ANL/ESD/TM-112

Contamination Source Review for Building E3163, Edgewood Area, Aberdeen Proving Ground, Maryland

Energy Systems Division
Argonne National Laboratory

Operated by The University of Chicago,
under Contract W-31-109-Eng-38, for the
United States Department of Energy

Argonne National Laboratory

Argonne National Laboratory, with facilities in the states of Illinois and Idaho, is owned by the United States Government, and operated by the University of Chicago under the provisions of a contract with the Department of Energy.

This technical memo is a product of Argonne's Energy Systems (ES) Division. For information on the division's scientific and engineering activities, contact:

Director, Energy Systems Division
Argonne National Laboratory
Argonne, Illinois 60439-4815
Telephone (708) 252-3724

Presented in this technical memo are preliminary results of ongoing work or work that is more limited in scope and depth than that described in formal reports issued by the ES Division.

Publishing support services were provided by Argonne's Information and Publishing Division (for more information, see IPD's home page: http://www.ipd.anl.gov/).

Disclaimer

ANL/ESD/TM-112

Contamination Source Review for Building E3163, Edgewood Area, Aberdeen Proving Ground, Maryland

A.K. Draugelis, K.L. Muir-Ploense, M.A. Glennon, J. Rueda, and R.E. Zimmerman

Center for Environmental Restoration Systems, Energy Systems Division,
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439

Published as

Contamination Source Review Edgewood Area, Aberdeen Proving Ground, Maryland — Building E3163

September 1995

Work sponsored by United States Department of Defense, United States Army, Aberdeen Proving Ground, Maryland

This report is printed on recycled paper.

Contents

Summary 1

1 Introduction 3

2 Methodology 5

3 Historical Record Search 6

4 Building Description 7

4.1 Site Description 7
4.1.1 Location 7
4.1.2 Proximity to Other Buildings 7
4.1.3 Building Structure 7
4.1.4 Exterior Dimensions 7
4.1.5 Topography 8
4.1.6 Vegetation in the Immediate Vicinity 8
4.1.7 External Aboveground Structures or Equipment 8
4.1.8 Connections with Adjacent Buildings 11
4.1.9 Location and Type of Underground Structures 11
4.1.10 Surface Drainage System 11
4.1.11 Utility Access Points 11
4.1.12 Exterior Piping 11
4.1.13 Nearby Roads and Sidewalks 11
4.2 North Exterior Elevation 12
4.2.1 Dimensions 12
4.2.2 Construction Materials 12
4.2.3 Doors and Windows 12
4.2.4 Piping 12
4.2.5 Utility Connections 12
4.2.6 External Equipment or Structures 12
4.2.7 Vegetation 12
4.2.8 Overall Condition 13
4.3 East Exterior Elevation 13
4.3.1 Dimensions 13
4.3.2 Construction Materials 13
4.3.3 Doors and Windows 13
4.3.4 Piping 13
4.3.5 Utility Connections 13
4.3.6 External Equipment or Structures 14
4.3.7 Vegetation 14
4.3.8 Overall Condition 14

Contents (Cont.)

4.4 South Exterior Elevation 14
4.4.1 Dimensions 14
4.4.2 Construction Materials 14
4.4.3 Doors and Windows 14
4.4.4 Piping 14
4.4.5 Utility Connections 15
4.4.6 External Equipment or Structures 15
4.4.7 Vegetation 15
4.4.8 Overall Condition 15
4.5 West Exterior Elevation 15
4.5.1 Dimensions 15
4.5.2 Construction Materials 15
4.5.3 Doors and Windows 16
4.5.4 Piping 16
4.5.5 Utility Connections 16
4.5.6 External Equipment or Structures 16
4.5.7 Vegetation 16
4.5.8 Overall Condition 16
4.6 Roof 17
4.6.1 Type and Dimensions 17
4.6.2 Height 17
4.6.3 Surface Materials 17
4.6.4 Roof Support System 17
4.6.5 Condition 17
4.6.6 Equipment Located on the Roof 17
4.6.7 Chimneys, Roof Vents, or Vent Stacks 17
4.6.8 Piping 18
4.7 Interior Floor Plan 18
4.7.1 Interior Room Number and Dimensions 18
4.7.2 Walls 18
4.7.3 Floor 18
4.7.4 Floor Penetrations 18
4.7.5 Interior Partitions 18
4.7.6 Equipment or Supplies 20
4.8 Room 1 20
4.8.1 Walls 20
4.8.2 Finish Materials 20
4.8.3 Piping 20
4.8.4 Doors and Windows 20
4.8.5 Ceiling and Floor 21

5 Geophysical Investigation 22

Contents (Cont.)

6 Air Monitoring 23

7 Underground Storage Tanks 24

8 Conclusions 25

9 References 26

Appendix: Preliminary Report — Environmental Geophysics: Building E3163 Decommissioning, Aberdeen Proving Ground 27

Figures

1 Map of Aberdeen Proving Ground Location 4

2 Kings Creek Medical Research Laboratories Site, Including Building E3163 8

3 Building E3163 Floor Plan 9

4 Photographs of Building E3163 Exterior 10

5 Photographs of Room 1 19

Contamination Source Review for Building E3163, Edgewood Area, Aberdeen Proving Ground, Maryland

by

A.K. Draugelis, K.L. Muir-Ploense, M.A. Glennon,
J. Rueda, and R.E. Zimmerman

Summary

This report was prepared by Argonne National Laboratory (ANL) to document the results of a contamination source review for Building E3163 at the Aberdeen Proving Ground (APG) in Maryland. This report may be used to assist the U.S. Army in planning for the future use or disposition of this building. The review included a historical records search, physical inspection, photographic documentation, and geophysical investigation. The field investigations were performed by ANL during 1994 and 1995.

Building E3163 (APG designation) is part of the Medical Research Laboratories E3160 Complex. This research laboratory complex is located west of Kings Creek, east of the airfield and Ricketts Point Road, and south of Kings Creek Road in the Edgewood Area of APG. The original structures in the E3160 Complex were constructed during World War II. The complex was originally used as a medical research laboratory. Much of the research involved wound assessment.

Building E3163, constructed in 1946, was used for toxicological studies on animals until 1965. All agent testing was done using laboratory-scale quantities of agents. All operational data were destroyed; total quantities and types of agents used during the testing are unknown. No experimentation has been conducted in the building since 1965. However, the building was used as overflow office space until the late 1980s. Since that time, the building has been unoccupied.

The physical inspection and photographic documentation of Building E3163 were completed in November 1994. The building is a single-story, single-room, rectangular Quonset-type structure, 48 ft 4 in. long by 21 ft wide. The building has a concrete foundation with a crawl area underneath the wooden floor. The curved metal frame is covered by corrugated sheet metal on the outside and particle boards on the inside. There was evidence of plumbing, heating, electrical connections, and floor drains inside the building during the ANL inspection.

In December 1994, ANL staff conducted geophysical surveys in the immediate vicinity of Building E3163 using several nonintrusive methods. Survey results suggest the presence of some underground objects near Building E3163, but they do not provide conclusive evidence of the source of the geophysical anomalies observed during the surveys.

No information was available regarding underground storage tanks or air quality at Building E3163.

On the basis of the information collected and reviewed by ANL for Building E3163, it is the authors' judgment that the anomalies detected in the vicinity of Building E3163 during the geophysical surveys should be further investigated. Suspected asbestos-containing materials should be evaluated and properly disposed of.

1 Introduction

The U.S. Army Aberdeen Proving Ground (APG) commissioned Argonne National Laboratory (ANL) to conduct a contamination source review to identify and define areas of toxic or hazardous contaminants and to assess the physical condition and accessibility of various APG buildings. The information obtained from this review may be used to assist the U.S. Army in planning for the future use or disposition of the buildings. The contamination source review consisted of the following tasks: historical records search, physical inspection, photographic documentation, and geophysical investigation. This report provides the results of the contamination source review for Building E3163.

Located on Chesapeake Bay in Harford and Baltimore counties, Maryland, APG occupies approximately 30,000 acres. The facility is divided into the Aberdeen and Edgewood areas (Figure 1). The primary mission at APG has been the testing and evaluation of U.S. Army warfare materials. Since its beginning in 1917, the Edgewood Area of APG has been the principal location for chemical warfare agent research, development, and testing in the United States. APG was also used for producing chemical warfare agents during both world wars and has been a center for the storage of chemical warfare material (Nemeth 1989).

Many of the APG facilities constructed between 1917 and the 1960s are no longer used because of obsolescence and their poor state of repair. Because many of these buildings were used for research, development, testing, and/or pilot-scale production of chemical warfare agents and other military substances (such as incendiary materials or munitions containing these materials), the potential exists for portions of the buildings to be contaminated with these substances, their degradation products, and other laboratory or industrial chemicals. These buildings and associated structures or appurtenances (e.g., underground or aboveground storage tanks, pipes, sumps) may contribute to environmental concerns at APG.

