

# 1.0 Introduction

**M. J. Hartman**

The U.S. Department of Energy (DOE) monitors groundwater at the Hanford Site to fulfill a variety of state and federal regulations, including the *Atomic Energy Act of 1954*, the *Resource Conservation and Recovery Act (RCRA)*, the *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, and Washington Administrative Code. DOE manages these activities through the Groundwater Performance Assessment Project (groundwater project; formerly Hanford Groundwater Monitoring Project), which is conducted by Pacific Northwest National Laboratory.

## 1.1 Purpose and Scope

*Hanford Site Groundwater Monitoring for Fiscal Year 2003* presents results of groundwater monitoring, vadose zone monitoring and characterization, and groundwater modeling. This report also summarizes groundwater remediation and well installation activities. Monitoring results primarily rely on data from samples collected between October 1, 2002, and September 30, 2003. Data received after November 14, 2003, may not have been considered in the interpretations.

Groundwater remediation and associated monitoring of pumping wells is the responsibility of Fluor Hanford, Inc. Vadose zone monitoring and characterization are conducted by Bechtel Hanford, Inc.; CH2M HILL Hanford Group, Inc.; Fluor Hanford, Inc.; and Pacific Northwest National Laboratory.

Table 1.1-1 summarizes highlights or changes for CERCLA groundwater operable units, RCRA sites, and other regulated units and indicates where to find additional information in this report. Supporting information for CERCLA groundwater operable units is presented in Appendix A. Appendices B and C present similar information for RCRA sites and other waste units, respectively. Appendix D describes results of the quality control program.

Background information, including descriptions of regulatory requirements, waste sites, analytical methods, regional geology, and statistics is included in a separately-published companion volume, *Hanford Site Groundwater: Setting, Sources and Methods* (PNNL-13080), and in the most recent update, which was provided in PNNL-13788, Appendix C. Those changes have been incorporated into the electronic version of this groundwater monitoring report.

*CERCLA regulates waste sites that were active before RCRA took effect. It covers sites where radioactive or hazardous waste was disposed or leaked and also requires groundwater monitoring where appropriate.*

*This report is designed to meet the following objectives:*

- *Provide a comprehensive report of groundwater conditions on the Hanford Site.*
- *Fulfill the reporting requirements of RCRA, CERCLA (for operable units with no active groundwater remediation), DOE orders, and Washington Administrative Code.*
- *Summarize the results of groundwater monitoring conducted to assess the effects of interim remedial actions conducted under CERCLA.*
- *Describe the results of vadose zone monitoring and characterization.*
- *Summarize groundwater modeling activities.*
- *Summarize the installation, maintenance, and decommissioning of Hanford Site monitoring wells.*

As in previous reports, the compact disk accompanying this report contains groundwater data for the fiscal year and historical data for selected constituents.

## 1.2 Related Reports

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Other reports and databases relating to Hanford Site groundwater include the following:

*RCRA regulates facilities used to treat, store, or dispose of hazardous, non-radioactive waste. At Hanford, the law applies to sites that contained hazardous or mixed (hazardous and radioactive) waste. RCRA stipulates requirements for monitoring the groundwater beneath these sites.*

- Hanford Environmental Information System (HEIS) — This is the main environmental database for the Hanford Site that stores groundwater chemistry data, as well as other environmental data (e.g., soil chemistry, survey data).
- Quarterly data transmittals — DOE transmits informal reports quarterly to the Washington State Department of Ecology after groundwater data collected for the RCRA program have been verified and evaluated. These reports describe changes or highlights of the quarter with reference to HEIS for the analytical results.
- *Fiscal Year 2002 Annual Summary Report for the 200-UP-1 and 200-ZP-1 Pump-and-Treat Operations* (DOE/RL-2002-67) — This report describes results of remediation and monitoring in two groundwater operable units in the 200 West Area.
- *Calendar Year 2002 Annual Summary Report for the 100-HR-3, 100-KR-4, and 100-NR-2 Operable Unit Pump-and-Treat Operations* (DOE/RL-2003-09) — This report describes results of remediation and monitoring in groundwater operable units in the 100-K, 100-N, 100-D, and 100-H Areas.
- *Fiscal Year 2002 Annual Summary Report for the In Situ Redox Manipulation Operations* (DOE/RL-2003-05) — This report describes activities related to the remediation system in the southwest 100-D Area.
- *Aquifer Sampling Tube Results for Fiscal Year 2003* (PNNL-14444) — This report presents results of analyses of water samples collected from monitoring points along the 100 Areas shoreline October 2002 through January 2003.
- *Hanford Site Environmental Report for Calendar Year 2002* (PNNL-14295) — This annual report summarizes environmental data, describes environmental management performance, and reports the status of compliance with environmental regulations.
- *Hanford Site Climatological Data Summary 2002 with Historical Data* (PNNL-14242) — This annual report summarizes data on temperature, precipitation, and other weather conditions that may impact groundwater recharge.

