

Mercury Vapor Sampling

KCKCC Field House
Kansas City, Kansas 66112

February 3, 2024 | Terracon Project No. 02247027

Prepared for:



Kansas City Kansas Community College



Nationwide
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- Facilities
- Environmental
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February 3, 2024

Kansas City Kansas Community College
7250 State Avenue
Kansas City, Kansas 66112

Attn: Dr. Shelley Kneuvean
P: (913) 288-7645
E: skneuvean@kckcc.edu

Re: Mercury Vapor Sampling
KCKCC Field House
7250 State Avenue.
Kansas City, Kansas 66112
Terracon Proposal No: 02247027

Dear Dr. Kneuvean:

Terracon Consultants, Inc. (Terracon) is pleased to present the results of the mercury vapor sampling conducted on January 31, 2024, at the above reference facility. This assessment was conducted in general accordance with our Proposal P02247027, dated January 25, 2024.

We appreciate the opportunity to be of service to you on this project. For more detailed information on all of Terracon's services please visit our website at www.terracon.com. If you have questions regarding this report or if we may be of further assistance, please do not hesitate to contact us at (913) 998-7395.

Sincerely,

Terracon

Prepared By:

Blake Harris

Blake Harris, MS, CIH
Project Industrial Hygienist

Reviewed By:

Robert Garrison

Robert Garrison
Principal
Department Manager, Industrial Hygiene

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1.0 Introduction

This report presents the results of mercury vapor sampling performed at the Kansas City Kansas Community College (KCKCC) Field House located in Kansas City, Kansas. This assessment was conducted by Mr. Blake Harris, Certified Industrial Hygienist (CIH), with Terracon Consultants, Inc. (Terracon) on January 31, 2024.

Terracon understands the facility was originally built in 1970 with rubberized athletic flooring directly applied to the slab on grade. In 2009, wood flooring was installed on top of the rubber flooring. Shortly after installation, issues with the levelness of the wood flooring developed and have episodically persisted over the years with multiple attempts to repair and correct these issues. Notable installation and repairs include the following:

- 2009 – Installation of a polyethylene vapor barrier over the rubber floor (does not appear to be sealed at floor penetrations or along exterior walls).
- 2013 – Electric heater and fan system installed on the west side of the gym to ventilate the subfloor and alleviate moisture (designed to blow air to the east side of the gym between the vapor barrier and wood floor).

The purpose of this survey was to determine if the mercury in the rubberized flooring material is off-gassing and impacting the ambient air quality within the gym.

1.1 Standard of Care

This industrial hygiene survey was conducted based on information provided to Terracon by Client and was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. Terracon did not attempt to identify every potential exposure or hazard present in the building. The results, findings, conclusions, and recommendations expressed in this report are based on conditions observed during our investigation. Many factors such as workload, variations in work material composition, and work processes can affect noise levels and monitoring results. The information contained in this report should not be relied upon to represent conditions that existed at a previous or later date. Terracon does not warrant the services of regulatory agencies, laboratories, or other third parties supplying information that may have been used in the preparation of this report.

2.0 Regulatory Overview

The Occupational Safety and Health Administration (OSHA) establishes Permissible Exposure Limits (PELs) for exposure to certain airborne constituents in the workplace. Most OSHA PELs are based on 8-hour time weighted average (8-hr TWA) exposure; when sampling

periods are less than 8-hours, the result must first be converted to an 8-hour TWA before comparing it to the OSHA PEL. Some OSHA PELs are based on Short Term Exposure Limits (STEL) of 15 minutes of worst-case exposure, or Ceiling Limits of worst-case peak exposures (sampled as a 15-minute exposure if direct-reading methods are not available). There are some OSHA standards that establish an Action Level (AL) that, if exceeded, triggers an action, such as additional periodic monitoring or medical surveillance. Limits for workplace toxic and hazardous substances are regulated by OSHA in 29 Code of Federal Regulations (CFR) 1910.1000 Tables Z-1, Z-2, and Z-3, and in 29 CFR 1910.1001 through 1910.1096. Employers are required by law to maintain employee exposures below OSHA PELs.

The American Conference of Governmental Industrial Hygienists (ACGIH®) has developed Threshold Limit Values (TLVs®) as guidelines to assist in the control of occupational health hazards. Unlike the OSHA PELs, these OELs are not regulatory values, but they are frequently used as industry guidelines, particularly where OSHA has not established a PEL for a constituent. The ACGIH TLV-STEL is a 15-minute exposure not to be exceeded at any time during a workday, even if the 8-hour TWA is below the TLV-TWA.

Table 1 provides a summary of OELs that may be applied to sampling conducted during this evaluation.

Table 1. Mercury Exposure Limits		
OSHA PEL-TWA ($\mu\text{g}/\text{m}^3$)	OSHA PEL-Ceiling (C) ($\mu\text{g}/\text{m}^3$)	ACGIH TLV-TWA ($\mu\text{g}/\text{m}^3$)
100	100	25
$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter of air		

3.0 Methods

Ambient air sampling was conducted to quantitatively assess potential mercury vapor off-gassing from the rubber floor. Sampling was performed using a Jerome® J405 Mercury Vapor Analyzer. The analyzer employs an active air sampling approach, in which mercury vapor reacts with a gold film sensor inside the gauge which undergoes an increase in electrical resistance proportional to the mass of mercury in the sample. The instrument has a detection range of 1 – 999 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$).

After a minimum warm-up period of five minutes, measurements were collected with the analyzer in “Sample Mode”, which provides a mercury concentration after a 16-second sampling cycle. Terracon collected a total of 64 measurements at representative locations. Sample locations were focused on the two sections of wood flooring (located on the east and west sides of the gym) that were previously cut out to allow for ground-penetrating radar (GPR) surveys, penetrations in the gym, followed by adjacent offices, common

spaces, storage areas, and the basement. At the time of this survey, the two sections of removed flooring were covered with plywood.

