If You Were the EPA Administrator

American Academy of
Environmental Scientists and Engineers
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U.S. Environmental Protection Agency

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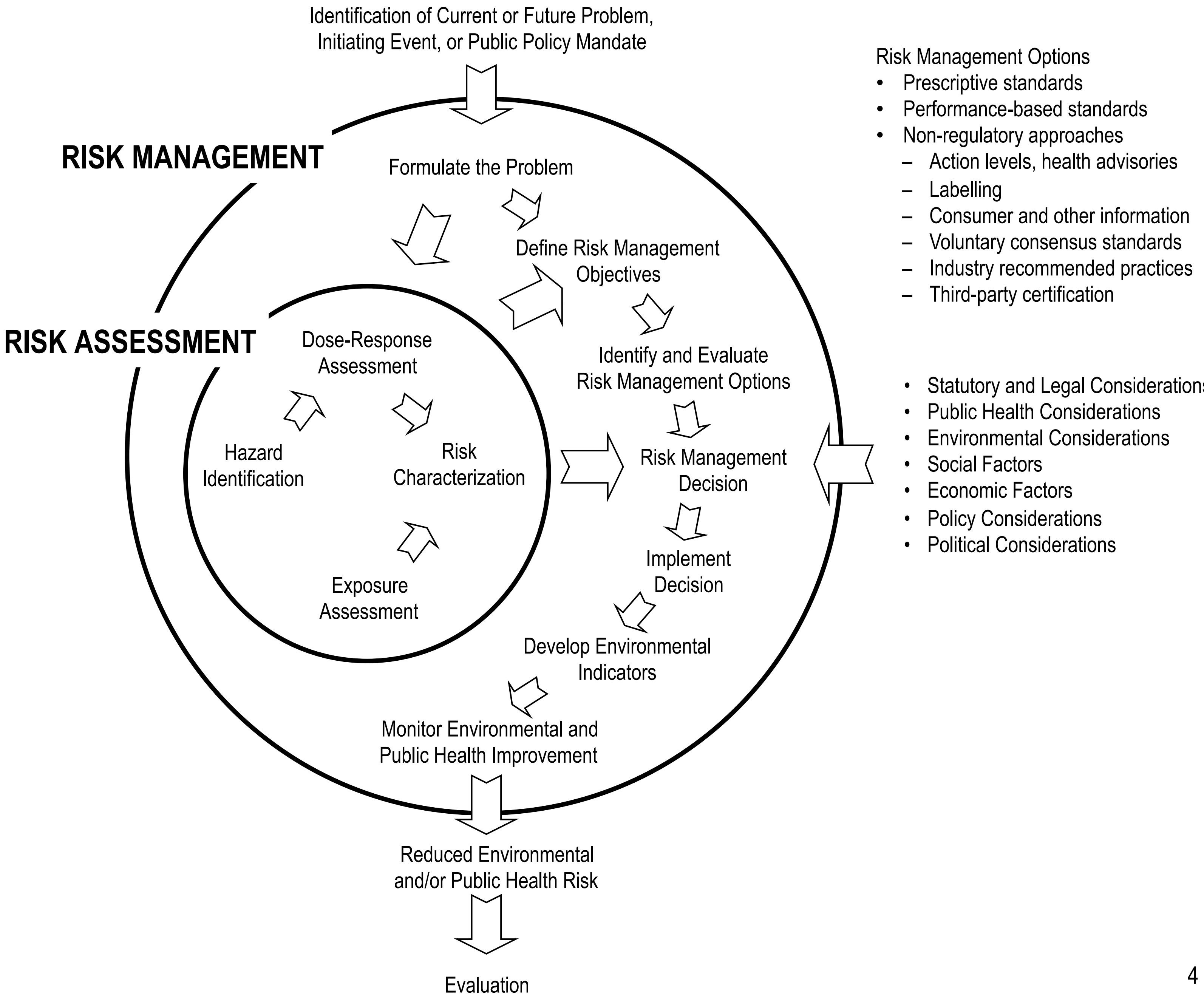
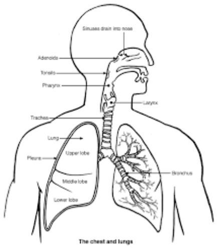
EPA Decision Making

