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OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

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Mr. John Hickman  
Division of Waste Management  
and Environmental Protection  
U.S. Nuclear Regulatory Commission  
Two White Flint North  
Mail Stop: 7F27  
11545 Rockville Pike  
Rockville, MD 20852-2738

**SUBJECT: IN-PROCESS INSPECTION SURVEY RESULTS FOR THE REMAINING  
SPENT FUEL POOL AND NORTHEASTERN UPPER RCA YARD  
EXCAVATIONS AND CONCRETE STRUCTURES WITHIN THE  
EXCAVATIONS AT THE YANKEE NUCLEAR POWER STATION, ROWE,  
MASSACHUSETTS [DOCKET NO. 50-29; RFTA NO. 05-008]**

Dear Mr. Hickman:

The Oak Ridge Institute for Science and Education (ORISE) performed in-process confirmatory inspection survey activities on the remaining Spent Fuel Pool (SFP) and Northeastern Upper RCA Yard excavations at the Yankee Nuclear Power Station in Rowe, Massachusetts during the period of December 6 and 7, 2005. These survey activities were requested and approved by the U.S. Nuclear Regulatory Commission (NRC). At the request of the NRC site representative, ORISE also performed cursory survey activities on the remaining concrete structures in these areas. Enclosed are the in-process survey results documenting these survey activities. The survey activities included gamma surface scans and soil sampling within the excavations and beta surface scans and direct measurements for total net beta activity on the remaining concrete surfaces.

If you have any questions or comments, please direct them to me at 865.576.0065 or J. Scott Kirk at 865.574.0685.

Sincerely,



Wade C. Adams  
Health Physicist/Project Leader  
Survey Projects

WCA:ar

Enclosure

c: T. McLaughlin, NRC/NMSS/TWFN T-7E18  
E. Knox-Davin, NRC/NMSS/TWFN 8A23  
J. Kottan, NRC/Region I

E. Abelquist, ORISE  
S. Kirk, ORISE  
File/1672

Distribution approval and concurrence:	Initials
Technical Management Team Member	JSK
Laboratory Manager	RDC
Quality Manager	ATP

**IN-PROCESS INSPECTION SURVEY RESULTS  
FOR THE REMAINING SPENT FUEL POOL  
AND NORTHEASTERN UPPER RCA YARD EXCAVATIONS AND  
CONCRETE STRUCTURES WITHIN THE EXCAVATIONS  
AT THE YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS**

## **INTRODUCTION**

The U.S. Nuclear Regulatory Commission (NRC) requested that the Oak Ridge Institute for Science and Education (ORISE) perform an in-process inspection survey of the remaining Spent Fuel Pool (SFP) and Northeastern Upper RCA Yard Excavations survey units (SU) at the Yankee Nuclear Power Station (YNPS). While on site, the NRC site representative also requested that ORISE perform cursory survey activities on the remaining concrete structures (pedestals and walls) within these excavations. The in-process inspection surveys were performed during the period of December 6 and 7, 2005.

## **PROCEDURES**

In-process inspection surveys were performed in accordance with a site-specific survey plan that was submitted to and approved by the NRC (ORISE 2005a). The site-specific survey plan follows the guidance provided in the ORISE Survey Procedures and Quality Assurance Manuals (ORISE 2004 and 2005b).

### **Remaining Concrete Structures**

Beta surface scans were performed using Geiger-Muller (GM) pancake detectors coupled to ratemeter-scalers with audible indicators. Surface scans were performed on up to 60% of the remaining concrete surfaces. Particular attention was given to cracks, joints, and scabbled areas in the evaluated structural surfaces where material may have accumulated. Direct measurements for total net beta activity were performed at ten locations on the concrete structures which were available for in-process survey activities. At the discretion of the NRC site representative, smear samples were not deemed necessary. Figures 1 through 10 are digital photographs indicating the portions of the remaining pedestals and walls that were part of these survey activities. Locations where direct measurements were taken are indicated on these figures.

### **NOL-05-02 and NOL-01-04 Excavations**

Gamma surface scans were performed on up to 80% of accessible portions of the two SU soil excavations using sodium iodide (NaI) scintillation detectors coupled to ratemeters with audible indicators. Soil samples were collected from three locations in NOL-05-02 and six locations in NOL-01-04. Figures 11 and 12 indicate the soil excavation survey units that were part of these survey activities. Locations where soil samples were taken are indicated on these figures.

## **SAMPLE ANALYSIS AND DATA INTERPRETATION**

Radiological data and sample media were returned to ORISE's laboratory in Oak Ridge, TN for analysis and interpretation. Radioassays were performed in accordance with the ORISE Laboratory

Procedures Manual (ORISE 2005c). Soil samples were analyzed by gamma spectroscopy for the primary radionuclides-of-concern [ROC (i.e., Co-60 and Cs-137)]. However, spectra were also reviewed for additional gamma-emitting fission and activation products associated with the YNPS and other identifiable total absorption peaks. Soil sample results were reported in units of picocuries per gram (pCi/g). Direct measurement data were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm<sup>2</sup>).

