

Arsenic and Old Lead

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Missouri Department of Natural Resources
Brownfields/Voluntary Cleanup Section

REGFORM Hazardous Waste Seminar
Columbia, Missouri
April 2, 2025

Topics

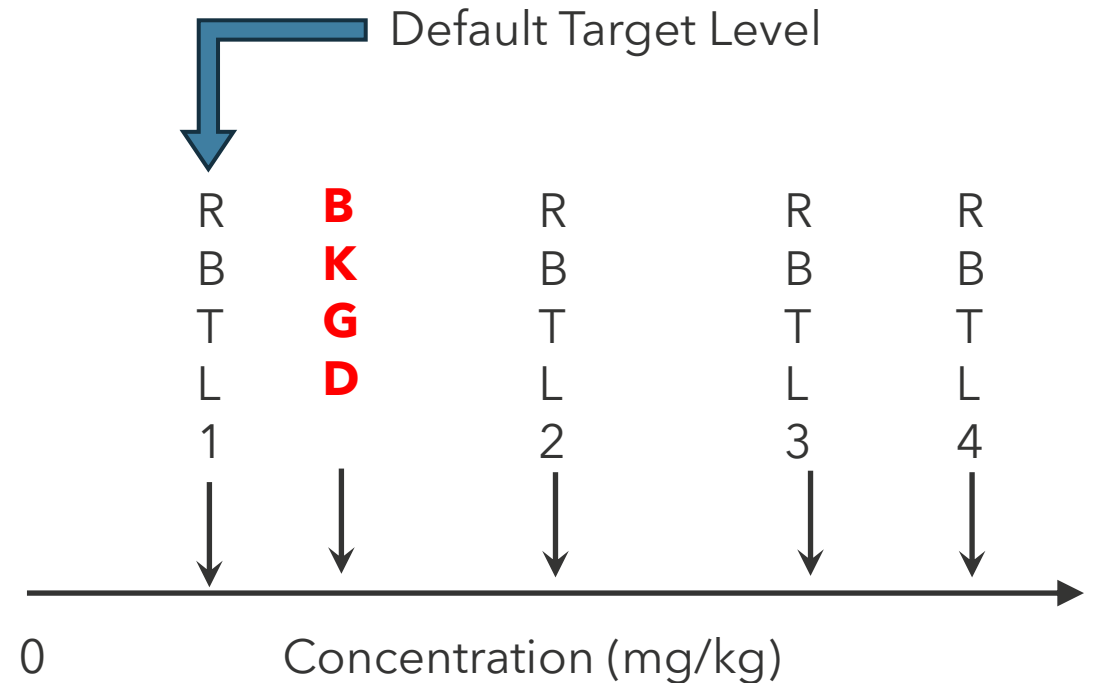
1. Background Metals in Soil
2. Origins of Quantitative Risk Assessment
3. How The Bedrock of Risk Based Remediation is Rumbling

Part 1

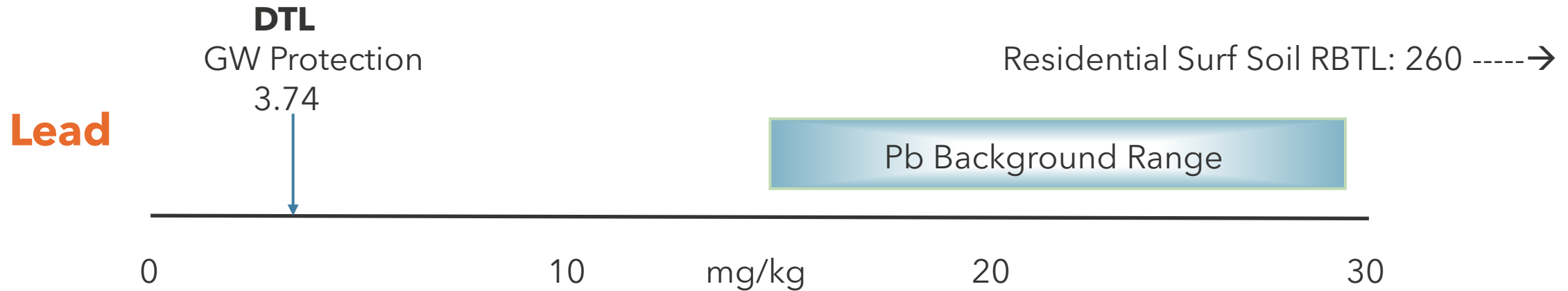
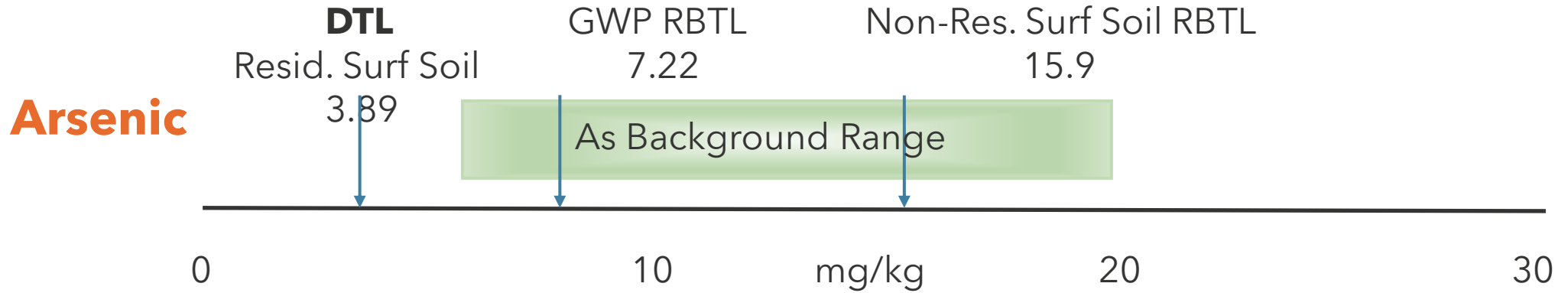
Tales from the Background

Risk Based Target Levels

- RBTLs calculated for each contaminant for different exposure pathways
- Based on toxicity, default exposure parameters, etc.
- Default Target Level:
 - Lowest of the RBTLs for soil, water
 - Used for screening
 - Does not require risk asst.

