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Pacific Northwest Laboratories
Richland, Washington 99352

AEC Research and Development Report

PHYSICAL EFFECTS OF THE HANFORD
WINDSTORMS OF JANUARY 11, 1972
AND JANUARY 21, 1972

JUNE 1972

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PHYSICAL EFFECTS OF THE HANFORD WINDSTORMS
OF JANUARY 11, 1972 AND JANUARY 21, 1972

by

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June 1972

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PHYSICAL EFFECTS OF THE HANFORD MISTGOWNS
OF JANUARY 17, 1952 AND JANUARY 21, 1952

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PHYSICAL EFFECTS OF THE HANFORD WINDSTORMS
OF JANUARY 11, 1972 AND JANUARY 21, 1972

C. H. Henager and J. J. Fuquay

SUMMARY

The windstorm of January 11 caused a minor amount of damage to the Hanford Reservation and Hanford vicinity. Damage sustained to Hanford Reservation structures (roofing, flashing, fences, windows) was approximately \$20,000. One building did receive structural damage to roof members. Evidence that wind pressures did not reach 30 lb/ft^2 during the January 11 windstorm was provided in the fact that specially designed exterior wall panels did not fail. These panels were designed and carefully proof-tested to insure that they would fail at a loading of 30 lb/ft^2 as a requirement of structural safety in the original design-construction program in 1952-1954. There was one power outage on the Hanford Reservation due to the January 11 windstorm (Rattlesnake Mountain Observatory). Damage to power lines and electrical facilities amounted to about \$1600.

Damage to structures in the Hanford vicinity (excluding the Hanford Reservation) from the January 11 windstorm was estimated to cost \$13,000. This does not include damage to private residences, etc., which has been estimated by others to be near \$250,000. Power line damage in the Hanford vicinity amounted to about \$80,000, of which \$60,000 was accounted for in the loss of four transmission towers in the tie-line between Priest Rapids and Wanapum Dams.

The January 21 windstorm, which struck Toppenish, Washington, was a straight-wind of the catabatic föehn type and not a tornado-type wind as described in newspaper accounts. No funnel cloud was associated with this windstorm. The maximum gust was about 85 mph at 30 ft above the ground. Cost estimates of damage in Toppenish were not available. There were no power outages or structural damage on the Hanford Reservation from the January 21 windstorm.

Total damage to the Hanford Reservation from the two windstorms was estimated to be about \$22,500.

SUMMARY

The windstorm of January 11 caused a minor amount of damage to the Hanford Reservation and Hanford vicinity. Damage sustained to Hanford Reservation structures (roofing, flashing, fences, windows) was approximately \$20,000. One building did receive structural damage to roof members. Evidence that wind pressures did not reach 30 mph during the January 11 windstorm was provided in the fact that specially designed exterior wall panels did not fail. These panels were designed and carefully post-tested to insure that they would fail at a loading of 30 lb/ft² as a requirement of structural safety in the original design-construct program in 1952-1954. There was one power outage on the Hanford Reservation due to the January 11 windstorm (Battelle's Hanford Observatory). Damage to power lines and electrical facilities amounted to about \$1500. Damage to structures in the Hanford vicinity (excluding the Hanford Reservation) from the January 11 windstorm was estimated to cost \$13,500. This does not include damage to private residences, etc., which has been estimated by others to be near \$250,000. Power line damage in the Hanford vicinity amounted to about \$50,000, of which \$20,000 was accounted for in the loss of four transmission towers in the line between Priest Rapids and Wenatchee dams. The January 21 windstorm, which struck Townsend, Washington, was a straight wind of the catastrophic debris type and not a tornado-type wind as described in newspaper accounts. No funnel cloud was associated with this windstorm. The maximum gust was about 55 mph at 10 ft above the ground. Cost estimates of damage in Townsend were not available. There were no power outages or structural damage on the Hanford Reservation from the January 21 windstorm.

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PHYSICAL EFFECTS OF THE HANFORD WINDSTORMS
OF JANUARY 11, 1972 AND JANUARY 21, 1972

C. H. Henager and J. J. Fuquay

INTRODUCTION

On January 11, 1972 winds of gale force with gusts exceeding hurricane force⁽¹⁾ were experienced at the AEC's Hanford Reservation in southeast Washington. Winds of similar force were experienced on January 21, 1972 in Toppenish, Washington, about 50 miles west of Richland, and to a lesser degree (gusts to 50 mph at the Hanford Meteorological tower) at the Hanford Reservation. A complete description of the January 11 windstorm is given in BNWL-1640, a portion of which is extracted in Appendix I.

