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**Results of the Radiological Characterization Survey of the
Building 7819 Decontamination Facility
at Oak Ridge National Laboratory, Oak Ridge, Tennessee**

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EXECUTIVE SUMMARY

A radiological characterization survey of the interior of the Building 7819 Decontamination Facility at Oak Ridge National Laboratory (ORNL) was conducted during July 1993. The investigation was performed by the Measurement Applications and Development Group of the Health Sciences Research Division of ORNL at the request of the Department of Energy Office of Environmental Restoration and Waste Management Facility Transition and Management Program. Building 7819 was in service during the 1960s and 1970s to decontaminate various types of operating equipment and materials in use at ORNL from laboratories and hot cells.

The interior of Building 7819 is grossly contaminated, and the contamination is highly transferable. Levels of alpha and beta contamination inside the building exceed ORNL guidelines for zoning as a Contamination Area. Gamma exposure rates at several locations in the building exceed ORNL guidelines for zoning as a Radiation Area. The survey team measured very high levels of contamination in the northeast corner of the building and lower levels in the southwest corner of the building. Suspected asbestos insulation was observed in the northwest corner of the building on a pipe near the floor. A snakeskin was observed on an overhead heater, indicating the intrusion of wildlife.

Gamma whole-body exposure rates generally ranged from 0.1 to 20 mR/h. Total beta-gamma surface contamination ranged from 1000 to 520,000 dpm/100 cm², and transferable beta-gamma contamination ranged from 200 to 174,000 dpm/100 cm². A pump and a metal table near the pit exhibited beta dose rates of 3 rad/h and 300 mrad/h, respectively, and gamma exposure rates of 250 mR/h and 25 mR/h at contact, respectively.

Total alpha contamination levels ranged from 100 to 110,000 dpm/100 cm², and transferable contamination ranged from 21 to 440 dpm/100 cm². The ledge at the north end of the pit above the sink demonstrated alpha contamination of approximately 100,000 dpm/100 cm². Radionuclide analysis of 11 smear samples showed the primary beta emitters to be ⁹⁰Sr and ¹³⁷Cs with trace amounts of ⁶⁰Co.

The Building 7819 Decontamination Facility was zoned as a Contamination Area and Radiation Area at the time of this survey, and the zoning is justified by the results of the survey. The building will also be zoned as an Airborne Radioactivity Area, based on the results of air sampling.* Recommendations for corrective actions are included.

*M. L. Conner, Office of Radiation Protection, Oak Ridge Natl. Lab., personal communication to K. J. Brown, Health Sciences Research Division, Oak Ridge Natl. Lab., November 1993.

1. INTRODUCTION

A radiological characterization survey of the interior of the Building 7819 Decontamination Facility at Oak Ridge National Laboratory (ORNL) was conducted during July 1993. The investigation was performed by the Measurement Applications and Development Group of the Health Sciences Research Division of ORNL at the request of the Department of Energy (DOE) Office of Environmental Restoration and Waste Management Facility Transition and Management Program.

The Building 7819 Decontamination Facility is located in Waste Area Group (WAG) 7. Building 7819 is shown at the number 7.1 in Fig. 1 (ref. 1). WAG 7 is located in Melton Valley about 1 mile south of the ORNL main plant area. The decontamination facility is located north of Lagoon Road near the entrance to Solid Waste Storage Area (SWSA) 4 at ORNL grid coordinates N19,330 feet and E27,040 feet. Figures 2 and 3 show views of the building looking northwest and southwest.

Prior to construction of the Building 7819 Decontamination Facility, decontamination activities at ORNL were carried out in Building 3036. Wastes were drained to holding tanks under the buildings and transported by truck to what was referred to as the Burial Ground (currently known as SWSA 6) for disposal. Building 7819 was constructed to isolate the decontamination activities from the main plant area and facilitate disposal of the large volumes of liquid waste generated during decontamination activities.

