

**ENVIRONMENTAL PERFORMANCE
TEST REPORT**

Rendered to:

SOLATUBE INTERNATIONAL, INC.

330 DS and 750 DS

TYPE: Tubular Daylighting Device (TDD)

Report No.: C3436.01-116-23
Report Date: 01/02/13

**ENVIRONMENTAL PERFORMANCE
TEST REPORT**

Rendered to:

SOLATUBE INTERNATIONAL, INC.
2210 Oak Ridge Way
Vista, California 92081

Report No.: C3436.01-116-23
Test Dates: 11/6/12 - 11/8/12
Report Date: 01/02/13

Project Summary: Architectural Testing, Inc. was contracted by Solatube International, Inc. to evaluate both the 330 DS and 750 DS systems for installation into cold storage applications. The purpose of this evaluation was to monitor and record air and surface temperatures inside and outside of each assembly and evaluate for condensation potential.

Test Sample Identification:

Series/Model: 330 DS Daylighting System
750 DS Daylighting System
Type: Tubular Daylighting Device (TDD)

Test Specimen Descriptions:

Test Specimen #1 - 330 DS Daylighting System consisting of the following:

330 DS Dome with fin seal, Tube ring seal, 8" roof flashing, 5' Spectralight Infinity tube, 15" Bottom Tube with Angle Adapter, Transition Box with Natural Effect Lens, and Diffuser. All joints were sealed with 2" foil tape. This specimen was tested without applied humidity exposure.

Test Specimen #2 - 330 DS Daylighting System consisting of the following:

330 DS Dome with fin seal, Tube ring seal, 8" roof flashing, 5' Spectralight Infinity tube, 15" Bottom Tube with Angle Adapter, Transition Box with Natural Effect Lens, Diffuser and foil faced wool insulation surrounding the transition box and 12" up on the tube. All joints were sealed with 2" foil tape. This specimen was tested without applied humidity exposure.

Test Specimen #3 - 750 DS Daylighting System consisting of the following:

750 DS Dome with fin seal, Tube ring seal, 8" roof flashing, 5' Spectralight Infinity tube, 15" Bottom Tube with Angle Adapter, Transition Box with Natural Effect Lens, Diffuser and foil faced wool insulation surrounding the transition box and 12" up on the tube. All joints were sealed with 2" foil tape. This specimen was tested without applied humidity exposure.

Test Specimen Descriptions: (continued)

Test Specimen #4 - 330 DS Daylighting System consisting of the following:

330 DS Dome with fin seal, Tube ring seal, 8" roof flashing, 5' Spectralight Infinity tube, 15" Bottom Tube with Angle Adapter, Transition Box with Natural Effect Lens, Diffuser and foil faced wool insulation surrounding the transition box and 12" up on the tube. All joints were sealed with 2" foil tape. This specimen was tested with humidity exposure in the attic space and the exterior dome areas.

Test Procedure: The test assembly was installed into the environmental test chamber per Solatube manufacturer instructions for a hard ceiling installation as well as custom instructions for a refrigeration application. The custom instructions consisted of applying spray foam insulation around the top transition box perimeter at the ceiling line, sealing any voids from the cutting of the transition box opening in the 3-1/2" thick refrigerator panel. The application of foil faced wool insulation taped over the transition box and up 12" on the tube was also employed for tests #2 through #4 .

The test assemblies were all tested to the following temperature conditions:

Cold Storage Area:	32°F (0°C)
Interior Plenum / Attic Space:	122°F (50°C)
Exterior above Roof Space:	122°F (50°C)

The diffuser, Natural Effect Lens, transition box, tubes, tube seal and flashing were the same for each of the tests performed; only the domes were changed.

Once the assembly was installed thermocouples were instrumented on the assembly for monitoring air and surface temperatures within the assembly and at the exterior surface of the assembly. All monitored locations are indicated in Appendix B of this report.

Test Results:

Test Specimen #1 - 330 DS Daylighting System:

			Temperatures (oF)	RH %
			Average	Max Level
Inside Tube Surface Temperatures	ID	Designations		
	TC 7	Nat. Effect Lens - Top Surface	83.29	40.8%
	TC 8	Tube - 1" From Nat. Effect Lens	109.31	90.5%
	TC 9	Tube - 6" From Nat. Effect Lens	110.34	93.2%
	TC 10	Tube - 12" From Nat. Effect Lens	111.31	95.9%
	TC 11	Tube - 18" From Nat. Effect Lens	111.59	96.6%
	TC 12	Tube - 24" From Nat. Effect Lens	113.38	100.0%
	TC 13	Tube - 30" From Nat. Effect Lens	113.78	100.0%
Exterior Tube and Surface Temperatures	TC 14	Tube - 36" From Nat. Effect Lens	114.42	100.0%
	TC 15	Transition Box Surface	95.25	49.8%
	TC 16	Tube - 1-1/2" From Transition Box	110.59	78.6%
	TC 17	Tube - 6" From Transition Box	111.16	79.8%
	TC 18	Tube - 12" From Transition Box	112.05	81.9%
	TC 19	Tube - 24" From Transition Box	112.35	82.6%
	TC 21	Dome Exterior Surface	112.40	82.7%
	TC 22	Diffuser Exterior Surface	54.98	100.0%
Air Temperatures	TC A	Average Inside Tube Air	112.78	
	TC 20	Between Diffuser and Nat. Effect Lens	84.53	
	TC 23	Cold Storage Compartment	31.69	
	TC 24	Attic and Dome Compartment	119.10	

Note: The Maximum Humidity Level is based on either the average interior surface temperature or exterior surface temperature measured in conjunction with the corresponding average ambient air temperature measured. This maximum humidity level represents the exposure level that each surface can see prior to anticipated surface condensation formation.

Additional data is provided in Appendix B of this test report.

The analysis of the temperature results from this evaluation indicates the following:

- 1) At the tested conditions, the humidity level within the tube must be maintained below 41% in order to mitigate condensation formation on any of the inside surfaces.
- 2) At the tested conditions, the humidity level within the Attic/Plenum must be maintained below 50% in order to mitigate condensation formation on any of the exposed surfaces.
- 3) At the tested conditions, the humidity level at the exterior of the dome must be maintained below 83% in order to mitigate condensation formation on any of the exposed dome surface.

Please note that the surface temperature results reported are only valid for the ambient temperatures tested. These temperatures will vary under different exposure climates.

Test Results: (continued)

Test Specimen #2-330 DS Daylighting System with Tube and Transition Box Insulation:

			Temperatures (oF)	RH %
			Average	Max Level
Inside Tube Surface Temperatures	ID	Designations		
	TC 7	Nat. Effect Lens - Top Surface	76.51	34.0%
	TC 8	Tube - 1" From Nat. Effect Lens	99.50	70.4%
	TC 9	Tube - 6" From Nat. Effect Lens	103.89	80.3%
	TC 10	Tube - 12" From Nat. Effect Lens	108.20	91.2%
	TC 11	Tube - 18" From Nat. Effect Lens	110.94	98.7%
	TC 12	Tube - 24" From Nat. Effect Lens	112.70	100.0%
	TC 13	Tube - 30" From Nat. Effect Lens	113.34	100.0%
Exterior Tube and Surface Temperatures	TC 14	Tube - 36" From Nat. Effect Lens	114.13	100.0%
	TC 15	Transition Box Surface	78.73	29.4%
	TC 16	Tube - 1-1/2" From Transition Box	100.06	57.6%
	TC 17	Tube - 6" From Transition Box	103.20	63.2%
	TC 18	Tube - 12" From Transition Box	110.00	77.2%
	TC 19	Tube - 24" From Transition Box	111.92	81.6%
	TC 21	Dome Exterior Surface	112.91	83.9%
	TC 22	Diffuser Exterior Surface	49.83	100.0%
Air Temperatures	TC A	Inside Tube Air	111.41	
	TC 20	Between Diffuser and Nat. Effect Lens	75.01	
	TC 23	Cold Storage Compartment	31.52	
	TC 24	Attic and Dome Compartment	119.11	

Note: The Maximum Humidity Level is based on either the average interior surface temperature or exterior surface temperature measured in conjunction with the corresponding average ambient air temperature measured. This maximum humidity level represents the exposure level that each surface can see prior to anticipated surface condensation formation.

Additional data is provided in Appendix B of this test report.

The analysis of the measured temperature results from this evaluation indicates the following:

- 1) At the tested conditions, the humidity level within the tube must be maintained below 34% in order to mitigate condensation formation on any of the inside surfaces.
- 2) At the tested conditions, the humidity level within the Attic/Plenum must be maintained below 77% in order to mitigate condensation formation on any of the exposed surfaces.
- 3) At the tested conditions, the humidity level at the exterior of the dome must be maintained below 83% in order to mitigate condensation formation on any of the exposed dome surface.

Please note that the surface temperature results reported are only valid for the ambient temperatures tested. These temperatures will vary under different exposure climates. Also note that thermocouples, TC15 through TC 17, are embedded beneath foil faced wool insulation resulting in the cooler temperatures. These areas may form condensation at a lower humidity level then reported in conclusion #2 above if the insulation is not properly sealed.

