand/soil, two soil samples will be collected from the surface (0-1 ft.) of the floor.

Burn Area - Post-Demolition Soil Testing

Twenty five core samples of soil will be collected from a 50 feet grid interval (5x5) to assess the contamination in the Burn Area. The soil samples will be characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. Therefore a total of 75 soil samples will be characterized from this grid.

Four additional core samples will be collected from the removed unit locations: the pyroshed, the open burn cubicle, Building 90, and the retort enclosure. The soil samples will be characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. Therefore a total of 12 soil samples will be characterized.

Eight additional soil samples will be collected from each of the excavation faces of the two treatment units.



BURN AREA CLOSURE PLAN
SOIL SAMPLING LOCATIONS

LEGEND

- CORE SAMPLES
- X EXCAVATION FACE SAMPLE

N

MOUND ERGIS

Environmental Restoration Geographic Information System

0 50 100

Scale in feet

Antimony UCL Calculations

Note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.76		0.76	-0.274436846
2	0.34	u	0.17	-1.771956842
3	0.31	u	0.155	-1.864330162
4	0.36	u	0.18	-1.714798428
5	0.33	u	0.165	-1.801809805
6	0.32	u	0.16	-1.832581464
7	0.32	u	0.16	-1.832581464
8	0.33	u	0.165	-1.801809805
9	0.32	u	0.16	-1.832581464
10	0.35	u	0.175	-1.742969305
11	0.34	u	0.17	-1.771956842
12	0.33	u	0.165	-1.801809805
13	0.33	u	0.165	-1.801809805
14	0.35	u	0.175	-1.742969305
15	0.34	u	0.17	-1.771956842
16	0.3	u	0.15	-1.897119985
17	0.36		0.36	-1.021651248
18	0.32	u	0.16	-1.832581464
19	0.32	u	0.16	-1.832581464
20	5		5	1.609437912
21	0.47		0.47	-0.755022584
22	0.33	u	0.165	-1.801809805
24	1.1		1.1	0.09531018
25	0.34	u	0.17	-1.771956842
26	0.34	u	0.17	-1.771956842
27	0.3	u	0.15	-1.897119985
28	0.49		0.49	-0.713349888
29	0.28		0.28	-1.272965676
30	0.31	u	0.155	-1.864330162
31	0.34	u	0.17	-1.771956842
32	0.32	u	0.16	-1.832581464
33	0.32	u	0.16	-1.832581464
34	0.32	u	0.16	-1.832581464
35	0.36	u	0.18	-1.714798428
36	0.34	u	0.17	-1.771956842
37	0.33		0.33	-1.108662625
38	0.8		0.8	-0.223143551
39	0.31	u	0.155	-1.864330162
40	0.29	u	0.145	-1.931021537
41	0.33	u	0.165	-1.801809805
42	0.28	u	0.14	-1.966112856
43	0.3	u	0.15	-1.897119985
44	0.33	u	0.165	-1.801809805
45	0.34		0.34	-1.078809661
47	0.29	u	0.145	-1.931021537
48	0.33	u	0.165	-1.801809805
49	0.62		0.62	-0.478035801
50	0.3	u	0.15	-1.897119985
51	0.29	u	0.145	-1.931021537
52	0.48		0.48	-0.733969175
53	0.33	u	0.165	-1.801809805
54	0.29	u	0.145	-1.931021537
55	0.59		0.59	-0.527632742

56	0.3 u	0.15	-1.897119985
57	0.26 u	0.13	-2.040220829
58	0.67	0.67	-0.400477567
59	1.5	1.5	0.405465108
60	0.37	0.37	-0.994252273
61	0.24 u	0.12	-2.120263536
62	0.38	0.38	-0.967584026
63	0.32 u	0.16	-1.832581464
64	0.32 u	0.16	-1.832581464
65	2.1	2.1	0.741937345
66	0.75	0.75	-0.287682072
67	0.24 u	0.12	-2.120263536
68	0.28 u	0.14	-1.966112856
70	0.53	0.53	-0.634878272
71	1	1	0
72	0.55	0.55	-0.597837001
73	3.5	3.5	1.252762968
74	0.38	0.38	-0.967584026
75	0.39	0.39	-0.94160854
76	1.7	1.7	0.530628251
77	1	1	0
78	0.37	0.37	-0.994252273
79	0.42	0.42	-0.867500568
80	0.34 u	0.17	-1.771956842
81	0.51	0.51	-0.673344553
82	0.58	0.58	-0.544727175
83	0.34	0.34	-1.078809661
84	0.47	0.47	-0.755022584
85	0.29 u	0.145	-1.931021537
86	0.94	0.94	-0.061875404
87	0.57	0.57	-0.562118918
88	0.29 u	0.145	-1.931021537
89	0.27 u	0.135	-2.002480501
90	0.42	0.42	-0.867500568
91	0.55	0.55	-0.597837001
93	0.4	0.4	-0.916290732
118	6.4	6.4	1.85629799
119	1.7	1.7	0.530628251
121	0.97	0.97	-0.030459207
122	1.4	1.4	0.336472237
123	0.91	0.91	-0.094310679
124	0.58	0.58	-0.544727175
125	0.96	0.96	-0.040821995
126	0.56	0.56	-0.579818495
127	0.37	0.37	-0.994252273

	GM
mean(x)	**mean(ln x)**
0.549846939	-1.13609979
std dev (x)	**std dev (ln x)**
0.904065404	0.898271767
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.701262789	0.58299814

Barium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	73.9		73.9	4.302712828
2	35.3		35.3	3.563882964
3	48.2		48.2	3.875359021
4	101		101	4.615120517
5	33.3		33.3	3.505557397
6	25.3		25.3	3.230804396
7	62.1		62.1	4.128745989
8	48.6		48.6	3.883623531
9	50.5		50.5	3.921973336
10	104		104	4.644390899
11	104		104	4.644390899
12	61.7		61.7	4.122283931
13	40.2		40.2	3.693866996
14	98.2		98.2	4.587006215
15	38		38	3.63758616
16	31.4		31.4	3.446807893
17	101		101	4.615120517
18	31.3		31.3	3.443618098
19	28.3		28.3	3.342861805
20	87.9		87.9	4.476199805
21	100		100	4.605170186
22	99.3		99.3	4.598145571
24	84.8		84.8	4.440295543
25	96.7		96.7	4.571613402
26	96.9		96.9	4.573679519
27	47.9		47.9	3.869115504
28	198		198	5.288267031
29	51.9		51.9	3.94931879
30	37.5		37.5	3.624340933
31	86.3		86.3	4.457829598
32	58.6		58.6	4.070734697
33	47.5		47.5	3.860729711
34	59.3		59.3	4.082609306
35	72.9		72.9	4.289088639
36	51		51	3.931825633
37	41.9		41.9	3.735285827
38	106		106	4.663439094
39	82.4		82.4	4.411585437
40	34.6		34.6	3.543853682
41	114		114	4.736198448
42	58.9		58.9	4.075841091
43	54		54	3.988984047
44	88.4		88.4	4.48187197
45	86.4		86.4	4.458987676
47	105		105	4.65396035
48	51.4		51.4	3.939638172
49	203		203	5.313205979
50	43.3		43.3	3.768152635
51	77.1		77.1	4.345103281
52	116		116	4.753590191
53	81.3		81.3	4.398146017
54	36.8		36.8	3.605497845
55	111		111	4.709530201

56	26.7	26.7	3.284663565
57	45.1	45.1	3.808882247
58	97.4	97.4	4.578826211
59	89.8	89.8	4.497584975
60	90.8	90.8	4.508659286
61	33.9	33.9	3.523415014
62	26.9	26.9	3.292126287
63	34.9	34.9	3.552486829
64	44.3	44.3	3.790984677
65	87.5	87.5	4.471638793
66	183	183	5.209486153
67	38.5	38.5	3.650658241
68	34.1	34.1	3.529297384
70	27.1	27.1	3.299533728
71	80.3	80.3	4.385769621
72	163	163	5.093750201
73	75.7	75.7	4.32677816
74	72.8	72.8	4.287715955
75	146	146	4.983606622
76	72.9	72.9	4.289088639
77	87.6	87.6	4.472780998
78	135	135	4.905274778
79	74.5	74.5	4.310799125
80	73.4	73.4	4.295923936
81	129	129	4.859812404
82	56.6	56.6	4.036008985
83	58.2	58.2	4.063885355
84	211	211	5.351858133
85	51.8	51.8	3.947390149
86	73.9	73.9	4.302712828
87	66.1	66.1	4.191168747
88	28.7	28.7	3.356897123
89	34.6	34.6	3.543853682
90	152	152	5.023880521
91	137	137	4.919980926
93	64	64	4.158883083
118	71	71	4.262679877
119	81.5	81.5	4.40060302
121	69.1	69.1	4.235554731
122	76.2	76.2	4.333361463
123	103	103	4.634728988
124	255	255	5.541263545
125	75.3	75.3	4.321480135
126	65.8	65.8	4.186619838
127	56.8	56.8	4.039536326

mean(x)	**mean(ln x)**
77.98061224	4.219790209
std dev (x)	**std dev (ln x)**
43.75432034	0.522193436
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
85.30872985	86.17631436

Beryllium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.55		0.55	-0.597837001
2	0.32		0.32	-1.139434283
3	0.46		0.46	-0.776528789
4	0.66		0.66	-0.415515444
5	0.3		0.3	-1.203972804
6	0.3		0.3	-1.203972804
7	0.56		0.56	-0.579818495
8	0.44		0.44	-0.820980552
9	0.43		0.43	-0.84397007
10	1		1	0
11	1		1	0
12	0.56		0.56	-0.579818495
13	0.44		0.44	-0.820980552
14	0.92		0.92	-0.083381609
15	0.49		0.49	-0.713349888
16	0.4		0.4	-0.916290732
17	0.87		0.87	-0.139262067
18	0.51		0.51	-0.673344553
19	0.43		0.43	-0.84397007
20	1.1		1.1	0.09531018
21	0.94		0.94	-0.061875404
22	0.91		0.91	-0.094310679
24	1		1	0
25	0.77		0.77	-0.261364764
26	0.87		0.87	-0.139262067
27	0.51		0.51	-0.673344553
28	1.5		1.5	0.405465108
29	0.52		0.52	-0.653926467
30	0.33		0.33	-1.108662625
31	0.75		0.75	-0.287682072
32	0.46		0.46	-0.776528789
33	0.46		0.46	-0.776528789
34	0.46		0.46	-0.776528789
35	0.73		0.73	-0.314710745
36	0.59		0.59	-0.527632742
37	0.47		0.47	-0.755022584
38	1.2		1.2	0.182321557
39	1.1		1.1	0.09531018
40	0.57		0.57	-0.562118918
41	1.2		1.2	0.182321557
42	0.82		0.82	-0.198450939
43	0.75		0.75	-0.287682072
44	0.94		0.94	-0.061875404
45	1		1	0
47	1		1	0
48	0.68		0.68	-0.385662481
49	2.9		2.9	1.064710737
50	0.55		0.55	-0.597837001
51	0.84		0.84	-0.174353387
52	1.4		1.4	0.336472237
53	0.81		0.81	-0.210721031
54	0.6		0.6	-0.510825624
55	1.1		1.1	0.09531018

56	0.42	0.42	-0.867500568
57	0.71	0.71	-0.342490309
58	0.8	0.8	-0.223143551
59	0.96	0.96	-0.040821995
60	0.67	0.67	-0.400477567
61	0.37	0.37	-0.994252273
62	0.32	0.32	-1.139434283
63	0.44	0.44	-0.820980552
64	0.54	0.54	-0.616186139
65	3.6	3.6	1.280933845
66	2	2	0.693147181
67	0.34	0.34	-1.078809661
68	0.26	0.26	-1.347073648
70	0.5	0.5	-0.693147181
71	0.79	0.79	-0.235722334
72	1.1	1.1	0.09531018
73	1.2	1.2	0.182321557
74	1.7	1.7	0.530628251
75	0.91	0.91	-0.094310679
76	0.74	0.74	-0.301105093
77	0.99	0.99	-0.010050336
78	1.1	1.1	0.09531018
79	0.56	0.56	-0.579818495
80	0.6	0.6	-0.510825624
81	1.7	1.7	0.530628251
82	0.5	0.5	-0.693147181
83	0.28	0.28	-1.272965676
84	1.9	1.9	0.641853886
85	0.49	0.49	-0.713349888
86	1.6	1.6	0.470003629
87	1.2	1.2	0.182321557
88	0.37	0.37	-0.994252273
89	0.34	0.34	-1.078809661
90	1.2	1.2	0.182321557
91	1.4	1.4	0.336472237
93	0.46	0.46	-0.776528789
118	0.92	0.92	-0.083381609
119	4.3	4.3	1.458615023
121	0.95	0.95	-0.051293294
122	4.7	4.7	1.547562509
123	0.84	0.84	-0.174353387
124	1.8	1.8	0.587786665
125	0.5	0.5	-0.693147181
126	0.51	0.51	-0.673344553
127	0.47	0.47	-0.755022584

mean(x)	**mean(ln x)**
0.903265306	-0.301353513
std dev (x)	**std dev (ln x)**
0.740111131	0.587685996
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
1.027221555	0.984295389

Cadmium CL Calclations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.25	u	0.125	-2.079441542
2	0.27	u	0.135	-2.002480501
3	0.25	u	0.125	-2.079441542
4	0.28	u	0.14	-1.966112856
5	0.26	u	0.13	-2.040220829
6	0.25	u	0.125	-2.079441542
7	0.25	u	0.125	-2.079441542
8	0.26	u	0.13	-2.040220829
9	0.25	u	0.125	-2.079441542
10	0.27	u	0.135	-2.002480501
11	0.27	u	0.135	-2.002480501
12	0.3		0.3	-1.203972804
13	0.26	u	0.13	-2.040220829
14	0.27	u	0.135	-2.002480501
15	0.27	u	0.135	-2.002480501
16	0.24	u	0.12	-2.120263536
17	0.26	u	0.13	-2.040220829
18	0.25	u	0.125	-2.079441542
19	0.25	u	0.125	-2.079441542
20	0.29	u	0.145	-1.931021537
21	0.27	u	0.135	-2.002480501
22	0.26	u	0.13	-2.040220829
24	0.45		0.45	-0.798507696
25	0.27	u	0.135	-2.002480501
26	0.26	u	0.13	-2.040220829
27	0.23	u	0.115	-2.162823151
28	0.61		0.61	-0.494296322
29	0.22	u	0.11	-2.207274913
30	0.25	u	0.125	-2.079441542
31	0.27	u	0.135	-2.002480501
32	0.27		0.27	-1.30933332
33	0.25	u	0.125	-2.079441542
34	0.25	u	0.125	-2.079441542
35	0.28	u	0.14	-1.966112856
36	0.27	u	0.135	-2.002480501
37	0.26	u	0.13	-2.040220829
38	0.24	u	0.12	-2.120263536
39	0.24	u	0.12	-2.120263536
40	0.23	u	0.115	-2.162823151
41	0.26	u	0.13	-2.040220829
42	0.22	u	0.11	-2.207274913
43	0.24	u	0.12	-2.120263536
44	0.26	u	0.13	-2.040220829
45	0.25	u	0.125	-2.079441542
47	0.23	u	0.115	-2.162823151
48	0.26	u	0.13	-2.040220829
49	0.26	u	0.13	-2.040220829
50	0.24	u	0.12	-2.120263536
51	0.23	u	0.115	-2.162823151
52	0.25	u	0.125	-2.079441542
53	0.26	u	0.13	-2.040220829
54	0.23	u	0.115	-2.162823151
55	0.24	u	0.12	-2.120263536

56	0.24 u	0.12	-2.120263536
57	0.2 u	0.1	-2.302585093
58	0.24 u	0.12	-2.120263536
59	0.35	0.35	-1.049822124
60	0.24 u	0.12	-2.120263536
61	0.19 u	0.095	-2.353878387
62	0.26 u	0.13	-2.040220829
63	0.25 u	0.125	-2.079441542
64	0.25 u	0.125	-2.079441542
65	0.28 u	0.14	-1.966112856
66	0.28 u	0.14	-1.966112856
67	0.19 u	0.095	-2.353878387
68	0.22 u	0.11	-2.207274913
70	0.22 u	0.11	-2.207274913
71	0.25 u	0.125	-2.079441542
72	0.19 u	0.095	-2.353878387
73	0.25 u	0.125	-2.079441542
74	0.26 u	0.13	-2.040220829
75	0.24 u	0.12	-2.120263536
76	0.27 u	0.135	-2.002480501
77	0.17 u	0.085	-2.465104022
78	0.26	0.26	-1.347073648
79	0.25	0.25	-1.386294361
80	0.27	0.27	-1.30933332
81	0.27	0.27	-1.30933332
82	1.4	1.4	0.336472237
83	0.23 u	0.115	-2.162823151
84	0.58 u	0.29	-1.237874356
85	0.23 u	0.115	-2.162823151
86	0.26 u	0.13	-2.040220829
87	0.25 u	0.125	-2.079441542
88	0.23 u	0.115	-2.162823151
89	0.21 u	0.105	-2.253794929
90	0.24 u	0.12	-2.120263536
91	0.24 u	0.12	-2.120263536
93	1.1	1.1	0.09531018
118	0.87	0.87	-0.139262067
119	0.29 u	0.145	-1.931021537
121	0.29 u	0.145	-1.931021537
122	0.35	0.35	-1.049822124
123	0.27 u	0.135	-2.002480501
124	0.56	0.56	-0.579818495
125	0.4	0.4	-0.916290732
126	0.25 u	0.125	-2.079441542
127	0.21 u	0.105	-2.253794929

mean(x)	**mean(ln x)**
0.185306122	-1.891113015
std dev (x)	**std dev (ln x)**
0.193925557	0.516059512
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.217785413	0.192621542

Chromium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	11.1		11.1	2.406945108
2	6.6		6.6	1.887069649
3	8.6		8.6	2.151762203
4	12.6		12.6	2.533696814
5	5.3		5.3	1.667706821
6	4.2		4.2	1.435084525
7	9.3		9.3	2.2300144
8	7.6		7.6	2.028148247
9	6.9		6.9	1.931521412
10	16.1		16.1	2.778819272
11	15.5		15.5	2.740840024
12	10.2		10.2	2.32238772
13	6.8		6.8	1.916922612
14	16.1		16.1	2.778819272
15	10.6		10.6	2.360854001
16	8.4		8.4	2.128231706
17	15.1		15.1	2.714694744
18	8.3		8.3	2.116255515
19	9.5		9.5	2.251291799
20	14.7		14.7	2.687847494
21	17		17	2.833213344
22	16.4		16.4	2.797281335
24	14.8		14.8	2.694627181
25	15.8		15.8	2.76000994
26	16.5		16.5	2.803360381
27	9.5		9.5	2.251291799
28	24.9		24.9	3.214867803
29	9.3		9.3	2.2300144
30	6.5		6.5	1.871802177
31	13		13	2.564949357
32	9.5		9.5	2.251291799
33	8.5		8.5	2.140066163
34	9.8		9.8	2.282382386
35	12.4		12.4	2.517696473
36	10.2		10.2	2.32238772
37	8.9		8.9	2.186051277
38	20.1		20.1	3.000719815
39	16.7		16.7	2.815408719
40	8.1		8.1	2.091864062
41	18		18	2.890371758
42	14.1		14.1	2.646174797
43	12.4		12.4	2.517696473
44	16.5		16.5	2.803360381
45	18.1		18.1	2.895911938
47	16		16	2.772588722
48	9.9		9.9	2.292534757
49	33.3		33.3	3.505557397
50	7.4		7.4	2.00148
51	13.9		13.9	2.63188884
52	20		20	2.995732274
53	12.1		12.1	2.493205453
54	7.7		7.7	2.041220329
55	13.8		13.8	2.624668592