## FINDINGS AND RESULTS

### Remaining Concrete Structures

Beta surface scans did not identify any areas of elevated activity on the remaining concrete structures. Total net beta activity measurements ranged from -600 to 900 dpm/100 cm<sup>2</sup>. A complete listing of the surface activity level results is presented in Table 1.

### NOL-05-02 and NOL-01-04 Excavations

Gamma surface scans identified four locations of elevated direct gamma radiation on the soil surfaces in SU NOL-01-04 and none in SU NOL-05-02. ORISE collected three soil samples from the SU NOL-05-02 and six soil samples from SU NOL-01-04. Three of the six samples from NOL-01-04 were from three of the four elevated direct gamma radiation locations identified during the gamma surfaces scans. ORISE requested that the three soil samples from the elevated direct gamma radiation locations be analyzed by the on-site Yankee Atomic Electric Company (YAEC) radioanalytical laboratory and the results ranged from 12 to 309,000 pCi/g of Co-60 and 78 to 1,200,000 pCi/g of Cs-137. Further investigations by the licensee and by the ORISE laboratory indicated that the elevated gamma activity was attributable to discrete particles within the soil matrices of the samples. The ranges of radionuclide concentrations for the six soil samples collected by ORISE (without discrete particles in the samples) were 0.01 to 0.10 pCi/g for Co-60 and 0.01 to 0.07 pCi/g for Cs-137. The radioactivity within the discrete particles for Samples 29, 31 and 32 ranged from  $-2.7 \times 10^{-4}$  to 1.41  $\mu$ Ci for Co-60 and  $7.5 \times 10^{-4}$  to 1.41  $\mu$ Ci for Cs-137. A complete listing of the soil sample and discrete particle results is presented in Table 2.

## SUMMARY

Since this was an in-process confirmatory survey, the licensee did not have final status survey (FSS) data available for review. YNPS personnel provided preliminary direct measurement and soil sample results to ORISE while on site.

Beta surface scans did not identify any areas of elevated beta activity on the remaining concrete structural surfaces within the excavations. Direct measurements were performed at ten locations and all results were well within the derived concentration guideline levels (DCGLs) for Co-60 and Cs-137 as provided in the License Termination Plan [LTP (YAEC 2004)]. The direct measurement results were also within the gross beta activity DCGL as determined by YAEC personnel. Therefore, the results of the survey activities for the remaining concrete structural surfaces confirmed that the radiological conditions were suitable for unrestricted use in accordance with cleanup criteria cited in the licensee's LTP.

Gamma surface scans identified four locations of elevated direct gamma radiation within the NOL-01-04 soil excavation. ORISE personnel collected soil samples from three of the four locations and

had the samples analyzed by the YAEC on-site laboratory in the presence of ORISE personnel. The YAEC analytical results exceeded the site DCGL's for Co-60 and Cs-137. The fourth location identified by ORISE was remediated by YAEC personnel; a discrete particle exceeding DCGL values was identified by YAEC. ORISE collected six additional samples from judgmentally-selected locations. Gamma spectroscopy results for the six samples indicated that the ROC's were well below the DCGL's while the results for the three discrete particles indicated Co-60 and Cs-137 activity at up to 1,400,000 pCi, each.

The in-process confirmatory surveys determined that detectable activity, in excess of the soil DCGLs, was present in four soil samples within the Northeastern Upper RCA Yard Excavation. Therefore, the results of the survey activities for the soil excavations failed to confirm that the radiological conditions were suitable for unrestricted use in accordance with clean up criteria cited in the licensee's LTP.



