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**Problems Associated with
the Use of Urea-
Formaldehyde Foam for
Residential Insulation**

**Part III: Residential Studies in
Colorado and Wisconsin**

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Part of
The National Program
for
Building Thermal Envelope Systems
and Insulating Materials

Prepared for the
U.S. Department of Energy
Conservation and Solar Energy
Office of Buildings and Community Systems
Buildings Division

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DEPARTMENT OF ENERGY**

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FOAM FOR RESIDENTIAL INSULATION

Part III: Residential Studies in Colorado and Wisconsin

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The National Program for
Building Thermal Envelope Systems and Insulating Materials

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FOREWORD

This is one of a series of reports to be published describing research, development, and demonstration activities in support of the National Program for Building Thermal Envelope Systems and Insulating Materials. The National Program involves several federal agencies and many other organizations in the public and private sectors who are addressing the national objective of decreasing energy wastes in the heating and cooling of buildings. Results described in this report are part of the National Program through delegation of management responsibilities for the DOE lead role to the Oak Ridge National Laboratory.

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OTHER REPORTS IN THE SERIES

1. DOE/CS-0059: The National Program Plan for Building Thermal Envelope Systems and Insulating Materials (January 1979).
2. LBL-8822: A New Measurement Strategy for In-Situ Testing of Wall Thermal Performance (March 1979).
3. LBL-8925: Thermal Performance of Buildings and Building Envelope Systems: An Annotated Bibliography (March 1979).
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10. ORNL/Sub-79/13660/I: Minnesota Retrofit Insulation In Situ Test Program Extension and Review (February 1980).
11. ORNL/TM-7266: An Experimental Study of Thermal Resistance Values (R-Values) of Low-Density Mineral-Fiber Building Insulation Batts Commercially Available in 1977 (April 1980).
12. NBS/BS Series 123: The Effect of Moisture on the Thermal Conductance of Roofing Systems (April 1980).
13. ORNL/Sub-78/97726/I: A Field Study of Moisture Damage in Walls Insulated Without a Vapor Barrier (May 1980).
14. ORNL/CON-46: An Appraisal of the M Factor and the Role of Building Thermal Mass in Energy Conservation (July 1980).
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16. NBSIR 80-2097: Precision Measurements on Fibrous Glass Insulation (July 1980).

17. NBSIR 80-2085: Fire Performance of Loose-Fill Cellulosic Insulation In Residential Occupancies (August 1980).
18. ORNL/Sub-7556/II: Corrosion Testing of Urea-Formaldehyde Foam Insulating Materials (September 1980).
19. NBSIR 80-2100: Thermal Resistance Measurements of a Built-Up Roof System (October 1980).
20. ORNL/CON-61: An Experimental Plan for Investigating Building-Earth Heat Transfer at the Joint Institute for Heavy-Ion Research Building (December 1980).
21. ORNL/Sub 7715/1: Operating Temperatures for a Convectively Cooled Recessed Incandescent Light Fixture (December 1980).
22. ORNL/TM-7481: Analysis of Heat Transfer in Building Thermal Insulations (December 1980).
23. ORNL/tr-4679: Roofing Felt on Polystyrene (December 1980).

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Residential Studies

In conjunction with the product testing the University of Iowa also measured formaldehyde levels in homes in "problem and non-problem" areas. The geographical areas selected for this study were the Denver-Boulder, Colorado area and southern portion of the state of Wisconsin. This residential home study was designed as a preliminary study to:

1. elucidate the severity and the extent of formaldehyde emission under field conditions.
2. help correlate laboratory findings with field observations.
3. to investigate the "cause and effect" relationship between U-F foam stability and weather conditions of an area.

Selection of homes:

The study population in the Denver-Boulder, Colorado area was selected from lists provided by the Colorado State Attorney's office and a home owner from Boulder, Colorado. The sampling schedule was finalized by contacting each potential participant by telephone. The final study population consisted of 16 homes. In this population there were three control homes, one mobile home with U-F insulation, two homes with U-F insulation removed, and ten homes with U-F insulation.

The study population in the southern portion of the state of Wisconsin was selected from lists provided by the State Health Department and requests from home owners in the area. The sampling schedule was finalized by contacting each potential participant by telephone. The study population consisted of eleven homes with U-F insulation. Control homes were not provided.

