

Mercury in Polyurethane Floors

East Rutherford School District—McKenzie School

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TECHNICAL SERVICES



Gallagher

Insurance | Risk Management | Consulting

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About the Presenter

- I. 25 Years experience – Schools and industries involving mercury exposure, clean-up, and controls. OSHA and community/demo.
- II. Kiddie College Investigator for NJ DOH – “How things go wrong.”
- III. Advocate for large communities surrounding former large industries. Families and children/home protection.
- IV. Information resource for South Jersey school systems.

Major Topics

Mercury in gymnasium floors:

- ✓ The problem
- ✓ Exposure pathway
- ✓ Health hazards and health effects
- ✓ Regulations/guidance
- ✓ Mitigation/control

The Mercury Issue

Gym Floors: The Mercury Problem

Polyurethane floors with phenyl mercuric acetate (PMA) catalyst were installed in school multipurpose rooms, gyms, cafeterias, auditoriums, stages, and indoor and outdoor tracks since the 1960s.

PMA breaks down and releases odorless, colorless mercury vapor at room temperatures. Under certain conditions, the floors and items that have been in contact with them emit mercury vapor indefinitely.

Gym Floors: The Mercury Problem (cont.)

This is not a new issue (Right Message-Right Time).

It's a developing issue in both public and private schools.

A nationwide issue impacting an unknown number of schools, likely tens of thousands.

Most schools are still unaware. The diligent ones are now actively investigating and addressing.

Mercury is a known entity and good guidance is available – for most there is a clear and safe path forward.

Exposure/Health Concerns

Gym Floors: Exposure/Health Concerns

Basic introduction to metric/mathematical terms (to be repeated):

- Sugar cube ~ 2-3 grams.
- Microgram (ug) – 1 ug = 1 millionth of a gram.
- Nanogram (ng) – 1 ng = 1 billionth of a gram.
- Cubic meter (m³) – mercury vapor concentrations and guidance values discussed are given in ug/m³ or ng/m³ of air.

Gym Floors: Exposure/Health Concerns (cont.)

Naturally occurring-mercury comes in several forms:

- Metallic (Elemental) Mercury – Classic liquid mercury. Increasingly generates and greater temperatures. Naturally present in our outdoor air – anywhere from ND - 80 ng/m³ based on our tristate (clean-air community) readings. Sustained readings of between 15 and 60 ng/m³ are commonplace. In alignment with published values in residences, extending up to 100 ng/m³.
- Salts (i.e., mercury combines with chlorine, sulphur or oxygen) – Non-volatile although an exposure concern via generation of dust(s)/debris.
- Organic (i.e., many industrial forms/uses – methyl mercury common) – Primarily an ingestion concern and sometimes in contaminated products (e.g., cosmetics).

Gym Floors: Exposure/Health Concerns (cont.)

Generation of free mercury vapor (i.e., metallic mercury) is the concern. Volatile mass reportedly doubles with every 9F.

Metallic mercury is poorly absorbed by the gastrointestinal tract; we know that ingestion is not an exposure route of concern.

The critical exposure and toxicology route is by inhalation.

Therefore, students and staff are best protected by controlling mercury vapor concentrations.

Gym Floors: Exposure/Health Concerns (cont.)

Not all flooring that contain mercury emit mercury vapors into the air.

There are many factors:

- Age
- Type and condition of installation
- Weather/Building environment
- Code Building Mechanical Controls (e.g., HVAC system/settings and outdoor air supply options)

Gym Floors: Health Concerns

In the right dose, mercury can be hazardous to the central nervous system, kidneys, lungs, eyes and skin. Children and pregnant (or soon to be pregnant) individuals, staff, and older students require special consideration.

Risk varies with level of mercury exposure (i.e., concentration, duration, age, and health status).

Regulations & Guidance

Gym Floors: Exposure/Health Concerns

Basic introduction to mathematical terms:

- Microgram (ug) – 1 ug = 1 millionth of a gram.
- Nanogram (ng) – 1 ng = 1 billionth of a gram.
- Cubic meter (m³) – mercury vapor concentrations and/or guidance values discussed here are given in ug/m³ or ng/m³ of air.

Gym Floors: Regulations/Guidance

General Consensus: There are no regulations requiring removal of an installed mercury-containing floor.

