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INTERIM RADIOLOGICAL SITE CHARACTERIZATION AND D&D STATUS REPORT

NEW BRUNSWICK LABORATORY

NEW JERSEY SITE

DECEMBER 1981

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INTERIM RADIOLOGICAL SITE CHARACTERIZATION AND D&D STATUS REPORT

NEW BRUNSWICK LABORATORY - NEW JERSEY SITE

D&D

Decontamination and decommissioning was conducted at the New Brunswick Laboratory in New Jersey from March 2, 1981, to September 29, 1981. During that period, all twelve buildings and a cooling tower (see Figure 1) were dismantled and removed from the site. The only remaining portion of a building for which there is still concern for radioactive contamination is the concrete slab, with embedded drain lines, from the former I building.

Radioactive contaminated material was separated from clean material by surveying all accessible surfaces of walls, floors, ceilings, pipes, ducts, beams, shelves, equipment, sidewalks, fence, etc., with different types of radiation detectors. Portable instruments used were: 1) A single channel pulse height analyzer rate meter with 2 mm thick by 50 mm diameter NaI (Tℓ) detector for optimum detection of low energy photons, 2) A rate meter with thin-window 61 cm^2 gas flow proportional

detector for measuring $\alpha\beta\gamma$ surface contamination and 3) A rate meter with thin-window 61 cm^2 gas flow proportional detector for measuring only α surface contamination. By repeating all surveys with instruments having different detector characteristics, there is greater assurance that no contamination is being missed. Over 0.5 million square feet of surface was surveyed with each portable instrument. When surface contamination was found, the exposure rate at 5 cm from the surface was also measured using a micro R meter (rate meter with 1 inch by 1 inch NaI (Tℓ) detector). All surveys were documented. The criteria for acceptable surface contamination levels is given in Table 1. Materials contaminated above the criteria were disposed of as radioactive waste.

In addition to using portable survey instruments for making direct surveys for contamination, paper smears (swipes) were taken of at least 5% of all exposed surfaces. Whenever contamination above criteria was found, an additional smear was taken of the contaminated surface. Swipes were counted in a laboratory gas flow proportional counter system for α only, and $\beta\gamma$ removable surface contamination. Also, samples (portions of various materials) were taken from each contaminated

item and analyzed with a germanium detector gamma-ray spectrometer to identify and quantify the radionuclide contaminants. Samples are archived for possible future reference.

Objects which could not be surveyed internally, but which had the potential for contamination, were cut open to permit complete surveys. If such objects could not be economically cut open to permit complete surveys, such as a small diameter drain pipe from a laboratory sink, it was disposed of as radioactive waste.

Whenever contaminated material was found, it was removed and placed directly into 120 cubic feet steel shipping bins which meet DOT and DOE/NV standards. All surveying activities and dismantling actions were coordinated to assure that possibly "hidden" contamination would be found. An attempt was made to decontaminate large contaminated items if the time and material cost was acceptable and if the cleaning waste was small compared to the item itself. In all cases, an effort was made to minimize the volume of radioactive waste, taking into account cost effectiveness.

Sixty-five (65) steel bins (7,800 ft^3) of contaminated material were isolated and shipped to NTS in Mercury, Nevada. The total quantity of radioactivity removed from the site is estimated to be about 81 mCi. The activity of each radionuclide detected is listed in Table 2. Most of the contaminated material was building rubble, but approximately 2300 ft^3 of contaminated soil was removed from C building plutonium laboratory and from a pipe trench between C building and I building. The predominant radionuclide in this soil was ^{241}Am at a concentration up to 216 pCi/g of soil. The excavation depth was increased in approximately 1' increments until sampling results were less than the EPA standard of 15 pCi/g of soil.[1] Other identified radionuclides in this soil were all in the range of background concentrations (see Table 3 for typical ranges of background concentrations).[2]

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[1]Criteria for Soil Cleanup, New Brunswick Laboratory (NBL) New Jersey Site, Decontamination and Decommissioning, August 1981, DOE Chicago Operations Office.

[2]Most of the ranges are obtained from offsite measurements in the vicinity of NBL-NJ Site and near Rutgers University and Princeton University during 1978 and 1980.

Analysis was not done for plutonium during the excavation, because it required radiochemistry, so it is possible that there was plutonium associated with the ^{241}Am contamination. However, a 1978 soil sample from the vicinity of the contaminated liquid waste system in the C building plutonium laboratory (room 326) showed that plutonium was at least 27 times less than americium (sample #78Y6: 3.3 x 10^4 pCi $^{241}Am/g$ and 0.12 x 10^4 pCi $^{239}Pu/g$, in the vicinity of sample location #129, see Figure 5). Based on this information, it was assumed that the ratio of plutonium to americium would be less at greater depths, therefore, the excavations were back-filled with clean soil prior to completing the radiochemical analysis of the samples from this area. It is planned to have radiochemical analysis done of samples from the excavated soil to determine whether further action will be necessary in this area during the next phase of the D&D.

A total of 275 truckloads (approximately 178,000 ft^3) of clean rubble were sent to the Edgeboro Waste Disposal Site in East Brunswick, New Jersey. One hundred and sixty-eight (168) additional loads of clean material (approximately 46,000 ft^3) were taken by the dismantling contractor as metal scrap and salvage.

I Building Concrete Pad

Precautions have been taken to reduce the possibility of contamination migrating from under I building to other portions of the site. To this end, the concrete pad was patched with asphalt, covered with 12 inches of shale fill and 6 inches of top soil, and seeded with grass. In a few areas, the asphalt patches were also covered with 0.005 inch thick vinyl plastic sheeting.

A radiation survey (exposure rate at approximately 0.5 meter above ground) was done of the entire site, including the covered pad, during the last days of the D&D operations. For most of the site, the exposure rate ranged from 4-10 μR/h but along the south fence, ("dump area") the range was 25-50 μR/h.

Test Wells

To further assess the possible migration of underground contamination, ten test wells were drilled around the site. The locations are shown in Figure 2. The wells ranged in depth from 13 feet to 20 feet. All

of the wells are 4 inch diameter and have at least 10 feet of PVC screen pipe. The above ground portion of the PVC well pipes are protected by 6 inch diameter steel pipes with locking caps. Typical well construction is shown in Figure 3. Samples were taken from the wells on September 29, 1981, and on November 12, 1981. In both cases, samples were shared with the New Jersey Department of Environmental Protection, Bureau of Radiation Protection. The water samples were analyzed for gross α and gross β contamination. The results are shown in Table 4. The radioactivity concentration found in all wells, except for the one taken from well G on September 29, are within the range of background for well water (see Table 3 for typical background). The highest concentration on November 12, 1981, (3.2 pCi/ℓ gross α and 5.9 pCi/ℓ gross β for Well G, was less than that specified in the EPA primary drinking water regulations.[3] At this time, there is no explanation for why the G well results were higher than all

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[3]The maximum concentration levels for radium-226, radium-228, and gross α particle radioactivity in community water systems are given in the regulations as: (a) Combined radium-226 and radium-228 - 5 pCi/ℓ. (b) Gross α particle activity (including radium-226 - 15 pCi/ℓ.
For beta particles and photon radioactivity of man-made radionuclides, the regulations state that the

[3] (Cont'd.)
average annual concentration in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year. However, it is further stated that compliance with this part of the regulation may be assumed without further analysis for specific radionuclides if the average annual concentration of gross beta particle activity is less than 50 pCi/ℓ, if there is no tritium and strontium-90. For the exact wording and a detailed explanation of the standards see: "National Interim Primary Drinking Water Regulations, EPA-570/9-76-003"; Environmental Protection Agency, Office of Water Supply.

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others on September 29, 1981, and dropped nearly an order of magnitude on November 12, 1981. However, the results for G well are still higher than those of the other wells. There is also no explanation for why the concentration in some wells was lower (9 times lower for α in D well) on November 12 than on September 29, while in others it was higher (7 times higher for β in C well). It is expected that future analyses will resolve these questions. Analysis of the collected water samples for specific radionuclides will be accomplished later. Soil samples were also taken at various depths during the drilling and will be analyzed later.

The water level in the wells on November 12, 1981, are shown in Figure 4. The wells were pumped "dry" on the previous day. It is planned to take samples from the wells for analysis at approximately 3 month intervals. The wells will be pumped dry and samples taken on the following day. The water level will be documented at each sampling.

Offsite Samples

Soil, water, and vegetation samples were taken at several offsite locations prior to beginning the D&D. The locations are shown in Figures 5 and 6 and results are shown in Tables 5A, 5B, 5C, 6 and 7. The vegetation samples were primarily grass and were taken over approximately one square meter. Continuous air samples were taken at the Delco plant on the east side of the site and at Rutgers University during the D&D. Sampling flow rate was 60 m^3/h and sampling media were changed approximately every 350 hours. None of the samples showed count rates above background of the laboratory counters (~ 4 cpm, 0.36 cpm/dpm for ^{239}Pu α and ~ 360 cpm, 0.33 cpm/dpm for ^{90}Sr-^{90}Y β).

Also, calcium fluoride thermoluminescent dosimeters were placed at the Delco Plant and at Rutgers University. The measured dose for seven months exposure was equal to natural background (24 - 39 mrem for 217 days).

Areas of Concern

The drain lines under the slab of I building are contaminated. The results of samples taken from some of the lines and from adjacent soil (see Figure 5 for locations) are shown in Table 8. The data confirms that plutonium and americium leaked from the lines into soil under the slab. Soil sample #124 was at least five times the background concentration listed in Table 3. Maybe so but does not appear so high in any event.

how many

The tons of ~~Belgian Congo~~ pitchblende contained present on the site, in the former railroad spur, was not disturbed during the D&D. Results of samples taken around the site (see Figure 5) prior to the start of D&D, are given in Tables 9 and 10. The soil samples listed in Table 9 were taken in one foot increments with a split-spoon sampler down to the depths given in the table.

For example, a sample taken at the 5 foot depth means that the split-spoon sampler collected soil from the 4 foot to the 5 foot depth. In cases where the sample bore hole was in rock, a core sample was obtained with a diamond tipped hollow bit. (Which samples were in rock?)

Table 10 which gives the radioactivity concentration found in filtered surface water samples and surface water residue (filtrate) samples has a large number of entries where the radioactivity was less than the Minimum Detectable Activity (MDA). When using gamma spectroscopy, the MDA for a given radionuclide depends on sample size, counting time, detector efficiency, gamma-ray yield, etc. However, in this case, it can be assumed that the MDA for the radionuclides listed are approximately the same as the typical background concentrations given in Table 3.

The black circles in Figure 5 represent sample locations where contamination was above background and the open circles indicate locations at which samples of radioactivity concentration were equivalent to background. The circles with a + sign indicate samples

which were determined by mass spectrometry to have uranium isotopic ratios higher than normal ratios. The mass spectral data for uranium isotopic ratios (atom percent) is given in Table 5D. The results given in Tables 9 and 10 are only for the samples identified by black circles. Results are not given in these tables for the open circle samples because they were all within the typical range of natural background listed in Table 3.

Offsite soil samples #130A and 133A have shown atom percents 1.029 and 1.210 respectively for ^{235}U (see Table 5D). Likewise, vegetation samples #130A and 130B have shown atom percents 1.357 and 1.694 respectively for ^{235}U. For natural uranium, the atom percent for the ^{235}U isotope should be 0.720. The atom percent anomalies do not mean that the uranium concentrations on the Delco property fall outside the background range. On the contrary, all of the indicated samples which show atom percent anomalies, show total U and ^{235}U concentrations (see Tables 5C and 7) which are in the background range. What the atom percent anomalies do imply is that some uranium on the Delco property,

even though not above background concentrations, may be due to past activities at NBL-NJ. Therefore, the possibility of above background concentrations at other spots cannot be ruled out. For example, surface soil sample #132 (see Table 5B) from the Delco property, does show an above background uranium concentration (9.81±6.59 pCi/g for ^{235}U analyzed by Ge(Li) spectroscopy). However, this sample is not labeled in Figure 5 as being above background (black circles) because the concentration measured by fluorometry is only 0.51±0.1 μg total U/g (0.3±0.1 pCi/g). This is an obvious discrepancy in the analytical techniques which cannot be resolved without additional sampling and analysis.

The X, Y coordinates of all samples taken on the site, are listed in Table 11. The major cluster of above background samples delineate the pitchblende area but there are several other isolated locations, such as the "dump area" (see Figure 2) along the rear fence, which are also contaminated above normal background.

