NUREG/CR-2722

# Radiological Survey of the West Lake Landfill St. Louis County, Missouri

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Prepared by L. F. Booth, D. W. Groff, G. S. McDowell, J. J. Adler, S. I. Peck, P. L. Nyerges, F. L. Bronson

**Radiation Management Corporation**

**Prepared for**
**U.S. Nuclear Regulatory Commission**

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**Prepared for**
**Division of Fuel Cycle and Material Safety**
**Office of Nuclear Material Safety and Safeguards**
**U.S. Nuclear Regulatory Commission**
**Washington, D.C. 20555**
**NRC FIN B6901**

# ABSTRACT

This report presents the results of a radiological survey of the West Lake Landfill, St. Louis County, Missouri, performed by Radiation Management Corporation during the spring and summer of 1981. Measurements were made to determine external radiation levels, concentrations of airborne contaminants and the identity and concentrations of subsurface deposits. Results indicate that large volumes of uranium ore residues, probably originating from the Hazelwood, Missouri, Latty Avenue site, have been buried at the West Lake Landfill. Two areas of contamination, covering more than 15 acres and located at depths of up to 20 feet below the present surface, have been identified. There is no indication that significant quantities of contaminants are moving off-site at this time.

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## I. INTRODUCTION

In August 1980, Radiation Management Corporation (RMC), under contract to the U. S. Nuclear Regulatory Commission (NRC), performed radiological evaluations of four burial grounds[1]. The first of these sites selected for evaluation was the West Lake Landfill in St. Louis County, Missouri. An initial site visit was completed in August 1980, and a preliminary radiological survey was completed in November 1980. The detailed radiological evaluation was performed in the spring and summer of 1981.

The purpose of this survey was to clearly define the radiological conditions of the West Lake Landfill site. The results of this survey should be sufficient to allow an engineering evaluation to be performed to determine whether remedial actions should and can be taken.

The methods used to evaluate this site include the following:

1) measurement of external gamma exposure rates 1 meter above the surfaces and beta-gamma count rates 1 cm above surfaces;
2) measurement of radionuclide concentrations in surface soils;
3) measurement of radionuclide concentrations in subsurface deposits;
4) measurement of gross activity and

radionuclide concentrations in surface and subsurface water samples;

5) measurement of radon flux emanating from surfaces;

6) measurement of airborne radioactivity; and

7) measurement of gross activity in vegetation.

These measurements were performed on-site using two mobile facilities designed by RMC. A small number of samples were returned to the RMC radiological laboratories in Philadelphia for analysis for nuclides which could not be detected in the field, and for quality assurance checks on the field measurements. A set of reference background measurements were made at three locations in the St. Louis area, near West Lake Landfill. In addition, a series of non-radiological measurements were performed to identify the possible presence of toxic or hazardous agents known or believed to have been buried at this landfill.

## II. SITE CHARACTERISTICS

The West Lake Landfill is located on St. Charles Rock Road just west of the Taussig Road intersection in Bridgeton, Missouri. The site is about one (1) mile northwest of Route 270 and approximately 1-1/2 miles east of the Missouri River. It is located in a combined rural-industrial area, and is bounded on three sides by farm land and on the fourth by St. Charles Rock Road, beyond which are located several commercial and industrial establishments. The nearest residential area is a trailer park located about 3/4 of a mile southeast of the landfill.

The site is approximately 200 acres and consists of a quarry, stone and limestone processing and storage areas, and several active and inactive landfills (Figure 1), which are open to the public during normal working hours. West Lake Landfill keeps track of entries for the purpose of assessing fees for disposal; however, access is not controlled for other reasons. Users are prohibited from disposing of hazardous materials at this site by current Missouri state law.

Studies indicate the landfill is on the alluvial floodplain of the Missouri River. This fact prompted the Missouri Geological Survey, in 1973, to propose classification of the site as hazardous under the then existing operating procedures. In addition, samples from perimeter monitoring wells taken in 1977 and 1978 indicated some movement of leachate into monitoring wells, based on chemcial (not radiological) analyses. However, recent studies by the Department of Natural Resources indicate little or no surface or sub-surface movement of materials from the site[2]. Leachate from the active sanitary landfill is collected and treated on-site. At this time there is no evidence of significant ground water contamination; however, geological reports indicate a potential for such problems.

In May 1976, the St. Louis Post-Dispatch[3] printed a story alleging that radioactive material had been erroneously dumped in the West Lake Landfill in 1973. The source of this material was identified as the Cotter Corporation, Hazelwood, Missouri, Latty Avenue Site.

An NRC investigation conducted by Region III in 1976 [4] concluded that about 7 tons of U3O8, contained in 8700 tons of leached barium sulfate residues, had been mixed with about 39,000 tons of soil at Latty Avenue and the entire volume disposed of at the West Lake Landfill. The earlier study by the Post- Dispatch (1976) claimed only 9000 tons (presumably the leached barium sulfate residues) had been buried, and that the remaining material had not been disposed of at West Lake. The Post-Dispatch alleged that the contractor hauling the dirt had admitted falsifying invoices for about 40,000 tons of soil. Discussions with site personnel indicated that a large quantity of soil from Latty Avenue had indeed been dumped at West Lake, although the exact amount was unknown.

A fly-over radiological survey (ARMS flight), performed for the NRC in 1978, showed external radiation levels as high as 100 uR/hr in the area indicated by West Lake personnel as containing the Latty Avenue material. In addition, this survey revealed another possibly contaminated zone in a fill area previously believed to be "clean".

Figure 2 shows the results of the 1978 aerial survey. The area in the southeast fill was believed to contain Latty Avenue material, while that on the northeast boundary was previously unidentified.

In addition to radioactive material, it is known that hazardous chemical wastes have been disposed of at this landfill. Since disposal was unregulated prior to 1973, little is known about the actual materials present. However, it is believed that aside from normal landfill materials, there are chemical industrial wastes in the landfill.

Among the chemical wastes believed to be present are:

| | |
|---|---|
| waste ink | halogenated intermediates |
| pigments | aromatics |
| oily sludges | oils |
| esters | wastewater sludges |
| alcohols | heavy metals |
| insecticides | herbicides |

## III. RADIOLOGICAL SURVEY METHODS

### (A) Measurement of External Radiation Levels

The two areas of contamination were gridded and surveyed for both gamma radiation levels at one meter above the surface, and beta-gamma levels at the ground surface.

The basic pattern at each contaminated area was survey blocks defined by a 10 meter grid system. External gamma levels at one meter were recorded at each grid point (i.e. at each intersection of two grid lines). Initially, precise exposure rate measurements at a few specially selected grid points were made with a sensitive Tissue Equivalent Ionization Chamber System (described in Appendix I). At the same time, NaI scintillation detector (described in Appendix I) measurements were made and a conversion factor for the NaI count rate versus uR/hr established (See Figure I-3). Once this factor was confirmed, the scintillation detector was used for all grid measurements at relatively low exposure rates. For the few higher rates encountered, a Geiger-Mueller portable survey instrument was used.

At each grid point, an end window G-M tube (described in Appendix I) was used for surface measurements. An open and closed window reading was made at 1 cm, and the ratio of the two used to indicate the presence or absence of surface contamination.

(B) Measurement of Surface Radioactivity

Based on the external surface measurements, surface soil samples were collected for analysis from both contaminated areas. These samples were collected from locations on-site where surface deposits were indicated, as well as locations where the drainage characteristics indicated the possibility that radioactive materials may have been carried or washed away from original burial locations. The soils were dried, ground and sealed in 500 ml aluminum cans for counting on the intrinsic germanium (IG) gamma ray spectroscopy system (described in Appendix I).

Vegetation on-site consisted only of grass and common weeds. Off-site, crops are grown on farm land immediately north and west of the site. Since the possibility of contamination exists here, crop samples were collected where indicated by surface measurements. These samples were dried, crushed and counted as described above.

(C) Measurements of Subsurface Radioactivity

Since it was known that most, or all, of the radioactive materials at the West Lake Landfill have been buried, extensive subsurface monitoring and sampling was required. The purpose of this activity was to determine the depth and lateral extent of subsurface contamination.

A series of holes through and bordering the contaminated deposits were drilled and lined with 4-inch PVC casing. Each hole was then scanned with a 2" by 2" NaI(Tl) scintillation detector and rate meter system.

Representative holes were then logged using an *in situ* gamma measurement system consisting of an intrinsic germanium (IG) detector coupled to a multichannel analyzer (described in Appendix I). Field analyses were then made, both qualitatively and quantitatively, thereby eliminating time consuming laboratory analyses and expensive core sampling of each hole. Measurement intervals ranged from 6" to 24", depending upon factors such as hole depth and activity. An occasional core sample was taken to verify the *in situ* measurements and to confirm the presence or absence of non-gamma emitting nuclides such as Th-230.

(D) Measurement of Radioactivity in Water

Whenever possible, water samples were taken from the bore holes and two off-site monitoring wells. Samples were also taken from standing water, run off water, and leachate liquids. Samples were filtered, evaporated and counted for gross activity, or were filtered and sealed in Marinelli beakers for gamma spectroscopic analysis.

(E) Measurement of Airborne Radioactivity

Measurements were made to determine if the material buried on-site is a source of airborne radioactivity. The isotopes of concern are Ra-226, Ra-224 and/or Ra-223, which decay to Rn-222, Rn-220 and Rn-219. This may result in the emanation of radon from the soil, and movement of radon and daughters off-site.

These measurements may be used to determine Rn flux emanation as a source term for off-site dose calculations, or as an indication of the presence of radium at or below the surface. Additional on-site Rn daughter measurements were made to perform working level (WL) determinations.

Radon flux measurements which are to be related to off-site dose calculations were of no value for Rn-219, due to its very short (4 sec) half-life. Therefore, only its long-lived daughters are of concern for off-site exposures. In addition, if the parent (Ra-223) is not within a few millimeters of the surface, Rn-219 is not likely to emanate into the atmosphere [5].

Due to these considerations, only Rn-222 and Rn-220 fluxes were measured. The principal measurement technique was collection of a filtered gas sample from an accumulator and subsequent counting in a radon gas analyzer (described in Appendix 1). Sequential alpha counting, starting immediately after sampling, allowed separation of Rn-222 from Rn-220 (if present). Repetitive samples were taken from several locations during the survey period in an effort to evaluate the effect of fluctuations between individual measurements, due to varying meteorological and soil conditions. A second method using charcoal canisters was also employed as a check on the accumulator technique.

The presence of Rn-219 was determined by detection of its daughters deposited on high volume particulate sample filters, using gamma spectroscopy. Total Rn daughter levels were also estimated by gross alpha activity on particulate filters. From this, a total working level (WL) determination was made.

## IV. SURVEY RESULTS

### (A) External Radiation Levels

Two areas of elevated external radiation levels have been identified by this survey. Figure 3 shows the two areas as they existed in November, 1980, at the time of the preliminary RMC site survey. As can be seen, both areas contained locations where levels exceeded 100 uR/hr at 1 meter, and in Area 2, gamma levels as high as 3-4 mR/hr were detected. The total areas exceeding 20 uR/hr were about 3 acres in Area 1 and 9 acres in Area 2.

External gamma levels measured in May and July of 1981 are shown in Figure 4. These levels had decreased significantly, especially in Area 1, due to continuing activities at the landfill. In both cases, contaminated areas were covered with additional fill material. RMC estimates that about 4 feet of sanitary fill was added to the entire area denoted as Area 1, and that an equal amount of construction fill was added to most of Area 2. As a result, only a small region of a few hundred square meters in Area 1 exceeds 20 uR/hr. In Area 2, the total area exceeding 20 uR/hr decreased by about 10%, and the highest levels are now about 1600 uR/hr, near the Shuman building.

Both areas were marked off in a 10 m by 10 m grid, based on a north-south line erected from a boundary marker, as laid out by a surveying team, as a reference line. Grid designations are shown in Figures 5 and 6. At each grid point, external gamma levels at 1 m, and beta-gamma count rates at 1 cm, were measured. Results of these measurements are given in Tables 1 and 2.

Beta-gamma measurements at 1 cm from the surface are given in count rates, rather than dose rates, due to the difficulty in measuring beta dose rates accurately with end window G-M tubes. Large differences between open- and closed-window readings indicate the possibility of surface contamination. Little surface contamination was found in Area 1, as would be expected due to fresh land fill cover over nearly the entire area.

Several isolated spots of surface contamination in Area 2 were indicated by beta-gamma measurements, and later confirmed by surface soil sampling. These spots are generally located near the northwest edge of Area 2, which includes the berm that bounds the landfill at that point. Some erosion and run-off is evident along the top of the fill, apparently uncovering deposits of radioactive material in the process. Thus far, fresh construction fill has not been added here, due to the inaccessibility of these spots.

A second region of surface contamination is found just north of the Shuman building. It is not clear why material appears on the surface here, except that it is possible that some digging or excavation has occurred here in the past.

(B) Surface Soil Analyses

A total of 61 surface soil samples were gathered and analyzed on-site for gamma activity. Samples were normally stored 10 to 14 days to allow ingrowth of radium daughters. Concentrations of U-238, Ra-226 (from PB-214 and Bi-214), Ra-223, Pb-211 and Pb-212 were determined for each sample. Locations of surface soil samples are shown in Figures 7 and 8, and the results in Table 3.

In all soil samples nothing other than uranium and/or thorium decay chain nuclides and K-40 was detected. Off-site background samples were on the order of 2 pCi/g for Ra-226. On-site samples ranged from about 1 to 21,000 pCi/g Ra-226, and from less than 10 to 2,100 pCi/g U-238. In those cases where elevated levels of Ra-226 were detected, the concentrations of U-238 were generally anywhere from a factor of 2 to 10 lower. In cases of elevated sample activity, daughter products of both U-238 and U-235 were found.

In general, surface activity was limited to Area 2, as indicated by the surface beta-gamma measurements. Only two small regions in Area 1 showed contamination, both located near the access road across from the site offices.

In addition to on-site gamma analyses, a set of 12 samples were submitted to the RMC radiochemical laboratories for thorium and uranium radiochemical determinations. The results of these measurements are shown in Table 4. They show that all samples contain high levels of Th-230. The ratio of Th-230 to Ra-226 (Bi-214) is about 20, which indicates an "enrichment" of thorium in these residues, as discussed in Section V.

(C) Subsurface Soil Analysis

Subsurface contamination was assessed by extensive "logging" of holes drilled through the landfill at locations known or thought to contain radioactive materials. Several holes were drilled in areas known to contain contamination, then additional holes were drilled outward in all directions until no further contamination was encountered. A total of 43 holes were drilled, (11 in Area 1 and 32 in Area 2), including 2 off-site water monitoring wells. All holes were drilled with a 6-inch auger and lined with 4-inch PVC casing. The location of these auger holes is shown in Figures 9 and 10.

Each hole was scanned with a 2-inch by 2-inch NaI(Tl) detector and rate meter system for an initial indication of the location of subsurface contamination. Based on the initial scans, certain holes were selected for detailed gamma logging using the IG detector and MCA. A total of 19 holes were logged in this manner.

The results of the NaI(Tl) counts and IG analyses are shown in Table 5. Concentrations of Bi-214, as determined by the IG system, ranged from less than 1 to 19,000 pCi/g. For those holes where both NaI(Tl) and IG counts were made, a good correlation between gross NaI(Tl) counts and Ra-226 concentrations, as determined by _in situ_ analysis of the daughter Bi-214 by the IG system, was found. Figure 11 is a plot of NaI(Tl) count rate versus IG determination of Ra-226, and shows a nearly linear relationship between the two at concentrations near the action criteria. The conclusion is that the NaI(Tl) data is a good estimation of the Ra-226 concentration in soil, so long as the radionuclide mix is reasonably constant. In the case of West Lake Landfill, this has been shown to be the case.

It was determined that the subsurface deposits extended beyond areas where surface radiation measurements exceeded action criteria. Figures 12 and 13 show the approximate area of subsurface contamination versus the area of elevated surface radiation levels. The total difference in areas is on the order of 5 acres.

The variations of contamination with depth are shown in Figure 14. As can be seen, the surface elevations vary by about 20 feet, with the highest elevations at locations of fresh fill. Contamination (> 5 pCi/g Ra-226) is found to extend from the surface, in several areas, to a depth of about 20 feet below surface, in two cases. In general, the subsurface contamination appears to be a continuous single layer, ranging from two to fifteen feet thick, located between elevations of 455 feet and 480 feet and covering 16 acres total area.

In Figures 15-19, representations of the subsurface deposits are provided based on auger hole measurements. These representations are consistent with the operating history of the site, which suggests that the contaminated material was moved onto the site within a few days' time, and spread as cover over fill material. Thus, one would expect a fairly continuous, thin layer of contamination, as indicated by survey results.

(D) Water Analyses

A total of 37 water samples were taken during this survey, 4 in the fall of 1980, and the remainder in the spring and summer of 1981. Results of water analyses are shown in Table 6.

None of the sample alpha activities exceeded the MPC for Ra-226 (the most restrictive nuclide present) in water for unrestricted areas. Only one sample exceeded the EPA gross alpha activity guidelines for drinking water and that was a sample of standing water near the Shuman building. Several samples, including all the leachate treatment plant samples, exceeded the EPA gross beta drinking water standards. Subsequent isotopic analyses indicated that all the beta activity can be attributed to K-40. None of the off-site samples exceeded either EPA standard.

## (E) Airborne Radioactivity Analyses

Both gaseous and particulate airborne radioactivity were sampled and analyzed during this study. Since it was known that the buried material consisted partially or totally of uranium ore residues, the sampling program concentrated on measuring radon and daughters in the air. Two methods were used: the first was a scintillation flask method for radon gas and the second was analysis of filter paper activity for particulate daughters.

A series of grab samples using the accumulator method (described in Appendix I) were taken between May and August of 1981. A total of 111 samples from 32 locations were collected. Results can be found in Table 7. Radon flux levels ranged from 0.2 pCi/sq.m-s in low background areas to 868 pCi/sq.m-s in areas of surface contamination.

At three locations, repetitive measurements were made over a period of two months. These results are plotted in Figure 20. As can be seen, significant fluctuations were observed at two locations. The fact that these fluctuations were real and not measurement artifacts was later confirmed by duplicate charcoal canister samples, as described below.

A total of 35 charcoal canister samples were gathered at 19 locations over a three month period. The results are listed in Table 8, and show levels ranging from 0.3 pCi/sq.m-s to 613 pCi/sq.m-s. On 24 different occasions, the charcoal canisters and accumulator were placed in essentially the same locations, at the same time, for duplicate sampling. The results of this side-by-side study are presented in Table 9, and show generally good correlation between the two methods.

A set of 10 minute high volume particulate air samples were taken to determine both short-lived radon daughter concentrations and long-lived gross alpha activity. Sample results are shown in Table 10. The highest levels were detected in November, 1980, near and inside the Shuman building. Only these two samples exceed MPC for radon daughters for unrestricted areas.

In addition to the routine 10 minute samples, five 20 minute high volume air samples were taken and counted immediately on the IG gamma spectroscopy system. The purpose of these analyses was to detect the presence of Rn-219 daughters. All samples were taken near surface contamination and are listed in Table 11. In addition to Rn-222 daughter gamma activities, Rn-219 daughters were detected by measuring the low abundance gamma rays of Pb-211. Concentrations of Rn-219 daughters ranged from 6E-11 uCi/cc to 9E-10 uCi/cc.

(F) Vegetation Analysis

Vegetation samples included weed samples from on-site locations and farm crop samples (winter wheat) from the northwest boundary of the landfill. This location was chosen due to possible run off from the fill into the farm field. No elevated activities were found in these samples.

(G) Non-Radiological Analysis

Six composite samples were submitted to the RMC Environmental Chemistry Laboratory for priority pollutant analysis. Five samples were taken from auger holes (one from Area 1 and four from Area 2) and the sixth from the West Lake leachate treatment plant sludge. The results, shown in Table 12, indicate a significant presence of organic solvents in Area 2 samples. The results of the leachate sludge analysis were not as high as any of the soil samples.

A chemical analysis of radioactive material from both areas was also performed by RMC labs and reported in Table 13. Results show elevated levels of barium and lead in most cases.

(H) Background Measurements and Remedial Action Criteria

Various off-site locations were selected for reference background measurements. The results of these measurements are summarized in Table 14, and can be compared with the established NRC target criteria for remedial action, for this project, shown in Table 15.

## V. CONCLUSIONS

Based on survey results, it is evident that the West Lake Landfill contains two areas of surface and/or subsurface contamination. These deposits yield detectable external radiation levels in both areas. However, only an area of less than 0.1 acre in Area 1 exceeds 20 uR/hr, while about 8 acres in Area 2 exceeds the 20 uR/hr criteria. The highest reading detected in the most recent survey was 1.6 mR/hr in Area 2, near the Shuman Building.

Analyses of soil samples from both areas, as well as *in situ* measurements, show that the contaminants present at West Lake consist of uranium and uranium daughters. Chemical analyses reveal high concentrations of barium and sulfates in the radioactive deposits. These results tend to confirm the reports that this contaminated material is uranium and uranium ore, contained in leached barium sulfate residues, and presumably transferred from the Latty Avenue Site in Hazelwood, Missouri.

Analysis of soils also shows a high Th-230 to Ra-226 ratio. Since the target criteria for Ra-226 is the most restrictive of those contaminants present, it has been assumed that Ra-226 would be the controlling radionuclide for remedial action determinations. However, since Th-230 levels may be from 5 to 50 times higher than Ra-226 concentrations, this assumption may be erroneous. It is likely that high concentrations of thorium resulted from separation of both uranium and radium from the ores, thus "depleting" the ores of uranium and radium, or, "enriching" the residues in thorium. This "enrichment" would also be evident in the U-235 chain, despite the short half-lives of Th-227 and Th-231, since the long-lived Pa-231 would remain in the residues. The concentrations of Pa-231, inferred from Ra-223 determinations, are also shown to be high.

Auger hole measurements show that nearly all the contamination present is located below the landfill surface,although a few locations near the northwest berm in Area 2 show surface, or near surface, deposits. These deposits range from 2 to 15 feet in thickness, and appear to form a contiguous layer covering an area of about 14 acres (68,000 sq.yd.) in Area 2 and about 2 acres (10,000 sq.yd.)in Area 1. If an average thickness of 2 yards is assumed, the estimated total volume is 150,000 cu.yd., which corresponds to roughly 170,000 tons of soil. This implies that if the source of contamination was the Latty Avenue material, the original volume of 40,000 tons has been diluted by a factor of about 4, which is not unexpected, with the continual movement and spreading of materials during fill operations.

As discussed previously, the auger hole measurements detected deposits exceeding 5 pCi/g Ra-226 within a few feet of the surface, in areas where surface external radiation levels were indistinguishable from normal background levels.

These results confirm suspected difficulties in detecting buried materials with surface measurements, even when using relatively sensitive portable survey instruments.

At no time has radioactivity in off-site water samples been above any applicable guidelines. These results indicate that the buried ore residues are probably not soluble and are not moving off-site via ground water. On-site samples have shown some gross beta activity above EPA drinking water guidelines (attributable to K-40); however, gross alpha and Ra-226 levels are within limits. The absence of significant contamination in the leachate liquid or sludge is consistent with the implication that the buried material is not moving through the landfill.

As would be expected, radon flux emanation rates were highest at locations of surface, or near surface, contamination. At locations where the material is covered by several feet of fill, flux levels are near background rates.

Particulate air samples established indicated the presence of Rn-222 and Rn-219 daughters near the locations of surface deposits. However, concentrations are very low, and do not exceed allowable levels for unrestricted areas, except in one location. In general, cover of a few feet of fill reduces airborne concentrations to near background levels.

The fact that West Lake is an active landfill presents several serious problems for performing radiological assessments and remedial actions. In the first place, as the landfill conditions change, so do the surface radiological characteristics. These changes were evident in the reduction of radiation levels in Area 1 between November 1980, and May 1981. It is possible that future landfill activities will obscure all detectable surface radiation levels at the site.

## REFERENCES


[1] U. S. Nuclear Regulatory Commission Letter Contract: NRC-02-080-034, August 13, 1980.

[2] Missouri Department of Natural Resources, "Groundwater Investigation, West Lake Landfill, St. Louis County, September 30 through October 1, 1980."

[3] St. Louis Post-Dispatch, May 30, 1976.

[4] U. S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, Region III, IE Inspection Report No. 76-01, June and August, 1976.

[5] Crawford, D. J., "Radiological Characteristics of Rn-219", Health Physics, Vol. 39, No. 3, pp. 450.

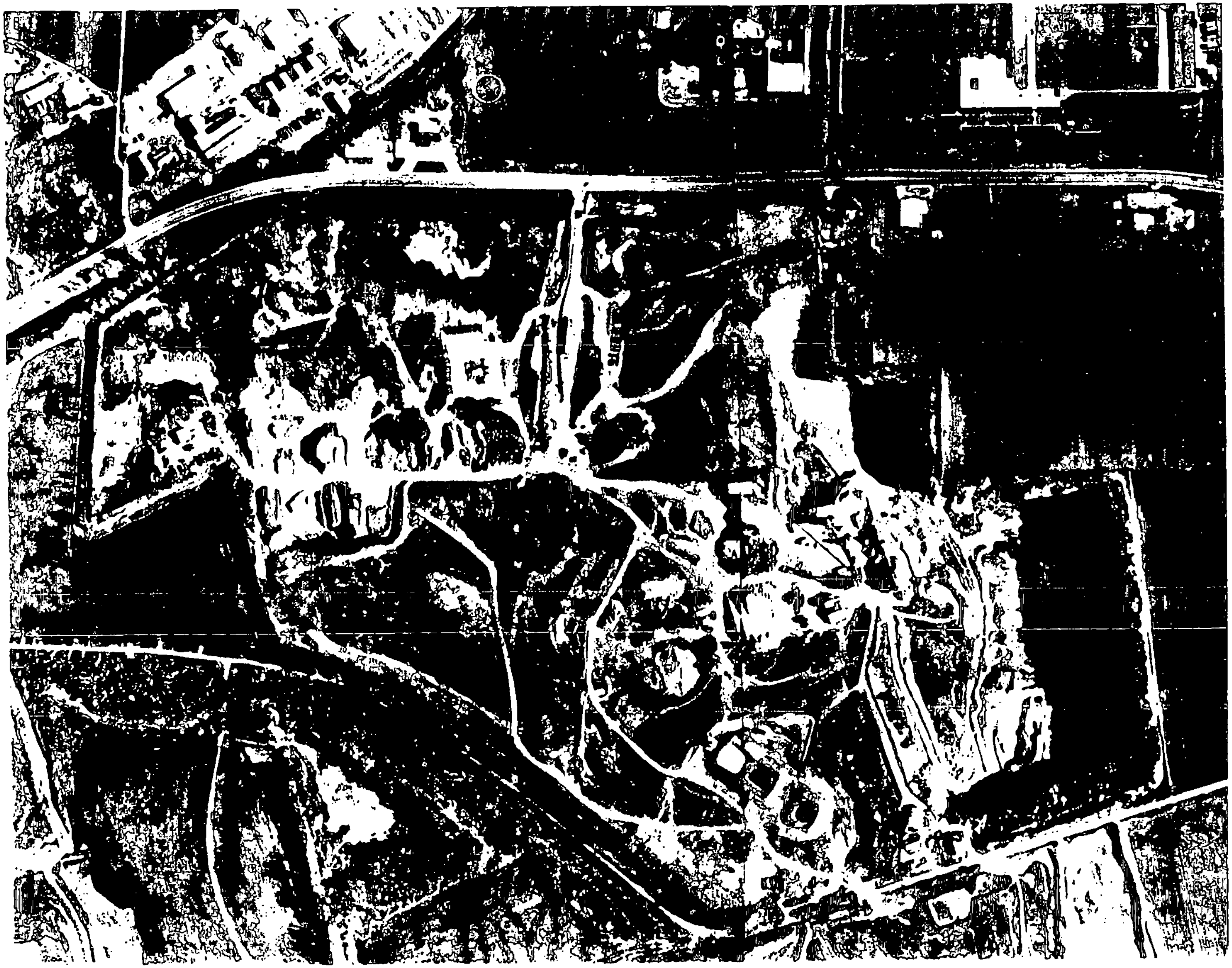
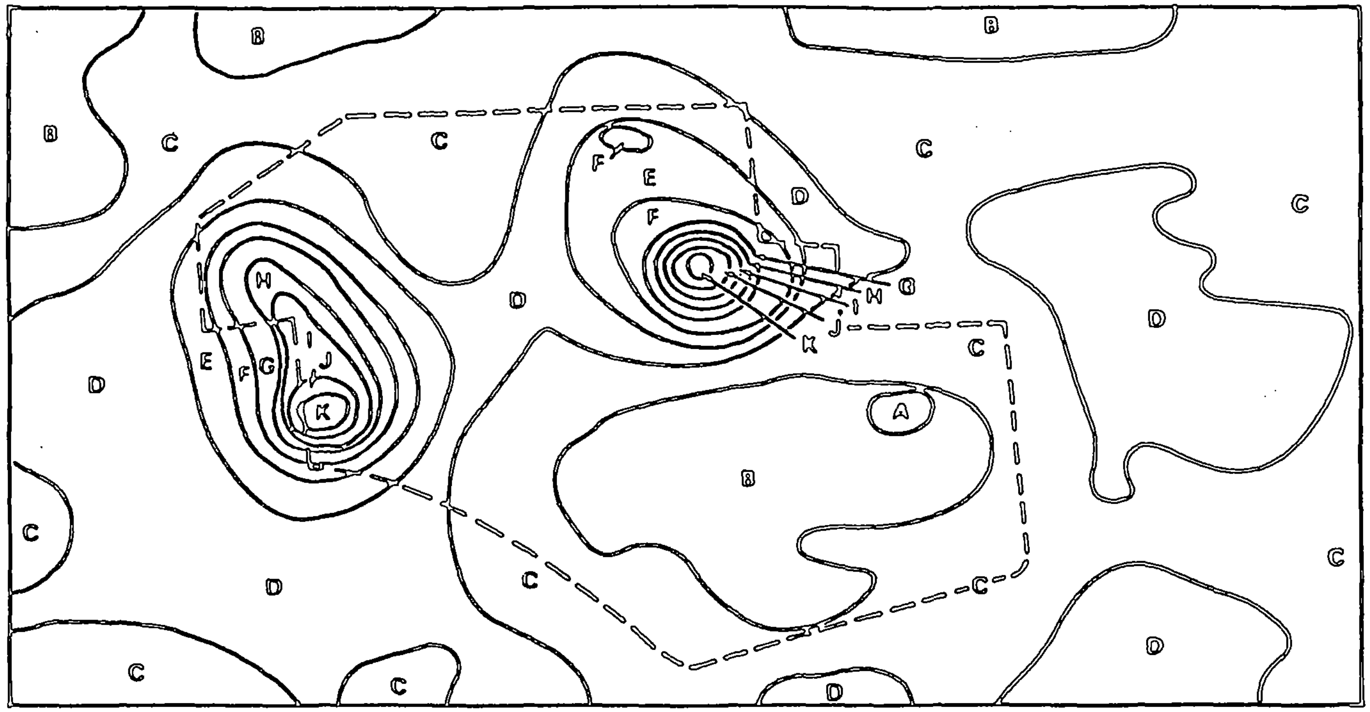
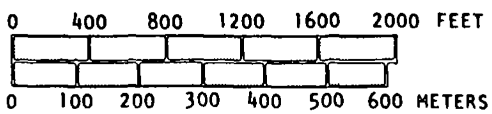
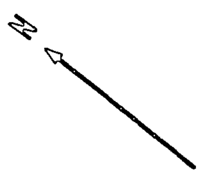


Figure 1. Aerial view of West Lake Landfill, St. Louis County, Missouri




| GROSS COUNT CONVERSION SCALE | |
|---|---|
| LETTER LABEL | GAMMA EXPOSURE RATE* 1 m LEVEL (μR/hr) |
| A | - 6 |
| B | 6 - 8 |
| C | 8 - 10 |
| D | 10 - 13 |
| E | 13 - 17 |
| F | 17 - 24 |
| G | 24 - 33 |
| H | 33 - 45 |
| I | 45 - 62 |
| J | 62 - 84 |
| K | 84 - 116 |

*AVERAGED OVER DETECTABLE FIELD-OF-VIEW AT 60 m ALTITUDE AND EXTRAPOLATED TO THE 1 m LEVEL INCLUDES 3.7 μR/hr COSMIC RADIATION.

— — — — — ESTIMATED LANDFILL OUTLINE

Figure 2. West Lake Landfill aerial survey isopleths.

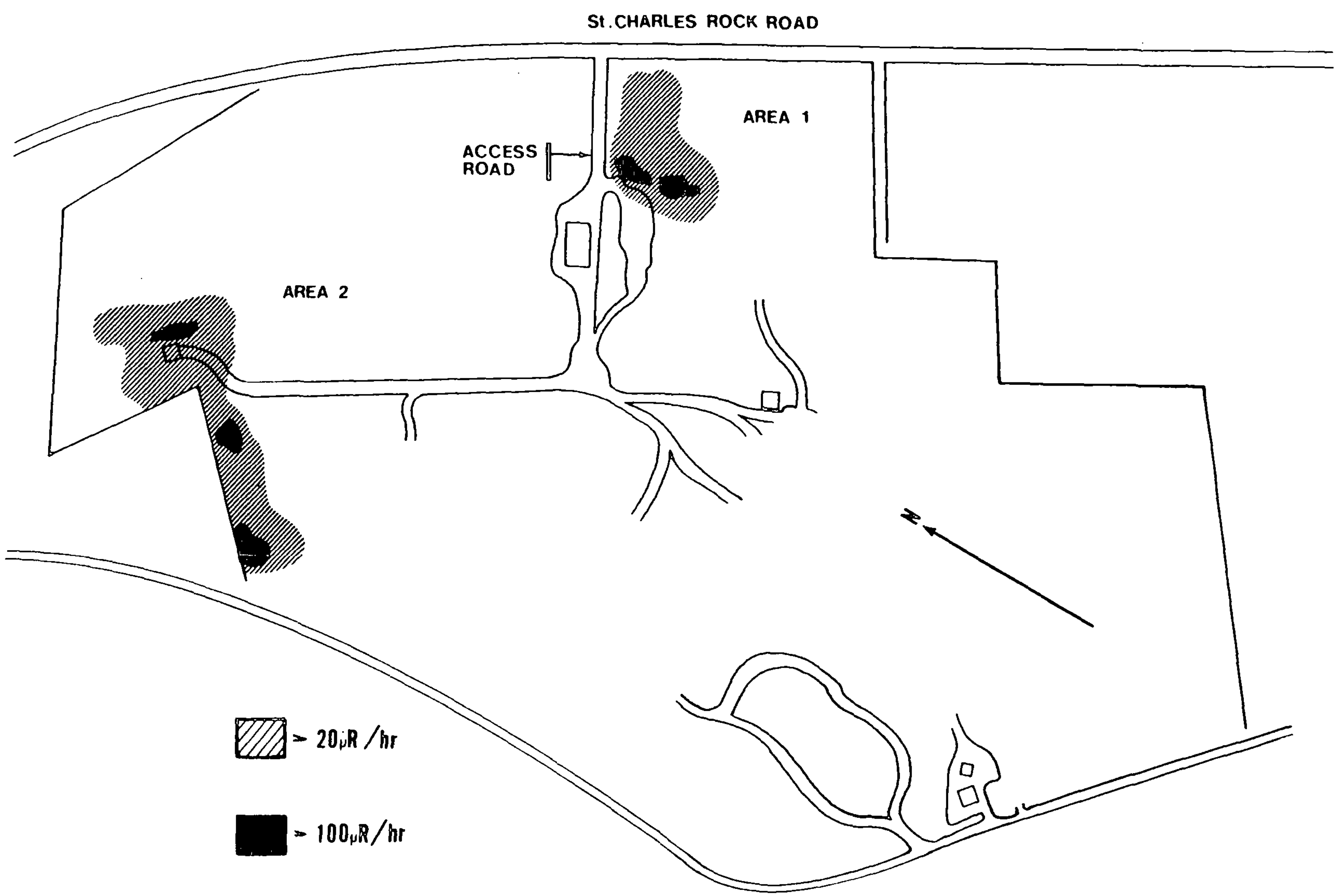



Figure 3. External gamma radiation levels, November 1980.

