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*Kellex  
Hardison  
TSD File*

OAK RIDGE NATIONAL LABORATORY

OPERATED BY  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION



POST OFFICE BOX X  
OAK RIDGE, TENNESSEE 37830

August 21, 1979

Department of Energy, Oak Ridge Operations  
Attention: E. L. Keller, Director for  
Technical Services Division  
Post Office Box E  
Oak Ridge, Tennessee 37830

Gentlemen:

Formerly Utilized Sites—Remedial Action Program — Post  
Decontamination Radiological Survey of a portion of the  
Former Kellex Laboratory Site, Jersey City, New Jersey

Decontamination of three (3) small land areas on the Levco portion of the former Kellex Laboratory site was completed by the Tobar Construction Company during the week ending August 11, 1979. Health physics and environmental monitoring services during clean-up operations were provided by Envirosphere Company (a Division of Ebasco Services, Inc.).

The principal objective of this decontamination operation was the removal of radioactivity to as-low-as-reasonably-achievable (ALARA) levels in accordance with an engineering plan prepared by Envirosphere Company.

A final radiological survey of the decontaminated portion of the site was conducted by ORNL Health and Safety Research Division staff. Results of this survey are enclosed. It is our belief that decontamination objectives for those decontaminated areas of the site have been met.

If you have questions regarding the enclosed data, or if you need further information, please let us know.

Sincerely,

A handwritten signature in cursive script that reads "Stephen V. Kaye".

Stephen V. Kaye, Ph.D.  
Director, Health and Safety  
Research Division

SVK:FFH:rod

Enclosures

cc: F. F. Haywood  
C. R. Richmond  
P. S. Rohwer  
File-RC

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POST DECONTAMINATION RADIOLOGICAL SURVEY OF THE  
FORMER KELLEX LABORATORY SITE, JERSEY CITY, NEW JERSEY

Introduction

A formal radiological survey of the former Kellex Laboratory site in Jersey City, New Jersey was conducted for the Department of Energy (DOE) in March 1977. A draft report of the findings of this survey was submitted to the Department of Energy in October 1977. Natural radioactivity was found in two small areas near a concrete pad upon which Building No. 11 (which housed the Kellex Laboratory) was located. Available records of previous Kellex operations were incomplete at the time of the survey and there was no indication that radioactivity was handled or stored on the site other than in Building 11.

In late 1978, DOE learned that much of the site had been sold and that plans were underway to develop a large shopping center on a portion of the site bordered by New Jersey Route 440 and Kellogg Street. Additional radiological survey measurements were made on the proposed shopping center site by ORNL and New Jersey State personnel in late March 1979 in order to determine if the radioactivity had been redistributed and to properly describe the boundaries of the contaminated areas. In the course of this follow-up survey, additional contamination (natural thorium) was found in the edge of a ditch which had been dug for installation of a water main. The source of this contamination was unknown. However, because of this latter development and as DOE initiated plans to decontaminate the site, other follow up investigations were initiated. These included: 1) drilling of a series of holes on the shopping center

site and on the remaining former Kellex property to identify subsurface deposits of radioactivity, and 2) conducting a comprehensive gamma-ray scan of the surface in order to identify deposits of radioactivity on the surface.

The results of these survey activities revealed several spotty areas of natural uranium and natural thorium contaminated soil in one section of the property still owned by Pierpoint Associates.

#### Location of areas to be decontaminated

A plan view of the Levco Shopping Center Site (southeastern section of the former Kellex property) is shown in Fig. 1. The three areas of the Levco property to be cleaned are depicted as areas 1, 2, and 3. For reference, coordinates of these areas were tied into a site grid system also shown in Fig. 1. Surface areas of the grid systems covering area 1, 2, and 3 are respectively 1512, 2106, and 1440 ft<sup>2</sup>.

#### Decontamination criteria

No firm and widely accepted criteria for residual radioactivity in soil exist. However, it has been suggested by both DOE and EPA that a uniform <sup>226</sup>Ra concentration of 5 pCi/g would be acceptable considering potential health effects. For the purpose of this decontamination operation, clean-up was approached on the basis of as-low-as-reasonably-achievable (ALARA) principles. That is, a reasonable effort was made to reduce the contamination to natural background levels. The upper limit for radionuclides such as <sup>232</sup>Th, <sup>226</sup>Ra and its precursors in soil was assumed to be 5 pCi/g in any 1 lb (450 g) sample chosen at random, or in a composite sample averaged over the decontaminated zone. Decontamination progress in the field was determined by counting soil samples in a NaI

gamma-ray spectrometer on site. Final results were determined using a high resolution gamma-ray spectrometer and neutron activation techniques at the Oak Ridge National Laboratory (ORNL).

#### Results of measurements and sample analyses

In order to document the location of post clean-up radiation readings and residual radionuclide concentrations, a grid system was established in each of the three areas as shown in Figs. 2-4. Within the borders of each area one can find a diagram of the portion of that area which was cleaned and the location of soil samples.

