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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 TURBINE  
BUILDING SLAB AREA AT THE YANKEE NUCLEAR POWER  
STATION, ROWE, MASSACHUSETTS [DOCKET NO. 50-29;  
RFTA NO. 05-008]**

Dear Mr. Hickman:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed in-process inspection survey activities on the Turbine Building (TB) concrete slab and excavation survey units at the Yankee Nuclear Power Station in Rowe, Massachusetts during the period of November 7 and 8, 2005. These survey activities were requested and approved by the U.S. Nuclear Regulatory Commission (NRC). The survey activities included beta and gamma surface scans, direct measurements for beta activity, and soil sampling. Enclosed are the in-process survey results documenting these survey activities.

If you have any questions or comments, please direct them to me at (865) 576-0065 or Scott Kirk at (865) 574-0685.

Sincerely,

Wade C. Adams  
Health Physicist/Project Leader  
Environmental Survey and  
Site Assessment Program

WCA:ar

Enclosure

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

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

Distribution approval and concurrence:	Initials
Technical Management Team Member	DJR for SK
Laboratory Manager	RDC
Quality Manager TLB for	TLB for ATP

# **IN-PROCESS INSPECTION SURVEY RESULTS FOR THE TURBINE BUILDING SLAB AREA 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's (ORISE) Environmental Survey and Site Assessment Program (ESSAP) perform an in-process inspection survey of the Turbine Building (TB) concrete slab and excavation area survey units (SU) at the Yankee Nuclear Power Station (YNPS). The in-process inspection surveys were performed during the period of November 7 and 8, 2005. Figure 1 indicates the survey units that were part of these survey activities.

## **PROCEDURES**

The 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 ORISE/ESSAP Survey Procedures and Quality Assurance Manuals were also followed (ORISE 2004 and 2005b).

### **Turbine Building Concrete Slab**

Beta surface scans were performed using gas proportional detectors coupled to ratemeter-scalers with audible indicators. Surface scans were performed on up to 70% of the TB structural 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 beta activity were performed at 30 random locations within the 10 TB SUs which were available for confirmatory survey activities. At the discretion of the NRC site representative, smear samples were deemed as not necessary. Locations where direct measurements were taken are indicated on Figure 1.

### **Turbine Building Soil Excavations**

Gamma surface scans were performed on up to 90% of accessible portions of the TB soil excavations using sodium iodide (NaI) scintillation detectors coupled to ratemeters with audible indicators. Soil samples were collected from five locations within the exposed soil excavations. Locations where soil samples were taken are also indicated on Figure 1.

## **SAMPLE ANALYSIS AND DATA INTERPRETATION**

Radiological data and sample media were returned to ESSAP's laboratory in Oak Ridge, TN for analysis and interpretation. Radioassays were performed in accordance with the ESSAP Laboratory Procedures Manual (ORISE 2005c). Soil samples were analyzed by gamma spectroscopy for the primary radionuclides of interest (i.e., Co-60 and Cs-137). However, spectra were also reviewed for other 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

### Turbine Building Concrete Slab

Beta surface scans did not identify any areas of elevated activity on the TB concrete base structure. The ranges of direct measurement total net beta activity for each of these SUs are as follows:

Survey Unit <sup>a</sup>	Range of Total Net Beta Activity (dpm/100 cm <sup>2</sup> )
TBN-01-01	-790 to 800
TBN-01-09	-23 to 800
TBN-01-10	-77 to 710
TBN-01-11	490 to 620
TBN-01-12	420 to 850
TBN-01-13	-530
TBN-01-14	-1,060 to 680
TBN-01-15	170 to 210
TBN-01-16	-54 to 550
TBN-01-17	0 to 610

<sup>a</sup>TBN = TurBiNe, the YNPS nomenclature for the Turbine Building Slab Area.

A complete listing of the direct measurement surface activity results is presented in Table 1.

### Turbine Building Soil Excavations

Gamma surface scans identified one location of elevated direct gamma radiation on the soil surfaces. ESSAP collected five soil samples from the TB soil excavation areas, including one sample (sample 21) from the location identified by the surface scans to have elevated gamma activity. ESSAP requested that sample 21 be analyzed by the on-site Yankee Atomic Electric Company (YAEC) radioanalytical laboratory and the result was 210 pCi/g of Co-60. Further investigations by the licensee, and by the ESSAP laboratory, indicated that the elevated gamma activity was attributable to a discrete particle within the soil matrix. The range of radionuclide concentrations for the five soil samples collected by ESSAP (minus the discrete particle in sample 21) were 0.00 to 0.03 pCi/g for Co-60 and -0.01 to 0.12 pCi/g for Cs-137. A complete listing of the soil sample 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 ESSAP while on site.