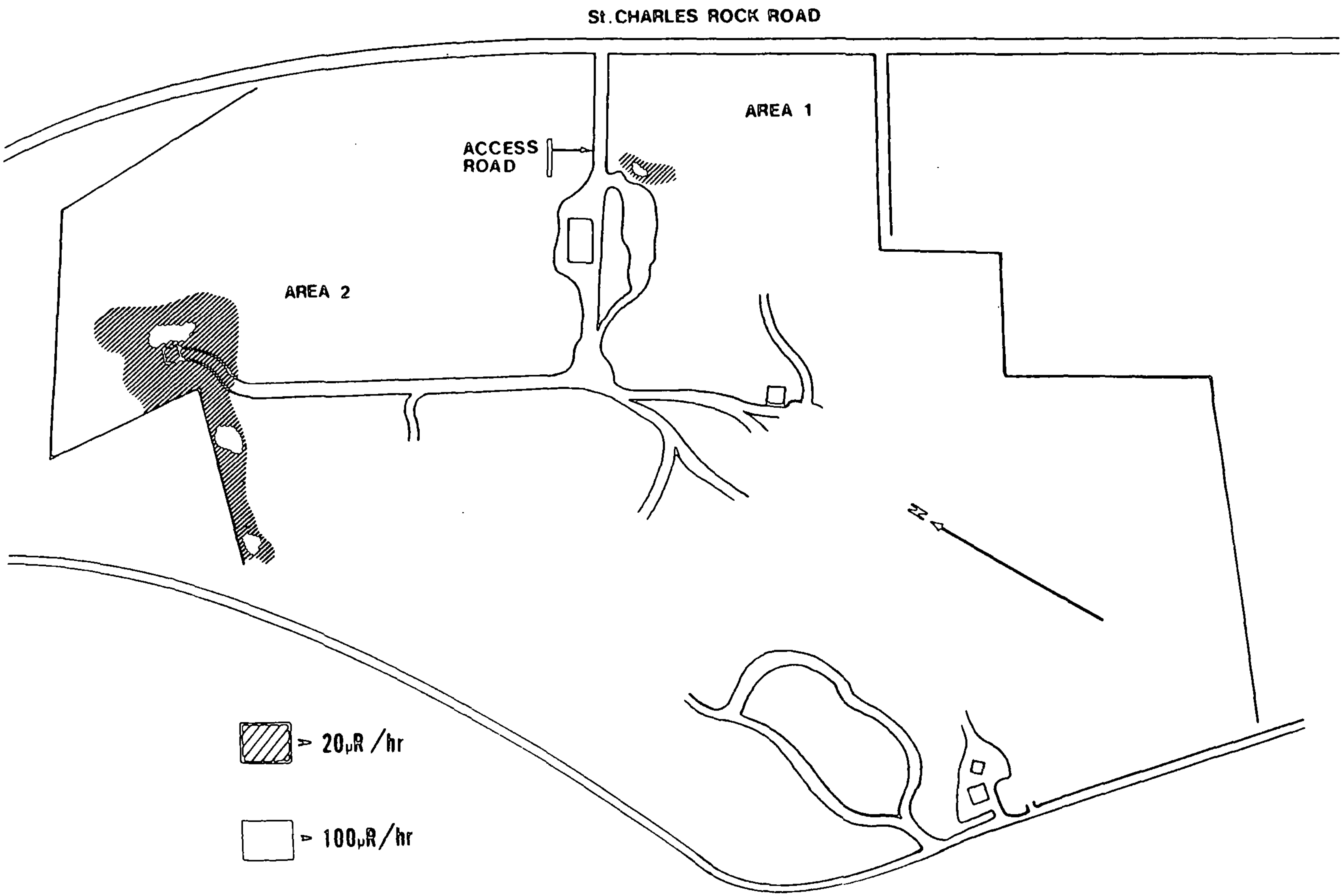



Figure 4.  External gamma radiation levels, May, 1981

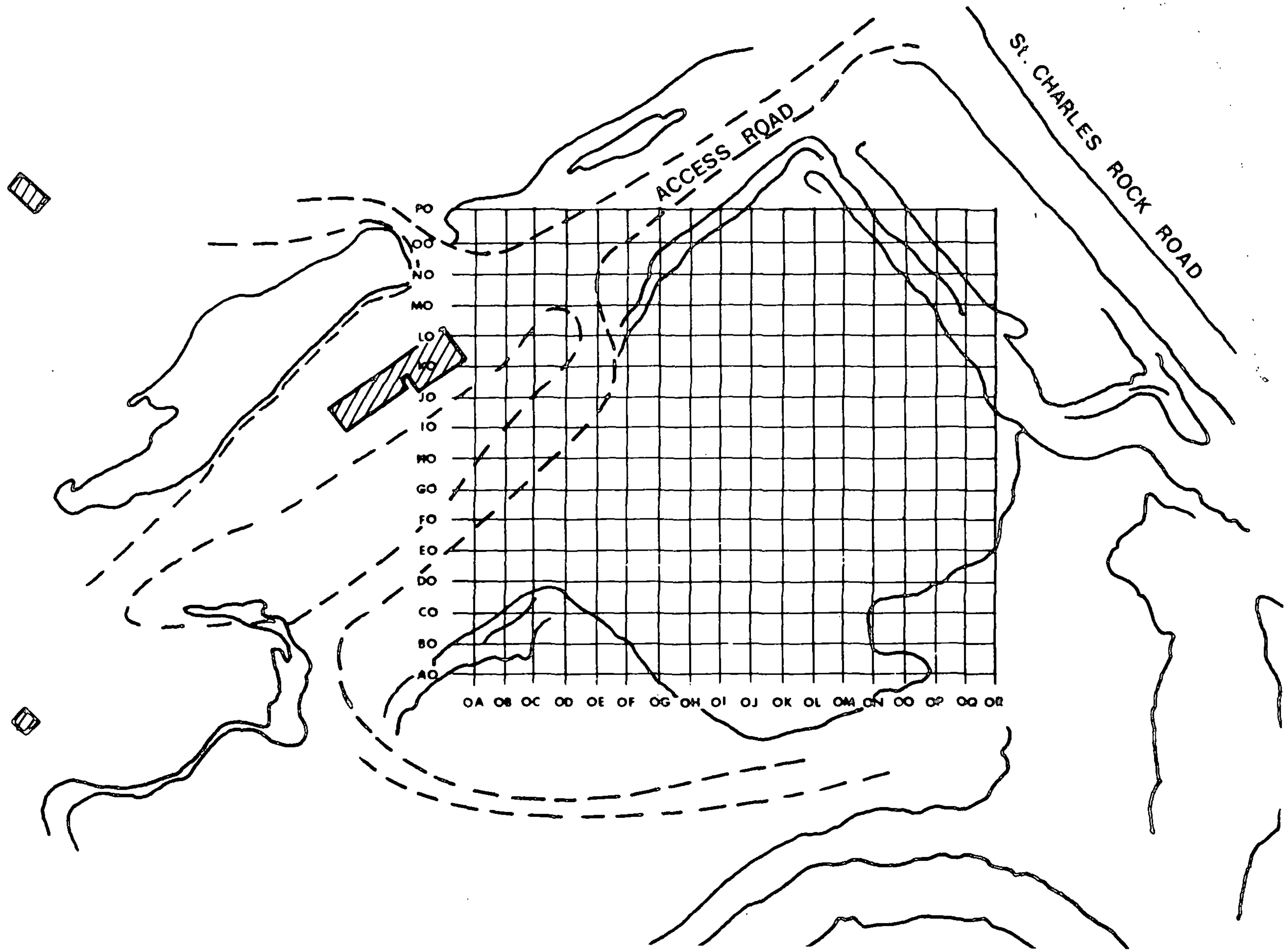



Figure 5. Grid locations for radiological survey, Area 1.

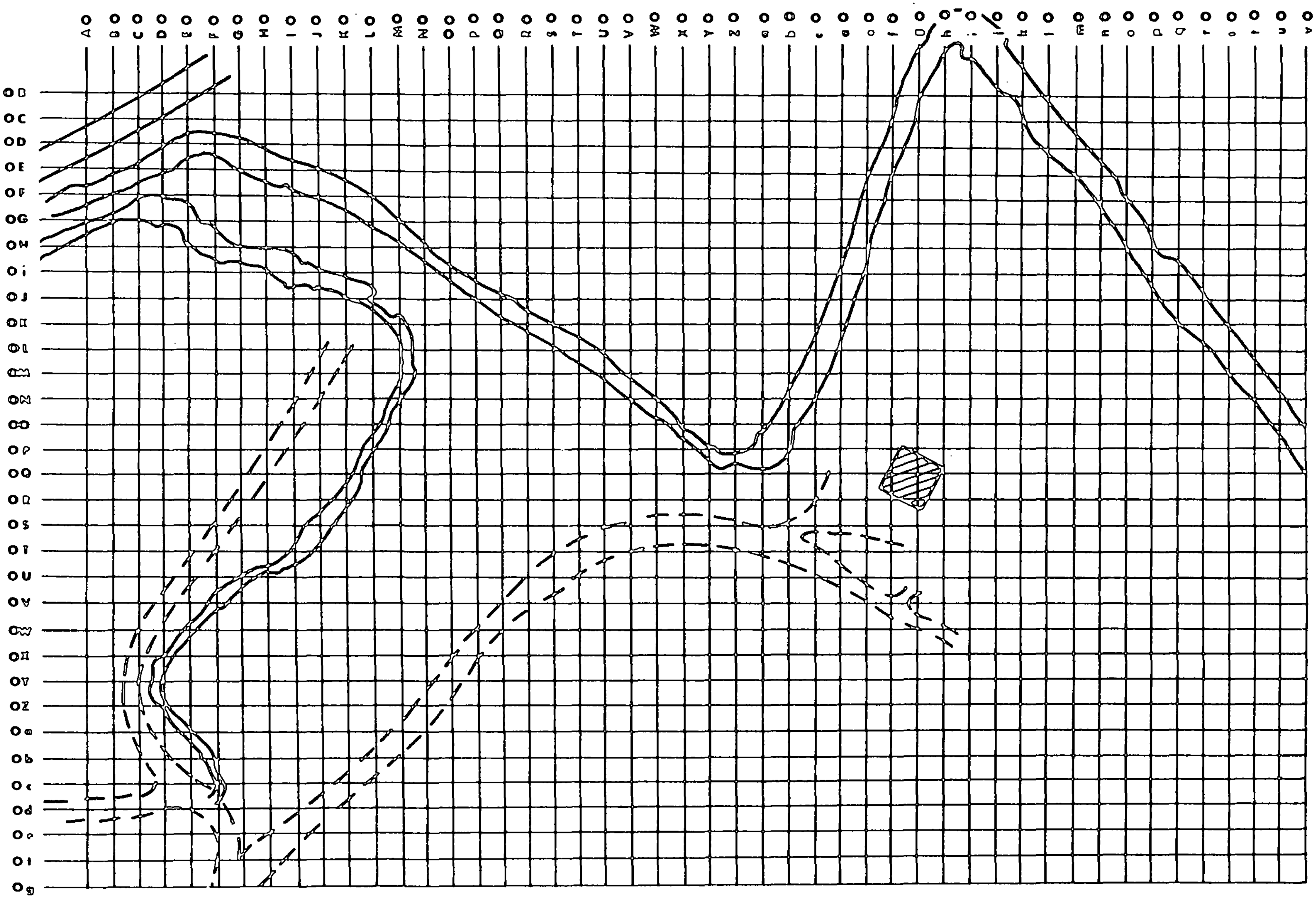


Figure 6. Grid locations for radiological survey, Area 2.

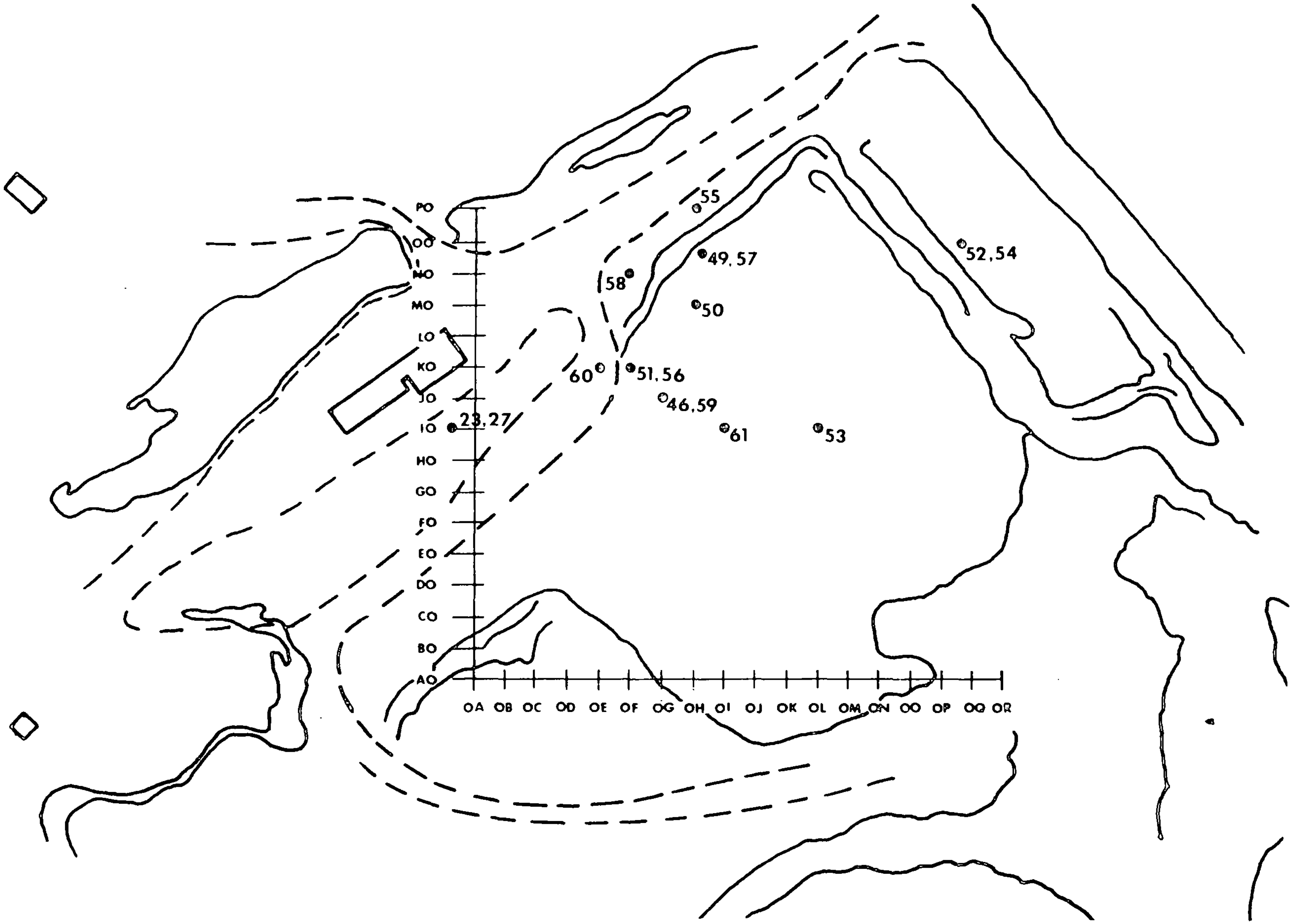



Figure 7. Location of surface soil samples, Area 1.

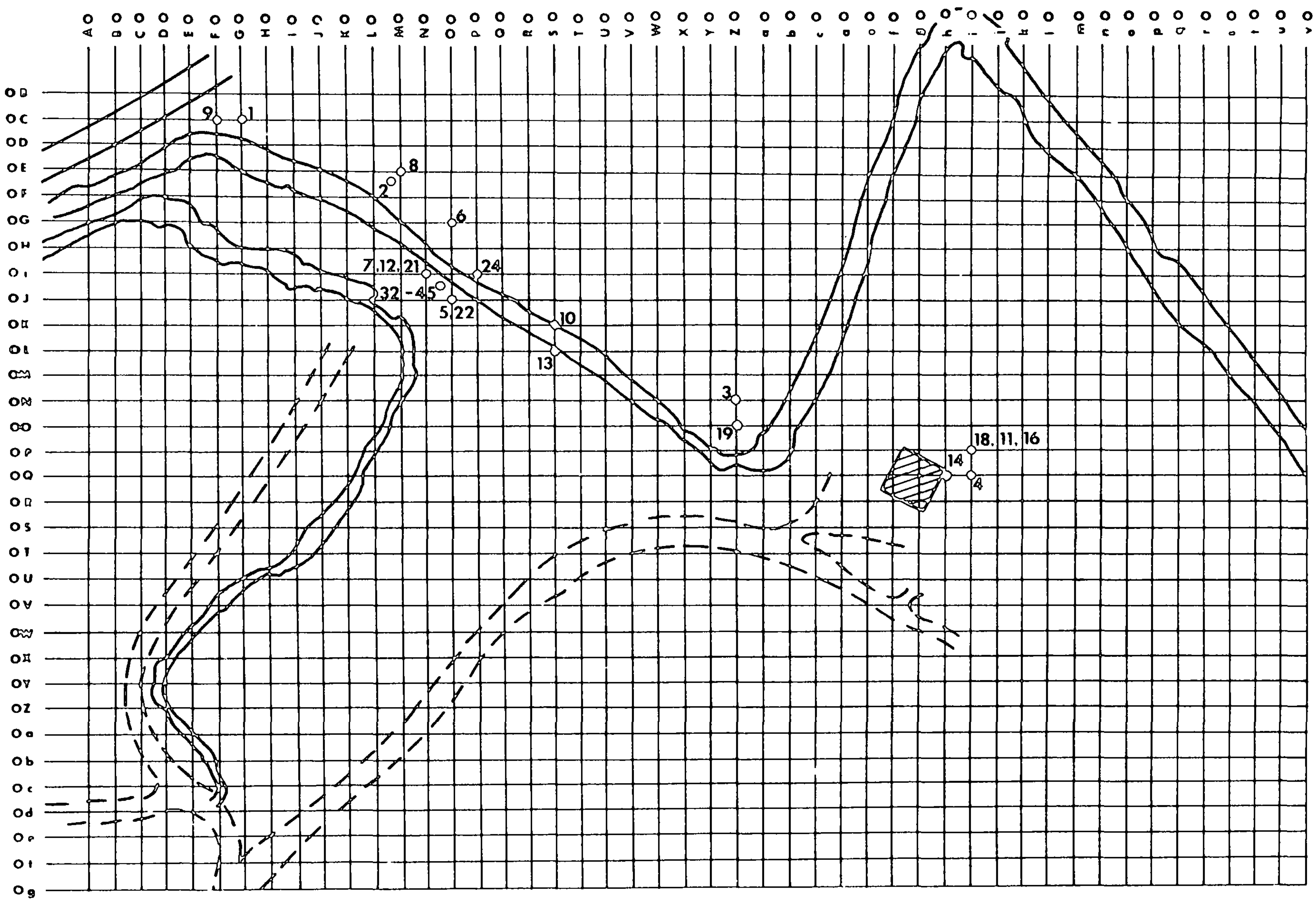



Figure 8. Location of surface soil samples, Area 2.

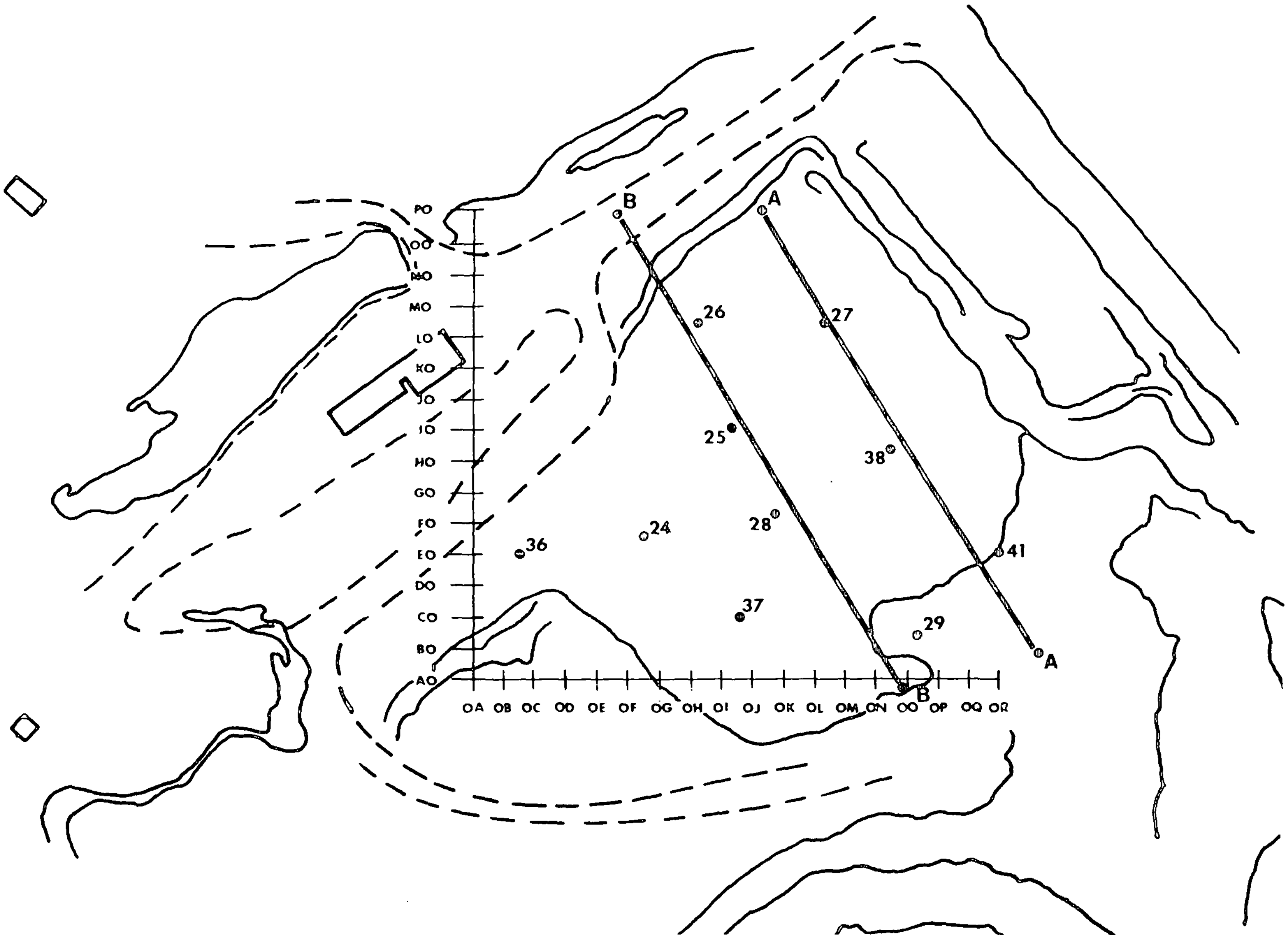



Figure 9. Location of auger holes, Area 1. Lines A-A and B-B indicate cross sectional areas shown in Figures 15 and 16.

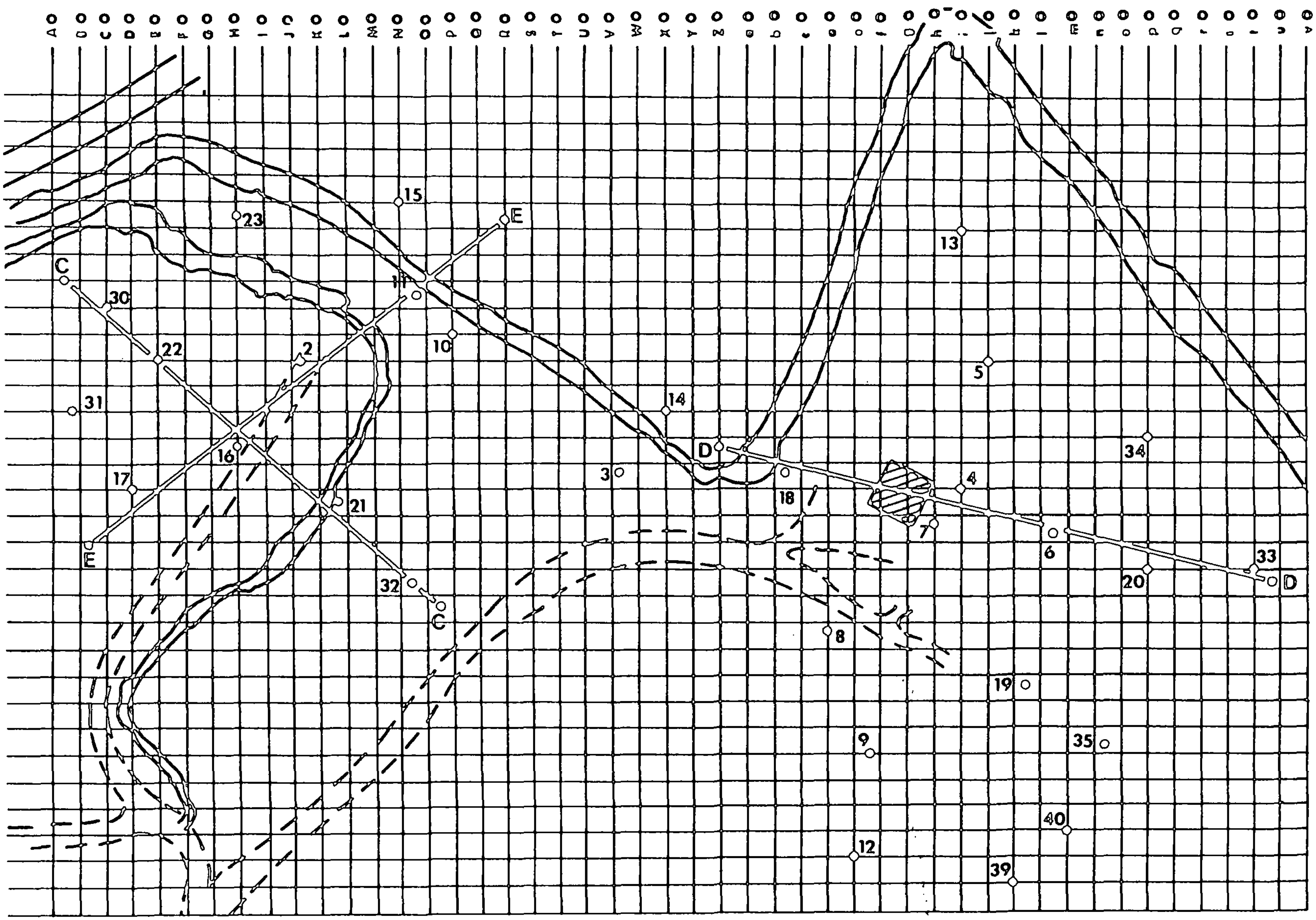



Figure 10. Location of auger holes, Area 2. Lines C-C, D-D, and E-E indicate cross sectional areas shown in Figures 17, 18, and 19.

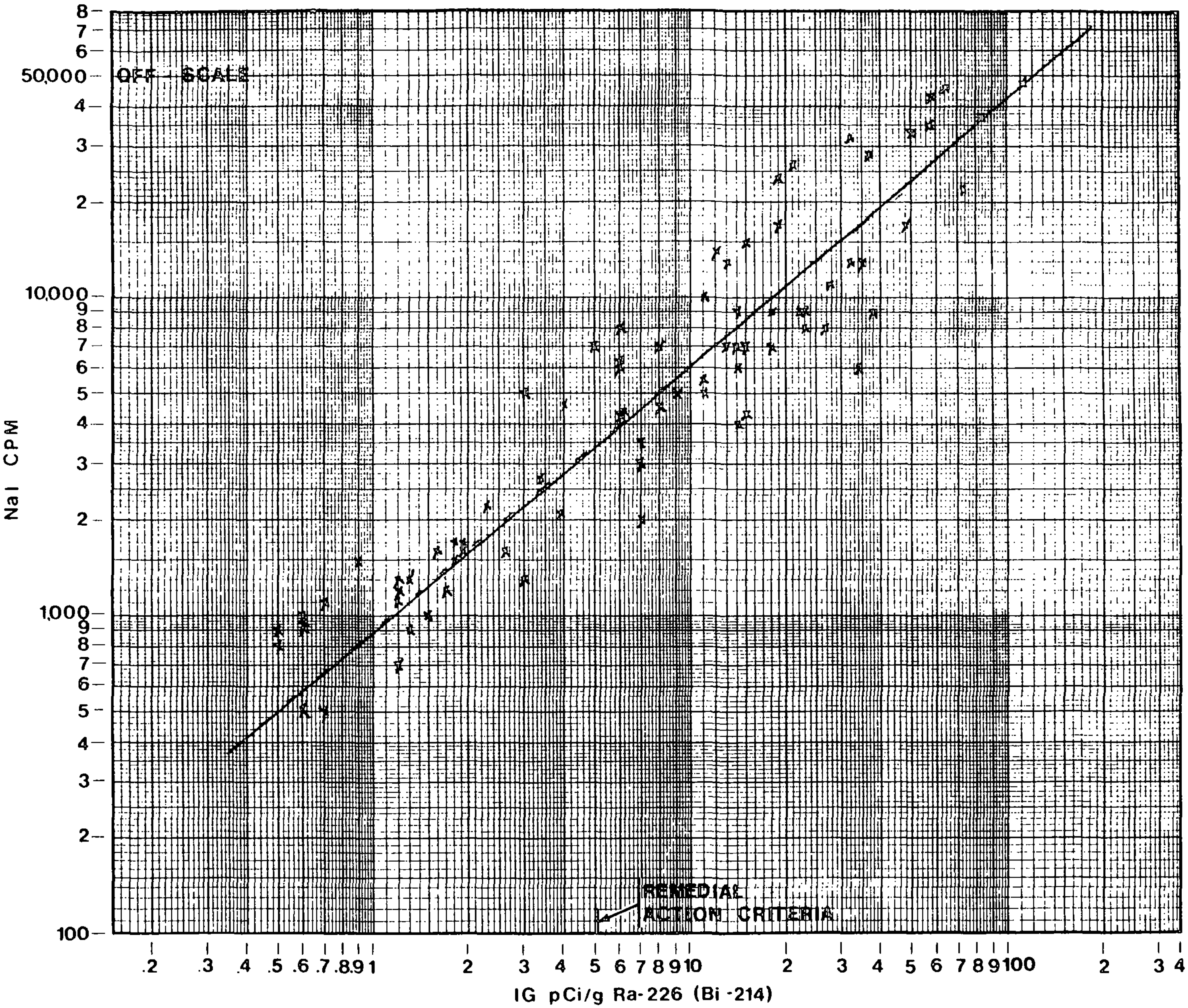



Figure 11. Auger hole NaI (Tl) count rate versus Ra-226 concentration, as determined by the I.G. in situ measurements. Data is from bore holes 16, 32, 22, 21, 31, 6, 19 and 20.

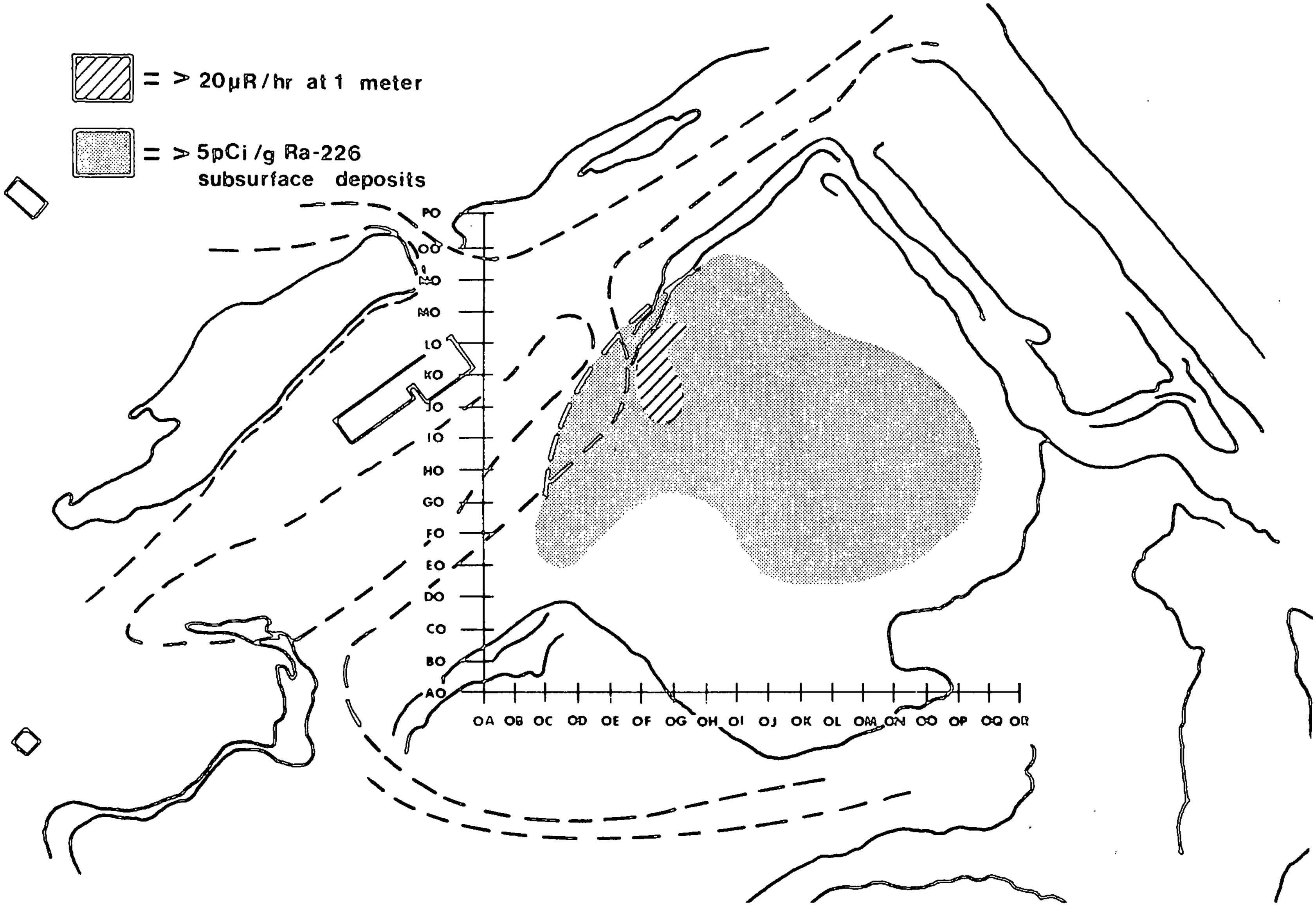



Figure 12. Location of subsurface contamination and surface radiation levels, Area 1. The shaded area shows a lateral contour for 5pCi/g Ra-226, regardless of depth. The cross hatched area shows the surface locations which exceed 20uR/hr at 1 meter.

