HEALTHY BUILDING NETWORK

West Coast office * 2464 West St, Berkeley CA 94702 * 510-845-5600 * tlent@healthybuilding.net * www.healthybuilding.net

July 2, 2014

Miriam B. Ingenito
Acting Director
California Department of Toxic Substances Control
P.O. Box 806
Sacramento CA 95812---0806
via email to SaferConsumerProducts@dtsc.ca.gov

Dear Ms Ingenito:

The Healthy Building Network is pleased to submit comments to the California Department of Toxic Substances and Control on the Priority Products Draft Regulatory Concepts and Topics for Stakeholder Input.

The Healthy Building Network is a non-profit organization that researches the contents and health impacts of building materials and encourages the use of inherently safer materials. Our comments in this letter are in support of the proposed prioritization of isocyanate in spray polyurethane foam (SPF).

In our research of isocyanates in SPF we find that the curing of SPF is poorly understood and poorly controlled and hence highly likely to lead to exposures for workers and occupants alike with serious health effects, including potentially to unborn children.

We further find that the use of SPF in buildings is unnecessary. While there are few direct alternatives to the isocyanate formulation in SPF, there are many technologies already on the market that accomplish the functions provided by SPF, plus some promising new emerging technologies that could add to the available options.

The comments and evidence supporting our findings are drawn largely from HBN's Dec. 2013 report, *Full Disclosure Required: A Strategy to Prevent Asthma*,[1] supplemented by the research we undertook in support of "Flame Retardant Alternatives for Hexabromocyclododecane (HBCD)"[2] and our Pharos Project Building Product Library.[3]

The State of California and the US EPA have made clear that unreacted isocyanates in spray polyurethane foam pose a serious occupational safety problem that is not easily resolved with protective measures. This type of chemistry is challenging to bring reliably and safely to completion without serious exposure problems in the controlled environment of the factory that have resulted in widespread bronchial problems and occasionally death. Bringing SPF manufacture into people's homes, schools, offices and other buildings, where working environments are far less regulated than factories, increases the likelihood that workers and occupants will be exposed to hazardous levels of unreacted components during and after installation.

Isocyanates are the subject of intensive federal government scrutiny:

- The Environmental Protection Agency (EPA) is researching "source issues of spray polyurethane foams (SPF) manufactured on site" and will be issuing an initial report in 2014.[4]

- In June 2013, the Occupational Safety and Health Association (OSHA) initiated a National Emphasis Program to identify and reduce or eliminate the incidence of adverse health effects associated with occupational exposure to isocyanates.[5]

OSHA identifies isocyanates as respiratory, eye, and gastrointestinal irritants. “Hypersensitivity pneumonitis (inflammation in the lungs caused by exposure to an allergen)” has been reported in workers exposed to isocyanates, with symptoms experienced months or even years after exposure ends, according to the agency. ”Deaths have occurred due to both asthma and hypersensitivity pneumonitis from isocyanate exposure,” according to the agency.[6]

Isocyanate exposures may occur through inhalation or touch. According to OSHA, “Studies indicate that dermal exposure is a significant cause of respiratory sensitization. Thus, workers with skin contact to isocyanates may develop sensitivity, resulting in asthma attacks with subsequent exposures.” Isocyanates are also allergic sensitizers, sometimes leading to “cross-sensitization” where exposure to one isocyanate leads to the development of an allergy to another isocyanate.[7]

The SPF industry has provided reassurances that field applied SPF products cure rapidly and completely. However, we have found no industry or government source that reliably documents how much time is needed until occupants can safely return to a building in which polyurethane insulation or adhesives have been installed.

An ASTM committee opened a work item in 2013 to develop “a new test method for estimating chemical emissions from SPF insulation.” The committee’s formed in 2013 to start to address this question. The committee’s scoping document notes that “Currently, there are no standardized test methods that adequately address measuring the chemical emissions of SPF insulation products.”
http://www.astm.org/database.cart/workitems/wk40293.htm

The National Institute for Occupational Safety and Health (NIOSH) requested field data to help answer this essential question in 2012.

The amount of time it takes to complete the chemical reactions in polyurethane systems, called the “cure rate,” appears to be determined by the amine catalysts used in the “B-side” of the two part system. Varying types and amounts of amine catalysts used in a given SPF formulation make predicting cure times, and thus safe re-entry time, difficult.[8]

David A. Marlow, a NIOSH industrial hygiene engineer, says his agency is trying to determine the “actual amount of time before the area is void of harmful levels of vapors. The idea that the area needs to be clear for 24 hours is anecdotal and has no scientific underpinning."[9]

A recent case report may represent the tip of the iceberg of residential exposures to isocyanates. A couple had SPF installed in the attic of their home. An array of asthma-related symptoms started immediately upon their return home after evacuating for the installation.

