YUCCA MOUNTAIN PROJECT
CONTROLLED SCIENTIFIC NOTEBOOK

CONTROLLED
LLNL-JG
No 487-13
COPY

Issued to: MAUREEN ALAI Date: 12/20/04

Activity Number/Task: RESEARCH SUPPORTING ENVIRONMENTAL CHEMISTRY EXPERIMENTS

THIS NOTEBOOK IS A QUALITY ASSURANCE RECORD

12/20/04

This Scientific notebook documents work that support the continuation of activities planned and documented, including the initial entries, in SN-LLNL-SCI-487-V1.

12-20-04

The following people are authorized to make entries in this notebook:

Name:	Signature:	Initials:	Date:
Maureen Alai			
Susan A. Carroll	Susan Carroll	SAC	2/10/06
Sarah K. Roberts			
Kirk J Staggs		KJS	12/20/04
Joseph A. Rard			
Henry F. Shaw			

Space below is reserved for additional names:

12-20-04

Supplement 1 of this notebook contains the validation data sheets for probes that have been evaluated. Additional supplements maybe added as required.

12-20-04

12-21-04

In response to CR2247 and later to CR5430 The following calibration/validation system and process was initiated. [illegible] 1-30-06

Description of High Temperature RH Validation Setup and Operation

In an effort to evaluate and/or validate the performance our Relative Humidity (RH) probes at elevated temperatures the YMP at LLNL initiated the development of a Two-Temperature validation system. Current information from the scientific community can be used to determine the RH of a water saturated atmosphere at a given temperature and pressure. The current system design provides a water-saturated atmosphere at pressures near or at one atmosphere and temperature between 105 and 180°C.

The concept of the system was to develop a saturated water vapor atmosphere by boiling water and transferring this atmosphere to a non-condensing chamber that could be heated to the desire test temperature. The RH probes under test would be placed in the non-condensing chamber along with thermal sensor to measure temperature. A picture of the overall setup is shown in [redacted] and the system is shown schematically in [redacted].

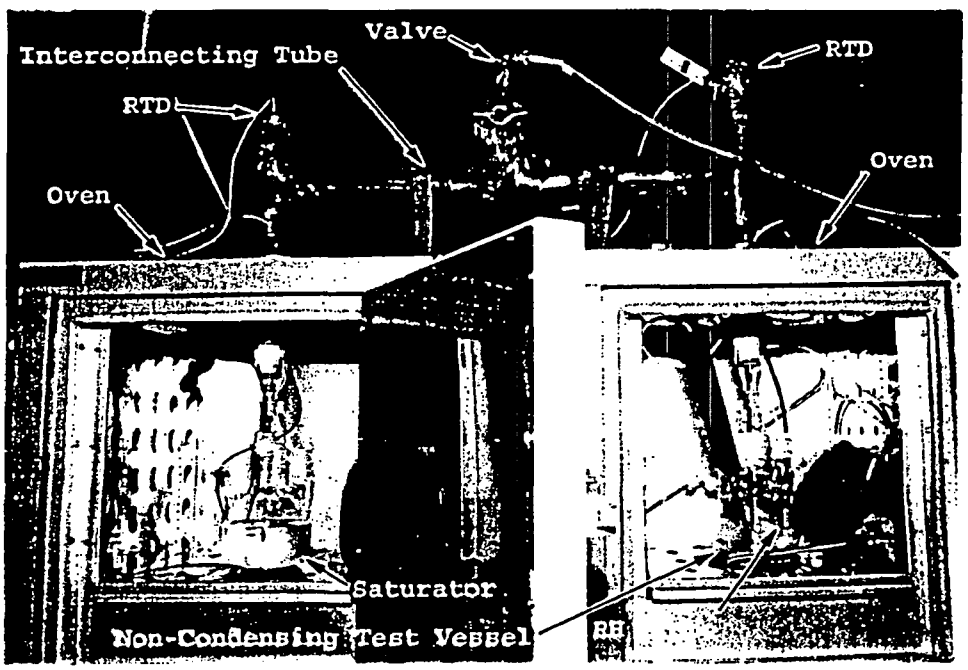

Photo 1. Overall view of setup

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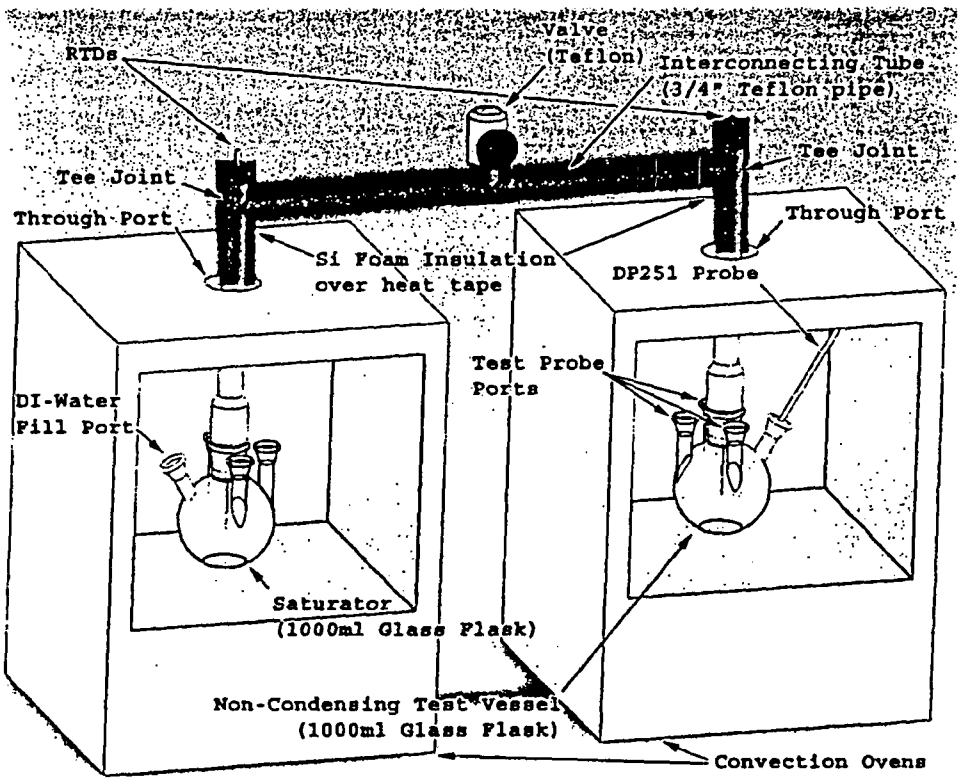

Figure 1. Schematic of test setup

* RTD stands for Resistive Temperature Device. 210-06

The setup consists of two each 1000ml glass flasks with four ports that are used for the saturator and non-condensing test chamber or vessel, an interconnecting tube, two convection ovens, a computer based data acquisition system, temperature controllers, and various temperature sensors. A valve installed at the center of the interconnecting tube is used to purge the system and as a connecting point to measure system pressure. All tubing, fittings, and valve are made of materials from the Teflon group (Teflon, FEP, PVDF, etc.).

The saturator [redacted] and non-condensing test vessel [redacted] were placed inside the convection ovens (VWR model 1330FZZ s/n 1000103 and 0700103) to heat these vessels and their contents to the desired temperatures. Convection oven were selected because they were available and would provide a more uniformed heating than resistive heaters. Various glass and Teflon fittings are used to connect the flasks to the interconnecting tube via the trough port in the top of the ovens. The interconnecting tube is wrapped with heat tape and controlled using two Digi-Sense Temperature controllers and type 'K' OMEGA SA1-K surface mount thermocouples. The convection oven temperature housing the non-condensing test vessel is controlled by the computer data acquisition system and an RTD* sensor that is inserted down from the top of the tee joint that connects the interconnecting tube to the flask.

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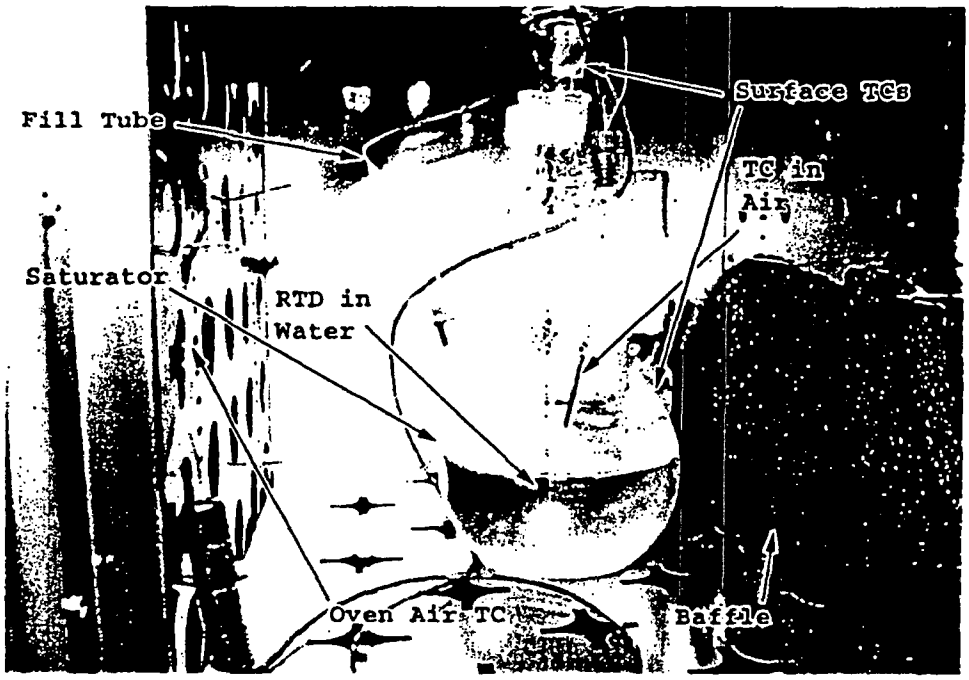

