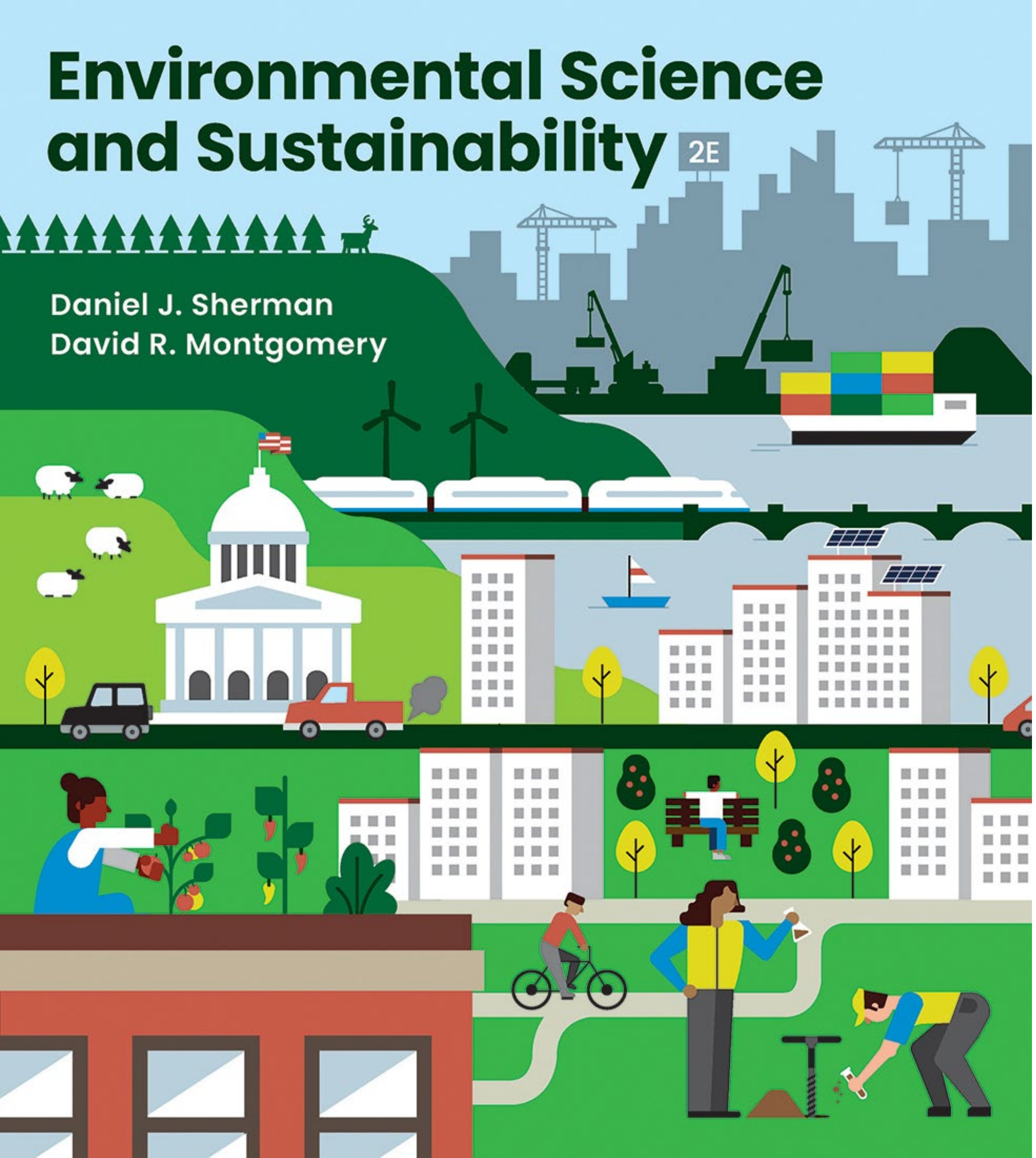


CHAPTER 17

Environmental Health and Justice: How Do Environmental Factors Affect the Places People Live, Work, and Play?


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

Cuyahoga river

The Environmental Justice Movement in the United States: A Timeline

The history of the environmental justice movement in the United States is relatively brief, so it is not surprising that challenges remain in ensuring that all people are safe from environmental hazards and have equal participation in setting environmental policy. Encouragingly, many governments now consider environmental justice an essential part of planning for the future.

(top): Barney Sellers/ZUMApress/Newscom; (bottom): Bettmann/Getty Images

1960s and 1970s

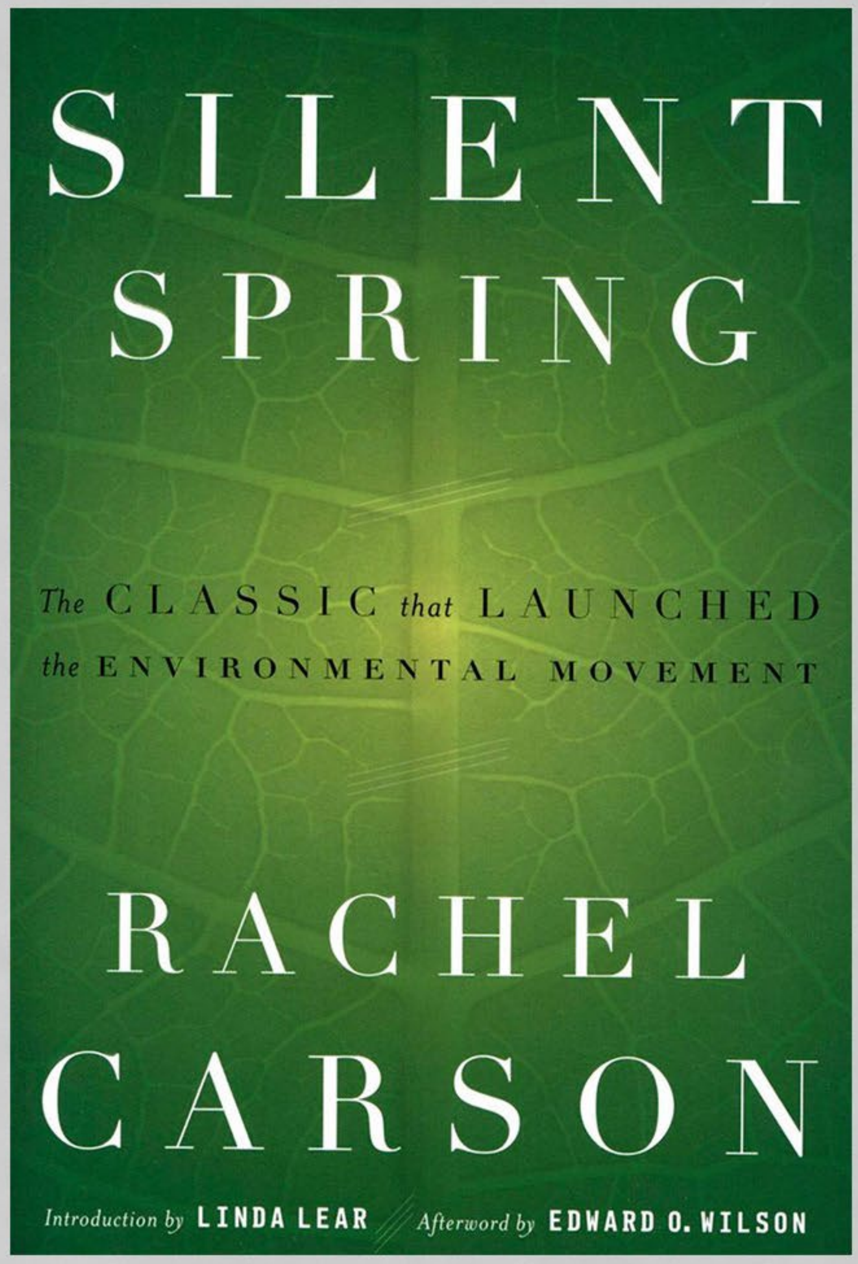
1964 US Congress passes the Civil Rights Act. Title VI prohibits use of federal funds to discriminate based on race, color, and national origin. This provides a legal tool to confront incidences of intentional environmental injustice.

1968 **Reverend Dr. Martin Luther King, Jr., organizes Memphis sanitation workers in a strike to protest working conditions—using the slogan "I AM A MAN."**

1970 US Public Health Service finds that lead poisoning is disproportionately affecting African American and Hispanic children.

1977 **People living in Love Canal, a working-class neighborhood near Niagara Falls, New York, discover that their houses and school had been built on top of a dump site containing more than 20,000 tons of hazardous waste from area chemical factories. Protests lead the government to fund the relocation of more than 800 families from the area and inspire a new federal law known as "Superfund" to clean up contaminated sites.**

1962


SILENT SPRING
The CLASSIC that LAUNCHED the ENVIRONMENTAL MOVEMENT
RACHEL CARSON
Introduction by LINDA LEAR
Afterword by EDWARD O. WILSON

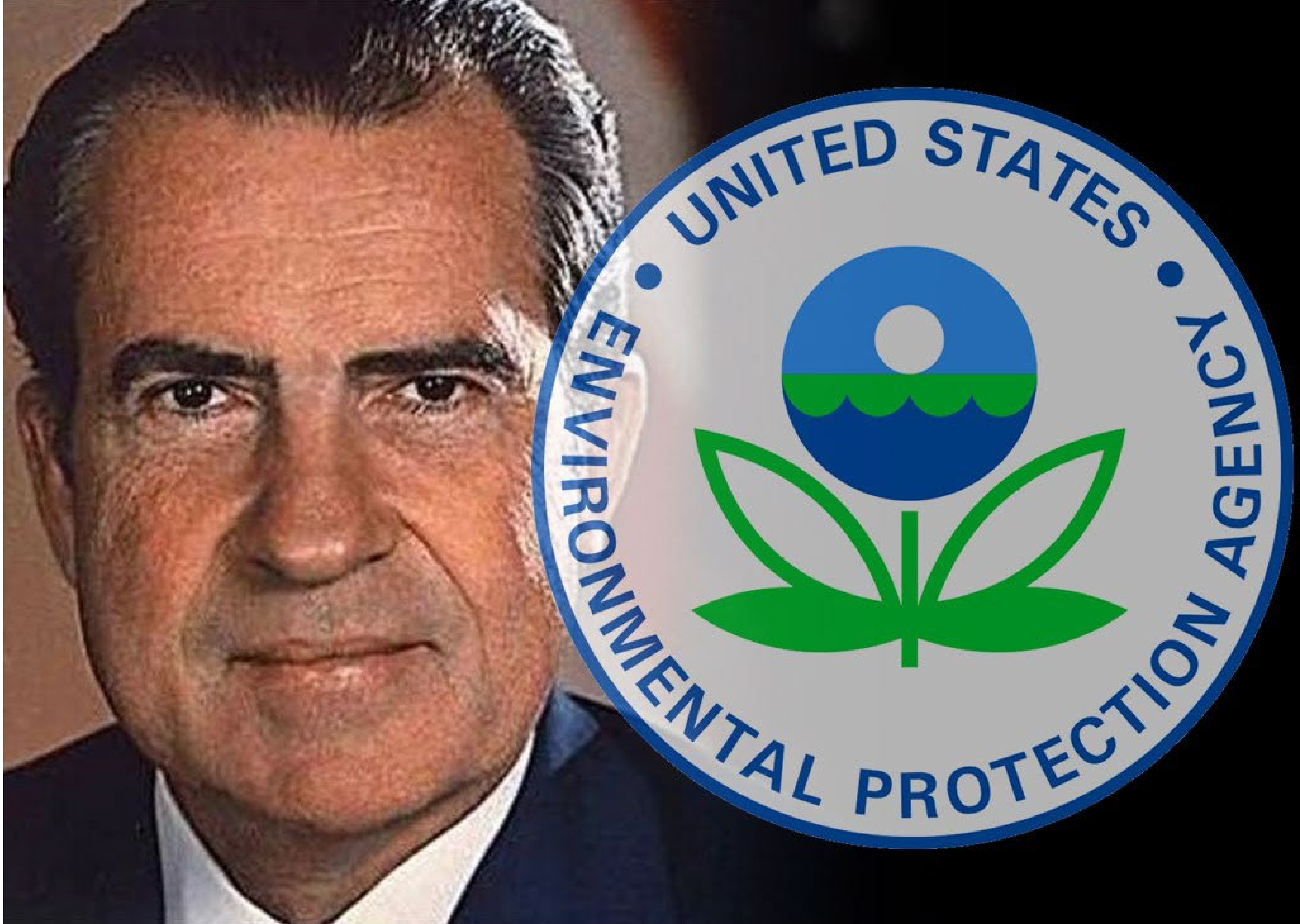
1970

The New York Times

NEW YORK, THURSDAY, APRIL 23, 1970

Millions Join Earth Day Observances Across the Nation

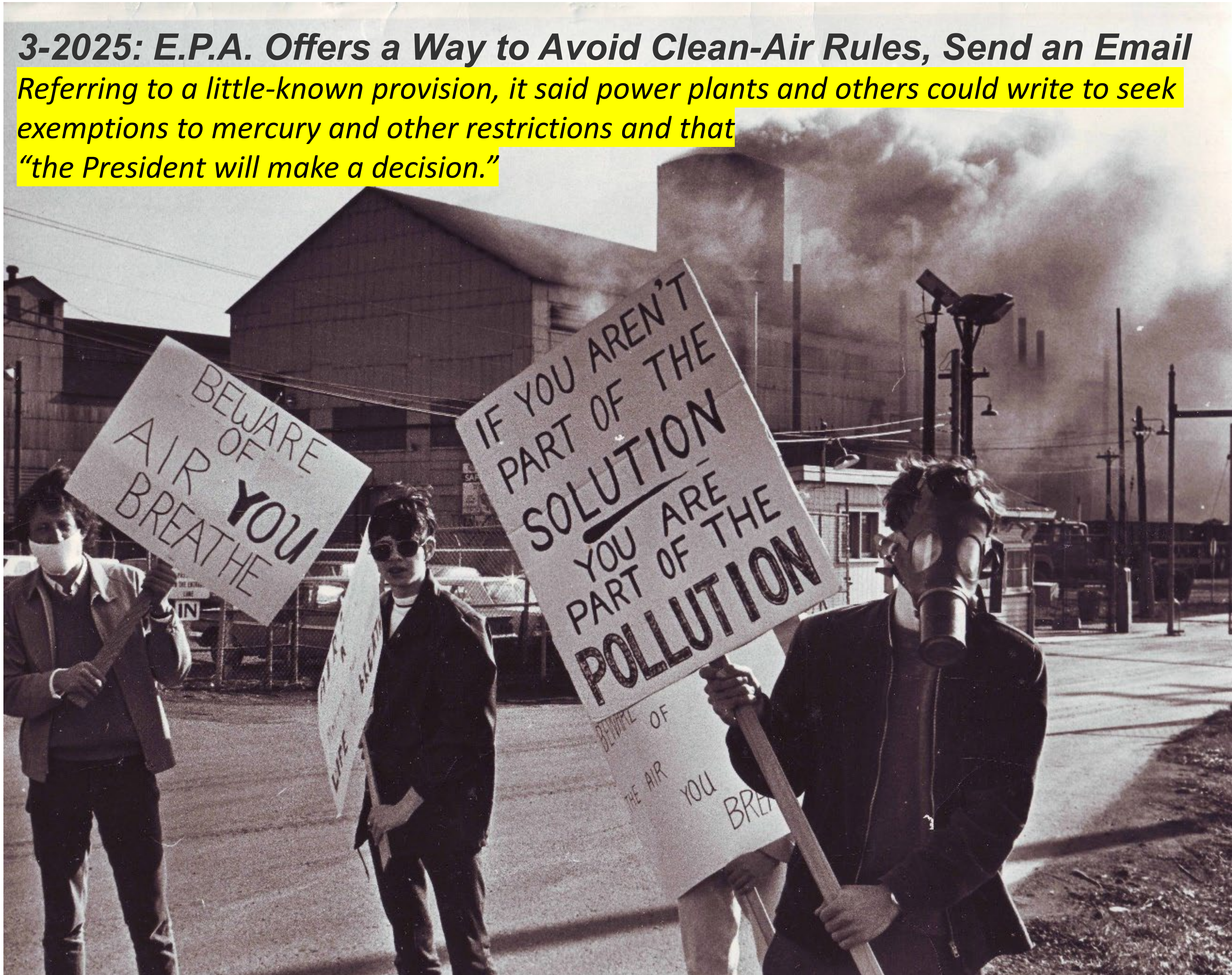
1970



1970s Clean Air & Water Acts

3-2025: E.P.A. Offers a Way to Avoid Clean-Air Rules, Send an Email

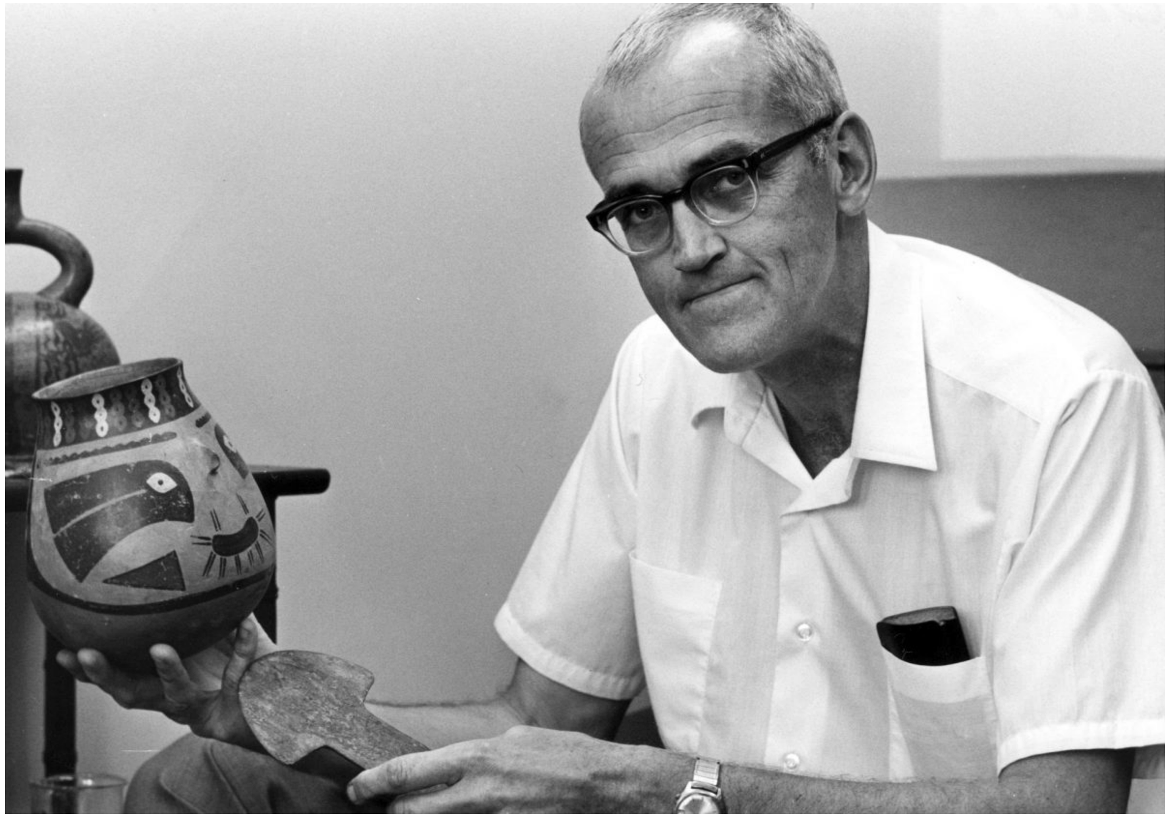
Referring to a little-known provision, it said power plants and others could write to seek exemptions to mercury and other restrictions and that “the President will make a decision.”



2025 Update

The Clean Air and Water Acts are facing a coordinated attack, with the US Environmental Protection Agency (EPA) under pressure to roll back regulations and weaken protections for clean air and water, potentially harming public health and the environment.

1971 – Get the lead out



https://californiascienceweekly.com/2019/11/08/the-little-known-california-scientist-who-may-have-saved-millions-of-lives/

1980s

1982

Residents of Warren County, North Carolina, protest the siting of a hazardous waste landfill in their community using civil disobedience tactics. The protests are widely seen as the catalyst for the environmental justice movement.

1983

The US General Accounting Office publishes Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities, which finds that 75% of the commercial hazardous waste facilities in the southeastern United States are located in predominantly African American communities.

1988

West Harlem Environmental Action is formed. New York's first environmental justice group protests pollution from the North River Sewage Treatment Plant. In response, the city provides pollution control upgrades to the plant and funds for community amenities.

(top): AP Photo/Steve Helber; (bottom): WE ACT for Environmental Justice

Clinton Presidential Library

1990s

1990 The Indigenous Environmental Network is founded to protect the sacred sites, land, water, air, and other natural resources of indigenous communities.

1991 The first National People of Color Environmental Leadership Summit is held in Washington, DC, outlining 17 principles of environmental justice.

1994 **President Bill Clinton signs Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This provides administrative tools for confronting agency decisions that lead to disparate environmental impacts for these populations and funds to remedy them.**

1999 America's Parks, America's People Conference is held in San Francisco, California, to draw attention to access to parks and open space in the United States for minority and low-income populations.

