



EPA's Report on the Environment

2008



Issues for Initial Consultation with the
SAB Advisory Committee on
EPA's Report on the Environment

June 2009



Historical Perspective and Future Direction

Topics

- Overview of the ROE
- Restructuring the ROE
- Consultation Issues:
 - Conceptual models
 - Supplemental information
- Examples:
 - Drinking water
 - Outdoor air

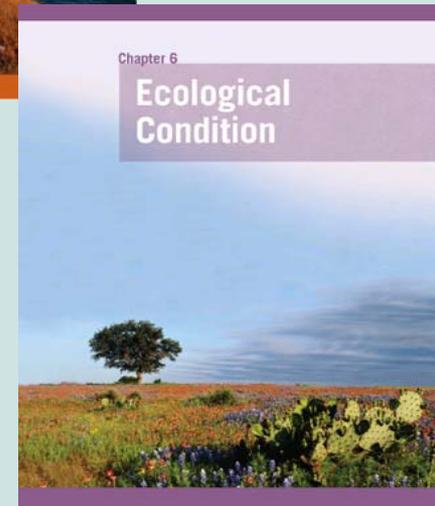
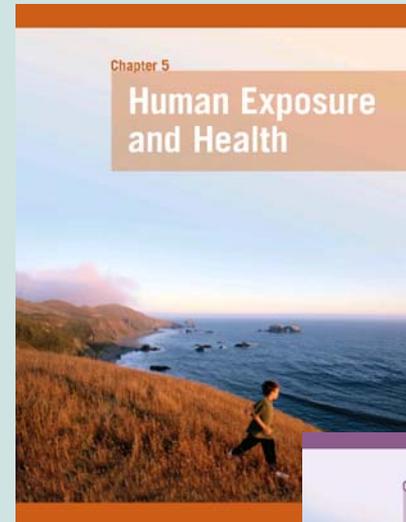
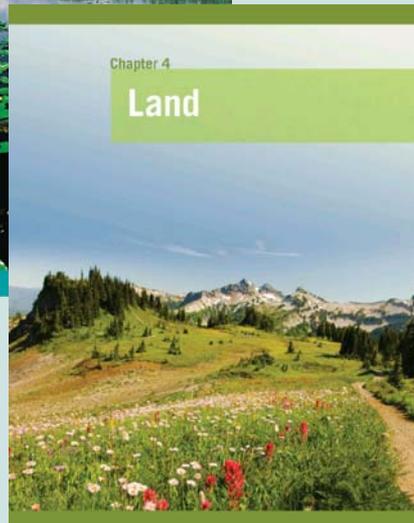


Overview of the ROE

ROE Purpose

- Presents scientifically sound indicators of status and trends and important gaps in environmental and human health conditions to answer questions important to EPA's mission.
 - Does *not* analyze or diagnose the reasons for, and relationships between, trends in stressors and environmental and health outcomes.
- Provides objective, reliable information on status and trends and important scientific input to EPA planning, decision making and priority setting.
 - Not intended to be the *only* scientific input needed to inform planning and decision making.

How is the ROE organized?



The ROE Questions—Examples

- *What are the trends in...*
 - *...outdoor air quality and their effects on human health and the environment?*
 - *...the quality of drinking water and their effects on human health?*
 - *...land cover and their effects on human health and the environment?*
 - *...human exposure to environmental contaminants?*
 - *...the extent and distribution of the nation's ecological systems?*

How does the ROE answer the questions?

- Presents 85 indicators
 - meet ROE indicator definition and criteria
 - peer reviewed
- Describes gaps
- Describes limitations

What are the ROE indicator criteria?

- The indicator is **useful**. It answers (or makes an important contribution to answering) a question in the ROE.
- The indicator is **objective**. It is developed and presented in an accurate, clear, complete, and unbiased manner.
- The underlying data are characterized by **sound collection methodologies, data management systems to protect their integrity, and quality assurance procedures**.

What are the ROE indicator criteria?

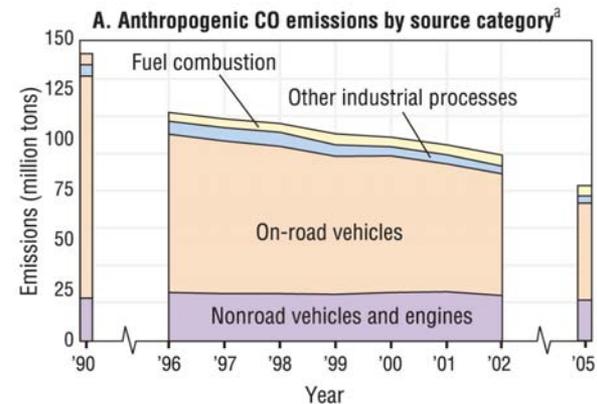
(continued)

- Data are available to **describe changes or trends** and the latest available data are **timely**.
- The data are **comparable across time and space**, and representative of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.
- The indicator is **transparent and reproducible**. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

ROE Indicator Examples

- *Examples from the air chapter:*
 - Example question: What are the trends in outdoor air quality and their effects on human health and the environment?
 - Example indicators: Carbon Monoxide Emissions, Regional Haze, Ozone Levels over North America
- See [Indicator: Carbon Monoxide Emissions](#)

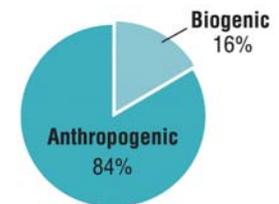
Exhibit 2-1. CO emissions in the U.S. by source category, 1990, 1996-2002, and 2005



^aData are presented for 1990, 1996-2002, and 2005, as datasets from these inventory years are all fully up-to-date. Data are available for inventory years 1991-1995 and 2003-2004, but these data have not been updated to allow comparison with data from 1990, 1996-2002, and 2005.

Data source: U.S. EPA, 2009

B. Relative amounts of CO emissions from anthropogenic and biogenic sources, 2005



Example of Gaps and Challenges

- Question:
 - *What are the trends in outdoor air quality and their effects on human health and the environment?*
- Gap:
 - No national-level indicators of human exposure to outdoor air pollutants or effects of those exposures.
- Challenges:
 - Actual measurements of human exposure nationwide would be highly resource intensive.
 - Incomplete scientific understanding of how all air pollutants, whether acting alone or in combination, can affect human health.

Major Gaps in 2008 ROE

- There are almost no reliable national indicators of trends in the effects of contaminants in air, water, and land on human health or ecological condition.
- Scaling of indicators remains challenging.
- Quantifying uncertainty is a priority.

The eROE

www.epa.gov/roe contains:

- Electronic version of the ROE (eROE)
- Underlying data, metadata, references, and peer review documentation for the ROE indicators
- Regional reports presenting ROE indicators relevant to each EPA Region
- Updates of the ROE indicators (quarterly)
- EPA's *2008 Report on the Environment: Highlights of National Trends* (highlights of the ROE for the interested public)

The screenshot displays the EPA's Report on the Environment (ROE) 2008 website. At the top right, it identifies the U.S. Environmental Protection Agency. The main heading is "Report on the Environment (ROE) 2008". Below this, there is a search bar with options for "All EPA" and "This Area", and a "Go" button. A breadcrumb trail indicates the user's location: "You are here: EPA Home » EPA's Report on the Environment (ROE)".

The page features a left-hand navigation menu with the following items: "Report on the Environment Home", "Basic Information", "Where You Live", "Frequent Questions", "Downloads", "Glossary", "What You Can Do", and "Related Links".

The main content area includes a descriptive paragraph: "The Report on the Environment (ROE) is a project that asks important questions about trends in our nation's environment over time. The ROE is composed of two reports – the '2008 Report on the Environment,' a technical document intended for environmental professionals, and the '2008 Report on the Environment: Highlights of National Trends,' (sometimes referred to as the ROE Highlights Document) which summarizes the key findings of the technical document without all of the technical detail. The ROE presents the best available, scientifically sound information on national environmental and human health trends critical to EPA's mission and of interest to the public."

Below this, another paragraph states: "This electronic presentation (also referred to as eROE) provides access to all the environmental trend data contained in both reports in one location and in a searchable format. This Web site also provides access to the methodology, references, and sources of additional information behind the indicators that form the foundation of the reports. The navigational graphic below is an integration of both the technical and highlight reports that gives you several options for accessing content (e.g., chapter tabs, pdfs, or dynamic Web sites)."

