From PBB to PFAS: Policy Lessons from Widespread Chemical Contaminations in Michigan

Support for this event is provided by the National Institute of Environmental Health Sciences
Event co-sponsors

Senator Winnie Brinks
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[Logos of various institutions]

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Health Effects of PBB Exposure in Michigan

Michele Marcus, Professor of Epidemiology and Environmental Health, Rollins School of Public Health
EARLY PUBERTY
WHY GIRLS ARE GROWING UP FASTER

Is it hormones?
Is it fat? Is it something in the water?
How parents and kids are coping
The Third Generation: Miscarried

“To this day, I grieve for my lost children.”
- Anonymous PBB Registry member
Additional Research Findings

• Thyroid problems
• Breast Cancer (GI Cancers? Lymphoma?)
• Epigenetics – regulation of gene activity
  (Is this how PBB impacts health?)
Current Research: Response to community concerns

• "Is there any way to help get rid of the PBB in my body?"

• “In my family, we have the same health problems you described but it was my father who was exposed. Could his exposure have affected us?”
What have we learned about PBB?

• Forever Chemical
• Can be transferred from mother to child in the womb and through breast milk
  – “I didn’t know that something that I was exposed to...could be passed to my kid. Did I just poison my kid?” Anonymous PBB Registry member
• Three generations have been impacted
Original Goals of the PBB Registry

- Determine the long-term effects of PBB exposure
- Make people aware of research findings, especially those that might help them prevent or mitigate damage
- Respond to concerns and requests for information from members

Establishment of the Registry funded by State and Federal sources
Recommendations

• Continue operation of the PBB Registry to determine risks of cancer and other diseases
  – “Bless you as you continue this important research”
  *Anonymous PBB Registry participant*

• Inform exposed Michiganders and their healthcare providers about health risks.
  “I had symptoms for years before my doctors considered thyroid problems as the cause. My years of suffering could have been avoided if the doctors knew my PBB level and the associated risks.”
  *Anonymous PBB Registry participant*

Research is funded by the National Institutes of Health
Questions?
The Lessons of the PBB Disaster
Edward C. Lorenz, Ph.D., Reid-Knox Professor Emeritus, Alma College

For background on Michigan Chemical, Velsicol and the economics of pollution you might check these two books on display today. Both are available from Michigan State University Press.
Ignored Warnings !!!

EXAMPLES:

• Elected officials – Saginaw City Council 1935 unanimously objected to river pollution
• Citizens - 126 St. Louis residents complained in a petition in 1941

Lesson learned: The local community is often the first to identify an environmental hazard.

Sign by playground across Pine River from Velsicol Superfund site.
False Reassurances Undermine Responses for Decades

As soon as the PBB accident became known, the state reassured the people that Michigan Chemical was a good company and that the community’s water and soil was not contaminated.

Only after 2010 was residential soil contamination finally addressed.

Lesser learned: Do not dismiss early concerns with false optimism; instead, start long-term and thorough environmental monitoring to reduce exposures as soon as warranted.
Consequences of weak regulation and delayed responses to contamination:

1. Eight million people consumed contaminated food,
2. Over 400 workers lost jobs,
3. Hundreds of farmers lost livelihoods,
4. Consumers of river fish contaminated for many years,
5. Local residents exposed to contaminated soil and water ‘longer than necessary’, &
6. Later generations are paying a half billion dollars for current remediation.

Final phase of 1999-2006 Pine River sediment remediation $140,000,000 (2019 dollars).

Lesson learned: Economic costs impact individual families and become a multigenerational tax burden.
Governor William Milliken’s response to interagency confusion and interests was creation of the interagency Toxic Substances Control Commission (TSCC) to assess responses to emergencies.

He appointed ‘PBB farmer’ Rick Halbert as TSCC chair.