This report documents the physical effects of the two windstorms that occurred at the Hanford Reservation and vicinity. These effects are categorized under damage to structures, power outages and damage to power lines; repair costs, where available, are also listed.

PHYSICAL EFFECTS OF JANUARY 11 WINDSTORM

In order to determine the total effect of the January 11 windstorm, reported damages to specific locations within the area were compiled.

HANFORD RESERVATION

Various reporting stations within the Hanford Reservation gave the following estimates of structural and power damages:

Damage to Structures

- Rattlesnake Slope - A converted barracks building housing the Emergency Relocation Center and Arid Lands Ecology Center received minor roof and window damage.⁽²⁾ Cost ... \$ 500

- Stores Area and Bus Lot, 1100 Area - No damage.^(2,3) Cost ... \$ 0
- Separations Areas, 200E and 200W - Wind pressure on Russian thistles accumulated against the 200E and 200W perimeter fence (25-year-old cedar post construction) broke several posts.⁽⁴⁾ Cost ... \$ 2,400
- Separations Areas, 200E and 200W - Several buildings required repairs to replace blown-off roofing.⁽⁴⁾ Cost ... \$ 1,750
- 272E Building - There was extensive roof damage, including structural damage to roof members, and broken windows.⁽⁴⁾ Cost ... \$ 9,669
- Rattlesnake Mountain Observatory Complex - Building 6652C, a flat roofed structure, experienced a roof flutter of 1/2 to 5/8 of an inch but received no damage.⁽⁵⁾ Cost ... \$ 0
- Battelle Complex - No damage.⁽⁵⁾ Cost ... \$ 0
- 300 Area - 1500 ft of chain link fencing around the 300 Area retention basin was blown over. The posts bent at splice welds which were made several years ago when the fencing was relocated.⁽⁶⁾ Cost ... \$ 500
- The 3707A Building - The west door was torn off.⁽⁷⁾ Cost ... \$ 30
- Other damage - A telephone survey of landlords in the 300 area revealed that all other damage was minor;⁽⁷⁾ e.g., 13 of 16 portable outdoor privies were blown over but were otherwise undamaged.⁽⁸⁾ Cost ... \$ 100
- 3000 Area, J. A. Jones Shops - The J. A. Jones Company reported no damage to their shops and yard facilities although one privy trailer was blown over but was undamaged.⁽⁹⁾ Cost ... \$ 0
- 100K Area - Approximately 4000 ft² of built-up roofing and several sections of copper flashing were blown from the roof of 105KW Building and required replacement. Flashing and sheet metal ducting were loosened at 105KE, 1704K and 1706KL Buildings, requiring refastening.⁽⁹⁾ Cost ... \$ 5,988
- It is significant that the exterior wall panels in the 105KE and 105KW Buildings did not fail in this wind. These panels were designed and

carefully proof-tested to insure that they would fail at a loading of 30 lb/ft² as a requirement of structural safety in the original design-construction program in 1952-1954.

Total Cost of Damage to Hanford Reservation Structures for the January 11 Windstorm \$20,937

Power Outages and Power Line Damage

- 200 Areas - One switch box and one electrical line were damaged in the 200 Areas. Although repairs were required,⁽¹⁰⁾ no electrical outage resulted. Cost ... \$ 1,025
- Rattlesnake Mountain Observatory - Because of a line down at Midway Station, the observatory was without an exterior source of electrical power for 8 hr on January 11 from 3 a.m. to 11 a.m.; auxiliary power was used.⁽⁵⁾ Eight spans of conductor were down on the ground due to broken tie wires (13.8 kV line).⁽¹¹⁾ Cost ... \$ 629
- There were no other power outages or line damage on the Hanford Reservation from the January 11 windstorm.

Total Cost of Damage to Power Lines at the Hanford Reservation from the January 11 Windstorm \$ 1,654

HANFORD VICINITY (EXCLUDING THE HANFORD RESERVATION)

Reporting stations from the Hanford vicinity gave the following estimates of the structural and power damage:

