1.0 Introduction

PA Hartsock

Since 1959, the U.S. Department of Energy (DOE) has published the Hanford Site Environmental Report annually to inform the public, regulators, stakeholders, and other interested parties of the site's environmental performance during the year. This calendar year (CY) 2015 report includes a description of the Hanford Site mission; compliance with applicable federal, state, and local environmental laws, regulations permits, executive orders, and DOE policies and directives; and descriptions of summary data from environmental programs. Previous years' annual environmental reports are available at http://msa.hanford.gov/page.cfm/enviroreports and include sections that describe the following:

- Site compliance with federal, state, and local environmental standards and requirements
- Site operations, including environmental restoration efforts and cleanup and closure activities
- Environmental management performance
- Environmental occurrences and responses
- Effluents and emissions from site facilities
- Results of on- and off-site environmental and groundwater monitoring efforts
- Cultural and biological resource assessments.

Additional detail is provided in the appendices, and descriptions of specific analytical and sampling methods used for 2015 monitoring efforts are provided in the latest version of the *Hanford Site Environmental Monitoring Plan* (DOE/RL-91-50).

Section 1.0 provides information about the Hanford Site location and detail the environmental setting, mission, management, primary operations and activities, and climate and meteorology. The report also discusses stakeholder involvement, the role of Native American tribes, and Hanford regulatory oversight.

1.1 Hanford Site Location

The Hanford Site is located within the semi-arid Pasco Basin of the Columbia Plateau in southeastern Washington State and occupies approximately 580 square miles (mi^2; 1,502 square kilometers [km^2]) north of the confluence of the Yakima and Columbia rivers. With restricted public access, the diverse geographic features and land (Figure 1.1) provide a buffer for areas once used for nuclear materials production and waste storage and disposal. The Columbia River flows through the northern part of the site and forms part of the eastern site boundary before turning south. Rattlesnake Mountain and the Yakima and Umtanum ridges form the southwestern and western boundaries, and the Saddle Mountains form the northern boundary. The closest population centers include Richland, Pasco, and Kennewick, collectively known as the Tri-Cities, which are located to the southeast of the site (PNNL-6415, Rev. 18).

The climate of the Hanford Site is influenced by the Pacific Ocean and Cascades to the west, along with other mountain ranges to the north and east. In addition to the Columbia River, natural surface waters include Rattlesnake and Snively springs and West Lake. With its shrub-steppe ecosystem, the site contains terrestrial and aquatic species, some of which are considered rare and/or declining or are of significant interest to federal, state, or tribal governments.

Figure 1.1. Detailed Geography of the Hanford Site, Hanford Reach National Monument (HRNM), and DOE Portions of the Hanford Site

1.2 Hanford Site Mission

The Hanford Site played a pivotal role in the nation's defense for over 40 years. During World War II and the Cold War, Hanford Site facilities were primarily dedicated to the production of plutonium to fuel atomic weapons and management of the resulting legacy waste. With the signing of the *Hanford Federal Facility Agreement and Consent Order* known as the Tri-Party Agreement (TPA; Ecology/EPA/DOE 1989a) by the Washington Department of Ecology (Ecology), U.S. Environmental Protection Agency (EPA), and DOE (collectively, TPA agencies), the primary mission shifted to developing new waste treatment and disposal technologies and characterizing and cleaning up the contamination from historical operations. The Hanford Site's current mission focuses on environmental restoration, which includes remediation of contaminated areas, decontamination and decommissioning of Hanford Site facilities, waste management (specifically, waste storage, treatment, and disposal), and related scientific and environmental research and development of waste management technologies. In addition, the recently established Manhattan Project National Historical Park, of which the Hanford B Reactor and other Hanford Site structures are a part, focuses on historic preservation and public education.

1.3 Primary Operations and Activities

The major DOE operational, administrative, research, and historically preserved areas in and around the Hanford Site include the following:

100 Area. The 100 Area consists of six distinct sites (100-B/C, 100-D, 100-F, 100-H, 100-K, and 100-N) along the Columbia River shore in the northern portion of the Hanford Site. These sites were the location of nine nuclear reactors that have since been retired. Collectively, the 100 Area occupies approximately 4 mi^2 (11 km^2). Now part of the Manhattan Project National Historical Park, the B Reactor National Historic Landmark is located in the 100-B Area. As the first industrial-scale nuclear reactor, B Reactor produced plutonium for the world's first nuclear detonation (Trinity Test) and the atomic bomb that was detonated over Nagasaki, Japan in 1945.

200 Area. The 200-East and 200-West Areas cover approximately 6 mi^2 (16 km^2) and are located on the Central Plateau between 5 and 7 mi (8 and 11 km) south and west of the Columbia River. The plateau surface is approximately 328 feet (ft; 100 meters [m]) above the level of the Columbia River and about 280 ft (85 m) above the underlying water table. These areas contain underground waste storage tanks and housed facilities known as separations plants that extracted plutonium from dissolved irradiated fuel. The 200-North Area covers approximately 58.6 acres (ac; 23.7 hectares [ha]) with operations mainly focused on irradiated nuclear fuel interim storage. Thermal cooling of the spent fuel required water that was disposed of at several sites in the 200-North Area. Remediation of these sites is ongoing.

300 Area. The 300 Area is located just north of Richland and covers approximately 0.6 mi^2 (1.5 km^2). From the early 1940s until the start of the environmental cleanup mission in 1989, nuclear fuel fabrication and research and development activities were performed at the 300 Area. Remediation of waste sites and decommissioning of 300 Area facilities is ongoing.

400 Area. The 400 Area is located northwest of the 300 Area and covers approximately 0.23 mi^2 (0.61 km^2). This area includes the Fast Flux Test Facility (FFTF), a nuclear reactor designed and used to

test various types of nuclear fuel, produce medical and industrial isotopes, and conduct cooperative international research. The FFTF operations were discontinued in 1992, and the facility is now in a low-cost, long-term surveillance and maintenance condition.

600 Area. The 600 Area includes all of the Hanford Site not occupied by the 100, 200, 300, and 400 Areas.

1100 Area. The former 1100 Area is located between the 300 Area and Richland, covering 1.2 mi^2 (3.1 km^2). In October 1998, this area was transferred to the Port of Benton as part of DOE's economic diversification efforts and is no longer part of the Hanford Site; however, DOE contractors continue to lease facilities in this area.

Richland North Area (off site). This area includes the DOE scientific user facility Environmental Molecular Sciences Laboratory (EMSL), Pacific Northwest National Laboratory (PNNL), and other DOE and contractor facilities (mostly office buildings) generally located in the northern part of Richland.