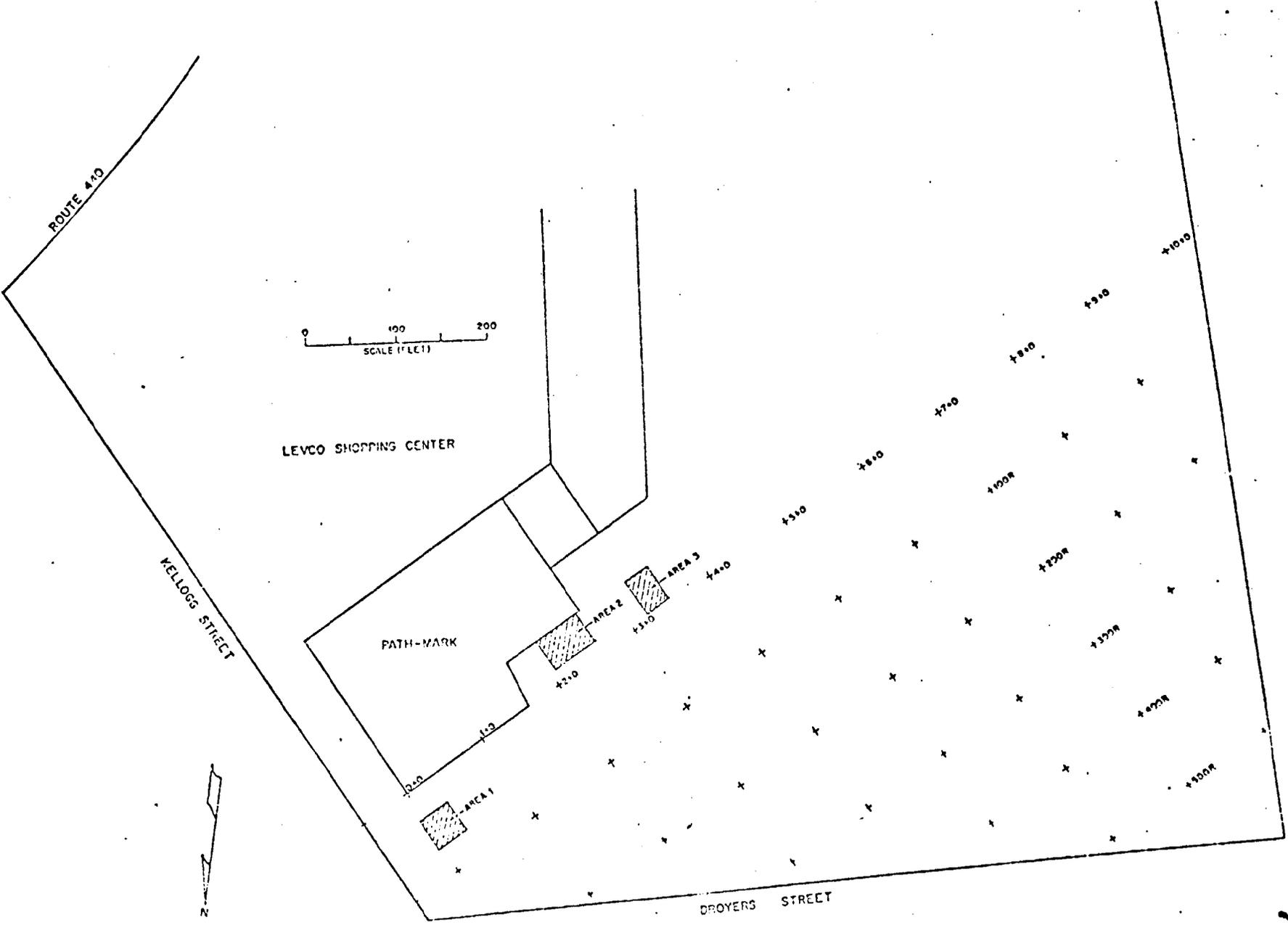
At each grid point, gamma-ray exposure rates were measured 1 m above the ground and beta gamma dose rates were measured about 1 cm above the ground. In addition, each grid block was scanned at a height above the ground which ranged from 0-10 cm. Results of these measurements for the three decontaminated areas are presented in Tables 1-3.

Final soil samples were returned to ORNL, processed, and analyzed using routine laboratory techniques. Each sample was counted with a Ge(Li) spectrometer for a period ranging from 3,600 to 40,000 sec and the concentration of  $^{232}\text{Th}$  and  $^{226}\text{Ra}$  was determined using a computer based multi-channel analyzer. Uranium determinations were made by the ORNL Analytical Chemistry Division using a neutron irradiation technique. Results of these analyses for soil samples collected in the three decontaminated areas are presented in Tables 4-6. It should be pointed out that these samples were counted shortly (within 24 hours) after they were dried and pulverized. Because of this,  $^{222}\text{Rn}$  will not have reached equilibrium with the parent  $^{226}\text{Ra}$ . However, based on previous experience the estimates of  $^{226}\text{Ra}$  should not increase by more than 20%.

The maximum observed  $^{226}\text{Ra}$  concentration was 3.0 pCi/g for sample K-65 (area 3), therefore it is unlikely that this value will exceed 3.6 pCi/g after  $^{222}\text{Rn}$  has reached equilibrium.