Figure 1: BRT01-12 Facing North—Direct Measurement Location #1

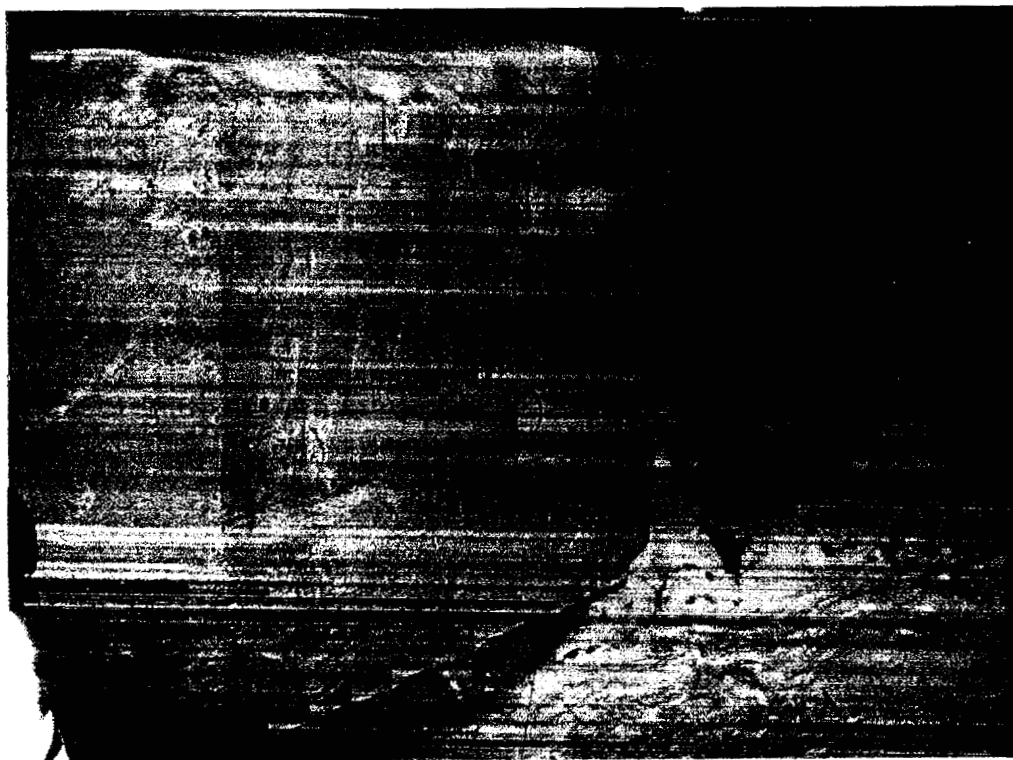


Figure 2: NSY12-01 East Side of Pedestal—Direct Measurement Location #2

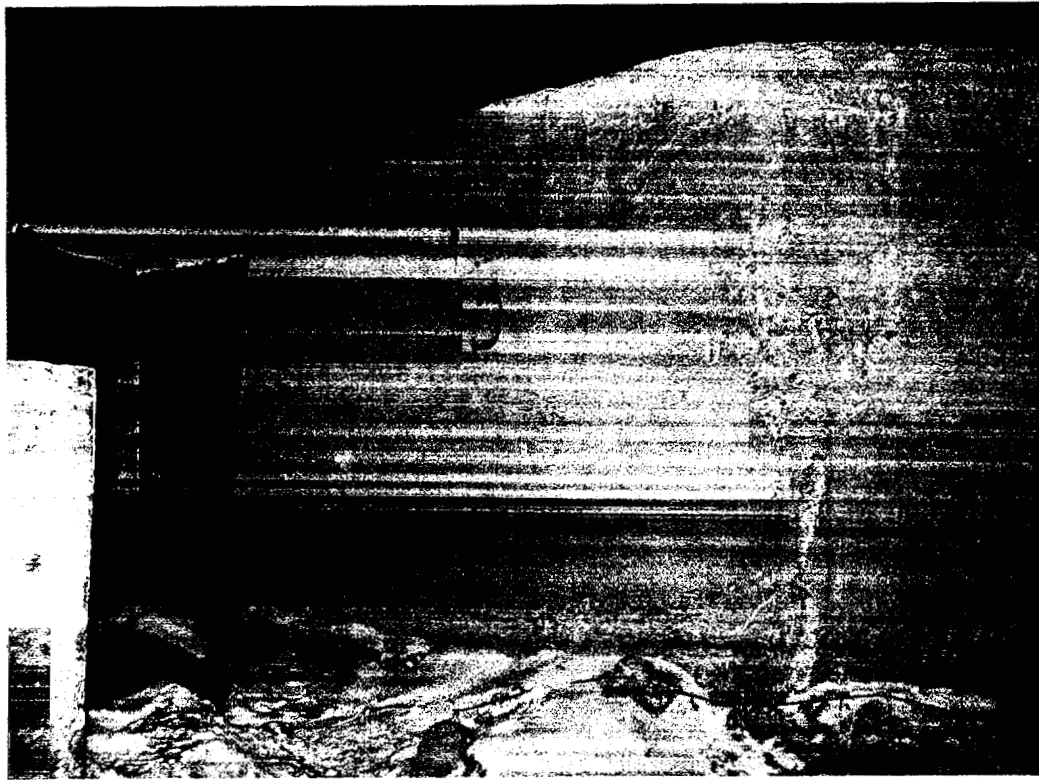


