

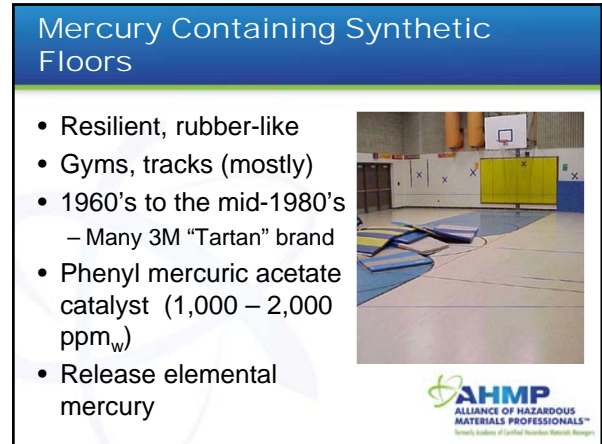


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Mercury Emissions from a Synthetic Gym Floor



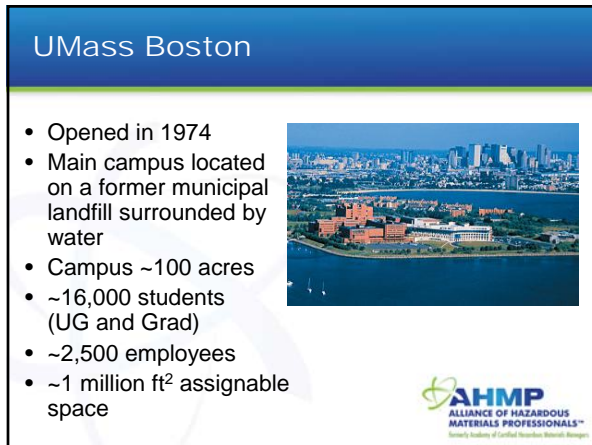
Risk-based Assessment, Control and Verification during Removal

Zehra Schneider-Graham, University of Massachusetts Boston
William Wade, Environmental Health and Engineering, Inc.
Joseph Allen, Environmental Health and Engineering, Inc.



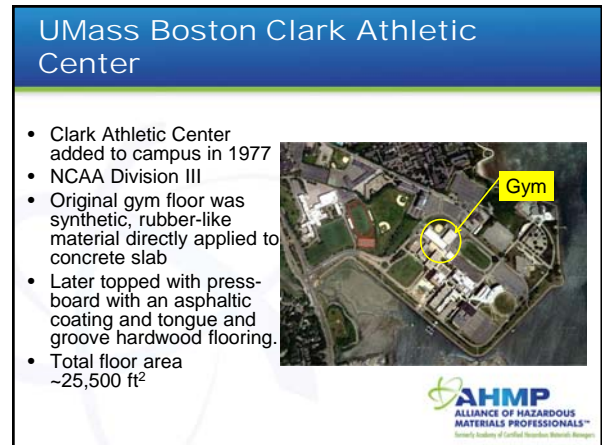
Mercury Containing Synthetic Floors

- Resilient, rubber-like
- Gyms, tracks (mostly)
- 1960's to the mid-1980's – Many 3M "Tartan" brand
- Phenyl mercuric acetate catalyst (1,000 – 2,000 ppm_w)
- Release elemental mercury



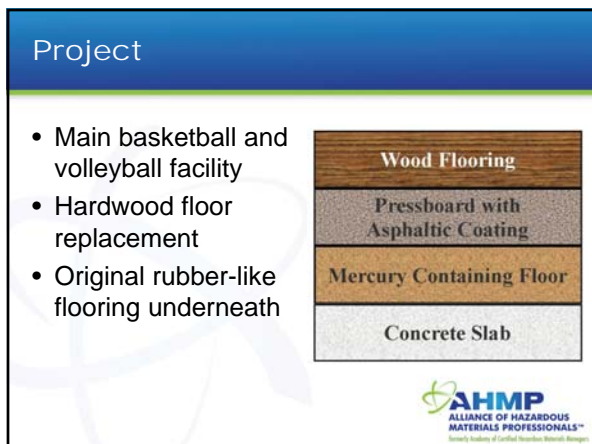
UMass Boston

- Opened in 1974
- Main campus located on a former municipal landfill surrounded by water
- Campus ~100 acres
- ~16,000 students (UG and Grad)
- ~2,500 employees
- ~1 million ft² assignable space