Damage to Structures

- Priest Rapids Dam - The roof of a 15 x 23 ft siphon intake building was blown loose, requiring repair and refastening.⁽¹²⁾ Cost ... \$ 1,500
- Wanapum Dam - A spawning channel drifted about half-full of sand, requiring dredging for removal.⁽¹²⁾ Cost ... \$ 3,500
- Schwana, Beverly, Mattawa, Desert-Air Vicinity - Three 3D- to 40-yr-old unoccupied frame and frame with concrete block buildings were blown down. Windows were blown out of two 40-yr-old buildings. A

wooden shelter was blown from a rest area, and several old buildings lost wooden shingles and roofing. The oiled shoulders on Highway 243 sustained damage when wind lifted the shot-and-cover layer. One 50-ft house trailer was destroyed at Schwana and one 15-ft camping trailer was overturned at Beverly (loss estimated at \$300). No other cost estimates were available.⁽¹³⁾

- Midway Substation - At the Midway Substation, 5 street lights were torn loose or broken; 3 houses lost telephone service; 3 houses had structural damage from falling trees; 16 buildings had shingle damage; 1 garage had minor structural damage; 4 buildings lost some windows; an oil storage shed was demolished; an untanking tower lost 60 ft of flashing; and 14 large trees were blown down.⁽¹⁴⁾ Cost ... \$ 8,000

Total cost of damage to Hanford Vicinity structures for January 11 windstorm (not including damage to residential and commercial structures in Tri-City area which was estimated by insurance adjustors to be in the order of \$250,000, according to the Tri-City Herald) \$13,000

Power Outages and Power Line Damage

- Benton County Public Utility District No. 1 - The district had one outage of 8 to 10 hr (power line feeding the Rattlesnake Mountain Area from Midway Substation). Six poles were broken and temporarily guyed. Eight spans of conductor wire (13.8 kV line) were down on the ground due to broken tie wires.⁽¹¹⁾ Cost ... \$ 629
- Public Utility District No. 1 of Franklin County - This district reported three outages. An overcurrent breaker on their R5 circuit locked out for 45 min from an unknown cause. Line fuses were blown at Road 92 and Court St. and Road 36 and Court St. in Pasco from improper spacing (too much sag) and from a tree top falling on a line. The outages were less than 1 hr each.⁽¹⁷⁾ Cost ... \$ 250
- Pacific Power and Light Co. - One power outage of 6 hr 41 min (Midway-Union Gap, 230 kV line) was reported.⁽¹⁴⁾ The wind forced a jumper onto a guy wire on the Black Rock 230 kV line near the Midway Substation. The cost to locate and repair this damage was \$500.⁽¹⁸⁾ Cost ... \$ 500

• Benton Rural Electric Association⁽¹⁹⁾

1. One outage for two accounts occurred at Satus peak south of White Swan when a transformer vibrated, broke the hangers and fell to the ground. The primary conductor and insulator tie wires were broken. The outage time was 7 days due to non-urgent electrical need. Cost ... \$ 450
2. Two rotted poles were stubbed in the Prosser area. No outage was involved. Cost ... \$ 200
3. One rotted pole was stubbed on Crosby Road near the top of Rattlesnake Mountain. Six accounts were without power for about 3 hr. Cost ... \$ 100
4. From Rimrock Dam to Indian Creek in Yakima county (7 miles of line), the main conductor was broken in 30 places. Four poles were broken and 30 trees were blown over into lines and required clearing out. Approximately 5000 ft of primary wire was replaced, plus 25 pin-type insulators. Approximately fifty secondary service drops were broken. Service to 31 accounts was affected for a minimum of 32 hr to a maximum of 104 hr for a total of 2136 consumer hours. Cost ... \$15,000
5. One rotted pole was stubbed at West Richland and approximately 75 accounts were off for 1 1/2 hr. Cost ... \$ 150
6. One primary conductor was broken at West Richland and approximately 50 accounts were off for 2 hr. Cost ... \$ 100

- Bonneville Power Administration - During the January 11 windstorm, Bonneville experienced the following power outages:

<u>Name of Line</u>	<u>Number of Outages</u>	<u>Length of Outage</u>
Midway-No. Bonneville #1, 230 kV Line	4	1 min each
Midway-Grandview, 115 kV Line	13	Momentary, each outage
Hanford-Vantage 500 kV Line	9	1 min each
Midway-Big Eddy	2	Momentary

None of the above outages resulted in any damage or repair costs.⁽¹⁴⁾

Cost ... \$ 0

- Grant County Public Utility District -
 1. Four 230 kV transmission towers were blown down near Beverly, Washington. Since this line is an intertie between Priest Rapids Dam and Wanapum Dam, there was no resultant outage.⁽¹²⁾ These towers are of a design in which the tower is pin-connected at the ground and supported at the top by four guy wires. The mode of failure was that the sand around the deadman anchors was eroded away by the wind to the extent that anchor resistance was lost. No direct structural failure was involved. Cost ... \$60,000
 2. Seven poles were downed in the Beverly-Mattawa area resulting in outages of 12 to 14 hr. No cost estimate.⁽¹²⁾
 3. One power outage on Midway-Priest Rapids 230 kV line of 34 hr 26 min. No cost estimate.⁽¹⁴⁾

