

## Mercury in Gym Flooring: Guidance for Clinicians to Respond to Parents' Concerns

### KEY POINTS

1. Some older gym floors may contain phenyl mercuric acetate (PMA), which can release very low levels of mercury vapor.
2. At this low level of exposure, the health risks associated with exposure to mercury vapor are small, and medical testing is generally not recommended.
3. Increasing ventilation and air movement is key to addressing this problem. To ensure a healthy learning environment, parents can advocate that their school adopt the EPA [Tools for Schools](#) Program, which has practical steps to reduce common air pollutants.

### Why is mercury found in some gym floors?

In the past, a form of mercury called phenyl mercuric acetate (PMA) was used in some gym floors, and over time, wear-and-tear of the floor can release low levels of mercury vapor into the air.

- In the past, a form of mercury called phenyl mercuric acetate (PMA) was used in polyurethane floors in some school gyms.<sup>1</sup>
- It was originally thought phenyl mercuric acetate (PMA) could not escape the floor because of a protective coating. However, it is now known that the **PMA can break down from daily use and release low levels of elemental mercury vapor into the air.**<sup>1</sup>
- In the past several years, school districts around New Jersey and New York learned about the possible presence of mercury in gym floors, and began to test school gym floors as well as indoor air.
- Mercury vapor is inhaled, absorbed through the lung, and enters the bloodstream. Once there, it is converted to inorganic mercury within the red blood cell, and then excreted in the urine. The body burden half-life of mercury vapor is approximately 1 to 2 months.

### What level of mercury vapor is allowed in schools?

While there are no laws or regulations controlling the amount of mercury vapor in schools, “guidance levels” for schools have been set at levels far below where health effects are expected to happen.

- There are no laws or regulations controlling the amount of mercury vapor in schools or homes. However, there are recommended levels set by state health departments and federal agencies such as the Agency for Toxic Substances and Disease Registry (ATSDR). These levels are very protective, meaning they are set far below the levels expected to cause health problems (see Figure on page 4).
- Generally, people do not start experiencing symptoms of mercury toxicity until vapors reach levels of 25  $\mu\text{g}/\text{m}^3$  in the air.<sup>2,3</sup> In order to be protective of health effects, guidance levels for mercury have been set well below the levels at which health effects are typically seen. These protective guidance values range from 0.06  $\mu\text{g}/\text{m}^3$  to 3  $\mu\text{g}/\text{m}^3$ .<sup>2,3</sup>

- As with other indoor air pollutants, it is prudent to strive for mercury levels as low as reasonably possible, especially for children and pregnant women.

### What are the health effects of mercury vapor exposure?

While mercury exposure can affect the nervous system and kidneys, the low-level intermittent exposure scenario from PMA flooring is unlikely to lead to health effects.

- As with many environmental exposures, the health effects associated with mercury vapor exposure are highly dependent on the dose/duration/route of exposure and age/health status of the individual.
- Little data exists on the effects of intermittent, low-level exposure to elemental mercury, such as periodic exposure to mercury from attending gym class in a room with PMA flooring. **However, the risk of health effects in this situation is thought to be small.**
- Typically, health effects can be seen when an individual is chronically exposed to air levels of mercury  $>25 \mu\text{g}/\text{m}^3$  (but more predominantly at concentrations  $\geq 100 \mu\text{g}/\text{m}^3$ ).<sup>2-4</sup> To our knowledge, typical levels measured in school gyms with PMA flooring have ranged from “not-detected” to approximately  $1.1 \mu\text{g}/\text{m}^3$ , with most levels below  $0.8 \mu\text{g}/\text{m}^3$ .
- Chronic exposures to mercury vapor **at levels much higher than typical levels in gyms** can affect the nervous system and kidneys. Potential health effects include: intention tremors, erethism (emotional lability, irritability, nervousness, mood swings, excitability, fearfulness, excessive shyness, depression), fatigue, weakness, diaphoresis, desquamating rash, hair loss, salivation, and kidney dysfunction.<sup>4,5</sup>
- **Acrodynia** is an idiosyncratic reaction in children exposed to elemental or inorganic mercury, which is characterized by maculopapular rash (desquamates), swollen/painful extremities, irritability, fever, and sweating. It may initially be confused with Kawasaki Disease or an infectious process. Although it is unclear what level of mercury vapor can trigger acrodynia due to individual genetic susceptibility<sup>4</sup>, it is unlikely to occur from intermittent low-level exposure to PMA in gym floors.

