



November 25, 2015

Lake Oswego School District
Brent Paul, Director of Facility Operations
PO Box 70
Lake Oswego, Oregon 97034

Re: Follow-Up IAQ Testing
River Grove Elementary School
5850 McEwan Road, Lake Oswego, Oregon 97035
PBS Project No. 21600.013 Phase 0004

Dear Mr. Paul:

On October 30, 2015, PBS Engineering and Environmental Inc. (PBS) performed formaldehyde air monitoring in Classroom D4 and carbon dioxide monitoring in Classroom D1. This testing was performed at the request of the District to provide follow-up data for testing originally performed on September 11, 2015. Below is a summary of our findings.

FINDINGS

Formaldehyde

PBS performed follow-up formaldehyde air monitoring in Classroom D4. A second sample was collected outdoors to gather outdoor background information. Samples were collected during school hours (approximately 10:00 am) with the building's HVAC system running under normal operating conditions. Samples were collected and analyzed in accordance with National Institute for Occupational Safety and Health (NIOSH) Method 2016. See Table 1 below for a summary of the sample results.

Table 1: NIOSH 2016 Formaldehyde Results

Sample Number	Sample Location	Result (ppm)
009	D Pod; Classroom D4	0.017
010	Outdoors; D Pod Area	0.0014

The below information was included in the original report and provided here again for reference purposes.

Currently, there are no generally agreed-upon standards for indoor formaldehyde concentrations. Various governmental agencies have established indoor limits or recommended thresholds. For your reference, Table 2 below summarizes the exposure limit thresholds by OSHA, the regulatory agency. Table 3 provides recommended limits by nonregulatory agencies.

Table 2: Formaldehyde Limits – Enforced

Agency	Exposure Limit
Occupational Safety and Health Administration (OSHA)	Permissible Exposure Limit = 0.75 ppm Short-Term Exposure Limit = 2.0 ppm

4412 SW Corbett Avenue, Portland, OR 97239
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Table 3: Formaldehyde Limits – Nonregulatory

Agency	Exposure Limit
American Conference of Governmental Industrial Hygienists (ACGIH)	Threshold Limit Value = 0.30 ppm
National Institute of Occupational Safety and Health (NIOSH)	Recommended Exposure Limit (REL) = 0.016 ppm
US Department of Housing and Urban Development (HUD)	Maximum Allowable Concentration = 0.30 ppm
World Health Organization (WHO)	Non-Occupational = 0.10 ppm for 30 minutes
State of California Office of Health Hazard Assessment (OHHEA)	Recommended Limit = 0.023 ppm (as low as reasonably achievable)

Ambient Background Levels

- Agency for Toxic Substances and Disease Registry (ATSDR) considers the ranges of background formaldehyde levels in outdoor air to be 0.0015–0.047 ppm in urban areas and 0.0002–0.006 ppm in rural and suburban areas.¹
- Consumer Product Safety Commission (CPSC) states background levels are typically “less than 0.03 ppm in both outdoor and indoor air.”

Classroom D4’s result fell below the OSHA’s permissible exposure limit, ACGIH’s threshold limit value, HUD’s maximum allowable indoor concentration, WHO’s indoor standard and State of California OHHEA recommended limit. The result barely exceeded the NIOSH REL by 0.001 ppm. Outdoor background levels fell within expected ranges as referenced above.

Ventilation Efficiency Monitoring

PBS utilized a Fluke Airmeter 975 to perform data log screening for carbon dioxide (CO₂), carbon monoxide (CO), relative humidity (RH), and temperature (°F) in Classroom D1. Testing was performed for a period of four days while school was in session. See Table 4 below for results. Also see attached time-plotted graphs for additional information.

Table 4: Ventilation Efficiency Monitoring Data Summary

	Temperature (°F)	RH (%)	CO (ppm)	CO ₂ (ppm)
Minimum	62.6	34.10	0	400
Maximum	73.4	53.90	0	1,297
Average	68.9	42.49	0	491

Carbon Dioxide (CO₂) – CO₂ levels did exceed the American Society of Heating, Refrigeration, and Air Conditioning Engineer (ASHRAE) recommended threshold of 1,095 ppm (700 ppm over outdoor level of 395 ppm) for a period of approximately 35 minutes early Tuesday morning (11/03/15) with a peak level of 1,297 ppm. CO₂ levels remained below the threshold for the remainder of the monitoring period. Please refer to the attached time-plotted graph for further details.

