Appendix C:
Comparison of Indicators Used in EPA's 2008 ROE and the 2003 Draft ROE

- Indicators new to the 2008 report are listed in **bold** font.
- Indicators in the 2003 report but withdrawn in 2008 are highlighted in gray.
- The rationale for withdrawing indicators is explained at the end of this appendix.
- Some indicators are used to answer more than one ROE question; indicators are listed in the table below only where they are first used to answer an ROE question in the 2008 report.

Air Chapter

Outdoor Air Quality	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Lead Emissions	Lead Emissions
Ambient Concentrations of Lead	Ambient Concentrations of Lead
Nitrogen Oxides Emissions	Emissions: Particulate Matter ($PM_{2.5}$ and PM_{10}), Sulfur Dioxide, Nitrogen Oxides, and Volatile Organic Compounds Emissions (Utility): Sulfur Dioxide and Nitrogen Oxides
Volatile Organic Compounds Emissions	Emissions: Particulate Matter ($PM_{2.5}$ and PM_{10}), Sulfur Dioxide, Nitrogen Oxides, and Volatile Organic Compounds
Ambient Concentrations of Ozone	Ambient Concentrations of Ozone: 8-hour and 1-hour
Ozone Injury to Forest Plants	Ozone Injury to Trees (from the ecological condition chapter)
Particulate Matter Emissions	Emissions: Particulate Matter ($PM_{2.5}$ and PM_{10}), Sulfur Dioxide, Nitrogen Oxides, and Volatile Organic Compounds
Ambient Concentrations of Particulate Matter	Ambient Concentrations of Particulate Matter: $PM_{2.5}$ and PM_{10}
Regional Haze	Visibility
Sulfur Dioxide Emissions	Emissions: Particulate Matter ($PM_{2.5}$ and PM_{10}), Sulfur Dioxide, Nitrogen Oxides, and Volatile Organic Compounds Emissions (Utility): Sulfur Dioxide and Nitrogen Oxides
Acid Deposition	Deposition: Wet Sulfate and Wet Nitrogen Atmospheric Deposition of Nitrogen (from the water chapter)

Outdoor Air Quality

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Lake and Stream Acidity	Acid Sensitivity in Lakes and Streams (from the water chapter)
Percent of Days with Air Quality Index Values Greater Than 100	Number and Percentage of Days That Metropolitan Statistical Areas (MSAs) Have Air Quality Index (AQI) Values Greater Than 100
Air Toxics Emissions	Air Toxics Emissions
Ambient Concentrations of Benzene	Ambient Concentrations of Selected Air Toxics
Concentrations of Ozone-Depleting Substances	Concentrations of Ozone-Depleting Substances (Effective Equivalent Chlorine)
Ozone Levels over North America	Ozone Levels over North America
Carbon Monoxide Emissions	
Ambient Concentrations of Carbon Monoxide	
Ambient Concentrations of Nitrogen Dioxide	
Mercury Emissions	
Ozone and Particulate Matter Concentrations for U.S. Counties in the U.S./Mexico Border Region	
Ambient Concentrations of Manganese Compounds in EPA Region 5	
Withdrawn	Worldwide and U.S. Production of Ozone-Depleting Substances (ODSs)
Withdrawn	Number of People Living in Areas with Air Quality Levels Above the NAAQS for Particulate Matter (PM) and Ozone

Greenhouse Gases

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
U.S. Greenhouse Gas Emissions	
Atmospheric Concentrations of Greenhouse Gases	

Indoor Air Quality

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
U.S. Homes Above EPA's Radon Action Level	U.S. Homes Above EPA's Radon Action Levels
Blood Cotinine Level	Blood Cotinine Level; Blood Cotinine Level in Children (from the human health chapter)
Withdrawn	Percentage of Homes Where Young Children Are Exposed to Environmental Tobacco Smoke

