Toxic Safety: Flame Retardants, Chemical Controversies, and Environmental Health

Dr. Alissia Cordner
Assistant Professor of Sociology
Whitman College

Alaska Collaborative on Health and the Environment Teleconference
April 6, 2016
TOXIC SAFETY

Flame Retardants, Chemical Controversies, and Environmental Health

ALISSA CORDNER

Columbia University Press, 2016
Research Questions

1. How do stakeholders engaged in the field of flame retardant chemicals define and act upon the risks and hazards of those chemicals?

2. What is the role of scientific knowledge in decision-making about chemical risks?

3. What are the implications of stakeholders’ different risk assessment paradigms for chemicals use and regulation in the United States?
Data and Methods

- Participant Observation
  - Chemical manufacturer
  - EPA’s Office of Pollution Prevention and Toxics
  - EPA’s Office of Research and Development
  - Academic environmental chemistry lab
  - Environmental Health NGO

- 116 in-depth interviews

- Literature and public document research

- All respondents anonymized

- Funding: 3-year EPA STAR Fellowship (FP-917119) and NSF (PI: Phil Brown, SES-0924241)
~100,000 chemicals have been inventoried in US commerce

- **Exposure data** – less than 1/5 of chemicals have any exposure data (Egeghy et al. 2012)

- **Toxicity data** – 34% have no toxicity data and only 28% had a high quality toxicity evaluation (Judson et al. 2009)
Flame Retardant Chemicals

- Widely used as additives to consumer products to decrease flammability

- Hundreds of individual chemicals and mixtures
  - PBDEs
  - Chlorinated Tris (TDCPP, TCEP, TCPP)
  - TBBPA
  - HBCD
  - Firemaster 550 (TBB and TBPH)
Fire Safety Regulations

- Intended to reduce fire occurrences, injuries, and deaths

- Annual Fire Deaths:
  - 1971 – 12,000
  - 2011 – 3,005

  *Source: US Fire Administration*

- Flame retardants remain a large and profitable international industry
Are PBDEs an environmental equity concern? Exposure disparities by socioeconomic status

AMI R. ZOTA
University of California, San Francisco, California

GARY ADAMKIEWICZ
Harvard School of Public Health, Boston, Massachusetts

RACHEL A. MORELLO-FROSCH
University of California, Berkeley, California

For example, recent studies have shown higher exposures among young children compared to adults (1). This finding is consistent with exposure profiles of other environmental contaminants, such as lead, where dust is an important exposure media; indeed, children spend more time close to the ground and engage in hand-to-mouth behavior which may increase their dust intake. There are also significant geographic differences in PBDE exposures with much higher serum, breast milk, and house dust levels reported in the U.S. compared to Europe. Within the U.S., PBDE congener characteristic of penta-BDE (e.g., BDE-47, -99, and -100) occur at higher concentrations in house dust and blood samples collected from Californians compared to other U.S. residents. This difference in exposure levels within the U.S. is likely due to California’s unique furniture flammability standard (TB117), which appears to be associated with body burdens that are twice as high as the rest of the U.S. and 10-fold higher than levels in Europe (2).
Health Effects of Some Flame Retardants

- **Persistent, Bioaccumulative, Toxic (PBT)**
- **Endocrine disruptors** (Rudel and Perovich 2009)
- **Reproductive disorders** (Main et al. 2007, Harley et al. 2010)
- **Changes in hormone levels** (Meeker et al. 2009, Chevrier et al. 2010)
Flame Retardants as Case Study

- pentaBDE
- TDCPP
- HBCD
- TCEP
- FM550
- decaBDE
- Br-Tris
- TBBPA
- PBBs
Regulation of Flame Retardants

• Regulation has been chemical-by-chemical
• State level bans
• United States
  o Environmental Protection Agency (EPA)
  o Consumer Products Safety Commission (CPSC)
• Internationally
  o Europe – Registration, Evaluation, and Authorization of Chemicals (REACH)
Limitations of Federal Chemicals Regulation

- Toxic Substances Control Act (TSCA)
- Limitations of TSCA include:
  - Limited authority to regulate “existing” chemicals
  - Risk-based regulations must be justified as “least burdensome”
  - No required toxicity or exposure data for new chemicals
  - Exemptions from full reporting for many chemicals
  - Confidential Business Information

- Pending Federal Legislation
State Level Regulation and Activism

- Broad coalition, including:
  - Environmental and health nonprofits
  - Public interest organizations
  - Parent groups
  - Environmental scientists
  - Legislators and regulators
  - Supply chain manufacturers and distributors
  - Firefighters
  - Fire scientists and fire safety experts
Blue-Green Alliances

- Environmental groups have successfully partnered with firefighters and fire safety experts
State Level Regulation and Activism

- “Patchwork Quilt” of state regulations
- “Retail regulation” and market campaigns
Corporate Advocacy

- Citizens for Fire Safety (no longer active)
- Bromine Science and Environmental Forum
- American Chemistry Council’s North American Flame Retardant Alliance
Conceptual Risk Formulas

Risk

Hazard
Exposure

Uncertainty
Conceptual Risk Formulas

- Classic Risk Formula
- Exposure-Centric Risk Formula
- Either-Or Risk Formula
- Emerging Toxicology Risk Formula
- Exposure-Proxy Risk Formula
- Hazard-Centric Risk Formula
Classic Risk Formula

- Risk = \( f(\text{Hazard} \times \text{Exposure}) \)

- Assumes a linear dose-response relationship

- Absence of data suggests absence of risk

- Widespread in environmental regulation, public discourse, and the chemical industry
Exposure-Centric Risk Formula

- Risk = \( f(\text{Hazard} \times \text{Physical-Chemical Properties} \times \text{Use Scenarios} \times \text{Exposure Pathways} \times \text{Measured Levels}) \)

- Formula is multifaceted and strictly multiplicative

- Exposure is controllable

- Widespread in the chemical industry
Either-Or Risk Formula

- Risk = f(Hazard) or f(Exposure)

- Critique of multiplicative risk assessment

  - “We prefer a hazards-based approach, which is, ‘let’s look at the chemicals. If it’s hazardous, don’t use it.’”
  
  OR

  - “You don’t even have to show a health effect. If you’re showing that these chemicals are getting into my body, that trespass is unauthorized.”

- Widespread in environmental and health activism
Implications of Conceptual Risk Definition

- Risk definition is strategic
- Reactionary versus precautionary risk management
- Protecting markets versus protecting public health
  - Risk definition as another tool used by industry to delay chemicals management
Questions?

Alissa Cordner
cordneaa@whitman.edu

*Toxic Safety* is available for purchase on the Columbia University website (cup.columbia.edu).

Use the discount code **CORTOX** for a 30% discount.