



## 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 in 2001 is provided in Table 8.1.1.

Local data to support the Hanford Meteorology Station operations are provided via 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 parameters collected at these stations include wind speed, wind direction, temperature, precipitation, atmospheric pressure, and relative humidity; however, not all parameters are collected at all stations. Figure 8.1.1 shows the 2001 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 the more severe cold polar air masses moving southward across Canada and winter storms associated with them.

The Hanford Meteorology Station is located on the 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 Meteorological 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, 2001

<b>Requestor</b>	<b>Number of Requests</b>												
	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual Total</b>
100 Area (other)	17	16	10	15	13	19	29	40	29	53	50	63	354
101 SY Complex	0	0	0	0	0	0	0	0	0	0	0	0	0
222S/WSCF Labs	3	0	2	5	2	1	2	1	0	3	2	1	22
300 Area (other)	34	10	13	8	8	24	4	13	16	2	3	5	140
B Plant <sup>(a,b)</sup>	0	1	0	0	0	0	1	0	0	0	0	0	2
BHI/subcontractors	2	3	0	0	1	0	0	1	0	1	1	1	10
Canister Storage	0	1	0	0	1	0	0	1	1	0	1	1	6
Construction	1	1	3	1	1	2	3	7	2	4	7	8	40
Crane and Rigging	0	0	0	0	0	13	1	2	1	7	1	0	25
DOE-RL	0	3	8	1	3	2	2	2	2	2	2	1	28
Electrical Disp.	25	19	27	23	24	18	20	17	22	24	23	26	268
Emerg. Preparedness	21	34	17	26	23	24	11	19	21	23	8	12	239
Energy Northwest	0	0	2	0	0	2	0	0	0	2	1	0	7
Evaporator	0	0	0	0	0	0	0	0	0	0	0	0	0
FDH (other)	3	21	10	4	4	2	1	12	1	2	1	2	63
FFTF	1	3	2	4	3	2	1	2	0	1	2	1	22
Fire Dept.	31	25	32	30	28	64	45	36	36	27	32	36	422
HAMMER Facility	0	1	1	4	4	4	3	5	3	3	0	0	28
Hanford Patrol	2	3	1	0	3	2	2	0	1	0	3	6	23
Industrial Hygiene	15	30	26	10	23	14	14	9	19	14	8	9	191
Pest Control	1	3	4	9	22	9	11	4	30	12	2	5	112
PFP	30	36	42	8	2	2	0	12	1	46	41	33	253
Photography	1	1	0	1	0	0	2	0	0	0	2	0	7
PNNL	9	1	6	4	3	4	10	31	4	27	44	15	158
Salt Wells	1	1	0	7	1	8	0	4	0	4	4	4	34
Solid Waste	2	0	1	0	0	0	0	0	0	0	0	1	4
T Plant	2	1	0	2	2	3	3	1	1	3	6	4	28
Tank farms	205	185	265	290	235	239	278	253	255	287	289	286	3067
ThermalHanford Inc.	0	0	0	0	0	0	0	0	0	0	0	0	0
Track/Road Maint.	12	7	0	2	0	0	0	0	0	0	12	20	53
WBGT	0	0	0	1	17	26	117	139	16	1	0	0	317
WRAP/ERDF/other	2	1	0	1	0	0	2	1	0	0	1	0	8
Monthly Total	420	407	472	456	423	484	562	612	461	548	546	540	5,931

**Table 8.1.1. (contd)**

<b>Requestor</b>	<b>Number of Requests</b>												
	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual Total</b>
Benton Co. PUD	3	0	0	0	0	0	0	0	0	0	0	0	3
City of Richland	0	0	1	0	0	0	0	0	0	0	0	0	1
DOE LAS	0	0	0	0	0	0	0	0	0	0	0	0	0
Lamb Weston	0	0	1	0	0	0	0	0	0	0	0	0	1
NWS	2	0	0	0	0	3	2	0	0	1	0	1	9
RLD Medical Off.	32	28	26	28	30	31	23	25	15	36	30	18	322
Tri City Herald	0	0	1	1	1	1	0	0	0	0	0	2	6
TV/Radio Stns.	0	0	0	0	0	0	0	0	0	2	0	0	2
US Fish/Wildlife	0	0	0	2	5	4	9	0	0	0	0	0	20
Monthly Total	37	28	29	31	36	39	34	25	15	39	30	21	364

(a) Includes production forecasts.

(b) Production forecasts no longer issued.

BHI = Bechtel Hanford, Inc.

DOE LAS = DOE Las Vegas

DOE-RL = DOE Richland Operations Office.

ERDF = Environmental Restoration Disposal Facility.