2000s to 2020s

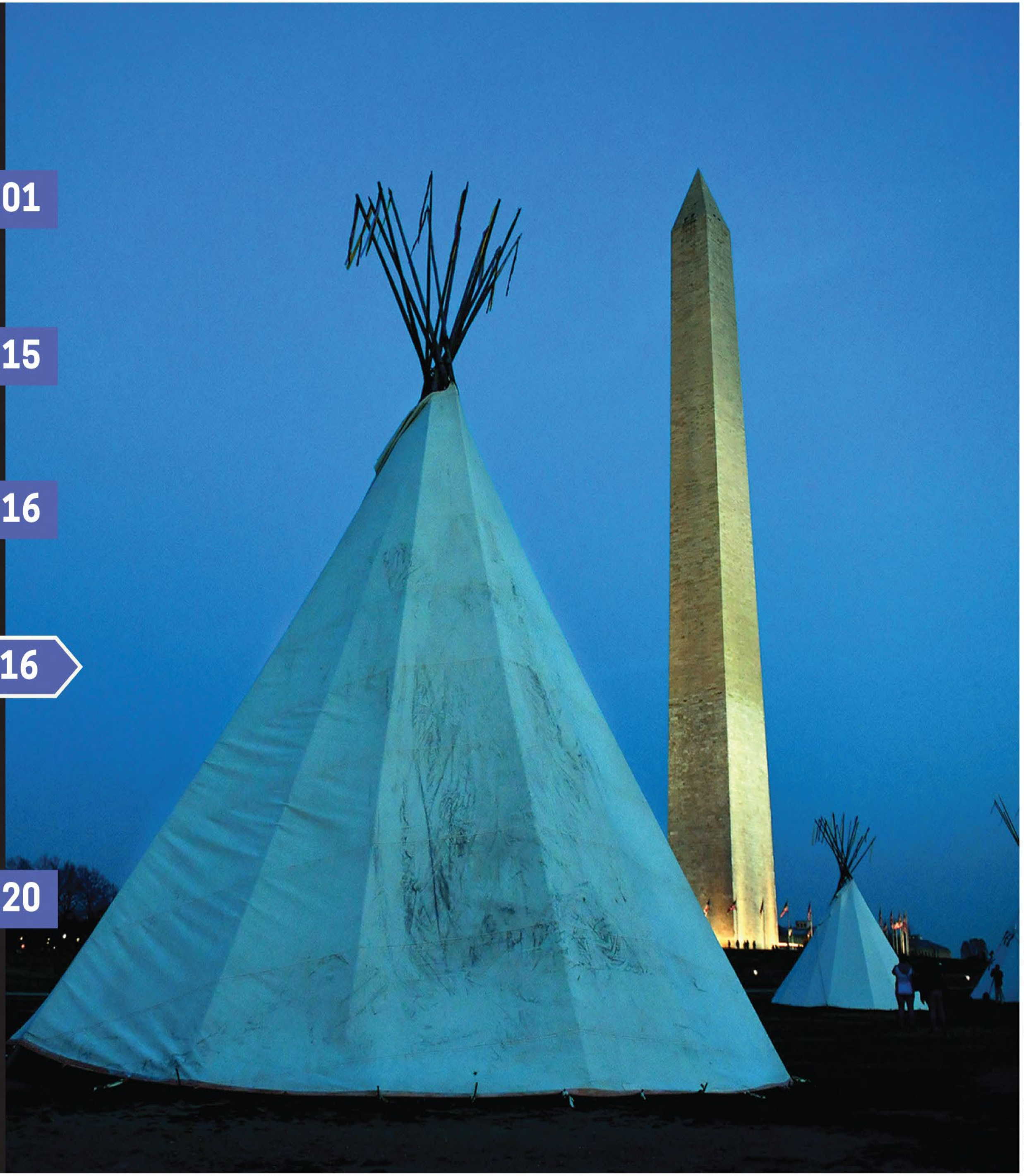
2001 Warren County, North Carolina, receives state and federal money to remediate the hazardous waste site located there. Cleanup is completed in 2003.

2015 EJSCREEN, an environmental justice mapping and analysis tool, is released by the EPA to aid communities and decision makers in identifying and addressing environmental justice concerns.

2016 EPA releases EJ 2020 Action Agenda, a strategic plan to improve the health and environment of overburdened communities and demonstrate progress on environmental justice challenges.

2016 **Plans to build the Dakota Access oil pipeline lessthan a mile from the Standing Rock Sioux Reservation catalyze the "Water is Life" movement of Indigenous peoples acting to protect their ancestral lands and waters. Their struggle inspires opposition to other pipeline projects throughout the country.**

2020 The Union Hill, Virginia community successfully halts the Atlantic Coast Pipeline Project, a proposed 600-mile natural gas pipeline with a massive compressor station sited less than a mile from the predominantly Black community. The 4th Circuit Court of appeals found that the environmental justice analysis was lacking.



UPI/Alamy Stock Photo

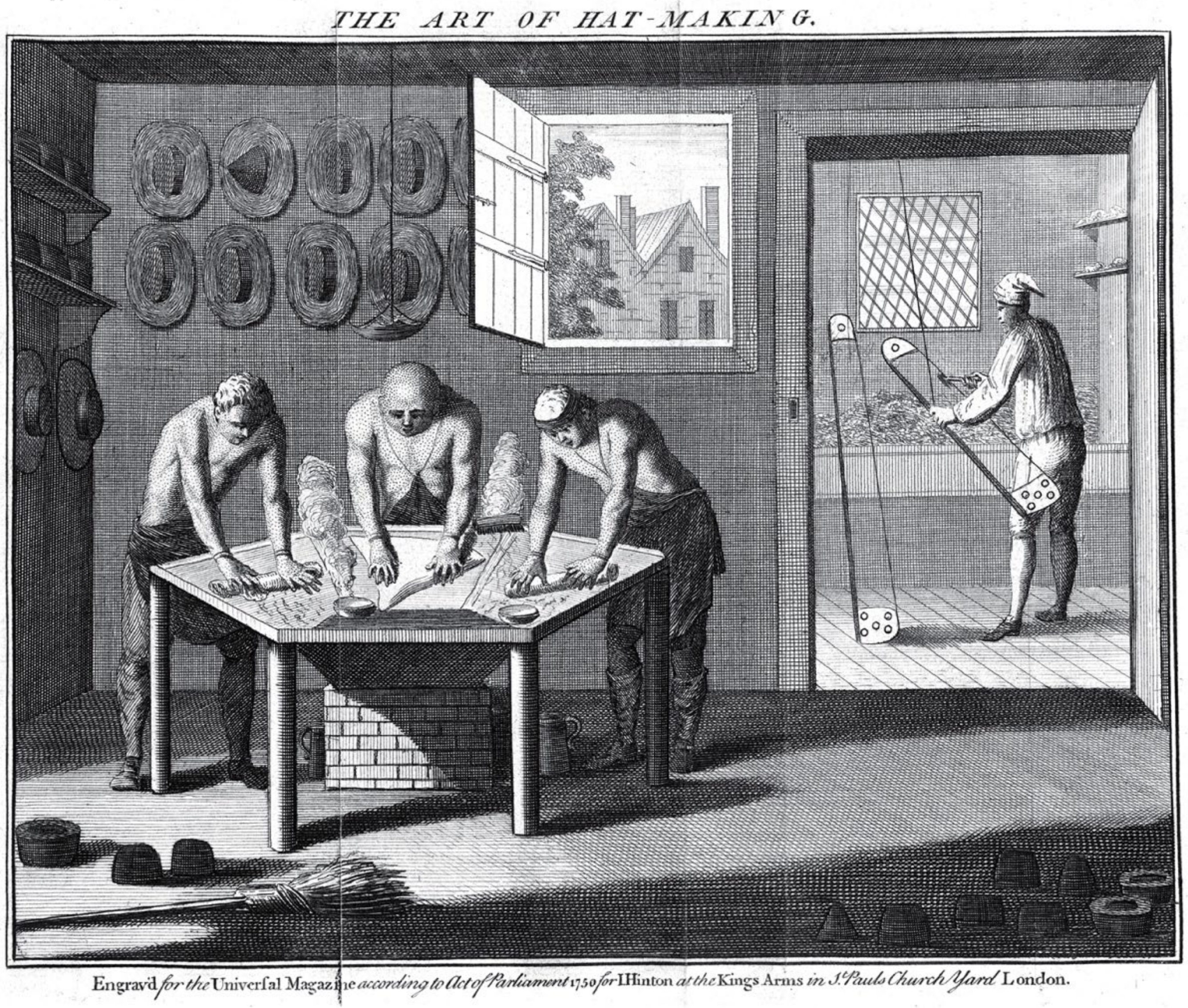
Jury Finds Greenpeace Liable for $660 Million in Pipeline Damages

South and North Dakota
Standing Rock Sioux Tribe

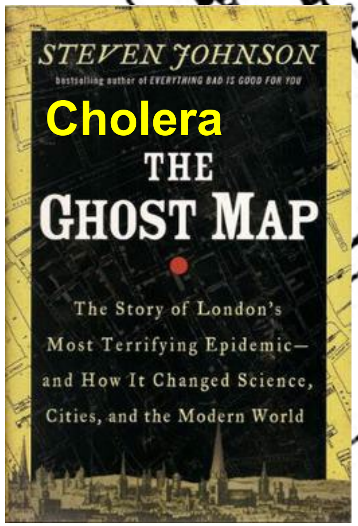
Environmental Health

Toxicology

Epidemiology



World History Archive/Alamy Stock Photo



Map of the book "On the Mode of Communication of Cholera" by John Snow, originally published in 1854 by C.F. Cheffins, Lith, Southhampton Buildings, London, England

Library of Congress, Bain News Service

Alice Hamilton – Early 1900s

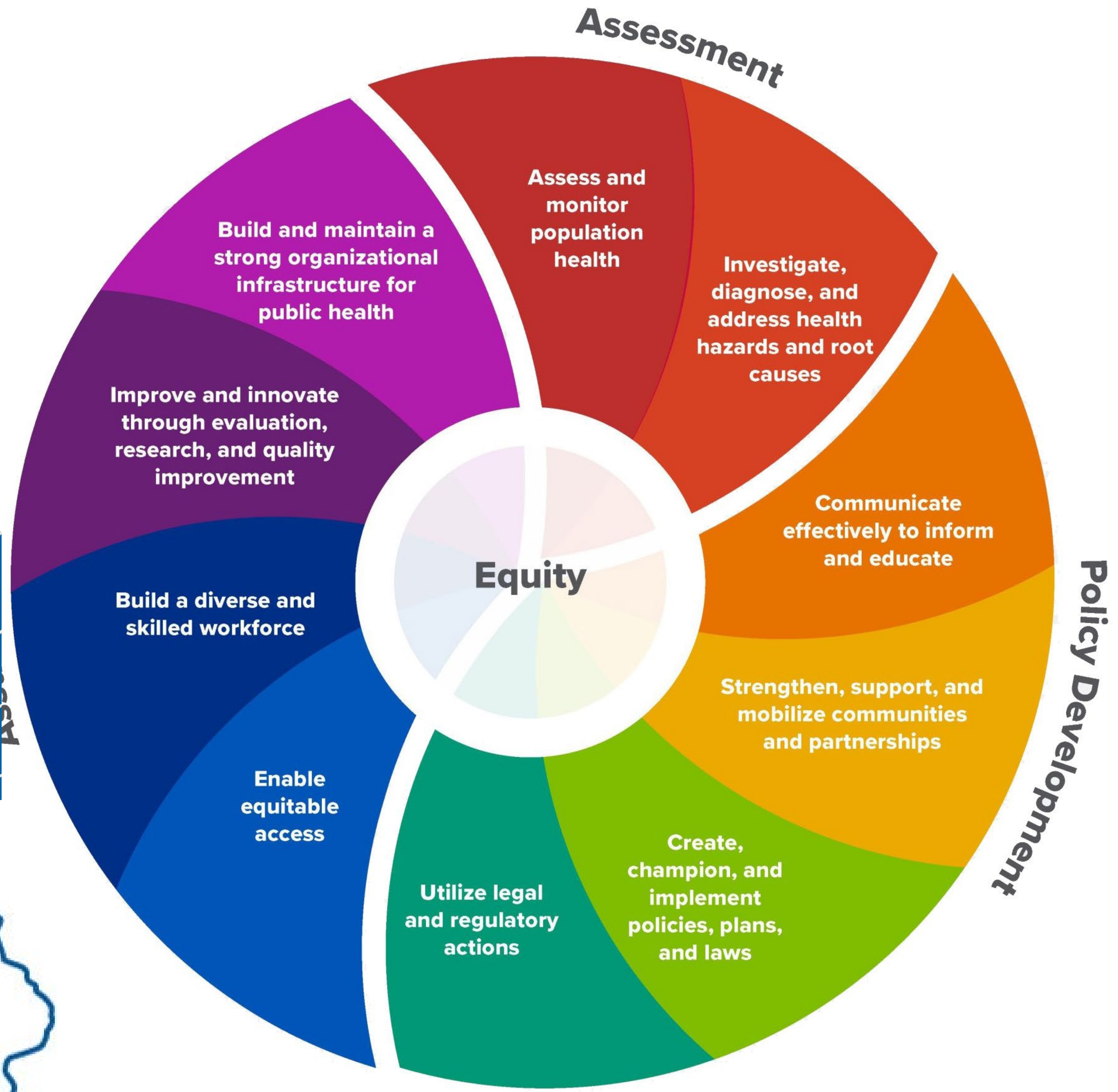
Stories of Discovery

- Alice Hamilton’s work often took her into factories where owners both denied that the workplace was causing health problems and argued that the health problems of their workers were not their responsibility.
- Voluntary changes did not work
- Regulations eventually led to better worker safety.

- *If it was your job to convince factory owners to voluntarily improve workplace conditions who would you make the case to them*?

Public Health

The Science and practice of protecting and improving the health of people where they live and work.



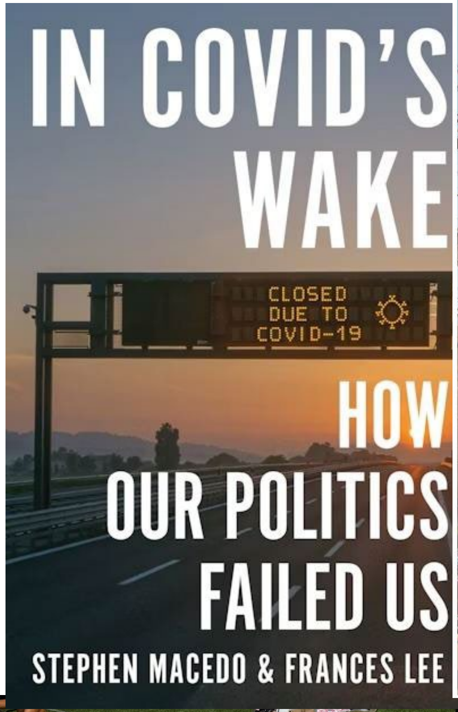
NIH National Institutes of Health

CDC Centers for Disease Control and Prevention

IDPH Iowa Department of Public Health

Backlash

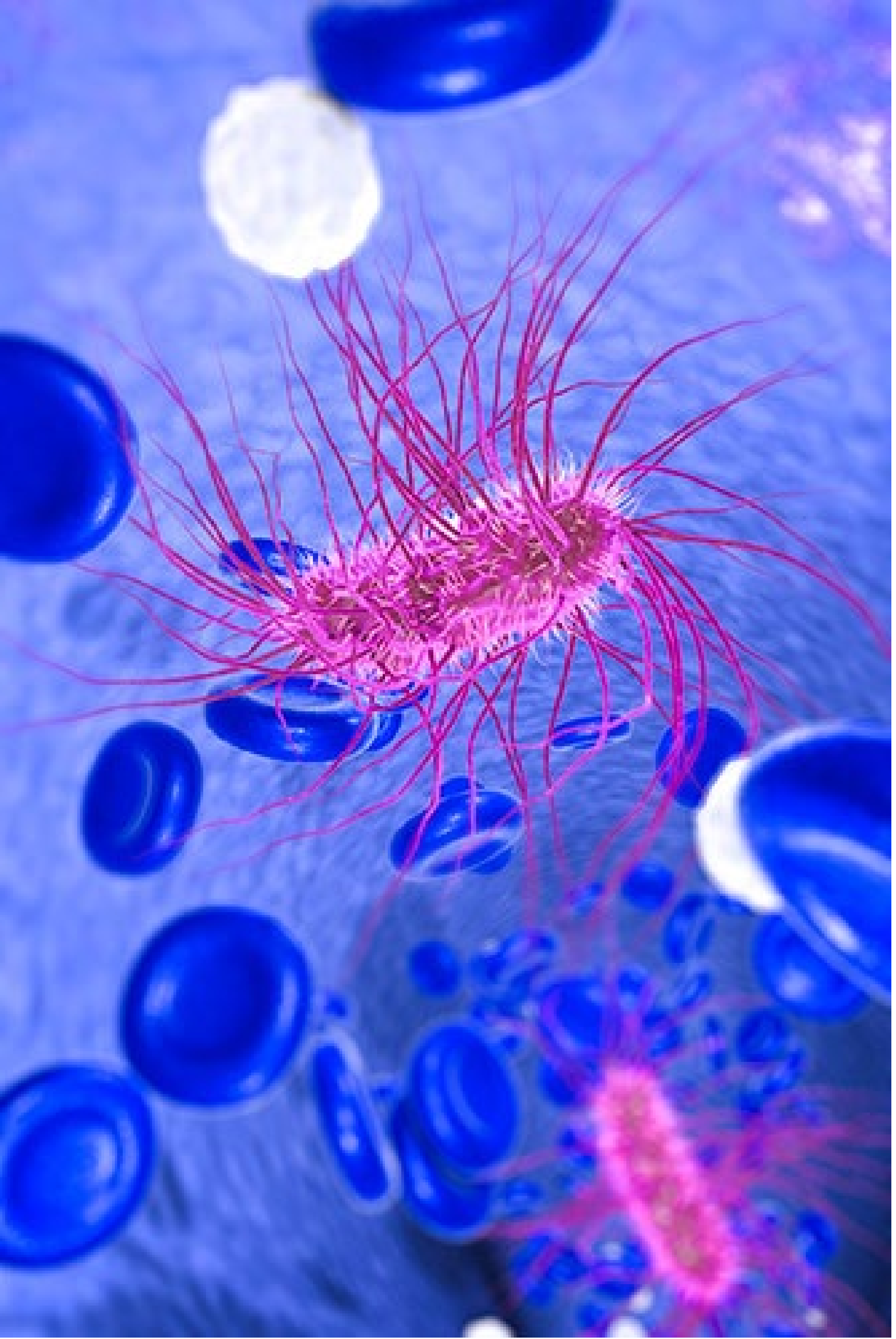
- Free will vs Public Safety
- Attacks on Science
- The Future..?