The sample results given in Tables 9 and 10 are rather detailed but are included because they will be valuable during the soil removal phase of the D&D. The

essence of what the data implies is: (1) The radioactivity concentration in the pitchblende area is not uniform in depth so efficient removal of contaminated soil will not be simple. (2) There are other areas of contamination on the site which are not due to the pitchblende. For example, water residue sample #159 (see Table 10) showed the presence of enriched uranium. (3) There may be other areas of subsurface contamination where samples were not taken.

As shown in Tables 6 and 7, not all samples were analyzed for the same number of radionuclides. A judgment was made that analysis cost could be reduced without sacrificing information required by doing a representative number of certain analyses for a limited number of samples. Analyses were done for radionuclides (^{137}Cs, ^{90}Sr, ^{60}Co, etc.) other than those listed in the tables but the results are not given for each sample because they were all within the range of background concentrations listed in Table 3.

A close examination of data in many of the tables show that there are some discrepancies between differ-

ent analytical techniques, such as differences between the analysis of uranium by fluorometry and by gamma-ray spectroscopy. These kinds of discrepancies are common for low activity environmental samples, particularly in regard to uranium assays, and cannot be resolved at the present time. However the differences do not change the kind of corrective action required.

Present Radiological Condition

The site in its present condition has several areas of contamination but they are all contained underground and do not present an immediate threat. Continued analysis of samples from site vegetation and test wells will serve as early indicators of potential changes in the radiological condition of the site. Changes, if any, are expected to be slow enough to allow early corrective action.

