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Results of the Supplementary Radiological Survey at the Former C. H. Schnoor and Company Site, 644 Garfield Street, Springdale, Pennsylvania (CVP001)

R. L. Coleman
M. E. Murray
K. S. Brown

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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R. L. Coleman, M. E. Murray and K. S. Brown

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Investigation Team

R. D. Foley-Measurement Applications and Development Manager
W. D. Cottrell - FUSRAP Project Director
M. E. Murray - Survey Team Leader

Survey Team Members

R. L. Coleman
R. A. Mathis
V. P. Patania
D. E. Rice
D. A. Rose
W. Winton
W. A. Williams*

*U. S. Department of Energy

Work performed by the
MEASUREMENT APPLICATIONS AND DEVELOPMENT GROUP

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
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ABSTRACT

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted radiological surveys at the former C. H. Schnoor and Company site, 644 Garfield Street, Springdale, Pennsylvania. The surveys were performed on October 11-13 and November 14-17, 1993, in order to provide a complete characterization prior to site remediation. The surveys included a gamma scan and a scan for surface contamination from alpha and beta-gamma emitters; measurement of direct and removable alpha and beta-gamma levels; systematic FIDLER measurements at the surface of the concrete; and the collection of samples from boreholes for radionuclide analysis.

Results of the surveys revealed radionuclide concentrations and surface contamination levels in excess of applicable DOE guidelines for ^{238}U. Radionuclide distributions were higher than typical background levels for ^{238}U in the Springdale, Pennsylvania area.

Results of the Supplementary Radiological Survey at the Former C. H. Schnoor and Company Site, 644 Garfield Street, Springdale, Pennsylvania (CVP001)*

INTRODUCTION

The Manhattan Engineer District (MED) was established as the lead agency in the development of nuclear energy for defense-related projects in the early 1940s. Commercial facilities were used as MED and Atomic Energy Commission (AEC) sites for storage and processing of uranium and thorium ores and for fabricating and machining metal made from these ores. 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).

The former C. H. Schnoor and Company site is located at 644 Garfield Street in Springdale, Pennsylvania. During the mid-1940's, the property was owned by C. H. Schnoor and Company and was used to machine extruded uranium for the Hanford Pile Project. The uranium operation may have continued until the spring of 1951, when the building was sold to a manufacturer of toys and coat hangers. In 1967 the property was acquired by the Unity Railway Supply Company, who founded the Premier Manufacturing Company and used the site to manufacture journal lubricators for railroad cars. The current owner, Conviber, Inc., uses the site for the fabrication of industrial drive and conveyer belts.

The original site consisted of a concrete block building, a quonset hut and a loading dock. The concrete building has since been enlarged with the addition of a new loading dock. During the uranium machining period, materials were reportedly received through the Garfield Street entrance and stored near the new loading dock.[1]

A radiological survey was conducted at the former C. H. Schnoor and Company Site on June 6, 1989, by the Measurement Applications and Development Group of Oak Ridge National Laboratory (ORNL) at the request of DOE. Additional samples were taken on June 21, 1990. Radionuclide analysis of eight samples taken on this date from a drilled hole in an area with elevated surface gamma radiation levels revealed ^{238}U concentrations ranging from 90 to 20,000 pCi/g. Survey results from these trips are discussed in a separate report.[1] Under current site use, residual uranium covered by concrete does not pose a health risk. However, these concentrations exceed typical site-specific guidelines for soil derived for

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

similar FUSRAP sites (see Table 1). Based on these findings, the site was considered and designated for inclusion in the FUSRAP program and slated for remediation.

On October 11-13, 1993, a team from Oak Ridge National Laboratory conducted an additional radiological survey of the interior of the concrete building at the Conviber site at the request of DOE. The purpose of the survey was a thorough characterization of the building before remediation efforts began. Based on concerns that the concrete floors severely limited the success of typical survey methods to adequately understand the contamination profile, a survey team returned to the site on November 14-17, 1993, with a different approach to characterizing subsurface contamination. The results of the 1993 surveys are presented in this report.

SCOPE OF THE SURVEY

The radiological survey included: (1) a thorough gamma scan of accessible areas inside the building; (2) measurement of direct and transferable alpha and beta-gamma radiation levels at selected locations in the building; (3) collection of samples from boreholes at selected locations in the building; and (4) systematic FIDLER measurements on a 5-foot grid over a section of the building.

