

MAR 11 1983

Mr. Frank Cosolito  
New Jersey Department of  
Environmental Protection  
380 Scotch Road  
Trenton, New Jersey 08628

Dear Mr. Cosolito:

I am enclosing three copies of the final post remedial action radiological survey report on areas 4 through 10 at the former Kellex site in Jersey City, New Jersey. This final report replaces the draft report sent to you on August 3, 1982. There does not appear to be any change in the data from the draft previously sent you; therefore, either one could be used to evaluate the site for certification purposes.

We are under extreme pressure to certify the former Kellex site, and we are ready to proceed with the final phases of the certification process upon receipt of written concurrence from the New Jersey Department of Environmental Protection.

Thank you for your cooperation and if there are any questions, please call me on 301-353-5439.

Sincerely,

Original Signed By  
Arthur J. Whitman

Arthur J. Whitman  
Division of Remedial Action Projects  
Office of Terminal Waste Disposal  
and Remedial Action  
Office of Nuclear Energy

Enclosure (3)

cc:  
S. Kuhrtz, NJDEQ, w/o encl.  
G. Fisher, NJDEP, w/o encl.

bcc:  
E. Delaney, w/o encl.  
E. Keller, OR, w/encl. (3)  
W. Bibb, OR, w/o encl.  
B. Berven, ORNL, w/o encl.  
A. Whitman, NE-24, w/o encl.  
Aerospace, w/encl. (2)

NE-73 (4)  
NE-24 RF  
Whitman RF

NE-24:AWhitman:ph:353-5439:3/8/83:DF-52:V-2-A-8

*AW*  
3/9/83

CONCURRENCES	
RTG. SYMBOL	NE-24
INITIALS/SIG.	<i>AW</i>
DATE	Bambnitz
RTG. SYMBOL	3/11/83
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	
RTG. SYMBOL	
INITIALS/SIG.	
DATE	



OAK  
RIDGE  
NATIONAL  
LABORATORY



OPERATED BY  
UNION CARBIDE CORPORATION  
FOR THE UNITED STATES  
DEPARTMENT OF ENERGY

DOE/EV-0005/29  
(Supplemental)  
ORNL/TM-8941

RESULTS OF THE POST REMEDIAL  
ACTION SURVEY OF AREAS 4  
THROUGH 10 AT THE FORMER KELLEX  
SITE IN JERSEY CITY, NEW JERSEY

C. Clark  
B. A. Berven  
W. D. Cottrell  
W. A. Goldsmith



DOE/EV-0005/29  
(Supplemental)  
ORNL/TM-8941

Contract No. W-7405-eng-26

Health and Safety Research Division

RESULTS OF THE POST REMEDIAL ACTION SURVEY  
OF AREAS 4 THROUGH 10 AT THE FORMER  
KELLEX SITE IN JERSEY CITY, NEW JERSEY

C. Clark  
B. A. Berven  
W. D. Cottrell  
W. A. Goldsmith

September 1983

Work performed as part of the  
REMEDIAL ACTION SURVEY AND CERTIFICATION  
ACTIVITIES PROGRAM

OAK RIDGE NATIONAL LABORATORY  
Oak Ridge, Tennessee 37830  
operated by  
UNION CARBIDE CORPORATION  
for the  
DEPARTMENT OF ENERGY

## CONTENTS

	<u>Page</u>
LIST OF FIGURES . . . . .	iii
LIST OF TABLES . . . . .	iv
INTRODUCTION . . . . .	1
SURVEY METHODS . . . . .	2
CRITERIA AND BACKGROUND LEVELS . . . . .	2
SURVEY RESULTS . . . . .	3
SIGNIFICANCE OF FINDINGS . . . . .	4
REFERENCES . . . . .	5

## LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	View of property and areas that were excavated during the 1979 post remedial action radiological survey at Kellex. . . . .	6
2	View of Area 4 . . . . .	7
3	View of Area 5 . . . . .	8
4	View of Area 6 and subareas . . . . .	9
5	View of Area 6A . . . . .	10
6	View of Area 6B . . . . .	11
7	View of Area 6C . . . . .	12
8	View of Area 6D . . . . .	13
9	View of Area 6D, trench areas 1, 2, and 3 . . . . .	14
10	View of Area 6E . . . . .	15
11	View of Area 6F . . . . .	16
12	View of Area 6G . . . . .	17
13	View of Area 6H . . . . .	18
14	View of Area 6I . . . . .	19
15	View of Area 6J . . . . .	20
16	View of Area 7 . . . . .	21
17	View of Area 8 . . . . .	22
18	View of Area 9 . . . . .	23
19	View of Area 10 . . . . .	24

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	A summary of applicable radiation guidelines for the former Kellex site . . . . .	25
2	Background radiation levels for the northern New Jersey area . . . . .	26
3	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 4 . . . . .	27
4	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 5 . . . . .	28
5	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6A . . . . .	29
6	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6B . . . . .	30
7	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6C . . . . .	31
8	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6D . . . . .	32
9	Former Kellex Laboratory: Jersey City, New Jersey trench survey of decontaminated Area 6D . . . . .	33
10	Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6E . . . . .	34
11	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 6F . . . . .	35
12	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 6G . . . . .	36
13	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 6H . . . . .	37
14	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 6I . . . . .	38
15	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 6J . . . . .	39
16	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 7 . . . . .	40

LIST OF TABLES (continued)

<u>Table</u>		<u>Page</u>
17	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 8 . . . . .	44
18	Former Kellex Laboratory: Jersey City, New Jersey grid survey of decontaminated Area 9 . . . . .	46
19	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 4 . . . . .	47
20	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 5 . . . . .	48
21	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6A . . . . .	49
22	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6B . . . . .	50
23	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6C . . . . .	51
24	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6D . . . . .	52
25	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6E . . . . .	53
26	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6F . . . . .	54
27	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6G . . . . .	55
28	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6H . . . . .	56
29	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6I . . . . .	57

LIST OF TABLES (continued)

<u>Table</u>		<u>Page</u>
30	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6J . . . .	58
31	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 7 . . . .	59
32	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 8 . . . .	60
33	Results of soil samples taken during the 1979 post remedial action radiological survey at Area 9 . . . .	62
34	Results of soil samples taken during the 1979 post remedial action radiological survey of Area 10 . . . .	63
35	Radionuclide concentration in water samples taken November 1979 . . . . .	64
36	Summary of soil sample data collected during post decontamination activities at the former Kellex Laboratory site . . . . .	65

RESULTS OF THE POST REMEDIAL ACTION SURVEY OF  
AREAS 4 THROUGH 10 AT THE FORMER KELLEX SITE  
IN JERSEY CITY, NEW JERSEY\*

INTRODUCTION

The M. W. Kellogg Company established the Kellex Corporation in 1943 at the intersection of New Jersey Route 440 and Kellogg Street.<sup>1</sup> The purpose of the Kellex facility was to design and construct the first gaseous diffusion uranium enrichment plant under a Manhattan Engineer District (MED) contract. Later, other uranium recovery and decontamination activities took place under MED/Atomic Energy Commission (AEC) contracts.<sup>1</sup> All uranium-related activities were discontinued at the former Kellex site in July 1952.

In June 1953, the VITRO Corporation of America prepared a contamination status report based on a radiological survey of one of the buildings at the former Kellex site.<sup>2</sup>

Comprehensive radiological surveys of the former Kellex facility were conducted by Oak Ridge National Laboratory (ORNL) in two phases following a preliminary radiological survey by ORNL on October 21, 1976.<sup>3</sup> The initial radiological survey was conducted on the eastern portion of the site in March 1977. The radiological survey on the western portion of the site was completed over the remaining area during the summer of 1979. The results of the ORNL survey are provided in Reference 3.

During these surveys, nine areas of contamination were found. The locations of these nine contaminated areas are schematically located in Fig. 1. A tenth area of contamination was found during decontamination activities in August 1979. The location of this area is also shown in Fig. 1.

Decontamination of Areas 1-3 at this site was conducted by EnviroSphere Company (a division of Ebasco Services, Inc.) with construction assistance by Tobar Construction Company during the week ending August 11, 1979.<sup>4</sup> The results of post remedial radiological survey of Areas 1-3 at the former Kellex site are presented in Reference 4.

Decontamination of Areas 4-9 was conducted by EnviroSphere during the period between August 12, 1979, and November 29, 1979. (Area 10 was not

---

\* Research sponsored by the Office of Operational Safety, U.S. Department of Energy, under contract W-7405-eng-26 with the Union Carbide Corporation.

decontaminated). The purpose of this report is to document results of the post remedial action survey conducted by ORNL on Areas 4-10.

## SURVEY METHODS

The survey at the former Kellex Laboratory site was performed in accordance with the survey plan to characterize the existing radiological status of the Kellex site.<sup>3</sup> Comprehensive descriptions of survey methods and instrumentation similar to those and for this survey have been provided in other reports.<sup>5</sup>

All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

For the purposes of this survey, biased soil samples are soil samples collected at specific locations where gamma radiation levels were measured at one and a half to twice the normal New Jersey background level. Composite soil samples are soil samples generated by taking small aliquots of soil at regular intervals over a specified area and mixing the aliquots into a single homogeneous soil sample.

## CRITERIA AND BACKGROUND RADIATION LEVELS

Applicable remedial action criteria have been summarized in Table 1. Since no firm or widely accepted criteria for residual radioactivity in soil existed at the time of the remedial action, a reasonable effort was made to reduce the contamination to near background levels. An upper limit for radionuclides  $^{232}\text{Th}$  and  $^{226}\text{Ra}$  and their precursors in soil was assumed to be 5 pCi/g for any sample of soil ( $\sim 1$  lb). The  $^{238}\text{U}$  criterion used during the clean-up of the Kellex site was 40 pCi/g in the top 20 cm of soil averaged over 400 m<sup>2</sup> of area. The normal background levels for the New Jersey area are presented in Table 2. These data are provided for comparison with the survey results.

## SURVEY RESULTS

In order to document the location of post-cleanup radiation measurements and residual radionuclide concentrations, a grid system was established in six areas (4-9) as shown in Figs. 1-18. Area 6 consisted of ten smaller contaminated areas which were designated Areas 6A-6J. Area 10 (Fig. 19) was excavated but not grided, and did not warrant any post-cleanup activities; however, soil samples were taken from this area for analysis. Within the borders of each area on these figures, an outline of the portion of that area which was excavated is shown.

Within the center of each grid block, gamma exposure rates were measured 1 m above the ground and beta gamma dose rates were measured at 1 cm above the ground. Each grid block was scanned at a height of 0-10 cm from the surface to measure the gamma exposure rate. Results of these measurements for the areas 4-9 are presented in Tables 3-18.

Final soil and water samples were returned to ORNL, processed, and analyzed using routine laboratory techniques. Each soil sample was counted with a Ge(Li) spectrometer and the concentration of  $^{232}\text{Th}$  and  $^{226}\text{Ra}$  was determined using a computer-based multichannel analyzer. Uranium determinations were made by the ORNL Analytical Chemistry Division using a neutron activation technique.<sup>6</sup> Results of these analyses for soil samples collected in the six decontaminated areas and area 10 are presented in Tables 19-34. Water sample results and a summary table of soil data are presented in Tables 35 and 36, respectively.

The maximum observed  $^{226}\text{Ra}$  concentration over the 5 pCi/g criteria was measured in samples KT13B (9.1 pCi/g) and KT13B1 (13 pCi/g) taken from area 10 at a depth of 46 cm. However, the area is believed to meet the criteria for  $^{226}\text{Ra}$  in soil averaged over a 100 m<sup>2</sup> area.

The major contaminant found in the areas surveyed was  $^{238}\text{U}$  which ranged from 1 to 140 pCi/g. Areas which showed no elevated radionuclide concentrations were: 4, 5, 6C, 6E, 6H, 7 and 9. Although Areas 6A, 6B, 6F, 6G, 6I, 6J, 8 and 10 contained some elevated concentration of  $^{238}\text{U}$ , these areas did not exceed the guideline value of 40 pCi/g of  $^{238}\text{U}$  in the top 20 cm of soil averaged over a 400-m<sup>2</sup> area.

### SIGNIFICANCE OF FINDINGS

Based upon the results of the post-remedial action survey performed by ORNL in Areas 4-10 on the former Kellex site, it appears that the remedial action was successful in reducing radioactive contamination on the site to criteria values established at the time of the post-remedial action survey.

