Oregon Department of Human Services
Superfund Health Investigation and Education Program (SHINE)

HEALTH CONSULTATION
Salem-Keizer School District
3M Flooring
Final Release

Salem, Oregon
June 2006

Prepared by the
Oregon Department of Human Services
Superfund Health Investigation and Education Program
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Purpose and Health Issues

The purpose of this health consultation is to determine the health risks to adults and children from mercury vapors released from polyurethane flooring found in school gyms in Oregon's Salem-Kaiser School District. It is also to evaluate whether removal of the flooring could pose a health hazard to the children in the school district. The potential for current and future exposure to mercury vapors emanating from the floor were the health issues that prompted the request for this consultation.

Background – Site Description and History

In September 2005, the Environmental Toxicology Program (ETP) at Oregon State Public Health (OSPH) issued a public health advisory to all school districts in Oregon (See Appendix A). The advisory was prompted by the release of two public health consultations from Ohio and Michigan related to flooring manufactured by the 3M Corporation from the early 1960's to 1980 [1] (see Appendix B). The 3M Tartan brand floor covering is a solid, rubber-like polymer floor covering developed in the 1960's. It was promoted as a substitute for and improvement over wood flooring in gymnasiums, and as a durable running surface for both indoor and outdoor track & field facilities. According to 3M, mercury was used as a catalyst when mixing the polymer to form the floor covering resulting in a finished product typically containing 0.1 to 0.2% mercury [2]. According to 3M, several other manufacturers used the term "Tartan" in marketing similar athletic flooring materials, and notes that "Tartan" may have developed as a generic term for this type of flooring.

In December 2005, an Environmental Safety Specialist from the Salem-Keizer School District (SKSD) contacted ETP to inquire about options for testing for mercury vapors in 21 schools identified as having this general type of flooring in their gymnasiums. ETP advised SKSD that bulk and air sampling should be completed to determine if mercury is present in the flooring and if mercury vapors were present. SKSD contracted with Wise Steps, Inc. to collect bulk and air samples to test for the presence of mercury and mercury vapors. Wise Steps collected bulk samples of the flooring, and used passive badge samplers and Jerome meters to measure for mercury vapors. SKSD also contacted Oregon Occupational Safety and Health Administration (OR-OSHA) because of the risk of mercury exposure to faculty and other adults working in the school facilities.

In January 2006, ETP program staff consulted with the Superfund Health Investigation & Education (SHINE) program because the school district requested additional guidance on the risk associated with exposure to mercury vapors from this type of flooring. SHINE operates under the same cooperative agreement program with the Agency for Toxic Substances and Disease Registry (ATSDR) as the Ohio and Michigan programs that produced the previous public health consultations related to this flooring in school settings. SKSD requested that SHINE complete a health consultation to advise them about risks to adults and children from inhaling mercury vapors being released from flooring material formulated using mercury. With guidance from ATSDR, SHINE and ETP recommended that Lumex equipment be used to test for mercury vapors because this equipment has been shown to have a high level of sensitivity and accuracy, when compared with the OSHA-140 method (See Appendix C); the standard method for testing for mercury vapors. The OSHA-140 method was also recommended, but the Lumex has the added benefit of providing "real-time" results. SHINE and ETP also provided guidance to the school district on acceptable levels of mercury vapors.

At the time this testing was being done, there was only one Lumex machine available in Oregon. The U.S. Environmental Protection Agency (USEPA) has this equipment and agreed to participate in the investigation by conducting the air testing. They agreed to provide the results to the school district and other agencies involved in the investigation. In January 2006, using the Lumex meter, the USEPA sampled the air in 7 schools identified as having floors containing mercury. In February 2006, Wise Steps completed the air sampling with a rented Lumex meter in the remaining 7 schools.

Data from all sampling events were provided to the SHINE program for use in evaluating the risk of adverse health to adults and children from mercury vapors released from polyurethane flooring found in school gyms.

Discussion

Sampling and Data

A few methods are commonly used to measure the form of mercury used in manufacturing the 3M Tartan flooring. Bulk sampling is a method that involves testing the actual flooring material to determine if mercury is present. Passive badge samplers and air pumps with sorbent tubes analyzed using the OSHA Method ID-140 and Lumex meters are methods of collecting air samples to measure concentrations of elemental mercury in air released by solid media such as the gym flooring. These methods are used to collect air samples and provide estimates for the amount of mercury that could be inhaled by a human. Some methods are more sensitive that others. For this reason, SHINE and ETP recommended that the school district use bulk sampling to determine if flooring contained mercury and either sorbent tubes or Lumex as the method for collecting and analyzing air data (See Appendix C).

Bulk Sampling

The school district had incomplete information about the manufacturer of the flooring located in each school, so a decision rule was made that the type of material (i.e. rubberized flooring) would be used as the basis for collecting bulk samples. Bulk samples were collected at all 21 schools with rubberized flooring, and were analyzed by Schneider Laboratories in Richmond, Virginia.

Mercury was detected in the flooring of 15 schools. The bulk samples were also used to perform Toxicity Characteristic Leaching Procedure (TCLP) tests on the flooring material. This procedure measures the material's toxicity in order to determine the most appropriate method of disposal if the school elects to remove and dispose of the flooring material. Although it was confirmed that mercury was detectable in all 15 samples, concentrations "detected in each of the samples was below the Resource Conservation and Recovery Act (RCRA) threshold for hazardous waste" [5]. Three samples were selected from the 15 and tested for 7 additional metals included cadmium, chromium, lead, arsenic, selenium, silver, and barium. No detectable metals were found in the three samples [5].

Table 1 - Bulk Data Collected October 2005, Total Mercury (µg)

ORIGINAL FLOORING		RESURFACED FLOORING		SHEETED/PVC FLOORING	
School	**(µg)**	**School**	**(µg)**	**School**	**(µg)**
Auburn	110	Hayesville	158	Eyre	ND
Cummings	86	Highland	40.5	Gubser	ND
Englewood	41	Hoover	108	Schirle	ND
Four Corners	114	Kennedy	158	Scott	ND
Myers	57	McKinley	166	Sumpter	ND
Richmond	ND	Morningside	160		
Washington	58	Swegle	164		
Wright	122				

Air Sampling

In October 2005 and January 2006, Wise Steps, Inc. collected air samples at all 20 schools, using passive dosimeters. Air data collected using the passive dosimeters was analyzed using the OSHA-140 method. Passive dosimeter (badges) were worn by adults in or placed in a stationary location in the gymnasiums for a period of 4 hours. Passive sampling using gold film samplers have a detection limit of 2 µg/m3, which is adequate for screening areas for further evaluation, and more accurate than a Jerome meter for the same purpose. Additional air samples were taken using a Jerome meter, but these data were eliminated from consideration due to the lack of sensitivity of detection of Jerome meters

In January 2006, SKSD consulted with Oregon OSHA because of concerns about possible exposure to faculty and staff who have up to 8 hours per day of potential exposure to the environments with the flooring. SKSD requested that OR-OSHA perform additional air testing. SHINE also consulted with the USEPA Region 10 Emergency Response Unit and requested that they participate in the collection of air data using a Lumex meter. The USEPA agreed to assist with data collection and to provide technical assistance to assess potential mercury exposure levels at several schools.