what amount any area

FIGURE I

ANL-HP DWG. NO. 81-24

NEW BRUNSWICK LABORATORY PRIOR TO D & D

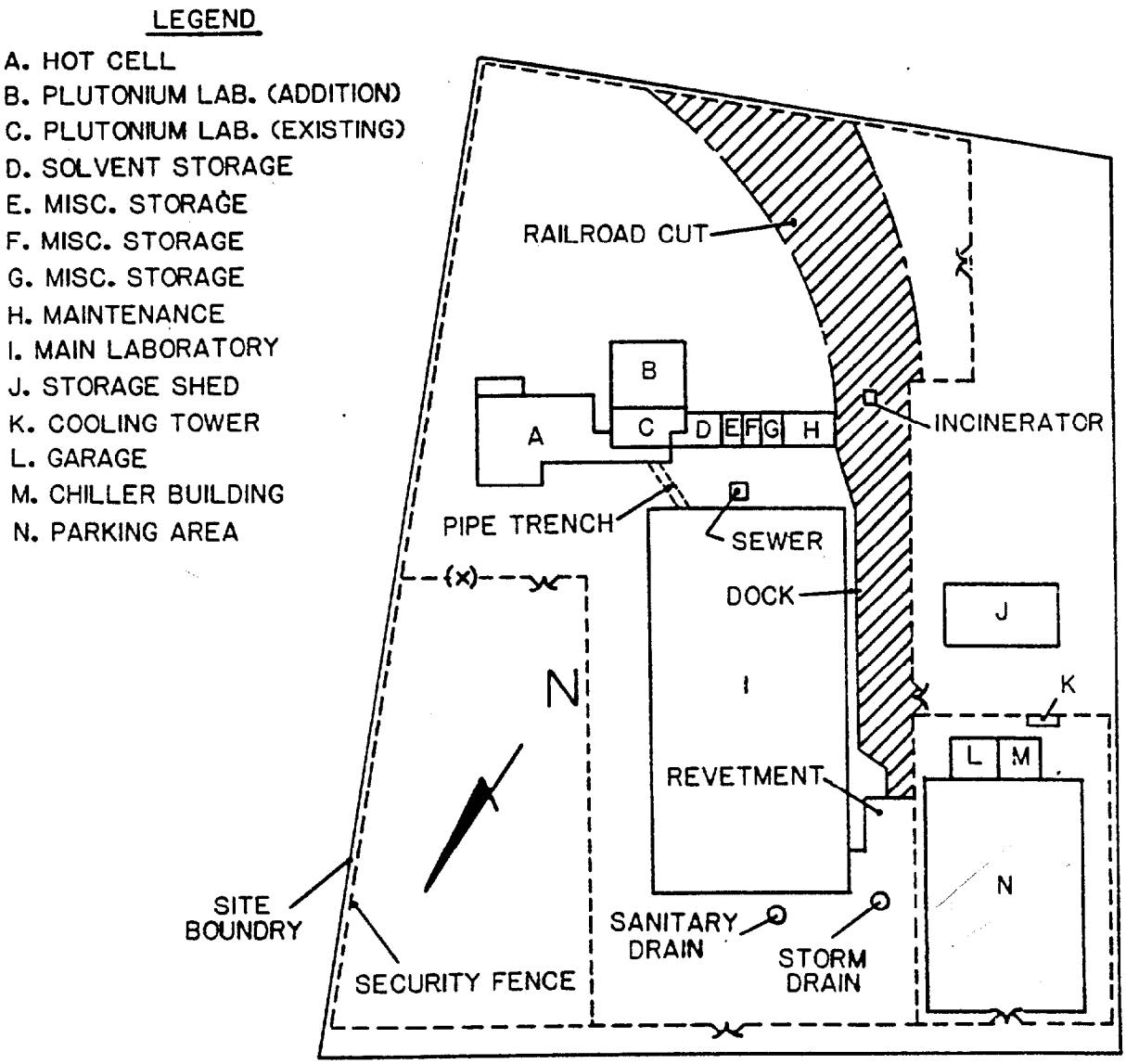

FIGURE 2

NEW BRUNSWICK LABORATORY WELL AND STORM DRAIN LOCATIONS

ANL-HP DWG. NO. 81-19

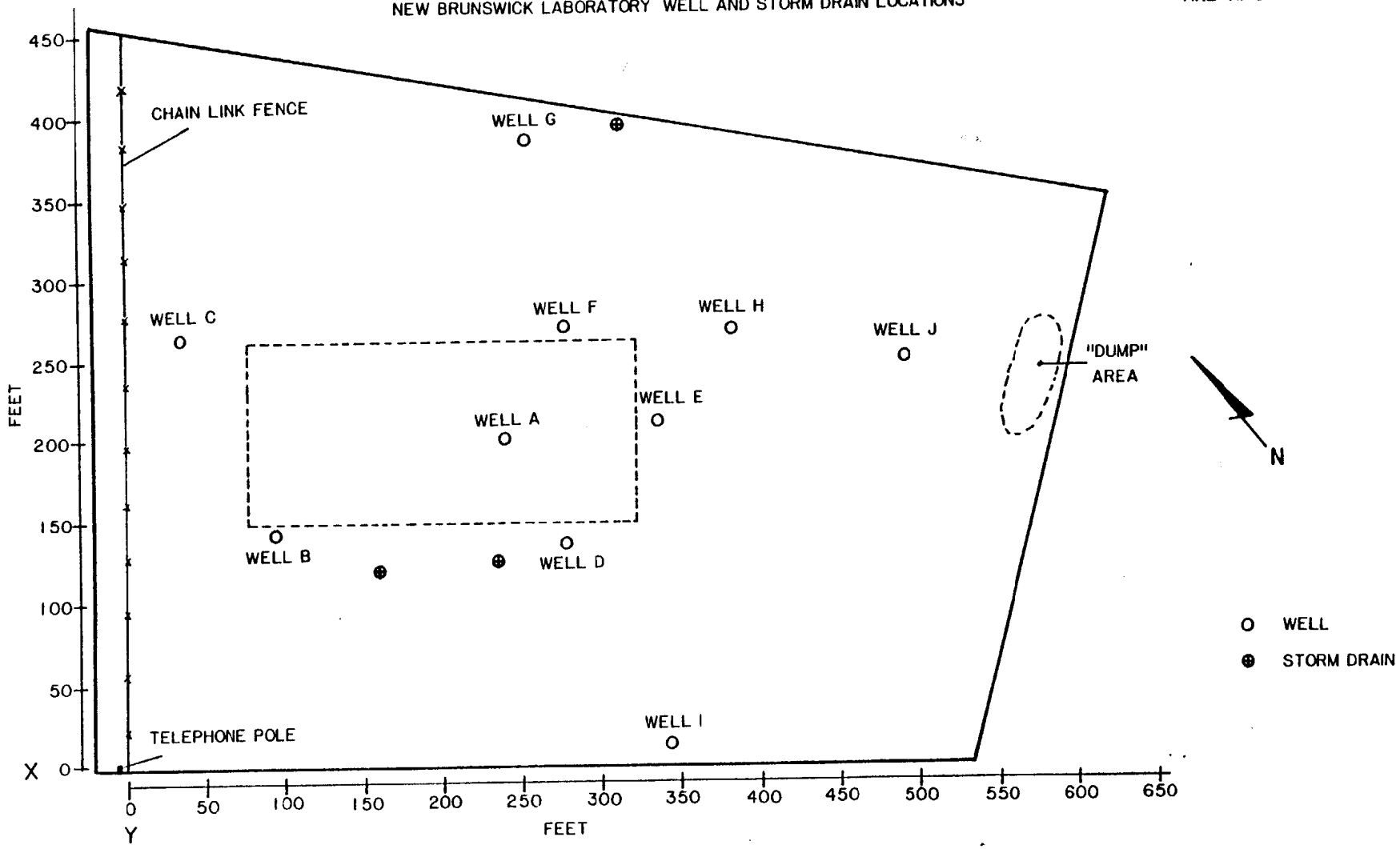

FIGURE 3

TYPICAL TEST WELL CONSTRUCTION

ANL-HP DWG.NO. 81-23

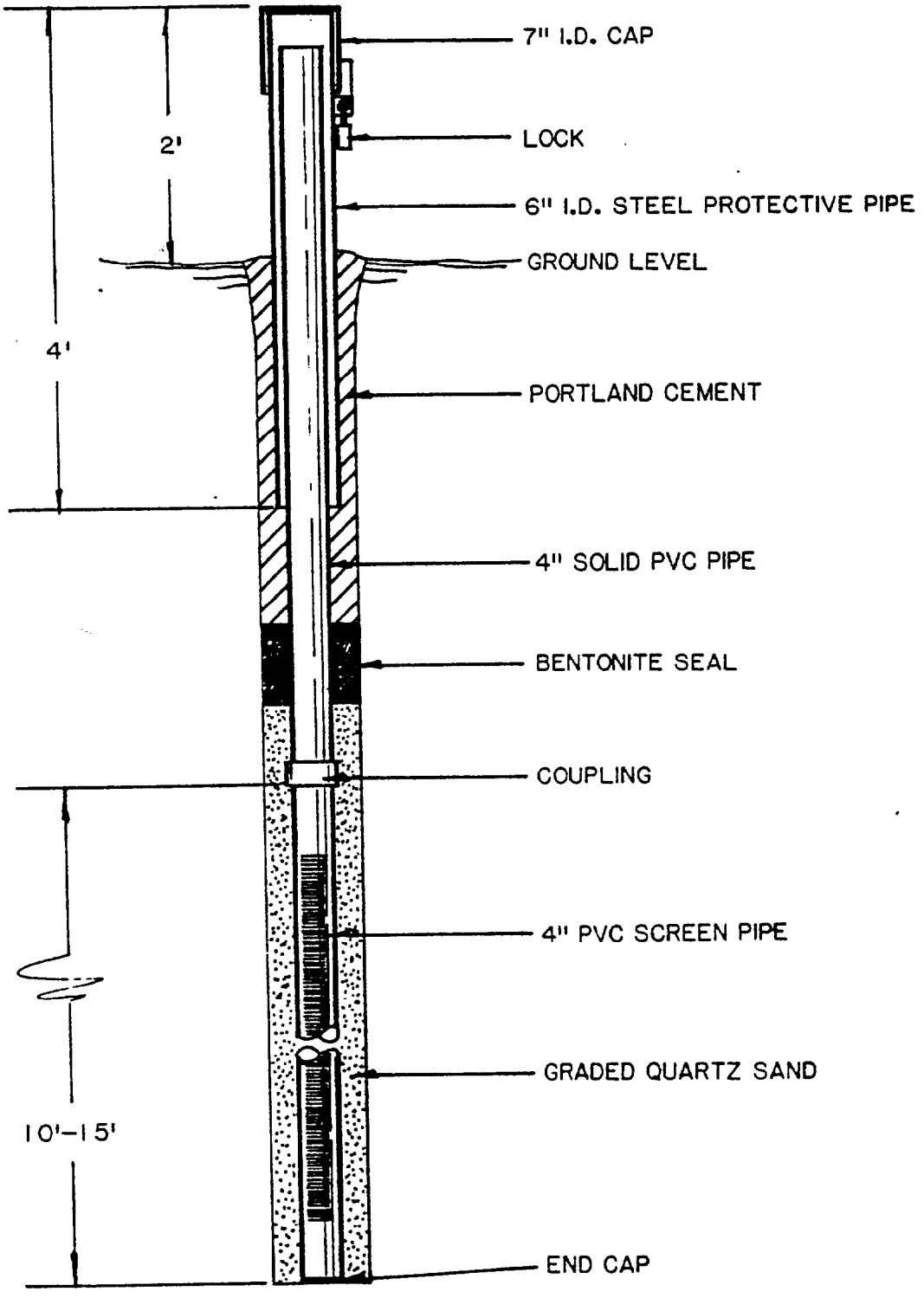

FIGURE 4

NEW BRUNSWICK LABORATORY TEST WELLS

ANL-HP DWG. NO. 81-20

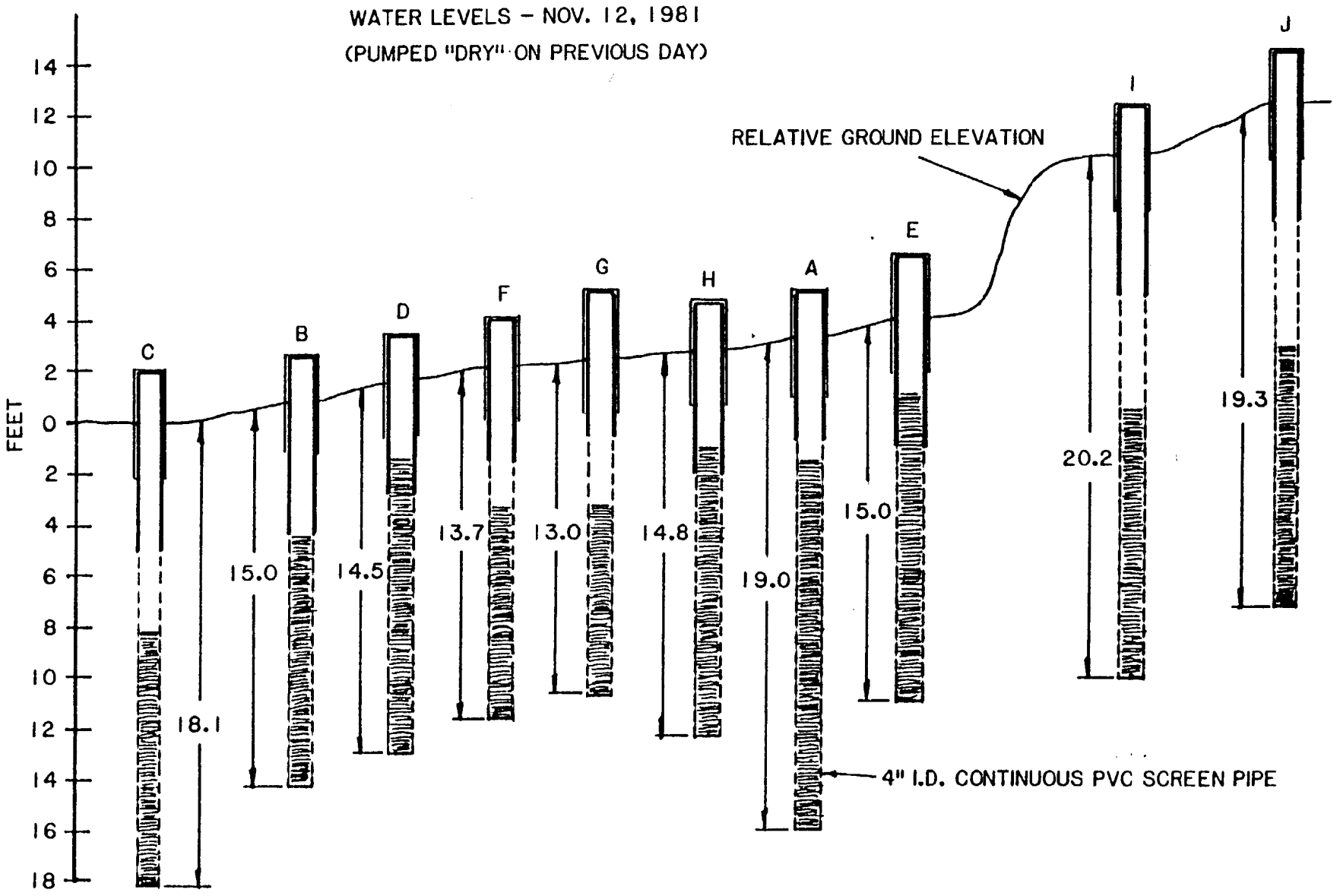

FIGURE 5

NEW BRUNSWICK LABORATORY SOIL SAMPLE LOCATIONS

ANL-HP DWG.NO. 81-18

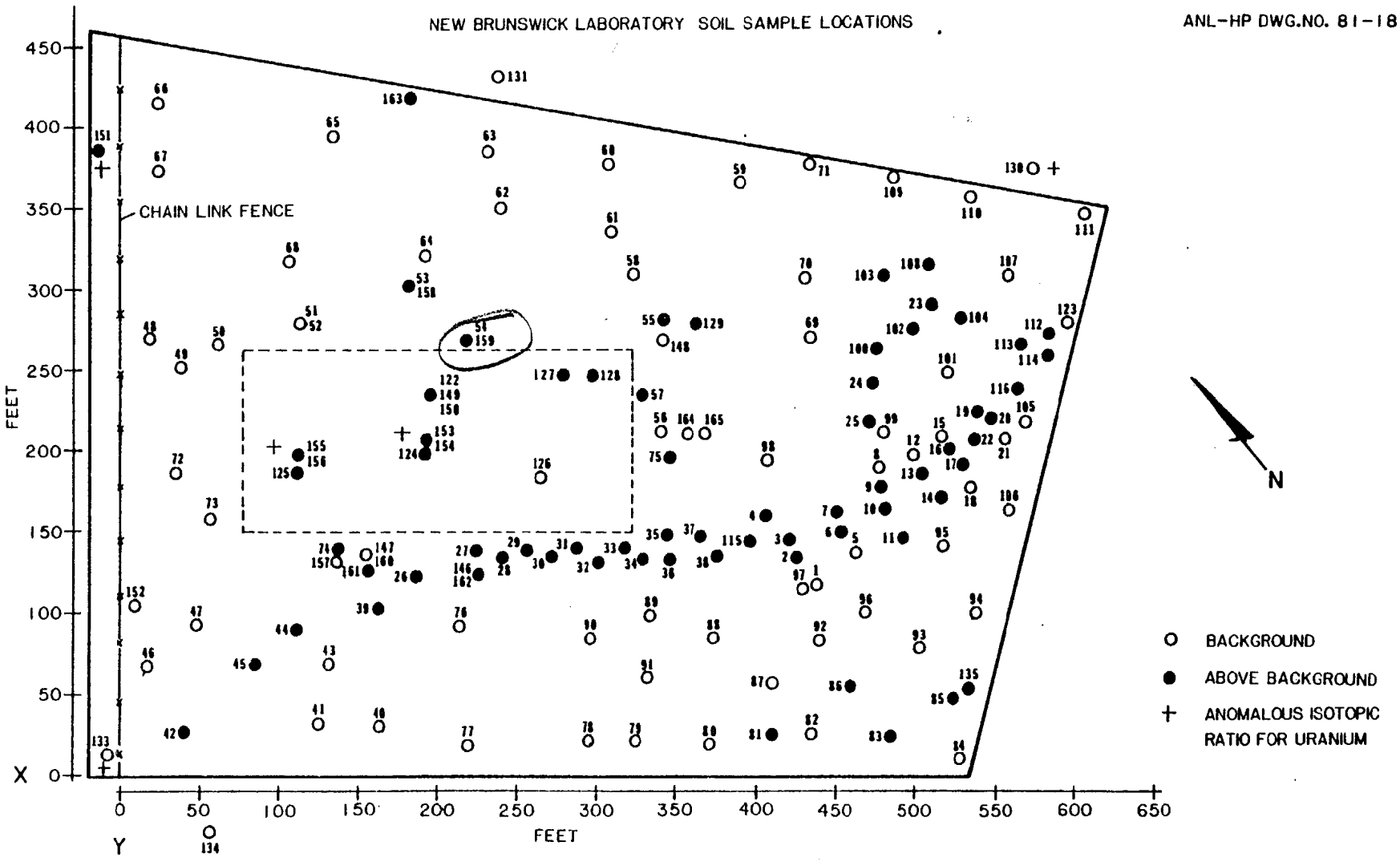

FIGURE 6

NEW BRUNSWICK LABORATORY OFF-SITE SAMPLE LOCATIONS

ANL-HP DWG. NO. 81-21

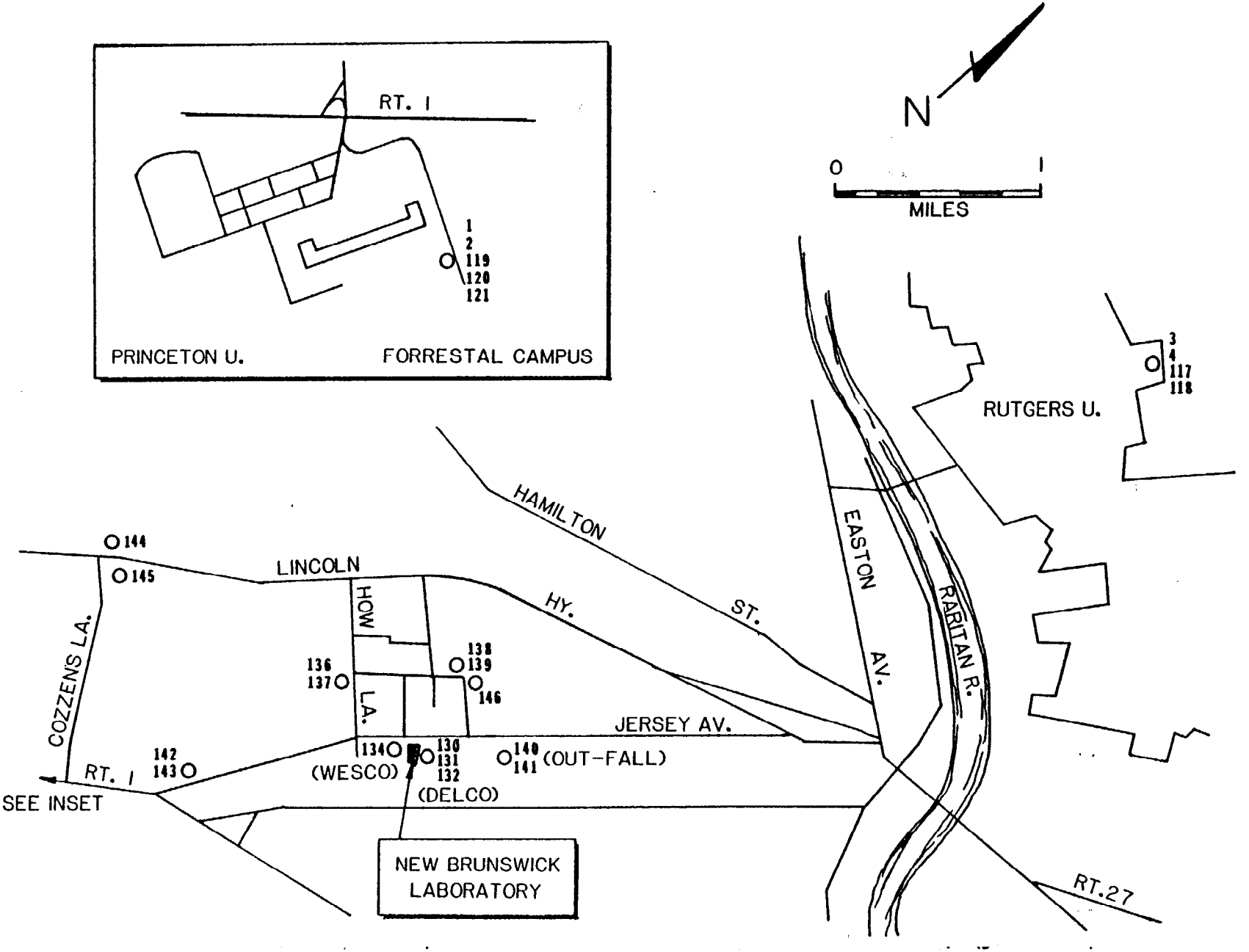

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LIMITS

Nuclide	Activity Limit (dpm/100 cm^2) Removable	Total (Fixed plus removable
^{239}Pu, ^{241}Am, other transuranics, ^{226}Ra, ^{228}Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	20	100
Th-nat, ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{131}I, ^{133}I	200	1000
U-nat, ^{235}U, ^{238}U, and associated decay products	1000	5000
Beta-gamma emitter (nuclides with decay modes other than alpha emission or spontaneous fission) except ^{90}Sr and other noted above.	1000	5000

NOTES: Measurement of average contaminant should not be averaged over more than 1 square meter.

