

**HEALTH AND SAFETY RESEARCH DIVISION**

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**Results of the Radiological Survey at the  
ALCOA Research Laboratory, 600 Freeport Road,  
New Kensington, Pennsylvania (ANK001)**

R. D. Foley and K. S. Brown

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**Investigation Team**

R. E. Swaja - Measurement Applications and Development Manager  
W. D. Cottrell - Project Director  
R. D. Foley - Field Survey Supervisor

**Survey Team Members**

P. F. Tiner  
R. A. Mathis

Work performed by the  
**MEASUREMENT APPLICATIONS AND DEVELOPMENT GROUP**

Prepared by the  
**OAK RIDGE NATIONAL LABORATORY**  
Oak Ridge, Tennessee 37831-6285  
managed by  
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## ABSTRACT

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania. The survey was performed on November 12, 1991. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally  $^{238}\text{U}$ , as a result of work done for the Manhattan Engineer District in 1944. The survey included measurement of direct alpha and beta-gamma levels in the northeast corner of the basement of Building 29, and the collection of a debris sample from a floor drain for radionuclide analysis. The survey area was used for experimental canning of uranium slugs prior to production activities at the former New Kensington Works nearby.

Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines for uranium. The radionuclide distributions were not significantly different from typical background levels in the Pittsburgh, Pennsylvania area.

# Results of the Radiological Survey at the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania (ANK001)\*

## INTRODUCTION

In the early 1940s, the Manhattan Engineer District (MED) was established as the lead agency in the development of nuclear energy for defense-related projects. Raw materials containing uranium ores were procured, stored, and processed into various uranium oxides, salts, and metals. Fabricators were contracted as needed to form (roll and machine) the metal into various shapes. At contract termination, sites used by contractors were decontaminated according to the criteria and health guidelines in use at that time. In some instances, however, documentation was limited and insufficient to establish the current radiological conditions at a site. Therefore, it was necessary to reevaluate the current radiological conditions at these sites under the U.S. Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP).

ALCOA conducted operations in support of the MED uranium slug canning program at the former Aluminum Research Laboratories on Freeport Road, now known as the ALCOA Research Laboratory, and the former New Kensington Works, now part of the Schreiber Industrial Development Co., a facility located approximately one mile from the laboratories along the Allegheny River. ALCOA performed research and development and production operations beginning at least as early as May 1943 and ending in early 1945. Experimental activities included soldering and welding of jacket (can) seams and end caps, identification of solder compounds and leak-testing of canned slugs. Production activities consisted of canning, welding and leak testing. Quoted production rates were 2000 to 3000 slugs per week, and up to 500 slugs per shift.

According to a review of approximately 40 historical documents, actual production canning of uranium slugs was performed between October 1943 and April 1944 at the New Kensington Works along the river. The estimated total number of canned slugs produced was 69,000, not including those fabricated during the experimental stage of canning between May and October of 1943 at the former Aluminum Research Laboratories. Canned, capped and tested slugs were sent to the Metallurgical Lab in Chicago, Illinois, the DuPont Company in Wilmington, Delaware and Pasco, Washington and to Clinton Laboratories in Tennessee.

Beginning on March 17, 1989, a radiological survey was performed at the ALCOA Research Laboratory under the direction of the ALCOA Technical Center, in preparation for the sale of the property to another party. Although this preliminary survey indicated no residual radioactive material above current guidelines, there was insufficient information to

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\*The survey was performed by members of the Measurement Applications and Development Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

recommend eliminating this site from FUSRAP. Therefore, a radiological survey of the property was scheduled.

On November 12, 1991, a radiological survey was conducted at the ALCOA Research Laboratory by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory (ORNL) at the request of DOE. Former ALCOA employees were interviewed before the survey and accompanied the survey team to the site during a preliminary site visit. The survey and sampling at this site (Fig. 2) covered an area in the northeast corner of the basement of Building 29. Survey emphasis was on the interior floors and walls, overhead light fixtures, a floor drain, and selected pieces of equipment.

