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# CURSORY RADIOLOGICAL ASSESSMENT BATTELLE COLUMBUS LABORATORY DECOMMISSIONING AND DECONTAMINATION PROJECT COLUMBUS, OHIO

MASTER

ENVIRONMENT, SAFETY, AND HEALTH DEPARTMENT
Technical Support Section
ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS

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October 1988

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## ABSTRACT

This document reports on the results obtained from a cursory radiological assessment of various properties at the Battelle Columbus Laboratory, Columbus, Ohio. The cursory radiological assessment, which also included a chemical assessment component, was performed at the King Avenue and West Jefferson sites by Argonne National Laboratory personnel as part of a preliminary investigation for the Battelle Columbus Laboratory Decommissioning and Decontamination Project.

The radiological assessment of Battelle Columbus Laboratory's two sites included conducting interior and exterior building surveys and collecting and analyzing air, sewer system, and soil samples. Direct radiological surveys were made of floor, wall, and overhead areas. Smear surveys were made on various interior building surfaces as well as the exterior building vents. Air samples were collected in select areas to determine concentrations of Rn-222, Rn-220, and Rn-219 daughters, in addition to any long-lived radioactive particulates. Radon-222 concentrations were continuously monitored over a 24-hr period at several building locations using a radon gas monitoring system. The sanitary sewer systems at King Avenue, West Jefferson-North, and West Jefferson-South were each sampled at select locations. All samples were submitted to the Argonne Analytical Chemistry Laboratory for various radiological and chemical analyses. Environmental soil corings were taken at both the King Avenue and West Jefferson sites to investigate the potential for soil contamination within the first 12-inches below grade. Further subsurface investigations at the West Jefferson-North and West Jefferson-South areas were conducted using soil boring techniques. A total of twenty bore holes were drilled, using 3-inch hollow stem augers, to depths down to 12-ft below grade. Split-spoon samples were taken from these bore holes at continuous 1-ft increments and sent back to Argonne National Laboratory for analysis. Each bore hole was also logged using a 2 x 2-inch NaI(Tℓ) detector and associated electronics.

# CURSORY RADIOLOGICAL ASSESSMENT
# BATTELLE COLUMBUS LABORATORY DECOMMISSIONING
# AND DECONTAMINATION PROJECT

## INTRODUCTION

Battelle Memorial Institute initially performed work for the Office of Scientific Research and Development during 1942 under Contract No. OEMsr-85. In April of 1943 work was performed for the United States of America under Contract No. W-7405-ENG-92. This was work primarily under the jurisdiction of the War Department as part of the Manhattan Engineer District Project (MED). Subsequent work was carried on under the Department of Energy and its predecessor organizations, Energy Research and Development Administration (ERDA) and the Atomic Energy Commission (AEC).

Operations were conducted at two sites: the King Avenue Facility located in the west-central portion of the City of Columbus, Ohio at 505 King Avenue and the West Jefferson Site located approximately 15 miles west of the King Avenue site on the Georgesville-Plain City Road, one mile south of Interstate Highway 70 (Fig. 1).

At the present time the Decommissioning and Decontamination Project is concerned with some fifteen buildings, their environs, and appurtenances, of the Battelle Columbus Division, that had been involved in radiological operations during the aforementioned era. This includes nine buildings at the King Avenue site (Buildings A, 1, 2, 3, 4, 5, 6, 7, and 9) and six buildings at the West Jefferson site (Buildings JN-1, JN-2, JN-3, JS-1, JS-10, and JS-12).

During July 1987, the Department of Energy's Chicago Operations Office tasked Argonne National Laboratory's Radiological Survey Group of the Environmental Safety and Health Department to conduct a cursory radiological assessment of the fifteen buildings. This involved radiological surveys of walls, floors, overheads; bore hole sampling and logging; environmental corings; sewer and drain sampling. The bore hole sampling was accomplished using "split spoon" samples in conjunction with hollow stem augers and involved the West Jefferson site only. Environmental corings were taken at select locations at the King Avenue and West Jefferson sites. The sewer

samples were submitted for radiological and chemical analyses. The chemical analyses included quantitative measurements for heavy metals and semivolatiles. The primary purpose of this cursory radiological assessment was to provide the USDOE - Chicago Operations Office with an independent evaluation regarding the magnitude and extent of radioactive contamination existing in facilities targeted as part of the planned D&D effort.

## RADIOLOGICAL ASSESSMENT

### GENERAL DISCUSSION

The cursory radiological assessment of the Battelle Columbus Laboratory's two sites included conducting interior and exterior building surveys and collecting and analyzing air, soil, and sewer system samples. Direct radiological surveys, using portable instrumentation as described in the next section, were made of floors, walls up to 7 ft off the floor and randomly selected overhead areas. Smear surveys were performed at randomly selected locations on interior surfaces and from selected areas and items where contamination was found by direct surveys. Air samples were collected in select areas to determine concentrations of radon (Rn-222), thoron (Rn-220), and actinon (Rn-219) daughters, as well as long-lived radioactive particulates. Additionally, radon (Rn-222) concentrations were continuously monitored at several sampling locations for a 24-hr period using a radon gas monitoring system.

Environmental soil corings were taken from each quadrant of the property at the periphery of the fifteen buildings located on the King Avenue and West Jefferson sites. Two off-site samples were collected at a park (Fig. 1) to determine background soil concentrations of the naturally occurring radionuclides in the Columbus, Ohio area. Water and sludge samples were taken from sewer lines, sumps and outfalls at both sites and analyzed for the presence of radioactive and chemical (metals and semivolatiles) contamination. Detailed descriptions of the instruments used in all radiological surveys and the computational and analytical procedures employed are provided in Appendices 1-4.

## INSTRUMENTATION

Three types of portable survey instruments were used to conduct the direct radiological surveys: (1) gas-flow (propane) proportional detectors with window areas of 100 $cm^2$ and 325 $cm^2$ (0.85 $mg/cm^2$), utilizing Eberline® PAC-4G-3 electronics, were used to survey for alpha and/or beta-gamma radiation; (2) NaI(Tl) crystal detectors, 2 inches in diameter by 2 mm thick with an 6.9 $mg/cm^2$ aluminum window, Eberline PG-2 with Eberline PRM-5-3 electronics were used to survey for low-energy x-ray and gamma radiation; and (3) NaI(Tl) crystal detectors, 1 inch in diameter by 1 inch thick, Eberline PRM-7 μR meter, were used to measure the ambient external penetrating radiation field (in units of μR/h) at 3 ft above grade level. The first two instruments were used to survey the floors and walls to a height of 7 ft and selected areas of overheads. A general survey of the facility was performed with the micro-R meter to establish general radiation fields. All three types of portable instruments were operated utilizing earphones for audible detection. These instruments and associated calibration procedures are detailed in Appendices 1 and 2.

## SMEAR SURVEYS

Dry smears were taken at representative locations in each area using 4.25-cm-diameter filter papers (Whatman #1*). A standard smear sample is obtained by applying moderate pressure with the tips of the first two fingers to the back of the filter paper and covering an area of approximately 1 $ft^2$. A total of 566 smears were taken on original structures and components such as walls, floors, overhead beams and vents. A 100 $cm^2$ smear was taken from random areas or objects indicated by a portable survey instrument to have a radiation levels notably above expected backgrounds. A 100 $cm^2$ smear was also taken if the surface was identified as extremely dusty.

To expedite to processing of the numerous smear samples collected, two counting techniques were employed using two types of counters. A large-area

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®Eberline Instrument Company, Santa Fe, N.M. 87501.

*Cellulose fiber filter manufactured by Whatman Laboratory Products, Inc., Clifton, N.J. 07014.

(~325 $cm^2$), thin window (0.85 $mg/cm^2$) gas-flow proportional counter (sensitive to alpha and/or beta-gamma radiation) was used to make an initial count on groups of smears. For confirmatory counts on individual smears noted to be above the expected background level, a Nuclear Measurement Corporation* Model PC-5 or Model 3A, $2\pi$ internal gas-flow proportional counter (PC counter) with a thin double aluminized Mylar window (referred to as a Mylar spun top) was used.

Initial counts were made with the large-area counter in groups of ten smears at a time. Smears from any group indicating a reading above the instrument background were then counted individually in a PC counter. In addition, at least two smears, randomly selected from each group of ten, were counted in a PC counter. All smears from the areas or objects with noted elevated direct survey readings were counted individually in a PC counter. More detailed descriptions of the counters and the counting and calibration techniques are presented in Appendix 2.

## AIR SAMPLES

Air particulate samples were collected using a commercial vacuum cleaner, modified by ANL, to pull air through a filter medium (Hollingsworth Vose** HV-70 or LB-5211).

A total volume of 26.7 $m^3$ of air was sampled at a flow rate of 40 $m^3/h$. A 10% portion (inner 5 cm diameter) of the filter medium was removed after collection and counted for both alpha and beta-gamma activity in a PC counter utilizing the Mylar spun top. Concentrations of radon (Rn-222) daughters, thoron (Rn-220) daughters, and the presence of any long-lived airborne radioactivity were determined, based on the results of several counts of each sample at specified time intervals post sampling.

Air-particulate samples were also collected concurrently using a Millipore‡ membrane filter. The sample was drawn at a flow rate of 1 $m^3/h$ for 90 minutes. A portion of each membrane filter sample was used for alpha

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*Nuclear Measurements Corporation, Indianapolis, Ind. 46218.

**Hollingsworth and Vose, Walpole, Mass. 02032.

‡Millipore Corporation, Bedford, Mass. 01730.

spectral analysis to determine the actinon (Rn-219) daughter concentration. Additionally, the radon concentration, was monitored continuously for at least a 20-h period at several select locations in various buildings. Eberline Radon Gas Monitors (RGM-1 and RGM-2) were used to measure the radon concentrations. Details of air sampling techniques and associated calculations are given in Appendix 3.

## SEWER, STORM AND WASTE SAMPLES

The sanitary sewer systems at King Avenue, West Jefferson-North, and West Jefferson-South were each sampled at select locations. There were four (4) liquid and two (2) sludge samples taken at the King Avenue site; four (4) liquid and two (2) sludge samples taken at West Jefferson-North; and two (2) liquid and two (2) sludge taken at West Jefferson-South. All sixteen (16) samples were submitted to the Argonne Analytical Chemistry Laboratory for various analyses (gamma spectral analysis, uranium fluorometric analysis, or inorganic/organic analysis). The King Avenue liquid samples are identified as 21LK003; 21LK004; 21LK007; and 21LK008. The King Avenue sludge samples are identified as 21DK005 and 21DK006. The four liquid samples taken at West Jefferson-North are identified as 21LJ009; 21LJ011; 21LJ012; 21LJ013 and the two sludge samples as 21DJ010 and 21DJ014. The two liquid samples taken at West Jefferson-South are identified as 21LJ015 and 21LJ018 and the two sludge samples as 21DJ016 and 21DJ017.

## SUBSURFACE INVESTIGATION

- Environmental Soil Corings

  Sixteen (16) environmental soil corings were taken at the King Avenue site; eight (8) at the West Jefferson-North site; and nine (9) at the West Jefferson-South site. In addition, two background corings were taken at Goodale Park in Columbus, Ohio (Fig. 2). These samples (4-inch-diameter by 12-inch-deep corings) were collected using a 4-inch-diameter, 6-inch-long right circular cylinderical cutting tool commonly used to cut cup holes on golf course greens. These are considered to be undisturbed samples. Each soil core was taken in four

segments for analysis. Starting from grade, three 2-inch segments were cut, bagged and marked A, B and C, respectively; the final 6-inch segment was cut, bagged and marked D. The segmented coring technique is used to determine if contaminant migration (percolation) may have occurred, to reduce the dilution of lower-level soil with the upper-level segments with respect to the surface deposition of the contaminants (or vice versa), and to reveal if any overburden or backfill had been added. The background samples were collected in order to establish the expected background concentrations for the contaminant radionuclides in this area. The sixteen (16) environmental corings from the King Avenue site were identified as 21SK019 through 21SK034; at the West Jefferson site 21SJ035 through 21SJ051; and the two background corings taken at Goodale Park 21SB-1 and 21SB-2.

In preparation for analysis, each soil sample was weighed in its "as collected" state, dried for approximately 48 h at 80°C, and then reweighed to determine the dry weight. Each sample was then put into a mill jar (8.7 liters) and milled for up to two hours. At no time were any rocks in these samples crushed, ground or pulverized, since this would act as a diluent and hence lower the reported concentrations of deposited radioactive material. After sufficient milling, the sample material was sieved. Each fraction (rocks and dross vs. fines) was bagged and weighed separately. Additional details of sample processing are given in Appendix 4.

All of the soil samples were analyzed at ANL. Aliquots of the milled material from the soil samples were loaded into screw-top plastic containers; aliquots of a measured level, generally about 100 g depending on the bulk density of the milled and sieved soil, were prepared for gamma spectral analysis; and aliquots of 5 g were prepared for radiochemical (fluorometric) analysis. A select number of samples with high levels of total uranium were isotopically analyzed. Every effort was made during sample preparation to prevent cross contamination. Soil samples suspected of containing elevated levels of radioactivity were processed in equipment separate from soil samples thought to contain background or near background levels. All processing equipment was scrubbed and air dried before introduction of the next sample.

- Environmental Soil Borings

Subsurface investigation in the West Jefferson-North and West Jefferson-South areas was conducted using soil-boring techniques. A total of 20 bore holes were drilled, using 3-inch hollow stem augers, to depths down to 12 ft below grade. Split-spoon (1½-inch inside diameter) samples were taken from these bore holes at continuous 1-ft increments. Each bore hole was logged using a 2x2-inch NaI(Tl) detector in conjunction with a Nuclear Data (ND-100) multichannel analyzer or a Nuclear Data (ND-6) portable multichannel analyzer. Measurements were made at grade level and at 2-ft increments thereafter. The bore-hole samples were identified by a three part number: (1) the site number (21); (2) the sequential bore-hole number preceded by an SJ designating soil West Jefferson site (e.g., SJ-066); and (3) a number designating the maximum depth of the sample in feet (e.g., 8 equates to the sample taken from 7.0 to 8.0 ft below grade). The 20 bore holes were identified as 21-SJ-052 through 21-SJ-071. All bore-hole samples were processed, weighed, loaded and submitted for analysis in the same manner as described in the preceding section involving environmental soil coring operations.

## RADIOLOGICAL SURVEY RESULTS

### GENERAL DISCUSSION

The detailed results of the cursory radiological surveys conducted in the fifteen (15) buildings located on the King Avenue and West Jefferson sites are discussed in the following subsections. The discussions are keyed to Tables and Figures presented at the end of the main text. Since the radiological survey was cursory in nature, the results provided in this report must be considered in this light, distinct from those results ordinarily expected of a full comprehensive radiological assessment.

The primary task of the radiological survey was the direct survey of interior floors, walls and select overheads with portable instrumentation. Smear surveys were performed at randomly selected locations on interior

surfaces as well as on select areas where background radiation and/or radioactivity was higher than expected. Particulate air samples were collected to determine concentrations of radon daughters (Rn-222), thoron daughters (Rn-220), actinon daughters (Rn-219) and long-lived activity. Radon Gas Monitors were run continuously for approximately 24 hrs at select locations to determine the temporal variations in the Rn-222 concentrations and to independently confirm the measured Rn-222 concentrations with those determined from the air particulate samples taken. Only buildings, and specified areas within the designated buildings, where work was performed for the Department of Energy (DOE) or its predecessor organizations [e.g., Energy Research and Development Administration (ERDA), Atomic Energy Commission (AEC), Manhattan Engineer District (MED) or the Office of Scientific Research and Development (OSRD)] were surveyed.

## CURSORY RADIOLOGICAL CHARACTERIZATION OF BUILDINGS SURVEYED

A complete tabulation of the survey results for each building surveyed can be found in Appendix 6. Discussions in this section of the report will be limited only to those significant findings made in the course of the building surveys. Although every attempt was made to identify and estimate the magnitude of radioactive contamination present, there were some obstacles which prevented this objective from being completely achieved. A number of floors, especially in Building 3, were intentionally covered with an epoxy/resin material to immobilize existing contamination and prevent it from spreading. The floor covering also served to limit the detection capabilities for alpha and beta particle radiation. Surveys with the PRM-5-3 (thin crystal sodium iodide detector) proved to be quite useful in detecting the low energy $x/\gamma$-rays emitted by the underlying contamination. The degree of contamination present under the floor sealant is assumed to be rather extensive in magnitude. A second problem encountered during the survey process involved radiation interferences (shine) from certain areas of some buildings. In these instances, it became virtually impossible to survey some rooms due to the radiation background interferences.

The results of all surveys performed with the PAC-4G-3 instruments are reported in dis/min-100 $cm^2$. There are a number of underlying assumptions implied in converting from cts/min to dis/min. The spatial distribution of

the contamination on a given surface, the energy of the particulate radiation being detected, and self-absorption are some of the factors which influence the use of an appropriate conversion value. In this work, it is assumed that the surface contamination was exclusively normal uranium and the appropriate conversion values (yield values) for the alpha and beta-gamma measurements, using the PAC-4G-3, are 37% and 42%, respectively.

- Building A -- The survey results from Building A showed spots of floor contamination up to 9500 dis/min-100 $cm^2$ beta-gamma contamination and exposure levels to 50 uR/h. A drain line under the floor of Room 492 measured 20-40 uR/h and 6000 dis/min-100 $cm^2$ beta-gamma. A room ventilation duct (rm 463) had a measured exposure rate up to 22 uR/h. Rooms containing face brick and mortar showed increased radiation levels above ambient background with the PRM-5-3 and PRM-7.

- Building 1 -- Fixed contamination was found on the ground floor of the foundry, levels as high as 9600 dis/min-100 $cm^2$ beta-gamma. Room 1106 showed contamination with the PRM-5-3 up to 5000 cts/min.

- Building 2 -- High levels of floor contamination were found in the basement of the building up to 71,000 dis/min-100 $cm^2$ beta-gamma and 20,000 cts/min with the PRM-5-3. A drain line in Room 2005 exhibited elevated radiation levels. Smear surveys were performed throughout the building including floors, walls, overheads, and ventilation ducts. No removable contamination was identified from the smear surveys. The measured radon-222 concentration on the ground floor was 1.2 pCi/ℓ.

- Building 3 -- High levels of floor contamination were found throughout the building. Special problems were encountered with respect to the extensive use of floor sealant, especially in areas of the basement. Floor contamination levels were measured up to 119,000 dis/min-100 $cm^2$ (PAC-4G-3) and 50,000 cts/min (PRM-5-3). A sink trap in Room 3112 had an exposure rate of 1,500 uR/h. No removable contamination was identified from the 69 smears taken. The measured radon-222 concentration in the building basement was 0.7 pCi/ℓ.

- Buildings 4, 5, 6, 7, and 9 -- Except for a few isolated spots of floor contamination, background radiation levels were measured in these

buildings. In a couple of rooms in Bldgs. 4 and 5 exposure rates up to 140 uR/h were measured. An RGM-1 was set up and run for 24 hours in the Bldg. 5 machine shop. The maximum radon-222 concentration measured was 2.1 pCi/ℓ. A drain line in Room 6034 of Bldg. 6 exhibited an elevated radiation level of 2,400 dis/min-100 $cm^2$ beta-gamma. A spot on the floor in Room 6049 of Bldg. 6 showed some fixed alpha contamination up to 10,000 dis/min-100 $cm^2$ and some beta-gamma contamination of up to 4,000 dis/min-100 $cm^2$. The measured exposure rate in this particular room was 400 uR/h. No removable contamination was identified in any of the rooms surveyed.

- Building JN-1 -- Radiation fields measured with the PRM-5-3 and the PRM-7 varied significantly depending upon the location within the building. Significant levels of spot floor contamination existed in the high bay area of the building, up to 1.2E6 dis/min-100 $cm^2$ beta-gamma. Shielded radiation sources, especially in the area around the hot cells, produced elevated radiation backgrounds which made the survey process difficult. No significant removable contamination was identified from the 28 smears taken. Four particulate air samples were taken in JN-1: machine shop; high bay area; and two in the hot cell area of the building. The results of these air samples are provided in Table 1. The RGM-1 was set up and run in the high bay area and showed a maximum concentration over a 24-hour period of 1.6 pCi/ℓ.

- Building JN-2 -- A few spots of floor contamination were identified in the subcritical assembly room and in Rooms 2118 and 2112. No significant removable contamination was identified on any of the 56 smears taken in the building. Two building particulate air samples were taken, one on the first floor and the other on the second floor. The results are provided in Table 1.

- Building JN-3 -- Many areas of floor contamination existed throughout the building. A spot on the second floor walkway exhibited a contamination level of 357,000 dis/min-100 $cm^2$ beta-gamma. The measured exposure rate in the north end of the reactor pool was 200 uR/h. No significant removable contamination was identified in the

93 smears taken in the building. The results of air samples taken are provided in Table 1. The RGM-2 was set up and run at four different locations within the building. The maximum radon-222 concentration measured over a 24-hour period was 1.0 pCi/ℓ.

- Buildings JS-1, JS-10, and JS-12 -- Radiation surveys conducted in these buildings did not reveal the presence of any surface contamination. An air sample taken near pit #3 of Building JS-1 showed a radon-222 concentration of 5.3 pCi/ℓ. The RGM-1 was set up near pit #3 and run for 24 hours to confirm the results of the air sample taken. The RGM-1 measured a maximum radon-222 concentration of 6.1 pCi/ℓ. These radon concentrations are at least five times those measured anywhere else on either the King Avenue or West Jefferson sites.

## SAMPLING PLAN AND RESULTS OF SAMPLE ANALYSES

### SCOPE OF SAMPLING PLAN

The sampling plan used at the Battelle Columbus Laboratory (BCL) sites was designed to provide radiological and nonradiological data that could be used to (1) satisfy NEPA requirements and (2) evaluate BCL's Decontamination and Decommission (D&D) assessment. The sampling plan addresses only those sites which were submitted to the USDOE for D&D operations. Sample collection was performed in a biased manner: that is, sampling locations were selected that had the greatest potential for contamination. Soil, sediment/sludge, and liquid media were sampled.

All samples were collected as grab samples, and recorded according to sample-type, location, and intended analysis(es). The individual sampling locations were chosen after historical information such as site use, associated industrial processes, disposal practices, and meteorological data were collected and evaluated. Goodale Park was chosen as a suitable site for obtaining soil samples to be used as background comparisons with all soil samples analyzed. The park is approximately three-quarters of a mile southeast of BCL (King Avenue), and is situated in an urban/residential

environment similar to BCL. It is largely a flat, grassy area with scattered hardwood trees, a large man-made pond, and a number of recreational facilities. Two shallow subsurface soil samples (21SB-1; 21SB-2) were collected near the center of the park in an open grassy section. These samples were analyzed using gamma-ray spectroscopy and uranium fluorometric techniques to provide a background reference standard for all other subsurface soil samples analyzed during the project.

King Avenue Samples:

Buildings 1, 2, and 3, and sections of Buildings A and 4 at King Avenue were historically associated with the major quantity of work with uranium and thorium, and therefore of most concern. In particular, Buildings 2 and 3, which were used as metalworking shops and various metallurgy labs, and Building 1 which was the foundry, had processed the greatest amount of radioactive material and probably a significant quantity of hazardous materials, such as solvents, acids, and assorted chemicals. All liquid and sediment/sludge samples from King Avenue were analyzed for total uranium, heavy metals, and semivolatile organic compounds.

Special attention was given to the waste stream process. After considerable review, it was decided that the most efficient method of sampling was to concentrate only on the major sewer line junctions. Sanitary system samples were collected at each of the discharge lines from the specified buildings. Diagrams submitted by BCL depicted several discharge lines for each facility. It was also understood by ANL personnel that not all of the changes to the underground discharge lines had been maintained up-to-date over the years. Because of the large number of building discharge lines, and the possibility of lost or unknown plumbing, the two major junctions of the sewer system were chosen to be sampled. These junctions, the North and South Lift Stations, essentially handle the entire volume of the site's discharged wastewater that enters the city's sanitary system. Sampling at these locations would possibly indicate (but not isolate) existing upstream problems. Liquid samples (21LK007 and 21LK008) were collected from the South and North Stations, respectively. In addition, Buildings 2 and 3 were specifically sampled from their sumps. Both liquid and sediment/sludge samples (21LK003, 21DK006, 21LK004, 21DK005) were obtained from each sump. Sump sludge samples were also analyzed by mass spectrometry to determine the uranium isotopic composition.

Another decision which had to be made was whether or not to drill boreholes on the King Avenue site. Based on the lack of evidence that onsite burial of hazardous wastes was ever practiced at the King Avenue site, it was decided that borehole drilling and sample taking was not warranted. Instead, soil corings were taken at various locations around the site buildings. The original intent was to collect a total of four core soil samples around each of the specified buildings. Due to the vast amount of asphalted parking lots and spaces, little sampling area was available immediately surrounding the majority of the King Avenue buildings. As a result, the soil corings (21SK019-21SK034) were taken along the perimeter of the King Avenue site. These samples were analyzed using a combination of analytical techniques which included gamma-ray spectroscopy and uranium fluorometric analyses.

West Jefferson Samples: North and South Areas

Site topography and drainage were key factors in developing the sampling plan for this site. Filter bed systems collected sanitary and chemical waste from the various buildings. These systems are also located in close proximity to Big Darby Creek. The north and south area systems may, in fact, be on the flood plain. In addition, storm drains from the north area empty directly into Battelle Lake, which it borders.

Hydrogeologic information supplied by BCL prompted all subsurface samples to be obtained from the positions noted on Figs. 7, 8, 9, and 10. These positions were described as being on the "downside" of a hydraulic gradient. Samples taken from these selected locations may provide some indication about any contaminant migration toward Big Darby Creek. These samples were taken to a maximum depth of 12 feet below grade. Each of these samples was designated for a uranium fluorometric and gamma spectroscopic analysis. Considering the overall size of the West Jefferson site and the economy of sampling, the perimeter sampling concept was employed.

North Area Samples:

Radioactive material was used in each of the buildings at the north area. Buildings JN-1, 2, and 3 were nuclear reactor research facilities, which included a reactor, several labs, a special nuclear material (SNM) storage vault, and a number of hot cells. A retired plutonium facility (JN-4) is also a part of this area and is currently operating as a Hazardous (nonradioactive) Materials Laboratory.

The sanitary and chemical sewer systems were to be sampled at the closest access point downstream from the specified buildings. However, upon inspection, none of these planned sampling points had an adequate flow, if any, for sampling. Sediment or sludge was not present at these locations. Both liquid and sediment were available in the area just north of the well house. The samples collected in this area included a liquid sample from the chemical waste septic tank (21LJ012), a sediment/sludge sample at its outfall across the road (21DJ014), a liquid sample from the storm drain manhole (21LJ011), and a few meters away, a corresponding sediment/sludge sample (21SK010) from its outfall. The outfall emptied into a cattail covered wetland adjoining the lake. A liquid sample (21LJ013) of the wastewater was taken from a manhole immediately following the north site filter and prior to the automatic chlorinator. All of these samples were analyzed for metals, semivolatile organic compounds, and radioactive contamination using gamma-ray spectroscopy techniques. The last analysis was chosen instead of a total uranium analysis to accommodate identification of radionuclides specific to the research conducted at this site.

One other liquid sample (21LJ009) was extracted from the subgrade storage tank located northwest of JN-3. The bottom of this tank was covered by about a foot of water. The tank had been designed to aid as a temporary storage for pool water. Site personnel had not recently checked this tank, and could not identify its contents. The sample was assigned a gamma-ray spectroscopic analysis.

South Area Samples:

Only three buildings (JS-1, 10, 12) in this area were designated for decontamination work. All of these buildings had a history of uranium usage: JS-1 -- military fuel fabrication; JS-10 and 12 -- ballistics tests of depleted uranium components. Of special note, a depleted uranium fire occurred in JS-1 several years ago.

The sanitary sewer system was sampled at the subsurface filter bed at the east end of the site. Both liquid and sediment samples (21LJ015 and 21DJ016) were taken. Sludge from the filter bed that services the holding tank north of JS-12 was sampled (21DJ017), as well as the standing liquid in the open holding tank (21LJ018). These samples were analyzed for metals, semivolatile organic compounds, and radioactive contamination using gamma-ray spectroscopy

techniques. Sludge samples were analyzed for total uranium content using uranium fluorometric techniques.

RESULTS OF RADIOLOGICAL SAMPLE ANALYSES

- Liquid sewer samples: Liquid sewer samples were collected at six different locations on the West Jefferson site and submitted for gamma spectral analysis:

  21LJ009 Underground storage tank north of JN-3
  21LJ011 Manhole northeast of JN-1
  21LJ012 Septic tank northeast of JN-1
  21LJ013 Underground tank between north site filter beds
  21LJ015 Manhole down by Big Darby Creek, south site
  21LJ018 Holding tank west of JS-12

No significant radioactivity above background was identified in any of the samples. Cesium-137 and Th-228 were measured, but their levels were quite low and approached the lower limit of detection of the instrument used in the analysis (Table 2). It should be noted that the quoted uncertainties associated with the measured values represent a one sigma statistical counting error only. The total propagated uncertainty for each measurement is a function of many variables in addition to the counting statistics component.

- Sewer sludge samples: Sludge samples were collected at six different locations including the King Avenue site and the West Jefferson site and submitted for gamma spectral analyses (Table 3).

  21DK005 Bldg. 3 sump
  21DK006 Bldg. 2 sump
  21DJ010 Outfall of storm sewer east of JN-1
  21DJ014 Outfall of septic tank, marshy area
  21DJ016 Manhole down by Big Darby Creek
  21DJ017 Filter bed north of JS-12

Analysis of sludge sample 21DK005 shows elevated levels of U-238 689 pCi/g and U-235 170 pCi/g in comparison to levels of these radionuclides in soil. A typical range of U-238 found in soil is 0.3-1.4 pCi/g (UNSCEAR77). Since the level of Ra-226 measured in 21DK005 is not in secular equilibrium with its parent U-238 (698 pCi/g versus 2.4 pCi/g), it is clear that some

uranium processing had occurred resulting in this state of disequilibrium. Daughter products of Th-232 were also measured in 21DK005 in high concentrations; Ac-228 49.5 pCi/g and Th-228 51.4 pCi/g. It is reasonable to assume that these daughter products are in secular equilibrium with the parent radionuclide Th-232. A uranium isotopic analysis performed on sample 21DK005 showed significant enrichment in the isotope U-235 (Table 7). Cobalt-60 (85 pCi/g), Am-241 (1.5 pCi/g), and Cs-137 (0.6 pCi/g) were also detected in sludge sample 21DK005.

Analysis of sludge sample 21DK006 revealed elevated levels of U-238 (86.8 pCi/g). A uranium isotopic analysis performed on this sample showed that it was slightly depleted in U-235 (Table 7).

Cobalt-60 (17.5 pCi/g), Am-241 (5.0 pCi/g), Cs-134 (0.3 pCi/g), Cs-137 (10.1 pCi/g), Pu-239/240 (17.37 pCi/g), Pu-238 (0.58 pCi/g), and Sr-90 (2.43 pCi/g) were measured in sample 21DJ010. No significant level of radioactive contamination was identified in any of the other three sludge samples analyzed (21DJ014, 21DJ016, and 21DJ018).

- Environmental corings: A total of thirty-three (33) corings were taken on the King Avenue and West Jefferson sites. It is interesting to note that when Cs-137 was identified (generally twice the levels found in Goodale Park), the top stratum of the core oftentimes exhibited the highest concentration of cesium.

Elevated levels of U-238 were identified in the following cores: 21SK023A (10.7 pCi/g) which was taken northeast of Bldg. 3; 21SK031C (12.0 pCi/g) which was taken south of Bldg. 9; and 21SK032D (5.8 pCi/g) which was taken west of Bldg. 9.

Elevated levels of U-235, 0.21 pCi/g and 0.12 pCi/g, were detected in cores 21SJ037A and 21SJ039C, respectively. Cobalt-60 (0.13 pCi/g) was identified in core 21SJ039A. A complete tabulation of all the uranium and thorium isotopic analyses performed is provided in Table 7.

- Environmental borings: Elevated levels of Cs-137 were identified in boreholes 21SJ052, 21SJ059, 21SJ062, and extensive Cs-137 contamination detected in borehole 21SJ063 (Table 5). The highest level of cesium measured occurred at the 6 ft level of borehole 21SJ063-6, 108.93 pCi/g. Uranium-238 was detected in boreholes 21SJ053-6 (8.16 pCi/g) and 21SJ059-7 (5.92 pCi/g).

An elevated level of Am-241 (2.91 pCi/g) was detected in borehole sample 21SJ063-6 along with Co-60 contamination (0.62 pCi/g), Pu-239/240 contamination (3.55 pCi/g) and Pu-238 contamination (0.09 pCi/g).

The results of the uranium fluorometric analyses performed on select soil and sludge samples are listed in Table 6. Samples exhibiting elevated levels of total uranium were further analyzed using mass spectrometry to determine their uranium isotopic composition. The results are shown in Table 7. The preferred analytical techniques to estimate the uranium content in samples is the uranium fluorometric analysis for a total uranium determination and a mass spectrometry analysis for uranium isotopic identification and quantification. Uranium analyses performed using gamma-ray spectrometry techniques (e.g., hyper-pure germanium detector) are regarded as less accurate when compared with those analytical techniques mentioned above. In general, the gamma-ray spectrometry technique will tend to overestimate the uranium content of the sample due the inherent interferences produced along the spectral continuum which affect the photopeaks used for uranium quantification. In this investigation, gamma-ray spectrometry was used to determine whether the samples contained enough uranium to merit a more sophisticated uranium analysis. Also shown in Table 7 are the results of the thorium isotopic analyses conducted on select soil corings and borings. Thorium contained in each sample is radiochemically extracted and analyzed using a surface barrier detector to identify and quantify the various thorium isotopes.

## RESULTS OF CHEMICAL SAMPLE ANALYSES

The chemical analysis of all samples was performed by the Analytical Chemistry Laboratory at Argonne National Laboratory. The procedures used for sample taking, preparation and analysis were consistent with those required by the U.S. EPA Contract Laboratory Program (CLP). Some of the samples required substantial dilution prior to analysis due to very high concentrations of certain compounds present in the samples. Diluted samples are so designated by the letters "DL" appended to the sample number (21DJ010CDL). The letter "C" designates that the sample was analyzed for the presence of semivolatile organic compounds.

Appendix 7 contains the results of analysis for various targeted semivolatile organic compounds in sludge samples. Results of analysis for various targeted semivolatile organic compounds is shown in Appendix 8 for the

liquid samples. In addition to the predetermined list of targeted compounds, a list of tentatively identified compounds is provided where applicable.

A review of the data involving various chemical analyses performed on sludge and wastewater samples yielded the following observations:

- The inorganic analysis of sludge samples reveals significant heavy metal contamination of two samples (21DK005 and 21DK006). High concentrations of chromium, lead, mercury, nickel, and silver were found in both samples. Depending upon the chemical form of these metals, this level of contamination could cause the sludge to qualify as an EP toxic hazardous waste. Wastewater samples 21LK007 and 21LK008 also showed relatively high concentrations of some of these same metals, as well as copper and zinc. The lead concentrations were particularly high. Sample 21LK003 was high in mercury. The remainder of metals analysis results were within the range normally encountered in uncontaminated samples.

- The results of the semivolatile organics analysis for sludge and wastewater samples indicate that several of the sludge samples (21DJ010 and 21DJ017) are significantly contaminated by a number of polynuclear aromatic compounds (PNAs). Sample 21DJ010CDL being the most contaminated (3,200,000 µg/kg phenanthrene, for example). These types of compounds are commonly found in fossil fuels such as heating oils and coal, but are also produced by the incomplete combustion of hydrocarbon fuels. Many of these compounds are carcinogenic and may require some special handling procedures during clean-up operations. They have very low solubility in water and would therefore tend to remain in sludge deposits for long periods of time. None of the wastewater samples showed significant concentrations of PNAs, indicating that the PNAs are not being resuspended or solubilized.

- Several of the samples, both sludge and wastewater (21DK006CDL, 21LK003C, 21LK007CRE, and 21LK008C), showed

significant amounts of phenol and chloro or methyl substituted phenols (cresols). Phenols and cresols are toxic compounds which have been known to cause problems with biological wastewater treatment systems.

- Two types of phthalates, di-n-butylphthalate and bis(2-ethyhexyl)phthalate, were detected in sludge and wastewater samples (21DK006CDL, 21LK003C, and 21LK007CRE). These two chemicals are very common and are found in many types of plastics and surface finishes. The concentrations found in the water samples were very low, only slightly above the quantitation limits.

- In addition to these regulated pollutants, the analysis revealed the presence of several unregulated organics in high concentrations in a number of samples, including an unknown organic (sample 21KL003CDL) and alkyl triphenyl phosphate (samples 21DK006CD6 and 21LK003C). This latter compound is frequently used in the refining of transuranium isotopes.

- Besides the compounds mentioned above, very few semivolatile organics were detected above the quantitation limits in either the sludge or wastewater samples. However, due to the high dilution factors necessary to analyze several of the sludge samples, the quantitation limits were quite high, making detection of low concentrations of pollutants impossible. In addition, since only the semivolatile pollutants were analyzed for, there is no way to estimate the presence of other toxic organics such as volatile organics, pesticides/PCBs or cyanide. Before this sludge is disposed of, it will have to be analyzed for RCRA hazardous waste characteristics to insure its proper disposal.

## SUMMARY

1.0 Building A - King Avenue Site

Cursory surveys and radiological assessment by ANL essentially confirms BCL's assessment of the building's radiological contamination status.

2.0 Building 1 - King Avenue Site

Radioactive contamination was found in this building consistent with those levels reported by BCL. It should be assumed that the drain lines from the foundry are contaminated with radioactive material.

3.0 Building 2 - King Avenue Site

Localized areas of the building floor were found to be radioactively contaminated. The building sump system was found to be highly contaminated, both radiologically and chemically and it follows that the building drain and sewer lines should also be considered contaminated.

4.0 Building 3 - King Avenue Site

This building was found to be extensively contaminated throughout. Analysis of samples taken from the building sump system revealed the presence of high concentrations of radiological and chemical (both organics and inorganics) contaminants. All drain and sewer lines should be considered contaminated. There is also evidence of radioactive contamination under the floor coating in many areas of the building. Large areas of floor contamination were intentionally covered with a sealing/fixing material to avoid the potential spread of the contamination. As a result, the floor coating prevented a complete evaluation of the levels of contamination present.

5.0 Building 4 - King Avenue Site

Several localized areas of radioactive contamination were found on the floor. Drain lines should be considered contaminated.

6.0 Building 5 - King Avenue Site

Several localized areas of radioactive contamination were found on the shop floor and in the mezzanine areas. The drain lines in this facility should be considered contaminated.

7.0 Building 6 - King Avenue Site

Several spots of radioactive contamination were found in the eight areas surveyed in this building. A sink and a drain were found to be radioactively contaminated; it is prudent to assume that the building drain and sewer lines are also contaminated.

8.0 Building 7 - King Avenue Site

The only elevated radiation levels detected in this building were from a couple of sinks located in two different rooms. It should be assumed that the drain and sewer lines are contaminated.

9.0 Building 9 - King Avenue Site

No radioactive contamination was detected in the areas surveyed. There is the possibility of drain line contamination in this building, however, it is not directly evident.

10.0 Sewer Lines - King Avenue Site

As a result of the analyses performed on the effluent samples taken from the north and south lift stations, the King Avenue sewer system, and the sumps located in Buildings 2 and 3, the sewer lines must be considered radioactively and chemically contaminated. The radioactive contamination is primarily uranium (normal, enriched, and depleted) and the chemical contamination consists of both organic compounds (phenols and polychlorinated biphenyls) and inorganic compounds (lead, cadmium, chromium and mercury). The concomitant soil contamination from leaking sewer lines should be considered a distinct possibility.

11.0 Environmental Corings - King Avenue Site

The results of the analyses of the environmental corings taken in the vicinity of Buildings 2 and 3 (21SK019 through 21SK023) reveal that an environmental insult may have occurred some time ago. This may be related to the uranium operations conducted in the two buildings. Mass spectrographic analyses indicated the samples from cores 21SK020 and 21SK022 exhibited slight uranium enrichment.

