ATTACHMENT 9

INDEPENDENT VERIFICATON CONTRACTOR (ORISE) SAMPLING AND ANALYSES RESULTS

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

October 25, 2000

Ms. Gail Penny
BGRR Decommissioning Project
Brookhaven Group
U.S. Department of Energy
Building 701
P.O. Box 5000
Upton, NY 11973-5000

SUBJECT: FINAL LETTER REPORT—VERIFICATION SURVEY OF THE PILE FAN SUMP TRENCH AND THE ASSOCIATED DRAIN PIPING SOILS THAT EXTENDED FROM BUILDINGS 801 AND 704 TO THE PFS, BROOKHAVEN GRAPHITE RESEARCH REACTOR, UPTON, NEW YORK

Dear Ms. Penny:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed an independent verification survey of the Pile Fan Sump (PFS) trench at the Brookhaven National Laboratory (BNL) in Upton, New York. Site activities were performed during the period of March 13 to 16, 2000. Verification procedures were conducted in accordance with a site-specific survey plan, submitted to and approved by the U.S. Department of Energy (DOE) (ORISE 2000).

BNL—situated on 5,265 acres of land owned by the DOE—is located at the former site of Camp Upton at Upton, New York, in Suffolk County (Figure 1). Approximately 25 percent of this area is developed for laboratory and support facilities, while the remainder is wooded and undeveloped. The Brookhaven Graphite Research Reactor (BGRR) is approximately equidistant from the north and south shores of Long Island and near the highest elevation along a north-south transect through Long Island. The BGRR is positioned atop a knoll, with grade elevation near the reactor building at approximately 100 feet above mean sea level (BSA 2000). The BGRR complex consists of a number of buildings and structures, including the reactor operations building (Building 701), the reactor pile itself (Building 702), reactor operations offices and laboratory (Building 703), and laboratories (Building 801). The graphite cube and fuel channels were and still are enclosed in a steel-lined, high-density, five-foot-thick concrete shield (called the biological shield). To support reactor operations, a series of auxiliary buildings were required, including the fan house (Building 704), the instrument house (Building 708), the canal house (Building 709), and the water treatment house (Building 709A).

The PFS trench area is located between Buildings 704 and 801 (Figure 2), and is approximately 3.8 meters (m) deep and 1.8 m by 2.3 m in cross section. The PFS was constructed of pre-cast steel-reinforced concrete pieces assembled in place, but was removed during excavation activities (BSA 2000).

Verification activities performed by ESSAP included document and data review (Type A verification) of the PFS trench and of the associated drain piping trench soils that extended from Buildings 801 and 704 to the PFS. In addition, BNL provided ESSAP with two samples for confirmatory analysis (0913S011 and 0913S012) from the associated drain piping trench soils that extended from Buildings 801 and 704 to the PFS. ESSAP also performed independent surveys (Type B verification) by performing 100 percent gamma radiation scans using NaI detectors coupled to ratemeters with audible indicators and collected random and judgmental soil samples.

Document reviews of BNL's revised field sampling and analysis plan for the PFS trench appeared to be appropriate to adequately identify radiological and/or chemical contamination (BSA 2000). ESSAP's primary comment on this document was to recommend to BNL that the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) approach for conducting final status surveys be fully considered prior to implementing this plan as written.

Field survey and analytical data for the PFS trench and the associated drain piping trench soils were also reviewed. These data appear to accurately and adequately reflect the radiological and chemical status of these areas. However, two comments were noted following this review: 1) ESSAP recommended that the contractor provide final status documentation and field data results prior to Type B verification activities, which allows for a more thorough independent third-party verification, and 2) ESSAP concurs with BNL's findings—based solely on field and analytical data review—that the associated drain piping trench soils are below the established Cs-137 DCGL of 23 pCi/g. However, ESSAP advocates that final status judgmental samples should have been collected by BNL at locations where soil remediation was performed. This approach would provide conclusive analytical data that all elevated residual activity identified was sufficiently remediated prior to backfill.

ESSAP's scans of the first caisson identified an area of elevated direct gamma radiation at the north-northeast corner, which concurred with BNL's findings. This area was marked for further evaluation. However, BNL decided to excavate the north-northeast area and use a second caisson. All gamma scans on the overburden soils in the PFS trench were at or near background levels.

