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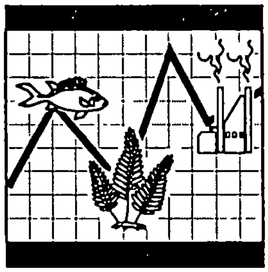


NATIONAL ENVIRONMENTAL GOALS AND INDICATORS CONFERENCE

"Measuring and Communicating Progress"

February 2-4, 1994

Conducted by the

Florida Center for Public Management, Florida State University

In cooperation with and funding provided by the

Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency

CLARION HOTEL NEW ORLEANS
NEW ORLEANS, LOUISIANA

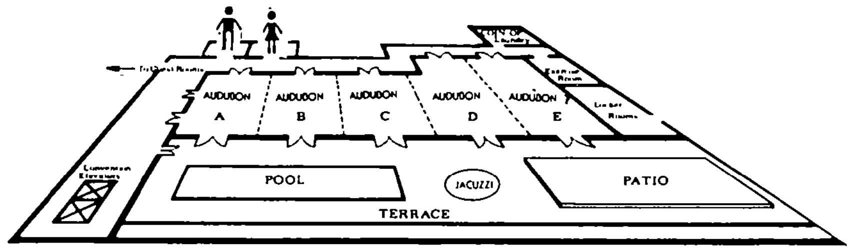
Schedule-At-A-Glance

All sessions will be held in Grand Ballroom Salon B (2nd floor), unless otherwise noted

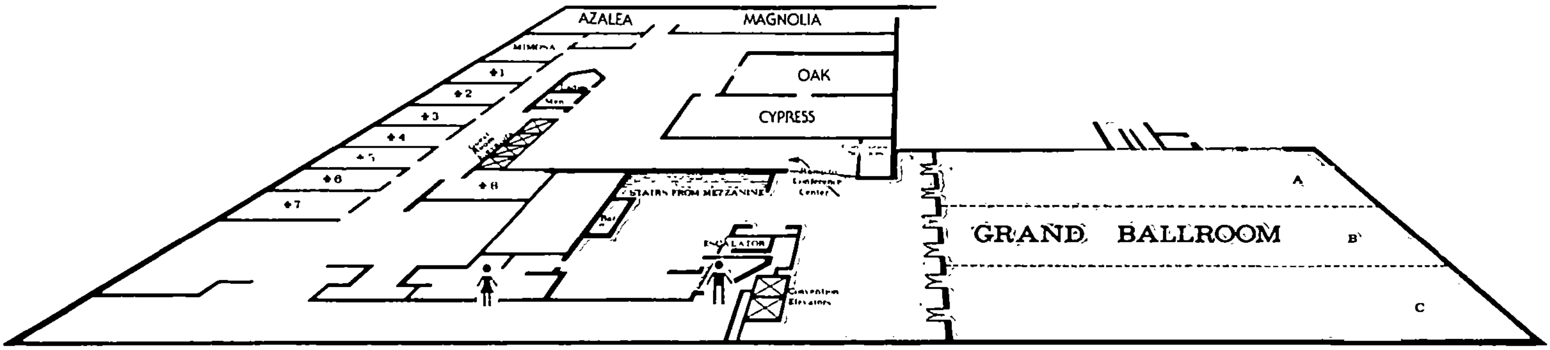
Day	Time	Session
Wednesday	8:30 AM	Registration
	9:00	Pilot Roundtable Meeting On Setting National Environmental Goals: — *Cypress Room (2nd floor)* The Rensellaerville Institute
		Special Pre-Session On Comparative Risk, Indicators and the Development of National Environmental Goals Ken Jones, Acting Director, Northeast Center for Comparative Risk
	2:00	Welcome and Overview Rick Sinding, Assistant Commissioner for Policy and Planning, New Jersey Department of Environmental Protection and Energy Bill Kucharski, Secretary, Louisiana Department of Environmental Quality
	2:30	The Future of Environmental Policy In America
	3:30	How Does It All Fit? Moderator: Kate Kramer, Director, Western Center for Comparative Risk Panel: Tom Looby, Director, Office of the Environment, Colorado Department of Health *A State Perspective* Bob Currie, Director, Strategic Planning and Management Division, U.S. Environmental Protection Agency *A Federal Perspective* Gil Bergquist, Senior Management Consultant, Florida Center for Public Management, Florida State University *The Nuts and Bolts of Environmental Indicators*
	6:00	Free Time
	6:30	Cajun Fais Do Do — *Cajun Barn*
Thursday	7:30 AM	Breakfast — *Grand Ballroom Salon A (2nd floor)*
	8:30	Overview and Expectations
	8:45	Summary of the Homework and Summary of the Four Regional Conferences Rick Sinding, Assist. Commissioner for Policy and Planning, New Jersey Department of Environmental Protection and Energy *Northeastern Conference* Gil Bergquist, Senior Management Consultant, Florida Center for Public Management, Florida State University *Southeastern Conference* Gerald Bulanowski, Colorado Department of Health *Mid-America Conference* Steve Hanna, California Environmental Protection Agency *Western Conference* Jim Bernard, Director, Natural Resources Policy Division, Maine State Planning Office *Homework Summary*
	9:45	Instructions for the Indicator Development Session
	10:00	Indicator Development Workshop Session I
	12:00	Luncheon Address — *Grand Ballroom Salon A* — Hans van Zijst, Counselor for Health and Environment, Royal Netherlands Embassy
	1:30	Transition
	1:45	Indicator Development Workgroup Session II
	5:00	Sessions Reports
	6:30	Drop-In Reception — *Pat O'Brien's On Bourbon Street*
Friday	7:00 AM	Breakfast — *Grand Ballroom Salon A*
	8:00	Plenary Discussion of Core Indicators
	10:30	Future Directions for EPA and the States
	12:00	Working Lunch — *Grand Ballroom Salon A*
	1:30	Regional Discussion Group Reports and Wrap-Up
	2:00	Conference Adjournment

Clarion Hotel Floor Plan

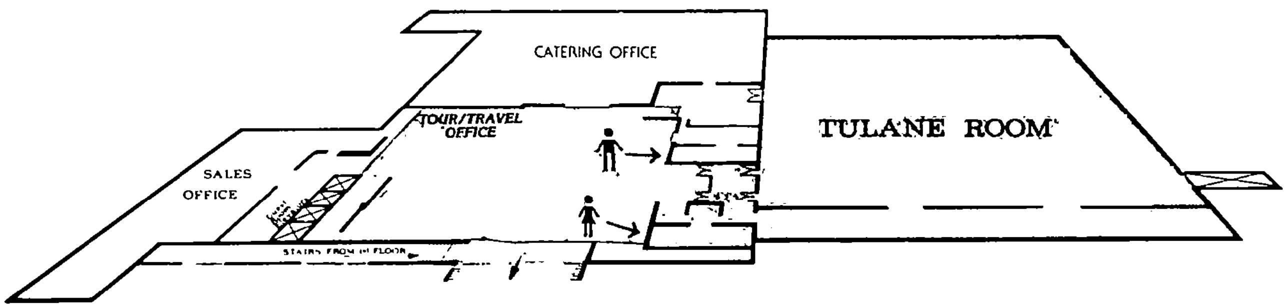
AUDUBON SUITES
6TH FLOOR



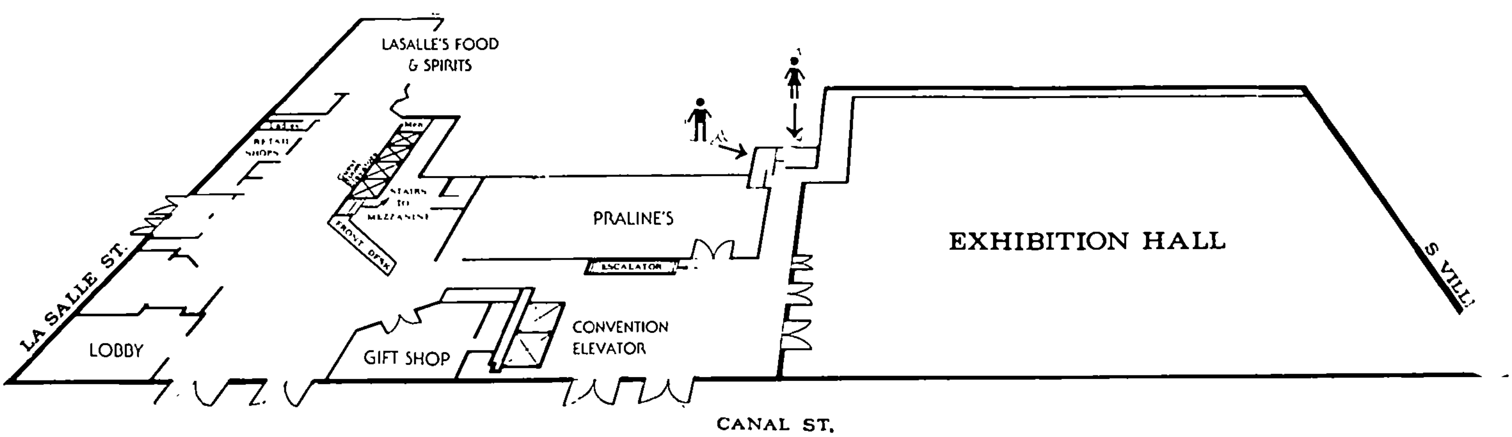
CONFERENCE CENTER/ GRAND BALLROOM
2ND FLOOR



TULANE ROOM
MEZZANINE LEVEL



EXHIBITION HALL
1ST FLOOR



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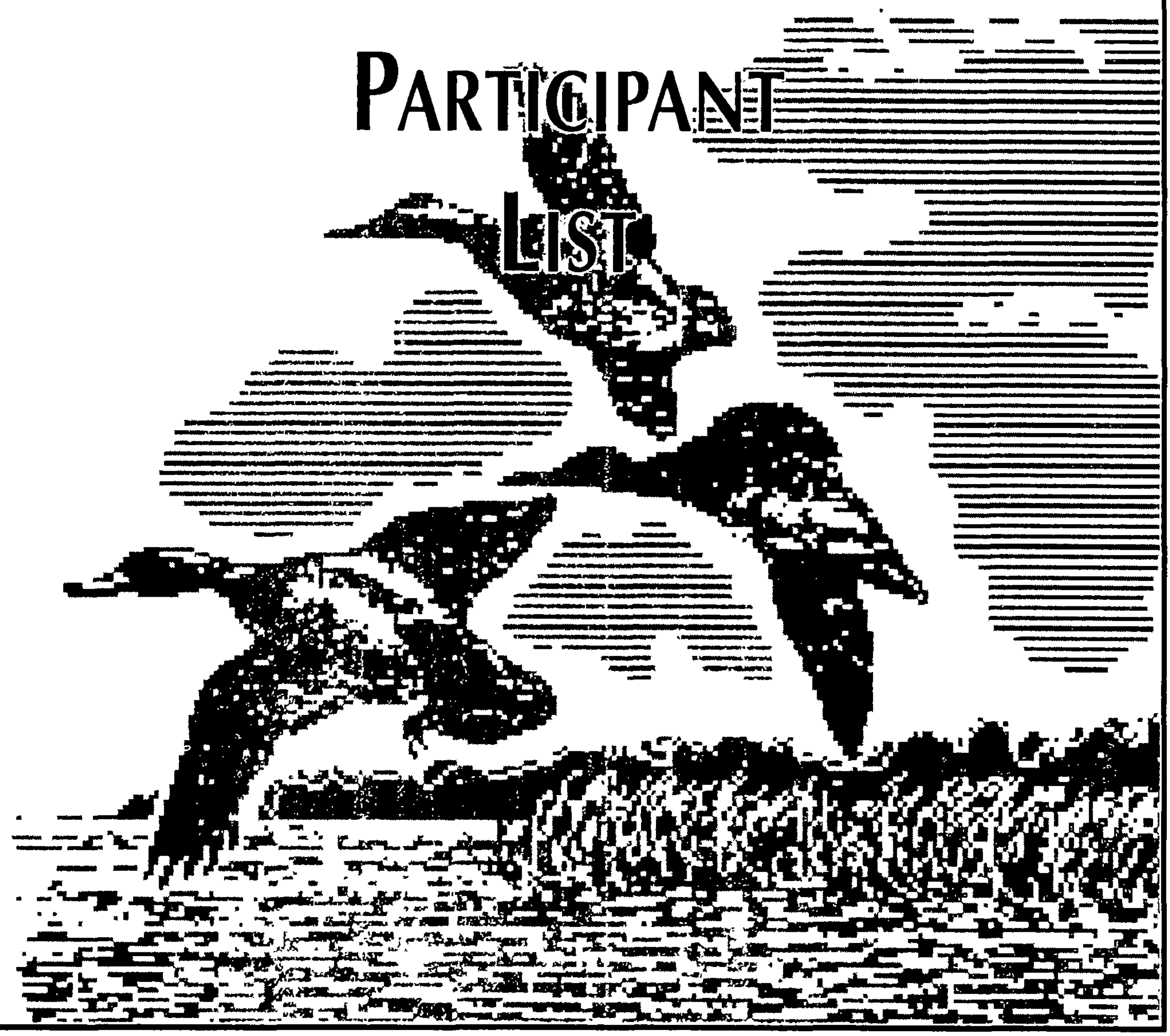
CONFERENCE EVALUATION FORM

PARTICIPANT LIST



DANIEL ABBASI
Special Assistant
USEPA
Washington, DC

FLOYD ADAMSEN
Soil Scientist
USDA, ARS
Phoeniz, AZ

DERRY ALLEN
Director, OSPED
USEPA
Washington, DC

KAREN ARMSTRONG-CUMMINGS
Director, Admin. Serv.
Frankfort, KY

LINA BALLUZ
Environmental Scientist
LA Dept. of Health
Baton Rouge, LA

RUSS BARNETT
Deputy Commissioner
Frankfort, KY

PHIL BASS
Chief, Field Services
Dept. of Environmental Quality
Jackson, MS

SUE BATTLE
Dept. Dir., Policy & Plng
Dept. of the Environment
Baltimore, MD

NANCY BEACH
Environmental Specialist
USEPA
Washington, DC

DAVID BEDAN
Sr. Policy Planner
Dept. of Natural Resources
Springfield, MO

STEVE BEIBER
Environmental Specialist
Dept. of the Environment
Baltimore, MD

SHERRY BISHKO
Program Analyst
USEPA, Region II
New York, NY

WILLIAM D. BRANNON
Assistant Chief
Div. of Environmental Protection
Nitro, WV

HENRY BRUBAKER
Program Analyust
USEPA, Region III
Philadelphia, PA

BARRY BURGON
USEPA
Washington, DC

MARY CARTER
Chief, PPAS
USEPA, Region VII
Kansas City, KS

DICK CASSET
Chief
Dept. of Pollution Control & Ecology
Little Rock, AR

JEAN CIRCIELLO
Management Analyst
USEPA, Region IV
San Francisco, CA

EDWARD COLE
Assistant Commissioner
Dept. of Environment & Conservation
Nashville, TN

BOB COONER
Environmental Manager
Dept. of Environmental Management
Montgomery, AL

ROBERT COOPER
Planning Unit Chief
USEPA, Region III
Atlanta, GA

JOYCE CROSSON
USEPA, Region 10
Seattle, WA

ROBERT CURRIE
Dir., Strategic Plng & Mgmt.
USEPA
Washington, DC

JOHN DABULIEWICZ
Assistant Commissioner
New Hampshire DES
Concord, NH

EDWARD DELHAGEN
Policy Associate
Northeast Center for Comparative Risk
South Royalton, VT

KIM DEVONALD
USEPA
Washington, DC

LEE DOGGETT
Project Director
Casco Bay Estuary Project
Portland, ME

WILLIAM EBERLE
Environmental Engineer 3
NYSDEC
Albany, NY

MARILYN ELLIOTT
Director, Permits & Serv.
Dept. of Environmental Management
Montgomery, AL

JANE EPHREMIDES
Director, RMES
USEPA
Washington, DC

Participant List (continued)

DAVID EVANS
Senior Analyst
Public Health Services
Atlanta, GA

PATRICK FELLING
Strategic Plng. Coord.
Dept. of Health
Honolulu, HI

ANNE FORBES
Special Assistant
Dept. of Natural Resources
Madison, WI

JOE FRANCIS
Assistant Director
Dept. of Environmental Quality
Lincoln, NE

LARRY GALES
Director, Support Service
Dept. of Environmental Quality
Oklahoma City, OK

RICHARD GATES
Lab Administrator
Dept. of Environmental Quality
Portland, OR

SHASHI GOEL
Program Planner
Dept. of Natural Resources
DesMoines, IA

WENDY GORDON
Project Manager
Texas Natural Res. Conservation Comm.
Austin, TX

ROBERT GRIFFITH
Chief, Strategic Planning
Dept. of Administration
Providence, RI

DR. ANNA HACKENBRACHT
Chief, Plng & Analysis
USEPA
San Francisco, CA

JAUNAE HANGER
Executive Assistant
Dept. of Environmental Management
Indianapolis, IN

STEPHEN HANNA
Asst. for Env. Info.
CA Environmental Protection Agency
Sacramento, CA

RUSSELL HARDING
Deputy Director
Dept. of Natural Resources
Lansing, MI

GALE HARMS
Policy Analyst
NM Environment Department
Santa Fe, NM

ABEER HASHEM
Chief, Chemical Control
USEPA, Region V
Chicago, IL

DENNIS HEITMANN
Supervisor, Ground Water Sec.
Dept. of Environmental Quality
Lincoln, NE

JERRY HILL
Bureau Director
Dept. of Health
Little Rock, AR

GARY HUGHES
Asst. to Deputy Director
Dept. of Natural Resources
Lansing, MI

SUSAN HUTCHERSON
Program Analyst
USEPA, Region 10
Seattle, WA

DEBBIE INGRAM
USEPA
Washington, DC

BILL JAROCKI
Division of Environmental Quality
Boise, ID

BERNARD JOHNSON
Special Assistant
Agency for Natural Resources
Waterbury, VT

KEN JONES
Acting Director
Northeast Center for Comparative Risk
South Royalton, VT

GREENE JONES
Director, Env. Serv. Div.
USEPA
Philadelphia, PA

CHARLES JONES
Director, Div. of Env.
Dept. of Health & Environment
Topeka, KS

MICHAEL KAKUK
Staff Attorney
Environmental Quality Council
Helena, MT

ROGER KANERVA
Env. Policy Advisor
IL Environmental Protection Agency
Springfield, IL

JACQUES KAPUSCINSKI
Management Analyst
USEPA, Office of Info. Res. Mgmt.
Washington, DC

PAM KASTER
President
Citizens for a Clean Environment
Baton Rouge, LA

STEVE KEEN
Chief, DEP
DEP - Information Services
Nitro, WV

TIM KEENEY
Commissioner
Dept. of Environmental Protection
Hartford, CT

EDDLEMON KENDRA
Ecologist
OK Conservation Commission
Oklahoma City, OK

DOUGLAS KIEVIT-KYLAR
Admin. Assistant II
Agency for Natural Resources
Waterbury, VT

ROBERT KING
Deputy Director
Dept. of Health & Environmental Control
Columbia, SC

KATRINA KIPP
Program Analyst
USEPA, Region I
Boston, MA

WILLIAM KIRK
Acting Director
Advanced Science & Res. Team, PA DER
Harrisburg, PA

ART KOINES
Deputy Director, OSPED
USEPA
Washington, DC

KATE KRAMER
Executive Director
Western Center for Comparative Risk
Boulder, CO

RANDY KREIL
Natural Res. Biologist
ND Game & Fish Dept.
Bismarck, ND

RONALD KREIZENBECK
ESD Division Director
USEPA, Region 10
Seattle, WA

BILL KUCHARSKI
Deputy Secretary
Dept. of Environmental Quality
Baton Rouge, LA

TONY LAFFERTY
Environmental Specialist
Ohio Environmental Protection Agency
Columbus, OH

MARK LAWRENCESON
Nat. Res. Program Scientist
Pierre, SD

JIM F. LEMONS
Chief, Branch Materials
Bureau of Mines
Washington, DC

MICHELE LESLIE
Policy Analyst
Science Applications Int'l Corp.
Falls Church, VA

TOM LOOBY
Director
Office of Environment
Denver, CO

J. W. LUNA
Commissioner
Dept. of Environment & Conservation
Nashville, TN

ROBERT LYNCH
Assistant Secretary
Office of the Secretary of Environment
Oklahoma City, OK

MICHAEL LYONS
Exec. Vice President
LA Mid-Continent Oil & Gas Assoc.
Baton Rouge, LA

SAM MABRY
Chief, Hazardous Waste
Dept. of Environmental Quality
Jackson, MS

RON MARIBETT
Director, Administration
Dept. of Environmental Protection
Boston, MA

PAT MARIELLA
Management Consultant
Dept. of Environmental Quality
Phoenix, AZ

BILL MARKLEY
Administrator
Pierre, SD

MARK MCCLANAHAN, PH.D.
Health Scientist
Center for Disease Control
Atlanta, GA

SCOTT MCDONALD
Assistant Professor
Jackson State University
Jackson, MS

MARY MCKENZIE
Executive Assistant
DNRES
Dover, DE

STACY MCVICKER
Program Analyst
USEPA
Kansas City, KS

MICHAEL MENGE
Director
Div. of Environmental Quality
Juneau, AK

ALISON MILLER
Statistician
TX Natural Resource Conservation Comm.
Austin, TX

Participant List (continued)

PHILIP MILLER
Execcutive Policy Asst.
Dept. of Ecology
Olympia, WA

JULIE MOBERLEY
Dept. of Natural Resources
Springfield, MO

JANE MOORE
Asst. Regional Admin.
USEPA, Region 10
Seattle, WA

TIM MULHOLLAND
Waste Management Engineer
Dept. of Natural Resources
Madison, WI

AGI NADAI
Geologist
USEPA
New York, NY

BEVERLY NEGRI
Chief, Planning & Grants
USEPA, Region VI
Dallas, TX

DAVID NICHOLAS
Budget Analyst
USEPA
Washington, DC

CHRIS PATERSON
University of North Carolina
Carrboro, NC

ROSE PAUL
Chief, Policy & Planning
Agency for Natural Resources
Wayerbury, VT

CHERYL PAVELLA
Special Assistant
Dept. of Env. Protection & Energy
Trenton, NJ

DEE PEACE RAGSDALE
Policy Planner
Dept. of Ecology
Olympia, WA

STEVE PILCHER
Administrator
Environmental Sciences Div.
Helena, MT

HARVEY G. PIPPIN, JR.
Office Director
USEPA, OARM, OGD
Washington, DC

DICK POIRIER
Plng. Program Manager
Office of State Planning
Honolulu, HI

JIM POWELL
Assistant Director
Div. of Environmental Quality
Juneau, AK

THOMAS POWERS
Deputy Commissioner
Dept. of Environmental Protection
Boston, MA

BONNIE RABE
Pesticides Specialist
Dept. of Agriculture
Alberquerque, NM

GREGG ROBERTSON
Deputy Secretary
Dept. of Environmental Regulation
Harrisburg, PA

MAUREEN ROSS
Grants Policy Specialist
USEPA
Washington, DC

CAROL ROWAN WEST
Director
Dept. of Environmental Protection
Boston, MA

MICHAEL ROWE
Division Director
Dept. of Health & Environmental Control
Columbia, SC

SUZANNE RUDZINSKI
Branch Chief
USEPA
Washington, DC

J. R. SANDOVAL
Assistant Administrator
Div. of Environmental Quality
Boise, ID

MIKE SANDUSKY
Pollution Control Agency
Minneapolis, MN

JOHN SCHELP
Program Analyust
NEIHS - NIH
Research Triangle Park, NC

PAUL SCHMEICHEN
Senior Planner
Pollution Control Agency
Minneapolis, MN

JOHN SCHNEIDER
Program Manager
Dept. of Nat. Res. & Env. Control
Dover, DE

JAMES SETSER
Chief, Program Coord.
Environmental Protection Div.
Atlanta, GA

CHRIS SIMMERS
Chief Planner
New Hampshire DES
Concord, NH

HARVEY SIMON
Environmental Specialist
USEPA, Region II
New York, NY

RICK SINDING
Assistant Commissioner
Dept. of Env. Protection & Energy
Trenton, NJ

BRUCE SLATER
Planner
Dept. of Environmental Quality
Salt Lake City, UT

MARC SNYDER
Senior Ecologist
Western Center for Comparative Risk
Boulder, CO

ROBERT STEIERT
Supervisory Engineer
USEPA, Region VII
Kansas City, KS

TIMOTHY STUART
Statistician
USEPA
Washington, DC

DAVID SULLIVAN
Env. Quality Spcialist
TX Natural Res. Conservation Comm.
Austin, TX

DICK SUMPTER
Program Analyst
USEPA, Region VII
Kansas City, KS

MATT THAYER
Project Manager
Dept. of the Environment
Baltimore, MD

DAVID TRIMBLE
Environmental Specialist
Dept. of Environmental Protection
Tallahassee, FL

JOHN TURNER
Chief, ESD
California Fish and Game
Sacramento, CA

CLARK VEGA
Associate
Harris, DeVille & Associates
Baton Rouge, LA

FREDERICK VINCENT
Assoc. Dir., Plng & Admin
Dept. of Environmental Management
Providence, RI

DAVID VOGT
Section Chief
Environmental Statistics & GIS
Raleigh, NC

KARL WAGENER
Executive Director
Council on Environmental Quality
Hartford, CT

BARBARA WELLS
Sr. Policy Analyst
National Governor's Association
Washington, DC

GWENDOLYN WHITT
Env. Protection Spec.
USEPA
Washington, DC

WILLIAM WILEY
Deputy Director
Dept. of Enviornment
Phoenix, AZ

KARL WILKINS
Environmental Specialist
Dept. of Environemtnal Protection
Augusta, ME

JIM WILKINS
Northeast Center for Comparative Risk
South Royalton, VT

DON WILLARD
Deputy Director
Mecklenburg Co.
Charlotte, NC

DAVID WORKMAN
Planner
Dept. of Environmental Quality
Salt Lake City, UT

JANET YOWELL
Research Associate
Western Center for Comparative Risk
Boulder, CO

GREGORY ZACCARDI
Environmental Scientist
USEPA
New York, NY

EDWARD ZIOMKOSKI
Program Analyst
EPA, Superfund
Washington, DC

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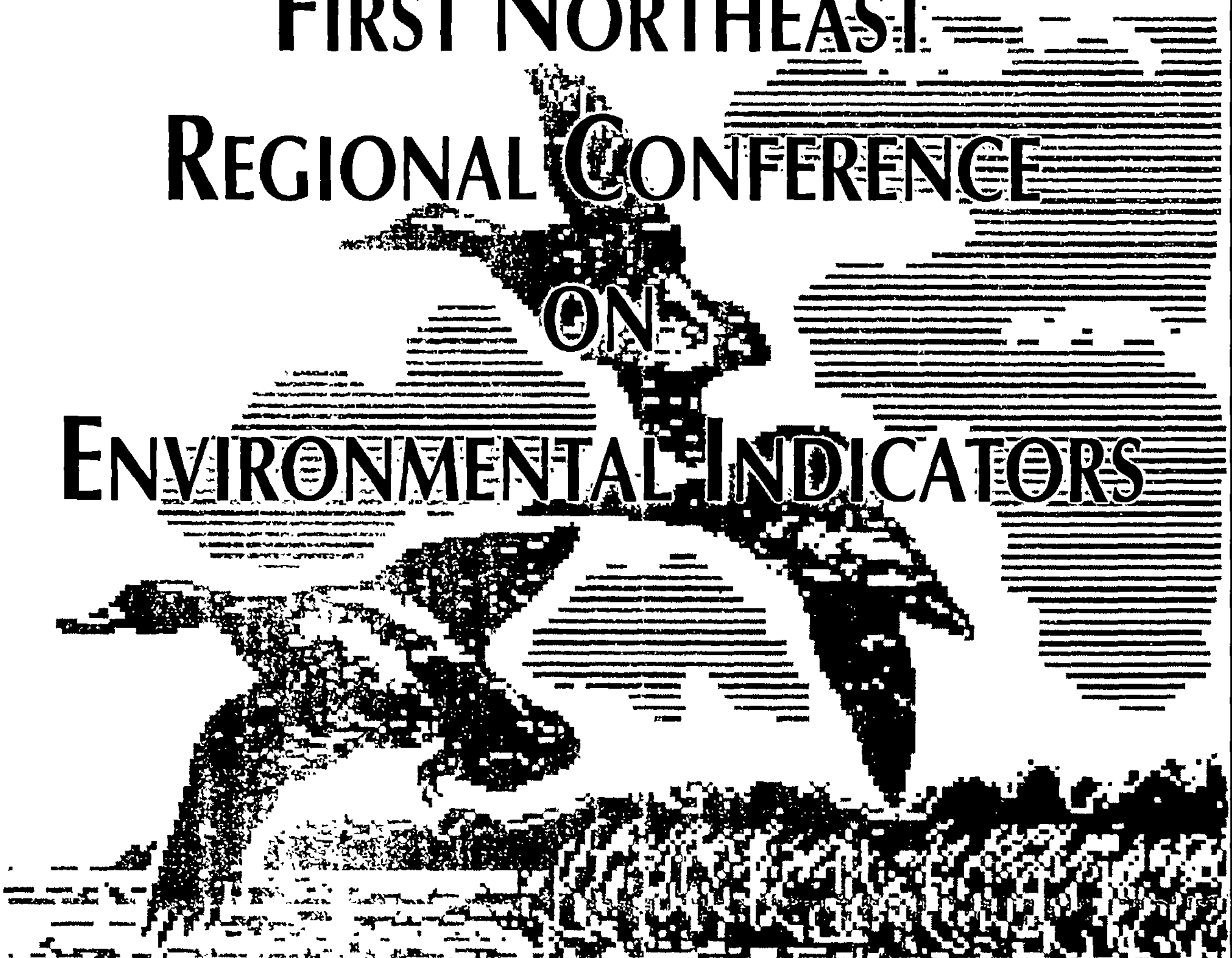
SUMMARY:
FIRST NORTHEAST REGIONAL CONFERENCE ON ENVIRONMENTAL INDICATORS



SUMMARY

The Environmental Indicators Conference of March 6-8 ended with a one and one-half hour open discussion summarizing what the participants learned from the conference. This discussion lay the foundation for deciding where to go from here.

Listed below are the five key points noted by the participants throughout the conference. The discussion ensuing around these topics is summarized.

1. There is no single, ideal environmental indicator.

2. The purpose of indicators is to measure progress toward achieving clearly stated environmental goals.

3. Stakeholders should be involved when developing environmental goals and indicators. Stakeholders include the public, industry, business, environmental groups, government agencies, academia, etc.

4. It is important to convey environmental progress to the public.

5. The environmental debate cannot be conducted in a vacuum but must be expanded to encompass social and financial arenas.

There Is No Single Ideal Indicator

Environmental indicators are a very complex topic. The conference workshop clearly established that there is no single ideal environmental indicator, nor is there a single list of indicators which would be adequate for all of the States. There are some indicators in use today which can provide us with models for developing environmental indicators.

Different indicators should be used for different audiences. For the public, generalized indicators would be appropriate. Generalized indicators simplify environmental information so it is easily understandable. One common technique for generalizing information is to develop a composite number.

An example of a general, composite indicator is the GNP (Gross National Product). This economic indicator is communicated to the public as a single number, but is derived by combining many separate values which represent different aspects of the nation's economic activity. These separate or component values are indicators themselves, but of a highly complex nature. The complexity of the component values often reflects the level of detail needed by specialists to scientifically measure complicated phenomena.

Composite indicators are a good communication tool for portraying a complex issue in a simple, comprehensive way for the public. This model can be used for environmental indicators. For example, "air quality" could be reported using a single number which was derived by measuring and combining several air quality characteristics. Not all conference participants approved of the general, composite indicator model for publicly reported indicators.

Other indicator models, such as comprehensive sets of indicators for each media were discussed. Accurate environmental reporting will likely require the use of several types of indicators.

Indicators may change over time. Developing and reporting indicators is a dynamic process. The process should start with available information that can be reported now. From this baseline, one can identify indicators that would be good to use and begin to collect the necessary information.

Since there are no ideal indicators, one can defend why individual indicators are selected by stating the indicator's benefits and limitations up front. It must be clear that indicators are one piece of a mosaic and like all measuring tools they are limited in some way. The panel discussion described earlier addresses several important issues concerning the limitations of indicators.

The Purpose Of Indicators Is To Measure Progress Toward Achieving Clearly Stated Environmental Goals

One of the most fundamental issues facing us today is the erosion of public confidence in government. The general lack of government credibility has several causes. Central to this is the government's failure to communicate more effectively with the public and to increase public involvement in decision-making. Developing and reporting environmental indicators is one way to improve government's relationship with the public.

Part of the credibility gap is because the communication focuses on the environmental agency. The communication focuses on government activities, not on ENVIRONMENTAL RESULTS. Government is reporting program expansion and successes, not environmental successes. State's have not answered some simple but important questions such as; "Is the environment better than it was before?" Or healthier? Or cleaner?

The public is interested in environmental accountability, not accounting. Indicators need to be tied to results oriented environmental goals. For example, the goals of the Clean Water Act are that the Nation's surface waters support fish propagation, maintenance and human swimming. Have the activities conducted since the passage of the Clean Water Act brought more streams to that level of quality? Have the billions of dollars spent for sewage treatment systems improved water quality? In which areas of the country are streams closer or farther away from the Clean Water Act goals? Public satisfaction and understanding will increase if environmental indicators can be used to track our progress toward specific goals.

Goals for environmental indicators can be taken from existing statutes. Other goals can be developed by the government, in concert with the stake holders in environmental issues.

There are many possible goals for environmental agencies. By developing indicators the environmental goals for the country will be opened for discussion. This is one of the most important aspects of increasing communication with the public and opening up the process to the stake holders involved.