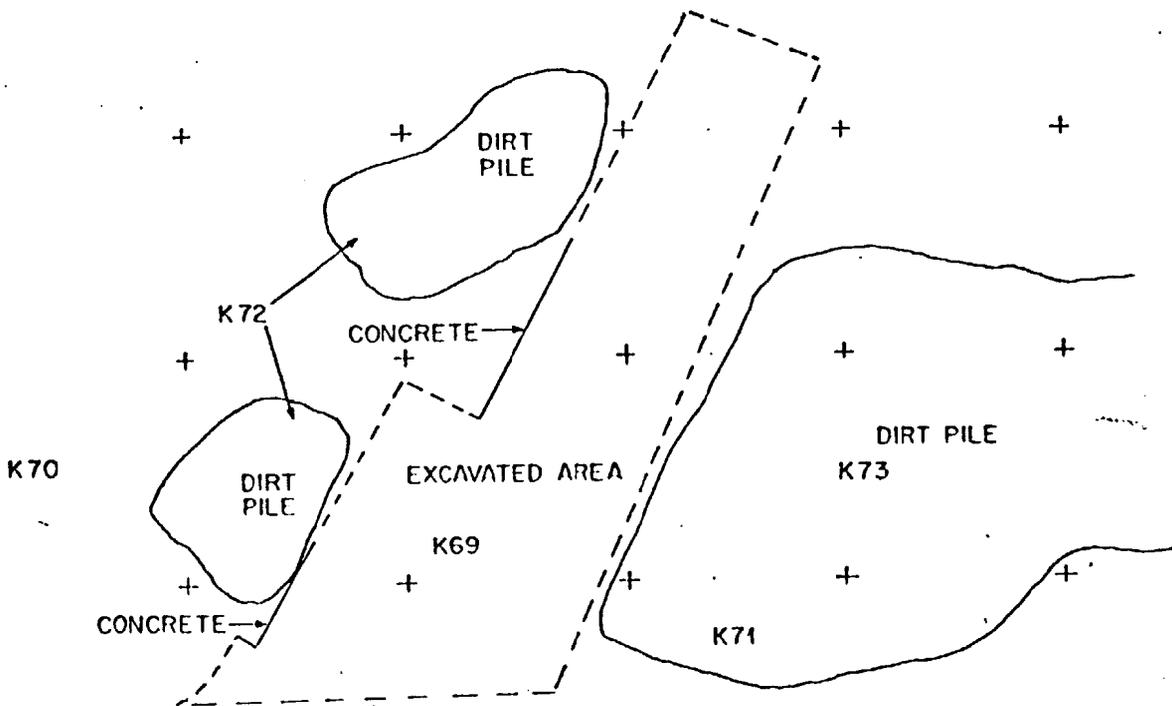
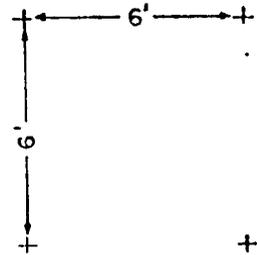
#### Conclusions

Based on the foregoing results of measurements, it appears that ALARA objectives were reached and the concentration of radionuclides in soil are well within the decontamination criteria.