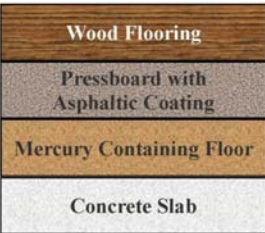
UMass Boston Clark Athletic Center

- Clark Athletic Center added to campus in 1977
- NCAA Division III
- Original gym floor was synthetic, rubber-like material directly applied to concrete slab
- Later topped with press-board with an asphaltic coating and tongue and groove hardwood flooring.
- Total floor area ~25,500 ft²


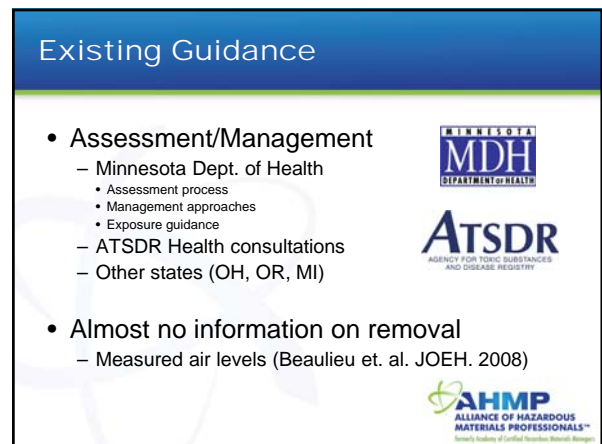




Project

- Main basketball and volleyball facility
- Hardwood floor replacement
- Original rubber-like flooring underneath






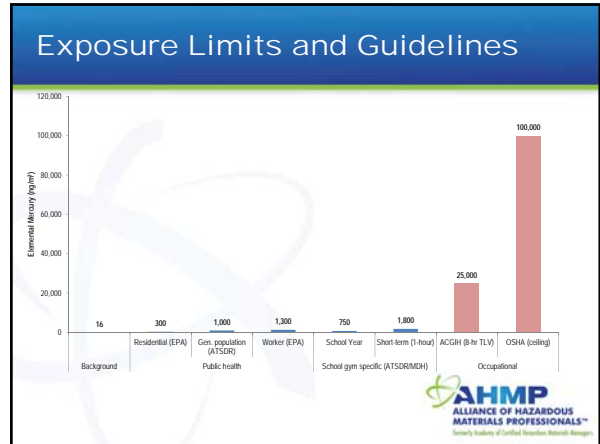
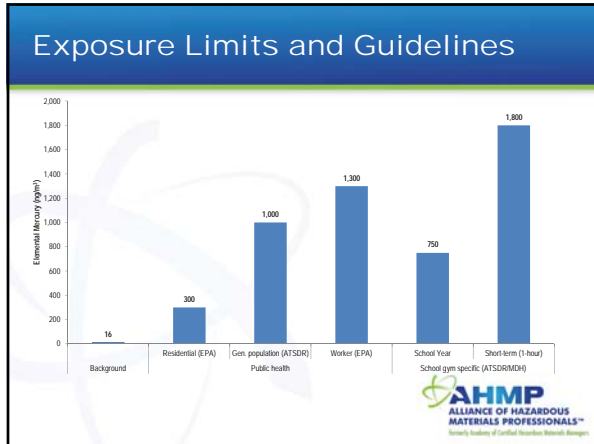
Wood Flooring
Pressboard with Asphaltic Coating
Mercury Containing Floor
Concrete Slab

Existing Guidance

- Assessment/Management
 - Minnesota Dept. of Health
 - Assessment process
 - Management approaches
 - Exposure guidance
 - ATSDR Health consultations
 - Other states (OH, OR, MI)
- Almost no information on removal
 - Measured air levels (Beaulieu et. al. JOEH. 2008)




Project Risk-Based Targets

Location		Mercury Vapor (ng/m³)	Basis
In gym during remediation		25,000 (PPE trigger)	ACGIH TLV
Outside gym during remediation		1,800 (one hour)	ATSDR/MDH/EPA
		1,000 (four hours)	
After remediation	Before new materials installed	2,500	ACGIH TLV (10%)
	At project completion	750	ATSDR/MDH