¹ Department of Health and Human Services, Public Health Service Agency for Toxic Substances and Disease Registry. (2008). Public health statement: Formaldehyde. Atlanta, GA: ATSDR, CAS #50-00-0. Available at <http://www.atsdr.cdc.gov/phs/phs.asp?id=218&tid=39>.

Carbon Monoxide (CO) – The carbon monoxide levels were not a concern during this monitoring event as they were not detected during this monitoring event.

Relative Humidity (RH) – RH levels fell within ASHRAE's recommended range of 30 to 60 percent.

Temperature – The average temperature over this monitoring period fell within ASHRAE's recommended range of 68°F to 82°F. Generally speaking, temperature readings during school hours fell within the recommended range with the exception of a few periods where readings dipped below the lower limit of 68°F.

CONCLUSIONS

- Classroom D4 – Follow-up formaldehyde testing in classroom D4 had a result of 0.017 ppm. This result appears to be consistent with the results from other D Pod classrooms. This sample result is below the above-referenced regulatory agency (OSHA) threshold limit. This result was also below all of the other nonregulatory limits with the exception of the NIOSH REL where it exceeded it by 0.001 ppm. Outdoor background levels came in at 0.0014 ppm. As stated in the original report, formaldehyde levels are expected to decrease over time. To demonstrate this trend, PBS recommends the District perform periodic monitoring in representative classrooms to assure levels remain at or below the current levels.
- Classroom D1 – On November 3, carbon dioxide levels did exceed ASHRAE's upper threshold for a period of 35 minutes (07:44 am–08:19 am). PBS does not have any information on whether or not the HVAC system was running at the time of this event. Given the location of the device (on the teacher's desk), the spike may be attributed to an individual working at the desk during this period. It may also be attributed to an increase in room occupancy. PBS recommends the District look into the classroom occupancy during this elevated period. If it is determined that the cause was an increase in occupancy, the district should review the system settings to make sure it is providing enough fresh air during periods of high occupancy.

The average temperature over the entire monitoring period fell within the ASHRAE recommended range. However, there were periods where it fell slightly below the lower limit of 68°F. Temperature levels did not appear to be of a concern during this monitoring event. That said, PBS recommends having the thermostat settings checked in all D Pod classrooms to make sure they are set properly.

Carbon monoxide and relative humidity readings both fell within their acceptable ranges.

LIMITATION OF SCOPE

This study is limited to the tests and locations indicated in the above scope of work. The site as a whole may have other concerns that will not be characterized by this study. Further study may be recommended. The findings and conclusions of this work are not scientific certainties but, rather, are probabilities based on professional judgment concerning the significance of the data gathered during the course of this investigation. PBS is not able to represent conditions on the site beyond those conditions detected or observed by PBS.

Feel free to contact me if you have any questions regarding these results. My direct line is 503.417.7607.

Sincerely,
PBS Engineering and Environmental Inc.

