TURI
TOXICS USE REDUCTION INSTITUTE
UMASS LOWELL

Making Massachusetts a safer place to live and work

Gym Creates Healthier and Safer Foam Pits

Removes Toxic Flame Retardants

Overview

The Toxics Use Reduction Institute (TURI) works with small businesses to help them reduce the use of toxic chemicals while maintaining their business's success. In this case, TURI worked with a Massachusetts gymnastics training facility to eliminate toxic flame retardants in their foam pit cubes while maintaining fire safety.

Background

Photo credit: Carrie Minshall, USAG

Flame-retardant chemicals (FRs) have been added to products for decades in an effort to improve fire safety; this includes foam cubes placed in pits in gymnastics training facilities and children's play centers. In these applications, foam cubes cushion the fall of a child or gymnast, thereby providing significant safety benefits. However, the chemicals added to help delay the start of a fire can easily escape from the cubes. The chemicals can then enter the body either when the chemicals attach to dust in the pit and the air and the dust is accidentally ingested, or when the chemicals are absorbed through the skin.

Health Implications

Over a decade of research indicates that some flame retardants can harm the developing brain, and have been linked to cancer as well as reproductive health issues; several are considered endocrine disruptors.[1] As endocrine disruptors, flame retardants disrupt action of the thyroid hormone system, which is important for development and metabolism, particularly during early life. Studies in humans have also found negative effects on fertility and neurodevelopment.

Making Changes in Massachusetts

TURI provided two grants to transition a Massachusetts gym from FR to non-FR foam pit cubes due to the exposure issues. One grant was to Harvard T.H. Chan School of Public Health and Silent Spring Institute researchers and the Worcester Polytechnic Institute (WPI) fire testing lab. The objective of this grant was to support flammability testing and an

intervention exposure study. Results of these two studies are summarized below. The second grant was given to Gymnastics and More for the purchase of the new non-FR foam pit cubes. TURI assisted with identifying manufacturers of FR-free cubes and facilitated the project, including a site review by the local fire department and State Fire Marshal's Office, also detailed below.

Foam Flammability Testing

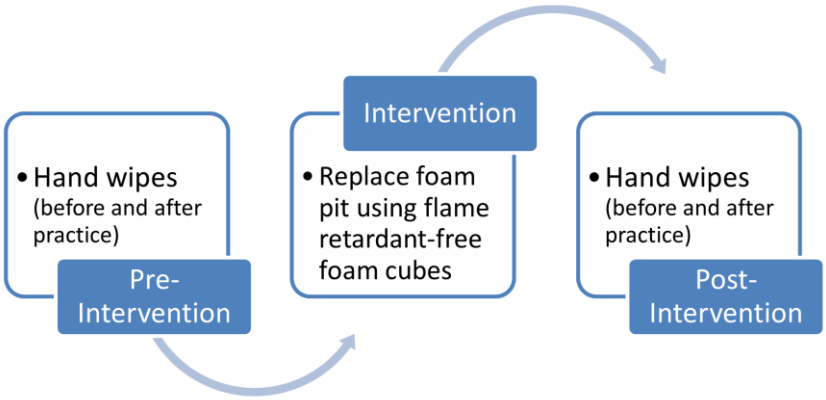
To help the gym move to non-FR foam pit cubes, TURI first needed to ensure that the gym would maintain fire safety. Flammability testing was conducted at WPI to determine the difference between cubes with FR versus cubes without FR using two experimental procedures based on standard test methods used in industry. The results of the flammability study showed that foam pits *with or without* FRs can produce severe fires when exposed to a small open flame ignition source.

Flammability testing at WPI. Flammability testing was done using bare foam pit cubes with and without FRs, and fabric-covered cubes without FRs. All three cubes are relatively safe, as it requires at least 23 watts of energy to cause any of them to continue to burn after exposure to a small flame; the FR-treated cube performed better by requiring 400 watts of energy (a larger flame). Once ignited, all of the cubes burned similarly. A smoldering fire (e.g., lit cigarette) did not cause any of the cubes to ignite. [2]

Photo credit: WPI Fire Protection engineering

Exposure Study

TURI and researchers at the Harvard School of Public Health, Silent Spring Institute, and Tufts University conducted an exposure study, replacing the FR-containing cubes in the foam pit with FR-free foam cubes and quantifying the change in gymnast exposure to FRs. Foam pit samples were collected from the foam pit and hand-wipe samples were collected from 15 collegiate gymnasts before and after a gymnastics training session both pre- and post-intervention. All samples were analyzed for FRs.



