

7.0 INVESTIGATIVE SAMPLING

Investigative samples were collected where known or suspected radioactive contamination was present, or to verify radiological conditions at project sites. Examples of investigative samples collected during 2003 included soil, vegetation, animals, and animal feces. Selected samples were analyzed for radionuclides at the 222-S Laboratory (200 West Area) and the results are provided in Table 7-1. Eighty-nine contaminated environmental samples were collected and disposed without isotopic analyses during clean-up operations during 2003. Field instrument readings were recorded for each and the results are provided in Table 7-2.

7.1 SOIL

During 2003, there were 30 instances of radiological contamination in which soil was identified as the carrier of contamination. One of these soil samples was submitted to the laboratory for radioisotopic analysis. Of the 30, 19 were identified only as specks or soil specks. Often, specks observed under high magnification are found to be small pieces of decomposed vegetation, most often tumbleweeds. External radioactivity levels ranged from slightly above background (approximately 2,500 disintegration's per minute [dpm]/100 cm²) to 3,600,000 dpm/100 cm². Contaminated areas were radiologically posted or cleaned up. The number of contamination incidents, the range of radiation dose rate levels, and radionuclide concentrations observed in 2003 were generally within historical ranges.

7.2 VEGETATION

In 2003, there were 32 instances in which vegetation was identified as the carrier of radiological contamination. None of these vegetation samples were submitted to the laboratory for radioisotopic analysis and the radioactivity levels were mostly within historical ranges. One contaminated vegetation instance had field readings in excess of one million dpm/100 cm².

The number of incidents in 2003 (32) is up from 16 in 2002, though still down from the high of 84 incidents in 1999. This overall decrease can be attributed to improvements in the deep-rooted weed prevention program. Nevertheless, contaminated tumbleweeds that grew in recent years continue to be identified by radiological surveys. It is expected that as contaminated vegetation from past years is identified and cleaned up, subsequent years will show the results of program improvements.

7.3 ANIMALS

Animals were collected either as part of an integrated pest management program or as a result of radiological surveys finding contaminated wildlife-related material (e.g., feces, nests, etc.). Animals were collected directly from or near facilities in an effort to monitor and track effectiveness of preventive measures designed to deter animal intrusion. For 2003, the number

of animals or animal-related materials found to be contaminated with radioactivity, 32 instances, the radioactivity levels and the range of radionuclide concentrations were within historical ranges. Of the 32 instances of radiological contamination caused by animals, 19 were caused by mud dauber wasp activity in the 100-H (18) and 100-N (1) Areas. In each case, decommissioning activities exposed contaminated soil and made it available for mud dauber wasp nest building.

After the shut down of the 105-H reactor, the fuel storage basins were backfilled with soil. To prevent airborne contamination from the soil during decontamination and decommissioning activities, the backfill was kept wet. Mud dauber wasps then used the mud created during this activity to build nests at various places in the 100-H Area. Contamination levels found in the wasp nests ranged from a low of 32,500 dpm/100 cm² beta/gamma to a high of 1,200,000 dpm/100 cm² beta/gamma and 1,300 dpm/100 cm² alpha. The contaminated areas created by the wasp nests were posted and will be cleaned up at a later date.

Similarly, in the 100-N Area, the contaminated mud dauber wasp nests came from the contaminated soil removal activities during the decommissioning of the 1325-N trench.

In 2003, six animals, or animal-related contamination instances were identified and from these, nine samples were submitted to the laboratory for analysis.

- In November 2002, two separate instances of contaminated mice were found along the perimeter of the 241-BX/BY tank farm (200 East Area). The results are reported here as the analyses had not been completed in time to be included in the 2002 data report. Contaminants included strontium-89/90 and cesium-137.
- In February 2003, contaminated soil was found to the west of the 241-TX/TY tank farm (200 West Area) in an old construction debris site. Contaminants included strontium-89/90 and cesium-137.
- In June 2003, a contaminated mouse was found in the 105-KE radiological monitoring office. Contaminants included strontium-89/90 and cesium-137.
- In June 2003, a contaminated starling carcass was found in the 317 Building stair well. Contaminants included cobalt-60, strontium-89/90, and cesium-134/137.
- In August 2003, a contaminated house mouse was found at 105-KE reactor building. Contaminants included strontium-89/90 and cesium-137.
- In August 2003, a contaminated cottontail rabbit was found outside the 272-S paint shop east of the 241-S/SX/SY tank farm complex (200 West Area). The rabbit was divided into four parts, skin, bone, gastrointestinal tract, and muscle. Contaminants included strontium-89/90 and cesium-137 with the highest result in the muscle.

