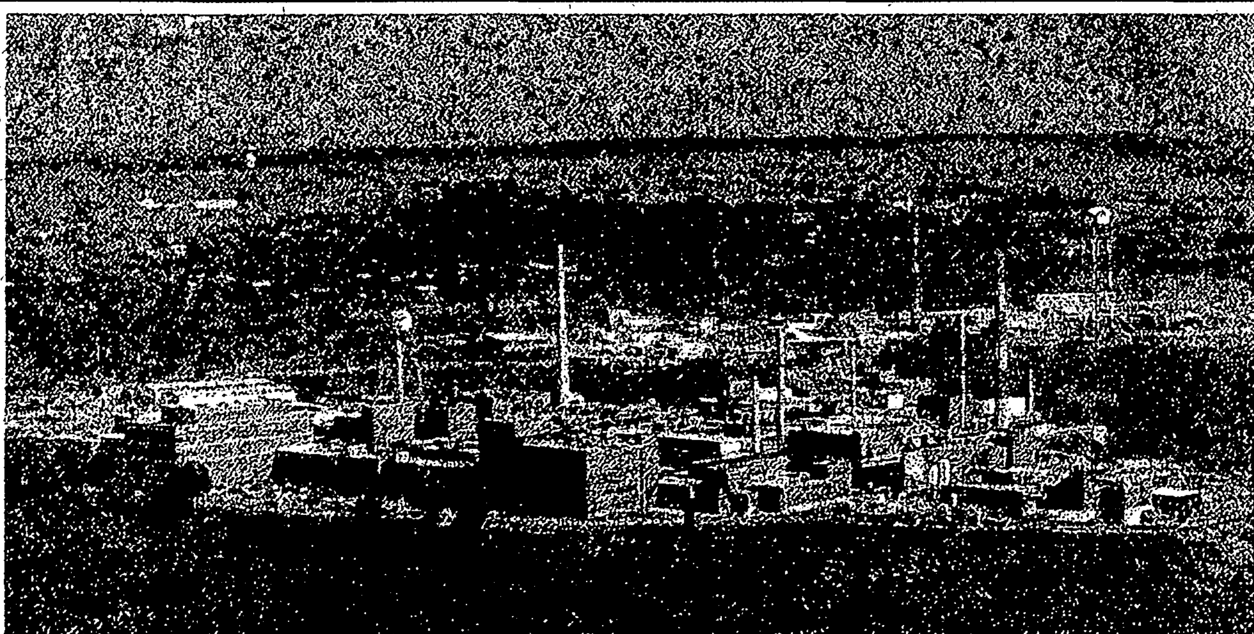
3001-0302180006

MOUND

Environmental
Restoration
Program

OhioEPA

MOUND PLANT
Potential Release Site Package
PRS #434, 435, 436



PRS 434, 435, 436

REV	DESCRIPTION	DATE
WORKING DRAFT		**August 10, 2000**
DRAFT	DOE adjustments incorporated. Binned Response Action (RA) required on 9/18/00.	**August 17, 2000**
DRAFT PROPOSED FINAL	Recommendation page signed and incorporated. Binning comments and OEPA comments addressed and incorporated. Distribution approval: 10/10/00.	**October 10, 2000**
PUBLIC REVIEW DRAFT	Public Review Period: 11/8/2000 – 12/11/2000	**November 1, 2000**
FINAL	Public review complete. MMCIC comments and Core Team responses incorporated into document.	**January 17, 2001**

MOUND

Environmental Restoration Program

MOUND PLANT POTENTIAL RELEASE SITE DATA PACKAGE

Notice of Public Review Period

The following Potential Release Site (PRS) Data Packages are available for public review in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio. Public comment on these documents will be accepted November 8, 2000 through December 11, 2000.

Potential Release Site 429, 430, 431, 432, 433: Main Hill Underground Lines (North Side of Bldg. T to Manhole 8)
Potential Release Site 434, 435, 436: Main Hill Underground Lines (South Side of Bldg. T to Manhole 8)

Questions can be referred to Paul Lucas at (937) 865-4578.

The Mound Core Team
P.O. Box 66
Miamisburg, Ohio 45343-0066

Mr. Daniel Bird, AICP
Planning Manager
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bird:

The Core Team, consisting of the U.S. Department of Energy Miamisburg Environmental Management Project (DOE-MEMP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comments on the PRSs 434, 435, and 436. Attached are our responses.

Should the responses to comments require additional detail, please contact Rob Rothman at (937) 865-3597 and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MEMP: ______________________
Robert S. Rothman, Remedial Project Manager

USEPA ______________________
Timothy J. Fischer, Remedial Project Manager

OEPA ______________________
Brian K. Nickel, Project Manager

Response to MMCIC Comments on the PRSs 434, 435, and 436Data Package Public Review Draft November 1, 2000

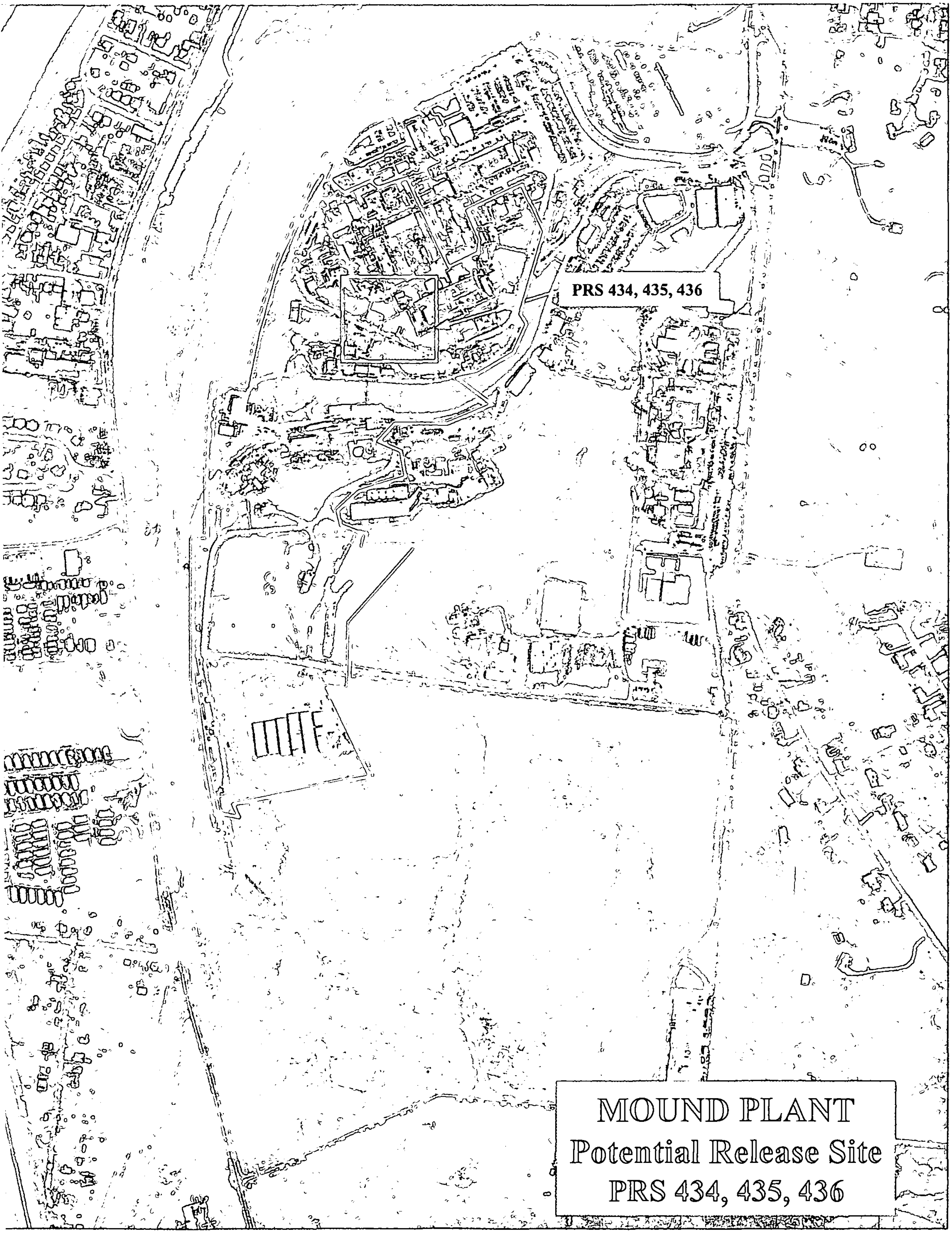
Substantive Comment

1. MMCIC agrees that a response action is warranted for PRS 434, 435, and 436.

2. Since most of the underground line segments referred to as PRS 434 to 436 exist beneath Building DS, which is occupied in part by MATC tenants, MMCIC requests that DOE/BWXTO notify and work with the MMCIC Facility Manager and the Mound Parking and Circulation Committee to coordinate MATC tenants access to office areas with Building DS and to current alternative parking areas behind Building DS during the PRS 434 to 436 response action.

Response:

DOE/MEMP and BWXTO will notify and work with the organization noted to coordinate the subject tenant access and parking requirements during the response action.


PRS 434, 435, 436
MOUND PLANT
Potential Release Site
PRS 434, 435, 436

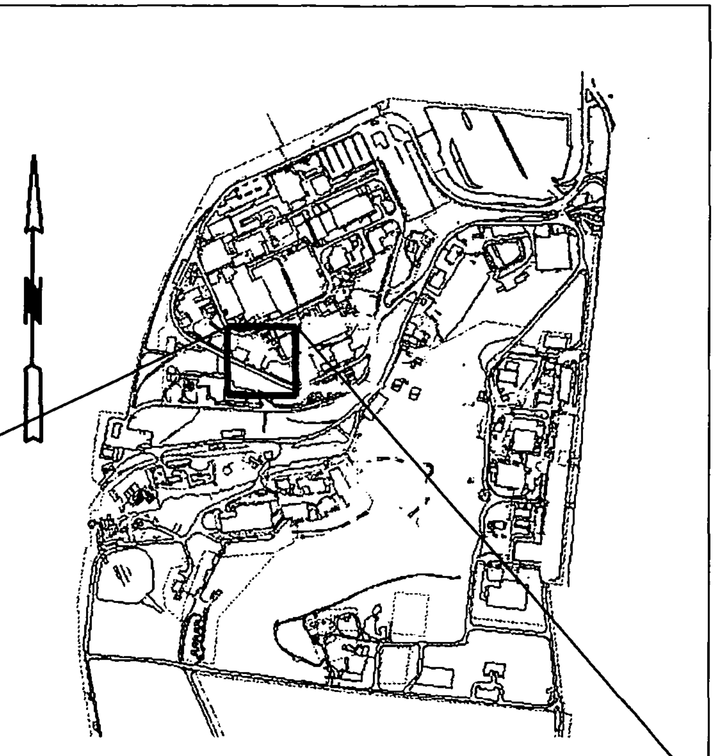
Mound Plant

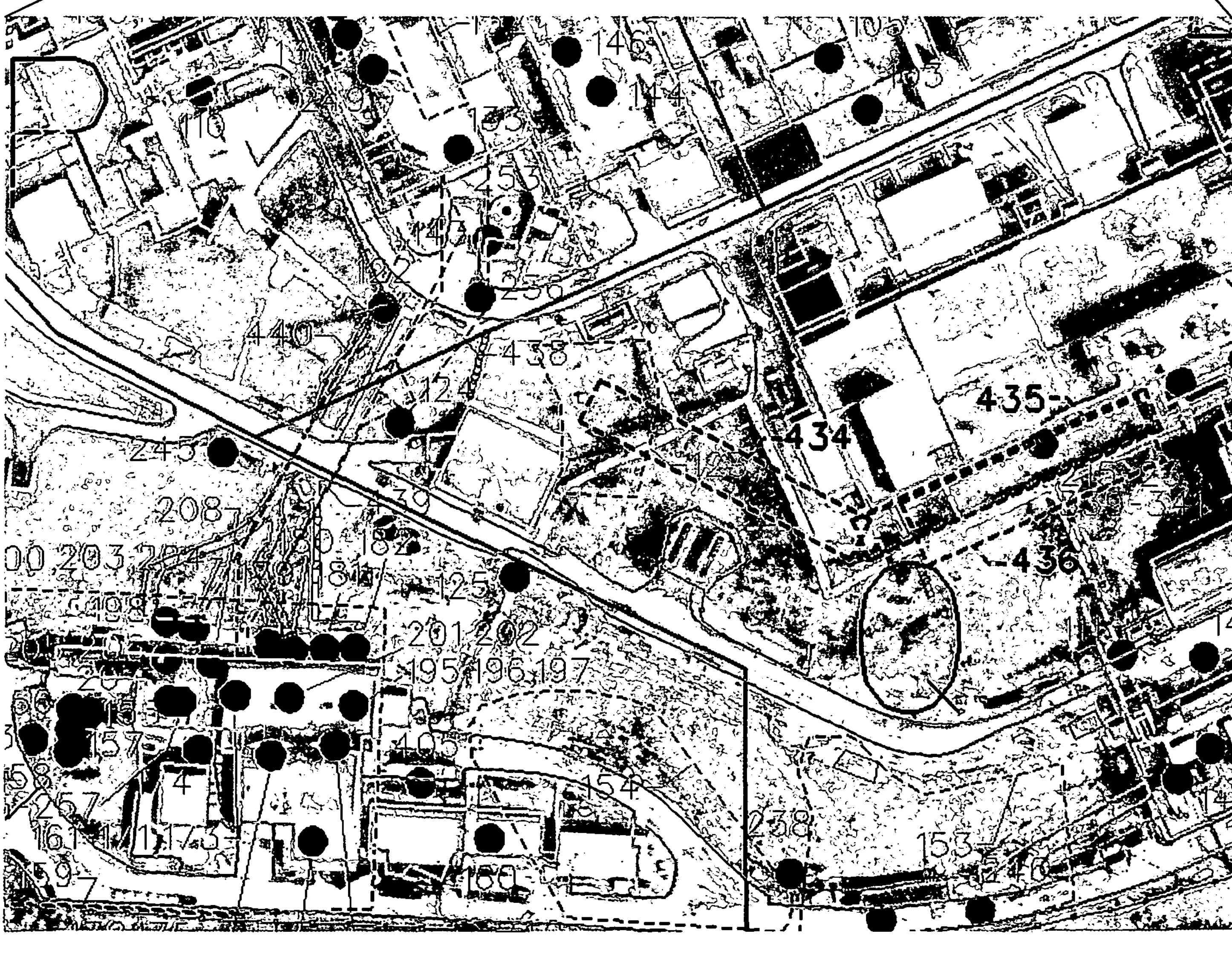
PRS 434, 435, 436

Main Hill Underground Lines:

South Side of Bldg. T to Manhole 8

On the map below:
- PRS number and location shown in black
- Fencing shown in red
- Elevation contours shown in brown
- Other PRS's shown in blue





PRS 434, 435, 436

PRS HISTORY:

A large portion of Mound Plant Main Hill Underground Waste Lines (Underground Lines/UGLys) were originally grouped as one Potential Release Site, PRS 122. The document, Operable Unit 9 Site Scoping Report: Volume 12 - Site Summary Report (Reference A), defines PRS 122 to include waste lines from B, H, R, and SW Buildings. The Core Team evaluation of DS Building assigned the same PRS number to waste lines associated with T Building operations.

In preparation for review and binning of PRS 122, it became obvious that the grouping of almost 4000 feet of such line under one PRS was not the most opportune position from which to begin the evaluation process. It was decided that the UGLys could be better studied and remediation decisions made if the lines were defined to exist in segments. PRS 122 was segmented into PRSs 423 through 440.

PRSs 434, 435, and.436 identify one group of UGLy segments associated with T Building operations.

BACKGROUND:

Potential Release Sites (PRSs) 434, 435, and 436 identify Underground Line segments that served to carry radioactively contaminated wastes from T Building operations enroute through other UGLy segments (PRSs) to the Waste Disposal (WD) Building. Note Figure A and introductory graphics. These wastes, from operations in the first floor of T Building, were directed to sumps that discharged the wastes through building lines to the subject PRSs. The T Building sumps and building drain lines are addressed by other Potential Release Sites (PRSs 215-233, 339-341), not the subject of this Data Package other than the contaminants carried.

PRSs 434, 435, and 436 carried wastes fed to the southern boundary wall of T Building. PRS 436 consists of 7 vertical pipes or risers that carried the waste up from the first floor of T Building to the PRS 435 segment of the UGLys. PRS 435 carried the waste westward to PRS 434. PRS 434 also carried the waste westward where it emptied into UGLy segment PRS 429.. Reference B provides physical description of the subject Potential Release Sites.

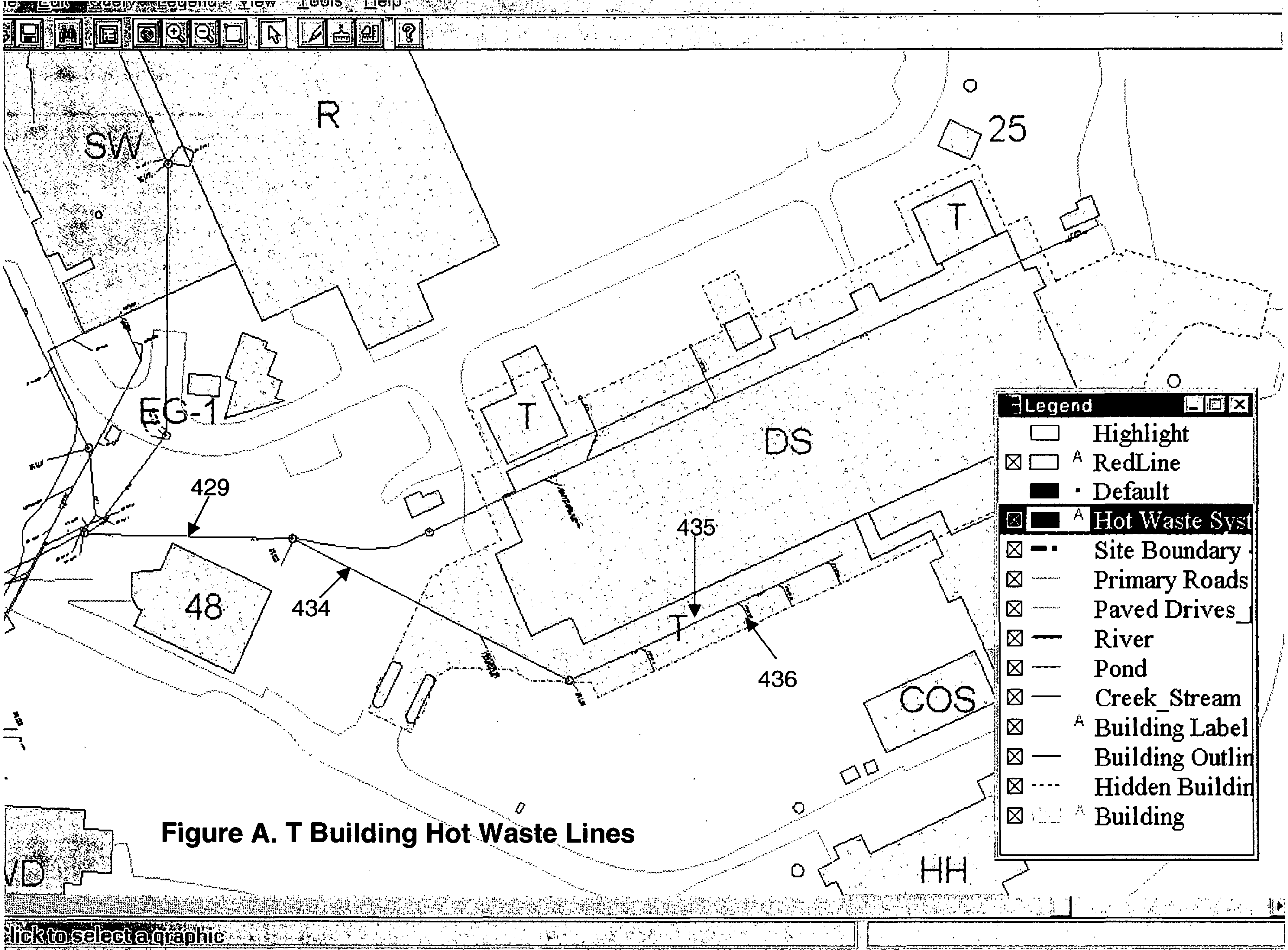


Figure A. T Building Hot Waste Lines

CONTAMINATION:

The operations and materials employed in T Building facilities provide insight into the contaminants potentially resident in UGLy PRSs 434, 435, and 436. See Reference C. A briefing presentation given by BWXT of Ohio Soils Project personnel indicates that Cobalt 60 and Cesium 137 are the primary contaminants of concern. Bismuth-210m and the now decayed Polonium 210 were also noted. See Reference D and again Reference B (introduction /distribution).

In late 1996 a robotics survey was conducted within PRS 434, 435, and 436. The intent of the survey was to note physical and radiological conditions in the underground lines. See Reference E, *Results of Radiological and Video Surveys of Drain Lines At The US DOE Mound Facility With The Pipe Explorer ™ System*, January 1997 (Excerpt). Figure 1 of Reference E (the Survey) indicates that survey Run #1 and Run #2 included PRSs 435 and 434 respectively. This figure is also presented below as Figure B. Reference Cobalt 60, results from the Survey are presented below as Figures C and D.

In part the Survey concludes that: "In general, the measurement results were other than expected. The initial belief was that these drain lines would exhibit little, if any, residual Co-60 contamination. The data show quite the contrary. Every line surveyed exhibited substantial amounts of residual Co-60 contamination."

Further insight into contamination potentially resident in PRSs 434, 435, and 436 can be gleaned by review of sampling conducted at PRS 123 - *Area 5, Radioactive Waste Line Break*. This is in the area to the west of PRS 434 that contains the UGLy segment PRS 429. Table A below displays GIS provided sampling/contamination information for PRS 123. See Reference F.

Table A: PRS 123 GIS Sampling/Contamination Information

Contaminant	Maximum Concentration Detected	Guideline Criteria (10^{-6})	Background Value
Cobalt-60	250 pCi/g	0.10 pCi/g	NA
Thorium-232+D	12.60 pCi/g	0.11 pCi/g	1.4 pCi/g
Cesium-137+D	1.60 pCi/g	0.46 pCi/g	0.42 pCi/g
Plutonium-238	225 pCi/g	5.5 pCi/g	0.13 pCi/g

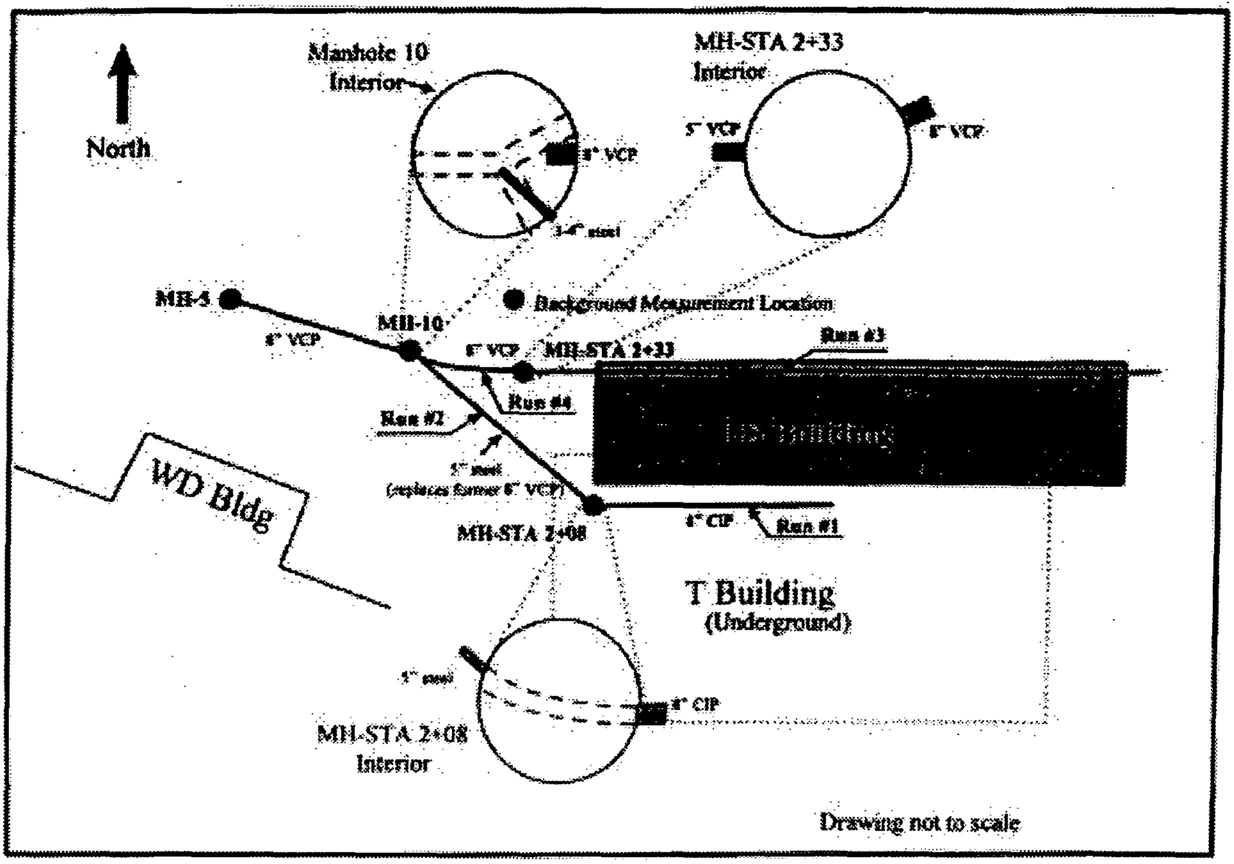


Figure B. Sketch of the pipe segments surveyed showing the access manholes and rum numbers.