700 Area (off site). The 700 Area includes DOE administrative buildings in central Richland.

Volpentest HAMMER Federal Training Center. Hazardous Materials Management and Emergency Response (HAMMER) is a worker safety training facility located on the Hanford Site near Richland and is used by site contractors, federal and state agencies, tribal governments, and private industry. HAMMER contracts with emergency response agencies and offers classes in fire suppression, hostage rescue, high-speed pursuit, and drug enforcement. The center works with the U.S. Department of State to train international border patrol agents and homeland security staff. The facility consists of a 0.12-mi^2 (0.31-km^2) main site and a 15.6-mi^2 (40.4-km^2) law enforcement and security training site.

Non-DOE Operations and Activities on Hanford Site Leased Land. Energy Northwest operates a commercial nuclear power reactor at the Columbia Generating Station north of the 300 Area on 1,090 ac (440 ha). U.S. Ecology Washington operates a commercial low-level radioactive waste burial site located west of the 200 East Area on 99 ac (40 ha). West of the 400 Area, the California Institute of Technology and Massachusetts Institute of Technology jointly operate the Laser Interferometer Gravitational-Wave Observatory sponsored by the National Science Foundation.

Non-DOE Nuclear Operations Near the City of Richland. AREVA NP, Inc. operates a commercial nuclear fuel fabrication facility near the southern boundary of the Hanford Site, and Perma-Fix Northwest, Inc. operates a low-level, mixed low-level radioactive waste processing facility located immediately adjacent to the southern boundary of the Hanford Site on 53 ac (21 ha). In addition, Westinghouse Electric Company operates the Richland Service Center, which provides chemical cleaning, decontamination, and related chemical and waste processing services to the nuclear industry.

Hanford Reach National Monument. Designated in June 2000 by Presidential Proclamation (65 FR 37253), the Hanford Reach National Monument (Figure 1.2) covers 195,000 ac (78,900 ha). The purpose of the monument is to protect the nation's only non-impounded stretch of the Columbia River upstream of Bonneville Dam and the remaining shrub-steppe ecosystem that once blanketed the Columbia River Basin. The monument is divided into five distinct administrative units: Rattlesnake (Fitzner/Eberhardt Arid Lands Ecology [ALE] Reserve), Columbia River Corridor, Ringold, Wahluke, and Saddle Mountain. Additionally, the U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW), and DOE-Richland Operations Office (-RL) manage portions of the monument. The DOE-RL

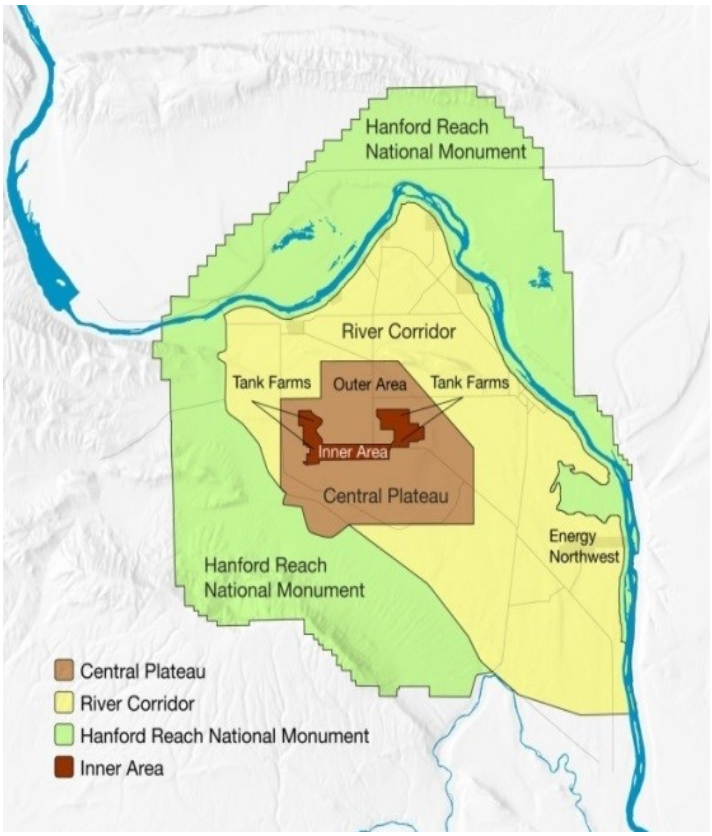

Figure 1.2. Hanford Site Area Overview

oversees a 14-mi^2 (36.4-km^2) area of the monument north and west of State Highway 24 and south of the Columbia River in Benton County known as McGee Ranch/Riverlands. DOE also manages the River Corridor Unit, which includes Hanford Reach islands (Benton County) and a 0.25-mi (0.4-km) wide strip of land along the Hanford Reach shoreline from Vernita Bridge to north of the 300 Area. This 39-mi^2 (101-km^2) area in Benton, Franklin, and Grant counties also includes the 9.9-mi^2 (25.6-km^2) Hanford Site Dunes north of Energy Northwest.

Manhattan Project National Historical Park. Established in November 2015 after a 15-year effort, one of the nation's newest national parks is located in three areas of the United States (Oak Ridge, TN; Los Alamos, NM; and Hanford, WA), areas that played critical roles in the research and development of the first nuclear bombs used in World War II. These sites were also at the origin of developing the national laboratory system that has given rise to U.S. scientific and technological advancement and capabilities. Key structures on the Hanford Site that are part of the permanently preserved park include:

- Bruggemann's Agricultural Warehouse Complex (existed during or since approximately/circa [ca.] 1900–1943) – The last remaining building from an irrigated farm, orchard, and fruit packing and shipping facility.
- B Reactor National Historic Landmark – The B Reactor was the world's first full-scale plutonium production reactor.
- Allard (Hanford Irrigation District) Pump House (ca. 1908) – With an irrigation canal headwall, businesses such as a hotel, pharmacy, mercantile and telephone companies, and real estate office created opportunity and industry in the towns of Hanford and White Bluffs.
- First Bank of White Bluffs (ca. 1907–1909) – The first European-American settlement of the late 1800s, White Bluffs was located in what was known as Washington territory. The bank represents the last remaining building of the pre-WWII town.
- Historic Hanford High School (ca. 1916) – The building served two generations of Hanford students and doubled as a hall for public meetings and social events.

These historical buildings represent some of the only remaining evidence of the agricultural towns of Hanford and White Bluffs and offer insight into the initial original settlement of the American West.

1.4 Hanford Site Management

PA Hartsock

DOE is responsible for operating the Hanford Site. DOE-RL and the Office of River Protection (ORP) jointly manage the site through several contractors and their subcontractors. Each contractor is responsible for the safe and environmentally sound maintenance of activities or facilities; waste management; evaluation and determination of all discharges to the environment; and for monitoring any potential effluent to ensure environmental regulatory compliance. DOE, USFWS, and WDFW each manage portions of the Hanford Reach National Monument, as described above. The Manhattan Project National Historical Park is a partnership between DOE, with existing and continuing oversight and management of multiple locations (including Hanford), and the U.S. Department of Interior's National Park Service as interpreter, offering visitor services and assistance with historical preservation.