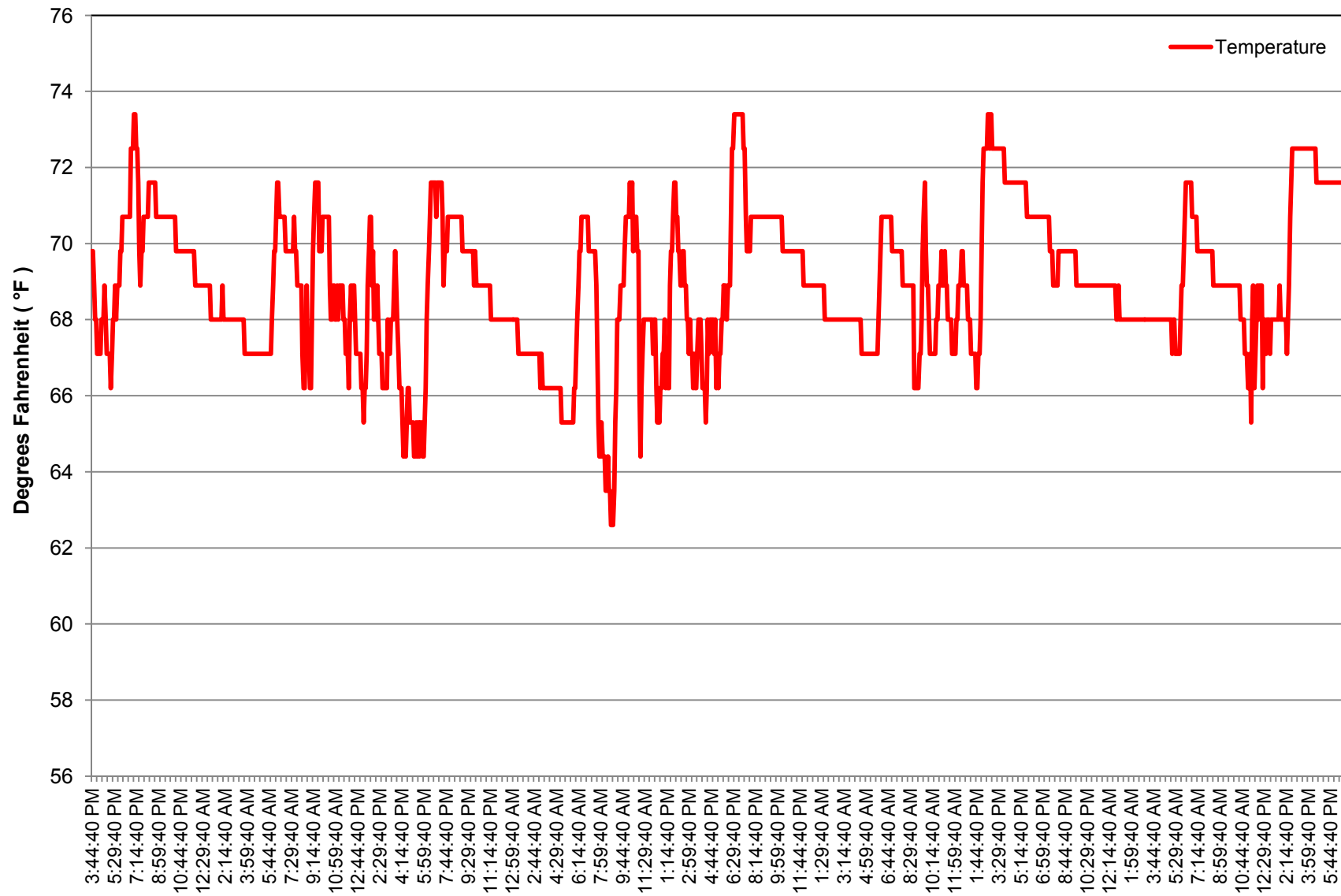


Bob Kleckner
Sr. Project Manager

Attachments: ALS Global Analytical Report
Fluke Meter Ventilation Monitoring Graphs