Photo 2. Saturator

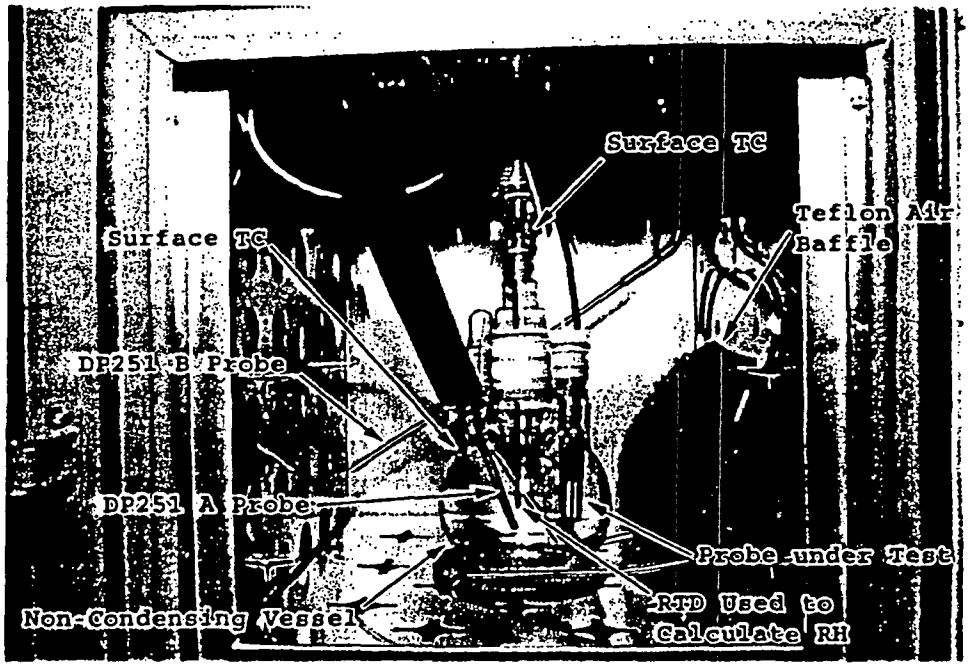

Photo 3. Non-Condensing Test Vessel

The data acquisition system is used to measure the various temperatures throughout the Two-Temperature system. All of these temperature measurements except one are non-Q. The temperature from RTD (cal number GG511/AA0263) inserted down through the tee joint above the non-condensing vessel is used to calculate the RH in the non-condensing

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test vessel, thus it is a Q measurement. This RTD (cal number GG511/AA0263) and the Saturator RTD (cal number GG510/AA0262) were scaled and corrected, using standard functions of the DasyLab software, against the DP251 in a Omega CL-740A Thermal Well and found to be acceptable (see Table 1 below).

DP251 Ch A	DP251 Ch B	RTD GG511	RTD GG510
20.04°C	20.06°C	20.06°C	20.05°C
75.05°C	75.00°C	74.94°C	74.90°C
140.17°C	140.05°C	140.03°C	140.03°C

Table 1. Corrected Reading of the RTDs compared to the DP251

The RH calculations versus temperature are based on a curve (see table 2 and figure 2) that was developed from temperature verses water vapor saturation data as shown in [redacted]3.

12-21-04

2-8-06
M+TE information:

RTD	GG511/AA0263	Cal due 5-27-04
RTD	GG510/AA0262	Cal due 5-27-04
DP251	008673	Cal due 2-04-05

Cal certs are in Supplement 1

2-8-06

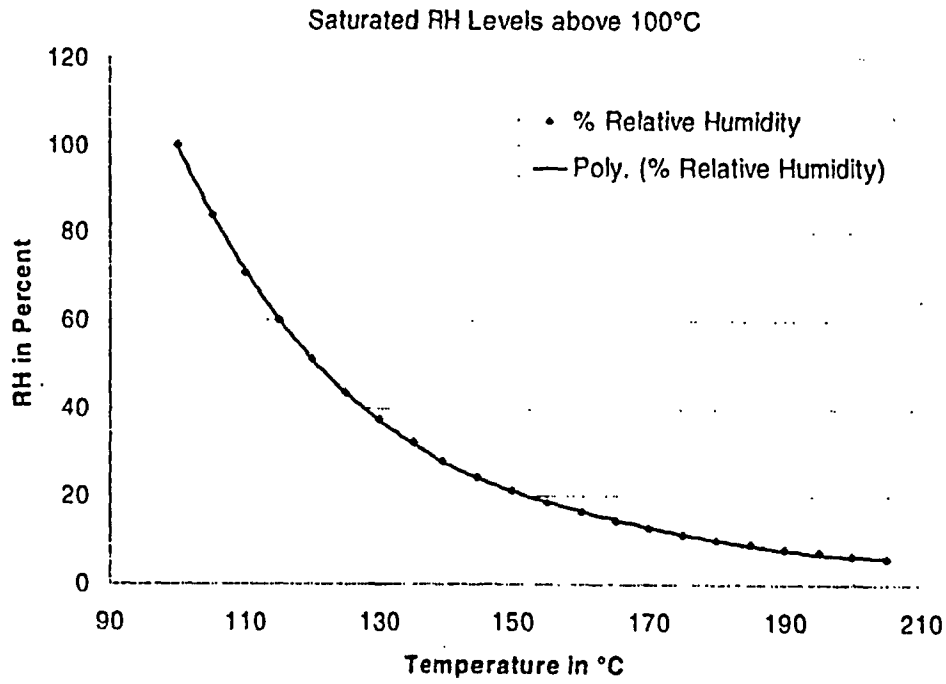

Figure 2. Plotted data and curve fit from CRC.

See pg22 for a description of the Software That was used To generate figure 2 and table 3.

Y = M0 + M1*x + ... M8*^{8}x+ M9*x^9	
M0	2491.8
M1	-65.66
M2	0.71886
M3	-0.0040281
M4	1.1448e-05
M5	-1.3125e-08
R	1

Table 3. (Equation constants derived from Table 2 Data)

Table 2. Data from CRC

Temperature (°C)	Vapor Pressure (mm) CRC	Relative Humidity (%)
100	760.00	100.00
105	906.07	83.88
110	1074.56	70.72
115	1267.98	59.94
120	1489.14	51.04
125	1740.93	43.65
130	2026.16	37.51
135	2347.26	32.38
140	2710.92	28.03
145	3116.76	24.38
150	3570.48	21.29
155	4075.88	18.65
160	4636.00	16.39
165	5256.16	14.46
170	5940.92	12.79
175	6694.08	11.35
180	7520.20	10.11
185	8423.84	9.02
190	9413.36	8.07
195	10488.76	7.25
200	11659.16	6.52
205	1292.12	5.88

Note: The data in table 2 was calculated from selected temperatures from the Handbook of Chemistry and Physics steam tables (R. C. Weast (Editor-in-Chief) *CRC Handbook of Chemistry and Physics* (CRC Press, Boca Raton, Florida, 1987–1988), pages B-119, B-130, B-131, D-189, D-190). At 110°C the RH value may actually be 70.73%RH, however the RH probe can only read to the first decimal place.

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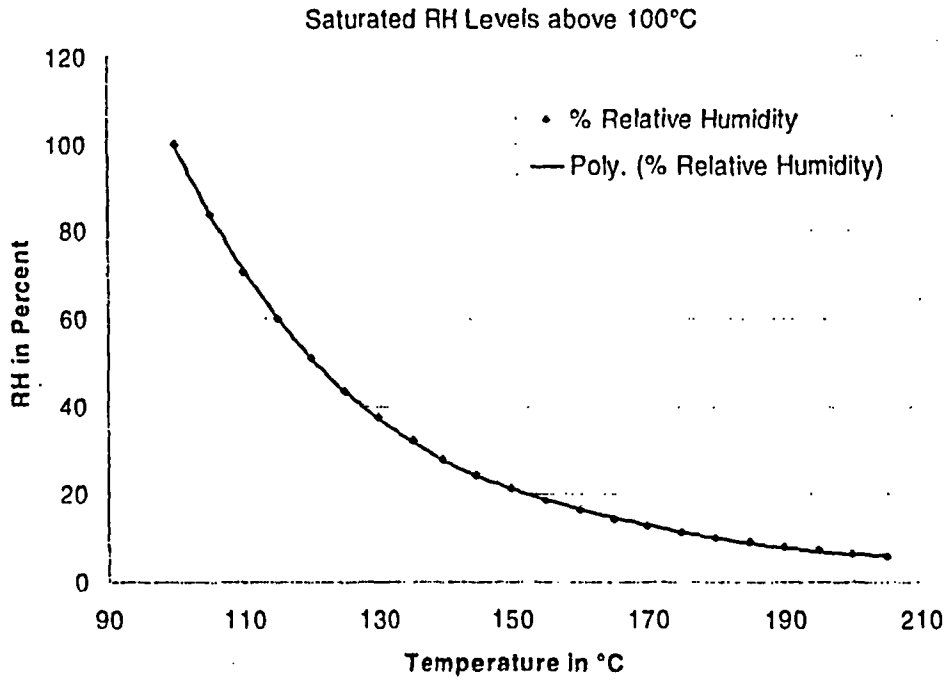

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140	2710.92	28.03
145	3116.76	24.38
150	3570.48	21.29
155	4075.88	18.65
160	4636.00	16.39
165	5256.16	14.46
170	5940.92	12.79
175	6694.08	11.35
180	7520.20	10.11
185	8423.84	9.02
190	9413.36	8.07
195	10488.76	7.25
200	11659.16	6.52
205	1292.12	5.88

Note: The data in table 2 was calculated from selected temperatures from the Handbook of Chemistry and Physics steam tables (R. C. Weast (Editor-in-Chief) *CRC Handbook of Chemistry and Physics* (CRC Press, Boca Raton, Florida, 1987–1988), pages B-119, B-130, B-131, D-189, D-190). At 110°C the RH value may actually be 70.73%RH, however the RH probe can only read to the first decimal place.

