

7.0 INVESTIGATIVE SAMPLING

Examples of investigative samples collected in 2002 included soil, vegetation, animals, animal feces, and water. Investigative samples were collected where known or suspected radioactive contamination was present, or to verify radiological conditions at project sites. Samples were analyzed for radionuclides at either the 222-S Laboratory in the 200 West Area of the Hanford Site or at the Severn Trent Laboratories in Richland, Washington. Analytical results are provided in Table 7-1. Another 55 contaminated environmental samples were collected and disposed without isotopic analyses (although field instrument readings were recorded) during clean-up operations. These results are provided in Table 7-2.

7.1 SOIL

In 2002, there were 22 instances of radiological contamination in which soil was identified as the carrier of contamination. None of these soil samples were submitted to the laboratory for radioisotopic analysis. Of these, 16 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 2,000 disintegration's per minute [dpm]/100 cm²) to greater than 200 mR/hr. 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 2002 were generally within historical ranges.

7.2 VEGETATION

In 2002, there were 16 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. One contaminated vegetation instance had field readings in excess of one million dpm/100 cm². The radioactivity levels and range of radionuclide concentrations were all within historical ranges.

The reduced number of incidents from 31 in 2001 to 16 in 2002 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 2002, the numbers of animals found to be contaminated with radioactivity, the radioactivity levels, and the range of radionuclide concentrations were within historical ranges.

In 2002, four instances of animals, or animal-related contamination were identified and from these, nine samples were submitted to the laboratory for analysis.

- In February 2002, a contaminated starling carcass was found in the ductwork in the 222-S Facility. Contaminants included cesium-137 and strontium-89/90.
- In March 2002, a feral canine that had been seen entering several radiologically controlled waste sites was captured at the 100-N Area. Contaminants included strontium-89/90 and uranium.
- In August 2002, near the 212-R Metal Storage Building railroad siding in the 200 North Area, a contaminated bushy tailed wood rat and its nest were discovered in a regulated Manitowoc Crane. Significant levels of cesium-137 and strontium-89/90 were measured in the wood rat samples. No samples from the nest were collected. The wood rat samples represented the highest radionuclide concentrations observed in investigative wildlife samples in 2002.
- In December 2002, the regulated Manitowoc Crane, was moved to the 218-W-3AE Burial Ground to off load incoming waste for disposal. While stored in the adjacent radiological materials storage area, feces from the contaminated wood rat were discovered. The feces were submitted for laboratory analysis and the contaminants found included strontium-89/90 and cesium-137.

7.4 WATER

Also in August 2002, while investigating the source of contamination for the wood rat, standing water was discovered in a cut off pipe at the abandoned 212-R Pump House. Although no contamination was evident in the water using field instruments, the laboratory gamma energy analysis of the sample revealed a measurable level of cesium-137.

7.5 SPECIAL CHARACTERIZATION SAMPLING

Special characterization projects were conducted in 2002 to ascertain the radiological status, and in some cases, the physical properties of site-specific operations and included the following:

- Deep-rooted vegetation, Big Sagebrush, and Rabbitbrush were collected on top of and along the perimeter of the SALDS located north of the 200 West Area to determine the concentrations of tritium being transported through the plant medium. The laboratory results from the three samples collected and analyzed for this sampling activity can be found in Table 7-1.

- 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 survey is being conducted on the proposed location for the Remote-Handled Immobilized Low-Activity Waste Disposal Facility in the 200 East Area. Tasks completed in 2002 included ground penetrating radar surveys and surface and subsurface soil sampling to a depth of 15 m (50 ft) at three locations located within the footprint of Disposal Trench 1. 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 scheduled for publication in 2005.

Table 7-1. Investigative Sample Results, 2002.