The **DOE-Richland Operations Office** serves as the Hanford Site property owner and oversees cleanup along the Columbia River and in Hanford's Central Plateau, including groundwater and waste site cleanup; management of solid waste, spent nuclear fuel and sludge; facility cleanout, deactivation and demolition; environmental restoration; plutonium management; and all site support services. The principal contractors for RL and their respective responsibilities include the following:

- Mission Support Alliance, LLC (MSA) was awarded the Mission Support Contract for the Hanford Site in 2009. MSA is a joint venture between Lockheed Martin, Jacobs, and Centerra Group as well as several partners with specialized Hanford expertise. MSA is responsible for site infrastructure services for the Hanford Cleanup mission, including but not limited to roads and transportation services; electrical and water services; facility maintenance; emergency response (fire and patrol) services; network and software engineering; cyber security and records management; and environmental compliance and clean energy solutions.
- CH2M Plateau Remediation Company (CHPRC) was awarded the Plateau Remediation Contract in 2008. CHPRC is responsible for the safe environmental cleanup of the Central Plateau at the Hanford Site, including waste retrieval and fuels management, groundwater and vadose zone remediation, demolition of facilities and canyons, closure of the Plutonium Finishing Plant (PFP), and remediating the 100-K Area along the Columbia River, which includes preparing for treatment of highly radioactive sludge that is now in the K-West Basin, where it will be stored until it can be treated.
- Washington Closure Hanford, LLC (WCH) was awarded the River Corridor Closure Contract in 2005. WCH consists of AECOM (which acquired the former URS Corporation in late 2014), Bechtel National, Inc. (BNI), and CH2M (formerly CH2M HILL). WCH workers are responsible for cleaning up waste sites at Hanford, decontaminating and decommissioning former plutonium production nuclear reactors and surplus facilities, and disposing of contaminated waste. WCH is expected to complete its mission for DOE-RL during 2016.
- HPMC Occupational Medical Services (HPMC) was awarded the occupational medical contract for the Hanford Site in 2012. HPMC is responsible for the health and safety needs of more than 10,000 Hanford workers, providing occupational medical services to DOE and Hanford employees. HPMC has clinics in Richland and the Hanford 200-West Area.

The **DOE Office of River Protection** was established by Congress in 1998 as a field office to manage the retrieval, treatment, and disposal of approximately 53 million gallons (gal; 200 million liters [L]) of radioactive tank waste currently stored in 177 underground tanks in the central part of the site. The tank waste is material left over from years of WW II and post-war production of nuclear weapons fuel. In support of this mission, ORP is responsible for the safe operation of the tank farms and construction and operation of the Waste Treatment and Immobilization Plant (WTP) located on the Central Plateau. ORP and its principal contractors and their respective responsibilities include the following:

- Advanced Technologies and Laboratories International, Inc. (ATL) was awarded the Laboratory Analytical Services and Testing contract in 2009. ATL operates the 222-S Laboratory Complex, the primary on-site laboratory for analysis of highly radioactive samples in support of all Hanford projects. Located in the 200-West Area, the ATL is equipped and staffed to receive, analyze, and store samples and report analytical results to the appropriate contractor. Each year, technicians test some 25,000 samples of materials in support of the Hanford cleanup mission.
- Bechtel National Inc. (BNI) was awarded the contract to design, construct, and start the WTP in 2000. When complete, the WTP will be used to transform approximately 53 million gal (200 million L) of radioactive and chemical wastes being stored in underground tanks at the Hanford 200 Area into a stable glass form for permanent disposal.
- Washington River Protection Solutions LLC (WRPS) was awarded the Tank Operations Contract in 2008. WRPS consists of AECOM, Energy Solutions, and AREVA as the primary subcontractor. WRPS is responsible for safely managing the underground waste storage tanks until the waste is prepared for disposal. The waste is stored in 149 older single-shell tanks and 28 newer and safer double-shell tanks that are grouped into 18 farms located in the 200 Area on the Hanford Site Central Plateau.

The **DOE Office of Science** manages DOE's science and technology programs, goals, and objectives at the Hanford Site. Its principal contractor is PNNL, which has been operated by Battelle Memorial Institute for DOE since 1965. As one of 10 DOE national laboratories, PNNL is responsible for conducting research and delivering scientific solutions from multiple scientific disciplines to solve energy, environmental, and national security challenges. PNNL supports not only DOE but also the U.S. Department of Homeland Security, National Nuclear Security Administration, and other government agencies, universities, and industries.

1.5 Climate and Meteorology

GE Gutierrez, PJ Perrault

The Hanford Meteorology Station is located on the Hanford Site Central Plateau. Meteorologists take meteorological measurements to support Hanford Site operations, emergency preparedness and response, and atmospheric dispersion calculations for dose assessments. Support is provided through weather forecasting and by maintaining and distributing meteorological and climatological data. Forecasting is provided to help manage weather-dependent operations. Climatological data are provided to help plan weather-dependent activities and to assess the environmental effects of site operations.

Hanford Meteorology Station staff members rely on data provided by the Hanford Meteorological Monitoring Network, which consists of 29 remote monitoring stations that transmit data to the Hanford Meteorology Station through radio telemetry every 15 min. There are three towers that are 10 ft (3 m) high, 22 towers that are 30 ft (9 m) high, 3 towers that are 200 ft (61 m) high, and one 400-ft (121-m) tower. Meteorological information collected at these stations includes wind speed, wind direction, temperature, precipitation, atmospheric pressure, dewpoint temperature, wet-bulb global temperature (WBGT), solar radiation, relative humidity, and subsurface soil temperature; however, not all data are collected at all stations.

Regional temperatures, precipitation, and winds are affected by mountain barriers. Beyond the city of Yakima to the northwest, the Cascade Mountain Range greatly influences the climate of the Hanford Site because of its rain-shadow effect. The Rocky Mountains and mountain ranges in southern British Columbia in Canada protect the region from severe, cold polar air masses moving southward across Canada and winter storms associated with them.

Prevailing wind direction on the Central Plateau is from the northwest all year long, with a secondary wind from the southwest. Summaries of wind directions indicate that winds from the northwestern quadrant occur most often during winter and summer. During spring and fall, the frequency of southwesterly winds increases with a corresponding decrease in the northwesterly flow. Monthly wind speeds are lowest during winter months, averaging about 6–7 miles per hour (mph; 3 meters per second [m/s]), and highest during summer, averaging about 8–9 mph (4 m/s). Wind speeds well above average are usually associated with southwesterly winds. However, summer drainage winds are generally northwesterly and frequently exceed 30 mph (13 m/s). These winds are most prevalent over the northern portion of the Hanford Site. Figure 1.3 shows the 2015 wind roses, diagrams showing direction and frequencies of wind, measured at a height of 30 ft (9 m) for 28 meteorological monitoring stations. **Note**: Stations 19 and 32 are 10 ft (3 m) tall and are located within and around the Hanford Site.

