

INDUSTRIAL HYGIENE ASSESSMENT

Wall Township Board of Education
1620 18th Avenue
Wall Township, New Jersey 07719

September 8, 2020
Partner Project Number: 20-286459.2

Prepared for:
Wall Township Board of Education
Wall, New Jersey



September 8, 2020

Mr. Nicholas Moretta
Facilities Manager
Wall Township Board of Education
1620 18th Avenue
Wall Township, NJ 07719

Sent Via Email: nmoretta@wall.k12.nj.us

Subject: Mercury Investigation Services
Wall Township Board of Education
1620 18th Avenue
Wall, NJ 07719
Partner Project No. 20-283593.2

Dear Mr. Moretta:

Partner Engineering and Science, Inc. (Partner) is pleased to provide the findings of the Industrial Hygiene Assessment conducted at the above-referenced facility.

This survey included a site reconnaissance, sampling, and laboratory analysis. This assessment was performed utilizing methods and procedures consistent with good commercial or customary practices designed to conform to acceptable industry standards. The independent conclusions presented herein are based upon existing conditions and the information and data available to us during this assignment.

We appreciate the opportunity to provide these services to Wall Township Board of Education. If you have any questions concerning this report, or if we can assist you in any other matter, please contact me at 908-497-8904.

Sincerely,

Partner Engineering and Science, Inc.



Brian Nemetz, CMC

Technical Director, Principal – Industrial Hygiene Services, Health & Safety Services

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EXECUTIVE SUMMARY

Partner Engineering and Science, Incorporated (Partner) was retained by Wall Board of Education to perform an Industrial Hygiene Assessment (IHA) at Wall High School located at 1620 18th Avenue in Wall Township, NJ on August 18, 2020. The IHA was performed in general conformance with the scope of work outlined in Partner's proposal dated August 3, 2020. The objective of the study was to investigate the presence of mercury vapor in the South Gym. A previous investigation performed by Partner on July 21, 2020 revealed area samples collected in the South Gym and surrounding areas contained no detectable mercury vapor. The Client requested Partner return to Wall High School to collect additional air samples with the heating and ventilation units in the South Gym turned off for 24-hours prior to the sampling event and for the duration of the sampling. Partner also collected direct-read measurements with a Lumex RA-915+ Mercury Vapor Analyzer.

Results were evaluated against the relevant Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) and the maximum contaminant level outlined by the New Jersey Department of Health (NJDOH) guidance document titled "*Evaluation and Management of Mercury-Containing Floors in New Jersey Schools: Guidance for School Districts and their Environmental Consultants*". PELs are legal exposure standards developed by OSHA.

The analytical results for area air samples collected during this assessment measured below the analytical detection limit for the method used and consequently were below the OSHA PEL and NJDOH guidance maximum contaminant level for mercury. Direct-read measurement of mercury vapor also revealed results below both the OSHA PEL and NJDOH guidance maximum contaminant level. Based on this data, Partner has no further recommendations with respect to the presence of Mercury vapor. Additional assessment activities should be conducted according to local, state and federal regulations and guidelines

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

Partner Engineering and Science, Inc. (Partner) performed an Industrial Hygiene Assessment (IHA) for Wall Board of Education (BOE) in general conformance with the scope of work outlined in Partner's proposal dated August 3, 2020. The IHA was completed at Wall High School on August 18, 2020. Dan Bracey, Project Manager, with Partner completed the IHA. Nicholas Moretta of Wall BOE was Partner's primary contact at the facility during the assessment.

1.2 BACKGROUND

Partner conducted an initial Mercury investigation on May 18, 2020, which included bulk sampling of the rubber-polyurethane floor in the South Gym (refer to Partner's Mercury Investigation report dated May 28, 2020). Mercury was detected at each bulk sample location. Based upon these results, Partner recommended collecting a representative number of full-day, breathing zone air samples in the South Gym for analysis by an accredited laboratory using NIOSH Method 6009.

June 3, 2020 Sampling Event

On June 3, 2020 Partner collected air samples within the affected building areas for mercury analysis. Air sampling was conducted in the designated areas, including the High School south gym. The air samples were analyzed using NIOSH method 6009: Mercury. Direct-read measurements for mercury were also collected during the air sampling event utilizing a J505 Mercury Vapor Analyzer. Based upon the results of the air sampling, Partner determined that mercury vapor was not detected above the laboratories minimum detection limit (MDL) in any of the samples and the direct-read measurements revealed mercury vapor measurements between $0 \mu\text{g}/\text{m}^3$ and $0.06 \mu\text{g}/\text{m}^3$, which is below the NJDOH maximum contaminant level (refer to Partners June 18, 2020 Industrial Hygiene Assessment report for additional information).

June 5, 2020 Sampling Event

Following the air sampling event, the Client requested Partner collect additional bulk samples of the polyurethane floors in the south gym. Partner returned to the High School on June 5, 2020 and collected three (3) additional bulk samples of the floor for analysis. The bulk samples revealed elevated concentrations of mercury within the rubber-like floors in the South Gym.

June 30, 2020 Sampling Event

On June 30, 2020 Partner collected five (5) bulk samples of the concrete slab from the gymnasium at Wall High School. The bulk samples were then split into two (2) samples per core (i.e., top 2 inches and bottom 2 inches) to determine mercury concentrations throughout the depth of the slab. Additionally, Partner collected four (4) soil samples from below the concrete slab. The

sample results revealed the underlying soils did not contain mercury concentrations that exceeded New Jersey Department of Environmental Protection (NJDEP) Soil Remediation Standards (SRS). The concrete sampling results revealed de minimis concentrations of mercury, with the exception of sample WHS630-2, which revealed a slightly elevated mercury concentration when compared the NJDEP SRS for mercury. Bulk samples of the concrete slab were collected to determine the absence or presence of mercury and soil samples were analyzed utilizing EPA method 7471B. Results of the concrete and soil sampling revealed de minimis concentration of mercury in both the soil and concrete, with slightly elevated concentrations of mercury in one concrete sample collected from the southeast corner of the gym (refer to Partner's July 16, 2020 Mercury Investigation report for additional information).