Total Cost of Power Line Damage in the Hanford Vicinity from the
January 11 Windstorm \$77,379

PHYSICAL EFFECTS OF JANUARY 21 WINDSTORM

A windstorm with velocities approaching those of January 11 occurred on January 21 at Toppenish, Washington. Contrary to newspaper accounts, the wind was not a tornado type wind but a catabatic föehn wind, more commonly called a "mountain wave" wind.⁽¹⁵⁾ All affected structures and trees were blown over or moved in a single direction; whereas, in a tornado, the twisting action causes debris to be thrown in all directions, including opposite to the funnel's main direction of travel.⁽¹⁶⁾ Wind velocity in gusts was measured at 85 mph 30 ft in the air on a "Tradewind" model 108 anemometer in a Toppenish private residence. Trooper Jim Davidson of the Washington State Patrol estimated the wind gust velocity at 100 mph and also confirmed that there was no funnel cloud associated with the windstorm.⁽¹⁵⁾ Damage from this wind occurred both to structures and to power transmission.

HANFORD RESERVATION

No significant damage was reported within the Hanford Reservation.

HANFORD VICINITY (EXCLUDING THE HANFORD RESERVATION)

Although no cost estimates were available, considerable damage was reported in the Toppenish, Washington area.

Damage to Structures

- The Kelly Oil service station at Ford Road and Highway 97 was severely damaged when the operator opened the door to a truck stall; the roof and walls of an attached truck stall were carried away. Examination of supporting columns revealed that there were no holddown bolts for uplift. Part of the structure roof was lost when windows facing into the wind were broken by flying debris (see photograph in Appendix B). The rise in internal pressure added to the partial vacuum existing about the roof from the venturi effect was sufficient to lift the toenailed wood rafters from the wooden headers.^(15,16)

- Other damage in Toppenish included three 12 x 60 ft mobile homes which were moved partially from their supports and one 12 x 60 ft mobile home which was overturned. All of these trailers were located with the long side normal to the wind. Numerous trees, primarily Locust, were blown over. ⁽¹⁵⁾
- An aluminum flagpole, 5 in. diameter at the base and flying two 4 x 6 ft flags, was bent (see photograph in Appendix B).
- A concrete block wall supporting the roof of a car wash facility was blown down onto a car which the owner had just parked there for protection. (See photograph in Appendix B.)
- Miscellaneous damage included signs blown over, damage to cars and a camping trailer from fallen trees, glass blown out of an elevated service station sign, and damage to a concrete block and brick parapet wall on an old brick building. No cost estimates of structural damage in Toppenish were available. ⁽¹⁵⁾

Total Cost of Damage to Structures in the Hanford Vicinity from the January 21 Windstorm No Cost Estimate

Power Outages and Power Line Damage

- Pacific Power and Light Co. - In the city of Toppenish there was one electrical outage affecting approximately 500 homes for 10 hr, caused when 5 poles blew down inside the city severing the power lines. One transmission pole was blown down but did not sever the line or cause a power outage. ⁽²⁰⁾ Cost ... \$ 6,000
- Public Utility District No. 1 of Franklin County - In irrigation block 14, the neutral conductors burned off and laid across the phase conductors at one point causing a 52 min outage. ⁽¹⁷⁾ Cost ... \$ 250
- Benton Rural Electric Association -
 1. The windstorm caused adjacent wires to wrap around the main feeder line in Toppenish. Approximately 75 accounts were without power for 2 hr. Cost ... \$ 75
 2. One rotted pole was stubbed at West Richland. No power outage was involved. Cost ... \$ 100

- No other power outages or power line damage was reported for the Hanford vicinity from the January 21 windstorm.

Total Cost of Power Line Damage in the Hanford Vicinity for the
January 21 Windstorm \$ 6,425

RECAPITULATION OF REPAIR COSTS^(a)

HANFORD RESERVATION

January 11 Windstorm - Structural	\$20,937
January 21 Windstorm - Structural	\$ 0
January 11 Windstorm - Power Lines	\$ 1,654
January 21 Windstorm - Power Lines	\$ 0

HANFORD VICINITY (EXCLUDING HANFORD RESERVATION)

January 11 Windstorm - Structural	\$13,000
January 21 Windstorm - Structural	No cost estimate
January 11 Windstorm - Power Lines	\$77,379
January 21 Windstorm - Power Lines	\$ 6,425

(a) Repair costs do not include damage to private residences or damage for which costs estimates were not available.