On January 25, 2006, OR-OSHA, the USEPA and Wise Steps conducted sampling at 7 schools; 5 schools identified as having detectable levels of mercury through bulk sampling and 2 identified as having no detectable levels of mercury through bulk sampling. Wise Steps used passive dosimeters to collect outdoor samples to test background levels and indoor samples (placed on teachers) to test the air in the gymnasiums. Data from this sampling event were reported by OR-OSHA [6], by the USEPA [7], and Wise Steps [8], and are summarized in Table 2.

Table 2 – Air Sampling Data, January 25, 2006

School	OSHA† Breathing Zone µg/m3	OSHA† Teacher µg/m3	OSHA† Outdoor µg/m3	Badge Teacher µg/m3	Badge Outdoor µg/m3	Lumex Breathing Zone* µg/m3	Lumex Outdoor µg/m3
Cummings	0.530	0.620	0.200	ND	ND	0.285	0.000
Englewood	1.580	1.020	0.410	0.003	ND	0.355	NA
Myers	0.510	0.740	0.210	ND	ND	0.436	0.000
Hayesville	0.520	0.420	0.100	ND	ND	0.212	0.013
Swegle	NA	NA	NA	NA	NA	NR	0.013
Eyre**	NA	NA	NA	NA	NA	0.241	0.230
Gubser**	NA	NA	NA	NA	NA	0.225	NA

† 8-hour time weighted averages
* Lumex Breathing Zone = Average of all grid locations
** Schools with no detectable mercury in bulk samples
NA = Not Applicable, Did not test
ND = Non-Detectable
NR - Data collected at Swegle were suspected to be incorrect because the Lumex meter was not correctly calibrated prior to collecting the sample.

OR-OSHA used an air pump to collect outdoor samples to test background levels, samples at breathing level of an adult, and samples at the breathing level of a child. EPA's START-3 contractor conducted mercury screening with the Lumex 915+ Mercury Vapor Spectrometer (Lumex) and the Jerome 431-X Mercury Vapor Analyzer (Jerome). USEPA collected indoor and outdoor samples to test background levels, and indoor samples both at the floor and at the breathing level of a child (1.5 meters above the floor).

In February 2006, Wise Steps, Inc. used a Lumex meter to collect additional air samples on the remaining 10 schools with detectable levels of mercury identified through bulk sampling (See Table 3). In addition, one school (Swegle Elementary) was re-tested because the Lumex meter was not calibrated correctly prior to testing during the first sampling event and the data collected from that school is considered to be incorrect due to this procedural error. The remaining 5 schools with no detectable levels of mercury identified through bulk sampling were also tested.

January 25, 2006 Air Sampling Event

Table 3 – Air Sampling Data†, February 13-17, 2006

School	Lumex Floor Level	Lumex Breathing Zone*	Lumex Outdoor
	µg/m3	µg/m3	µg/m3
Auburn	.297	.279	ND
Four Corners	.386	.373	ND
Richmond**	.094	.093	ND
Washington	.141	.132	ND
Wright	.228	.217	.008
Highland	.821	.762	.010
Hoover	.205	.178	ND
Kennedy	.669	.675	ND
McKinley	.103	.108	.005
Morningside	.395	.299	.025
Swegle	.152	.148	.016
Eyre**	ND	ND	ND
Gubser**	.005	.004	ND
Schirle**	ND	.012	ND
Scott**	ND	ND	ND
Sumpter**	ND	ND	ND

† Multiple samples were taken. These data report the highest mercury levels found.
* Lumex Breathing Zone = Average of all grid locations
** Schools with no detectable mercury in bulk samples

Salem-Kaiser School District has limited information on the manufacturer of the flooring contained in their 21 elementary schools. While it is possible that 3M Corporation manufactured all of the flooring used in these schools, it is also possible that other companies manufactured some or all of the flooring. The fact that mercury was not detected in the flooring of all 21 schools could be explained by varying degrees of degradation in the flooring material, but it raises the possibility some variation in the source of the flooring.

In a general sense, there is reasonable agreement between the bulk data and the air data in that we see non-detectable or very low levels of mercury in the air data collected in the schools with non-detectable mercury in the bulk samples. However, there is not a strong enough relationship between the amount of mercury detected in the flooring and the amount detectable in the air the levels of mercury in the bulk data to allow to be able to predict mercury levels detected in the air based on bulk sampling.

Pathways Analysis and Public Health Implications

Five elements of an exposure pathway were evaluated to determine whether people are being exposed to mercury vapors from the rubberized flooring. If all the criteria are met for the five elements, then the exposure pathway is 'completed'. The five elements for a completed exposure pathway are listed below.

- *A contaminant source or release* – mercury vapors were released from flooring material manufactured with mercury as a catalyst.

- *A way for the chemical to move through the environment to a place that contains the contaminant* – mercury vapors move through the breathable air space in gymnasiums where the flooring is installed.
- *Exposure point or area* – School gymnasiums where the flooring is installed.
- *Route of exposure or a way for the contaminant to reach a population* – inhalation of mercury vapors.
- *A population that comes in contact with the contaminant* – adults and children inhale mercury vapors.

SHINE determined that there is a completed exposure pathway for inhalation of mercury vapors from the rubberized flooring material.

<u>*Mercury Levels*</u>
ATSDR typically considers mercury vapor concentrations at or below 1 µg/m^3 an acceptable level of exposure to airborne mercury in a residential scenario. This number is based on guidance from the USEPA for residential occupancy and assumes a 24-hour/day, 7 day per week exposure. This public health consultation addresses the question of mercury exposure in a school setting and assumes an 8-hour/day, 5 day per week exposure. ATSDR recommends using 3 µg/m^3 as the safe level for adults working and children playing in the environment up to 8 hours per day, 5 days per week. There are several factors that make this level protective. The approach used to determine what levels of exposure are acceptable is conservative. Additionally, there are no credible studies that indicate or suggest that health effects due to inhalation of mercury vapor might occur at air mercury concentrations less than 10 µg/m^3 (ATSDR, 1997).