Stake Holders Should Be Involved When Developing Environmental Goals

There are many non-governmental (external) stake holders in environmental issues. Indicators need to be objective measures of the environment and environmental progress. Government agencies will always generate distrust among some groups of the public. Different vested interests, holding different environmental philosophies, may disagree on the appropriate indicator for a medium or a region. Therefore, indicators must be subject to outside peer review if they are to build a public trust among environmentalists, business, industry, legislators, academics, local officials and community residents.

One use of environmental indicators is as an environmental agency report card. This makes government agencies key stake holders. Measuring progress toward external goals instead of measuring internal activities requires self-examination and invites external criticism. This a necessary step to improving government's credibility. The report card concept can be a positive step since it highlights environmental successes, which often go unreported to the general public. Environmental failures will need to be addressed. In either case agencies would be more accountable for managing the environment.

Using indicators as a report card can highlight the fact that a government agencies performance is not necessarily the dominant factor controlling environmental conditions. Often environmental results depend upon activities conducted by the general public, the community or industry. A critical use of environmental indicators is to educate the public about their role in environmental protection, such as non-point source pollution control.

The most important role for stakeholders is in goal setting. The selection of indicators should involve all stakeholders, but should be influenced by technical experts in the various fields. This is because all indicators contain some bias. The benefits and limitations of environmental goals and the indicators used to measure the goals must be clearly stated.

It Is Important To Convey Environmental Progress To The Public

To be meaningful to the public indicators must relay progress, and in some manner show improvement or degradation. The indicators may need to be interpreted to be understood. One cannot merely report uninterpreted environmental conditions because the same environmental outcome can be viewed by one interest group as a success and by another interest group as a failure. Success and failure are value judgments. Well thought-out environmental goals and indicators provide a measure for the degree of progress achieved.

Environmental goal setting and indicator selection are an opportunity for bridge building with the public. However, before agreement can be reached on measuring progress, the stake holders must understand what environmental conditions have been and what they are now. Documenting environmental trends is a useful place to begin communication with the public.

Simplifying environmental issues for the public is a complex undertaking. For example, in many areas of the country phosphorus loading into surface waters has decreased markedly. This decrease is generally attributed to the bans on phosphorus in laundry detergent. The result is less eutrophication in the nation's lakes due to phosphorus. Is the public aware of this reduction? The government's role in this achievement? The public's own role in this achievement? Is the phosphorus related reduction in eutrophication relevant given the simultaneous decline in lake health due to acid deposition and non-point source pollution? Are fewer or more lakes eutrophied than a decade ago? What role did natural eutrophication processes play in the current environmental status of lakes? What are the relevant successes and failures in the water quality of the Nation's lakes?

The answers are not always known or intuitively obvious. Indicator reports on environmental conditions should include cause and effect explanations whenever possible, if indicators are to be used as an educational tool to increase the public's understanding of environmental issues. Unfortunately, cause and effect explanations of environmental conditions are often elusive or not fully understood. Many factors influence the environment: agency activities, public and business activities, population densities, climatic fluctuation, hydrologic fluctuations, solar incidence, volcanic activity, ozone levels, etc. Given the inability to fully explain cause and effect in some cases, one must report indicators in terms of success, failure or some level of progress.

There is an intimate relationship between accurate indicators and the scientific networks which monitor environmental conditions. Finding ways to distill the complex data for public use will be difficult. Geographic information systems can be a useful technology for portraying the geographic complexities of environmental information.

Reporting progress is important if we are to follow through on our commitments and set realistic time horizons for our goals. This can be difficult in government due to the periodic changes in administration, the political environment and the need to respond to the media. Is the environment improving? Are we achieving our goals? What goals have we set and who determined them? Periodic reporting of our successes, failures and progress to the general public will focus the environmental debate on these issues.

The Environmental Debate Cannot Be Conducted In Isolation, But Must Be Expanded To Encompass Social And Financial Arenas

A better job needs to be done in collecting and reporting positive economic benefits associated with environmental goals. Only anecdotal evidence is regularly reported, such as jobs created from recycling efforts. The thorough collecting and reporting of economic information will help to find areas of consensus among competing interests. For example, changes in the water quality of Chesapeake Bay could be tied to economic indicators related to fishing jobs. One of the roles of government is to supply the environmental debate with concrete information.

Indicators will not stop the debate on the environment, whether the environment is improving or what costs are valid for what benefits. Much of the current environmental debate is over the effectiveness of command and control strategies to manage the current pollution threats. Hopefully, indicators will focus the debate on environmental results, not government activities.

The debate over environmental sustainability versus growth is becoming a major issue. Another fundamental issue is whether we plan to spend a larger piece of our total resources to achieve environmental goals or if we will reallocate existing environmental spending to achieve new goals. These issues must be examined during our search for goals and indicators, but must not be allowed to confuse immediate concerns or halt progress.

One participant noted that government environmental agencies have become holding companies for folks administering environmental statutes. On the other hand the country and the general public hold the same agencies accountable for managing and cleaning the environment. There are questions concerning how many of the existing regulatory and statutory mandates are getting us closer to our environmental goals? The situation is staged for failure if many environmental statutes and regulation are not effectively achieving environmental results.

Many statutes and regulations need to be reevaluated, some eliminated and some changed. One outcome of national, regional or state goal setting should be statutory and regulatory evaluation. Managing and cleaning the environment requires goals and strategies as much as rules and regulations.

Summary

There was unanimous agreement among participants that the conference was productive and thought provoking. The conference achieved its goal of reaching a consensus about the purposes for environmental indicators. Clearly enough information exists to begin reporting some indicators to the public now. Those states which have ongoing environmental indicators programs have much to offer states beginning this process. One outcome from this conference will be the start of indicator programs in additional states.

WATER WORKSHOP

The water workshop of the Environmental Indicators Conference began at 9 a.m. on Sunday, March 7. The moderator was Caren Glofelty, Deputy Secretary for Water Management, Department of Environmental Resources, Office of Water Management for the State of Pennsylvania. The workshop was attended by twenty-six individuals from a variety of backgrounds. Most participants were from state environmental agencies; however there were representatives from industry, the general public, local and federal government agencies. The goal of the workshop was to develop a list of environmental indicators which would be useful for managing coastal, surface, ground and drinking water resources.

To aid the group in developing the list of indicators for water resources, a comprehensive list of 142 potential water-resources indicators was provided. The purpose of this list was to give the participants a starting point for selecting specific indicators. The list provided contains a wide range of physical, biological, chemical, regulatory and other indicators used as measures for surface, ground, coastal or drinking waters. Water-quality, availability, and use indicators were included. It was stressed that the participants were not to feel restricted by the indicator list provided since its purpose was to provide a starting point for discussion. Participants were encouraged to add any indicators or areas they felt were important. The long list was completed from a thorough literature review and is reproduced in the appendices.

Ms. Glofelty opened the workshop by suggesting that the group define an environmental indicator and its uses. The group agreed that water quality is a good indicator of overall environmental health.

Defining An Environmental Indicator

Some water indicators measure contamination levels, while others measure the health of humans or the ambient environment. A comprehensive set of indicators would measure all three conditions. Also, a good indicator system would assist in identifying problems, their magnitude, and provide an early warning system for developing issues. A good indicator shows historical trends. Trends are increases or decreases in the value measured over time.

Environmental indicators can measure very general or very specific qualities. To explain this concept an analogy was used during our discussion which compared the environment to a patient. A general indicator is analogous to a thermometer, which assesses a basic symptom (fever) of an illness. The symptom could be a result of many different causes. A specific indicator is analogous to a CAT scan, which delineates the precise cause of an illness.

General indicators, such as biodiversity, usually assess ambient conditions or the degree of contamination. Specific indicators, such as the concentration of nitrates in water, usually identify the causal factors of contamination and may be obtained from scientific monitoring networks.

The reliance of many indicators on data from routine monitoring networks was noted. Many environmental indicators are part of baseline monitoring networks. For others, the information collected from monitoring networks provides the scientific defense for the reliability and accuracy of the environmental indicator. Budget constraints on monitoring networks can affect the reliability and accuracy of environmental trends communicated to the public and policy makers.

The Use Of Indicators

All agreed that indicators should be based upon and measure progress towards specific and defined goals. Existing environmental laws and regulations can provide the basis for some indicator goals. For example, the federal Clean Water Act states that the fresh waters of the states should be able to support primary contact recreation (swimming), and the maintenance and propagation of natural and established biota. Good indicators would measure progress toward these goals.

Indicators not based upon environmental laws and regulations should have clearly stated goals. Goal based indicators enhance the degree of accountability between environmental organizations and the public or legislative bodies which empower them. As one participant succinctly stated, "The public wants accountability, not accounting."

Indicators which measure the cost of environmental protection activities should be developed. Such economic indicators should be linked with the indicators which measure the environmental results achieved. Together, economic and environmental indicators can help the public make informed choices among competing issues.

Trends are valuable when educating the public about environmental issues. During this discussion there was repeated mention of the need to educate the public about its role in contributing to pollution and encouraging environmental protection. Public activities such as street sweeping, septic-systems maintenance, catch-basin cleaning and other non-point-source activities were noted.

The group developed a comprehensive list of the qualities and functions of a good indicator. These qualities are listed below.

Characteristics Of A Good Environmental Indicator

1. goal based
2. can show progress toward goals
3. uses available data
4. identifies problems
5. shows historical trends
6. prioritizes among issues
7. sensitive to changes
8. cumulative pollution impacts

9. educates public
10. educates politicians
11. shows lifestyle impacts
12. understandable or translatable
13. cost efficient
14. scientifically reliable
15. spatially distributed
16. representative
17. robust and defendable
19. assesses environment

Developing An Indicators List For Water Resources

Having identified the characteristics that make a good indicator, the group focused on the workshop exercise of selecting twenty-five indicators for water resources. The group recognized that to complete the workshop exercise it must agree on an environmental goal and a target audience. It was decided the goal was to determine the overall status of environmental health in a state. The level of detail sought would be an overall assessment, using general indicators. The audience for the information was to be the public and government officials.

The group decided that due to the time allotted they would not account for all of the important characteristics of an indicator. Therefore, six of the nineteen characteristics noted above were agreed upon for the workshop exercise. The indicator should be understandable, cost efficient, reliable/representative /defendable, show progress, enhance accountability, and educate the general public. Given the time constraints, it was agreed that the workshop list would be an exercise, and not a fully considered, usable indicator list.

The short list was developed by allowing each individual to nominate one indicator. Several participants were allowed to nominate two. Participants debated the merits of several indicators which were nominated; however none were rejected due to disagreement. Thus, the list is reflective of the accumulation of many individual values, and does not represent extensive debate or compromise. The final list contained twenty-five water-resource indicators.

Once the workshop list was completed the group wanted to rank the list to emphasize the most valuable indicators. Each participant picked the 5 indicators he or she believed most important from the 25 and voted for them. The total number of votes each indicator received was counted. The one receiving the most votes is listed first (#1), the one receiving the next highest number of votes is listed second (#2) and so on. The indicator receiving the fewest votes is listed last (#25). It was pointed out that no economic indicators were chosen and this is an important area that should not be ignored when developing a set of indicators for use in a specific state.

The following twenty-five indicators, listed in order of importance as ranked by the group, is the outcome of the workshop discussions.

Water Workshop Exercise: Indicator Set

1. Land Use/Land Cover
2. Water-Quality Index
3. Benthic and Fish Abundance, Assemblage and Diversity
4. Habitat Status
5. Percentage of Designated-Use Attainment
6. Percentage and Acreage of Shellfish and Fish Areas Opened & Closed
7. Nitrate Concentration
8. Public Environmental Education and Activity Index
9. Index of Water Supply versus Water Demand
10. Presence and Absence of Indigenous and Noxious Vegetation
11. Number of Exceedences of Ground-Water-Quality Standards
12. In-Stream Water-Flow Measurements (peak, low, and 7Q10 day)
13. Number of Sites with Confirmed Contamination
14. Sediment Contamination
15. Index of Environmental Agency Coordination
16. Dissolved Oxygen
17. Pollution Loading per Area (including pesticides)
18. Total Phosphorus
19. Water-Body Status
20. Percentage of Population Using Public Community Water Supplies in Compliance with Safe Drinking Water Standards
21. Number of Fish and Drinking Water Advisories
22. Fecal Coliform
23. Baseflow/Runoff Ratio
24. Volatile Organic Compounds
25. Number of Permits and Percentage in Compliance with Standards

Summary

The results of the workshop exercise are that the development of a list of indicators for a State or a region will entail substantial work, debate and compromise. Several techniques used during the workshop could be employed when developing indicators for actual use by a state. Identifying goals and targeting ones audience is an important first step. The list of desired characteristics of an indicator is a good tool for comparing indicators. The water workshop adjourned at noon.

AIR WORKSHOP

The air workshop was moderated by Sally Dudley, Executive Director, Association of New Jersey Environmental Commissions. The discussion began at 9 a.m. and ended at 10:30 a.m. A working list of example air indicators was distributed to the conference participants prior to the workshop. This list was used as a starting point for workshop discussion and is shown in Appendix C.

The purpose of the workshop was to develop a list of air indicators which measure environmental progress, that are easily understood and can be reported to the public.

Defining An Environmental Indicator

Workshop participants discussed the importance of defining an environmental indicator. Historically, national air pollution standards were based on perception and nuisance. If you can smell it or see it then it is a pollutant that should not be present. For example, at one time in Los Angeles the soiling of laundry hanging outside by air contaminants was used as an indicator of air quality.

Traditionally, there has been reliance on visibility as an important indicator of air quality. In California the inability to see the mountain range from one's home reduces property values substantially. Also, odor complaints are traditional air quality indicators. These are all perception based indicators. If you can see or smell something the air quality is "bad". The problem with perception based air indicators is that they do not measure health impacts; or include colorless or odorless air contaminants, management strategies, ecosystem impacts.

Other common indicators do address management strategies and air conditions. The indicators selected in the Clean Air Act demonstrate this focus. In the Clean Air Act, Title I measurements focus on air quality standards and criteria pollutants. Title II indicators emphasize motor vehicle measurements, such as reducing the number of vehicle miles traveled (VMT). Title III indicators measure air toxics. These indicators are technology based or activity based because the health effects and ecosystem impacts of the 189 identified hazardous air pollutants are not well understood.

Following a discussion, the group agreed that environmental indicators for air should measure the following six areas.

1. Health Impacts
2. Air Conditions
3. Actual Emissions
4. Management Activities
5. Environmental Impacts
6. Public Perceptions and Actions

Health impacts are difficult to directly tie to daily air conditions. Monitoring of air conditions, emissions and management activities are somewhat standardized today. There is a marked absence of ecosystem impact monitoring presently in use. This is reflected in the absence of environmental impact indicators noted on the list of example indicators handed out at the beginning of the workshop. Each of these topics was discussed in greater detail.

Indicators Which Measure Health Impacts

Human risks due to air exposure are determined today by a standard calculation. This is done using actual emissions data and toxicity data to determine the potential exposure and subsequent potential health risk. The risk to human health due to potential exposure to the air is an important indicator; however, one could not report all potential exposures to the public without overwhelming them. One might list the top three carcinogenic exposure risks each year, along with information on the degree of exposure, for the public. This would indicate the critical chemical compounds. The top three chemical compounds may change from year to year. This change could indicate progress in managing air quality.

Another possible health indicator can be obtained from the Right To Know data bases maintained by the States. Those carcinogens identified in the top ten category of volume or risk could be included in the potential health exposure calculations; along with the top non-carcinogens based on either volume or reference inhalation exposure.

Indicators Which Measure Air Conditions

Several indicators were discussed which measure general air conditions on a daily or periodic basis. Visibility is a simple and useful indicator that the public can understand. New Jersey monitors visibility at one wildlife refuge site, but the indicator does not differentiate between natural, facility, or mobile source generated smog. Some states do not measure visibility.

Many States use the number of exceedances of the National Ambient Air Quality Standards as an indicator. One example is the New Jersey Pollution Standard Index (PSI) which measures ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, smoke and particulates. The index combines the individual measurements into one value between 0 and 500. A daily value between 0 and 50 indicates good quality air; while a value between 300 and 500 indicates hazardous air quality. In general, a value above 100 adversely affects human health. This single index is reported daily and provides the public with a general understanding of overall air quality with three main caveats. The index includes only six pollutants and its accuracy is based on the extent of a given State's air monitoring network. There are questions about the geographical extent of a given exceedance. For example, a carbon monoxide monitoring exceedance may represent conditions which exist at one location the size of a street block.

Criteria pollutant ambient data is available now, but does not hold the public's attention. These indicators could be changed to health based indicators. One option is to report the number of person hours of exposure to each pollutant. Another option for a health based measurement is the duration of time an average person is exposed to exceedance concentrations of a criteria pollutant.

The last air indicators discussed were the pH of acid rain and the concentration of ground-level ozone. There was some debate whether these indicators measure the quality of the air, the health of the ecosystem or the potential impact on human health and welfare. These measures have broad implications and may not be tied to air conditions or ecosystem impacts as closely as some proponents suggest.

Indicators Which Measure Emissions

Measuring or estimating actual emissions from vehicles and facilities is very difficult and prone to large errors. Generally, experts agree that surrogate indicators for emissions are acceptable; however there are difficulties with some commonly used surrogate indicators. Typical issues and problems were discussed.

The number of cars or the percentage of cars that annually fail emissions inspections was discussed as a possible indicator. One problem with this indicator is that emissions standards change, so emission standards five years from now will likely be different from today's emission standards. This affects the usefulness of the indicator over time and makes year to year comparisons of questionable value. The group did agree that emission inspections of light and heavy duty vehicles should be mandatory.

Vehicle miles traveled (VMT) is a good surrogate indicator for emissions data. One problem with this surrogate indicator is determining what threshold value is meaningful to regulators. Similarly, what threshold value is meaningful to the general public? For example, New Jerseyans travel 60 billion VMT each year; is that too much? At certain times of the day, on certain roadways, traffic slows down and emissions per mile change; thus, VMT are not a straightforward surrogate for actual vehicle emissions. Another issue is that VMT has been increasing at 3 percent per year for most of the 1980's. It is difficult to explain why VMT is increasing while air quality is actually improving.

Another emissions related indicator is the percentage of vehicles using alternative fuels. Alternative fuel vehicles run on natural gas and propane. Last year 5 percent of all vehicles used alternative fuel. The percent of alternative vehicles could indicate several areas of progress to the public; including research and development progress and reduction in emissions. Also, this indicator can be used to educate the public about the dynamics between environmental and social issues. Presently, alternative vehicles do not pay fuel tax. While increasing percentages of alternative fuel vehicles are a positive indicator from an emissions standpoint, they are a negative indicator from an infrastructure funding standpoint.

Emissions are used as an air quality monitoring tool by government and as a market tool by industry. Industries trade emissions as a commodity, obtaining credits for mobile or stationary sources or they bank the emission credits for future use. Thus, emission markets and credits should be included in any final air indicators list.

Indicators Which Measure Management Activities

Management activites include permit, control and enforcement activities. Permitting information links the sources with the emissions. However, permits do not provide information on actual amounts (volumes and concentrations) of emissions. Still, permits provide useful data for assessing changes over time in the number, type and volume of facility emissions. This baseline is needed for new numbers, different types or different volumes of emissions to indicate either progress or lack of progress. Typical permitting indicators include the number of each type of air permit, the number with a certain volume of emissions or the total volume of emissions permitted.

One participant suggested reductions in commuter trips as a management activity indicator. Other participants were concerned that these control measures were not accounting for the largest segment of automobile use. Some information suggests that 65 percent of automobile movement is travel to shopping centers or entertainment centers. It is clear from this discussion that measures of management activities are only valid indicators when a verifiable, measurable relationship has been demonstrated between the activity monitored and specific impacts in air quality, ecosystem and/or human health. Without a demonstrated relationship between activity and actual impacts the meaning of the indicator is not clear and open to misinterpretation and misuse.

Another typical air indicator is to count the number of enforcement activities or the amount of fines assessed or collected from enforcement activities. This indicator measures the efficiency of the State's environmental agency as much as it measures the number of problem facilities affecting the environment. Thus, the actual meaning of the indicator, in any given report, is open to several interpretations. Another question raised is whether the public is really interested in this type of information.

Indicators Which Measure Ecosystem Impacts

Ecosystem impacts due to air quality are difficult to quantify. One example is research into the effects of air pollution on crops. Rutgers University has done extensive research on the relationship between ozone levels and crop development. The results are mixed depending on the specific crop, the concentrations of ozone and the duration of exposure.

Other air quality conditions, such as ground-level ozone and acid deposition, are not directly tied to measurable ecosystem impacts. Instead, the air quality conditions may result in an effect, which in combination with other conditions or following a complicated series of intermediate effects, impact the environment in a measurable way. A common example is using the percentage dieback of certain tree species to indicate the impact of acid deposition. It is important that other causes of dieback, such as disease or drought, are incorporated into the interpretation of general ecosystem changes.

The type or appropriateness of an indicator may be geographically determined. For example, acid rain damage on blue spruce in Vermont is regionally specific. Another example is lichens which can be affected by atmospheric concentrations of metals, but are geographically limited. Some ecosystem impact indicators will likely be regionally specific.

Another possible ecosystem impact indicator is the monitoring of metals in lake sediments or nitrates in estuary waters. Research has shown that atmospheric deposition is an important mechanism in the accumulation of contaminants in these areas. Often though, there are other mechanisms which contribute to the contaminant accumulation and separating the portion due to air deposition is difficult.

Some participants noted that identifying causes, and the relative contribution of various sources to a given environmental problem was not necessary because indicators should measure general environmental health. For example, nitrate accumulation in water can be caused by air deposition, agricultural runoff, urban runoff and other sources. Therefore, determining the amount of nitrate accumulation due to air deposition as opposed to that from agricultural runoff, was not necessary. They expressed the position that the nitrate concentration indicates general ecosystem health and that was sufficient to gauge environmental progress. Others felt that to translate indicators into positive actions, one should choose indicators that can be tied to specific media or activities. Most agreed that it is important to understand the cause and effect relationships underlying general ecosystem measures before one uses indicators as a basis for actions or response.

Indicators Which Measure Public Perceptions and Actions

One problem with indicators is that they may be misinterpreted by the public. For example, the air may look dirty, but the health quality may be fine. To avoid this indicators should be reported which can be easily explained and understood. Visibility is not a primary indicator, it is a secondary indicator; but it is easily understood by the public. It can be used to drive the indicator process and familiarize the public with the more important primary indicators, which are health based and not merely aesthetic measures.

Indicators can be used to educate the public about their role in air quality. Private industry alone should not be asked to make sacrifices to improve the nation's air quality. The general public over the past four decades has increased car ownership significantly. High schools have changed from having no parking lots to fully loaded parking lots. Most of the major point sources of air contamination are under management. Dramatic air quality improvements in problem zones must address individual behaviors and lifestyle choices.

Another issue that must be addressed is determining "how clean is clean", and how much we as a society are willing to pay for a certain level of air quality. An indicator which can stimulate this debate is to express pollutant costs in dollars per ton of pollutant. In California it costs $20,000 per ton to control hydrocarbons. For industries at the 98% control level the cost rises dramatically to achieve a 99% pollutant control level. Do we, as a society, wish to pay those costs? Are there creative solutions, such as pollution credit banking, borrowing or trading which can be used to achieve the desired reduction? Two indicators were suggested to highlight this issue. One is dollars spent per pollutant. The second is tons of ambient pollution over gross regional product. This second indicator gives one a very broad measure of the relationship between a pollutant and the industrial base.

It is clear that indicators can contribute to the air quality debate. Indicators must be chosen which can be realistically interpreted by the public. Trade associations, such as the American Institute of Plant Engineers, should be consulted and included in the indicator selection process as much as the general public and environmental interest groups. The problem with developing indicators is selecting ones which are understandable and reflect the value the public places on clean air. Public awareness and public perception are crucial to the development of appropriate environmental indicators.

Air Workshop Indicators Exercise

To complete the workshop exercise, selecting environmental indicators for air, the participants agreed to focus on those indicators for which data are collected. This was done because only these indicators could be implemented and reported to the public in the immediate future. Fourteen indicators were selected and are listed below. It was agreed that these indicators are a good starting point for air indicator development, but that there was insufficient time to finalize the list or fully debate the merits and disadvantages of the following choices. All categories of indicators discussed are represented in the indicators selected.

Air Indicators Exercise

Health Impacts Indicators

1. Number of Person Hours of Exposure to NAAQS Violations

Air Conditions Indicators

2. Pollution Standard Index
3. Visibility
4. Odor Complaints
5. Smoke Shade

Actual Emissions Indicators

6. Emissions Data
7. Emissions Inventory (including Right-to-Know)
8. Emissions by Type

Management Activities Indicators

9. Percent Vehicles Failing Emissions Testing

Ecosystem Health Indicators

10. Crop Damage
11. Needle Damage
12. Ames Testing (mutagenicity)

Public Perception Indicators

13. Amount of Emissions Trading
14. Amount of Expenditure for Controlling or Buying Offsets

Summary

As a final caution the participants noted that care must be exercised when selecting indicators because standards and technology will change significantly over time. Meaningful information one year may not be comparable with information collected in the next year or the next decade. For example, the number of vehicle miles traveled will not mean the same thing if future vehicles run very cleanly.

Also, it is important to be knowledgeable about the impacts of our actions. Methyl tertiary butyl ether (MBTE) is used as a gasoline oxygenate to help meet the oxygenated fuel standards during the winter months in some areas. The purpose is to reduce carbon monoxide emissions. Some people are reporting illnesses from MBTE exposure. There are questions now about controlling a criteria pollutant with a substitute which may be an air toxic or health issues. These experiences highlight the complexity and depth involved in environmental management and the need for careful selection of indicators which will be used to measure our environmental progress.

NATURAL RESOURCES WORKSHOP

The session was attended by sixteen people, mainly representatives from state governments. The session was moderated by James Bernard, Director, Natural Resources Policy Division, Maine State Planning Office. The moderator and the group members were provided with a list of example indicators in this area to facilitate discussion.

The group concluded that environmental indicators are used to measure environmental conditions and trends. Process measures, such as the number of hunting licenses or permits issued, are generally not good indicators.

There are three questions that an acceptable indicator should address:

1. What is happening to the state of the environment, what are the changes and the trends ?

2. Why is this happening/changing - what are the causes of change, what are the stresses ?

3. What is being done about it, what is the management response?

During this session natural resources indicators were placed into four categories: land, biota (wildlife, human demography), natural economic resources (agriculture, forestry, fisheries), and outdoor recreation. The group agreed on a list of indicators for each category, and discussed the advantages and disadvantages of each. All of the indicators selected measure the state of the environment or environmental trends.

Land

1. Land in Conservation Ownership

This is an indicator which would ordinarily be quantifiable at the state and federal levels. Possible subcategories for this indicator would be: lands that are open to the public, private lands, land managed by the Department of Defense. Lands open to the public may not be a good indicator because an area that is open to the public may not be a protected area.

2. Land Use/Land Cover Change Over Time, in acres

3. Percent and Absolute Change in Wetlands, by type

This could be expressed as percentage of total acreage in a state that is titled as wetlands by type, geographical distribution, by county, and percentage lost since the time of European settlement. There are different systems in place for inventorying wetlands and data collection could be a problem. The health of wetlands is important to their characterization and difficult to determine; therefore an indicator species could be used as a sub-category. In view of these constraints, an aggregate measure may be more suitable for wetlands.

Biota

4. Chemical Contaminant Levels in Raptors

5. Reproductive Successes of Raptors

6. Eggshell Thickness of Raptors

Wildlife species are good indicators of the effects of chemical contamination, human impact, and loss of wetlands. Amphibians and reptiles are good indicators of habitat change and quality, so they can be used for a measurements of ecosystem health.

7. Migratory and Wintering Bird Populations

8. Deer Harvested by Hunters

9. Canada Goose Reproduction and Distribution

Geese may not be good to use as an indicator because their populations are subject to significant influence by human activities. Canada goose populations are so high in some areas that the goose is considered a nuisance by some; this does not mean the bird is a poor indicator.

10. Breeding Populations of Waterfowl

An overabundance of wildlife could provide useful information for policy makers. Also changes in the size of animal/bird populations could indicate changes in habitats. There are good data available on the above list of indicators. In the case of migratory birds, data collected helped to focus on causes outside North America.

11. Furbearer Populations Measured in Absolute Numbers

Trapping data should not be used, because this is subject to much outside influences. Presence of furbearers could be a good indirect indicator of the impact of cutting down forests.

Natural Economic Resources

Due to time constraints opportunities for discussion in this area were limited.

12. Estimated Number of Cold Water Species

This indicator provides an estimation of the productivity of streams for cold water species.

13. Shellfish and Finfish Landings. lbs., year/level of effort

The precise method for determining the level of effort was not discussed. This should consider numbers of fish or pounds of fish, not dollar values; dollars only provide the going rate for fish.

14. Shellfish and Finfish Population Levels

Population levels could be measured in terms of abundance, size, frequency, mortality and growth.

15. Heavy Metal Concentrations in Shellfish

16. Percentage of Acres of Shellfish Harvest Areas Opened and Closed

17. Acres and Species Composition of Undisturbed Forests

18. Productivity of Forests

This indicator can be reported in terms of increases or declines of individual species.

<u>Summary</u>

The indicators selected were three from land, eight from biota and seven for natural resources. Due to time constraints, outdoor recreation was not addressed. Indicators do not necessarily have a cause-and-effect relationship. The trends revealed by well selected indicators will provide information and assist in determining future questions to be asked.

HAZARDOUS WASTE, HAZARDOUS SUBSTANCES AND SOLID WASTE WORKSHOP

Welcoming remarks and introductions were made by the moderators, Mary Sheil of the NJDEPE and Bret Burdick of Virginia Waste Management. The workshop was held on March 7, 1993 from 9:00 until 10:30 a.m.

The attendees reviewed lists of potential hazardous waste and solid waste indicators that were prepared by the NJDEPE. The workshop participants were asked by the moderators to avoid defining whether any indicator is the best, but rather to categorize these indicators into subheadings.

A question was posed to the group about whether the hazardous and solid waste lists should be combined or kept separate. It was agreed because of time constraints that hazardous waste and solid waste indicators would be discussed together and the group would attempt to develop a list of waste management indicators covering both types of waste.

What Makes A Good Indicator

The group felt that indicators should be chosen to reflect the status of the environment, and not measures of process or performance of agencies. Process and performance measures are used extensively in the hazardous waste area. There was general agreement on this point.

Indicators As A Measure Of Environmental Quality

The discussion focused on environmental quality. A question was raised as to how indicators can be used to show that the environment has been affected because of the management of hazardous and solid waste. The following five items were cited as important issues.

1. A major goal should be source reduction of the waste.

2. A mechanism to quantify successes in waste management is needed; this could be done on a per capita basis.

3. The toxicity and treatment of waste materials must be considered in light of the issue of relative risk.

4. The focus should be on source reduction of toxics rather than the "end of the pipe" solutions; the issue of pollution prevention was raised.

5. It is easy to focus on the process and measures of activity, but this may not be the best type of indicator.

How Do You Categorize Waste And Quantify Source Reduction

Waste reduction was cited as a key issue. There was an extensive discussion on creating separate categories for residential, commercial and industrial waste and how to quantify source reduction. The following five points were raised on this subject.

1. Should waste, such as dredging materials from New York harbor be considered? If so, what is the overall impact on the environment?

2. Information from manifests and origin/destination forms could be helpful.

3. The absence of complete data should not render an issue unimportant.

4. There must be separate consideration for residential vs. industrial amounts of waste. Small amounts of a significantly hazardous waste (e.g., plutonium) is an important issue.

5. The amount of the waste is not the only factor; toxicity and relative risk must also be considered.

The Florida SAFE Report And Waste Management

The Florida SAFE report and its lack of indicators for hazardous waste management was discussed. The group felt that RCRA considerations were a relevant topic, since adding a small amount of a hazardous material to a large quantity of non-hazardous material could result in all of the material being classified as hazardous. The effect of solid and hazardous waste management and contaminated site cleanup activities in other media such as water and land was also cited. Not all waste that is generated can be reclaimed; therefore, relative risk is especially important. Four criteria for the selection of indicators for hazardous and solid waste are listed below.

1. The volume of waste material disposed.

2. The need for a combination of indicators that are direct and indirect measures of environmental quality.

3. Consideration of the environmental impacts of not disposing of waste or not creating waste.

4. The best perspective for waste management is to think in terms of not creating waste.

Impact of Waste On Other Media

The impact of hazardous waste and solid waste management on other media was discussed. This topic was viewed as extremely important since improper management often affects other media. It was acknowledged that information on historical trends for this topic is difficult to obtain.

Should A Good Indicator Measure Ambient Quality Or Process

There was discussion on what process measures show and what their impacts are on issues such as air quality. How waste management affects resource allocation and planning and how this information could define gaps in data were also considered. It was mentioned that there may be several different levels of indicators that need to be used to consider the overall environmental impact of waste management. The amount of material that is released or discharged was noted as a critical factor.

Public Awareness And Participation

The following points were made relative to public awareness and participation.

1. Today, the public is better informed about waste disposal but may not know all of the details.

2. The amount of hazardous and nonhazardous waste recycling is an important measure.

3. Is the amount of money spent on site remediation a useful indicator? It may not be.

4. We need to define, evaluate and quantify the value that society places on waste management and waste avoidance.

5. We need to consider what the relative risk is of not cleaning up. Are resources being used to clean up something that is not a "big risk"?

Releases To The Ambient Environment

The impacts of hazardous and solid waste releases to the environment were discussed and the following issues were noted.

1. Linking indicators could be discussed in terms of fate and transport.

2. A separate category for accidental releases may be needed.

3. The Toxic Release Inventory (TRI) data may be helpful; we need to know which media are being affected.

4. Enforcement actions are the traditional activity measure for this issue; however, direct measures such as monitoring wells and other ambient monitoring functions are another way of assessing this impact.