Water Chapter

Fresh Surface Waters	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
High and Low Stream Flows	Changing Stream Flows Number/Duration of Dry Stream Flow Periods in Grassland/Shrublands
Nitrogen and Phosphorus in Streams in Agricultural Watersheds	Nitrate in Farmland, Forested, and Urban Streams and Ground Water (partially replaced, partially withdrawn) Phosphorus in Farmland, Forested, and Urban Streams (partially replaced, partially withdrawn)
Nitrogen and Phosphorus Loads in Large Rivers	Partly new information and partly from indicator: Movement of Nitrogen (from the ecological condition chapter)
Pesticides in Streams in Agricultural Watersheds	Pesticides in Farmland Streams and Ground Water
Benthic Macroinvertebrates in Wadeable Streams	Macroinvertebrate Biotic Integrity Index for Streams
Streambed Stability in Wadeable Streams	
Nitrogen and Phosphorus in Wadeable Streams	
Withdrawn	Altered Fresh Water Ecosystems
Withdrawn	Lake Trophic State Index
Withdrawn	Percent Urban Land Cover in Riparian Areas
Withdrawn	Agricultural Lands in Riparian Areas
Withdrawn	Sedimentation Index
Withdrawn	Nitrate in Farmland, Forested, and Urban Streams and Ground Water (partially withdrawn)
Withdrawn	Phosphorus in Farmland, Forested, and Urban Streams (partially withdrawn)
Withdrawn	Phosphorus in Large Rivers
Withdrawn	Atmospheric Deposition of Mercury
Withdrawn	Chemical Contamination in Streams and Ground Water
Withdrawn	Sediment Contamination of Inland Waters
Withdrawn	Fish Index of Biotic Integrity in Streams

Ground Water	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Nitrate and Pesticides in Shallow Ground Water in Agricultural Watersheds	Pesticides in Farmland Streams and Ground Water Nitrate in Farmland, Forested, and Urban Streams and Ground Water (partially replaced, partially withdrawn)
Withdrawn	Nitrate in Farmland, Forested, and Urban Streams and Ground Water (partially withdrawn)

Wetlands

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Wetland Extent, Change, and Sources of Change	Wetland Extent and Change Sources of Wetland Change/Loss

Coastal Waters

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Trophic State of Coastal Waters	Water Clarity in Coastal Waters Dissolved Oxygen in Coastal Waters Chlorophyll Concentrations Total Nitrogen in Coastal Waters Total Phosphorus in Coastal Waters
Coastal Sediment Quality	Sediment Contamination of Coastal Waters Sediment Toxicity in Estuaries
Coastal Benthic Communities	Benthic Community Index (for Coastal Waters) (presented in both the water and ecological condition chapters)
Submerged Aquatic Vegetation in the Chesapeake Bay	Submerged Aquatic Vegetation (changed to a Regional Indicator; from the ecological condition chapter)
Hypoxia in the Gulf of Mexico and Long Island Sound	
Withdrawn	Total Organic Carbon in Sediments
Withdrawn	Population Density in Coastal Areas

Drinking Water

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Population Served by Community Water Systems with No Reported Violations of Health-Based Standards	Population Served by Community Water Systems That Meet All Health-Based Standards

Recreational Waters

2008 ROE Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Withdrawn	Number of Beach Days That Beaches Are Closed or Under Advisory

Consumable Fish and Shellfish	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Coastal Fish Tissue Contaminants	Chemical Contamination (from the ecological condition chapter) (partially withdrawn)
Contaminants in Lake Fish Tissue	Contaminants in Fresh Water Fish
Withdrawn	Percent of River Miles and Lake Acres Under Fish Consumption Advisories
Withdrawn	Number of Watersheds Exceeding Health-Based National Water Quality Criteria for Mercury and PCBs in Fish Tissue

Land Chapter

Land Cover	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Land Cover	Extent of Grasslands and Shrublands Extent of Forest Area, Ownership, and Management Patches of Forest, Grassland, Shrubland, and Wetland in Urban/Suburban Areas (from the ecological condition chapter) Ecosystem Extent (from the ecological condition chapter)
Land Cover in the Puget Sound/Georgia Basin	

Land Use	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Land Use	Extent of Urban and Suburban Lands Extent of Agricultural Land Uses
Urbanization and Population Change	Extent of Developed Lands (plus land chapter introduction from 2003 Draft ROE)
Withdrawn	The Farmland Landscape
Withdrawn	Sediment Runoff Potential from Croplands and Pasturelands

Wastes	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Quantity of Municipal Solid Waste Generated and Managed	Quantity of Municipal Solid Waste (MSW) Generated and Managed Number and Location of Municipal Solid Waste (MSW) Landfills
Quantity of RCRA Hazardous Waste Generated and Managed	Quantity of RCRA Hazardous Waste Generated and Managed Number and Location of RCRA Hazardous Waste Management Facilities (partially replaced, partially withdrawn)
Withdrawn	Quantity of Radioactive Waste Generated and in Inventory
Withdrawn	Number and Location of Municipal Solid Waste (MSW) Landfills (partially withdrawn)
Withdrawn	Number and Location of RCRA Hazardous Waste Management Facilities (partially withdrawn)
Withdrawn	Number and Location of Superfund National Priorities List (NPL) Sites
Withdrawn	Number and Location of RCRA Corrective Action Sites