Sampling Methods and Analysis:

The sampling method was the accepted National Institute of Occupational Safety and Health double impinger method using the DuPont 4000 personal sampling pumps. The sample time was 2 hours at a calibrated pump speed of 1 liter/minute. A total volume of 120 liters of air was drawn through the sodium bisulfite solution. The Lawrence Berkeley Laboratory Pump was also used to obtain duplicate samples for the Denver-Boulder area.

The samples were analyzed by the chromotropic acid method at The Institute of Agricultural Medicine and Environmental Health, University of Iowa, Iowa City, Iowa.

Interview:

Interviews were conducted by the field technicians. The question content included:

1. Number of occupants and number of occupants that smoke.

Table 1. Physical Characteristics of Homes
in Denver - Boulder Area.

Homes	# of Occupants	# that Smoke	Age of Home (yrs.)	Area of Living Space (sq. ft.)	Vapor-Barrier 0 = none 1 = outside 2 = inside	Area of Carpets (sq. ft.)	# of Fireplaces	Type of Attic Vent 0 = none 1 = forced 2 = gravity
1	3	0	11	2,170	0	2,000	1	1
2 ^a	4	0	14	1,800	0	1,600	1	0
3	2	0	100	1,124	1 & 2	0	0	2
4	5	1	10	2,000	0	1,800	0	2
5	2	0	6	1,800	0	900	0	2
6 ^a	3	0	65	2,200	0	1,100	2	0
7	4	2	34	1,000	1	900	0	1
8 ^b	2	0	9	780	1	300	0	0
9	4	1	18	2,450	1	1,300	1	2
10 ^a	3	0	5	3,300	2	1,400	2	2
11 ^c	2	0	23	980	1	700	0	2
12	4	0	20	2,000	0	1,400	0	2
13 ^c	3	0	10	1,800	2	1,200	1	2
14	1	1	10	2,000	0	800	1	1
15	4	0	9	2,850	0	2,200	1	2
16	2	0	19	3,400	1	800	2	2

a = control home, b = foamed trailer home, c = foam removed from home

Table 2. Physical Parameters and Formaldehyde Concentrations
Homes in Denver-Boulder Area.

Homes	Age of U-F Foam (years)	Odor Problem	Eye Irritation	Outdoor Temp(^o C)	Home Temp(^o C)	Outdoor Rel.Hum.(%)	Home Rel.Hum.(%)	(HCHO) ppm
1	4	Yes	No	6	18	38	19	0.063 ^d , 0.028 ^d
2 ^a	-	No	No	9	18	40	34	0.024 ^d , 0.025 ^e
3	5	Yes	Yes	3	20	26	18	0.072 ^e
4	7	No	No	3	21	19	49	0.112 ^d , 0.121 ^d
5	6	No	No	0	19	--	--	0.036 ^d , 0.043 ^e
6 ^a	-	No	No	1	19	--	--	<0.010 ^d , 0.016 ^e
7 [*]	2	Yes	Yes	6	23	--	--	0.033 ^d , <0.01 ^e
8 ^b	3	Yes	Yes	4	23	34	30	0.033 ^e , 0.053 ^f
9	4	No	Yes	4	22	47	--	0.028 ^d , 0.037 ^e , 0.015 ^f
10 ^a	-	No	No	1	22	61	12	<0.020 ^e
11 ^c	(3)	No	Yes	5	22	75	42	0.025 ^f , 0.015 ^g
12 [*]	3	No	Yes	2	18	79	30	<0.010 ^d , 0.018 ^d
13 ^c	(3)	Was	Was	0	18	80	34	0.059 ^d , 0.053 ^e
14	3	Yes	Yes	0	18	80	34	0.058 ^d , 0.024 ^e
15	5	No	No	3	18	78	30	0.028 ^d , 0.026 ^d
16	4	Yes	Yes	3	21	78	30	0.014 ^d , 0.012 ^h
(ND, 0.005, 0.009) ⁱ								

* home close to heavy traffic.

a = control home, b = foamed trailer home, c = foam removed from home, d = bedroom, e = living room

f = kitchen, g = bathroom, h = family room, i = outside

2. Type of home construction, square footage, existence and location of vapor barriers, area and age of carpets, area of particle board, type of heating system, type of ventilation existence of humidifier.
3. Date, extent and location of U-F foam insulation.
4. Questions regarding odor, and eye, throat and nose irritation.