ESSAP collected a total of ten soil samples from the exposed soil areas of the PFS trench (Figure 3). Three samples were collected inside the first caisson (0913S001 and 0913S003) and two inside the second caisson (0913S009 and 0913S010), following remediation. The remaining five samples (0913S004 through 0913S008) were from the exterior excavation areas outside of the caissons (overburden).

Soil samples were initially analyzed by gamma spectroscopy and the results are provided in Table 1. The only gamma-emitting radionuclide of concern identified was Cs-137, with concentrations ranging from 0.1 to 5.9 pCi/g. No other gamma-emitting radionuclides were identified, other than those naturally occurring in nature and these were within expected background concentrations.

ESSAP performed wet chemistry analyses on samples 0913S005 and 0913S012 for Tc-99, samples 0913S001 and 0913S011 for Pu-238/239, and samples 0913S011 and 0913S012 for Sr-90. The results of these analyses are also provided in Table 1. There were no significant concentrations of these radionuclides identified in these samples.

The primary contaminant of concern for the PFS is Cs-137. Additional radionuclides associated with the BGRR operations may also be present. Verification samples were compared to each derived concentration guideline level (DCGL) and the unity rule (sum-of-ratios) was applied with both guideline conditions being satisfied. Review of BNL's analytical data, where BNL compared the results to each derived concentration guideline level (DCGL) and applied the unity rule (sum-of-ratios), concluded that both guideline conditions were satisfied

BNL provided ESSAP samples from the PFS trench for chemical verification. A DOE-approved laboratory analyzed these samples for metals and volatile organics. Clean-up action limits and analytical results are provided in Table 2. All analyses were less than the BNL clean-up action limits.

Should you have any comments or concerns on this interim report, please contact me at (865) 576-3355 or Timothy J. Vitkus at (865) 576-5073.

Sincerely,

Wade C. Adams

for Duane R. Quayle
Health Physicist/Project Leader
Environmental Survey and
Site Assessment Program

DRQ:ar

Enclosure

cc: S. Mallette, DOE/Brookhaven Group
W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
T. Vitkus, ORISE/ESSAP
File/0913