Kurt Storey 2-8-06

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In preparation for testing, the RH probes and the temperature sensors (some probes have a separate temperature sensor) are inserted through one of the ports in the non-condensing vessel. Soft silicone stoppers are used to seal around the cables and vessel ports or to seal any unused or opened ports. The computer based data acquisition is started and set to the desired temperature. The convection oven that houses the non-condensing test vessel is then turned on to allow for all surfaces and/or component to heat up above 100°C. The heat tape controllers for the interconnecting tube are also started at this time and set for 160°C. After the non-condensing vessel air temperature and interconnecting tube have exceeded 100°C, the saturator vessel is then filled above the halfway mark (>500ml) with DI-water. The saturator oven is then turned on and set to 150-160°C. At this point it takes 2-4 hours for the unit to come up to temperature and stabilize. During warm-up, testing, and between temperature adjustments DI-water has to be added to the saturator.

The computer based data acquisition system has been setup to monitor various water, air, and surface temperatures to aid in determining when the system is stable and for diagnostic purposes. In addition, as previously indicated above, this data acquisition system control the non-condensing vessel oven temperature using the input from the RTD and calculating the RH from this RTD temperature. This system was comprised of the following components:

- Dell Optiplex GS260 running Window 2000 Professional version 5.02195 Service Pack 4
- Data acquisition software; DasyLabs version 7.00.05 (DASYTec USA)
- IOtech DaqBook 2000A S/N 236721
- DBK84 Thermocouple Module
- DBK42 5B Signal Conditioning Chassis
- 5B RTD modules model SCM5B34-03
- DBK5 4 channel current output card

When the system has stabilized at the selected temperature the following parameters are recorded:

- Date and time
- The target or set point temperature
- Saturator water temperature
- The Reading from the DP251 probe (channel A) cal number 008673
- Reading from the non-condensing RTD
- RH probe temperature under test
- RH probe RH under test

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Data is not electronically stored from the data acquisitions, but selected data is recorded manually on validation record sheets. These validation record sheets are placed in Supplement 1 of this notebook. The data is recorded in an Excel spreadsheet. The Q-temperature reading from the RTD (cal number GG511/AA0263) and DP251 (cal number 008673) is used to calculate the expected RH by using the curve developed in Figure 2 and Tables 2 and 3. This information can be used to help evaluate the humidity probes' performance.

Additional performance evaluations of this High Temperature RH validation system is on going.

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During Testing it was recognized that the RTD (cal # GG511/AA0263) was not always in close agreement with the DP251 (cal# 008673). Therefore, it was decided that the Temperature measurements from the DP251 would be used to calculate the RH of the Test vessel that is used as the RH standard for validating the RH probes under Test.

1-12-05

12-22-04

Probes T 4610030 and X3250114 have been evaluated and their data sheet placed in Supplement 1.

12-22-04

12-23-04

Probes V0810003 and X3250115 have been ~~evaluated~~ USED IN an evaluation and their data sheets have been placed in Supplement 1

JAP 2-10-06 This is a special evaluation of the Saturator and not a probe validation.

12-23-04

12-28-04

Probes 21440127 and 21440126 have been evaluated and their data sheets have been placed in Supplement 1.

12-28-04

12-27-04

Probes T 4610030 and X3250114 have been ~~evaluated~~ USED IN an evaluation and their data sheets have been placed in Supplement 1

JAP 2-10-06 This is a special evaluation of the Saturator and not a probe validation.

12-29-04

1-5-05

Probes ~~212~~ 21420005 and AB5733 ~~(cnt #)~~ have been evaluated and their data sheets have been placed in supplement 1

1-5-05

1-10-05

Probes 21420006 and Y1110102 have been evaluated and their data sheets have been placed in Supplement 1

1-10-05

3-23-05

Added Teflon ~~baffle~~ baffle 2-8-06 to non-condensing vessel over to try and ~~even out~~ even out the temperature on the vessel. 2-8-06

Set up computer to calculate RH from manual input of DP251 probe A temperature. Use same calibration curve as list on page 7 of this notebook. The DP251 is the temperature standard for RH.

3-23-05

3-30-05

Probes 21440126 and 21440127 have been evaluated and their data sheets have been added to Supplement 1

[illegible] 3-30-05

4-5-05

Probes 21420005 and 21420006 have been evaluated and their data sheets have been added to Supplement 1

[illegible] 4-5-05

14

6-20-05

Probes Z1420005, U5110014, and
Z1420006 ~~Z1442006~~ have been evaluated and
their data sheets have been added to
Supplement 1

6-24-05

~~7/6/05~~ 7-8-05 7-8-05

Probes Z1440127 and T4610030
have been evaluated and their data
sheets have been added to Supplement 1

7-8-05

8/15/05

Probes U5110014, X3250114, and
Y4710001 have been evaluated and
their data sheets have been added
to Supplement 1

8-16-05

8-27-05

Probes Y1110102, T4610030, and Y4710001 have been evaluated and their data sheets have been added To Supplement 1

[signature] 8-27-05

8-29-05

Probes Z1420005, Z1440127, and Z1420006 have been evaluated and their data sheets have been added To Supplement 1

[signature] ~~8-29-08~~ 8-29-05 JK

2-8-06

The DP251 went out of cal on 2-4-05 and an OCR was issued on 4-8-05 (LLNL-2005-015). The unit was calibrated on 8-4-2005 and as received (Found) it was in calibration. The OCR was Closed on 8-11-05.

[signature] 2-8-06

9-8-05

It was determined that a check of the relative humidity temperature probes should be conducted against the DP251 temperature standard (secondary standard) to evaluate their performance over the range of intended use. To perform this evaluation an oil bath was setup using high temperature silicone oil in a 1000ml beaker that was placed in Glas-Co heating mantle for this size beaker. A fixture was machined to support the RH probe temperature sensors and DP251 probe. A motorized stirrer was use to stir the oil for uniformed heating. Three ~~reads~~ readings of each probe were taken from the HMP243 display approximately 5 minutes apart and averaged. This average was compared against the DP251 average reading to determine the error. A spread sheet showing the result of these measurements is attached to page 17 of this notebook.

The DP 251 was calibrated 08/04/2005 by Bechtel Nevada under ID# 008673. The calibration is due 08/04/06. The greatest error noted in this calibration is 0.006°C, however the tolerance of the calibration is 0.05°C, thus it is this 0.05°C tolerance that should be applied to the measurements made in this survey.

9-8-05

RH Probe Calibration			Degrees C									
				Seial Number of the HMP243 probe								
Date	Time	Set Temp.	DP251	T4610028	T4610030	Y4750012	Y1110101	X3250115	Z1420005	V0810002	Z1420006	T4610029
8/30/2005	16:00	50	50.09	50.2	50.0	50.1	24.4	50.1	50.0	50.0	49.9	50.0
8/30/2005	16:16	50	49.98	50.1	49.9	50.0	24.6	50.0	49.8	49.9	49.8	49.9
8/30/2005	16:26	50	49.96	50.1	49.9	50.0	24.6	50.0	49.8	49.9	49.8	49.8
	Average		50.01	50.1	49.9	50.0	24.5	50.0	49.9	49.9	49.8	49.9
8/30/2005	17:34	100	99.65	99.9	99.6	99.8	25.2	99.8	99.6	99.7	99.7	99.7
8/30/2005	17:39	100	99.97	100.2	99.8	100.0	25.2	99.9	99.7	99.8	99.8	99.8
8/30/2005	17:44	100	99.33	99.6	99.2	99.4	25.2	99.4	99.2	99.2	99.2	99.2
	Average		99.65	99.9	99.5	99.7	25.2	99.7	99.5	99.6	99.6	99.6
8/31/2005	7:59	125	124.59	124.6	124.2	124.4		124.3	124.2	124.2	124.2	124.3
8/31/2005	8:06	125	124.31	124.6	124.2	124.4		124.4	124.2	124.3	124.3	124.3
8/31/2005	8:12	125	124.27	124.6	124.1	124.4		124.3	124.1	124.1	124.2	124.2
	Average		124.39	124.6	124.2	124.4		124.3	124.2	124.2	124.2	124.3
8/31/2005	9:13	150	149.48	149.9	149.3	149.6		149.6	149.4	149.4	149.4	149.5
8/31/2005	9:18	150	149.12	149.5	148.9	149.2		149.1	148.9	148.9	149.0	149.0
8/31/2005	9:45	150	149.35	149.7	149.2	149.5		149.4	149.2	149.3	149.3	149.4
	Average		149.32	149.7	149.1	149.4		149.4	149.2	149.2	149.2	149.3
8/31/2005	11:33	180	179.34	179.8	179.2	179.6		179.4	179.3	179.2	179.4	179.5
8/31/2005	11:39	180	179.33	179.8	179.1	179.6		179.4	179.2	179.2	179.3	179.4
8/31/2005	11:44	180	179.39	179.9	179.2	179.6		179.5	179.3	179.3	179.4	179.5
	Average		179.35	179.8	179.2	179.6		179.4	179.3	179.2	179.4	179.5
Error of the probe averages		50	50.01	0.1	-0.1	0.0	-25.5	0.0	-0.1	-0.1	-0.2	-0.1
		100	99.65	0.3	-0.1	0.1	-74.5	0.1	-0.1	-0.1	-0.1	-0.1
		125	124.39	0.2	-0.2	0.0	-124.4	-0.1	-0.2	-0.2	-0.2	-0.1
		150	149.32	0.4	-0.2	0.1	-149.3	0.0	-0.2	-0.1	-0.1	0.0
		180	179.35	0.5	-0.2	0.2	-179.4	0.1	-0.1	-0.1	0.0	0.1

