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

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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.

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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

* NRC: 7 tons uranium + 8700 barium sulfate + 39,000 soil - [from Latty!]
P.D. - 9000 tons total - plus unknown -

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). pp.112→ 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). → p.121 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. pp. 44, 47

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. berm 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. (p.20) p.58

(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

p.59 from U-238 a beta emitter

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.

pp. 39 thru 42

(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.

p.73

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.

865? [p.76]

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. p.75→78

sq.meter-second

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. p.43

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, p.79

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. p. 80

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. pp. 81-82

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. p. 83

(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. pp. 84 thru 108.

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. 109

(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. p.110 p.111

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.

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[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.

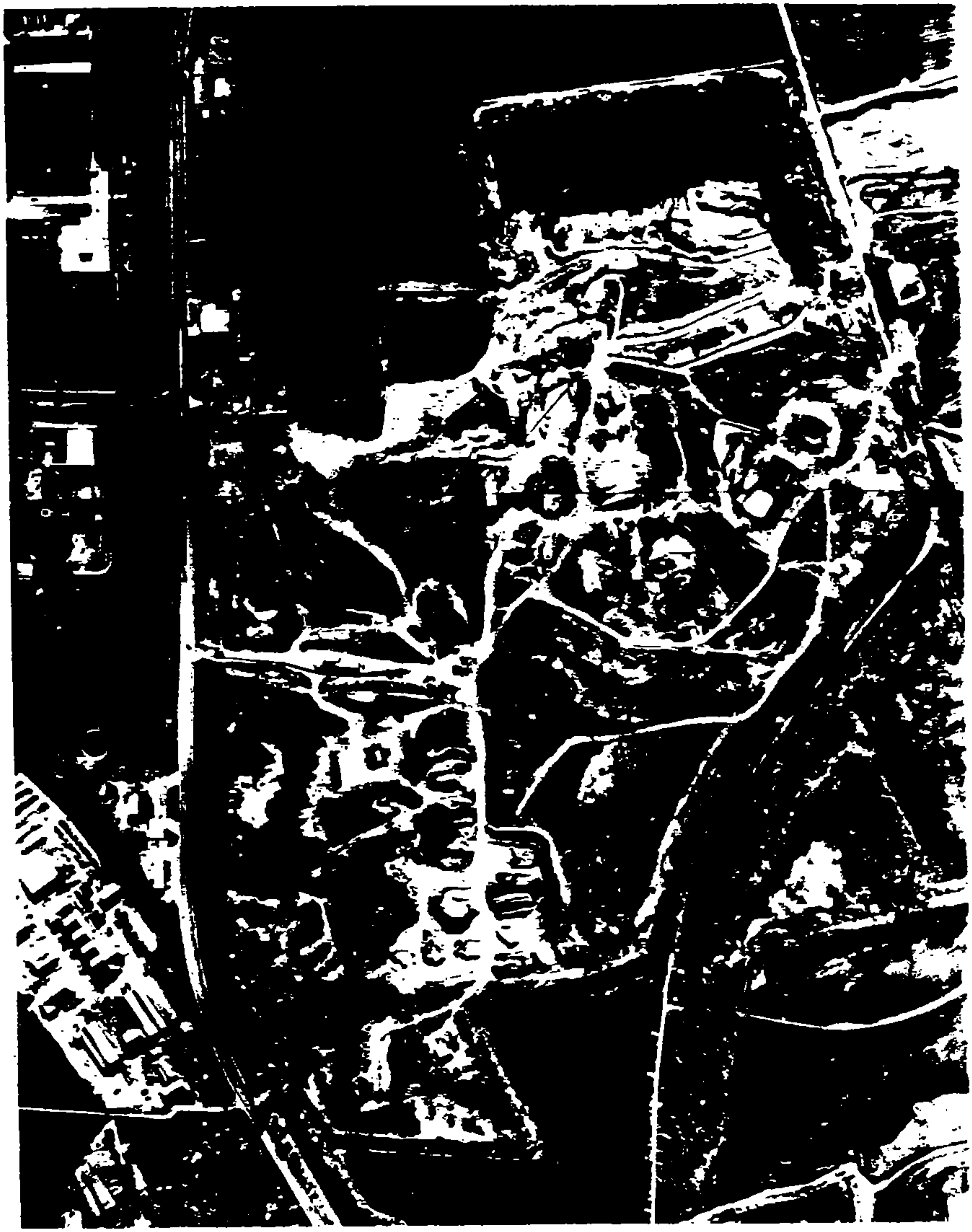
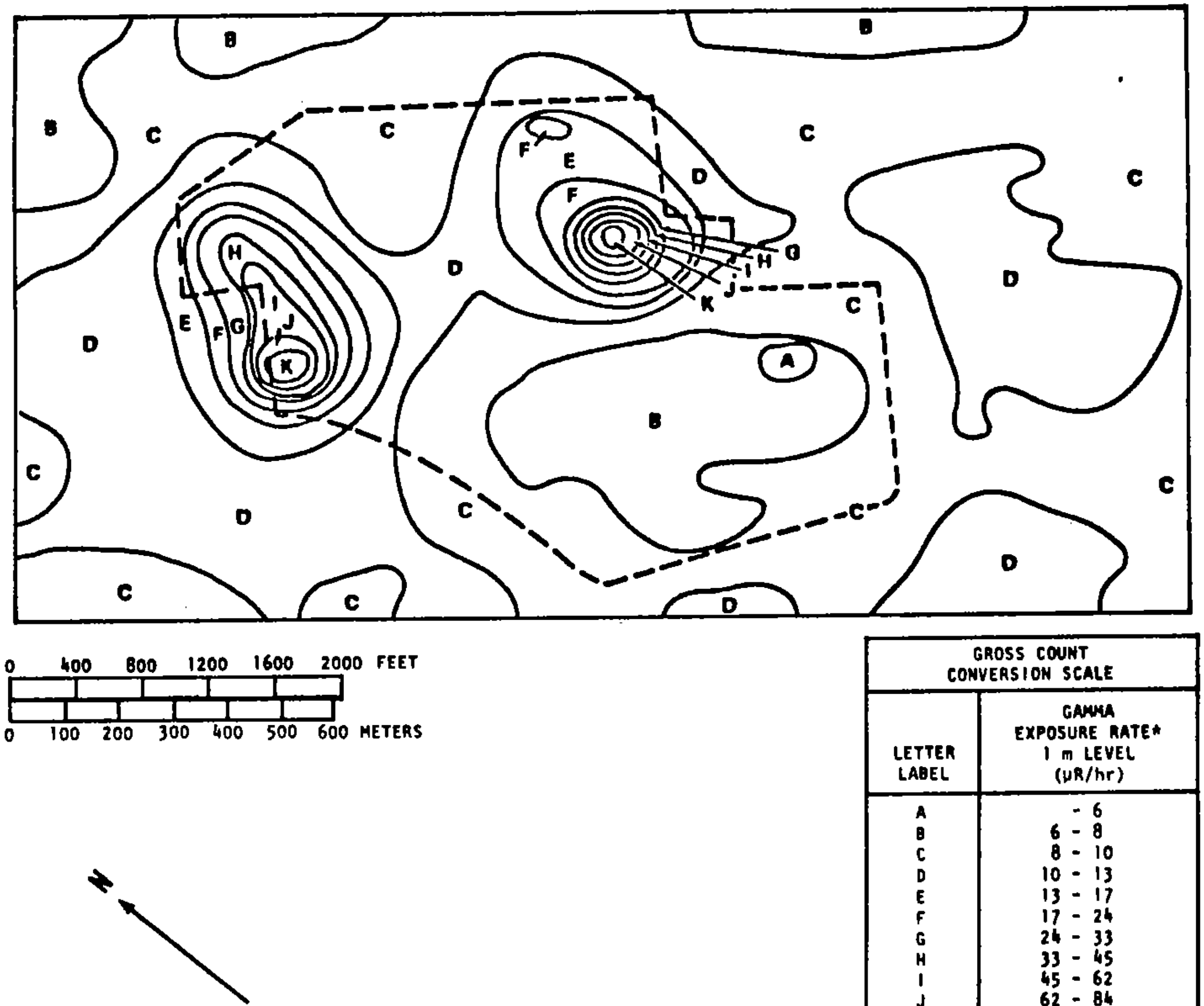


Figure 1. Aerial view of West Lake Landfill, St. Louis County, Missouri



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.

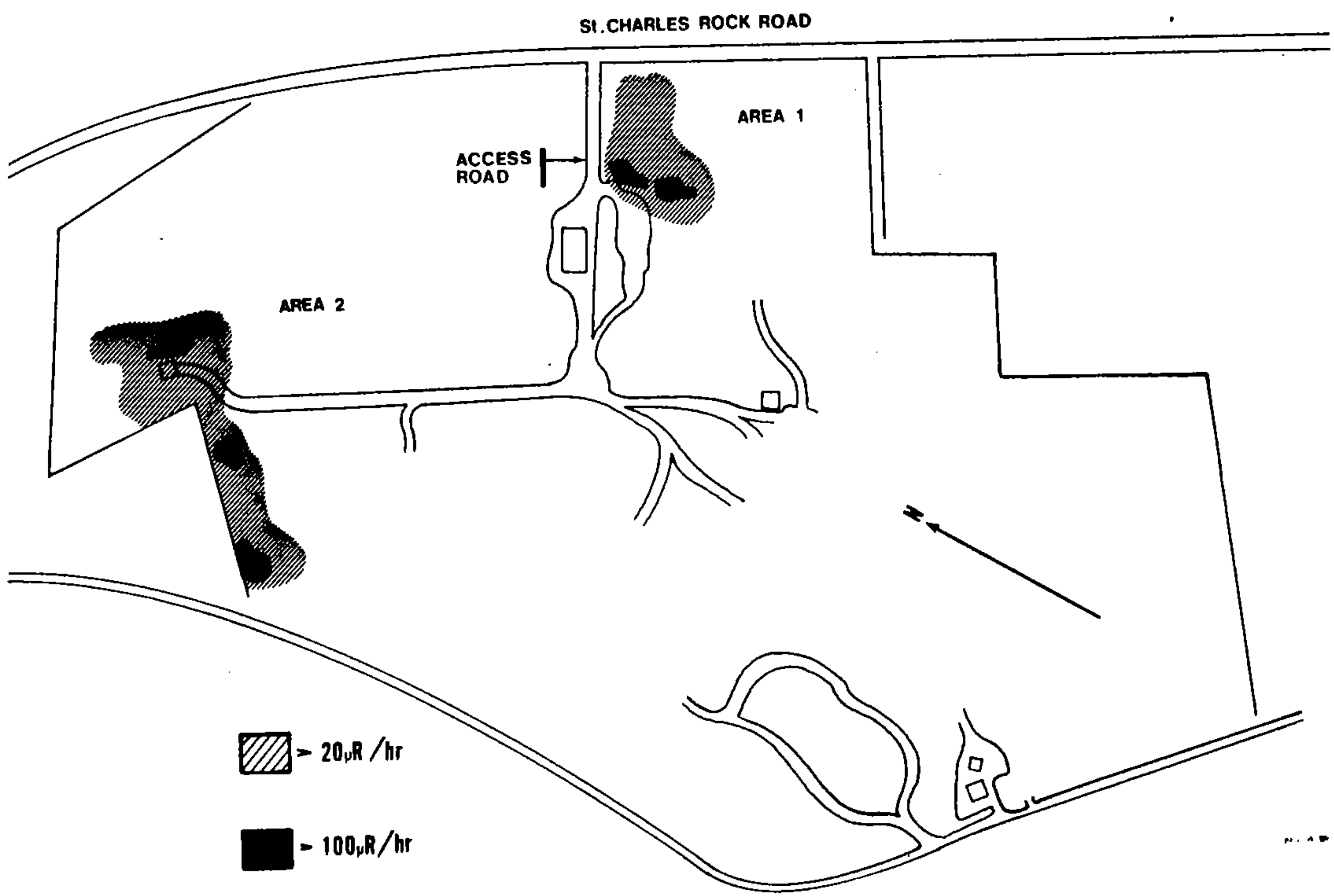


Figure 3. External gamma radiation levels, November 1980.