Conclusion

The meeting concluded with the group deciding upon the following ten candidate indicators for hazardous and solid waste. These are not presented in any particular order of priority, although source reduction and recycling were viewed as important subjects.

1. Source Reduction - total amount of solid/hazardous waste generated per capita/per industrial process or units

2. Source Reduction - total amount of solid/hazardous waste decreased per capita/per industrial process or units

3. Source Reduction - change in total amount of hazardous/toxic materials used in industrial processes

4. Total Amount of Solid/Hazardous Waste Diverted to Recycling Processes

5. Change in Relative Risk - as a function of a process or waste management activity

6. Collection of Waste - illegally or improperly managed waste in tonnage or by the percentage of reduction

7. Number of Curbside Programs for the Collection of Recyclables

8. Public Participation in and Awareness of Recycling/Household Hazardous-Waste Programs

9. Resources Diverted to Waste Management Systems

10. Releases and Transfers (TRI) to Ambient Environment

ENERGY AND MISCELLANEOUS WORKSHOP

The session was moderated by Joe Sullivan of the NJDEPE and Carol Stokes Cawley of the USEPA, Region III. The group consisted of about twenty participants who represented government agencies, the public and industry. The group first discussed the criteria for selection of indicators and then chose indicators and evaluated them against the selected criteria. The list that was developed was not meant to be comprehensive but rather an aid in determining what is a good environmental indicator.

Indicator Criteria

The criteria for selection of good indicators are listed below.

1. Availability of data

2. Useful purpose of the indicator

3. Connection to environmental quality

4. Connection to environmental quantity

5. Understandable by the public

6. Predictive

A key question is whether indicators should predict what may happen or whether they should be measures in and of themselves. A good indicator should show cause and effect as well as changes in the environment. If we consider every environmental issue, then there could be 2000 separate environmental indicators. Indicators should be judged for relevance and priorities; intrinsic quality of life items may not be suitable. Indicators should be a reflection of environmental health whether or not they are driven by economic forces.

Environmental quantity may be just as important as environmental quality. There can never be enough of certain things; for example, bald eagles. Indicators should be results oriented, the endpoint should be something we want, and they should be comprehensible to the public.

There may be an occasional lack of consistency in the data. For example, if you are sampling a stream and you sample from different parts of a stream at different times, you change the sampling conditions. In addition certain indicators may be useful but there may be a lack of data. Do not rule out something because there are insufficient data.

Agriculture

The indicators for agriculture were chosen and compared to the listing of criteria to determine how many of the criteria could be met.

This appears to be the only indicator group which has been developed which reflects a specific industry. Agriculture may be considered as a resource or as a measure of development.

1. Acres in Production or Organically Farmed - meets all criteria

2. Number of Farm Acres Gained or Lost - meets all criteria

3. Soil Loss Rate (due to erosion) - meets all criteria

4. Calorie Input per Food Calorie Produced - meets all criteria except predictive to the public

5. Tons of Fertilizer Used/Removed - meets all criteria

6. Herbicides/Pesticides - meets all criteria

7. Public Dollars - resources expended to keep acres out of production, meets availability-of-data criteria only

8 Acreage in Agricultural Easement - meets all criteria

9. Pesticides in Surface Water - meets all criteria

10. Total Agricultural Production - meets all criteria

11. Animal Waste Produced - meets all criteria except environmental quantity and comprehensible by the public

Public Health

Direct health measures do not relate only to the environment. Three indicators were chosen in this category and debated as to their limitations and benefits. Prevalence of rabies in animals is a public concern and a possible indicator. Is rabies environmentally connected and how does environmental management affect rabies? Another instance is the prevalence of Lyme disease; does an increase in Lyme disease indicate that the deer population is on the rise or lyme is being passed from one animal to another?

Another consideration would be specific concerns related to one specific industry; for example, in Florida there is a concern over phosphate mining operations. The issue might be in-plant vs. out-of-plant, focusing on health down-wind from a smelter or a coke oven.

A third possible indicator that was discussed is cancer rates. A direct correlation between cancer rates and an environmental exposure may be difficult to determine. Cancer rates may run parallel to the ozone hole, for example. Cancers would be in a generic category because there is so much interest in the dose-risk area. There is an inconsistency when you avoid using a cancer indicator and the policies are driven by cancer rates. This is important since public health is often the true goal, not environmental quality.

The indicators chosen in this section are listed below.

1. Asthma Health Statistics - number of individuals affected

2. Allergies

3. Pb Blood Levels

4. Skin Cancer Incidents

5. Prevalence of Rabies in Animals

6. Outbreaks of Waterborne Diseases

7. Occupational Health Data

Energy

The group agreed to focus on transportation issues and not stationary sources. Non-point sources are not as controlled and tend to be dependent on human behavior patterns, as opposed to the stationary/point sources. Environmental agencies can control electricity, power plants, etc. more directly.

Some states are currently monitoring the effectiveness of their conservation measures. Environmental emissions by category fuels and the environmental impacts due to fossil fuel combustion can be measured. Some states have initiated aggressive fuel conservation programs without any methods in place for measuring reduction in usage. This is a problem because they cannot show the effectiveness of their conservation programs.

Demand-side management (DSM) consists of ways of gaining additional capacity by conserving energy. This does not always mean wearing a sweater, etc. DSM may also be technology driven. This would be presented as energy produced and energy consumed.

The group decided on the following ten indicators.

1. Vehicle Miles Traveled or Emissions of NOX, CO, per Vehicle Mile Traveled

2. Energy Usage per Capita - can be used as a base figure for energy

3. Land Use - mass transit ridership miles, useful for states that have a high population density

4. Global Energy Use - power mix of the total fuel use: petroleum, coal, nuclear, hydropower, bio fuels, alternative energies

5. Recoverables or Renewables as percentage of the mix

6. Conservation Rates - should be included since the United States uses 3 times as much energy as the rest of the world combined

7. Energy Taxes - might not be a suitable indicator because they are a means of promoting one type of energy source over another

8. Waste-to-Energy Conversion

9. Waste Disposal Costs per Energy Type

10. Growth in Energy Production vs. Population Growth

11. Low Level/High Level Radioactive Wastes

CROSS MEDIA WORKSHOPS

SESSION 1

SESSION 2

CROSS MEDIA WORKSHOP - SESSION 1

The cross media workshop of the Environmental Indicators Conference began at 2:30 p.m. on Sunday, March 7. The workshop was divided into two sessions with at least one representative from each State in each session. Session 1 was moderated by Jim Bernard, Director, Natural Resources Policy Division, of the Maine State Planning Office. A similar session was conducted at the same time with the remaining conference participants. Nearly thirty-five individuals attended the session 1 cross media workshop. Most participants were from state environmental agencies; however there were representatives from industry, the general public, local and federal government agencies. The goal of the cross media session was to examine the interconnections among indicators used for different media: namely water, air, energy, natural resources, hazardous substances and hazardous waste.

Defining Cross Media Indicators

Session 1 started by discussing cross media issues and indicators. Land, air, water and natural resources interact in the environment. A cross media indicator is one which involves two or more media. A cross media indicator may be sensitive to more than one stressor. For example, air and energy media often use the same indicator, as do natural resources and water.

One cross media issue is lead in the environment. The human health indicator for lead is lead levels in human blood. The environmental indicator for lead is concentration in soil, water or biota. High blood lead levels may be traced back to lead from paint chips, soil, air, or drinking water.

Another cross media indicator is the number of shellfish harvest areas that have been closed. Closures of shellfish harvest areas involve point and non-point pollution, water quality, natural resources and human health. It was agreed that little work has been done in the area of cross media indicators and that our purpose was to initiate discussion on this topic.

The group agreed that indicators should be goal-oriented and shaped by public policy and needs. Central issues include:

1. What does the public want to know?
2. What is happening in the environment?
3. Is the environment better now? How do we know?
4. Why is change happening? (cause and effect)
5. What are the environmental trends?
6. What is the government's response to trends?
7. Are government policies having the intended effect?

8. Are government programs having the intended effect?

9. How much does it cost? Why has it cost so much?

10. Are the priorities correct?

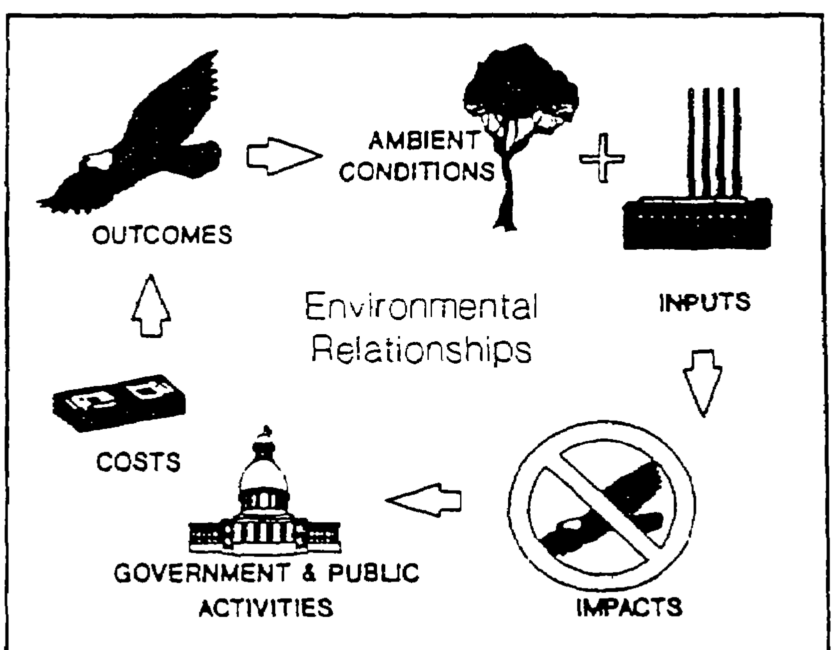
11. Are we improving the environment or just moving pollution from one medium to another?

12. What is the public's perception of environmental quality?

Cause, Effect And Environmental Trends

The focus of these questions is understanding environmental trends. Environmental trends can be established for single media or for cross media indicators, such as those used in this discussion. To fully understand the environment and its trends, knowledge of the cause and effect relationships is essential. A model of environmental cause and effect relationships is described below.

At any given time the environment can be measured as having a given level of quality (**ambient condition**). That level of quality is affected by contamination sources or stressors (**inputs**). The result is a change in the environment's quality (**impacts**). Dramatic changes in the environment's quality often result in government actions (**activity measures**). Regulatory actions should influence environmental quality (**outcomes**) by changing human behaviors. Regulatory actions have associated social and financial **costs**. The cycle is essentially one of **ambient conditions** which are affected by **inputs** that cause **impacts**; the impacts then promote subsequent **activities**, which have **outcomes** and **costs**. In general, good cross media indicators describe **outcomes**. Other indicators would explain environmental cause-and-effect relationships to the public.



The closure of shellfish beds will be used to demonstrate this model. The general status of shellfish resources may be evaluated from the fecal coliform levels in the water and the toxic compound or metal concentrations in shellfish tissues (**ambient conditions**). The ambient quality is affected by stressors, such as discharges from combined sewage overflows, non-point source runoff, acid deposition and boats (**inputs**). The result of excessive contamination is a change in the ambient quality and an increase in the number of shellfish harvest areas closed (**impacts**). Dramatic changes may increase permitting and enforcement actions (**activities**). Changes in human actions which are imposed by regulatory and enforcement actions should increase the number of harvest areas opened (**outcomes**). It is possible to weigh the costs of regulating the various inputs against the costs of losing portions of the shellfish harvest beds (**costs**).

The cumulative cross media indicator in this example is the number of shellfish harvest areas opened and closed (**impact indicator**) and the trend of this indicator over time (**outcome indicator**). The other indicators provide the public with a sense of the environmental and social interactions influencing the trend.

The group agreed that the topic of cross media indicators is complicated. Indicators should show environmental successes, failures, trends and financial expenditures. Financial indicators were seen as important because they raise issues concerning environmental priorities and resource use. Financial indicators should include the costs of not doing cleanups or regulating potential sources of pollution. It is important that tradeoffs be considered when regulations or restrictions curtail industrial or community activities.

Matrix Analyses Of Cross Media Indicators

The group attempted matrix analyses of several cross media indicators. Each matrix focused on one cross media indicator and defined it using the model discussed above. For example, the lead matrix listed the possible sources of contamination input. In addition, the matrix contained the major indicators for ambient conditions, such as lead levels in drinking water or air particulate concentrations. The outcome indicators listed were lead levels in human blood and bone. No regulatory activity or cost indicators were included during the exercise. A matrix was completed for closures in shellfish harvest areas and another for biodiversity levels.

Summary

The group recognized the difficulty of presenting this information to the public in an understandable format. To simplify indicator explanations for the public some individuals favored using outcome indicators only. Other individuals favored using cross media indices instead of single indicators.

Indices combine several complicated indicators into a single value. This single value can be ranked. Ranking generally takes the form of high, medium and low or some easily understood value. The U.S. Environmental Protection Agency is moving away from combining single indicators together into one index. Other individuals believe that any indicator could be presented to the public in three sentences or less. Rhode Island's experience is that frequently reported indicators will be understood by the public in time, even if the indicator is relatively obscure.

There is no ideal multimedia indicator which adequately covers all media. The central issue is to find clusters of indicators which cross several media and portray a sense of overall environmental improvement or degradation. Biodiversity is an example of an indicator which represents cumulative air, water, soil and natural resources conditions. The whole is often greater than the sum of the parts. The application of this principal to indicators suggests other important cross media indicators such as forest diversity, land use, land cover, etc.

The Cross Media Session 1 adjourned at 4 p.m. Overall the discussion was inconclusive and most participants expressed the need for continued work in this area.

CROSS MEDIA WORKSHOP - SESSION 2

The Cross Media Indicator Session 2 was conducted on Sunday afternoon, March 7. The moderator was Douglas W. Kievit-Kylar, Administrative Assistant, Agency of Natural Resources. The session was attended by approximately thirty five participants. The purpose of the session was to select indicators which qualified as crossing media. This was done by dividing the conference attendees into two groups, providing them with the lists of potential environmental indicators developed in the earlier breakout sessions, and discussing cross media indicators.

The goal was to select indicators which cross several environmental media: for example air quality, water quality, and land use. Cross media indicators may be composite indices like the pollution standards index, bio-diversity scores or the water quality index. Indices provide information on a number of environmental variables by combining several measurements into one composite score. Indices provide easily understood information to the public.

Candidate Cross Media Indicators

The group identified a series of indicators which span a number of environmental media, as this was our first requirement in selecting candidate indicators for our list. The media include air, water, land, natural resources, etc. These indicators are listed below.

1. Land Use/Land Cover - affects natural resources, energy use

2. Population Density - affects land use, air pollution, solid waste generation/disposal

3. Habitat Status - measure of health and condition of numerous land and water species, measures physical and biological changes in the ecosystem

4. Energy - affects air pollution, water pollution

5. Public Health - measures adverse health effects whose source of exposure may be through air, water, other media

6. Accumulation Measures - human exposures, through various media to contaminants which may bioaccumulate

7. Public Education/Awareness - an outreach process which informs the public on several environmental media and problems specific to those media

8. Source Reduction - changes in industrial processes which result in multiple environmental benefits, across several media

The process of compiling the list of indicators was difficult and complex. It was decided that the best way to proceed was to decide upon the criteria to select and evaluate indicators. The group discussed some of the problems inherent in establishing cross-media indicators. Three main problems were identified.

Problems Inherent in Establishing Cross Media Indicators

Any list of cross-media indicators is likely to be made up of some indicators which affect the environment and others which reflect the results of human actions whether positive or negative. This may restrict comparability among cross-media indicators. For example, Land Use/Land Cover measurement is a good cross media indicator which affects the environment. Habitat status is a good cross media indicator which reflects the results of human or natural actions. Having two measures which are mutually exclusive makes it impossible to develop one composite indicator. It is important to realize that this dilemma will occur in trying to compile one list of cross media indicators, and to clearly state this in any explanation of process to the potential readers or users of these data to avoid possible confusion.

Cross-media indicators will be valued differently in various geographic regions of the country. For example, if a cross-media indicator includes ground water as a component it measures, Florida would consider it important because ground water is highly valued in that geographic region. However, another state which is not dependent upon groundwater may assign a lesser value to this indicator. Regional differences make it hard to reach consensus about which cross media indicators should be most highly valued. There may be no single cross media indicator list appropriate for the entire country.

Cross-media indicators are often general system measures and are not detailed enough to identify cause-and-effect relationships. A biologic indicator such as the number of fish diseases may not isolate any predominant environmental stressór on the affected species. For example, if diseased fish are found, additional information is needed to determine the route of exposure (air, water, sediment) or the cause (toxics, pathogens, metals, etc.) which led to the development of the illness.

Characteristics Of A Good Indicator

The group then compiled a list of "What Makes a Good Indicator". It was determined that a good indicator had the characteristics listed below.

1. Cost-efficient

2. Ease of Data Collection

3. Reliable

4. Defensible

5. Reflects Accountability - not accounting

6. Understandable

7. Translatable - must have the ability to be translated into a remedial action which will be beneficial

8. Has the capacity to educate the public of their role in creating or solving the problem

9. Can be prioritized among all other indicators chosen

10. Is sensitive to change - must be able to reflect changes occurring in the media it is reporting on

Uses of Cross Media Indicators

The group next considered the uses for cross media indicators and compiled the following list.

1. Consensus Building
2. Problem Definition
3. Educational Tools - behavior modification
4. Agency Direction/Policy
5. Resource Allocation
6. Measuring Change in Environmental Quality Over Time
7. A Strategic Planning Aid

It is interesting to note that some of the items on the list, such as education, resource allocation, and sensitivity to change, also appear on the list of what makes a good indicator. These indicators translate into measures of the environment and recommended actions at the same time, giving us indications of potential problems and identifying our appropriate response for reacting to them.

Cross Media Indicators Exercise

The group finished by making a "first cut" at listing potential indicators which meet the following criteria: they are cross media measures; they provide information which will not be geographically limited in its usefulness; and, they can be used to identify cause-and- effect relationships. The following indicators are based on topics from the first list which also meet the two additional criteria. The list is as follows:

1. Nitrate Concentration

2. Mercury Concentration

3. Lead Measures - including blood/lead levels

4. Land Use and Demographic Information

5. Shellfish Bed Closings - could signify coliform, eutrophication, or air contaminant level problems

6. Percentage of Designated-Use Attainment - swimmability, fishability and drinkability measures

7. Measures Indicating Change In Biological Diversity

8. Increase Or Decrease In Indigenous Species

9. Raptor Population Size - eagles, falcons and other birds of prey

10. Water Quality And Flow

11. Sediments

12. Human Health Impacts

Summary

The consensus of the group was that identification of cross media indicators is an extremely difficult process. The group began with the goal of organizing environmental data in a manner that provides maximum information to the public, while using a small number of simple, easily understood indicators. The progress of the group was quickly impeded by the recognition of several limiting factors. Specifically, since some indicators affect the environment and others reflect results of human actions, our process of reducing the list of potential cross media indicators will reach a point where further progress will be stymied.

Cross media indicators will be valued differently in different regions of the country. Finally, cross media indicators are often general system measures which are not suitable for establishing cause-and-effect relationships.

Also, indicators which pass these tests must be judged on whether they qualify as a "good indicator". In other words, are they cost-efficient, reliable, defensible, useful for consensus building, etc. The attached list is provided with the caveat that it is by no means a completed process. Rather, it is intended to stimulate additional research, debate, and to be used as a starting point for further work in this area.

APPENDIX D

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Summary:
Southeastern Regional Environmental Indicators Conference

Conference Summary and Recommendations

In conclusion, the following comments and recommendations are offered:

- A review of the products of the breakout groups and the individual responses demonstrates broad and generally consistent agreement on the types of indicators that should be included in the national system. Time and a lack of immediate access to technical information prevented specific, technically correct indicators from being developed. Further, even though the structure of the New Jersey and Florida conferences was different with regard to the number and types of small groups, there was generally consistent results, a heartening finding. It is recommended that future conferences attempt to continue to incorporate the results of the New Jersey and Florida conferences into their findings

- One of the principal reasons that EPA sponsored these four regional conferences was to allow states to identify indicators that had special relevance to their region of the country. As appealing as this idea is, there is little evidence found in the conferences that would suggest that states find this distinction useful. Every one of the 8 groups either did not include regional indicators, failed to distinguish between regional and national indicators or, in the few cases where list of regional and national indicators were offered, caveats were entered disclaiming the utility of regional indicators An examination of the New Jersey proceedings similarly showed to no great result from the distinction.

- While the reporting of data gaps was useful, with a number of important indicator data gaps being reported in most groups, it would appear that the number of data gaps is substantially understated. The indicators surfacing from the small groups and from the individual work, which supposedly meet the selection criteria, are highly suspect. It is likely that much more work is need in filling data gaps than is evident.

- There is some evidence that "comparative risk assessment syndrome" is at work. Since the indicators selected in most of the groups tend to be the product of existing programs, and not based upon some comprehensive and logical assessment of risk across all environmental issues, there may be reason to believe that some important, high risk issues are not represented poorly or not at all, and that other less risky, but well documented, issues are, perhaps, over represented. The absence of any real consideration of indoor air issues is perhaps indicative of this condition. In the long term, it may be useful to structure a national indicator system around the issues identified in a national comparative risk assessment study.

- Though the structure of the small groups was not particularly conducive to dealing with indicators from a policy perspective,there was some diffuse pressure to produce indicators that reflected some of the major policy positions being assumed by states and promoted by EPA -- pollution prevention, sustainability and environmental equity.

Future conferences may want to consider focusing some small group activity on specifically developing indicators that deal with these issues

- The results plainly reflect the problems with the quality of the available data. In spite of some considerable effort to ensure that participants focused on indicators that reflected an environmental result, a number of program activity measures were still offered, particularly among the individual responses. At the high end of the scale -- indicators providing direct measures of human and environmental health -- there were few indicators, with virtually nothing available for human health. Obviously there is tremendous work left to accomplish in developing quality indicators.

- Of the many data gaps directly identified of indirectly inferred, perhaps two of them should selected for immediate and intensive treatment. **Human health** because of its importance as a top level type of indicator and because of the near total absence of meaningful national data, needs priority treatment. **Land use/cover** because of its overall value in setting the context for other issues and because of its use in GIS systems for creating new indicators is prime for focused effort. The amount of available, but presently unusable and disorganized land use/cover information, offers the opportunity for rapid and valuable progress.

Water Quality

Water Quality is obviously a key area for indicator development because of the overwhelming importance of water as an environmental value. This group was intended to serve as a forum for dealing with water quality issues of all types -- surface and ground water, fresh water and salt water as well as drinking water. Given the importance, size and complexity of this issue, it may be a candidate for further division in subsequent deliberations. Water quality was a highly popular issue, requiring two separate sessions to accommodate at the conferees wishing to participate in this issue.

Group Presentation Summaries

Group 1

National Indicators

Ground Water: Number of public drinking supplies violating maximum contaminant levels (MCLs)

Surface Water: Percent of miles/acres of water bodies meeting or not meeting designated uses.

Drinking water: Percent of population served by systems violating MCLs.

Regional Indicators

Ground water:

1. Percent of leaking underground petroleum tanks.
2. Quantities of impervious surface.
3. Number of contaminated sites.

Surface Water:

1. Fish advisories.
2. Percent of shellfish beds closed to harvesting.

Data Gaps

1. Biological indicators (surface water).
2. Ground water monitoring.
3. Storm water pollutant loadings to surface water.
4. Percent of septic tank failures.

Workgroup Comments: This workgroup provided no interpretative comments as part of its presentation

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Group 2

National and Regional Indicators

Ground water:

1. Ambient ground water quality.
2. Withdrawals/recharge rates.
3. Number of major sources of ground water contaminants.

Surface Water:

1. Bodies of water that meet ambient water quality standards.
2. Percent that meets designated usage of all water bodies chemical/physical/ biological.
3. Natural species diversity baseline index

Drinking Water:

1. Percent of public drinking water in compliance.
2. Percent population served by systems in compliance.
3. Number of advisories.

Water Resources:

1. Disturbance in the drainage basin.
2. Percent of low flow permitted by water withdrawal.

Data Gaps

1. Ambient water quality data.
2. Biological baselines for flora and fauna in the water.

Workgroup Comments

This group agreed that there is little merit to differentiating between national and regional indicators. Nationwide standardization is needed in order to make the use of these indicators universally acceptable.

Summary and Analysis

Reflecting the depth, diversity and complexity of water quality issues, the indicators emerging from the results of the group and individual processes, as well as the results of the New Jersey work, not much is generated in the way of a consistent structure of water quality indicators. Instead, the collected information yields a rich array of indicator possibles which may assume greater conceptual cohesion in the context a more refined analysis of water quality issues.

Review of the work of the two work groups and of the individual work did, however, produce some clear indications of some types of indicators that should support the water quality issue. In general, four broad areas drew support:

- **Surface Water Quality:**
  A large number of indicators dealt, in one fashion or another, with the quality of surface water, an amazing number of them being unique contributions. The two commonly cited indicators in this group are:
  1) Water Quality Standards Exceedances, and
  2) Designated Use Measures.

- **Ground Water Quality**
  There was considerable interest in developing measures of water quality for ground water given its importance. However, much of the support came in the individual responses and most of those responses seemed to be based on measures found in Florida's SAFE document, which projects data not generally available to other states. Nonetheless, there was substantial support for indicators that supported information concerning violations of water quality standards for ground water. Measures regarding septic tanks also drew attention

- **Drinking Water:**
  Drinking water indicator recommendations had some variety as well, but there was general consensus that an indicator based on violations of maximum contaminant levels (MCLs) was desirable

- **Effects of Surface Water Contamination:**
  Another clear group of proposed indicators focused around the effects that surface water pollution has upon ecological and human health values. Commonly mentioned examples of ecologically-based environmental indicators include shellfish closings, fishkills, biodiversity and habitat impacts. On the human health side, measures dealing with populations affected by exposure to water contamination and public health advisories typify the suggested measures.

A review of the water quality indicators produced by the New Jersey process seems to indicate the same difficulty in finding a clean structure capable of organizing water quality indicators The twenty-five ranked indicators found in their proceedings provides a useful list of indicator potentials, but, like the results of the present analysis, requires more refined analysis to be useful in developing a comprehensive and cohesive indicator system.

It is plain that water quality is an area where considerable additional work needs to be done. The diversity of suggested indicators demonstrates both its importance and the potential wealth of information that might be applied to the area. Probably more than any other issue, water quality evoked recommendations for issues that are not directly water measures. A number of measures were recommended that dealt with land use (habitat change, land cover/use, drainage basis disturbances) and another group tied water quality to measures of biological performance. Future regional conferences and the national conference should investigate the dimensions of water quality more fully to ensure its proper treatment.

Waste

Waste is another broad area of environmental concern that projects a number of important dimensions: solid waste management, pollution prevention, hazardous waste management and a variety of specialized waste issues.

Group Presentation Summary

National Indicators

1. Total and per capita generation of all solid waste.
2. Total and per capita generation of municipal solid waste.
3. Solid waste management by: type, strategy, final disposition (landfilling, incineration, composting, recycling, and reuse), total tonnage, percentage breakdown and per capita use.
4. Number and percentage of all sites with confirmed contamination (soil and ground water).
5. Low level total amount of radioactive waste generation and methods of disposal.
6. Hazardous waste management by type, strategy, final disposition by total tonnage and percentage breakdown.

Regional Indicators

1. Waste tons traveled per mile
2. Sewage generated per capita (sewage sludge) and disposal methods.

Data Gaps

1. Source reduction

Workgroup Comments

This group's concern is whether the above indicators measure ecological damage due to waste contamination, or simply waste generation. While some of the indicators may be ecological, most are related to waste activities alone, such as amounts of waste, where its flowing, etc. This does not provide any indication of how the waste is *affecting* the environment. The direct impacts to humans and ecosystems were discussed; however the group could not develop any indicators to measure these impacts.

The group did not distinguish much between national and regional indicators, although the lists above show some differences. All of the indicators above can be used at the national or regional level. The group noted that it is important to clarify definitions in order for all levels of government to collect the same type of data.

Summary and Analysis

Since waste is effectively an artificially created construct -- and not a specific resource like air, water, land or wildlife -- it is largely defined by the programs that have been developed to manage its impacts. Not surprisingly, the majority of the indicators developed to deal with waste issues have their base in relatively compartmentalized programmatic activities. As consequence, in contrast to the previous water quality issue, waste issues tend to break out into relatively clear and consistent groups that should make the development of cogent clusters of waste indicators relatively simple.

A review of the group presentation summary and the individual responses indicates at least five clear areas for indicator development:

- **Solid Waste:**
  A review of both the individual and group responses indicates strong support for a variety of solid waste-related indicators. At least four general types of solid waste indicators were identified:
  1) measures dealing the total and per capita amounts of waste generated,
  2) measures dealing with the recycling of solid waste,
  3) measures dealing with solid waste facilities (capacity, facilities causing pollution, open dump counts), and
  4) measures dealing with rates and methods of disposition of solid waste.

- **Hazardous Waste:**
  A considerable number of responses identified a need for hazardous waste indicators, with most of the candidate indicators focusing on either hazardous waste management or on source reduction. While a number of waste management indicators were offered, no clear choice was made Source reduction indicators were consistently suggested, but the lack of data in this area prevented any serious candidate indicators from being provided.

- **Contaminated Sites:**
  Mirroring all of the highly visible site-based cleanup programs existing at the state level, strong sentiment was expressed for the inclusion of measures that summarize cleanup activity. CERCLA cleanups were the most common specific choice for an indicator in this area.

- **Toxic Releases:**
  Several measures were suggested involving the Toxics Release Inventory data, though discussions in the group questioned the meaning and validity of that data source.

- **Effects**
  As in all of the groups there was considerable concern for ecological and human health aspects of the waste issue. A variety of measures were recommended that dealt with the number of contaminated drinking water well, exposure levels of waste pollutants,

etc. A desire for measures that correlate waste exposures with human health effects was demonstrated, but specific indicators were not offered due to lack of data.

Other suggested indicators covered a variety of subjects including such things as radiological wastes, medical wastes, and sewage.

Several clear data gaps did appear that are worthy of note. First, spurred by the development of pollution prevention programs, indicators capable of providing measures of source reduction activities were strongly supported, though the lack of data prevented any specific candidate indicators from being offered. This is an area that is prime for some sort of focused data collection effort. A second area deals with the lack of data capable of associating waste source exposures to human health effects.

The New Jersey workshop results produced ten unprioritized and ungrouped indicators which could easily be integrated into the five groups identified above or that demonstrated a desire to develop indicators where important data gaps existed. In general, the New Jersey results supported the results found in this conference.

Water Quantity

The management of water supplies for all of the competing uses is not an issue that falls within EPA's mission. As a consequence, indicators that reflect strictly the use or the quantitative side of water issues are not usually at the forefront of indicator lists developed within the EPA context. Water quantity as an independent issue is emphasized in this conference because 1) water use is an important mission issue for many state governments, and 2) water use is an important aspect of any comprehensive assessment of environmental conditions.

Group Presentation Summary

National and Regional Indicators

1. Total/per capita freshwater withdrawal by use.
2. Number of public water suppliers pumping from receding aquifers
3. Number of inter basin transfers.
4. Use of reclaimed water.
5. Population affected by water restriction days.
6. Total annual average precipitation.

Data Gaps

1. Waterbed levels, flows, and inflows not meeting ecological, recreational, aesthetic, and consumptive use needs.
2. Surface and ground water availability.

Workgroup Comments

This group thought mainly in terms of regional indicators, although these could be used nationally, taking into consideration regional differences. During the group's report, the question was raised as to whether these indicators would be valid in other climates, such as arid areas. The group stated that the indicators would show some differences, but would be appropriate overall. One attendee noted that some of the listed indicators are "bean counts," or input measures rather than measures of results.

Summary and Analysis

The Water Quantity group produced a relatively coherent and focused set of results that provides a good structure around which to structure indicators. Indicators clustered into three main groups:

- **Water Use:**
  Virtually all individuals and well as the group presentation indicated support for one or more indicators that measured use or withdrawal of both surface and ground water usually by major sector (public supply, agriculture, industrial, thermoelectric, etc.) Where appropriate, both total and per capita measures were suggested.

- **Effects of Water Use on Water Supply:**
  Though the specific recommended measures were less certain, a number of individuals identified indicators that sought to measure the effects that man's use of water had on the water supply. Candidate indicators such as measures of flows and levels, aquifer declines, and wells contaminated by water level declines are examples of this type of indicator.

- **Effects of Water Use on Humans and the Environment:**
  A similar set of proposed indicators sought to describe the impact the man's use of water resource has had on man and on other environmental values. Stream impairment, salt water intrusion, flows and levels impacts on wildlife, fisheries and recreation are measures proposed that fit this type of indicator.

The New Jersey conference combined water quality and water quantity into a single discussion issue. Only two of the 25 indicators brought forward by that workshop dealt with water use issues.

The data gaps in this area are likely very substantial. Good information is available through the US Geological Survey concerning water withdrawals by sector that may have some national consistency Otherwise, while some types of data may be good at the state or subnational level, there would appear to be a general lack of data concerning most of the dimensions of water use identified. The collection of water use data is an area that needs considerably more attention.

Land Use/Demography/Resource Protection

Man's use of and impact on land resources is an area that is largely the responsibility of state and local governments and of federal agencies other than EPA. A national environmental indicator system, however, needs measures that assess these impacts because they set the context within which almost all of the other issues are set. This group was created to provide a focal point for the development of indicators that reflect processes occurring in the broader society that have impacts on environmental values.

Group Presentation Summary

National & Regional Indicators, & Data Gaps (Top Six Indicators)

1. Land use by category.
2. Population shifts - growth.
3. Level of land use control.
4. Land use by ownership.
5. Identification of critical sites.
6. Chemical use and application.