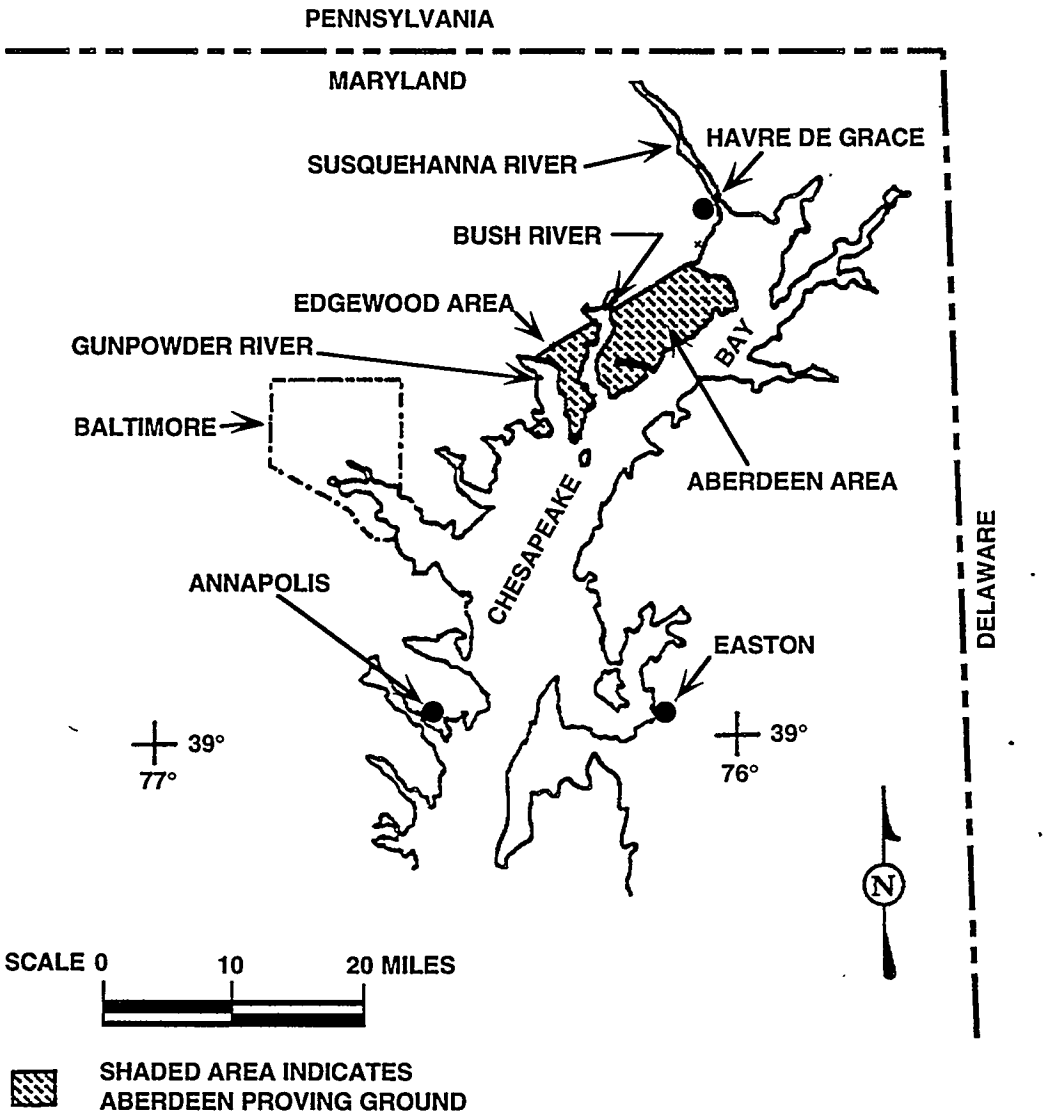


FIGURE 1 Map of Aberdeen Proving Ground Location

2 Methodology

Before the detailed building inspection, ANL personnel made a preliminary site visit to locate the building and obtain building records from APG, identify potential issues to be addressed in the health and safety plan, resolve any access restriction issues, and identify required support services.

Photographs were taken of the building's exterior and interior surfaces during the building inspection in November 1994. The photographs followed a set sequence whenever possible. The exterior was photographed starting on the north side and continuing clockwise around the building; walls were photographed starting in the north or northwest corner of each room and continuing clockwise until reaching the starting point. The ceiling and floor of each room were also photographed.

The area around Building E3163 was examined during December 1994 using several nonintrusive geophysical survey methods, including total field magnetics, electrical conductivity (EM-31), time-domain electrical induction (EMF or EM-61), and ground-penetrating radar (GPR) techniques.

Detailed descriptions of the methodology used for the geophysical investigation are provided in the appendix to this report.

3 Historical Record Search

Building E3163 (APG designation) is part of the Medical Research Laboratories E3160 Complex. This research laboratory complex is located west of Kings Creek, east of the airfield and Ricketts Point Road, and south of Kings Creek Road in the Edgewood Area of APG. The original structures in the E3160 Complex area were constructed during World War II. Building E3163 was constructed in 1946. The complex was originally used as a medical research physics laboratory.

Building E3163, constructed in 1946, was used for toxicological studies on animals until 1965 (EAI Corporation 1989). All agent testing was done using laboratory-scale quantities of agents, and the testing operations were conducted under exhaust hoods. All agents were consumed during the testing. Operational data were destroyed and total quantities and types of agents used during the testing are unknown. No experimentation has been conducted in the building since 1965 (EAI Corporation 1989). However, the building was used as overflow office space until the late 1980s. Since that time, the building has been unoccupied.

Building E3163 was decontaminated twice in 1983, and the interior of the building has been monitored for agents. Because the data pertinent to the decontamination and sampling operations were lost (EAI Corporation 1989), there is no verification that the building was completely clean of hazardous materials. Suspected asbestos-containing materials were observed on the inside piping during a building inspection in 1988/1989 (EAI Corporation 1989).

The floor plan of Building E3163 was developed from measurements taken during the ANL field survey and historical documentation (EAI Corporation 1989). Photographs of the exterior of Building E3163 were taken during the field survey in November 1994.

4 Building Description

This section provides a detailed physical description of Building E3163 and the surrounding site as they appeared during the ANL inspection detailed in November 1994. This physical description includes an account of the condition of the exterior walls, roof, interior walls, ceiling, and floor of the building. There was evidence of plumbing, heating, and electrical connections and floor drains inside the building during the ANL inspection. At that time, the building was accessible through its open doors. Currently, the windows and doors are boarded up.

4.1 Site Description

4.1.1 Location

Building E3163 is part of the Building E3160 Complex of the Medical Research Laboratories. This research laboratory complex is located west of Kings Creek, east of the airfield and Ricketts Point Road, and south of Kings Creek Road in the Edgewood Area of APG (Figure 2). Building E3163 is approximately 230 ft south of Kings Creek Road.

4.1.2 Proximity to Other Buildings

The north wall of Building E3163 is located about 5 ft south of Building E3160.

4.1.3 Building Structure

Building E3163 is a single-story, rectangular, Quonset-type structure oriented east to west. The exterior is corrugated sheet metal attached to a curved metal framework. A crawlspace is located between the wooden floor and the building's concrete foundation. Building E3163 has a total of ten metal framework windows; the internal measurements of each are 42 in. wide and 18 in. high. The building has two exterior doors, each measuring 42 in. wide and approximately 90 in. high, on the east and west ends. The windows and doors are presently boarded up. Figure 3 shows the building floor plan, developed during the ANL inspection. Figure 4 provides photographs of the building exterior.

4.1.4 Exterior Dimensions

The exterior horizontal dimensions of Building E3163 are 48 ft 4 in. (north wall) by 21 ft (east wall). Building E3163 is 10 ft 6 in. high along the center of the east wall.

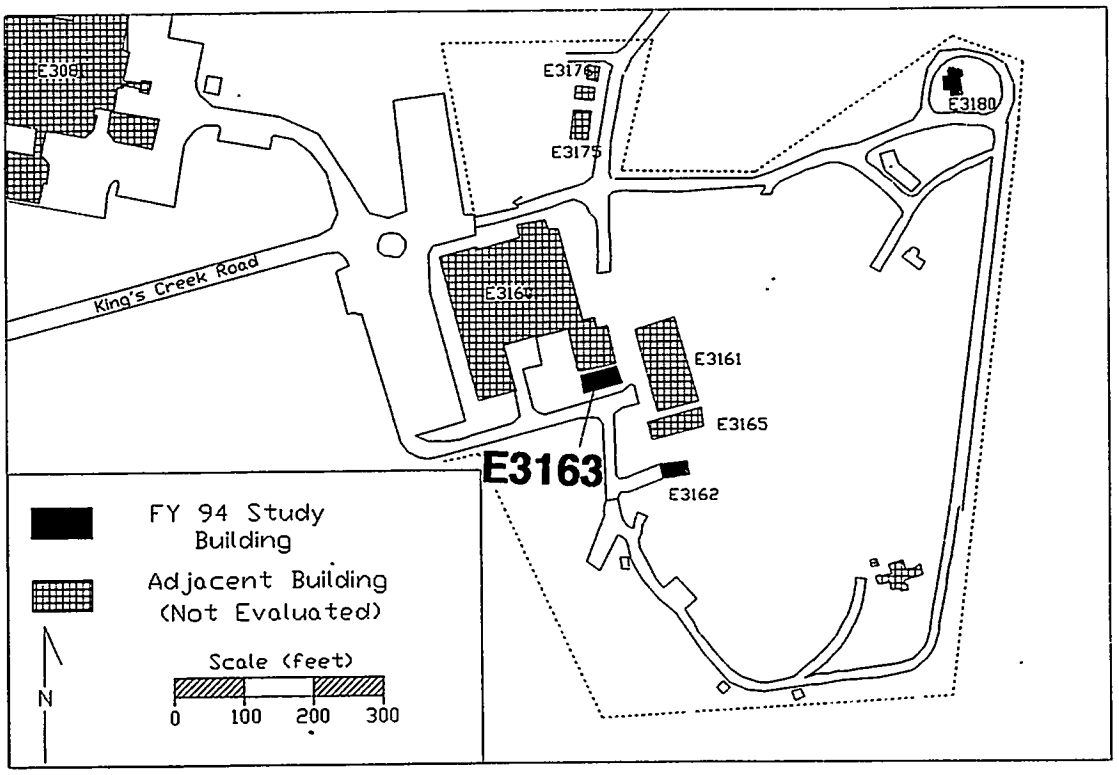


FIGURE 2 Kings Creek Medical Research Laboratories Site, Including Building E3163

4.1.5 Topography

The area directly surrounding Building E3163 is flat and dry. There are concrete walks located at the east and west entrances.