Beta surface scans did not identify any areas of elevated beta activity on the TB concrete base structural surfaces. Direct measurements were performed at 30 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 ESSAP survey activities for the remaining TB concrete slab confirmed that the radiological conditions were suitable for unrestricted use, based on a comparison to the cleanup criteria cited in the licensee's LTP.

Gamma surface scans identified one location of elevated direct gamma radiation within the TB slab soil excavation. ESSAP personnel collected a soil sample (sample 21) from this location and had the sample analyzed by the YAEC on-site laboratory in the presence of ESSAP personnel. The analytical result was 210 pCi/g for Co-60, which exceeds the site DCGL.

After ESSAP personnel left the site, YAEC personnel requested approval from the ESSAP site representative to open the sealed sample container for further analysis on sample 21. Permission was granted, however, the chain-of-custody (COC) for all of the samples was then considered to be breached. YAEC personnel segregated the clean soil from the discrete particle that was within the sample 21 matrix. The discrete particle was shipped in a separate container to ESSAP but was not analyzed by the ESSAP laboratory.

ESSAP's analytical results are considered qualified due to the COC breach; however, these results substantiated the findings from uncompromised ESSAP confirmatory scan data. Furthermore, the TB slab soil excavation determinations remain unchanged. Based on the negligible amount of Co-60 and Cs-137 in sample 21 (minus the discrete particle), the elevated activity can be attributed to the discrete particle that had been removed from the sample matrix by YAEC personnel.

In conclusion, the in-process confirmatory surveys determined that detectable activity, in excess of the soil DCGLs, was present in one soil sample within the TB slab soil excavation. Therefore, the results of the survey activities for the TB slab soil excavation failed to confirm that the radiological conditions were suitable for unrestricted use in accordance with cleanup criteria cited in the licensee's LTP.