• No other power outages or power line damage was reported for the Hartford vicinity from the January 21 Windstorm.

Total Cost of Power Line Damage in the Hartford Vicinity for the January 21 Windstorm \$ 6,425

REPAIRATION OR REPLACEMENT COSTS

HARTFORD RESERVATION

January 21 Windstorm - Structural	\$20,937
January 21 Windstorm - Structural	0
January 21 Windstorm - Power Lines	\$ 1,654
January 21 Windstorm - Power Lines	0

HARTFORD VICINITY (EXCLUDING HARTFORD RESERVATION)

January 21 Windstorm - Structural	\$18,000
January 21 Windstorm - Structural	No cost estimate
January 21 Windstorm - Power Lines	\$17,370
January 21 Windstorm - Power Lines	\$ 2,428

(a) Repair costs do not include damage to private residences or damage for which costs estimates were not available.

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APPENDIX A

DATA AND WIND SPEEDS FOR JANUARY 11 WINDSTORM

APPENDIX A

DATA AND WIND SPEEDS FOR JANUARY 11 WINDSTORM

The data in this Appendix was extracted from BNWL-1640 "The Hanford Wind Storm of January 11, 1972," AEC Research and Development Report, Battelle, Pacific Northwest Laboratories, February, 1972.

B R I T I S H C O L U M B I A

FIGURE A-1. THE HANFORD RESERVATION IN RELATION TO SURROUNDING AREA

BNWL-1670

TABLE A-1. AVERAGES AND EXTREMES OF CLIMATIC ELEMENTS AT HANFORD
(Based on All Available Records to and Including the Year 1970)

AVERAGES AND EXTREMES OF CLIMATIC ELEMENTS AT HANFORD

(BASED ON ALL AVAILABLE RECORDS TO AND INCLUDING THE YEAR 1970)

	TEMPERATURE (°F)										DEGREE DAYS (BASE 65°F)		PRECIPITATION (INCHES)																						
	1912-1970 AVERAGES					1912-1970 EXTREMES					1945-1970 TOTALS		1912-1970 TOTALS																						
	DAILY MAXIMUM					DAILY MINIMUM					DAILY MAXIMUM		DAILY MINIMUM		DAILY MAXIMUM					DAILY MINIMUM															
	DAILY MAXIMUM	DAILY MINIMUM	HIGHEST MONTHLY	LOWEST MONTHLY	YEAR	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	YEAR	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	YEAR	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	YEAR	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST											
Jan.	36.7	22.1	29.4	42.5	1955	12.1	19.5	66	1968	2	1950	51	1971	25	1912-1970	1096	1460	1951	1951	0.91	2.47	1950	0.33	1962	2.08	1948	5.2	75.8	1910	7.1	1954	12.0	1948	12.0	
Feb.	45.3	27.1	36.2	44.5	1955	23.4	19.5	71	1974	3	1952	25	1952	25	1912-1970	738	1147	1946	1970	0.62	1.64	1950	1	1962	2.08	1914	5.3	75.8	1916	5.2	1959	10.0	1948	10.0	
Mar.	53.3	33.8	45.2	48.3	1956	24.4	19.5	76	1980	1960	1960	28	1961	28	1912-1970	1046	1567	1947	1976	0.76	1.82	1950	0	1962	1.91	1951	2.2	1957	6.9	1949	6.9	1948	6.9		
Apr.	63.1	40.1	53.2	59.8	1956	34.5	19.5	94	41	1964	40	1964	32	1955	381	522	1955	1960	1.04	2.22	1949	0	1953	0.51	1951	7	1	1960	1	1968	0	1948	0		
May	75.3	48.0	62.8	68.8	1947	56.4	19.5	103	1949	49	1918	70	1956	234	235	1962	34	1947	4.05	3.71	1948	0	1953	0.51	1942	0	1960	1	1960	1	1960	1	1948	1	
June	83.2	55.5	69.4	75.4	1952	61.0	19.5	112	1966	106	1964	81	1950	33	1957	34	1958	2.57	2.82	1950	0	1950	1.54	0	1950	1.54	0	1950	1.54	0	1950	1.54	0	1950	1.54
July	91.8	61.0	76.4	81.8	1940	72.6	19.5	119	59	1960	82	1925	41	1918	3	22	1951	0	1970	0.14	0.81	1960	0	1959	1.23	1942	0	0	1954	0	1954	0	1954	0	
Aug.	99.2	69.2	84.2	89.2	1967	69.8	1964	113	1961	81	1961	40	1918	5	32	1960	0	1918	0.18	1.38	1920	0	1959	0.75	1947	0	0	1954	0	1954	0	1954	0		
Sept.	94.4	50.8	85.2	90.2	1970	58.8	1962	120	1962	52	1934	72	1955	6	22	1961	3	1967	0.34	1.24	1947	1	1961	0.87	1947	1	1961	0.87	1947	1	1961	0.87	1947	1	
Oct.	85.1	40.1	53.1	45.2	1952	48.8	1958	120	1958	6	1959	24	1959	6	1959	1946	1946	0.58	0.58	1952	1952	1951	1.91	1951	1.91	1951	1.91	1951	1.91	1951	1.91	1951	1.91		
Nov.	68.4	31.5	40.8	45.8	1953	33.1	1955	73	1954	14	1952	52	1959	1	1955	746	1038	1957	1967	0.38	2.05	1920	1	1958	0.76	1922	1.27	1955	4.3	1950	5.1	1940	5.1		
Dec.	59.2	28.0	32.4	37.4	1958	28.1	1959	68	2033	3	1919	53	1933	27	1919	991	1228	1944	482	1957	0.86	2.55	1931	0.11	1960	1.37	134	1955	5.4	1940	5.4	1940	5.4		
Year	64.8	41.4	53.1	61.8	1957	73.5	1959	3	1959	82	1925	27	1919	3287	3040	1957	0	1957	0.625	3.08	1940	0	1955	1.91	1957	12.2	26	1916	71	1948	12.3	1948	12.3		