Building 7819 was in service during the 1960s and 1970s to decontaminate various forms of operating equipment and materials in use at ORNL from laboratories and hot cells. Examples of items subject to decontamination include electrical tools and isotope carriers of various sizes. Acid baths and abrasive blasting were used in the decontamination process, primarily in the northern section of the building. Liquid wastes were released from Building 7819 into Pit 1 (identified as numeral 7.5 on Fig. 1). Decontamination processes were halted due to concerns about the environmental impact of (1) disposal of large volumes of liquid wastes, and (2) potential runoff from disposal areas in surface water and groundwater.*

The building is currently inactive and unoccupied. Some contaminated equipment is stored inside. The interior of the building is zoned as a Contamination Area. The exterior of the building is surrounded by barbed-wire fencing on three sides and a chain-link fence fronting Lagoon Road with radiation control warning signs at intervals.

The survey included the following:

- measurement of direct gamma radiation at 1 m above the floor,
- a survey for total alpha contamination,

*A. C. Butler, Geofon Inc., personal communication to K. J. Brown, Health Sciences Research Division, Oak Ridge Natl. Lab., October 1993.

- a limited survey for fixed beta-gamma contamination,
- collection of one air sample to be counted for gross alpha and gross beta contamination,
- determination of potential dose rates from exposure to neutrons, and
- assessment of possible nonradiological hazards such as suspected asbestos material.

Fig. 1. Location of the Building 7819 Decontamination Facility in Waste Area Grouping 7.

ORNL Photo 5948-93

Fig. 2. View looking northwest at the Building 7819 Decontamination Facility (July 1993).

ORNL Photo 5949-93

Fig. 3. View looking southwest at the Building 7819 Decontamination Facility (July 1993).

2. RADIOLOGICAL SURVEY METHODS

A description of typical methods and instrumentation providing guidance for the conduct of this survey is presented in *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600 (April 1987)².

Prior to exiting the site, survey personnel were checked for alpha and beta-gamma contamination. A Bicon Analyst meter with an ORNL zinc sulfide (ZnS) alpha scintillator probe was used to check for alpha contamination. A Bicon Analyst meter with an HP-260 probe ("pancake") was used to check for beta-gamma contamination.

2.1 GAMMA MEASUREMENTS

Gamma radiation exposure rates were measured with a Bicon Analyst RSO-5 ionization chamber (standard model) throughout the building. Measurements were taken in the center of each 1-m grid block 1 m above the floor and in contact with selected equipment in the building.

2.2 BETA-GAMMA MEASUREMENTS

Beta-gamma radiation levels were measured in each accessible floor grid block using a portable Bicon Analyst scaler/ratemeter with an Eberline HP-210 Geiger-Mueller pancake detector ($<2 \text{ mg/cm}^2$ wall thickness) with fine mesh screen. One-minute counts were taken in the middle of each floor grid. In some areas elevated radiation levels due to shine* from material in the building prevented determination of total beta contamination. In other areas the beta radiation levels were so high that it was necessary to use an RSO-5 ionization chamber instrument and measure only beta radiation dose rates. A smear sample was taken from the floor in each accessible grid block to determine transferable beta-gamma contamination.

Building walls were partially scanned for beta-gamma contamination, because shine from surrounding objects prevented determination of total beta-gamma contamination in some wall sections, and other sections were inaccessible. Transferable beta-gamma contamination on selected walls, equipment, floor drains, and overhead surfaces was assessed by taking smear samples.

*The term *shine* refers to gamma radiation emanating from a source or sources extrinsic to the area being defined. This extraneous radiation may increase gamma radiation levels above actual levels associated with the area of interest.

2.3 ALPHA MEASUREMENTS

Alpha radiation was measured in each accessible floor grid block using a portable Bicon Analyst alpha survey meter with a Bicon Analyst A50 "bear-claw" type ZnS scintillation probe. Counts per minute were recorded for a 60-s direct measurement and converted to disintegrations per minute (dpm) per 100 cm² using an instrument-specific conversion factor. Personnel, equipment, and smear sample containers were monitored for alpha contamination.

2.4 NEUTRON MEASUREMENTS

An NRC RemRad NP-A2 ("Snoopy") fast neutron meter was used to determine potential fast neutron dose rates in selected areas.