A navigation bar contains tabs for "ROE", "Air", "Water", "Land", "Human Health", and "Ecological Condition". Below this, there are sections for "Reports" and "What is the ROE".

The "What is the ROE" section features a large image of the 2008 EPA Report on the Environment cover. To the right of the image, there are two main sections:

- Report on the Environment**: "Access the EPA 2008 ROE to view EPA's answers to today's environmental questions:"
 - [ROE Dynamic Web Site](#): "Click into the details of the EPA's 2008 ROE - chapter text and individual indicators."
 - [EPA's 2008 Report on the Environment \(pdf\)](#)
- Highlights of National Trends**: "Access the ROE: Highlights of National Trends Report to learn more about the key points:"
 - [ROE Highlights Dynamic Web site](#): "Click into the details of the EPA's ROE Highlights Document - for overviews and key points."
 - [EPA's 2008 Report on the Environment: Highlights of National Trends \(pdf, 40 pp, 2.9 Mb, About EDE\)](#)

A "Next >" link is located at the bottom of the page.

Chronology

- 2001-2002 Peer review of indicators, internal Agency review, external review.
- Jun 2003 EPA publishes 2003 Draft ROE TD.
- **Mar 2004** **SAB Panel reviews the 2003 Draft ROE TD.**
- Jun 2005 External peer review of proposed indicators for 2007 ROE TD.
- Jul 2005 Public peer review workshop on the proposed indicators.
- Oct 2005 EPA announces a second public peer review and public comment period for additional and updated proposed indicators.
- Feb 2006 Agency review of 2007 draft report.
- Mar 2006 EPA releases the updates to the indicators, external peer review comments, and EPA's Response to Comments.
- Oct 2006 Interagency review of the 2007 draft report.
- May 2007 EPA releases the draft report for public review and comment.
- **Jul 2007** **SAB Panel reviews the 2007 draft report.**
- May 2008 EPA releases the final report, EPA's 2008 ROE.



ROE Future Directions

- EPA intends to publish the next full edition of the ROE in 2012.
 - Emphasis on presenting the status and trends information to environmental and human to inform the Agency's planning and decision making.
- EPA intends to restructure the ROE to more directly it with the Agency's Strategic Plan.
 - Will take into account the new Administration's goals and priorities.
- EPA plans to enhance indicator information to include quantitative uncertainty information.

SAB Comments (2007): Conceptual Frameworks

- EPA should incorporate a conceptual framework to illustrate the connectedness between the media, human health, and ecological condition.
- The conceptual framework should address relationships between source, transport, and fate of human and environmental health hazards, as well as exposure to receptors, dose, and impact.
- EPA should explicitly state how each question in the Report is related to a conceptual framework.
- EPA should provide a clear description of why each indicator is important, the rationale for selecting the indicator, what it tells, and the documented relationship between the indicator and human health and ecological condition

SAB Comments (2007): Indicators

- The criterion of national representation excludes potentially valuable and relevant regional indicators supported by long-term data sets.
- EPA should consider relaxing the restrictive indicator selection criteria so that additional indicators can be included.

SAB Comments (2007) for Future Consultations

- Systematic treatment of indicator uncertainty
- Scaling and sub-national indicators
- Synthesis and integration component



Restructuring the ROE

Restructuring the ROE to Better Meet EPA's Information Needs

- More visibly align ROE with Agency's strategic architecture.
 - Align 2012 ROE chapters with EPA Strategic Plan Goals
 - Align 2012 ROE policy questions with objectives in EPA Strategic Plan
- Develop conceptual models for each ROE question.
- Include supplemental information.

Background: EPA's Strategic Plan

- The public manifestation of Agency planning.
- Serves as the Agency's road map over 5-year horizons and guides EPA in establishing the annual goals.
- Helps EPA measure progress in achieving strategic goals and recognize where adjustments are needed.
- Basis to focus on the highest priority environmental issues and ensure taxpayer dollars used effectively.

EPA Strategic Architecture

- Five Goals
 - Clean Air and Global Climate Change
 - Clean and Safe Water
 - Land preservation and Restoration
 - Healthy Communities and Ecosystems
 - Compliance and Environmental Stewardship
 - Objectives
 - Sub-objectives
 - Strategic measures

Example

- Goal 2: Clean and Safe Water
 - Objective 2.1: Protect human health
 - Sub-objective 2.1.1: Water safe to drink
 - Strategic measure: By 2014, 93 percent of population served by CWS will received water meeting all health-based standards

NOTE: Agency Strategic Plans must be updated every three years. The examples provided here are from the 2009-2014 "Change Document" which proposes changes to the 2006-2011 Strategic Plan, and are intended for illustrative purposes only.

Example 1

Based on 2008 ROE Drinking Water Question

- Example will show:
 - Alignment with EPA Strategic Plan
 - Use of conceptual model
 - Use of supplemental information

**EPA Strategic Plan Goal 2:
Clean and Safe Water**

**ROE Chapter 2:
Water**

**EPA STRATEGIC OBJECTIVE
2.1 Protect Human Health**

Protect human health by reducing exposure to contaminants in drinking water (including source waters), in fish and shellfish, and in recreational waters

**Sub-objective 2.1
Water Safe to Drink**

Strategic Measures

2008 ROE POLICY QUESTION

What are the trends in the quality of drinking water and their effects on human health?

Indicators

Alignment of Strategic Measures and ROE Information: Drinking Water

STRATEGIC PLAN (Change Document)

- **Strategic measures**
 - Populations served by CWS with no health-based violations
 - Percent of CWS providing drinking water that meets health-based standards
 - Actions taken to protect source waters
 - Safe drinking water for tribal populations
 - Safe drinking water in US-Mexico border area and Pacific Island territories (Goal 4)
- **Proposed “changes in strategies”**
 - Emerging contaminants, measures related to SWTR and DBP Rule
- **“Challenge” (from 2008 PAR)**
 - Water scarcity

2008 ROE

- **ROE indicator**
 - Populations served by CWS with no health-based violations
- **Proposed ROE indicator**
 - Expanded coverage to tribal populations
- **ROE indicator gaps**
 - Quality of water from systems *with* violations
 - Bottled water
 - Private wells
 - WBD outbreaks and illnesses

Conceptual Model to Support Planning, Problem Formulation, and Decision-Making

- Helps build consensus about the scope and intent of question
- Provides a common framework
 - To identify and select indicators
 - To identify gaps and supplemental information needs
 - To identify possible strategic measures and where research might be directed
- Envision dialogue around ROE questions

Conceptual Diagram for the 2008 ROE Drinking Water Question

QUESTION: What are the trends in the quality of drinking water and their effects on human health?