56	5.2	5.2	1.648658626
57	9.9	9.9	2.292534757
58	13.8	13.8	2.624668592
59	21.6	21.6	3.072693315
60	12.4	12.4	2.517696473
61	5.5	5.5	1.704748092
62	5.5	5.5	1.704748092
63	6.3	6.3	1.840549633
64	8.9	8.9	2.186051277
65	11.2	11.2	2.415913778
66	23.5	23.5	3.157000421
67	5.7	5.7	1.740466175
68	5	5	1.609437912
70	7.8	7.8	2.054123734
71	21.4	21.4	3.063390922
72	20.1	20.1	3.000719815
73	11	11	2.397895273
74	22.1	22.1	3.095577609
75	14.9	14.9	2.701361213
76	13.8	13.8	2.624668592
77	18.8	18.8	2.93385687
78	18.1	18.1	2.895911938
79	10.6	10.6	2.360854001
80	10.4	10.4	2.341805806
81	19.5	19.5	2.970414466
82	7.6	7.6	2.028148247
83	8.5	8.5	2.140066163
84	34.5	34.5	3.540959324
85	8.3	8.3	2.116255515
86	6	6	1.791759469
87	10.9	10.9	2.388762789
88	4.6	4.6	1.526056303
89	5.2	5.2	1.648658626
90	17.9	17.9	2.884800713
91	20.6	20.6	3.025291076
93	8.4	8.4	2.128231706
118	18.9	18.9	2.939161922
119	9.4	9.4	2.240709689
121	17.6	17.6	2.867898902
122	10.9	10.9	2.388762789
123	18.2	18.2	2.901421594
124	24.4	24.4	3.194583132
125	12.1	12.1	2.493205453
126	9.6	9.6	2.261763098
127	8.6	8.6	2.151762203

mean(x)	**mean(ln x)**
12.75306122	2.443108135
std dev (x)	**std dev (ln x)**
5.942546299	0.458192662
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.83
UCL normal	**UCL lognormal**
13.74833844	13.91843771

Lead UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	10.6		10.6	2.360854001
2	2.9	u	1.45	0.371563556
3	4.2		4.2	1.435084525
4	5.8		5.8	1.757857918
5	2.8	u	1.4	0.336472237
6	2.7	u	1.35	0.300104592
7	6.9		6.9	1.931521412
8	2.8	u	1.4	0.336472237
9	4.5		4.5	1.504077397
10	18.5		18.5	2.917770732
11	15.5		15.5	2.740840024
12	5.8		5.8	1.757857918
13	5.3		5.3	1.667706821
14	18.2		18.2	2.901421594
15	4.6		4.6	1.526056303
16	8.9		8.9	2.186051277
17	19.9		19.9	2.990719732
18	2.9		2.9	1.064710737
19	4.4		4.4	1.481604541
20	24.2		24.2	3.186352633
21	7.6		7.6	2.028148247
22	7		7	1.945910149
24	13.2		13.2	2.58021683
25	14.8		14.8	2.694627181
26	9.2		9.2	2.219203484
27	4.4		4.4	1.481604541
28	21.2		21.2	3.054001182
29	2.5		2.5	0.916290732
30	2.7	u	1.35	0.300104592
31	14.8		14.8	2.694627181
32	2.7	u	1.35	0.300104592
33	4.8		4.8	1.568615918
34	2.7	u	1.35	0.300104592
35	6		6	1.791759469
36	5.2		5.2	1.648658626
37	3.5		3.5	1.252762968
38	13.9		13.9	2.63188884
39	4.1		4.1	1.410986974
40	4.3		4.3	1.458615023
41	15		15	2.708050201
42	3.1		3.1	1.131402111
43	2.6	u	1.3	0.262364264
44	14.6		14.6	2.681021529
45	16.8		16.8	2.821378886
47	8.1		8.1	2.091864062
48	3.2		3.2	1.16315081
49	15.1		15.1	2.714694744
50	4.5		4.5	1.504077397
51	5.8		5.8	1.757857918
52	10.1		10.1	2.312535424
53	5.1		5.1	1.62924054
54	3.5		3.5	1.252762968
55	9.2		9.2	2.219203484

56	2.6 u	1.3	0.262364264
57	4.9	4.9	1.589235205
58	6.4	6.4	1.85629799
59	11.5	11.5	2.442347035
60	7.9	7.9	2.066862759
61	3.1	3.1	1.131402111
62	5	5	1.609437912
63	2.8	2.8	1.029619417
64	3.5	3.5	1.252762968
65	17.1	17.1	2.839078464
66	10.4	10.4	2.341805806
67	3.4	3.4	1.223775432
68	4.2	4.2	1.435084525
70	13.1	13.1	2.57261223
71	13	13	2.564949357
72	9.6	9.6	2.261763098
73	73.8	73.8	4.301358732
74	10.9	10.9	2.388762789
75	8.6	8.6	2.151762203
76	14.1	14.1	2.646174797
77	11.5	11.5	2.442347035
78	7.1	7.1	1.960094784
79	11.9	11.9	2.4765384
80	12.6	12.6	2.533696814
81	8.4	8.4	2.128231706
82	6	6	1.791759469
83	7.5	7.5	2.014903021
84	6.3 u	3.15	1.147402453
85	2.5	2.5	0.916290732
86	9.8	9.8	2.282382386
87	13.1	13.1	2.57261223
88	2.5 u	1.25	0.223143551
89	8.1	8.1	2.091864062
90	11	11	2.397895273
91	9.1	9.1	2.208274414
93	5	5	1.609437912
118	113	113	4.727387819
119	3.1 u	1.55	0.438254931
121	11.2	11.2	2.415913778
122	3 u	1.5	0.405465108
123	7.8	7.8	2.054123734
124	13	13	2.564949357
125	15.9	15.9	2.766319109
126	6.9	6.9	1.931521412
127	4.1	4.1	1.410986974

mean(x)	**mean(ln x)**
9.686734694	1.864920298
std dev (x)	**std dev (ln x)**
13.52462922	0.868293527
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
11.95188412	11.34214869

Nickel UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	15.3		15.3	2.727852828
2	18.7		18.7	2.928523524
3	16.1		16.1	2.778819272
4	21		21	3.044522438
5	8.6		8.6	2.151762203
6	7.5		7.5	2.014903021
7	19.6		19.6	2.975529566
8	14.4		14.4	2.667228207
9	12.9		12.9	2.557227311
10	21.3		21.3	3.058707073
11	22.8		22.8	3.126760536
12	16		16	2.772588722
13	13.7		13.7	2.617395833
14	22.1		22.1	3.095577609
15	16.5		16.5	2.803360381
16	13.8		13.8	2.624668592
17	19.7		19.7	2.980618636
18	13.2		13.2	2.58021683
19	17.7		17.7	2.87356464
20	16.8		16.8	2.821378886
21	25.9		25.9	3.254242969
22	29.8		29.8	3.394508394
24	20.5		20.5	3.020424886
25	16.5		16.5	2.803360381
26	20.2		20.2	3.005682604
27	13.8		13.8	2.624668592
28	34		34	3.526360525
29	12.1		12.1	2.493205453
30	9.1		9.1	2.208274414
31	16.6		16.6	2.809402695
32	17.2		17.2	2.844909384
33	11.5		11.5	2.442347035
34	14.3		14.3	2.660259537
35	19.1		19.1	2.949688335
36	15.8		15.8	2.76000994
37	15.6		15.6	2.747270914
38	19.8		19.8	2.985681938
39	22.3		22.3	3.104586678
40	10.8		10.8	2.379546134
41	21.5		21.5	3.068052935
42	15.2		15.2	2.721295428
43	16.5		16.5	2.803360381
44	17.6		17.6	2.867898902
45	16.9		16.9	2.827313622
47	21.9		21.9	3.086486637
48	13.7		13.7	2.617395833
49	47.2		47.2	3.854393893
50	9.5		9.5	2.251291799
51	19.5		19.5	2.970414466
52	29.5		29.5	3.384390263
53	17.4		17.4	2.856470206
54	11.4		11.4	2.433613355
55	25.5		25.5	3.238678452

56	8.2	8.2	2.104134154
57	14.6	14.6	2.681021529
58	17.5	17.5	2.862200881
59	17.7	17.7	2.87356464
60	18.8	18.8	2.93385687
61	10.6	10.6	2.360854001
62	5.7	5.7	1.740466175
63	9.1	9.1	2.208274414
64	13.6	13.6	2.610069793
65	33.1	33.1	3.499533282
66	28.2	28.2	3.339321978
67	8.5	8.5	2.140066163
68	8.2	8.2	2.104134154
70	2.8	2.8	1.029619417
71	19.5	19.5	2.970414466
72	28.6	28.6	3.353406718
73	8.7	8.7	2.163323026
74	21.9	21.9	3.086486637
75	22.9	22.9	3.131136911
76	11.4	11.4	2.433613355
77	17.9	17.9	2.884800713
78	25.2	25.2	3.226843995
79	8.6	8.6	2.151762203
80	9.5	9.5	2.251291799
81	37.1	37.1	3.61361697
82	17.2	17.2	2.844909384
83	5.2	5.2	1.648658626
84	55.1	55.1	4.009149716
85	15.5	15.5	2.740840024
86	7.8	7.8	2.054123734
87	12	12	2.48490665
88	8.9	8.9	2.186051277
89	4.6	4.6	1.526056303
90	38.1	38.1	3.640214282
91	33.9	33.9	3.523415014
93	14.2	14.2	2.653241965
118	27.9	27.9	3.328626689
119	12.8	12.8	2.549445171
121	15.2	15.2	2.721295428
122	14.8	14.8	2.694627181
123	16.6	16.6	2.809402695
124	89.8	89.8	4.497584975
125	15.9	15.9	2.766319109
126	13.3	13.3	2.587764035
127	12.4	12.4	2.517696473

mean(x)	**mean(ln x)**
18.31632653	2.77280445
std dev (x)	**std dev (ln x)**
11.27792017	0.51552559
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
20.20518973	20.1795495

Silver UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.46	u	0.23	-1.46967597
2	0.49	u	0.245	-1.406497068
3	0.45	u	0.225	-1.491654877
4	0.52	u	0.26	-1.347073648
5	0.46	u	0.23	-1.46967597
6	0.45	u	0.225	-1.491654877
7	0.46	u	0.23	-1.46967597
8	0.47	u	0.235	-1.448169765
9	0.46	u	0.23	-1.46967597
10	0.49	u	0.245	-1.406497068
11	0.49	u	0.245	-1.406497068
12	0.47	u	0.235	-1.448169765
13	0.47	u	0.235	-1.448169765
14	0.5	u	0.25	-1.386294361
15	0.48	u	0.24	-1.427116356
16	0.43	u	0.215	-1.537117251
17	0.47	u	0.235	-1.448169765
18	0.46	u	0.23	-1.46967597
19	0.46	u	0.23	-1.46967597
20	0.52	u	0.26	-1.347073648
21	0.49	u	0.245	-1.406497068
22	0.47	u	0.235	-1.448169765
24	0.49	u	0.245	-1.406497068
25	0.48	u	0.24	-1.427116356
26	0.48	u	0.24	-1.427116356
27	0.42	u	0.21	-1.560647748
28	0.52		0.52	-0.653926467
29	0.41	u	0.205	-1.5847453
30	0.45	u	0.225	-1.491654877
31	0.49	u	0.245	-1.406497068
32	0.45	u	0.225	-1.491654877
33	0.45	u	0.225	-1.491654877
34	0.46	u	0.23	-1.46967597
35	0.5	u	0.25	-1.386294361
36	0.49	u	0.245	-1.406497068
37	0.47	u	0.235	-1.448169765
38	0.81		0.81	-0.210721031
39	0.75		0.75	-0.287682072
40	0.5		0.5	-0.693147181
41	0.93		0.93	-0.072570693
42	0.41	u	0.205	-1.5847453
43	0.51		0.51	-0.673344553
44	0.74		0.74	-0.301105093
45	0.69		0.69	-0.371063681
47	0.53		0.53	-0.634878272
48	0.47	u	0.235	-1.448169765
49	1.5		1.5	0.405465108
50	0.43	u	0.215	-1.537117251
51	0.59		0.59	-0.527632742
52	0.98		0.98	-0.020202707
53	0.47	u	0.235	-1.448169765
54	0.41	u	0.205	-1.5847453
55	0.82		0.82	-0.198450939

56	0.43 u	0.215	-1.537117251
57	0.44	0.44	-0.820980552
58	0.45 u	0.225	-1.491654877
59	0.65	0.65	-0.430782916
60	0.44 u	0.22	-1.514127733
61	0.35 u	0.175	-1.742969305
62	0.48 u	0.24	-1.427116356
63	0.46 u	0.23	-1.46967597
64	0.46 u	0.23	-1.46967597
65	1	1	0
66	1	1	0
67	0.35 u	0.175	-1.742969305
68	0.39 u	0.195	-1.63475572
70	0.41 u	0.205	-1.5847453
71	0.71	0.71	-0.342490309
72	0.77	0.77	-0.261364764
73	1.4	1.4	0.336472237
74	0.91	0.91	-0.094310679
75	0.47	0.47	-0.755022584
76	0.59	0.59	-0.527632742
77	0.77	0.77	-0.261364764
78	0.89	0.89	-0.116533816
79	0.63	0.63	-0.46203546
80	0.74	0.74	-0.301105093
81	1.2	1.2	0.182321557
82	0.47 u	0.235	-1.448169765
83	0.42 u	0.21	-1.560647748
84	1.5	1.5	0.405465108
85	0.41 u	0.205	-1.5847453
86	0.47 u	0.235	-1.448169765
87	0.61	0.61	-0.494296322
88	0.41 u	0.205	-1.5847453
89	0.39 u	0.195	-1.63475572
90	2.4	2.4	0.875468737
91	1.2	1.2	0.182321557
93	0.43	0.43	-0.84397007
118	2.4	2.4	0.875468737
119	1.2	1.2	0.182321557
121	0.95	0.95	-0.051293294
122	0.84	0.84	-0.174353387
123	0.49 u	0.245	-1.406497068
124	0.95	0.95	-0.051293294
125	0.43 u	0.215	-1.537117251
126	0.46 u	0.23	-1.46967597
127	0.39 u	0.195	-1.63475572

mean(x)	**mean(ln x)**
0.491071429	-0.983942707
std dev (x)	**std dev (ln x)**
0.43587526	0.68912283
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.96
UCL normal	**UCL lognormal**
0.564073252	0.54370051

Dibutylphthalate UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	380	u	190	5.247024072
2	21	jb	21	3.044522438
3	22	jb	22	3.091042453
4	23	jb	23	3.135494216
5	390	u	195	5.272999559
6	390	u	195	5.272999559
7	420	u	210	5.347107531
8	400	u	200	5.298317367
9	22	jb	22	3.091042453
10	420	u	210	5.347107531
11	420	u	210	5.347107531
12	390	u	195	5.272999559
13	410	u	205	5.323009979
14	410	u	205	5.323009979
15	400	u	200	5.298317367
16	380	u	190	5.247024072
17	22	jb	22	3.091042453
18	390	u	195	5.272999559
19	25	jb	25	3.218875825
20	47	jb	47	3.850147602
21	33	jb	33	3.496507561
22	410	u	205	5.323009979
24	410	u	205	5.323009979
25	410	u	205	5.323009979
26	400	u	200	5.298317367
27	400	u	200	5.298317367
28	26	jb	26	3.258096538
29	400	u	200	5.298317367
30	380	u	190	5.247024072
31	410	u	205	5.323009979
32	380	u	190	5.247024072
33	380	u	190	5.247024072
34	390	u	195	5.272999559
35	430	u	215	5.370638028
36	420	u	210	5.347107531
37	400	u	200	5.298317367
38	410	u	205	5.323009979
39	390	u	195	5.272999559
40	400	u	200	5.298317367
41	410	u	205	5.323009979
42	390	u	195	5.272999559
43	390	u	195	5.272999559
44	420	u	210	5.347107531
45	400	u	200	5.298317367
47	410	u	205	5.323009979
48	21	j	21	3.044522438
49	420	u	210	5.347107531
50	380	u	190	5.247024072
51	390	u	195	5.272999559
52	400	u	200	5.298317367
53	420	u	210	5.347107531
54	380	u	190	5.247024072
55	420	u	210	5.347107531
56	33	j	33	3.496507561
57	29	j	29	3.36729583
58	330	u	165	5.105945474

59	330 u	165	5.105945474
60	23 j	23	3.135494216
61	330 u	165	5.105945474
62	330 u	165	5.105945474
63	330 u	165	5.105945474
64	330 u	165	5.105945474
65	21 j	21	3.044522438
66	330 u	165	5.105945474
67	330 u	165	5.105945474
68	330 u	165	5.105945474
70	330 u	165	5.105945474
71	330 u	165	5.105945474
72	19 j	19	2.944438979
73	330 u	165	5.105945474
74	330 u	165	5.105945474
75	22 j	22	3.091042453
76	330 u	165	5.105945474
77	330 u	165	5.105945474
78	33 jb	33	3.496507561
79	38 jb	38	3.63758616
80	28 jb	28	3.33220451
81	25 jb	25	3.218875825
82	24 jb	24	3.17805383
83	41 jb	41	3.713572067
84	65 jb	65	4.17438727
85	28 jb	28	3.33220451
86	36 jb	36	3.583518938
87	27 jb	27	3.295836866
88	43 jb	43	3.761200116
89	39 jb	39	3.663561646
90	40 jb	40	3.688879454
91	36 jb	36	3.583518938
93	21 jb	21	3.044522438
118	49 jb	49	3.891820298
119	700 b	700	6.551080335
121	28 jb	28	3.33220451
122	26 j	26	3.258096538
123	440 u	220	5.393627546
124	470 u	235	5.459585514
125	410 u	205	5.323009979
126	410 u	205	5.323009979
127	230 j	230	5.438079309

mean(x)	**mean(ln x)**
142.1530612	4.61826868
std dev (x)	**std dev (ln x)**
97.69501797	0.943092078
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.205
UCL normal	**UCL lognormal**
158.5153444	195.2192096

j = estimated concentration (below MDL)
b = blank contaminant
u = not detected (MDL)

APPENDIX D

RISK ASSESSMENT FOR THE RISK-BASED CLOSURE MOUND PLANT BURN AREA SOIL

Mound Plant
Miamisburg, Ohio

January 22, 1998

Prepared for
U.S. DEPARTMENT OF ENERGY
Ohio Field Office
Miamisburg Environmental Management Project
P. O. Box 66
Miamisburg, Ohio 45343-0066

PREFACE

This report presents a risk assessment of the residual contamination detected at the Burn Area following post demolition soil sampling activities. Acceptance of this attachment by the regulatory agencies will allow the unit to be considered risk-based closed.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABS	Absorption Factor
CDI	Chronic Daily Intake
CFR	Code of Federal Regulations
COPC	Contaminant of Potential Concern
DOE	United States Department of Energy
E	Exposure level
FR	Federal Register
g	Gram
HEAST	Health Effects Assessment Summary Table
HI	Hazard Index
IRIS	Integrated Risk Information System
Kg	Kilogram
Mg	Milligram
Ohio EPA	Ohio Environmental Protection Agency
OSWER	Office of Solid Waste and Emergency Response
PCBs	Polychlorinated biphenyls
PEF	Particulate Emissions Factor
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RME	Reasonable Maximum Exposure
SF	Slope Factor
TCLP	Toxicity Characteristic Leaching Procedure
TICs	Tentatively Identified Compounds
UCL	Upper Confidence Limit
U.S. EPA	United States Environmental Protection Agency
VF	Volatilization Factor

EXECUTIVE SUMMARY

Mound is situated on two hills overlooking the river and the city of Miamisburg. The Burn Area is located on the southeastern hill and includes two storage units, Magazine 53 and the Pyroshed; and four treatment units, the Open Burn Unit, the Retort Unit, the Energetic Materials Pretreatment Unit, and the Thermal Treatment Unit. From September 1996 through July 1997, the storage and treatment units were removed and/or demolished as part of the closure activities for the Burn Area. Following these activities, post demolition soils were sampled to identify any residual contamination. Analysis of these samples revealed minimal levels of antimony present; these detections prevented the area from being clean closed.