Pathogens :Micro-organisms

Air, Blood, Water

Respiratory infections, Diarrheal and other diseases



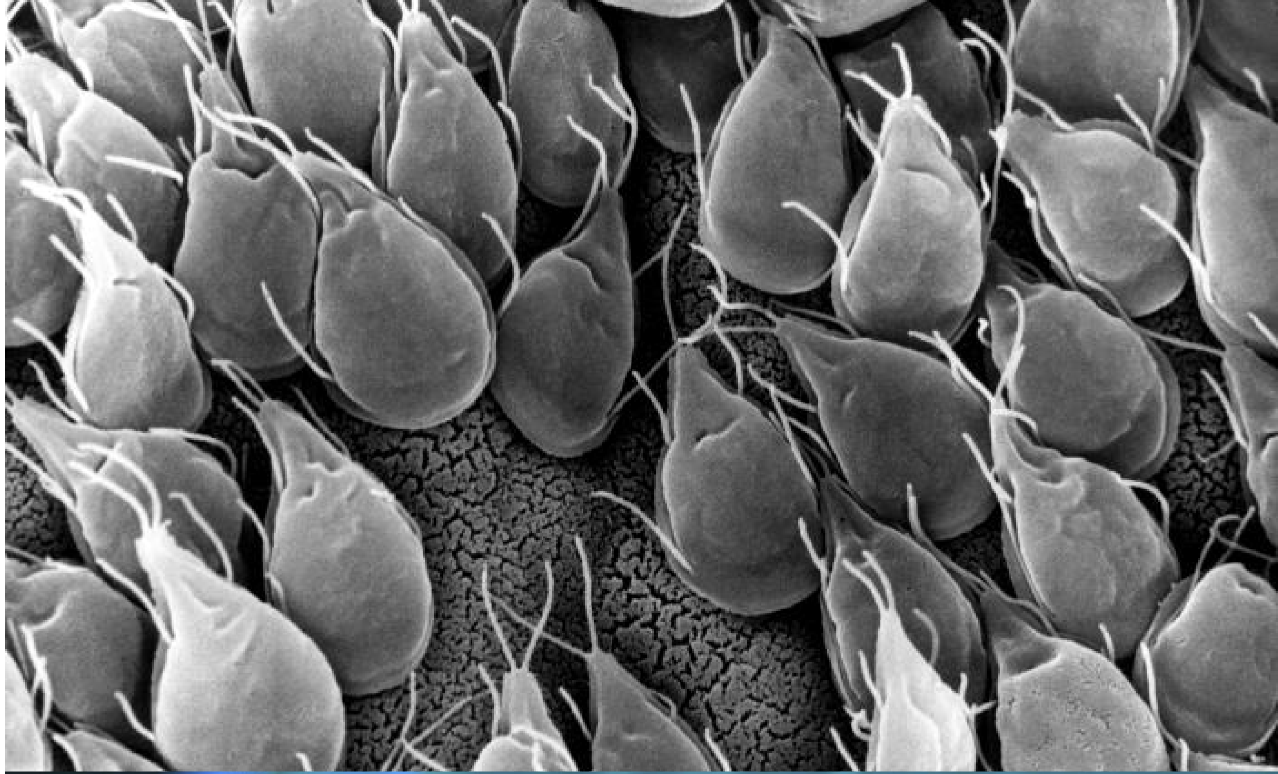
Escherichia coli (E. coli) - coliform bacteria

- Contact with contaminated food or water
- Human or animal waste
- Stomach pain, diarrhea, urinary infection
- Treatment – Antibiotics

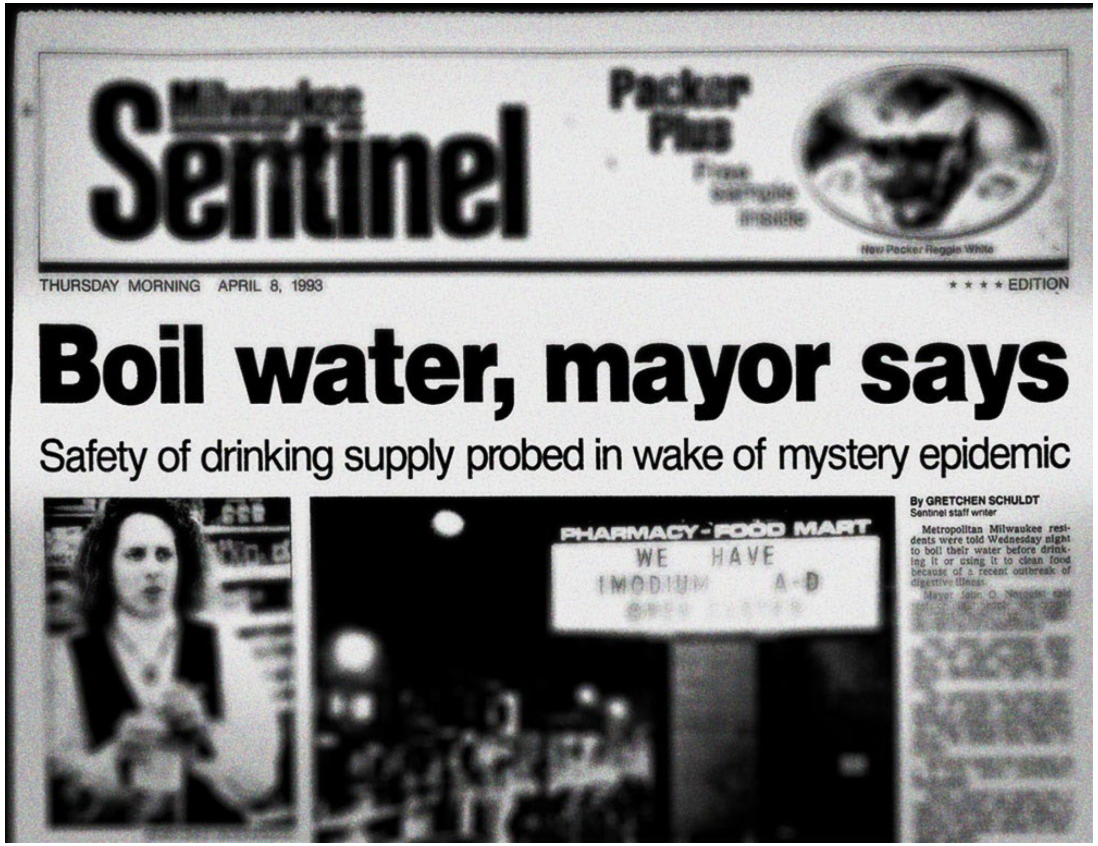
Giardia – Parasite

- Contact with contaminated food or water
- Human or animal waste
- Stomach pain, diarrhea, urinary infection, fatigue
- Treatment – Antibiotics

Cryptosporidium – Parasite



1993 – 400,000+ get diarrhea at the same time!


Milwaukee Sentinel

Packer Plus
Free sample inside

New Packer Reggie White

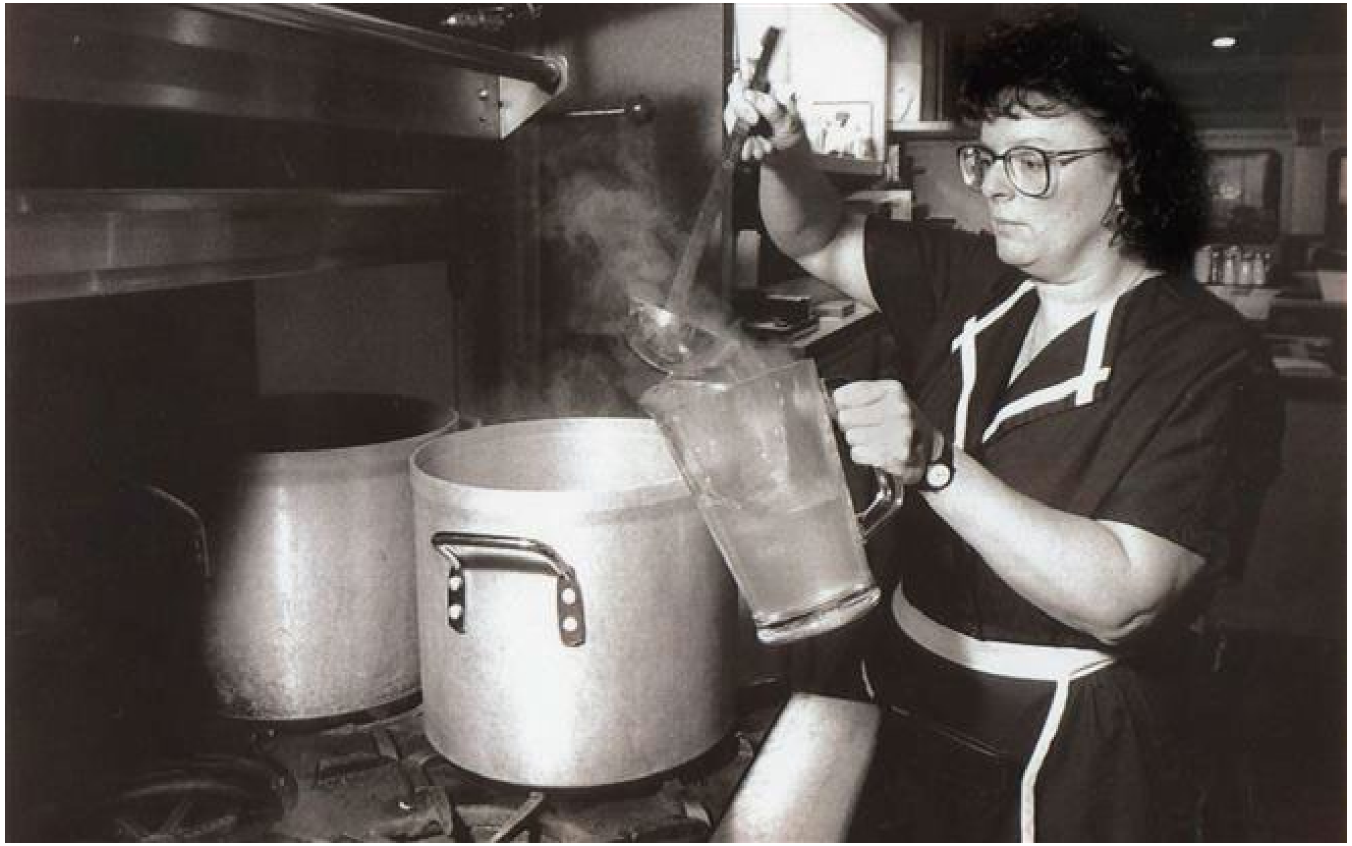
THURSDAY MORNING APRIL 8, 1993 ★ ★ ★ ★ EDITION

Boil water, mayor says

Safety of drinking supply probed in wake of mystery epidemic

By GRETCHEN SCHULDT
Sentinel staff writer

Metropolitan Milwaukee residents were told Wednesday night to boil their water before drinking it or using it to clean food because of a recent outbreak of digestive illness.

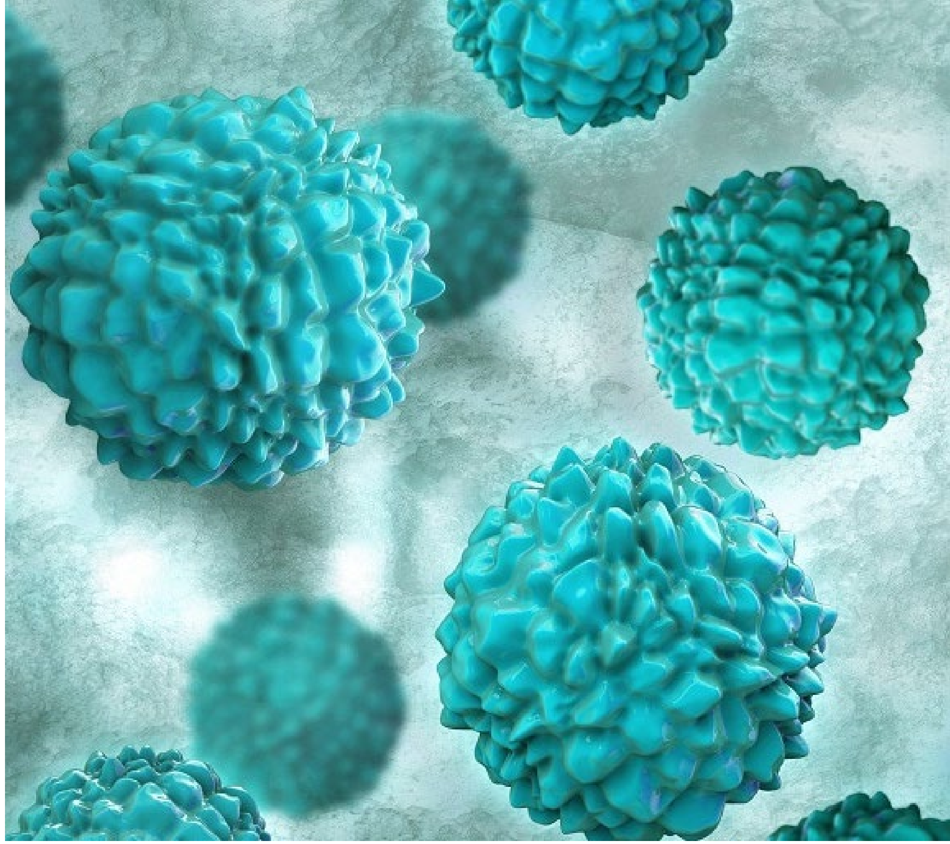


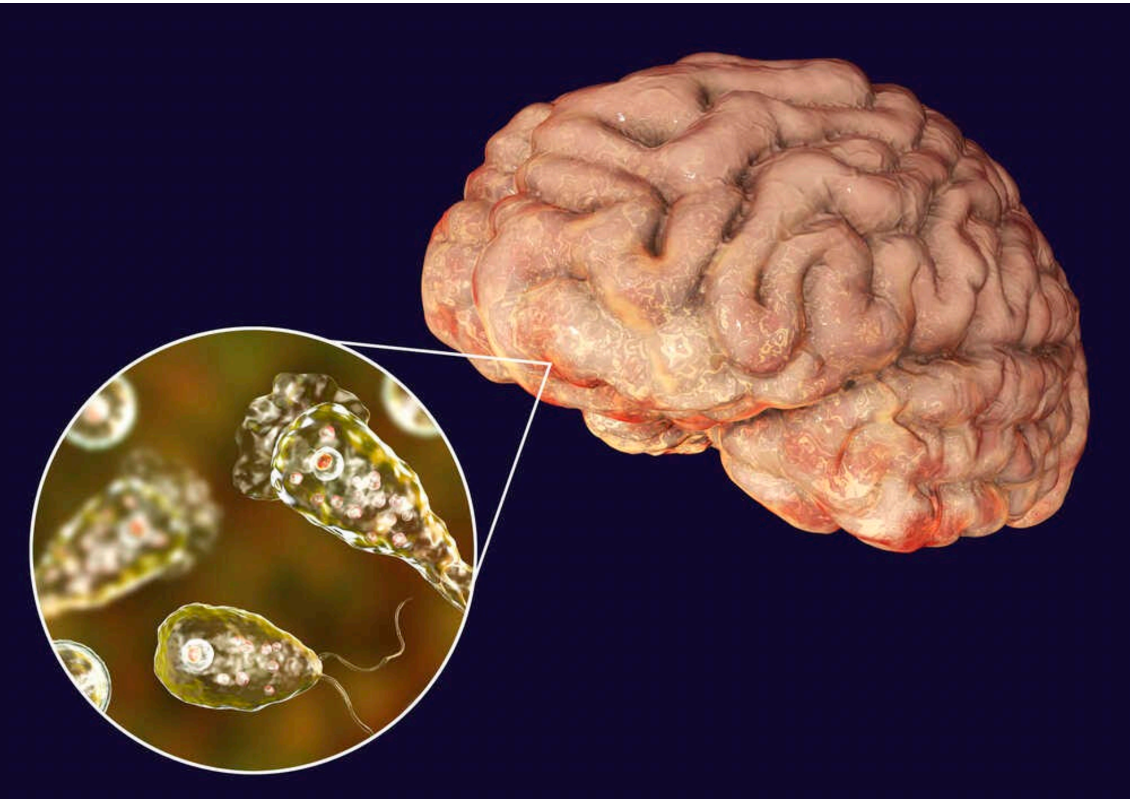
cryptosporidium

Milwaukee, WI

Naegleria fowleri, an amoeba

Naturally found in fine grained sediment of ponds and rivers
Causes a disease called primary amebic meningoencephalitis (PAM).
It's both extremely rare — and extremely deadly (97% mortality)
Lake of Three Fires State Park- SW Iowa 2022

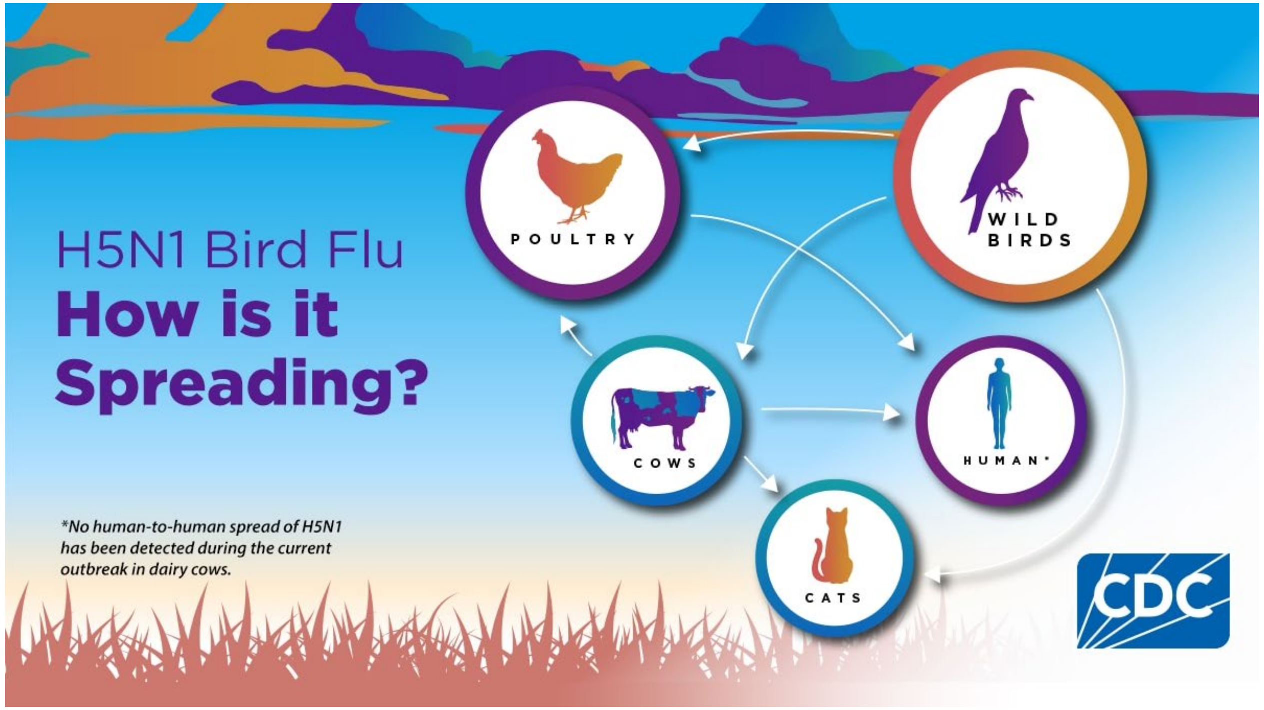


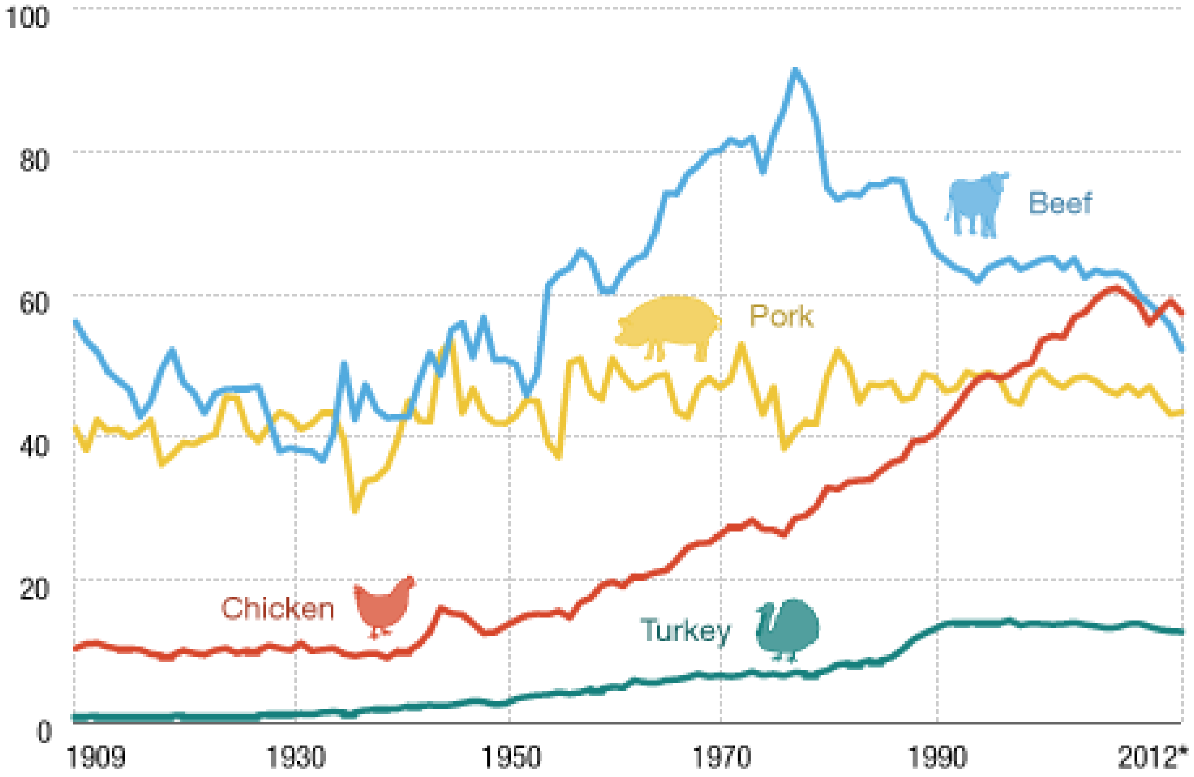


Norovirus

Human or animal waste
Stomach pain, diarrhea, urinary infection, fatigue
Treatment – Antibiotics