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Assessment

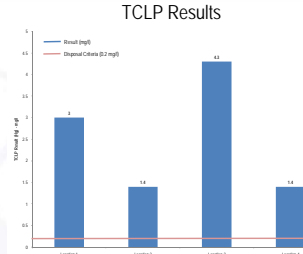
- Mercury-containing?
 - Test holes
 - Airborne measurements
 - TCLP
- Currently safe?
 - Breathing zone air measurements
- Controls required during removal?
 - Pilot removal



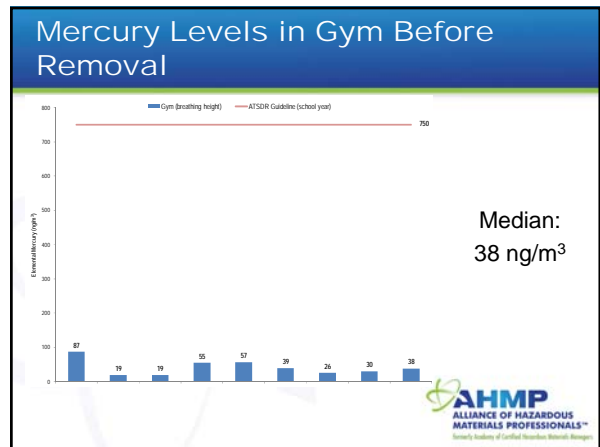
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Assessment

- TCLP
 - Synthetic floor elevated
 - Hardwood & pressboard low
- Mercury emissions
 - 2,160 to 4,204 ng/m³ above test locations
- Elevated in work zone during pilot remediation
 - 4,000 ng/m³

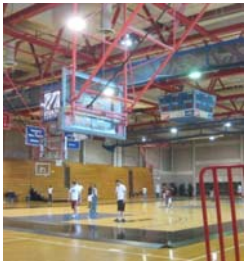



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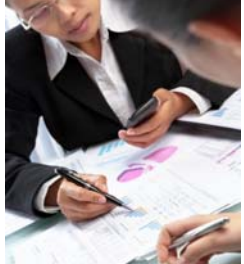

Assessment Summary

- Concentrations in gym safe
- Synthetic floor is mercury-containing
- High levels expected during removal
 - Appropriate contractor
 - Control impacts to adjacent areas
 - Disposal as hazardous waste

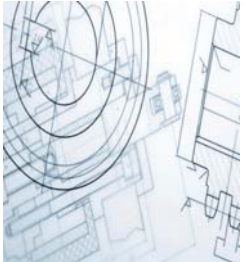

Decision to Remove

- “No action” not possible
 - Current floor not suitable; replacement required
- Covering not feasible
 - New floor system installation/warranty issues
 - Dimension change concerns
 - “Manage in place” not desirable
- Funding available

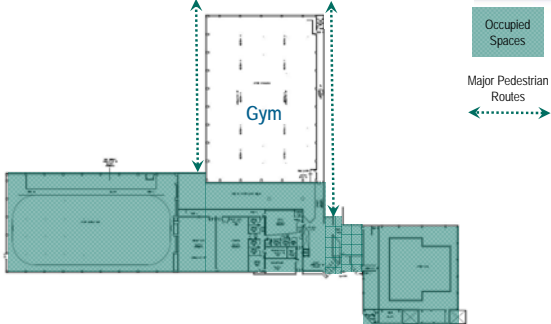




Challenges


- Adjacent locations
 - Students/Visitors
 - Athletic Dept. Staff
 - Pedestrian routes (outdoors)
- Containment/control
 - Shared HVAC-system
 - Large volume (>1 million ft³)
- Concentrations after removal


Challenges

Containment/Logistics Plan



- Entrances sealed
- HVAC-systems isolated and shut-down
- Negative pressure
 - Exhaust systems
- Segregated work zones
- Pedestrian access restricted

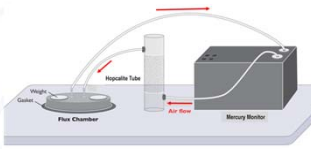



Containment/Logistics Plan

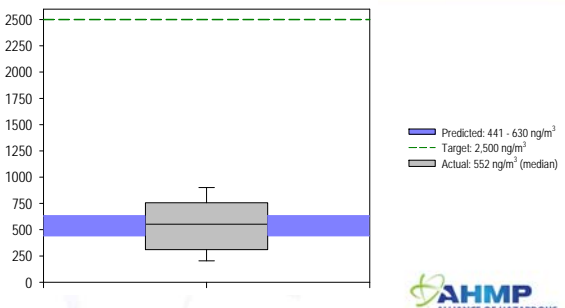



Emissions from Cleaned Slab


- Scarification required for new floor installation
 - Elevated levels expected
 - Completed during remediation
- Worker protection needed after?
 - Flux measurements
 - Predicted mercury concentrations