	WIND (mph)										RELATIVE HUMIDITY (%)		SKY COVER (SCALE 0-10)		SOLAR RADIATION (LANGLEYS)*	
	1945-1970 AVERAGES					1945-1970 EXTREMES					1945-1970 AVERAGES		1945-1970 EXTREMES		1945-1970 AVERAGES	
	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST
Jan.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Feb.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Mar.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Apr.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
May	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
June	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
July	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Aug.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Sept.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Oct.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Nov.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Dec.	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Year	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0

	NUMBER OF DAYS (1945-1970)**										PRECIP.		SNOW	
	CLEAR					CLOUDY					0.10 INCH OR MORE		1.0 INCH OR MORE	
	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST
Jan.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Feb.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Mar.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Apr.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
May	13	0	13	0	13	0	13	0	13	0	13	0	13	0
June	13	0	13	0	13	0	13	0	13	0	13	0	13	0
July	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Aug.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Sept.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Oct.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Nov.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Dec.	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Year	13	0	13	0	13	0	13	0	13	0	13	0	13	0

	NUMBER OF DAYS (1945-1970)										NUMBER OF DAYS (1912-1970)									
	3" OR MORE SHOW ON GND.					PEAK GUST 40 MPH OR GREATER					MAX. TEMP. 40 OR ABOVE					MAX. TEMP. 100 OR ABOVE				
	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST	RECORD HIGHEST	RECORD LOWEST
Jan.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Feb.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Mar.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Apr.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
May	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
June	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
July	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Aug.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Sept.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Oct.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Nov.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Dec.	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0
Year	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0	13	0

* CALORIES/CM²

** SKY COVER AND PRECIPITATION OBSERVATIONS NOT BEGUN UNTIL 1946

† LESS THAN 1/2

‡ ALSO ON EARLIER YEARS

LOCATION AND HISTORY

PRECIPITATION LOCATION 25 MILES NW OF RICHLAND, WASHINGTON
LATITUDE 46° 34' N. LONGITUDE 119° 14' W. ELEVATION 773 FEET
OBSERVATIONS FROM 1912 TO 1944 WERE BY UNITED STATES
WEATHER BUREAU COOPERATIVE OBSERVERS AT A SITE ABOUT
10 MILES E. OF PRESENT LOCATION. SINCE 1944 OBSERVATIONS
HAVE BEEN MAINTAINED ON A 24 HOUR-A-DAY BASIS BY THREE
DIFFERENT AEC CONTRACTORS.