Complete Listing:

-- Population.
-- Land ownership.
-- Land use by percent.
-- Chemical use - pesticides and fertilizers, etc.
-- Rates of visitation to public lands and parks.
-- What can be done with land – property rights.
-- Preservation/conservation – special uses.
-- Land use – environmental justice.
-- Permitting and enforcement.
-- Conservation – forest to other uses.
-- Conservation from other uses to development.
-- Number of cleanup sites.
-- Changes in wetlands.
-- Percent of population using sewage treatment by type.
-- Per capita vehicle miles traveled.
-- Population density/growth.
-- Demographics – population shift.
-- Environmental education programs.
-- Prime farm land.
-- Percent of land being used – industry, waste disposal.
-- Abandoned industrial sites.
-- Species control programs.

-- Percent of urban land underutilized.
-- Streams and shorelines with forested buffers.
-- Land use in flood plains.
-- Planning/management/regulation that includes all air, land, water.
-- Government land acquisition.
-- Homeowner responsibilities.
-- Land use control via environmental protection.
-- Definitions.

Workgroup Comments

The land use group noted that it is very difficult to get a good grasp of this subject because of such issues as property rights. Some indicators can be used to measure how land is being used versus how land is being regulated. If we want to examine how land is being controlled, this information will be difficult to obtain, since some areas have no land use planning per se. To this group, regional and national indicators are fairly synonymous. However, one area's definition of "industrial" may be quite different from another area's. For this subject, clarity of definitions is very important up front.

Rather than addressing data gaps, the group was more concerned with definition questions and such questions as what are the categories of land use that we want to use.

One attendee suggested that soil resources, specifically topsoil, should be considered. Another suggestion was to look at land cover to measure disturbance, rather than land use. However, how the land cover is used is also important to measure. Another suggestion was that the urban/rural mix is important to track.

Summary and Analysis

Although there was considerable diversity in the types of indicators that were suggested, the general areas where the participants felt that indicators should be developed were fairly distinct. Four such broad areas emerged:

- **Population**
  Both the group and individual responses strongly supported measures that summarize trends in population. Common recommended indicators include: total population, population density, urban/rural growth, and population growth rates.

- **Change in Land Use/Cover**
  Similarly, the group response and almost all of the individual responses identified at least one indicator of change in land use/cover as worthy of inclusion and quite a variety of candidate indicators were provided. There seemed to be concern, however, that a current source of data was not available.

- **Protected Lands**
  Another area of general consensus is the need for an indicator that measures the amount of land that is some sort of protected status. Quite a number of indicators were proposed that defined protected lands in a number of ways and it is doubtful that any national indicator is presently available for lands other than federal. Appropriately defined, data could be collected from state governments that could support a good national indicator.

- **Habitat**
  The final indicator type drawing consistent support is wildlife and aquatic habitat. As with many of the other land use/cover indicators suggested in this issue, a consistent data source appropriate for national use likely does not exist at the moment.

The New Jersey conference did not have a workshop that was the direct equivalent of this group. It did have a workshop dealing with natural resource issues that recommended several indicators dealing with land us/cover and an indicator that would summarize the status of protected lands, measure generally supportive of the finding to this conference..

While data for a variety of demographic indicators is easily available, data associated with land use/cover indicators is either not available or, or more likely, is not collected or prepared in an appropriate format to support national indicators. This is an area that is important to a national indicator system where usable data probably exists, but is not currently available. Sizable progress could probably be made with EPA leadership in providing nation-wide analysis of satellite information at state scale and by EPA working with other federal agencies (Interior, NOAH, Fish and Wildlife Service) to identify useful data.

Air Quality

Air Quality rivals the two water issues as an indicator area because of its intrinsic importance to the support of life and because of its importance to the mission of EPA. This group was developed to capture indicators reflecting all dimensions of air quality, including indoor air.

Group Presentation Summary

National Indicators

1. Number of people living in non-attainment areas by.
   - A. Income level, and
   - B. Ethnic group.
2. Average pH of rainfall.
3. Number of non-attainment areas nationally.
4. Mobile per capita source emissions.
5. Visibility.
6. Top ten hazardous air pollutants from the Toxic Release Inventory (TRI).

Regional Indicators

1. Trends in measured pollutants from vehicles.
2. Number of days lost at work/school from illness caused by air.
3. Trends in criteria air pollutants emissions
4. Number of homes/schools over the national radon level
5. Number of major industrial facilities NOT meeting federal regulations.
6. Blood lead levels in children.
7. Population trends.
8. Vehicle miles traveled (VMT).
9. Emissions from pulp/paper/chemical plants.
10. Regional map of releases by chemical (bar graph).

Other Indicators:

-- Citizen complaints.
-- Acres of agricultural/forest land burned.
-- Emissions from newly permitted sources.
-- Average state ozone as percent of national emissions.
-- Percent of population impacted by odor.
-- Pollution standard index (PSI) greater than 100 or anything greater than moderate levels.

Data Gaps

1. Epidemiology data on disease associated with criteria air pollutants.

2. Epidemiology associated with non-criteria air pollutants.
3. No health risk data available.
4. No method for monitoring air toxics.
5. No understanding of ozone generation.
6. No understanding of ozone transport.
7. No data on long-range transport
8. Non-compliance of air quality standards.
9. Solar radiation.
10. Odor - short term measures.
11) No adequate system of recording complaints.

Other Data Gaps:

-- Toxic release data from sources other than TRI (government facilities, utilities, small and mobile facilities).
-- Ecological effects from air pollution
-- Economic impacts from air pollution.
-- Materials damage from air pollution.
-- Proportions of emissions from each source.
-- Visibility monitoring data.
-- Relative exposure by emissions source
-- QAQC improvement for each region with shared airsheds for all air pollutants.
-- Agriculture acres burned
-- Weighing of hazardous air pollutants (TRI).

Workgroup Comments

This group did not particularly distinguish between national and regional indicators, although they provided a list for each. They agreed that many can be used at either level. They noted the equity issue brought up in the first indicator. Creating and maintaining a regional map of releases to show "hot spots" would be very useful.

Summary and Analysis

The air quality issue produced perhaps the best results of any of the groups. This likely results from the strong data collection efforts that support the national programs that define the content of the air issue Four clear areas for indicator development emerged:

- **Violations of Air Quality Standards**
  The group response and virtually all individual responses featured at least one candidate indicator that dealt with violation of air quality standards. These indicators most commonly took the form of some of measure reflecting nonattainment status. Similarly popular were indicators measuring exceedances of various air pollutants.

- **Emissions**

  Another area with strong and consistent support for indicators was air emissions. Specifcally, emissions indicators were suggested for use with.

  1. criteria air pollutants,
  2. Toxic Release Inventory data, and
  3) VOCs.

  Presenting emissions data within the context of stationary and mobile sources was consistently supported, where that distinction is appropriate.

- **Air Quality Effects**

  A lot of attention was focused on identifying indicators that demonstrated the effects or impacts of air quality A number of different types of effects were identified to include

  1. human health (blood lead levels in children,
  2. damage to resources (water resources, land, biota, crops), and
  3. economic productivity (work days lost, crop damage).

  Closely related to the human health class of indicator is another suggested group of indicators that would summarize levels of human exposure to various types of air pollution (people living in nonattainment areas, population exposed to excessive radon).

- **Acid Deposition**

  A surprisingly weak fourth issue was acid deposition. The indicator commonly specified was average rain pH

Several other issues gaining some attention were

1. radon,
2. odor,
3. visibility, and
4. vehicle miles traveled.

The New Jersey workshop dealing with air issues was also strong and their results strongly mirrored and supported the results of this conference New Jersey identified 14 issues placed into 6 groups. They are

1. Health Impacts (equivalent to Air Quality Effects),
2. Air Conditions (equavalent to Air Quality Standards),
3. Actual Emissions (equivalent to Emissions),
4. Management Activities
5. Environmental Impacts (equivalent to Air Quality Effects), and
6. Public Perceptions and Actions (equivaalent to part of theMiscellaneous issue.)

Three distinct data gaps emerged, though a number of other were listed. They are:

1. data capable of linking air quality with human health impacts,
2. data on air toxics, and
3. data on visibility.

It would appear that the ability to develop indicators appropriate for inclusion in a national system is better for air quality than for many of the other areas. Good monitoring systems associated with EPA air programs has insured a good database from which to develop a good foundation of program related indicators Air suffers, however, from the same inability to relate pollution to either human or ecological health in a direct way.

Almost totally missing from the group and the individual work is any reference to indicators dealing with indoor air pollution, an interesting omission given its relative importance in comparative risk assessment projects.

Wildlife

Indicators of the condition of wildlife are important to include in a comprehensive indicator system for a variety of reasons. First, they are good indirect measures of the health of the broader environment, capable of providing a type of summary measure of the livability of the system. Second, to the general public they are flagship indicators of the condition of the environment, providing a visible and very understandable indicator of environmental performance.

Group Presentation Summary

National and Regional Indicators

1. Decline/recovery of threatened/endangered species.
2. Decline/recovery of recreationally important species.
3. Decline/recovery of commercially important species
4. Diversity of wildlife species.
5. Incidence of exotic, alien species.
6. Diversity of wildlife habitats.
7. Lands set aside for preservation and conservation.
8. Health of wildlife.
9. Public commitment to wildlife.

Data Gaps

Not addressed by group.

Workgroup Comments

This group struggled with the differences between national and regional indicators and ended up combining its list. Also discussed was a definition for wildlife, which was not ultimately decided The group did not have time to discuss data gaps, but generally agreed that there are a number of gaps in the indicators listed by the group.

During the group report, a discussion of several data projects occurred. The U.S. Department of the Interior has just created the National Biological Survey, but it will be some time before this new organization gets moving, and it is unclear just what data will be collected. It was noted that the National Water File is a good source of data, and although the national Audubon bird count has some data problems, it is also useful. The EPA has had some staff to staff discussions with U.S. Fish and Wildlife about the use of its data, especially as it concerns the national goal setting project which overlaps a number of agencies. At this point it is not clear how involved other agencies will be with EPA in setting goals and providing data.

The assembly noted that collection of wildlife data is made more difficult because wildlife constantly move. One conferee suggested that indicators should focus on ecosystems versus lands (as in #7 above), as this would be a more holistic approach.

Summary and Analysis

This group had more difficulty than any other in getting started and in conceptualizing their issue, primarily because of problems in achieving consensus with regard to definitional concerns. Despite these problems analysis of the the small group presentation and the individual responses two clusters of indicator types relevant to wildlife:

- **Viability of Populations,**
  This group of candidate indicators seeks to focus on the wildlife themselves. Suggestions included measures of:
  1. the status of threatened and endangered species,
  2. populations of key species,
  3. plant and animal species diversity,
  4. exotic species, and
  5. physical and reproductive health.

- **Viability of Habitat**
  A second group of proposed indicators focused on habitat. This cluster included measures of the:
  1. quality and quantity of habitat loss,
  2. diversity of habitat,
  3. wildlife corridors,
  4. acquisition of wildlife habitat, and
  5. habitat reclamation.

The New Jersey workshop on Natural Resources dealt with some potential indicators involving wildlife populations, but the choice of species reflected regional concerns and was not particuarly helpful to this issue.

Clearly, much work needs to be done in this area in identifying data appropriate to creating indicators of the types idenfied above. EPA could be great help to states in developing a database for wildlife by working closely with other federal agencies and the responsible state agencies.

Human Health

Human health is another one of those issues not considered to be part of the main mission of EPA. It is an area, however, of such importance that it must be included in any national indicator system. Human health indicators represent the highest form of environmental indicator -- indicators showing changes in health Further, if future environmental management wil be based on the comparative riskassessment methodology, then measures to chart progress in dealing with huan health issues are required. This issue group was added with the full knowledge that there is virtually no data capable of creating human health indicators that are compatible with the selection criteria. In fact, the issue was included specifically because it is known that very little usable data exists and that discussion of the data gaps is, at this stage in the process, probably the most useful thing that could be done

Group Presentation Summary

National & Regional Indicators

1. Cancer incidence.
2. Respiratory disease
3. Water borne disease.
4. Birth defects/infant mortality.
5. Lead blood levels.
6. Fish/shellfish advisories.
7. Breast milk indicators.

Data Gaps

1. Imported foods.
2. Pesticide residue.
3. Indoor air in schools.
4. Soil samples (lead).
5. Radon monitoring.
6. National Human EXposure ASsessment (NHEXAS).
7. Reportable diseases (environmental).
8. Epidemiology data.
9. Liver tissue samples.
10. Mercury emissions/cycle.
11. Animal health comparisons.

Workgroup Comments

This group agreed that national and regional indicators in the area of human health are the same. In its report, the group noted that, no matter how health outcomes are caused, these results are the important things to measure. Many of the indicators listed do have data gaps, in fact, there are more data gaps than indicators. The suggestion was made that, along with liver tissue samples, hair and nail samples are good indicators to measure the presence of heavy metals. Another comment focused on the idea of using biomarkers as indicators. One attendee noted that the Centers for Disease Control do not keep socio-economic statistics on cancer incidence, but should be encouraged to do so. Another suggestion was to use international data in some cases

Summary and Analysis

Needless to say, the session produced little in the way of specific, usable indicators concerning human health It was quite successful, however, providing a structure for human health indicators and it identified a useful list of data gaps. Two major areas for focusing human health indicators emerged.

- **Health Effects**
  This group of indicators would identify and measure specific incidences of environmental diseases. Candidate indicators would include:
  1. cancer incidence,
  2. pulmonary disease,
  3. birth defects, and
  4. water bourne disease.

- **Exposure**
  Another group of potential indicators includes measures of exposure to toxic materials that creates a health risk. Candidate indicators include:
  1. blood lead level,
  2. ambient and food residue pesticide exposures, and
  3. human tissue toxic levels.

The New Jersey conference identified 7 human health indicators, 5 of which are direct equivalents of issues and indicators identified above. Two other -- rabies and occupational diseases -- were not identified in this process.

The need, obviously, is for the development of data capable of building good indicators. This is not an easy task. In the process of developing the SAFE indicator system in Florida, staff was not able to identify a single indicator where there was confidence that the health effect was related to environmental causes. If it was this difficult in one state, the likelihood that there will be much in the way of data that can be used to build national indicators is slight This is an issue that needs serious and continuing attention.

Miscellaneous

This group was included to provide the opportunity for conference participants to correct any oversights in the structuring of the other issue groups by identifying indicators need as part of the national system that were not being treated in the other groups. Further,significant issues such as energy and public perception which do not fit well with the other groups still needed a place for examination and discussion.

Group Presentation Summary

National & Regional Indicators

1. Public perception (related to indicators of the environment).
2 Percent of unsafe levels of radon (total # of households in which radon exists).

Energy Indicators:

1. Electricity used and consumed (total and per capita).
2 Energy efficiency (loss through transmission). Efficiency/inefficiency of energy generation (output/input)
3. Amount of energy saved in dollars (demand side management).
4. Mass transportation (data available by municipalities/states, etc). Identify goals and assess outcomes/incentives.
5. Industrial energy use

Food Production Indicators:

1. Energy involved in production of crops (relative efficiency).
2. Chemical use/pesticides.
3. Agricultural viability involving soil depletion.
4. Energy embodied in products and food (quantified per unit of product sales)

Data Gaps

1. The way states/municipalities handle materials. (How do you quantify economic benefit of environmental indicators/regulation/cost?)
2. Dollar figures/health benefits of Clean Air Act.

Workgroup Comments

This group simply included indicators for subjects of concern to individuals in the group

Summary and Analysis

This group was probably influenced in its choice of "miscellaneous" indicators by suggestions that energy and public perception might be appropriate for inclusion Not surprisingly, they were prominent, but some other issues emerged as well. Three general dimensions emerged:

- **Energy**
  A number of indicators of energy were offered for consideration:
  1. measures of total and and per capita energy consumption,
  2. measures of energy consumption by economic sector,
  3. measures of transportation efficiency (mass transit, vehicle miles traveled, gas efficiency)

- **Sustainability**
  A group of candidate indicators were offered that attempted to measure progress toward achieving sustainability. Indicator suggested included:
  1. food production,
  2. energy (renewable resources), and
  3. water/soil depletion

- **Public Perception**
  While not a direct measure of environmental conditions, measures of the public's perception of the condition of environmental values and of the performance of society in the preservation environmental quality is important information for decisionmakers to know and should probably be included in any comprehensive indicator system. The lack of any known, comprehensive assessment of public attitudes concerning the environment is a current limitation to the development of useful indicators.

The New Jersey conference identified 11 indicators dealing with energy, most of which are good candidates and would fit well within the energy or sustainability groups outlined above. In addition, they identified 11 agriculturally-based indicators, several of which clearly support the sustainability group.

All three of these miscellaneous indicator cluster are important and all three need further examination and definition. The sustainability cluster is particularly interesting and could take on greater meaning as the concept of sustainable development gathers momentum

SUMMARY: MID-AMERICAN CONFERENCE ON ENVIRONMENTAL INDICATORS

BREAKOUT SESSION: DEFINE CRITERIA TO EVALUATE AND RATE ENVIRONMENTAL INDICATORS

DRAFT

Moderator: **Tim Mulholland**

Date: **Monday, January 10, 1994**

Time: **2:00 P.M.**

The conference attendees were allowed to sign-up for one of the following four categories for the breakout session:

Air Quality Issues
Water Quality Issues
Waste/Land Use Issues
Biological, Wildlife and Human Health Issues

This portion of the proceedings will summarize the discussions that had taken place in this breakout session. More importantly, the results of these four breakout groups have also been provided. Each breakout session summary generally includes but is not limited to the following topics, although not necessarily in the following order:

Facilitator/Groups Represented/Spokesperson
Introduction
Goals of Environmental Indicators
Criteria
Environmental Indicators

Following this activity summary for each of the breakout groups, a summary is provided of the Plenary Session. The purpose of the Plenary Session was to share the results of each of the breakout sessions. Therefore, the Plenary Session may be considered an abstract of the summary.

AIR QUALITY ISSUES BREAKOUT SESSION

DRAFT

Paul Schmiechen was the facilitator for the Air Quality Issues Breakout Session.

In attendance in the Air Quality Issues Breakout Session were representatives from Utah, New Mexico, Colorado, South Dakota and Minnesota. Also in attendance was a local government representative, a member of the Western Center for Comparative Risk, and an EPA representative from Region V.

Dave Workman will report the results of the Breakout session.

INTRODUCTION

The charge of the breakout was discussed with the group. This session will provide information on selecting environmental indicators. First a goal will be determined. Then a list of potential environmental indicators will be developed. The group will learn how to select environmental indicators and what are considered practical indicators of air quality. Finally, the group will determine what criteria will be used to evaluate the environmental indicators, and apply several of the criteria towards the environmental indicators developed.

GOALS OF ENVIRONMENTAL INDICATORS

The facilitator indicated that Minnesota uses "clear, clean, odorless air" as the goal in air quality. It was agreed that this would make a good preliminary goal. The group discussed whether to include a section in the goal which provides a human health interest. However, achievement of the goal would be in the interest of public health. Therefore, public health would not necessarily be a goal of the program.

The group discussed the term undetectable air, but agreed that clear and odorless may accommodate the term. Sustainability of the environment and sustainability of the economy may also be a goal for which air quality environmental indicators may strive. As for ecological issues, clear, clean, odorless air would remedy any potential ecological threats. Therefore, of all the issues discussed, the following became the goal of the air quality group:

"Clean, clear, odorless air"

ENVIRONMENTAL INDICATORS

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The group developed a list of potential environmental indicators. Each indicator was discussed and debated within the group to either delete an indicator, narrow the focus of an indicator, or add an associated indicator. The following represents the initial list of environmental indicators developed by the Air Quality Issues group.

Potential Environmental Indicators

Visibility - as it relates to power plants, car exhaust such as vehicle miles traveled, and industrial sources

Volume of Emissions over Time - tons/day of stationary and non-stationary sources

Industrial Emissions

Asthma/Respiratory Problems - Number of cases

Number of People in Areas Not Meeting Air Quality Standards

Number/Size/Trends in Non-attainment Areas

Amount of Emissions Versus Product Manufactured

Welfare Effects - such as crop damage and building degradation

Traffic Congestion

Percent of Facilities in Compliance

Days Lost at School or Work due to Respiratory Illness

Number of Burn/Nonburn Days (pollution alerts)

Inspection/Maintenance Fail Rates - number of cars that fail inspections

Upset Conditions - violation of standards for stationary sources

TRI Data - in non-attainment areas

Air Quality Standards

Pollution Standards Index - synergy of ozone, PM10, emissions, etc. This index condenses a substantial amount of information into one number.

Nuisance or Odor Complaints - number of complaints to air hotline

Number of Areas Maintained in Attainment - for instance Moab or Price, Utah wants to build a processing plant. Because it would be highly regulated, these cases could be added to the number.

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Exceedances Measured in Attainment Areas

Climatic Conditions - pollution transport (accurate indicator because it is not ambient)

Population Trends/Futures Analysis - discussed state population growth and how some urban areas have leapfrogged out into the suburbs

CRITERIA

The question then is whether the list above is feasible. Criteria must be defined on what makes a good indicator. The following list of parameters were discussed which could be used as criteria:

Is it measurable?

Does it cost?

Is there quality data?

Is it relevant to the common people?

Is it understandable?

> In other words, is the public concerned. For instance, visibility in New England may not be an appropriate indicator because the fog inhibits visibility. In addition, we cannot have just a set of indicators for the scientific community and then one for the public. The indicators must be understood by each and represent a mix of concerns. They should bring in the governor, policy-makers, and legislators.

Is there historical data or trends data?

Does the indicator show valuable information and can any conclusions be reached? (Relevance to stated goals)

Is the data application to different areas?

> Can we get more bang for our buck?

Is the collection of data mandatory or voluntary?

> Will regulators respond to a problem, or have any thresholds been tripped which makes response necessary?

Who collects the data?

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Is the data collection and use a resource drain?

Is there funding available?

Is collecting the data feasible?

Can you act on what the indicator says?
This includes both political and scientific.

Is the indicator politically correct?
We must keep in mind that even in the regional sense we are dealing with many different people from a variety of backgrounds, for example the prairie versus the deserts.

Do you believe the data? (data credibility)

Can success be measured and communicated?

Is the indicator a direct measure or an indirect measure?

EVALUATION OF THE INDICATORS

The facilitator requested that four criteria be selected to evaluate the list of environmental indicators which we had listed. The four that were chosen included the following:

Is the indicator measurable? - To be represented with an "M" for measurable, and "non-M" for not measurable.

What is the cost? - To be represented with an "E" for expensive, and "non-E" for inexpensive.

Is the indicator relevant? - To be represented with an "R" for relevant, and "non-R" for irrelevant.

Is the indicator a direct or indirect measure of air quality? - To be represented with an "D" for direct, and "I" for indirect.

The following chart illustrates evaluation of eight of the environmental indicators with the captioned criteria.

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Indicator	Measurable	Cost	Relevant	Direct	Comments
Visibility	M	E	R	D	Regional
Emissions	M	Non-E	R	I	Not a direct measure of quality
Asthma/Respiratory Cases	M	Non-E	R	D	Correlate w/air qual.
People in Non-attainment	M	E	R	D	
Size of Non-attainment Areas	M	E	R	D	
Efficiency (prod v emiss)	M	Non-E	R	I	
Welfare Effects	Non-M	E	Non-R	I	
Traffic Congestion	M	Non-E	R	I	

Discussions regarding visibility included whether it was a regional problem, such as in the case of regional haze. How would a visibility indicator be defined or measured was discussed and the five levels of indicators were discussed. For example, Level I includes regional action, Levels III includes emission sources, and Level V includes body burden uptake. The measure of visibility is a direct indication of air quality and is quite inexpensive, but an analysis of the source of visibility problems is when the process becomes expensive.

The group reviewed the list of environmental indicators that Tim Mulholland of Wisconsin had compiled, specifically the definition of direct and indirect indicators. This definition was used to determine whether the indicator chosen was direct or indirect.

When discussing the number of people in non-attainment areas, it was noted that a distinction needs to be made as to whether a person lives, or works, or both in the area, and that non-attainment is very regional. The environmental indicators in this segment of the exercise are in a very gray area. This indicator would include attainment trends and the number or size of non-attainment areas. This indicator may need to be discussed further.

As the session was concluded, a suggestion was made by the facilitator that the next step would be to go back and reevaluate the indicators. For example, if an indicator was expensive, but measurable, relevant, and direct, should the money be spent to use the indicator? It was decided to revisit these indicators in tomorrow's breakout session which will also focus on the worksheet compiled by Tim Mulholland. Then we will compare our thinking with the other regions.

DRAFT

WATER ISSUES BREAKOUT SESSION

DRAFT

Doug Johnson was the facilitator for the Water Quality Issues Breakout Session.

In attendance in the Water Quality Issues Breakout Session were representatives from Colorado, Montana, South Dakota, Missouri, Iowa, Wisconsin, and Michigan. Also in attendance were representatives from the Eight Northern Indian Pueblo Council, Colorado School of Mines, and EPA Headquarters.

Kim Devonald will report the results of the Breakout session.

INTRODUCTION

The group began by identifying goals for water programs, proceeded to identifying possible indicators to measure those goals, and ended by identifying criteria for evaluating those indicators. There were also several general comments and observations made about the list of example regional indicators developed by Tim Mulholland and about the possible use of indicators.

GOALS OF ENVIRONMENTAL INDICATORS

Surface Water

"Fishable and swimmable" should be included as a goal because this language is used by the Clean Water Act. The group noted that "fishable and swimmable" could be considered "readout" indicators. For example, if fish are in the stream, it must be fishable. Other goals suggested by the group included the following:

Is the water supporting the designated use?

How much water is there? Does it support human capacity?

Restore/enhance/improve biological integrity.

Preservation/Conservation/Protection.

Ground Water

The goals for ground water seemed to closely parallel those of surface water and included the following:

How much water is there? Does it support human capacity?

Protect beneficial uses of nation's ground water:
Involves quantity and quality.

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Drinking Water Supply Monitoring Data
(tends to be more widely available than aquifer monitoring)

Number of User Days and/or Number of Advisories

CRITERIA

The group suggested the following criteria for evaluating environmental indicators.

Single Variable Versus Multiple Variable - Either or both may be appropriate in different situations. However, it is important to note that a single variable (i.e., oxygen content of water) may give a very narrow, incomplete, and sometimes misleading picture of the overall situation (e.g., water quality of a stream)

Communicable - Indicators must be easily understandable to all interested parties including the general public and policy makers.

Goals/Indicators May Be Needed on a Regional/Ecosystem/Ecoregional Basis - Political boundaries such as state lines may not make the most sense in evaluating an environmental problem. (e.g., Great Lakes wildlife reproductive indicators).

Adequate Spatial and Temporal Sampling Design - The sampling should reasonably represent conditions in a geographical area.

Reflects Risk - Ecological integrity including human.

Doability - Are the resources available? Is the political support there?

Quality of Data/Standard Measurement Methods/Reproducability

Sustainability - Indicators should measure sustainability.

One group member noted that the indicators included in Tim Mulholland's example regional indicator list seemed to be primarily point-source measurements. Few measurements addressed the non-point source problem. The measures in this list also seem to be "bean counts." For example, the number of contaminated sites is not really an environmental indicator but measures an activity.

The number of leaking underground storage tanks should be reported instead of the percent of leaking underground storage tanks. The number of leaking underground storage tanks discovered is constantly increasing. It would be more informative to report the total number discovered and the percentage of those cleaned up. Also, it might be helpful to report the percentage of tanks meeting the new standards. This indicator would help identify the potential problems prevented. It is difficult to quantify but is important in the regulatory field. The group noted that this is an activity measure. However, to capture prevention, activity measures may have to be used.

States may or may not have set uses or standards.

DRAFT

The group noted that some of these goals may actually cross over into the indicators area.

Other Considerations Discussed

The group also had suggestions on issues that need to be considered in developing goals and indicators.

The goals/indicators should provide a framework which shows whether legislation/regulations are effective at improving ground water and surface water quality.

Goals should account for human carrying capacity.

One goal of an environmental indicator effort should address data gaps. The group agreed that the lack of data could have a significant impact on any environmental indicator effort.

LIST OF ENVIRONMENTAL INDICATORS

The group suggested the following indicators for surface water and ground water.

Surface Water

Production of Bass, Trout, etc.

Indicator Species of Various Kinds

Contaminant Levels in Fish

Amount of Water
(supply issues) - instream flows

Transient Variables
(e.g., succession, global change)

Stream Habitat Quality/Riparian Condition/Wetlands
(cross reference to wildlife/biological group)

Ground Water

Maintaining Fossilized Ground Water Sources
such as the Ogalalla Formation. This indicator is similar to the surface water indicator to maintain instream flows.

Good Data for Particular Aquifers
but not comprehensive nationally

 DRAFT

The group questioned whether the Water Resources category on the example indicator list is actually necessary. Group members commented that this area seemed to be sufficiently covered by water quality and quantity.

The group discussed whether water indicators would be sufficiently covered under surface water and ground water categories. Some group members expressed an interest in having a third category, drinking water, because of the different set of regulations applied to drinking water. This issue was not resolved in the group discussion, but relevant points were raised.

The group offered suggestions on potential uses for environmental indicators. Those included:

Indicators can be used for interdiction.

Indicators can identify previously unidentified problems, for example, mercury in fish populations in Florida.

Indicators can help decide what interdiction may be appropriate.

LAND USE/WASTE ISSUES BREAKOUT SESSION

DRAFT

Howard Roitman was the facilitator for the Land Use/Waste Issues Breakout Session.

In attendance in the Land Use/Waste Issues Breakout Session were representatives from Nebraska, Colorado, South Dakota, Missouri, Michigan, and Wisconsin. Also in attendance was a local government representative, a member of the Florida Center for Public Management, and a Corps of Engineers representative.

Elizabeth Browne will report the results of the Breakout Session.

INTRODUCTION

The 10-person team established an indicator selection process for national land use and waste issues. After two breakout sessions, one on Monday, January 10, and one on Tuesday, January 11, the team concluded with a particular order in which the process must follow. As indicated in the following figure, this is a cyclic process which promotes opportunities for continuous improvement.

paste graphic

Consistent reference to goals, issues, and criteria is vital during the indicator selection process. This is to ensure proper focus during group discussion.

Team building methods were used in order to obtain general consensus and positive discussion among team members. Consensus prioritizing was essential in order to rank the established list of criteria and indicators.

The following outline is a record of this breakout session which was primarily a practice session. During this session the team became acquainted with the indicator development process.

The second day, increased team consensus was recognized and the criteria and associated indicators were redefined and consolidated.

GOALS OF ENVIRONMENTAL INDICATORS

DRAFT

The following goals were designed to be important, specific, measurable, and achievable:

Waste Minimization
Integration of Land Use
Best Land Use
Minimize Land Conversion from Natural
Revise Land Conversion Standards
Environmental Clean-up
Protect/Improve Ground Water

CRITERIA

The following list of criteria represents the factors which will be used to evaluate the environmental indicators:

Measurable
Importance to Environment(direct, indirect)
Quality of Data
Accessibility, Availability, and Cost of Data
Data Understandable to Audience(s)
Spatial (geographical, regional)
Historic Baseline
Public Value

Indicators should be inexpensive, easy to use, and provide meaningful information. However, this criteria should not prohibit the need for more expensive and difficult measurements in order to obtain desired results for key environmental goals.

Quantifying risk reduction was recognized as a constant criteria for any indicator selected.

ENVIRONMENTAL INDICATORS

The group suggested the following indicators for waste and land use:

Waste

Heavy Metals
VOC's
Percent Solid Waste Recycled/Incinerated/Placed in Landfill
Point of Origin Distribution (import/export)
Human/Ecological Risk Reduction

Land Use

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Percent Absolute Change in Use
Soil Loss
Percent Protected Land
Population Shift

Indicators are not always a direct measure of environmental conditions. In most instances, indicators are, in fact, and indication of improvement or degradation of the environmental goal. After the criteria and indicators were established they were then placed in a matrix for consensus prioritizing. (See Attachment 1)

BIOLOGICAL, WILDLIFE, AND HUMAN HEALTH ISSUES BREAKOUT SESSION

DRAFT

Dick Sumpter was the facilitator for the Biological, Wildlife, and Human Health Issues Breakout Session.

The Biological, Wildlife, and Human Health Issues Breakout Session group was represented by participants from Alaska, Colorado, Iowa, Indiana, Michigan, and Wisconsin, as well as the Eight Northern Indian Pueblo Council Tribes, The U.S. Geological Survey, and The Western Center for Comparative Risk. A wide variety of backgrounds were evident, with biologists being well-represented.

Amy Owen will report the results of the breakout session.

INTRODUCTION

The session began with a discussion of the definition of "biology" and "wildlife." It was decided by the group that the term wildlife was to mean biota, or more specifically, flora and fauna. The group then discussed what would be considered good indicators, as well the difficulty of making an accurate assessment of indicators related to biological, wildlife, and human health issues.

LIST OF ENVIRONMENTAL INDICATORS

The preliminary list of environmental indicators related to biological, wildlife and human health issues developed is as follows:

Abundance of Species
Abundance of Indicator Species
e.g. sensitive or keystone species
Landscape/Physical Habitat
Reproductive Ability
Population Viability
Health of Population and Individuals
e.g. presence and concentration of toxics

The group also developed a preliminary list of indicators for human health which proved to be considerably easier than those for biological and wildlife issues:

Air-borne Disease
Water-borne Disease
NAAQS Data
Blood-lead Levels
Contaminants found in blood, tissue, and organs
Advisories
Hospital Admittances During Exceedances of Air Quality Standards.

CRITERIA

DRAFT

The group then discussed the following criteria to be used to evaluate the environmental indicators:

Does it answer the question or address the goal?

Is it meaningful in relation to the environment?

Is it measurable?
An indicator should be both measurable AND meaningful, with low error, not ambiguous, sensitive and specific to the question.