Atmospheric dispersion is a function of wind speed, wind duration and direction, atmospheric stability, and mixing depth. Dispersion conditions are generally good if winds are moderate to strong, the atmosphere is of neutral or unstable stratification, and there is a deep mixing layer. Good dispersion conditions associated with neutral and unstable stratification exist approximately 57% of the time during summer. Less-favorable conditions may occur when wind speed is light and the atmospheric dispersion-mixing layer is shallow. These conditions are most common during winter when moderate to extremely stable stratification exists (approximately 66% of the time). Occasionally, there are extended periods of poor dispersion conditions primarily during winter that are associated with stagnant air in stationary high-pressure systems.

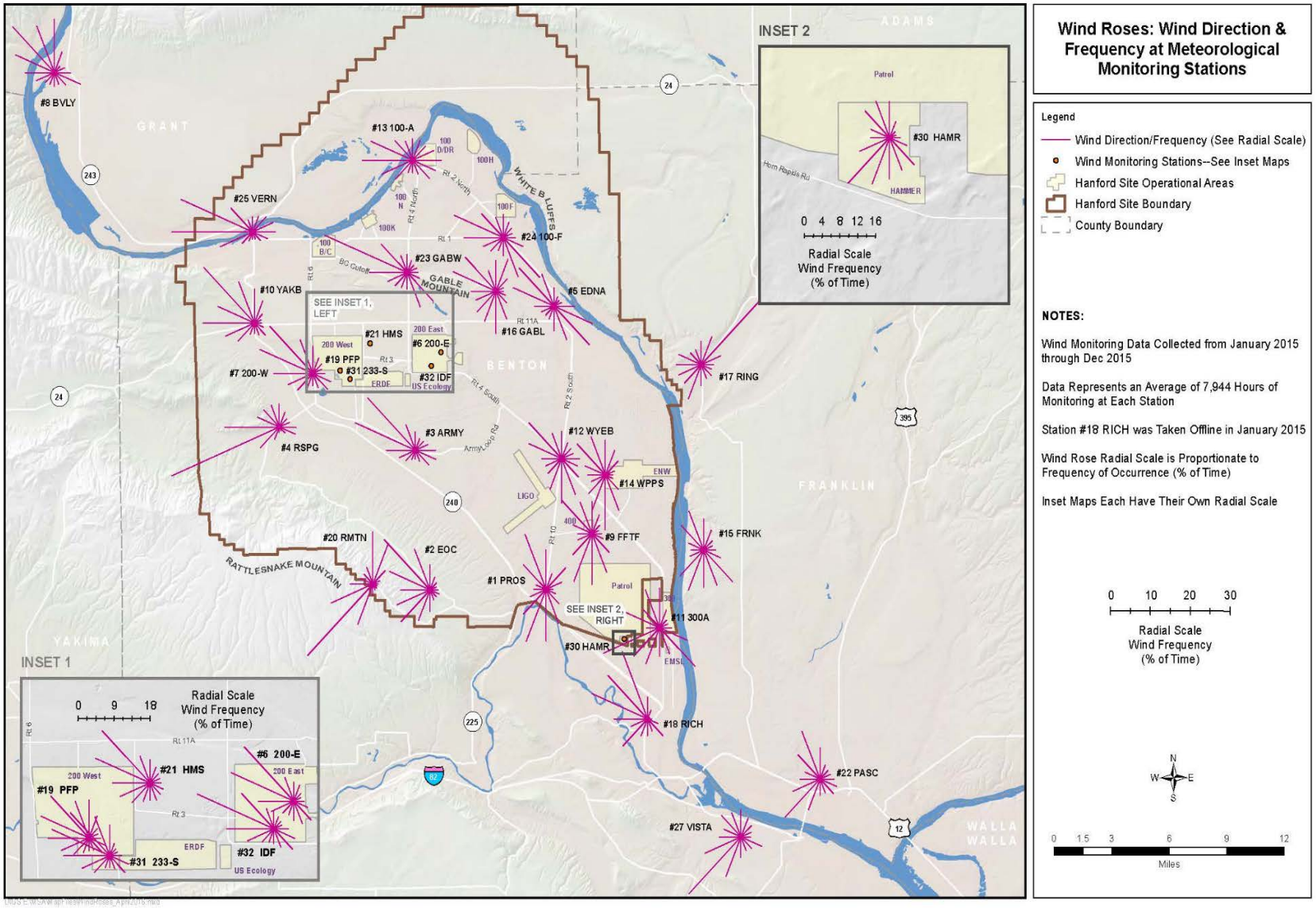

Figure 1.3. Meteorological Monitoring Network Wind Roses from 2015
measured at a height of 30 ft (9 m)

1.5.1 Historical Climatological Information

The following climatological information is for the Hanford Meteorological Station covering 1945 to 2015.

Temperature. The normal annual average temperature at the Hanford Meteorological Station is 53.9° Fahrenheit (F; 12.2° Celsius [C]). The monthly average temperature ranges from a high of 77.1°F (25.1°C) in July to a low of 31.1°F (–0.5°C) in December. The record highest monthly average temperature is 82.8°F (28.2°C) recorded in July 2014, and the record lowest monthly average temperature is 12.1°F (–11.1°C) recorded in January 1950. The highest daily temperature ever recorded at the Hanford Meteorological Station is 113°F (45°C) on three separate occasions: August 1961, July 2002, and July 2006. The lowest daily temperature ever recorded has been –23°F (–31°C) in February 1950.

Relative Humidity. The normal annual relative humidity at the Hanford Meteorological Station is 55.3%. Relative humidity is highest during winter (December and January), averaging 77.2%, and is lowest during summer (June through August), averaging 36.5%. The record highest monthly average relative humidity is 90.5% recorded in December 1950. The record lowest monthly average relative humidity is 21.9%, recorded in July 1959. The hourly relative humidity has ranged from 100% to 6%.

Precipitation. Normal annual precipitation at the Hanford Meteorological Station is 7.08 in. (17.98 cm). Most precipitation occurs during the winter, with more than half of the annual amount occurring between November and February. During the wettest year on record in 1995, the area received 12.31 in. (31.23 cm) of precipitation; the driest in 1976 received 2.99 in. (7.59 cm). The highest 24-hr total of precipitation was 1.91 in. (4.9 cm) recorded in October 1957. The normal seasonal snowfall is 14.7 in. (37.3 cm). The record highest seasonal snowfall total is 56.1 in. (142.5 cm) recorded in the 1992–93 season. The record lowest seasonal snowfall total is 0.3 in. (0.8 cm) recorded in the 1957–58 season. The most snowfall from a single storm is 12.4 in. (31.5 cm) recorded in February 1993. The record for snow depth is 15.6 in. (39.6 cm) in December 1985.