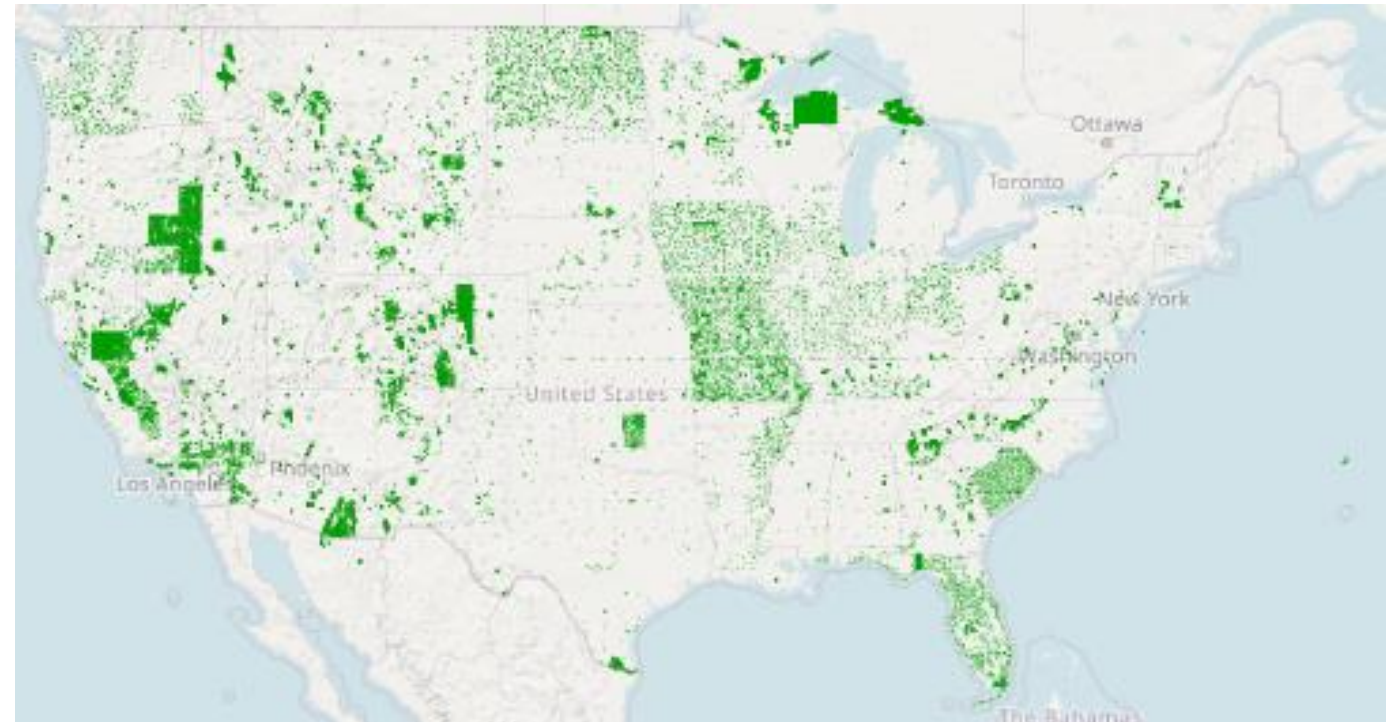


As and Pb: The Usual Suspects



PLUTO: The USGS National Geochemical Survey Database

- 2600 samples of ag soil covering every MO county
- Includes data from Tidball (1984) plus additional later sampling
- Downloadable in multiple database formats



Setting Background Values Is Not a Trivial Problem

- Natural background has a distribution -> some samples will exceed the average
- Does every confirmation sample have to be below the average background?
- What about screening vs. cleanup?
- Options
 - Mean or Median
 - Mean + Std. Deviation [or 2x SD]
 - 2xMean or 3xMean
 - 95% UCL

Pb and As for Greene County

	MRBCA DTL	PLUTO # of Samples (n)	Mean	Std. Dev.	95% UCL	Mean +2SD	2x Mean
Arsenic	3.89	22	9.7	5.1	11.6	19.9	19.4
Lead	3.74	22	23.3	8.0	26.3	39.3	46.6

All values in mg/kg = ppm

The Plan

- Select which stats to use
- Calculate values for Pb and As for metro areas
- Publish for use in BVCP
- Explore usage in other programs
- NGD is available for anyone to use
 - <https://www.usgs.gov/centers/gggsc/science/national-geochemical-database>
- Comments welcome!

Part 2

"Acceptable" Risk

1958: The Delaney Clause

No cancer-causing agent, as demonstrated in humans or animals, shall be deliberately added to, or found as a contaminant in food.

Federal Food Drug and Cosmetic Act

November 5, 1959: Record Crop

Cranberry crop the biggest

Nothing, of course, can challenge Plymouth Rock as one of the shrines of American history, but a Midwestern state is making a bid to challenge another American tradition that is almost as old.

The first Thanksgiving dinner at Plymouth, Mass., is supposed to have included wild turkey and wild cranberries. And for many years most of our cranberries came from carefully tended cranberry bogs

within a relatively short distance of Plymouth Rock or on near-by Cape Cod. But in recent years, Wisconsin farmers have gone into the cranberry business in increasing numbers, making use of land that was too marshy for growing ordinary crops.

The United States Department of Agriculture says that the total cranberry crop this year looks like the biggest ever, and most of the increase

is in Wisconsin. About half our cranberries are grown in Massachusetts, close to Plymouth Rock, but about a fourth of the supply this year will be harvested from relatively new cranberry bogs in Wisconsin. New Jersey, Oregon and Washington provide the remaining fourth.

If you have a home freezer, this might be a good time to freeze fresh cranberries for use later on. No preparation, no

sweetening; simply put the cranberries in freezer bags and into the freezer. That's the simplest way. Or, if you intend to use the cranberries for sauce later on, put the berries into containers and cover with a cold sugar sirup.

ONION PICK-UP

Add one teaspoon instant-minced onion to a three ounce package of cream cheese. Spread on crackers for quick and delicious appetizers.

St. Louis Globe-Democrat

Nov. 10 – Day 1: FDA Issues Warning

operating. | blew up," he said. (AP Wirephoto.) | he had filed the charge in magistrat

Cranberry Findings Worry U. S.

WASHINGTON (UPI) — The government issued a pre-Thanksgiving warning Monday that a portion of the nation's supply of cranberries is contaminated with a possible cancer - producing agent.

A spokesman for cranberry growers promptly accused the government of headline-hunting.

He said steps already have been taken "to prevent any allegedly contaminated products from reaching the housewife."

Arthur S. Flemming, secretary of health, education and welfare, said government inspectors found that cranberries from the 1958 and 1959 crop grown in the North-

west were coated with the residue of a chemical weed killer which induces cancer in rats.

He said, however, it was not yet known whether the substance would cause cancer in humans.

Flemming also told a news conference there was no way at present for buyers to tell which berries might be contaminated.

He said this included both the canned and fresh varieties.

Until a procedure is worked out by the government and industry for removing the contaminated product, he said, the public would be "on the safe side" to refrain from buying cranberries.