Wood floor penetrations were sampled by inserting the instrument probe into the opening or as close possible, depending on the size of the gap. Additional measurements were collected with the probe between approximately two-inches to four-feet above the floor surface. Appendix A includes a drawing with sample locations and results. Photos taken during the assessment are included in Appendix B.

4.0 Findings

A summary of detectable mercury vapor concentrations measured on January 31, 2024, are presented in Table 2. Mercury vapor was not detected at the remaining sample locations. Unless otherwise indicated, the location description represents point-source samples (sampling probe inside/as close as possible to floor penetrations). A drawing with sample locations and results is provided in Appendix A.

Location Description	Time of Sample	Results ($\mu\text{g}/\text{m}^3$)
Gym: west plywood section, near northwest corner	6:28 AM	12.86
Gym: west plywood section, northeast corner	6:29 AM	1.52
Gym: west plywood section, west-center	7:30 AM	4.31
Gym: electrical box cover, west side of gym, south latch opening	6:34 AM	1.12
Gym: volleyball post hole, west side (at cover plate keyhole)	6:35 AM	1.44
Gym: volleyball post hole, west-center (cover plate removed)	6:37 AM	4.15
Gym: east perimeter wall, north end of bleachers	6:47 AM	0.68
Gym: north perimeter, metal threshold ramp at east column	6:51 AM	4.81
Gym: north perimeter, metal threshold ramp at west exit	6:53 AM	2.04
Gym: west plywood section, north-center (2" above floor)	7:09 AM	0.98
Gym: west plywood section, northwest corner	7:11 AM	17.32
Gym: west plywood section, east/southeast corner	7:15 AM	2.34
Gym: west plywood section, southeast corner	7:16 AM	1.35

5.0 Conclusions

Based on the results of this survey, Terracon concludes the following:

- Of the 64 mercury vapor measurements collected on January 31, 2024, 13 measurements had detectable concentrations ranging from 0.68 to 17.32 $\mu\text{g}/\text{m}^3$.
 - 7 of the 13 detected concentrations were measured around the perimeter of the west section of plywood covering the rubber flooring.
 - The two highest concentrations (12.86 and 17.32 $\mu\text{g}/\text{m}^3$) were sampled at the northwest corner of the west section of plywood with approximately 43 minutes between the two samples.
 - Three floor penetrations revealed mercury vapor at the two volleyball post holes and the electrical box cover on the west side of the gym (between center court and the west section of plywood).
 - Three samples collected along the perimeter of wood floor also indicated the presence of mercury vapor: two locations on the north perimeter and one location on the east wall.
- Based on the grouping of detectable concentrations, the west section of plywood appears to be the primary source of mercury off-gassing. This may, in part, be influenced by potential disturbances of the rubber floor (i.e., cutting the rubber when removing the wood floor, screws used to secure the plywood, etc.). However, the rubber floor was not visible at the time of this survey and Terracon was unable to verify if any significant damage was present.
 - On the contrary, no detectable concentration was observed around the east section of plywood indicating that the west side may be influenced by another unknown factor.
- At the time of this survey, Terracon did not detect mercury vapor in any of the offices on the south end of the gym, the north lobby, concessions area, mechanical room, or in the basement hallway.
 - Some of these sample locations include near gouges in exposed rubber flooring and at edges of the wood floor (at office door thresholds).
- Although mercury vapors were detected (generally, as close to the rubber floor as reasonably possible), samples collected above the floor suggests that the airborne concentrations are quickly diluted as no vapor was detected near the breathing zone. One sample on the north side of the west section of plywood had a detectable concentration (0.98 $\mu\text{g}/\text{m}^3$) at approximately 2-inches above the wood floor.

6.0 Recommendations

Based on the results of this survey, detectable concentrations of mercury were identified at floor level in multiple areas of the gym. Terracon recommends periodic air monitoring for mercury vapor until abatement of the rubberized flooring material can be conducted.

General abatement guidelines are presented in Appendix D. Prior to removal of the mercury-containing floor materials, a consultant should prepare site-specific abatement specifications to define the scope of work, required engineering controls, and to establish safe practice procedures to protect workers and adjacent indoor locations.

7.0 General Comments

The level of effort and associated tasks completed for this assessment were limited to the scope of services outlined in Terracon Proposal No. P02247027 dated January 25, 2024. Terracon did not attempt, nor would it be practical, to identify every potential exposure or hazard present in the subject building. The results, findings, conclusions, and recommendations expressed in this report are based on conditions observed on the survey date. No warranty, express or implied is made.

This report is prepared for the exclusive use of our Client for the specific application to the project discussed and has been prepared in accordance with generally accepted industrial hygiene practices. In the event any changes in nature or location of processes, materials, or other conditions as outlined in this report are observed, the conclusions contained in this report cannot be considered valid unless the changes are reviewed, and the conclusions of this report are modified or verified in writing by the industrial hygienist.