Wind Speed. The normal annual wind speed at the Hanford Meteorological Station is 7.6 mph (3.4 m/sec). The monthly average wind speed ranges from a high of 9.0 mph (4.0 meters per second) in June to a low of 5.9 mph (2.6 m/s) in December. The record highest monthly average wind speed is 11.1 mph (5.0 m/s) on multiple dates: April 1959 and 1972, and February 1999. The record lowest monthly average wind speed is 2.9 mph (1.3 m/s) in November 1956 and January 1985. The record highest daily wind speed is 33.7 mph (15.1 m/s) recorded in January 1972, and the record lowest daily wind speed is 0.3 mph (0.1 m/s) in January 1982 and November 1989. The record highest peak wind gust is 80 mph (36 m/s) in January 1972. The record highest hourly wind speed is 51 mph (23 m/s) in January 1972.

Pressure. The normal annual station pressure at the Hanford Meteorological Station is 29.213 in. of mercury. The monthly average station pressure ranges from a high of 29.329 in. in December to a low of 29.129 in. in August. The record highest monthly station pressure was 29.638 in. in December 1985, and the record lowest pressure was 28.999 in. in February 1998. The record highest hourly station pressure was 30.23 in. (adjusted sea level pressure of 1053.8 millibars [mb]) in January 1979. The record lowest hourly station pressure is 28.10 in. (adjusted sea level pressure of 977.3 mb) in December 1951.

Miscellaneous Weather. Daily and monthly averages and extremes of ambient temperature, dew point temperature, wet bulb temperature, pressure, wind, precipitation, sky cover, fog, solar radiation, relative humidity, thunderstorms, and other miscellaneous weather phenomena for 1945 through 2004 are reported in the 2004 climatological summary with historical data (PNNL-15160).

1.5.2 Monitoring

The average temperature for 2015 was 57.5°F (14.2°C), which was 3.6°F above normal. This made 2015 the warmest year on record. During 2015, 10 months were warmer than normal, two months were cooler than normal, and June had the greatest positive departure at 9.4°F above normal. The months of February, March, June, and October 2015 all broke records for highest mean monthly temperature for their respective month. September had the greatest negative departure at –1.2°F below normal.

Precipitation totaled 6.48 in. (16.46 cm), which is 92% of normal precipitation (7.08 in. [17.98 cm]). Greatest monthly total of precipitation was 1.49 in. (3.78 cm) in May, and lowest monthly total was a trace in August. May 12 and 13 had the greatest 24-hour precipitation at 1.34 in. (3.4 cm). Snowfall for 2015 totaled 10.8 in. (27.4 cm), which was 70% of normal (15.3 in. ([38.6 cm]). On April 25, a trace amount of hail [0.25 in. (0.64 cm)] fell at the Hanford Meteorological Station. The average is approximately one occurrence of hail every 2 years, and there has been at least one occurrence of hail each of the last 3 years.

Average wind speed was 8.0 mph (3.6 m/s), which was 0.4 mph (0.2 m/s) above normal. Occurring on November 17, the peak gust for the year was SW at 72 mph (32.2 m/s), the highest gust ever recorded in November. Peak gusts of 55 mph (25 m/s) were recorded in August and October. The peak gust recorded on August 29 out of the west is tied for the third highest gust ever recorded for August. These wind events caused blowing dust with reduced visibility, dropping to as low as 0.25 mi. In November, the highest recorded wind on Rattlesnake Mountain was a sustained SW wind of 95 mph (42.5 m/s) with gusts up to 115 mph (51 m/s).

The growing season was 201 days in 2015. The last frost in spring was April 16, and the first frost in fall was November 4. The longest growing season was 2014 with 224 days, and the shortest growing season was 1974 at 142 days.

Monthly and annual climatological data collected at the Hanford Meteorology Station is provided in Table 1.1. Real-time and historical data from the Hanford Meteorology Station are available at http://www.hanford.gov/hms, which includes hourly weather observations, 15-min data, monthly climatological summaries, and historical data.

Table 1.1. Meteorology Station* Monthly and Annual Climatological Data

	Temperature (°F)								Precipitation (in)				Relative Humidity (%)		15-m Wind †				
	Averages				Extremes						Snowfall					Peak Gusts			
Month	Daily Maximum	Daily Minimum	Monthly	Departure‡	Highest	Date	Lowest	Date	Total	Departure‡	Total	Departure‡	Average	Departure‡	Average Speed (mph)	Departure‡	Speed (mph)	Direction	Date
Jan	39.3	29.4	34.4	+1.0	58	18	11	1	0.67	–0.27	0.4	-4.2	87.8	+8.0	4.8	–1.5	41	WSW	18
Feb	55.2	35.4	45.3	+7.1	65	10	22	23	0.42	–0.28	T	-2.3	67.2	–3.5	7.2	+0.3	48	SW	7
Mar	64.8	38.3	51.5	+5.0	78	27	21	4	0.65	+0.08	0	-0.4	54.5	–2.7	7.6	–0.3	50	SW	15
Apr	68.7	40.4	54.6	+1.1	86	28	32	16§	0.09	–0.46	0	0	40.2	–8.1	9.2	+0.7	45	SW	10
May	80.5	52.4	66.5	+4.4	94	29	40	6	1.49	+0.98	0	0	40.7	–2.5	8.6	-0.2	47	WNW	24
Jun	93.7	64.3	79.0	+9.4	111	28	53	13	0.13	–0.38	0	0	25.4	–14.2	9.5	+0.5	43	S	28
Jul	96.5	66.2	81.4	+4.3	108	3	55	23	0.05	–0.13	0	0	25.6	–8.5	9.3	+0.7	43	WNW	18
Aug	93.0	62.8	77.9	+2.1	107	2§	53	31	T	–0.18	0	0	28.8	–6.9	9.0	+1.1	55	W	29
Sep	79.9	50.5	65.2	-1.2	97	12	40	15	0.06	–0.25	0	0	39.9	–3.1	7.7	+0.4	46	NW	5
Oct	72.1	47.6	59.9	+6.8	86	10	38	21	0.28	–0.21	0	0	53.3	–2.8	7.8	+1.1	55	WSW	10
Nov	47.9	31.7	39.8	–0.7	66	17	14	28§	0.60	–0.35	3.4	+1.4	70.7	–3.2	7.9	+1.2	72	SW	17
Dec	41.4	28.2	34.8	+3.7	66	8	14	31	2.04	+0.84	7.0	+1.1	82.9	+1.7	7.1	+1.2	47	SW	9
Year**	69.4	45.6	57.5	+3.6	111	Jun 28	11	Jan 1	6.48	–0.60	10.8	-4.4	51.4	–3.9	8.0	+0.4	72	SW	Nov 17

Note: Refer to Appendix A, Table A.2, Conversion Table, in the Helpful Information section for unit conversion information.
*The Hanford Meteorology Station is 25 mi (40 km) northwest of Richland, WA at latitude 46°34'N, longitude 119°35'W, elevation 733 ft (223 m)
†Measured on a tower 50 ft (15 m) above ground
‡Departure columns indicate positive or negative departure of meteorological parameters from 30-year (1981–2010) climatological normal.
§Latest of multiple occurrences
**Yearly averages, extremes, and totals

1.6 Stakeholder Involvement

DOE encourages information exchange and public involvement in discussions and decision making regarding Hanford Site cleanup and remediation actions. Active participants include the public; Native American tribes; federal, state, and local government agencies; advisory boards; activist groups; and other entities in the public and private sectors. The roles and involvement of select stakeholders are described in the following sections.