CONTAMINANT SOURCES

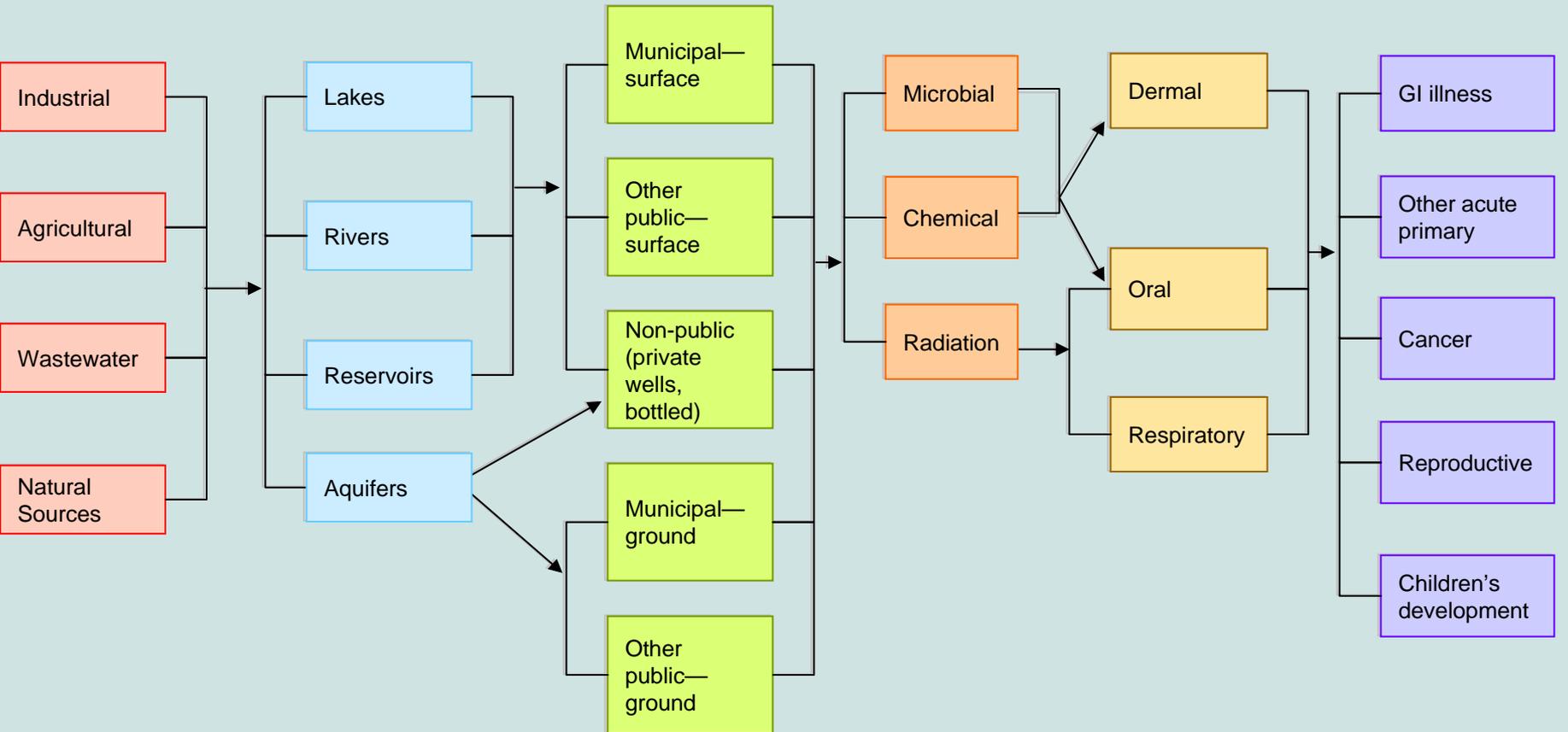
DRINKING WATER SOURCES

DRINKING WATER SYSTEMS

CONTAMINANTS OF CONCERN

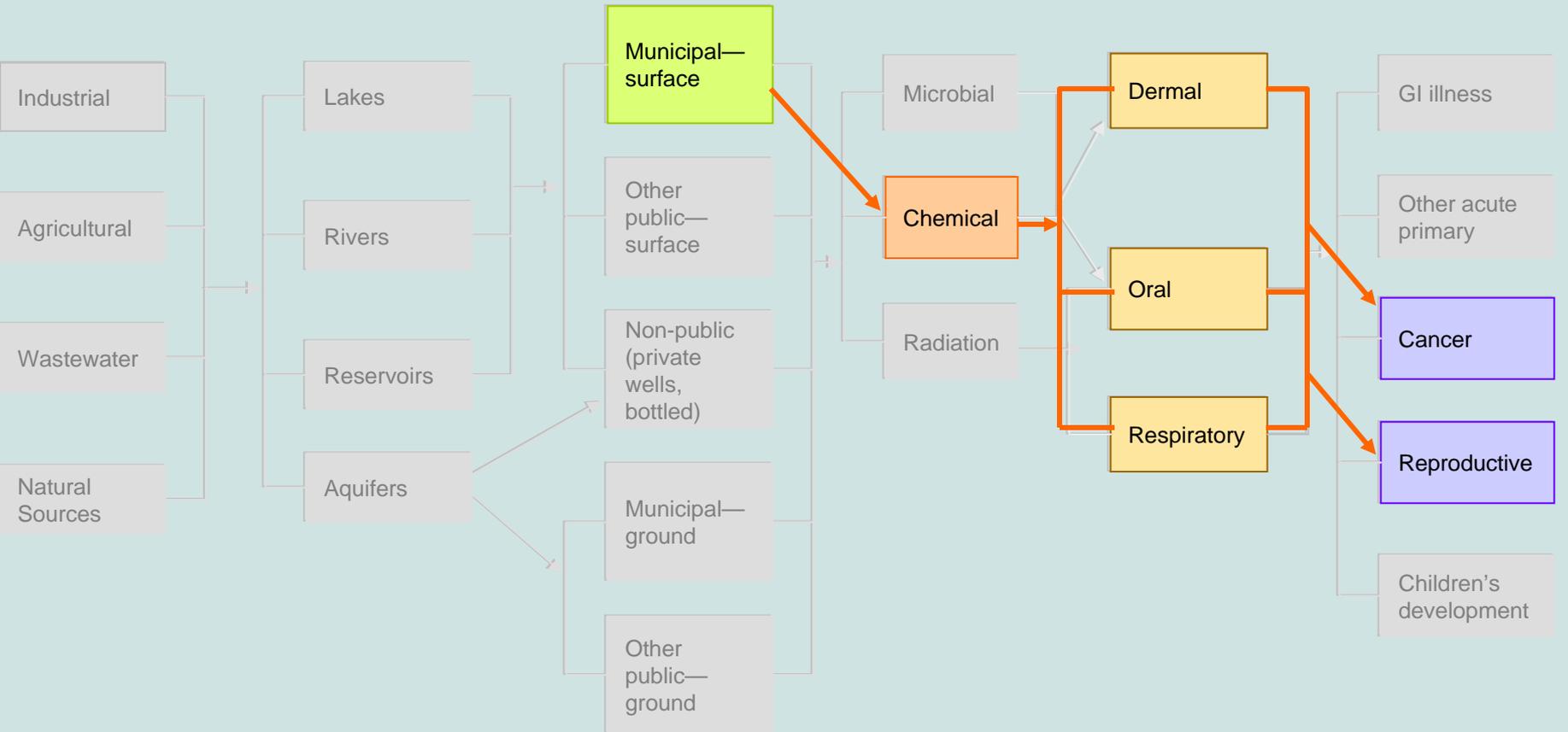
EXPOSURE

HEALTH EFFECTS



Conceptual Diagram for the 2008 ROE Drinking Water Question

QUESTION: What are the trends in the quality of drinking water and their effects on human health?