Additional information collected consisted of:

1. Temperature in homes and outdoors
2. Relative humidity in homes and outdoors
3. Sky condition
4. Traffic conditons near home.

Copies of the investigation forms are presented in Appendix 1.

Results:

Denver-Boulder Area:

Physical characteristics of the residential homes are listed in Table 1. The age of U-F insulated homes ranged from 6 to 100 years with a mean age of 24 years. Four U-F foam insulated homes had exterior vapor barriers and one U-F foam insulated home had an interior vapor barrier. Five U-F foam insulated homes had fireplaces. Two homes were ventilated with an attic fan to force the air through the attic to the outside.

Physical parameters and formaldehyde concentrations for the homes visited are listed in Table 2. The age of the U-F foam insulation in the 10 homes ranged from two to seven years with a mean age of 4.3 years. Five of the 10 home owners experienced an odor problem and eye irritation. The outdoor temperature ranged from 0° to 9° Celsius during the sampling period and inside temperature ranged from 18° to 22° Celsius. Outdoor relative humidity ranged from 19 to 80% and inside relative humidity ranged from 12 to 49%. The formaldehyde concentrations in the 10 U-F insulated homes were determined to be between less than 0.010 and 0.021 ppm with a mean value of 0.039 ppm. The formaldehyde concentrations outside the home ranged from nondetectable to 0.009 ppm. The formaldehyde concentration in the three control homes ranged from less than 0.010 to 0.025 ppm with a mean value of 0.019 ppm.

Southern Wisconsin:

Physical characteristics of the residential houses tested are listed in Table 3. The age of the U-F insulated homes range from 20 to 130 years with a mean age of 59 years. Four of the U-F foam insulated homes had exterior vapor barriers, while four houses had fireplaces. Two homes were ventilated with attic fans.

Physical parameters and formaldehyde concentrations measured are listed in Table 4. The age of the U-F foam insulation ranged from $\frac{1}{2}$ to 5 years with a mean age of 3.1 years. Eight of the eleven experienced an odor problem and five home owners experienced eye irritation. The outdoor temperature ranged between 10° and 24° Celsius during the sampling period, while inside temperatures ranged from 21° to 28° Celsius. Outdoor relative humidity ranged from 30 to 100% and inside relative humidity was between 30 and 50%. The formaldehyde concentrations in the homes were between 0.028 and 0.144 ppm by volume with a mean value of 0.079 ppm. The data from the number of homes studied in Colorado and Wisconsin shows no observable correlation between age of home, age of foam and formaldehyde concentration. The formaldehyde levels in the Wisconsin area were higher than those the the Colorado homes. This apparent increase may be due to the difference in ambient temperature and relative humidity.

Appendix II presents for Denver, Colorado and Madison, Wisconsin the date, temperature range ($^{\circ}\text{C}$), relative humidity range, and total precipitation for the months of Jan., Feb., and March.

Continued Monitoring

Two participants in the Colorado study, expressed an interest in cooperating with The University of Iowa in a continued monitoring program. Both participants have science backgrounds and were given instructions on sampling techniques. The homes studied continuously for the month of April, May and June are numbers 13 and 14. Data collected for home #13 are listed in Table 5 and for home #14 are listed in Table 6. The plots of formaldehyde concentration vs date of sampling are graphically represented in Figure 1 for home #13 and Figure 2 for home #14. It appears that the formaldehyde concentration in the home #13, from which the U-F foam was removed levels off at about 0.10 ppm. The formaldehyde concentration in home #14 increased gradually with time. This increase appears to be related with the increase in ambient temperature and/or humidity.

Table 3. Physical Characteristics of Homes in Southern Wisconsin

Home #	# of Occupants	# that Smoke	Age of Home	Area of Living Space (sq. ft.)	Vapor barrier 0 = none 1 = outside 2 = inside	Area of Carpets	# of Fireplaces	Type of Attic Ventilation 0 = none 1 = forced 2 = gravity
17	5	0	20	1,064	0	600	0	2
18	5	0	24	1,400	1,2	1,300	0	2
19	2	0	56	2,200	0	1,400	1	2
20	2	0	45	1,800	1	1,600	1	2
21	4	0	50	1,800	1	800	1	2
22	2	0	50	1,500	1	500	0	2
23	6	0	78	4,532	0	2,400	2	0
24	2	1	55	1,200	0	1,000	0	2
25	2	0	130	1,120	0	360	0	1
26	2	1	25	1,000	2	800	0	1
27	2	2	78	1,144	2	944	0	1

