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Idaho National Engineering Laboratory

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Date : February 19, 1992
Subject: Subsurface Imaging Results for the High Level Waste Tank Farm Replacement (HLWTFR) Project

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Project File - HLWTFR

Ref: 1) Final Report on Robotic Geophysical Survey - NEJ-28-91, dated December 2, 1991

2) Portable Pipe Mapper (PPM) Field Test at the Idaho Chemical Processing Plant (ICPP), dated January 1992

Attached are copies of the referenced subsurface imaging reports prepared for the HLWTFR Project and a HLWTFR report which puts the referenced reports into perspective. The reports are provided for information only.

If you have any questions, please call me.

Charles J Urbanski

C. J. Urbanski, Project Engineer
HLWTFR Project

/jl

Attachments

CC = Dee Williamson w/attach, no map
John Williams w/attach and maps
Carol Mascareñas w/attach no map
ER Tech Route w/attach no maps
Section file - 04 3-07 w/attach no maps
Is this useful?
r/Keenan

Westinghouse Idaho Nuclear Company, Inc.

Attachment
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Subsurface Imaging Program Report
by the
High Level Waste Tank Farm Replacement Project

Background

The HLWTFR Project investigated various subsurface imaging techniques for identifying the location of underground pipes, ductbanks, and other obstructions in the HLWTFR Project excavation areas. The intent was to obtain data that would (1) reduce the risk of damage to underground piping and utilities and (2) improve the efficiency of excavation operations. The subsurface imaging activities were centered around services provided through EG&G and Carnegie Mellon University due to the diversity of sensing techniques.

Soldier Robot Interface Project Vehicle

EG&G had access to a Soldier Robot Interface Project (SRIP) vehicle for use in demonstrating remote subsurface imaging capabilities for locating buried waste at the Radioactive Waste Management Complex (RWMC) and for use with the HLWTFR Project. The SRIP vehicle's features included:

1. ground penetrating radar,
2. soil gas analyzer,
3. NaI gamma detector,
4. magnetometer sensor,
5. EM31 conductivity sensor, and
6. x-y position correlation sensor.

The ground penetrating radar equipment was the same as that owned by WINCO's Quality Assurance Department. Therefore it is not surprising that the equipment did not perform any better than previous demonstrations provided by QA. Due to the presence of silt, the soil conditions are not conducive to ground penetrating radar techniques. Ground penetrating radar was attempted but was abandoned after early data was analyzed as being indeterminate.

The soil gas analyzer and the NaI gamma detector were not used since the data to be gathered was to be obtained from "clean" areas and the effort and expense did not warrant using them.

The magnetometer sensor was not used due to magnetic interference caused by the SRIP vehicle itself and the fundamental limitations of the magnetometer.

The EM31 conductivity sensor provided "reasonably useful" data. Attachment 1 is the analysis of that data and contains marked-up ICPP underground utility drawings showing the interpretation of the data. The term "reasonably useful" is used because the data in general showed a strong correlation to known underground utilities, but the analysis also identified some areas not expected to have underground obstructions.

The x-y position correlation sensor was used to determine continuously the exact location of the SRIP vehicle within surveyed grids. The x-y position correlation sensor provided excellent results but is limited to open areas without significant metallic interference such as fences, buildings and vehicles. It is also limited in the grid size it can accommodate (approximately 200' X 200' in open areas).

The SRIP vehicle itself provided a remote means of gathering the data; however, this is considered somewhat of a disadvantage due to its slow speed, noisiness, and awkwardness near obstacles or in tight locations. It would have advantages over hand carrying an EM31 sensor to gather vast quantities of data in wide open areas.

<u>Carnegie Mellon University's Portable Pipe Mapper</u>

Carnegie Mellon University (CMU) has developed a Portable Pipe Mapper (PPM) for locating underground metallic objects such as pipes and cables. The PPM technique required the active injection of a signal into the target pipe and tracing that signal as it propagates along the line. At first an attempt was made to apply a signal at one end of a pipe and complete the circuit by connecting to a ground rod driven into the earth; however, the cathodic protection system at the plant effectively connects all underground piping and unintelligible data resulted. Good results were obtained when the signal was applied at one end of a pipe, the return was connected to the same pipe at some distance away, and the pipe was mapped between these points.

The data was gathered, analyzed, computer enhanced and is shown in Attachment 2. The results of the CMU PPM were impressive for the most part and correlated well with the existing underground drawings. However, the results shown on page 6 of the report (Figure 02-0927) and the data associated with the mapping effort on Olive Avenue do not provide information consistent with the existing underground drawings.

<u>Conclusions</u>

Use of the SRIP vehicle in the future is not recommended for the following reasons:

1. Uncertainties involved with scheduling use of the vehicle (stationed at the Oak Ridge National Laboratory);

2. Most of the sensors do not/will not provide information useful for improving the efficiency of excavation operations;

3. Cost associated with operation of the vehicle including: transportation, maintenance, equipment operators, and support personnel; and

4. Cost associated with interpretation of the data by qualified geophysists.

The EM31 ground conductivity sensor provided worthwhile qualitative data for location and depth of potential underground obstructions and EG&G can obtain this data manually and analyze it far more cost effectively. Actual excavation of the areas mapped will be the final judge on the quality, accuracy and usefulness of the data obtained.

In general, use of the CMU PPM is limited in usefulness at the ICPP to low density underground metallic areas where a signal can be applied by connecting to two ends of a pipe or cable. The quantitative location and depth information derived from the data obtained can be impressive; however, most underground utility and process line location information is already shown on existing underground drawings and a fairly good estimate of the depth is available.