### SURVEY METHODS

The radiological survey included: (1) a beta-gamma scan of the floor of a previously existing room and adjacent floor areas, a courtyard and a receiving area in the Building 29 basement where experimental activities were conducted, and existing walls in the survey area; (2) an alpha scan of accessible areas of the floor and walls in the same areas; (3) measurement of beta-gamma activity on a small hydraulic press and a work bench in the research area; (4) measurement of fixed alpha activity levels on overhead light fixtures; and (5) collection of a debris sample from the floor drain west of the survey area in Building 29 for radionuclide analysis. Surface gamma levels were measured near a floor drain approximately ten feet northeast of the previously existing room. Surface gamma levels were not recorded in the remaining survey area because of slightly elevated background due to the yellow brick walls and fire brick stored in the area. The survey area and the sampling location are shown in Fig. 2. Glazed, yellow building brick and fire brick inherently contain naturally occurring radionuclides which will slightly increase the background gamma levels.

A comprehensive description of the survey methods and instrumentation used in this survey is given in *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600 (April 1987).<sup>2</sup>

### SURVEY RESULTS

DOE guidelines are summarized in Table 1. Typical background radiation levels for the Pittsburgh, Pennsylvania area are presented in Table 2. These data are provided for comparison with survey results presented in this section. 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 the debris sample.

Current photographs of the site are shown in Figs. 3 and 4.

## GAMMA EXPOSURE RATE MEASUREMENTS

Due to elevated gamma background measurements ranging from 14–28  $\mu\text{R/h}$ , a GM thin-window detector was used to survey for uranium instead of the Victoreen gamma scintillator. The elevated readings were attributed to glazed yellow brick used in construction of the walls and fire brick stored near the survey area. A gamma exposure rate of 7–10  $\mu\text{R/h}$  was measured in a drain lined with clay pipe approximately ten feet northeast of the room.

## BETA-GAMMA AND ALPHA RADIATION MEASUREMENTS ON FLOORS AND WALLS

Beta-gamma dose rates measured indoors above accessible areas of the floor ranged from 0.02 to 0.05 mrad/h. This is well below the DOE surface dose-rate limit of 0.20 mrad/h averaged over not more than 1  $\text{m}^2$ . Surface alpha measurements ranged from <25 to 28 dpm/100  $\text{cm}^2$ . All alpha measurements were near or below the minimum detectable activity (MDA) of 25 dpm/100  $\text{cm}^2$  and well below the DOE average surface contamination guideline value of 5000 dpm/100  $\text{cm}^2$  (Table 1) for uranium.

## RADIATION MEASUREMENTS ON LIGHT FIXTURES

Direct alpha and beta-gamma measurements were taken on overhead light fixtures and pipes. In all cases, directly measured alpha radiation levels were near or below the MDA<sup>†</sup> of 25 dpm/100  $\text{cm}^2$ , and directly measured beta-gamma dose rates were well below the DOE guideline of 0.20 mrad/h (Table 1).

## DEBRIS SAMPLE

Radionuclide analysis was performed on a debris sample collected from a floor drain at the location indicated in Fig. 2 (M1). Results of analysis are listed in Table 3. Sample results were below DOE guidelines (Table 1).

## SIGNIFICANCE OF FINDINGS

Radionuclide analysis of the debris sample collected at the site of the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania, showed no radionuclide concentrations above DOE guidelines (Table 1). None of the indoor radiation measurements were elevated above DOE guidelines. The slight elevations in gamma levels found near some walls in the building are typical of naturally-occurring radioactive sub-

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<sup>†</sup>The instrument-specific MDAs for directly measured and removable alpha radiation levels are 25 and 10 dpm/100  $\text{cm}^2$ , respectively. For directly measured and removable beta-gamma radiation levels the MDAs are 0.01 mrad/h and 200 dpm/100  $\text{cm}^2$ , respectively.

stances present in fire brick and in yellow brick used in building construction. Based on the results of this radiological assessment, it is recommended that this site be eliminated from consideration for inclusion in the remedial action program.

### REFERENCES

1. E. I. DuPont DeNemours and Company, Inc., *Design and Procurement History of Hanford Engineer Works and Clinton Semi-Work*, Volume II, E. I. DuPont DeNemours and Company, Engineering Department, December 1945.
2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., April 1987.

