

October 18, 2021

VIA EMAIL: ernest.sandland@whrsd.org

Mr. Ernest Sandland
Facilities Department
Whitman Hanson Regional School District
600 Franklin Street
Whitman, MA 02382

TRC Project No. 455410

**Subject: Final Report
Indoor Air Quality Evaluation
Hanson Middle School
111 Liberty Street
Hanson, Massachusetts**

Dear Mr. Sandland:

TRC Environmental, Inc. (TRC) is pleased to present its final report entitled "*Indoor Air Quality Evaluation*" performed at the Hanson Middle School located at 111 Liberty Street in Hanson, MA.

TRC appreciates the opportunity to be of service. If you have any questions or concerns, please contact me at (781) 337-0016.

Very Truly Yours,
TRC ENVIRONMENTAL, INC.



Olivia Smaracko
BSI - Sr. Industrial Hygienist



Gregory Hatch
BSI - Office Practice Leader

Indoor Air Quality
at

**Hanson Middle School
111 Liberty Street
Hanson, Massachusetts**

TRC Project No. 455410
October 18, 2021

Prepared for:

**Whitman Hanson Regional School District
Facilities Department
600 Franklin Street
Whitman, MA 02382**

Prepared by:

**TRC Environmental, Inc.
814 Broad Street
Weymouth, Massachusetts
781.337.0016**

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A DIRECT-READING ENVIRONMENTAL MEASUREMENTS

B. IAQ MONITOR CALIBRATION REPORT

1.0 INTRODUCTION

Mr. Ernest Sandland of the Whitman Hanson Regional School District (WHRSD) authorized TRC Environmental, Inc. (TRC) to perform an indoor air quality evaluation at the Hanson Middle School at 111 Liberty Street, Hanson, Massachusetts.

WHRSD requested this evaluation to be conducted in a proactive manner to address potential occupant concerns. TRC Industrial Hygienist, Gregory Hatch visited the school to perform the evaluation on August 25, 2021. During the evaluation, building access and information was provided by Mr. Ernest Sandland of the WHRSD Facilities Department.

Appendix A presents the results of instantaneous direct-reading environmental measurements. Appendix B presents the monitoring instrument calibration report.

2.0 OBSERVATIONS AND DISCUSSION

TRC's evaluation included evaluating representative occupied spaces at the school building. TRC's observations and discussions were based on the following:

- Inspecting for possible microbiological reservoirs or amplifiers and sources of odor, chemical air contaminants, and combustion products within the survey areas and associated with the heating, ventilating and air conditioning (HVAC) system serving those areas.
- Collecting instantaneous, direct-reading measurements for dry bulb temperature, relative humidity, carbon dioxide and carbon monoxide concentrations indoors in the representative areas and outdoors for comparison.

2.1 OCCUPIED SPACE

The building is typical school building with office space, common areas such as hallways, Cafeteria/Auditorium, Library, Gymnasium, and classroom space. The following was noted:

- School was not in session yet, but a few teachers were present preparing classrooms for opening day.
- Most of the classrooms now have wall mounted Mitsubishi air conditioners. Most of the air conditioners in classrooms were in operation.
- The outdoor temperatures were measured and ranged from 84.9-90.8 °F during the survey.
- No substantial water leaks or intrusion areas were observed.

2.2 DIRECT-READING ENVIRONMENTAL MEASUREMENTS

TRC performed direct-reading environmental measurements within select classrooms, offices, the auditorium, the gymnasium, the cafeteria, and outdoors, on August 25, 2021. TRC measured for dry bulb temperature, relative humidity, carbon dioxide and carbon monoxide concentrations using a TSI Q-Trak Indoor Air Quality Monitor. This is a direct-reading instrument.

Appendix A presents direct-reading environmental measurements and Appendix B provides the updated instrument calibration report.

2.2.1 Dry Bulb Temperature and Relative Humidity

On the day of the survey, TRC measured indoor dry bulb temperatures ranging from 68.4 to 78.1 °F. The outdoor dry bulb temperature ranged from 84.9 to 90.8 °F. TRC measured indoor relative humidity in the occupied spaces ranging from 56.1 to 83.9%. The outdoor relative humidity ranged from 40.5 to 61.7%.

Occupant thermal comfort is based on a combination of temperature and relative humidity. The American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE) Standard 55-1992, *Thermal Environmental Conditions for Human Occupancy*, and Standard 55a-1995 Amendment, recommends a range and combination of temperature and relative humidity considered as acceptable for general occupant comfort.