4.1.6 Vegetation in the Immediate Vicinity

The area directly surrounding Building E3163 on the south, east, and west sides consists of lawn (cut grass). A shrub is located in front of the west wall at the northwest corner of the building. The area north of Building E3163, up to the next building, consists of gravel and weeds.

4.1.7 External Aboveground Structures or Equipment

External aboveground structures associated with Building E3163 include five light poles, each 25 ft high, evenly spaced 10 ft south and parallel to the south wall. A utility pole measuring 25 ft high is located adjacent to the northwest corner of the building.

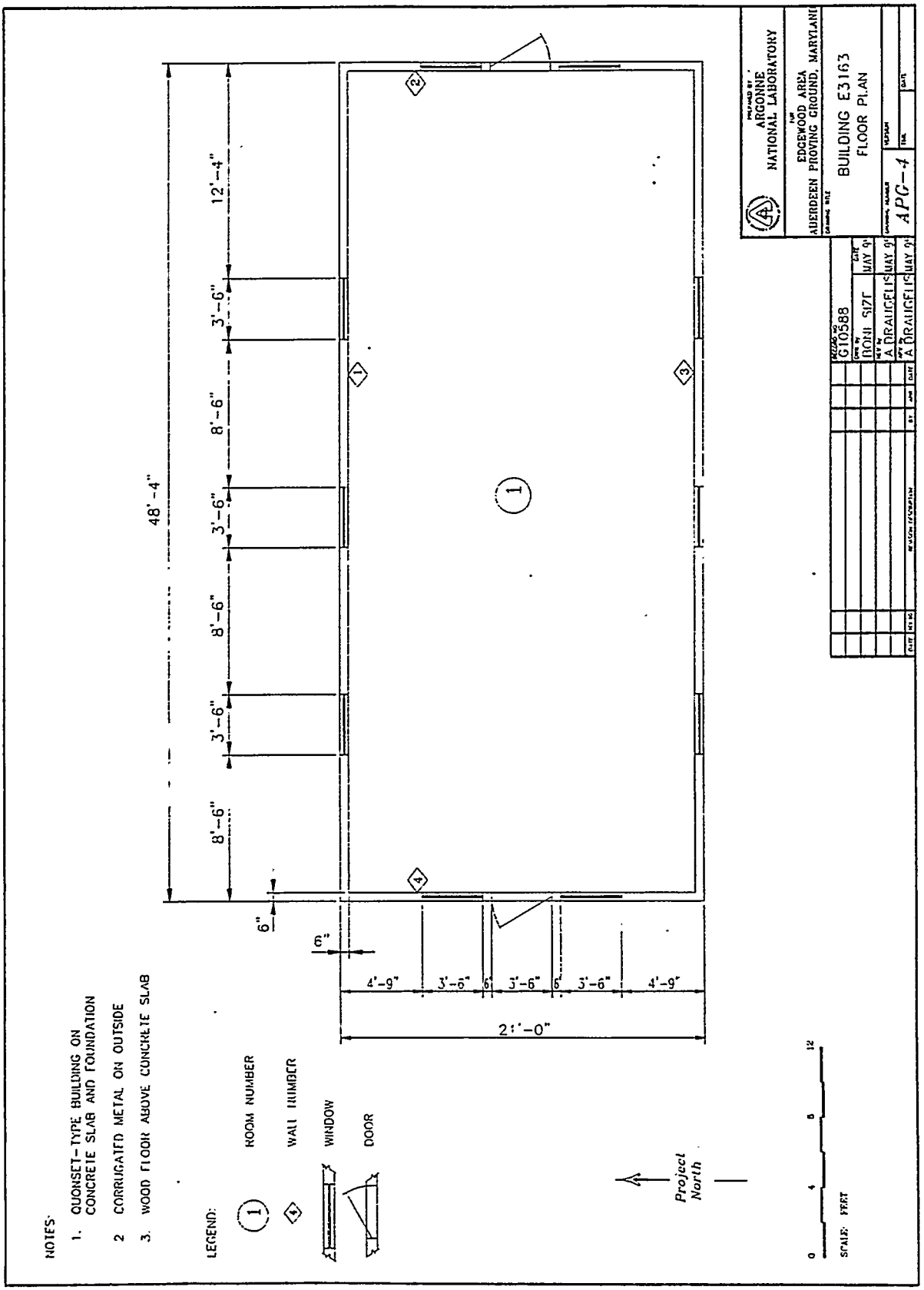
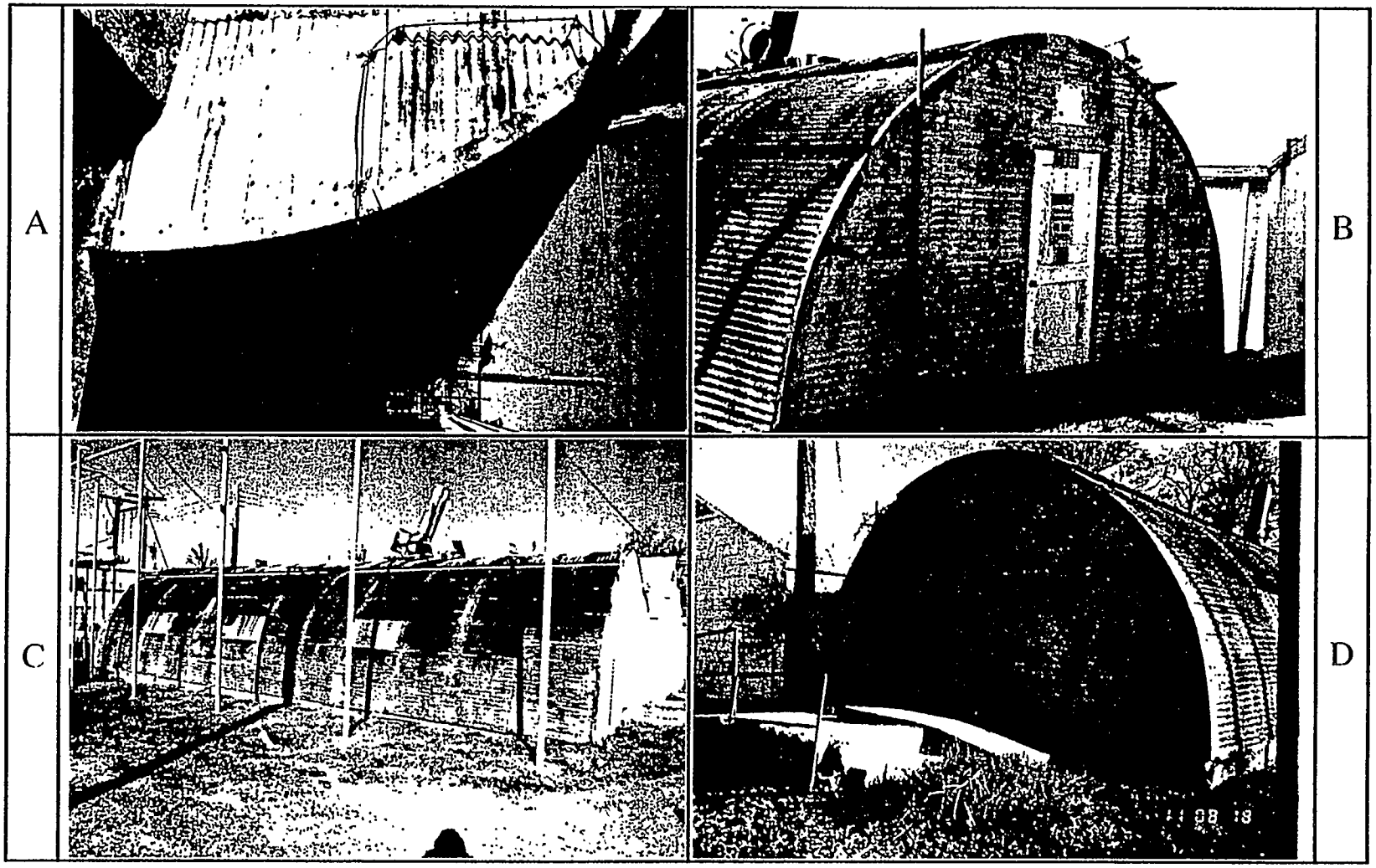


FIGURE 3 Building E3163 Floor Plan



A	North Elevation
C	South Elevation

East Elevation	B
West Elevation	D

FIGURE 4 Photographs of Building E3163 Exterior

4.1.8 Connections with Adjacent Buildings

None.