Chemicals Used on the Land	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Fertilizer Applied for Agricultural Purposes	Fertilizer Use
Toxic Chemicals in Production-Related Wastes Combusted for Energy Recovery, Released, Treated, or Recycled	Quantity and Type of Toxic Chemicals Released and Managed Number and Location of RCRA Hazardous Waste Management Facilities (partially replaced, partially withdrawn)
Pesticide Residues in Food	Pesticide Residues in Food
Reported Pesticide Incidents	
Withdrawn	Agricultural Pesticide Use
Withdrawn	Potential Pesticide Runoff from Farm Fields
Withdrawn	Risk of Nitrogen Export
Withdrawn	Risk of Phosphorus Export
Withdrawn	Pesticide Leaching Potential (from the ecological condition chapter)

Contaminated Land	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Current Human Exposures Under Control at High-Priority Cleanup Sites	
Migration of Contaminated Ground Water Under Control at High-Priority Cleanup Sites	

Human Exposure and Health Chapter

Exposure to Environmental Contaminants	
2008 ROE Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Blood Lead Level	Blood Lead Level Blood Lead Level in Children
Blood Mercury Level	Blood Mercury Level Blood Mercury Level in Children
Blood Cadmium Level	Blood Cadmium Level
Urinary Pesticide Level	Urine Organophosphate Levels to Indicate Pesticides
Blood Persistent Organic Pollutants Level	
Urinary Phthalate Level	
Withdrawn	Urine Arsenic Level
Withdrawn	Blood Volatile Organic Compound Levels

Health Status	
ROE 2008 Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Life Expectancy at Birth	Life Expectancy
Infant Mortality	Infant Mortality
General Mortality	(partially based on "Leading Causes of Death" in the contextual information provided in the 2003 Draft ROE human health chapter)

Disease and Conditions	
ROE 2008 Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Cancer Incidence	Cancer Incidence
Childhood Cancer Incidence	Childhood Cancer Incidence
Cardiovascular Disease Prevalence and Mortality	Cardiovascular Disease Mortality Cardiovascular Disease Prevalence
Chronic Obstructive Pulmonary Disease **Prevalence** and Mortality	Chronic Obstructive Pulmonary Disease Mortality
Asthma Prevalence	Asthma Prevalence Childhood Asthma Prevalence
Infectious Diseases Associated with Environmental Exposures or Conditions (with the following new additions: **Giardiasis, Lyme Disease, Rocky Mountain Spotted Fever, West Nile Virus, Legionellosis)**	Cholera Prevalence Cryptosporidiosis Prevalence *E. coli* O157:H7 Prevalence Hepatitis A Prevalence Salmonellosis Prevalence Shigellosis Prevalence Typhoid Fever Prevalence
Birth Defects Prevalence and Mortality	Deaths Due to Birth Defects Birth Defect Incidence
Low Birthweight	Low Birthweight Incidence
Preterm Delivery	
Withdrawn	Cancer Mortality
Withdrawn	Asthma Mortality
Withdrawn	Childhood Cancer Mortality
Withdrawn	Childhood Asthma Mortality

Ecological Condition Chapter

Extent and Distributon	
ROE 2008 Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Forest Extent and Type	Extent of Area by Forest Type
Forest Fragmentation	Forest Pattern and Fragmentation
Ecological Connectivity in EPA Region 4	
Relative Ecological Condition of Undeveloped Land in EPA Region 5	
Withdrawn	Forest Age Class
Withdrawn	Extent of Ponds, Lakes, and Reservoirs
Withdrawn	Extent of Estuaries and Coastline

Diversity and Biological Balance	
ROE 2008 Indicator Title	**Corresponding 2003 Draft ROE Indicator Title**
Bird Populations	
Fish Faunal Intactness	
Non-Indigenous Benthic Species in the Estuaries of the Pacific Northwest	
Withdrawn	At-Risk Native Forest Species
Withdrawn	Populations of Representative Forest Species
Withdrawn	Tree Condition
Withdrawn	At-Risk Native Grassland and Shrubland Species
Withdrawn	Population Trends of Invasive and Native Non-Invasive Bird Species
Withdrawn	At-Risk Native Fresh Water Species
Withdrawn	Non-Native Fresh Water Species
Withdrawn	At-Risk Fresh Water Plant Communities
Withdrawn	Coastal Living Habitats
Withdrawn	Shoreline Types
Withdrawn	Fish Diversity
Withdrawn	At-Risk Native Species
Withdrawn	Bird Community Index