Occupational Standards for the American worker:

- 1) OSHA PEL (1976): 100 ug/m³ as an eight (8) hour average (skin);
- 2) NIOSH REL (1973): 50 ug/m³ as a ten (10) hour average (skin);
- 3) ACGIH TLV (1991): 25 ug/m³ as a eight (8) hour average (skin).*

OSHA has the force of the law but is outdated. Each of the NIOSH REL and the ACGIH TLV are guidance values based on the most recent science. The ACGIH represents a peer review process.

*The concentration to which a healthy worker may be repeatedly exposed over a working lifetime with no adverse health effects.

Gym Floors: Guidance

Note: The following guidance values are based on community values. These include degrees of protections for sensitive (i.e., young, old, or infirmed) populations nearly continuously (worst case) over a lifetime. Note that all of the following use the same or a select grouping of existing exposure studies.

State of Minnesota Department of Health (MN DOH) = 0.75 ug/m^3 (750 ng/m^3) for staff (40-hours) and children (16 hours or less) per week as a working average over the course of a school year. Implementation in combination with representative surface testing.

This is based on the US EPA Guidance (1995) Reference Concentration (RfC) value of 300 ng/m^3 for chronic mercury inhalation. This is a lifetime exposure not expected to result in appreciable adverse health effects – modified for time spent in schools (and normal background).

Gym Floors: Guidance (cont.)

Note: Many of following guidance values are based on community scenarios. These include degrees of protections for sensitive (i.e., young, old, or infirm) populations nearly continuously (worst case) over a lifetime.

New Jersey Department of Health (NJ DOH) = 0.8 ug/m^3 (750 ng/m^3). No time limits are provided but are assumed to cover “normal” school activities. This reviewer interprets this value as being equivalent to the MN DOH value and proportionally adjusts student/staff total weekly exposures.

NJ DOH is currently allowing schools to decide how they want to handle the issue. Discussions and correspondence with the US EPA indicate that they are in agreement with this value. Note these values are below the traditional federal residential clearance level of $<1 \text{ ug/m}^3$.

Gym Floors: Regulations & Guidance

The Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Level (MRL) for chronic inhalation of mercury vapor (1999) = 200 ng/m³.

It is believed that this level is unlikely to produce adverse health consequences based upon continuous exposure over a person's lifetime. In and of itself not appropriate for a school environment.

US EPA Guidance (1995) Integrated Risk Information System (IRIS) Reference Concentration (RfC) for chronic mercury inhalation value of 300 ng/m³. Lifetime exposure is not expected to result in appreciable adverse health effects to most people, including sensitive groups.

Gym Floors: Regulations & Guidance (cont.)

California Office of Environmental Health (Cal OEH) Hazard Assessment has provided California RELs (2008) for mercury vapor inhalation.

- 1) 30 ng/m³ for long-term inhalation exposure;
- 2) 60 ng/m³ for long-term, repeated, eight-hour inhalation exposures;
- 3) 600 ng/m³ for short-term, acute, one-hour inhalation exposure.

Values represent California law which require additional safety factors where there is “No Observed Effect Level” (NOEL). Accordingly, prior-referenced and standard toxicology based-exposure levels are reduced by orders of magnitude.

These values present practical and scientific concerns.

Gym Floors: Regulations & Guidance

Practical Concerns:

We live in the Tristate Area (i.e., major population/combustion sources)

- 1) We live directly downwind of major (i.e., coal-fired) energy production facilities.
- 2) Normal background levels for our area fluctuate based on a number of factors but will routinely exceed California guidance criteria.

Scientific Concerns:

California law-mandated safety factors are widely regarded as arbitrary and not science-based.

Path Forward/Action Plan

Gym Floors: Regulations & Guidance

Mercury floors may be managed in place under the right conditions. Necessary components include:

- 1) Initial professional assessment. In some cases, floors may be old (40+ years) and in need of replacement regardless;
- 2) Functional and effective HVAC system/ventilation dilution ventilation (i.e., outside air changes) in order to offset vapor release levels;
- 3) Air conditioning during warmer months to maintain 68 – 79F;
- 4) Professional air monitoring services to assess representative and worst-case (e.g., summer time) conditions;
- 5) Comparison to applicable guidance values, floor/system maintenance/hygiene, awareness/training, NJ PEOSH requirements.