4.1.9 Location and Type of Underground Structures

None.

4.1.10 Surface Drainage System

ANL observed evidence of floor drains and floor penetrations for various pipes entering the crawlspace below the floor.

4.1.11 Utility Access Points

The proximity of utility poles to Building E3163 suggests that the building was equipped with operating electrical lines.

4.1.12 Exterior Piping

None.

4.1.13 Nearby Roads and Sidewalks

Kings Creek Road extends east to west approximately 230 ft north of the building. A gravel road runs in a north-south direction to Kings Creek Road, and turns at the southeast corner of Building E3163, extending east to west.

4.2 North Exterior Elevation

4.2.1 Dimensions

The north exterior elevation of Building E3163 measures 48 ft 4 in. long by 10 ft 6 in. high (Figure 3).

4.2.2 Construction Materials

The north exterior wall is covered by corrugated sheet metal.

4.2.3 Doors and Windows

No doors are present on the north elevation. Three windows in the north wall are covered with corrugated fiberglass. Each window measures 42 in. wide by 18 in. high.

4.2.4 Piping

None.

4.2.5 Utility Connections

The proximity of utility poles to Building E3163 suggests that the building was equipped with operating electrical lines.

4.2.6 External Equipment or Structures

A utility pole measuring 25 feet high is adjacent to the northwest corner of the building.

4.2.7 Vegetation

To the north of Building E3163 is an area of gravel with weeds.

4.2.8 Overall Condition

Because of a lack of building maintenance, the north elevation shows signs of deterioration and weathering. Oxidized metals were observed at the time of this investigation.

4.3 East Exterior Elevation

4.3.1 Dimensions

The east elevation measures 21 ft long by 10 ft 6 in. high (Figure 3).

4.3.2 Construction Materials

The east elevation consists of corrugated sheet metal.

4.3.3 Doors and Windows

One door is present on the east exterior elevation; the door measures 42 in. wide by 90 in. high. There are two windows covered with corrugated fiberglass. Each window measures 42 in. wide by 18 in. high.

4.3.4 Piping

The east exterior elevation of Building E3163 contains one section of vertical piping, measuring approximately 3 in. in diameter and approximately 10 ft long, and located approximately 4 ft west of the southeast corner of the building.

4.3.5 Utility Connections

Electrical lines are attached to the east exterior elevation of Building E3163 at the northeast corner.

4.3.6 External Equipment or Structures

None.

4.3.7 Vegetation

The area directly to the east of Building E3163 consists of lawn (cut grass).

4.3.8 Overall Condition

Because of a lack of building maintenance, the east elevation shows signs of deterioration and weathering. Oxidized metals were observed at the time of the investigation.

4.4 South Exterior Elevation

4.4.1 Dimensions

The south exterior elevation of Building E3163 measures 48 ft 4 in. long by 10 ft 6 in. high.

4.4.2 Construction Materials

The south exterior elevation consists of corrugated sheet metal.

4.4.3 Doors and Windows

No doors are present on the south elevation. There are three windows covered with corrugated fiberglass. Each window measures 42 in. wide by 18 in. high.

4.4.4 Piping

None.

4.4.5 Utility Connections

The proximity of utility poles to Building E3163 suggests that the building was equipped with operating electrical lines.

4.4.6 External Equipment or Structures

External aboveground structures associated with Building E3163 include five light poles 25 ft high, evenly spaced 10 ft south of and parallel to the south wall.

4.4.7 Vegetation

To the south of Building E3163 is an area of lawn (cut grass).

4.4.8 Overall Condition

Because of a lack of building maintenance, the south elevation shows signs of deterioration and weathering. Oxidized metals were observed at the time of the investigation.

4.5 West Exterior Elevation

4.5.1 Dimensions

The west exterior elevation of Building E3163 measures 21 ft long by 10 ft 6 in. high (Figure 3).

4.5.2 Construction Materials

The west exterior elevation consists of corrugated sheet metal.

4.5.3 Doors and Windows

One door is present on the west exterior elevation of Building E3163; the door measures 42 in. wide by 90 in. high. There are two windows in the west elevation covered with corrugated fiberglass. Each window measures 42 in. wide by 18 in. high.

4.5.4 Piping

None.

4.5.5 Utility Connections

The proximity of utility poles to Building E3163 suggests that the building was equipped with operating electrical lines.

4.5.6 External Equipment or Structures

None.

4.5.7 Vegetation

The area directly west of Building E3163 consists of lawn (cut grass).

4.5.8 Overall Condition

Because of a lack of building maintenance, the west elevation shows signs of deterioration and weathering. Oxidized metals were observed at the time of the investigation.

4.6 Roof

4.6.1 Type and Dimensions

Building E3163 has a curved, Quonset-type roof measuring approximately 48 ft 4 in. by 21 ft.

4.6.2 Height

The top of the roof is 10 ft 6 in. above ground level.

4.6.3 Surface Materials

The roof of Building E3163 is made of corrugated sheet metal.

4.6.4 Roof Support System

The roof is supported by a metal framework.

4.6.5 Condition

The roof of Building E3163 appeared to contain no leaks; however, the corrugated sheet metal shows signs of deterioration and weathering, including oxidation.

4.6.6 Equipment Located on the Roof

A mechanical ventilation unit was located on the roof of Building E3163 at the time of the investigation.

4.6.7 Chimneys, Roof Vents, or Vent Stacks

A single ventilation stack, with an attached motor and three roof vents, was located on the roof of Building E3163.

4.6.8 Piping

None.

4.7 Interior Floor Plan

4.7.1 Interior Room Number and Dimensions

Building E3163 is a single-story, single-room rectangular-shaped building with interior dimensions of 47 ft 2 in. long by 20 ft wide (Figures 3 and 5).

4.7.2 Walls

The walls of the room, which coincide with the exterior and interior walls of the building, are 6 in. thick. The exterior is covered with corrugated sheet metal and the interior with particle board. The interior walls are damaged.

4.7.3 Floor

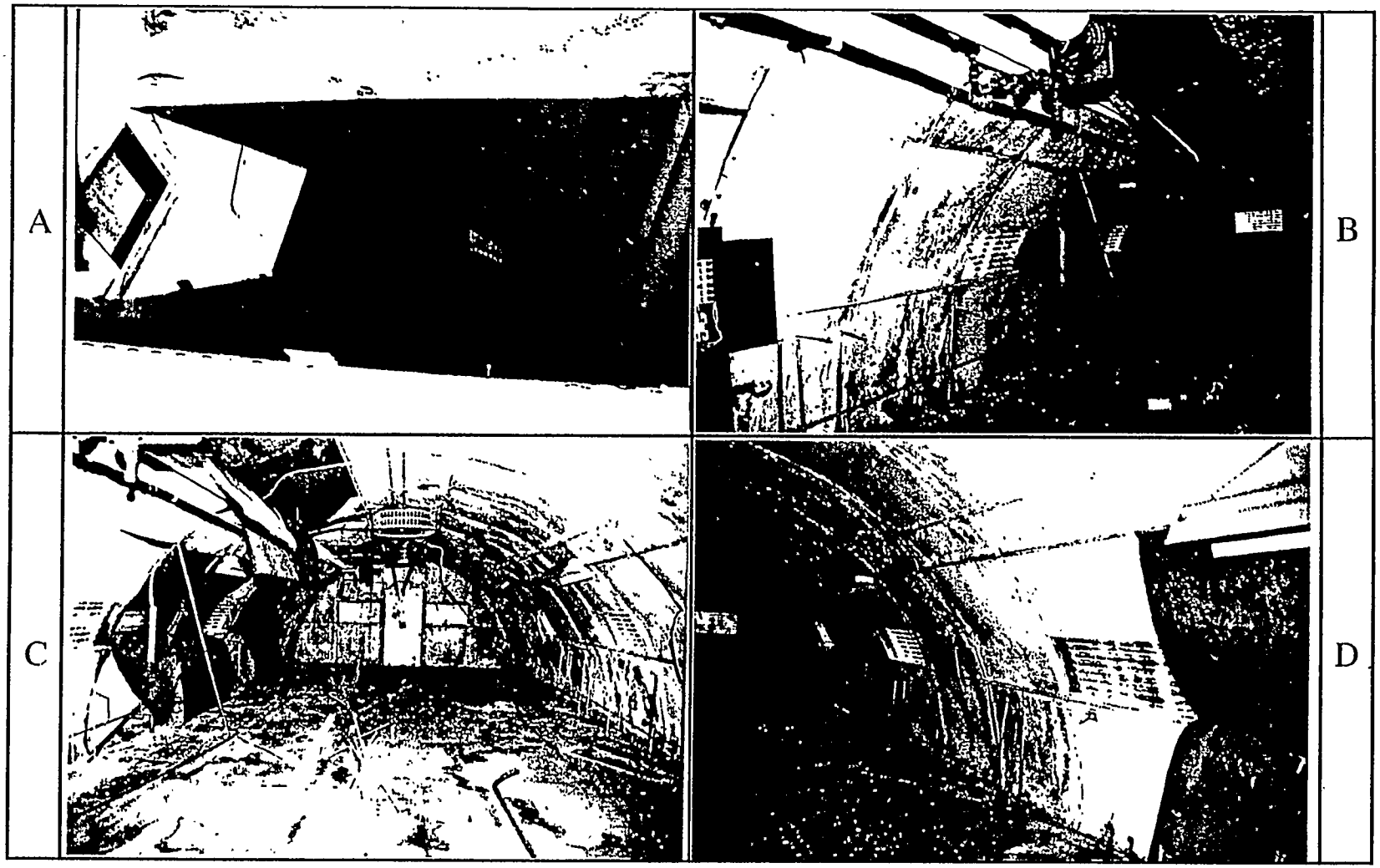
Building E3163 has a wooden floor that is damaged and in poor condition. There is evidence to suggest that the floor of this building was modified.