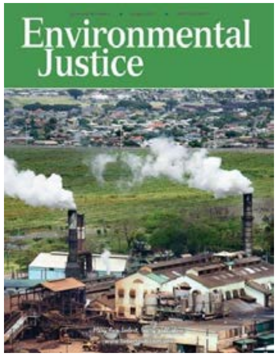

Identification of Current or Future Problem,
Initiating Event, or Public Policy Mandate
RISK MANAGEMENT
RISK ASSESSMENT
Formulate the Problem
Define Risk Management
Objectives
Identify and Evaluate
Risk Management Options
Risk Management
Decision
Implement
Decision
Develop Environmental
Indicators
Monitor Environmental and
Public Health Improvement
Dose-Response
Assessment
Hazard
Identification
Risk
Characterization
Exposure
Assessment
Reduced Environmental
and/or Public Health Risk
Evaluation
Risk Management Options
• Prescriptive standards
• Performance-based standards
• Non-regulatory approaches
– Action levels, health advisories
– Labelling
– Consumer and other information
– Voluntary consensus standards
– Industry recommended practices
– Third-party certification
• Statutory and Legal Considerations
• Public Health Considerations
• Environmental Considerations
• Social Factors
• Economic Factors
• Policy Considerations
• Political Considerations

Risk Assessment Considerations

Exposure x Dose-Response = Risk



- Cancer and non-cancer hazards
- Acute and chronic exposures
- Occupational and public health
- General and susceptible populations
  - Examples of susceptible populations: children, elderly, asthmatics, highly exposed, hypersensitive
- Ecological and Health Risks



Risk Management Options

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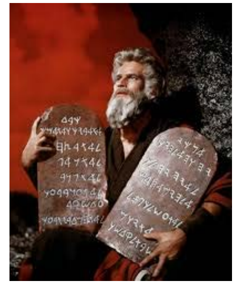
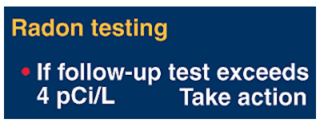
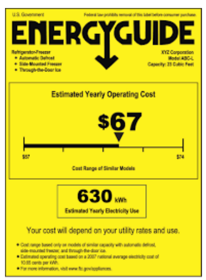
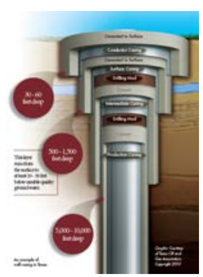




US EPA DW Health Advisories

Cyanotoxin	US EPA 10-day HA	
	Bottle-fed infants and pre-school children	School-age children and adults
Microcystins	0.3 µg/L	1.6 µg/L
Cylindrospermopsin	0.7 µg/L	3 µg/L