2.5 SAMPLES

Smear samples were collected at systematic locations on floors and walls for measurement of transferable contamination. In addition, smear samples were collected from selected equipment and drains at locations of elevated radiation levels, and from overhead beams and ledges, for determination of transferable alpha and beta contamination. Selected smear samples from the building interior and equipment were sent to the ORNL Analytical Chemistry Division for radionuclide analysis.

An area air sample was obtained in Building 7819 while survey work was being conducted. The air sampler was placed in grid block F,3 at a height of 5 ft 2 in. and sampled a volume of 112 ft³ in 160 min. The air was then filtered through an 0.8- μ m millipore filter. The filter was counted on smear counters for gross alpha and gross beta contamination.

3. SURVEY RESULTS

3.1 GENERAL OBSERVATIONS

The interior of Building 7819 is grossly contaminated, and the contamination is extremely transferable. Levels of contamination inside the building exceed ORNL guidelines for alpha and beta contamination. The survey team measured very high levels of contamination in the northeast corner of the building and lower levels in the southwest corner of the building. The telephone on the north wall is contaminated. Dust and oil were found on the floor. Cobwebs and dust were observed throughout the building. Lead bricks and boxes were found, in addition to bagged material (waste) bearing radiation tags from 1978 stating "Highly alpha contaminated." Most drains are plugged. Suspected asbestos was observed in the northwest corner of the building on a pipe near the floor (see Fig. 4). A snakeskin was observed on an overhead heater (Fig. 5), indicating the intrusion of wildlife at one time. Figs. 6-10 are photos of the interior of Building 7819 showing surveying procedures, the general condition of the building, and areas of elevated radioactivity.

3.2 RADIATION MEASUREMENTS

Gamma exposure rates inside the building exceeded ORNL guidelines for posting as a Radiation Area in several locations. Gamma whole-body exposure rates generally ranged from 0.1 to 20 mR/h. Figure 11 and Table 1 indicate the gamma exposure rate (mR/h) 1 m above the floor in each grid block of Building 7819.

Total beta-gamma surface contamination ranged from 1000 to 520,000 dpm/100 cm², and transferable beta-gamma contamination ranged from 200 to 174,000 dpm/100 cm². A pump occupying grid blocks D,7 and D,8 demonstrated a beta dose rate of 3 rad/h and a gamma exposure rate of 250 mR/h at contact (Fig. 12). A metal table in grid block L,7 showed a beta dose rate of 300 mrad/h and a gamma exposure rate of 25 mR/h at contact (Fig. 13). Table 1 shows total surface beta-gamma contamination and transferable beta-gamma contamination in disintegrations/minute/100 cm² in each grid block of the floor of Building 7819.

Alpha contamination was detected in several locations. Total contamination levels ranged from 100 to 110,000 dpm/100 cm², and transferable contamination ranged from 21 to 440 dpm/100 cm². The ledge at the north end of the pit above the sink indicated alpha contamination of approximately 100,000 dpm/100 cm² (Fig. 14). Table 1 shows total surface alpha contamination and transferable alpha contamination in disintegrations/minute/100 cm² in each grid block of the floor of Building 7819.

Neutron radiation dose rates were less than 0.2 mrem/h.

3.3 SAMPLE ANALYSIS

Sampling locations for transferable alpha and beta-gamma contamination are shown in Fig. 15 for samples taken from the walls and in Fig. 16 for samples taken from equipment.

ORNL Photo 5977-93

Fig. 4. Evidence of suspect asbestos in northwest corner of Building 7819 (July 1993).

ORNL Photo 5967-93

Fig. 5. Snakeskin on overhead heater in Building 7819 (July 1993).

ORNL Photo 5978-93

Fig. 6. Interior of eastern side of Building 7819 showing pit mill (July 1993).

ORNL Photo 5955-93

Fig. 7. Collection of overhead smear samples in Building 7819 (July 1993).

Fig. 8. Air sampler located on interior wall of Building 7819 (July 1993).