## 1.3 Groundwater Remediation Project

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The goal of the Groundwater Remediation Project is to protect human health and the environment from Hanford contaminants. Fluor Hanford, Inc. manages the Groundwater Remediation Project for DOE. The groundwater project is under the umbrella of the Groundwater Remediation Project.

The Groundwater Remediation Project has five focus areas (DOE/RL-2002-68):

- Remediating high-risk waste sites.
- Reducing recharge (preventing water from moving contaminants through the soil).
- Shrinking the contaminated area.
- Remediating groundwater.
- Monitoring groundwater.

The Groundwater Remediation Project also is working to develop and apply technology that solves some of Hanford's toughest groundwater problems. In addition, the project performs site-wide assessments aimed at understanding contaminant behavior and associated risks and manages Hanford's key environmental data systems.

Throughout its work, the Groundwater Remediation Project will continually seek the active involvement of state and federal regulators, tribal governments, the state of Oregon, stakeholders, and the public.

## 1.4 Helpful Information

All of the groundwater and aquifer tube data from fiscal year 2003, including anomalous values and data flags, are included in the data files that accompany this report and in the HEIS database.

This report uses the following conventions for displaying data.

Contaminant plume maps:

- Are based on average fiscal year 2003 data for each well, excluding data that appear erroneous.
- Use data from fiscal years 2001 and 2002 if there were no new data for a well in fiscal year 2003.

Trend plots:

- Use open symbols to show levels of contaminants so low the laboratory could not detect them. These results are typically reported and plotted as values that represents the detection limit.
- Display analytical results that appear to be erroneous if they do not distort the scale or obscure the data trends. If the outlying data distort the figure, they are not plotted.

Chemical results:

- Express nitrate and nitrite as the  $\text{NO}_3$  and  $\text{NO}_2$  ions, respectively.
- Figures showing chromium include total chromium in filtered samples and hexavalent chromium in filtered or unfiltered samples. Dissolved chromium in Hanford Site groundwater is virtually all hexavalent, so filtered total chromium represents hexavalent chromium.
- Are compared with state or federally enforceable drinking water standards. Although Hanford Site groundwater is not generally used for drinking, these levels provide perspective on contaminant concentrations. Radionuclide concentrations also are compared with DOE derived concentration guides (Table 5.2 of PNNL-13080).

### Conversion Table

The primary units of measurement in this report are metric. To convert metric units to English units, use the information provided in this table.

Multiply	By	To Obtain
centimeters	0.394	inches
meters	3.28	feet
kilometers	0.621	miles
kilograms	2.205	pounds
liters	0.2642	gallons
square meters	10.76	square feet
hectares	2.47	acres
square kilometers	0.386	square miles
cubic meters	1.308	cubic yards
curie	$3.7 \times 10^{10}$	becquerel
picocurie	0.03704	becquerel
rem	0.01	sievert
$^{\circ}\text{C}$	$(^{\circ}\text{C} \times 9/5) + 32$	$^{\circ}\text{F}$

### Units of Measure

$\mu\text{g/L}$	micrograms per liter
$\mu\text{S/cm}$	microsiemens per centimeter
$\text{mg/L}$	milligrams per liter
$\text{mL/g}$	milliliters per gram
$\text{mM}$	millimolar
$\text{mm/yr}$	millimeters per year
$\text{pCi/g}$	picocuries per gram
$\text{pCi/L}$	picocuries per liter
$\text{pCi/mg}$	picocuries per milligram
ppb	parts per billion
ppm	parts per million
ppmv	parts per million volume