ATSDR's chronic inhalation Maximum Risk Level (MRL) for metallic mercury vapor is 0.2 µg/m^3. EPA's Reference Concentration (RfC) is 0.3 µg/m^3 They are both based upon the same study (Fawer et al., 1983), an occupational study in which workers exposed to an average airborne mercury concentration of 26 µg/m^3 for an average length of 15.3 years experienced subtle neurologic effects (electrophysiologically-measured fine motor tremors during mechanical stress). To calculate the MRL, the 26 µg/m^3 was adjusted from the 8 hour per day, 5 day per week occupational exposure scenario in which it was measured to a 24 hour per day, 7 day per week continuous exposure scenario (the worst case exposure scenario that might be encountered). The calculated value was then divided by an uncertainty factor of 30 [10 to account for variability within the human population and 3 for the use of the lowest observed adverse effect level (LOAEL), rather than a "no observed adverse effect level" (NOAEL) in the derivation process]. Mathematically, this calculation is as follows:

26 µg/m^3 x 8/24 hours a day x 5/7 days a week = 6.2 µg/m^3

6.2 µg/m^3 divided by 30 = 0.2 µg/m^3.

The amount of mercury detectable through badge, OSHA-140, and Lumex testing indicate that mercury vapors do not exceed 1 µg/m^3 ; below the level of concern at 3 µg/m^3.

Health Effects of Mercury Exposure

The primary exposure route of concern for elemental mercury at the schools with this flooring is the inhalation of mercury vapors. Approximately 80% of inhaled mercury vapors are retained by the body [3], and accumulate in fatty tissues such as the brain, liver and kidneys. Breathing metallic mercury vapors may affect neurobehavioral and psychological performance potentially resulting in tremors, personality changes, muscle coordination, disturbances in vision and difficulty with memory. In addition, the kidneys are sensitive to the effects of mercury, since it is a major site for mercury accumulation. If exposure is high, effects on the cardiovascular, gastrointestinal and respiratory systems are possible as well. Chronic exposure studies of elemental mercury inhalation from spills in homes have noted abdominal pain, weight loss, diarrhea, and painful mouth [4]. Although these effects have been observed, the occurrences of these effects have been associated with exposure to high levels of mercury in the air. We do not expect any child or adult in the vicinity of the gymnasiums to experience these effects.

Child Health Considerations

SHINE and ATSDR recognize that infants and children may be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, resulting in a greater likelihood to breathe dust, soil, and heavy vapors close to the ground.
- Children are smaller, resulting in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Because children depend on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at schools with flooring material manufactured using mercury. It is important to note that the mercury thresholds recommended by SHINE were derived from comparison values that incorporate a high level of protectiveness for children.

Community Concerns

Parents, teachers, school and district administrators are naturally concerned with the need to ensure that children are in no danger of adverse health effects from mercury vapors from this type of flooring. The data collected and analyzed from these schools indicate that the level of mercury vapors being emitted from the floors pose no health risks at this time.

In addition to the children who attend school and who occupy the gymnasiums with these floors, other groups including before and after school programs, sports teams, and other community groups who use the facilities have expressed concern about the possible health effects of being exposed to mercury vapors from this flooring material. The data collected and analyzed on these schools indicate that the level of mercury vapors being emitted from the floors pose no health risks at this time.

Public Review

This health assessment was initially released on March 7, 2006, and was available for public comment until April 21, 2005. The document was sent to the Salem-Keizer School District, which distributed the document to parents, teachers and school officials through its communication network. A copy of the document was on display and available at all elementary schools in the Salem-Keizer School District. It was also sent to representatives of OR-OSHA, and the USEPA. The document was also available on the web at http://www.healthoregon.org/superfund. A public meeting was held on April 21, 2006, attended by 3 parents. A fact sheet was prepared for this meeting. (See Appendix F). No additional comments were received.

Conclusions

The levels of mercury vapor detected in the Salem-Keizer Schools poses "***no apparent health hazard"*** to the students attending school, faculty working in the gymnasium, or community groups who use the facility before and/or after school hours. Based on the relatively low levels of mercury vapor, it is unlikely that anyone exposed to the mercury vapors would suffer from adverse health effects. Adults and children may continue to use or to reoccupy gymnasiums that have been identified as having this type of flooring as long as the mercury vapors do not exceed 3 $\mu g/m^3$.

The Salem-Keizer School District is considering the possibility of removing the floors with mercury content, thereby eliminating the mercury source of exposure. The actions associated with removal of the mercury-containing material could create a short-term increase in mercury vapor levels to concentrations of concern and therefore could pose a health hazard in the future if appropriate precautions are not taken to limit exposure. If the flooring is removed, TCLP data indicate that the material does not have to be treated as hazardous waste, but appropriate precautions should be taken to prevent exposure to mercury vapors released from the destruction of the flooring material.

Recommendations

Gymnasiums with flooring identified as having detectable mercury should be monitored on an annual basis. If mercury vapor levels exceed 3 $\mu g/m^3$, access to the gymnasium should be limited until actions to cap or remove the flooring have been completed.

OSHA140 or Lumex monitoring should be used to test for level of mercury when determining if adults and children may continue to use or to reoccupy gymnasiums.

If it is determined that the flooring will be removed, SHINE recommends the following precautions be taken in the removal of the flooring material:

1. During the removal there should be no person present except those involved in the removal and they should be using personal protection and safety equipment suitable to the task.

2. After the flooring and any contaminated items and residue have been removed from the gymnasium, the room should be thoroughly ventilated to the outdoors to exhaust residual mercury vapors.
3. Before any replacement flooring is installed, levels of mercury vapor in the room should be checked with a Lumex® or an equivalently sensitive mercury vapor analyzer.

Public Health Action Plan

The public health action plan for the site contains a description of actions that have been or will be taken by SHINE and other government agencies at the site. The purpose of the public health action plan is to ensure that this public health consultation both identifies public health hazards and provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of SHINE to follow up on this plan to ensure that it is implemented.