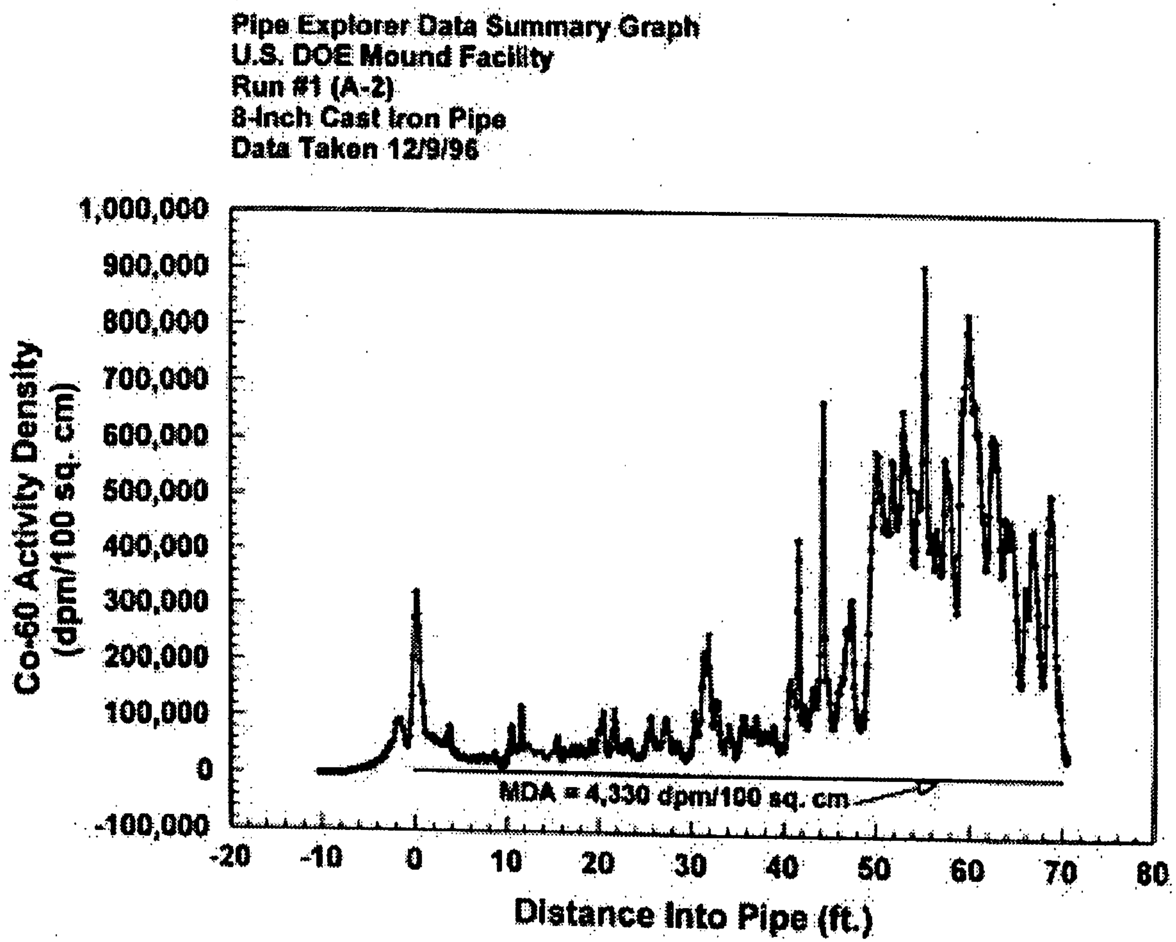


Figure C. Pipe Explorer Data Summary Graph

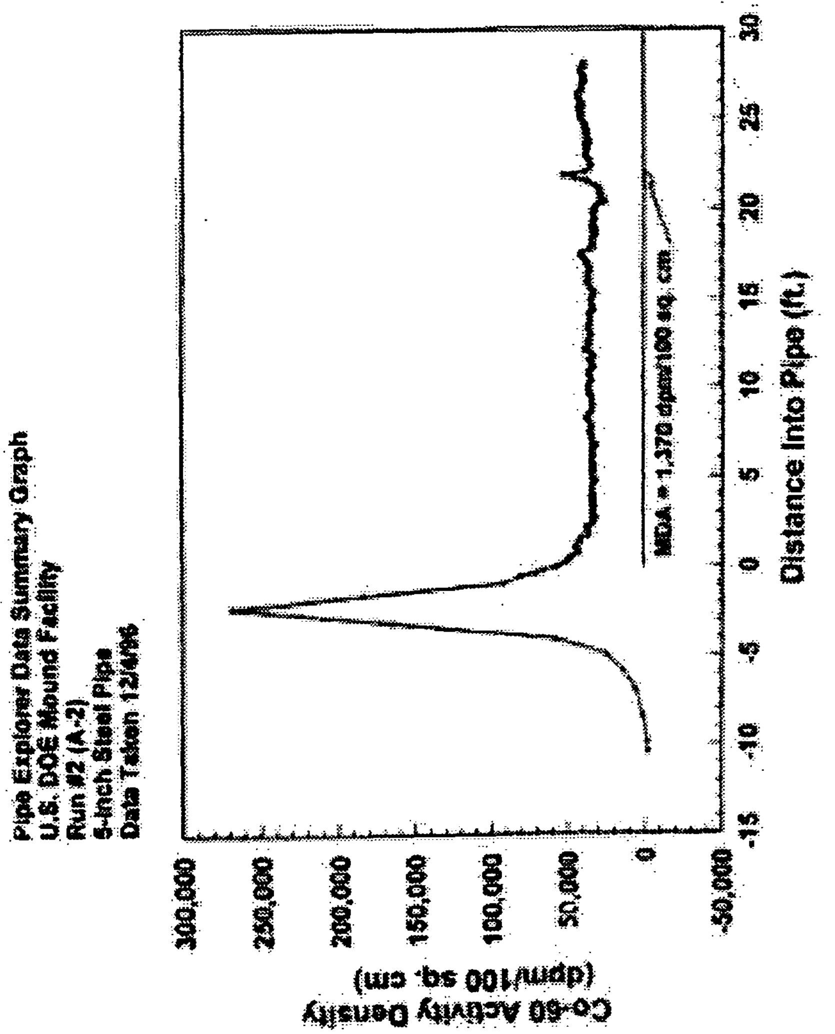


Figure D. Pip Explorer Data Summary Graph

READING ROOM REFERENCES:

A) *Operable Unit 9 Site Scoping Report: Volume 12 - Site Summary Report* (Excerpt)

C) *Mound Technical Manual, MD-22153, Issue 2, Mound Site Radionuclides By Location* (Excerpt)

E) *Results of Radiological and Video Surveys of Drain Lines At The US DOE Mound Facility With The Pipe Explorer ™ System, January 1997* (Excerpt)

G) *Operable Unit 9 Site Scoping Report: Volume 7 - Waste Management* (not attached)

OTHER REFERENCES:

B) Cost Estimate Assumptions and Ground Rules, B&W Services, Inc. (Excerpt)

D) Technical Presentation, Main Hill Underground Lines, PRS 122-124, Preview of the PRS Package (Excerpt)

F) GIS Sampling and Contamination Information, PRS 123

PREPARED BY:

Joseph C. Geneczko, BWXT of Ohio Technical Staff
Karen M. Arthur, BWXT of Ohio Soils Project Engineer

MOUND PLANT
PRS #434, 435, 436

RECOMMENDATION:

PRSs 434, 435 and 436 were identified because the underground line segments carried radioactively contaminated effluent from T Building operations to the Waste Disposal building (WD). Several radionuclides (including Cobalt-60) are present in the waste lines at a greater than 1 in 10,000 (10^{-4}) risk level.

Therefore, a RESPONSE ACTION is recommended for PRSs 434, 435, & 436.

CONCURRENCE:

DOE/MEMP: [signature] 9/18/00
Robert S. Rothman, Remedial Project Manager (date)

USEPA: [signature] 9/18/00
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: [signature] 9/18/00
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 11/08/2000 to 12/11/2000

☐ No comments were received during the comment period.

☒ Comment responses can be found ~~on page~~ at beginning of this package.

R

REFERENCE MATERIAL FOR PRSs 434, 435, 436

434 –

Reference A

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 9
SITE SCOPING REPORT:
VOLUME 12 - SITE SUMMARY REPORT

MOUND PLANT
MIAMISBURG, OHIO

December 1994

U.S. DEPARTMENT OF ENERGY
OHIO FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

FINAL

CONTENTS

FIGURES

TABLES

ACRONYMS

AEA	Atomic Energy Act of 1954
AL	U. S. Department of Energy Albuquerque Operations Office
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
AUST	active underground storage tank
CAA	Clean Air Act
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-To-Know Act of 1986 (also known as SARA Title III)
ER	Environmental Restoration (Program)
FFA	Federal Facility Agreement
FS	feasibility study
HRS	Hazard Ranking System, CERCLA
HSWA	Hazardous and Solid Waste Amendments of 1984
HWMU	hazardous waste management unit
LFI	limited field investigation
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFA	no further action
NPDES	National Pollutants Discharge Elimination System
NPL	National Priorities List
OEPA	Ohio Environmental Protection Agency
PA	preliminary assessment
PBR	permit by rule
POTW	publicly owned treatment works
PR	preliminary review
PRS	potential release site
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SI	site inspection
SMCL	secondary maximum contaminant level
SWMU	solid waste management unit
UIC	underground injection control
UST	underground storage tank
VOC	volatile organic compound
VSI	visual site inspection
WHP	Well Head Protection (program)

ACKNOWLEDGMENTS

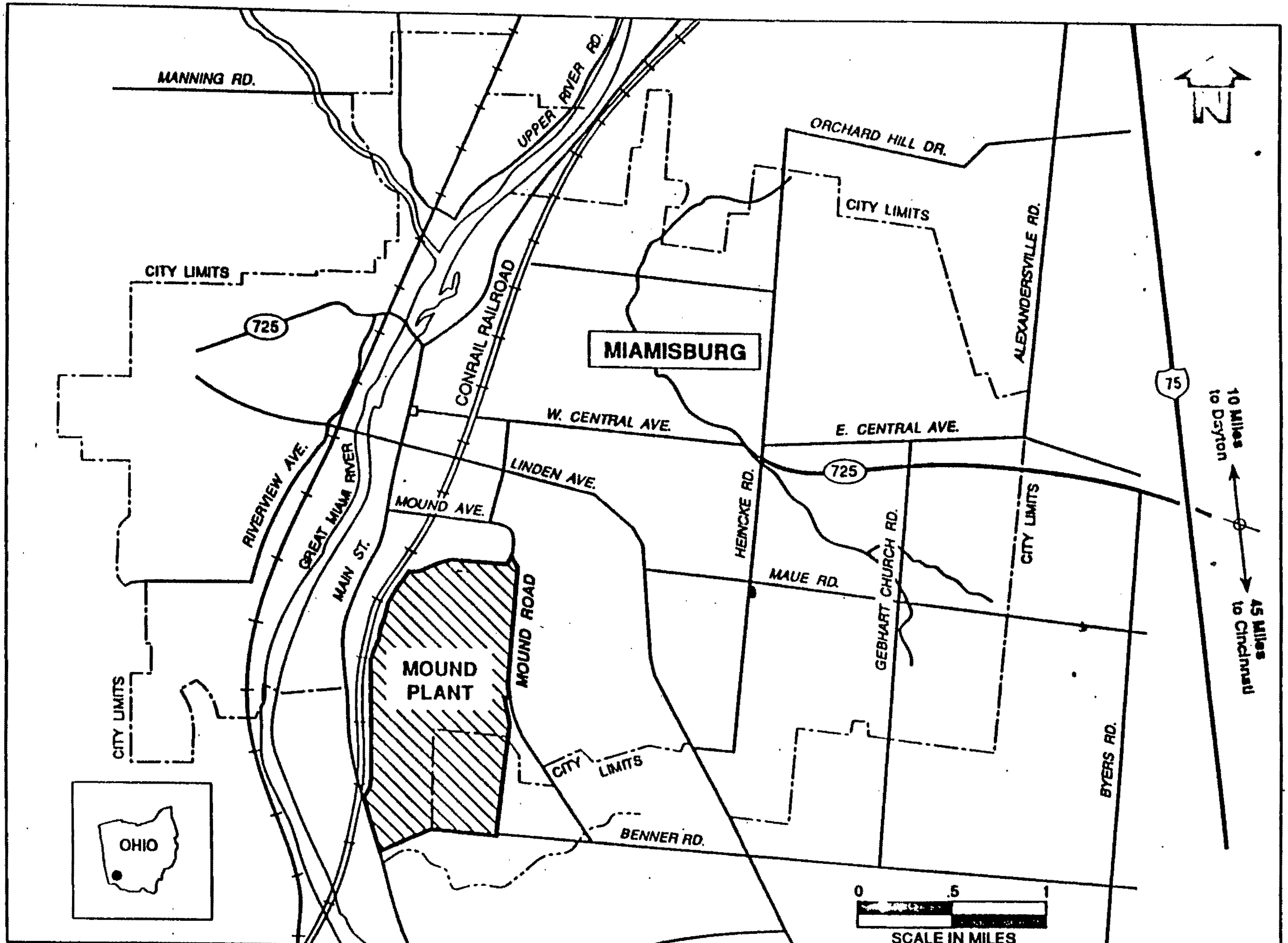
This report was prepared by Roy. F. Weston, Inc., Albuquerque, New Mexico, under Basic Ordering Agreement 24251 with EG&G Mound Applied Technologies, Miamisburg, Ohio. The principal authors of this document were Bill Criswell and Kris Anderson. Members of the report team included Michael Byrd, Frank Kabot, Paul Darr, and Randy Gabriel. Senior review was provided by John Price and Joan Dunn. Graphics, technical editing, and word processing were provided by the Albuquerque office. Special acknowledgment is given to EG&G Mound Applied Technologies personnel who contributed information regarding status of sites and schedules of operation including Dan Carfagno, Larry Klingler, Carol Anderson, Billy Farmer, and Bill Davis; Dennis Gault provided a thorough review of the map and Tables A.1 and A.2. Dick Neff of the Dayton Area Office provided a thorough review of technical content and policy descriptions. This report was revised in response to comments by EPA and Ohio EPA.

1. INTRODUCTION

The U.S. Department of Energy (DOE) Mound Plant, Miamisburg, Ohio (Figure 1.1), was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund) National Priorities List (NPL) on November 21, 1989 (54 Federal Register 48184). The placement of the Mound Plant on the NPL occurred as a consequence of historic disposal practices and releases of contaminants to the environment. The Mound Plant received an overall Hazard Ranking System (HRS) score of 34.61, which exceeded the threshold (28.51) for NPL listing (40 CFR 300, Appendix A). Pursuant to its NPL status, the DOE signed a CERCLA Section 120 Federal Facility Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) that became effective October 11, 1990 (Administrative Docket #VW-'90-C-075). The Ohio EPA (OEPA) became a signatory to the agreement in July 1993. The terms of the FFA require that the DOE develop and implement remedial investigations (RIs) and feasibility studies (FSs) and conduct interim remedial actions in order to ensure that environmental impacts associated with past and present activities at the site are thoroughly investigated and appropriate action is taken to protect the public health, welfare, and the environment.

The DOE Albuquerque Operations Office (AL) established the Environmental Restoration (ER) Program in 1984 to collect and assess environmental data in order to develop a conceptual site model, to assess both the nature and extent of contamination, and to identify potential exposure pathways and potential human and environmental receptors. In order to provide the EPA with sufficient information and data gathered during these previous investigations, a multivolume scoping report, providing background information, has been prepared. The Site Scoping Report provides descriptions and summaries of the current conditions and characteristics of Mound Plant and consists of the following volumes:

1. Groundwater Data: February 1987 - July 1990 with Addendum
2. Geologic Log and Well Information Report
2. Addendum - Stratigraphic and Lithologic Logs
3. Radiological Site Survey
4. Engineering Map Series
5. Topographic Map Series
6. Photo History
7. Waste Management
8. Environmental Monitoring Data
8. Addendum - Vegetation and Foodstuff
9. Annotated Bibliography
10. Permits and Enforcement Actions
11. Spills and Response Actions
12. Site Summary Report



Mound location map/7-26-93

Figure 1.1. Location of Mound Plant, Miamisburg, Ohio.

1.1. SCOPE OF REPORT

This report is intended as a summary document to complete the Site scoping process for Mound Plant as described in Section 1 of Attachment 1 to the FFA. It includes 1) summaries of the previous 11 volumes of the scoping report; 2) a comprehensive summary of the potential release sites identified through the scoping process, including summaries of whether releases are known and the environmental data available for each site; 3) identification of the regulated units and the regulatory authorities responsible for operation, contaminant release, and spill response and closure; 4) recommendations of potential release sites that require no further action; and 5) a review of the Site conceptual model. Plate 1 provides a map of the Site and the potential release sites. References to other documents that contain background information, Site characteristics, or data that may assist in assessing the known or suspected nature and extent of contamination, and potential exposure pathways and potential human and environmental receptors are provided as appropriate.

The term potential release site (PRS) is an informal term not defined by regulation or the FFA. The term is defined, for the purposes of this report, as a potential area of concern in which knowledge of historic or current use indicates that the site may be considered a solid waste management unit (SWMU) or has been identified as an area with potential releases of concern. This definition is consistent with informal terminology used in the FFA and the Resource Conservation and Recovery Act (RCRA) Facility Assessment Guidance (EPA 1986).

The identification of a PRS in this report does not necessarily mean that the site poses a threat to human health or the environment. The tabulation of data for all PRSs simply provides an explicit means of identifying and evaluating all potential releases of concern, the need for further action and the identification of the authority responsible for action. Recommendations for no further action for those PRSs that pose no threat to human health or the environment are included in this report. In accordance with the FFA, the decision for no further action will be documented in subsequent RI/FS work plans or other documents, as appropriate.

Section 2 of this report describes a comprehensive tabulation of potential release sites (Appendix A). This tabulation is compiled from the list of scoping documents and reports of other response actions. Summaries of the PRS identification processes are included. To facilitate cross-reference and identification, each PRS is numbered and the numbers are used on Plate 1 for site location.

Section 3 of this report discusses the interaction of appropriate responses of the Mound Plant FFA and other regulatory entities. As the Mound Plant is an operational facility, many PRSs are currently active and operational. Many are regulated under the RCRA, the Clean Water Act (CWA) or the Clean Air Act

(CAA). Mound Plant, however, conducts its routine operations under the Atomic Energy Act of 1954 (AEA). One of the goals of this report is to ensure that all PRSs are properly evaluated for their inclusion or omission from the ER Program.

1.2. OVERVIEW OF MOUND PLANT SCOPING PROCESS

Prior to signing the FFA, the DOE collected and interpreted data to develop a Site conceptual model to assess both the nature and extent of contamination and to identify potential exposure pathways and potential human and environmental receptors. The multivolume scoping report, compiled under the guidance of the FFA Statement of Work, provides descriptions and summaries of current conditions and characteristics of the Mound Plant Site. The volumes are arranged to provide a systematic data set as follows:

- Volume 1 Groundwater Data: February 1987 - July 1990 (Final February 1992). Provides a tabulation of laboratory reports of groundwater sample analyses from ER Program monitoring wells, plant supply wells and groundwater seeps collected from February 1987 to July 1990, before the FFA became effective.

- Volume 2 Geologic Log and Well Information Report (Final May 1992). Provides a location map, and construction and borehole lithology details for monitoring and production wells on and adjacent to Mound Plant that have been used to collect environmental samples. Selected residential and municipal wells are also included where appropriate.

- Volume 2 Addendum Stratigraphic and Lithologic Logs (Final June 1992). Provides stratigraphic and lithologic information including borehole logs and borehole location maps compiled from plant engineering, planning, and foundation studies and contaminant infiltration and movement investigations.

- Volume 3 Radiological Site Survey (Final June 1993). Provides a summary and tabulation of available radiological data collected at Mound Plant with emphasis on the extensive radiological characterization investigation conducted by Mound Plant during the Site Survey Project (Stought et al. 1988).

- Volume 4 Engineering Map Series (Final February 1992). Provides a series of engineering maps of the Site, including plant utilities, potable water and condensate cooling lines, process piping and tanks, municipal utilities adjacent to the plant, surrounding land uses and easements, adjacent property owners, and copies of the boundary survey conducted in 1982. All maps were reproduced at a scale of 1 inch = 200 ft and use the Ohio State Plane coordinate system.

- Volume 5 Topographic Map Series (Final February 1992). Provides a series of topographic maps of the Mound Plant and adjacent areas, including a topographic map with 2-ft contours, a map of surface water features, a digitized topographic map of the northern part of the site before the plant was constructed in 1946, and a contour map with 10-ft contours that estimates the amounts of cut and fill performed from 1946 to 1986, principally along the plant drainage ditch. All maps were reproduced at a scale of 1 inch = 200 ft and use the Ohio State Plane coordinate system.

- Volume 6 Photo History Report (Final February 1992). Provides a series of interpretive maps compiled from historical aerial photos of Mound Plant that span the years 1959 to 1981. Maps of the upper and lower valley areas were compiled for 1959, 1964, 1968, 1973, 1975, 1979, and 1981, as these areas were known to have been used for waste disposal and experienced significant changes in morphology and terrain elevation.

- Volume 7 Waste Management Report (Final February 1993). Provides a description of the history of ownership and operation of the plant with emphasis on the generation, treatment, storage, and disposal of hazardous wastes through the perspective of the major programs and projects at the plant. Also provides a summary list of the hazardous substances generated through process information. This tabulation was used to compile the list of analytical parameters for the Operable Unit 9 RI/FS (DOE 1993a).

- Volume 8 Environmental Monitoring Data: 1976-1989 (Final February 1992). Provides summaries and tabulations of environmental sampling conducted by Mound Plant as part of the ongoing environmental surveillance program, the Potable Water Standards Project (Dames and Moore 1976a,b) and the Plutonium Soil Inventory Program (MRC 1977). Analytical data included tritium, plutonium-238, uranium-233, uranium-234, and uranium-238 in surface water and silt samples collected from the Great Miami River from 1974 to 1989, tritium in groundwater from the Buried Valley aquifer from 1975 to 1990, and plutonium-238 in regional soils measured in 1977.

- Volume 8 Addendum Vegetation and Foodstuff (Draft March 1994). Provides summary of analytical data on tritium and plutonium-238 concentrations in vegetation (grass) and foodstuff (fish, vegetables and milk) for the years 1972 to 1991. Data was collected and reported as part of the Mound Plant environmental monitoring and surveillance program required by DOE.

- Volume 9 Annotated Bibliography (Final February 1993). Provides an annotated list of reports prepared for the Site prior to the signing of the FFA. The bibliography includes reports prepared by government agencies, subcontractors, scientific journal articles, and maps and drawings that may be relevant to the preparation of the RI/FS. Reports published or compiled since the effective date of the FFA are beyond the scope of Volume 9.

- Volume 10 Permits and Enforcement Actions (Final May 1992). Provides a summary of past and present permits and registrations requested and received by Mound Plant, as well as a summary of enforcement actions. As a government-owned, contractor-operated facility, Mound Plant must operate not only in compliance with Executive Orders and Orders of the DOE, but also with federal and state statutes and regulations, and corporate policies. This report includes only those activities relating to compliance with federal, state, and county environmental regulations and statutes. Conditions of discharges and other permit limitations were beyond the scope of the report. Copies of permits of interest were copied in the appendix of the report.

- Volume 11 Spills and Response Actions (Final March 1992). Provides summaries of past product and hazardous substance spills, including amounts and locations and the response actions conducted. Data were compiled from records and incident reports of the Mound Plant safety office. Limited data were also available from the health physics office. Only incidents that resulted in a spill or an environmental release are included in this report. Laboratory and tabletop accidents, releases that were entirely contained within buildings, and personal injuries and radiation or hazardous substance exposures that did not apparently result in an environmental release were beyond the scope of this report. Summaries of response actions conducted by the EPA and OEPA are also included.

Description of History and Nature of Waste Handling						Hazardous Conditions and Incidents			Environmental Data		
No.	Site Name	Location	Status	Potential Hazardous Substances	Ref	Releases	Media	Ref	Analytes[a]	Results	Ref
118	M Building Soils	E-7	Grounds	Copper cyanide, Silver cyanide Machine oils, Solvents	4	Oils, Copper cyanide, Silver cyanide	S	10	1 14	SGS[b] Table B.4 Locations 1050, 1051, 1062 Table B.9 RSS[c] Locations S0162, S0163, S0252 (Appendix E in Ref. 6)	12 6
119	Room M-38 Metal Plating Rinse Water Sump (Tank 225)	E-7	Surplus	Rinse waters from metal plating operations. Possible contaminants include nickel, cadmium, silver, gold, manganese, cyanide, and aluminum. Sodium hydroxide solution Potassium permanganate	3, 4	None Suspected			No Data		
120	Room M-108 Metal Plating Rinse Water Tank (Tank 119)	E-7	In service	Rinse waters from metal plating operations. copper, gold, silver, nickel, aluminum, and uranium	3, 4	Silver cyanide	SW	10	No Data		
121	Vapor Degreasers	E-7	In service	Perclene D (perchloroethylene)	4, 5, 18	None Suspected			No Data		
122	Underground Radioactive Waste Lines (Main Hill)	E-6 F-6	Inactive	Alpha wastes from SW Bldg., R Bldg., and H Bldg. Wastewater from B Building Plutonium-238, Cobalt-60	4, 18	Suspected	S	4, 10	No Data		
123	Area 5, Radioactive Waste Line Break	F-6 F-7	Grounds	Cobalt-60, Cesium-137, Plutonium-238	1, 5, 18	Cobalt-60	S	1, 18	2, 14, 16	Table B.1 (Table III.3 in Ref. 6)	6
124	Building 48 Hillside	F-6	Inactive	Plutonium-238		Plutonium-238	S	6	14	Table B.1	6
125	Underground Sanitary Sewer Line G24	F-6	In service	Organic solvents, Plating Solutions, Laboratory chemicals, Nitric acid, Hydrochloric acid, Methylene chloride, Strong acids and bases		Suspected	S	5, 18	3, 4, 5, 6, 14, 16	Tables B.6, B.7, and B.8	7
126	Building 28 Solvent Storage Area	E-8	Grounds	Organic solvents (including alcohol, methylene chloride, and acetone)	4, 5, 9, 18	Suspected	S	4	1	SGS[b] Table B.4 Location 1054	12

Description of History and Nature of Waste Handling						Hazardous Conditions and Incidents			Environmental Data		
No.	Site Name	Location	Status	Potential Hazardous Substances	Ref	Releases	Media	Ref	Analytes[a]	Results	Ref
127	Building 28 Solvent Storage Shed	E-8	In Service	Organic solvents (including alcohol, methylene chloride, and acetone)	4, 5, 18	Suspected	S	4	1	SGS[b] Table B.4 Locations 1190 and 1231	12
128	DS Building Solvent Storage Shed	F-7	In service	Organic solvents (including 1,1,1-trichloroethane, trichlorofluoromethane, ethanol, and trichloroethane)	4, 5, 18	Suspected	S	4	1 14	SGS[b] Table B.4 Location 1194 No Hits Table B.9 RSS[c] Location S0128 (Appendix E in Ref. 6)	12 6
129	B Building Solvent Storage Shed	E-6	Inactive	Organic solvents (including trichloroethene, trichlorofluoromentane, ethanol, methonal, isopropanol, acetone, methylene chloride, toluelene) Oils	4, 5, 18	Suspected	S	4	1 14	SGS[b] Table B.4 Locations 1202, 1203 Table B.9 RSS[c] Location S0146 (Appendix E in Ref. 6)	12 6
130	B Building Temporary Drum Storage Area	E-6	Inactive	Waste solvents, waste oil, and trash from E and B Bldgs.	4						
131	SW Building Soils	E-6 F-6	Grounds	Tritium, Radium-226, Actinium-227, Thorium-232	4, 6, 18	Tritium beneath the building	S	1, 18	14, 16	Table B.1 RSS[c] Locations S0154 and S0180 (Appendix E in Ref. 6)	6
132	Area 15, Entombed SW Cave (Room SW 1-B)	F-6	Historical	Radon-222, Radium-226, Actinium-227, Thorium-228	1, 4, 6, 18	Radon-222	A	1, 6	No Data		
133	SW Building Room 1-A	F-6	Historical	High-activity wastewater from radium and actinium processing, reactor waste including Radium-226, Actinium-227, Cesium-137, Plutonium-238, and Uranium-238.	4	Cesium-137 (sealed in concrete in building floor)		4	No Data		
134	SW Building Drum Storage Area	E-6	In service	Hazardous wastes Asbestos, Waste oils, Antifreeze	4, 5, 18				14	Table B.9 RSS[c] Location S0180 (Appendix E in Ref. 6)	6
135	Room SW-8 Beta Wastewater Tank (Tank 20)	F-6	In service	Tritium	3, 4				No Data		

Reference B

PRS #	UGLy Subsystem	Line Designation (prelim. cost est.)	Linear Feet (LF)
	Bldg H to Bldg WD	1a	180
	Bldg H to Bldg WD	1b	132
	Bldg H to Bldg WD	2	20
	Bldg H to Bldg WD	5	321
	Bldg H to Bldg WD	6	223
	Bldg H to Bldg WD	7	223
	East Exhaust Tower to Manhole 6	9	285
	East Exhaust Tower to Manhole 6	9a	60
	East Exhaust Tower to Manhole 6	10a	390
	East Exhaust Tower to Manhole 6	11	53
	East Exhaust Tower to Manhole 6	12	56
[redacted] 434	South Side of Bldg T to Manhole 8	13a	208
435	South Side of Bldg T to Manhole 8	13b	185
[redacted] 436	South Side of Bldg T to Manhole 8	14	114
	Manhole 20 to Bldg WD	3	65
	Manhole 20 to Bldg WD	4	150
	Manhole 20 to Bldg WD	4a	223
	Bldg SW to Bldg WD	8	337

B&W SERVICES, INC.