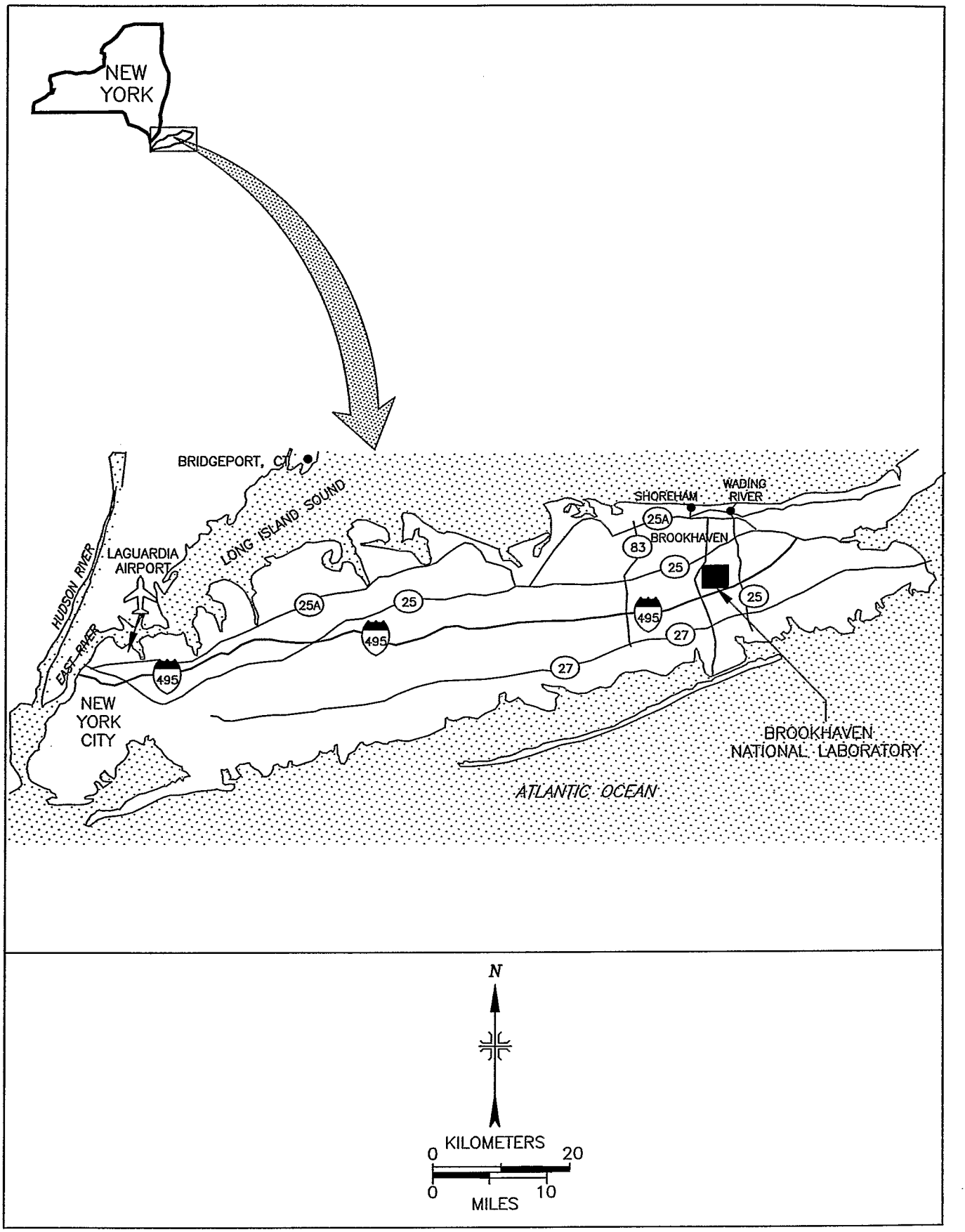

FIGURE 1: Location of Brookhaven National Laboratory, Upton, New York

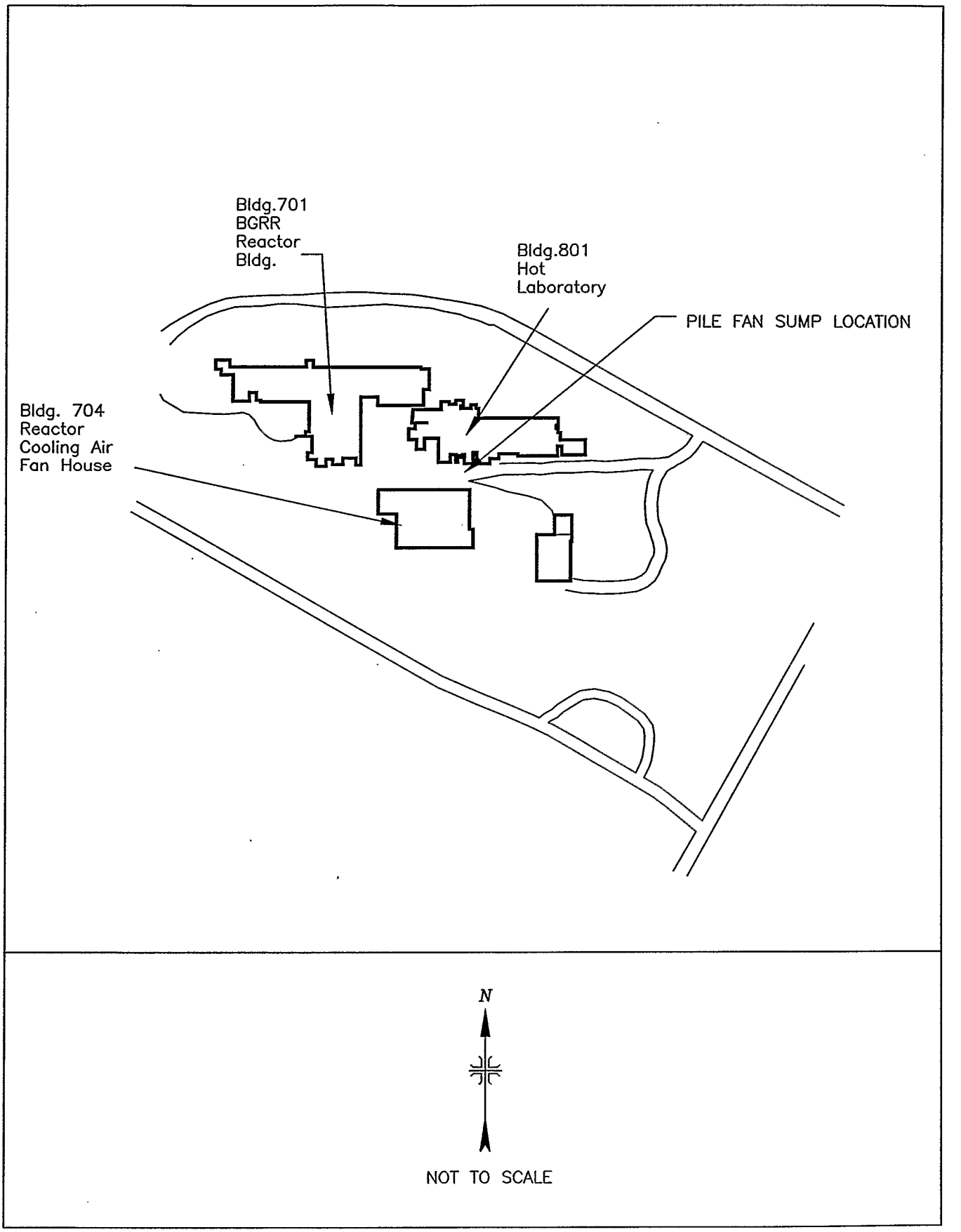

FIGURE 2: Pile Fan Sump – Plot Plan

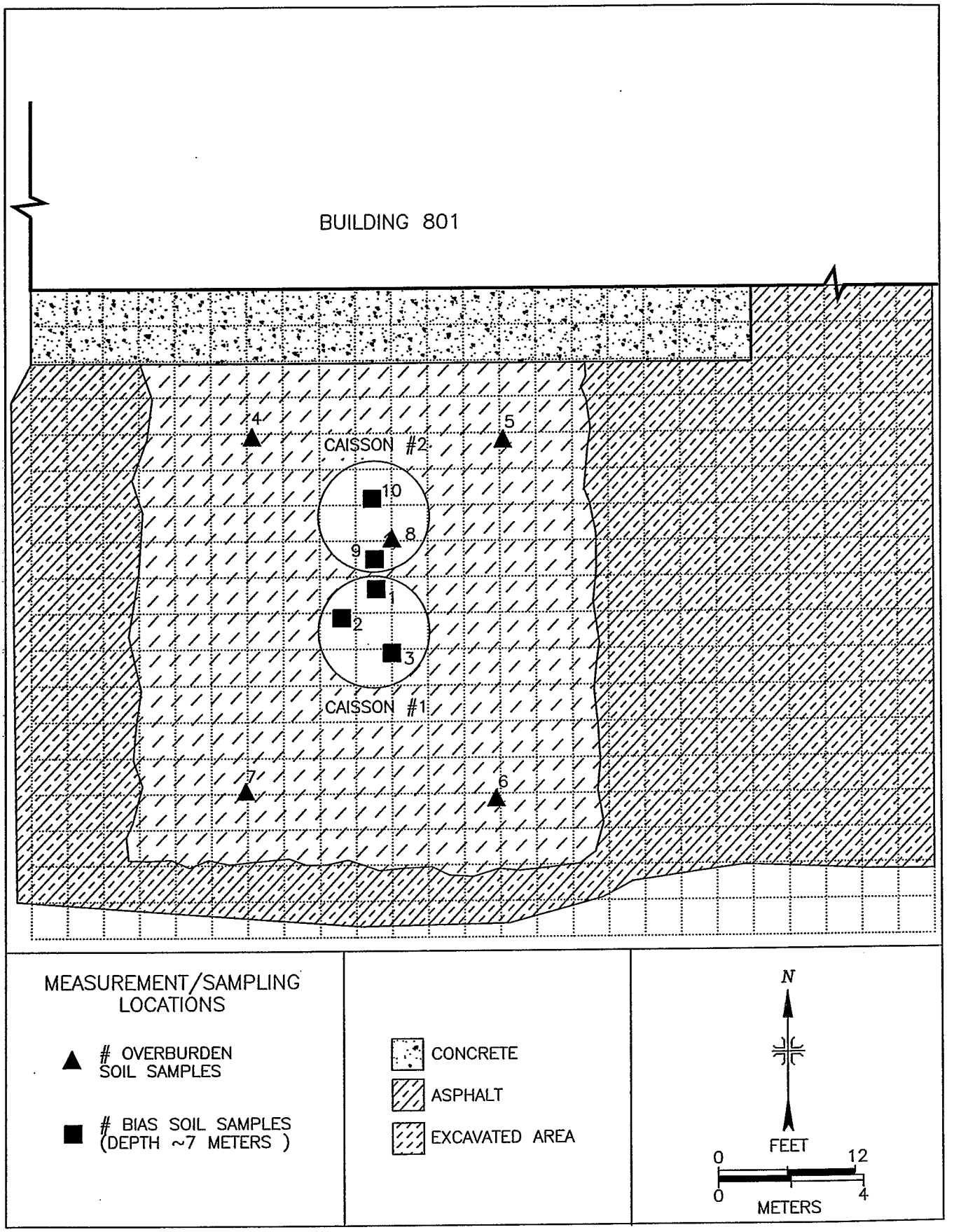

FIGURE 3: Pile Fan Sump Area – Measurement and Sampling Locations

TABLE 1

RADIONUCLIDE CONCENTRATIONS IN SOIL PILE FAN SUMP TRENCH AND THE ASSOCIATED DRAIN PIPING SOILS BROOKHAVEN NATIONAL LABORATORY UPTON, NEW YORK

Sample ID	Radionuclide Concentrations[a] (pCi/g)														
	Co-60	Sr-90	Tc-99	I-129	Cs-137	Eu-152	Eu-154	Eu-155	Ra-226	Th-232	U-235	U-238	Pu-238	Pu-239	Am-241
DCGL[b]	1100	15	44	2.4	23	49	170	1.5E5	5	5	9	9	65	40	39
Verification Samples from the PFS trench															
0913S001	< 0.1	----[c]	----	< 0.1	5.9 ± 0.3[d]	< 0.2	< 0.1	< 0.1	< 0.7	0.4 ± 0.1	< 0.3	0.3 ± 0.4	0.02 ± 0.03	0.05 ± 0.03	< 0.1
0913S002	< 0.1	----	----	< 0.1	0.7 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.2	0.4 ± 0.1	< 0.1	0.7 ± 0.3	----	----	< 0.1