Ecological Processes	
ROE 2008 Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Carbon Storage in Forests	Carbon Storage
Withdrawn	Forest Disturbance: Fire, Insects, and Disease

Physical and Chemical Attributes	
ROE 2008 Indicator Title	Corresponding 2003 Draft ROE Indicator Title
U.S. and Global Mean Temperature and Precipitation	
Sea Surface Temperature	
Sea Level	
Withdrawn	Soil Compaction
Withdrawn	Soil Erosion (Forests)
Withdrawn	Soil Erosion (Farmland)
Withdrawn	Processes Beyond the Range of Historic Variation
Withdrawn	Soil Quality Index
Withdrawn	Terrestrial Plant Growth Index
Withdrawn	Chemical Contamination (partially withdrawn)

Ecological Exposure to Contaminants	
ROE 2008 Indicator Title	Corresponding 2003 Draft ROE Indicator Title
Withdrawn	Animal Deaths and Deformities
Withdrawn	Fish Abnormalities
Withdrawn	Unusual Marine Mortalities

Explanation of Indicators Used in the 2003 Draft ROE But Not in the 2008 ROE

A number of indicators were included in EPA's 2003 Draft ROE that are not included in the 2008 ROE. The general reasons for these changes are described below, followed by indicator-specific explanations.

- Members of the independent scientific review panel that reviewed the draft indicators for the 2008 ROE recommended their withdrawal.
- The EPA Science Advisory Board Committee review of the 2003 Draft ROE recommended EPA develop and utilize a more precise definition of "indicator" than was used for 2003 Draft ROE.
- EPA developed a set of specific indicator criteria to provide a more precise conformance to Office of Management and Budget and EPA Information Quality Guidelines.
- The 2008 ROE introduced a Regional Pilot Project and developed and implemented a relevant process. Sub-National or Regional Indicators that were included in the 2003 Draft ROE but did not go through this pilot are not included in the 2008 ROE.

A small number of the indicators in 2003 Draft ROE did not conform to one or more of these requirements. Explanations for not including these indicators were peer-reviewed by an independent scientific panel along with the indicators in this report. Broadly speaking, the explanations for withdrawal fall into five categories, coded as follows:

- **(D) Definition.** The indicator fails to meet the improved indicator definition for the 2008 ROE.
- **(C) Criteria.** The indicator fails to meet one of the six indicator criteria that were established to conform to EPA Information Quality Guidelines.

- **(N) New indicator.** The indicator is replaced by a "new" and superior indicator that was not available for the 2003 Draft ROE.
- **(R) Regional.** The indicator is not national in scope and is not part of the 2008 ROE Regional Pilot Project.
- **(P) Peer review.** The independent peer review panel recommended withdrawing the indicator from the 2008 ROE.

The following information briefly explains the rationale for withdrawing specific indicators from the 2008 ROE. Each indicator is categorized as D, C, N, R, or P. The indicators are organized by chapter.

Air Chapter

Worldwide and U.S. Production of Ozone-Depleting Substances (ODSs)—C

This 2003 Draft ROE indicator presented estimates of the amount of ODSs produced worldwide in 1986 and 1999, and annual U.S. production from 1958 to 1993. This indicator was withdrawn because of issues concerning data reliability and relevance. Global ODC production data are not reliable with respect to comparability among reporting countries. The U.S. estimates are more reliable because of legal reporting requirements and the small number of sources. However, the data set fails to account for imports, and annual production is not a good surrogate for emissions of ODCs into the environment because the time between production and eventual entry into the environment is highly variable among the various products and recovery systems.

Number of People Living in Areas with Air Quality Levels Above the NAAQS for Particulate Matter (PM) and Ozone—C

This 2003 Draft ROE indicator conveyed how many people (based on census data) lived in counties where air pollutant levels at times were above the level of the NAAQS during the year stated. It was intended to give the reader some indication of the number of people potentially exposed to unhealthy air. Because of changing populations and air quality standards, however, this indicator masks actual trends in the levels of air pollutants. It is not a valid exposure indicator for the ROE because it is not based on measurement of an actual marker of exposure measured on or in individuals.