BWX Technologies, Inc. *a McDermott company*

To: **Distribution**	
From: **R. S. Kingsley**	*File No.:*
Subject: **Cost Estimate Assumptions and Ground Rules**	*Date:*

Distribution

A Task Force was formed to develop a cost estimate for the remediation of the hot waste sewers at the Mound site. The hot waste sewer lines transported radioactively contaminated hot waste from site research and development, operating, and site support buildings to a waste treatment complex located in the WD Building. Characterization information indicates that several segments of this hot waste sewer system are extensively contaminated with radioactive materials (i.e. >700,000 pCi Co^{60} /100 cm^2 and > 400 nCi Pu^{238}. A series of alternative actions for the disposition of these lines is being developed. The objective of the task force was the estimation of the remediation costs for removal of the lines as one of the options to be considered for treatment action of these lines. This task force was composed of William Crisswell (Roy F Weston construction engineer), Chuck Finkenbein (BWXO radiation protection), Richard Kingsley (BWSI senior supervisory engineer), and Roger Murray (Morrison Knudsen Estimating Manager).

The task force met on March 13, 14, and 15 to develop the work scope and define the assumptions to be used in completing this cost estimate. The meeting:

- Described the underground lines (which the Mound project refers to as the UGLy (Underground Lines),
- Completed two site walk downs of the UGLy lines,
- Described current conditions of the UGLy lines,
- Grouped the underground lines into discrete segments for estimating convenience,
- Identified and defined cost study assumptions, and
- Identified additional information required completing a cost estimate.

Appendix A contains a copy of the view graphs used during the meeting by R. S. Kingsley to kick-off the meeting and describes the problems involved in the remediation of the UGLy lines.

This memo will:

- Describe follow-up actions items required to initiate the cost estimate study,
- Summarize guidance provided by John Price for preparing the UGLy line cost estimate,
- Document the underground line groupings to be used during the cost estimate, and
- Summarize cost study assumptions and ground rules developed by the Task Force for the completion of the Cost Study.

A. Follow-up Action Items

During the course of the three-day Task Force meeting, a series of action items were identified that were to be completed by R. S. Kingsley. These action items include:

1. Identifying the location, number and routing of vertical riser/horizontal lateral lines connecting the T Building to the 8-inch diameter hot waste sewer trunk lines below and adjacent to the DS Building. In addition, it should be determined if these lines are encased in the T Building concrete walls (second priority). This action was completed and drawing sets forwarded to William Murray. The lines are not encased in the T Building walls.

2. Obtaining addition copies of the overall underground utility site plans for William Crisswell and John Murray (first priority). This action was completed.

3. Establishing the disposition of the 8-inch diameter hot waste sewer line along the south side of the DS Building at the present location of the COS Building (included with the second priority). Was this section of hot waste line rerouted, removed, or left in place during construction of the COS building? In addition, the design/construction drawings for the COS building should be located and forwarded to Task Force members. This action was completed. As-built drawings of the COS Building indicate that all effected hot waste sewer risers were removed during COS Building construction. The COS construction drawings were forwarded to Task Force members.

4. Obtaining a set of photographs of the surface above the UGLy lines should be obtained and sent to Roger Murray (third priority). This activity was completed and a set of photographs was forwarded to Roger Murray. In addition, a set of photographs will be placed in the soils group library along with a copy of this memo.

5. Obtaining a set of the original site construction drawings showing the layout of the site and the UGLy pipe trenches should be obtained and sent to Roger Murray. This action item was completed and a set of the original site underground line construction drawings was obtained and forwarded to Roger Murray.

6. In order to develop a remediation schedule, a number of questions must be answered including:

- What happens to Building 48 and when is it scheduled to happen?

- What happens to the T Building ventilation heads houses and when are they scheduled to happen?

- What happens to the pipe bridges and their supported utility systems located south of the DS Building between manhole 8 and 8A and when are they scheduled to happen?

- What happens to the pipe bridges and their supported utility systems located south of DS Building and when are they scheduled to happen?

- What is the disposition of I Building and when is it scheduled to happen?

- What is the color-coding on the hydrants on the west side of the DS Building (i.e. red, red/yellow, and green)?

- What is the disposition of the liquid N_2 system supporting TERF and when is it scheduled to happen?

- What is the disposition of the DS Building emergency generator and when is it scheduled to occur?

The above is a fourth priority in importance. The task force did not complete this action. Answering these questions requires extensive integration with a master site closure plan. A detailed site master closure plan does not exist in sufficient detail to answer these questions. Thus a schedule for remediation of these underground lines cannot be developed at this time.

7. Cost study waste management ground rules and guidelines will be developed in consultation with BWXO waste management personnel (i.e. John Kruger's staff). This discussion should define ground rules for establishing waste packaging, waste disposal, and waste transportation costs. In addition, reference waste disposal sites should be identified by type of contaminated waste produced during UGLy line remediation. Roger Murray completed this action and the results reflected in the cost estimate report.

8. Develop an analysis and sampling plan for excavated waste. This plan should define assumptions for waste characterization during remediation and disposal. In addition the plan should include assumption for the frequency and cost for worker bioassay. Roger Murray completed this action and the results reflected in the cost estimate.

9. Roger Murray will meet with xxx Hall to discuss project cost estimating guidelines.

10. The cost estimate report must include a discussion of the current baseline cost estimate for the remediation of the UGLy lines (directive received from ?? Hall). Guidance provided during this conversation on March 15 includes:

    - John Price will have to provide site support cost estimates

B. Cost Estimate Study Guidance

John Price (BWXO soils project manager) provided guidance for the preparation of a cost estimate for the remediation of the UGLy system. This guidance included:

1. The cost estimate should be organized in the following three categories:

   - Work planning (i.e. engineering planning for UGLy line remediation, etc.),

   - Fieldwork. Fieldwork should include all of the work activities completed in the field to remediate the lines. Fieldwork should include all phase including field mobilization, field execution, line grouting, remediation, bottom-of-hole sampling, sampling and characterization of remediated soils, demobilization etc. The field work cost estimate should contain assumption for the size of the field crew (based upon past experience), number of samples taken per day, assumed ft^3 of soil excavated per day, assumed liner ft. of UGLy line remediated per day, assumed liner ft. of line grouted per day, etc., and

   - Reporting. This activity will include the preparation of final reports documenting the completion of the UGLy line remediation.

2. The Corps of Engineers reviews all project remediation cost estimates. Thus, this cost estimate must be defended to the Corps. For this reason, it is essential that all assumptions etc. used in developing this cost estimate must be documented.

3. The cost estimate should be developed assuming that the work is subcontracted to an outside firm. This includes all aspects of the job including supporting functions such as radiation control technicians, field labor, etc. Two exceptions to guidance include radiochemical laboratory support and project oversight, which will be provided by the Soils Project. In addition, the subcontractor will utilize DOE site equipment.

4. The cost estimate should develop:

   - A low estimate,

   - A medium (i.e. most likely estimate), and

   - Worst estimate.

   These three estimates can be based upon differing remediation assumptions, differing assumptions on the quantities of contaminated soils, differing remediation methodologies, or on combinations of these assumptions. The selection of these conditions is up to the task force. A matrix of the various alternative field conditions (i.e. differing levels of overburden contamination) could be developed and the likely hood that this assumed condition encountered estimated. Than a weighted average cost estimate calculated.

5. The UGLy remediation schedule should be connected to the remediation schedule for:

- TERF (i.e. Tritium Environmental Recovery System),
- Above ground utility system remediation (as shown in the current Primavera schedule),
- Remediation of buildings R, SW, and H, and
- Stack deconstruction.

6. UGLy line remediation is a fourth level WBS (i.e. WBS number 1.2.7.25) The three UGLy system activities (i.e. work planning, fieldwork, and reporting) are WBS level 5 activities. Segment remediation (i.e. Mound labor as $/hr., subcontract cost, etc.) is a level 6 activity, and the details backing up these totals are a WBS level 7 activity.

C. Definition of Underground Line Segments

During the site walk down, the Task Force concluded that it was more efficient to break the UGLy lines down into segments for cost estimating purposes. The following discussions define those segments and summarize the assumptions made for the remediation of each segment. Throughout this discussion, the basic assumptions describe below concerning the UGLy lines and their remediation is applicable. These general assumptions include:

- The UGLy line is bedded in concrete,
- The dimensions of the concrete are 48 inches wide and 12 inches deep,
- A 20 inch wide bucket will be used to excavate the overburden and expose the line,
- The interior of all lines will be grouted prior to remediation, and
- The lines will be cut into segments and removed from the trench.

1. UGLy Line Segment 1A. This UGLy sewer line segment starts 5 ft. from H Building wall, runs ~ 23 ft. in a westerly direction to Manhole HW -22 (which is buried under asphalt) and then on another ~ 157 ft. to Manhole HW -20. During this traverse between the H Building and Manhole HW -22, this UGLy line segment cross beneath a number of other underground utilities including:

   - A 6 inch diameter cast iron (i.e. CIP) water line,
   - A 4 inch diameter CIP sanitary waste line,
   - An 8 inch diameter CIP fire line,
   - A 15 inch diameter concrete (CONC) storm sewer,
   - A second 5 inch diameter CIP water line,

- An ADT cable,
- A 1-4" electrical tile,
- Three 4 inch condensate lines, and
- A second 6-inch diameter vitreous clay (VCP) storm sewer.

In addition, segment 1A crosses beneath the breezeway that also supports a pipe bridge carrying a number of other utility lines.

Assumptions made about UGLy segment 1A include:

- This UGLy segment can be removed following removal of the breezeway and the utility lines that are supported on the pipe bridge attached to it's roof,
- H Building will be removed prior to the remediation of the UGLy line segment,
- Soils surrounding 1 ft. the UGLy line pipe trench contain low level waste,
- This UGLy line segment is 8 inch diameter VCP encased in concrete,
- A 10% excess will be added to the soil excavated from the pipe trench as a contingency for segment structural failure, and
- Overburden above this UGLy line segment is uncontaminated and will be used as backfill.

2. <u>UGLy Line Segment 1B.</u> This UGLy sewer line segment runs ~ 132 ft. in a westerly direction from Manhole HW -20 to Manhole HW 18. During this traverse, this UGLy line segment cross beneath a number of other underground utilities including:

- An abandoned 8 inch diameter CIP line,
- An 8 inch diameter VCP storm sewer,
- A second 8 inch diameter VCP storm sewer,
- A 4 inch diameter CIP water line,
- An abandoned 6 inch diameter CIP water line, and
- An 8-inch diameter ACP fire waterline.

In addition, ~ 87 ft. of segment 1B crosses beneath the elevated Building 58 that house the SW Building ventilation fans and filters. Filtered SW Building room air is discharged from this building directly to an adjacent exhaust stack. Thus, Building 58 must remain active as long as the SW Building contains radioactive contamination. In addition, ~ 20 ft. of this UGLy segment crosses a main Mound site north south roadway.

Assumptions made about UGLy segment 1B include:

- This UGLy segment cannot be removed until after the SW Building has been remediated and Building 58 dismantled.
- This UGLy line segment is 8 in. diameter VCP encased in concrete,
- Soils surrounding 1 ft. the UGLy line pipe trench contain low level waste,
- A 10% excess will be added to the soil excavated from the pipe trench as a contingency for segment structural failure, and
- Overburden above this UGLy line segment is uncontaminated and will be used as backfill.

3. UGLy Line Segment 3. This UGLy sewer line segment runs ~ 65 ft. from Manhole HW-20 in a southerly direction to the northern edge of the SW Building. (NOTE: This sewer segment is part of the hot waste drain line that runs ~ [illegible]0 ft. from Manhole HW -20 to Manhole HW -14. Approximately 115 ft. of the line lies beneath the SW building and the remainder lies outside the building. Manhole HW -[illegible] lies inside of the SW Building. This line segment is part of a total ~ 358 ft. hot waste line section that formerly ran from Manhole MH-20 through Manhole MH-12 to Manhole MH-6. This latter hot waste sewer section has been capped and abandoned in place. Remediation of the sections of this UGLy line lying beneath the SW building are the responsibility of the building manager and are not the responsibility of John P[illegible]e's Soils Group. Thus, the remediation cost for the hot waste sewer segment beneath the SW Building is not included in this cost estimate. The Soils Group will only be responsible for the remediation of the ~65 ft. of this UGLy line segment that runs between Manhole HW-20 and the north outer wall of the SW Building as defined by segment 3.)

During this traverse of this UGLy line segment between the Manhole HW -20 and the northern wall of the SW Building, this UGLy line segment cross beneath a number of other underground utilities including:

- A telephone cable,
- An ADT line,
- A 24 inch diameter CONC storm sewer,
- A [illegible] inch diameter CIP abandoned line, and
- A 4-inch diameter CIP water line.

In addition, segment 3 ends at an ~ 18 thick concrete foundation outside of an access door into the SW Building. Formerly, this area was an ~ 10 ft, wide north south alley that ran between the R and SW Buildings. In order to increase the SW Building floor space, a roof was added over the alley along with north and south walls enclosing this alley creating the addition SW Building floor space. In the process of enclosing this space, Manhole HW-14 was also enclosed within the building.

Assumptions made about UGLy segment 3 include:

- Remediation of this UGLy line segment is not constrained by the presence of the SW Building. Remediation however is constrained by the presence of the other underground utility lines.
- This UGLy line segment is 8 in. diameter VCP encased in concrete,
- Soils surrounding 1 ft. the UGLy line pipe trench contain low level waste,
- A 10% excess will be added to the soil excavated from the pipe trench as a contingency for segment structural failure, and
- Overburden above this UGLy line segment is uncontaminated and will be used as backfill.
- Soils surrounding 1 ft. the UGLy line pipe trench contain low level waste,
- A 10% excess will be added to the soil excavated from the pipe trench as a contingency for segment structural failure, and
- Overburden above this UGLy line segment is uncontaminated and will be used as backfill.

4. <u>UGLy Line Segment 4</u>. This UGLy sewer line segment runs ~ 88 ft. in a south southwesterly direction from the southern outside wall of the SW Building to Manhole HW-12. From Manhole HW-12, this UGLy sewer segment proceeds ~ 64 ft. in a southwesterly direction towards Manhole HW-6. This sewer segment terminates in a blank at ~ 20 ft. before Manhole HW-6 and does not actually enter Manhole HW-6. However, a two inch diameter line continues from the blanked off main 8 inch diameter VCP line to the WD Building. (The 2-inch diameter line will be described as Segment 4-A below). Details of this latter piping logic can be found in Monsanto Research Corp. drawing 5-1398 (reference insert for Manhole HW-6. (NOTE: This sewer segment is part of the hot waste drain line that runs ~ 178 ft. from Manhole HW -14 to Manhole HW -12. Approximately 90 ft. of the line lies beneath the SW building and the remainder lies outside the building. Manhole HW -14 lies inside of the SW Building. This line segment is part of a total ~ 358 ft. hot waste line section that formerly ran from Manhole MH-20 through Manhole MH-12 to Manhole MH-6. This latter hot waste sewer section has been capped and abandoned in place. Remediation of the sections of this UGLy line lying beneath the SW building are the responsibility of the building manager and are not the responsibility of John Price's Soils Group. The Soils Group will only be responsible for the remediation of the ~88 ft. of this UGLy line segment that runs between the south outer wall of the SW Building and Manhole HW-12 and beyond to the line termination as defined by segment 4. The cost estimate does not include the remediation of the hot waste sewer running beneath the SW Building.)

During this traverse between SW Building southern wall and the segments termination at a blank, this UGLy line segment cross beneath a number of other underground utilities including:

- An 8 inch diameter fire line, and
- A 33-inch diameter CONC storm sewer.

Significantly, this sewer segment does not cross over any underground utilities between the south outer wall of the SW Building and Manhole HW-12. However, in this section of the site, this UGLy sewer segment does cross beneath ~ 93 ft. of Mound roadway and SW Building Driveway.

Assumptions made about UGLy segment 4 include:

- Remediation of this UGLy line segment is not constrained by the presence of the SW Building or, in a significant way, by the presence of the other underground utility lines.
- This UGLy line segment is 8 in. diameter VCP encased in concrete,
- Manhole HW-12 is filled with concrete (completed by the waste management group in October 1999.
- Soils surrounding 1 ft. the UGLy line pipe trench contain low level waste,
- A 10% excess will be added to the soil excavated from the pipe trench as a contingency for segment structural failure, and
- Fifty percent of the overburden above this UGLy line segment is contaminated. It is assumed that:
  - 5 % of the overburden is TRU waste,
  - 5 % of the overburden is mixed waste, and
  - 40% of the overburden is low-level waste.

  It is assumed that the balance of the overburden is clean and can be recycled and used as fill.

5. UGLy line Segment 4A. This UGLy sewer line segment runs ~ 232 ft. in a southwesterly direction from the blank in the 8 inch diameter VCP line described in Segment 4 to the WD Building. Details of the piping logic between these two hot waste sewer line connections can be found in Monsanto Research Corp. drawing 5-1398 (reference insert for Manhole HW-6. (NOTE: This sewer segment does not actually enter Manhole HW-6, but diverts away from the sewer ~ 20 ft. from the sewer. During this traverse between the blank in the 8 in. VCP line and the WD Building, this UGLy line segment cross beneath a number of other underground utilities including:

- An 8 inch diameter VCP hot waste sewer line (described below as UGLy line segment 7),
- Two ten inch diameter concrete storm sewers, and
- An 8-inch diameter ACP fire line.

In addition, this UGLy sewer segment does cross beneath ~ 27 ft. of Mound roadway.

Assumptions made about UGLy segment 4A include:

- Remediation of this UGLy line segment is not constrained in a significant way by the presence of the other underground utility lines. One of the four lines above this sewer segment is another UGLy line segment of the hot waste sewer.
- This UGLy line segment is 2-in. diameter steel saran lined pipe. The line is assumed not to be encased in concrete and that this sewer segment is bedded in a pipe trench in the ground,
- Soils surrounding 1 ft. the UGLy line pipe trench contain low level waste,
- A 10% excess will be added to the soil excavated from the pipe trench as a contingency for segment structural failure, and
- Fifty percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
    - 5 % of the overburden is TRU waste,
    - 5 % of the overburden is mixed waste, and
    - 40% of the overburden is low-level waste.

  It is assumed that the balance of the overburden is clean and can be recycled and used as fill

6. UGLy Line Segment 5. This UGLy sewer line segment runs ~ 318 ft. in a southerly direction from Manhole HW-18 to HW-16. This UGLy line segment runs parallel to the west outside wall of the SW Building on the far side of the Mound site road that also parallels this SW Building. During this traverse between Manhole HW 18 and HW16, this UGLy line segment cross beneath a number of other underground utilities including:

- Two ADT ducts,
- A 2 inch diameter CIP line,
- A 2-4 inch CND line,

- A 4-4" electrical duct,
- A 3 inch diameter CIP water line, and
- An 8-inch diameter CIP fire line.

In addition, this UGLy sewer segment crosses beneath the liquid N_2 storage tank farm across from the SW Building. This liquid nitrogen tank farm supplies an inert gas to the Tritium Environmental Recovery system and is an essential utility service to SW Building operations. This UGLy sewer segment also crosses beneath two ~17 ft. wide Mound site roadways. All of these utility systems cover a 136-ft. long section between Manhole 18 and site coordinate STA 5 +00. Thus, approximately 182 ft. of this UGLy line segment does not lie above other site underground utilities and the task force concluded that this ~182 ft. segment between site coordinate STA 5 + 00 and Manhole HW 16 could remediated at any time with limited impact on site operations. Remediation of the remaining ~ 136 ft. of this UGLy line segment must await the final shutdown of the SW Building.

Assumptions made about UGLy segment 5 include:

- This UGLy line segment is 8 inch diameter VCP The line is assumed not to be encased in concrete and that this sewer segment is bedded in a pipe trench in the ground,
- Twenty five percent of the length of this line has failed structurally,
- Ten percent of the overburden is contaminated with low level waste, and
- Twenty five percent of the pipe chase material is contaminated with low-level waste.

7. UGLy Line Segment 6. This 22 ft. long UGLy sewer line segment runs in a southwesterly direction from Manhole HW-16 to HW-6. During this traverse between Manhole HW 16 and HW-6, this UGLy line segment cross beneath a number of other underground utilities including:

- An 1 1/2 inch diameter steel hot waste line described below as UGLy line segment 8, and
- A 2-inch diameter saran lined steel hot waste line described above as UGLy line segment 4-A.

In addition, this UGLy sewer segment crosses beneath a 1-foot wide sidewalk.

Assumptions made about UGLy segment 6 include:

- This UGLy line segment is 8 inch diameter VCP The line is assumed not to be encased in concrete and that this sewer segment is bedded in a pipe trench in the ground,

- This UGLy line segment could be remediated at any time with minimal impact upon site operations,
- Ninety five percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
  - 5 % of the contaminated overburden is TRU waste,
  - 5 % of the contaminated overburden is mixed waste, and
  - 85% of the overburden is low-level waste.
- Twenty five percent of the length of this line has failed structurally, and
- Twenty five percent of the pipe chase material is contaminated in the same percentages described above for the overburden.

8. UGLy Line Segment 7. This UGLy sewer line segment runs ~ 148 ft. in a westerly direction from Manhole HW 6 to Manhole HW 4. The UGLy segment than runs ~ 98 ft. in a northerly direction from Manhole HW 4 to Manhole HW 2. During this ~ 246 ft. traverse between Manhole HW 6 and HW-2, this UGLy line segment cross beneath a number of other underground utilities including:

   - An 1 1/2 inch diameter steel hot waste line described below as UGLy line segment 8,
   - A 2-inch diameter saran lined steel hot waste line described above as UGLy line segment 4-A,
   - Three separate on-ground hot waste lines,
   - A two inch diameter storm sewer, and
   - An 8-inch diameter fire line.

   In addition, this UGLy sewer segment crosses beneath a 5-ft. wide sidewalk and a 12 ft. wide roadway.

   Assumptions made about UGLy segment 7 include:

   - This UGLy line segment is 8 inch diameter VCP The line is assumed not to be encased in concrete and that this sewer segment is bedded in a pipe trench in the ground,
   - This UGLy line segment could be remediated at any time with minimal impact upon site operations. However, it is assumed that the fire line and the storm water sewer will remain in place after the site is turned over to the sewer. Thus, costs will put in

the study to return these utilities to operations. In addition, costs will be put in the study to maintain these utilities during how waste sewer remediation,

- Sixty percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
    - 5 % of the contaminated overburden is TRU waste,
    - 5 % of the contaminated overburden is mixed waste, and
    - 90% of the overburden is low-level waste.
- Twenty five percent of the length of this line has failed structurally, and
- Twenty five percent of the pipe chase material is contaminated in the same percentages described above for the overburden.

9. UGLy Line Segment 8. This UGLy sewer line segment runs ~ 540 ft. in a southerly and southwesterly direction from the outside south wall of the SW Building to the WD Building. During much of this run, this UGLy sewer segment runs parallel to the UGLy sewer segment described as segment 4A. The two lines are ~ 2 ft. apart for approximately 181 ft. between site coordinates STA 2 + 00 and STA 0 + 70. During this ~ 540 ft. traverse between the SW Building and the WD Building, this UGLy line segment cross beneath a number of other underground utilities including:

    - A 6 inch diameter CIP line,
    - An electrical junction box,
    - An 8 inch diameter hot waste line described in UGLy line segment 7,
    - A 12 inch diameter storm sewer,
    - A 10 inch diameter storm sewer,
    - A 10 inch diameter concrete storm sewer, and
    - An 8-inch diameter ACP fire line.

    In addition, this UGLy sewer segment crosses beneath a 25-ft. wide roadway and a second 25-ft. wide roadway.

    Assumptions made about UGLy segment 6 include:

    - This UGLy line segment is 2-inch diameter welded steel pipe. It is assumed that this line carried only low-level liquid tritium waste and that there were no insoluble compounds present in this waste. The line is assumed not to be encased in concrete and that this sewer segment is bedded in a pipe trench in the ground,

- This UGLy line segment could be remediated at any time with minimal impact upon site operations. However, it is assumed that the fire line and the three storm water sewers will remain in place after the site is turned over to the sewer. Thus, costs will put in the study to return these utilities to operations. In addition, costs will be put in the study to maintain these utilities during how waste sewer remediation,

- The ~ 100 ft. of line to the immediate south of the SW Building is assumed to have fifty percent of the overburden above this UGLy line segment contaminated. It is further assumed that:

    - 5 % of the contaminated overburden is TRU waste,

    - 5 % of the contaminated overburden is mixed waste, and

    - 90% of the overburden is low-level waste.