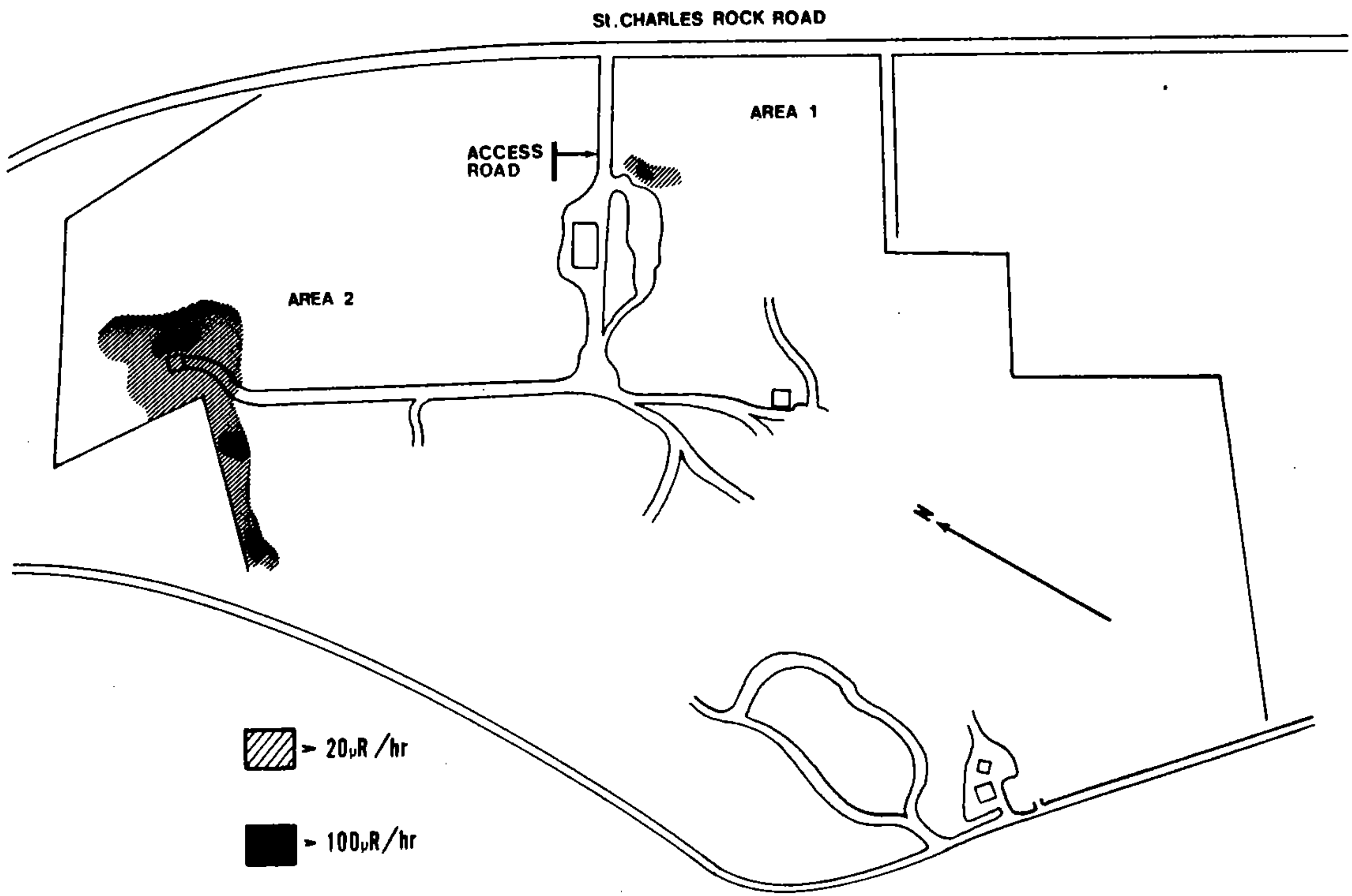


Figure 4. External gamma radiation levels, May, 1981

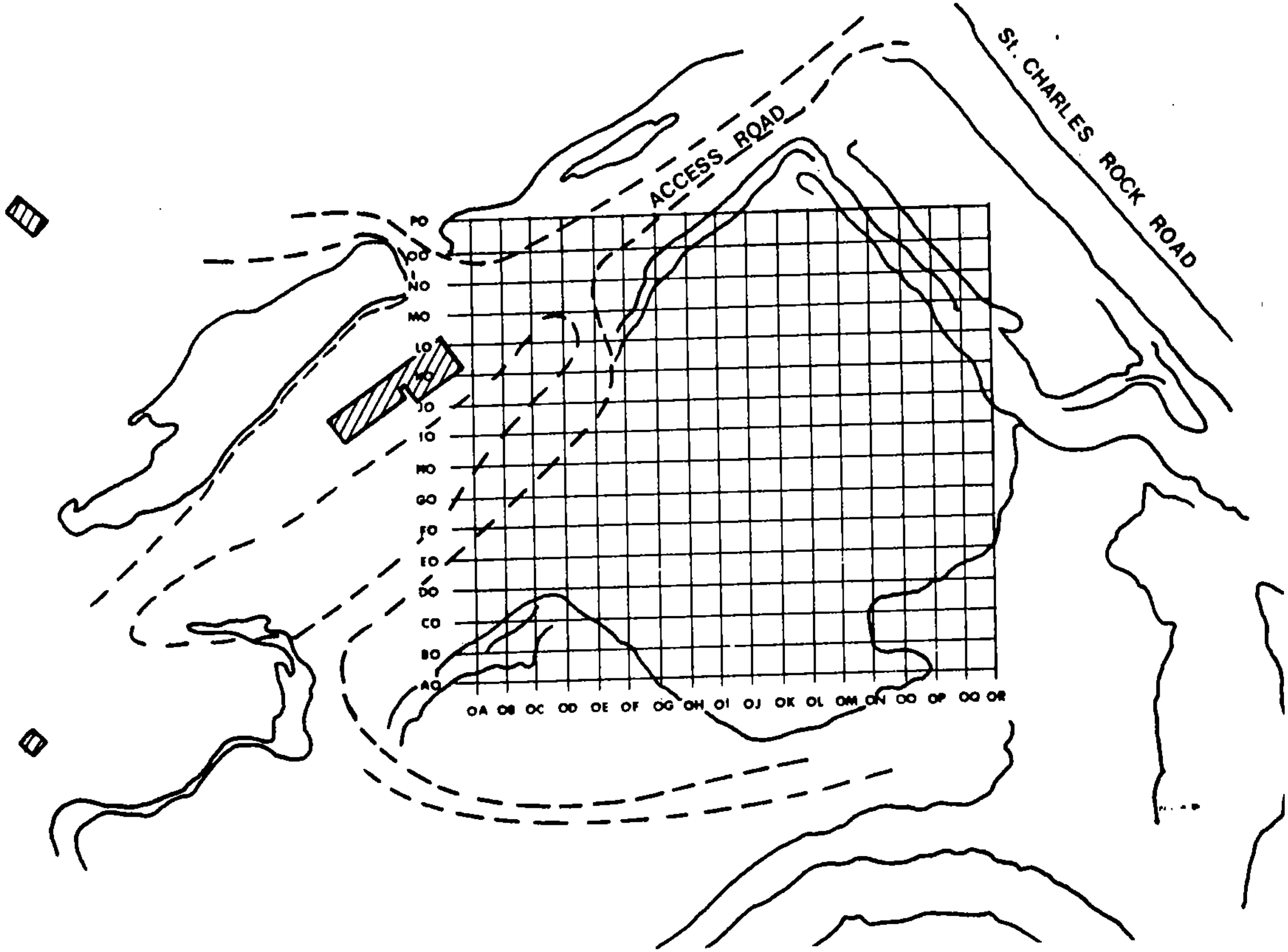


Figure 5. Grid locations for radiological survey, Area 1.

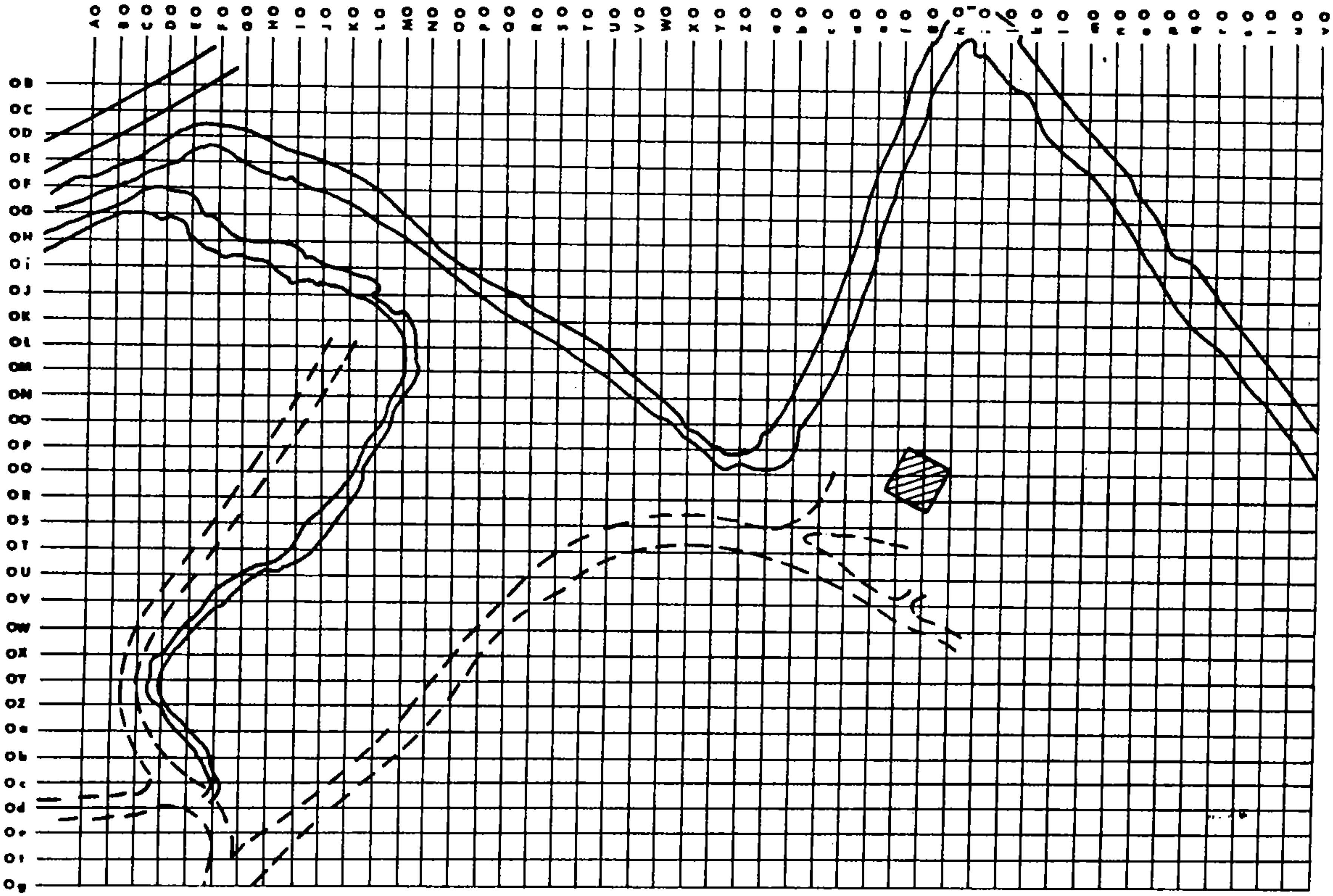


Figure 6. Grid locations for radiological survey, Area 2.