Appendix A

Mercury Vapor Sampling Location Summary

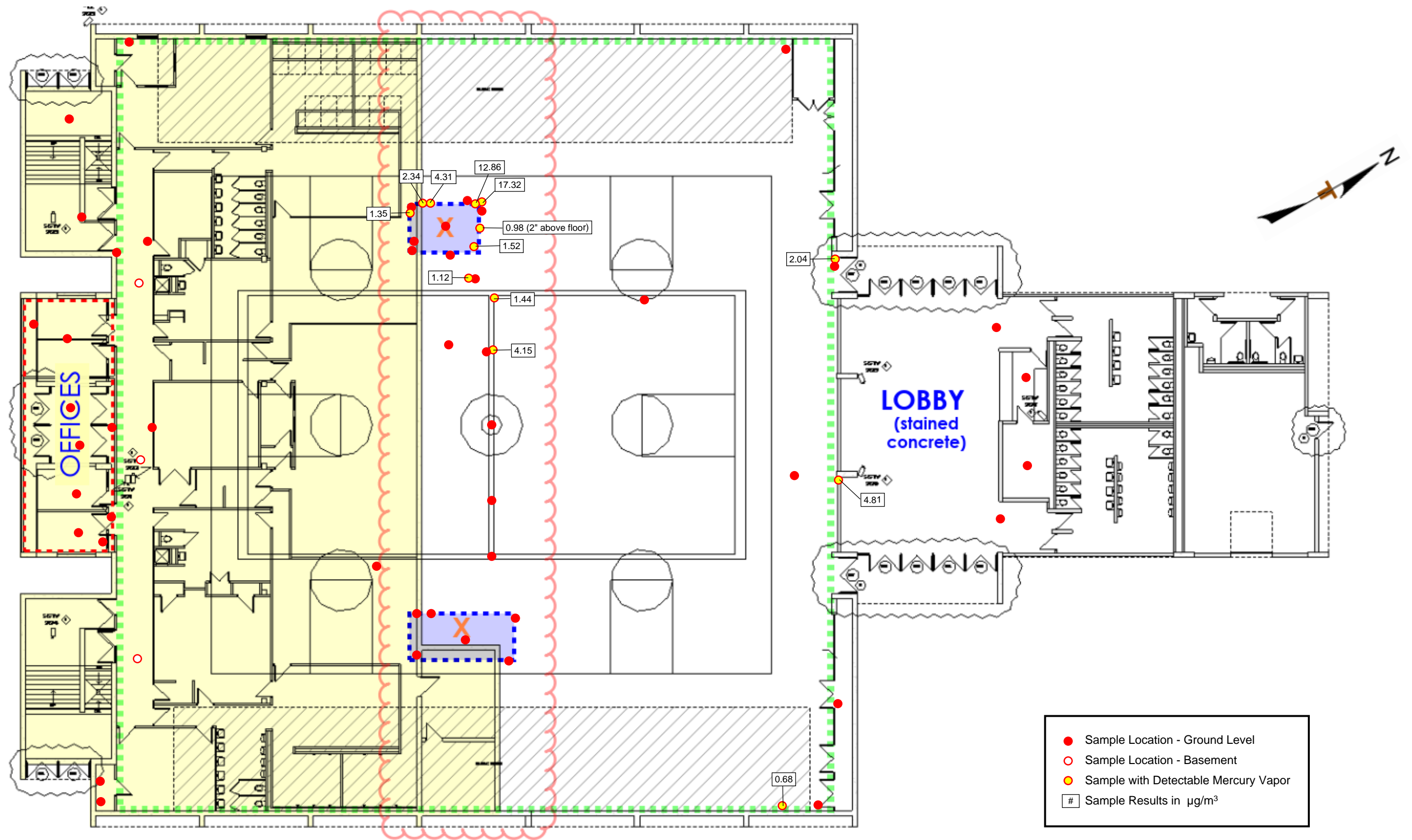



DIAGRAM IS INTENDED FOR GENERAL USE ONLY, AND IS NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE.

Project Mgr: BEH	Project No: 02247027	 15620 W 113TH ST PH. (913) 492-7777	MERCURY VAPOR SAMPLE LOCATIONS Kansas City Kansas Community College Field House 7250 State Avenue Kansas City, Kansas 66112	EXHIBIT 1
Approved By:	Scale: NTS			
Checked By: BEH	Date: 2/1/2024			
Drawn By: BEH	File No: 02247027.E1			

Appendix B

Photo Log

Photo Log

KCKCC Field House | Kansas City, Kansas

Terracon Project No. 02247027

Date Photos Taken: 1/31/2024

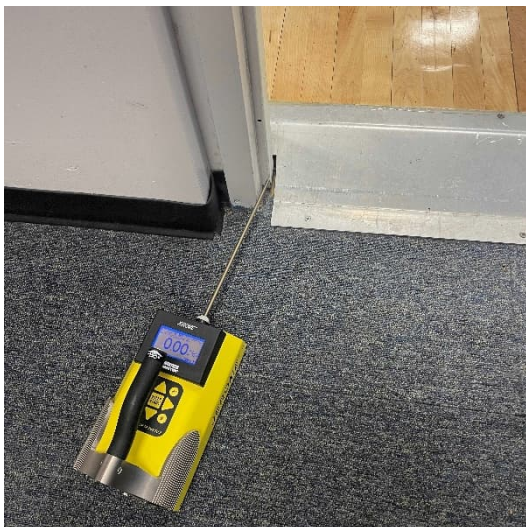


Photo 1: Non-detect sample collected at Room 3804 (actual sample taken with probe inserted between the threshold and doorframe).



Photo 2: Room 3800 – View of observed gouges in exposed rubber flooring.

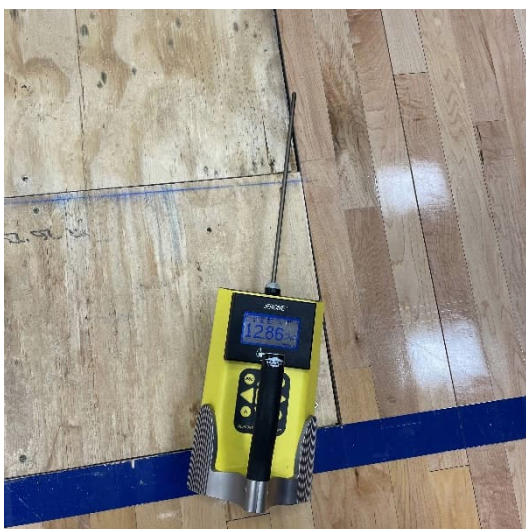


Photo 3: West section of plywood, northwest corner, 12.86 $\mu\text{g}/\text{m}^3$.