- The ~ 180 ft. of line that runs parallel to the UGLy line segment 4 A will be remediated with that segment. Thus, the volume of waste (i.e. due to overburden and trench bed contamination) will not be included in the cost estimate (i.e. these costs will not be double counted). Only the actual volume of the UGLy line 8 steel pipe will be included in the cost estimate.

- Remediation of the UGLy line segment will commence at the SW Building and proceed towards the WD Building down the hillside.

10. UGLy Line Segment 9. This UGLy sewer line segment runs ~ 143 ft. in a southeasterly direction from Manhole HW 6 to Manhole HW 8. The UGLy segment than continues in a southeasterly direction for ~ 97 ft. to Manhole HW 8A. This line segment then continues for an additional ~47 ft. in an easterly direction to the edge of the DS Building. This UGLy line segment also contains an ~ 30 ft. length of 3 inch diameter CIP pipe connecting this hot waste sewer to a sump in the T Building ventilation tower adjacent to this UGLy line section. During this ~ 287 ft. traverse between Manhole HW 6 and the western edge of the DS Building, this UGLy line segment crosses beneath a number of other underground utilities including:

- Two 4 inch electrical conduits, and

- A 10-inch diameter VCP line.

In addition, this UGLy sewer segment crosses beneath an overhead pipe bridge containing a number of other active and inactive utility systems.

Assumptions made about UGLy segment 6 include:

- This UGLy line segment is 8-inch diameter VCP pipe. According to the original site drawings for the hot waste sewer system, this line segment is not be encased in concrete. It is assumed that the segment is bedded in a pipe trench in the ground. The site drawings also indicate that there is a second abandoned 8-inch diameter hot waste sewer steel line abandoned in-place beneath this segment. The drawing indicates that this abandoned line is encased in concrete. It is assumed that the upper line segment is slightly contaminated with low-level waste while the abandoned line is high contaminated with low-level waste. Thus, the volume of remediated line waste must be doubled because of the presence of the abandoned line.

- This UGLY line segment could be remediated at any time with minimal impact upon site operations. The major impediment to line remediation is the pipe bridge and it's overhead utilities. Once this pipe bridge is abandoned, this UGLy section can be remediated. These are minimal below grade utility systems that impact the remediation of this UGLy line segment, and

- Twenty five percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:

  - 5 % of the contaminated overburden is TRU waste,

  - 0 % of the contaminated overburden is mixed waste, and

  - 95% of the contaminated overburden is low-level waste.

11. UGLy Line Segment 10. This UGLy sewer line segment runs ~ 304 ft. in an easterly direction along the north side of the DS Building along it's entire length. During this ~ 304 ft. traverse of the DS Building, this UGLy line segment does not cross any other underground utilities. However, there is on lateral tie in a vertical riser from the T Building.

    Assumptions made about UGLy segment 10 include:

    - This UGLy line segment is 8-inch diameter VCP pipe. It is assumed that the line is encased in concrete and that there are no other abandoned underground hot waste lines beneath the north side of the DS Building.

    - The 3-inch diameter, 30-ft. branch line to the T Building ventilation head house sump will also be remediated as part of this UGLy line segment. This line is assumed to contaminated with low level waste,

    - This UGLy line segment is located ~ 9 ft. below the finish grade elevation of the DS Building floor,

    - Based upon the insitu Co^{60} surveillance study, it is assumed that 100% of this UGLy line segment is highly contaminated with low-level waste. In addition, the line segment is contaminated with other gamma emitting radioisotopes.

    - The cost study will assumed that the interior walls and floor of the north side of the DS Building would be removed to expose this hot waste sewer segment.

    - This UGLY line segment could be remediated at any time with minimal impact upon site operations, and

- Ten percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
    - 0 % of the contaminated overburden is TRU waste,
    - 0 % of the contaminated overburden is mixed waste, and
    - 100% of the contaminated overburden is low-level waste.

12. UGLy Line Segment 11. This UGLy sewer line segment runs ~ 53 ft. in a westerly direction from the east wall of the DS Building to the T Building Exhaust Tower sump. During this ~ 53 ft. traverse, this UGLy line segment does not cross beneath any other underground utilities.

    Assumptions made about UGLy segment 6 include:

    - This UGLy line segment is 8-inch diameter VCP pipe. The line is assumed to be encased in concrete,
    - This UGLy line segment could be remediated at any time with minimal impact upon site operations. The major impediment to line remediation is the pipe bridge and it's overhead utilities, and
    - Ten percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
        - 0 % of the contaminated overburden is TRU waste,
        - 0 % of the contaminated overburden is mixed waste, and
        - 100% of the contaminated overburden is low level waste.

13. UGLy Line Segment 12. This UGLy sewer line segment is the lateral riser from the T Building sump that transported that building's hot waste to the main hot waste trunk line described in UGLy line segment 10.

    Assumptions made about UGLy segment 12 include:

    - This UGLy line segment is 3-inch diameter pipe,
    - Details of the placement of this UGLy line segment along the T Building wall and the length of the lateral/riser line are assumed to be present in T Building construction drawings.
    - This UGLy line segment could be remediated at any time with minimal impact upon site operations. The major impediment to the remediation of this line segment is the pipe bridge and it's overhead utilities, and
    - Ten percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:

- 0 % of the contaminated overburden is TRU waste,
- 0 % of the contaminated overburden is mixed waste, and
- 100% of the contaminated overburden is low-level waste.

14. UGLy Line Segment 13. This UGLy sewer line segment runs ~ 217 ft. in a southeasterly direction from Manhole HW 8 to Manhole HW 10. The UGLy segment than continues in an easterly direction for ~ 184 ft. ~~This line segment then continues for an additional ~47 ft. in an easterly direction to the edge of the DS Building~~. During this ~ 287 ft. traverse between Manhole HW 6 and the eastern end of this hot waste line, this UGLy line segment cross beneath a number of other underground utilities including:

    - Two ground wires,
    - An 8 inch diameter CIP sanitary sewer line, and
    - A 12-inch diameter storm water sewer line.

    In addition, this UGLy sewer segment between Manholes HW 8 and HW-10 crosses beneath an overhead pipe bridge containing active and inactive utilities. This UGLY line segment runs parallel to the same pipe bridge for it's entire ~ 184 ft. length.

    Assumptions made about UGLy segment 6 include:

    - The ~ 217 ft. UGLy line segment between Manhole HW 8 and HW 10 is an 8-inch diameter vitreous clay pipe. This pipe segment replaced a 5-inch diameter cast iron pipe that is abandoned in place adjacent to the 8-inch VCP pipe. It is assumed that the original cast iron is highly contaminated with low-level waste and that the replacement segment is slightly contaminated with low-level waste. It is further assumed that the original cast iron line is encased in concrete while the newer line is not encased in concrete and that this sewer segment is bedded in soil. Thus, the volume of remediated line waste must be doubled because of the presence of the abandoned line,
    - The ~ 184 ft. UGLy line segment between Manhole HW 10 and the end of the line is an 8 inch diameter cast iron pipe that is the original line installed at the time of T Building construction.
    - This UGLy line segment could be remediated at any time with minimal impact upon site operations. The major impediment to segment remediation is the pipe bridge and it's overhead utilities. Once this pipe bridge is abandoned, this UGLy section can be remediated. These are minimal below grade utility systems that impact the remediation of this UGLy line segment, and
    - Ten percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
        - 0 % of the contaminated overburden is TRU waste,

- 0 % of the contaminated overburden is mixed waste, and
- 100% of the contaminated overburden is low-level waste.

15. UGLy Line Segment 14. [redacted].

Assumptions made about UGLy segment 14 include:

- This UGLy line segment consist of three 3-inch diameter pipe vertical riser that carried low risk and high risk wastes from T Building sumps to the hot waste main sewer trunk line for transport to the WD Building,
- Details of the placement of this UGLy line segment along the T Building wall and the length of the lateral/riser line are assumed to be present in T Building construction drawings.
- This UGLy line segment could be remediated at any time with minimal impact upon site operations. The major impediment to segment remediation is the pipe bridge and it's overhead utilities, and
- Ten percent of the overburden above this UGLy line segment is contaminated. It is further assumed that:
  - 0 % of the contaminated overburden is TRU waste,
  - 0 % of the contaminated overburden is mixed waste, and
  - 100% of the contaminated overburden is low-level waste.

D. Cost Study Assumptions and Ground Rules

During the March 13-15 meeting, the Task Force developed a series of ground rules and assumptions for the completion of the cost study. These included general study assumptions and specific study assumptions. The following describes these assumptions.

General Cost Study Assumptions

1. During the Task Force site walk-downs of the UGLy system, it became clear that the remediation of these lines would be compromised and complicated by all of the underground and aboveground utilities serving the site. The aboveground utilities are run on pipe bridges that crisscross the site while the below ground lines run in individual trenches throughout the site. The task force concluded that it would be cost prohibitive to remediate the UGLy lines if the majority of these above and below ground utility systems remained in place. Thus, before the UGLy lines are remediated, the other utilities serving the site must be abandoned, isolated, and removed by others (i.e. the removal of these other utility systems will not be included in this cost estimate). However, the cost for the excavation of an underground utility to gain access to an UGLy line would be included in

the cost estimate. The Task Force believes that certain essential site utilities (e.g. storm water lines) can be handled (i.e. rerouted) during UGLy line remediation. However, the cost for such rerouting and isolation of these essential utilities will not be included in this cost estimated because a master plan for the eventual configuration of the site has not been developed (i.e. which sanitary storm sewers remain and which will require rerouting etc.?). Some examples of the site utilities that will impact UGLy line remediation include:

- Steam distribution from the central site power plant used for plant heat (distributed throughout the site on pipe bridges throughout the site),
- Condensate return to the site power plant (distributed throughout the site on pipe bridges),
- Glycol supply and return for site cooling (distributed throughout on pipe bridges),
- Plant air (distributed throughout the site in underground main headers),
- Process water (distributed throughout the site in underground main headers),
- Etc.

The coordination of UGLy line remediation with the removal of other Mound site utilities was the main problem identified by the Task Force that could affect the UGLY system remediation cost and schedule. Attempting to remediate the UGLY system without shutting down these other site utilities will be prohibitively expensive.

2. A related interference with UGLy system remediation involves utilities serving the SW Building. On of these utilities includes the liquid N_2 cryogenic storage tanks located on the west side of the SW building. This system is a part of the Tritium Environmental Recovery System, which must remain operational until this building is shut down. An UGLy main trunk line runs in a north south direction beneath this tank farm. A second SW Building utility impacting UGLy line remediation is an elevated building (Building 58) which houses the SW Building's HVAC fans and filter systems and thus must remain operational until this building is shut down. An east west UGLy main trunk line is located beneath Building 58. A third SW Building interference with UGLy line remediation is a large number of underground utility lines that serve the building. As a result of these three major interference's, the Task Force assumed that the UGLy lines to the north and west of the SW Building would not be remediated until SW Building operations were terminated.

3. The overburden above an UGLy line segment will be graded by the Task Force on a case-by-case basis estimating the percentage of soil radiological contamination, chemical contamination, and mixed waste contamination above waste disposal limits (depending upon location within the Mound site). This percentage will be applied to the quantity of overburden required to access the UGLy line at the depth in a sewer segment. The volume of overburden above an UGLy system line will be estimated and the volume of radiologically contaminated, chemically contaminated, and mixed waste contaminated soil calculated for each line segment.

4. Any irregularities in the contamination condition of soil overburden will be handled as an overall contingency assigned to each line segment.

5. Soils containing less than radiological contamination and chemical contamination limits will be returned to the site and used as backfill.

6. Fieldwork productivity's (i.e. ft^3 excavated and loaded per day) will be assigned by the type of contamination assumed (i.e. clean soil, low level radiological contamination, TRU radiological contamination). The estimated man-hours will be completed by line segment and the productivity will be added for each segment reflecting productivity and contamination assumptions for that segment.

7. A 20-inch wide bucket will be assumed for the remediation. It is assumed that all UGLy lines were placed in concrete and that this concrete is 48-inch wide concrete and 12 inches deep. The overburden above the line will be excavated in a 1 to 1 slope.

8. A decontamination/change room trailer will be provided at the site to support the field staff. Capabilities of this trailer complex will include change room with lockers, health physics instrumentation for personnel monitoring, and shower room with waste disposal capability.

9. The battery limit for UGLy line remediation will be five ft. from building. Within this limit, the building manager is responsible for UGLy line remediation. The principle exception to this assumption is the DS Building. The remediation of the UGLy line beneath the DS Building (and above the T Building) will be included in the cost estimate. In addition the remediation of all-UGLy line laterals and vertical risers originating in the T Building will be included in the cost estimate. (NOTE: The remediation of the UGLy main trunk line that runs beneath the SW Building and Manhole MH-xx located inside of the SW Building is the responsibility of the SW Building manager and will not be included in this cost estimate.)

10. General contingencies that will be added to the overall cost estimate include unknown TRU contamination, additional unknown mixed waste contamination, and unknown/unidentified UGLy lines. An across the board 15% will be added to the total cost estimate to cover these unknown/unidentified conditions.

The cost estimate will not include cost for the final grading of the site and the final drainage of the site. Others will estimate this cost when final disposition plans for the site are completed.

Reference C

USE CATEGORY C ML-9771A	This procedure shall be available to workers, though not necessarily at the work location. This procedure may be performed without referring to the procedure; however, the user is still responsible for adhering to the procedure.

MOUND

TECHNICAL MANUAL

MD–22153, ISSUE 2
MOUND SITE RADIONUCLIDES BY LOCATION

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CHANGES INCORPORATED

- [•] Replace Pages 1, 2, and 3 and Introduction
- [•] Insert (New Pages) Appendix C
- [ ] Remove
- [ ] Complete Reprint

This issue has been reviewed and approved for publication by TR, D. L. Wirkus.

David J Wirkus 3-4-98
Date

All appropriate reviews by senior safety committees were conducted. This issue is authorized for use by Advance Change Order on file in Technical Manuals.

K. E. Sirois, 2–11–98
Acting Radiological Control Manager

6. T-BUILDING

6.1 OVERVIEW

T-Building was host to a multitude of research, development, and production programs with various radioisotopes. The two major radionuclide programs are the polonium and the tritium programs. From 1949 to 1973 polonium-210 programs included a processing and separation program, a fuels research and development program, neutron source program, and a variety of other research, development, and production programs with polonium. This work was all done on the first and second floors of T-Building.

An extensive renovation program from 1966 through 1968 prepared the way for additional polonium fuels research and development.[767] However, government funding was radically reduced and most all renovations were not used as anticipated. T-Building was essentially dormant from 1969 till about 1972 because of a loss of this funding. Decontamination work was done from 1971 through 1973 on the polonium-210 processing area.[768] Activity resumed with the tritium programs in the mid 1970's.[769]

A variety of other activities have been done in T-Building such as nondestructive testing, environmental testing, gamma and mass spectroscopy, calorimetry, neutron activation analysis, and safeguards R&D.

All references to plutonium-238 was of the mixture ratio identified below. This mixture also included trace amounts of americium-241 and neptunium-237.[770] This information was obtained from MLM-1564 (AEC Research and Development Report), page 31.

1E-4% Pu-236
80.2% Pu-238
15.9% Pu-239
3.0% Pu-240
0.6% Pu-241
0.1% Pu-242

Note: MLM-1564 also makes reference to other mixtures.

Plutonium-239 used in the various projects was over 95% pure with trace amounts of plutonium-240,241. [771]

All analytical labs and support rooms for the polonium-210 program from 1949 to about 1973 probably had the following radionuclides and compounds which were common to the polonium processing: [772]

iron-55,59	silicon-31
cobalt-60	lead-209
tin-121	zinc-65
chromium-55	vanadium-52
gallium-70,72	cesium-137
strontium-90	selenium-75
bismuth-210	silver-112
antimony-124	tellurium-121-->134?
mercury-203	polonium-208,209,210
silver polonide	tellurium polonide
aluminum chloride	bismuth chloride
polonium chloride	polonium nitrate

1) Exceptions to this would have been T-248 through T-259 which had very pure polonium handled in this area.

The abundant use of tritium in T-Building and the reactivity of tritium with other materials makes tritium an isotope of concern.

All dates represent the duration of actual usage of radioisotopes in their respective projects. It is clearly understood that residual amounts of all radioisotopes referred to in each room may still be found in floors, walls, and ceilings and should be considered, up to the present, in every case for D&D work. The statement, sometimes made, that there are no radionuclides of concern refers only to there being no radionuclides used during the period specified and does NOT refer to residual radionuclides which MAY BE present as fixed radiation.

All radionuclides are ranked according to the degree of concern for uptake and amount of activity for internal dosimetry considerations. Rooms which are referenced to Appendix B for additional radionuclides do not have a ranking in this manual since the ranking is done in Appendix B where all radionuclides are listed. This situation is identified as "see Appendix B for ranking." Rooms where additional information on processing or radionuclides in Appendix B does not effect the ranking are identified as "see Appendix B" only.

Nickel Carbonyl has been identified in several incident reports. It is a highly poisonous gas mixture but is NOT radioactive. It should be disregarded in internal dosimetry analysis.

Table 6 is a summary of rooms, dates, and radioisotopes for T-Building.

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-1W, 2W, 4E	See Appendix B	1965-1987
T-5W	H-3, HTO .... H-3, HTO	1956-1962 1975-1982
T-5E	Pu-238,239, H-3, Co-60, Ir-192, Fe-55,59, Ra-226, Am-241, Cd-109: All were encapsulated	1955-PRES
T-8	Po-210.	1949-1965
T-9, 9A	H-3, Pu-238(encapsulated)	1987-PRES
T-13	Po-210.	1949-1953
T-15B	Neutron generator producing many possible radionuclides from surface of materials present	1963-PRES
T-16A	H-3, tritiated organics	1984-PRES
T-18	Neutron generator producing many possible radionuclides from surface of materials present	1963-PRES
T-19, 19A	Pu-238,239, H-3, Co-60, Ir-192, Fe-55, Ra-226, Am-241, Cd-109: All were encapsulated. .... H-3, tritiated organics	1985-PRES 1985-PRES
T-20	Never went hot.	1985-PRES
T-22	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . ... Pu-238,239 (encapsulated)	1949-1969 1979-PRES

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-25, 26	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . Pu-238,239 (encapsulated)	1949-1969 1979-PRES
T-27	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . Pu-238,239 (encapsulated)	1949-1969 1979-PRES
T-28,29,30,31, 32,33,34,35	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . .	1949-1969
T-36, 36A	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . See Appendix B.	1949-1969 1985-PRES
T-37	H-3, U-238(D,T), Pu-238(encapsulated), tritiated organics.	1985-PRES
T-40	H-3, Pu-238(encapsulated)	1985-PRES
T-41	H-3	1985-PRES
T-46	Po-210.	1949-1969
T-48, 49, 50	H-3, U-238(D,T), See Appendix B	1983-PRES

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-53	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203	1949-1969
T-54, 55, 55A	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203	1949-1969
T-57	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . H-3, ...	1949-1971 1985-PRES
T-58	H-3, ...	1985-PRES
T-59	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . H-3, U-238(D,T) . . . . H-3, ...	1949-1969 1985-PRES 1985-PRES
T-61, 61A	Po-210, Pu-238,239. . . . . Po-210. . . . . H-3, U-238(D,T)	1960-1963 1964-1966 1973-PRES
T-63	H-3, HTO.	1973-PRES

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-72,73,74,75, 92,93,96,97, 98	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203	1949-1969
T-99	$AlCl_3$, $BiCl_4$, Ag-Po, Te-Po, $PoCl_2$, Po-210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . H-3, ...	1947-1969 1984-PRES
T-100,102,103, 104	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . H-3, ...	1949-1969 1972-PRES
T-208A	Pu-238,239, H-3, Co-60, Ir-192, Fe-55, Ra-226, Am-241, Cd-109, Po-210: All were encapsulated.	1947-PRES
T-229	Po-210, Pu-238,239. . . . . Rn-222, Po-210,214,218, Bi-210, Pb-210,214 . . . . Pu-238,239(encapsulated).	1963-1964 1978-1988 1989-PRES
T-234	H-3, See Appendix B	1988-PRES

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-236	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . H-3, U-235,238,239, Pu-238,239 (Pu was encapsulated)	1949-1973 1985-PRES
T-237	Ag-Po, Te-Po, $PoCl_2$, Po-208,209,210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . H-3, Pu238,239(encapsulated).	1949-1971 1985-PRES
T-238	H-3, Pu-238(encapsulated)	1985-PRES
T-242	Po-210.	1949-1964
T-243	H-3, HTO.	1956-1982
T-245	Po-210. . . . . Pu-238 (encapsulated)	1949-1969 1968-1974
T-246	H-3, ...	1972-1980
T-247	Po-210, See Appendix B. . . . . Po-208,209,210, rare earth polonides, See Appendix B.	1949-1958 1966-1969
T-248-->T-259	Po-210.See Appendix B . . . . (T-257 only) - Orphan sources	1949-1965 1993-PRES
T-260	Po-210, See Appendix B. . . . . Po-208,209,210, rare earth polonides, See Appendix B.	1949-1969 1966-1969

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-266, 267	Po-210, Bi-209,210, See Appendix B. . . . . Po-208,209,210, rare earth polonides, See Appendix B. . . . . H-3, U-238(D,T)	1949-1969 1963-1966 1988-PRES
T-270	Po-210, Bi-209,210, See Appendix B.	1949-1963
T-274	External dose only . . . . Po-210, Bi-210, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . H-3, U-238(D,T)	1948-1971 1966-1969 1986-PRES
T-275, 276	$AlCl_3$, $BiCl_4$, Ag-Po, Te-Po, $PoCl_2$, Po-210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203	1949-1969
T-277, 279	Po-210, Am-241.See Appendix B . . . . Po-210 . . . . Po-210, Bi-209,210	1949-1964 1962-1969 1964-1969
T-300A	Orphan Sources; sources left in containers.	
T-307	Po-210 . . . . H-3, ...	1949-1964 1972-PRES
T-310	$AlCl_3$, $BiCl_4$, Ag-Po, Te-Po, $PoCl_2$, Po-210, Bi-210, $Po(NO_3)_2$, Fe-55,59, Si-31, Co-60, Pb-209, Sb-124, Sn-121, Zn-65, Cr-55, V-52, Ga-70,72, Cs-137, Sr-90, Se-75, Ag-112, Te-121-->134?, Hg-203 . . . . Pu-238,239,240,241, Pm-147, U-233,235, Am-241, H-3 . . . . Pu-238,239(encapsulated).	1949-1969 1969-1983 1986-PRES

Table 6 - T-BUILDING

ROOMS	RADIONUCLIDES AND RELATED COMPOUNDS	DATE USED
T-311	Po-210. .... Pu-238,239 (encapsulated)	1949-1969 1986-PRES
T-319	Pu-238,239,240,241, Pm-147, U-233,235, Am-241, H-3, HTO	1949-PRES
Please Note: T-43,44,48,50, 57,58,59, Corridor-51	These rooms have high fixed radiation from the old polonium program. Radioisotopes of concern are: Co-60, Cs-137, Sr-90.	

Note: All references to plutonium-238 was of the mixture ratio identified in the introduction to T-Building above. This mixture also included trace amounts of americium-241,neptunium-237, and uranium-234. Plutonium-239 used in the various projects was over 95% pure with trace amounts of plutonium-240,241. [773]

Reference D

Main Hill Underground Lines

PRSs 122-124

Preview of the PRS Package

Section 6

T Building
Radiological Data and Information

Introduction

There is more available information for T Bldg. than for R/SW, because the Pipe Explorer test was done on the T Bldg.. Lines.

This section is divided into 3 subsections:

- 6.1 Construction
- 6.2 Process History
- 6.3 Radiological Data

Introduction

- 1996 Video & Radiological Surveillance Of RWS Sewers Serving T Building
  - "Pipe Explorer™" Used for remote surveillance of underground lines
    - pneumatically operated tubular membrane inserted into underground line
    - membrane tows a housing containing surveillance tools
      - video camera with illumination lamps
      - NaI detector

Introduction

- 1996 Video & Radiological Surveillance Of RWS Sewers Serving T Building (contd.)
  - To Interpret Results Must Understand:
    - Operating history of T Building
    - Po^{210} recovery/purification process chemistry
    - Po^{210} process engineering
    - T Building process design, and
    - T Building facility engineering design

Section 6.1 - T Bldg. Process & Operational History

- T Building Operating History
  - T Building built in 1947 for Po^{210} source production (T 1/2 138 days)
    - Po^{210} source used as nuclear weapon initiators
    - Po^{210} program continued until early 1970's
    - T Building deactivated & decontaminated by 1975
      - **<u>All</u>** "high risk" and "low risk" rad sumps sealed
      - **No T Building connections to HW sewer after 1975!**
      - Any current radiological contamination of HW sewer happened prior to early 1970's

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Recovery/Purification Process Chem.
  - Po^{210} produced by Bismuth target irradiation at Hanford or Savannah River Reactors
  - Irradiated Targets Shipped to Mound where they were processed and Po^{210} recovered, purified, converted to metal, and initiator foils manufactured
  - some process wastes initially treated in HH Building

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - During irradiation, Po^{210} formed
    - irradiated target mostly contains Bi metal and
    - minor trace levels of Po^{210}
  - Mound's process objective was the separation of a small quantity of Po^{210} from a large mass of Bi, concentrate it, purify it to > 95% purity (with limited other radionuclides), and electroplate Po metal on initiator foils.

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - targets are aluminum clad bismuth metal
    - aluminum cladding and Bi metal target material contained impurities including natural cobalt
      - during irradiated impurities "activated" by neutron flux forming radioactive "activation products"
        - » principle "activation product" was Co^{60} (T 1/2 = 5.3 years)
        - » other products are also formed (mostly short half life) in both Bi and Al

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - irradiated targets stored in T Building in water pool for shielding
    - Typical as-received targets had dose rates in the 2 R/hr range
    - Targets were loaded into clad dissolver charging baskets in the pool

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - Al Cladding dissolved in concentrated HCl
    - Bismuth metal generally unaffected
    - Acid decladding solution initially transferred to HH Building for treatment (1947 to 1958)
      - Transfer in glass Corning Pyrex® "double tough pipe"
      - Pipe pipe located in dedicate concrete trench
      - Following treatment in HH, solution sent to WD Building for further treatment

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - Decladding treatment transferred to T Building in 1958
    - subsequent to the transfer, treated decladding solutions sent to WD Building through the main hill hot waste sewer system for final treatment

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - Acidic decladding solution neutralized with $Al(OH)_3$
    - aluminum precipitated and filtered
      - solids disposed of as low level waste
      - filtrate forwarded to WD Building for further treatment
        - » HH produced filtrate piped in dedicated trench to WD
        - » T Building filtrates (1958 to early 1970's) transferred in HW sewer (i.e. surveyed during 1996 program)

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - Bismuth metal target dissolved in aqua regia (3 parts concentrated HNO_3 and 1 part concentrated HCl)
    - aqua regia dissolves gold
  - Dissolver product solution denitrated with formic acid
  - Po^{210} is concentrated in a bed of powdered Bi metal

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Chemistry (contd.)
  - Powdered Bi dissolved in H_2O_2/HCl
  - Po^{210} valence adjusted with stannous chloride
  - valence adjustment/purification cycles continued to obtain Po^{210} purification specifications
  - Po^{210} electroplated onto foil from dilute HNO_3

Radiological Characterization Study: T Building HW Sewers

- Summary: Po^{210} Process Chemistry
  - There are a number of individual dissolution steps, filtration steps, and other chemical process steps involving solids and solid separation steps.
  - There is extensive use of very corrosive inorganic mineral acids.
  - There are a number of radioisotopes present in the irradiated targets.