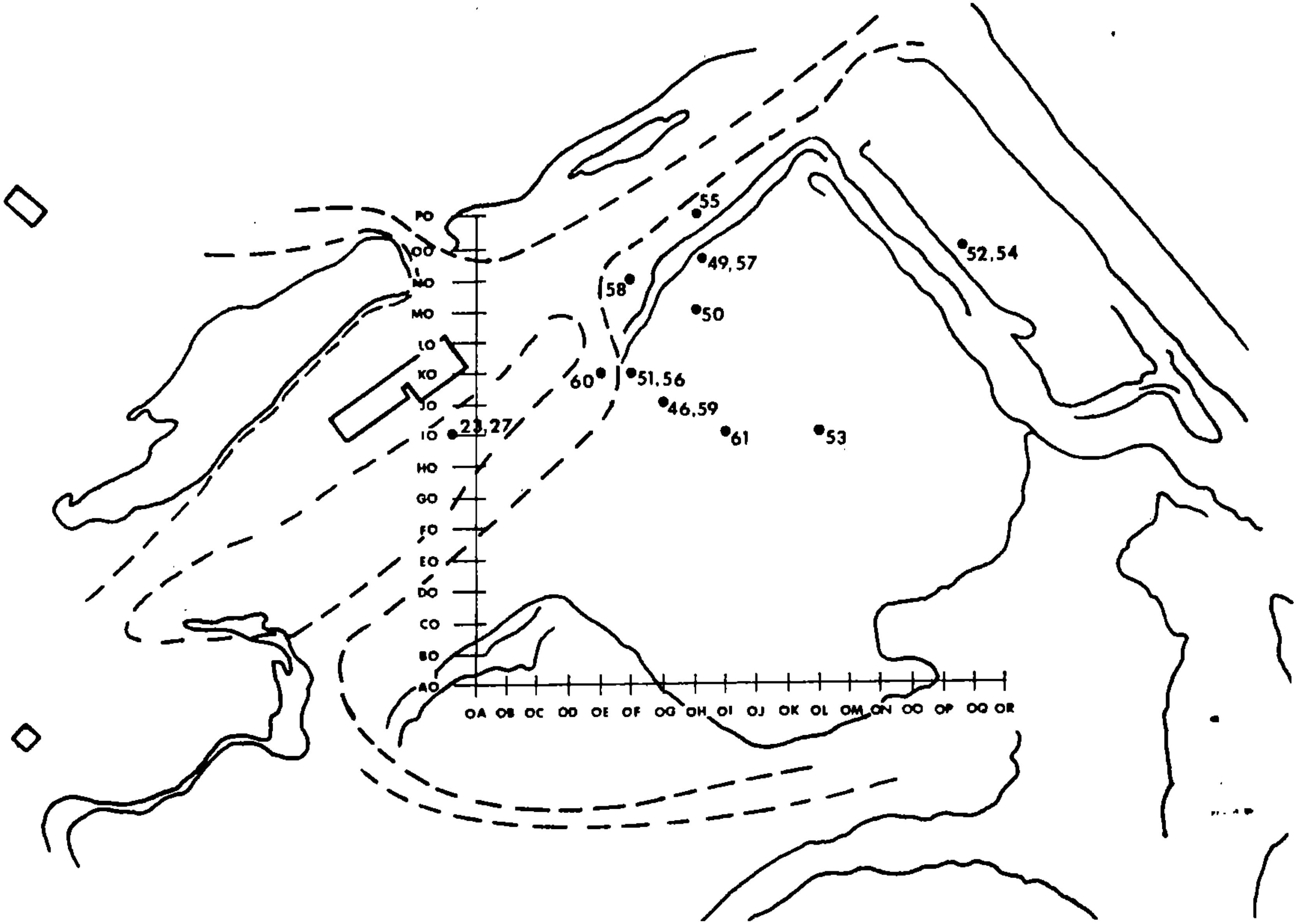


Figure 7. Location of surface soil samples, Area 1.

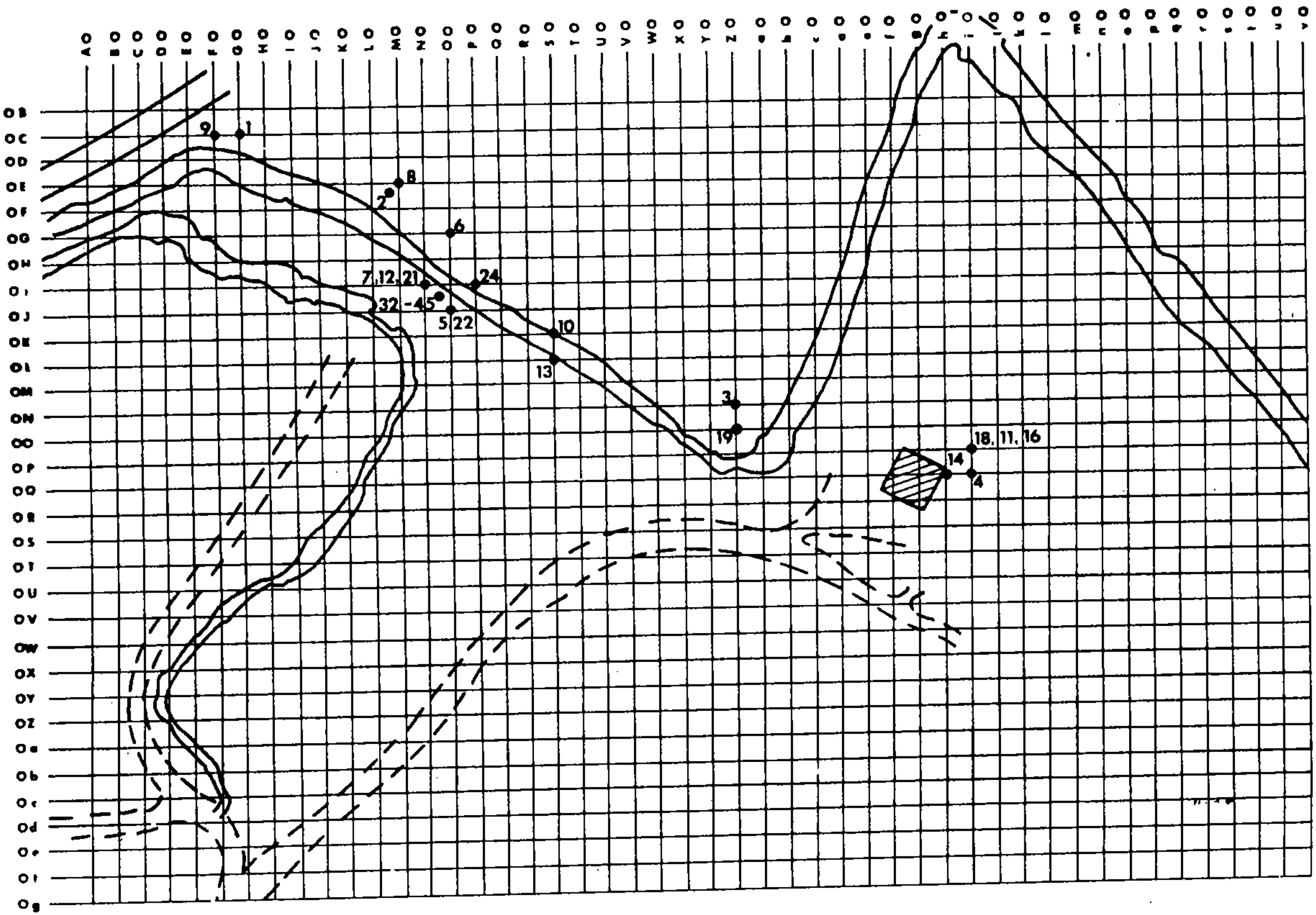


Figure 8. Location of surface soil samples, Area 2.

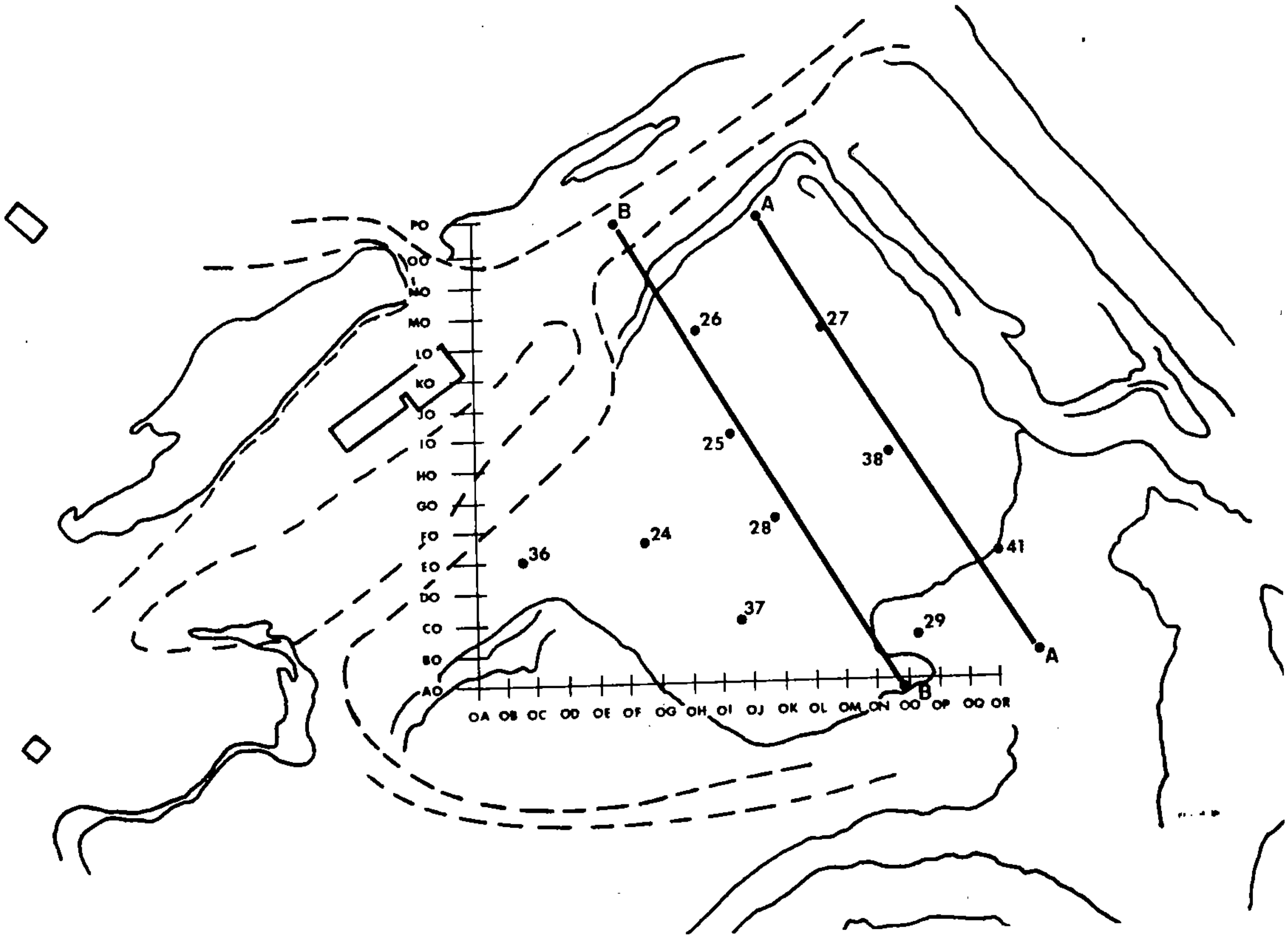


Figure 9. Location of auger holes, Area 1. Lines A-A and B-B indicate cross sectional areas shown in Figures 15 and 16.