H5N1 Bird Flu and Our Food System

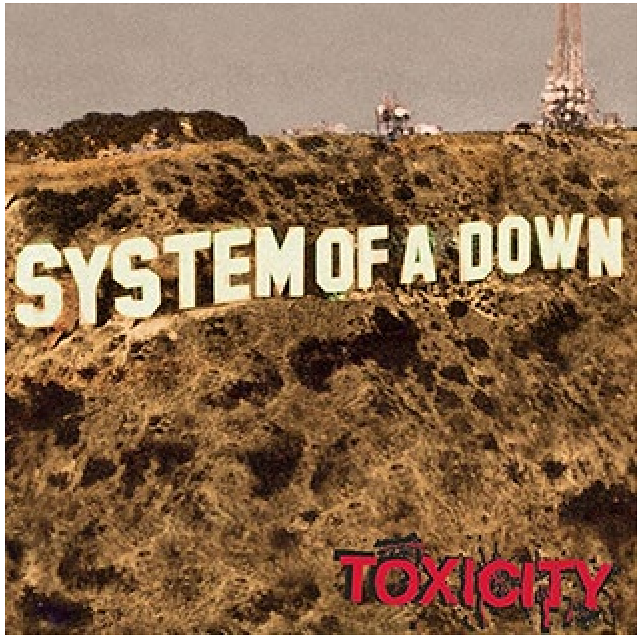


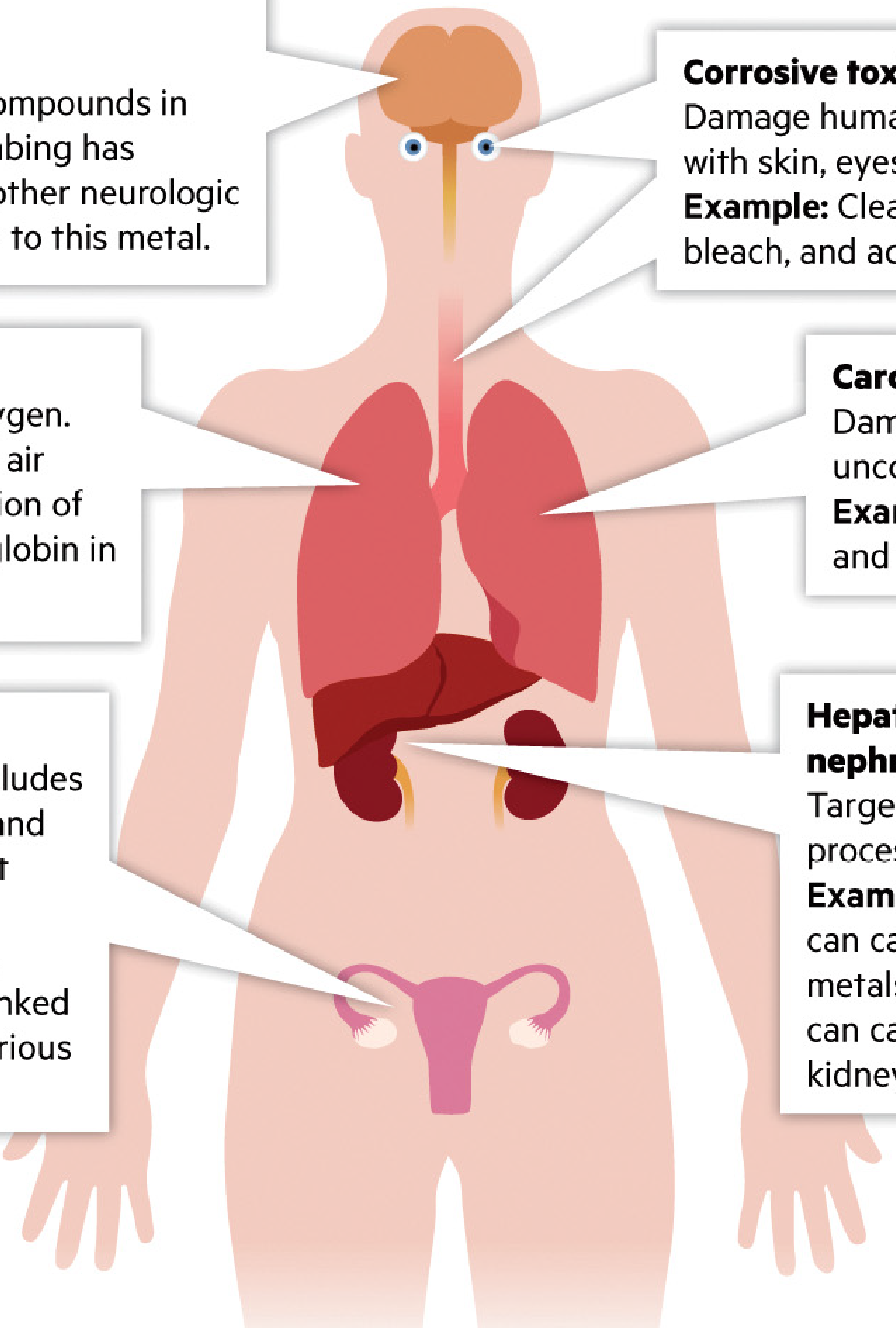


CDC Posts, Then Deletes, Data on Bird Flu

Staff at CDC and NIH are reeling as Federal administration cuts workforce

Toxicity: Inorganic chemicals





Neurotoxins
Damage the nervous system.
Example: Lead. The presence of lead compounds in paints, gasoline, and pipes used in plumbing has caused developmental disabilities and other neurologic problems in those affected by exposure to this metal.

Corrosive toxins
Damage human tissue when they come into contact with skin, eyes, or the respiratory tract.
Example: Cleaning products such as ammonia, bleach, and acids.

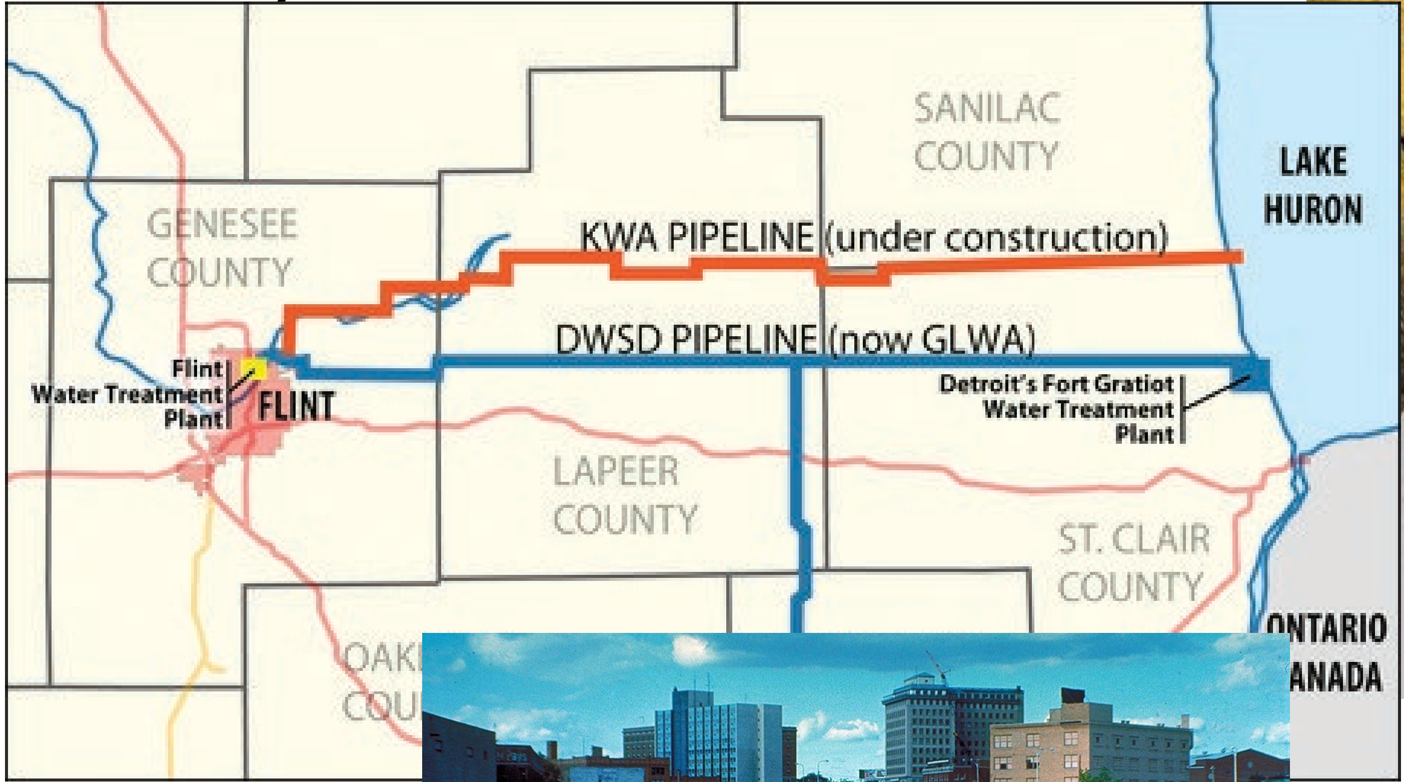
Asphyxiants
Restrict the body's ability to absorb oxygen.
Example: Carbon monoxide, a common air pollutant from the incomplete combustion of fossil fuels, inhibits the ability of hemoglobin in the blood to absorb oxygen.

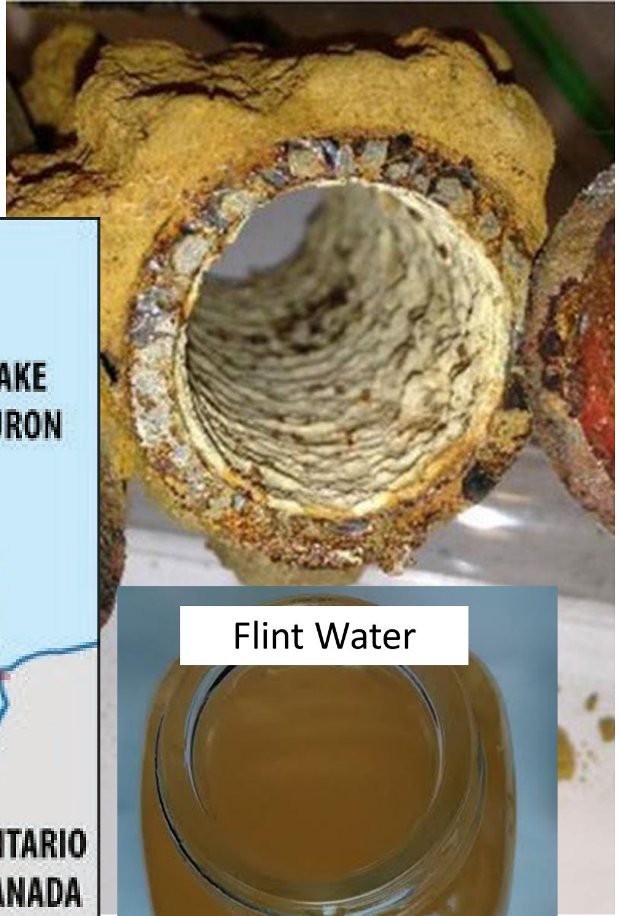
Carcinogens
Damage cell DNA and initiate or promote uncontrolled growth of tumors.
Example: Cigarette smoke is a carcinogen and the leading cause of lung cancer.

Reprotoxins
Disrupt reproductive functions. This includes chemicals that can cause miscarriages and birth defects as well as those that affect fertility.
Example: Exposures to the metals lead, mercury, arsenic, and cadmium are all linked to miscarriage, low birth weight, and various birth defects.

Hepatotoxins (target liver) and nephrotoxins (target kidneys)
Target the liver or kidneys, organs that process toxins.
Example: Excessive alcohol consumption can cause liver damage over time. Heavy metals such as lead, mercury, and cadmium can cause damage to both the liver and the kidneys.

Flint, MI 2014





Treated Water From Different Sources		
	Detroit River/ Lake Huron	Flint River
pH	7.38	7.89
Na, mg/L	4.6	18
K	0.8	1
Ca	22.5	40
Mg	5.8	3
Al	0.215	0.037
Fe	0.175	0.097
Mn	0.005	0.0037
Alk	106	118
SO4	33.9	31
Cl	39.8	95
PO4	1.05	0
TOC, before treatment	1.5-1.8	6.

Small variations lead to big changes – Unintended consequences of trying to save money

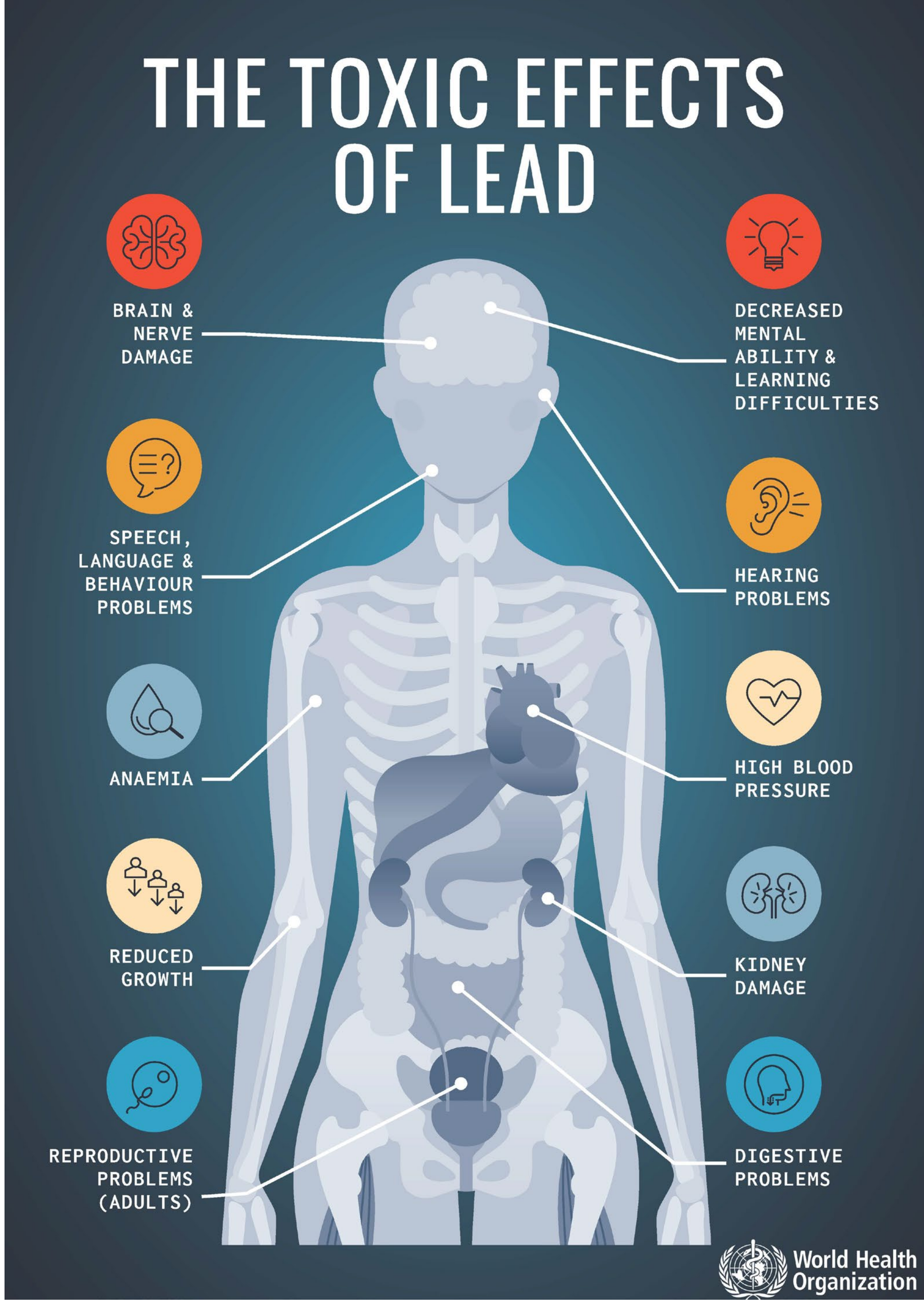
- Daily fluctuations varied between ±0.2 to 0.3 pH units, and as high as 1.1 log units in late April 2014.
- Changes in pH more than 0.2 units per week are not recommended (Hill & Cantor 2011). Rapid changes in water chemistry (as experienced in the Flint system) may adversely affect system equilibrium and the passivation layer and scales on the insides of the pipes.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5353852/pdf/nihms845813.pdf

Lead concerns

- Lowered IQ.
- Damage to the brain and nervous system.
- Learning and behavioral difficulties.
- Slowed growth.
- Hearing problems.
- Headaches.

Chelation therapy (a treatment that uses a medication to remove lead from the body when BLLs are very high)



Lead (Pb) in water

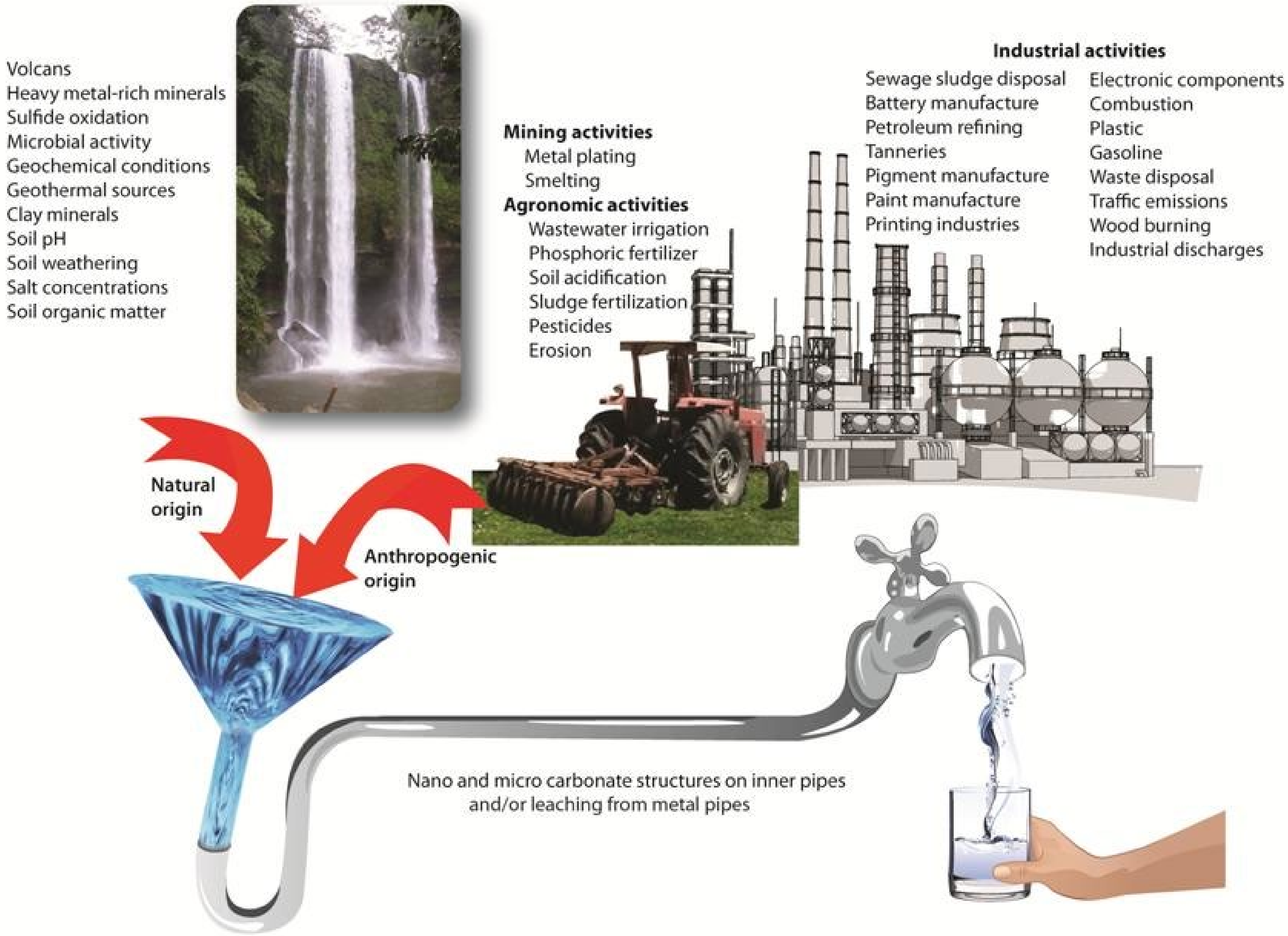
- EPA WIIN Grant
  - Lyn Jenkins -Education Program Consultant
  - Melissa Walker - Administrative Consultant of School Health
- https://educate.iowa.gov/pk-12/operation-support/school-facilities/lead-testing
- https://cheec.uiowa.edu/sites/cheec.uiowa.edu/files/Des-Moines-Register-Related-Article.pdf

- https://sites.google.com/iowa.gov/wiin-grants/home

Rome

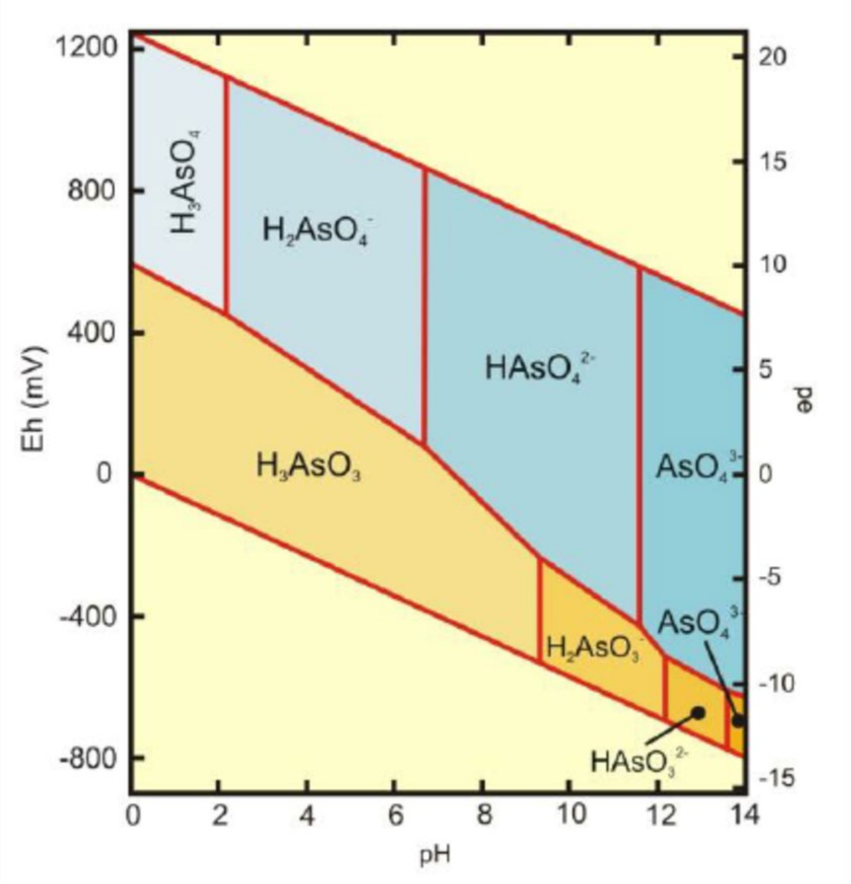
Other common metal – water contaminants

- Beryllium
- Strontium
- Barium
- Chromium
- Cobalt
- Nickel
- Copper
- Cadmium
- Mercury