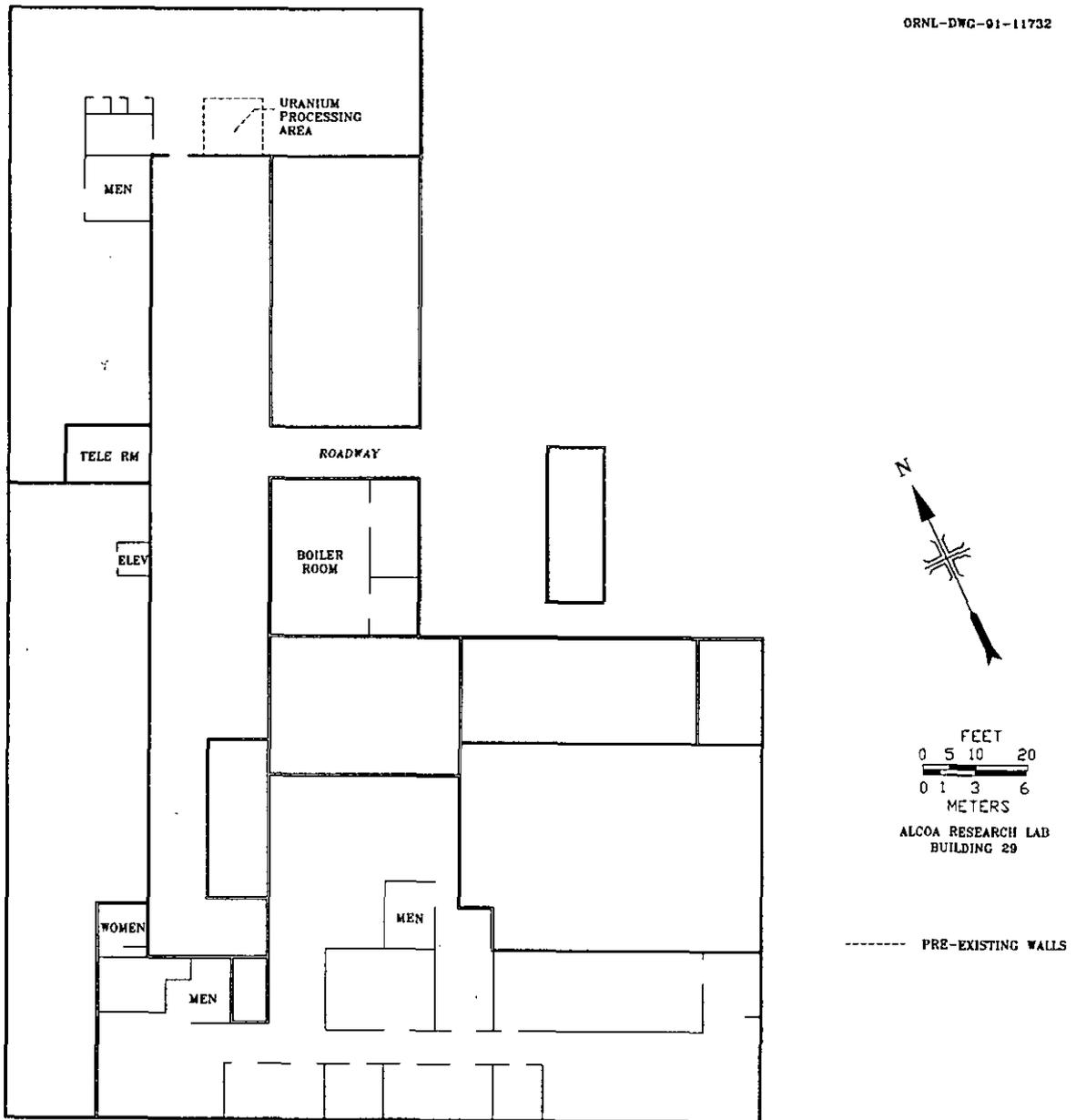


Fig. 1. Basement of Building 29 at the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania.