SURVEY METHODS

Procedural guidance for 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).[2]

A slow, thorough gamma scan was conducted throughout the building. Surface gamma levels were recorded for accessible areas of the floor using (1) a NaI scintillation detector system, and (2) a large area proportional detector (floor monitor). Measurements were recorded in counts per minute (cpm).

A Field Instrument for Detection of Low-Energy Radiation (FIDLER) was used during the November, 1993 survey to perform 2-minute and 5-minute timed interval counts on a 5-foot grid at contact with the floor surface. Measurements were concentrated in the present supply and belt fabrication area. Isolated readings were taken in other areas of the building. Measurements were recorded in cpm (see Fig. 1).

Using a Geiger-Mueller pancake detector, beta-gamma levels were recorded and then converted from cpm to dpm/100 cm^2. Alpha levels were measured at selected locations with a ZnS alpha scintillation detector, and then converted from cpm to dpm/100 cm^2.

The floors of the building are concrete of a 4 to 10-inch thickness; therefore, a coredrill was used to remove plugs of concrete to gain access to the subsurface soil. A hand auger was used to collect samples systematically in 15-cm increments from boreholes through the concrete floor. Sample locations S1-S8 are near the spot of elevated radiation ("hot spot") discovered in the July 1990 survey. Ten other sample locations were then drilled systematically in the building. Two biased sample locations are near an area adjacent to the new loading dock with original concrete which showed surface contamination. One biased

sample was collected near the "hot spot." Concentrations of various radionuclides were determined in systematic and biased samples by gamma spectroscopy. Three smears were obtained from selected surfaces in the area adjacent to the new loading dock to determine the presence of transferable alpha and beta-gamma activity levels. Sample and smear locations are shown on Fig. 2.

SURVEY RESULTS

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

GAMMA MEASUREMENTS

A summary of normalized FIDLER measurements is shown on Fig. 1. Measurements range from 6,500 cpm to 21,000 cpm. The highest readings appear near the hot spot (Fig. 2). Data shown in Fig. 1 should be interpreted with caution. Although higher values indicate the presence of higher gamma radiation, the measurements cannot be related to the uranium concentration or volume of contamination. Also, low values cannot be used to infer that uranium contamination is not present under the concrete surface.

Using NaI detectors with conversion factors based on ^{238}U, gamma measurements at biased sampling sites B4, B5, and B6 were 45 μR/h, 25 μR/h, and 1.8 mR/h, respectively. The above measurements for B4 and B5 reflected surface contamination, while the measurement at B6 was made at approximately 12 inches below the concrete surface. Gamma levels at biased sampling locations exceeded DOE guidelines (Table 1), and also exceeded typical background levels for the Springdale, Pennsylvania area (Table 2).

DIRECT AND TRANSFERABLE BETA-GAMMA AND ALPHA RADIATION MEASUREMENTS

Direct beta-gamma and alpha radiation levels measured in the building were below DOE guidelines, with the exception of measurements taken adjacent to the new loading dock.

Eight direct alpha and beta-gamma measurements taken in the contaminated area adjacent to the new loading dock are summarized in Table 3. Locations are indicated on Fig. 2. Directly measured beta-gamma levels well exceeded the maximum DOE guideline of 15,000 dpm/100 cm^2 (Table 1). The three smears showed transferable alpha levels above the MDA but below DOE guidelines. One of the three smears showed transferable beta-gamma levels above the MDA but below DOE guidelines.

SOIL SAMPLES FROM BOREHOLES

All samples, including B6C, were collected and handled using similar procedures. Boreholes were placed through concrete, then soil was collected by removing hand auger cores in 6-inch increments relative to the surface of the concrete. Soil was mixed by hand, then an aliquot of approximately 0.5 kg was removed as a sample. Samples were dried, ground to a powder and mixed, then analyzed on an HPGe detector system.

Radionuclide analysis was performed on samples collected from boreholes at systematic and biased locations indicated on Fig. 2. Results of analysis are listed in Table 4. Since it is not possible to fully mix a sample to a homogeneous state during the collection process, the potential always exists that a sample could show a concentration higher or lower than the true value. Concentrations of ^{238}U generally exceeded DOE guidelines for derived concentrations at the Schnoor site in biased sample B6 and some systematic samples. Concentrations of ^{226}Ra were near typical background concentrations in the Springdale, Pennsylvania area, and below DOE guidelines.

