Gamma Weld-Logging in Burial Ground of the Savannah River Site (U)

by

W. G. Winn

Westinghouse Savannah River Company

Savannah River Site

Aiken, South Carolina 29808

K. J. Hofstetter

K. W. Macmurdo

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

gl

A document prepared for 1995 WINTER MEETING OF AMERICAN NUCLEAR SOCIETY ANS TRANSACTIONS at San Francisco from 10/29/95 - 11/02/95.

DOE Contract No. DE-AC09-89SR18035

This paper was prepared in connection with work done under the above contract number with the U. S. Department of Energy. By acceptance of this paper, the publisher and/or recipient acknowledges the U. S. Government's right to retain a nonexclusive, royalty-free license in and to any copyright covering this paper, along with the right to reproduce and to authorize others to reproduce all or part of the copyrighted paper.

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; prices available from (615) 576-8401.

Available to the public from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Gamma Well-Logging in Burial Ground of Savannah River Site

W.G. Winn, K.J. Hofstetter, K.W. MacMurdo

Westinghouse Savannah River Company
Savannah River Technology Center
Aiken, SC 29808

INTRODUCTION

Gamma well-logging measurements were conducted in an inactive, radioactive waste burial ground of the Savannah River Site to appraise whether any evidence existed for downward movement of radioactivity toward the water table¹. Similar measurements on the same wells were conducted earlier (1980)², providing a baseline from which to measure any changes in their radioactive plumes. In particular, the recent (1994) measurements sought to detect significant changes in depth location and radiation magnitude of the plumes, as well as the existence of any new plumes. By comparing measurements on a number of these wells, which were distributed on a grid pattern, it was anticipated that the general status of this section of the burial ground could be established.

EQUIPMENT

The well-logging measurements utilized a Medicoach van, which had an Onan generator that could operate the equipment for 35 hr before refueling. An UPS assured clean, continuous power for the computer and detector electronics.

Both an 8.8%-efficient HPGe and a 7.6 cm x 7.6 cm NaI detector were used as sonde probes. The HPGe detector was also used in the earlier work². Its liquid nitrogen hold-time of 18 hr permitted unattended operations during the night when personnel were not allowed in the burial ground.

A special device automatically lowered the detector 15.2 cm following each gamma count of 5 minutes, using pneumatically controlled grippers connected to a 2.5 cm diameter plastic tube attached to the detector. The tube also housed the detector cables. A metal tape measure passing over a wheel counter reeled out as the detector was lowered, providing an accurate depth for each measurement.

An IBM-286 computer was configured to control the collection and storage of the detector depth and gamma spectrum for each of the sequential measurements. The computer communicated with the detector lowering device using a custom interface, and contained an ACETM card to emulate a multichannel analyzer. Typical unattended logging appraised only the dry section of a well extending down to depths of 15 m, whereby about 100 depth and spectral files were collected in 10 hr.

MEASUREMENTS

Measurements on a well provided gamma-ray count rates for specific isotopes as a function of depth, as illustrated in Figure 1. Such depth profiles were deduced following analysis of

all individual spectra of a well. Although the detector was efficiency calibrated for both continuous soil media and point sources within the soil, it was recognized that source distributions were not sufficiently known to predict isotopic activities even within an order of magnitude¹. Thus, all measurements are presented as gamma-ray count rates.

RESULTS

Measurements on 44 wells yielded numerous comparisons between the 1980 and 1994 results. Essentially the same radioactive plumes were observed both times, generally agreeing both in location and magnitude. It is also noteworthy that 23 wells indicated no radioactive plumes in either 1980 or 1994, and this also supports the general premise that little change occurred.

Figure 2 compares the 1980 and 1994 plume locations, which show no downward movement except for two wells, which are represented by the four points above the line. However, the 1994 measurements of these plumes show no tailing toward the previous location, which would be expected for radioactivity diffusion through soil. Indeed, the movement is within the region of the buried materials, suggesting that a hot item simply dropped inside a burial cavity. Thus, no conclusive evidence was found for soil migration of radioactivity toward the water table.

ACKNOWLEDGEMENTS

The authors wish to thank R.W. Johnson and W.B. Matthews for conducting many of the field measurements. Also, equipment development contributions by V.W. Walker, R.A. Sigg, M.A. Sanders, F.S. Moore, W.D. Diamond, G. Hall, and R.J. Maus were important to the success of this work. Finally, W.W. Bowman is thanked for consultation relative to the 1980 study.

REFERENCES

1. W.G. Winn et al, "Gamma Well-Logging in the Old Burial Ground of the Savannah River Site", SRS report WSRC-TR-95-0502 (1995).
2. W.W. Bowman, "In situ High Resolution Gamma Spectrometric Survey of Burial Ground Monitoring Wells", SRS Report DP-1598 (1981).

Figure 1. Cs-137 Activity in Well A07

Figure 2. Comparison of 1980 and 1994 Plume Depths