Percentage of Homes Where Young Children Are Exposed to Environmental Tobacco Smoke—D

This 2003 Draft ROE indicator portrayed the percentage of homes in the U.S. in which young children were exposed to tobacco smoke in 1998 versus 1957. The survey was based on a questionnaire (do children live in the home, and does someone who smokes regularly live in the home), rather than on measurements of the amount of smoke actually present or the degree to which children were exposed to the resulting smoke. This indicator violates the ROE indicator definition, which requires that indicators be based on actual measurements; furthermore, the 2008 ROE's Blood Cotinine indicator better indicates children's exposure to smoke.

Water Chapter

Altered Fresh Water Ecosystems—C

Percent Urban Land Cover in Riparian Areas—C

Agricultural Lands in Riparian Areas—C

These 2003 Draft ROE indicators were based on the percentage of land within 30 meters of the edge of a stream or lake that is classified as urban or agriculture based on 1991 satellite data (NLCD). Baseline data are incomplete, there are no reference points for the appropriate percentage of such cover, and it is not clear that the indicators could be reproduced with newer satellite data. There are no data for other alterations such as damming, channelization, etc.

Lake Trophic State Index—R, C

This 2003 Draft ROE indicator was based on phosphorus data collected in a one-time statistical sample of lakes in the northeastern U.S. during 1991-1994. It is not included in the 2008 ROE Regional Pilot Project.

Sedimentation Index—R, C, N

This 2003 Draft ROE indicator was based on data collected on freshwater streams in the Mid-Atlantic Highlands Region during a one-time 1993-1994 statistical survey. It is not included in the 2008 ROE Regional Pilot Project. The 2008 ROE's Streambed Stability in Wadeable Streams indicator provides a more complete nationwide picture of sedimentation in streams.

Nitrate in Farmland, Forested, and Urban Streams and Ground Water (partially withdrawn)—N

Phosphorus in Farmland, Forested, and Urban Streams (partially withdrawn)—N

These 2003 Draft ROE indicators were replaced by two new indicators, "Nitrogen and Phosphorus in Streams in Agricultural Watersheds" and "Nitrate and Pesticides in Shallow Ground Water in Agricultural Watersheds." The NAWQA streams in forested and urban watersheds were based on a small sample size, and may not be representative of forested and urban streams in general.

Phosphorus in Large Rivers—C

The indicator was based on phosphorus concentrations in large rivers sampled periodically by the USGS National Stream Quality Accounting Network (NASQAN). Monitoring at many of the large river NASQAN sites has been discontinued. Information on phosphorus loads in four major rivers has been incorporated into the new 2008 ROE indicator, Nitrogen and Phosphorus Loads in Large Rivers.

Atmospheric Deposition of Mercury—C

This indicator was withdrawn following peer review of the indicators because trend data could not be analyzed in time to revise it.

Chemical Contamination in Streams and Ground Water—C

This 2003 Draft ROE indicator was based on data from a large number of USGS National Water Quality Assessment

(NAWQA) watersheds. The sampling and analytical protocols (including the analytes measured) are not comparable across all NAWQA watersheds.

Sediment Contamination of Inland Waters—C

This 2003 Draft ROE indicator was based on reported concentrations of sediment contaminants collected by a large number of organizations focusing particularly on places where sediment contamination is perceived to be a problem (the EPA National Sediment Inventory). The database suffers from a number of limitations: the data are heavily biased toward sites at which there is a known or suspected toxicity problem and to particular geographic areas (non-representative of the nation), the data cover different dates in different locations (making estimation of trends difficult), and the data and procedures used to assign sites to a toxicity category are not uniform from watershed to watershed. It is unsuitable for trend estimation.

Fish Index of Biotic Integrity in Streams—R, C

This 2003 Draft ROE indicator was based on fish community data collected on freshwater fish in the Mid-Atlantic Highlands Region during a one-time 1993-1996 statistical survey. Condition cannot be assessed in streams where no fish were caught, because data were insufficient to indicate whether the stream had poor quality or simply no fish. It is not included in the 2008 ROE Regional Pilot Project.

Total Organic Carbon in Sediments—R

This 2003 Draft ROE indicator was based on data collected in a survey of Mid-Atlantic estuaries during a one-time 1997-1998 statistical survey. It is not included in the 2008 ROE Regional Pilot Project. Also, total organic carbon in sediments is useful in understanding sediment toxicity, but there are unlikely to be trends in sediment total organic carbon, and therefore it would be of limited value as an ROE indicator.

