REPORT OF THE 2005 PEER REVIEW OF PROPOSED INDICATORS FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S REPORT ON THE ENVIRONMENT 2007 (ROE07) TECHNICAL DOCUMENT

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Note

This report was prepared by Eastern Research Group, Inc. (ERG), under contract to the U.S. Environmental Protection Agency (EPA) (Contract No. 68-C-02-060, Task Order 68). This report summarizes discussions, in response to charge questions, among peer reviewers at a meeting in July 2005 and during two teleconference calls in November 2005. This report summarizes key points raised during the discussions. It does not contain a verbatim transcript of all issues discussed, nor does it embellish, interpret, or enlarge upon matters that were incomplete or unclear. Except as specifically otherwise noted, no statements in this report represent analyses by or positions of EPA or ERG.

CONTENTS

1. Introduction

2. July 2005 Peer Review

2.1 Introductory Remarks
2.2 Air Indicators
2.3 Water Indicators
2.4 Land Indicators
2.5 Human Health Indicators
2.6 Ecological Condition Indicators

Appendix 2A: July 2005 Reviewers

Appendix 2B: July 2005 Peer Reviewer Charges

2B-1: Air
2B-2: Water
2B-3: Land Chemical
2B-4: Land Waste
2B-5: Human Health
2B-6: Ecological Condition

Appendix 2C: July 2005 Consolidated Pre-Meeting Comments

2C-1: Air
2C-2: Water
2C-3: Land Chemical
2C-4: Land Waste
2C-5: Human Health
2C-6: Ecological Condition

Appendix 2D: July 2005 Observers

Appendix 2E: July 2005 Agendas

2E-1: Air
2E-2: Water
2E-3: Land Chemical
2E-4: Land Waste
2E-5: Human Health
2E-6: Ecological Condition

CONTENTS (cont.)

3. November 2005 Peer Review

3.1 Air Indicators
3.2 Water and Ecological Condition Indicators

Appendix 3A: November 2005 Reviewers

Appendix 3B: November 2005 Peer Reviewer Charges
3B-1: Air
3B-2: Water and Ecological Condition

Appendix 3C: November 2005 Consolidated Pre-Teleconference Comments
3C-1: Air
3C-2: Water and Ecological Condition

1. INTRODUCTION

In 2003, the U.S. Environmental Protection Agency (EPA) released the first of a series of reports, EPA's Draft Report on the Environment 2003 (ROE03). The intent of the report was to improve the Agency's ability to report on the status of and trends in environmental conditions and their impacts on human health and the nation's natural resources. The ROE03 consisted of a Technical Document and a shorter Public Document prepared for a non-technical audience.

These two reports were intended to identify and present the best available national-level indicators to help answer EPA's broad questions about the state of the nation's environment in five topic areas: air, water, land, human health, and ecological condition.

EPA's Administrator requested that generation of Reports on the Environment be continued into the future and that work begin to develop the next edition to be published in 2007. As a key step in ROE07 development, EPA compiled a set of 88 proposed environmental indicators to help answer the questions posed for the 2007 ROE (see Tables 1-1 and 1-2, beginning on page 3). As with ROE03, the questions are organized into five topic areas: air, water, land, human health, and ecological condition. To help answer these questions, EPA identified national-level indicators, national-level indicators that are broken out at the scale of EPA (or other) regions, and several regional indicators.

Many of the indicators proposed for ROE07 were also included in ROE03, but some were new and others had new data sources. The ROE indicator definition and criteria were both revised (see Boxes 1-1 and 1-2, on the next page) and, after careful review, EPA decided not to include some of the ROE03 indicators in ROE07.

To ensure that the indicators presented in the ROE07 TD are supported by data that are technically sound, meet the established indicator definition and criteria, and help answer the questions posed in the ROE, EPA contracted with Eastern Research Group, Inc. (ERG) to organize an independent peer review of the proposed ROE07 indicators. The review was conducted in two parts:

- On July 27–29, 2005, a 3-day workshop was held to peer-review the 88 proposed indicators.
- In November 2005, 11 indicators were reviewed by teleconference. This set consisted of 7 new indicators and 4 that had been substantially revised since the July peer review.