Gym Floors: Regulations & Guidance (cont.)

Following is a unified, recommended overall Action Plan; this is generally alignment with NJEA, WEC, and HSN:

- 1) Build group consensus (i.e., school staff, parents, and communities) with help from a Health & Safety committee.
- 2) Request technical assistance from a qualified industrial hygiene consultant to guide “The Team” in the technical process. Alert the District as appropriate based on findings.
- 3) Assess and test suspect flooring.

Gym Floors: Regulations & Guidance (cont.)

Recommended overall Action Plan (cont.):

- 4) Floors with leachate that exceeds the EPA maximum concentration of 0.2 ppm (mg/L) of mercury must be disposed of as hazardous waste. If mercury in floor levels are greater than 1 ppm, proper floor maintenance, adequate ventilation and cooling, and initial/worst-case air sampling should be implemented.
- 5) Develop procedures (e.g., ventilation, gym use/maintenance, surface hygiene, etc.) needed to control exposures while floor/space is in use.

Gym Floors: Regulations & Guidance (cont.)

Recommended overall Action Plan (cont.):

- 6) Coordinate decisions with all Team members regarding public awareness/training/path forward decisions (e.g., including but not limited to community groups, staff, labor unions, affected families, attorneys, insurance carriers, and health professionals).
- 7) Develop plans for maintenance, mitigation (i.e., removal/replacement or sealing) with cost analysis/budgeting for indefinite support services versus replacement.

What's Happening at McKenzie School?

Gym Floors: McKenzie School Update

How to solve the gym floor issue:

- 1) ERSD is collecting necessary information to define the problem.
- 2) ERSD is making necessary HVAC system inspection(s), repair(s), and adjustment(s), as appropriate, to properly ventilate the gym space.
- 3) ERSD is building a Team to determine next steps for the community, staff, and students. Properly managed gym floors can be safely managed with no harmful effects to students, staff, or the community.
- 4) ERSD is scheduling removal and replacement of the gym floor for Summer 2020.

Gym Floors: McKenzie School Update

Historic data – Summer 2019

Gym floor content (Total Mercury ~ Mercury content is not an indicator of exposure.)

Sample A – 4.9 parts per million

Sample B – 33 parts per million

Gym Air Quality (Summer- 2019)

Gymnasium (No Occupancy, Peak Summer Heat [90-100F], No HVAC/Ventilation, Sealed Conditions – Worst-Case Drill): 3,000 – 3,800 ng/m³

Immediately Prior to School Open(Normal Occupancy Conditions/Settings): 750 – 1,000 ng/m³

Gym Floors: McKenzie School Update

October 15, 2019 Data - ***Note, NJ DOH criteria = 800 ng/m³ (0.8 ug/m³)**

Outside Air Quality: (Early morning; 5 – 10 ng/m³), Noon; 25 – 30 ng/m³) and Afternoon (30 – 35 ng/m³)

Gym Air Quality (68F, 25% OA & Continuous Fan Mode – All Gym HVAC Systems):

Gymnasium: 260 – 320 ng/m³ (300/319/340 ng/m³ at entrance)

2nd Floor Hallway/Classrooms (Outside Gymnasium): 32 - 148 ng/m³

1st Floor Hallway/Classrooms: 83 – 173 ng/m³

3rd floor Hallway/Classrooms: 38 – 106 ng/m³

4th floor Hallway/Classrooms: 25 – 105 ng/m³

5th floor Hallway/Classrooms: 70 – 95 ng/m³

Gym Floors: McKenzie School Update

Summary of Data

Test Date	Gymnasium	Outer School Areas
July 2019 (Worst-Case Drill)	3,000 – 3,800 ng/m ³	No Data/Non-Test Area
August 2019 - 2019 School Opening (Standard Op.)	750 – 1,000 ng/m ³	No data – Presumed 25 – 50% Peak
September 2019	750 – 1,000 ng/m ³	Final Data received & Analyzed
September 2019	750 – 1,000 ng/m ³	Parent/Staff letter distributed
October 2019 (Current HVAC)	260 – 320 ng/m ³	25 – 173 ng/m ³