Population Density in Coastal Areas—D

Discussion of population density in coastal areas was moved to the introduction of the water chapter section responding to the question, "What are the trends in the extent and condition of coastal waters and their effects on human health and the environment?"

Number of Beach Days That Beaches Are Closed or Under Advisory—D

Percent of River Miles and Lake Acres Under Fish Consumption Advisories—D

These 2003 Draft ROE indicators were based on the frequency of beach closures or fish consumption advisories as reported to EPA voluntarily by states and local government organizations. The data are not nationally or temporally consistent because of different and changing criteria for closing beaches or issuing fish consumption advisories in the different states, many of which do not involve actual water quality measurements. They are therefore administrative indicators (based on administrative action rather than actual physical measurements) and fail to meet the definition for ROE indicators.

Number of Watersheds Exceeding Health-Based National Water Quality Criteria for Mercury and PCBs in Fish Tissue—C

This 2003 Draft ROE indicator was based on voluntary reporting of mercury contamination using data that had not undergone formal QA/QC review. It is not representative of the nation, or suitable for trend monitoring.

Land Chapter

The Farmland Landscape—C

This 2003 Draft ROE indicator represented croplands and the forests, woodlots, wetlands, grasslands, and shrublands that surround or are intermingled with them, and the degree to which croplands dominate the landscape. The indicator relied on data generated using early 1990s satellite data, and it is unclear whether the definition of "farmland landscape" is sufficiently precise to be replicated independently, especially with respect to any future satellite data availability.

Sediment Runoff Potential from Croplands and Pasturelands—C

This 2003 Draft ROE indicator represented the estimated sediment runoff potential for croplands and pasturelands based on topography; weather patterns; soil characteristics; land use, land cover, and cropping patterns; and the Universal Soil Loss equation. The indicator addressed "potential" and not actual/current condition, and relied on a model (the Soil and Water Assessment Tool: http://www.brc.tamus.edu/swat) to predict ambient characteristics based on pressure/stressor measurements, which violates a fundamental ROE protocol on the use of models in indicators. Trends in this indicator would likely be associated only with trends in land cover, cropping practices, and weather (topography and soil type are unlikely to change). No reliable spatial trend data at the appropriate scale exist for either cropping practices or land cover, and consequently trends in this indicator would be difficult to calculate.

Agricultural Pesticide Use—C

Agricultural pesticide usage data, measured at the national aggregate level for all pesticides, are very difficult to interpret. From one time period to another, the mix of pesticides changes, pest pressures change, agricultural practices change, agricultural acreage changes, regulatory status of key uses changes, and many other important variables change. Moreover, the effects of pesticide usage are encountered at three levels of the product's life cycle: production, usage, and residues on foods. The geographic distribution of those effects renders difficult the interpretation of national usage levels for all pesticides, taken as a group. While it is of course possible to compare magnitudes of aggregates at different times, the real significance for the environment is in the differences in the content and geographic distribution of the aggregates, not in the magnitude of the aggregate.

Potential Pesticide Runoff from Farm Fields—C

Pesticide Leaching Potential—C

These 2003 Draft ROE indicators represented the potential movement of agricultural pesticides from the site of application

to ground and surface waters, based on estimates of pesticide leaching and runoff losses derived from soil properties, field characteristics, management practices, pesticide properties, and climate for 243 pesticides applied to 120 specific soils in growing 13 major agronomic crops. The indicators address "potential" and not actual/current condition, and rely on models to predict ambient characteristics based on measurements of pressures/stressors. This violates a fundamental ROE protocol on the use of models in indicators.

Risk of Nitrogen Export—C

Risk of Phosphorus Export—C

These 2003 Draft ROE indicators represented the potential movement of nitrogen and phosphorus from the site of application to surface waters, based on a large empirical dataset relating land use to nitrogen and phosphorus observed in receiving streams over several decades at a variety of locations. The indicators address "potential" and not actual/current conditions, and rely on statistical models to predict ambient characteristics based on measurements of pressures/stressors. This violates a fundamental ROE protocol on the use of models in indicators.