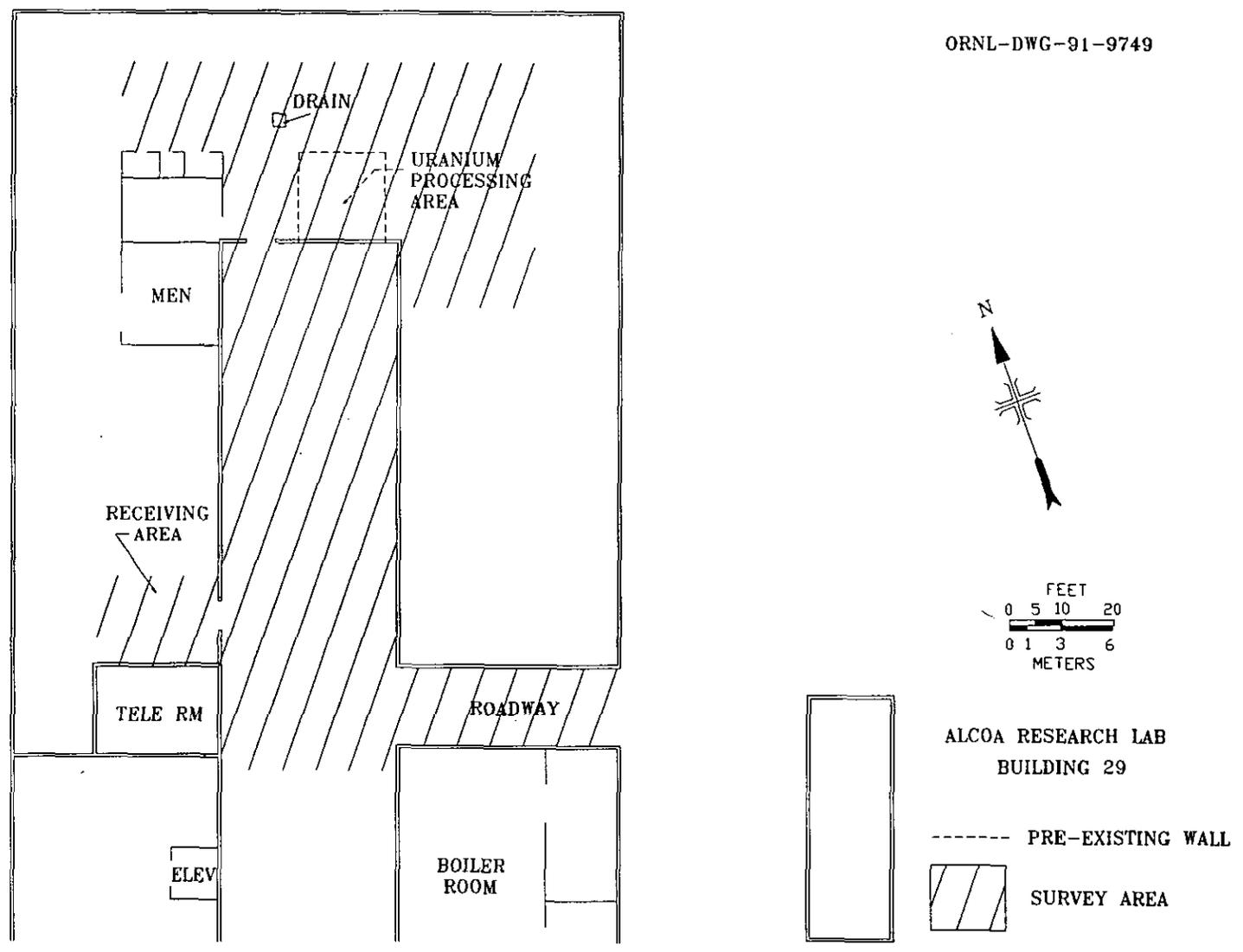


Fig. 2. Location of beta-gamma scan and debris sampling at ALCOA Research Laboratory.



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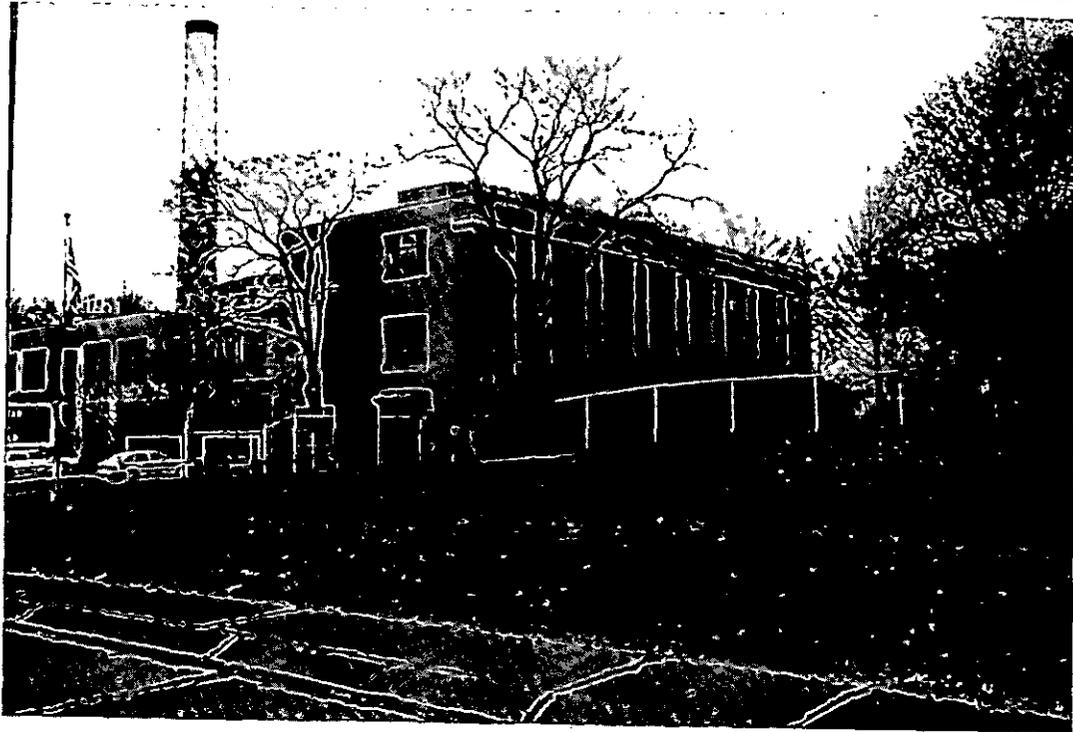