Public health actions that have been taken include the following:

- The Environmental Toxicology Program at Oregon State Public Health issued a public health advisory notifying schools of the potential risk to students and faculty from this flooring material.
- SHINE worked with the Risk Management Unit of the Salem-Keizer School District to analyze and interpret bulk and air samples.
- SHINE solicited EPA to conduct air sampling using a Lumex machine
- OR-OSHA conducted air sampling using OSHA-140 method at seven of the identified schools
- USEPA conducted air sampling using a Lumex machine at seven of the identified schools

Public health actions to be implemented follow:

- It is likely that 3M Tartan brand floors, and other flooring products made using the same manufacturing process are present in a large number of school gymnasiums in Oregon. Both SHINE and ETP at Oregon State Public Health will continue to communicate with other schools in Oregon that may contain this type of flooring and assist them in evaluating the risk of exposure to mercury vapors from flooring material.
- SHINE will continue to recommend that when this type of flooring is identified in a school or other setting, a series of steps are taken to evaluate the potential that mercury vapors could be released from the flooring and cause harm to adults and children in the area (See Appendix B)
- SHINE remains available to address any public health questions or concerns regarding this contamination event for parents, administrators, or other concerned individuals. Please contact the Oregon State Public Health, Superfund Health Investigation & Education Program at 1-503-731-4025

Site Team

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References

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Certification

The Superfund Health Investigation and Education Program of the Oregon Department of Human Services prepared the Salem-Keizer School District 3M Flooring Public Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. This document is in accordance with approved methodology and procedures.

Gregory Ulirsch, Ph.D.
Technical Project Officer for Oregon, SSAB, DHAC

I have reviewed this health consultation, as the designated representative of the Agency for Toxic Substances and Disease Registry and concur with its findings.

Alan Yarbrough, M.S.
Leader, Cooperative Agreement Team, SSAB, DHAC

Appendix A – Public Health Advisory

Public Health Advisory to Schools : Mercury in 3M Tartan flooring installed between 1950 and 1970

From: Environmental Toxicology Section, Department of Human Services

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September 22, 2005

It has recently come to our attention that 3M Tartan flooring used widely in the US in public buildings, schools, gymnasia, etc. from approximately 1950 through the early 1970's contains mercury as a stabilizer and with aging and mechanical damage, the mercury can escape as mercury vapor. Assessments performed at two mid-western schools by US CDC-ATSDR and by the State Health Department of Michigan confirmed the release of mercury vapor in two US schools, but concluded that the levels of mercury in the air of the buildings was safe for routine classes and normal usage. Mechanical injury and normal aging of the flooring leads to increasing release of mercury. Removal or other major disturbance of the flooring can produce dangerous levels of mercury in air, and disposal of the flooring requires special attention because of the mercury content.

You can read the ATSDR and Michigan assessments by linking to http://www.atsdr.cdc.gov/HAC/PHA/westerville/wes_p1.html and http://michigan.gov/documents/Middleton .

Excessive mercury vapor exposure can lead to neurological injury. The levels of mercury exposure in the schools that have been assessed are not high enough to produce any immediate symptoms of illness. Exposure to the levels found in the two schools for a few hours per day are also believed to be insufficient to produce measurable long-term harm.

Workplace exposure limits for mercury vapor are 25 µg of mercury per cubic meter of air for an average 8 hour exposure period or for 40 hours per week. Residential settings in which persons (especially elderly, children and pregnant women) are exposed continuously for up to 24 hours per day, seven days per week should have much lower levels (0.2 to 0.5 μg/m3). For classroom exposures of an hour for five days per week during the school year, levels of 1-10 μg/m3 in the breathing zone are considered safe by most health authorities. The manufacturer concedes that the product contains 1000-2000 ppm mercury and can produce indoor building vapor levels as high as 22 μg/m3. In the schools assessed by ATSDR and the state of Michigan, levels of 1.6 μg/m3 (Westerville) and 0.007 to 0.05 μg/m3 (Fulton) were measured in the normal breathing zones of students and staff. Higher levels up to 17 μg/m3 were measured at the floor in the immediate area of damaged flooring at Fulton school.

If your school facilities have any 3M Tartan flooring you may want to consider having a commercial Industrial Hygiene firm perform mercury vapor tests in affected rooms, especially if the flooring is aging, softening or breaking up. Our office is available to discuss any concerns with you and to assist you in interpreting any test findings you may have.

Appendix B – Letter from Environmental Services, 3M Company

3M General Offices

3M Center
St Paul, MN 55144-1000
651 733 1110

3M

January 23, 2006

Kenneth W. Kauffman
Environmental Health Specialist
Environmental Toxicology Program
Department of Human Services
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Portland, Oregon 97232

VIA UPS

Dear Mr. Kaufmann:

It was a pleasure speaking with you on January 19, 2006 relative to the 3M Tartan Brand flooring. As we discussed I am sending some comments and additional information on 3M Tartan Brand flooring, which was the subject of an "Advisory" dated September 22, 2005 that you forwarded to schools in Oregon regarding polyurethane flooring. The 3M Company was a producer of athletic flooring material and we would like to clarify some of the content of your Advisory. Once you have read these comments please feel free to contact me with any further questions.

In the way of background, 3M Company manufactured and sold the "3M Tartan Brand" flooring beginning in the early 1960's and discontinued sales of this product in the early 1980's. However, we are aware that there have been several other manufacturers of polyurethane floors, and other companies not associated with 3M have used the "Tartan" name in marketing athletic flooring and surfaces, from at least the early 1990s. Moreover, usage of the term "Tartan" appears to have become widespread as a way to refer to any resilient athletic flooring or surface. Thus, the suggestion in the Advisory that 3M is or was the only manufacturer of "Tartan flooring" or polyurethane flooring generally is not accurate. Also, it has not been demonstrated that the resilient floors in Ohio and Michigan cited in your Advisory were manufactured by 3M.

When 3M is asked about resilient athletic flooring, we reply based on the product information on the 3M Tartan Brand flooring, but we are careful to point out that there were other manufacturers. We also try to avoid confusion on this by referring to "polyurethane flooring" or "resilient athletic flooring" in a general manner. It is important that schools or gymnasiums with resilient athletic flooring make the effort to determine the type of flooring or its composition. There are other chemical processes and materials used to manufacture some resilient athletic floors that do not use mercury compounds as an ingredient at all. Some of these resilient floors may present use and disposal issues that need to be considered.

The Advisory refers to mercury in the product as a "stabilizer." The 3M Tartan Brand flooring contained a very small amount of phenyl mercuric acetate (PMA), used as a catalyst (not a stabilizer) in producing the product. This was used by other flooring manufacturers as well. It would generally be bound in the flooring. Additionally, the 3M Tartan Brand flooring was covered with a topcoat of a different chemistry to seal the flooring and create a nontacky surface.