Quantity of Radioactive Waste Generated and in Inventory—C

This 2003 Draft ROE indicator was based on production and inventory data collected by the Department of Energy. Although the data continue to be collected, they are no longer publicly available post-September 11, 2001; therefore, ongoing data trends are not and will not be available for this indicator in the future. Moreover, the earlier data reflected two distinct periods in the history of waste generation in the nuclear weapons complex. The first reflected a period during which wastes and other materials were being generated as an integral part of the production of weapons-grade nuclear materials and components. The period after 1989 reflected the cessation of large-scale production of such materials and the initiation of cleanup activities and wastes from those initiatives. Thus, even before the truncation of data in the post-9/11 period, there were significant issues with the comparability of the data over time.

Number and Location of Municipal Solid Waste (MSW) Landfills—D, N

This 2003 Draft ROE indicator represents an administrative count of landfills, rather than an amount of waste produced, and therefore does not meet the 2008 ROE indicator definition. The indicator was replaced by a new and superior indicator that tracks the quantity of municipal solid waste generated and how it is managed.

Number and Location of RCRA Hazardous Waste Management Facilities (partially withdrawn)—D, N

This 2003 Draft ROE indicator, by itself, represents an administrative decision to force a cleanup, rather than an amount of waste present or removed, and therefore does not meet the 2008 ROE indicator definition. The data were combined into a new indicator, Quantity of RCRA Hazardous Waste Generated and Managed, which combines information from several 2003 Draft ROE indicators.

Number and Location of Superfund National Priorities List (NPL) Sites—D

This 2003 Draft ROE indicator represented an administrative decision to force a cleanup, rather than an amount of waste present or removed, and therefore does not meet the 2008 ROE indicator definition.

Number and Location of RCRA Corrective Action Sites—D

This 2003 Draft ROE indicator represented an administrative decision to force a cleanup, rather than an amount of waste present or removed, and therefore does not meet the 2008 ROE indicator definition.

Human Exposure and Health Chapter

Urine Arsenic Level—R

This 2003 Draft ROE indicator was based on data from EPA Region 5 only, and is not part of the 2008 ROE Regional Pilot.

Blood Volatile Organic Compound Levels—C

This 2003 Draft ROE indicator was based on a convenience sample whose representativeness cannot be determined or necessarily used as a baseline for future sampling. The indicator is based on detects only, so there is no reference level. Also, volatile organic compounds are cleared from the bloodstream rapidly (about 1 hour), so there is a significant possibility of false negatives, considering that exposure tends to be associated with occupational and indoor settings.

Cancer Mortality—P

Childhood Cancer Mortality—P

Asthma Mortality—P

Childhood Asthma Mortality—P

The independent peer review panel recommended the removal of the cancer and asthma mortality indicators because trends in these indicators are less likely to be due to changes in environmental factors than to changes in social factors such as availability/access to healthcare.

Ecological Condition Chapter

Forest Age Class—N

While forest age class has implications for biodiversity and ecological function, this indicator was withdrawn in favor of indicators of forest extent and type and forest fragmentation.

Extent of Ponds, Lakes, and Reservoirs—C

This 2003 Draft ROE indicator was based on data from the USGS National Wetlands Inventory. While these data are based on a valid statistical sampling design, the total amount of surface water is less than half the area of lakes, reservoirs, and ponds greater than 6 acres in size in the USGS National Hydrography Data Set. Until this discrepancy is resolved, the indicator may not satisfy the ROE criteria.

Extent of Estuaries and Coastline—C

This 2003 Draft ROE indicator was based on remote sensing data, but is unlikely to show trends unrelated to sea level rise and changing tides, so it is not a very useful indicator for trends.

At-Risk Native Species—C

At-Risk Native Grassland and Shrubland Species—C

At-Risk Native Forest Species—C

Populations of Representative Forest Species—C

Non-Native Fresh Water Species—C

At-Risk Native Fresh Water Species—C

At-Risk Fresh Water Plant Communities—C

The ecological condition chapter was restructured from the 2003 Draft ROE organization per the recommendation of EPA's Science Advisory Board and numerous stakeholders. As such, the chapter no longer requires that the above indicators be broken out by ecosystem. In addition, the ability to track trends of many of these indicators is questionable.

Tree Condition—C

This 2003 Draft ROE indicator was based on an ongoing statistical sample of forests across the contiguous U.S. and comprises components that relate to crown (tree canopy) condition, the ratio of dead to live wood, and the fire class. This indicator likely relates more to forest management practices than to environmental condition, and for this reason has low relevance value to EPA.

