

**GEOSCIENCES AND ENGINEERING DIVISION  
NONCONFORMANCE REPORT**

Project No. 20.OHD20.131

NCR No. 2007-31

**PART 1: DESCRIPTION OF NONCONFORMANCE**

Temp/Humidity Transmitter (model: Vaisala HMP235, s/n W1840062, AN008769) was found to be out of tolerance at 60% and 70% relative humidity and at 45°C and 65°C temperature per SwRI Cal. Lab. during a normally scheduled calibration.

Initiated by: Don Bannon

Date: 23 AUG 2007

Action Required by: Chandrika Manepally

Response Due Date: 21 Sep 2007

**PART 2: PROPOSED DISPOSITION AND CORRECTIVE ACTION**

**Disposition:** The impact of out of tolerance of the Vaisala probe was evaluated for the 20-percent drift-scale test results conducted in March-April 2006 and are documented in Manepally et al., (2007). The analysis (See SN536E for details) indicated that overall conclusions of the test will not change.

**Basis of Disposition:** The calibration report dated August 2007 for AN008769 showed that at the 70% RH point, the measured RH was 2.68% lower than the calibration standard. All of the RH values measured by this sensor in the tests are greater than 70%; so, it was assumed that the 2.68% deviation was applicable to all values above 70%. This assumption was used to adjust the temperature and relative humidity values measured during the test. The adjusted values indicated that overall conclusions of the test will not change.

**Action to Correct Nonconformance:** The Temp/RH Transmitter was adjusted and recalibrated. The basis for disposition was recorded in SN536E.

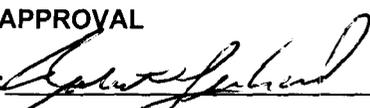
**Reference:** Manepally, C., R. Green, F. Viana, and R. Fedors. "Evaluation of In-Drift Heat Transfer Processes", San Antonio, TX.: Center for Nuclear Waste Regulatory Analyses: April, 2007.

Target date for completion: Completed

Proposed by: Chandrika Manepally

Date: 9/25/07

**PART 3: APPROVAL**

Manager: 

Date: 9/26/2007

Director of QA: 

Date: 9/26/2007

Comments/Instructions:

**PART 4: CLOSE OUT**

Comments: None

**Distribution:**  
Original-CENTER QA Records  
ORIGINATOR BANNON  
PRINCIPAL INVESTIGATOR MANEPALLY  
MANAGER LENHARD  
ASSISTANT DIRECTOR WITTMAYER

Verified by:  Date: 9/26/07

# SOUTHWEST RESEARCH INSTITUTE

6220 CULEBRA ROAD • POST OFFICE DRAWER 28510 • SAN ANTONIO, TEXAS, 78228-0510 • TEL (210) 522-5215 • FAX (210) 522-3692

**To:** Don Bannon, Div 20, Ext 5118  
**From:** Walt Hill, Metrology Group Leader  
Institute Calibration Laboratory  
**Date:** Aug. 14, 2007  
**Subject:** Out-of-tolerance Notice

AUG '07

The purpose of this notice is to alert you of a condition, which may have caused erroneous measurements affecting safety or the quality of products or services your organization provides. The attached as-found readings are provided for your evaluation to determine if the instrument listed below had an impact and if further action is required.

When the as-found results are near the specification limit, +/- a margin less than the measurement uncertainty, it is not possible to state in-tolerance or out-of-tolerance with a 95% level of confidence. It is the Institute Calibration Laboratory policy that the client is made aware of this situation because the end-user is taking some of the risk that the instrument listed below may not meet the end-user measurement requirements.

Your review/evaluation should be conducted in accordance with your organizational quality policy and procedural requirements. If we can be of further assistance, please contact the Calibration Laboratory at 522-5215.

**Manufacturer:** Vaisala

**Model:** HMP235

**Description:** Humidity/Temp Meter

**Serial Number:** W1840062

**Asset Number:** 8769

**User ID Number:**

**Last Calibration:** Dec 29, 2005

**Date Received for Service:** Aug. 07, 2007 **Work Order Number:** 303075862

**Service Requested:** Scheduled calibration

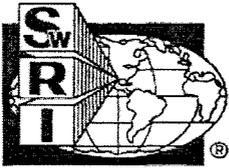
**Remarks:** Temp and %RH out of tolerance. See Measurement Report.