## REFERENCES

1. U. S. Department of Energy, *A Background Report for the Formerly Utilized Manhattan Engineer District/Atomic Energy Commission Sites Program*, DOE/EV-0097A (September 1980).
2. VITRO Corporation of America, "Contamination Status Report Jersey City Laboratory," June 25, 1953.
3. Berven, B. A., H. W. Dickson, W. A. Goldsmith, W. M. Johnson, W. D. Cottrell, R. W. Doane, F. F. Haywood, M. T. Ryan, and W. H. Shinpaugh, *Radiological Survey of the Former Kellex Research Facility, Jersey City, New Jersey*, Oak Ridge National Laboratory, ORNL-5734, DOE/EV-0005/29 (February 1982).
4. Letter to E. L. Keller, Director for Technical Services Division, DOE/ORO, from S. V. Kaye, Director of the Health and Safety Research Division, Oak Ridge National Laboratory, "Post Decontamination Radiological Survey of the Former Kellex Laboratory Site, Jersey City, New Jersey," (letter dated August 21, 1979).
5. R. W. Leggett, D. L. Anderson, W. D. Cottrell, D. J. Crawford, R. W. Doane, F. F. Haywood, T. E. Myrick, W. H. Shinpaugh, and E. B. Wagner, *Radiological Surveys of Properties in the Middlesex, New Jersey, Area*, Oak Ridge National Laboratory, Oak Ridge, Tennessee, DOE/EV-0005/1 (Supplement), ORNL-5680, (March 1981).
6. F. F. Dyer, J. F. Emery, and G. W. Leddicotte, *A Comprehensive Study of the Neutron Activation Analysis of Uranium by Delayed Neutron Counting*, ORNL-3342 (October 1962).
7. A. C. George and A. J. Breslin, "The Distribution of Ambient Radon and Radon Daughters in Residential Buildings in the New Jersey - New York Area," *Proceedings of the Natural Radiation Environment III*, pp. 1272-93, CONF-780422 (Vol. 2), UTIS, 1980.

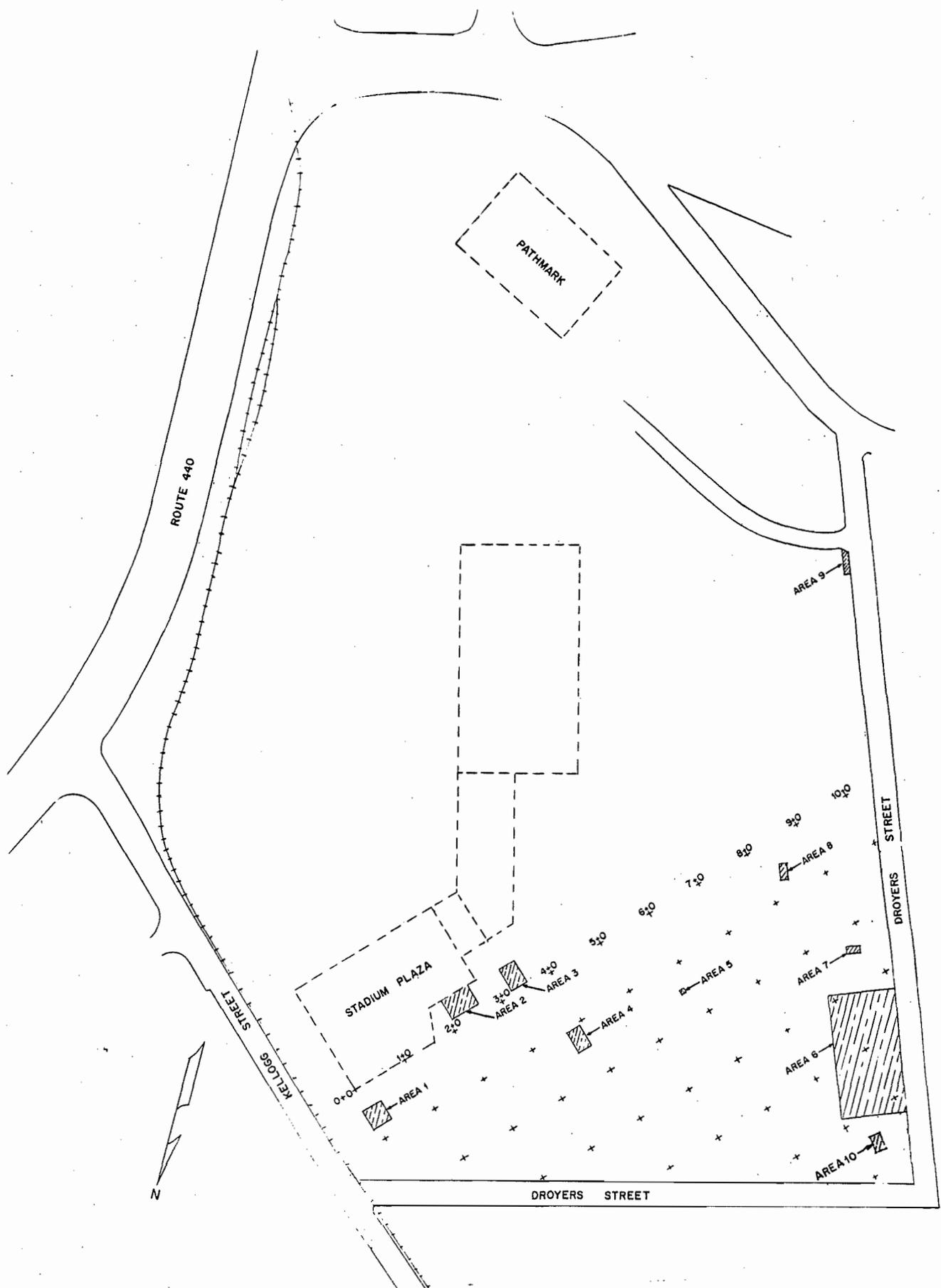


Fig. 1. Schematic view of property and areas that were excavated during the 1979 post remedial action survey at Kellex.

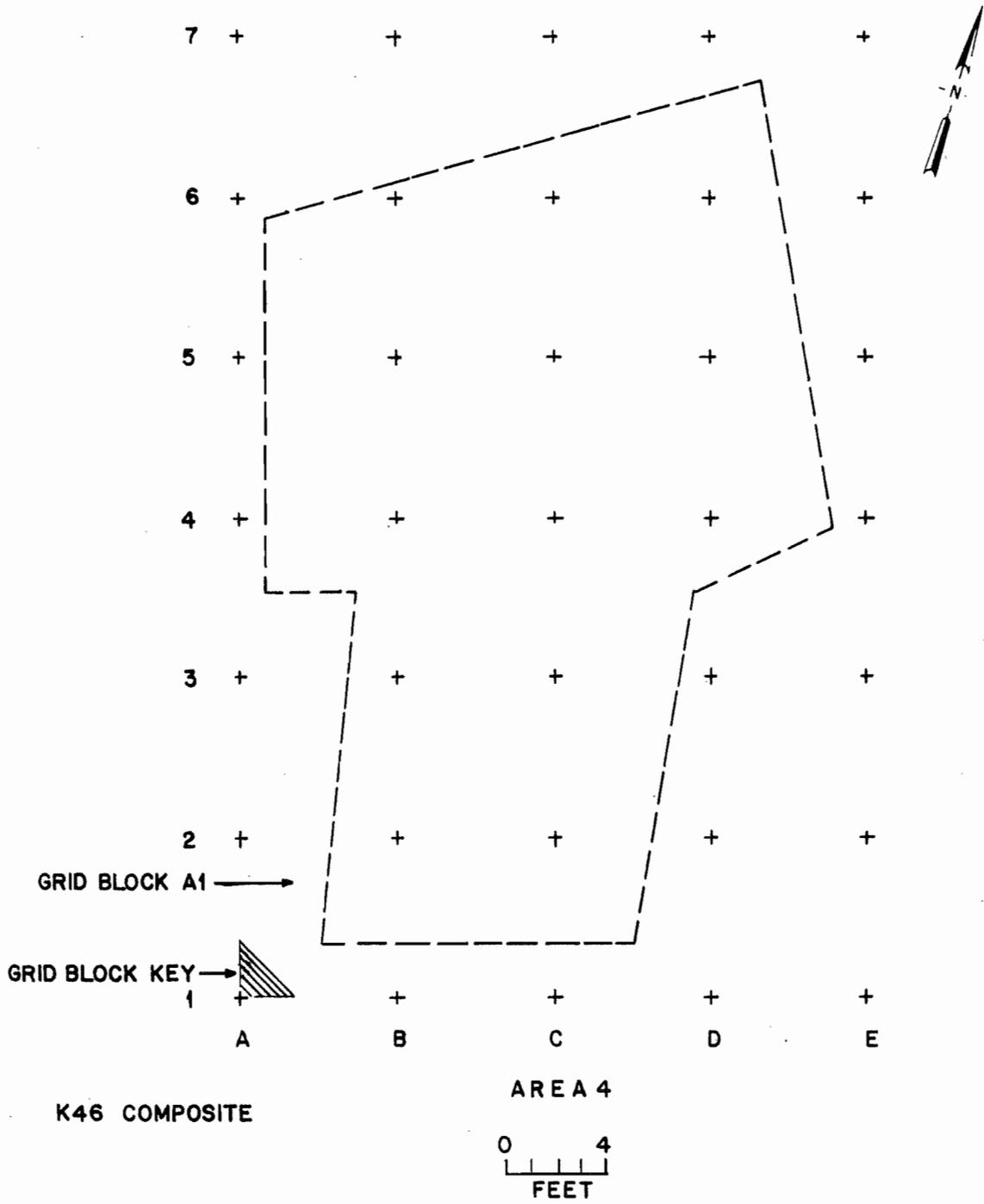
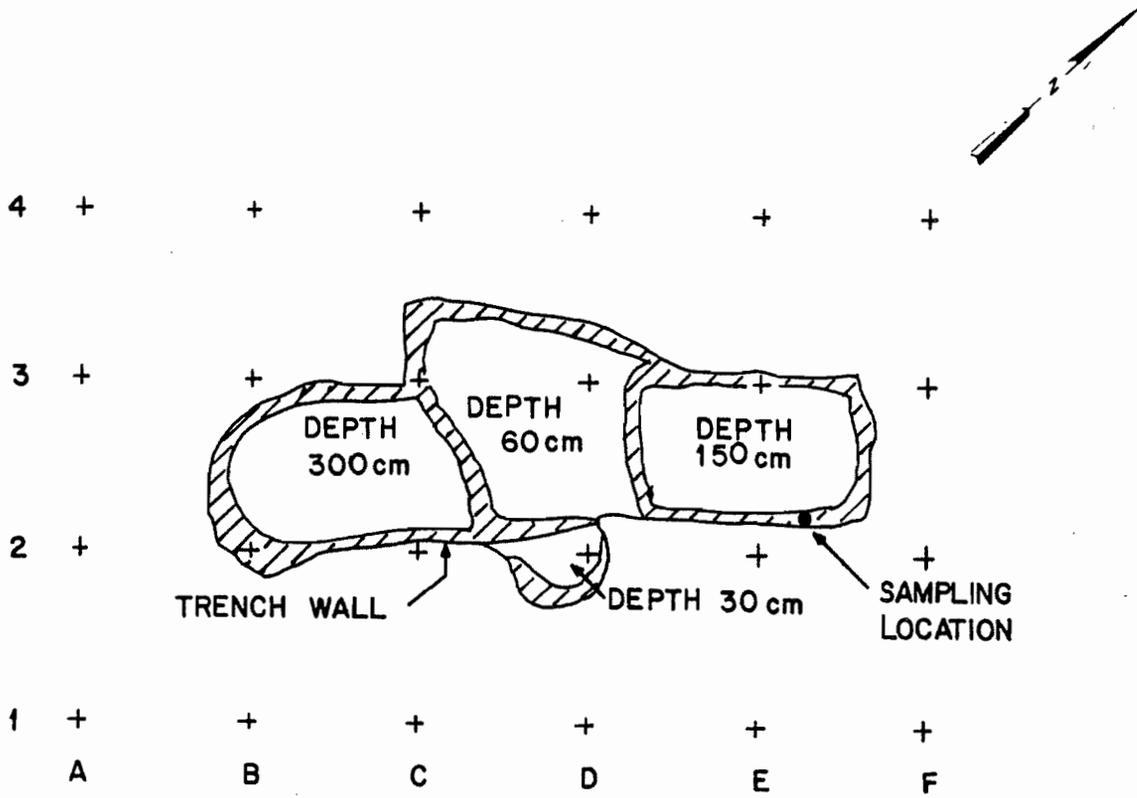


Fig. 2. View of Area 4.



AREA 5



K 390	Depth 0-30 cm
K 391	" 30-60 cm
K 392	" 60-183 cm
K 393	" 183-732 cm

Fig. 3. View of Area 5.

