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Revision 83

Quarterly Environmental Radiological Survey Summary

Fourth Quarter Calendar Year 2011
100, 200, 300, and 600 Areas

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-09RL14728

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Richland, Washington 99352

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M. C. Dorsey
Mission Support Alliance

Date Published
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QUARTERLY ENVIRONMENTAL RADIOLOGICAL SURVEY SUMMARY FOURTH QUARTER CALENDAR YEAR 2011 – 100, 200, 300, AND 600 AREAS

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EXECUTIVE SUMMARY

This report provides a summary of the radiological surveys performed in support of near-facility environmental monitoring at the Hanford Site during the fourth quarter of calendar year (CY) 2011. The survey results and the status of actions required are summarized below:

- One hundred fifty two routine environmental radiological surveys scheduled during October, November, and December were performed as planned.

- Eighteen routine surveys were conducted at Mission Support Alliance, LLC (MSA) managed sites, eighty-eight at CH2M HILL Plateau Remediation Company (CHPRC) managed sites, forty six at Washington River Protection Solutions, LLC (WRPS) managed sites, and none at Washington Closure Hanford, LLC (WCH) managed sites. Surveys at WCH managed sites were completed prior to the current reporting period.

- Scheduled radiological surveys found contamination at four of the waste sites and non-scheduled surveys found contamination at one additional site. Contamination above background levels was found at three of the CHPRC sites, one of the WRPS sites, one of the WCH sites, and none of the MSA sites. Contamination levels were detected as high as 300,000 disintegrations per minute (dpm) per 100 cm^2 beta/gamma. Of these contaminated sites, four were in unposted areas and one was found in underground radioactive materials areas (URMAs). All of the contamination was removed for proper disposal to meet the requirements of MSC-5173, *MSC Radiological Control Manual*, CHPRC-00073, *CH2M HILL Plateau Remediation Company Radiological Control Manual*, and/or HNF-5183, *Tank Farms Radiological Control Manual.*

  Of the five contamination incidents discovered, one was caused by animal related material, four were caused by vegetation uptake, and none were soil/specks.

Since the last reporting period of CY 2011, 39 waste sites (300-80, 300-16:2, 300-24, 300-218, 100-K-77, 100-D-7, 1607-D5, 100-D-28:1, 118-H-1, 118-H-1:2, 300-258, 100-D-31:10, 100-D-31:8, 100-D31:9, 118-H-6:5, 600-151, 120-KW-3, 120-KW-4, 120-KW-1, 120-KW-2, 600-149, 600-149:1, 100-K-109, 300-48, 300-249, 300-28, 300-16:3, 300-43, 132-D-1, 300-276, 100-F-44:8, 100-F-56:1, UPR-100-F-3, 100-F-25, 100-F-49, 100-F-45, 100-F-47, 100-F-48, and 100-D-45) were interim closed.

Biological Control Program activity for the fourth quarter of CY 2011 includes:

- 364 hectares (900 acres) of Hanford land were treated with herbicides.

- 3.6 hectares (9 acres) of noxious weeds were treated with the application of herbicides in the fourth quarter of CY 2011.

- 638 pest control responses were conducted for Hanford Site facilities.

- 3406 animal control devices and bait stations were placed at Hanford operation areas and facilities.

- 20.5 non-regulated compactor truckloads of tumbleweeds were taken to the 200-W burn pit for disposal (one compactor truckload ≅ 11,000 ft^3 of uncompacted tumbleweeds).

- 4 regulated compactor truckloads of tumbleweeds were taken to the Environmental Restoration Disposal Facility (ERDF) for disposal. These tumbleweeds are collected from contamination areas (CAs). Most of them are not contaminated but have blown into the CA from clean areas and are required to be treated as though they were contaminated.

Below are the waste sites with values that are among the highest in each category. Rankings are based on levels and types of contamination, proximity to human occupied or utilized areas, and the history or potential to spread contamination. The prioritization system and rankings are described in Section 2.2 of this report.

TOP TEN PRIORITY RANKING FOR CONTAMINATED WASTE SITES

Waste Site	Custodian	Levels	Location	Mobility
200-E-109 200-E Fenceline	CHPRC	4	3	5
218-E-12B Burial Ground	CHPRC	4	3	5
218-E-12A Burial Ground	CHPRC	4	3	5
216-BC Cribs/Control Area	CHPRC	4	3	5
216-U-10 Pond	CHPRC	4	3	5
241-B Tank Farm	WRPS	5	1	5
241-SX/SY Tank Farm	WRPS	5	1	5
241-BX/BY Tank Farm	WRPS	4	2	5
241-C Tank Farm	WRPS	4	2	5
241-S Tank Farm	WRPS	4	2	5

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1.0 INTRODUCTION

Routine radiological surveys are an integral part of near-facility environmental monitoring for tracking facility and waste site status, and to aid in directing the reduction of the radiological areas at the Hanford Site. The River Corridor Contractor, Plateau Remediation Contractor, Tank Farm Operations Contractor, and the Mission Support Contractor Radiological Control Groups perform the routine radiological surveys.

The surveys are performed at inactive waste sites, outdoor radiological control areas, tank farm perimeters, diversion boxes, lift stations, vent stations, perimeters of active or uncovered waste sites (such as burial grounds, retention basins, ponds, process trenches, and ditches), underground pipelines, and road surfaces (see Figures 1 through 10).

This report summarizes the radiological surveys performed in support of near-facility environmental monitoring at the Hanford Site during the fourth quarter of calendar year (CY) 2011. The survey results and the status of actions required are also discussed.

Complete surveillance coverage was assured by completing a waste site survey schedule, HNF-SP-0098, *Environmental Monitoring Schedule, Calendar Year 2011*. Ecological Monitoring & Environmental Surveillance personnel working with the site Radiological Control Groups developed the schedule. Ecological Monitoring & Environmental Surveillance personnel review the radiological survey reports and enter the information into a data base for summarization in the site annual environmental report. Radiological conditions are tracked and trends noted for use by the facility managers and the landlords.

All known outdoor radioactive waste sites are surveyed at least once each year. Newly discovered radioactive waste sites/unplanned release sites are added to the schedule as necessary. The survey frequencies for particular sites are based on site history, radiological conditions, and general maintenance. Special surveys may be conducted at irregular frequencies if conditions warrant (i.e., growth of deep-rooted vegetation is noted at a waste site). Radiological surveys are conducted to detect surface contamination and document changes in vegetation growth, biological intrusion, erosion, and site maintenance conditions. Survey data are compared with standards identified in MSC-5173, *MSC Radiological Control Manual*, CHPRC-00073, *CH2M HILL Plateau Remediation Company Radiological Control Manual*, and/or HNF-5183, *Tank Farms Radiological Control Manual*, as well as previous surveys to determine trends, assess environmental impact, and allow determination of where corrective actions are needed.

The Occurrence Reporting System is used to track legacy radioactive contamination greater than ten times the total contamination values in Title 10 Code of Federal Regulations (CFR) Part 835, "Occupational Radiation Protection," Appendix D, and is found outside a posted Contamination Area (CA), High Contamination Area, Airborne Radioactivity Areas, Radiological Buffer Areas, and areas controlled in accordance with 10 CFR 835.1102(c).

These radiological surveys are conducted to determine surface radiological conditions and do not constitute a release survey. Therefore, surveys that detect no contamination in radiological areas do not release the site from control, but may result in a posting status change. Surveillance of the active nuclear facilities and the areas inside the tank farm fences is the responsibility of the individual facility landlord.

Figure 1. 100-B/C Area.

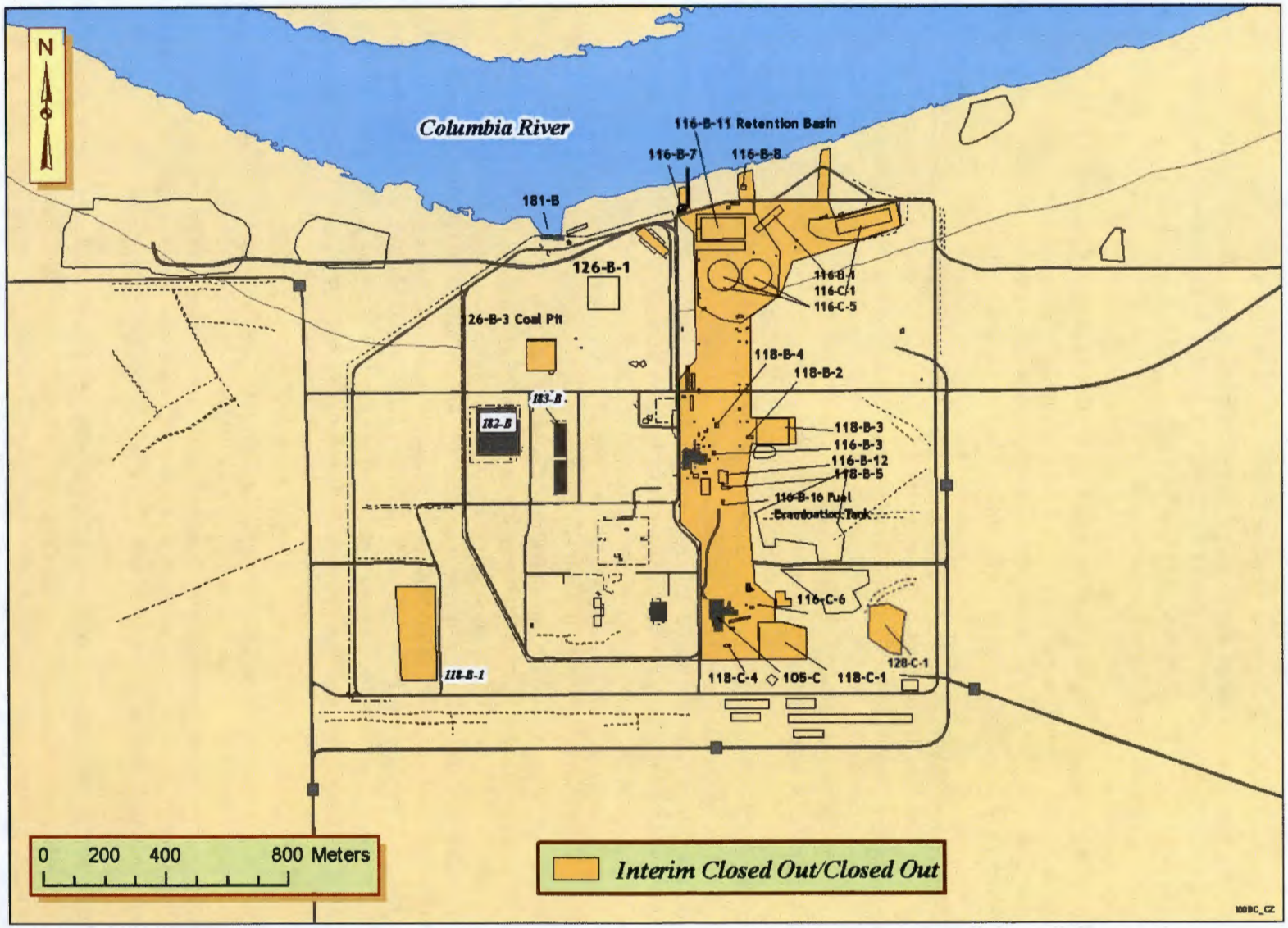


Figure 2. 100-D/DR Area.