The purpose of this Appendix to the Amended Burn Area Closure Plan is to determine whether the residual contaminant, antimony, is present at levels in compliance with Resource Conservation and Recovery Act (RCRA) risk-based closure standards. Compliance with these standards will allow the Burn Area to be considered risk-based closed.

In an effort to demonstrate compliance, a human health risk assessment was conducted in accordance with Environmental Protection Agency (EPA) guidance for RCRA risk-based closures (U.S. EPA 1987a and Ohio EPA 1993b). Soil samples were taken in areas were the highest amount of antimony was excepted per Ohio EPA based on previous sampling efforts. The samples were analyzed for TCLP. The current and planned land use of the site is industrial; however both a residential land use and industrial land use scenario were evaluated in the risk assessment.

Risks were then characterized for each exposure pathway for antimony. The risk based standards were not achieved for the residential land use scenario due to the groundwater pathway. Based on the industrial land use scenario risk assessment performed, human health risks from residual contamination do not exceed EPA target values. The Burn Area is considered risk-based closed under the industrial land use scenario; however since both the residential land use and the industrial land use scenario risk assessments indicated that the drinking water pathway is the critical pathway, deed restrictions will be imposed.

1.0 BACKGROUND

The Burn Area, located on the southeastern hill, includes two storage units, Magazine 53 and the Pyroshed; and four treatment units, the Open Burn Unit, the Retort Unit, the Energetic Pretreatment Unit, and the Thermal Treatment Unit. Figure 1-1 shows the location of the Burn Area at Mound. By July 1997, all storage units and treatment units except for Magazine 53 were demolished and/or removed from the project site. Magazine 53 was washed and rinsate tested. Rinsate test results passed RCRA closure standards.

The purpose of this closure risk assessment is to determine whether constituents remaining in soil at the Burn Area are present at levels in compliance with RCRA health-based closure standards. In order to demonstrate risk-based closure of the Burn Area, a human health risk assessment was conducted in accordance with EPA guidance (U.S. EPA 1987a and Ohio EPA 1993). The human health risk assessment includes four steps:

(1) Data Evaluation and Selection of Contaminants of Potential Concern;
(2) Exposure Assessment;
(3) Toxicity Assessment; and
(4) Risk Characterization.

2.0 DATA EVALUATION/SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN

The Burn Area site comprises an area of about 40,000 square feet. Twenty-seven core samples and eight excavation face samples (from the Treatment Units) were collected to confirm the removal of gross contamination. The core samples were characterized at three depth intervals: 0-0.5 feet, 1-2 feet, and 2-3 feet. The sampling plan map (Figure 2-1) locates the grid where confirmatory samples, referred to as post-demolition samples, hereinafter, were collected.

Samples were collected and analyzed per the Burn Area Closure Plan. Samples were analyzed for organic and inorganic constituents using U.S. EPA's SW-846 Publication, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. Constituents of Burn Area Wastes are presented in Table 1. Complete analytical results are presented in Appendix A.

2.1 Comparison to Action Levels - Background and Practical Quantitation Limit

Distribution testing using the tests in SAS, a statistics analysis software, was performed on the Burn Area Data and the applicable Mound Background data. These data were shown to be lognormally distributed using descriptive statistics (see Appendix B).

Background soil data were considered to be those data for similar soils as extracted from the OU9, Background Soils Investigation: Soil Chemistry Report. Burn Area soil types were believed to be most similar to the Fairmont silty clay loams and Ritchey silt loams described in this Report.

The initial evaluation of Burn Area soil data for contaminants of concern involved the calculation of the 95% upper confidence limit (UCL) point of the data distribution for each RCRA contaminant for comparison to its corresponding action level. The action level for a naturally occurring constituent that is lognormally distributed (as with the Burn Area data and the applicable Mound Background data) is the 95% UCL point of the distribution. For lognormal data, this is calculated from the geometric mean of the background population and the standard deviation of the background population. The action level for contamination originating from non-naturally occurring or non-detectable chemicals is equal to the practical quantitation limit (PQL) for the testing method. Specific action levels or clean up goals are presented and compared with the respective 95% UCL point of the RCRA potential contaminants of concern data distribution in Table 2.

2.2 Selection of Contaminants of Potential Concern

Antimony was the only inorganic closure constituent detected in post-demolition samples with a 95% UCL point of the distribution greater than its PQL or action level; therefore, it was assumed to be related to the Burn Area. No explosive compounds or organics were detected in any sample that exceeded its corresponding action level. Antimony is considered the only Burn Area contaminant of potential concern.

3.0 EXPOSURE ASSESSMENT

The current and planned land use of the site is industrial with restricted access; however, a residential land use scenario was evaluated in the risk assessment in order to establish whether the Burn Area meets the most restrictive standards for risk-based closure. Demonstrating compliance with risk-based closure standards under a residential scenario will allow unrestricted land use of the Burn Area. The residential land use scenario evaluation assumptions, calculations, and results are found in Appendix C. The risk assessment evaluated under the residential land use scenario did not meet risk-based closure standards. Therefore, the industrial land use scenario was evaluated in the risk assessment to determine whether risk-based standards could be met. The industrial land use scenario evaluation assumptions, calculations, and results are found in Appendix D. Results are summarized in Section 5.2.

3.1 Point of Exposure

U.S. EPA (1989) specifies that the potential point of exposure to hazardous waste constituents is assumed to be directly within the unit boundary. Therefore, post-demolition samples taken directly in the Burn Area boundary were used to determine exposure intakes. Due to the close proximity of the soil sample locations to the former units, the samples are likely to contain the highest residual contaminant levels. Using the analytical data from these samples will result in conservative estimates of residual risks.

3.2 Exposure Pathways

Table C-1 lists the exposure pathways evaluated for the Burn Area residential land use scenario risk assessment, and Figure 3-1a depicts the related conceptual unit exposure model. These pathways represent all feasible pathways based on a residential land-use scenario. Table D-1 lists the exposure pathways evaluated for the Burn Area industrial land use risk assessment, and Figure 3-1b depicts the corresponding conceptual unit exposure model. Soil is the only contaminated media identified at the Burn Area. The Burn Area Closure Plan did not require groundwater testing for closure. However, the RCRA Risk Assessment Guidance (Ohio EPA, 1993b) does address groundwater impacts via calculations.

As stated earlier, the residential land use scenario was initially evaluated for the Burn Area. In order to evaluate a residential land use scenario, the groundwater pathway must be included in the Risk Assessment or excluded based on specific exceptions noted in Ohio EPA 1993b. Upon examination, it was determined the exclusionary exceptions do not apply to the Burn Area; therefore, the groundwater pathway was addressed.

To evaluate the impact of residual soil contamination on groundwater, either a published or site-specific chemical dependent partition coefficient (Kd) for antimony had to be used to predict attenuation of the contaminant or toxicity characteristic leaching procedure (TCLP) testing (55 FR 11798, 40 CFR 261.24) for antimony had to be performed. After the post-demolition samples were taken and analyzed, it was determined that there is no published or site-specific chemical dependent partition coefficient for antimony. It was then decided that additional Burn Area soil samples for TCLP antimony testing would be taken.

Four TCLP soil samples were taken. These samples were selected to avoid areas where previous results indicated antimony non-detects. Post-demolition total antimony soil results were overall relatively low (many non-detects) with a few spots at relatively higher levels.

TCLP soil leachate concentrations for antimony were determined using SW-846 methodology. The TCLP soil leachate data, extraction efficiencies, and their means and standard deviations are presented on Table 4. The 95% UCL of the mean antimony TCLP concentration data is also

shown on Table 4. Note, the average concentration of the antimony in the Leachate is at the drinking water standard of 6 ppb. The TCLP probably overestimates the concentration in the groundwater because the site is not a landfill and the TCLP soil samples were biased samples. Nevertheless, the 95% confidence level of the mean antimony leachate concentration was used to estimate the amount of antimony that would potentially contaminate the future hypothetical drinking water supply.

3.3 Exposure Parameters

Exposure equations and parameters for a residential land use scenario for soils are listed in Tables C-2 through C-4. These equations and parameters are consistent with those listed in Ohio EPA's Closure Plan Review Guidance for RCRA Facilities, Appendix E, Tables 1 through 5 (Ohio EPA, 1993a).

Exposure equations and parameters for residential use of groundwater are listed in Tables C-5 and C-6. As noted, groundwater is not used as a potable water supply on-site. Future use of groundwater is not expected based on the planned use of the property as an industrial facility. However, in order to evaluate the impact of residual soil contaminants on groundwater, the ingestion and dermal contact pathways were evaluated for residential receptors based on TCLP leachate results.

Exposure equations and parameters for an industrial land use scenario for soils are listed in Tables D-2 through D-4. These equations and parameters are consistent with those listed in Ohio EPA's Closure Plan Review Guidance for RCRA Facilities, Appendix E, Tables 6 through 10 (Ohio EPA, 1993a). Exposure equations and parameters for industrial use of groundwater are listed in Tables D-5 and D-6. The ingestion and dermal contact pathways were also evaluated for the adult industrial worker receptor based on TCLP leachate results.

3.4 Intake Equations

The intake calculations for each residential land use exposure route are presented in Tables C-7 through C-16. The intake calculations for each industrial land use exposure route are presented in Tables D-7 through D-11. Intakes were estimated using the standard intake equations provided in Ohio EPA (Ohio EPA, 1993 a). Chemical specific intakes were estimated for receptors and are expressed as the amount of chemical at the exposure boundary (e.g., skin, lungs, gut) that is available for absorption. Intakes from dermal contact with soils and groundwater are expressed in terms of absorbed dose.

Air intakes were assessed because individuals may be exposed to the chemical in the vapor phase (volatiles) or adsorbed to particulates (dust) generated from contaminated soils. Airborne emissions may result from the volatilization of organic constituents from soils. Risk from

inhalation of volatiles is assumed to be relevant only for chemicals that easily volatilize. Therefore, intakes from volatile emissions are only calculated for those constituents with a Henry's Law Constant of greater than 1 x 10^{-5} atm-m^3/mole and a molecular weight of less than 200 g/mole. Antimony is not easily volatilized.

Intakes from inhalation of particulate phase chemicals were derived using a particulate emission factor (PEF). The PEF is used to relate the contaminant concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from surface soils. This relationship is derived by Cowhead (1985) and provides an assessment procedure for hazardous waste sites where the surface contamination is assumed to provide a continuous and constant potential for emission over an extended period of time. The PEF of 4.63 E+09 m^3/kg was used for antimony as defined in the OSWER Directive 9285.7-01B (U.S. EPA 1991).

4.0 TOXICITY ASSESSMENT

Toxicological data used to evaluate risk were obtained from the U.S. EPA's Integrated Risk Information System (IRIS). IRIS is an electronic database containing the most current descriptive and quantitative U.S. EPA regulatory information on chemical and radiological constituents. Chemical files maintained in IRIS contain information relating to noncarcinogenic and carcinogenic health effects. The antimony reference dose (RfD) and antimony trioxide reference concentration (RfC) obtained from IRIS are listed in Table C-17 and D-12.

5.0 RISK CHARACTERIZATION

Risks were characterized by integrating the toxicity and exposure assessments into quantitative and qualitative expressions of risk. To characterize carcinogenic risks, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical specific dose-response information. To characterize potential noncarcinogenic effects, comparisons are made between the projected intakes of substances and approved toxicity values.

5.1 Quantification of Carcinogenic Risks

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., incremental or excess individual lifetime cancer risk). The EPA does not consider antimony a potential carcinogen (IRIS, 1997a and b). As a result, quantification of carcinogenic risks are not applicable.

5.2 Quantification of Noncarcinogenic Risks

For noncarcinogens, the potential for toxic effects is measured by comparing an exposure level over a specific time period with a chemical-specific reference dose derived for a similar exposure period. This ratio of exposure is called a hazard quotient. The noncancer hazard quotient assumes that there is a level of exposure below which it is unlikely that adverse health effects will occur, even to sensitive sub-populations. The threshold level is determined through animal and human epidemiological studies and is called the reference dose or RfD. The equation for determining the hazard quotient is described below:

Noncancer Hazard Quotient = E/RfD

Where:

E = exposure level (or intake) (mg/Kg-day);

RfD or RfC = chemical-specific reference dose or chemical-specific reference concentration (mg/Kg-day)

If the exposure level exceeds unity (1), there may be a potential noncancer effect. The ratio of E/RfD does not represent a statistical probability; therefore, the level of concern does not increase linearly as the RfD or RfC is approached or exceeded.

To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach is used. This approach assumes that simultaneous subthreshold exposures to several chemicals could result in an adverse health effect.

The HI is equal to the sum of the hazard quotients, as shown below:

Noncancer Hazard Index = $E_1/RfD_1 + E_2/RfD_2 + \ldots E_i/RfD_i$*

Where:

E_i = exposure level (or intake) for the ith toxicant;

RfD_i = chemical-specific reference dose for the ith toxicant

Note* use RfC_i, as applicable

The HI assumes that the magnitude of the effect will be proportional to the sum of the hazard quotients. Since there is only one contaminant of potential concern, antimony, the noncancer

hazard index equals the exposure level for antimony divided by the chemical-specific reference dose (or the reference concentration, as applicable) for antimony for each exposure pathway.

Risks were specifically evaluated and characterized for each residential land use exposure pathway for the adult and child resident. Risks were specifically evaluated and characterized for each industrial land use exposure pathway for the adult industrial worker.

A summary of the risk evaluations is presented in Table C-17 for the residential land use scenario. For the future adult resident, the total noncarcinogenic HI is 0.7 (rounded to one significant figure) which is less than the EPA target value of 1. For the future child resident, the total noncarcinogenic HI is 3.0, which is more than the EPA target value of 1. The groundwater pathway is the critical pathway because HI value for the ingestion groundwater pathway exceeds the EPA target value of 1. Therefore, human health risks from residual contamination are not acceptable under the residential land use scenario.

Summaries of risk evaluations are presented in Table D-12 for the industrial land use scenario. For the future adult industrial worker, the total noncarcinogenic HI is 0.7 (rounded up to one significant figure) which is less than the EPA target value of 1. Therefore, human health risks from residual contamination do not exceed EPA target values under an industrial land use scenario.

6.0 UNCERTAINTY ASSESSMENT

The risk values calculated in the risk assessment are not fully probabilistic estimates of risk, but conditional estimates given a considerable number of assumptions about exposure and toxicity. Therefore, there are many uncertainties inherent in the risk assessment evaluations. Perhaps the greatest number of assumptions made to assess risk are made in the exposure assessment.

The risk assessment evaluated a residential land use scenario and industrial land use scenario for all RCRA contaminants associated with the Burn Area that were above specific action limits. A multi-route, multi-constituent evaluation of all exposure routes associated with a residential scenario was evaluated in order to determine the risks associated with these pathways. For each exposure pathway evaluated under the each scenario, standard default parameters that represent reasonable worst case were used. Values were taken from Ohio EPA (Ohio EPA 1993b). Many of the exposure parameters represent 90th to 95th percentile values. When several upper bound values are combined in estimating exposure for any one pathway, resulting risk estimates may be in excess of the 99th percentile exposure and thereby be outside the range of exposures that might reasonably be expected to occur at the site. Therefore, the risks calculated are conservative and most likely overestimate the actual exposures that may be associated with the site.