7.4 SPECIAL CHARACTERIZATION SAMPLING

Special characterization projects were conducted in 2003 to ascertain the radiological status, and in some cases, the physical properties of site-specific operations and included the following:

A preoperational monitoring plan (*Remote-Handled Immobilized Low-Activity Waste Disposal Facility Preoperational Monitoring Plan*, RPP-6877 [Horton et al. 2000]) has been developed in support of the Waste Vitrification initiative. As part of this plan, an on-going environmental survey is being conducted on the proposed location for the Integrated Disposal Facility (IDF), formerly the Immobilized Low-Activity Waste Disposal (ILAW) Facility, in the 200 East Area. Tasks completed in 2003 included bulk soil sampling for geophysical properties. Following the completion of all the tasks outlined in the monitoring plan, the data collected will be published in a final report. The report is currently scheduled for publication in 2005.

Soil, vegetation and ground-dwelling invertebrate samples were collected at Gable Mountain Pond and B-Pond in October 2003 to identify potential exposure pathways and support remedial action decisions (Lane et al. 2003).

Table 7-1. Investigative Sample Results, 2003.

Number	Matrix	Sample		Date	Isotope	Result ^a	Analytical
		TSN	Location			(pCi/Sample) ^b ±	Uncertainty
6911	Mouse	180360	241-BX/BY Tank Farm (200 East Area)	11/13/02	⁶⁰ Co	<6.8E+00	
					^{89,90} Sr	3.7E+02 ± 4.7E+00	
					¹³⁴ Cs	<2.4E+01	
					¹³⁷ Cs	1.4E+01 ± 4.4E-01	
					¹⁵² Eu	<6.2E+01	
					¹⁵⁴ Eu	<3.9E+01	
					¹⁵⁵ Eu	<7.3E+01	
					Total U ^c	<2.2E+04	
					²³⁸ Pu	<3.7E-01 ± 1.0E+02	
					^{239,240} Pu	<2.1E-01 ± 1.0E+02	
6912	Mouse	180360	241-BX/BY Tank Farm (200 East Area)	11/19/02	⁶⁰ Co	<1.2E+00	
					^{89,90} Sr	<7.0E+03 ± 6.2E-01	
					¹³⁴ Cs	<1.3E+01	
					¹³⁷ Cs	<5.3E+04	
					¹⁵² Eu	<3.6E+01	
					¹⁵⁴ Eu	<6.0E+00	
					¹⁵⁵ Eu	<4.1E+01	
					Total U ^c	<1.3E=04	
					²³⁸ Pu	<3.3E-01 ± 1.0E+02	
					^{239,240} Pu	<1.8E-01 ± 1.0E+02	
6913	Soil	100	241-TX/YY Tank Farm (200 West Area)	02/13/03	⁶⁰ Co	<1.8E-01	
					^{89,90} Sr	<1.9E-01 ± 1.4E+02	
					¹³⁴ Cs	<1.4E-01	
					¹³⁷ Cs	<3.0E+03 ± 2.3E-01	
					¹⁵² Eu	<3.4E+00	
					¹⁵⁴ Eu	<4.6E-01	
					¹⁵⁵ Eu	<4.2E+00	
					Total U ^c	<1.0E+03	
					²³⁸ Pu	<4.2E-01 ± 1.0E+02	
					^{239,240} Pu	<5.9E-01 ± 1.4E+02	

Table 7-1. Investigative Sample Results, 2003. (cont)