Test Results: (continued)

Test Specimen #3-750 DS Daylighting System with Tube and Transition Box Insulation:

			Temperatures (oF)	RH %
			Average	Max Level
Inside Tube Surface Temperatures	ID	Designations		
	TC 7	Nat. Effect Lens - Top Surface	76.38	33.8%
	TC 8	Tube - 1" From Nat. Effect Lens	99.53	70.3%
	TC 9	Tube - 6" From Nat. Effect Lens	104.02	80.4%
	TC 10	Tube - 12" From Nat. Effect Lens	108.42	91.5%
	TC 11	Tube - 18" From Nat. Effect Lens	111.09	98.9%
	TC 12	Tube - 24" From Nat. Effect Lens	112.89	100.0%
	TC 13	Tube - 30" From Nat. Effect Lens	113.47	100.0%
Exterior Tube and Surface Temperatures	TC 14	Tube - 36" From Nat. Effect Lens	114.23	100.0%
	TC 15	Transition Box Surface	78.28	28.5%
	TC 16	Tube - 1-1/2" From Transition Box	100.01	56.5%
	TC 17	Tube - 6" From Transition Box	103.25	62.2%
	TC 18	Tube - 12" From Transition Box	110.09	76.1%
	TC 19	Tube - 24" From Transition Box	111.99	80.3%
	TC 21	Dome Exterior Surface	113.30	83.4%
Air Temperatures	TC 22	Diffuser Exterior Surface	49.67	100.0%
	TC A	Inside Tube Air	111.48	
	TC 20	Between Diffuser and Nat. Effect Lens	74.53	
	TC 23	Cold Storage Compartment	31.49	
	TC 24	Attic and Dome Compartment	119.74	

Note: The Maximum Humidity Level is based on either the average interior surface temperature or exterior surface temperature measured in conjunction with the corresponding average ambient air temperature measured. This maximum humidity level represents the exposure level that each surface can see prior to anticipated surface condensation formation.

Additional data is provided in Appendix B of this test report.

The analysis of the measured temperature results from this evaluation indicates the following:

- 1) At the tested conditions, the humidity level within the tube must be maintained below 34% in order to mitigate condensation formation on any of the inside surfaces.
- 2) At the tested conditions, the humidity level within the Attic/Plenum must be maintained below 76% in order to mitigate condensation formation on any of the exposed surfaces.
- 3) At the tested conditions, the humidity level at the exterior of the dome must be maintained below 83% in order to mitigate condensation formation on any of the exposed dome surface.

Please note that the surface temperature results reported are only valid for the ambient temperatures tested. These temperatures will vary under different exposure climates. Also note that thermocouples, TC15 through TC 17, are embedded beneath foil faced wool insulation resulting in the cooler temperatures. These areas may form condensation at a lower humidity level then reported in conclusion #2 above if the insulation is not properly sealed.

Test Results: (continued)

Test Specimen #4-330 DS Daylighting System with Tube and Transition Box Insulation:

			Temperatures (oF)	RH %
			Average	Max Level
Inside Tube Surface Temperatures	ID	Designations		
	TC 7	Nat. Effect Lens - Top Surface	78.37	33.6%
	TC 8	Tube - 1" From Nat. Effect Lens	101.96	70.3%
	TC 9	Tube - 6" From Nat. Effect Lens	106.60	80.7%
	TC 10	Tube - 12" From Nat. Effect Lens	111.59	93.2%
	TC 11	Tube - 18" From Nat. Effect Lens	115.33	100.0%
	TC 12	Tube - 24" From Nat. Effect Lens	116.81	100.0%
	TC 13	Tube - 30" From Nat. Effect Lens	117.12	100.0%
Exterior Tube and Surface Temperatures	TC 14	Tube - 36" From Nat. Effect Lens	117.51	100.0%
	TC 15	Transition Box Surface	80.90	31.4%
	TC 16	Tube - 1-1/2" From Transition Box	102.43	61.5%
	TC 17	Tube - 6" From Transition Box	105.79	67.9%
	TC 18	Tube - 12" From Transition Box	113.51	84.9%
	TC 19	Tube - 24" From Transition Box	116.07	91.3%
	TC 21	Dome Exterior Surface	115.79	90.6%
	TC 22	Diffuser Exterior Surface	50.01	100.0%
Air Temperatures	TC A	Inside Tube Air	114.04	
	TC 20	Between Diffuser and Nat. Effect Lens	76.54	
	TC 23	Cold Storage Compartment	31.91	
	TC 24	Attic and Dome Compartment	119.32	

Note: The Maximum Humidity Level is based on either the average interior surface temperature or exterior surface temperature measured in conjunction with the corresponding average ambient air temperature measured. This maximum humidity level represents the exposure level that each surface can see prior to anticipated surface condensation formation.

Additional data is provided in Appendix B of this test report.

The analysis of the measured temperature results from this evaluation indicates the following:

- 1) At the tested conditions, the humidity level within the tube must be maintained below 34% in order to mitigate condensation formation on any of the inside surfaces.
- 2) At the tested conditions, the humidity level within the Attic/Plenum must be maintained below 85% in order to mitigate condensation formation on any of the exposed surfaces.
- 3) At the tested conditions, the humidity level at the exterior of the dome must be maintained below 91% in order to mitigate condensation formation on any of the exposed dome surface.

Please note that the surface temperature results reported are only valid for the ambient temperatures tested. These temperatures will vary under different exposure climates. Also note that thermocouples, TC15 through TC 17, are embedded beneath foil faced wool insulation resulting in the cooler temperatures. These areas may form condensation at a lower humidity level then reported in conclusion #2 above if the insulation is not properly sealed.

Test Results: (continued)

Humidity was added to the plenum / attic space and exterior roof space for this testing. The humidity levels were monitored in 4 locations, as indicated below.

Relative Humidity			Relative Humidity (%)
	ID	Designations	Average
	RH1	Attic and Exterior Dome RH	44.30
	RH2	Cold Storage RH	58.79
	RH3	Interior Tube RH	21.00
	RH4	Transition Box (between lens) RH	64.68

The purpose of the induced humidity testing was to monitor the assembly for condensation formation. From this evaluation there was no visible condensation. This validates the data collected and reported since none of the maximum humidity levels were reached.

Conclusions:

- 1) The surface temperatures were affected by the addition of foil faced wool insulation at the base of the tube and transition box. This insulation isolates these surfaces from the warm ambient air and humid environment and results in cooler surfaces. Even though these surfaces become cooler this insulation, if properly sealed, will prevent the humid air from reaching these surfaces by acting as a vapor barrier and mitigate surface condensation formation.
- 2) As long as the maximum humidity levels are not exceeded, condensation formation would not be anticipated at the tested ambient air conditions.
- 3) The dome configuration did not have a significant impact on the monitored temperatures.

A complete set of photographs of the setup has been provided in Appendix A of this test report. All data collected during testing has been provided in Appendix B. This appendix includes graphs plotting the temperatures monitored as well as provides the summary information at stability.

Architectural Testing will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period. The test record retention end date for this report is November 8, 2016.

Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

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KSL:ksl
C3436.01-116-23

Attachments (pages):

Appendix A: Photographs (6)

Appendix B: Summary Data and Graphs (16)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
.01R0	11/14/2012	All	Original Report Issued to Solatube International, Inc.

Photographs

Test Setup Photographs



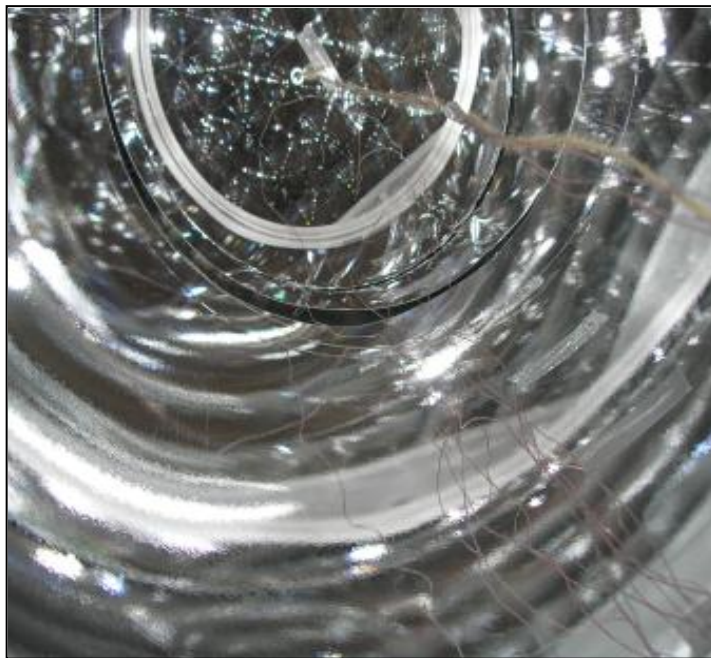
Test Setup Photographs



Test Setup Photographs



Test Setup Photographs



Test Setup Photographs



Test Setup Photographs



Summary Data and Graphs

Test #1: 330 Dome with No Tube Insulation

Air Temperatures	ID	Designations	Temperatures (°F)		
			Average	Min	Max
	TC 1	Air - 1" From Natural Effect Lens	110.72	109.90	111.70
	TC 2	Air - 12" From Natural Effect Lens	112.85	112.00	113.80
	TC 3	Air - 24" From Natural Effect Lens	113.23	112.60	113.90
	TC 4	Air - 36" From Natural Effect Lens	114.18	113.60	114.90
	TC 5	Air - 48" From Natural Effect Lens	112.60	112.00	113.20
	TC 6	Air - 60" From Natural Effect Lens	113.13	112.50	113.80
	Average	Inside Tube Air	112.78	-	-
	TC 20	Between Diffuser and Nat. Effect Lens	84.53	83.40	85.10
	TC 23	Cold Storage Compartment	31.69	26.13	37.06
	TC 24	Attic and Dome Compartment	119.10	110.91	125.19