Non metal - e.g. Arsenic

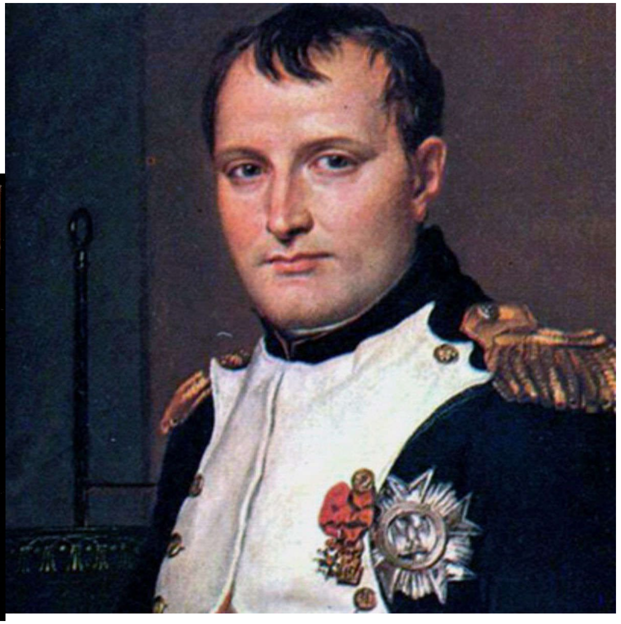
- Source
  - Burning coal
  - Ore smelting
  - Insecticides
  - Embalming
- Carcinogen , skin lesions, death
- Remedy – hydration, most will leave the body through kidneys and urine in days to months



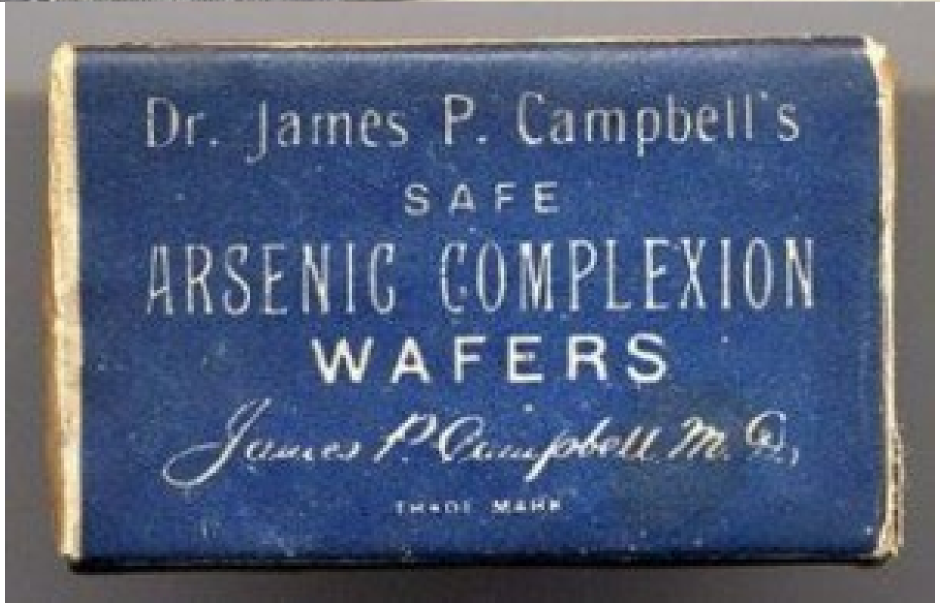
Eh represents the oxidation-reduction potential based on the standard hydrogen potential (SHE)

pH represents the activity of the hydrogen ion (H^+, also known as a proton)

Scheeles Green, late 1700s




DR. ROSE'S
Arsenic
Complexion
WAFERS.
SEARS ROEBUCK & CO. INC
CHICAGO ILL.


Dr. James P. Campbell's
SAFE
ARSENIC COMPLEXION
WAFERS
James P. Campbell M.D.
TRADE MARK


LADI
If you desire a trans
FRESH complexion,
blemish, roughness,
ness, freckles, or
DR. CAMPB
SAFE ARSENIC COMPLEXION
AND
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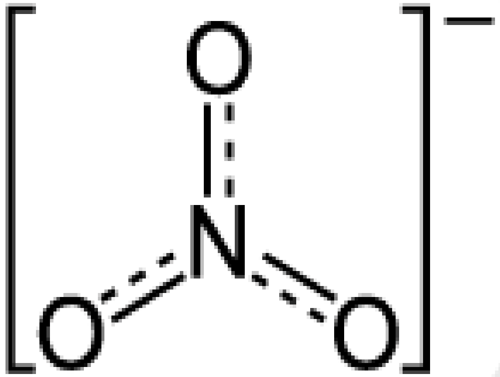
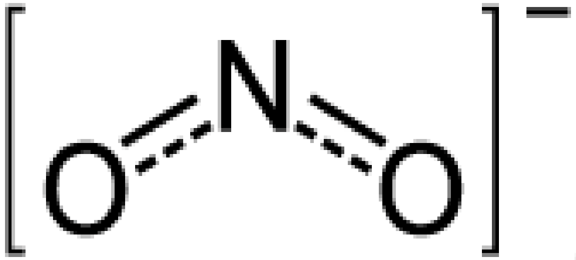
The only real true beautifiers in the world.
satisfaction in every case or money refu
six large boxes, $5. Soap, per cake,
Address, H. B. Fould, 214 Sixth Avenue,
SOLD BY DRUGGISTS EVERY

NITRATE VS. NITRITE





NITRATE

- Nitrate is made up of three Oxygen atom and one Nitrogen atom.

NITRITE

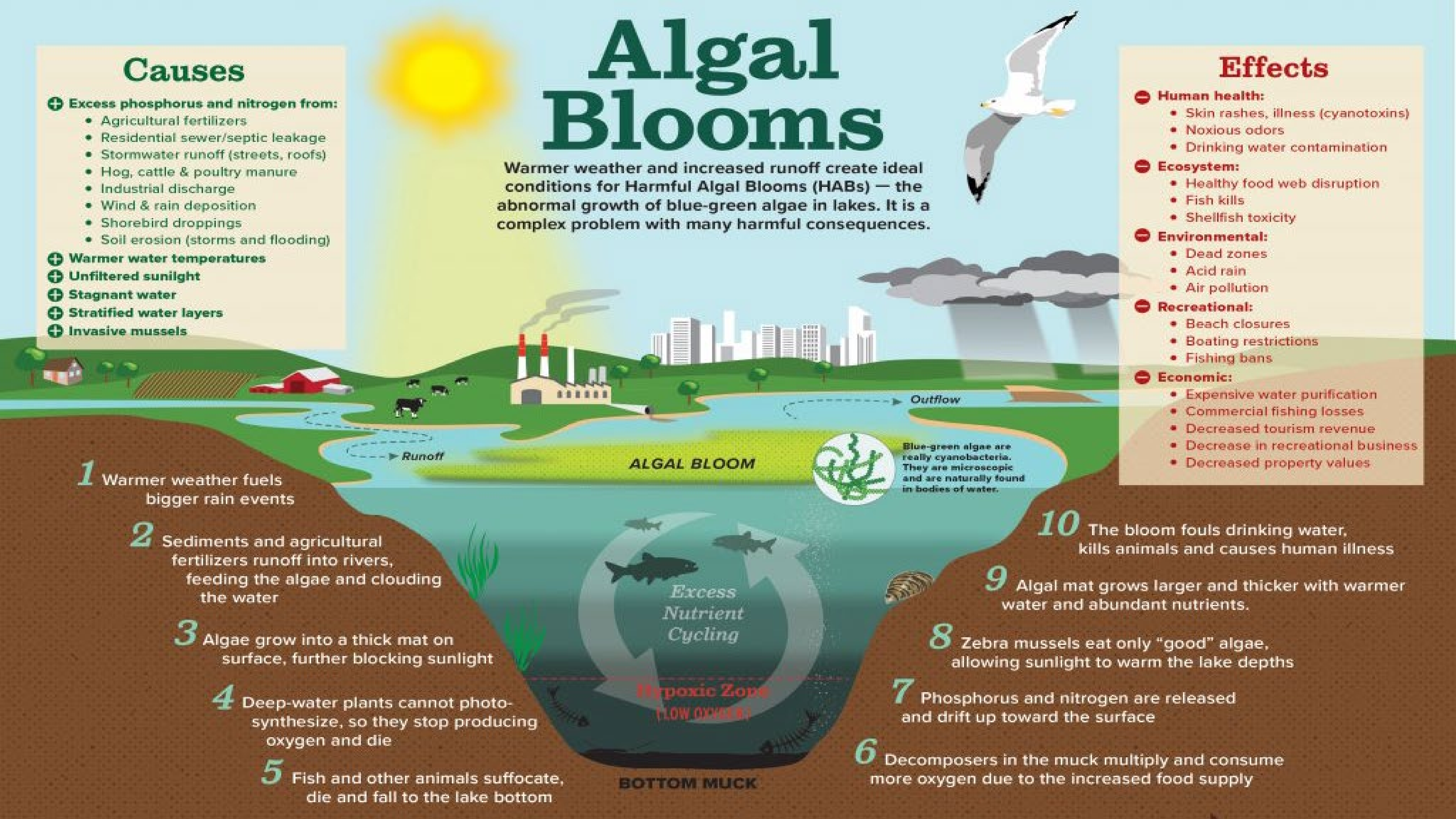
- Nitrite is made up of one Nitrogen atom and two Oxygen atoms.

Anhydrous Ammonia

Nitrates are compounds which form naturally when nitrogen combines with oxygen, and they exist naturally in soil and in water.

This benefits plants, which absorb nitrates from the soil to make amino acids. Farmers use fertilizers to increase the level of nitrates in the soil, and help crops grow

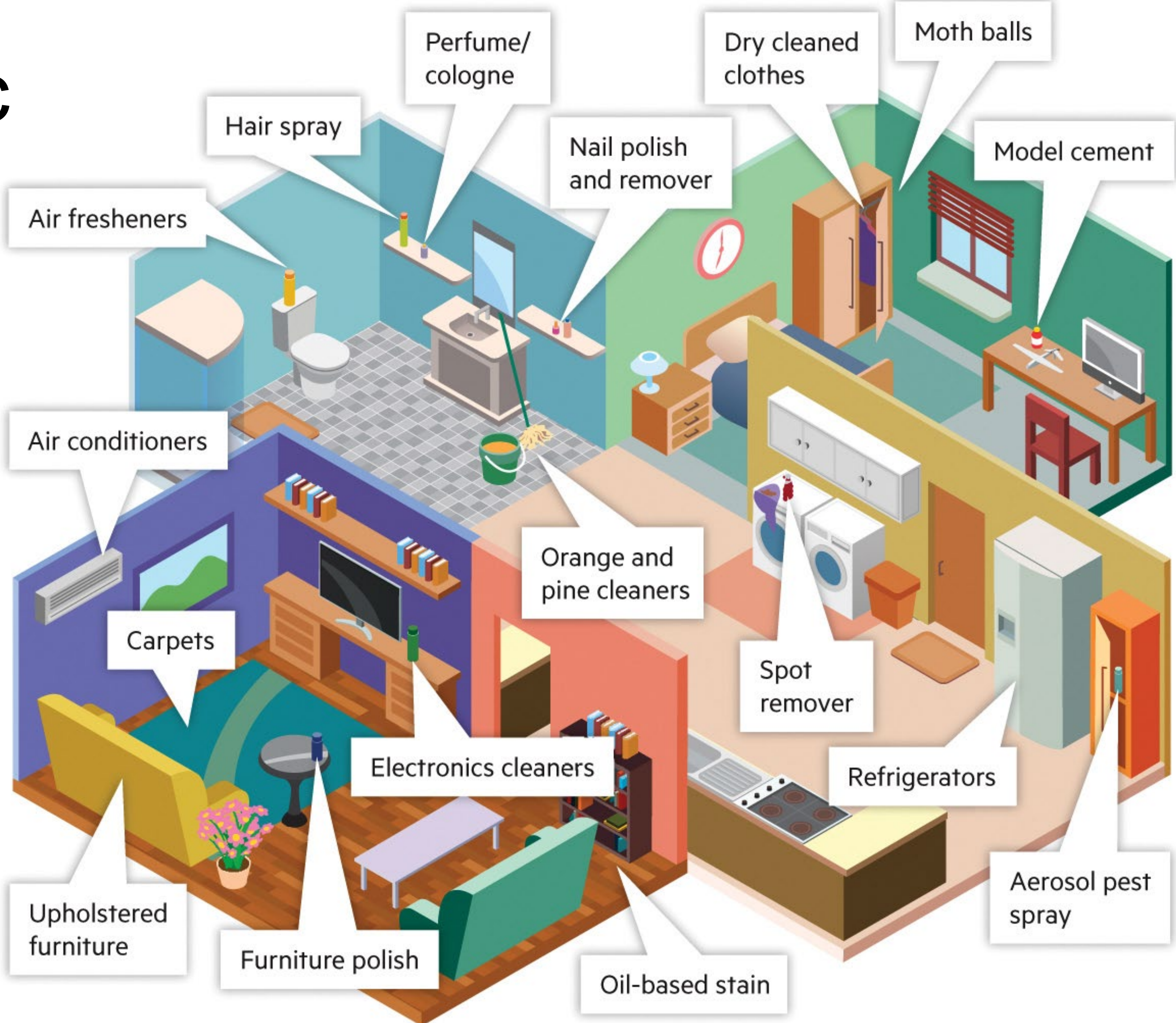
To notify the public about potentially dangerous water contamination in recreational areas, **public agencies may rely heavily or solely on signs posted at the affected beach.**


Algal Blooms
Warmer weather and increased runoff create ideal conditions for Harmful Algal Blooms (HABs) — the abnormal growth of blue-green algae in lakes. It is a complex problem with many harmful consequences.
Causes
Excess phosphorus and nitrogen from:
• Agricultural fertilizers
• Residential sewer/septic leakage
• Stormwater runoff (streets, roofs)
• Hog, cattle & poultry manure
• Industrial discharge
• Wind & rain deposition
• Shorebird droppings
• Soil erosion (storms and flooding)
Warmer water temperatures
Unfiltered sunilght
Stagnant water
Stratified water layers
Invasive mussels
Effects
Human health:
• Skin rashes, illness (cyanotoxins)
• Noxious odors
• Drinking water contamination
Ecosystem:
• Healthy food web disruption
• Fish kills
• Shellfish toxicity
Environmental:
• Dead zones
• Acid rain
• Air pollution
Recreational:
• Beach closures
• Boating restrictions
• Fishing bans
Economic:
• Expensive water purification
• Commercial fishing losses
• Decreased tourism revenue
• Decrease in recreational business
• Decreased property values
Outflow
Runoff
ALGAL BLOOM
Blue-green algae are really cyanobacteria. They are microscopic and are naturally found in bodies of water.
1 Warmer weather fuels bigger rain events
2 Sediments and agricultural fertilizers runoff into rivers, feeding the algae and clouding the water
3 Algae grow into a thick mat on surface, further blocking sunlight
4 Deep-water plants cannot photo-synthesize, so they stop producing oxygen and die
5 Fish and other animals suffocate, die and fall to the lake bottom
Excess Nutrient Cycling
Hypoxic Zone
(LOW OXYGEN)
BOTTOM MUCK
6 Decomposers in the muck multiply and consume more oxygen due to the increased food supply
7 Phosphorus and nitrogen are released and drift up toward the surface
8 Zebra mussels eat only "good" algae, allowing sunlight to warm the lake depths
9 Algal mat grows larger and thicker with warmer water and abundant nutrients.
10 The bloom fouls drinking water, kills animals and causes human illness

Organic chemicals

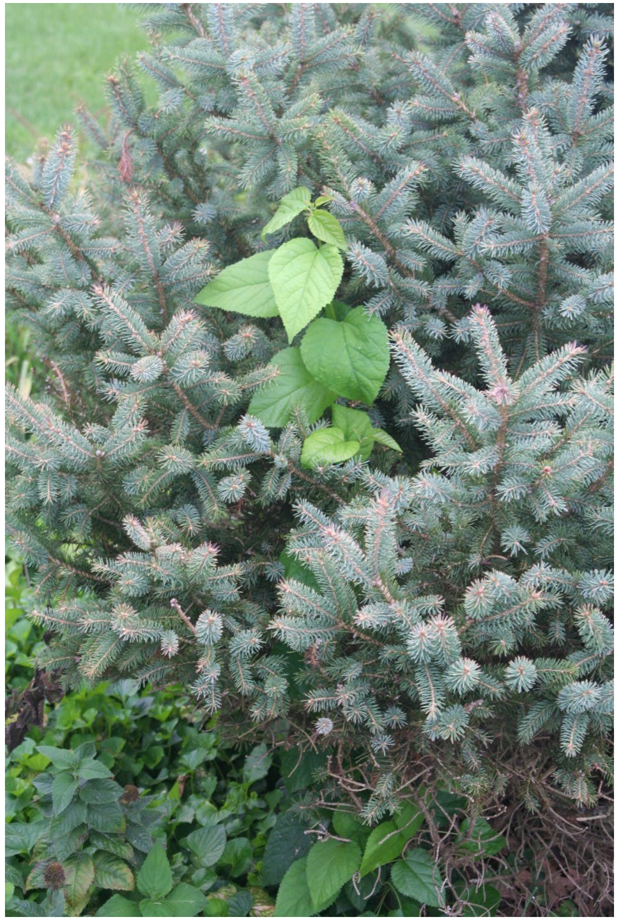
Volatile Organic Compounds (VOCs)

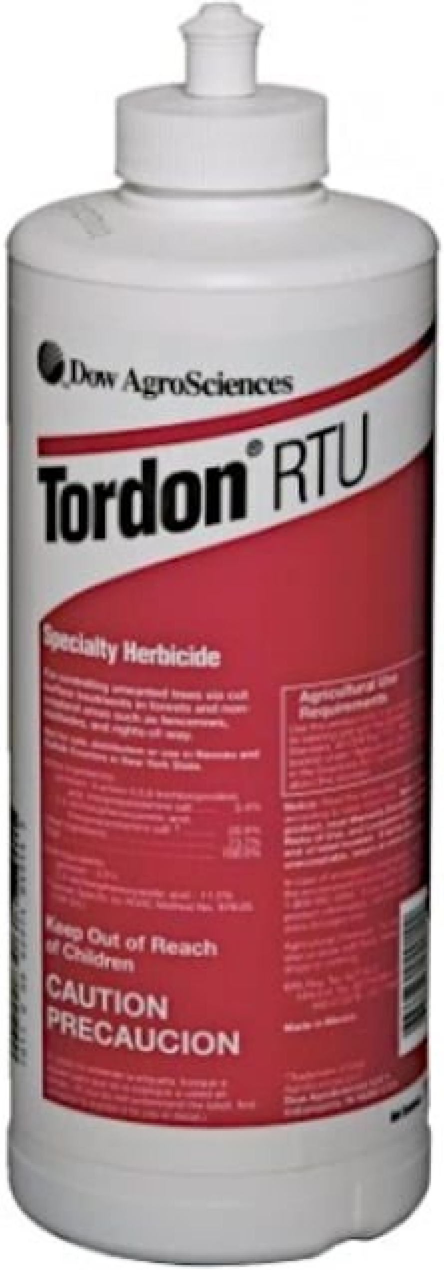
Examples: benzene, toluene, formaldehyde, xylene, ethanol, acetone, and acetaldehyde



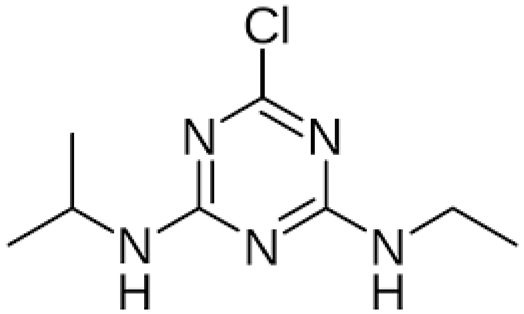
Adapted from New York State Department of Health (n.d.)