Levels may be averaged provided the maximum activity in any area of 100 cm^2 is less than 3 times the limit.

Many of the nuclides listed decay by alpha emission, while others such as ^{228}Ra, ^{227}Ac, ^{129}I, ^{131}I, ^{133}I, and ^{90}Sr decay primarily be beta emission. Therefore, the complete absence of alpha contamination might be used in some cases to infer the absence of certain nuclides.

TABLE 2

ESTIMATED TOTAL QUANTITY OF RADIOACTIVITY
SHIPPED FROM NBL-NJ TO NTS

Radionuclide	Activity (μCi)
^{241}Am	29,762
^{238}U	13,281
^{235}U	2,286
^{234}U	13,281
^{232}Th	11,350
^{228}Ac	11,350
^{137}Cs	2
TOTAL	81,312

TABLE 3

TYPICAL BACKGROUND LEVELS

	Soil	Vegetation	Water
^{40}K	10-15 pCi/g		
^{60}Co	0.02-0.8 pCi/g		
^{90}Sr	0.04-0.2 pCi/g	0.04-0.07 pCi/g	~ 0.5 pCi/ℓ
^{137}Cs	0.1-0.9 pCi/g		
^{226}Ra Chain	0.4-1.5 pCi/g (0.24-1.4 pCi/g)*	~ 0.5 pCi total U/g	~ 1.5 pCi total U/ℓ
^{228}Th	~ 1.0 pCi/g	0.01-0.04 pCi/g	~ 0.1 pCi/ℓ
^{230}Th	~ 1.0 pCi/g	0.008-0.02 pCi/g	~ 0.1 pCi/ℓ
^{232}Th Chain	0.7-2.2 pCi/g (0.31-1.5 pCi/g)*	0.001-0.02 pCi/g	~ 0.05 pCi/ℓ
^{235}U		~ 0.001 pCi/g	
^{238}Pu	8.E-4 - 3.E-3 pCi/g		0.04E-2 - 3.E-2 pCi/ℓ
$^{239,240}Pu$	8.E-3 - 3.E-2 pCi/g	0.0006-0.004 pCi/g	0.9E-2 -1.2E-2 pCi/ℓ
^{241}Am	4.E-3 - 2.E-2 pCi/g	.008 - .03	3.E-2 - 4.E-2 pCi/ℓ
U Total	0.5-4.0 μg/g	.004 - .02	-
Gross α			1.0-3.0 pCi/ℓ
Gross β	-	-	0.4-7.0 pCi/ℓ

Typical background exposure rate at 1 meter above ground is 5-10 μR/h (2.3-13 μR/h)*

*The values quoted in the parenthesis are taken from "State Background Radiation Levels: Results of Measurements Taken During 1975-1979," ORNL/TM-7343, November 1981.

TABLE 4

RADIOACTIVITY CONCENTRATION IN NBL-NJ TEST WELLS

	Samples Collected Sept. 29, 1981			Samples Collected November 12, 1981		
Well	Sample Number	Gross α (pCi/ℓ)	Gross β (pCi/ℓ)	Sample Number	Gross α (pCi/ℓ)	Gross β (pCi/ℓ)
A	81Y26	0.35±0.21	1.47±0.24	81Y36	0.95±0.20	1.86±0.30
B	81Y27	2.44±0.18	4.85±0.30	81Y37	0.6±0.2	1.8±0.3
C	81Y28	2.04±0.24	0.40±0.13	81Y38	0.17±0.13	2.98±0.51
D	81Y29	6.10±0.67	5.51±0.28	81Y39	0.71±0.13	5.18±0.59
E	81Y30	1.1±0.1	3.0±0.3	81Y40	1.01±0.16	3.37±0.30
F	81Y31	2.9±0.3	3.2±0.3	81Y41	0.6±0.2	2.8±0.3
G	81Y32	21.4±0.8	27.2±0.6	81Y42	3.2±0.2	5.9±0.4
H	81Y33	0.7±0.2	2.9±0.3	81Y43	0.6±0.2	3.9±0.3
I	81Y34	0.38±0.09	5.68±0.35	81Y44	0.6±0.2	3.3±0.4
J	81Y35	0.58±0.11	5.43±0.42	81Y45	0.8±0.1	3.6±0.3

TABLE 6A

(See Figure 6 for sample locations)[1]

OFFSITE SOIL SAMPLE RADIOACTIVITY CONCENTRATION

Sample ID#	Depth (Feet)	Ge(Li) Spectra ^{232}Th Chain pCi/g**	Ge(Li) Spectra ^{226}Ra Chain pCi/g*	^{137}Cs pCi/g	Fluorometric Analysis µgU/g	Fluorometric Analysis Uranium pCi/g***	Remarks
5-SB-1	A	1.12±0.22	1.01±0.12	1.95±0.10	1.9±0.3	1.3±0.2	First 2" of soil
	B				1.8±0.3	1.2±0.2	Second 2" of soil: no Ge(Li) spectrum
	C				1.0±0.2	0.7±0.1	Third 2" of soil: no Ge(Li) spectrum
	D				1.5±0.2	1.0±0.1	Last 6" of soil: no Ge(Li) spectrum
5-SB-2	A	1.37±0.18	1.16±0.09	2.54±0.13	1.0±0.2	0.7±0.1	First 2" of soil
	B				1.8±0.3	1.2±0.2	Second 2" of soil: no Ge(Li) spectrum
	C				1.2±0.2	0.8±0.1	Third 2" of soil: no Ge(Li) spectrum
	D				2.4±0.3	1.6±0.2	Last 6" of soil: no Ge(Li) spectrum
5-SB-3	A	1.68±0.24	0.90±0.14	1.9±0.10	1.6±0.09	1.1±0.1	First 2" of soil
	B				1.3±0.3	0.9±0.2	Second 2" of soil: no Ge(Li) spectrum
	C				1.3±0.3	0.9±0.2	Third 2" of soil: no Ge(Li) spectrum
	D				1.8±0.3	1.2±0.2	Last 6" of soil: no Ge(Li) spectrum
5-SB-4	A	1.82±0.16	1.07±0.10	1.48±0.07	1.6±0.4	1.1±0.3	First 2" of soil
	B				2.4±0.4	1.6±0.3	Second 2" of soil: no Ge(Li) spectrum
	C				1.8±0.3	1.2±0.2	Third 2" of soil: no Ge(Li) spectrum
	D				2.2±0.3	1.5±0.2	Last 6" of soil: no Ge(Li) spectrum
5-SB-117	1	0.40±0.06	0.41±0.03	0.12±0.04			Samples 5-SB-117 through 5-SB-121 were not analyzed by fluorometry for uranium.
	2	0.86±0.06	0.48±0.03	< 0.03			
	3	1.63±0.11	1.11±0.08	< 0.03			
	4	1.51±0.11	1.17±0.08	< 0.02			
5-SB-118	1	0.98±0.07	1.23±0.08	0.20±0.04			
	2	1.29±0.09	2.05±0.14	< 0.03			
	3	2.24±0.16	3.74±0.26	< 0.03			
	4	2.02±0.14	3.27±0.23	< 0.03			
5-SB-119	1	1.14±0.08	1.28±0.09	0.24±0.04			
	2	1.51±0.10	1.29±0.09	< 0.03			
	3	0.98±0.07	0.78±0.05	< 0.03			
	4	1.44±0.10	1.11±0.08	0.04±0.02			
	5	2.75±0.19	0.93±0.06	0.07±0.03			
	6	5.72±0.40	1.02±0.07	< 0.03			
	7	7.39±0.52	1.18±0.08	< 0.03			
	8	5.38±0.38	0.83±0.06	< 0.03			

TABLE 5A
(Cont'd.)

OFFSITE SOIL SAMPLE RADIOACTIVITY CONCENTRATION

		Ge(Li) Spectra			Fluorometric Analyses		
Sample ID#	Depth (Feet)	^{232}Th Chain pCi/g**	^{226}Ra Chain pCi/g*	^{137}Cs pCi/g	μgU/g	Uranium pCi/g***	Remarks
5-SB-120	1	1.58±0.11	1.28±0.09	0.16±0.04			
	2	1.70±0.12	1.88±0.13	< 0.03			
	3	1.86±0.13	1.90±0.13	< 0.03			
	4	1.87±0.13	2.07±0.14	< 0.03			
	5	1.76±0.12	1.50±0.10	< 0.03			
	6	2.47±0.17	1.73±0.12	< 0.03			
	7	2.48±0.17	2.01±0.14	< 0.03			
	8	3.24±0.23	1.44±0.10	< 0.03			
5-SB-121	1	1.01±0.07	1.01±0.07	0.29±0.04			
	2	1.19±0.08	1.14±0.08	0.22±0.04			
	3	1.62±0.11	1.43±0.10	0.06±0.03			
	4	1.65±0.12	1.14±0.08	0.04±0.02			
	5	1.50±0.11	0.91±0.06	< 0.03			
	6	1.82±0.13	0.86±0.06	0.08±0.03			
	7	2.07±0.14	1.05±0.07	0.05±0.03			
	8	2.18±0.15	0.88±0.06	0.06±0.03			

†In Figure 6, sample locations are marked by the serial number only. For example, 5-SB-1 is identified as 1.

*From ^{214}Bi 609.0 keV line.

**From ^{228}Ac 908.0 keV line.

***Calculated from the fluorometric data assuming uranium equilibrium by using the conversion factor 0.6867 pCi/μg.

TABLE 5B
(See Figure 6 for sample locations)†

RADIOACTIVITY CONCENTRATIONS IN OFFSITE SURFACE
SOIL SAMPLES (approx. 2" depth)

	Ge(Li) Spectroscopy						Fluorometric Analysis	
	^{235}U pCi/g	^{238}U pCi/g	^{226}Ra Chain pCi/g*	^{232}Th Chain pCi/g**	^{40}K pCi/g	^{137}Cs pCi/g	μgU/g	pCi/g*** (Uranium)
9-SB-132	< MDA	9.81±6.59	0.85±0.07	0.99±0.14	19.1±0.6	0.95±0.05	0.5±0.1	0.3±0.1
9-SB-142	< MDA	< MDA	0.41±0.08	0.67±0.01	10.6±0.7	0.66±0.06	0.7±0.1	0.5±0.1
→9-SB-143	< MDA	< MDA	0.41±0.07	0.84±0.01	11.2±0.6	0.85±0.06	0.8±0.1	0.5±0.1
9-SB-144	< MDA	< MDA	0.39±0.08	0.72±0.01	11.2±0.7	0.39±0.05	2.5±0.1	1.7±0.1
→9-SB-145	< MDA	< MDA	0.49±0.07	0.72±0.01	15±0.7	0.33±0.04	0.8±0.1	0.5±0.1

†In Figure 6, sample locations are marked by the serial number only. For example, 5-SB-142, is identified as 142.

*From ^{214}Bi 609.0 keV line

**From ^{228}Ac 908.0 keV line

***Calculated from the fluorometric data assuming uranium equilibrium by using the conversion factor 0.6867 pCi/g.

→These samples have indicated anomolous isotopic ratios for U. See Table 5D.

TABLE 5C
(See Figures 5 and 6 for sample locations)†

RADIOACTIVITY CONCENTRATIONS IN OFFSITE SURFACE SOIL SAMPLES (pCi/g)

		Radiochemical Analysis						Fluorometric Analysis		
	Depth (Inches)	^{90}Sr	^{230}Th	^{228}Th	^{232}Th	^{238}Pu	$^{239\ 240}Pu$	^{241}Am	Uranium (Total) μg/g	Uranium pCi/g*
9-SB-130A	2	1.73±0.11E-1	6.91±0.37E-1	9.5±0.46E-1	8.1±0.41E-1	1.35±0.36E-2	3.18±0.16E-2	2.63±0.26E-2	1.0±0.1	0.69±0.07
9-SB-130B	4	1.52±0.10E-1	5.51±0.33E-1	7.63±0.43E-1	7.28±0.4E-1	7.54±0.16E-4	2.16±0.08E-2	2.09±0.23E-2	0.7±0.1	0.48±0.07
9-SB-131A	2	1.05±0.07E-1	8.07±0.47E-1	8.98±0.05E-1	9.52±0.51E-1	1.93±0.41E-3	2.33±0.13E-2	1.95±0.37E-2	1.2±0.1	0.82±0.07
5-SB-1A	2	0.10±0.05		1.86±0.09	1.61±0.08	1.38±0.14E-3	42.8±2.0E-3	9.81±0.88E-3	1.9±0.3	1.3±0.2
5-SB-2A	2	0.16±0.01		1.92±0.10	1.69±0.08	1.78±0.16E-3	40.8±2.0E-3	9.65±0.97E-3	1.0±0.2	0.7±0.1
5-SB-3A	2	0.18±0.05		2.72±0.30	2.10±0.23	1.0±0.1E-3	26.6±1.3E-3	7.96±0.96E-3	1.6±0.09	1.1±0.1
5-SB-4A	2	0.31±0.06		1.46±0.09	1.42±0.08	0.63±0.13E-3	24.5±1.2E-3	7.92±1.50E-3	1.6±0.4	1.1±0.3

†In Figures 5 and 6, sample locations are marked by the serial number only. For example, 9-SB-130, is identified as 130.