July 21, 2020 Sampling Event

On July 21, 2020 Partner collected air samples within the affected building areas for mercury analysis. Air sampling was conducted in the designated areas, including the High School south gym. The air samples were analyzed using NIOSH method 6009: Mercury. Direct-read measurements for mercury were also collected during the air sampling event utilizing a Lumex RA915+ Mercury Vapor Analyzer. Based upon the results of the air sampling, Partner determined that mercury vapor was not detected above the laboratories minimum detection limit (MDL) in any of the samples and the direct-read measurements revealed mercury vapor measurements between 0.002 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and .045 $\mu\text{g}/\text{m}^3$, which is below the NJDOH maximum contaminant level. Direct-read samples were also collected from the floor-level at two of the concrete sample locations, which were not yet repaired. The direct-read sample results in these areas ranged from 0.617 $\mu\text{g}/\text{m}^3$ to 0.621 $\mu\text{g}/\text{m}^3$; however, these elevated levels dissipated at the breathing zone height in these areas to the background levels above (refer to Partners August 4, 2020 Industrial Hygiene Assessment report for additional information).

1.3 LIMITING CONDITIONS

This study utilized the sample collection procedure identified within the NJDOH guidance document, which recommends the ventilation within the room operate at the usual capacity. The exhaust fans and air handling units, which are combination heating and fresh air intakes, within the south gym were turned off 24 hours prior to the sampling event and remained off during the duration of the sampling at the request of Wall Township BOE. No dedicated air conditioning units were located within the gym. Temperatures within the gym at the time of the study ranged from 77.4°F to 79.8°F. The outside temperature was approximately 78°F and relative humidity was approximately 59.4%. No obvious limiting conditions were identified during the mercury vapor study, with the exception of the auxiliary gym being recently waxed. Due to the wet wax, a sample could not be safely collected from this area; however, samples had previously been collected from this area, with no analytical results for mercury vapor exceeding the laboratories method limit for detection.

2.0 METHODOLOGY

2.1 AIR SAMPLES

Mercury Vapor Sampling

Area air monitoring was conducted to evaluate the presence of mercury vapors in the South Gym. The air samples were collected using Buck Libra Plus LP-5 personal air sampling pumps. During sampling, tygon tubing was run from the sampling pump to the sampling media. The sampling media was clipped to a camera stand set between approximately 4 and 4.5 feet, i.e. the typical “breathing zone.” Air was then drawn through the sampling media at a known flow rate. Samples collected in this manner are industry standard to represent possible exposure.

The specific sampling protocol, media used, and air flow through the media is identified in the table below.

Chemical Agent	Sampling and Analytical Method	Sampling Media*	Air Flow
Metal Fumes	NIOSH 6009	7 cm long solid charcoal sorbent tube	0.20 liters per minute (lpm)

The air flow rate through the sampling media was field calibrated prior to and after the sampling period using a BIOS Defender 510-L. The air flow meter was calibrated against a National Institute of Standards and Technology (NIST) standard. A copy of the calibration certificate is contained in Appendix D.

Direct-Read Measurements

A Lumex RA-915+ Mercury Vapor Analyzer was utilized to measure mercury vapors in the South Gym and surrounding areas during the mercury vapor sampling event. The mercury vapor analyzer was factory-calibrated in accordance with manufacturer requirements prior to the assessment (refer to Appendix D). Measurements were repeated two times throughout the day to account for temperature variations. The measurements were collected from between approximately 4 and 4.5 feet, i.e. the typical “breathing zone.” Additional measurements were collected from the former concrete sampling locations, which were not yet fully repaired at the time of the sampling event to determine if mercury is vaporizing from these damaged floor areas. The Lumex sampling device was held at ground floor level to collect these measurements

3.0 STANDARDS & GUIDELINES

3.1 AIR SAMPLES

Federal

OSHA has established federal regulations for employee exposures to air contaminants that are published in Title 29, Code of Federal Regulations (CFR), Part 1910.1000. These standards set permissible exposure limits (PELs), most often as 8-hour time-weighted averages (TWAs), for a variety of chemical hazards. OSHA has also adopted action levels for some regulated chemical and physical hazards. If the action levels are exceeded, the employer must institute specific programs to control exposures and to protect workers.

For a limited number of chemicals, OSHA has promulgated standards, called short-term exposure limits (STELs) that allow employee exposures above the TWA for a defined period of time, usually 15 minutes. OSHA has also promulgated standards for some substances, called ceiling limits. The maximum peak exposures that OSHA has established for these chemicals, designated by a "C" preceding the concentration, must not be exceeded at any time during the work shift.

It is the goal of the sampling plan to collect an 8-hour sample. In this sampling event an 8-hour sample was not possible. As such, Partner assumed uniform exposure as a worst-case scenario for the un-sampled time period when calculating the 8-hour TWA. Samples were collected for over 7 hours.

When attempting to establish compliance with a promulgated standard such as a PEL, the air samples are traditionally collected on workers to collect personal air samples. In this case as there is no practical way to collect personal air samples without a significant disruption to the school's operation, Partner opted to collect area air samples within the normal breathing range. These measurements are considered screening samples by OSHA and cannot be directly compared to PELs for regulatory compliance.

The OSHA PEL for mercury is a ceiling limit of 0.1 milligrams per cubic meter of air (mg/m^3), which is currently enforced as an 8-hour time-weighted average. Other organizations suggest lower exposure levels. The National Institute for Occupational Safety and Health (NIOSH) recommends that exposures to mercury metal be limited to an average of $0.05 \text{ mg}/\text{m}^3$ over a 10-hour workday, in addition to a ceiling limit of $0.1 \text{ mg}/\text{m}^3$. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that metallic mercury exposures be limited to an average of $0.025 \text{ mg}/\text{m}^3$ over an 8-hour workday. Whereas as the OSHA standard is enforceable, the NIOSH and ACGIH values are recommendations.

New Jersey

As per the NJDOH guidance document titled "*Evaluation and Management of Mercury-Containing Floors in New Jersey Schools: Guidance for School Districts and their Environmental Consultants*", exposure limits such as those by OSHA should not apply to school exposures as they apply to workers and more protective limits are necessary because children are being exposed. The guidance suggests using a guidance maximum contaminant level of $0.8 \mu\text{g}/\text{m}^3$ (i.e., $0.0008 \text{ mg}/\text{m}^3$) for long term repeated 8-hour exposures for up to 180-days. Any detectable concentration of mercury vapor in the gym below this level would also require additional quarterly air sampling to determine if seasonal changes effect the mercury vapor concentration in the gym.