Inside Tube Surface Temperatures	ID	Designations	Temperatures (°F)			RH %	
			Average	Min	Max	Max Level 1	Max Level 2
	TC 7	Nat. Effect Lens - Top Surface	83.29	82.80	83.50	40.8%	43.3%
	TC 8	Tube - 1" From Nat. Effect Lens	109.31	107.80	110.90	90.5%	96.0%
	TC 9	Tube - 6" From Nat. Effect Lens	110.34	109.00	111.80	93.2%	95.9%
	TC 10	Tube - 12" From Nat. Effect Lens	111.31	110.40	112.40	95.9%	95.7%
	TC 11	Tube - 18" From Nat. Effect Lens	111.59	110.60	112.70	96.6%	95.9%
	TC 12	Tube - 24" From Nat. Effect Lens	113.38	112.50	114.40	100.0%	100.0%
	TC 13	Tube - 30" From Nat. Effect Lens	113.78	112.90	114.80	100.0%	100.0%
	TC 14	Tube - 36" From Nat. Effect Lens	114.42	113.40	115.60	100.0%	100.0%

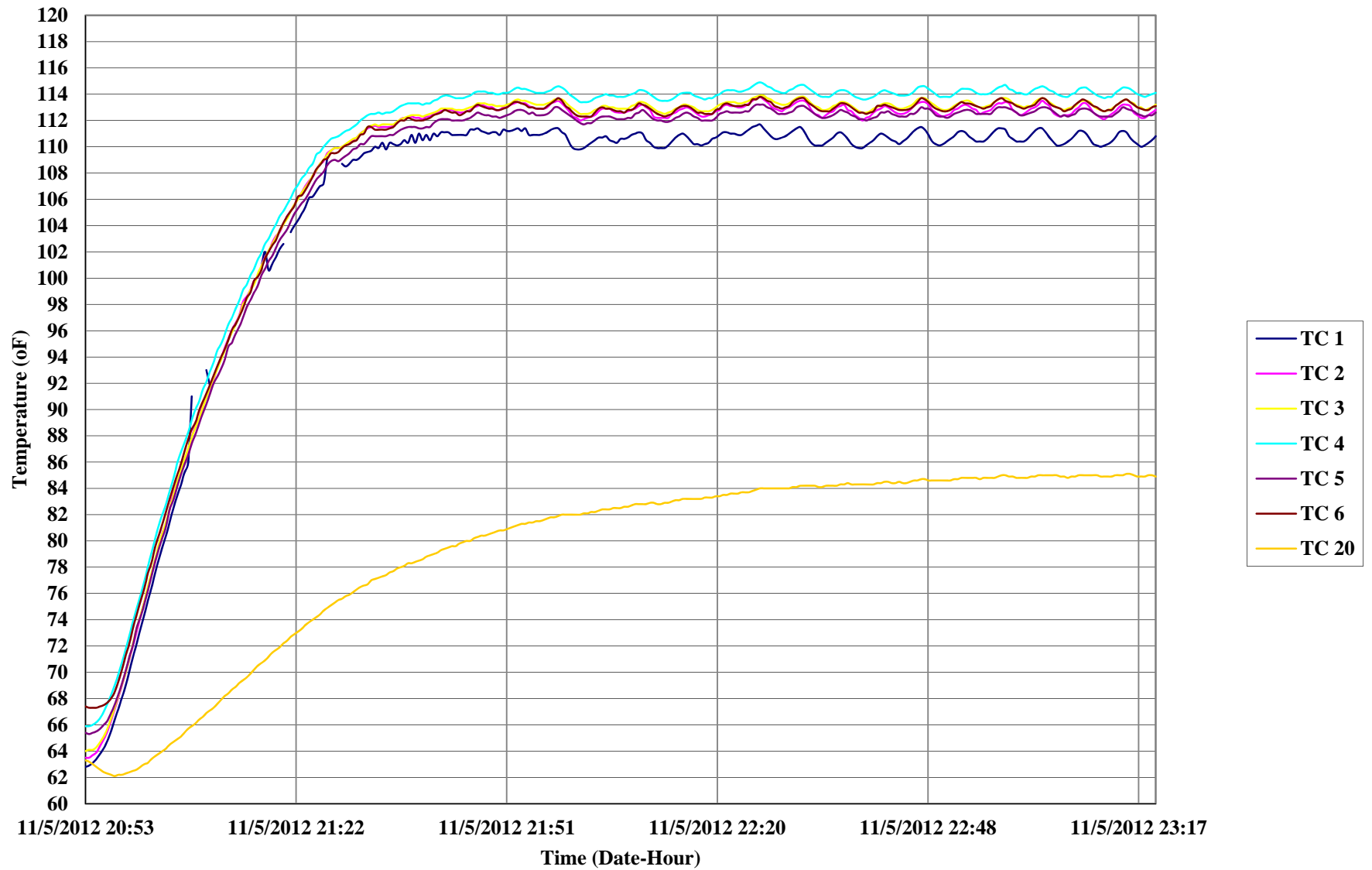
Note: Maximum Humidity Level 1 based on the average surface temperature measured and the average air temperature within the tube (112.8°F)

Note: Maximum Humidity Level 2 based on the average surface temperature measured and the air temperature within the tube at the respective height

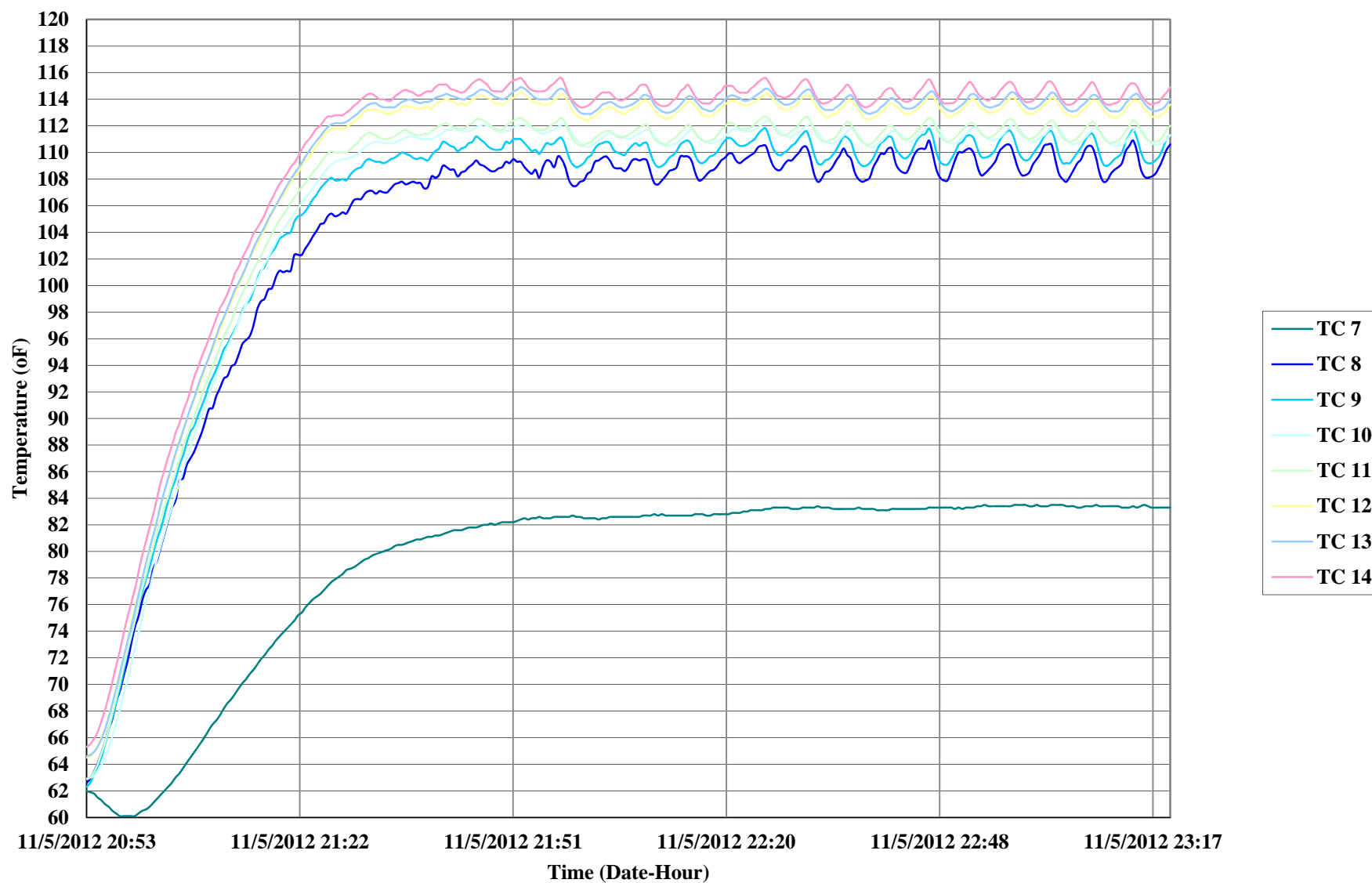
Exterior Tube and Surface Temperatures	ID	Designations	Temperatures (°F)			RH %	
			Average	Min	Max	Max Level	
	TC 15	Transition Box Surface	95.25	94.70	96.10	49.8%	
	TC 16	Tube - 1-1/2" From Transition Box	110.59	109.20	111.90	78.6%	
	TC 17	Tube - 6" From Transition Box	111.16	109.70	112.50	79.8%	
	TC 18	Tube - 12" From Transition Box	112.05	110.80	113.30	81.9%	
	TC 19	Tube - 24" From Transition Box	112.35	111.50	113.40	82.6%	
	TC 21	Dome Exterior Surface	112.40	112.00	112.90	82.7%	
	TC 22	Diffuser Exterior Surface	54.98	53.90	56.20	N/A	