* Probe temperature sensor failed and would not respond

9-8-05

9-8-05

2-10-06

This notebook was Transferred To Kirk STAGGS from Maureen Alai on 10-11-2005

Kirk Staggs

Kirk Staggs 2-10-06

2-10-06

1. BI-THERMAL CALIBRATION METHOD FOR RELATIVE HUMIDITY PROBES

a. Background

The bi-thermal apparatus for relative humidity calibration at temperatures between 115 and 180°C is a modification of a bi-thermal system developed by Stokes and Robinson (1947) to measure water activity (or relative humidity) in electrolyte solutions. We used the bi-thermal apparatus to calibrate the relative humidity probes by equilibrating water vapor between two vessels at two different temperatures. The lower temperature reservoir contains boiling pure liquid water at 100°C; the higher temperature reservoir contains only a vapor phase (no liquid water or solution is present). After diffusion of water vapor between the two reservoirs for a sufficient period of time the water vapor pressure will be the same in the two reservoirs. However, the water vapor pressure in the higher temperature reservoir $p_{w,T2}$ will be below saturation at that temperature. Pressure equilibrium requires that:

$$p_{w,T2} = p_w{}^{\circ}{}_{T1} \quad (1)$$

The relative humidity in the lower temperature reservoir will always be 100% at the liquid water/water vapor interface. In the higher temperature reservoir the relative humidity is given by:

$$RH_{T2} = 100(p_{w,T2} / p_w{}^{\circ}{}_{T2}) \quad (2)$$

Substitution of equation (1) into (2) yields an expression for the relative humidity of the higher temperature reservoir as a unique ratio of the saturation vapor pressures of pure water at the two temperatures T_2 and T_1 (Table 2.2):

$$RH_{T2} = 100\{p_w{}^{\circ}(T_1)/ p_w{}^{\circ}(T_2)\} \quad (3)$$

We used the temperature dependence of vapor pressure of water from the steam tables in the *CRC Handbook of Chemistry and Physics*, 68th edition (Weast et al., 1987, p. D-189 to D-191) as our standard (Page 7, LLNL-SCI-487, V.3), because no NIST standard is available for the calibration of relative humidity probes to temperatures above 60°C. Steam tables from the earlier 62nd edition (Weast and Astle, 1981, p. D-168-D-169) containing apparently identical data were qualified as product output (after units conversion of torr to kPa) in the *Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier* AMR (BSC 2004a, DTN: LL040601512251.103). We note that steam tables are also built into the NUFT 3.0 code used to calculate the thermal budget of the

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repository (BSC 2005b: *Multiscale Thermohydrologic Model*). Determination of percent relative humidity from the steam tables still requires that the temperature probes are calibrated against a NIST traceable standard. The relative humidity probes used in our experiments contain separate temperature sensors that were calibrated against a NIST traceable standard (DP251) in an Omega CL-740A thermal well (Page 6 &17, LLNL-SCI-487, V.3). In principle, the bi-thermal apparatus allows calibration from 100°C and 100% RH to 180°C and 10% RH.

b. Method

The bi-thermal apparatus used to calibrate relative humidity at elevated temperatures is shown schematically on page 4 (LLNL-SCI-487, V3). The setup consists of two connected glass vessels (1 L) in convection ovens to control temperature, one to three RH and T probes for calibration, a NIST traceable temperature probe, a computer based data acquisition system, other temperature sensors, and temperature controllers. A central valve in the connection tube between the two vessels is used to purge the system. The tube is connected to the vessels through a port in the top of the ovens using both glass and Teflon fittings. Heat loss and condensation are prevented by heating the connection tube with regulated heat tape (Digi-Sense temperature controllers and type 'K' OMEGA SA1-K surface mount thermocouples). Oven temperatures are controlled by a computer data acquisition system and RTD (Resistance Temperature Detector) sensors calibrated against the NIST traceable temperature probe (Page 6, LLNL-SCI-487.V3). The data acquisition system measures temperature (non-Q) at several locations in the system to monitor uniform environment.

The relative humidity probes are calibrated from 115 to 180°C, by placing the probes and corresponding temperature probes in higher temperature vessel ports through a soft silicone stopper. All unused ports are sealed with soft silicone stoppers. Prior to beginning the calibration, the system is conditioned by heating vessel T2 and the connection tube above 100°C, and by heating vessel T1 with about 500 ml of pure water to boiling (oven temperature is about 160°C). The warm up period takes between 2 and 4 hours and is monitored by the data acquisition system. Additional water may need to be added to vessel T1 as the system temperature stabilizes. A 5 to 7 point calibration from 115 to 180°C is then conducted by raising the temperature of vessel T2 to a given value, allowing the temperature to stabilize, and measuring relative humidity and temperature in triplicate using the RH probe sensors. The temperature in vessel T2 is changed and the process is repeated. Data are recorded in Supplemental Binder 1. Important parameters for calibration are the as measured probe RH and T and the as measured T from the NIST traceable temperature sensor (DP251). All other sensors are used to monitor steady-state conditions in the apparatus.

c. Reduction Of Probe Calibration Data

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Percent RH is calibrated against a linear regression of RH measured versus the RH standard of combined the pre and post experiment calibrations (e.g. Figure 1). The RH standard is determined from the recorded temperatures by using a 5th order polynomial fit of RH versus temperature from the steam tables. RH Probes with separate temperature sensors that have been validated against the NIST traceable temperature sensor (DP251) can use the RH probe temperature reading to determine the RH standard. RH probes without separate temperature sensors shall use the temperature measurements from the High Precision Thermometer (DP251) to determine the RH standard. Uncertainty in RH is calculated as the standard deviation of RH calculated for the pre- and post-calibration runs separately and is typically less than 1.5% RH units.

An RH probe should be calibrated before it is used in a new or extensively modified experiment and after the experiment or selected set of experiments are complete prior to sending it out for adjustment and calibration at low temperature. Probe adjustment is required when linear regressions of RH measured versus RH standard yield $R^2 < 0.90$ for probes used between 115 and 180°C and calibrated with the bi-thermal method. Probe adjustment and calibration is required on an annual basis for use at temperatures below 115°C.

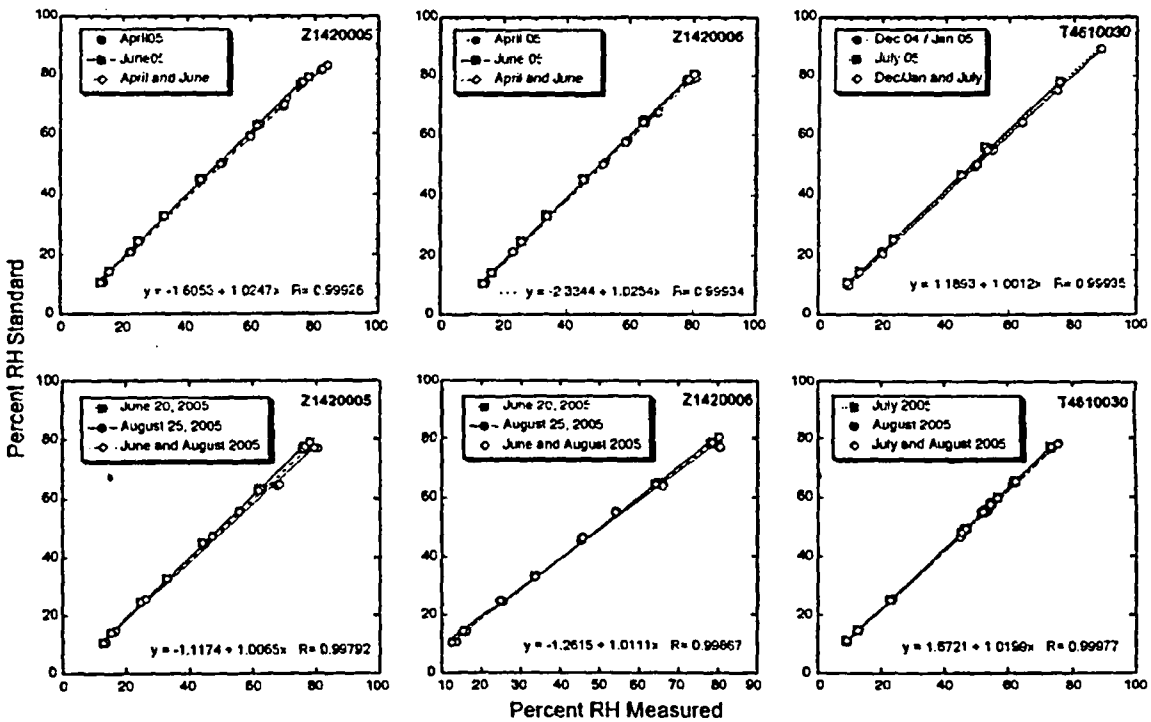

Figure 1. Relative humidity calibration. Percent RH Standard was calculated

2-10-06

2-10-06

using data for the vapor pressure of water over pure liquid water. The temperature was determined using a Q temperature sensor within the RH probe. Calibration is documented in DTN: LL050800623121.053 and LL050903412251.150.