FDH = Fluor Hanford, Inc.

FFTF = Fast Flux Test Facility.

NWS = National Weather Service.

PFM = Plutonium Finishing Plant.

PNNL = Pacific Northwest National Laboratory.

PUD = Public Utility District.

RLD = Richland.

WBGT = Wet bulb globe temperature (heat stress).

WRAP = Waste Receiving and Packaging Facility.

WSCF = Waste Sampling and Characterization Facility.



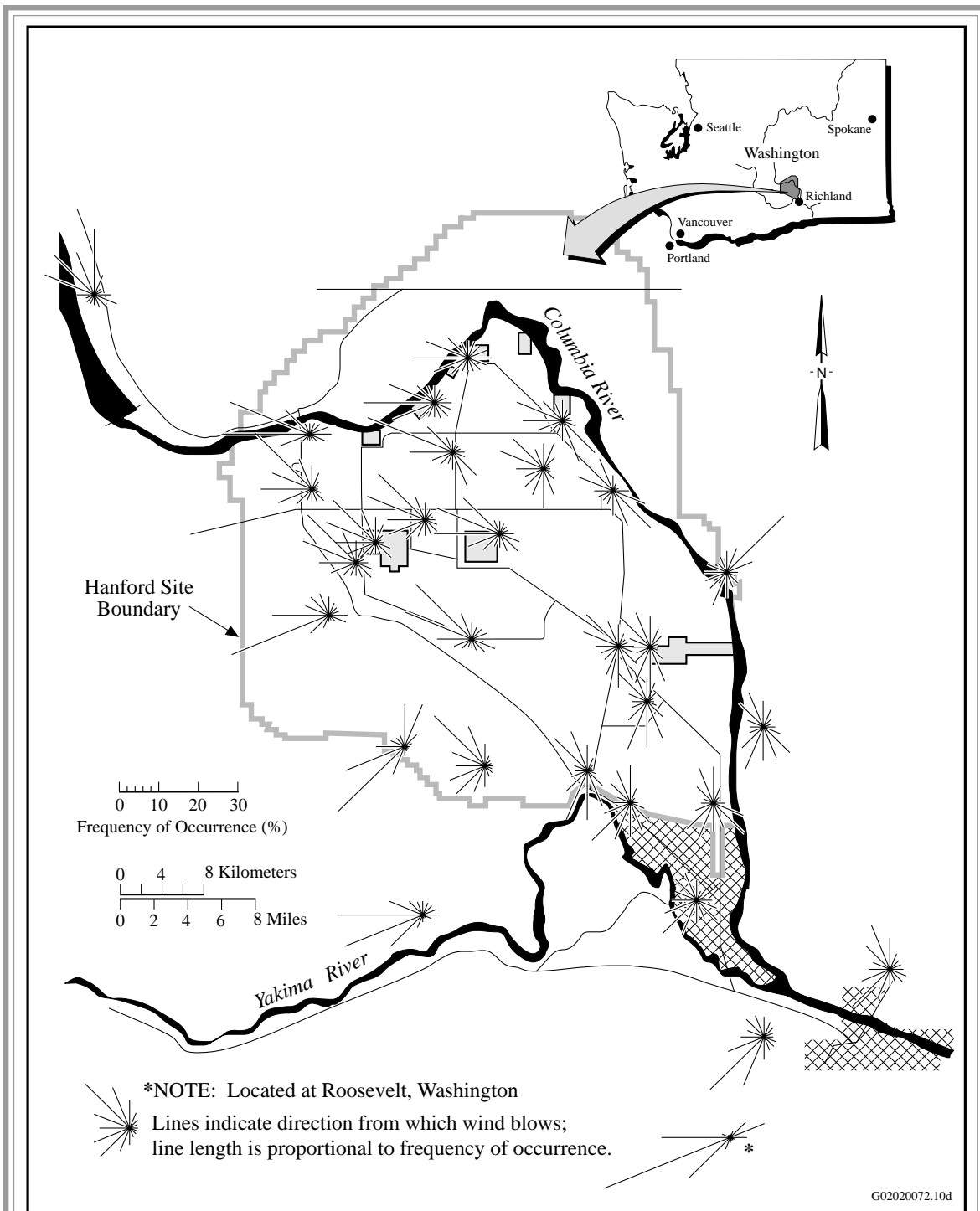


Figure 8.1.1. Hanford Meteorological Monitoring Network Wind Roses, 2001 (measured at a height of 9 meters [30 feet]). Individual lines indicate direction from which wind blows.

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## 8.1.1 Historical Information

Daily and monthly averages and extremes of temperature, dew point temperature, and relative humidity for 1945 through 2001 are reported in PNNL-13859. From 1945 through 2001, the record maximum temperature was 45°C (113°F) recorded in August 1961, 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.