Fig. 3. View looking west at ALCOA Research Laboratory.

ORNL-PHOTO 6723-92

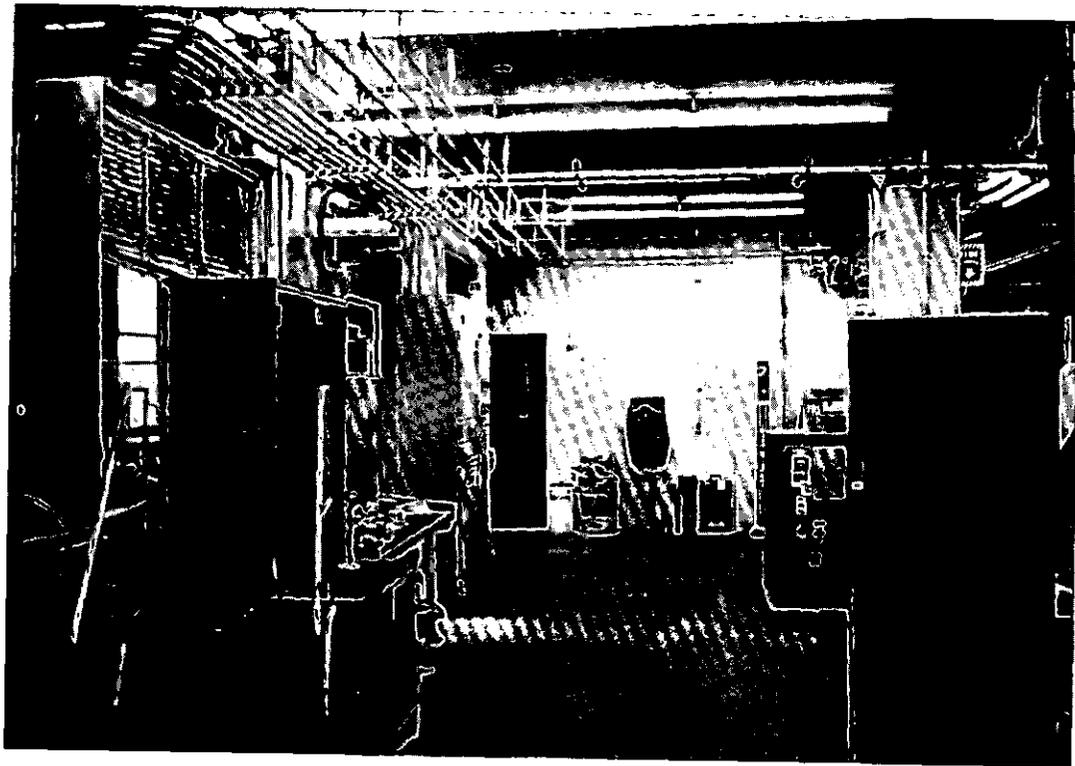


Fig. 4. View looking west in survey area at ALCOA Research Laboratory.