References

BSC (Bechtel SAIC Company) 2004. *Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier.* ANL-EBS-MD-000001 REV 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20041116.0005.

BSC (Bechtel SAIC Company) 2005. *Multiscale Thermohydrologic Model.* ANL-EBS-MD-000049 REV 03. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20050711.0001.

Weast, R.C. and Astle, M.J., eds. 1981. *CRC Handbook of Chemistry and Physics.* 62nd Edition. Boca Raton, Florida: CRC Press. TIC: 240722.

2-10-06

This entry is made for clarification on the software that was used for part of the description and operation of the apparatus:

The Curve shown on page 7 was developed from the data listed in table 3 on page 7 using Excel 2002 (10.6713.6735). KaleidaGraph version 3.5 or higher were used to generate the 5th order polynomial equation for the curve shown on page 7 and the graphs shown on page 21.

2-10-06

2-10-06

The data sheets for each probe contain the following information:

1. Header
   - Humidity Probe ID -- Serial number (and in once case the calibration identification number from LLNL-M&TE coordinator).
   - Approved YMP Calibration Cal Date (or cal date) -- Calibration date by an approved YMP vendor from the QSL for the use of probes at temperatures less than 115°C (to date in this notebook Thunder Scientific was the QSL vendor).
   - Cal Due Date (cal due) -- Calibration due date by an approved YMP vendor from the QSL for the use of probes at temperatures less than 115°C (to date in this notebook Thunder Scientific was the QSL vendor).
   - Date – The date for which the bi-thermal calibration started.
2. Table Headings
   - Date – Measurement date (unless all data were collected on the calibration start date listed in the header).
   - Saturator Air Temp – Non-Q measure of air temperature in the saturator.
   - Saturator Water Temp -- Non-Q measure of water temperature in saturator.
   - Target Temp – Test target temperature.
   - Calc RH -- Expected RH in the chamber calculated from the steam tables (see LLNL-SCI-487.V3 page 7) and a RTD probe or DP251. This entry is approximate RH reference point and was not used to calibrate the probe.
   - Test Vessel Computer Temp (Test Chamber Temp1) -- Non-Q measure of the test vessel temperature.
   - Test Vessel DP251 Temp (Test Chamber 2) -- Qualified temperature measure using the DP251 (NIST traceable certification in the supplement).
   - Probe RH – As measured RH from RH probe under test.
   - Probe Temp – As measured temperature from the RH probe under test.
3. Other information:
   - For sheets dated 12/3/04 and 12/29/04, non-Q pressure measurements were recorded to determine if the system was operating a slightly positive pressure. Measurements were taken with an incline manometer in inches of water. As expected, these measurements show a slight positive pressure.

2/10-06

2-10-06

- All of the data sheets in the supplement to this notebook except four where conducted with RH probes installed in the test vessel. Four data sheet using probes X3250115, V0810003, T4610030, and X3250114 were used to evaluate the saturator side of the vessel on 12/23/04 and 12/29/04. For these tests, the saturator RH was recorded under the column heading "Saturator RH" and the RH probe temperature was recorded under the column heading "Saturator Temp", which was a measure of the air temperature in the saturator. These were non-Q measurements.

2-10-06

TECHNICAL REVIEWER

I have technically reviewed the portions of this notebook and supplements, as applicable, identified on the technical review form used to document my review. Technical comments have been resolved and the notebook entries are evaluated as being technically adequate.

Signature Thomas J. Wolery
Printed name Thomas J. Wolery
Date 2/13/2006

RESPONSIBLE MANAGER

The technical review is acceptable.

Signature Susan A. Carroll
Printed name Susan A. Carroll
Date 2/13/2006

BSC

Scientific Notebook Compliance Review Worksheet

QA: QA
Page 1 of 3

Complete only applicable items.

Scientific Notebook Identifier (from Scientific Notebook Register)	Investigator
SN-LLNL-SCI-487-V3	K. Staggs

Scientific Notebook Title
Research Supporting Environmental Chemistry Experiments

Reviewed by: Print Name	Signature	Organization	Date
Leigh A. Gouveia	L. Gouveia	LLNL-Engr. Assurance	2/9/06

Review Comment Resolution Satisfactory: Print Name	Signature	Organization	Date
Leigh A. Gouveia	L. Gouveia	LLNL-Engr. Assurance	2/10/06

Review Acceptance *(to be signed by Responsible Manager after the Compliance Review is complete)*: Print Name	Signature	Organization	Date
Susan A. Carroll	Susan A Carroll	LLNL-Technical Area Lead	2/10/06

Type of Compliance Review: Scientific Notebook page range reviewed 1 to ~~17~~ 24 2/10/06

1. Initial Entry Review — ☐ *Complete Parts 1 and 2*
2. Interim Review — ☑ *Complete Parts 1 and 3*
3. Closure Review — ☐ *Complete Parts 1, 3, and 4*

Additional Implementing Documents Identification (e.g., technical procedures, APs, etc., if applicable)

Instructions for Completing This Form:

1. If any part of a compound question in the Requirements/Criteria column cannot be answered **YES**, then mark the entire requirement **NO**, and provide an explanation in the **COMMENTS** column.
2. Marking the **N/A** box means the criteria is not applicable to this notebook.
3. All criteria marked **NO** require an explanation in the **COMMENTS** column and will be considered a non-compliance issue that the investigator must address in comment response.
4. The Review Acceptance box above will be completed by the Responsible Manager only after the Reviewer has signed above for satisfactory Comment Resolution.

Comments (e.g., Identification of Scientific Notebook Supplemental Records reviewed)

Part 1, Item 4: the requirement to initial/date lines through excessive open space at closure did not become effective until 4/19/05.

Part 1, Item 6: The following probe calibration data sheets in Supplement 1 do not contain names/signatures/dates or Thunder Scientific calibration dates: V0810003 (12/23/04), X3250115 (12/23/04), T4610030 (12/29/04), X3250114 (12/29/04), Z1420006 (1/10/05), Y1110102 (1/10/05). corrected

Requirements/Criteria and Relevant Paragraph [LP-SIII.11Q-BSC, Paragraph No.]	CRITERIA MET Yes	No	N/A	Comments
PART 1. GENERAL/IDENTIFICATION AND CONTROL OF SCIENTIFIC NOTEBOOKS				
1. Use of pre-bound notebook? [5.1.2]	✓			
2. Consecutive pagination? [5.1.2]	✓			
3. Loose material permanently attached? [5.1.3]	✓			
4. Excessive open spaces lined through? [5.1.6]	✓			See Comments section before Part 1.
5. Supplement contents properly cross-referenced? [5.1.7]	✓			
6. All entries signed/initialed and dated? [5.1.10]	✓ 2/10/06	X		See Comments section before Part 1.
7. Corrections lined through, initialed, and dated? [5.1.11]	✓ 2/10/06	X		See Comments section after Part 2.
8. Table of Contents adequate? [5.1.13]	✓			
9. First numbered page of Scientific Notebook contains the Scientific Notebook title, SNR ID, name of Investigator, and QA designator [5.2.2c)]	✓			See Comments section after Part 2.

Complete only applicable items.