With respect to the Advisory's comments on the mercury vapor readings, 3M agrees with the conclusions that the measurements cited, from schools in Ohio and Michigan, show that in day-to-day use, the floors studied, i.e., organo-mercury-catalyzed polyurethane floors, are safe for staff and students on or near the floors. As noted above, it was not determined that these were 3M Tartan Brand floors.

A few specific points related to the mercury vapor discussion section:

- The Advisory references "that the product contains 1000-2000 ppm mercury and can produce indoor building vapor levels as high as 22 ug/m3." This statement is based on one set of data taken in 1971, at a location six inches from the floor and not in the breathing zone. This should be noted in the Advisory. Additionally, the 1000-2000 ppm number represented the amount of PMA, a compound containing mercury. The actual amount of mercury actually would be about approximately ½ those numbers.
- Occasionally we are asked questions regarding possible repair or replacement of resilient athletic floors. Repair or removal of the product may require worker protection, depending on the nature of the removal techniques and whether dust may be generated. Because we do not know the conditions involved in a particular situation (e.g., the type of flooring, whether it is a 3M Tartan flooring or a flooring made by another manufacturer, the type of removal or repair anticipated, or the other materials that may be present), we support your recommendation in the Advisory that a qualified industrial hygienist be involved to determine what safety practices will be necessary for workers to remove the flooring.

In addition, we recommend that any removed product be appropriately tested to determine if it meets criteria requiring disposal as a hazardous waste under federal and state laws.

If you have any questions, please contact me at 651 733-6374.

Sincerely,

Michael A. Santoro

Michael A. Santoro, Director
Environmental, Health, Safety and
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Appendix C. Guidance Letter on Sampling and Hg Thresholds

Oregon

John A. Kitzhaber, M.D., Governor

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Vonnie B. Good
Environmental Safety Specialist
Risk Management
Salem-Keizer School District
3630 State Street
Salem, OR 97301-5316

Dear Ms. Good,

This letter is in response to your request for guidance on testing for possible mercury vapors being released from polymer-based flooring installed in some of your schools. Based on previous work evaluating the risks to children and adult faculty associated with exposure to this type of flooring we recommend the following:

Sampling

Bulk Sampling

We recommend that bulk sample of flooring be taken at all schools identified as having this type of flooring material produced or installed between 1960 and 1980. If a school's flooring is determined to contain mercury, air sampling is recommended.

Air Sampling

We recommend breathing zone sampling at all schools found to have mercury in their bulk samples. We recommend that the air sampling method and equipment meet the following criteria:

1. Equipment used is either a Lumex meter or SKC 226-17-1A (hopcalite) sorbent tubes analyzed using OSHA method ID-140. Other methods of measurement are not sensitive enough for this type of investigation and may produce false negative and/or false positive results.
2. In order to get representative samples of air being breathed by persons in the gyms during normal activities, samples should be collected in the normal breathing zone (3-5 feet above the floor) and as near as possible to normal gym activities. .
3. Normal activities should be going on during the sampling periods. Mercury vapor is heavier than air and tends to lie along the surface of the floor, so it is important that normal activity and normal heating/ventilation systems be operating to maintain as uniform mixing of air as is possible.

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4. Sampling should be done by an active airflow sampler equipped with an effective mercury trap that can be analyzed by the laboratory at the end of the sampling period.
5. The sampling period should be prolonged. An 8-hour period is best because this is a normal workday and most time-weighted averaging is done with 8-hour sampling period.
6. The sampling process should provide accurate and consistent sampling flow and accurate timing to allow for accurate calculation of the average mercury in the air during the sampling period.

Mercury Vapor Threshold

Bulk Samples

According to 3M's reports about their early Tartan floorings, their materials could contain as much as 500 to1000 ppm. We have no basis upon which to evaluate the relationship between mercury concentration in the flooring and the amount of vapors released into the air. Therefore, we recommend that any amount of mercury found in the bulk samples indicate the need for additional investigation and air sampling. If no mercury is found in the bulk samples and you have reason to suspect other mercury sources at a school, further evaluation is unwarranted.

Air Samples

There are no credible studies that indicate or suggest that health effects due to inhalation of mercury vapor might occur at air mercury concentrations less than 10 $\mu g/m^3$. The recommended guidance from the United States Environmental Protection Agency's (EPA) for residential occupancy is 1 $\mu g/m^3$. This level which assumes a 24-hour/day, 7 day per week exposure. ATSDR typically considers mercury vapor concentrations of 1 $\mu g/m^3$ to satisfy the safety requirements for airborne mercury exposure in a residential scenario. It is important to note that the 1 $\mu g/m^3$ threshold is based on a residential exposure which is at least three times the exposure period that would be expected in a school setting. Therefore, we recommend using 3 $\mu g/m^3$ as the safe level for adults working and children playing in the environment up to 8 hours per day, 5 days per week.

If you have any questions or concerns about this guidance please contact us.

Sincerely,

Jae P. Douglas
Epidemiologist
Superfund Health Investigation
& Education Program

Kenneth Kauffman
Environmental Health Specialist
Environmental Toxicology Program

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Appendix D - ATSDR Suggested Action Levels for Indoor Mercury Vapors in Homes or Businesses with Indoor Gas Regulators

Purpose: This document is intended solely as a quick reference guide for use by public health and environmental officials in evaluating data collected from structures in which mercury pressure regulating devices for natural gas meters were moved from inside to outside the structures as part of a modernization process. It does not provide detailed justifications for environmental sampling requirements, as health consultations or environmental sampling plans may do.

In the past, ATSDR has been reluctant to provide a list of suggested action levels such as this because of the site specific nature of exposures. ATSDR has recognized that action levels can differ according to differing populations, exposure durations, concentrations, and specific hazards. However, the immediacy and extent of the potential health risk associated with mercury contamination in the present situation require publication of this guide. Many parts of the country may be affected by the possible exposure to mercury resulting from re-positioning of mercury-containing gas pressure regulators and the subsequent response efforts of gas utilities, public health and environmental officials. Moreover, the involvement of multiple health and environmental jurisdictions creates a need for consistency in presenting health risk information. Therefore, ATSDR, at the request of a state health department and an U.S. EPA regional office, is attempting to provide suggested action levels for various response activities under different exposure scenarios.

Background: In this context, an *action level* is an indoor air concentration of mercury vapor, which should prompt consideration of the need to implement a recommended response by public health and environmental officials. The various suggested action levels provided in this document are intended as recommendations, not as regulatory values or cleanup values, although some may correspond to present or future values adopted by regulatory authorities.