Non-regulatory approaches

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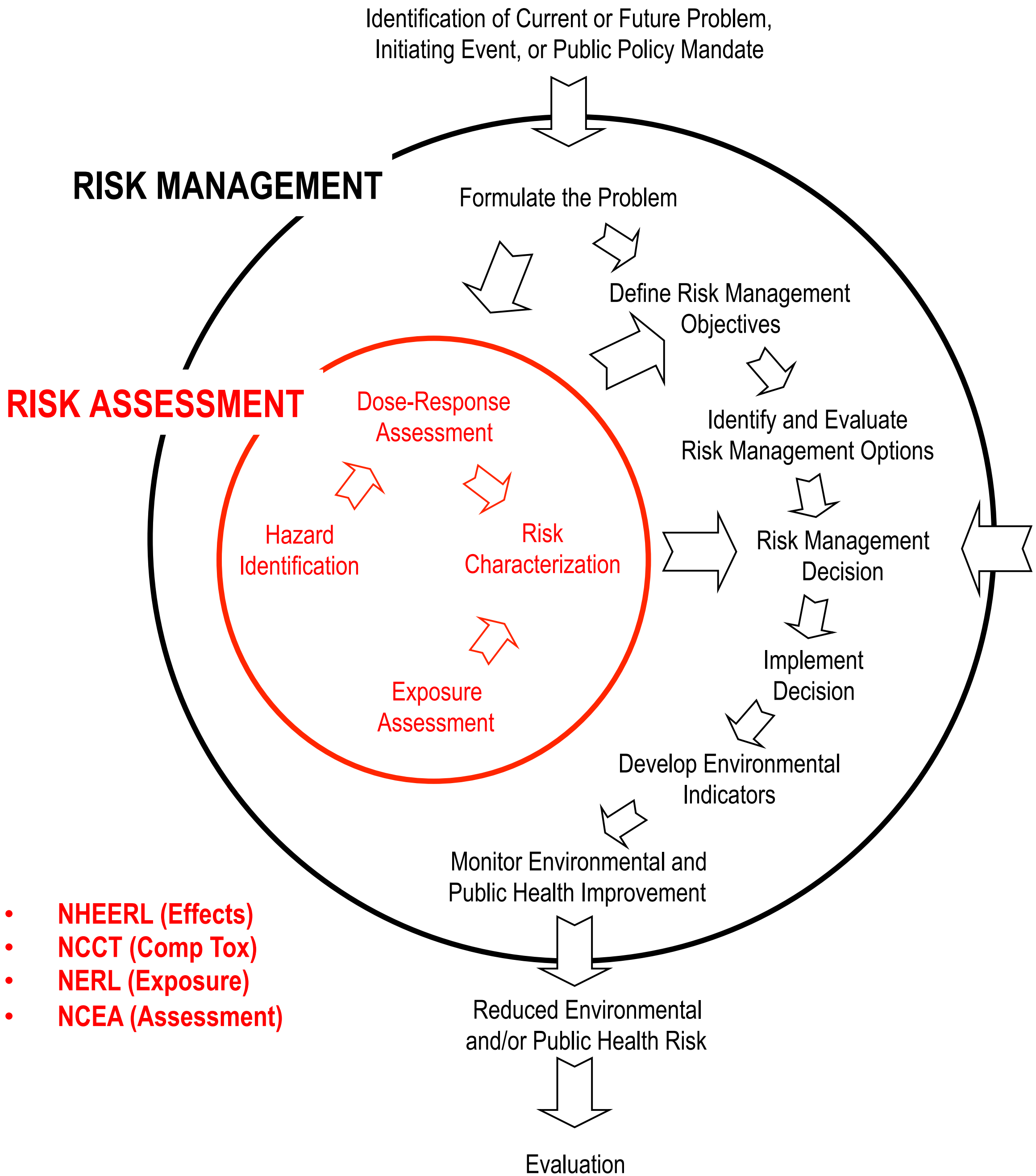

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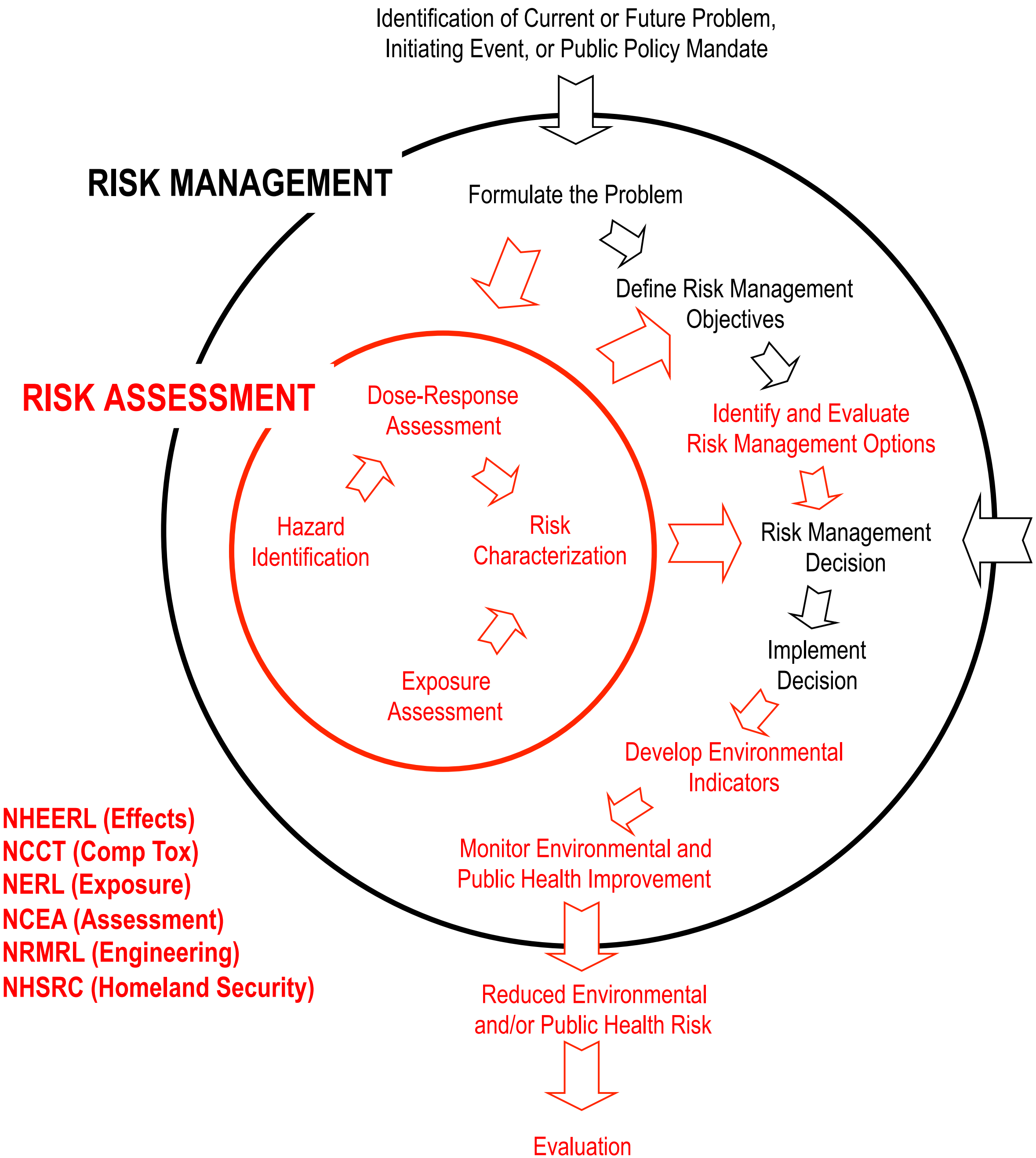
- **NHEERL (Effects)**
- **NCCT (Comp Tox)**
- **NERL (Exposure)**
- **NCEA (Assessment)**