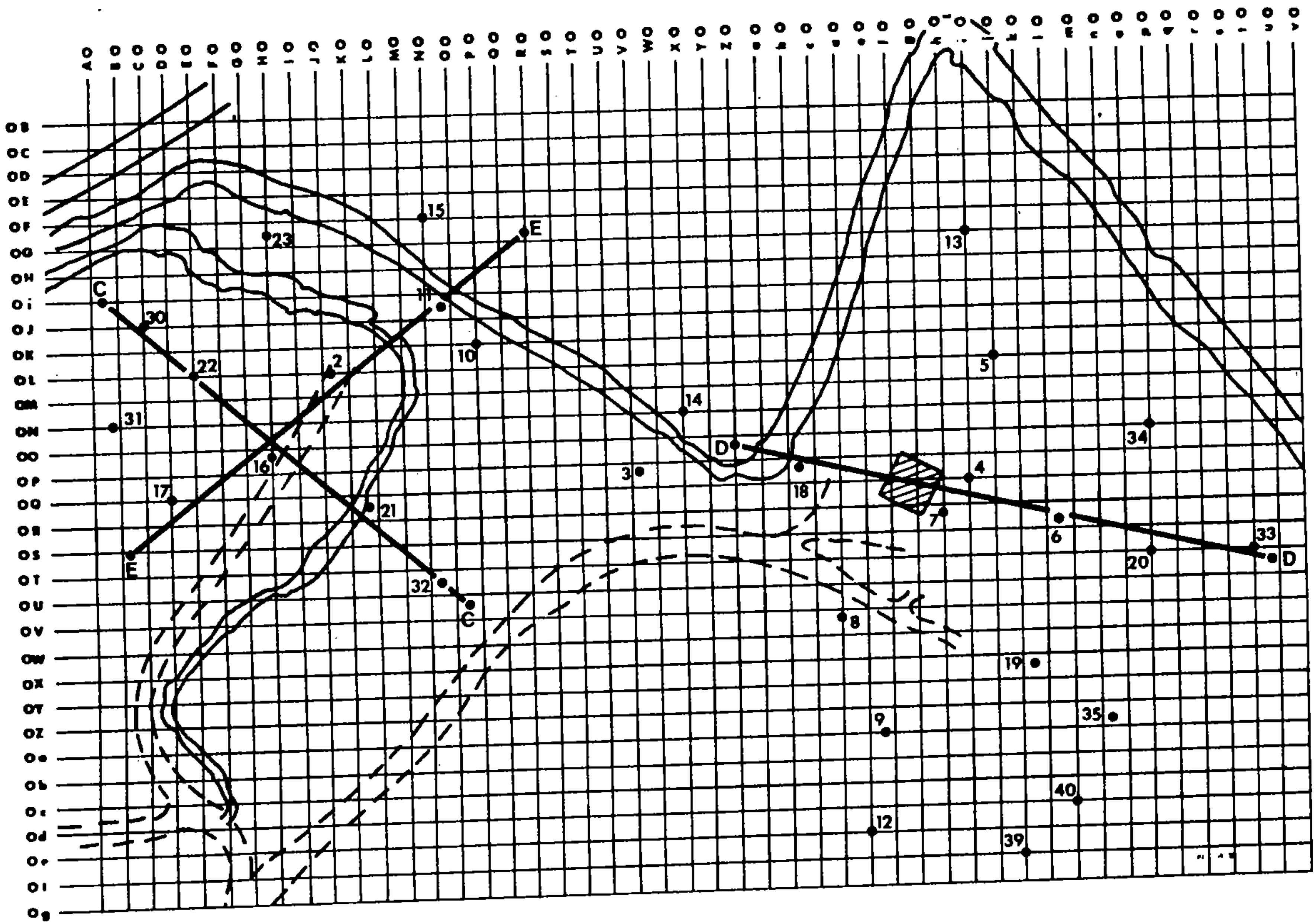


Figure 10. Location of auger holes, Area 2. Lines C-C, D-D, and E-E indicate cross sectional areas shown in Figures 17, 18, and 19.

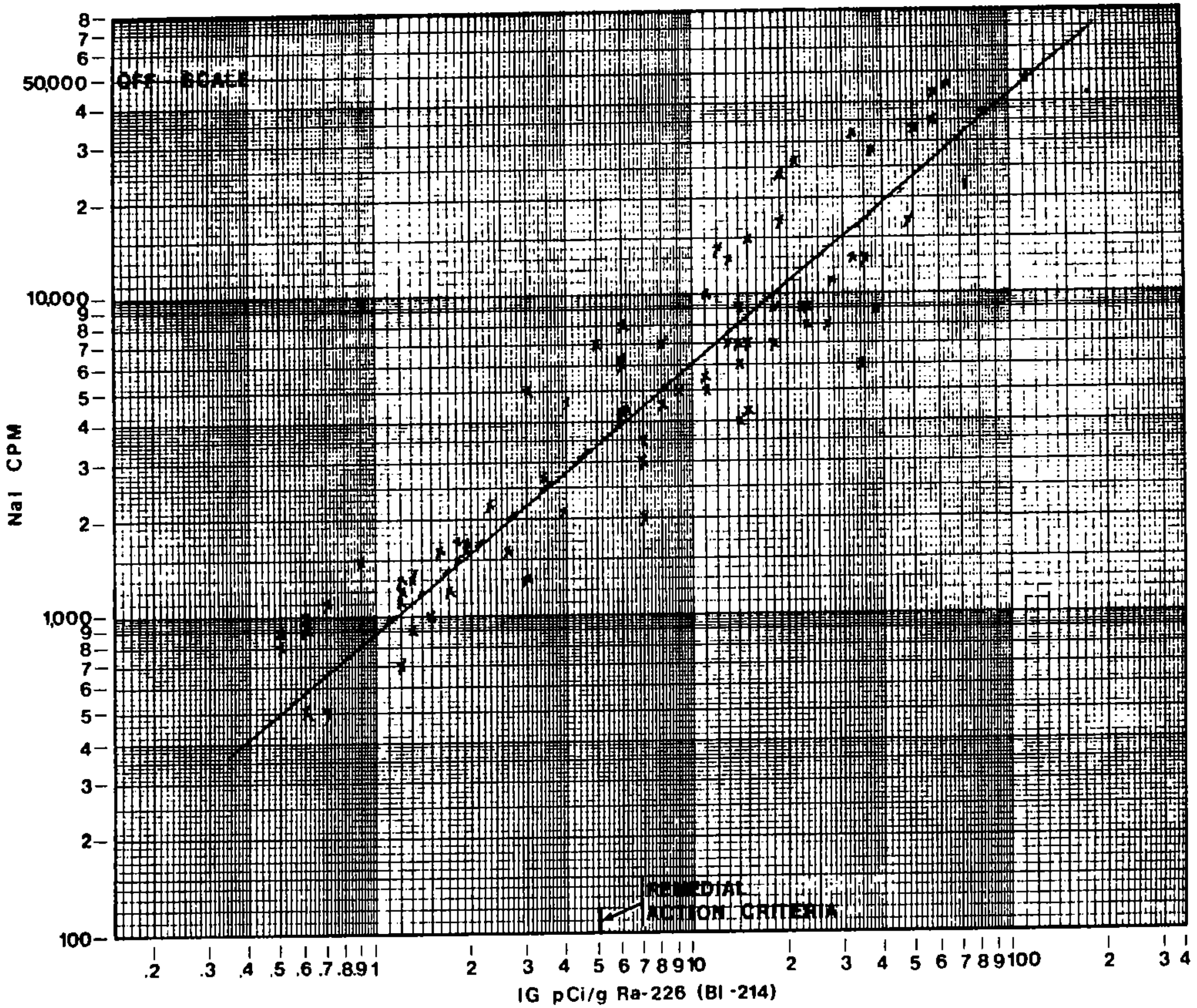


Figure 11. Auger hole NaI (Tl) count rate versus Ra-226 concentration, as determined by the I.G. in situ measurements. Data is from bore holes 16, 32, 22, 21, 31, 6, 19 and 20.

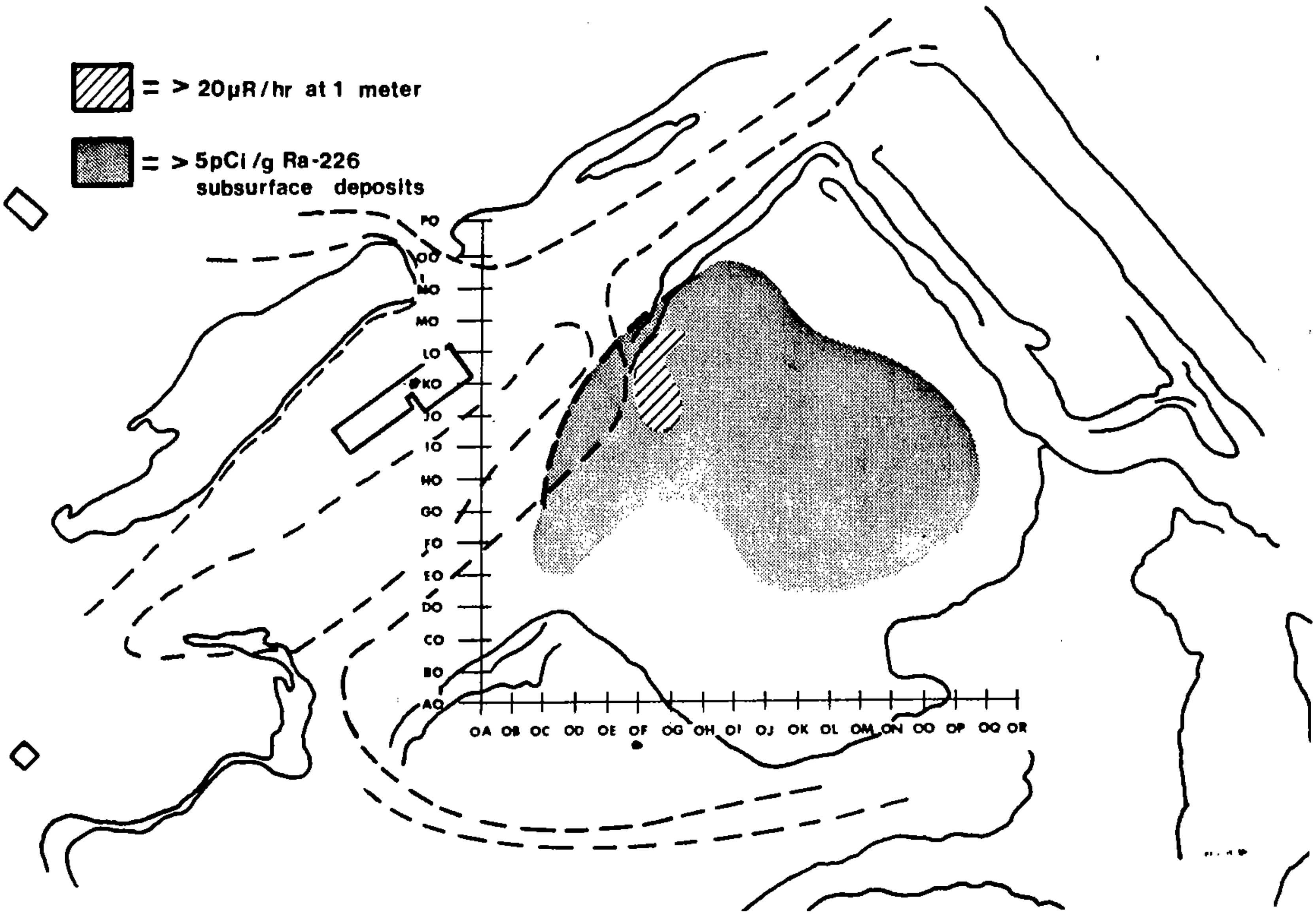


Figure 12. Location of subsurface contamination and surface radiation levels, Area 1. The shaded area shows a lateral contour for 5pCi/g Ra-226, regardless of depth. The cross hatched area shows the surface locations which exceed 20uR/hr at 1 meter.