Flemming said government in-

spectors found that the weed killer had gotten into berries produced in Washington and Oregon. He said on-the-spot checks were being made to see whether berries from other producing areas—Massachusetts, Wisconsin, Michigan and New Jersey—also have been contaminated.

A spokesman for a big New Jersey firm said the chemical had not been used in that state.

Commissioner George P. Larrick of the food and drug administration (FDA) said the government and industry were co-operating on a plan for isolating contaminated berries.

An FDA spokesman said the

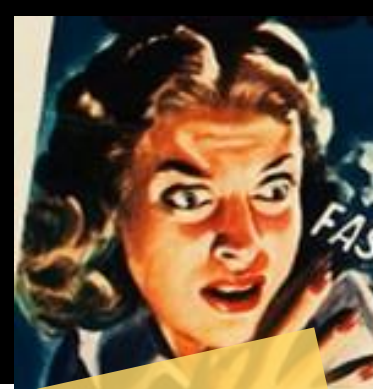
danger existed whether the berries were fresh, frozen or canned.

And in Bar Harbor, Maine, a cancer research specialist, Dr. Nathan Kaliss of the Roscoe B. Jackson Memorial laboratory, said "any substance found to cause cancer in animals should be highly suspect in relation to man."

However, L. S. Hitchner, executive secretary of the National Agriculture Chemicals Association, a private trade group here, said the "extremely small amounts" of the chemical weed killer found on cranberries "could not offer any significant risk to the consumer."



See... Terror
in the Kitchen!



**GOVERNMENT
INSPECTORS
UNLEASHED!**

CRANBERRY PANIC!



**MEDIA
FRENZY!**



**HARMLESS CONDIMENT OR
TOXIC CREATURE FROM THE
CRANBERRY LAGOON?**

Nov 10-Day 1: Media Does Media Stuff

Cancer-Causing Weed Killer Can Be Bought Easily Here

Rockefeller Urges No Cut In Work Week

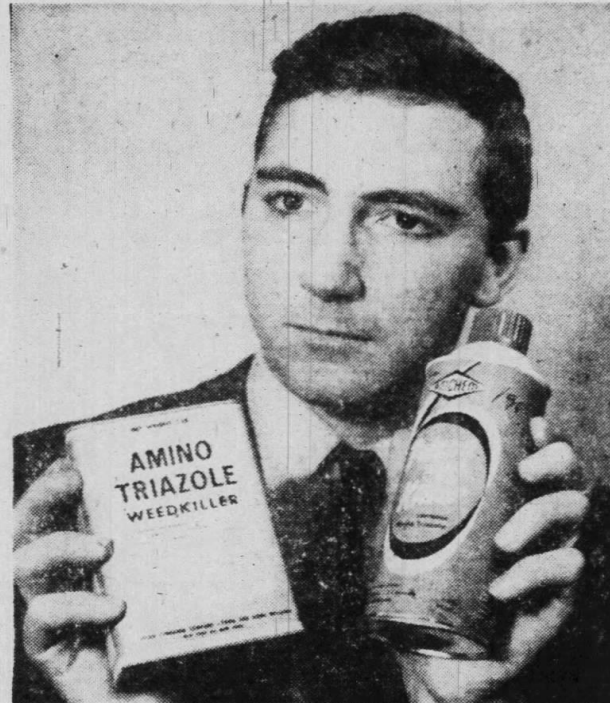
Says Economic Growth of U. S. Can Be Doubled

By Associated Press

NEW YORK—Republican Gov. Nelson A. Rockefeller suggested Monday that if American labor foregoes further work-week reductions the national economic growth rate can almost double.

He said such a step could bring higher living standards, expanded government services and as much as a 15 per cent cut in taxes.

In the face of growing union pressure for a 30-hour week, Gov. Rockefeller told the Economic Club of New York in a major speech:



CANCER-PRODUCING WEED KILLER purchased here is displayed by Globe-Democrat reporter George McNulty. —Globe-Democrat Photo

Tests to Be Made On Other Foods Besides Cranberries

Globe-Democrat Reveals Danger Is Widespread

By SUE ANN WOOD
Globe-Democrat Staff Writer

Tests will be made on "a great many other foods" besides cranberries to determine if they are contaminated with a cancer-producing chemical weed killer. The Globe-Democrat was told Monday.

George P. Larrick, United States Food and Drug Administration Commissioner, reached by telephone in Washington, said his staff has started planning extensive tests of food products, including those grown and sold in the St. Louis area.

"We only have 400 inspectors

Reporter Buys Deadly Chemical In Two Forms

Aminotriazole, the weed killer which has a cancer producing agent, is a common item on the St. Louis market.

Within a short time after it was announced in Washington that cranberry crops in Oregon and Washington had been contaminated by the chemical, George McNulty, a reporter for The Globe-Democrat, was dispatched to buy some.

Mr. McNulty bought two brands of the weed killer.

NAME ON LABEL

The label listed the one producer as American Cyanamid Company, New York, and the

St. Louis Globe-Democrat

Nov. 10-Day 1: Denials

Yakovlev declared Lodge's conduct the test.

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Weed Killer Produces Cancer Report Cranberries Tainted Gets Quick Producer Denial

.. WASHINGTON (AP)—The government threw a shadow over the Thanksgiving dinner table Monday by disclosing some contamination of the 1958 and 1959 cranberry crop by a cancer-producing chemical. But producers quickly

that if she is unable to learn the origin and year of the berries "to be on the safe side she doesn't buy."

Flemming's disclosure brought a statement from Ambrose E. Stevens, executive vice president of

Nov. 11-Day 2: Never Enough Inspectors

FDA BLAMES SHORTAGE OF INSPECTORS

Why Cranberry Inspection Bogged Down

By EDWARD W. O'BRIEN
Chief of The Globe-Democrat
Washington Bureau.

WASHINGTON.—A shortage of field inspectors and chemists contributed to the failure of the Food and Drug Administration to check the 1958 cranberry crop for the presence of a chemical weed killer, The Globe-Democrat was told Tuesday.

"We did not check the 1958 crop because the job did not have a sufficiently high priority

was not known in 1958 that amino triazole is a cancer-producing agent. This was established only last May.

Since May, Food and Drug has been checking growers' spraying practices and perfecting a way of detecting residues of the chemical in the berries.

What brought the whole affair to a head was the conclusion reached last Friday afternoon that two shipments from the newly-harvested 1959 Northwest-

Drug Administration personnel is at a record level. The number of chemists and inspectors has been going up for several years. For the present fiscal year, Congress gave the agency \$2,000,000 more than the Eisenhower Administration requested.

The spokesman said the agency suffered "some cuts" around 1954 or 1955. The Citizens Advisory Committee made a study of the agency in 1955 for the

then Secretary Oveta Culp Hobby and recommended an increase of three or four times within five to 10 years.