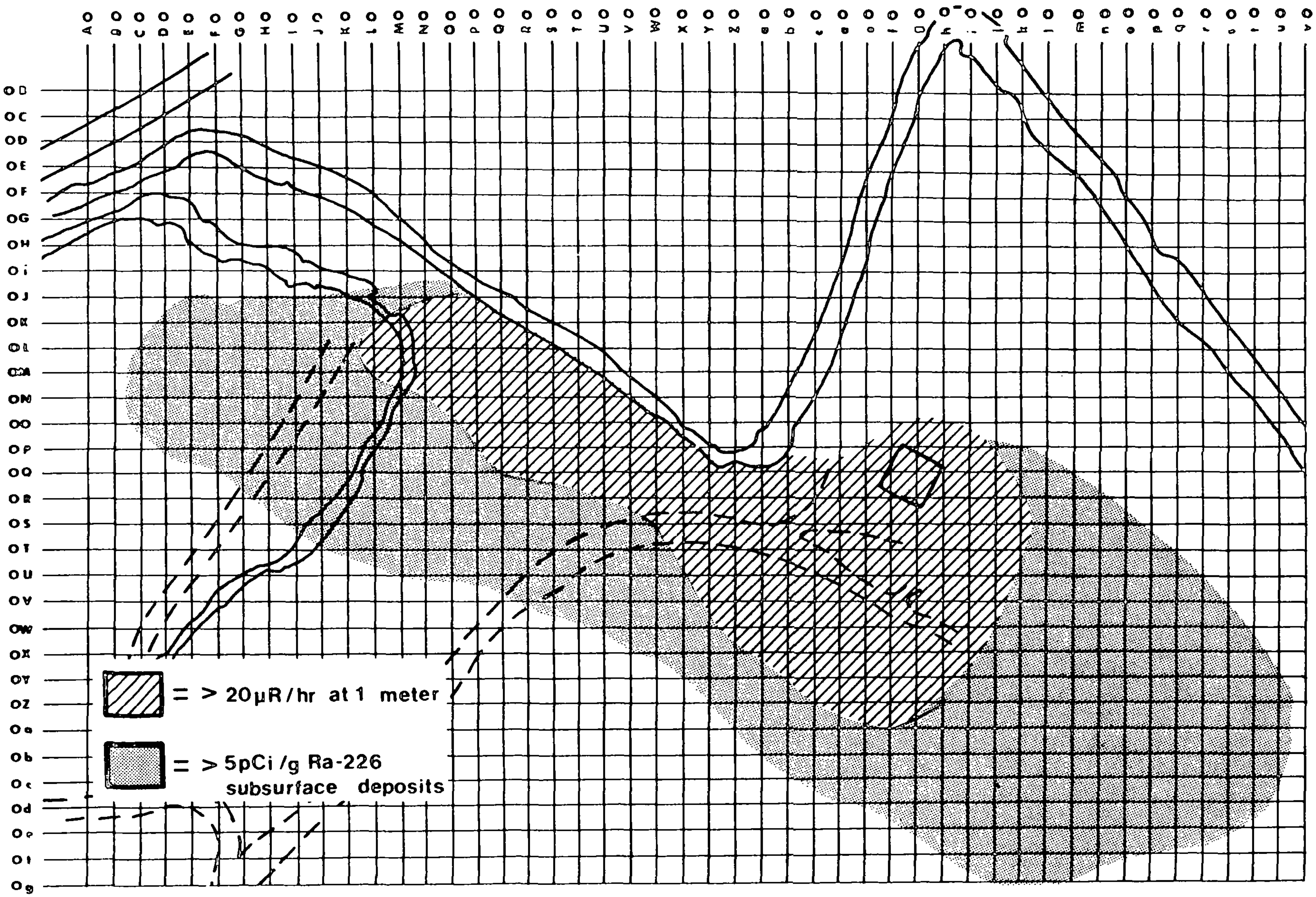



Figure 13. Location of subsurface contamination and surface radiation level, Area 2. The shaded area shows a lateral contour for 5pCi/g Ra-226, regardless of depth. The cross hatched area shows the surface location which exceeds 20uR/hr at 1 meter.

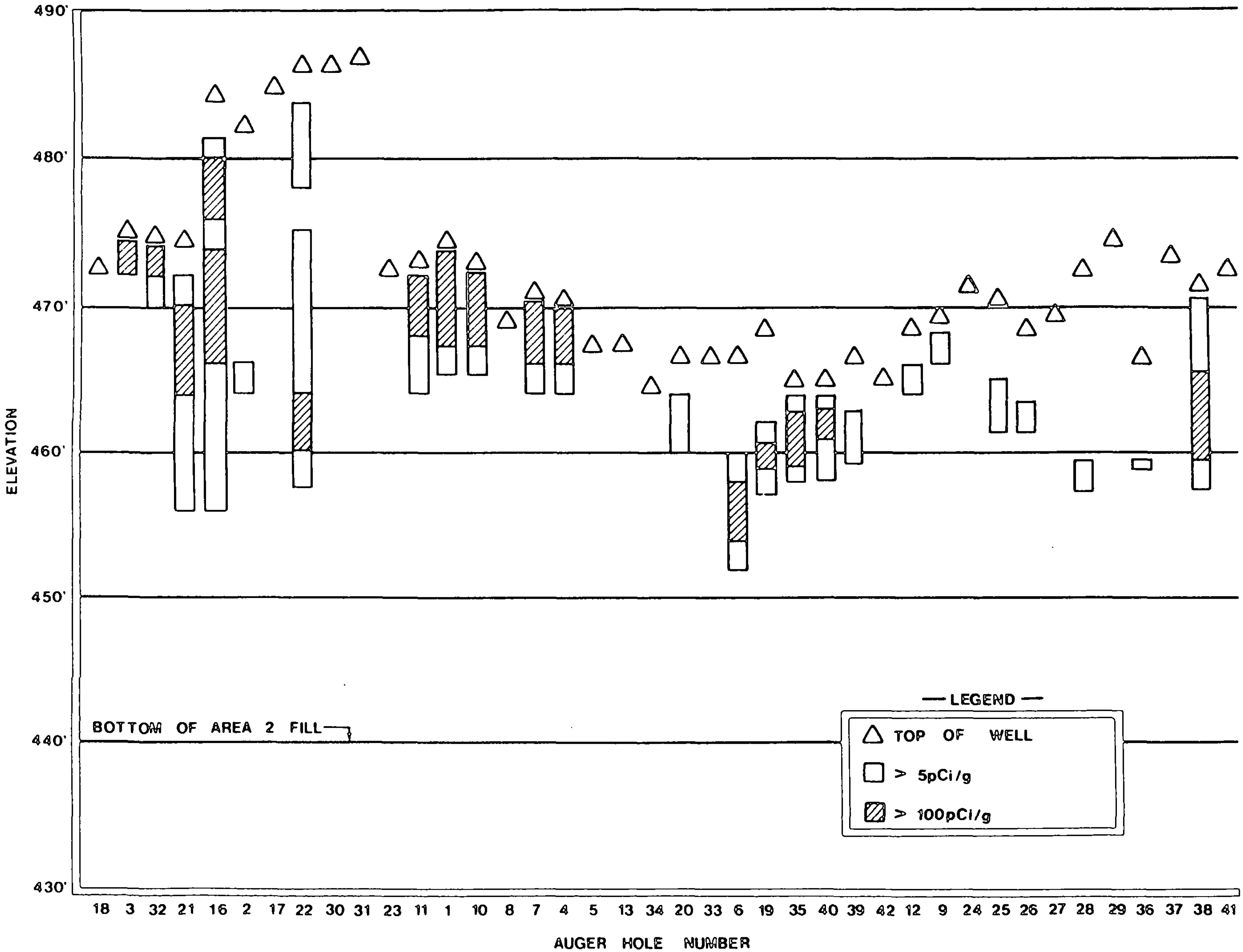



Figure 14. Auger hole elevations and location of contamination within each hole.

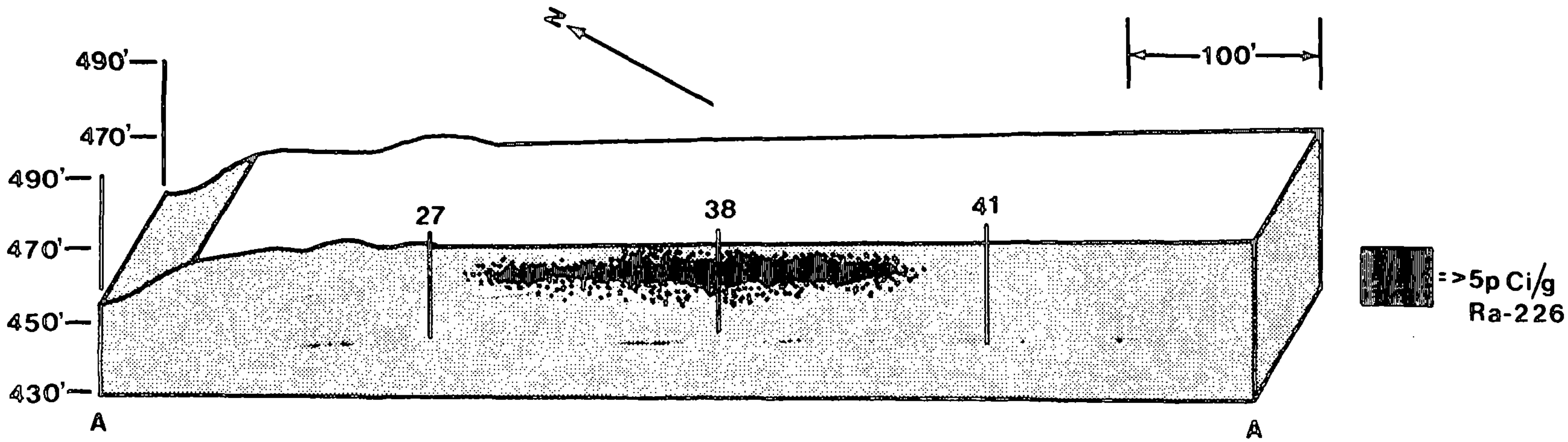



Figure 15. Cross section A-A (from Figure 9) showing subsurface deposits in Area 1. The blackened areas indicate the estimated extent of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

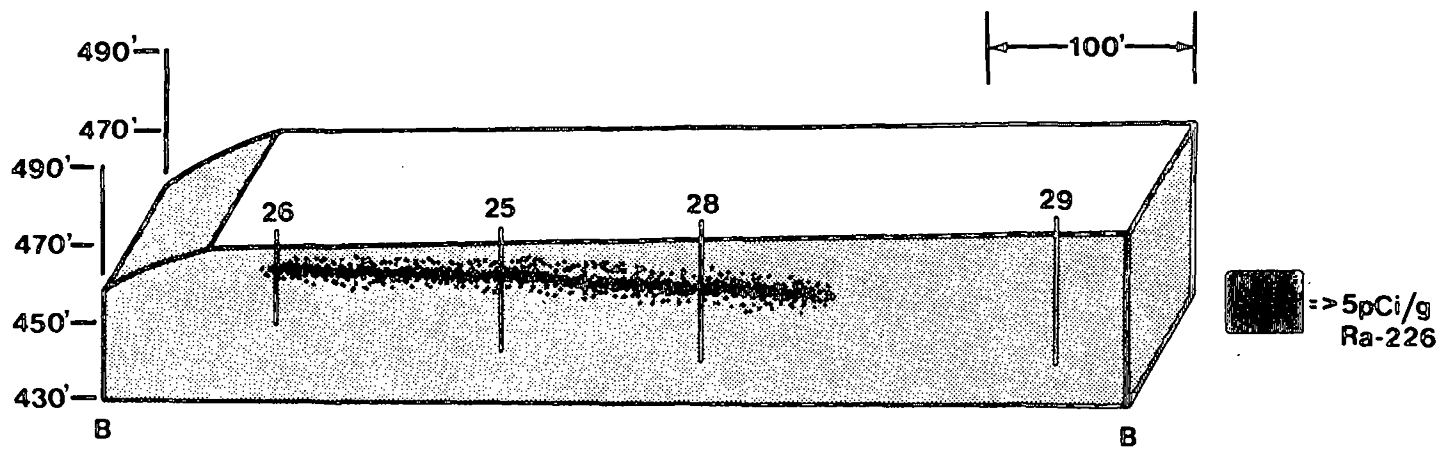



Figure 16. Cross section B-B (from Figure 9) showing subsurface deposits in Area 1. The blackened areas indicate the estimated extent of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

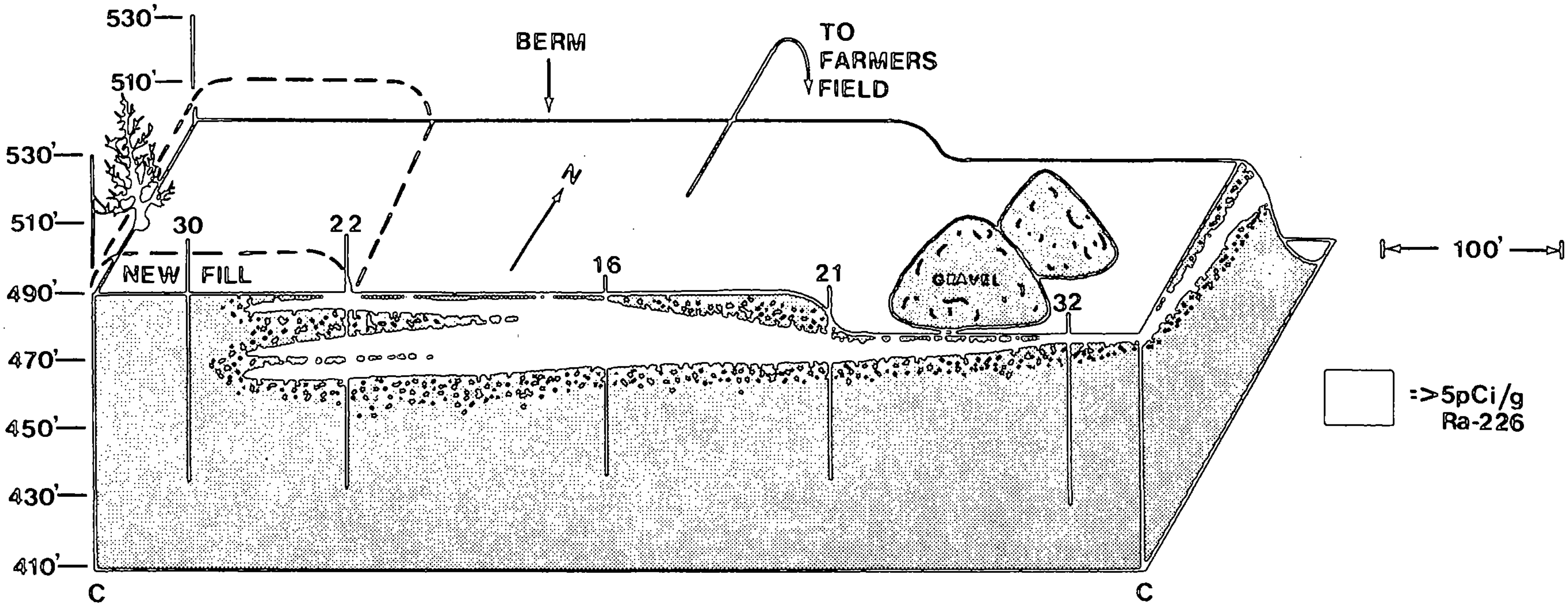



Figure 17. Cross section C-C (from Figure 10) showing subsurface deposits in Area 2. Blackened areas indicate the estimated location of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

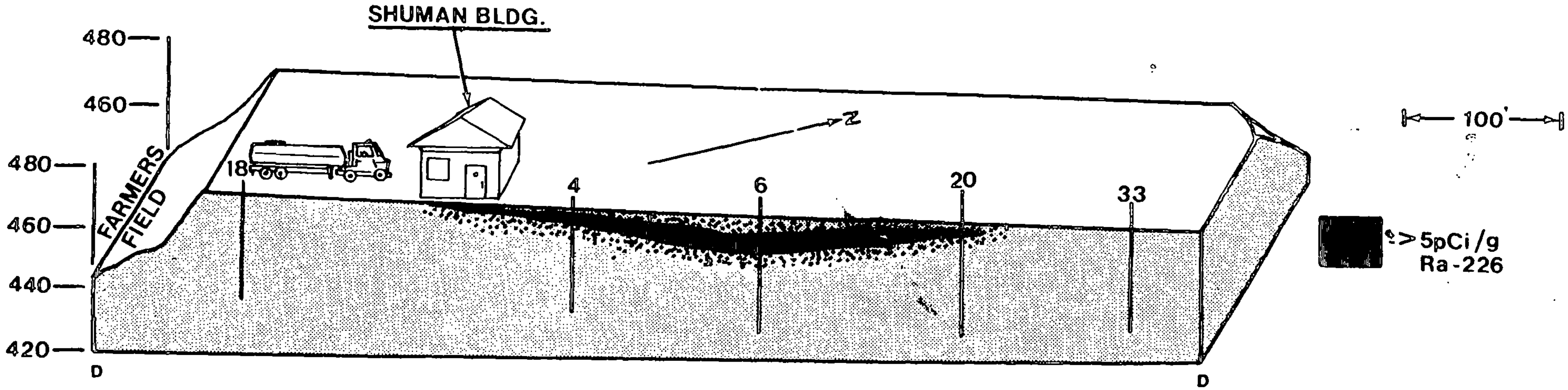



Figure 18. Cross section D-D (from Figure 10) showing subsurface deposits in Area 2. Blackened areas indicate the estimated location of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

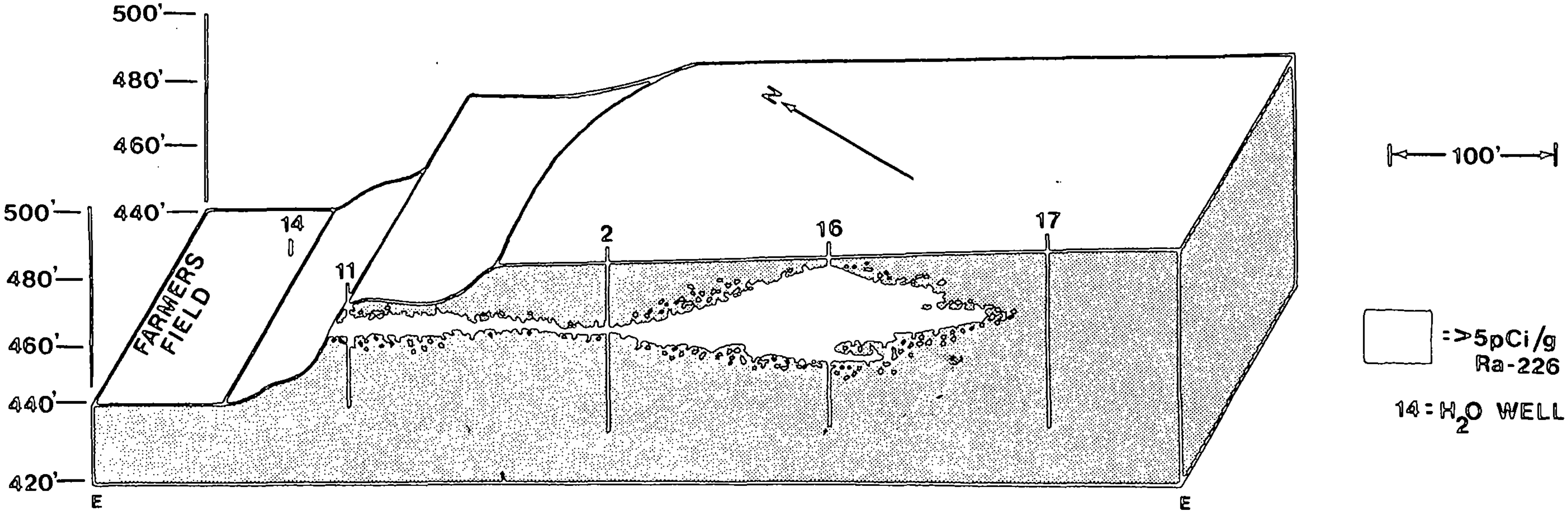



Figure 19. Cross section E-E (from Figure 10) showing subsurface deposits in Area 2. Blackened areas indicate the estimated location of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

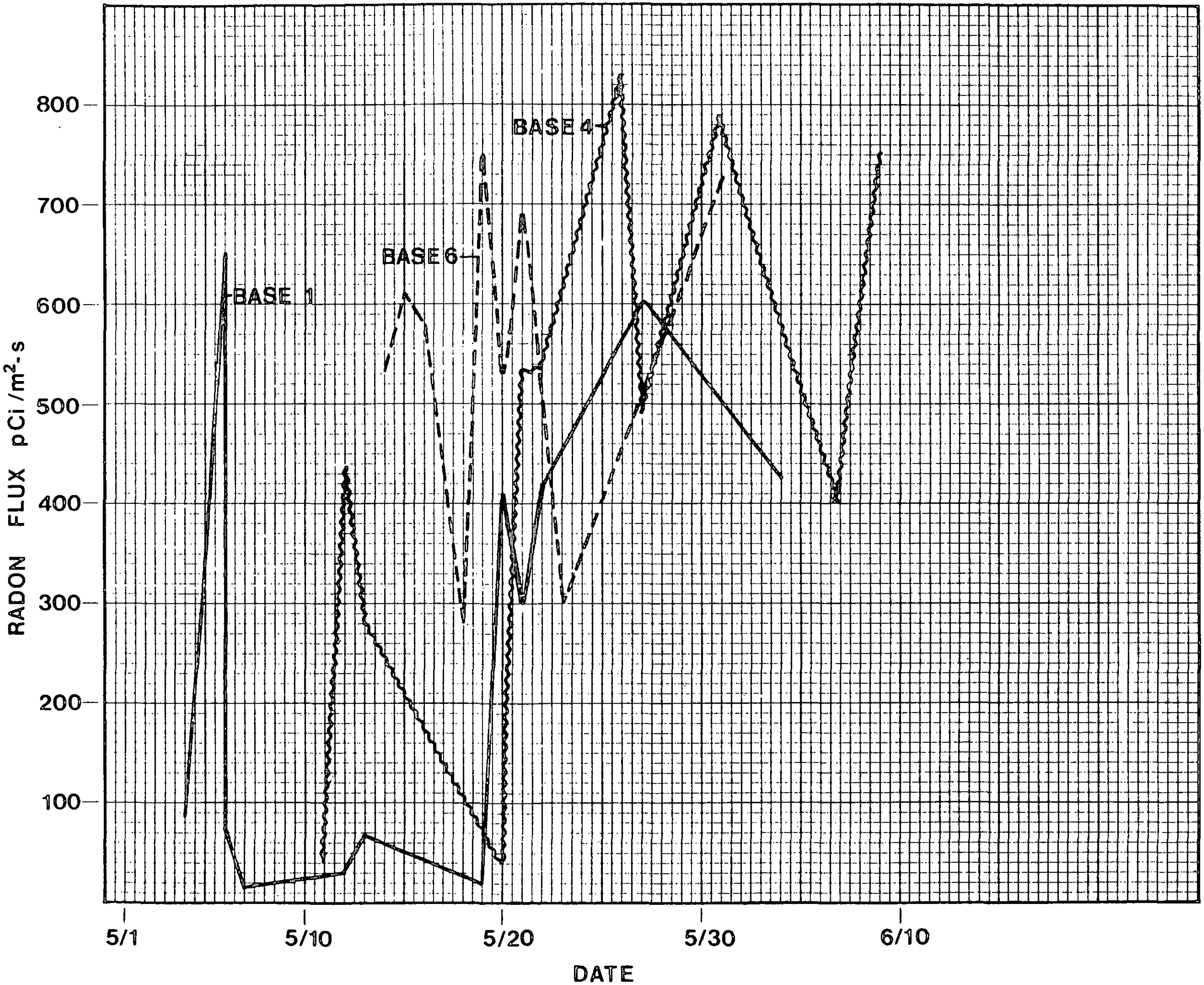



Figure 20. Radon-222 flux measurements at three locations in Area 2, for May, 1981.

Table 1

Gamma Radiation Levels and Beta-Gamma Count Rates at Grid Locations in Area 1

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| G00E | 1000 | 10 | 30 | 40 |
| H00E | 900 | 9 | 60 | 50 |
| I00E | 1200 | 11 | 30 | 50 |
| J00E | 800 | 8 | 40 | 40 |
| K00E | 800 | 8 | 20 | 30 |
| L00E | 1200 | 11 | 20 | 30 |
| M00E | 800 | 8 | 40 | 40 |
| N00E | 760 | 7 | 40 | 30 |
| P00H | 1100 | 10 | 50 | 50 |
| P00I | 1200 | 11 | 40 | 30 |
| Q00I | 1000 | 10 | 50 | 50 |
| P00J | 1100 | 10 | 50 | 50 |
| Q00J | 1200 | 11 | 40 | 60 |
| P00K | 1100 | 10 | 40 | 30 |
| Q00K | 1200 | 11 | 30 | 50 |
| C00F | 900 | 9 | 40 | 50 |
| D00F | 900 | 9 | 30 | 40 |
| E00F | 1100 | 10 | 40 | 50 |
| F00F | 1200 | 11 | 30 | 40 |
| G00F | 900 | 9 | 40 | 40 |
| H00F | 1000 | 10 | 40 | 40 |
| I00F | 1200 | 11 | 40 | 40 |
| J00F | 2000 | 16 | 40 | 50 |
| K00F | 2700 | 20 | 50 | 50 |
| L00F | 2100 | 17 | 40 | 60 |
| M00F | 1500 | 12 | 60 | 60 |
| N00F | 1000 | 10 | 40 | 60 |
| O00F | 800 | 8 | 30 | 30 |
| E00G | 1100 | 10 | 20 | 30 |
| F00G | 1000 | 10 | 30 | 60 |
| G00G | 900 | 9 | 40 | 40 |
| H00G | 1000 | 10 | 20 | 40 |
| I00G | 1200 | 11 | 30 | 30 |
| J00G | 1000 | 10 | 30 | 40 |
| K00G | 1600 | 13 | 60 | 70 |
| L00G | 1300 | 11 | 40 | 50 |
| M00G | 2200 | 17 | 60 | 50 |
| N00G | 1300 | 11 | 30 | 40 |
| O00G | - | - | 50 | 40 |
| E00H | 1100 | 10 | 40 | 40 |
| F00H | 900 | 9 | 30 | 30 |
| G00H | 1100 | 10 | 30 | 50 |
| H00H | 1200 | 11 | 50 | 40 |
| I00H | 1000 | 10 | 40 | 50 |

Table 1, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| J00H | 1000 | 10 | 50 | 40 |
| K00H | 1000 | 10 | 20 | 50 |
| L00H | 1100 | | 20 | 50 |
| M00H | 1200 | 11 | 50 | 40 |
| N00H | 1500 | 12 | 50 | 80 |
| O00H | - | - | 40 | 40 |
| E00I | 1000 | 10 | 40 | 30 |
| F00I | 1000 | 10 | 30 | 40 |
| G00I | 800 | 8 | 30 | 30 |
| H00I | 1000 | 10 | 50 | 40 |
| I00I | 1100 | 10 | 30 | 60 |
| J00I | 1000 | 10 | 30 | 40 |
| K00I | 900 | 9 | 30 | 40 |
| L00I | 1000 | 10 | 30 | 40 |
| M00I | 900 | 9 | 40 | 40 |
| N00I | 1100 | 10 | 40 | 40 |
| O00I | 1100 | 10 | 30 | 50 |
| E00J | 1100 | 10 | 40 | 60 |
| F00J | 1200 | 11 | 30 | 40 |
| G00J | 1300 | 11 | 50 | 40 |
| H00J | 1200 | 11 | 50 | 50 |
| I00J | 1100 | 10 | 50 | 50 |
| J00J | 1000 | 10 | 30 | 30 |
| K00J | 1100 | 10 | 40 | 40 |
| L00J | 1000 | 10 | 40 | 50 |
| M00J | 1200 | 11 | 50 | 40 |
| N00J | 900 | 9 | 40 | 30 |
| O00J | 900 | 9 | 40 | 40 |
| E00K | 1000 | 10 | 50 | 50 |
| F00K | 900 | 9 | 40 | 50 |
| G00K | 1000 | 10 | 50 | 50 |
| H00K | 1100 | 10 | 50 | 60 |
| I00K | 800 | 8 | 50 | 50 |
| J00K | 900 | 9 | 40 | 40 |
| K00K | 900 | 9 | 40 | 40 |
| L00K | 1000 | 10 | 30 | 30 |
| M00K | 900 | 9 | 30 | 60 |
| N00K | 800 | 8 | 30 | 40 |
| O00K | 900 | 9 | 40 | 40 |
| E00L | 800 | 8 | 40 | 60 |
| F00L | 1000 | 10 | 50 | 50 |
| G00L | 900 | 9 | 40 | 40 |
| H00L | 900 | 9 | 40 | 60 |
| I00L | 1000 | 10 | 50 | 50 |
| J00L | 1000 | 10 | 50 | 60 |
| K00L | 1000 | 10 | 50 | 50 |
| L00L | 900 | 9 | 20 | 30 |

Table 1, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (UR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| M00L | 1100 | 10 | 30 | 40 |
| N00L | 1000 | 10 | 50 | 40 |
| O00L | 900 | 9 | 20 | 40 |
| F00M | 900 | 7 | 30 | 40 |
| G00M | 1100 | 10 | 20 | 30 |
| H00M | 1000 | 10 | 30 | 40 |
| I00M | 1000 | 10 | 40 | 50 |
| J00M | 800 | 8 | 30 | 40 |
| K00M | 1000 | 10 | 40 | 40 |
| L00M | 1100 | 10 | 40 | 30 |
| M00M | 1000 | 10 | 30 | 30 |
| N00M | 1000 | 10 | 30 | 50 |
| O00M | 1000 | 10 | 30 | 40 |
| F00N | 900 | 9 | 30 | 50 |
| G00N | 1000 | 10 | 30 | 30 |
| H00N | 1100 | 10 | 30 | 30 |
| I00N | 900 | 9 | 40 | 30 |
| J00N | 900 | 9 | 40 | 50 |
| K00N | 800 | 8 | 40 | 60 |
| L00N | 900 | 9 | 40 | 30 |
| M00N | 1100 | 10 | 30 | 30 |
| G00O | 1000 | 10 | 40 | 60 |
| H00O | 1100 | 10 | 20 | 30 |
| I00O | 1000 | 10 | 20 | 30 |
| J00O | 1200 | 11 | 30 | 40 |
| K00O | 1000 | 10 | 40 | 50 |