Southwest Research Institute  
Calibration Laboratory  
Measurement Report

Work Order:	303075862	Mfr.	VAISALA	Technician:	bit
Asset No.	008769	Model	HMP235 -20 to 180 C		
Serial No.	W1840062	Type.	Temp/RH Transmitter	Cal Date:	13-Aug-07
Remarks:	Temperature accuracy is based on worst case error. Manufacturer %RH Limits are +/-1% 0 to 90%RH. CALIBRATED 25 to 65 °C				

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found	
% RH	% RH	mAmp	% RH	% RH	% RH	Result	
0-100	20.09	7.1	19.38	-0.72	1.0	0.58	Pass
	40.01	10.271	39.19	-0.82	1.0	0.58	Pass
	59.99	13.275	57.97	-2.02	1.0	0.58	Fail
	69.99	14.77	67.31	-2.68	1.0	0.58	Fail
Degrees	°C	mAmp	°C	°C	°C	°C	
	24.93	7.615	25.19	0.26	0.60	0.021	Pass
	43.68	9.268	45.85	2.17	0.60	0.038	Fail
	63.57	10.890	66.13	2.55	0.60	0.055	Fail

END OF REPORT



# SOUTHWEST RESEARCH INSTITUTE®

6220 Culebra Road, P.O. Drawer 28510  
Institute Quality Systems  
Institute Calibration Laboratory  
Phone: 210-522-5215 Fax 210-522-4834



Calibration Laboratory  
Certificate #0972-01

## Certificate of Calibration

Submitted By: DIV20

Address: B57

Contact: DON BANNON

Manufacturer / Model: VAISALA / HMP235

Description: HUMIDITY/TEMPERATURE TRANSMITTER

Serial No: W1840062

Asset No: 008769

Procedure: HUMIDITY-DEW POINT - 19 MAY 06

Work Order: 303075862

Date Issued: Aug 15, 2007

Calibration Date: Aug 15, 2007

\*Calibration Due: Aug 15, 2008

Calibration Location: Bldg. 64

Environment: Temp. 73.0°F Hum. 40 %RH

\*\*Data Type: AS-LEFT

DivID/Location: N/A

This certificate documents traceability to the National Institute of Standards and Technology (NIST) and the International System of Units (SI). The Laboratory quality system conforms to ISO/IEC 17025, 2005, ANSI/NCSL Z540-1-1994 and relevant requirements of the ISO 9000-2000 standard. This certificate shall not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. This certificate shall not be used to claim product endorsement by Southwest Research Institute, American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government. Results of this calibration relate only to the instrument described above at the time of calibration and does not imply any long term stability of the instrument.

\*Determined by the customer, does not imply the instrument will remain within tolerance as any number of factors may cause an out-of-tolerance condition before this date. \*\*Found/Left = adjustment and/or repair was not required, As Left = adjusted and/or repaired was required. The client has sole responsibility for determination of in-/out-of-tolerance or compliance/noncompliance. See Remarks or attached Measurement Report with the same Work Order number for data.

Reported uncertainty calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM) and represents an expanded uncertainty with a coverage factor of k=2 to approximate a 95% confidence level.

Remarks: -20 to 180°C (4-20 mA) 0 to 100 %RH (4-20 mA)

### Standards Used

Asset No.	Serial No.	Manufacturer	Model	Description	Cal Due
009414	A25788	HART SCIENTIFIC	1502A	TEMPERATURE READOUT	Oct 05, 07
010375	8426006	FLUKE	45	MULTIMETER	Jul 17, 08
010692	632656	HART SCIENTIFIC	5618	RTD (3RS)	Oct 05, 07
012098	9096026	FLUKE	45	MULTIMETER	Mar 02, 08
006404	9806123	THUNDER SCIENTIFIC	2560	HUMIDITY GENERATOR	May 30, 08

Reviewed by: ( ) wgh ( ) srt ( ) jrg ( ) blt ( ) lpcw

Metrology Technician

m:\a2la1.rpt Rev date August 15, 2005

Measurements by: Bob Trollinger

Metrology Technician

Southwest Research Institute  
Calibration Laboratory  
Measurement Report

Work Order:	303075862	Mfr. VAISALA	Technician: bit
Asset No.	008769	Model HMP235 -20 to 180 C	
Serial No.	W1840062	Type. Temp/RH Transmitter	Cal Date: 15-Aug-07
Remarks: Temperature accuracy is based on worst case error. Manufacturer %RH Limits are +/-1% 0 to 90%RH. CALIBRATED 25 to 65 °C			