Conceptual Approach for Estimating Human Chloroform Uptake

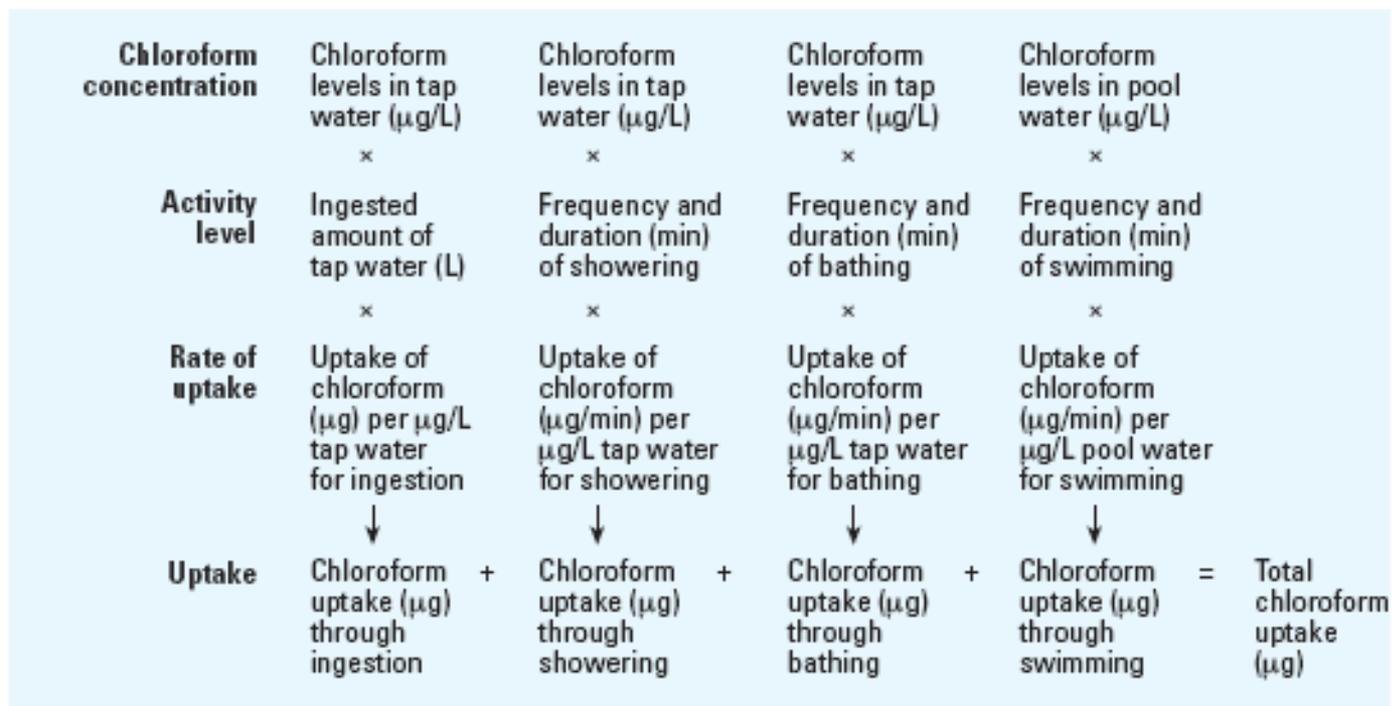
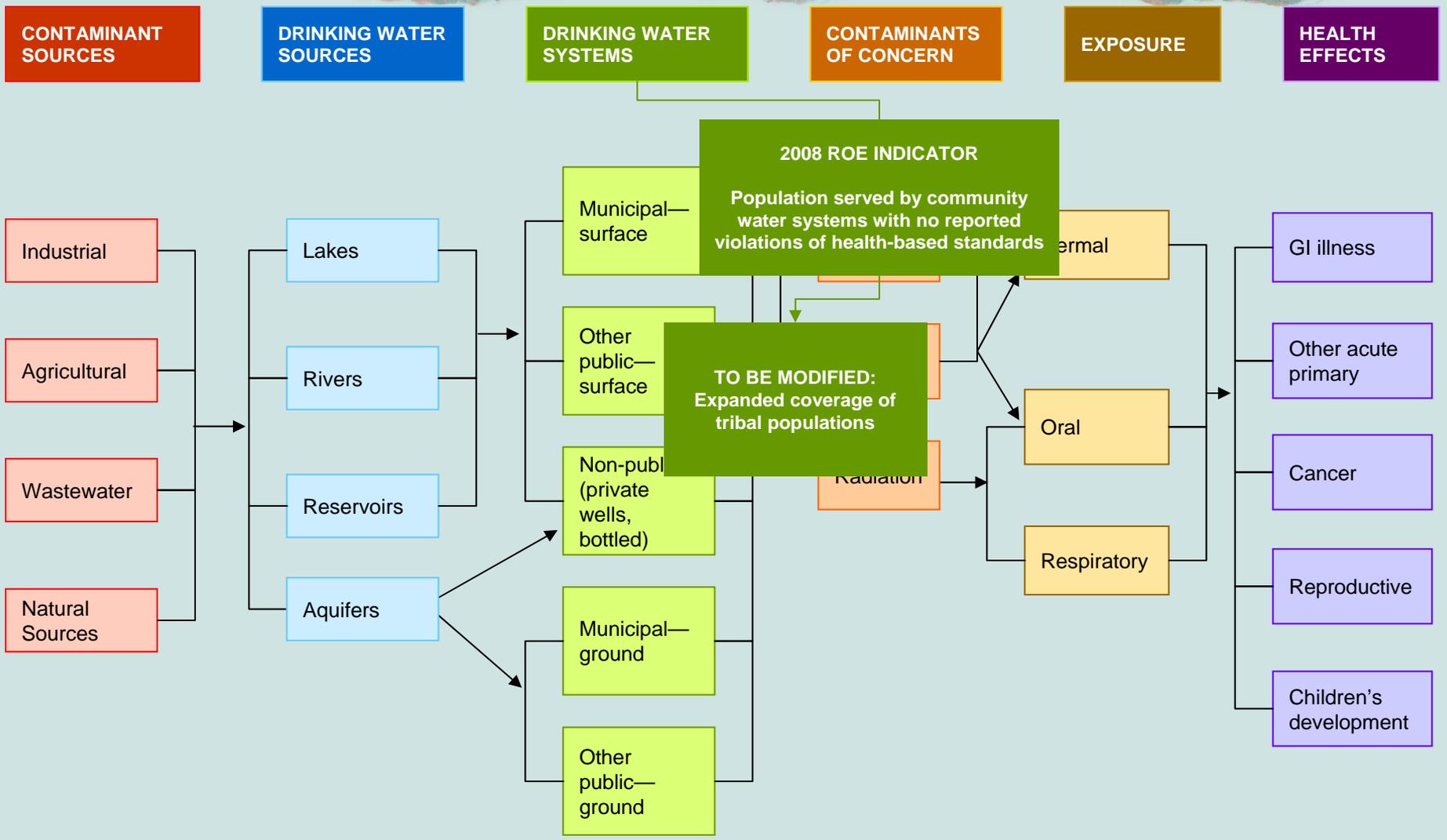


Figure 1. Schematic overview of the simulation of chloroform uptake for a mother.

Source: Whitaker et al., 2003. The Relationship between Water Concentrations and Individual Uptake of Chloroform: A Simulation Study. *Environ Health Perspect* 111:688–694.

Conceptual Diagram for the 2008 ROE Drinking Water Question

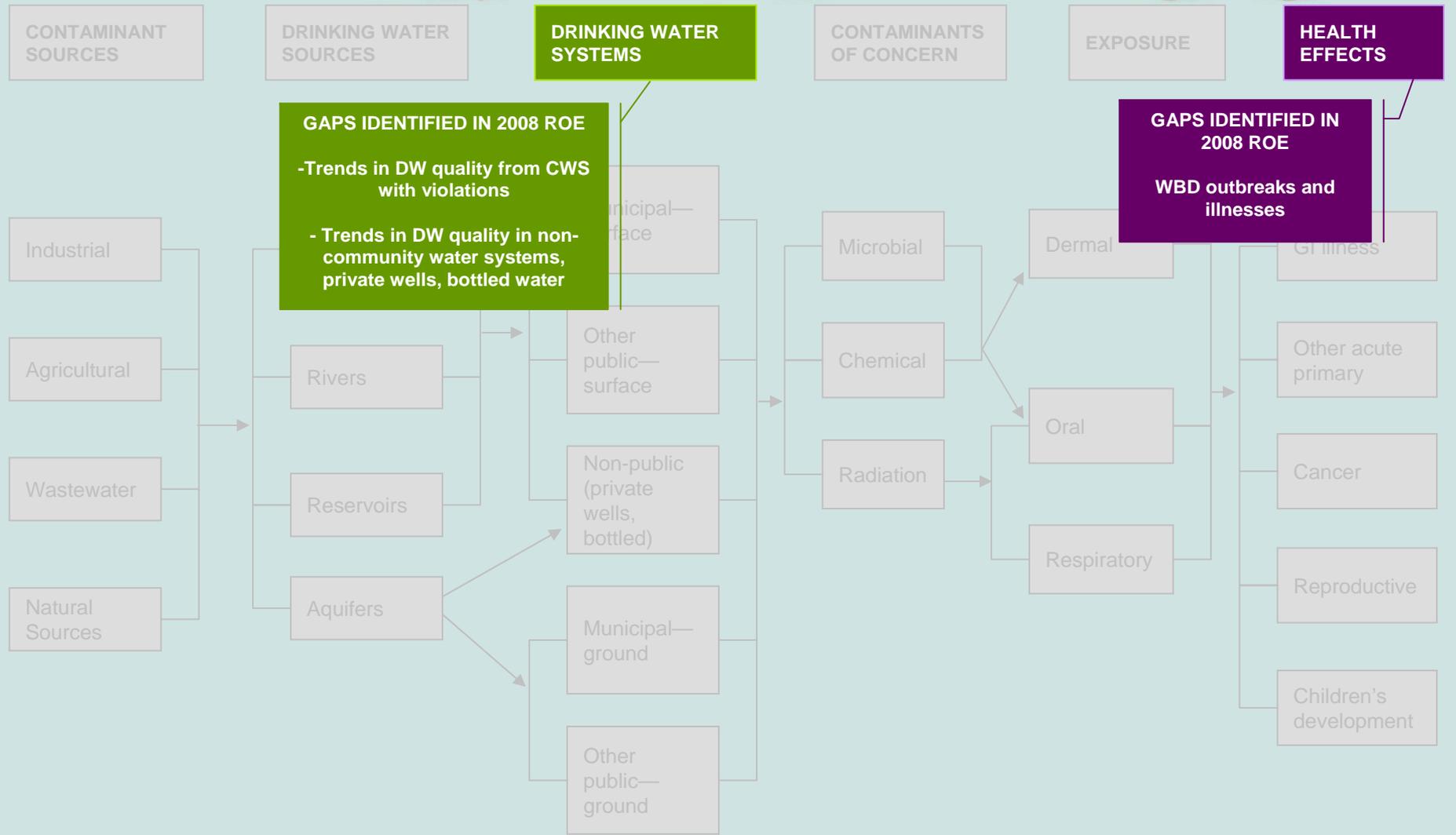
QUESTION: What are the trends in the quality of drinking water and their effects on human health?