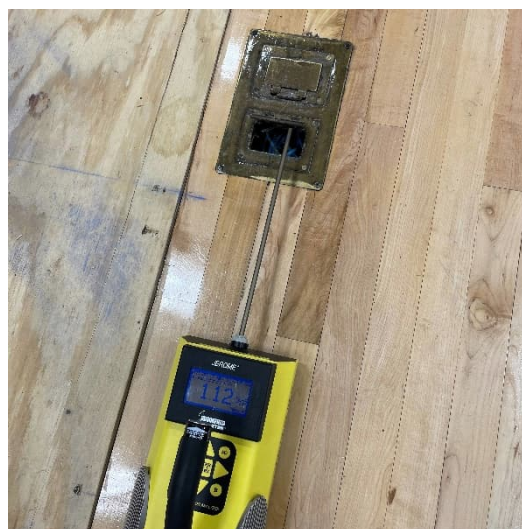


Photo 4: 1.12 $\mu\text{g}/\text{m}^3$ detected inside the south side of the electrical floor box cover (no detection in the north portion).

Photo Log

KCKCC Field House | Kansas City, Kansas

Terracon Project No. 02247027

Date Photos Taken: 1/31/2024



Photo 5: $4.15 \mu\text{g}/\text{m}^3$ measured at the west-center volleyball post hole with cover removed.



Photo 6: $0.68 \mu\text{g}/\text{m}^3$ measured at the east wall, north end of the bleachers.

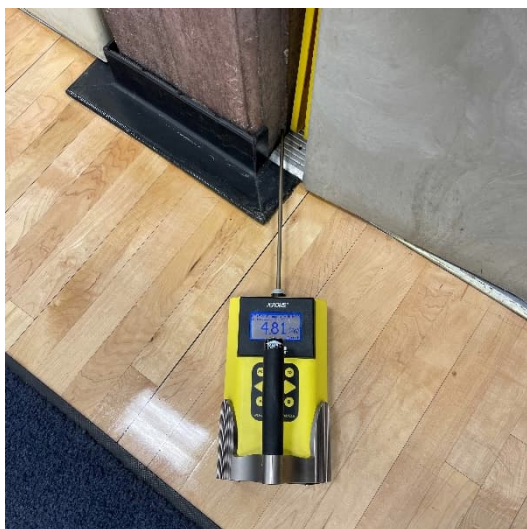


Photo 7: $4.81 \mu\text{g}/\text{m}^3$ measured at the north perimeter, east column (actual sample taken with probe inserted between the threshold and column).



Photo 8: $2.04 \mu\text{g}/\text{m}^3$ measured at the northwest exit ramp.

Photo Log

KCKCC Field House | Kansas City, Kansas

Terracon Project No. 02247027

Date Photos Taken: 1/31/2024

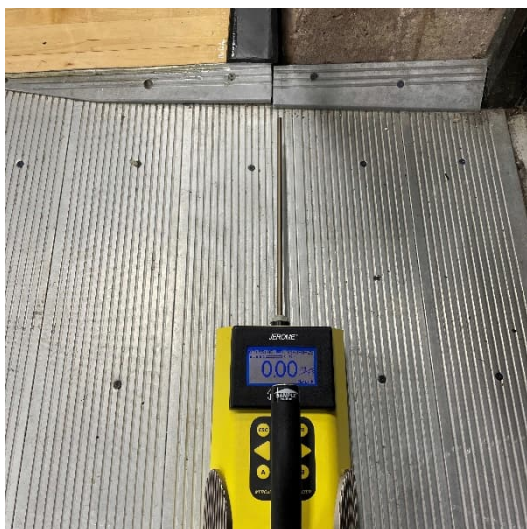


Photo 9: Same general location as previous photo, probe removed approximately 3" from opening.



Photo 10: Highest detected concentration ($17.32 \mu\text{g}/\text{m}^3$), measured at the northwest corner of the west plywood section.



Photo 11: Example of non-detectable sample collected at the east section of plywood.



Photo 12: View of wall opening in the southeast corner (no detection).

Appendix C

Calibration Certificate

0011656 03103123



CERTIFICATE NUMBER 334873
CUSTOMER NAME PREMIER SAFETY
ADDRESS 33596 STERLING PONDS BLVD
STERLING HEIGHTS MI 48312
USA

INSTRUMENTATION & SPECIALTY CONTROLS DIVISION
11 Commerce Blvd. | Middleboro, MA 02346
P: 508.946.6200 | F: 508.946.6262

CERTIFICATE OF INSTRUMENT CALIBRATION

<u>MODEL</u>	<u>SERIAL NUMBER</u>	<u>CALIBRATION DATE</u>	<u>CALIBRATION DUE DATE</u>
J405-0007	40501640	7/18/2023	7/16/2024

To the NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY within the limitations of the Institute's calibration services, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration techniques. Disclaimer: Any unauthorized adjustments, removal or breaking of QC seals, or other customer modifications on your Jerome Analyzer WILL VOID this factory calibration. Because any of the above acts could affect the calibration and readings of the instrument, their certification will no longer be valid and, further, AMETEK Brookfield WILL NOT be responsible for any liabilities created as a result of using the instrument after such adjustments, seal removal, or modifications. This document shall not be reproduced, except in full, without the written approval of AMETEK Brookfield.

REFERENCE EQUIPMENT USED TO CALIBRATE THE EQUIPMENT

<u>TYPE/MODEL</u>	<u>SERIAL/LOT NUMBER</u>	<u>CALIBRATION DATE</u>	<u>CALIBRATION DUE DATE</u>
Perm Tube	S89-58050	3/3/2023	3/3/2024
<u>TYPE/MODEL</u>	<u>SERIAL/LOT NUMBER</u>	<u>CALIBRATION DATE</u>	<u>CALIBRATION DUE DATE</u>
Dynacal	M1878	7/1/2023	7/1/2024
<u>TYPE/MODEL</u>	<u>SERIAL/LOT NUMBER</u>	<u>CALIBRATION DATE</u>	<u>CALIBRATION DUE DATE</u>
Alicat	46848	1/4/2023	1/5/2024
<u>TYPE/MODEL</u>	<u>SERIAL/LOT NUMBER</u>	<u>CALIBRATION DATE</u>	<u>CALIBRATION DUE DATE</u>
Fluke	469706285	1/9/2023	1/9/2024

NIST TRACE # ISO13265; 072958

PROCEDURE #: 730-0039

All reference equipment used to calibrate the instrument listed upon this certificate have calibrations that are traceable to the National Institute of Standards and Technology (NIST).

