From PBB to PFAS:

Policy Lessons from Widespread Chemical Contaminations in Michigan

The goal of this program is to identify more effective strategies for preventing and responding to large-scale contaminations in Michigan. We welcome you to join this important discussion as a leader charged with overseeing Michigan's environment, protecting our citizens' health, and supporting our economy.

March 21, 2019 11:30am - 1:00pm

Michigan Senate Binsfeld Office Building 5th Floor, Room 5550 201 Townsend St, Lansing, MI 48933

11:30am-12:00pm Short Presentations

Michele Marcus, Professor, School of Public Health, Emory University "Health Effects of PBB Exposure in Michigan"

Edward Lorenz, Reid-Knox Professor Emeritus, Alma College "Important Lessons From the PBB Accident"

Al Franzblau, Professor of Environmental Health Sciences, University of Michigan "PFAS: A Contemporary Environmental Contamination in Michigan"

12:00-12:30pm Questions and Answer Segment

12:30-1:00pm Poster Sessions and Networking

Event Cosponsors: Senator Winnie Brinks, Senator Kevin Daley, Senator Peter MacGregor, Senator Sean McCann, Senator Rick Outman, Representative Abdullah Hammoud, Representative James Lower, and Representative Hank Vaupel

Support for this event provided by:

University of Michigan's Michigan Lifestage Environmental Exposures and Disease (M-LEEaD) Center

Central Michigan University's History Department

Emory University's Health and Exposome Research Center: Understanding Lifetime Exposures (HERCULES)

The National Institute of Environmental Health Sciences, National Institutes of Health

From PBB to PFAS

Lessons Learned

- 1. Long-term health monitoring is critical.
- 2. Contamination affects health, the economy and the community.
- 3. Community voices are essential in understanding the impacts.
- 4. Michigan healthcare providers need education on health impacts of chemical contaminations.

Community Voices

"I still can't imagine living that life, for the farmers. For all those years. Having everything going down, day by day. Animals, their family, their farm...The PFAS contamination is not exactly the same [as PBB], but it's going to have similar consequences, I think. And it's going to go on a long time because it's called the 'Eternal Chemical,' or something like that, because it doesn't break down very quickly."

-C. Muldoon

"There was a lot of anger in the community. 'Why did this happen? How could this have happened? And why did it take so long to be discovered when there were so many sick animals dying?' There was a reason for it, and it just took *too* long to discover why."

-D. Reynolds

"I found out that all of my doctors—oncologists, radiologists, family practice doctors—nobody had ever heard of PBB. So I find that very sad if that is the biggest contamination in the state of Michigan that ever occurred and nobody is even aware at major medical centers that it happened. So I feel strongly that more research needs to be done."

-M. de Bahena

"I hope that through this research that we can come up with solid legislation, [a] solid action plan... Like I always said at the beginning, this thing evolves in chapters, and the last chapter of this book has not been written."

-T. Neyer

PBB and PFAS in Michigan

Quarantined Farms Resulting from PBB Exposure in Farm Animals

Quarantined farms reflect the following PBB limits:

May, 1974: 1 parts per million

November, 1974: 0.3 parts per million

August, 1977: 0.02 parts per million

Note: This map is based on historic documents stating the number of farms that were quarantined for each PBB limit. Some farms may have been quarantined more than once resulting in those farms being double-counted on this map.



Fig 1. Farms quarantined across the state of Michigan due to Velsicol Chemical mistakenly shipping PBB instead of a nutritional supplement for farm animal feed. Quarantined animals were buried in the two burial pits.

Michigan PFAS Sites Being Investigated

PFAS SITES BEING INVESTIGATED

PFAS sites are where one or more groundwater sample exceeds the Part 201 cleanup criteria for groundwater used as drinking water, which is 70 ppt PFOS + PFOA.

New site summaries are routed through MPART so that all agencies are aware of the site and can contribute to the investigation as needed. Sites are added to the map at the right after being vetted through MPART.