Tordon Herbicide

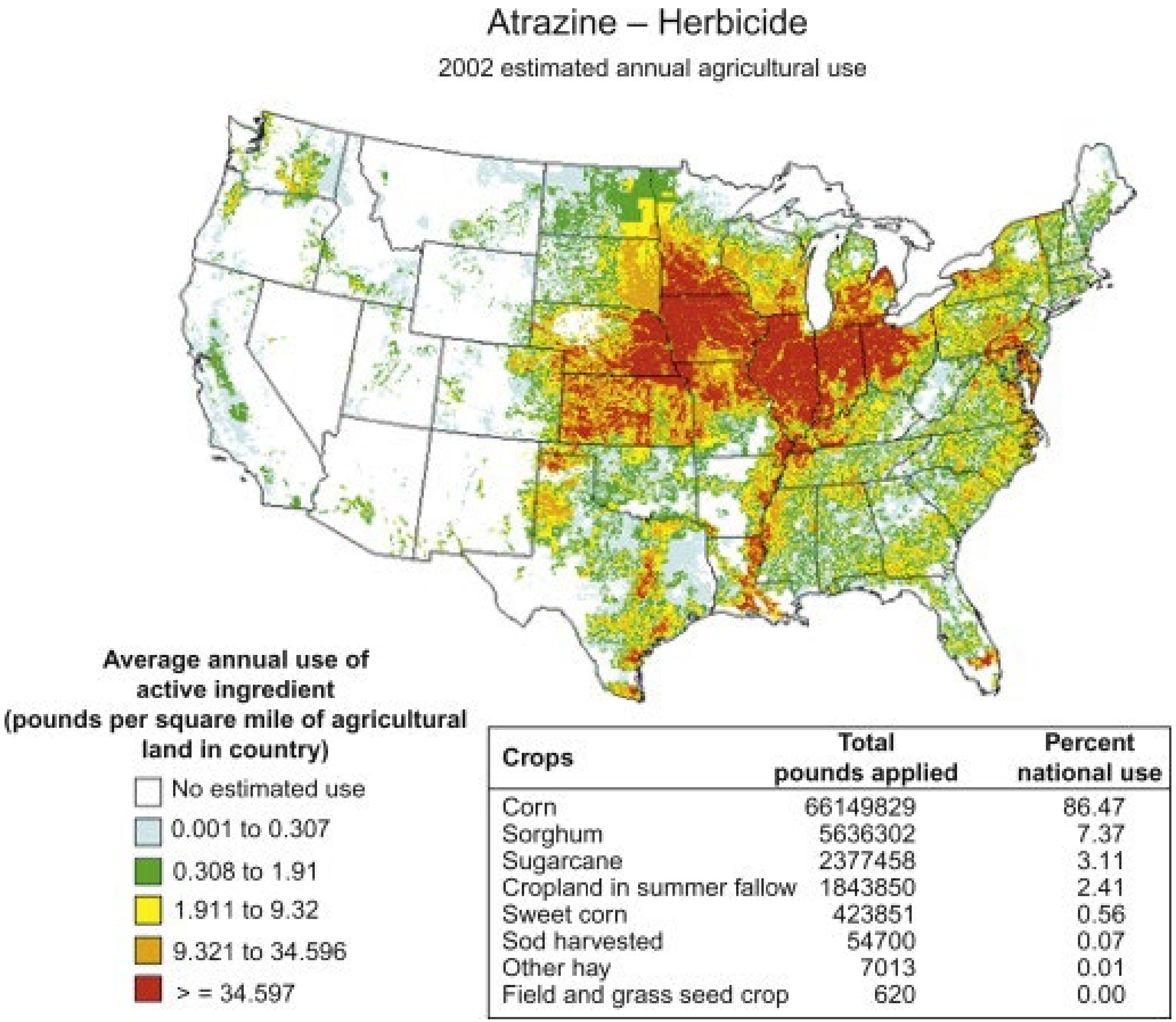




Atrazine



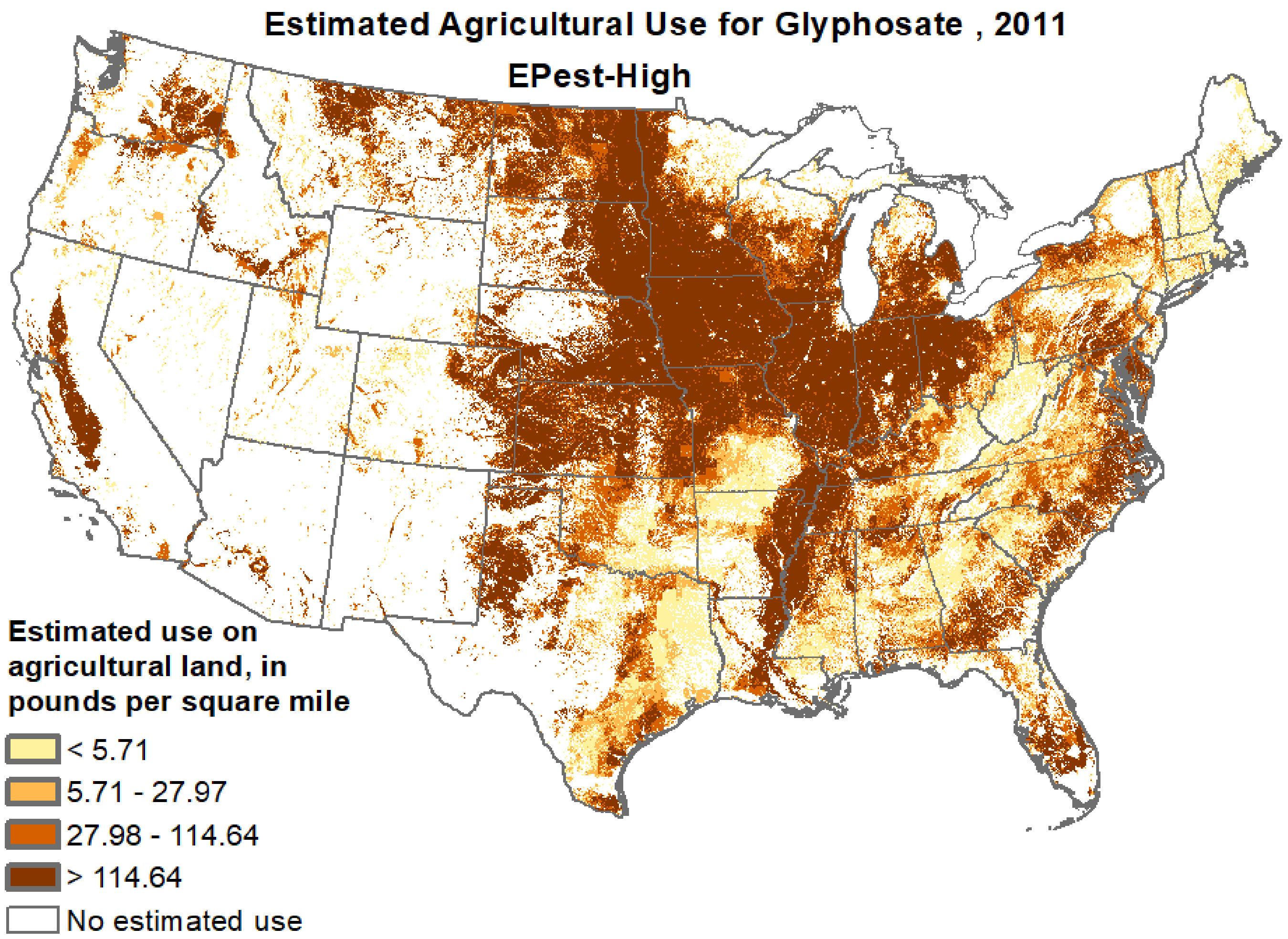
- Herbicide that is widely used to kill weeds
- Adverse effect on health such as tumors, breast, ovarian, and uterine cancers as well as leukemia and lymphoma.



Crops	Total pounds applied	Percent national use
Corn	66149829	86.47
Sorghum	5636302	7.37
Sugarcane	2377458	3.11
Cropland in summer fallow	1843850	2.41
Sweet corn	423851	0.56
Sod harvested	54700	0.07
Other hay	7013	0.01
Field and grass seed crop	620	0.00

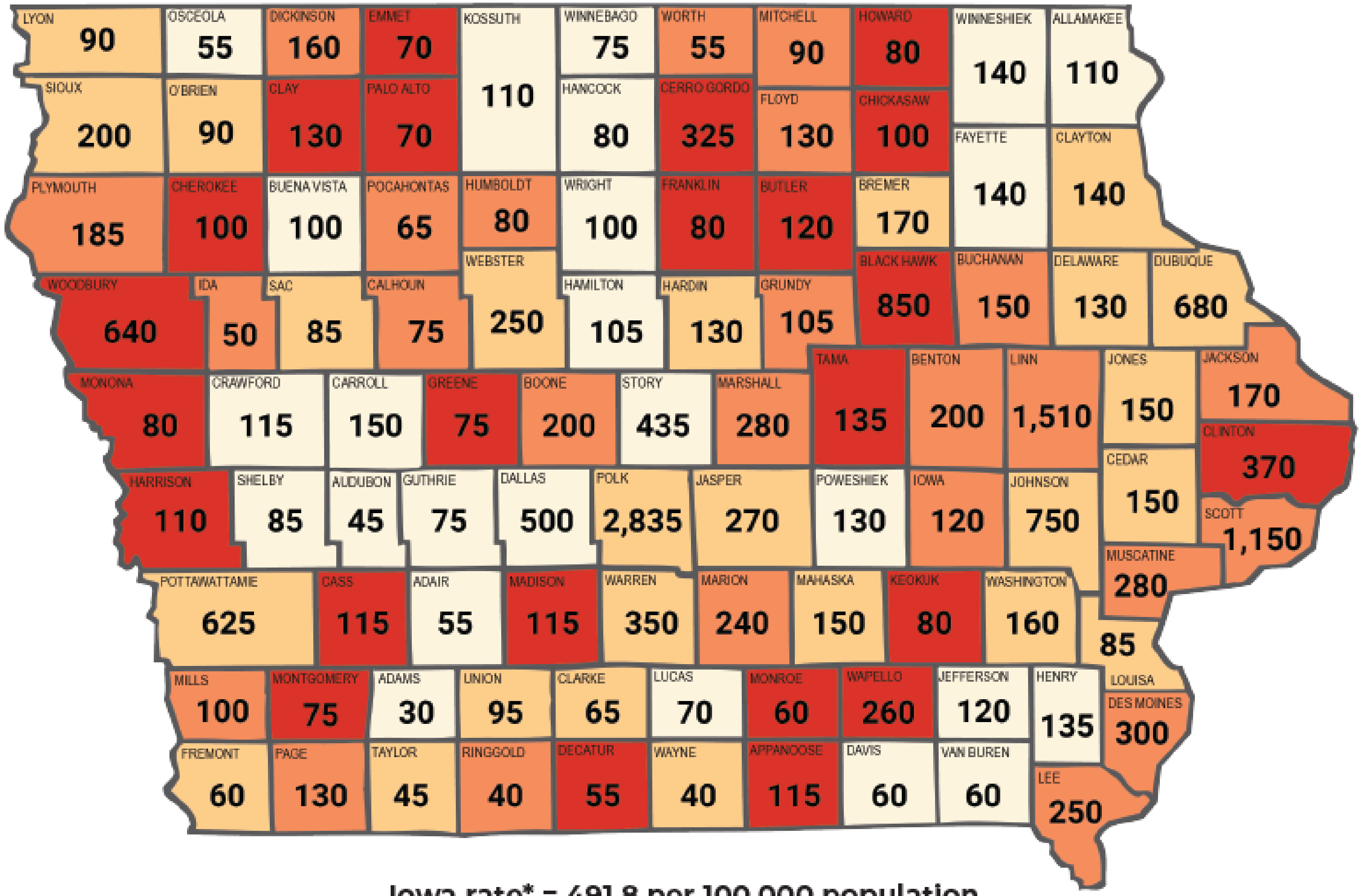
Glyphosate/Roundup

- Herbicide that kills certain weeds and grasses. It blocks an enzyme essential for plant growth. Used primarily in agriculture, but also in forestry and lawn and garden care.
- Harm? Pending…



Estimates for New Cancers for 2025

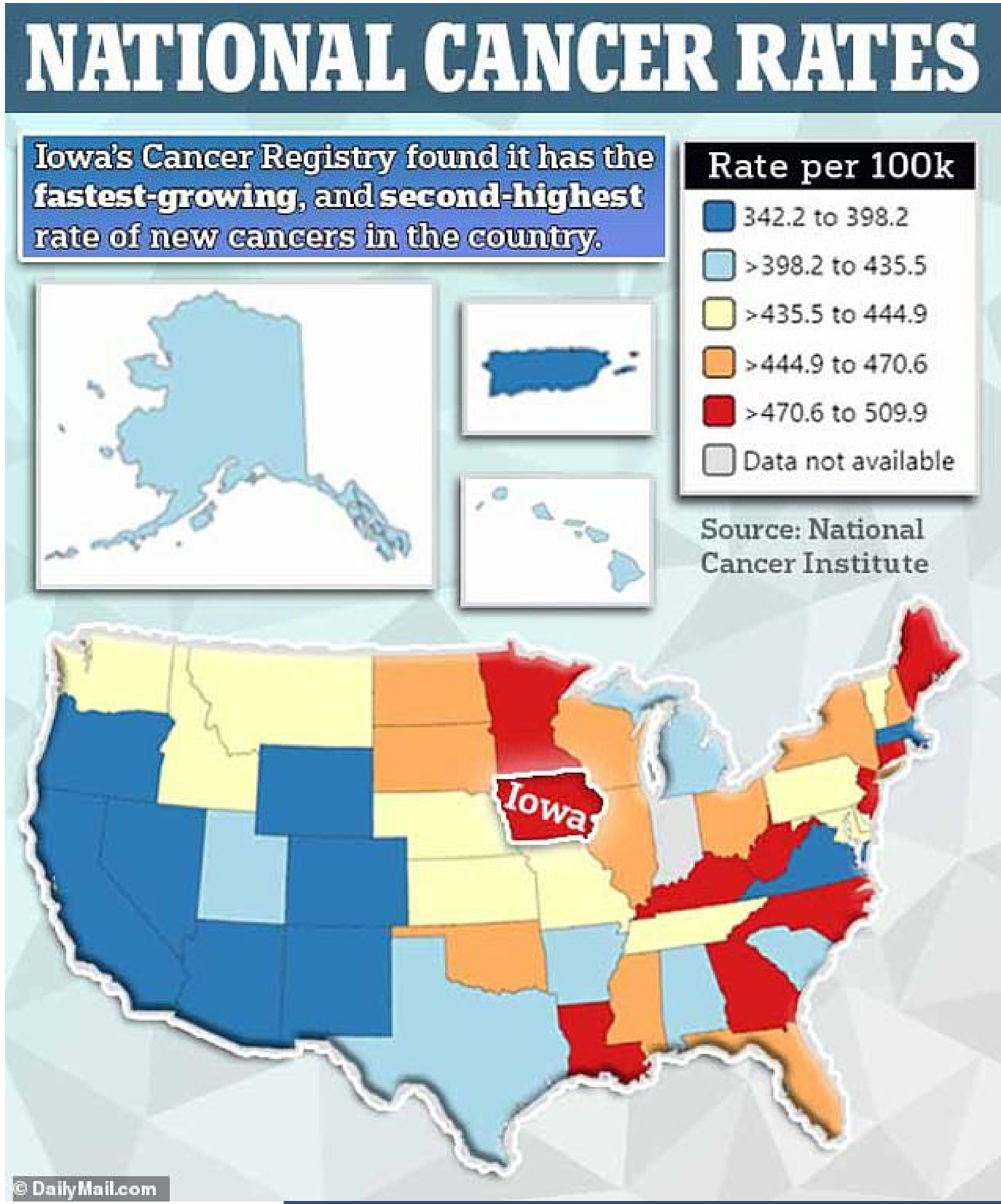
The numbers in each of the counties represent the estimated counts of new cancer cases for 2025 (meaning cancers that were diagnosed as stages 1-4, as well as in situ or stage 0 bladder cancers). The populations of each county vary widely in terms of size and age, so when comparing new cancers across counties it is important to focus on age-adjusted rates. The color of the county shows the rate of new cancers for years 2017-2021, with the counties with the lowest rates shaded cream and highest rates shaded dark red.



Iowa rate* = 491.8 per 100,000 population

- 396.9-466.9 (lowest rates in state)
- 467.8-492.3 (includes state rate)
- 493.8-513.6 (greater than state rate)
- 514.1-580.0 (highest rates in state)