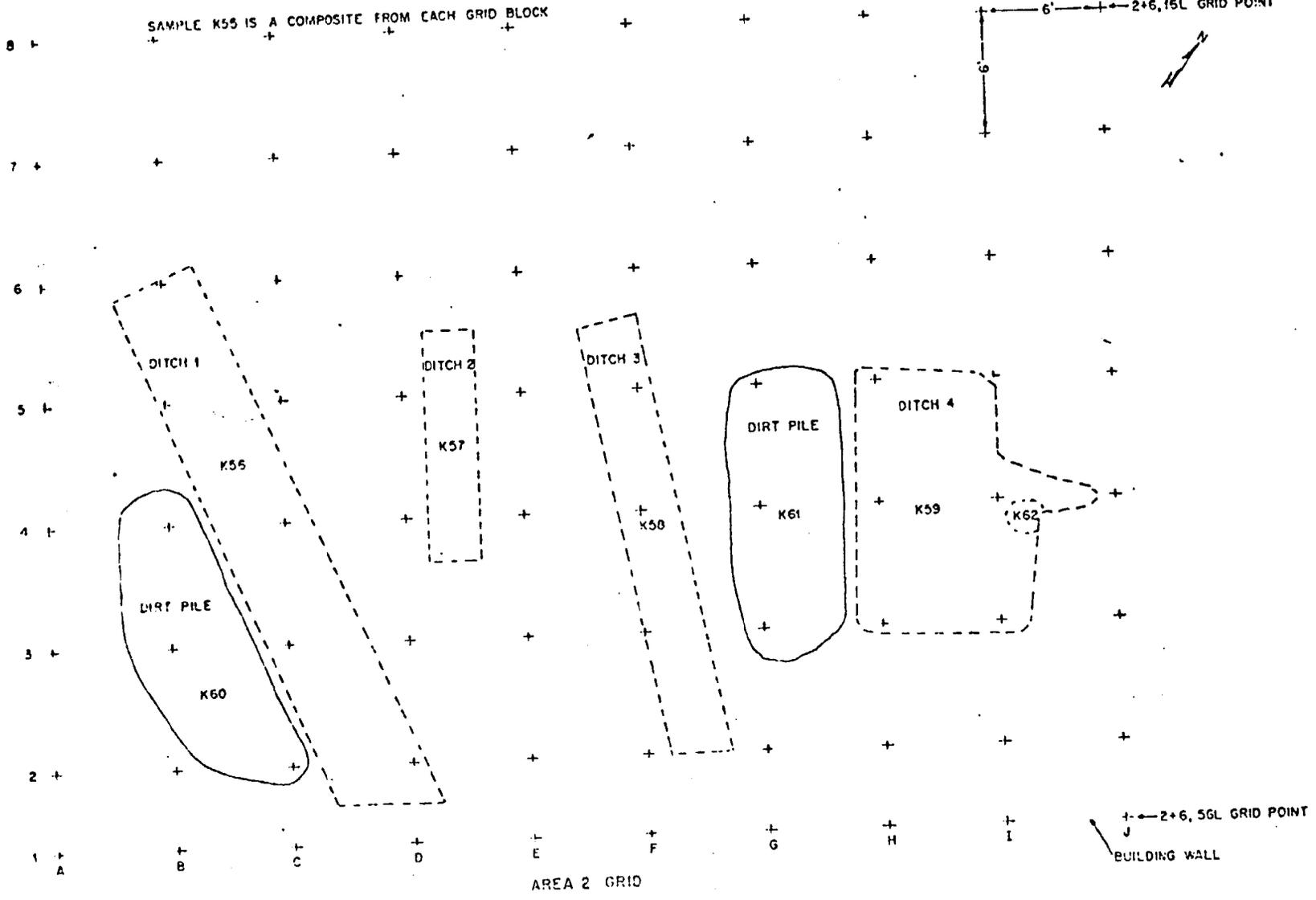


SAMPLE K68 COMPOSITE FROM EACH GRID BLOCK

7 + ← 0+26, 69R +  
6 + + + + +  
5 + + + + +  
4 + + + + +  
3 + + + + +  
2 + + + + +  
1 + + + + +  
A B C D E F

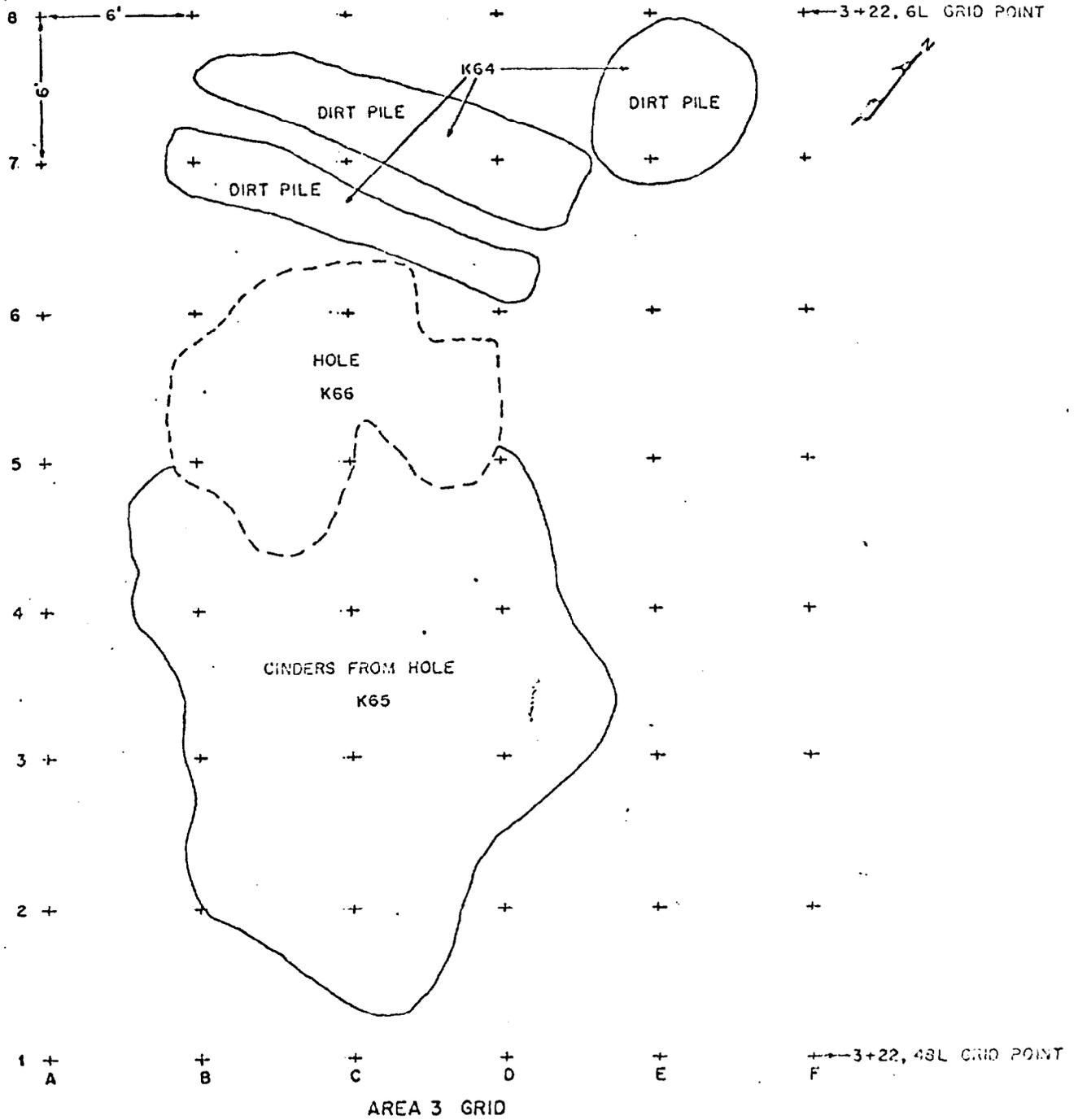


+ ← 0-10, 33R GRID POINT  
G



79 1928

K63 COMPOSITE SAMPLE FROM EACH GRID BLOCK  
K67 SAMPLE FROM OUTER PERIMETER GRID BLOCKS WITHOUT CINDERS