APPROVAL SIGNATURE

TODD PLACE, QUALITY ENGINEER

CALIBRATION PERFORMED BY CS



July 18, 2023
3375 N. Delaware Street, Chandler, AZ 85225
800.528.7411 Fax 602.281.1745
BrookfieldEngineering.com

J405 Incoming / Outgoing Data Sheet

MODEL

J405

SRO NUMBER

S180024

SERIAL NUMBER

40501640

INCOMING

Calibration Gas

Allowable Range
23.25-26.75 ug/m3 Hg

Mean
 ug/m3 Hg

$\leq 3\%$
RSD

Calibration Status as Received: **Out of Calibration.**

OUTGOING

Calibration Gas

Allowable Range
23.75-26.25 ug/m3 Hg

Concentration

Mean @ Saturation

ug/m3 Hg

$\leq 3\%$
RSD

Calibration Status as Left: **In Calibration.**

Estimated Uncertainty of Calibration System: 3.5%

Appendix D

Recommended General Abatement Guidelines

Removal of Mercury Containing Floor Material

General Guidelines

The information contained in this document is meant to provide general abatement guidelines and best practices. This document should not be used as comprehensive technical specifications.

1.0 Project Coordination

1.1 General

- A. The Contractor should be experienced in the removal and disposal of hazardous materials.
- B. The Contractor should be responsible for inspecting the site prior to work to confirm the scope of the work. The calculation and verification of actual quantities of materials to be encountered is the responsibility of the Contractor.
- C. The Contractor should be responsible for all costs including, but not limited to: permit fees, labor, materials, services, insurance, and equipment necessary to carry out the requirements of the contract in accordance with the plans and specifications, the United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) regulations, Department of Transportation (DOT) regulations, and any applicable state and local government regulations.
- D. The Contractor/Employer must offer his employees a workplace free of recognized hazards causing or likely to cause serious injury or death.
- E. The Contractor should be responsible for all costs associated with employee exposure monitoring to meet OSHA requirements.

1.2 Post-Job Submittals

- A. Contractor should submit post-job documents the Owner following the final completion of the work. Examples include:
 - 1. Employee List: Provide copies of lists of supervisors and workers utilized on the project.
 - 2. Medicals: Provide copies of current medical information indicating the employee has been medically cleared to perform the work, outlined herein, in accordance with OSHA 29 CFR 1910.134 Respiratory protection.

3. Permits and Notifications: Provide copies of approval of a waste disposal site in compliance with 40 CFR 261.24.
4. Respirator Training: Copies of most recent respirator fit test records, individually signed for each worker utilized on the project.
5. Safety Data Sheets: Provide SDS's for chemicals or materials used during the project, including (but not limited to) solvents, cleaners, and encapsulants.
6. Manufacturer's Catalog Data Sheets: Provide manufacturer information for equipment and supplies used on this project, including (but not limited to) duct tape, poly sheeting, spray poly, shower filtration units, negative air pressure machines, high efficiency particulate air (HEPA)-filtered vacuums and airless sprayers.
7. Any other programs or training as outlined by the OSHA and EPA standards.
8. Manifest: Waste shipment record receipt from landfill operator which acknowledges the Contractor's delivery of any waste material. Include date, quantity of material delivered and signature of authorized representative of landfill. Include the name of waste transporter.
9. Daily Log: Copies of all daily logs showing the following: name, date, entering and leaving time, company or agency represented, any new workers added to the job, reason for entry for all persons entering the work area, employee's daily air monitoring data as required by OSHA.

1.3 Special Reports

- A. General: Submit special reports to Owner within one day of occurrence of events or accidents requiring special report, with copies to others affected by occurrence.
- B. Reporting Unusual Events: When an event of unusual and significant nature occurs at site (examples: failure of negative pressure system, rupture of temporary enclosures), prepare and submit a special report to the and/or Owner's Representative immediately, listing chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects and similar pertinent information.
- C. Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Comply with industry standards for reporting accidents. A significant accident is defined to include events where personal injury or property loss is sustained, or where the event posed a significant threat of loss or personal injury (near miss).

1.4 Contingency Plan

- A. Contingency Plan: Prepare a contingency plan for emergencies including fire, accident, power failure, negative pressure system failure, supplied air system failure (if applicable), evacuation of injured persons for both life threatening and non-life threatening, or any other event that may require modification or abridgment of decontamination or work area isolation procedures. Include in plan specific procedures for decontamination or work area isolation. Nothing should impede safe exiting or providing of adequate medical attention in the event of an emergency. Plans must be maintained on-site.
- B. Post outside/in clean room of Personnel Decontamination Unit (PDU):
 - 1. Telephone numbers and locations of emergency services including (but not limited to) fire, ambulance, doctor, hospital, police, power company and telephone company.
 - 2. A copy of Safety Data Sheets (SDS) for any chemicals used during the project.
 - 3. Post mercury hazard signs in appropriate languages.

2.0 Codes and Regulations

2.1 Reference Specifications

The Contractor should assume full responsibility and liability for compliance with all applicable federal, state and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

The general work practices found in asbestos regulations should serve as a general guideline for mercury flooring removal including critical barriers, negative pressure, containment, PDUs and waste loadout (WLO).