12.0 Building JN-1, West Jefferson Site-North

This building was found to be highly contaminated, as expected, primarily in the cave and storage areas. Drain and sewer line radioactive contamination should be considered probable.

13.0 Building JN-2, West Jefferson Site-North

Several spots of radioactive contamination were found in the subcritical assembly room of this facility. Drain and sewer line contamination should be considered possible. Floors have been coated with a sealer in several areas of this building, thus preventing an accurate determination of the level of contamination present.

14.0 Building JN-3, West Jefferson Site-North

This former reactor building revealed several areas of extensive radioactive contamination; notably, the center reactor area and the pump room. Several drains exhibited elevated radiation levels thus leading to the conclusion that the building's drain and sewer lines should be treated as contaminated.

15.0 Building JS-1, West Jefferson Site-South

Cursory surveys revealed no contamination in this building. Elevated Radon-222 concentrations were found near pit #3. The radon daughter concentrations in this area ranged from 40-60 milli-working levels for a 22-hour period. Modine space heaters were operational and the doors to the facility were open during the time of sampling.

16.0 Building JS-10, West Jefferson Site-South

Cursory direct and smear surveys of this facility revealed no measurable radioactive contamination present.

17.0 Building JS-12, West Jefferson Site-South

Cursory direct and smear surveys of this facility revealed no measurable radioactive contamination present.

18.0 Storm Drain, West Jefferson Site-North

A sludge sample (21DJ010) taken from the storm drain outfall revealed the presence of radioactive contamination; 5.0 pCi/gram of

Am-241, 17.5 pCi/gram of Co-60, 17.4 pCi/gram of Pu-239/240, and 2.4 pCi/gram of Sr-90. The storm drain serves Buildings JN-1 and JN-4. It is prudent to consider the soil peripheral to the outfall and the storm drain itself radioactively contaminated.

19.0 Abandoned Filter Beds, West Jefferson Site-North

Soil in an area south-southeast of an abandoned filter bed was found to be radioactively contaminated down to the 12 ft, level below grade. Borehole logging of sites 21SJ062 and 21SJ063 revealed the presence of Cs-137 contamination from grade to the 12 ft level. Analysis of split spoon samples taken at the 6 ft level of borehole 21SJ063 showed elevated levels of Cs-137 (108.93 pCi/gram); Am-241 (2.91 pCi/gram); Pu-239/240 (3.55 pCi/gram); Pu-238 (0.09 pCi/gram); and Co-60 (0.62 pCi/gram). As a result of these findings, all of the sewer lines leading to the abandoned filter beds should be considered radioactively contaminated. Due to the limited number of boreholes drilled around the filter beds, a pattern of contamination migration cannot be established.

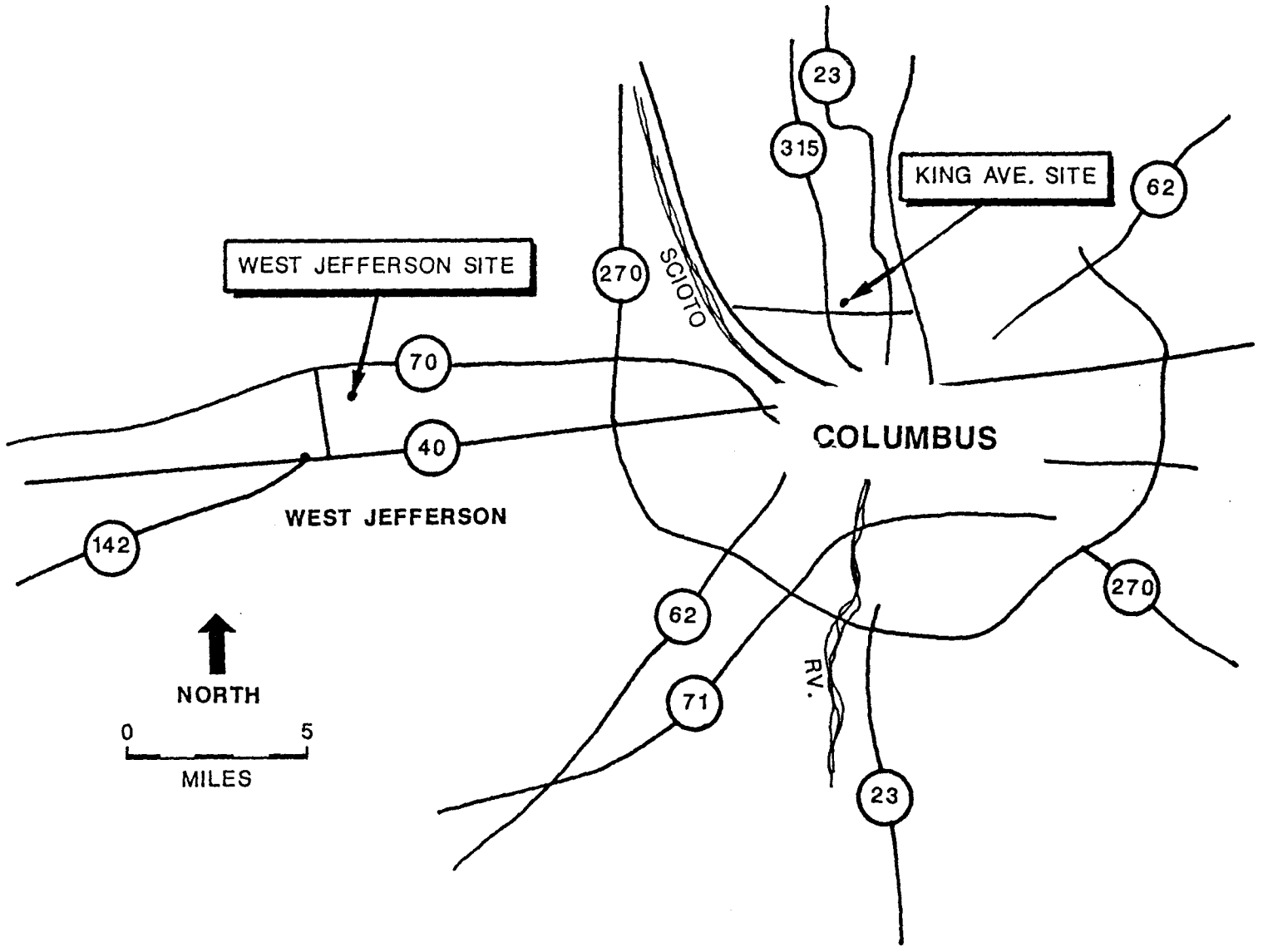
## REFERENCES

1.0 United States Nuclear Regulatory Commission Regulatory Guide 1.86 (1982) entitled, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product Source, or Special Nuclear Material."

2.0 Battelle Columbus Laboratories Technical Report to the USDOE - Chicago Operations Office entitled "Submission of Report on Facilities for Acceptance under the DOE Surplus Facilities Management Program," August 16, 1984.

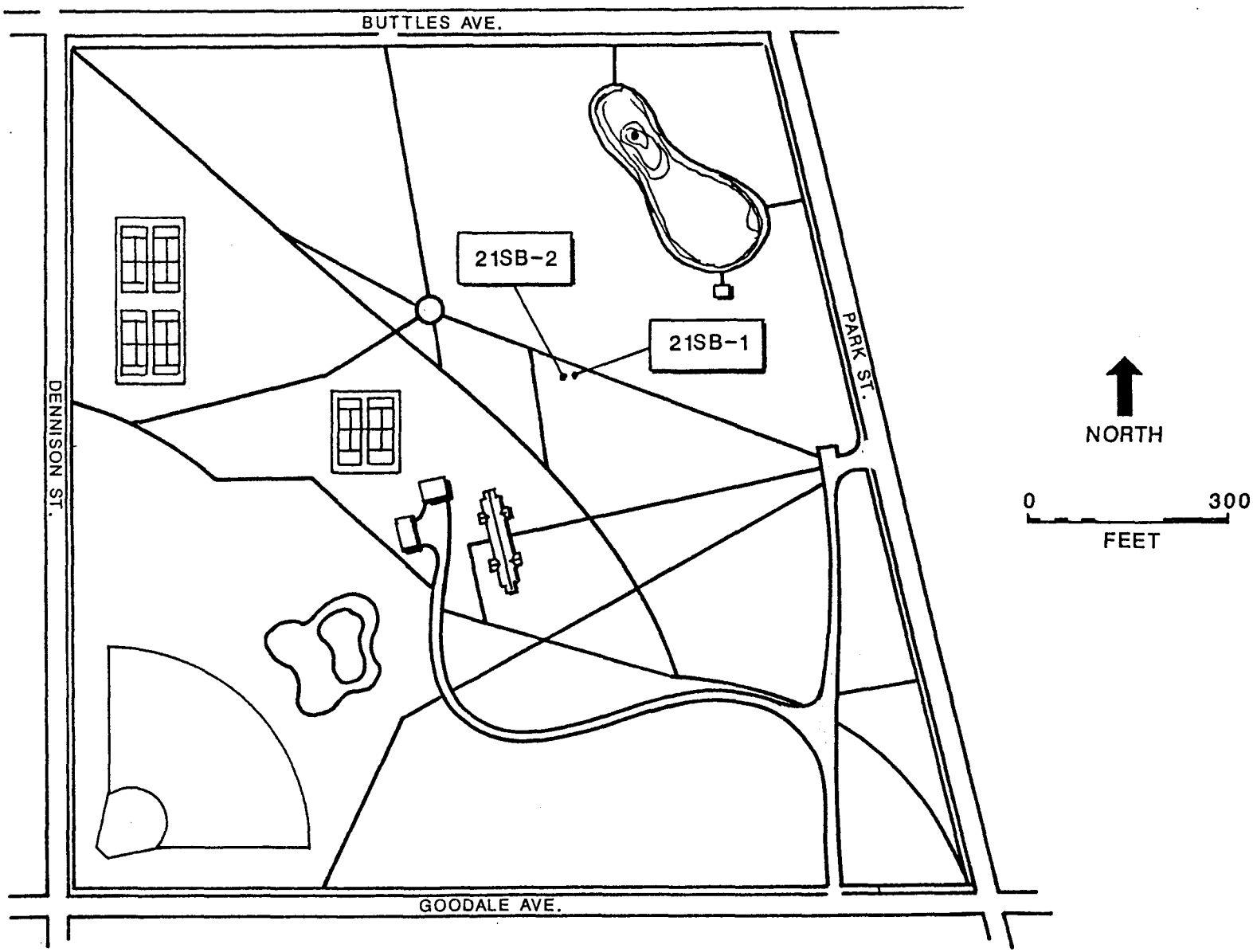
3.0 United Nations Scientific Committee on the Effects of Atomic Radiation, "Sources and Effects of Ionizing Radiation," 1977.

4.0 U.S. Department of Energy Publication entitled, "The Environmental Survey Manual," August 1987.



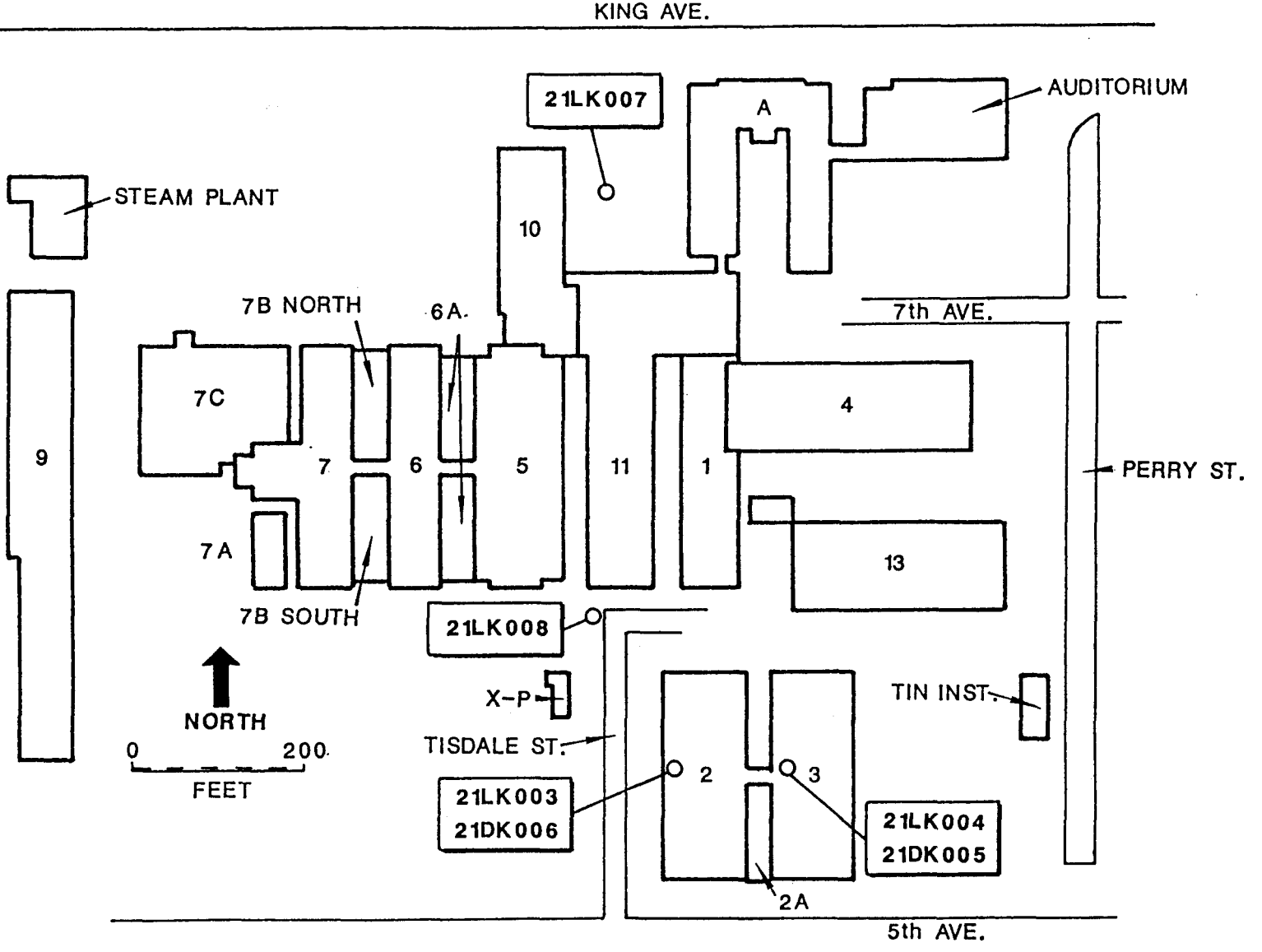

Battelle-Columbus Laboratory, King Avenue and West Jefferson Sites

Fig. 1



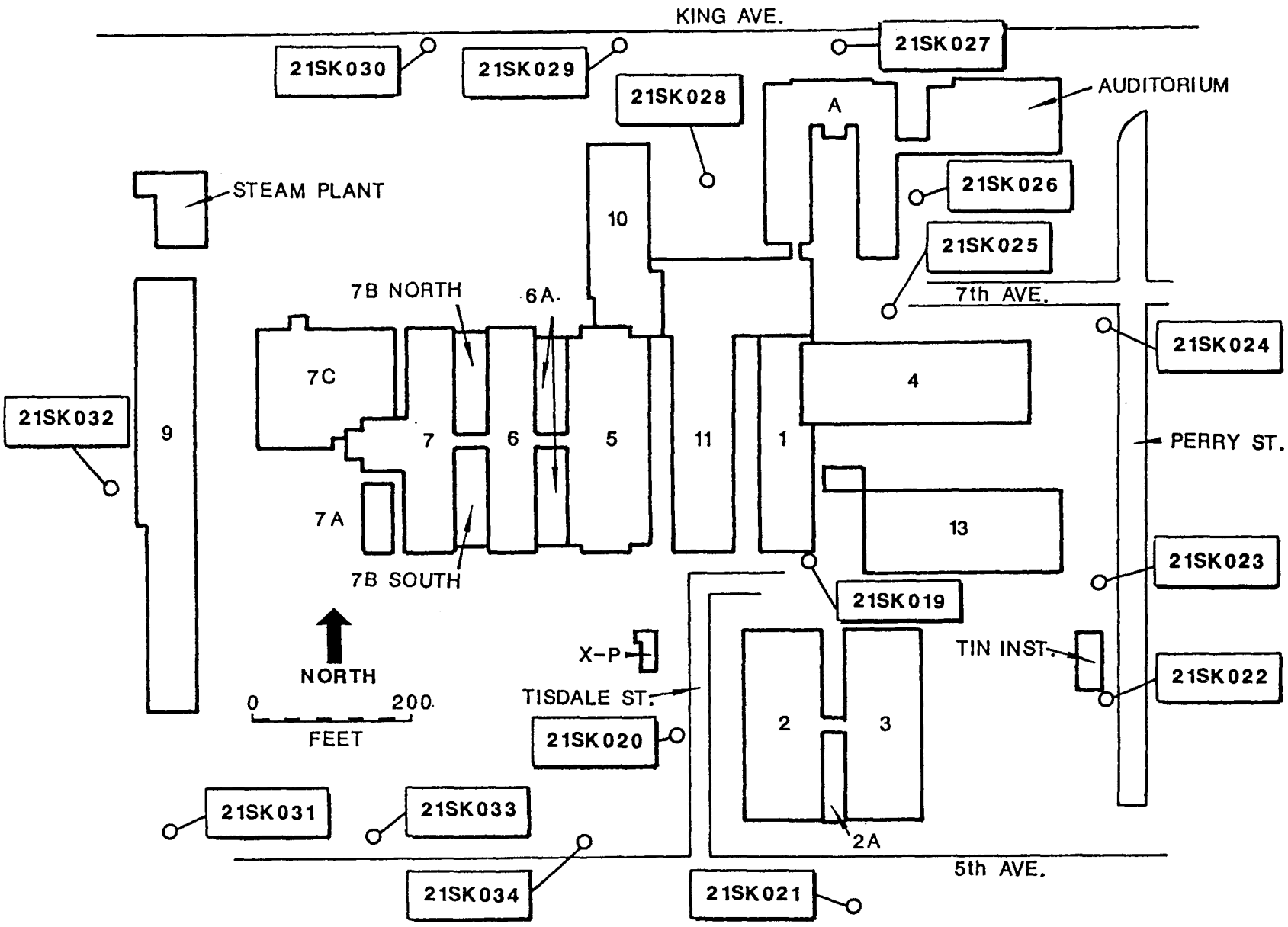

Locations of Environmental Background Soil Samples
Taken in Goodale Park

Fig. 2



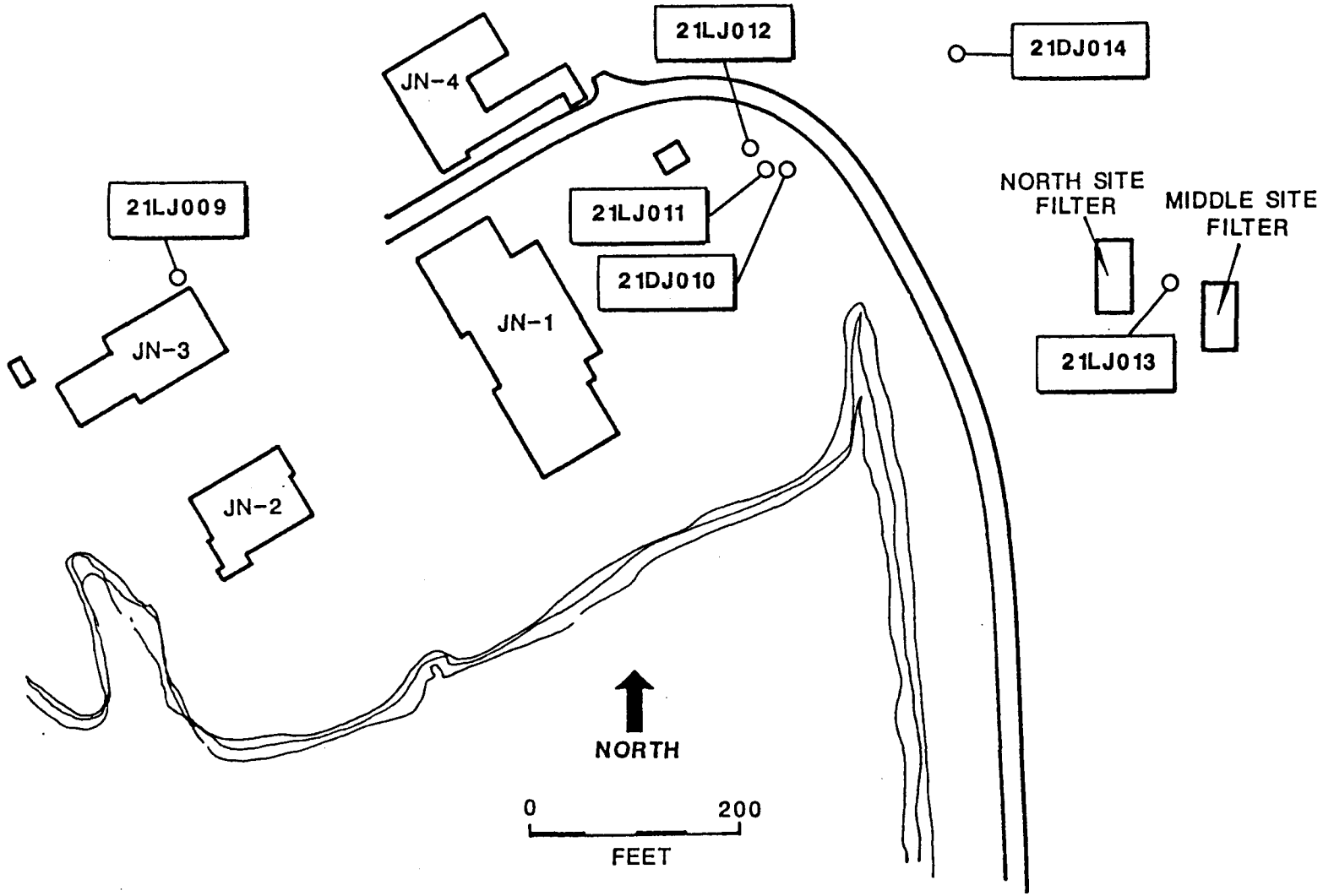

Locations of Liquid Samples Taken at the King Avenue Site

Fig. 3



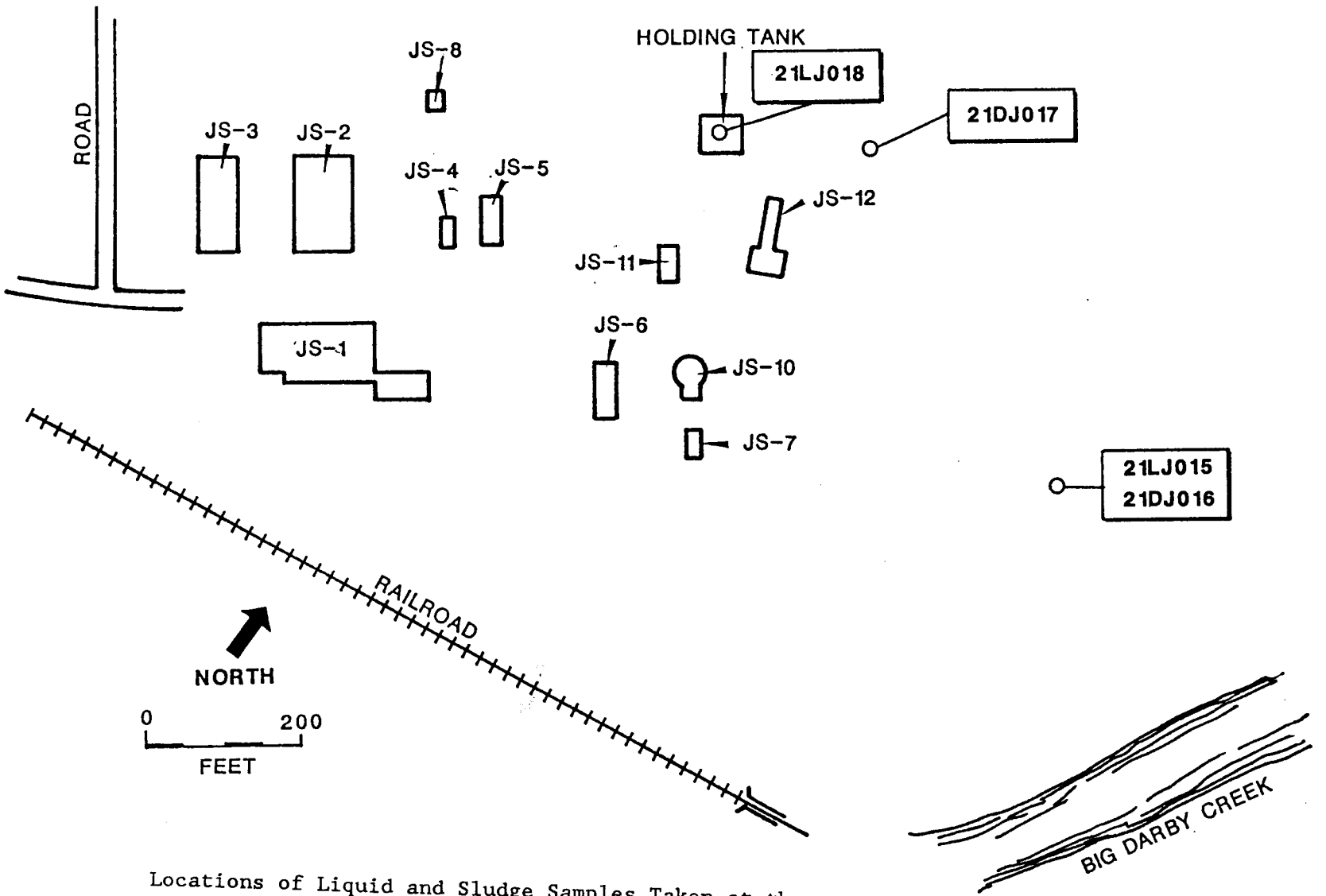

Locations of Environmental Soil Corings Taken at the King Avenue Site

Fig. 4



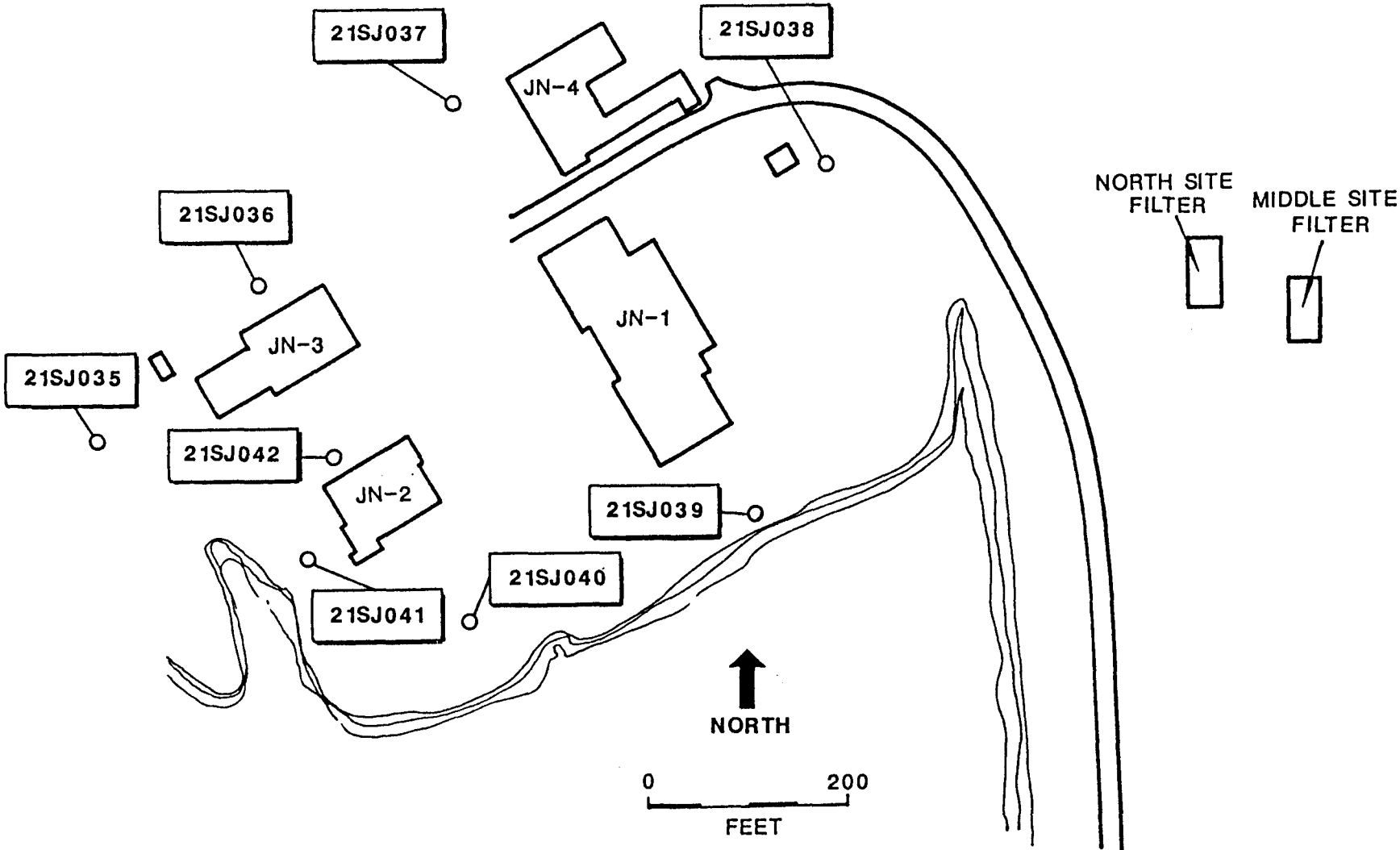

Locations of Liquid and Sludge Samples Taken at the
West Jefferson Site - North End

Fig. 5



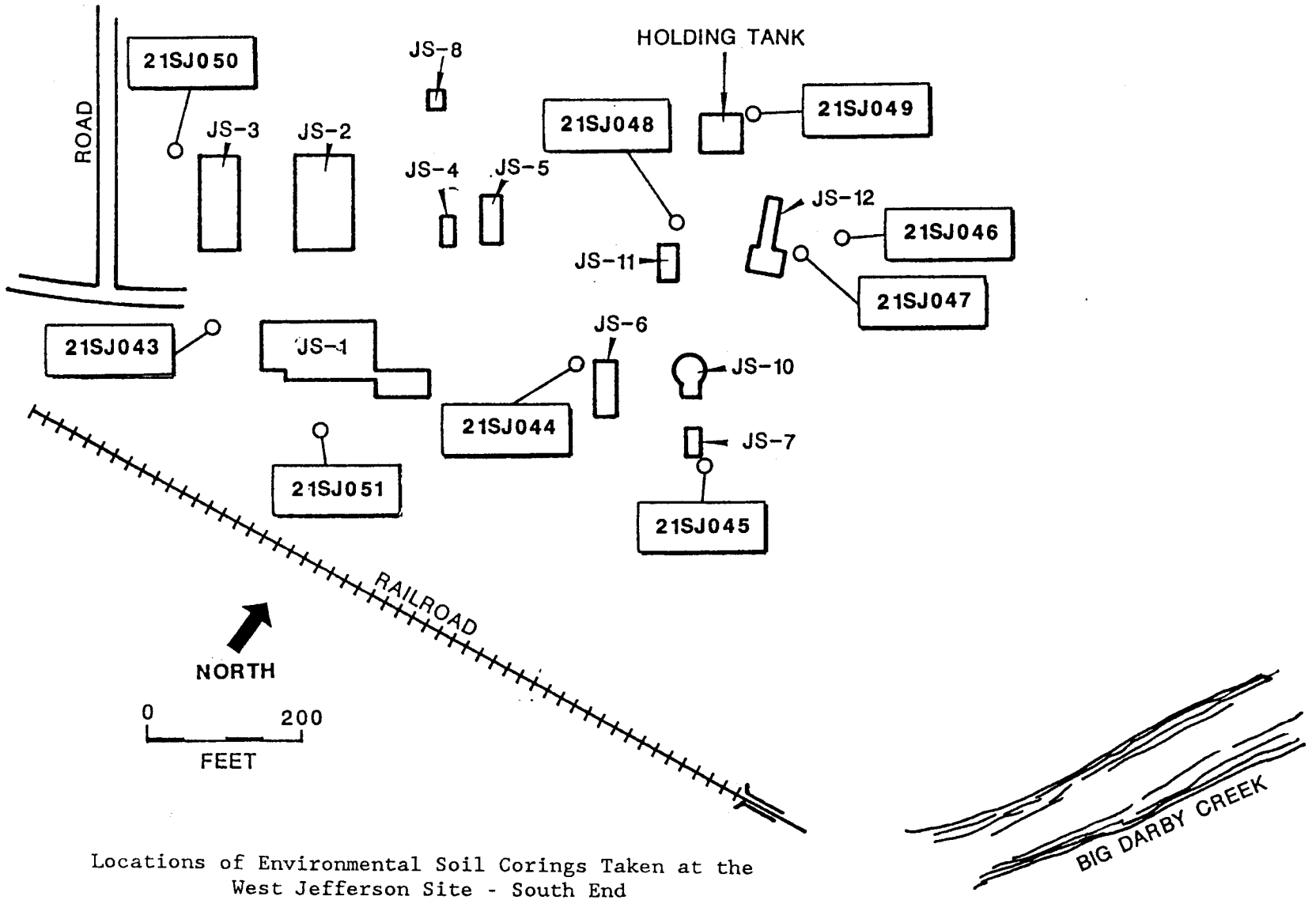

Locations of Liquid and Sludge Samples Taken at the West Jefferson Site - South End

Fig. 6



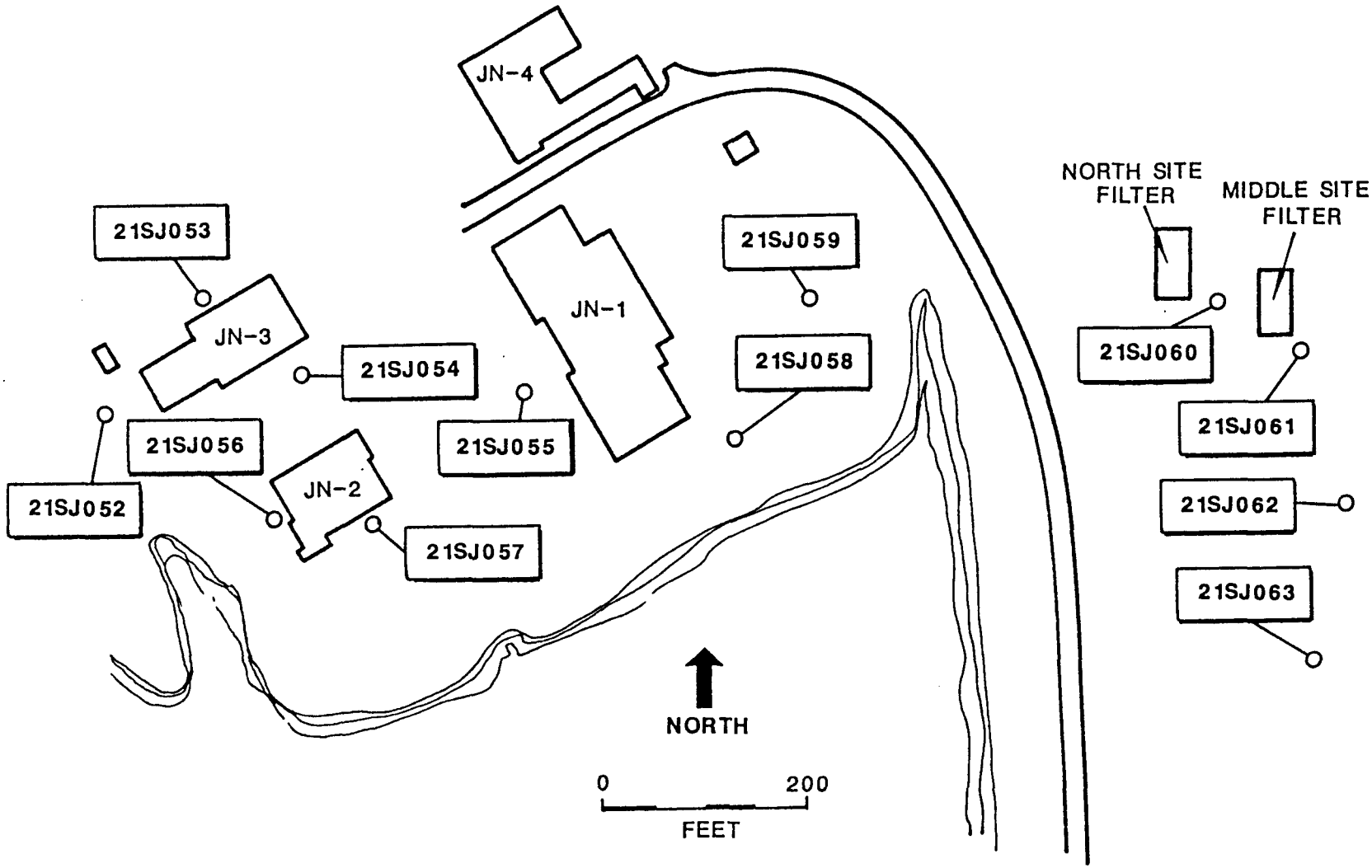

Locations of Environmental Soil Corings Taken at the West Jefferson Site - North End

Fig. 7



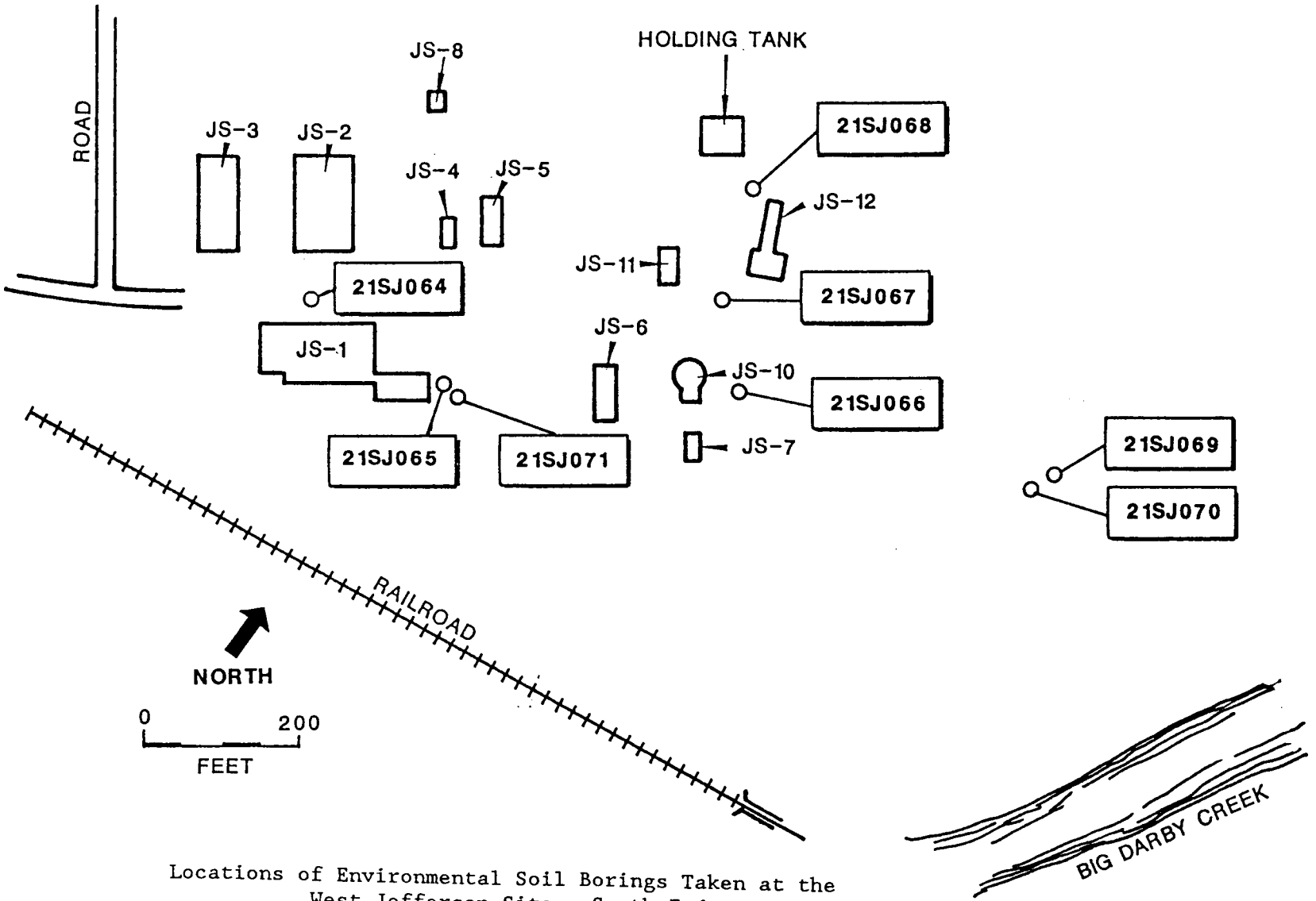

Locations of Environmental Soil Corings Taken at the West Jefferson Site - South End

Fig. 8




Locations of Environmental Soil Borings Taken at the
West Jefferson Site - North End

Fig. 9




Locations of Environmental Soil Borings Taken at the West Jefferson Site - South End

Fig. 10

Table 1. Building Air Sample Results

| Sample Number | Location | Radon $^{222}Rn$ (pCi/ℓ) | Radon Daughters (mWL) | Thoron $^{220}Rn$ (pCi/ℓ) | Actinon $^{219}Rn$ (pCi/ℓ) |
|---|---|---|---|---|---|
| 1 | Bldg. 1 Foundry Area | 0.42 | 4.2 | 7.6 | BDL |
| 2 | Bldg. 1 Foundry Area | 0.52 | 5.2 | 16.3 | BDL |
| 3 | Bldg. 2 Ground Floor | 1.16 | 11.6 | 6.7 | BDL |
| 4 | Bldg. 3 Room 3671 | 0.69 | 6.9 | 1.1 | BDL |
| 5 | Bldg. 5 Machine Shop | 1.00 | 10.0 | 9.4 | BDL |
| 6 | JS-1 High Bay Area | 0.81 | 8.1 | 2.5 | BDL |
| 7 | JS-1 Pit Area | 5.29 | 52.9 | 12.7 | BDL |
| 8 | JS-10 | 0.35 | 3.5 | 3.8 | BDL |
| 9 | JS-12 Tunnel Area | 2.73 | 27.3 | BDL | BDL |
| 10 | JN-1 Hot Cell Area | 0.49 | 4.9 | BDL | BDL |
| 11 | JN-1 Hot Cell Area | 0.18 | 1.8 | BDL | BDL |
| 12 | JN-1 Machine Shop | BDL | BDL | BDL | BDL |
| 13 | JN-1 High Bay Area | 0.31 | 3.1 | 0.5 | BDL |
| 14 | JN-2 First Floor | 0.44 | 4.4 | 4.4 | BDL |
| 15 | JN-2 Second Floor | 0.69 | 6.9 | 11.7 | BDL |
| 16 | JN-3 First Floor | 1.08 | 10.8 | 13.2 | BDL |
| 17 | JN-3 Second Floor | 0.45 | 4.5 | 4.8 | BDL |
| 18 | JN-3 Basement | 1.19 | 11.9 | 13.2 | BDL |

Working Level (WL) is defined as any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of $1.3 \times 10^5$ MeV of potential alpha energy. The numerical value of the WL is derived from the alpha energy released by the total decay through RaC' of the short-lived radon daughter products, RaA, RaB, RaC, and RaC' in radioactive equilibrium with 100 pCi of $^{222}Rn$ per liter of air. A milliWorking Level (mWL) is $10^{-3}$ WL.