The guidance document "*Evaluation and Management of Mercury-Containing Floors in New Jersey Schools: Guidance for School Districts and their Environmental Consultants*" can be found in the Appendix E of this report.

4.0 RESULTS

4.1 AIR SAMPLES

Five area samples for mercury vapor were collected, three (3) samples located within the south gym, one (1) sample located in the locker room hallway (located adjacent to the south gym and auxiliary gym) and one (1) sample located within classroom E-12.

The air samples collected are compared to the applicable PELs and the NJDOH guidance maximum contaminant level in the Tables of Appendix A. At the time of the study, the gym was vacant, and the area samples represented the worst possible condition for exposure (i.e., exposure over a full day).

The samples collected indicate that the mercury vapors monitored were below the applicable PELs, NIOSH and ACGIH recommended limits, as well as the NJDOH guidance maximum contaminant level. The analytical results indicated concentrations of elemental mercury below the analytical method limit of detection. Refer to Appendix A for the laboratory results, Appendix B for a sample location map, and Appendix C for photographs of sampling locations.

Direct-Read Measurements

Direct-read measurements from six locations in the gym and surrounding areas were screened for mercury vapors utilizing a Lumex RA-915+ Mercury Vapor Analyzer. The measurements yielded the following information:

Measurement Location	Time	Result ($\mu\text{g}/\text{m}^3$)	NJDOH Maximum Contaminant Level ($\mu\text{g}/\text{m}^3$)
South Gym – Center	1020	0.017	0.8
South Gym – West	1021	0.017	0.8
South Gym – East	1022	0.017	0.8
Locker Room Hallway	1023	0.015	0.8
Classroom E-12	1025	0.017	0.8
South Hallway	1028	0.023	0.8
Cafeteria	1029	0.023	0.8
South Gym – Center	1427	0.020	0.8
South Gym – West	1428	0.018	0.8
South Gym – East	1430	0.017	0.8
Locker Room Hallway	1435	0.013	0.8
Classroom E-12	1440	0.019	0.8
South Hallway	1444	0.015	0.8
Cafeteria	1445	0.014	0.8
South Gym – Southeast Concrete Sample Location (floor-level)	1448	0.167	0.8
South Gym – Center Concrete Sample Location (floor-level)	1450	0.027	0.8

$\text{ng}/\text{m}^3 = \text{nanograms per cubic meter}$

The direct-read measurements collected are compared to the applicable NJDOH guidance maximum contaminant level. The measurements collected indicate that the mercury vapors monitored were below the NJDOH guidance maximum contaminant level. The two concrete

sample located measurements were collected at floor level from two penetrations in the South Gym floor, which would represent a worst-case scenario measurement of mercury vapor due to the floor being damaged. Typical breathing zone level measurements were also collected in these areas, which are provided above. Per the NJDOH Guidance document, quarterly air sampling is recommended to account for seasonal variations.

5.0 RECOMMENDATIONS

Mercury vapor can be managed by ventilation and temperature control according to local, state and federal regulations. The gym is equipped with six (6) air handling units, as well as two (2) exhaust fans in the ceiling, which were off at the time of the sampling event. In accordance with the NJDOH guidance document "*Evaluation and Management of Mercury-Containing Floors in New Jersey Schools: Guidance for School Districts and their Environmental Consultants*". Partner recommends the following to ensure mercury vapors are properly controlled:

- Continue to use the gym under ventilation system conditions similar to the previous sampling events (i.e., July 21, 2020 sampling event).
- Perform quarterly, seasonal air sampling for mercury vapors throughout the year to ensure seasonal variability has been assessed. Elevated mercury vapors concentrations are related to temperature.
- Maintain the room temperature and ventilation system to remain consistent with the HVAC operations.
- If conditions of the flooring change (i.e., cracks, signs of deterioration or damage), additional air sampling for mercury vapors is recommended.

In addition, the gym floor should be cleaned using non-abrasive methods. The current holes in the gym floor should be repaired and sealed to prevent further vaporizing of mercury into the gym.

In the event the floors are damaged and/or additional air sampling reveals mercury vapor exceeding the NJDOH maximum contaminant level, the floors should be removed and replaced with a non-mercury containing floor.

It is Partner's understanding that the air handling units in the south gym are combination heating and fresh air intake units. To assist in controlling any mercury vapors it may be prudent for Wall Township Board of Education to install air conditioning/cooling units in the south gym to control temperatures, although this is not required.

6.0 CLOSING

Results of this study are based on the conditions and activities which occurred during the site investigation. Substantial changes in the materials, conditions, or methods could affect future results.

Please contact us if you have any questions regarding this report. We thank you for this opportunity to be of service and hope you will consider us for any future occupational health and safety needs.

This report has been peer reviewed as a part of our internal quality process.

This report was prepared by:



Dan Bracey, CSP, CHMM
Project Manager
Industrial Hygiene & Health and Safety Services
PARTNER Engineering and Science, Inc.

This report was reviewed by:



Benjamin Jelin, Ph.D., CIH, CSP
Senior Project Manager,
Industrial Hygiene & Health and Safety Services
PARTNER Engineering and Science, Inc.

APPENDIX A
AIR SAMPLE RESULTS TABLES

Location:
 Wall High School
 1630 18th Avenue
 Wall, NJ 07719

Table 1
 Mercury Air Monitoring Results
 August 18, 2020



Sample Type	Sample Number	Location	Contaminant	Measured Concentration	OSHA PEL	NJDOH Maximum Contaminant Level	Units	Duration Minutes	Flow (Lpm)
Area	WHS818-1	South Gym Southeast	Mercury	<0.12	100 (C)	0.8	ug/m ³	424	0.2 / 0.2
Area	WHS818-2	South Gym Northwest	Mercury	<0.12	100 (C)	0.8	ug/m ³	424	0.2 / 0.2
Area	WHS818-3	South Gym Southwest	Mercury	<0.12	100 (C)	0.8	ug/m ³	424	0.2 / 0.2
Area	WHS818-4	Locker Room Hallway	Mercury	<0.12	100 (C)	0.8	ug/m ³	423	0.2 / 0.2
Area	WHS818-5	Classroom E-12	Mercury	<0.12	100 (C)	0.8	ug/m ³	417	0.2 / 0.2