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- **NERL (Exposure)**
- **NCEA (Assessment)**
- **NRMRL (Engineering)**
- **NHSRC (Homeland Security)**

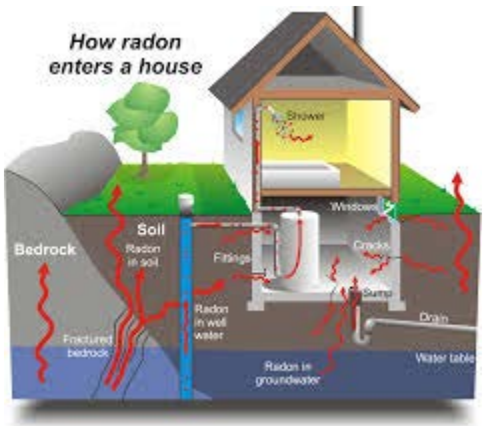
Example Case Studies

- Environmental Tobacco Smoke
- Radon
- Particulate Matter
- Lead in Drinking Water

Environmental Tobacco Smoke

- “Smoking and Health: Report of the Advisory Committee of the Surgeon General of the Public Health Service” (1964)
- “The Health Consequences of Involuntary Smoking: A Report of the Surgeon General” (1986)
- EPA’s Risk Assessment, “Respiratory Health Effects of Passive Smoking” concluded that environmental tobacco smoke is causally associated with lung cancer in adults and designated ETS as a known human carcinogen (1992).
- Executive Order 13058, "Protecting Federal Employees and the Public from Exposure to Tobacco Smoke in the Federal Workplace" (1997)

Radon



- A nuclear power plant employee triggered a radiation detector as he walked *into* work at the Limerick, PA nuclear power plant (1984).
- EPA publication “A Citizen’s Guide to Radon: What It Is and What To Do About It” (1986)
- “Indoor Radon: Exploring U.S. Federal Policy for Controlling Human Exposures” (Nazaroff and Teichman, ES&T, June 1990)
- Revised Citizen’s Guide: “If you smoke and your home has high radon levels, your risk of lung cancer is especially high.” (2012)