BDL = Below Detectable Limits.

Table 2. Gamma Spectral Analyses of Liquid Sewer Samples (pCi/ml)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | Others |
|---|---|---|---|---|---|---|
| 21LJ009 | <0.03 | <0.02 | <0.04 | <0.03 | 0.03±0.01 | - |
| 21LJ011 | <0.02 | <0.02 | <0.03 | <0.03 | - | - |
| 21LJ012 | <0.02 | <0.02 | <0.03 | <0.02 | 0.02±0.01 | - |
| 21LJ013 | <0.03 | <0.03 | <0.06 | <0.04 | <0.02 | - |
| 21LJ015 | <0.04 | <0.03 | <0.08 | <0.05 | <0.02 | - |
| 21LJ018 | <0.03 | <0.03 | <0.05 | 0.02±0.01 | <0.02 | - |

Less than values indicate the measurement was below the detection limit of the instrument. Note: The 352 KeV energy line listed under the Ra-226 heading above is actually attributable to a radium daughter product, Pb-214.

Table 3. Gamma Spectral Analyses of Sewer Sludge Samples (pCi/gram)

| Sample Number | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | Others |
|---|---|---|---|---|---|---|
| 21DK005 | 2.4±0.1 | 2.4±0.1 | 49.5±0.6 | 51.4±0.5 | 0.6±0.1 | U-238 689.2±16.5, U-235 170.3±3.0, Co-60 85.0±3.0, K-40 5.6±0.6, Am-241 1.5±0.1 |
| 21DK006 | 0.4±0.1 | 0.3±0.1 | 1.5±0.1 | 1.5±0.7 | <0.1 | U-238 86.8±3.5, U-235 0.6±0.1, K-40 <21, Am-241 <0.2 |
| 21DJ010 | 1.0±0.1 | 1.1±0.1 | 0.4±0.1 | 0.3±0.1 | 10.1±0.1 | Cs-134 0.3±0.1, Co-60 17.5±0.1, K-40 <3, Am-241 5.0±0.1, Pu-239-/240[a] 17.37±0.25, Sr-90[b] 2.43 ±0.16, Pu-238 0.58 ±0.01 |
| 21DJ014 | 0.8±0.2 | 1.1±0.3 | <1.0 | 0.8±0.1 | <0.4 | Co-60 <0.3, K-40 <10 |
| 21DJ016 | 2.0±0.1 | 2.1±0.1 | 1.0±0.1 | 1.2±0.1 | 0.08±0.01 | - |
| 21DJ017 | 0.8±0.1 | 0.8±0.1 | 0.3±0.1 | 0.3±0.1 | 0.05±0.01 | K-40 5.7±0.4 |

[a]Alpha spectrometry.

[b]Radiochemical separation.

Table 4. Gamma Spectral Analyses of Environmental Soil Corings (pCi/gram)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Environmental Background Corings | | | | | |
| 21SB-1A | 2.14±0.1 | 2.22±0.08 | 1.16±0.15 | 0.96±0.1 | 0.49±0.04 | - | - | 14.62±0.93 | - | - |
| 21SB-1B | 2.41±0.08 | 2.32±0.07 | 1.08±0.11 | 0.86±0.08 | 0.52±0.03 | - | - | 17.91±0.63 | - | - |
| 21SB-1C | 2.47±0.06 | 2.44±0.05 | 1.12±0.08 | 1.07±0.06 | 0.42±0.02 | - | - | 15.09±0.52 | <0.10 | - |
| 21SB-1D | 2.29±0.17 | 2.14±0.17 | 1.10±0.18 | 1.15±0.19 | 0.20±0.04 | - | - | 18.06±1.07 | - | - |
| 21SB-2A | 2.22±0.15 | 2.33±0.10 | 0.75±0.17 | 1.00±0.13 | 0.44±0.06 | - | - | 12.90±1.47 | - | - |
| 21SB-2B | 2.59±0.07 | 2.42±0.06 | 1.09±0.09 | 1.04±0.07 | 0.49±0.02 | <10.4 | - | 17.06±0.60 | - | - |
| 21SB-2C | 2.35±0.10 | 2.50±0.07 | 1.01±0.12 | 0.99±0.08 | 0.38±0.03 | - | - | 16.02±0.70 | - | - |
| 21SB-2D | 2.39±0.07 | 2.66±0.09 | 1.16±0.12 | 1.19±0.08 | 0.11±0.02 | - | - | 17.51±0.56 | - | - |
| | | | | | Environmental Corings | | | | | |
| 21SK019A | 2.38±0.07 | 2.60±0.05 | 1.00±0.08 | 1.00±0.06 | 0.30±0.02 | - | - | 16.17±0.49 | <0.08 | - |
| 21SK019B | 2.81±0.11 | 2.83±0.08 | 1.10±0.14 | 1.13±0.11 | 0.28±0.04 | - | - | 18.20±1.00 | - | - |
| 21SK019C | 2.17±0.11 | 2.26±0.08 | 0.98±0.14 | 1.00±0.11 | 0.26±0.04 | - | - | 15.24±0.96 | - | - |
| 21SK019D | 3.17±0.09 | 3.19±0.08 | 1.13±0.08 | 1.13±0.06 | 0.22±0.02 | - | - | 16.38±0.52 | - | - |
| 21SK020A | 2.78±0.11 | 2.68±0.08 | 0.72±0.12 | 0.82±0.09 | 1.08±0.04 | - | - | 13.97±0.79 | - | - |
| 21SK020B | 2.78±0.10 | 2.70±0.07 | 0.98±0.09 | 1.05±0.08 | 0.63±0.03 | - | - | 16.55±0.54 | - | - |
| 21SK020C | 2.86±0.12 | 2.82±0.10 | 1.10±0.16 | 0.94±0.12 | <0.15 | - | - | 14.47±1.27 | - | - |
| 21SK020D | 3.36±0.08 | 3.44±0.08 | 1.03±0.08 | 1.05±0.06 | 0.17±0.02 | - | - | 16.30±0.45 | - | - |
| 21SK021A | 3.43±0.01 | 3.18±0.09 | 1.10±0.16 | 0.98±0.10 | 0.12±0.03 | - | - | 16.57±1.11 | - | - |
| 21SK021B | 3.38±0.07 | 3.33±0.07 | 1.20±0.08 | 1.04±0.06 | 0.10±0.02 | - | - | 17.03±0.49 | <0.10 | - |
| 21SK021C | 3.34±0.12 | 3.19±0.09 | 1.37±0.16 | 1.35±0.14 | <0.13±0.02 | - | - | 15.59±1.18 | - | - |
| 21SK021D | 1.82±0.10 | 1.68±0.08 | 0.68±0.11 | 0.68±0.11 | 0.21±0.05 | - | - | 7.70±0.96 | - | - |
| 21SK022A | 2.40±0.10 | 2.20±0.07 | 0.92±0.10 | 0.93±0.08 | 0.47±0.04 | - | - | 14.61±0.69 | - | - |
| 21SK022B | 2.50±0.06 | 2.51±0.17 | 1.02±0.07 | 1.03±0.05 | 0.46±0.02 | - | - | 15.70±0.46 | 0.13±0.03 | - |
| 21SK022C | 2.54±0.10 | 2.45±0.07 | 0.93±0.13 | 1.06±0.10 | 0.57±0.04 | - | - | 17.74±1.00 | - | - |
| 21SK022D | 2.47±0.11 | 2.28±0.09 | 0.85±0.16 | 0.89±0.11 | 0.26±0.05 | - | - | 17.48±1.28 | - | - |
| 21SK023A | 2.81±0.08 | 2.81±0.08 | 0.84±0.08 | 0.96±0.06 | 0.35±0.02 | 10.75±3.00 | - | 16.24±0.49 | - | - |
| 21SK023B | 2.98±0.12 | 2.82±0.07 | 1.12±0.12 | 1.06±0.11 | <0.09 | - | - | 18.07±0.82 | - | - |
| 21SK023C | 2.47±0.08 | 2.52±0.06 | 1.21±0.10 | 1.28±0.08 | 0.11±0.02 | - | - | 18.04±0.61 | - | - |
| 21SK023D | 2.75±0.06 | 2.78±0.05 | 1.13±0.09 | 1.04±0.06 | 0.09±0.02 | <8.9 | - | 15.64±0.50 | <0.09 | - |
| 21SK024A | 2.00±0.09 | 2.15±0.07 | 0.87±0.13 | 0.68±0.11 | 0.59±0.04 | - | - | 15.86±0.85 | - | - |
| 21SK024B | 2.56±0.12 | 2.25±0.09 | 1.24±0.17 | 0.93±0.12 | 0.52±0.05 | - | - | 15.16±1.10 | - | - |
| 21SK024C | 2.48±0.09 | 2.35±0.07 | 0.80±0.09 | 0.87±0.08 | 0.32±0.02 | - | - | 17.67±0.57 | - | - |
| 21SK024D | 1.92±0.08 | 1.86±0.06 | 0.77±0.11 | 0.60±0.08 | <0.08 | - | - | 14.05±0.71 | - | - |
| 21SK025A | 2.00±0.09 | 2.03±0.06 | 1.04±0.11 | 0.76±0.07 | 0.55±0.03 | - | - | 16.19±0.55 | - | - |
| 21SK025B | 2.47±0.06 | 2.51±0.05 | 0.81±0.06 | 0.85±0.05 | 0.33±0.02 | - | - | 15.15±0.44 | <0.11 | - |

Table 4 - (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SK025C | 2.30±0.09 | 2.44±0.07 | 0.79±0.12 | 0.80±0.11 | 0.20±0.03 | - | - | 15.80±0.99 | - | - |
| 21SK025D | 2.51±0.07 | 2.56±0.04 | 0.90±0.06 | 0.85±0.05 | 0.05±0.01 | - | - | 14.53±0.42 | <0.08 | - |
| 21SK026A | 2.36±0.11 | 2.24±0.09 | 0.74±0.15 | 0.97±0.11 | 0.82±0.05 | - | - | 16.55±1.18 | - | - |
| 21SK026B | 2.02±0.12 | 2.17±0.08 | 1.02±0.14 | 1.02±0.10 | 0.25±0.05 | - | - | 14.85±0.95 | - | - |
| 21SK026C | 2.49±0.06 | 2.40±0.05 | 1.16±0.08 | 1.02±0.05 | 0.17±0.02 | - | - | 17.73±0.46 | <0.09 | - |
| 21SK026D | 2.25±0.09 | 2.36±0.07 | 0.88±0.12 | 0.95±0.09 | 1.21±0.28 | - | - | 15.42±0.80 | - | - |
| 21SK027A | 2.21±0.11 | 2.28±0.09 | 0.77±0.16 | 0.92±0.12 | 0.64±0.05 | - | - | 16.88±1.26 | - | - |
| 21SK027B | 2.43±0.08 | 2.49±0.06 | 0.98±0.11 | 1.03±0.08 | 0.30±0.03 | - | - | 16.17±0.71 | - | - |
| 21SK027C | 2.86±0.08 | 2.95±0.09 | 0.93±0.09 | 1.25±0.10 | 0.28±0.02 | - | - | 18.20±0.53 | - | - |
| 21SK027D | 2.50±0.08 | 2.58±0.06 | 0.78±0.08 | 0.77±0.07 | 0.21±0.02 | - | - | 12.93±0.45 | - | - |
| 21SK028A | 2.60±0.09 | 2.63±0.07 | 0.78±0.12 | 0.84±0.09 | 0.92±0.04 | - | - | 15.90±0.95 | - | - |
| 21SK028B | 2.32±0.10 | 2.68±0.08 | 0.89±0.13 | 1.08±0.15 | 0.32±0.04 | - | - | 17.82±1.07 | - | - |
| 21SK028C | 2.02±0.10 | 1.88±0.08 | 0.85±0.14 | 0.84±0.10 | 0.15±0.04 | - | - | 15.04±1.12 | - | - |
| 21SK028D | 2.67±0.12 | 2.70±0.10 | 0.79±0.15 | 0.87±0.12 | <0.12 | - | - | 16.66±0.99 | - | - |
| 21SK029A | 2.83±0.06 | 2.78±0.04 | 0.90±0.07 | 0.94±0.06 | 0.89±0.02 | - | - | 15.31±0.47 | <0.10 | - |
| 21SK029B | 3.07±0.08 | 3.01±0.07 | 1.04±0.12 | 1.20±0.11 | 0.41±0.03 | - | - | 18.32±0.57 | - | - |
| 21SK029C | 2.79±0.10 | 3.05±0.08 | 1.28±0.14 | 1.24±0.11 | <0.11 | - | - | 18.11±1.15 | - | - |
| 21SK029D | 2.66±0.08 | 2.57±0.07 | 0.97±0.10 | 0.90±0.08 | 0.12±0.02 | - | - | 17.26±0.71 | - | - |
| 21SK030A | 2.58±0.11 | 2.57±0.09 | 1.01±0.15 | 1.09±0.11 | 0.45±0.05 | - | - | 15.42±0.95 | - | - |
| 21SK030B | 2.97±0.12 | 2.77±0.11 | 1.16±0.19 | 1.09±0.11 | <0.16 | - | - | 15.60±1.19 | - | - |
| 21SK030C | 2.98±0.06 | 2.91±0.06 | 1.00±0.07 | 0.96±0.06 | 0.10±0.02 | - | - | 17.03±0.49 | <0.11 | - |
| 21SK030D | 2.03±0.11 | 1.88±0.07 | 1.11±0.13 | 0.83±0.10 | <0.12 | - | - | 13.70±0.99 | - | - |
| 21SK031A | 1.91±0.11 | 2.02±0.08 | 0.95±0.14 | 0.97±0.10 | 0.58±0.05 | - | - | 14.03±1.05 | - | - |
| 21SK031B | 2.31±0.09 | 2.27±0.07 | 0.92±0.13 | 0.73±0.11 | 0.77±0.05 | - | - | 12.21±0.82 | - | - |
| 21SK031C | 2.59±0.09 | 2.69±0.06 | 1.08±0.12 | 0.93±0.09 | 0.59±0.03 | 12.04±3.02 | - | 14.27±0.72 | - | - |
| 21SK031D | 2.61±0.07 | 2.48±0.06 | 0.81±0.08 | 0.94±0.07 | 0.30± | - | - | 14.54±0.42 | - | - |
| 21SK032A | 1.79±0.11 | 1.64±0.07 | 0.82±0.13 | 1.05±0.10 | 0.68±0.05 | - | - | 14.07±0.88 | - | - |
| 21SK032B | 1.53±0.08 | 1.61±0.07 | 0.70±0.12 | 0.94±0.10 | 0.55±0.04 | - | - | 13.59±0.81 | - | - |
| 21SK032C | 1.75±0.07 | 1.77±0.06 | 0.91±0.11 | 0.83±0.08 | 0.42±0.03 | - | - | 14.95±0.71 | - | - |
| 21SK032D | 1.76±0.04 | 1.77±0.04 | 0.80±0.07 | 0.83±0.04 | 0.18±0.02 | 5.82±1.61 | - | 14.15±0.47 | <0.07 | - |
| 21SK033A | 1.89±0.11 | 1.79±0.08 | 0.67±0.14 | 0.60±0.12 | 0.47±0.05 | <14.3 | - | 11.97±0.93 | - | - |
| 21SK033B | 2.41±0.09 | 2.42±0.08 | 0.90±0.13 | 1.01±0.09 | 0.17±0.04 | - | - | 17.84±0.84 | - | - |
| 21SK033C | 2.11±0.10 | 2.14±0.08 | 0.76±0.12 | 0.76±0.11 | <0.13 | - | - | 12.98±0.80 | - | - |
| 21SK033D | 2.45±0.06 | 2.35±0.05 | 0.82±0.08 | 0.94±0.07 | 0.20±0.04 | - | - | 17.88±0.47 | - | - |
| 21SK034A | 2.29±0.09 | 2.23±0.07 | 1.00±0.16 | 1.17±0.10 | 0.51±0.04 | - | - | 16.24±0.88 | - | - |
| 21SK034B | 2.72±0.06 | 2.69±0.05 | 1.06±0.07 | 0.89±0.05 | 0.26±0.02 | <5.4 | - | 15.38±0.53 | <0.08 | - |
| 21SK034C | 2.29±0.09 | 2.29±0.07 | 0.79±0.14 | 0.53±0.10 | 0.22±0.04 | - | - | 14.50±0.83 | - | - |
| 21SK034D | 3.30±0.10 | 2.97±0.08 | 1.00±0.16 | 0.97±0.10 | 0.234±0.04 | - | - | 17.23±0.96 | - | - |

Table 4 - (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ035A | 1.46±0.10 | 1.65±0.08 | 0.96±0.14 | 1.02±0.10 | 0.37±0.04 | - | - | 14.40±0.99 | - | - |
| 21SJ035B | 1.69±0.08 | 1.72±0.08 | 0.92±0.14 | 1.05±0.10 | 0.30±0.04 | - | - | 16.87±0.82 | - | - |
| 21SJ035C | 2.13±0.05 | 2.19±0.05 | 1.10±0.06 | 1.14±0.06 | 0.21±0.01 | <6.8 | - | 17.22±0.35 | - | - |
| 21SJ035D | 1.81±0.07 | 1.78±0.06 | 1.03a0.11 | 0.93±0.07 | 0.39±0.03 | - | - | 16.17±0.71 | - | - |
| 21SJ036A | 1.85±0.06 | 1.89±0.05 | 1.01±0.08 | 0.94±0.06 | 0.41±0.02 | - | - | 16.09±0.49 | - | - |
| 21SJ036B | 2.16±0.05 | 2.02±0.04 | 0.84±0.06 | 0.87±0.04 | 0.29±0.02 | - | - | 15.22±0.38 | <0.07 | - |
| 21SJ036C | 1.96±0.08 | 1.99±0.07 | 0.67±0.11 | 0.86±0.08 | 0.14±0.03 | - | - | 13.77±0.95 | - | - |
| 21SJ036D | 1.88±0.10 | 1.90±0.09 | 0.99±0.13 | 0.95±0.10 | 0.11±0.03 | - | - | 15.54±0.81 | - | - |
| 21SJ037A | 2.73±0.07 | 2.75±0.05 | 1.01±0.06 | 1.12±0.06 | 0.49±0.02 | <6.7 | 0.21±0.02 | 16.22±0.37 | - | - |
| 21SJ037B | 2.18±0.07 | 2.23±0.06 | 1.06±0.12 | 1.15±0.07 | 0.32±0.02 | - | - | 15.35±0.68 | - | - |
| 21SJ037C | 1.79±0.06 | 1.77±0.05 | 1.08±0.10 | 1.09±0.08 | 0.23±0.02 | - | - | 16.44±0.46 | - | - |
| 21SJ037D | 1.92±0.05 | 1.94±0.04 | 1.10±0.07 | 1.02±0.05 | 0.08±0.01 | - | - | 15.01±0.38 | <0.07 | Co-60 <0.04 |
| 21SJ038A | 1.44±0.10 | 1.68±0.07 | 0.67±0.14 | 0.75±0.09 | 0.33±0.04 | - | - | 15.54±0.99 | - | - |
| 21SJ038B | 1.46±0.10 | 1.53±0.06 | 0.98±0.15 | 1.01±0.10 | 0.19±0.04 | - | - | 19.62±0.82 | - | - |
| 21SJ038C | 1.73±0.06 | 1.72±0.06 | 0.87±0.06 | 1.01±0.05 | 0.08±0.01 | <8.3 | - | 18.78±0.38 | - | - |
| 21SJ038D | 1.35±0.07 | 1.23±0.04 | 0.79±0.09 | 0.79±0.07 | <0.06 | - | - | 16.45±0.63 | - | - |
| 21SJ039A | 2.20±0.07 | 2.34±0.08 | 0.85±0.08 | 0.84±0.06 | 1.32±0.04 | - | - | 14.76±0.56 | - | Co-60 0.13±0.02 |
| 21SJ039B | 2.13±0.08 | 2.03±0.07 | 0.74±0.12 | 0.68±0.10 | 0.60±0.04 | - | - | 14.98±0.78 | <0.14 | - |
| 21SJ039C | 2.64±0.06 | 2.64±0.06 | 0.93±0.09 | 1.02±0.06 | 0.17±0.02 | <6.8 | 0.12±0.01 | 16.35±0.49 | - | - |
| 21SJ039D | 2.48±0.09 | 2.27±0.07 | 0.66±0.10 | 0.81±0.08 | 0.07±0.02 | - | - | 13.65±0.68 | <0.14 | - |
| 21SJ040A | 1.58±0.07 | 1.55±0.06 | 0.93±0.09 | 0.77±0.06 | 0.67±0.09 | - | - | 18.22±0.49 | - | - |
| 21SJ040B | 1.59±0.05 | 1.61±0.04 | 0.72±0.07 | 0.74±0.05 | 0.67±0.02 | - | - | 15.35±0.41 | <0.10 | - |
| 21SJ040C | 1.98±0.10 | 1.87±0.08 | 1.24±0.16 | 1.04±0.12 | 0.14±0.04 | - | - | 18.83±0.49 | - | - |
| 21SJ040D | 2.32±0.10 | 2.18±0.12 | 1.19±0.15 | 0.99±0.11 | <0.13 | - | - | 17.34±2.00 | - | - |
| 21SJ041A | 2.11±0.08 | 2.01±0.06 | 0.72±0.07 | 0.84±0.06 | 0.75±0.03 | <8.5 | - | 13.39±0.45 | - | - |
| 21SJ041B | 1.64±0.07 | 1.66±0.07 | 0.73±0.11 | 0.71±0.07 | 0.56±0.03 | - | - | 12.50±0.68 | - | - |
| 21SJ041C | 1.92±0.07 | 1.98±0.07 | 1.14±0.12 | 0.94±0.09 | 0.22±0.02 | - | - | 16.43±0.71 | - | - |
| 21SJ041D | 2.13±0.06 | 2.12±0.05 | 1.09±0.08 | 0.96±0.06 | 0.18±0.02 | - | - | 15.03±0.48 | <0.08 | - |
| 21SJ042A | 2.10±0.09 | 2.17±0.08 | 0.90±0.16 | 0.74±0.10 | 1.15±0.06 | - | - | 14.75±1.08 | - | - |
| 21SJ042B | 1.91±0.12 | 2.04±0.09 | 1.04±0.18 | 1.23±0.15 | 0.66±0.06 | - | - | 13.37±2.27 | - | - |
| 21SJ042C | 2.88±0.08 | 2.82±0.06 | 1.01±0.08 | 1.07±0.07 | 0.32±0.02 | <8.3 | - | 16.93±0.50 | - | - |
| 21SJ042D | 2.01±0.08 | 1.96±0.10 | 0.79±0.11 | 0.68±0.08 | 0.17±0.02 | - | - | 15.00±0.92 | - | - |
| 21SJ043A | 2.23±0.08 | 2.22±0.07 | 0.88±0.11 | 0.91±0.08 | 0.55±0.03 | - | - | 16.08±0.65 | - | - |
| 21SJ043B | 2.77±0.07 | 2.74±0.06 | 1.00±0.08 | 0.89±0.06 | 0.58±0.02 | - | - | 15.68±0.53 | 0.11±0.03 | - |
| 21SJ043C | 2.22±0.12 | 2.28±0.08 | 1.20±0.18 | 0.83±0.11 | 0.34±0.04 | - | - | 16.24±0.96 | - | - |
| 21SJ043D | 2.06±0.10 | 2.05±0.08 | 0.95±0.14 | 0.98±0.11 | <0.14 | - | - | 15.29±1.20 | - | - |
| 21SJ044A | 2.08±0.07 | 2.04±0.06 | 0.84±0.08 | 0.94±0.06 | 0.42±0.02 | <8.3 | - | 14.35±0.45 | - | - |
| 21SJ044B | 2.10±0.11 | 2.01±0.11 | 1.08±0.19 | 0.87±0.12 | 0.35±0.06 | - | - | 18.48±1.07 | - | - |

Table 4 - (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ044C | 2.21±0.08 | 2.19±0.08 | 0.72±0.08 | 1.0±0.08 | 0.25±0.02 | - | - | 16.57±0.46 | - | - |
| 21SJ044D | 2.00±0.08 | 1.89±0.07 | 0.95±0.12 | 0.95±0.09 | 1.16±0.25 | - | - | 15.81±0.94 | - | - |
| 21SJ045A | 1.75±0.09 | 1.82±0.08 | 0.68±0.09 | 0.83±0.09 | 0.38±0.03 | - | - | 14.61±0.55 | - | - |
| 21SJ045B | 1.84±0.05 | 1.76±0.05 | 0.79±0.06 | 0.72±0.05 | 0.27±0.02 | - | - | 12.07±0.41 | <0.09 | - |
| 21SJ045C | 2.18±0.11 | 2.13±0.09 | 0.93±0.15 | 0.78±0.11 | 0.37±0.05 | - | - | 15.83±1.01 | - | - |
| 21SJ045D | 2.11±0.07 | 2.01±0.06 | 1.05±0.08 | 1.13±0.09 | 0.15±0.02 | <7.3 | - | 15.68±0.43 | - | - |
| 21SJ046A | 1.56±0.08 | 1.56±0.07 | 0.71±0.13 | 0.77±0.10 | 0.18±0.03 | - | - | 11.89±0.83 | - | - |
| 21SJ046B | 1.85±0.09 | 1.74±0.06 | 0.75±0.10 | 0.99±0.08 | 0.24±0.02 | - | - | 16.16±0.58 | - | - |
| 21SJ046C | 1.63±0.05 | 1.56±0.05 | 0.90±0.08 | 1.01±0.06 | 0.21±0.02 | - | - | 14.81±0.48 | <0.08 | - |
| 21SJ046D | 1.78±0.10 | 1.79±0.09 | 1.41±0.17 | 1.22±0.13 | <.16 | - | - | 17.72±1.02 | - | - |
| 21SJ047A | 1.52±0.07 | 1.34±0.06 | 0.76±0.09 | 0.84±0.08 | 0.48±0.03 | - | - | 14.81±0.57 | - | - |
| 21SJ047B | 2.04±0.11 | 1.85±0.09 | 0.94±0.14 | 0.95±0.10 | 0.54±0.04 | - | - | 15.57±0.87 | - | - |
| 21SJ047C | 1.95±0.10 | 1.83±0.07 | 1.04±0.15 | 1.08±0.12 | 0.44a0.04 | - | - | 17.24±0.92 | - | - |
| 21SJ047D | 2.28±0.07 | 2.16±0.07 | 1.00±0.10 | 1.03±0.09 | 0.22±0.02 | - | - | 17.53±0.56 | - | - |
| 21SJ048A | 1.98±0.10 | 2.00±0.09 | 0.78±0.15 | 1.11±0.11 | 0.45±0.04 | - | - | 16.77±1.15 | - | - |
| 21SJ048B | 1.99±0.14 | 1.95±0.09 | 0.99±0.17 | 0.90±0.13 | 0.44±0.06 | - | - | 18.02±1.39 | - | - |
| 21SJ048C | 1.95±0.11 | 2.01±0.07 | 1.29±0.17 | 1.24±0.11 | 0.41±0.04 | - | - | 18.90±0.95 | - | - |
| 21SJ048D | 1.92±0.10 | 1.82±0.08 | 1.13±0.15 | 1.00±0.11 | 0.40±0.05 | - | - | 17.42±1.01 | - | - |
| 21SJ049A | 2.26±0.06 | 2.23±0.05 | 0.89±0.08 | 0.97±0.07 | - | - | - | 15.56±0.46 | - | - |
| 21SJ049B | 2.35±0.05 | 2.22±0.04 | 0.80±0.06 | 0.85±0.05 | 0.14±0.01 | - | - | 13.57±0.39 | <0.08 | - |
| 21SJ049C | 2.14±0.09 | 2.21±0.07 | 0.91±0.13 | 0.92±0.10 | 0.17±0.03 | - | - | 15.85±0.82 | - | - |
| 21SJ049D | 1.92±0.11 | 1.84±0.09 | 0.94±0.14 | 0.89±0.09 | 0.32±0.04 | <20 | - | 13.91±0.84 | - | - |
| 21SJ050A | 2.01±0.07 | 2.01±0.06 | 0.94±0.11 | 0.98±0.07 | 0.23±0.02 | - | - | 15.25±0.73 | - | - |
| 21SJ050B | 1.94±0.10 | 1.92±0.08 | 0.85±0.14 | 0.76±0.10 | 0.25±0.04 | - | - | 14.03±1.02 | - | - |
| 21SJ050C | 1.95±0.09 | 1.86±0.07 | 0.91±0.17 | 0.93±0.10 | 0.12±0.03 | - | - | 17.53±0.84 | - | - |
| 21SJ050D | 2.22±0.08 | 2.16±0.06 | 1.17±0.09 | 1.27±0.07 | 0.06±0.02 | <7.7 | - | 15.64±0.57 | - | - |
| 21SJ051A | 2.57±0.07 | 2.52±0.06 | 0.89±0.09 | 0.90±0.07 | 0.12±0.02 | - | - | 14.88±0.45 | - | - |
| 21SJ051B | 2.16±0.09 | 2.19±0.07 | 0.83±0.13 | 0.71±0.09 | <0.08 | - | - | 14.17±0.86 | - | - |
| 21SJ051C | 2.25±0.06 | 2.26±0.05 | 0.88±0.09 | 0.81±0.05 | <0.05 | - | - | 13.76±0.57 | <0.08 | - |
| 21SJ051D | 2.03±0.11 | 2.11±0.09 | 0.82±0.14 | 1.04±0.10 | <0.11 | - | - | 15.11±0.84 | - | - |

Table 5. Gamma Spectral Analyses of Soil Borings (pCi/gram)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ052-1 | 1.46±0.09 | 1.60±0.08 | 0.89±0.15 | 0.90±0.11 | 10.98±0.12 | - | - | 12.19±1.02 | - | - |
| 21SJ052-2 | 1.93±0.08 | 1.91±0.05 | 0.95±0.08 | 0.96±0.06 | 2.02±0.05 | <8.6 | - | 16.43±0.49 | - | - |
| 21SJ052-3 | 1.77±0.11 | 1.85±0.08 | 0.69±0.13 | 0.82±0.10 | 0.38±0.03 | - | - | 14.01±0.88 | - | - |
| 21SJ052-4 | 1.49±0.07 | 1.57±0.09 | 0.98±0.10 | 0.90±0.08 | 1.46±0.04 | - | - | 16.47±0.62 | - | Co-60 <0.06 |
| 21SJ052-5 | 1.64±0.05 | 1.67±0.04 | 0.89±0.07 | 0.91±0.06 | 1.96±0.03 | - | - | 17.00±0.47 | <0.08 | - |
| 21SJ052-6 | 1.36±0.05 | 1.32±0.04 | 0.89±0.07 | 0.80±0.06 | 0.40±0.02 | - | - | 17.42±0.53 | <0.10 | - |
| 21SJ052-7 | 1.03±0.08 | 1.03±0.06 | 0.61±0.11 | 0.53±0.11 | <0.09 | - | - | 16.16±0.85 | - | - |
| 21SJ052-8 | 1.30±0.06 | 1.26±0.05 | 0.58±0.07 | 0.76±0.06 | <0.05 | - | - | 15.79±0.44 | - | - |
| 21SJ052-9 | 0.98±0.06 | 0.89±0.05 | 0.73±0.10 | 0.42±0.08 | <0.07 | - | - | 13.38±0.80 | - | - |
| 21SJ052-10 | 1.09±0.07 | 0.97±0.05 | 0.84±0.09 | 0.70±0.08 | - | - | - | 14.45±0.55 | - | - |
| 21SJ052-11 | 1.16±0.05 | 1.21±0.05 | 0.83±0.07 | 0.90±0.06 | - | <7.8 | - | 17.19±0.45 | - | - |
| 21SJ052-12 | 1.01±0.07 | 1.04±0.05 | 0.96±0.11 | 0.89±0.09 | <0.08 | - | - | 17.99±0.77 | - | - |
| 21SJ053-1 | 2.20±0.10 | 2.33±0.10 | 1.30±0.16 | 0.89±0.10 | 0.21±0.04 | - | - | 16.03±0.96 | - | - |
| 21SJ053-2 | 2.00±0.06 | 1.98±0.05 | 1.10±0.07 | 1.08±0.06 | 0.13±0.02 | <7.47 | - | 16.19±0.43 | - | - |
| 21SJ053-3 | 2.05±0.09 | 2.12±0.07 | 1.15±0.11 | 1.02±0.08 | - | - | - | 14.82±0.53 | - | - |
| 21SJ053-4 | 1.89±0.09 | 2.08±0.06 | 0.61±0.12 | 0.58±0.10 | <0.08 | - | - | 11.32±0.69 | <0.14 | - |
| 21SJ053-5 | 2.03±0.05 | 2.05±0.05 | 0.56±0.06 | 0.62±0.05 | <0.04 | - | - | 12.60±0.47 | <0.07 | - |
| 21SJ053-6 | 2.16±0.06 | 2.07±0.04 | 0.61±0.07 | 0.54±0.05 | <0.05 | 8.16±2.00 | - | 12.21±0.45 | <0.08 | - |
| 21SJ053-7 | 1.28±0.04 | 1.24±0.04 | 0.85±0.05 | 0.77±0.05 | - | - | - | 15.83±0.35 | - | - |
| 21SJ053-8 | 1.07±0.04 | 1.11±0.04 | 0.69±0.06 | 0.76±0.06 | <0.04 | <6.11 | - | 15.06±0.35 | - | - |
| 21SJ053-9 | 0.89±0.08 | 0.95±0.06 | 0.71±0.11 | 0.53±0.08 | <0.08 | - | - | 13.72±0.73 | - | - |
| 21SJ053-10 | 1.05±0.05 | 1.05±0.04 | 0.87±0.09 | 0.59±0.06 | - | - | - | 16.45±0.48 | - | - |
| 21SJ053-11 | 0.93±0.05 | 0.93±0.03 | 0.71±0.05 | 0.63±0.04 | <0.04 | - | - | 14.96±0.40 | <0.06 | - |
| 21SJ053-12 | 1.04±0.09 | 0.76±0.07 | 0.61±0.13 | 0.47±0.09 | <0.12 | - | - | 14.11±0.92 | - | - |
| 21SJ054-1 | 1.99±0.05 | 1.93±0.05 | 0.68±0.07 | 0.70±0.05 | 0.11±0.01 | - | - | 14.66±0.43 | <0.08 | - |
| 21SJ054-2 | 1.93±0.07 | 2.01±0.06 | 0.80±0.11 | 0.84±0.08 | 0.14±0.03 | - | - | 15.64±0.80 | - | - |
| 21SJ054-3 | 1.87±0.07 | 2.03±0.06 | 0.71±0.10 | 0.66±0.09 | <0.08 | - | - | 14.75±0.72 | <0.11 | - |
| 21SJ054-4 | 2.16±0.08 | 2.00±0.07 | 0.85±0.08 | 0.92±0.07 | 0.12±0.02 | - | - | 15.68±0.51 | - | - |
| 21SJ054-5 | 2.20±0.13 | 2.09±0.09 | 0.88±0.14 | 0.80±0.11 | <0.14 | - | - | 13.95±1.07 | - | - |
| 21SJ054-6 | 1.77±0.09 | 1.82±0.10 | 0.66±0.14 | 0.98±0.11 | <0.11 | - | - | 15.65±0.97 | - | - |
| 21SJ054-7 | 1.55±0.09 | 1.59±0.06 | 0.72±0.12 | 0.57±0.11 | <0.08 | - | - | 13.04±0.85 | 0.16±0.05 | - |
| 21SJ054-8 | 1.71±0.11 | 1.59±0.10 | 0.68±0.15 | 0.75±0.11 | <0.14 | - | - | 13.87±1.32 | - | - |
| 21SJ054-9 | 2.27±0.06 | 2.23±0.05 | 0.90±0.07 | 0.81±0.06 | 0.05±0.01 | <8.12 | - | 16.51±0.49 | - | - |
| 21SJ054-10 | 1.95±0.05 | 1.95±0.04 | 0.70±0.06 | 0.75±0.05 | 0.24±0.02 | - | - | 14.27±0.45 | <0.07 | - |
| 21SJ054-11 | 1.57±0.07 | 1.57±0.05 | 0.71±0.08 | 0.71±0.07 | - | - | - | 14.79±0.53 | - | - |
| 21SJ054-12 | 1.29±0.05 | 1.41±0.05 | 0.57±0.06 | 0.68±0.06 | <0.04 | - | - | 14.06±0.37 | - | - |