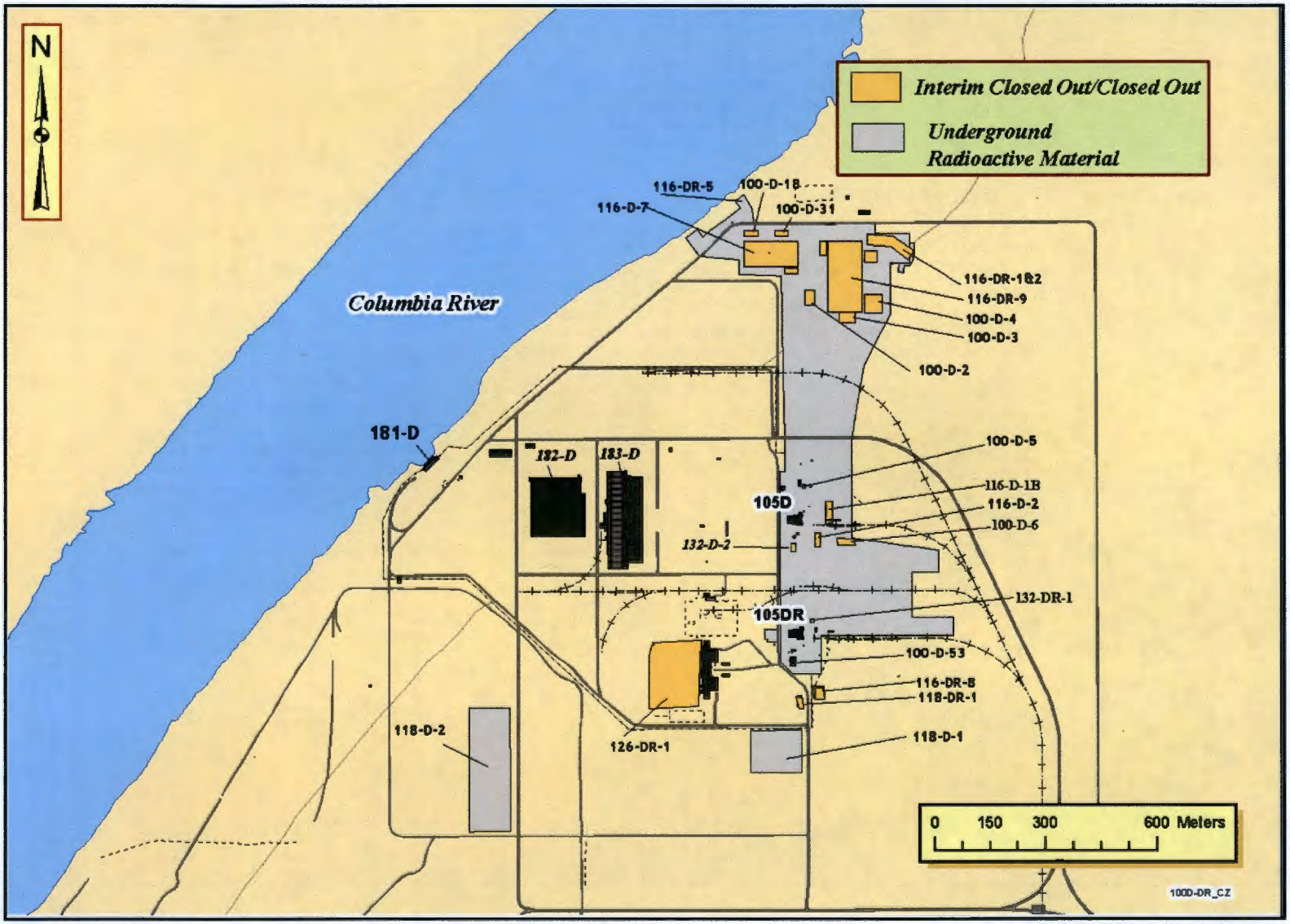


Figure 3. 100-F Area.

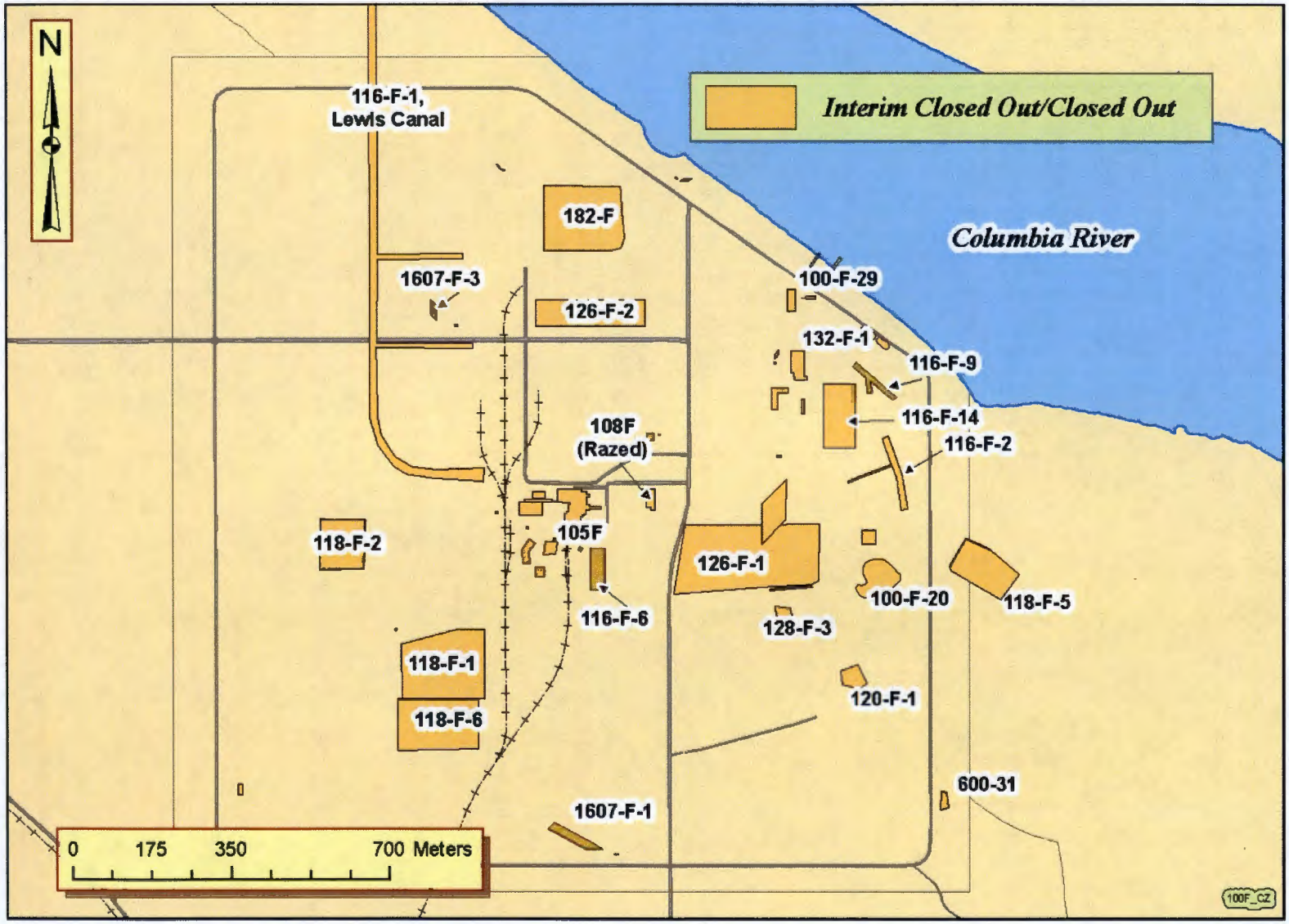


Figure 4. 100-H Area.

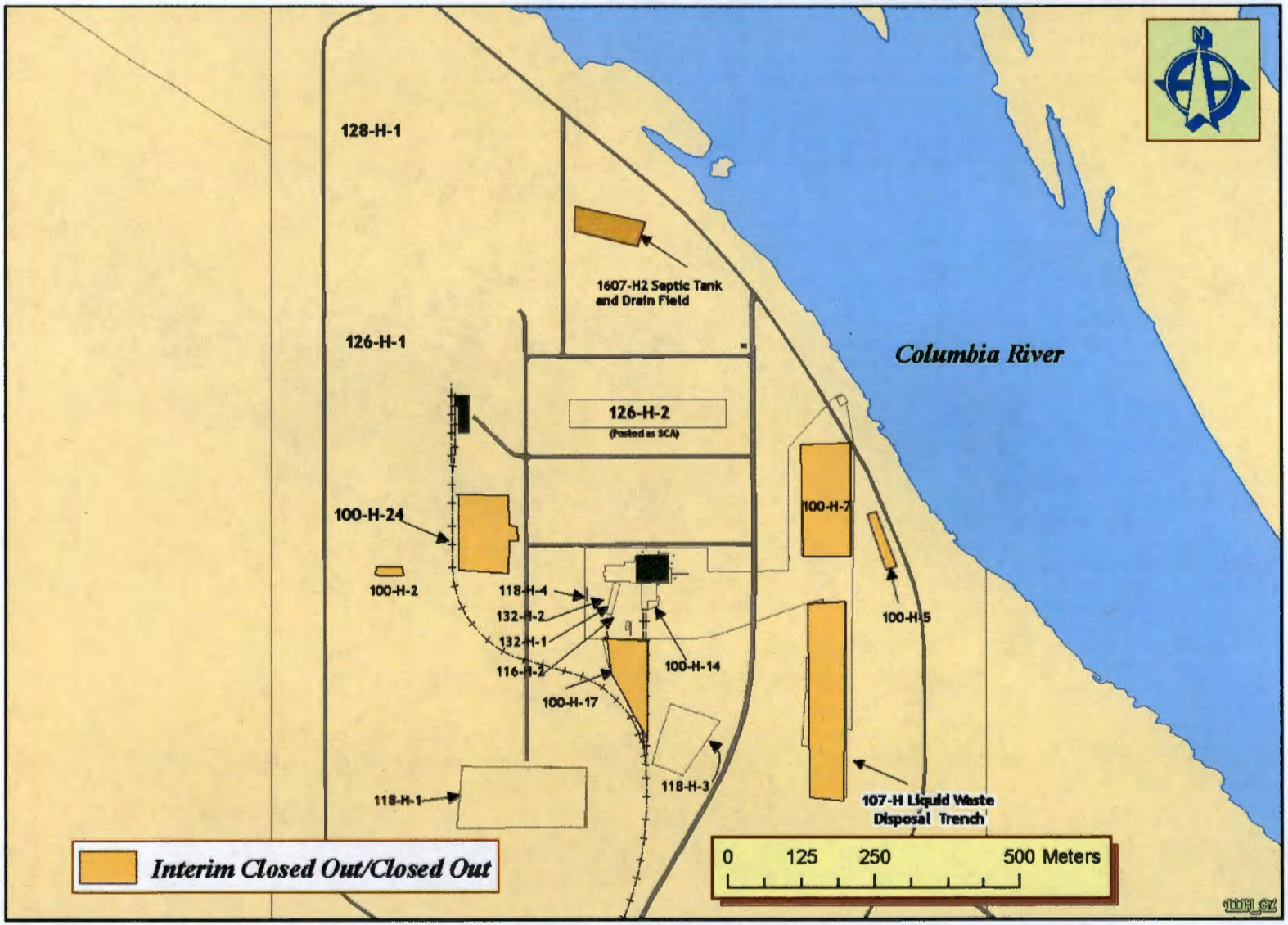


Figure 5. 100-K Area.