The temperatures and relative humidity levels recommended in ASHRAE Standard 55-1992 and Standard 55a-1995 provide for conditions for which 90 percent of occupants will not express discomfort. The range of temperatures and relative humidity prescribed change from summer to winter and assume that occupants dress appropriately for the season. Ranges of temperature include adjustment factors based on occupant activity (metabolic rate) and clothing factor.

For occupants of office spaces with a metabolic range of 0.8 to 1.2, the recommended comfort ranges for temperature and relative humidity are:

- **Winter**

Temperature - Dry Bulb: 67 to 76 °F at 64 °F Wet Bulb
(85 to 54 Percent Relative Humidity)
and
69 to 76 °F at 36 °F Dew Point
(30 to 23 Percent Relative Humidity)

- **Summer**

Temperature - Dry Bulb: 73 to 79 °F at 68 °F Wet Bulb
(78 to 58 Percent Relative Humidity)
and
74 to 87 °F at 36 °F Dew Point
(28 to 20 Percent Relative Humidity)

If space utilization or clothing factors change, then the temperature range will also change in accordance with:

$T_{\text{active}} = T_{\text{sedentary}} - 5.4 (1 + \text{Clo}) (\text{Met} - 1.2)$
Regardless of the metabolic rate calculation from above;
the minimum temperature permitted is 59 °F

ASHRAE Standard 62:2001, *Ventilation for Acceptable Indoor Air Quality*, recommends that, to avoid fungal amplification in building fabrics, relative humidity in occupied spaces should be maintained below 60 percent.

The measured indoor temperatures were found to be within the acceptable range. Most of the relative humidity readings were above the recommended 60% maximum level. This is likely due to the high humidity heat wave of the past couple of days.

2.2.2 Carbon Dioxide

On the day of the survey, TRC measured outdoor carbon dioxide concentrations between 402 to 532 parts per million (ppm). Indoor carbon dioxide concentrations ranged from between 394 to 545 ppm.

ASHRAE Standard 62:2001, *Ventilation for Acceptable Indoor Air Quality*, identifies indoor carbon dioxide concentrations as a surrogate determination of ventilation efficiency. For a building under normal occupancy load and operating in its normal conditioning, a comparison of indoor air and outdoor air carbon dioxide concentrations can be used to indicate relative ventilation efficiency for the occupied spaces. Provided the occupant density does not exceed the recommended levels in ASHRAE Standard 62:2001, when the peak indoor carbon dioxide concentration exceeds the outdoor concentration by more than 700 ppm, the ventilation rate for that space is inadequate for the occupant loading.

An indoor carbon dioxide concentration of 700 ppm above the outdoor concentration is not a significant risk to health; however, other bio-effluents from occupants and pollutants from building components may accumulate to irritant levels or result in discomfort for the occupants due to inadequate ventilation.

None of the indoor measurements collected on August 25, 2021, exceeded the recommended maximum 1,102 ppm (700+402), the calculated ASHRAE recommended indoor carbon dioxide concentration at the start of the survey.

2.2.3 Carbon Monoxide

Carbon monoxide is an odorless, colorless toxic gas produced by the incomplete combustion of solid, liquid, and gaseous fuels. Elevated indoor carbon monoxide concentrations may be a result of combustion sources indoors or the introduction of combustion products from outdoors into the indoor air. In the absence of indoor sources, indoor carbon monoxide concentrations are usually less than, or equal to outdoor concentrations. ASHRAE Standard 62-2001 recommends an upper limit for carbon monoxide of 9 ppm as a 24-hour average, and 35 ppm as a 1-hour average.

The indoor and outdoor carbon monoxide concentrations were less than 1ppm.

3.0 CONCLUSIONS AND RECOMMENDATIONS

TRC's conclusions and recommendations are based on its observations, including visual surveys, sample results and inspections presented in this report.

3.1 CONCLUSIONS

- A. Temperature readings were within normal ranges.
- B. Most of the relative humidity readings were above the recommended 60% maximum level. This is likely due to the high humidity heat wave during the past couple of days.
- C. The CO₂ and carbon monoxide levels were within the recommended limits. The direct read measurements are attached in Appendix A.
- D. No visible suspect mold or water staining was observed.

3.2 RECOMMENDATIONS

TRC presents the following recommendations to assist the WHRSD in improving indoor air quality:

- Make sure the unit ventilators and supplemental wall mounted air conditioners are in operation to maintain the temperature and humidity levels within the recommended ranges when school is in session.

TRC currently has no additional recommendations for improving indoor air quality. Should you have any questions or if things change within the building, please give us a call.