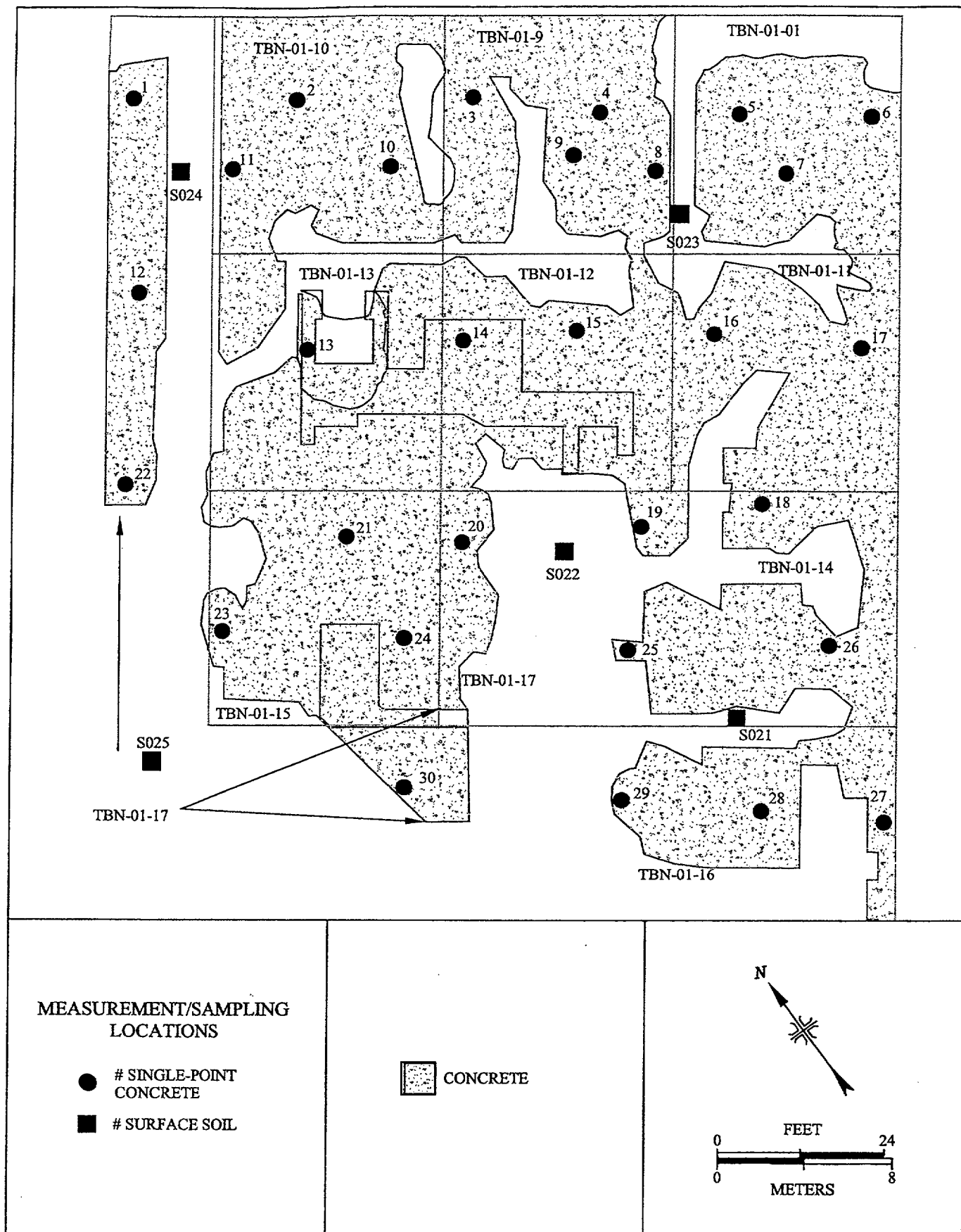


FIGURE 1: Yankee Nuclear Power Station, Turbine Building Slab and Excavation - Measurement and Sampling Locations

TABLE 1

**SURFACE ACTIVITY LEVELS  
TURBINE BUILDING CONCRETE SLAB  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS**

Survey Unit/ Location <sup>a</sup>	Total Net Beta Activity (dpm/100 cm <sup>2</sup> )	Survey Unit/ Location <sup>a</sup>	Total Net Beta Activity (dpm/100 cm <sup>2</sup> )
<b>TBN-01-01<sup>b</sup></b>		<b>TBN-01-14</b>	
5	-790 ± 270 <sup>c</sup>	18	330 ± 330
6	800 ± 350	19	680 ± 340
7	710 ± 350	20	520 ± 340
<b>TBN-01-09</b>		25	-1,060 ± 250
3	370 ± 330	26	280 ± 330
4	-23 ± 310	<b>TBN-01-15</b>	
8	790 ± 350	21	190 ± 320
9	800 ± 350	23	210 ± 320
<b>TBN-01-10</b>		24	170 ± 320
2	-77 ± 310	<b>TBN-01-16</b>	
10	710 ± 350	27	220 ± 320
11	140 ± 320	28	-54 ± 310
<b>TBN-01-11</b>		29	550 ± 340
16	620 ± 340	<b>TBN-01-17</b>	
17	490 ± 340	1	8 ± 310
<b>TBN-01-12</b>		12	260 ± 320
14	850 ± 350	22	0 ± 310
15	420 ± 330	30	610 ± 340
<b>TBN-01-13</b>		-- <sup>d</sup>	--
13	-530 ± 280	--	--

<sup>a</sup>Refer to Figure 1.

<sup>b</sup>TBN= TurBiNe; the YNPS nomenclature for the Turbine Building Slab Area. 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>.

<sup>c</sup>Uncertainties represent the 95% confidence level, based on counting statistics only.

<sup>d</sup>Not Applicable.

**TABLE 2**

**RADIONUCLIDE CONCENTRATIONS  
IN SOIL SAMPLES  
TURBINE BUILDING SLAB EXCAVATION  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS**

Sample Location <sup>a</sup>	Radionuclide Concentrations (pCi/g) <sup>b</sup>	
	Co-60	Cs-137
1672S0021 <sup>c</sup>	0.03 ± 0.03 <sup>d</sup>	0.06 ± 0.03
1672S0022	0.03 ± 0.03	0.04 ± 0.03
1672S0023	0.01 ± 0.03	0.12 ± 0.03
1672S0024	0.00 <sup>e</sup> ± 0.03	-0.01 ± 0.02
1672S0025	0.01 ± 0.03	0.02 ± 0.02

<sup>a</sup>Refer to Figure 1.

<sup>b</sup>The LTP DCGL values are 2.8 pCi/g for Cs-137 and 1.3 pCi/g for Co-60. The sample chain-of-custody was breached for these soil samples.

<sup>c</sup>This sample was analyzed on site by the YAEC laboratory and was determined to contain 210 pCi/g of Co-60. A discrete Co-60 particle was removed by YAEC personnel from the sample matrix. The discrete particle was not analyzed with the sample by the ESSAP laboratory.

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

<sup>e</sup>Zero values are due to rounding.

## 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. Confirmatory Survey Plan for the Turbine Building Slab Area, Yankee Nuclear Power Station, Rowe, Massachusetts [Docket No. 50-29; RFTA No. 05-008]. Oak Ridge, Tennessee; November 4, 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.