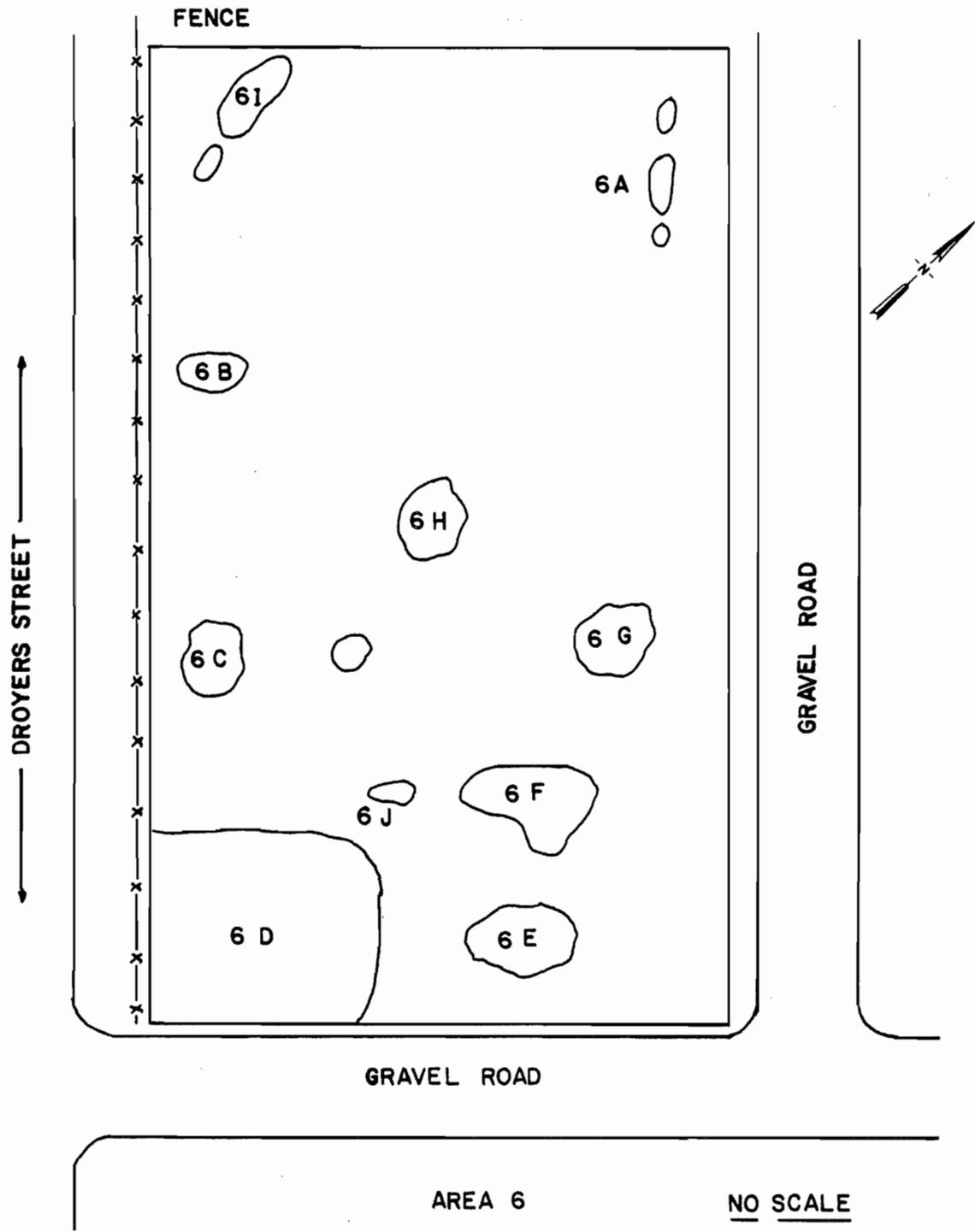
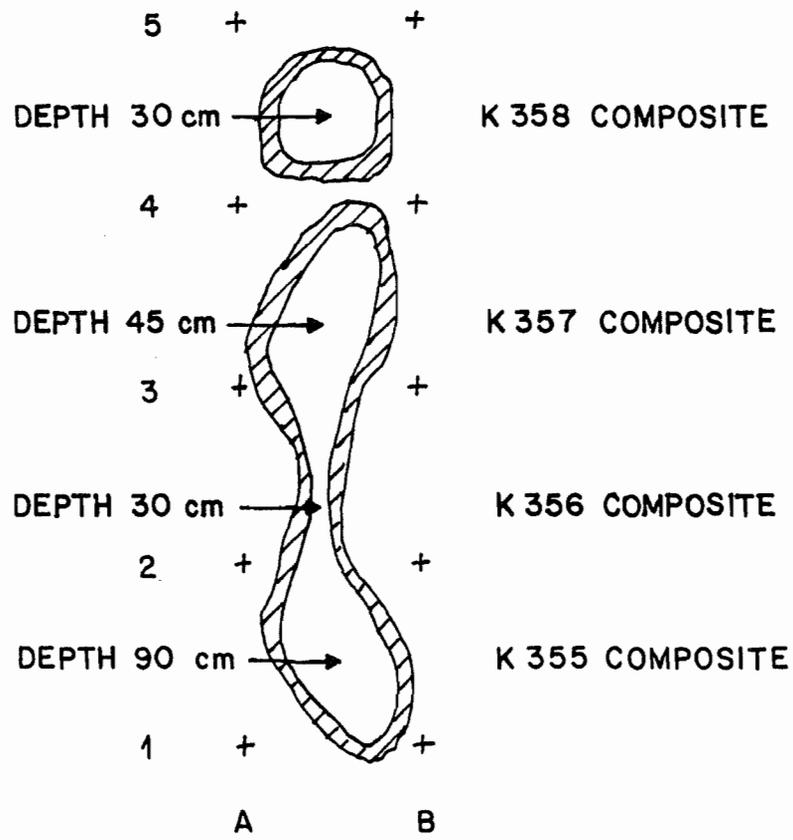


Fig 4. View of Area 6 and subareas.



AREA 6A

NO SCALE

Fig. 5. View of Area 6A.

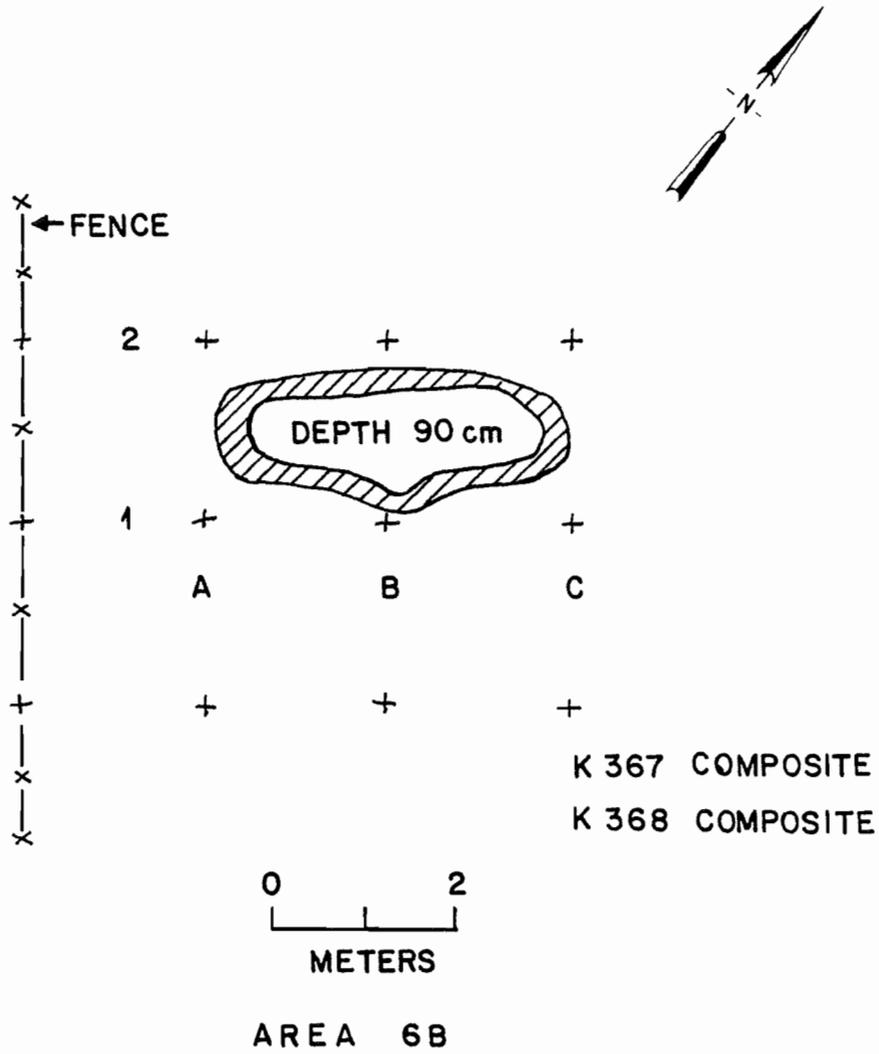


Fig. 6. View of Area 6B.

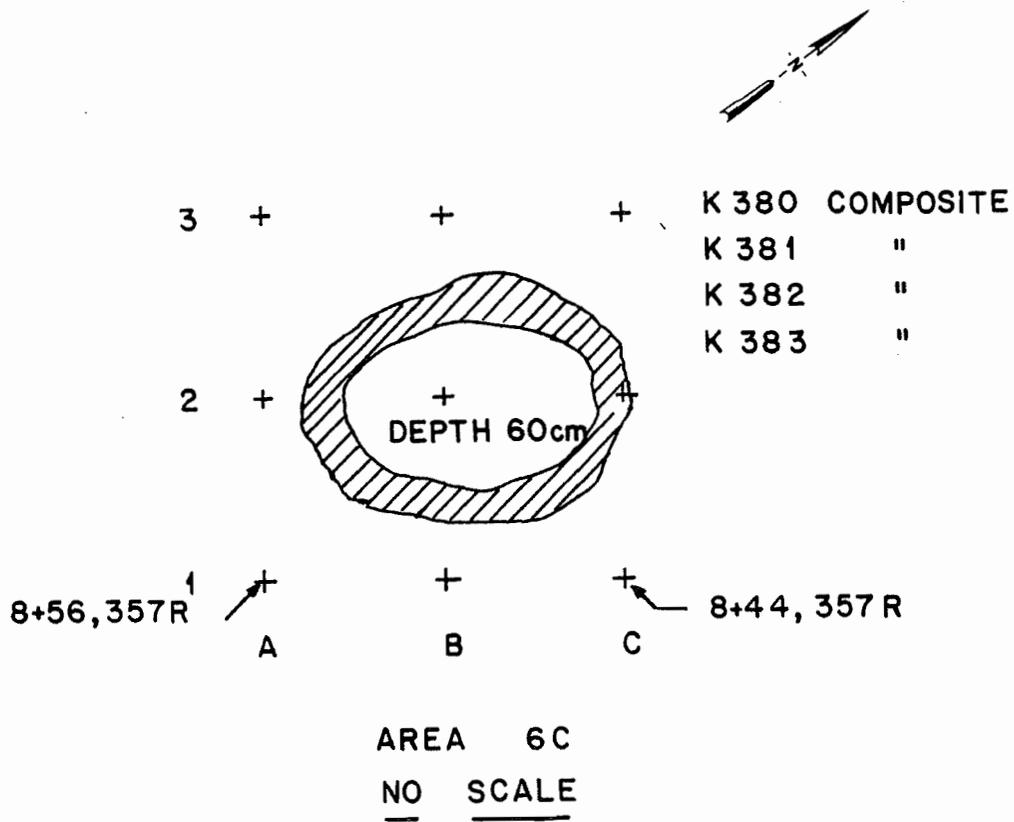
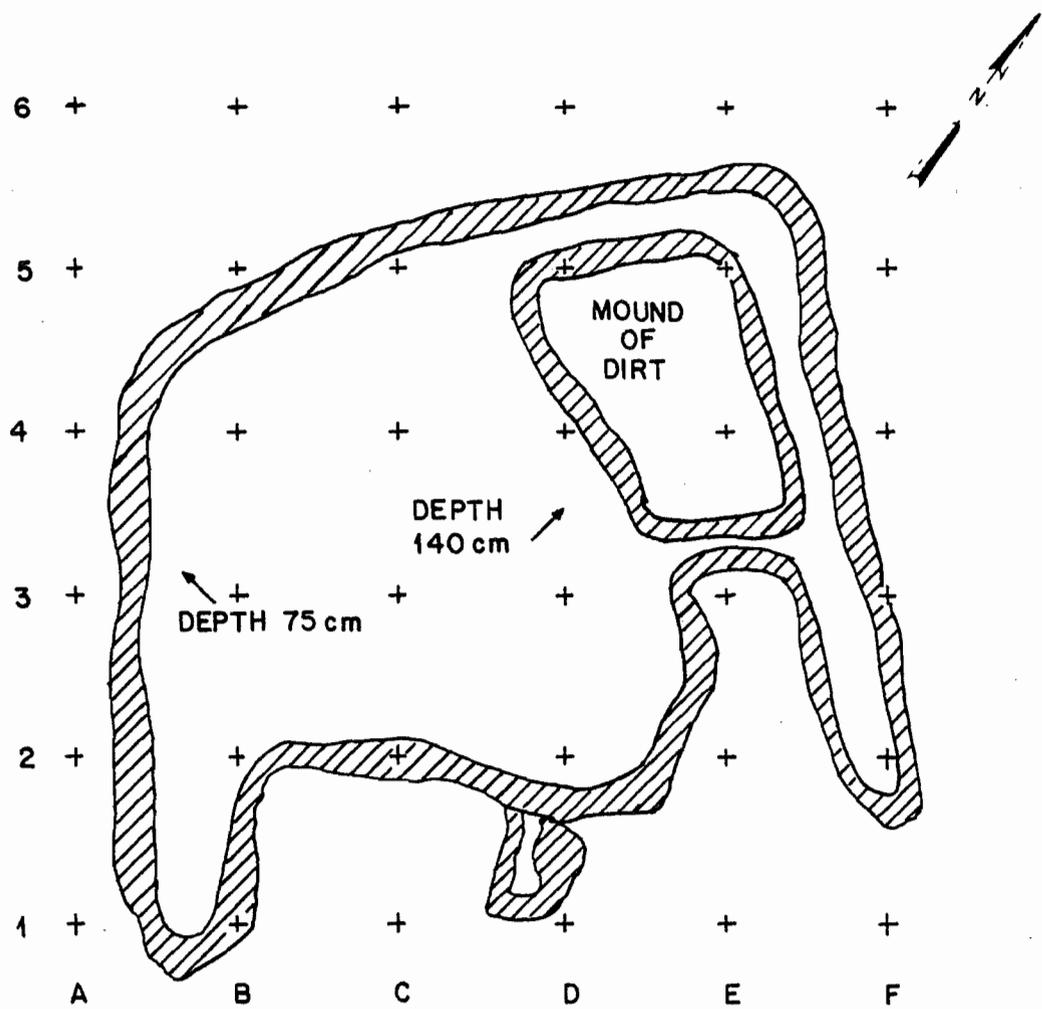


Fig. 7. View of Area 6C.