This report prepared by:

Gregory Hatch
BSI - Office Practice Leader



This report reviewed by:

Olivia Smaracko
BSI – Senior Industrial Hygienist

Date: October 18, 2021

APPENDIX A

DIRECT-READING ENVIRONMENTAL MEASUREMENTS

School Name: Hanson Middle School Date: 8/25/21
 111 Liberty Street, Hanson, MA

LOCATION	Time	Temp (°F)	CO (ppm)	CO ₂ (ppm)	RH (%)	Comments/ [Number of Occupants]
ACCEPTABLE LIMIT	a.m./p.m.	69 – 76	9	1,152	<60	
Outdoor	11:45 am	87.5	0	402	55.6	Sunny
	12:50 pm	84.9	0	532	61.7	Sunny
	2:52 pm	90.8	0	420	40.5	Sunny
	3:31 pm	87.3	0	408	40.8	Sunny
Room 205	11:57 am	74.6	0	545	58.3	0 (occupants)/Wall mounted AC on
	3:03 pm	76.7	0	467	56.1	0 (occupants)/Wall mounted AC on
Room 202	12:01 pm	75.0	0	493	73.4	0 (occupants)/Wall mounted AC on
	3:05 pm	68.4	0	441	67.1	0 (occupants)/Wall mounted AC on
Room 208	12:05 pm	75.0	0	431	75.7	0 (occupants)/Wall mounted AC on
	3:07 pm	71.7	0	398	61.8	0 (occupants)/Wall mounted AC on
Room 215	12:08 pm	75.9	0	466	77.3	0 (occupants)/Wall mounted AC on
	3:09 pm	73.8	0	409	74.4	0 (occupants)/Wall mounted AC on
Room 212	12:12 pm	72.2	0	426	75.2	0 (occupants)/Wall mounted AC on
	3:10 pm	72.1	0	394	61.6	0 (occupants)/Wall mounted AC on
Room 213	12:16 pm	74.4	0	502	74.4	0 (occupants)/Wall mounted AC on
	3:11 pm	71.6	0	403	62.5	0 (occupants)/Wall mounted AC on
Room 106	12:22 pm	74.8	0	434	74.7	0 (occupants)/Wall mounted AC on
	3:13 pm	73.5	0	432	77.7	0 (occupants)/Wall mounted AC on

Room 109	12:25 pm	73.6	0	449	73.4	0 (occupants)/Wall mounted AC on
	3:14 pm	73.3	0	442	73.2	0 (occupants)/Wall mounted AC on
Library	12:26 pm	72.7	0	533	69.4	0/Central air
	3:16 pm	72.6	0	436	67.0	0/Central air
Room 101	12:29 pm	72.7	0	483	83.9	0 (occupants)/Wall mounted AC on
	3:17 pm	72.4	0	395	78.5	0 (occupants)/Wall mounted AC on
Room 104	12:32 pm	72.4	0	437	80.5	0 (occupants)/Wall mounted AC on
	3:19 pm	73.1	0	402	80.4	0 (occupants)/Wall mounted AC on
Conference Room – Main Office	12:35 pm	74.4	0	426	74.9	0/Central air
	3:21 pm	73.8	0	409	75.8	0/Central air
Cafeteria	12:38 pm	76.0	0	438	75.4	0/Central air
	3:22 pm	75.5	0	461	77.1	0/Central air
Art Room 121	12:40 pm	74.8	0	494	71.9	0 (occupants)/Wall mounted AC on
	3:24 pm	75.5	0	408	72.0	0 (occupants)/Wall mounted AC on
Room 117	12:42 pm	74.6	0	421	68.4	0 (occupants)/Wall mounted AC on
	3:26 pm	77.3	0	410	58.4	0 (occupants)/Wall mounted AC on
Auditorium	12:45 pm	74.0	0	426	74.3	0 (occupants)/Wall mounted AC on
	3:28 pm	76.2	0	410	67.6	0 (occupants)/Wall mounted AC on
Gym	12:47 pm	76.3	0	422	76.2	3 (occupants)/Central air not on
	3:25 pm	78.1	0	510	78.2	20 (occupants)/Central air not on

APPENDIX B

IAQ MONITOR CALIBRATION REPORT



CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
 Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

ENVIRONMENT CONDITIONS			MODEL	7575-X
TEMPERATURE	71.52 (22.0)	°F (°C)	SERIAL NUMBER	7575X1421005
RELATIVE HUMIDITY	50.7	%RH		
BAROMETRIC PRESSURE	29.10 (985.4)	inHg (hPa)		