Particulate Matter

- Particulate matter (PM) is one of six national ambient air quality pollutants identified in the Clean Air Act.
- Over time, the standard has regulated smaller particles: Total Suspended Particles (1971), PM_{10} (1987), $PM_{2.5}$ and PM_{10} (1997, 2006, 2012).
  - Finer particles (PM_1)?
  - Ultrafine particles ($PM_{0.1}$)?
- Avoided health effects include, but are not limited to, premature adult mortality, respiratory symptoms in asthmatics, hospital admissions (asthma, non-fatal heart attacks), lost work days.
- PM NAAQS Benefit/Cost ratio: 10-171 : 1
  - Costs: \$44 M - \$290 M per year
  - Benefits: \$2,980 M - \$7532 M per year

220 km visibility

20 km visibility

Lead (Pb) in Drinking Water

- Pb exposure in young children has been linked to learning disabilities, and children with blood lead concentrations greater than 10 µg/dL are in danger of developmental disabilities.

  Pb can be found in air, water, soil, and paint (pre-1978).
  - Lead can occur in drinking water as a result of corrosion of plumbing materials, such as lead pipes, fixtures and solder.
  - Pb-Cu (LCR) rule sets a 15 ppb limit for lead measured at customer taps; if 10% exceed 15 ppb, a system must take action to control corrosion.

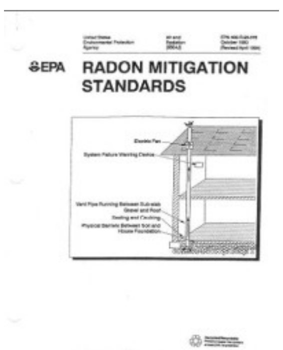
- Flint, MI
  - In 2014, the City of Flint changed its drinking water source without introducing control corrosion, elevating blood lead levels in children.
  - In March 2017, EPA awarded $100M to MI for Flint water infrastructure improvements.

Examples of AAEES Superior Achievement Award Winners (2016)

- Arsenic Removal
- De-Ammonification
- Sub-slab Depressurization for VOC
- Anaerobic Digesters
- Water Loss Detection

Exemplary Contributions from EPA's National Risk Management Research Laboratory

- Arsenic Removal
- De-Ammonification
- Sub-slab Depressurization for VOC, Radon
- Anaerobic Digesters
- Water Loss Detection
- Green Infrastructure
- Citizen Science