The couple's doctors reported, “The SPF used in our patients' home was a two-component SPF system (Sealection® 500; Dimilec USA, LLC, Arlington, TX) that contained polymeric diphenylmethane diisocyanate (MDI) (50% to 60%), 4,4'-MDI (35% to 45%), and 2,4'-MDI (1% to 5%) in side A. Both patients were diagnosed with asthma or reactive airway dysfunction syndrome induced by exposure to isocyanates and were treated with bronchodilators and inhaled steroids.... *Our patients were told to return 4 hours after the application was completed, and thus were likely exposed to high concentrations of MDI*.”[10] (emphasis added). This is only one of many anecdotal reports of occupant impacts.

Numerous claims against SPF manufacturers and installers have been consolidated into a national class action lawsuit. In July, US District Judge Jan E. DuBois determined at that SPF can off-gas dangerous chemicals into the air, and that "plaintiffs have adequately pled a cause of action for negligence against defendants."[11]

A recent EPA presentation notes that "SPF Insulation component chemicals can migrate to other areas of the building" and that isocyanates "can trigger severe or fatal asthma attacks in sensitized persons upon further exposure, even at very low levels."[12]

In comments submitted to EPA earlier this year, the American Chemistry Council (ACC, the industry's trade association) failed to answer questions about curing rates and safe re-occupancy times.

“There are various ways to define when SPF insulation is fully cured," the ACC wrote to EPA. "Some look at certain physical properties of the installed SPF and believe when these have been achieved the insulation is cured (the SPF is tack-free within several minutes of application, and may achieve its desired physical properties within 24 hours of application). Others may look at the amount of unreacted isocyanate (which appears to be below the limit of detection on the surface of the foam within 15 minutes and below the limit of detection in the air within 2 hours after application). Additional discussion may be needed in this area to agree on an exact definition of cured SPF.... Also, while curing time and re-occupancy time may be related, they are not necessarily one in the same.”[13]

Into this uncertainty enters another troubling hypothesis: that neonatal exposures to isocyanates in polyurethane products may cause asthma. In 2003, a research team looked for isocyanates in polyurethane medical materials used in a New Zealand neonatal unit, found that the “opportunities for dermal exposures to polyurethane products and isocyanates are numerous.” They noted that isocyanates “are notable because of their capacity to elicit respiratory response at extremely low levels of exposure,” and that the skin of young children is “thin, delicate, and susceptible to alterations in integrity... “Thus, we theorize that neonatal exposure to polyurethane products containing isocyanate residue may contribute to an immune system imbalance and predispose children to asthma development.”[14]

Exposure pathways may begin even sooner than early childhood. The new field of epigenetics is exploring the roles environmental exposures to certain chemicals may have in gene transcription. In a study of mice, the offspring of mothers exposed to TDI before becoming pregnant had an increased susceptibility to asthma.[15]

Isocyanates are low vapor pressure substances and are not assessed in IAQ testing protocols. As a result, the California DPH VOC tests that are the backbone of IAQ certifications provide no protection for users of spray foam insulation systems from unsafe level of isocyanates.

In conclusion, we find that the curing of SPF is poorly understood and poorly controlled and hence highly likely to lead to exposures for workers and occupants alike with serious health effects, including potentially to unborn children.

There are numerous alternative technologies that can accomplish the functions of SPF. SPF is used in building construction projects to accomplish one or both of two functions: air sealing and thermal insulation.

SPF is a relatively new addition to the arsenal of tools used by contractors to air seal houses. A wide range of caulking materials have been used for decades, including silicones, latexes, acrylics and clay rope. Air sealing tapes made of polyethylene, polypropylene, butyl acrylate, Tyvek and other adhesives and polyurethane gaskets are more recent and equally effective technologies.[16] Tapes and gaskets used in conjunction with house wrap can be particularly effective. These solutions have a range of human health and environmental impacts which also should be taken into account in any alternatives assessment. See the Healthy Building Network’s Pharos database for evaluations of these substances’ impacts.[17]

On the insulation side there are many options. Open vertical cavities can be filled with blanket insulations made of fiberglass, rockwool (mineral fibers), recycled cotton, wool, silica aerogels and various polymer fibers or sprayed insulations made of cellulose or fiberglass. Rigid board foam insulations made from EPS, XPS, polyisocyanates, perlite, fiberglass, rockwool, calcined coke (carbon foam), phenolics and from sand, limestone and soda ash (foamglas) can also be used in these applications. A new mycelium based rigid board insulation product just merging on the market shows great promise to be far and away the least toxic board insulation product yet.[18] Closed cavities and horizontal open cavities and vertical open cavities with a restraining mesh can

use loosefill or blown cellulose or fiberglass or beads of aerogel or perlite. Again, HBN's Pharos database provides product content and health impact information about many of these potential alternatives.

Some of these insulation alternatives now are beginning to be packaged with air sealing technologies as a system approach, such as a latex sealant and fiberglass batt marketed by Knauf under the EcoSeal label. More content disclosure is needed on these systems to insure avoidance of related chemicals of concern. For example, the indication in an MSDS of hydrogen bromide released from EcoSeal during combustion may indicate the presence of brominated flame retardants.