**Table 1.1-1.** Regulated Units and Groundwater Operable Units on the Hanford Site

Site or Operable Unit	Type of Monitoring Program	Text	FY 2003 Highlights
<b>CERCLA Groundwater Operable Units (well/constituent tables in Appendix A)</b>			
100-BC-5	Long-term monitoring	2.2	New sampling and analysis plan
100-FR-3	Long-term monitoring	2.7	New sampling and analysis plan
100-HR-3 (D pump and treat)	IRA; interim ROD	2.5	Chromium > remediation goal
100-HR-3 (D redox site)	IRA; interim ROD	2.5	Chromium > remediation goal; barrier complete
100-HR-3 (H pump and treat)	IRA; interim ROD	2.6	Chromium > remediation goal
100-KR-4	IRA; interim ROD	2.3	Chromium > remediation goal
100-NR-2	IRA; interim ROD	2.4	No decrease in plume size
1100-EM-1	Natural attenuation; final ROD	2.13	Average TCE <5 µg/L
200-BP-5	Long-term monitoring	2.10	New sampling and analysis plan
200-PO-1	Long-term monitoring	2.11	New draft sampling and analysis plan
200-UP-1	Interim action ROD	2.9	Technetium-99 < remediation goal; uranium > remediation goal
200-ZP-1	Interim action ROD	2.8	Heart of plume contained
300-FF-5 (300 Area)	Natural attenuation; interim ROD	2.12	Average TCE <5 µg/L; uranium remains elevated
300-FF-5 (north)	Operations and Maintenance plan	2.12	Tritium levels decreasing
<b>RCRA Units (well location maps, well/constituent tables, statistics tables, and flow rates in Appendix B)</b>			
116-N-1 (1301-N) facility	Indicator evaluation	2.4.3.1	No CIP exceedance <sup>(a)</sup>
116-N-3 (1325-N) facility	Indicator evaluation	2.4.3.3	No CIP exceedance <sup>(a)</sup>
120-N-1, 120-N-2 (1324-N/NA) facilities	Indicator evaluation	2.4.3.2	No CIP exceedance <sup>(a)</sup>
116-H-6 (183-H) evaporation basins	Corrective action	2.6.3	Monitoring during IRA; chromium, nitrate, technetium-99, uranium
216-A-29 ditch	Indicator evaluation	2.11.3.3	No CIP exceedance <sup>(a)</sup>
216-B-3 pond	Indicator evaluation	2.11.3.5	Demonstration of alternative statistical method
216-B-63 trench	Indicator evaluation	2.10.3.2	No CIP exceedance <sup>(a)</sup>
216-S-10 pond and ditch	Indicator evaluation	2.9.3.4	No CIP exceedance; <sup>(a)</sup> two downgradient wells remain
216-U-12 crib	Assessment	2.9.3.1	Continued assessment; two downgradient wells remain; new monitoring plan
316-5 process trenches	Corrective action	2.12.3	Monitoring during natural attenuation IRA; demonstration of alternative statistical method
LERF	Indicator evaluation	2.10.3.5	Insufficient wells; no statistical comparisons
LLWMA 1	Indicator evaluation	2.10.3.3	No CIP exceedance <sup>(a)</sup>
LLWMA 2	Indicator evaluation	2.10.3.4	No CIP exceedance <sup>(a)</sup>
LLWMA 3	Indicator evaluation	2.8.3.1	No CIP exceedance <sup>(a)</sup>
LLWMA 4	Indicator evaluation	2.8.3.2	No CIP exceedance; <sup>(a)</sup> two downgradient wells remain
NRDWL	Indicator evaluation	2.11.3.6	No CIP exceedance
PUREX cribs	Assessment	2.11.3.1	Continued assessment; nitrate
SST WMA A-AX	Indicator evaluation	2.11.3.2	No CIP exceedance <sup>(a)</sup>

**Table 1.1-1. (contd)**

Site or Operable Unit	Type of Monitoring Program	Text	FY 2003 Highlights
<b>RCRA Units (well location maps, well/constituent tables, statistics tables, and flow rates in Appendix B) (contd)</b>			
SST WMA B-BX-BY	Assessment	2.10.3.1	Continued assessment; nitrate, nitrite
SST WMA C	Indicator evaluation	2.10.3.6	Temporarily ceased CIP comparisons
SST WMA S-SX	Assessment	2.9.3.3	Continued assessment; chromium
SST WMA T	Assessment	2.8.4.3	Continued assessment
SST WMA TX-TY	Assessment	2.8.4.4	Continued assessment; chromium
SST WMA U	Assessment	2.9.3.3	Continued assessment; nitrate
<b>Other Regulated Units (well location maps, well/constituent tables in Appendix C)</b>			
100-K basins	AEA	2.3.3	No leaks detected
200 Area TEDF	WAC 173-216	2.11.5.1	No influence in upper aquifer
4608 B/C process ponds	WAC 173-216	2.11.5.3	No permit limits exceeded
ERDF	CERCLA	Appendix C	No impact on groundwater
SALDS	WAC 173-216	2.8.5	No permit limits exceeded; tritium plume possibly reached 200 West boundary; two dry wells
SWL	WAC 173-304	2.11.5.2	Five constituents exceeded background or standards; low levels of organics

(a) Analysis of CIP provided no evidence of groundwater contamination with hazardous constituents from the unit.

AEA = Atomic Energy Act of 1954.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.

CIP = Contamination indicator parameters.

ERDF = Environmental Restoration Disposal Facility.

FY = Fiscal year.

IRA = Interim remedial action.

LERF = Liquid Effluent Retention Facility.

LLWMA = Low-level waste management area.

NRDWL = Nonradioactive Dangerous Waste Landfill.

PUREX = Plutonium-Uranium Extraction Plant.

RCRA = Resource Conservation and Recovery Act.

ROD = Record of decision.

SALDS = State-Approved Land Disposal Site.

SST = Single-shell tank.

SWL = Solid Waste Landfill.

TCE = Trichloroethene.

TEDF = Treated Effluent Disposal Facility.

WAC = Washington Administrative Code.

WMA = Waste management area.

*For additional information on contaminants that are found at the Hanford Site, see “Summary Fact Sheets for Selected Environmental Contaminants to Support Health Risk Analysis” (Peterson et al. 2002), available on the website of Environmental Assessment Division, Argonne National Laboratory (<http://www.ead.anl.gov>). Click on “publications” and search for the title.*