SWMM
Storm Water Management Model

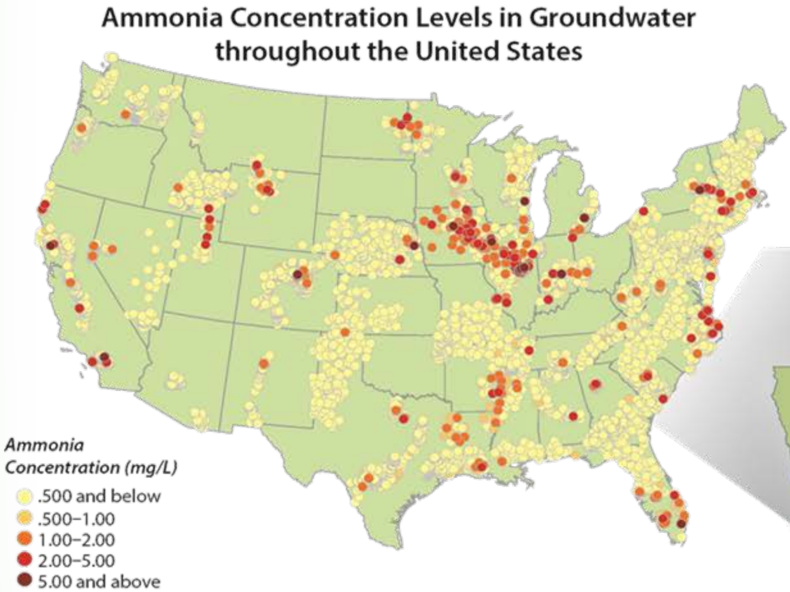
Arsenic Removal Technologies

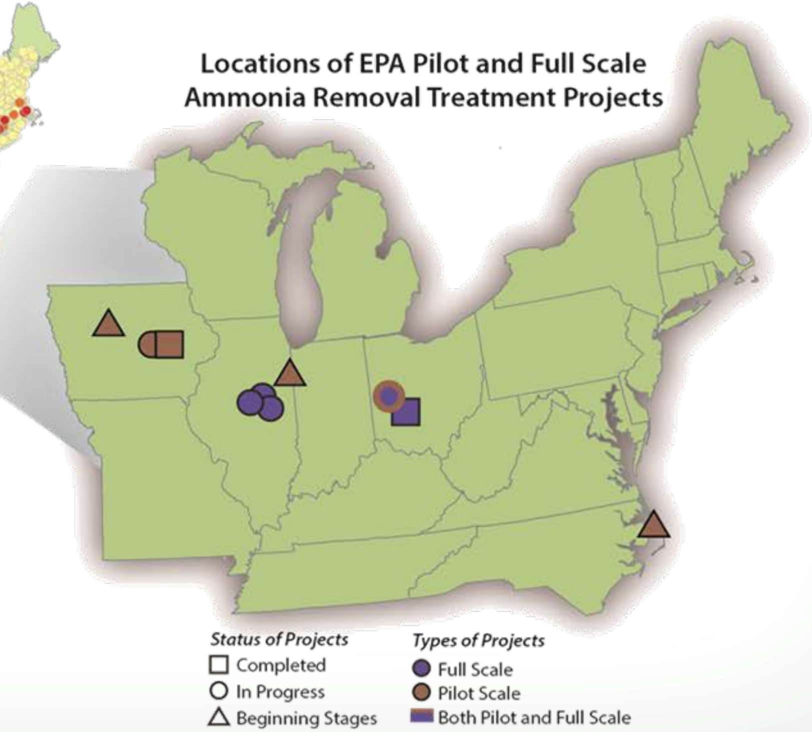
Abul Hassam

- Funded 50 small, full-scale arsenic removal systems in 26 different states, impacting over 60,000 consumers
- Data from extensive set of archived final reports is being extracted and repackaged to assist small systems.
  - Impact of arsenic on distribution system quality
  - Simultaneous removal of co-occurring contaminants
  - Residuals characterization
  - Media regeneration
  - Technology costs
- Revisiting selected demonstration sites to provide long-term performance data to the study

Ammonia and Drinking Water in the U.S.

EPA has completed or is currently conducting pilot studies and full-scale water plant evaluations at small drinking water ammonia treatment systems





Ammonia Treatment in Palo, Iowa

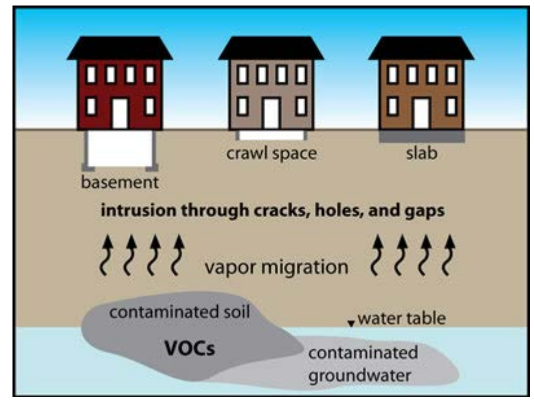
- Palo, Iowa (pop. ≈ 1000) with over 3 mg N/L ammonia in source water
- Year-long pilot study of an innovative biological treatment process was conducted on-site.
- Cooperative approach and data resulted in acceptance by State and Region.
- Full-scale plant was designed and built based on the pilot.
- Full-scale plant is in operation (since Jan. 2014) and meeting treatment goals.

Pilot Scale

Full Scale

Vapor Intrusion and Mitigation

- Vapor intrusion is the process by which chemicals in soil or groundwater, especially volatile organic compounds (VOCs) and radon, can migrate into indoor air.
- Vapor intrusion can be mitigated through the use of sub-slab ventilation systems.



Anaerobic Biological Treatment for Drinking Water

- Anaerobic biological treatment research is being studied for treatment for nitrate and perchlorate.
- Concurrent removal of contaminants amenable to anaerobic biological removal include pesticides, EDCs, personal care products, and chemicals of emerging concern.
- Work is being conducted at EPA facilities and select water utilities
- This research is providing guidance on the design and operation of biological treatment systems for the removal of pesticides and chemicals of emerging concern.