Tables 1-1 and 1-2 list the indicators reviewed in July and November 2005. The peer review was conducted according to the Office of Management and Budget's (OMB's) specifications for peer review of "Highly Influential Scientific Assessments" as specified in OMB's "Final Information Quality Bulletin for Peer Review" (OMB, 2004). EPA announced the peer reviews in the Federal Register and also posted the proposed indicators on a Web site for public comment. EPA's responses to reviewer and public comments are available at http://www.epa.gov/ncea/ROEIndicators/ROEprcomments.html.

This report summarizes the results of both peer reviews. Following this introduction (Section 1), the report is divided into two parts:

- **Section 2** provides the report on the July 2005 review.
- **Section 3** provides the report on the November 2005 review.

Box 1-1. Definition: Environmental Indicator

For purposes of ROE, an "indicator" is ***a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition*** *over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment*. Indicators and their underlying data must meet criteria (see the box below) for data quality, comparability, representativeness, and adequate coverage in time and space. Note that indicators rely on an underlying database or set of databases, but the databases themselves are not indicators.

Box 1-2. Environmental Indicator Criteria

1) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

2) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

3) The underlying data are characterized by sound collection methodologies, data management systems that protect their integrity, and quality assurance procedures.

4) Data are available to describe changes or trends, and the latest available data are timely.

5) 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.

6) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

Table 1-1. Proposed ROE07 Indicators Peer-Reviewed in July 2005

AIR

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

PM emissions
SO_2 emissions
NO_x emissions
VOC emissions
Lead emissions
Air toxics emissions
CO emissions
Mercury emissions
Ambient PM concentrations
Ambient ozone concentrations
Ambient lead concentrations
Ambient concentration of a selected air toxic: benzene
Ambient CO concentrations
Number and percent of days with AQI values >100
Ambient concentrations of manganese metal compounds
Ozone and PM for U.S./Mexico border counties
Ozone levels over North America*
Concentrations of ozone-depleting substances
Atmospheric deposition of mercury*
Acid deposition*
Ozone injury to forest plants
Visibility

What are the trends in greenhouse gas emissions and concentrations?

U.S. greenhouse gas emissions
Ambient concentrations of greenhouse gases

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

U.S. homes above EPA's radon action levels
Blood cotinine

WATER

What are the trends in extent and condition of fresh surface waters in the United States?

Lake and stream acidity*
Nitrate, phosphorus, and pesticides in streams in agricultural watersheds*
Nitrogen and phosphorus discharges from large rivers*

What are the trends in extent and condition of groundwater in the United States?

Nitrate and pesticides in groundwater in agricultural watersheds

What are the trends in extent and condition of wetlands?

Wetland extent, change, and sources of change*
Coastal habitat index*

* This indicator appears twice in this list because it was proposed to answer two ROE questions.

Table 1-1 (continued). Proposed ROE07 Indicators Peer-Reviewed in July 2005

What are the trends in extent and condition of coastal waters?

Coastal condition index
Coastal water quality index*
Coastal sediment quality index*
Coastal benthic index*
Extent of hypoxia in Gulf of Mexico and Long Island Sound*
Harmful algal bloom outbreaks*
Chesapeake Bay blue crabs: mature females—spawning stock abundance*
Submerged aquatic vegetation in Chesapeake Bay*

What are the trends in the quality of drinking water?

Population served by community water systems with no reported violations of health-based standards

What are the trends in the condition of recreational waters?

No indicators

What are the trends in the contamination/quality/safety of consumable fish and shellfish?

Coastal fish tissue contaminants index*

LAND

What are the trends in chemicals used on the land and their effects on human health and the environment? (Chemicals to include toxic substances, pesticides, fertilizers, etc.)

Fertilizer applied for agricultural purposes
Reported toxic chemicals in wastes released, treated, recycled, or recovered for energy use
Pesticide residues in food
Pesticide-resistant arthropod species*
Pesticide poisonings

What are the trends in wastes and their effects on human health and the environment?

Quantity of municipal solid waste generated and managed
Quantity of RCRA hazardous waste generated and managed

What are the trends in contaminated land and their effects on human health and the environment?

Human exposure under control on contaminated lands
Contaminated groundwater under control on contaminated lands

What are the trends in land cover and their effects on human health and the environment?

Land cover*
Forest extent and type*

What are the trends in land use and their effects on human health and the environment?

Land use*
Urbanization and population change*

* This indicator appears twice in this list because it was proposed to answer two ROE questions.

Table 1-1 (continued). Proposed ROE07 Indicators Peer-Reviewed in July 2005

HUMAN HEALTH

What are the trends in health status in the U.S.?