Figure 3: NSY12-01 South Side of Pedestal-Direct Measurement Location #3

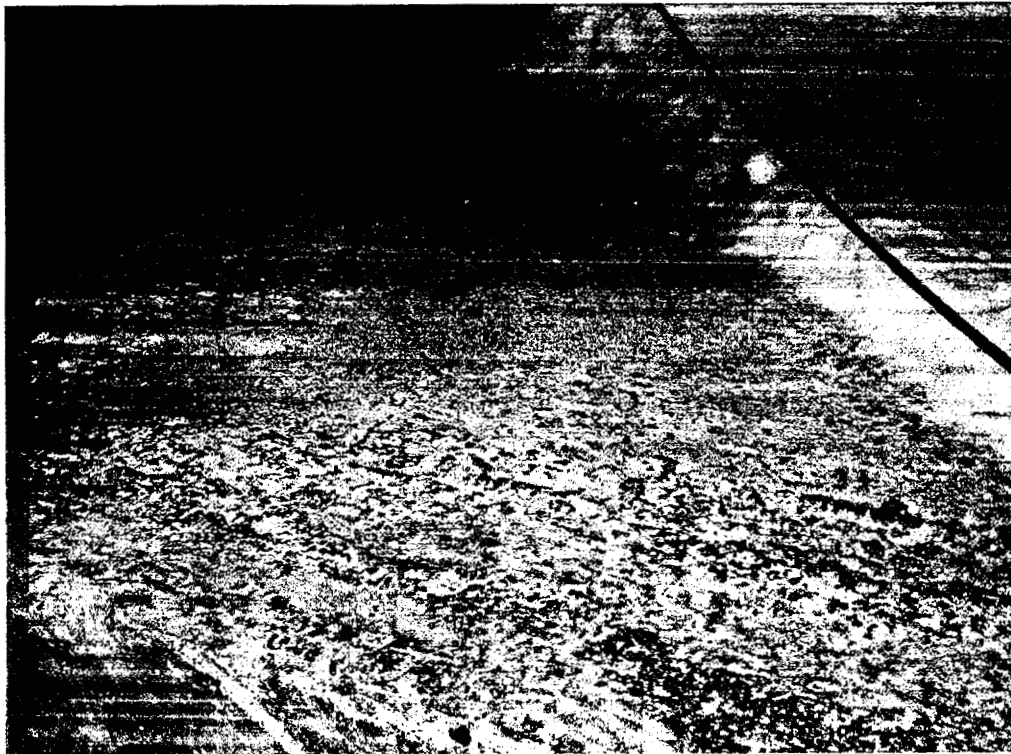


Figure 4: BRT01-13 West Top of Block-Direct Measurement Location #4

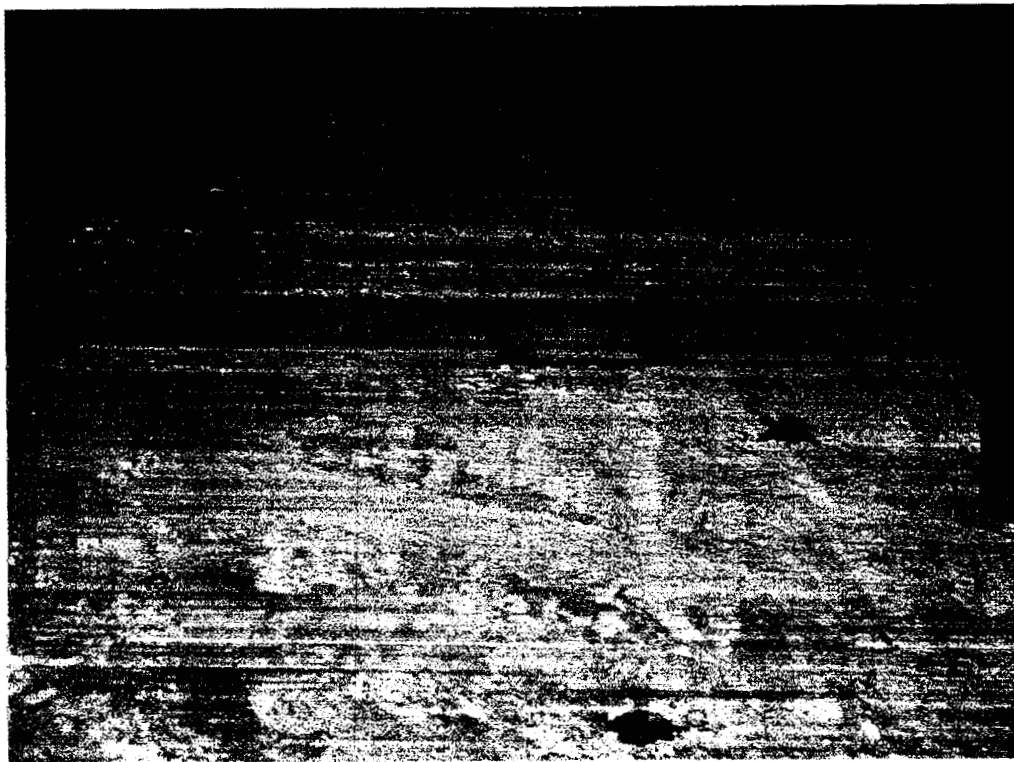