- K 384 A-1
- K 385 A-4
- K 386 B-1
- K 387 B-4
- K 388 B-5
- K 389 D-1



AREA 6 D

Fig. 8. View of Area 6D.

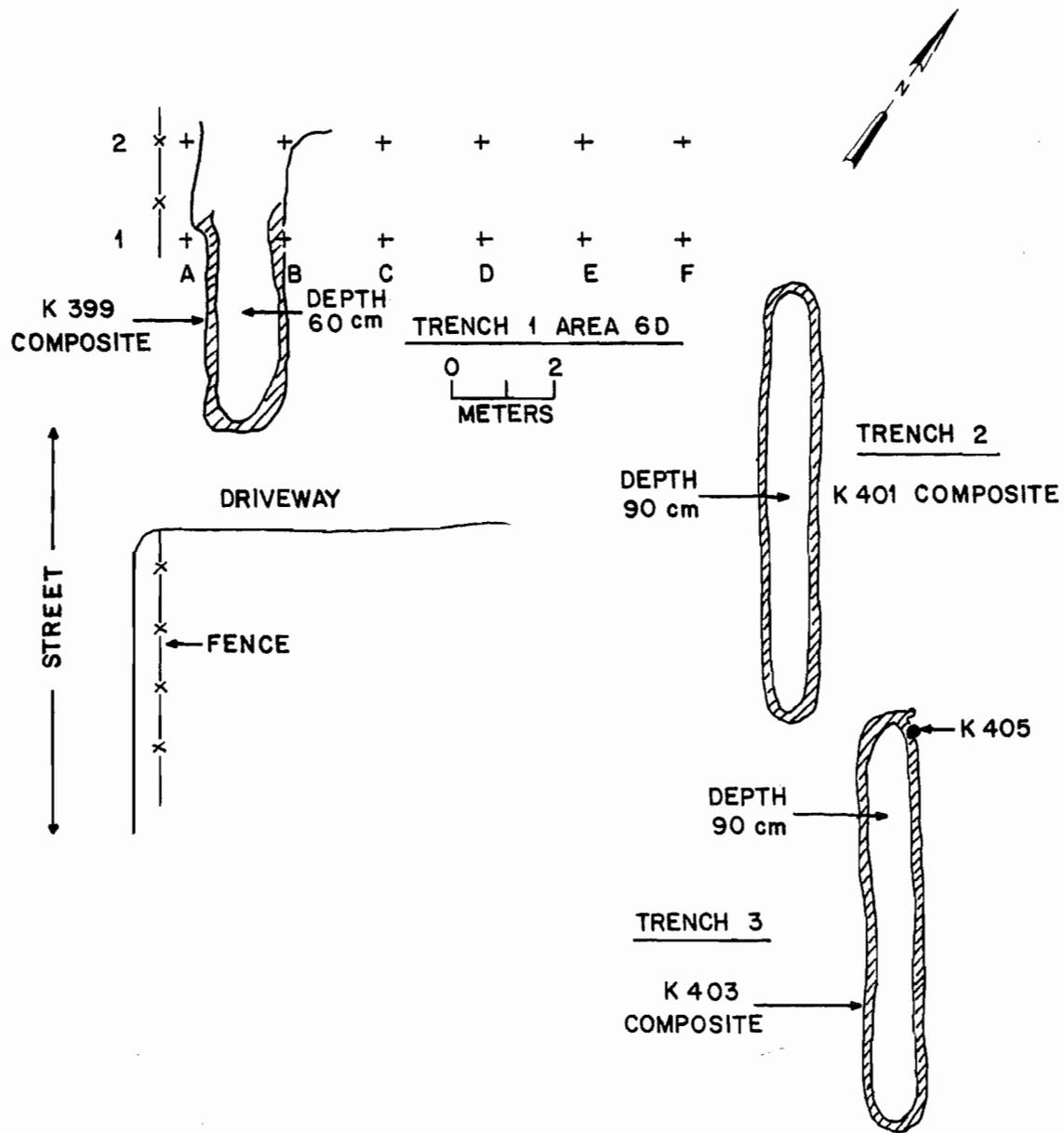


Fig. 9. View of Area 6D trench areas 1, 2, and 3.

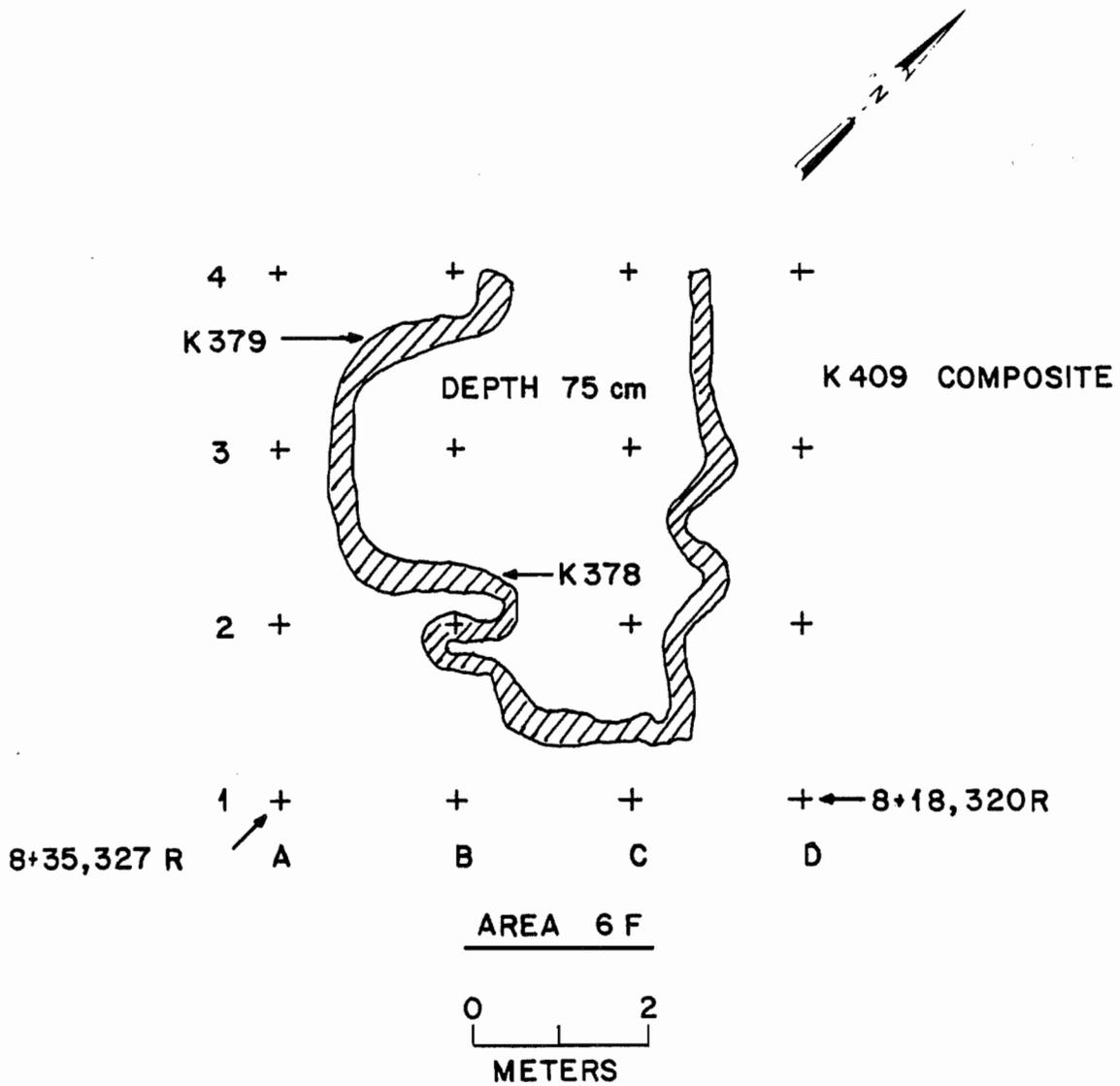
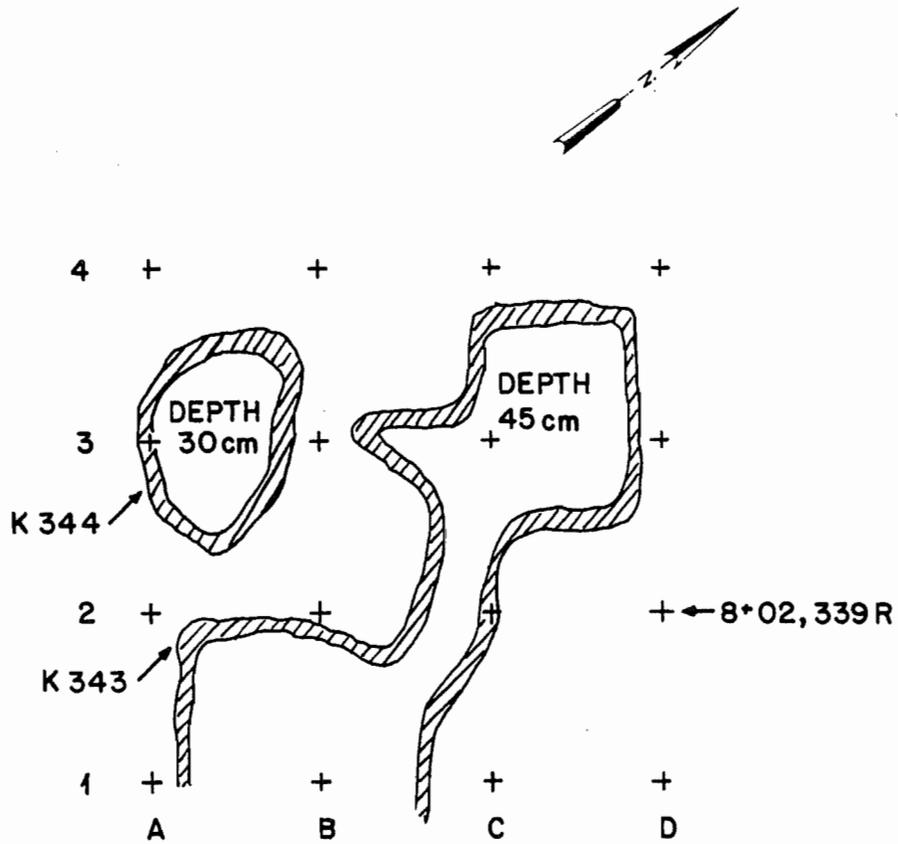


Fig. 11. View of Area 6F.



K 345	COMPOSITE
K 346	"
K 347	"
K 348	"
K 349	"
K 350	"
K 351	"
K 352	"
K 353	"

AREA 6G



Fig. 12. View of Area 6G.