Table 2

Gamma Radiation Levels and Beta-Gamma Count Rates at Grid Locations in Area 2

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| B00F | 600 | 10 | 40 | 40 |
| C00E | 600 | 10 | 20 | 20 |
| C00F | 600 | 10 | 20 | 30 |
| C00G | 700 | 11 | 30 | 40 |
| D00B | 800 | 12 | - | - |
| D00C | 800 | 12 | - | - |
| D00D | 700 | 11 | 20 | 40 |
| D00E | 500 | 9 | 20 | 20 |
| D00F | 600 | 10 | 20 | 20 |
| D00G | 700 | 11 | 30 | 50 |
| D00H | 800 | 12 | 50 | 50 |
| D00I | 700 | 11 | 30 | 50 |
| D00J | 1100 | 15 | 30 | 40 |
| E00A | 500 | 9 | - | - |
| E00B | 800 | 12 | - | - |
| E00C | 800 | 12 | - | - |
| E00D | 700 | 11 | - | - |
| E00E | 700 | 11 | 30 | 30 |
| E00F | 500 | 9 | 20 | 20 |
| E00G | 500 | 9 | 30 | 30 |
| E00H | 800 | 12 | 30 | 40 |
| E00I | 700 | 11 | 30 | 30 |
| E00J | 900 | 13 | 30 | 30 |
| F00A | 800 | 12 | - | - |
| F00B | 900 | 13 | - | - |
| F00C | 800 | 12 | 40 | 40 |
| F00D | 900 | 13 | 30 | 30 |
| F00E | 1000 | 14 | 30 | 40 |
| F00F | 500 | 9 | 30 | 30 |
| F00G | 800 | 12 | 40 | 40 |
| F00H | 700 | 11 | 50 | 50 |
| F00I | 800 | 12 | 30 | 40 |
| F00J | 800 | 12 | 30 | 30 |
| G00A | 800 | 12 | - | - |
| G00B | 900 | 13 | - | - |
| G00C | 800 | 12 | 30 | 40 |
| G00D | 900 | 13 | 40 | 40 |
| G00E | 700 | 11 | 30 | 40 |
| G00F | 1000 | 14 | 30 | 40 |
| G00G | 1000 | 14 | 40 | 40 |
| G00H | 800 | 12 | 30 | 40 |
| G00I | 800 | 12 | 30 | 30 |
| G00J | 800 | 12 | 20 | 40 |
| H00A | 800 | 12 | - | - |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| H00B | 800 | 12 | - | - |
| H00C | 800 | 12 | 30 | 30 |
| H00D | 1000 | 14 | 30 | 40 |
| H00E | 900 | 13 | 40 | 40 |
| H00F | 800 | 12 | 30 | 30 |
| H00G | 800 | 12 | 30 | 40 |
| H00H | 700 | 11 | 30 | 30 |
| H00I | 600 | 10 | 30 | 30 |
| H00J | 900 | 13 | 30 | 30 |
| H00K | 800 | 12 | 40 | 60 |
| H00L | 800 | 12 | 30 | 50 |
| I00A | 900 | 13 | - | - |
| I00B | 1000 | 14 | - | - |
| I00C | 1000 | 14 | 30 | 30 |
| I00D | 900 | 13 | 40 | 40 |
| I00E | 800 | 12 | 40 | 40 |
| I00F | 800 | 12 | 20 | 40 |
| I00G | 900 | 13 | 30 | 40 |
| I00H | 800 | 12 | 30 | 30 |
| I00I | 600 | 10 | 40 | 40 |
| I00J | 900 | 13 | 40 | 40 |
| I00K | 900 | 13 | 40 | 60 |
| I00L | 1100 | 15 | 40 | 80 |
| J00A | 900 | 13 | - | - |
| J00B | 800 | 12 | - | - |
| J00C | 900 | 13 | - | - |
| J00D | 1000 | 14 | 30 | 50 |
| J00E | 900 | 13 | 40 | 40 |
| J00F | 1200 | 16 | 30 | 40 |
| J00G | 1000 | 14 | 40 | 40 |
| J00H | 800 | 12 | 40 | 40 |
| J00I | 600 | 10 | 40 | 50 |
| J00J | 900 | 13 | 30 | 30 |
| J00K | 900 | 13 | 40 | 40 |
| J00L | 600 | 10 | 30 | 30 |
| K00B | 1000 | 14 | - | - |
| K00C | 1100 | 15 | - | - |
| K00D | 1200 | 16 | 40 | 50 |
| K00E | 1100 | 15 | 40 | 60 |
| K00F | 2000 | 23 | 30 | 40 |
| K00G | 1400 | 18 | 40 | 40 |
| K00H | 1000 | 14 | 40 | 40 |
| K00I | 1000 | 14 | 40 | 60 |
| K00J | 800 | 12 | 20 | 30 |
| K00K | 800 | 12 | 30 | 30 |
| K00L | 800 | 12 | 20 | 40 |
| L00B | 1000 | 14 | - | - |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| L00C | 1100 | 15 | - | - |
| L00D | 1800 | 21 | 50 | 50 |
| L00E | 2600 | 27 | 40 | 40 |
| L00F | 2500 | 27 | 940 | 1000 |
| * L00G | >50000 | 640 | 2100 | 2200 |
| L00H | 7000 | 55 | 70 | 120 |
| L00I | 2300 | 25 | 140 | 140 |
| L00J | 1300 | 17 | 40 | 80 |
| L00K | 2100 | 24 | 50 | 50 |
| L00L | 700 | 11 | 40 | 60 |
| * L73E | >50000 | 400 | - | - |
| M00B | 1100 | 15 | - | - |
| M00C | 1500 | 19 | - | - |
| M00D | 1900 | 22 | - | - |
| M00E | 3700 | 35 | 80 | 80 |
| M00F | 8000 | 60 | 80 | 90 |
| M00G | 3600 | 35 | 50 | 50 |
| M00H | 5000 | 44 | 40 | 50 |
| M00I | 7000 | 55 | 80 | 90 |
| M00J | 1800 | 21 | 60 | 70 |
| M00K | 900 | 13 | 30 | 40 |
| M00L | 900 | 13 | 30 | 60 |
| N00B | 1200 | 16 | - | - |
| N00C | 1300 | 17 | - | - |
| N00D | 1600 | 20 | - | - |
| N00E | 2000 | 23 | - | - |
| N00F | 3300 | 32 | - | - |
| N00G | 1000 | 14 | 30 | 40 |
| N00H | 1000 | 14 | 40 | 50 |
| N00I | 47000 | 210 | 680 | 1020 |
| N00J | 2300 | 25 | 30 | 30 |
| N00K | 1000 | 14 | 40 | 50 |
| N00L | 900 | 13 | 30 | 50 |
| O00C | 1200 | 16 | - | - |
| O00D | 1100 | 15 | - | - |
| O00E | 1400 | 18 | - | - |
| O00F | 1400 | 18 | 50 | 60 |
| O00G | 900 | 13 | 40 | 40 |
| O00H | 1000 | 14 | 40 | 50 |
| O00I | 900 | 13 | 20 | 40 |
| * O00J | >50000 | 840 | 4800 | 5200 |
| O00K | 1500 | 19 | 50 | 50 |
| O00L | 600 | 10 | 20 | 20 |
| P00D | 1100 | 15 | - | - |
| P00E | 1200 | 16 | - | - |
| P00F | 1000 | 14 | 40 | 60 |
| P00G | 1000 | 14 | 30 | 50 |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| P00H | 1100 | 14 | 30 | 50 |
| P00I | 1000 | 14 | 50 | 60 |
| P00J | 1000 | 14 | 400 | 50 |
| P00K | 20000 | 115 | 240 | 300 |
| P00L | 3300 | 32 | 130 | 130 |
| P00M | 500 | 9 | - | - |
| P00N | 500 | 9 | - | - |
| Q00E | 1000 | 14 | - | - |
| Q00F | 900 | 13 | - | - |
| Q00G | 1000 | 14 | 30 | 40 |
| Q00H | 1000 | 14 | 30 | 40 |
| Q00I | 800 | 12 | 30 | 60 |
| Q00J | 800 | 12 | 30 | 40 |
| Q00K | 800 | 12 | 30 | 40 |
| Q00L | 1200 | 16 | 40 | 40 |
| Q00M | 1300 | 17 | 70 | 70 |
| Q00N | 600 | 10 | 20 | 40 |
| R00F | 1000 | 14 | - | - |
| R00G | 900 | 13 | - | - |
| R00H | 900 | 13 | 40 | 40 |
| R00I | 1000 | 14 | 30 | 30 |
| R00J | 800 | 12 | 40 | 40 |
| R00K | 900 | 13 | 40 | 40 |
| R00L | 1000 | 14 | 60 | 60 |
| R00M | 700 | 11 | 40 | 40 |
| R00N | 700 | 11 | 40 | 50 |
| R00O | 600 | 10 | 20 | 30 |
| S00G | 800 | 12 | - | - |
| S00H | 900 | 13 | 30 | 60 |
| S00I | 900 | 13 | 40 | 50 |
| S00J | 1000 | 14 | 50 | 60 |
| S00K | 900 | 13 | 40 | 40 |
| S00L | 1200 | 16 | 40 | 40 |
| S00M | 6000 | 48 | 80 | 80 |
| S00N | 500 | 9 | 30 | 30 |
| S00O | 2300 | 25 | 90 | 90 |
| S00P | 800 | 12 | 30 | 40 |
| T00G | 800 | 12 | - | - |
| T00H | 1100 | 15 | - | - |
| T00I | 1000 | 14 | - | - |
| T00J | 900 | 13 | 30 | 50 |
| T00K | 1000 | 14 | 30 | 40 |
| T00L | 1000 | 14 | 40 | 40 |
| T00M | 1600 | 20 | 60 | 70 |
| T00N | 2500 | 27 | 180 | 200 |
| T00O | 3100 | 31 | 70 | 70 |
| T00P | 16000 | 98 | 600 | 700 |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| T00Q | 1500 | 19 | 30 | 40 |
| T00R | 500 | 9 | 30 | 40 |
| T00S | 700 | 11 | - | - |
| U00H | 700 | 11 | - | - |
| U00I | 900 | 13 | - | - |
| U00J | 800 | 12 | - | - |
| U00K | 700 | 11 | 40 | 50 |
| U00L | 900 | 13 | 50 | 50 |
| U00M | 1000 | 14 | 40 | 50 |
| U00N | 2800 | 29 | 100 | 140 |
| U00O | 3500 | 34 | 20 | 80 |
| * U00P | >50000 | 450 | 1300 | 1500 |
| U00Q | 35000 | 170 | 400 | 720 |
| U00R | 1500 | 19 | 40 | 40 |
| U00S | 1000 | 14 | - | - |
| V00J | 800 | 12 | - | - |
| V00K | 900 | 13 | 40 | 40 |
| V00L | 1000 | 14 | 50 | 50 |
| V00M | 900 | 13 | 40 | 40 |
| V00N | 900 | 13 | 40 | 40 |
| V00O | 13000 | 85 | 500 | 500 |
| V00P | 4700 | 42 | 70 | 70 |
| V00Q | 12000 | 80 | 170 | 190 |
| V00R | 5000 | 44 | 100 | 100 |
| V00S | 700 | 11 | - | - |
| W00K | 800 | 12 | - | - |
| W00L | 800 | 12 | 30 | 30 |
| W00M | 800 | 12 | 30 | 30 |
| W00N | 900 | 13 | 40 | 50 |
| W00O | 1000 | 14 | 50 | 50 |
| W00P | 2100 | 120 | 600 | 800 |
| W00Q | 40000 | 190 | 900 | 1100 |
| W00R | 20000 | 115 | 140 | 170 |
| W00S | 1100 | 15 | - | - |
| X00K | 900 | 13 | - | - |
| X00L | 1100 | 15 | - | - |
| X00M | 1100 | 15 | 40 | 40 |
| X00N | 1000 | 14 | 40 | 40 |
| X00O | 1100 | 15 | 30 | 50 |
| X00P | 4000 | 37 | 120 | 160 |
| X00Q | 12000 | 80 | 300 | 400 |
| * X00R | >50000 | 740 | 1900 | 2000 |
| X00S | 1500 | 19 | - | - |
| Y00I | 1000 | 14 | - | - |
| Y00J | 1300 | 17 | - | - |
| Y00K | 1600 | 20 | - | - |
| Y00L | 1600 | 20 | - | - |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| Y00M | 1100 | 15 | 40 | 40 |
| Y00N | 3000 | 30 | 30 | 50 |
| Y00O | 1700 | 20 | 40 | 50 |
| Y00P | 2100 | 24 | 40 | 60 |
| Y00Q | 9000 | 66 | 200 | 280 |
| Y00R | 40000 | 190 | 1000 | 1400 |
| Y00S | 3600 | 35 | - | - |
| Z00I | 800 | 10 | 40 | 40 |
| Z00J | 1000 | 14 | 40 | 50 |
| Z00K | 1800 | 21 | 70 | 90 |
| Z00L | 3200 | 32 | 80 | 80 |
| Z00M | 3700 | 35 | 120 | 150 |
| Z00N | 5000 | 44 | 110 | 130 |
| Z00O | 3300 | 32 | 80 | 120 |
| Z00P | 1900 | 22 | 50 | 60 |
| Z00Q | 2400 | 26 | 50 | 60 |
| Z00R | 12000 | 80 | 300 | 380 |
| Z00S | 2600 | 27 | - | - |
| a00I | 900 | 13 | 40 | 50 |
| a00J | 900 | 13 | 20 | 40 |
| a00K | 1300 | 17 | 50 | 90 |
| a00L | 1800 | 21 | 60 | 80 |
| a00M | 1900 | 22 | 120 | 140 |
| a00N | 1200 | 16 | 90 | 100 |
| a00O | 1300 | 17 | 40 | 40 |
| a00P | 1000 | 14 | 20 | 30 |
| a00Q | 2200 | 24 | 60 | 60 |
| a00R | 2300 | 25 | 70 | 100 |
| a00S | 2600 | 27 | - | - |
| b00I | 900 | 13 | - | - |
| b00J | 900 | 13 | - | - |
| b00P | 800 | 12 | 40 | 50 |
| b00Q | 700 | 11 | 30 | 70 |
| b00R | 2400 | 26 | 60 | 90 |
| b00S | 2400 | 26 | - | - |
| c00N | 700 | 11 | - | - |
| c00O | 700 | 11 | 40 | 40 |
| c00P | 1000 | 14 | 50 | 50 |
| c00Q | 1300 | 17 | 60 | 80 |
| c00R | 1900 | 22 | 50 | 80 |
| c00S | 1800 | 21 | - | - |
| d00O | 1400 | 18 | 40 | 60 |
| d00P | | | 30 | 50 |
| d00Q | | | 30 | 60 |
| d00R | 2000 | 23 | 60 | 70 |
| d00S | 2000 | 23 | - | - |
| d00T | 900 | 13 | - | - |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count R ate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| d00U | 1800 | 21 | - | - |
| d00V | 2200 | 24 | 50 | 50 |
| d00W | 2500 | 27 | 100 | 100 |
| d00X | 700 | 11 | 30 | 30 |
| e00L | 600 | 10 | 70 | 70 |
| e00O | 1700 | 14 | - | - |
| e95O | 1000 | 14 | - | - |
| e00P | - | - | 70 | 100 |
| e95Q | 1000 | 14 | 40 | 40 |
| e95R | 1300 | 17 | 40 | 80 |
| e95S | 1800 | 21 | - | - |
| e95T | 2500 | 27 | - | - |
| e95U | 3500 | 34 | - | - |
| e95V | 3400 | 33 | 100 | 100 |
| e95W | 4000 | 37 | 120 | 140 |
| e95X | 3000 | 30 | 100 | 100 |
| e95Y | 1500 | 19 | 50 | 60 |
| e95Z | 1700 | 20 | 70 | 80 |
| e00a | 2300 | 25 | 90 | 100 |
| f00K | 600 | 10 | 60 | 60 |
| f00L | 700 | 11 | 50 | 80 |
| f00O | 1100 | 15 | 40 | 60 |
| f57Q | 3400 | 33 | - | - |
| f00R | 2700 | 28 | 60 | 60 |
| f00S | 2700 | 28 | - | - |
| f00T | 4500 | 41 | - | - |
| f00U | 6000 | 50 | - | - |
| f00V | 50000 | 230 | 1060 | 1080 |
| f00W | 6000 | 50 | 120 | 140 |
| f00X | 6000 | 50 | 100 | 100 |
| f00Y | 1500 | 19 | 50 | 60 |
| f00Z | 1000 | 14 | 40 | 40 |
| f00a | 1000 | 14 | 30 | 50 |
| f00M | - | - | 60 | 60 |
| g00K | 700 | 11 | 50 | 50 |
| g00L | 600 | 10 | 80 | 90 |
| g00M | 600 | 10 | 60 | 90 |
| g00O | 2000 | 23 | 80 | 110 |
| g00P | 2000 | 23 | 50 | 90 |
| g00Q | 3300 | 32 | 70 | 100 |
| g00R | 21000 | 120 | 300 | 420 |
| g00S | 8000 | 62 | - | - |
| g00T | 6000 | 50 | - | - |
| g00U | 15000 | 95 | - | - |
| g00V | 11000 | 77 | 180 | 260 |
| g00W | 7000 | 56 | 110 | 140 |
| g00X | 2500 | 27 | 50 | 60 |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| g00Y | 2200 | 24 | 90 | 120 |
| g00Z | 1500 | 19 | 50 | 70 |
| g00a | 1000 | 14 | 30 | 30 |
| h00K | 700 | 11 | 30 | 30 |
| h00L | 800 | 12 | 70 | 70 |
| h00M | 900 | 13 | 70 | 80 |
| h00N | 1000 | 14 | - | - |
| h00O | 3100 | 31 | 70 | 70 |
| h00P | 17000 | 105 | 180 | 280 |
| * h00Q | >50000 | 1050 | 4200 | 4200 |
| h00R | 27000 | 140 | 560 | 660 |
| h00S | 45000 | 205 | 900 | 1080 |
| h00T | 4000 | 37 | 150 | 150 |
| h00U | 6500 | 52 | 170 | 190 |
| h00V | 10000 | 72 | 240 | 250 |
| h00W | 3800 | 36 | 200 | 300 |
| h00X | 1000 | 14 | 60 | 80 |
| h00Y | 1800 | 21 | 50 | 50 |
| h00Z | 700 | 11 | 20 | 30 |
| h00a | 700 | 11 | 40 | 40 |
| h72P | - | - | 8000 | 9400 |
| i00K | 800 | 12 | 40 | 50 |
| i00L | 900 | 13 | 60 | 60 |
| i00M | 1700 | 20 | 90 | 110 |
| i00N | 8000 | 60 | 110 | 110 |
| i00O | 36000 | 175 | 1000 | 1100 |
| * i00P | >50000 | 1600 | 7200 | 8400 |
| * i00Q | >50000 | 1170 | 2800 | 3600 |
| i00R | 30000 | 155 | 900 | 1120 |
| i00S | 800 | 60 | 180 | 300 |
| i00T | 1600 | 20 | 40 | 40 |
| i00U | 3000 | 30 | 130 | 180 |
| i00V | 2200 | 24 | - | - |
| i00W | 1400 | 18 | 40 | 60 |
| i00X | 1000 | 14 | 40 | 60 |
| i00Y | 1500 | 19 | 70 | 70 |
| j00K | 800 | 12 | 60 | 60 |
| j00L | 900 | 13 | 60 | 80 |
| j00M | 2000 | 23 | 90 | 90 |
| j00N | 6000 | 49 | 130 | 160 |
| j00O | 10000 | 70 | 130 | 180 |
| j00P | 20000 | 115 | 400 | 420 |
| j00Q | 16000 | 98 | 410 | 500 |
| j00R | 21000 | 120 | 560 | 700 |
| j00S | 1900 | 22 | 70 | 90 |
| j00T | 1200 | 16 | 50 | 60 |
| j00U | 1000 | 14 | 60 | 60 |

Table 2, cont.

| Grid Location | NaI Count Rate (c/min) | Exposure Rate (uR/hr) | Beta-Gamma Count Rate w/window (c/min) | Beta-Gamma Count Rate w/o window (c/min) |
|---|---|---|---|---|
| j00V | 1800 | 21 | 70 | 70 |
| j00W | 1200 | 16 | 70 | 80 |
| j00X | 1000 | 14 | 50 | 50 |
| j00Y | 1100 | 15 | 60 | 60 |
| k00L | 1000 | 14 | 70 | 70 |
| k00M | 1100 | 15 | 90 | 110 |
| k00N | 1000 | 14 | 60 | 90 |
| k00O | 1000 | 14 | 70 | 90 |
| k00P | 1100 | 15 | 80 | 110 |
| k00Q | 1400 | 18 | 40 | 40 |
| k00R | 7500 | 58 | 140 | 180 |
| k00S | 1100 | 15 | 50 | 50 |
| k00T | 1100 | 15 | 30 | 50 |
| k00U | 1700 | 20 | 60 | 60 |
| k00V | 1700 | 20 | 50 | 60 |
| k00W | 700 | 11 | 40 | 40 |
| k00X | 700 | 11 | 40 | 50 |
| k00Y | 1000 | 14 | 40 | 50 |
| l00L | 900 | 13 | 70 | 70 |
| l00M | 900 | 13 | 70 | 80 |
| l00N | 800 | 12 | 70 | 70 |
| l00O | 900 | 13 | 80 | 90 |
| l00P | 700 | 11 | 60 | 70 |
| l00Q | 900 | 13 | 50 | 50 |
| l00R | 800 | 12 | 40 | 40 |
| l00S | 1200 | 16 | 40 | 50 |
| l00T | 1200 | 16 | 60 | 70 |
| l00U | 1100 | 15 | 60 | 80 |
| l00V | 900 | 13 | 30 | 40 |
| m00O | 800 | 12 | 80 | 80 |
| m00P | 700 | 11 | 60 | 60 |
| m00Q | 700 | 11 | 40 | 40 |
| m00R | 900 | 13 | 30 | 50 |
| m00S | 1000 | 14 | 40 | 40 |

* Reading >50,000 on NaI, reading was made with end window GM tube with beta shield.

Table 3

Surface Soil Sample Radionuclide Concentrations
(pCi/g), by Gamma Analysis

| Location | Sample | K-40 | U-238 | Ra-226 | Pb-214 | Bi-214 | Ra-223 | Rn-219 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|---|
| G00C | Area 2, Berm | 2.4E1 | ----- | 2.1E0 | 2.1E0 | 2.1E0 | ----- | ----- | ----- | ----- |
| i00Q | Area 2, Near Shuman Bld | ----- | 3.0E2 | 8.6E2 | 9.6E2 | 7.6E2 | 1.6E2 | 3.1E2 | 3.6E2 | ----- |
| Z00N | Area 2, Road Surface | ----- | 4.4E1 | 6.0E2 | 6.6E2 | 5.4E2 | 2.0E1 | 2.0E1 | ----- | ----- |
| O00J | Area 2, Near Berm | ----- | 5.7E2 | 2.3E3 | 2.5E3 | 2.0E3 | 6.0E2 | 7.8E2 | 9.6E2 | ----- |
| O00G | Area 2, Near Berm | 2.1E1 | ----- | 1.0E1 | 1.1E1 | 9.6E0 | ----- | ----- | ----- | ----- |
| N00I | Area 2, Near Berm | ----- | 5.5E2 | 2.0E3 | 2.0E3 | 2.1E3 | 4.9E2 | 7.9E2 | 8.9E2 | ----- |
| M00E | Area 2, Berm | 1.3E1 | ----- | 3.9E1 | 4.2E1 | 3.6E0 | ----- | ----- | ----- | ----- |
| F00C | Area 2, Berm | 1.4E1 | ----- | 1.7E0 | 1.9E0 | 1.5E0 | ----- | ----- | ----- | ----- |
| S00K | Area 2, Near Gravel Pile | 3.2E1 | ----- | 3.9E0 | 3.9E0 | ----- | ----- | ----- | ----- | ----- |
| i00P | Area 2, Near Shuman Bldg | ----- | 8.3E2 | 4.0E3 | 4.4E3 | 3.6E3 | 9.6E2 | 9.6E2 | 1.5E3 | ----- |
| S00L | Area 2, Near Gravel Pile | 2.8E1 | ----- | 2.5E0 | 2.4E0 | 2.6E0 | ----- | ----- | ----- | ----- |
| h00Q | Area 2, Near Shuman Bldg | ----- | 1.5E2 | 3.0E1 | 3.4E2 | 2.6E2 | 1.7E2 | 1.9E2 | 1.5E2 | ----- |
| SPEC | Off-site Bkg Earth City | 2.6E1 | ----- | 2.5E0 | 2.5E0 | 2.5E0 | ----- | ----- | ----- | ----- |
| i00P | Area 2, Duplicate | ----- | 6.4E2 | 2.7E3 | 3.0E3 | 2.4E3 | 2.3E3 | 1.2E3 | 1.1E3 | ----- |
| SPEC | Off-site Bkg Earth City | 1.9E1 | ----- | 2.7E0 | 2.5E0 | 2.9E0 | ----- | ----- | ----- | ----- |
| Z00O | Area 2, Road Surface | ----- | 2.8E1 | 5.2E1 | 5.7E1 | 4.8E1 | 3.1E1 | 3.1E1 | 3.4E1 | ----- |
| SPEC | Leachate Treatment Sludge | ----- | ----- | 6.9E0 | 7.9E0 | 5.9E0 | ----- | ----- | ----- | ----- |
| N00I | Area 2, Near Berm | ----- | 7.6E2 | 7.1E3 | 1.0E4 | 4.2E3 | 2.2E3 | 2.0E3 | 1.8E3 | ----- |
| SPEC | Area 1, Base 6 Near Road | ----- | 6.5E2 | 2.4E3 | 2.7E3 | 2.1E3 | 1.6E3 | 1.4E3 | 1.0E3 | ----- |
| P00I | Area 2, Near Berm | 1.7E1 | 1.0E0 | 7.0E0 | 7.3E0 | 6.8E0 | ----- | ----- | ----- | ----- |
| SPEC | Area 1, Base 7 Near Road | ----- | 3.7E1 | 2.7E2 | 3.4E2 | 2.1E2 | 2.9E1 | ----- | 5.8E1 | 2.2E0 |
| SPEC | Leachate Treatment Sludge | ----- | ----- | 2.3E0 | ----- | 2.3E0 | ----- | ----- | ----- | ----- |
| SPEC | Area 1, Base 6 Near Road | ----- | 6.5E2 | 2.7E3 | 3.1E3 | 2.5E3 | 1.2E3 | 1.1E3 | 9.5E2 | ----- |
| SPEC | Area 1, Base 5 Brown Soil | ----- | 3.9E2 | 1.1E3 | 1.6E3 | 8.2E2 | 2.8E2 | 3.8E2 | 3.7E2 | ----- |
| SPEC | Area 1, Base 5 Black Soil | ----- | 3.1E2 | 6.8E2 | 7.8E2 | 5.8E2 | 3.1E2 | 3.2E2 | 3.2E2 | ----- |
| SPEC | Off-site Bkg Taussig Road | 3.2E1 | ----- | 2.5E0 | 2.4E0 | 2.6E0 | ----- | ----- | ----- | 2.4E0 |
| SPEC | Area 1, Base 5 White Soil | ----- | 2.1E3 | 2.1E4 | 2.3E4 | 1.9E4 | 5.3E3 | 5.3E3 | 5.0E3 | ----- |
| i00P | Area 2, Duplicate | ----- | 6.2E2 | 3.5E3 | 3.7E3 | 3.2E3 | 1.3E3 | 1.3E3 | 1.7E3 | ----- |
| J00G | Area 1, Hot Spot | ----- | 3.4E1 | 9.7E1 | 1.1E2 | 8.3E1 | 4.3E1 | 4.3E1 | 4.6E1 | ----- |
| M00H | Area 1, Low Level Area | 2.2E1 | ----- | 2.7E0 | 2.6E0 | 2.8E0 | ----- | ----- | ----- | 3.0E0 |
| K00F | Area 1 | 2.0E1 | ----- | 3.7E0 | 3.6E0 | 3.8E0 | ----- | ----- | ----- | 2.1E0 |
| SPEC | Area 1, East Berm | 2.4E1 | ----- | 2.6E0 | 2.2E0 | 2.9E0 | ----- | ----- | ----- | ----- |

Table 3 cont.

| Location | Sample | K-40 | U-238 | Ra-226 | Pb-214 | Bi-214 | Ra-223 | Rn-219 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|---|
| I00L | Area 1 | ----- | ----- | 2.9E0 | 3.2E0 | 2.6E0 | ----- | ----- | ----- | 2.3E0 |
| SPEC | Area 1, East Berm | 1.8E1 | ----- | 2.4E0 | 2.2E0 | 2.6E0 | ----- | ----- | ----- | ----- |
| P00H | Area 1, Near Road | 3.0E1 | ----- | 4.3E0 | 5.2E0 | 3.3E0 | ----- | ----- | ----- | 1.8E0 |
| N62H | Area 1 | 2.5E1 | ----- | 4.1E0 | 3.4E0 | 4.7E0 | ----- | ----- | ----- | 3.0E0 |
| O11J | Area 1, Near Berm | ----- | 9.4E2 | 4.2E3 | 4.6E3 | 3.9E3 | 2.0E3 | 2.1E3 | 2.1E3 | ----- |
| L73E | Area 2, Side of Hill | ----- | 3.8E2 | 1.1E3 | 1.2E3 | 1.0E3 | 4.5E2 | 4.6E2 | 3.8E2 | ----- |
| K00F | Area 1 | 3.9E1 | ----- | 4.4E0 | 5.2E0 | 3.5E0 | ----- | ----- | ----- | ----- |
| N62H | Area 1, Fill | 2.7E1 | ----- | 3.1E0 | 3.1E0 | 3.1E0 | ----- | ----- | ----- | 1.3E0 |
| N00F | Area 1, Fill | ----- | ----- | 2.6E0 | 3.0E0 | 2.1E0 | ----- | ----- | ----- | 2.6E0 |
| J00G | Area 1, Fill | ----- | ----- | 2.3E0 | 3.5E0 | 1.1E0 | ----- | ----- | ----- | 1.5E0 |
| K66E | Area 1, Near Parking Lot | ----- | ----- | 1.5E1 | 1.7E1 | 1.3E1 | ----- | ----- | ----- | ----- |
| I00I | Area 1, Fill | 3.1E1 | ----- | 3.8E0 | ----- | 3.8E0 | ----- | ----- | ----- | 1.6E0 |

Soil Radiochemical Analysis

Table 4

Bi-214 from Gamma Spectroscopy

| Sample | Activity pCi/gm | | |
|---|---|---|---|
| | U-238 | Th-230 | Bi-214 |
| | (All +/- 25%) | (All +/- 25%) | (All +/- 25%) |
| Area 1 Surface (1980) | 3.8 | 82 | 2.1 |
| Area 1 Surface (1980) | 12 | 597 | 25 |
| Area 1 Borehole 1 (1980) | 21 | 188 | 44 |
| Area 2 Surface (1980) | 175 | 6,095 | 1,488 |
| Area 2 Surface (1980) | 18 | 338 | 9.4 |
| Base 5 Surface (1981) | 101 | 178,000 | 19,000 |
| Base 6 Surface (1981) | 54 | 46,100 | 2,600 |
| Borehole 11 (1981) | 82 | 29,200 | 1,800 |
| N11J Surface (1981) | 127 | 27,200 | 2,000 |
| O11J Surface (1981) | 1.0 | 52,000 | 3,900 |

Auger Hole NaI Counts and IG Analysis

Table 5

Borehole #1 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | >50,000 | 1.6E1 | 1.6E2 | 1.7E2 | 1.6E2 | ------ | ------ | ------ | ------- |
| 01 | >50,000 | 7.5E2 | 6.5E2 | 9E2 | 1.7E2 | ------ | ------ | 1.4E2 | ------- |
| 02 | >50,000 | 2.2E4 | 2.4E4 | 1.9E4 | ------ | ------ | ------ | 4.2E3 | ------- |
| 03 | >50,000 | 4.0E3 | 3.0E3 | 4.8E3 | ------ | 1.1E3 | ------ | 2.1E2 | ------- |
| 04 | >50,000 | 1.3E3 | 1.2E3 | 1.4E3 | 9.3E1 | ------ | ------ | ------ | ------- |
| 05 | 20,000 | 2.4E1 | ------- | 2.4E1 | ------ | ------ | 8.0E0 | ------ | ------- |
| 06 | 4,500 | 3.9E0 | 3.5E0 | 4.3E0 | ------ | ------ | 1.1E1 | ------ | ------- |
| 08 | 2,200 | 2.3E0 | 2.3E0 | 2.2E0 | ------ | ------ | 1.4E1 | ------ | 7.2E-1 |
| 10 | 2,000 | 2.3E0 | 2.4E0 | 2.2E0 | ------ | ------ | 1.3E1 | ------ | 8.3E-1 |
| 12 | 1,500 | 1.9E0 | 2.2E0 | 1.6E0 | ------ | ------ | 1.3E1 | ------ | ------- |
| 14 | 1,300 | 1.8E0 | 1.9E0 | 1.7E0 | ------ | ------ | 9.7E0 | ------ | 6.3E-1 |
| 16 | 800 | 1.3E0 | 1.2E0 | 1.3E0 | ------ | ------ | 1.0E1 | ------ | 3.9E-1 |
| 18 | 800 | 1.2E0 | 1.6E0 | 8.0E-1 | ------ | ------ | 3.3E0 | ------ | 3.0E-1 |
| 20 | 800 | 8.1E-1 | 7.4E-2 | 8.7E-1 | ------ | ------ | 1.0E1 | ------ | 3.2E-1 |
| 22 | 500 | 6.5E-1 | 4.0E-1 | 9.0E-1 | ------ | ------ | 2.5E0 | ------ | ------- |
| 24 | 150 | 2.5E-1 | 2.8E-1 | 2.1E-1 | ------ | ------ | 1.5E0 | ------ | ------- |
| 26 | 1,000 | 6.3E-1 | 7.2E-1 | 5.4E-1 | ------ | ------ | 6.3E0 | ------ | 3.1E-1 |
| 28 | 1,300 | 8.7E-1 | 8.4E-1 | 8.9E-1 | ------ | ------ | 1.2E1 | ------ | 5.7E-1 |
| 30 | 500 | 4.3E-1 | ------- | 4.3E-1 | ------ | ------ | 3.0E0 | ------ | 2.1E-1 |
| 32 | 700 | 1.3E0 | 1.E0 | 1.2E0 | ------ | ------ | 6.1E0 | ------ | 4.2E-1 |
| 34 | 1,400 | 2.4E0 | 2.5E0 | 2.2E0 | ------ | ------ | 6.1E0 | ------ | 5.4E-1 |
| 36 | 1,800 | 1.4E0 | 1.5E0 | 1.2E0 | ------ | ------ | 1.2E1 | ------ | ------- |

Borehole #3 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | >50,000 | 8.4E2 | 7.8E2 | 8.4E2 | ------ | ------ | ------ | 6.4E1 | ------- |
| 01 | >50,000 | 1.5E4 | 1.3E4 | 1.9E4 | 1.4E3 | ------ | ------ | ------ | ------- |
| 02 | >50,000 | 7.0E3 | 5.3E3 | 8.7E3 | ------ | ------ | ------ | ------ | ------- |
| 03 | 1,400 | 2.3E1 | 1.4E1 | 3.2E1 | ------ | ------ | 1.2E1 | ------ | ------- |
| 05 | 2,300 | 6.2E0 | 5.8E0 | 6.6E0 | ------ | ------ | 8.9E0 | ------ | ------- |
| 07 | 3,000 | 4.7E0 | 4.9E0 | 4.4E0 | ------ | ------ | 6.9E0 | ------ | ------- |
| 09 | 1,800 | 3.5E0 | 4.2E0 | 2.8E0 | ------ | 3.6E0 | 8.2E0 | ------ | ------- |
| 11 | 1,000 | 1.8E0 | 2.1E0 | 1.5E0 | ------ | ------ | 4.1E0 | ------ | ------- |
| 13 | 600 | 1.7E0 | 1.4E0 | 2.0E0 | ------ | ------ | ------ | ------ | ------- |
| 15 | 1,800 | 4.5E0 | 4.6E0 | 4.4E0 | ------ | 4.7E0 | 4.2E0 | ------ | ------- |

Table 5, cont.

| Borehole #3, cont. | | | | Radionuclide Concentrations [pCi/g] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
| 17 | 1,000 | 9.0E-1 | 1.1E0 | 7.3E-1 | ------ | ------ | 6.4E0 | ------ | 4.4E-1 |
| 19 | 500 | 2.9E-1 | 3.E-1 | 2.1E-1 | ------ | ------ | 2.2E0 | ------ | ------- |
| 21 | 500 | 5.0E-1 | 7.E-1 | 2.2E-1 | ------ | ------ | 2.0E0 | ------ | ------- |
| 23 | 700 | 1.0E0 | 1.1E0 | 8.7E-1 | ------ | ------ | 6.3E0 | ------ | 5.3E-1 |
| 25 | 600 | 3.3E-1 | 3.7E-1 | 2.9E-1 | ------ | ------ | ------ | ------ | ------- |
| 27 | 900 | 9.7E-1 | 1.1E0 | 8.4E-1 | ------ | ------ | 6.5E0 | ------ | 5.4E-1 |
| 29 | 1,000 | 5.4E-1 | 4.8E-1 | 6.0E-1 | ------ | ------ | 7.6E0 | ------ | ------- |

| Borehole #4 | | | | Radionuclide Concentrations [pCi/g] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
| 00 | >50,000 | ------ | 1.5E2 | 1.7E2 | 1.3E2 | 9.5E1 | ------ | 9.9E1 | ------- |
| 01 | >50,000 | 5.3E2 | 2.1E3 | 1.7E3 | 2.5E3 | 9.8E2 | ------ | 1.2E3 | ------- |
| 02 | >50,000 | ------ | 1.2E2 | 9.E1 | 1.5E2 | ------ | 3.6E0 | ------ | ------- |
| 03 | 14,000 | ------ | 2.8E0 | 2.1E0 | 3.5E0 | ------ | 3.8E0 | ------ | ------- |
| 04 | 2,900 | ------ | 1.6E0 | 1.6E0 | 1.6E0 | ------ | 3.6E0 | ------ | ------- |
| 06 | 1,100 | ------ | 1.4E0 | 1.5E0 | 1.2E0 | 8.6E-1 | 4.1E0 | ------ | ------- |
| 08 | 1,200 | ------ | 1.7E0 | 1.9E0 | 1.5E0 | 9.0E-1 | 7.1E0 | ------ | ------- |
| 10 | 1,500 | ------ | 2.7E | 2.8E0 | 2.5E0 | 8.3E-1 | 9.3E0 | 3.8E0 | ------- |
| 12 | 2,600 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |
| 14 | 1,500 | ------ | 1.7E0 | 1.6E0 | 1.7E0 | 7.0E-1 | 7.0E0 | ------ | ------- |
| 16 | 1,400 | ------ | 1.0E0 | 1.2E0 | 8.4E-1 | ------ | ------ | ------ | ------- |
| 18 | 1,100 | ------ | 8.0E-1 | 8.E1-1 | 8.0E-1 | ------ | 8.5E0 | ------ | 3.8E-1 |
| 20 | 800 | ------ | 7.6E-1 | 8.6E-1 | 6.6E-1 | ------ | ------ | ------ | ------- |
| 22 | 1,100 | ------ | 1.1E0 | .1E0 | 1.1E0 | ------ | 7.7E0 | ------ | 4.1E1 |
| 24 | 1,200 | ------ | 7.5E-1 | 8.1E-1 | 7.0E-1 | ------ | 1.6E-1 | ------ | 3.5E-1 |
| 26 | 1,000 | ------ | 4.8E-1 | 4.2E-1 | 5.4E-1 | ------ | 6.6E0 | ------ | 3.0E-1 |
| 28 | 700 | ------ | 7.1E-1 | 7.2E-1 | 7.0E-1 | ------ | ------ | ------ | ------- |
| 30 | 1,300 | ------ | 8.7E-1 | 9.9E-1 | 7.5E-1 | ------ | 1.4E1 | ------ | 6.4E-1 |
| 32 | 1,500 | ------ | 9.5E-1 | 9.5E-1 | 9.5E-1 | ------ | 1.5E1 | ------ | ------- |
| 34 | 1,700 | ------ | 1.9E0 | 2.2E0 | 1.6E0 | ------ | 1.3E1 | ------ | 5.5E-1 |

| Borehole #5 | | | | Radionuclide Concentrations [pCi/g] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
| 00 | 1,800 | 1.8E0 | ------- | 1.7E0 | ------ | ------ | 6.3E0 | ------ | ------- |
| 02 | 1,500 | 2.5E0 | 2.9E0 | 2.0E0 | ------ | 3.4E0 | 4.0E0 | ------ | ------- |
| 04 | 2,700 | 3.4E0 | 3.7E0 | 3.1E0 | ------ | ------ | 4.4E0 | ------ | ------- |
| 06 | 1,600 | 1.7E0 | 1.5E0 | 1.9E0 | ------ | ------ | 1.1E1 | ------ | 9.2E-1 |

Table 5, cont.

Borehole #5, cont. — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 08 | 1,000 | 1.3E0 | 1.6E0 | 1.0E0 | ------ | ------ | 1.0E1 | ------ | ------- |
| 10 | 3,000 | 4.3E0 | 4.3E0 | 4.3E0 | ------ | ------ | 4.7E0 | ------ | 2.0E0 |
| 12 | 1,700 | 2.1E0 | 1.9E0 | 2.3E0 | ------ | ------ | 2.9E0 | 2.2E0 | ------- |
| 14 | 1,000 | 1.8E0 | 1.3E0 | 2.3E0 | ------ | ------ | 3.0E0 | ------ | ------- |
| 16 | 700 | 8.3E-1 | 6.0E-1 | 1.1E0 | ------ | ------ | 2.1E0 | ------ | ------- |
| 18 | 500 | 8.9E-1 | 6.8E-1 | 1.1E0 | ------ | ------ | 2.1E0 | ------ | ------- |

Borehole #6 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 2,000 | ------ | 7.3E0 | 8.3E0 | 6.4E0 | 7.4E0 | 9.4E0 | 1.2E1 | ------- |
| 02 | 2,000 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |
| 04 | 3,200 | 2.2E1 | 2.5E0 | 3.0E1 | .0E1 | 2.0E1 | ------ | 1.9E1 | ------- |
| 06 | 3,500 | ------ | 2.1E0 | 2.2E1 | 2.1E1 | 1.9E1 | ------ | 1.6E1 | ------- |
| 07 | 6,000 | 1.6E1 | 1.5E1 | 1.7E1 | 1.3E1 | 8.1E0 | ------ | ------ | ------- |
| 08 | 26,000 | 3.9E1 | 2.1E1 | 2.2E1 | 2.1E1 | 1.8E1 | ------ | 1.5E1 | ------- |
| 09 | >50,000 | ------ | 4.0E1 | 4.1E1 | 4.0E1 | 3.6E1 | ------ | ------ | ------- |
| 10 | 43,000 | ------ | 5.8E1 | 5.3E1 | 6.3E1 | 4.1E1 | ------ | 4.01E | ------- |
| 11 | >50,000 | ------ | 3.6E2 | 2.8E2 | 2.3E2 | 2.0E2 | ------ | 1.7E2 | ------- |
| 12 | 16,000 | 4.4E1 | 9.9E1 | 9.1E1 | 1.1E2 | 3.9E1 | ------ | 5.6E1 | ------- |
| 13 | 2,600 | ------ | 6.4E0 | 7.2E0 | 5.5E0 | 4.4E0 | 8.5E0 | ------ | ------- |
| 15 | 1,100 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |

Borehole #8 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 2,000 | ------ | 3.7E0 | 4.0E0 | 3.4E0 | 1.5E0 | 5.2E0 | ------ | 4.9E-1 |
| 02 | 1,500 | ------ | 1.4E0 | 1.5E0 | 1.3E0 | ------ | 6.5E0 | ------ | ------- |
| 04 | 1,100 | ------ | 1.1E0 | 1.2E0 | 9.2E-1 | ------ | 4.7E0 | ------ | ------- |
| 06 | 1,400 | ------ | 1.1E0 | 1.1E0 | 1.1E0 | ------ | 1.1E1 | ------ | 8.3E-1 |
| 08 | 1,400 | ------ | 1.1E0 | 1.1E0 | 1.1E0 | ------ | 1.1E1 | ------ | 8.E-1 |
| 10 | 1,500 | ------ | 1.2E0 | 1.2E0 | 1.1E0 | ------ | 1.1E1 | ------ | ------- |
| 12 | 1,400 | ------ | 1,2E0 | 1.1E0 | 1.3E0 | ------ | 1.3E1 | ------ | 7.E-1 |
| 14 | 1,600 | ------ | 1.1E0 | 1.1E0 | 1.1E0 | ------ | 1.5E1 | ------ | ------- |
| 16 | 1,000 | ------ | 1.1E0 | 1.3E0 | 8.2E-1 | ------ | 1.1E1 | ------ | ------- |
| 18 | 1,400 | ------ | 1.2E0 | 1.4E | 1.1E0 | ------ | 1.4E1 | ------ | 4.7E-1 |
| 20 | 1,700 | ------ | 1.8E0 | 2.0E0 | 1.6E0 | 1.1E0 | ------ | ------ | 8.4E-1 |

Table 5, cont.