Number	Matrix	Sample			Isotope	Result ^a	Analytical (pCi/g) ^b ± Uncertainty
		TSN	Location	Date			
6914	Mouse	180360	105-KE RM Office (100-K Area)	06/13/03	⁶⁰ Co	<1.1E+00	
					^{89,90} Sr	1.00E+02 ± 4.2E+00	
					¹³⁴ Cs	<9.1E-01	
					¹³⁷ Cs	3.70E+01 ± 5.1E+00	
					¹⁵² Eu	<2.0E+00	
					¹⁵⁴ Eu	<3.0E+00	
					¹⁵⁵ Eu	<2.7E+00	
					Total U ^c	<6.0E+02	
					²³⁸ Pu	<2.3E+00 ± 9.6E+00	
					^{239,240} Pu	<2.1E+00 ± 6.2E+00	
6915	Starling Carcass	179637	317 Building Stair Well (300 Area)	06/13/03	⁶⁰ Co	2.2E+00 ± 9.2E+00	
					^{89,90} Sr	3.2E+01 ± 7.3E+00	
					¹³⁴ Cs	3.5E+00 ± 7.8E+00	
					¹³⁷ Cs	1.6E+03 ± 2.5E-01	
					¹⁵² Eu	<1.6E+00	
					¹⁵⁴ Eu	<5.8E-01	
					¹⁵⁵ Eu	<2.0E+00	
					Total U ^c	<5.2E+02	
					²³⁸ Pu	<9.7E-01 ± 1.1E+01	
					^{239,240} Pu	<5.5E-01 ± 1.4E+01	
6916	House Mouse	180360	105-KE (100-K Area)	08/05/03	⁶⁰ Co	<1.0E+00	
					^{89,90} Sr	7.6E+00 ± 4.1E+00	
					¹³⁴ Cs	<9.8E-01	
					¹³⁷ Cs	2.0E+02 ± 2.1E+01	
					¹⁵² Eu	<1.9E+00	
					¹⁵⁴ Eu	<2.8E+00	
					¹⁵⁵ Eu	<1.5E+00	
					Total U ^c	<7.3E+02	
					²³⁸ Pu	<1.7E+00 ± 1.0E+02	
					^{239,240} Pu	<1.3E+00 ± 7.1E+00	

Table 7-1. Investigative Sample Results, 2003. (cont)

Number	Matrix	Sample		Date	Isotope	Result ^a	Analytical
		TSN	Location			(pCi/gm) ^b ±	Uncertainty
6917	Cotton Tail Rabbit Skin	180126	272-S Paint Shop (200 West Area)	08/05/03	⁶⁰ Co	<1.7E-01	
					^{89,90} Sr	2.3E+02 ± 1.5E+00	
					¹³⁴ Cs	<8.2E-01	
					¹³⁷ Cs	1.3E+03 ± 4.3E-01	
					¹⁵² Eu	<2.0E+00	
					¹⁵⁴ Eu	<1.2E+00	
					¹⁵⁵ Eu	<1.5E+00	
					Total U ^c	<8.0E+02	
					²³⁸ Pu	<3.9E-01 ± 1.0E+02	
					^{239,240} Pu	<2.0E-01 ± 1.5E+01	
6918	Cotton Tail Rabbit Bone	180126	272-S Paint Shop (200 West Area)	08/05/03	⁶⁰ Co	<9.1E-01	
					^{89,90} Sr	3.1E+03 ± 5.4E-01	
					¹³⁴ Cs	<1.4E+00	
					¹³⁷ Cs	1.4E+00 ± 7.3E-01	
					¹⁵² Eu	<303E+00	
					¹⁵⁴ Eu	<2.9E+00	
					¹⁵⁵ Eu	<2.6E+00	
					Total U ^c	<1.2E+03	
					²³⁸ Pu	<8.7E-01 ± 1.0E+02	
					^{239,240} Pu	<4.4E-01 ± 1.0E+02	
6919	Cotton Tail Rabbit GI Tract	180126	272-S Paint Shop (200 West Area)	08/05/03	⁶⁰ Co	<2.2E-01	
					^{89,90} Sr	2.7E+01 ± 6.1E+00	
					¹³⁴ Cs	<6.8E-01	
					¹³⁷ Cs	1.2E+03 ± 3.8E-01	
					¹⁵² Eu	<1.6E+00	
					¹⁵⁴ Eu	<5.2E-01	
					¹⁵⁵ Eu	<1.2E+00	
					Total U ^c	<6.6E+02	
					²³⁸ Pu	<3.0E-01 ± 1.0E+02	
					^{239,240} Pu	<1.7E-01 ± 1.0E+02	