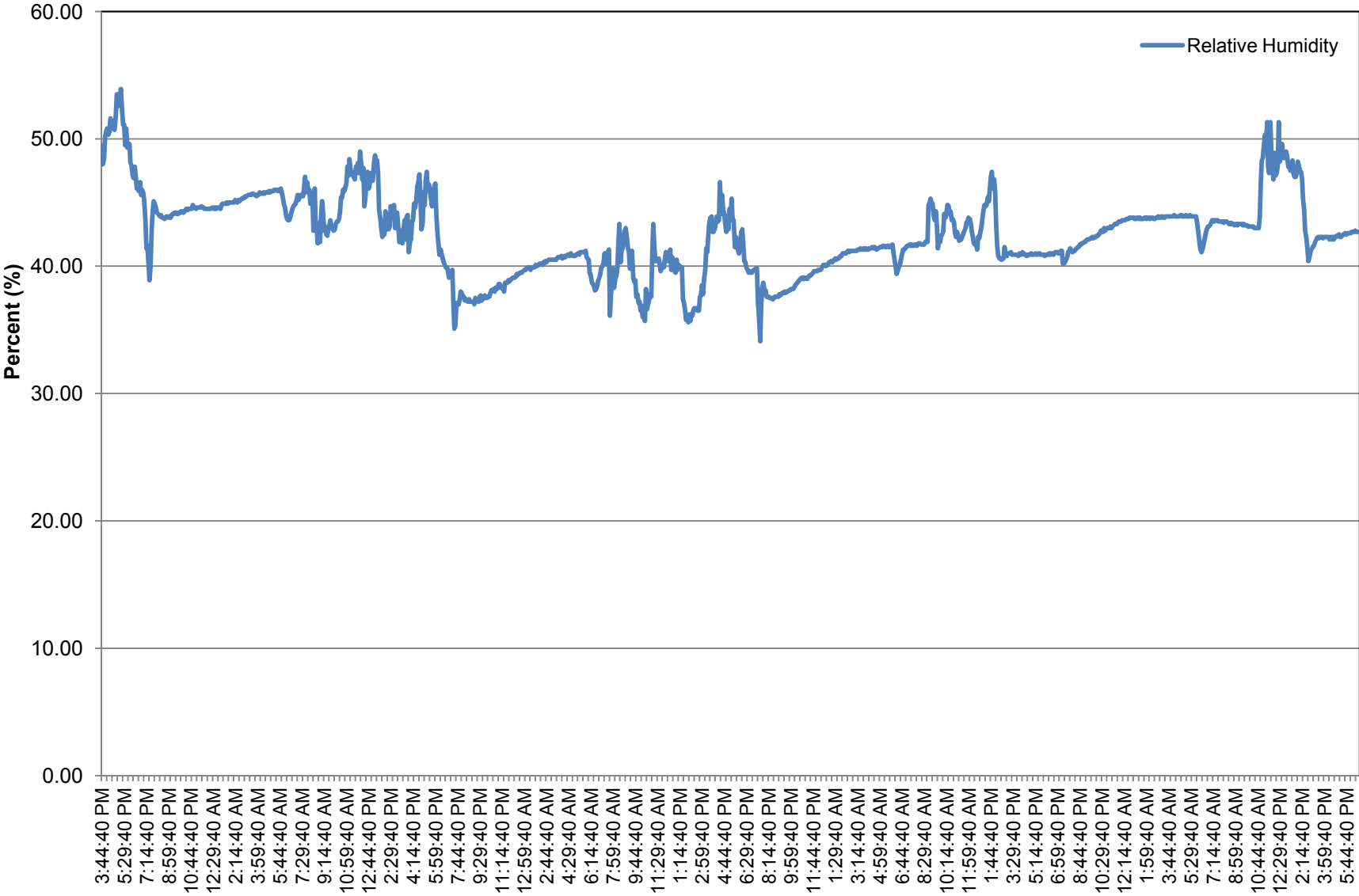
BK:DM:ln

River Grove Elementary
D Pod Classroom D1



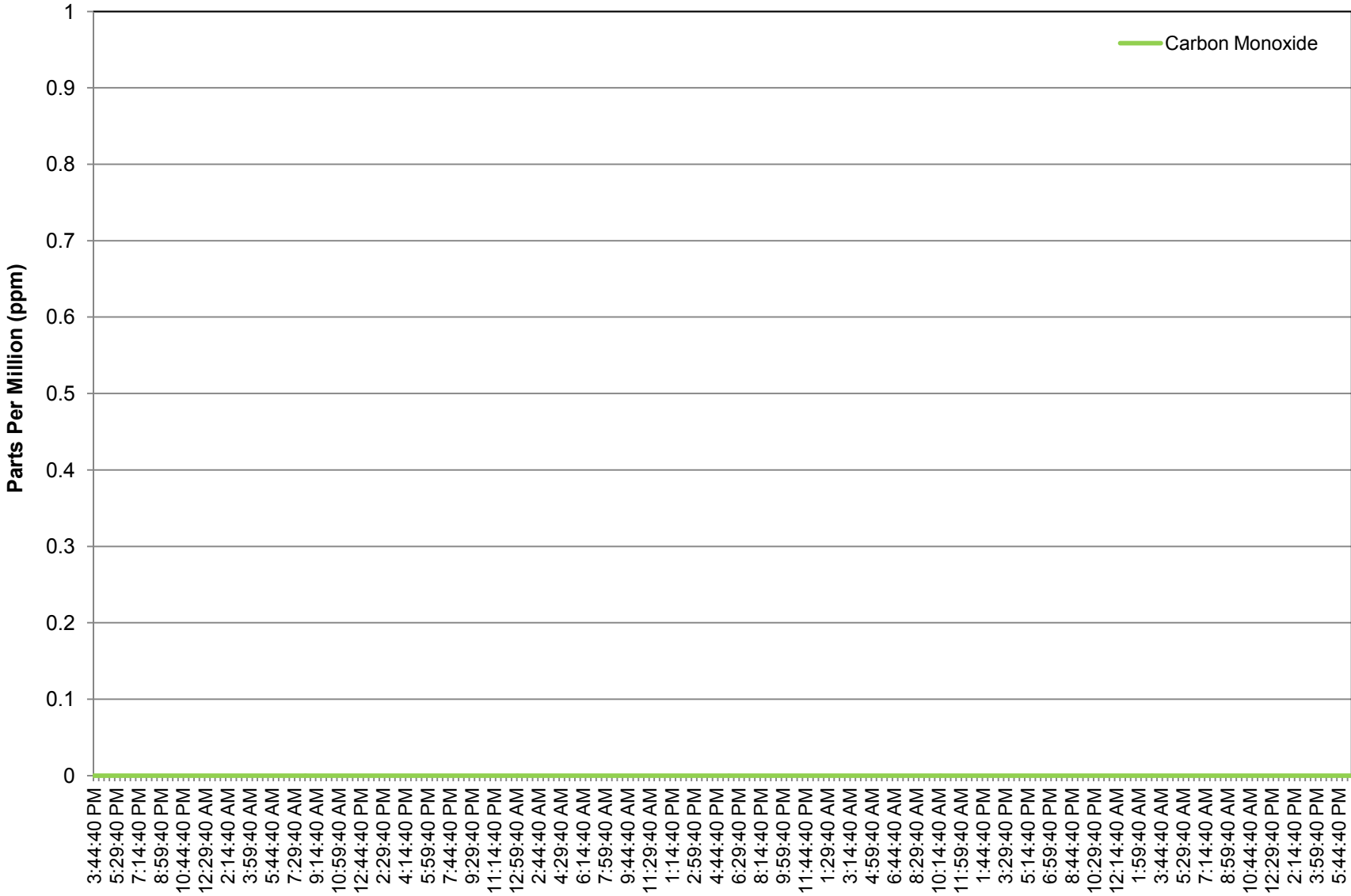
11/2/15 - 11/6/15

River Grove Elementary
D Pod Classroom D1



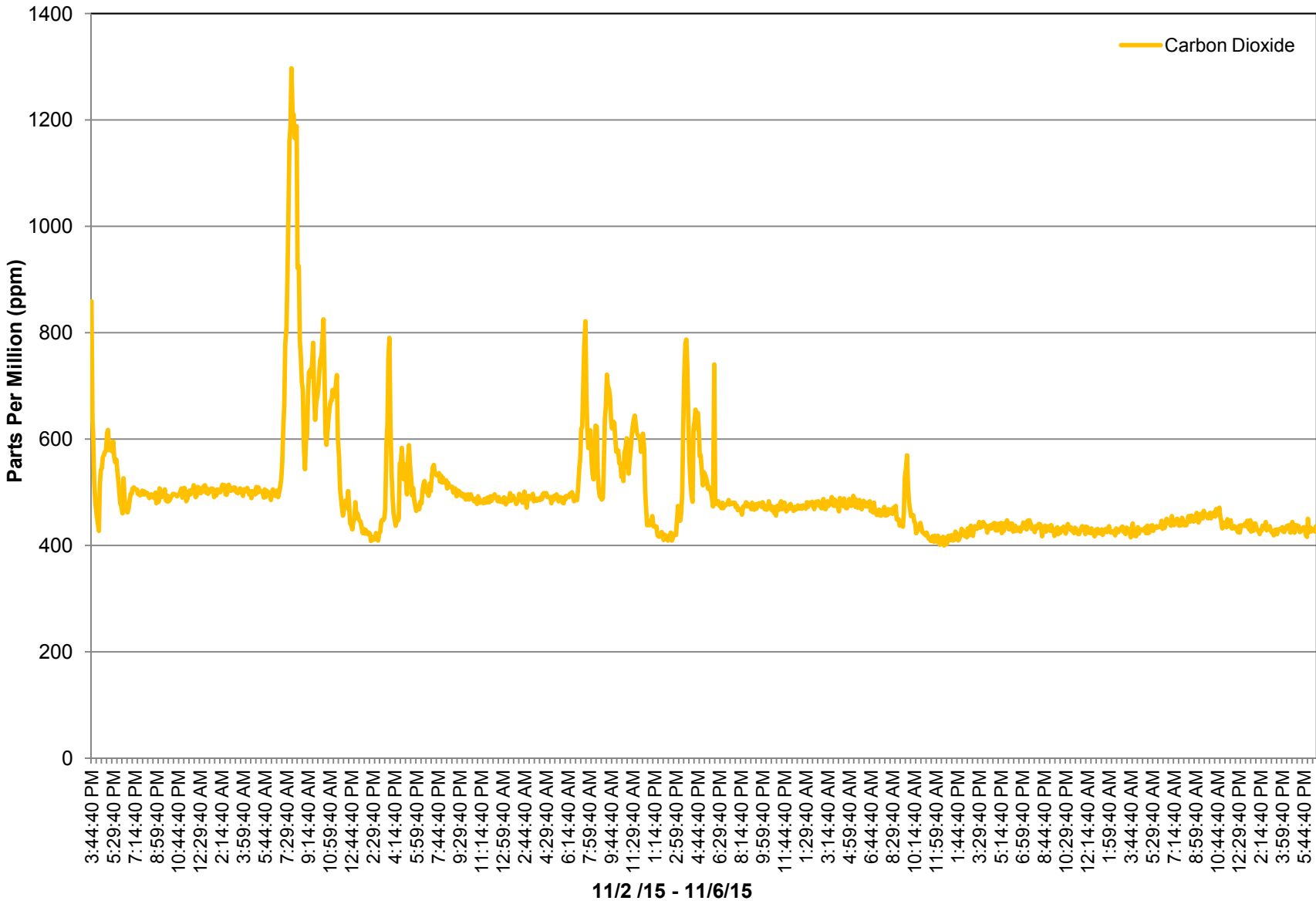
11/2/15 - 11/6/15

River Grove Elementary
D Pod Classroom D1



11/2/15 - 11/6/15

River Grove Elementary
D Pod Classroom D1





ANALYTICAL REPORT

Report Date: November 06, 2015

Bob Kleckner
PBS Environmental
4412 SW Corbett Ave.
Portland, OR 97239

Phone: (503) 248-1939
Fax: (503) 248-0223
E-mail: bob@pbsenv.com

