



8.1 CLIMATE AND METEOROLOGY

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Meteorological measurements are taken to support Hanford Site emergency preparedness and response, operations, and atmospheric dispersion calculations for dose assessments (Appendix E, Tables E.5 and E.7 through E.9). Support is provided through weather forecasting and maintaining and distributing climatological data. Forecasting is provided to help manage weather-dependent operations. Climatological data are provided to help plan weather-dependent activities and are used as a resource to assess the environmental effects of site operations. A summary of requests for meteorological data from facilities and organizations both on and off the Hanford Site during 2002 is provided in Table 8.1.1.

The Hanford Meteorology Station relies on data provided by the Hanford Meteorological Monitoring Network. This network consists of 30 remote monitoring stations that transmit data to the Hanford Meteorology Station via radio telemetry every 15 minutes. There are twenty-seven 9-meter (30-foot) towers and three 61-meter (200-foot) towers. Meteorological information collected at these stations includes wind speed, wind direction, temperature, precipitation, atmospheric pressure, and relative humidity; however, not all of these data are collected at all stations. Figure 8.1.1 shows the 2002 wind roses (i.e., diagrams showing direction and frequencies of wind) measured at a height of 9 meters (30 feet) for the 30 meteorological monitoring stations on and around the Hanford Site.

The Cascade Range, beyond Yakima to the west, greatly influences the climate of the Hanford Site because of its rain shadow effect. The regional temperatures, precipitation, and winds are affected also by the presence of mountain

barriers. The Rocky Mountains and ranges in southern British Columbia protect the inland basin from severe, cold polar air masses moving southward across Canada and winter storms associated with them.

The Hanford Meteorology Station is located on the Hanford Site's Central Plateau, where the prevailing wind direction is from the northwest during all months of the year. The secondary wind direction is from the southwest. Summaries of wind direction 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 average wind speeds are lowest during winter months, averaging about 3 meters per second (6 to 7 miles per hour), and highest during summer, averaging about 4 meters per second (8 to 9 miles per hour). Wind speeds that are well above average are usually associated with southwesterly winds. However, summertime drainage winds are generally northwesterly and frequently exceed 13 meters per second (30 miles per hour). These winds are most prevalent over the northern portion of the 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 ~57% of the time during summer. Less favorable conditions may occur when wind speed is light and the mixing layer is shallow. These conditions are most common during winter, when moderate to extremely stable stratification exists ~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.

Real-time and historical data from the Hanford Meteorology Station can be obtained at <http://etd.pnl.gov:2080/HMS>. Data on this web site include hourly weather observations, 15-minute data from the Hanford Meteorological Monitoring Network, monthly climatological summaries, and historical data.

Table 8.1.1. Requests for Meteorological Data from Facilities and Organizations On and Off the Hanford Site, 2002

Requestor	Number of Requests												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Onsite													
100 Areas (other)	94	55	120	81	81	50	30	33	49	47	38	22	700
222S/WSCF Labs	3	3	2	1	1	2	1	0	2	2	2	1	20
300 Area (other)	19	11	15	8	7	11	2	3	32	11	12	9	140
BHI/subcontractors	2	0	4	1	3	1	2	6	2	1	2	7	31
Canister Storage	1	0	0	1	1	0	0	1	0	0	1	0	5
Construction	2	1	4	1	0	2	0	3	0	3	0	0	16
Crane and Rigging	1	0	1	0	0	0	1	0	1	2	1	2	9
DOE-RL	1	1	5	1	4	3	3	0	0	0	0	1	19
Electrical Dispatcher	25	21	22	22	27	16	25	19	26	16	22	24	265
Emerg. Preparedness	18	12	14	7	23	27	13	25	14	15	23	8	199
Energy Northwest	0	0	1	0	0	1	0	0	0	0	0	1	3
Evaporator Facility	0	0	0	1	0	0	0	0	0	0	0	0	1
FDH (other)	3	1	5	2	1	0	2	2	27	1	6	0	50
FFTF	1	3	0	2	1	0	3	1	3	0	1	0	15
Fire Dept.	31	30	34	35	40	57	28	31	27	30	28	27	398
HAMMER Facility	1	0	7	7	3	1	1	0	1	0	1	2	24
Hanford Patrol	3	1	3	0	1	3	3	0	0	2	0	4	20
Industrial Hygiene	24	21	22	10	12	7	2	14	14	13	10	9	158
Pest Control	6	5	13	14	9	8	6	15	11	10	6	1	104
PFP	59	40	32	16	7	3	1	3	5	18	30	26	240
Photography	5	1	0	0	0	0	0	0	0	2	1	0	9
PNNL	14	13	11	9	12	16	9	7	5	9	11	6	122
Salt Wells	0	1	6	2	4	2	4	22	29	8	5	3	86
Solid Waste	1	0	2	0	2	2	4	1	0	0	1	1	14
T Plant	0	3	0	2	1	0	0	0	0	1	0	1	8
Tank farms	336	300	513	338	390	303	382	291	348	272	234	284	3,991
Track/Road Maint.	8	5	7	1	1	0	0	0	0	1	1	13	37
Vitrification Plant	0	5	7	9	5	2	7	10	11	10	10	18	94
WBGY	0	0	0	0	0	89	202	62	8	0	0	0	361
WRAP/ERDF/other	0	0	3	0	2	0	1	0	1	1	2	0	10
Monthly Total	658	533	853	571	638	606	732	549	616	475	448	470	7,149