Table 7-1. Investigative Sample Results, 2003. (cont)

Number	Matrix	Sample		Date	Isotope	Result ^a	Analytical
		TSN	Location			(pCi/L) ^d	± Uncertainty
6920	Cotton Tail Rabbit Muscle	180126	272-S Paint Shop (200 West Area)	08/05/03	⁶⁰ Co	<2.2E-01	
					^{89,90} Sr	6.3E+01 ± 1.9E+00	
					¹³⁴ Cs	<9.4E-01	
					¹³⁷ Cs	2.2E+03 ± 2.9E-01	
					¹⁵² Eu	<2.3E+00	
					¹⁵⁴ Eu	<5.9E-01	
					¹⁵⁵ Eu	<1.6E+00	
					Total U ^c	<9.1E+02	
					²³⁸ Pu	<4.0E-01 ± 1.0E+02	
					^{239,240} Pu	<2.6E-01 ± 1.0E+02	

^aA "<" symbol indicates that the analyte was analyzed for but not detected. Uncertainty values were not reported by the laboratory for all results.

^bTo convert to international metric system units (SI), multiply pCi/g by 0.03704 to obtain Bq/g.

^cTotal uranium concentrations are reported by the laboratory in units of ug/g. These results have been converted to pCi/g using a specific activity of 9.6E+05 pCi/g for total uranium.

^dTo convert to international metric system units (SI), multiply pCi/L by 0.03704 to obtain Bq/L.

Table 7-2. Investigative Samples Not Analyzed, 2003.