ORNL Photo 5973-93

Fig. 9. Drains in western side of Building 7819 (July 1993).

ORNL Photo 5956-93

Fig. 10. Office area in southwest corner of Building 7819 (July 1993).

* = INACCESSIBLE

12-1-93

GRID
BLOCK
KEY

Fig. 11. Gamma exposure rate (mR/h) 1 m above the floor in each grid block of Building 7819.

Table 1. Summary of radiation measurements on floor of Building 7819 Decontamination Facility

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
A,0	0.1	<100	<1,000	1	<20	<200
A,1	0.2	<100	2,700	2	<20	250
A,2	0.2	<100	8,000	3	<20	<200
A,3	0.5	<100	18,000	4	<20	480
A,4	0.7	<100	55,000	5	<20	<200
A,5	1.5	140	84,000	6	<20	600
A,6	1.4	100	<i>a</i>	7	<20	210
A,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
A,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
A,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
B,0	0.1	<100	2,300	11	<20	<200
B,1	0.1	<100	3,000	12	<20	<200
B,2	0.1	<100	4,900	13	<20	200
B,3	0.5	<100	20,000	14	<20	310
B,4	0.8	<100	24,000	15	<20	260
B,5	1.6	240	<i>a</i>	16	<20	700
B,6	6.0	190	<i>a</i>	17	<20	1,500

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
B,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
B,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
B,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
C,0	0.1	<100	3,300	21	<20	<200
C,1	0.1	<100	2,100	22	<20	<200
C,2	0.1	<100	3,300	23	<20	<200
C,3	0.5	<100	22,000	24	<20	5,700
C,4	0.9	<100	<i>a</i>	25	<20	280
C,5	1.4	270	20,000	26	<20	510
C,6	3.8	200	150,000	27	<20	910
C,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
C,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
C,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
D,0	0.0	<100	12,000	31	<20	<200
D,1	0.1	<100	4,400	32	<20	<200
D,2	0.0	<100	1,800	33	<20	<200
D,3	0.6	130	11,000	34	<20	<200

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
D,4	0.9	<100	<i>a</i>	35	<20	<200
D,5	1.5	180	<i>a</i>	36	<20	240
D,6	4.4	130	<i>a</i>	37	<20	530
D,7	10.0	<100	<i>a</i>	38	<20	560
D,8	5.0	270	<i>a</i>	39	<20	600
D,9	3.3	140	<i>a</i>	40	<20	370
E,0	<0.1	<100	21,000	41	<20	<200
E,1	<0.1	<100	9,400	42	<20	360
E,2	<0.1	100	21,000	43	<20	220
E,3	0.7	<100	8,000	44	28	270
E,4	0.8	<100	<i>a</i>	45	<20	290
E,5	1.6	200	<i>a</i>	46	<20	1,600
E,6	2.6	200	<i>a</i>	47	<20	460
E,7	4.3	170	<i>a</i>	48	21	550
E,8	3.4	470	<i>a</i>	49	<20	1,500
E,9	2.8	<100	<i>a</i>	50	28	4,800
F,0	0.1	<100	16,000	51	28	<200

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
F,1	0.1	<100	5,400	52	28	260
F,2	0.2	<100	3,800	53	<20	250
F,3	0.7	<100	10,000	54	35	340
F,4	0.9	130	4,700	55	35	310
F,5	1.0	<100	35,000	56	<20	2,200
F,6	1.5	<100	17,000	57	35	230
F,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
F,8	<i>b</i>	<i>b</i>	<i>b</i>	278	56	600
F,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
G,0	0.2	<100	19,000	61	<20	<200
G,1	0.2	<100	20,000	62	28	700
G,2	0.2	<100	11,000	63	<20	370
G,3	0.6	<100	20,000	64	<20	410
G,4	0.7	<100	<i>a</i>	65	28	370
G,5	0.8	200	<i>a</i>	66	21	2,800
G,6	0.8	100	10,000	67	28	380
G,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
G,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
G,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
H,0	0.2	<100	28,000	71	35	630
H,1	0.2	<100	19,000	72	<20	420
H,2	0.4	<100	12,000	73	28	<200
H,3	0.4	<100	<1,000	74	42	540
H,4	0.5	<100	<i>a</i>	75	35	380
H,5	0.7	<100	21,000	76	70	1,500
H,6	1.2	120	13,000	77	21	280
H,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
H,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
H,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
I,0	0.2	<100	10,000	81	28	460
I,1	0.2	<100	11,000	82	28	250
I,2	0.3	<100	3,100	83	<20	400
I,3	0.4	<100	25,000	84	<20	<200
I,4	0.5	<100	13,000	85	<20	300