Table 4. Physical Parameters and Formaldehyde Concentrations:
Homes in Southern Wisconsin

Home #	Age of U-F Foam (years)	Odor Problem	Eye Irritation	Outdoor Temp (°C)	Home Temp (°C)	Outdoor Rel.Hum.(%)	Home Rel.Hum.(%)	(HCHO) ppm
17	2	Yes	No	23	22	30	30	0.140 ^d , 0.056 ^d
18	5	No	No	14	21	65	35	0.084 ^d , 0.088 ^d
19	3	Yes	Yes	10	22	100	35	0.032 ^d , 0.044 ^h
20	3	No	No	10	22	40	35	0.076 ^d , 0.112 ^f
21	5	Yes	Yes	22	23	30	36	0.056 ^d , 0.088 ^h
22	4	Yes	No	23	22	30	35	0.072 ^d , 0.056 ^e
23	5,4,& 3	No	No	22	21	40	50	0.076 ^d , 0.116 ^e
24	3	Yes	No	20	24	36	35	0.028 ^d , 0.036 ^d
25	½	Yes	Yes	24	22	40	30	0.096 ^l , 0.040 ^j
26	1	Yes	Yes	23	28	50	46	0.124 ^d , 0.144 ^d
27	3	Yes	Yes	23	27	35	30	0.080 ^d , 0.088 ^d , 0.088 ^k
								(0.004, 0.004) ⁱ

d = bedroom, e = livingroom, f = kitchen, h = family room, i = outside, j = attic, k = porch,
l = inside kitchen cabinets

Table 5. Physical Parameters and Formaldehyde Concentrations: Home #13

Date of Sampling	Inside Temperature °C	Outside Temperature °C	Wind Direction	Inside Rel. Hum. %	Sky Condition	Location	Concentration ppm
1/18/80	18	2	0	30	Cloudy	LR	0.059
4/30/80	18	4	E Breeze	46	Cloudy	Study	.116
5/2/80	19	13	SE Breeze	49	P Cloudy	M Br	.128
5/16/80	18	7	0	52	P Cloudy	Study	.116
5/16/80	19	12	0	52	Cloudy	M Br	.144
5/31/80	21	17	E Breeze	43	Cloudy	M Br (no vent)	0.101
5/31/80	18	22	NW Gusts	43	Cloudy	Study (no vent)	0.087
5/31/80	19	26	NW Strong Gusts	37	Clear	B Br (closed 20 hrs)	0.095
5/31/80	24	24	NW Strong Gusts	32	Clear	M Br (room ventilated before sampling, closed during sampling)	0.087

Table 6. Physical Parameters and Formaldehyde Concentrations: Home #14

Date of Sampling	Inside Temperature °C	Outside Temperature °C	Wind Direction & Speed	Inside Rel.Hum. %	Sky Condition	Location	Concentration
1/18/80	18	8	0	34	Cloudy	B Br. LR	0.058 0.024
4/13/80	21	2	-	42	P Cloudy	B Fr	0.130
4/ 6/80	21	6	NW 5 mph	42	Rain	B Fr	0.130
4/13/80	21	8	0	32	Clear	LR	0.720
4/13/80	14	8	0	32	Clear	B Br	0.080
4/20/80	21	25	0 - 5 NE	30	P Cloudy	B Br	0.128
4/20/80	19	19	0	31	P Cloudy	LR	0.130
4/27/80	22	11	0	33	P Cloudy	LR	0.120
4/27/80	24	14	0	31	P Cloudy	B Br	0.156
5/ 4/80	20	16	0	35	Clear	B Br	0.160
5/18/80	18	12	0	32	Clear	B Br	0.176
5/18/80	22	12	0	35	P Cloudy	LR	0.156
6/ 1/80	21	20	0	30	Cloudy	LR	0.178
6/ 1/80	19	16	0	31	Cloudy	B Br	0.195