Table 8.1.1. (contd)

<u>Requestor</u>	<u>Number of Requests</u>												
<u>Offsite</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Annual Total</u>
City of Richland	0	1	0	3	2	0	2	1	0	0	0	0	9
NWS	0	0	0	0	0	1	0	0	0	1	0	1	3
RLD Medical Off.	21	17	14	20	25	14	11	18	20	13	16	17	206
Tri-City Herald	1	2	0	0	0	0	4	0	0	2	0	2	11
TV/Radio Stns.	0	0	0	0	0	0	1	0	0	0	0	0	1
US Fish/Wildlife	0	0	1	0	0	0	0	0	0	1	0	0	2
Monthly Total	22	20	15	23	27	15	18	19	20	17	16	20	232

- BHI = Bechtel Hanford, Inc.
- DOE-RL = DOE Richland Operations Office.
- ERDF = Environmental Restoration Disposal Facility.
- FDH = Fluor Hanford, Inc.
- FFTF = Fast Flux Test Facility.
- NWS = National Weather Service.
- PFP = Plutonium Finishing Plant.
- PNNL = Pacific Northwest National Laboratory.
- PUD = Public Utility District.
- RLD = Richland.
- WBGF = Wet bulb globe temperature (heat stress).
- WRAP = Waste Receiving and Packaging Facility.
- WSCF = Waste Sampling and Characterization Facility.