Beginning in 1956, "there has been steady progress toward that goal," he said, except for the fiscal year, 1958, when there was no increase.

"We can still use more people but there is a limit to how fast an organization can grow," he said.

Nov. 15-Day 6: Markets React



THERE'S NO BUSINESS like the cranberry business and there is just no business for James and William Pappas, partners in a cannery at Cologne, N. J. They are surrounded by cases of unwanted cranberry sauce. Dozens of orders have been cancelled since a government statement that some cranberries grown on the west coast have been contaminated by improper use of a weed killer.

—A. P. Wirephoto

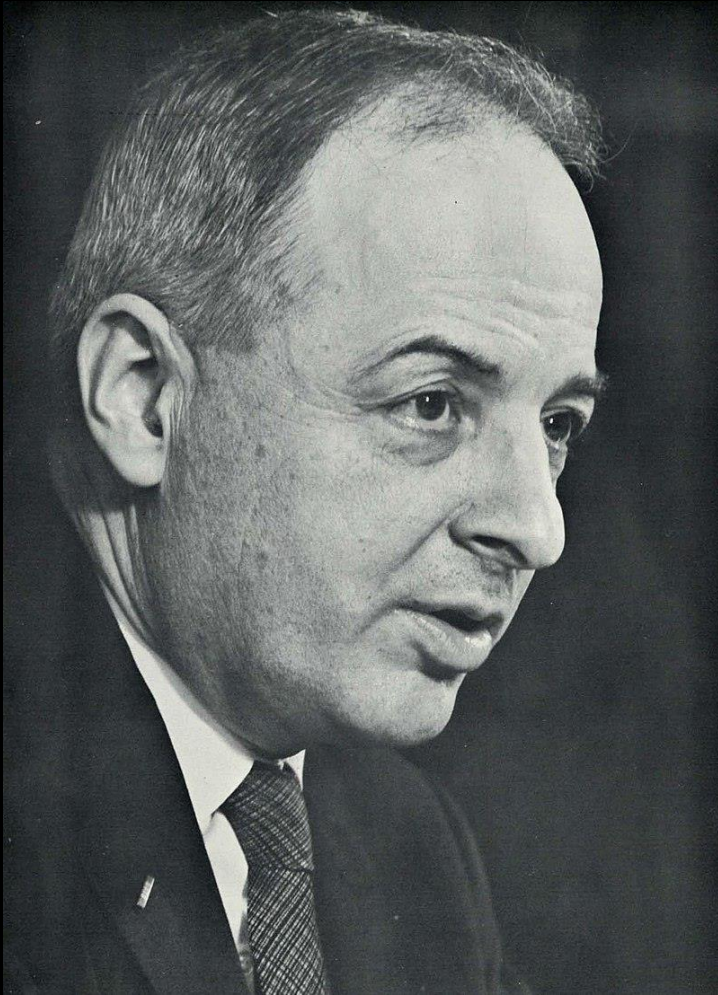
Nov. 15-Day 6: Wisconsin Cranberries Too

TAINED CRANBERRIES IN CHICAGO

BULLETIN

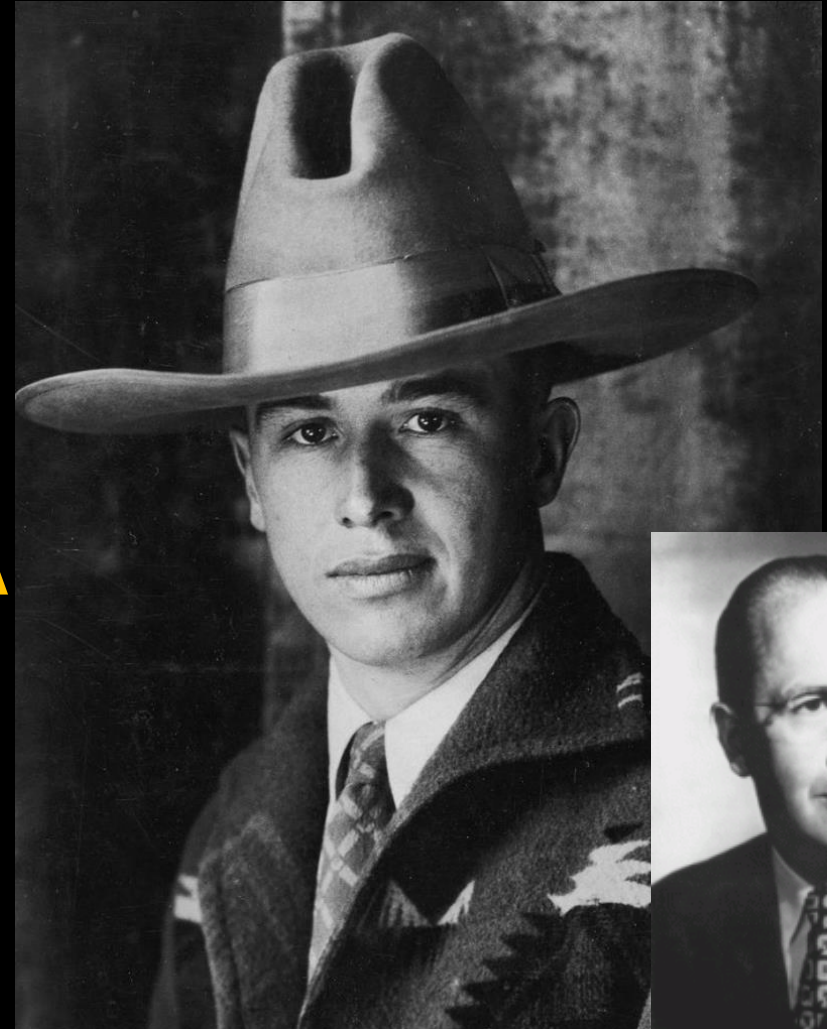
WASHINGTON, (AP)—The Welfare Department said tonight it is asking the Justice Department to seize in Chicago a shipment of tainted cranberries grown in Wisconsin.

Battle of the Bureaucracies



Arthur Flemming, Secretary of Health,
Education and Welfare

FDA
VS
USDA



Ezra Benson, Secretary of Agriculture



Nov. 18-20: Public Reactions

JUST before our wife, poor wretch, took off for a month's visit with her favorite grandchildren, she made up a gallon of cranberry sauce to leave in the refrigerator so we wouldn't be so likely to eat all beefsteak and fried eggs while she is away, and last week we started doubling our servings so as to have it all gone before somebody proves cranberries are poison or Ezra Benson proves the U. S. Department of Health investigation is rigged.