Notes:

C = Ceiling Limit
 Analytical method: NIOSH 6009

KEY:

ACGIH® - American Conference of Governmental Industrial Hygienists
 C - Ceiling limit: A concentration that is not to be exceeded at any part of the workday
 i - As the inhalable fraction
 lpm - Liters per minute
 mg/m³ - Milligrams per cubic meter
 NE - Not established
 NA - Not applicable
 < - Denotes less than

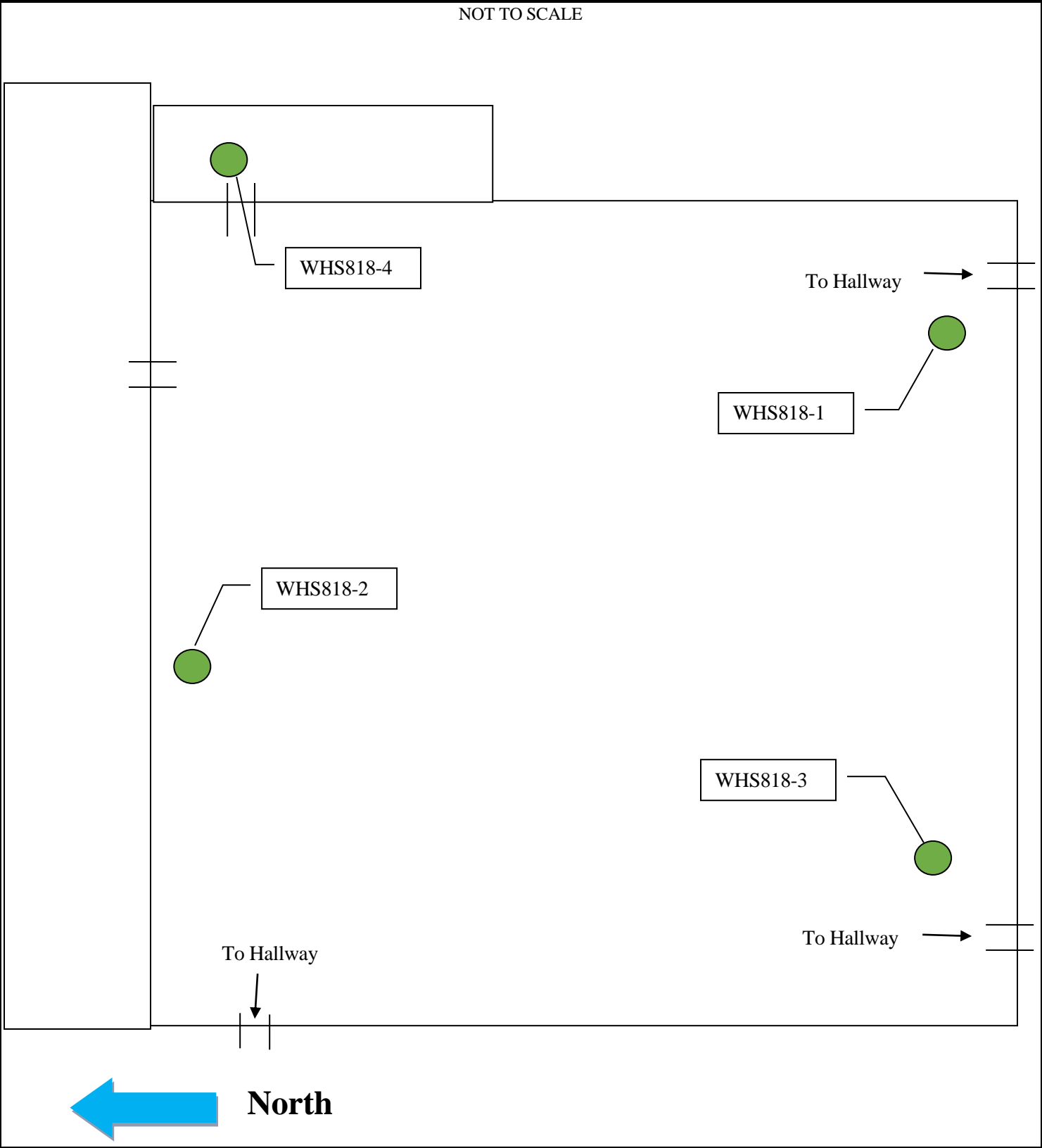
PEL - Permissible Exposure Limit
 ppm - Parts Per Million
 R - As the respirable fraction
 STEL - Short Term Exposure Limit
 TLV® - The ACGIH® Threshold Limit Value
 TWA - Time-Weighted Average (8-hour basis)
 µg - Micrograms
 µg/m³ - Micrograms per cubic meter
 * - Internal pump timer used for run time

Calibrator Used:
 BIOS Defender 510-L

Collected By:
 Dan Bracey (Partner)

APPENDIX B
SAMPLE LOCATION DIAGRAM

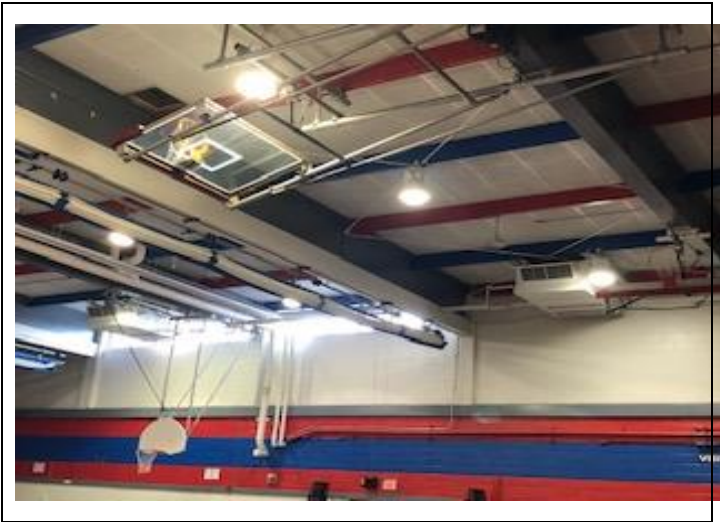
NOT TO SCALE



Approximate Sample Location
Wall High School

 Air Sample Location

APPENDIX C
PHOTOGRAPHS



1. View of South Gym.



2. View of closed auxiliary gym.



3. View of south hallway.



4. View of cafeteria.



3. View of concrete sample location.



4. View of classroom E-12.

APPENDIX D
CALIBRATION DOCUMENTS

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

92 North Main St, Building 20
Windsor, NJ 08561

Toll-free: (800) 301-9663



Pine Environmental Services, Inc.