0913S003	< 0.1	----	----	< 0.1	0.8 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.3	0.3 ± 0.1	< 0.1	0.3 ± 0.3	----	----	< 0.1
0913S004	< 0.1	----	----	< 0.1	0.2 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.3	0.4 ± 0.1	< 0.1	0.5 ± 0.4	----	----	< 0.1
0913S005	< 0.1	----	0.3 ± 0.1	< 0.1	0.1 ± 0.1	< 0.1	< 0.1	< 0.1	0.4 ± 0.3	0.4 ± 0.1	< 0.1	0.6 ± 0.3	----	----	< 0.1
0913S006	< 0.1	----	----	< 0.1	0.1 ± 0.1	< 0.1	< 0.1	< 0.1	0.6 ± 0.3	0.5 ± 0.1	< 0.1	0.3 ± 0.4	----	----	< 0.1
0913S007	< 0.1	----	----	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4 ± 0.2	0.4 ± 0.1	< 0.1	0.4 ± 0.3	----	----	< 0.1
0913S008	< 0.1	----	----	< 0.1	0.2 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.2	0.5 ± 0.1	< 0.2	0.2 ± 0.4	----	----	< 0.1
0913S009	< 0.1	----	----	< 0.1	4.7 ± 0.2	< 0.1	< 0.1	< 0.1	< 0.4	0.1 ± 0.1	< 0.2	0.2 ± 0.4	----	----	< 0.1
0913S010	< 0.1	----	----	< 0.1	1.4 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.3	< 0.1	< 0.1	< 0.4	----	----	< 0.1
Confirmatory Samples from the Associated Drain Piping Trench Soils															
0913S011	< 0.1	< 0.8	----	< 0.1	0.1 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.3	0.3 ± 0.1	< 0.1	0.2 ± 0.3	0.07 ± 0.03	0.02 ± 0.03	< 0.1
0913S012	< 0.1	< 0.8	0.3 ± 0.1	< 0.1	0.1 ± 0.1	< 0.1	< 0.1	< 0.1	0.3 ± 0.2	0.3 ± 0.1	< 0.1	0.3 ± 0.3	----	----	< 0.1

[a]Radionuclide concentrations include background.
[b]These Derived Concentration Guideline Levels (DCGL) are specified in Appendix B, Table B1-3 of the *BGRR Sampling and Analysis Program for the Cleanup Verification of Soil and Disposal of Debris from the Removal of the Pile Fan Sump, Piping, and Aboveground Ducts* (BSA 2000).
[c] ---- = Analysis was not performed on these samples.
[d]Uncertainties are total propagated uncertainties at the 95% confidence level.