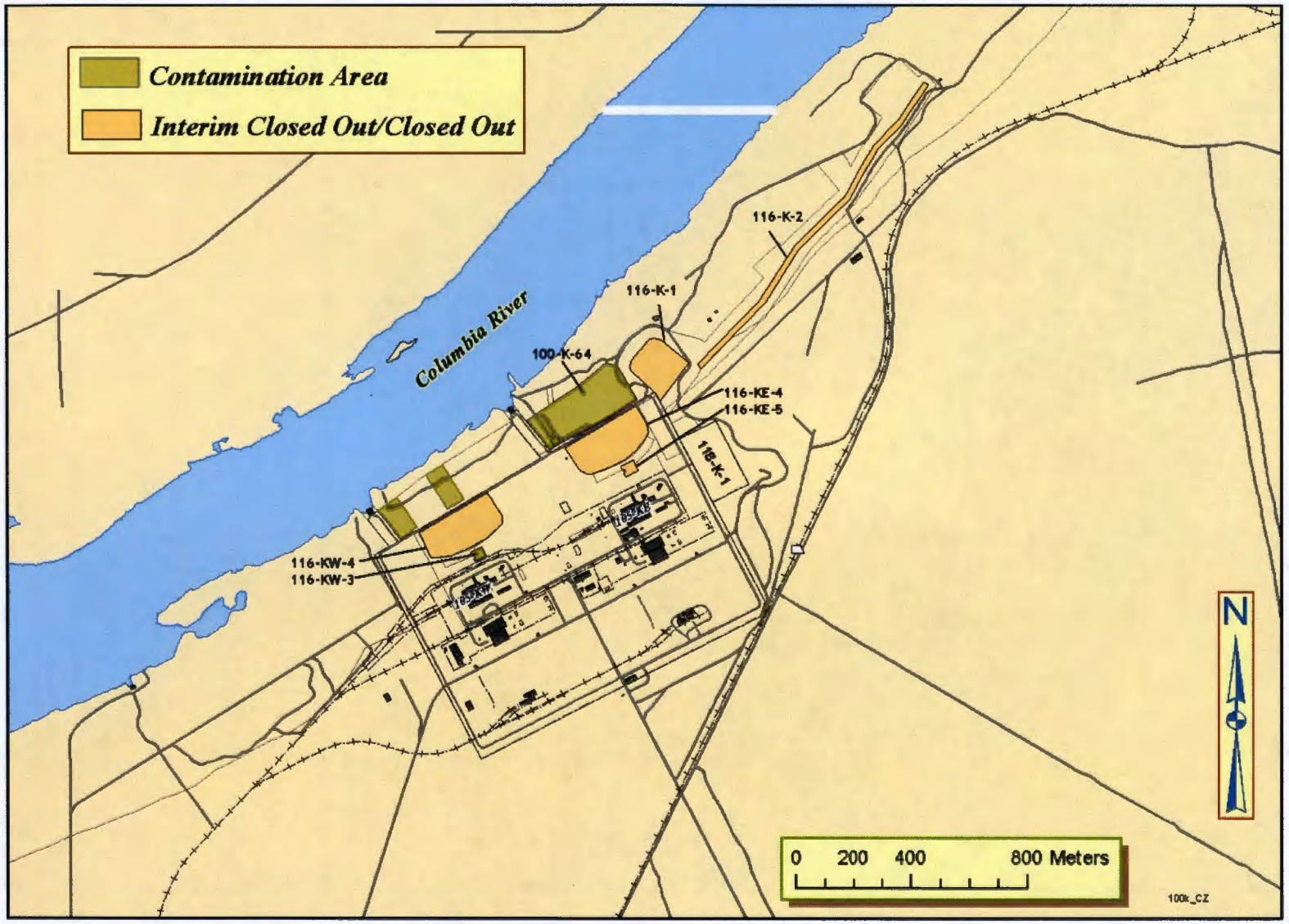


Figure 6. 100-N Area.

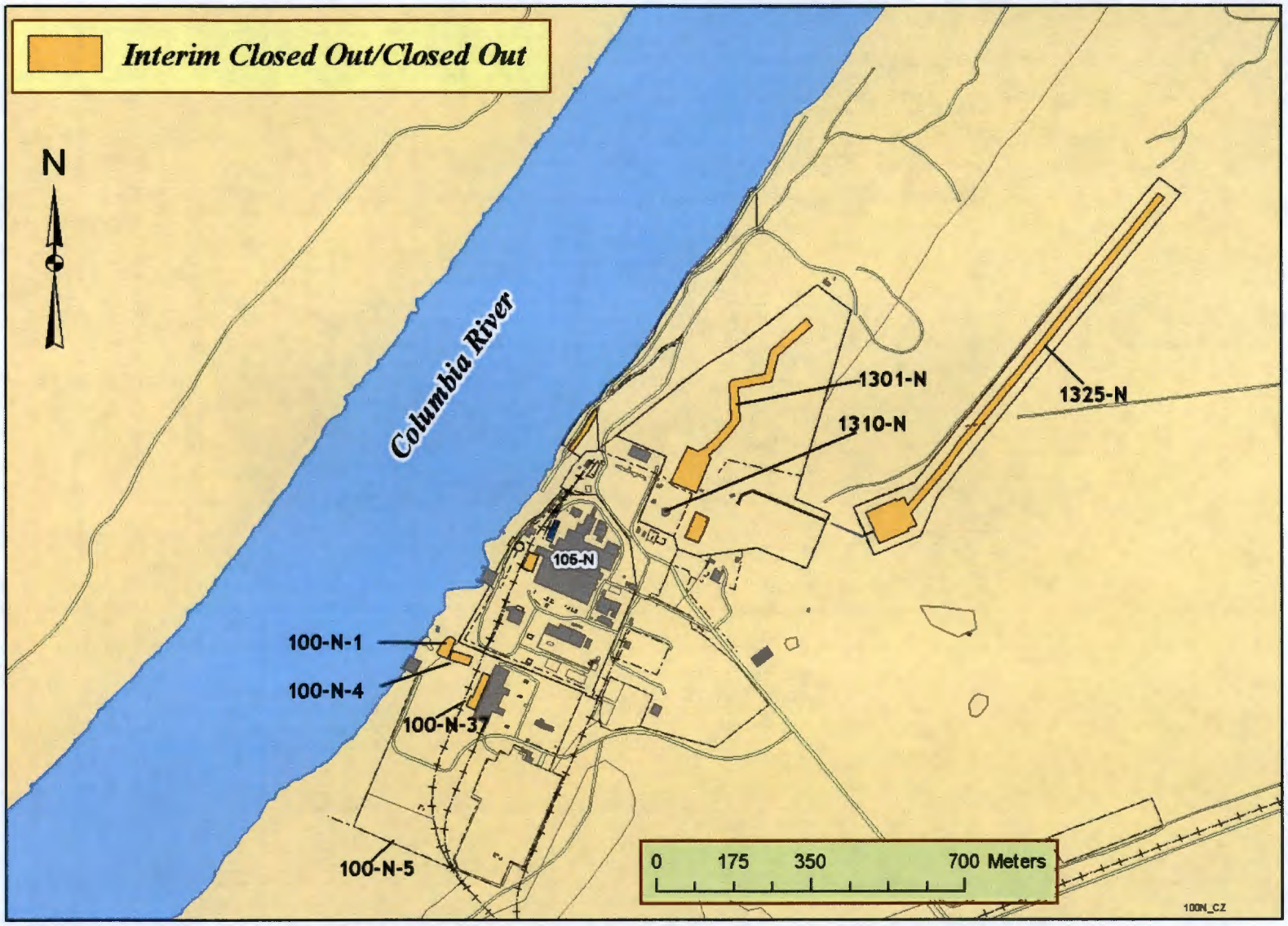


Figure 7. 200 East Area.

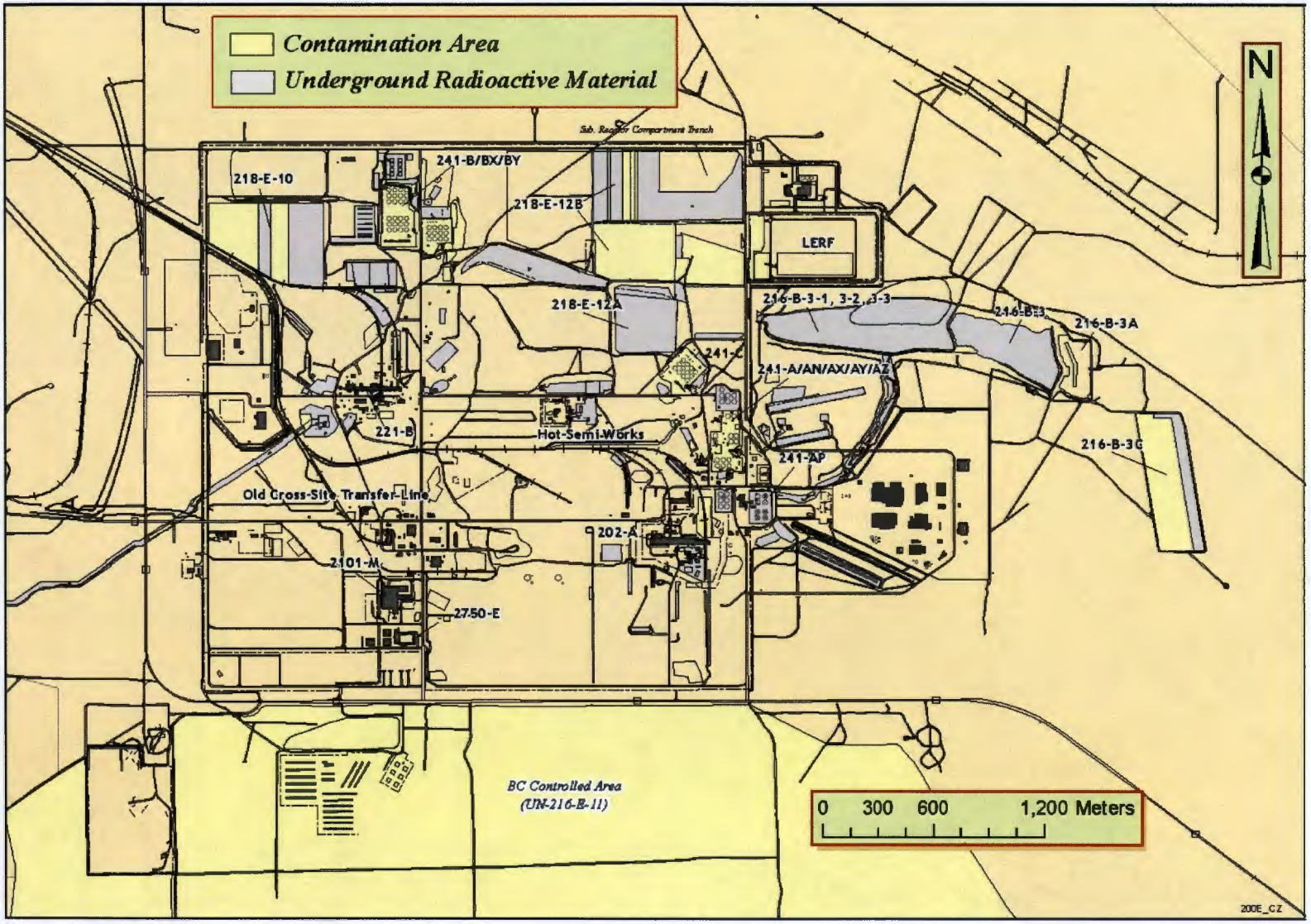


Figure 8. 200 West Area.