SIGNIFICANCE OF FINDINGS

Results of the supplementary radiological survey at the former C. H. Schnoor and Company Site, 644 Garfield Street, Springdale, Pennsylvania suggest that concentrations of ^{238}U above DOE guidelines may still be found under the concrete in the northern half of the building. In addition, concrete which was in place during the period of former AEC activities in the area adjacent to the new loading dock shows surface contamination above DOE release criteria.

REFERENCES

1. R. D. Foley, W. D. Cottrell, and J. W. Crutcher, *Results of the Radiological Survey at Conviber Inc., 644 Garfield Street, Springdale, Pennsylvania (CVP001)*, ORNL/RASA-89/18, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab, October 1991.

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.

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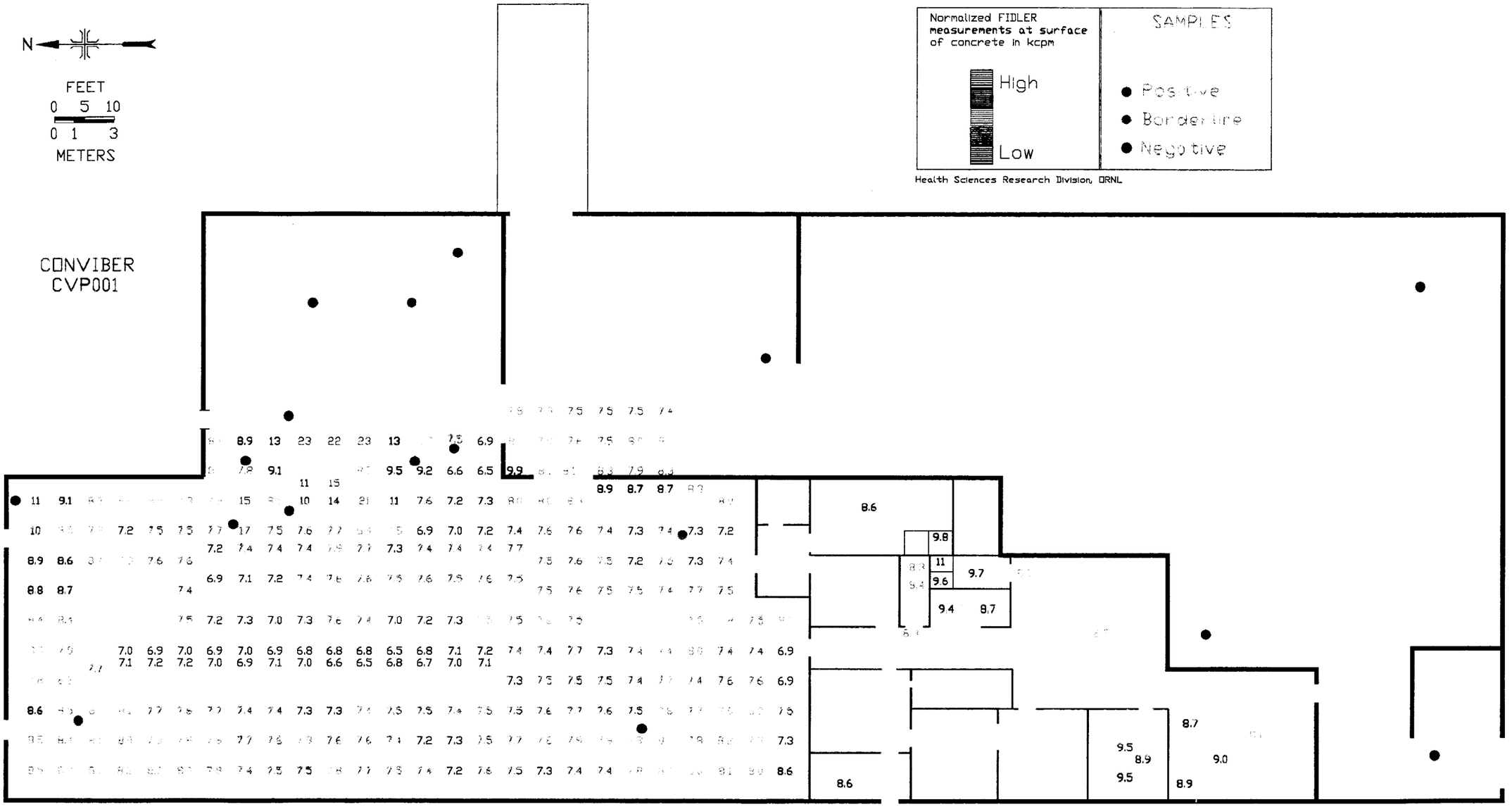

Fig. 1. Normalized measurements in thousands of cpm taken with Field Instrument for Detection of Low-Energy Radiation (FIDLER) at Conviber, Inc., Springdale, Pennsylvania.