Borehole #9 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 1,400 | ------ | 2.2E0 | 2.3E0 | 2.0E0 | ------ | ------ | ------ | 3.2E-1 |
| 02 | 22,000 | 4.6E1 | 5.6E1 | 5.6E1 | 5.5E1 | 3.5E1 | 1.1E1 | 3.1E1 | ------- |
| 03 | 11,000 | ------ | 5.4E0 | 4.2E0 | 6.5E0 | ------ | 1.2E1 | ------ | ------- |
| 04 | 2,000 | ------ | 1.3E0 | 1.3E0 | 1.4E0 | ------ | 9.3E0 | ------ | ------- |
| 06 | 600 | ------ | 7.0E-1 | 8.4E-1 | 5.6E-1 | ------ | 3.8E0 | ------ | ------- |
| 08 | 1,000 | ------ | 9.8E-1 | 7.8E-1 | 1.2E0 | ------ | 6.1E0 | ------ | ------- |
| 10 | 900 | ------ | 8.0E-1 | 9.5E-1 | 6.5E-1 | ------ | 5.E0 | 1.6E0 | ------- |
| 12 | 1,000 | ------ | 1.1E0 | 1.3E0 | 1.0E0 | ------ | 8.1E0 | ------ | 3.4E-1 |
| 14 | 700 | 2.7E0 | 7.7E1 | 8.3E-1 | 7.0E-1 | ------ | 4.9E0 | ------ | 5.0E-1 |
| 16 | 1,100 | ------ | 1.0E0 | 1.0E0 | 1.0E0 | ------ | ------ | ------ | 4.7E-1 |
| 18 | 1,300 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |
| 20 | 1,000 | 7.6E-1 | 1.1E0 | 1.2E0 | 9.8E-1 | ------ | 8.7E0 | ------ | ------- |
| 22 | 1,200 | ------ | 1.3E0 | 1.3E0 | 1.2E | ------ | 9.5E0 | ------ | 5.3E-1 |

Borehole #10 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 7,000 | ------ | 3.5E0 | 3.3E0 | 3.7E0 | 9.4E-1 | 3.6E0 | ------ | ------- |
| 01 | 35,000 | ------ | 1.4E1 | 9.2E0 | 1.8E1 | 4.4E0 | 3.6E0 | ------ | ------- |
| 02 | >50,000 | ------ | 4.2E2 | 3.7E2 | 4.8E2 | ------ | ------ | ------ | ------- |
| 03 | >50,000 | ------ | 4.8E2 | 4.4E2 | 5.2E2 | ------ | ------ | ------ | ------- |
| 04 | 35,000 | ------ | 2.5E1 | 1.8E1 | 3.E1 | ------ | ------ | ------ | ------- |
| 05 | 13,000 | ------ | 9.4E0 | 8.3E0 | 1.E1 | ------ | ------ | ------ | ------- |
| 06 | 4,500 | ------ | 1.2E1 | 1.4E1 | 1.0E1 | 3.9E0 | ------ | 5.0E0 | 3.1E-1 |
| 08 | 2,000 | ------ | 1.3E1 | 1.1E1 | 1.5E1 | ------ | ------ | ------ | 2.4E-1 |
| 10 | 1,800 | 7.3E1 | 1.2E2 | 1.3E2 | 1.0E2 | 7.0E1 | ------ | 4.5E1 | ------- |
| 12 | 2,000 | 1.2E1 | 1.6E1 | 1.8E1 | 1.3E1 | 1.1E1 | 4.2E0 | 1.1E1 | ------- |
| 14 | 500 | 4.9E0 | 5.1E0 | 6.1E0 | 4.0E0 | 2.7E0 | 3.0E0 | ------ | ------- |

Borehole #11 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | >50,000 | 8.4E1 | 6.6E1 | 1.0E2 | ------ | 2.2E1 | 5.6E0 | ------ | ------- |
| 01 | >50,000 | 3.6E3 | 2.9E3 | 4.4E3 | 7.7E2 | ------ | ------ | ------ | ------- |
| 02 | >50,000 | 1.3E4 | ------- | 1.3E4 | 2.9E3 | ------ | ------ | ------ | ------- |
| 03 | >50,000 | 1.7E3 | 1.1E3 | .2E3 | ------ | ------ | ------ | ------ | ------- |
| 04 | 30,000 | 7.0E0 | 5.3E0 | 8.6E0 | ------ | ------ | ------ | ------ | ------- |
| 05 | 22,000 | 4.9E0 | 4.6E0 | 5.2E0 | ------ | 3.6E0 | 1.3E1 | 7.1E0 | 7.4E0 |

Table 5, cont.

Borehole #11, cont. — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | Ra-226 | Pb-214 | Bi-214 | U-238 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 06 | 20,000 | 7.1E0 | 7.4E0 | 6.7E0 | ------ | 4.6E0 | 1.5E1 | ------ | ------- |
| 07 | 20,000 | 8.3E0 | 8.8E0 | 7.8E0 | ------ | ------ | 1.1E1 | ------ | |
| 08 | 20,000 | 1.3E1 | 1.5E1 | 1.2E1 | ------ | 2.0E1 | 1.0E1 | 5.8E0 | ------- |
| 09 | 20,000 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |

Borehole #16 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 02 | 6,000 | 1.3E1 | 1.4E1 | 1.6E1 | 1.1E1 | 4.3E0 | 6.2E0 | 6.1E0 | ------- |
| 03 | 9,000 | ------ | 1.8E1 | 2.2E1 | 1.5E1 | 6.9E0 | 7.9E0 | 8.8E0 | ------- |
| 04 | 33,000 | 2.8E1 | 5.0E1 | 5.9E1 | 4.2E1 | 2.0E1 | 5.0E0 | 1.6E1 | ------- |
| 05 | 48,000 | 6.5E1 | 1.1E2 | 1.3E2 | 9.8E1 | 5.6E1 | 1.0E1 | 3.7E1 | ------- |
| 06 | 35,000 | ------ | 1.2E2 | 1.4E2 | 1.0E2 | 7.8E1 | 6.7E0 | 4.3E1 | ------- |
| 07 | 9,000 | ------ | 4.8E1 | 5.5E1 | 3.1E1 | 3.1E1 | ------ | 2.0E1 | 8.2E-1 |
| 08 | 6,000 | 1.2E1 | 1.4E1 | 1.5E1 | 1.2E1 | 4.8E0 | 3.7E0 | ------ | ------- |
| 09 | 15,000 | ------ | 1.5E1 | 1.7E1 | 1.3E1 | 7.0E0 | 4.1E0 | 5.5E0 | ------- |
| 10 | 35,000 | ------ | 5.8E1 | 6.6E1 | 5.0E1 | 7.5E1 | 2.3E0 | 2.5E1 | ------- |
| 11 | >50,000 | 1.7E2 | 3.8E2 | 4.5E2 | 3.1E2 | 1.7E2 | ------ | 1.4E2 | 8.5E-1 |
| 12 | >50,000 | 1.9E2 | 5.1E2 | 6.0E2 | 4.8E2 | 3.0E2 | ------ | 1.4E2 | 2.8E0 |
| 13 | >50,000 | 1.2E2 | 2.4E2 | 2.4E2 | 2.4E2 | 7.2E1 | ------ | 2.6E1 | ------- |
| 14 | >50,000 | 3.3E2 | 5.4E2 | 4.7E2 | 6.0E | 2.4E2 | ------ | 4.0E2 | ------- |
| 15 | >50,000 | ------ | 9.2E3 | 6.9E3 | 1.1E4 | ------ | ------ | ------ | ------- |
| 16 | >50,000 | ------ | 7.7E3 | 6.1E3 | 9.2E3 | ------ | ------ | ------ | ------- |
| 17 | 37,000 | ------ | 8.2E1 | 8.1E1 | 8.3E1 | 1.6E1 | 5.7E0 | 2.6E1 | ------- |
| 18 | 8,000 | ------ | 2.9E1 | 3.0E1 | 2.7E1 | 6.1E0 | ------ | 1.5E1 | ------- |
| 19 | 6,000 | 1.3E1 | 3.4E1 | 4.2E1 | 2.6E1 | 1.5E2 | ------ | 1.9E1 | ------- |

Borehole #17 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 700 | ------ | 1.2E0 | 1.1E0 | 1.2E0 | ------ | 4.4E0 | ------ | ------- |
| 02 | 600 | ------ | 5.4E-1 | 5.3E-1 | 5.4E-1 | ------ | 2.3E0 | ------ | 1.3E-1 |
| 04 | 300 | ------ | 3.3E-1 | 3.7E-1 | 2.9E-1 | ------ | 1.8E0 | ------ | 1.8E-1 |
| 06 | 250 | ------ | 2.6E-1 | 2.4E-1 | 2.7E-1 | ------ | 1.9E0 | ------ | ------- |
| 08 | 300 | ------ | 2.4E-1 | 2.9E-1 | 1.9E-1 | ------ | ------ | ------ | ------- |
| 10 | 300 | ------ | 2.9E-1 | 3.6E-1 | 2.2E-1 | ------ | 2.0E0 | ------ | ------- |
| 12 | 400 | ------ | 2.7E-1 | ------ | 2.7E-1 | ------ | 3.0E0 | ------ | 2.1E-1 |
| 14 | 700 | ------ | 5.9E-1 | 5.3E-1 | 6.5E-1 | ------ | 4.7E0 | ------ | 6.5E-1 |

Table 5, cont.

Borehole #17, cont. — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 16 | 1,500 | ------ | 1.2E0 | ------ | 1.2E0 | ------ | 1.E1 | ------ | ------- |
| 18 | 800 | ------ | 1.5E0 | 1.5E0 | 1.4E0 | ------ | 5.3E0 | ------ | ------- |
| 20 | 3,000 | ------ | 8.5E0 | 9.0E0 | 8.0E0 | 2.9E0 | 6.5E0 | ------ | ------- |
| 22 | 1,000 | ------ | 1.6E0 | 1.7E0 | 1.5E0 | ------ | 4.3E0 | ------ | ------- |

Borehole #18 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 1,000 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |
| 02 | 1,500 | ------ | 1.3E0 | 1.3E0 | 1.2E0 | 7.2E-1 | 7.8E0 | ------ | ------- |
| 04 | 1,100 | ------ | 9.3E-1 | 1.0E0 | 8.3E-1 | ------ | ------ | ------ | ------- |
| 06 | 1,000 | ------ | 9.9E-1 | 1.1E0 | 8.8E-1 | ------ | 6.90E | ------ | ------- |
| 08 | 600 | ------ | 4.1E-1 | 3.3E-1 | 4.8E-1 | ------ | 2.5E0 | ------ | ------- |
| 10 | 600 | ------ | 5.7E-1 | 6.5E-1 | 4.9E-1 | ------ | 2.5E0 | ------ | ------- |
| 12 | 1,100 | ------ | 7.7E-1 | 9.4E-1 | 6.1E-1 | ------ | ------ | ------ | ------- |
| 14 | 1,000 | ------ | 6.7E-1 | 7.2E-1 | 6.1E-1 | ------ | ------ | ------ | ------- |
| 16 | 1,000 | ------ | 7.6E-1 | 1.0E0 | 5.0E-1 | ------ | ------ | ------ | 4.8E-1 |
| 18 | 1,200 | ------ | ------- | ------ | ------ | ------ | ------ | ------ | ------- |

Borehole #19 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 1,000 | ------ | 1.3E0 | 1.4E0 | 1.3E0 | ------ | 1.6E0 | ------ | ------- |
| 02 | 1,700 | ------ | 3.9E0 | 4.3E0 | 3.4E0 | 2.1E0 | 4.4E0 | ------ | 4.1E-1 |
| 04 | 2,100 | ------ | 3.9E0 | 4.2E0 | 3.5E0 | ------ | 1.4E1 | ------ | 8.1E-1 |
| 06 | 4,400 | ------ | 6.0E0 | 6.3E0 | 5.8E0 | 2.3E0 | 1.0E1 | ------ | 8.6E-1 |
| 07 | 28,000 | 3.3E1 | 3.7E1 | 3.5E1 | 3.9E1 | 2.2E1 | 1.3E1 | 2.5E1 | ------- |
| 08 | >50,000 | 4.2E1 | 3.4E2 | 3.4E2 | 3.4E2 | 2.3E2 | 7.5E0 | 2.3E2 | ------- |
| 09 | 17,000 | 2.7E1 | 1.9E1 | 1.7E1 | 2.2E1 | 5.3E0 | ------ | 1.3E1 | ------- |
| 10 | 4,600 | ------ | 4.2E0 | 3.9E0 | 4.4E0 | ------ | 6.1E0 | ------ | ------- |
| 12 | 1,000 | ------ | 6.5E-1 | 6.0E-1 | 7.0E-1 | ------ | 4.9E0 | ------ | ------- |
| 14 | 600 | ------ | 8.6E-1 | 1.1E0 | 6.4E-1 | ------ | ------ | ------ | 2.1E-1 |
| 16 | 500 | ------ | 6.4E-1 | 7.1E-1 | 5.7E-1 | ------ | 2.4E0 | ------ | ------- |

Table 5, cont.

Borehole #20 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 10,000 | ------ | 8.9E0 | 3.8E0 | 1.4E1 | 6.9E0 | 6.8E0 | ------ | ------- |
| 01 | 23,000 | ------ | 7.2E1 | 6.8E1 | 7.6E1 | 4.3E1 | 1.0E1 | 3.9E1 | ------- |
| 02 | 9,000 | ------ | 1.4E1 | 9.9E0 | 1.7E1 | 2.9E0 | 8.2E0 | 1.7E1 | ------- |
| 03 | 2,200 | ------ | 2.7E0 | ------ | 2.7E0 | ------ | 6.0E0 | ------ | ------- |
| 05 | 900 | ------ | 1.3E0 | 1.4E0 | 1.1E0 | ------ | ------ | ------ | ------- |
| 07 | 700 | ------ | 1.2E0 | 1.2E0 | 1.1E0 | ------ | 9.9E0 | ------ | ------- |
| 09 | 1,000 | ------ | 1.5E0 | 2.0E0 | 1.0E0 | ------ | 1.5E1 | ------ | ------- |
| 11 | 1,600 | ------ | 1.9E0 | 1.9E0 | 1.8E0 | ------ | 2.7E1 | ------ | 1.3E0 |
| 13 | 1,200 | ------ | 1.2E0 | 1.3E0 | ------ | ------ | ------ | ------ | 1.2E0 |
| 15 | 1,100 | ------ | 1.2E0 | 1.3E0 | 1.1E0 | ------ | 1.8E0 | ------ | 6.6E-1 |
| 17 | 500 | ------ | 7.0E-1 | 7.7E-1 | 6.4E-1 | ------ | ------ | ------ | 3.6E-1 |

Borehole #21 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 14,000 | 2.1E1 | 3.4E1 | 4.2E1 | 2.7E1 | ------ | ------ | ------ | ------- |
| 01 | 13,000 | ------ | 1.3E1 | 1.3E1 | 1.2E1 | 3.2E0 | 1.8E0 | ------ | ------- |
| 02 | 1,300 | ------ | 1.2E0 | 9.5E-1 | 1.4E0 | ------ | 2.1E0 | ------ | ------- |
| 03 | 1,300 | ------ | 1.3E0 | 1.3E0 | 1.3E0 | ------ | ------ | ------ | ------- |
| 04 | 7,000 | ------ | 5.4E0 | 5.2E0 | 5.6E0 | ------ | ------ | ------ | ------- |
| 05 | 46,000 | 1.8E1 | 6.2E1 | 6.0E1 | 6.4E1 | 3.2E1 | 9.2E0 | 2.1E1 | ------- |
| 06 | >50,000 | 1.7E1 | 6.6E2 | 5.4E2 | 7.8E2 | ------ | ------ | 3.3E2 | ------- |
| 07 | >50,000 | 4.5E2 | 3.2E3 | 2.8E3 | 3.7E3 | 8.3E2 | ------ | 1.5E3 | ------- |
| 08 | >50,000 | 3.2E1 | 7.3E1 | 6.7E1 | 7.9E1 | 2.9E1 | ------ | 3.2E1 | ------- |
| 09 | 32,000 | ------ | 3.6E1 | 3.6E1 | 3.5E1 | 9.3E0 | 8.2E0 | 1.2E1 | ------- |
| 10 | 9,000 | ------ | 2.2E1 | 2.8E1 | 2.0E1 | 1.9E0 | 5.6E0 | ------ | ------- |
| 11 | 4,300 | ------ | 1.5E1 | 1.7E1 | 1.2E1 | ------ | 3.3E0 | ------ | ------- |
| 12 | 6,000 | ------ | 5.8E0 | 6.2E0 | 5.4E0 | ------ | 5.9E0 | ------ | ------- |
| 13 | 7,000 | ------ | 8.1E0 | 8.8E0 | 7.3E0 | 3.8E0 | 1.1E1 | ------ | 8.5E-1 |
| 14 | 7,000 | ------ | 1.3E1 | 1.5E1 | 1.1E1 | 6.1E0 | 1.1E1 | ------ | ------- |
| 15 | 10,000 | 5.6E0 | 1.1E1 | 1.3E1 | 9.4E0 | 5.3E0 | 9.4E0 | 5.1E0 | 6.7E-1 |
| 16 | 8,000 | ------ | 6.5E0 | 7.2E0 | 5.7E0 | 3.2E0 | 4.4E0 | ------ | ------- |
| 17 | ,000 | ------ | 6.1E0 | 7.1E0 | 5.2E0 | 3.7E0 | 3.1E0 | ------ | ------- |
| 18 | 3,500 | 5.6E0 | 5.7E6 | 6.4E0 | 4.4E9 | 2.7E0 | 3.0E0 | ------ | ------- |
| 20 | 3,000 | ------ | 6.9E0 | 8.3E0 | 5.5E0 | 4.4E0 | ------ | ------ | ------- |

Table 5, cont.

Borehole #22 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 10,000 | ------ | 2.4E1 | 2.7E1 | 2.1E1 | 1.6E1 | 2.7E0 | ------ | ------- |
| 01 | 13,000 | 2.0E1 | 3.2E1 | 3.8E1 | 2.5E1 | 1.5E1 | 5.9E0 | 1.7E1 | 5.6E-1 |
| 02 | 11,000 | 1.9E1 | 2.8E1 | 3.2E1 | 2.5E1 | 1.6E1 | 4.1E0 | 1.5E1 | ------- |
| 03 | 4,300 | ------ | 5.6E0 | 6.3E0 | 4.9E0 | 2.2E0 | 4.1E0 | ------ | 6.7E-1 |
| 04 | 5,500 | ------ | 1.1E1 | 1.2E1 | 8.8E0 | 5.9E0 | 6.5E0 | ------ | ------- |
| 06 | 4,500 | ------ | 8.1E0 | 9.4E0 | 6.7E0 | 5.4E0 | 3.8E0 | 5.7E0 | 3.6E-1 |
| 07 | 5,000 | 9.4E0 | 8.9E0 | 1.0E1 | 7.3E0 | 5.4E0 | 6.3E0 | ------ | 7.0E-1 |
| 08 | 5,000 | 1.0E1 | 1.0E1 | 1.3E1 | 8.4E0 | 7.1E0 | 3.7E0 | 6.6E0 | ------- |
| 10 | 4,300 | ------ | 1.5E1 | 1.8E1 | 1.2E1 | 7.3E0 | 2.8E0 | 5.E0 | ------- |
| 12 | 7,000 | ------ | 1.4E1 | 1.7E1 | 1.1E1 | ------ | 4.1E0 | ------ | ------- |
| 13 | 4,000 | 1.5E1 | 1.4E1 | 1.6E1 | 1.1E1 | 6.9E0 | 2.9E0 | 6.1E0 | ------- |
| 14 | 7,000 | 9.1E0 | 1.3E1 | 1.6E1 | 1.1E1 | 4.7E0 | 4.8E0 | ------ | ------- |
| 15 | 9,000 | ------ | 2.3E1 | 2.9E1 | 1.7E1 | 1.3E1 | 3.7E0 | 1.0E1 | ------- |
| 16 | 8,000 | ------ | 2.3E1 | 2.8E1 | 1.9E1 | 1.6E1 | 2.0E0 | 1.1E1 | ------- |
| 17 | 3,500 | 7.3E0 | 7.4E0 | 8.3E0 | 6.4E0 | 5.0E0 | 2.3E0 | ------ | ------- |
| 18 | 7,000 | 1.8E1 | 1.8E1 | 2.0E1 | 1.5E1 | 6.1E0 | ------ | ------ | ------- |
| 19 | 9,000 | ------ | 1.7E1 | 2.0E1 | 1.4E1 | 1.2E1 | 3.8E0 | ------ | ------- |
| 20 | 13,000 | ------ | 3.5E1 | 4.0E1 | 3.0E1 | 2.5E1 | 3.7E0 | 1.5E1 | ------- |
| 21 | 10,000 | ------ | 1.1E1 | 1.1E1 | 1.1E1 | 3.5E0 | 3.6E0 | ------ | ------- |
| 22 | 24,000 | ------ | 1.9E1 | 1.6E1 | 2.1E1 | 4.1E0 | 4.3E0 | 6.3E0 | ------- |
| 23 | >50,000 | ------ | 5.8E3 | 5.8E3 | 5.8E3 | 3.0E2 | ------ | 2.6E2 | ------- |
| 24 | >50,000 | ------ | 7.0E2 | 6.4E2 | 7.5E2 | 2.9E2 | ------ | 3.3E2 | ------- |
| 25 | >50,000 | ------ | 6.4E2 | 6.4E2 | 6.4E2 | 3.6E2 | ------ | 3.4E2 | ------- |

Borehole #31 — Radionuclide Concentrations [pCi/g]

| Depth | Gross NaI | U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 1,200 | ------ | 6.5E-1 | 5.6E-1 | 7.4E-1 | ------ | 7.8E0 | ------ | 5.6E-1 |
| 02 | 900 | ------ | 5.6E-1 | 5.9E-1 | 5.3E-1 | ------ | ------ | ------ | 4.5E-1 |
| 04 | 1,500 | ------ | 9.1E-1 | 9.3E-1 | 8.9E-1 | ------ | 6.5E0 | 1.7E0 | ------- |
| 06 | 1,000 | ------ | 6.3E-1 | 6.4E-1 | 6.3E-1 | ------ | 6.1E0 | ------ | ------- |
| 08 | 800 | ------ | 5.1E-1 | 4.5E-1 | 5.7E-1 | ------ | ------ | ------ | ------- |
| 10 | 800 | ------ | 4.9E-1 | 5.2E-1 | 4.5E-1 | ------ | ------ | ------ | 3.8E-1 |
| 12 | 1,500 | ------ | 3.7E-1 | 3.7E-1 | ------ | ------ | 3.7E0 | ------ | ------- |
| 14 | 1,100 | ------ | 7.1E-1 | ------ | 7.1E-1 | ------ | 1.3E1 | ------ | ------- |
| 16 | 1,000 | ------ | 5.1E-1 | ------ | 5.1E-1 | ------ | 4.0E0 | ------ | 3.1E-1 |
| 18 | 1,500 | 8.5E-1 | 8.1E-1 | 8.6E-1 | 7.7E-1 | ------ | 8.1E0 | ------ | 8.0E-1 |

Table 5, cont.

Borehole #31, cont.

| Depth | Gross NaI | Radionuclide Concentrations [pCi/g] U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 600 | ------ | 4.9E-1 | 4.8E-1 | 5.0E-1 | ------ | ------ | ------ | 6.2E-1 |
| 22 | 1,300 | ------ | 7.1E-1 | 8.4E-1 | 5.9E-1 | ------ | ------ | ------ | ------- |
| 24 | 1,300 | ------ | 1.1E0 | 1.1E-1 | 1.0E0 | ------ | 6.2E0 | ------ | ------- |

Borehole #32

| Depth | Gross NaI | Radionuclide Concentrations [pCi/g] U-238 | Pb-214 | Bi-214 | Ra-226 | Ra-223 | K-40 | Pb-211 | Pb-212 |
|---|---|---|---|---|---|---|---|---|---|
| 00 | 16,000 | ------ | 8.3E0 | 6.5E0 | 1.0E1 | 2.0E0 | 2.2E0 | ------ | ------- |
| 01 | >50,000 | ------ | 1.5E2 | 1.4E2 | 1.6E2 | 1.1E2 | ------ | 6.9E1 | ------- |
| 02 | 17,000 | ------ | 4.9E1 | 4.1E1 | 5.7E1 | 2.0E1 | 3.9E0 | 1.9E1 | ------- |
| 03 | 5,000 | ------ | 3.1E0 | 2.1E0 | 4.2E0 | ------ | ------ | ------ | ------- |
| 04 | 1,300 | ------ | 3.1E0 | 2.1E0 | 4.2E0 | ------ | ------ | ------ | ------- |
| 06 | 1,700 | ------ | 1.7E0 | 1.9E0 | 1.4E0 | ------ | ------ | ------ | 3.1E-1 |
| 08 | 1,700 | ------ | 1.9E0 | 2.2E0 | 1.6E0 | ------ | 8.2E0 | ------ | 3.8E-1 |
| 10 | 1,700 | ------ | 1.8E0 | 2.0E0 | 1.5E0 | ------ | 1.2E1 | ------ | ------- |
| 12 | 1,600 | ------ | 1.6E0 | 1.7E0 | 1.5E0 | ------ | 1.2E1 | ------ | 6.0E-1 |
| 14 | 1,600 | ------ | 2.6E0 | 2.7E0 | 2.4E0 | ------ | ------ | ------ | ------- |
| 16 | 1,800 | ------ | 1.7E0 | 1.5E0 | 1.9E0 | ------ | ------ | ------ | 7.1E-1 |
| 18 | 1,900 | ------ | 9.3E-1 | 8.7E-1 | 9.9E-1 | ------ | 1.4E1 | ------ | 8.5E-1 |

Auger Hole NaI (Tl) Counts

Table 5, cont.

| Borehole #2 Depth | Borehole #2 NaI CPM | Borehole #7 Depth | Borehole #7 NaI CPM | Borehole #12 Depth | Borehole #12 NaI CPM |
|---|---|---|---|---|---|
| ft | | ft | | ft | |
| 00 | 700 | 00 | >50,000 | 00 | 1,000 |
| 01 | 1,300 | 01 | >50,000 | 01 | 1,500 |
| 02 | 1,000 | 02 | >50,000 | 02 | 1,300 |
| 03 | 1,000 | 03 | 23,000 | 03 | 2,000 |
| 04 | 1,400 | 04 | 7,000 | 04 | 3,000 |
| 05 | 1,000 | 05 | 3,600 | 05 | 3,500 |
| 06 | 1,400 | 06 | 1,300 | 06 | 1,500 |
| 07 | 1,400 | 07 | 1,000 | 07 | 1,000 |
| 08 | 1,300 | 08 | 1,000 | 08 | 800 |
| 09 | 1,200 | 09 | 1,100 | 09 | 700 |
| 10 | 1,000 | 10 | 1,000 | 10 | 700 |
| 11 | 700 | 11 | 1,100 | 11 | 500 |
| 12 | 800 | 12 | 1,200 | 12 | 500 |
| 13 | 800 | 13 | 1,400 | 13 | 350 |
| 14 | 1,200 | 14 | 1,200 | 14 | 350 |
| 15 | 3,500 | 15 | 1,200 | 15 | 500 |
| 16 | 11,000 | 16 | 1,400 | 16 | 350 |
| 17 | 2,500 | 17 | 1,500 | 17 | 900 |
| 18 | 1,400 | 18 | 1,700 | 18 | 900 |
| 19 | 1,000 | 19 | 1,700 | 19 | 1,000 |
| 20 | 1,000 | 20 | 4,000 | 20 | 1,500 |
| 21 | 800 | 21 | 2,200 | 21 | 1,500 |
| 22 | 1,000 | 22 | 2,000 | 22 | 1,300 |
| 23 | 800 | -- | ----- | 23 | 500 |
| 24 | 800 | -- | ----- | 24 | 600 |
| 25 | 800 | -- | ----- | -- | ----- |
| 26 | 1,500 | -- | ----- | -- | ----- |
| 26 | 1,500 | -- | ----- | -- | ----- |
| 27 | 1,000 | -- | ----- | -- | ----- |
| 28 | 800 | -- | ----- | -- | ----- |
| 29 | 600 | -- | ----- | -- | ----- |
| 30 | 600 | -- | ----- | -- | ----- |
| 31 | 500 | -- | ----- | -- | ----- |
| 32 | 700 | -- | ----- | -- | ----- |
| 33 | 1,000 | -- | ----- | -- | ----- |
| 34 | 1,000 | -- | ----- | -- | ----- |
| 35 | 1,000 | -- | ----- | -- | ----- |

| Borehole #13 | | Borehole #23 | | Borehole #24 | |
|---|---|---|---|---|---|
| 00 | 900 | 00 | 1,100 | -- | ----- |
| 01 | 1,300 | 01 | 1,100 | 01 | 1,200 |
| 02 | 800 | 02 | 700 | 02 | 2,000 |
| 03 | 600 | 03 | 1,200 | 03 | 1,600 |
| 04 | 700 | 04 | 1,300 | 04 | 1,800 |
| 05 | 400 | 05 | 900 | 05 | 1,600 |
| 06 | 500 | 06 | 600 | 06 | 1,500 |

Table 5, cont.

| Borehole #13 | | Borehole #23 | | Borehole #24 | |
|---|---|---|---|---|---|
| Depth | NaI CPM | Depth | NaI CPM | Depth | NaI CPM |
| ft | | ft | | ft | |
| 07 | 400 | 07 | 400 | 07 | 1,000 |
| 08 | 700 | 08 | 300 | 08 | 1,000 |
| 09 | 1,000 | 09 | 300 | 09 | 300 |
| 10 | 900 | 10 | 300 | 10 | 700 |
| 11 | 600 | 11 | 400 | 11 | 1,000 |
| 12 | 600 | 12 | 400 | 12 | 1,800 |
| 13 | 900 | 13 | 500 | 13 | 1,200 |
| 14 | 600 | 14 | 600 | 14 | 1,500 |
| 15 | 500 | 15 | 600 | 15 | 700 |
| 16 | 600 | 16 | 400 | 16 | 600 |
| 17 | 700 | 17 | 500 | 17 | 500 |
| 18 | 1,000 | 18 | 700 | 18 | 1,000 |
| 19 | 800 | 19 | 600 | 19 | 900 |
| 20 | 900 | 20 | 600 | 20 | 1,200 |
| 21 | 800 | 21 | 500 | 21 | 1,500 |
| 22 | 800 | 22 | 400 | 22 | 800 |
| 23 | 700 | -- | ----- | 23 | 500 |
| 24 | 900 | -- | ----- | 24 | 500 |

| Borehole #25 | | Borehole #26 | | Borehole #27 | |
|---|---|---|---|---|---|
| 00 | 1,200 | -- | ----- | -- | ----- |
| 01 | 1,900 | 01 | 1,600 | 01 | 1,300 |
| 02 | 1,800 | 02 | 2,500 | 02 | 1,800 |
| 03 | 2,600 | 03 | 2,600 | 03 | 1,200 |
| 04 | 2,400 | 04 | 3,500 | 04 | 1,200 |
| 05 | 2,200 | 05 | 19,000 | 05 | 1,300 |
| 06 | 12,000 | 06 | 10,000 | 06 | 600 |
| 07 | 19,000 | 07 | 2,100 | 07 | 700 |
| 08 | 5,000 | 08 | 1,300 | 08 | 300 |
| 09 | 1,900 | 09 | 800 | 09 | 300 |
| 10 | 1,700 | 10 | 500 | 10 | 600 |
| 11 | 800 | 11 | 500 | 11 | 700 |
| 12 | 1,100 | 12 | 500 | 12 | 700 |
| 13 | 800 | 13 | 600 | 13 | 600 |
| 14 | 500 | 14 | 500 | 14 | 1,000 |
| 15 | 700 | 15 | 600 | 15 | 1,300 |
| 16 | 800 | 16 | 1,100 | 16 | 800 |
| 17 | 500 | 17 | 800 | 17 | 900 |
| 18 | 500 | 18 | 600 | 18 | 500 |
| 19 | 700 | 19 | 900 | 19 | 400 |
| 20 | 400 | 20 | 1,200 | 20 | 500 |
| 21 | 400 | 21 | 1,000 | 21 | 500 |
| 22 | 400 | 22 | 1,200 | 22 | 700 |
| 23 | 400 | 23 | 900 | 23 | 1,000 |
| 24 | 900 | 24 | 600 | 24 | 1,000 |
| 25 | 1,000 | 25 | 500 | -- | ----- |
| 26 | 600 | 26 | 800 | -- | ----- |

Table 5, cont.

| Borehole #25 | | Borehole #26 | | Borehole #27 | |
|---|---|---|---|---|---|
| Depth | NaI CPM | Depth | NaI CPM | Depth | NaI CPM |
| ft | | ft | | | |
| 27 | 400 | 27 | 500 | -- | ----- |
| 28 | 500 | 28 | 500 | -- | ----- |
| 29 | 600 | 29 | 600 | -- | ----- |
| 30 | 700 | 30 | 500 | -- | ----- |
| 31 | 700 | 31 | 600 | -- | ----- |
| 32 | 1,000 | 32 | 700 | -- | ----- |
| 33 | 1,700 | 33 | 900 | -- | ----- |
| 34 | 1,100 | 34 | 600 | -- | ----- |
| 35 | 1,000 | 35 | 800 | -- | ----- |
| 36 | 1,600 | 36 | 1,500 | -- | ----- |
| 37 | 1,700 | 37 | 1,500 | -- | ----- |
| 38 | 1,100 | 38 | 1,000 | -- | ----- |
| -- | ----- | 39 | 1,000 | -- | ----- |

| Borehole #28 | | Borehole #29 | | Borehole #30 | |
|---|---|---|---|---|---|
| 01 | 1,600 | 01 | 1,300 | 01 | 600 |
| 02 | 1,200 | 02 | 1,300 | 02 | 600 |
| 03 | 600 | 03 | 1,300 | 03 | 800 |
| 04 | 700 | 04 | 1,000 | 04 | 300 |
| 05 | 1,000 | 05 | 800 | 05 | 500 |
| 06 | 1,500 | 06 | 1,200 | 06 | 400 |
| 07 | 1,400 | 07 | 1,800 | 07 | 500 |
| 08 | 1,100 | 08 | 1,400 | 08 | 300 |
| 09 | 1,400 | 09 | 2,000 | 09 | 600 |
| 10 | 1,800 | 10 | 2,000 | 10 | 1,100 |
| 11 | 1,900 | 11 | 1,200 | 11 | 600 |
| 12 | 2,800 | 12 | 1,200 | 12 | 800 |
| 13 | 2,900 | 13 | 1,500 | 13 | 700 |
| 14 | 9,000 | 14 | 1,700 | 14 | 1,000 |
| 15 | 32,000 | 15 | 1,300 | 15 | 1,200 |
| 16 | 4,200 | 16 | 600 | 16 | 800 |
| 17 | 2,000 | 17 | 500 | 17 | 300 |
| 18 | 1,600 | 18 | 500 | 18 | 250 |
| 19 | 1,200 | 19 | 600 | 19 | 400 |
| 20 | 1,300 | 20 | 700 | 20 | 500 |
| 21 | 1,100 | 21 | 600 | 21 | 700 |
| 22 | 500 | 22 | 600 | 22 | 600 |
| 23 | 500 | 23 | 500 | 23 | 500 |
| -- | ----- | -- | ----- | 24 | 400 |
| -- | ----- | -- | ----- | 25 | 600 |
| -- | ----- | -- | ----- | 26 | 1,200 |
| -- | ----- | -- | ----- | 27 | 500 |
| -- | ----- | -- | ----- | 28 | 300 |
| -- | ----- | -- | ----- | 29 | 300 |
| -- | ----- | -- | ----- | 30 | 600 |
| -- | ----- | -- | ----- | 31 | 500 |
| -- | ----- | -- | ----- | 32 | 400 |
| -- | ----- | -- | ----- | 33 | 400 |