*Rates are age-adjusted and per 100,000 population, 2017-2021

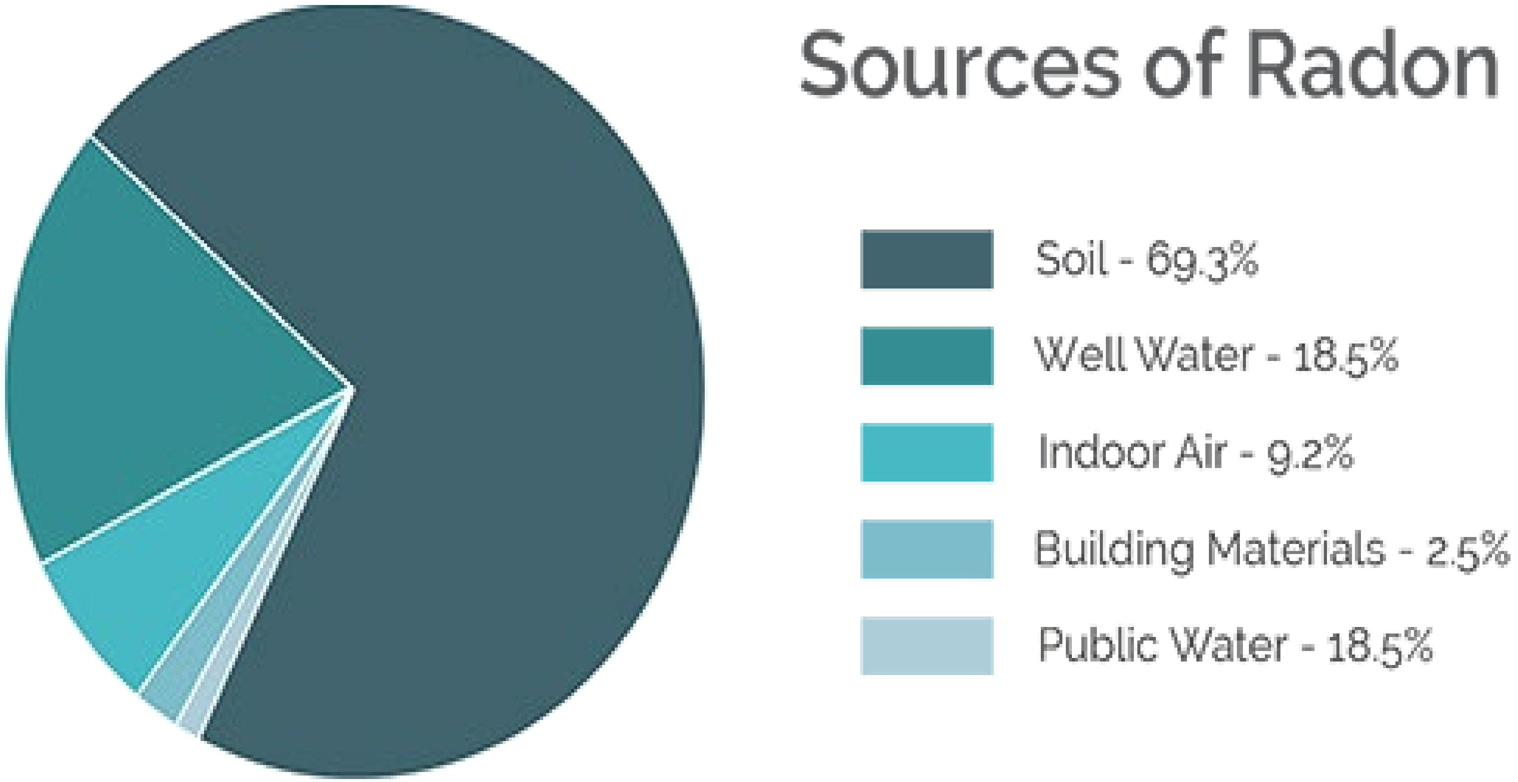


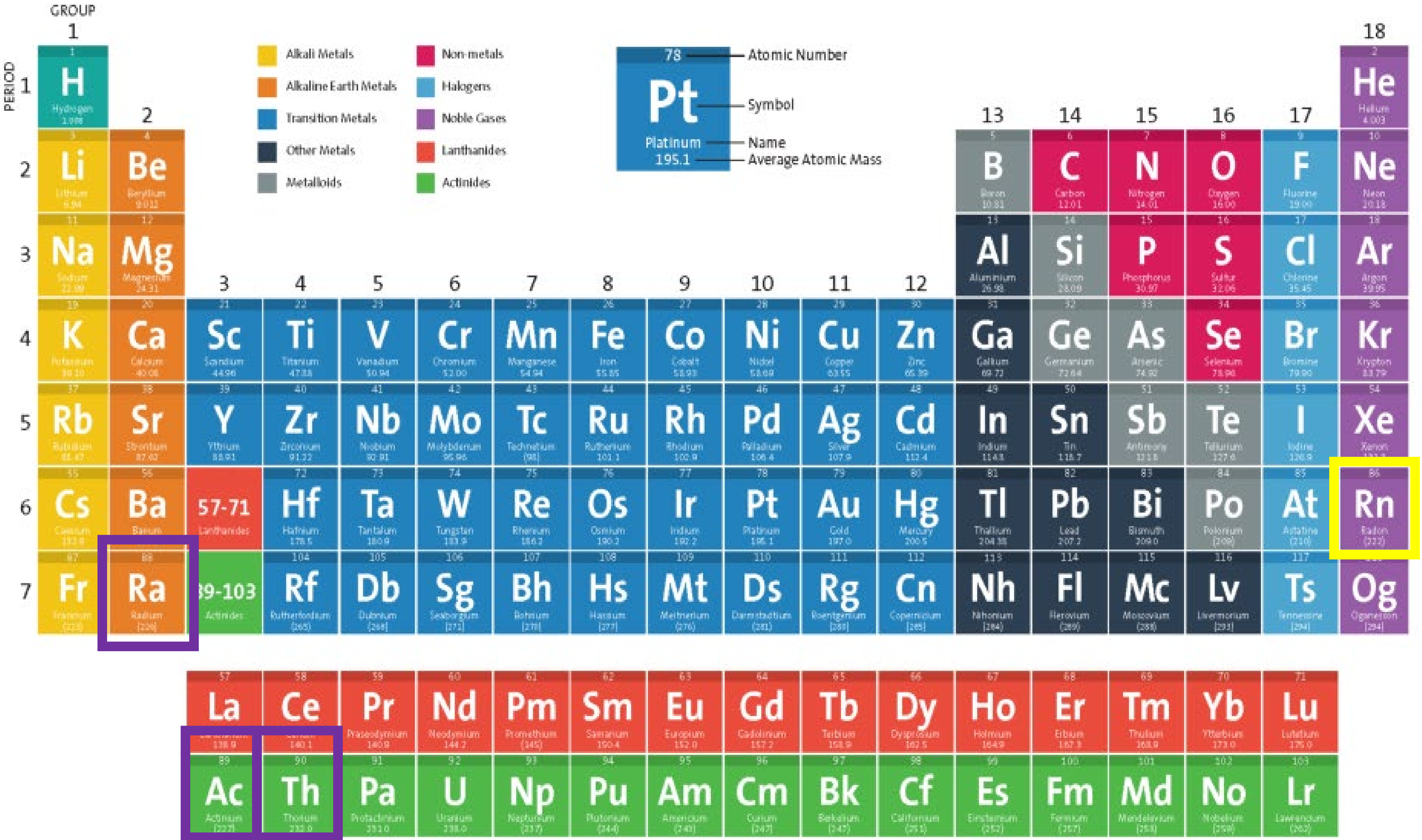
Cancer InFocus™
Iowa

Radon in Iowa

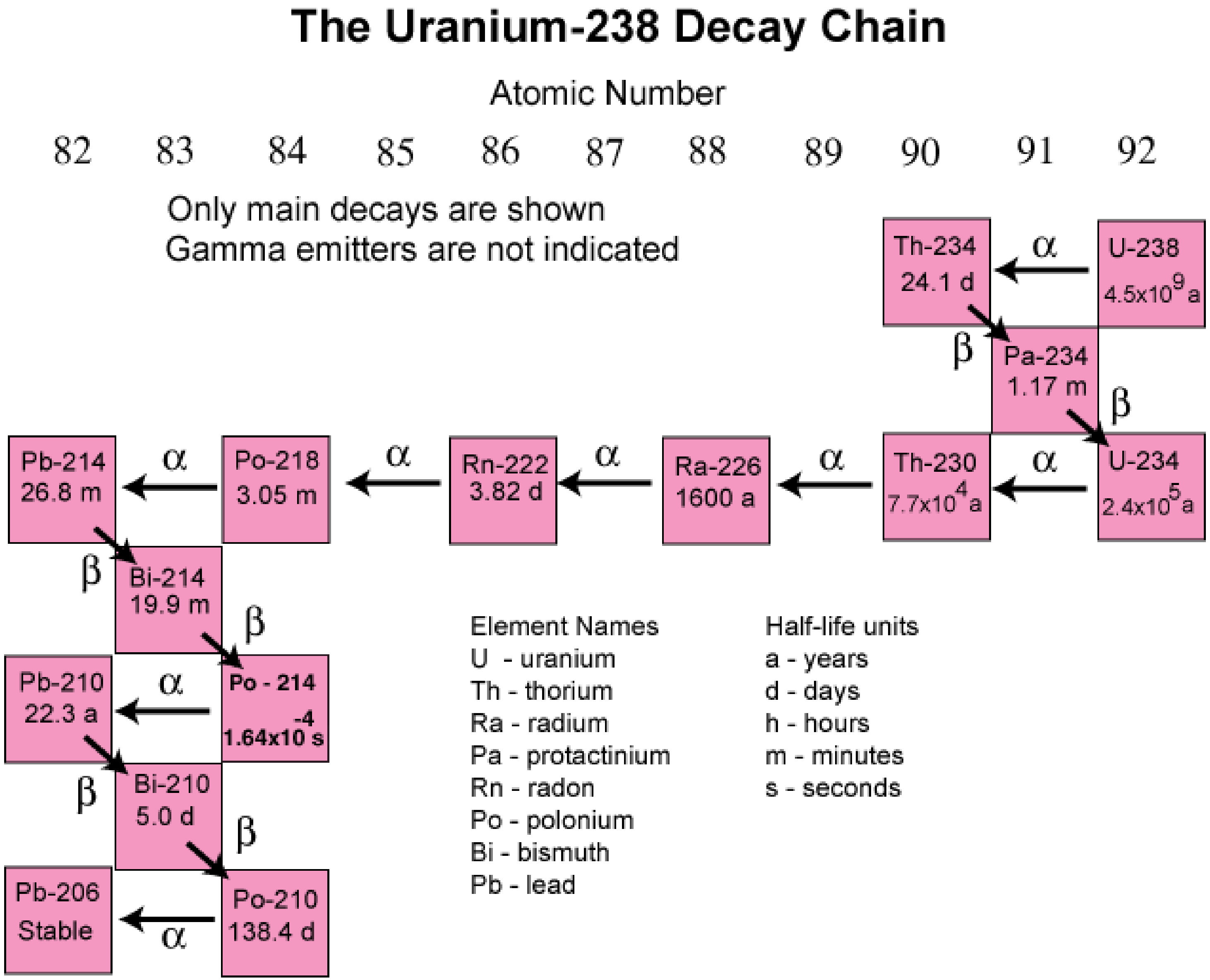
Radon

- Source – Genesis
- Anthropogenic effects
  - Construction
  - Mitigation
- Health implications
- Regulations
- Action




GROUP
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
PERIOD
Alkali Metals
Alkaline Earth Metals
Transition Metals
Other Metals
Metalloids
Non-metals
Halogens
Noble Gases
Lanthanides
Actinides
78
Pt
Platinum
195.1
Atomic Number
Symbol
Name
Average Atomic Mass
H Hydrogen
He Helium
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba 57-71 Lanthanides Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra 89-103 Actinides Rf Db Sg Bh Hs Mt Ds Rg Cn Nh Fl Mc Lv Ts Og
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr

- Uranium-238 culminates in Lead-206, after forming intermediates such as Uranium-234, Thorium-230, Radium-226, and Radon-22



Radon – parent-elements

- Radium-226 decays by alpha particle radiation to an inert gas, radon-222, which also decays by alpha particle radiation
- Thorium-232 is typically present with its decay product radium-224, which will produce radon-220 gas
- Actinium-227, has a half-life of 21.77 years. It decays into francium-223 through alpha decay or into thorium-227 through beta decay

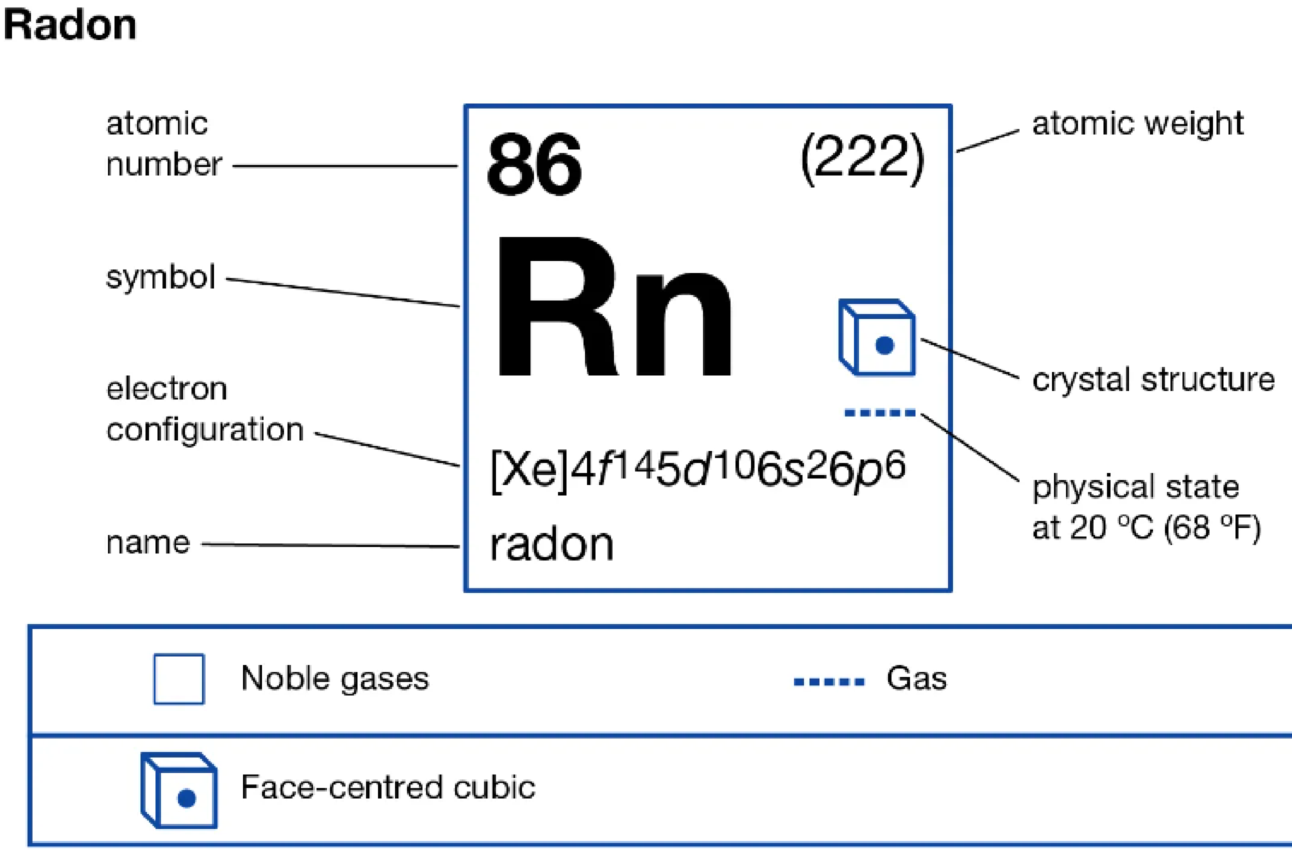
Radon

Radon is a naturally-occurring radioactive gas

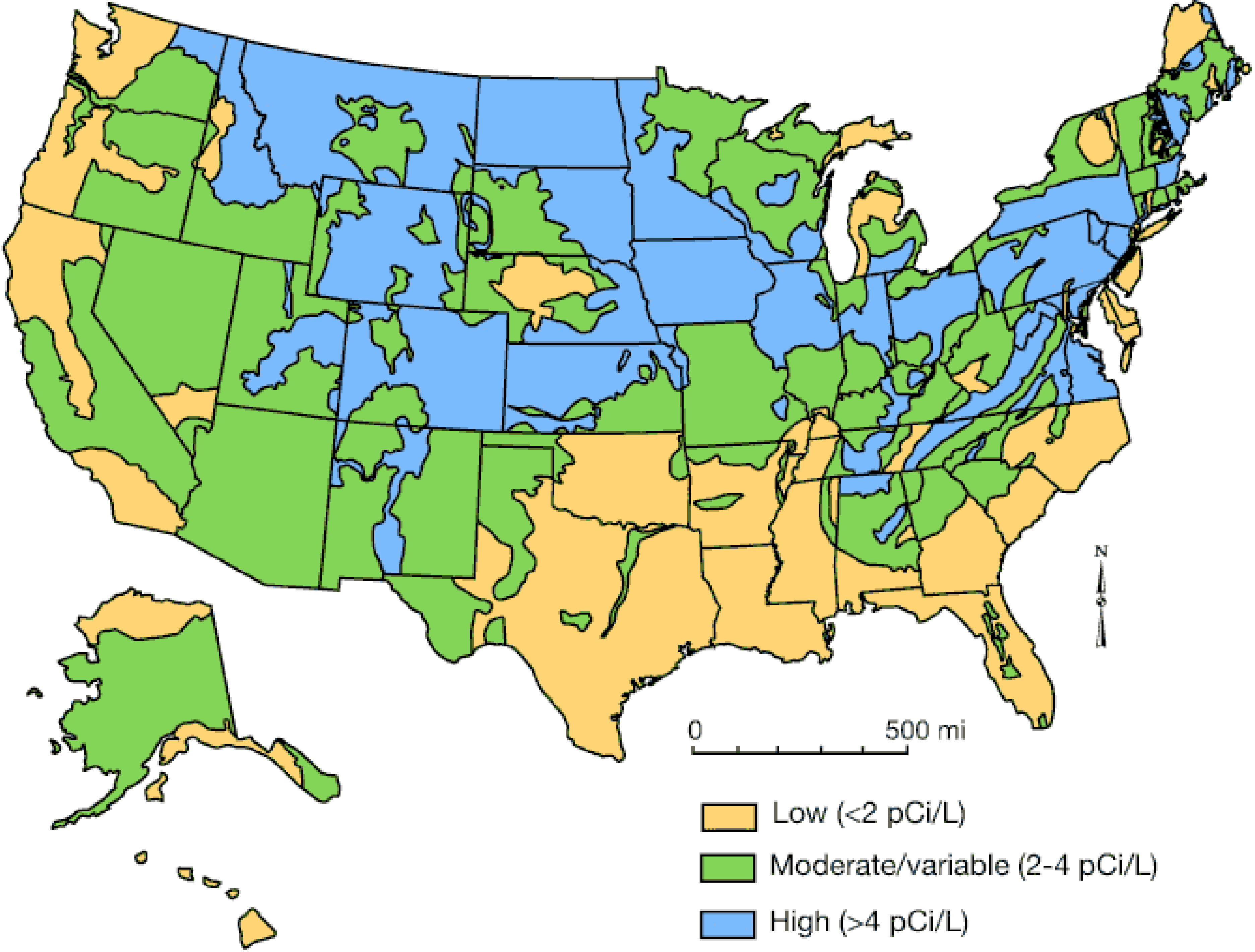
Radon gas is inert, colorless and odorless.

Exposure may contribute to lung cancer.

Smoking intensifies radon exposure and can also contribute to lung cancer



Radon in the U.S.



Anthropogenic modifications

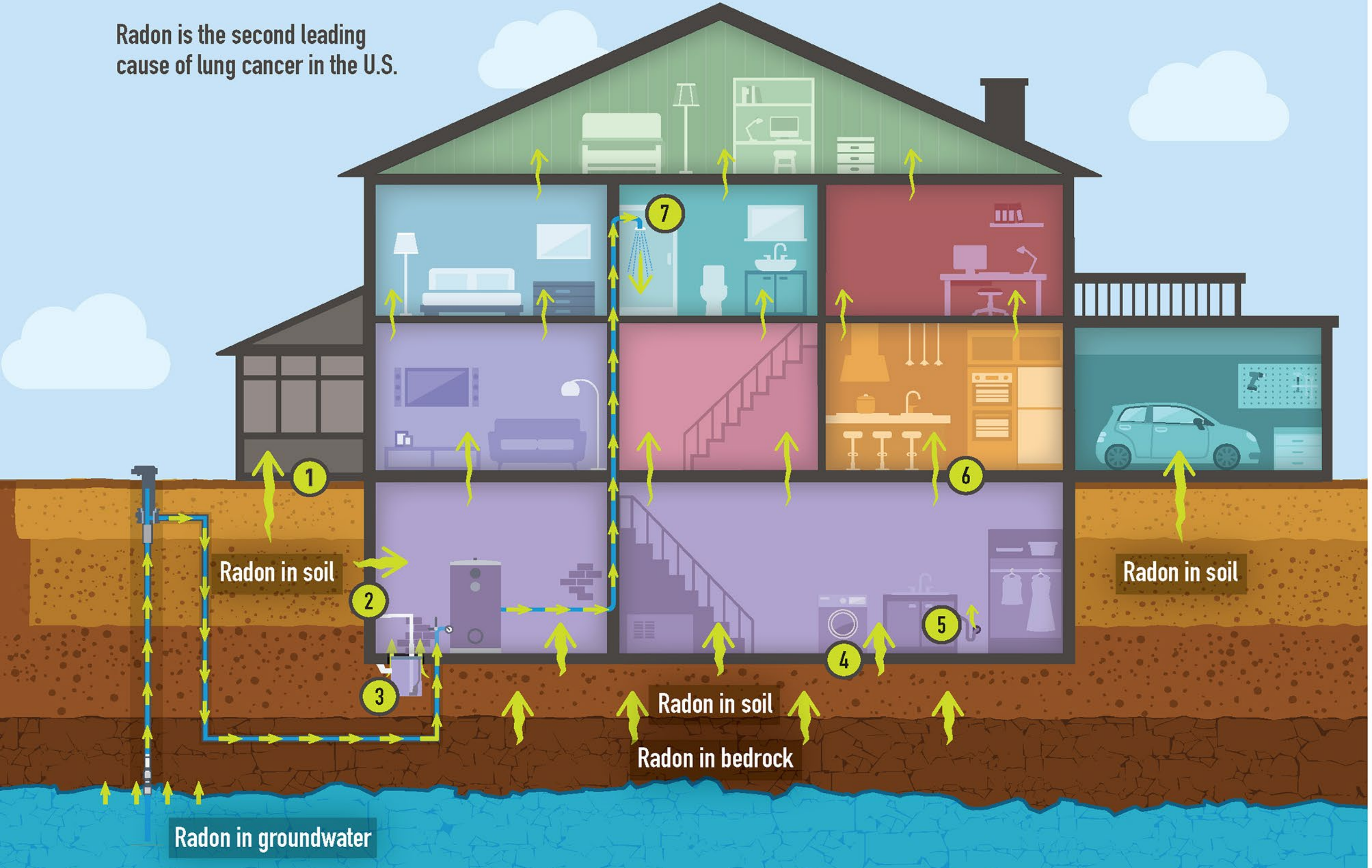
Part 1

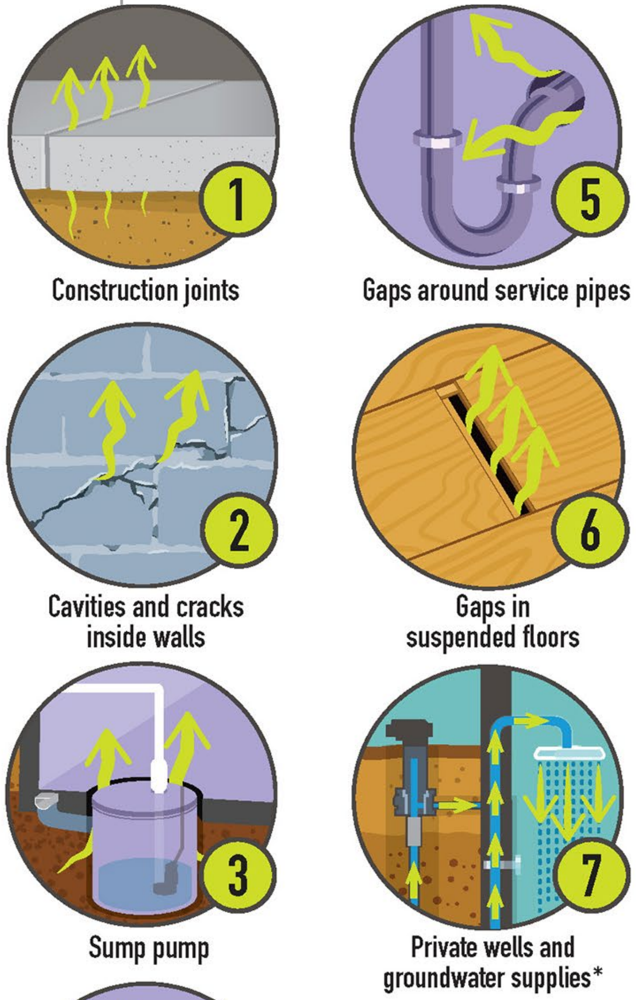
How Radon Gets into Your Home

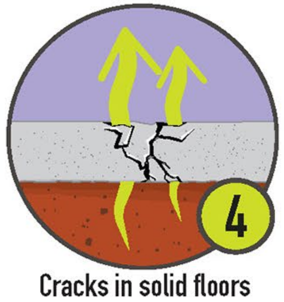
Radon is the second leading cause of lung cancer in the U.S.

CS 327538 | 12/01/2021

Test your home | Make repairs | Learn more: www.cdc.gov/radon/index.html







* High radon levels in the water supply are more likely when its source is groundwater such as private wells or a public water supply system that uses groundwater. Most public water supplies are sourced from surface water (lakes,

Radon Health Effects

Understanding Radon Levels

EPA recommends fixing your home if radon level is above 4 pCi/L

Radon Level 4 pCi/L	**Equals 200 chest x-ray per year or 8 cigarettes per day**
Radon Level 8 pCi/L	**Equals 400 chest x-ray per year or 16 cigarettes per day**
Radon Level 20 pCi/L	**Equals 1000 chest x-ray per year or 40 cigarettes per day**

Source: U.S. Department of Health and Human Services, ABDR (1990). Toxicological Profile for Radon. Atlanta. GA.