Site investigations get started for a variety of reasons. At some sites, like Superfund sites, DEQ staff have been overseeing environmental cleanup efforts for many years, and may add PFAS sampling to ongoing sampling if PFAS was known or suspected to have been used at the site. DEQ staff also conduct routine monitoring of rivers and lakes, and if a sample exceeds water quality standards, staff work upstream until they find the site contributing to the PFAS. Other sites were sampled due to historical information, such as Carl's Retreading, which was where tires burned for many days and firefighting foam containing PFAS was used. DEQ is committed to continuing to do all of these types of sampling efforts.

PBB Contamination Timeline

Lasting impact in Michigan



What We Have Learned from the Michigan PBB Registry



PBB research is supported by the National Institutes of Environmental Health Sciences.

"We were blessed once we found out it wasn't our fault. There really was a reason."

-Bonnie Davis, on discovering her farm's exposure to PBB.



Alfred and Bonnie Davis, 1950s. Courtesy of Bonnie Davis for the Michigan PBB Oral History Project.

Bonnie and Alfred Davis had a thriving herd of Holsteins in the early 1970s when PBB hit. After the state quarantined their farm, they sent 300 animals to the Kalkaska burial site. She explained:

"It was hard putting those steers on that truck. We never sold a calf, they always grew up to become a cow... That was hard (long pause). That was hard. You hated to say goodbye." On April 10, 1975, Representative Donald Albosta, co-chair of the Michigan House Agricultural Committee, took a busload of state legislators on a tour of farms with low-level contamination. Albosta wanted to show his colleagues some clean, well-managed farms where livestock were sick and dying through no fault of the farmers, especially after stories circulated the capitol that herds were more likely suffering from poor husbandry than PBB.

The group had lunch in the Davis family's kitchen. Their farm had been quarantined. Bonnie recalled:

"We went to the barn the day they came and toured it. And they asked me questions about how, how was it? How hard was it? And how did you know, like you're asking me actually. We just knew we had a problem and we were afraid it was our problem, and we were doing something wrong. We had no clue."



Aerial photo of Bonnie and Alfred Davis's farm after PBB (late-1970s). Courtesy of Bonnie Davis for the Michigan PBB Oral History Project.



Davis family portrait, 1972. Courtesy of Bonnie Davis for the Michigan PBB Oral History Project.

Bonnie worked as a waitress and in the kitchen of a local restaurant to help the family survive the quarantine and while waiting on a settlement. When they received an offer to settle, they refused to sign a waiver for human health:

"I looked at Alfred, [he] looked at me... We got up and left. And the only thing else Alfred said is, 'I will not promise you what will happen if it gets in my family.' And we walked out."

For information about the Michigan PBB Oral History Project, contact Brittany Fremion, Assistant Professor of History, Central Michigan University (see flyer at end of document)

"We ended up in bankruptcy...I remember the day our farm was auctioned. I was walking around with tears running down my cheeks."

-Yvonne Yarnell, reflecting upon the loss of her family's dairy farm.



Yvonne and Floyd Yarnell, 1960s. Courtesy of Yvonne Yarnell for the Michigan PBB Oral History Project.

"First the cattle got abscesses, aborted calves and their milk production went way down until we couldn't afford to feed them anymore because they weren't giving enough milk to pay the bills. So we had to sell them. At that time the agriculture department was pushing selling low tolerance saying, 'There's nothing wrong with them. You have to sell them.' So we did, but if I had to do it over again. I would've never put them on the market. I would've had them shot like some of the people did. And I would've gone to jail if I had to because I didn't realize at the time how sick we were going to get."

—Y. Yarnell

"We had 125 cows that we had to milk at ten o'clock in the morning. After we got done, we pulled this homemade cart that had a 500 gallon tank on it, that we pumped the milk into, and we took it out to a hole that we had an excavator dig—a ten foot hole—and we had to run it into the pit, and then go back. You had to—there was no stopping working, you were always working, and you didn't get any money." —G.T. Never

"It took the heart right out of farming because we lost those herds."