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
I,5	0.7	220	44,000	86	<20	3,400
I,6	1.4	120	24,000	87	<20	1,200
I,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
I,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
I,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
J,0	0.4	120	19,000	91	28	750
J,1	0.4	<100	6,300	92	21	340
J,2	0.3	<100	6,800	93	<20	470
J,3	0.3	<100	6,400	94	<20	290
J,4	0.4	640	26,000	95	<20	620
J,5	0.6	240	63,000	96	28	8,100
J,6	0.9	400	59,000	97	<20	1,900
J,7	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
J,8	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
J,9	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
K,0	0.5	<100	13,000	101	28	1,400
K,1	0.6	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
K,2	0.4	120	4,200	103	<20	480
K,3	0.3	<100	5,100	104	28	440
K,4	0.4	300	6,700	105	49	4,500
K,5	0.5	250	190,000	106	<20	10,000
K,6	1.5	13,000	520,000	107	230	31,000
K,7	20.0	900	99,000	108	98	50,000
K,7	<i>b</i>	<i>b</i>	<i>b</i>	279	100	6,800
K,8	1.3	220	11,000	109	<20	20,000
K,9	0.7	230	<i>a</i>	110	35	3,500
L,0	1.1	<100	26,000	111	<20	280
L,1	0.4	120	<i>a</i>	112	<20	250
L,2	0.3	<100	6,400	113	<20	1,000
L,3	0.3	120	4,700	114	<20	480
L,4	0.5	170	5,000	115	<20	610
L,5	0.5	450	49,000	116	<20	1,300
L,6	0.8	1,300	150,000	117	<i>c</i>	<i>c</i>
L,7	1.4	950	190,000	118	<i>c</i>	<i>c</i>

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
L,8	1.7	260	96,000	119	c	c
L,9	0.6	300	a	120	c	c
M,0	4.8	180	a	121	<20	290
M,1	1.5	<100	a	122	21	560
M,2	1.0	<100	1,200	123	21	380
M,3	0.5	<100	2,700	124	<20	440
M,4	0.5	170	23,000	125	<20	800
M,5	0.4	400	41,000	126	35	2,800
M,6	0.6	140	100,000	127	<20	2,200
M,7	1.2	190	79,000	128	28	2,600
M,8	2.6	310	22,000	129	<20	2,600
M,9	1.2	190	25,000	130	21	1,600
N,0	1.7	<100	3,000	131	<20	580
N,1	0.8	<100	5,600	132	<20	390
N,2	0.4	<100	3,900	133	<20	310
N,3	0.3	140	10,000	134	<20	<200
N,4	0.2	180	a	135	<20	990

Table 1 (continued)

Location (Grid ID)	Gamma exposure rate, center survey block 1 m above floor (mR/h)	Total alpha contamination (dpm/100 cm ²)	Total beta-gamma contamination (dpm/100 cm ²)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
N,5	0.2	280	26,000	136	<20	270
N,6	0.6	380	<i>a</i>	137	<20	330
N,7	0.9	510	280,000	138	<20	610
N,8	1.7	170	<i>a</i>	139	21	4,600
N,9	1.0	<100	14,000	140	<20	350
O,0	0.3	100	11,000	141	<20	310
O,1	0.3	<100	51,000	142	<20	330
O,2	0.3	190	48,000	143	<20	<200
O,3	0.3	180	16,000	144	<20	<200
O,4	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
O,5	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
O,6	0.1	330	370,000	147	21	340
O,7	0.5	240	31,000	148	21	1,300
O,8	0.9	230	13,000	149	<20	900
O,9	0.7	<i>b</i>	<i>b</i>	150	<i>b</i>	<i>b</i>

^a Radioactive shine from surrounding objects prevented determination of total beta-gamma contamination.