Cementitious foam made from magnesium oxide is the closest technology on the market to match the approach of SPF. Unlike SPF it also does not require hazardous flame retardants. In fact many of these alternative insulations and air sealants are far less hazardous than SPF.

Another technology that is near market ready that uses the same approach as SPF (insulating and adhering to the walls to seal air) is the previously mentioned mycelium based insulation product now also being developed in a grow-in-place application by the Ecovative company in New York.

Alternative technologies and approaches abound for air sealing and insulation. It is highly justified to go forward with the alternatives assessment process for isocyanates in SPF. Eliminating this exposure could have a tremendous benefit to many thousands of workers and occupants without a negative impact on important energy considerations in the building.

The Pharos Project developed by the Healthy Building Network provides two online tools that may be useful to DTSC in the discovery and assessment of alternative products and chemistries. The Building Product Library catalogs and assesses building products and their contents and associates those contents with potential health hazards. It currently includes about 1500 building products, including an extensive catalog of insulation products. The Chemical and Material Library provides associations between over 34,000 substances and 60 up to date authoritative hazard lists and restricted substance lists. It also provides process chemistry information on a subset of those substances.

Thank you for the opportunity to provide this testimony. We applaud the important work of the DTSC on this critical issue and are pleased to offer our experience and assessment tools to forward the effort.

Sincerely,

---

[1] Lott, Sarah and Jim Vallette, "Full Disclosure Required: A Strategy to Prevent Asthma", Healthy Building Network December 2013 http://www.healthybuilding.net/reports/asthmagens/HBN_Report_Full_Disclosure_Asthma.pdf

[2] US Environmental Protection Agency, Design for the Environment "Flame Retardant Alternatives for Hexabromocyclododecane (HBCD)".June 2014 http://www.epa.gov/dfe/pubs/projects/hbcd/about.htm

[3] Pharos Project, Healthy Building Network, online tool. www.pharosproject.net

[4] "Minutes of the Webinar/Meeting for 13-February-2013," *Federal Interagency Committee on Indoor Air Quality*, Accessed February 13, 2013, www.epa.gov/iaq/ciaq/02_13_13meeting_minutes.pdf.

[5] "OSHA announces new National Emphasis Program for occupational exposure to isocyanates," *Office of Communications, Occupational Safety & Health Administration,* Accessed June 25, 2013, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=NEWS_RELEASES&p_id=24273

[6] Occupational Safety and Health Administration, "National Emphasis Program - Occupational Exposure to Isocyanates," *OSHA Instruction CPL 03-00-017,* Last updated June 20, 2013, https://www.osha.gov/OshDoc/Directive_pdf/CPL_03-00-017.pdf. (OSHA 2013)

[7] OSHA 2013.

[8] Spence, Mark, "The Current MDI Industrial Hygiene Data on Spray Foam," Presentation at the American Chemistry Council Polyurethanes Technical Conference, National Harbor, MD, October 5-7, 2009.
[9] David A. Marlow, "Help Wanted: Spray Polyurethane Foam Insulation Research," NIOSH Science Blog, March 21, 2012 (1:55 p.m.), http://blogs.cdc.gov/niosh-science-blog/2012/03/21/sprayfoam/ .
[10] Tuang, Wayne and Yuh-Chin Yuh, "Asthma Induced by Exposure to Spray Polyurethane Foam Insulation in a Home," *Journal of Occupational and Environmental Medicine* 54, no. 3 (2012): 272-273. (Tuang and Yuh 2012)
[11] Andrew Scurria, "Spray Foam Insulation Class Action Gets Green Light," *Law360*, July 8, 2013, http://www.law360.com/cases/50abf8d3a895c0596d000001/dockets.
[12] Anjali Lamba, "Spray Polyurethane Foam (SPF): EPA Considerations," Office of Pollution Prevention and Toxics, US EPA, 2013
[13] American Chemistry Council Diisocyanates Panel, "RE: Toluene Diisocyanate (TDI) And Related Compounds Action Plan, RIN 2070-ZA15, April 2011," February 26, 2013, http://www.regulations.gov/contentStreamer?objectId=090000648120ceac&disposition=attachment&contentType=pdf
[14] Krone, Cheryl, Tom Klingner, and John Ely, "Polyurethanes and childhood asthma," Medical Science Monitor, 2003; 9(12): HY39-43.
[15] Lim et al. 2007.
[16] Holladay, Martin "Air-Sealing Tapes and Gaskets" Green Building Advisor, March 8, 2013 http://www.greenbuildingadvisor.com/blogs/dept/musings/air-sealing-tapes-and-gaskets
[17] www.pharosproject.net
[18] Lott, Sarah, Looking Forward to 2014: Growing the Built Environment, Healthy Building Network http://www.pharosproject.net/blog/detail/id/178/growing-the-built-environment