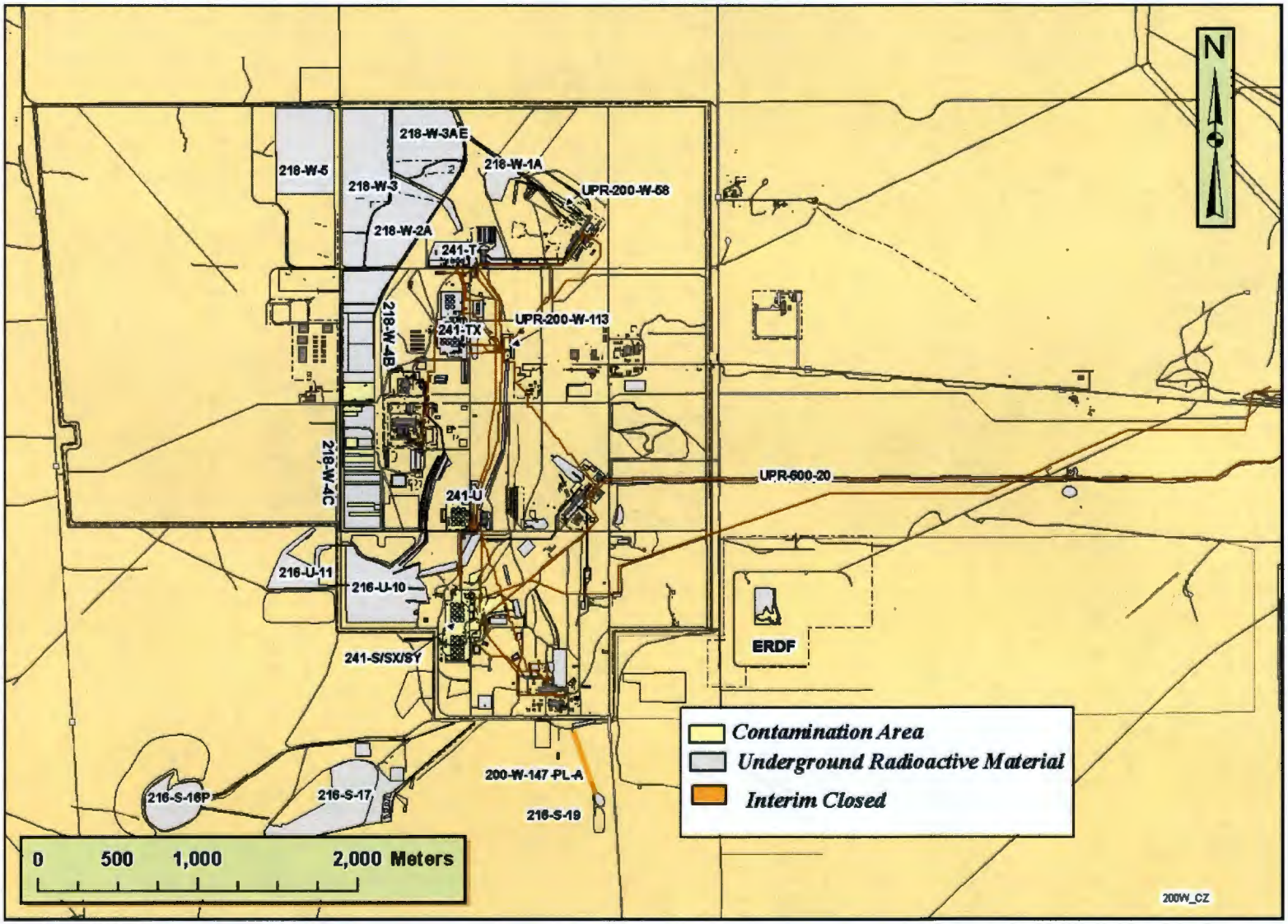


Figure 9. 300 Area.

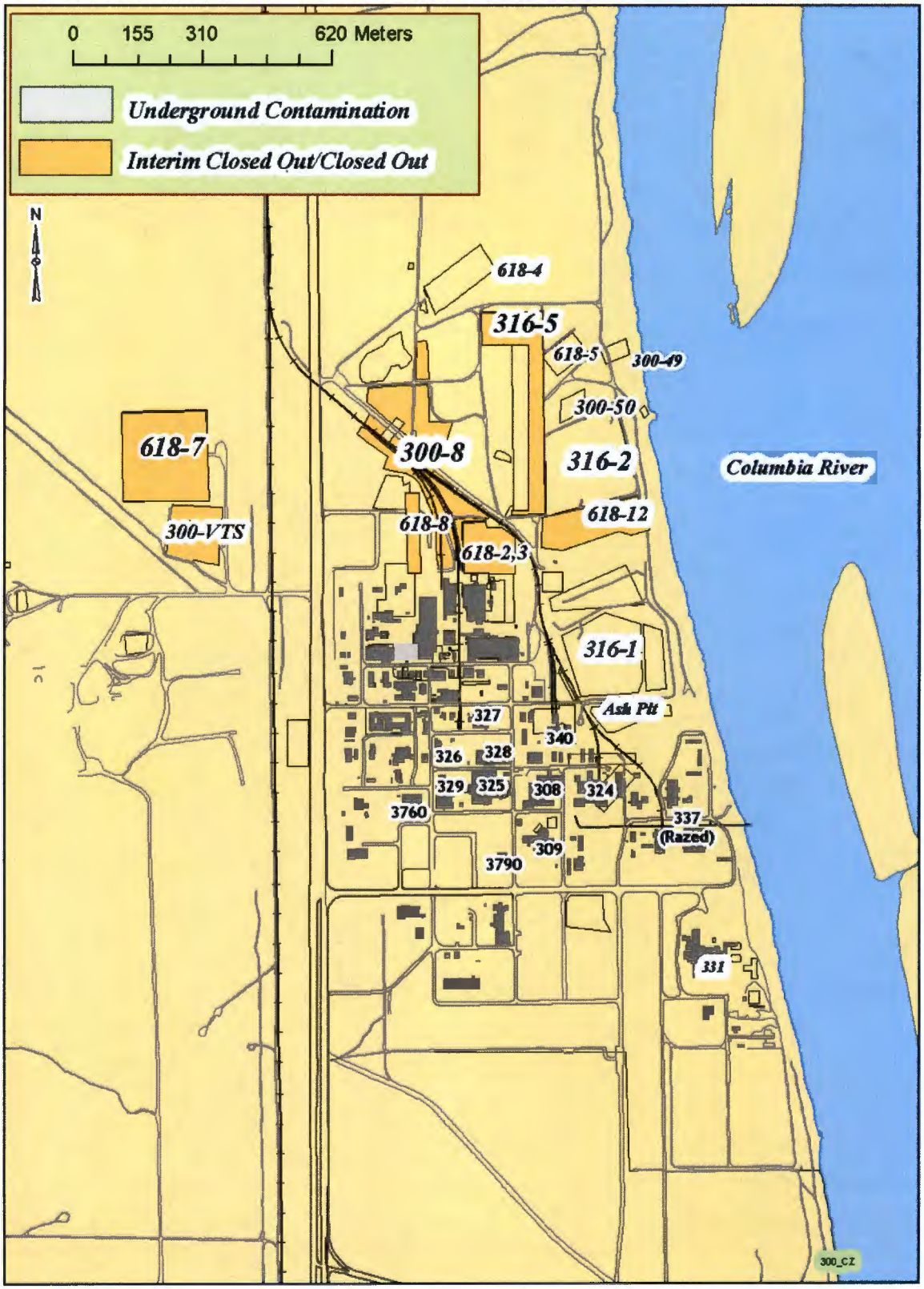
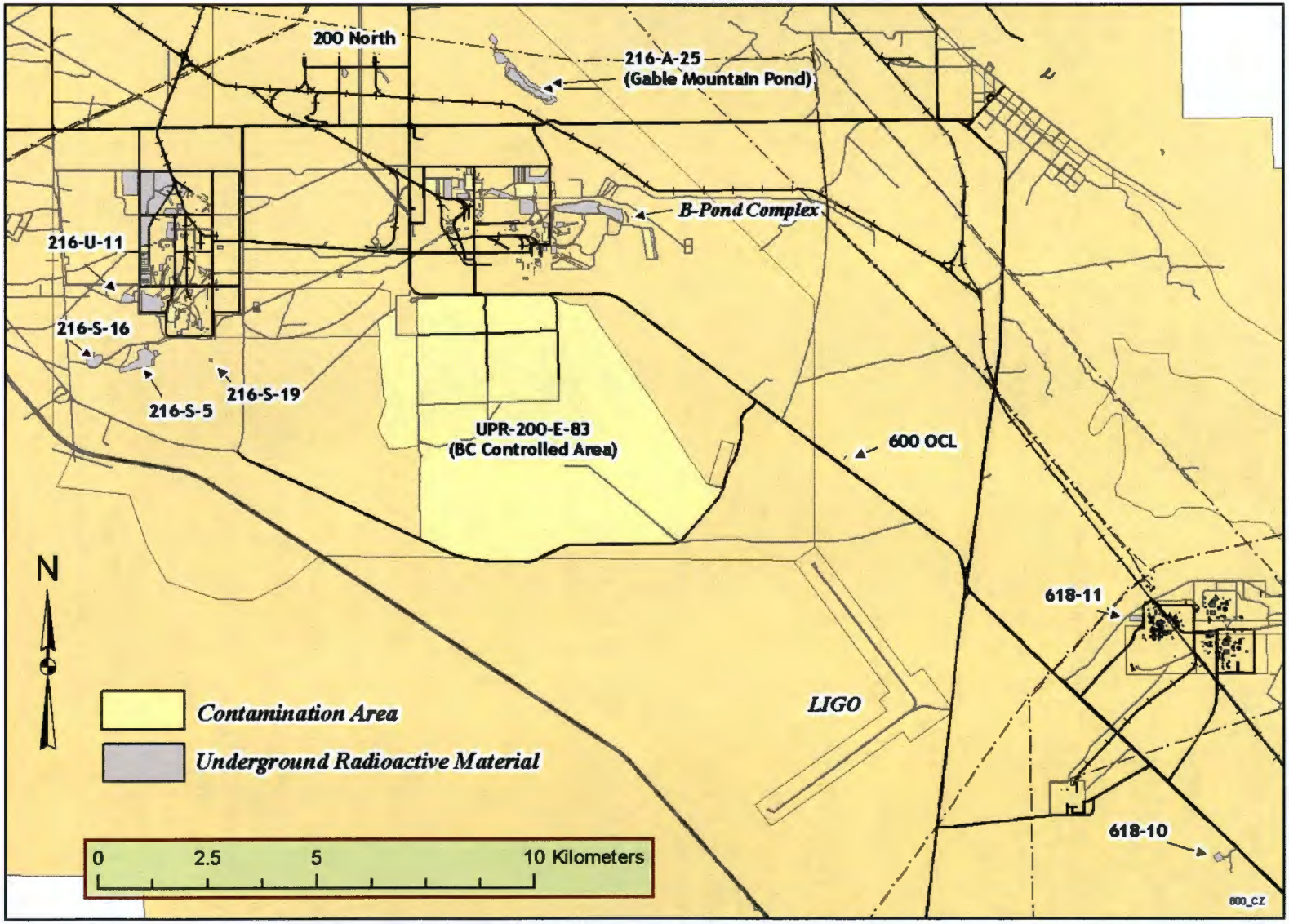


Figure 10. 600 Area.



2.0 PROGRAM DESCRIPTION

2.1 ENVIRONMENTAL RADIOLOGICAL SURVEY OBJECTIVES

Radiological surveys are conducted to determine whether there have been changes in the radiological status of the 100, 200, 300, and 600 Areas outdoor radioactive waste sites. These sites include surface water disposal units, cribs, trenches, burial grounds, tank farm and diversion box perimeters, and reverse wells. HNF-SP-0098 lists the waste sites and the survey frequency. Determining trends in radiation levels or radiological contamination may aid in assessing the adequacy of waste containment by detecting the movement of radioactive material away from radiological control areas, or by detecting releases that might otherwise go unrecognized. When activity is detected, a thorough survey is performed using a portable count rate meter equipped with a thin-window, pancake-type probe. The appropriate facility manager or landlord is notified if contamination is identified and the responsible manager initiates corrective actions.