Note: Maximum humidity level based on the surface temperature measured and the Attic and Dome compartment temperature of 119.1°F

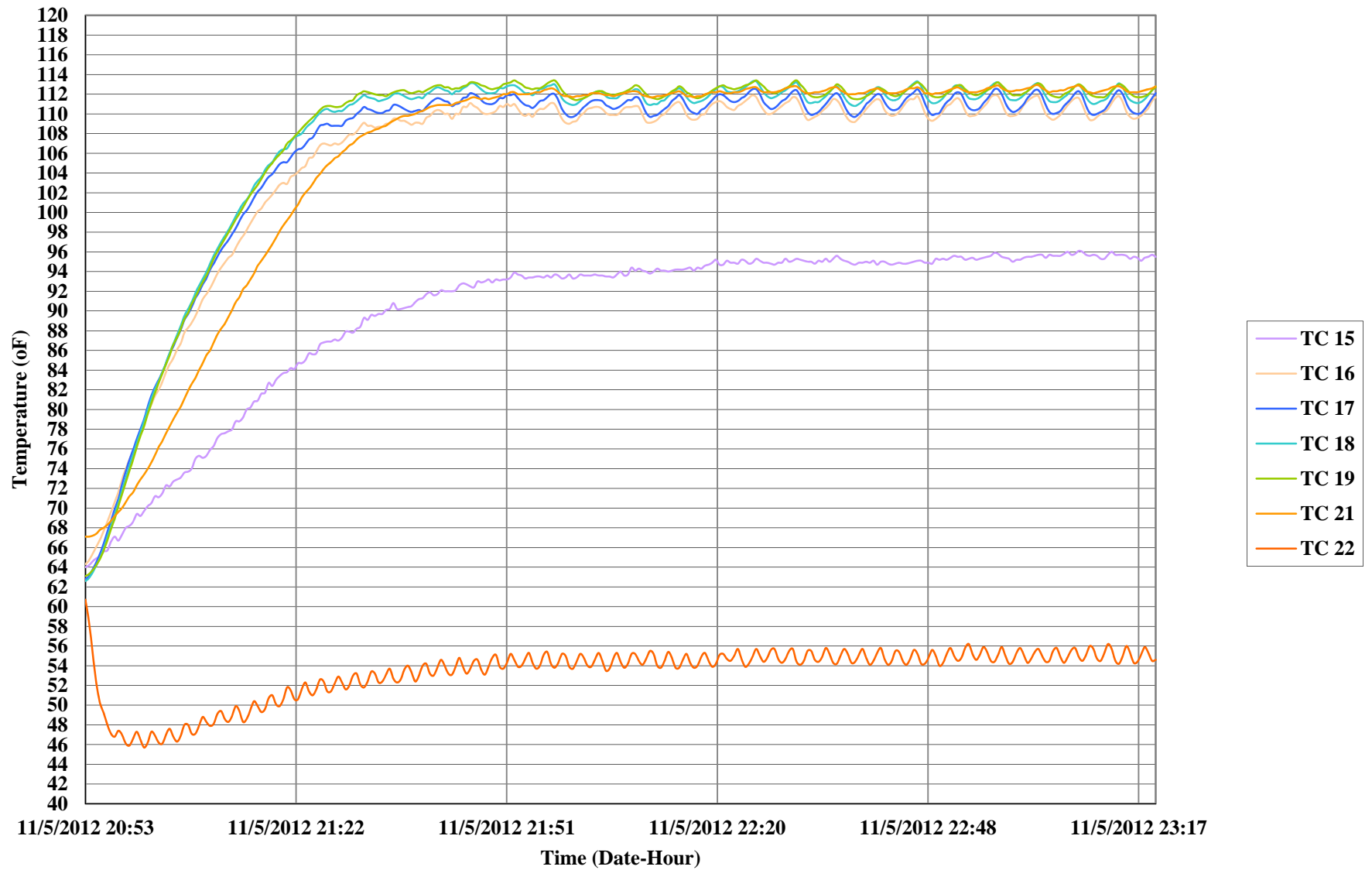
Test #1 - 330 Dome with No Tube Insulation - Air Temps.



Test #1 - 330 Dome with No Tube Insulation - Interior Surface Temps.



Test #1 - 330 Dome with No Tube Insulation - Exterior Surface Temps.



Test #2: 330 Dome with 12" of Tube Insulation and covering Transition Box

Air Temperatures	ID	Designations	Temperatures (°F)		
			Average	Min	Max
	TC 1	Air - 1" From Natural Effect Lens	103.88	103.70	104.00
	TC 2	Air - 12" From Natural Effect Lens	111.40	110.80	112.00
	TC 3	Air - 24" From Natural Effect Lens	112.87	112.30	113.40
	TC 4	Air - 36" From Natural Effect Lens	114.10	113.60	114.60
	TC 5	Air - 48" From Natural Effect Lens	112.83	112.40	113.30
	TC 6	Air - 60" From Natural Effect Lens	113.39	113.00	113.90
	Average	Inside Tube Air	111.41	-	-
	TC 20	Between Diffuser and Nat. Effect Lens	75.01	74.90	75.10
	TC 23	Cold Storage Compartment	31.52	26.41	36.89
	TC 24	Attic and Dome Compartment	119.11	111.41	125.25

Inside Tube Surface Temperatures	ID	Designations	Temperatures (°F)			RH %	RH %
			Average	Min	Max	Max Level 1	Max Level 2
	TC 7	Nat. Effect Lens - Top Surface	76.51	76.40	76.60	34.0%	42.4%
	TC 8	Tube - 1" From Nat. Effect Lens	99.50	99.40	99.60	70.4%	87.7%
	TC 9	Tube - 6" From Nat. Effect Lens	103.89	103.60	104.10	80.3%	89.6%
	TC 10	Tube - 12" From Nat. Effect Lens	108.20	107.70	108.70	91.2%	91.2%
	TC 11	Tube - 18" From Nat. Effect Lens	110.94	110.00	112.10	98.7%	96.6%
	TC 12	Tube - 24" From Nat. Effect Lens	112.70	111.90	113.60	100.0%	99.5%
	TC 13	Tube - 30" From Nat. Effect Lens	113.34	112.60	114.20	100.0%	99.6%
	TC 14	Tube - 36" From Nat. Effect Lens	114.13	113.30	115.20	100.0%	100.0%

Note: Maximum Humidity Level 1 based on the average surface temperature measured and the average air temperature within the tube (111.4°F)

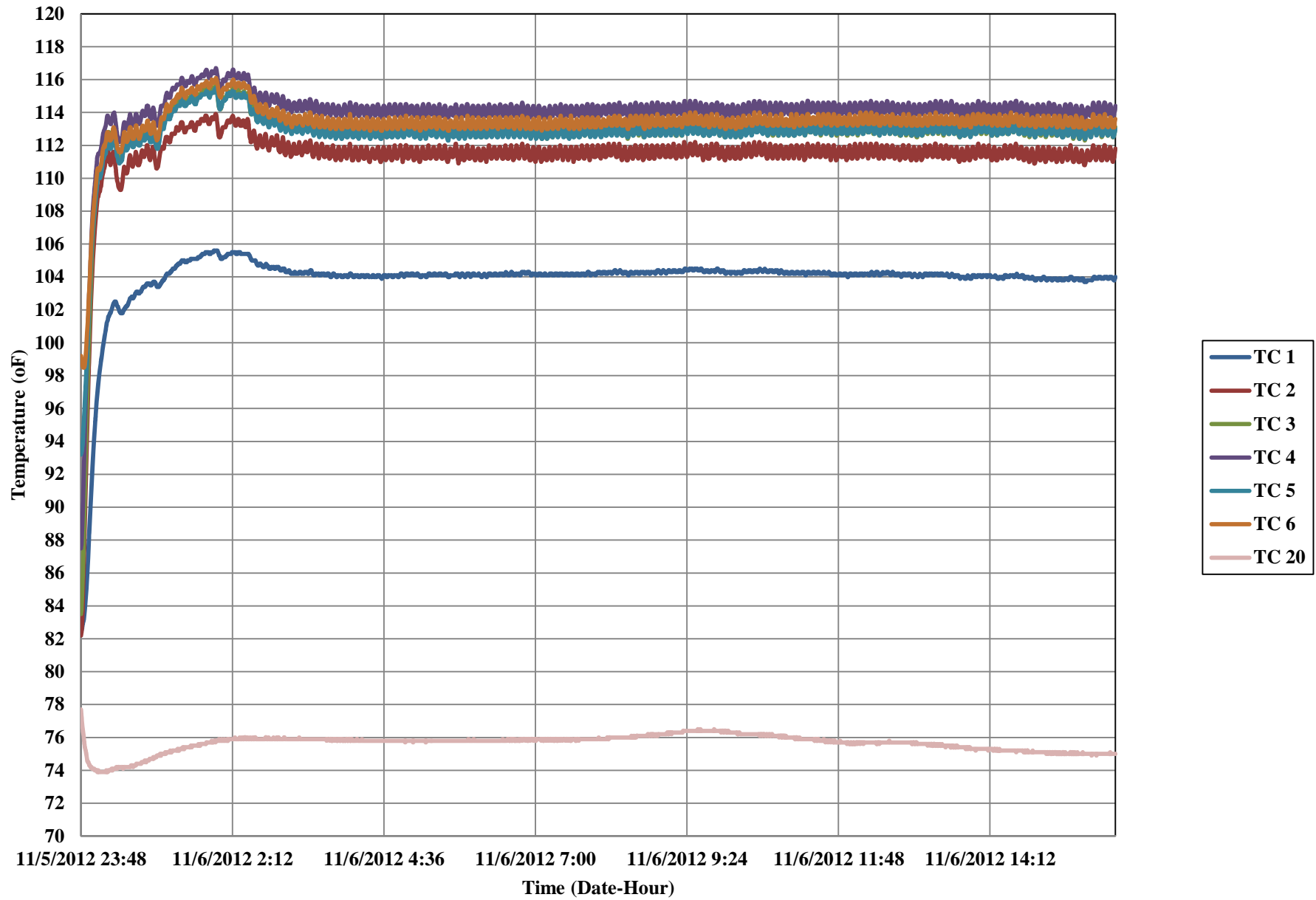
Note: Maximum Humidity Level 2 based on the average surface temperature measured and the air temperature within the tube at the respective height

