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**This document was reviewed following the
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01/09/95

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7. Abstract

Mitchell, T. H. and K. A. Bergstrom, 1994, "Geophysical Surveys for Proposed Boreholes 299-W15-25, 26, and 27, 200 West Area." WHC-SD-EN-TI-282, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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1.0 OBJECTIVE

The objective of the survey was to locate subsurface obstructions that may affect the drilling of proposed boreholes 299-W15-25, 299-W15-26, and 299-W15-27, north of the 321-Z Building (Figure 1). The possible drill sites within the zone with the least likelihood of encountering identified obstructions were identified based on the results of the survey. An initial survey over a portion of the area was conducted in June, 1993, in support of proposed borehole 299-W15-25 (Mitchell and Bergstrom 1993). Subsequently, boreholes 299-W15-26 and 299-W15-27 were proposed, requiring an expansion of the geophysical coverage. Ground-penetrating radar (GPR) was the geophysical method chosen for the shallow characterization of this site.

2.0 GROUND-PENETRATING RADAR METHODOLOGY

The GPR system used for this work utilized a 300-megahertz transducer. The transducer transmits electromagnetic energy into the ground. Buried objects such as pipes, barrels, foundations, and buried wires can cause all, or a portion, of the transmitted energy to be reflected back towards a receiving antenna. Geologic features such as crossbedding, caliche horizons, paleosols, and clays can also cause reflections of the transmitted energy. The reflected energy provides the means for mapping the subsurface features of interest, whether man-made or geologic.

The maximum depth of investigation varies from site to site and is a function of the transmit power, receiver sensitivity, frequency of the antenna, and attenuation of the transmitted energy. The attenuation of the energy is primarily a function of the local soil conditions. Depth of investigation is also affected by highly conductive material, such as metal drums and pipes which essentially reflect all the energy. Therefore, the method cannot "see" directly below areas of highly reflective material. Maximum depths of penetration for these surveys ranged from 10 to 15 ft.

Display and interpretation of GPR data are similar to that of seismic reflection data (i.e., data displayed as horizontal distance vs. time, depicting pseudo cross-sections of the earth). The approach to an interpretation is quite variable and influenced by the objectives of the survey and the experience of the interpreter. There are also numerous data processing techniques available that may or may not aid in the interpretation process. In some areas, interpretations can be straight forward, but often a highly variable subsurface yields complex data that is difficult to interpret. A common end-product is a plan view map showing the locations and depths of the features that were detected within the survey area.

GPR data in these surveys were collected with a Geophysical Survey Systems Inc. (GSSI) Subsurface Interface Radar (SIR)[™] System 8, model 4800, and digitally stored on a GSSI DT6000A tape drive. A recording window of 100 nanoseconds, two-way travel time, was used.

[™]A trademark of Geophysical Survey Systems, Inc. (GSSI).

3.0 GRID LOCATION

The survey boundary is basically rectangular, measuring 80 ft by 65 ft (Figure 2). Painted stakes mark the corners of the grid. The long axis of the survey strikes approximately east-west. All distances were measured and posted in feet. The southwestern corner of the grid is designated E70/N100 and serves as the "origin" for the survey locations. The letters "E" or "N" refer to a direction that trends generally east or north, respectively. The number refers to a distance in feet. For example, grid point E135/N120 lies 35 ft "east" and 20 ft "north" of grid point E100/N100.

The data were collected in two phases. First a 50- by 50-ft grid was collected with the initial "origin" at E100/N100. Subsequently, the survey area was expanded 30 ft to the west and 15 ft to the north. Data were collected along two sets of profiles perpendicular to each other. Spacing between profiles was 5 ft.

4.0 QUALITY CONTROL

These data were collected using procedures in WHC-CM-7-7, EII 11.2, Rev. 3, *Environmental Investigations and Site Characterization Manual*, Westinghouse Hanford Company (WHC). The data and records are stored in the Geophysics files. Figure 3 summarizes survey parameters.

5.0 RESULTS

A reflective horizon is evident at about 6 ft below the surface across most of the site. This reflective horizon is probably geologic, possibly a paleosol or caliche horizon, or possibly a result of some backfill in the area. Another reflective horizon, also probably geologic, is at about 14 ft and is observed between E80 to E100 and N110 to N125 (Figure 2). This deeper horizon may continue throughout more of the survey area but be beyond the depth of investigation.

Widely scattered, isolated anomalies were detected across the survey area. No alignments of these anomalies were identified that would be indicative of a buried utility or pipeline.

6.0 REFERENCES

Mitchell, T.H. and K.A. Bergstrom, 1993, *Geophysical Investigation for Proposed Boreholes 299-W15-25 and 299-W15-223, 200 West Area*, WHC-SD-EN-TI-196, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, *Environmental Investigations and Site Characterization Manual*,
WHC-CM-7-7, EII 11.2, Rev. 3, Westinghouse Hanford Company, Richland,
Washington.

Figure 1. Location Map.

- ③ Buried anomaly; depth in feet.
- C Buried anomaly; depth < 1.5 feet
- Anomalous horizon - probably geologic
- Proposed well locations 299-W15-25, -26, -27
- ~~~~~ Anomalous / "Disturbed" zone

Questions: Contact surface geophysics @ 6-4024
T.H. Mitchell, K. A. Bergstrom

N ↑

Figure 2. Summary Interpretation for the Area Around Boreholes 299-W15-25, 299-W15-26, and 299-W15-27.

NOTES: Only widely scattered, isolated anomalies were detected across the survey site with no indication of "through-going" linears. A reflective horizon, probably geologic/caliche, etc. is evident at about 6 feet across most of the site. Maximum depth of penetration was about 12 to 14 feet.

Figure 3. GPR Parameters for the 299-W15-25, 299-W15-26, and 299-W15-27 Site.

GROUND PENETRATING RADAR (GPR) SURVEY

Team Geophysics, Westinghouse Hanford Operations

TITLE: Boreholes 299-W15-25, -26, and -27		DATE: 6-14-93/5-5-94	
LOCATION: North of 231-Z building.			
CLIENT: Joe Jimenez/Olin Amos		DATA COLLECTED BY J.P. Kiesler & T.H. Mitchell & K.A. Bergstrom	
EQUIPMENT USED: GSSI System 8, model 4800 Calibrator Model P731 Digital Tape Recoder DT6000A		ANTENNA(S) USED: 100 ____ 300 <u>XX</u> 100 BISTATIC ____	
		LOG BOOK: EFL1028 / EFL1122	
		TIME WINDOW (NS): 100	
PROCEDURES FOLLOWED: WHC-CM-7-7 EII 11.2, REV. 3			
GRID : <u>80X65'</u> NO. OF PROFILES: <u>31</u> TOTAL FOOTAGE COLLECTED: <u>1900</u>			
PARAMETERS: Data collected along two sets of perpendicular profiles; 5 feet between profiles.			
DATA TAPE NO.: <u>93-18/94-19</u>		RECORDS LOCATION: <u>Geophysical field files</u>	
<u>40671-52896</u>		<u>51777-52896</u>	
TAPE ADDRESS : <u>28296-37476</u>		CALIBRATION ADDRESS: <u>28296-28422</u>	
INTERPRETED BY : <u>KAB AND THM</u>		REVIEWED BY : <u>THM AND KAB</u>	
INTERPRETATION DELIVERED TO <u>Joe Jimenez / Olin Amos</u> DATE : <u>8-22-93/6-2-94</u>			
OBJECTIVE(S): To locate debris free area for drilling. Locate possible underground utilities.			
NOTES: Antenna pulled by hand at 1-2 mph. 30-meter cable.			