Radon by the Numbers

21,000
lung cancer deaths per year

#1
environmental cause of **any cancer**

#1
cause of lung cancer among people who have **never smoked**

10x risk of lung cancer among **people who smoke** compared with people who never smoked with same radon exposure

1 in 15
homes in the US have **high radon levels**

If radon levels are **≥ 4.0 pCi/L**, EPA recommends installing a **radon reduction system**.
This equals...

200 chest x-rays per year **or** **8** cigarettes per day

pCi/L is shorthand for picocuries per liter, the units of measurement of the amount of radon in an air sample.

2 steps
to protect yourself from radon-associated lung cancer:

Test your home's **radon levels.**

Radon Test Results
Concentration
4.0 pCi/L
1.0 2.0 3.0 4.0

Fix your home if radon levels are **≥ 4pCi/L.**

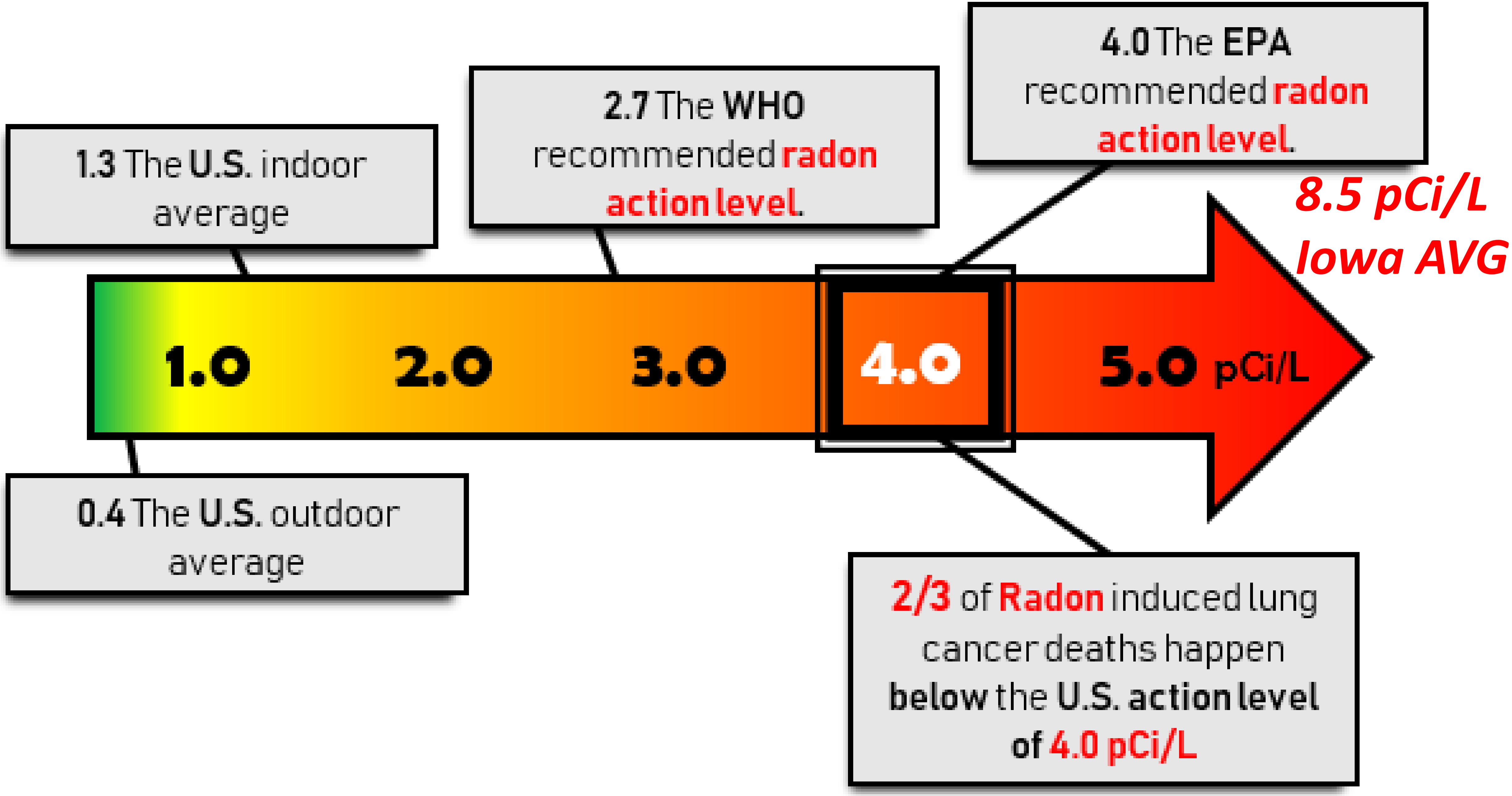
CDC

www.cdc.gov/radon

Data sources: Environmental Protection Agency (EPA) and the American Association of Radon Scientists & Technologists

Radon Regulation*

TESTING: The only way to know if you have a radon



Iowa Regulations

- 2022 A new Radon Testing Bill was signed into law, May 24,requiring thorough and more frequent radon testing for schools.

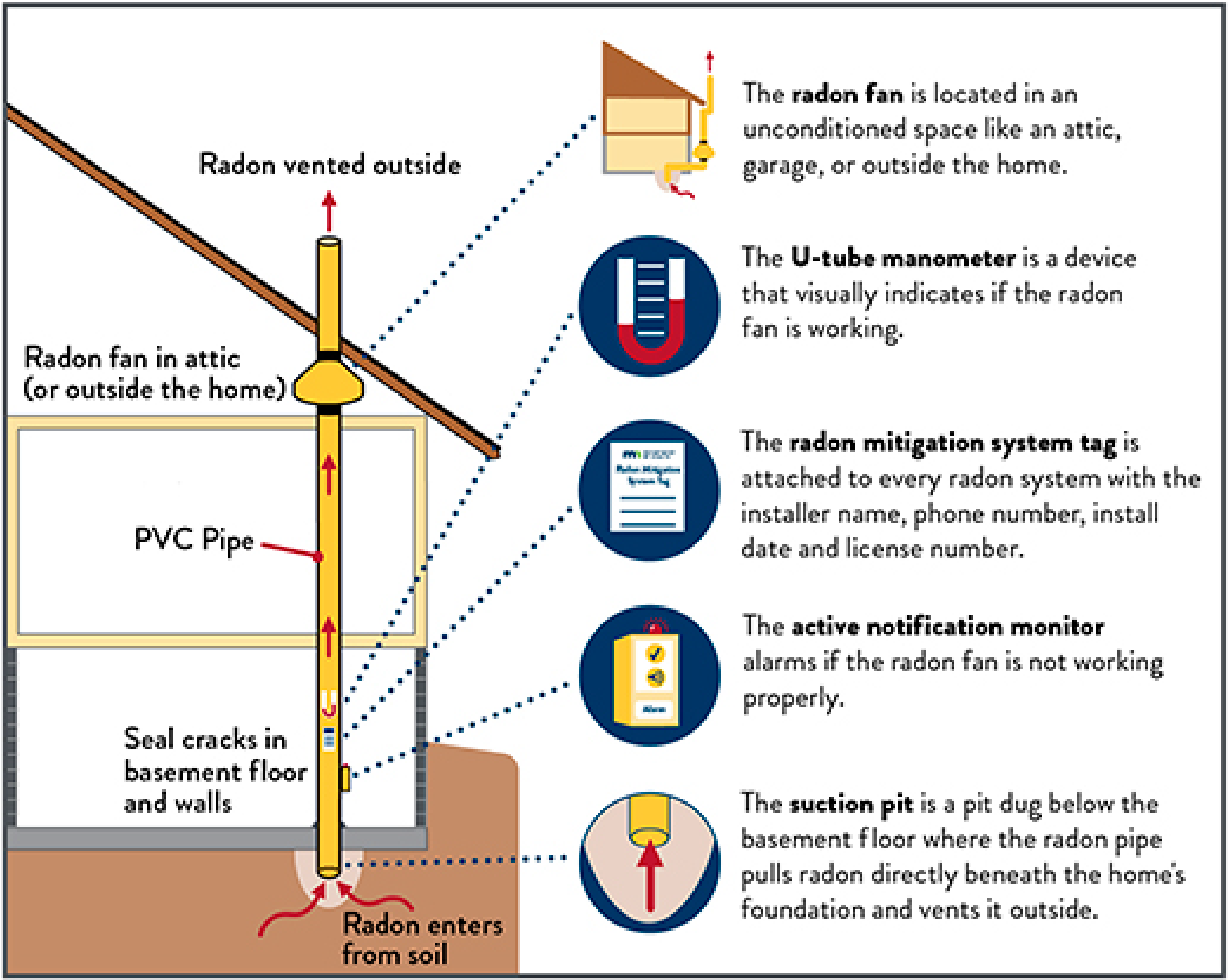
- 2021 Iowa City: Radon mitigation systems for rental units will be required to be installed by a Radon Mitigation Specialist certified by the State of Iowa. Most rental units will be required to retest for hazardous radon levels every eight years, to ensure continued functionality of the system.

- Cedar Falls - ? https://www.cedarfalls.com/1182/Rental-Code-Information

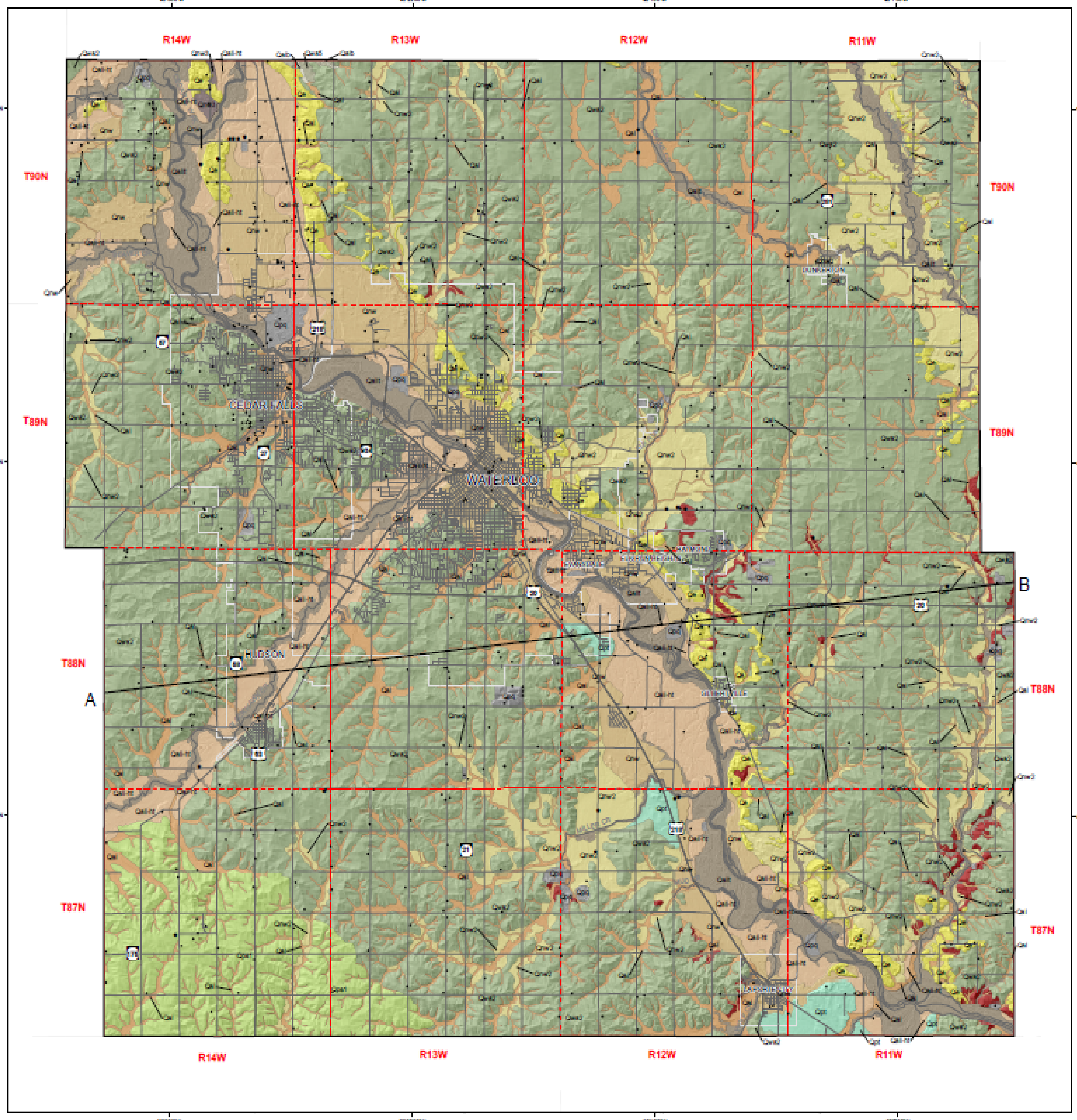
Anthropogenic modifications

Part 2- Mitigation


VS


Radon vented outside
Radon fan in attic (or outside the home)
PVC Pipe
Seal cracks in basement floor and walls
Radon enters from soil
The **radon fan** is located in an unconditioned space like an attic, garage, or outside the home.
The **U-tube manometer** is a device that visually indicates if the radon fan is working.
The **radon mitigation system tag** is attached to every radon system with the installer name, phone number, install date and license number.
The **active notification monitor** alarms if the radon fan is not working properly.
The **suction pit** is a pit dug below the basement floor where the radon pipe pulls radon directly beneath the home's foundation and vents it outside.

Surficial Geology of Black Hawk County, Iowa



LEGEND

CENOZOIC

QUATERNARY SYSTEM

HUDSON EPISODE

Qal — **Qal - Alluvium** (DeForest Formation-Undifferentiated)

Qalb — **Qalb - Alluvium Shallow to Bedrock** (DeForest Formation-Undifferentiated)

Qallt — **Qallt - Low Terrace** (DeForest Formation-Camp Creek Mbr. and Roberts Creek Mbr.)

Qall-ht — **Qall-ht - Intermediate High Terrace** (DeForest Formation-Gunder Mbr.)

HUDSON and WISCONSIN EPISODE

Qe — **Qe - Sand Dunes and Sand Sheets** (Peoria Formation-sand facies)

Qnw2 — **Qnw2 - Sand and Gravel** (Noah Creek Formation)

WISCONSIN EPISODE

Qpt — **Qpt - Loess Mantled Terrace**

Qps1 — **Qps1 - Loess and Intercalated Eolian Sand** (Peoria Formation-silt facies)

Qnw — **Qnw - Sand and Gravel** (Noah Creek Formation)

Qnw3 — **Qnw3 - Sand and Gravel Shallow to Bedrock** (Noah Creek Formation)

Qwa2 — **Qwa2 - Loamy and Sandy Sediment Shallow to Glacial Till**

Qwa5 — **Qwa5 - Loamy and Sandy Sediment Shallow to Rock**

PRE-ILLINOIS EPISODE

Qwa3 — **Qwa3 - Till** (Wolf Creek or Alburnett formations)

Other Mapping Units

Qpq — **Qpq - Pits and Quarries**

Bedrock

PALEOZOIC

DEVONIAN SYSTEM

Dlgc

Dcv

Dlc

Dw

SILURIAN SYSTEM

Sl

Shb

ORDOVICIAN SYSTEM

Om

Drill Holes

Wells

SURFICIAL GEOLOGY OF BLACK HAWK COUNTY, IOWA

Iowa Geological and Water Survey
Open File Map OFM-13-4
September 2013

prepared by

Stephanie Tassier-Surine, Deb Quade, Robert Rowden, Robert McKay, Huaibao Liu, and James Giglierano

Iowa Geological and Water Survey, Iowa City, Iowa

Iowa Department of Natural Resources, Chuck Gipp, Director
Iowa Geological and Water Survey, Robert D. Libra, State Geologist

Supported in part by the U.S. Geological Survey
Cooperative Agreement Number G12AC20280
National Cooperative Geologic Mapping Program (STATEMAP)

ACKNOWLEDGMENTS

Recognized for contributions to map's production: Special thanks to Sharon Lundy of BMC Aggregates, and Les Price of Paul Niemann Construction for allowing us access to their properties. New subsurface geologic data was mostly generated by University of Iowa students Kyle Bracken and Jaime Ricci who produced descriptive logs of water well drill samples. Michael Bounk and Tom Marshall of the Iowa Geological and Water Survey (IGWS) provided additional descriptive logging of water wells. Jason Vogelgesang and Carolyn Koebel (IGWS) prepared well samples for stratigraphic logging and assisted with field work during core collection. Ray Anderson and Brian Witzke (IGWS) provided valuable background information concerning the bedrock topography, geology and stratigraphy of the area. Cody Hackney and Casey Kohrt (IGWS) provided assistance with aerial imagery and GIS mapping technical help. A special thank you to landowners who graciously allowed access to their land for drilling: John Becker, Ron Droppert, William Droppert, Lonnie Even, Mike Even, Wayne Fitkin, Richard and Dorothy Green, Garry Hansen, Ralph Kraus, Larry Maas, Dave Myers (Heartland Farms), John and Dennis Rottinghaus, Craig Sharp, Mike and Christi Watson, Dave Zelen, Mike Zuck, Les Youngblut, the Cedar Falls Gun Club, Vern Fish (Black Hawk County Conservation Board) and Scott Graham (Dunkerton Sportsmans Club). Geoffry Tinker and Catherine Nicholas, Black Hawk County Engineers Office, allowed access to county roads for drilling and geophysics. Roger Reiter provided assistance with locating drilling sites. Drilling was provided under contract with Cahoy Well and Pump Service of Sumner, Iowa. Special thanks to driller Mark Claassen. Thank you to Joshua McNary of Aerial Services, Inc. for assistance in acquiring 2008 flood photos of the Cedar River valley. The imagery was courtesy of Aerial Services, Inc. (ASI) of Cedar Falls, Iowa - AerialServicesInc.com

Introduction to the Surficial Geology of Black Hawk County

Black Hawk County lies within the Iowan Erosion Surface (IES) Landform Region (Prior and Kohrt, 2006) in northeast Iowa. This area has been subjected to multiple periods of Quaternary glaciations and subaerial erosion. Generally speaking, the map area consists of unnamed loamy sediments (IES materials) of variable thickness overlying Pre-Illinoian glacial sediments. The Cedar and Wapsipinicon river valleys are filled with Wisconsin Episode Noah Creek Formation sand and gravel and mantled with younger Holocene terrace materials. These deposits are regionally extensive.

Previous surficial geologic mapping completed as part of the STATEMAP program includes the Gilbertville (Tassier-Surine et al., 2011) and Cedar Falls (Tassier-Surine et al., 2012) quadrangles in Black Hawk County and mapping to the north in adjacent Bremer County (Tassier-Surine et al., 2007, 2009, 2010). The only other regional surficial map of the area consists of the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991).

At least seven episodes of Pre-Illinoian glaciations occurred in this region between approximately 2.2 and 0.5 million years ago (Boellstorff, 1978a,b; Hallberg, 1980, 1986). Episodic erosion during the last 500,000 years has led to the destruction of pre-existing glacial landforms associated with Pre-Illinoian glaciations. A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years ago (Bettis, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landform recognized as the IES (Prior, 1976). A periglacial environment prevailed during this period with intensive freeze-thaw action, solifluction, strong winds, and a host of other periglacial processes (Walters, 1996). Surface soils were removed from the IES and the Pre-Illinoian till surface was significantly eroded, resulting in the development of a region-wide colluvial lag deposit referred to as a "stone line." Another common feature of this region are paha, isolated and uneroded topographic highs of loess-mantled Pre-Illinoian till with a directional orientation from northwest to southeast that exist as erosional outliers of the once higher and older landscape. Thick packages of stratified loamy and sandy sediments located low in the upland landscape and adjacent to streams are remnants of solifluction lobes associated with the formation of the IES. These materials can commonly be found along tributaries of the Cedar River.

Black Hawk County is covered by various Quaternary deposits with a maximum thickness of up to 73 m (240 ft) occurring in bedrock valleys. Surficial deposits of the map area are composed of five formations: DeForest, Noah Creek, Peoria, Wolf Creek, and Alburnett formations as well as unnamed erosion surface sediments. Hudson age deposits associated with fine-grained alluvial and colluvial sediments are composed of the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder, and Corrington members. The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe, as well as coarse to finer grained fluvial deposits associated with local stream and river valleys. Unnamed erosion surface sediments consist of reworked till and slopewash deposits associated with peri-glacial activity during the Wisconsin ice advance and may be up to 8 m (26 ft) thick. Peoria Formation eolian materials consist of fine sand and silt. A relatively thin (up to 3 m, 10 ft) loess mantle is present in the southwest portion of the county. Thick deposits of eolian sand are only present adjacent to the Cedar and Wapsipinicon river valleys. Additional eolian materials may be intermittently present mantling most other mapping units and are more abundant near stream valleys and on terraces. Pre-Illinoian glacial deposits in northeast Iowa consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation. The Wolf Creek Formation is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburnett Formation consists of several "undifferentiated" members. Pre-Illinoian till is not exposed in the map area but is mantled throughout Black Hawk County by IES materials, eolian sand, or alluvial sediments.

The Quaternary materials are underlain by Devonian and Silurian carbonate bedrock. Eleven bedrock outcrops (five quarries, five road cuts and one excavation for a lift station) were found in the map area during the field investigation. In