Workorder: **34-1530724**

Client Project ID: River Grove Elementary
Purchase Order: 21600.013 Phase 0004
Project Manager: Stella Hanis

Analytical Results

Sample ID: 009		Collected: 10/30/2015		
Lab ID: 1530724001		Sampling Location: River Grove Elementa		Received: 11/03/2015
Method: NIOSH 2016		Media: SKC 226-119, Silica Gel (2,4-Dinitrophenylhydrazine)		Analyzed: 11/05/2015
Sampling Parameter: Air Volume 30 L				
Analyte	Result (ug/sample)	Result (mg/m³)	Result (ppm)	RL (ug/sample)
Formaldehyde	0.61	0.020	0.017	0.050

Sample ID: 010		Collected: 10/30/2015		
Lab ID: 1530724002		Sampling Location: River Grove Elementa		Received: 11/03/2015
Method: NIOSH 2016		Media: SKC 226-119, Silica Gel (2,4-Dinitrophenylhydrazine)		Analyzed: 11/05/2015
Sampling Parameter: Air Volume 30 L				
Analyte	Result (ug/sample)	Result (mg/m³)	Result (ppm)	RL (ug/sample)
Formaldehyde	0.050	0.0017	0.0014	0.050

Report Authorization (/S/ is an electronic signature that complies with 21 CFR Part 11)

Method	Analyst	Peer Review
NIOSH 2016	/S/ Lyle Edwards 11/06/2015 12:08	/S/ Christopher Winter 11/06/2015 12:48