Scientific Notebook Identifier (from Scientific Notebook Register)
SN-LLNL-SCI-487-V3

Requirements/Criteria and Relevant Paragraph [LP-SIII.11Q-BSC, Paragraph No.]	CRITERIA MET Yes	No	N/A	Comments
PART 2. SCIENTIFIC NOTEBOOK INITIAL ENTRY				
10. Statement of objective, identification of methods to be used and description of work? [5.3a) 1)]			✓	Items 10-20 are not required for an Interim Compliance Review.
11. List of sample types? [5.3a) 2)]			✓	
12. List of test equipment to be used? [5.3a) 3)]			✓	
13. Calibration information described? [5.3a) 3)]			✓	
14. Description of procurement activity? [5.3a) 4)]			✓	
15. All aspects required for software to be used [5.3.a) 5)]			✓	
16. List of special training/qualification requirements, prerequisite actions, environmental conditions, and potential sources of error? [5.3a) 6)]			✓	
17. Provisions for controls of any electronically managed information? [5.3a) 7)]			✓	
18. Printed name, signature and initials of investigator? [5.3a) 8)]			✓	
19. Initial entry initialed and dated? [5.3a)]			✓	
20. Approved planning document noted [5.3a)]			✓	

Comments

Part 1, Item 7: corrections made without initials/dates: Supplement 1, probe calibration data sheets for Z1420005 (1/5/05), AB 5733 (1/5/05), Z1420006 (1/10/05), Y1110102 (1/10/05), Z1420005 (4/4/05), Z1420006 (4/4/05), Z1440127 (7/6/05), Y1110102 (8/23/05), T1460030 (8/23/05), Y4710001 (8/23/05), Z1420005 (8/25/05), Z1440127 (8/25/05). Corrected

Part 1, Item 9: Information is contained on SN inside cover, which was acceptable practice on 12/20/04 when the SN was initiated. It was not a requirement to put this information on the first numbered page until 4/22/05.

Part 3, Item 21: Sarah Roberts and Maureen Alai completed probe calibration data sheets, but their signatures/initials are not entered in the SN on Pg.1. In addition, Maureen Alai is designated as the investigator on the inside cover of the SN, however, there is no official turnover to K. Staggs, who has completed all the SN entries. Names on data sheets is acceptable per V. Barish. Pg. 18 documents transfer to K. Staggs. [illegible] 2/1/06

Complete only applicable items.

Scientific Notebook Identifier (from Scientific Notebook Register)
SN-LLNL-SCI-487-V3

Requirements/Criteria and Relevant Paragraph [LP-SIII.11Q-BSC, Paragraph No.]	CRITERIA MET Yes	No	N/A	Comments
PART 3. SCIENTIFIC NOTEBOOK IN-PROCESS ENTRIES/SUBMITTAL AND TRACEABILITY OF DATA				
21. Names, signatures and initials of contributors to the notebook provided prior to making entries in the notebook? [5.3a) 8)]	✓ 2/10/06	✓		See Comments section after Part 2 resolved.
22. Description of work performed? [5.4a) 1)]	✓			
23. Investigation results given? [5.4a) 1)]	✓			
24. Changes or additions to initial entry adequate? [5.4a) 4)]			✓	None made.
25. Conditions described that might adversely affect the research? [5.4a) 5)]	✓			Pg. 3 contains a reference to CR 2247 & CR 5430 for probe calibration issues.
26. Samples properly identified? [5.4a) 6)]			✓	SN is for probe calibration.
27. Test equipment properly identified? [5.4a) 6)]	✓ 2/10/06	✓		Pg. 14. probe Z142006 number is missing a digit. corrected
28. M&TE calibration adequately documented? [5.4a) 6)]	✓			
29. Computer software properly identified? [5.4a) 6)]	✓			DasyLabs and Excel.
30. Preliminary data used in the investigation identified? [5.4a) 7)]			✓	SN is for probe calibration.
31. For new volumes, initial entry copied into or referenced at the beginning of the volume? [5.4b) 1)]	✓			Pg. 1 refers to Initial Entry in SN 487-V1.
32. Adequate controls documented for electronically managed information? [5.5.3a) 3)]			✓	
33. Input data obtained from the TDMS or TIC? [5.4a) 6)]			✓	SN is for probe calibration.
34. Data submitted to TDMS in accordance with AP-SIII.3Q? [5.6a)]			✓	SN is for probe calibration.
35. Identification of rejected or non-Q data [5.4a) 8)]			✓	SN is for probe calibration.
36. Adequate cross-reference to SN Supplements [5.4a) 9)]	✓			
PART 4. CLOSURE OF SCIENTIFIC NOTEBOOKS				
37. Concluding entry entered, signed, and dated? [5.7.1b)]			✓	Items 37–40 are not required for an Interim Compliance Review
38. Non-collection of data statement, if appropriate? [5.7.1b)]			✓	
39. Technical review completed? [5.7.1d)]			✓	
40. All supplements referenced in the notebook provided for the closure compliance review? [5.7.2a)]			✓	

Comments

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487 TJW 2/10/06 QA:QA

TECHNICAL REVIEW FOR SN-LLNL-SCI-~~178~~-V3

Scientific Notebook Page Range Reviewed 1 to 17

Supplemental Notebooks Reviewed (as applicable) Supp 1

Supplemental Notebook Page Range Reviewed All to All

(Document each supplemental notebook and the inclusive pages/sections reviewed)

Review Type (check all that apply): Annual ☒ /Interim ☐/Close-Out ☐

General Notebook Review Criteria (per LP-SI11.11Q-BSC, Rev 0, ICN 0)

Technical Reviewer: Thomas J. Wolery (Printed Name)/Date: 02/07/2006

Address the following criteria when performing this review. ***DOCUMENT A JUSTIFICATION FOR ANY CRITERIA THAT ARE NOT APPLICABLE.***

1. The investigation is described in sufficient detail to retrace the investigation and confirm the results, or to repeat the investigation and achieve comparable results, without recourse to the original investigator.

Several deficiencies were noted. See attached comments.

2. Software used is qualified and suitable to the problem being solved in accordance with LP-SI.11Q-BSC, *Software Management.*

The documentation of software used is incomplete. See attached comments.

3. The documentation for any electronically managed information is in accordance with Initial Entry Requirements.

An "Initial Entry Requirements" was not found. There appears to be little if any electronically managed information associated with this notebook.

487 TJW 2/10/06

QA:QA

TECHNICAL REVIEW FOR SN-LLNL-SCI-~~478~~ -V 3
Scientific Notebook Page Range Reviewed 1 to 17
Supplemental Notebooks Reviewed (as applicable) Supp 1
Supplemental Notebook Page Range Reviewed All to All
(Document each supplemental notebook and the inclusive pages/sections reviewed)

4. Technical adequacy/concerns comments(Use a continuation page, if required):

Comments are given in the three-page attachment.

Technical Reviewer — Date 02/07/2006

Technical Review Comments Resolved

Technical Reviewer — Date 2/13/2006

NOTE: Once the technical review is complete and all comments are resolved the Technical Reviewer must sign a statement in the scientific notebook that the technical comments have been resolved and that the notebook entries are evaluated as being technically adequate. If no mandatory comments must be resolved then the Technical Reviewer indicates N/A (or signs and dates, if preferred) in the resolution block and signs the statement in the scientific notebook as described in the previous sentence.

Technical Review Comments
SN-LLNL-SCI-~~475~~-V3 487 DW 2/10/06

Thomas J. Wolery (LLNL)
02/07/2006

This review encompasses this notebook volume up to and including page 17, also the loose-leaf material presently found in the Supplement 1 binder. This is a technical review; however, some compliance issues are necessarily addressed. The response to this technical review should be coordinated with the response to the compliance review where overlap occurs.

General: The inside cover documents the issuance of this notebook to Maureen Alai. However, on p. 2, only Kirk Staggs is authorized to make entries in this notebook. There is no explicit record of a hand-off. I am not sure if that is a problem, but point this out for the compliance reviewer. All entries are signed by Kirk Staggs.

General: Information on hardware items (e.g., descriptions, serial numbers, associated calibration dates) is scattered about in the report. Detailed information often appears well after the first reference. A master table summarizing this information should be added after page 17. This table should be listed in the table of contents. This may be a compliance issue, but if not, it could still be an issue when this notebook is audited (e.g., transparency).

General: Information on software is similarly scattered. On p. 6 there is the first reference to the Dasylab software, but with no specific information such as version number or QA status. On p. 8, this software is declared with version number but no QA status is given. On p. 7, calculated results appear without identification of the software used (probably Excel and/or KaleidaGraph), and on p. 17 there is what appears to be output from Excel. All software used (whether qualified or exempt, M&TE or not) needs to be declared (noting version numbers, QA status, and applicable and actual platforms and OS used). Summarize all software information in another table after page 17 and note its existence in the table of contents. This may also be a compliance issue, but again if not, it goes to the need for transparency.

General: The calibration process is not completely defined or explained. No TIP or equivalent procedure is cited. The data sheets in Supplement 1 include two to three independent measurements of temperature in the test chamber. Which was or is to be used? The process of getting the reported "Calculated RH%" values is not sufficiently explained, but appears to involve the vapor pressure fit described on p. 7 along with the usage of one of these data sets for test chamber temperature. In the absence of other information, one would have to assume that the calibration then is determined by comparing the reported "Calculated RH%" values with the corresponding probe values. However, in the course of interviewing the notebook proprietor (Kirk Staggs), I heard that in other notebooks documenting experiments using the probes noted in the present notebook, there may have been a switch in the temperature set used and generation of a

different set of calculated RH% values than the ones appearing in Supplement 1. The manner in which the data in the present notebook have actually been used (or may be used) for calibration should be clearly documented in the present notebook. This may require references to other notebooks if the calibration process is completed or amended in them.