Feasibility in relation to cost, time, and available technology.
For instance, the cost, time, and technology it takes to collect the data.

Is it spatially and temporally linked to the question or goal?

Relative Importance - Is the indicator interpretable/communicable, and of interest to all stakeholders?

Is it a surrogate for the value identified in the goal?

Is the trend data feasible and available?
chemical concentrations in ecological resources
body burdens of chemicals

BREAKOUT SESSIONS: ANALYSIS OF EXAMPLE REGIONAL INDICATORS

DRAFT

Moderator: Paul Riederer

Date: Tuesday, January 11, 1994

Time: 10:00 A.M.

The conference attendees returned to their respective breakout groups, which pertained to one of the following issues:

Air Quality Issues
Water Quality Issues
Waste/Land Use Issues
Biological, Wildlife and Human Health Issues

This portion of the proceedings will summarize the discussions that had taken place in this breakout session. More importantly, the results of these four breakout groups have also been provided. Each breakout summary generally includes the following topics, although not necessarily in the following order:

Facilitator/Groups Represented/Spokesperson
Introduction
Goals of Environmental Indicators
Criteria
Environmental Indicators

Following this activity summary for each of the breakout groups is a summary of the Plenary Session. The purpose of the Plenary Session was to share the results of each of the breakout sessions. Therefore, the Plenary Session may be considered an abstract of this summary.

AIR QUALITY ISSUES BREAKOUT SESSION

DRAFT

Paul Schmiechen was the facilitator for the Air Quality Issues Breakout Session.

In attendance in the Air Quality Issues Breakout Session were representatives from Utah, New Mexico, Colorado, South Dakota and Minnesota. Also in attendance was a local government representative, a member of the Western Center for Comparative Risk, and an EPA representative from Region V.

Kate Fay will report the results of the Breakout session.

INTRODUCTION

Today's breakout session reviewed the indicators developed yesterday and reviewed the air quality indicators on Tim Mulholland's list of example regional indicators presented this morning. We have also been assigned with a review of the miscellaneous indicators on Tim Mulholland's list of indicators. This group is charged with the complete development of a list of indicators for both air quality and miscellaneous issues that meet all of the criteria by the end of this session.

GOALS OF ENVIRONMENTAL INDICATORS

First the goal was reviewed and again agreed upon by the group:

"Clean, clear, odorless air"

CRITERIA

Then the criteria was reviewed and revised:

Data - must be available, of good quality and quantity

Relevance - must be directly relevant to the stated goal

A discussion pursued on political funding, whether this should enter into our criteria. What would we do about resources, communication problems, policy requirements, usefulness of the indicator, feasibility of the solutions, and whether the knowledge of a degradation could lead to action?

Communicability - specifically with the public

Cost and Resources - should we let this restrict our thinking at this stage of the exercise? The reality is that, depending upon the persuasion factor, the cost may or may not be a problem. If the right people were sold on the measure, then it could be made a reality even with high cost. This may not be a sufficient criteria for evaluating an indicator, but should it be listed as a thought?

Can it lead to an action? - or will it lead to no action?

Is it measurable? - can the indicator be measured in a causality situation, for instance, can the information be obtained? What about effects that are observable but not measurable? Could obtainability mean measurability? The group discussed the difference between data and measurable. Having data available means that it is measurable.

Is it important? - does "importance" fall under the "relevance" criteria? The group decided they were not the same and kept the criteria, *is it important*, and added '*who cares*.'

Final Criteria for the Air Quality Issues Group

Is the data available on the indicator of high quality and adequate quantity?

Does the indicator have direct relevance to the stated goal?

Is the indicator easily communicated to the public?

Can the indicator lead to action?

Is the indicator measurable?

Are there available resources to support costs?

Is the indicator important? Who cares?

ENVIRONMENTAL INDICATORS

The following two lists of air quality environmental indicators have been produced:

Tim Mulholland's list of environmental indicators which was provided to each of the conference attendees for comment.

The list of air quality environmental indicators produced by this group in yesterday's breakout session.

The group decided to review the list of indicators developed by Tim Mulholland first. The air quality section of this list is provided below with the results of the conference attendees voting process. A high score listed under the national or regional indicator column reflects an agreement that the environmental indicator would be an adequate measure of air quality. A negative number indicates that the item would be a poor air quality environmental indicator. It was agreed by the group that all negative numbers would be automatically deleted from consideration.

Each of the following indicators were reviewed. Under each indicator is a comment, which is preceded by an asterisk, summarizing the conversations which resulted.

INDICATORS			AIR QUALITY	
National	Regional	DATA?	Air Quality Indicators	
14	15	12	1	Number of people living in non-attainment areas by:
6	7	3		A. Income level; and,
7	8	3		B. Ethnic group
				*This will be changed to *Population Exposed to Non-attainment Areas*. Income and ethnic groups are not an indicator of air quality.
15	11	8	2	Average pH of precipitation.
				*Surface Water Issue
22	12	15	3	Number of non-attainment areas nationally.
				*Included as *Data on Ambient Trends*.
7	13	6	4	Mobile per capita source emissions.
				*Include with *Quantities of Emissions* under mobile sources, such as vehicle miles traveled.
10	14	2	5	Visibility.
				*Group compared this to criteria and accepted it as an indicator.
7	6	11	6	Top ten hazardous air pollutants from the Toxic Release Inventory (TRI)
				*Include with *Quantities of Emissions*.
8	13	8	7	Trends in measured pollutants from vehicles.
				*Include with *Quantities of Emissions*
8	13	-13	8	Number of days lost at work/school from illness cause by air.
				*This will be changed to *Human Health Effects Trends*, and include worker/school productivity, children's blood-levels, asthma cases, etc.
17	17	10	9	Trends in criteria air pollutants emissions.
				*Include with *Trends Data*.
12	13	-2	10	Number of homes/schools over the national radon level.
				*Should be an indoor air issue.
10	12	8	11	Number of major industrial facilities NOT meeting federal regulations.

				*Include with *Trends Data*.
19	20	1	12	Blood lead levels in children.
				*Include with *Health Effects*.
9	14	10	13	Vehicle miles travelled (VMT).
				*Include with *Quantities of Emissions*.
3	5	3	14	Emissions from pulp/paper/chemical plants.
				*Include with *Quantities of Emissions*.
1	8	4	15	Regional map of releases by chemical (bar graph).
				*Not an indicator, just a presentation method.
1	5	-2	16	Number of person-hours of exposure to NAAQS violations.
				*Include with *Trends Data*.
5	11	6	17	Pollution standard index.
				*Include as a subcategory under *Trends Data*.
14	14	9	18	Emissions by type.
				*Include with *Trends Data*
0	10	6	19	Percent of vehicles failing emissions testing.
				*This is an issue which requires analysis of public perception. Everyone must learn that it is all miles driven and not blame air quality problems on the 10% that do not pass emissions testing. This is not a direct measure of air quality.
7	13	-6	20	Crop damage.
				*Should be a wildlife indicator and is not related to any aspect of the goal.
-4	-1	-1	21	Amount of emissions trading.
				*Not considered.
-6	-4	-3	22	Amount of expenditures for controlling or buying offsets.
				*Not considered.
8	10	1	23	Asthma health statistics - number of individuals affected.
				*Included under *Health Effects*.
7	6	2	24	Acres of agricultural/forest land converted.
				*Should be a Wildlife/Biological indicator.
3	6	4	25	Emissions from newly permitted sources.
				*Included under *Quantities of Emissions*.
-3	-3	1	26	Average state ozone as percent of national emissions.
				*Not considered.

3	7	5	27	Pollution standard index (PSI) greater than 100 or anything greater than moderate levels.
				*Included under *Trends Data*.
2	3	-1	28	Biomonitoring of sensitive spp (lichens, moss, etc)
				Moss is one of the main indicators of air quality and points to historical trends because they are stable and slow growing. Therefore, add an *Ecological Health Effects* which will include biomonitoring of sensitive species
1	1	-1	29	Damage to natural vegetation
				*Include with *Ecological Health Effects*.
1	1	0	30	Emissions trends of persistent, toxic, bioaccumulative pollutants.
				*Include in *Quantities of Emissions*.
1	1	-1	31	Emissions/unit production by source.
				*Included under *Quantity of Emissions*.

After consideration of the above indicators, the list of indicators produced yesterday was reviewed to either be placed into the resultant list under an already existing category, or to be added as a new category.

The following is the resultant list of environmental indicators developed by the Air Quality Issues group:

Population Exposed to Non-attainment Air Quality
Ambient Air Quality Trends
Pollution Standard Index
Emissions Trends Data
    Mobile
    TRI Data
Visibility Impairment
Health Effects, Trends Data
    Ecological Health Effects

The group then reviewed the Miscellaneous Indicators on Tim Mulholland's list. These indicators were compared to the criteria and discussed as to their significance, relevance, and importance. The following is the list of Miscellaneous Indicators:

INDICATORS			MISCELLANEOUS	
National	Regional	DATA?	Miscellaneous Indicators	
8	12	-6	1	Public perception (related to indicators of the environment).
6	7	-3	2	Percent of unsafe levels of radon (total # of households in which radon exists).
17	18	13	3	Energy used and consumed (total per capita).
10	4	9	4	Global energy use relative to US energy use (by type and total).
6	7	1	5	Energy efficiency (loss through transmission). Efficiency /inefficiency of energy generation (output/input).
3	6	3	6	Amount of energy saved in dollars (demand-side management).
12	11	4	7	Recoverable/renewable energy as percent of total.
8	8	-1	8	Energy conserved.
7	9	3	9	Waste-to-energy conversion.
-4	1	1	10	Waste disposal costs per energy type.
7	7	7	11	Growth in energy production vs. population growth.
4	8	7	12	Mass transportation (data available by municipalities/state/etc.) Identify goals; assess outcomes/incentives.
5	7	5	13	Industrial energy use.
1	1	1	14	Population growth and density
1	1	0	15	Energy Efficiency - Energy use/GNP

The final list of Miscellaneous Environmental Indicators divided the individual indicators listed above into four groups. The only indicator not included with the final list of miscellaneous indicators that is listed above is the Radon Levels indicator which should be included with indoor air issues. The following is the final list of Miscellaneous Indicators:

Public Perception/Education
Measured by polls and surveys

Public Willingness to Pay
Willingness to pay monetarily and also in changes of habit

Energy Sources, Use, and Consumption
Waste of energy
Conservation
Renewable energy resources

Mass Transportation

- Land use issues
- Air quality issues
- Energy use issues

The consensus of the Air Quality Issues group was that the above indicators should not be considered miscellaneous, and that separate categories should be identified for these very relevant issues.

WATER ISSUES BREAKOUT SESSION

Doug Johnson was the facilitator for the Water Quality Issues Breakout Session.

In attendance in the Water Quality Issues Breakout Session were representatives from Colorado, Montana, South Dakota, Missouri, Iowa, Wisconsin, and Michigan. Also in attendance were representatives from the Eight Northern Indian Pueblo Council, Colorado School of Mines, and EPA Headquarters.

Kim Devonald will report the results of the Breakout session.

INTRODUCTION

The group reviewed the material developed on Monday in the Breakout Session, Define Criteria to Evaluate and Rate Environmental Indicators, and made changes as appropriate. This included adding some indicators and reorganizing criteria. The goals identified by the group on Monday remained the same. The group considered what would be appropriate regional indicators. The group also discussed the possible use of indices as environmental indicators.

The charge of the group was to review the indicators relating to water issues on the list presented by Tim Mulholland and to make recommendations on appropriate regional indicators.

INDICES

Group members seemed interested in the use of indices as environmental indicators. One member commented that it would be convenient to have a Water Quality Indices similar to the current Air Quality Indices. Other general comments about indices included the following:

> An index of ecological integrity may be do-able. To be meaningful, it would have to be regionally calibrated.
>
> Water Quality Indices would provide a great deal more information than a single parameter. The difficulty would be that it could not be successfully applied in all locations. Also, the use of this type of methodology is very controversial.
>
> Indices may be helpful in communicating the concept of ecosystem health to the public.

CRITERIA

DRAFT

The group refined the criteria developed on Monday by grouping it into four major categories. Those categories are as follows:

Scientific/Engineering/Measurability

Spatial/Temporal Sampling Design
Do-ability (resources available)
Quality of Data/Standard Measurement Methods/Reproducability

Does It Represent Important Aspects of the Ecosystem

Does it represent all components that should be there, single variable vs. multiple variable?
Is it sensitive to that ecosystem and calibrated to it?

Communicable

Make scientific information readily understandable to the general public.

Public Policy/Relevance

Indicators should be relevant to goals.
Reflect risk to ecosystem (including humans).
Measure sustainability.
Political do-ability.

The group discussed differences in approach to ecosystem indicators. Some individuals prefer a few aggregated measures while some do not.

LIST OF ENVIRONMENTAL INDICATORS

In preparing to identify appropriate regional environmental indicators, the group reviewed the list of indicators developed on Monday. Through the process, the group divided the surface water and ground water indicators into quality and quantity sub-groups. Further, the group identified some additional indicators for consideration.

Surface Water

The group determined that the following indicators from Monday's session should be considered indicators which deal with surface water "quality."

Production of Bass, Trout, etc.
Indicator Species of Various Kinds
Contaminant Levels in Fish
Transient Variables
(e.g., succession, global change)
Stream Habitat Quality/Riparian Condition/Wetlands
(cross reference to wildlife/biological group)

Through discussion, the group added the following indicators to assess surface water "quality."

Bodies of Water Meeting Standards - (lakes, rivers, wetlands, etc.) This would be based on enforceable criteria (chemical plus those biocriteria that exist).

Bodies of Water Supporting Beneficial Uses - based on biological information as well as chemical data if available. Includes BPJ.

Aquatic-dependent Wildlife Reproductive Success

Geomorphological Conditions - The group noted that this is do-able, but little data is currently available.

Index of Ecological Integrity - (ecoregion based)

Amphibian Population Trends

Index of Biotic Integrity - (ecoregion based - fish communities)

Toxics in Fish Tissue

The group identified the following two indicators to assess water quantity:

Amount of Water - Supply issues, instream flows (identified in Monday's session).

Amounts of Diversion - (identified in Tuesday's session).

Ground Water

The group proposed the following as detailed indicators for ground water quality:

Plant Community Health - in discharge/shallow groundwater zones

Drinking Water Standards Met - (e.g., number of user days, number of advisories per year)

Other Beneficial Uses Supported - including recharge to surface water that needs to support ecological health and industrial use

Number of Contaminated Sites - including leaking underground storage tanks (number identified and number mitigated), landfills, and mining waste

The group proposed the following indicators to address the quantity/supply issue:

Maintaining Fossilized Ground Water Sources - such as the Ogalalla Formation. This indicator is similar to the surface water indicator to maintain instream flows.

Energy Consumed Per Retrieval at Various Aquifers - This would be an indirect measure.

Overall Environmental Indicators

The group discussed three different ways to organize environmental indicators related to water issues. First, they discussed the organization started on Monday and carried into the breakout session on Tuesday. That is, looking at quantity and quality indicators under surface water and ground water. Second, the group discussed dividing the indicators into different levels. This breakout might be habitat level, chemical level, and biological level. The third option suggested was to identify the detailed indicators needed to support an overall indicator, for example, "To support beneficial use." The group decided to proceed with the third option and developed the following overall indicator.

Bodies of Water Supporting Beneficial Uses (rivers, streams, lakes, aquifers, wetlands) - This composite environmental indicator would include the following detailed information:

Biological information which should be tied to ecoregions

Chemical information compared to standards

Stream habit and riparian conditions

Fish consumption and health advisories

LAND USE/WASTE ISSUES BREAKOUT SESSION

DRAFT

Howard Roitman was the facilitator for the Land Use/Waste Issues Breakout Session.

In attendance in the Land Use/Waste Issues Breakout Session were representatives from Nebraska, Colorado, South Dakota, Missouri, Michigan, and Wisconsin. Also in attendance was a local government representative, a member of the Florida Center for Public Management, and a Corps of Engineers representative.

Dave Bedan will report the results of the Breakout session.

INTRODUCTION

The 10-person team established an indicator selection process for national land use and waste issues. After two breakout sessions, one on Monday, January 10, and one on Tuesday, January 11, the team concluded with a particular order in which the process must follow and selected a final set of environmental indicators

Consistent reference to goals, issues, and criteria was vital during the indicator selection process to ensure proper focus during group discussion. Team building methods were used in order to obtain general consensus and positive discussion among team members. Consensus prioritizing was essential in order to rank the established list of criteria and indicators.

The following outline is a record of this breakout session in which increased team consensus was recognized and the criteria and associated indicators were redefined and consolidated.

GOALS OF ENVIRONMENTAL INDICATORS

The following goals were designed to be important, specific, measurable, and achievable.

Waste Minimization
Integration of Land Use
Best Land Use
Minimize Land Conversion from Natural
Revise Land Conversion Standards
Environmental Clean-up
Protect/Improve Ground Water

DRAFT

CRITERIA

The following criteria was developed to be used to evaluate the environmental indicators:

Impact to Health
- Direct
- Indirect
- Administrative

Data
- Measurable, Applicable
- Spatial, Temporal
- Quality, Availability, Consistency

Public
- Understandable
- Perception, Values

LIST OF ENVIRONMENTAL INDICATORS

Listed below are the final environmental indicators selected for the Land Use/Waste Issues Breakout Session.

Solid Waste

Environmental indicators for the solid waste portion of this issue include the following:

Type and Source of Generation
- Total
- Per Capita

Type of Waste Management

Roadside Dumps
- Percent Cleaned-up
- Number Cleaned-up

Facilities in Compliance
- Subtitle D and other Regulations

Public Perception of Management Programs

General Hazardous Waste

The following is a list of environmental indicators which could be used for the general hazardous waste category:

DRAFT

Type and Source of Generation
Total
Per Capita

Type of Waste Management

Facilities in Compliance

Facilities Location/Demographics

Facilities Under Clean-up

Releases/Accidents per Mile

Hazardous Mining Waste

The following is a list of environmental indicators which could be used for the hazardous mining waste category:

River Miles Impacted

Ground Water Impacted

Percent Total Acres Disturbed/Reclaimed

Population Impacted by Non-reclaimed Sites

Land Use

The following is a list of environmental indicators which could be used for the Land Use portion of the Land Use/Waste Issues Breakout Session:

Changes in Land Use (urban sprawl)

Changes in Land Use by Cover
Forest
Wetland
Grassland
Rangeland
Agriculture

Population Shifts

Acres of Land in Protective Status

Soil Loss
Natural
Anthropogenic

Households on Septic Systems

Density of Households

Number of Households

DRAFT

BIOLOGICAL, WILDLIFE, AND HUMAN HEALTH ISSUES BREAKOUT SESSION

Dick Sumpter was the facilitator for the Biological, Wildlife, and Human Health Issues Breakout Session.

The Biological, Wildlife, and Human Health Issues Breakout Session group was represented by participants from Alaska, Colorado, Iowa, Indiana, Michigan, and Wisconsin, as well as the Eight Northern Indian Pueblo Council, The U.S. Geological Survey, and The Western Center for Comparative Risk. A wide variety of backgrounds were evident, with biologists being well-represented.

Stephen Porter will report the results of the breakout session.

INTRODUCTION

The group chose to discuss the ecosystem approach and to try to pare down the previous day's list of criteria to that which would be considered communicable and of interest to the public. Some areas of regional interest were discussed, as well as topics of specific biological and scientific importance.

GOALS OF ENVIRONMENTAL INDICATORS

The goal of the Biological, Wildlife, and Human Health Breakout Session environmental indicators list was the following:

> *The long-term health and viability of living systems*

CRITERIA

The following is the final list of criteria with which the group evaluated the environmental indicators:

> *Is the indicator a meaningful measure of health and viability?*
>
> *Is the indicator measurable? Is it unambiguous, low in error, sensitive and specific to the goal?*

Before listing indicators, the group began a short review to identify threats to living systems by three categories:

> Physical: Habitat fragmentation and habitat loss (destruction, alteration, and simplification)
>
> Chemical: Contaminants

Biological: Introduction of alien species and communicable disease

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LIST OF ENVIRONMENTAL INDICATORS

By using the list of indicators provided by Tim Mulholland, the group voted on those that each member thought followed the chosen criteria. The resulting list was then shortened to delete entries with common linkages. Due to the complexity of choosing indicators from this category, the list was not prioritized.

Flora/Fauna

The Number of Keystone and/or Sensitive Species and Recreational Species

The Number of Species Becoming Threatened/Endangered - (emphasis was placed on those species that are currently listed)

Diversity of Habitat - the percentage of habitat loss, fragmentation, and alteration

Species and Genetic Diversity

Incidence of Exotic Species

Land Set Aside for Preservation and Conservation

Wildlife Health - deformities, cancers, reproductive success, contaminant concentration

The Number and Extent of Natural Community Types

Human Health

Cancer Incidence

Respiratory Disease

Water-borne Disease

Birth Defects/Infant Mortality

Measured Contaminant Concentration in Humans - (breast milk, blood-lead levels, etc.) This also relates to real or potential exposure, for example, the number of people exposed to MCL violations

NAAQS Data - Also, the number of hospital admittances during exceedances in air quality control standards, which is also related to real, or potential exposure

Occupational Health Data - it was not discussed what those data were to be

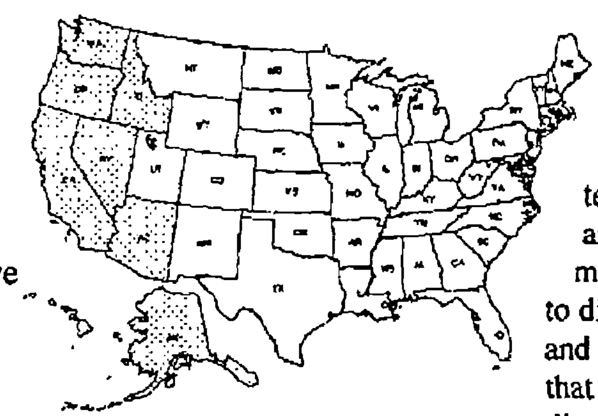
Food Safety/Pesticide Residues

SUMMARY: 1994 WESTERN REGIONAL ENVIRONMENTAL INDICATORS CONFERENCE

The Western States Environmental Indicators Conference

There is no question that the formulation of a National Indicators Program has the potential to characterize our environmental progress, engage the public and change the future direction of our planning. There is also no question that a National Indicators Program will require significant ongoing discussion among all the States, careful scientific analysis, and considerable political will all exercised over a long period.

Eight western States including Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon and Washington, came together on January 6 and January 7 in Sacramento, California to discuss their common interest in this subject.



These States represent almost 800,000 square miles of land and the interests of over forty-five million people. It is hard to imagine a more heterogenous group of geographic entities. The highest and lowest points in the United States are located here. The Northern-most and Southern most points in the country are in this region. The most densely populated and the least densely populated areas are here. The coldest and the hottest spots in the Nation are here. Several hundred floristic provinces give witness to the incredible biodiversity of this area which is home to an ever increasing mix of peoples of different races and ethnic origins.

From the first day of planning this meeting it was clear that the Western States group faced a monumental task. How could two people from each State come together to construct a meaningful two-day dialog that addressed the most important issues associated with finding common measures of the condition of this diverse region?

Over a period of three months, representatives from these States met six times to explore the direction this conference was to take. What emerged was a program that spanned topics ranging from goal setting and public involvement to scientific accuracy, management effectiveness and environmental justice.

Eventually seventy people joined the dialog in Sacramento. Their time was split between hearing distinguished speakers address technical, management and social concerns and meeting in small groups to discuss their own visions and concerns. The results that follow are taken directly from the summaries of these discussion sessions. They do not represent a consensus but they do suggest the issues which rose to the top in facilitated meetings.

The Vision

The dominanant vision of the role of a national indicators program as seen by the majority of participants at the conference can be summed up as follows.

To promote long term planning for sustaining a healthy environment and a high quality of life that cuts across political, geographical, racial and ethnic boundaries by:

Involving the public in the decision making process

Improving environmental education, information sharing and communications

Establishing environmental protection priorities using a variety of decision making tools

Developing standardized and comprehensive methods for measuring success and failure based on the best available science and social criteria

Challenging the status quo of environmental management and regulation.

Standards for Indicators

Communication
Easy to Communicate/Understand
Targeted to the Audience
Free of Politics
Worthy of Public Trust
Supportive of Community Involvement
Supportive of Community Consensus

Management
Relates to Environmental Goals
Directs Action
Can be Done with Limited Resources
Addresses Sustainability
Provides for Easy Review/Verification
Commands management commitment
Can be "Institutionalized" for Continuity

Science
Employs Credible Data Collection Methods
Generates Objective Data
Suggests Causality of Condition
Can be Integrated with Other Systems
Is Useful to a Broad Audience

Indicators

The only consensus clearly reached at this meeting was that group was not ready to recommend a palette of indicators that would suit the needs of the Western States. While there was enthusiasm for the concept, representatives agreed that far more work is needed in the areas of goal development, consensus building and scientific consideration before such an undertaking would be realistic. Nevertheless, the group did offer the following indicators. The group's caveat was that these only be used for stimulating the further discussions which must follow:

Air
Number of Unhealthy Air/Person/Days
Quantity of Energy Used/Person
Quantity of Gasoline Used/Person
Exeedence of Air Quality Standards

Water
Water Meets Drinking Water Standards
Fresh Water Consumption/Person
USGS Water Consumption Surveys
Exeedence of Water Quality Standards

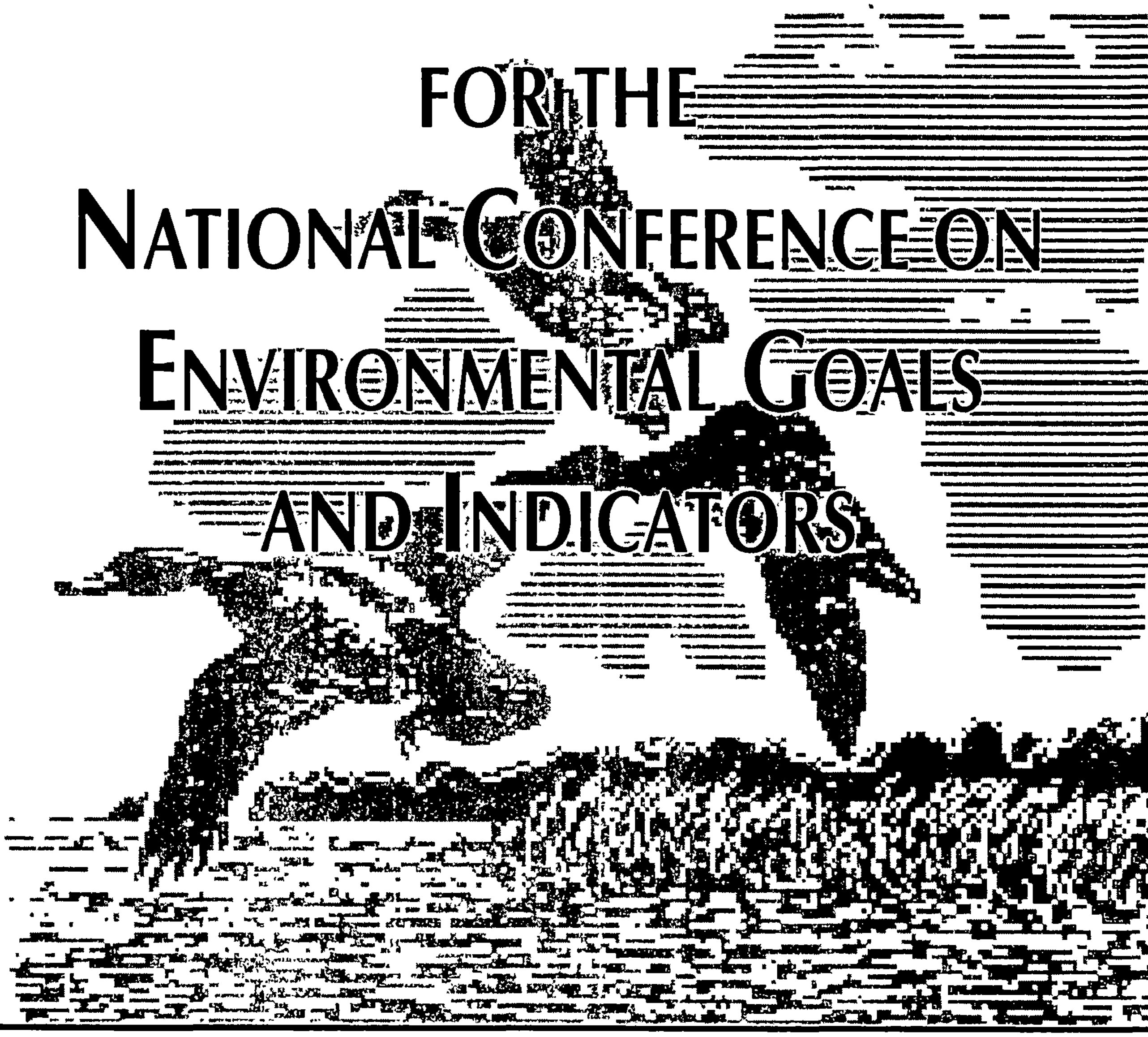
Biodiversity
Rate of Habitat Alteration
Land Use/Land Cover
Endangered Species Listings

Waste
Quantity of Waste Produced/Person
Waste Disposition
Toxic Release Inventory

Economic
Cost/Benefit of Regulations
Measures of Amenity Values
Quality of Life Indicators
Traditional Economic Vitality Indicators

Document produced by: Mike McCoy, Program Director
University of California, Davis, Extension
Land Use and Environmental Planning Unit
(916) 757-8890
mcmccoy@ucdavis.edu

Summary: Homework Assignment for the National Conference on Environmental Goals and Indicators



Summary of the Homework Assignment

In order to save valuable conference time and to give conference attendees a head start in thinking about environmental indicators, each of the supported state participants was asked to complete a homework assignment. The purpose of the assignment was to have each respondent review the work that had been accomplished at the New Jersey and Florida regional conferences and to identify in each of eight substantive environmental areas their top three candidate indicators as well as to list any other indicators concerning that area that they believed had merit. The areas are:

Water	Air Quality	Waste	Natural Resources
• Water Quality	• Outdoor Air	• Solid Waste	• Land
• Water Quantity	• Indoor Air	• Hazardous Waste	• Biota

By the cutoff date responses had been received from 30 individuals representing more than half of the states. For the purposes of this summary a brief analysis was performed on the top three choices of each of the respondents. What follows is a listing by area of the types of indicators that emerged in each group. The list reflects an ordered account of indicator types based on the frequency that each indicator was mentioned as a top three choice across all 30 responses. The number in parentheses following each indicator title represents the number of times respondents identified that indicator as a top three choice. With the single exception of indoor air, indicators receiving a single vote were not included.

This summary represents only a partial analysis of this information and is intended only to provide an overview and executive review of the homework. As each of the groups goes through its process of identifying the final candidate core indicators list, additional data from the homework assignment will be available, including information concerning the indicator selection criteria scoring.

Participants should keep in mind that the lists found in the following pages do not, in most cases, contain technically correct indicators, but instead identify a type of indicator that respondents think they would like to see developed or represent a source of data from which a technically correct indicator can be developed. A part of the activities of the workgroups will involve moving these classifications of indicator types closer to specific, technically correct indicators.