*Calculated from the fluorometric data using 0.6867 pCi/μg as conversion factor assuming uranium equilibrium. If isotopic ratios for uranium are higher than the ratios of natural uranium, then the total uranium activity higher. For uranium isotopic atom ratios, see Table 5D.

TABLE 5D

MASS SPECTRAL ANALYSIS OF URANIUM FOR SELECTED SOIL, WATER, AND VEGETATION SAMPLES

(Results given in atom percent)

SOIL

Sample ID #	^{234}U	^{235}U	^{238}U
9-SB-130A	0.0077±0.0009	1.029±0.011	98.963±0.011
9-SB-130B	0.0064±0.0003	0.825±0.004	99.169±0.004
9-SB-131A	0.00606±0.00014	0.8180±0.0028	99.1760±0.0028
9-SB-131B	0.00601±0.00026	0.8177±0.0012	99.1763±0.0013
9-SB-132B	0.0057±0.0013	0.806±0.028	99.188±0.028
9-SB-133A	0.0105±0.0004	1.210±0.005	98.780±0.005
9-SB-133B	0.0068±0.0008	0.769±0.007	99.224±0.007
9-SB-134	0.00605±0.00020	0.800±0.004	99.194±0.004
9-SB-135A	0.0066±0.0003	0.865±0.009	99.129±0.009
9-SB-135B	0.00656±0.00028	0.780±0.005	99.213±0.005
9-SB-143	0.0103±0.0015	0.853±0.013	99.137±0.013
9-SB-145	0.0072±0.0005	0.848±0.005	99.144±0.005
9-S-150	0.01167±0.00008	1.5089±0.0029	98.4752±0.0029
9-S-151	0.01416±0.00015	1.588±0.004	98.394±0.004
9-S-155	0.01987±0.00008	2.191±0.004	97.783±0.004
9-S-156	0.01657±0.00010	1.8403±0.0021	98.1387±0.0022
9-S-160	0.00607±0.00004	0.7851±0.0026	99.2088±0.0026
9-S-163	0.0077±0.0007	0.8831±0.006	99.104±0.006

TABLE 5D
(Cont'd.)

MASS SPECTRAL ANALYSIS OF URANIUM FOR SELECTED
SOIL, WATER, AND VEGETATION SAMPLES

WATER

Sample ID#	^{234}U	^{235}U	^{238}U
9-WB-136	0.0064±0.0019	0.725±0.007	99.269±0.007
9-WB-137	0.00522±0.00013	0.7129±0.0030	99.2819±0.0030
9-WB-138	0.00573±0.00016	0.745±0.004	99.249±0.004
9-WB-139	0.0076±0.0019	0.758±0.016	99.234±0.016
9-WB-140	0.01089±0.00025	0.759±0.012	99.230±0.012
9-WB-141	0.0083±0.0008	0.725±0.014	99.268±0.015

VEGETATION

Sample ID #	^{234}U	^{235}U	^{238}U
130A	0.015±0.007	1.357±0.011	98.629±0.013
130B	0.018±0.004	1.694±0.010	98.288±0.010
133A	0.0064±0.0007	0.794±0.005	99.205±0.005
135A	0.0059±0.0006	0.825±0.005	99.169±0.005
135B	0.00602±0.00029	0.826±0.005	99.168±0.005

TABLE 6
(See Figures 5 and 6 for Sample Locations)†

OFFSITE WATER SAMPLES RADIOACTIVITY CONCENTRATION
(All results are in pCi/g or pCi/mℓ except where noted otherwise)

	Radiochemical Analysis							Mass Spectral Analysis		
Sample ID#	^{90}Sr	^{230}Th	^{228}Th	^{232}Th	^{238}Pu	$^{239,240}Pu$	^{241}Am	Uranium µg/g or µg/mℓ	Uranium* pCi/g or pCi/mℓ	Remarks
9-WB-136	4±1.3E-4	1.0±0.2E-4	1.3±0.2E-4	0.5±0.2E-4	0.2±0.6E-4	0.11±0.06E-4	< MDA	2.07±0.02E-4	1.42±0.01E-4	Filtered water
9-WB-137	3±3E-3	1.3±0.3E-3	1.8±0.3E-3	0.9±0.2E-3	0.23±0.13E-3	0.1±0.1E-3	< MDA	2.69±0.03E-3	1.85±0.02E-3	Filtered water
9-WB-137(S)	2.5±0.4E-2	69±9E-2	100±14E-2	73±9E-2	0.4±1.4E-5	1.1±0.2E-3	1±2E-4	1.51±.02	1.04±0.01	Sediment
9-WB-138	0.7±1E-4	2.8±1.5E-5	8±1.5E-5	3.6±1.2E-5	1.4±0.4E-5	0.5±0.3E-5	4±4E-5	1.31±0.02E-3	0.90±0.01E-3	Filtered water
9-WB-139	1.2±0.2E-2	1.1±0.5E-3	4.4±1.3E-3	5±5E-4	1.7±1.3E-4	0.4±1.3E-5	1±2E-4	6.74±0.11E-3	4.63±0.08E-3	Filtered water
9-WB-139(S)	5.2±0.8E-2	5.6±0.3E-1	8.1±0.4E-1	7.7±0.4E-1	5±2E-4	8.7±0.7E-3	1±2E-4	2.01±.02	1.38±0.01	Sediment
9-WB-140	2±4E-4	9±2E-5	9±2E-5	4±2E-5	3±4E-6	5±5E-6	0.31±1.2E-5	2.46±0.03E-4	1.69±0.02E-4	Outfall north-east of Jersey Avenue
9-WB-141	1±3E-3	8.8±1.6E-4	7.2±2E-4	3.5±0.8E-4	6±7E-5	1.2±0.6E-4	2±2E-4	4.43±0.05E-3	3.04±0.03E-3	Outfall north-east of Jersey Avenue
9-WB-141(S)	2.2±0.3E-2	3.7±0.2E-1	5.5±0.3E-1	4.5±0.2E-1	7±7E-4	3.6±0.4E-3	1±2E-4	1.67±0.02	1.15±0.01	Sediment

†In Figures 5 and 6, sample locations are marked by the serial number only. For example, 9-WB-136, is identified as 136.

*Calculated from mass spectral analysis data using the conversion factor 0.6867 pCi/µg for uranium and assuming equilibrium.

TABLE 7
(See Figures 5 and 6 for Sample Locations)

OFFSITE SURFACE VEGETATION SAMPLES RADIOACTIVITY CONCENTRATION
(All concentrations in pCi/g unless otherwise noted)

	Radiochemical Analysis							Mass Spectral Analysis		
ID#	^{90}Sr	^{230}Th	^{228}Th	^{232}Th	^{238}Pu	$^{239,240}Pu$	^{241}Am	(Uranium) µg/g	(Uranium) pCi/g*	Remarks
130A Delco side: washed sample	4.5±0.6E-1	8±5E-3	2.±0.6E-2	5±4E-3	< MDA	1.3±1.3E-3	< MDA	9.85±0.12E-3	6.76±0.08E-3	Mass spectrum indicates anomalous isotopic ratio for U. See Table 5D.
130B Delco side: unwashed sample	5.0±0.4E-1	5±4E-3	1.3±0.5E-2	7±3E-3	< MDA	< MDA	1.0±0.08E-3	9.55±0.10E-3	6.56±0.07E-3	Mass spectrum indicates anomalous isotopic ratio for U. See Table 5D.
133A North of fence, Jersey Avenue, washed sample	5.9±0.4E-1	1.1±0.3E-2	2.4±0.4E-2	7±2E-3	7±5E-4	1.9±9.6E-3	6±6E-4	28.10±0.28E-3	19.30±0.19E-3	Mass spectrum indicates anomalous isotopic ratio for U. See Table 5D.
133B Unwashed sample	7.2±0.4E-1	8.6±2.1E-3	2.6±0.3E-2	1±0.19E-3	5±3E-4	1.2±0.4E-3	< MDA	30.48±0.30E-3	20.93±0.21E-3	Anomalous isotopic ratio for U. See Table 5D.
135A† Delco side: washed sample	4.5±0.3E-1	1.2±0.3E-2	2.4±0.3E-2	1.4±0.3E-2	9±4E-3	1.2±0.4E-3	5±6E-4	48.20±0.50E-3	33.10±0.34E-3	Mass spectrum indicates anomalous isotopic ratio for U. See Table 5D.
135B† Wesco side: unwashed sample	5±0.4E-1	2±0.4E-2	3.8±0.5E-2	2.1±0.4E-2	< MDA	4.4±1.8E-3	< MDA	61.60±0.60E-3	42.30±0.41E-3	Mass spectrum indicates anomalous isotopic ratio for U. See Table 5D

*Calculated from mass spectral data using the coversion factor 0.6867 pCi/µg for uranium assuming equilibrium. If isotopic ratios for uranium are higher than the ratios of natural uranium, then the total uranium activity will be higher. For uranium isotopic atom ratos, see Table 5D.

†These samples are onsite but were initially believed to be offsite because they were outside the original fence.

TABLE 8
(See Figure 5 for Sample Locations)

SAMPLES FROM I BUILDING PAD

	Ge(Li) Spectra					Radiochemistry				
Sample ID #	^{235}U pCi/g	^{238}U pCi/g	^{232}Th Chain pCi/g	^{226}Ra Chain pCi/g	^{40}K pCi/g	$^{239,240}Pu$ pCi/g	^{241}Am pCi/g	Uranium µg/g	Uranium pCi/g*	Remarks
122	-	-	1.8±0.13	4.82±0.34	-	-	-	7.6±.7	5.2±0.5	Soil near pipe
149	< MDA	< MDA	< MDA	< MDA	< MDA	-	-	2.8±.1	1.9±0.1	Pipe fragments, scraped residue
150	5.8±1.4	< MDA	32.6±1.3	< MDA	6.29±2.26	3130±160	550±55	178±10	122.2±6.9	Pipe fragments small residue Mass spectra indicates $^{235,238}U$ atom ratio anomoly. Sample #122, 149 & 150 are from same location.
124	< MDA	< MDA	1.17±0.26	2.68±0.16	21.2±1.3	0.162±.004	0.107±0.006	0.11±0.03	0.08±0.03	Soil near pipe
153	< MDA	5.93±3.16	1.41±0.16	0.26±0.07	2.16±0.43	200±3	38.7±2.1	29±2	19.9±1.4	Pipe fragments & residue. Radiochemistry indicated 37.4±1.6 ^{232}Th. Mass spectra shows ^{235}U, ^{238}U anomoly.
154	< MDA	< MDA	< MDA	< MDA	< MDA	59	-	-	-	Sample #124, 153 154 are from same location
125	0.44±0.29	< MDA	1.43±0.22	1.17±0.12	18.1±1.3	0.128±0.004	0.075±.005	1.7±0.2	1.2±0.1	Soil near pipe

TABLE 8
(Cont'd.)

SAMPLES FROM I BUILDING PAD

Sample ID #	Ge(Li) Spectra ^{235}U pCi/g	^{238}U pCi/g	^{232}Th Chain pCi/g	^{226}Ra Chain pCi/g	^{40}K pCi/g	Radiochemistry $^{239,240}Pu$ pCi/g	^{241}Am pCi/g	Uranium µg/g	Uranium pCi/g*	Remarks
155	0.05±0.03	< MDA	0.99±0.03	< MDA	0.72±0.05	3700±80	498±28	151±8	103.7±5.5	Pipe fragments residue. Mass spectral anomoly for U. Radiochemistry indicated 553±32 ^{232}Th
156	0.84±0.01	3.64±1.17	3.61±0.06	0.09±0.03	0.91±0.14	4020±110	642±33	428±21	293.9±14.4	Sludge Mass spectra anomoly for U. Radiochemistry indicated 572±25 ^{232}Th.
126			1.34±0.09	2.86±0.30						Soil (trowel sample)
127			15.1±0.06	7.06±0.69						Soil (trowel sample)
128A			470±33	3.87±0.27						Soil (4" deep trowel sample)
128B			123±9	2.41±0.17						Soil (8" deep trowel sample)

*Calculated from the fluorometric data using 0.6867 pCi/µg as conversion factor, assuming equilibrium. If isotopic ratios for uranium are higher than the ratios of natural uranium, then the total uranium activity will be higher. For uranium isotopic ratios, see Table 5D.