General: I didn't see much about uncertainties to apply when using the calibrated RH probes. I would expect something to come out of the calibration process. And I am not talking here about the measurement uncertainty ascribed to the probes by the manufacturer.

p. 3-5: Note what an RTD is.

p. 5-6: RTDs are identified by "cal" numbers (example, from p. 5, "cal number GG511/AA0263"). These identifiers should be explained. I believe they incorporate the serial numbers.

p. 6: Too much open space.

p. 7, Table 2: "Data from CRC". The cited source needs to be more definitive. I would suggest Weast and Astle 1981 [DIRS: 100833], p. D-168 to D-169 (Note: Greg Gdowski has a copy of this version of the CRC Handbook). If this is used, the units are "torr.", not "mm" (actually mm Hg), though these are numerically equivalent. The RH% numbers are calculated, not taken from any CRC source I am familiar with. How they were calculated needs to be documented, including identifying any software used and any resulting spreadsheet, including DTN, that may be involved. For 110°C, the RH% is given as 70.72. I calculated 70.73 (rounded to two decimal places).

p. 7, Table 3: The equation given (to nine-th order) is not what was actually used. It is clear from a recalculation I did that the fit was only to fifth-order, matching the coefficient labels given in the table. Using Excel's "regression tool" I got slightly different results for the coefficients themselves, possibly because the RH% values I used were not truncated to two decimal points as in Table 2, or possibly because of the 70.72 value instead of 70.73 noted above. There is a documentation issue here. How were these coefficients obtained, and with what software (obviously something was used).

p. 9: The DP251 standard has been pressed into routine use in the bi-thermal apparatus. I'm not sure if there is an issue there or not.

p. 11: Illegible part: "(??? #) have been evaluated " (line 2 following the date).

p. 12: Illegible parts: "Added teflon b??????" (line 1 following the date) and "to try and ever ???" (on line 2).

p. 17: Some but not all probe numbers appear here. Why? A few that do appear here do not appear elsewhere in this notebook (e.g., X3250115). Why?

Comments Specific to Supplement 1:

General: Which numbers are used in calibration and which aren't? What is supposed to be Q and what represents non-Q data taken simply to help evaluate the performance of the apparatus? How are the calculated RH values obtained? What software was used?

General: The data sheets themselves are not initialed or signed, apart from dating and initialing of some but not all corrections. Some data sheets identify an "operator," and some do not (e.g., those in the second plastic "protector").

General: Explain the meaning of the cited "calibration" and "calibration due" dates. If these dates are not directly applicable to the current calibrations, explain when the current calibrations become out of date.

Second plastic protector set of data sheets (covering V0810003, 12/23/04): Explain '" H_2O system pressure' (what it is, where and how it is measured, what exactly are the units). Are these data supposed to be Q? How do they relate to the calibration of the probes?

AB5733, 1/5/05: Missing initial and date on one or more corrections.

2142006 and Y1110102, 1/10/05: Ditto.

Z1440127, 7/6/05: Ditto.

U5110014, 8/15/05: Ditto.

Y11110102, T4610030, and Y4710001, 8/23/05: Ditto.

Z1420005, 8/25/05: Ditto.

Z1440127, 8/25/05: Ditto.

Z1440127, 8/25/05: There are a couple of ugly write-overs, e.g., 49.94 over 59.94.

End of comments

Accepted.
Thomas J. Wolery
2/13/06

Technical Review Comments
SN-LLNL-SCI-487-V3
Thomas J. Wolery (LLNL)
02/07/2006
Comments to Technical Review (Kirk Staggs and Susan Carroll)
02/10/06

This review encompasses this notebook volume up to and including page 17, also the loose-leaf material presently found in the Supplement 1 binder. This is a technical review; however, some compliance issues are necessarily addressed. The response to this technical review should be coordinated with the response to the compliance review where overlap occurs.

General: The inside cover documents the issuance of this notebook to Maureen Alai. However, on p. 2, only Kirk Staggs is authorized to make entries in this notebook. There is no explicit record of a hand-off. I am not sure if that is a problem, but point this out for the compliance reviewer. All entries are signed by Kirk Staggs.
Transfer is noted on Page 18

General: Information on hardware items (e.g., descriptions, serial numbers, associated calibration dates) is scattered about in the report. Detailed information often appears well after the first reference. A master table summarizing this information should be added after page 17. This table should be listed in the table of contents. This may be a compliance issue, but if not, it could still be an issue when this notebook is audited (e.g., transparency).
Information on hardware is summarized page 6 and pages 22-24 in scientific notebook and again in the front of Supplement Binder 1.

General: Information on software is similarly scattered. On p. 6 there is the first reference to the Dasylab software, but with no specific information such as version number or QA status. On p. 8, this software is declared with version number but no QA status is given. On p. 7, calculated results appear without identification of the software used (probably Excel and/or KaleidaGraph), and on p. 17 there is what appears to be output from Excel. All software used (whether qualified or exempt, M&TE or not) needs to be declared (noting version numbers, QA status, and applicable and actual platforms and OS used). Summarize all software information in another table after page 17 and note its existence in the table of contents. This may also be a compliance issue, but again if not, it goes to the need for transparency.
References to software are referenced where appropriate and an entry was made on page 7 and 22 for equations and graphs generated with exempt Excel and KaleidaGraph software.

General: The calibration process is not completely defined or explained. No TIP or equivalent procedure is cited. The data sheets in Supplement 1 include two to three independent measurements of temperature in the test chamber. Which was or is to be

used? The process of getting the reported "Calculated RH%" values is not sufficiently explained, but appears to involve the vapor pressure fit described on p. 7 along with the usage of one of these data sets for test chamber temperature. In the absence of other information, one would have to assume that the calibration then is determined by comparing the reported "Calculated RH%" values with the corresponding probe values. However, in the course of interviewing the notebook proprietor (Kirk Staggs), I heard that in other notebooks documenting experiments using the probes noted in the present notebook, there may have been a switch in the temperature set used and generation of a different set of calculated RH% values than the ones appearing in Supplement 1. The manner in which the data in the present notebook have actually been used (or may be used) for calibration should be clearly documented in the present notebook. This may require references to other notebooks if the calibration process is completed or amended in them.
Calibration process is explained on pages 19-22

General: I didn't see much about uncertainties to apply when using the calibrated RH probes. I would expect something to come out of the calibration process. And I am not talking here about the measurement uncertainty ascribed to the probes by the manufacturer.
Calibration uncertainty is captured in the explanation of the calibration process on page 21

p. 3-5: Note what an RTD is.
Noted on page 4

p. 5-6: RTDs are identified by "cal" numbers (example, from p. 5, "cal number GG511/AA0263"). These identifiers should be explained. I believe they incorporate the serial numbers.
Calibration numbers are assigned by the LLNL-MOLLE coordination and in this case are not serial numbers

p. 6: Too much open space.
Open space has been used

p. 7, Table 2: "Data from CRC". The cited source needs to be more definitive. I would suggest Weast and Astle 1981 [DIRS: 100833], p. D-168 to D-169 (Note: Greg Gdowski has a copy of this version of the CRC Handbook). If this is used, the units are "torr,", not "mm" (actually mm Hg), though these are numerically equivalent. The RH% numbers are calculated, not taken from any CRC source I am familiar with. How they were calculated needs to be documented, including identifying any software used and any resulting spreadsheet, including DTN, that may be involved. For 110°C, the RH% is given as 70.72. I calculated 70.73 (rounded to two decimal places).
Equation properly noted on page 7

p. 7, Table 3: The equation given (to nine-th order) is not what was actually used. It is clear from a recalculation I did that the fit was only to fifth-order, matching the

coefficient labels given in the table. Using Excel's "regression tool" I got slightly different results for the coefficients themselves, possibly because the RH% values I used were not truncated to two decimal points as in Table 2, or possibly because of the 70.72 value instead of 70.73 noted above. There is a documentation issue here. How were these coefficients obtained, and with what software (obviously something was used).
As noted by reviewer, fit is to the 5th polynomial. The 0th order heading is general format generated by Kaleidagraph software used to fit the data. Difference noted in second significant figure at 110 C for calculated RH is likely a rounding artifact between fitting procedures in Excel used by the reviewer and Kaleidagraph used by the investigator. This difference is inconsequential because probes read to only one significant figure. See entry on page 7 and 22.

p. 9: The DP251 standard has been pressed into routine use in the bi-thermal apparatus. I'm not sure if there is an issue there or not.
Use of DP251 is explained on pages 19-24

p. 11: Illegible part: "(??? #) have been evaluated " (line 2 following the date).
Corrected

p. 12: Illegible parts: "Added teflon b??????" (line 1 following the date) and "to try and ever ???" (on line 2).
Corrected

p. 17: Some but not all probe numbers appear here. Why? A few that do appear here do not appear elsewhere in this notebook (e.g., X3250115). Why?
Table represents available probes at that time that might be need in near future experiments.

Comments Specific to Supplement 1:

General: Which numbers are used in calibration and which aren't? What is supposed to be Q and what represents non-Q data taken simply to help evaluate the performance of the apparatus? How are the calculated RH values obtained? What software was used?
Explained on page 20 and 23 in scientific notebook.

General: The data sheets themselves are not initialed or signed, apart from dating and initialing of some but not all corrections. Some data sheets identify an "operator," and some do not (e.g., those in the second plastic "protector").
Compliance review noted that identification of operator by name and date of measurements was sufficient. Corrections have been made and initialed and dated.

General: Explain the meaning of the cited "calibration" and "calibration due" dates. If these dates are not directly applicable to the current calibrations, explain when the current calibrations become out of date.
Explained on pages 23 and 24.

Second plastic protector set of data sheets (covering V0810003, 12/23/04): Explain "H_2O system pressure" (what it is, where and how it is measured, what exactly are the units). Are these data supposed to be Q? How do they relate to the calibration of the probes?