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Engineering
  - Po^{210} recovery process involved
    - the handling of a short half live alpha emitting radioisotope (T 1/2 = 138 days)
      - neutron exposure problems
        - » alpha/n reactions with everything
      - intense alpha radiation fields
        - » burn hood gloves
    - the use of very corrosive concentrated mineral acids

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Engineering (contd.)
  - processes conducted in shielded cells
    - remote operations through one wall of cell
    - glove box operation through the other cell wall
  - process equipment constructed from Corning Pyrex® "double tough" glass pipe components
    - material is strong
    - some breakage occurs
    - gasket joints occasionally leak

Radiological Characterization Study: T Building HW Sewers

- Po^{210} Process Engineering (contd.)
  - Spent process solutions transferred to WD Building for treatment
    - spills also collected and either recycled for Po^{210} recovery or forwarded to WD for treatment
    - separation of waste solutions from solids is never quantitative (especially considering the short half live of the radionuclides involved)
      - fine suspensions or colloidal radioactive solids can be included in waste solutions sent to WD for treatment

Section 6.2 - T Bldg. Engineering Design & Construction

- T Building Facility Engineering Design
  - T Building Design Is Very Unusual (particularly as it pertains to liquid waste discharge from the building)
    - design must be understood in order to interpret characterization surveillance results and plan remediation requirements

Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - Building contains two floors
    - Service floor (first floor) contains
      - utilities including power & HVAC etc.
      - waste collection sumps and sump discharge
      - maintenance, etc.
    - Operations floor (second floor) contains
      - target storage pool
      - process cells
      - control labs, etc.

Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - T Building constructed underground
    - bottom of first floor slab at ~ 809 ft.
    - finish grade first floor elevation at ~ 817 ft.
    - finish roof grade at 866 ft.
    - grade level ~ 872 ft.
      - outside walls and roof are ~ 17 ft.thick reinforced concrete
      - designed to take direct 500 # bomb direct hit

Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - T Building Waste Collection and Disposal
    - there is no bottom-of-building drains for any wastes
    - all wastes (sanitary, cold, low-risk contaminated waste, and high-risk contaminated wastes) collected in individual sumps and pumped up through building, through the 17 ft. outside walls, vertically up the outside walls to main waste headers
    - main sanitary and hot waste sewers located on roof of T Building

Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - T Building Waste Collection and Disposal
    - Building first floor contains
      - 6 high risk hot waste sumps below the first floor grade (including one installed spare),
      - 4 low risk hot waste sumps below the first floor grade,
      - 4 cold waste sumps below the first floor grade, and
      - 5 sanitary waste sumps below the first floor grade.
    - Wastes flow by gravity from their respective sources on the first or second floor to sumps on service floor

Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - Sumps collected wastes collected from
    - floor drains (cold wastes, high risk wastes, low risk wastes, and sanitary waste floor drains)
    - drains in HH building transfer trench (HR waste)
    - drains in bottom of process cell (HR waste)
      - cell is lead lined
    - drain in bottom of target storage pool

Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - HR/LR Sump Waste sources
    - leaks in process cell equipment
      - solutions could be collected from cell floor and recycled; otherwise it went flowed by gravity to a high risk sump
    - leaks in HH Building transfer trench
      - wastes collected in separate HR Sump, recycle or sent to WD Building in HW sewer
    - decontamination room decon. solutions collected and sent to HR sump

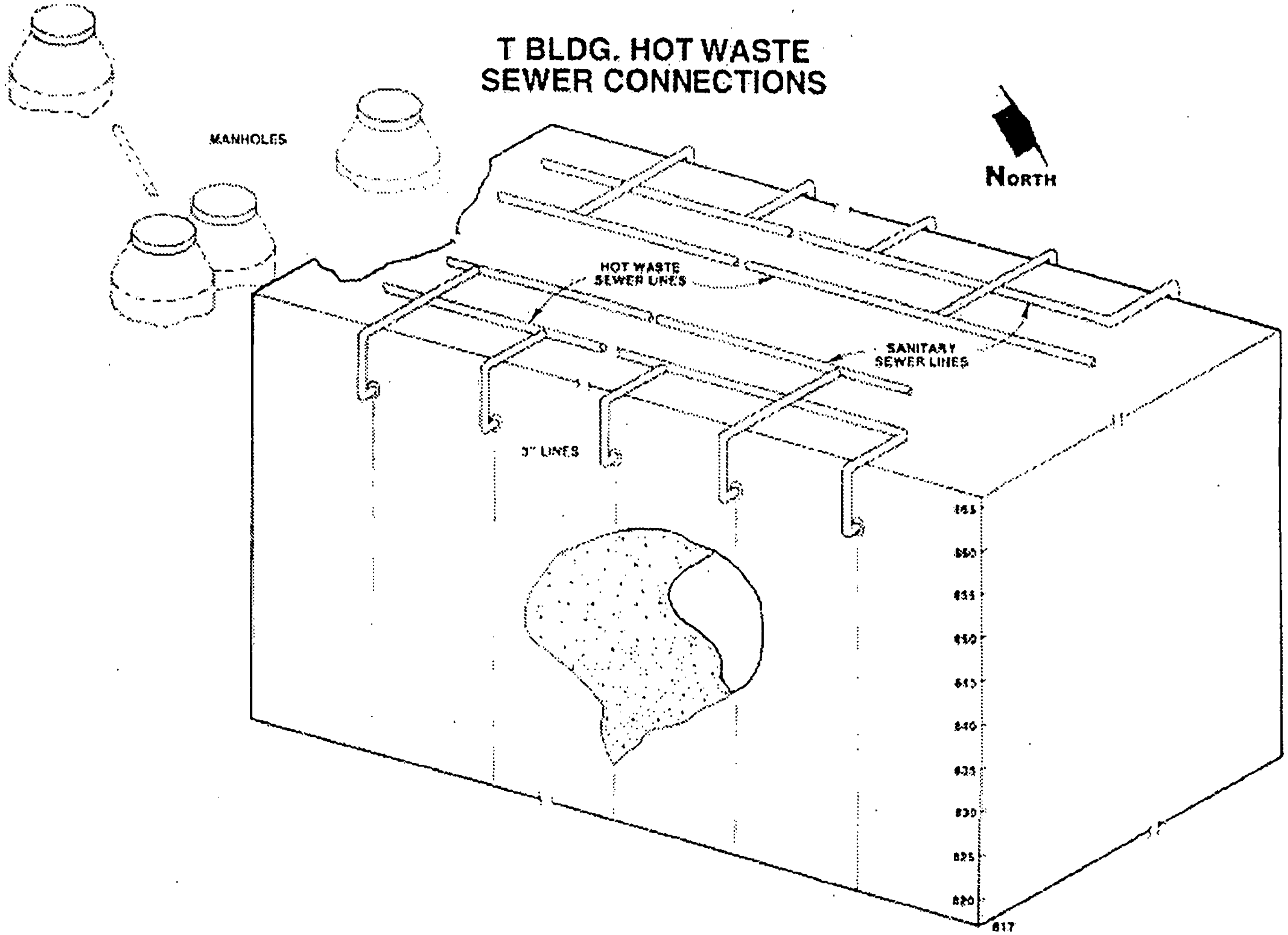
Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - HR/LR Sump Waste sources (contd.)
    - Pool water
      - pool has no water treatment system!
      - bottom-of-pool drain connected to LR sump
      - when pool lost visibility, solids allowed to settle to ~ 6 in depth
      - pool water decanted and sent to LR sump
      - solids in bottom of pool slurried, drained to LR sump, and pumped to the hot waste sewer and WD Building

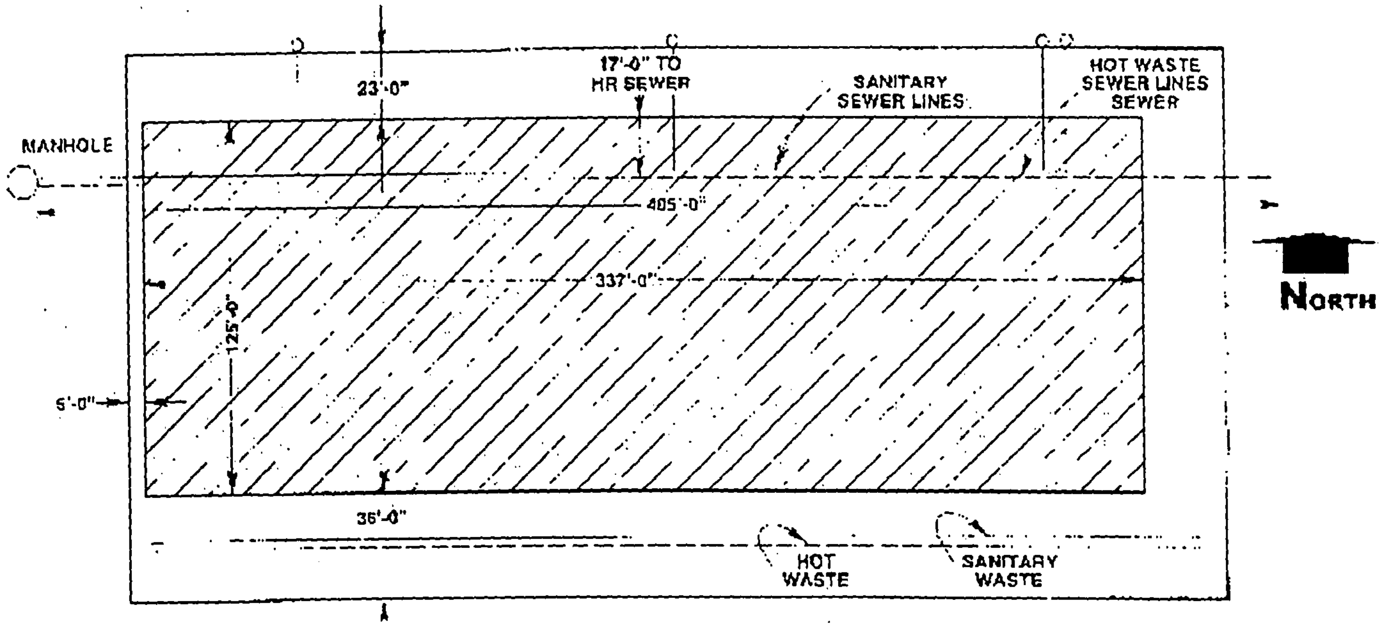
Radiological Characterization Study: T Building HW Sewers

- T Building Engineering Design (cont.)
  - Complicating T Building Design
    - DS Building built on top of T Building (finish floor elevation ~ 6 ft. above the T Building roof)
      - built in three segments: 1971, 1976, and 1978
      - no hot wastes originated in DS Building and no connections to the hot waste sewer
    - The north side hot waste and sanitary sewer lines are sandwiched between the DS Building Floor and T Building Roof.

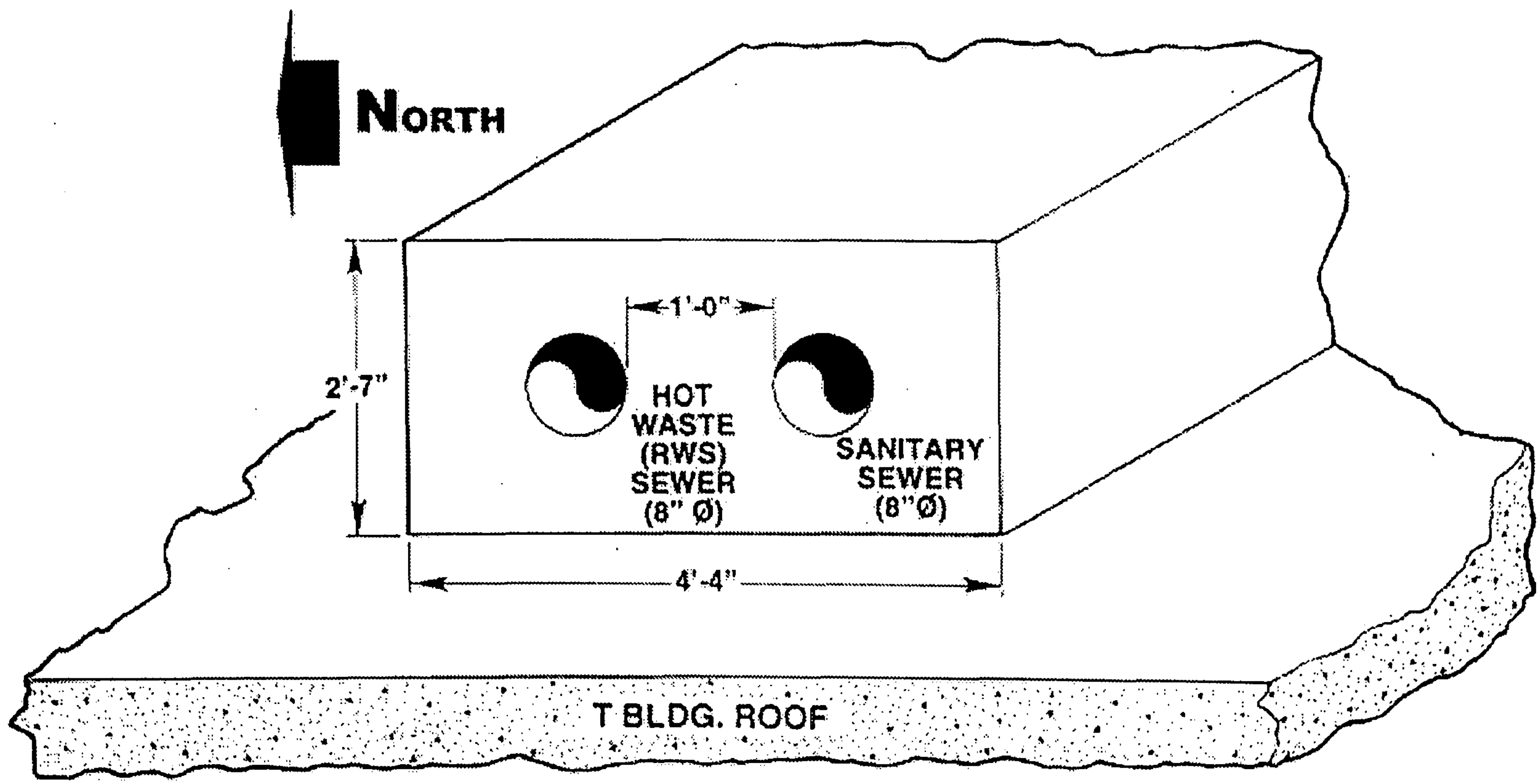
T BLDG. HOT WASTE SEWER CONNECTIONS



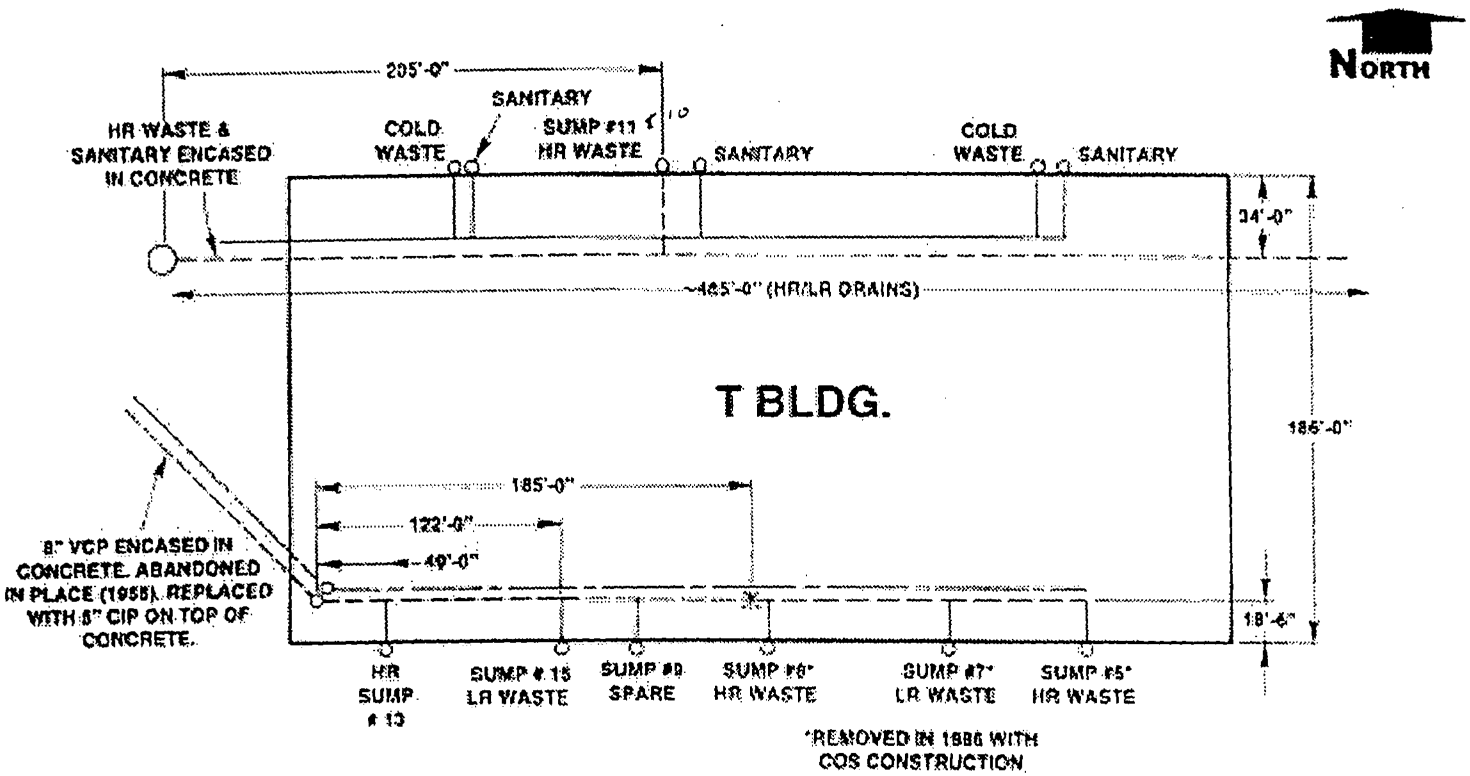
DS BLDG.
(PLAN VIEW)



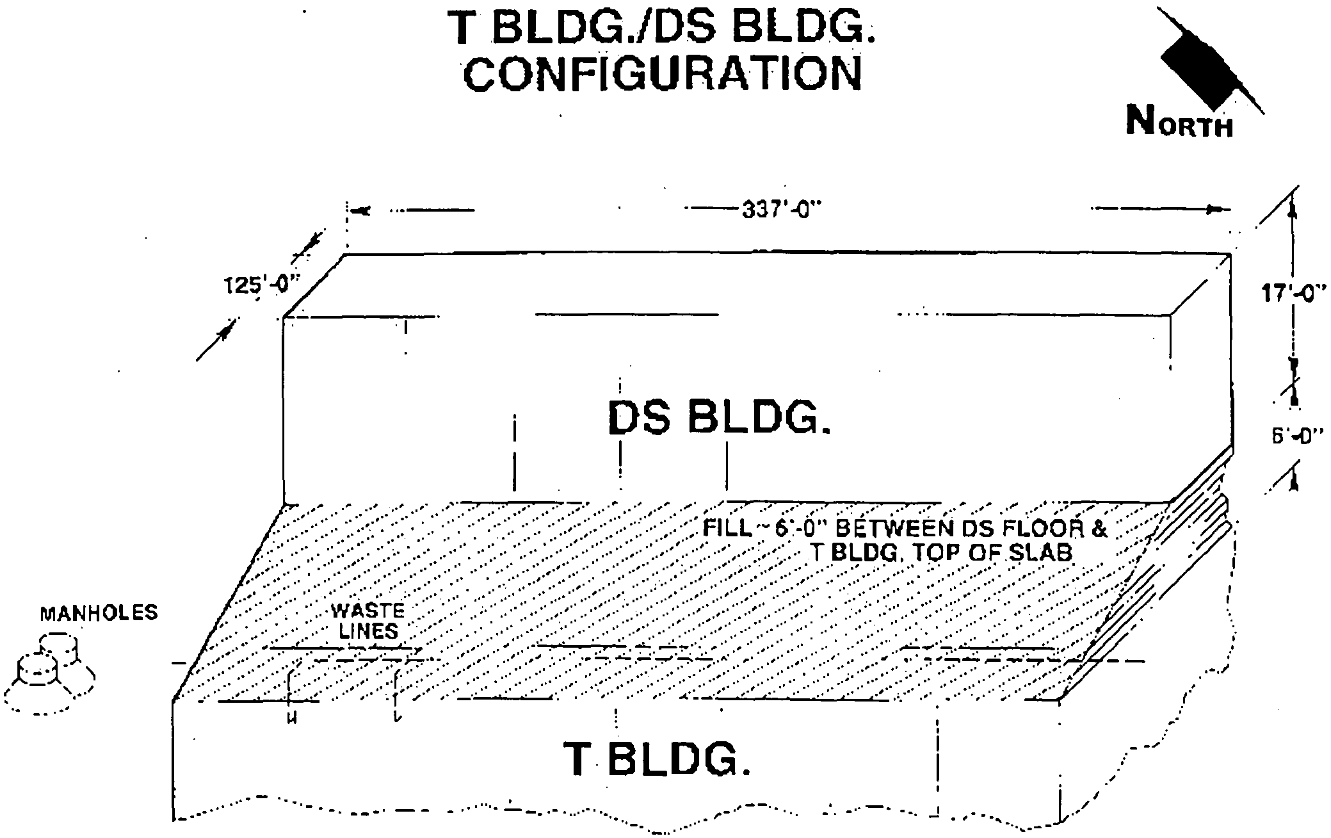
HOT WASTE/SANITARY WASTE SEWER CONCRETE ENCASEMENT



T BLDG. HOT WASTE SEWER CONNECTIONS
(PLAN VIEW)

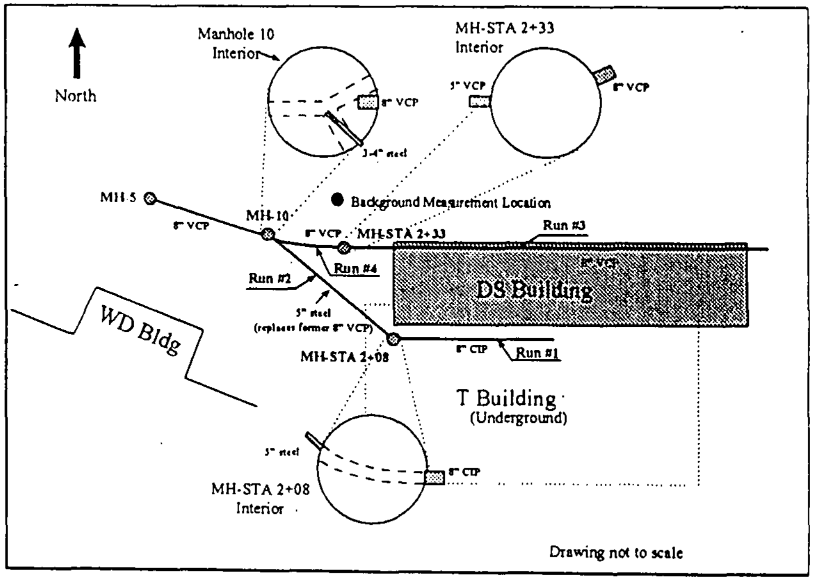


T BLDG./DS BLDG. CONFIGURATION



Section 6.3 - T Building 12/96 HW Sewer Surveillance Studies

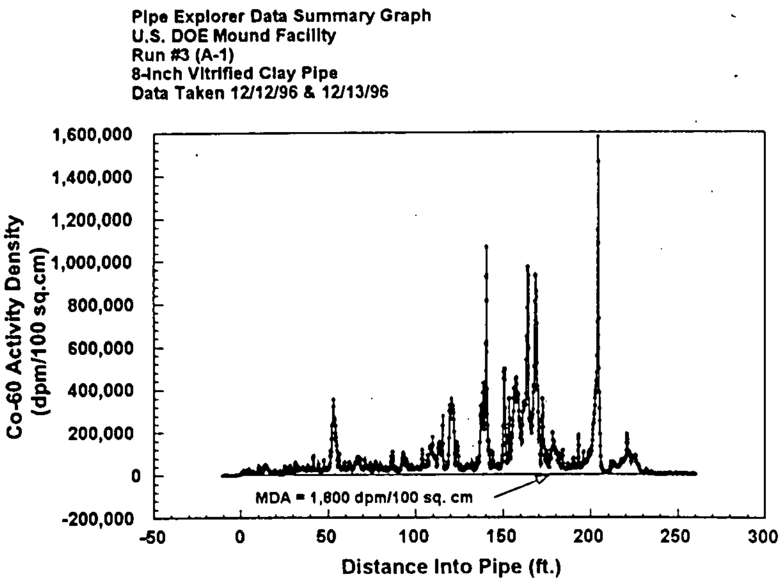
- Video and radiological surveillance study of four HW sewer segments servicing T Building
- Goal: Demonstrate that HW sewer is uncontaminated



T Building HW Sewers Surveillance

- Surveillance system tows a NaI detector and black and white video camera through sewer
  - continuous surveillance for Co^{60} activity density
    - dpm/100 cm^2 or pCi Co^{60}/100 cm^2
  - total gamma isotopic analysis at 8 locations
- Four segments surveyed
  - segment lengths total 1002 ft.
  - 492 ft. video surveillance
  - 445 ft. radiological surveillance

Radiological Surveillance Run # 3 Co^{60} Activity Density Profile



- General range of contamination source activity densities 7,000 to 14,000 pCi $Co^{60}/100\ cm^2$
- 30 contamination sources with > 45,000 pCi $Co^{60}/100\ cm^2$,
  - average source 2.6 ft. wide
- maximum contamination source 712,000 pCi $Co^{60}/100\ cm^2$
  - contamination source located at 204 ft.(near HR sump # 10 riser) 11 & 10
  - contamination source 8.2 ft. wide

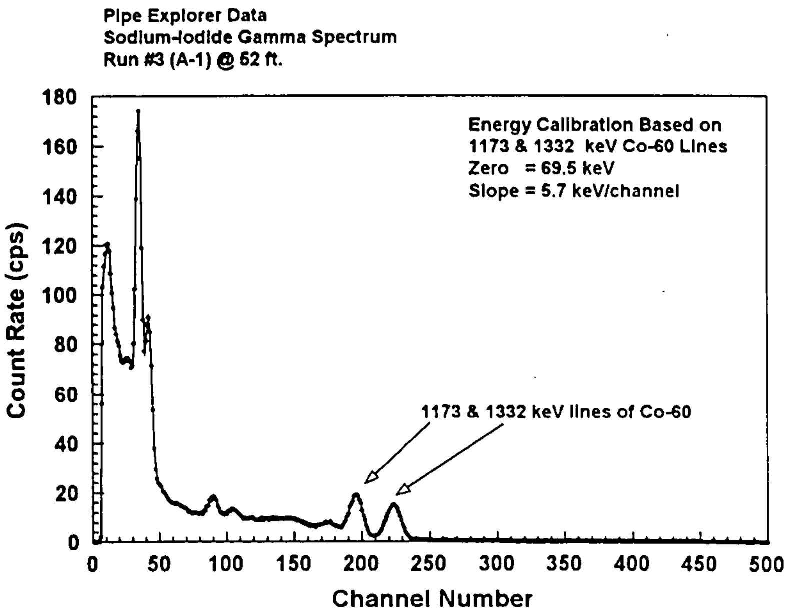
Radiological Surveillance Run # 3 Co^{60} Activity Density Profile

- Additional Surveillance Conclusions
  - Co^{60} contamination is present as discrete insoluble pieces of material
    - Most likely source is individual small pieces of undissolved aluminum cladding containing Co^{60}.
      - Dissolved material would not have the appearance of contamination point sources
        - » soluble material would be uniformly distributed
      - The width of Co^{60} contamination source varies between 0.9 ft. and 5.0 ft. with an average contamination source width of 2.6 ft.