Laboratory Contact Information

ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

Phone: (801) 266-7700
Email: als@alsglobal.com
Web: www.alsslc.com

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ANALYTICAL REPORT

Workorder: **34-1530724**

Client Project ID: River Grove Elementary

Purchase Order: 21600.013 Phase 0004

Project Manager: Stella Hanis

General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

Testing Sector	Accreditation Body (Standard)	Certificate Number	Website
Environmental	ACCLASS (DoD ELAP)	ADE-1420	http://www.aiclasscorp.com
	Utah (NELAC)	DATA1	http://health.utah.gov/lab/labimp/
	Nevada	UT00009	http://ndep.nv.gov/bsdwlabservice.htm
	Oklahoma	UT00009	http://www.deq.state.ok.us/CSDnew/
	Iowa	IA# 376	http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx
	Florida (TNI)	E871067	http://www.dep.state.fl.us/labs/bars/sas/qa/
	Texas (TNI)	T104704456-11-1	http://www.tceq.texas.gov/field/qa/lab_accred_certif.html
Industrial Hygiene	AIHA (ISO 17025 & AIHA IHLAP/ELLAP)	101574	http://www.aihaaccreditedlabs.org
Lead Testing:			
CPSC	ACCLASS (ISO 17025, CPSC)	ADE-1420	http://www.aiclasscorp.com
Soil, Dust, Paint ,Air	AIHA (ISO 17025, AIHA ELLAP and NLLAP)	101574	http://www.aihaaccreditedlabs.org
Dietary Supplements	ACCLASS (ISO 17025)	ADE-1420	http://www.aiclasscorp.com

Definitions

LOD = Limit of Detection = MDL = Method Detection Limit, A statistical estimate of method/media/instrument sensitivity.

LOQ = Limit of Quantitation = RL = Reporting Limit, A verified value of method/media/instrument sensitivity.

ND = Not Detected, Testing result not detected above the LOD or LOQ.

NA = Not Applicable.

** No result could be reported, see sample comments for details.

< This testing result is less than the numerical value.

() This testing result is between the LOD and LOQ and has higher analytical uncertainty than values at or above the LOQ.



Sample Receipt Notification

Workorder Information

Workorder: 34-1530724

Client: PBS Environmental

Contract/PO: 21600.013 Phase 0004

COC No.: Not Provided

Collector: Not Provided

Airbill: Not Provided

Reporting Level 1

Manager: Stella Hanis

Stella.Hanis@ALSGlobal.com

Project: River Grove Elementary

Profile: B Kleckner

Format: Report < LOQ

Program: NA

Due: 11/10/15
Received: 11/03/15
TAT: 5 work days
from receipt

Sample Condition at Receipt

Temperature(s)	Expired at Receipt	Notes
NA	NO	Sample(s) received in good condition unless otherwise noted.

Report Delivery Information

-- Analytical Report Address --

Bob Kleckner
PBS Environmental
4412 SW Corbett Ave.
Portland, OR 97239

Email Delivery: bob@pbsenv.com
Stella.Hanis@ALSGlobal.com

EDD Requested: EDD001<[Standard]][NOQC]>

Invoice Delivery Information

-- Invoice Address --

Accounts Payable
PBS Environmental
4412 SW Corbett Ave.
Portland, OR 97239

Email Delivery: accounts payable@PBSenv.com
bob@pbsenv.com
Stella.Hanis@ALSGlobal.com

Laboratory Contact Information

-- Laboratory Address --

ALS Environmental
960 W. LeVoy Drive
Salt Lake City, UT 84123

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Sample Receipt Notification

Workorder: 34-1530724

Sample Information

Sample(s)								Containers	
Client Sample ID	Lab Samp. ID	QC	Matrix	Sampling Site	Collected	Received	Tests	#	Parameter
009	1530724001	N	Air	River Grove Elementa	10/30/15	11/03/15	1	1	30 L
010	1530724002	N	Air	River Grove Elementa	10/30/15	11/03/15	1	1	30 L