Table 9

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

(See Figure 5 for Sample Locations)

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th Chain (pCi/g)*	^{226}Ra Chain (pCi/g)**	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
2	1	1.68±0.12	2.05±0.14			3±2	2.1±1.4
	2	1.47±0.10	1.38±0.10			1±3	0.7±2.1
	3	1.06±0.07	56.6±4.0			85±4	58.4±2.8
	4	2.52±0.18	120±8			95±5	65.2±3.4
	5	1.02±0.07	93.5±6.6			126±6.6	86.5±4.1
	6	1.49±0.10	147±10			270±10	185.4±6.9
	7	1.71±0.12	118±8			103±16	70.7±11.0
	8	1.82±0.13	172±12			284±20	195±13.7
	9	2.23±0.16	215±15			46±4	31.6±2.8
	10	1.75±0.12	135±9			420±130	288.4±89.3
	11	3.69±0.26	187±13			660±30	453.2±20.6
	11.5	2.09±0.15	1.58±0.11			48±6	33±4.1
	12	1.60±0.11	26.4±1.9			35±2	24±1.4
3	1	2.01±0.14	8.0±0.56			13±2	8.9±1.4
	2	1.65±0.12	58.5±4.1			134±7	92.0±4.8
	3	2.22±0.16	178±12			300±10	206.0±6.9
	4	1.33±0.09	98.6±6.9			295±60	202.6±41.2
	5	1.03±0.07	29.7±2.1			52±3	35.7±2.1
	6	1.21±0.08	121±9			235±12	161.4±8.2
	7	1.67±0.12	81.1±5.7			125±6	85.8±4.1
	8	1.23±0.09	10.3±0.7			241±12	165.5±8.2
	9	1.42±0.10	5.44±0.38			94±5	64.6±3.4
	10	1.34±0.09	1.61±0.11			32±2	22.0±1.4
	10.5	1.55±0.11	3.29±0.23			15±1	10.3±0.7

Table 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of Uranium***
6	1	2.03±0.14	1.10±0.08			1.1±0.7	0.8±0.5
	2	1.78±0.42	3.47±0.24			1.7±0.8	1.2±0.6
	3	2.15±0.15	78.2±5.5			275±14	188.8±9.6
	4	1.69±0.12	46.1±3.2			118±6	81.0±4.1
	5	1.32±0.09	117±8			212±11	145.6±7.6
	6	1.51±0.11	63.1±4.4			115±6	79.0±4.1
	7	1.16±0.08	148±10			220±8	151.1±5.5
	8	1.21±0.08	93.6±6.6			330±16	226.6±11.0
	9	1.29±0.09	173±12			482±24	331.0±16.5
	9.75	1.83±0.13	30.6±2.1			459±23	315.2±15.8
7	1	1.39±0.10	2.32±0.16			6±1	4.1±0.7
	2	1.47±0.10	14.6±1.0			31±1.6	21.3±1.1
	3	1.88±0.13	163±11			342±17	243.9±11.7
	4	1.13±0.08	242±17			793±40	544.6±27.5
	6	2.40±0.17	110±8			602±30	413.4±20.6
	7	5.96±0.42	4032±280			9300±500	6386.3±343.4
	9	1.36±0.10	100±7			574±29	394.2±19.9
9	1	1.40±0.10	1.35±0.09			2±1	1.4±0.7
	2	1.80±0.13	17.9±1.3			36±2	24.7±1.4
	3	1.56±0.11	366±26			547±27	376.5±18.5
	5	1.38±0.10	125±9			326±16	223.9±11.0
	6	1.22±0.09	95.6±6.7			263±13	180.6±8.9
	7	1.21±0.09	160±11			280±14	192.3±9.6

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
9 (Cont'd.)	8	1.19±0.08	10.9±0.8			153±8	105.1±5.5
	9	1.29±0.09	36.5±2.6			104±5	71.4±3.4
	9.3	1.59±0.11	20.4±1.4			20±1	13.7±0.7
10	1	1.06±0.07	1.14±0.08			2±1	1.4±0.7
	2	1.15±0.08	1.11±0.08			3±1	2.1±0.7
	3	1.20±0.08	23.2±1.6			66±3	45.3±2.1
	4	0.93±0.07	67.8±4.7			101±5	69.4±3.4
	5	1.97±0.14	83.9±5.9			127±6	87.2±4.1
	6	1.62±0.11	169±12			441±12	302.8±15.1
	7	1.87±0.13	33.7±2.4			325±16	223.2±11.0
	8	2.17±0.15	186±13			339±17	232.8±11.7
	8.5	1.25±0.09	60.9±4.3			219±11	150.4±7.6
	10.0	1.66±0.12	7.86±0.55			49±2	33.6±1.4
	10.5	1.37±0.10	2.29±0.16			18±1	12.4±0.7
11	1	1.68±0.12	1.40±0.10			2±1	1.4±0.7
	2	1.93±0.14	1.39±0.10			< 1	< 0.7
	3	1.78±0.12	1.45±0.10			3±1	2.1±0.7
	4	1.86±0.13	1.28±0.09			4±1	2.7±0.7
	5	1.94±0.14	1.48±0.10			3±1	2.1±0.7
	6	1.59±0.11	0.91±0.06			3±1	2.1±0.7
13	1	1.04±0.07	1.01±0.07			1.1±0.1	0.8±0.1
	2	1.24±0.09	13.2±0.9			25.1±2.5	17.2±1.7
	5	2.03±0.14	45.0±3.2			81.6±8.2	56.0±5.6
	6	1.43±0.10	20.7±1.4			46.2±4.6	31.7±3.2

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
13 (Cont'd.)	7	1.51±0.11	28.9±2.0			35.6±3.6	24.4±2.5
	8	1.56±0.11	10.3±0.7			82.0±8.2	56.3±5.6
	8.75	1.56±0.11	7.53±0.53			180.0±20.0	123.6±13.7
14	1	0.88±0.06	1.08±0.08			0.3±0.1	0.2±0.1
	2	0.88±0.06	1.03±0.07			1.3±0.1	0.9±0.1
	3	1.05±0.07	33.7±2.4			120.0±15.0	82.4±10.3
	4	1.25±0.09	23.6±1.6			44.0±4.0	30.2±2.7
	5	1.19±0.08	36.6±2.6			100.0±10.0	68.7±6.9
	7	1.06±0.07	1.69±0.12			27.0±3.0	18.5±2.1
	8	1.64±0.11	1.64±0.11			13.8±1.5	9.5±1.0
16	1	0.69±0.05	1.83±0.13			1.6±0.2	1.1±0.1
	2	1.49±0.10	93.9±6.6			220.0±22.0	151.1±15.1
	3	2.37±0.17	91.5±6.4			70.0±10.0	48.1±6.9
	4	1.61±0.11	50.8±3.6			70.0±10.0	48.1±6.9
	5	1.49±0.10	58.6±4.1			54.0±5.0	37.1±3.4
	6	1.22±0.09	6.56±0.46			22.0±2.0	15.1±1.4
	7	0.70±0.05	13.2±0.9			8.9±0.9	6.1±0.6
	8	1.49±0.10	29.7±2.1			38.0±4.0	26.1±2.7
	9	0.69±0.05	11.3±0.8			13.1±1.3	9.0±0.9
	9.75	0.71±0.05	14.0±1.0			14.0±1.4	9.6±1.0
17	1	0.43±0.11	0.67±0.05			0.7±0.1	0.5±0.1
	2	0.87±0.06	0.72±0.05			0.8±0.1	0.5±0.1
	3	1.18±0.08	55.7±3.9			62.0±6.0	42.6±4.1
	4	1.17±0.08	73.3±5.1			82.0±8.0	56.3±5.5

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of Uranium***
17 (Cont'd.)	5	1.55±0.11	71.1±5.0			96.0±10.0	65.9±6.9
	6	0.99±0.07	148±10			240.0±25.0	164.8±17.2
	7	1.93±0.14	46.9±3.3			94.0±9.0	64.5±6.2
	8	1.24±0.09	24.1±1.7			55.0±6.0	37.8±4.1
	9	1.68±0.12	4.46±0.31			11.5±1.2	7.9±0.8
	9.75	1.45±0.10	2.08±0.15			2.9±0.3	2.0±0.2
19	1	0.88±0.06	1.46±0.10			1.0±0.1	0.7±0.1
	2	0.92±0.06	23.0±1.6			37.0±4.0	25.4±2.7
	3	1.44±0.10	1.81±0.13			9.6±1.0	6.6±0.7
	4	1.54±0.11	1.19±0.08			0.6±0.1	0.4±0.1
	5	1.32±0.09	1.47±0.10			0.7±0.1	0.5±0.1
	5.5	1.46±0.10	1.34±0.09			1.1±0.1	0.8±0.1
20	1	0.66±0.05	2.40±0.17			1.8±0.2	1.2±0.1
	2	0.74±0.05	0.89±0.06			0.6±0.1	0.4±0.1
	3	< 0.03	1.92±0.13			3.1±0.3	2.1±0.2
	5	1.42±0.10	22.5±1.6			1.6±0.2	1.1±0.1
	6	1.33±0.09	34.2±2.4			37.0±4.0	25.4±2.7
	7	1.16±0.08	19.7±1.4			7.7±0.8	5.3±0.5
	8	1.46±0.10	7.67±0.54			4.7±0.5	3.2±0.3
22	1	< MDA	0.73±0.25	< MDA	< MDA	0.2±0.1	0.1±0.1
	2	0.46±0.50	0.64±0.25	< MDA	< MDA	< 0.05	< 0.03
	3	1.28±0.48	12.03±0.32	1.35±0.34	40.96±8.03	16.6±1.7	11.4±1.2
	4	1.31±0.26	28.12±0.30	1.90±0.39	40.69±8.24	57.0±6.0	39.1±4.1

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
22 (Cont'd.)	5	2.06±0.59	68.92±0.65	6.89±0.74	66.05±16.71	130±13	89.3±8.9
	6	0.55±0.52	36.69±0.45	3.95±0.53	41.19±15.24	95.0±10.0	65.2±6.9
	7	1.14±0.43	38.67±0.39	4.22±0.43	59.64±10.56	105±11.0	72.1±7.6
	7.5	1.92±0.78	19.30±0.56	2.91±0.72	23.00±16.93	45.0±5.0	30.9±3.4
	8	0.45±0.14	1.27±0.08	0.63±0.18	14.62±4.43	22.0±2.0	15.1±1.4
	9	0.24±0.12	0.75±0.06	< MDA	< MDA	0.5±0.1	0.3±0.1
23	1	1.11±0.53	65.38±0.55	7.62±0.70	99.14±16.0	240±24.0	164.8±16.5
	2	1.03±0.40	1.76±0.22	< MDA	< MDA	2.5±0.3	1.7±0.2
	3	1.23±0.20	1.64±0.11	< MDA	< MDA	4.1±0.4	2.8±0.3
	4	1.45±0.17	1.32±0.09	< MDA	< MDA	2.7±0.3	1.9±0.2
	5	1.37±0.17	3.33±0.10	0.37±0.18	< MDA	3.1±0.3	2.1±0.2
24	1	1.27±0.22	21.53±0.21	2.12±0.32	31.84±7.24	50.0±5.0	34.3±3.4
	2	1.27±0.39	0.82±0.20	< MDA	< MDA	1.8±0.2	1.2±0.1
	3	1.11±0.38	0.94±0.16	< MDA	< MDA	0.6±0.1	0.4±0.1
	4	1.41±0.19	0.94±0.10	< MDA	< MDA	1.9±0.2	1.3±0.1
	4.5	1.50±0.18	0.81±0.08	< MDA	< MDA	< 0.05	< 0.03
25	1	1.68±0.21	5.25±0.15	< MDA	< MDA	286±14	196.4±9.6
	2	1.27±0.41	1.27±0.21	< MDA	< MDA	2.1±0.2	1.4±0.1
	3	1.38±0.18	0.85±0.08	< MDA	< MDA	2.6±0.2	1.8±0.1
	4	1.47±0.36	0.95±0.19	< MDA	< MDA	1.2±0.3	0.8±0.2
	4.5	1.53±0.44	1.26±0.25	< MDA	< MDA	53.0±3.0	36.4±2.1