2.2 PRIORITY RANKING SYSTEM

A numerical ranking system is used for categorizing contaminated waste sites relative to environmental radiological concerns. This system provides guidance to responsible landlords for clean up or interim stabilization of waste sites.

The history of each waste site, level, and type of contamination, site accessibility and size, and contamination mobility, are all used as a basis for review. A numerical value is assigned to each site based on this review.

Contamination levels ranging from 1,000 disintegrations per minute (dpm) to greater than 10 millirads per hour (mrad/hr) (as measured on Radiological Control's field survey instruments) are considered and assigned a numerical value of one (lowest value) to five (greatest value). Any removable alpha contamination is considered a high priority and automatically receives a numerical rank value of five.

The location is evaluated for accessibility. A restricted site in a remote area would receive the lowest point value of one. They would progress up to a value of five where the public may have access.

Mobility scoring is based on contamination that can be, or has a history of being, transported from where it was originally identified to places outside of the posted radiological area. Fixed contamination would receive a value of one progressing to contamination that can potentially be blown by the wind or through biological uptake and transport receiving a value of five. There is a maximum of 15 points possible with this ranking system.

It should be noted that this system is not intended to be a total qualitative or quantitative risk assessment, but rather a way of communicating environmental significance to the landlord and respective program office. Before a site is designated for remediation, other elements of the site clean-up process are also considered such as costs, location, public/regulatory interest, risk assessments, and engineering strategies.

2.3 ENVIRONMENTAL STANDARDS

Radiological survey data are used to determine compliance of Radioactive Waste Sites with MSC-PRO-15334, *Effluent and Environmental Monitoring*, and MSC-RD-15332, *Environmental Protection Requirements*, for Mission Support Alliance, LLC (MSA) managed sites; TFC-ESHQ-RP-MON-P-10, *Required Radiological Surveillances,* for Washington River Protection Solutions, LLC (WRPS) managed sites; and PRC-RD-EP-15332, *Environmental Protection Requirements*, and PRC-PRO-EP-15334, *Effluent and Environmental Monitoring for Radionuclide Airborne Emissions*, for CH2M HILL Plateau Remediation Company (CHPRC) managed sites. ENV-1, *Environmental Monitoring and Management*, Chapter 1.9, provides compliance requirements for Washington Closure Hanford, LLC (WCH) managed sites.

In order to compare field instrument values with the standards listed in the Contractor's radiological control manual, a conversion factor is necessary. This conversion factor has been established using a Geiger-Mueller detector with a pancake type probe where 20,000 dpm (2,000 counts per minute [cpm]) are approximately equivalent to one millirem per hour for beta-emitting radionuclides as indicated in UCRL-88275, *Evaluation of Beta Energy (E max) and Spectral Type Using Survey Instruments*. It should be understood that converting field instrument values, which include both beta and gamma energies, is approximate for field reporting purposes and does not allow for absolute precision.

2.4 SURVEY METHODS AND PROCEDURES

Surveys documented in this report include road surfaces, cribs, underground pipelines, stabilized burial grounds, covered ponds and ditches, tank farm perimeters, active burial ground perimeters, unplanned release sites, and other radiological areas. Methods and procedures for these surveys can be found in MSC-PRO-EI-0611, *Near-Facility Environmental Monitoring*; MSC-13536, *MSC Radiological Control Procedures*; CHPRC-00073; and ENV-1.

Waste sites and other radiological areas are surveyed with portable site approved field instruments. The portable field instrument survey results are reported in dpm per 100 cm^2. Efficiency correction factors, as documented in the various Contractor radiological control manual/procedures, are applied. These can vary between contractors, but are approved as part of each Contractor's radiological control program. Surveys include the perimeter and portions of the ground surface of radiological areas. Wherever possible, smear surveys are made on the surface of exposed equipment and other hard surfaces within a radiological area.

Vegetation, animal burrows, and animal feces are also monitored to detect biological transport.

3.0 RADIOLOGICAL SURVEY SUMMARY

Scheduled routine environmental radiological surveys were completed during the fourth quarter of CY 2011. Road surveys were started during the first quarter of 2011.

Routine surveys found contamination above background levels at four of the surveyed sites. Non-routine radiological surveys found one additional incident of contamination discovered outside posted CAs. Contamination levels ranging from a low of 2,000 dpm/100 cm^2 beta/gamma to 450,000 dpm/100 cm^2 beta/gamma were reported. The contamination was found at three of the CHPRC sites, one of the WRPS sites, none of the MSA sites, and one of the WCH sites. Of the incidents of contamination found, one was located in underground radioactive materials areas (URMAs) and four were inside unposted areas.

The contamination found was immediately cleaned up and no further action was required.

The radiologically contaminated areas are posted to meet the requirements as outlined in the respective Contractor's radiological control manual. The posting includes the following categories: High Contamination (activity >100,000 dpm/100 cm^2 β/γ and/or >2,000 dpm/100 cm^2 α), Contamination, Soil Contamination, Underground Radioactive Material, Radiological Buffer, and Radiation/High Radiation areas. For continuity between quarterly reports, the use of the term "Contamination Areas" in this report includes High Contamination, Contamination, and Soil Contamination Areas (SCAs) categories/designations. Underground Radioactive Material, Radiological Buffer, Radiologically Controlled Areas, and Radiation/High Radiation Areas are referred to when required.

While conducting radiological surveys, contaminated media were encountered and collected for analysis and/or disposal. Media found above actions levels defined in the respective Contractor's radiological control manual are documented via the various contractor reporting mechanisms such as Radiological Problem Reports, Problem Evaluation Requests, and/or Occurrence Reports. Table 1 summarizes the contamination found, location, survey document, and the corresponding field readings.

3.1 WASTE INFORMATION DATA SYSTEM (WIDS) SUMMARY

Since the last reporting period of CY 2011, 39 waste sites (300-80, 300-16:2, 300-24, 300-218, 100-K-77, 100-D-7, 1607-D5, 100-D-28:1, 118-H-1, 118-H-1:2, 300-258, 100-D-31:10, 100-D-31:8, 100-D31:9, 118-H-6:5, 600-151, 120-KW-3, 120-KW-4, 120-KW-1, 120-KW-2, 600-149, 600-149:1, 100-K-109, 300-48, 300-249, 300-28, 300-16:3, 300-43, 132-D-1, 300-276, 100-F-44:8, 100-F-56:1, UPR-100-F-3, 100-F-25, 100-F-49, 100-F-45, 100-F-47, 100-F-48, and 100-D-45) were interim closed. Of the 39 waste sites, 12 were known to contain radioactive material and have been released from radiological monitoring and control.

HNF-48562, *Administrative Interface Agreement between CH2M HILL Plateau Remediation Company (CHPRC) and Washington Closure Hanford (WCH), Washington River Protection Solutions (WRPS), Mission Support Alliance (MSA), and Pacific Northwest National Laboratory (PNNL) for Hanford Environmental Data Integration*, states that an area that is posted SCA or CA (and not located on an existing WIDS site) should be added to the WIDS database as a new waste site if it cannot be cleaned up and downposted within 90 days.

Table 1. Contamination Incidents to Date in Calendar Year 2011. (2 sheets)

SAMPLE NUMBER	DATE	DESCRIPTION	LOCATION	DOCUMENT	FIELD READING (Beta/Gamma)
N/A	01/04/11	Specks	Exterior perimeter 241-B Tank Farm	DAR 01/04/2011	300,000 dpm/100cm^2
N/A	01/05/11	Speck	Outside northwest perimeter fence 241-S	DAR 01/05/2011	>1,000,000 dpm/100cm^2
N/A	01/12/11	Soil & Rail Plate	200 yds south of 100-H on railroad spur	WCH-REMACT-2011-0001	>1,000,000 dpm/100cm^2
N/A	01/18/11	Windblown Tumbleweed	Along fenceline a UPR-100-N-31	ARJ 01/19/2011	12,000 dpm/100cm^2
N/A	01/25/11	Tumbleweed Fragments	Outside the 216-BC Cribs/Trenches perimeter	RC-1100039	80,000 dpm/100cm^2
N/A	01/26/11	Step Ladder	Next to scrap metal dumpster Outside 2266-E	MSC-FSS-2011-0004	115,614 dpm/100cm^2 α
N/A	01/27/11	Speck	Outside the east perimeter fenceline of 241-SY	DAR 01/27/2011	>1,000,000 dpm/100cm^2
N/A	02/01/11	Plywood	Next to wood scrap bin outside 2266-E	MSC-FSS-2011-0005	80,000 dpm/100cm^2
N/A	02/02/11	Tumbleweed Fragment	East perimeter of the 241-AZ Tank Farm	WRPS-PER-2011-0195	6,000 dpm/100cm^2
N/A	02/03/11	Tumbleweed Fragments/Speck	Outside 241-S Tank Farm perimeter	WRPS-PER-2011-0201	360,000 dpm/100cm^2
N/A	02/09/11	Tumbleweed	At the 241-U-151 Diversion Box	DAR 02/09/2011	200,000 dpm/100cm^2
N/A	02/10/11	Tumbleweed Fragments/Specks	Outside perimeter of 241-AY/AZ Tank Farm	WRPS-PER-2011-0241	40,000 dpm/100cm^2
N/A	02/11/11	Animal feces & Urine	Near 241-SY change trailer & 242-S	DAR 02/11/2011	400,000 dpm/100cm^2
N/A	02/17/11	Tumbleweed Fragments	West side of the 241-B Tank Farm	WRPS-PER-2011-0303	6,000 dpm/100cm^2
N/A	03/17/11	Tumbleweed Fragments	Outside 241-B Tank Farm perimeter fence	WRPS-PER-2011-0522	20,000 dpm/100cm^2
N/A	03/24/11	Cotton Tail Rabbit Feces	Between 241-C and 241-AN Tank Farms	WRPS-PER-2011-0569	150,000 dpm/100cm^2
N/A	03/30/11	Ant Mound and Tumbleweed	Inside 218-E-2 Burial Ground	RC-1100162	500,000 dpm/100cm^2
N/A	03/30/11	Mud Dauber Nests	Under Mobile Office MO-648	MSC-General-2011-0002	121,000 dpm/100cm^2
N/A	03/30/11	Cotton Tail Rabbit Feces	Outside north perimeter of 241-SY Tank Farm	WRPS-PER-2011-0641	20,000 dpm/100cm^2
N/A	04/05/11	Rocks from Harvester Ants	200-E-199 Pipeline	RC-1100172	850,000 dpm/100cm^2
N/A	04/11/11	Tumbleweed Fragments	East perimeter of 218-E-12A Burial Ground	DAR 04/11/2011	220,000 dpm/100cm^2
N/A	04/13/11	Tumbleweed Fragments	North of 12th Street at 218-E12B Burial Ground	ARJ 04/13/2011	400,000 dpm/100cm^2
N/A	04/27/11	Tumbleweed Fragments	Outside southeast perimeter of 241-B Tank Farm	WRPS-PER-2011-0870	70,000 dpm/100cm^2
N/A	05/03/11	Tumbleweed Fragments	Trench 94 (Naval Reactor Trench)	DAR 05/4/2011	480,000 dpm/100cm^2
N/A	05/05/11	Rabbit Brush Root	Alongside of 200-E-111-PL Pipeline	DAR 05-06-2011	60,000 dpm/100cm^2
N/A	05/09/11	Speck	Perimeter of 241-C Tank Farm	DAR 05/10/2011	>1,000,000 dpm/100cm^2
N/A	05/11/11	Tumbleweeds	Trench 94 (Naval Reactor Trench)	DAR 05/12/2011	390,000 dpm/100 cm^2
N/A	05/12/11	Tumbleweeds	Trench 94 (Naval Reactor Trench)	ARJ 05/12/2011	600,000 dpm/100cm^2
N/A	05/16/11	Tumbleweed Fragment	Outside 241-SY Tank Farm perimeter	WRPS-PER-2011-0999	10,000 dpm/100cm^2
N/A	05/23/11	Barn Swallow Nest Mud	105-N	DAR 05/24/2011	100,000 dpm/100cm^2
N/A	05/31/11	Windblown Tumbleweeds	Along east fence of Liquid Effluent Facility.	DAR 05/31/2011	420,000 dpm/100cm^2
N/A	06/01/11	Tumbleweed Fragments	Along east fence of 241-BX/BY	DAR 06/02/2011	50,000 dpm/100cm^2
N/A	06/04/11	Specks	Outside east and northeast fence of 241-S/SX/SY Tank Farms	ARJ 06/04/2011	300,000 dpm/100cm^2
N/A	06/04/11	Speck	Outside east fence line of 241-BX/BY Tank Farm	ARJ 06/04/2011	40,000 dpm/100cm^2
N/A	06/04/11	Tumbleweed Fragment	Outside west fence line of 241-B Tank Farm	ARJ 06/04/2011	200,000 dpm/100cm^2
N/A	06/22/11	Rock	Inside security perimeter fence of 202-A PUREX	ARJ 06/22/2011	550,000 dpm/100cm^2
N/A	07/07/11	Specks	Outside perimeter fence of 241-SX Tank Farm	WRPS-PER-2011-1343	300,000 dpm/100cm^2
N/A	07/12/11	Rabbit Feces	West perimeter fence of 241-S Tank Farm	WRPS-PER-2011-1366	>1,000,000 dpm/100cm^2
N/A	07/13/11	Tumbleweed Fragments	Outside perimeter fence of 241-BY Tank Farm	WRPS-PER-2011-1388	5,000 dpm/100cm^2
N/A	07/14/11	Rabbit Feces/Urine	Outside perimeter fence of 241-SX Tank Farm	WRPS-PER-2011-1391	30,000 dpm/100cm^2
N/A	07/14/11	Tumbleweed Fragments	Outside perimeter fence of 241-B Tank Farm	WRPS-PER-2011-1393	20,000 dpm/100cm^2