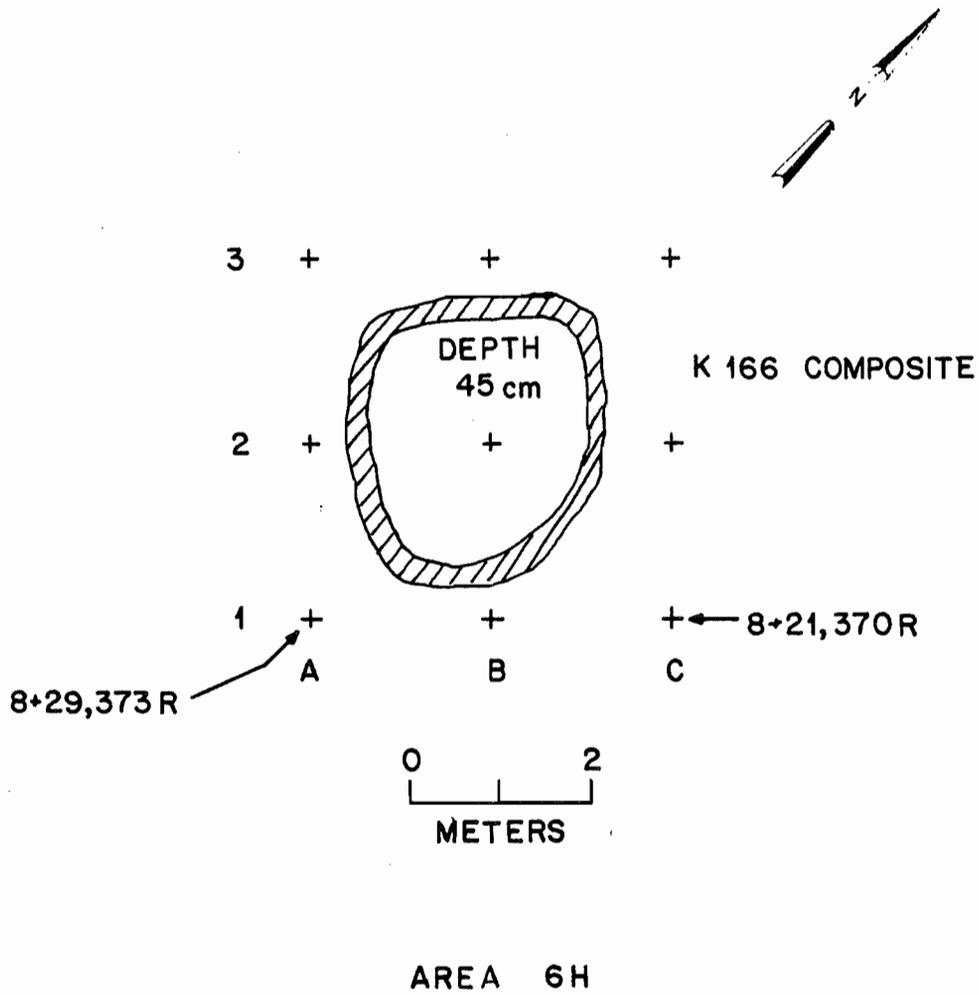
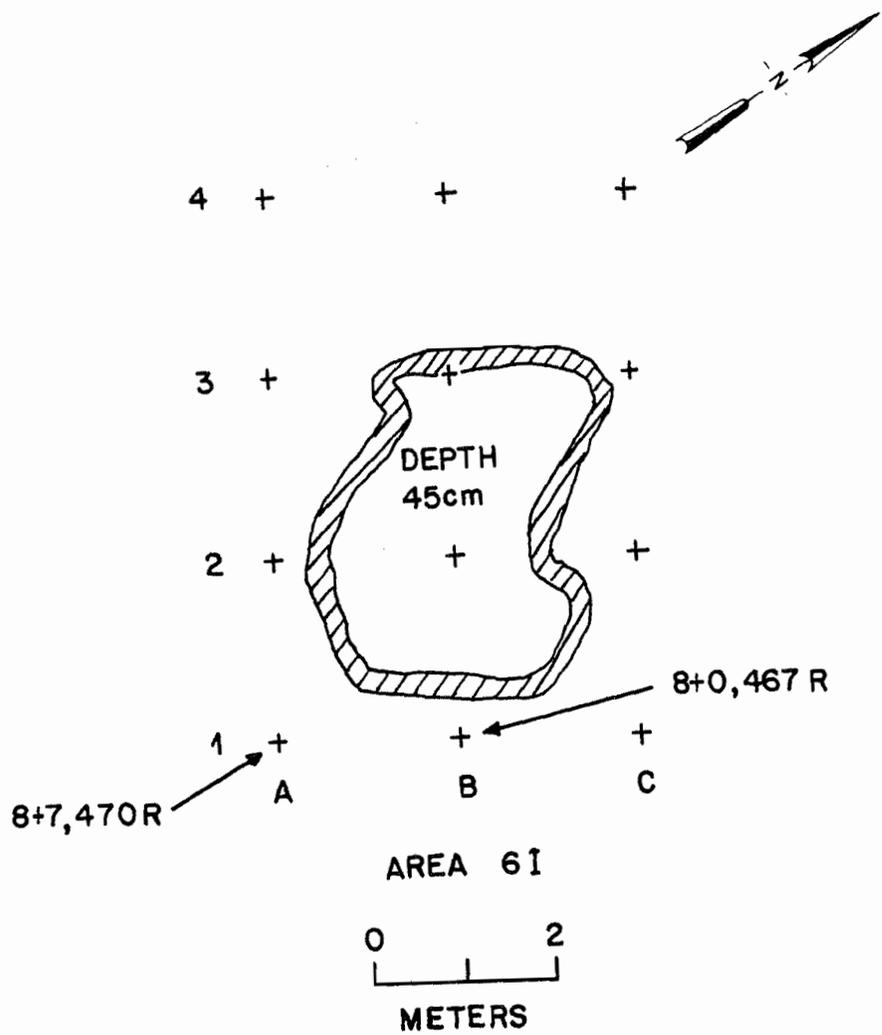


Fig. 13. View of Area 6H.



- K 361 COMPOSITE
- K 362 "
- K 363 "
- K 364 "
- K 365 "
- K 366 "

Fig. 14. View of Area 6I.

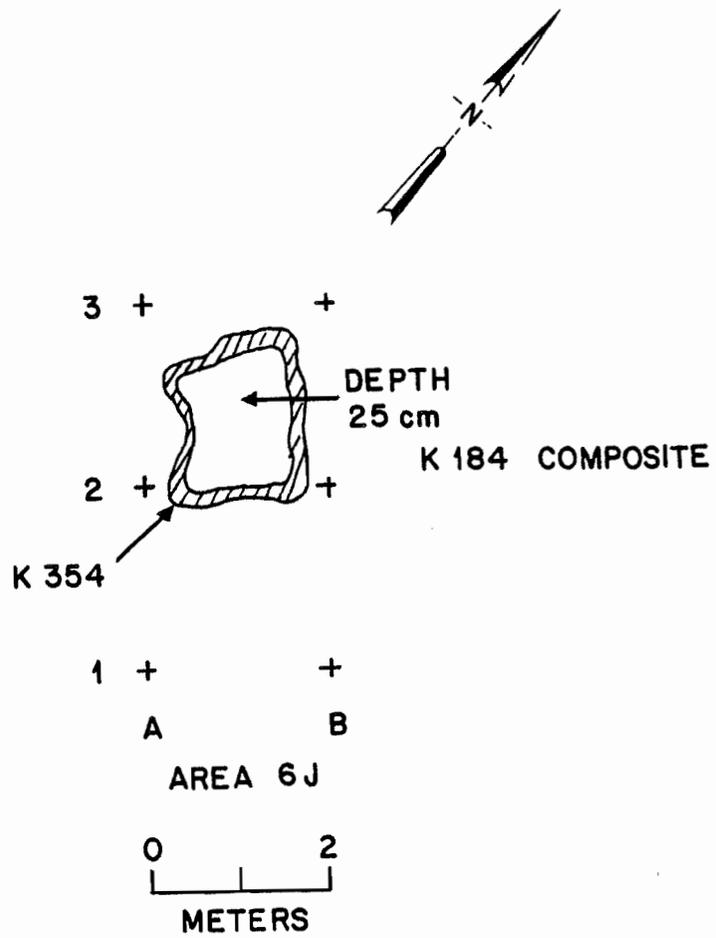


Fig. 15. View of Area 6J.

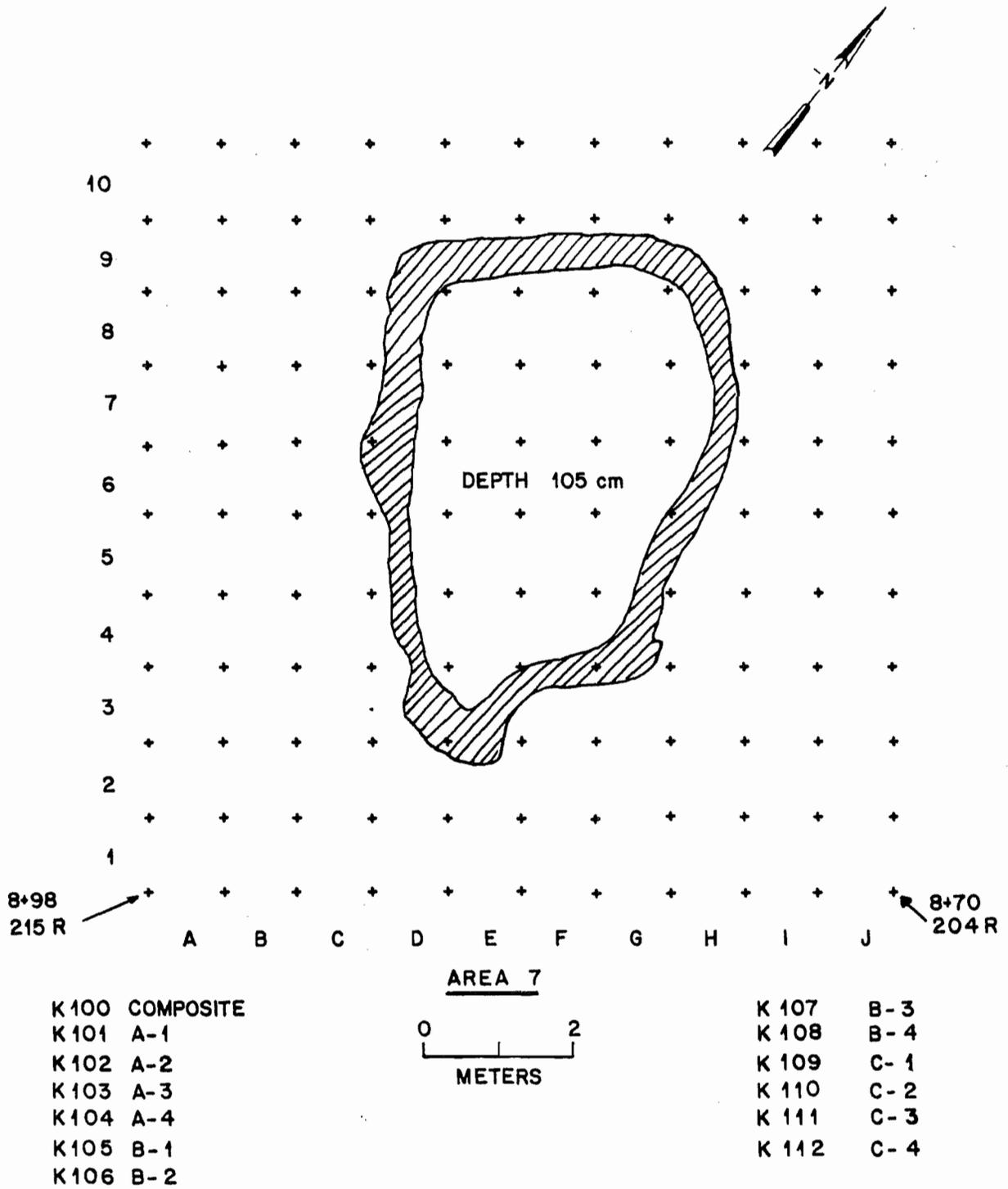


Fig. 16. View of Area 7.

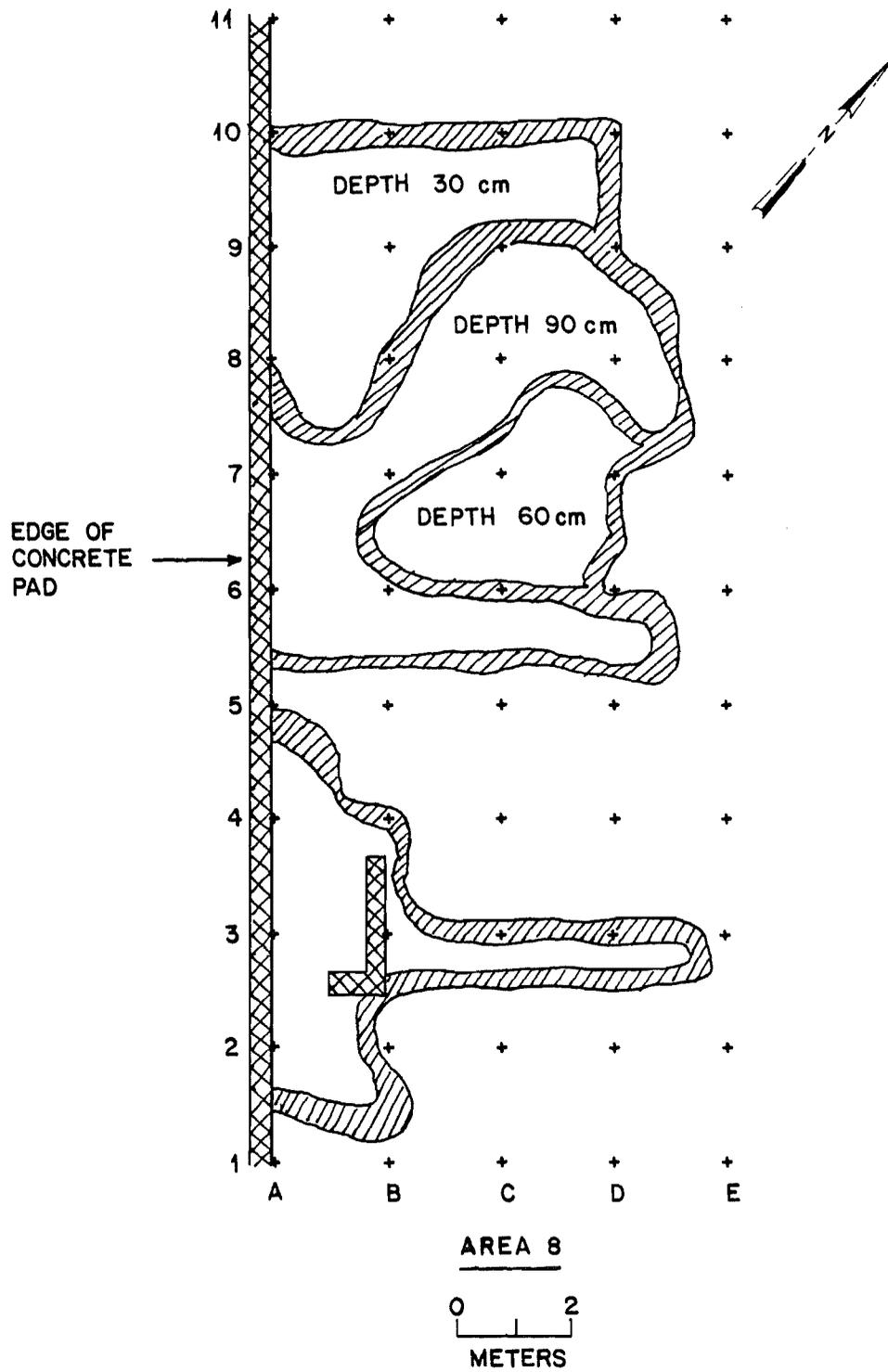


Fig. 17. View of Area 8.