^b Inaccessible.

^c Not removed from envelope. Selected for further analysis.

ORNL Photo 5959-93

Fig. 12. View of highly contaminated pump in southeastern end of Building 7819 (July 1993).

ORNL Photo 5970-93

Fig. 13. View of contaminated metal table in northeastern side of Building 7819 (July 1993).

ORNL Photo 5963-93

Fig. 14. View of grossly contaminated ledge above sink in northeastern end of Building 7819 (July 1993).

Fig. 15. Sampling locations for transference alpha and beta-gamma contamination on walls in Building 7819.

Fig. 16. Sampling locations for transference alpha and beta-gamma contamination on equipment in Building 7819.

Figures 17 and 18, respectively, indicate the locations of samples taken from drains and overhead surfaces. Transferable alpha and beta-gamma contamination at smear locations on walls, equipment, drains, and overhead surfaces is shown in Tables 2-5, respectively, in disintegrations/minute/100 cm².

Table 6 shows results of radionuclide analysis of a subset of 11 samples taken from areas of elevated radioactivity in Building 7819 and sent to ORNL Analytical Chemistry Division for analysis. Sample results show the primary beta-emitters to be ⁹⁰Sr and ¹³⁷Cs with trace amounts of ⁶⁰Co. Analysis of smear samples to identify alpha-emitting radionuclides was inconclusive, because insufficient amounts of transferable alpha activity were picked up on the smear samples during collection.

Air sample results showed net activity levels less than the Minimum Detectable Activity (MDA) of 22 dpm for beta and less than the MDA of 1.5 dpm for alpha. When the MDA was used to calculate results, gross beta contamination was less than 0.2% of the Derived Air Concentration (DAC) for ⁹⁰Sr, and gross alpha contamination was less than 9% of the DAC for ²³⁹Pu.

ORNL-DWG 93-16425

① = FLOOR DRAIN &
SMEAR LOCATION
(OP.) = OPEN DRAIN
(CL.) = CLOSED DRAIN

12-1-93

GRID
BLOCK
KEY

Fig. 17. Sampling locations for transferable alpha and beta-gamma contamination on drains in Building 7819.

ORNL-DWG 93-16426

// = OVERHEAD BEAM
 ● = SMEAR LOCATION
 ⊙ = LIGHT FIXTURE &
 SMEAR LOCATION

12-1-93

GRID
BLOCK
KEY

Fig. 18. Sampling locations for transferable alpha and beta-gamma contamination on overhead surfaces in Building 7819.

Table 2. Summary of radiation measurements on interior and exterior walls of Building 7819 Decontamination Facility

Location (Grid ID)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta- gamma contamination (dpm/100 cm ²)
Exterior Walls ^a			
A,0,1	151	<20	<200
B,0,2	152	<20	<200
C,0,1	153	<20	<200
D,0,2	154	21	<200
E,0,1	155	<20	<200
F,0,2	156	<20	<200
G,0,1	157	<20	<200
H,0,2	158	<20	200
I,0,1	159	<20	<200
J,0,2	160	21	540
K,0,1	161	<20	<200
L,0,2	162	21	270
M,0,1	163	<20	<200
N,0,2	164	<20	<200
O,0,1	165	<20	<200
O,0,2	166	<20	<200
O,1,1	167	<20	<200
O,2,2	168	<20	<200
O,3,1	169	<20	<200
O,4,2	<i>b</i>	<i>b</i>	<i>b</i>
O,5,1	<i>b</i>	<i>b</i>	<i>b</i>
O,6,2	172	<20	<200
O,7,1	173	28	700
O,8,2	174	<20	<200
O,9,1	175	<20	<200
O,9,2	176	<20	<200
N,9,1	177	<20	<200