Leak Detection Platform and Research

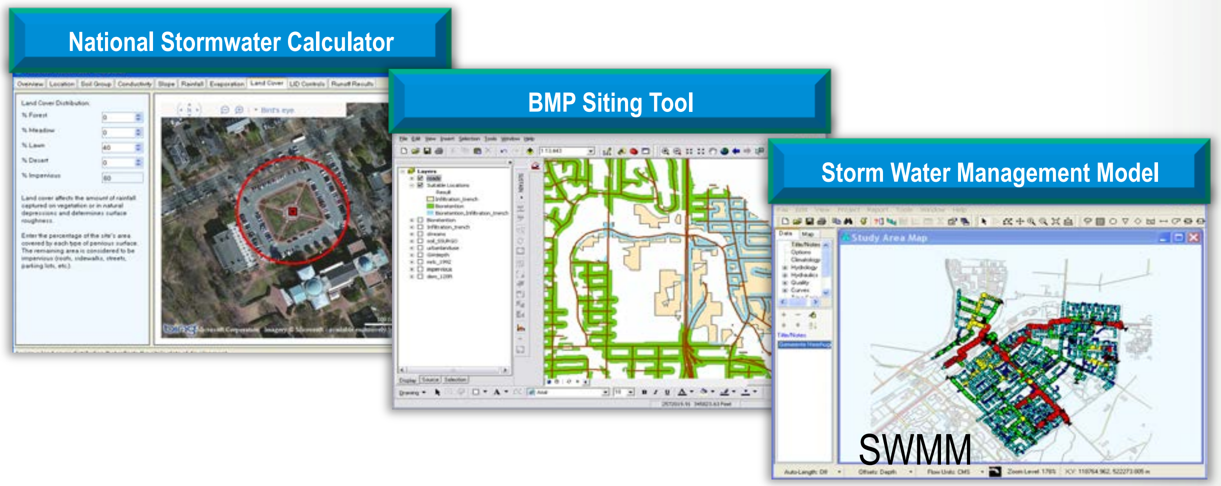
- Water loss or non-revenue water in distribution averages ~19% nationwide; up to ~50-60% in old pipe systems.
- New and well-maintained systems can achieve water loss rates <10%.
    - Experimental station built at an EPA facility
    - Testing acoustic technologies as a way to improve estimates of water loss

Green Infrastructure

Facilitating Adoption of Green Infrastructure for Stormwater Management

Partnerships

- Cincinnati, OH
- Cleveland, OH
- Omaha, NE
- Detroit, MI
- Philadelphia, PA
- Louisville, KY
- Kansas City, MO
- Camden, NJ

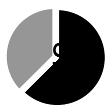


Citizen Science: The Village Green Project

Real-time data for research and environmental awareness

2012-2013:
Proof of concept (ORD NRMRL/ NERL)

ACE



PECASE award (Hagler)

2014-2015:
Pilot expansion (ORD, OAR, OECA)

R5 RARE (1 station in Chicago)

ORD Innovation (1 station, Hong Kong)

ACE (prototype support)

OECA/E-Enterprise
(5 new USA stations with state partners)

R&D for multiple installation scenarios

Rooftop version (for school in Hong Kong)

Combined solar-wind for northern latitudes

Cold weather capability

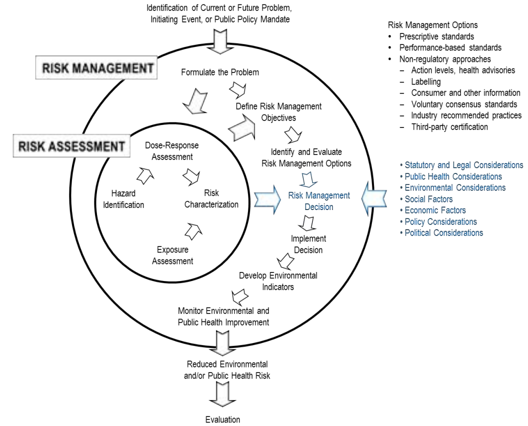
New system and website deployment (7 new stations expected by end of FY15)

New websites:

AirNow-supported data site; EPA info site`

solar/wind power • $PM_{2.5}$, ozone, weather data • public outreach

Recommendations to Improve the Use of Science in Regulatory Policy



- The Administration needs to promulgate guidelines to ensure that when Federal agencies are developing regulatory policies, they explicitly differentiate, to the extent possible, between questions that involve scientific judgments and questions that involve judgments about economics, ethics, and other matters of policy.

- The Federal government, universities, scientific journals and scientists themselves can help improve the use of science in the regulatory process by strengthening peer review, setting and enforcing clear standards governing conflict of interest, and expanding the information available about scientific studies.