Table 5 - (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ055-1 | 2.10±0.09 | 1.95±0.09 | 0.85±0.17 | 0.94±0.10 | 0.79±0.05 | - | - | 16.29±1.14 | - | - |
| 21SJ055-2 | 1.75±0.10 | 1.72±0.08 | 0.73±0.14 | 0.56±0.10 | 0.15±0.04 | - | - | 11.42±1.02 | - | - |
| 21SJ055-3 | 2.46±0.05 | 2.32±0.04 | 0.83±0.07 | 0.80±0.21 | <0.05 | - | - | 13.08±0.44 | 0.19±0.02 | - |
| 21SJ055-4 | 2.19±0.08 | 2.18±0.06 | 0.64±0.07 | 0.73±0.06 | - | - | - | 13.79±0.45 | - | - |
| 21SJ055-5 | 1.98±0.07 | 2.14±0.06 | 0.62±0.12 | 0.45±0.08 | <0.06 | - | - | 12.58±0.66 | - | - |
| 21SJ055-6 | 1.30±0.07 | 1.41±0.07 | 0.53±0.12 | 0.83±0.10 | <0.09 | - | - | 16.13±0.79 | - | - |
| 21SJ055-7 | 0.94±0.08 | 0.88±0.07 | 0.82±0.14 | 0.46±0.09 | <0.13 | - | - | 11.52±1.19 | - | - |
| 21SJ055-8 | 0.95±0.05 | 1.03±0.04 | 0.57±0.09 | 0.50±0.07 | <0.06 | - | - | 15.02±0.59 | <0.11 | - |
| 21SJ055-9 | 1.00±0.04 | 1.01±0.03 | 0.68±0.06 | 0.64±0.04 | <0.04 | - | - | 14.64±0.46 | 0.13±0.02 | - |
| 21SJ055-10 | 1.10±0.05 | 1.01±0.04 | 0.76±0.07 | 0.78±0.06 | - | - | - | 17.25±0.57 | - | - |
| 21SJ055-11 | 0.85±0.09 | 0.83±0.07 | 0.57±0.14 | 0.65±0.11 | <0.14 | - | - | 12.84±1.02 | - | - |
| 21SJ055-12 | 0.86±0.09 | 0.86±0.07 | 0.54±0.13 | 0.66±0.10 | <0.14 | - | - | 14.65±1.21 | - | - |
| 21SJ056-1 | 2.07±0.06 | 2.19±0.05 | 0.92±0.09 | 0.94±0.06 | 0.26±0.02 | - | - | 15.65±0.51 | <0.08 | - |
| 21SJ056-2 | 1.94±0.10 | 1.97±0.08 | 1.05±0.15 | 0.85±0.11 | 0.18±0.04 | - | - | 16.54±0.97 | - | - |
| 21SJ056-3 | 1.63±0.10 | 1.60±0.10 | 1.00±0.17 | 0.72±0.11 | <0.14 | - | - | 14.91±1.29 | - | - |
| 21SJ056-4 | 2.38±0.07 | 2.36±0.06 | 1.03±0.08 | 1.05±0.06 | <0.05 | - | - | 17.96±0.54 | <0.10 | - |
| 21SJ056-5 | 1.98±0.06 | 1.90±0.05 | 0.67±0.07 | 0.84±0.08 | - | - | - | 15.79±0.48 | - | - |
| 21SJ056-6 | 1.52±0.10 | 1.39±0.08 | 0.54±0.16 | 0.75±0.15 | <0.08 | - | - | 12.27±0.78 | - | - |
| 21SJ056-7 | 1.56±0.04 | 1.51±0.03 | 0.54±0.05 | 0.53±0.04 | <0.04 | - | - | 11.07±0.34 | <0.07 | - |
| 21SJ056-8 | 1.43±0.10 | 1.43±0.08 | 0.55±0.14 | 0.62±0.10 | <0.14 | - | - | 10.65±1.03 | - | - |
| 21SJ056-9 | 1.42±0.07 | 1.31±0.06 | 0.85±0.07 | 0.69±0.06 | - | <7.42 | - | 16.39±0.43 | - | - |
| 21SJ056-10 | 0.96±0.09 | 1.16±0.09 | 0.97±0.17 | 0.52±0.13 | - | - | - | 15.84±0.93 | - | - |
| 21SJ056-11 | 1.17±0.06 | 1.14±0.05 | 0.74±0.10 | 0.71±0.07 | - | - | - | 15.85±0.53 | - | - |
| 21SJ056-12 | 1.22±0.06 | 1.18±0.04 | 0.62±0.07 | 0.75±0.06 | <0.05 | - | - | 15.66±0.56 | <0.11 | - |
| 21SJ057-1 | 1.35±0.07 | 1.37±0.06 | 0.53±0.10 | 0.51±0.08 | 0.21±0.03 | - | - | 5.85±0.81 | - | - |
| 21SJ057-2 | 2.12±0.07 | 2.17±0.07 | 0.89±0.09 | 0.94±0.08 | 0.16±0.02 | <7.90 | - | 12.40±0.48 | - | - |
| 21SJ057-3 | 3.10±0.13 | 2.86±0.10 | 1.24±0.18 | 1.07±0.12 | <0.18 | - | - | 16.42±1.28 | - | - |
| 21SJ057-4 | 2.56±0.09 | 2.42±0.08 | 0.76±0.07 | 0.83±0.08 | - | <8.38 | - | 15.08±0.44 | - | - |
| 21SJ057-5 | 2.51±0.06 | 2.50±0.06 | 0.81±0.07 | 0.78±0.06 | <0.04 | - | - | 15.42±0.48 | - | - |
| 21SJ057-6 | 1.40±0.08 | 1.37±0.07 | 0.86±0.12 | 0.90±0.09 | <0.08 | - | - | 16.79±1.07 | - | - |
| 21SJ057-7 | 1.01±0.08 | 1.07±0.07 | 0.71±0.14 | 0.85±0.11 | <0.11 | - | - | 16.37±0.81 | - | - |
| 21SJ057-8 | 0.95±0.08 | 0.90±0.07 | 0.70±0.12 | 0.82±0.09 | <0.12 | - | - | 13.82±0.70 | - | - |
| 21SJ057-9 | 1.01±0.04 | 1.01±0.03 | 0.67±0.06 | 0.63±0.05 | <0.04 | - | - | 16.18±0.38 | <0.10 | - |
| 21SJ057-10 | 1.30±0.05 | 1.25±0.04 | 0.82±0.06 | 0.85±0.05 | <0.04 | <6.5 | - | 16.40±0.43 | - | - |
| 21SJ057-11 | 0.95±0.05 | 0.96±0.04 | 0.65±0.08 | 0.81±0.06 | - | - | - | 17.06±0.45 | - | - |
| 21SJ057-12 | 1.01±0.07 | 0.99±0.06 | 0.55±0.11 | 0.60±0.07 | <0.078 | - | - | 12.40±0.77 | - | - |

Table 5. (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ058-1 | 1.85±0.09 | 1.84±0.08 | 0.74±0.15 | 0.71±0.10 | 0.27±0.04 | - | - | 14.65±0.82 | - | - |
| 21SJ058-2 | 1.78±0.11 | 1.90±0.08 | 0.61±0.13 | 0.72±0.09 | <0.15 | - | - | 12.97±1.06 | - | - |
| 21SJ058-3 | 2.15±0.06 | 2.05±0.04 | 0.63±0.07 | 0.85±0.05 | <0.05 | - | - | 16.41±0.49 | <0.14 | - |
| 21SJ058-4 | 1.61±0.05 | 1.64±0.05 | 0.83±0.08 | 0.90±0.06 | - | - | - | 18.39±0.60 | - | - |
| 21SJ058-5 | 2.36±0.06 | 2.37±0.05 | 0.85±0.06 | 0.79±0.05 | <0.05 | - | - | 15.21±0.44 | - | - |
| 21SJ058-6 | 1.42±0.07 | 1.60±0.08 | 0.66±0.12 | 0.72±0.08 | <0.08 | - | - | 12.98±0.82 | - | - |
| 21SJ058-7 | 1.23±0.05 | 1.21±0.06 | 0.90±0.07 | 0.97±0.06 | <0.06 | <7.6 | - | 17.70±0.42 | - | - |
| 21SJ058-8 | 1.16±0.07 | 1.09±0.06 | 0.77±0.11 | 0.90±0.08 | <0.08 | - | - | 17.59±0.78 | - | - |
| 21SJ058-9 | 1.36±0.07 | 1.22±0.05 | 0.85±0.10 | 0.90±0.08 | - | - | - | 19.67±0.66 | - | - |
| 21SJ058-10 | 1.39±0.11 | 1.06±0.08 | <0.50 | 0.73±0.11 | <0.15 | - | - | 15.35±1.06 | - | - |
| 21SJ058-11 | 1.22±0.09 | 1.19±0.07 | 1.17±0.14 | 0.86±0.10 | <0.11 | - | - | 15.95±0.91 | - | - |
| 21SJ058-12 | 1.07±0.09 | 1.08±0.07 | 1.11±0.15 | 0.82±0.10 | <0.11 | <15 | - | 17.24±1.17 | - | - |
| 21SJ059-1 | 1.25±0.10 | 1.23±0.08 | 0.77±0.17 | 0.76±0.11 | 2.93±0.07 | - | - | 14.35±1.28 | - | Co-60 <0.11 |
| 21SJ059-2 | 1.61±0.11 | 1.66±0.08 | 0.83±0.14 | 0.85±0.10 | 0.63±0.04 | - | - | 16.17±1.12 | - | - |
| 21SJ059-3 | 2.09±0.05 | 1.95±0.04 | 0.97±0.06 | 1.00±0.05 | <0.04 | - | - | 16.37±0.44 | <0.07 | - |
| 21SJ059-4 | 2.09±0.08 | 2.06±0.06 | 1.15±0.09 | 1.26±0.07 | 0.55±0.03 | <7.8 | - | 17.90±0.40 | - | - |
| 21SJ059-5 | 3.08±0.07 | 3.08±0.08 | 1.19±0.08 | 1.31±0.09 | - | - | - | 20.96±0.52 | - | - |
| 21SJ059-6 | 2.69±0.08 | 2.71±0.07 | 1.25±0.14 | 0.89±0.07 | <0.07 | - | - | 19.03±0.71 | - | - |
| 21SJ059-7 | 1.41±0.04 | 1.37±0.03 | 0.88±0.07 | 0.97±0.05 | <0.04 | 5.92±1.60 | - | 17.54±0.50 | <0.07 | - |
| 21SJ059-8 | 1.05±0.09 | 1.00±0.07 | 1.00±0.13 | 0.88±0.09 | <0.10 | - | - | 17.20±0.91 | - | - |
| 21SJ059-9 | 0.91±0.06 | 0.93±0.05 | 1.08±0.13 | 0.78±0.07 | <0.07 | - | - | 16.67±0.70 | <0.12 | - |
| 21SJ059-10 | 1.11±0.04 | 1.02±0.03 | 0.84±0.07 | 0.93±0.04 | <0.04 | - | - | 17.03±0.38 | <0.08 | - |
| 21SJ059-11 | 1.04±0.06 | 1.02±0.05 | 0.87±0.08 | 0.92±0.07 | - | - | - | 18.36±0.48 | - | - |
| 21SJ059-12 | 0.74±0.05 | 0.72±0.05 | 1.01±0.06 | 0.91±0.05 | <0.08 | - | - | 17.51±0.38 | <0.06 | - |
| 21SJ060-1 | 1.08±0.05 | 1.08±0.04 | 0.69±0.07 | 0.81±0.07 | - | - | - | 14.69±0.44 | - | - |
| 21SJ060-2 | 1.00±0.05 | 0.83±0.05 | 0.72±0.06 | 0.94±0.06 | - | <6.9 | - | 15.97±0.43 | - | - |
| 21SJ060-3 | 1.08±0.06 | 1.28±0.07 | 0.75±0.10 | 0.89±0.07 | <0.06 | - | - | 14.99±0.70 | <0.11 | - |
| 21SJ060-4 | 1.02±0.04 | 1.06±0.03 | 0.69±0.06 | 0.68±0.04 | <0.04 | - | - | 14.08±0.36 | <0.07 | - |
| 21SJ060-5 | 0.93±0.09 | 0.91±0.06 | 0.60±0.13 | 0.53±0.10 | <0.13 | - | - | 12.63±0.88 | - | - |
| 21SJ060-6 | 1.21±0.04 | 1.15±0.04 | 0.62±0.62 | 0.68±0.04 | <0.05 | - | - | 15.16±0.44 | <0.08 | - |
| 21SJ060-7 | 1.11±0.07 | 1.11±0.06 | 0.74±0.12 | 0.70±0.08 | <0.10 | - | - | 14.76±0.75 | - | - |
| 21SJ060-8 | 0.93±0.09 | 0.95±0.07 | 0.64±0.13 | 0.50±0.09 | <0.13 | - | - | 15.32±0.93 | - | - |
| 21SJ060-9 | 1.23±0.06 | 1.13±0.05 | 0.62±0.08 | 0.65±0.07 | - | - | - | 15.77±0.49 | - | - |
| 21SJ060-10 | 1.24±0.10 | 1.16±0.07 | 0.85±0.13 | 0.75±0.10 | <0.10 | - | - | 15.33±0.81 | - | - |
| 21SJ060-11 | 1.01±0.08 | 1.05±0.07 | 0.86±0.14 | 0.61±0.10 | <0.10 | - | - | 16.00±0.83 | - | - |
| 21SJ060-12 | 1.49±0.06 | 1.43±0.06 | 1.10±0.09 | 1.12±0.06 | <0.07 | <8.1 | - | 20.32±0.53 | - | - |

Table 5 - (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ061-1 | 1.94±0.12 | 1.81±0.08 | 1.18±0.15 | 0.81±0.12 | 0.91±0.05 | - | - | 14.25±0.99 | - | - |
| 21SJ061-2 | 2.10±0.05 | 2.09±0.04 | 0.95±0.06 | 0.89±0.05 | 0.38±0.02 | - | - | 16.63±0.50 | <0.08 | - |
| 21SJ061-3 | 2.29±0.10 | 2.04±0.08 | 1.17±0.15 | 1.09±0.12 | <0.12 | - | - | 18.20±1.14 | - | - |
| 21SJ061-4 | 2.12±0.08 | 1.95±0.07 | 1.03±0.12 | 1.10±0.08 | <0.10 | - | - | 16.20±0.93 | 0.16±0.04 | - |
| 21SJ061-5 | 2.43±0.07 | 2.43±0.06 | 1.19±0.10 | 1.16±0.09 | - | - | - | 21.36±0.55 | - | - |
| 21SJ061-6 | 1.74±0.09 | 1.57±0.08 | 0.82±0.13 | 0.67±0.10 | <0.11 | - | - | 11.71±0.81 | - | - |
| 21SJ061-7 | 1.55±0.07 | 1.52±0.06 | 0.70±0.08 | 0.66±0.06 | <0.07 | <7.6 | - | 11.85±0.45 | 0.18±0.04 | - |
| 21SJ061-8 | 1.08±0.07 | 1.18±0.06 | 0.61±0.11 | 0.50±0.07 | <0.10 | - | - | 10.46±0.68 | - | - |
| 21SJ061-9 | 1.49±0.07 | 1.41±0.05 | 0.97±0.09 | 0.96±0.07 | - | - | - | 18.32±0.50 | - | |
| 21SJ061-10 | 1.86±0.06 | 1.81±0.05 | 1.52±0.11 | 1.66±0.09 | <0.07 | - | - | 29.04±0.68 | <0.10 | - |
| 21SJ061-11 | 1.70±0.12 | 1.61±0.10 | 1.14±0.17 | 0.79±0.12 | <0.14 | - | - | 15.12±1.01 | - | - |
| 21SJ061-12 | 1.59±0.10 | 1.32±0.08 | 1.13±0.14 | 0.73±0.11 | <0.14 | - | - | 15.06±0.98 | - | - |
| 21SJ062-1 | 2.03±0.11 | 1.73±0.08 | 1.04±0.13 | 0.71±0.10 | 0.55±0.04 | - | - | 16.15±1.01 | - | - |
| 21SJ062-2 | 1.96±0.06 | 1.89±0.07 | 0.94±0.06 | 0.88±0.05 | 0.18±0.02 | <7.8 | - | 15.77±0.37 | 0.11±0.02 | |
| 21SJ062-3 | 1.53±0.06 | 1.48±0.06 | 0.60±0.10 | 0.66±0.07 | 1.85±0.04 | - | - | 11.68±0.59 | 0.58±0.03 | - |
| 21SJ062-4 | 1.79±0.06 | 1.72±0.07 | 0.74±0.08 | 0.84±0.07 | 0.13±0.02 | - | - | 15.32±0.48 | - | - |
| 21SJ062-5 | 1.74±0.04 | 1.62±0.04 | 0.85±0.06 | 0.79±0.05 | <0.05 | - | - | 15.12±0.40 | <0.08 | - |
| 21SJ062-6 | 2.73±0.07 | 2.60±0.05 | 1.08±0.09 | 1.08±0.07 | <0.06 | - | - | 15.41±0.47 | 0.18±0.13 | - |
| 21SJ062-7 | 1.20±0.04 | 1.16±0.03 | 0.60±0.05 | 0.69±0.04 | - | - | - | 8.51±0.27 | - | - |
| 21SJ062-8 | 2.26±0.13 | 2.14±0.09 | 0.94±0.19 | 0.73±0.11 | <0.15 | - | - | 13.12±1.25 | - | - |
| 21SJ062-9 | 1.10±0.08 | 1.19±0.07 | <0.41 | 0.43±0.09 | <0.11 | - | - | 6.76±1.06 | - | - |
| 21SJ062-10 | 1.12±0.06 | 1.07±0.05 | 0.37±0.06 | 0.26±0.05 | <0.04 | <6.5 | - | 5.87±0.29 | - | - |
| 21SJ062-11 | 0.82±0.06 | 1.00±0.06 | <0.29 | 0.24±0.07 | <0.08 | - | - | 3.41±0.72 | - | - |
| 21SJ062-12 | (no sample available at 12 ft level, struck water) | | | | | | | | | |
| 21SJ063-1 | 1.90±0.07 | 1.92±0.06 | 0.80±0.10 | 0.90±0.06 | 1.71±0.05 | - | - | 14.89±0.49 | - | - |
| 21SJ063-2 | 1.80±0.05 | 1.74±0.05 | 0.73±0.06 | 0.71±0.06 | 0.58±0.02 | - | - | 13.93±0.41 | 0.20±0.03 | - |
| 21SJ063-3 | 1.45±0.09 | 1.50±0.08 | 0.94±0.15 | 0.69±0.10 | 2.00±0.05 | - | - | 12.81±1.06 | - | - |
| 21SJ063-4 | 2.01±0.10 | 2.15±0.08 | 0.87±0.14 | 1.35±0.13 | 0.29±0.04 | - | - | 16.80±1.02 | - | - |
| 21SJ063-5 | 2.18±0.07 | 2.22±0.08 | 1.08±0.09 | 0.97±0.06 | 2.78±0.10 | <8.3 | - | 18.61±0.55 | 0.31±0.02 | - |
| 21SJ063-6 | 1.70±0.08 | 1.75±0.09 | <0.30 | 0.44±0.10 | 108.93±0.22 | - | - | 7.88±0.62 | 2.91±0.06 | Co-60 0.62±0.03; Pu-239/240 3.55 ±0.05; Sr-90 <1.04 Pu-238 0.09±0.01 |
| 21SJ063-7 | <0.10 | <0.11 | 0.15±0.03 | 0.12±0.03 | 12.94±0.07 | - | - | 2.97±0.18 | 0.40±0.01 | - |
| 21SJ063-8 | 2.01±0.07 | 1.95±0.07 | 0.58±0.07 | 0.77±0.07 | 3.61±0.12 | - | - | 9.44±0.39 | - | - |
| 21SJ063-9 | 2.03±0.07 | 2.00±0.06 | 0.93±0.08 | 1.04±0.07 | 3.79±0.05 | - | - | 15.40±0.51 | - | - |
| 21SJ063-10 | 1.48±0.09 | 1.49±0.07 | <0.41 | <0.29 | 1.33±0.05 | - | - | 7.11±0.85 | - | - |
| 21SJ063-11 | 0.92±0.09 | 1.10±0.07 | <0.39 | <0.30 | 0.31±0.04 | - | - | 6.97±0.79 | - | - |
| 21SJ063-12 | 1.25±0.07 | 1.19±0.06 | 0.42±0.10 | 0.29±0.07 | 0.24±0.03 | - | - | 7.67±0.68 | - | - |

Table 5. (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ064-1 | 1.55±0.10 | 1.73±0.07 | 0.46±0.12 | 0.82±0.09 | 0.20±0.03 | - | - | 12.94±0.85 | - | - |
| 21SJ064-2 | 1.92±0.08 | 1.79±0.05 | 0.86±0.08 | 0.92±0.07 | 0.12±0.02 | - | - | 13.50±0.56 | - | - |
| 21SJ064-3 | 2.00±0.11 | 2.17±0.10 | 1.06±0.16 | 0.97±0.11 | <0.15 | - | - | 15.05±1.09 | - | - |
| 21SJ064-4 | 2.75±0.07 | 2.54±0.08 | 1.15±0.10 | <1.7 | - | - | - | 18.23±0.55 | - | - |
| 21SJ064-5 | 2.51±0.10 | 2.75±0.07 | 0.86±0.11 | 0.86±0.10 | <0.08 | - | - | 16.06±0.96 | - | - |
| 21SJ064-6 | 1.76±0.05 | 1.78±0.04 | 0.85±0.07 | 0.72±0.05 | <0.04 | - | - | 13.53±0.40 | <0.07 | - |
| 21SJ064-7 | 1.69±0.08 | 1.88±0.08 | 0.62±0.12 | 0.61±0.08 | <0.08 | - | - | 12.49±1.73 | - | - |
| 21SJ064-8 | 1.49±0.07 | 1.63±0.05 | 0.49±0.09 | 0.62±0.07 | <0.07 | - | - | 12.19±0.64 | - | - |
| 21SJ064-9 | 1.54±0.05 | 1.54±0.04 | 0.73±0.06 | 0.60±0.05 | <0.05 | - | - | 15.27±0.43 | <0.07 | - |
| 21SJ064-10 | 0.99±0.04 | 0.99±0.04 | 0.73±0.07 | 0.81±0.05 | <0.05 | - | - | 14.30±0.43 | <0.07 | - |
| 21SJ064-11 | 0.39±0.06 | 0.27±0.04 | 0.91±0.06 | 1.02±0.05 | <0.04 | <5.5 | - | 15.92±0.33 | 0.30±0.02 | - |
| 21SJ064-12 | 0.82±0.05 | 1.03±0.04 | 0.78±0.09 | 0.84±0.07 | <0.07 | - | - | 12.97±0.59 | - | - |
| 21SJ065-1 | 1.78±0.06 | 1.90±0.06 | 0.94±0.07 | 1.04±0.06 | 0.26±0.03 | - | - | 16.28±0.56 | - | - |
| 21SJ065-2 | 1.71±0.05 | 1.75±0.05 | 0.95±0.06 | 0.92±0.06 | 0.05±0.02 | - | - | 15.80±0.42 | <0.08 | - |
| 21SJ065-3 | 2.61±0.08 | 2.47±0.06 | 1.08±0.08 | 1.08±0.07 | <0.14 | - | - | 18.64±0.50 | 0.16±0.04 | - |
| 21SJ065-4 | 2.01±0.12 | 2.13±0.08 | 0.77±0.15 | 0.98±0.11 | <0.14 | - | - | 10.99±1.04 | - | - |
| 21SJ065-5 | 2.03±0.11 | 1.86±0.07 | 0.59±0.13 | 0.65±0.09 | <0.11 | - | - | 12.11±1.10 | - | - |
| 21SJ065-6 through 21SJ065-12 samples are unavailable due to hard rock below the 5 ft level | | | | | | | | | | |
| 21SJ066-1 | 1.19±0.06 | 1.14±0.06 | 0.94±0.07 | 0.93±0.07 | 0.22±0.22 | - | - | 15.45±0.40 | - | - |
| 21SJ066-2 | 1.77±0.08 | 2.03±0.06 | 0.98±0.11 | 0.89±0.08 | 0.09±0.03 | - | - | 15.92±0.77 | - | - |
| 21SJ066-3 | 2.93±0.10 | 2.81±0.06 | 1.15±0.09 | 1.31±0.08 | 0.07±0.02 | - | - | 21.39±0.58 | - | - |
| 21SJ066-4 | 2.02±0.06 | 2.12±0.04 | 0.84±0.07 | 0.78±0.05 | <0.05 | - | - | 16.56±0.42 | 0.12±0.03 | - |
| 21SJ066-5 | 1.45±0.10 | 1.54±0.09 | <0.47 | 0.58±0.10 | <0.14 | - | - | 10.69±1.00 | - | - |
| 21SJ066-6 | 1.57±0.08 | 1.60±0.07 | 0.80±0.12 | 0.51±0.08 | <0.12 | - | - | 13.44±0.80 | - | - |
| 21SJ066-7 | 1.10±0.06 | 0.94±0.06 | 0.82±0.07 | 0.81±0.05 | - | <7.8 | - | 15.68±0.39 | - | - |
| 21SJ066-8 | 1.42±0.07 | 1.70±0.06 | 0.64±0.10 | 0.72±0.08 | <0.08 | - | - | 13.68±0.74 | - | - |
| 21SJ066-9 | 1.77±0.06 | 1.63±0.05 | 0.72±0.08 | 0.74±0.05 | - | - | - | 15.88±0.50 | - | - |
| 21SJ066-10 | 1.12±0.04 | 1.14±0.04 | 0.70±0.06 | 0.68±0.05 | <0.04 | - | - | 13.96±0.40 | <0.11 | - |
| 21SJ066-11 | 1.13±0.09 | 1.14±0.07 | 0.48±0.12 | 0.80±0.11 | <0.12 | - | - | 11.13±0.93 | - | - |
| 21SJ066-12 | 1.25±0.07 | 1.31±0.07 | 0.70±0.14 | 0.78±0.09 | <0.09 | - | - | 14.55±0.79 | - | - |
| 21SJ067-1 | 1.65±0.07 | 1.59±0.05 | 1.01±0.07 | 1.01±0.06 | 0.19±0.02 | <7.3 | - | 18.80±0.42 | - | - |
| 21SJ067-2 | 3.17±0.08 | 3.45±0.07 | 1.13±0.11 | 1.20±0.08 | <0.08 | - | - | 18.62±0.73 | <0.12 | - |
| 21SJ067-3 | 2.90±0.10 | 2.75±0.06 | 1.13±0.09 | 1.23±0.07 | - | - | - | 18.41±0.53 | - | - |
| 21SJ067-4 | 2.28±0.05 | 2.39±0.04 | 0.64±0.05 | 0.70±0.04 | <0.04 | - | - | 13.49±0.37 | <0.08 | - |
| 21SJ067-5 | 1.53±0.11 | 1.64±0.07 | 0.72±0.16 | 0.59±0.11 | <0.14 | - | - | 13.23±1.05 | - | - |
| 21SJ067-6 | 1.98±0.09 | 1.79±0.07 | 0.72±0.16 | 1.04±0.13 | <0.12 | - | - | 13.92±1.04 | - | - |
| 21SJ067-7 | 0.88±0.07 | 0.78±0.05 | 0.85±0.07 | 0.93±0.06 | <0.05 | - | - | 16.51±0.41 | - | - |

Table 5. (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ067-8 | 1.40±0.07 | 1.61±0.05 | 0.71±0.10 | 0.83±0.07 | <0.07 | - | - | 12.87±0.67 | <0.11 | - |
| 21SJ067-9 | 1.63±0.07 | 1.59±0.05 | 0.78±0.07 | 0.82±0.06 | - | - | - | 15.32±0.41 | - | - |
| 21SJ067-10 | 1.85±0.05 | 1.87±0.05 | 0.83±0.06 | 0.79±0.05 | <0.04 | <6.8 | 0.21±0.02 | 15.46±0.39 | - | - |
| 21SJ067-11 | 1.96±0.09 | 1.54±0.07 | 0.73±0.14 | 0.67±0.10 | <0.12 | - | - | 14.25±1.04 | - | - |
| 21SJ067-12 | 2.02±0.06 | 2.04±0.05 | 0.63±0.07 | 0.64±0.05 | <0.06 | <6.4 | - | 14.90±0.53 | <0.07 | - |
| 21SJ068-1 | 1.95±0.09 | 2.06±0.09 | 0.70±0.13 | 0.62±0.08 | <0.08 | - | - | 14.02±0.77 | - | - |
| 21SJ068-2 | 1.95±0.08 | 1.88±0.06 | 0.83±0.08 | 0.71±0.07 | - | - | - | 12.40±0.52 | - | - |
| 21SJ068-3 | 1.68±0.09 | 1.72±0.08 | 0.58±0.13 | 0.80±0.09 | <0.09 | - | - | 11.95±1.03 | - | - |
| 21SJ068-4 | 1.90±0.11 | 1.85±0.07 | 0.82±0.16 | 0.83±0.10 | <0.11 | - | - | 14.99±0.85 | - | - |
| 21SJ068-5 | 1.89±0.05 | 1.92±0.05 | 0.67±0.06 | 0.78±0.06 | <0.05 | - | - | 15.01±0.42 | 0.14±0.02 | - |
| 21SJ068-6 | 1.98±0.09 | 1.93±0.06 | 0.70±0.11 | 0.66±0.08 | <0.07 | - | - | 13.44±0.90 | - | - |
| 21SJ068-7 | 1.68±0.08 | 1.71±0.06 | 0.88±0.08 | 0.89±0.07 | - | - | - | 15.45±0.48 | - | - |
| 21SJ068-8 | 1.40±0.12 | 1.54±0.09 | 0.89±0.17 | 1.18±0.14 | <0.11 | - | - | 13.99±1.12 | - | - |
| 21SJ068-9 | 1.23±0.08 | 1.22±0.07 | 0.80±0.13 | 0.87±0.10 | <0.10 | - | - | 15.53±0.84 | - | - |
| 21SJ068-10 | 0.85±0.04 | 0.76±0.03 | 0.46±0.05 | 0.46±0.04 | <0.04 | - | - | 7.17±0.33 | - | - |
| 21SJ068-11 | 0.92±0.07 | 1.07±0.05 | 0.38±0.09 | 0.32±0.07 | <0.06 | - | - | 8.01±0.61 | - | - |
| 21SJ068-12 | 1.10±0.05 | 1.09±0.05 | 0.67±0.07 | 0.56±0.06 | - | - | - | 13.34±0.52 | - | - |
| 21SJ069-1 | 2.07±0.10 | 1.86±0.08 | 1.05±0.09 | 1.15±0.06 | <0.06 | <8.1 | - | 15.81±0.48 | - | - |
| 21SJ069-2 | 2.03±0.11 | 1.77±0.11 | 0.92±0.16 | 1.42±0.17 | <0.11 | - | - | 13.82±1.08 | - | - |
| 21SJ069-3 | 2.20±0.11 | 2.03±0.07 | 1.00±0.13 | 0.98±0.10 | 0.12±0.03 | <17 | - | 15.76±1.09 | - | - |
| 21SJ069-4 | 2.29±0.07 | 2.29±0.05 | 0.87±0.08 | 1.02±0.07 | 0.10±0.02 | - | - | 14.67±0.63 | - | - |
| 21SJ069-5 | 2.10±0.10 | 2.14±0.07 | 0.91±0.12 | 0.81±0.08 | 0.12±0.03 | - | - | 14.44±0.82 | - | - |
| 21SJ069-6 | 2.15±0.09 | 1.99±0.08 | 1.07±0.07 | 1.25±0.08 | <0.05 | <8.3 | - | 16.64±0.44 | - | - |
| 21SJ069-7 | 1.59±0.07 | 1.47±0.05 | 1.21±0.08 | 0.92±0.07 | - | - | - | 15.03±0.46 | - | - |
| 21SJ069-8 | 1.63±0.05 | 1.58±0.04 | 0.81±0.06 | 0.81±0.04 | <0.04 | - | - | 12.96±0.37 | - | - |
| 21SJ069-9 | 1.56±0.09 | 1.61±0.06 | 0.98±0.11 | 0.85±0.08 | <0.07 | - | - | 13.59±0.75 | - | - |
| 21SJ069-10 | 1.34±0.07 | 1.21±0.05 | 0.30±0.05 | 0.36±0.04 | 0.08±0.01 | <7.0 | - | 8.11±0.31 | - | - |
| 21SJ069-11 | 1.87±0.06 | 1.88±0.06 | 0.91±0.10 | 0.84±0.06 | - | - | - | 7.49±0.35 | - | - |
| 21SJ069-12 | 2.09±0.09 | 2.20±0.08 | 1.62±0.15 | 1.78±0.11 | <0.09 | - | - | 7.10±1.03 | - | - |
| 21SJ070-1 | 1.98±0.09 | 2.03±0.08 | 1.12±0.14 | 1.26±0.11 | <0.12 | - | - | 16.83±1.18 | - | - |
| 21SJ070-2 | 2.26±0.11 | 2.24±0.11 | 1.17±0.16 | 1.10±0.11 | <0.11 | - | - | 13.92±1.01 | - | - |
| 21SJ070-3 | 2.13±0.10 | 2.12±0.08 | 1.13±0.15 | 1.10±0.12 | <0.12 | - | - | 16.37±0.94 | - | - |
| 21SJ070-4 | 2.41±0.06 | 2.50±0.05 | 1.21±0.08 | 1.12±0.06 | <0.05 | - | - | 16.66±0.47 | 0.13±0.02 | - |
| 21SJ070-5 | 2.12±0.09 | 2.21±0.08 | 1.47±0.14 | 1.41±0.09 | <0.08 | - | - | 16.74±1.02 | - | - |
| 21SJ070-6 | 1.80±0.08 | 1.76±0.07 | 0.87±0.08 | 1.07±0.06 | <0.04 | <7.7 | - | 15.71±0.38 | - | - |
| 21SJ070-7 | 1.77±0.06 | 1.90±0.06 | 0.98±0.09 | 0.95±0.07 | - | - | - | 16.22±0.52 | - | - |
| 21SJ070-8 | 1.45±0.09 | 1.52±0.08 | 0.75±0.13 | 0.76±0.10 | <0.10 | - | - | 12.55±1.09 | - | - |

Table 5. (cont'd.)

| Sample No. | Bi-214 609 KeV | Ra-226 352 KeV | Ac-228 911 KeV | Th-228 583 KeV | Cs-137 661 KeV | U-238 1001 KeV | U-235 185 KeV | K-40 1460 KeV | Am-241 60 KeV | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| 21SJ070-9 | 1.77±0.09 | 1.72±0.07 | 0.75±0.13 | 0.96±0.10 | <0.11 | - | - | 14.35±0.90 | - | - |
| 21SJ070-10 | 1.33±0.11 | 1.65±0.08 | 0.98±0.14 | 1.07±0.10 | <0.10 | - | - | 3.28±0.85 | - | - |
| 21SJ070-11 | 1.70±0.09 | 1.59±0.07 | 1.89±0.15 | 1.96±0.12 | <0.11 | - | - | 5.29±0.79 | - | - |
| 21SJ070-12 | 1.45±0.08 | 1.65±0.06 | 1.97±0.13 | 1.79±0.08 | <0.07 | - | - | 4.63±0.72 | - | - |
| 21SJ071-1 | 1.86±0.08 | 1.81±0.07 | 0.92±0.08 | 1.00±0.07 | 0.36±0.02 | - | - | 15.38±0.48 | - | - |
| 21SJ071-2 | 2.51±0.07 | 2.58±0.07 | 1.04±0.07 | 0.96±0.07 | 0.07±0.01 | <7.1 | - | 16.45±0.41 | - | - |
| 21SJ071-3 | 2.82±0.10 | 2.76±0.09 | 1.11±0.14 | 1.17±0.12 | <0.10 | - | - | 17.42±0.91 | - | - |
| 21SJ071-4 | 2.70±0.10 | 2.81±0.08 | 0.85±0.13 | 1.04±0.09 | <0.10 | - | - | 17.42±0.81 | - | - |
| 21SJ071-5 | 2.04±0.07 | 2.19±0.06 | 0.70±0.09 | 0.53±0.06 | <0.05 | - | - | 11.97±0.59 | - | - |
| 21SJ071-6 | 2.21±0.07 | 2.35±0.06 | 0.81±0.06 | 0.86±0.05 | <0.04 | <6.9 | - | 16.39±0.36 | - | - |
| 21SJ071-7 | 2.07±0.06 | 2.02±0.06 | 0.77±0.07 | 0.73±0.06 | - | - | - | 16.33±0.46 | - | - |
| 21SJ071-8 | 1.84±0.10 | 1.85±0.08 | 0.87±0.14 | 1.00±0.11 | <0.12 | - | - | 13.80±0.96 | - | - |
| 21SJ071-9 | 2.04±0.06 | 1.99±0.05 | 0.80±0.06 | 0.80±0.05 | <0.05 | - | - | 13.43±0.39 | - | - |
| 21SJ071-10 | 1.73±0.06 | 1.72±0.04 | 0.86±0.06 | 0.84±0.05 | <0.04 | <8.5 | - | 15.88±0.36 | - | - |
| 21SJ071-11 | 1.64±0.06 | 1.55±0.05 | 0.74±0.08 | 0.79±0.06 | - | - | - | 16.00±0.48 | - | - |
| 21SJ071-12 | 1.24±0.09 | 1.17±0.07 | 0.86±0.13 | 0.75±0.08 | <0.09 | - | - | 15.12±0.93 | - | - |