In 1988, the state abolished the TSCC as redundant.
Lessons of PBB Policy

1. Community knowledge is important. The local community is often the first to identify an environmental hazard.

2. Long-term and thorough environmental monitoring is important to reduce exposures.

3. Economic costs impact individual families and become a multigenerational tax burden. (Similar to health effects.)

4. Better coordination among environmental & health agencies is needed, such as establishing a new interagency ‘TSCC.’
Per- and Polyfluoroalkyl Substances (PFAS) in Michigan: A Contemporary Widespread Chemical Contamination

Alfred Franzblau, MD
Examples of Environmental Contamination in Michigan

PBBs in Michigan (1973: Michigan Chemical Corp)
PCBs in Saginaw River watershed (1980’s: GM and others)
Dioxane in ground water under Ann Arbor (1980’s: Pall-Gelman)
Dioxins & furans in Tittabawassee River (1999: Dow Chemical)
Heavy crude oil in Kalamazoo River (2010: Enbridge Energy)
PFAS across Michigan (early 2000’s?: multiple sources)
Future episodes (???)
What are PFAS?

- Synthetic compounds with a totally fluorinated carbon chain with a functional group (e.g., carboxylic acid or sulfonic acid)
- Consumer/industrial applications (both water and oil repellants)
  - Stain-resistant coatings for upholstery and carpeting (Scotchgard, Stainmaster)
  - Water-resistant breathable outdoor clothing (Gore-tex)
  - Greaseproof food packaging
  - Non-stick cookware (Teflon)
  - Aqueous film-forming foams (AFFF): used to fight hydrocarbon fires
- Surfactant

![Perfluorooctanoic acid (PFOA)](image1)

![Perfluorooctane sulfonic acid (PFOS)](image2)
How are people exposed to PFAS?

- People can be exposed from air, indoor dust, food, and water, and in some home products (e.g. non-stick pans).
- The main sources of exposure are usually from eating food and drinking water. (Note: No federal MCL, only Health Advisory Level)
- Other routes: breast feeding; stain-resistant carpet (especially children); workers in facilities that use or make PFAS; living in communities with high levels in drinking water.
- Other key factors:
  - Long persistence in the environment (‘Forever Chemicals’)
  - Long half-life in humans (e.g., PFOA – 8 years; PFOS – 5.4 years)
  - Production phased out in US in 2000’s, but replaced with???
Blood Levels in People Who Were Exposed to PFAS

**PFOA**
- 3M Workers, 2000
- Dupont Workers, 2004
- Little Hocking Community, 2005-2006
- Ohio River Valley Community, 2005-2006
- North Alabama Community, 2010
- North Alabama Community, 2016
- Pease NH Community (age < 12), 2015-2016
- Red Cross Blood Donors, 2006
- Pease NH Community (age ≥ 12), 2015-2016
- NHANES 2011-2012
- NHANES 2013-2014

**Average* Blood Level**
(micrograms per liter, ug/L)

**PFOS**
- 3M Workers, 2000
- North Alabama Community, 2010
- North Alabama Community, 2016
- Red Cross Blood Donors, 2006
- Pease NH Community (age ≥ 12), 2015-2016
- Pease NH Community (age < 12), 2015-2016
- NHANES 2011-2012
- NHANES 2013-2014

*Average = geometric mean
PFAS Sites in Michigan (most are confirmed)
Health Effects of PFAS

• High levels of certain PFAS may be related to:
  – Increased cholesterol; thyroid disease; liver damage; decreased fertility in women; pregnancy complications (HTN); asthma

• PFAS may increase the risk of kidney and testicular cancer, but human studies are not consistent
  – IARC has classified PFOA as ‘possibly carcinogenic’, but not other PFAS
  – EPA suggests that there is evidence that PFOA and PFOS may have the potential to cause cancer
PFAS: What can be done?

• Continue to assess exposures, particularly in drinking water
• Continue to assess potential adverse health effects
• Action by Michigan (e.g., SB 14) and other States
• More generally, consider how ‘new’ chemicals are regulated and allowed to enter into commerce with minimal or no toxicologic information
• MORE/CONTINUING RESEARCH IS NEEDED!
PFAS: Examples of State Actions

• Proposed or adopted state actions:
  – Set enforceable drinking water standards (lower than EPA Health Advisory Level) – NH, MI
  – Regulate or ban certain PFAS products (e.g., fire-fighting foam, food packaging, etc.) – GA, NH, NJ, NY, RI, VA, WA
  – Fund research on PFAS – MN
Questions?
For more information about PBB and PFAS contaminations in Michigan visit:

http://pbbregistry.emory.edu/index.html

http://mleead.umich.edu/EHMI_PFAS_Per_Polyfluoroalkyl_Substances.php

https://www.michigan.gov/pfasresponse
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