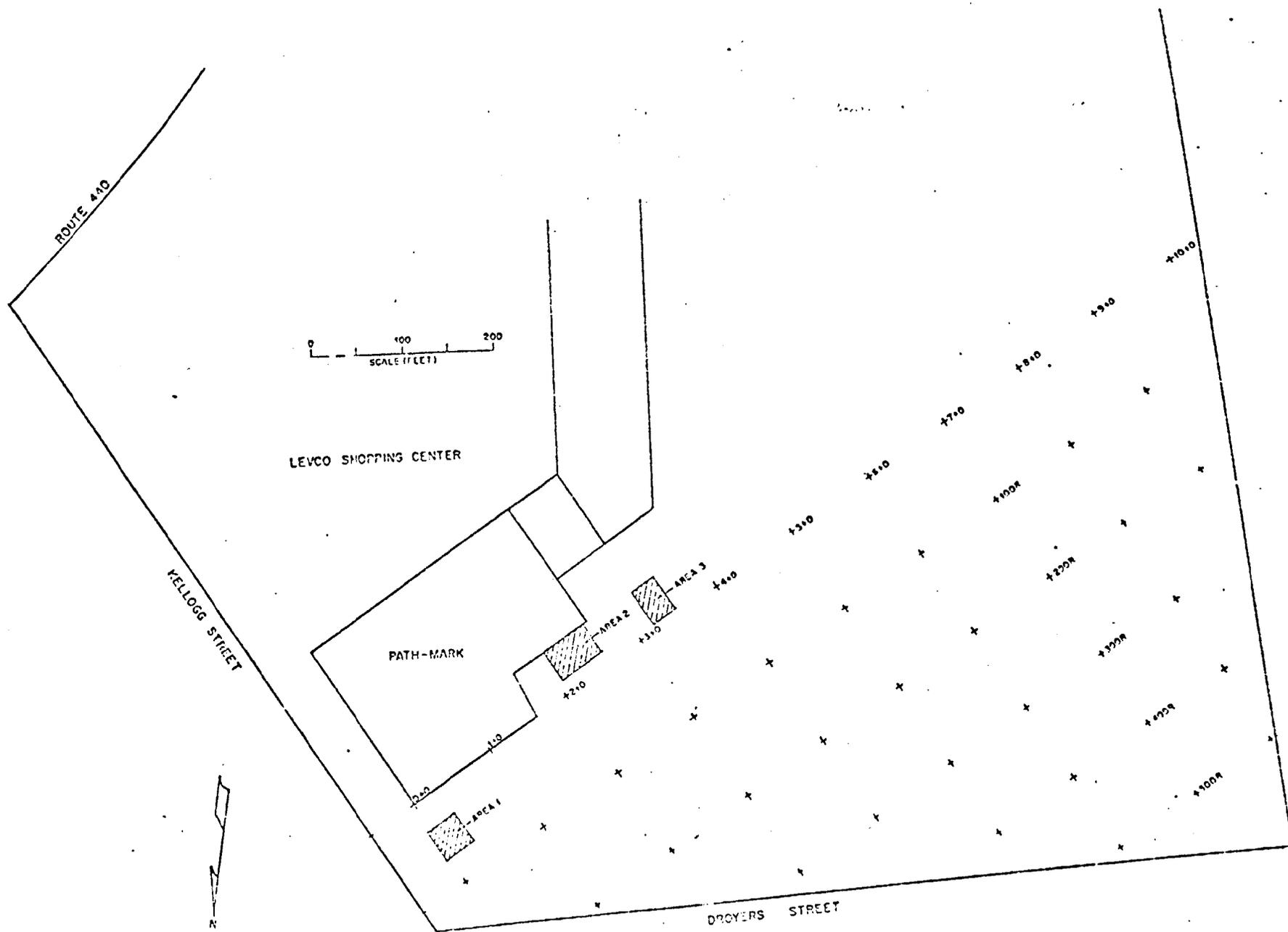
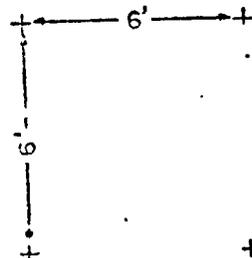


Fig. 1. Plan view of Levco Shopping Center showing the location of decontamination areas 1, 2, and 3.

SAMPLE K68 COMPOSITE FROM EACH GRID BLOCK

7 + ← O+26, 69R +



6 +

5 +

4 +

3 +

2 +

1 +

A

B

C

D

E

F

+ ← O-10, 33R GRID POINT  
G

FIG. 2. Plan view of area 1.