4.7.4 Floor Penetrations

ANL observed evidence that floor drains and floor penetrations of various pipes enter the crawlspace below the floor.

4.7.5 Location Partitions

Building E3163 consists of a single room with no interior partitions.



A	Wall 1
C	Walls 1, 2, 3

Walls 1, 2	B
Walls 4, 1	D

FIGURE 5 Photographs of Room 1

4.7.6 Equipment or Supplies

There are several light fixtures and heaters on the ceiling. Electrical fuse boxes are located on the north wall and electrical conduit runs throughout the room. There are various lengths of piping throughout the room and on the floor. Some of the pipes are covered with suspected asbestos-containing materials.

4.8 Room 1

4.8.1 Walls

The interior walls are covered with particle board.

4.8.2 Finish Materials

The walls are painted white.

4.8.3 Piping

Several light fixtures and heaters are located on the ceiling. Electrical fuse boxes were observed on the north wall. Electrical conduit and various lengths of piping run throughout the room and along the floor. Some of the pipes are covered with suspected asbestos-containing materials.

4.8.4 Doors and Windows

There are two doors in the building: one on the east and one on the west wall. Each measures 42 in. wide by 90 in. high. There are three windows in the north and three in the south elevation; the windows are covered with corrugated fiberglass. Each of these windows measures 42 in. wide by 18 in. high. There are two windows each in the east and west elevations; each also measures 42 in. wide by 18 in. high.

4.8.5 Ceiling and Floor

Building E3163 has a wooden floor that is damaged and in poor condition. There is evidence to suggest that the floor of this building was modified.

5 Geophysical Investigation

The area immediately surrounding Building E3163 was examined during December 1994 by means of several nonintrusive geophysical survey methods, including total field magnetics, electrical conductivity (EM-31), time-domain electrical induction (EMF or EM-61), and GPR techniques. The geophysical investigation report is provided in Appendix A.

Results of the geophysical surveys revealed the following:

- EMF and GPR anomalies were observed between 12 ft and 17 ft south of the south elevation and 17 ft west of the east elevation, to a depth of 2.4 ft.

- Strong GPR reflections were detected along a line 18 ft east of the east elevation, between 13 ft and 25 ft north of the south elevation. An EMF anomaly 1.3 ft deep is centered at 18 ft east of the east elevation and 15 ft north of the south elevation.

- Isolated GPR and EMF anomalies with unknown sources were also detected.

6 Air Monitoring

No information on air monitoring associated with Building E3163 is available.

7 Underground Storage Tanks

No information on underground storage tanks associated with Building E3163 is available.

8 Conclusions

On the basis of the information collected and reviewed by ANL for Building E3163, it is the authors' judgment that the anomalies detected in the vicinity of Building E3163 during the geophysical surveys should be further investigated and evaluated. Suspected asbestos-containing materials observed on the inside piping and as insulation between the interior and exterior walls should be evaluated and properly disposed of.

9 References

EAI Corporation, 1989, *Historical Records Search and Site Survey of the Edgewood Area Building — Final Report*, prepared for U.S. Army Chemical Research, Development, and Engineering Center, Aberdeen Proving Ground, Maryland, under contract no. DAAIS-87-D0021.

Nemeth, G., 1989, *RCRA Facility Assessment Report, Edgewood Area, Aberdeen Proving Ground, Maryland*, unnumbered report prepared for Aberdeen Proving Ground, Maryland.

Appendix:

Preliminary Report — Environmental Geophysics: Building E3163 Decommissioning, Aberdeen Proving Ground

Preliminary Report — Environmental Geophysics: Building E3163 Decommissioning, Aberdeen Proving Ground

by

M.A. Glennon, M.D. Thompson, C.R. Daudt, M.A.Benson,
J.E. Stefanov, and G. J. Keucher

Center for Environmental Restoration Systems
Energy Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

August 1995

Sponsored by

U.S. Army
Aberdeen Proving Ground, Maryland

Contents

Abstract 33

1 Introduction 33

2 Instrumentation 36

3 Induced EMF Measurements: EM-61 38

4 Ground-Penetrating Radar Measurements 40

5 Discussion 43

6 Conclusions 44

Table

1 List of anomalies observed near E3163 43

Figures

1 General Site Map of the Kings Creek Area, Aberdeen Proving Ground, Maryland 34

2 Detailed Location Map of Building E3163 35

3 Location of GPR and EM-61 profiles conducted near E3163 37

4 Three EMF profiles conducted near E3163 39

5 Ground-Penetrating Radar Profile along X=103 41

6 Ground-Penetrating Radar Profile along X=170 42

Preliminary Report — Environmental Geophysics: Building E3163 Decommissioning, Aberdeen Proving Ground

Abstract

The immediate vicinity surrounding Building E3163, a potentially contaminated site in the Kings Creek area of Aberdeen Proving Ground, was examined using two nonintrusive, geophysical surveys, time-domain electrical induction (EMF or EM-61), and ground-penetrating radar (GPR) techniques. At a depth of about 2.4 ft, GPR and EMF anomalies are detected along X=150 between Y=100 and 105. A large EMF positive anomaly at (170, 130) is detected near strong GPR reflections. Other isolated EMF and GPR anomalies are observed. The sources of these anomalies are unknown.

1 Introduction

Environmental geophysics studies have been conducted at Building E3163, located in the Kings Creek Area, Aberdeen Proving Ground (Figure 1). These studies were conducted by ANL staff in mid-June 1994.

Building E3163 is located south of South Kings Creek Road (Figure 1). According to building records examined by EAI Corporation (1989), the building was constructed in 1946. Toxicological studies on animals were conducted at E3163 from 1946 until 1965, when all experimentation ceased at the building. The total quantities and type agents used during testing is unknown as all operational data were destroyed. The building was used as overflow office space between 1965 and 1978 when E3163 was abandoned. E3163 was decontaminated twice in 1983; however, the results were lost and there is no verification that the building was completely clean of hazardous materials.

A 2 in. water pipe and 6 in. sanitary sewer services the building. Potential contaminants include laboratory scale quantities of unknown agents, as well as asbestos found on building inspection in 1988/1989 (EAI Corp. 1989). Building E3163 is a single-room, single-story rectangular Quonset structure. Building E3160 is located less than 5 ft north of E3613. In addition, train tracks and metal poles are along the northwest and south sides of the building, respectively.