Tri-County News, King City, MO

OH, MR. FLEMMING NOW THEY'RE DRINKING JUICE

PLYMOUTH, MASS. (P.—) A thousand gallons of cranberry juice was quaffed Sunday at possibly the biggest cranberry party ever held.

But none of the thousand raised a glass was Coast Secretary of Health and Welfare Administration.

Ice estimates of the throng which trooped through the quarters of radio station WPLM, where the pouring took place, ranged from 7000 to 10,000. A large portion were children.

St. Louis Globe-Democrat

An irate housewife in Cedar Rapids, Ia., marched into a supermarket last Wednesday carrying a steaming hot pan of cranberry sauce and demanded her money back. The refund was made, then she asked for a refund of the two cups of sugar used. And, doggone, if she didn't get that, too.

Stanberry MO Herald-Headlight

Nov. 19/Day 10: Persuasion

CRANBERRY ANNOUNCEMENT

We received the following wire from our packer of Topmost Cranberry Sauce which is self-explanatory:

"We wish to assure you that our Cranberry Sauce furnished to you is free from any contamination of aminotriazole spray. We have had our cranberries for canning that they have not used any aminotriazole spray. Growers are furnishing us with signed statements that they come from nearby growers in New Jersey and a

SPECIAL

TOPMOST

Cranberry Sauce
GANNON'S BI-RITE

122 NORTH MAIN —

Jefferson Republic
DeSoto MO

NOTICE

As you know there has been a lot of talk recently about Cranberries, which may or may not have just grounds for criticism, as just about everything is now being sprayed.

We are not going to try and sell too many fresh Cranberries, as of course, they are this year's crop.

We were fortunate in being able sometime ago to buy a "slug" of "Northern" sauce and will have it on sale as long as it lasts. We of course couldn't promise that we wouldn't have a stomach ache after either Holiday feed from Cranberries or turkey. We can't guarantee that either we sell isn't free from germs, but will guarantee that we will eat both as I have all year; I like them and I'm not afraid of them. If you eat these Cranberries, it will take me quite sometime to eat them.

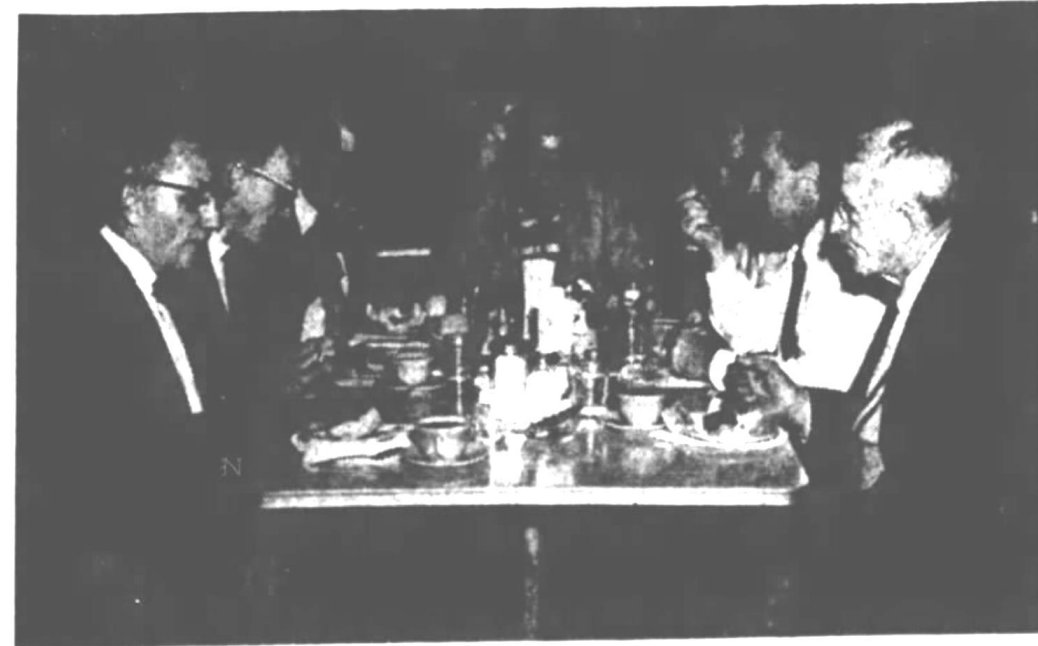
We buy from very large and very reliable concerns and as a result we have discontinued selling the product; so we are not too concerned about germs.

Frankly, if you want Cranberry sauce for Thanksgiving, we would suggest you get your Christmas order also; we'll all be eating them.

Happy Thanksgiving, with or without Cranberries.

Clinton, MO Eye

No Cranberry Fear Here



Washington Missourian

Getting together for a "cranberry break" are these Washington super market

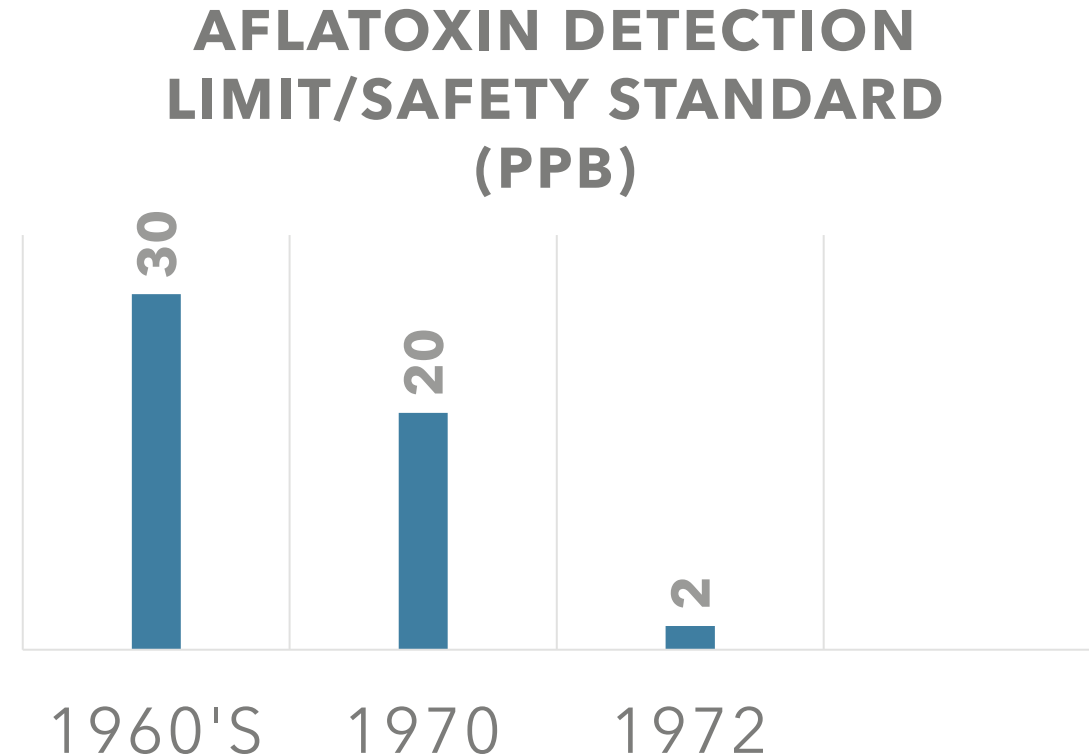
Outcomes: Cranberries

- Thanksgiving was not cancelled
- Crop was found to be 99% safe
- Cranberry Juice became a thing
- 2024 crop: 800 million lb
- 800 pesticides now registered for US crops
- At least 20 for use on Cranberries