Life expectancy
Infant mortality
General mortality

What are the trends in human disease and conditions for which environmental pollutants are thought to be risk factors including across population subgroups and geographic regions?

Cancer incidence and mortality
Cardiovascular disease (CVD) mortality
Asthma mortality and prevalence
Chronic obstructive pulmonary disease (COPD) mortality
Infectious gastrointestinal and arthropod-borne disease prevalence
Low birthweight
Birth defect incidence and mortality
Childhood cancer incidence and mortality
Childhood asthma prevalence and mortality
Preterm delivery

What are the trends in biomeasures of exposure to common environmental pollutants including across population subgroups and geographic regions?

Blood lead level
Blood mercury level
Blood cadmium level
Blood persistent organic pollutants (POPs) level
Urinary pesticide/herbicide level
Phthalate exposure

ECOLOGICAL CONDITION

What are the trends in the extent and distribution of the Nation's ecological systems?

Forest pattern and fragmentation
Extent of coral reef cover
Ecological framework
Relative ecological condition of undeveloped land
Land cover change in Puget Sound basin
Wetland extent, change, and sources of change*
Coastal habitat index*
Land cover*
Land use*
Forest extent and type*
Urbanization and population change*

* This indicator appears twice in this list because it was proposed to answer two ROE questions.

Table 1-1 (continued). Proposed ROE07 Indicators Peer-Reviewed in July 2005

What are the trends in the diversity and biological balance of the Nation's ecological systems?

Terrestrial plant growth index
Bird populations
Fish faunal intactness
Threatened and endangered species
Non-indigenous species in the estuaries of Oregon and Washington
Coastal benthic index*
Harmful algal bloom outbreaks*
Submerged aquatic vegetation in Chesapeake Bay*
Chesapeake Bay blue crabs: mature females—spawning stock abundance*
Pesticide-resistant arthropod species*

What are the trends in the ecological processes that sustain the Nation's ecological systems?

Forest disturbance
Nitrogen and phosphorus discharges from large rivers*

What are the trends in the critical physical and chemical attributes of the Nation's ecological systems?

Changing streamflows
Carbon storage in forests
U.S. and global mean temperature and precipitation
Ozone levels over North America*
Atmospheric deposition of mercury*
Acid deposition*
Coastal water quality index*
Coastal sediment quality index*
Lake and stream acidity*
Extent of hypoxia in Gulf of Mexico and Long Island Sound*
Nitrate, phosphorus, and pesticides in streams in agricultural watersheds*

What are the trends in biomeasures of exposure to common environmental pollutants in plants and animals?

Coastal fish tissue contaminants index*

* This indicator appears twice in this list because it was proposed to answer two ROE questions.

Table 1-2. Proposed ROE07 Indicators Peer-Reviewed in November 2005

AIR

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

Ambient nitrogen dioxide concentrations
Ambient concentrations of manganese compounds in EPA Region 5†
Ozone and particulate matter (PM) concentrations for U.S. counties in the U.S./Mexico border region (EPA Regions 6 and 9)†

WATER

What are the trends in extent and conditions of fresh surface waters?

Streambed stability in wadeable streams*
Nitrogen and phosphorus in wadeable streams*
Benthic macroinvertebrates in wadeable streams*

What are the trends in the contamination/quality/safety of consumable fish and shellfish?

Contaminants in lake fish tissue*

What are the trends in extent and condition of coastal waters?

Coastal sediment quality†
Harmful algal bloom outbreaks in Gulf of Mexico (Region 4)†

ECOLOGICAL CONDITION

What are the trends in the critical physical and chemical attributes of the Nation's ecological systems?

Streambed stability in wadeable streams*
Nitrogen and phosphorus in wadeable streams*
Sea level
Sea surface temperature

What are the trends in the diversity and biological balance of the Nation's ecological systems?

Benthic macroinvertebrates in wadeable streams*

What are the trends in biomeasures of exposure to common environmental pollutants in plants and animals?

Contaminants in lake fish tissue*

* This indicator appears twice in this list because it was proposed to answer two ROE questions.
† A prior version of this indicator was peer-reviewed in July 2005.

1.1 July 2005 Review[1]

Reviewer Selection

Using selection criteria specific to each topic area, ERG independently identified 21 reviewers for the July review. The reviewers were divided into six groups: air, water, land chemical, land waste, human health, and ecological condition. Reviewers hailed from academia, state government, nonprofit organizations, consulting, and the private sector. **Appendix 2A** provides the list of reviewers by topic area.