Conceptual Diagram for the 2008 ROE Drinking Water Question

Gaps as Identified in 2008 ROE

QUESTION: What are the trends in the quality of drinking water and their effects on human health?



Supplemental Information in the ROE

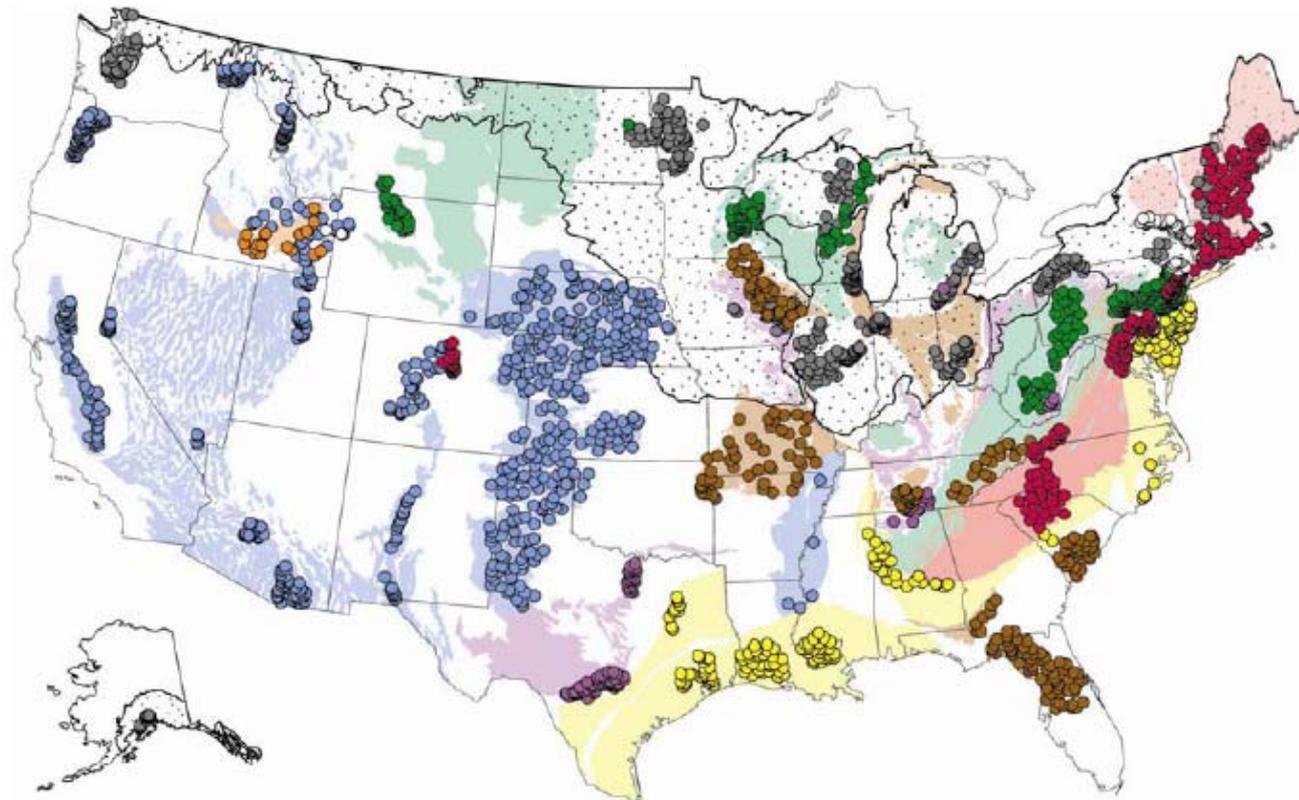
- The 2008 ROE does not include “case studies” that are not representative of a target population, or data sets that do not meet other ROE criteria.
- *Supplemental information* may help address the ROE questions and could provide candidates for future indicators.
- Considerations regarding *what* to include and *how* to incorporate, e.g.,
 - Inclusion criteria
 - An indicator “incubator” site to link ROE to valuable non-indicator information

Supplemental Information: Drinking Water Question

- **Noted gap in 2008 ROE:** No currently available indicators of DW quality for non-community water systems or bottled water that meet ROE indicator definition and criteria.
- **Possible solution:** Fill the gap using supplemental information to augment that provided by the indicators and more thoroughly answer the ROE question

Example Supplemental Information

- Recent U.S. Geological Survey (USGS) study
 - Concentrations of contaminants in 2,100 private drinking wells across the United States.
 - Sampled private wells in most of the major ground-water aquifers in the United States.
 - http://water.usgs.gov/nawqa/studies/domestic_wells/
 - Shows the range of contaminants that can occur in private well water