T Building HW Sewers Surveillance Run # 3

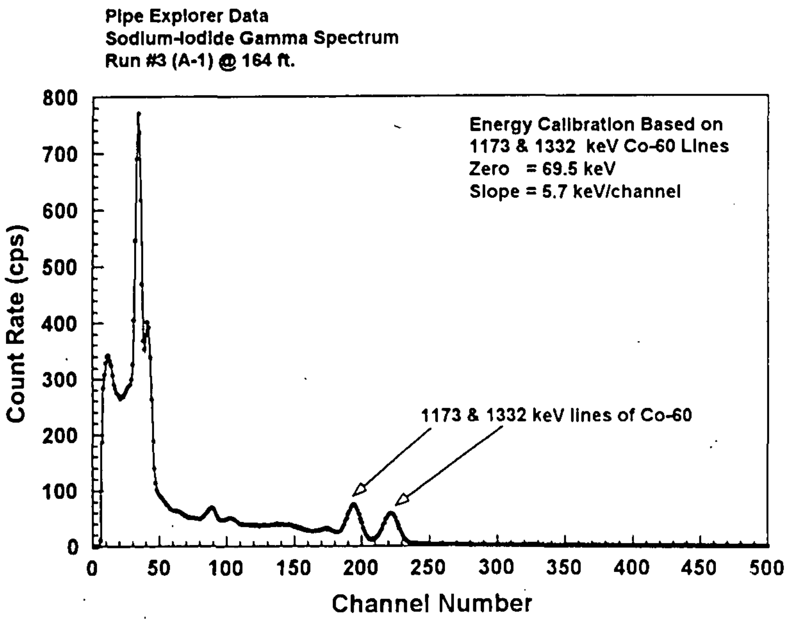
- Video Surveillance Conclusions
  - Approximately 50% of segment completely free of ruble/solids/debris
    - 20% of segment contains solid material
      - solids occupy between 5 and 50% of sewer segment cross sectional area
  - There is an estimated 0.7 and 1.3 GPM water inflow at four separate locations
    - there may have been a structural line failure

T Building HW Sewers Surveillance Run # 3 (GEA)



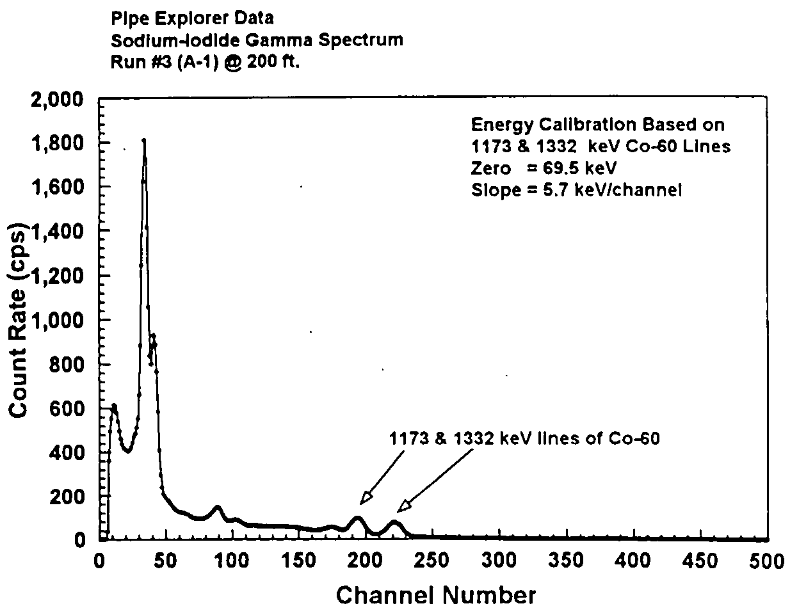
- **Gamma Energy Analysis @ 52 ft.**
  - Peak count rate 174 cps @ ~ 269 keV
  - Bi^{210m} @ channels 35, 40, and 104 (i.e. ~269 keV, 309 keV, and 662 keV.)
  - other gamma peaks (i.e. 138 keV and 577 keV) are unidentified

T Building HW Sewers Surveillance Run # 3 (GEA)



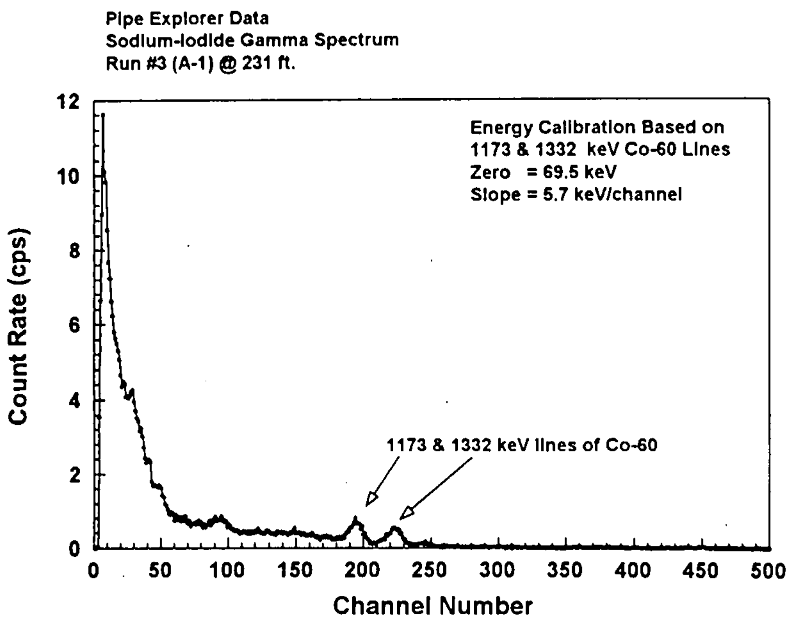
- **Gamma Energy Analysis @ 164 ft.**
  - Peak count rate 770 cps @ ~ 263 keV
  - Bi^{210m} @ channels 34, 40, and 104 (i.e. ~263 keV, 303 keV, and 657 keV.)
  - other gamma peaks (i.e. 138 keV and 577 keV) are unidentified

T Building HW Sewers Surveillance Run # 3 (GEA)



- **Gamma Energy Analysis @ 200 ft.**
  - Peak count rate 1810 cps @ ~ 263 keV
  - Bi^{210m} @ channels 34 and 41 (i.e. ~263 keV and 303 keV.)
  - other gamma peaks (i.e. 138 keV and 571 keV) are unidentified

T Building HW Sewers Surveillance Run # 3 (GEA)



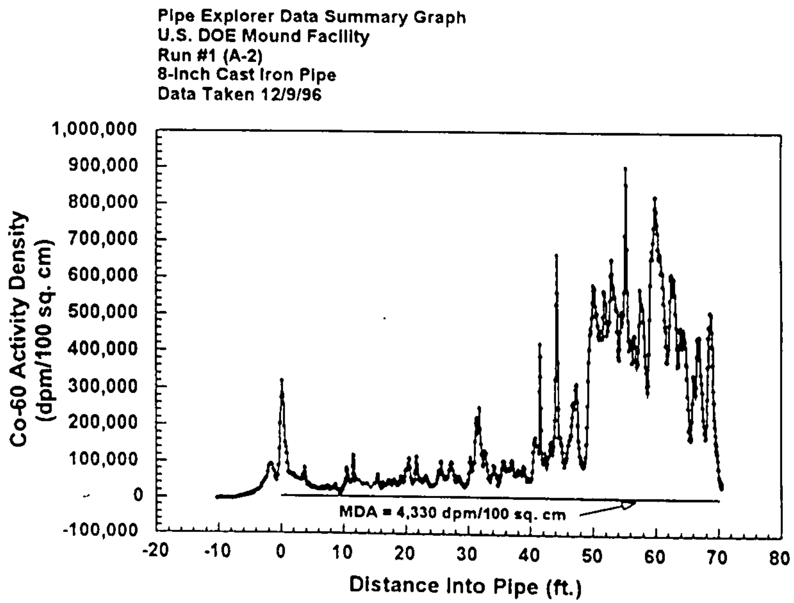
- **Gamma Energy Analysis @ 231 ft.**
  - Peak count rate 11 cps @ ~ 109 keV

T Building HW Sewers Surveillance Run # 3 (GEA)

- Other gamma energy analysis conclusions include
  - the main source of the contamination is between 200 and 231 ft.
    - High risk sump # 10 is the only T Building Sump discharge entering the HW sewer on the north side. It enters the sewer at 205 ft.
    - The Co^{60} count rates in these four analyses are much lower than for the other radionuclides (i.e. Bi^{210m} and the unknown radionuclides)

Radiological Surveillance Run # 1 Co^{60} Activity Density Profile

- 29 contamination sources with activity densities varying between 38,000 and 409,000 pCi Co^{60}/100 cm^2,
- ~17 ft. long band of contamination between 48 and 65 ft.
- maximum contamination source 409,000 pCi Co^{60}/100 cm^2
  - contamination source located at 55 ft.

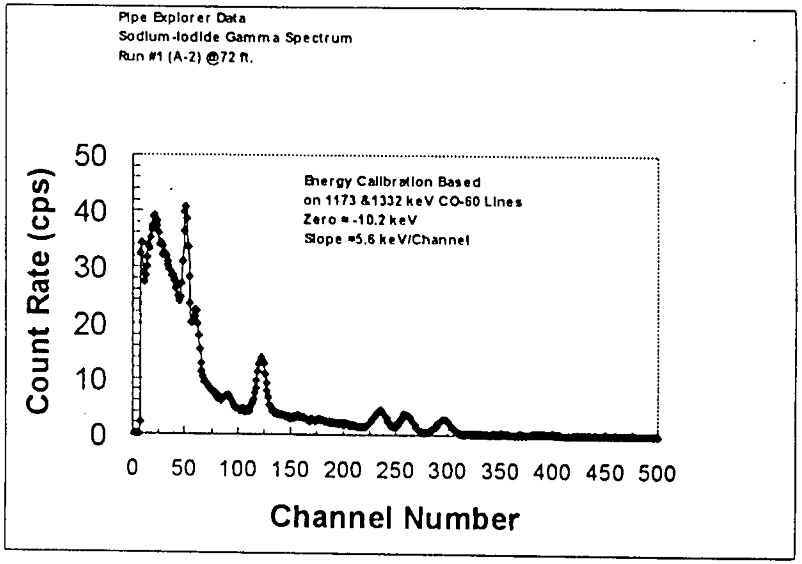


Radiological Surveillance Run # 1 Co^{60} Activity Density Profile

- Video Surveillance Conclusions
  - majority of segment free of solids
    - lumps of debris distributed through our sewer segment occupying 5 to 40 % of the sewer cross sectional area
      - many of Co^{60} contamination source associated with ruble/debris/sediments
      - many of the ruble/debris/sediment lumps are located at sewer joints
  - estimated 0.01 to 0.05 GPM water inflow

T Building HW Sewers Surveillance Run # 1 (GEA)

- **Gamma Energy Analysis @ 71 ft.**
  - Bi^{210m} @ channels 59, 68, and 130 (i.e. ~264 keV, 315 keV, and 673 keV.)
  - other gamma peaks (i.e. 102 keV, 483 keV, and 1,295 keV) are unidentified



T Building HW Sewers Surveillance Run # 1 (GEA)

- Other gamma energy analysis conclusions include
  - there are a larger number of unknown radioisotopes present in this sewer segment
    - this segment received was connected to all 4 low risk and 5 high risk T Building sumps
      - discharged target storage pool clean water and sludge
    - segment contains three unidentified gamma emitting radionuclides (~102 keV,~483 keV, and ~1295 keV)

Reference E

RESULTS OF RADIOLOGICAL AND VIDEO SURVEYS OF DRAIN LINES AT THE US DOE MOUND FACILITY WITH THE PIPE EXPLORER™ SYSTEM

Prepared for

EG&G Mound Applied Technologies
US DOE Mound Facility

Work Performed Under Purchase Order 14535

January 1997

Science & Engineering Associates, Inc.

Science & Engineering Associates, Inc.
6100 Uptown Blvd.
Albuquerque, New Mexico 87110
(505) 884-2300

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CONTENTS

RESULTS OF RADIOLOGICAL AND VIDEO SURVEYS OF DRAIN LINES AT THE US DOE MOUND FACILITY WITH THE PIPE EXPLORER™ SYSTEM

INTRODUCTION

EG&G Mound Applied Technologies contracted with Science & Engineering Associates, Inc. (SEA) to perform both radiological and video surveys of portions of two buried radiological waste transport drain lines at the US DOE Mound Facility. This report summarizes the results of that characterization effort.

SEA personnel first visited the Mound Facility on November 4, 1996, to attend a kick-off meeting and general orientation of the work site. SEA then calibrated the 2x2-Inch sodium iodide gamma detector for the specific pipe geometries of the lines. The Pipe Explorer equipment was then mobilized, arriving at the Mound Facility on Monday December 2, 1996. The two person SEA field crew arrived at the facility on Monday as well.

New data regarding the radiological conditions in the drain lines required that the SEA personnel complete the Mound Facility, Radiological Worker II training. This training was completed on Monday and Tuesday mornings. The equipment was unpacked on Monday evening and staged at the first access point, manhole STA 2+08. Some minor repairs were made to the equipment on Tuesday afternoon to correct damage suffered during shipment to the Mound Facility. After completing this task, the surveys were initiated. The last survey was completed during the afternoon of Friday December 13. The equipment was then demobilized, and surveyed for potential contamination by an EG&G Radiological Control Technician (RCT). The equipment was packed for shipment on Monday, December 16, and shipped out on Tuesday December 17.

Many of the drain lines surveyed, exhibited properties which made deployment of the Pipe Explorer™ inverting membrane difficult at best. At the outset of this project is was assumed that the drain lines would exhibit little, if any, radiological contamination. Thus, the intent was to survey the entire length of the drain lines to verify that no significant Co-60 contamination was present. The measurements quickly revealed that there was, in fact, substantial amounts of residual Co-60 contamination in each of the drain lines entered. Because of this finding, it was decided not to expend the extra time, both on the part of the EG&G support personnel and the SEA personnel, that would have been necessary to survey the entire length of the drain lines, as the return for the extra effort would have been of marginal value.

DESCRIPTION OF THE DRAIN LINES SURVEYED

The pipe segments surveyed were part of a waste transport system composed of two lines (A-1) and (A-2), which join at Manhole 10. Table 1 provides a listing of the four pipe runs that were surveyed, giving the run ID that is used throughout the remainder of this report, as well as various information particular to the pipe run. The original scope included a fifth run to begin at Manhole 10 and run to the west. The EG&G Project Manager dropped this run from the scope as it became clear that all of the pipes exhibited significant amounts of radiological contamination, and would eventually need to be excavated. Figure 1 shows a sketch of the drain lines that were surveyed. This sketch is not to scale, and is intended only to show the orientation of the lines with respect to each other and identify major features in the area.

Table 1. Description of pipe runs surveyed.

Run ID	Access ID manhole	Deployment direction	Pipe diameter (in.)	Segment length (ft.)	Video survey Length (ft.)	Radiological survey length (ft.)
Run # 1 (A-2)	MH STA 2+08	West->East	8	202	121	71
Run # 2 (A-2)	MH STA 2+08	SE->NW	5	210	29	28
Run # 3 (A-1)	MH STA 2+33	West->East	8	500	259	260
Run # 4 (A-2)	MH STA 2+33	East->West	8	90	83	86

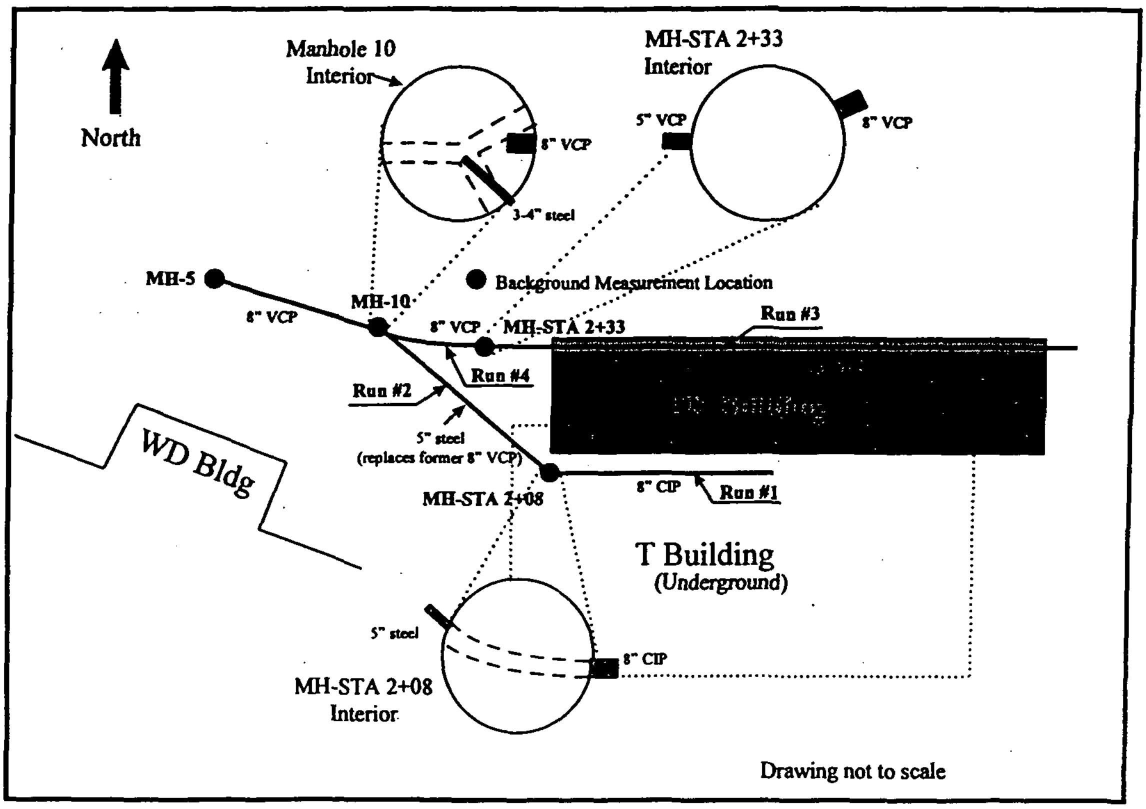


Figure 1. Sketch of the pipe segments surveyed showing the access manholes and Run #'s.

VIDEOTAPING

The videotaping was accomplished by towing a small black & white, CCD video camera equipped with a pin-hole lens. This camera is mounted in a sensor housing that is deployable with the Pipe Explorer™ system. The housing is also equipped with several small incandescent lamps to illuminate the pipe interior. The video signal, with the text identifying the run, date, time and camera distance, was recorded in SVHS format on a high resolution VCR. Two copies of an edited version of this video master are provided in standard VHS format for each of the four pipe runs videotaped. The pipe run ID imprinted on each tape is referenced in Table 1 and Figure 1 for correlation with location of the pipe segments. Due to obstructions and blind ends in some of the pipe runs, SEA was not always able to videotape the entire run length. The actual footage of video surveys performed for each run is shown in Table 1. A short description of the prominent features of each of the videotapes is provided below.

General Deployment Notes

In portions of some videotapes the characters imprinted on the video signal exhibit jitter, making it difficult to read the information. The characters can be easily read by pressing the "pause" button on the VCR during playback. In all of the videotapes there is a white ball like object appearing in more or less the center of the screen. This is the point of attachment of the membrane to the camera harness. This knot is approximately 1-inch in diameter, and is 16 inches in front of the camera lens. Another feature common to most of the videotapes is the occurrence of membrane ribbons protruding toward the center of the pipe. This occurs when the membrane diameter is larger than the effective pipe inside diameter (ID). This occurrence of these ribbons becomes most pronounced when the pipe is filled with sediment, effectively reducing the pipe ID.

The camera harness design employed by the Pipe Explorer™ does not restrict the camera from rotating about the axis of deployment. This is necessary for the camera to be able to be deployed around multiple elbows at all possible orientations and in small diameter pipes. Thus, the camera view occasionally rotates. The bottom of the pipe is usually determinable by observing sediment build-up on the bottom of the pipe. In the descriptions that follow the initial orientation of the pipe bottom is given at the beginning, and major or abrupt changes are noted. The orientation is given by reference to a clock face, where 12 O'clock would be the top of the screen and 6 O'clock would be the bottom of the screen.

Run #1 (A-2)

The videotape for Run #1 (A-2) was initiated at manhole STA 2+08, with deployment occurring from the manhole in an easterly direction, up stream. The videotape starts at the end of the pre-pipe, which SEA installed as a means of connecting the Pipe Explorer™ canister outlet to the drain line. The drain line is an 8-inch cast iron pipe showing moderate corrosion. This pipe run appears to be constructed of pipe segments 5 ft. in length. A 14-inch Lay Flat membrane was used for this deployment. The initial orientation of the pipe bottom is at 1 O'clock. The initial few feet of the pipe exhibit debris accumulating to approximately 0.75 inches. At a distance of 4.1 ft. the pipe bottom orientation has changed to 3 O'clock. An example of a pipe segment joint is observable just by the membrane knot at a distance of 13.0 ft. At this point the bottom is oriented at the 4 O'clock position. A small pile of debris occurs at approximately 41 ft. Several such small piles appear to coincide with joints in the pipe. A "T" into the line is observable at 51.4 ft. at the 12 O'clock position. A large clast appears at 56.0 ft. Sediment has filled-in upstream of this obstruction to as much as 1 inch. At a camera distance of 72 ft. the deployment slows and becomes jerky. This is attributable to the membrane front having difficulty negotiating an obstacle in the pipe. At this point the membrane front is at a distance of approximately 104 ft. This occurs again at a camera distance of 77 ft. At 96.7 ft. a "T" becomes visible at the 9 O'clock position. At 97.6 ft. the bottom changes orientation to the 12 O'clock position as the camera harness passes over a large pile of debris, which occurs at a distance of 99 ft. The pile of debris coincides with the location of the "T" and fills nearly half of the pipe cross section. The region upstream from this debris pile is filled to a depth of approximately 1 to 1.25 inches with sediment. The deployment ends at 120.7 ft. The canister pressure is relieved which results in an inflow of fluid from upstream beginning at the time stamp 9:36:38. Note that this fluid is carrying small particles down stream, towards the camera. Presumably buildup of fluid, and/or air pressure in front of the membrane inversion point offset the membrane's ability to create a towing force on the tether.

Run #2 (A-2)

The videotape for Run #2 was initiated at manhole STA 2+08, with deployment occurring in a northwesterly, or downstream direction. The pipe is 5-inch steel material exhibiting substantially more corrosion than the cast iron pipe in Run #1. Difficulties in deployment occurred in this pipe, resulting in several attempts to videotape the pipe run. On the last attempt, it was possible only to deploy to a distance of 28.8 ft. The videotape for this run starts with the camera deployed to this distance. The videotaping was performed during retrieval, which accounts for the depth numbers decreasing from the 0 ft. to -28.8 ft. at the start of the pre-pipe. The end of the membrane is clearly visible, just behind the knot, at the start of the tape. The initial orientation of the pipe bottom is at 1 O'clock. By -3.7 ft. (25.1 ft actual distance) the pipe bottom has changed orientation to the 3 O'clock position. The debris in the bottom of the pipe appears to be a combination of loose pipe scale, gravel, and fine grained sediment. Note the ribbon of extra membrane at the 9 O'clock position. At approximately -12.3 ft indicated (16.5 ft. actual) a ribbon appears at the 6 O'clock position, indicating a decrease in the pipe ID. At -24 ft. indicated (4.8 ft. actual) the pipe bottom changes orientation to the 12 O'clock position. At -28.8 ft indicated the camera starts into the pre-pipe, ending the survey.