Figure 1. Formaldehyde Concentration $\bar{v}$ s Time - Home #13

Figure 2. Formaldehyde Concentration vs Time - Home #14

APPENDIX I

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Home Information

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INVESTIGATION FORM
FORMALDEHYDE LEVELS IN RESIDENTIAL HOMES

Home Information con't

- 20). WAS HOME VENTILATED AT TIME OF FOAM INSTALLATION: YES _____ NO _____
- 21). NUMBER OF EXHAUST FANS TO OUTSIDE _____
- 22). ATTIC FAN: YES _____ NO _____
- 23). TYPE OF ATTIC VENTILLATION _____ FORCED _____ GRAVITY _____
- 24). INSTALLATION DATE OF U-F FOAM INSULATION _____
- 25). NAME AND ADDRESS OF U-F FOAM CONTRACTOR _____

- 26). BRAND NAME OF INSULATION _____
- 27). WAS FOAMING AGENT AND/OF RESIN PREMIXED OR MIXED ON SITE _____
- 28). WAS TRUCK HEATED _____
- 29). WERE FOAM LINES INSULATED _____
- 30). WERE RESIN AND FOAMING AGENT TEMPERATURES CONTROLLED _____
- 31). ADDITIONAL TYPES OF INSULATION _____
- 32). AREAS WITH THIS INSULATION _____
- 33). IS THERE AN ODOR PROBLEM: YES _____ NO _____
- 34). IS THERE EYE IRRITATION: YES _____ NO _____
- 35). IS THERE THROAT AND NOSE IRRITATION: YES _____ NO _____

FLOOR DIAGRAM

INVESTIGATION FORM
FORMALDEHYDE LEVELS IN RESIDENTIAL HOMES
Ambient Conditions

- 1). DATE _____
- 2). INVESTIGATOR'S NAME _____
- 3). ADDRESS OF AREA SAMPLED _____
- 4). SAMPLE(S) NUMBER ASSIGNED _____
- 5). TEMPERATURE OF OUTDOOR AIR _____
- 6). TEMPERATURE OF INSIDE AIR _____
- 7). RELATIVE HUMIDITY % OUTDOOR _____
- 8). RELATIVE HUMIDITY % INDOORS _____
- 9). WIND SPEED _____
DIRECTION (from airport nearest site) _____
- 10). SKY CONDITIONS AT SAMPLING TIME _____
- 11). PRECIPITATION AT SAMPLING TIME _____
- 12). TRAFFIC CONDITIONS NEAR HOME _____
- 13). INDUSTRY WITHIN 1 MILE OF HOME: YES _____ NO _____
- 14). TYPE OF INDUSTRY _____
- 15). ROOMS SAMPLED _____
- 16). NUMBER OF WINDOWS OPEN DURING SAMPLING PERIOD _____
- 17). FORMALDEHYDE CONCENTRATION _____

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Weather Information - Denver, Colorado

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
12/22/79	-3 → 12	25 - 75	19.4
12/24/79	-9 → -2	69 - 87	19.9
12/25/79	-10 → 2	50 - 80	19.9
12/27/79	.5 → 4	52 - 79	19.93
12/19/79	-4.4 → -1	69 - 89	20.35
12/31/79	-12 → 2	45 - 83	20.36
1/1/80	-12 → 12	27 - 67	.01
1/2/80	-1 → 7	43 - 78	.01
1/3/80	-9 → 3	62 - 88	.05
1/4/80	-3 → 7	36 - 88	.05
1/5/80	-3 → 4	46 - 85	.05
1/7/80	-12 → 12	27 - 77	.05
1/8/80	-14 → -4	54 - 83	.05
1/9/80	-12 → -3	55 - 84	.05
1/10/80	-9 → -.5	58 - 87	.05
1/11/80	-4 → 10	32 - 78	.06
1/12/80	-7 → 2	32 - 58	.06
1/14/80	4 → 16	25 - 60	.06
1/15/80	2 → 15	40 - 70	.06
1/17/80	-4 → 9	32 - 82	.06
1/18/80	-2 → 10	28 - 88	.06
1/19/80	-2 → 2	64 - 81	.25
1/21/80	-12 → -3	60 - 80	.40
1/22/80	-13 → 4	48 - 92	.42
1/23/80	-8 → 3	32 - 91	.42
1/24/80	-2 → 9	29 - 57	.42