Table 5, cont.

| Borehole #33 | | Borehole #34 | | Borehole #35 | |
|---|---|---|---|---|---|
| Depth | NaI CPM | Depth | NaI CPM | Depth | NaI CPM |
| ft | | ft | | ft | |
| 01 | 1,900 | 01 | 2,600 | 01 | 10,000 |
| 02 | 1,200 | 02 | 1,300 | 02 | 38,000 |
| 03 | 800 | 03 | 1,400 | 03 | >50,000 |
| 04 | 700 | 04 | 1,000 | 04 | >50,000 |
| 05 | 600 | 05 | 1,500 | 05 | 22,000 |
| 06 | 1,000 | 06 | 1,500 | 06 | 22,000 |
| 07 | 1,000 | 07 | 1,000 | 07 | 1,500 |
| 08 | 800 | 08 | 400 | 08 | 1,500 |
| 09 | 800 | 09 | 300 | 09 | 800 |
| 10 | 500 | 10 | 400 | 10 | 700 |
| 11 | 500 | 11 | 500 | 11 | 700 |
| 12 | 400 | 12 | 800 | 12 | 600 |
| 13 | 300 | 13 | 700 | 13 | 00 |
| 14 | 00 | 14 | 500 | 14 | 1,100 |
| 15 | 400 | 15 | 600 | 15 | 1,400 |
| 16 | 500 | 16 | 900 | 16 | 1,400 |
| 17 | 900 | 17 | 600 | 17 | 800 |
| 18 | 900 | 18 | 700 | 18 | 700 |
| 19 | 1,000 | 19 | 1,300 | 19 | 600 |
| 20 | 1,100 | 20 | 800 | 20 | 600 |
| 21 | 800 | 21 | 400 | 21 | 600 |
| 22 | 800 | 22 | 300 | 22 | 700 |
| -- | ----- | 23 | 300 | -- | ----- |

| Borehole #36 | | Borehole #37 | | Borehole #38 | |
|---|---|---|---|---|---|
| 01 | 1,200 | 01 | 1,500 | 01 | 7.000 |
| 02 | 700 | 02 | 1,400 | 02 | 7,000 |
| 03 | 900 | 03 | 1,100 | 03 | 8,000 |
| 04 | 1,600 | 04 | 1,100 | 04 | 12,000 |
| 05 | 1,800 | 05 | 1,200 | 05 | 22,000 |
| 06 | 2,500 | 06 | 1,500 | 06 | >50,000 |
| 07 | 5,000 | 07 | 1,700 | 07 | >50,000 |
| 08 | 1,700 | 08 | 800 | 08 | >50,000 |
| 09 | 1,000 | 09 | 800 | 09 | >50,000 |
| 10 | 800 | 10 | 800 | 10 | >50,000 |
| 11 | 900 | 11 | 1,000 | 11 | >50,000 |
| 12 | 700 | 12 | 1,600 | 12 | 21,000 |
| 13 | 700 | 13 | 1,400 | 13 | 7,000 |
| 14 | 800 | 14 | 1,500 | 14 | 5,000 |
| 15 | 500 | 15 | 1,700 | 15 | 1,600 |
| 16 | 500 | 16 | 1,900 | 16 | 1,000 |
| 17 | 600 | 17 | 1,800 | 17 | 1,000 |
| 18 | 900 | 18 | 1,400 | 18 | 600 |
| 19 | 800 | 19 | 900 | 19 | 800 |
| 20 | 700 | 20 | 1,000 | 20 | 600 |
| 21 | 600 | 21 | 1,500 | 21 | 400 |
| -- | ----- | 22 | 600 | 22 | 700 |
| -- | ----- | 23 | 600 | 23 | 1,000 |
| -- | ----- | 24 | 500 | -- | ----- |

Table 5, cont.

| Borehole #39 | | Borehole #40 | | Borehole #41 | |
|---|---|---|---|---|---|
| Depth | NaI CPM | Depth | NaI CPM | Depth | NaI CPM |
| ft | | ft | | ft | |
| 01 | 3,000 | 01 | 7,000 | 01 | 1,400 |
| 02 | 11,000 | 02 | 26,000 | 02 | 1,400 |
| 03 | 4,000 | 03 | 6,000 | 03 | 1,200 |
| 04 | 1,900 | 04 | 2,100 | 04 | 1,500 |
| 05 | 1,000 | 05 | 1,600 | 05 | 1,900 |
| 06 | 1,500 | 06 | 1,900 | 06 | 1,200 |
| 07 | 1,000 | 07 | 3,500 | 07 | 700 |
| 08 | 700 | 08 | 5,000 | 08 | 600 |
| 09 | 500 | 09 | 3,200 | 09 | 700 |
| 10 | 500 | 10 | 1,500 | 10 | 1,000 |
| 11 | 400 | 11 | 800 | 11 | 1,000 |
| 12 | 500 | 12 | 1,200 | 12 | 1,300 |
| 13 | 400 | 13 | 1,500 | 13 | 1,000 |
| 14 | 800 | 14 | 1,500 | 14 | 600 |
| 15 | 1,200 | 15 | 1,300 | 15 | 600 |
| 16 | 1,300 | 16 | 1,000 | 16 | 600 |
| 17 | 900 | 17 | 800 | 17 | 500 |
| 18 | 600 | 18 | 600 | 18 | 500 |
| 19 | 700 | 19 | 1,200 | 19 | 200 |
| 20 | 1,000 | 20 | 1,200 | 20 | 200 |
| -- | ----- | 21 | 1,300 | 21 | 300 |
| -- | ----- | 22 | 1,300 | 22 | 300 |
| -- | ----- | -- | ----- | 23 | 300 |
| -- | ----- | -- | ----- | 24 | 500 |

Table 6

## Water Sample Analysis Results

| Sample No. | Date | Location | Gross Alpha | | Gross Beta | |
|---|---|---|---|---|---|---|
| | | | pCi/l | | pCi/l | |
| 7001 | 6/8/81 | Surface Water North of Shuman Building | 3.11E0 | +/-8.8% | 2.25E1 | +/-3.0% |
| 7002 | 6/9/81 | Surface Water West of Shuman Building | 8.00E0 | +/-9.9% | 2.34E1 | +/-4.4% |
| 7003 | 6/10/81 | Drainage Pipe at NE Boundary | 1.56E0 | +/-22% | 9.88E0 | +/-6.8% |
| 7004 | 6/11/81 | Stream Beneath Earth City Expressway (offsite) | 1.04E0 | +/-14% | 1.97E1 | +/-4.8% |
| 7009 | 6/29/81 | Borehole #14 | 4.50E0 | +/-39% | 2.23E1 | +/-14% |
| 7010 | 6/29/81 | Borehole #15 | 2.60E0 | +/-52% | 1.52E1 | +/-17% |
| 7011 | 6/18/81 | Borehole #14 | 3.12E0 | +/-47% | 1.06E1 | +/-20% |
| 7012 | 6/18/81 | Borehole #15 | 7.10E0 | +/-31% | 1.66E1 | +/-16% |
| 7013 | 6/3/81 | Middle Leachate Treatment Lagoon | -1.04E0 | +/-275% | 1.30E2 | +/-5.7% |
| 7014 | 6/3/81 | North Leachate Treatment Lagoon | 1.35E0 | +/-55% | 1.36E2 | +/-5.5% |
| 7015 | 6/3/81 | South Leachment Treatment Lagoon | 2.43E0 | +/-55% | 1.03E2 | +/-6.4% |
| 7016 | 6/3/81 | Sludge Drainage Pipe | -1.21E0 | +/-234% | 9.89E1 | +/-6.5% |
| 7017 | 7/10/81 | Borehole #14 | 5.20E-1 | +/-115% | 3.36E1 | +/-11% |
| 7018 | 7/10/81 | Borehole #15 | 6.76E0 | +/-32% | 3.61E1 | +/-11% |
| 7019 | 6/29/81 | Surface Pond North of Entrance on St. Charles Rock Road | 1.91E0 | +/-60% | 3.00E1 | +/-12% |
| 7020 | 6/17/81 | Borehole #15 | 8.84E0 | +/-28% | 3.01E1 | +/-12% |
| 7021 | 7/20/81 | Tap Water | 1.56E0 | +/-67% | 2.91E1 | +/-12% |
| 7022 | 7/10/81 | Middle Leachate Treatment Lagoon | 3.45E0 | +/-141% | 1.07E2 | +/----% |
| 7023 | 7/10/81 | North Leachate Treatment Lagoon | -2.95E0 | +/-189% | 1.22E2 | +/-5.8% |
| 7024 | 7/10/81 | South Leachment Treatment Lagoon | -1.56E0 | +/-179% | 8.67E1 | +/-6.9% |
| 7025 | 7/21/81 | Settling Pond at North Boundary of Site | 1.56E0 | +/-67% | 3.65E1 | +/-11% |
| 7026 | 6/17/81 | Borehole #14 | -8.66E-1 | +/-332% | 3.89E1 | +/-10% |
| 7027 | 5/11/81 | Standing Water at Earth City Background Site | 1.04E0 | +/-82% | 3.25E1 | +/-11% |
| 7028 | 4/29/81 | Standing Water at NW Corner of Shuman Building | 4.52E1 | +/-6.2% | 8.78E1 | +/-6.9% |
| 7029 | 4/29/81 | West Ditch Runoff | -2.08E0 | +/-131% | -3.62E0 | +/-137% |
| 7030 | 7/28/81 | Pond at North Boundary of Site | 5.20E-1 | +/-115% | 3.51E1 | +/-11% |
| 7031 | 7/28/81 | Surface Pond North of Entrance on St. Charles Rock Road | -1.39E0 | +/-203% | 2.63E1 | +/-13% |
| 7032 | 7/30/81 | Missouri River Water | -2.6E0 | +/-102% | 2.63E1 | +/-13% |
| 7033 | 7/30/81 | Missouri River Water | 1.04E0 | +/-82% | 2.90E1 | +/-12% |
| 7034 | 7/28/81 | North Leachate Treatment Lagoon | -1.39E0 | +/-203% | 1.03E2 | +/-6.3% |
| 7035 | 7/28/81 | Middle Leachate Treatment Lagoon | 1.04E0 | +/-82% | 8.45E1 | +/-7.0% |

Table 6, cont.

| Sample No. | Date | Location | Gross Alpha pCi/l | | Gross Beta pCi/l | |
|---|---|---|---|---|---|---|
| 7036 | 7/28/81 | South Leachate Treatment Lagoon | -2.95E0 | +/-189% | 6.96E1 | +/-7.7% |
| 1 | 11/80 | Leachate Observation Well | 7.3E0 | +/-120% | 8.0E1 | +/-25% |
| 2 | 10/80 | Off-site Sample Well 3, West Boundary of Landfill | 1.5E1 | +/-17% | 4.1E1 | +/-10% |
| 3 | 10/80 | Off-site Sample Well 4, North Boundary of Landfill | 2.9E0 | +/-29% | 7.6E0 | +/-26% |
| 4 | 11/80 | Settling Pond North of Landfill | 2.9E0 | +/-150% | 2.6E1 | +/-110% |

| Sample No. | Date | Location | Isotopic Analysis K-40 pCi/l | | Isotopic Analysis Ra-226 pCi/l | |
|---|---|---|---|---|---|---|
| 7014 | 6/3/81 | North Leachate Treatment Lagoon | 1.38E2 | +/-15% | 1.20E0 | +/-21% |
| 7015 | 6/3/81 | South Leachate Treatment Lagoon | 1.36E2 | +/-16% | 3.92E0 | +/-233% |
| 7016 | 6/3/81 | Sludge Drainage Pipe | 1.02E2 | +/-15% | 2.40E0 | +/-290% |
| 7022 | 7/10/81 | Middle Leachate Treatment Lagoon | 1.04E2 | +/-18% | 2.40E0 | +/-290% |
| 7028 | 4/29/81 | Standing Water at NE Corner Shuman Bldg. | 1.24E2 | +/-28% | 1.15E0 | +/-195% |

Radon Flux Measurements Using Accumulator Method

Table 7

| Date | Time | Location | Environmental Conditions | Flux pCi/sq.m-s |
|---|---|---|---|---|
| 04/21 | 09:33 | Base 1 (Area 2, O11J) | 10 degrees C, damp ground, moderate wind | 28 |
| 04/21 | 10:21 | Base 2 (Area 2, L38K) | 10 degrees C, damp ground, moderate wind | 6.7 |
| 04/22 | 11:48 | Base 1 (Area 2, O11J) | 15 degrees C, soaked ground, 1 hour after rain | 332 |
| 04/22 | 12:38 | Base 3 (Area 2, M99H) | 15 degrees C, soaked ground, 1 hour after rain | 1.7 |
| 04/23 | 08:24 | Base 1 (Area 2, O11J) | 15 degrees C, damp ground, sunny, last rain approx. 12 hours | 293 |
| 04/23 | 09:12 | Base 3 (Area 2, M99H) | 15 degrees C, damp ground, sunny, last rain approx. 12 hours | 7.9 |
| 04/23 | 10:00 | Base 2 (Area 2, L38K) | 15 degrees C, damp ground, sunny, last rain approx. 12 hours | 5.9 |
| 04/24 | 08:38 | Base 3 (Area 2, M99H) | 7 degrees C, damp ground, cloudy, last rain approx. 2 days | 2.7 |
| 04/24 | 08:40 | Base 1 (Area 2, O11J) | 7 degrees C, damp ground, cloudy, last rain approx. 2 days | 9.8 |
| 04/24 | 09:29 | Base 2 (Area 2, L38K) | 7 degrees C, damp ground, cloudy, last rain approx. 2 days | 1.5 |
| 04/27 | 09:05 | Base 3 (Area 2, M99H) | 21 degrees C, hot, ground dry, sunny | 2.2 |
| 04/29 | 08:52 | Base 3 (Area 2, M99H) | 18 degrees C, sunny, last rain approx. 12 hours, light breeze | 14 |
| 04/29 | 09:36 | Base 1 (Area 2, O11J) | 18 degrees C, sunny, last rain approx. 12 hours, light breeze | 540 |
| 04/29 | 11:10 | Base 4 (Area 2, i00P) | 18 degrees C, sunny, last rain approx. 12 hours, light breeze | 63 |
| 05/04 | 10:05 | Base 1 (Area 2, O11J) | Cloudy, drizzle, last heavy rain approx. 1 day | 43 |
| 05/04 | 15:34 | Base 1 (Area 2, O11J) | Cloudy, drizzle, last heavy rain approx. 1 day | 33 |
| 05/05 | 09:44 | Base 1 (Area 2, O11J) | Cloudy, drizzle, soaked ground, no wind | 177 |
| 05/06 | 09:49 | Base 1 (Area 2, O11J) | 7 degrees C, windy, wet ground, last rain approx. 12 hours | 269 |
| 05/07 | 09:32 | Base 1 (Area 2, O11J) | 10 degrees C, windy, ground dry at surface, sunny | 34 |
| 05/07 | 10:48 | Base 3 (Area 2, M99H) | 10 degrees C, windy, ground dry at surface, sunny | 1.5 |
| 05/08 | 09:45 | Base 3 (Area 2, M99H) | 15 degrees C, cloudy, moderate wind, ground moist | 8.5 |
| 05/08 | 10:28 | Base 4, (Area 2, i00P) | 15 degrees C, cloudy, moderate wind, ground moist | 243 |
| 05/11 | 11:43 | Base 4 (Area 2, i00P) | 13 degrees C, light wind, soaked ground, rain approx. 12 hours ago | 28 |

Table 7, cont.

| Date | Time | Location | Environmental Conditions | Flux pCi/sq.m-s |
|---|---|---|---|---|
| 05/12 | 11:15 | Base 4 (Area 2, i00P) | 15 degrees C, windy, cloudy, last rain approx. 1 day | 310 |
| 05/12 | 12:08 | Base 1 (Area 2, O11J) | 15 degrees C, windy, cloudy, last rain approx. 1 day | 18 |
| 05/13 | 10:10 | Base 4 (Area 2, i00P) | 13 degrees C, cloudy, ground moist, last rain approx. 8 hours | 206 |
| 05/13 | 10:50 | Base 1 (Area 2, O11J) | 13 degrees C, cloudy, ground moist, last rain approx. 8 hours | 30 |
| 05/14 | 10:30 | Base 5 (Area 2, ) | 13 degrees C, cloudy, light wind, drizzle | 43 |
| 05/14 | 11:04 | Base 6 (Area 1, I00A) | 13 degrees C, cloudy, light wind, drizzle | 376 |
| 05/15 | 09:51 | Base 6 (Area 1, I00A) | 15 degrees C, sunny, light wind | 380 |
| 05/18 | 10:13 | Base 6 (Area 1, I00A) | 10 degrees C, cloudy, heavy rain last 2 days, strong wind | 188 |
| 05/19 | 09:44 | Base 1 (Area 2, O11J) | 10 degrees C, drizzle, ground soaked | 8.0 |
| 05/19 | 10:24 | Base 4 (Area 2, i00P) | 10 degrees C, drizzle, ground soaked | 17 |
| 05/19 | 10:24 | Base 6 (Area 1, I00A) | 10 degrees C, drizzle, ground soaked | 538 |
| 05/20 | 10:01 | Base 1 (Area 2, O11J) | 18 degrees C, no wind, sunny, ground damp | 276 |
| 05/20 | 10:41 | Base 4 (Area 2, i00P) | 18 degrees C, no wind, sunny ground damp | 119 |
| 05/20 | 11:23 | Base 6 (Area 1, I00A) | 18 degrees C, no wind, sunny ground damp | 353 |
| 05/21 | 09:53 | Base 1 (Area 2, O11J) | 21 degrees C, sunny, no wind, dry soil | 212 |
| 05/21 | 10:27 | Base 4 (Area 2, i00P) | 21 degrees C, suny, no wind, dry soil | 406 |
| 05/27 | 08:51 | Base 6 (Area 1, I00A) | 21 degrees C, sunny, light breeze, dry soil | 350 |
| 05/27 | 09:33 | Base 1 (Area 2, O11J) | 21 degrees C, sunny, light breeze, dry soil | 596 |
| 05/27 | 10:12 | Base 4 (Area 2, i00P) | 21 degrees C, sunnny, light breze, dry soil | 865 |
| 05/28 | 08:43 | Base 4 (Area 2, i00P) | 28 degrees C, dry soil, last rain 2 days 29.90" hg | 400 |
| 05/28 | 11:44 | Base 4 (Area 2, i00P) | 28 degrees C, dry soil, last rain 2 days 29,90" hg | 397 |
| 05/29 | 09:14 | Area 2, k00R | 29 degrees C, damp soil, light wind | 1.8 |
| 06/02 | 08:45 | Base 6 (Area 1, I00A) | 30 degrees C, dry soil, 29.90" hg | 620 |
| 06/03 | 14:54 | Base 4 (Area 2, i00P) | 32 degrees C, slight wind, dry soil 29.85 hg | 580 |
| 06/04 | 09:03 | Base 1 (Area 2, O11J) | 34 degrees C, light wind, dry soil | 388 |
| 06/04 | 10:10 | Area 2, I00F | 39 degrees C, no wind, damp soil | 0.6 |
| 06/08 | 11:37 | Base 4 (Area 2, i00P) | 33 degrees C, dry soil, moderate breeze | 245 |
| 06/09 | 09:21 | Base 4 (Area 2, i00P) | 33 degrees C, dry soil, slight breeze | 579 |
| 06/09 | 10:39 | Base 8 (Area 1, I00I) | 33 degrees C, dry soil, strong wind | 3.0 |
| 06/10 | 11:17 | Area 2, M62J | 21 degrees C, dry soil, no wind 29.92" | 1.3 |
| 06/11 | 10:16 | Area 2, U00P | 18 degrees C, dry soil, light breeze | 38 |

Table 7, cont.

| Date | Time | Location | Environmental Conditions | Flux pCi/sq.m-2 |
|---|---|---|---|---|
| 06/11 | 10:39 | Area 2, T00P | 18 degrees C, dry soil, light breeze | 85 |
| 06/11 | 12:07 | Area 2, h00X | 18 degrees C, dry soil, light breeze | 1.8 |
| 06/11 | 12:20 | Area 2, j00W | 18 degrees C, dry soil, light breeze | 1.9 |
| 06/12 | 09:56 | Area 2, U00P | 26 degrees C, damp soil, light breeze 29.98" hg | 14 |
| 06/12 | 10:08 | Area 2, T00P | 26 degrees C, damp soil, light breeze 29.98" hg | 35 |
| 06/12 | 11:20 | Area 2, h00X | 26 degrees C, damp soil, light breeze 29,98" hg | 0.6 |
| 06/12 | 11:30 | Area 2, j00W | 26 degrees C, damp soil, light breeze 29.98" hg | 1.0 |
| 06/15 | 10:03 | Area 2, I00L | 29 degrees C, dry soil, gusty, 760.5mm hg | 0.8 |
| 06/15 | 10:15 | Area 2, J00L | 29 degrees C, dry soil, gusty, 760.5mm hg | 0.7 |
| 06/23 | 10:17 | Earth City, offsite bkg | 27 degrees C, damp soil, no wind 30.14 hg | 0.5 |
| 06/23 | 13:50 | Taussig Rd, offsite bkg | 27 degrees C, damp soil, no wind 30.14 hg | 1.5 |
| 06/29 | 10:03 | Area 2m U00P | n/a | 16 |
| 07/06 | 10:20 | Base 4 (Area 2, i00P) | Damp soil, slight breeze | 138 |
| 07/06 | 11:24 | Taussig Rd, offsite bkg | Damp soil, slight breeze | 0.3 |
| 07/08 | 14:00 | Area 2, J30L | 31 degrees C, dry soil, slight breeze, 30.20" hg | 0.4 |
| 07/08 | 14:30 | Area 2, H04O | 31 degrees C, dry soil, slight brze, 30.20" hg | 0.4 |
| 07/10 | 10:19 | Taussig Rd, offsite bkg | Damp soil, started to rain during accumulation | 0.3 |
| 07/10 | 10:09 | Old St. Charles Rock Rd Bkg | Damp soil, started to rain during accumulation | 1.0 |
| 07/16 | 10:49 | Area 1, M10G | 26 degrees C, damp soil, 29.96" hg | 22 |
| 07/17 | 10:10 | Area 1, M10G | 25 degrees C, dry soil, no wind, 30.02" hg | 14 |
| 07/20 | 10:25 | Base 6 (Area 1, I00A) | 30 degrees C, damp soil, mild wind, 29.86" hg | 59 |
| 07/22 | 11:25 | Old St. Charles Rock Rd Bkg | 26 degrees C, damp soil, no wind 30.10" hg | <0.1 |
| 07/24 | 08:14 | Area 1, M10G | 24 degrees C, damp soil, light wind, 30.06" hg | 15 |
| 07/24 | 08:31 | Area 2, p07S | 24 degrees C, damp soil, light wind, 30.05" hg | 168 |
| 07/28 | 09:05 | Area 2, p07S | 23 degrees C, damp soil, mild wind, 30.06" hg | 34 |
| 07/28 | 09:23 | Area 1, M10G | 23 degrees C, damp soil, mild wind, 30.06" hg | 61 |
| 07/29 | 08:09 | Base 8 (Area 1, I00I) | 18 degrees C, damp soil, light wind, 30.21" hg | 0.5 |
| 07/29 | 08:26 | Area 2, p07S | 18 degrees C, damp soil, light wind, 30.21" hg | 173 |
| 07/29 | 10:04 | Old St. Charles Rock Rd Bkg | 21 degrees C, damp soil, light wind, 30.21" hg | 0.3 |
| 07/29 | 10:50 | Taussig Road offsite bkg | 21 degrees C, damp soil, light wind, 30.21" hg | 0.2 |
| 07/30 | 08:09 | Area 2, p07S | 23 degrees C, dry soil, sunny, light wind, 30.21" hg | 38 |
| 07/30 | 08:16 | Area 1, O00M | 23 degrees C, dry soil, sunny, light wind, 30.21" hg | 3.2 |
| 07/30 | 09:20 | Old St. Charles Rock Rd Bkg | 23 degrees C, dry soil, sunny, light wind, 30.21'hg | 0.2 |
| 07/31 | 10:08 | Area 1, O00M | 24 degrees C, very dry soil, sunny, light wind, 30.25" hg | 2.0 |

Table 7, cont.

| Date | Time | Location | Environmental Conditions | Flux |
|---|---|---|---|---|
| | | | | pCi/sq.m-2 |
| 07/31 | 10:13 | Area 1, E00F | 24 degrees C, very dry soil, sunny, light wind, 30.25" hg | 0.5 |
| 08/03 | 10:11 | Area 1, E00F | 25 degrees C, dry soil, light wind, 29.94" hg | 3.4 |
| 08/03 | 10:14 | Area 1, O00M | 25 degrees C, dry soil, light wind, 29.94" hg | 0.4 |
| 08/04 | 09:05 | Area 1, E00F | 29 degrees C, dry soil, light wind, 30.04" hg | 6.4 |
| 08/04 | 09:11 | Area 1, O00M | 29 degrees C, dry soil, light wind, 30.04" hg | 0.5 |
| 08/05 | 09:21 | Area 1, E00F | 28 degrees C, dry soil, light wind, 30.07" hg | 9.6 |
| 08/05 | 09:25 | Area 1, O00M | 28 degrees C, dry soil, light wind, 30.07" hg | 9.6 |
| 08/06 | 08:35 | Area 1, E00F | 27 degrees C, dry soil, light wind, 30.01" hg | 0.4 |
| 08/06 | 08:40 | Area 1, M10G | 27 degrees C, dry soil, light wind, 30.01" hg | 5.1 |
| 08/07 | 09:08 | Area 2, p07S | 27 degrees C, dry soil, light wind, 30.01" hg | 122 |
| 08/07 | 09:15 | Base 8 (Area 1, I00I) | 27 degrees C, dry soil, light wind, 30.01" hg | 0.4 |
| 08/17 | 10:05 | Area 2, I00F | 20 degrees C, dry soil, light wind, 30.08" hg | 0.6 |
| 08/17 | 10:10 | Area 2, I00L | 20 degrees C, dry soil, light wind, 30.08" hg | 0.3 |
| 08/18 | 09:14 | Area 2, I00L | 18 degrees C, dry soil, no wind, 30.11" hg | <0.1 |
| 08/18 | 09:17 | Area 2, I00F | 18 degrees C, dry soil, no wind, 30.11" hg | 0.5 |
| 08/19 | 09:34 | Area 2, I00L | 18 degrees C, dry soil, no wind, 30.11" hg | 0.3 |
| 08/19 | 09:40 | Area 2, I00F | 18 degrees C, dry soil, no wind, 30.11" hg | 0.4 |

Radon Flux Measurements Using the Charcoal Canister Method

Table 8

| Date | Location | Sampling Time(sec) | Enviromental Conditions | Flux pCi/sq.m-s |
|---|---|---|---|---|
| 06/02 | Base 6 (Area 1, I00a) | 6,000 | 30 degrees C, dry soil, 29.90" hg | 362 |
| 06/03 | Base 4 (Area 2, i00P) | 4,980 | 32 degrees C, dry soil, light wind, 29.85" hg | 29 |
| 06/03 | Base 4 (Area 2, i00P) | 1,200 | 32 degrees C, dry soil, light wind, 29.85" hg | 613 |
| 06/04 | Base 1 (Area 1, O11J) | 7,200 | 34 degrees C, dry soil light wind | 147 |
| 06/10 | Base 8 (Area 2, I00I) | 55,320 | 21 degrees C, dry soil, no wind, 29.92" hg | 2.0 |
| 06/10 | Area 2, M00I | 18,000 | 21 degrees C, dry soil, no wind, 29.92" hg | 2.3 |
| 06/11 | Area 2, L00G | 60,300 | 18 degrees C, dry soil, light breeze | 163 |
| 06/11 | Area 2, U00P | 22,500 | 18 degrees C, dry soil, light breeze | 44 |
| 06/18 | Area 2, 100S | 54,900 | n/a | 2.2 |
| 06/12 | Area 2, T00P | 17,640 | 26 degrees C, damp soil, light breeze, 29.98" hg | 30 |
| 06/23 | Earth City, offsite bkg | 21,600 | 27 degrees C, damp soil, no wind, 30.14" hg | 0.9 |
| 06/24 | Taussig Road, offsite bkg | 61,200 | n/a | 0.8 |
| 06/30 | Area 2, p00J | 55,320 | n/a | 8.7 |
| 06/30 | Area 2, U00P | 20,940 | n/a | 74 |
| 07/01 | Old St. Charles Rd, bkg | 20,040 | n/a | 0.8 |
| 07/06 | Area 2, i00P | 50,400 | Damp soil, light breeze | 178 |
| 07/08 | Area 1, H25N | 14,100 | 31 degrees C, dry soil, slight breeze, 30.20" hg | 0.9 |
| 07/08 | Area 2, J30L | 50,140 | 31 degrees C, dry soil, slight breeze, 30.20" hg | 0.3 |
| 07/10 | Area 1, I00L | 22,540 | Damp soil, during rain | 0.6 |
| 07/15 | Old St. Charles Rock Rd, bkg | 54,540 | n/a | 1.6 |
| 07/16 | Area 1, M10G | 22.380 | 26 degrees C, damp soil, 29.96" hg | 24 |
| 07/17 | Area 1, M10G | 57,240 | 25 degrees C, dry soil, no wind, 30.20" hg | 14 |
| 07/20 | Base 6 (Area 1, I00A) | 5,880 | 30 degrees C, damp soil, mild wind, 29.86" hg | 13 |
| 07/22 | Old St. Charles Rock Rd, bkg | 68,640 | 26 degrees C, damp soil, no wind, 30.10" hg | 0.3 |
| 07/23 | Area 1, M10G | 60,960 | n/a | 4.5 |
| 07/28 | Area 1, M10G | 61,560 | 23 degrees C, damp soil, 30.06" hg | 9.1 |
| 07/28 | Area 2, p04S | 63,240 | 23 degrees C, damp soil, 30.06" hg | 32 |
| 07/29 | Area 1, I00I, Base 6 | 57,540 | 18 degrees C, damp soil, light wind, 30.21"hg | 0.4 |
| 07/29 | Area 1, O00I | 57,960 | 18 degrees C, damp soil, light wind, 30.21" hg | 1.3 |
| 07/30 | Area 2, p04S | 55,080 | 23 degrees C, dry soil, light wind, 30.21" hg | 212 |
| 07/30 | Area 1, O00M | 56,820 | 23 degrees C, dry soil, light wind, 30.21" hg | 7.6 |
| 07/31 | Area 1, E00F | 56,340 | 24 degrees C, very dry soil, light wind, 30.25" hg | 0.4 |
| 07/31 | Area 1, O00M | 56,220 | 24 degrees C, very dry soil, light wind, 30.25" hg | 5.2 |
| 08/05 | Area 1, E00F | 52,800 | 28 degrees C, dry soil, light wind, 30.07" hg | 0.6 |

Side-By-Side Radon Flux Measurements,
Accumulator versus Charcoal Canister Methods

Table 9

| Location | Date | Charcoal Canister | Accumulator |
|---|---|---|---|
| | | pCi/sq.m-2 | pCi/sq.m-2 |
| Base 6 | 6-2 | 400 | 740 |
| Base 4 | 6-3 | 680 | 790 |
| Base 1 | 6-4 | 170 | 370 |
| Base 8 | 6-9 | 2.1 | 3.0 |
| Base 3 | 6-10 | 2.4 | 1.3 |
| Borehole 3 | 6-11 | 50 | 38 |
| T00P(Area 2) | 6-12 | 30 | 35 |
| Earth City | 6-23 | 0.9 | <1 |
| Taussig Road | 6-24 | 0.8 | 1.5 |
| Base 4 | 7-6 | 180 | 140 |
| Borehole 2 | 7-8 | <0.5 | <1 |
| M10G(Area 1) | 7-16 | 22.2 | 22.3 |
| M10G(Area 1) | 7-17 | 13.4 | 14.0 |
| Base 6 | 7-20 | 14.1 | 59.2 |
| Old St. Charles Rd | 7-22 | 0.3 | <1 |
| M10G(Area 1) | 7-24 | 4.6 | 15.3 |
| M10G(Area 1) | 7-28 | 9.8 | 60.5 |
| 20' W of Borehole #20 | 7-28 | 36.4 | 34.3 |
| Base 8 | 7-29 | 0.5 | 0.5 |
| 20' W of Borehole #20 | 7-30 | 218 | 38 |
| O00M(Area 1) | 7-30 | 2.9 | 3 |
| O00M(Area 1) | 7-31 | 5.8 | 0.2 |

Working Level (WL) and Long-Lived Gross Alpha Activity
on High Volume Air Samples

Table 10

Sample Duration: 10 min.
Flow Rate: 570 l/min.
Total Volume: 1.4E6 ml

| Date/Time | Location | 7 Day Activity | WL |
|---|---|---|---|
| | | uCi/cc | |
| 8105010805 | Outside Trailer | 2.03E-13+/-122% | .0016 |
| 8105010819 | Outside Trailer | 2.66E-13+/-103% | .0015 |
| 8105010918 | Base 3 | 0+/-211% | .0010 |
| 8105010931 | Base 1 | 3.13E-13+/-93% | .0008 |
| 8105040942 | Outside Trailer | 4.69E-14+/-365% | .0010 |
| 8105041013 | Base 1 | 1.09E-13+/-188% | .0009 |
| 8105041124 | C00G | 4.69E-14+/-365% | .0012 |
| 8105041150 | Base 4 | 2.66E-13+/-103% | .0016 |
| 8105111034 | Earth City Background | 4.69E-14+/-365% | .0003 |
| 8105121046 | Earth City Background | 4.69E-14+/-365% | .0004 |
| 8105121402 | Outside Trailer | 0+/-211% | .0002 |
| 8105121447 | Base 4 | 4.22E-13+/-78% | .0006 |
| 8105121504 | Outside W-L Office Bldg | 7.34E-13+/-57% | .0003 |
| 8105121528 | Base 1 | 1.56E-13+/-145% | .0002 |
| 8105121551 | T00P | 4.69E-14+/-365% | .0003 |
| 8105131154 | Z00N | 4.69E-14+/-365% | .0010 |
| 8105151010 | Base 6 | 2.03E-13+/-122% | .0003 |
| 8105151035 | Base 7 | 1.09E-13+/-188% | .0002 |
| 8105181022 | Base 6 | 2.03E-13+/-122% | .0003 |
| 8105201107 | Base 4 | 2.66E-13+/-103% | .0004 |
| 8105201137 | Base 6 | 2.66E-13+/-103% | .0004 |
| 8105270821 | Inside Trailer | 1.41E-12+/-40% | .0110 |
| 8105271040 | Base 6 | 7.81E-13+/-55% | .0002 |
| 8106021429 | 000J | 2.03E-13+/-122% | .0007 |
| 8106021450 | h000 | 4.69E-14+/-365% | .0007 |
| 8106080957 | Drilling Borehole #1 | 1.56E-13+/-146% | .0006 |
| 8106081335 | Drilling Borehole #2 | 4.69E-14+/-365% | .0005 |
| 8106091015 | Drilling Borehole #3 | 7.34E-13+/-57% | .0009 |
| 8106091318 | Drilling Borehole #4 | 1.15E-11+/-14% | .0020 |
| 8106091350 | Drilling Borehole #4 | 8.55E-12+/-16% | .0027 |

Table 10, cont.

| Date/Time | Location | 7 Day Activity uCi/cc | WL |
|---|---|---|---|
| 8106100945 | Drilling Borehole #5 | 2.66E-13+/-103% | .0012 |
| 8106101231 | Drilling Borehole #7 | 4.22E-13+/-78% | .0015 |
| 8106101411 | Drilling Borehole #8 | 4.22E-13+/-78% | .0012 |
| 8106231028 | Earth City Background | 1.09E-13+/-188% | .0005 |
| 8106231146 | Inside Shuman | 1.98E-12+/-33% | .0011 |
| 8106231407 | Taussig Rd Background | 4.69E-14+/-365% | .0005 |
| 8106300931 | Borehole #32 | 4.69E-14+/-365% | .0006 |
| 8107070919 | Old St. Charles Rd Bkg | 0+/-211% | .0017 |
| 8011130845 | Area 1, Near Road | -------------- | .017 |
| 8011131030 | Area 1 Highest Ext. Level | -------------- | .014 |
| 8011131445 | Area 2 Highest Ext. Level | -------------- | .019 |
| 8011131507 | Area 2 Suspected Surface Mat. | -------------- | .038 |
| 8011140735 | Inside Shuman Building | -------------- | .031 |

| Date/Time | Location | Isotopic Activities U-238 | Isotopic Activities Ra-226 |
|---|---|---|---|
| Composite Sample | All Onsite Samples | 9.1E-14+/-1% | 4.3E-14+/-1% |

Note: Individual sample sensitivities are low due to short sampling time. However, all gross alpha activities except two are less than the maximum permissible concentrations (MPCs) for U-238 or Ra-226, for unrestricted areas, as listed in Appendix B, Table II, of 10CFR20. (These MPCs are 3.0E-12 uCi/cc for either nuclide.) The two exceptions occurred when drilling through contaminated materials.