Sample Preservation

Container	Preservative	Temperature	pH	Tests
226-119	COOL	NA	NA	NIOSH 2016



Sample Receipt Notification

Workorder: 34-1530724

Analysis Information

				Requested Analysis											
				NIOSH 2016											
Client Sample ID	Lab Samp. ID	QC	Matrix												
009	1530724001		Air	X											
010	1530724002		Air	X											

Test(s)				Units			
Method	Samples	Matrix	Container	Primary	Det. Lim.	Additional	Additional
NIOSH 2016	2	Air	226-119	ug/sample	ug/sample	mg/m ³	ppm
Analyte(s): Formaldehyde							

ANALYTICAL REQUEST FORM

1530724



1. ☒ REGULAR Status

☐ RUSH Status Requested - ADDITIONAL CHARGE
RESULTS REQUIRED BY _____
DATE _____

CONTACT ALS DATACHEM PRIOR TO SENDING SAMPLES

2. Date 11/2/15 Purchase Order No. 21600.013 Phase 0004

4. Quote No. _____

3. Company Name PBS Engineering and Environmental

ALS Project Manager = Stella Hanis

Address 4412 SW Corbett Avenue

5. Sample Collection

Portland, Oregon 97239

Sampling Site River Grove Elementary

Person to Contact Bob Kleckner

Industrial Process Classroom D4

Telephone (503) 248-1939

Date of Collection 10/30/15

Fax Telephone () _____

Time Collected 10:00am

E-mail Address bob@pbsenv.com

Date of Shipment 11/2/15

Billing Address (if different from above)

Chain of Custody No. 21600.013 Phase 0004

Same

6. REQUEST FOR ANALYSES

Laboratory Use Only	Client Sample Number	Matrix*	Sample Volume	ANALYSES REQUESTED - Use method number if known	Units**
	009	226-119	30 L	NIOSH 2016 Mod	ppm
	010	226-119	30 L	NIOSH 2016 Mod	ppm

* Specify: Solid sorbent tube, e.g. Charcoal; Filter type; Impinger solution; Bulk sample; Blood; Urine; Tissue; Soil; Water; Other

** 1. mg/sample 2. mg/m³ 3. ppm 4. % 5. _____ (other) Please indicate one or more units in the column entitled Units**

Comments _____

Possible Contamination and/or Chemical Hazards _____

Relinquished by Bob Kleckner Date/Time 11/2/15 14:00

Received by [Signature] Date/Time 11/03/15 10:25

Relinquished by _____ Date/Time _____

Received by _____ Date/Time _____

Relinquished by _____ Date/Time _____

Received by _____ Date/Time _____

960 West LeVoy Drive, Salt Lake City, UT 84123

800-280-8071 or 800-356-9135 / FAX: 775-213-8852

ALS Environmental



Engineering +
Environmental

LABORATORY TRANSMITTAL AND CHAIN OF CUSTODY

Project No.: 21600.013 Phase No.: 0004 Task No.: _____

Project Site/Location: RIVER GROVE ELEMENTARY

Individuals signing this form warrant that the information provided is correct and complete. The Sender should keep a copy and send the original. The Receiver should complete the form, keep a copy and return the original to the Sender. Receiver shall report damage of package immediately to Sender.

SENDER

Date Sent: 11/2/15

PBS Engineering + Environmental
4412 SW Corbett Avenue
Portland, Oregon 97239
503.248.1939 Fax: 503.248.0223

BOB KLECKNER

Name

Authorized Signature

Date

RECEIVER (lab use only)

Date Received: _____

Company: _____

Address: _____

Phone: _____

Receiver Name

Authorized Signature

Date

Email Results To: _____

Verbal Results To: _____ Phone: _____

Sample No.	Sample Type & Description (asb. /lead, bulk/air, vol. /area, etc.)	Analysis Requested
- 009	FORMALDEHYDE AIR ; CLASSROOM D4	NIOSH 2010 MOD
- 010	FORMALDEHYDE AIR ; OUTSIDE CLASSROOM D4	NIOSH 2010 MOD
-		
-		
-		
-		
-		
-		
-		
-		
-		
-		
-		

TURNAROUND DESIRED: NORMAL

SPECIAL INSTRUCTIONS:

Please email the results to the above Sender. Please archive any remaining sample components for a minimum of thirty days after analysis date.