Instrument ID 16346
Description BIOS Defender 510-L
Calibrated 8/7/2020 1:24:39PM

Manufacturer Bios
Model Number Defender 510
Serial Number/ Lot S/N 116663
Number
Location New Jersey
Department

State Certified
Status Pass
Temp °C 24
Humidity % 37

Calibration Specifications

Group # 1
Group Name Tested against low flow
pumps

Test Performed: Yes As Found Result: Pass

As Left Result: Pass

Test Instruments Used During the Calibration

(As Of Cal Entry Date)

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Last Cal Date/ Opened Date	Next Cal Date/ Expiration Date
------------------	-------------	--------------	--------------	-------------------------------	-------------------------------	-----------------------------------

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Kemar Rumble

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT



Advanced Labs

Environmental Services, Inc

Instrument ID 16346
 Description Bios Defender 510-L
 Calibrated 7/6/2020

Manufacturer Bios
 Model Number 510-L
 Serial Number 116663
 Location New Jersey
 Temp 75

Classification
 Status pass
 Frequency Yearly ICOM
 Department Lab
 Humidity 37

Calibration Specifications

Group # 1
 Group Name Calibration
 Stated Accy Pet of Reading

Range Acc % 0.0000
 Reading Acc % 1.0000
 Plus/Minus 0.00

<u>Num In Val</u>	<u>In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Find As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
30.00	30.33	cc/min	30.33	cc/min	30.20	30.20	-0.43%	Pass
100.00	100.36	cc/min	100.36	cc/min	100.20	100.20	-0.16%	Pass
500.00	500.04	cc/min	500.04	cc/min	497.50	497.50	-0.51%	Pass

Test Instruments Used During the Calibration

<u>Test Instrument ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Serial Number</u>	<u>(As Of Cal Entry Date)</u>	
				<u>Last Cal Date</u>	<u>Next Cal Date</u>
ML-500-10	Met Lab ML-500-10	Bios International	119826	3/26/2020	3/26/2021
ML-500-24	Met Lab ML-500-24	Bios International	116617	3/26/2020	3/26/2021
ML-500-44	Met Lab ML-500-44	Bios International	120274	3/26/2020	3/26/2021
ML-500-B	Met Lab ML-500-B	Bios International	120696	3/26/2020	3/26/2021

Notes about this calibration

Calibration Result Calibration Successful
 Who Calibrated David Galego

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.



INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC
92 North Main St, Building 20
Windsor, NJ 08561
Toll-free: (800) 301-9663

Pine Environmental Services, Inc.

Instrument ID 14009
Description Lumex 915+
Calibrated 8/7/2020 8:40:48AM

Manufacturer Lumex
Model Number 915
Serial Number/ Lot Number 1282
Location New Jersey
Department

State Certified
Status Pass
Temp °C 26.1
Humidity % 56

Calibration Specifications

Group # 1

Group Name baseline test

Test Performed: Yes **As Found Result: Pass**

As Left Result: Pass

Test Instruments Used During the Calibration

<u>Test Standard ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number / Lot Number</u>	<u>(As Of Cal Entry Date)</u>	
					<u>Last Cal Date/ Opened Date</u>	<u>Next Cal Date/ Expiration Date</u>

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Kelly McGuire

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

APPENDIX E
LABORATORY ANALYTICAL RESULTS



EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Phone: (856) 303-2500 Fax: (856) 858-4571 Email: EnvChemistry2@emsl.com

Attn:

Daniel Bracey
Partner Engineering and Science, Inc.
611 Industrial Way West
Eatontown, NJ 07724

9/3/2020

Phone: (732) 380-1700

Fax: (732) 380-1701

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 8/20/2020. The results are tabulated on the attached data pages for the following client designated project:

20-286459.2

The reference number for these samples is EMSL Order #012008905. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry
Laboratory Director



The test results contained within this report meet the requirements of NELAP and/or the specific certification program that is applicable, unless otherwise noted.
NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, CA ELAP 1877

Report amended 09/03/2020 10:33:04 Replaces initial report from 08/27/2020 14:06:05 Reporting Units corrected.

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements established by the NELAP, unless specifically indicated. All results for soil samples are reported on a dry weight basis, unless otherwise noted. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

**EMSL Analytical, Inc.**

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 858-4571

<http://www.EMSL.com>EnvChemistry2@emsl.com

EMSL Order:	012008905
CustomerID:	32PRTN78G
CustomerPO:	
ProjectID:	

Attn: **Daniel Bracey**
Partner Engineering and Science, Inc.
611 Industrial Way West
Eatontown, NJ 07724

Phone: (732) 380-1700
 Fax: (732) 380-1701
 Received: 08/20/20 9:45 AM

Project: 20-286459.2

Analytical Results

Client Sample Description WHS818-F1
Blank
Collected: 8/18/2020
Lab ID: 012008905-0001

Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.010 µg/tube	8/25/2020	08/26/20 9:18 SW
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Client Sample Description WHS818-F2
Blank
Collected: 8/18/2020
Lab ID: 012008905-0002

Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.010 µg/tube	8/25/2020	08/26/20 9:21 SW
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Client Sample Description WHS818-1
South Gym - SE
Collected: 8/18/2020
3:49:00 PM
Lab ID: 012008905-0003

Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.12 µg/m³	8/25/2020	08/26/20 9:23 SW
------	---------	----	------------	-----------	------------------

Client Sample Description WHS818-2
South Gym - NW
Collected: 8/18/2020
3:50:00 PM
Lab ID: 012008905-0004

Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.12 µg/m³	8/25/2020	08/26/20 9:25 SW
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Client Sample Description WHS818-3
South Gym - SW
Collected: 8/18/2020
3:51:00 PM
Lab ID: 012008905-0005

Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.12 µg/m³	8/25/2020	08/26/20 9:27 SW
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**EMSL Analytical, Inc.**