- A. The following documents published by the American National Standards Institute (ANSI):
 - 1. *"Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems,"* ANSI/AIHA/ASSE Z9.2-2012
 - 2. *"American National Standard for Respiratory Protection,"* ANSI/ASSE Z88.2 – 2015.
- B. The following document published by the National Institute for Occupational Safety and Health (NIOSH):

1. "Method 6009" – Mercury (NIOSH Manual of Analytical Methods (NMAM), Fourth Edition, 8/15/94).
- C. The following documents published by the Agency for Toxic Substances and Disease Registry (ATSDR):
 1. "Toxicological Profile for Mercury"; www.astdr.cdc.gov
 2. ATSDR, 2012. Agency for Toxic Substances and Disease Registry. Chemical-Specific Health Consultation for Joint EPA/ATSDR National Mercury Cleanup Policy Workgroup Action Levels for Elemental Mercury Spills. Division of Toxicology and Environmental Medicine Prevention, Response and Medical Support Branch Emergency Response Team. Available from: www.atsdr.cdc.gov

3.0 Air Monitoring

3.1 General

- A. The Contractor should be responsible for personal air monitoring to comply with OSHA regulations.

3.2 Description of Work

- A. The Contractor's Project Manager is responsible for overseeing the protection of the environment from contamination, protection of persons in adjacent areas, and assurance that the areas are acceptable for occupancy in accordance with applicable regulations.
- B. Copies of Contractor's Project Manager field notes and reports of observations shall be kept in an on-site project logbook.

3.3 Air Monitoring

- A. Ambient Air Monitoring: A Consultant should perform ambient air monitoring to detect discrepancies in the work area isolation such as:
 1. Contamination of the building outside of the work area with hazardous materials.
 2. Failure of filtration or rupture in the negative pressure system.
 3. The work practices established by the Contractor and respiratory protection provided for employees are adequate.
- B. Work Area Mercury Vapor Levels: A Consultant should monitor mercury vapor levels in the work area. The purpose of this air monitoring is to detect mercury vapor levels which may challenge the ability of the work area

isolation procedures to protect the balance of the building or outside of the building from contamination by mercury vapors.

- C. Work Area Clearance (When Applicable): Consultant should determine if the elevated mercury vapor levels encountered during abatement operations have been reduced to an acceptable level as established in a site-specific abatement specification.
- D. Equipment: Ambient and work area monitoring should be performed using a Jerome J405 mercury vapor analyzer (or similar device) to obtain real time measurement. Measurements will be collected and recorded at several locations inside and outside the work area during work activities.

4.0 Negative Pressure System

4.1 General

- A. HEPA-filtered exhaust systems equipped with new HEPA filters for each project should be used. Carbon filters designated for mercury vapor filtration (mercury absorbing activated charcoal filters) should also be installed. Exhaust equipment and systems should comply with ANSI/AIHA/ASSE Z9.2-2012 and should be used according to the manufacturer's recommendations.
- B. A system of HEPA-equipped air filtration devices should be used to establish a pressure differential between the work area and the surrounding area (no less than -0.02 inches of water). A data logging manometer should be used to confirm negative pressure.
- C. Additional air filtration devices shall be provided inside the work area for emergency standby as well as for circulation of dead air spaces.
- D. The pressure differential should be maintained at all times after preparation is complete and until a Consultant completes final visual inspections and air tests confirm the area is clean and acceptable for occupancy.
- E. Air will be exhausted outside the work area.
- F. The Contractor should maintain air filtration devices daily and record in logbook.
- G. There shall be a minimum of four air changes per hour in negative pressure enclosures.

5.0 Work Area Preparation

5.1 General

- A. Before work begins in an area, a decontamination unit must be in operation.
- B. Contractor must construct a work enclosure(s) with 6-mil (minimum) polyethylene sheeting that completely isolate the work areas from other parts of the building to prevent contamination beyond the isolated areas.
- C. The Contractor should set up a work area, load out and decontamination area. The decontamination facility outside of the work area should consist of a change room, shower room and equipment room.
- D. Place work area under negative air pressure using HEPA-filtered/mercury vapor absorbing activated charcoal filter exhaust system.
- E. Integrity of seals and critical barriers shall be regularly checked and maintained by the Contractor.

6.0 Worker Protection

6.1 General

- A. Provide worker protection as required by OSHA, state, and local standards applicable to the work. Contractor is responsible for enforcing worker protection requirements at least equal to those specified.
- B. Each time the work area is entered the Contractor should require all persons to remove all street clothes in the changing room of the personnel decontamination unit and put on new disposable coverall, new head cover, and a clean respirator.
- C. Workers should not eat, drink, smoke, chew gum, chew tobacco or apply cosmetics in the work area, the equipment room, the load out area or the clean room.

6.2 Worker Training

- A. Contractor must train all workers in accordance with 29 CFR 1926 regulations regarding the dangers inherent in handling mercury, proper work procedures and personal and area protective measures.

6.3 Medical Examinations

- A. Provide medical examinations for all workers that meet OSHA requirements as set forth in 29 CFR 1926.

6.4 Protective Clothing

- A. Provide disposable full-body coveralls, disposable head covers, and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.
- B. Boots: Provide work boots with non-skid soles and, where required by OSHA, foot protection for all workers.
- C. Gloves: Provide work gloves to all workers and require that they be worn at the appropriate times. Gloves shall be nitrile or a similar type that is chemically resistant. Do not remove gloves from work area. Dispose of work gloves as mercury-contaminated waste at the completion of the project.
- D. Safety Glasses: Provide safety glasses with side shields as needed and to be worn if half respirators are used by the workers.

6.5 Additional Protective Equipment

- A. Half or full-face respirators equipped with filter cartridges for mercury vapor and P-100 filters, disposable coveralls, head covers and footwear covers shall be provided by the Contractor for authorized representatives who may inspect the job site. Contractor may deny entry to work area by visitors without hazardous material training or respirator fit tests.