Date	Sample matrix	Location	Field reading (Beta/Gamma)
02/10/03	Speck in soil	West of 241-U tank farm perimeter	199,000dpm/100cm ²
02/19/03	Soil	200-W-92 West of 241-TX/TY	750,000dpm/100cm ²
02/21/03	Spot on ground	RBA South of 221-B Plant	11,000dpm/100cm ²
03/03/03	Soil between RR Tracks	200-W-83	200,000dpm/100cm ²
03/06/03	Soil	216-B-3A Pond SCA/CA Area	2,500dpm/100cm ²
03/07/03	Rabbit Feces	200-W-54	10,000dpm/100cm ²
03/10/03	Speck in soil	West of 241-C Tank Farm	60,000dpm/100cm ²
03/18/03	Choker	6290 Crane & Rigging Facility	30,000dpm/100cm ²
03/24/03	Speck	241-C Tank Farm Perimeter	400,000dpm/100cm ²
03/25/03	Speck	241-AX Tank Farm Perimeter	80,000dpm/100cm ²
03/31/03	8-Tumbleweeds	216-A-34 Crib	36,000dpm/100cm ²
04/08/03	Scaffold Knuckle	300 Area Laydown Yard	10,000dpm/100cm ²
04/16/03	Concrete Pad	219-S TSD	440,000dpm/100cm ²
04/17/03	Tumbleweed	241-B Tank Farm Perimeter	990,000dpm/100cm ²
04/21/03	Electrical Wire	2101-M Laydown Yard	1,204dpm/100cm ² Alpha
04/29/03	Soil Speck	NW Corner 241-TX/TY Tank Farm Fence	199,000dpm/100cm ²
05/06/03	8-Tumbleweeds	216-B-3 Pond	24,000dpm/100cm ²
05/13/03	Soil	Outside of the posted 200-E-121UPR	14,000dpm/100cm ²
05/14/03	Soil	Outside the posted 200-W-091	30,000dpm/100cm ²
05/21/03	Tumbleweeds/Grass	218-E-12A Burial Ground	114,000dpm/100cm ²
05/28/03	Speck	South East Corner 241-A Tank Farm	11,000dpm/100cm ²
06/13/03	Specks	West side of the 241-B Tank Farm	90,000dpm/100cm ²
06/26/03	Mud Dauber Wasp Nest	Counting Booth at the 105-H Reactor Building	1,200,000 dpm/100cm ²
07/08/03	Rocks/Soil	100-H Fuel Storage Basin	2,000,000dpm/100cm ²
07/09/03	Soil Specks	200-E-122	200,000dpm/100cm ²
07/14/03	Mud Dauber Wasp Nest	Counting Booth at the 105-H Reactor Building	440,000 dpm/100cm ²
07/14/03	Mud Dauber Wasp Nest	Counting Booth at the 105-H Reactor Building	1,300 dpm/100cm ² alpha
07/16/03	Specks	West side of 241-B Tank Farm	100,000dpm/100cm ²
07/23/03	Specks	North side of 241-S Tank Farm	300,000dpm/100cm ²
07/23/03	Specks	Near the 272-S Maintenance Shop	400,000dpm/100cm ²
08/05/03	Mud Dauber Wasp Nest	Inside Air Monitoring Dog House @ 1325-N	>2,000 dpm/100cm ²
08/08/03	Rabbit Feces	272-S RMA	100,000dpm/100cm ²
08/08/03	Base of Rabbit Brush/Soil	272-S RMA	240,000dpm/100cm ²
08/08/03	Speck	Near the 241-SX Tank Farm	90,000dpm/100cm ²
08/08/03	Mud Dauber Wasp Nests	105-H Drinking Water Station	200,000dpm/100cm ²
08/11/03	Speck	241-ER-151Perimeter	350,000dpm/100cm ²
08/11/03	Mud Dauber Wasp Nests	105-H Power Poles & Chemical Storage Cabinet	270,000dpm/100cm ²
08/12/03	Mud Dauber Wasp Nests	1143 Maintenance Build. Generator	260,000dpm/100cm ²
08/13/03	Mud Dauber Wasp Nests	Outside the 105-H D&D Perimeter Fence	800,000dpm/100cm ²
08/13/03	Bird Feces	Outside the 105-H D&D Perimeter Fence	800,000dpm/100cm ²
08/13/03	Mud Dauber Wasp Nests	1713-H Warehouse Building	560,000dpm/100cm ²
08/18/03	Mud Dauber Wasp Nests	126-H-2 (105-H Clear Well)	1,200,000dpm/100cm ²
08/18/03	Tumbleweed Fragments	inside posted CA @ 200-E-121	900,000dpm/100cm ²
08/19/03	Mud Dauber Wasp Nests	1713-H Warehouse Parking Area RR Ties	399,000dpm/100cm ²
08/20/03	Owl Pellet	Outside the 105-H Fuel Storage Basins	57,900dpm/100cm ²
08/20/03	Tumbleweed	Outside the 241-B Tank Farm	1,200,000dpm/100cm ²
08/21/03	Soil & Tumbleweed Fragments	200-E-132 outside 241-BX/BY	3,600,000dpm/100cm ²
08/21/03	Mud Dauber Wasp Nests	Power poles approx. 1/2 m. west of 1713-H	106,000dpm/100cm ²

Table 7-2. Investigative Samples Not Analyzed, 2003. (cont)