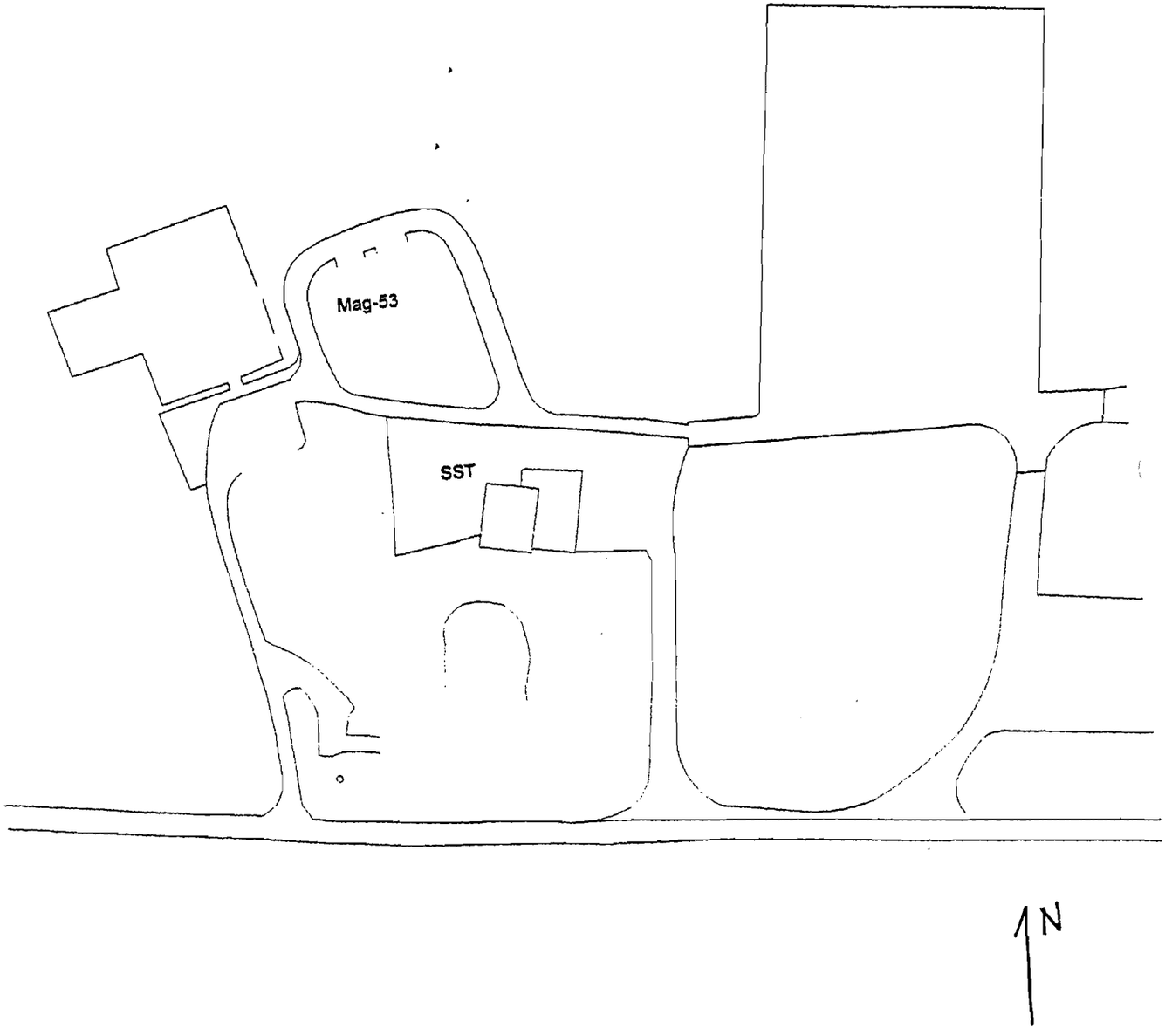

Figure 1-1, Location of the Burn Area

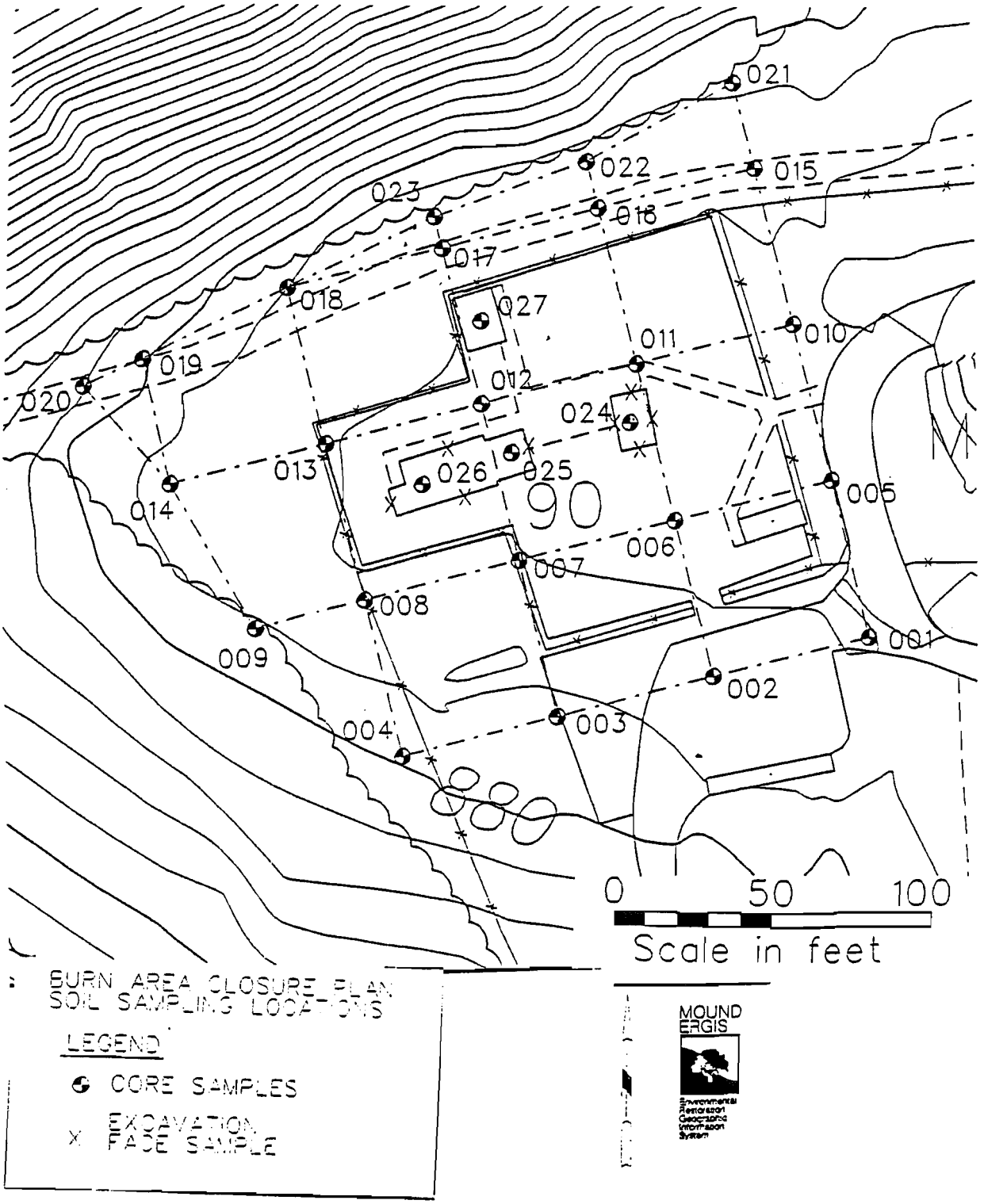

Figure 2-1, Location of Burn Area Post-Demolition Soil Samples

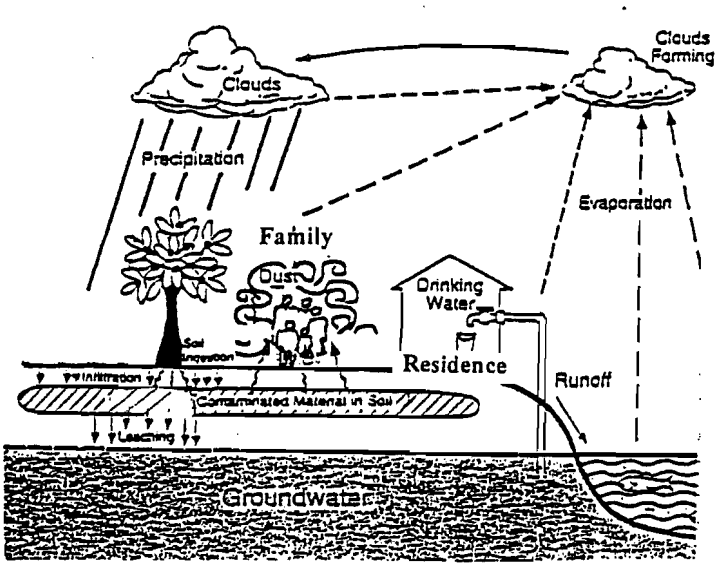

Figure 3.1a, Conceptual Unit Exposure Model - Residential Land Use Scenario

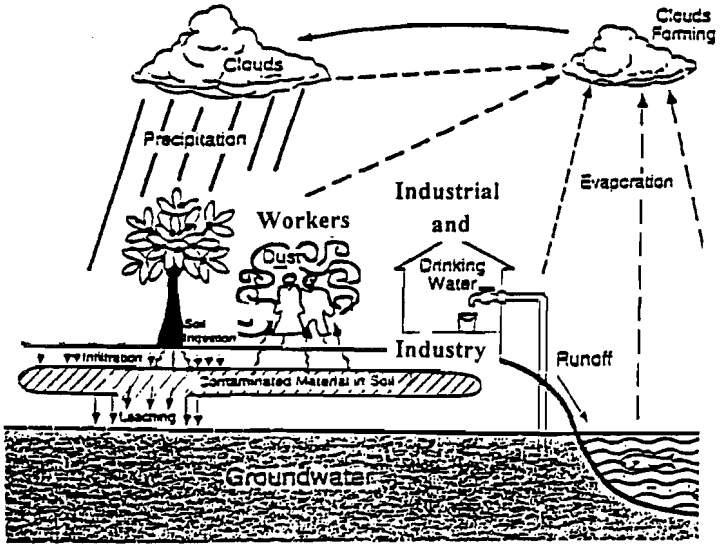

Figure 3.1b, Conceptual Unit Exposure Model - Industrial Land Use Scenario

Table 1

Constituents of Burn Area Wastes

Waste Constituent	CAS Number	Action Level (mg/kg)
Antimony	7440-36-0	0.44
Barium	7440-39-3	208.0
Beryllium	7440-41-7	1.45
Cadmium	7440-43-9	1.25
Chromium	7440-47-3	22.0
Dibutylphthalate	84-74-2	Any detectable (PQL)
Diphenylamine	122-39-4	Any detectable (PQL)
Lead	7439-92-1	61.5
Nickel	7440-02-0	30.9
Nitroglycerin	55-63-0	Any detectable (PQL)
Silver	7440-22-4	1.22

PQL = Practical Quantitation Limit

Table 2

Post Demolition Soil Sampling Results for Hazardous Constituents Burn Area Waste

Analyte	Maximum Concentration Detected	95% UCL of the Mean Concentration	Action Limit (AL) Conc.	Detects above the AL (Frequency)
INORGANICS				
Antimony	6.4 mg/kg	0.58 mg/kg	0.44 mg/kg	Yes (32/98)
Barium	255 mg/kg	86 mg/kg	208 mg/kg	Yes (2/98)
Beryllium	4.7 mg/kg	0.98 mg/kg	1.45 mg/kg	Yes (11/98)
Cadmium	1.4 mg/kg	0.19 mg/kg	1.25 mg/kg	Yes (1/98)
Chromium	34.5 mg/kg	13.9 mg/kg	22 mg/kg	Yes (5/98)
Lead	113 mg/kg	11.3 mg/kg	61.5 mg/kg	Yes (2/98)
Nickel	55.1 mg/kg	20.2 mg/kg	30.9 mg/kg	Yes (6/98)
Silver	2.4 mg/kg	0.54 mg/kg	1.22 mg/kg	Yes (5/98)
ORGANICS				
Dibutylphthalate	700 μg/kg	195 μg/kg	~ 400 μg/kg	Yes (1/98)
Diphenylamine	ND	< 400 μg/kg	~ 400 μg/kg	No (0/98)
EXPLOSIVES				
Nitroglycerin	ND	< 1000 μg/kg	~1000 μg/kg	No (0/98)
PETN	ND	< 1000 μg/kg	~1000 μg/kg	No (0/98)

ND = not detected.
UCL = 95% Upper Confidence Limit of a Mean.

Appendix A

Soil Analytical Results and TCLP Leachate Concentrations

Antimony UCL Calculations

Note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.76		0.76	-0.274436846
2	0.34	u	0.17	-1.771956842
3	0.31	u	0.155	-1.864330162
4	0.36	u	0.18	-1.714798428
5	0.33	u	0.165	-1.801809805
6	0.32	u	0.16	-1.832581464
7	0.32	u	0.16	-1.832581464
8	0.33	u	0.165	-1.801809805
9	0.32	u	0.16	-1.832581464
10	0.35	u	0.175	-1.742969305
11	0.34	u	0.17	-1.771956842
12	0.33	u	0.165	-1.801809805
13	0.33	u	0.165	-1.801809805
14	0.35	u	0.175	-1.742969305
15	0.34	u	0.17	-1.771956842
16	0.3	u	0.15	-1.897119985
17	0.36		0.36	-1.021651248
18	0.32	u	0.16	-1.832581464
19	0.32	u	0.16	-1.832581464
20	5		5	1.609437912
21	0.47		0.47	-0.755022584
22	0.33	u	0.165	-1.801809805
24	1.1		1.1	0.09531018
25	0.34	u	0.17	-1.771956842
26	0.34	u	0.17	-1.771956842
27	0.3	u	0.15	-1.897119985
28	0.49		0.49	-0.713349888
29	0.28		0.28	-1.272965676
30	0.31	u	0.155	-1.864330162
31	0.34	u	0.17	-1.771956842
32	0.32	u	0.16	-1.832581464
33	0.32	u	0.16	-1.832581464
34	0.32	u	0.16	-1.832581464
35	0.36	u	0.18	-1.714798428
36	0.34	u	0.17	-1.771956842
37	0.33		0.33	-1.108662625
38	0.8		0.8	-0.223143551
39	0.31	u	0.155	-1.864330162
40	0.29	u	0.145	-1.931021537
41	0.33	u	0.165	-1.801809805
42	0.28	u	0.14	-1.966112856
43	0.3	u	0.15	-1.897119985
44	0.33	u	0.165	-1.801809805
45	0.34		0.34	-1.078809661
47	0.29	u	0.145	-1.931021537
48	0.33	u	0.165	-1.801809805
49	0.62		0.62	-0.478035801
50	0.3	u	0.15	-1.897119985
51	0.29	u	0.145	-1.931021537
52	0.48		0.48	-0.733969175
53	0.33	u	0.165	-1.801809805
54	0.29	u	0.145	-1.931021537
55	0.59		0.59	-0.527632742

56	0.3 u	0.15	-1.897119985
57	0.26 u	0.13	-2.040220829
58	0.67	0.67	-0.400477567
59	1.5	1.5	0.405465108
60	0.37	0.37	-0.994252273
61	0.24 u	0.12	-2.120263536
62	0.38	0.38	-0.967584026
63	0.32 u	0.16	-1.832581464
64	0.32 u	0.16	-1.832581464
65	2.1	2.1	0.741937345
66	0.75	0.75	-0.287682072
67	0.24 u	0.12	-2.120263536
68	0.28 u	0.14	-1.966112856
70	0.53	0.53	-0.634878272
71	1	1	0
72	0.55	0.55	-0.597837001
73	3.5	3.5	1.252762968
74	0.38	0.38	-0.967584026
75	0.39	0.39	-0.94160854
76	1.7	1.7	0.530628251
77	1	1	0
78	0.37	0.37	-0.994252273
79	0.42	0.42	-0.867500568
80	0.34 u	0.17	-1.771956842
81	0.51	0.51	-0.673344553
82	0.58	0.58	-0.544727175
83	0.34	0.34	-1.078809661
84	0.47	0.47	-0.755022584
85	0.29 u	0.145	-1.931021537
86	0.94	0.94	-0.061875404
87	0.57	0.57	-0.562118918
88	0.29 u	0.145	-1.931021537
89	0.27 u	0.135	-2.002480501
90	0.42	0.42	-0.867500568
91	0.55	0.55	-0.597837001
93	0.4	0.4	-0.916290732
118	6.4	6.4	1.85629799
119	1.7	1.7	0.530628251
121	0.97	0.97	-0.030459207
122	1.4	1.4	0.336472237
123	0.91	0.91	-0.094310679
124	0.58	0.58	-0.544727175
125	0.96	0.96	-0.040821995
126	0.56	0.56	-0.579818495
127	0.37	0.37	-0.994252273

GM

mean(x)	**mean(ln x)**
0.549846939	-1.13609979
std dev (x)	**std dev (ln x)**
0.904065404	0.898271767
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.701262789	0.58299814

Barium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	73.9		73.9	4.302712828
2	35.3		35.3	3.563882964
3	48.2		48.2	3.875359021
4	101		101	4.615120517
5	33.3		33.3	3.505557397
6	25.3		25.3	3.230804396
7	62.1		62.1	4.128745989
8	48.6		48.6	3.883623531
9	50.5		50.5	3.921973336
10	104		104	4.644390899
11	104		104	4.644390899
12	61.7		61.7	4.122283931
13	40.2		40.2	3.693866996
14	98.2		98.2	4.587006215
15	38		38	3.63758616
16	31.4		31.4	3.446807893
17	101		101	4.615120517
18	31.3		31.3	3.443618098
19	28.3		28.3	3.342861805
20	87.9		87.9	4.476199805
21	100		100	4.605170186
22	99.3		99.3	4.598145571
24	84.8		84.8	4.440295543
25	96.7		96.7	4.571613402
26	96.9		96.9	4.573679519
27	47.9		47.9	3.869115504
28	198		198	5.288267031
29	51.9		51.9	3.94931879
30	37.5		37.5	3.624340933
31	86.3		86.3	4.457829598
32	58.6		58.6	4.070734697
33	47.5		47.5	3.860729711
34	59.3		59.3	4.082609306
35	72.9		72.9	4.289088639
36	51		51	3.931825633
37	41.9		41.9	3.735285827
38	106		106	4.663439094
39	82.4		82.4	4.411585437
40	34.6		34.6	3.543853682
41	114		114	4.736198448
42	58.9		58.9	4.075841091
43	54		54	3.988984047
44	88.4		88.4	4.48187197
45	86.4		86.4	4.458987676
47	105		105	4.65396035
48	51.4		51.4	3.939638172
49	203		203	5.313205979
50	43.3		43.3	3.768152635
51	77.1		77.1	4.345103281
52	116		116	4.753590191
53	81.3		81.3	4.398146017
54	36.8		36.8	3.605497845
55	111		111	4.709530201

56	26.7	26.7	3.284663565
57	45.1	45.1	3.808882247
58	97.4	97.4	4.578826211
59	89.8	89.8	4.497584975
60	90.8	90.8	4.508659286
61	33.9	33.9	3.523415014
62	26.9	26.9	3.292126287
63	34.9	34.9	3.552486829
64	44.3	44.3	3.790984677
65	87.5	87.5	4.471638793
66	183	183	5.209486153
67	38.5	38.5	3.650658241
68	34.1	34.1	3.529297384
70	27.1	27.1	3.299533728
71	80.3	80.3	4.385769621
72	163	163	5.093750201
73	75.7	75.7	4.32677816
74	72.8	72.8	4.287715955
75	146	146	4.983606622
76	72.9	72.9	4.289088639
77	87.6	87.6	4.472780998
78	135	135	4.905274778
79	74.5	74.5	4.310799125
80	73.4	73.4	4.295923936
81	129	129	4.859812404
82	56.6	56.6	4.036008985
83	58.2	58.2	4.063885355
84	211	211	5.351858133
85	51.8	51.8	3.947390149
86	73.9	73.9	4.302712828
87	66.1	66.1	4.191168747
88	28.7	28.7	3.356897123
89	34.6	34.6	3.543853682
90	152	152	5.023880521
91	137	137	4.919980926
93	64	64	4.158883083
118	71	71	4.262679877
119	81.5	81.5	4.40060302
121	69.1	69.1	4.235554731
122	76.2	76.2	4.333361463
123	103	103	4.634728988
124	255	255	5.541263545
125	75.3	75.3	4.321480135
126	65.8	65.8	4.186619838
127	56.8	56.8	4.039536326

mean(x)	**mean(ln x)**
77.98061224	4.219790209
std dev (x)	**std dev (ln x)**
43.75432034	0.522193436
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
85.30872985	86.17631436

Beryllium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.55		0.55	-0.597837001
2	0.32		0.32	-1.139434283
3	0.46		0.46	-0.776528789
4	0.66		0.66	-0.415515444
5	0.3		0.3	-1.203972804
6	0.3		0.3	-1.203972804
7	0.56		0.56	-0.579818495
8	0.44		0.44	-0.820980552
9	0.43		0.43	-0.84397007
10	1		1	0
11	1		1	0
12	0.56		0.56	-0.579818495
13	0.44		0.44	-0.820980552
14	0.92		0.92	-0.083381609
15	0.49		0.49	-0.713349888
16	0.4		0.4	-0.916290732
17	0.87		0.87	-0.139262067
18	0.51		0.51	-0.673344553
19	0.43		0.43	-0.84397007
20	1.1		1.1	0.09531018
21	0.94		0.94	-0.061875404
22	0.91		0.91	-0.094310679
24	1		1	0
25	0.77		0.77	-0.261364764
26	0.87		0.87	-0.139262067
27	0.51		0.51	-0.673344553
28	1.5		1.5	0.405465108
29	0.52		0.52	-0.653926467
30	0.33		0.33	-1.108662625
31	0.75		0.75	-0.287682072
32	0.46		0.46	-0.776528789
33	0.46		0.46	-0.776528789
34	0.46		0.46	-0.776528789
35	0.73		0.73	-0.314710745
36	0.59		0.59	-0.527632742
37	0.47		0.47	-0.755022584
38	1.2		1.2	0.182321557
39	1.1		1.1	0.09531018
40	0.57		0.57	-0.562118918
41	1.2		1.2	0.182321557
42	0.82		0.82	-0.198450939
43	0.75		0.75	-0.287682072
44	0.94		0.94	-0.061875404
45	1		1	0
47	1		1	0
48	0.68		0.68	-0.385662481
49	2.9		2.9	1.064710737
50	0.55		0.55	-0.597837001
51	0.84		0.84	-0.174353387
52	1.4		1.4	0.336472237
53	0.81		0.81	-0.210721031
54	0.6		0.6	-0.510825624
55	1.1		1.1	0.09531018

56	0.42	0.42	-0.867500568
57	0.71	0.71	-0.342490309
58	0.8	0.8	-0.223143551
59	0.96	0.96	-0.040821995
60	0.67	0.67	-0.400477567
61	0.37	0.37	-0.994252273
62	0.32	0.32	-1.139434283
63	0.44	0.44	-0.820980552
64	0.54	0.54	-0.616186139
65	3.6	3.6	1.280933845
66	2	2	0.693147181
67	0.34	0.34	-1.078809661
68	0.26	0.26	-1.347073648
70	0.5	0.5	-0.693147181
71	0.79	0.79	-0.235722334
72	1.1	1.1	0.09531018
73	1.2	1.2	0.182321557
74	1.7	1.7	0.530628251
75	0.91	0.91	-0.094310679
76	0.74	0.74	-0.301105093
77	0.99	0.99	-0.010050336
78	1.1	1.1	0.09531018
79	0.56	0.56	-0.579818495
80	0.6	0.6	-0.510825624
81	1.7	1.7	0.530628251
82	0.5	0.5	-0.693147181
83	0.28	0.28	-1.272965676
84	1.9	1.9	0.641853886
85	0.49	0.49	-0.713349888
86	1.6	1.6	0.470003629
87	1.2	1.2	0.182321557
88	0.37	0.37	-0.994252273
89	0.34	0.34	-1.078809661
90	1.2	1.2	0.182321557
91	1.4	1.4	0.336472237
93	0.46	0.46	-0.776528789
118	0.92	0.92	-0.083381609
119	4.3	4.3	1.458615023
121	0.95	0.95	-0.051293294
122	4.7	4.7	1.547562509
123	0.84	0.84	-0.174353387
124	1.8	1.8	0.587786665
125	0.5	0.5	-0.693147181
126	0.51	0.51	-0.673344553
127	0.47	0.47	-0.755022584

mean(x)	**mean(ln x)**
0.903265306	-0.301353513
std dev (x)	**std dev (ln x)**
0.740111131	0.587685996
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
1.027221555	0.984295389

