

**TOXICS USE REDUCTION INSTITUTE**
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Flame-retardant (FR) chemicals have been added to products in an effort to improve fire safety, including foam cubes placed in pits in gymnastics training facilities and children’s play centers. In these applications, the foam cubes are used to cushion the child or gymnast when they fall into the pit and has provided significant safety benefits for these purposes. However, we now understand that the chemicals added to help prevent the spread of fire can easily evaporate from the cubes, entering the air then our bodies. The main way they enter the body is when chemicals attach to dust in the air and the dust is accidentally ingested. The chemicals may also be inhaled or absorbed through the skin. Over a decade of research indicates that some flame retardants can harm the developing brain, have been linked to cancer as well as reproductive health issues, and several are considered endocrine disruptors.

Due to the exposure and health issues outlined above, fire safety testing has been conducted at Worcester Polytechnic Institute (WPI) to determine if the flame-retardant chemicals provide enough of a benefit for fire protection to make the potential health risks worth any added benefit. The goal of the WPI testing was to determine the difference in flammability of cubes with FR versus cubes without FR using two experimental procedures which are based off of standard test methods used in industry. Two ignition sources used for the tests were a smoldering cigarette and a small flame.

The results of the testing showed that all three systems tested (system 1 = cube with FR; system 2 = cube without FR; system 3 = cube without FR, but with a fabric cover) are relatively safe as it requires at least 23 watts of energy to cause any of them to continue to burn after exposure. Lit cigarettes are not enough to cause any of the systems to ignite. The cover on System 3 slightly delays the initial fire growth but not significantly. The cover also causes the heat release rate to be greater than System 2 without the covers. Therefore, the cover is not a useful fire protective addition to the non-FR cubes. System 1 is more fire resistant than the other two as it takes around 400 watts more of energy to cause the System 1 cubes to continue to burn in comparison to the others. System 1 delays ignition by several minutes, and is therefore more fire resistant, but the non-FR cubes in Systems 2 and 3 are sufficiently fire resistant to withstand likely ignition sources like a lit cigarette.

By removing the FRs from the foam pit cubes, the fall protection would remain, but the exposure to the chemicals would be significantly reduced, and the fire protection would not be compromised. Based on a thorough literature review, it was found that gym fires are very infrequent and if ignition sources such as cigarettes or welding sparks are appropriately restricted from the area, the chance of fire is very minimal. However, to ensure safety should a fire break out, it would be recommended that the following measures be in place:

* A fire evacuation plan for the facility must be in place 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.
* The facility must have an appropriate sprinkler system in place that transmits an alarm to a monitoring station.
* The egress from all points in the building must comply with requirements of the existing MA building code.
* All state and local requirements for fire protection system impairments, hot work, and general fire safety must be followed.

With adherence to the list above, fire protection and safety can be maintained while reducing exposure of vulnerable populations to hazardous chemicals.