K70

K72

DIRT PILE

CONCRETE

DIRT PILE

EXCAVATED AREA

K69

CONCRETE

DIRT PILE

K73

K71

AREA 1 GRID

79 1928

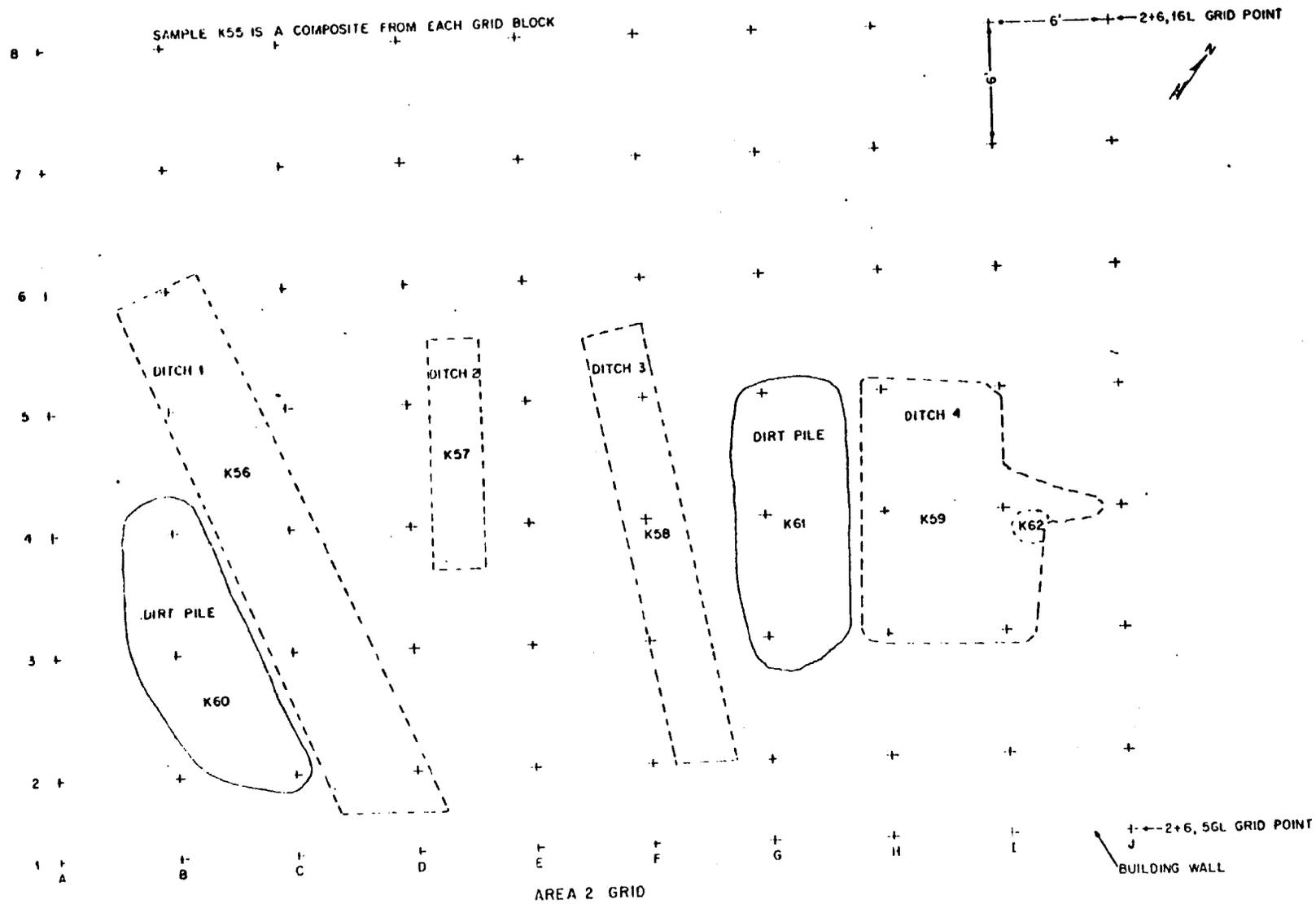


Fig. 3. Plan view of area 2.

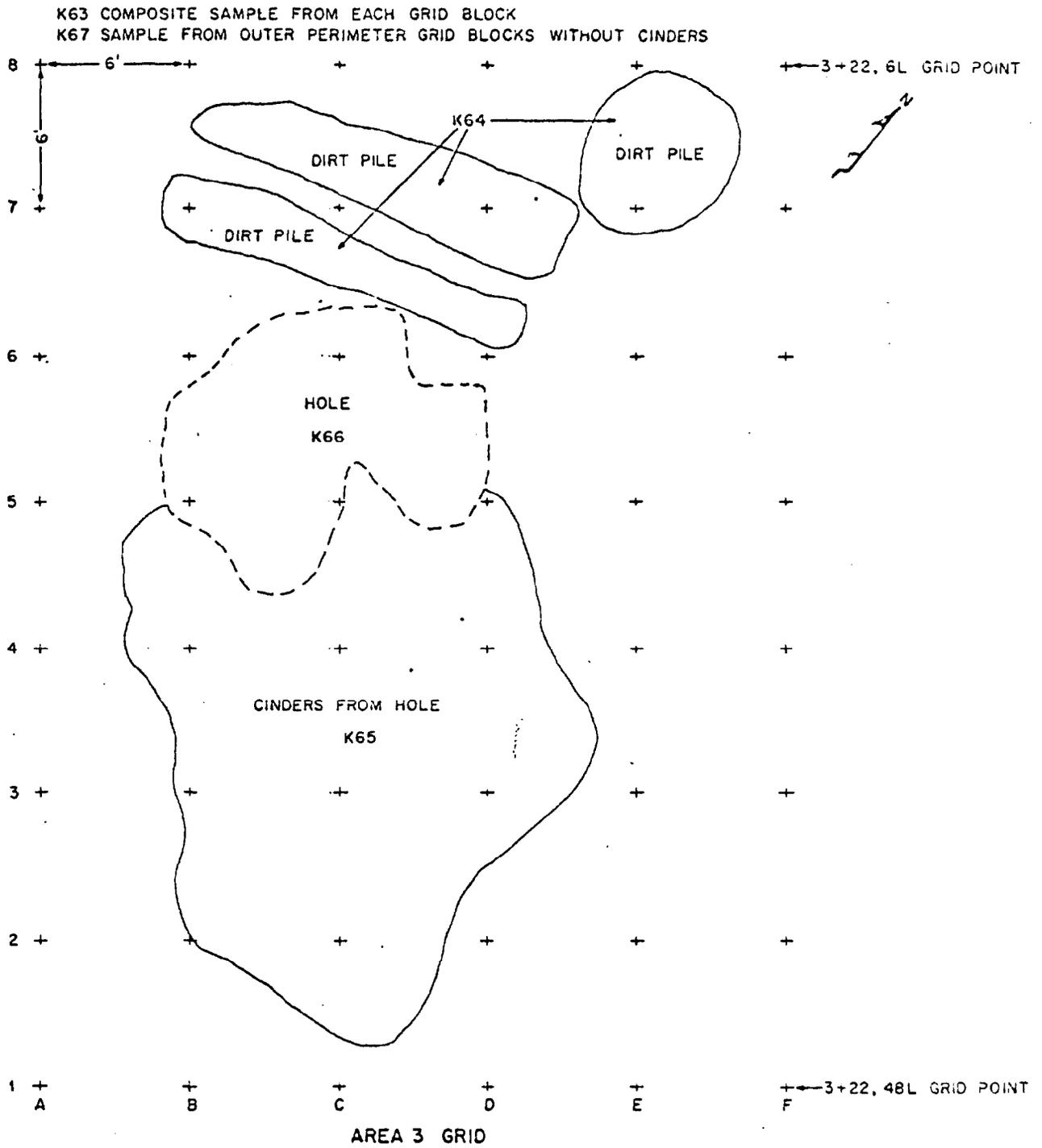


Fig. 4. Plan view of area 3.