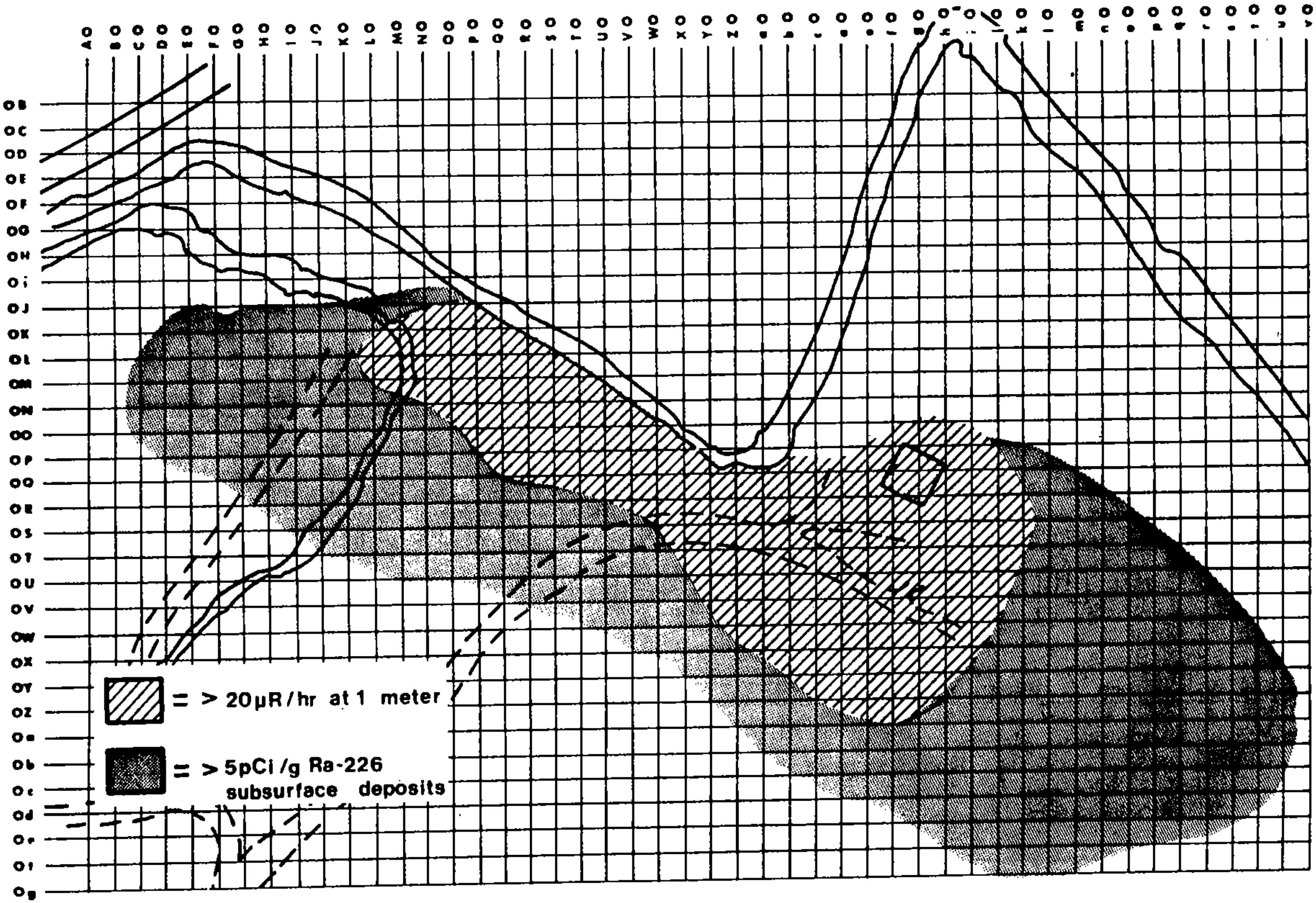


Figure 13. Location of subsurface contamination and surface radiation level, Area 2. The shaded area shows a lateral contour for 5pCi/g Ra-226, regardless of depth. The cross hatched area shows the surface location which exceeds 20uR/hr at 1 meter.

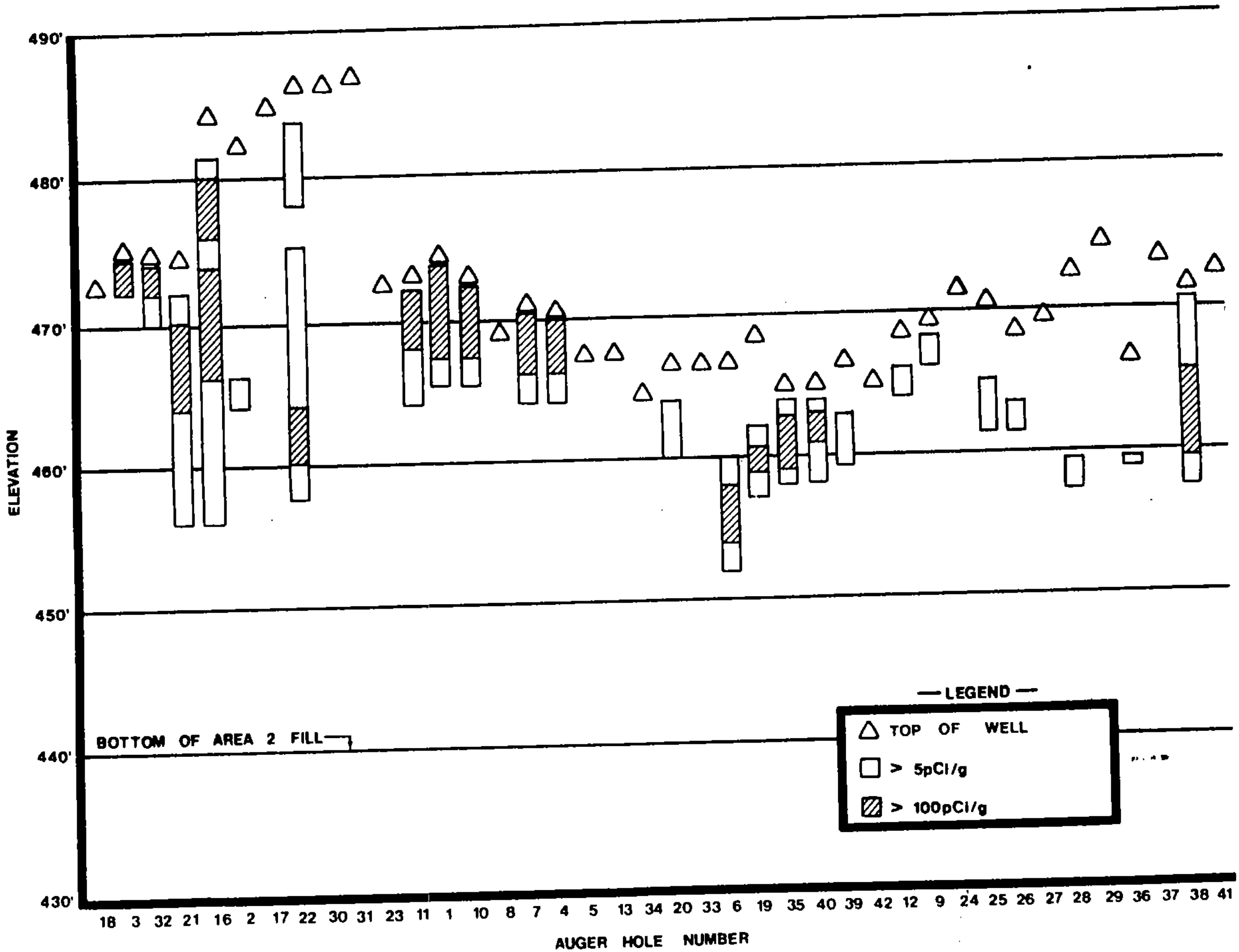


Figure 14. Auger hole elevations and location of contamination within each hole.

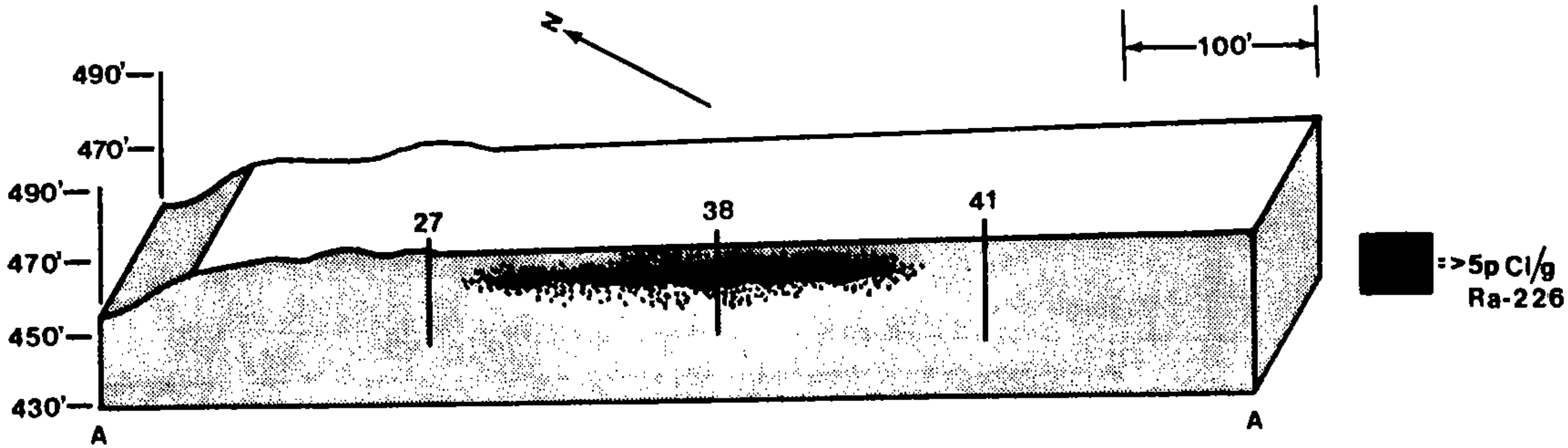


Figure 15. Cross section A-A (from Figure 9) showing subsurface deposits in Area 1. The blackened areas indicate the estimated extent of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

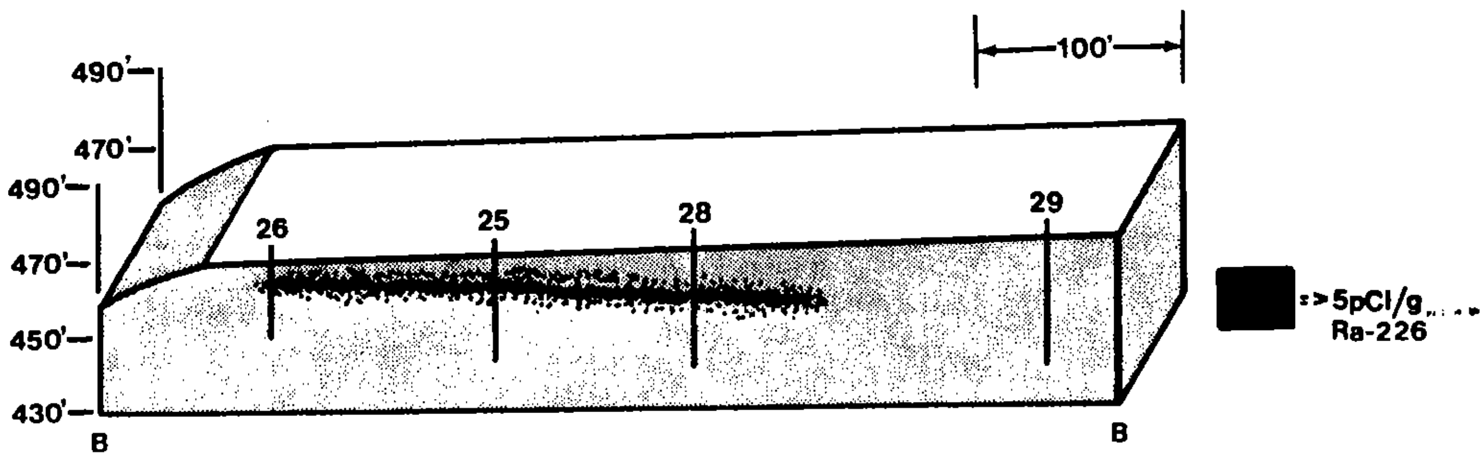


Figure 16. Cross section B-B (from Figure 9) showing subsurface deposits in Area 1. The blackened areas indicate the estimated extent of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