EXTREME AVERAGES OR TOTALS AND YEAR OR SEASON OF OCCURRENCE

1912-1970 TEMPERATURE AVERAGES (°F)

HIGHEST ANNUAL 56.2 1964
LOWEST ANNUAL 30.2 1949
HIGHEST WINTER (12-2) 41.1 1955-56
LOWEST WINTER 24.2 1948-49
HIGHEST SPRING (4-6) 58.2 1967
LOWEST SPRING 48.0 1955
HIGHEST SUMMER (7-9) 78.2 1958
LOWEST SUMMER 70.3 1964
HIGHEST FALL (10-11) 56.8 1963
LOWEST FALL 49.6 1966

1912-1970 PRECIPITATION TOTALS (IN.)

GREATEST ANNUAL 11.41 1960
LEAST ANNUAL 3.26 1967
SNOW, ICE PELLETS (GALLONS)
GREATEST SEASONAL 43.6 1955-56
LEAST SEASONAL 0.3 1957-58

1945-1970 WIND SPEED AVERAGE (mph)

HIGHEST ANNUAL 8.3 1960
LOWEST ANNUAL 6.3 1957

1945-1970 RELATIVE HUMIDITY AVERAGE (%)

HIGHEST ANNUAL 57.9 1960
LOWEST ANNUAL 49.8 1967

1945-1970 SKY COVER AVERAGES (SCALE 0 TO 10)

GREATEST ANNUAL 6.4 1966
LOWEST ANNUAL 1.1 1969

1945-1970 SOLAR RADIATION AVERAGE DAILY TOTAL (LANGLEYS)

HIGHEST ANNUAL 186 1957
LOWEST ANNUAL 152 1967

NUMBER OF DAYS

CLEAR 10.1 MONTHS SKY COVER, 5R TO 5S
GREATEST ANNUAL (1946-70) 141 1955
LEAST ANNUAL (1966-70) 80 1966

CLOUDY 10.1 MONTHS SKY COVER, 5R TO 5S

TABLE A-2. DATA RECORDED BY THE AEC (BATTELLE) NETWORK OF WIND SENSORS ON JANUARY 11, 1972

Observation Site	Location (a)	Elevation, MSL-ft	Height of Sensor Above Ground, ft	Wind, mph	Time, PST
Hanford Met Tower	(a)	727	7	64	0345
	(a)	727	50	80	0345
	(a)	727	100	79	0835
	(a)	727	150	--(b)	--(b)
	(a)	727	200	84	0835
	(a)	727	250	82	0837
	(a)	727	300	84 ^(c)	0835
	(a)	727	400	84	0827
Rattlesnake Mt.	11.0 S	3568	10	150+ ^(d)	0546-0924
Army Loop Road	7.5 ESE	555	50	60+ ^(e)	0900-1700
Central Wahluke Slope ^(f)	12.0 NNW	660	23	32	0155
Yakima Barricade ^(f)	6.0 WNW	795	23	45	0455
Gable Mountain ^(f)	7.0 ENE	1100	23	41	0055
Wye Barricade ^(f)	11.5 SE	550	23	43	0055
Prosser Barricade ^(f)	14.5 SE	450	23	35	0055
Richland Barricade ^(f)	26.5 SE	390	23	33	0355
Rattlesnake Mt. ^(f)	11.0 S	3568	9	--(g)	--(g)
Eastern Wahluke Slope ^(f)	17.5 NE	800	23	34	0455
Ringold ^(f)	17.5 E	620	23	30	0355

a. Distance (miles) and direction from the Hanford Meteorology Tower located at 46° 34'N latitude, 119° 36'W longitude, approximately 25 miles NW of Richland, Washington

b. Equipment malfunction

c. Interpolated value

d. Limit of recorder 150 mph, also visually observed by (b)

e. Temporary research equipment - limit of recorder 60 mph

f. Radio-telemetered Automatic Weather Station - highest hourly integrated wind speed, not equipped with gust recorder

g. Power outage for telemetering equipment during periods of peak winds.

