Mercury Action Levels And Guidance For Indoor Spills

This document is a quick reference guide for public health and environmental officials who must evaluate environmental data collected from residential, school, and office settings where indoor mercury spills have occurred. Air concentrations at or above the action level should prompt a response. The CT DPH uses these levels to guide actions to be taken following the spill. The rationale for using these guidance values is provided in the table. It is important to note that these mercury action levels are intended as recommendations and are not regulatory or enforceable cleanup values.

CT DPH recommends that DEP and environmental consultants contact CT DPH Environmental and Occupational Health Assessment Program staff at 860-509-7740 (after hours, call 860-509-8000) if you are in doubt about application of this mercury guidance.

For additional information about metallic mercury health effects, residential clean-up guidance, mercury and compact fluorescent bulbs (CFLs), and spill response in schools, please visit the CT DPH website: http://www.ct.gov/dph/mercury

Note to Environmental Consultants/Field Personnel:
All of our guidance information for mercury vapor is based upon air data, since the route of exposure we are concerned about is via inhalation. Dermal and ingestion exposures do not present a significant health risk with metallic mercury. Therefore, we will not accept or comment upon results obtained from wipe samples.

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CT DPH's mercury action levels are extrapolated from health guidance values (HGVs) independently developed by two federal agencies, ATSDR and EPA. They are based upon both animal studies and human epidemiology studies that evaluated the health effects associated with inhalation of mercury vapors in air. ATSDR developed a chronic Minimal Risk Level (MRL) of 0.2 μg/m^3 based upon an occupational study of workers. The MRL means that exposure to air concentrations of mercury vapor up to 0.2 μg/m^3 every day for more than a year is unlikely to result in adverse, non-cancer health effects. EPA used the same study to develop a Reference Concentration (RfC) of 0.3 μg/m^3 using different assumptions and uncertainty factors. CT DPH used these HGVs in combination with information about field and laboratory testing methods and practices, remediation practices, and exposure factors in residential, school, and office settings to develop the guidance values presented in the table.

	Indoor Air Concentration	Action	Method of Analysis	Rationale for Action Level
Residential Initial Screen	<0.5 ug/m^3 (averaged over all results in each impacted room/area)[a]	No further action is required.	Direct reading instrument[a], NIOSH 6009, or equivalent	An area-wide average of 0.3 ug/m^3 (USEPA RfC) is a health protective chronic target level.
	0.5 to < 2.0 ug/m^3 (averaged over all results each impacted room/area)[a]	Remediation is necessary, but it is not necessary to remove occupants from the home.	Direct reading instrument[a], NIOSH 6009, or equivalent	"Cleaning in place" is advised to reduce household disruption when levels are below the CT DPH acute 1 hr target of 2.0 ug/m^3
	≥ 2.0 ug/m^3 (averaged over all results in each impacted room/area)[a]	Remediation is necessary, plus remove occupants from affected area.	Direct reading instrument[a], NIOSH 6009, or equivalent	The CT DPH acute 1 hr target is 2.0 ug/m^3 and CalEPA is 1.8 ug/m3. Evacuation is needed to prevent possible neurological effects in sensitive individuals
Residential Re-Entry	No single detection reading above 0.5 ug/m^3 for each impacted room/area	Residential re-entry level after remediation	Direct reading instrument[a], NIOSH 6009, or equivalent	The risk-based residential chronic IAQ target of 0.3 ug/m^3 (USEPA RfC) should ultimately be the target. However, this is an area-wide average. Field measurements ≥ 0.5 ug/m^3 should receive special attention, i.e., additional cleaning.

[a]When using direct reading instruments, it is essential to take readings in enough locations to have a representative sample for assessing mercury vapor concentration in the room or area. Contact DPH (860-509-7740) for further direction.

[b]Do not collect wipe samples for assessing exposure to mercury *vapor*. CT DPH will not evaluate wipe sample results for reoccupancy after a spill.

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	Indoor Air Concentration	Action	Method of Analysis	Rationale for Action Level
Schools & Offices Initial Screen	≤ 1.0 ug/m^3 (averaged over all results in each impacted room/area)[a]	No further action is required.	Direct reading instrument[a], NIOSH 6009, or equivalent	This level is higher than chronic USEPA RfC target level, since children and adults are in school for a shorter percentage of time than they are at home.
	1.1 to < 2.0 ug/m^3 (averaged over all results in each impacted room/area)[a]	Remediation is necessary, but it is not necessary to remove occupants from the area.	Direct reading instrument[a], NIOSH 6009, or equivalent	"Cleaning in place" is advised to reduce school/office disruption when levels are below the CT DPH acute 1 hr target of 2.0 ug/m^3
	≥ 2.0 ug/m^3 (averaged over all results for each impacted room/area)	Remediation is necessary plus remove occupants from affected area.	Direct reading instrument[a],-NIOSH 6009, or equivalent	The CT DPH acute 1 hr target is 2.0 ug/m^3. Evacuation or removal from exposure offers the greatest amount of protection.
Schools & Offices – Re-entry	No single detection reading above 1.0 ug/m^3 for each impacted room/area	Re-entry level for schools & offices.	Direct reading instrument[a], NIOSH 6009, or equivalent	This clearance level is double that of the residential re-entry limit, since children and adults are in school for a shorter percentage of time than they are at home.
Personal Effects	≤ 5.0 μg/m^3 measured as headspace in enclosed container containing personal effects	Acceptable level in a modified test procedure to allow personal effect to remain in the owner's possession	Real-time, direct reading air monitoring instrument	When personal effects, such as clothing, shoes, backpacks are placed in a discrete plastic container much smaller than a typical room (e.g. garbage bag) this concentration of mercury in the air trapped inside the container is considered safe and personal effects can be returned to the owner.