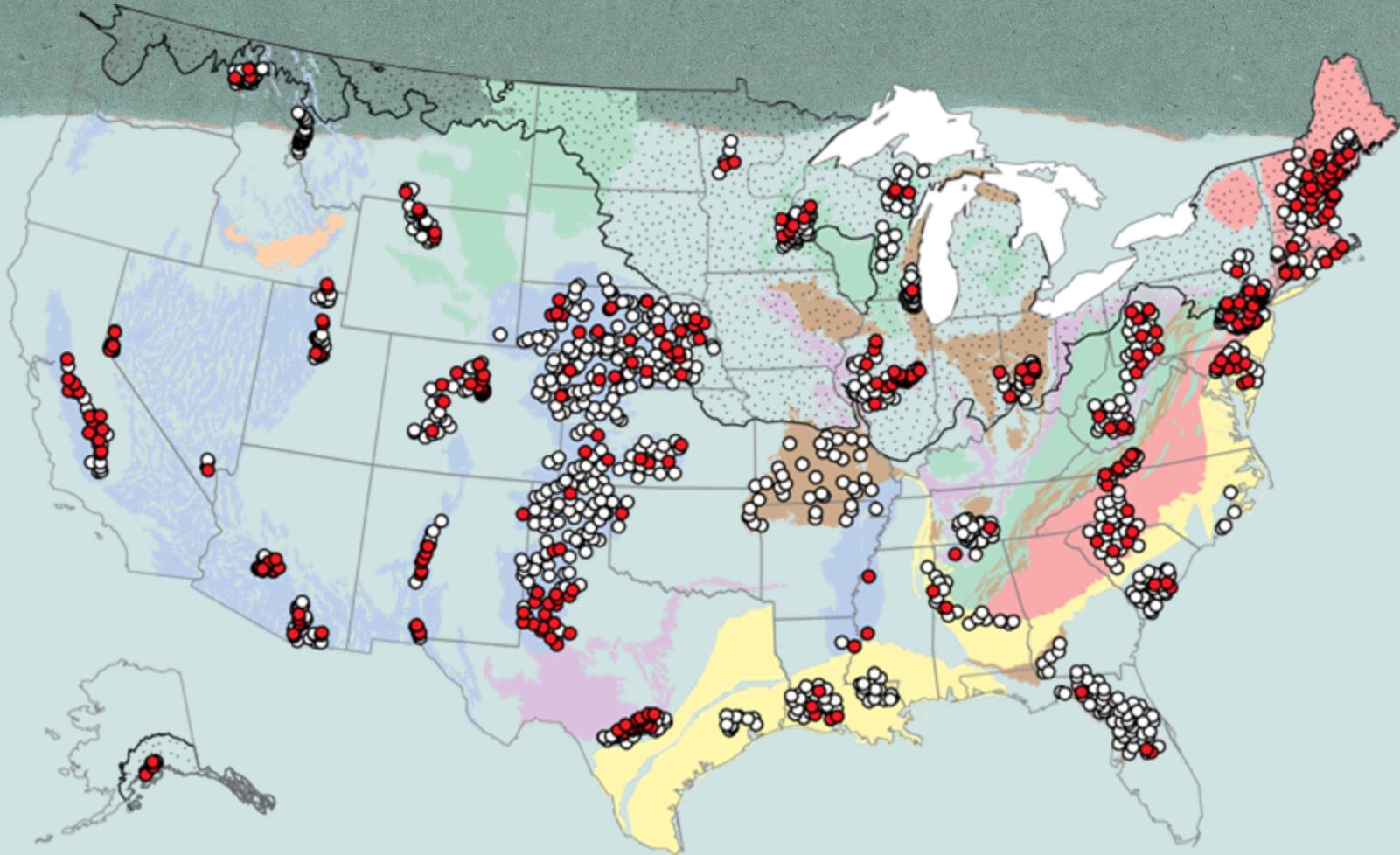


PRINCIPAL AQUIFER ROCK OR SEDIMENT TYPE

- | | |
|--|-------------------------|
| Basin-fill and other non-glacial sand and gravel | Sandstone and carbonate |
| Glacial sand and gravel (discontinuous) | Carbonate |
| Coastal plain semi-consolidated sand | Basalt |
| Sandstone | Crystalline |

Figure 1. Domestic wells sampled in this study are located in 48 states and parts of 30 of the 62 principal aquifers of the United States. Domestic wells are categorized by principal aquifer rock type: *blue*—basin-fill and other non-glacial sand and gravel aquifers; *grey*—glacial aquifers; *yellow*—coastal plain aquifers; *green*—sandstone aquifers; *purple*—sandstone and carbonate aquifers; *brown*—carbonate aquifers; *orange*—basalt aquifers; *red*—crystalline-rock aquifers.

Quality of Water from Domestic Wells in the United States



EXPLANATION

- At least one contaminant concentration greater than a human-health benchmark
- No contaminant concentration greater than a human-health benchmark

Example 2

Based on 2008 ROE Outdoor Air Question

- Example will show:
 - Alignment with EPA Strategic Plan
 - Use of conceptual model
 - Use of supplemental information

Alignment of ROE Policy Question and EPA Strategic Objective

Outdoor Air

**EPA Strategic Plan Goal 1:
Clean Air and Global Climate Change**

**ROE Chapter 1:
Air**

**EPA STRATEGIC OBJECTIVE
1.1 Healthier Outdoor Air**

Sub-objective 1.1.1
Reduce criteria pollutants
and regional haze

Sub-objective 1.1.2 Reduce air toxics

Sub-objective 1.1.3 Reduce the adverse
effects of acid deposition

Strategic Measures

2008 ROE POLICY QUESTION

What are the trends in outdoor
air quality and their effects
on human health and the environment?

Indicators

Alignment of Strategic Measures and ROE Indicators: Outdoor Air

STRATEGIC PLAN (Change Document)

- **Strategic measures: criteria pollutants and regional haze**
 - Criteria pollutant emission reductions
 - Criteria pollutant emission inventories
 - Visibility improvement
- **Strategic measures: air toxics**
 - Air toxics emission reductions
- **Strategic measures: acid deposition**
 - Reduction of number of acidic water bodies
 - SO₂ emissions reductions
 - Sulfur and nitrogen deposition reductions

2008 ROE

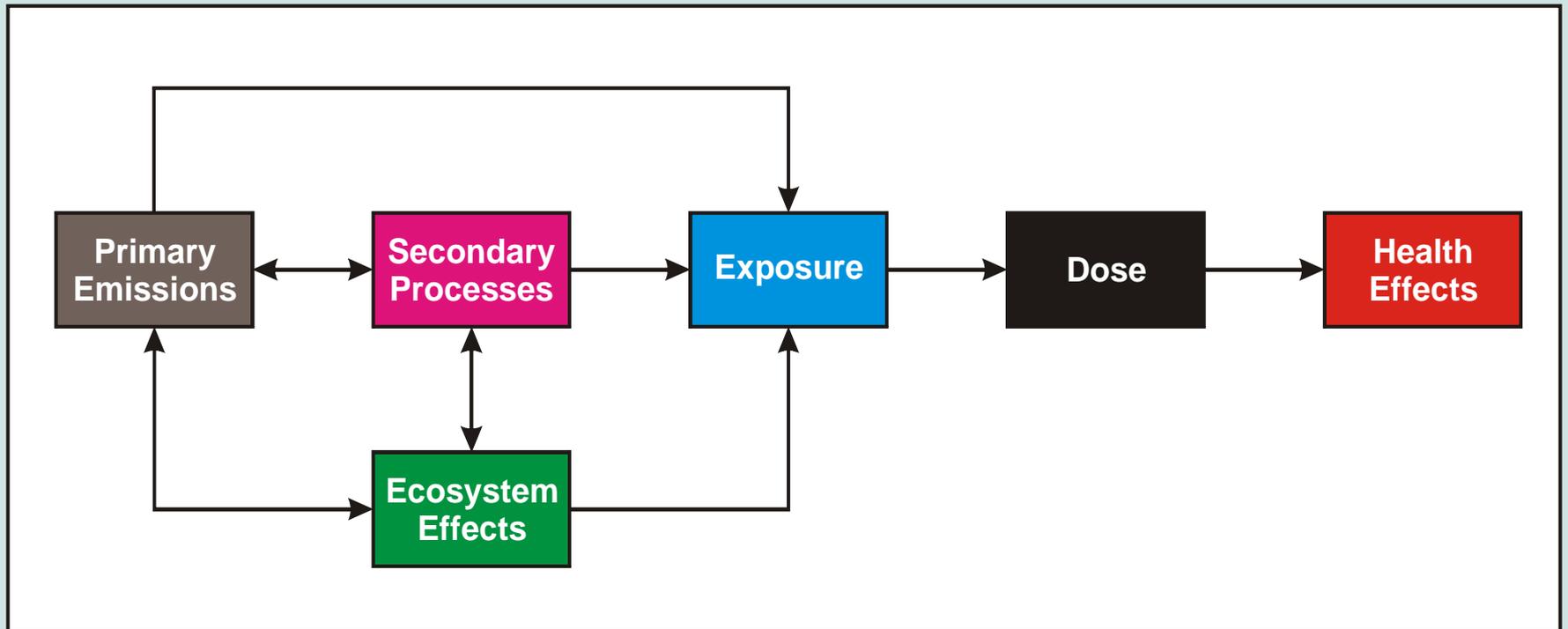
- **ROE indicators**
 - Criteria pollutant (and precursors) emissions, ambient concentrations, pollution-related effects
 - Air toxics emissions (from NEI)
 - Mercury emissions
 - Ambient concentrations of benzene
- **ROE indicator gaps**
 - Particulate matter speciation
 - Indicators of most air toxics emissions and ambient concentrations
 - National-level exposure and effects indicators