### Is medical testing for mercury exposure recommended in this scenario?

While several different tests are available to assess for mercury exposure, we do not recommend routine medical testing to assess exposure to mercury vapor from PMA flooring in school gyms.

- **We DO NOT recommend routine mercury testing (urine, blood, or hair) in children who attend a school with PMA flooring, given the limitations of testing in this low-risk exposure scenario.**

Test	Indications for Use	Interpretation of Results
<b>Urine Mercury</b>  (Spot or 24-Hour Level)	<ul style="list-style-type: none"> <li>• Preferred test to document <b>chronic</b> exposure to elemental (metallic) and inorganic mercury at levels higher than those typically seen in school gyms (i.e., occupational exposures or mercury vapor exposure from a spill).<sup>4</sup></li> <li>• An individual would require inhalational exposure to mercury vapors <math>\geq 10 \mu\text{g}/\text{m}^3</math> (magnitude larger than typical levels found in gyms with PMA flooring) to have urine levels elevated above the population’s “background level” of urinary mercury.</li> <li>• Urinary levels from exposure to air mercury vapor levels <math>&lt;10 \mu\text{g}/\text{m}^3</math> may not be accurate, and should not be relied upon as an indication of exposure.<sup>6,7</sup></li> <li>• Half-life of elemental mercury is 1 to 2 months.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Reference range:</b> <math>&lt; 5 \mu\text{g}/\text{L}</math> (reflects background exposure levels)</li> <li>• <b>Excessive exposure:</b> <math>&gt;10\text{-}20 \mu\text{g}/\text{L}</math> (above background levels, warranting an environmental history for <a href="#">sources of mercury exposure</a>)</li> <li>• <b>Neurologic symptoms:</b> <math>&gt;100 \mu\text{g}/\text{L}</math></li> </ul> <p><i>Urine levels do not correlate well with symptoms, especially with intermittent exposures.</i></p>

<b>Whole Blood Mercury</b>	<ul style="list-style-type: none"> <li>Used to assess for organic mercury exposure (the form of mercury found in some fish and shellfish).</li> <li>May be used to assess <b>acute, severe</b> toxicity from very high levels of mercury vapor exposure. In this case, levels may be elevated in the first 1-2 days, then return to normal (urine levels remain elevated).<sup>4,8</sup></li> </ul>	<ul style="list-style-type: none"> <li><b>Reference range:</b> &lt; 5µg/L</li> <li>Low level mercury vapor exposures (such as in gym) would not cause elevated levels.</li> <li>In asymptomatic individuals, an elevated level suggests an alternate source of exposure, such as <a href="#">certain types of seafood</a>.</li> </ul>
<b>Hair</b>	<ul style="list-style-type: none"> <li>Limited utility in the clinical setting.</li> <li>Some epidemiologic studies use hair levels as a proxy for body burden from <b>chronic</b> organic mercury exposure.<sup>4,8</sup></li> </ul>	<ul style="list-style-type: none"> <li><b>No reference range.</b> Hair testing not used in the clinical setting due to <a href="#">multiple limitations</a>.</li> </ul>

**Should my patients be exempt from participating in gym class with PMA flooring?**

No, the presence of PMA flooring should not limit a child's participation in gym class.

- To our knowledge, the levels of mercury vapor found in the schools are low and do NOT warrant missing out on gym class and the benefits of physical activity.
- Schools with PMA flooring are implementing plans to reduce the amount of mercury vapor in the air - either through replacing the floor or optimizing the ventilation system.

**What advice can I share with concerned parents?**

Moving forward, the most important steps parents can take is to work with the school to implement a comprehensive indoor air quality program, such as the EPA's [Tools for Schools](#).