The suggested action levels presented in this document recognize that an individual must be exposed to a sufficient concentration over some specific period of time in order for mercury vapor to cause adverse health effects. The suggested action levels also recognize that while individual susceptibility may vary, developing fetuses and young children under six years old are generally at higher risk than others of incurring adverse health effects from exposure to mercury vapor. If the indoor air concentration corresponding to any suggested action level is exceeded, then a potential health risk may be present, and responders should evaluate the exposures at that location and consider implementing appropriate protective measures to reduce or eliminate the risk.

The suggested action levels presented here are based on data available in ATSDR's Toxicological Profile for Mercury (1999) or in the Hazardous Substance Databank of the Toxicology Data Network at the National Library of Medicine. ATSDR has also made use of additional data collected by the US Environmental Protection Agency (EPA) and of specific experiences of ATSDR at other sites. Other factors considered in the development include available information on normal background levels and analytical detection limits of various techniques for evaluating airborne contamination. Any information specific to the exposures at any given location as described below should also be considered before implementing a response action.

These suggested action levels are extrapolated from health guidance values (HGVs) independently developed by two federal agencies, ATSDR and EPA. These HGVs are based on both animal studies and human epidemiology studies that detail the health effects of inhalation of mercury-contaminated air. ATSDR has developed a chronic Minimal Risk Level (MRL) of 0.2 ug/m^3 that is based on a 1983 study of workers exposed to an average Lowest Observed Adverse Effect Level (LOAEL) of 26 ug/m^3 over an average of 15 years. This workplace average exposure was adjusted from a 40 hour per week exposure to a 168 hour per week exposure (i.e., 24 hours/day, 7 days/week) and then divided by an uncertainty factor of 30 to account for the use of the LOAEL and the different sensitivities of individuals. In addition, EPA has used the same study to develop a Reference Concentration (RfC) of 0.3 ug/m^3, using different assumptions and uncertainty factors. ATSDR considers the RfC and the Chronic MRL to be the same value for all practical purposes. An MRL, then, is defined as an estimate of the daily exposure level to a hazardous substance (in this case, metallic mercury) that is likely to be without appreciable risk of adverse, non-cancer health effects (metallic mercury is not considered to be a carcinogenic substance) over a specific exposure route and duration of exposure. For further information, see Section 2.5, Chapter 7, and Appendix A of the ATSDR Tox Profile and the EPA's Integrated Risk Information System (IRIS) on the Internet at www.epa.gov/ngispgm3/iris/index.html.

The suggested action levels in the tables below were designed for a group of structures where pressure regulators using approximately 2 teaspoons (and perhaps more) of mercury (~10 ml or 135 g) and the accompanying gas meters were re-positioned from the interior of buildings (including homes) to the exterior. During this adjustment of regulator location that may have taken place some time ago, mercury was spilled in some instances. However, spills of mercury may not have occurred indoors. Therefore, the categories of exposure include (a) buildings that may have had no spills; (b) buildings that had spills and needed cleanup but had air mercury levels that constitute no immediate health risk; and (c) buildings that had spills resulting in indoor air concentrations sufficient to warrant isolating humans from the exposure. In general, the screening for these homes or businesses consists of: (1) confirming that a natural gas meter had been in the building and moved outside; (2) observing the area where the gas meter had been originally for metallic mercury; (3) asking the resident if they had ever noticed metallic mercury in the vicinity of the gas meter; and, (4) evaluating the area with a Jerome™ meter or the equivalent. If there is any positive indicator of mercury on the Jerome Mercury Vapor Analyzer (a real-time air monitoring instrument) that cannot be explained by interferences, then the building is placed on the list for further characterization.

Visible mercury is not only a source of vapors but also a tracking hazard and an attractive nuisance. No matter what the airborne concentration is, free liquid mercury may pose a problem in the general population. Generally, a condition that no visible mercury be present is stipulated only at stages when cleanup is completed. This condition may be considered as much a check on the data quality as anything else. It is rare that liquid mercury exists at concentrations as low as would be considered safe in most exposure scenarios other than a workplace where mercury is used in the production process.

General Exposure Assessment Considerations: The primary route of entry for metallic mercury is by inhalation; ingestion and skin absorption of this form of mercury is usually not biologically significant. Sensitive populations to mercury exposure are those with developing central nervous systems, including young children and the fetuses of women who are pregnant. Other individuals of potential concern are those with pre-existing kidney conditions, usually at exposures to much higher concentrations than the first group. The specific exposure of these groups in any given situation should be considered when assessing the need for any given response action. Specific concerns are mentioned in the tables below. If there is any doubt, responders should consult with state or local public health officials before deciding on a course of action. Responders may also contact ATSDR at 404-639-0615, 24 hours a day.

Exposure Assumptions for Different Settings: For the purposes of this document, the residentially exposed population includes infants, small children, and pregnant women presumed to have inhaled mercury for a period up to 24 hours per day, 7 days per week potentially for months or even years. Occupational or commercial settings include those individuals that are primarily healthy adults exposed up to 8-10 hours per day, 40 hours per week, with transient exposures by sensitive populations (e.g., a retail establishment or schools). The concentrations provided as suggested action levels are for comparison to the environmental data collected in affected residences and workplaces.

Suggested Action Levels for Mercury (CAS # 7439-97-6) – **Residential Settings** †