From pre- to post-intervention a 2-fold decline in FR concentration on hand wipe samples was observed in the samples taken before and after the gymnasts' training session. The results indicate that replacing foam pits using FR-free foam can substantially reduce gymnast exposure to FRs in the gym environment. These results are awaiting publication; however, a CDC report published in 2017 corroborates the findings.[3]

Fire Protection Community Engagement

The local fire department is the regulating authority ensuring proper fire protection at gymnastics training facilities in their jurisdiction. TURI and the gym worked with the local fire department to ensure their agreement with the use of the non-FR pit cubes.

The results from the WPI flammability study were shared with the local fire department and State Fire Marshal's office along with a request from the gym to allow replacement of the cubes using FR-free foam cubes. TURI, the gym owners, the intervention study team, the local fire department, and the Chief Fire Protection Engineer (FPE) from the Massachusetts Department of Fire Services met. The fire professionals recommended an independent FPE assess the facility for fire safety and make recommendations. An FPE was hired, conducted a site visit, and produced a report. That report was transmitted to the local fire department and they conducted another walkthrough at the gym to discuss the recommendations. Based on appropriate fire control and response measures, the local fire department approved replacing the existing cubes with FR-free foam cubes. The local building department was also provided with the FPE report, and gave approval through the local fire department to move forward with the pit cube change-out.

Fire Protection Recommendations

Gym fires are infrequent and, if ignition sources such as cigarettes or welding sparks are appropriately restricted from the area, the potential for fire is minimal. However, to ensure safety in case of a fire, the FPE report prescribed certain measures be in place:

- A fire evacuation plan for the facility with approval from the local fire department. The maximum occupancy load should be included and posted. Staff should be instructed on the plan and drilled periodically.
- An appropriate sprinkler system that transmits an alarm to a monitoring station.
- Egress from all points in the building compliant with requirements of the existing MA building code.
- Adherence to all state and local requirements for fire protection system impairments, hot work, and general fire safety.

With adherence to the list above, fire protection and safety can be maintained while reducing exposure of vulnerable populations to hazardous chemicals. Each facility that considers changing their foam pit cubes to those without FRs should invite their local fire department into their facility for a comprehensive walkthrough to evaluate all fire protection measures and agree on a path forward. TURI can provide additional technical reports and guidance to help with this process.

Conclusions

Findings from the intervention study indicate that replacing FR-treated foam with FR-free foam can substantially reduce gymnast exposure to toxic FRs in the gym environment without significantly impacting fire safety.

Results of the fire safety study indicate that foam pits with or without FR can produce severe fires when exposed to ignition sources of small open flames and that holistic consideration of fire safety can be applied in gyms to improve fire safety without the use of FR in foam pits.

Follow-Up

Since working with the gym highlighted in this case study, TURI supported Walker's Gymnastics and Dance in Lowell, MA, with a grant to purchase FR-free foam pit cubes for two pits in their facility. TURI worked with the Lowell Fire Department and Building Department to ensure fire safety even when the flame retardants were removed from the facility. TURI also helped coordinate the purchase and delivery of the new cubes.

The gym is very happy with the replacement of the foam pit cubes. Janine Walsh, the owner of Walker's Gymnastics and Dance, said, "It was still quite a costly endeavor, but I can't tell you how good it feels to know that these kids are jumping into healthy, safe foam."

For additional information about flame-retardant chemicals and other resources for gymnasts, please visit these sites:

TURI resources for gymnastics facilities
https://www.turi.org/Our_Work/Business/Small_Businesses/Gymnastics_Facilities

The Gymnast Flame Retardant Collaborative
http://gymnastcollaborative.org/

CDC report on flame retardants in four gymnastics studios
https://www.cdc.gov/niosh/hhe/reports/pdfs/2014-0131-3268.pdf

Silent Spring Institute's additional information about flame retardants
https://silentspring.org/research-area/flame-retardants

[1] USEPA 2015. *Flame Retardants Used in Flexible Polyurethane Foam: An Alternatives Assessment Update*. Accessed at https://www.epa.gov/sites/production/files/2015-08/documents/ffr_final.pdf

[2] Brokaw, Frederick and Dembsey, Nicholas*, 6 Inch Pit Cube Testing Letter Report*, WPI, Fire Protection Engineering Department, May 2, 2017, available at: https://www.turi.org/Our_Work/Business/Small_Businesses/Gymnastics_Facilities

[3] Broadwater, Kendra, et al., *Evaluation of Occupational Exposure to Flame Retardants at Four Gymnastics Studios*, Health Hazard Evaluation Program, CDC/NIOSH Report No. 2014-0131-3268, September 2017.