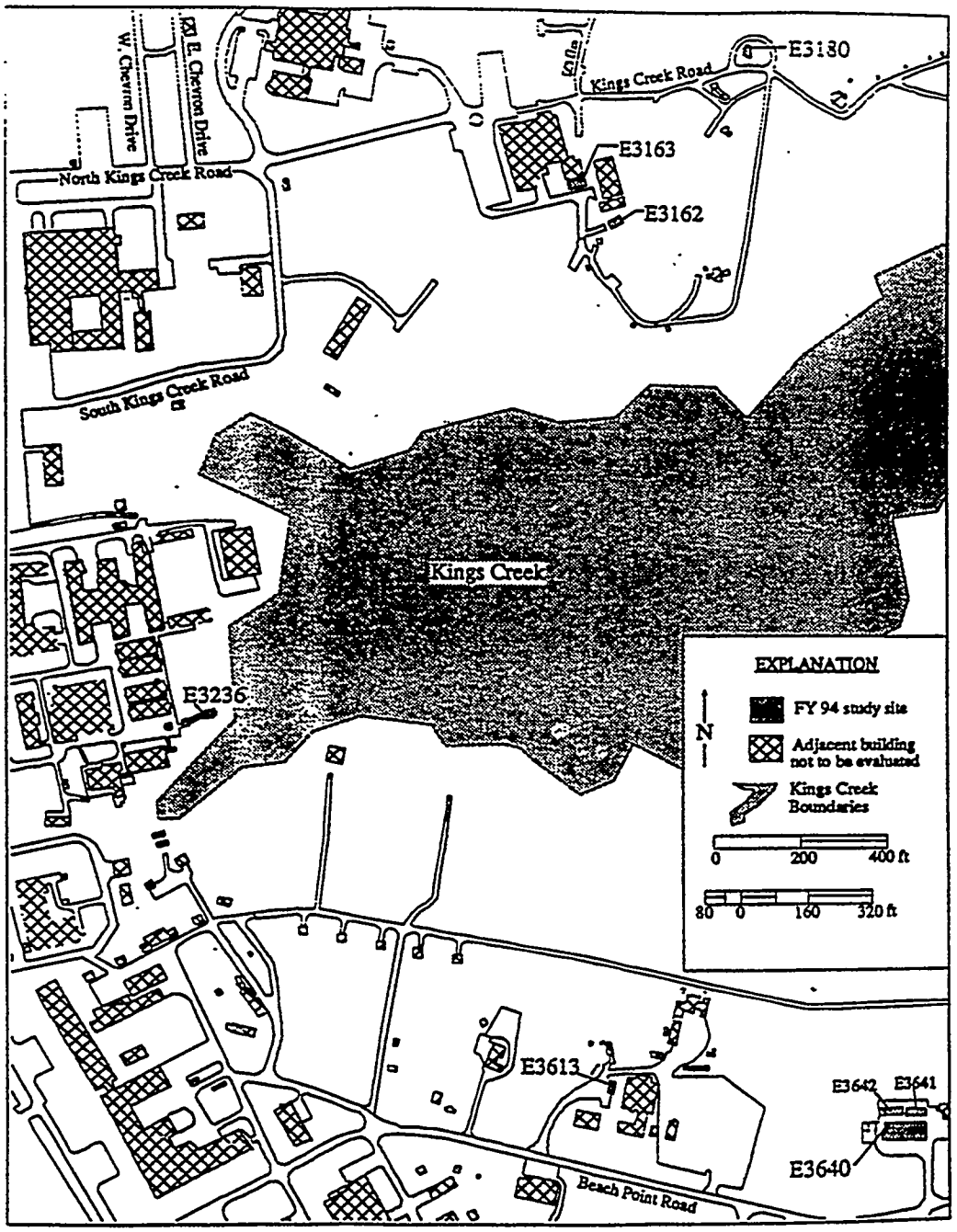


FIGURE 1 General Site Map of the Kings Creek Area, Aberdeen Proving Ground, Maryland

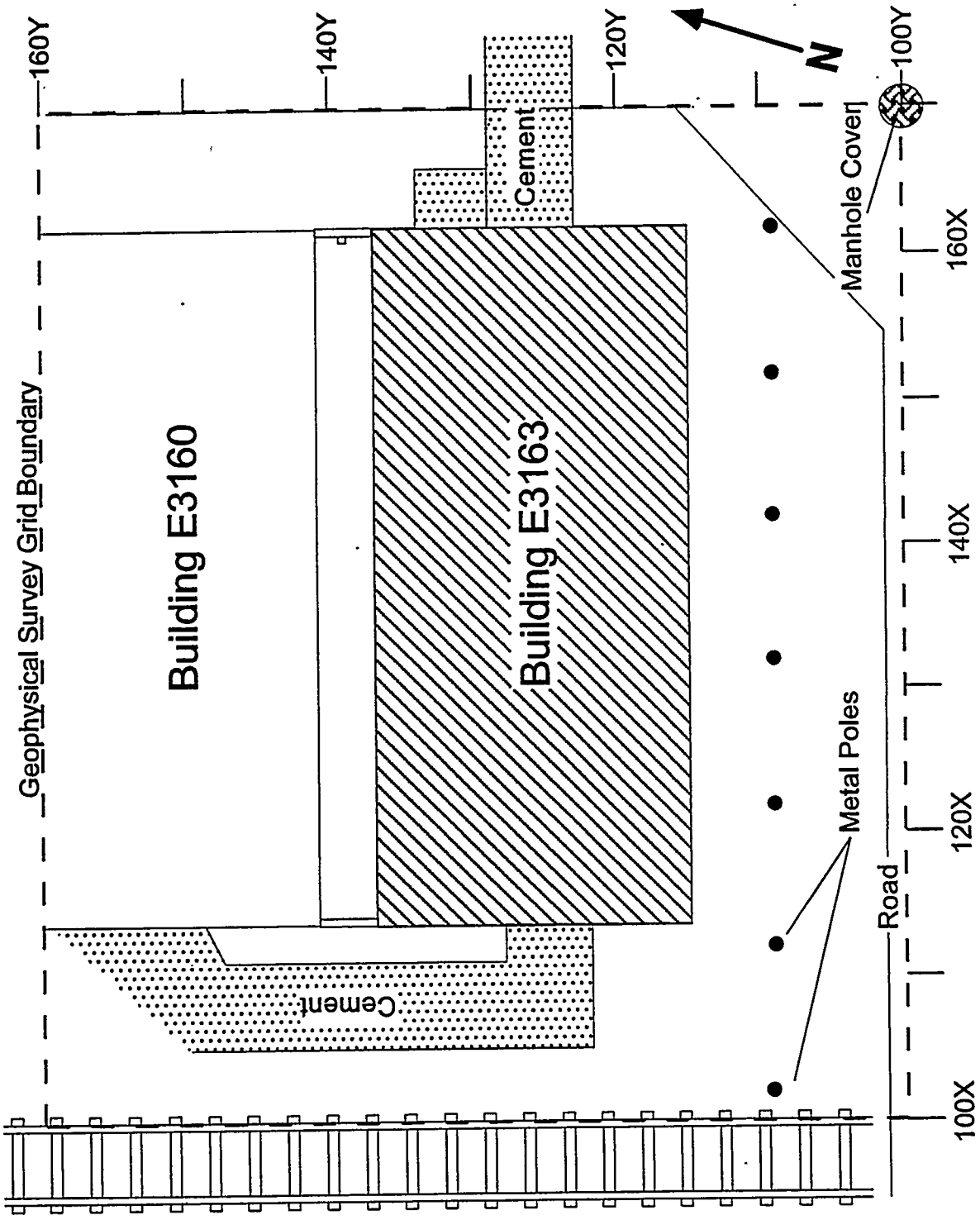


FIGURE 2 Detailed Location Map of Building E3163

2 Instrumentation

Survey coordinates were positioned so that the southwestern grid corner was located at coordinates X=100, Y=100, and was oriented so that its axes were parallel to the edges of the building. Positive X and Y coordinates were measured approximately northeast and northwest of the starting coordinate (Figure 2). For convenience, a location of X=100, Y=150 will be represented as (100, 150). The proximity of anthropogenic structures to E3613 limited the size of the survey to three profiles using the Time-Domain Geonics EM (EM-61), designed for detection of metals (labeled as profiles A, B, and C in Figure 3) and four profiles using Ground-Penetrating radar GSSI, SIR 2 (labeled as profiles 1-4 in Figure 3). Locations of the beginning, middle and end of each profile were measured and are accurate to within about 1-2 ft. However, locations along the profiles depend upon a constant walking rate and these locations are accurate to within about 2-4 ft. Magnetometer and EM-31 measurements were not made because of interference effects caused by buildings, metal pipes and the railroad bed.