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## 8.1.2 Results of 2001 Monitoring

Calendar year 2001 was slightly warmer than normal and precipitation was below normal.

The average temperature for 2001 was 12.4°C (54.3°F), which was 0.4°C (0.7°F) above normal (12.0°C [53.6°F]). Eight months during 2001 were warmer than normal; four months were cooler than normal. December had the greatest positive departure, 1.8°C (3.2°F); and June, at 1.6°C (2.8°F) below normal, had the greatest negative departure.

Precipitation for 2001 totaled 16.9 centimeters (6.66 inches), 95% of normal (17.7 centimeters [6.98 inches]). Snowfall for 2001 totaled 38.4 centimeters (15.1 inches) (compared to an annual normal snowfall of 39.1 centimeters [15.4 inches]).

The average wind speed for 2001 was 3.4 meters per second (7.6 miles per hour), which was normal. The peak gust for the year was 31 meters per second (69 miles per hour) on December 16.

There were eight dust storms recorded at the Hanford Meteorology Station during 2001. There have been an average of five dust storms per year at the Hanford Meteorology Station during the entire period of record (1945-2001).

Table 8.1.2 provides monthly and annual climatological data from the Hanford Meteorology Station for 2001.



Table 8.1.2. Monthly and Annual Climatological Data from the Hanford Meteorology Station, 2001

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 <sup>(a)</sup>				
	Averages				Extremes				Total	Departure <sup>(b)</sup>	Snowfall		Average	Departure <sup>(b)</sup>	Average Speed, m/s	Departure <sup>(b)</sup>	Peak Gusts		
	Daily Maximum	Daily Minimum	Monthly	Departure <sup>(b)</sup>	Highest	Date	Lowest	Date			Total	Departure <sup>(b)</sup>					Average	Departure <sup>(b)</sup>	Speed, m/s
J	3.7	-2.1	0.8	+0.9	13.3	31 <sup>(c)</sup>	-6.7	15	0.7	-1.5	5.8	-4.8	84.8	+7.5	2.4	-0.4	15.6	SW	5
F	6.9	-2.9	2.1	-1.2	12.2	24 <sup>(c)</sup>	-8.3	17	1.1	-0.7	10.9	+4.3	72.4	+1.9	2.9	-0.3	14.8	WNW	5
M	15.0	1.5	8.2	+0.4	21.1	24	-5.0	3	1.7	+0.2	0	-1.0	59.2	+2.6	3.6	0	25.0	W	13
A	17.5	4.1	10.8	-1.2	28.3	26 <sup>(c)</sup>	-2.2	14 <sup>(c)</sup>	2.1	+1.0	0	-T <sup>(d)</sup>	50.8	+3.5	3.8	-0.1	22.4	WSW	28
M	26.2	9.1	17.6	+1.1	38.3	23	1.1	3	0.2	-1.2	0	0	35.1	-7.9	4.1	+0.1	22.8	SW	28
J	26.6	11.7	19.2	-1.6	37.8	21	6.7	2	3.2	+2.2	0	0	42.7	+3.1	3.9	-0.1	19.7	SSW	24
J	32.7	16.3	24.4	-0.2	41.1	4	11.7	21 <sup>(c)</sup>	0.1	-0.6	0	0	34.1	+0.7	3.8	0	17.9	WNW	5
A	34.1	16.7	25.4	+1.3	40.6	12	10.0	24	0.2	-0.5	0	0	35.1	-0.5	3.5	0	18.3	WNW	18
S	29.2	11.9	20.6	+1.7	35.0	15 <sup>(c)</sup>	3.3	29	0.3	-0.5	0	0	38.2	-4.1	3.3	0	19.7	WNW	6
O	18.6	5.3	11.9	+0.3	28.3	1	-0.6	28	0.9	-0.3	0	-0.3	51.9	-4.5	3.6	+0.7	28.2	WSW	23
N	10.5	1.5	6.0	+1.5	20.0	14	-3.3	29 <sup>(c)</sup>	4.2	+1.8	12.7	+6.9	81.4	+7.7	2.6	-0.3	19.7	S	14
D	5.3	-2.1	1.6	+1.8	14.4	16	-8.9	25	2.0	-0.8	8.9	-5.8	78.7	-1.4	3.4	+0.8	30.8	S	16
Y <sup>(e)</sup>	18.8	5.9	12.4	+0.4	41.1	Jul 4	-8.9	Dec 25	16.9	-0.8	38.4	-0.8	55.4	+0.8	3.4	0	30.8	S	Dec 16

**NOTE:** See Appendix A, Table A.2 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.