1.6.1 Role of Native American Tribes

JA Conrad

The role of Native American tribes at the Hanford Site is guided by *Department of Energy American Indian Tribal Government Interactions and Policy* (DOE O 144.1), which communicates departmental, programmatic, and field responsibilities for interacting with American Indian governments. This Order incorporates policy and consultation guidance in working with Native American tribes. DOE will consult with any American Indian or Alaska Native tribal government with regard to any property to which that tribe attaches religious or cultural importance, which might be affected by a DOE action. The policy outlines the trust relationship that DOE has with Native American tribes and commits the agency to institute government-to-government relations with the tribes. DOE O 144.1 Attachment 3, "Office of Environmental Management, Office of Nuclear Energy, Office of Science, and the National Nuclear Security Administration (NNSA) Framework to Provide Guidance for Implementation of U.S. Department of Energy's American Indian and Alaska Native Tribal Government Policy," provides additional guidance on how tribal consultation is to be conducted.

The U.S. government has a unique political and legal relationship with tribal governments as defined by treaties, the U.S. Constitution, court decisions defining the federal trust responsibility, and executive orders. Additional federal laws and regulations requiring DOE to consult with Native American tribes on certain issues include the *American Indian Religious Freedom Act* (42 U.S.C. 1996), the *National Environmental Policy Act of 1969* (NEPA; 42 U.S.C. 4321 et seq.), *Archaeological Resources Protection Act of 1979* (16 U.S.C. 470), *National Historic Preservation Act of 1966* (NHPA; 16 U.S.C. 470), and the *Native American Graves Protection and Repatriation Act of 1990* (Public Law 101-601).

As Hanford Site cleanup progresses, Native American tribes review various aspects of cleanup activities, including how these activities will affect cultural, natural, and biological resources, and the tribes' future ability to use and consume the resources that once existed at the site.

DOE works primarily with The Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and Confederated Tribes and Bands of Yakama Nation, all of with whom the U.S. government negotiated treaties (*Treaty with The Nez Percés* [U.S. Government 1855a]; *Treaty of Walla Walla* [U.S. Government 1855b]; *Treaty with The Yakama* [U.S. Government 1855c]) in 1855. Each Treaty included provisions that reserved the rights of Native American tribes to fish at all usual and accustomed places, hunt, gather roots and berries, and pasture horses and cattle on open and unclaimed land, among other rights. Located in Priest Rapids, the Wanapum, which once resided on lands that are now the Hanford Site with historic ties to the area, has a long-standing relationship with DOE. Additionally, DOE provides financial assistance through cooperative agreements with the Nez Perce Tribe, CTUIR, and Confederated Tribes and Bands of Yakama Nation, and supports tribal involvement in decisions made at Hanford.

Funding enables Native American tribes to retain staff to facilitate reviews and comment on site-related draft documents and plans as well as participate in meetings and activities. Tribal experts in tribal culture, history, and resources often contribute their insight and expertise to Hanford Site decision-making processes and activities. Further information regarding the DOE Tribal Program is available at http://www.hanford.gov/page.cfm/inp.

1.6.2 Cultural and Historic Resource Consultations

MK Wright

The NHPA (16 U.S.C. 470) requires DOE to consult with the Washington State Historic Preservation Officer, Native American tribes, local government representatives, the public, and other interested parties on cultural and historic resource matters. Regulations require that DOE solicit and gather input from Native American tribes and interested parties, obtain concurrence from the Washington State Historic Preservation Officer on the identification of cultural resources, evaluate the significance of these resources, and assess impacts of DOE activities on cultural resources. The *Hanford Cultural Resources Management Plan* (DOE/RL-98-10) provides guidance to DOE on cultural and historic resources issues.

DOE's Cultural and Historic Resource Protection (CHRP) program consults with the Washington State Historic Preservation Officer, the Nez Perce Tribe, CTUIR, Confederated Tribes and Bands of Yakama Nation, and the Wanapum through individual meetings and discussions, field walk-downs, and project comment resolution. Tribal cultural experts discuss project scope and design on a monthly basis with DOE, tribal representatives, and other interested parties.

DOE also consults with the Washington State Historic Preservation Officer and other parties that express an interest in historic resources located on the Hanford Site, including groups such as the B Reactor Museum Association, White Bluffs Pioneers, Benton County Historical Society, East Benton County Historical Museum, and Franklin County Historical and Museum Society.

1.6.3 Hanford Natural Resource Trustee Council

SH Wisness

The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA; 42 U.S. Code [U.S.C.] 9601) and implementing regulations in 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," establish DOE as both the CERCLA lead response agency at departmental facilities and a trustee for natural resources under its jurisdiction. As the lead response agency, DOE must conduct response actions to correct or mitigate threats to human health and the environment that result from the release of hazardous substances during the execution of its assigned missions. CERCLA also provides authority for assessment and restoration of natural resources that have been damaged by a hazardous substance release or response.

Under CERCLA, the United States is liable for damages or injury to, destruction of, or loss of natural resources resulting from release of hazardous substances or from removal or remedial activities made necessary because of such releases, including the cost of assessing such damage. The President of the United States by Executive Order 12580, "Superfund Implementation," appointed the Secretary of Energy as the primary trustee for all natural resources located on, over, or under DOE-administered land, including the Hanford Site.

Natural resource trustees are government officials who act on behalf of the public when there is injury to, destruction of, loss of, or threat to natural resources (for which they have management responsibility) from contaminant release. Federal, state, and tribal entities are authorized to act as trustees pursuant to CERCLA, Section 301(c), which covers Natural Resource Damage Assessments (NRDAs). Trustees for the Hanford Site include:

- DOE on behalf of the U.S. federal government
- U.S. Department of the Interior through the USFWS
- U.S. Department of Commerce through the National Oceanic and Atmospheric Administration
- State of Washington (through Ecology) in consultation with the WDFW
- State of Oregon through the Oregon Department of Energy
- Nez Perce Tribe
- CTUIR
- Confederated Tribes and Bands of the Yakama Nation (Yakama Nation).

Established in 1996 via a Memorandum of Agreement (DOE et al. 1996), the Hanford Natural Resource Trustee Council (Council) is a voluntary association of trust organizations. Members collaborate and coordinate on issues, documents, and actions concerning natural resources. The primary purpose of the Council is to facilitate the coordination and cooperation of the trustees in their efforts to mitigate effects to natural resources that result from either hazardous substance releases on the Hanford Site or remediation of those releases. The Council has adopted bylaws to direct the process of arriving at consensus on all substantive decisions.