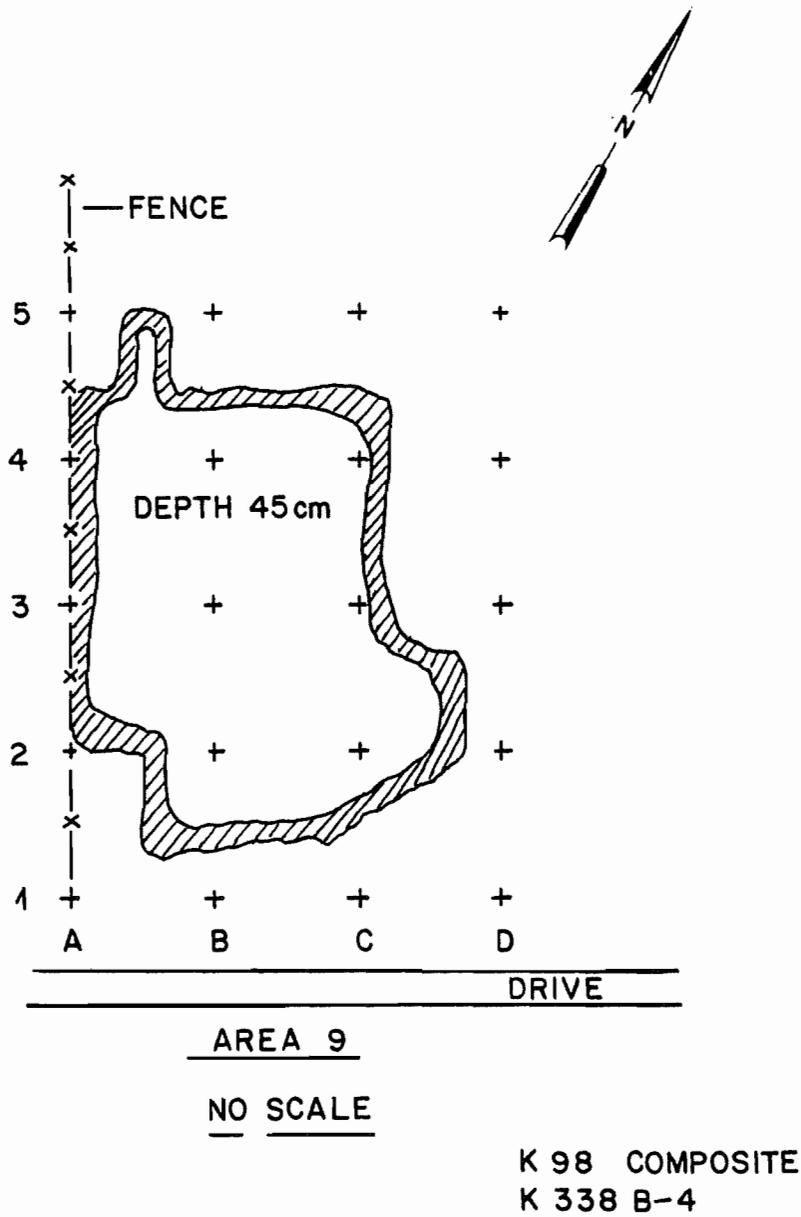
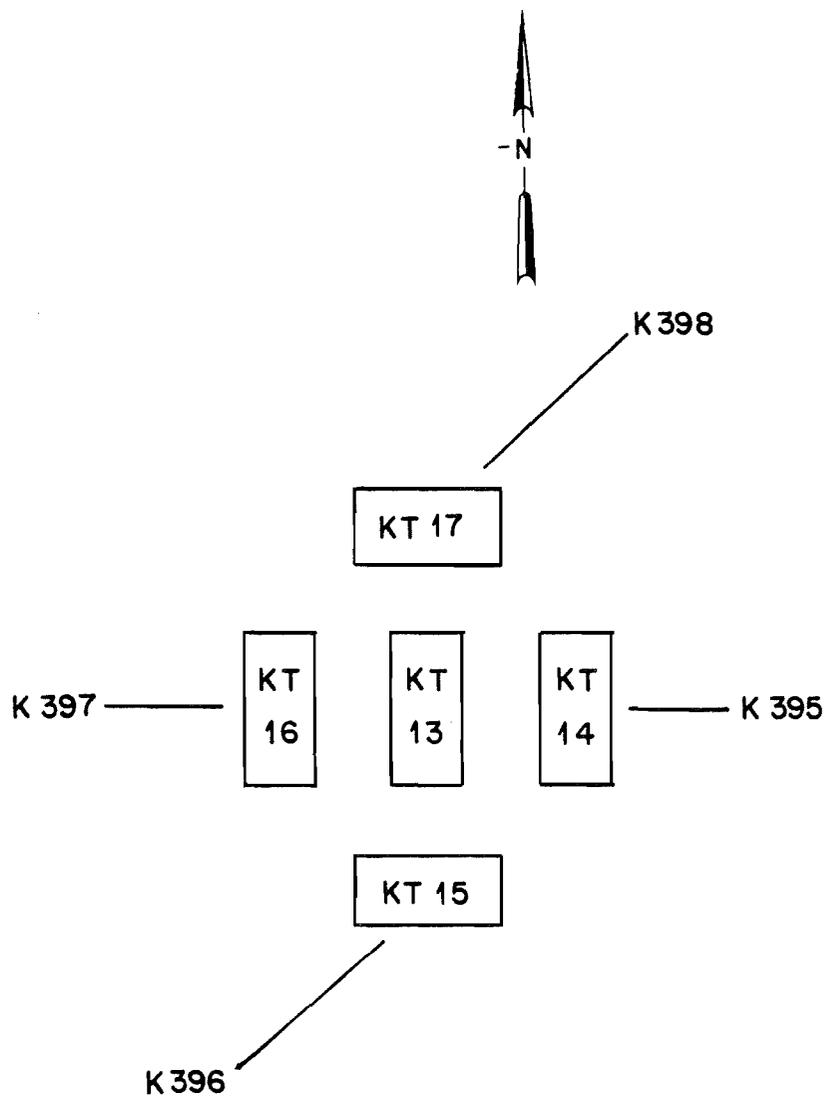


Fig. 18. View of Area 9.



AREA 10

NO SCALE

Fig. 19. View of Area 10.

Table 1. A summary of applicable radiation guidelines for the former Kellex site

Mode of exposure	Exposure conditions	Guideline value	Guideline source
1. External gamma radiation <sup>a</sup>	Continuous exposure to individual in general population (whole body)	60 µR/h	Nuclear Regulatory Commission (NRC) - Standards for Protection Against Radiation (10 CFR 20.105)
2. Surface alpha contamination <sup>a</sup>	<sup>226</sup> Ra contamination fixed on surfaces	100 dpm/100 cm <sup>2</sup>	NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source, or Special Nuclear Material (Adapted from NRC Reg. Guide 1.86)
	Removable <sup>226</sup> Ra contamination	20 dpm/100 cm <sup>2</sup>	
3. Surface beta contamination <sup>a</sup>	Removable beta-gamma emitters	1000 dpm/100 cm <sup>2</sup>	Same as number 2
4. Beta-gamma dose rates <sup>a</sup>	Average dose rate on an area no greater than 1 m <sup>2</sup>	0.20 mrad/h	Same as number 2
	Maximum dose rate in any 100 cm <sup>2</sup> area	1.0 mrad/h	Same as number 2
5. Exposure to radon <sup>a</sup>	Maximum permissible concentration of <sup>222</sup> Rn in air in unrestricted areas	3.0 pCi/L	NRC 10 CFR 20.103, Appendix B, Table II
6. Radionuclides in water <sup>a</sup>	Maximum contaminant level for combined <sup>226</sup> Ra and <sup>228</sup> Ra in drinking water	5 pCi/L	EPA Interim Standards 40 CFR 141.15
	Maximum permissible concentration of the following radionuclides in water for unrestricted areas <sup>226</sup> Ra <sup>238</sup> U <sup>230</sup> Th <sup>210</sup> Pb	30 pCi/L 40,000 pCi/L 2,000 pCi/L 100 pCi/L	NRC 10 CFR 20.103 Appendix B, Table II
7. Uranium concentration in soil	Average concentration of <sup>238</sup> U in the top 20 cm of soil averaged over 400 m <sup>2</sup> (including background)	40 pCi/g	DOE letter from William E. Mott to Department of Environmental Protection, State of New Jersey dated June 13, 1980

<sup>a</sup>This appendix contains a complete listing of standard.

Table 2. Background radiation levels for the northern New Jersey area

Type of radiation measurement or sample	Radiation level or radionuclide concentration
Gamma exposure rate at 1 m above floor or ground surface ( $\mu\text{R/h}$ )	8
Direct alpha activity on indoor floor or wall surface (dpm/100 $\text{cm}^2$ )	25
Transferable alpha activity on indoor floor or wall surface (dpm/100 $\text{cm}^2$ )	10
Transferable beta-gamma activity on indoor floor or wall surface (dpm/100 $\text{cm}^2$ )	20
Beta-gamma dose rate activity on ground, floor, and wall surfaces (mrad/h)	0.01–0.03
Indoor radon concentration (pCi/L) <sup><math>\alpha</math></sup>	
Basement	1.7
Upstairs	0.8
Indoor radon daughter concentration (WL) <sup><math>\alpha</math></sup>	
Basement	0.008
Upstairs	0.004
Concentration of radionuclides in soil (pCi/g)	
<sup>232</sup> Th	0.9
<sup>238</sup> U	0.9
<sup>226</sup> Ra	0.9

<sup>$\alpha$</sup> Reference 7.

Table 3. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 4

Grid <sup>a</sup> point	Grid point measurements		Grid block scan
	Gamma exposure rate at 1 m ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	7	0.02	10
A2	7	0.02	10
A3	6	0.01	10
A4	6	0.01	10
A5	6	0.02	10
A6	7	0.02	10
A7	7	0.02	10
B1	7	0.02	10
B2	7	0.02	10
B3	7	0.01	10
B4	8	0.02	10
B5	8	0.02	10
B6	8	0.02	10
B7	8	0.02	10
C1	7	0.02	10
C2	7	0.02	10
C3	8	0.02	10
C4	9	0.02	10
C5	8	0.02	10
C6	9	0.03	10
C7	9	0.02	10
D1	8	0.02	10
D2	8	0.02	10
D3	8	0.01	10
D4	8	0.01	10
D5	8	0.02	10
D6	8	0.01	10
D7	9	0.01	10
E1	7	0.02	10
E2	6	0.01	10
E3	6	0.02	10
E4	7	0.01	10
E5	8	0.01	10
E6	7	0.02	10
E7	8	0.02	10

<sup>a</sup>See Fig. 2 for grid location.

Table. 4. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 5

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	8	0.01	10
A2	8	0.01	11
A3	8	0.01	10
B1	8	0.01	10
B2	8	0.02	13
B3	8	0.01	9
C1	8	0.01	10
C2	8	0.02	13
C3	8	0.01	9

<sup>a</sup>See Fig. 3 for grid block location.

Table. 5. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6A

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	7	0.02	10
A2	7	0.02	10
A3	8	0.01	9
A4	7	0.02	8

<sup>a</sup>See Fig. 5. for grid block location.

Table. 6. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6B

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	8	0.01	10
B1	8	0.01	10

<sup>a</sup>See Fig. 6 for grid block location.

Table. 7. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6C

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	8	0.03	10
A2	8	0.02	9
B1	8	0.01	8
B2	8	0.01	8

<sup>a</sup>See Fig. 7 for grid block location.