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Table 1.

Former Kellex Laboratory: Jersey City, New Jersey

## Grid Survey for Decontaminated Area 1

Grid point	Gamma exposure rate 1 m above grid point ( $\mu\text{R/hr}$ )	Beta gamma dose rate at 1 cm at grid point (mrad/hr)	Grid block scan average gamma exposure rate ( $\mu\text{R/hr}$ ) 0-3 in. above surface
A1	6.9	0.01	8.0
A2	7.2	0.01	6.6
A3	7.7	0.01	6.6
A4	8.8	0.01	5.3
A5	6.1	0.01	6.6
A6	7.2	0.01	6.6
A7	6.1	0.01	--
B1	7.2	0.02	8.0
B2	7.4	0.01	8.0
B3	6.6	0.02	9.3
B4	7.2	0.01	8.0
B5	6.6	0.02	8.0
B6	6.1	0.01	8.0
B7	6.1	0.02	8.0
C1	7.7	0.01	8.0
C2	8.5	0.02	9.3
C3	8.0	0.02	10.7
C4	8.0	0.01	10.7
C5	7.2	0.02	9.3
C6	6.6	0.02	8.0
C7	6.1	0.02	8.0
D1	6.6	0.01	8.0
D2	8.5	0.02	10.7
D3	8.8	0.02	12.0
D4	8.5	0.01	10.7
D5	7.4	0.02	10.7
D6	7.2	0.02	9.3
D7	6.1	0.01	8.0
E1	8.8	0.01	8.0
E2	7.5	0.02	10.7
E3	9.9	0.02	10.7
E4	8.5	0.01	10.7
E5	8.0	0.02	10.7
E6	6.7	0.01	10.7
E7	7.5	0.02	9.3
F1	8.5	0.01	8.0
F2	8.0	0.02	9.3
F3	8.8	0.02	9.3
F4	8.8	0.02	9.3
F5	6.7	0.01	9.3

Table 1. (continued)

Former Kellex Laboratory: Jersey City, New Jersey

## Grid Survey for Decontaminated Area 1

Grid point	Gamma exposure rate 1 m above grid point ( $\mu\text{R/hr}$ )	Beta gamma dose rate at 1 cm at grid point (mrad/hr)	Grid block scan average gamma exposure rate ( $\mu\text{R/hr}$ ) 0-3 in. above surface
F6	7.2	0.02	8.0
F7	7.2	0.02	8.0
G1	7.5	0.02	--
G2	8.0	0.02	--
G3	8.0	0.02	--
G4	8.5	0.02	--
G5	8.0	0.01	--
G6	7.5	0.01	--
G7	6.7	0.02	--

Table 2.

Former Kellex Laboratory: Jersey City, New Jersey

Grid Survey for Decontaminated Area 2

Grid point	Gamma exposure rate 1 m above grid point ( $\mu$ R/hr)	Beta gamma dose rate at 1 cm at grid point (mrad/hr)	Grid block scan average gamma exposure rate ( $\mu$ R/hr) 0-3 in. above surface
A1	9.3	0.01	8.0
A2	8.0	0.01	9.3
A3	9.3	0.02	9.3
A4	8.0	0.02	10.7
A5	9.3	0.02	10.7
A6	8.0	0.02	9.3
A7	8.0	0.02	8.0
A8	8.0	0.02	--
B1	9.3	0.02	8.0
B2	9.3	0.02	8.5
B3	9.3	0.02	9.3
B4	9.3	0.02	10.7
B5	8.0	0.02	10.7
B6	8.0	0.02	8.5
B7	8.0	0.02	7.5
B8	8.0	0.02	--
C1	9.3	0.02	10.7
C2	9.3	0.02	10.7
C3	9.3	0.02	9.3
C4	9.3	0.02	9.3
C5	9.3	0.02	8.5
C6	8.5	0.02	8.0
C7	8.0	0.02	8.0
C8	8.0	0.02	--
D1	8.5	0.02	9.3
D2	10.1	0.02	9.3
D3	9.3	0.02	10.7
D4	9.3	0.02	8.5
D5	8.5	0.02	8.8
D6	8.5	0.02	8.0
D7	8.5	0.02	7.5
D8	7.5	0.02	--
E1	9.3	0.02	8.0
E2	10.7	0.02	8.5
E3	10.7	0.02	9.3
E4	9.3	0.02	10.7
E5	9.3	0.02	10.7
E6	9.3	0.02	8.0
E7	8.5	0.02	7.5
E8	7.5	0.02	--
F1	8.0	0.02	10.7

Table 2. (continued)