Gamma Analysis of High Volume Air Samples for Rn-219 Daughters (Pb-211)

Table 11

| Date | Time | Location | ---Sample Activity (uCi/cc) at--- 405 KeV (3.4% ab) | 427 KeV (1.8% ab) | 832 KeV (3.4% ab) | Average uCi/cc |
|---|---|---|---|---|---|---|
| 6/3 | 14:21 | Base 4 (Area 2, i00P) | 2.3E-10 | --------- | 2.5E-10 | 2.4E-10 |
| 6/4 | 8:31 | Base 1 (Area 2, 000J) | 5.7E-11 | --------- | --------- | 5.7E-11 |
| 6/4 | 12:30 | Base 4 | 1.0E-9 | 8.9E-10 | 9.3E-10 | 9.5E-10 |
| 6/18 | 14:00 | Base 4 | 5.6E-10 | 4.8E-10 | 4.6E-10 | 5.0E-10 |
| 6/29 | 12:23 | Base 6 (Area 1, N00A) | 9.0E-11 | --------- | 1.3E-10 | 1.1E-10 |

Table 12: Priority Pollutant Analyses of Auger Hole and Leachate Sludge Samples

Results of Chemical Analyses of
West Lake Landfill
7 July 1981

| Parameter | Units | WTP * | BH-2 * | BH-13 * | BH-25 * | BH-31 * | BH-35 * |
|---|---|---|---|---|---|---|---|
| Antimony | mg/kg | 0.077 | 0.268 | 0.325 | 0.355 | 0.218 | 21.0 |
| Arsenic | mg/kg | 0.62 | 6.0 | 7.0 | 2.0 | 4.0 | 1.0 |
| Beryllium | mg/kg | 0.038 | 0.12 | 0.24 | 0.18 | 0.20 | 0.14 |
| Cadmium | mg/kg | 0.052 | 2.2 | 2.3 | 2.27 | 4.0 | 37.5 |
| Chromium | mg/kg | 1.41 | 40.9 | 34 | 7.0 | 26.2 | 215 |
| Copper | mg/kg | 0.459 | 1039 | 88 | 23.2 | 131.6 | 356 |
| Cyanide | mg/kg | 0.10 | 0.028 | 0.12 | 1.61 | 0.376 | 0.97 |
| Lead | mg/kg | 19.7 | 356 | 431 | 49.0 | 251.6 | 1490 |
| Mercury | mg/kg | 5 | 0.22 | 0.36 | 0.14 | 0.10 | 0.84 |
| Nickel | mg/kg | 3.00 | 20.0 | 45.1 | 11.3 | 4 | 218.0 |
| Selenium | mg/kg | 0.12 | 1.6 | 1.2 | 1.2 | 1.2 | 0.9 |
| Silver | mg/kg | 0.134 | 0.580 | 0.369 | 0.165 | 0.264 | 0.409 |
| Thallium | mg/kg | 14.0 | 10.0 | 2.0 | <0.1 | 0.6 | 3.5 |
| Zinc | mg/kg | 41.4 | 246 | 270 | 180 | 89 | 2395 |

* WTP - Waste treatment plant leachate sludge
BH-2 - Auger hole 2, Area 2
BH-13 - Auger hole 13, Area 2
BH-25 - Auger hole 25, Area 1
BH-31 - Auger hole 31, Area 2
BH-35 - Auger hole 35, Area 2

# SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. W.T.P. (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #569 DATE ANALYSIS COMPLETED 16 July 1981

## ACID COMPOUNDS

| | μg/l |
|---|---|
| 2,4,6-trichlorophenol | ND |
| o-chloro-m-cresol | ND |
| 2-chlorophenol | ND |
| 2,4-dichlorophenol | ND |
| 2,4-dimethylphenol | ND |
| 2-nitrophenol | ND |
| 4-nitrophenol | * |
| 2,4-dinitrophenol | * |
| 4,6-dinitro-o-cresol | ND |
| pentachlorophenol | ND |
| phenol | 8.1 |

ND - Less than 1 μg/l
* - Less than 25 μg/l
** - Less than 250 μg/l

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. W.T.P. (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #569 DATA ANALYSIS COMPLETED 22 July 1981

### BASE/NEUTRAL COMPOUNDS

| | µg/l | | µg/l |
|---|---|---|---|
| acenaphthene | ND | nitrobenzene | ND |
| benzidine | ☆☆ | N-nitrosodimethylamine | ☆☆ |
| 1,2,4-trichlorobenzene | ND | N-nitrosodiphenylamine | ☆☆ |
| hexachlorobenzene | ND | N-nitrosodi-n-propylamine | ☆☆ |
| hexachloroethane | ND | bis(2-ethylhexyl)phthalate | ☆ |
| bis(2-chloroethyl)ether | ND | butyl benzyl phthalate | ND |
| 2-chloronaphthalene | ND | di-n-butyl phthalate | ND |
| 1,2-dichlorobenzene | ND | di-n-octyl phthalate | ND |
| 1,3-dichlorobenzene | ND | diethyl phthalate | ND |
| 1,4-dichlorobenzene | ND | dimethyl phthalate | ND |
| 3,3'-dichlorobenzidine | ☆ | benzo(a)anthracene | ND |
| 2,4-dinitrotoluene | ☆☆ | benzo(a)pyrene | ND |
| 2,6-dinitrotoluene | ☆ | benzo(b)fluoranthene[1] | ND |
| 1,2-diphenylhydrazine | ND | benzo(k)fluoranthene[1] | ND |
| fluoranthene | ND | chrysene | ND |
| 4-chlorophenyl phenyl ether | ND | acenaphthylene | ND |
| 4-bromophenyl phenyl ether | ND | anthracene | ND |
| bis(2-chloroisopropyl)ether | ☆ | benzo (g.h.i.) perylene | ☆ |
| bis(2-chloroethoxy)methane | ND | fluorene | ND |
| hexachlorobutadiene | ND | phenanthrene | ND |
| hexachlorocyclopentadiene | ☆ | dibenzo (a,h)anthracene | ☆ |
| isophorone | ND | indeno(1,2,3-c,d)pyrene | ND |
| naphthalene' | ND | pyrene | ND |
| bis(chloromethyl)ether | ☆☆ | 2,3,7,8-tetrachlorodibenzo-p-dioxin | ☆☆ |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l
☆☆ - Less than 25 µg/l

[1] Benzo(b)fluoranthene and benzo(k)fluoranthene could not be resolved, values reported indicate the sum of both compounds.

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. W.T.P. (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #569 DATE ANALYSIS COMPLETED 24 July 1981

### PESTICIDES

| | µg/l | | µg/l |
|---|---|---|---|
| aldrin | ND | a-BHC | ND |
| dieldrin | ND | b-BHC | ND |
| chlordane | ND | δ-BHC | ☆ |
| 4,4'-DDT | ND | g-BHC | ND |
| 4,4'-DDE | ND | PCB - 1242 | ND |
| 4,4'-DDD | ND | PCB - 1254 | ND |
| endosulfan I | ☆ | PCB - 1221 | ND |
| endosulfan II | ☆ | PCB - 1232 | ND |
| endosulfan sulfate | ☆ | PCB - 1248 | ND |
| endrin | ☆ | PCB - 1260 | ND |
| endrin aldehyde | ☆ | PCB - 1016 | ND |
| heptachlor | ND | toxaphene | ND |
| heptachlor epoxide | ☆ | | |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. W.T.P. (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. 0569 DATE ANALYSIS COMPLETED 5 August 1981

VOLATILES

| | µg/l | | µg/l |
|---|---|---|---|
| acrolein | ☆☆ | 1,2-dichloropropane | ND |
| acrylonitrile | ☆☆ | 1,3-dichloropropylene[1] | ☆ |
| benzene | 2.0 | ethylbenzene | ND |
| carbon tetrachloride | ☆ | methylene chloride | 15.6 |
| chlorobenzene | ND | methyl chloride | ☆ |
| 1,2-dichloroethane | ND | methyl bromide | ☆ |
| 1,1,1-trichloroethane | ND | bromoform | ND |
| 1,1-dichloroethane | ND | dichlorobromomethane | ND |
| 1,1,2-trichloroethane | ND | trichlorofluoromethane | 2.3 |
| 1,1,2,2-tetrachloroethane | ND | dichlorodifluoromethane | ☆ |
| chloroethane | ☆ | chlorodibromomethane | ND |
| 2-chloroethylvinyl ether | ☆ | tetrachloroethylene | ND |
| chloroform | 4.3 | toluene | 1.8 |
| 1,1-dichloroethylene | ND | trichloroethylene | ND |
| 1,2-trans-dichloroethylene | ☆ | vinyl chloride | ☆ |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l
☆☆ - Less than 100 µg/l

[1] 1,3-cis-dichloropropylene and 1,3-trans-dichloropropylene could not be resolved, values reported indicate the sum of both compounds.

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-2 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #570 DATE ANALYSIS COMPLETED 16 July 1981

ACID COMPOUNDS

| | μg/l |
|---|---|
| 2,4,6-trichlorophenol | ND |
| p-chloro-m-cresol | ND |
| 2-chlorophenol | ND |
| 2,4-dichlorophenol | ND |
| 2,4-dimethylphenol | ND |
| 2-nitrophenol | ND |
| 4-nitrophenol | * |
| 2,4-dinitrophenol | * |
| 4,6-dinitro-o-cresol | ND |
| pentachlorophenol | ND |
| phenol | 7.8 |

ND - Less than 1 μg/l
* - Less than 25 μg/l
** - Less than 250 μg/l

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-2 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #570 DATA ANALYSIS COMPLETED 22 July 1981

### BASE/NEUTRAL COMPOUNDS

| | µg/l | |
|---|---|---|
| acenaphthene | ND | nitrobenzene |
| benzidine | ☆☆ | N-nitrosodimethylamine |
| 1,2,4-trichlorobenzene | ND | N-nitrosodiphenylamine |
| hexachlorobenzene | ND | N-nitrosodi-n-propylamine |
| hexachloroethane | ND | bis(2-ethylhexyl)phthalate |
| bis(2-chloroethyl)ether | ND | butyl benzyl phthalate |
| 2-chloronaphthalene | ND | di-n-butyl phthalate |
| 1,2-dichlorobenzene | ND | di-n-octyl phthalate |
| 1,3-dichlorobenzene | ND | diethyl phthalate |
| 1,4-dichlorobenzene | ND | dimethyl phthalate |
| 3,3'-dichlorobenzidine | ☆ | benzo(a)anthracene |
| 2,4-dinitrotoluene | ☆☆ | benzo(a)pyrene |
| 2,6-dinitrotoluene | ND | benzo(b)fluoranthene[1] |
| 1,2-diphenylhydrazine | ND | benzo(k)fluoranthene[1] |
| fluoranthene | ND | chrysene |
| 4-chlorophenyl phenyl ether | ND | acenaphthylene |
| 4-bromophenyl phenyl ether | ND | anthracene |
| bis(2-chloroisopropyl)ether | ND | benzo (g.h.i.) perylene |
| bis(2-chloroethoxy)methane | ND | fluorene |
| hexachlorobutadiene | ND | phenanthrene |
| hexachlorocyclopentadiene | ☆ | dibenzo (a,h)anthracene |
| isophorone | ND | indeno(1,2,3-c,d)pyrene |
| naphthalene | ND | pyrene |
| bis(chloromethyl)ether | ☆☆ | 2,3,7,8-tetrachlorodibenzo-p-dioxin |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l
☆☆ - Less than 25 µg/l

[1]Benzo(b)fluoranthene and benzo(k)fluoranthene could not be resolved, values reported indicate the sum of both compounds.

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-2 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #570 DATE ANALYSIS COMPLETED 24 July 1981

### PESTICIDES

| | µg/l | | µg/l |
|---|---|---|---|
| aldrin | ☆ | α-BHC | ☆ |
| dieldrin | ND | β-BHC | ND |
| chlordane | ND | δ-BHC | ☆ |
| 4,4'-DDT | ND | γ-BHC | ND |
| 4,4'-DDE | ND | PCB - 1242 | ND |
| 4,4'-DDD | ND | PCB - 1254 | ND |
| endosulfan I | ☆ | PCB - 1221 | ND |
| endosulfan II | ☆ | PCB - 1232 | ND |
| endosulfan sulfate | ☆ | PCB - 1248 | ND |
| endrin | ☆ | PCB - 1260 | ND |
| endrin aldehyde | ☆ | PCB - 1016 | ND |
| heptachlor | ND | toxaphene | ND |
| heptachlor epoxide | ☆ | | |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-2 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #570 DATE ANALYSIS COMPLETED 5 August 1981

VOLATILES

| | µg/l | | µg/l |
|---|---|---|---|
| acrolein | ** | 1,2-dichloropropane | ND |
| acrylonitrile | ** | 1,3-dichloropropylene[1] | * |
| benzene | 1.4 | ethylbenzene | 1.2 |
| carbon tetrachloride | * | methylene chloride | 21.4 |
| chlorobenzene | 1.9 | methyl chloride | * |
| 1,2-dichloroethane | 7.1 | methyl bromide | 13.1 |
| 1,1,1-trichloroethane | ND | bromoform | ND |
| 1,1-dichloroethane | ND | dichlorobromomethane | ND |
| 1,1,2-trichloroethane | ND | trichlorofluoromethane | 2.4 |
| 1,1,2,2-tetrachloroethane | ND | dichlorodifluoromethane | * |
| chloroethane | * | chlorodibromomethane | ND |
| 2-chloroethylvinyl ether | ND | tetrachloroethylene | 1.7 |
| chloroform | 6.2 | toluene | 7.3 |
| 1,1-dichloroethylene | ND | trichloroethylene | 1.7 |
| 1,2-trans-dichloroethylene | 3.4 | vinyl chloride | * |

ND - Less than 1 µg/kg
* - Less than 10 µg/kg
** - Less than 100 µg/kg

[1] 1,3-cis-dichloropropylene and 1,3-trans-dichloropropylene could not be resolved, Values reported indicate the sum of both compounds.

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-13 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #571 DATE ANALYSIS COMPLETED 16 July 1981

### ACID COMPOUNDS

| | µg/l |
|---|---|
| 2,4,6-trichlorophenol | ND |
| p-chloro-m-cresol | ND |
| 2-chlorophenol | ND |
| 2,4-dichlorophenol | ND |
| 2,4-dimethylphenol | ND |
| 2-nitrophenol | ND |
| 4-nitrophenol | * |
| 2,4-dinitrophenol | ND |
| 4,6-dinitro-o-cresol | ND |
| pentachlorophenol | ND |
| phenol | 2.6 |

ND - Less than 1 µg/l
* - Less than 25 µg/l
** - Less than 250 µg/l

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. EH-13 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #571 DATA ANALYSIS COMPLETED 22 July 1981

### BASE/NEUTRAL COMPOUNDS

| | μg/l | | μg/l |
|---|---|---|---|
| acenaphthene | ND | nitrobenzene | ND |
| benzidine | ☆☆ | N-nitrosodimethylamine | ☆☆ |
| 1,2,4-trichlorobenzene | ND | N-nitrosodiphenylamine | ☆☆ |
| hexachlorobenzene | ND | N-nitrosodi-n-propylamine | ☆☆ |
| hexachloroethane | ☆ | bis(2-ethylhexyl)phthalate | 10.1 |
| bis(2-chloroethyl)ether | ☆ | butyl benzyl phthalate | ☆ |
| 2-chloronaphthalene | ND | di-n-butyl phthalate | ND |
| 1,2-dichlorobenzene | ND | di-n-octyl phthalate | ND |
| 1,3-dichlorobenzene | ND | diethyl phthalate | ND |
| 1,4-dichlorobenzene | ND | dimethyl phthalate | ND |
| 3,3'-dichlorobenzidine | ☆ | benzo(a)anthracene | ND |
| 2,4-dinitrotoluene | ☆☆ | benzo(a)pyrene | ☆ |
| 2,6-dinitrotoluene | ☆ | benzo(b)fluoranthene[1] | ☆ |
| 1,2-diphenylhydrazine | ☆ | benzo(k)fluoranthene[1] | ☆ |
| fluoranthene | ND | chrysene | ☆ |
| 4-chlorophenyl phenyl ether | ☆ | acenaphthylene | ND |
| 4-bromophenyl phenyl ether | ☆ | anthracene | ND |
| bis(2-chloroisopropyl)ether | ☆ | benzo (g.h.i.) perylene | ☆☆ |
| bis(2-chloroethoxy)methane | ☆ | fluorene | ND |
| hexachlorobutadiene | ☆ | phenanthrene | ND |
| hexachlorocyclopentadiene | ☆ | dibenzo (a,h)anthracene | ☆☆ |
| isophorone | ☆ | indeno(1,2,3-c,d)pyrene | ☆ |
| naphthalene | ND | pyrene | ND |
| bis(chloromethyl)ether | ☆☆ | 2,3,7,8-tetrachlorodibenzo-p-dioxin | ☆☆ |

ND - Less than 1 μg/l
☆ - Less than 10 μg/l
☆☆ - Less than 25 μg/l

[1]Benzo(b)fluoranthene and benzo(k)fluoranthene could not be resolved, values reported indicate the sum of both compounds.

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-13 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #571 DATE ANALYSIS COMPLETED 24 July 1981

PESTICIDES

| | μg/l | | μg/l |
|---|---|---|---|
| aldrin | * | a-BHC | * |
| dieldrin | * | b-BHC | * |
| chlordane | ND | d-BHC | * |
| 4,4'-DDT | * | g-BHC | * |
| 4,4'-DDE | * | PCB - 1242 | ND |
| 4,4'-DDD | * | PCB - 1254 | ND |
| endosulfan I | * | PCB - 1221 | ND |
| endosulfan II | * | PCB - 1232 | ND |
| endosulfan sulfate | * | PCB - 1248 | ND |
| endrin | * | PCB - 1260 | ND |
| endrin aldehyde | * | PCB - 1016 | ND |
| heptachlor | * | toxaphene | ND |
| heptachlor epoxide | * | | |

ND - Less than 1 μg/l
* - Less than 10 μg/l

# SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. RW-13 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #571 DATE ANALYSIS COMPLETED 5 August 1981

## VOLATILES

| | μg/l | | μg/l |
|---|---|---|---|
| acrolein | ☆☆ | 1,2-dichloropropane | ND |
| acrylonitrile | ☆☆ | 1,3-dichloropropylene[1] | ☆ |
| benzene | ND | ethylbenzene | 4.4 |
| carbon tetrachloride | ☆ | methylene chloride | ND |
| chlorobenzene | ND | methyl chloride | ☆ |
| 1,2-dichloroethane | ND | methyl bromide | ☆ |
| 1,1,1-trichloroethane | ND | bromoform | ND |
| 1,1-dichloroethane | ND | dichlorobromomethane | ND |
| 1,1,2-trichloroethane | ND | trichlorofluoromethane | 33.8 |
| 1,1,2,2-tetrachloroethane | ND | dichlorodifluoromethane | ☆ |
| chloroethane | ☆ | chlorodibromomethane | ND |
| 2-chloroethylvinyl ether | ND | tetrachloroethylene | 4.6 |
| chloroform | 7.8 | toluene | ND |
| 1,1-dichloroethylene | ND | trichloroethylene | 1.8 |
| 1,2-trans-dichloroethylene | ND | vinyl chloride | ☆ |

ND - Less than 1 μg/kg
☆ - Less than 10 μg/kg
☆☆ - Less than 100 μg/kg

[1] 1,3-cis-dichloropropylene and 1,3-trans-dichloropropylene could not be resolved, values reported indicate the sum of both compounds.

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-25 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #572 DATE ANALYSIS COMPLETED 16 July 1981

## ACID COMPOUNDS

| | µg/l |
|---|---|
| 2,4,6-trichlorophenol | ND |
| o-chloro-m-cresol | ND |
| 2-chlorophenol | ND |
| 2,4-dichlorophenol | ND |
| 2,4-dimethylphenol | ND |
| 2-nitrophenol | ND |
| 4-nitrophenol | * |
| 2,4-dinitrophenol | ** |
| 4,6-dinitro-o-cresol | * |
| pentachlorophenol | ND |
| phenol | 52.8 |

ND - Less than 1 µg/l
* - Less than 25 µg/l
** - Less than 250 µg/l

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. EH-25 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. 0572 DATA ANALYSIS COMPLETED 22 July 1981

BASE/NEUTRAL COMPOUNDS

| | µg/l | | µg/l |
|---|---|---|---|
| acenaphthene | ND | nitrobenzene | ☆ |
| benzidine | ☆☆ | N-nitrosodimethylamine | ☆☆ |
| 1,2,4-trichlorobenzene | ND | N-nitrosodiphenylamine | ☆☆ |
| hexachlorobenzene | ND | N-nitrosodi-n-propylamine | ☆☆ |
| hexachloroethane | ☆ | bis(2-ethylhexyl)phthalate | 3.5 |
| bis(2-chloroethyl)ether | ☆ | butyl benzyl phthalate | ☆ |
| 2-chloronaphthalene | ND | di-n-butyl phthalate | ND |
| 1,2-dichlorobenzene | ND | di-n-octyl phthalate | ND |
| 1,3-dichlorobenzene | ND | diethyl phthalate | ND |
| 1,4-dichlorobenzene | ND | dimethyl phthalate | ND |
| 3,3'-dichlorobenzidine | ☆ | benzo(a)anthracene | ND |
| 2,4-dinitrotoluene | ☆☆ | benzo(a)pyrene | ☆ |
| 2,6-dinitrotoluene | ☆ | benzo(b)fluoranthene[1] | ☆ |
| 1,2-diphenylhydrazine | ND | benzo(k)fluoranthene[1] | ☆ |
| fluoranthene | ND | chrysene | ND |
| 4-chlorophenyl phenyl ether | ☆ | acenaphthylene | ND |
| 4-bromophenyl phenyl ether | ☆ | anthracene | ND |
| bis(2-chloroisopropyl)ether | ☆ | benzo (g.h.i.) perylene | ☆ |
| bis(2-chloroethoxy)methane | ☆ | fluorene | ND |
| hexachlorobutadiene | ☆ | phenanthrene | ND |
| hexachlorocyclopentadiene | ☆ | dibenzo (a,h)anthracene | ☆☆ |
| isophorone | ☆ | indeno(1,2,3-c,d)pyrene | ☆ |
| naphthalene | ND | pyrene | ND |
| bis(chloromethyl)ether | ☆☆ | 2,3,7,8-tetrachlorodibenzo-p-dioxin | ☆☆ |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l
☆☆ - Less than 25 µg/l

[1] Benzo(b)fluoranthene and benzo(k)fluoranthene could not be resolved, values reported indicate the sum of both compounds.

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-25 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #572 DATE ANALYSIS COMPLETED 24 July 1981

### PESTICIDES

| | μg/l | | μg/l |
|---|---|---|---|
| aldrin | ☆ | a-BHC | ☆ |
| dieldrin | ND | b-BHC | ND |
| chlordane | ND | δ-BHC | ☆ |
| 4,4'-DDT | ND | g-BHC | ND |
| 4,4'-DDE | ND | PCB - 1242 | ND |
| 4,4'-DDD | ND | PCB - 1254 | ND |
| endosulfan I | ☆ | PCB - 1221 | ND |
| endosulfan II | ☆ | PCB - 1232 | ND |
| endosulfan sulfate | ☆ | PCB - 1248 | ND |
| endrin | ☆ | PCB - 1260 | ND |
| endrin aldehyde | ☆ | PCB - 1016 | ND |
| heptachlor | ND | toxaphene | ND |
| heptachlor epoxide | ☆ | | |

ND - Less than 1 μg/l
☆ - Less than 10 μg/l

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. EH-25 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #572 DATE ANALYSIS COMPLETED 5 August 1981

### VOLATILES

| | µg/l | | µg/l |
|---|---|---|---|
| acrolein | ☆☆ | 1,2-dichloropropane | ND |
| acrylonitrile | ☆☆ | 1,3-dichloropropylene[1] | ☆ |
| benzene | 1.1 | ethylbenzene | 21.3 |
| carbon tetrachloride | ☆ | methylene chloride | 11.4 |
| chlorobenzene | ND | methyl chloride | ☆ |
| 1,2-dichloroethane | 5.4 | methyl bromide | ☆ |
| 1,1,1-trichloroethane | ND | bromoform | ND |
| 1,1-dichloroethane | ND | dichlorobromomethane | ND |
| 1,1,2-trichloroethane | ND | trichlorofluoromethane | ☆ |
| 1,1,2,2-tetrachloroethane | ND | dichlorodifluoromethane | ☆ |
| chloroethane | ☆ | chlorodibromomethane | ND |
| 2-chloroethylvinyl ether | ND | tetrachloroethylene | 48.4 |
| chloroform | ND | toluene | 45.3 |
| 1,1-dichloroethylene | ☆ | trichloroethylene | 4.4 |
| 1,2-trans-dichloroethylene | 23.1 | vinyl chloride | ☆ |

ND - Less than 1 µg/kg
☆ - Less than 10 µg/kg
☆☆ - Less than 100 µg/kg

[1] 1,3-cis-dichloropropylene and 1,3-trans-dichloropropylene could not be resolved, values reported indicate the sum of both compounds.

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-31 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #573 DATE ANALYSIS COMPLETED 16 July 1981

ACID COMPOUNDS

| | µg/l |
|---|---|
| 2,4,6-trichlorophenol | * |
| o-chloro-m-cresol | ND |
| 2-chlorophenol | 26.0 |
| 2,4-dichlorophenol | ND |
| 2,4-dimethylphenol | ND |
| 2-nitrophenol | ND |
| 4-nitrophenol | * |
| 2,4-dinitrophenol | * |
| 4,6-dinitro-o-cresol | ND |
| pentachlorophenol | ND |
| phenol | 2.6 |

ND - Less than 1 µg/l
* - Less than 25 µg/l
** - Less than 250 µg/l

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. EH-31 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #573 DATA ANALYSIS COMPLETED 22 July 1981

### BASE/NEUTRAL COMPOUNDS

| | µg/l | | µg/l |
|---|---|---|---|
| acenaphthene | ND | nitrobenzene | ND |
| benzidine | ☆☆ | N-nitrosodimethylamine | ☆☆ |
| 1,2,4-trichlorobenzene | ND | N-nitrosodiphenylamine | ☆☆ |
| hexachlorobenzene | ND | N-nitrosodi-n-propylamine | ☆☆ |
| hexachloroethane | ND | bis(2-ethylhexyl)phthalate | ☆ |
| bis(2-chloroethyl)ether | ND | butyl benzyl phthalate | 16.2 |
| 2-chloronaphthalene | ND | di-n-butyl phthalate | ND |
| 1,2-dichlorobenzene | ND | di-n-octyl phthalate | 1.4 |
| 1,3-dichlorobenzene | ND | diethyl phthalate | ND |
| 1,4-dichlorobenzene | ND | dimethyl phthalate | ND |
| 3,3'-dichlorobenzidine | ☆ | benzo(a)anthracene | ND |
| 2,4-dinitrotoluene | ☆☆ | benzo(a)pyrene | ND |
| 2,6-dinitrotoluene | ND | benzo(b)fluoranthene[1] | ND |
| 1,2-diphenylhydrazine | ND | benzo(k)fluoranthene[1] | ND |
| fluoranthene | ND | chrysene | ND |
| 4-chlorophenyl phenyl ether | ND | acenaphthylene | ND |
| 4-bromophenyl phenyl ether | ND | anthracene | ND |
| bis(2-chloroisopropyl)ether | ND | benzo (g.h.i.) perylene | ☆ |
| bis(2-chloroethoxy)methane | ND | fluorene | ND |
| hexachlorobutadiene | ND | phenanthrene | ND |
| hexachlorocyclopentadiene | ☆ | dibenzo (a,h)anthracene | ☆ |
| isophorone | ND | indeno(1,2,3-c,d)pyrene | ND |
| naphthalene' | ND | pyrene | ND |
| bis(chloromethyl)ether | ☆☆ | 2,3,7,8-tetrachlorodibenzo-p-dioxin | ☆☆ |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l
☆☆ - Less than 25 µg/l

[1]Benzo(b)fluoranthene and benzo(k)fluoranthene could not be resolved, values reported indicate the sum of both compounds.

# SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-31 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #573 DATE ANALYSIS COMPLETED 24 July 1981

## PESTICIDES

| | µg/l | | µg/l |
|---|---|---|---|
| aldrin | ND | a-BHC | ☆ |
| dieldrin | ND | b-BHC | ND |
| chlordane | ND | d-BHC | 8.5 |
| 4,4'-DDT | ND | g-BHC | ND |
| 4,4'-DDE | ND | PCB - 1242 | ND |
| 4,4'-DDD | ND | PCB - 1254 | ND |
| endosulfan I | ☆ | PCB - 1221 | ND |
| endosulfan II | ☆ | PCB - 1232 | ND |
| endosulfan sulfate | ☆ | PCB - 1248 | ND |
| endrin | ☆ | PCB - 1260 | ND |
| endrin aldehyde | ☆ | PCB - 1016 | ND |
| heptachlor | ND | toxaphene | ND |
| heptachlor epoxide | ☆ | | |

ND - Less than 1 µg/l
☆ - Less than 10 µg/l

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. EH-31 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #573 DATE ANALYSIS COMPLETED 5 August 1981

### VOLATILES

| | µg/l | | µg/l |
|---|---|---|---|
| acrolein | ** | 1,2-dichloropropane | ND |
| acrylonitrile | ** | 1,3-dichloropropylene[1] | * |
| benzene | ND | ethylbenzene | 30.4 |
| carbon tetrachloride | * | methylene chloride | 1.4 |
| chlorobenzene | 9.6 | methyl chloride | * |
| 1,2-dichloroethane | 4.2 | methyl bromide | * |
| 1,1,1-trichloroethane | 1.4 | bromoform | ND |
| 1,1-dichloroethane | ND | dichlorobromomethane | ND |
| 1,1,2-trichloroethane | ND | trichlorofluoromethane | 2.6 |
| 1,1,2,2-tetrachloroethane | ND | dichlorodifluoromethane | * |
| chloroethane | * | chlorodibromomethane | ND |
| 2-chloroethylvinyl ether | ND | tetrachloroethylene | 19.3 |
| chloroform | 3.1 | toluene | 30.9 |
| 1,1-dichloroethylene | ND | trichloroethylene | 13.1 |
| 1,2-trans-dichloroethylene | 40.2 | vinyl chloride | * |

ND - Less than 1 µg/kg
* - Less than 10 µg/kg
** - Less than 100 µg/kg

[1] 1,3-cis-dichloropropylene and 1,3-trans-dichloropropylene could not be resolved, values reported indicate the sum of both compounds.

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-35 DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #574 DATE ANALYSIS COMPLETED 16 July 1981

### ACID COMPOUNDS

| | µg/l |
|---|---|
| 2,4,6-trichlorophenol | * |
| o-chloro-m-cresol | ND |
| 2-chlorophenol | 1414.7 |
| 2,4-dichlorophenol | ND |
| 2,4-dimethylphenol | ND |
| 2-nitrophenol | ND |
| 4-nitrophenol | * |
| 2,4-dinitrophenol | ** |
| 4,6-dinitro-o-cresol | * |
| pentachlorophenol | * |
| phenol | 159.0 |

ND - Less than 1 µg/l
* - Less than 25 µg/l
** - Less than 250 µg/l

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. EH-35 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. 0574 DATA ANALYSIS COMPLETED 22 July 1981

BASE/NEUTRAL COMPOUNDS

| | µg/l | | µg/l |
|---|---|---|---|
| acenaphthene | ND | nitrobenzene | * |
| benzidine | ** | N-nitrosodimethylamine | ** |
| 1,2,4-trichlorobenzene | ND | N-nitrosodiphenylamine | ** |
| hexachlorobenzene | ND | N-nitrosodi-n-propylamine | ** |
| hexachloroethane | ND | bis(2-ethylhexyl)phthalate | ** |
| bis(2-chloroethyl)ether | ND | butyl benzyl phthalate | 18.4 |
| 2-chloronaphthalene | ND | di-n-butyl phthalate | * |
| 1,2-dichlorobenzene | ND | di-n-octyl phthalate | ND |
| 1,3-dichlorobenzene | ND | diethyl phthalate | ND |
| 1,4-dichlorobenzene | ND | dimethyl phthalate | ND |
| 3,3'-dichlorobenzidine | * | benzo(a)anthracene | ND |
| 2,4-dinitrotoluene | ** | benzo(a)pyrene | ND |
| 2,6-dinitrotoluene | * | benzo(b)fluoranthene[1] | ND |
| 1,2-diphenylhydrazine | ND | benzo(k)fluoranthene[1] | ND |
| fluoranthene | ND | chrysene | ND |
| 4-chlorophenyl phenyl ether | ND | acenaphthylene | ND |
| 4-bromophenyl phenyl ether | ND | anthracene | ND |
| bis(2-chloroisopropyl)ether | ND | benzo (g.h.i.) perylene | * |
| bis(2-chloroethoxy)methane | ND | fluorene | ND |
| hexachlorobutadiene | ND | phenanthrene | ND |
| hexachlorocyclopentadiene | * | dibenzo (a,h)anthracene | * |
| isophorone | ND | indeno(1,2,3-c,d)pyrene | ND |
| naphthalene' | 3.8 | pyrene | ND |
| bis(chloromethyl)ether | ** | 2,3,7,8-tetrachlorodibenzo-p-dioxin | ** |

ND - Less than 1 µg/l
* - Less than 10 µg/l
** - Less than 25 µg/l

[1]Benzo(b)fluoranthene and benzo(k)fluoranthene could not be resolved, values reported indicate the sum of both compounds.

## SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-35 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #574 DATE ANALYSIS COMPLETED 24 July 1981

### PESTICIDES

| | μg/l | | μg/l |
|---|---|---|---|
| aldrin | * | a-BHC | ND |
| dieldrin | ND | b-BHC | ND |
| chlordane | 940 | d-BHC | * |
| 4,4'-DDT | ND | g-BHC | ND |
| 4,4'-DDE | ND | PCB - 1242 | ND |
| 4,4'-DDD | ND | PCB - 1254 | ND |
| endosulfan I | * | PCB - 1221 | ND |
| endosulfan II | * | PCB - 1232 | ND |
| endosulfan sulfate | * | PCB - 1248 | ND |
| endrin | * | PCB - 1260 | ND |
| endrin aldehyde | * | PCB - 1016 | ND |
| heptachlor | ND | toxaphene | ND |
| heptachlor epoxide | * | | |

ND - Less than 1 μg/l
* - Less than 10 μg/l

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

CLIENT West Lake

CLIENT I.D. BH-35 DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. 0574 DATE ANALYSIS COMPLETED 5 August 1981

VOLATILES

| | μg/l | | μg/l |
|---|---|---|---|
| acrolein | ☆☆ | 1,2-dichloropropane | ND |
| acrylonitrile | ☆☆ | 1,3-dichloropropylene[1] | ☆ |
| benzene | 15.7 | ethylbenzene | 487.9 |
| carbon tetrachloride | 22.4 | methylene chloride | 26.4 |
| chlorobenzene | ND | methyl chloride | ☆ |
| 1,2-dichloroethane | 81.6 | methyl bromide | 57.6 |
| 1,1,1-trichloroethane | ND | bromoform | ND |
| 1,1-dichloroethane | 18.4 | dichlorobromomethane | ND |
| 1,1,2-trichloroethane | ND | trichlorofluoromethane | 147.9 |
| 1,1,2,2-tetrachloroethane | ND | dichlorodifluoromethane | ☆ |
| chloroethane | ☆ | chlorodibromomethane | ND |
| 2-chloroethylvinyl ether | ☆ | tetrachloroethylene | 45.3 |
| chloroform | 25.1 | toluene | 277.1 |
| 1,1-dichloroethylene | 5.2 | trichloroethylene | 724.9 |
| 1,2-trans-dichloroethylene | 7.7 | vinyl chloride | ☆☆ |

ND - Less than 1 μg/kg
☆ - Less than 10 μg/kg
☆☆ - Less than 100 μg/kg

[1] 1,3-cis-dichloropropylene and 1,3-trans-dichloropropylene could not be resolved, values reported indicate the sum of both compounds.