Cadmium CL Calclations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.25	u	0.125	-2.079441542
2	0.27	u	0.135	-2.002480501
3	0.25	u	0.125	-2.079441542
4	0.28	u	0.14	-1.966112856
5	0.26	u	0.13	-2.040220829
6	0.25	u	0.125	-2.079441542
7	0.25	u	0.125	-2.079441542
8	0.26	u	0.13	-2.040220829
9	0.25	u	0.125	-2.079441542
10	0.27	u	0.135	-2.002480501
11	0.27	u	0.135	-2.002480501
12	0.3		0.3	-1.203972804
13	0.26	u	0.13	-2.040220829
14	0.27	u	0.135	-2.002480501
15	0.27	u	0.135	-2.002480501
16	0.24	u	0.12	-2.120263536
17	0.26	u	0.13	-2.040220829
18	0.25	u	0.125	-2.079441542
19	0.25	u	0.125	-2.079441542
20	0.29	u	0.145	-1.931021537
21	0.27	u	0.135	-2.002480501
22	0.26	u	0.13	-2.040220829
24	0.45		0.45	-0.798507696
25	0.27	u	0.135	-2.002480501
26	0.26	u	0.13	-2.040220829
27	0.23	u	0.115	-2.162823151
28	0.61		0.61	-0.494296322
29	0.22	u	0.11	-2.207274913
30	0.25	u	0.125	-2.079441542
31	0.27	u	0.135	-2.002480501
32	0.27		0.27	-1.30933332
33	0.25	u	0.125	-2.079441542
34	0.25	u	0.125	-2.079441542
35	0.28	u	0.14	-1.966112856
36	0.27	u	0.135	-2.002480501
37	0.26	u	0.13	-2.040220829
38	0.24	u	0.12	-2.120263536
39	0.24	u	0.12	-2.120263536
40	0.23	u	0.115	-2.162823151
41	0.26	u	0.13	-2.040220829
42	0.22	u	0.11	-2.207274913
43	0.24	u	0.12	-2.120263536
44	0.26	u	0.13	-2.040220829
45	0.25	u	0.125	-2.079441542
47	0.23	u	0.115	-2.162823151
48	0.26	u	0.13	-2.040220829
49	0.26	u	0.13	-2.040220829
50	0.24	u	0.12	-2.120263536
51	0.23	u	0.115	-2.162823151
52	0.25	u	0.125	-2.079441542
53	0.26	u	0.13	-2.040220829
54	0.23	u	0.115	-2.162823151
55	0.24	u	0.12	-2.120263536

56	0.24 u	0.12	-2.120263536
57	0.2 u	0.1	-2.302585093
58	0.24 u	0.12	-2.120263536
59	0.35	0.35	-1.049822124
60	0.24 u	0.12	-2.120263536
61	0.19 u	0.095	-2.353878387
62	0.26 u	0.13	-2.040220829
63	0.25 u	0.125	-2.079441542
64	0.25 u	0.125	-2.079441542
65	0.28 u	0.14	-1.966112856
66	0.28 u	0.14	-1.966112856
67	0.19 u	0.095	-2.353878387
68	0.22 u	0.11	-2.207274913
70	0.22 u	0.11	-2.207274913
71	0.25 u	0.125	-2.079441542
72	0.19 u	0.095	-2.353878387
73	0.25 u	0.125	-2.079441542
74	0.26 u	0.13	-2.040220829
75	0.24 u	0.12	-2.120263536
76	0.27 u	0.135	-2.002480501
77	0.17 u	0.085	-2.465104022
78	0.26	0.26	-1.347073648
79	0.25	0.25	-1.386294361
80	0.27	0.27	-1.30933332
81	0.27	0.27	-1.30933332
82	1.4	1.4	0.336472237
83	0.23 u	0.115	-2.162823151
84	0.58 u	0.29	-1.237874356
85	0.23 u	0.115	-2.162823151
86	0.26 u	0.13	-2.040220829
87	0.25 u	0.125	-2.079441542
88	0.23 u	0.115	-2.162823151
89	0.21 u	0.105	-2.253794929
90	0.24 u	0.12	-2.120263536
91	0.24 u	0.12	-2.120263536
93	1.1	1.1	0.09531018
118	0.87	0.87	-0.139262067
119	0.29 u	0.145	-1.931021537
121	0.29 u	0.145	-1.931021537
122	0.35	0.35	-1.049822124
123	0.27 u	0.135	-2.002480501
124	0.56	0.56	-0.579818495
125	0.4	0.4	-0.916290732
126	0.25 u	0.125	-2.079441542
127	0.21 u	0.105	-2.253794929

mean(x)	**mean(ln x)**
0.185306122	-1.891113015
std dev (x)	**std dev (ln x)**
0.193925557	0.516059512
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
0.217785413	0.192621542

Chromium UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	11.1		11.1	2.406945108
2	6.6		6.6	1.887069649
3	8.6		8.6	2.151762203
4	12.6		12.6	2.533696814
5	5.3		5.3	1.667706821
6	4.2		4.2	1.435084525
7	9.3		9.3	2.2300144
8	7.6		7.6	2.028148247
9	6.9		6.9	1.931521412
10	16.1		16.1	2.778819272
11	15.5		15.5	2.740840024
12	10.2		10.2	2.32238772
13	6.8		6.8	1.916922612
14	16.1		16.1	2.778819272
15	10.6		10.6	2.360854001
16	8.4		8.4	2.128231706
17	15.1		15.1	2.714694744
18	8.3		8.3	2.116255515
19	9.5		9.5	2.251291799
20	14.7		14.7	2.687847494
21	17		17	2.833213344
22	16.4		16.4	2.797281335
24	14.8		14.8	2.694627181
25	15.8		15.8	2.76000994
26	16.5		16.5	2.803360381
27	9.5		9.5	2.251291799
28	24.9		24.9	3.214867803
29	9.3		9.3	2.2300144
30	6.5		6.5	1.871802177
31	13		13	2.564949357
32	9.5		9.5	2.251291799
33	8.5		8.5	2.140066163
34	9.8		9.8	2.282382386
35	12.4		12.4	2.517696473
36	10.2		10.2	2.32238772
37	8.9		8.9	2.186051277
38	20.1		20.1	3.000719815
39	16.7		16.7	2.815408719
40	8.1		8.1	2.091864062
41	18		18	2.890371758
42	14.1		14.1	2.646174797
43	12.4		12.4	2.517696473
44	16.5		16.5	2.803360381
45	18.1		18.1	2.895911938
47	16		16	2.772588722
48	9.9		9.9	2.292534757
49	33.3		33.3	3.505557397
50	7.4		7.4	2.00148
51	13.9		13.9	2.63188884
52	20		20	2.995732274
53	12.1		12.1	2.493205453
54	7.7		7.7	2.041220329
55	13.8		13.8	2.624668592

56	5.2	5.2	1.648658626
57	9.9	9.9	2.292534757
58	13.8	13.8	2.624668592
59	21.6	21.6	3.072693315
60	12.4	12.4	2.517696473
61	5.5	5.5	1.704748092
62	5.5	5.5	1.704748092
63	6.3	6.3	1.840549633
64	8.9	8.9	2.186051277
65	11.2	11.2	2.415913778
66	23.5	23.5	3.157000421
67	5.7	5.7	1.740466175
68	5	5	1.609437912
70	7.8	7.8	2.054123734
71	21.4	21.4	3.063390922
72	20.1	20.1	3.000719815
73	11	11	2.397895273
74	22.1	22.1	3.095577609
75	14.9	14.9	2.701361213
76	13.8	13.8	2.624668592
77	18.8	18.8	2.93385687
78	18.1	18.1	2.895911938
79	10.6	10.6	2.360854001
80	10.4	10.4	2.341805806
81	19.5	19.5	2.970414466
82	7.6	7.6	2.028148247
83	8.5	8.5	2.140066163
84	34.5	34.5	3.540959324
85	8.3	8.3	2.116255515
86	6	6	1.791759469
87	10.9	10.9	2.388762789
88	4.6	4.6	1.526056303
89	5.2	5.2	1.648658626
90	17.9	17.9	2.884800713
91	20.6	20.6	3.025291076
93	8.4	8.4	2.128231706
118	18.9	18.9	2.939161922
119	9.4	9.4	2.240709689
121	17.6	17.6	2.867898902
122	10.9	10.9	2.388762789
123	18.2	18.2	2.901421594
124	24.4	24.4	3.194583132
125	12.1	12.1	2.493205453
126	9.6	9.6	2.261763098
127	8.6	8.6	2.151762203

mean(x)	**mean(ln x)**
12.75306122	2.443108135
std dev (x)	**std dev (ln x)**
5.942546299	0.458192662
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.83
UCL normal	**UCL lognormal**
13.74833844	13.91843771

Lead UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	10.6		10.6	2.360854001
2	2.9	u	1.45	0.371563556
3	4.2		4.2	1.435084525
4	5.8		5.8	1.757857918
5	2.8	u	1.4	0.336472237
6	2.7	u	1.35	0.300104592
7	6.9		6.9	1.931521412
8	2.8	u	1.4	0.336472237
9	4.5		4.5	1.504077397
10	18.5		18.5	2.917770732
11	15.5		15.5	2.740840024
12	5.8		5.8	1.757857918
13	5.3		5.3	1.667706821
14	18.2		18.2	2.901421594
15	4.6		4.6	1.526056303
16	8.9		8.9	2.186051277
17	19.9		19.9	2.990719732
18	2.9		2.9	1.064710737
19	4.4		4.4	1.481604541
20	24.2		24.2	3.186352633
21	7.6		7.6	2.028148247
22	7		7	1.945910149
24	13.2		13.2	2.58021683
25	14.8		14.8	2.694627181
26	9.2		9.2	2.219203484
27	4.4		4.4	1.481604541
28	21.2		21.2	3.054001182
29	2.5		2.5	0.916290732
30	2.7	u	1.35	0.300104592
31	14.8		14.8	2.694627181
32	2.7	u	1.35	0.300104592
33	4.8		4.8	1.568615918
34	2.7	u	1.35	0.300104592
35	6		6	1.791759469
36	5.2		5.2	1.648658626
37	3.5		3.5	1.252762968
38	13.9		13.9	2.63188884
39	4.1		4.1	1.410986974
40	4.3		4.3	1.458615023
41	15		15	2.708050201
42	3.1		3.1	1.131402111
43	2.6	u	1.3	0.262364264
44	14.6		14.6	2.681021529
45	16.8		16.8	2.821378886
47	8.1		8.1	2.091864062
48	3.2		3.2	1.16315081
49	15.1		15.1	2.714694744
50	4.5		4.5	1.504077397
51	5.8		5.8	1.757857918
52	10.1		10.1	2.312535424
53	5.1		5.1	1.62924054
54	3.5		3.5	1.252762968
55	9.2		9.2	2.219203484

56	2.6 u	1.3	0.262364264
57	4.9	4.9	1.589235205
58	6.4	6.4	1.85629799
59	11.5	11.5	2.442347035
60	7.9	7.9	2.066862759
61	3.1	3.1	1.131402111
62	5	5	1.609437912
63	2.8	2.8	1.029619417
64	3.5	3.5	1.252762968
65	17.1	17.1	2.839078464
66	10.4	10.4	2.341805806
67	3.4	3.4	1.223775432
68	4.2	4.2	1.435084525
70	13.1	13.1	2.57261223
71	13	13	2.564949357
72	9.6	9.6	2.261763098
73	73.8	73.8	4.301358732
74	10.9	10.9	2.388762789
75	8.6	8.6	2.151762203
76	14.1	14.1	2.646174797
77	11.5	11.5	2.442347035
78	7.1	7.1	1.960094784
79	11.9	11.9	2.4765384
80	12.6	12.6	2.533696814
81	8.4	8.4	2.128231706
82	6	6	1.791759469
83	7.5	7.5	2.014903021
84	6.3 u	3.15	1.147402453
85	2.5	2.5	0.916290732
86	9.8	9.8	2.282382386
87	13.1	13.1	2.57261223
88	2.5 u	1.25	0.223143551
89	8.1	8.1	2.091864062
90	11	11	2.397895273
91	9.1	9.1	2.208274414
93	5	5	1.609437912
118	113	113	4.727387819
119	3.1 u	1.55	0.438254931
121	11.2	11.2	2.415913778
122	3 u	1.5	0.405465108
123	7.8	7.8	2.054123734
124	13	13	2.564949357
125	15.9	15.9	2.766319109
126	6.9	6.9	1.931521412
127	4.1	4.1	1.410986974

mean(x)	**mean(ln x)**
9.686734694	1.864920298
std dev (x)	**std dev (ln x)**
13.52462922	0.868293527
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.117
UCL normal	**UCL lognormal**
11.95188412	11.34214869

Nickel UCL Calculations

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	15.3		15.3	2.727852828
2	18.7		18.7	2.928523524
3	16.1		16.1	2.778819272
4	21		21	3.044522438
5	8.6		8.6	2.151762203
6	7.5		7.5	2.014903021
7	19.6		19.6	2.975529566
8	14.4		14.4	2.667228207
9	12.9		12.9	2.557227311
10	21.3		21.3	3.058707073
11	22.8		22.8	3.126760536
12	16		16	2.772588722
13	13.7		13.7	2.617395833
14	22.1		22.1	3.095577609
15	16.5		16.5	2.803360381
16	13.8		13.8	2.624668592
17	19.7		19.7	2.980618636
18	13.2		13.2	2.58021683
19	17.7		17.7	2.87356464
20	16.8		16.8	2.821378886
21	25.9		25.9	3.254242969
22	29.8		29.8	3.394508394
24	20.5		20.5	3.020424886
25	16.5		16.5	2.803360381
26	20.2		20.2	3.005682604
27	13.8		13.8	2.624668592
28	34		34	3.526360525
29	12.1		12.1	2.493205453
30	9.1		9.1	2.208274414
31	16.6		16.6	2.809402695
32	17.2		17.2	2.844909384
33	11.5		11.5	2.442347035
34	14.3		14.3	2.660259537
35	19.1		19.1	2.949688335
36	15.8		15.8	2.76000994
37	15.6		15.6	2.747270914
38	19.8		19.8	2.985681938
39	22.3		22.3	3.104586678
40	10.8		10.8	2.379546134
41	21.5		21.5	3.068052935
42	15.2		15.2	2.721295428
43	16.5		16.5	2.803360381
44	17.6		17.6	2.867898902
45	16.9		16.9	2.827313622
47	21.9		21.9	3.086486637
48	13.7		13.7	2.617395833
49	47.2		47.2	3.854393893
50	9.5		9.5	2.251291799
51	19.5		19.5	2.970414466
52	29.5		29.5	3.384390263
53	17.4		17.4	2.856470206
54	11.4		11.4	2.433613355
55	25.5		25.5	3.238678452

56	8.2	8.2	2.104134154
57	14.6	14.6	2.681021529
58	17.5	17.5	2.862200881
59	17.7	17.7	2.87356464
60	18.8	18.8	2.93385687
61	10.6	10.6	2.360854001
62	5.7	5.7	1.740466175
63	9.1	9.1	2.208274414
64	13.6	13.6	2.610069793
65	33.1	33.1	3.499533282
66	28.2	28.2	3.339321978
67	8.5	8.5	2.140066163
68	8.2	8.2	2.104134154
70	2.8	2.8	1.029619417
71	19.5	19.5	2.970414466
72	28.6	28.6	3.353406718
73	8.7	8.7	2.163323026
74	21.9	21.9	3.086486637
75	22.9	22.9	3.131136911
76	11.4	11.4	2.433613355
77	17.9	17.9	2.884800713
78	25.2	25.2	3.226843995
79	8.6	8.6	2.151762203
80	9.5	9.5	2.251291799
81	37.1	37.1	3.61361697
82	17.2	17.2	2.844909384
83	5.2	5.2	1.648658626
84	55.1	55.1	4.009149716
85	15.5	15.5	2.740840024
86	7.8	7.8	2.054123734
87	12	12	2.48490665
88	8.9	8.9	2.186051277
89	4.6	4.6	1.526056303
90	38.1	38.1	3.640214282
91	33.9	33.9	3.523415014
93	14.2	14.2	2.653241965
118	27.9	27.9	3.328626689
119	12.8	12.8	2.549445171
121	15.2	15.2	2.721295428
122	14.8	14.8	2.694627181
123	16.6	16.6	2.809402695
124	89.8	89.8	4.497584975
125	15.9	15.9	2.766319109
126	13.3	13.3	2.587764035
127	12.4	12.4	2.517696473

mean(x)	**mean(ln x)**
18.31632653	2.77280445
std dev (x)	**std dev (ln x)**
11.27792017	0.51552559
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.891
UCL normal	**UCL lognormal**
20.20518973	20.1795495

Silver UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	0.46	u	0.23	-1.46967597
2	0.49	u	0.245	-1.406497068
3	0.45	u	0.225	-1.491654877
4	0.52	u	0.26	-1.347073648
5	0.46	u	0.23	-1.46967597
6	0.45	u	0.225	-1.491654877
7	0.46	u	0.23	-1.46967597
8	0.47	u	0.235	-1.448169765
9	0.46	u	0.23	-1.46967597
10	0.49	u	0.245	-1.406497068
11	0.49	u	0.245	-1.406497068
12	0.47	u	0.235	-1.448169765
13	0.47	u	0.235	-1.448169765
14	0.5	u	0.25	-1.386294361
15	0.48	u	0.24	-1.427116356
16	0.43	u	0.215	-1.537117251
17	0.47	u	0.235	-1.448169765
18	0.46	u	0.23	-1.46967597
19	0.46	u	0.23	-1.46967597
20	0.52	u	0.26	-1.347073648
21	0.49	u	0.245	-1.406497068
22	0.47	u	0.235	-1.448169765
24	0.49	u	0.245	-1.406497068
25	0.48	u	0.24	-1.427116356
26	0.48	u	0.24	-1.427116356
27	0.42	u	0.21	-1.560647748
28	0.52		0.52	-0.653926467
29	0.41	u	0.205	-1.5847453
30	0.45	u	0.225	-1.491654877
31	0.49	u	0.245	-1.406497068
32	0.45	u	0.225	-1.491654877
33	0.45	u	0.225	-1.491654877
34	0.46	u	0.23	-1.46967597
35	0.5	u	0.25	-1.386294361
36	0.49	u	0.245	-1.406497068
37	0.47	u	0.235	-1.448169765
38	0.81		0.81	-0.210721031
39	0.75		0.75	-0.287682072
40	0.5		0.5	-0.693147181
41	0.93		0.93	-0.072570693
42	0.41	u	0.205	-1.5847453
43	0.51		0.51	-0.673344553
44	0.74		0.74	-0.301105093
45	0.69		0.69	-0.371063681
47	0.53		0.53	-0.634878272
48	0.47	u	0.235	-1.448169765
49	1.5		1.5	0.405465108
50	0.43	u	0.215	-1.537117251
51	0.59		0.59	-0.527632742
52	0.98		0.98	-0.020202707
53	0.47	u	0.235	-1.448169765
54	0.41	u	0.205	-1.5847453
55	0.82		0.82	-0.198450939

