

**HEALTH AND SAFETY RESEARCH DIVISION**

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**Results of the Radiological Survey at the  
former ALCOA New Kensington Works, Pine and Ninth Streets,  
New Kensington, Pennsylvania (ANK002)**

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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 former ALCOA New Kensington Works, Pine and Ninth Streets, 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 a gamma scan of three bays inside Building 18; measurement of direct alpha and beta-gamma levels in the same area; and collection of a dust sample for radionuclide analysis from the center of each bay.

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 former ALCOA New Kensington Works, Pine and Ninth Streets, New Kensington, Pennsylvania (ANK002)\***

## **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 Corporation, 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. After 1980 the ALCOA production facility and several associated buildings were sold to Schreiber Industrial Development Company.

On November 12, 1991, a radiological survey was conducted at the former ALCOA New Kensington Works (Schreiber properties) by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory (ORNL) at

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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.

the request of DOE. The survey and sampling emphasis at this site was on floors and walls in three bays of Building 18 corresponding to an area where uranium slugs were produced. The site of the production canning operation was determined during a preliminary site visit by the Oak Ridge National Laboratory team leader in consultation with former ALCOA employees.

## SCOPE OF THE SURVEY

The radiological survey included: (1) a surface gamma scan of the floor and walls in three bays in the Building 18 warehouse where a production area of approximately 35' x 60' existed and the railroad track outside the building by which the uranium was brought on-site; (2) a beta-gamma scan of the floor and walls inside the building in the same area as the gamma survey and the indoor route from the railroad siding to the production area; (3) an alpha scan of the floor, walls, brick columns, and ceiling beams inside the building; and (4) collection of three dust samples from a ceiling beam in the center of each bay. A walk-over beta-gamma scan was performed in areas adjacent to the production area. However, the available floor space for the walk-over was limited to a few walkways between stored equipment.

## SURVEY METHODS

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>

Using a NaI scintillation probe connected to a Victoreen ratemeter, surface gamma levels were recorded for the survey area. The detector was held approximately 2 in. above the floor/ground/wall surface, and measurements were recorded and then converted to  $\mu\text{R/h}$ . Using a Geiger-Mueller pancake detector, beta-gamma levels were recorded and then converted to mrad/h. Alpha levels were measured at selected locations with an ORNL alpha meter connected to a ZnS scintillation probe and then converted to dpm/100  $\text{cm}^2$ .

Dust samples were collected from a 3" x 12" area in the center of an overhead beam approximately 15' from the ground in the center of each bay; these samples were analyzed for  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$ , and  $^{238}\text{U}$ .

## 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 dust samples.

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

### **GAMMA EXPOSURE RATE MEASUREMENTS**

A gamma scan of the floor and walls inside the building and the route by which the uranium was transported inside showed an average of 7 to 10  $\mu\text{R}/\text{h}$ . Most gamma levels were near typical background levels for the Philadelphia, Pennsylvania area (Table 2). All exposure rates were below the DOE indoor guideline of 20  $\mu\text{R}/\text{h}$  above background (Table 1).

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

Beta-gamma dose rates measured above the ground and on walls ranged from 0.01 to 0.04 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).

### **DUST SAMPLES**

Three dust samples from overhead beams were collected for radionuclide analyses. Sample locations are shown on Fig. 2 (M1-M3), and analytical results are provided in Table 3 (M1-M3). For sample M3, concentrations of  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$ , and  $^{238}\text{U}$  were within typical background ranges. Samples M1 and M2 contained slightly elevated concentrations of  $^{238}\text{U}$ . Radionuclide contamination in dust, which is easily removable from overhead horizontal surfaces, can be compared to surface removable guidelines when the concentration, dust mass, and area from which the sample was taken are known. Concentrations of  $^{238}\text{U}$  ranged from 1.0-4.0 pCi/g, and were converted to dpm/100  $\text{cm}^2$  (130 to 170 dpm/100  $\text{cm}^2$ ). These calculations showed that  $^{238}\text{U}$  concentrations were between 13% and 17% of the guideline of 1000 dpm/100  $\text{cm}^2$  for residual removable  $^{238}\text{U}$  contamination (Table 1). All samples were well below DOE guidelines.

### **RADIATION MEASUREMENTS ON BEAMS**

Three direct alpha and beta-gamma measurements were taken on overhead beams after dust samples were collected. 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)<sup>†</sup>.

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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.

## SIGNIFICANCE OF FINDINGS

Radionuclide analysis of the dust samples collected at the site of the former ALCOA New Kensington Works (Schreiber properties), Pine and Ninth Streets, New Kensington, Pennsylvania, showed no radionuclide concentrations above DOE guidelines (Table 1). Radionuclide concentrations in the surveyed areas (Table 3) were similar to typical background values in the Pittsburgh, Pennsylvania area (Table 2). 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.