DISCUSSION

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Report on the Environment

- Shows how the environment and human health in the United States is changing over time (2003 (draft), 2008, 2015)

- Presents the best available *lagging* indicators of national trends in air, water, land, human exposure and health, and ecological conditions
  - What are the trends in outdoor air quality and their effects on human health and the environment?
    - 24 indicators including NAAQS concentrations, emissions, acid deposition, ozone injury to plants, etc.
  - What are the trends in indoor air quality and their effects on human health?
    - 2 indicators: Homes at or above the EPA radon action level; serum cotinine

- http://cfpub.epa.gov/roe/index.cfm

Water Quality in Large Buildings

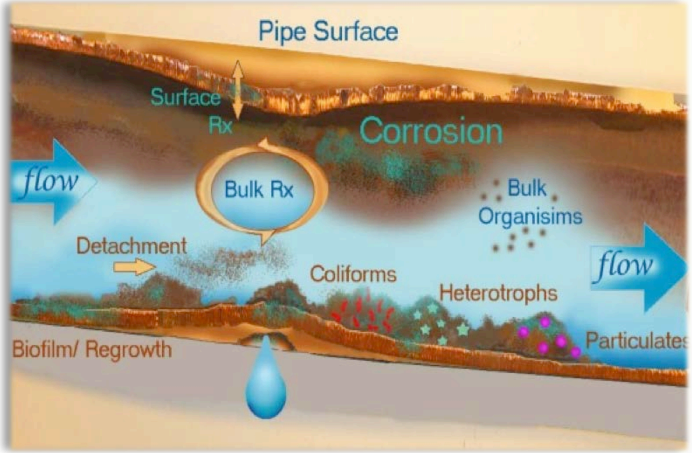
Collaborative effort between EPA, multiple hospitals, multiple States, Greater Cincinnati Water Works, VA, Army, Regions

Issue

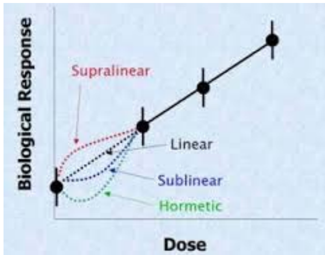
- Poor water quality poses potentially serious health implications due to long plumbing runs, complicated plumbing configurations, usage patterns, low-flow fixtures, and storage tanks.

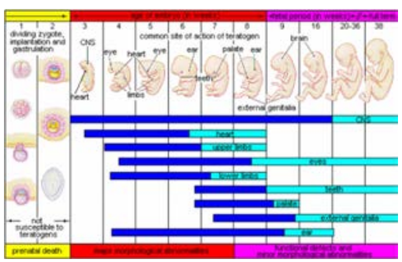
Challenges

- Corrosion
- Biofilm control
- Legionella and other pathogens
- Accumulated contaminants
- Disinfectant residual maintenance



Challenges and Opportunities





- Extrapolation from…
  - Occupational exposures to environmental exposures
  - Animal toxicology studies to human health effects
  - In vivo, in vitro, in silico toxicology to human health effects
- Harmonization of…
  - Cancer and non-cancer risks
  - Ecological and public health risks
- Chemical Mixtures and Cumulative Risk Assessment
  - Including non-chemical stressors
- Exposure Guidelines
  - Exposure is a function of concentration and time
  - Windows of susceptibility
- Uncertainty and Variability
- Leading vs. Lagging Indicators of Environmental Conditions
- Evolution of Genomics and Genome Engineering

Improving the Use of Science in Regulatory Policy

- The use of science in the formulation of regulatory policy – by both the Executive Branch and the Congress – has been a political flashpoint in recent decades.
- Policy makers often claim that particular regulatory decisions have been driven by, or even required by science; their critics, in turn, have attacked the quality or the interpretation of that science.
- Such conflict has left the U.S. with a system that is plagued by charges that science is being “politicized” and that regulation lacks a solid scientific basis.
- As a result, needed regulation may be stymied, dubious regulations may be adopted, issues can drag on without conclusion and policy debate is degraded.
- Moreover, the morale of scientists is weakened, and public faith in both government and science is undermined.
- The question is not whether scientific results should be used in developing regulatory policy, but how they should be used.

Bipartisan Policy Center
August, 2009