Exterior Tube and Surface Temperatures	ID	Designations	Temperatures (°F)			RH %
			Average	Min	Max	Max Level
	TC 15	Transition Box Surface	78.73	78.70	78.80	29.4%
	TC 16	Tube - 1-1/2" From Transition Box	100.06	100.00	100.10	57.6%
	TC 17	Tube - 6" From Transition Box	103.20	103.00	103.40	63.2%
	TC 18	Tube - 12" From Transition Box	110.00	109.20	110.90	77.2%
	TC 19	Tube - 24" From Transition Box	111.92	111.10	112.80	81.6%
	TC 21	Dome Exterior Surface	112.91	112.50	113.40	83.9%
	TC 22	Diffuser Exterior Surface	49.83	48.70	50.90	N/A

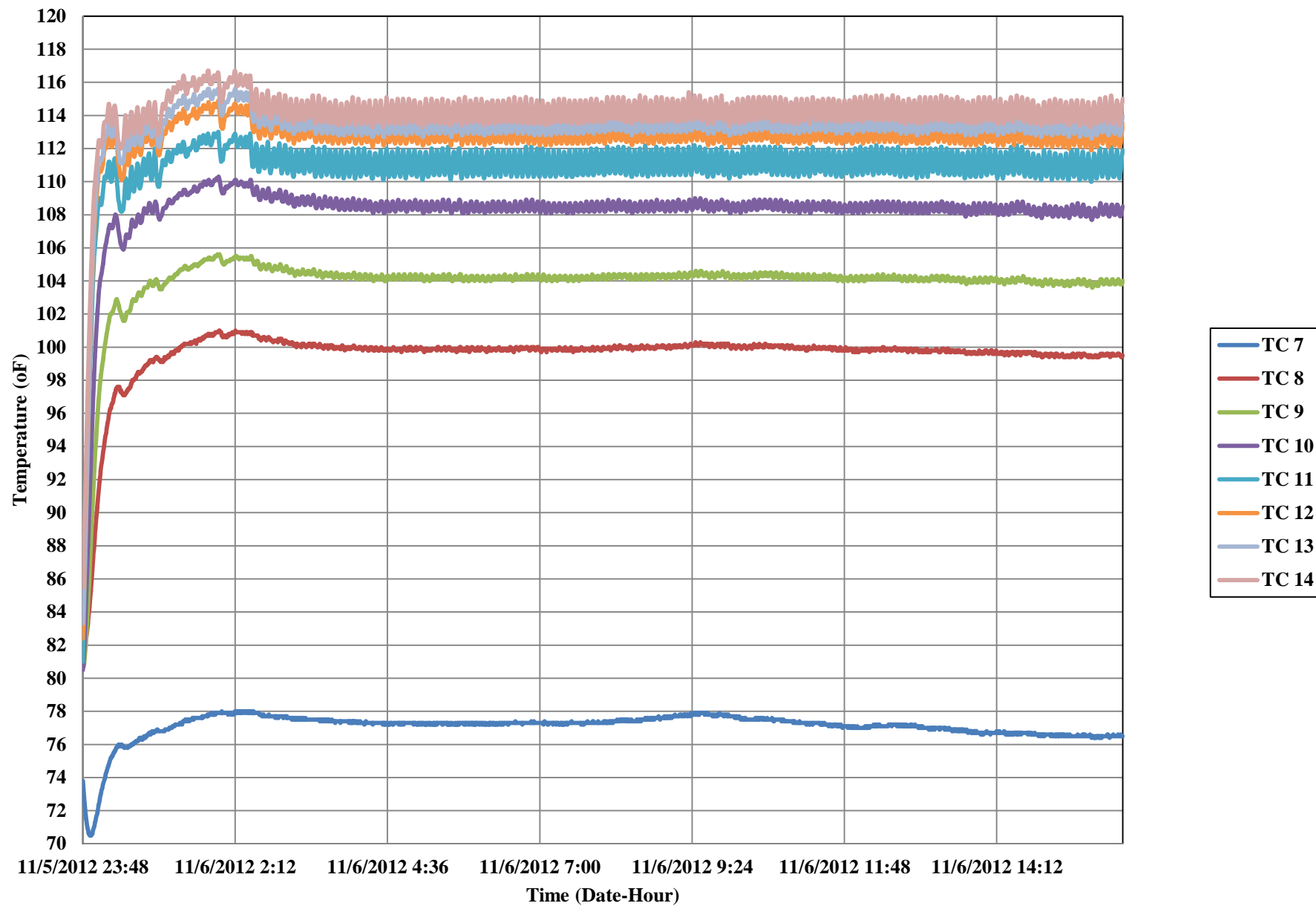
Note: Maximum humidity level based on the surface temperature measured and the Attic and Dome compartment temperature of 119.1°F

Note: The highlighted humidity levels are based on thermocouple sensors attached beneath the applied insulation

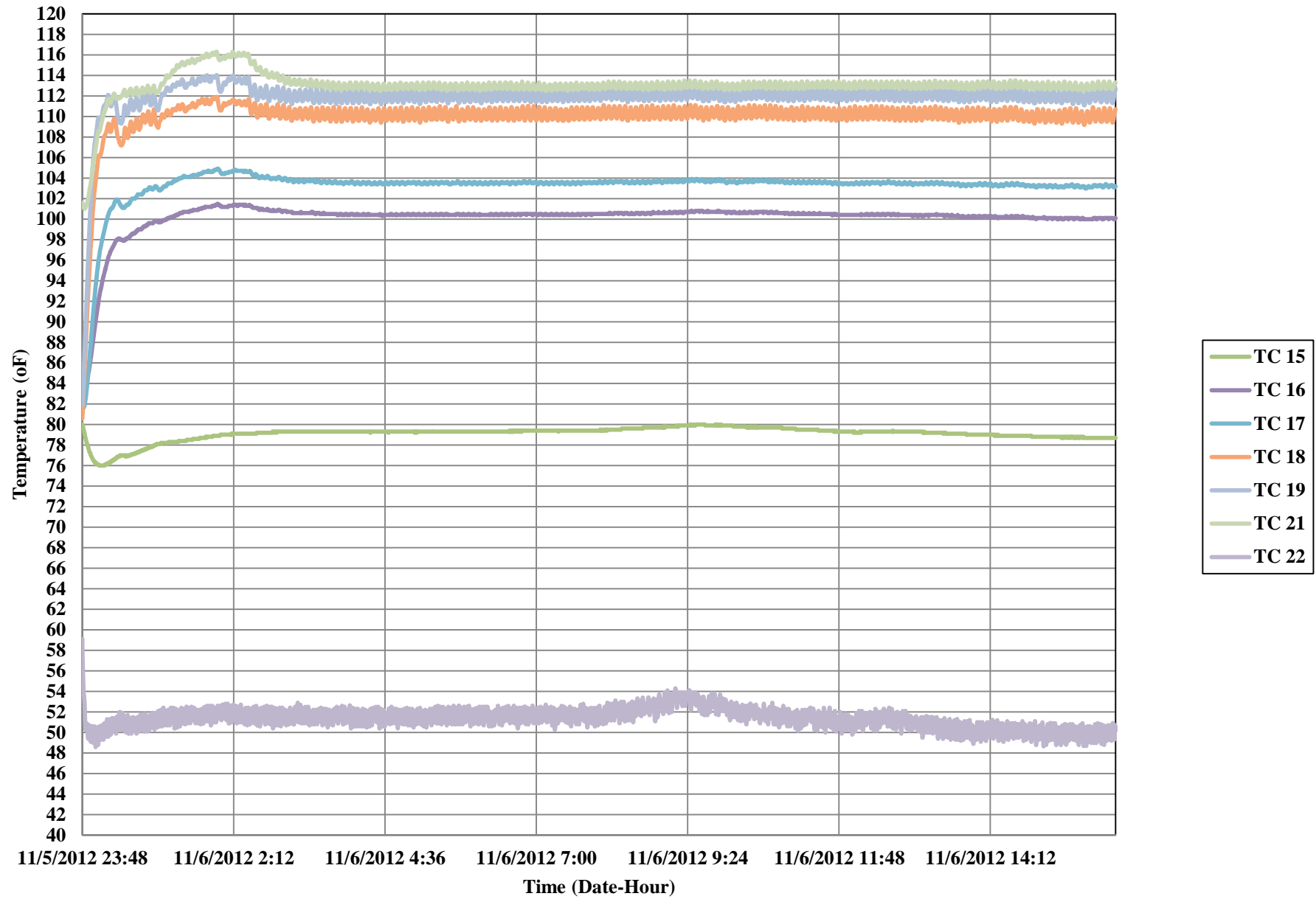
Test #2 - 330 Dome with 12" Tube Insulation - Air Temps