Table 6. Uranium Fluorometric Analyses of Soil, Sludge, and Liquid Samples

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SB1A | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SB1B | 6.3±0.6 | 4.3±0.4 | - | - |
| 21SB1C | 5.6±0.6 | 3.8±0.4 | - | - |
| 21SB1D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SB2A | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SB2B | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SB2C | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SB2D | 3.8±0.4 | 2.6±0.3 | - | - |
| 21LK003 | - | - | 2.2±0.2 | 1.5±0.2 |
| 21LK004 | - | - | 0.54±0.05 | 0.37±0.4 |
| 21DK005 | 1010.00±101 | 689±69 | - | - |
| 21DK006 | 450.0±45 | 307±31 | - | - |
| 21LK007 | - | - | 0.31±0.03 | 0.21±0.02 |
| 21LK008 | - | - | 0.27±0.03 | 0.18±0.02 |
| 21DJ016 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21DJ017 | 2.1±0.2 | 1.4±0.1 | - | - |
| 21SK019A | 6.9±0.7 | 4.7±0.5 | - | - |
| 21SK019B | 6.6±0.7 | 4.5±0.5 | - | - |
| 21SK019C | 4.7±0.5 | 3.2±0.3 | - | - |
| 21SK019D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SK020A | 6.5±0.7 | 4.4±0.4 | - | - |
| 21SK020B | 5.7±0.6 | 3.9±0.4 | - | - |
| 21SK020C | 6.6±0.7 | 4.5±0.5 | - | - |
| 21SK020D | 5.6±0.6 | 3.8±0.4 | - | - |
| 21SK021A | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SK021B | 6.3±0.6 | 4.3±0.4 | - | - |
| 21SK021C | 6.2±0.6 | 4.2±0.4 | - | - |
| 21SK021D | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SK022A | 6.1±0.6 | 4.2±0.4 | - | - |
| 21SK022B | 5.3±0.5 | 3.6±0.4 | - | - |
| 21SK022C | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SK022D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SK023A | 6.4±0.6 | 4.4±0.4 | - | - |
| 21SK023B | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SK023C | 4.7±0.5 | 3.2±0.3 | - | - |
| 21SK023D | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SK024A | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SK024B | 5.2±0.5 | 3.5±0.4 | - | - |
| 21SK024C | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SK024D | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SK025A | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK025B | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SK025C | 5.2±0.5 | 3.5±0.4 | - | - |
| 21SK025D | 4.9±0.5 | 3.3±0.3 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SK026A | 5.5±0.6 | 3.8±0.4 | - | - |
| 21SK026B | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SK026C | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SK026D | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SK027A | 5.4±0.5 | 3.7±0.3 | - | - |
| 21SK027B | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK027C | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SK027D | 5.0±0.5 | 3.4±0.3 | - | - |
| 21SK028A | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK028B | 5.2±0.5 | 3.5±0.4 | - | - |
| 21SK028C | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SK028D | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK029A | 5.2±0.5 | 3.5±0.4 | - | - |
| 21SK029B | 5.5±0.6 | 3.8±0.4 | - | - |
| 21SK029C | 5.1±0.5 | 3.5±0.4 | - | - |
| 21SK029D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SK030A | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK030B | 5.2±0.5 | 3.5±0.4 | - | - |
| 21SK030C | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SK030D | 5.1±0.5 | 3.5±0.4 | - | - |
| 21SK031A | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK031B | 5.0±0.5 | 3.4±0.3 | - | - |
| 21SK031C | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK031D | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SK032A | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SK032B | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SK032C | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SK032D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SK032A | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SK032B | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SK032C | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SK032D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SK033A | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SK033B | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SK033C | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SK033D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SK034A | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SK034B | 5.0±0.5 | 3.4±0.3 | - | - |
| 21SK034C | 5.2±0.5 | 3.5±0.3 | - | - |
| 21SK034D | 5.5±0.6 | 3.8±0.4 | - | - |
| 21SJ035A | 2.9±0.3 | 2.0±0.2 | - | - |
| 21SJ035B | 2.8±0.3 | 1.9±0.2 | - | - |
| 21SJ035C | 2.8±0.3 | 1.9±0.2 | - | - |
| 21SJ035D | 2.6±0.3 | 1.9±0.1 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ036A | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ036B | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ036C | 4.2±0.4 | 2.9±0.3 | - | - |
| 21SJ036D | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ037A | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ037B | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ037C | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ037D | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ038A | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ038B | 2.9±0.3 | 2.0±0.3 | - | - |
| 21SJ038C | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ038D | 2.0±0.2 | 1.4±0.1 | - | - |
| 21SJ039A | 5.6±0.6 | 3.8±0.4 | - | - |
| 21SJ039B | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ039C | 4.7±0.5 | 3.2±0.3 | - | - |
| 21SJ039D | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SJ040A | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ040B | 4.2±0.4 | 2.9±0.3 | - | - |
| 21SJ040C | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ040D | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ041A | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ041B | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ041C | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ041D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ042A | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ042B | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ042C | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ042D | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ043A | 4.2±0.4 | 2.9±0.3 | - | - |
| 21SJ043B | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SJ043C | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ043D | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ044A | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ044B | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ044C | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ044D | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ045A | 6.8±0.7 | 4.6±0.5 | - | - |
| 21SJ045B | 5.3±0.5 | 3.6±0.4 | - | - |
| 21SJ045C | 5.6±0.6 | 3.8±0.4 | - | - |
| 21SJ045D | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SJ046A | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ046B | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ046C | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ046D | 3.4±0.3 | 2.3±0.2 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ047A | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ047B | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ047C | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ047D | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ048A | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ048B | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ048C | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ048D | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ049A | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ049B | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ049C | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ049D | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ50A | 3.9±0.4 | 2.6±0.3 | - | - |
| 21SJ50B | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ50C | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ50D | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ51A | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ51B | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ51C | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ51D | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ052-1 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ052-2 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ052-3 | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ052-4 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ052-5 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ052-6 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ052-7 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ052-8 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ052-9 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ052-10 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ052-11 | 2.4±0.2 | 2.1±0.2 | - | - |
| 21SJ052-12 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ053-1 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ053-2 | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ053-3 | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SJ053-4 | 4.7±0.5 | 3.2±0.3 | - | - |
| 21SJ053-5 | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SJ053-6 | 5.0±0.5 | 3.4±0.3 | - | - |
| 21SJ053-7 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ053-8 | 2.8±0.3 | 1.9±0.2 | - | - |
| 21SJ053-9 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ053-10 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ053-11 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ053-12 | 2.6±0.3 | 1.8±0.2 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ054-1 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ054-2 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ054-3 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ054-4 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ054-5 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ054-6 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ054-7 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ054-8 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ054-9 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ054-10 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ054-11 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ054-12 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ055-1 | 4.9±0.5 | 3.3±0.3 | - | - |
| 21SJ055-2 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ055-3 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ055-4 | 4.2±0.4 | 2.9±0.3 | - | - |
| 21SJ055-5 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ055-6 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ055-7 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ055-8 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ055-9 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ055-10 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ055-11 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ055-12 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ056-1 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ056-2 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ056-3 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ056-4 | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ056-5 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ056-6 | 2.8±0.3 | 1.9±0.2 | - | - |
| 21SJ056-7 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ056-8 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ056-9 | 2.2±0.2 | 1.5±0.2 | - | - |
| 21SJ056-10 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ056-11 | 2.1±0.2 | 1.4±0.1 | - | - |
| 21SJ056-12 | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SJ057-1 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ057-2 | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SJ057-3 | 5.7±0.6 | 3.9±0.4 | - | - |
| 21SJ057-4 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ057-5 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ057-6 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ057-7 | 2.0±0.2 | 1.4±0.1 | - | - |
| 21SJ057-8 | 2.0±0.2 | 1.4±0.1 | - | - |
| 21SJ057-9 | 2.2±0.2 | 1.5±0.2 | - | - |
| 21SJ057-10 | 1.9±0.2 | 1.3±0.1 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ057-11 | 1.8±0.2 | 1.2±0.1 | - | - |
| 21SJ057-12 | 2.0±0.2 | 1.4±0.1 | - | - |
| 21SJ058-1 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ058-2 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ058-3 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ058-4 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ058-5 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ058-6 | 2.9±0.3 | 2.0±0.2 | - | - |
| 21SJ058-7 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ058-8 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ058-9 | 2.6±0.3 | 1.8±0.2 | - | - |
| 21SJ058-10 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ058-11 | 2.6±0.3 | 1.8±0.2 | - | - |
| 21SJ058-12 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ059-1 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ059-2 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ059-3 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ059-4 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ059-5 | 5.6±0.6 | 3.8±0.4 | - | - |
| 21SJ059-6 | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SJ059-7 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ059-8 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ059-9 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ059-10 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ059-11 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ059-12 | 2.1±0.2 | 1.4±0.1 | - | - |
| 21SJ060-1 | 2.1±0.2 | 1.4±0.1 | - | - |
| 21SJ060-2 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ060-3 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ060-4 | 2.1±0.2 | 1.4±0.1 | - | - |
| 21SJ060-5 | 2.1±0.2 | 1.4±0.1 | - | - |
| 21SJ060-6 | 2.2±0.2 | 1.5±0.2 | - | - |
| 21SJ060-7 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ060-8 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ060-9 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ060-10 | 2.8±0.3 | 1.9±0.2 | - | - |
| 21SJ060-11 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ060-12 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ061-1 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ061-2 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ061-3 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ061-4 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ061-5 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ061-6 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ061-7 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ061-8 | 2.6±0.3 | 1.8±0.2 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ061-9 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ061-10 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ061-11 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ061-12 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ062-1 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ062-2 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ062-3 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ062-4 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ062-5 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ062-6 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ062-7 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ062-8 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ062-9 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ062-10 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ062-11 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ063-1 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ063-2 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ063-3 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ063-4 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ063-5 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ063-6 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ063-7 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ063-8 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ063-9 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ063-10 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ063-11 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ063-12 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ064-1 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ064-2 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ064-3 | 4.2±0.4 | 2.8±0.3 | - | - |
| 21SJ064-4 | 7.0±0.7 | 4.8±0.5 | - | - |
| 21SJ064-5 | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SJ064-6 | 4.7±0.5 | 3.2±0.3 | - | - |
| 21SJ064-7 | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ064-8 | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SJ064-9 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ064-10 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ064-11 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ064-12 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ065-1 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ065-2 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ065-3 | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SJ065-4 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ065-5 | 4.0±0.4 | 2.7±0.3 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ066-1 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ066-2 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ066-3 | 5.1±0.5 | 3.5±0.4 | - | - |
| 21SJ066-4 | 4.8±0.5 | 3.3±0.3 | - | - |
| 21SJ066-5 | 3.6±0.4 | 2.5±0.3 | - | - |
| 21SJ066-6 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ066-7 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ066-8 | 4.5±0.5 | 3.1±0.3 | - | - |
| 21SJ066-9 | 4.6±0.5 | 3.1±0.3 | - | - |
| 21SJ066-10 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ066-11 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ066-12 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ067-1 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ067-2 | 5.8±0.6 | 4.0±0.4 | - | - |
| 21SJ067-3 | 6.0±0.6 | 4.1±0.4 | - | - |
| 21SJ067-4 | 4.7±0.5 | 3.2±0.3 | - | - |
| 21SJ067-5 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ067-6 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ067-7 | 5.2±0.5 | 3.5±0.4 | - | - |
| 21SJ067-8 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ067-9 | 4.3±0.4 | 2.9±0.3 | - | - |
| 21SJ067-10 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ067-11 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ067-12 | 5.7±0.6 | 3.9±0.4 | - | - |
| 21SJ068-1 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ068-2 | 4.1±0.4 | 2.8±0.3 | - | - |
| 21SJ068-3 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ068-4 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ068-5 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ068-6 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ068-7 | 3.7±0.4 | 2.5±0.3 | - | - |
| 21SJ068-8 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ068-9 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ068-10 | 1.9±0.2 | 1.3±0.1 | - | - |
| 21SJ068-11 | 2.3±0.2 | 1.6±0.2 | - | - |
| 21SJ068-12 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ069-1 | 2.9±0.3 | 2.0±0.2 | - | - |
| 21SJ069-2 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ069-3 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ069-4 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ069-5 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ069-6 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ069-7 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ069-8 | 2.7±0.3 | 1.8±0.2 | - | - |
| 21SJ069-9 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ069-10 | 2.5±0.3 | 1.7±0.2 | - | - |

Table 6 - (cont'd.)

| Sample No. | µg/g±10% | pCi/g±10% | µg/ℓ±10% | pCi/ℓ±10% |
|---|---|---|---|---|
| 21SJ069-11 | 2.9±0.3 | 2.0±0.2 | - | - |
| 21SJ069-12 | 4.4±0.4 | 3.0±0.3 | - | - |
| 21SJ070-1 | 3.2±0.3 | 2.2±0.2 | - | - |
| 21SJ070-2 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ070-3 | 3.1±0.3 | 2.1±0.2 | - | - |
| 21SJ070-4 | 2.8±0.3 | 1.9±0.2 | - | - |
| 21SJ070-5 | 2.5±0.3 | 1.7±0.2 | - | - |
| 21SJ070-6 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ070-7 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ070-8 | 3.0±0.3 | 2.0±0.2 | - | - |
| 21SJ070-9 | 2.9±0.3 | 2.0±0.2 | - | - |
| 21SJ070-10 | 2.4±0.2 | 1.6±0.2 | - | - |
| 21SJ070-11 | 2.0±0.2 | 1.4±0.1 | - | - |
| 21SJ070-12 | 2.0±0.2 | 1.4±0.1 | - | - |
| 21SJ071-1 | 3.8±0.4 | 2.6±0.3 | - | - |
| 21SJ071-2 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ071-3 | 4.4±0.4 | 3.1±0.3 | - | - |
| 21SJ071-4 | 4.0±0.4 | 2.7±0.3 | - | - |
| 21SJ071-5 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ071-6 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ071-7 | 3.5±0.4 | 2.4±0.2 | - | - |
| 21SJ071-8 | 3.9±0.4 | 2.7±0.3 | - | - |
| 21SJ071-9 | 2.6±0.3 | 1.8±0.2 | - | - |
| 21SJ071-10 | 3.4±0.3 | 2.3±0.2 | - | - |
| 21SJ071-11 | 3.3±0.3 | 2.3±0.2 | - | - |
| 21SJ071-12 | 1.9±0.2 | 1.3±0.1 | - | - |

Notes: SB ~ soil background sample
LK ~ liquid sample, King Avenue
DJ ~ sludge sample, West Jefferson site
SK ~ soil sample, King Avenue
SJ ~ soil sample, West Jefferson site

Table 7. Uranium and Thorium Isotopic Analyses of Soil and Sludge Samples

| Sample No. | U-234 (% by weight) | U-235 (% by weight) | U-236 (% by weight) | U-238 (% by weight) |
|---|---|---|---|---|
| 21DK005 | 0.0269±0.0005 | 2.782±0.001 | 0.0081±0.0005 | 97.183±0.001 |
| 21DK006 | 0.0042±0.0005 | 0.5889±0.0005 | 0.0012±0.0005 | 99.406±0.001 |
| 21SK019A | 0.0048±0.0005 | 0.7117±0.0005 | <0.0005 | 99.284±0.001 |
| 21SK020A | 0.0050±0.0005 | 0.7853±0.0005 | <0.0005 | 99.209±0.001 |
| 21SK021A | 0.0044±0.0005 | 0.7117±0.0005 | <0.0005 | 99.284±0.001 |
| 21SK022A | 0.0048±0.0005 | 0.7397±0.0005 | <0.0005 | 99.254±0.001 |
| 21SK023A | 0.0051±0.0005 | 0.7259±0.0005 | <0.0005 | 99.269±0.001 |
| 21SJ064-4 | 0.0043±0.0005 | 0.7118±0.0005 | <0.0005 | 99.284±0.002 |
| 21SJ066-3 | 0.0047±0.0005 | 0.7128±0.0005 | <0.0005 | 99.283±0.002 |
| 21SJ067-3 | 0.0045±0.0005 | 0.7120±0.0005 | <0.0005 | 99.283±0.002 |

| Sample No. | Th-232 (pCi/g) | Th-230 (pCi/g) | Th-228 (pCi/g) |
|---|---|---|---|
| 21SK019A | 0.72±0.04 | 1.62±0.08 | 0.70±0.04 |
| 21SK020A | 0.61±0.04 | 1.77±0.07 | 0.61±0.04 |
| 21SK021A | 0.64±0.04 | 1.58±0.10 | 0.58±0.06 |
| 21SK022A | 0.42±0.04 | 0.96±0.04 | 0.41±0.02 |
| 21SK023A | 0.69±0.04 | 1.52±0.07 | 0.69±0.04 |
| 21SJ063-6 | 0.30±0.02 | 1.42±0.08 | 0.39±0.03 |
| 21SJ064-4 | 0.81±0.05 | 1.85±0.10 | 0.88±0.06 |
| 21SJ066-3 | 0.53±0.02 | 1.20±0.04 | 0.52±0.02 |
| 21SJ067-3 | 0.78±0.05 | 1.97±0.10 | 0.87±0.05 |

Notes: DK ~ sludge sample, West Jefferson site
SK ~ soil sample, King Avenue
SJ ~ soil sample, West Jefferson site

Table 8. Inorganic Analyses of Liquid Sample by Furnace Atomic Absorption Method -- µg/liter

| | Sample Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Element | 21LK003 | 21LK004 | 21LK007 | 21LK008 | 21LJ011 | 21LJ012 | 21LJ013 | 21LJ015 | 21LJ018 |
| Arsenic | 3.8 U | 3.8 U | 3.8 U | 3.8 U | 3.8 U | 3.8 U | 3.8 U | 3.8 U | 3.8 U |
| Lead | 3.7 U | 3.7 U | NR | NR | 3.7 U | 3.7 U | 3.7 U | 3.7 U | 3.7 U |
| Selenium | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |

Legend: U ~ Instrument Detection Limit
E2, E3, etc. = $10^2$, $10^3$, etc.
NR ~ Not requested

Table 9. Inorganic Analyses of Liquid Samples by Inductive Coupled Plasma Method -- µg/liter

| Element | Sample Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 21LK003 | 21LK004 | 21LK007 | 21LK008 | 21LJ011 | 21LJ012 | 21LJ013 | 21LJ015 | 21LJ018 |
| Aluminum | [1.89E2] | [1.4E2] | 1.05E3 | 2.2E2 | 3.1E2 | [1.9E2] | 2.05E2 | 9.96E2 | [8.6E2] |
| Antimony | 4.9E1 U | 4.9E1 U | 4.9E1 U | 4.9E1 U | 4.9E1 U | 4.9E1 U | 4.9E1 U | 4.9E1 U | [1.42E2] |
| Arsenic | 1.44E2 U | 1.44E2 U | 1.44E2 U | 1.44E2 U | 1.44E2 U | 1.44E2 U | 1.44E2 U | 1.44E2 U | 1.44E2 U |
| Barium | [1.8E1] | [1.4E1] | [6.7E1] | [1.5E1] | [4.9E1] | [1.45E2] | [3.0E1] | 1.26E2 | [2.0E1] |
| Beryllium | [0.59] | [4.6] | [1.5] | [0.64] | [0.73] | [2.8] | [0.68] | 0.14 U | [1.0] |
| Cadmium | [2.8] | 2.3 U | [3.2] | 2.3 U | 2.3 U | 2.3 U | 2.3 U | 2.3 U | 2.3 U |
| Calcium | 3.1E4 | 2.84E4 | 5.5E4 | 2.9E4 | 3.76E4 | 1.28E5 | 3.58E4 | 7.18E4 | 2.08E4 |
| Chromium | 2.2E1 | 1.4E1 | 8.2E1 | 2.0E1 | 1.8E1 | 2.2E1 | 1.9E1 | 1.2E1 | 1.4E1 |
| Cobalt | 1.8E1 U | 1.8E1 U | 1.8E1 U | 1.8E1 U | 1.8E1 U | 1.8E1 U | 1.8E1 U | 1.8E1 U | 1.8E1 U |
| Copper | 3.0E1 | 5.9E1 | 1.35E3 U | 1.01E3 | 3.3E1 | [2.5E1] | 4.2E1 | 6.5E1 | [2.2E1] |
| Iron | 2.36E2 | 2.5E2 | 8.03E3 | 9.47E2 | 6.17E2 | [6.4E1] | 2.64E2 | 3.21E3 | 3.44E2 |
| Lead | [1.31E2] | 8.6E1 U | 3.54E2 | 1.73E2 | 8.6E1 U | 8.6E1 U | 8.6E1 U | 8.6E1 U | 8.6E1 U |
| Magnesium | 1.03E4 | 1.02E4 | 2.34E4 | 1.07E4 | 1.28E4 | 8.2E4 | 1.24E4 | 2.64E4 | 6.33E3 |
| Manganese | 1.5E1 | [1.3E1] | 2.48E2 | 2.5E1 | 2.6E1 | 2.7E1 | 1.6E1 | 1.32E2 | 2.1E1 |
| Mercury* | 2.1 | 0.5 | 6.7 | 0.5 | 0.2 U | 0.2 U | 0.2 U | 0.5 | [0.1] |
| Nickel | [2.4E1] | 8.4 U | 1.08E2 | [2.8E1] | [2.3E1] | [9.0] | 8.4 U | [1.4E1] | 8.4 U |
| Potassium | [4.58E3] | [4.44E3] | 9.95E3 | 5.58E3 | [1.64E3] | [2.59E3] | 6.5E3 | 3.68E3 | 1.4E3 |
| Selenium | 1.06E2 U | 1.06E2 U | 1.06E2 U | 1.06E2 U | 1.06E2 U | 1.06E2 U | 1.06E2 U | 1.06E2 U | 1.06E2 U |
| Silver | [6.0] | [4.1] | 5.6E1 | [4.8] | [7.5] | [2.5E1] | [7.4] | 8.3E1 | [8.3] |
| Sodium | 3.85E4 | 3.73E4 | 4.56E4 | 4.035E4 | 1.54E5 | 2.54E5 | 1.82E5 | 9.92E4 | 2.05E5 |
| Thallium | 1.93E2 U | 1.93E2 U | 1.93E2 U | 1.93E2 U | 1.93E2 U | 1.93E2 U | 1.93E2 U | 1.93E2 U | 1.93E2 U |
| Vanadium | [2.4E1] | [2.2E1] | 5.5E1 | [2.4E1] | [2.8E1] | 7.6E1 | [2.8E1] | 5.8E1 | [2.6E1] |
| Zinc | 6.58E2 | 6.31E2 | 2.2E3 | 1.15E3 | 8.3E1 | 2.2 U | 2.2 U | 1.32E2 | 5.5E1 |

Legend: U = Instrument Detection Limit
[ ] = Greater than instrument detection limit but less than Method Detection Limit
* = Cold Vapor Atomic Absorption Method
E2, E3, etc. = $10^2$, $10^3$, etc.

Table 10. Inorganic Analyses of Sludge Samples by Inductive Coupled Plasma Method -- mg/kg

| | Sample Number | | | | | |
|---|---|---|---|---|---|---|
| Element | 21DK005 | 21DK006 | 21DJ010 | 21DJ014 | 21DJ016 | 21DJ017 |
| Aluminum | 1.67E3 | 1.02E4 | 2.68E3 | 6.49E3 | 5.58E3 | 1.76E3 |
| Antimony | 7.4E1 | 8.0E1 | [1.9E1] | [2.4E1] | [1.6E1] | 9.8 U |
| Arsenic | 2.9E1 U | 2.9E1 U | 2.9E1 U | 2.9E1 U | 2.9E1 U | 2.9E1 U |
| Barium | 3.15E3 | 2.4E3 | 5.2E1 | 1.16E2 | 1.5E2 | [2.0E1] |
| Beryllium | [2.8] | 4.97E2 | [0.76] | 1.6 | 1.7 | 1.7 |
| Cadmium | 4.3E1 | 4.1E1 | [2.3] | [1.8] | 6.3 | [2.0] |
| Calcium | 1.06E4 | 1.84E4 | 3.55E4 | 8.59E4 | 8.53E4 | 1.06E5 |
| Chromium | 3.25E3 | 1.78E3 | 1.2E1 | 2.9E1 | 1.9E1 | 1.3E1 |
| Cobalt | 9.4E1 | 1.15E2 | [5.2] | [9.8] | 1.2E1 | [4.2] |
| Copper | 2.19E3 | 1.97E3 | 1.44E2 | 5.9E1 | 6.9E1 | 2.3E1 |
| Iron | 3.72E4 | 8.33E4 | 9.99E3 | 2.53E4 | 1.93E4 | 1.23E4 |
| Lead | 3.33E3 | 2.35E3 | 4.8E1 | 1.16E2 | [3.4E1] | 1.7E1 U |
| Magnesium | 5.46E3 | 7.63E3 | 7.76E3 | 1.35E4 | 2.61E4 | 3.21E4 |
| Manganese | 2.03E3 | 3.13E2 | 1.66E2 | 3.25E2 | 5.02E2 | 2.5E2 |
| Mercury* | 9.2E1 | 8.5E2 | 2.5 | 1.8 | 0.55 | [0.05] |
| Nickel | 1.9E5 | 1.54E3 | 1.3 | 3.1E1 | 2.7E1 | 1.9E1 |
| Potassium | [1.83E2] | [2.39E2] | [4.2E2] | 1.08E3 | [8.14E2] | [2.9E2] |
| Selenium | 2.1E1 U | 2.5E2 | 2.1E1 U | 2.1E1 U | 2.1E1 U | 2.1E1 U |
| Silver | 6.5E1 | 1.27E2 | 7.5 | 9.1 | 2.7E1 | 8.0 |
| Sodium | [1.49E2] | [1.96E2] | [3.41E2] | [4.59E2] | [2.61E2] | [2.11E2] |
| Thallium | 3.9E1 U | 8.5E1 | 3.9E1 U | 7.2E1 | 3.9E1 U | 3.9E1 U |
| Vanadium | 2.1E1 | 1.03E3 | 2.4E1 | 3.6E1 | 3.1E1 | 2.1E1 |
| Zinc | 1.6E3 | 5.28E3 | 5.62E2 | 1.86E2 | 2.35E2 | 4.92E2 |

Legend: U = Instrument Detection Limit
[] = Greater than instrument detection limit but less than Method Detection Limit
* = Cold Vapor Atomic Absorption Method
E2, E3, etc. = $10^2$, $10^3$, etc.

# APPENDIX 1

## DESCRIPTION OF INSTRUMENTATION

### 1.0 PORTABLE RADIATION SURVEY INSTRUMENTS

#### 1.1 Gas-Flow Proportional Survey Meters

The Eberline PAC-4G-3 is a gas-flow proportional counter that utilizes a propane gas-proportional detector, 51 $cm^2$ (AC-21), 100 $cm^2$ or 325 $cm^2$ (AC-22) in area, with a thin double-aluminized Mylar window (~0.85 $mg/cm^2$).

Since this instrument has multiple high-voltage settings, it can be used to distinguish between alpha and beta-gamma contamination. This instrument is initially used in the beta mode. In that mode, the detector responds to alpha and beta particles and x- and gamma-rays. When areas indicate a higher count rate than the average instrument background, the beta-mode reading is recorded, and the instrument is then switched to the alpha mode to determine any alpha contribution. In the alpha mode, the instrument responds only to particles with high specific ionization. The alpha voltage is set to 1600 V, and the input discriminator is set to 1.5 mV. The instrument is calibrated in the alpha mode with four flat-plate, infinitely-thin NBS-traceable $^{239}Pu$ standards, and in the beta mode with a flat-plate, infinitely-thin NBS-traceable $^{90}Sr$-$^{90}Y$ standard. The PAG-4G-3 instruments are calibrated to an apparent 50% detection efficiency.

#### 1.2 Beta-Gamma End Window Survey Meter

When an area of contamination is found with a PAC instrument, a reading is taken with an Eberline Beta-gamma Geiger-Mueller Counter, Model E-530, with a HP-190 probe. This probe has a thin mica end window and is, therefore, sensitive to alpha and beta particles and x- and gamma-rays. A thin piece of aluminum is added to the mica, making the window density approximately 7 $mg/cm^2$. At this density, the instrument is not sensitive to the majority of alpha emissions. A maximum reading is obtained with the probe placed in contact with the area of contamination. In this position, the response (in mR/h) to gamma radiation is generally conservative relative to a determination of mrad/h at 1 cm. This instrument is calibrated in mR/h with a $^{226}Ra$ standard.

**APPENDIX 1**
**(Cont'd)**

1.3 Low-Energy Gamma Scintillation Survey Meter

An Eberline Model PRM-5-3 with a PG-2 gamma scintillation detector is used to determine the presence of low-energy X and gamma radiation.

The PG-2 detector consists of a thin Na(Tℓ) scintillation crystal 5 cm in diameter by 2 mm thick. This instrument is calibrated on three separate high voltages for three energy regions using Pu-239 (17 keV), Am-241 (59.5 keV), and U-235 (185.7 keV) sources. This instrument can be operated in either a differential (to discriminate between different energy regions) or integral mode.

1.4 High-Energy Micro "R" Scintillation Survey Meter

An Eberline Micro "R" meter model PRM-7 is used to detect high-energy gamma radiation. This instrument contains an internally mounted NaI(Tℓ) scintillation crystal 2.5 cm in diameter by 2.5 cm thick and can be used to measure fields of low-level radiation between 10 μR/h and 5000 μR/h. This instrument is used to survey ambient background radiation. It is held 1 m from the surface during survey. This instrument is also calibrated with a standard Ra-226 source and checked daily with a Cs-137 source.

1.5 Integrating Radiation Meter

In addition to the PRM-7, a pressurized ion chamber (Reuter Stokes Model RSS-111) is used at selected locations to determine the ambient radiation field. The RSS-111 has three output modes: (1) instantaneous exposure rate, (2) strip chart differential readout, and (3) integrated exposure. The chamber is mounted on a tripod, 3 ft above the surface, and has a uniform energy response from about 0.2 MeV to about 4 MeV. A three-hour period of operation is usually sufficient to obtain significant data.

2.0 SMEAR COUNTING INSTRUMENTATION

2.1 Large Area Counter

An ANL-designed gas-flow proportional detector connected to an Eberline Mini-Scaler Model MS-2 is used to count multiple smears simultaneously. This detector has a double-aluminized Mylar window (400 $cm^2$) and uses P-10 (90% argon and 10% methane) as the counting

**APPENDIX 1**
**(Cont'd)**

gas. The metal sample holder for this detector has been machined to hold ten smear papers. This particular system consists of two Mini Scalers and two detectors. One is used to count in the alpha mode the other is used in the beta mode. Up to ten samples can be counted simultaneously.

2.2 Proportional Counters

Any smear taken from a contaminated area is counted individually in a Nuclear Measurements Corporation gas-flow proportional counter (PC-5 or PC-3A). These instruments have been modified to contain a double-aluminized Mylar spun top window. This top is placed over nonconducting media (e.g., paper smears) to negate the dielectric effect on the counter. This counter also uses P-10 counting gas. Smears are counted in both the alpha and beta modes.

2.3 Calibration Procedures

A PC counter is calibrated by adjusting the input discriminator with the high voltage set at 700 V until it begins to count an alpha source. The plateaus are run to establish the operating voltages for alpha and beta-gamma. Additional information can be found in Appendix 2.

3.0 AIR SAMPLING EQUIPMENT

3.1 Filter Queen

Air samples are collected using a commercially available (ANL-modified Filter Queen) vacuum cleaner. Air is drawn through a filter medium at a flow rate of 40 $m^3/h$. The filters consist of 200-$cm^2$ sheets of Hollingsworth-Vose (HV-70) or LB5211-9 mil filter paper. The collection efficiency at these flow rates for 0.3-μm particles is about 99.9%.

3.2 Positive Displacement Pump

A separate air sample can be taken with a positive displacement pump drawing about 20 liters/min through a Millipore membrane (0.5 to 0.8 μm) filter paper for about one hour. An alpha spectrum can be measured from a section of this filter paper. The ratio of actinon ($^{219}Rn$) daughters (6.62 MeV α, AcC) to radon ($^{222}Rn$) daughters (7.69 MeV α, RaC') can be determined from this spectrum.

**APPENDIX 1**
**(Cont'd)**

4.0 GAMMA SPECTROSCOPY EQUIPMENT

4.1 Sample Analyses

4.1.1 A Nuclear Data Multichannel Analyzer Model ND-100, utilizing a 7.6-cm (3-in.) diameter by 7.6-cm (3-in.) thick NaI(Tℓ) lead shielded scintillation crystal is commonly used for gamma spectral analyses. The crystal and lead shielding are located inside the radiological survey vehicle. This instrument is calibrated with NBS-traceable gamma sources. This system can be used to identify contaminant radionuclides by analyzing the gamma-rays emitted by samples from contaminated areas.

4.1.2 A hyper-pure Germanium detector (ORTEC-17% efficiency right-circular cylinders) can be used when more sophisticated, high resolution gamma-ray analyses are required. The HPGe detector can be coupled to a variety of Multichannel Analyzers (Models ND-60, ND-66, or ND-100).

4.2 In-Situ Analyses (Borehole logging)

4.2.1 The gamma-ray spectrum of a borehole is logged using the Bicron 5.1 cm (2 in.) by 5.1 cm (2 in.) NaI crystal and either the ND-66 or the ND-100. This crystal is specially designed to withstand the temperature changes that can be encountered in boreholes. A permanent record of the spectra can be obtained by a channel by channel dump of the spectrum to a line printer.

4.2.2 A Nuclear Data portable multichannel analyzer, ND-6, utilizing a 5.1 cm diameter by 5.1 cm thick (2-inch by 2-inch) NaI(Tℓ) scintillation crystal is commonly used for borehole logging in areas that are inaccessible to the mobile laboratory. The instrument is battery operated and has both internal storage capabilities and a tape cassette. This instrument is also calibrated with NBS-traceable gamma-ray sources and is used to identify the presence of radionuclide contamination in the borehole.

# APPENDIX 2

## INSTRUMENT CONVERSION FACTORS

### 1.0 INSTRUMENTATION

The factors used to convert the survey instrument readings to units of disintegrations per minute per 100 $cm^2$ (dis/min-100 $cm^2$) and the derivation of those factors are listed below:

#### 1.1 Conversion Factors

| | PAC-4G-3 (51 $cm^2$) | | PAC-4G-3 (100 $cm^2$) | | Floor Monitor (FM-4G) | |
|---|---|---|---|---|---|---|
| | Alpha | Beta | Alpha | Beta | Alpha | Beta |
| To 100 $cm^2$ | 1.96 | 1.96 | 1.00 | 1.00 | 0.31 | 0.31 |
| dis/min per cts/min for $^{90}Sr$-$^{90}Y$ | - | 2 | - | 2 | - | 2 |
| dis/min per cts/min for $^{239}Pu$ | 2 | - | 2 | - | 2 | - |
| dis/min per cts/min for normal U | 3.5 | 2.7 | 2.7 | 2.4 | 3.0 | 2.5 |
| dis/min per cts/min for $^{226}Ra$ plus daughters | 1.7 | 1.8 | 1.7 | 1.8 | 1.7 | 1.8 |

Note: These values are multipliers to the measured net count rate to determine dis/min

#### 1.2 Derivation of Conversion Factors

Floor Monitor

Window Area: 325 $cm^2$
Conversion to 100 $cm^2$ = 0.31 times floor monitor readings

PAC-4G-3

Window Area: 51 $cm^2$
Conversion to 100 $cm^2$ = 1.96 times PAC reading

**APPENDIX 2**
**(Cont'd)**

Window Area: 100 $cm^2$
Conversion to 100 $cm^2$ = 1.00 times PAC reading

1.3 2π Internal Gas-Flow Counter PC Counter

Geometry: Solid Steel Spun Top - 0.50

Geometry: Mylar Spun Top - 0.43
Mylar spun tap {double-aluminized Mylar window (0.85 mg/$cm^2$)} utilizes the well of the PC counter and is a method developed and used by the Argonne National Laboratory Health Physics Section for negating the dielectric effect in counting samples on nonconducting media.

The PAC-4G-3 and PC counters were calibrated as described in Appendix 1. With a flat-plate, infinitely thin $^{226}Ra$ plus short-lived daughters standard used as a source of alpha emissions, the plate was counted in a 2π Internal Gas-Flow Counter (PC counter) with the source leveled to an apparent 2π geometry. The alpha counts per minute (cts/min) reading was found to be $1.86 \times 10^4$ cts/min, or $1.86 \times 10^4 \div 0.51^* = 3.65 \times 10^4$ disintegrations per minute (dis/min) alpha. Since the source was infinitely-thin, the alpha component was used as the total alpha dis/min of the source.

The same $^{226}Ra$ plus daughters source, when counted with the PAC instrument in the alpha mode, was found to be $2.18 \times 10^4$ cts/min at contact. The conversion factor for cts/min to dis/min for the PAC instrument is $3.65 \times 10^4 \div 2.18 \times 10^4 = 1.7$ dis/min per cts/min alpha.

The same source was covered with two layers of conducting paper, each 6.31 mg/$cm^2$, to absorb the alpha emissions. With the PC counter in the beta mode and the paper in good contact with the chamber, the count was found to be $1.17 \times 10^4$ cts/min, or $1.17 \times 10^4 \div 0.50 = 2.35 \times 10^4$ dis/min beta. With the PAC-4G-3 in the beta mode and in contact with the covered source in the center of the probe, the count was found to be $1.36 \times 10^4$ cts/min. This indicates a conversion factor of $2.35 \times 10^4 \div 1.36 \times 10^4 = 1.7$ dis/min per cts/min beta-gamma. All three detectors (51 $cm^2$, 100 $cm^2$ and 325 $cm^2$) gave readings similar to those reported above for the alpha and beta-gamma modes.

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*The value of 0.51 includes the following factors: geometry (g)=0.50; backscatter factor (bg)=1.02; sample absorption factor (sa)=1.0; window air factor (waf)=1.0. The product of g x bf x sa x waf is 0.51.

**APPENDIX 2**
**(Cont'd)**

Utilizing a 1.25 inch x 1.25 inch x 0.005 inch normal uranium foil as a source of uranium alpha emissions, the foil was counted in a PC counter with the source leveled to an apparent $2\pi$ geometry. The same normal uranium source, covered with two layers of conducting paper in good contact with the chamber, each 6.31 mg/cm$^2$ to negate the alpha emissions, was counted for composite beta and gamma emissions in the PC counter. The source was leveled to an apparent $2\pi$ geometry; however, no provision was made for backscatter.

The normal uranium source was also counted with the PAC instruments using all three detector areas in the alpha mode and covered with two layers of conducting paper in the beta mode. The conversion factors were calculated as for $^{226}$Ra.

2.0 SMEAR COUNT

The conversion factors for cts/min-100 cm$^2$ to dis/min-100 cm$^2$ for smear counts are given below:

2.1 Conversion Equation (Alpha)

$$\frac{\text{cts/min - (Bkgd)}}{\text{g x bf x sa x waf}} = \text{dis/min } \alpha$$

A geometry (g) of 0.43 is standard for all flat-plate counting using the Mylar spun top.

A backscatter factor (bf) of 1.0 is used when determining alpha activity on a filter media.

The self-absorption factor (sa) is assumed to be 1, unless otherwise determined.

If energies of the isotope are known, the appropriate window air factor (waf) is used; if the energies of the isotopes are not known, the (waf) of $^{239}$Pu is used.

The (waf) for alpha from $^{226}$Ra plus daughters is 0.55.

2.2 Conversion Equation (Beta)

$$\frac{\text{cts/min - \{}\beta\text{ Bkgd (cts/min) + }\alpha\text{ cts/min\}}}{\text{g x bf x sa x waf}} = \text{dis/min } \beta$$

## APPENDIX 2
## (Cont'd)

A geometry (g) of 0.43 is standard for all flat-plate counting using the Mylar spun top.

A backscatter factor (bf) of 1.1 is used when determining beta activity on a filter media.

A self-absorption factor (sa) is assumed to be 1, unless otherwise determined.

If the energies of the isotopes are known, the appropriate window air factor (waf) is used; if the energies of the isotopes are unknown, the (waf) of $^{90}Sr$-$^{90}Y$ (0.85) is used.

The (waf) for betas from $^{226}Ra$ plus daughters is 0.85.

# APPENDIX 3

## AIRBORNE RADIONUCLIDE CONCENTRATION CALCULATIONS

Calculations for determining radon concentrations in air samples collected with an Argonne National Laboratory-designed air sampler using HV-70 or LB-5211 filter media are summarized below. The basic assumptions and calculations used to derive the air concentrations also are included.

### 1.0 RADON CONCENTRATIONS

The following postulates are assumed in deriving the radon ($^{222}Rn$) concentrations based on the RaC' alpha count results:

1.1 RaA, RaB, RaC, and RaC' are in equilibrium.

1.2 RaA is present only in the first count and not the 100-minute decay count.

1.3 One-half of the radon progeny is not collected on the filter media, (i.e., unattached fraction).

1.4 The geometry factor (g) is 0.43 for both the alpha and beta activity.

1.5 The backscatter factor (bf) for the alpha activity is 1.0.

1.6 The sample absorption factor (sa) for RaC' is 0.77.

1.7 The window air factor (waf) for RaC' is 0.8.

1.8 RaB and RaC, being beta emitters, are not counted in the alpha mode.

1.9 The half-life of the radon progeny is approximately 36 minutes, based on the combined RaB and RaC half-lives.

1.10 Thoron and long-lived alpha emitters are accounted for using the 360-minute decay count and the seven-day count, respectively.

1.11 For all practical purposes, RaC' decays at the rate of the composite of RaB and RaC, which is about 36 minutes.

## APPENDIX 3
## (Cont'd)

The following postulates are assumed in deriving the thoron ($^{220}Rn$) concentrations:

1.12 ThA, ThB, ThC, and ThC' are in equilibrium.

1.13 ThA and RaC' have decayed by the 360-minute decay count.

1.14 The geometry factor (g), backscatter factor (bf), sample absorption factor (sa) and window air factor (waf) all are the same for thoron as for radon.

1.15 ThB and 64% of ThC, being beta emitters, are not counted in the alpha mode.

1.16 The half-life of the thoron progeny is 10.64 hours (638.4 minutes) based on the ThB half-life.

1.17 For all practical purposes, 36% of the ThC (alpha branch) and the ThC' decay at the same rate as ThB, which is 638.4 minutes.

1.18 The counter does not differentiate between ThC alphas and the ThC' alphas.

The following postulates are assumed in deriving the actinon ($^{219}Rn$) concentrations:

1.19 AcA, AcB, and AcC are in equilibrium.

1.20 AcA has decayed by the 100-minute decay count.

1.21 The geometry (g), backscatter (bf), sample absorption (sa), and window air factor (waf) factors all are the same for actinon as for radon.

1.22 AcB, being a beta emitter, is not counted in the alpha mode.

1.23 The half-life of the actinon progeny is 36.1 minutes based on the AcB half-life.

1.24 For all practical purposes, the AcC decays at the same rate as AcB, which is 36.1 minutes.

1.25 84% of the AcC decays by 6.62 MeV alpha emissions and 16% decays by 6.28 MeV alpha emissions.