Table 1. Contamination Incidents to Date in Calendar Year 2011. (2 sheets)

SAMPLE NUMBER	DATE	DESCRIPTION	LOCATION	DOCUMENT	FIELD READING (Beta/Gamma)
N/A	07/15/11	Tumbleweed Fragment	Outside perimeter of 244-A Lift Station	WRPS-PER-2011-1396	60,000 dpm/100cm^2
N/A	08/06/11	Specks	On 200-E-216 PL Inactive Pipeline	DAR 08/06/2011	>1,000,000 dpm/100cm^2
N/A	08/15/11	Rabbit Feces	On UPR 200-W-115	ARJ 08/22/2011	69,000 dpm/100cm^2
N/A	08/16/11	Rabbit Feces	On UPR 200-W-115	ARJ 08/22/2011	109,000 dpm/100cm^2
N/A	08/17/11	Rabbit Feces	On UPR 200-W-115	ARJ 08/22/2011	199,000 dpm/100cm^2
N/A	08/18/11	Rabbit Feces	On UPR 200-W-115	ARJ 08/22/2011	49,000 dpm/100cm^2
N/A	08/20/11	Tumbleweed Fragments	On 200-W-105-PL Pipeline	DAR 08/21/2011	360,000 dpm/100cm^2
N/A	08/24/11	Ant Mound	Inside UPR-200-W-97	RC-1100471	18,000 dpm/100cm^2
N/A	09/08/11	Rock Pigeon Droppings	At 600-214 Modu-Tanks	GW-110264	47,000 dpm/100cm^2
N/A	09/21/11	Tumbleweed Fragment	Outside perimeter fence of 241-B Tank Farm	WRPS-PER-2011-1946	250,000 dpm/100cm^2
N/A	09/23/11	Tumbleweed	Inside 218-W-4A Burial Ground	RC-1100526	8,000 dpm/100cm^2
N/A	09/26/11	Rock Pigeon Droppings	Edge of Interim Storage Area pad at Canister Storage Building	DAR 09/26/2011	360,000 dpm/100cm^2
N/A	09/27/11	Mud Dauber Nest	105-N Reactor	DAR 9/27/2011	706,000 dpm/100cm^2
N/A	09/27/11	Mouse Feces	Under MO-633	WRPS-PER-2011-2037	19,500 dpm/100cm^2
N/A	11/02/11	Tumbleweed Fragment	Inside WIDS Site 200-W-43	RC-1100594	250,000 dpm/100cm^2
N/A	11/17/11	Tumbleweed Fragment	Outside Perimeter Fence of 241-B Tank Farm	N-11-0537	20,000 dpm/100cm^2
N/A	11/21/11	Tumbleweeds	Inside ETF Perimeter Fence	ARJ 11/21/2011	300,000 dpm/100cm^2
N/A	12/01/11	Mud Dauber Nest	Inside 100-N CONEX	ARJ 12/01/2011	100,000 dpm/100cm^2
N/A	12/06/11	Tumbleweeds	Inside LEF Perimeter Fence	ARJ 12/06/2011	450,000 dpm/100cm^2

Note: The referenced documents are as follows:

N-XX-XXXX are NRS Environmental/WSCF Radiological Survey Reports
MSC-General-2011-XXXX, MSC-FSS-2011-XXXX, WCH-REMACT-2011-XXXX etc., are Occurrence Reports
DAR XX/XX/2011, ARJ XX/XX/2011 are Daily Activity Reports
GW-XXXXX are CHPRC Groundwater Radiological Survey Reports
RC-XXXXXXX are CHPRC decontamination and decommissioning Radiological Survey Reports
WRPS-PER-2011-XXXX are WRPS Problem Evaluation Reports

Abbreviations:
cm^2 = Square Centimeter
dpm = Disintegrations per minute
N/A = Not applicable or submitted for analysis

Activity levels reported are the maximum observed in the field.

Nine new waste sites (200-W-243, 200-E-293, 100-K-112, 100-N-105, 600-392, 100-B-35, 100-K-113, 100-K-114, and 200-E-294) were added to the WIDS database during the fourth quarter of CY 2011.

The Environmental Restoration Disposal Facility (ERDF) continued to receive waste from the remediation activities in the 100, 200, 300, and 600 Areas.

Table 2 summarizes the contamination incidents by area and media type through December 31, 2011. The column "Other" in this table is for miscellaneous items (e.g., clothing, equipment, etc.).

4.0 BIOTIC TRANSPORT

Waste management, environmental protection, safety, and as low as reasonably achievable (ALARA) practices on the Hanford Site require that whenever possible, radiological contamination exposed to the environment be cleaned up or stabilized so that it is not easily transported from posted radiological control areas. 10 CFR 835 requires that appropriate controls be maintained and verified which prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions.

In response to a U.S. Department of Energy, Richland Operations Office concern, Fluor Hanford, Inc. /MSA established a centralized Biological Control Program (BCP) to control the spread of contamination caused by biotic vectors. Prior to the establishment of the BCP, the biological control funding and requests for the application of biological control techniques were the responsibility of the affected facilities. The BCP provides vegetation control through herbicide application, grubbing, and vegetation removal in areas of accumulation. Trapping, baiting, fumigation, and the application of pesticides are used to control the spread of contamination by animals/insects.

4.1 DEEP-ROOTED VEGETATION VECTORS

Deep-rooted vegetation (e.g., tumbleweeds, sagebrush) growing over underground sources of radionuclides may selectively uptake contaminants into their tissues. When radionuclides are transported from roots to aerial portions of the plant, as often happens with tumbleweeds, surface contamination may result. This surface contamination poses a potential risk of environmental transport or human contact and can be very costly to clean up and/or stabilize. The MSA procedures/requirements, MSC-PRO-15333, *Environmental Protection Processes*, MSC-PRO-15334, MSC-RD-15332 and the WCH procedure ENV-1, require that the tumbleweeds and other deep-rooted vegetation be removed from waste sites where radionuclide uptake is detected or probable.

A review of radiological reports (Radiological Problem Reports, Problem Evaluation Reports, Daily Activity Reports, Occurrence Reports, and Radiological Survey Records) indicates that during the fourth quarter of CY 2011, there were four incidents of contaminated vegetation. All of these incidents were tumbleweeds/tumbleweed fragments.

Table 2. Contamination Incidents by Area and Type during Calendar Year 2011.

Area/Waste Site Type	Vegetation	Animals	Soil/Specks	Other	Total Incidents
200 East Tank Farms	12	1	3	0	16
200 West Tank Farms	2	4	4	0	10
200 East Burial Grounds	6	1	0	0	7
200 West Burial Grounds	1	0	0	0	1
200 East Cribs, Ponds, & Ditches	0	0	0	0	0
200 West Cribs, Ponds, & Ditches	0	0	0	0	0
200 East Fence Lines	0	0	0	0	0
200 West Fence Lines	0	0	0	0	0
200 East Roads & Rail Roads	0	0	0	0	0
200 West Roads & Rail Roads	0	0	0	0	0
200 East Unplanned Release Sites	0	0	0	0	0
200 West Unplanned Release Sites	0	5	0	0	5
200 East Underground Pipelines	1	1	1	0	3
200 West Underground Pipelines	2	0	0	0	2
Cross-Site Transfer Line	0	0	0	0	0
200-BC Cribs and Trenches	1	0	0	0	1
200 East Miscellaneous	2	1	1	2	6
200 West Miscellaneous	1	1	0	0	2
200 North Area	0	0	0	0	0
100 Areas	1	4	1	0	6
300 Areas	0	0	0	0	0
400 Areas	0	0	0	0	0
600 Areas	0	1	0	0	1
1100 Areas	0	0	0	0	0
TOTALS	29	19	10	2	60

Table 3 summarizes the number of incidents of contaminated vegetation found and the range of activity encountered between 1994 and December 31, 2011. It has been determined through field readings that the dose rate for meter readings on tumbleweeds having greater than 6,000,000 dpm/100 cm^2 ranges from approximately 2.0 to 50 mrad/hr.

Figure 11 depicts graphically, on a cumulative by quarter basis, the contaminated vegetation incidents encountered between 1994 and the end of the fourth quarter of CY 2011. The number of incidents in a given quarter is an aggregate/integrated total of those in the preceding quarters of the same calendar year.

Figure 12 displays the number of contaminated vegetation incidents, cumulative by month, between 1994 and the end of the fourth quarter of CY 2011. The upper line in this figure for 2008 indicates the most incidents (127) that have occurred during the last 15 years, while the lower line represents the fewest number of incidents (12), which occurred in 1995.

4.2 ANIMAL VECTORS

Biotic transport of radiological contamination through animal (insects, mice, etc.) vectors has been a major cause of contamination spread throughout the Hanford Site for a number of years.

A review of radiological reports (Radiological Problem Reports, Problem Evaluation Reports, Daily Activity Reports, Occurrence Reports, and Radiological Survey Records) indicates that during the fourth quarter of CY 2011, there was one incident of contaminated animals and animal related material (mud dauber wasp). Table 4 shows the number of contaminated animal related incidences found and the range of activity encountered for the years 1994 through December 31, 2011. It should be noted that the dose rates for meter readings greater than 6,000,000 dpm/100 cm^2 or 1,000,000 dpm/PA detected in the animals/insects can range as much as approximately 1.5 to 15 mrad/hr.