56	0.43 u	0.215	-1.537117251
57	0.44	0.44	-0.820980552
58	0.45 u	0.225	-1.491654877
59	0.65	0.65	-0.430782916
60	0.44 u	0.22	-1.514127733
61	0.35 u	0.175	-1.742969305
62	0.48 u	0.24	-1.427116356
63	0.46 u	0.23	-1.46967597
64	0.46 u	0.23	-1.46967597
65	1	1	0
66	1	1	0
67	0.35 u	0.175	-1.742969305
68	0.39 u	0.195	-1.63475572
70	0.41 u	0.205	-1.5847453
71	0.71	0.71	-0.342490309
72	0.77	0.77	-0.261364764
73	1.4	1.4	0.336472237
74	0.91	0.91	-0.094310679
75	0.47	0.47	-0.755022584
76	0.59	0.59	-0.527632742
77	0.77	0.77	-0.261364764
78	0.89	0.89	-0.116533816
79	0.63	0.63	-0.46203546
80	0.74	0.74	-0.301105093
81	1.2	1.2	0.182321557
82	0.47 u	0.235	-1.448169765
83	0.42 u	0.21	-1.560647748
84	1.5	1.5	0.405465108
85	0.41 u	0.205	-1.5847453
86	0.47 u	0.235	-1.448169765
87	0.61	0.61	-0.494296322
88	0.41 u	0.205	-1.5847453
89	0.39 u	0.195	-1.63475572
90	2.4	2.4	0.875468737
91	1.2	1.2	0.182321557
93	0.43	0.43	-0.84397007
118	2.4	2.4	0.875468737
119	1.2	1.2	0.182321557
121	0.95	0.95	-0.051293294
122	0.84	0.84	-0.174353387
123	0.49 u	0.245	-1.406497068
124	0.95	0.95	-0.051293294
125	0.43 u	0.215	-1.537117251
126	0.46 u	0.23	-1.46967597
127	0.39 u	0.195	-1.63475572

mean(x)	**mean(ln x)**
0.491071429	-0.983942707
std dev (x)	**std dev (ln x)**
0.43587526	0.68912283
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	1.96
UCL normal	**UCL lognormal**
0.564073252	0.54370051

Dibutylphthalate UCL Calculations

note: Nondetects (u) were calculated = MDL/2

Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)	ln(x)
1	380	u	190	5.247024072
2	21	jb	21	3.044522438
3	22	jb	22	3.091042453
4	23	jb	23	3.135494216
5	390	u	195	5.272999559
6	390	u	195	5.272999559
7	420	u	210	5.347107531
8	400	u	200	5.298317367
9	22	jb	22	3.091042453
10	420	u	210	5.347107531
11	420	u	210	5.347107531
12	390	u	195	5.272999559
13	410	u	205	5.323009979
14	410	u	205	5.323009979
15	400	u	200	5.298317367
16	380	u	190	5.247024072
17	22	jb	22	3.091042453
18	390	u	195	5.272999559
19	25	jb	25	3.218875825
20	47	jb	47	3.850147602
21	33	jb	33	3.496507561
22	410	u	205	5.323009979
24	410	u	205	5.323009979
25	410	u	205	5.323009979
26	400	u	200	5.298317367
27	400	u	200	5.298317367
28	26	jb	26	3.258096538
29	400	u	200	5.298317367
30	380	u	190	5.247024072
31	410	u	205	5.323009979
32	380	u	190	5.247024072
33	380	u	190	5.247024072
34	390	u	195	5.272999559
35	430	u	215	5.370638028
36	420	u	210	5.347107531
37	400	u	200	5.298317367
38	410	u	205	5.323009979
39	390	u	195	5.272999559
40	400	u	200	5.298317367
41	410	u	205	5.323009979
42	390	u	195	5.272999559
43	390	u	195	5.272999559
44	420	u	210	5.347107531
45	400	u	200	5.298317367
47	410	u	205	5.323009979
48	21	j	21	3.044522438
49	420	u	210	5.347107531
50	380	u	190	5.247024072
51	390	u	195	5.272999559
52	400	u	200	5.298317367
53	420	u	210	5.347107531
54	380	u	190	5.247024072
55	420	u	210	5.347107531
56	33	j	33	3.496507561
57	29	j	29	3.36729583
58	330	u	165	5.105945474

59	330 u	165	5.105945474
60	23 j	23	3.135494216
61	330 u	165	5.105945474
62	330 u	165	5.105945474
63	330 u	165	5.105945474
64	330 u	165	5.105945474
65	21 j	21	3.044522438
66	330 u	165	5.105945474
67	330 u	165	5.105945474
68	330 u	165	5.105945474
70	330 u	165	5.105945474
71	330 u	165	5.105945474
72	19 j	19	2.944438979
73	330 u	165	5.105945474
74	330 u	165	5.105945474
75	22 j	22	3.091042453
76	330 u	165	5.105945474
77	330 u	165	5.105945474
78	33 jb	33	3.496507561
79	38 jb	38	3.63758616
80	28 jb	28	3.33220451
81	25 jb	25	3.218875825
82	24 jb	24	3.17805383
83	41 jb	41	3.713572067
84	65 jb	65	4.17438727
85	28 jb	28	3.33220451
86	36 jb	36	3.583518938
87	27 jb	27	3.295836866
88	43 jb	43	3.761200116
89	39 jb	39	3.663561646
90	40 jb	40	3.688879454
91	36 jb	36	3.583518938
93	21 jb	21	3.044522438
118	49 jb	49	3.891820298
119	700 b	700	6.551080335
121	28 jb	28	3.33220451
122	26 j	26	3.258096538
123	440 u	220	5.393627546
124	470 u	235	5.459585514
125	410 u	205	5.323009979
126	410 u	205	5.323009979
127	230 j	230	5.438079309

mean(x)	**mean(ln x)**
142.1530612	4.61826868
std dev (x)	**std dev (ln x)**
97.69501797	0.943092078
count (n)	**count (n)**
98	98
Student-t	**H-statistic**
1.658	2.205
UCL normal	**UCL lognormal**
158.5153444	195.2192096

j = estimated concentration (below MDL)
b = blank contaminant
u = not detected (MDL)

	A	B	C	D	E	F
1				Cadmium CL Calculations		
2						
3						
4						
5						
6						
7						
8	Sample #	CONC. (mg/kg)	u = MDL	CONC.(x)		ln(x)
9						
10	1	0.25	u	=IF(C10="u", B10/2,B10)		=LN(D10)
11	2	0.27	u	=IF(C11="u", B11/2,B11)		=LN(D11)
12	3	0.25	u	=IF(C12="u", B12/2,B12)		=LN(D12)
13	4	0.28	u	=IF(C13="u", B13/2,B13)		=LN(D13)
14	5	0.26	u	=IF(C14="u", B14/2,B14)		=LN(D14)
15	6	0.25	u	=IF(C15="u", B15/2,B15)		=LN(D15)
16	7	0.25	u	=IF(C16="u", B16/2,B16)		=LN(D16)
17	8	0.26	u	=IF(C17="u", B17/2,B17)		=LN(D17)
18	9	0.25	u	=IF(C18="u", B18/2,B18)		=LN(D18)
19	10	0.27	u	=IF(C19="u", B19/2,B19)		=LN(D19)
20	11	0.27	u	=IF(C20="u", B20/2,B20)		=LN(D20)
21	12	0.3		=IF(C21="u", B21/2,B21)		=LN(D21)
22	13	0.26	u	=IF(C22="u", B22/2,B22)		=LN(D22)
23	14	0.27	u	=IF(C23="u", B23/2,B23)		=LN(D23)
24	15	0.27	u	=IF(C24="u", B24/2,B24)		=LN(D24)
25	16	0.24	u	=IF(C25="u", B25/2,B25)		=LN(D25)
26	17	0.26	u	=IF(C26="u", B26/2,B26)		=LN(D26)
27	18	0.25	u	=IF(C27="u", B27/2,B27)		=LN(D27)
28	19	0.25	u	=IF(C28="u", B28/2,B28)		=LN(D28)
29	20	0.29	u	=IF(C29="u", B29/2,B29)		=LN(D29)
30	21	0.27	u	=IF(C30="u", B30/2,B30)		=LN(D30)
31	22	0.26	u	=IF(C31="u", B31/2,B31)		=LN(D31)
32	24	0.45		=IF(C32="u", B32/2,B32)		=LN(D32)
33	25	0.27	u	=IF(C33="u", B33/2,B33)		=LN(D33)
34	26	0.26	u	=IF(C34="u", B34/2,B34)		=LN(D34)
35	27	0.23	u	=IF(C35="u", B35/2,B35)		=LN(D35)
36	28	0.61		=IF(C36="u", B36/2,B36)		=LN(D36)
37	29	0.22	u	=IF(C37="u", B37/2,B37)		=LN(D37)
38	30	0.25	u	=IF(C38="u", B38/2,B38)		=LN(D38)
39	31	0.27	u	=IF(C39="u", B39/2,B39)		=LN(D39)
40	32	0.27		=IF(C40="u", B40/2,B40)		=LN(D40)
41	33	0.25	u	=IF(C41="u", B41/2,B41)		=LN(D41)
42	34	0.25	u	=IF(C42="u", B42/2,B42)		=LN(D42)
43	35	0.28	u	=IF(C43="u", B43/2,B43)		=LN(D43)
44	36	0.27	u	=IF(C44="u", B44/2,B44)		=LN(D44)
45	37	0.26	u	=IF(C45="u", B45/2,B45)		=LN(D45)
46	38	0.24	u	=IF(C46="u", B46/2,B46)		=LN(D46)
47	39	0.24	u	=IF(C47="u", B47/2,B47)		=LN(D47)
48	40	0.23	u	=IF(C48="u", B48/2,B48)		=LN(D48)
49	41	0.26	u	=IF(C49="u", B49/2,B49)		=LN(D49)
50	42	0.22	u	=IF(C50="u", B50/2,B50)		=LN(D50)
51	43	0.24	u	=IF(C51="u", B51/2,B51)		=LN(D51)
52	44	0.26	u	=IF(C52="u", B52/2,B52)		=LN(D52)
53	45	0.25	u	=IF(C53="u", B53/2,B53)		=LN(D53)
54	47	0.23	u	=IF(C54="u", B54/2,B54)		=LN(D54)
55	48	0.26	u	=IF(C55="u", B55/2,B55)		=LN(D55)
56	49	0.26	u	=IF(C56="u", B56/2,B56)		=LN(D56)
57	50	0.24	u	=IF(C57="u", B57/2,B57)		=LN(D57)
58	51	0.23	u	=IF(C58="u", B58/2,B58)		=LN(D58)
59	52	0.25	u	=IF(C59="u", B59/2,B59)		=LN(D59)
60	53	0.26	u	=IF(C60="u", B60/2,B60)		=LN(D60)
61	54	0.23	u	=IF(C61="u", B61/2,B61)		=LN(D61)
62	55	0.24	u	=IF(C62="u", B62/2,B62)		=LN(D62)
63	56	0.24	u	=IF(C63="u", B63/2,B63)		=LN(D63)
64	57	0.2	u	=IF(C64="u", B64/2,B64)		=LN(D64)
65	58	0.24	u	=IF(C65="u", B65/2,B65)		=LN(D65)
66	59	0.35		=IF(C66="u", B66/2,B66)		=LN(D66)
67	60	0.24	u	=IF(C67="u", B67/2,B67)		=LN(D67)
68	61	0.19	u	=IF(C68="u", B68/2,B68)		=LN(D68)
69	62	0.26	u	=IF(C69="u", B69/2,B69)		=LN(D69)
70	63	0.25	u	=IF(C70="u", B70/2,B70)		=LN(D70)
71	64	0.25	u	=IF(C71="u", B71/2,B71)		=LN(D71)
72	65	0.28	u	=IF(C72="u", B72/2,B72)		=LN(D72)
73	66	0.28	u	=IF(C73="u", B73/2,B73)		=LN(D73)
74	67	0.19	u	=IF(C74="u", B74/2,B74)		=LN(D74)
75	68	0.22	u	=IF(C75="u", B75/2,B75)		=LN(D75)

	A	B	C	D	E	F
76	70	0.22	u	=IF(C76="u", B76/2,B76)		=LN(D76)
77	71	0.25	u	=IF(C77="u", B77/2,B77)		=LN(D77)
78	72	0.19	u	=IF(C78="u", B78/2,B78)		=LN(D78)
79	73	0.25	u	=IF(C79="u", B79/2,B79)		=LN(D79)
80	74	0.26	u	=IF(C80="u", B80/2,B80)		=LN(D80)
81	75	0.24	u	=IF(C81="u", B81/2,B81)		=LN(D81)
82	76	0.27	u	=IF(C82="u", B82/2,B82)		=LN(D82)
83	77	0.17	u	=IF(C83="u", B83/2,B83)		=LN(D83)
84	78	0.26		=IF(C84="u", B84/2,B84)		=LN(D84)
85	79	0.25		=IF(C85="u", B85/2,B85)		=LN(D85)
86	80	0.27		=IF(C86="u", B86/2,B86)		=LN(D86)
87	81	0.27		=IF(C87="u", B87/2,B87)		=LN(D87)
88	82	1.4		=IF(C88="u", B88/2,B88)		=LN(D88)
89	83	0.23	u	=IF(C89="u", B89/2,B89)		=LN(D89)
90	84	0.58	u	=IF(C90="u", B90/2,B90)		=LN(D90)
91	85	0.23	u	=IF(C91="u", B91/2,B91)		=LN(D91)
92	86	0.26	u	=IF(C92="u", B92/2,B92)		=LN(D92)
93	87	0.25	u	=IF(C93="u", B93/2,B93)		=LN(D93)
94	88	0.23	u	=IF(C94="u", B94/2,B94)		=LN(D94)
95	89	0.21	u	=IF(C95="u", B95/2,B95)		=LN(D95)
96	90	0.24	u	=IF(C96="u", B96/2,B96)		=LN(D96)
97	91	0.24	u	=IF(C97="u", B97/2,B97)		=LN(D97)
98	93	1.1		=IF(C98="u", B98/2,B98)		=LN(D98)
99	118	0.87		=IF(C99="u", B99/2,B99)		=LN(D99)
100	119	0.29	u	=IF(C100="u", B100/2,B100)		=LN(D100)
101	121	0.29	u	=IF(C101="u", B101/2,B101)		=LN(D101)
102	122	0.35		=IF(C102="u", B102/2,B102)		=LN(D102)
103	123	0.27	u	=IF(C103="u", B103/2,B103)		=LN(D103)
104	124	0.56		=IF(C104="u", B104/2,B104)		=LN(D104)
105	125	0.4		=IF(C105="u", B105/2,B105)		=LN(D105)
106	126	0.25	u	=IF(C106="u", B106/2,B106)		=LN(D106)
107	127	0.21	u	=IF(C107="u", B107/2,B107)		=LN(D107)
108						
109						
110						
111				**mean(x)**		**mean(ln x)**
112				=AVERAGE(D10:D107)		=AVERAGE(F10:F107)
113						
114				**std dev (x)**		**std dev (ln x)**
115				=STDEV(D10:D107)		=STDEV(F10:F107)
116						
117				**count (n)**		**count (n)**
118				=COUNT(D10:D107)		=COUNT(F10:F107)
119						
120				**Student-t**		**H-statistic**
121				1.658		2.117
122						
123				**UCL** normal		**UCL** lognormal
124				=D112+D121*(D115/SQRT(D118))		=EXP(F112+(0.5*F115*F115)+(F115*F121/(SQRT(F118-1))))

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RECRA LabNet
a division of Recra Environmental, Inc.

208 Welsh Pool Road
Lionville, PA 19341-1313
Phone: (610) 280-3000
Fax: (610) 280-3041

DATE: 9/8/97

TIME:

NO. PAGES: _____ (including cover sheet)

TO: Trisha Beckham

OF: DOE

FAX #: 937-865-4489

FROM: Judy Stone

COPY TO:

Garden Horn — Dave Gloebler / Mound 937-865-3835

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MESSAGE:

Preliminary Sb. data — analyzed SW846. Being rerun — CLP — later today (totals) Results not likely to change much at-all. TCLP are fine.

Recra LabNet - Lionville

INORGANICS DATA SUMMARY REPORT 09/08/97

CLIENT: BOLG MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT	DILUTION FACTOR
-001	000150	Antimony, Total	3.6		MG/KG	0.11	1.0
-002	000151	Antimony, Total	1.9		MG/KG	0.1	1.0
-003	000152	Antimony, Total	1.3		MG/KG	0.09	1.0
-004	000153	Antimony, Total	1.5		MG/KG	0.09	1.0
-005	000150	Antimony, TCLP Leachate	30.2	u	UG/L	30.2	1.0
-006	000151	Antimony, TCLP Leachate	30.2	u	UG/L	30.2	1.0
-007	000152	Antimony, TCLP Leachate	30.9		UG/L	30.2	1.0
-008	000153	Antimony, TCLP Leachate	30.2	u	UG/L	30.2	1.0

150: $\frac{.0044 \text{ mg/l}}{3.6 \text{ mg/kg}} = .0012$

151: $\frac{.0096}{1.9} = .0051$

152: $\frac{.0075}{1.3} = .0058$

153: $\frac{.0038}{1.5} = .0025$

avg. TCLP = .0063

= avg. ratio = .0037

$= \frac{x}{0.58 \text{ mg/kg}}$

* $x = .0021$ mg/l

Recra LabNet - Lionville

INORGANICS METHOD BLANK DATA SUMMARY PAGE 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT	DILUTION FACTOR
BLANK1	97L1746-MB1	Antimony, Total	0.09	u	MG/KG	0.09	1.0
BLANK1	97L1754-MB1	Antimony, TCLP Leachate	30.2	u	UG/L	30.2	1.0
BLANK2	97L1754-MB2	Antimony, TCLP Leachate	30.2	u	UG/L	30.2	1.0

Recra LabNet - Lionville

INORGANICS ACCURACY REPORT 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	DILUTION FACTOR(SPK)
-001	000150	Antimony, Total	125	3.6	61.8	196.8	20.0
-005	000150	Antimony, TCLP Leachat	4970	30.2 u	5000	99.4	1.0

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INORGANICS PRECISION REPORT 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	RPD	DILUTION FACTOR (REP)
-001REP	000150	Antimony, Total	3.6	3.2	11.5	1.0

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INORGANICS LABORATORY CONTROL STANDARDS REPORT 09/08/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9708L080

WORK ORDER: 05376-069-001-1000-01

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	97L1746-LC1	Antimony, LCS	324	300	MG/KG	108.0
LCS1	97L1754-LC1	Antimony, LCS	2930	3000	UG/L	97.7

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RECRA LabNet
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208 Welsh Pool Road
Lionville, PA 19341-1313
Phone: (610) 280-3000
Fax: (610) 280-3041

DATE: 9/13/97

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TO: Trisha Bechlin / Dave Glocchler
OF: DOE / mound
FAX #: 937-865-4489 937-865-38

FROM: Judy Stone

COPY TO:
Bordin Horn / Craig Stoll
of RGW

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MESSAGE:
Here is revised matrix spike recovery - LIMS had calculated as a water sample instead of TCLP originally - recovery is much more acceptable. Sorry for the confusion.