Number	Sample			Isotope	Result ^a	Analytical
	Matrix	Location	Date		(pCi/Sample) ^b ±	Uncertainty
6896	Starling Carcass	222-S Room S3-C Duct Works	02/20/02	⁶⁰ Co	<1.2E+01	
				^{89,90} Sr	4.2E+01 ± 2.0E+00	
				¹³⁴ Cs	<1.0E+01	
				¹³⁷ Cs	1.0E+02 ± 1.7E+01	
				¹⁵² Eu	<2.6E+01	
				¹⁵⁴ Eu	<3.9E+01	
				¹⁵⁵ Eu	<3.6E+01	
				Total U ^c	<7.4E+02	
				²³⁸ Pu	<4.9E+00 ± 1.0E+02	
				^{239,240} Pu	<1.16E+05	
6897	Canine Intestinal Tract	100-N Area	03/02/02	⁶⁰ Co	<1.3E-02	
				^{89,90} Sr	3.5E+02	
				¹³⁴ Cs	<1.1E-02	
				¹³⁷ Cs	<2.4E-02	
				¹⁵² Eu	<2.7E-02	
				¹⁵⁴ Eu	<3.9E-02	
				¹⁵⁵ Eu	<3.9E-02	
				Total U ^c	7.9E+00	
				²³⁸ Pu	<1.6E-02 ± 1.0E+02	
				^{239,240} Pu	<1.2E+02	
6898	Canine Leg	100-N Area	03/02/02	⁶⁰ Co	<1.6E-01	
				^{89,90} Sr	<3.6E-01 ± 8.8E+01	
				¹³⁴ Cs	<1.4E-01	
				¹³⁷ Cs	<2.5E-01	
				¹⁵² Eu	<3.5E-01	
				¹⁵⁴ Eu	<4.7E-01	
				¹⁵⁵ Eu	<4.9E-01	
				Total U ^c	<1.0E+02	
				²³⁸ Pu	<2.2E-01 ± 1.3E+01	
				^{239,240} Pu	<1.6E+03	
6899	Canine Liver	100-N Area	03/02/02	⁶⁰ Co	<2.0E-02	
				^{89,90} Sr	<2.1E-02 ± 4.3E+02	
				¹³⁴ Cs	<1.6E-02	
				¹³⁷ Cs	<2.9E-02	
				¹⁵² Eu	<4.1E-2	
				¹⁵⁴ Eu	<5.8E-02	
				¹⁵⁵ Eu	<5.8E-02	
				Total U ^c	<1.2E+01	
				²³⁸ Pu	<2.1E-02 ± 1.3E+01	
				^{239,240} Pu	<1.9E+02	

Table 7-1. Investigative Sample Results, 2002. (cont)

Number	Sample			Isotope	Result ^a	Analytical
	Matrix	Location	Date		(pCi/gm) ^b	± Uncertainty
6901	Vegetation	600 Area SALDS	07/23/02	³ H	9.7E-01 ± 1.7E-01	
6902	Vegetation	600 Area SALDS	07/23/02	³ H	6.5E-01 ± 4.3E-01	
6903	Vegetation	600 Area SALDS	07/23/02	³ H	<1.3E-01 ± 9.7E-02	
6904	Bushy Tailed Wood Rat Intestinal Tract	212-R (Manitowac Crane)	08/08/02	⁶⁰ Co	1.9E+01 ± 6.7E+00	
				^{89,90} Sr	9.0E+01 ± 1.8E+01	
				¹³⁴ Cs	<6.1E+00	
				¹³⁷ Cs	1.4E+04 ± 2.5E-01	
				¹⁵² Eu	<1.8E+01	
				¹⁵⁴ Eu	<2.9E+00	
				¹⁵⁵ Eu	<2.1E+01	
				Total U ^c	<5.1E+03	
				²³⁸ Pu	<3.7E-01 ± 1.0E+02	
				^{239,240} Pu	<7.9E+00	
6905	Bushy Tailed Wood Rat Muscle	212-R (Manitowac Crane)	08/08/02	⁶⁰ Co	<4.7E-01	
				^{89,90} Sr	1.7E+03 ± 1.7E+00	
				¹³⁴ Cs	<4.0E+00	
				¹³⁷ Cs	1.9E+04 ± 1.3E-01	
				¹⁵² Eu	<1.2E+01	
				¹⁵⁴ Eu	<1.7E+00	
				¹⁵⁵ Eu	<1.4E+01	
				Total U ^c	<3.4E+03	
				²³⁸ Pu	<1.1E-01 ± 1.0E+02	
				^{239,240} Pu	<5.2E+04	
6906	Bushy Tailed Wood Rat Bone	212-R (Manitowac Crane)	08/08/02	⁶⁰ Co	<1.2E+00	
				^{89,90} Sr	8.9E+03 ± 1.5E+00	
				¹³⁴ Cs	<6.6E+00	
				¹³⁷ Cs	1.4E+04 ± 2.7E-01	
				¹⁵² Eu	<1.9E+01	
				¹⁵⁴ Eu	<3.5E+00	
				¹⁵⁵ Eu	<2.4E+01	
				Total U ^c	<5.6E+03	
				²³⁸ Pu	<4.0E-01 ± 1.0E+02	
				^{239,240} Pu	<8.6E+04	