[illegible]

[illegible] has been made.

- AB5733, 1/5/05: Missing initial and date on one or more corrections.
- 2142006 and Y1110102, 1/10/05: Ditto.
- Z1440127, 7/6/05: Ditto.
- U5110014, 8/15/05: Ditto.
- Y11110102, T4610030, and Y4710001, 8/23/05: Ditto.
- Z1420005, 8/25/05: Ditto.
- Z1440127, 8/25/05: Ditto.
- Z1440127, 8/25/05: There are a couple of ugly write-overs, e.g., 49.94 over 59.94.

End of comments

End of comments to comment

Humidity Probe ID: U5110014 Date: 8/15/05

Approved YMP Calibration Cal Date: 14 Jul 05 Cal Due Date: 14 Jul 06

Operator Name: Staggs

NOTE: Wait for computer and DP251 temperature readings to stabilized before recording readings. Ensure system is under positive pressure at all times and that the saturator water level is between the marks on the side of the vessel.

JAL 2-10-06

Date	Time	Saturator Air Temp	Saturator water Temp	Target Temp	Calc RH	Test Vessel Computer Temp	Test Vessel DP251 Temp	Probe RH	Probe Temp
~~8/15 2005~~	~~11:22~~	~~111.406~~	~~101.00~~	~~110~~	~~67.03~~	~~114.50~~	~~111.50~~	~~67.5~~	~~113.2~~
		~~110.896~~	~~100.861~~	~~110~~	~~69.02~~		~~111.75~~		
8/15 2005	11:53		100.941	110	70.17	110.407	111.34	64.8	113.1
	13:18		101.016	115	61.16	114.643	115.65	57.5	116.8
	15:50		100.873	120	50.10	120.605	121.96	47.8	122.6
	16:22		100.854	140	28.34	139.297	140.96 ~~141.03~~	27.5	142.4
	16:32		100.891	140	27.30	140.629	141.33	27.4	142.6
8/16	9:29		100.991	160	16.20	161.133	161.63 ~~161.89~~	17.3	162.7
	9:38		100.927	160	15.85	162.039	161.89	17.2	163.1
	9:50		101.059	160	15.51	162.975	163.00	17.4	164.1
	11:39		100.879	175	11.62	175.074	174.95	14.2	176.4 ~~176.2~~
	11:46		100.911	175	11.72	174.759	174.87	14.3	176.3
	11:56		100.993	175	11.75	174.656	174.81	14.4	176.2
	2:10		100.866	140	27.97	139.745	140.55	26.3	142.6
	2:20		100.812	140	26.68	141.450	142.50	26.4	143.6
	2:30		100.860	140	26.98	141.031	142.41	26.4	143.5

JAL 8/15/05

JAL 8/16/05

US11994

8/16 2005	3:44		100.884	120	50.41	120.370	121.74	47.5	122.6
	3:55		100.787	120	56.21	117.105	121.67	47.6	122.6
	4:10		100.812	120	50.06	120.693	121.59	47.7	122.5
	4:59		100.864	110	69.65	110.665	111.93	63.6	113.5
	5:10		100.817	110	68.41	111.670	111.99	63.5	113.5
	5:19		100.791	110	68.78	111.032	111.97	63.8	113.4
	5:43		100.705	105	80.24	106.433	106.99	73.1	109.1 ~~108.7~~ 8/16/05
	5:58		100.721	105	79.92	106.529	105.95	74.6	108.6
	6:08		100.750	105	80.09	106.456	106.90	74.7	108.5

Temperature in °C
RH in percent

NOTES:

Operator Name: Staggs / ALAI

Humidity Probe ID T461Ø3Ø , cal date

Date 12/29/04 21APRIL04 cal due APRIL05 2-10-06

Time	Saturator RH	Saturator Temp	Saturator Water Temp1	Saturator Water Temp2	Test Chamber RH	Test Chamber Temp1	Test Chamber Temp2	System pressure
1125	33.7	132.6	132.32	100.3	49.0	121.0	119.95	4.5
1135	33.2	133.3	132.65	100.4	49.7	120.6	119.59	5.4
1145	33.1	133.5	132.95	100.5	49.8	120.6	119.99	6.0
1200	32.9	133.1	132.93	101.6	49.7	120.6	120.13	5.5
1310	33.1	132.9	131.85	101.5	20.3	150.9	150.02	0.2
1335	32.0	134.2	131.92	101.3	20.2	150.0	150.06	1.5
1345	32.0	134.4	132.16	101.4	20.3	150.6	150.26	3.7
1400	31.9	134.7	132.54	101.5	20.2	151.2	150.93	4.6
1515	31.8	135.1	133.85	101.6	9.8	180.1	179.50	5.6
1525	31.4	135.6	134.00	101.5	9.7	180.5	179.99	5.2
1530	31.5	135.5	—	101.5	9.7	180.6	180.6	5.2
1/3 1637	32.4	129.5	100.5	117.1	98.6	103.3	102.68	4.0
1/4 1430	32.6	133.8	101.6	116.1	74.9	108.3	107.8	5.1
1525	30.1	136.1	107.1	123.8	63.9	113.0	112.63	5.0
1606	30.0	131.1	109.5	125.9	54.8	114.1	114.5	4.7

Operator Name: STACGS / ALAI

Cal. date 4-21-04

Humidity Probe ID X3250114

Date 21 APRIL 05 cal due

↳ 12/29/04

Exp 2-10-06

Time	Saturator RH	Saturator Temp	~~Saturator Water~~ Air Temp1	Saturator Water Temp2	Test Chamber RH	Test Chamber Temp1	Test Chamber Temp2	System pressure
1125	33.8	132.6	132.36	100.3	52.2	121.2	119.91	4.5
1135	33.3	133.3	132.63	100.5	53.0	120.7	119.61	5.4
1145	33.1	133.5	132.84	100.6	53.1	120.7	119.75	6.0
1200	32.9	133.7	132.70	101.5	52.9	120.7	120.13	5.4
1310	33.1	132.9	131.85	101.5	23.5	151.1	150.02	0.2
1335	32.0	134.2	131.92	101.3	23.2	150.2	150.06	1.5
1345	32.0	134.4	132.16	101.4	23.4	150.9	150.26	3.7
1400	31.9	134.7	132.54	101.5	23.3	151.4	150.93	4.6
1515	31.8	135.1	133.85	101.6	15.0	180.4	179.50	5.6
1525	31.4	135.6	134.00	101.5	14.9	180.8	179.99	5.2
1530	31.5	135.5	—	101.5	14.9	180.9	180.60	5.2
1/3 1625	32.8	128.4	100.3	114.3	92.9	103.3	102.54	5.0
1/4 1430	32.6	133.8	101.6	116.1	78.5	108.4	107.7	5.1
1575	30.7	136.1	102.1	123.8	64.3	113.1	112.63	5
1600	30.0	137.1	109.5	125.9	52.8	112.8	112.5	4.8

OCRWM	COMMENT SHEET	1. QA: NA 2. Page 8 of 5

3. Document Title: Control of Measuring and Test Equipment	
4. Document No. /Rev./ICN: AP-12.1Q, Rev. 0, ICN# 3	5. Date: 01/06/2004 Draft A
6. Manager of Reviewing Organization (Print Name): Michael Mason	7. Org./Discipline: BSC QA

8. CODE	9. SECT./PARA.	10. COMMENT/SUGGESTED RESOLUTION	11. RESPONSE
31. *	5.7.2 b)	Change 1), first sentence to read: "Apply an M&TE Out of Service Tag or other similar tag to indicate out of calibration conditions." As stated in the NOTE in comment 1, some M&TE used in ongoing corrosion experiments at LLNL cannot be recalled for calibration at the required intervals because it would disrupt data taking for these experiments. In these instances an OCR is issued to identify that M&TE is in use past its recalibration due date and a tag indicating this condition is affixed to the M&TE. Although tagging is appropriate in these conditions, an out of service tag is not for the following reasons: a) The equipment is not out of service...it is in use past its calibration due date. b) Allowing personnel to observe equipment in use with an out of service tag attached might cause them to think that using other equipment with out of service tags is acceptable. Change 2) to read: "As soon as possible segregate the out-of-calibration M&TE..." (CW)	Comment 1) accepted. Comment 2) not accepted. This is not necessary since you do not need to segregate AND tag the M&TE. Therefore, you would not need to segregate as soon as possible.
32. *	5.7.6 a) 1)	Change to: "If it determined that there is an impact (i.e., other than "use-as-is" determination), document this on...." (Review criterion 2.5) (DJS)	Comment not incorporated. As discussed with individual providing comment, the disposition of items, samples, and data will not be done within this procedure, but rather entirely within AP-16.1Q.
33. *	5.7.6 a) 2)	Change to: "If it is determined that there is no impact (i.e., "use-as-is" determination), document..." (Review criterion 2.5) (DJS)	Comment not incorporated. As discussed with individual providing comment, the disposition of items, samples, and data will not be done within this procedure, but rather entirely within AP-16.1Q.
34.	5.8.5	Change to: "....as a result of the loss of M&TE or the use of damaged M&TE,....." (DJS)	Comment incorporated, though not exactly word-for-word. Added to subsection 5.7.6.a rather than 5.8.5 since 5.8 was combined with 5.7.