Run #3 (A-1)

The videotape for Run #3 (A-1) was initiated at manhole STA 2+33, with deployment occurring in an easterly, upstream direction. This line was constructed from 8-inch vitrified clay pipe. The videotape starts at the end of the pre-pipe. This line is characterized by zones of substantial debris and sediment accumulation interspersed with very clean zones. Initially the pipe bottom is oriented at the 10 O'clock position as the camera is held against the top of the pipe, hanging upside down. A sharp object protruding at the 3 O'clock position resulted in a punctured membrane during the first attempt at video taping this line. At 0.5 ft. the pipe bottom changes orientation to the 5 O'clock position. A pipe joint occurs at 2.5 ft., coinciding with a change in the slope of the drain line. Note that the line is also substantially cleaner. At 4.3 ft. the pipe bottom changes orientation to the 3 O'clock position. Pipe joints visible at the 5.8 and 8.8 ft. positions indicate pipe lengths of 3 ft. were used in construction of the drain line. The pipe bottom changes orientation to the 12 O'clock position at approximately 6.4 ft. The object seen on the inside of the membrane at 10.1 ft. is a piece of grass, picked up when the membrane was stretched out on the grass for measurement prior to its loading into the manual canister. A short section of pipe from 32.7 ft to 34.3 ft. coincides with a change in the slope of the line. At 32.4 ft. the pipe bottom occurs at approximately the 10:30 position as is evident from the dark staining showing the bottom. At 34 ft. the pipe bottom is at the 9 O'clock position and changes to the 6 O'clock position at approximately 34.6 ft. as the camera passes over the change in slope. At approximately 38 ft. accumulation of small amounts of sediment is observable. At 44.5 ft. the pipe bottom is at the 3 O'clock position. Greater thickness of sediment and debris are observable at 55 ft., increasing in depth at approximately 68 ft. A small pile of debris occurs at 110 ft. At 117 ft. the pipe bottom has changed orientation to the 12 O'clock position. Also note a small volume of fluid flowing between the membrane and the pipe wall at this distance. A "T" is observable at the 4 O'clock position at a depth of 120.7 ft. Also note the small volume of fluid flowing in from the "T" and the debris pile directly below the "T" on the pipe bottom. The debris pile and sediment accumulation on the upstream side of this pile extend to a distance of approximately 132 ft. Past this the pipe is relatively clean and free from sediment and debris until approximately 139 ft., where another pile of debris occurs. At this point the pipe bottom is at the 10 O'clock position. Another pile of debris occurs at 152 ft. The debris from 159 ft. to 190 ft. appear to include angular pieces of gravel. A relatively clean section of pipe begins at 198 ft. A "T" is visible at 202 ft. at the 4 O'clock position. At this point the pipe bottom is between the 11 O'clock and 12 O'clock positions. Upstream from this "T" is a debris pile approximately 3 inches deep. There is an apparent build-up of fluid between the pipe wall and the membrane beginning at approximately 213 ft. At this distance the pipe bottom is at the 11 O'clock position. This accumulation of fluid continues to the end of the deployment at 256.8 ft.

Run #4 (A-1)

The videotape for Run #4 was initiated at manhole STA 2+33, with deployment occurring in a westerly to north westerly, downstream direction. This line was constructed from 8-inch vitrified clay pipe. In general this pipe exhibited almost no accumulation of debris and sediment. A 12-inch Lay Flat membrane was used for this pipe, which was slightly undersized, since the pipe exhibited no accumulation of sediment. This resulted in the membrane being decoupled from the pipe wall over a portion of the pipe's interior circumference. Since there were no significant features observed in the pipe it was decided not to repeat the video run with the larger 14-inch Lay Flat membrane. The videotape starts with the camera at its fully deployed distance of 83.1 ft. and shows the retrieval back upstream. Thus the distance imprinted on the screen starts at 0 ft. and decreases. The distance from the start of the pipe at manhole STA 2+33 is the sum of 83.1 ft. and the indicated distance. Initially the pipe bottom is oriented at the 1 O'clock position. The membrane is decoupled on the right side of the screen. The line appears to have been constructed from 10 ft. lengths of pipe. Joints are clearly visible at indicated distances of -14 ft, -23.8 ft., -33.8 ft., -43.8 ft., -53.8 ft, -63.6 ft. and -73.5 ft. The pipe bottom changes orientation at -63.5 ft. to the 3 O'clock position. The pipe bottom again changes orientation at an indicated distance of -82.3 ft. The camera enters the pre-pipe at an indicated distance of 83.1 ft., ending the run.

RADIOLOGICAL SURVEYS

Radiological characterizations of the drain lines were conducted using a Canberra model 802 gamma detector (2x2-inch NaI(Tl)) set-up specifically to detect the 1173.2 & 1332.5 keV gamma emissions of Co-60. The detector package included a Canberra model 2007B preamplifier. This detector package was operated with NIM standard electronics consisting of an Ortec model 478 high voltage bias supply, a Canberra model 2022 spectroscopy amplifier, a Canberra model 2030 single channel analyzer (SCA), and an Ortec model 996 counter/timer. The SCA was used to establish an energy window encompassing the two principal gamma ray energies from Co-60. Figure 2 shows a gamma spectrum obtained with the NaI(Tl) detector and a Co-60 source with the energy window indicated by the box labeled Region of Interest. Any pulse occurring within the energy window results in the generation of an output pulse from the SCA to the counter/timer, which increments its count register. Pulses occurring outside of the energy window do not result in recorded counts. The energy window is somewhat wider than might appear optimum to accommodate small temperature driven gain shifts in the counting system that may have occurred during the course of a survey.

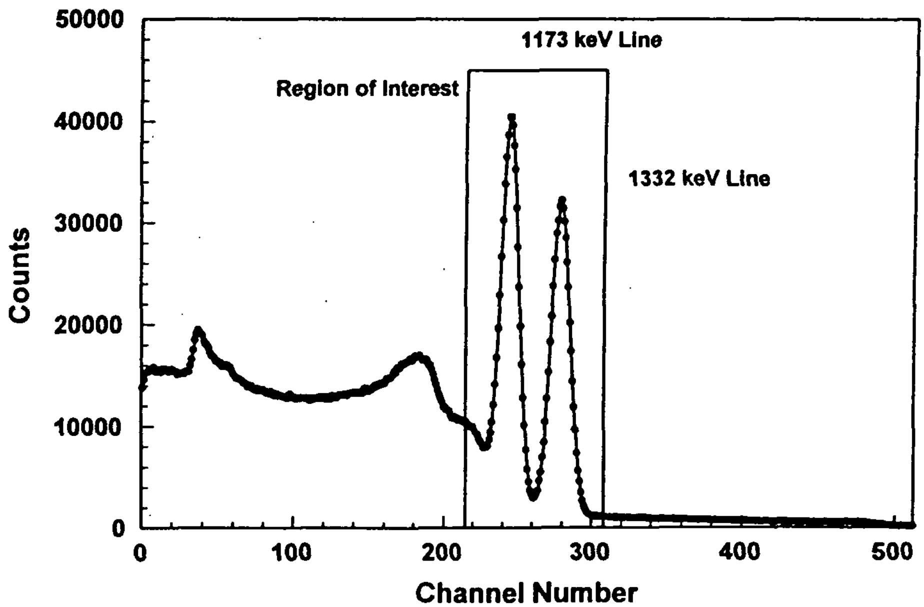


Figure 2. Shows a gamma ray spectrum from the detector employed in these measurements. The region of interest used is indicated by the box surrounding the two principal photopeaks of Co-60.

The radiological surveys were performed by towing the NaI(Tl) detector package through the drain line to be surveyed with the SEA Pipe Explorer™ system at a known rate and logging the detector output versus distance in the pipe with a data acquisition system. The data acquisition system was comprised of a rack mount personal computer interfaced to various components of the Pipe Explorer™ system through a data acquisition program written in LabView. A count time was selected at the start of each survey. This is the time over which the counter/timer was allowed to accumulate counts before being reset by the program. The total counts accumulated by the counter/timer in this interval and the detector distance in the pipe were recorded by the program at the end of each interval. The program also recorded various other parameters related to the deployment process, such as the canister pressure and tether tension.

The count time selected for each survey was dependent upon the planned logging rate. In no case was the count time allowed to be longer than the time that it took for the detector crystal to pass over a fixed point, i.e. a distance of 2 inches. In several surveys the raw data were recorded using count times much shorter than this time. The raw data were subsequently combined into a longer effective count time by summing the counts over a fixed number of recorded intervals and computing the average distance over this same number of intervals. The gross count rate was computed by dividing the total counts by the total count time in seconds. A net count rate was then obtained by subtracting the measured background count rate from this gross count rate. The activity density (dpm/100 cm^2) was computed by dividing the net count rate (cps) by the yield factor appropriate for the particular pipe geometry. The logging rate employed for each survey, as well as the effective count time of the reduced data is recorded in the header information in the tabular data listing.

Calibration of the counting system was performed prior to the commencement of field activities for two different pipe geometry's, an 8-inch pipe diameter and a 5-inch pipe diameter. These calibrations were carried out following the SEA Environmental Technologies Group Technical Procedure, Pipe Explorer™ Gamma Detector Calibration. A copy of this procedure is included in Appendix A for reference. A 0.46 μCi Co-60 gamma source was used in this calibration process. The activity contained within this source is certified by the manufacturer, and is NIST traceable. A copy of the source certificate of calibration is included in Appendix A for reference. The results of these calibration activities are also included in Appendix A. These results include a calibration data summary sheet and a tabulation of the calibration data for each of the two different pipe geometries. The calibration data summary sheet shows a surface trend plot of the detector response region and lists the equipment settings, computed yield factor, and check source information. As part of the calibration procedure the net count rate response of the counting system to a Co-60 check source (ID # 163C26) was determined. This check source was used in the field to assure that the system performance had not changed since the calibration.

Prior to the start of each survey, after warming up the electronics, the gain of the system was adjusted to place the 1173.2 keV photopeak of the Co-60 check source at 4.7 volts. Then a 1-minute background count, and a 1-minute count of the check source were taken. The net count rate of the check source was then computed and compared against the 3σ range established for the check source during calibration. In all cases the measured check source net count rate fell within the specified 3σ range. Copies of the daily check source count are also included in Appendix A.

In order to obtain an accurate measure of the activity within the drain lines it was necessary to estimate the background count rate of the counting system under conditions similar to those which occur within the drain lines themselves. This background response was then subtracted from the detector response measured within the drain lines to give a net count rate. To this end, EG&G provided a vertical hole approximately 8-inches in diameter and 3 feet deep in soil which they determined to be free of Co-60 contamination. This hole was located adjacent to the area of the drain lines. Its approximate location is shown in Figure 1. Two separate measurements of the detector background count rate were made with the detector in the bottom of this hole, lying against one side. These measurements were made on December 4, 1996 and again on December 13, 1996. Each measurement consisted of one 5-minute count, yielding 2,197 counts for the first measurement and 2,338 counts for the second measurement. These two counts agree within 2σ counting statistics and give an average background count rate of 7.56 counts per second (cps).

The minimum detectable activity is an important concept related to the type of measurement performed during these surveys. The minimum detectable activity, or MDA, is the minimum activity for a given measurement scenario which can be detected with a 95% certainty. Specifically, this is a 5% chance of concluding that there is activity above the background activity when none is actually present and a 5% chance of concluding that there is not activity above the background activity when there actually is. It is important to note that at the MDA a binary decision is being made; Is there activity above background or not? No meaningful quantitative assessment of the activity can be made at this level. As activity levels increase, the certainty in the measure of the amount (or concentration) of activity increases substantially.

The MDA for measurements made inside a pipe geometry, assuming uniform activity distribution, is given by the following formula:

$$MDA = \frac{2.71 + 4.65\sqrt{BKR \cdot t}}{Y \cdot t}$$

Where: MDA = Minimum Detectable Activity Concentration (dpm/100 cm^2)
BKR = Background Count Rate (cps)
Y = Yield Factor [net cps/(dpm/ 100 cm^2)]
t = The count time (s)

An MDA was computed for the measurement conditions incurred for each pipe surveyed. These MDA's are plotted on the data plots in Appendix B and given in the header information of the tabular listings for each survey in Appendix C. The count time used in these computations is the combined count time in those cases where shorter count times were combined into longer intervals.

The measurement results are provided in graphical form in Appendix B. A separate graph is provided for each pipe surveyed with distance from the start of the pipe plotted on the X axis and the computed activity density plotted on the Y axis. The measurement results are also presented in tabular form in Appendix C. The information particular to the run, such as Run ID, information about the pipe, instrument settings used, effective count time, yield factor, background count rate, logging rate, and MDA are all included in the header for the table. The table itself consists of three columns; The sample time, the distance from the pipe datum, and the computed Co-60 activity density in dpm/100 cm^2. The data for Run #3 (A-1) were collected over two days. This break in the data collection appears on page 18 of the data table. Because the data collection occurred over more than one day, a second check source count was performed when the detector was removed from the pipe on 12/13/96. The results of both the beginning and ending check source counts are listed in the table header. Difficulties with the data acquisition during Run #4 (A-1) resulted in the loss of the initial portion of the data for that run. Thus, the initial portion of the run was repeated. This accounts for the break in the sample time seen on page 2 in the tabular data.

DISCUSSION OF RESULTS

In general, the measurement results were other than expected. The initial belief was that these drain lines would exhibit little, if any, residual Co-60 contamination. The data show quite the contrary. Every line surveyed exhibited substantial amounts of residual Co-60 contamination. In general, it appears as though the increased levels of contamination coincide with accumulation of sediment and debris in the lines. The largest activity density measured occurs in Run #3 (A-1) at a distance of 204 ft., which coincides with a debris accumulation and a "T" junction into to the drain line from T-Building.

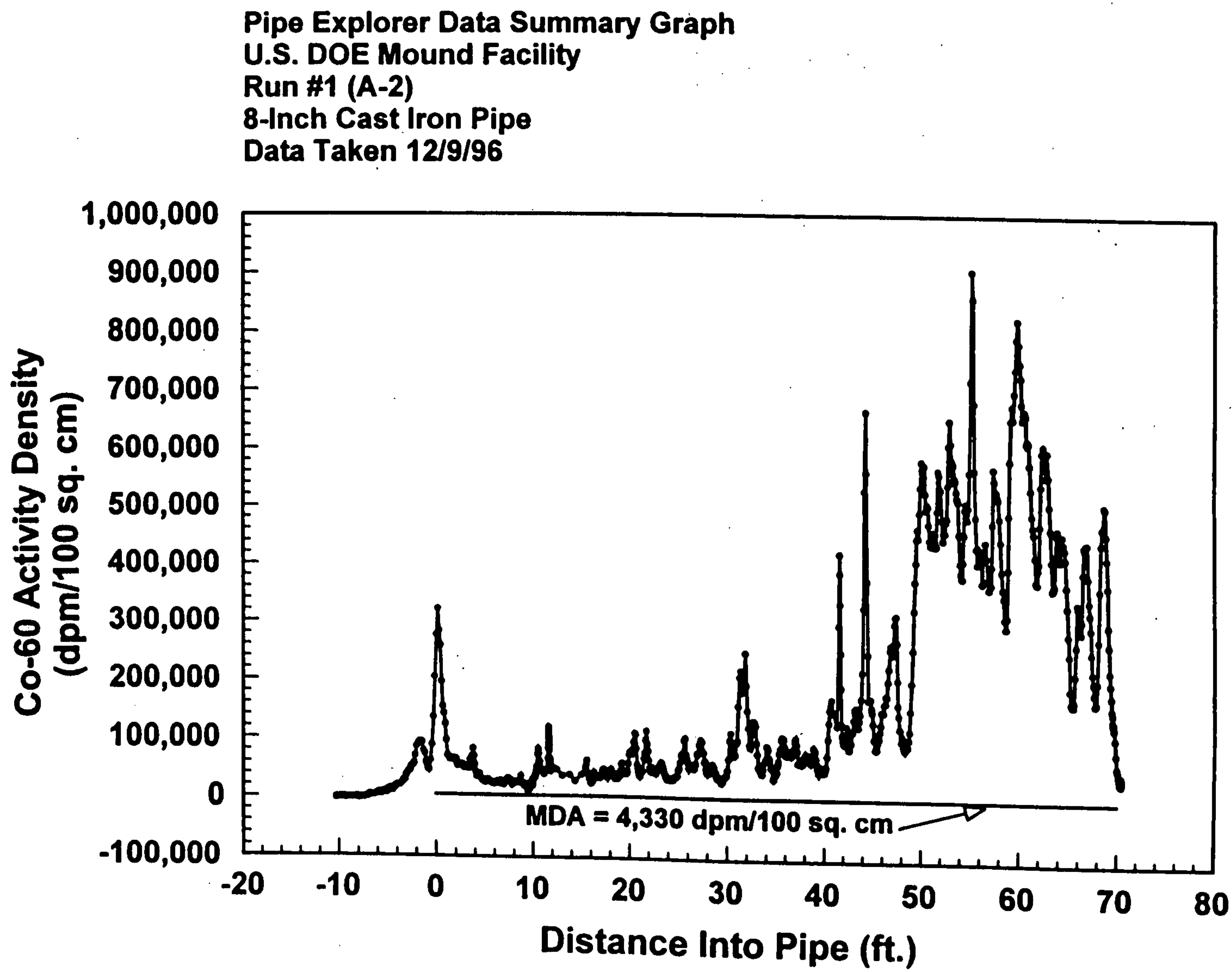
A special note is warranted regarding the large activity spike seen at a distance of -2.24 ft. in Run #2 (A-2). At this distance the detector was situated within the pre-pipe, approximately at the center of manhole STA 2+08. The pre-pipe was known to be free of contamination, indicating that the signal observed was coming from either surface contamination within the manhole, or contaminated soil associated with the manhole. It should also be noted that because the detector was not in the calibrated geometry, i.e. within the pipe, the activity present is higher that indicated by the data. Note that this feature, although more subdued, occurs in the data from Run #1 (A-2) as well.

As is evident from the videotape of Run #4 (A-1), this line is remarkably free of sediment and debris, compared to the other drain lines. Correspondingly, the measured activity levels are very low for the bulk of this line. Only when the line approaches Manhole 10 does the measured activity begin to increase. This could be an indication of contamination in the manhole, in the soil surrounding the manhole, or in the small 3-inch pipe which is located just above the drain line surveyed in the vicinity of the manhole. A quick examination of the tabular data from Run #4 (A-1) reveals that the bulk of the measured values are negative. This is probably explained by a combination of a shielding effect of the clean clay pipe in Run #4 as compared to bare soil and slightly elevated Co-60 levels in the soil at the background location chosen.

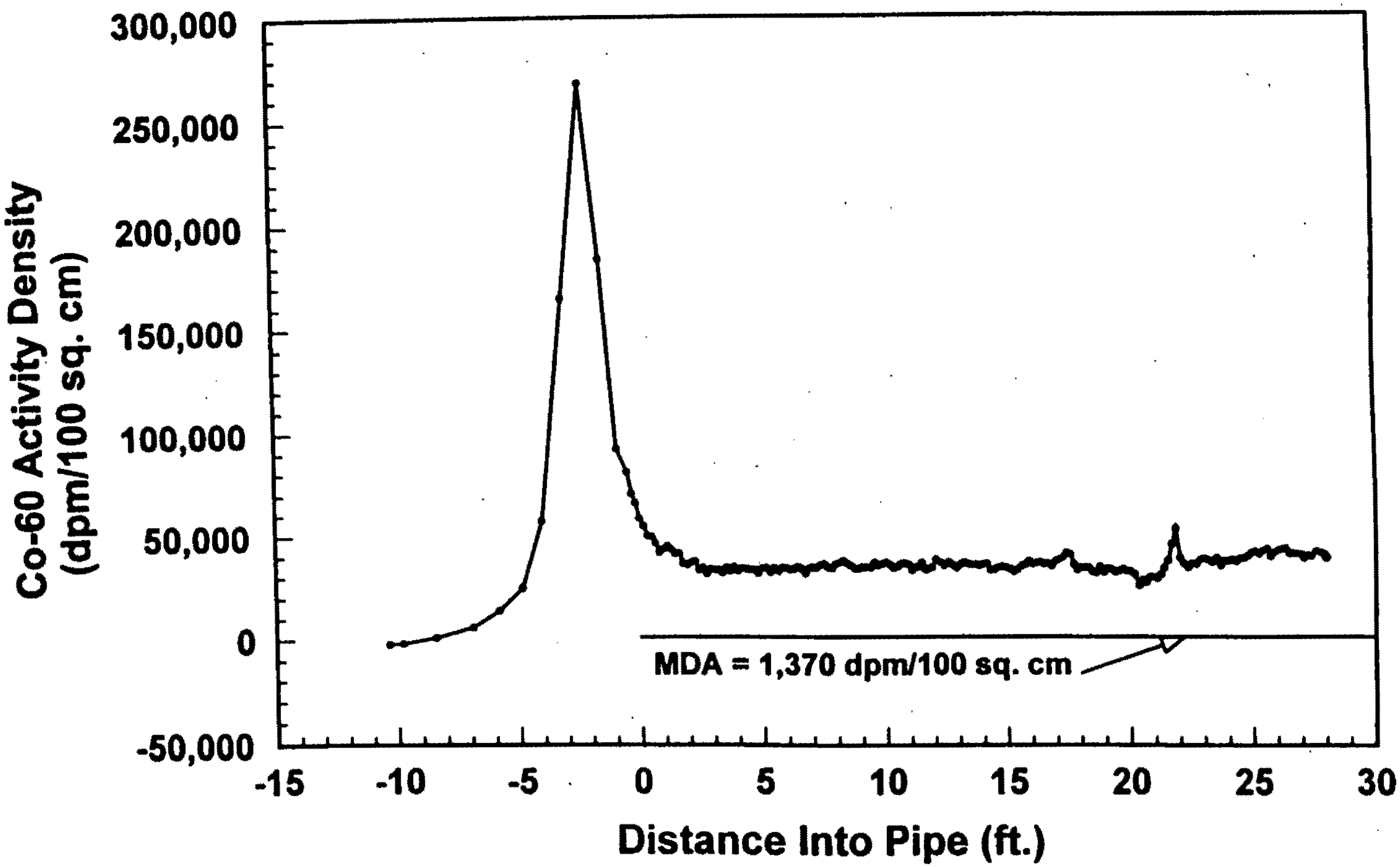
GAMMA RAY SPECTRA

Although not planned as part of the original scope, SEA also collected gamma ray spectra from each of the drain lines surveyed. A total of eight spectra were collected, one in Run #1 (A-2), one in Run #2 (A-2), four in Run #3 (A-1), and two in Run #4 (A-1). The intent was to determine whether or not there were gamma emitting isotopes present other than Co-60. These spectra were collected using a Canberra NaI Plus Multi-Channel Analyzer (MCA) board running in a second personal computer. The detector signal (preamplifier output signal) was redirected from the spectral amplifier to the MCA card, and counts were accumulated while the detector remained stationary within the drain line. The total count times varied from 90 seconds to 300 seconds. These spectra are presented in graphical form in Appendix D. The Run ID and distance from the pipe access point are indicated on the graph for each of the spectra. It is clear from these spectra that there are substantial amounts of gamma emitters other than C0-60 in the drain lines.

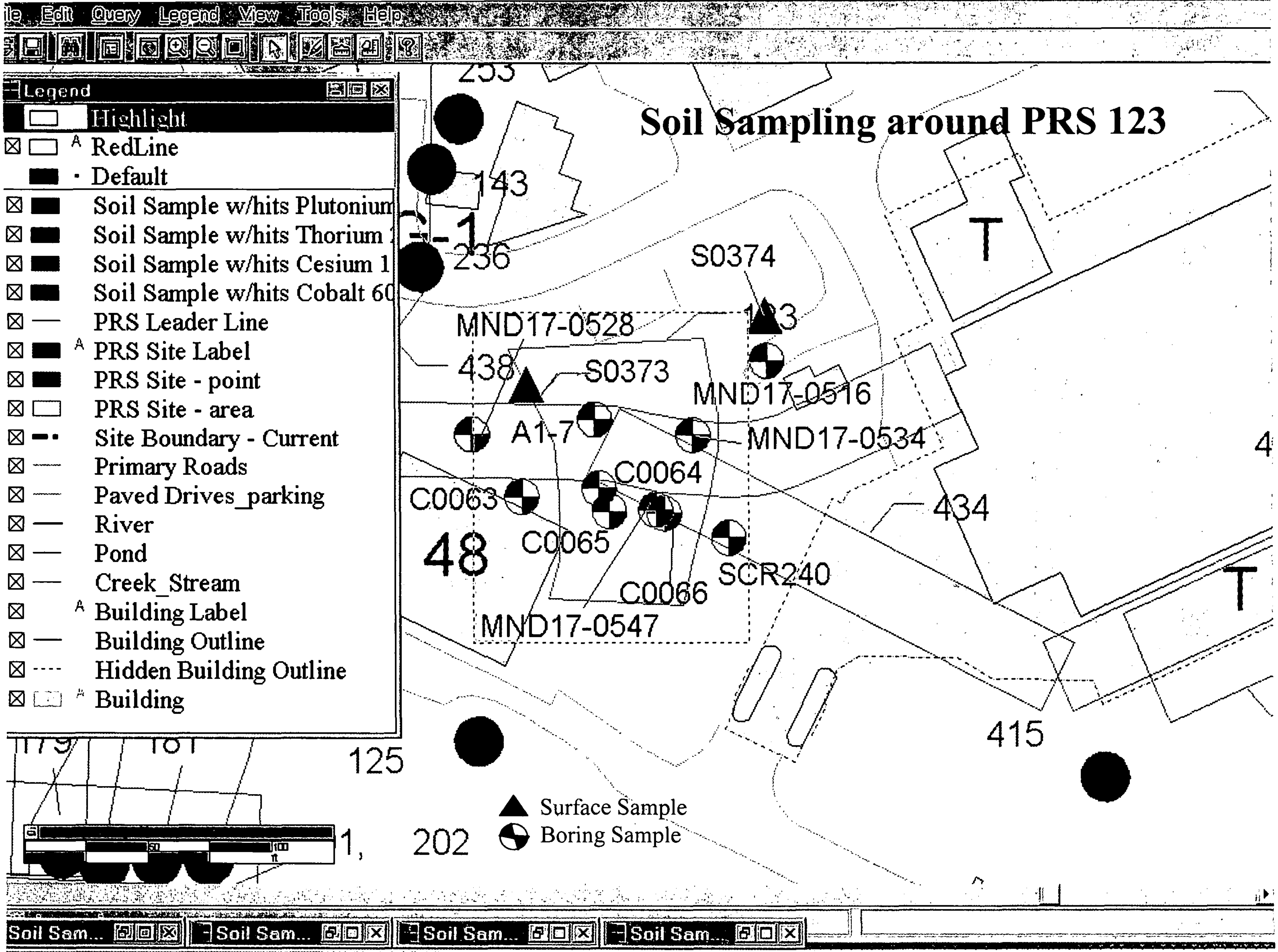
Because this was not a planned activity, a rigorous energy calibration of the system was not performed. An approximate energy calibration was computed, based on the two principle energies of Co-60. The slope and zero intercept of this approximate energy calibration is also listed on the graph. The uncertainty in these approximate calibrations becomes quite large at the lower energies. Thus, it should be used only as a guide, and should not be used to positively identify the isotopes present.


Pipe Explorer Data Summary Graph
U.S. DOE Mound Facility
Run #1 (A-2)
8-Inch Cast Iron Pipe
Data Taken 12/9/96
Co-60 Activity Density (dpm/100 sq. cm)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
-100,000
MDA = 4,330 dpm/100 sq. cm
-20
-10
0
10
20
30
40
50
60
70
80
Distance Into Pipe (ft.)