Emissions from Cleaned Concrete



- Predicted: 441 - 630 ng/m³
- Target: 2,500 ng/m³
- Actual: 552 ng/m³ (median)



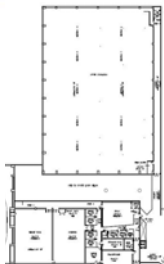

Removal Process



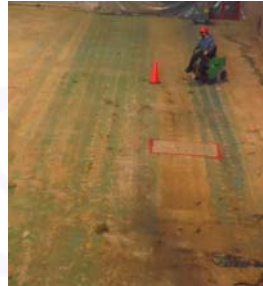


Verification


- Risk-based targets
- Systematic measurement approach
 - Every phase
 - Inside & outside work zone
- Real-time mercury vapor analyzer
 - Breathing height
 - 1,000 measurements

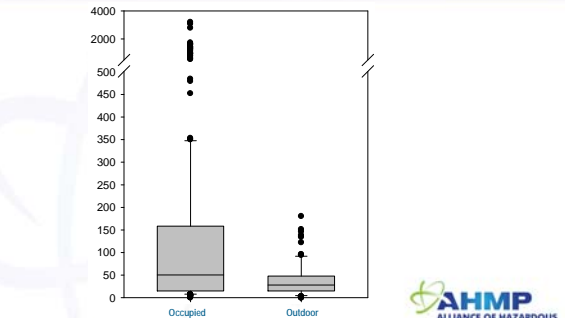

Mercury Levels in Gym

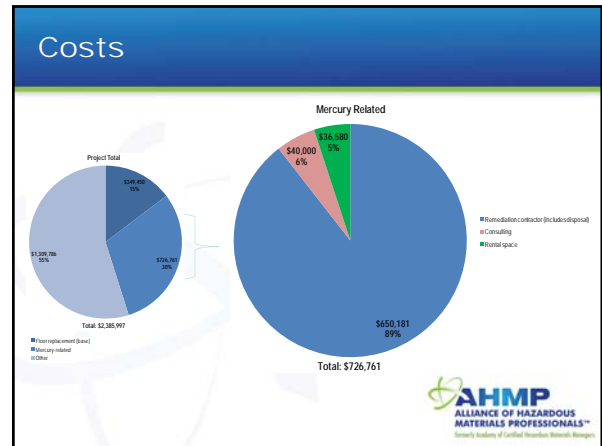
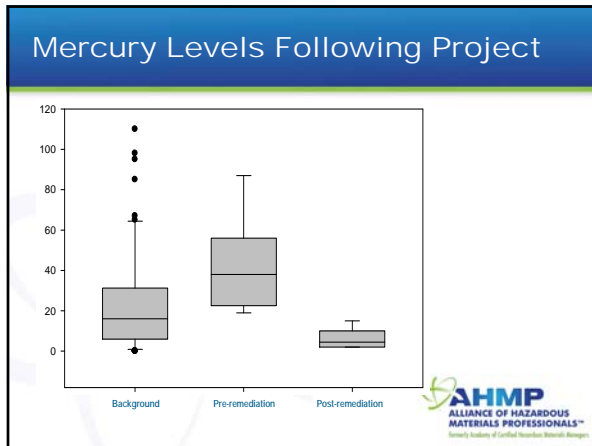


- In work area
 - Median: 3,282 ng/m³
 - 109 to 59,100 ng/m³
 - Highest during scarification
- Outside work area
 - Median: 87 ng/m³
 - 10 to 8,049 ng/m³



Mercury Levels in Adjacent Areas



- ### Conclusions
- Risk-based measures can be implemented to
 - Control replacement work
 - Achieve background mercury levels at completion
 - Removal can be a significant source of airborne mercury, particularly during concrete scarification
 - Flux measurements and modeling can predict exposure concentrations and aid in decision-making
 - Assessment should be completed regardless of plans to renovate
 - Costs for removal can be significant
- AHMP**
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