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Left
% RH 0-100	% RH	mAmp	% RH	% RH	% RH	% RH
	20.00	7.182	19.89	-0.11	1.0	0.58
	40.01	10.455	40.34	0.33	1.0	0.58
	59.97	13.613	60.08	0.11	1.0	0.58
	70.00	15.192	69.95	-0.05	1.0	0.58
Degrees	°C	mAmp	°C	°C	°C	°C
	25.30	7.621	25.26	-0.03	0.60	0.021
	44.25	9.140	44.25	0.00	0.60	0.038
	62.95	10.670	63.38	0.42	0.60	0.055

END OF REPORT

**rbrient**

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**From:** rbrient [rbrient@swri.edu]  
**Sent:** Thursday, September 27, 2007 5:12 PM  
**To:** wesley.patrick@swri.org; budhi.sagar@swri.org; dbannon@cnwra.swri.edu; cmanepally@cnwra.swri.edu; 'Robert Lenhard'; gwitt@cnwra.swri.edu  
**Cc:** 'rbrient'; 'Mike Simpson'  
**Subject:** RE: NCR 2007-31

Wes:

I consulted with Chandrika and Don Bannon to prepare this response to your questions.

1. No, this particular probe was last used on the blue tube experiment. However, other Vaisala probes have been used on GED deliquescence tests.

2. Yes, we are using the same Vaisala brand probes as did LLNL.

3. The problem at LLNL was when the probes were used well above 100 degrees C, which is beyond a reasonable extrapolation from a 65 degrees C calibration point that LLNL's vendor used.

4. Using an error of 2.68 for RH > 70% may be non-conservative. The error in the probe measurements appears to increase linearly at about -0.6% per 10%, so the error at 70% could be extrapolated to -about 4.0 at 90% RH. However, the experiment used several other probes, so there is cross verification. The cross verification is part of the basis of the statement that the error did not impact the conclusions.

5 and 6. The SwRI cal lab calibrates at 4 humidity (from 20-70% RH) and 3 temperature (from 25-65C) points, which is enough to establish a reasonable degree of linearity, accuracy, and extrapolation beyond the calibration points. I will add this Out of tolerance report to the NCR for a more complete package.

7. We have several years experience with several Vaisala probes, and while we experienced a few out-of-tolerances, we haven't noticed trends. According to the DOE investigation of the LLNL probes, the reliability of these probes gets suspect when used at temps >> 100 degrees C, which we haven't used.

Currently the calibration interval is 1 year. This probe was last used for measurement in June 2006 (about 6 months prior to its scheduled recalibration). Recalibration waited for dismantling the blue tube.

We should keep an eye on out of tolerance experience with these probes and shorten to 6 months if we experience any trends.

Bob Brient  
Director, Quality Assurance  
Geosciences and Engineering Division  
Southwest Research Institute  
(210) 522-5537

-----Original Message-----

**From:** Wesley Patrick [mailto:wpatrick@swri.edu]  
**Sent:** Thursday, September 27, 2007 2:11 PM  
**To:** budhi.sagar@swri.org; dbannon@cnwra.swri.edu; cmanepally@cnwra.swri.edu; 'Robert Lenhard'; gwitt@cnwra.swri.edu  
**Cc:** 'rbrient'; 'Mike Simpson'  
**Subject:** RE: NCR 2007-31

9/28/2007

Chandrika and Bob Brient,

Please provide additional information about this situation. In particular, address the following.

1. Are these probes measuring the same properties as were brought into question in DOE/LLNL tests?
2. Whether or not Item 1 is true, was the manufacturer the same as at DOE/LLNL?
3. Has there been a history of problems with these probes either here, reported by other research groups, or indicated by the manufacturer?
4. Why is it necessary to assume that the out-of-tolerance level at 70 degrees be applied at all temperatures above that level?
5. Further to Item 4, was calibration data taken at enough points along the temperature curve to implement a more precise and accurate adjustment to the data?
6. If data were not taken per Item 5, can a more complete calibration be run now—if warranted—to support such an improved response?
7. Given that problems are inherent to M&TE generally and given the DOE/LLNL experience in particular, should we have been more diligent in advance of the NCR; for example, should a shorter calibration period have been specified?

Answers to these questions aim to more thoroughly address a potentially wider spread future problem and to prevent recurrence.

Thanks in advance. Stop by to discuss, as needed.

Wes.