**APPENDIX 3**
**(Cont'd)**

The following postulate is assumed in deriving the long-lived concentration:

1.26 The long-lived activity, as determined from the seven-day count, is assumed to be constant during the entire counting period. This assumption is valid for isotopes with half-lives longer than a few years.

2.0 EQUATIONS USED TO DERIVE AIR CONCENTRATIONS

$$A_o = \frac{A}{e^{-\lambda t}}$$

where: $A_o$ = activity (dis/min) present at the end of the sampling period (usually 40 minutes).

$A$ = activity (dis/min) at some time, t, after end of the sampling period.

$t$ = time interval (minutes) from end of sampling period to counting interval (usually 100 minutes).

$$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$$

$t_{\frac{1}{2}}$ = half-life of radionuclide (minutes).

Concentration is determined by the following equation.

$$C = \frac{A_o \lambda}{f} \frac{1}{\left(1 - e^{-\lambda t'}\right)}$$

where: $C$ = concentration (dis/min-$m^3$)

$A_o$ = activity on filter media at end of sampling period (dis/min)

$f$ = sampling rate ($m^3$/min = $m^3$/h x 1 h/60 min)

$t'$ = length of sampling time (min)

$$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$$

$t_{\frac{1}{2}}$ = half-life of radionuclide or controlling parent (min).

**APPENDIX 3**
**(Cont'd)**

3.0 ACTINON CORRECTION

Since the actinon ($^{219}Rn$) progeny (AcB & AcC) decays at the AcB life of 36 minutes, it cannot be distinguished from the radon ($^{222}Rn$) progeny using standard air sampling with HV-70 or LB-5211 filter media and standard alpha-counting techniques. A positive displacement pump is used to collect a sample on Millipore membrane (0.5 to 0.8 μm) filter media. The sample rate is approximately 20 liters/minute for a sampling time of at least 90 minutes. The center portion of the sample is removed and counted in an alpha spectrometer which exhibits the 6.62 MeV AcC alpha emissions and the 7.69 MeV RaC' alpha emissions. If these two peaks are observed in the spectrum, then the following calculations are performed:

$$B_j = \sum_{i=1}^{n} b_{ij}$$

where: $B_j$ = summation of the counts in n channels under peak j.

$b_{ij}$ = the number of counts in channel i of peak j.

j = 1 for the 6.62 MeV peak of actinon; 2 for the 7.69 MeV peak of radon

n = total number of channels in the summation.

The fractions of the activity with a 36-minute half-life due to actinon and radon are then:

$$\text{Actinon} = \frac{B_1/0.84}{B_1/0.84+B_2}$$

$$\text{Radon} = \frac{B_2}{B_1/0.84+B_2}$$

where 1 refers to actinon progeny and 2 refers to radon progeny.

**APPENDIX 3**
**(Cont'd)**

4.0 EXAMPLE CALCULATION

Data have been created to correspond to values likely to occur if all possible types of contamination are present in the air of a room where a sample is collected. The applications of the equations for determining all types of activity and their concentrations are given below:

| | |
|---|---|
| $f = 40\ m^3/60\ min$ | $t_s = 40\ min$ |
| at $t = 100\ min$ | $A = 200\ dis/min$ |
| at $t = 360\ min$ | $A = 140\ dis/min$ |
| at $t = 7\ days$ | $A = 5\ dis/min$ |

For long-lived activity:

$$A_o = A = 5\ dis/min$$

$$C(L) = A_o/fxt_s = \frac{5}{40/60x40} = 0.19\ dis/min\text{-}m^3.$$

For thoron:

$$A_o = \frac{140-5}{\exp - \frac{0.693 \times 360}{638.4}} = 199.6\ dis/min$$

$$C(Tn) = \frac{199.6 \times \frac{0.693}{638.4}}{40/60} \times \frac{1}{1 - \exp - \frac{0.693 \times 40}{638.4}} = 7.6\ dis/min\text{-}m^3$$

For radon ($^{222}Rn$) and actinon ($^{219}Rn$), activity due to thoron at $t = 100$ min:

$$A = \frac{135}{\exp - \frac{0.693 \times 260}{638.4}} = 179\ dis/min.$$

Activity due to the isotopes with a 36-minute half-life:

$$A = 2000 - 179 - 5 = 1816\ dis/min$$

## APPENDIX 3
## (Cont'd)

$$A_o = \frac{1816}{\exp - \frac{0.693 \times 100}{36}} = 12{,}454 \text{ dis/min}$$

$$C(36) = \frac{12{,}454 \times \frac{0.693}{36}}{40/60} \times \frac{1}{1 - \exp \frac{-0.693 \times 40}{36}} = 669.7 \text{ dis/min-m}^3$$

When an actinon peak is seen at 6.62 MeV, the counts under the two peaks are summed. For example, if 10 channels are summed, the following counts are found:

For 6.62 MeV peak: 44 counts in 10 channels, where the 6.62 alpha emissions are 84% of the total.

For 7.69 MeV peak: 601 counts in 10 channels, where the 7.69 MeV alpha emissions are 100% of the total.

$B_1$ = 44 counts

$B_1/0.84$ = 52 counts

$B_2$ = 601 counts

Actinon = 52/653 = 0.08

Radon = 601/653 = 0.92

C(Rn) = C(36) x Radon% = 669.7 x 0.92 = 616.1 dis/min-m$^3$

C(Am) = C(36) x Actinon% = 669.7 x 0.08 = 53.6 dis/min-m$^3$

Since we assume that on the average half of the progeny is not adhered to the filter paper, the above concentrations are then doubled to determine actual concentrations in the air. We assume that there is no unattached fraction for the long-lived activity.

C actual = C measured x progeny correction factor

C(L) = 0.19 dis/min-m$^3$

C(Tn) = 7.6 dis/min-m$^3$ x 2 = 15.2 dis/min-m$^3$

**APPENDIX 3**
**(Cont'd)**

$C(An) = 53.6 \text{ dis/min-m}^3 \times 2 = 107.2 \text{ dis/min-}^3$

$C(Rn) = 616 \text{ dis/min-m}^3 \times 2 = 1232 \text{ dis/min-m}^3.$

These would then be the resulting concentrations in dis/min-$m^3$. To convert to pCi/ℓ, divide the concentrations by $2.2 \times 10^3$:

$$C(L) = \frac{0.19 \text{ dis/min-m}^3}{2{,}220 \text{ dis/min-m}^3 \text{ pCi/ℓ}} = 8.6 \times 10^{-5} \text{ pCi/ℓ}$$

$$C(Tn) = \frac{15.2 \text{ dis/min-m}^3}{2{,}220 \text{ dis/min-m}^3 \text{ pCi/ℓ}} = 0.0068 \text{ pCi/ℓ}$$

$$C(An) = \frac{107.2 \text{ dis/min-m}^3}{2{,}220 \text{ dis/min-m}^3 \text{ pCi/ℓ}} = 0.048 \text{ pCi/ℓ}$$

$$C(Rn) = \frac{1232 \text{ dis/min-m}^3}{2{,}220 \text{ dis/min-m}^3 \text{ pCi/ℓ}} = 0.55 \text{ pCi/ℓ}.$$

## 5.0 RADON MONITORING INSTRUMENTS

Continuous monitoring of the radon concentration (and concomitant Working Level) is conducted with a commercially available Eberline Radon Gas Monitor Model 1 (RGM-1) and/or Model 2 (RGM-2). Details of these instruments can be found in their respective operating manuals. The manual for the instruments is available from the Eberline Division of the Thermo Electron Corp., P.O. Box 2108, Santa Fe, New Mexico 87501.

### 5.1 Radon Gas Monitor (RGM-1)

The Model RGM-1 Radon Gas Monitor is a complete portable system for continuous measurement of radon gas in air. The instrument incorporates a 1 liter scintillation cell detector for radon gas daughter product detection. A pump is used for continuous air flow through the detector. Counts from the detector are summed in a preset times scaler. The summed counts are recorded on a mechanical tape recorder at a preset time, generally 60 minutes. After recording the counts, the unit resets the scales and initiates a second 60 min counting series, thus allowing a continuous series of 60 min counts.

## APPENDIX 3
## (Cont'd)

The instrument is housed in an insulated aluminum suitcase to allow for operation in an exterior environment.

5.2 Radon Gas Monitor (RGM-2)

The Model RGM-2 Radon Gas Monitor is a complete, semiportable system for continuous measurement of radon gas. The instrument incorporates a 1-liter scintillation cell detector for radon gas detection and a microcomputer for data analysis. A pump is included for continuous gas flow, and an alphanumerical printer is used to record the data for unattended operation. The electronics section contains a variable high voltage supply and a charge-sensitive input amplifier. The power supply source is designed to operate from normal power line sources or from a dc power source, and it incorporates an internal battery as backup, for power source disturbances. All the electronic circuits are solid state with integrated circuits used extensively to enhance reliability.

The microcomputer is programmed to provide data output, in picocuries per liter (pCi/ℓ), by computing the data from gross detector counts divided by the detector calibration factor and subtracting the detector background counts. Normal data output is printed hourly, and a 24-hour average is printed at the end of a 24-hour period. A test routine; status conditions of alarm, power and airflow; and day/time-of-day functions are included. Operator control is provided by a 16-key keyboard.

The instrument is housed in an insulated steel cabinet for environmental protection. Detachable legs and handles are provided for ease of transportation.

The Radon Gas Monitors (RGM-1 and RGM-2) are calibrated with a Radon gas bubbler constructed from an NBS standard radium source. The efficiency determined in this fashion is consistent with the efficiency value supplied by the manufacturer. The RGM-1 determines counts per minute that can be converted to picocuries per liter of radon. The RGM-2 determines picocuries per liter of radon. Assuming equilibrium between the radon parent and the short-lived daughters, these values are readily converted to Working Levels.

# APPENDIX 4

## SAMPLE PREPARATION AND ANALYSIS GENERIC PROTOCOL

### 1.0 SOIL-SAMPLE PREPARATION

Soil samples are collected as described previously. These samples are bagged and identified at the collection site and returned to ANL. If there is an indication of radioactive contamination, the sample is sealed in a Nalgene jar. At ANL, the soil samples are logged into the soil-sample book, and each sample is weighed (on a tared balance scale) and the weight is marked on the container. This weight is recorded in the soil book as a "wet weight."

After all samples are marked, weighed, and recorded, they are dried. Each sample is placed in a pyrex beaker marked with the sample identification number. If more than one beaker is necessary, additional numbers (e.g., 1-3, 2-3, 3-3) are used. The original containers are saved for repackaging the dried samples. The beaker is set in an 80°C oven until the soil is dry (approximately 48 hours). The sample is returned to the original container and reweighed using a tared balance scale. This weight is also marked on the container and in the soil-sample book, where it is referred to as a "dry weight."

After all the samples are returned to their original containers, the milling process is started. Each dried sample is transferred to a 2.3-gallon ceramic mill jar containing mill balls (1¼" x 1¼" Burundum cylinders). The mill jar number is marked on the original container. The jars are sealed and the samples are milled for two hours or until sufficient material is produced to obtain 100 g and 5 g samples for analyses. The samples are milled six at a time. A second set of six jars is prepared while the milling of the first set is proceeding. After each sample is milled, the mill balls are removed with tongs and placed in a tray. A large plastic bag is inverted over the mill jar. Both are inverted and shaken until all the soil is transferred to the bag. If the soil plates the inside of the mill jar, a small paint brush is used to loosen the soil before the jar is inverted. A separate brush is used for each jar to prevent cross-contamination of the soil samples.

After milling, each sample is sieved through a number 30 standard testing sieve (600 μ mesh, about 5 minutes) and transferred to a 12" x 12" ziplock bag. Rocks and dross are bagged separately from the sieved material. The bags are marked with the sample number, the sieve number and R(rocks) or S(soil). The balance is tared and the weights of the soil (or rocks) are measured and recorded in the soil-sample book. A 100-g sample of the sieved material is transferred to a 4-oz. Nalgene bottle. These samples are analyzed by suitable analytical techniques, including, as a minimum, gamma spectroscopy (GeLi). A 5-g sample of the sieved material is transferred to a 1-oz. Nalgene bottle. One gram of this sample is used for the determination of uranium by laser fluorometry; 100 grams of this are needed for radiochemical analysis for

**APPENDIX 4**
**(Cont'd)**

Pu, Am, and Th if these analyses are required. The bottles containing these weighed samples are marked with sample number and date, and this information is recorded in the soil-sample book. The rocks (and dross) and remaining soil are placed in storage.

The sieves, mill jars, and Burundum milling balls used in this work are classified in two sets. One set is used for background samples exclusively. The other set is used for all samples from suspect areas. Soil samples with elevated levels of radioactivity based on instrument measurements are milled in one-gallon Nalgene bottles using Burundum balls from the set used for suspect samples. After use, these balls are either decontaminated (see below) or disposed of as radioactive waste. The Nalgene bottles are always disposed of as radioactive waste. The sieves used for these samples are also from the set used for suspect samples and are decontaminated after use.

2.0 EQUIPMENT DECONTAMINATION

The care of the milling apparatus is as important as the actual sample preparation. Proper care prevents cross-contamination of successive samples. The beakers used to dry the samples are washed thoroughly by placing a small amount of Haemo-Sol in each beaker and filling with warm water. The beaker is then scrubbed thoroughly on the inside and scoured on the outside with scouring powder. The beakers are rinsed three times with tap water and three times with demineralized water, and finally dried thoroughly before reuse.

The milling apparatus (tongs, brushes, milling jars, lids, and milling balls) are rinsed. The tongs and brushes are washed thoroughly with Haemo-Sol. Eight Burundum balls are returned to each milling jar along with about one pint of clean road gravel, one spoon of Haemo-Sol, one spoon of scouring powder with bleach, and one quart of water. The lid is tightened on the jar and the jar is placed on the rolling mill and rolled for approximately two hours or until the balls and the inside of the jar appear to be physically clean. After this time, the mill jar is removed from the rolling mill and its contents are dumped into a screen or basket. The lid and balls are then rinsed thoroughly three times with tap water followed by three times with demineralized water. The inside of the jar is rinsed until it is absolutely clean. The milling apparatus is air dried with warm air. Room air is drawn through the mill jars with a hose attached to a fume hood or specially constructed drying box.

The sieves are rinsed, washed in Haemo-Sol, thoroughly rinsed (three times with tap water, followed by three rinses with demineralized water) and then air dried as above before use.

**APPENDIX 4**
**(Cont'd)**

## 3.0 WATER AND SLUDGE

Water samples are collected in 0.1-liter, 0.5-liter, and/or 1-liter quantities as deemed appropriate. These samples are forwarded directly to a certified radiochemistry laboratory for preparation and analysis. The customary analysis procedure consists of filtration to obtain the suspended solids followed by evaporation to obtain the suspended solids. Both suspended and dissolved solids are analyzed by appropriate radiochemical analytical techniques. Sludge samples are collected in 0.1-liter bottles and are processed as outlined above for water samples.

## 4.0 SOIL ANALYSIS PROCEDURES

A 100-g fraction from each soil sample is analyzed by high resolution gamma-ray spectroscopy using a germanium crystal detector coupled to a multichannel analyzer. This analysis allows for a quantitative determination of the $^{226}Ra$ decay chain (via the 609 keV gamma-ray of $^{214}Bi$) and the $^{232}Th$ decay chain (via the 911 keV gamma-ray of $^{228}Ac$), as well as any other gamma emitting radionuclide (e.g., $^{137}Cs$) present in the soil.

The total uranium (elemental) present in the soil is determined by an acid leach of the soil sample followed by laser fluorometry of the leached sample.

Thorium analysis consists of an acid leach of the soil (using a $^{234}Th$ spike for yield determination) followed by plating a thin source of the radiochemically separated thorium and determining the thorium isotopes ($^{228}Th$, $^{230}Th$, and $^{232}Th$) by alpha spectroscopy.

The results of the above measurements allow for quantitative determination of the relative amounts of normal uranium and natural uranium, (i.e., $^{226}Ra$ decay chain), thorium ($^{232}Th$), mesothorium ($^{228}Ra$ decay chain), radiothorium ($^{228}Th$ decay chain), plutonium ($^{238}Pu$, $^{239,240}Pu$), and americium ($^{241}Am$) present in the contaminated material.

A mass spectrometric analysis of the uranium fraction is conducted when it is known or it is surmised that depleted or enriched uranium might be present.

# APPENDIX 5

## CALCULATION OF URANIUM SPECIFIC ACTIVITY

The specific activity for normal uranium was obtained by summing the measured specific activities for the individual isotopes weighted according to their normal abundances. Best values for these specific activities were taken from A.H. Jaffey et al., Phys. Rev. C 4 1889 (1971). The half-life for each isotope was taken from David C. Kocher, "Radioactive Decay Tables-A Handbook of Decay Data for Application to Radiation Dosimetry and Radiological Assessments" (1981). The percent abundances were taken from N.E. Holden, BNL-NCS-50605 (1977). Atomic weights were taken from the Handbook of Chemistry and Physics, 52nd Edition (1971). The specific activity of $^{234}U$ was calculated from the half-life.

| Isotope | Specific Activity (dis/min-g) | Half-life (years) | Abundance (atom %) | Atomic Weight (grams) | Abundance (wt %) |
|---|---|---|---|---|---|
| $^{234}U$ | $1.387 \times 10^{4}$ | $2.446 \times 10^{5}$ | 0.0054 | 234.0409 | 0.0053 |
| $^{235}U$ | 4.798 | $7.038 \times 10^{8}$ | 0.720 | 235.0439 | 0.7110 |
| $^{238}U$ | 0.746 | $4.4683 \times 10^{9}$ | 99.2746 / 100.0000 | 238.0508 | 99.2837 / 100.0000 |

where $(wt\ \%)_i =$

$$\frac{(atom\ \%)_i\ (atomic\ weight)_i}{\text{all } \Sigma_j (atom\ \%)_j\ (atomic\ weight)_j} = \frac{(atomic\ \%)_i\ (atomic\ weight)_i}{238.0289}$$

Specific activity for normal uranium:

$$0.746 \times 0.99284 \times 2 = 1.481 \text{ dis/min-}\mu g \text{ for } ^{234}U \text{ \& } ^{238}U$$

$$4.798 \times 0.00711 = \underline{0.034} \text{ dis/min-}\mu g \text{ for } ^{235}U$$

$$\sum = 1.515 \text{ dis/min-}\mu g \text{ for normal U}$$

or $(1.515 \text{ dis/min-}\mu g)/(2.22 \text{ dis/min-pCi}) = 0.683 \text{ pCi/}\mu g$.

where $^{234}U$ is assumed to be in secular equilibrium with the $^{238}U$ parent. Note that 2.24% of the total activity is due to $^{235}U$ and 48.88% each is due to $^{234}U$ and $^{238}U$.

## APPENDIX 5
## (Cont'd)

Calculation of the specific activity of other than normal mixtures of uranium isotopes is performed in a similar manner. For example, uranium having the isotopic composition (atom %) 238(0.99268), 236(0.000007) 235 (0.007233), 234(0.000064) and 233(0.000012) as determined by mass spectrometry would have the composition (weight %) of 238(.99278), 236 (0.000007), 235 (0.007142), 234(0.000063), and 233(0.000012) and the following specific activity:

$0.99278 \times 0.746 = 0.7406$ dis/min-μg from $^{238}U$

$0.000007 \times 1.436 \times 10^2 = 0.0010$ dis/min-)g from $^{236}U$*

$0.007142 \times 4.798 = 0.0343$ dis/min-μg from $^{235}U$

$0.000063 \times 1.387 \times 10^4 = 0.8738$ dis/min-μg from $^{234}U$

$0.000012 \times 2.140 \times 10^4 = \underline{0.2568}$ dis/min-μg from $^{233}U$‡

1.9065 dis/min-g U total

corresponding to:

(1.9065 dis/min-μg)/(2.22 dis/min-pCi) = 0.859 pCi/g U

Note that the uranium mixture is slightly enriched in the isotope $^{235}U$ (e.g., 0.7142% versus 0.7110%).

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*The half-life for $^{236}U$ ($2.342 \times 10^7$ yr) and the corresponding specific activity ($1.436 \times 10^2$ dis/min-μg) were taken from K.F. Flynn et al., J. Inorg. Nucl. Chem. 34 1121 (1972).

‡The half-life for $^{233}U$ ($1.5911 \times 10^5$ yr) and the corresponding specific activity ($2.140 \times 10^4$ dis/min-μg) were taken from A.H. Jaffey, K.F. Flynn et al., Phys. Rev. C 9 1991 (1974).

## APPENDIX 6

## INDIVIDUAL BUILDING SURVEY RESULTS

Building A

Radiological surveys were conducted in sixteen (16) rooms and/or areas in Building A. Four rooms exhibited radiation levels above background, the results of which are shown below:

| Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| 463 | <135 | 720 | 2,500 | 22 |
| 464A | <135 | 6,000 | 2,500 | <14 |
| 464B | <135 | 6,000 | <1,500 | <14 |
| 489A | <135 | 9,600 | <1,500 | 50 |
| 492 | <135 | 6,000 | 10,000 | 40 |

Instrument backgrounds in this building were:

- PAC-4G-3 600 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 5-14 uR/h

Background radiation levels were measured in the remaining rooms surveyed, including 005; 006A; 006B; 006C; 006D; 006E; 006F; 007A; 017, 163A, 163B, 163E, 464 and 470. A total of thirteen (13) smears were taken in various rooms of Building A; however, all smears indicated background levels. No air samples were taken in Building A.

**APPENDIX 6**
**(Cont'd)**

Building 1

Radiological surveys were conducted in seven (7) rooms and/or areas in Building 1. Four rooms exhibited radiological anomalies, the results of which are shown below:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| Foundry, ground floor | <135 | 28,000 | 3,500 | 5-10 |
| Foundry, ground floor | <135 | 4,800 | <2,000 | 5-10 |
| Foundry, ground floor | <135 | 9,600 | <2,000 | 5-10 |
| Foundry, ground floor | 1,000 | 9,600 | 2,500 | 5-10 |
| 1106 | <135 | <800 | 5,000 | 5-10 |
| 1230 | <135 | <800 | <2,000 | 4-12 |
| 1231 | <135 | <800 | <2,000 | 4-7 |

Instrument backgrounds in this building were:

- PAC-4G-3 800 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 2000 cts/min
- PRM-7 3-10 uR/h

Background radiation levels were measured in all of the other rooms surveyed, including Rooms 1317; 1317A; 1319; 1319A; and 1319B. Rooms containing face brick and mortar showed increased radiation levels above ambient background with the PRM-7 and PRM-5-3. A total of forty-two (42) smears were taken in various rooms/area of Building 1. No positive smears indicative of removable contamination above background were identified.

**APPENDIX 6**
**(Cont'd)**

Building 2

Radiological surveys were conducted throughout Building 2. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| Drain line, 2005 | <135 | <2,400 | 2,500 | 8 |
| Basement, north end | <135 | 71,000 | 20,000 | 3-5 |
| Basement, drain line | <135 | <2,400 | 4,000 | 3-5 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1000 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1300 cts/min
- PRM-7 5 uR/h

**APPENDIX 6**
**(Cont'd)**

Building 3

Radiological surveys were conducted throughout Building 3. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| Room 3071 | <135 | 24,000-60,000 | 2,000 | 4-6 |
| Room 3075 | <135 | 1,200 | 3,000-5,000 | to 40 |
| Room 3041 | <135 | 119,000 | 50,000 | 26 |
| Room 3023 | <135 | 24,000 | 6,000 | 6 |
| Room 3064 | <135 | 9,500 | - | 5 |
| Room 3051 | <135 | 1,600 | 3,500 | 16 |
| Room 3009 | <135 | 24,000 | 4,000 | 20 |
| Room 3014 | <135 | <800 | 5,000 | 15 |
| Room 3112, sink | - | - | - | 25 |
| Room 3112, sink top | - | - | - | 1,500 |
| Room 3178 | - | 3,600 | 2000-3000 | 10-14 |
| Room 3206 | <135 | 28,000 | <2,000 | 8-10 |
| Room 3277, hallway | <135 | 7,000 | <2,000 | 8-10 |
| Room 3233 | <135 | 24,000 | <2,000 | 10 |
| Room 3226, drain | <135 | 5,000 | <2,000 | 10 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 800 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 2000 cts/min
- PRM-7 5-10 uR/h

**APPENDIX 6**
**(Cont'd)**

Building 4

Radiological surveys were conducted in thirteen (13) rooms and/or areas in Building 4. Three areas exhibited radiological anomalies, the results of which are as follows:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| 4295 | <135 | <500 | <1,500 | 3-14 |
| 4255 | <135 | <500 | <1,500 | to 50 |
| 4009E | <135 | 4,800 | 43,000 | to 140 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 500 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 3-10 uR/h

Background radiation levels were measured in the following rooms: 4206; 4293; 4224; 4122; 4022; 4007; 4006; 4005; 4033; and 4009E. A total of 17 smears were taken on a combination of floors and walls in the rooms surveyed. No significant removable contamination was identified. There were no air samples taken in Building 4.

**APPENDIX 6**
**(Cont'd)**

Building 5

Radiological surveys were conducted in fifteen (15) rooms and/or areas in Building 5. The following areas exhibited radiological anomalies:

| Area/ Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| Machine shop | <135 | 6,000 (spots) | to 6,000 | to 22 |
| Grinding lab. | <135 | <800 | <1,500 | 12 |
| 5144 | <135 | 6,000 | 1,500 | to 140 |
| 5245 | <135 | 6,000 | 1,500 | 80 (spot) |
| 5247 | <135 | 6,000 | 1,500 | 4-6 |
| 5249 | <135 | 6,000 | 3,000 (spot) | 30 (spot) |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 800 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 4-7 uR/h

Background radiation levels were measured in the following rooms: 5044; 5140E; 5140D; 5149; 5103; 5111; 5244; 5246; and 5248. A total of 14 smears were taken on the floors of the rooms surveyed. No significant removable contamination was identified. An air sample taken in the Building 5 machine shop showed a Radon-222 concentration of 1.0 pCi/ℓ. The RGM-1 was run from 24-25 February 1988 in the Building 5 machine shop along the northwest wall. The maximum measured radon concentration during this period was 2.1 pCi/ℓ.

**APPENDIX 6**
**(Cont'd)**

Building 6

Radiological surveys were conducted in eight (8) rooms and/or areas in Building 6. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| 6034 | <135 | 2,400 (drain) | <1,000 | 5-7 |
| 6023 | <135 | 6,000 (spot) | 1,500 | 120 (spot) |
| 6049 | 10,000 | 4,000 | 6,000 | 400 |
| 6137 | <135 | <500 | 2,500 | 5-15 |
| 6138 | <135 | <500 | <1,000 | 10 (sink) |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 500 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1000 cts/min
- PRM-7 4-7 uR/h

Background radiation levels were measured in the following rooms: 6021; 6129; and 6139B. Smears were taken of the floor drain in Room 6021 and on the floor in Room 6049. No significant removable contamination was identified on either smear. No air samples were taken in Building 6.

**APPENDIX 6**
**(Cont'd)**

Building 7

Radiological surveys were conducted throughout Building 7. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| 7037 | <135 | <800 | 1,500 | 8 (sink) |
| 7138 | <135 | <800 | <1,500 | 10 (sink) |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 800 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 4-7 uR/h

Background radiation levels were measured in the following rooms: 7146; 7148; 7147; 7307; 7344; 7250; and 7205.

**APPENDIX 6**
**(Cont'd)**

Building 9

Radiological surveys were conducted in four (4) rooms located in Building 9. The results of those surveys are shown below.

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| 9018 | <135 | <600 | 1,500 | 5-6 |
| 9126-C | <135 | <600 | 35,000 (bench) | 4-150 (bench) |
| 9126-E | <135 | <600 | 1,500 | 4-7 |
| 9126-F | <135 | <600 | 1,500 | 4-6 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 600 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 7 uR/h

A total of 10 smears were taken in these four rooms. No significant removable contamination was identified on the smears.

**APPENDIX 6**
**(Cont'd)**

Building JN-1

Radiological surveys were conducted throughout Building JN-1. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| High bay area | <135 | 1.2E6 (spot) | 3,500 | 5-10 |
| Mezzanine area | <135 | 8,000 | <2,000 | 5-10 |
| Hot cell area, west | <135 | <1,200 | <2,000 | 5-10 |
| Hot cell area, east | 1,000 | <1,200 | 2,500 | 5-10 |
| Antiway area | <135 | <1,200 | 5,000 | 5-10 |
| Offices & corridor | <135 | <1,200 | <2,000 | 4-12 |
| Trailer | <135 | <1,200 | <2,000 | 4-7 |
| Machine shop | <135 | 5,000 (drain) | 3,000 | 15 (drain) |
| Room 1106 | <135 | 6,000 | 5,000-10,000 | 10-200 |
| Room 1122 | <135 | <1,200 | 3,000 | 10-200 |
| Basement | <135 | <1,200 | to 250,000 | 400-2,000 |
| Old shop area | <135 | 6,000 | to 30,000 | 100-2,000 |
| Furnace room | <135 | <1,200 | 5,000-10,000 | 10-100 |
| Locker room | <135 | 10,700 | 25,000 | 60-1,400 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1,200 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1,500 cts/min
- PRM-7 5-20 uR/h

**APPENDIX 6**
**(Cont'd)**

Building JN-2

Radiological surveys were conducted throughout Building JN-2. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| 1st floor corridor | <135 | 1,000 | 1,500 | 5-14 |
| Room 2118 | <135 | 1,000 | 5,000-10,000 | 5-20 |
| Rooms 2119 & 2101A | <135 | 1,000 | 1,500 | 5-20 |
| North stairwell | <135 | 1,000 | 1,000-5,000 | 5-120 |
| Rooms 2106 & 2106A | <135 | 2,400 | 2,500 | 10-20 |
| Subcritical assembly room | <135 | 11,000 (spot) | 24,000 (spot) | 20-25 |
| Room 2112 | <135 | 1,000 | 12,000 | 10-340 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1000 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 5-10 uR/h

Background radiation levels were measured in the following rooms: 1st floor janitor's closet, men's room/locker room; radiation dosimetry accident evaluation room; all of the 2nd floor offices; control room; Room 2108; and the building fan loft.

**APPENDIX 6**
**(Cont'd)**

Building JN-3

Radiological surveys were conducted throughout Building JN-3. The following areas exhibited radiological anomalies:

| Area/Room Number | PAC-4G-3 dis/min-100 $cm^2$ alpha | PAC-4G-3 dis/min-100 $cm^2$ beta-gamma | PRM-5-3 w/PG-2 detector cts/min | PRM-7 uR/h |
|---|---|---|---|---|
| First floor, Room 3222 | <135 | 1,000 | 2,500 | 4-10 |
| Corridor | <135 | 1,000 | 2,500 | 10-20 |
| Northwest stairwell | <135 | 1,000 | 2,500 | 10-15 |
| Basement | <135 | 60,000 (spot) | 2,000 | 10-15 |
| Basement | <135 | 40,000 (drain) | 2,500 | 10-15 |
| Second floor walkway | <135 | 36,000 (spot) | 2,500 | 5-10 |
| Second floor walkway | <135 | 357,000 (spot) | 2,500 | 5-10 |
| Second floor walkway | <135 | 1,000 | 25,000 (spot) | 5-10 |
| Room 3205 | <135 | 17,000 (spot) | 2,000 | 5-25 |
| Reactor pool, south | <135 | 71,000 (spot) | 2,500 | 150 |
| Reactor pool, north | <135 | 83,000 (spot) | to 25,000 | to 200 |
| Pump room | <135 | 71,000 (spot) | to 25,000 | 20-30 |
| Waste storage area | <135 | 3,600 | 5,000 | to 140 |
| Electronic equipment storage | <135 | 6,000 (wall) | 2,500 | 5-14 |

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1000 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 2000 cts/min
- PRM-7 5-10 uR/h

Background radiation levels were measured in the following rooms: 3220; 3219; 3218; 3216; lavatory; 3210; 3211; 3212; 3214; 3215; 3223; and the furnace room.

**APPENDIX 6**
**(Cont'd)**

Building JS-1

Radiological surveys were conducted throughout Building JS-1. The RGM-1 was set up near pit #3 and run for 24 hours. The maximum radon-222 concentration measured during this period was 6.1 pCi/ℓ. An air sample also taken alongside pit #3 indicated a radon-222 concentration of 5.3 pCi/ℓ thus confirming the RGM-1 measurement. A total of 38 smears were taken on various walls, floors and overheads. No significant removable contamination was identified. Background radiation levels were measured in all of the rooms/areas in JS-1.

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1000 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1500 cts/min
- PRM-7 5-10 uR/h

**APPENDIX 6**
**(Cont'd)**

Building JS-10

Radiological surveys were conducted throughout Building JS-10. A total of six smears were taken in JS-10. No significant removable contamination was identified. An air sample taken in the building showed a radon-222 concentration of 0.4 pCi/ℓ. Background radiation levels were measured in all areas within JS-10.

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1000 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 500 cts/min
- PRM-7 3-5 uR/h

Building JS-12

Radiological surveys were conducted throughout Building JS-12. A total of eleven (11) smears were taken in JS-12. No significant removable contamination was identified. An air sample taken in the tunnel area of the building showed a radon-222 concentration of 2.7 pCi/ℓ. Background radiation levels were measured in all areas within JS-12.

Instrument backgrounds in this building were as follows:

- PAC-4G-3 1000 dis/min-100 $cm^2$ beta-gamma; 135 dis/min-100 $cm^2$ alpha
- PRM-5-3 1000 cts/min
- PRM-7 3-15 uR/h

Appendix 7

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DH005CDL

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: 88800101

Sample wt/vol: 30.5 (g/mL) G Lab File ID: B880011

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 49 dec. Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) Y pH: 7.1 Dilution Factor: 30.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | C |
|---|---|---|---|
| 108-95-2 | phenol | 4900 | BDJ |
| 111-44-4 | bis(2-Chloroethyl)Ether | 19000 | U |
| 95-57-8 | 2-Chlorophenol | 1100 | DJ |
| 541-73-1 | 1,3-Dichlorobenzene | 19000 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 19000 | U |
| 100-51-6 | Benzyl Alcohol | 19000 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 19000 | U |
| 95-48-7 | 2-Methylphenol | 2800 | DJ |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 19000 | U |
| 106-44-5 | 4-Methylphenol | 8000 | DJ |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 19000 | U |
| 67-72-1 | Hexachloroethane | 19000 | U |
| 98-95-3 | Nitrobenzene | 19000 | U |
| 78-59-1 | Isophorone | 19000 | U |
| 88-75-5 | 2-Nitrophenol | 19000 | U |
| 105-67-9 | 2,4-Dimethylphenol | 3400 | DJ |
| 65-85-0 | Benzoic Acid | 23000 | DJ |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 19000 | U |
| 120-83-2 | 2,4-Dichlorophenol | 19000 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 19000 | U |
| 91-20-3 | Naphthalene | 19000 | U |
| 106-47-8 | 4-Chloroaniline | 19000 | U |
| 87-68-3 | Hexachlorobutadiene | 19000 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 19000 | U |
| 91-57-6 | 2-Methylnaphthalene | 19000 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 19000 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 19000 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 93000 | U |
| 91-58-7 | 2-Chloronaphthalene | 19000 | U |
| 88-74-4 | 2-Nitroaniline | 93000 | U |
| 131-11-3 | Dimethyl Phthalate | 3200 | DJ |
| 208-96-8 | Acenaphthylene | 19000 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 19000 | U |

Appendix 7
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DK005CDL

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: 88800101

Sample wt/vol: 30.5 (g/mL) G Lab File ID: B8800011

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 49 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) Y pH: 7.1 Dilution Factor: 30.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 93000 | U |
| 83-32-9 | Acenaphthene | 19000 | U |
| 51-28-5 | 2,4-Dinitrophenol | 93000 | U |
| 100-02-7 | 4-Nitrophenol | 93000 | U |
| 132-64-9 | Dibenzofuran | 19000 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 19000 | U |
| 84-66-2 | Diethylphthalate | 19000 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 19000 | U |
| 86-73-7 | Fluorene | 19000 | U |
| 100-10-6 | 4-Nitroaniline | 93000 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 93000 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 19000 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 19000 | U |
| 118-74-1 | Hexachlorobenzene | 19000 | U |
| 87-86-5 | Pentachlorophenol | 93000 | U |
| 85-01-8 | Phenanthrene | 19000 | U |
| 120-12-7 | Anthracene | 770 | DJ |
| 84-74-2 | Di-n-Butylphthalate | 45000 | BD |
| 206-44-0 | Fluoranthene | 540 | DJ |
| 129-00-0 | Pyrene | 19000 | U |
| 85-68-7 | Butylbenzylphthalate | 1700 | DJ |
| 91-94-1 | 3,3'-Dichlorobenzidine | 38000 | U |
| 56-55-3 | Benzo(a)Anthracene | 890 | DJ |
| 218-01-9 | Chrysene | 19000 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 58000 | D |
| 117-84-0 | Di-n-Octyl Phthalate | 1400 | DJ |
| 205-99-2 | Benzo(b)Fluoranthene | 19000 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 19000 | U |
| 50-32-8 | Benzo(a)Pyrene | 19000 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 19000 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 19000 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 19000 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 7
(Cont'd.)