-M. Zuiderveen

"It takes years and years to build a herd that you can put your stamp on because you breed for what you like...I mean we wanted a certain style of cow that did a certain amount—that was efficient—and over a twenty-year period if you did anything right and had any breaks you started having your style of animal. Well, bang (pounds table) all of a sudden they're all buried. Now you're middle aged, and to start over, that in itself is a challenge (laughs). But you know, we survived it. It kind of cut the heart out of you. It wasn't just—in our case it was not just the money thing, I mean money is always important. You gotta make a living and you gotta pay your bills and all that, but if you work—it's like [being] an artist; building a good herd of cows is artwork.

—H. Zuiderveen



Hubert and Martha Zuiderveen as newlyweds (1960s) and in the early 2000s. Courtesy of the Zuiderveens for the Michigan PBB Oral History Project.



The Zuiderveen's farmhouse in Falmouth, Michigan. Courtesy of the Zuiderveens for the Michigan PBB Oral History Project.

The Michigan PBB Oral History Project will be preserved in a special research collection at the Museum of Cultural and Natural History at CMU (see flyer at end of document).

"ACTION " NEWSLETTER

Volume I, No. 8

Published by the PBB Action Committee, Inc. Reed City, Michigan

May-June, 1977

Organizing Farmers

On March 20, 1976, approximately 300 farm family members traveled to Mount Pleasant, Michigan, to attend a meeting on the campus of Central Michigan University. The mass meeting was the first attempt to mobilize farmers across the state. At the conclusion of the day, the group identified six priorities:

- 1. lowering the tolerance level from 0.3 ppm to 0.002 ppm immediately;
- 2. settlement of outstanding claims;
- complete testing of all livestock and removal of those showing signs of contamination;
- a ban on shipment of meat and milk from contaminated stock within 72 hours;
- 5. immediate research into human health;
- 6. and investigation of the Departments of Agriculture and Public Health by the state legislature.



Flyer, ca. 1976. Courtesy of Tim Neyer, Personal Papers, Clarke Historical Library, CMU.

The PBB Action Committee

The PBB Action Committee, formed in 1976 and led by Hilda Green, Louis Trombley, and Patricia Miller, united farmers in a grassroots movement to address PBB exposure. The organization's efforts provided the farming community with a voice in the political arena and advocated on behalf of public health. For instance, some of its officers met with White House officials and testified before Congressional committees in 1977. Ultimately, however, the committee did not make the impact it needed or deserved.

March 22, 1976: Protest in Lansing

Louis Trombley of Hersey, Michigan, led a demonstration at the state capitol on March 22, 1976. The protest was described as a "turning point for farmers" by journalist Joyce Egginton, who wrote *The Poisoning of Michigan* (second edition, Michigan State University Press, 2009). The event initiated a wave of news coverage that produced strong visuals. According to Egginton:

"Trombley shot one of his sickest cows for the occasion. He chained her body to the front of his truck, and on the back loaded a coffin draped with the American flag to which he had pinned the slogan: 'Is this our future—PBB?"



PBB Action Committee Newsletter, ca. 1977. Courtesy of Dr. Alpha Clark, Personal Papers, Clarke Historical Library, CMU.

For more information about the Clarke Historical Library's collections at Central Michigan University, click here.

"It was—it's an important story—PBB is an important part of the history of this nation, not just Michigan."

-Christine Muldoon, reflecting upon the legacy of PBB.



Christine Muldoon worked as an assistant to Dr. Irving Selikoff, who arrived in Grand Rapids from Mount Sinai Hospital in New York to begin a health study in 1976. In addition to scheduling patient appointments for Selikoff, Chris supported the work of her partner, Patrick Muldoon, an attorney who represented farm families in human health litigation. Both she and Pat have had their blood tested for PBB in recent years and discovered that they have shockingly high levels.