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 858-4571

<http://www.EMSL.com>EnvChemistry2@emsl.com

EMSL Order:	012008905
CustomerID:	32PRTN78G
CustomerPO:	
ProjectID:	

Attn: **Daniel Bracey**
Partner Engineering and Science, Inc.
611 Industrial Way West
Eatontown, NJ 07724

Phone: (732) 380-1700
 Fax: (732) 380-1701
 Received: 08/20/20 9:45 AM

Project: 20-286459.2

Analytical Results

Client Sample Description	WHS818-4 Locker Hallway	Collected:	8/18/2020 3:52:00 PM	Lab ID:	012008905-0006
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Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.12 µg/m³	8/25/2020	08/26/20 9:29 SW
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Client Sample Description	WHS818-5 E-12	Collected:	8/18/2020 3:55:00 PM	Lab ID:	012008905-0007
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Method	Parameter	Result	RL Units	Prep Date & Analyst	Analysis Date & Analyst
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METALS

6009	Mercury	ND	0.12 µg/m³	8/25/2020	08/26/20 9:31 SW
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Definitions:

- MDL - method detection limit
- J - Result was below the reporting limit, but at or above the MDL
- ND - indicates that the analyte was not detected at the reporting limit
- RL - Reporting Limit (Analytical)
- D - Dilution Sample required a dilution which was used to calculate final results

Industrial Hygiene
Chain of Custody
EMSL Order Number (Lab Use Only):

012008905

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: 1-800-220-3675
FAX: (856) 786-5974

Report To Contact Name: Daniel Bracey
Company Name: Partner Engineering & Science, Inc.
Street: 611 Industrial Way West Suite A
City: Eatontown **State/Province:** NJ **Zip/Postal Code:** 07724
Phone: (908) 497-8904 **Fax:** (732) 380-1701

Bill To Company: Partner Engineering & Science, Inc.
Attention To: Daniel Bracey
Street: 611 Industrial Way West, Suite A
City: Eatontown **State/Province:** NJ **Zip/Postal Code:** 07724
Phone: (908) 497-8904 **Fax:** (732) 380-1701

Project Name: 20-286459.2 **Email Results To:** dbracey@partneresi.com **U.S. State where Samples Collected:** NJ
Samples in Shipment: 7 **Date of Shipment:** 8/19/20 **Purchase Order:** **Sampled By (Signature):** [Signature]

Turnaround Time (TAT) - Please Check: If No Selection Made, Standard 2 Week TAT Will Apply
 2 Week 1 Week 4 Day 3 Day 2 Day 1 Day Other (Call Lab)

Media Type: corvite (HPRP)
Manufacturer/Part #: 226-1-14 **Lot #:** 1330

Client Sample ID	Location/Description	Analyte / Method	Media	Flow (lpm)	Sample Time		Volume / Area	Sample Type		Sample Date	Comments
					On	Off		Area	Personal		
1	Blank	NIOSH 660 Mercury	Tube	02				<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal	8/19/20	8241507559
2	Blank							<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal		8241507555
3	South Gym-SE							<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal		8241507556
4	South Gym-NW							<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal		8241507560
5	South Gym-SW							<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal		8241507553
6	Locker hallway							<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal		8241507554
7	E-12							<input checked="" type="checkbox"/> Area	<input type="checkbox"/> Personal		8241507562

Note: Most NIOSH and OSHA methods require field blanks. It is the IH field sampler's responsibility to submit the proper number of field blanks and duplicates.

Released By: [Signature] **Date:** 8/19/20 **Received By:** Colleen Palladino **Date:** 8/20/20 9:45am

Comments:

25.2°C

APPENDIX F
NJDOH GUIDANCE DOCUMENT



Evaluation and Management of Mercury-Containing Floors in New Jersey Schools:

Guidance for School Districts and their Environmental Consultants

February 6, 2020

Health Consultation
prepared by:

New Jersey Department of Health
Environmental and Occupational Health Surveillance Program



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Purpose

This guidance document provides a systematic approach for school districts and their environmental consultants to evaluate whether installed mercury-containing flooring systems emit mercury vapors in excess of New Jersey Department of Health's (NJDOH) recommended maximum contaminant level of 0.8 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of air.

Introduction

In the 1960s, a number of companies began manufacturing and installing a thin layer of synthetic, polyurethane flooring on top of concrete sub-floors, to provide a resilient and rubberlike surface (ATSDR 2010; ATSDR 2006a; ATSDR 2006b). Typically, liquid polyurethane was poured directly over concrete sub-floors, and in some cases over a rubberized shock-absorbing cushion material. Certain formulations of polyurethane incorporated mercury catalysts, such as phenylmercuric acetate (PMA), to produce a solid, seamless rubber-like floor. Depending on the required thickness of the floor, multiple pours of polyurethane were often employed. The concentration of mercury in such polyurethane flooring systems are reported to contain between 0.1 and 0.2 percent total mercury (Bush 2011; ATSDR 2006a; Reiner 2005).

Mercury-containing polyurethane floors were widely installed in school gymnasiums across the United States until being reportedly discontinued amid concerns over their emissions of elemental mercury vapor (NEWMOA 2010). It is to be noted that depending on the type and brand of polyurethane flooring, these floors may have been installed even as late as in 2005 or 2006 (Washington Township, New Jersey 2019; Bush 2011).

The following list of manufacturers are consistently referenced as having produced polyurethane products known to contain PMA in their formulation (Garrison, 2019). It is important to recognize this list is not an all-inclusive list. It is believed other manufacturers may also have included mercury catalysts in their polyurethane flooring systems.

- 3M under the name of Tartan® floors and Tartan® track
- American Biltrite Rubber Co. Inc.
- Amtico Rubber Flooring
- Athletic Polymer Systems (APS)
- Chemothane
- Crossfields Products (DexOTex)
- Mondo Rubber
- Pitzer Inc.
- Pulastic Systems
- Robbins Sport Surfaces - Chemturf
- Selby Battersby & Company Surfacing Systems

- Sportan Surfaces, Inc.
- Whittaker Synthetic Surfaces

Studies have shown that some of these flooring systems emit mercury vapor into the indoor air, leading to a concern about mercury exposures in schools. It is not known how many of these floors currently exist, whether they are still being installed, or what schools have them (ATSDR 2004; ATSDR 2006a; ATSDR 2006b; ATSDR 2010; Bush 2011; Garrison 2019).