6.6 Decontamination Procedures

- A. Contractor should require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area:
 - 1. Remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.
 - 2. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid mercury dust while showering. The following procedure is required:
 - a. Thoroughly wet body including hair and face.
 - b. With respirator still in place thoroughly wash body, hair, respirator face piece, and all exterior parts of the respirator.
 - c. Take a deep breath, hold it and/or exhale slowly, completely wet hair, face and respirator. While still holding breath, remove respirator and hold it away from face before starting to breathe.
 - d. Carefully wash face piece of respirator inside and out.

- e. Shower completely with soap and water; rinse thoroughly.
 - f. Rinse shower room walls and floor prior to exit.
 - g. Proceed from shower to changing (clean) room and change into street clothes or new disposable work items.
3. After showering, each employee shall inspect, clean and repair his respirator as needed. The respirator shall be dried, placed in a suitable storage bag and properly stored.

7.0 Respiratory Protection

7.1 Description of Work

- A. Instruct and train each worker involved in the project in proper respirator use and require that each worker always wear a respirator, properly fitted on the face, in the work area from the start of any operation which may cause airborne mercury dust or increased mercury vapors until the work area is completely decontaminated. Use respiratory protection appropriate for the exposure level encountered in the workplace or as required for other toxic or oxygen-deficient situations encountered.

7.2 General

- A. Provide workers with personally issued and marked respiratory equipment approved by NIOSH and suitable for the mercury exposure level in the work areas according to OSHA Standard 29 CFR 1926 and other possible contaminants employees might be exposed to during the project. It is the Contractor's responsibility to ensure that his employees are afforded the respiratory protection as required by the OSHA standard for respiratory protection (29 CFR 1910.134, December, 2008) or the respiratory protection requested by the employee.
- B. Provide respiratory protection from the time the first operation involved in the project requires disturbance of mercury-containing materials until acceptance of final air clearance test results by the air monitoring Consultant.
- C. The minimum respiratory protection for the project during gross removal of mercury-containing flooring shall half or full-face respirators equipped with filter cartridges for mercury and P-100 filters.
- D. Respirator fit testing shall be performed as a minimum at the beginning of the project, at any change in respiratory protection equipment, and at any

time during the project if requested by the employee. Fit testing is to be performed by one of the methods listed in the 29 CFR 1910.134.

8.0 Decontamination Units

8.1 Description of Work

- A. Provide a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces, Changing Room, Shower Room, and Equipment Room. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose.

8.2 General

- A. Changing Room (Clean Room):
 - 1. Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing. Construct using polyethylene sheeting, at least 6-mil in thickness, to provide an airtight seal between the Changing Room and the rest of the building. Locate so that access to Work Area from Changing Room is through Shower Room. Separate Changing Room from the building by a sheet polyethylene flapped doorway. Do not remove equipment or materials through Personnel Decontamination Unit.
 - 2. Provide temporary lighting within decontamination units as necessary to reach an adequate lighting level.
 - 3. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in changing room. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
 - 4. Provide a continuously adequate supply of disposable bath towels.
 - 5. Provide posted information for all emergency phone numbers and procedures.
 - 6. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
 - 7. Visual Barrier: Where the decontamination area is immediately adjacent to and within view of occupied areas, provide a visual barrier of opaque plastic sheeting so that worker privacy is maintained and work procedures are not visible to building occupants. Where the area adjacent to the decontamination area is accessible to the public,

construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with wood or metal studs, max. 16 inches on center, covered with minimum 3/8 inch plywood.

B. Shower Room:

1. Provide a completely watertight operational shower to be used for transit by cleanly dressed workers entering the Work Area from the Changing Room, or for showering by workers exiting the Work Area after undressing in the Equipment Room.
2. Construct room by providing a shower pan and two shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining floor in the shower pan at an elevation that is at the top of pan.
3. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene sheeting.
4. Separate this room from the Changing and Equipment Rooms with airtight walls fabricated of 6-mil polyethylene sheeting.
5. Provide splash-proof entrances to Changing and Equipment Rooms with two doors arranged in the following configuration:
6. At each entrance to the Shower Room construct a doorframe out of lumber, PVC pipe or equivalent. Attach to this door frame two overlapping flaps fastened at the head (top) and jambs (sides). Overlap the flaps that present a shingle-like configuration to the water stream from the shower. Arrange so that any air movement out of the Work Area will cause the flaps to seal against the door frame.
7. Provide shower head and controls. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.
8. Provide a continuously adequate supply of soap and maintain in sanitary condition. Arrange so that water from showering does not splash into the Changing or Equipment Rooms.
9. Provide flexible hose showerhead. Pump wastewater to drain or to storage for use in amended water. If pumped to drain, provide 20 micron and 5 micron waste water filters in line to drain or waste water storage. Change filters daily or more often if necessary.
10. Provide Hose Bib. Provide heavy bronze angle type with wheel handle, vacuum breaker, and 3/4" National Standard male hose outlet.

C. Equipment Decontamination Units:

1. Provide an equipment decontamination unit consisting of a minimum of one chamber for removal of equipment and material from work area. Additional chambers, if built, and the entrances/exits shall be separated by a minimum of three curtain doorways. Do not allow personnel to enter or exit work area through equipment decontamination unit.
2. Equipment or Material: Obtain all equipment or material from the work area through the equipment decontamination unit according to the following procedure:
 - a. When passing contaminated equipment, sealed plastic bags, drums or containers into the washroom, close all doorways of the equipment decontamination unit, other than the doorway between the work area and the washroom. Keep all outside personnel clear of the equipment decontamination unit.
 - b. Once inside the equipment decontamination unit, wet-clean the bags and/or equipment.
 - c. When cleaning is complete, remove the waste from the equipment decontamination unit.
 - d. Workers from the building exterior enter the equipment decontamination unit to remove decontaminated equipment and/or waste for disposal. Require these workers to wear full protective clothing and respiratory protection.