Date	Sample Matrix	Location	Field reading (Beta/Gamma)
08/28/03	Speck	East Perimeter of 241-S	800,000dpm/100cm ²
08/28/03	Mud Dauber Wasp Nest	Power Poles east of 1713-H	114,000dpm/100cm ²
09/02/03	Mud Dauber Nest	Power pole #130 west of 1713-H	32,500dpm/100cm ²
09/02/03	Speck	241-ER-151 Perimeter	450,000dpm/100cm ²
09/03/03	Specks in soil	North stairs of the 1713-H Warehouse Building	199,000dpm/100cm ²
09/03/03	Soil	Around perimeter of UPR-200-E-78	600,000dpm/100cm ²
09/03/03	3-Soil Specks	241-BX-155 Diversion Box	>1,000,000dpm/100cm ²
09/04/03	Tumbleweed	South of the 241-B Diversion Box	60,000dpm/100cm ²
09/05/03	Fence Post (wasp nests)	West of the 1713-H Warehouse	200,000dpm/100cm ²
09/10/03	Tumbleweed	Northeast of 241-U (UN-216-W-35)	120,000dpm/100cm ²
09/11/03	Stainless Steel Canister	126-B-3 Coal Pit	100,000dpm/100cm ²
09/16/03	Tumbleweed Fragment	North Fenceline of 241-SY Tank Farm	70,000dpm/100cm ²
09/17/03	Tumbleweed	Northeast of 241-C (UN-216-E-115)	6,000dpm/100cm ²
09/22/03	Speck	inside 244-A lift station perimeter	400,000dpm/100cm ²
09/22/03	(6) Mud Dauber Nests	105-H south of 116-H-1	280,000dpm/100cm ²
10/03/03	(21) Mud Dauber Nests	105-H south of 116-H-1	540,000dpm/100cm ²
10/03/03	Tumbleweeds	216-U-10 Pond	60,000dpm/100cm ²
10/14/03	Tumbleweed Fragments	6290 Riggers Loft	220,000dpm/100cm ²
10/15/03	Starling Carcass	B-Cell inside of 327 Building	100,000dpm/100cm ²
10/21/03	Tumbleweeds	TC-4 Rail Road Spur UPR-200-E-43	30,000dpm/100cm ²
10/21/03	Tumbleweed Fragment	Old 200-E Burn Pit 200-E-53	60,000dpm/100cm ²
10/28/03	Rabbit Brush/Tumbleweeds	200-E-139 (CA north of 241-C)	18,000dpm/100cm ²
10/29/03	Specks	241-C Tank Farm Perimeter	400,000dpm/100cm ²
10/29/03	Choker	MO-235 Crane & Rigging Facility	240,000dpm/100cm ²
10/30/03	Tumbleweeds	216-U-10 Pond	60,000dpm/100cm ²
10/31/03	Tumbleweeds	216-U-10 Pond	96,000dpm/100cm ²
11/03/03	Tumbleweeds	East Side of 200-E-121	85,000dpm/100cm ²
11/03/03	Tumbleweeds	216-U-10 Pond	96,000dpm/100cm ²
11/04/03	Tumbleweeds	216-U-10 Pond	60,000dpm/100cm ²
11/04/03	Mud Dauber Nests	Well 199-H3-2A, 105-H area	349,000dpm/100cm ²
11/05/03	Tumbleweeds	216-U-10 Pond	60,000dpm/100cm ²
11/11/03	Tumbleweeds	216-T-21 Trench	240,000dpm/100cm ²
11/11/03	Tumbleweeds	241-A Tank Farm Perimeter	21,500dpm/100cm ²
11/11/03	Tumbleweeds	241-BY Tank Farm Perimeter	60,000dpm/100cm ²
11/12/03	Tumbleweeds	216-Z-5 Trench	42,000dpm/100cm ²
11/12/03	Mud Dauber Wasp Nest	Well 1-N-125 south of the 1304-N Dump Tank	156,000dpm/PA
11/17/03	Tumbleweeds	North East perimeter of 218-E-12B	800,000dpm/100cm ²
11/19/03	Tumbleweed Fragments	Eastern Fenceline 241-SX/SY	99,000dpm/100cm ²
11/19/03	Tumbleweeds	216-U-10 Pond	96,000dpm/100cm ²
11/20/03	Tumbleweeds	UPR-600-20 Cross Site Transfer Line	24,000dpm/100cm ²
12/04/03	Tumbleweeds	East of 241-A & West of 216-A-8 Crib	30,000dpm/100cm ²
12/16/03	Soil	North of 241-SX/SY by 242-S	80,000dpm/100cm ²

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