This document provides guidance to school districts investigating the potential mercury vapors being emitted from these floors.

Steps for Assessment of Flooring

1. School districts should conduct a visual inspection to determine if poured-polyurethane floors (soft material in one contiguous piece that is clearly not wood or tile) have been installed in the school. If this type of flooring is identified in the school, a licensed indoor environmental consultant should be hired. A list of these consultants can be found on the Department's website at: <https://www.nj.gov/health/ceohs/documents/childcare/constl.pdf>
2. Check if the manufacturer is noted in the list above and/or review the floor's Safety Data Sheet (SDS) for PMA. If the presence of PMA is confirmed, then skip step 3 below (as bulk sampling is not necessary to confirm the presence of mercury). It is not possible to rule out the potential presence of mercury based on the list above as other flooring system manufacturers and installers may have incorporated PMA in their polyurethane formulations. Further, the SDS may not be conclusive as the company might list the PMA ingredient as proprietary information.
3. If the record review was inconclusive, the district and its consultant may choose to collect a bulk sample of the flooring material to test for the presence of mercury. A bulk sampling plan overview is outlined below for the consultant to follow. The consultant will determine the timing between the bulk sampling and any indoor air sampling as these should not occur concurrently. The bulk sampling test may be informative in confirming there is no mercury present. The bulk sample must be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory available at: <https://www.aihaaccreditedlabs.org/>
4. If the record review or bulk sampling confirmed the presence of mercury in the flooring, an appropriate air testing and monitoring program is warranted. A sampling plan overview is outlined below for your consultant to follow.

Sampling Plan Overview

A sampling plan that includes specific sampling and analytical methods is critical for evaluating mercury levels contained in synthetic flooring and the mercury levels in the indoor air. The district should hire and work with a licensed environmental consultant to understand the sampling plan before the plan is implemented. The consultant must provide sampling protocols, procedures, and an understanding of how to interpret the results to the district. The details for these procedures are provided in the sections below.

Bulk Sampling

The purpose of the bulk sampling is to determine if mercury is present in the flooring material and if indoor air monitoring is necessary. A sampling plan must be developed to ensure that the bulk samples are representative of the floor area(s) being evaluated. As noted above, the consultant will determine the timing between the bulk sampling and any indoor air sampling as these should not occur concurrently. The plan must include a diagram of the floor(s) showing the sampling locations and the laboratory results of the bulk samples. The environmental consultant should identify the rooms that contain the suspect flooring, coordinate the collection of bulk samples with school facilities staff, and execute the bulk sampling plan. The environmental consultant must ensure that all floor sampling locations are sealed and repaired after the bulk samples are collected.

Sampling Methods and Procedures

1. An appropriate size sample of the flooring material needs to be collected for analysis. The thickness of most poured polyurethane floors typically ranges from ¼-inch to 1-inch. Bulk samples of rubberized floor must represent the entire thickness/depth of the floor material. Sampling of only the surface or partial thickness of the floor must be avoided. Coring tools are commonly used to collect the bulk sample of the floor material. The environmental consultant must provide information on the bulk sample collection tools as well as the procedure to collect the sample from the entire thickness of the floor.
2. The recommended number of samples is: one floor sample from rooms that are less than 1,000 square feet, two samples from rooms 1,000 to 5,000 square feet, and three samples from rooms greater than 5,000 square feet. The sample locations should be selected, to the extent possible, in areas where the sample extraction is less likely to present a visual blemish (such as in room corners, in closets, behind doors, etc.)

Bulk samples of floor material must be analyzed using USEPA Method 7471B to determine the mercury content. An accredited laboratory should be contacted to ensure the proper amount of floor material is being collected. Typically, laboratories require 10 grams of floor material to analyze for mercury content.

If the floor contains mercury at any concentration, the NJDOH recommends sampling of the indoor air to evaluate the mercury vapor levels.

Indoor Air Sampling

The primary route of exposure to mercury vapor is through inhalation. Therefore, it is important to conduct air sampling to provide data which characterizes the mercury vapor levels in the indoor air.

General Requirements

- An indoor air sampling plan must be developed before any samples are collected. The sampling plan should ensure that air samples are taken from several locations to be representative of the floor area or room being evaluated. Samples should be collected at the breathing zone level, which is typically between three to five feet above the floor. Your consultant should include procedures for using a direct read instrument, the NIOSH 6009 method or both in the plan. See below for general sampling requirements using these methods. For all sampling plans, a diagram of the floor area or room showing the locations of the air samples must be developed. Sampling adjacent hallways and rooms should be included in the sampling plan. Ambient readings should be collected outside the facility to establish background levels.

Airborne mercury levels are affected by the operation of the Heating, Ventilation and Air Conditioning (HVAC) system. Given this relationship, the indoor air samples should be collected under typical HVAC operational conditions. Sampling under these conditions will represent the typical ventilation and temperature conditions under which the building is being maintained and occupied. The room temperature and typical operational settings of the HVAC system should be documented prior to collecting any air samples.

Field notes should include a visual inspection of the condition of the floor at locations where samples are collected, specifically noting if the floor surface is compromised in any manner.

Sampling Methods and Procedures

The following two widely used sampling and analytical methods are available for quantifying mercury levels in the indoor air.

1. Direct Reading Instruments:

- The Lumex RA-915M Mercury Vapor Analyzer (OhioLumex Co., Inc.) or the Jerome J505 (AMETEK Arizona Instrument) can be used to measure mercury vapor concentrations in air. These direct read instruments are portable mercury

vapor analyzers that have very little cross-sensitivity to chemicals other than elemental mercury. These instruments have low detection limits (ranging from 0.002 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to 0.05 $\mu\text{g}/\text{m}^3$) and can measure mercury vapor levels under a variety of sample collection protocols.

Sample Collection Procedures

- Ensure that the instrument has been properly calibrated according to the manufacturer's recommended procedures. Calibration records must be retained to document that the instrument is functioning correctly.
- Temperature, humidity, and air pressure measurements must be collected during the sampling events.
- Direct read measurements should be taken in a predetermined pattern throughout the gym/room where the flooring material is located.
- Direct reading measurements should be taken at various heights above the floor.
- Readings collected at locations where the floor surface is compromised should be noted.