Table 7-1. Investigative Sample Results, 2002. (cont)

Number	Sample		Date	Isotope	Result ^a	Analytical
	Matrix	Location			(pCi/gm) ^b	± Uncertainty
6907	Bushy Tailed Wood Rat Fur/Skin	212-R (Manitowac Crane)	08/08/02	⁶⁰ Co	3.9E+01 ± 4.5E+00	
				^{89,90} Sr	4.6E+03 ± 1.9E+00	
				¹³⁴ Cs	<7.2E+00	
				¹³⁷ Cs	1.9E+04 ± 2.2E-01	
				¹⁵² Eu	<2.1E+01	
				¹⁵⁴ Eu	<3.6E+00	
				¹⁵⁵ Eu	<2.6E+01	
				Total U ^c	<6.1E-03	
				²³⁸ Pu	3.7E+00 ± 3.6E+00	
				^{239,240} Pu	<9.3E+04	
6908	Bushy Tailed Wood Rat Feces	212-R (Manitowac Crane)	08/08/02	⁶⁰ Co	<3.2E-01	
				^{89,90} Sr	2.3E+02 ± 2.2E+00	
				¹³⁴ Cs	<3.2E-01	
				¹³⁷ Cs	3.5E+01 ± 3.1E+00	
				¹⁵² Eu	<8.6E-01	
				¹⁵⁴ Eu	<8.8E-01	
				¹⁵⁵ Eu	<1.1E+00	
				Total U ^c	<2.3E+02	
				²³⁸ Pu	1.3E-01 ± 1.0E+02	
				^{239,240} Pu	<3.7E+03	
6909	Water	212-R Pump House	08/08/02	⁶⁰ Co	<1.2E+00	
				¹³⁴ Cs	<3.38E+00	
				¹³⁷ Cs	1.6E+01 ± 5.1E+01	
				¹⁵² Eu	<1.1E+00	
				¹⁵⁴ Eu	<4.8E+00	
				¹⁵⁵ Eu	<8.6E+00	

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

b - To convert to international metric system units (SI), multiply pCi/g by 0.03704 to obtain Bq/g.

c - Total 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.

d - To convert to international metric system units (SI), multiply pCi/L by 0.03704 to obtain Bq/L.

Table 7-2. Investigative Samples Not Analyzed, 2002.