Figure 5: BRT01-13 Top of Block-Direct Measurement Location #5



Figure 6: SVC01-18 West Side-Direct Measurement Location #6

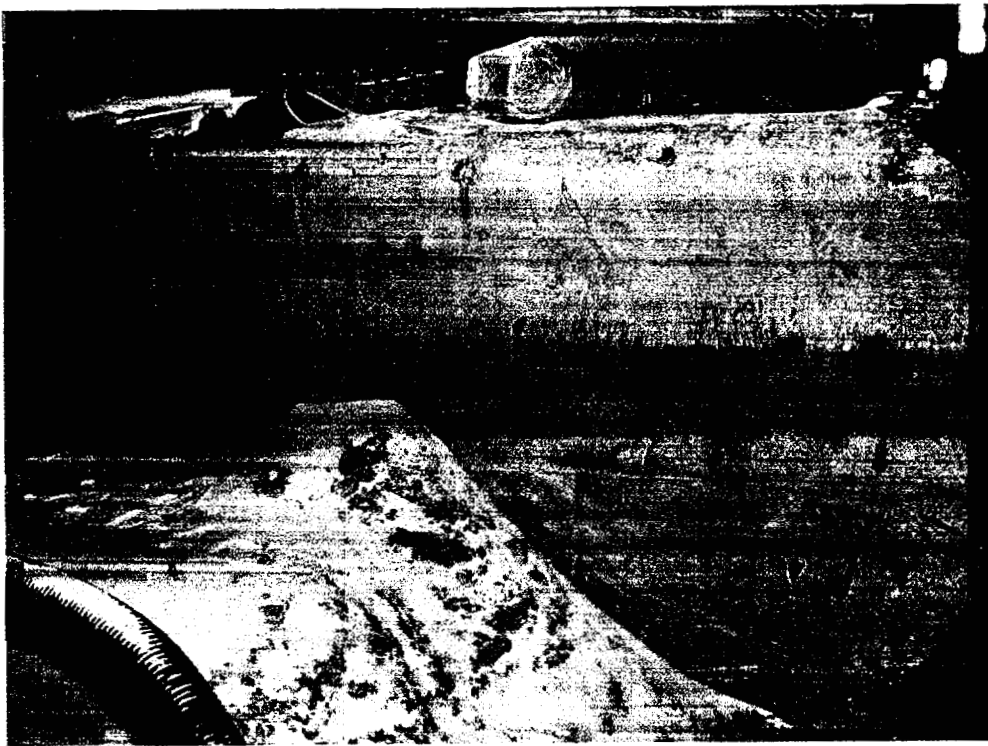


Figure 7: SVC01-18 West Side—Direct Measurement Location #7