Researchers estimate that millions of people living in Michigan in the 1970s ate food containing PBB. Yet, Chris pointed out: "a lot of our doctors are probably not old enough to remember this stuff."

Christine and Patrick Muldoon in Grand Rapids, 2018. Photo: Brittany Fremion. Courtesy of the Michigan PBB Oral History Project.

"I was calling people from...around the state. And my recollection —cause I thought of this even then—is, 'nobody is refusing to come'...I don't recall a *single* person, a single farmer or family, that I talked with that said, 'Well, we'll have to think about it' or 'No, I'm sorry, we're not interested.' I personally can't recall that. Every single person in my recollection agreed to come, and they agreed to whatever time and date we had available. And that struck me as pretty amazing. It just goes to show you how serious this was for them."



Detroit Free Press (Sunday, February 13, 1977): 14-A.

FARMERS BLAME STATE IN PBB FIASCO

Cows Be Damned . . . 'What About People?'

Selikoff Study

Dr. Irving Selikoff was a pioneer in environmental and occupational health. In the 1970s, he was director of the Environmental Sciences Laboratory at Mount Sinai Hospital in New York, the country's leading resource for environmental medicine. When Selikoff learned about PBB he agreed to investigate. Funded by the American Cancer Society and National Institutes of Health, he had unmatched experience and funding to travel to Michigan. The politics of PBB, however, delayed Selikoff's arrival in Michigan until 1976-two years after the mix-up had been confirmed. He set up a seven-day clinic in the east wing of the Kent Community Hospital in Grand Rapids, where his team worked for almost two months. Selikoff's study depended upon volunteer patients-1,029 individuals came forward.

The results of his investigation were striking:

- 96% of breast milk samples taken from 108 women had detectable levels of PBB;
- there were high levels of PBB in Michigan consumers, not just farmers;
- a variety of PBB isomers with different toxicities were present in patient tissues;
- and patients complained of neurological disorders, skin changes, breathing problems, and joint issues.

Litigating Human Health

"The human side of PBB...There was no 0.3 parts per million, like there was with the animals. You either had a disease or you didn't have a disease. Dr. Selikoff came to Grand Rapids in 1976...He had a lot of people—Chris signed them up—and they were hurting. And nobody listened to them."

For information about the long-term health study and research, visit the PBB Registry: http://pbbregistry.emory.edu

"Under the law in the 1980s, the EPA could have cleaned up the river, the plant site, and all the other dumping sites and then charged the expenses to Velsicol. Instead EPA and others let them off the hook."

-Jane Keon in her memoir, Tombstone Town.

The Pine River Superfund Citizen Task Force

In 1998 a group of local citizens formed the Pine River Superfund Citizen Task Force to oversee EPA cleanups in the St. Louis, Michigan area, including contaminated river sediment, a radioactive site, and three Superfund sites. The aim of the Task Force is a complete cleanup of the water and soil in their community, making it safe for any use. The Task Force believes citizen groups can improve the effectiveness of technical work, the precision of research about risks, and the permanence of decisions about remedies. Having completed 20 years as a persistent voice in Mid-Michigan and the nation, its members remain dedicated to the protection of human health and the environment.



Jim Hall, chair of the Task Force and long-time resident of St. Louis, stands next to the grave of his daughter Jerra Mia Hall, who passed away at 2-years old in 2005 after being born with hypoplastic left heart syndrome. Jim has high levels of PBB in his body. Photo: Ryan Garza, *Detroit Free Press* (March 7, 2018).