Indoor Air Concentration (ug/m³)	Use of the Action Level	Rationale for Action Level	Method of Analysis *	Reference
≤1.0	Level acceptable for occupancy of any structure after a spill (also called the residential occupancy level.)	A spill occurred in this building, and the risk manager needs to know if the building is safe for occupancy. ATSDR would prefer no one ever be chronically exposed to concentrations above the MRLs; however, experience has shown cleanup operations in a response to concentrations below 1 ug/m³ can be extremely disruptive to individual and family quality of life. While this concentration is slightly above HGVs, this level is still 25 times lower than the human LOAEL on which the MRL is based. An indoor air concentration of 1 ug/m³, as measured by the highest quality data (e.g., NIOSH 6009 or equivalent), is considered safe and acceptable by ATSDR, provided no visible metallic mercury is present.	NIOSH 6009 or equivalent	Based on HGVs above. ATSDR, 1999. EPA/IRIS
No qualitative detection on an Arizona Instrument's Jerome™ Meter.	Screening level for homes that had indoor gas meters with no evidence of a spill	Mercury was present in the regulator inside the home, but no evidence of a spill is found. The qualitative detection limit of the most commonly available air monitoring instruments approximates 1 order of magnitude below levels of known human health effects. As there was no spill, no visible metallic mercury should be present. Natural ventilation (e.g., windows, HVAC air changes, etc.) should reduce any concentration even lower with no disruption of family life or costs.	Real-time Air monitoring instrument (i.e., Jerome™ meter or equivalent)	
10	Isolate residents from the exposure	When adjusted from an intermediate to chronic exposures to a continuous exposure scenario (i.e., 24 hrs/day, 7days/week), this concentration approaches levels reported in the literature to cause subtle human health effects. Applied to acute exposures with good accuracy by real-time instruments, this value allows for interventions before health effects would be expected. Whenever possible, the mercury vapors should be prevented from reaching living spaces rather than temporarily relocating individuals. See the building evaluation protocol developed for these situations in your area and Section 2.1 of ATSDR's Toxicological Profile.	Real-time Air monitoring instrument (i.e., Jerome™ meter or equivalent)	ATSDR, 1999.
10	Acceptable level in a modified test procedure to allow personal effects to remain in the owner's possession	For personal effects, such as clothing, warmed in a discrete plastic container much smaller than a typical room (e.g., a garbage bag), this concentration in the air trapped inside the container is considered safe by ATSDR based on a number of factors.	Real-time Air monitoring instrument (i.e., Jerome™ meter or equivalent)	

*** - Environmental analysis should be in accordance with the requirements specified by environmental authorities. When real-time air monitoring instruments are specified in this table, laboratory analysis may be substituted at the discretion of the risk managers involved in the event. Operation of real-time instruments should be in accordance with manufacturer's instructions.**

† - Structures where mercury pressure regulating devices for natural gas meters were moved from inside the structure to outside the structure.

Suggested Action Levels for Mercury (CAS # 7439-97-6) – **Occupational and Commercial Settings** †

Indoor Air Concentration (ug/m³)	**Use of the Action Level**	**Rationale for Action Level**	**Method of Analysis ***	**Reference**
3.0	Re-occupancy after a spill of an occupational or commercial setting where mercury is not usually handled.	Based on residential occupancy level but adjusted for the shorter duration exposures typical of most workplaces. This concentration approximates one order of magnitude below levels of known human health effects, provided no visible metallic mercury is present to act as an attractive nuisance or a source for more vapors. Those exposed in this instance would not expect hazards associated with mercury as part of their normal work and may include transient exposures by more sensitive individuals (e.g., retail facilities).	NIOSH 6009 or equivalent	HGVs. ATSDR, 1999. EPA/IRIS
25	Occupational settings where mercury is handled. •	Based on the 1996 ACGIH TLV. Assumes hazards communications programs as required by OSHA; engineering controls as recommended by NIOSH; and medical monitoring programs as recommended by the ILO, NIOSH, and ACGIH are in place. This concentration is ½ the peer-reviewed 1973 NIOSH REL and 1/4 the regulatory 1972 OSHA PEL. See HSDB at toxnet.nlm.nih.gov/sis on the Internet.	Real-time Air monitoring instrument (i.e., Jerome™ meter or equivalent)	HSDB, 1999
25	Response Worker Protective Equipment Upgrade. •	Response workers subject to HAZWOPER should evaluate need to upgrade protective equipment. Based on the 1996 ACGIH TLV. Assumes hazards communications programs as required by OSHA; engineering controls as recommended by NIOSH; and medical monitoring programs as recommended by the ILO, NIOSH, AND ACGIH are in place. This concentration is half the peer-reviewed NIOSH REL and a quarter of the regulatory OSHA PEL. See HSDB at toxnet.nlm.nih.gov/sis on the Internet. For these workers, engineering controls are not typically in place, and it is not possible to control the exposure by other safety techniques.	Real-time Air monitoring instrument (i.e., Jerome™ meter or equivalent)	29 CFR 1910.120; 40 CFR 311; NIOSH, 1987
10,000	IDLH. Response Workers Protective Equipment upgrade.	Response workers subject to HAZWOPER should upgrade protective equipment. See http://www.cdc.gov/niosh/idlh/ on the Internet.	Real-time Air monitoring instrument (i.e., Jerome™ meter or equivalent)	29 CFR 1910.120; 40 CFR 311; NIOSH 1987

*** - Environmental analysis should be in accordance with the requirements specified by environmental authorities. When real-time air monitoring instruments are specified in this table, laboratory analysis may be substituted at the discretion of the risk managers involved in the event. Operation of real-time instruments should be in accordance with manufacturer's instructions.**

† - Structures where mercury pressure regulating devices for natural gas meters were moved from inside the structure to outside the structure.

• - Women workers in these settings who are pregnant or attempting to become pregnant should consult their physicians regarding their mercury exposure.

APPENDIX E - ATSDR glossary of environmental health terms.

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR serves the public by using the best science to take responsive public health actions and provides trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR=s toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption
For a person or animal, absorption is the process through which a substance enters the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with **chronic**].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with **intermediate duration exposure** and **chronic exposure]**.

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Agranulocytosis
An acute disease marked by high fever and a sharp drop in circulating granular white blood cells.

Aplastic Anemia
A form of anemia in which the capacity of the bone marrow to generate red blood cells is defective and red blood cell production ceases.

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for developing cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic
Occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Completed exposure pathway [see **exposure pathway**].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see **route of exposure**].

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An Aexposure dose@ is how much of a substance is encountered in the environment. An Aabsorbed dose@ is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose-response relationship
The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Epidemiology

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people=s past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching); and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Groundwater
Water beneath the earth=s surface in the spaces between soil particles and between rock surfaces [compare with **surface water**].

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore

more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Indeterminate public health hazard
The category used in ATSDR=s public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with **prevalence**].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

MRL
Minimum Risk Level; An estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse no-cancer health effects over a specified duration of exposure.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR=s public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

Oxidation
The combination of a substance with oxygen or a reaction in which the atoms in an element lose electrons and the valence of the element is correspondingly increased.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific period [contrast with **incidence**].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with **health consultation**].

Public health hazard
A category used in ATSDR=s public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are **no public health hazard**, **no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public health statement
The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting
A public forum with community members for communication about a site.

Reference Concentration (RfC)
The concentration of a chemical in air that is very unlikely to have adverse effects if inhaled continuously over a lifetime.

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfC
See **reference concentration.**

RfD
See **reference dose**.

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].

Safety factor [see **uncertainty factor]**

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Substance
A chemical.