D. Work Area:

1. Separate work area from the Equipment Room by polyethylene barriers. If the mercury vapor level in the Work area is expected to be high, add an intermediate cleaning space between the Equipment Room and the Work area. Damp wipe clean all surfaces after each shift change. Provide one additional floor layer of 6-mil polyethylene sheeting per shift change and remove contaminated layer after each shift.

E. Waste Load Out Area:

1. The Contractor will conduct the waste load out in areas separate from any non-project personnel or passers-by.

F. Personnel Decontamination Unit Contamination:

1. If the air quality in the personnel decontamination unit exceeds background ambient mercury vapor levels as analyzed by a Jerome J405 (or similar device) or its integrity is diminished through use, no employee shall use the unit until corrective steps are taken.

9.0 Project Decontamination

9.1 General

- A. Carry out a first cleaning of all surfaces of the work area including plastic sheeting, tools, and/or staging by use of damp-cleaning and mopping and/or a HEPA filter vacuum until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces. Do not perform dry-dusting or dry-sweeping.
- B. Equipment shall be cleaned, and all contaminated materials removed before removing polyethylene from the walls.
- C. The Contractor should replace all pre-filters and clean the inside and outside of the HEPA-filtered exhaust units.
- D. After cleaning the work area, the Contractor should allow the area to thoroughly dry the Contractor will inspect the area and, if needed, wet-clean and/or HEPA-filter vacuum all surfaces in work area again.
- E. At the completion of the cleaning operation, the Contractor's supervisor should perform a complete visual inspection of the work area to ensure that the work area is dust-and-fiber free.
- F. Visual inspection for acceptance shall be performed after all areas are dry.
- G. After the work area is found to be in compliance, all entrances and exits should be unsealed and the plastic sheeting, tape and any other trash and debris shall be disposed of in sealable plastic bags (6-mil minimum) and disposed of as outlined in Section 11.0.
- H. All HEPA-filter unit intakes and exhausts will be wrapped with 6-mil polyethylene before leaving the work area.
- I. After the final project decontamination and the Contractor has completed the tear down for occupancy by others, the Contractor will perform the project final inspection as outlined in Section 1.0.
- J. Any residual mercury-containing debris that may be present after removing critical barriers will be cleaned.

10.0 Final Clearance Testing (*When Appropriate*)

- A. After cleaning operations, the following procedure test will be performed for each work area:
 - 1. A final visual inspection shall be conducted by third-party industrial hygienist. The inspection will include observation for visible

accumulations of mercury-containing debris. If the work area is found visibly clean, air samples will be collected by the industrial hygienist.

2. During the air testing, the temperature in the work area should be a minimum of 85° Fahrenheit. The area may be heated with space heaters or similar devices suitable for interior spaces.
3. Final clearance air samples will be collected for a minimum of four hours and not more than eight hours and analyzed by NIOSH Method 6009 for mercury vapor. Air samples will be collected from a height of between two and four feet above the floor. Final clearance criteria for air samples collected will be established in a site-specific abatement specification.

11.0 Disposal of Mercury-Containing Waste Material

11.1 General

- A. All mercury-containing materials and miscellaneous contaminated debris shall be properly sealed and protected, and the loadout vehicle/dumpster will be locked, while located on the project site and then transported to a pre-designated disposal site in accordance with 40 CFR 61.150 and DOT 49 CFR Parts 100-399.
- B. An enclosed vehicle will be used to haul waste material to the disposal site. No rental vehicles or trailers shall be used. Vehicle selection, vehicle covers, and work practices shall assure that no mercury-containing materials or mercury vapor becomes airborne during the loading, transport and unloading activity and that material is placed in the waste site without breaking any seals.
- C. Waste disposal polyethylene (6-mil) and containers, non-porous (steel/plastic) drums or equivalent, with labels, appropriate for storing mercury waste during transportation to the disposal site shall be used. In addition to the OSHA labeling requirements, all containers shall be labeled with the name of the waste generator and the location at which the waste was generated.
- D. Use of the waste loadout corridor (Section 9.0, F) will allow the Contractor to remove waste from the work area directly to the vehicle/dumpster without individual bags/drums. However, the material must be sealed with 6-mil minimum polyethylene sheeting prior to removal from the site.
- E. The Contractor shall transport the containers and bags of waste material to the approved waste disposal site. All waste shall be disposed of as regulated hazardous mercury waste.

- F. The Contractor shall use a Waste Shipment Record for disposal records and distribute a copy of all waste shipment records to the Owner after the completion of the project.

12.0 Mercury Gym Flooring Removal

12.1 General

- A. The work as defined herein will be performed to minimize mercury-containing dust or mercury vapor release during removal.
- B. All loose mercury-containing material removed in the work area will be bagged, sealed and labeled properly before personnel breaks or end of shift.
- C. All plastic sheeting, tape, cleaning material, clothing and all other disposable material or items used in the work area will be packed into sealable plastic bags (6-mil minimum) and treated as contaminated material.
- D. All waste material will be double bagged.
- E. All excess water (except shower water) will be combined with removed material or other absorptive material and properly disposed of per EPA regulations. Contractor will not place water in storm drains, onto lawns, or into ditches, creeks, streams, rivers or oceans.

12.2 Cleanup and Removal of Mercury-Containing Material

- A. Removal and disposal of mercury-containing gym flooring:
 - 1. Prepare work area as set forth in Section 5.0.
 - 2. Carefully remove mercury-containing gym flooring from the concrete slab substrate. Use straight edge scrapers or a floor scraping machine equipped with straight edge blades. Do not use saws or other tools with serrated or toothed edges.
 - 3. Several passes will likely be required to remove remnants of gym flooring material from the concrete substrate.
 - 4. After gross removal of the flooring and related debris or mastics, if present, the concrete slab should be diamond buffed using a range of 16-100 grit pads, as needed, prior to final HEPA-filtered vacuum cleaning and damp wiping.
 - 5. Clean work area as specified in Section 10.0.