Recra LabNet - Lionville

INORGANICS ACCURACY REPORT 09/13/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	DILUTION FACTOR(SPK)
-001	000150	Antimony, TCLP Leachat	5680	4.4	5000	113.5	200

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208 Welsh Pool Road
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Phone: (610) 280-3000
Fax: (610) 280-3041

DATE: 9/12/97

TIME:

NO. PAGES: (including cover sheet)

TO: Trisha Beckler

OF: DOE

FAX #: 937-865-4489

FROM: Judy Stone

COPY TO: Dave Gloekler / Mound
937-865-3835

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MESSAGE:

TCLP Sb by furnace method

Recra LabNet - Lionville

INORGANICS DATA SUMMARY REPORT 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT	DILUTION FACTOR
-001	000150	Antimony, TCLP Leachate	4.4	UG/L	0.90	1.0
-002	000151	Antimony, TCLP Leachate	9.6	UG/L	0.90	1.0
-003	000152	Antimony, TCLP Leachate	7.5	UG/L	0.90	1.0
-004	000153	Antimony, TCLP Leachate	3.8	UG/L	0.90	1.0

Recra LabNet - Lionville

INORGANICS METHOD BLANK DATA SUMMARY PAGE 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT	DILUTION FACTOR
BLANK1	97L1754-MB1	Antimony, TCLP Leachate	0.90 u	UG/L	0.90	1.0
BLANK2	97L1754-MB2	Antimony, TCLP Leachate	0.90 u	UG/L	0.90	1.0

Recra LabNet - Lionville

INORGANICS ACCURACY REPORT 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	DILUTION FACTOR(SPK)
-001	000150	Antimony, TCLP Leachat	5680	4.4	500	1135	200

Recra LabNet - Lionville

INORGANICS LABORATORY CONTROL STANDARDS REPORT 09/12/97

CLIENT: EG&G MOUND-BURN AREA RECRA LOT #: 9709L305

WORK ORDER: 05376-069-001-1000-00

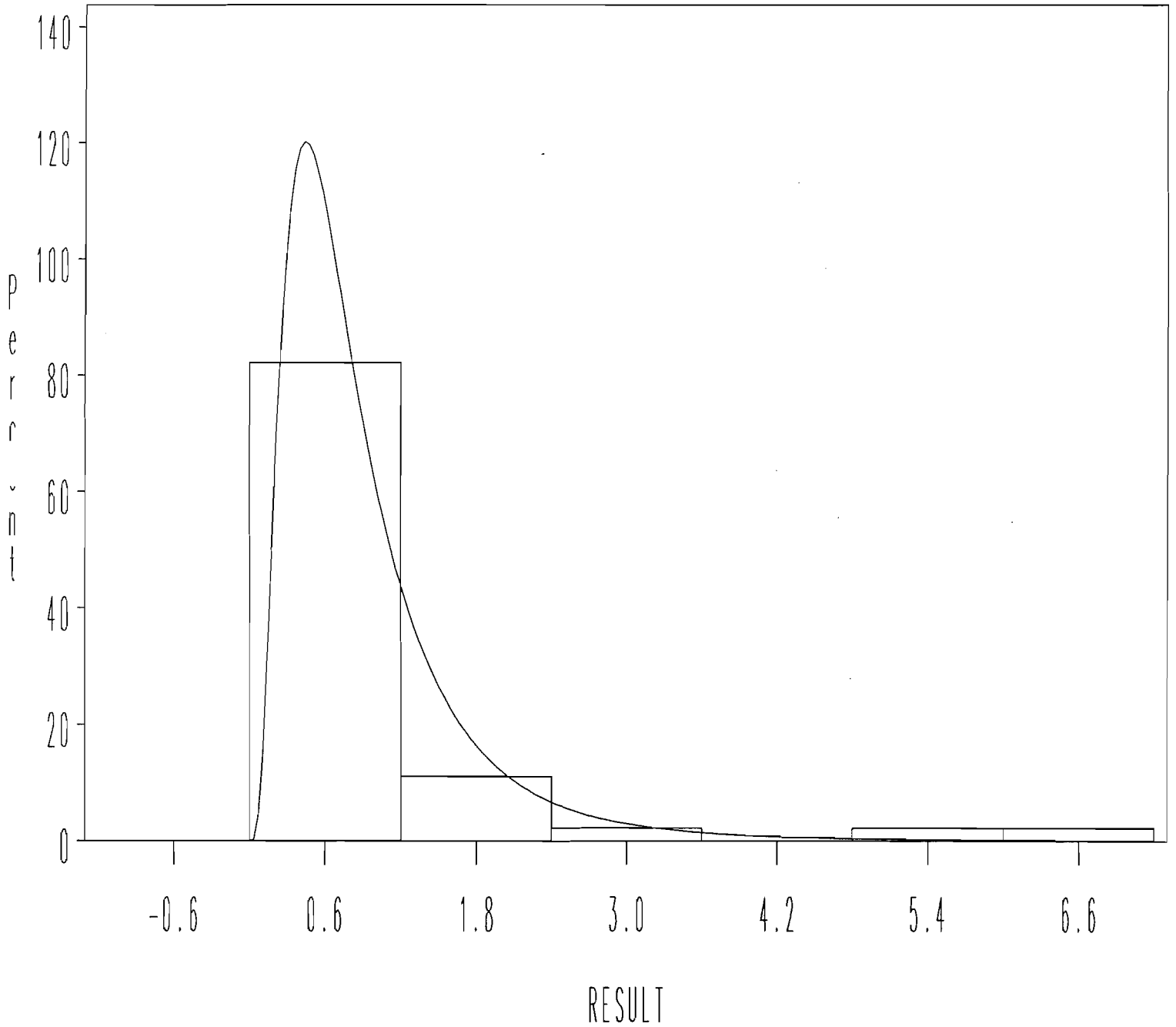
SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	97L1754-LC1	Antimony, LCS	3060	3000	UG/L	102.0

Appendix B

Antimony Data Evaluation

Histogram Of Burn Area Sample Results
With Lognormal Distribution Superimposed
(Only Results Above MDAs Are Utilized)

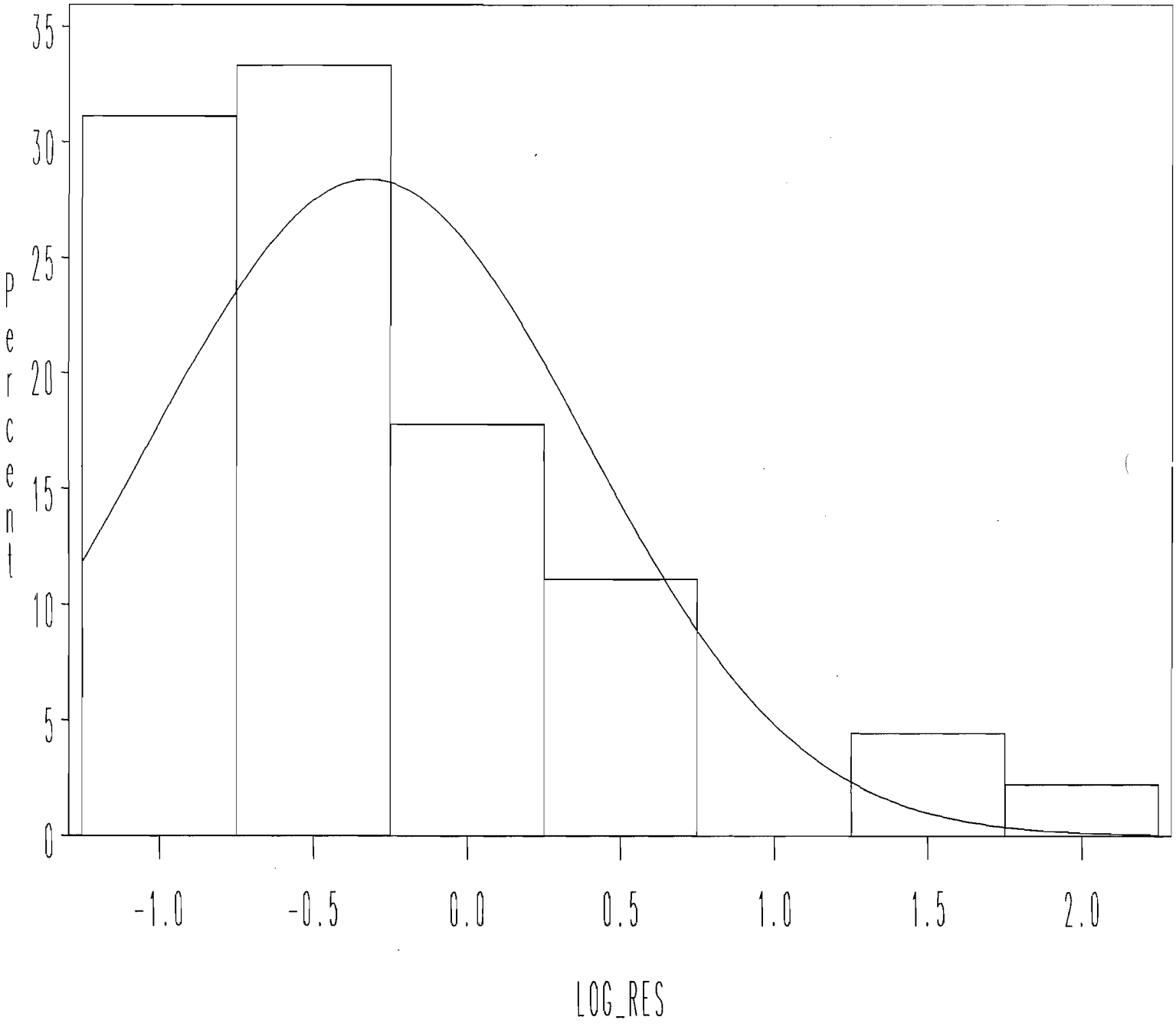
NAME=Antimony



Curve: —— Lognormal(Theta=0 Shape=0.7 Scale=-.3)

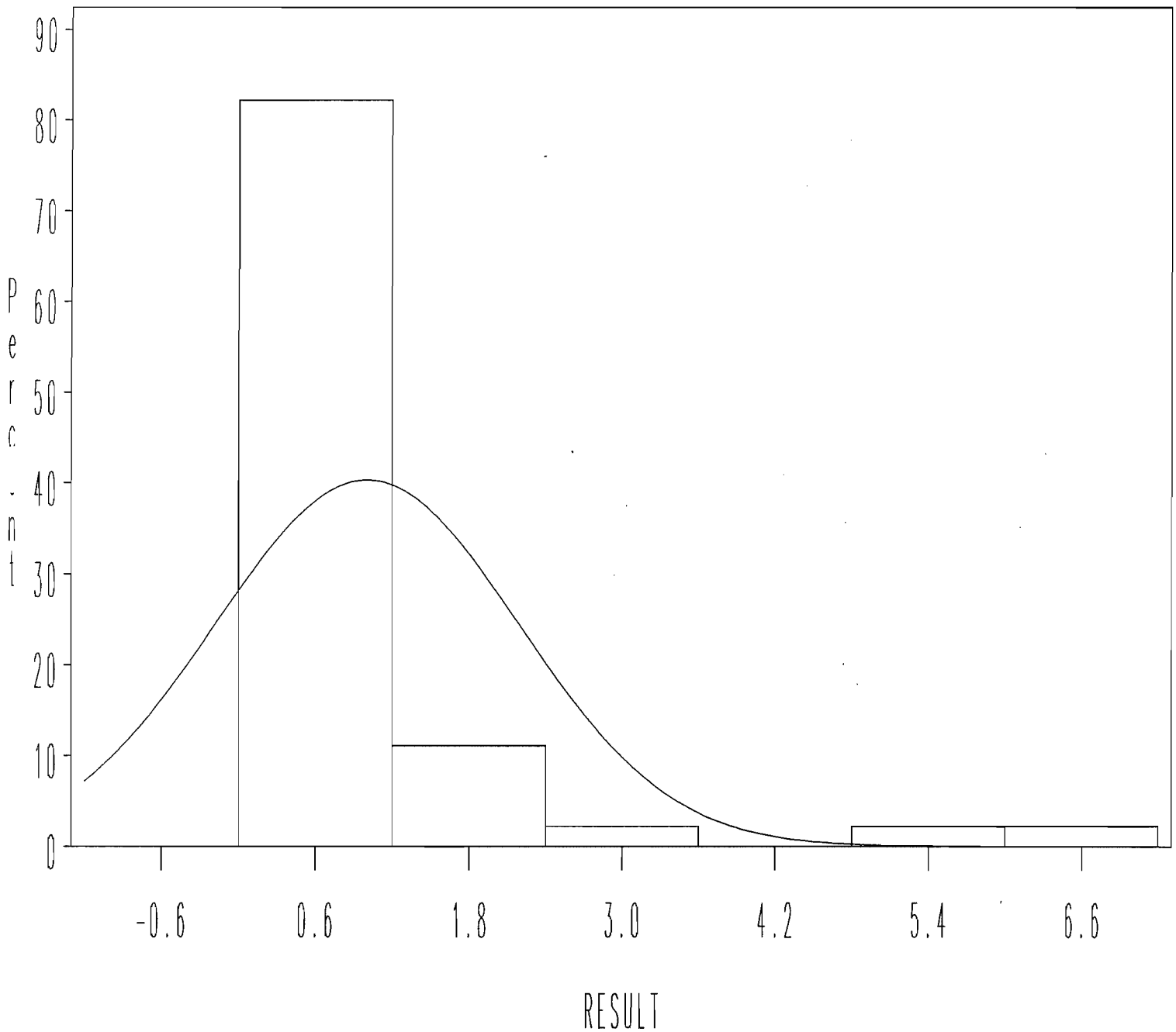
Histogram Of Burn Area Sample Results
With Normal Distribution Superimposed
(Only Results Above MDAs Are Utilized)

NAME=Antimony



Curve: —— Normal(Mu=-0.321 Sigma=0.7024)

Histogram Of Burn Area Sample Results
With Normal Distribution Superimposed
(Only Results Above MDAs Are Utilized)
NAME=Antimony



Curve: —— Normal(Mu=1.0056 Sigma=1.1866)

Appendix C

Residential Land Use Scenario Evaluation

Table C-1

Residential Land Use Scenario
Exposure Routes/Pathways
Burn Area

Medium	Route of Exposure	Exposure Activity	Potential Receptors	Exposure Source
Soils	Ingestion	Incidental Contact	Adult and Child Residents	Soils
	Dermal	Direct Contact	Adult and Child Residents	Soils
	Inhalation	Fugitive Dust (outdoor)	Adult and Child Residents	Soils
Groundwater	Ingestion	Direct Contact	Adult and Child Residents	Potential Potable Water Supply
	Dermal	Direct Contact (showering)	Adult and Child Residents	Groundwater
	Inhalation of mist	Direct Contact (showering)	Adult and Child Residents	Groundwater

Table C-2

TCLP Leachate Results for the Burn Area

Sample ID	Sb(TCLP) mg/L	Total Sb mg/kg	Extraction Efficiency kg/L
000150	4.4	3600	1.22E-03
000151	9.6	1900	5.05E-03
000152	7.5	1300	5.77E-03
000153	3.8	1500	2.53E-03
	Mean	Mean	Mean
	6.3	2075	3.64E-03
n= 4	std dev =2.7	t-value = 2.35	95%UCL of mean = 9.5 mg/L = 9.5E-03 mg/L

Table C-3

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SOILS AND DUST

Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

Parameter	Resident
CS = Concentration in Soil (mg/kg)	95% UCL
IR = Ingestion Rate (mg/day)	100 (adult), 200 (child)
CF = Conversion Factor (kg/mg)	1.00E-06
FI = Fraction Ingested (unitless)	1
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10,950 (adult), 2,190 (child)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table C-4

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SOIL AND DUST

Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

Parameter	Resident
CS = Concentration in Soil (mg/kg)	95% UCL
CF = Conversion Factor (kg/mg)	1.00E-06
SA = Skin Surface Area Available for contact (cm^2/day)	5000 (adult), 2000 (child)
AF = Soil to Skin Adherence Factor (mg/cm^2)	1
ABS = Absorption Factor (unitless)	Chemical Specific (a)
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10,950 (adult), 2,190 (child)

(a) 1% for metals recommended by OEPA (Ohio EPA Interim Final RCRA Closure Guidance, September 1993)

Table C-5

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF AIRBORNE CHEMICALS IN FUGITIVE DUST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Resident
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL
IR = Inhalation Rate (m^3/hour)[a]	0.83
ET = Exposure Time (hours/day)	24
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10950 (adult), 2190 (child)

References: Ohio EPA Interim Final RCRA Closure Guidance, September 1993
[a] - 20 m^3/day = 0.83 m^3/hour

Table C-6

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN GROUNDWATER

Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

Parameter	Resident
CW = Concentration in water (mg/L)	95% UCL of mean TCLP leachate concentration
IR = Ingestion Rate (L/day)	2
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10,950 (adult), 2,190 (child)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table C-6a

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN GROUNDWATER

Absorbed Dose (mg/kg-day) = (CW x SA x PC x ET x EF x ED x CF) / (BW x AT)

Parameter	Resident
CW = Absorbed Dose (mg/cm^2)	95% UCL of mean TCLP leachate concentration
SA = Skin Surface Area Available for contact (cm^2)	20000 (adult), 7000 (child)
PC = Dermal Permeability Constant (cm/hr)	1.0E-03[a]
ET = Exposure Time (hrs./day)	0.2 [b]
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	10950 (adult), 2190 (child)
CF = Conversion Factor (L/cm^3)	1/1000

[a] - From Risk-Base Guideline Values Report - Appendix A, Table P2, Parameters for Chemical of Concern, March 1997, page 127

[b] - Based on the 90th percentile shower time of 12 minutes (12min/day x 1hr/60min= 0.2 hr/day)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table C-6b

RESIDENTIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF CHEMICALS IN WATER MIST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Resident
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL
IR = Inhalation Rate (m^3/hour)	0.60
ET = Exposure Time (hours/day)	0.2
EF = Exposure Frequency (days/yr.)	350
ED = Exposure Duration (yrs.)	30 (adult), 6 (child)
BW = Body Weight (kg)	70 (adult), 15 (child)
AT = Averaging Time (days) Noncarcinogens (ED x 365 days/yr.)	10950 (adult), 2190 (child)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

TABLE C-7 INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
SOIL INGESTION INTAKE
Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	IR (mg/day)	CF (kg/mg)	FI (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Intake (mg/kg-day) Noncarcinogens
Antimony	0.58	100	1.00E-06	1	350	30	70	10950	7.95E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 100 mg/day x 1E-06 kg/mg x 1 x 350 days/yr x 30 yrs / (70 kg x 10950 days)
Intake = 7.95E-07 mg/kg-day

TABLE C-8. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
SOIL INGESTION INTAKE
Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	IR (mg/day)	CF (kg/mg)	FI (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Intake (mg/kg-day) Noncarcinogens
Antimony	0.58	200	1.00E-06	1	350	6	15	2190	7.42E-06

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 200 mg/day x 1E-06 kg/mg x 1 x 350 days/yr x 6 yrs / (15 kg x 2190 days)
Intake = 7.42E-06 mg/kg-day

TABLE C-9. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
DERMAL CONTACT WITH CHEMICALS IN SOILS AND DUST
Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CF (kg/mg)	SA (cm^2/day)	AF (mg/cm^2)	ABS (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Abs. Dose (mg/kg-day) Noncarcinogens
Antimony	0.58	1.00E-06	5000	1	0.01	350	30	70	10950	3.97E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 1 E-06 kg/mg x 5000 cm^2/day x 1mg/cm^2 x 0.01 x 350 days/yr x 30 yrs / (70 kg x 10950 days)
Intake = 3.97E-07 mg/kg-day

ABS (Absorption Factor) is chemical specific

TABLE C-10. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
DERMAL CONTACT WITH CHEMICALS IN SOILS AND DUST
Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CF (kg/mg)	SA (cm^2/day)	AF (mg/cm^2)	ABS (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Abs. Dose (mg/kg-day) Noncarcinogens
Antimony	0.58	1.00E-06	2000	1	0.01	350	6	15	2190	7.42E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 1 E-06 kg/mg x 2000 cm^2/day x 1 mg/cm^2 x 0.01 x 350 days/yr x 6 yrs / (15 kg x 2190 days)
Intake = 7.42E-07 mg/kg-day

ABS (Absorption Factor) is chemical specific

TABLE C-11. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
INHALATION OF CHEMICALS IN FUGITIVE DUST
Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET [hrs/day] OUTDOOR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.83	24	350	30	70	10950	3.41E-11

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10mg/m^3 x 0.83 m^3/hr x 24 hr/day x 350 days/yr x 30 yrs / (70 kg x 10950 days)
OUTDOOR Intake = 3.41E-11 mg/kg-day

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) SHOWERING	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.6	0.2	350	30	70	10950	2.05E-13

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25 E-10 mg/m^3 x 0.60 m^3/hr x 0.2 hr/day x 350 days/yr x 30 yrs / (70 kg x 10950 days)
SHOWERING Intake = 2.05E-13 mg/kg-day

TABLE C-12. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
INHALATION OF CHEMICALS IN FUGITIVE DUST AND WATER MIST
Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) OUTDOOR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.83	24	350	6	15	2190	1.59E-10