Population Trends of Invasive and Native Non-Invasive Bird Species—R

This 2003 Draft ROE indicator was based on an analysis of USGS Breeding Bird Survey data in grassland and shrubland ecosystems for 5-year periods ranging from the late 1960s to 2000. Because the ecological condition questions are no longer directed at specific ecosystem types, this appears to be a Regional Indicator. Also, it is not clear at this time that the data for this indicator will be collected in the future.

Coastal Living Habitats—C

This 2003 Draft ROE indicator was based on remote sensing data of coastal wetlands, mudflats, sea-grass beds, etc., but the only system for which a National Indicator has been developed is coastal vegetated wetlands, which already is covered in another indicator (the 2008 ROE's Wetlands indicator).

Shoreline Types—C

This 2003 Draft ROE indicator was based on NOAA's Environmental Sensitivity Index. The index is based on a standardized mapping approach, but coverage is not complete for large parts of the coastline and the data in some of the atlases are more than 15 years old. Consequently, this indicator is not appropriate for measurement of representative, national trends.

Fish Diversity—R

This 2003 Draft ROE indicator was based on a statistical sample of fish trawls in Mid-Atlantic estuaries during 1997-1998. This indicator is not part of the 2008 ROE Regional Pilot Project, and EPA's Environmental Monitoring and Assessment Program (EMAP) is no longer collecting fish samples to support this indicator.

Bird Community Index—R

This 2003 Draft ROE indicator was not national in scope or part of the ROE EPA Regional Pilot.

Forest Disturbance: Fire, Insects, and Disease—P

The independent peer review panel recommended that this indicator be withdrawn because it was "limited in many aspects of its coverage: temporally, spatially, and in types of disturbance…Ecological interpretation of disturbance patterns is difficult…For example, the lack of fire may actually represent an ecological disturbance, while fire suppression can lead to overcrowded forests that are more conducive to insect and disease outbreaks." The reviewers also commented that the data were questionable and that the interdependence among the disturbance categories could result in significant double-counting. Finally, timber harvest was not included even though it disturbs more acres than fires, insects, or disease.

Soil Compaction—C

Soil Erosion—C

These 2003 Draft ROE indicators are based on an ongoing statistical sample of soils in forests across the contiguous U.S., but the actual indicators are based on models rather than measurement. This violates a fundamental ROE protocol on the use of models in indicators.

Processes Beyond the Range of Historic Variation—C

This 2003 Draft ROE indicator was based on an analysis of recent Forest Inventory and Analysis data on climate events, fire frequency, and forest insect and disease outbreaks, which were then compared to anecdotal data for the 1800-1850 period. Because the early data are anecdotal, and because the data mostly relate to forest management practices, etc., it is proposed that this indicator has low relevance to EPA and that trend data are of questionable utility as an ROE indicator.

Soil Quality Index—R

This 2003 Draft ROE indicator was based on a survey of soils in the Mid-Atlantic region during the 1990s; that survey was not repeated and is not part of the Regional Pilot Project for the 2008 ROE.

Terrestrial Plant Growth Index—P

The independent peer review panel recommended that this indicator be withdrawn because "The results are too ambiguous and not explained, or perhaps, unexplainable…NDVI is a crude measure of growth. [Also,] The relative deviation of the Plant Growth Index (20-40%) without explanation during the period of analysis suggests that the indicator might lack the precision needed to assess national trends in productivity."

Chemical Contamination (partially withdrawn)—C

This 2003 Draft ROE indicator combined data from the NAWQA program that are not consistent in terms of sampling frequency or analytical protocols. The part of this indicator presenting contaminant levels in coastal fish as measured by EMAP was moved to a separate indicator in the water chapter of the 2008 ROE: Coastal Fish Tissue Contaminants.

Animal Deaths and Deformities—C

This 2003 Draft ROE indicator was based on data reported by a number of different organizations to USGS on incidences of death or deformities in waterfowl, fish, amphibians, and mammals. Trends are available only for waterfowl, and because data reporting is voluntary rather than systematic, the data are not adequate to determine actual trends versus trends in reporting.

Fish Abnormalities—C

This 2003 Draft ROE indicator was based on a statistical sample of fish trawls in estuaries in the Atlantic and Gulf, but the data are no longer being collected by EMAP to support this indicator.

Unusual Marine Mortalities—C

This 2003 Draft ROE indicator was based on voluntary reporting of unusual mortality events to NOAA. Because there is no systematic requirement to report, these data are not suitable to support national trends in the indicator.