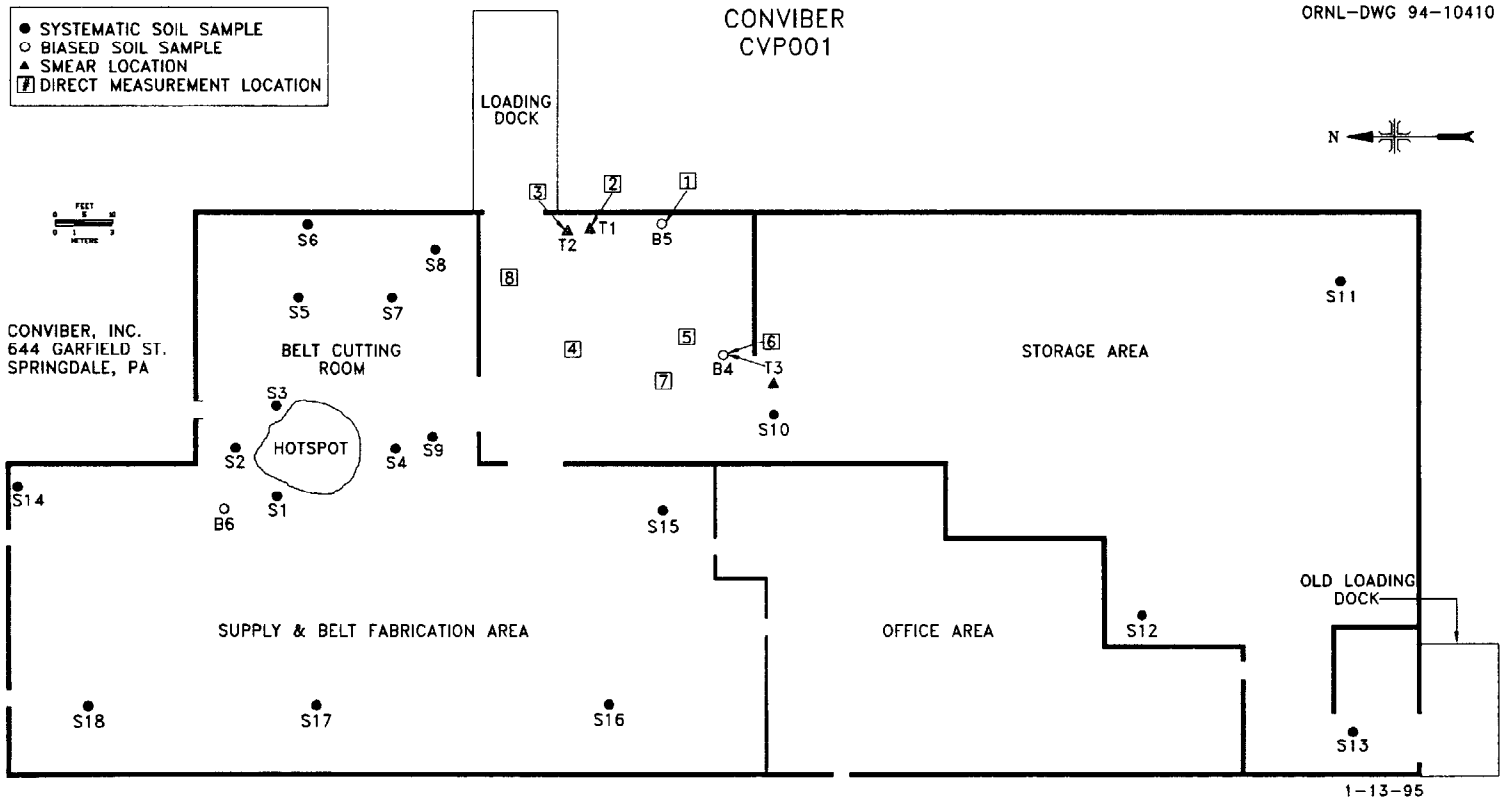

Fig. 2. Locations of direct measurements adjacent to the new loading dock, smears, systematic and biased samples at Conviber, Inc., Springdale, Pennsylvania.