Michigan Chemical Company (later Velsicol Chemical)

Most of the original Task Force members lived in St. Louis while Michigan Chemical was in production (1936-1978), and several of them worked at the factory, which manufactured DDT, PBB, and more than 200 other chemical compounds. During those decades, the chemical company dumped and buried its chemical and radioactive waste in places around the community, with much of it going into the Pine River. The PBB disaster was the beginning of the end for Velsicol in Michigan. After closing the doors to the St. Louis plant in 1978, the company estimates it spent \$38.5 million on clean-up, although the total cost to date is \$480 million.



The Task Force at Twenty (1998-2018)

Projects Completed	Completion Date
Deep injection well on Crumbaugh property (east of St. Louis)	1999
Total Refinery judicial action clause in consent judgment	2000
Horse Creek and confluence with Pine River in St. Louis	2004
Impoundment area behind the St. Louis dam on the Pine River	2006
Oxford Automotive bankruptcy settlement	2008
Breckenridge radioactive site (east of St. Louis)	2012
pCBSA in St. Louis drinking water wells	2015
Excavation of DDT soil from high school athletic fields	2015
Excavation of 12 blocks of residential yard in St. Louis	2016
Area 1 of Former Plant Site, ISTT	2018
Projects Underway	Completion Date
Burn Pit site in St. Louis	2025
Pine River downstream from St. Louis dam	2025
52-acre chemical plant site in St. Louis	2036
Health studies of St. Louis residents and chemical workers	ongoing
Projects Pending	Completion Date
Smith Farms site (vinyl chloride in groundwater) south of St. Louis	unknown
Gratiot County Landfill south of St. Louis (PBB dump site)	unknown
Pine River upstream (agricultural and industrial wastes)	unknown

The Velsicol Superfund sites in St. Louis, Michigan. Map: Kaye Lafond, Michigan Radio.

"Forever Chemicals" in Livestock: A Public Health Risk

PBB

Poly Brominated Biphenyl

Chemical companies such as Velsicol produced a number of chemicals ranging from pesticides (DDT), nutritional supplements (Magnesium Oxide), to fire retardants (PBB). This cross-production of chemicals for different uses and industries exists today, but is now GLOBAL and less "in the hands" of one country or end-user. While PBB is no longer produced, next generation fire retardants with similar chemical structures ARE being used today.

∑PBDE and ∑PCB concentrations in organic and conventional milk.



Chen et al (2017) Quantification of PCBs and

https://doi.org/10.1371/journal.pone.0170129

PBDEs in Commercial cows' milk by Mass

Spectrometry. PLOS One 12 (1) e0170129.

Forever Chemicals are in the environment, they are found in ORGANIC products.

Once

"We are going to have more environmental emergencies like this. My responsibility is to develop the intellectual capacity to accept as a fire brigade, but we must come to the fire faster and faster. We can only work effectively if people sound the alarm rapidly, and do not wait until the flames go through the roof before they pull the lever."

> -Dr. Irving Selikoff in 1977, as quoted in Joyce Egginton's *The Poisoning of Michigan*

PBB Analogies to PFAS in the Human Food Supply

- Both PBB and PFAS were known to be toxic if ingested, long before widespread use and subsequent contamination of the environment.
- Both PBB & PFAS accumulate in people consuming contaminated animal products (meat, milk or eggs) or water
- Both can cause immune, thyroid, reproductive problems, may harm fetus, and pass through human breastmilk
- Industrial chemicals are not routinely tested for in wells, animal feed, nor as a "drug residue" by the USDA
- Questions remain if animal agriculture around the St. Louis Velsicol plant site may be inadvertently contaminated/ recontaminated
- Both PBB and PFAS are "Forever Chemicals," but PFAS travels easily in water and is concentrated 1,000-fold in fish
- PFAS have already been found in white-tailed deer in Michigan
- PFAS could also enter the food chain through contaminated farm well water (an identified PUBLIC HEALTH RISK in New Mexico)

PFAS

Per/ Polyfluoroalkyl Substances

This class of chemicals was used across numerous industries including paper, fabric and shoe treatments, cook wear coatings, and fire fighting. The distribution of PFAS contamination in Michigan follows those industries, firefighting training, and military bases.