Test #2 - 330 Dome with 12" Tube Insulation - Interior Surface Temps.



Test #2 - 330 Dome with 12" Tube Insulation - Exterior Surface Temps.



Test #3: 750 Dome with 12" of Tube Insulation and covering Transition Box

Air Temperatures	ID	Designations	Temperatures (°F)		
			Average	Min	Max
	TC 1	Air - 1" From Natural Effect Lens	104.01	103.90	104.20
	TC 2	Air - 12" From Natural Effect Lens	111.59	111.00	112.20
	TC 3	Air - 24" From Natural Effect Lens	112.99	112.50	113.60
	TC 4	Air - 36" From Natural Effect Lens	114.15	113.70	114.60
	TC 5	Air - 48" From Natural Effect Lens	112.83	112.40	113.30
	TC 6	Air - 60" From Natural Effect Lens	113.31	112.90	113.80
	Average	Inside Tube Air	111.48	-	-
	TC 20	Between Diffuser and Nat. Effect Lens	74.53	74.30	74.80
	TC 23	Cold Storage Compartment	31.49	26.64	36.89
	TC 24	Attic and Dome Compartment	119.74	112.19	124.58

Inside Tube Surface Temperatures	ID	Designations	Temperatures (°F)			RH %	RH %
			Average	Min	Max	Max Level 1	Max Level 2
	TC 7	Nat. Effect Lens - Top Surface	76.38	76.30	76.50	33.8%	42.0%
	TC 8	Tube - 1" From Nat. Effect Lens	99.53	99.40	99.80	70.3%	87.5%
	TC 9	Tube - 6" From Nat. Effect Lens	104.02	103.80	104.30	80.4%	89.5%
	TC 10	Tube - 12" From Nat. Effect Lens	108.42	108.00	108.90	91.5%	91.2%
	TC 11	Tube - 18" From Nat. Effect Lens	111.09	110.20	112.20	98.9%	96.6%
	TC 12	Tube - 24" From Nat. Effect Lens	112.89	112.20	113.80	100.0%	99.7%
	TC 13	Tube - 30" From Nat. Effect Lens	113.47	112.80	114.30	100.0%	99.7%
	TC 14	Tube - 36" From Nat. Effect Lens	114.23	113.40	115.20	100.0%	100.0%

Note: Maximum Humidity Level 1 based on the average surface temperature measured and the average air temperature within the tube (111.5°F)

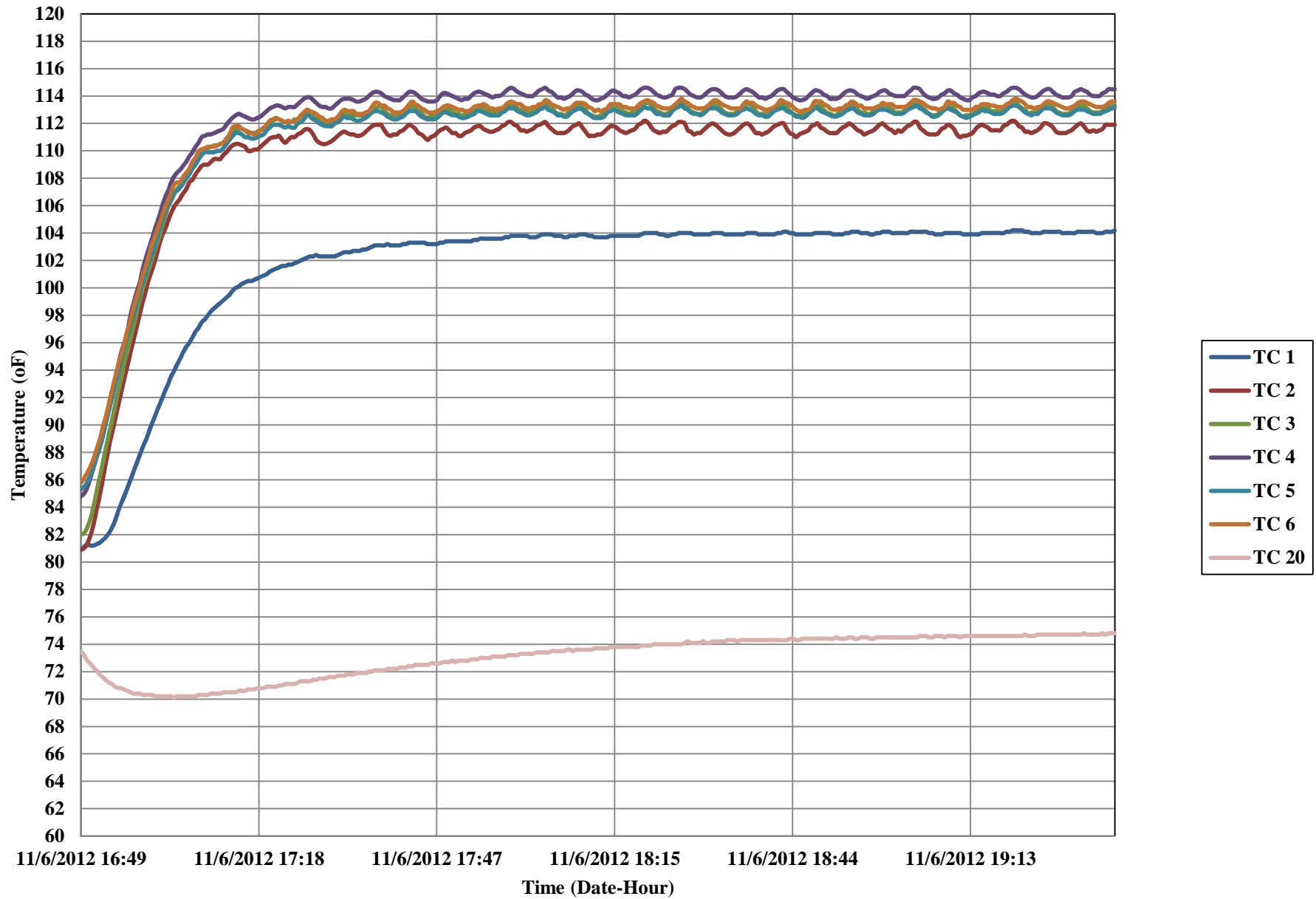
Note: Maximum Humidity Level 2 based on the average surface temperature measured and the air temperature within the tube at the respective height

Exterior Tube and Surface Temperatures	ID	Designations	Temperatures (°F)			RH %
			Average	Min	Max	Max Level
	TC 15	Transition Box Surface	78.28	78.00	78.60	28.5%
	TC 16	Tube - 1-1/2" From Transition Box	100.01	99.90	100.20	56.5%
	TC 17	Tube - 6" From Transition Box	103.25	103.10	103.50	62.2%
	TC 18	Tube - 12" From Transition Box	110.09	109.40	110.90	76.1%
	TC 19	Tube - 24" From Transition Box	111.99	111.20	112.90	80.3%
	TC 21	Dome Exterior Surface	113.30	112.90	113.70	83.4%
	TC 22	Diffuser Exterior Surface	49.67	48.60	50.90	N/A