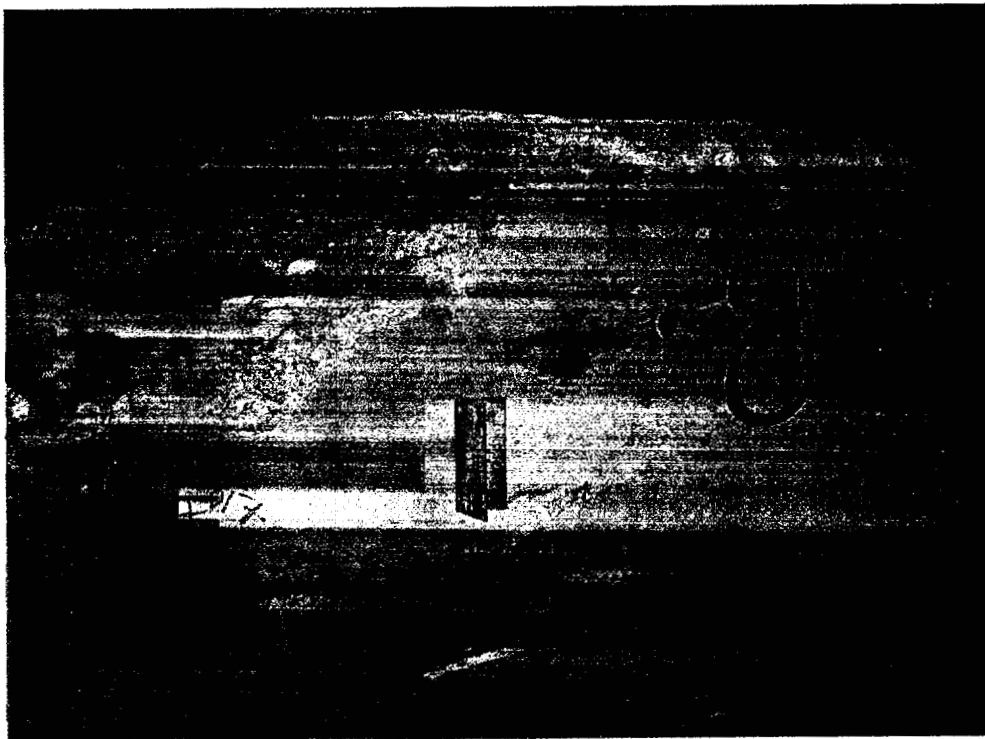


Figure 8: SVC01-18 South Side—Direct Measurement Location #8





Figure 9: SVC01-18 South Side-Direct Measurement Location #9

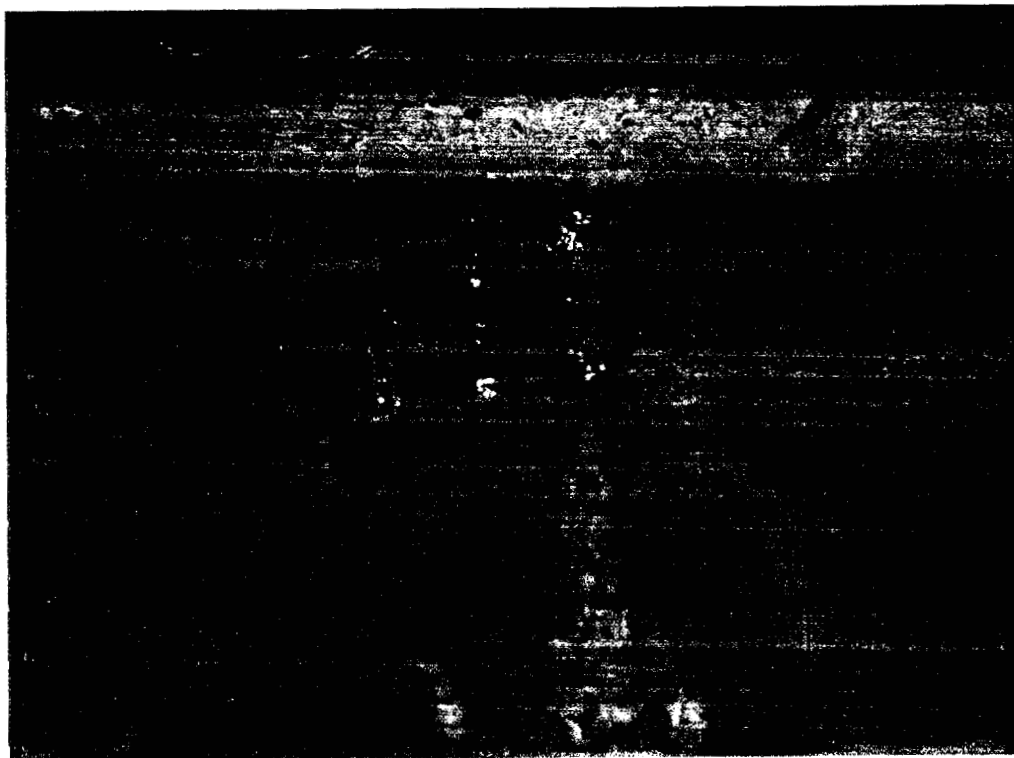