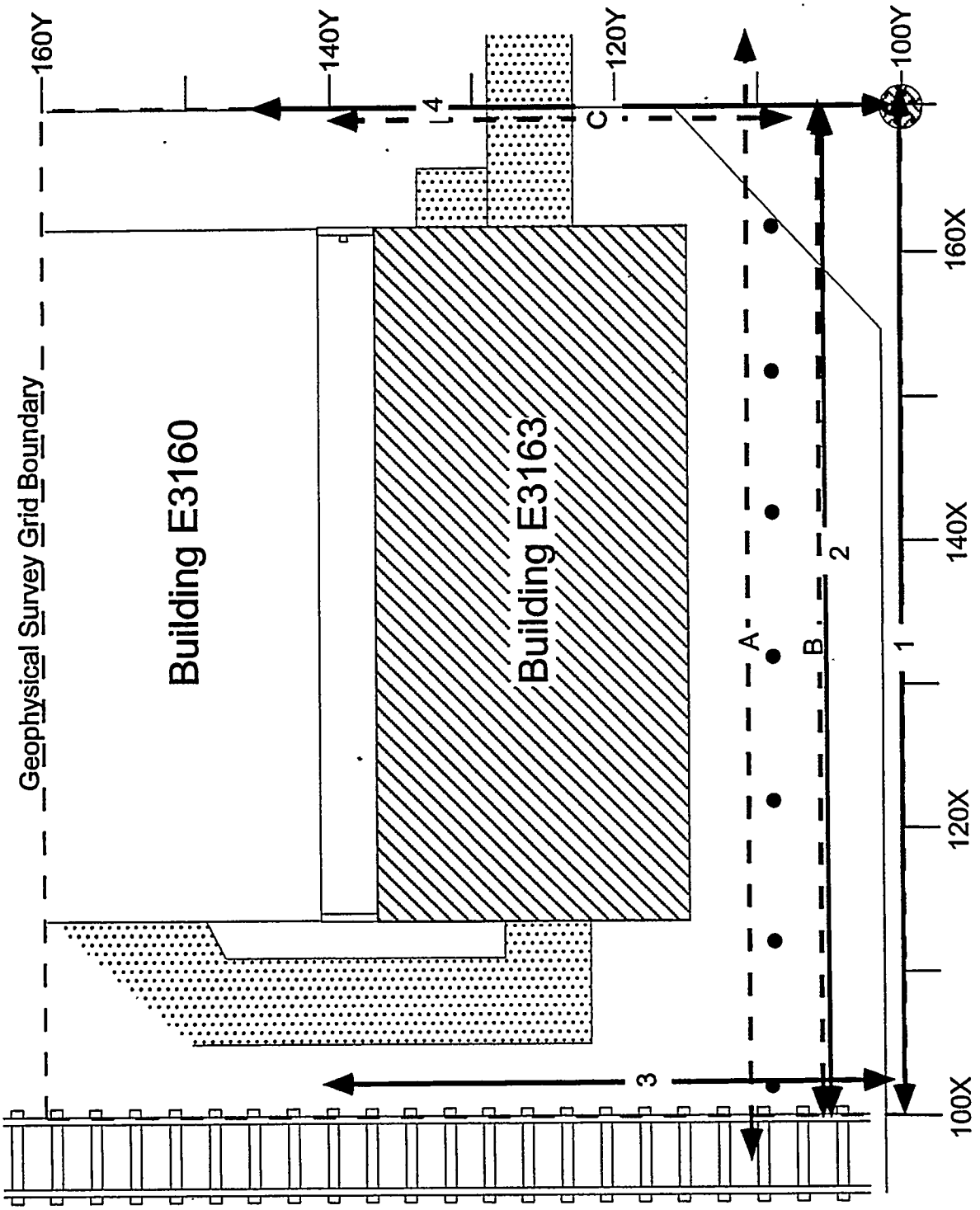


FIGURE 3 Location of GPR and EM-61 profiles conducted near E3163

3 Induced EMF Measurements: EM-61

An EM-61 electrical induction instrument transmits an electrical pulse into the ground and measures secondary EMF's caused by metallic objects beneath the instrument. As a consequence of its coil arrangement, it is relatively insensitive to surface interference and is more sensitive to deeply buried metallic targets. Data are recorded on three channels including a response from an upper coil, lower coil, and a coil difference. Because of its spatial positioning, the lower coil responds to signals from all depths within the instrument range. Data recorded on the coil difference channel are less sensitive to surficial debris. Negative values on the difference channel are often associated with metallic objects located above the surface (such as overhead steam pipes). Furthermore, since the amplitude of response is highly dependent on the distance between the coil assembly and target, small near surface anomalies will often produce a response orders of magnitude larger than much bigger, but deeper targets (Geonics Limited 1994).

Lower coil and coil difference channels are plotted in Figure 4 for the three EM-61 profiles conducted near E3163. Profile A was conducted adjacent to the metal pipes and the complicated lower coil signals combined with the negative coil difference anomalies suggests interference from these structures. The highest amplitude lower coil anomalies on lines B and C have negative coil difference anomalies, suggesting an above ground target. On the other hand, positive lower coil and coil difference anomalies at (132, 105), (145, 105) and (170, 130) suggest subsurface sources. The apparent depth to each target, approximated with software supplied with the EM-61 instrument (Geonics Limited 1994), is greater than 1.8 ft (Figure 4). The sources of these anomalies are unknown.

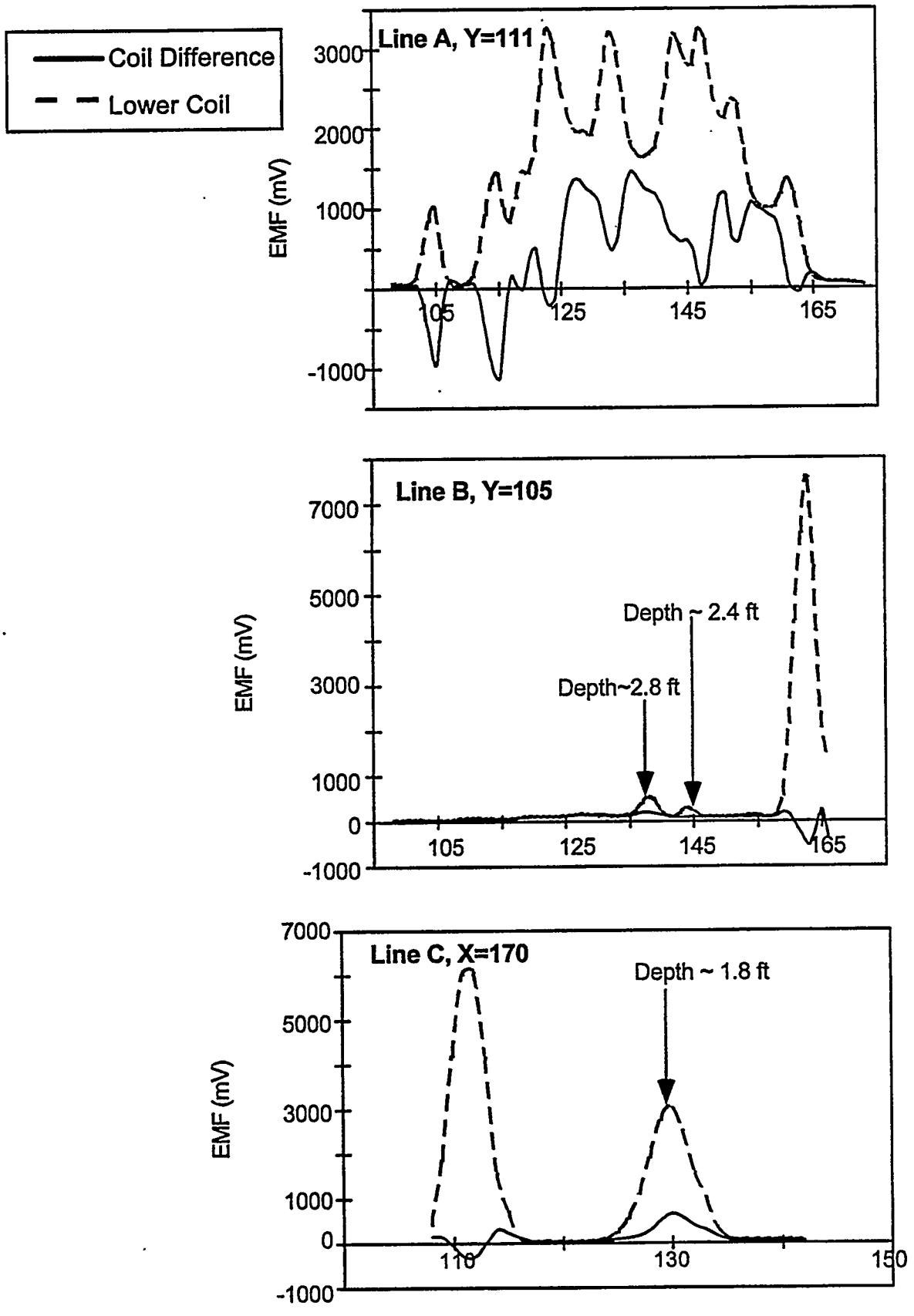


FIGURE 4 Three EMF profiles conducted near E3163

4 Ground-Penetrating Radar Measurements

Good penetration was observed over most of the site. Wave-velocity characteristics of near-surface materials were derived from tables of travel-time conversion to depth for various earth materials (Geophysical Survey Systems 1987). For example, the two-way conversion to depth for average soil is 7-9 ns/ft. As the degree of soil saturation increases, the two-way conversion to depth also increases which, in effect, decreases the maximum penetration depth. An increase in clay within the subsurface tends to decrease the maximum penetration depth. At Building E3163, a range setting of 100 ns was used for the entire survey. Due to unknown saturation conditions and subsurface heterogeneities, the depth of penetration with GPR at E3163 can range between 11 and 15 ft below the ground surface. For the purposes of this report, a maximum penetration depth of 14 ft was assumed.

Four GPR profiles were conducted in the vicinity of E3163 (Figure 3). Along X=103 (Figure 5), two shallow hyperbolas are detected at Y=103 and Y=133. The sources of these anomalies are unknown. Along the same profile, strong reflections are observed at depths greater than about 6 ft near Y=108, which may be sourced by subsurface disturbances associated with the nearby metal pole. The strong reflections along X=170 between Y=122 and 128 can be attributed to the concrete slab (Figure 6). However, along the same profile, similar reflections are also detected between Y=128 and Y=140 that can not be associated with that structure. Along Y=100 and Y=105, shallow hyperbolas are detected at X=150. The sources of these anomalies are unknown