Table 2 (continued)

Location (Grid ID)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta- gamma contamination (dpm/100 cm ²)
M,9,2	178	<20	<200
L,9,1	179	<20	<200
K,9,2	180	<20	<200
J,9,1	181	<20	<200
I,9,2	<i>b</i>	<i>b</i>	<i>b</i>
H,9,1	<i>b</i>	<i>b</i>	<i>b</i>
G,9,2	<i>b</i>	<i>b</i>	<i>b</i>
F,9,1	<i>b</i>	<i>b</i>	<i>b</i>
E,9,2	186	<20	<200
D,9,1	187	<20	<200
C,9,2	<i>b</i>	<i>b</i>	<i>b</i>
B,9,1	<i>b</i>	<i>b</i>	<i>b</i>
A,9,2	<i>b</i>	<i>b</i>	<i>b</i>
A,9,1	<i>b</i>	<i>b</i>	<i>b</i>
A,8,2	<i>b</i>	<i>b</i>	<i>b</i>
A,7,1	<i>b</i>	<i>b</i>	<i>b</i>
A,6,2	194	<20	<200
A,5,1	195	21	<200
A,4,2	196	<20	<200
A,3,1	197	<20	<200
A,2,2	198	<20	<200
A,1,1	199	<20	<200
A,0,2	200	<20	<200

Table 2 (continued)

Location (Grid ID)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta- gamma contamination (dpm/100 cm ²)
Interior Walls ^c			
E,0	253	<20	<200
F,2	254	<20	<200
G,2	255	<20	<200
F,3	256	<20	<200
C,3	257	<20	<200
D,1	258	<20	<200
C,3	259	<20	<200
A,3	260	<20	<200

^a Smear samples from exterior walls were taken at 0.5 m and 1.5 m above the ground in alternate grids.

^b Inaccessible.

^c Smear samples from interior walls were taken 1 m above the floor.

**Table 3. Summary of radiation measurements on equipment in Building 7819
Decontamination Facility**

Location (Grid ID)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
A,0	201	<20	<200
C,1	202	28	260
D,2	203	<20	<200
C,0	205	<20	<200
B,3	206	<20	<200
A,5	207	21	<200
A,6	208	<20	<200
B,6	209	21	<200
C,8	210	<20	<200
C,7	211	<20	<200
D,7	212	<20	2,000
D,8	213	56	59,000
D,9	214	290	6,800
F,9	215	<20	660
F,8	216	<20	290
F,7	217	<20	<200
F,7	218	91	530
I,4	219	<20	<200
F,3	220	<20	<200
J,0	221	<20	1,200
J,1	222	21	<200
L,1	223	<20	<200
M,0	224	<20	<200
N,0	225	<20	320
O,2	226	<20	<200
O,2	227	<20	<200
N,2	228	21	600

Table 3 (continued)

Location (Grid ID)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
O,5	229	21	<200
O,6	230	<20	<200
N,7	231	<20	730
O,7	232	21	580
O,8	233	42	1,300
K,7	234	<20	280
L,9	235	49	850
L,9	236	<20	300
L,7	237	440	17,000
L,7	238	270	58,000
E,1	239	<20	430
G,1	240	<20	<200
E,0	241	<20	<200
F,0	242	<20	<200
H,2	243	28	<200
K,7	244	56	31,000

Table 4. Summary of radiation measurements on drains in Building 7819 Decontamination Facility

Location (Grid ID)	Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
D,4	245	<20	820
E,0	246	<20	610
E,1	247	<20	<200
F,1	248	<20	260
F,2	249	<20	<200
G,0	250	<20	<200
L,3	251	<20	370
M,7	252	<20	900

**Table 5. Summary of overhead radiation measurements in Building 7819
Decontamination Facility**

Smear number	Transferable alpha contamination (dpm/100 cm ²)	Transferable beta-gamma contamination (dpm/100 cm ²)
204	<20	260
261	<20	<200
262	<20	<200
263	<20	<200
264	<20	<200
265	<20	<200
266	<20	<200
267	<20	<200
268	<20	<200
269	<20	<200
270	<20	<200
271	<20	<200
272	<20	<200
273	<20	<200
274	<20	<200
275	<20	350
276	<20	520
277	<20	380
280	<20	<200