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

- CALIBRATION VERIFICATION RESULTS -

THERMO COUPLE				SYSTEM PRESSURE01-02				Unit: °F (°C)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	70.9 (21.6)	70.9 (21.6)	68.9~72.9 (20.5~22.7)					

BAROMETRIC PRESSURE				SYSTEM PRESSURE01-02				Unit: inHg (hPa)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	29.11 (985.8)	29.11 (985.8)	28.53~29.69 (966.1~1005.4)					

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

<u>Measurement Variable</u>	<u>System ID</u>	<u>Last Cal.</u>	<u>Cal. Due</u>		<u>Measurement Variable</u>	<u>System ID</u>	<u>Last Cal.</u>	<u>Cal. Due</u>
Temperature	E004626	02-14-20	02-28-21		Pressure	E005254	10-10-19	10-31-20
Pressure	E003982	07-21-20	01-31-21		DC Voltage	E003493	06-17-20	06-30-21

ChaoVang

CALIBRATED

July 31, 2020

DATE



CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
 Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

ENVIRONMENT CONDITIONS			MODEL	7575-X
TEMPERATURE	71.55 (22.0)	°F (°C)	SERIAL NUMBER	7575X1421005
RELATIVE HUMIDITY	50.5	%RH		
BAROMETRIC PRESSURE	29.11 (985.8)	inHg (hPa)		

<input type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input checked="" type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

- CALIBRATION VERIFICATION RESULTS -

THERMO COUPLE				SYSTEM PRESSURE01-02				Unit: °F (°C)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	70.8 (21.6)	70.6 (21.4)	68.8~72.8 (20.4~22.7)					

BAROMETRIC PRESSURE				SYSTEM PRESSURE01-02				Unit: inHg (hPa)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	29.12 (986.1)	29.08 (984.8)	28.54~29.70 (966.5~1005.8)					

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

<u>Measurement Variable</u>	<u>System ID</u>	<u>Last Cal.</u>	<u>Cal. Due</u>	<u>Measurement Variable</u>	<u>System ID</u>	<u>Last Cal.</u>	<u>Cal. Due</u>
Temperature	E004626	02-14-20	02-28-21	Pressure	E005254	10-10-19	10-31-20
Pressure	E003982	07-21-20	01-31-21	DC Voltage	E003493	06-17-20	06-30-21

ChaoVang

VERIFIED

July 31, 2020

DATE



CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
 Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 <http://www.tsi.com>

ENVIRONMENT CONDITIONS			MODEL	982
TEMPERATURE	71.50 (21.9)	°F (°C)	SERIAL NUMBER	P14180028
RELATIVE HUMIDITY	47.4	%RH		
BAROMETRIC PRESSURE	29.24 (990.2)	inHg (hPa)		

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

- CALIBRATION VERIFICATION RESULTS -

TEMPERATURE VERIFICATION				SYSTEM T-101				Unit: °F (°C)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	32.1 (0.0)	32.2 (0.1)	31.1~33.1 (-0.5~0.6)	2	140.0 (60.0)	140.0 (60.0)	139.0~141.0 (59.5~60.6)	

HUMIDITY VERIFICATION				SYSTEM H-102				Unit: %RH
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	10.0	8.9	7.8~12.2	4	70.0	69.7	67.8~72.2	
2	30.0	29.1	27.8~32.2	5	90.0	89.2	87.8~92.2	
3	50.0	49.7	47.8~52.2					

CO2 GAS VERIFICATION				SYSTEM G-101				Unit: ppm
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	0	0	0~50	4	3018	3030	2928~3109	
2	501	502	451~551	5	5031	5035	4880~5182	
3	1005	1019	955~1055					

CO GAS VERIFICATION				SYSTEM G-101				Unit: ppm
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	35	36	32~38	2	101	100	98~104	

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E010657	02-14-20	02-28-21	Temperature	E010658	02-14-20	02-28-21
Temperature	E010655	01-21-20	01-31-21	Humidity	E003539	02-26-20	08-31-20
5000 CO2	14a044096	04-06-20	04-06-28	200 CO	149801	03-24-20	03-24-28
N2	13B110153	04-27-20	04-27-28	Air	A79204	05-20-20	05-20-28
Flow	E003341	09-03-19	09-30-20	Flow	E003980	04-22-20	04-30-21
Flow	E003525	01-06-20	01-31-21	Flow	E003342	09-03-19	09-30-20
2000 C4H8	EB0054467	08-13-19	08-12-22	100 C4H8	CC507339	03-24-20	03-24-28

Baw yary

CALIBRATED

August 3, 2020

DATE