Denver

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
1/25/80	-1 → 12	25 - 57	.42
1/26/80	-9 → 3	54 - 99	.46
1/28/80	-18 → -13	52 - 65	.62
1/29/80	-18 → -14	49 - 69	.63
1/30/80	-18 → -11	54 - 68	.64
1/31/80	-19 → -4	34 - 75	.64
2/ 1/80	-9 → 1	35 - 77	.64
2/ 2/80	-9 → 11	26 - 74	.64
2/ 5/80	-2 → 11	36 - 75	.64
2/ 6/80	-3 → 3	48 - 72	.64
2/ 7/80	-1 → 8	43 - 75	.64
2/ 8/80	-13 → .5	74 - 88	.88
2/ 9/80	-21 → -18	50 - 87	.90
2/11/80	-12 → 5	39 - 83	.90
2/12/80	-9 → 3	39 - 88	.90
2/13/80	-3 → 11	22 - 88	.90
2/14/80	-4 → 12	26 - 88	.91
2/15/80	-6 → -2	81 - 88	.92
2/18/80	1 → 10	32 - 88	.94
2/19/80	-4 → 15	34 - 61	.94
2/20/80	.5 → 15	21 - 59	.94
2/22/80	-1 → 10	41 - 69	.94
2/23/80	-1 → 9	42 - 78	.94
2/24/80	1 → 6	55 - 71	.94
2/25/80	-3 → 8	26 - 81	1.01
2/26/80	1 → 13	17 - 73	1.01
2/27/80	3 → 0	20 - 52	1.01

Denver

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
2/28/80	-1 → 21	15 - 57	1.01
2/29/80	-2 → 18	19 - 85	1.03
3/ 3/80	2 → 14	21 - 85	1.09
3/ 4/80	2 → 11	38 - 82	1.15
3/ 5/80	-5 → 3	68 - 85	1.17
3/ 6/80	-4 → .5	66 - 78	1.17
3/ 7/80	-1 → 12	42 - 75	1.20
3/ 8/80	-2 → 4	59 - 81	1.23
3/10/80	.5 → 12	17 - 56	1.23
3/11/80	-.5 → 16	19 - 61	1.23
3/12/80	.5 → 14	20 - 64	1.23
3/13/80	-5 → 10	14 - 57	1.23
3/14/80	.5 → 14	15 - 52	1.23
3/17/80	-8 → 0	33 - 81	1.30
3/18/80	-3 → 12	23 - 81	1.30
3/19/80	-.5 → 19	1 - 63	1.30
3/20/80	-5 → 16	17 - 79	1.31
3/21/80	-3 → 12	23 - 82	1.34
3/23/80	2 → 4	51 - 67	1.34
3/24/80	-2 → 3	62 - 78	1.39
3/26/80	.5 → 12	27 - 78	1.39
3/28/80	-2 → 2	61 - 81	1.77
3/29/80	-2 → .5	69 - 82	1.88
3/30/80	-4 → 6	45 - 75	2.00
3/31/80	0 → 11	33 - 75	2.05

Weather Information - Madison, Wisconsin

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
1/ 8/80	-16 → -14	76 - 83	.15
1/ 9/80	-18 → -17.8	56 - 79	.15
1/10/80	-20 → -16	48 - 75	.16
1/11/80	-12 → 2	59 -100	.16
1/12/80	-13 → 9	47 - 96	.23
1/13/80	-16 → -8	58 - 76	.23
1/14/80	-2 → -1.5	53 - 92	.23
1/15/80	-7 → 0	82 -100	.25
1/16/80	0 → 3	96 -100	.29
1/17/80	3 → 6	96 -100	.89
1/18/80	.5 → 1	85 - 96	.97
1/19/80	-4 → -2	78 - 88	.97
1/20/80	-6 → -4	84 - 96	.97
1/21/80	-12 → -3	60 - 80	.97
1/22/80	-8 → -3	50 - 85	.97
1/23/80	-10 → -3	64 - 85	.97
1/24/80	-16 → -12	47 - 79	.97
1/25/80	-13 → -6	88 - 92	1.09
1/26/80	-11 → -7	70 - 88	1.10
1/27/80	-17 → -14	57 - 62	1.10
1/28/80	-16 → -15	54 - 61	1.10
1/29/80	-17 → -14	54 - 66	1.10
1/30/80	-16 → -14	54 - 64	1.10
1/31/80	-16 → -13	62 - 83	1.10
2/ 1/80	-18 → -8	54 - 79	1.11
2/ 2/80	-16 → -9	51 - 71	1.11
2/ 3/80	-13 → -8	43 - 67	1.11
2/ 4/80	-17 → -8	64 - 79	1.11