Lisa Halbert on her family's farm near Battle Creek, Michigan. Her dad, Rick Halbert, is credited with discovering the PBB mix-up. Courtesy of Lisa Halbert.

The Neyer family's dairy herd was also affected by PBB exposure in the 1970s. Courtesy of T. Neyer.



"My first report says I have 1.16 ppm in my fat; they did a fat biopsy. So if I was a dairy cow I'd be up in the landfill, they'd shoot me and bury me.

-G.T. Neyer

"Who pays for accidents?"

-Edward Lorenz in his study, Civic Empowerment in an Age of Corporate Greed.

The Socio-Economic Cost of the PBB Accident

- 1. Eight million people consumed contaminated food.
- 2. Over 400 workers lost jobs when Michigan Chemical (Velsicol) closed its doors in 1978.
- 3. Hundreds of farmers lost their livelihoods.
- 4. Local residents were exposed to contaminated soil and water "longer than necessary."
- 5. According to the former City Manager of St. Louis, the "overall stigma associated with contamination" undermined property values and the local tax base.
- 6. Since Superfund tax was repealed in 1995, later generations are paying a half billion dollars for current remediation efforts.

Lessons Learned

- Economic costs impact individual families and become a multigenerational tax burden.
- The benefits to the community for forty years of Michigan Chemical operation never totaled the post 1980 costs.
- Better practices and regulation during Michigan Chemical operation could have kept the firm in operation today.



Aerial photograph of Michigan Chemical, 1940s.

Michigan Chemical's Yearly Production of PBB

Year	Amount
1971	200,000 lbs
1972	2.3 million lbs
1973	3.9 million lbs
1974	4.8 million lbs (projected)

Thomas H. Corbett, M.D., Cancer and Chemicals (1977): 129



1999-2006 Pine River Sediment Remediation: \$140 million (2019 dollars)



Current former plant site remediation will cost \$350 million

PBB Still Matters

Michigan PBB Levels Remain High



PBB Levels by Exposure Group



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We would like to thank the following event co-sponsors:

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Support for this event provided by:



Support for this event provided by the National Institute of Environmental Health Sciences, National Institutes of Health

Participate in an interview to help create a permanent record that documents your experience as connected to the PBB livestock feed mix-up.

THE MICHIGAN PBB ORAL HISTORY PROJECT GATHERING AND PRESERVING STORIES

FOR INFORMATION OR TO SIGN UP, CONTACT: BRITTANY FREMION

ASSISTANT PROFESSOR OF HISTORY CENTRAL MICHIGAN UNIVERSITY FREMI1B@CMICH.EDU OR 989-774-1094

Click <u>here</u> to access Brittany's faculty webpage and <u>here</u> to visit the Museum of Cultural and Natural History's website.

THE MICHIGAN PBB ORAL HISTORY PROJECT

IMPORTANT STEPS

1. Confirm Participation

Sign up today! You will be contacted to confirm your interest and schedule a day, time, and location for your interview.

2. Grant Consent Before starting the int

Before starting the interview, the researcher will go over the project consent form and deed of gift. Both contain information about the project, interview and preservation processes, and potential use of your interview materials.

3. The Interview

The researcher will ask you to tell your story related to the PBB mix-up. The interview will be audio recorded and transcribed. Photographs and additional documentation may also be collected. Interviews may take 50 minutes to 2 hours, sometimes occurring over multiple meetings.

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4. Review Recording

The researcher will provide you with a copy of the interview recording so you may clarify or modify what has been gathered and may be preserved.

5. Oral History Products

Interview materials will be preserved in a special research collection at the Museum of Cultural and Natural History at Central Michigan University for use by educators, researchers, and community members. Portions of interviews may also be made available online and/or used in an exhibit, for educational purposes, or future undefined research.