2. Industrial Hygiene Sampling:

- NIOSH Method 6009 - Analysis of Mercury in Air, is a common method for collecting airborne mercury vapors for laboratory analysis. Using this method, samples may be collected over customized periods of time to represent typical occupied conditions. The sample collection method includes a solid sorbent tube (Hopcalite sample collection media) which is connected to a properly calibrated sampling pump. Sampling pumps must be calibrated using a recognized primary standard to document the sampling flowrate. The NIOSH 6009 method should be consulted for the sample collection flowrates and detection limits.

Sample Collection Procedure

- To be representative of the gym/room, three to five samples should be collected. The number of samples within the gym/room may vary depending on the size of the room being evaluated. When determining the number of samples to be collected, the consultant should ensure that there are a sufficient number of samples to represent the gym/room and adjacent areas being evaluated.
- Temperature, humidity, and air pressure measurements must be collected during the sampling events.
- Samples should be collected at a height between three and five feet above the floor.
- The sampling time should be between six to eight hours to represent a typical day within the gym/room.
- Samples should be collected at a flowrate between 0.20 – 0.25 liters per minute (LPM)
- Collect between 90 and 100 liters of air to ensure that the lowest limit of detection (LOD) for the method is reached.

- Record the sampling information on a chain of custody form for submission to the accredited laboratory.
- Follow the quality control procedures outlined in the method for the submission of blank samples to the laboratory.
- Submit the samples to an accredited laboratory for analysis.

Risk Assessment

The primary exposure to mercury vapor is by inhalation. The NJDOH has adopted Standards for Indoor Environment Certification and for Licensure of Indoor Environmental Consultants (N.J.A.C. 8:50¹). These regulations provide a risk assessment model that can be used to evaluate indoor air contaminants for school children and staff. This model is very conservative and adjusts for body weight, inhalation rate, and the amount of time spent in school for both children and staff. Based on the toxicological information and this regulated risk assessment model, the NJDOH has issued a guidance maximum contaminant level of 0.8 µg/m³ for evaluating mercury in flooring. **This level is protective for children as young as three years old and is based on an exposure frequency of 8-hours per day for 180 days (NJDOH 2017).** The NJDOH acknowledges that there are other guidance levels for mercury vapors established by ATSDR, USEPA and other states, but there is no national standard (ATSDR 2004; 2006a; 2006b; 2010; Bush 2011; OEHHA; USEPA). The NJDOH guidance value is based on the exposure scenario in the risk model that is protective of preschool-aged children and a level at which adverse health effects are not likely to occur.

Evaluate and Mitigate Exposures

Based on the air sampling results, school districts may encounter the following scenarios:

Airborne mercury levels lower or equal to 0.8 µg/m³

- Continue to use the gym/room under the occupied conditions that the samples were collected.
- Quarterly, seasonal sampling is recommended to ensure that the seasonal variability's impact on mercury concentrations is captured. Assessing the seasonal mercury level variation will ensure that the mercury indoor air level is always lower than 0.8 µg/m³. Mercury vapor levels are related to temperature, so it is important to test during all seasons, especially during the heat of the summer.
- Maintain the room temperature and ventilation system to remain consistent with the operations at the time of sampling.

¹ https://www.nj.gov/health/ceohs/documents/eohap/njac_850_adoption.pdf

- If conditions of the flooring change, i.e., if there are cracks or other signs of deterioration or damage, resampling of mercury vapors in indoor air is necessary.
- Mercury vapor levels can be managed by active ventilation and temperature control of the room.

Airborne mercury levels above 0.8 µg/m³

- Work with the environmental consultant to develop a feasible plan to reduce the mercury vapor levels below 0.8 µg/m³. Mercury vapor levels can be reduced by active ventilation and temperature control of the room.
- Make adjustments to the HVAC system including increasing the ventilation/fresh air intake and/or lowering the temperature in the room. Verify (by retesting) that these adjustments have reduced mercury vapor levels to equal to or less than 0.8 µg/m³.
- If these adjustments are inadequate to maintain the levels to 0.8 µg/m³ or below, reduce the amount of time spent in the room to less than 8 hours per day or do not allow use of the room.
- If ventilation adjustments sufficiently reduce the levels to less than or equal to 0.8 µg/m³, monitor the indoor air at least quarterly to evaluate the mercury levels during other seasons.
- If ventilation adjustments do not sufficiently reduce the levels to less than or equal to 0.8 µg/m³, additional actions including removal of the flooring should be considered. Discussions with the environmental consultant will be needed to determine the appropriate course of action.

In addition, the gym floor should be cleaned using non-abrasive cleaning methods to avoid damaging the floor which could result in an increase in mercury emissions into the air.

Disposal of Floor Materials

If the flooring contains mercury and a decision is made to remove it, a determination needs to be made whether the material would be regulated as a hazardous waste for disposal. Contact the NJDEP's Bureau of Solid and Hazardous Waste² for information on the proper disposal of the flooring material. The Bureau of Solid and Hazardous Waste can be reached at (609) 633-1418 or (609) 984-0565.

For general questions, please contact the NJDOH - Consumer, Environmental, & Occupational Health Services at 609-826-4920.

² <https://www.nj.gov/dep/enforcement/hw.html>;
<https://www.nj.gov/dep/easyaccess/compenf.htm#hazwastecompenf>

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Technical Resources

Analytical Methods for Mercury

- EPA 7471B Mercury in solid or semisolid waste (manual cold-vapor technique) <https://www.epa.gov/sites/production/files/2015-07/documents/epa-7471b.pdf>
- EPA TCLP Method 1311 SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure <https://www.epa.gov/sites/production/files/2015-12/documents/1311.pdf>
- NIOSH Method 6009 <https://www.cdc.gov/niosh/docs/2003-154/pdfs/6009.pdf>
- TCLP test <https://www.epa.gov/sites/production/files/2015-12/documents/1311.pdf>

Sources for Direct Reading Instruments for Mercury

- Lumex of Ohio, <https://www.ohiolumex.com/mercury-analyzer-915m>
- Arizona Instruments/Jerome, <https://www.azic.com/jerome/j505/>

REPORT PREPARATION

This health consultation providing guidance for evaluation of mercury in flooring was prepared by the New Jersey Department of Health.

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