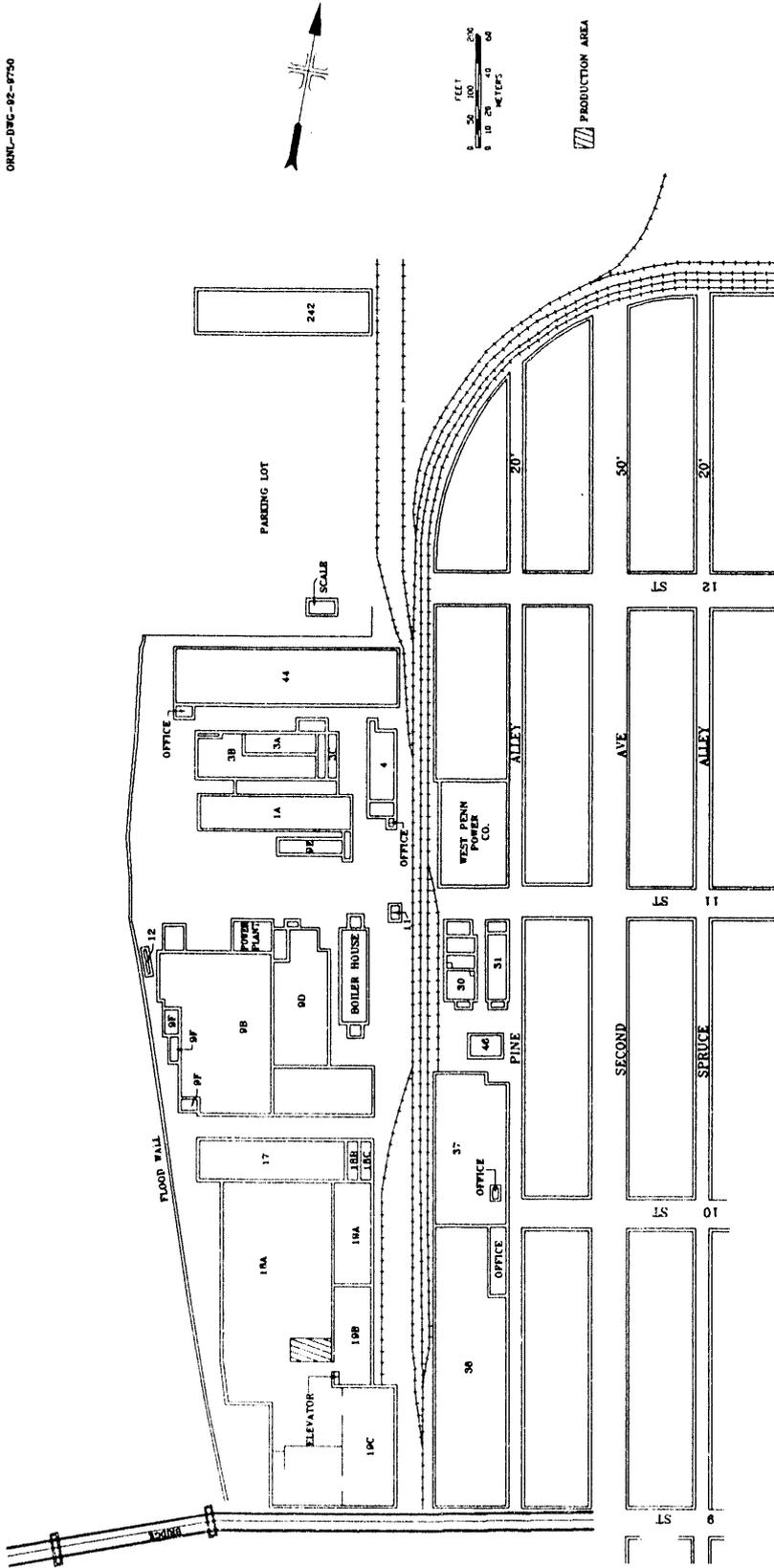


Fig. 1. The former ALCOA New Kensington Works, Pine and Ninth Streets, New Kensington, Pennsylvania.