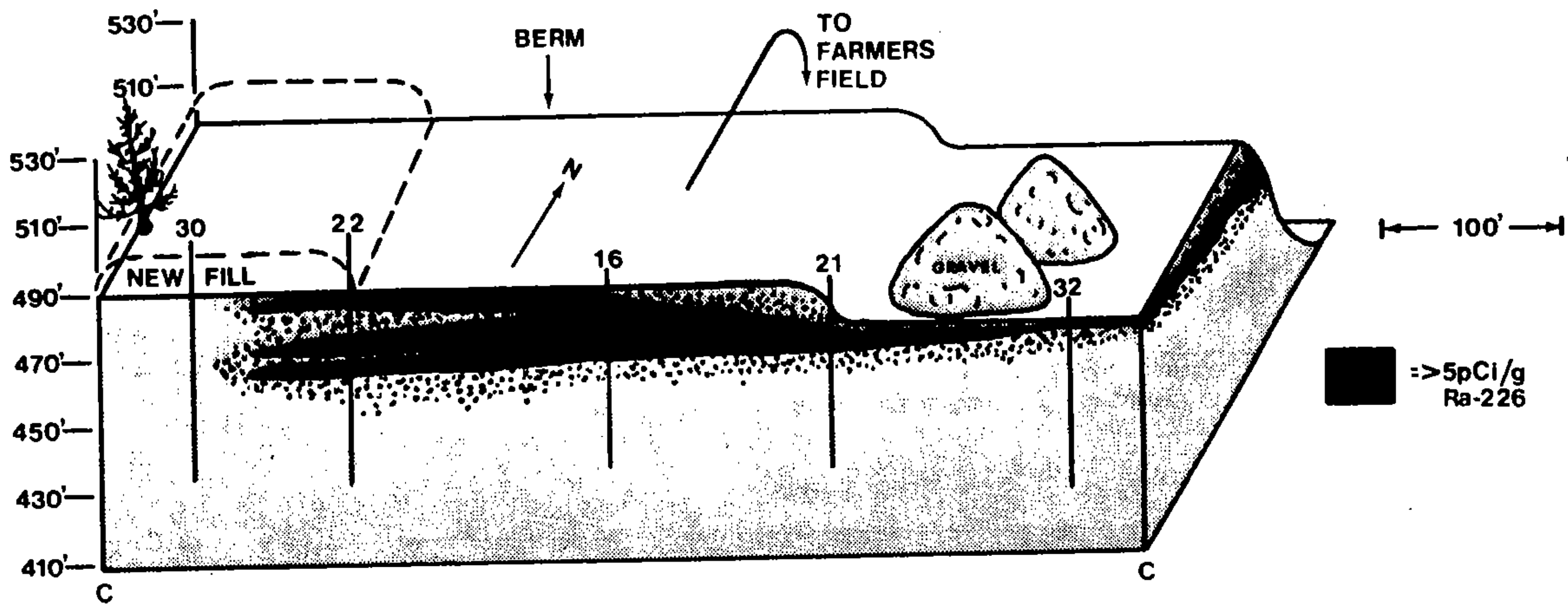


Figure 17. Cross section C-C (from Figure 10) showing subsurface deposits in Area 2. Blackened areas indicate the estimated location of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

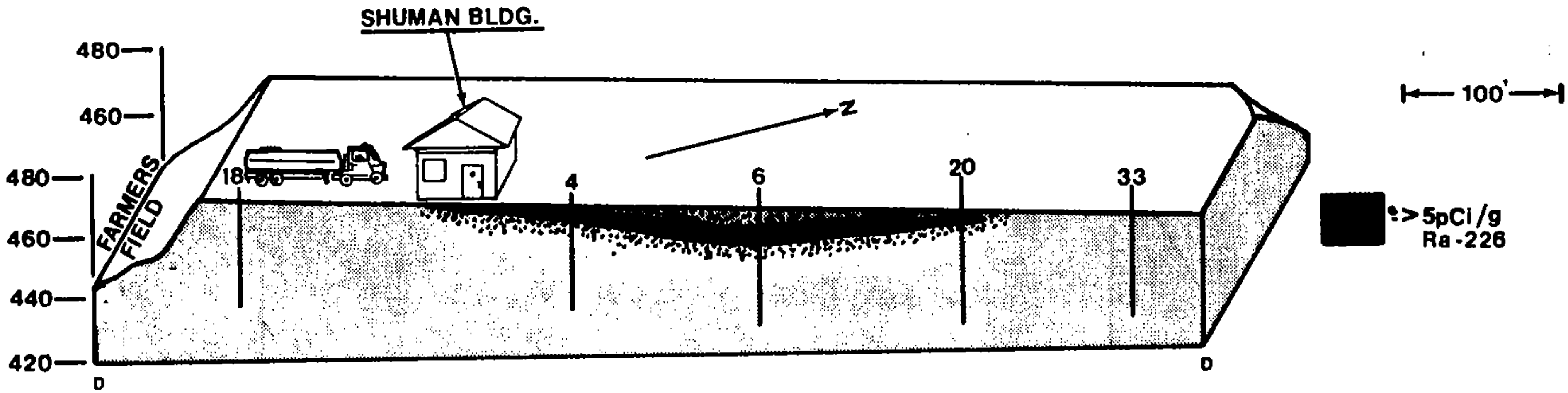


Figure 18. Cross section D-D (from Figure 10) showing subsurface deposits in Area 2. Blackened areas indicate the estimated location of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

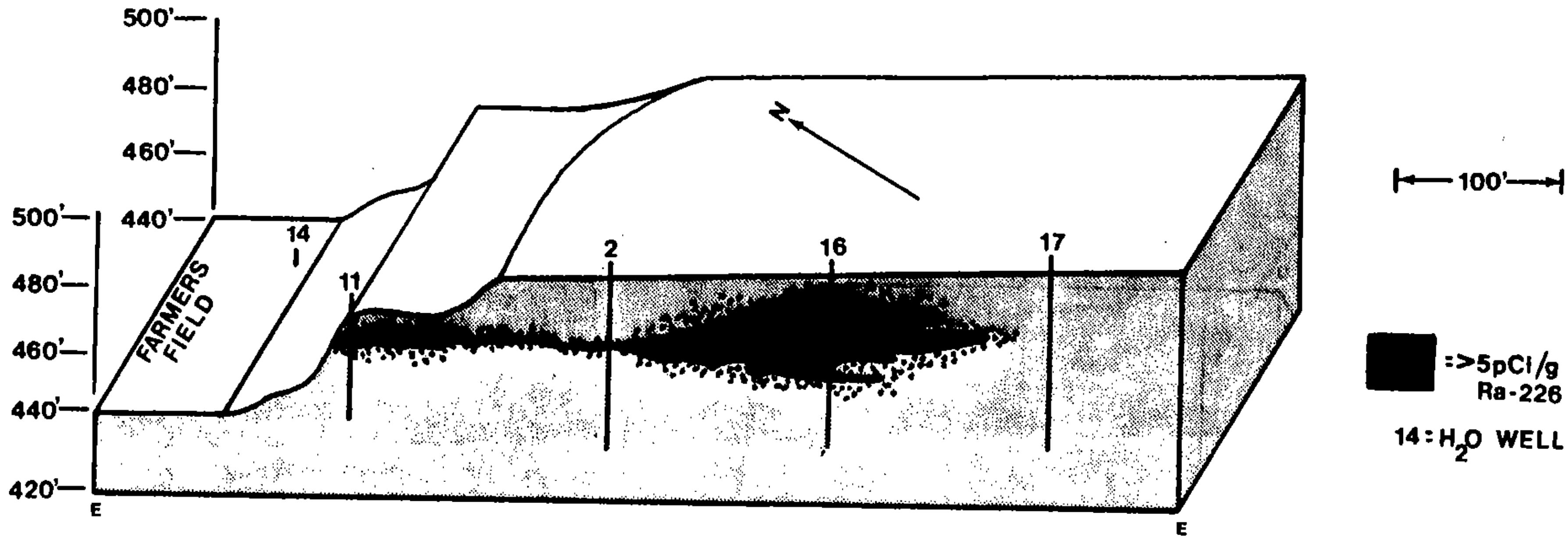


Figure 19. Cross section E-E (from Figure 10) showing subsurface deposits in Area 2. Blackened areas indicate the estimated location of contamination exceeding 5pCi/g Ra-226, based on surface and auger hole measurements.

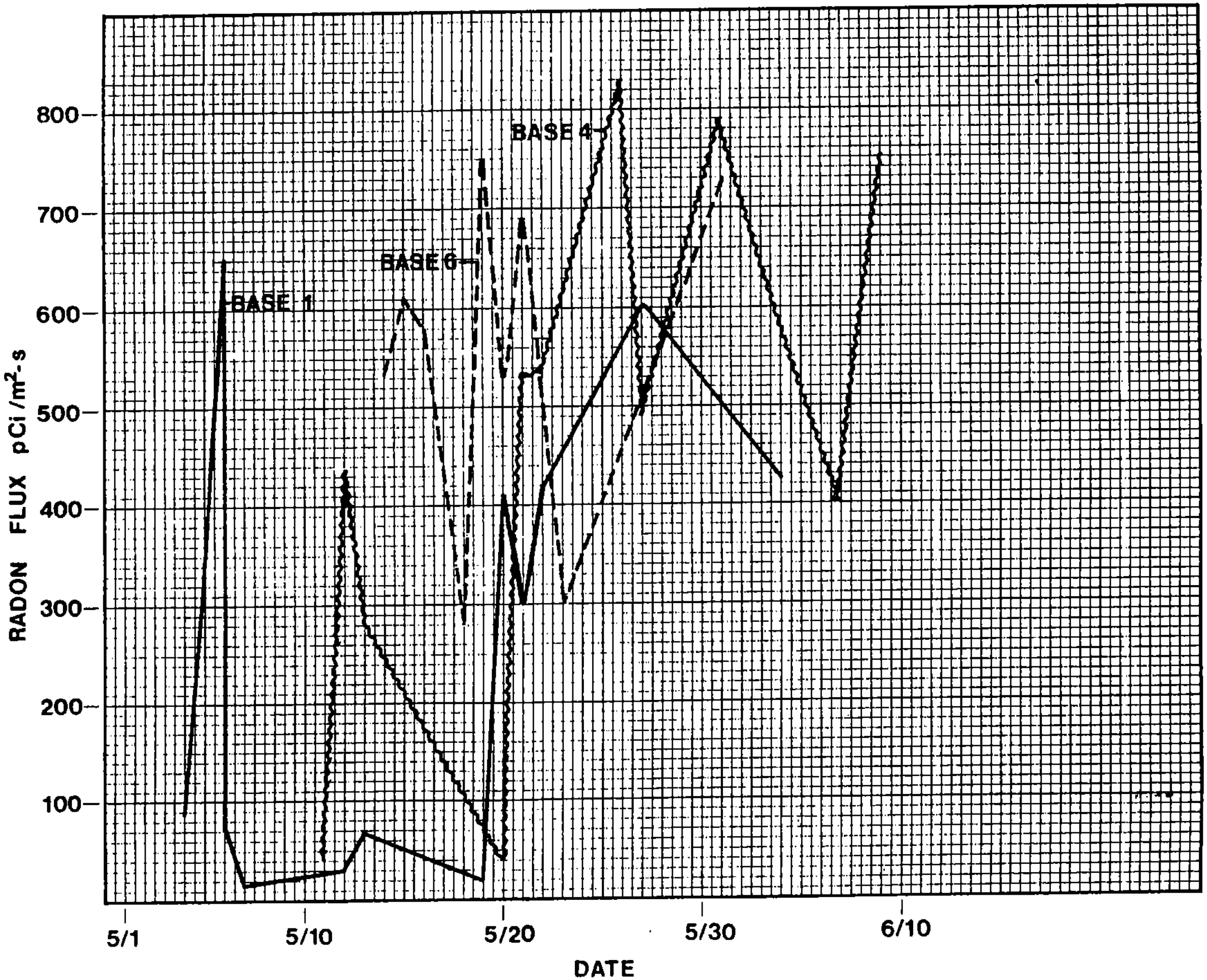


Figure 20. Radon-222 flux measurements at three locations in Area 2, for May, 1981.

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

→ Locations = p. 36

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

→ Locations - p. 37

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

* see pp. 13-14.

Auger Hole NaI Counts and IG Analysis

Table 5

Borehole #1

Depth	Gross NaI	Ra-226	Pb-214	Bi-214	U-238	Ra-223	K-40	Pb-211	Pb-212
		Radionuclide Concentrations [pCi/g]							
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

Depth	Gross NaI	Ra-226	Pb-214	Bi-214	U-238	Ra-223	K-40	Pb-211	Pb-212
		Radionuclide Concentrations [pCi/g]							
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.

Depth	Gross NaI	Ra-226	Pb-214	Radionuclide Concentrations [pCi/g] 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

Depth	Gross NaI	U-238	Pb-214	Radionuclide Concentrations [pCi/g] 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

Depth	Gross NaI	Ra-226	Pb-214	Radionuclide Concentrations [pCi/g] 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.

Depth	Gross NaI	Ra-226	Pb-214	Bi-214	U-238	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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. Depth	Gross NaI	Ra-226	Pb-214	Radionuclide Concentrations [pCi/g] 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 Depth	Gross NaI	U-238	Pb-214	Radionuclide Concentrations [pCi/g] 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 Depth	Gross NaI	U-238	Pb-214	Radionuclide Concentrations [pCi/g] 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.