1F

EPA SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

21DF005DL

Lab Name: ANL/ANL - RIW Contract: ____

Lab Code: ANL Case No.: BA SAS No.: ____ SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: BRR00101

Sample wt/vol: 30.5 (g/mL) G Lab File ID: BRR0011

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 49 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) Y pH: 7.1 Dilution Factor: 30.0

Number TICs found: 22

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 14040-11-0 | TUNGSTEN CARBONYL (W(CO)6), | 8.40 | 5100 | JX |
| 2. | 79-34-5 | 1,1,2,2-TETRACHLOROETHANE | 8.89 | 3100 | JX |
| 3. | 29538-77-0 | CYCLOHEXANOL, 4-CHLORO-, TRA | 12.10 | 18000 | BJX |
| 4. | 62016-19-7 | OCTANE, ETHYL-METHYL- | 12.39 | 4000 | JX |
| 5. | 55499-04-2 | TRIMETHYL NONANE | 12.94 | 5300 | JX |
| 6. | 100-52-7 | BENZALDEHYDE | 10.30 | 2400 | JX |
| 7. | 6044-71-9 | DODECANE, 6-METHYL- | 17.15 | 1300 | JX |
| 8. | 26730-14-3 | TRIDECANE, 7-METHYL- | 18.62 | 2200 | JX |
| 9. | 629-50-5 | TRIDECANE | 19.27 | 950 | JX |
| 10. | 85-44-9 | PHTHALATE ANHYDRIDE | 19.72 | 1700 | JX |
| 11. | 27322-34-5 | BENZENE, TRIS(1-METHYLETHYL) | 20.25 | 2000 | JX |
| 12. | | C14-HYDROCARBON | 21.09 | 3100 | JX |
| 13. | | C15-HYDROCARBON | 23.00 | 5700 | JX |
| 14. | | C16-HYDROCARBON | 25.92 | 1600 | JX |
| 15. | | C17-HYDROCARBON | 28.02 | 2600 | JX |
| 16. | | C22-HYDROCARBON | 35.16 | 5600 | JX |
| 17. | | C23-HYDROCARBON | 36.19 | 7500 | JX |
| 18. | 4337-65-9 | HEXANEDIOIC ACID, MONO(2-ETH | 37.21 | 24000 | BJX |
| 19. | | PHOSPHORIC ACID, BIS(PHENYL) | 38.07 | 22000 | JX |
| 20. | 1330-78-5 | PHOSPHORIC ACID, TRIS(METHYL | 40.17 | 79000 | JX |
| 21. | | UNKNOWN | 43.63 | 1500000 | JX |
| 22. | | UNKNOWN | 47.26 | 39000 | JX |

Appendix 7
1B (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DK006CDI

Lab Name: ANL/ACL - RTW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ01oC

Matrix: (soil/water) SOIL Lab Sample ID: B8800102

Sample wt/vol: 6.4 (g/mL) G Lab File ID: B880012

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 32 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/04/88

GPC Cleanup: (Y/N) Y pH: 6.6 Dilution Factor: 39.9

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 1600000 | BDE |
| 111-44-4 | bis(2-Chloroethyl)Ether | 91000 | U |
| 95-57-8 | 2-Chlorophenol | 91000 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 91000 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 91000 | U |
| 100-51-6 | Benzyl Alcohol | 91000 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 91000 | U |
| 95-48-7 | 2-Methylphenol | 1100000 | D |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 91000 | U |
| 106-44-5 | 4-Methylphenol | 1700000 | DE |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 91000 | U |
| 67-72-1 | Hexachloroethane | 91000 | U |
| 98-95-3 | Nitrobenzene | 91000 | U |
| 78-59-1 | Isophorone | 91000 | U |
| 88-75-5 | 2-Nitrophenol | 91000 | U |
| 105-67-9 | 2,4-Dimethylphenol | 170000 | D |
| 65-85-0 | Benzoic Acid | 440000 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 91000 | U |
| 120-83-2 | 2,4-Dichlorophenol | 91000 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 91000 | U |
| 91-20-3 | Naphthalene | 91000 | U |
| 106-47-8 | 4-Chloroaniline | 91000 | U |
| 87-68-3 | Hexachlorobutadiene | 91000 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 91000 | U |
| 91-57-6 | 2-Methylnaphthalene | 2900 | DJ |
| 77-47-4 | Hexachlorocyclopentadiene | 91000 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 91000 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 440000 | U |
| 91-58-7 | 2-Chloronaphthalene | 91000 | U |
| 88-74-4 | 2-Nitroaniline | 440000 | U |
| 131-11-3 | Dimethyl Phthalate | 91000 | U |
| 208-96-8 | Acenaphthylene | 91000 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 91000 | U |

Appendix 7
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DK006CDL

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: 88800102

Sample wt/vol: 6.4 (g/mL) G Lab File ID: B880012

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 32 dec. Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/04/88

GPC Cleanup: (Y/N) Y pH: 6.6 Dilution Factor: 39.9

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 440000 | U |
| 83-32-9 | Acenaphthene | 91000 | U |
| 51-28-5 | 2,4-Dinitrophenol | 440000 | U |
| 100-02-7 | 4-Nitrophenol | 440000 | U |
| 132-64-9 | Dibenzofuran | 91000 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 91000 | U |
| 84-66-2 | Diethylphthalate | 91000 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 91000 | U |
| 86-73-7 | Fluorene | 91000 | U |
| 100-10-6 | 4-Nitroaniline | 440000 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 440000 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 91000 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 91000 | U |
| 118-74-1 | Hexachlorobenzene | 91000 | U |
| 87-86-5 | Pentachlorophenol | 440000 | U |
| 85-01-8 | Phenanthrene | 91000 | U |
| 120-12-7 | Anthracene | 91000 | U |
| 84-74-2 | Di-n-Butylphthalate | 260000 | BD |
| 206-44-0 | Fluoranthene | 11000 | DJ |
| 129-00-0 | Pyrene | 10000 | DJ |
| 85-68-7 | Butylbenzylphthalate | 91000 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 180000 | U |
| 56-55-3 | Benzo(a)Anthracene | 15000 | DJ |
| 218-01-9 | Chrysene | 16000 | DJ |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 160000 | D |
| 117-84-0 | Di-n-Octyl Phthalate | 91000 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 91000 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 91000 | U |
| 50-32-8 | Benzo(a)Pyrene | 91000 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 91000 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 91000 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 91000 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 7
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

21DF006DL

Lab Name: ANALYTICAL - ROW  Contract: ____

Lab Code: ANL  Case No.: BA___  SAS No.: ____  SDG No.: 21DJ01oC

Matrix: (soil/water) SOIL  Lab Sample ID: 88800102

Sample wt/vol: 6.4 (g/mL) G  Lab File ID: B880012

Level: (low/med) LOW  Date Received: 10/08/87

% Moisture: not dec. 32  dec. ____  Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC  Date Analyzed: 01/04/88

GPC Cleanup: (Y/N) Y  pH: 6.6  Dilution Factor: 39.9

Number TICs found: 19  CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 17302-28-2 | NONANE, 2,6-DIMETHYL- | 12.02 | 30000 | JX |
| 2. | | UNKNOWN HYDROCARBON,(C-11) | 14.14 | 200000 | JX |
| 3. | | UNKNOWN | 17.12 | 33000 | JX |
| 4. | 629-59-4 | TETRADECANE | 21.59 | 48000 | JX |
| 5. | | UNKNOWN HYDROCARBON,(C-14) | 22.97 | 21000 | JX |
| 6. | | UNKNOWN HYDROCARBON,(C-15) | 23.79 | 52000 | JX |
| 7. | 544-76-3 | HEXADECANE | 25.87 | 30000 | JX |
| 8. | 13029-08-8 | 1,1'-BIPHENYL, 2,2'-DICHLORO | 26.56 | 31000 | JX |
| 9. | | UNKNOWN HYDROCARBON,(C-17) | 27.87 | 25000 | JX |
| 10. | 34883-43-7 | 1,1'-BIPHENYL, 2,4'-DICHLORO | 28.16 | 53000 | JX |
| 11. | 37680-65-2 | 1,1'-BIPHENYL, 2,2',5-TRICHL | 30.41 | 60000 | JX |
| 12. | 37680-65-2 | 1,1'-BIPHENYL, 2,2',5-TRICHL | 31.24 | 140000 | JX |
| 13. | 37680-65-2 | 1,1'-BIPHENYL, 2,2',5-TRICHL | 31.57 | 87000 | JX |
| 14. | 37680-65-2 | 1,1'-BIPHENYL, 2,2',5-TRICHL | 31.81 | 48000 | JX |
| 15. | 20273-27-2 | BICYCLOHEXYL, 4-PHENYL- | 32.89 | 59000 | JX |
| 16. | 20273-27-2 | BICYCLOHEXYL, 4-PHENYL- | 33.52 | 35000 | JX |
| 17. | | UNKNOWN | 35.11 | 14000 | JX |
| 18. | | UNKNOWN HYDROCARBON,(C-22) | 36.14 | 14000 | JX |
| 19. | | ALKYL TRIPHENYL PHOSPHATE | 41.12 | 52000000 | JX |

Appendix 7
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DK006CDL

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ01OC

Matrix: (soil/water) SOIL Lab Sample ID: BB800102

Sample wt/vol: 6.4 (g/mL) G Lab File ID: BB12

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 32 dec. Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 02/29/88

GPC Cleanup: (Y/N) Y pH: 6.6 Dilution Factor: 160

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 1200000 | D |
| 111-44-4 | bis(2-Chloroethyl)Ether | 360000 | U |
| 95-57-8 | 2-Chlorophenol | 360000 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 360000 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 360000 | U |
| 100-51-6 | Benzyl Alcohol | 360000 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 360000 | U |
| 95-48-7 | 2-Methylphenol | 700000 | D |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 360000 | U |
| 106-44-5 | 4-Methylphenol | 1400000 | D |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 360000 | U |
| 67-72-1 | Hexachloroethane | 360000 | U |
| 98-95-3 | Nitrobenzene | 360000 | U |
| 78-59-1 | Isophorone | 360000 | U |
| 88-75-5 | 2-Nitrophenol | 360000 | U |
| 105-67-9 | 2,4-Dimethylphenol | 150000 | DJ |
| 65-85-0 | Benzoic Acid | 1800000 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 360000 | U |
| 120-83-2 | 2,4-Dichlorophenol | 360000 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 360000 | U |
| 91-20-3 | Naphthalene | 360000 | U |
| 106-47-8 | 4-Chloroaniline | 360000 | U |
| 87-68-3 | Hexachlorobutadiene | 360000 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 360000 | U |
| 91-57-6 | 2-Methylnaphthalene | 360000 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 360000 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 360000 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 1800000 | U |
| 91-58-7 | 2-Chloronaphthalene | 360000 | U |
| 88-74-4 | 2-Nitroaniline | 1800000 | U |
| 131-11-3 | Dimethyl Phthalate | 360000 | U |
| 208-96-8 | Acenaphthylene | 360000 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 360000 | U |

Appendix 7
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ006CDL

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: 88800102

Sample wt/vol: 6.4 (g/mL) G Lab File ID: B812

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 32 dec. Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 02/29/88

GPC Cleanup: (Y/N) Y pH: 6.6 Dilution Factor: 160

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 1800000 | U |
| 83-32-9 | Acenaphthene | 360000 | U |
| 51-28-5 | 2,4-Dinitrophenol | 1800000 | U |
| 100-02-7 | 4-Nitrophenol | 1800000 | U |
| 132-64-9 | Dibenzofuran | 360000 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 360000 | U |
| 84-66-2 | Diethylphthalate | 360000 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 360000 | U |
| 86-73-7 | Fluorene | 360000 | U |
| 100-10-6 | 4-Nitroaniline | 1800000 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 1800000 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 360000 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 360000 | U |
| 118-74-1 | Hexachlorobenzene | 360000 | U |
| 87-86-5 | Pentachlorophenol | 1800000 | U |
| 85-01-8 | Phenanthrene | 360000 | U |
| 120-12-7 | Anthracene | 360000 | U |
| 84-74-2 | Di-n-Butylphthalate | 180000 | DJ |
| 206-44-0 | Fluoranthene | 360000 | U |
| 129-00-0 | Pyrene | 360000 | U |
| 85-68-7 | Butylbenzylphthalate | 360000 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 730000 | U |
| 56-55-3 | Benzo(a)Anthracene | 55000 | DJ |
| 218-01-9 | Chrysene | 27000 | DJ |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 43000 | DJ |
| 117-84-0 | Di-n-Octyl Phthalate | 360000 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 360000 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 360000 | U |
| 50-32-8 | Benzo(a)Pyrene | 360000 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 360000 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 360000 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 360000 | U |

(1) - Cannot be separated from Diphenylamine

1F

EPA SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

21DK006CDL

Lab Name: ANL/ACL - RJU Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ01oC

Matrix: (soil/water) SOIL Lab Sample ID: 88800102

Sample wt/vol: 6.4 (g/mL) G Lab File ID: B812

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 32 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 02/29/88

GPC Cleanup: (Y/N) Y pH: 6.6 Dilution Factor: 160

Number TICs found: 23

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 124-18-5 | C10-ALKANE | 11.20 | 87000 | J |
| 2. | 17302-27-1 | C11-ALKANE | 13.94 | 120000 | J |
| 3. | 90-00-6 | PHENOL, C2- | 15.02 | 58000 | J |
| 4. | 526-75-0 | PHENOL, C2- | 15.30 | 390000 | J |
| 5. | 526-75-0 | PHENOL, C2- | 15.84 | 210000 | J |
| 6. | 526-75-0 | PHENOL, C2- | 16.05 | 110000 | J |
| 7. | 112-40-3 | C12-ALKANE | 16.55 | 78000 | J |
| 8. | 17301-32-5 | C13-ALKANE | 19.04 | 64000 | J |
| 9. | 629-59-4 | C14-ALKANE | 21.35 | 53000 | J |
| 10. | 74645-98-0 | C15-ALKANE | 23.55 | 65000 | J |
| 11. | 17301-32-5 | C16-ALKANE | 25.64 | 22000 | J |
| 12. | 13029-08-8 | BIPHENYL,-DICHLORO- | 26.24 | 21000 | J |
| 13. | 629-78-7 | C17-ALKANE | 27.61 | 14000 | J |
| 14. | 54105-67-8 | C17-ALKANE | 27.72 | 7900 | J |
| 15. | 2974-92-7 | BIPHENYL, DICHLORO- | 27.86 | 53000 | J |
| 16. | 11141-16-5 | AROCLOR 1232 | 29.39 | 390000 | J |
| 17. | 37680-65-2 | BIPHENYL,-TRICHLORO- | 30.07 | 73000 | J |
| 18. | 55702-46-0 | BIPHENYL,-TRICHLORO- | 30.96 | 160000 | J |
| 19. | 55702-46-0 | BIPHENYL,-TRICHLORO- | 31.27 | 62000 | J |
| 20. | 20273-27-2 | BICYCLOHEXYL, 4-PHENYL- | 32.59 | 150000 | J |
| 21. | 20273-27-2 | BICYCLOHEXYL, 4-PHENYL- | 33.24 | 60000 | J |
| 22. | 115-86-6 | PHOSPHORIC ACID, TRIPHENYL E | 37.14 | 1200000 | J |
| 23. | 115-86-6 | PHOSPHORIC ACID, TRIPHENYL E | 39.26 | 270000000 | JX |

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ010CDI

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ01CC

Matrix: (soil/water) SOIL Lab Sample ID: 88800601

Sample wt/vol: 30.4 (g/mL) G Lab File ID: B8800061

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 37 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/04/88

GPC Cleanup: (Y/N) Y pH: 7.3 Dilution Factor: 480

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 250000 | U |
| 111-44-4 | bis(2-Chloroethyl)Ether | 250000 | U |
| 95-57-8 | 2-Chlorophenol | 250000 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 250000 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 250000 | U |
| 100-51-6 | Benzyl Alcohol | 250000 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 250000 | U |
| 95-48-7 | 2-Methylphenol | 250000 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 250000 | U |
| 106-44-5 | 4-Methylphenol | 250000 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 250000 | U |
| 67-72-1 | Hexachloroethane | 250000 | U |
| 98-95-3 | Nitrobenzene | 250000 | U |
| 78-59-1 | Isophorone | 250000 | U |
| 88-75-5 | 2-Nitrophenol | 250000 | U |
| 105-67-9 | 2,4-Dimethylphenol | 250000 | U |
| 65-85-0 | Benzoic Acid | 1200000 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 250000 | U |
| 120-83-2 | 2,4-Dichlorophenol | 250000 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 250000 | U |
| 91-20-3 | Naphthalene | 140000 | DJ |
| 106-47-8 | 4-Chloroaniline | 250000 | U |
| 87-68-3 | Hexachlorobutadiene | 250000 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 250000 | U |
| 91-57-6 | 2-Methylnaphthalene | 120000 | DJ |
| 77-47-4 | Hexachlorocyclopentadiene | 250000 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 250000 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 1200000 | U |
| 91-58-7 | 2-Chloronaphthalene | 250000 | U |
| 88-74-4 | 2-Nitroaniline | 1200000 | U |
| 131-11-3 | Dimethyl Phthalate | 250000 | U |
| 208-96-8 | Acenaphthylene | 250000 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 250000 | U |

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ010CDL

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: B8800601

Sample wt/vol: 30.4 (g/mL) G Lab File ID: B880061

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 37 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/04/88

GPC Cleanup: (Y/N) Y pH: 7.3 Dilution Factor: 480

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 1200000 | U |
| 83-32-9 | Acenaphthene | 450000 | D |
| 51-28-5 | 2,4-Dinitrophenol | 1200000 | U |
| 100-02-7 | 4-Nitrophenol | 1200000 | U |
| 132-64-9 | Dibenzofuran | 320000 | D |
| 121-14-2 | 2,4-Dinitrotoluene | 250000 | U |
| 84-66-2 | Diethylphthalate | 250000 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 250000 | U |
| 86-73-7 | Fluorene | 440000 | D |
| 100-10-6 | 4-Nitroaniline | 1200000 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 1200000 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 250000 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 250000 | U |
| 118-74-1 | Hexachlorobenzene | 250000 | U |
| 87-86-5 | Pentachlorophenol | 1200000 | U |
| 85-01-8 | Phenanthrene | 3200000 | D |
| 120-12-7 | Anthracene | 540000 | D |
| 84-74-2 | Di-n-Butylphthalate | 250000 | U |
| 206-44-0 | Fluoranthene | 2300000 | D |
| 129-00-0 | Pyrene | 1900000 | D |
| 85-68-7 | Butylbenzylphthalate | 250000 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 500000 | U |
| 56-55-3 | Benzo(a)Anthracene | 1200000 | D |
| 218-01-9 | Chrysene | 890000 | D |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 250000 | U |
| 117-84-0 | Di-n-Octyl Phthalate | 250000 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 1100000 | D |
| 207-08-9 | Benzo(k)Fluoranthene | 770000 | D |
| 50-32-8 | Benzo(a)Pyrene | 1800000 | D |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 610000 | D |
| 53-70-3 | Dibenz(a,h)Anthracene | 250000 | D |
| 191-24-2 | Benzo(g,h,i)Perylene | 590000 | D |

(1) - Cannot be separated from Diphenylamine

**Appendix 7**
**(Cont'd.)**

1F

EPA SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

21DJ010CDL

Lab Name: ANL/ACL - RJW Contract: ~

Lab Code: ANL Case No.: BA SAS No.: - SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: 88800601

Sample wt/vol: 30.4 (g/mL) G Lab File ID: B8800061

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 37 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/04/88

GPC Cleanup: ~~(Y/N)~~ Y pH: 7.3 Dilution Factor: 480

Number TICs found: 18

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 29538-77-0 | CYCLOHEXANOL, 4-CHLORO-, TRA | 12.05 | 52000 | BJX |
| 2. | 2471-83-2 | NAPHTHALENE,METHYL | 19.62 | 70000 | JX |
| 3. | 571-61-9 | NAPHTHALENE, DIMETHYL- | 22.15 | 40000 | JX |
| 4. | 939-27-5 | NAPHTHALENE, ETHYL- | 21.55 | 16000 | JX |
| 5. | 939-27-5 | NAPHTHALENE, ETHYL- | 21.80 | 32000 | JX |
| 6. | 644-08-6 | 1,1-BIPHENYL, 4-MEHTYL- | 26.14 | 45000 | JX |
| 7. | 644-08-6 | 1,1-BIPHENYL, 4-METHYL- | 26.29 | 30000 | JX |
| 8. | 7320-53-8 | DIBENZOFURAN, METHYL- | 26.52 | 50000 | JX |
| 9. | 7320-53-8 | DIBENZOFURAN, METHYL- | 26.79 | 49000 | JX |
| 10. | | UNKNOWN | 28.86 | 83000 | JX |
| 11. | | UNKNOWN | 29.14 | 120000 | JX |
| 12. | 2788-23-0 | 9H-CARBAZOLE, 9-NITROSO- | 30.61 | 150000 | JX |
| 13. | 613-12-7 | ANTHRACENE, 2-METHYL- | 31.62 | 120000 | JX |
| 14. | 203-64-5 | 4H-CYCLOPENTA[DEF]PHENANTHRE | 31.91 | 110000 | JX |
| 15. | 84-65-1 | 9,10-ANTHRACENEDIONE | 32.64 | 92000 | JX |
| 16. | 2381-21-7 | PYRENE, 1-METHYL- | 35.62 | 150000 | JX |
| 17. | 203-12-3 | BENZO[GHI]FLUORANTHENE | 37.52 | 160000 | JX |
| 18. | 316-49-4 | BENZ[A]ANTHRACENE, 4-METHYL- | 39.57 | 76000 | JX |

Appendix 7
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ014C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ01C

Matrix: (soil/water) SOIL Lab Sample ID: 88800602

Sample wt/vol: 7.0 (g/mL) G Lab File ID: B880062

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 40 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 12/23/87

GPC Cleanup: (Y/N) Y pH: 7.1 Dilution Factor: 2.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 330 | BJ |
| 111-44-4 | bis(2-Chloroethyl)Ether | 4700 | U |
| 95-57-8 | 2-Chlorophenol | 4700 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 4700 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 4700 | U |
| 100-51-6 | Benzyl Alcohol | 4700 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 4700 | U |
| 95-48-7 | 2-Methylphenol | 4700 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 4700 | U |
| 106-44-5 | 4-Methylphenol | 4700 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 4700 | U |
| 67-72-1 | Hexachloroethane | 4700 | U |
| 98-95-3 | Nitrobenzene | 4700 | U |
| 78-59-1 | Isophorone | 4700 | U |
| 88-75-5 | 2-Nitrophenol | 4700 | U |
| 105-67-9 | 2,4-Dimethylphenol | 4700 | U |
| 65-85-0 | Benzoic Acid | 23000 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 4700 | U |
| 120-83-2 | 2,4-Dichlorophenol | 4700 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 4700 | U |
| 91-20-3 | Naphthalene | 4700 | U |
| 106-47-8 | 4-Chloroaniline | 4700 | U |
| 87-68-3 | Hexachlorobutadiene | 4700 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 4700 | U |
| 91-57-6 | 2-Methylnaphthalene | 4700 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 4700 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 4700 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 23000 | U |
| 91-58-7 | 2-Chloronaphthalene | 4700 | U |
| 88-74-4 | 2-Nitroaniline | 23000 | U |
| 131-11-3 | Dimethyl Phthalate | 4700 | U |
| 208-96-8 | Acenaphthylene | 4700 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 4700 | U |

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ014C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ01oC

Matrix: (soil/water) SOIL Lab Sample ID: 88800602

Sample wt/vol: 7.0 (g/mL) G Lab File ID: B880062

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 40 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 12/23/87

GPC Cleanup: (Y/N) Y pH: 7.1 Dilution Factor: 2.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | C |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 23000 | U |
| 83-32-9 | Acenaphthene | 4700 | U |
| 51-28-5 | 2,4-Dinitrophenol | 23000 | U |
| 100-02-7 | 4-Nitrophenol | 23000 | U |
| 132-64-9 | Dibenzofuran | 4700 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 4700 | U |
| 84-66-2 | Diethylphthalate | 4700 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 4700 | U |
| 86-73-7 | Fluorene | 4700 | U |
| 100-10-6 | 4-Nitroaniline | 23000 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 23000 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 4700 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 4700 | U |
| 118-74-1 | Hexachlorobenzene | 4700 | U |
| 87-86-5 | Pentachlorophenol | 23000 | U |
| 85-01-8 | Phenanthrene | 810 | J |
| 120-12-7 | Anthracene | 100 | J |
| 84-74-2 | Di-n-Butylphthalate | 2000 | BJ |
| 206-44-0 | Fluoranthene | 830 | J |
| 129-00-0 | Pyrene | 1000 | J |
| 85-68-7 | Butylbenzylphthalate | 4700 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 9400 | U |
| 56-55-3 | Benzo(a)Anthracene | 580 | J |
| 218-01-9 | Chrysene | 570 | J |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 340 | J |
| 117-84-0 | Di-n-Octyl Phthalate | 4700 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 570 | J |
| 207-08-9 | Benzo(k)Fluoranthene | 4700 | U |
| 50-32-8 | Benzo(a)Pyrene | 4700 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 4700 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 4700 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 4700 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 7
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21DJ014C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ010C

Matrix: (soil/water) SOIL Lab Sample ID: 88800602

Sample wt/vol: 7.0 (g/mL) G Lab File ID: B880062

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. 40 dec. ____ Date Extracted: 10/19/87

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 12/23/87

GPC Cleanup: (Y/N) Y pH: 7.1 Dilution Factor: 2.00

Number TICs found: 15

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 52896-87-4 | HEPTANE, 4-(1-METHYLETHYL)- | 7.83 | 15000 | JX |
| 2. | 5921-82-4 | 2-HEPTANOL, ACETATE | 9.09 | 11000 | BJX |
| 3. | 930-68-7 | 2-CYCLOHEXEN-1-ONE | 9.50 | 4200 | BJX |
| 4. | 3240-09-3 | 5-HEXEN-2-ONE, 5-METHYL- | 10.25 | 5500 | BJX |
| 5. | | PROBABLE C-2 HEPTANONE | 11.25 | 3000 | BJX |
| 6. | 29538-77-0 | CYCLOHEXANOL, 4-CHLORO-, TRA | 12.14 | 32000 | BJX |
| 7. | | UNKNOWN | 23.80 | 700 | JX |
| 8. | | UNKNOWN | 24.12 | 1500 | JX |
| 9. | | UNKNOWN HYDROCARBON,(C-15) | 27.86 | 1700 | JX |
| 10. | 17851-53-5 | PHTHALATE ESTER | 30.96 | 1700 | BJX |
| 11. | 1120-25-8 | 9-HEXADECENOIC ACID, METHYL | 31.46 | 710 | JX |
| 12. | 5129-60-2 | PENTADECANOIC ACID ESTER | 31.74 | 610 | JX |
| 13. | 10544-50-0 | SULFUR, MOL. (S8) | 33.74 | 23000 | JX |
| 14. | 4337-65-9 | HEXANEDIOIC ACID, MONO(2-ETH | 37.19 | 83000 | BJX |
| 15. | 630-07-9 | UNKNOWN HYDROCARBON,(C-30) | 43.48 | 2400 | JX |

Appendix 7
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ016C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) SOIL Lab Sample ID: 88801401

Sample wt/vol: 16.6 (g/mL) G Lab File ID: BA80141

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. 37 dec. — Date Extracted: 05/18/88

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 08/05/88

GPC Cleanup: (Y/N) Y pH: 7.3 Dilution Factor: 2.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 540 | BJ |
| 111-44-4 | bis(2-Chloroethyl)Ether | 1900 | U |
| 95-57-8 | 2-Chlorophenol | 1900 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 1900 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 1900 | U |
| 100-51-6 | Benzyl Alcohol | 1900 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 1900 | U |
| 95-48-7 | 2-Methylphenol | 1900 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 1900 | U |
| 106-44-5 | 4-Methylphenol | 240 | J |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 1900 | U |
| 67-72-1 | Hexachloroethane | 1900 | U |
| 98-95-3 | Nitrobenzene | 1900 | U |
| 78-59-1 | Isophorone | 1900 | U |
| 88-75-5 | 2-Nitrophenol | 1900 | U |
| 105-67-9 | 2,4-Dimethylphenol | 1900 | U |
| 65-85-0 | Benzoic Acid | 9200 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 1900 | U |
| 120-83-2 | 2,4-Dichlorophenol | 1900 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 1900 | U |
| 91-20-3 | Naphthalene | 1900 | U |
| 106-47-8 | 4-Chloroaniline | 1900 | U |
| 87-68-3 | Hexachlorobutadiene | 1900 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 1900 | U |
| 91-57-6 | 2-Methylnaphthalene | 1900 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 1900 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 1900 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 9200 | U |
| 91-58-7 | 2-Chloronaphthalene | 1900 | U |
| 88-74-4 | 2-Nitroaniline | 9200 | U |
| 131-11-3 | Dimethyl Phthalate | 1900 | U |
| 208-96-8 | Acenaphthylene | 1900 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 1900 | U |

Appendix 7
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ016C

Lab Name: ANL/ACL - RJW Contract: ——

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) SOIL Lab Sample ID: 88801401

Sample wt/vol: 16.6 (g/mL) G Lab File ID: BA80141

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. 37 dec. — Date Extracted: 05/18/88

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 08/05/88

GPC Cleanup: (Y/N) Y pH: 7.3 Dilution Factor: 2.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 9200 | U |
| 83-32-9 | Acenaphthene | 1900 | U |
| 51-28-5 | 2,4-Dinitrophenol | 9200 | U |
| 100-02-7 | 4-Nitrophenol | 9200 | U |
| 132-64-9 | Dibenzofuran | 1900 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 1900 | U |
| 84-66-2 | Diethylphthalate | 1900 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 1900 | U |
| 86-73-7 | Fluorene | 1900 | U |
| 100-10-6 | 4-Nitroaniline | 9200 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 9200 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 1900 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 1900 | U |
| 118-74-1 | Hexachlorobenzene | 1900 | U |
| 87-86-5 | Pentachlorophenol | 9200 | U |
| 85-01-8 | Phenanthrene | 95 | J |
| 120-12-7 | Anthracene | 1900 | U |
| 84-74-2 | Di-n-Butylphthalate | 3100 | B |
| 206-44-0 | Fluoranthene | 110 | J |
| 129-00-0 | Pyrene | 120 | J |
| 85-68-7 | Butylbenzylphthalate | 1900 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 3800 | U |
| 56-55-3 | Benzo(a)Anthracene | 1900 | U |
| 218-01-9 | Chrysene | 1900 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 1400 | BJ |
| 117-84-0 | Di-n-Octyl Phthalate | 1900 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 170 | J |
| 207-08-9 | Benzo(k)Fluoranthene | 180 | J |
| 50-32-8 | Benzo(a)Pyrene | 1900 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 1900 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 1900 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 1900 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 7
1F (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21DJ016C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) SOIL Lab Sample ID: 88801401

Sample wt/vol: 16.6 (g/mL) G Lab File ID: BA80141

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. 37 dec. — Date Extracted: 05/18/88

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 08/05/88

GPC Cleanup: (Y/N) Y pH: 7.3 Dilution Factor: 2.00

Number TICs found: 6

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | | UNDECANE | 14.39 | 1200 | J |
| 2. | 281-23-2 | TRICYCLO[3.3.1.1]DECANE | 23.47 | 520 | J |
| 3. | | C17-ALKANE | 28.24 | 400 | J |
| 4. | | ALKALOID | 48.81 | 3300 | J |
| 5. | | ALKALOID | 49.99 | 2200 | J |
| 6. | 55334-01-5 | PHENANTHRENE, 9-DODECYLTETRA | 50.88 | 1200 | J |

Appendix 7
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ017C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) SOIL Lab Sample ID: 88801402

Sample wt/vol: 15.6 (g/mL) G Lab File ID: B880142

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. 12 dec. — Date Extracted: 05/18/88

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 08/11/88

GPC Cleanup: (Y/N) Y pH: 7.6 Dilution Factor: 8.01

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 730 | J |
| 111-44-4 | bis(2-Chloroethyl)Ether | 5800 | U |
| 95-57-8 | 2-Chlorophenol | 5800 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 5800 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 5800 | U |
| 100-51-6 | Benzyl Alcohol | 5800 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 5800 | U |
| 95-48-7 | 2-Methylphenol | 5800 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 5800 | U |
| 106-44-5 | 4-Methylphenol | 5800 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 5800 | U |
| 67-72-1 | Hexachloroethane | 5800 | U |
| 98-95-3 | Nitrobenzene | 5800 | U |
| 78-59-1 | Isophorone | 5800 | U |
| 88-75-5 | 2-Nitrophenol | 5800 | U |
| 105-67-9 | 2,4-Dimethylphenol | 5800 | U |
| 65-85-0 | Benzoic Acid | 28000 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 5800 | U |
| 120-83-2 | 2,4-Dichlorophenol | 5800 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 5800 | U |
| 91-20-3 | Naphthalene | 5300 | J |
| 106-47-8 | 4-Chloroaniline | 5800 | U |
| 87-68-3 | Hexachlorobutadiene | 5800 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 5800 | U |
| 91-57-6 | 2-Methylnaphthalene | 1500 | J |
| 77-47-4 | Hexachlorocyclopentadiene | 5800 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 5800 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 28000 | U |
| 91-58-7 | 2-Chloronaphthalene | 5800 | U |
| 88-74-4 | 2-Nitroaniline | 28000 | U |
| 131-11-3 | Dimethyl Phthalate | 5800 | U |
| 208-96-8 | Acenaphthylene | 7600 | |
| 606-20-2 | 2,6-Dinitrotoluene | 5800 | U |

Appendix 7
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21DJ017C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) SOIL Lab Sample ID: 88801402

Sample wt/vol: 15.6 (g/mL) G Lab File ID: B880142

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. 12 dec. — Date Extracted: 05/18/88

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 08/11/88

GPC Cleanup: (Y/N) Y pH: 7.6 Dilution Factor: 8.01

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 28000 | U |
| 83-32-9 | Acenaphthene | 320 | J |
| 51-28-5 | 2,4-Dinitrophenol | 28000 | U |
| 100-02-7 | 4-Nitrophenol | 28000 | U |
| 132-64-9 | Dibenzofuran | 1400 | J |
| 121-14-2 | 2,4-Dinitrotoluene | 5800 | U |
| 84-66-2 | Diethylphthalate | 5800 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 5800 | U |
| 86-73-7 | Fluorene | 2600 | J |
| 100-10-6 | 4-Nitroaniline | 28000 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 28000 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 5800 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 5800 | U |
| 118-74-1 | Hexachlorobenzene | 5800 | U |
| 87-86-5 | Pentachlorophenol | 28000 | U |
| 85-01-8 | Phenanthrene | 9900 | |
| 120-12-7 | Anthracene | 2900 | J |
| 84-74-2 | Di-n-Butylphthalate | 2700 | J |
| 206-44-0 | Fluoranthene | 13000 | |
| 129-00-0 | Pyrene | 16000 | |
| 85-68-7 | Butylbenzylphthalate | 5800 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 12000 | U |
| 56-55-3 | Benzo(a)Anthracene | 11000 | |
| 218-01-9 | Chrysene | 9200 | |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 790 | J |
| 117-84-0 | Di-n-Octyl Phthalate | 5800 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 5800 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 19000 | |
| 50-32-8 | Benzo(a)Pyrene | 14000 | |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 10000 | |
| 53-70-3 | Dibenz(a,h)Anthracene | 1100 | J |
| 191-24-2 | Benzo(g,h,i)Perylene | 9800 | |

(1) - Cannot be separated from Diphenylamine

Appendix 7
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21DJ017C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) SOIL Lab Sample ID: 88801402

Sample wt/vol: 15.6 (g/mL) G Lab File ID: B880142

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. 12 dec. — Date Extracted: 05/18/88

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 08/11/88

GPC Cleanup: (Y/N) Y pH: 7.6 Dilution Factor: 8.01

Number TICs found: 9

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | | C1-NAPHTHALENE | 19.87 | 1600 | J |
| 2. | 615-22-5 | BENZOTHIAZOLE, 2-(METHYLTHIO | 26.36 | 4700 | J |
| 3. | 203-64-5 | 4H-CYCLOPENTA[DEF]PHENANTHRE | 32.11 | 3600 | J |
| 4. | 612-94-2 | NAPHTHALENE, 2-PHENYL- | 32.82 | 2400 | J |
| 5. | 2381-21-7 | PYRENE, 1-METHYL- | 35.81 | 4600 | J |
| 6. | | UNKNOWN PNA | 37.69 | 2800 | J |
| 7. | | BENZOPYRENE ISOMER | 42.99 | 7500 | J |
| 8. | | BENZOPYRENE ISOMER | 43.83 | 13000 | J |
| 9. | | UNKNOWN PNA | 47.13 | 4700 | J |

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LK003C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ011C

Matrix: (soil/water) WATER Lab Sample ID: 88800001

Sample wt/vol: 910 (g/mL) ML Lab File ID: BA880001

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 150 | |
| 111-44-4 | bis(2-Chloroethyl)Ether | 11 | U |
| 95-57-8 | 2-Chlorophenol | 24 | |
| 541-73-1 | 1,3-Dichlorobenzene | 11 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 11 | U |
| 100-51-6 | Benzyl Alcohol | 11 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 11 | U |
| 95-48-7 | 2-Methylphenol | 270 | |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 11 | U |
| 106-44-5 | 4-Methylphenol | 370 | E |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 11 | U |
| 67-72-1 | Hexachloroethane | 11 | U |
| 98-95-3 | Nitrobenzene | 11 | U |
| 78-59-1 | Isophorone | 11 | U |
| 88-75-5 | 2-Nitrophenol | 11 | U |
| 105-67-9 | 2,4-Dimethylphenol | 11 | U |
| 65-85-0 | Benzoic Acid | 55 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 11 | U |
| 120-83-2 | 2,4-Dichlorophenol | 11 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 11 | U |
| 91-20-3 | Naphthalene | 11 | U |
| 106-47-8 | 4-Chloroaniline | 11 | U |
| 87-68-3 | Hexachlorobutadiene | 11 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 11 | U |
| 91-57-6 | 2-Methylnaphthalene | 11 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 11 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 11 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 55 | U |
| 91-58-7 | 2-Chloronaphthalene | 11 | U |
| 88-74-4 | 2-Nitroaniline | 55 | U |
| 131-11-3 | Dimethyl Phthalate | 11 | U |
| 208-96-8 | Acenaphthylene | 11 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 11 | U |

Appendix 8
1C (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: 21LK003C

Lab Name: ANL/ACL - RJW  Contract: —

Lab Code: ANL  Case No.: BA  SAS No.: —  SDG No.: 21LJ011C

Matrix: (soil/water) WATER  Lab Sample ID: 88800001

Sample wt/vol: 910 (g/mL) ML  Lab File ID: BA880001

Level: (low/med) LOW  Date Received: 10/08/87

% Moisture: not dec. ____ dec. ____  Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF  Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N  pH: 6.0  Dilution Factor: 1.00

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NO. | COMPOUND | 0 | |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 55 | U |
| 83-32-9 | Acenaphthene | 11 | U |
| 51-28-5 | 2,4-Dinitrophenol | 55 | U |
| 100-02-7 | 4-Nitrophenol | 55 | U |
| 132-64-9 | Dibenzofuran | 11 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 11 | U |
| 84-66-2 | Diethylphthalate | 11 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 11 | U |
| 86-73-7 | Fluorene | 11 | U |
| 100-10-6 | 4-Nitroaniline | 55 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 55 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 11 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 11 | U |
| 118-74-1 | Hexachlorobenzene | 11 | U |
| 87-86-5 | Pentachlorophenol | 55 | U |
| 85-01-8 | Phenanthrene | 1 | J |
| 120-12-7 | Anthracene | 11 | U |
| 84-74-2 | Di-n-Butylphthalate | 64 | |
| 206-44-0 | Fluoranthene | 2 | J |
| 129-00-0 | Pyrene | 1 | J |
| 85-68-7 | Butylbenzylphthalate | 11 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 55 | U |
| 56-55-3 | Benzo(a)Anthracene | 3 | J |
| 218-01-9 | Chrysene | 11 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 11 | U |
| 117-84-0 | Di-n-Octyl Phthalate | 11 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 11 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 11 | U |
| 50-32-8 | Benzo(a)Pyrene | 11 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 11 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 11 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 11 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
1F (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.: 21LK00SC

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01

Matrix: (soil/water) WATER Lab Sample ID: BB800001

Sample wt/vol: 910 (g/mL) ML Lab File ID: BA880001

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

Number TICs found: 27

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | | DIMETHYL PHENOL | 14.59 | 29 | JX |
| 2. | | DIMETHYL PHENOL | 15.62 | 43 | JX |
| 3. | | DIMETHYL PHENOL | 15.84 | 66 | JX |
| 4. | | DIMETHYL PHENOL | 16.65 | 15 | JX |
| 5. | | CHLORODIMETHYL PHENOL | 16.67 | 7.7 | JX |
| 6. | | DIMETHYL PHENOL | 17.09 | 6.0 | JX |
| 7. | | DICHLOROPHENOL | 17.09 | 9.5 | JX |
| 8. | | C3-PHENOL | 17.85 | 12 | JX |
| 9. | | C3-PHENOL | 18.72 | 8.2 | JX |
| 10. | | DICHLOROMETHYL PHENOL | 19.27 | 12 | JX |
| 11. | | DICHLORODIMETHYL PHENOL | 21.82 | 9.7 | JX |
| 12. | | CHLORODIMETHYL PHENOL | 21.82 | 9.1 | JX |
| 13. | | TRICHLOROMETHYL PHENOL | 23.77 | 24 | JX |
| 14. | | C16-ALKANE | 25.91 | 3.8 | JX |
| 15. | | TRICHLORODIMETHYL PHENOL | 26.56 | 12 | JX |
| 16. | | C17-ALKANE | 27.89 | 5.8 | JX |
| 17. | | UNKNOWN ALKANE | 28.02 | 3.9 | JX |
| 18. | | DICHLOROBIPHENYL | 28.17 | 3.7 | JX |
| 19. | | TRICHLOROBIPHENYL | 30.42 | 6.1 | JX |
| 20. | | PHTHALATE ESTER | 31.06 | 7.1 | JX |
| 21. | | TRICHLOROBIPHENYL | 31.24 | 11 | JX |
| 22. | | TETRACHLROBIPHENYL | 32.77 | 2.8 | JX |
| 23. | | PHENYL BICYCLOHEXYL | 32.91 | 19 | JX |
| 24. | | PHENYL BICYCLOHEXYL | 33.56 | 10 | JX |
| 25. | | 1,1-CYCLOHEXYLIDENE BIS BENZ | 34.02 | 22 | JX |
| 26. | | 1,1-CYCLOHEXYLIDENE BIS BENZ | 34.57 | 12 | JX |
| 27. | | ALKYL TRIPHENYL PHOSPHATE | 40.89 | 2200 | JX |

Appendix 8
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LK004C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01C