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	µg/U/g	pCi/g of*** Uranium
26	1	1.04±0.17	0.70±0.08	< MDA	< MDA	2.2±0.2	1.5±0.1
	2	1.53±0.16	0.80±0.07	< MDA	< MDA	1.6±0.3	1.1±0.1
	3	1.69±0.33	0.44±0.18	< MDA	< MDA	0.6±0.4	0.4±0.3
	4	2.50±0.46	0.32±0.21	< MDA	< MDA	3.3±0.3	2.3±0.2
	5	1.43±1.59	1.33±0.86	< MDA	< MDA	2.4±0.3	1.6±0.2
	6	1.35±0.19	0.86±0.09	0.29±0.22	< MDA	2.3±0.3	1.6±0.2
	7	1.62±0.16	0.78±0.07	< MDA	< MDA	0.8±0.2	0.5±0.1
27	1	1.33±0.43	1.07±0.23	< MDA	< MDA	1.9±0.2	1.3±0.1
	2	1.41±0.25	0.68±0.15	0.33±0.22	< MDA	1.4±0.2	1.0±0.1
	3	1.49±1.05	1.16±0.55	< MDA	< MDA	1.9±0.4	1.3±0.1
	4	1.52±1.00	0.50±0.52	< MDA	< MDA	1.3±0.4	1.0±0.3
	5	1.56±0.40	1.17±0.21	1.63±0.25	< MDA	62.0±3.0	42.6±2.1
	6	1.39±0.17	0.94±0.08	0.88±0.21	12.44±4.47	42.0±2.0	28.8±1.4
28	1	1.42±0.16	0.85±0.08	< MDA	< MDA	2.4±0.4	1.6±0.3
	2	0.24±1.09	0.61±0.55	< MDA	< MDA	3.1±0.4	2.1±0.3
	3	1.26±0.44	0.58±0.22	< MDA	< MDA	4.5±0.3	3.1±0.2
	4	1.64±0.48	1.25±0.25	< MDA	< MDA	5.9±0.3	4.1±0.2
	5	3.31±0.24	1.43±0.12	0.59±0.23	12.37±5.08	26.0±1.0	17.9±0.7
	6	1.63±0.17	1.01±0.09	< MDA	< MDA	10.0±1.0	6.9±0.7
29	1	1.00±0.20	0.80±0.10	0.20±0.18	< MDA	6.6±0.3	4.5±0.2
	2	1.51±0.19	0.85±0.10	< MDA	< MDA	2.6±0.2	1.8±0.1
	3	1.42±0.44	0.86±0.24	< MDA	< MDA	5.1±0.3	3.5±0.2
	4	1.27±0.19	0.69±0.09	< MDA	< MDA	1.3±0.1	0.9±0.1
	5	1.68±0.19	1.20±0.10	3.47±0.28	62.20±6.26	372.0±19.0	255.5±13.0
	5.9	1.58±0.40	0.92±0.21	< MDA	< MDA	42.0±2.0	28.8±1.4

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
30	1	1.27±0.17	0.82±0.08	0.16±0.14	< MDA	4.4±0.2	3.0±0.1
	2	1.25±0.18	0.84±0.08	< MDA	< MDA	2.8±0.2	1.9±0.1
	3	1.65±1.44	0.63±0.73	< MDA	< MDA	1.5±0.2	1.0±0.2
	4	0.71±0.56	0.64±0.18	< MDA	< MDA	1.8±0.2	1.2±0.1
	5	1.46±0.30	1.12±0.16	1.30±0.17	24.74±4.45	44±2	30.2±1.4
31	1	1.09±0.23	1.00±0.11	0.42±0.23	< MDA	3.1±0.2	2.1±0.1
	2	1.85±0.35	0.88±0.19	< MDA	< MDA	1.5±0.2	1.0±0.1
	3	1.12±0.18	0.67±0.08	0.24±0.17	< MDA	1.3±0.2	0.9±0.1
	4	1.45±0.35	0.92±0.19	< MDA	< MDA	3.0±0.2	2.1±0.1
	5	4.52±0.21	11.34±0.16	3.20±0.30	61.46±6.95	246.0±12.0	168.9±8.2
	6	1.55±0.19	1.27±0.10	0.68±0.20	18.23±5.46	50.0±3.0	34.3±2.1
32	1	1.27±0.32	0.90±0.17	< MDA	< MDA	1.3±0.2	0.9±0.1
	2	1.11±0.34	0.36±0.19	< MDA	< MDA	2.3±0.3	1.6±0.2
	3	0.33±1.12	0.77±0.55	< MDA	< MDA	2.0±0.3	1.4±0.2
	4	1.71±2.22	1.03±0.10	< MDA	< MDA	6.6±0.3	4.5±0.2
	5	1.24±0.17	0.95±0.09	< MDA	< MDA	14.0±1.0	9.6±0.7
33	1	1.46±0.34	0.99±0.18	< MDA	< MDA	2.7±0.5	1.9±0.3
	2	1.40±0.18	0.76±0.10	< MDA	< MDA	1.6±0.5	1.1±0.3
	3	1.69±0.35	0.88±0.18	< MDA	< MDA	7.3±0.4	5.0±0.3
	4	1.75±0.19	3.17±0.12	4.15±0.28	74.11±6.85	143.0±7.0	98.2±4.8
	5	1.21±0.29	1.59±0.16	1.61±0.21	20.76±6.08	70.0±4.0	48.1±2.7

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
34	1	1.26±0.15	0.98±0.07	< MDA	< MDA	5.8±0.3	4.0±0.2
	2	1.73±0.39	1.23±0.22	< MDA	< MDA	5.4±0.3	3.7±0.2
	3	5.14±0.35	1.89±0.19	< MDA	< MDA	15.0±1.0	10.3±0.7
	4	10.43±0.31	2.87±0.13	0.58±0.28	7.29±4.75	27.0±1.0	18.5±0.7
	5	1.92±0.22	2.67±0.13	< MDA	< MDA	9.5±0.5	6.5±0.3
35	1	1.15±0.16	1.24±0.08	< MDA	< MDA	3.0±0.3	2.1±0.2
	2	1.80±0.31	1.02±0.15	< MDA	< MDA	7.7±0.4	5.3±0.3
	3	1.52±0.27	1.20±0.15	< MDA	< MDA	8.3±0.4	5.7±0.3
36	1	1.40±0.39	1.05±0.20	< MDA	< MDA	2.8±0.2	1.9±0.1
	2	1.46±0.44	1.37±0.19	< MDA	< MDA	2.8±0.7	1.9±0.5
	3	3.43±0.38	1.70±0.19	2.06±0.33	23.90±8.96	55.0±3.0	37.8±2.1
	4	0.09±1.78	< MDA	< MDA	< MDA	No Sample	
	4.5	1.56±0.19	1.99±0.11	0.70±0.21	14.14±6.10	28.0±1.0	19.2±0.7
37	1	1.97±0.31	4.52±0.19	< MDA	< MDA	14.0±1.0	9.6±0.7
	2	1.19±0.34	1.03±0.17	< MDA	< MDA	2.6±0.4	1.8±0.3
	2.5	1.39±0.17	1.17±0.09	< MDA	< MDA	3.0±0.4	2.1±0.3
38	1	0.77±0.30	1.09±0.16	< MDA	< MDA	1.5±0.3	1.0±0.2
	2	0.95±0.31	0.83±0.16	2.28±0.24	< MDA	No Sample	
	3	1.29±0.88	0.49±0.48	3.67±0.65	70.49±19.60	23.0±1.0	15.8±0.7
	4	1.50±0.12	2.93±0.07	1.05±0.14	17.26±3.80	96.0±5.0	65.9±3.4
	5	0.87±0.13	1.58±0.07	< MDA	< MDA	< 1.0	< 0.7

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
39	1	1.06±0.07	0.93±0.07			3.2±0.3	2.2±0.2
	2	1.21±0.08	1.17±0.08			2.6±0.3	1.8±0.2
	3	1.26±0.09	1.82±0.13			5.8±0.6	4.0±0.4
42	2	1.51±0.11	1.09±0.08			2.2±0.2	1.5±0.1
	3	1.83±0.13	1.83±0.13			4.8±0.5	3.3±0.3
	4	1.52±0.11	2.04±0.14			7.0±0.7	4.8±0.5
	5	1.96±0.14	3.64±0.25			8.3±0.8	5.7±0.5
44	2	1.35±0.09	1.57±0.11			2.5±0.3	1.7±0.2
	3	1.79±0.13	2.53±0.18			4.4±0.4	3.0±0.3
	4	1.44±0.10	2.31±0.16			7.8±0.8	5.4±0.5
45	2	1.77±0.12	2.06±0.14			2.7±0.3	1.9±0.2
	3	1.72±0.12	2.21±0.15			4.0±0.4	2.7±0.3
	4	1.39±0.10	2.18±0.15			6.7±0.7	4.6±0.5
53	1	1.15±0.08	2.06±0.14			447.0±44.7	307±30.7
	2	1.44±0.10	1.39±0.10			31.0±3.1	21.3±2.1
	3	1.35±0.09	1.13±0.08			5.3±0.5	3.6±0.3
	4	1.48±0.10	1.28±0.09			2.6±0.3	1.8±0.2
	5	1.46±0.10	1.06±0.07			4.1±0.4	2.8±0.3
54	1	2.10±0.15	1.36±0.10			1420±142	975.1±97.5
	2	1.55±0.10	1.66±0.12			3.3±0.3	2.3±0.2
	3	1.44±0.10	1.78±0.12			6.4±0.6	4.4±0.4

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
54 (Cont'd.)	4	1.89±0.13	1.89±0.13			45.0±4.5	30.9±3.1
	5	1.11±0.08	3.15±0.22			14.0±1.4	9.6±1.0
55	1	30.90±2.20	1.51±0.11			197±19.7	135.3±13.5
	2	2.42±0.17	2.81±0.20			21.0±2.1	14.4±1.4
	3	1.74±0.12	1.03±0.07			5.4±0.5	3.7±0.3
56	1	1.80±0.13	2.06±0.14			16.0±1.6	11.0±1.1
	2	1.73±0.12	0.84±0.06			3.0±0.3	2.1±0.2
57	1	9.73±0.68	4.42±0.31			86.0±8.6	59.1±5.9
	2	2.26±0.16	1.03±0.07			8.6±0.9	5.9±0.6
	3	1.68±0.12	0.72±0.05			2.0±0.2	1.4±0.1
74	1	51.0±5.0	24.0±2.0			140.0±10.0	96.1±6.9
	2		1.8±2.0			12.0±1.0	8.2±0.7
	3	3.6±0.4	2.6±0.3			18.0±2.0	12.4±1.4
	4	2.1±0.2	4.0±0.4			9.3±0.9	6.4±0.6
	5	1.7±0.3	3.3±0.3			8.4±1.2	5.8±0.8
75	1	1.6±0.2	1.9±0.2			12.0±1.0	8.2±0.7
	2		0.9±0.1			4.3±0.4	3.0±0.3
81	1	0.62±0.48	0.87±0.20			1.3±0.2	0.9±0.1
	2	1.08±0.34	0.74±0.15			2.7±0.3	1.9±0.2
	3	1.43±0.20	0.79±0.09			1.9±0.2	1.3±0.1

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
81 (Cont'd.)	4	1.03±0.29	0.62±0.12			1.0±0.1	0.7±0.1
	5	1.61±0.21	1.02±0.09			7.4±0.4	5.1±0.3
	6	1.21±0.17	0.52±0.06			7.5±0.4	5.2±0.3
83	1	1.21±0.37	0.76±0.22			0.4±0.1	0.3±0.1
	2	1.27±0.20	0.79±9.40			1.1±0.2	0.8±0.1
	3	2.02±0.31	1.20±0.15			7.1±0.4	4.9±0.3
	4	1.64±0.19	0.80±0.09			6.7±0.5	4.6±0.3
85	1	1.30±0.27	1.05±0.12			1.6±0.2	1.1±0.1
	2	1.72±0.20	0.84±0.09			1.6±0.2	1.1±0.1
	3	2.08±0.41	0.47±0.19			4.4±0.4	3.0±0.3
	4	1.90±0.29	0.80±0.13			2.5±0.6	1.7±0.4
	5	1.30±0.23	0.61±0.10			0.2±0.1	0.1±0.1
	6	1.06±0.27	0.90±0.12			6.0±0.3	4.1±0.2
86	1	1.51±0.26	0.95±0.13			2.9±0.3	2.0±0.2
	2	1.78±0.23	0.93±0.11			1.9±0.2	1.3±0.1
	3	1.87±0.31	1.02±0.13			2.9±0.3	2.0±0.2
	4	1.90±0.23	0.79±0.09			0.2±0.2	0.1±0.1
	5	1.82±0.17	0.64±0.08			11.0±2.0	7.6±1.4
	6	1.22±0.34	0.82±0.13			0.5±0.1	0.3±0.1
100	1	1.16±0.08	1.56±0.11			7.8±0.8	5.4±0.5
	2	1.39±0.10	0.93±0.06			3.2±0.3	2.2±0.2
	3	1.61±0.11	0.73±0.05			3.1±0.3	2.1±0.2