Table 6. Activity levels of gross alpha, gross beta, ⁹⁰Sr, ⁶⁰Co, and ¹³⁷Cs in smear samples from Building 7819 Decontamination Facility

Smear number	Activity (dpm/100 cm ²)				
	Gross alpha ^a	Gross beta	⁹⁰ Sr	⁶⁰ Co	¹³⁷ Cs
96	<600	5,580	2,640	<i>b</i>	360
107	<600	35,400	12,600	366	1,080
108	<600	47,400	21,600	<i>b</i>	2,100
109	<600	18,600	10,200	240	1,620
117	<600	3,960	1,800	<i>b</i>	378
118	<600	6,600	2,400	<i>b</i>	360
119	<600	174,000	114,000	1,140	1,080
120	<600	7,200	6,000	<i>b</i>	2,100
213	<600	96,000	2,640	114	66,000
237	<600	18,000	7,200	<i>b</i>	2,880
238	<600	46,200	21,600	300	2,280

^a Insufficient activity on smear sample to identify transuranic isotopes.

^b Not analyzed.

4. SIGNIFICANCE OF FINDINGS

The interior of the Building 7819 Decontamination Facility is grossly contaminated, and the contamination is extremely transferable. The survey team measured high levels of contamination in the northern side of the building, where acid baths and sand blasting were used in the equipment decontamination process, and lower levels in the southern section of the building. Suspected asbestos was observed in the northwest corner of the building. A snakeskin was observed on an overhead heater, indicating the intrusion of wildlife.

Levels of alpha and beta contamination inside the building exceed ORNL guidelines for zoning as a Contamination Area. Gamma exposure rates in several locations in the building exceed ORNL guidelines for zoning as a Radiation Area. Gamma whole-body exposure rates generally ranged from 0.1 to 20 mR/h. Total beta-gamma surface contamination ranged from 1000 to 520,000 dpm/100 cm², and transferable beta-gamma contamination ranged from 200 to 174,000 dpm/100 cm². A pump and a metal table near the pit indicated beta dose rates of 3 rad/h and 300 mrad/h, respectively, and gamma exposure rates of 250 mR/h and 25 mR/h at contact, respectively.

Total alpha contamination levels ranged from 100 to 110,000 dpm/100 cm², and transferable contamination ranged from 21 to 440 dpm/100 cm². The ledge at the north end of the pit above the sink indicated alpha contamination of approximately 100,000 dpm/100 cm². Radionuclide analysis of 11 samples showed the primary beta emitters to be ⁹⁰Sr and ¹³⁷Cs with trace amounts of ⁶⁰Co.

The Building 7819 Decontamination Facility was zoned as a Contamination Area and Radiation Area at the time of this survey, and the zoning is certainly justified by the results of the survey. The building will also be zoned as an Airborne Radioactivity Area, based on the results of air sampling.* A minimum of personal protective equipment (PPE) necessary to enter the building should include one pair of coveralls, two pairs of shoe covers, two pairs of gloves, and full-face respirators with HEPA cartridges. The level of PPE may be upgraded, depending on the type of work to be performed inside the building.

The presence of high levels of contamination warrants corrective action measures. Three basic approaches to interim corrective actions are (1) continued isolation of the contaminated area (e.g., roping), including measures to minimize the intrusion of wildlife; (2) removal of contaminated waste, debris, and equipment in the building, to allow a more representative characterization survey without the influence of shine from surrounding objects, and disposal in a designated radioactive waste disposal site; and (3) unplugging of closed drains and resurveying of all drains in the building, followed by replugging of drains to prevent additional contamination of the drainage system.

*M. L. Conner, Office of Radiation Protection, Oak Ridge Natl. Lab., personal communication to K. J. Brown, Health Sciences Research Division, Oak Ridge Natl. Lab., November 1993.

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