Water Quality

The water quality issue produced the greatest diversity of candidate indicators (13) and the lowest level of unanimity (the top choices received support on only a third of the responses). Indicator classes include:

- Designated Use Attainment (10)
- Maximum Contaminant Levels (MCL) violations for drinking water (10)

- Contaminated groundwater sites (10)

- Exceedances of surface water quality standards (8)
- Benthic and fish abundance (8)

- Exceedances of ground water quality standards (6)
- Fish advisories (6)
- Biological diversity (5)

- River and streams meeting surface water quality standards (4)
- Shellfish closings (4)
- Populations served by systems with MCL violations (4)

- Water Quality Index (3)
- Drinking water advisories (2)

Water Quantity

- Aquifer declines (13)
- Withdrawal by use (USGS data) (11)
- Water demand/supply ratio or index (11)

- Water restriction days (8)
- Flows and levels (8)

- Precipitation (6)

- Use of reclaimed water (2)
- Inter basin transfers of water (2)

Indoor Air

Indoor air is an area where the lack of data will, at least, initially restrict the development of the range of indicators required to measure progress in this area. Neither the New Jersey nor Florida conferences produced much in the way of candidate indicators and the results of the homework demonstrated a similar scarcity Candidate indicators identified include:

- Number of sites above the federal radon level (12)

- Incidence of respiratory disease (4)

- Asbestos (2)
- Complaints (2)

- Incidence of "sick building syndrome" (1)

Outdoor Air

The requirements of the federal Clean Air Act have caused a variety of good quality data sets to be created dealing with this issue and this is reflected in the responses. Indicator classes identified include:

- Ambient air quality (13)
- Air quality standards exceedances (12)
- Population affected by air quality violations (12)

- Criteria air pollutant measures (7)
- Incidence of air-related human health and disease (6)
- Visibility (6)
- Pollution Standards Index (6)

- Emissions (5)
- TRI releases (4)

- Vehicle miles traveled (2)

Solid Waste

Solid waste is the most compact of all of the issues, containing the highest degree of agreement on the candidate core indicator types. They include:

- Solid waste disposition (recycle, incineration, landfill) (25)
- Solid waste generated (total and per capita) (20)

- Landfills associated with water pollution (10)

- Regulatory status of landfills (6)

- Landfill capacity (4)

Hazardous Waste

Like the solid waste issue, candidate indicators for hazardous waste tend to mirror data available from several federal programs. They include:

- Hazardous waste generation (21)

- Sites contaminated by hazardous waste (14)

- Toxic releases (TRI data) (11)

- Hazardous waste managed by type (7)
- Hazardous waste recycled (6)

- Hazardous waste disposition by type (4)

- Number of hazardous waste generators (2)

Land

Land, as an element of natural resources, produced a very compact group that had a high degree of agreement among the respondents. Land candidate indicators include:

- Land use/cover (amount and rate of change) (21)

- Wildlife habitat (amount and change) (13)
- Wetlands (amount and change) (12)
- Demography (population) (11)

- Amount of protected lands (6)

Biota

The number of biota candidates were similarly few in number and the counts were evenly spread. Candidate indicator types included:

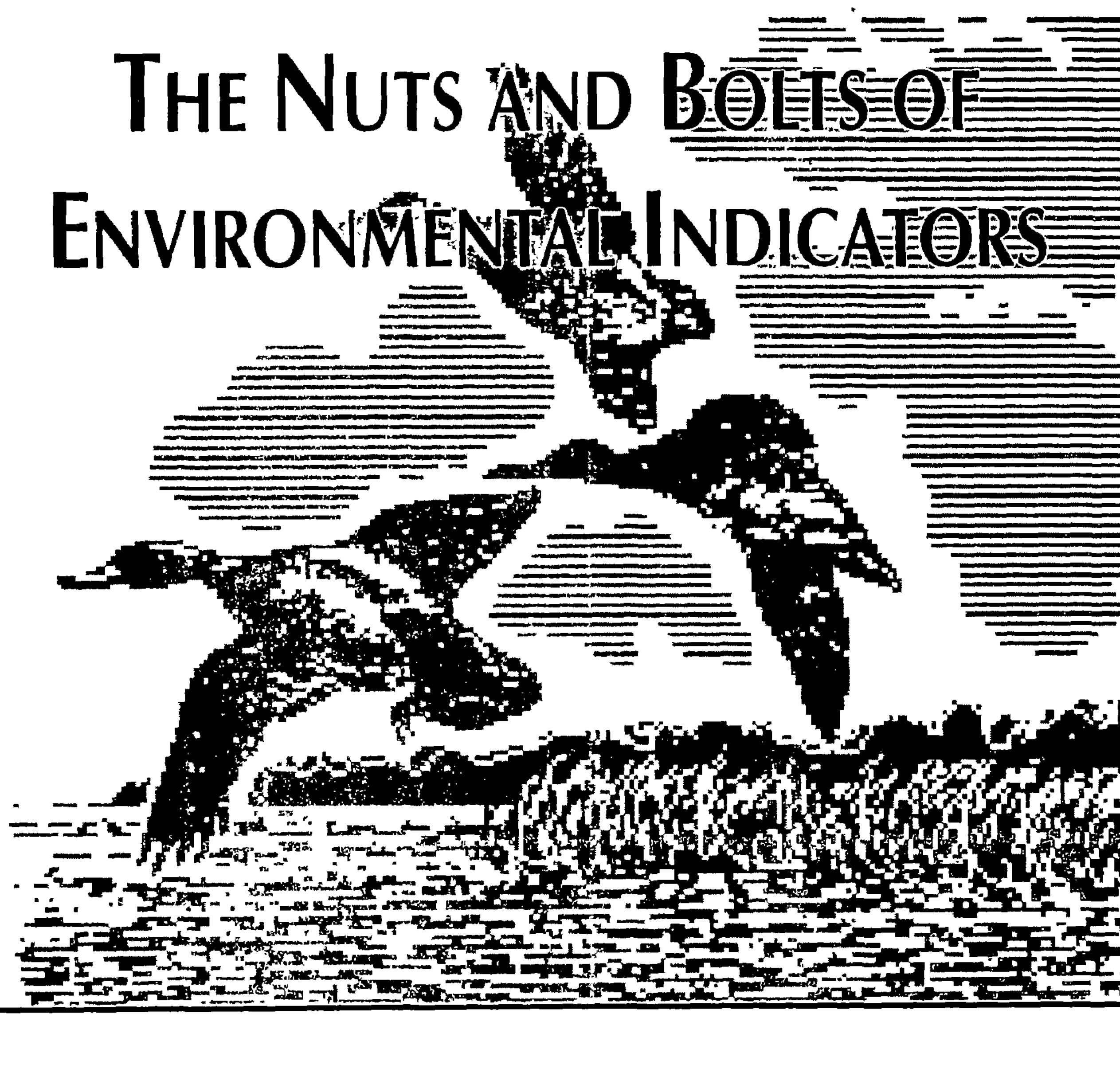
Habitat (amount and change) (18)

Biodiversity (14)
Endangered, threatened and species of special concern (12)
Populations of key species (12)

Bioaccumulation (5)

3

THE NUTS AND BOLTS OF ENVIRONMENTAL INDICATORS



The Nuts and Bolts of Environmental Indicators

Definitions

Parameter A property that is measured or observed.

Indicator A parameter, or a value derived from parameters, which points to/provides information about/describes the state of a phenomenon/environment/area with a significance extending beyond that directly associated with a parameter value.

Index A set of aggregated or weighted parameters or indicators.

Source: Group on Environmental Performance, OECD Core Set of Indicators for Environmental Performance Reveiws, Synthesis Report By the Group on the State of the Environment, October 15, 1993, pg.6.

What Makes A Good Indicator?

Selection Criteria

1) **National Applicability:** The indicator deals with an issue that is national in scope and has equal application among all 50 states. The environmental issue reflected by the indicator generally has the same meaning and consequences for all states.

2) **Data Consistency:** The collection of the data is consistent across all states. Collection methodologies, frequency of collection and the scope of collection are sufficiently consistent among states to insure that the indicator means the same thing in each state.

3) **Data Quality:** The data supporting the indicators are adequately supported by sound collection methodologies, data management systems and quality assurance procedures to insure that the indicator is accurately represented. The data should be clearly defined, verifiable, scientifically acceptable and easy to reproduce.

4) **Importance:** The indicator must measure some aspect of environmental quality that reflects an issue of major national importance to states and to EPA in demonstrating the current and future condition of the environment. Ideally the indicator should be related to existing, important policy objectives.

5) **Results:** The indicator should measure a direct environmental result (an impact on human health or ecological conditions). Indicators expressing changes in ambient conditions or changes in measures reflecting discharges or releases are acceptable, but not preferred. Process measures (permits, compliance and enforcement activities, etc.,) are not acceptable.

6) **Understandibility**: The indicator should be simple and clear, and sufficiently nontechnical to be comprehensible to the general public with brief explanation. The indicator should lend itself to effective and appealing display and presentation.

7) **Availability:** The indicator should currently exist and should reflect a reasonable cost/benefit ratio to use.

8) **Trends:** The data for the indicator should have been collected over a sufficient period of time to allow some analysis of trends. The indicator should show reliability over time, bringing to light a representative trend, preferably annual.

9) **Causality:** The indicator should be responsive to a cause and effect relationship. The indicator should reflect the environmental effect of some other activity or identify some activity that causes a known environmental effect.

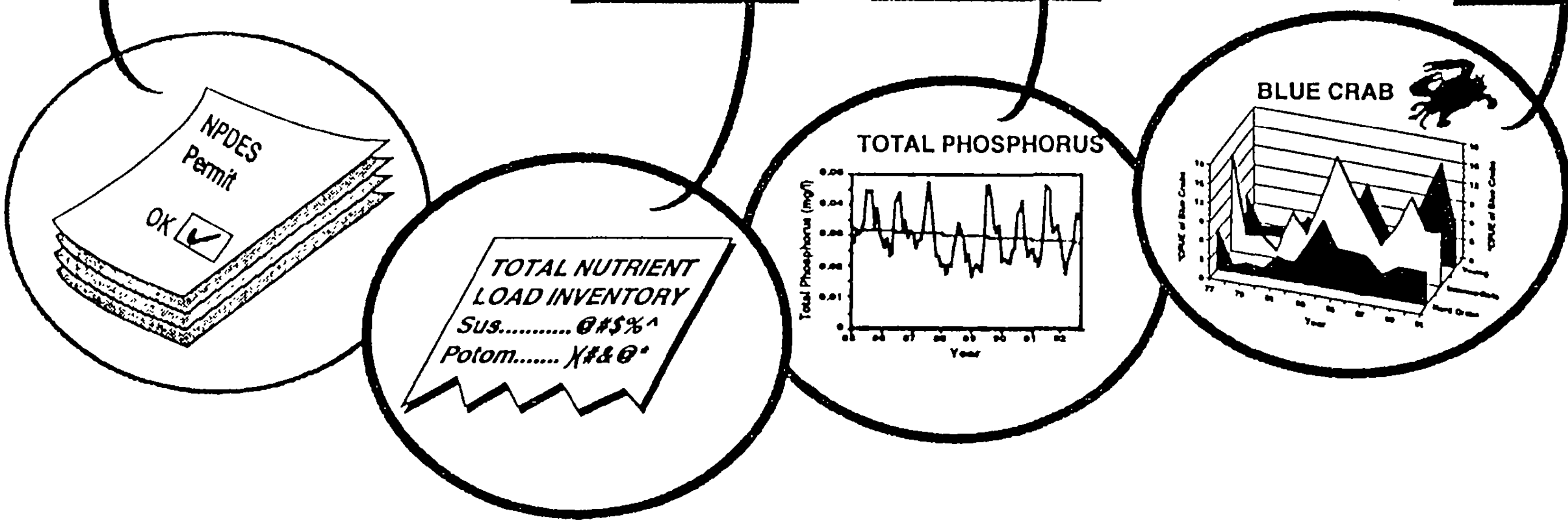
10) **Aggregation:** The indicator should aggregate information to a level appropriate for making policy decisions. Highly specific and specialized parameters, useful to technical staff, will not likely be of much use to policy staff or management.

CHESAPEAKE BAY PROGRAM • ENVIRONMENTAL INDICATORS

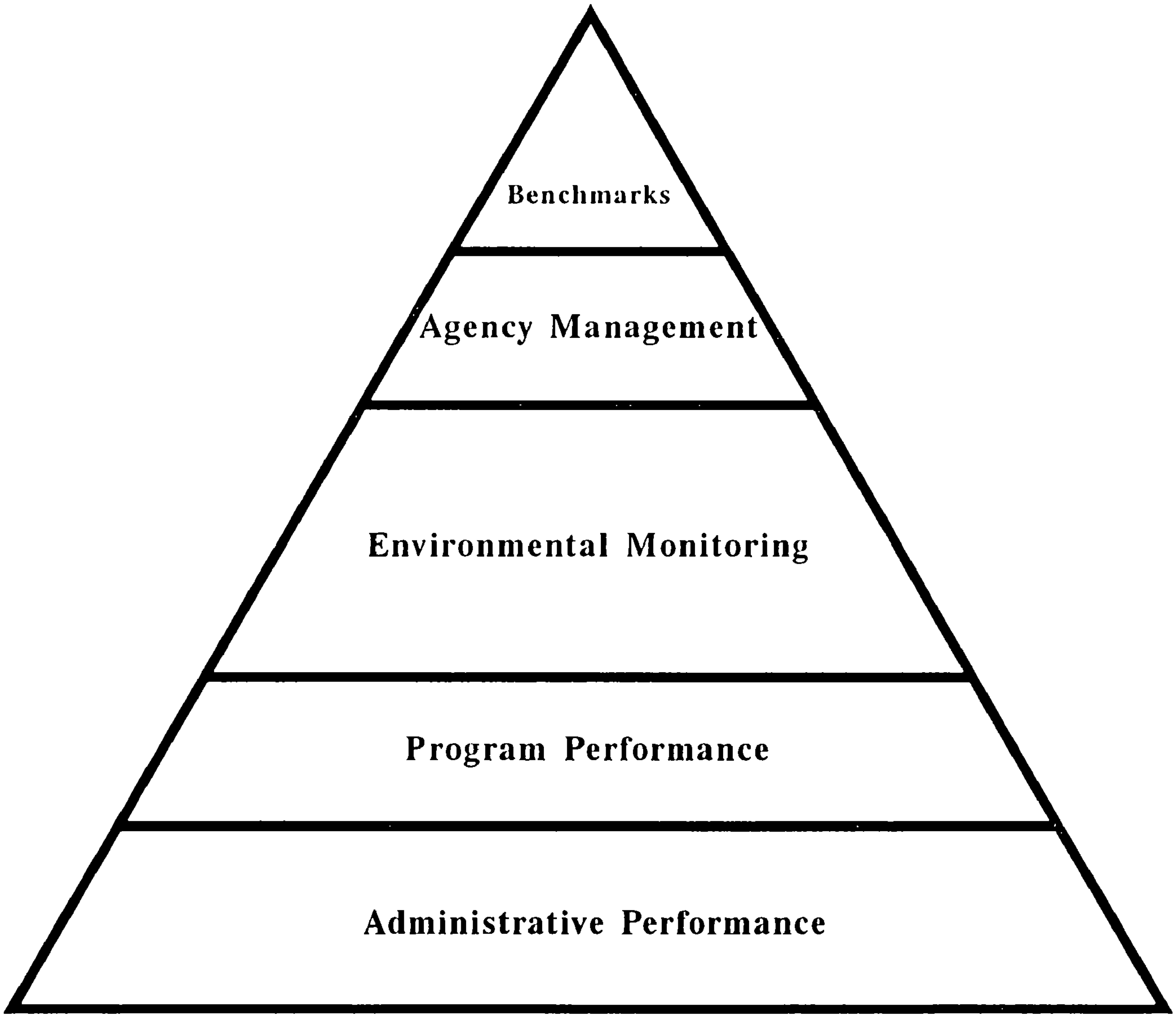
Hierarchy of Indicators

This is how we measure environmental change

Administrative		Environmental			
LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Actions by EPA/State Regulatory Agencies	Responses of the Regulated Community	Changes in Discharge/ Emission Quantities	Changes in Ambient Conditions	Changes in Uptake and/or Assimilation	Changes in Health, Ecology, or Other Effects



Levels of Indicator Usage



Management Related Uses of Environmental Indicators

Agency Evaluation

Strategic Planning (and Budgeting)

- Setting Goals and Objectives
- Source Data for the Strategic Analysis
- Basis for Measuring and Communicating Progress (Monitoring the Results)
- Fundamental Budget Decisions

Program Planning (and Budgeting)

Public Information and Public Relations

Environmental Education

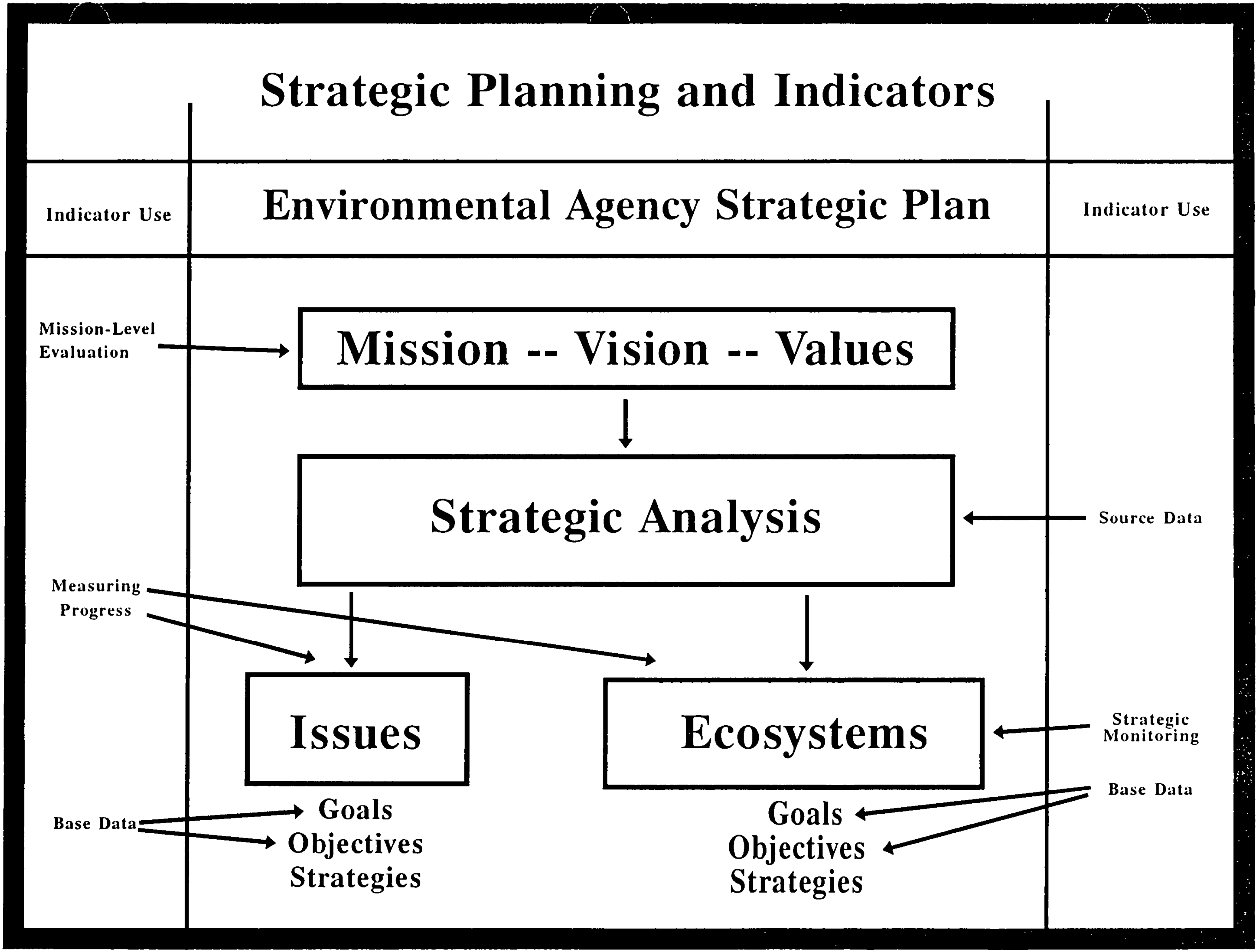

Strategic Planning and Indicators
Indicator Use
Environmental Agency Strategic Plan
Indicator Use
Mission-Level Evaluation
Mission -- Vision -- Values
Strategic Analysis
Source Data
Measuring Progress
Issues
Ecosystems
Strategic Monitoring
Base Data
Goals
Objectives
Strategies
Base Data
Goals
Objectives
Strategies

Figure 5 Summary of Short-Term Indicators[a] by Environmental Issue[b]

Issues	PRESSURE Indicators of environmental pressures	STATE Indicators of environmental conditions	RESPONSE Indicators of societal responses
1. Climate change	Emissions of CO_2	Atmospheric concentrations of greenhouse gases Global mean temperature	Energy intensity
2. Stratospheric ozone depletion	Apparent consumption of CFCs	Atmospheric concentration of CFCs	
3. Eutrophication	Apparent consumption of fertilizers, measured in N,P	BOD, DO, N and P in selected rivers	% of population connected to waste water treatment plants
4. Acidification	Emissions of SOx and NOx	Concentrations in acid precipitations (pH, SO_4, NO_3)	Expenditure for air pollution abatement
5. Toxic contamination	Generation of hazardous waste	Concentration of lead, cadmium, chromium, copper in selected rivers	Market share of unleaded petrol
6. Urban environmental quality		Concentrations of SO_2, NO_2, particulates in selected cities	
7&8 Biological diversity and landscape	Land use changes	Threatened or extinct species as % of known species	Protected areas as % of total area
9. Waste	Generation of municipal, industrial, nuclear, hazardous waste	not applicable	Expenditure on waste collection and treatment Waste recycling rates (paper and glass)
10. Water resources	Intensity of use of water resources		
11. Forest resources		Area, volume and distribution of forests	
12. Fish resources	Fish catches		
13. Soil degradation (desertification and erosion)	Land use changes		
14 General indicators, not attributable to specific issues	Population growth and density GDP growth Industrial and agric. production Energy supply and structure Road traffic and vehicle stock	not applicable	Pollution abatement and control expenditure Public opinion on the environment

a) Only indicators which are available in the short term at international level are shown in this table. See Chapter 3 for other indicators. This table identifies key elements of indicators at this point; no normalisation with respect to GDP, population, etc. is suggested. See Chapter 3 on use of indicators for a discussion.

b) For a brief discussion of each individual issue, see Chapter 3.

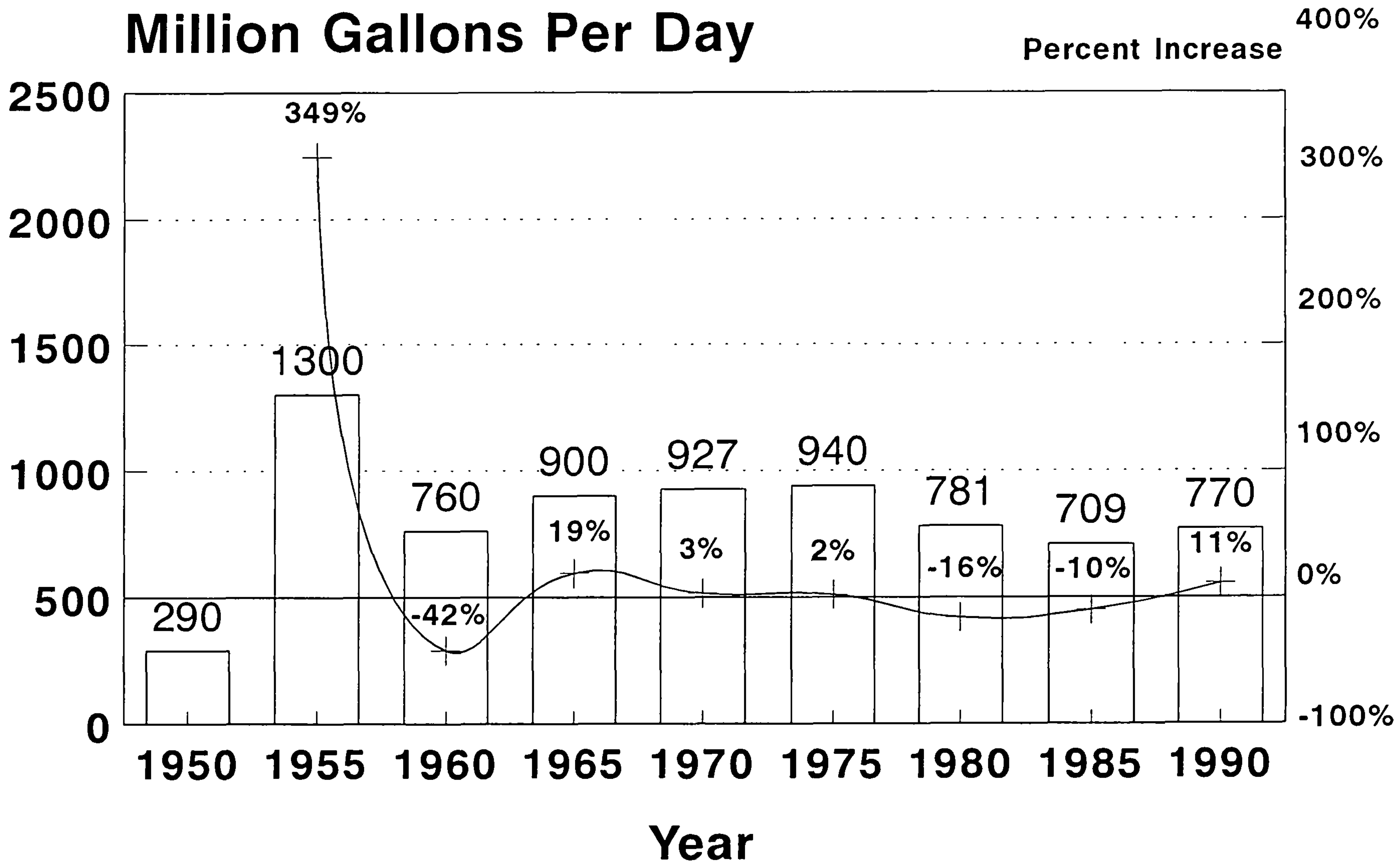
TOWARD A TAXONOMY OF ENVIRONMENTAL INDICATORS
50 NATIONAL INDICATORS

Environmental Categories	Sub Headings	Issue/Area	Specific Indicator Examples/Clusters	Regional, Coastal, Great Lakes Additions
Water (8)	Quality (5)	Groundwater, rivers, lakes, marine nonpoint source	Stream miles fishable/swimmable, Pand Nin lakes, etc.	
	Quantity (3)	Use, supply, flows	Total, sector, Per capita	
Air Quality (8)	Indoor (3)	Source-related	Radon, lead paint, woodstoves	
	Atmosphere (5)	Greenhouse gases, acid precip	Criteria air pollutants SO_2, NO_x, CO_2, Ozone	
Natural Resources (8)	Land (3)	Land use/land cover, wetlands conservation lands, species	Acreage, change over time	
	Biota (5)	Game, non-game, rare & endangered	Bald eagles, waterfowl, pine martens etc	
		Habitat	Nesting areas, foraging areas etc.	
Environmentally-Related Human Health (8)	Direct Exposure (4)	Drinking water, recreation, food	MCLs, swimming bans, shellfish closures	
	Ambient Emissions/ Discharges (4)	Radiation, toxics, pesticides	Dioxin, VOCs, cancer incidence	
Waste (6)	Hazardous (2)	Generation, storage/disposal, source reduction	By sector and/or geography over time	
	Solid (3)	Generation, disposal, facilities, recycling	By sector and/or geography over time	
Energy (6)	Resource/reserves(2)	Production, consumption	Electricity from fuel source	
	Use (3)	Economic sector, Per capita, mobile/stationary	Measures of efficiency	
Sustainability (6)	Economics (3)	Renewables - fisheries, forestry, agriculture Non-renewables - mining/metals	Production measures, inputs measures, species compposition, NRA	
	Ecosystems/Biodiversity (3)	Change in Natural Systems	Total species, genetic diversity viability	

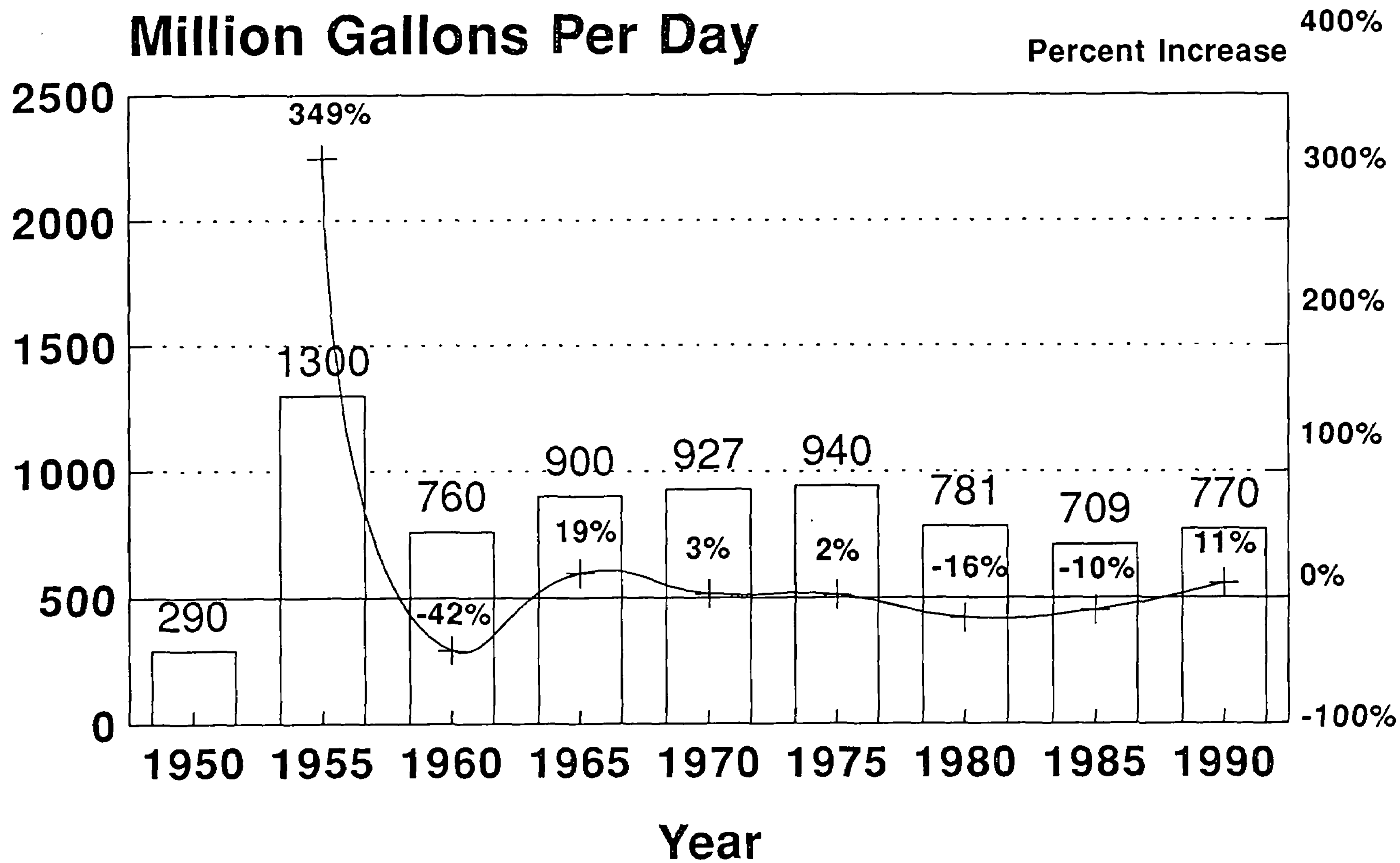
Water Withdrawal By Use

	Public	Agricultural	Comm.-Ind.	Domestic	Thermoelectric
1950	170	365	290	50	2051
1955	319	510	1300	38	510
1960	530	683	760	110	1700
1965	710	1750	900	150	1934
1970	884	2129	927	169	1690
1975	1146	2931	940	203	1696
1980	1361	3057	781	251	1855
1985	1677	2979	709	259	652
1990	1925	3895	770	299	732

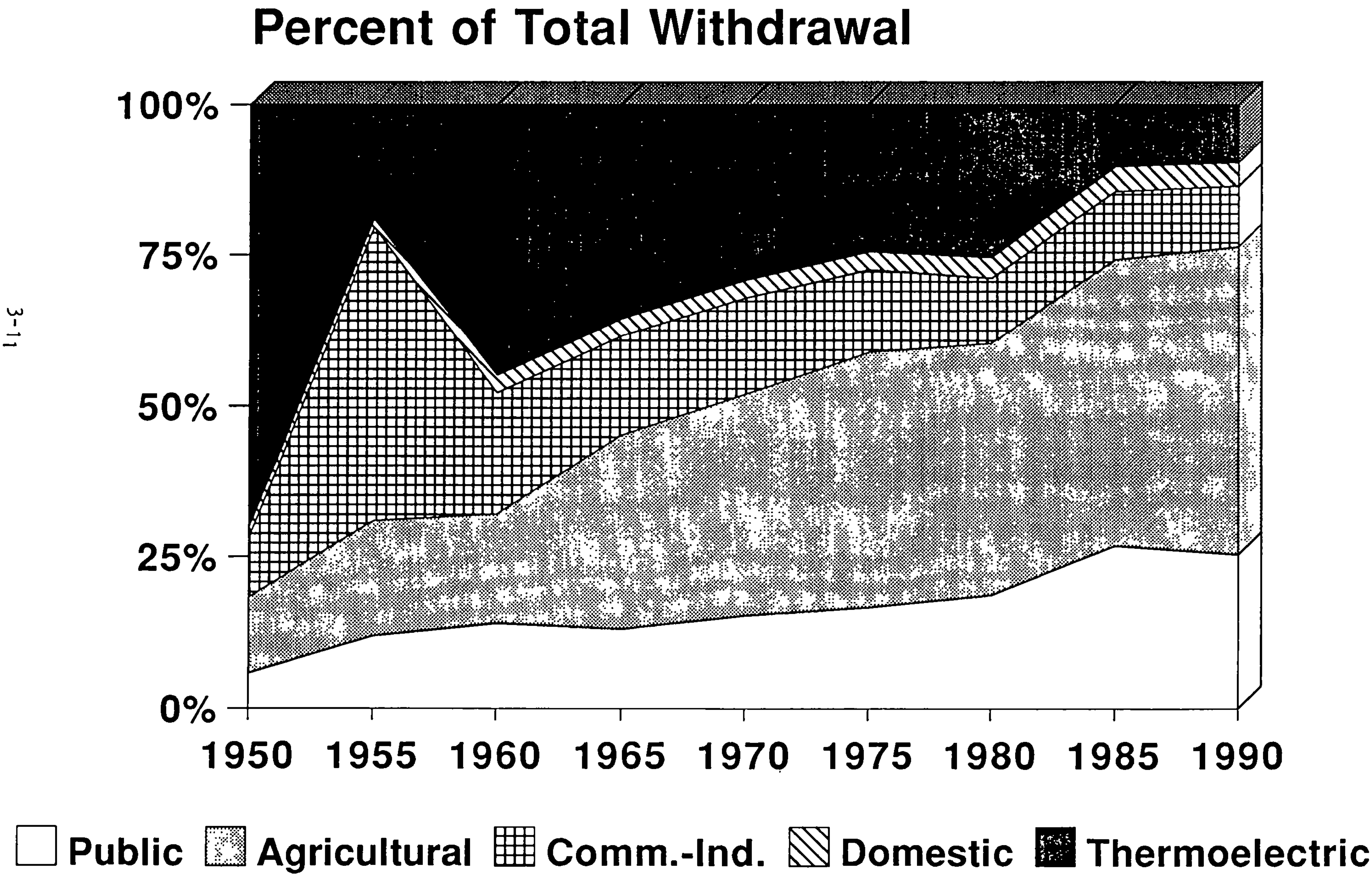
Commercial-industrial Self-supplied Water Withdrawal