TABLE 2

CHEMICAL CONCENTRATIONS IN SOIL
PILE FAN SUMP TRENCH
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Analyte	Clean-up Action Limit (mg/kg)	Sample 6515-002 (mg/kg)	Sample 6515-004 (mg/kg)
Metals			
Aluminum	16,491	2,410	1,290
Antimony	13.1	0.09	0.09
Arsenic	7.5	1.1	0.06
Barium	300	6.1	9.5
Beryllium	0.43	0.22	0.07
Cadmium	1.5	0.02	0.02
Calcium	434	308	238
Chromium	14.2	11.2	2.2
Cobalt	30	1.1	0.77
Copper	25	3.5	2.3
Iron	14,429	3,530	1,840
Lead	15.8	4.4	2.3
Magnesium	2,122	364	279
Manganese	148	48	99.3
Mercury	0.15	0.02	0.02
Nickel	13	2.4	1.4
Potassium	628	119	98.9
Selenium	2	0.23	0.23
Silver	2	0.05	0.05
Sodium	196	42.9	26.7
Thallium	0.35	0.2	0.19
Analyte	**Clean-up Action Limit (mg/kg)[a]**	**Sample 6515-001 (µg/kg)**	**Sample 6515-003 (µg/kg)**
Volatile Organics			
Chloromethane	NL	1 [b]	16
Bromomethane	NL	< 11	< 10
1 – Chloroethenes	1.9	< 11	<10
Chloroethane	1.9	< 11	< 10
Dichloromethane (Methylene Chloride)	0.1	< 6	2 [b,c]
2-Propane (Acetone)	0.2	5 [b,c]	5 [b,c]
Carbon disulfide	2.7	< 6	< 5

TABLE 2 (Continued)

CHEMICAL CONCENTRATIONS IN SOIL
PILE FAN SUMP TRENCH
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Analyte	Clean-up Action Limit TAGM (mg/kg)	Sample 6515-001 (µg/kg)	Sample 6515-003 (µg/kg)
Volatile Organics (continued)			
1,1-Dichloroethene	0.4	< 6	< 5
1,1-Dichloroethane	0.2	< 6	< 5
1,2-Dichloroethylene (total)	NL	< 6	< 5
Chloroform	0.3	< 6	< 5
1,2-Dichloroethane	0.1	< 6	< 5
2-Butanone (Methyl ethyl ketone)	0.3	< 11	< 10
1,1,1-Trichloroethane	0.8	< 6	< 5
Carbon tetrachloride	0.6	< 6	< 5
Bromodichloromethane	NL	< 6	< 5
1,2-Dichloropropene	NL	< 6	< 5
cis-1,3-Dichloropropane	0.3	< 6	< 5
Dibromochloromethane	NL	< 6	< 5
1,1,2-Trichloroethane	NL	< 6	< 5
Benzene	0.06	< 6	< 5
Trans-1,3-Dichloropropene	NL	< 6	< 5
4-Methyl-2-pentanone (MIBK)	1	< 11	< 10
2-Hexanone	NL	< 11	< 10
1,1,2,2-Tetrachloroethane	0.6	< 6	< 5
Toluene	1.5	< 6	< 5
Chlorobenzene	1.7	< 6	< 5
Ethyl benzene	5.5	< 6	< 5
Styrene	NL	< 6	< 5
Xylene	1.2	< 6	< 5

[a] Divide clean-up action limit by 1000 to convert mg/kg to µg/kg.
[b] Estimated value.
[c] Compound identified in blank.

REFERENCES

Brookhaven Science Associates (BSA). Final—Brookhaven Graphite Research Reactor Sampling and Analysis Program for the Cleanup Verification of Soil and Disposal of Debris from the Removal of the Pile Fan Sump, Piping, and Aboveground Ducts. Environmental Quality Management for Brookhaven Science Associates. Long Island, NY; February 28, 2000.

Oak Ridge Institute for Science and Education (ORISE). Proposed Verification Survey Plan For The Brookhaven Graphite Research Reactor Pile Fan Sump Removal Action Brookhaven National Laboratory Upton, New York Oak Ridge, TN; March 1, 2000.