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

Mode of exposure	Exposure conditions	Guideline value
Gamma radiation	Indoor gamma radiation level (above background)	20 μR/h[a]
Total residual surface contamination[b]	^{238}U, ^{235}U, U-natural (alpha emitters)	
	Maximum	15,000 dpm/100 cm^2
	Average	5,000 dpm/100 cm^2
	Removable	1,000 dpm/100 cm^2
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m^2	0.20 mrad/h
	Maximum dose rate in any 100-cm^2 area	1.0 mrad/h
Derived concentrations	^{238}U	50 pCi/g[c]
Guideline for non-homogeneous contamination (used in addition to the 100-m^2 guideline)[d]	Applicable to locations with an area ≤25 m^2, with significantly elevated concentrations of radionuclides ("hot spots")	$G_A = G_i(100/A)^{1/2}$, where G_A = guideline for "hot spot" of area (A) G_i = guideline averaged over a 100-m^2 area

[a]The 20 μR/h shall comply with the basic dose limit (100 mrem/year) when an appropriate-use scenario is considered.

[b]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.

[c]DOE guidelines for uranium are derived on a site-specific basis. See *Uranium Guidelines for the Schnoor Site, Springdale, Pennsylvania*, memorandum from J. W. Wagoner II, Director, Off-Site/Savannah River Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, August 25, 1994.

[d]DOE guidelines specify that every reasonable effort shall be made to identify and to remove any source that has a concentration exceeding 30 times the guideline value, irrespective of area (adapted from *Revised Guidelines for Residual Radioactive Material at FUSRAP and Remote SFMP Sites*, April 1987).

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; and U. S. Department of Energy Radiological Control Manual, DOE N 5480.6 (DOE/EH-256T), June 1992.

Table 2. Background radiation levels for the area near Springdale, Pennsylvania

Type of radiation measurement or sample	Radiation level or radionuclide concentration
Average external gamma exposure rate at 1 m above ground surface	6 μR/h[a]
Concentration of radionuclides in surface soil	
^{226}Ra	1.9 ± 0.20 pCi/g[b]
^{238}U	1.7 pCi/g[c]

[a]Average of 3 to 4 measurements.
[b]Standard deviation is the 2σ value.
[c]Error in measurement is ±5% (2σ).

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. Results of survey of contaminated area adjacent to new loading dock at Conviber, Inc., 644 Garfield Street, Springdale, Pennsylvania

Location Number[a]	Directly measured radiation levels[b]		Smear Number	Removable radioactivity	
	Alpha[c] (dpm/100 cm^2)	Beta-gamma[d] (dpm/100 cm^2)		Alpha[e] (dpm/100 cm^2)	Beta-gamma[f] (dpm/100 cm^2)
1	930	160,000	NA[g]	NA	NA
2	3500	200,700	T1	43	60
3	1800	170,000	T2	31	72
4	480	60,200	NA	NA	NA
5	1200	330,000	NA	NA	NA
6	7000	940,000	T3	240	460
7	180	29,000	NA	NA	NA
8	<60	33,000	NA	NA	NA

[a]Locations are shown on Fig. 2.
[b]Point measurements for 100-cm^2 sections of floor surface.
[c]MDA = 60 dpm/100 cm^2. Not corrected for absorption within surface residues or concrete.
[d]MDA = 1200 dpm/100 cm^2. Not corrected for absorption within surface residues or concrete.
[e]MDA = 17 dpm/100 cm^2.
[f]MDA = 95 dpm/100 cm^2.
[g]NA = Not applicable.