Matrix: (soil/water) WATER Lab Sample ID: 88800002

Sample wt/vol: 945 (g/mL) ML Lab File ID: B880002

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 2 | J |
| 111-44-4 | bis(2-Chloroethyl)Ether | 11 | U |
| 95-57-8 | 2-Chlorophenol | 11 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 11 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 11 | U |
| 100-51-6 | Benzyl Alcohol | 11 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 11 | U |
| 95-48-7 | 2-Methylphenol | 11 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 11 | U |
| 106-44-5 | 4-Methylphenol | 1 | J |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 11 | U |
| 67-72-1 | Hexachloroethane | 11 | U |
| 98-95-3 | Nitrobenzene | 11 | U |
| 78-59-1 | Isophorone | 11 | U |
| 88-75-5 | 2-Nitrophenol | 11 | U |
| 105-67-9 | 2,4-Dimethylphenol | 11 | U |
| 65-85-0 | Benzoic Acid | 53 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 11 | U |
| 120-83-2 | 2,4-Dichlorophenol | 11 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 11 | U |
| 91-20-3 | Naphthalene | 11 | U |
| 106-47-8 | 4-Chloroaniline | 11 | U |
| 87-68-3 | Hexachlorobutadiene | 11 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 11 | U |
| 91-57-6 | 2-Methylnaphthalene | 11 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 11 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 11 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 53 | U |
| 91-58-7 | 2-Chloronaphthalene | 11 | U |
| 88-74-4 | 2-Nitroaniline | 53 | U |
| 131-11-3 | Dimethyl Phthalate | 11 | U |
| 208-96-8 | Acenaphthylene | 11 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 11 | U |

Appendix 8
1C (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: 21LK004C

Lab Name: ANL/ACL - RJW  Contract: —

Lab Code: ANL  Case No.: BA  SAS No.: —  SDG No.: 21LJ011C

Matrix: (soil/water) WATER  Lab Sample ID: 88800002

Sample wt/vol: 945 (g/mL) ML  Lab File ID: B880002

Level: (low/med) LOW  Date Received: 10/08/87

% Moisture: not dec. ____  dec. ____  Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF  Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N  pH: 6.0  Dilution Factor: 1.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 53 | U |
| 83-32-9 | Acenaphthene | 11 | U |
| 51-28-5 | 2,4-Dinitrophenol | 53 | U |
| 100-02-7 | 4-Nitrophenol | 53 | U |
| 132-64-9 | Dibenzofuran | 11 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 11 | U |
| 84-66-2 | Diethylphthalate | 11 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 11 | U |
| 86-73-7 | Fluorene | 11 | U |
| 100-10-6 | 4-Nitroaniline | 53 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 53 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 11 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 11 | U |
| 118-74-1 | Hexachlorobenzene | 11 | U |
| 87-86-5 | Pentachlorophenol | 53 | U |
| 85-01-8 | Phenanthrene | 11 | U |
| 120-12-7 | Anthracene | 11 | U |
| 84-74-2 | Di-n-Butylphthalate | 10 | J |
| 206-44-0 | Fluoranthene | 11 | U |
| 129-00-0 | Pyrene | 11 | U |
| 85-68-7 | Butylbenzylphthalate | 11 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 53 | U |
| 56-55-3 | Benzo(a)Anthracene | 11 | U |
| 218-01-9 | Chrysene | 11 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 4 | J |
| 117-84-0 | Di-n-Octyl Phthalate | 11 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 11 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 11 | U |
| 50-32-8 | Benzo(a)Pyrene | 11 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 11 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 11 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 11 | U |

(1) - Cannot be separated from Diphenylamine

1F

EPA SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

21LK004C

Lab Name: ANL/ACL - RJW Contract: _____

Lab Code: ANL Case No.: BA SAS No.: _____ SDG No.: 21LJ01

Matrix: (soil/water) WATER Lab Sample ID: 88800002

Sample wt/vol: 945 (g/mL) ML Lab File ID: B880002

Level: (low/med) LOW Date Received: 10/08/87

% Moisture: not dec. _____ dec. _____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

Number TICs found: 14

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 108-94-1 | CYCLOHEXANONE | 8.39 | 30 | JX |
| 2. | 124-18-5 | DECANE | 11.37 | 3.8 | BJX |
| 3. | 54410-99-0 | CYCLOHEXANE, 1-BUTYL-3-ETHYL | 12.19 | 8.1 | BJX |
| 4. | 22037-28-1 | UNKNOWN | 12.92 | 5.6 | JX |
| 5. | 17301-32-5 | UNDECANE, 4,7-DIMETHYL- | 14.14 | 4.6 | JX |
| 6. | 69687-94-1 | PENTANOIC ACID, 5-METHOXY-, | 14.25 | 9.5 | JX |
| 7. | 629-40-3 | OCTANEDINITRILE | 14.74 | 4.4 | JX |
| 8. | 128-37-0 | PHENOL, BIS(1,1-DIMETHYLETHY | 23.27 | 3.5 | BJX |
| 9. | 128-37-0 | PHENOL, BIS(1,1-DIMETHYLETHY | 24.19 | 3.3 | BJX |
| 10. | 2719-61-1 | BENZENE, (1-METHYLUNDECYL)- | 29.94 | 2.9 | JX |
| 11. | 17851-53-5 | 1,2-BENZENEDICARBOXYLIC ACID | 30.97 | 6.7 | JX |
| 12. | 4337-65-9 | HEXANEDIOIC ACID, MONO(2-ETH | 37.17 | 41 | JX |
| 13. | 115-86-6 | PHOSPHORIC ACID,BIS(METHYLPH | 38.87 | 5.4 | JX |
| 14. | | UNKNOWN | 51.89 | 25 | JX |

Appendix 8

1B (Cont'd)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: 21LK007CRE

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01JC

Matrix: (soil/water) WATER Lab Sample ID: 88800704

Sample wt/vol: 300 (g/mL) ML Lab File ID: 880074

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/23/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.999

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 108-95-2 | phenol | 41 | |
| 111-44-4 | bis(2-Chloroethyl)Ether | 33 | U |
| 95-57-8 | 2-Chlorophenol | 33 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 33 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 33 | U |
| 100-51-6 | Benzyl Alcohol | 7 | J |
| 95-50-1 | 1,2-Dichlorobenzene | 33 | U |
| 95-48-7 | 2-Methylphenol | 6 | J |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 33 | U |
| 106-44-5 | 4-Methylphenol | 390 | |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 33 | U |
| 67-72-1 | Hexachloroethane | 33 | U |
| 98-95-3 | Nitrobenzene | 33 | U |
| 78-59-1 | Isophorone | 33 | U |
| 88-75-5 | 2-Nitrophenol | 33 | U |
| 105-67-9 | 2,4-Dimethylphenol | 33 | U |
| 65-85-0 | Benzoic Acid | 160 | J |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 33 | U |
| 120-83-2 | 2,4-Dichlorophenol | 33 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 33 | U |
| 91-20-3 | Naphthalene | 33 | U |
| 106-47-8 | 4-Chloroaniline | 33 | U |
| 87-68-3 | Hexachlorobutadiene | 33 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 33 | U |
| 91-57-6 | 2-Methylnaphthalene | 33 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 33 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 33 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 170 | U |
| 91-58-7 | 2-Chloronaphthalene | 33 | U |
| 88-74-4 | 2-Nitroaniline | 170 | U |
| 131-11-3 | Dimethyl Phthalate | 33 | U |
| 208-96-8 | Acenaphthylene | 33 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 33 | U |

Appendix 8 (Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LK007CRS

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01C

Matrix: (soil/water) WATER Lab Sample ID: 88800704

Sample wt/vol: 300 (g/mL) ML Lab File ID: 880074

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/23/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.999

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 170 | U |
| 83-32-9 | Acenaphthene | 33 | U |
| 51-28-5 | 2,4-Dinitrophenol | 170 | U |
| 100-02-7 | 4-Nitrophenol | 170 | U |
| 132-64-9 | Dibenzofuran | 33 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 33 | U |
| 84-66-2 | Diethylphthalate | 33 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 33 | U |
| 86-73-7 | Fluorene | 33 | U |
| 100-10-6 | 4-Nitroaniline | 170 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 170 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 33 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 33 | U |
| 118-74-1 | Hexachlorobenzene | 33 | U |
| 87-86-5 | Pentachlorophenol | 170 | U |
| 85-01-8 | Phenanthrene | 33 | U |
| 120-12-7 | Anthracene | 33 | U |
| 84-74-2 | Di-n-Butylphthalate | 39 | |
| 206-44-0 | Fluoranthene | 33 | U |
| 129-00-0 | Pyrene | 33 | U |
| 85-68-7 | Butylbenzylphthalate | 10 | J |
| 91-94-1 | 3,3'-Dichlorobenzidine | 170 | U |
| 56-55-3 | Benzo(a)Anthracene | 33 | U |
| 218-01-9 | Chrysene | 33 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 48 | |
| 117-84-0 | Di-n-Octyl Phthalate | 33 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 33 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 33 | U |
| 50-32-8 | Benzo(a)Pyrene | 33 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 33 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 33 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 33 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

21LP007CRE

Lab Name: ANL/ACL - RJW  Contract: —

Lab Code: ANL  Case No.: BA  SAS No.: —  SDG No.: 21LJ011C

Matrix: (soil/water) WATER  Lab Sample ID: 88800704

Sample wt/vol: 300 (g/mL) ML  Lab File ID: 880074

Level: (low/med) LOW  Date Received: 10/09/87

% Moisture: not dec. ____  dec. ____  Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF  Date Analyzed: 12/23/87

GPC Cleanup: (Y/N) N  pH: 6.0  Dilution Factor: 0.999

Number TICs found: 21

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 109-52-4 | PENTANOIC ACID | 8.34 | 170 | JX |
| 2. | 54446-78-5 | ETHANOL, 1-(2-BUTOXYETHOXY)- | 8.80 | 540 | JX |
| 3. | 4536-23-6 | HEXANOIC ACID, 2-METHYL- | 10.24 | 66 | JX |
| 4. | 55499-04-2 | NONANE, 2,2,3-TRIMETHYL- | 12.02 | 22 | JX |
| 5. | 55170-80-4 | DECENE, DIMETHYL- | 12.20 | 53 | JX |
| 6. | 17301-32-5 | NONANE | 14.10 | 28 | JX |
| 7. | | SUBSTITUTED C15 ALKANE | 15.85 | 36 | JX |
| 8. | 103-82-2 | BENZENEACETIC ACID | 18.32 | 140 | JX |
| 9. | 120-72-9 | 1H-INDOLE | 19.17 | 25 | JX |
| 10. | 501-52-0 | BENZENEPROPANOIC ACID | 20.27 | 96 | JX |
| 11. | 95-20-5 | 1H-INDOLE, 2-METHYL- | 21.37 | 29 | JX |
| 12. | 128-37-0 | PHENOL, 2,6-BIS(1,1-DIMETHYL | 24.15 | 34 | BJX |
| 13. | 3910-35-8 | BENZENE,BIS (DIMETHYL-BUTENY | 28.44 | 24 | JX |
| 14. | 2719-61-1 | BENZENE, (1-METHYLUNDECYL)-C | 29.89 | 18 | JX |
| 15. | 17851-53-5 | PHTHALATE ESTER | 30.92 | 20 | JX |
| 16. | 10544-50-0 | SULFUR, (S8) | 33.61 | 450 | JX |
| 17. | 57-11-4 | OCTADECANOIC ACID | 34.72 | 160 | JX |
| 18. | 4337-65-9 | HEXANEDIOIC ACID, MONO(2-ETH | 37.12 | 130 | JX |
| 19. | 74685-30-6 | 5-EICOSENE, (E)- | 38.02 | 64 | BJX |
| 20. | 80-97-7 | CHOLESTANOL (VAN) | 48.19 | 28 | JX |
| 21. | 57-88-5 | CHOLESTEROL | 49.48 | 180 | JX |

Appendix 8
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ008C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01C

Matrix: (soil/water) WATER Lab Sample ID: 88800705

Sample wt/vol: 880 (g/mL) ML Lab File ID: B880075

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

CONCENTRATION UNITS:

| CAS NO. | COMPOUND | (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 1 | J |
| 111-44-4 | bis(2-Chloroethyl)Ether | 11 | U |
| 95-57-8 | 2-Chlorophenol | 11 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 11 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 11 | U |
| 100-51-6 | Benzyl Alcohol | 11 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 11 | U |
| 95-48-7 | 2-Methylphenol | 11 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 11 | U |
| 106-44-5 | 4-Methylphenol | 13 | |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 11 | U |
| 67-72-1 | Hexachloroethane | 11 | U |
| 98-95-3 | Nitrobenzene | 11 | U |
| 78-59-1 | Isophorone | 11 | U |
| 88-75-5 | 2-Nitrophenol | 11 | U |
| 105-67-9 | 2,4-Dimethylphenol | 11 | U |
| 65-85-0 | Benzoic Acid | 57 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 11 | U |
| 120-83-2 | 2,4-Dichlorophenol | 11 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 11 | U |
| 91-20-3 | Naphthalene | 11 | U |
| 106-47-8 | 4-Chloroaniline | 11 | U |
| 87-68-3 | Hexachlorobutadiene | 11 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 11 | U |
| 91-57-6 | 2-Methylnaphthalene | 11 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 11 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 11 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 57 | U |
| 91-58-7 | 2-Chloronaphthalene | 11 | U |
| 88-74-4 | 2-Nitroaniline | 57 | U |
| 131-11-3 | Dimethyl Phthalate | 11 | U |
| 208-96-8 | Acenaphthylene | 11 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 11 | U |

Appendix 8
1C (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LK008C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01C

Matrix: (soil/water) WATER Lab Sample ID: 88800705

Sample wt/vol: 880 (g/mL) ML Lab File ID: B880075

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 57 | U |
| 83-32-9 | Acenaphthene | 11 | U |
| 51-28-5 | 2,4-Dinitrophenol | 57 | U |
| 100-02-7 | 4-Nitrophenol | 57 | U |
| 132-64-9 | Dibenzofuran | 11 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 11 | U |
| 84-66-2 | Diethylphthalate | 0.9 | J |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 11 | U |
| 86-73-7 | Fluorene | 11 | U |
| 100-10-6 | 4-Nitroaniline | 57 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 57 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 11 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 11 | U |
| 118-74-1 | Hexachlorobenzene | 11 | U |
| 87-86-5 | Pentachlorophenol | 57 | U |
| 85-01-8 | Phenanthrene | 11 | U |
| 120-12-7 | Anthracene | 11 | U |
| 84-74-2 | Di-n-Butylphthalate | 5 | J |
| 206-44-0 | Fluoranthene | 11 | U |
| 129-00-0 | Pyrene | 11 | U |
| 85-68-7 | Butylbenzylphthalate | 11 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 57 | U |
| 56-55-3 | Benzo(a)Anthracene | 11 | U |
| 218-01-9 | Chrysene | 11 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 3 | J |
| 117-84-0 | Di-n-Octyl Phthalate | 11 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 11 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 11 | U |
| 50-32-8 | Benzo(a)Pyrene | 11 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 11 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 11 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 11 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21LJ008C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01C

Matrix: (soil/water) WATER Lab Sample ID: 88800705

Sample wt/vol: 880 (g/mL) ML Lab File ID: B880075

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/15/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

Number TICs found: 14

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 124-18-5 | DECANE | 11.37 | 3.9 | BJX |
| 2. | | SUBSTITUTED C12-ALKENE | 12.20 | 15 | JX |
| 3. | 128-37-0 | PHENOL, 2,6-BIS(1,1-DIMETHYL | 24.20 | 4.2 | BJX |
| 4. | 143-07-7 | DODECANOIC ACID | 25.14 | 4.5 | JX |
| 5. | 544-63-8 | TETRADECANOIC ACID | 29.07 | 9.7 | JX |
| 6. | 58-08-2 | CAFFEINE | 30.71 | 2.0 | JX |
| 7. | 1002-84-2 | PENTADECANOIC ACID | 30.97 | 3.0 | JX |
| 8. | | UNKNOWN | 34.62 | 51 | JX |
| 9. | 57-11-4 | OCTADECANOIC ACID | 34.84 | 99 | JX |
| 10. | 4337-65-9 | HEXANEDIOIC ACID, MONO(2-ETH | 37.17 | 89 | JX |
| 11. | 74685-30-6 | 5-EICOSENE, (E)- | 38.06 | 18 | BJX |
| 12. | 7683-64-9 | SQUALENE | 42.46 | 11 | JX |
| 13. | | STEROL | 48.46 | 270 | JX |
| 14. | | STEROL | 49.59 | 170 | JX |

Appendix 8
1B (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: 21LJ011C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ011C

Matrix: (soil/water) WATER Lab Sample ID: B8800701

Sample wt/vol: 910 (g/mL) ML Lab File ID: B880071

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 11 | U |
| 111-44-4 | bis(2-Chloroethyl)Ether | 11 | U |
| 95-57-8 | 2-Chlorophenol | 11 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 11 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 11 | U |
| 100-51-6 | Benzyl Alcohol | 11 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 11 | U |
| 95-48-7 | 2-Methylphenol | 11 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 11 | U |
| 106-44-5 | 4-Methylphenol | 11 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 11 | U |
| 67-72-1 | Hexachloroethane | 11 | U |
| 98-95-3 | Nitrobenzene | 11 | U |
| 78-59-1 | Isophorone | 11 | U |
| 88-75-5 | 2-Nitrophenol | 11 | U |
| 105-67-9 | 2,4-Dimethylphenol | 11 | U |
| 65-85-0 | Benzoic Acid | 55 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 11 | U |
| 120-83-2 | 2,4-Dichlorophenol | 11 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 11 | U |
| 91-20-3 | Naphthalene | 11 | U |
| 106-47-8 | 4-Chloroaniline | 11 | U |
| 87-68-3 | Hexachlorobutadiene | 11 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 11 | U |
| 91-57-6 | 2-Methylnaphthalene | 11 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 11 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 11 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 55 | U |
| 91-58-7 | 2-Chloronaphthalene | 11 | U |
| 88-74-4 | 2-Nitroaniline | 55 | U |
| 131-11-3 | Dimethyl Phthalate | 11 | U |
| 208-96-8 | Acenaphthylene | 11 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 11 | U |

Appendix 8
1C (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
21LJ011C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ011C

Matrix: (soil/water) WATER Lab Sample ID: 88800701

Sample wt/vol: 910 (g/mL) ML Lab File ID: B880071

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NO. | COMPOUND | | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 55 | U |
| 83-32-9 | Acenaphthene | 11 | U |
| 51-28-5 | 2,4-Dinitrophenol | 55 | U |
| 100-02-7 | 4-Nitrophenol | 55 | U |
| 132-64-9 | Dibenzofuran | 11 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 11 | U |
| 84-66-2 | Diethylphthalate | 11 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 11 | U |
| 86-73-7 | Fluorene | 11 | U |
| 100-10-6 | 4-Nitroaniline | 55 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 55 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 11 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 11 | U |
| 118-74-1 | Hexachlorobenzene | 11 | U |
| 87-86-5 | Pentachlorophenol | 55 | U |
| 85-01-8 | Phenanthrene | 11 | U |
| 120-12-7 | Anthracene | 11 | U |
| 84-74-2 | Di-n-Butylphthalate | 1 | J |
| 206-44-0 | Fluoranthene | 11 | U |
| 129-00-0 | Pyrene | 11 | U |
| 85-68-7 | Butylbenzylphthalate | 11 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 55 | U |
| 56-55-3 | Benzo(a)Anthracene | 11 | U |
| 218-01-9 | Chrysene | 11 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 9 | J |
| 117-84-0 | Di-n-Octyl Phthalate | 11 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 11 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 11 | U |
| 50-32-8 | Benzo(a)Pyrene | 11 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 11 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 11 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 11 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21LJ011C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ011C

Matrix: (soil/water) WATER Lab Sample ID: 88800701

Sample wt/vol: 910 (g/mL) ML Lab File ID: B880071

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 1.00

Number TICs found: 7

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 124-18-5 | DECANE | 11.37 | 2.3 | BJX |
| 2. | 54410-99-0 | CYCLOHEXANE, 1-BUTYL-3-ETHYL | 12.19 | 5.9 | BJX |
| 3. | 17302-27-1 | NONANE, 2,5-DIMETHYL- | 14.14 | 3.0 | BJX |
| 4. | | PHENOL, BIS(1,1-DIMETHYLETHY | 23.25 | 1.4 | JX |
| 5. | 128-37-0 | PHENOL, 2,6-BIS(1,1-DIMETHYL | 24.19 | 1.4 | BJX |
| 6. | 23586-64-3 | BENZENE, 1,1'(3,3-DIMETHYL-1 | 28.47 | 5.2 | JX |
| 7. | 74685-30-6 | 5-EICOSENE, (E)- | 38.04 | 4.8 | BJX |

Appendix 8
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ012C

Lab Name: ANL/ACL - RJW Contract: ~

Lab Code: ANL Case No.: BA SAS No.: ~ SDG No.: 21LJ011C

Matrix: (soil/water) WATER Lab Sample ID: 88800702

Sample wt/vol: 950 (g/mL) ML Lab File ID: B880072

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.998

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 11 | U |
| 111-44-4 | bis(2-Chloroethyl)Ether | 11 | U |
| 95-57-8 | 2-Chlorophenol | 11 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 11 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 11 | U |
| 100-51-6 | Benzyl Alcohol | 11 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 11 | U |
| 95-48-7 | 2-Methylphenol | 11 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 11 | U |
| 106-44-5 | 4-Methylphenol | 11 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 11 | U |
| 67-72-1 | Hexachloroethane | 11 | U |
| 98-95-3 | Nitrobenzene | 11 | U |
| 78-59-1 | Isophorone | 11 | U |
| 88-75-5 | 2-Nitrophenol | 11 | U |
| 105-67-9 | 2,4-Dimethylphenol | 11 | U |
| 65-85-0 | Benzoic Acid | 53 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 11 | U |
| 120-83-2 | 2,4-Dichlorophenol | 11 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 11 | U |
| 91-20-3 | Naphthalene | 11 | U |
| 106-47-8 | 4-Chloroaniline | 11 | U |
| 87-68-3 | Hexachlorobutadiene | 11 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 11 | U |
| 91-57-6 | 2-Methylnaphthalene | 11 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 11 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 11 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 53 | U |
| 91-58-7 | 2-Chloronaphthalene | 11 | U |
| 88-74-4 | 2-Nitroaniline | 53 | U |
| 131-11-3 | Dimethyl Phthalate | 11 | U |
| 208-96-8 | Acenaphthylene | 11 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 11 | U |

Appendix 8
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ012C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ011C

Matrix: (soil/water) WATER Lab Sample ID: 88800702

Sample wt/vol: 950 (g/mL) ML Lab File ID: B880072

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.998

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NO. | COMPOUND | Q |
|---|---|---|
| 99-09-2 | 3-Nitroaniline | 53 U |
| 83-32-9 | Acenaphthene | 11 U |
| 51-28-5 | 2,4-Dinitrophenol | 53 U |
| 100-02-7 | 4-Nitrophenol | 53 U |
| 132-64-9 | Dibenzofuran | 11 U |
| 121-14-2 | 2,4-Dinitrotoluene | 11 U |
| 84-66-2 | Diethylphthalate | 1 J |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 11 U |
| 86-73-7 | Fluorene | 11 U |
| 100-10-6 | 4-Nitroaniline | 53 U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 53 U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 11 U |
| 101-55-3 | 4-Bromophenyl-phenylether | 11 U |
| 118-74-1 | Hexachlorobenzene | 11 U |
| 87-86-5 | Pentachlorophenol | 53 U |
| 85-01-8 | Phenanthrene | 11 U |
| 120-12-7 | Anthracene | 11 U |
| 84-74-2 | Di-n-Butylphthalate | 2 J |
| 206-44-0 | Fluoranthene | 11 U |
| 129-00-0 | Pyrene | 11 U |
| 85-68-7 | Butylbenzylphthalate | 11 U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 53 U |
| 56-55-3 | Benzo(a)Anthracene | 11 U |
| 218-01-9 | Chrysene | 11 U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 8 J |
| 117-84-0 | Di-n-Octyl Phthalate | 11 U |
| 205-99-2 | Benzo(b)Fluoranthene | 11 U |
| 207-08-9 | Benzo(k)Fluoranthene | 11 U |
| 50-32-8 | Benzo(a)Pyrene | 11 U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 11 U |
| 53-70-3 | Dibenz(a,h)Anthracene | 11 U |
| 191-24-2 | Benzo(g,h,i)Perylene | 11 U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21LJ012C

Lab Name: ANL/ACL - RJW  Contract: —

Lab Code: ANL  Case No.: BA  SAS No.: —  SDG No.: 21LJ011C

Matrix: (soil/water) WATER  Lab Sample ID: 88800702

Sample wt/vol: 950 (g/mL) ML  Lab File ID: B880072

Level: (low/med) LOW  Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____  Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF  Date Analyzed: 12/21/87

GPC Cleanup: (Y/N) N  pH: 6.0  Dilution Factor: 0.998

Number TICs found: 6

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 124-18-5 | DECANE | 11.34 | 3.9 | BJX |
| 2. | 54410-99-0 | CYCLOHEXANE, 1-BUTYL-3-ETHYL | 12.17 | 6.8 | BJX |
| 3. | 17302-27-1 | NONANE, 2,5-DIMETHYL- | 14.12 | 2.1 | BJX |
| 4. | | PHENOL, BIS(1,1-DIMETHYLETHY | 23.24 | 1.5 | JX |
| 5. | 128-37-0 | PHENOL, 2,6-BIS(1,1-DIMETHYL | 24.17 | 2.8 | BJX |
| 6. | | HEPTADECANOL | 38.01 | 3.5 | JX |

Appendix 8

1B (Cont'd.)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: 21LJ013C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01

Matrix: (soil/water) WATER Lab Sample ID: 88800703

Sample wt/vol: 950 (g/mL) ML Lab File ID: B880073

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.998

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 11 | U |
| 111-44-4 | bis(2-Chloroethyl)Ether | 11 | U |
| 95-57-8 | 2-Chlorophenol | 11 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 11 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 11 | U |
| 100-51-6 | Benzyl Alcohol | 11 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 11 | U |
| 95-48-7 | 2-Methylphenol | 11 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 11 | U |
| 106-44-5 | 4-Methylphenol | 11 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 11 | U |
| 67-72-1 | Hexachloroethane | 11 | U |
| 98-95-3 | Nitrobenzene | 11 | U |
| 78-59-1 | Isophorone | 11 | U |
| 88-75-5 | 2-Nitrophenol | 11 | U |
| 105-67-9 | 2,4-Dimethylphenol | 11 | U |
| 65-85-0 | Benzoic Acid | 53 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 11 | U |
| 120-83-2 | 2,4-Dichlorophenol | 11 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 11 | U |
| 91-20-3 | Naphthalene | 11 | U |
| 106-47-8 | 4-Chloroaniline | 11 | U |
| 87-68-3 | Hexachlorobutadiene | 11 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 11 | U |
| 91-57-6 | 2-Methylnaphthalene | 11 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 11 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 11 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 53 | U |
| 91-58-7 | 2-Chloronaphthalene | 11 | U |
| 88-74-4 | 2-Nitroaniline | 53 | U |
| 131-11-3 | Dimethyl Phthalate | 11 | U |
| 208-96-8 | Acenaphthylene | 11 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 11 | U |

Appendix 8
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

| 21LJ013C |
|---|

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01IC

Matrix: (soil/water) WATER Lab Sample ID: 8880703

Sample wt/vol: 950 (g/mL) ML Lab File ID: B880073

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.998

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | 0 |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 53 | U |
| 83-32-9 | Acenaphthene | 11 | U |
| 51-28-5 | 2,4-Dinitrophenol | 53 | U |
| 100-02-7 | 4-Nitrophenol | 53 | U |
| 132-64-9 | Dibenzofuran | 11 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 11 | U |
| 84-66-2 | Diethylphthalate | 11 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 11 | U |
| 86-73-7 | Fluorene | 11 | U |
| 100-10-6 | 4-Nitroaniline | 53 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 53 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 11 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 11 | U |
| 118-74-1 | Hexachlorobenzene | 11 | U |
| 87-86-5 | Pentachlorophenol | 53 | U |
| 85-01-8 | Phenanthrene | 11 | U |
| 120-12-7 | Anthracene | 11 | U |
| 84-74-2 | Di-n-Butylphthalate | 2 | J |
| 206-44-0 | Fluoranthene | 11 | U |
| 129-00-0 | Pyrene | 11 | U |
| 85-68-7 | Butylbenzylphthalate | 11 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 53 | U |
| 56-55-3 | Benzo(a)Anthracene | 11 | U |
| 218-01-9 | Chrysene | 11 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 11 | U |
| 117-84-0 | Di-n-Octyl Phthalate | 11 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 11 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 11 | U |
| 50-32-8 | Benzo(a)Pyrene | 11 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 11 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 11 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 11 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
(Cont'd.)

1F

EPA SAMPLE NO.

21LJ013C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21LJ01C

Matrix: (soil/water) WATER Lab Sample ID: 88800703

Sample wt/vol: 950 (g/mL) ML Lab File ID: B880073

Level: (low/med) LOW Date Received: 10/09/87

% Moisture: not dec. ____ dec. ____ Date Extracted: 10/14/87

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 12/22/87

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.998

Number TICs found: 9

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| | CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|---|
| 1. | 124-18-5 | DECANE | 11.39 | 2.1 | BJX |
| 2. | 54410-99-0 | CYCLOHEXANE, 1-BUTYL-3-ETHYL | 12.20 | 8.0 | BJX |
| 3. | 17302-27-1 | NONANE, 2,5-DIMETHYL- | 14.15 | 1.9 | BJX |
| 4. | | PHENOL, BIS(1,1-DIMETHYLETHY | 23.27 | 1.0 | JX |
| 5. | 128-37-0 | PHENOL, 2,6-BIS(1,1-DIMETHYL | 24.20 | 4.2 | BJX |
| 6. | 2719-61-1 | BENZENE, (1-METHYLUNDECYL)- | 29.96 | 2.2 | JX |
| 7. | | UNKNOWN | 30.97 | 2.4 | JX |
| 8. | 4337-65-9 | HEXANEDIOIC ACID, MONO(2-ETH | 37.17 | 12 | JX |
| 9. | 74685-29-3 | 9-EICOSENE, (E)- | 38.06 | 4.8 | JX |

Appendix 8
(Cont'd.)

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ015C

Lab Name: ANL/ACL - RJW Contract: ——

Lab Code: ANL Case No.: BA SAS No.: —— SDG No.: 21DJ016C

Matrix: (soil/water) WATER Lab Sample ID: 88801301

Sample wt/vol: 970 (g/mL) ML Lab File ID: BA80131

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. —— dec. —— Date Extracted: 05/19/88

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/04/88

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.999

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NO. | COMPOUND | 0 | |
|---|---|---|---|
| 108-95-2 | phenol | 10 | U |
| 111-44-4 | bis(2-Chloroethyl)Ether | 10 | U |
| 95-57-8 | 2-Chlorophenol | 10 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 10 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 10 | U |
| 100-51-6 | Benzyl Alcohol | 10 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 10 | U |
| 95-48-7 | 2-Methylphenol | 10 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 10 | U |
| 106-44-5 | 4-Methylphenol | 10 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 10 | U |
| 67-72-1 | Hexachloroethane | 10 | U |
| 98-95-3 | Nitrobenzene | 10 | U |
| 78-59-1 | Isophorone | 10 | U |
| 88-75-5 | 2-Nitrophenol | 10 | U |
| 105-67-9 | 2,4-Dimethylphenol | 10 | U |
| 65-85-0 | Benzoic Acid | 52 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 10 | U |
| 120-83-2 | 2,4-Dichlorophenol | 10 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 10 | U |
| 91-20-3 | Naphthalene | 10 | U |
| 106-47-8 | 4-Chloroaniline | 10 | U |
| 87-68-3 | Hexachlorobutadiene | 10 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 10 | U |
| 91-57-6 | 2-Methylnaphthalene | 10 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 10 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 10 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 52 | U |
| 91-58-7 | 2-Chloronaphthalene | 10 | U |
| 88-74-4 | 2-Nitroaniline | 52 | U |
| 131-11-3 | Dimethyl Phthalate | 10 | U |
| 208-96-8 | Acenaphthylene | 10 | U |
| 606-20-2 | 2,6-Dinitrotoluene | 10 | U |

Appendix 8
(Cont'd.)

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ015C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) WATER Lab Sample ID: 88801301

Sample wt/vol: 970 (g/mL) ML Lab File ID: BA80131

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. — dec. — Date Extracted: 05/19/88

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/04/88

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.999

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L Q | |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 52 | U |
| 83-32-9 | Acenaphthene | 10 | U |
| 51-28-5 | 2,4-Dinitrophenol | 52 | U |
| 100-02-7 | 4-Nitrophenol | 52 | U |
| 132-64-9 | Dibenzofuran | 10 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 10 | U |
| 84-66-2 | Diethylphthalate | 10 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 10 | U |
| 86-73-7 | Fluorene | 10 | U |
| 100-10-6 | 4-Nitroaniline | 52 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 52 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 10 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 10 | U |
| 118-74-1 | Hexachlorobenzene | 10 | U |
| 87-86-5 | Pentachlorophenol | 52 | U |
| 85-01-8 | Phenanthrene | 10 | U |
| 120-12-7 | Anthracene | 10 | U |
| 84-74-2 | Di-n-Butylphthalate | 5 | BJ |
| 206-44-0 | Fluoranthene | 10 | U |
| 129-00-0 | Pyrene | 10 | U |
| 85-68-7 | Butylbenzylphthalate | 10 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 52 | U |
| 56-55-3 | Benzo(a)Anthracene | 10 | U |
| 218-01-9 | Chrysene | 10 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 6 | BJ |
| 117-84-0 | Di-n-Octyl Phthalate | 10 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 10 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 10 | U |
| 50-32-8 | Benzo(a)Pyrene | 10 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 10 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 10 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 10 | U |

(1) - Cannot be separated from Diphenylamine

1F

EPA SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

21LJ015C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) WATER Lab Sample ID: 88801301

Sample wt/vol: 970 (g/mL) ML Lab File ID: BA80131

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. — dec. — Date Extracted: 05/19/88

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/04/88

GPC Cleanup: (Y/N) N pH: 6.0 Dilution Factor: 0.999

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|

**No Tentatively Identified Compounds Found**

**Appendix 8**
**(Cont'd.)**

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ018C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) WATER Lab Sample ID: 88801302

Sample wt/vol: 980 (g/mL) ML Lab File ID: BA80132

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. — dec. — Date Extracted: 05/19/88

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/04/88

GPC Cleanup: (Y/N) N pH: 6.5 Dilution Factor: 1.000

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 108-95-2 | phenol | 10 | U |
| 111-44-4 | bis(2-Chloroethyl)Ether | 10 | U |
| 95-57-8 | 2-Chlorophenol | 10 | U |
| 541-73-1 | 1,3-Dichlorobenzene | 10 | U |
| 106-46-7 | 1,4-Dichlorobenzene | 10 | U |
| 100-51-6 | Benzyl Alcohol | 10 | U |
| 95-50-1 | 1,2-Dichlorobenzene | 10 | U |
| 95-48-7 | 2-Methylphenol | 10 | U |
| 39638-32-9 | bis(2-Chloroisopropyl)Ether | 10 | U |
| 106-44-5 | 4-Methylphenol | 10 | U |
| 621-64-7 | N-Nitroso-Di-n-Propylamine | 10 | U |
| 67-72-1 | Hexachloroethane | 10 | U |
| 98-95-3 | Nitrobenzene | 10 | U |
| 78-59-1 | Isophorone | 10 | U |
| 88-75-5 | 2-Nitrophenol | 10 | U |
| 105-67-9 | 2,4-Dimethylphenol | 10 | U |
| 65-85-0 | Benzoic Acid | 51 | U |
| 111-91-1 | bis(2-Chloroethoxy)Methane | 10 | U |
| 120-83-2 | 2,4-Dichlorophenol | 10 | U |
| 120-82-1 | 1,2,4-Trichlorobenzene | 10 | U |
| 91-20-3 | Naphthalene | 2 | J |
| 106-47-8 | 4-Chloroaniline | 10 | U |
| 87-68-3 | Hexachlorobutadiene | 10 | U |
| 59-50-7 | 4-Chloro-3-Methylphenol | 10 | U |
| 91-57-6 | 2-Methylnaphthalene | 10 | U |
| 77-47-4 | Hexachlorocyclopentadiene | 10 | U |
| 88-06-2 | 2,4,6-Trichlorophenol | 10 | U |
| 95-95-4 | 2,4,5-Trichlorophenol | 51 | U |
| 91-58-7 | 2-Chloronaphthalene | 10 | U |
| 88-74-4 | 2-Nitroaniline | 51 | U |
| 131-11-3 | Dimethyl Phthalate | 10 | U |
| 208-96-8 | Acenaphthylene | 1 | J |
| 606-20-2 | 2,6-Dinitrotoluene | 10 | U |

**Appendix 8**
**(Cont'd.)**

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

21LJ018C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) WATER Lab Sample ID: 88801302

Sample wt/vol: 980 (g/mL) ML Lab File ID: BA80132

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. — dec. — Date Extracted: 05/19/88

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/04/88

GPC Cleanup: (Y/N) N pH: 6.5 Dilution Factor: 1.000

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L | Q |
|---|---|---|---|
| 99-09-2 | 3-Nitroaniline | 51 | U |
| 83-32-9 | Acenaphthene | 10 | U |
| 51-28-5 | 2,4-Dinitrophenol | 51 | U |
| 100-02-7 | 4-Nitrophenol | 51 | U |
| 132-64-9 | Dibenzofuran | 10 | U |
| 121-14-2 | 2,4-Dinitrotoluene | 10 | U |
| 84-66-2 | Diethylphthalate | 10 | U |
| 7005-72-3 | 4-Chlorophenyl-phenylether | 10 | U |
| 86-73-7 | Fluorene | 10 | U |
| 100-10-6 | 4-Nitroaniline | 51 | U |
| 534-52-1 | 4,6-Dinitro-2-Methylphenol | 51 | U |
| 86-30-6 | N-Nitrosodiphenylamine (1) | 10 | U |
| 101-55-3 | 4-Bromophenyl-phenylether | 10 | U |
| 118-74-1 | Hexachlorobenzene | 10 | U |
| 87-86-5 | Pentachlorophenol | 51 | U |
| 85-01-8 | Phenanthrene | 3 | J |
| 120-12-7 | Anthracene | 10 | U |
| 84-74-2 | Di-n-Butylphthalate | 5 | BJ |
| 206-44-0 | Fluoranthene | 3 | J |
| 129-00-0 | Pyrene | 3 | J |
| 85-68-7 | Butylbenzylphthalate | 10 | U |
| 91-94-1 | 3,3'-Dichlorobenzidine | 51 | U |
| 56-55-3 | Benzo(a)Anthracene | 1 | J |
| 218-01-9 | Chrysene | 10 | U |
| 117-81-7 | bis(2-Ethylhexyl)Phthalate | 4 | BJ |
| 117-84-0 | Di-n-Octyl Phthalate | 10 | U |
| 205-99-2 | Benzo(b)Fluoranthene | 10 | U |
| 207-08-9 | Benzo(k)Fluoranthene | 10 | U |
| 50-32-8 | Benzo(a)Pyrene | 10 | U |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 10 | U |
| 53-70-3 | Dibenz(a,h)Anthracene | 10 | U |
| 191-24-2 | Benzo(g,h,i)Perylene | 10 | U |

(1) - Cannot be separated from Diphenylamine

Appendix 8
(Cont'd.)

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
21LJ018C

Lab Name: ANL/ACL - RJW Contract: —

Lab Code: ANL Case No.: BA SAS No.: — SDG No.: 21DJ016C

Matrix: (soil/water) WATER Lab Sample ID: 88801302

Sample wt/vol: 980 (g/mL) ML Lab File ID: BA80132

Level: (low/med) LOW Date Received: 10/27/87

% Moisture: not dec. — dec. — Date Extracted: 05/19/88

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/04/88

GPC Cleanup: (Y/N) N pH: 6.5 Dilution Factor: 1.000

Number TICs found: 0

CONCENTRATION UNITS:
(ug/l or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---|---|---|---|---|

**No Tentatively Identified Compounds Found**

## Distribution for ANL-ESH/TS-88-102

Internal:

J.G. Ello
K.F. Flynn
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