Wisconsin

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
2/ 5/80	-12 → -7	51 - 70	1.11
2/ 6/80	-8 → -6	88 - 92	1.19
2/ 7/80	-9 → -5	81 - 88	1.32
2/ 8/80	-13 → -8	74 - 84	1.32
2/ 9/80	-17 → -6	74 - 79	1.32
2/10/80	-18 → -5	60 - 96	1.32
2/11/80	-11 → -7	74 - 84	1.32
2/12/80	-15 → -8	59 - 87	1.32
2/13/80	-17 → -8	67 - 91	1.32
2/14/80	-8 → -4	74 - 78	1.32
2/15/80	-11 → -5	60 - 96	1.32
2/16/80	-8 → -6	71 - 84	1.38
1/17/80	-17 → -12	48 - 59	1.38
2/18/80	-15 → -10	61 - 83	1.38
2/19/80	-16 → -2	60 - 79	1.38
2/20/80	-2 → 2	64 - 75	1.38
2/21/80	.5 → 3	82 - 89	1.38
2/22/80	2 → 2	85 - 89	1.47
2/23/80	0 → 2	85 - 89	1.58
2/24/80	-3 → .5	75 - 89	1.58
2/25/80	-3 → 2	75 - 89	1.58
2/26/80	-11 → -6	50 - 84	1.66
2/27/80	-17 → -8	44 - 84	1.66
2/28/80	-6 → -4	42 - 71	1.66
2/29/80	-13 → -6	56 - 91	1.75
3/ 1/80	-14 → -13	47 - 53	1.75
3/ 2/80	-17 → -8	34 - 68	1.75
3/ 3/80	-17 → -6	31 - 62	1.75

Wisconsin

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
3/ 4/80	-11 + -1	46 - 73	1.75
3/ 5/80	-7 + .5	56 - 89	1.93
3/ 6/80	-9 + -8	49 - 81	2.06
3/ 7/80	-17 + -7	64 - 84	2.11
3/ 8/80	-16 + -3	75 - 96	2.11
3/ 9/80	-7 + -.5	56 - 88	2.11
3/10/80	-10 + .5	72 - 96	2.13
3/11/80	-8 + 1	42 - 85	2.14
3/12/80	-16 + -6	36 - 57	2.14
3/13/80	-11 + -4	52 - 58	2.14
3/14/80	-6 + -3	81 - 88	2.32
3/15/80	-8 + 1	59 - 88	2.32
3/16/80	-6 + 6	70 - 96	2.32
3/17/80	5 + 11	66 - 93	2.32
3/18/80	.5 + 1	41 - 82	2.32
3/19/80	5 + 8	51 - 84	2.32
3/20/80	2 + 9	52 - 79	2.32
3/21/80	1 + 8	60 - 89	2.32
3/22/80			
3/23/80	-8 + 1	43 - 81	2.32
3/24/80	-1 + 1	89 - 96	2.43
3/25/80	-1 + .5	64 - 92	2.43
3/26/80	-8 + .5	61 - 88	2.43
3/27/80	-7 + 5	53 - 96	2.43
3/28/80	.5 + 7	65 - 82	2.43
3/29/80	2 + 4	73 - 85	2.43
3/30/80	0 + 6	51 - 85	2.43
3/31/80	0 + 7	53 - 82	2.43

Wisconsin

Date	Temp. Range °C	Humidity Range %	Accumulated Precipitation inches
4/ 1/80	.5 → 12	30 - 64	2.43
4/ 2/80	-4 → 11	39 - 81	2.43
4/ 3/80	12 → 13	31 - 96	2.43
4/ 4/80	2 → 3	79 - 96	2.82
4/ 5/80	0 → 9	36 - 85	3.06
4/ 6/80	0 → 15	33 - 82	3.06
4/ 7/80	8 → 13	53 - 77	3.14
4/ 8/80	9 → 17	35 - 80	3.23
4/ 9/80	7 → 9	79 - 93	3.86
4/10/80	0 → 1	89 - 96	4.06
4/11/80	-.5 → 2	70 - 82	4.06
4/12/80	0 → 7	42 - 75	4.06
4/13/80	-2 → 6	45 - 85	4.12
4/14/80	-4 → 6	30 - 88	4.12

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