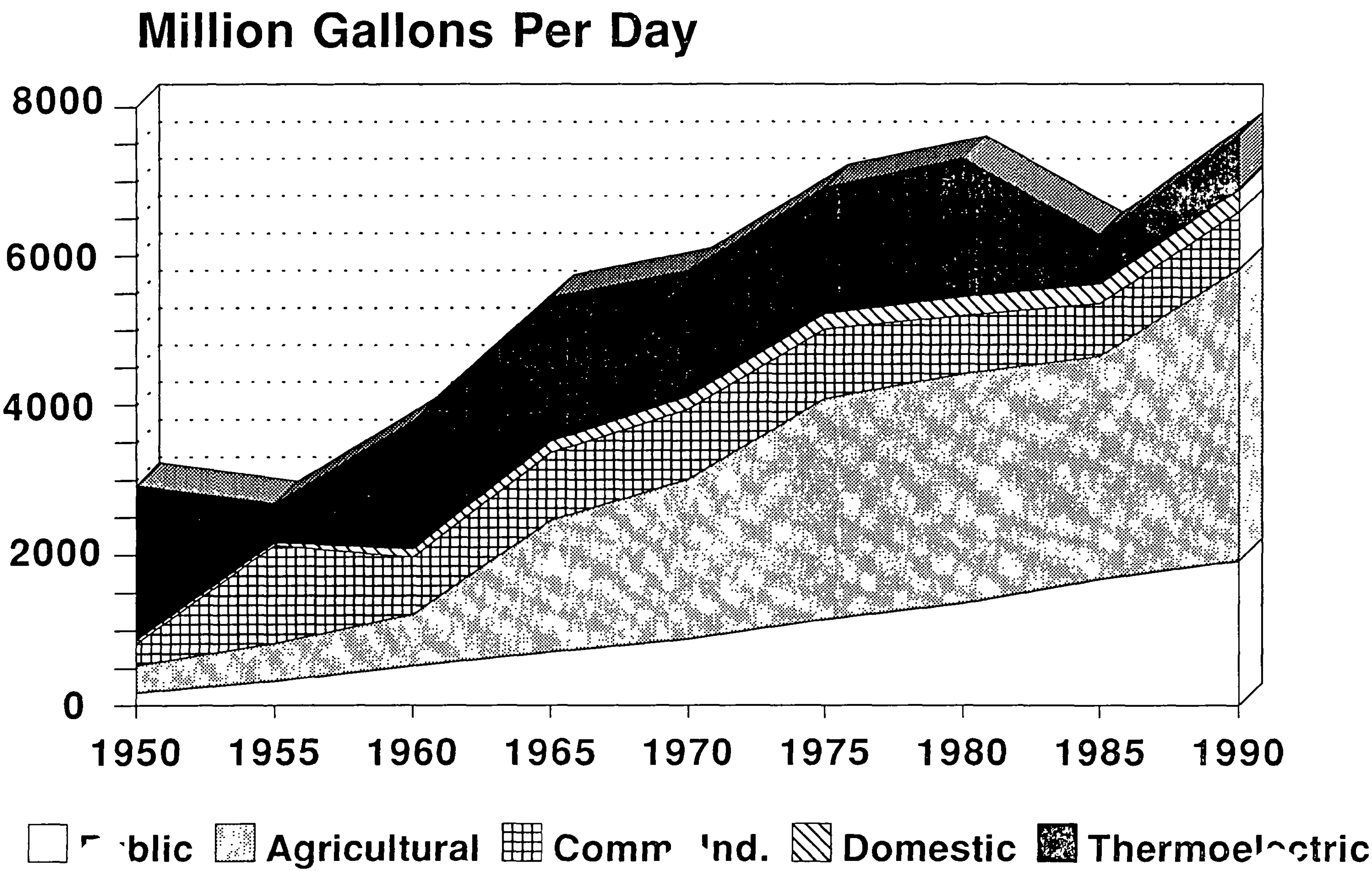
Commercial-industrial Self-supplied Water Withdrawal

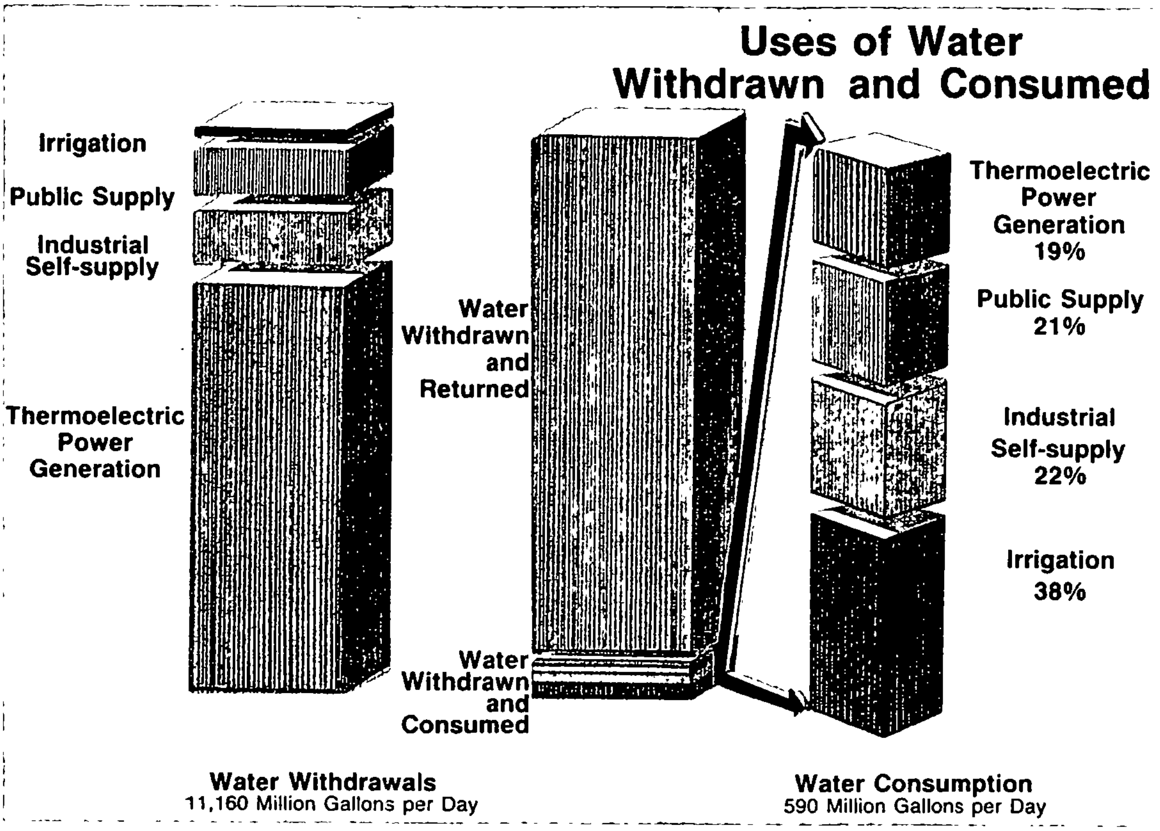


% Freshwater Withdrawal By Use

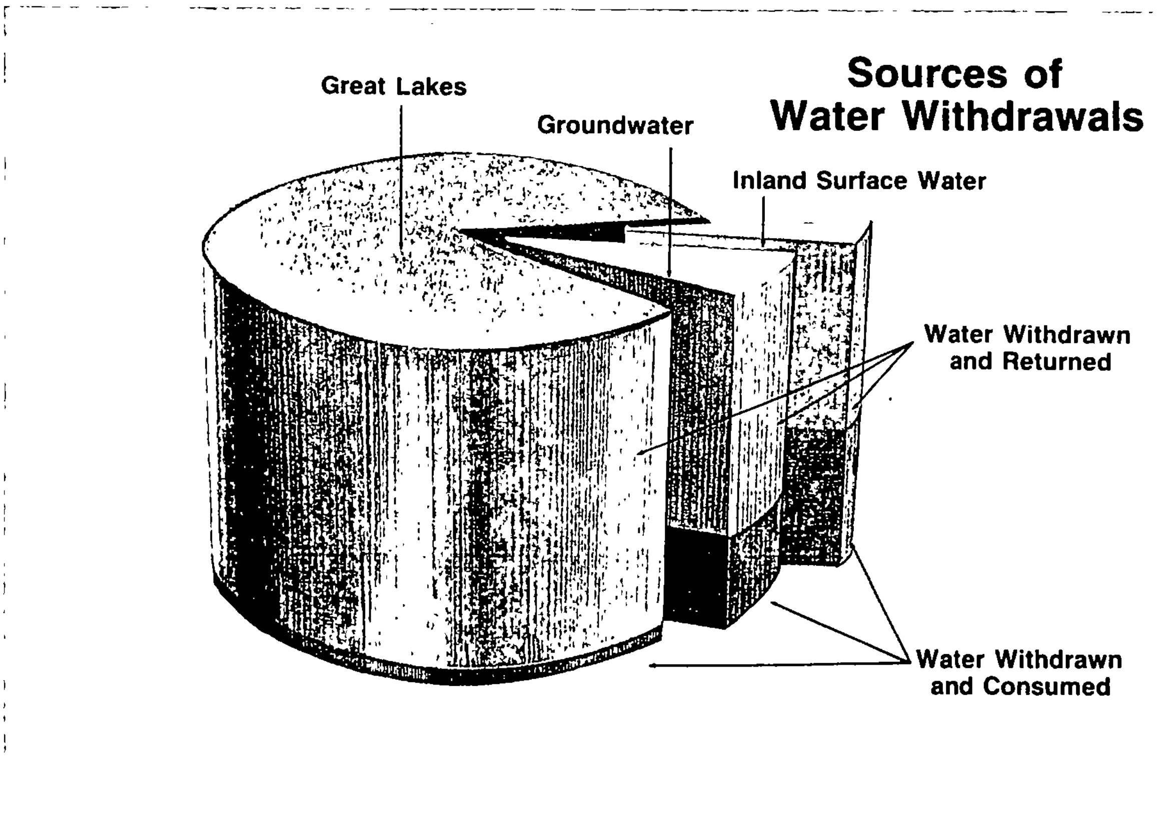


Water Withdrawal By Use

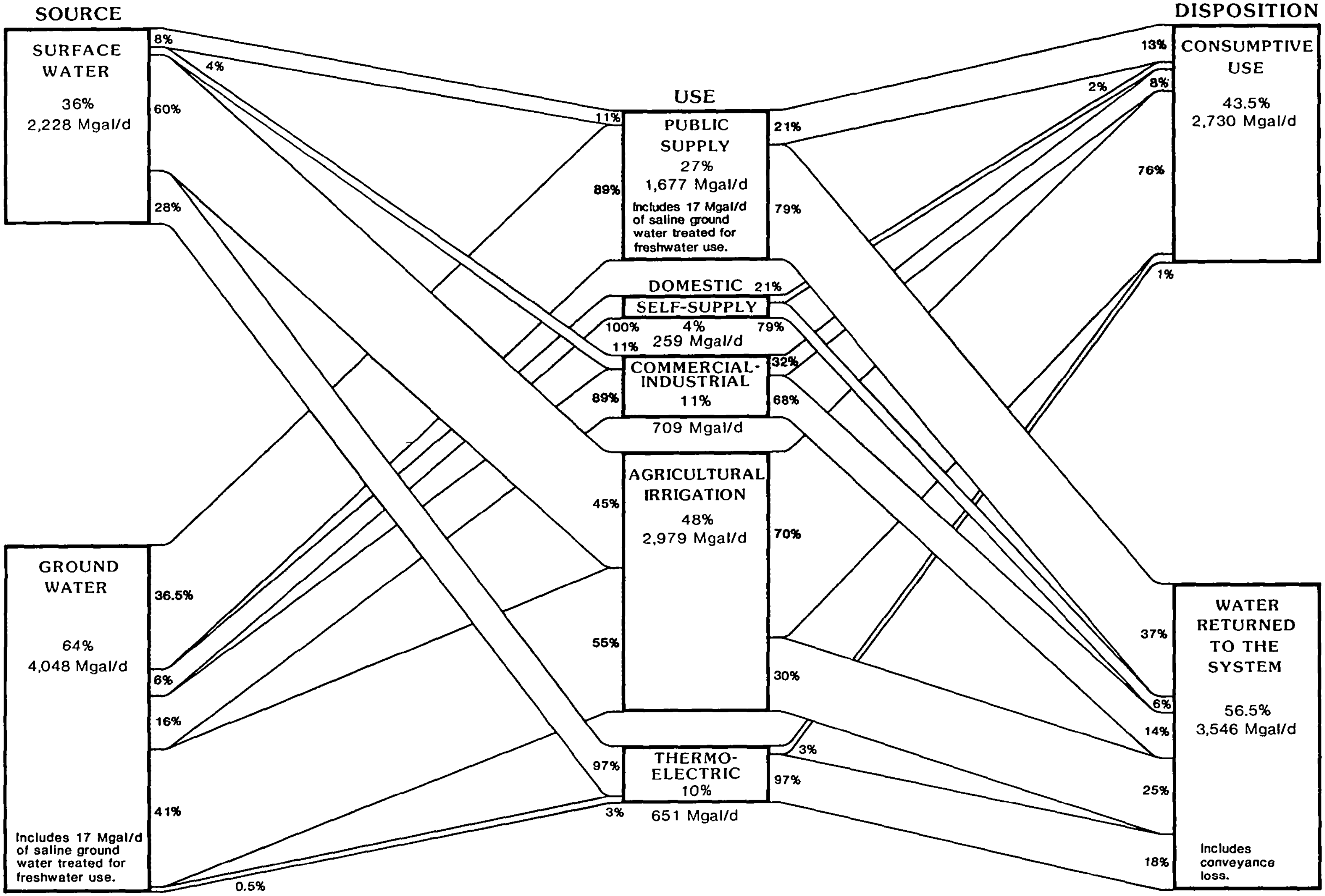




Uses of Water
Withdrawn and Consumed
Irrigation
Public Supply
Industrial Self-supply
Thermoelectric Power Generation
Water Withdrawn and Returned
Water Withdrawn and Consumed
Thermoelectric Power Generation 19%
Public Supply 21%
Industrial Self-supply 22%
Irrigation 38%
Water Withdrawals
11,160 Million Gallons per Day
Water Consumption
590 Million Gallons per Day



Sources of
Water Withdrawals
Great Lakes
Groundwater
Inland Surface Water
Water Withdrawn and Returned
Water Withdrawn and Consumed



FIGURES MAY NOT ADD TO TOTALS BECAUSE OF INDEPENDENT ROUNDING.

Figure 8.--Source, use, a isposition of freshwater in Florida, 1985.

4

Group on Environmental Performance

OECD Core Set of Indicators for Environmental Performance Review

Synthesis Report by the Group on the State of the Environment

10/26/93

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

ENVIRONMENT DIRECTORATE

ENVIRONMENT POLICY COMMITTEE

RESTRICTED

Paris, drafted: 15th-Oct-1993
OLIS:
dist. :

Scale D

ENV/EPOC/GEP(93)5/ADD

Or. Eng.

GROUP ON ENVIRONMENTAL PERFORMANCE

OECD CORE SET OF INDICATORS FOR ENVIRONMENTAL PERFORMANCE REVIEWS

SYNTHESIS REPORT BY THE GROUP ON THE STATE OF THE ENVIRONMENT

COMPLETE DOCUMENT AVAILABLE ON OLIS IN ITS ORIGINAL FORMAT

Note by the Secretariat

This report was endorsed by the Group on the State of the Environment at its meeting on 30th September - 1st October 1993. It incorporates the amendments and comments made by the Group at the meeting on the earlier version of the report [ENV/EPOC/SE(93)6] and is transmitted to the OECD Group on Environmental Performance.

The report combines:

-- the results of three OECD workshops on indicators for use in OECD environmental performance reviews held in February, May and September 1993;

-- input provided by a number of countries through their written contributions on specific issues as well as by the informal steering group (including Canada, Germany, the Netherlands, Norway, the United States) who met at several occasions to prepare the individual workshops;

-- elements of more detailed work on specific indicators carried out in the context of other parts of the work programme on environmental indicators.

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INTRODUCTION

Demand for the development of environmental indicators by OECD has been expressed along two complementary lines. First, the OECD Council in 1989 called for further work to integrate environment and economic decision-making. This was reiterated in consecutive G-7 summits and led to the approval of an OECD Council Recommendation on Environmental Indicators and Information by OECD Governments in 1991. Second, the OECD has been entrusted by its Member countries to launch a new programme of environmental performance reviews with the principal aim of helping Member countries to improve their individual and collective performance in environmental management. Reviews are conducted under the auspices of the Group on Environmental Performance and evaluate individual countries' environmental performance in respect of environmental quality, national objectives and international commitments. One year after the UNCED conference in Rio de Janeiro, with several new conventions adopted, this international dimension is of particular relevance.

These demands are reflected in the OECD work programme on environmental indicators, comprising indicator development for the integration of environmental concern into sectoral policies, environmental and natural resource accounting and the development of indicators for use in environmental performance reviews (see also section "uses of indicators" below).

During the meeting of the Group on Environmental Performance on 15-16 April 1992, the Delegations of the Netherlands, Norway and the United States proposed to hold several workshops concerning environmental indicators to support work on environmental performance evaluation. The Group on Environmental Performance and the Group on the State of the Environment welcomed these suggestions.

The main objectives established for this work were:

-- to contribute to the harmonization of the many individual initiatives of OECD Member countries in the field of environmental indicators;

-- to prepare, in an OECD context, guidance for the use of environmental indicators in connection with the evaluation of environmental performance;

-- to stimulate, within the OECD programme on environmental indicators, the development of a core set of selected and/or aggregated indicators (so-called Indicators), thereby giving priority to the development of a limited set for international use.

The present document is organised accordingly:

-- Harmonization: Chapter 1 presents the common framework and terminology adopted by the OECD Group on the State of the Environment; the development of a common set of environmental issues and indicator proposals also contributes to the harmonization of individual countries' initiatives;

-- Guidance: Chapter 2 proposes general guidelines for the use of indicators in the context of environmental performance reviews and presents examples from reviews already carried out;

-- Core set of indicators: Chapter 3 summarises the discussion on the development of a core set of indicators, each indicator ranked with respect to data availability and measurability.

Chapter 1

TERMINOLOGY AND FRAMEWORK

1.1 Definition and functions of environmental indicators

In a very general way, an indicator can be defined as a parameter or a value derived from parameters, which provides information about a phenomenon (see Table 1). The indicator has significance that extends beyond the properties directly associated with the parameter value. Indicators possess a synthetic meaning and are developed for a specific purpose. This points to two major functions of indicators:

- they reduce the number of measurements and parameters which normally would be required to give an "exact" presentation of a situation. As a consequence, the size of a set of indicators and the amount of detail contained in the set need to be limited. A set with a large number of indicators will tend to clutter the overview it is meant to provide. Too few or even a single indicator, on the other hand, may be insufficient to provide all the necessary relevant information. In addition, methodological problems related to weighting tend to become greater with an increasing level of aggregation:

- they simplify the communication process by which the information of results of measurement is provided to the user. Due to this simplification and adaptation to user needs, indicators may not always meet strict scientific demands to demonstrate causal chains. Indicators should therefore be regarded as an expression of "the best knowledge available".

As indicators are used for varying purposes it is necessary to define general criteria for the selection of indicators. Three basic criteria have been used in OECD work: policy relevance, analytical soundness and measurability. Table 2 offers a more detailed presentation of these general criteria.

1.2 Indicators in the Pressure-State-Response framework

The Pressure-State-Response framework

There are several frameworks around which indicators can be developed and organised. There is no unique framework that generates sets of indicators for every purpose. Also, a framework may change over time as scientific understanding of environmental problems increases, and as societal values evolve. In the context of the work of the Group on the State of the Environment, the Pressure-State-Response (PSR) framework has been used. The PSR framework (Figure 1a) is based on a concept of causality: human activities exert pressures on the environment and change its quality and the quantity of natural resources (the "state" box). Society responds to these changes through environmental, general economic and sectoral policies (the "societal response"). The latter form a feedback loop to pressures through human activities. In a wider sense, these steps form part of an environmental (policy) cycle which includes problem perception, policy formulation, monitoring and policy evaluation.

While the PSR framework has the advantage of highlighting these links, it tends to suggest linear relationships in the human activity-environment interaction. This should not obstruct the view of more complex relationships in ecosystems and in environment-economy interactions.

Table 1. Definition of Terms

INDICATOR	A parameter, or a value derived from parameters, which points to/provides information about/describes the state of a phenomenon/environment/area with a significance extending beyond that directly associated with a parameter value.
INDEX	A set of aggregated or weighted parameters or indicators.
PARAMETER	A property that is measured or observed.
INDICATORS OF ENVIRONMENTAL CONDITIONS	Correspond to "state" box of the Pressure-State-Response framework. They comprise environmental quality and aspects of quantity and quality of natural resources.
INDICATORS OF ENVIRONMENTAL PRESSURES	Correspond to "pressure" box of PSR framework. They describe pressures on the environment caused by human activities. They comprise *indicators of proximate pressure* (stress indicators) and *indicators of indirect pressure* (background indicators).
RESPONSE INDICATORS	Correspond to "Response" box in PSR framework. In the present context, the word "response" is used only for *societal* (not ecosystem) *response*.
INDICATORS FOR USE IN PERFORMANCE EVALUATION	Selected and/or aggregated indicators of environmental conditions, indicators of environmental pressures and indicators of societal responses for the purpose of environmental performance evaluation.
ENVIRONMENTAL INDICATORS	Comprise all indicators in the Pressure-State-Response framework, i.e. indicators of environmental pressures, conditions and responses.

Indicators

Within the PSR framework, three broad types of indicators can be distinguished:

a) Indicators of environmental pressures correspond to the "pressure" box of the PSR framework. They describe pressures from human activities exerted on the environment, including the quality and quantity of natural resources. A distinction can be drawn between indicators of proximate pressures (pressures directly exerted on the environment, normally expressed in terms of emissions or consumption of natural resources) and indicators of indirect pressures (background indicators reflecting human activities which lead to proximate environmental pressures).

b) Indicators of environmental conditions correspond to the "state" box of the PSR framework and relate to the quality of the environment and the quality and quantity of natural resources. As such they reflect the ultimate objective of environmental policy making. Indicators of environmental conditions should be designed to give an overview of the situation (the state) of the environment and its development over time, and not the pressures on it. In practice, the distinction between environmental conditions and the pressures may be ambiguous and the measurement of environmental conditions can turn out to be difficult or very costly. Therefore, the measurement of environmental pressures is often used as a substitute for the measurement of environmental conditions.

Table 2. Criteria for Indicator Selection*

Policy relevance and utility for users

An environmental indicator should:

- provide a representative picture of environmental conditions, pressures on the environment or society's responses;
- be simple, easy to interpret and able to show trends over time;
- be responsive to changes in the environment and related human activities;
- provide a basis for international comparisons;
- be either national in scope or applicable to regional environmental issues of national significance;
- have a threshold or reference value against which to compare it so that users are able to assess the significance of the values associated with it.

Analytical soundness

An environmental indicator should:

- be theoretically well founded in technical and scientific terms;
- be based on international standards and international consensus about its validity;
- lend itself to being linked to economic models, forecasting and information systems.

Measurability

The data required to support the indicator should be:

- readily available or made available at a reasonable cost/benefit ratio;
- adequately documented and of known quality;
- updated at regular intervals in accordance with reliable procedures.

*These criteria describe the "ideal" indicator and not all of them will be met in practice.

c) Indicators of societal responses correspond to the "response" box in the PSR framework. Societal response indicators are measurements which show to what degree society is responding to environmental changes and concerns. Societal responses refer to individual and collective actions to mitigate, adapt to or prevent human-induced negative impacts on the environment and to halt or reverse environmental damage already inflicted. Societal responses also include actions for the preservation and the conservation of the environment and natural resources.

Compared to indicators of environmental pressures and many indicators of environmental conditions, most indicators of societal responses have a shorter history and are still in a phase of development, both conceptually and in terms of data availability. This must be taken into account in their use to avoid misinterpretation. Two more specific points arise with societal response indicators.

First, the distinction between indicators of environmental pressures and indicators of societal responses may become blurred when response indicators capture the feedback effect of society's responses on environmental pressures. A reduction in greenhouse gas emissions or improvements in energy efficiency could, for example, be interpreted both as a pressure and as a response indicator for climate change. Ideally, the response indicator should reflect society's efforts in tackling a particular environmental problem.

Second, as indicators are of a quantitative nature, societal response indicators are limited to responses which are measurable in quantitative terms. Responses which can only be expressed in qualitative terms (e.g. whether an international environmental agreement has been ratified or not) are therefore absent in the present set of indicators. In a number of cases, responses may be measurable in principle but are too specific or too numerous to be measured in practice. A case in point is the area of technology-related regulations and standards with comprehensive, detailed rules which are difficult to express in a concise way or to compare internationally. In performance reviews, qualitative and scientific information typically supplements the quantitative indicators.

Use of indicators

Different users of environmental indicators have different needs. Thus, the appropriate set of indicators depends on their particular use. In the work of the Group on the State of the Environment four major categories of use are present:

- measurement of environmental performance;
- integration of environmental concerns in sector policies[1];
- integration of environmental and economic decision-making more generally (e.g. through environmental accounting[2]);
- reporting on the state of the environment.

[1] Indicators for integration of environmental concerns in sectoral policies are, in the OECD context, specialized sub-sets covering the whole range of indicators for use by sectoral decision-makers.

[2] Although indicators of environmental pressures, conditions and societal responses provide input for work on environmental accounting, frameworks different from the PSR model underlie the work on environmental accounting.

Conceptually, indicators for these specific purposes (performance evaluation, reporting on the state of the environment) should be distinguished from specific types of indicators, i.e. indicators of environmental conditions, pressures, societal responses (see Figure 1b). There is no one-to-one correspondence between indicators distinguished by their nature and indicators distinguished by their use: for each type of use, background, stress, environmental quality, natural resource, and response indicators are of potential relevance. For example, indicators for state of the environment reporting could well be drawn from all types of indicators -- pressure indicators, indicators of environmental conditions and response indicators.

Similarly, a set of indicators would be selected from all types to meet the specific needs of policy performance evaluation. Indicators for performance evaluation would encompass indicators of environmental pressures, conditions and societal responses. What characterizes such indicators would be that these indicators are used to evaluate performance, mainly by putting them into the context of national[3] and international goals, objectives and targets.

[3] This may include sub-national issues of national significance.

Figure 1a

Pressure - State - Response Framework

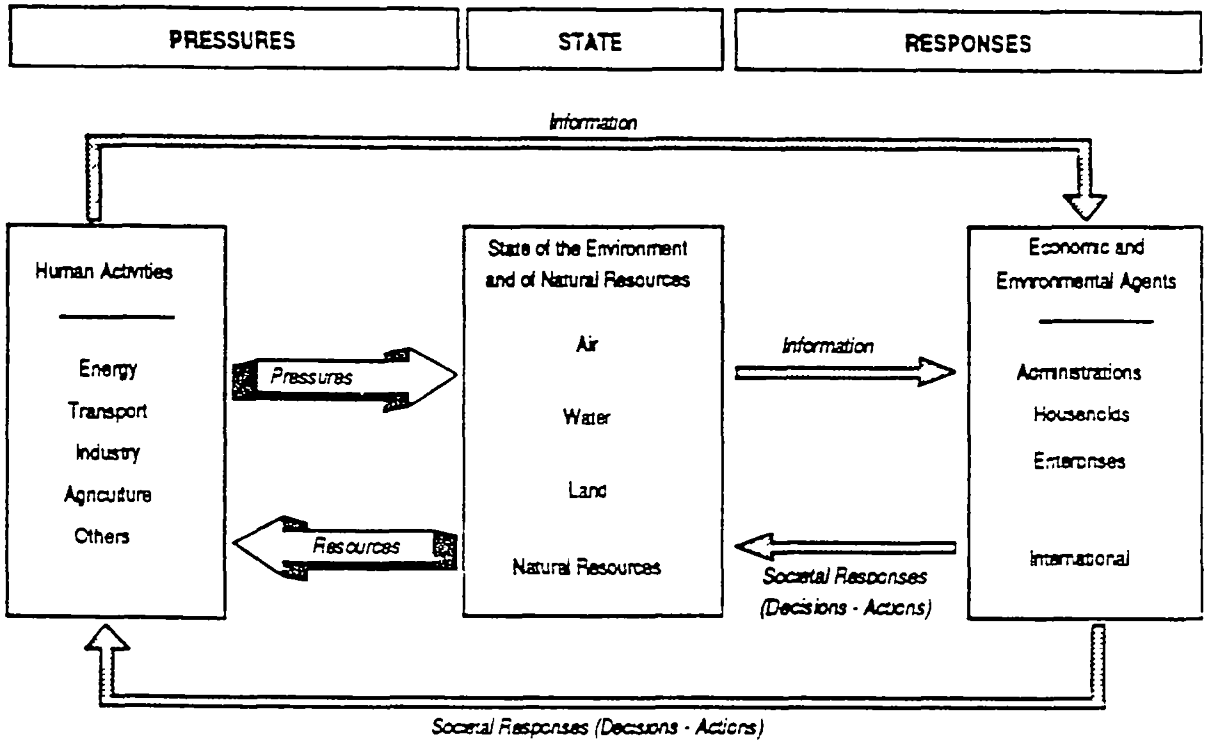
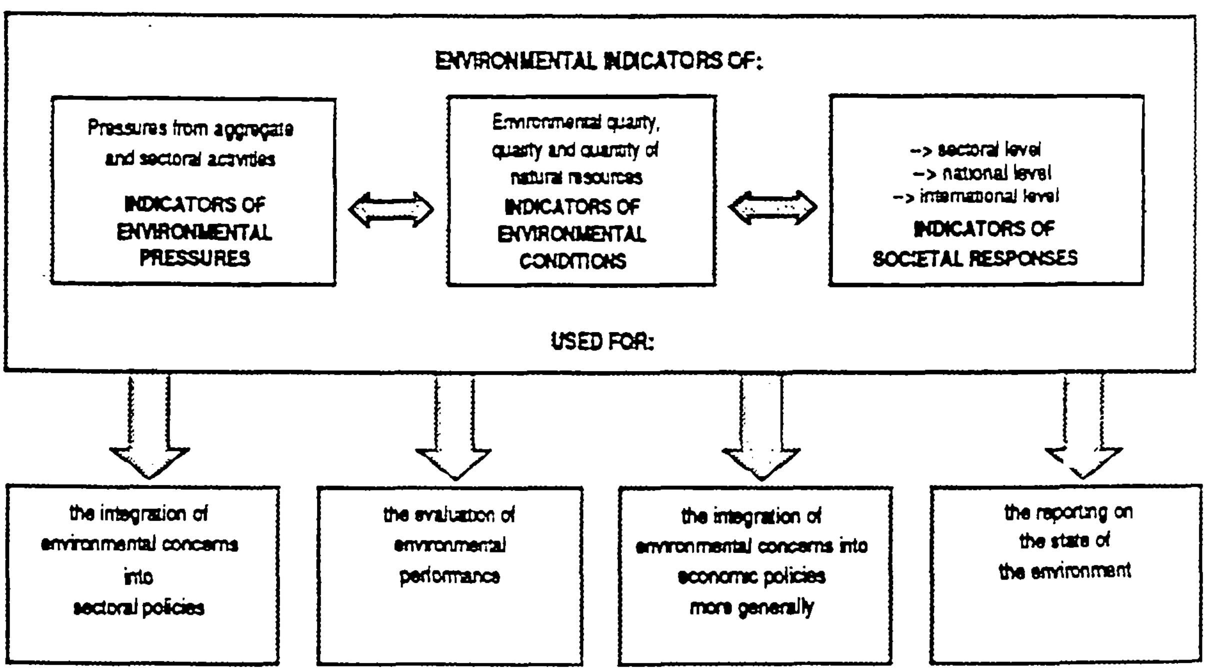


Figure 1b

Nature and Use of Environmental Indicators



1.3 Structuring elements: environmental issues and economic sectors

Environmental issues

The Pressure-State-Response framework structures and classifies types of indicators. The broad categories following from the PSR framework (indicators of environmental pressures, environmental conditions and societal responses), give, however, insufficient guidance for the choice of the specific environmental areas for which indicators need to be developed. In its February workshop, the Group on the State of the Environment identified a list of issues which reflect current environmental challenges. These issues represent the first structuring element. By necessity, they depend on changing and sometimes conflicting perceptions. The list of issues is not necessarily final nor exhaustive. In fact, the list is flexible and new issues can be incorporated or old ones abandoned according to their environmental relevance. The purpose of the list is to serve as a focus for indicator development: Figure 2 shows how indicators of environmental conditions, pressures and responses can be associated with individual issues.

Broadly spoken, issues 1 to 9 can be considered "sink-oriented", dealing with issues of environmental quality, whereas issues 10 to 13 are "source-oriented", focusing on the quantity aspect of natural resources. Not all indicators can be directly associated with a specific environmental issue (e.g., population growth, economy-wide environmental expenditure or public opinion on the environment). A category of general and/or not attributable indicators has therefore been introduced in the framework in Figure 2.

Sectors in the Pressure-State-Response framework

In principle, pressure and societal response indicators can be considered at a sectoral level. Data availability permitting, such a disaggregation is one tool in analysing the environmental pressures exerted by sectors such as agriculture, industry, energy or transport. Similarly, for societal responses, government responses could be distinguished from those of the business sector (including agriculture, energy, industry etc.) or private households (see Figure 3). Indicators at the sectoral level are therefore a useful tool in the context of environmental performance reviews for reviewing the integration of environmental and sectoral policies.

There exists a direct link to the work of the Group on the State of the Environment on indicators for the integration of environmental concerns into sectoral policies. So far, work has been undertaken in the areas of energy, transport, forestry and agriculture[4]. Selected indicators from these activities can provide a direct input to the core set of indicators for use in environmental performance reviews.