**Table 1. Applicable guidelines for protection against radiation  
(Limits for uncontrolled areas)**

Mode of exposure	Exposure conditions	Guideline value
Total residual surface contamination <sup>a</sup>	<sup>238</sup> U, <sup>235</sup> U, U-natural (alpha emitters)	
	or	
	Beta-gamma emitters <sup>b</sup>	
	Maximum	15,000 dpm/100 cm <sup>2</sup>
	Average	5,000 dpm/100 cm <sup>2</sup>
	Removable	1,000 dpm/100 cm <sup>2</sup>
	<sup>232</sup> Th, Th-natural (alpha emitters)	
	or	
	<sup>90</sup> Sr (beta-gamma emitter)	
	Maximum	3,000 dpm/100 cm <sup>2</sup>
	Average	1,000 dpm/100 cm <sup>2</sup>
	Removable	200 dpm/100 cm <sup>2</sup>
	<sup>226</sup> Ra, <sup>230</sup> Th, transuranics	
	Maximum	300 dpm/100 cm <sup>2</sup>
	Average	100 dpm/100 cm <sup>2</sup>
	Removable	20 dpm/100 cm <sup>2</sup>
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m <sup>2</sup>	0.20 mrad/h
	Maximum dose rate in any 100-cm <sup>2</sup> area	1.0 mrad/h
Radionuclide concentrations in soil (generic)	Maximum permissible concentration of the following radionuclides in soil above background levels, averaged over a 100-m <sup>2</sup> area <sup>226</sup> Ra <sup>232</sup> Th <sup>230</sup> Th	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface

Table 1 (continued)

Mode of Exposure	Exposure conditions	Guideline value
Derived concentrations	$^{238}\text{U}$  Concentration limit in surface soil above background levels based on dose estimates from major exposure pathways	Site specific <sup>c</sup>

<sup>a</sup>DOE surface contamination guidelines are consistent with *NRC Guidelines for Decontamination at Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material*, May 1987.

<sup>b</sup>Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except  $^{90}\text{Sr}$ ,  $^{228}\text{Ra}$ ,  $^{223}\text{Ra}$ ,  $^{227}\text{Ac}$ ,  $^{133}\text{I}$ ,  $^{129}\text{I}$ ,  $^{126}\text{I}$ ,  $^{125}\text{I}$ .

<sup>c</sup>DOE guidelines for uranium are derived on a site-specific basis. Guidelines of 35–40 pCi/g have been applied at other FUSRAP sites. *Source*: J. L. Marley and R. F. Carrier, *Results of the Radiological Survey at 4 Elmhurst Avenue, Colonie, New York (AL219)*, ORNL/RASA-87/117, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., February 1988; B. A. Berven et al., *Radiological Survey of the Former Kellex Research Facility, Jersey City, New Jersey*, DOE/EV-0005/29, ORNL-5734, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., February 1982.

*Sources*: Adapted from U.S. Department of Energy, DOE Order 5400.5, April 1990, and U.S. Department of Energy, *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March 1987.

**Table 2. Background radiation levels for the Pittsburgh, Pennsylvania, area**

Type of radiation measurement or sample	Radiation level or radionuclide concentration
Average external gamma exposure rate at 1 m above ground surface	9.2 $\mu$ R/h <sup>a</sup>
Concentration of radionuclides in surface soil	
<sup>226</sup> Ra	1.1 $\pm$ 0.04 pCi/g <sup>b</sup>
<sup>232</sup> Th	1.1 $\pm$ 0.10 pCi/g <sup>b</sup>
<sup>238</sup> U	1.2 pCi/g <sup>c</sup>

<sup>a</sup>Average of 3 to 4 measurements.

<sup>b</sup>Standard deviation is the 2 $\sigma$  value.

<sup>c</sup>Error in measurement is  $\pm$ 5% (2 $\sigma$ ).

Source: T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., November 1981.

**Table 3. Concentrations of radionuclides in debris sample collected from the basement of the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania<sup>a</sup>**

Sample No.	Radionuclide concentration (pCi/g) <sup>b</sup>		
	<sup>226</sup> Ra	<sup>232</sup> Th	<sup>238</sup> U
M1 <sup>c</sup>	0.15 $\pm$ 0.01	0.12 $\pm$ 0.02	1.16 $\pm$ 0.31

<sup>a</sup>Sample location is shown on Fig. 2.

<sup>b</sup>Indicated counting error is at the 95% confidence level ( $\pm$ 2 $\sigma$ ).

<sup>c</sup>Debris sample collected from the floor drain in basement.

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