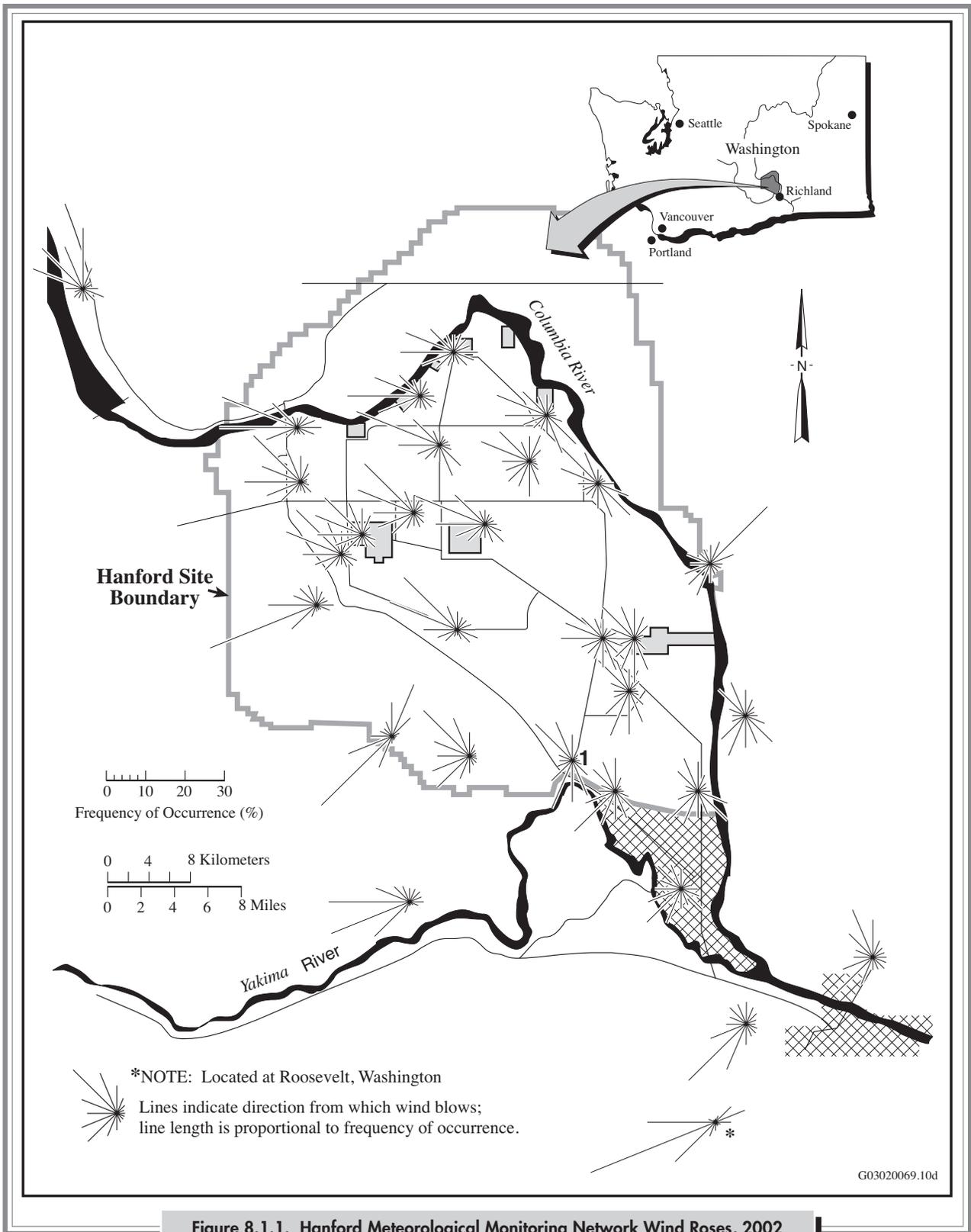


Figure 8.1.1. Hanford Meteorological Monitoring Network Wind Roses, 2002 (measured at a height of 9 meters [30 feet]).

8.1.1 HISTORICAL CLIMATOLOGICAL INFORMATION

Daily and monthly averages and extremes of temperature, dew point temperature, and relative humidity for 1945 through 2002 are reported in PNNL-14242. From 1945 through 2002, the record maximum temperature was 45°C (113°F) recorded during August 1961 and July 2002, and the record minimum temperature was -30.6°C (-23°F) in February 1950. Normal monthly average temperatures ranged from a low of -0.2°C (31.7°F) in December to a high of 24.6°C (76.3°F) in July. During winter, the highest monthly average temperature at the Hanford Meteorology Station was 6.9°C (44.5°F) in February 1991, and the record lowest was -11.1°C (12.1°F) in January 1950. During summer, the record maximum monthly average temperature was 27.9°C (82.2°F) in July 1985, and the record minimum was 17.2°C (63.0°F) in June 1953. The normal annual relative humidity at the Hanford Meteorology Station is 54%. Humidity is highest during winter, averaging ~76%, and lowest during summer, averaging ~36%. Normal annual precipitation at the Hanford Meteorology Station is 17.7 centimeters (6.98 inches). The wettest year on record, 1995, received 31 centimeters (12.31 inches) of precipitation; the driest, 1976, received 8 centimeters (2.99 inches). Most precipitation occurs during late autumn and winter, with more than half of the annual amount occurring from November through February. The snowiest winter on record, 1992-1993, received 142.5 centimeters (56.1 inches) of snow.

8.1.2 RESULTS OF 2002 MONITORING

Calendar year 2002 was slightly warmer than normal and precipitation was below normal.

The average temperature for 2002 was 12.4°C (54.4°F), which was 0.4°C (0.8°F) above normal (12.0°C [53.6°F]). Seven months during 2002 were warmer than normal; four months were cooler than normal. January had the greatest positive departure, 3.2°C (5.8°F); and March, at 2.1°C (3.7°F) below normal, had the greatest negative departure.

Precipitation during 2002 totaled 13.7 centimeters (5.41 inches), 78% of normal (17.7 centimeters [6.98 inches]). Snowfall for 2002 totaled 7.1 centimeters (2.8 inches) (compared to an annual normal snowfall of 39.1 centimeters [15.4 inches]).