Hanford NRDA work in FY 2015 was focused primarily on continuation of five injury studies initiated in prior years and the start of five new studies based on the Injury Assessment Plan (IAP). The Council prioritized the list of studies from the IAP that is subject to funding availability. Implementation of the IAP is a dynamic, iterative process, and the list of studies is subject to change as additional data becomes available during the injury assessment process. The Council's goal is to complete the injury assessment and prepare a Restoration Plan by 2024. Planning efforts resulted in an update of a Project Execution Plan (PEP) that defines the overall work scope, schedule, and budget for the Hanford injury assessment and establishes the means to execute, monitor, and control the project in a disciplined manner. The PEP is updated annually based on actual budgets and new information gained from the injury assessment process.

Ten initial injury studies are ongoing: five studies initiated in prior years and five new studies for FY 2015. Of the studies initiated in prior years, a final report summarizing results of a Groundwater Contaminant Plume Mapping study was drafted by the contractor (USGS), a Mussel Toxicity Study (also USGS) is nearing completion, and three tribal service loss studies are in various stages of completion. The five new injury studies initiated during the year address: 1) determination of groundwater services and valuation; 2) inventory of terrestrial habitat disturbance/injury; 3) compilation of data characterizing re-establishment of terrestrial habitat, including recovery trajectories; 4) scoping for near shore aquatic injury assessment; and 5) scoping for evaluation of contaminant concentrations in soils of non-process areas.

The Council continued to meet monthly to plan, organize, implement, and direct Hanford NRDA activities. Technical work groups (TWGs) also meet regularly to assist in study development, oversee studies, review environmental/contaminant release data, and make recommendations to the Council. Each TWG prepared (and the Council approved) updated 5-year work plans providing a prioritized list of tasks, task descriptions, and sequencing information for TWG work. A data management system for the Hanford NRDA was developed and approved for implementation in FY 2016. A process for setting up and maintaining the Council Administrative Record (AR) and case file is also expected to be implemented in FY 2016. Information about the Council, including its objectives, history, and projects, is available online at http://www.hanford.gov/page.cfm/hnrtc.

1.6.4 Public Involvement in Hanford Site Decisions

KL Holmes

RL and ORP believe that public involvement is essential to the ultimate success of Hanford Site cleanup. Both field offices have staff members who coordinate, plan, and schedule public participation activities for DOE on the Hanford Site.

Previously known as the *Community Relations Plan*, the *Hanford Public Involvement Plan* (TPA 2012) serves as the overall guidance document for public participation and outreach activities at Hanford. The document outlines the public participation processes used by the TPA agencies and offers ways in which the public can be involved in Hanford Site cleanup decision-making processes. The first plan was developed and approved with public input in 1990 and was last revised in November 2012.

A key goal of public involvement is to facilitate broad-based participation and obtain stakeholder and public perspectives on Hanford Site cleanup decisions. DOE uses various forums to inform the public about upcoming public involvement and participation opportunities, including but not limited to the following:

Hanford Cleanup Line. The TPA agencies strive to provide a timely response to all information requests that come in by telephone. The former 1-800 number dedicated to Hanford calls that provided approximately 20 years of service will be transitioned in favor of increasing use of other media formats. On public involvement materials, the phone number listed for information purposes will be (509) 372-7950, a weekday-staffed line at Ecology. This number is advertised in a variety of ways, including within TPA announcements; in media formats such as newspaper articles, brochures, and meeting notices; and on Hanford Site fact sheets.

Listserv Notices and Printed Mailings. The TPA agencies use a Listserv to communicate electronically about upcoming public involvement activities, along with information on ways to be involved in Hanford cleanup decisions. To be added to the Listserv or to the printed mailing list, send an email to Hanford@ecy.wa.gov or call (509) 372-7950.

Hanford Site Public Involvement Activities. Available at http://www.hanford.gov, the Hanford Site Events Calendar provides an overview of public involvement opportunities for the coming months and identifies current forums and emerging opportunities to inform and involve stakeholders and the public.

TPA Agencies Public Involvement Calendar for the Hanford Site. Available on the Hanford Advisory Board (HAB) communications website (http://www.hanford.gov/page.cfm/PICCSummary), a public involvement calendar is available that frequently provides upcoming key public activities, including HAB meeting dates and locations.

TPA Agencies Public Involvement Summary. Each year since the early 2000s, the TPA agencies have distributed an annual survey to encourage feedback, share information, and provide education about the Hanford Site cleanup. What began as a challenging, hand-written response interpretation and information gathering at biennial meetings has become an annual electronic survey. This year's publication is available for review (TPA 2016a) and promotes and encourages the sharing of links through a wide variety of online media. Previous years public involvement summary reports can be found online at https://issuu.com/hanford_edoutreach.

Hanford Site Informational Links. Information concerning Hanford Site events, issues, cleanup activities, and public involvement opportunities is available at http://www.hanford.gov/.

Comment and Response Documents. Following a DOE or TPA public comment period, a comment and response document is developed to record public comments received on an issue. Comment and response documents are distributed to members of the public who provide comments or request a copy. These documents are also available at the DOE Public Reading Room (Washington State University Tri-Cities Consolidated Information Center, 2710 University Dr., Richland, WA); on the TPA AR Public Information Repository (PIR) website (TPA 2016b); and, for proposed changes to the TPA that underwent public comment, on the TPA website at http://www.hanford.gov/page.cfm/TriParty/ModificationsforPublicComment.

Informational Public Meetings. All TPA quarterly public involvement planning, semiannual, and special meetings and workshops are open to the public. In addition, the TPA agencies welcome opportunities for co-sponsoring meetings organized by local, state, and tribal governments and citizen groups.

Hanford Site cleanup documents are also available to the public through the TPA AR PIR website (TPA 2016b). Responsible federal and state governments provide the public a variety of opportunities to offer input and influence Hanford Site cleanup decisions, including informal and formal public comment periods, such as those described in Ecology/EPA/DOE 1989a, CERCLA, RCRA, and NEPA; HAB meetings; State of the Hanford Site presentations; and other Hanford Site-related public involvement and information meetings, workshops, or activities.

For more information about Hanford Site cleanup activities, contact the TPA agencies at the following contact numbers:

RL	(509) 376-7501
ORP	(509) 372-8656
Hanford Site Cleanup Line/Ecology	(509) 372-7950
EPA	(509) 376-8631

For more information about Hanford Site public involvement, visit the Hanford Site website at http://www.hanford.gov.