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = default value = 4.63 x 10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10 mg/m^3 x 0.83 m^3/hr x 24 hr/day x 350 days/yr x 6 yrs / (15 kg x 2190 days)
OUTDOOR Intake = 1.59E-10 mg/kg-day

WATER MIST WHILE SHOWERING

CONTAMINANT	CS (mg/kg)	CA (mg/m3)	IR (m3/hr)	ET (hrs/day) SHOWERING	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.6	0.2	350	6	15	2190	9.59E-13

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = default value = 4.63 x 10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10 mg/m^3 x 0.83 m^3/hr x 0.2 hr/day x 350 days/yr x 6 yrs / (15 kg x 2190 days)
SHOWERING Intake = 9.59E-13 mg/kg-day

TABLE C-13. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
GROUNDWATER INGESTION INTAKE
Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	IR (L/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	INTAKE (mg/kg-day)
Antimony	0.0095	2	350	30	70	10950	2.60E-04

CW= Concentration in water (mg/L) 95% UCL of mean TCLP leachate concentration

Calculations

Noncarcinogen
Intake (mg/kg-day) = 9.5E-03 mg/L x 2 L/day x 350 days/yr x 30 yrs / (70 kg x 10950 days)
Intake = 2.60 E-04 mg/kg-day

TABLE C-14. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
GROUNDWATER INGESTION INTAKE
Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	IR (L/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	INTAKE (mg/kg-day)
Antimony	0.0095	2	350	6	15	2190	1.21E-03

CW= Concentration in water (mg/L) 95% UCL of mean TCLP leachate concentration

Calculations

Noncarcinogen
Intake (mg/kg-day) = 9.5E-03 mg/L x 2 L/day x 350 days/yr x 6 yrs / (15 kg x 2190 days)
Intake = 1.21 E-03 mg/kg-day

TABLE C-15. INTAKE VALUES FOR ADULT RESIDENT LAND USE SCENARIO
GROUNDWATER DERMAL ABSORBED DOSE (SHOWERING)
INTAKE (mg/kg-day) = (CW x CF x SA x PC x ET x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	CF (L/cm^3)	SA (cm^2)	PC (cm/hr)	ET (hrs/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.0095	1.00E-03	20000	1.00E-03	0.2	350	30	70	10950	5.21E-07

CALCULATION

Noncarcinogen

Intake (mg/kg-day) = 9.5 E-03 mg/L x 1.0E-03 L/cm^3 x 20,000 cm^2 x 1.0E-03 cm/hr x 0.2 hrs/day x 350 days/yr x 30yrs/ (70 kg x 10950 days)
Intake = 5.21 E-07 mg/kg-day

TABLE C-16. INTAKE VALUES FOR CHILD RESIDENT LAND USE SCENARIO
GROUNDWATER DERMAL ABSORBED DOSE (SHOWERING)
INTAKE (mg/kg-day) = (CW x CF x SA x PC x ET x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	CF (L/cm^3)	SA (cm^2)	PC (cm/hr)	ET (hrs/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.0095	1.00E-03	7000	1.00E-03	0.2	350	6	15	2190	8.50E-07

CALCULATION

Noncarcinogen

Intake (mg/kg-day) = 9.5E-03 mg/L x 1.0E-03 L/cm^3 x 7,000 cm^2 x 0.2 hrs/day x 1.0E-03 cm/hr x 350 days/yr x 6 yrs/ (15 kg x 2190 days)
Intake = 8.50 E-07 mg/kg-day

TABLE C-17. Summary of Total Risk
All Pathways
Burn Area

cenario and Recepto	Media	Pathway	onCarcinogen Risk (Dose)	RfD***	HQ = HI	
Future Scenario - Adult Resident	Soil	Ingestion	7.95E-07	4.00E-04	1.99E-03	B
		Dermal	3.97E-07	4.00E-04	9.93E-04	B
		Inhalation of Dust* (outdoor exposur	3.41E-11	6.00E-05	5.68E-07	B
		SUBTOTAL	1.19E-06		2.98E-03	B
	Groundwater	Ingestion	2.60E-04	4.00E-04	6.50E-01	B
		Dermal	5.21E-07	4.00E-04	1.30E-03	B
		Inhalation of mist (showering)	2.05E-13	6.00E-05	3.42E-09	B
		SUBTOTAL	2.61E-04		6.51E-01	B
		TOTAL	2.62E-04		**6.54E-01**	B
Future Scenario - Child Resident	Soil	Ingestion	7.42E-06	4.00E-04	1.86E-02	B
		Dermal	7.42E-07	4.00E-04	1.86E-03	B
		Inhalation of Dust* (outdoor exposur	1.59E-10	6.00E-05	2.65E-06	B
		SUBTOTAL	8.16E-06		2.04E-02	B
	Groundwater	Ingestion	1.21E-03	4.00E-04	3.03E+00	
		Dermal	8.50E-07	4.00E-04	2.13E-03	B
		Inhalation of mist (showering)	9.59E-13	6.00E-05	1.60E-08	B
		SUBTOTAL	1.21E-03		3.03E+00	
		TOTAL	1.22E-03		**3.05E+00**	

* exposure time = 24 hours
** exposure time = 0.2 hours
***equals RfC (antimony trioxide) for airborne intake
HI = Hazard Index

B = Below EPA target risk levels (HI<1)

Appendix D

Industrial Land Use Scenario Evaluation

Table D-1

Industrial Land Use Scenario
Exposure Routes/Pathways
Burn Area

Medium	Route of Exposure	Exposure Activity	Potential Receptors	Exposure Source
Soils	Ingestion	Incidental Contact	Adult Industrial Worker	Soils
	Dermal	Direct Contact	Adult Industrial Worker	Soils
	Inhalation	Fugitive Dust	Adult Industrial Worker	Soils
Groundwater	Ingestion	Direct Contact	Adult Industrial Worker	Potential Potable Water Supply
	Dermal	Direct Contact	Adult Industrial Worker	Groundwater
	Inhalation of mist	Direct Contact (showering)	Adult Industrial Worker	Groundwater

Table D-2

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN SOILS AND DUST

Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CS = Concentration in Soil (mg/kg)	95% UCL
IR = Ingestion Rate (mg/day)	50
CF = Conversion Factor (kg/mg)	1.00E-06
FI = Fraction Ingested (unitless)	1
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-3

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN SOIL AND DUST

Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

Parameter	Adult Industrial Worker
CS = Concentration in Soil (mg/kg)	95% UCL
CF = Conversion Factor (kg/mg)	1.00E-06
SA = Skin Surface Area Available for contact (cm^2/day)	5000
AF = Soil to Skin Adherence Factor (mg/cm^2)	1
ABS = Absorption Factor (unitless)	Chemical Specific [a]
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

[a] 1% for metals recommended by OEPA
Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-4

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF AIRBORNE CHEMICALS IN FUGITIVE DUST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL soil concentration
IR = Inhalation Rate (m^3/hour)	0.83 [a](outdoor)
ET = Exposure Time (hours/day)	8 (outdoor)
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days) Noncarcinogens (ED x 365 days/yr.)	9,125

[a] - 20 m^3/day = 0.83 m^3/hour
References: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-5

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INGESTION OF CHEMICALS IN GROUNDWATER

Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CW = Concentration in water (mg/L)	95% UCL of mean TCLP antimony leachate concentration
IR = Ingestion Rate (L/day)	2
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-6

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH CHEMICALS IN GROUNDWATER

Absorbed Dose (mg/kg-day)=(CW x SA x PC x ET x EF x ED x CF)/(BW x AT)

Parameter	Adult Industrial Worker
CW = Chemical Concentration in Water (mg/L)	95% UCL of mean TCLP antimony leachate concentration
SA = Skin Surface Area Available for contact (cm^2)	20,000
PC = Dermal Permeability Constant (cm/hr)	1.0E-03[a]
ET = Exposure Time (hrs./day)	0.2[b]
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
CF = Conversion Factor (L/cm^3)	1/1000
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

[a] - From Risk-Base Guideline Values Report - Appendix A, Table P2, Parameters for Chemical of Concern, March 1997, page 127

[b] - Based on the 90th percentile shower time of 12 minutes (12min/day x 1hr/60min= 0.2 hr/day)

Reference: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

Table D-6a

INDUSTRIAL EXPOSURE: INTAKE ASSUMPTIONS FOR INHALATION OF CHEMICALS IN WATER MIST

Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

Parameter	Adult Industrial Worker
CA = CS (mg/kg) x 1/PEF (m^3/kg)	CS Modeled from 95% UCL soil concentration
IR = Inhalation Rate (m^3/hour)	0.6 (showering)
ET = Exposure Time (hours/day)	0.2 (showering)
EF = Exposure Frequency (days/yr.)	250
ED = Exposure Duration (yrs.)	25
BW = Body Weight (kg)	70
AT = Averaging Time (days)	
Noncarcinogens (ED x 365 days/yr.)	9,125

References: Ohio EPA Interim Final RCRA Closure Guidance, September 1993

TABLE D-7 INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
SOIL INGESTION INTAKE
Intake (mg/kg-day) = (CS x IR x CF x FI x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	IR (mg/day)	CF (kg/mg)	FI (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	Intake (mg/kg-day) Noncarcinogens
Antimony	0.58	50	1.00E-06	1	250	25	70	9125	2.84E-07

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 0.58 mg/kg x 50 mg/day x 1E-06 kg/mg x 1 x 250 days/yr x 25 yrs / (70 kg x 9125 days)
Intake = 2.84E-07 mg/kg-day

TABLE D-8. INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
DERMAL CONTACT WITH CHEMICALS IN SOILS AND DUST
Absorbed Dose (mg/kg-day) = (CS x CF x SA x AF x ABS x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CF (kg/mg)	SA (cm^2/day)	AF (mg/cm^2)	ABS (unitless)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.58	1.00E-06	5000	1	**0.01**	250	25	70	9125	2.84E-07

Calculation (Antimony)

Noncarcinogen

Intake (mg/kg-day) = 0.58 mg/kg x 1 E-06 kg/mg x 5000 cm^2/day x 1 mg/cm^2 x 0.01 x 250 days/yr x 25 yrs / (70 kg x 9125 days)
Intake = 2.84E-07 mg/kg-day

ABS (Absorption Factor) is chemical specific

TABLE D-9. INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
INHALATION OF CHEMICALS IN FUGITIVE DUST
Intake (mg/kg-day) = (CA x IR x ET x EF x ED) / (BW x AT)

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) OUTDOOR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.83	8	250	25	70	9125	8.12E-12

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10mg/m^3 x 0.83 m^3/hr x 8 hr/day x 250 days/yr x 20 yrs / (70 kg x 9125 days)
OUTDOOR Intake = 8.12E-12 mg/kg-day

CONTAMINANT	CS (mg/kg)	CA (mg/m^3)	IR (m^3/hr)	ET (hrs/day) SHOWERIN	EF (days/yr)	ED (yrs)	BW (kg)	AT (days) Noncarcinogens	INTAKE (mg/kg-day) Noncarcinogens
Antimony	0.58	1.25E-10	0.6	0.2	250	25	70	9125	1.47E-13

CA (mg/m^3) = CS (mg/kg) X 1/PEF
* PEF = 4.63×10^9 m^3/kg

Calculation (Antimony)

Noncarcinogen
Intake (mg/kg-day) = 1.25E-10 mg/m^3 x 0.6 m^3/hr x 0.2 hr/day x 250 days/yr x 25 yrs / (70 kg x 9125 days)
SHOWERING Intake = 1.47E-13 mg/kg-day

TABLE D-10 INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
GROUNDWATER INGESTION INTAKE
Intake (mg/kg-day) = (CW x IR x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	IR (L/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	INTAKE (mg/kg-day)
Antimony	0.0095	2	250	25	70	9125	1.86E-04

CW= Concentration in water (mg/L) 95% UCL of mean TCLP leachate concentration

Noncarcinogen
Intake (mg/kg-day) = 9.5E-03 mg/L x 2 L/day x 250 days/yr x 25 yrs / (70 kg x 9125 days)
Intake = 1.86E-04 mg/kg-day

TABLE D-11. INTAKE VALUES FOR INDUSTRIAL LAND USE SCENARIO
GROUNDWATER DERMAL ABSORBED DOSE (SHOWERING)
INTAKE (mg/kg-day) = (CW x CF x SA x PC x ET x EF x ED) / (BW x AT)

CONTAMINANT	CW (mg/L)	CF (L/cm^3)	SA (cm^2)	PC (cm/hr)	ET (hrs/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Abs. Dose (mg/kg-day)
Antimony	0.0095	1.00E-03	20000	1.00E-03	0.2	250	25	70	9125	3.72E-07

CALCULATION

Noncarcinogen

Intake (mg/kg-day) = 9.5E-03 mg/L x 1.0E-03 L/cm^3 x 20,000 cm^2 x 1.0E-03 cm/hr x 0.2 hrs/day x 250 days/yr x 25 yrs/ (70 kg x 9125 days)
Intake = 3.72E-07 mg/kg-day

TABLE D-12. Summary of Total Risk
All Pathways
Burn Area

Scenario and Receptor	Media	Pathway	onCarcinogen Risk (Dose)	RfD***	HQ = HI	
Future Scenario Industrial Land Use	Soil	Ingestion	2.84E-07	4.0E-04	7.10E-04	B
		Dermal	2.84E-07	4.0E-04	7.10E-04	B
		Inhalation of Dust* (outdoor exposure)	8.12E-12	6.0E-05	1.35E-07	B
		SUBTOTAL	5.68E-07		1.42E-03	B
	Groundwater	Ingestion	1.86E-04	4.0E-04	4.65E-01	B
		Dermal	3.72E-07	4.0E-04	9.30E-04	B
		Inhalation (showering)	1.47E-13	6.0E-05	2.45E-09	B
		SUBTOTAL	1.86E-04		4.66E-01	B
		TOTAL	1.87E-04		**4.67E-01**	B

* exposure time = 8 hours
** exposure time =0.2 hours
***equals RfC (antimony trioxide) for airborne intake
HI = Hazard Index

B = Below EPA target risk levels (HI<1)

Appendix E

References

References

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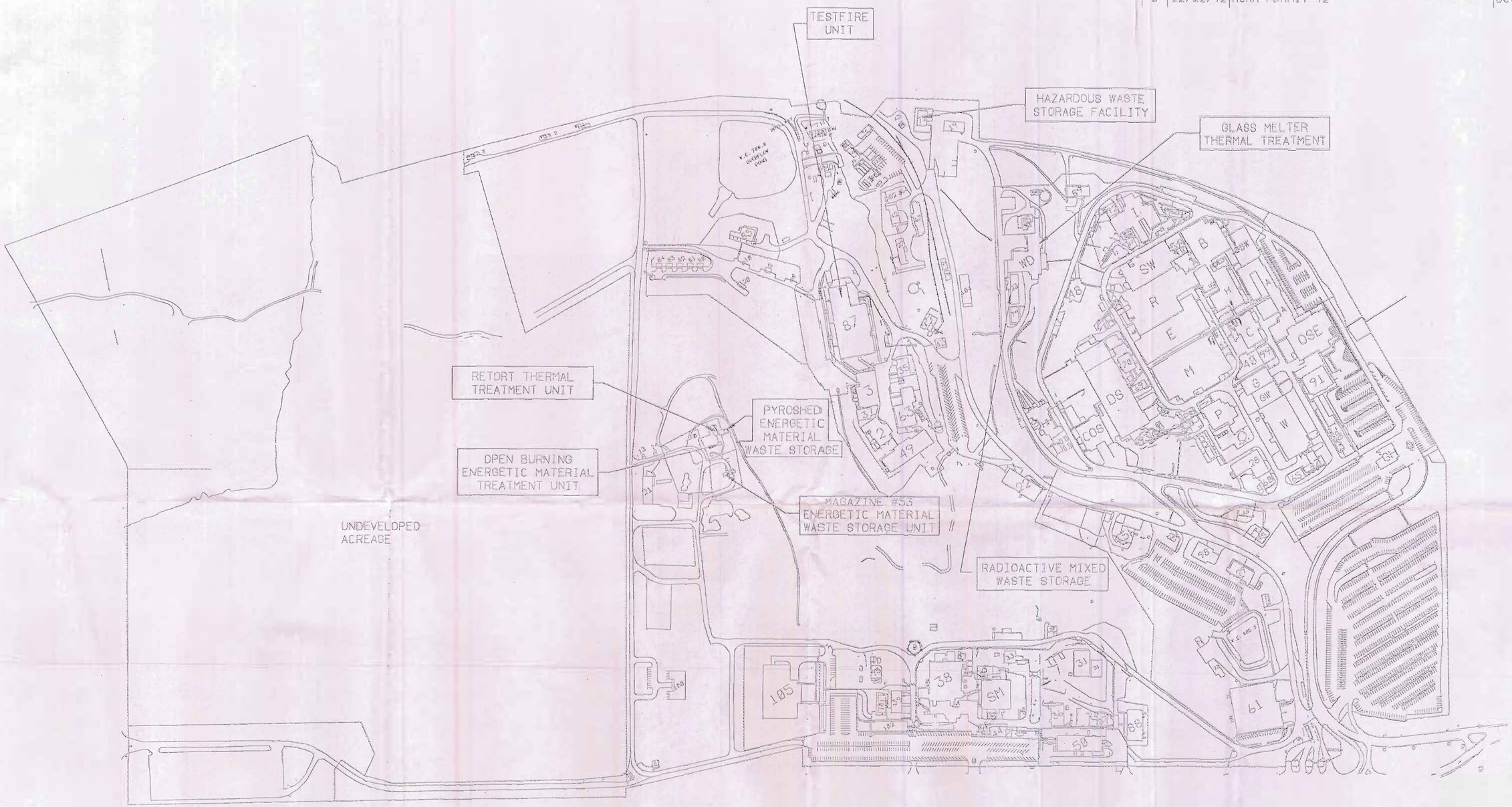
ISS	DATE	REVISION	BY	CHKR	ENG	LPAEC	APVD	M
Ø	12/22/92	RCRA PERMIT-92	DCW				DVD	



NO. REQD	DESCRIPTION/MATERIAL	ITEM

SHEET	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
ISSUE																					

SHEET	1	2	3	4	5	6
ISSUE	Ø					

PART CLASSIFICATION

TITLE (U) TITLE CLASSIFICATION

CURRENT HAZARDOUS WASTE MANAGEMENT FACILITIES

DRAWING CLASSIFICATION	SIZE	DRAWING NUMBER	JOB NUMBER
UNCLASSIFIED	D	FSD92Ø925	12402

DWG TYPE	PROM	ENGC	SCALE	SHEET
STE	RCRA	14065	1/200	1 OF 1

STATUS MD-REL-12/22/92 ORIGIN MD-BR3-V3.0

APPROVALS: DATE:
SAFETY COMMITTEE REQUIRED:
___NONE ___TRUESOC ___TESOC ___EMSOC
TECH. RESP. _____ _____
SR. MGR. _____ _____
TRUESOC _____ _____
TESOC _____ _____
EMSOC _____ _____

DESIGN ENG	PROJ MGR
SPONS	ENG SUPV
LP & SC	PEER REV
ENG MGR	
APVD	DATE

NO REQD	DESCRIPTION/MATERIAL	ITEM

SHEET	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
ISSUE																					
SHEET	1	2	3	4	5	6															
ISSUE	0																				

TITLE (U) TITLE CLASSIFICATION

TOPOGRAPHIC MAP OF MOUND SHOWING WATER AND LAND USES AROUND SITE

PART CLASSIFICATION

DESIGN ENG	PROJ MGR
SPONS	ENG SUPV
LP & EC	PEER REV
ENG MGR	
APVD	DATE

DRAWING CLASSIFICATION	SIZE	DRAWING NUMBER	JOB NUMBER
UNCLASSIFIED	E	FSE 920963	12402
		FSCM 14065 SCALE GRAPHIC	SHEET 1 OF 1
STATUS MD-REL-12-22-92		ORIGIN	