Table. 8. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6D

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	10	0.01	10
A2	9	0.01	10
A3	8	0.01	10
A4	8	0.01	11
A5	9	0.01	11
B1	8	0.01	11
B2	9	0.01	10
B3	9	0.01	10
B4	9	0.01	9
B5	9	0.01	11
C1	8	0.01	10
C2	9	0.01	10
C3	9	0.02	11
C4	9	0.02	9
C5	9	0.01	10
D1	9	0.01	11
D2	10	0.01	10
D3	9	0.01	11
D4	9	0.01	9
D5	11	0.01	9
E1	9	0.02	10
E2	9	0.01	10
E3	9	0.01	11
E4	9	0.02	10
E5	9	0.01	10

<sup>a</sup>See Fig. 8 for grid block location.

Table 9. Former Kellex Laboratory: Jersey City, New Jersey  
trench survey of decontaminated Area 6D

Trench <sup>a</sup>	Average gamma exposure rate at surface ( $\mu\text{R/h}$ )	Maximum gamma exposure rate at surface ( $\mu\text{R/h}$ )	Maximum beta-gamma dose rate (mrad/h)
#1	9	10	0.01
#2	9	13	0.02
#3	10	40 <sup>b</sup>	0.2

<sup>a</sup>See Fig. 9 for schematic of trench areas.

<sup>b</sup>The north end of trench scanned 24–40  $\mu\text{R/h}$ .

Table. 10. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6E

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	9	0.01	10
A2	7	0.01	10
B1	9	0.01	9
B2	8	0.02	9

<sup>a</sup>See Fig. 10 for grid block and sample location.

Table. 11. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6F

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	9	0.02	10
A2	9	0.02	10
A3	9	0.01	10
B1	10	0.02	11
B2	10	0.03	11
B3	10	0.02	11
C1	9	0.01	10
C2	9	0.02	11
C3	9	0.02	9

<sup>a</sup>See Fig. 11 for grid block and sample location.

Table. 12. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6G

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	8	0.01	10
A2	9	0.01	10
A3	9	0.01	10
B1	9	0.02	8
B2	9	0.01	10
B3	9	0.01	11
C1	8	0.01	10
C2	9	0.01	9
C3	9	0.01	9

<sup>a</sup>See Fig. 12 for grid block and sample location.

Table. 13. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6H

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	8	0.01	10
A2	7	0.02	10
B1	7	0.01	10
B2	7	0.01	10

<sup>a</sup>See Fig. 13 for grid block location.

Table. 14. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 6I

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	7	0.02	8
A2	7	0.01	8
A3	7	0.01	7
B1	7	0.01	8
B2	7	0.01	7
B3	7	0.01	7

<sup>a</sup>See Fig. 14 for grid block location.

Table. 15. Former Kellex Laboratory: Jersey City, New Jersey  
grid survey for decontaminated Area 6J

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	9	0.01	9
A2	9	0.02	10

<sup>a</sup>See Fig. 15 for grid block location.

Table. 16. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 7

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	9	0.02	10
A2	8	0.02	9
A3	9	0.02	9
A4	8	0.02	9
A5	7	0.01	9
A6	7	0.01	9
A7	8	0.02	8
A8	8	0.02	9
A9	8	0.02	9
A10	8	0.02	9
B1	8	0.02	10
B2	8	0.01	10
B3	7	0.02	9
B4	7	0.02	10
B5	8	0.02	10
B6	7	0.02	10
B7	7	0.02	8
B8	8	0.01	10
B9	8	0.01	11
B10	8	0.02	10
C1	8	0.02	8
C2	8	0.02	10
C3	8	0.03	11
C4	8	0.02	9
C5	8	0.02	10
C6	8	0.02	10
C7	7	0.02	9
C8	8	0.01	10
C9	8	0.01	9
C10	8	0.02	10
D1	9	0.01	11
D2	8	0.01	10
D3	8	0.02	10
D4	8	0.02	10
D5	9	0.01	10

Table 16. (continued)

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu\text{R/h}$ )	Beta-gamma dose rate at 1 cm above center ( $\text{mrad/h}$ )	Average gamma exposure rate 0-3 in. above surface ( $\mu\text{R/h}$ )
D6	8	0.01	10
D7	7	0.01	9
D8	8	0.01	9
D9	7	0.01	9
D10	8	0.01	9
E1	8	0.02	10
E2	9	0.02	11
E3	9	0.03	9
E4	8	0.02	12
E5	7	0.02	9
E6	7	0.02	8
E7	7	0.02	8
E8	8	0.02	8
E9	8	0.02	11
E10	9	0.02	12
F1	9	0.02	11
F2	9	0.02	11
F3	8	0.02	10
F4	8	0.02	10
F5	7	0.02	9
F6	7	0.01	8
F7	7	0.02	8
F8	8	0.01	9
F9	8	0.02	10
F10	9	0.02	12
G1	9	0.02	11
G2	9	0.02	11
G3	9	0.02	11
G4	8	0.02	10
G5	8	0.02	10
G6	8	0.02	11
G7	7	0.02	9
G8	8	0.02	10
G9	8	0.01	11
G10	9	0.02	13

Table 16. (continued)

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
H1	9	0.02	11
H2	8	0.02	11
H3	9	0.02	11
H4	9	0.02	11
H5	8	0.02	12
H6	9	0.03	10
H7	8	0.01	10
H8	8	0.02	10
H9	9	0.02	12
H10	9	0.03	11
I1	8	0.01	10
I2	8	0.02	12
I3	9	0.02	12
I4	8	0.02	12
I5	8	0.02	13
I6	9	0.02	12
I7	8	0.02	11
I8	9	0.03	12
I9	9	0.02	12
I10	8	0.02	12
J1	8	0.02	9
J2	7	0.02	11
J3	8	0.02	11
J4	8	0.02	12
J5	9	0.02	11
J6	8	0.02	11
J7	7	0.02	11
J8	8	0.02	10
J9	8	0.02	10
J10	8	0.02	10
Walls of pits inside grid blocks			
D3		0.02	13
D4		0.02	13

Table 16. (continued)

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
D5		0.02	13
D6		0.02	13
D7		0.01	12
D8		0.02	11
D9		0.02	14
E3		0.02	12
E9		0.02	12
F3-F4		0.02	12
F9		0.03	12
G4		0.02	12
G5		0.02	13
G9		0.02	12
H6		0.02	11
H7		0.02	12
H8		0.02	13
H9		0.03	11

<sup>a</sup>See Fig. 16 for grid block location.

Table. 17. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 8

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	7	0.02	11
A2	7	0.02	11
A3	7	0.02	11
A4	7	0.02	11
A5	6	0.02	11
A6	7	0.02	11
A7	7	0.02	11
A8	7	0.02	11
A9	7	0.02	11
A10	6	0.01	11
B1	7	0.01	11
B2	7	0.03	11
B3	8	0.02	11
B4	7	0.01	11
B5	7	0.01	11
B6	7	0.02	11
B7	8	0.02	11
B8	7	0.02	11
B9	6	0.01	11
B10	7	0.01	11
C1	7	0.01	11
C2	8	0.01	11
C3	8	0.01	11
C4	7	0.01	11
C5	8	0.02	11
C6	8	0.02	11
C7	8	0.02	11
C8	8	0.02	11
C9	8	0.02	11
C10	7	0.01	11
D1	7	0.02	11
D2	8	0.01	11
D3	8	0.01	11
D4	7	0.02	11
D5	8	0.01	11
D6	8	0.02	11
D7	8	0.01	11

Table 17. (continued)

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
D8	8	0.01	11
D9	8	0.02	11
D10	8	0.02	11

<sup>a</sup>See Fig. 17 for grid block location.

Table. 18. Former Kellex Laboratory: Jersey City, New Jersey grid survey for decontaminated Area 9

Grid <sup>a</sup> block	Grid block measurements		Grid block scan
	Gamma exposure rate at 1 m above center ( $\mu$ R/h)	Beta-gamma dose rate at 1 cm above center (mrad/h)	Average gamma exposure rate 0-3 in. above surface ( $\mu$ R/h)
A1	8	0.01	10
A2	7	0.01	10
A3	8	0.01	10
A4	8	0.01	10
B1	8	0.01	10
B2	7	0.01	10
B3	8	0.01	10
B4	9	0.01	10
C1	7	0.01	10
C2	7	0.01	10
C3	7	0.01	10
C4	8	0.01	10

<sup>a</sup>See Fig. 18 for grid block location.

Table 19. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 4

Sample Number	Grid block <sup>a</sup> location	Sample <sup>b</sup> type	Depth <sup>c</sup> (cm)	Radionuclide concentration (pCi/g) <sup>d</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-46	A1-A6, B1-B6, C1-C6, D1-D6	Composite	0-8	1.5	2.6±0.3	1.3±0.08

<sup>a</sup>Area from which sample was collected is shown in Fig. 2.

<sup>b</sup>The composite was comprised of aliquots of soil from each grid block indicated, and mixed into a single homogeneous sample.

<sup>c</sup>A depth of 0-8 cm was considered a surface sample.

<sup>d</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

Table 20. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 5

Sample Number <sup>a</sup>	Grid block location <sup>b</sup>	Sample type	Depth (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-390	E2 (trench)	Biased <sup>d</sup>	0-30	1.5	1.9±5	2.0±7.2
K-391	E2 (trench)	Biased	30-60	2.2	2.4±0.1	2.7±0.2
K-392	E2 (trench)	Biased	60-183	1.7	2.4±0.3	1.7±0.2
K-393	E2 (trench)	Biased	183-732	1.7	1.6±5.1	1.3±0.7

<sup>a</sup>Samples were taken from the same location at different depths.

<sup>b</sup>Sample locations are shown in Fig. 3.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>Samples were taken from locations showing maximum gamma exposure rates.

Table 21. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6A

Sample Number	Grid block <sup>a</sup> location	Sample <sup>b</sup> type	Depth <sup>c</sup> (cm)	Radionuclide concentration (pCi/g) <sup>d</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-355	A1	Composite	0-8	2.2	1.4±0.08	2.3±0.09
K-356	A2	Composite	0-8	1.6	1.4±0.03	3.2±0.06
K-357	A3	Composite	0-8	8.3	1.2±0.6	2.8±0.3
K-358	A4	Composite	0-8	2.1	1.5±1	3.6±0.8

<sup>a</sup>Areas from which samples were collected are shown in Fig. 5.

<sup>b</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>c</sup>A depth of 0-8 cm was considered a surface sample.

<sup>d</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

Table 22. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6B

Sample Number	Grid block <sup>a</sup> location	Sample <sup>b</sup> type	Depth <sup>c</sup> (cm)	Radionuclide concentration (pCi/g) <sup>d</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-367	A1	Composite	0-8	16	e	e
K-368	B2	Composite	0-8	13	e	e

<sup>a</sup>Areas from which samples were collected are shown in Fig. 6.

<sup>b</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>c</sup>A depth of 0-8 cm was considered a surface sample.

<sup>d</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>e</sup>Analysis for this radionuclide was not performed.

Table 23. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6C

Sample Number	Grid block <sup>a</sup> location	Sample <sup>b</sup> type	Depth <sup>c</sup> (cm)	Radionuclide concentration (pCi/g) <sup>d</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-380	A1	Composite	0-8	9.5	<i>e</i>	<i>e</i>
K-381	A2	Composite	0-8	1.8	<i>e</i>	<i>e</i>
K-382	B1	Composite	0-8	1.5	<i>e</i>	<i>e</i>
K-383	B2	Composite	0-8	8.9	<i>e</i>	<i>e</i>

<sup>a</sup>Areas from which samples were collected are shown in Fig. 7.

<sup>b</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>c</sup>A depth of 0-8 cm was considered a surface sample.

<sup>d</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>e</sup>Analysis for this radionuclide was not performed.

Table 24. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6D

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K384	A1	Biased <sup>d</sup>	0-8	2.6	e	e
K385	A4	Biased	0-8	2.8	e	e
K386	B1	Biased	0-8	15	e	e
K387	B4	Biased	0-8	4.3	e	e
K388	B5	Biased	0-8	4.8	e	e
K389	D1	Biased	0-8	12	e	e
K399	Trench #1	Composite <sup>f</sup>	0-8	3.3	1.5±0.03	1.5±0.06
K401	Trench #2	Composite	0-8	30	1.2±0.08	1.1±0.03
K403	Trench #3	Composite	0-8	7.8	1.3±0.4	1.6±0.13
K405	Trench #3 (north end)	Biased	0-8	140	e	e

<sup>a</sup>Areas from which samples were collected are shown in Figs. 8 and 9.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>Samples were taken from locations showing elevated gamma measurements.

<sup>e</sup>Analysis for this radionuclide was not performed.

<sup>f</sup>Composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

Table 25. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6E

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>e</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-342	A2	Biased <sup>d</sup>	0-8	24	<sup>e</sup>	<sup>e</sup>
K-188	A1, A2, B1, B2	Composite <sup>f</sup>	0-8	12	2.1±0.06	1.9±0.2

<sup>a</sup>Areas from which samples were collected are shown in Fig. 10.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>Sample was taken from location showing elevated gamma measurements.

<sup>e</sup>Analysis for this radionuclide was not performed.