The average wind speed during 2002 was 3.5 meters per second (7.8 miles per hour), which was 0.1 meter per second (0.2 mile per hour) above normal. The peak gust for the year was 28.2 meters per second (63 miles per hour) on December 27.

There were eight dust storms recorded at the Hanford Meteorology Station during 2002. There has been an average of five dust storms per year at the Hanford Meteorology Station during the entire period of record (1945-2002).

Table 8.1.2 provides monthly and annual climatological data collected at the Hanford Meteorology Station during 2002.

Table 8.1.2. Monthly and Annual Climatological Data from the Hanford Meteorology Station, 2002

Hanford Meteorology Station, 40 kilometers (25 miles) northwest of Richland, Washington,
latitude 46° 34'N, longitude 119° 35'W, elevation 223 meters (733 feet)

Month	Temperatures, °C								Precipitation (cm)				Relative Humidity (%)		15-m Wind ^(a)				
	Averages				Extremes				Total	Departure ^(b)	Snowfall		Average	Departure ^(b)	Average Speed, m/s	Departure ^(b)	Peak Gusts		
	Daily Maximum	Daily Minimum	Monthly	Departure ^(b)	Highest	Date	Lowest	Date			Total	Departure ^(b)					Average	Departure ^(b)	Speed, m/s
J	7.3	-1.2	3.1	+3.2	17.2	7	-10.6	29	1.1	-1.1	1.5	-9.1	73.1	-4.2	3.7	+0.8	25.5	W	12
F	9.8	-2.7	3.6	+0.3	20.0	21	-8.9	27 ^(c)	1.7	-T ^(d)	0.5	-6.1	67.7	-2.8	2.7	-0.4	19.7	SW	21
M	12.0	-0.4	5.8	-2.1	21.1	31	-7.8	3	0.5	-1.0	3.6	+2.5	57.0	+0.4	4.0	+0.3	26.8	SW	11
A	19.2	4.3	11.8	-0.2	26.7	30	-1.7	4	0.7	-0.4	0	-T ^(d)	46.0	-1.3	4.0	+0.1	22.4	WSW	14
M	23.1	8.2	15.6	-0.9	30.0	27	0.0	8	0.4	-1.0	0	0	42.5	-0.5	4.1	+0.1	23.2	W	5
J	29.9	14.0	22.0	+1.3	40.0	26	7.8	8 ^(c)	1.6	+0.6	0	0	40.4	+0.8	4.0	0	21.0	NW	7
J	35.4	17.6	26.4	+1.8	45.0	13	10.0	4	0.4	-0.3	0	0	32.1	-1.3	4.2	+0.3	23.7	NW	7
A	32.4	15.9	24.2	0	39.4	14	10.0	17	T ^(d)	-0.8	0	0	34.5	-1.1	3.7	+0.1	18.3	NW	10
S	27.6	10.4	19.1	+0.2	35.6	22	3.3	22	T ^(d)	-0.8	0	0	38.8	-3.5	3.4	0	17.4	WNW	15
O	18.6	1.9	10.2	-1.4	27.2	6	-13.9	31	0.3	-0.9	0	-0.3	50.1	-5.3	2.8	-0.2	19.2	NNE	29
N	10.3	-0.3	5.0	+0.5	19.4	19	-11.7	2 ^(c)	1.0	-1.5	T ^(d)	-5.8	72.7	-1.0	2.5	-0.3	16.1	SSW	16
D	5.3	0.4	2.9	+3.1	13.3	16	-5.0	22	6.0	+3.2	1.5	-13.2	88.7	+8.6	2.5	-0.1	28.2	SW	27
Y ^(e)	19.2	5.7	12.4	+0.4	45.0	Jul 13	-13.9	Oct 31	13.7	-4.0	7.1	-32.0	53.6	-1.0	3.5	+0.1	28.2	SW	Dec 27

NOTE: See Appendix A, Table A.2 in this report for unit conversion information.

- (a) Measured on a tower 15 meters (50 feet) above the ground.
- (b) Departure columns indicate positive or negative departure of meteorological parameters from 30-year (1971-2000) climatological normals.
- (c) Latest of several occurrences.
- (d) Trace.
- (e) Yearly averages, extremes, and totals.