TABLE A-3. HANFORD METEOROLOGY TOWER AVERAGE WIND SPEEDS AND PEAK GUSTS FOR JANUARY 11, 1972

Time	10-Minute Intervals During Highest Hourly Average, MPH											
	7 ft		50 ft		100 ft		200 ft		300 ft		400 ft	
	Avg	Peak Gust	Avg	Peak Gust	Avg	Peak Gust	Avg	Peak Gust	Avg	Peak Gust	Avg	Peak Gust
0800-0810	36	55	48	66	56	67	60	76			63	74
0810-0820	37	57	49	69	56	73	60	74			64	73
0820-0830	38	54	51	67	59	73	65	81			68	84
0830-0840	40	53	51	62	59	68	67	84			69	81
0840-0850	38	54	52	70	59	68	64	79			69	80
0850-0900	36	56	52	68	59	72	64	78			69	80
Avg Hourly Speed	38		51		58		63				67	

NEW RECORD WIND SPEEDS

The windstorm of January 11, 1972 established three 50-ft wind speed records at the Hanford Meteorology station as indicated below:

1. A peak gust of 80 mph was recorded at 0345 PST. This was 8 mph higher than the previous record of 72 mph recorded on June 5, 1957. (Observational period of record, 27 years.)
2. An hourly average wind speed of 51 mph from 0800-0900 PST was recorded. This exceeded the previous record of 48 mph recorded on March 28, 1963. (Observational period of record, 26 years.)
3. The 24-hr average wind speed for January 11, 1972 was 33.7 mph. This exceeded the previous record of 27 mph recorded on December 3, 1968. (Observational period of record, 27 years.)

The 1957 peak wind gust records for the 200- and 400-ft tower levels, however, remained intact (Table A-4).

TABLE A-4. TOWER PEAK GUST COMPARISONS

<u>Tower Level, ft</u>	<u>January 11, 1972, mph</u>	<u>June 5, 1957, mph</u>
50	80	72
200	84	89
400	84	93

Several peak gusts of over 150 mph (limit of recording equipment) were recorded during the period 0546-0924 PST on Rattlesnake Mountain (elevation 3568 ft MSL), located 11 miles south of the Hanford Meteorology Station. (See Appendix B.) The previous record for the same observational site was 142 mph recorded on March 22, 1969.

TABLE A-5. WIND OBSERVATIONS ON OR NEAR THE HANFORD RESERVATION
FOR JANUARY 11, 1972

Observation Site	Location ^(a)	Height of Sensor Above Ground, ft	Type of Data Readout	Peak Wind, mph	Time, PST	Operating Agency	Remarks
FFTF	15.0 SE	13	Analog Tape	--	--	AEC (HEDL)	Recorder limit, 60 mph Equipment malfunction
FFTF	15.0 SE	25	Dial	65	A.M.	AEC (Bechtel)	Visual observation
N-Reactor	8.0 NNE	200	Analog Tape	42	0830- 0900	AEC (DUN)	Recorder not activated; visual observation
Richland Airport	22.0 SE	30	Strip Chart	74	0245	AEC (Battelle)	
Priest Rapids Dam	18.0 NW	30	Dial	100+	0700+	Grant County PUD	Visual observation; dial limit - 100 mph
Richland By-Pass Highway	24.0 SE	35	Dial	100+	A.M.	Teleprompter Cable TV Co.	Visual observation; dial limit - 100 mph
Tri-Cities Air- port (Pasco)	30.0 SE	16	Dial	63	A.M.	Hughes Air- west	Visual observation
KONA Radio (Pasco)	32.0 SE	30	Manometer	7B	1000	KONA Radio	Visual observation
Columbia TV (Kennewick)	35.0 SE	40	Dial	100+	1200- 1300	Columbia TV	Visual observation; dial limit - 100 mph

a. Miles from Hanford Meteorology Station.

APPENDIX B

PHOTOGRAPHS OF DAMAGE IN TOPPENISH FROM THE JANUARY 21 WINDSTORM

FIGURE B-1. THE KELLY OIL SERVICE STATION IN TOPPENISH, WASHINGTON - An attached truck garage was demolished.

FIGURE B-2. THE KELLY OIL STATION - The front of the building faced the wind. The four upper windows were broken by flying debris allowing the wind pressure to build up inside the building.

FIGURE B-3. A 12 X 60 FT MOBILE HOME TURNED OVER IN TOPPENISH.

FIGURE B-4. A BRICK PARAPET WAS BLOWN OFF IN THE TOPPENISH AREA.

FIGURE B-5. TOPPENISH - A wood and concrete block car wash collapsed on an auto parked there for protection.

FIGURE B-6. TOPPENISH - A 5-inch diameter (at base) aluminum flag pole was bent by the January 21 windstorm. State of Washington Dept. of Social and Health Service Building.

FIGURE B-5. TOPPENISH - A wood and concrete block car wash collapsed on an auto parked there for protection.

FIGURE B-6. TOPPENISH - A 6-inch diameter (at base) aluminum pipe was bent by the January 21 windstorm. State of Washington Dept. of Social and Health Service Building.

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