

United States
Department of
Agriculture

Soil
Conservation
Service

Northeast NTC
160 East 7th Street
Chester, PA 19013

Subject: Ground-penetrating radar field
assistance: Seneca Falls Landfill

Date: May 27, 1988

To: Edward Freeborn
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File code: 210

Purpose:

To demonstrate the potentials of using ground-penetrating radar techniques for the assessment of site conditions within a large landfill in western New York.

Participants:

James Doolittle, Soil Specialist (GPR), SCS, Chester, PA
Ed Freeborn, Test Engineer, SUNY Oswego, NY
Michael Lane, Researcher, SURC, Oswego, NY
Ronald Scudato, Director, SURC, Oswego, NY

Activities:

The GPR unit arrived at the Seneca Falls Landfill site on 10 May 1988. Radar surveys of the landfill site were conducted on 10 and 11 May. The GPR unit returned to Chester on 12 May 1988.

Equipment:

The equipment used during this field trip was the SIR System-8 radar. This unit consist of the model 4800 control unit, ADTEK SR-8004H graphic recorder, and the ADTEK DT-6000 tape recorder. The 120 MHz antenna with the 705DA transceiver was used for these surveys. The unit was powered by a 12-volt vehicle battery. The selected scanning times on the control unit were 60 and 120 nanoseconds (ns).

Discussion:

Ground-penetrating radar (GPR) techniques have been successfully used to delineate the boundaries of landfill sites and, in some areas, to map the internal features of the fill. Often, the highly conductive nature of the fill, leachate, and/or liner has been a limiting factor for deep profiling by the GPR. In areas of high conductivity, other geophysical techniques, such as seismic, EM, or resistivity, provide greater depth

of penetration and more complete information concerning the internal features and characteristics of the landfill site.

The Seneca Falls Landfill site is located in an area mapped as Niagara (fine-silty, mixed, mesic Aeric Ochraqualfs) silt loam.¹ Niagara series consist of deep, somewhat poorly drained silty soils formed in lacustrine deposits which are calcareous. The GPR is extremely depth restricted in these soils because relatively high clay, moisture, and soluble salt contents rapidly attenuate the radar signal and limit the depth of signal penetration. Prior to the radar survey of the Seneca Falls Landfill site, the probability for successful radar applications was estimated to be low.

Results:

Preliminary calibration tests were conducted. The scanning time on the control unit was set at 60 and 120 ns, which based on a calculated velocity of propagation of 0.183 ft/ns, provided scanning depths of 11.0 and 22 feet, respectively. However, as a result of high rates of signal attenuation, discernable images were restricted to depths of 1.8 to 8.8 feet. The average depth of consistent profiling within the Seneca Falls Landfill was about 3.5 feet. Depth of signal penetration is dependent upon the electromagnetic characteristics of the fill materials which are variable across the landfill site.

Multiple traverses were conducted with the radar unit within older and active portions of the landfill site. The 120 MHz antenna did discerned many subsurface anomalies and strata within the upper 3.5 feet of the fill materials. However, the GPR is too depth restricted and, alone, is not an effective technique for assessing site conditions within landfills. Ground-penetrating radar is the most efficient technique for delineating the boundaries of landfills. At this and similar landfill sites a synergistic approach, using various geophysical techniques, is recommended.

Copies of the radar's graphic profiles were left with the principal participants of this field study.

JAMES A. DOOLITTLE
Soil Specialist (GPR)

cc:

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1. Frank Z. Hutton, Jr. 1972. Soil Survey of Seneca County, New York. USDA-Soil Conservation Service. Govt. Printing Office. Washington, D.C.