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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

Depth	Gross NaI	U-238	Pb-214	Radionuclide Concentrations [pCi/g] 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

Depth	Gross NaI	U-238	Pb-214	Radionuclide Concentrations [pCi/g] 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

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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

Depth	Gross NaI	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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	U-238	Pb-214	Bi-214	Ra-226	Ra-223	K-40	Pb-211	Pb-212
				Radionuclide Concentrations [pCi/g]					
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		Borehole #7		Borehole #12	
Depth	NaI CPM	Depth	NaI CPM	Depth	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

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

Borehole #23

Depth	NaI CPM
ft	
07	400
08	300
09	300
10	300
11	400
12	400
13	500
14	600
15	600
16	400
17	500
18	700
19	600
20	600
21	500
22	400
--	-----
--	-----

Borehole #24

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

Borehole #25

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

Borehole #26

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

Borehole #27

--	-----
01	1,300
02	1,800
03	1,200
04	1,200
05	1,300
06	600
07	700
08	300
09	300
10	600
11	700
12	700
13	600
14	1,000
15	1,300
16	800
17	900
18	500
19	400
20	500
21	500
22	700
23	1,000
24	1,000
--	-----
--	-----

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 Depth	Borehole #39 NaI CPM	Borehole #40 Depth	Borehole #40 NaI CPM	Borehole #41 Depth	Borehole #41 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 pCi/l		Gross Beta 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		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
TOOP(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
OOOM(Area 1)	7-30	2.9	3
OOOM(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 uCi/cc	WL
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, O00J)	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	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. W.T.P. (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #569 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
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	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	
DNT 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	*	a-BHC	*
dieldrin	ND	b-BHC	ND
chlordane	ND	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-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
o-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. BH-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. BH-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. BH-25 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #572 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	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-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. BH-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. BH-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. BH-35 (NPDES) DATE SAMPLE RECEIVED 6 July 1981

RMC I.D. #574 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. #574 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

*Background

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

NRC's

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 : gamma

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

Appendix I

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 U-238 uranium series (Ra-226 and daughters), Th-232 thorium series and potassium. Therefore, the conversion factor established at West Lake will apply only to naturally occurring radionuclides distributed in soil.

What about the actinium series — U-235

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.

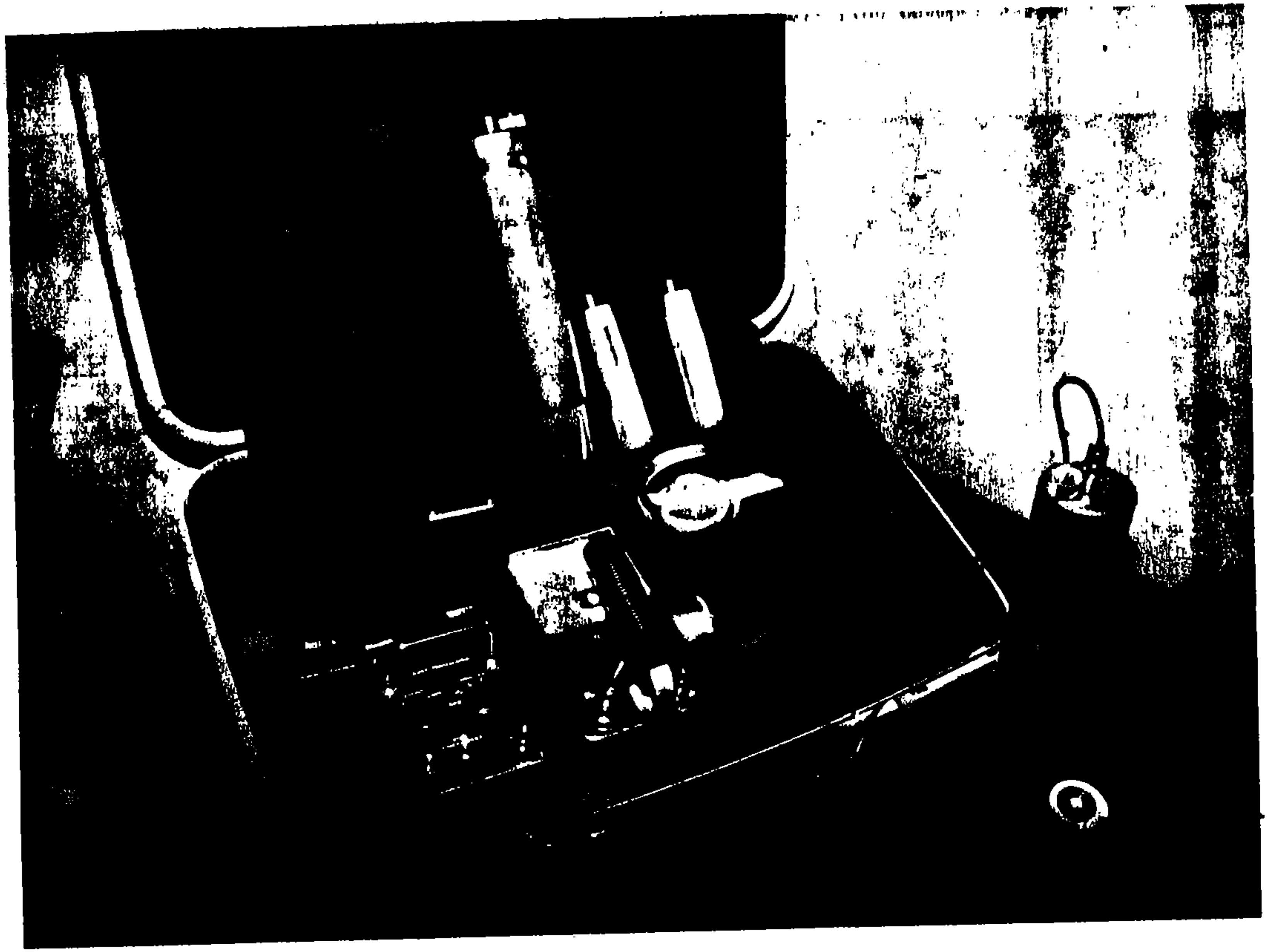


Figure I-1. Portable Survey Instrument Kit.

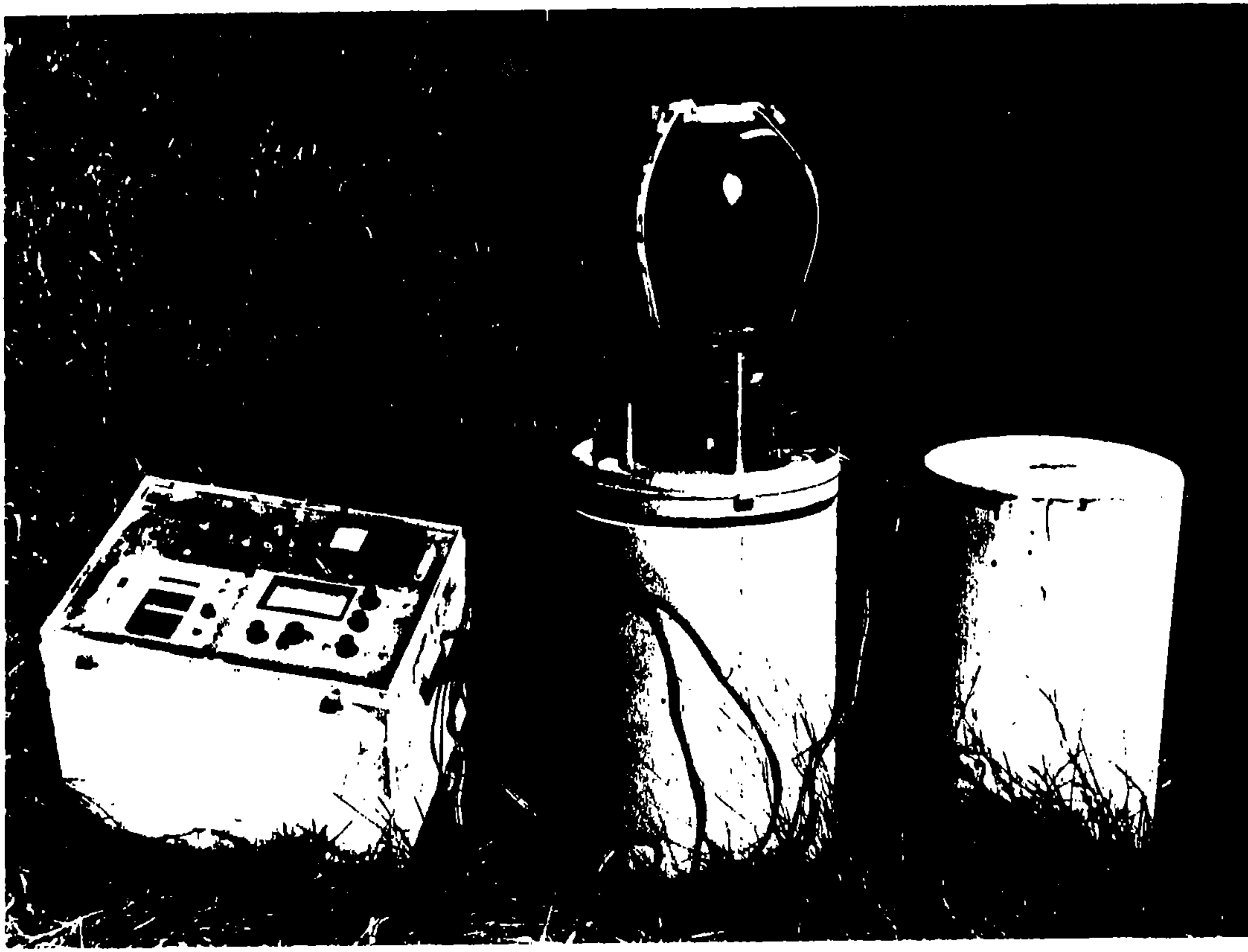


Figure I-2. High sensitivity tissue equivalent ionization chamber system.

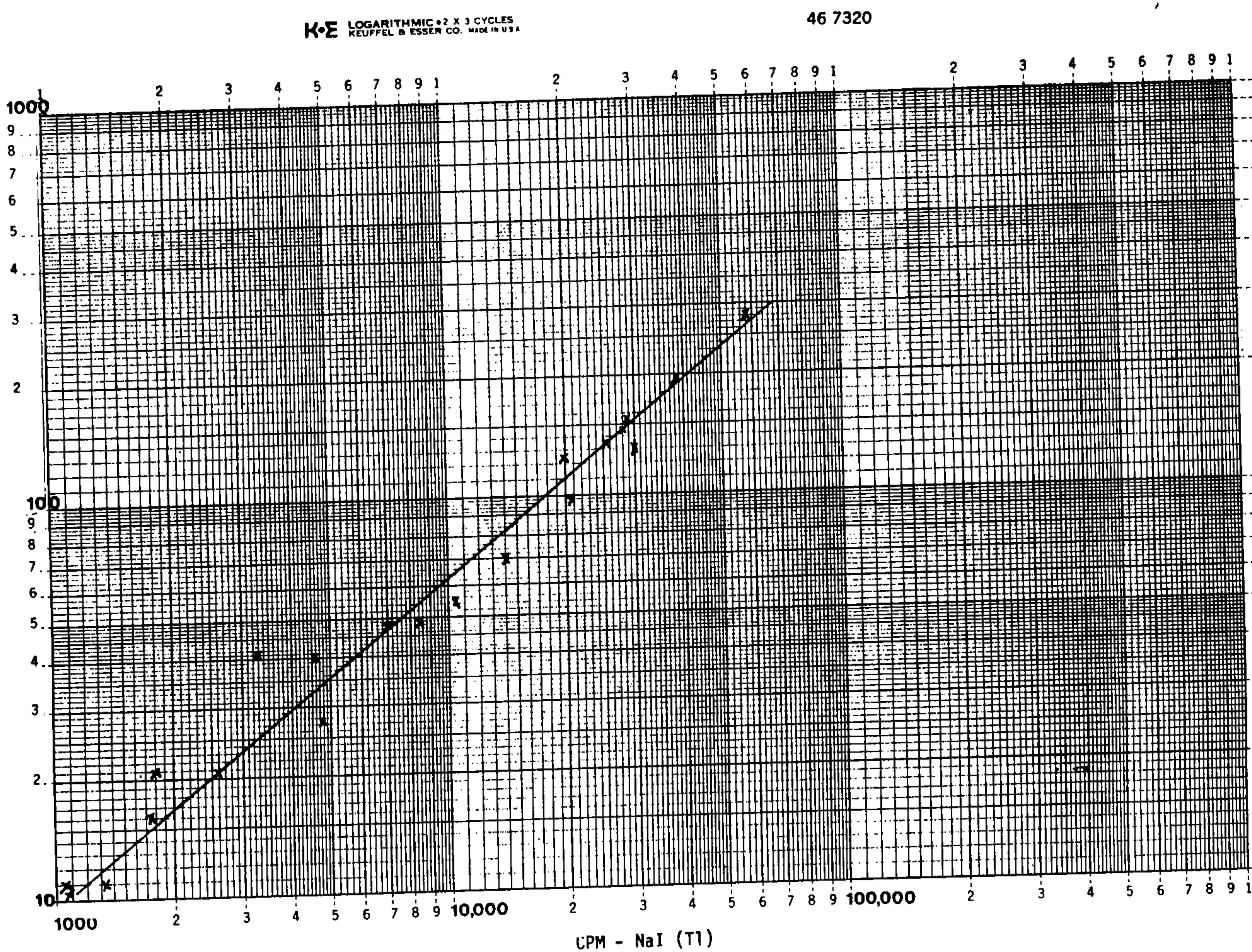


Figure I-3. Ion chamber exposure rates versus NaI (Tl) count rates, West Lake landfill site