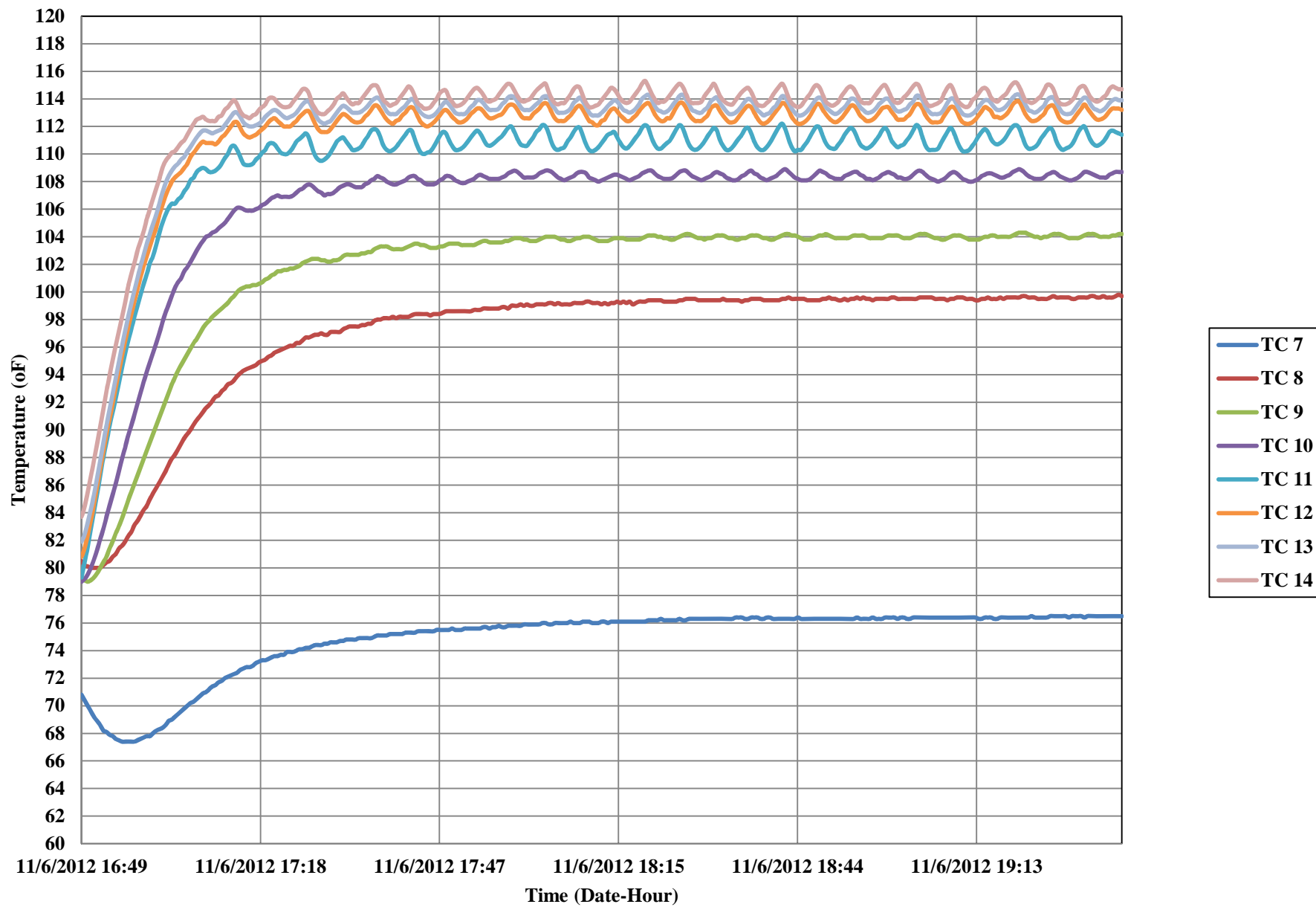
Note: Maximum humidity level based on the surface temperature measured and the Attic and Dome compartment temperature of 119.7°F

Note: The highlighted humidity levels are based on thermocouple sensors attached beneath the applied insulation

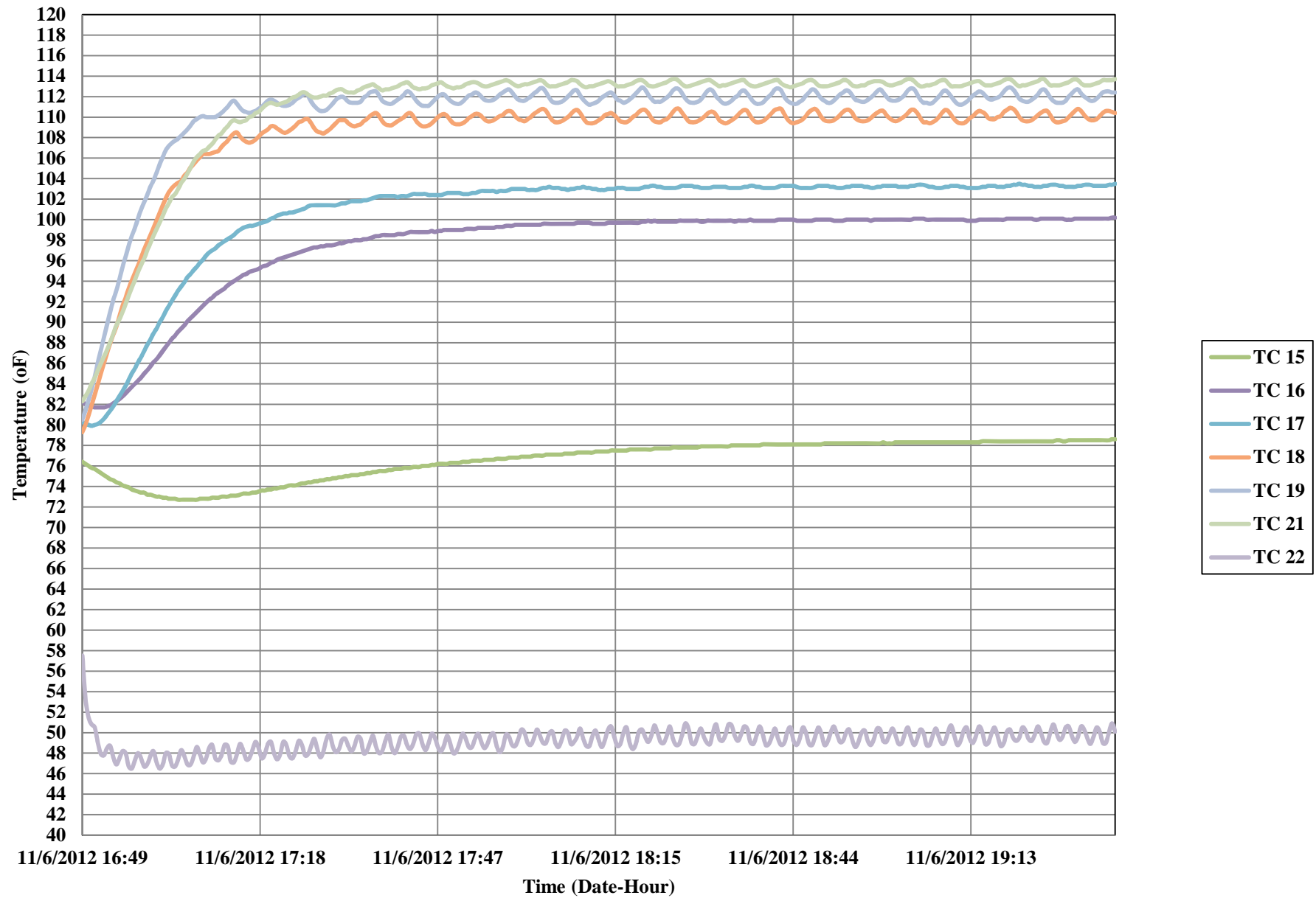
Test #3 - 750 Dome with 12" Tube Insulation - Air Temps



Test #3 - 750 Dome with 12" Tube Insulation - Interior Surface Temps.



Test #3 - 750 Dome with 12" Tube Insulation - Exterior Surface Temps.



Test #4: 330 Dome and 12" of Tube Insulation and covering Transition Box and Induced Humidity

	ID	Designations	Temperatures (°F)		
			Average	Min	Max
Air Temperatures	TC 1	Air - 1" From Natural Effect Lens	106.05	105.80	106.30
	TC 2	Air - 12" From Natural Effect Lens	114.23	113.70	114.80
	TC 3	Air - 24" From Natural Effect Lens	116.37	115.90	116.90
	TC 4	Air - 36" From Natural Effect Lens	116.53	116.10	116.90
	TC 5	Air - 48" From Natural Effect Lens	115.27	114.90	115.70
	TC 6	Air - 60" From Natural Effect Lens	115.81	115.40	116.30
	Average	Inside Tube Air	114.04	-	-
	TC 20	Between Diffuser and Nat. Effect Lens	76.54	75.90	77.00
	TC 23	Cold Storage Compartment	31.91	26.52	36.55
	TC 24	Attic and Dome Compartment	119.32	113.60	125.08

	ID	Designations	Relative Humidity (%)		
			Average	Min	Max
Relative Humidity	RH1	Attic and Exterior Dome RH	44.30	37.17	49.24
	RH2	Cold Storage RH	58.79	47.50	71.78
	RH3	Interior Tube RH	21.00	19.50	22.00
	RH4	Transition Box RH	64.68	64.00	67.00

	ID	Designations	Temperatures (°F)			RH %	RH %
			Average	Min	Max	Max Level 1	Max Level 2
Inside Tube Surface Temperatures	TC 7	Nat. Effect Lens - Top Surface	78.37	78.00	78.60	33.6%	42.3%
	TC 8	Tube - 1" From Nat. Effect Lens	101.96	101.70	102.20	70.3%	88.6%
	TC 9	Tube - 6" From Nat. Effect Lens	106.60	106.30	106.90	80.7%	90.20%
	TC 10	Tube - 12" From Nat. Effect Lens	111.59	111.20	112.00	93.2%	92.70%
	TC 11	Tube - 18" From Nat. Effect Lens	115.33	114.40	116.40	100.0%	100%
	TC 12	Tube - 24" From Nat. Effect Lens	116.81	116.10	117.70	100.0%	100%
	TC 13	Tube - 30" From Nat. Effect Lens	117.12	116.40	118.00	100.0%	100%
	TC 14	Tube - 36" From Nat. Effect Lens	117.51	116.70	118.50	100.0%	100%