Conceptual Model to Support Planning, Problem Formulation, and Decision-Making

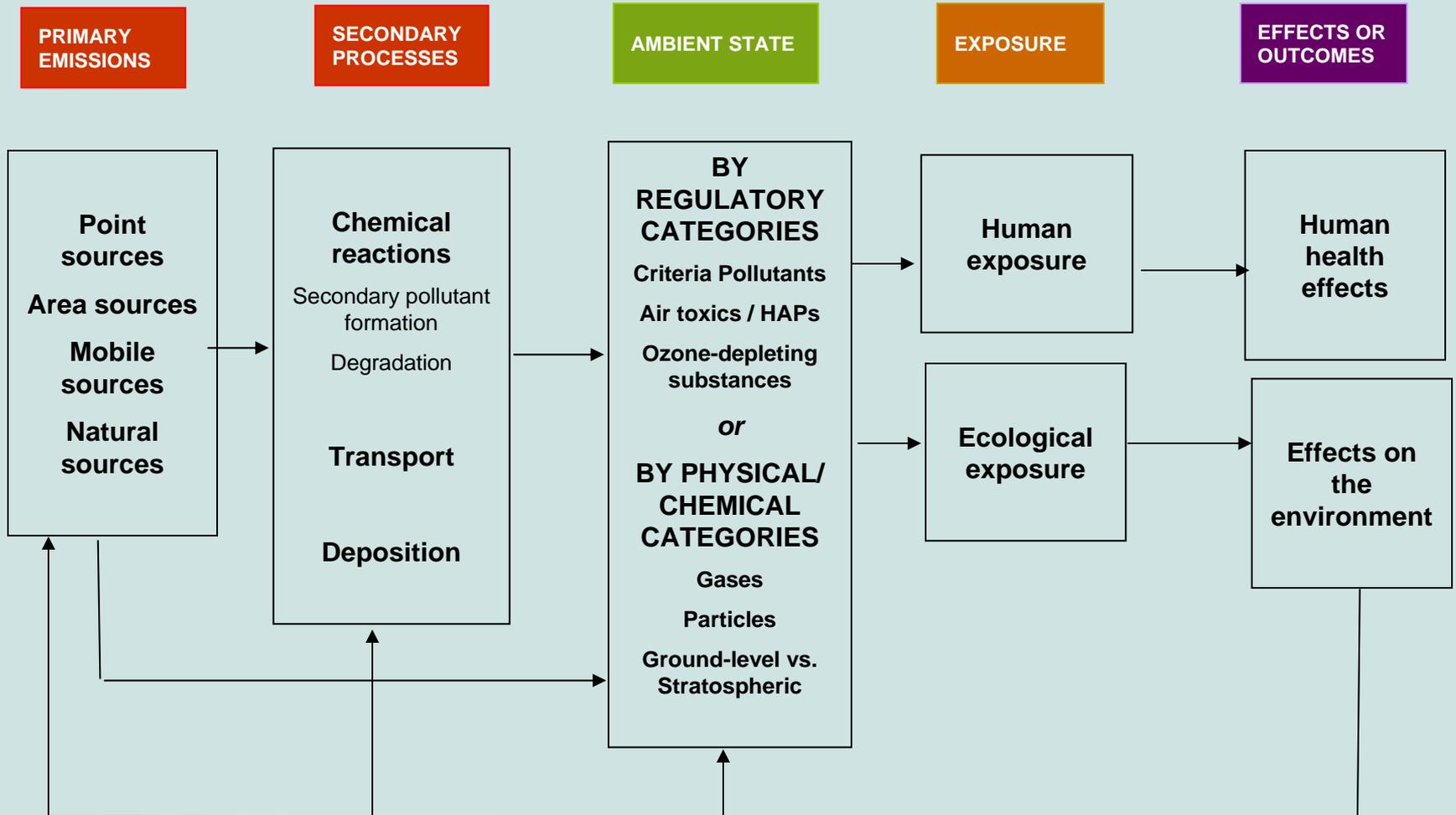
Outdoor Air

Air Conceptual Model - Panel



Conceptual Model for the 2008 ROE Outdoor Air Question

QUESTION: What are the trends in outdoor air quality and their effects on human health and the environment?



Conceptual Model - Implications

- Hierarchical sets of models needed, based on:
 - Time–space relationships
 - Compatible indicator time–space scales
 - Exposure and effects
 - Incomplete linkage – missing national/regional exposure–effects indicators
 - Multi-pollutant interactions
 - Helps relate and illustrate pollutant interactions and importance of considering multi-pollutant interactions

Outcome of Draft Model for Outdoor Air

- Appropriate and useful for depicting situations that involved direct exposure to toxic pollutants (e.g., criteria pollutants and air toxics where the exposure pathway is direct atmospheric exposure).
- Not appropriate for outdoor air pollutants that exert their primary effects through another media (e.g., acid deposition, mercury, and lead).
- Conceptual models for this question should accommodate the concepts of human welfare so that these effects also are recognized and included as explicit outcomes of interest (e.g., regional haze impacting scenic vistas).
- *Consider more (more focused) questions for outdoor air?*

Supplemental Information: Outdoor Air

- No national indicators available that track over time the occurrence of health effects attributable solely to exposure to one or more air pollutants.
- However, substantial epidemiologic evidence base links specific diseases to these exposures.
- Supplemental information could help address the question:
 - An analysis using data from 51 U.S. metro areas showed that over the period of record, overall life expectancy has increased by 2.7 years, and reduction in exposure to $PM_{2.5}$ accounted for as much as 15 percent of that increase (Pope et al., 2007).

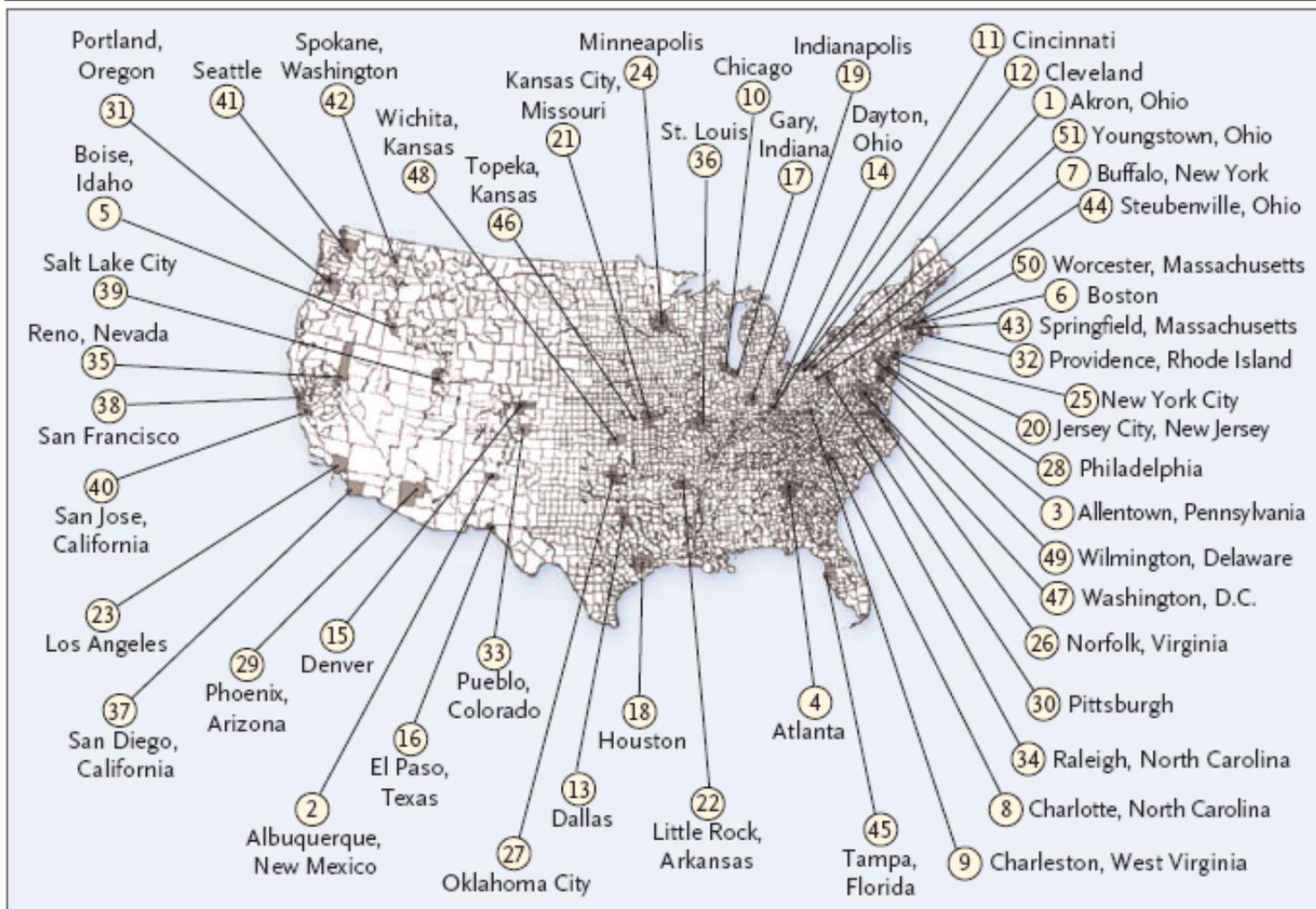


Figure 1. Distribution of Study Areas.