Figure 13 summarizes, on a cumulative by quarter basis, the contaminated animal incidents encountered from 1994 through the fourth quarter of CY 2011. The number of incidents in a given quarter is an aggregate/integrated total of those in the preceding quarters of the same calendar year. This graphic also demonstrates the decreased activity of animals during the winter.

Figure 14 displays the number of contaminated animal incidents, cumulative by month, between 1994 and the end of the fourth quarter of CY 2011.

4.3 BIOLOGICAL CONTROL PROGRAM

The BCP continues to work towards controlling the spread of radioactive contamination by biological vectors. The BCP scope includes: (1) integrated surveillance, (2) cleanup, (3) control, and (4) site restoration.

Table 3. Yearly Summary of Contaminated Vegetation Incidents (1994 through December 31, 2011).

Year	Number of Incidents	Maximum Activity (dpm)B/G[a]	Minimum Activity (dpm)B/G
2011	29	>1,000,000/100cm^2	5,000/100cm^2
2010	31	>1,000,000/100cm^2	7,000/100cm^2
2009	88	>6,000,000/100cm^2	2,500/100cm^2
2008	127	>6,000,000/100cm^2	6,000/100cm^2
2007	62	2,400,000/100cm^2	3,000/100cm^2
2006	75	5,397,000/100cm^2	10,000/100cm^2
2005	66	1,800,000/100cm^2	6,000/100cm^2
2004	60	540,000/100cm^2	4,000/100cm^2
2003	32	3,600,000/100cm^2	6,000/100cm^2
2002	16	1,800,000/100cm^2	3,000/100cm^2
2001	31	>6,000,000/100cm^2 [b]	6,000/100cm^2
2000	65	>1,000,000/100cm^2	5,000/100cm^2
1999	84	>1,000,000/100cm^2	8,000/100cm^2
1998	51	>1,000,000/100cm^2	4,000/100cm^2
1997	42	>1,000,000/PA	2,500/PA
1996	21	800,000/PA	6,000/PA
1995	12	250,000/PA	2,000/PA
1994	20	600,000/PA	2,000/PA

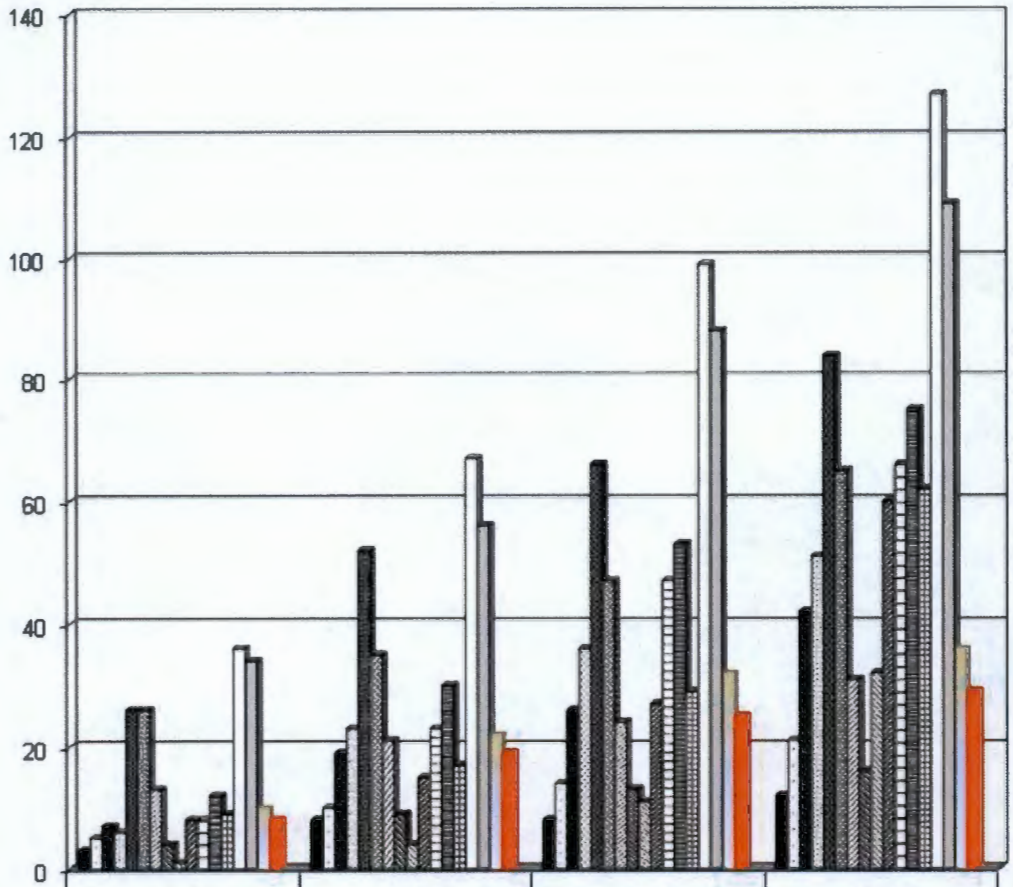
[a] The reporting of the activity changed in 1998 to meet the requirements identified in MSC-5173. The activity is reported in dpm per probe area prior to 1998 and in dpm per 100 cm^2 since 1998 (unless otherwise noted e.g., for a speck or insect).

[b] >6,000,000/100 cm^2 being used in 2001and subsequent years includes a correction factor of 6 to correct from probe area to 100 cm^2 which was not used in previous years.

Abbreviations used are as follows:

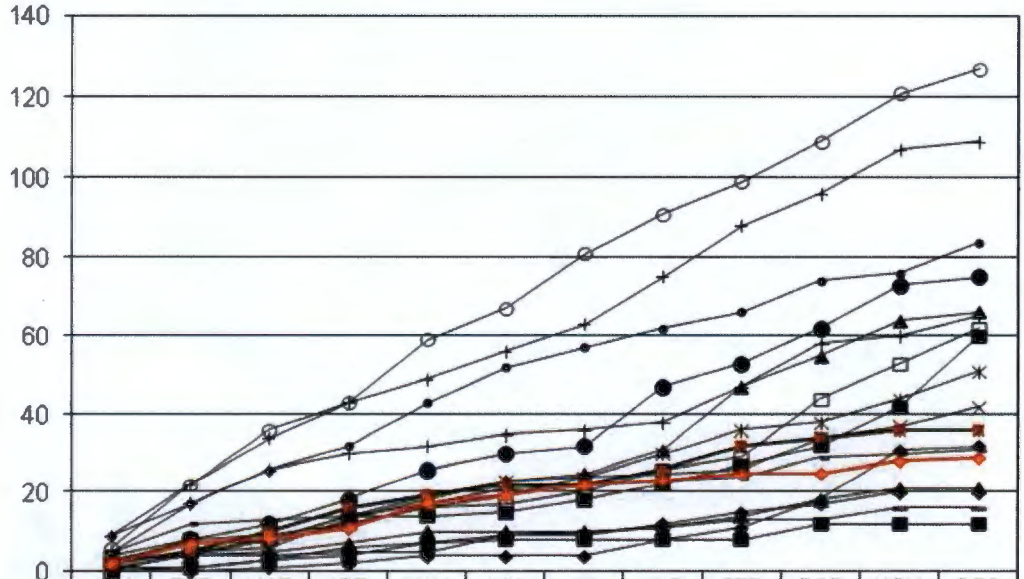
B/G = Beta/Gamma
dpm = Disintegrations per minute
PA = Probe Area

Figure 11. Contaminated Vegetation Incidents 1994 through 2011 (Cumulative by Quarter).



	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
1995	3	8	8	12
1996	5	10	14	21
1997	7	19	26	42
1998	6	23	36	51
1999	26	52	66	84
2000	26	35	47	65
2001	13	21	24	31
2002	4	9	13	16
2003	1	4	11	32
2004	8	15	27	60
2005	8	23	47	66
2006	12	30	53	75
2007	9	17	29	62
2008	36	67	99	127
2009	34	56	88	109
2010	10	22	32	36
2011	8	19	25	29

Figure 12. Contaminated Vegetation Incidents
(Cumulative by Month).



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1994	1	1	3	6	7	9	9	12	15	17	20	20
1995	0	1	3	4	7	8	8	8	8	12	12	12
1996	3	4	5	7	10	10	10	11	14	18	21	21
1997	3	7	7	12	16	19	24	25	26	34	37	42
1998	2	5	6	13	18	23	24	30	36	38	44	51
1999	9	17	26	32	43	52	57	62	66	74	76	84
2000	5	17	26	30	32	35	36	38	47	58	60	65
2001	5	12	13	14	17	21	22	23	24	29	30	31
2002	3	4	4	5	5	9	10	11	13	13	16	16
2003	0	0	1	2	4	4	4	8	11	18	31	32
2004	0	5	8	14	14	15	18	22	27	32	42	60
2005	1	4	8	14	19	23	25	31	47	55	64	66
2006	2	8	12	18	26	30	32	47	53	62	73	75
2007	4	8	9	12	16	17	20	26	29	44	53	62
2008	6	22	36	43	59	67	81	91	99	109	121	127
2009	9	22	34	43	49	56	63	75	88	96	107	109
2010	2	5	10	16	19	22	22	26	32	34	36	36
2011	2	7	8	11	17	19	22	23	25	25	28	29

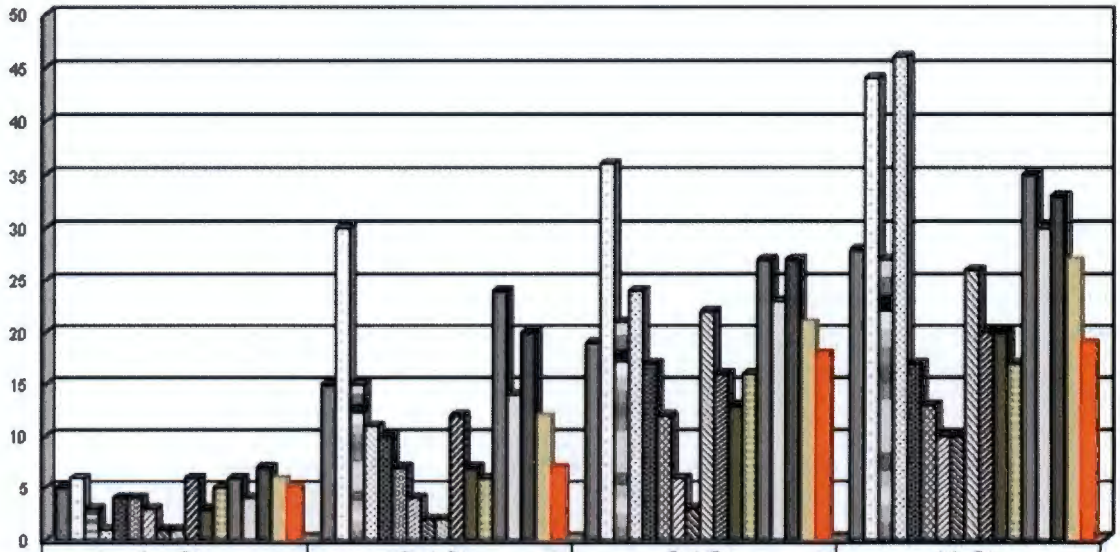
Table 4. Contaminated Animal Incidents
(1994 through December 31, 2011).