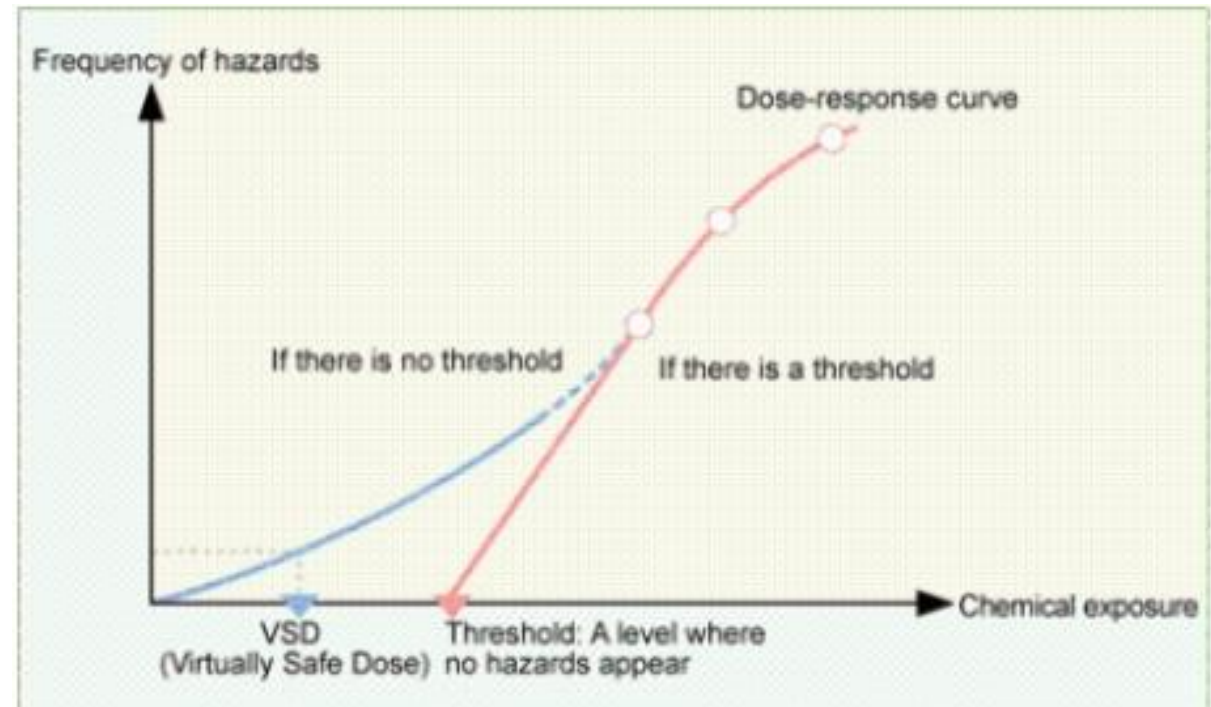
Outcomes: Toxics

- “No safe level” persisted into '60s
- But - FDA limits on aflatoxins in food set at detection limits - NOT a measure of safety
- 1974: “Virtually Safe Dose”: 1 in 1 million cancer risk
- Applied to animal drugs (DES)
- DES finally banned 1979



Quantitative RA Spreads to EPA, OSHA

- EPA had similar issues in the 70s - Relying on MDL
- RCRA, CERCLA, CWA
- Big debate on low-dose extrapolation methods
- 1979: Interagency Working Group report
- 1981: Supreme Ct. API vs OSHA



Outcomes: Risk Assessment Policy & Regulation

1. FDA the first to *codify* acceptable risk level: FDA, 1973 ($10e-6$)
2. 1980s: $10e-6$ widely used in early days of EPA-led cleanups
3. 1986: "Acceptable Risk" mentioned in SPF Health Eval. Manual ($10e-4$ - $10e-7$), then the NCP (1990, $10e-4$ - $10e-6$)
4. Factors affecting the selection of risk levels: social, political, economic and technical
5. There is no real *scientific* basis for the selection of any particular risk level