[a]When using direct reading instruments, it is essential to take readings in enough locations to have a representative sample for assessing mercury vapor concentration in the room or area. Contact DPH (860-509-7740) for further direction.
[b]Do not collect wipe samples for assessing exposure to mercury *vapor*. CT DPH will not evaluate wipe sample results for reoccupancy after a spill.

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Measurement of Mercury Vapor and Remediation.

Since there is no single protocol for cleaning up mercury spills in homes and schools, each situation will require thoughtful evaluation of a number of parameters before selecting a clean-up method. It is important to remember that the concentration of mercury vapor in an indoor space is influenced by a number of factors besides how much (quantity) of metallic mercury was spilled. These additional factors include room temperature, size of the room (volume), ventilation, how recently and how much was the mercury source disturbed prior to taking measurements, the surface area of the mercury source, and how long the mercury has been there. The presence of these factors may lead to higher air concentrations. It is important to be aware of these modifying factors so that appropriate data interpretations can be made.

Some Factors Affecting Indoor Mercury Vapor Concentration:

- Room temperature
- Size of the room (volume)
- Ventilation
- How recently and how much was the mercury source disturbed prior to taking measurements
- Surface area of the mercury source
- How long the mercury has been there

Expect Higher Concentrations When:

- High room temp
- Minimal ventilation
- A lot of movement that disturbs the source (like walking on a contaminated carpet, sitting on contaminated furniture)
- Large surface area (sweeping & vacuuming increase surface area)
- Recent (fresh) source

How To Measure

Air contaminants stick to media in a solid sorbent tube after air is drawn through with a pump. Analysis occurs in the lab.

Regardless of which method is chosen, it is important to take enough samples in each area to develop a meaningful representation of the air concentration in each of those areas. Obviously, multiple data points will give a better representation than fewer. It is important to keep in mind that measurements of mercury vapor are highly affected by air currents. Even micro-currents that are created by someone simply walking past the sampler can cause a spike or drop in vapor concentration in the vicinity of the sampler. This is especially important to bear in mind when collecting grab samples with direct reading instrumentation (meters). The way to minimize this effect is to collect more samples and average the results, or to sample for a longer period of time to negate momentary spikes/drops in concentration. Practically speaking, this means that every time you write down a result, it should be an average of at least 3 collections. For example, if a Gold Film Mercury Vapor analyzer is used, press the button at least 3 times and average all of those readings to get one data point. Do this in each spot that you want to collect a sample. Alternatively, traditional industrial hygiene sampling may be performed by sampling for 2-8 hours (continuously) using a pump with a flow rate of 200–250 cc/min. Hopcalite is the solid sorbent media used to collect mercury vapor with this method (NIOSH Method 6009).

One of the advantages of having a direct reading instrument is that it allows the field investigator to easily collect air samples in numerous locations in each room. In addition to scanning the entire affected room/area, look for potential "hot spots" where liquid mercury may accumulate. If metallic mercury is spilled in a room with tile or wood floors, collect air samples near cracks and crevices between floor boards/tiles, where mercury beads may become trapped. Also check cabinet interiors and drawers (especially corners and joints) if a thermometer or other device containing mercury broke there. If clothing may have been contaminated and then washed in a home washer, take meter readings inside of the washer and dryer. Don't forget to check the bottom of shoes.

Special portable direct reading instruments like this one provide instant mercury vapor results.

Where to Measure

Consider who might be exposed in the home, school, or office. Take measurements close to the breathing zone. This means that it may be necessary to collect air samples at different heights. For example, the breathing zone of an infant is close to the ground. In an office where adults are seated at desks for most of the day, the

breathing zone would be around 4 feet from the ground.

Pay attention to the behaviors of the occupants. If there is a spill on the carpet in the living room and the children typically sit or lie on the floor in front of the TV, take a lot of measurements in that area. If the spill is on a couch, bed or chair, take a lot of measurements there. In both cases, occupants might have direct exposure for extended periods of time.

Breathing Zone Heights	
Infant	Near the floor
Toddlers & young kids	2-3 ft from floor
Seated adults	4 feet from the floor
Standing adults	5-6 feet from floor

Measurement After Remediation

Remediation activities are inherently disruptive and cause a lot of air movement. Measurements at the end of a clean-up day may indicate low to non-detectable air concentrations of mercury. However, despite the best clean-up efforts, sometimes we find elevated air concentrations a day or two after remediation has been performed. Why does this happen?

During the daytime, remediators may remove most solid/liquid sources of metallic mercury. However, some of this mercury may become suspended in the air, especially if the room is warm. During the evening, the room will presumably cool down. As the air cools, mercury vapor turns back into liquid and re-condenses onto surfaces in different/additional locations. It then re-vaporizes as the air warms and is again detectable with air monitoring equipment. Also, tiny mercury beads are sometimes left behind in cracks/crevices. They can become covered with dust, which may suppress vapor formation. The next day when the air is stirred up and dust is disturbed, those beads give off vapor that is detectable with air monitoring equipment. The remediators may need to come back and re-clean. This rebound effect is normal and not an indication that they did an incomplete job the first time. We recommend that they continue to clean until the CT Action Guidelines are reached. You may wish to re-measure a day or two after the clean-up is complete to look for rebounding.

Application of CT DPH Guidance Values

Field investigators should re-scan the entire affected room/area to be sure the CT Guidance levels for re-entry are met before allowing people to re-occupy an area after a spill. Mercury toxicity is related to cumulative exposure. Exposure is determined by concentration multiplied by time (how much and for how long). Whereas emergency response personnel are concerned with short-term exposure to large amounts of contaminants, health professionals are also concerned with chronic, long term, low-level exposures that have effects which build up in the body. This is especially important with vulnerable populations such as children and pregnant women.