<sup>f</sup>Composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

Table 26. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6F

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>e</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-409	A1-A3, B1-B3, C1-C3	Composite <sup>d</sup>	0-8	21	<i>e</i>	<i>e</i>
K-378	B2	Biased <sup>f</sup>	0-8	70	<i>e</i>	<i>e</i>
K-379	B3	Biased	0-8	50	<i>e</i>	<i>e</i>

<sup>a</sup>Areas from which samples were collected are shown in Fig. 11.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>e</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>e</sup>Analysis for this radionuclide was not performed.

<sup>f</sup>Samples were taken from location showing elevated gamma measurements.

Table 27. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6G

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>e</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-345	A1	Composite <sup>d</sup>	0-8	70	e	e
K-346	A2	Composite	0-8	5.3	e	e
K-347	A3	Composite	0-8	12	e	e
K-348	B1	Composite	0-8	1.7	e	e
K-349	B2	Composite	0-8	20	e	e
K-350	B3	Composite	0-8	20	e	e
K-351	C1	Composite	0-8	24	e	e
K-352	C2	Composite	0-8	13	e	e
K-353	C3	Composite	0-8	7.6	e	e
K-343	A1	Biased <sup>f</sup>	0-8	60	e	e
K-344	A2	Biased	0-8	50	e	e

<sup>a</sup>Areas from which samples were collected are shown in Fig. 12.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>e</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquotes were mixed into a single homogeneous sample.

<sup>e</sup>Analysis for this radionuclide was not performed.

<sup>f</sup>Samples were taken from locations showing elevated gamma exposure rates.

Table 28. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6H

Sample Number	Grid block <sup>a</sup> location	Sample <sup>b</sup> type	Depth <sup>c</sup> (cm)	Radionuclide concentration (pCi/g) <sup>d</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-166	A1, A2, B1, B2	Composite	0-8	11	1.3±0.04	1.3±0.04

<sup>a</sup>Area from which sample was collected is shown in Fig. 13.

<sup>b</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>c</sup>A depth of 0-8 cm was considered a surface sample.

<sup>d</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

Table 29. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6I

Sample Number	Grid block <sup>a</sup> location	Sample <sup>b</sup> type	Depth <sup>c</sup> (cm)	Radionuclide concentration (pCi/g) <sup>d</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-361	A1	Composite	0-8	5.7	1.6±0.09	1.7±0.3
K-362	A2	Composite	0-8	2.7	1.2±0.05	1.3±0.1
K-363	A3	Composite	0-8	1.3	0.84±0.02	0.91±0.09
K-364	B1	Composite	0-8	11	1.6±0.04	1.7±0.06
K-365	B2	Composite	0-8	3	6.6±0.3	1.2±0.2
K-366	B3	Composite	0-8	1.1	0.69±0.1	0.86±0.06

<sup>a</sup>Areas from which samples were collected are shown in Fig. 14.

<sup>b</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>c</sup>A depth of 0-8 cm was considered a surface sample.

<sup>d</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

Table 30. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 6J

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-184	A1, A2	Composite <sup>d</sup>	0-8	5.2	<i>e</i>	<i>e</i>
K-354	A1	Biased <sup>f</sup>	0-8	41	<i>e</i>	<i>e</i>

<sup>a</sup>Areas from which samples were collected are shown in Fig. 15.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>e</sup>Analysis for this radionuclide was not performed.

<sup>f</sup>Sample was taken from location showing elevated gamma exposure rate.

Table 31. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 7

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-100	A1-A10, B1-B1 C1-C10	Composite <sup>d</sup>	0-8	9.4	1.5±0.04	1.6±0.08
K-101	A1	Systematic <sup>e</sup>	0-8	4.4	f	f
K-102	A2	Systematic	0-8	3.3	f	f
K-103	A3	Systematic	0-8	1.9	f	f
K-104	A4	Systematic	0-8	5.4	f	f
K-105	B1	Systematic	0-8	14	f	f
K-106	B2	Systematic	0-8	2.6	f	f
K-107	B3	Systematic	0-8	13	f	f
K-108	B4	Systematic	0-8	27	f	f
K-109	C1	Systematic	0-8	5.2	f	f
K-110	C2	Systematic	0-8	1.3	f	f
K-111	C3	Systematic	0-8	5.4	f	f
K-112	C4	Systematic	0-8	2.4	f	f

<sup>a</sup>Areas from which samples were collected are shown in Fig. 16.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>e</sup>Approximately 400 g of soil were taken from the center of each grid block.

<sup>f</sup>Analysis for this radionuclide was not performed.

Table 32. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 8

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-114	A1-A5, D1-D5	Composite <sup>d</sup>	0-8	16.3	0.9±0.048	1.0±0.056
K-115	A6-A10, D6-D10	Composite	0-8	15.5	0.9±0.04	0.9±0.04
K-116	A1	Systematic <sup>e</sup>	0-8	16.2	f	f
K-339	A2	Systematic	0-8	1.1	f	f
K-118	A3	Systematic	0-8	34.7	f	f
K-119	A4	Systematic	0-8	10.6	f	f
K-120	A5	Systematic	0-8	30.7	f	f
K-121	A6	Systematic	0-8	7.7	f	f
K-122	A7	Systematic	0-8	25.2	f	f
K-340	A8	Systematic	0-8	51 <sup>g</sup>	f	f
K-124	A9	Systematic	0-8	20.2	f	f
K-125	A10	Systematic	0-8	1.1	f	f
K-126	B1	Systematic	0-8	34.3	f	f
K-127	B2	Systematic	0-8	8.4	f	f
K-128	B3	Systematic	0-8	12.5	f	f
K-129	B4	Systematic	0-8	19.6	f	f
K-130	B5	Systematic	0-8	7.7	f	f
K-131	B6	Systematic	0-8	21.7	f	f
K-132	B7	Systematic	0-8	22.9	f	f
K-133	B8	Systematic	0-8	12.8	f	f
K-134	B9	Systematic	0-8	2.1	f	f
K-135	B10	Systematic	0-8	0.6	f	f
K-136	C1	Systematic	0-8	4.2	f	f
K-137	C2	Systematic	0-8	5.1	f	f

Table 32. (continued)

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-138	C3	Systematic	0-8	4.9	<i>f</i>	<i>f</i>
K-139	C4	Systematic	0-8	13.6	<i>f</i>	<i>f</i>
K-140	C5	Systematic	0-8	5.9	<i>f</i>	<i>f</i>
K-141	C6	Systematic	0-8	9.8	<i>f</i>	<i>f</i>
K-341	C7	Systematic	0-8	14.7	<i>f</i>	<i>f</i>
K-143	C8	Systematic	0-8	7.3	<i>f</i>	<i>f</i>
K-144	C9	Systematic	0-8	10.5	<i>f</i>	<i>f</i>
K-145	C10	Systematic	0-8	3.0	<i>f</i>	<i>f</i>
K-146	D1	Systematic	0-8	4.9	<i>f</i>	<i>f</i>
K-147	D2	Systematic	0-8	2.6	<i>f</i>	<i>f</i>
K-148	D3	Systematic	0-8	5.3	<i>f</i>	<i>f</i>
K-149	D4	Systematic	0-8	16.6	<i>f</i>	<i>f</i>
K-150	D5	Systematic	0-8	3.0	<i>f</i>	<i>f</i>
K-151	D6	Systematic	0-8	3.8	<i>f</i>	<i>f</i>
K-152	D7	Systematic	0-8	10.4	<i>f</i>	<i>f</i>
K-153	D8	Systematic	0-8	4.9	<i>f</i>	<i>f</i>
K-154	D9	Systematic	0-8	1.5	<i>f</i>	<i>f</i>
K-155	D10	Systematic	0-8	2.3	<i>f</i>	<i>f</i>
K-157	B2, C2, D2 (within trench)	Biased <sup>h</sup>	0-8	15.4	1.0±0.04	1.06±0.06
K-160	A5, B5, C5, D5 (within trench)	Biased	0-8	19.3	1.0±0.04	1.02±0.04

<sup>a</sup>Areas from which samples were collected are shown in Fig. 17.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

<sup>e</sup>Approximately 400 g of soil were taken from the center of each grid block.

<sup>f</sup>Analysis for this radionuclide was not performed.

<sup>g</sup>Contaminated soil probably spilled over into the sampling area during excavation.

<sup>h</sup>Samples were taken from locations showing elevated gamma exposure rates.

Table 33. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 9

Sample Number	Grid block <sup>a</sup> location	Sample type	Depth <sup>b</sup> (cm)	Radionuclide concentration (pCi/g) <sup>c</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
K-98	A1-A4, B1-B4, C1-C4	Composite <sup>d</sup>	0-8	1	1.7±0.04	1.2±0.06

<sup>a</sup>Area from which sample was collected is shown in Fig. 18.

<sup>b</sup>A depth of 0-8 cm was considered a surface sample.

<sup>c</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>d</sup>The composite was comprised of aliquots of soil from each grid block indicated; aliquots were mixed into a single homogeneous sample.

Table 34. Results of soil samples taken during the 1979 post remedial action radiological survey at Area 10

Sample	Grid block <sup>a</sup> location	Sample type	Depth (cm)	Radionuclide concentration (pCi/g) <sup>b</sup>		
				<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th
KT13A <sup>c</sup>	7+15, 520R	Biased <sup>d</sup>	0-30	1.6	1.7±0.05	1.6±0.07
KT13B	7+15, 520R	Biased	30-46	4.6	9.1±0.2	4.05±0.1
KT13B1	7+15, 520R	Biased	30-46	5.2	13±0.3	4.9±0.1
KT13C	7+15, 520R	Biased	182	0.55	0.52±0.04	0.66±0.04
K395	7+21, 520R	Biased	91	0.4	0.5±0.06	0.6±0.08
K396	7+15, 526R	Biased	91	1.09	1.04±0.1	0.76±0.1
K397	7+9, 520R	Biased	91	0.91	0.6±0.09	0.72±0.06
K398	7+15, 514	Biased	91	2.7	2.6±0.05	2.4±8

<sup>a</sup>Grid block locations are shown in Fig. 1

<sup>b</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>c</sup>Samples were taken from the same location at different depths.

<sup>d</sup>Samples were taken from locations showing maximum gamma exposure rates.

Table 35. Radionuclide concentrations in water samples taken November 1979

Sample	Radionuclide concentrations (pCi/L) <sup>a</sup>			
	<sup>210</sup> Pb	<sup>226</sup> Ra	<sup>230</sup> Th	<sup>238</sup> U
KW5	$<4.5 \times 10^{-3}$	$<5 \times 10^{-4}$	$4.5 \times 10^{-5} \pm 4.5 \times 10^{-5}$	1±1
KW6	$4.5 \times 10^{-3} \pm 0.01$	$<5 \times 10^{-4}$	$<4.5 \times 10^{-5}$	2±2
KW7	$4.5 \times 10^{-3} \pm 0.01$	$<5 \times 10^{-4}$	$4 \times 10^{-4} \pm 4 \times 10^{-4}$	$2 \times 10^{-4} \pm 2 \times 10^{-4}$
RCGW <sup>b</sup>	100	30 <sup>c</sup>	2,000	40,000

<sup>a</sup>Indicated errors associated with these concentrations are two standard deviations (95% confidence level).

<sup>b</sup>Radionuclide concentration guideline values for ground water taken from 10 CFR 20.

<sup>c</sup>The EPA drinking water standard for radium is 5 pCi/L, including <sup>226</sup>Ra and <sup>228</sup>Ra.

Table 36. Summary of soil data collected during post decontamination activities at the former Kellex Laboratory site

Area	Sample <sup>a</sup>	Grid block location	Average radionuclide concentration (pCi/g)			Maximum <sup>238</sup> U concentration (pCi/g)
			<sup>238</sup> U	<sup>226</sup> Ra	<sup>232</sup> Th	
4	K-46	A-E	1.5	2.6	1.3	1.5
5	K-391	Trench E2	1.8	2.1	1.9	2.2
6A	K-357	A3	3.6	1.4	3	8.3
6B	K-367	A1	14.5	<i>e</i>	<i>e</i>	16
6C	K-380	A1	5.4	<i>e</i>	<i>e</i>	9.5
6D	K-386	b1	6.9	<i>e</i>	<i>e</i>	15
6D	K-399	Trench #1	3.3	1.5	1.5	1.5
6D	K-401	Trench #2	30	1.2	1.1	30 <sup>b</sup>
6D	K-403	Trench #3	7.8	1.3	1.6	140 <sup>b</sup>
6E	K-188	A-B	12	2.1	1.9	12 <sup>b</sup>
6F	K-378	B2	21	<i>e</i>	<i>e</i>	70
6G	K-345	A1	19.2	<i>e</i>	<i>e</i>	70 <sup>b</sup>
6H	K-166	A-C	11	1.3	1.3	11 <sup>b</sup>
6I	K-364	B1	4.1	2.1	1.3	11
6J	K-354	A1	5.2	<i>e</i>	<i>e</i>	40
7	K-108	B4	7.1	<i>e</i>	<i>e</i>	30
8	K-340	A8	12	<i>e</i>	<i>e</i>	50
9	K-338	B4	1.03	1.7	1.2	1.1
10	KT13B1	7+15, 520R	2.1	3.6	1.9	5.2

<sup>a</sup>Refer to Figs. 2-19 for sample location.

<sup>b</sup>Only one sample was taken in area.

<sup>c</sup>Analysis of radionuclide concentration was not performed.