Chemical Analysis of Radioactive Material From Areas 1 and 2

Table 13

Concentration in ppm

| | Offsite Bkg Sample | Area 1 Surface (#101) | Area 1 Surface (#102) | Area 1 Borehole (#103) | Area 2 Surface (#104) | Area 2 Surface (#105) |
|---|---|---|---|---|---|---|
| Barium | 250 | 300 | 1811 | 2386 | 1158 | 1197 |
| Lead | 16 | 15 | 108 | 121 | 11 | 50 |
| Zinc | 132 | 146 | 94 | 76 | 28 | 167 |
| Sulfate | 20 | 15 | 108 | 121 | 11 | 50 |

Summary of Background Measurements in the Vicinity of West Lake Landfill,
St. Louis County Missouri

Table 14

| Sample Type | Background Location: Earth City | Taussig Road | Old St. Charles Rock Road |
|---|---|---|---|
| Flux (Av)(pCi/m2.s) | 0.50 +/- 54% | 0.58 +/- 27% | 0.50 +/- 30% |
| Exposure Rate (uR/hr) | 10.6 | 8.0 | -------------- |
| Soil Conc. (Ra-226 pCi/gm) | 2.6 +/- 23% | 2.5 +/- 19% | -------------- |
| HVAS (W.L.) | 1.1E-3 | 5E-3 | 1.7E-3 |

Target Criteria and Measurements LLDs for West Lake Landfill

Table 15

Soil Contaminants

| Nuclide | Target Criteria | LLD |
|---|---|---|
| Ra-226 | 5pCi/g | 1pCi/g |
| Total U | 15pCi/g | 3pCi/g |
| U-238 | 30pCi/g | 6pCi/g |
| U-235 | 30pCi/g | 6pCi/g |
| Th-232 | 5pCi/g | 1pCi/g |
| Th-230 | 15pCi/g | 3pCi/g |

Water and Airborne Contaminants

| Nuclide | Target Criteria | LLD |
|---|---|---|
| All | MPC Unrestricted | 20% MPC |
| Radon Daughters | 0.03 W.L. | 0.006 W.L. |
| Ra-226 (water) | 3E-8 uCi/ml | 6E-9 uCi/ml |

External Radiation

| Nuclide | Target Criteria | LLD |
|---|---|---|
| All | 20 uR/hr | 4 uR/hr |

APPENDIX I

# Radiological Survey Instruments and Methods

A. Portable Survey Instrument

The portable survey instruments used at West Lake included two complete sets of Johnson equipment, which consist of battery operated rate meters, scalers and alpha, beta and gamma probes. These systems (see Figure I-1) are totally portable and can be used in the field for both measurements and sample counting.

The alpha probes use a ZnS (Ag) scintillation detector; the beta detector is a thin window (1.4mg/cm2 mica) GM tube, and the gamma detector is a 2" by 2" NaI(Tl) crystal. The alpha and beta probes were calibrated with "NBS traceable" sources at the RMC calibration facility in Philadelphia and the gamma scintillator was cross-calibrated with a primary ionization chamber system, described below.

B. Ionization Chamber System

External gamma dose rates were accurately measured with the RMC constructed Tissue Equivalent Ionization Chamber System (Figure I-2). This system consisted of a 16 liter tissue equivalent, gas filled ionization chamber (Shonka chamber), a Keithley vibrating capacitor electrometer, a printer and battery pack. It is capable of measuring dose rates at background levels to a precision of a few percent.

Since this system is bulky and somewhat fragile, it is not as suited for extensive field measurements as a smaller, lightweight NaI(Tl) portable survey instrument. Therefore, the NaI(Tl) detector was used for the majority of the field gamma measurements. Since this detector's response is energy dependent, it cannot be used as a "micro R meter" unless it is initially calibrated for such use.

The calibration performed by RMC consisted of accurately measuring the exposure rate at several locations at West Lake Landfill, using the Tissue Equivalent Ionization Chamber, then recording NaI(Tl) measurements at the same location. In this manner a set of NaI(Tl) count-rate versus exposure rates were obtained and a uR/hr calibration factor established, as shown in Figure I-3.

Due to the energy dependence of the NaI detector, this conversion factor will apply only to the radionuclides and geometries for which the calibrations were made. In the case of West Lake, analyses have verified the presence only of naturally occurring nuclides of the uranium series (Ra-226 and daughters), thorium series and potassium. Therefore, the conversion factor established at West Lake will apply only to naturally occurring radionuclides distributed in soil.

C. Mobile Lab Gamma Analysis System

The mobile lab gamma analysis system (Figure I-4) consists of a PGT 15% efficient (relative to a 3" x 3" NaI(Tl) crystal) intrinsic germanium (IG) detector, shield and Tennecomp TP-50 laboratory computer data acquisition module. The analysis system was calibrated for all counting geometries with an NBS supplied Eu-152 source.

Each count was analyzed by a computer program for determination of gamma energies and peak areas. All results were printed out immediately following analysis on-site, and data was stored on floppy discs for future analysis, as needed.

Samples were sealed in counting containers and stored to allow for complete ingrowth of radon and daughters, whenever possible. In these cases, Ra-226 was determined by counting the daughter Bi-214 gamma-ray lines at 609 and 1764 KeV. Pb-214 was determined by the 295 and 352 KeV lines, U-238 from its 93 KeV line, Ra-223 from its 270 KeV line, Rn-219 from its 401 KeV line, Pb-211 from its 405 and 832 KeV lines, Th-227 from its 237 KeV line and K-40 from its 1462 KeV line.

Typical LLDs for Ra-226 were 0.1 pCi/g in soil and vegetation, and 0.4 pCi/l in water. For Rn-219 daughters on air filters, LLDs were 0.4 pCi/l. The LLD for U-238 in soil was on the order of 1 pCi/g.

D. Auger Hole Logging System

Detailed logging of selected auger holes was performed with the system shown in Figure I-5. This system consists of a custom designed EG&G Ortec intrinsic germanium detector (10% eff) with a narrow dewar, coupled to a Tracor-Northern

1750 MCA used for data acquisition and initial field evaluations. Data was stored on a tape cassette recorder, then transferred to the lab computer system for final analysis. The entire system, including an NIM module power supply with a bias power supply and amplifier, was powered in the field by a portable 5000 watt gasoline-driven generator.

The logging system was calibrated as described in Attachment 1. Field counting times varied from 2 minutes to 10 minutes at each location, depending upon the level of activity present. Typical LLDs for this system and relatively short count times are 0.3 pCi/g for Bi-214, 1 pCi/g for U-238, 0.2 pCi/g for Pb-212 and 0.1 pCi/g for K-40.

The field use of this system was somewhat limited by initial failure due to high humidity effects on the pre-amp components and thermal insulation of the detector housing. These problems were partially corrected by sealing the detector in an outer container and allowing dry air to flow through the container.

E. Radon Analysis Systems

Radon flux was determined using the accumulator system shown in Figure I-6, which is similar to those used by Wilkening [1] and others. Accumulation times varied from 15 minutes to 2 hours. Gas samples were drawn and counted in the EDA Radon Detector, usually 2 hours after sampling, to allow for daughter ingrowth. Standard MSA charcoal canisters were used for the canister method, as described by Countess [2].

F. Alpha-Beta Counting System.

All samples were counted for gross alpha or beta activity on the Gamma Products low background gas flow proportional counter, shown in Figure I-7. The system is automatic and can be programmed for a variety of counting parameters.

## REFERENCES


[1] M. Wilkening, "Measurement of Radon Flux by the Accumulation Method", Workshops on Methods for Measuring Radiation in and Around Uranium Mills, 3, 9, 1977, pp. 131-137.

[2] R. J. Countess, "Measurements of Rn-222 Flux with Charcoal Canisters" ibid. pp. 139-147.

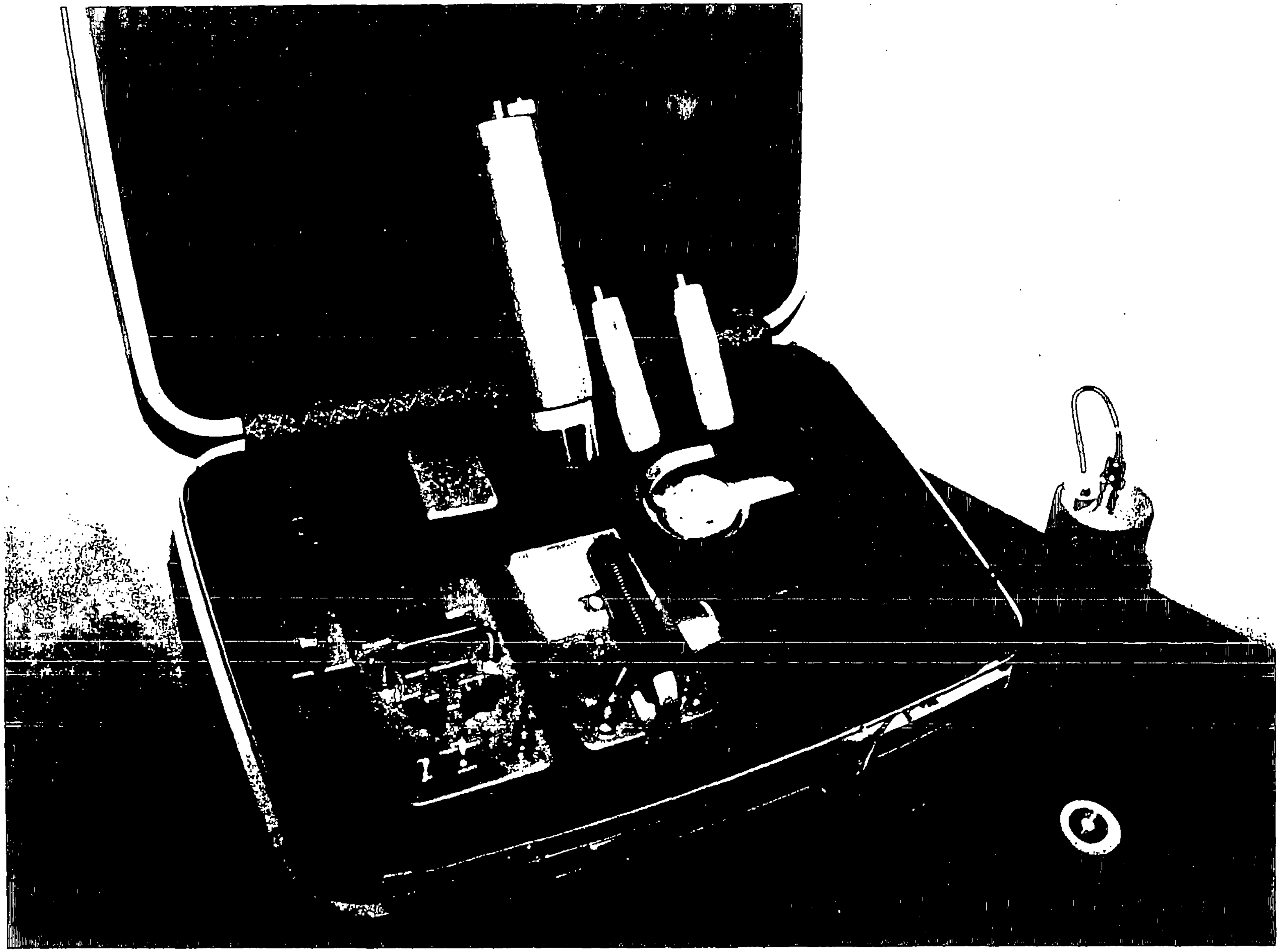


Figure I-1.  Portable Survey Instrument Kit.

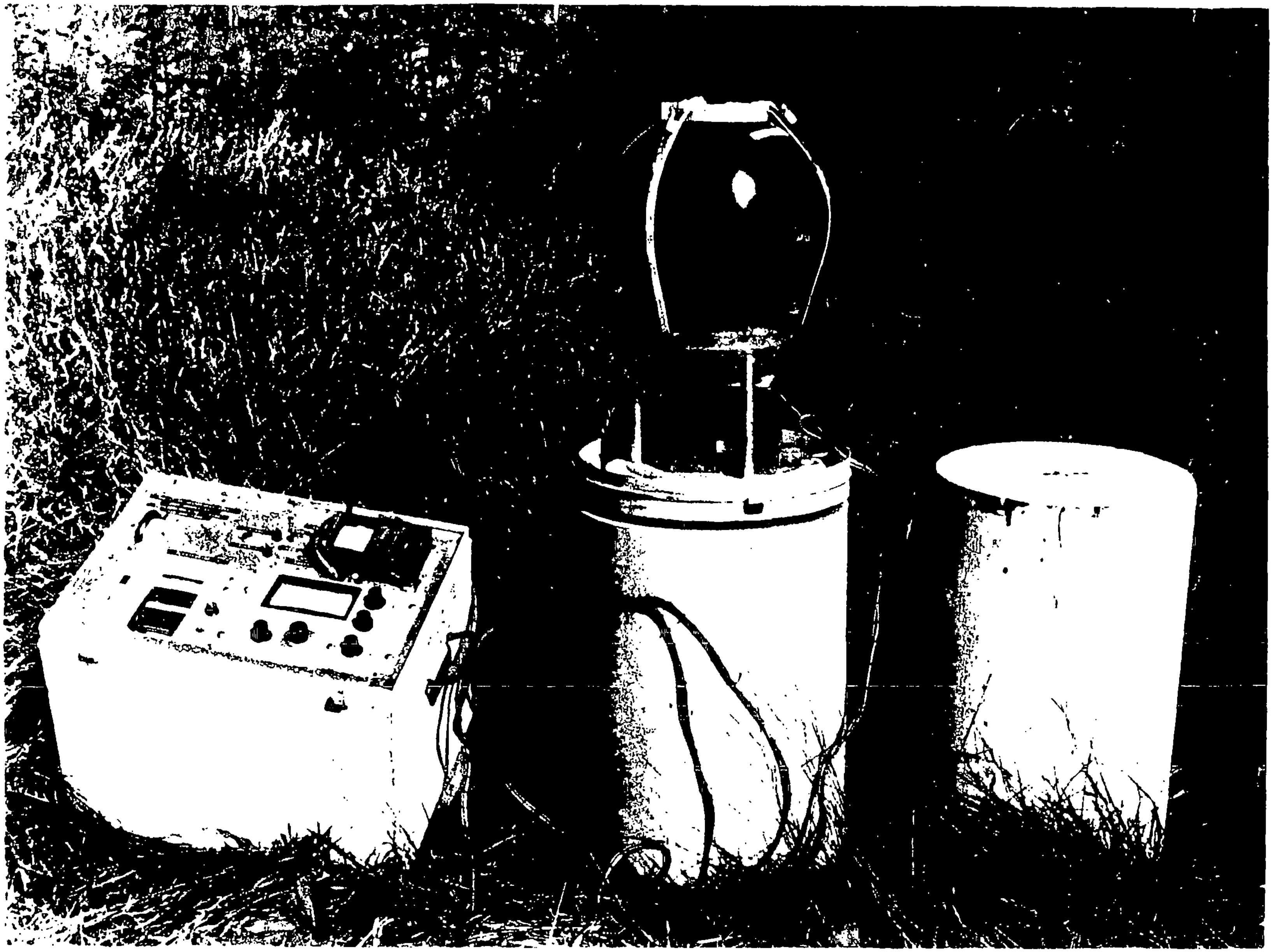


Figure I-2. High sensitivity tissue equivalent ionization chamber system.

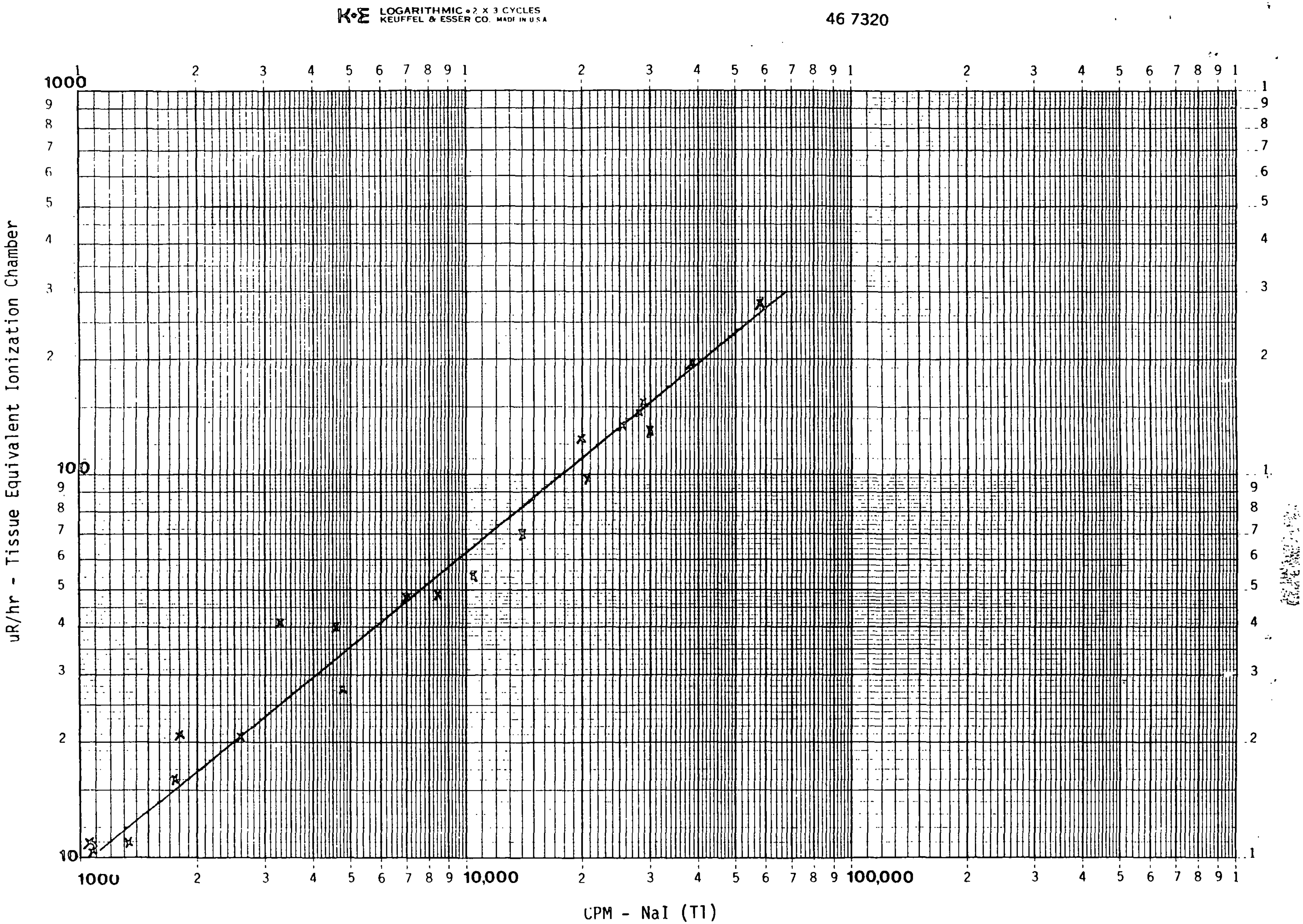



Figure I-3. Ion chamber exposure rates versus NaI (Tl) count rates, West Lake landfill site.

Figure I-4. Interior of mobile lab showing gamma counting system and other equipment.

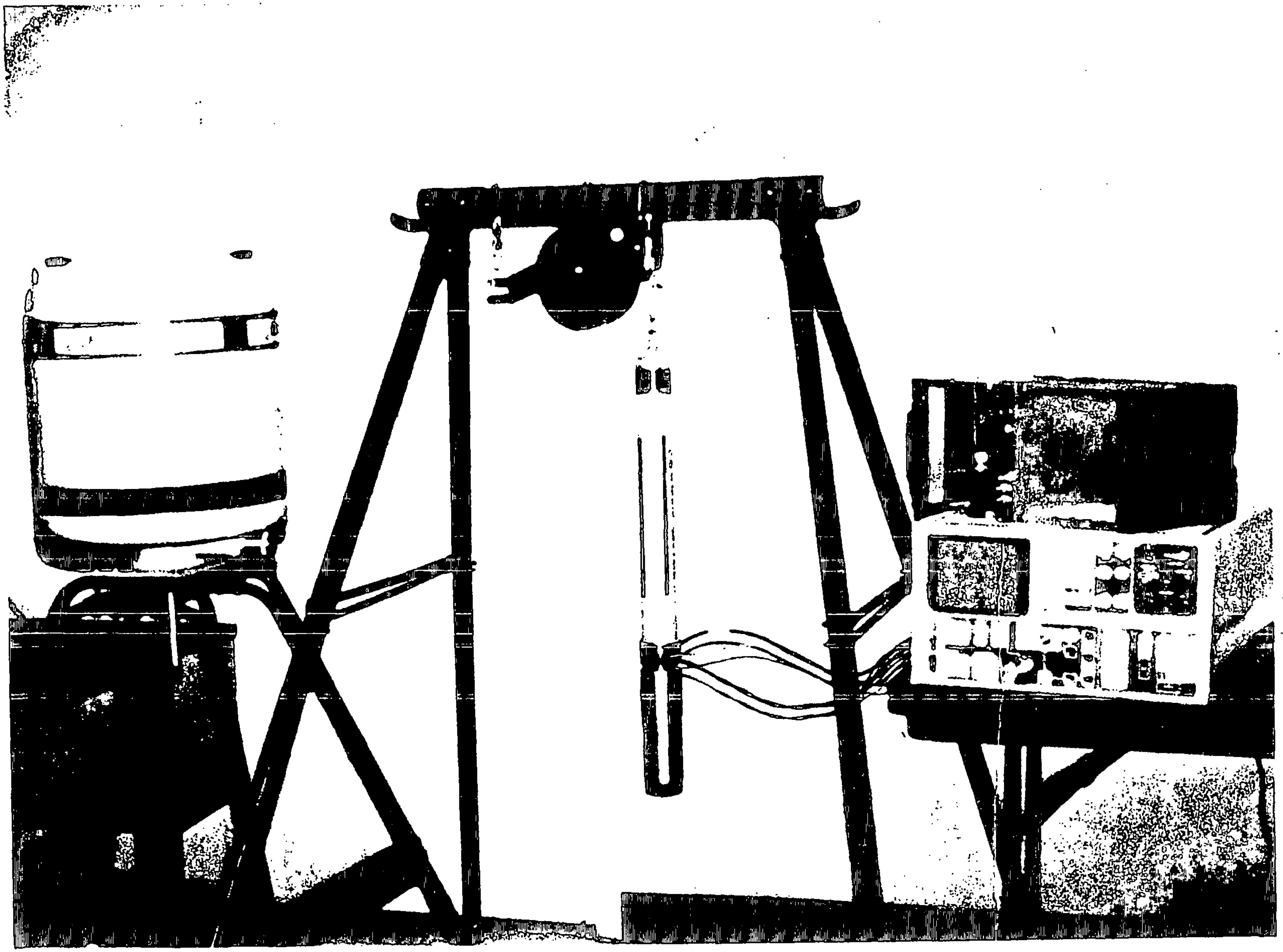


Figure I-5. In-situ auger hole logging system with intrinsic germanium detector and narrow dewar assembly, data acquisition equipment and storage/fill dewar.

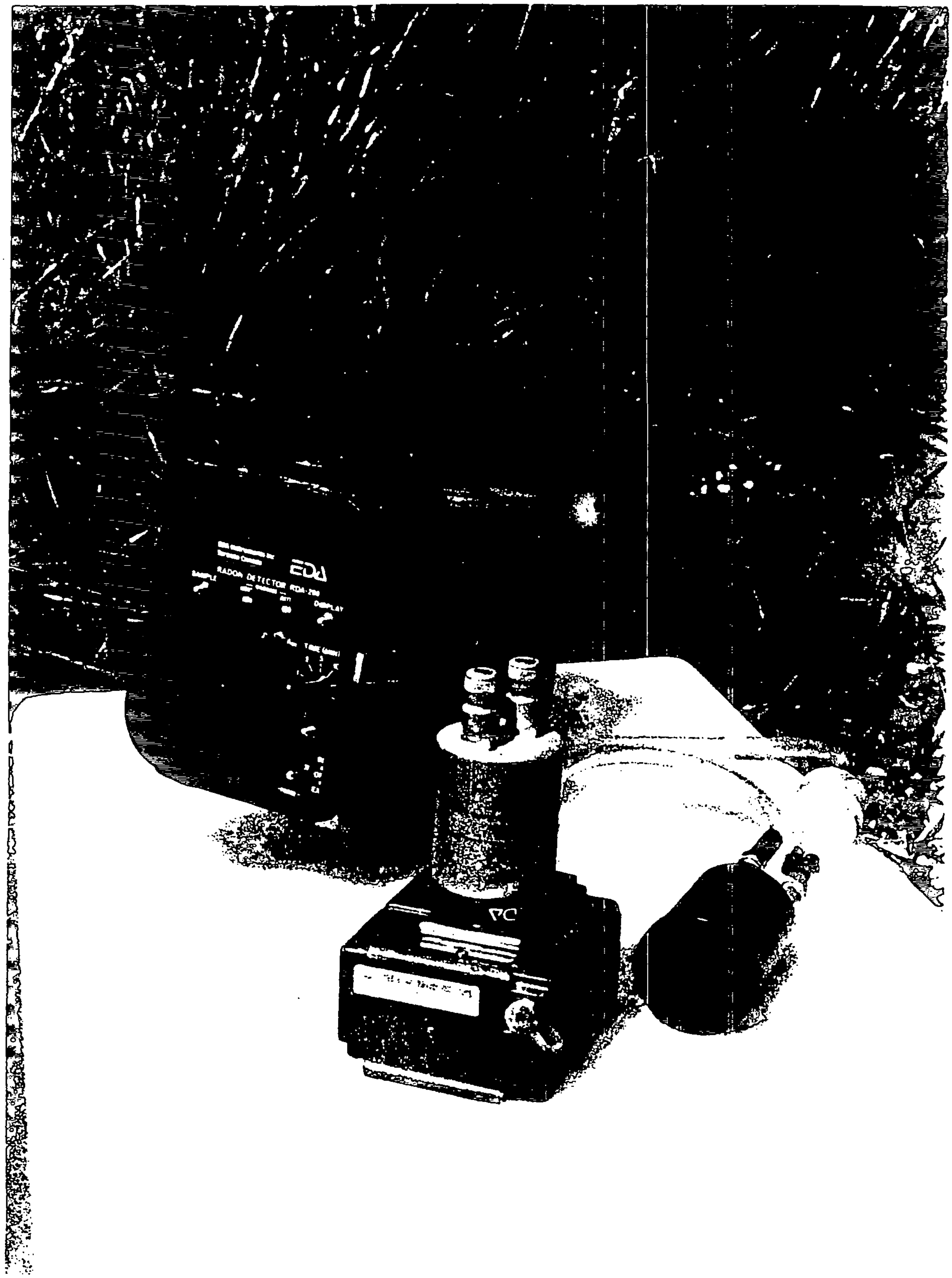



Figure I-6. Radon sampling cells, pump, and gas analyzer, sitting atop a radon accumulator tub.


Figure I-7. Automatic beta-gamma gas flow proportional counter.

ATTACHMENT 1 TO APPENDIX I

INTRINSIC GERMANIUM WELL LOG

DETECTOR CALIBRATION

The intrinsic germanium detector was connected to the pulse height analysis system consisting of the following components:

Ortec Model 459 High Voltage Power Supply

Canberra 2011 Spectroscopy Amplifier

Tracor Northern 1750 MCA

Teletype Model 43 Printer

Gain and voltage supply settings were adjusted to obtain an energy spectrum of 0 to 2000 kev, which corresponds to approximately 1 kev per channel.

Calibration of the well logging system was performed using the calibration rig shown in Figure 1. This rig is constructed as a series of four concentric rings surrounding a 6 inch PVC casing. Each ring contains thin plastic tubes 1-1/4" diameter by 36" long. A set of "source rods" and "background rods" were prepared and loaded into these tubes in a variety of configurations for the various calibration and test counts.

The geometry of the rig is such that the distance from the center of the casing (or detector) to the center of the innermost ring is 3.75 inches, to the center of the second ring is 5.0 inches, to the center of the third ring is 6.25

inches, and to the center of the fourth ring is 7.50 inches. All voids between tubes were filled with low background sand. It was determined that the ratio of source volume in each ring to the total ring area was about 0.6. Hence, when source rods were fully loaded into a given ring, the activity counted represented approximately 60% of the total area (volume) the detector viewed, and counts were adjusted accordingly.

Each source tube is a 12 inch high by 1 inch diameter tube filled with a material containing Eu-152. The source material was prepared by mixing the standard Eu-152 source solution with plaster of paris, at a constant ratio designed to give a uniform specific activity of 440 pCi/gram. Background rods were filled with "clean" plaster of paris. Plaster of paris was chosen because of its ease of handling, ability to uniformly distribute the source throughout the material, and its density, which approximates that of common soil. (Density of soil, 1.7-2.3 g/cubic cm; density of plaster, 1.5 g/cubic cm; density of sand, 1.4 g/cubic cm)

Four different configurations of source and blank tubes were used for the calibration. Source tubes were placed three high in one of the four concentric rings of the rig for each count while the balance of the rig was filled with blanks. These configurations correspond to the source material being a radial distance of 3.75, 5.00, 6.25 and 7.50 inches from the detector.

Each configuration was counted for 900 seconds, and the area under each of the eight major Eu-152 photopeaks determined for each count.

Calculation of counts per gamma per gram was determined by the following method:

NCNTS/GAMMA/GRAM =

[NCNTS]/[(440pCi/g)(3.7E-2d/s/pCi)(900s)(ABUNDANCEgamma/d)]

For each gamma energy, the net counts/gamma/gram vs distance from the center of the detector was listed. These response curves were then plotted for each energy, for distances and activities which extend to zero net counts. This represents an "infinite" distance from the detector. Using these curves, the total counts from the detector to an infinite distance was calculated by integrating the area under the curve using Simpson's rule for approximating integrals. Of prime importance is the integral from 2 inches to infinity, since this is the area the detector will view when placed inside a 4 inch PVC casing.

Finally, the integrated net count/gamma/gram, from 2 inches to infinity, was plotted vs energy, for each of the Eu-152 photons. With this efficiency curve, a specific activity in soil (pCi/gram) can be determined from a bore hole count, assuming the radionuclide can be identified and its gamma abundance determined. The calculation is:

SPECIFIC ACTIVITYpCi/gm(in soil) =

[NETCOUNTS]/[(ABUNDANCEgamma/dis)(2.22 dis/min/pCi)

(MINUTES COUNTED)(EFFICIENCYcounts/gamma/gm)]

This determination will be valid so long as the radioactive material is uniformly distributed to an "infinite" distance in soil, and the detector is in a 4 inch PVC (or similar material) casing. Although soil should be at the surface of the casing, the data indicates that small voids will not produce significant errors in activity estimations.

Results of this calibration indicate that an "infinite" thickness in soil for a bore hole logging device is about 10 inches from the center of the detector. Thus, for a 4 inch hole, gamma logging will only "see" activity out to about 7 or 8 inches from the hole. For low energies (100-500 kev), 50 to 60% of the total activity seen is in the interval of 2 to 4 inches. For energies above 500 Kev, this value is 40 to 50%. While this volume may not seem large, it represents several thousand (2000 to 4000) grams of soil, which is much larger than typical core samples, and is therefore more representative of the actual soil activity.

This calibration indicates that the sensitivity of the IG well logging system is such that the Ra-226 daughter Bi-214, as measured by the 47% abundant 609 KeV peak, can be easily detected at 1 pCi/gram in soil, in a five minute count, with a 95% confidence level and precision of 0.4 pCi/g.

Figure 1

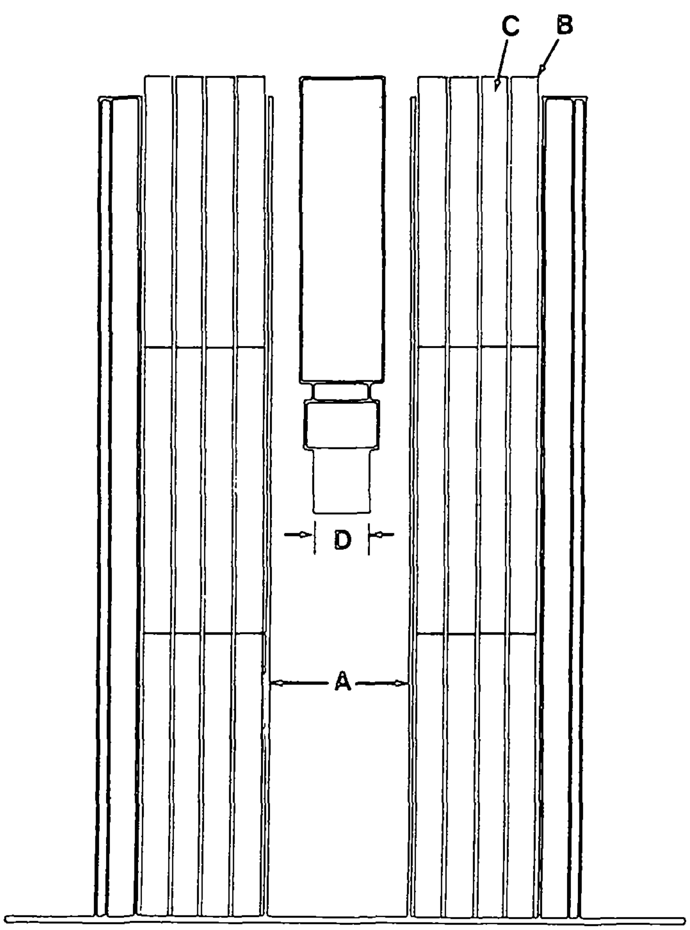
CALIBRATION RIG ASSEMBLY

"A" - 6" I.D. PVC Pipe

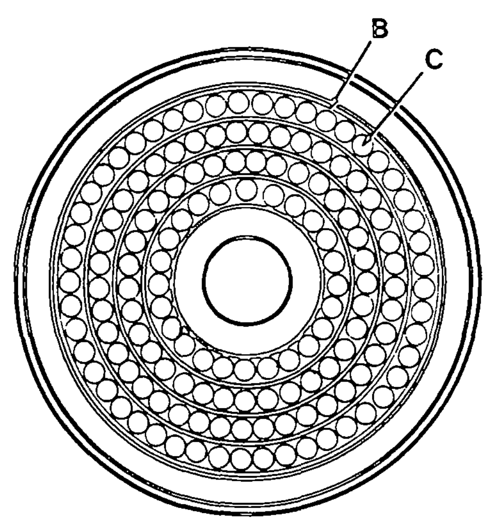
"B" - 1.25" diameter x 36" long butyrate source holder tubes

"C" - 1" diameter x 12" long source tubes. 3 per holder tube

"D" - IG Detector




Cross Section




Top View

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16. ABSTRACT (200 words or less)

This report presents the results of a radiological survey of the West Lake Landfill, St. Louis County, Missouri, performed by Radiation Management Corporation during the spring and summer of 1981. Measurements were made to determine external radiation levels, concentrations of airborne contaminants and the identity and concentrations of subsurface deposits. Results indicate that large volumes of uranium ore residues, probably originating from the Hazelwood, Missouri, Latty Avenue site, have been buried at the West Lake Landfill. Two areas of contamination, covering more than 15 acres and located at depths of up to 20 feet below the present surface, have been identified. There is no indication that significant quantities of contaminants are moving off-site at this time.

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