Note: Maximum Humidity Level 1 based on the average surface temperature measured and the average air temperature within the tube (114.0°F)

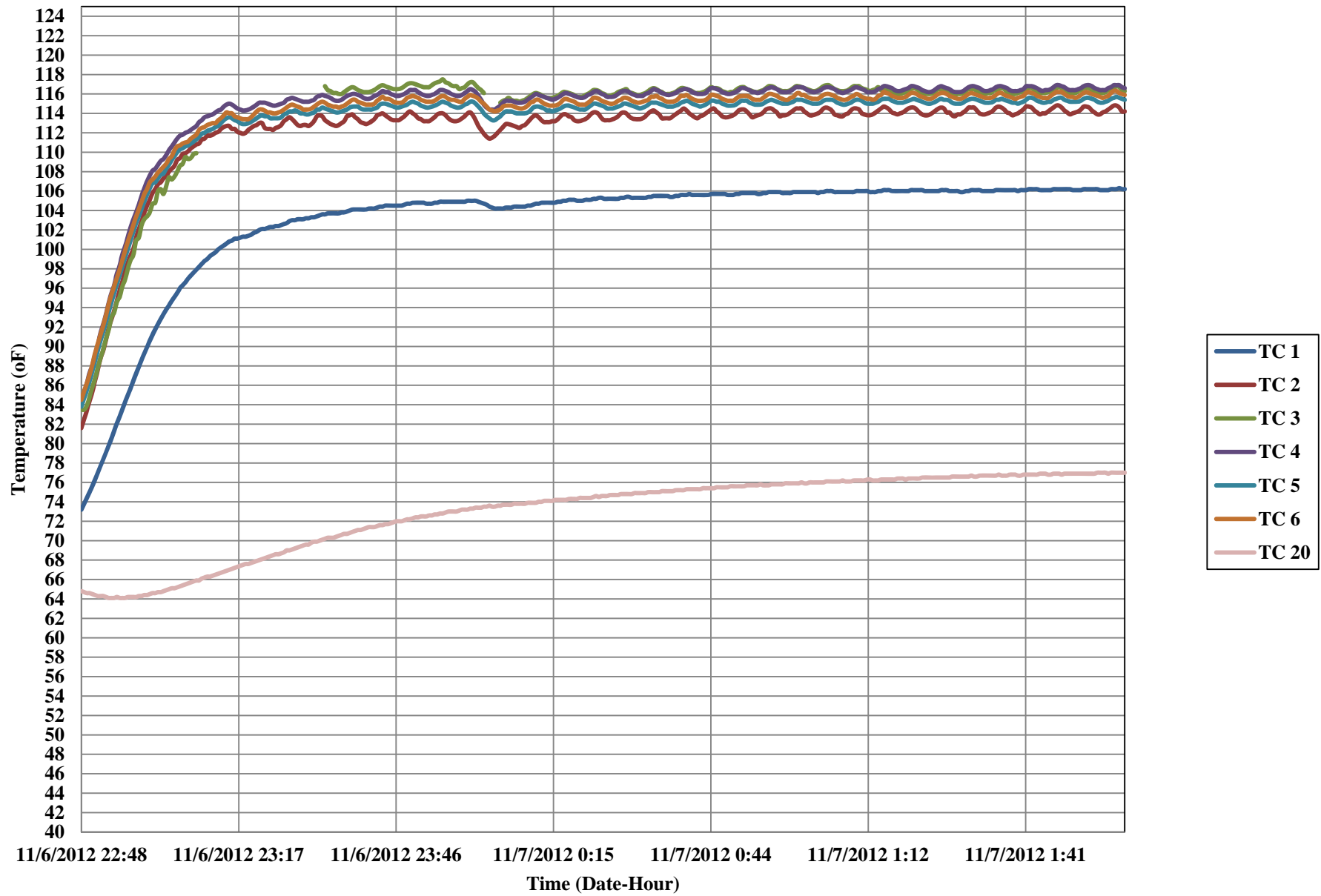
Note: Maximum Humidity Level 2 based on the average surface temperature measured and the air temperature within the tube at the respective height

	ID	Designations	Temperatures (°F)			RH %
			Average	Min	Max	Max Level
Exterior Tube and Surface Temperatures	TC 15	Transition Box Surface	80.90	80.20	81.50	31.4%
	TC 16	Tube - 1-1/2" From Transition Box	102.43	102.10	102.70	61.5%
	TC 17	Tube - 6" From Transition Box	105.79	105.50	106.00	67.9%
	TC 18	Tube - 12" From Transition Box	113.51	112.90	114.30	84.9%
	TC 19	Tube - 24" From Transition Box	116.07	115.30	117.00	91.3%
	TC 21	Dome Exterior Surface	115.79	115.40	116.30	90.6%
	TC 22	Diffuser Exterior Surface	50.01	48.40	51.90	-

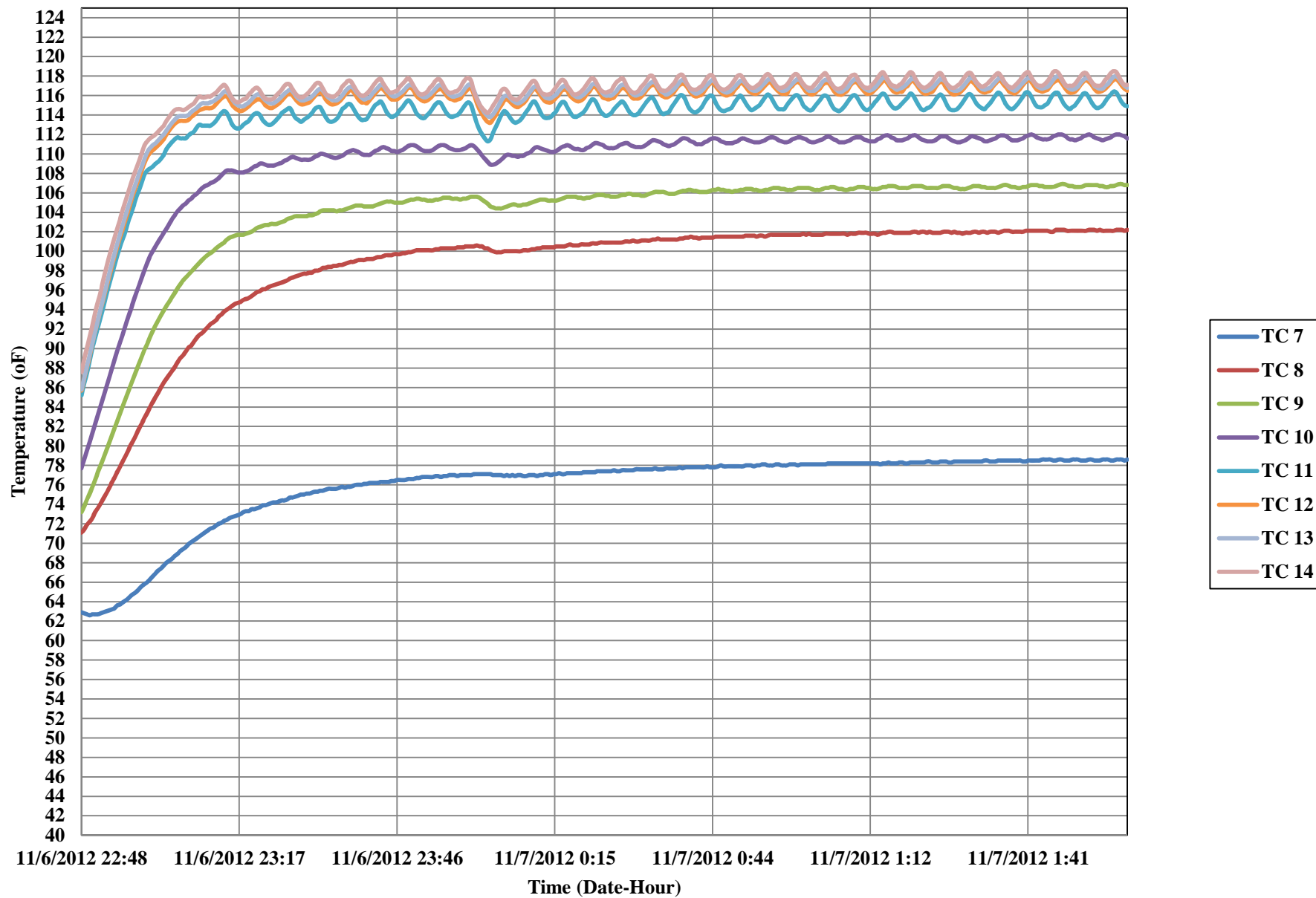
Note: Maximum humidity level based on the surface temperature measured and the Attic and Dome compartment temperature of 119.3°F

Note: The highlighted humidity levels are based on thermocouple sensors attached beneath the applied insulation

Test #4 - 330 Dome with 12" Tube Insulation - Air Temps.



Test #4 - 330 Dome with 12" Tube Insulation - Interior Surface Temps.



Test #4 - 330 Dome with 12" Tube Insulation - Exterior Surface Temps.