Charge to Reviewers

Each set of reviewers received a separate charge (provided in **Appendix 2B**). All charges were similar in their basic structure, charge questions, and components. Each charge contained the entire list of indicators (Attachment 1 of the charges), as well as specific questions, information, and comment sheets. Reviewers were also provided with a list of ROE03 indicators that EPA was proposing not to include in ROE07, and the Agency's rationale for withdrawing them. Overall, reviewers were charged with four tasks:

- Assess whether the proposed indicators are appropriate, adequate, and useful for evaluating and establishing an overall picture of our nation's air, waters, land, human health, and ecological condition.
- Evaluate the proposed indicators' importance in terms of their ability to respond to the ROE07 question(s) they are proposed to answer.
- Evaluate the proposed indicators and their underlying data with respect to the ROE indicator definition and criteria.
- Identify any additional *national-level* indicators that currently exist which meet the ROE indicator definition and criteria, help answer one of the ROE questions, and for which data are readily available such that text and graphics describing the indicator could be developed within a short time frame (approximately 6 weeks).

Variations to the charges occur primarily due to variations in the types of review requested for different indicators:

- Most indicators were reviewed by just one group of reviewers.
- A few indicators were reviewed by two review groups. One group addressed the overall value of the indicator for evaluating our nation's environment and answering the ROE question. The second group reviewed the extent to which the indicator meets the indicator definition and criteria.
- A few indicators (referred to as "referenced indicators") were proposed to answer more than one ROE question. In such cases, one group of reviewers addressed the overall value of the indicator for evaluating our nation's environment, reviewed the extent to which the indicator meets the indicator definition and criteria, and reviewed the indicator's value for answering the ROE question the indicator was proposed to answer in their topic area. The second group commented on the indicator's value for answering the ROE question it was proposed to answer in *their* topic area.

[1] At the time of this peer review, EPA intended to publish the ROE Technical Document in 2006. Therefore, subsequent sections of this report refer to the "2006 Report on the Environment" and "ROE06." These terms are synonymous with all references to the "2007 Report on the Environment" and "ROE07" elsewhere in this report.

Review Materials and Public Comments

Reviewers received copies of the charge and proposed indicators. At the same time, EPA posted copies of the indicators and charge on its Web site so that interested stakeholders could view the peer review materials and provide comments directly to the Agency. EPA issued a Federal Register notice of the meeting inviting stakeholders to provide written comments and attend the meeting as observers, with opportunities to sign up to make oral comments. Reviewers were provided with information about and access to EPA's public comment docket so they could consider the written public comments as they reviewed the indicators.

Pre-Meeting Comments

Reviewers worked individually to prepare written pre-meeting comments. ERG compiled these comments, by indicator (see **Appendix 2C**), and distributed them to the peer reviewers to prepare for the workshop. These comments were preliminary in nature and intended as background and preparation for discussion at the peer review meeting.

Peer Review Meeting

The peer review meeting was held July 27-29, 2005, at the Almas Temple in Washington, D.C. The meeting was attended by the 21 peer reviewers, as well as observers including EPA staff and stakeholders (see **Appendix 2D** for the list of observers).

The meeting began with a plenary session during which ERG and EPA made opening remarks. Reviewers then divided into six groups to discuss the indicators they had been asked to review. All groups met in close proximity; each group had the opportunity to involve other reviewers in discussions as needed, and observers could easily move among groups. Aside from observer comment sessions, there were no further plenary sessions—discussion continued in the topic groups. There were opportunities for public comment each day of the meeting. Two groups (land waste and land chemical) met only on the first day. The other four groups met all three days. Agendas for each group are provided in **Appendix 2E**.

At the meeting, reviewers discussed the charge questions for each indicator and, where they agreed, drafted conclusions and recommendations. Reviewers distinguished between recommendations they considered "critical" (i.e., EPA should not include the indicator in the ROE07 Technical Document without making the recommended changes) and "suggested" recommendations (i.e., EPA could still include the indicator even if it decided not to make the suggested change). As the last step in their discussions for an indicator, reviewers were asked to make an overall recommendation for the indicator:

- Include in the ROE07 Technical Document.
- Include in the ROE07 Technical Document only if modifications identified as critical are made.
- Don't include in the ROE07 Technical Document.

ERG writers took notes and prepared a summary report of the discussions. Reviewers checked the draft report for accuracy and completeness before it was finalized.