1.6.5 State of Oregon

KL Holmes

DOE recognizes Oregon's unique role and interests at the Hanford Site and its concerns with protecting Columbia River resources. DOE is interested in sharing, facilitating, and accommodating the exchange of information with the State of Oregon. RL and ORP entered into a Memorandum of Understanding (DOE-

RL and Office of River Protection 2004) with the State of Oregon to consult (and whenever possible, cooperate) on Hanford Site environmental issues. DOE will consult with and include the Oregon Department of Energy in planning and conducting Hanford Site-related public involvement activities in the State of Oregon.

1.6.6 Hanford Advisory Board (HAB)

KL Holmes

The HAB is a broadly representative body consisting of a balanced mix of members that represent diverse interests affected by Hanford Site cleanup decisions. The TPA agencies created the HAB in 1994 and was ultimately chartered as one of eight environmental management site-specific advisory boards across the country. The HAB comprises 32 members and their alternates, including representatives from the Nez Perce Tribe and the Confederated Tribes and Bands of the Yakama Nation. A representative of the CTUIR participates on the board in an ex-officio status. Current members with their affiliations are listed on the HAB website at http://www.hanford.gov/page.cfm/hab.

The HAB assists the broader public in becoming more informed and meaningfully involved in Hanford Site cleanup decisions through its open public meetings. Board members' formal advice on cleanup issues reflects the values of its constituents. Copies of their advice and DOE's responses are on the HAB website for Advice and Responses at http://www.hanford.gov/?page=453. Additional information about the HAB, including its charter (operating ground rules), is available at http://www.hanford.gov/?page=449.

1.7 Hanford Site Regulatory Oversight

PA Hartsock

Several federal, state, and local regulatory agencies are responsible for monitoring and enforcing compliance with applicable environmental regulations at the Hanford Site, including the EPA, Ecology, Washington State Department of Health (WDOH), and the Benton Clean Air Agency.

1.7.1 Environmental Regulations

The EPA is the primary federal regulatory agency that develops, promulgates, and enforces environmental regulations and standards as directed in federal statutes. In some instances, EPA has delegated authority to the state or enabled the state program to operate in lieu of the federal program when the state's program meets or exceeds EPA requirements. In other activities, the state program is assigned direct environmental oversight of the DOE program, as provided by federal law. Where federal regulatory oversight is not delegated or only partially authorized to the state, the EPA Pacific Northwest Regional Office (Region 10) is responsible for reviewing and enforcing compliance with EPA regulations as they pertain to the Hanford Site. The EPA periodically reviews state environmental programs and may directly enforce federal environmental regulations.

1.7.2 Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)

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The TPA is an agreement (Ecology/EPA/DOE 1989a) among the TPA agencies to achieve environmental regulation compliance on the Hanford Site with CERCLA and RCRA treatment, storage, and disposal (TSD) unit regulations and corrective action provisions. The TPA is an interagency agreement under

CERCLA, Section 120, a corrective action order under RCRA, and a consent order under the Revised Code of Washington (RCW), "Hazardous Waste Management" (RCW 70.105) that 1) defines RCRA and CERCLA cleanup commitments; 2) establishes responsibilities; 3) provides a basis for budgeting; and 4) reflects a concerted goal to achieve regulatory compliance and remediation with enforceable milestones. Attachment 2 of the TPA Action Plan (Ecology/EPA/DOE 1989b) describes how public information and involvement activities are conducted for TPA decisions.

The TPA has evolved as Hanford Site cleanup has progressed. Since its initial publication in 1989, the TPA agencies have negotiated changes to the agreement to meet the changing conditions and needs of cleanup activities on the Hanford Site. All significant changes undergo a process of public involvement designed to enhance communication and address public concerns prior to final approvals. Revision 8 of the TPA was published in July 2011. As new change control forms are approved through the TPA change control process, they are incorporated into the TPA. Printed copies of Revision 8 of the TPA are publicly available at DOE's Public Reading Room located in the Washington State University Tri-Cities Consolidated Information Center, 2770 University Dr., Richland, WA and at public information repositories in Seattle and Spokane, WA and Portland, OR. To be placed on the mailing list to obtain TPA information, call the Hanford Cleanup Line at (509) 372-7950 or e-mail to Hanford@ecy.wa.gov.

1.7.2.1 Tri-Party Agreement Milestone Status

The TPA commits DOE to comply with the remedial-action provisions of CERCLA as well as with *Resource Conservation and Recovery Act of 1976* (RCRA; 42 U.S.C. 6901) TSD unit regulations and corrective-action provisions, including Washington State's implementing regulations (Washington Administrative Code [WAC] 173-303, "Dangerous Waste Regulations"). From 1989 through December 31, 2015, a total of 1,265 TPA milestones were completed, and 336 target dates were met. During 2015, 40 specific cleanup milestones were scheduled for completion; of those, 30 milestones were completed on time, no milestones were missed, 5 were in negotiation, and 5 were in dispute resolution. In addition, 4 target dates were met.

1.7.2.2 Tri-Party Agreement Approved Modifications

During 2015, 11 negotiated change control forms to the TPA were approved and can be viewed on the TPA website at http://www.hanford.gov/c.cfm/tpa/.

1.8 Additional Hanford Area Websites

PA Hartsock

Company or Organization	Website
AECOM (formerly URS Corporation)	http://www.aecom.com/
AREVA Inc. (branch local to Richland, WA)	http://us.areva.com/en/home-427/areva-inc-richland-fuel-production.html
City of Kennewick	http://www.go2kennewick.com/
City of Pasco	http://www.pasco-wa.gov/
City of Richland	http://www.ci.richland.wa.us/
City of West Richland	http://www.westrichland.org/
Environmental Molecular Sciences Laboratory (EMSL)	https://www.emsl.pnl.gov/emslweb/
Hanford's Environmental Restoration Disposal Facility	http://www.hanford.gov/page.cfm/erdf
Geology of Washington, Columbia Basin	http://www.dnr.wa.gov/programs-and-services/geology/explore-popular-geology/geologic-provinces-washington/columbia-basin
Hanford Reach National Monument	http://www.fws.gov/refuge/hanford_reach/
Hanford Site Tours	http://www.hanford.gov/page.cfm/HanfordSiteTours
Lockheed Martin Corporation	http://www.lockheedmartin.com/
Manhattan Project National Historical Park (Hanford-specific portion)	https://www.nps.gov/mapr/hanford.htm
Mission Support Alliance	https://msa.hanford.gov/
Pacific Northwest National Laboratory	http://www.pnnl.gov/
Pacific Northwest Seismic Network	http://pnsn.org/
Perma-Fix Northwest Richland	http://www.perma-fix.com/facilities/pf_nuclear_richland/
Port of Benton	http://www.portofbenton.com/
Tri-Cities Visitor & Convention Bureau	http://www.visittri-cities.com/
Volpentest HAMMER Federal Training Center	http://www.hammertraining.com/
Washington Department of Fish & Wildlife	http://wdfw.wa.gov/
Washington State Department of Ecology (Hanford-specific information)	http://www.ecy.wa.gov/programs/nwp/index.html