Year	Number of Incidents	Maximum Activity (dpm)B/G[a]	Minimum Activity (dpm)B/G
2011	19	>1,000,000/100cm^2	18,000/100cm^2
2010	21	1,950,000/100cm^2	3,000/100cm^2
2009	26	>1,000,000/100cm^2	20,000/100cm^2
2008	30	3,600,000/100cm^2	1,500/100cm^2
2007	6	600,000/100cm^2	20,000/100cm^2
2006	17	>1,000,000/100cm^2	4,000/100cm^2
2005	13	>1,000,000/100cm^2	4,000/100cm^2
2004	20	649,000/100cm^2	1,500/100cm^2
2003	26	1,200,000/100cm^2	900cpm
2002	10	42,000/100cm^2 Alpha[b]	2,500/100cm^2
2001	10	>6,000,000/100cm^2 [c]	1,000/PA
2000	13	300,000/100cm^2	3,000/100cm^2
1999	17	500,000/100cm^2	2,000/PA
1998	46	>1,000,000/100cm^2	4,000/100cm^2
1997	27	>1,000,000/PA	NR
1996	44	>1,000,000/PA	500/PA
1995	28	>1,000,000/PA	2,000/PA
1994	24	>1,000,000/PA	2,000/PA

[a] The reporting of the activity changed in 1998 to meet the requirements identified in MSC-5173. The activity is reported in dpm per probe area prior to 1998 and in dpm per 100 cm^2 since 1998 (unless otherwise noted e.g., for a spec or insect). Activity reported as beta/gamma unless otherwise noted.
[b] No Beta/Gamma reported on this incident.
[c] >6,000,000/100 cm^2 being used in 2001 and subsequent years includes a correction factor of 6 to correct from probe area to 100 cm^2 which was not used in previous years.

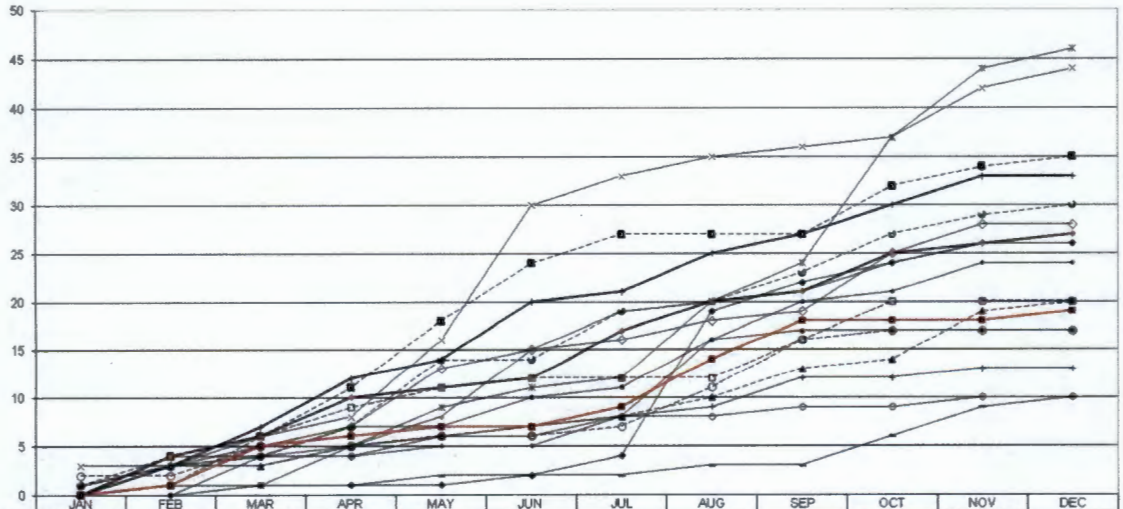
Abbreviations used are as follows:
B/G = Beta/Gamma
dpm = Disintegrations per minute
NR = No activity above background recorded in the field
PA = Probe Area

Figure 13. Contaminated Animal/Insect Incidents 1994 through 2011 (Cumulative by Quarter).



	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
1995	5	15	19	28
1996	6	30	36	44
1997	3	15	21	27
1998	1	11	24	46
1999	4	10	17	17
2000	4	7	12	13
2001	3	4	6	10
2002	1	2	3	10
2003	1	2	22	26
2004	6	12	16	20
2005	3	7	13	20
2006	5	6	16	17
2007	6	24	27	35
2008	4	14	23	30
2009	7	20	27	33
2010	6	12	21	27
2011	5	7	18	19

Figure 14. Contaminated Animal Incidents
(Cumulative by Month).



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1994	1	3	4	4	5	5	8	16	20	21	24	24
1995	1	3	5	7	13	15	16	18	19	25	28	28
1996	3	3	6	8	16	30	33	35	36	37	42	44
1997	1	3	3	5	8	15	19	20	21	24	26	27
1998	0	1	1	5	9	11	12	20	24	37	44	46
1999	0	0	4	7	7	10	11	16	17	17	17	17
2000	0	4	4	5	6	7	8	9	12	12	13	13
2001	0	3	4	4	6	6	8	8	9	9	10	10
2002	0	1	1	1	2	2	2	3	3	6	9	10
2003	0	0	1	1	1	2	4	19	22	24	26	26
2004	0	1	6	9	11	12	12	12	16	20	20	20
2005	1	3	3	5	6	7	8	10	13	14	19	20
2006	2	2	5	5	6	6	7	11	16	17	17	17
2007	0	4	6	11	18	24	27	27	27	32	34	35
2008	1	4	4	7	14	14	19	20	23	27	29	30
2009	0	3	7	12	14	20	21	25	27	30	33	33
2010	0	4	6	10	11	12	17	20	21	25	26	27
2011	0	1	5	6	7	7	9	14	18	18	18	19

4.3.1 Surveillance

Radioactivity monitoring and surveillance activities indicate that the control of contaminated vegetation and animal related material was maintained during the fourth quarter of CY 2011. The number of vegetation (4) and animal (1) related incidents reported during the fourth quarter were consistent with the average reported during this period at 13 and 6, respectively.

4.3.2 Cleanup

The BCP continued removal and cleanup of tumbleweeds in the operations areas in CY 2011.

Cleanup and stabilization activities during the fourth quarter of CY 2011 included the following:

- 20.5 non-regulated compactor truckloads of tumbleweeds were taken to the 200-W burn pit for disposal (one compactor truckload ≅ 11,000 ft^3).
- 4 regulated compactor truckloads of tumbleweeds were taken to the ERDF for disposal.

4.3.3 Control

The number of animal incidents is about average/typical of those reported during the same period in previous years (see Figure 13). The control of contaminated vegetation vectors does appear to be effective in 2011 when compared to 2008, 2009, and 2010. An assessment of the BCP conducted during CY 2006 concluded that the vegetation had developed a chemical resistance from the usage of the same herbicide over a period of years. A program was developed to rotate the herbicides used to control deep rooted vegetation and was implemented in CY 2009. Test plots were set up outside the 200 East and 200 West Areas to test several herbicides and their application rates. The herbicides showing the greatest effect are being used in 2011. Some improvements have been noticed as to the effectiveness of the herbicides being used and new products are being tested to try and find the "silver bullet."

Highlights for the fourth quarter of CY 2011 include:

- Approximately 364 hectares (900acres) of Hanford Site land were treated with herbicides.
- 638 pest control responses for Hanford Site facilities were conducted.
- 3,406 bait stations and animal control devices were in place.
- 237 animals were captured, none of which were contaminated.

4.3.4 Noxious Weed Control

The U.S. Department of Energy (DOE) is obligated by the *Agriculture Risk Protection Act of 2000* to actively control noxious weeds. Washington Administrative Code (WAC) 16-750, "State Noxious Weed List and Schedule of Monetary Penalties," and Revised Code of Washington (RCW) 17.10, "Noxious Weeds – Control Boards," require all landowners to control noxious weeds on their property and impose specific penalties for failure to do so. Washington State Noxious Weed laws are enforced by the county Noxious Weed Control Boards. In compliance with federal, state, and local laws, each DOE facility is required to have a noxious weed management program.

During the fourth quarter of CY 2011, noxious weeds were treated with herbicide applications when found on "industrial areas" such as waste sites, parking lots, and road shoulders. However, noxious weeds have not been treated outside of active industrial areas. Recent decisions regarding application of the *National Environmental Policy Act of 1969* (NEPA) to noxious weed control have affected our ability to control weeds. Resolution to the issues is currently being sought.

In 1996, when the active noxious weed program began at Hanford, NEPA requirements were investigated and it was determined that legally required noxious weed control was part of routine maintenance and covered under the Site-Wide Categorical Exclusion. Additionally, there were discussions about noxious weed control being a "de minimis" activity. At the time, it was not deemed appropriate to conduct a cultural and ecological review each time someone walked or drove briefly off a paved surface.

About the third quarter of 2010, our historic assessment of NEPA application to noxious weed control was reevaluated. It was determined that site specific and activity specific NEPA evaluation was required for noxious weed spraying (with the exclusion of active industrial areas, clearly covered under the existing Site-Wide Categorical Exclusion).

The implications of this decision are that reviews must be performed, taking weeks or months, each time weeds need to be sprayed in non-industrial areas. Reviewing large blocks of land to allow noxious weed control is being investigated. Until a resolution is found to the current NEPA restrictions on noxious weed control, the control of noxious weeds is not within the budget available. For a detailed description of the noxious weeds found on the Hanford Site, see the Hanford Site Environmental Report.

4.3.5 Site Restoration

There were no opportunities for site restoration as part of the BCP during the fourth quarter of CY 2011.

5.0 SUMMARY

One hundred fifty two routine outdoor radiological surveys were completed during the fourth quarter of CY 2011 in the 100, 200 East/West, 300, and 600 Areas.

5.1 BIOTIC TRANSPORT ACTIVITY

During the third quarter of CY 2011, there were four incidents of contaminated vegetation and one incident of contaminated animals and animal-related matter (feces/urine). This corresponds, respectively, to four incidents of contaminated vegetation and six incidents of contaminated animal related matter during the same period in 2010. Levels of activity found ranged from 20,000 dpm/100 cm^2 to 450,000 dpm/100 cm^2 beta/gamma and no alpha in biota reported.

6.0 REFERENCES

10 CFR 835, "Occupational Radiation Protection," Title 10, *Code of Federal Regulations*, Part 835, as amended.

Agriculture Risk Protection Act of 2000, 7 USC 1501, et seq.

CHPRC-00073, *CH2M HILL Plateau Remediation Company Radiological Control Manual,* CH2M HILL Plateau Remediation Company, Richland, Washington.

ENV-1, *Environmental Monitoring and Management,* Washington Closure Hanford, LLC, Richland, Washington.

HNF-48562, *Administrative Interface Agreement between CH2M HILL Plateau Remediation Company (CHPRC) and Washington Closure Hanford (WCH), Washington River Protection Solutions (WRPS), Mission Support Alliance (MSA), and Pacific Northwest*

National Laboratory (PNNL) for Hanford Environmental Data Integration, CH2M HILL Plateau Remediation Company, Richland, Washington.

HNF-5183, *Tank Farms Radiological Control Manual,* Washington River Protection Solutions, LLC, Richland, Washington.

HNF-SP-0098, *Environmental Monitoring Schedule,* Mission Support Alliance, LLC, Richland, Washington.

MSC-5173, *MSC Radiological Control Manual*, Mission Support Alliance, LLC, Richland, Washington.

MSC-13536, *MSC Radiological Control Procedures,* Mission Support Alliance, LLC, Richland, Washington.

MSC-PRO-15333, *Environmental Protection Processes,* Mission Support Alliance, LLC, Richland, Washington.

MSC-PRO-15334, *Effluent and Environmental Monitoring*, Mission Support Alliance, LLC, Richland, Washington.

MSC-PRO-EI-0611, *Near-Facility Environmental Monitoring*, Mission Support Alliance, LLC, Richland, Washington.

MSC-RD-15332, *Environmental Protection Requirements,* Mission Support Alliance, LLC, Richland, Washington.

National Environmental Policy Act of 1969, 42 USC 4321, et seq.

PNNL-20548, *Hanford Site Environmental Report*, Pacific Northwest National Laboratory, Richland, Washington.

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