Date	Sample Matrix	Location	Field Reading ^a
01/04/02	Concrete	105-KE Reactor Building	150,000dpm/100cm ²
01/07/02	Tumbleweed	URM Pipeline south of 16th	14,750dpm/100cm ²
01/11/02	Pavement	UPR-200-E-69	145,000dpm/100cm ²
01/21/02	Specks,T.W. Fragments, roofing, maslin cloth	100-F ISS Project Site	600,000dpm/probe area
01/25/02	Speck	East of 241-C Tank Farm	450,000dpm/100cm ²
01/28/02	Tumbleweed Fragments & Soil	Construction Forces Area East of 2201-B	40,000dpm/100cm ²
01/28/02	Soil	116-N-1 Trench	10,000dpm/probe area
02/04/02	Truck tail gate	209-E 90 Day Storage Area	200,000dpm/100cm ²
02/05/02	Tumbleweeds	UPR-600-20/UN-216-E-41	30,000dpm/100cm ²
02/22/02	Specks	116-N-1 Trench	10,000dpm/100cm ²
02/27/02	Soil	West of the 241-TX/TY Tank Farm	40,000dpm/100cm ²
03/13/02	Speck	Outside 105-F perimeter fence	56,000dpm/probe area
03/14/02	Speck	Outside 241-C Tank Farm perimeter fence	100,000dpm/probe area
03/20/02	Plastic	ERDF	58,450dpm/100cm ²
03/21/02	Speck	Outside 241-C Tank Farm perimeter fence	250,000dpm/100cm ²
03/27/02	Empty Waste Boxes	Central Waste Complex Staging Area	15,000dpm/100cm ²
03/28/02	Carpet and Specks	100-F ISS Project Site	60,000dpm/100cm ²
04/01/02	Tumbleweed Fragments	200-W-79 (URM Pipeline, 241-T-151 to 216-T-36)	50,000dpm/100cm ²
04/23/02	Steel Plate	1162 Shipping Facility	25,000dpm/100cm ²
04/24/02	Speck	241-BY Tank Farm	199,000dpm/100cm ²
05/13/02	Tehebrionid Beetle (Stink Bug)	Inside 235-SZ (PFP)	42,000dpm/100cm ² (alpha)
05/20/02	Speck	3730 Building	3,000dpm/100cm ²
05/29/02	Speck	100-B/C Pipeline RAP	772,000dpm/100cm ²
06/01/02	Tumbleweeds	LERF Fenceline	72,000dpm/100cm ²
06/04/02	Tumbleweed	URM Pipeline to 241-BX/BY	66,000dpm/100cm ²
06/05/02	Tumbleweed	LERF Transfer line from 242-A	1,800,000dpm/100cm ²
06/07/02	Tumbleweed	218-E-14 (PUREX Tunnel)	70,000dpm/100cm ²
06/19/02	Speck	Outside 241-B Tank Farm south Fence	99,000dpm/100cm ²
06/28/02	Plastic	ERDF	51,000dpm/100cm ²
07/22/02	Concrete	Rt. 4S & 11A Intersection	60,000dpm/100cm ²
07/28/02	Tumbleweed Fragment	241-AY	60,000dpm/100cm ²
08/01/02	Soil	Inside 200-E fenced area near 2255-EA	8,000dpm/100cm ²
08/01/02	Tumbleweed	URM Transfer Line west of U-Plant	60,000dpm/100cm ²
08/05/02	Soil	200-E-130	28,500dpm/100cm ²
08/06/02	Soil	183-K Outfall	149,000dpm/100cm ²
08/07/02	Soil	Outside posted URMA at 200-E-129	64,500dpm/100cm ²
08/15/02	Soil Speck	Outside perimeter of 241-BX	70,000dpm/100cm ²
09/05/02	Tumbleweeds	200-E-77(241-B-154 Diversion Box)	10,000dpm/100cm ²
09/20/02	Tumbleweeds	200-E-115 North fo 241-C	15,000dpm/100cm ²
10/02/02	House Fly	231-W-151 Diversion Box	3,000dpm/100cm ²
10/04/02	Bird	105-KW FTS Annex CTO Staging Area	2,500dpm/100cm ²
10/10/02	Speck	618-1 Burial Ground	2,000dpm/100cm ²
10/15/02	Speck	East of 241-AZ Tank Farm	100,000dpm/100cm ²
11/01/02	Tumbleweed	216-A-30 Crib	120,000dpm/100cm ²
11/08/02	Soil/Dust	100-NR-1(116-N-1 Crib)	200mR/hr

Table 7-2. Investigative Samples Not Analyzed, 2002. (cont)

Date	Sample Matrix	Location	Field Reading ^a
11/13/02	Tumbleweeds	241-BX/BY Tank Farm Perimeter	360,000dpm/100cm ²
11/13/02	Mouse	241-BX/BY Tank Farm Perimeter	60,000dpm/100cm ²
11/13/02	Mouse Bait Stations	241-BX/BY Tank Farm Perimeter	20,000dpm/100cm ²
11/13/02	Soil	241-BX/BY Tank Farm Perimeter	60,000dpm/100cm ²
11/15/02	Control Rod Button	North perimeter of 241-B Tank Farm	4,000dpm/100cm ²
11/18/02	Mouse Feces and Nest	Inside Truck Cab at 2713-W RCV/RMA area	30,000dpm/100cm ²
11/19/02	Mouse	Outside 241-BX Tank Farm	500,000dpm/100cm ²
11/25/02	Tumbleweed Fragments	Inside posted CA 241-B Tank Farm Perimeter	500,000dpm/100cm ²
12/12/02	Mouse Feces and Nest	HO-17-4005 Manitowoc Crane	600,000dpm/100cm ²
12/28/02	Speck	TC-4 Rail Spur	800,000dpm/100cm ²

a - Field readings listed are Beta/Gamma unless otherwise noted.

Field monitoring results are typically of two types: Alpha and Beta/Gamma.

Alpha values are obtained through the use of a portable alpha meter (PAM). PAM readings are displayed as counts per minute and are then converted to disintegrations per minute using an individual instrument's efficiency factor that is determined during the instrument's routine calibration.

Beta/Gamma values are obtained through the use of a Geiger-Müller (GM) detector. GM readings are expressed as disintegrations per minute (dpm) per probe area and the geometry of the source is not considered; or as millirad per hour (mrads/h) when an ion chamber is used. To obtain Beta/Gamma field instrument readings expressed as dpm/100cm², the measured background radioactivity is subtracted from the GM reading (in counts per minute) and converted to dpm by multiplying x 10 (an average conversion), and further converted to dpm per 100 cm² by multiplying x 6 (approximate number of probe areas in 100 cm²).