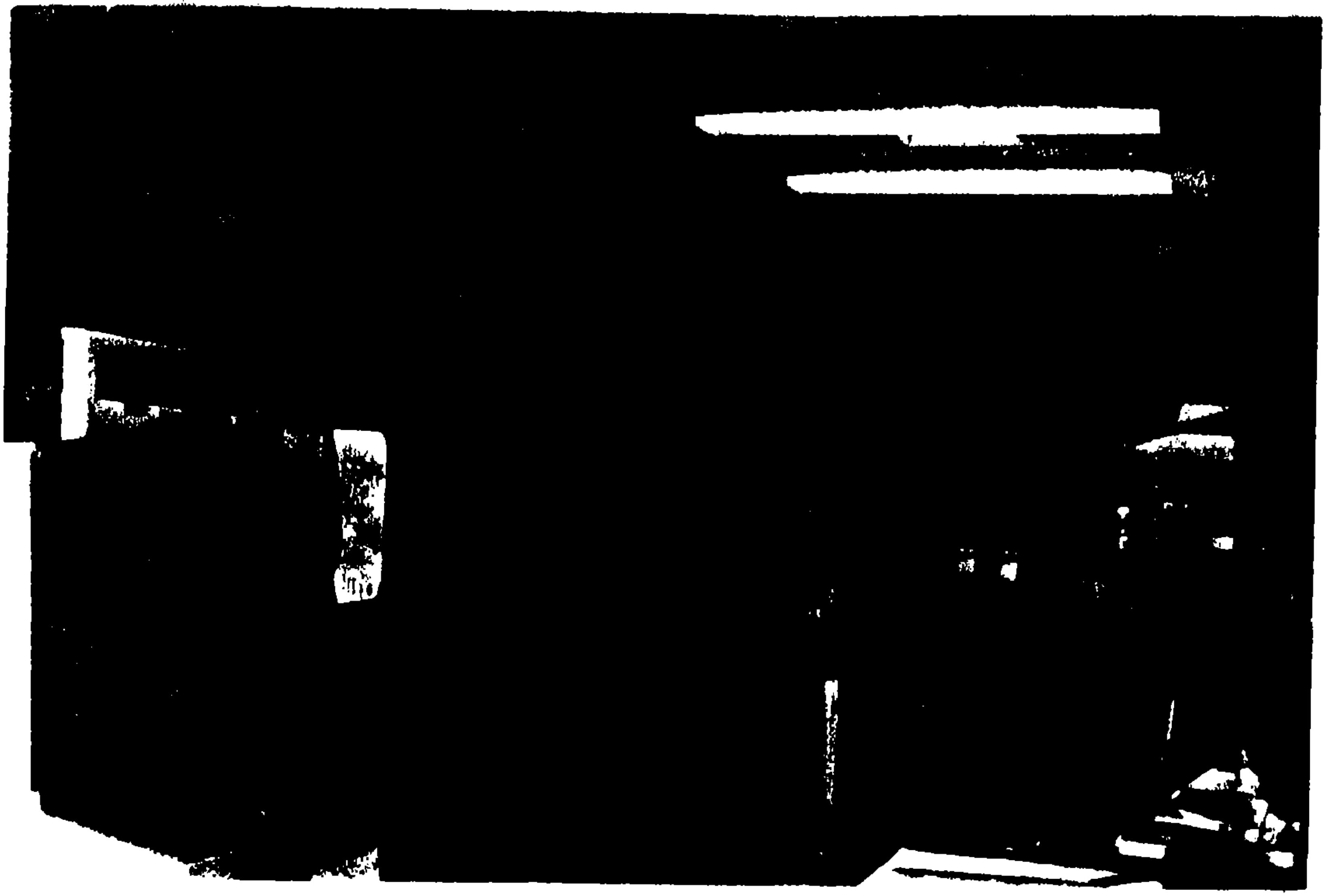


Figure I-4. Interior of mobile lab showing gamma counting system and other equipment.

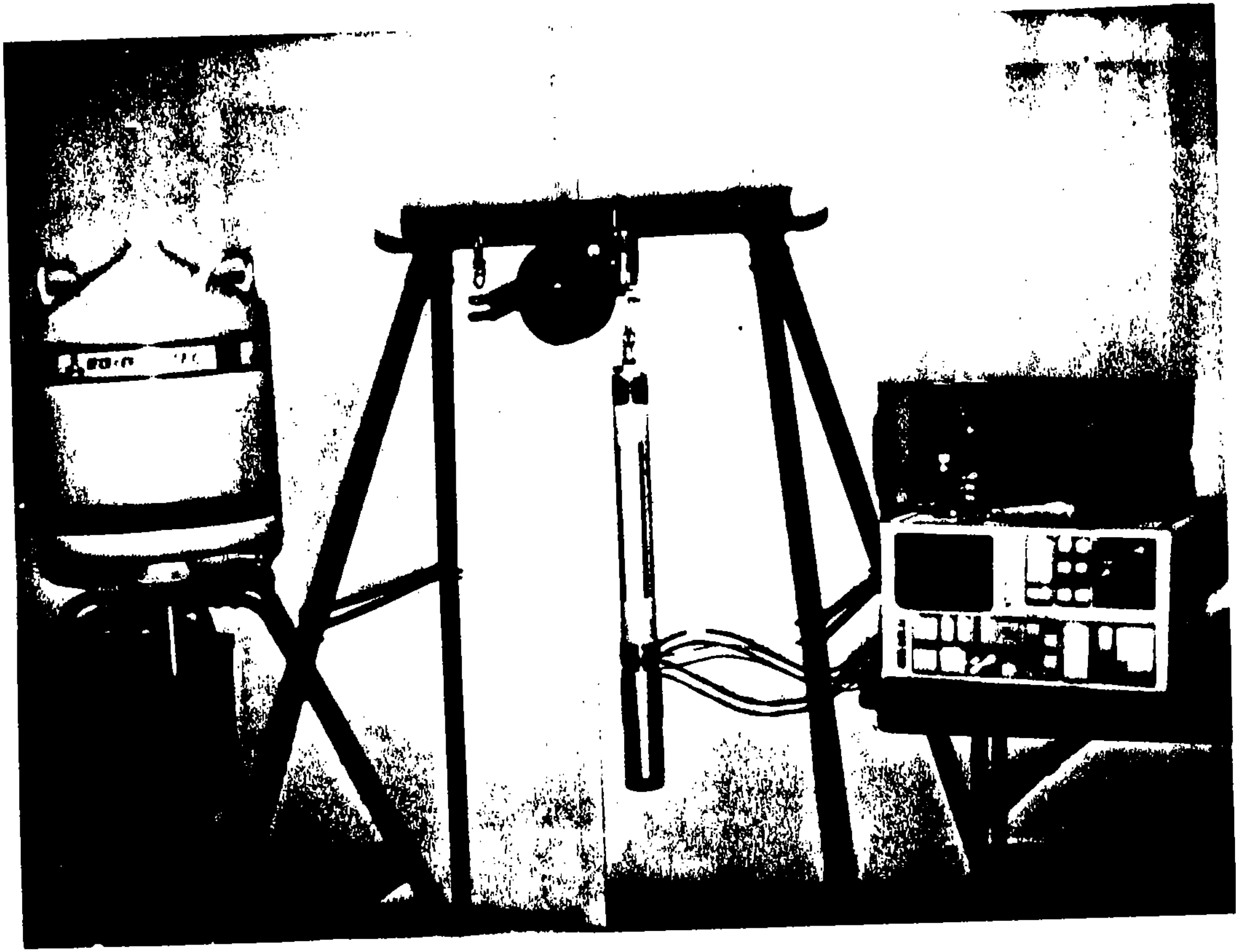


Figure I-5. In-situ auger hole logging system with intrinsic germanium detector and narrow dewar assembly, data acquisition equipment and storage/ fill dewar.

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

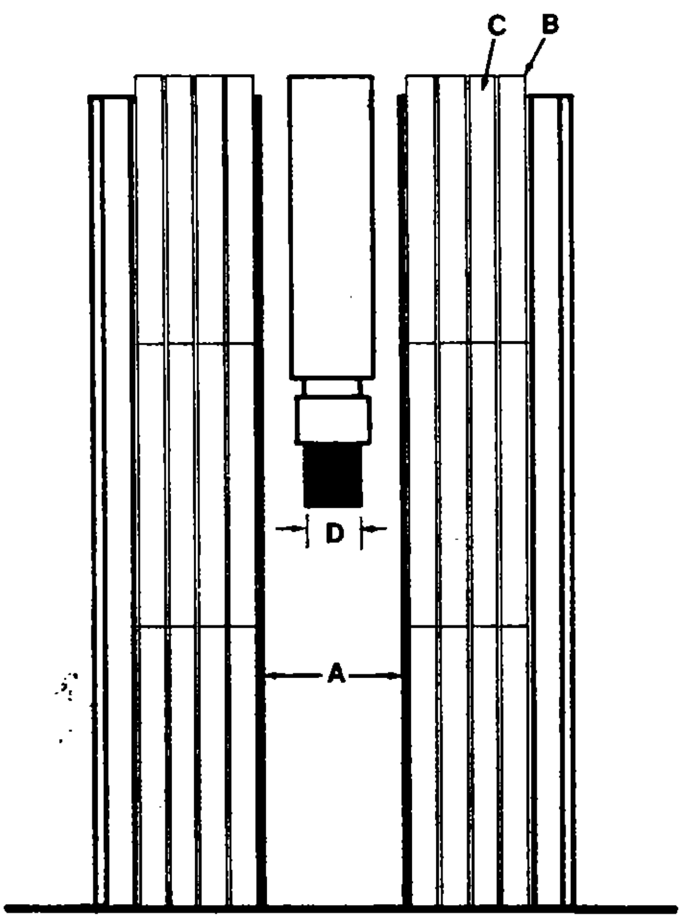
CALIBRATION RIG ASSEMBLY

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

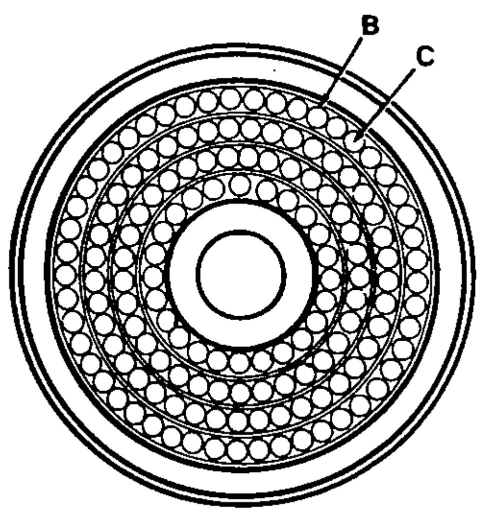
"B" - 1.25" diameter x 36" long butyrate source holder tubes

"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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