Former Kellex Laboratory: Jersey City, New Jersey

## Grid Survey for Decontaminated Area 2

Grid point	Gamma exposure rate 1 m above grid point ( $\mu\text{R/hr}$ )	Beta gamma dose rate at 1 cm at grid point (mrad/hr)	Grid block scan average gamma exposure rate ( $\mu\text{R/hr}$ ) 0-3 in. above surface
F2	9.3	0.02	12.0
F3	10.7	0.02	16.0
F4	9.3	0.02	12.0
F5	12.0	0.02	12.0
F6	10.1	0.02	10.7
F7	9.3	0.02	8.5
F8	8.0	0.02	--
G1	9.3	0.02	9.9
G2	10.1	0.02	9.3
G3	8.5	0.02	9.3
G4	8.5	0.02	9.3
G5	9.3	0.02	10.7
G6	10.7	0.02	9.3
G7	9.3	0.02	6.7
G8	8.0	0.02	--
H1	10.7	0.02	10.7
H2	9.3	0.02	10.7
H3	10.1	0.02	13.3
H4	10.7	0.02	12.0
H5	6.7	0.02	9.3
H6	9.3	0.02	9.3
H7	8.5	0.02	9.3
H8	7.5	0.02	--
I1	10.7	0.02	10.7
I2	10.7	0.02	9.3
I3	10.1	0.02	9.3
I4	10.7	0.02	9.3
I5	9.3	0.02	8.5
I6	8.5	0.02	8.5
I7	8.0	0.02	8.0
I8	8.0	0.02	--
J1	10.7	0.02	--
J2	9.3	0.02	--
J3	9.3	0.02	--
J4	8.5	0.02	--
J5	9.3	0.02	--
J6	7.5	0.02	--
J7	6.7	0.02	--
J8	8.0	0.02	--

Table 3.

Former Kellex Laboratory: Jersey City, New Jersey

## Grid Survey for Decontaminated Area 3

Grid point	Gamma exposure rate 1 m above grid point ( $\mu\text{R/hr}$ )	Beta gamma dose rate at 1 cm at grid point (mrad/hr)	Grid block scan average gamma exposure rate ( $\mu\text{R/hr}$ ) 0-3 in. above surface
A1	9.3	0.02	9.3
A2	9.3	0.02	9.3
A3	9.6	0.02	12.0
A4	10.7	0.01	12.0
A5	12.0	0.02	9.3
A6	9.9	0.02	9.3
A7	8.8	0.02	8.0
A8	8.8	0.01	--
B1	10.1	0.02	13.3
B2	10.1	0.02	9.3
B3	12.5	0.02	12.0
B4	11.5	0.01	16.0
B5	13.3	0.02	17.3
B6	11.2	0.02	10.7
B7	9.9	0.01	9.3
B8	9.9	0.01	--
C1	10.1	0.01	10.7
C2	12.5	0.02	13.3
C3	12.8	0.02	13.3
C4	12.5	0.01	12.0
C5	12.8	0.01	13.3
C6	12.5	0.02	10.7
C7	10.7	0.01	9.3
C8	9.3	0.02	--
D1	9.3	0.02	10.7
D2	12.0	0.02	14.7
D3	12.5	0.02	12.0
D4	12.5	0.01	10.7
D5	11.2	0.01	9.3
D6	10.1	0.01	9.3
D7	10.1	0.01	8.0
D8	8.8	0.02	--
E1	10.1	0.02	9.3
E2	10.1	0.02	10.7
E3	9.9	0.02	9.3
E4	11.5	0.02	9.3
E5	9.3	0.02	8.0
E6	10.1	0.02	8.0
E7	9.9	0.02	8.0
E8	8.8	0.01	--

Table 4.

Former Kellex Laboratory: Jersey City, New Jersey  
Results of Soil Samples from Decontaminated Area 1

Sample No.	$^{226}\text{Ra}$ pCi/g	$^{232}\text{Th}$ pCi/g	$^{238}\text{U}$ pCi/g
K-68 <sup>a</sup> (composite)	0.63	1.5	0.64
K-69	<0.99	4.4	0.60
K-70	<0.13	12	0.53
K-71	<0.74	8.2	0.71
K-72	0.85	1.4	0.85
K-73	0.80	4.1	0.74
K-83 <sup>b</sup> (post K-70)	0.73	5.14	0.72
K-84 <sup>c</sup> (post K-71)	0.56	2.6	0.60

<sup>a</sup> Composite sample from grid points.

<sup>b</sup> Sample after recleaning at K-70.

<sup>c</sup> Sample after recleaning at K-71.

Table 5.

Former Kellex Laboratory: Jersey City, New Jersey  
 Results of Soil Samples from Decontaminated Area 2

Sample No.	$^{226}\text{Ra}$ pCi/g	$^{232}\text{Th}$ pCi/g	$^{238}\text{U}$ pCi/g
K-54	0.99	1.3	0.92
K-55 <sup>a</sup> (composite)	0.90	1.0	0.74
K-56	0.82	0.94	0.79
K-57	0.70	1.3	0.76
K-58	1.5	1.2	0.77
K-59	0.92	1.0	0.85
K-60	0.78	0.97	0.83
K-61	1.2	1.2	0.93
K-62	2.1	2.2	2.0

<sup>a</sup>Composite sample from grid points.

Table 6.

Former Kellex Laboratory: Jersey City, New Jersey  
 Results of Soil Samples from Decontaminated Area 3

Sample No.	$^{226}\text{Ra}$ pCi/g	$^{232}\text{Th}$ pCi/g	$^{238}\text{U}$ pCi/g
K-63 <sup>a</sup> (composite)	1.4	1.1	1.3
K-64	1.0	0.94	2.2
K-65	3.0	2.1	3.9
K-66	2.5	1.8	3.0
K-67	0.74	0.95	0.75

<sup>a</sup>Composite sample from grid points.