Pipe Explorer Data Summary Graph
U.S. DOE Mound Facility
Run #2 (A-2)
5-Inch Steel Pipe
Data Taken 12/4/96



Reference F



Soil Sampling around PRS 123
Legend
Highlight
RedLine
Default
Soil Sample w/hits Plutonium
Soil Sample w/hits Thorium
Soil Sample w/hits Cesium 1
Soil Sample w/hits Cobalt 60
PRS Leader Line
PRS Site Label
PRS Site - point
PRS Site - area
Site Boundary - Current
Primary Roads
Paved Drives_parking
River
Pond
Creek_Stream
Building Label
Building Outline
Hidden Building Outline
Building
S0374
MND17-0528
S0373
MND17-0516
MND17-0534
A1-7
C0064
C0063
C0065
SCR240
C0066
MND17-0547
143
236
438
48
434
415
125
202
Surface Sample
Boring Sample

Location_name	Sample_id	Location_t	Collection	Media	Value_name	Measured_v	Value_u	Detection	Chem	Start	End	Depth	Cas_number	Lab	Project_cod	Data	Comment
A1-7	2007-0009	Borehole	19930825	Soil	Thorium-228	0.60	PCI/G	0.16	RAD	8	10	FT	14274-82-9		MND16		
A1-7	2007-0009	Borehole	19930825	Soil	Thorium-230	0.78	PCI/G	0.13	RAD	8	10	FT	14269-63-7		MND16		
A1-7	2007-0009	Borehole	19930825	Soil	Thorium-232	0.82	PCI/G	0.10	RAD	8	10	FT	7440-29-1		MND16		
C0063	10379	Borehole	19850901	Soil	Cobalt-60	1.10	PCI/G	0.50	RAD	11	11	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10384	Borehole	19850901	Soil	Cobalt-60	38.00	PCI/G	0.50	RAD	3	3	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10385	Borehole	19850901	Soil	Cobalt-60	22.00	PCI/G	0.50	RAD	5	5	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10386	Borehole	19850901	Soil	Cobalt-60	3.30	PCI/G	0.50	RAD	6	6	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10388	Borehole	19850901	Soil	Cobalt-60	250.00	PCI/G	0.50	RAD	9	9	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10389	Borehole	19850901	Soil	Cobalt-60	6.00	PCI/G	0.50	RAD	11	11	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10390	Borehole	19850901	Soil	Cobalt-60	2.00	PCI/G	0.50	RAD	12	12	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10391	Borehole	19850901	Soil	Cobalt-60	3.00	PCI/G	0.50	RAD	14	14	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0064	10392	Borehole	19850901	Soil	Cobalt-60	9.00	PCI/G	0.50	RAD	15	15	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10393	Borehole	19850901	Soil	Cobalt-60	15.00	PCI/G	0.50	RAD	2	2	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10394	Borehole	19850901	Soil	Cobalt-60	26.00	PCI/G	0.50	RAD	3	3	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10395	Borehole	19850901	Soil	Cobalt-60	15.00	PCI/G	0.50	RAD	5	5	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10396	Borehole	19850901	Soil	Cobalt-60	26.00	PCI/G	0.50	RAD	6	6	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10397	Borehole	19850901	Soil	Cobalt-60	23.00	PCI/G	0.50	RAD	8	8	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10398	Borehole	19850901	Soil	Cobalt-60	5.00	PCI/G	0.50	RAD	9	9	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10399	Borehole	19850901	Soil	Cobalt-60	6.00	PCI/G	0.50	RAD	11	11	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10401	Borehole	19850901	Soil	Cobalt-60	1.30	PCI/G	0.50	RAD	14	14	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10403	Borehole	19850901	Soil	Cobalt-60	1.10	PCI/G	0.50	RAD	17	17	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0065	10405	Borehole	19850901	Soil	Cobalt-60	1.30	PCI/G	0.50	RAD	20	20	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10406	Borehole	19850901	Soil	Cobalt-60	0.60	PCI/G	0.50	RAD	2	2	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10409	Borehole	19850901	Soil	Cobalt-60	5.00	PCI/G	0.50	RAD	6	6	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10410	Borehole	19850901	Soil	Cobalt-60	10.00	PCI/G	0.50	RAD	8	8	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10411	Borehole	19850901	Soil	Cobalt-60	14.00	PCI/G	0.50	RAD	9	9	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10412	Borehole	19850901	Soil	Cobalt-60	4.00	PCI/G	0.50	RAD	11	11	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10413	Borehole	19850901	Soil	Cobalt-60	13.00	PCI/G	0.50	RAD	12	12	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
C0066	10414	Borehole	19850901	Soil	Cobalt-60	4.00	PCI/G	0.50	RAD	14	14	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
MND17-0516	0516-0001	Borehole		Soil	Thorium-228	0.70	PCI/G	0.16	RAD	0	1	FT	14274-82-9		MND17		
MND17-0516	0516-0001	Borehole		Soil	Thorium-230	0.91	PCI/G	0.09	RAD	0	1	FT	14269-63-7		MND17		
MND17-0516	0516-0001	Borehole		Soil	Thorium-232	0.76	PCI/G	0.06	RAD	0	1	FT	7440-29-1		MND17		
MND17-0516	0516-0001	Borehole		Soil	Thorium-232	0.76	PCI/G		RAD	0	1	FT	7440-29-1		MND17		
MND17-0516	0516-5001	Borehole		Soil	Thorium-232	0.15	PCI/G		RAD	0	1	FT	7440-29-1		MND17		
MND17-0528	0528-0001	Borehole		Soil	Thorium-228	0.77	PCI/G	0.02	RAD	0	1	FT	14274-82-9		MND17		
MND17-0528	0528-0001	Borehole		Soil	Thorium-230	0.89	PCI/G	0.01	RAD	0	1	FT	14269-63-7		MND17		
MND17-0528	0528-0001	Borehole		Soil	Thorium-232	0.79	PCI/G	0.01	RAD	0	1	FT	7440-29-1		MND17		
MND17-0528	0528-0001	Borehole		Soil	Thorium-232	0.90	PCI/G		RAD	0	1	FT	7440-29-1		MND17		
MND17-0528	0528-5001	Borehole	19950413	Soil	Thorium-232	0.20	PCI/G		RAD	0	1	FT	7440-29-1		MND17		
MND17-0534	0534-5001	Borehole	19950419	Soil	Plutonium-238	25.00	PCI/G	25.00	RAD	0	1	FT	13981-16-3		MND17		1-Exceeds soil 10-6 GV. 2-Exceeds background value.
MND17-0547	0547-0001	Borehole		Soil	Cobalt-60	2.79	PCI/G		RAD	0	1	FT	10198-40-0		MND17		1-Exceeds soil 10-6 GV.
MND17-0547	0547-0001	Borehole		Soil	Thorium-228	0.86	PCI/G	0.04	RAD	0	1	FT	14274-82-9		MND17		1-Exceeds soil 10-6 GV.
MND17-0547	0547-0001	Borehole		Soil	Thorium-230	0.89	PCI/G	0.02	RAD	0	1	FT	14269-63-7		MND17		
MND17-0547	0547-0001	Borehole		Soil	Thorium-232	0.80	PCI/G	0.03	RAD	0	1	FT	7440-29-1		MND17		
MND17-0547	0547-0001	Borehole		Soil	Thorium-232	0.95	PCI/G		RAD	0	1	FT	7440-29-1		MND17		
MND17-0547	0547-5001	Borehole		Soil	Cobalt-60	1.71	PCI/G		RAD	0	1	FT	10198-40-0		MND17		1-Exceeds soil 10-6 GV.
MND17-0547	0547-5001	Borehole		Soil	Plutonium-238	108.20	PCI/G		RAD	0	1	FT	13981-16-3		MND17		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
MND17-0547	0547-5001	Borehole		Soil	Thorium-232	0.71	PCI/G		RAD	0	1	FT	7440-29-1		MND17		
S0373	9830	Surface lo	19850601	Soil	Cesium-137	1.60	PCI/G	0.50	RAD	0	0	FT	10045-97-3		RSS		1-Exceeds soil 10-6 GV. 2-Exceeds background value.
S0373	9830	Surface lo	19850601	Soil	Cobalt-60	1.00	PCI/G	0.50	RAD	0	0	FT	10198-40-0		RSS		1-Exceeds soil 10-6 GV.
S0374	6259	Surface lo	19840801	Soil	Plutonium-238	8.14	PCI/G	0.01	RAD	0	0	FT	13981-16-3		RSS		1-Exceeds soil 10-6 GV. 2-Exceeds background value.
SCR240	90103053	Borehole	19901030	Soil	Plutonium-238	59.00	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR240	90103053	Borehole	19901030	Soil	Thorium-232	4.10	PCI/G		RAD	0	0	FT	7440-29-1		SCRDATA		2-Exceeds background value.
SCR240	90103054	Borehole	19901030	Soil	Plutonium-238	54.00	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR240	90103054	Borehole	19901030	Soil	Thorium-232	3.10	PCI/G		RAD	0	0	FT	7440-29-1		SCRDATA		2-Exceeds background value.
SCR240	90103055	Borehole	19901030	Soil	Plutonium-238	118.00	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR240	90103055	Borehole	19901030	Soil	Thorium-232	5.40	PCI/G		RAD	0	0	FT	7440-29-1		SCRDATA		2-Exceeds background value. 3-Exceeds other criteria.
SCR240	90103056	Borehole	19901030	Soil	Plutonium-238	189.00	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR240	90103056	Borehole	19901030	Soil	Thorium-232	12.60	PCI/G		RAD	0	0	FT	7440-29-1		SCRDATA		2-Exceeds background value. 3-Exceeds other criteria.
SCR240	92100812	Borehole	19921008	Soil	Plutonium-238	38.00	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR240	92100812	Borehole	19921008	Soil	Thorium-232	2.00	PCI/G		RAD	0	0	FT	7440-29-1		SCRDATA		2-Exceeds background value.
SCR240	92100813	Borehole	19921008	Soil	Plutonium-238	28.00	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.

Location_nar	Sample_id	Location_t	Collection_d	Media	Value_name	Measured	Value_ui	Detec	Chem_	Start	End_(	Depth	Cas_number	Lab_(	Project_code	Dat	Comment
SCR159	90072554	Borehole	19900725	Soil	Plutonium-238	**27.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR159	90072555	Borehole	19900725	Soil	Plutonium-238	**29.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR159	90072557	Borehole	19900725	Soil	Plutonium-238	**225.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR159	90072559	Borehole	19900725	Soil	Plutonium-238	**26.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR159	90072560	Borehole	19900725	Soil	Plutonium-238	**30.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR159	90072561	Borehole	19900725	Soil	Plutonium-238	**31.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.
SCR161	9312024-O	Borehole	19931202	Soil	Plutonium-238	**26.00**	PCI/G		RAD	0	0	FT	13981-16-3		SCRDATA		1-Exceeds soil 10-6 GV. 2-Exceeds background value. 3-Exceeds other criteria.

comp_no	par_code	parameter name	comparison value	units
1	7440-41-7	Beryllium	7.00E-01	MG/KG
1	7440-43-9	Cadmium	5.00E+04	MG/KG
1	7440-47-3	Chromium	7.50E+03	MG/KG
1	121-82-4	RDX	2.70E+01	UG/KG
1	72-55-9	4,4'-DDE	9.00E+00	MG/KG
1	50-29-3	4,4'-DDT	9.00E+00	MG/KG
1	12672-29-6	Aroclor-1248	3.85E-01	MG/KG
1	11096-82-5	Aroclor-1260	3.85E-01	MG/KG
1	319-85-7	Beta-BHC	1.65E+00	MG/KG
1	60-57-1	Dieldrin	1.85E-01	MG/KG
1	56-55-3	Benzo(a)anthracene	4.10E+00	MG/KG
1	50-32-8	Benzo(a)pyrene	4.10E-01	MG/KG
1	205-99-2	Benzo(b)fluoranthene	4.10E+00	MG/KG
1	207-08-9	Benzo(k)fluoranthene	4.10E+01	MG/KG
1	117-81-7	Bis(2-ethylhexyl)phthalate	2.15E+02	MG/KG
1	218-01-9	Chrysene	4.10E+02	MG/KG
1	53-70-3	Dibenz(a,h)anthracene	4.10E-01	MG/KG
1	193-39-5	Indeno(1,2,3-cd)pyrene	4.10E+00	MG/KG
1	78-59-1	Isophorone	3.15E+03	MG/KG
1	86-30-6	N-Nitrosodiphenylamine	6.00E+02	MG/KG
1	87-86-5	Pentachlorophenol	2.50E+01	MG/KG
1	107-06-2	1,2-Dichloroethane	1.10E+01	MG/KG
1	71-43-2	Benzene	3.20E+01	MG/KG
1	75-27-4	Bromodichloromethane	4.80E+01	MG/KG
1	75-25-2	Bromoform	3.75E+02	MG/KG
1	56-23-5	Carbon Tetrachloride	1.20E+01	MG/KG
1	67-66-3	Chloroform	1.55E+01	MG/KG
1	124-48-1	Dibromochloromethane	3.55E+01	MG/KG
1	75-09-2	Dichloromethane	3.95E+02	MG/KG
1	79-01-6	Trichloroethene	1.25E+02	MG/KG
1	AC-227	Actinium-227	1.00E+00	PCI/G
1	14596-10-2	Americium-241	4.95E+00	PCI/G
1	13982-38-2	Bismuth-207	1.75E-01	PCI/G
1	BI-207	Bismuth-207	1.75E-01	PCI/G
1	10045-97-3	Cesium-137	4.60E-01	PCI/G
1	10198-40-0	Cobalt-60	1.00E-01	PCI/G
1	13981-16-3	Plutonium-238	5.50E+00	PCI/G
1	15117-48-3	Plutonium-239	5.50E+00	PCI/G
1	PU239/240	Plutonium-240	5.50E+00	PCI/G
1	13982-63-3	Radium-226	1.40E-01	PCI/G
1	10098-97-2	Strontium-90	3.00E+00	PCI/G
1	14274-82-9	Thorium-228	8.50E-01	PCI/G
1	14269-63-7	Thorium-230	4.40E+01	PCI/G
1	7440-29-1	Thorium-232	5.00E+01	PCI/G
1	10028-17-8	Tritium	2.35E+04	PCI/G
1	U-233	Uranium-233	3.70E+01	PCI/G
1	13966-29-5	Uranium-234	3.75E+01	PCI/G
1	15117-96-1	Uranium-235	3.35E+00	PCI/G
1	24678-82-8	Uranium-238	1.10E+01	PCI/G
2	7429-90-5	Aluminum	19000	MG/KG

comp_no	par_code	parameter name	comparison value	units
2	7440-38-2	Arsenic	8.6	MG/KG
2	7440-39-3	Barium	180	MG/KG
2	7440-69-9	Bismuth	ND	MG/KG
2	7440-41-7	Beryllium	1.3	MG/KG
2	7440-43-9	Cadmium	2.1	MG/KG
2	7440-70-2	Calcium	310000	MG/KG
2	7440-47-3	Chromium	20	MG/KG
2	7440-48-4	Cobalt	19	MG/KG
2	7440-50-8	Copper	26	MG/KG
2	57-12-5	Cyanide	ND	MG/KG
2	7439-89-6	Iron	35000	MG/KG
2	7439-92-1	Lead	48	MG/KG
2	7439-93-2	Lithium	26	MG/KG
2	7439-95-4	Magnesium	40000	MG/KG
2	7439-96-5	Manganese	1400	MG/KG
2	7439-97-6	Mercury	ND	MG/KG
2	7439-98-7	Molybdenum	27	MG/KG
2	7440-02-0	Nickel	32	MG/KG
2	7440-09-7	Potassium	1900	MG/KG
2	7440-22-4	Silver	1.7	MG/KG
2	7782-49-2	Selenium	ND	MG/KG
2	7440-23-5	Sodium	240	MG/KG
2	7440-28-0	Thallium	0.46	MG/KG
2	7440-31-5	Tin	20	MG/KG
2	7440-62-2	Vanadium	25	MG/KG
2	7440-66-6	Zinc	140	MG/KG
2	72-54-8	4,4'-DDD	4.2	MG/KG
2	72-55-9	4,4'-DDE	4.3	MG/KG
2	50-29-3	4,4'-DDT	13	MG/KG
2	309-00-2	Aldrin	ND	MG/KG
2	5103-71-9	Alpha-Chlordane	ND	MG/KG
2	319-84-6	Alpha-BHC	ND	MG/KG
2	12672-29-6	Aroclor-1248	ND	MG/KG
2	11097-69-1	Aroclor-1254	58	MG/KG
2	11096-82-5	Aroclor-1260	ND	MG/KG
2	319-85-7	Beta-BHC	ND	MG/KG
2	60-57-1	Dieldrin	ND	MG/KG
2	959-98-8	Endosulfan I	ND	MG/KG
2	1031-07-8	Endosulfan Sulfate	ND	MG/KG
2	72-20-8	Endrin	ND	MG/KG
2	7421-93-4	Endrin Aldehyde	ND	MG/KG
2	53494-70-5	Endrin Ketone	ND	MG/KG
2	5103-74-2	Gamma-Chlordane	ND	MG/KG
2	58-89-9	Gamma-BHC (Lindane)	ND	MG/KG
2	76-44-8	Heptachlor	ND	MG/KG
2	1024-57-3	Heptachlor Epoxide	ND	MG/KG
2	72-43-5	Methoxychlor	30	MG/KG
2	77-47-4	Hexachlorocyclopentadiene	ND	MG/KG
2	14596-10-2	Americium-241	ND	MG/KG
2	13982-38-2	Bismuth-207	ND	MG/KG

comp_no	par_code	parameter name	comparison value	units
2	BI-207	Bismuth-207	ND	MG/KG
2	BI-210M	Bismuth-210m	ND	MG/KG
2	10045-97-3	Cesium-137	0.42	PCI/G
2	13981-16-3	Plutonium-238	0.13	PCI/G
2	13966-00-2	Potassium-40	37	PCI/G
2	13982-63-3	Radium-226	2	PCI/G
2	10098-97-2	Strontium-90	0.72	PCI/G
2	14274-82-9	Thorium-228	1.5	PCI/G
2	14269-63-7	Thorium-230	1.9	PCI/G
2	7440-29-1	Thorium-232	1.4	PCI/G
2	10028-17-8	Tritium	1.6	PCI/G
2	13966-29-5	Uranium-234	1.1	PCI/G
2	15117-96-1	Uranium-235	0.11	PCI/G
2	24678-82-8	Uranium-238	1.2	PCI/G
3	7439-92-1	Lead	400	MG/KG
3	13982-63-3	Radium-226	5	PCI/G
3	13981-16-3	Plutonium-238	25	PCI/G
3	7440-29-1	Thorium-232	5	PCI/G
5	7440-36-0	Antimony	0.0006	MG/L
5	7440-38-2	Arsenic	0.05	MG/L
5	7440-39-3	Barium	2	MG/L
5	7440-41-7	Beryllium	0.004	MG/L
5	7440-43-9	Cadmium	0.005	MG/L
5	7440-47-3	Chromium	0.1	MG/L
5	7440-50-8	Copper	1.3	MG/L
5	57-12-5	Cyanide	0.2	MG/L
5	7439-92-1	Lead	0.015	MG/L
5	7439-97-6	Mercury	0.002	MG/L
5	7440-02-0	Nickel	0.1	MG/L
5	7782-49-2	Selenium	0.05	MG/L
5	7440-28-0	Thallium	0.002	MG/L
5	16984-48-8	Flouride	4	MG/L
5	NO3	Nitrate	10	MG/L
5	NO2	Nitrite	1	MG/L
5	57-74-9	Chlordane	0.002	MG/L
5	72-20-8	Endrin	0.002	MG/L
5	76-44-8	Heptachlor	0.0004	MG/L
5	1024-57-3	Heptachlor Epoxide	0.0002	MG/L
5	72-43-5	Methoxychlor	0.04	MG/L
5	8001-35-2	Toxaphene	0.003	MG/L
5	120-82-1	1,2,4-Trichlorobenzene	0.07	MG/L
5	95-95-4	2,4,5-Trichlorophenol	0.05	MG/L
5	50-32-8	Benzo(a)pyrene	0.002	MG/L
5	118-74-1	Hexachlorobenzene	0.001	MG/L
5	77-47-4	Hexachlorocyclopentadiene	0.05	MG/L
5	87-86-5	Pentachlorophenol	0.001	MG/L
5	71-55-6	1,1,1-Trichloroethane	0.2	MG/L
5	79-00-5	1,1,2-Trichloroethane	0.005	MG/L
5	75-35-4	1,1-Dichloroethene	0.007	MG/L
5	156-59-2	1,2-cis-Dichloroethene	0.07	MG/L

comp_no	par_code	parameter name	comparison value	units
5	107-06-2	1,2-Dichloroethane	0.005	MG/L
5	78-87-5	1,2-Dichloropropane	0.005	MG/L
5	106-46-7	1,4-Dichlorobenzene	0.075	MG/L
5	108-90-7	Chlorobenzene	0.1	MG/L
5	96-12-8	Dibromochloropropane	0.0002	MG/L
5	106-93-4	1,2-Dibromoethane	0.00005	MG/L
5	95-50-1	1,2-Dichlorobenzene	0.6	MG/L
5	75-09-2	Dichloromethane (Methylene Chloride)	0.005	MG/L
5	88-85-7	Dinoseb	0.007	MG/L
5	1746-01-6	Dioxin	0.00000003	MG/L
5	94-75-7	2,4-D	0.07	MG/L
5	156-60-5	1,2-trans-Dichloroethene	0.01	MG/L
5	71-43-2	Benzene	0.005	MG/L
5	75-27-4	Bromodichloromethane	0.008	MG/L
5	75-25-2	Bromoform	0.008	MG/L
5	56-23-5	Carbon Tetrachloride	0.005	MG/L
5	67-66-3	Chloroform	0.008	MG/L
5	100-41-4	Ethylbenzene	0.07	MG/L
5	58-89-9	Gamma-BHC (Lindane)	0.0002	MG/L
5	117-81-7	bis(2-ethylhexyl)phthalate	0.006	MG/L
5	100-42-5	Styrene	0.1	MG/L
5	127-18-4	Tetrachloroethene	0.005	MG/L
5	108-88-3	Toluene	1	MG/L
5	79-01-6	Trichloroethene	0.005	MG/L
5	75-01-4	Vinyl Chloride	0.002	MG/L
5	1330-20-7	Xylenes, Total	10	MG/L
5	AC-227	Actinium-227	0.4	PCI/L
5	14596-10-2	Americium-241	1.2	PCI/L
5	13982-38-2	Bismuth-207	1200	PCI/L
5	10045-97-3	Cesium-137	120	PCI/L
5	10198-40-0	Cobalt-60	400	PCI/L
5	13981-16-3	Plutonium-238	1.6	PCI/L
5	13982-63-3	Radium-226	4	PCI/L
5	10098-97-2	Strontium-90	40	PCI/L
5	14274-82-9	Thorium-228	16	PCI/L
5	14269-63-7	Thorium-230	12	PCI/L
5	7440-29-1	Thorium-232	2	PCI/L
5	10028-17-8	Tritium	20000	PCI/L
5	U-233	Uranium-233	20	PCI/L
5	13966-29-5	Uranium-234	20	PCI/L
5	15117-96-1	Uranium-235	24	PCI/L
5	24678-82-8	Uranium-238	24	PCI/L
6	7440-47-3	Chromium	1.10E+03	MG/KG
6	7440-36-0	Antimony	8.50E+01	MG/KG
6	7440-38-2	Arsenic	6.40E+01	MG/KG
6	7440-39-3	Barium	1.50E+04	MG/KG
6	7440-41-7	Beryllium	1.10E+03	MG/KG
6	7440-43-9	Cadmium	2.10E+02	MG/KG
6	57-12-5	Cyanide	4.30E+03	MG/KG
6	7439-96-5	Manganese	2.70E+04	MG/KG

comp_no	par_code	parameter name	comparison value	units
6	7439-97-6	Mercury	6.40E+01	MG/KG
6	7440-02-0	Nickel	4.30E+03	MG/KG
6	7440-22-4	Silver	1.10E+03	MG/KG
6	7440-62-2	Vanadium	1.50E+03	MG/KG
6	7440-66-6	Zinc	6.40E+04	MG/KG
6	2691-41-0	HMX	1.10E+04	UG/KG
6	121-82-4	RDX	6.40E+04	UG/KG
6	50-29-3	4,4'-DDT	1.10E+02	MG/KG
6	11097-69-1	Aroclor-1254	4.30E+00	MG/KG
6	60-57-1	Dieldrin	1.10E+01	MG/KG
6	106-44-5	4-Methylphenol	1.10E+03	MG/KG
6	120-12-7	Anthracene	6.40E+04	MG/KG
6	65-85-0	Benzoic Acid	8.50E+05	MG/KG
6	117-81-7	Bis(2-ethylhexyl)phthalate	4.30E+03	MG/KG
6	85-68-7	Butyl Benzyl Phthalate	4.30E+04	MG/KG
6	84-74-2	Di-n-butyl Phthalate	2.10E+04	MG/KG
6	117-84-0	Di-n-octyl Phthalate	4.30E+03	MG/KG
6	206-44-0	Fluoranthene	8.50E+03	MG/KG
6	78-59-1	Isophorone	4.30E+04	MG/KG
6	87-86-5	Pentachlorophenol	6.40E+03	MG/KG
6	108-95-2	Phenol	1.30E+05	MG/KG
6	129-00-0	Pyrene	6.40E+03	MG/KG
6	75-34-3	1,1-Dichloroethane	7.80E+00	MG/KG
6	156-60-5	1,2-trans-Dichloroethene	4.30E+03	MG/KG
6	108-10-1	2-Methyl-4-pentanone	7.00E+02	MG/KG
6	67-64-1	Acetone	2.10E+04	MG/KG
6	75-27-4	Bromodichloromethane	4.30E+03	MG/KG
6	75-25-2	Bromoform	4.30E+03	MG/KG
6	75-15-0	Carbon Disulfide	2.80E+02	MG/KG
6	56-23-5	Carbon Tetrachloride	1.50E+02	MG/KG
6	75-00-3	Chloroethane	1.60E+02	MG/KG
6	67-66-3	Chloroform	2.10E+03	MG/KG
6	124-48-1	Dibromochloromethane	4.30E+03	MG/KG
6	75-09-2	Dichloromethane	1.00E+03	MG/KG
6	100-41-4	Ethylbenzene	4.80E-01	MG/KG
6	110-54-3	Hexane	9.10E+01	MG/KG
6	127-18-4	Tetrachloroethene	2.10E+03	MG/KG
6	108-88-3	Toluene	2.50E+02	MG/KG
6	75-69-4	Trichlorofluoromethane	7.30E+02	MG/KG
6	1330-20-7	Xylenes, Total	4.30E+05	MG/KG
6	78-93-3	2-Butanone	9.30E+03	MG/KG

1 Value is 10-6 Risk-Based Guide Value
2 Value is OU9 Soil Background Value
3 Value is other criteria, I.e. 5 pCi/g for certain radionuclides
   25 pCi/g plutonium
5 Value is MCL
6 Value is the Guide Value based on the hazard index

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