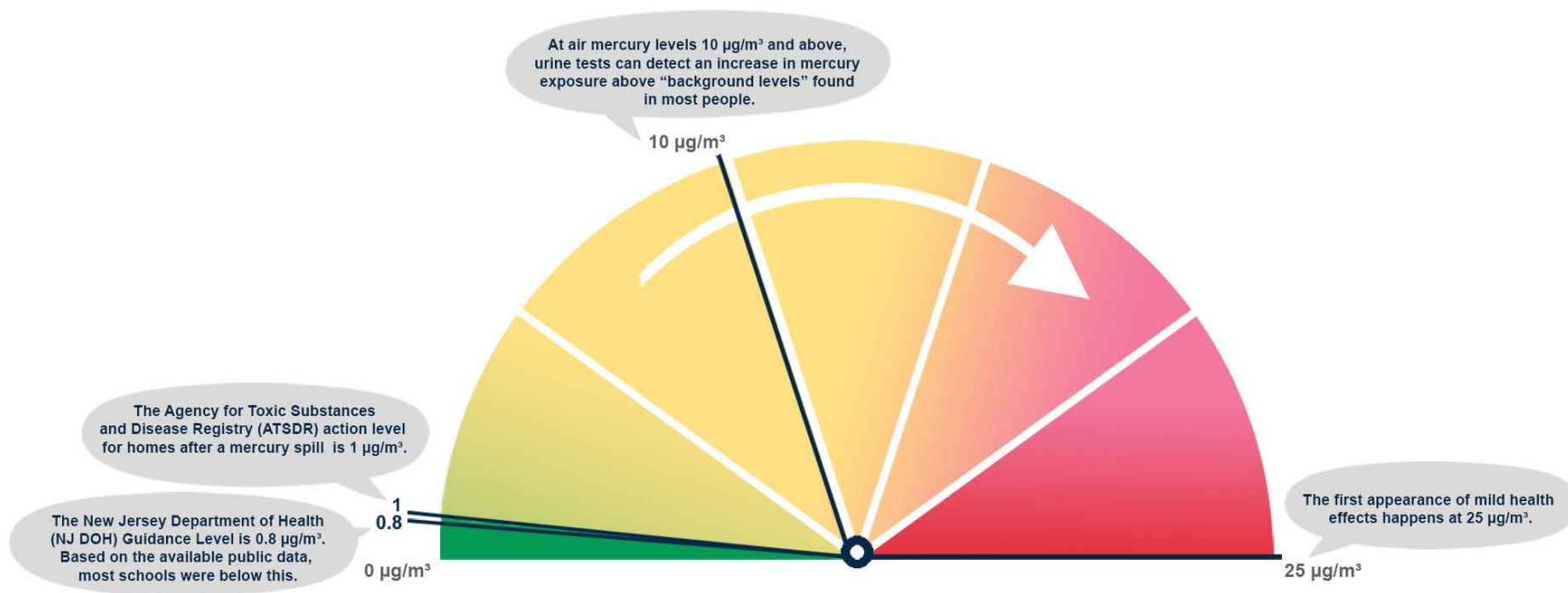
- Programs such as Tools for Schools help ensure that ventilation is optimized throughout the school building and sources of potential indoor air pollutants (such as mold and volatile organic compounds) are reduced. Improving indoor air quality can improve student performance, reduce asthma/allergy symptoms, among other benefits.<sup>9</sup>

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## Air Mercury Levels in Schools Are Well Below Levels Where Health Effects Are Typically Seen



Keep your school in the “green”!

Parents, teachers, and schools can work together to promote a healthy school by implementing the “Tools for Schools” program that can improve overall indoor air quality! [www.epa.gov/iaq-schools](http://www.epa.gov/iaq-schools)

### Where can I go for more information on mercury?

- Healthcare providers can contact local experts in pediatric environmental health for additional guidance. Find your local Pediatric Environmental Health Specialty Unit (PEHSU) [here](#). Or reach out to the New York State Children’s Environmental Health Centers [here](#).
- Refer to the [New York Department of Health](#) or the [Agency for Toxic Substances and Disease Registry](#) (ATSDR) guide on reference levels of mercury exposure.