Recommended Reading

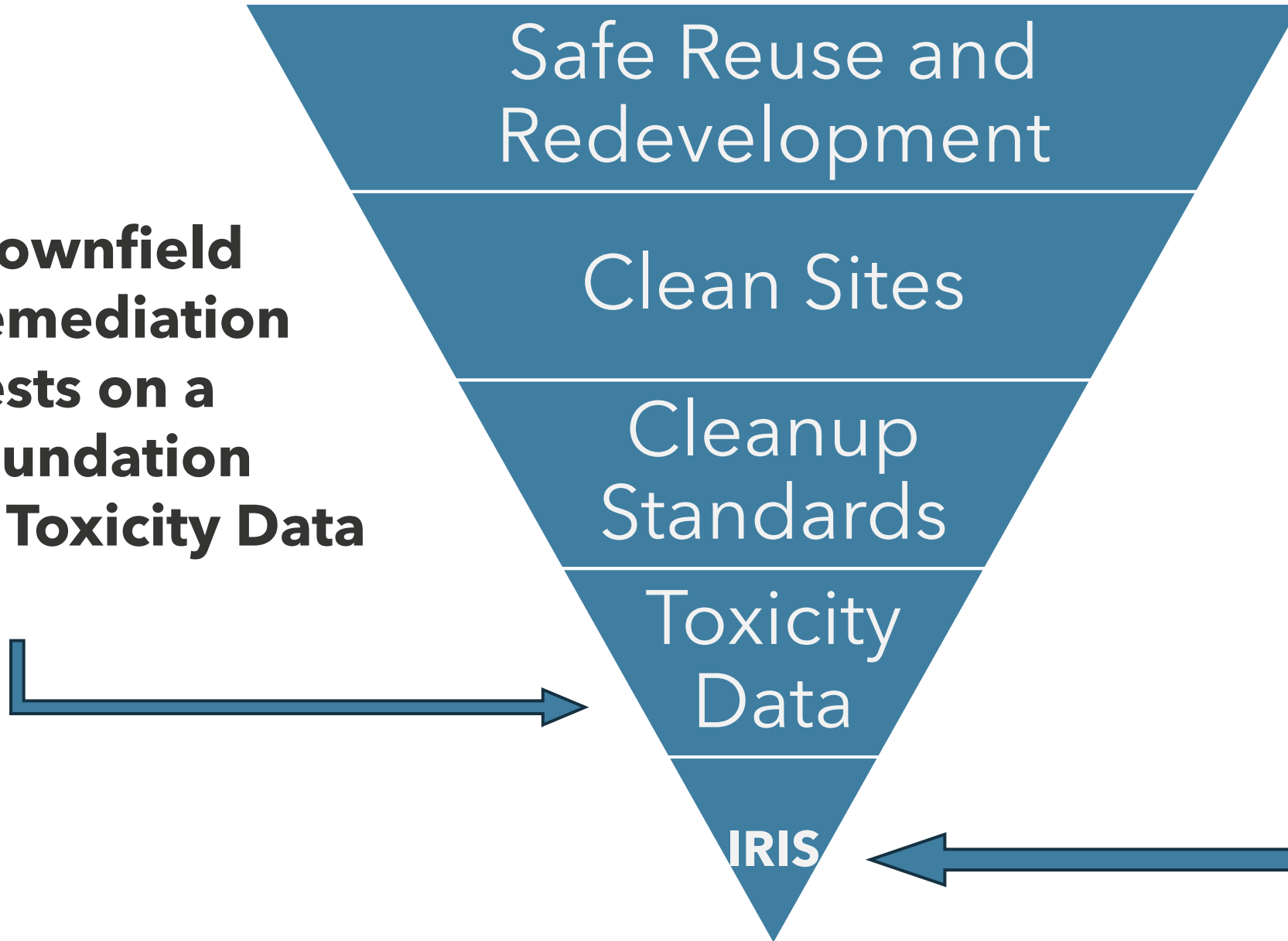
1. *The Myth of 10^{-6} as a Definition of Acceptable Risk*, Kelly, K., *Proc. Of the Air and Waste Mgmt Assn*, 1991.
2. *When Risk Assessment Came to Washington: A Look Back*, Rodricks, J. of *Dose-Response: An International Journal* Jan-Mar 2019:1-15.

Part 3

What Good Are Federal Agencies Anyway?



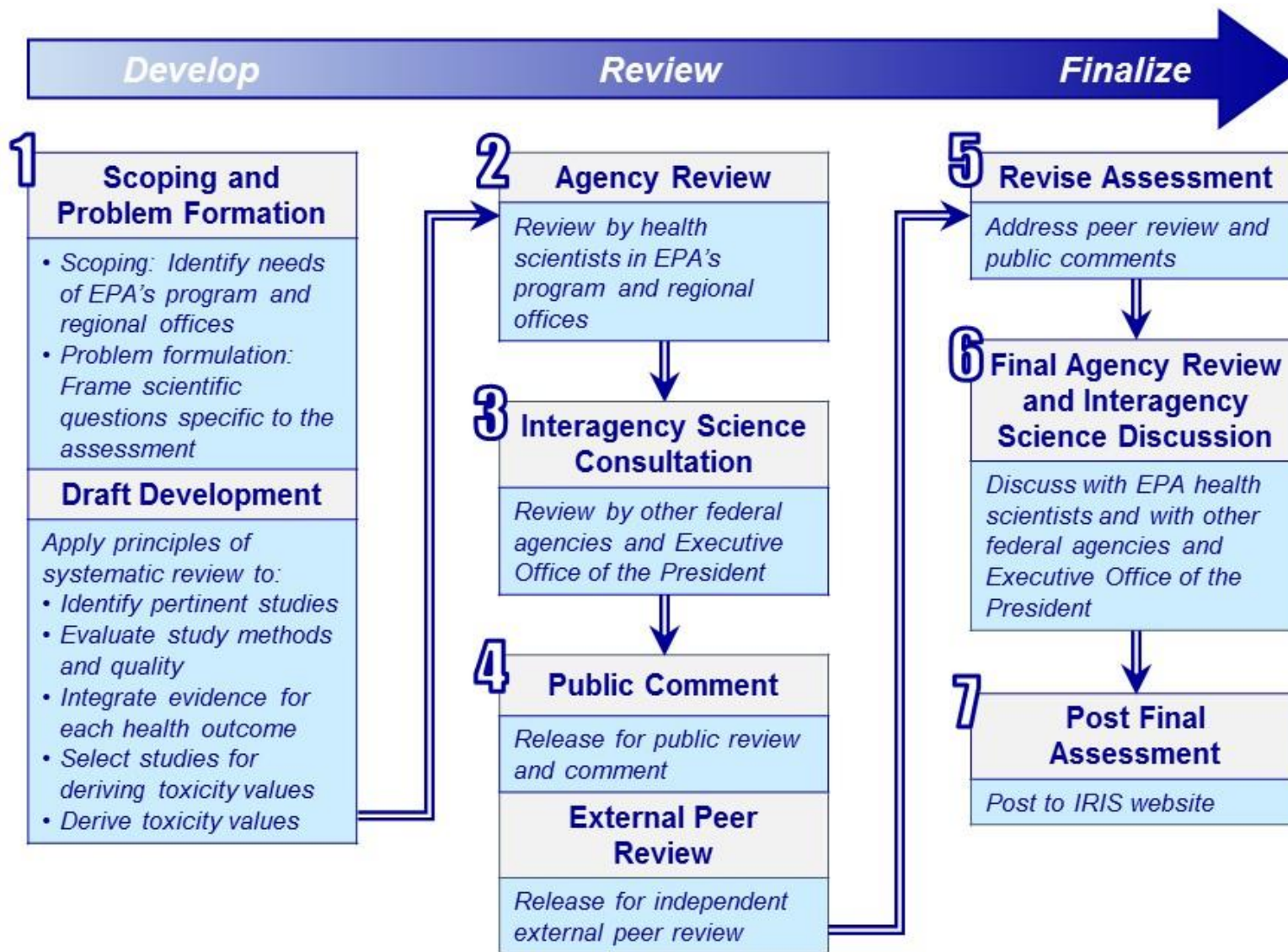
**Brownfield
Remediation
Rests on a
Foundation
of Toxicity Data**



**...which
comes from
EPA**

Integrated Risk Information System

- Created by EPA (1985) - to promote consistency amongst regulatory programs
- Maintained by science-based group with no regulatory role
- Mission: Gather the best toxicity research and bring it together
- Online in 2004 for everyone to use



IRIS ASSESSMENT DEVELOPMENT PROCESS

Source: EPA.gov

The 7-step process has not changed. This figure refines earlier versions and includes the 2013 IRIS enhancements and the incorporation of systematic review approaches.