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people=s sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard
A category used in ATSDR=s public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other Glossaries and Dictionaries
Environmental Protection Agency
http://www.epa.gov/OCEPAterms/

National Center for Environmental Health (CDC)
http://www.cdc.gov/nceh/dls/report/glossary.htm

National Library of Medicine (NIH)
http://www.nlm.nih.gov/medlineplus/mplusdictionary.html

Appendix F – PHC Summary Fact Sheet

DHS
Oregon Department of Human Services

Salem-Keizer Schools Gym Flooring: Not a Health Concern

Superfund Health Investigation & Education

Should I be concerned about mercury in Salem-Keizer Schools gym flooring?
No. Oregon State Public Health's SHINE (Superfund Health INvestigation and Education) Program has concluded in a report that the flooring in schools does not emit enough mercury to affect the students' or teachers' health. The air in school gyms were tested and the levels were well within what is considered to be safe. This fact sheet summarizes SHINE's findings.

Why have there been concerns about gym flooring lately?
In September 2005, Oregon State Public Health learned that some types of floor covering used in school gyms contain mercury. The type of flooring that is most likely to contain mercury is a solid, rubber-like polymer floor covering, sometimes called "Tartan" brand flooring. It was promoted as a substitute for and improvement over wood flooring in gymnasiums, and as a durable running surface for both indoor and outdoor track & field facilities. Upon learning about this issue, Salem-Keizer School District asked that the SHINE Program investigate whether the mercury in the floor covering could be affecting the health of students, teachers, and others spending time in the schools' gymnasiums.

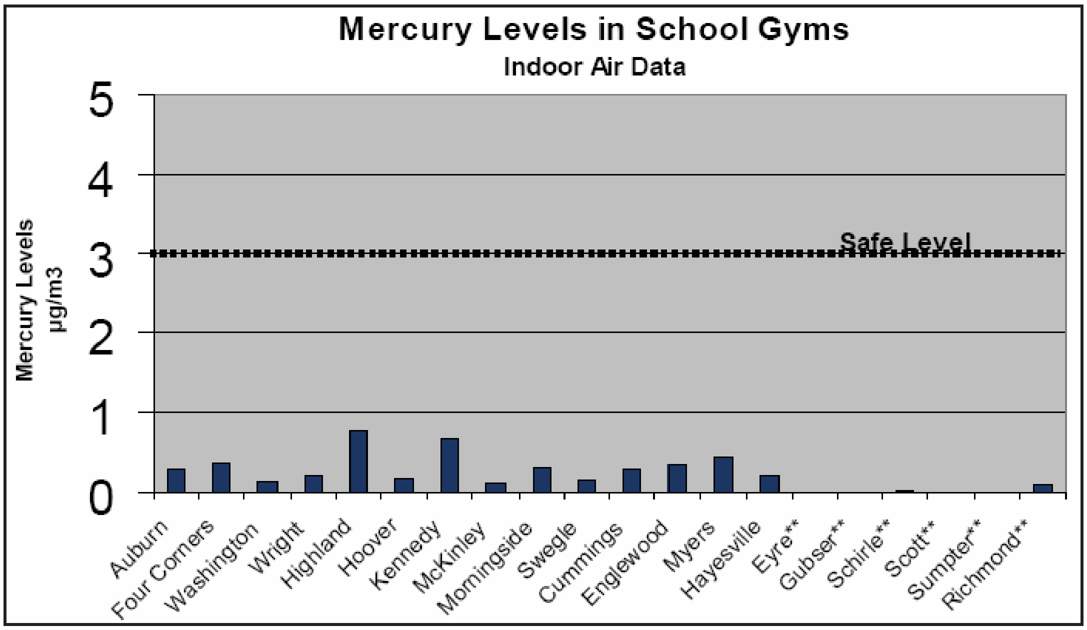
How is mercury used in the flooring?
During the production of Tartan brand flooring, mercury was used as a catalyst to help the mixture maintain its soft texture resulting in a finished product typically containing 0.1-0.2% mercury. 3M Corporation was the primary manufacturer of this kind of flooring. According to 3M, several other manufacturers used the term "Tartan" in marketing similar athletic flooring materials, and notes that it may have developed as a generic term for this type of flooring.

Why does mercury pose a concern?
Mercury is unique among metals in that, not only is it typically a liquid, it also will readily vaporize at room temperature. Mercury does not pose much of a health risk when it is ingested or comes into contact with the skin because it is not readily absorbed in the liquid phase. However, mercury is almost completely absorbed by the body when it is inhaled. The primary organs most affected by mercury vapor are the brain and kidneys. Typical health effects associated with exposures to mercury vapors include irritability, shyness, nervousness, memory difficulties, and in more long term cases tremors and kidney damage.

The public comment version of the report "Salem-Keizer School District 3M Flooring" will be available at the Salem-Keizer School District Communications Office, Lancaster Professional Center at 2450 Lancaster Dr. NE in Salem, or online at ***www.healthoregon.org/superfund.***
Public comments to the consultation are requested and must be received by 5 p.m. on April 20, 2006. Comments may be sent via FAX to (503) 872-5398, or emailed to jae.p.douglas@state.or.us or by regular mail to the SHINE Program, 800 N.E. Oregon Street, #827, Portland, OR 97232.

What did Oregon State Public Health find in its investigation?

- The levels of mercury vapor detected in the Salem-Keizer Schools are well below safe levels. The mercury in the flooring poses "no apparent health hazard" to the students attending school, faculty working in the gymnasium, or community groups who use the facility before and/or after school hours.
- Based on the relatively low levels of mercury vapor, it is unlikely that anyone exposed to the mercury vapors would suffer from adverse health effects.
- Adults and children may continue to use or to reoccupy gymnasiums that have been identified as having this type of flooring as long as the mercury vapors do not exceed 3 µg/m3, the level established as safe.



**No mercury was found in the floor material in these schools.

How did SHINE come to the conclusion that the gym floors are not currently a health concern?
All twenty schools in the Salem-Keizer School District were tested by OSHA, an independent consultant, and the EPA. A Lumex machine was used to test the level of mercury in the air inside the gymnasiums. The results of the testing were compared to the level considered to be safe (3 micrograms/square meter). The graph above shows how the results from each of the school gyms fall well below 3 µg/m3.

What is SHINE recommending to Salem-Keizer Public Schools?

- Gymnasiums with flooring identified as having mercury should be tested on an annual basis.
- If mercury vapor levels exceed 3 µg/m3, use of the gymnasium should be limited until actions to cap or remove the flooring have been completed.
- If it is determined that the flooring will be removed, SHINE recommends that health protective precautions be taken in the removal of the flooring material.