Figure 10: SVC01-18 South Side-Direct Measurement Location #10

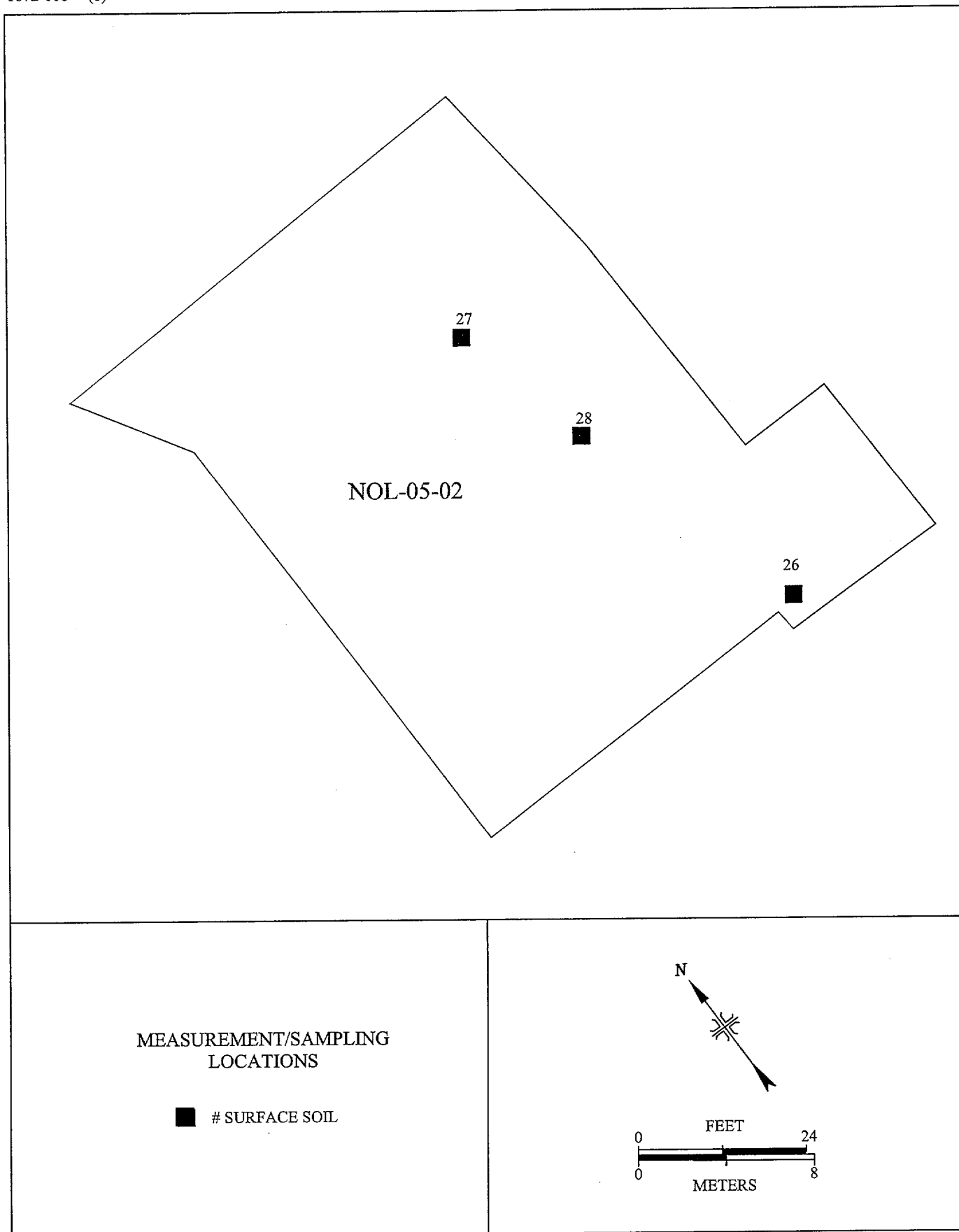


FIGURE 11: Yankee Nuclear Power Station, Survey Unit NOL-05-02 - Measurement and Sampling Locations