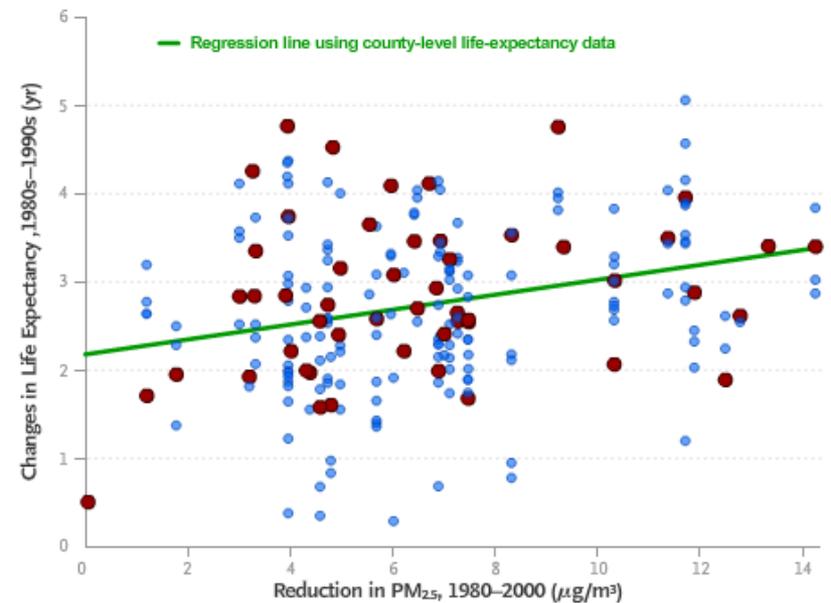
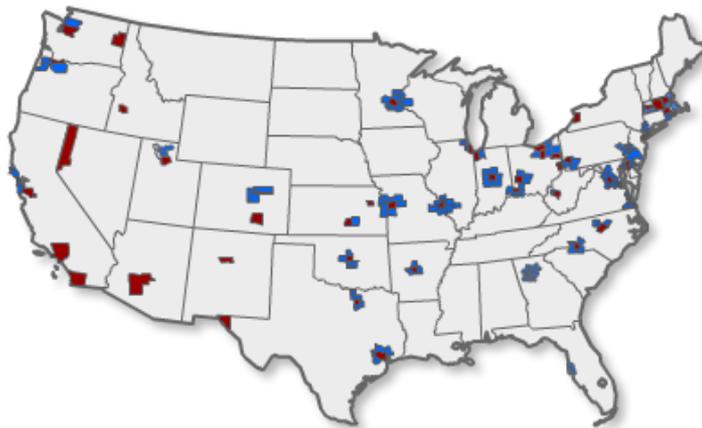
The locations of the counties included in the study are shown in gray, and the dots represent the approximate locations of the 51 metropolitan areas in the study.

Life Expectancies, 1978–1982

Life Expectancies, 1997–2001

Changes in Life Expectancy, 1980s–1990s

Choose metropolitan area to view results



Copyright © 2009 Massachusetts Medical Society

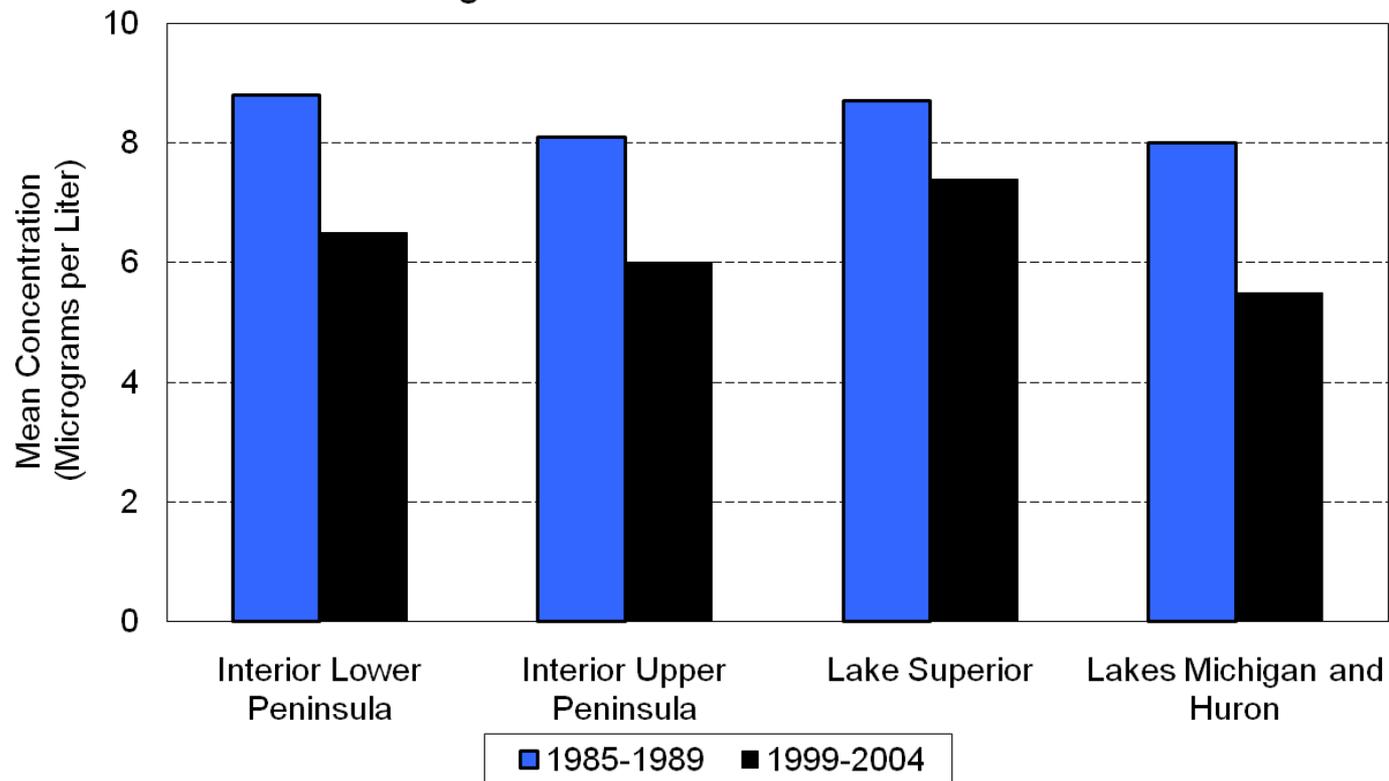
Pope CA III, Ezzati M, Dockery DW. Fine-particulate air pollution and life expectancy in the United States. *N Engl J Med* 2009;360:376-86.

<http://content.nejm.org/cgi/content/full/360/4/376/DC1>

Supplemental information for outdoor air: Air pollutants and effects in wildlife

- State of Michigan monitors mercury in bald eagle feathers on Great Lakes shores.
- Slight decrease between the 1985-1999 and 1999-2004 sampling periods, corresponding to mercury emissions reductions.
- Data not necessarily representative of eagle populations nationwide.
- Air or sediment?

Exhibit 20. Geometric Mean Mercury Concentrations in Nestling Bald Eagle Feathers 1985 - 1989 and 1999 - 2004





Summary and Conclusions

Value of Conceptual Models in the ROE

- Clearly illustrate the scope of the question.
- Depict the scientific conceptual foundation of the question.
- Show the role played by each indicator in helping to answer the question, and interrelationships of indicators.
- Illustrate where indicator gaps exist.
- Highlight where supplemental information might be useful to help answer the question.
- Communication tool for discussion among scientists, policy developers, and decision-makers to improve ROE's usefulness in strategic planning.

Value of Supplemental Information in the ROE

- Provide some insight into health and environmental trends that are relevant to the question.
- Help illustrate how indicator gaps might be filled.
- Identify possible future ROE indicators.

Charge Questions

Charge Question #1

Please comment on whether EPA's proposed conceptual models approaches are logical and useful for:

- Aligning the ROE questions with the Agency's strategic goals and objectives.
- Communicating the intent and scope of questions in the ROE.
- Presenting the underlying scientific foundation of questions in the ROE.
- Providing a framework for selecting indicators and identifying associated gaps, limitations, and useful supplemental information.

Charge Question #2:

Does the Committee have recommendations concerning other possible approaches to conceptual model development that would be useful in identifying or highlighting important ROE topics, indicators for consideration, research, or development?

Charge Question #3

Please comment on the logic and utility of EPA's proposed use of supplemental information to answer questions in the next version of the ROE.

Charge Question #4

Does the Committee have recommendations for criteria to assure that supplemental information included in the ROE is objective, free from bias, scientifically valid, and supports intended purpose of the report?



Questions?