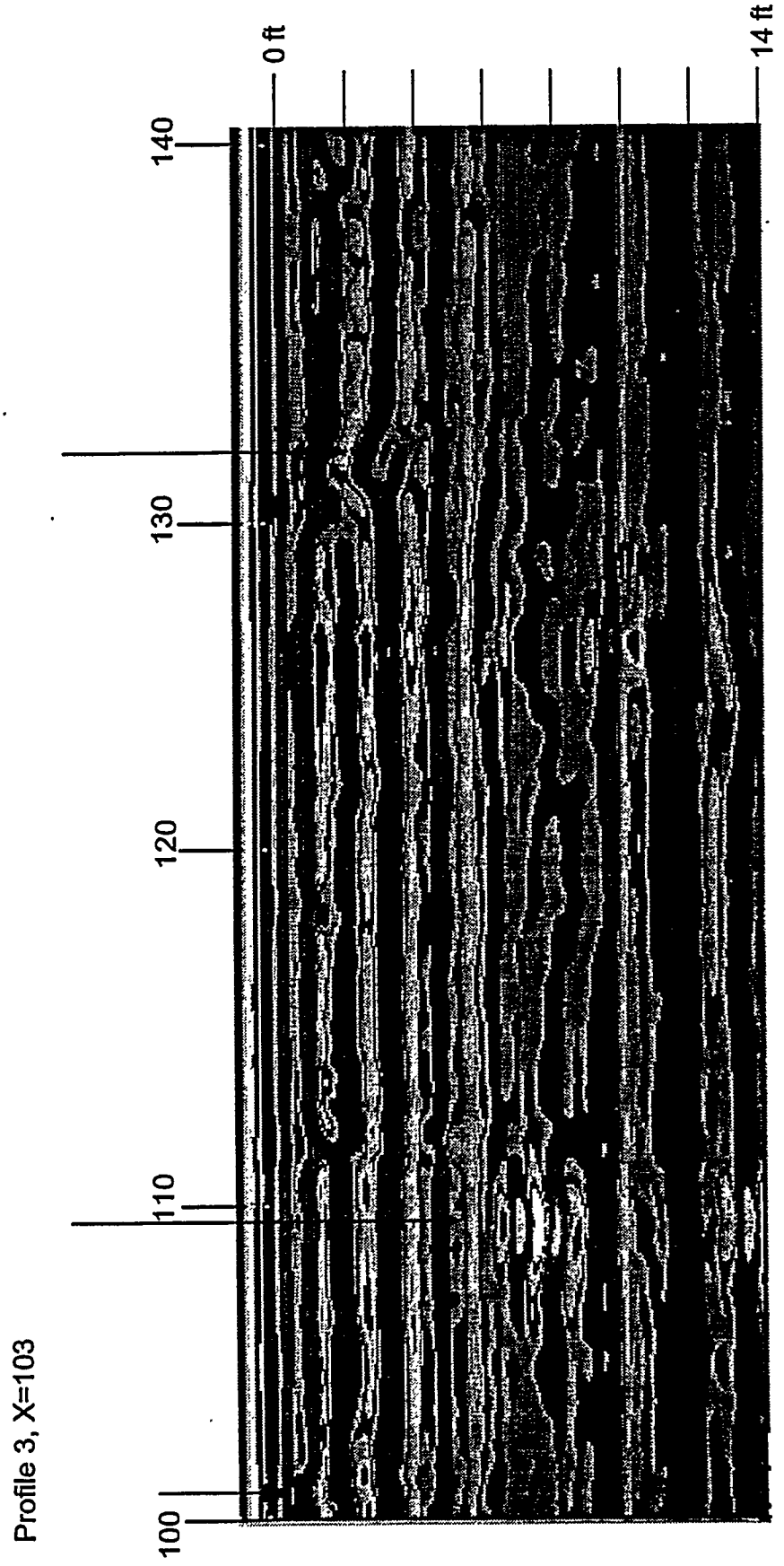


FIGURE 5 Ground-Penetrating Radar Profile along X=103

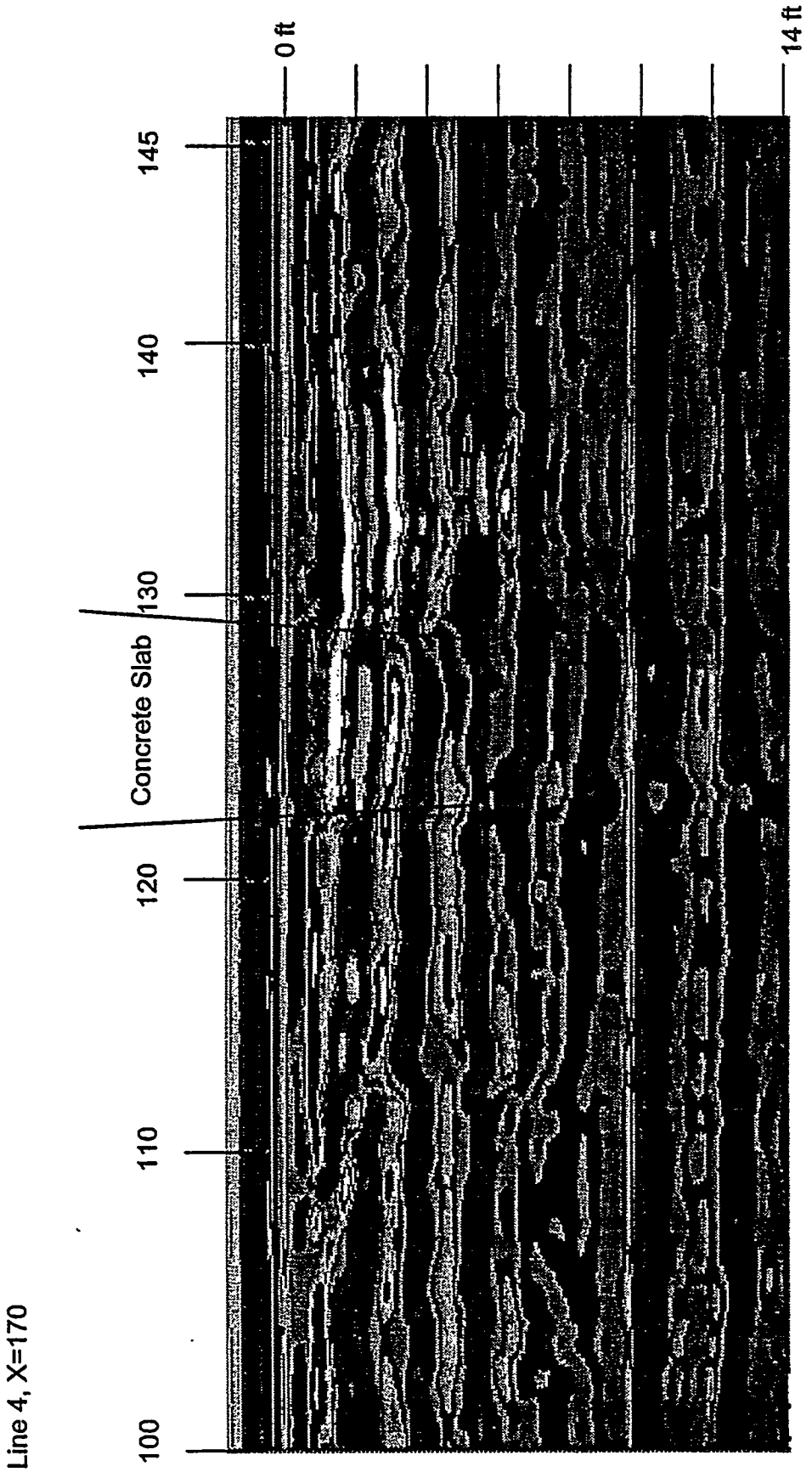


FIGURE 6 Ground-Penetrating Radar Profile along X=170

5 Discussion

Table 1 summarizes the locations of the observed geophysical anomalies around Building E3163, as well as their probable cause. Due to the proximity of anthropogenic structures to E3163, isolated geophysical profiles were conducted. For this reason, identification of buried objects from geophysical anomalies at E3163 is not possible.

A buried object is delineated by GPR hyperbolas between Y=100 and 105 at X=145 and an EMF anomaly at (150, 105). Depths determined from both geophysical observations are in general agreement at about 2-3 ft. Strong GPR reflections, associated with the concrete slab along X=170, extend past this structure from X=128 to X=140. A 3000 mV EMF anomaly is also centered at (170, 130). The source of this anomaly is unknown.

Interference from metal poles located along Y=110 probably cause the EMF positive anomalies along profile A (Figures 3 and 4). Deep GPR reflections are detected at (103, 108) which could also be sourced by subsurface disturbances associated with a metal pole.

Isolated EMF and GPR anomalies are detected (Table 1) that are sourced by buried targets. On the other hand, the EMF anomalies detected at (160, 105) and (170, 110) are probably sourced by targets along the ground surface.

TABLE 1 List of anomalies observed near E3163

Coordinates		Geophysical Instrument*		Possible Origin
X	Y	EM-61	GPR	
132	105	X		Source Unknown
150	100-105		X	Source Unknown
145	105	X		Source Unknown
170	130	X		Source Unknown
170	123-128		X	Concrete Slab
170	128-140		X	Source Unknown
103	110		X	Source Unknown
160	105	X		Unknown surface source
170	110	X		Unknown surface source
103	132		X	Source Unknown
103	103		X	Source Unknown

6 Conclusions

Site geophysical surveys consisting of EM-61 millivolt, and ground-penetrating radar around building E3163 permit the following conclusions:

1. EMF and GPR anomalies are observed along X=145 between Y=100-105 at a depth of about 2.4 ft.

2. Strong GPR reflections are detected along X=170 between Y=128-140. An EMF anomaly at 1.8 ft is centered on 170, 130. The source of this anomaly is unknown.

3. Isolated GPR and EMF anomalies are detected with unknown sources.