Summary Report

Section 2 of this report summarizes the introductory remarks at the peer review meeting, as well as the reviewer discussions, conclusions, and recommendations. It is organized into seven sections: introductory

remarks (Section 2.1), air (Section 2.2), water (Section 2.3), land chemical (Section 2.4), land waste (Section 2.5), human health (Section 2.6), and ecological condition (Section 2.7).

Sections 2.2 to 2.7 are organized as follows:

- Table of contents.
- Introduction, including table listing the indicator dispositions recommended by reviewers (include in ROE07 TD; include only with critical modifications; don't include).
- Discussion summaries organized by indicator, with consensus statements presented in tables. (When an indicator was reviewed by two groups of reviewers, the two reviews are presented sequentially.)
- Summaries of reviewers' response to the two general charge questions.

1.2 November 2005 Review[2]

Reviewer Selection

The November 2005 review had two sets of reviewers:

- Three reviewers for the air indicators.
- Six reviewers for the water and ecological condition indicators.

ERG selected these reviewers from among the prior air, water, and ecological condition reviewers based on the relevance of their expertise to the indicators to be reviewed. ERG also added one new reviewer with expertise relevant to two of the newly proposed ecological condition indicators. This reviewer reviewed only those two indicators. **Appendix 3A** provides the list of reviewers by topic area.

Charge to Reviewers

The November 2005 review had two charges (provided in **Appendix 3B**): one for air indicators and the other for water and ecological condition indicators. Reviewers were asked to focus on:

- Assessing whether the proposed indicators are appropriate, adequate, and useful for evaluating and establishing an overall picture of our nation's air, waters, and/or ecological condition.
- Evaluating the proposed indicators' importance in terms of their ability to respond to the ROE question(s) they are proposed to answer.
- Evaluating the proposed indicators and their underlying data with respect to the ROE indicator definition and criteria.

Review Materials and Public Comments

Reviewers received copies of the draft indicators and charge, as well as EPA's responses to the July 2005 reviewer comments for the four revised indicators. At the same time, EPA posted copies of the indicators and charge on its Web site so that interested stakeholders could view the peer review materials and provide comments directly to the Agency. EPA issued a Federal Register notice about this review inviting

[2] At the time of this peer review, EPA intended to publish the ROE Technical Document in 2006. Therefore, subsequent sections of the report refer to the "2006 Report on the Environment" and "ROE06." These terms are synonymous with all references to the "2007 Report on the Environment" and "ROE07" elsewhere in this report.

stakeholders to provide written comments. EPA's responses to reviewer and public comments are available at http://www.epa.gov/ncea/ROEIndicators/ROEprcomments.html.

Pre-Teleconference Comments

Reviewers worked individually to prepare written pre-teleconference comments. ERG compiled these comments, by indicator (see **Appendix 3C**), and distributed them to the peer reviewers to prepare for the teleconference. These comments were preliminary in nature and intended as background and preparation for discussion.

Peer Review Teleconference

The peer review teleconferences were held on:

- November 7, 2005, for the air indicators.
- November 15, 2005, for the water and ecological condition indicators.

ERG facilitated the call; discussions were chaired by one of the peer reviewers. Reviewers discussed the charge questions for each indicator and, where they agreed, drafted conclusions and recommendations. As with the July 2005 review, reviewers distinguished between "critical" recommendations (i.e., EPA should not include the indicator in the ROE07 Technical Document without making the recommended changes) and "suggested" recommendations (i.e., EPA could still include the indicator even if it decided not to make the suggested change). Again, reviewers were asked to recommend one of three dispositions for each indicator:

- Include in the ROE07 Technical Document.
- Include in the ROE07 Technical Document only if modifications identified as critical are made.
- Don't include in the ROE07 Technical Document.

An ERG writer took notes and prepared a summary report of the discussions. Reviewers checked the draft report for accuracy and completeness before it was finalized.

Summary Report

Section 3 of this report summarizes the reviewer discussions, conclusions, and recommendations from the November 2005 teleconferences. It is organized into the two sections: air (Section 3.1) and water and ecological condition (Section 3.2). These sections are organized as follows:

- Table of contents.
- Introduction, including table listing the indicator dispositions recommended by reviewers.
- General comments.
- Discussion summaries organized by indicator.

Reference

OMB, 2004. Final Information Quality Bulletin for Peer Review. December 16, 2004. Office of Management and Budget, Washington, D.C.