IRIS is Under Threat

Environment

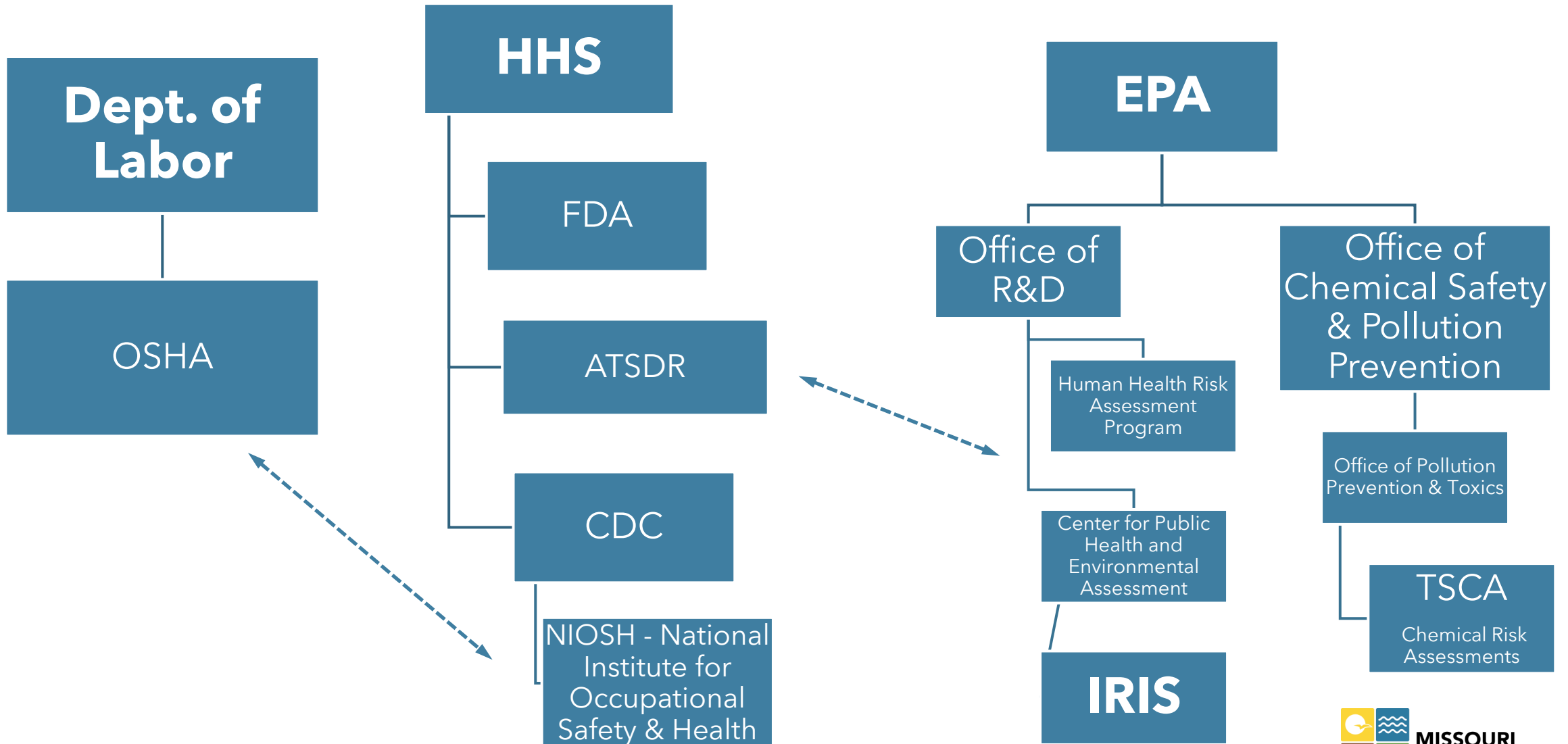
Industry-Backed Legislation Would Bar the Use of Science Behind Hundreds of Environmental Protections

March 6, 2025

INDUSTRY, GOP LAWMAKERS PRESSURE EPA TO SCRAP IRIS PROGRAM

February 19, 2025

Federal Toxicology Resources

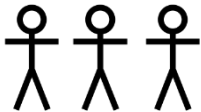


State of Missouri Toxicological Risk Assessment Resources

Dept. of Health
and Senior Services



Bureau of
Environmental
Epidemiology

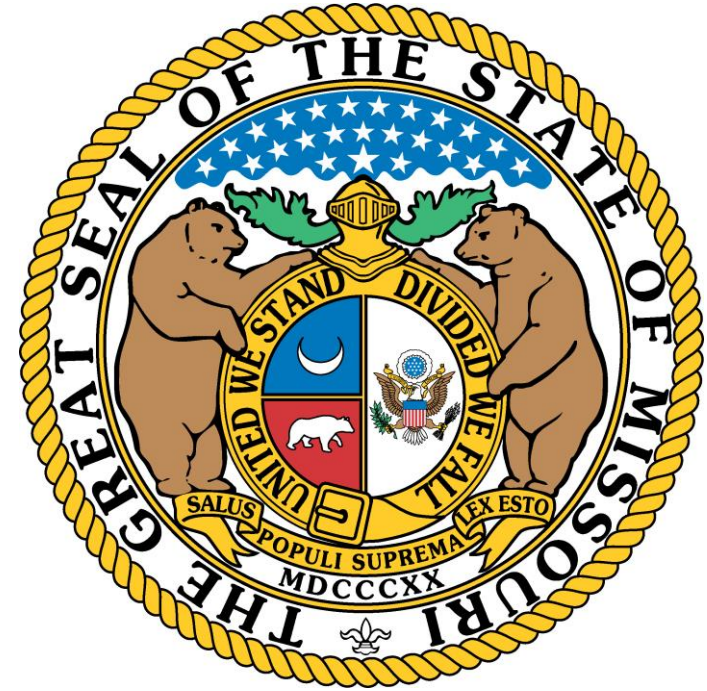


Points to Ponder

- Public reaction to poorly understood toxic threats has not changed much since 1959
- Today's risk assessments for air, water, land and haz waste have very old roots
- How we ensure public health and safety with respect to toxic chemicals is too complex to 'throw it out and start over'
- Understand it before you 'fix' it
- Keep it active, non-regulatory, and apolitical

Value of the BVCP to Missouri

- Efficient use of state, federal and private funds
 - MO specific cleanup standards
 - Brownfields
- Assessed/Remediated:
- >1000 sites
 - >9000 acres
 - Billions in private investment
- We can only do it with federal resources (including IRIS)



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