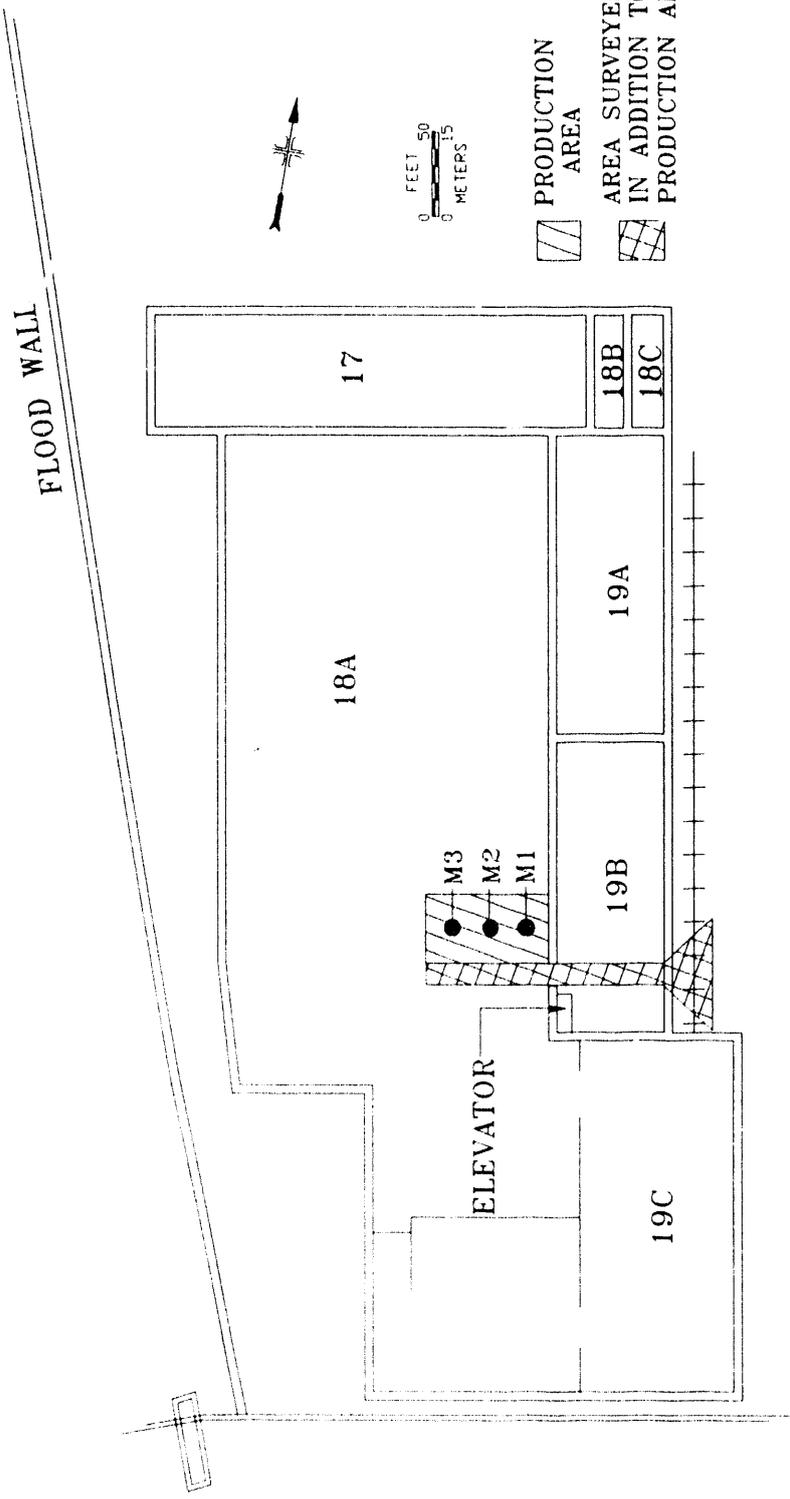


Fig. 2. Production area access and sampling locations for dust (M) at the former ALCOA New Kensington Works.

ORNL-PHOTO 6724-92



Fig. 3. View looking north at the former ALCOA New Kensington Works.

ORNL-PHOTO 6725-92



Fig. 4. View looking northeast in survey area at the former ALCOA New Kensington Works.

**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 $\mu\text{R/h}^a$
Concentration of radionuclides in surface soil	
$^{226}\text{Ra}$	1.1 $\pm$ 0.04 pCi/g <sup>b</sup>
$^{232}\text{Th}$	1.1 $\pm$ 0.10 pCi/g <sup>b</sup>
$^{238}\text{U}$	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 dust samples collected at the site of the former New Kensington Works, Pine and Ninth Streets, New Kensington, Pennsylvania<sup>a</sup>**

Sample No.	Radionuclide concentration (pCi/g) <sup>b</sup>		
	$^{226}\text{Ra}$	$^{232}\text{Th}$	$^{238}\text{U}$
M1 <sup>c</sup>	0.42 $\pm$ 0.07	0.21 $\pm$ 0.10	4.64 $\pm$ 2.00
M2	0.20 $\pm$ 0.03	0.15 $\pm$ 0.05	3.03 $\pm$ 0.73
M3	0.18 $\pm$ 0.04	0.11 $\pm$ 0.03	1.51 $\pm$ 0.45

<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>A dust sample was collected from an overhead beam in the center of each bay.

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