Table 4. Concentrations of radionuclides in samples collected from boreholes at the Former C. H. Schnoor and Company Site, 644 Garfield Street, Springdale, Pennsylvania

Sample number[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{238}U	^{235}U
		Systematic samples[c]		
S1A	15–30	1.6 ± 0.1	50 ± 10	2.2 ± 0.2
S1B	30–45	1.4 ± 0.4	5100 ± 400	230 ± 40
S1C	45–60	2.3 ± 0.2	380 ± 30	20 ± 3
S1D	60–76	1.3 ± 0.1	180 ± 50	8.0 ± 2
S2A	15–30	1.5 ± 0.1	30 ± 6	<1.5
S2B	30–45	1.1 ± 0.2	260 ± 10	14 ± 1
S2C	45–61	2.1 ± 0.2	20 ± 6	0.75 ± 0.2
S3B	12–29	2.0 ± 0.1	150 ± 50	6.5 ± 1.0
S3C	29–45	1.3 ± 0.1	310 ± 60	11 ± 2
S3D	45–61	1.2 ± 0.1	90 ± 10	4.5 ± 1.0
S4B	15–30	1.7 ± 0.1	150 ± 30	5.5 ± 0.6
S4C	30–45	1.1 ± 0.1	81 ± 10	3.2 ± 0.4
S4D	45–61	1.1 ± 0.1	62 ± 10	2.3 ± 0.2
S5A	15–30	1.6 ± 0.1	18 ± 6	0.74 ± 0.2
S5B	30–46	1.2 ± 0.1	7.9 ± 1.5	<0.3
S6A	12–30	1.3 ± 0.1	120 ± 30	5.0 ± 2
S6B	30–46	1.3 ± 0.1	35 ± 7	1.7 ± 0.4
S7A	12–30	1.5 ± 0.1	50 ± 10	2.0 ± 0.2
S7B	30–46	1.3 ± 0.1	37 ± 7	1.3 ± 0.3
S8A	15–30	1.4 ± 0.1	9.9 ± 2.0	<0.6
S8B	30–46	1.7 ± 0.1	2.9 ± 1.0	<0.3
S9A	15–30	1.7 ± 0.1	64 ± 7	2.7 ± 0.4
S9B	30–46	1.0 ± 0.1	10 ± 2	<0.7
S10A	20–30	1.2 ± 0.1	1.6 ± 0.4	<0.2
S10B	30–46	1.1 ± 0.1	1.7 ± 1	<0.2
S11A	10–31	1.7 ± 0.1	1.7 ± 0.7	<0.3
S11B	31–46	1.7 ± 0.1	1.8 ± 0.3	<0.2
S12A	10–30	1.4 ± 0.1	1.1 ± 0.6	<0.3
S12B	30–46	1.0 ± 0.1	1.5 ± 0.4	<0.2
S13A	10–30	1.6 ± 0.1	1.3 ± 0.4	<0.2
S13B	30–46	1.7 ± 0.1	2.0 ± 1	<0.3

Table 4 (continued)

Sample number[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]		
		^{226}Ra	^{238}U	^{235}U
S14A	12–30	1.1 ± 0.1	200 ± 50	10 ± 2
S14B	30–45	1.2 ± 0.1	330 ± 80	14 ± 3
S14C	45–61	1.1 ± 0.1	160 ± 30	7.0 ± 1
S15A	10–30	1.5 ± 0.1	5.2 ± 0.5	<0.4
S15B	30–46	1.7 ± 0.1	25 ± 5	1.0 ± 0.4
S16A	18–30	1.3 ± 0.1	3.0 ± 1.0	<0.3
S16B	30–46	1.6 ± 0.1	2.5 ± 0.6	<0.3
S17A	17–31	1.3 ± 0.1	3.9 ± 0.5	<0.3
S17B	31–43	1.2 ± 0.1	16 ± 4	0.7 ± 0.3
S18A	10–30	1.3 ± 0.1	4.0 ± 2	<0.3
S18B	30–46	1.8 ± 0.1	27 ± 5	1.4 ± 0.3
		Biased samples[d]		
B4B	10–31	1.4 ± 0.1	6.0 ± 1	<0.3
B4C	31–46	1.4 ± 0.1	2.7 ± 0.6	<0.3
B5B	10–31	1.4 ± 0.1	5.2 ± 2	<0.3
B6B	23–31	1.5 ± 0.1	31 ± 2	1.4 ± 0.4
B6C	31–46	<2.2	50,000±10,000	1500 ± 300
B6D	46–61	1.7 ± 0.4	4000 ± 500	170 ± 70
B6E	61–76	1.4 ± 0.2	1600 ± 400	60 ± 10

[a]Sample locations are shown on Fig. 2.

[b]Indicated counting error is at the 95% confidence level (±2σ).

[c]Systematic samples are taken at locations irrespective of gamma exposure rates.

[d]Biased samples are taken from areas with elevated gamma exposure rates. Biased samples B1-B3 were taken in a previous survey.[1]

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