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
100 (Cont'd.)	4	1.44±0.10	0.96±0.07			3.10.3	2.1±0.2
	5	1.45±0.10	1.11±0.08			3.5±0.4	2.4±0.3
	6	1.34±0.09	1.16±0.08			2.8±0.3	1.9±0.2
102	1	1.80±0.13	2.10±0.15			7.2±0.7	4.9±0.5
	2	1.51±0.11	1.16±0.08			3.2±0.3	2.2±0.2
	3	1.13±0.08	0.88±0.06			2.9±0.3	2.0±0.2
	4	1.80±0.13	1.15±0.08			2.9±0.3	2.0±0.2
	5	1.43±0.10	0.81±0.06			2.7±0.3	1.9±0.2
	6	1.53±0.11	0.77±0.05				
103	1	1.72±0.12	1.93±0.14			6.2±0.6	4.3±0.4
	2	0.48±0.05	0.35±0.02			3.7±0.4	2.5±0.3
	4	< 0.06	0.89±0.06			3.4±0.3	2.3±0.2
	6					2.8±0.3	1.9±0.2
104	1	2.32±0.16	3.44±0.24			10.6±1.1	7.3±0.8
	2	1.75±0.12	1.32±0.09			2.6±0.3	1.8±0.2
	3	1.54±0.11	1.09±0.08			2.6±0.3	1.8±0.2
	4	1.90±0.13	1.21±0.08			2.1±0.2	1.4±0.1
	5	2.08±0.15	1.15±0.08			2.6±0.3	1.8±0.2
112	1	6.18±0.43	18.8±1.3			68.0±6.8	46.7±4.7
	2	4.10±0.30	14.2±1.0			44.0±4.4	30.2±3.0
	3	6.15±0.43	2.28±0.16			39.0±3.9	26.8±2.7
	4	2.28±0.16	3.30±0.21			13.0±1.3	8.9±0.9
	5	1.52±0.11	1.41±0.10			5.9±0.6	4.1±0.4

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
113	1	1.96±0.14	9.96±0.70			28.0±2.8	19.2±1.9
	2	1.74±0.12	1.84±0.13			3.1±0.3	2.1±0.2
	3	1.87±0.13	1.04±0.07			1.8±0.2	1.2±0.1
	4	1.77±0.12	1.25±0.09			1.9±0.2	1.3±0.1
114	1	354.0±25.0	25.4±1.8			276.0±27.6	189.5±19.0
	2	15.3±1.1	45.4±3.2			182.0±18.2	125.0±12.5
	3	10.4±0.7	6.04±0.42			53.0±5.3	36.4±3.6
115	1	1.72±0.12	4.94±0.34			36.0±3.6	24.7±2.5
	3	1.27±0.09	2.23±0.16			201.1±20.±	138.0±13.8
	4	2.16±0.15	7.77±0.54			313.0±31.3	214.9±21.5
	5	1.38±0.10	3.26±0.23			48.0±4.8	33.0±3.3
116	2					223.0±22.3	153.1±15.3
	4	1.76±0.12	0.58±0.04			52.0±5.2	35.7±3.6
	5	2.41±0.17	2.54±0.08			21.0±2.1	14.4±1.4
	6	1.93±0.14	3.08±0.22			20±2.0	13.7±1.4
117	1	0.40±0.06	0.41±0.03			1.5±0.2	1.0±0.1
	2	0.86±0.06	0.48±0.03			2.0±0.2	1.4±0.1
	3	1.63±0.11	1.11±0.08			4.0±0.4	2.7±0.3
	4	1.51±0.11	1.17±0.08			4.1±0.4	2.8±0.03
119	1	1.14±0.08	1.28±0.09				
	2	1.51±0.10	1.29±0.09				
	3	0.98±0.07	0.78±0.005				

TABLE 9
(Cont'd.)

RADIOACTIVITY CONCENTRATIONS OF SOIL SAMPLES FROM NBL-NJ SITE

		Ge(Li) Spectra				Fluorometric Analyses	
Sample ID #	Depth (Feet)	^{232}Th* Chain (pCi/g)	^{226}Ra** Chain (pCi/g)	^{235}U pCi/g	^{238}U pCi/g	μgU/g	pCi/g of*** Uranium
119 (Cont'd.)	4	1.44±0.10	1.11±0.08				
	5	2.75±0.19	0.93±0.06				
	6	5.72±0.40	1.02±0.07				
	7	7.39±0.52	1.18±0.08				
	8	5.38±0.38	0.83±0.06				
122	~ 0.2	1.80±0.13	4.82±0.34				
127	~ 0.2	1511±106	7.06±0.49				
128A	~ 0.2	470.0±33.0	3.87±0.27				
128B	~ 0.4	123.0±9.0	2.41±0.17				
129	~ 0.2	0.34±0.07	0.89±0.06 - This sample indicated 3460.0±240.0 pCi/g of ^{241}Am.				

*From ^{228}Ac gamma line of 908.0 keV, equilibrium assumed.

**From ^{214}Bi gamma line of 609.0 keV, equilibrium assumed.

***Calculated from the fluorometric analysis data using 0.6867 pCi/μg as the conversion factor for uranium in equilibrium.

TABLE 10
(See Figure 5 for Sample Locations)†

RADIOACTIVITY CONCENTRATION OF FILTERED SURFACE WATER SAMPLES AND SURFACE WATER RESIDUE SAMPLES FROM NBL SITE

(Activity concentration in pCi/g except where stated otherwise)

	Ge(Li) Spectra					Fluorometric Analysis for Uranium	pCi/g or pCi/mℓ (Uranium)*	
Sample ID#	^{235}U	^{238}U	^{226}Ra Chain	^{232}Th Chain	^{40}K			Remarks
151W	< MDA	< MDA	< MDA	< MDA	< MDA	1.4 μg/mℓ	0.96	Filtered water
151R	< MDA	< MDA	< MDA	< MDA	< MDA	57 μg/g	39.14	Residue dried
152W	0.5±0.3	< MDA	< MDA	< MDA	< MDA	0.005 μg/mℓ	0.003	Filtered water.
152R	< MDA	< MDA	< MDA	< MDA	< MDA	0.8 μg/g	0.55	Residue dried
157W	< MDA	< MDA	< MDA	< MDA	< MDA	1.5 μg/mℓ	1.03	Filtered water
157R	< MDA	< MDA	4.94±0.34	4.06±0.52	24.8±1.9	12 μg/g	8.24	Residue dried
158W	< MDA	< MDA	< MDA		0.27±0.08			Filtered water
158R	< MDA	< MDA	1.39±0.79	< MDA	45.2±6.1	8.1 μg/g	5.56	Residue dried
159W	< MDA	< MDA	< MDA	< MDA	< MDA			Filtered water
159R	0.77±0.52	< MDA	1.57±0.20	1.09±0.35	23.2±1.8	24 μg/g	16.45	Residue dried
160S	1.49±0.20	23.3±3.6	0.85±0.07	1.31±0.12	10.7±0.5			Sludge, dried.
161W	< MDA	< MDA	< MDA	< MDA	< MDA	2.2±0.1E-3 μg/mℓ	1.51±0.07	Filtered water Catch basin #4
161R	< MDA	< MDA	< MDA	< MDA	38.9±21	95 μg/mℓ	65.24	Residue dried

TABLE 10
(Cont'd.)

RADIOACTIVITY CONCENTRATION OF FILTERED SURFACE WATER SAMPLES
AND SURFACE WATER RESIDUE SAMPLES FROM NBL SITE

Sample ID#	Ge(Li) Spectra ^{235}U	^{238}U	^{226}Ra Chain	^{232}Th Chain	^{40}K	Fluorometric Analysis for Uranium	pCi/g or pCi/mℓ Uranium*	Remarks
162W	5.96±2.89E-2	7.66±5.35E-1	< MDA	< MDA	< MDA	4±0.3E-3 μg/mℓ	2.75±0.21E-3	Catch basin west of main bldg., pitchblende area. Filtered water.
162R	< MDA	< MDA	< MDA	< MDA	< MDA	407±15 μg/g	279.49±10.30	Residue dried
163	< MDA	2790±140	< MDA	< MDA	< MDA	4±1 μg/g	2.75±0.69	Sewer sample (small wt. 0.123 g). Mass spectrum indicates anomalous isotopic ratio for U. See Table 5D.

†In Figure 5, the sample location numbers do not include W, R and S. For example, 151W is identified as 151.

*Calculated from fluorometric data using the conversion factor 0.6867 pCi/μg for uranium assuming equilibrium. If isotopic ratios for uranium are higher than the ratios of natural uranium, then the total uranium activity will be higher. For uranium isotopic atom ratios, see Table 5D.

TABLE 11

NBL SOIL SAMPLE LOCATION COORDINATES
(X, Y ORIGIN AT JERSEY AVENUE, WEST FENCE CORNER)

Measurements in feet

Location No.	X	Y	Location No.	X	Y
1	118	443	31	137	290
2	135	429	32	128	305
3	148	423	33	137	321
4	161	415	34	131	332
5	133	466	35	147	349
6	151	458	36	131	351
7	163	452	37	146	368
8	189	477	38	135	381
9	174	483	39	101	167
10	163	488	40	28	166
11	146	496	41	30	126
12	195	503	42	26	42
13	185	508	43	64	133
14	169	518	44	88	112
15	210	518	45	66	85
16	201	520	46	64	19
17	188	533	47	90	51
18	174	539	48	268	19
19	225	543	49	247	39
20	217	549	50	263	66
21	203	559	51	274	114
22	203	541	52	274	114
23	284	515	53	298	184
24	240	474	54	264	218
25	217	473	55	279	348
26	122	188	56	210	346
27	136	226	57	231	331
28	133	243	58	306	325
29	138	258	59	363	394
30	132	275	60	375	310

TABLE 11
(Cont'd.)

NBL SOIL SAMPLE LOCATION COORDINATES
(X, Y ORIGIN AT JERSEY AVENUE, WEST FENCE CORNER)

Measurements in feet

Location No.	X	Y	Location No.	X	Y
61	332	312	91	60	334
62	348	252	92	81	445
63	383	235	93	81	519
64	320	194	94	101	546
65	394	137	95	141	525
66	415	27	96	101	473
67	371	27	97	112	436
68	317	109	98	193	402
69	279	439	99	210	486
70	306	436	100	261	479
71	378	438	101	248	524
72	185	36	102	275	503
73	158	59	103	308	485
74	139	140	104	282	535
75	195	351	105	217	575
76	92	213	106	163	565
77	17	223	107	308	563
78	20	300	108	313	514
79	19	328	109	369	490
80	17	376	110	354	539
81	24	415	111	345	620
82	24	441	112	270	591
83	25	488	113	262	571
84	11	534	114	257	591
85	49	529	115	143	400
86	56	465	116	236	569
87	58	417	117	RUTGERS	
88	83	378	118	RUTGERS	
89	98	337	119	PRINCETON	
90	83	299	120	PRINCETON	

TABLE 11
(Cont'd.)

NBL SOIL SAMPLE LOCATION COORDINATES
(X, Y ORIGIN AT JERSEY AVENUE, WEST FENCE CORNER)

Measurements in feet

Location No.	X	Y	Location No.	X	Y
121	PRINCETON		144	Offsite	
122	233	196	145	Offsite	
123	278	599	146	124	228
124	206	196	147	125	158
125	199	115	148	266	344
126	181	267	149	233	196
127	248	280	150	233	196
128	245	299	151	388	-14
129	278	366	152	103	10
130	373	580	153	206	196
131	429	239	154	206	196
132	516	13	155	199	115
133	19	-8	156	199	115
134	-34	59	157	139	140
135	61	545	158	298	184
136	Offsite		159	264	218
137	Offsite		160	125	158
138	Offsite		161	125	158
139	Offsite		162	124	224
140	Offsite		163	413	186
141	Offsite		164	208	361
142	Offsite		165	208	374
143	Offsite				

TABLE 11
(Cont'd.)

NBL SOIL SAMPLE LOCATION COORDINATES
(X, Y ORIGIN AT JERSEY AVENUE, WEST FENCE CORNER)

Measurement in feet

Location No.	X	Y	Location No.	X	Y
Well A	199	240	Well H	266	382
Well B	141	94	Well I	12	342
Well C	263	36	Well J	249	489
Well D	134	277	Storm Drains	119	159
Well E	210	336		124	234
Well F	274	276		392	311
Well G	384	254			