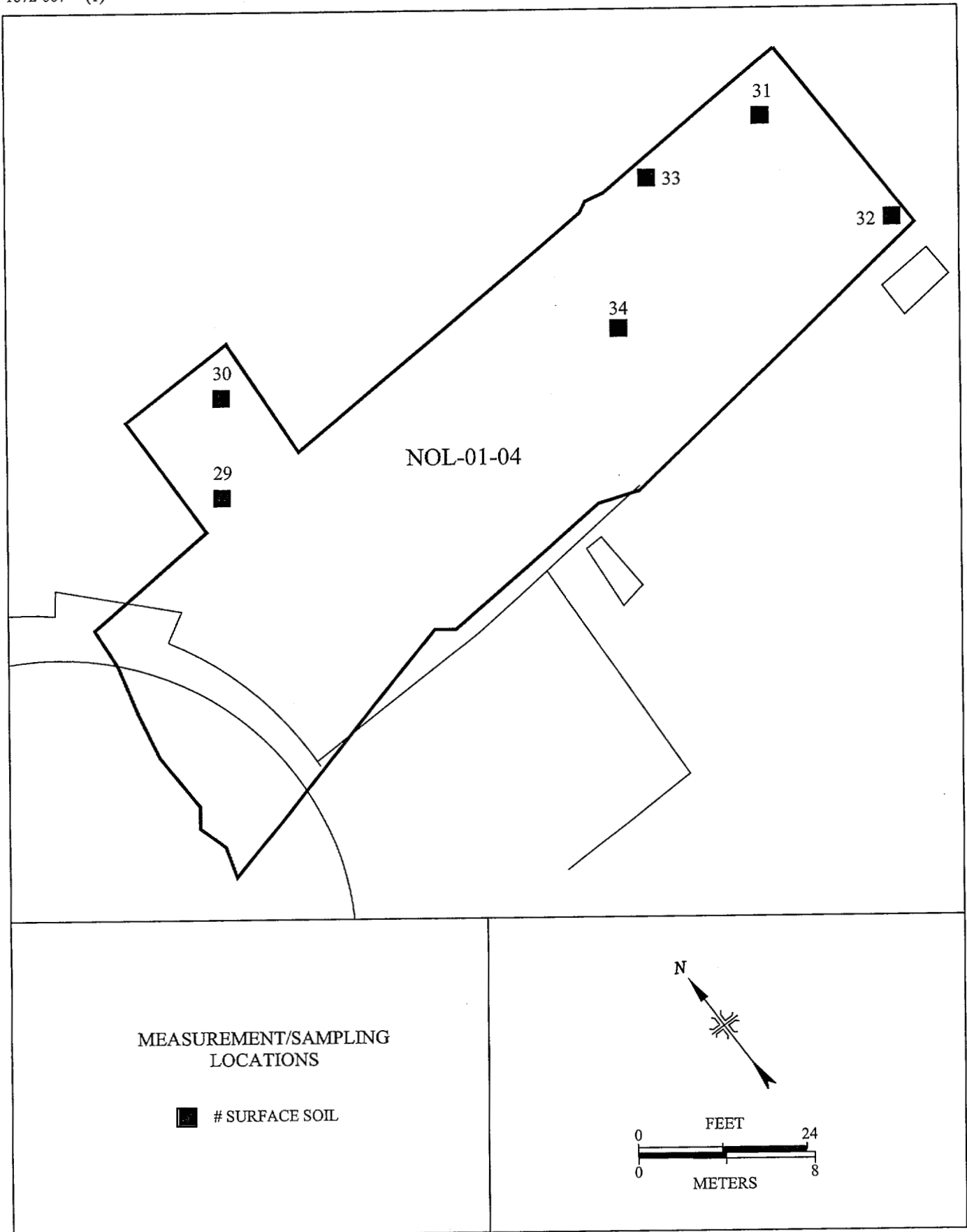


FIGURE 12: Yankee Nuclear Power Station, Survey Unit NOL-01-04 - Measurement and Sampling Locations

**TABLE 1**

**SURFACE ACTIVITY LEVELS  
REMAINING CONCRETE STRUCTURES  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS**

Location <sup>a</sup>	Total Net Beta Activity (dpm/100 cm <sup>2</sup> )
1	-300 ± 1,100 <sup>b</sup>
2	600 ± 1,200
3	900 ± 1,200
4	300 ± 1,200
5	-600 ± 1,000
6	-100 ± 1,100
7	200 ± 1,100
8	0 ± 1,100
9	-600 ± 1,000
10	-300 ± 1,200

<sup>a</sup>Refer to Figures 1 through 10.

<sup>b</sup>The LTP DCGL values are 22,000 dpm/100 cm<sup>2</sup> for Cs-137 and 6,300 dpm/100 cm<sup>2</sup> for Co-60 and the Gross Beta DCGL is 9,800 dpm/100 cm<sup>2</sup>. Uncertainties represent the 95% confidence level, based on counting statistics only.

**TABLE 2**

**RADIONUCLIDE CONCENTRATIONS  
IN SOIL AND DISCRETE PARTICLE SAMPLES  
REMAINING SPENT FUEL POOL AND  
NORTHEASTERN UPPER RCA YARD EXCAVATIONS  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS**

Sample Location <sup>a</sup>	Radionuclide Concentrations	
	Co-60	Cs-137
<b>Soil Samples</b>	(pCi/g) <sup>b</sup>	
1672S0026	0.03 ± 0.04 <sup>c</sup>	0.07 ± 0.04
1672S0027	0.04 ± 0.03	0.05 ± 0.02
1672S0028	0.02 ± 0.03	0.02 ± 0.03
1672S0030	0.01 ± 0.03	0.01 ± 0.02
1672S0033	0.10 ± 0.06	0.06 ± 0.03
1672S0034	0.03 ± 0.03	0.05 ± 0.02
<b>Discrete Particle Samples<sup>d</sup></b>	(μCi /sample) <sup>b</sup>	
1672S0029	0.56 ± 0.02	7.5 x 10 <sup>-4</sup> ± 9.7 x 10 <sup>-4</sup>
1672S0031	-2.7 x 10 <sup>-4</sup> ± 2.5 x 10 <sup>-4</sup>	1.41 ± 0.14
1672S0032	1.41 ± 0.41	0.10 ± 0.01

<sup>a</sup>Refer to Figures 11 and 12.

<sup>b</sup>The LTP DCGL values are 3.0 pCi/g for Cs-137 and 1.4 pCi/g for Co-60.

<sup>c</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

<sup>d</sup>Data are qualified. Geometries have not been established for this type of sample.

## REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Survey Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; September 2, 2004.

Oak Ridge Institute for Science and Education. Proposed—In-Process Survey Plan for the Remaining Spent Fuel Pool and Northeastern Upper RCA Yard Excavations, Yankee Nuclear Power Station, Rowe, Massachusetts [Docket No. 50-29; RFTA No. 05-008]. Oak Ridge, Tennessee; December 1, 2005a.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; July 28, 2005b.

Oak Ridge Institute for Science and Education. Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; June 20, 2005c.

Yankee Atomic Electric Company (YAEC). Yankee Atomic Electric Company (YAEC) License Termination Plan (LTP) for the Yankee Nuclear Power Station (YNPS). Revision 1. Rowe, Massachusetts; November 2004.