Sector disaggregation can be carried out in

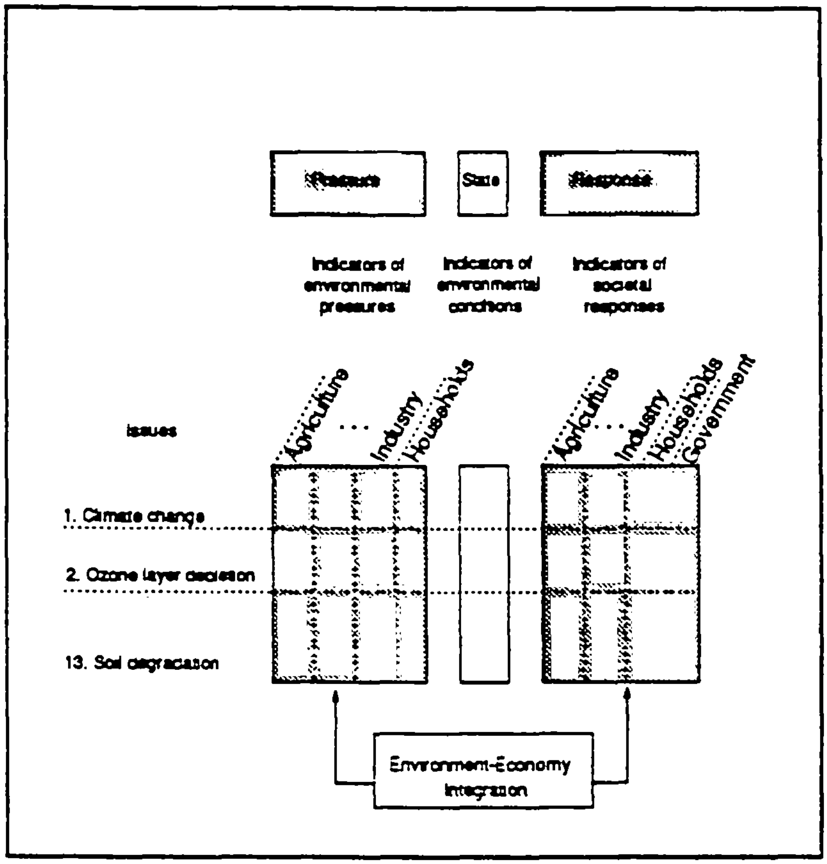
-- a functional sense (relating to sources of pollution): sectors relate to specific, environmentally relevant activities. The transport sector, for example, would comprise all transport activities, irrespective of whether they are carried out by manufacturing industry, private households or specialised transportation firms;

[4] See "Indicators for the integration of environmental concerns into energy policies" [ENV/EPOC/SE(92)4/REV1]; "Indicators for the integration of environmental concerns into transport policies" [ENV/EPOC/SE(91)17/REV1]; "Indicators for the integration of environmental concerns into agricultural policies" [ENV/EPOC/SE(93)2]; "Indicators for the integration of environmental concerns into forestry policies" [ENV/EC/SE(91)16].

Figure 2 Structure of Indicators by Environmental Issue

Issues	PRESSURE **Indicators of environmental pressures** ***workshop May 1993***	STATE **Indicators of environmental conditions** ***workshop February 1993***	RESPONSE **Indicators of societal responses** ***workshop May 1993***
1. Climate change			
2. Ozone layer depletion			
3. Eutrophication			
4. Acidification			
5. Toxic contamination			
6. Urban environmental quality			
7. Biological diversity			
8. Landscape			
9. Waste			
10. Water resources			
11. Forest resources			
12. Fish resources			
13. Soil degradation (desertification and erosion)			
14. General indicators, not attributable to specific issues			

Figure 3: Sectors in the Pressure-State-Response Framework



an <u>institutional</u> sense (relating to economic activity): sectors relate to the primary activities of economic establishments or firms. In this sense, the transport sector would be restricted to that part of the service sector dealing with transport services as a primary activity. Transport activities carried out in conjunction with manufacturing would be recorded in the sector "manufacturing industry". Industry classifications such as ISIC (International Standard Industry Classification) are based on this principle.

The following lists show sectors organised along the two approaches:

Institutional approach (economic sectors):	Functional approach (sources of pollution):
Agriculture	Agriculture
Forestry	Forestry
Fishery	Fishery
Mining and quarrying	Mining and quarrying
Manufacturing	Manufacturing
Electricity generation	Energy (extraction, production, distribution, use)
Transport services	Transport
	Tourism
Other services	Other services
Private households	Private households

It should be noted that private households are included as a sector. This category differs from the other sectors as it does not have a significant impact as a sector of production, but underlines the role of households as consumers. According to the specific question under consideration, sectoral sub-divisions can be developed either in a functional or an institutional sense. If double-counting is to be avoided, however, consistency of use (functional or institutional) needs to be assured. Also, with a view to combining data on sectoral pressures and economic activity, environmental data and economic data need to be collected and applied in a consistent manner.

Issue-profiles

In principle, it is possible to establish a systematic link between environmental pressures and different sectors in the form of issue-profiles[5]. An issue-profile consists of the contributions of relevant sectors to a particular environmental pressure (e.g. greenhouse gas emissions) which in turn can be linked to an issue (e.g. climate change). Figure 4 presents a stylised issue-profile. Issue-profiles could help to identify the economic activity causing a particular environmental problem and, combined with information on sectoral responses, provide useful information for performance reviews. At present, however, problems of data availability and measurement severely constrain any systematic development of issue profiles at the international level.

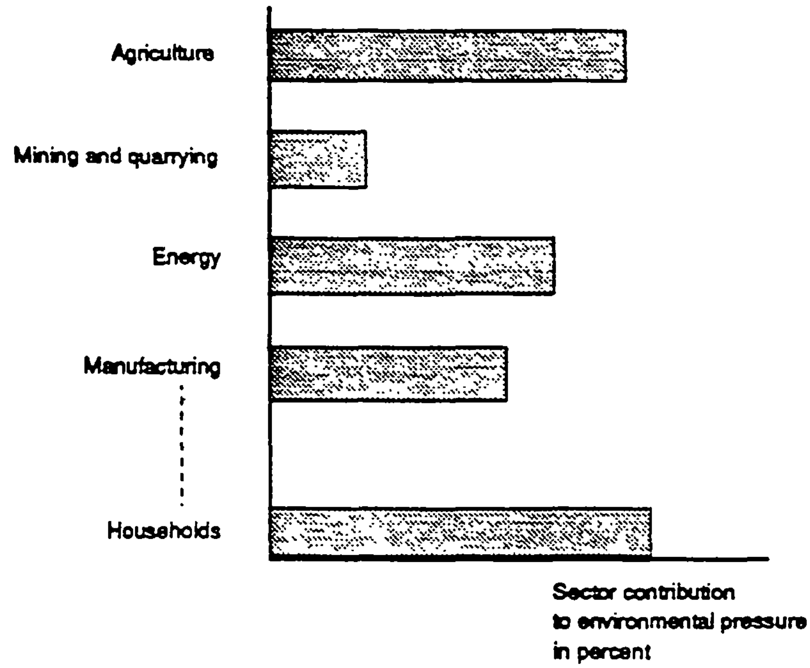
Future developments

As a medium-term perspective, further integration of economic and environmental information should be possible with a view to fostering sustainable development strategies. Pressure indicators could, for example, be related to parameters reflecting economic activity thus providing an analytical tool for the integration of economy and environment in decision making.

---

[5]Conceptually, issue profiles are distinct from the approach taken in other OECD work on indicators for the integration of environmental concern into sectoral policies. The latter are broad sets of indicators covering the whole interface between sectoral policies (energy, transport, agriculture etc.) and environment. Issue profiles would be more constrained in the sense that they only deal with one particular environmental issue and that they focus on environmental pressures. On the other hand, they permit the systematic allocation of environmental pressures across sectors -- a feature not present in other work on sectoral indicators. Also, issue profiles can be organised along economic sectors, i.e., in an institutional sense whereas the work on indicators for the integration of environmental concerns into sectoral policies follows a functional approach.

Figure 4 Issue-profile by sector



Chapter 2

THE USE OF INDICATORS IN ENVIRONMENTAL PERFORMANCE REVIEWS

Efforts of the OECD programme of environmental performance reviews are directed at promoting sustainable development, with the principal aim of improving the individual and collective performances in environmental management. Environmental performance reviews are structured to further the following principal goals[6]:

- reducing the overall pollution burden and managing natural resources in a sustainable way;
- integrating environmental and economic or sectoral policies;
- strengthening international co-operation.

Environmental performance is to be assessed by comparing achievements or progress with:

- national objectives;
- international commitments;
- absolute levels of environmental quality, taking account of each country's physical, human and economic context.

Seven principles apply for the use of environmental indicators in performance reviews. This chapter briefly discusses these principles and presents examples of the use of indicators in environmental performance reviews.

1. Indicators provide one of the tools in the process of performance evaluation and need to be supplemented by other qualitative and scientific information.

Indicators have the advantage of being concise and having a meaning that goes beyond the simple parameter value. However, there is a danger of misinterpretation if indicators are presented without appropriate supplementary information. Such information is particularly needed to explain driving forces behind indicator changes which in turn form the basis for any assessment of environmental performance. Box 1 presents an example from the review of Iceland where indicators of air emissions are embedded in supplementary information about the source of emissions.

2. There is no unique normalisation for the comparison of environmental variables across countries: where possible, normalisation by unit of GDP should be shown in parallel with a normalisation by the number of inhabitants. Other possibilities such as total surface exist for normalisation and may be appropriate for specific environmental pressures.

When comparing emissions across countries, the outcome of the assessment will depend greatly on whether GDP or population size are chosen as denominator. Although standardisation is needed to facilitate cross-country comparisons, absolute values may be the appropriate measure where, for example, international commitments are linked to absolute levels of emissions.

---

[6] As set forth by the OECD Environment Ministers in their 1991 communiqué on the "OECD Environmental Strategy for the 1990s".

> 3. **The set of indicators developed in the series of workshops of the Group on the State of the Environment is a core set. In the context of performance reviews, this core set is common to all or most Member countries, and will generally be supplemented by more detailed, country-specific indicators.**

Boxes 1 and 2 are examples of this principle put into practice: core indicators on air pollution (Box 1) provide a cross-country comparison but are confined to a particular point in time. In addition, air pollution in Iceland is shown for a larger number of pollutants and for several years. Similarly, in the review of Germany (Box 2) types and evolution of waste water treatment in Germany are shown in detail to supplement the cross-country comparison provided by the core indicator on the percentage of the population connected to waste water treatment plants with biological and/or chemical treatment.

> 4. **For performance evaluation, indicators must be reported and interpreted in the appropriate context, taking into account the ecological, geographical, social, economic and structural features of countries.**

In performance reviews, this principle is followed in two ways. First, the text directly accompanying the indicator contains a certain amount of contextual information (see, for example, the first paragraphs in Box 1 and Box 2). Second, in every performance review, an introductory chapter deals with the overall physical, demographic, economic and administrative context of the respective country.

> 5. **Not every area of assessment lends itself to the use of quantitative information. Certain policy areas may be assessed in qualitative terms. Thus, the issues covered by environmental indicators are a subset of the issues covered by performance reviews.**

> 6. **In conceptual and in empirical terms, indicators of societal responses tend to be less advanced than indicators of environmental pressures or indicators of environmental conditions. Thus, particular caution needs to be applied when interpreting and using indicators of societal responses.**
>
> **More generally, key information on methodology for indicator derivation should accompany the use of indicators in performance reviews.**

> 7. **There is no necessary one-to-one correspondance between environmental issues and the indicators identified: a specific indicator can be relevant for more than one environmental issue.**

Box 1. The Use of Indicators: Example from the Environmental Performance Review of Iceland

Air pollution

Although Iceland's per capita consumption of energy is high and is higher than that of any other OECD country, its unusually high proportion of hydro and geothermal energy contributes substantially to maintaining pollution at low levels. Total primary energy supply (TPES) per unit of GDP in 1990 was 84 per cent above the OECD average and 69 per cent above the average for the other Nordic countries. TPES per capita was 71 per cent greater than the OECD average and 57 per cent higher than the average for other Nordic countries. The Icelandic authorities successfully reduced oil consumption through substitution of renewable resources. Electricity is generated almost exclusively from hydropower, and geothermal energy contributes a high share of space heating.

Context and supplementary information

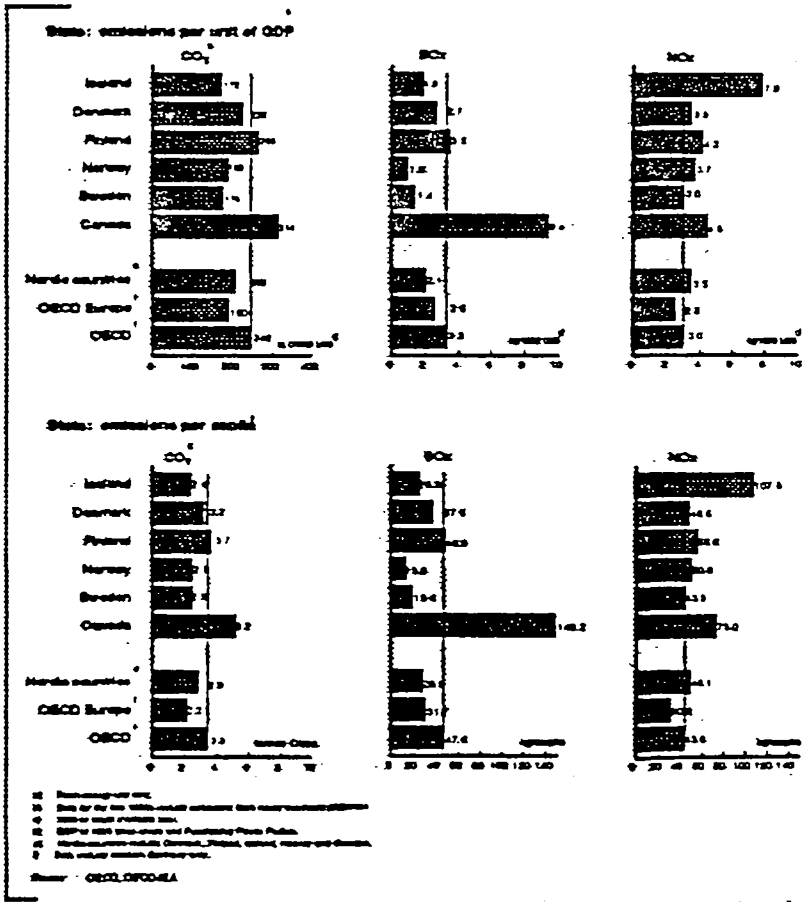
Trends in Iceland

		1975	1980	1985	1991	% change 1975-1991
SOx	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOx	[illegible]	15.0	18.7	[illegible]	27.4	[illegible]
Carbon monoxide	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72.7
Volatile organic compounds	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Country-specific indicators and data

Core indicator

Assessment

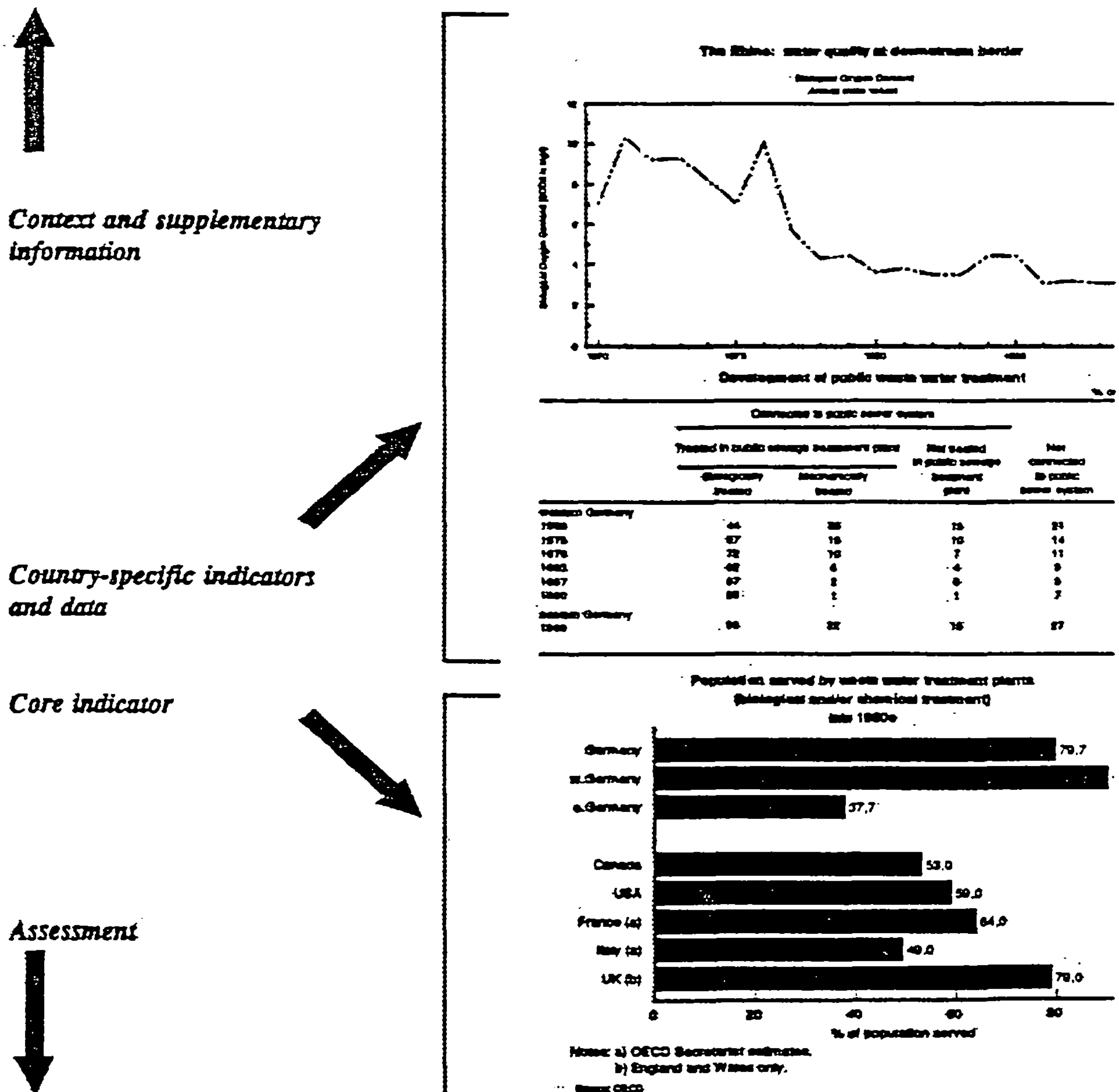


The implications of these increases in certain pollution emissions for human health and ecosystems may be minor due to the assimilative capacity of the environment. For example, in spite of the sharp expansion in NOx emissions, the level of depositions is at least three times lower than in any European country. Thus, the Icelandic authorities have drawn special attention to the need to consider pollution concentrations and ambient levels in implementing international commitments.

Box 2. The Use of Indicators: Example from the Environmental Performance Review of Germany

Surface water

The authority to establish water quality objectives in surface or ground water rests with the Länder. The goal of the western Länder is to achieve Quality Class II in all rivers, i.e. Moderate Pollution, the third from highest quality in Germany's seven-tiered water quality ranking system. Class II is defined as: water sections with moderate pollution and good oxygen supply; a very wide variety of species and dense colonisation by individual algae, snails, entomostracans and insect larvae; aquatic plants covering large areas; and fertile fishing waters. No date has been set for achieving this overall goal.



Major improvements in the quality of surface waters have occurred in western Germany, particularly with respect to oxygen-demanding substances and toxic compounds such as heavy metals. These improvements can be explained both by the progressive equipment of municipalities with sewage treatment plants providing relatively efficient biological and advanced treatment of waste waters and by impressive progress in the installation of treatment equipment at industrial facilities. This has led to significant improvements in the waters of the Rhine, Danube, Neckar and Main rivers.

Chapter 3

INDICATOR DEVELOPMENT BY ENVIRONMENTAL ISSUE

This chapter summarises the work on indicator development, carried out during the workshops of the Group on the State of the Environment. In addition, a number of lead countries provided specific input for the different issues. In this sense, significant parts of the indicators or elements of indicators described below represent an interim consensus. None of them should, however, be perceived as final or necessarily exhaustive in character: they may change as knowledge and perception of environmental problems evolve, they still require detailed technical descriptions and they may be of varying relevance for different countries.

In this chapter, first-choice indicators are highlighted and placed in white boxes. Where these are not readily measurable, one or several proxy indicators are added in grey fields. Grey fields also contain supplementary indicators to round up the picture provided by the core indicator or its substitutes. All indicators or elements of indicators are classified according to their availability: "S" for indicators measurable in the short-term; "M" for indicators which require additional empirical work and data collection efforts and which are therefore only measurable in the medium term and "L" for indicators measurable only in the long term because they would need significant data development work. All the indicators measurable in the short run are brought together in the overview in Figure 5 at the end of this chapter.

The treatment of indicators for each environmental issue comprises the following elements:

a) a table summarising indicators and classifying them by degree of measurability;

b) a short description of the environmental concern and policy relevance of the issue with reference to major international agreements or conventions (e.g. Agenda 21, the Montreal Protocol);

c) a brief discussion of the indicators of environmental pressures, environmental conditions and societal responses where possible;

d) a note concerning the data availability for each category of indicator.

Issue 1: Climate Change

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Index of GHG emissions*	S/M
O Emissions of CO_2	S
O Emissions of CH_4	S/M
O Apparent consumption of CFC 11 and 12; halons*	S/M
O Emissions of N_2O	M
Environmental conditions:	
● *Atmospheric concentration of greenhouse gases*	S
● *Global mean temperature*	S
Societal responses:	
● *Energy efficiency*	M/L
O Energy intensity	S
O Implicit and explicit tax on energy/CO_2	M/L
O Expenditure on energy efficiency, alternative energies, climate change research	M

*Apparent consumption = production plus imports minus exports.

The environmental concern and policy relevance: in recent decades, the balance in the radiative energy budget of the earth-atmosphere system has been disturbed by the addition of gases generated by human activities. An increase of the atmospheric concentration of these greenhouse gases changes the radiative energy balance and leads to temperature and climate change.

One of the major international agreements which emerged from 1992 "Earth Summit" in Rio de Janeiro was the UN Framework Convention on Climate Change. A number of countries have made commitments to reduce their emissions of greenhouse gases over the coming years.

Indicators of environmental pressures: four different radiately active gases have direct effects on climate change: carbon dioxide, methane, nitrous oxide, halocarbons. The indicators of environmental pressures relate to gross emissions, i.e., they do not consider sinks of greenhouse gases. For an aggregate indicator of greenhouse gas emissions, all four gases should be taken into account. Aggregation supposes a weighting scheme, based on global warming potentials (GWP) as proposed by the Intergovernmental Panel on Climate Change. To date, however, major uncertainties exist about the size of these weighting factors. Until definitive weighting factors are put forward, it is proposed to consider each greenhouse gas individually. In the future, it may also be necessary to include emissions of substitutes for CFCs with high GWP.

Data availability: CO_2 emissions are well covered, in particular emissions from energy use (Source: OECD/IEA). For CFCs, apparent consumption is monitored under the Montreal Protocol. Estimates on methane emissions exist but country coverage is smaller and there are wide divergences between estimates from different sources (Source: OECD). Information on halons is very limited. Significant measurement problems exist with N_2O.

Indicators of environmental conditions: the atmospheric concentration of greenhouse gases and the changes in global mean temperature are common indicators for climate change. These indicators remain of limited direct use for environmental performance reviews as they cannot be related to a particular country's environmental performance.

Indicators of societal responses: efforts to reduce GHG emissions include a large number of individual actions and policy instruments (taxes, regulations, subsidies etc.), mostly designed to improve energy efficiency. The different efforts are difficult to capture in a single indicator. It is therefore proposed to employ an indicator of energy efficiency, reflecting, at least partly, society's efforts to reduce greenhouse gas emissions. Supplementary indicators such as energy and CO_2 tax rates and environmental expenditure should help to trace individual policy instruments. As always, expenditure data need to be put into the right context for appropriate interpretation.
Data availability: measures of energy efficiency are not readily available. As a first step, it is therefore proposed to use energy intensity measures (Source: OECD/IEA), although they reflect structural factors as well as changes in energy efficiency. Data on government R&D expenditure on energy efficiency and alternative energy sources are partly available (Source: IEA); implicit and explicit tax rates on CO_2 have also been evaluated (Source: OECD), although country coverage is incomplete.

Issue 2: Stratospheric Ozone Depletion

Summary of indicators

Indicator	Measurability
Environmental pressures:	
● *Index of apparent consumption* of ozone-depleting substances*	M
O Apparent consumption of CFCs	S
halons	M
Environmental conditions:	
● *Atmospheric concentration of ozone-depleting substances*	M
● *UV-B radiation at ground level*	M
O Atmospheric concentration of CFCs	S
O Stratospheric ozone levels over selected areas	S/M
Societal responses:	
● *CFC recovery rates*	M
O Expenditure for CFC recovery and replacement technologies	L
O Countries' contributions to the Interim Fund associated with the Montreal Protocol	M

*Apparent consumption equals production plus imports minus exports.

Environmental concern and policy relevance: in 1974 it was discovered that chlorine-containing substances pose a threat to the ozone layer. Ozone is mainly found in an atmospheric layer at stratospheric altitudes, between 20 and 40 kilometres, and acts as a shield against harmful solar ultra-violet radiation.

In 1985, the Vienna Convention for the Protection of the Ozone Layer was signed, followed by the Montreal Protocol and London and Copenhagen Amendments on Substances that Deplete the Ozone Layer.

Indicators of environmental pressures: principal among the ozone-depleting substances are CFCs, halons, methyl chloroform and carbon tetrachloride, and HCFCs, plus methyl bromide. Individual substances vary considerably in their ozone-depleting capacity. To reflect the combined depletion capacity, the apparent consumption of each individual substance has to be weighted in proportion to its ozone-depleting potential relative to CFC-11.
Data availability: CFC-11 and CFC-12 account for half of the ozone-depleting substances and are therefore proposed as parameters. Actual emissions of CFCs are difficult to measure but production or apparent consumption can be used as a proxy. Data on halons are less readily available so that a short-run indicator will be confined to CFCs (Source: OECD).

Indicators of environmental conditions: first choices for an indicator of environmental conditions are the global atmospheric concentration of ozone-depleting substances, and, closer to effects, the radiation of UV-B at ground level. Changes in the concentration of CFC-11 and CFC-12 help to track the magnitude and rate of change of the atmospheric reservoir of the most abundant ozone-depleting substances. As in the case of greenhouse gases, the indicator remains of limited use in the specific context of environmental performance reviews as it cannot be related to a particular country and its environmental performance. A second indicator, more closely associated with particular countries, is the trend in stratospheric ozone levels over selected measurement points.
Data availability: information on global atmospheric CFC concentrations is readily available. Trend data of ozone concentrations for individual monitoring stations are available for 19 OECD countries.

Indicators of societal responses: recovery rates of CFC and society's expenditure for that purpose as well as for replacement technologies are possible indicators. Important contextual information is the extent to which a country has committed itself to the phasing-out of CFCs. These targets could then be compared to environmental pressures in terms of production and/or consumption of CFCs. A different indicator for governments' specific efforts at the international level are countries' contributions to the Interim Multilateral Fund associated with the Montreal protocol. The fund, which was established on a pilot basis for three years, aims at helping developing countries to adopt replacements for CFCs.
Data availability: Information on CFC recovery rates is scattered and virtually no data are currently obtainable for expenditure on CFC recovery or replacement.

Issue 3: Eutrophication

Summary of indicators

Indicator	Measurability
Environmental pressures:	
● *Emissions of N and P into water and soil*	L
O Apparent consumption of fertilizers, measured in N,P	S
O Waste water discharges	M
O Livestock density	S/M
Environmental conditions:	
● *BOD/DO, concentration of N and P in inland and marine waters*	S/M M/L
Societal responses:	
● *Percentage of population connected to sewage treatment with biological and/or chemical treatment*	M/L
O Percentage of population connected to waste water treatment	S
O User charges for waste water treatment	M
O Market share of phosphate-free detergents	S/M

Environmental concern and policy relevance: The consequences of over-nourishment of aquatic plants (eutrophication) has become a major problem of water pollution in Member countries, affecting surface water, groundwater and marine waters. Excess nutrients can also be found in soil and sediments. The annual mean concentration of nitrates has, for example, been increasing at the downstream frontiers of rivers, mainly as a reflection of pollution from agricultural origins such as animal manure or excess fertilizers.

Acceptable levels of dissolved oxygen and nutrient levels in receiving waters have been established in national and international standards and agreements such as the International Joint Commission Agreement on Great Lakes Water Quality in North America.

Indicators of environmental pressures: a complete set of pressure indicators would comprise emissions of nitrogen and phosphate from manure, fertilizer, domestic and industrial waste water, sewage sludge, dredge spoil and solid waste, corrected for the absorption of phosphates and nitrogen by crops. This could be further extended to reflect a proper nutrient balance.

Data availability: at the international level, few data are available for the entire range of emission sources of phosphorus or nitrogen as well as for the absorption of phosphates and nitrogen by crops. Currently, measurements are confined to the apparent consumption of fertilizers and general information on waste water discharges. Aggregate amounts of fertilizers must be measured in terms of N or P to account for different types of fertilizers. Livestock density provides a rough but measurable proxy for potential eutrophication from manure.

Indicators of environmental conditions: direct indicators of the extent of eutrophication relate to the phosphate and nitrate contents of inland and marine waters. Biological oxygen demand of water bodies or the degree of dissolved oxygen can also be considered indicative of eutrophication. Measuring excess nutrients in soil complicates matters significantly. The focus of indicators is therefore on water. A general problem related to indicators of ambient quality is how to carry out spatial aggregation to present meaningful national figures: forming averages is seldom a satisfactory solution so that often data of representative sites are shown rather than national figures.

Data availability: at the international level, data are available for BOD, phosphate and nitrate concentrations for selected rivers in OECD countries (Source: OECD).

Indicators of societal responses: several indicators would appear useful to show society's efforts towards reducing eutrophication and excess nutrients: the extent of chemical and/or biological waste water treatment, the extent to which levies on sewage water treatment cover actual costs, the market share of phosphate-free detergents. For non-point sources, in particular agricultural ones, an indicator reflecting best farming practices could be introduced.

Data availability: for OECD countries, data on the share of the population connected to sewage treatment plants are available in the short run (Source: OECD). Information on the type of treatment and on waste water charges remains partial. Data on the market share of phosphate-free detergents should be available more easily (Source: industry associations).

Issue 4: Acidification

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Index of acidifying substances*	M/L
O Emissions of SOx and NOx	S
ammoniac	M
Environmental conditions:	
● *Exceedance of the critical loads of potential acid in water and soil*	S/M
O Concentration in acid precipitations (pH, SO_4, NO_3)	S
O Total depositions of acidifying substances	M
Societal responses:	
● *Percentage of car fleet equipped with catalytic converters*	S/M
● *Capacity of SOx and NOx abatement equipment of stationary sources*	M/L
O Expenditure for air pollution abatement	S

Environmental concern and policy relevance: in the atmosphere, emissions of sulphur and nitrogen compounds are transformed into acidifying substances such as sulphuric and nitric acid. When these substances reach the ground, acidification of soil, water and buildings arises. Soil acidification is one important factor causing forest damage. Acidification of the aquatic environment may severely impair the life of plant and animal species.

Problems of acidification have triggered several international agreements to reduce emissions, e.g., the 1979 Convention on Long-range Transboundary Air Pollution and the 1985 Helsinki Protocol on the reduction of sulphur emissions as well as the 1988 Sophia Protocol on the control of emissions of nitrogen oxides.

Indicators of environmental pressures: as sulphur and nitrogen compounds are at the source of acidification, emissions of SOx, NOx and NH_3 provide meaningful indicators of environmental pressures.

Data availability: international data on SOx and NOx emissions are immediately available (Source: OECD): information on NH_3 is more difficult to obtain at the international level.

Indicators of environmental conditions: there are several possibilities to reflect the state of acidification of soil and water: a) by means of an indicator of acid precipitations and/or depositions (exceedence of the critical loads of potential acids in soils and waters); b) by means of the direct indication of the pH-value of lakes or soil; c) through indirect measures such as the crown density of forest.

Data availability: for the short-run, only concentrations of acidifying substances in precipitation can be measured at the international level (Source: OECD). Data on depositions, exceedence of critical loads and measurements of pH-values in surface waters and soil are available in a number of countries (Source: EMEP, OECD) but further efforts to improve data collection and harmonization are needed internationally.

Indicators of societal responses: physical and expenditure data on the capacity of equipment to abate SOx and NOx emissions provide meaningful indicators with respect to industry's efforts. Households' efforts could be reflected through the percentage of the car fleet equipped with catalytic converters. More generally, efforts of environmental policy could be captured through comparison between ambient standards for SO_2 and NO_2 concentrations.

Data availability: currently, data on pollution abatement expenditure are only available for air pollution abatement as a whole, including expenditure for non-acidifying air emission abatement (Source: OECD). Partial information is at hand for physical equipment, in particular for utilities. A comparison of ambient air standards necessitates further work to make them comparable across countries.

Issue 5: Toxic Contamination

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Emissions of heavy metals*	M/L
● *Emissions of organic compounds*	L
O Consumption of Pb,Hg,Cd,Ni	S/M
O Apparent consumption of pesticides[a]	S/M
O Generation of hazardous waste	S/M
Environmental conditions:	
● *Concentration of heavy metals and organic compounds in environmental media and living species*	L
O Concentration of lead, cadmium, chromium, copper in rivers	S/M
Societal responses:	
● *Changes of toxic contents in products and production processes*	L
O Rehabilitated areas as percentage of total areas identified as contaminated	L/M
O Market share of unleaded petrol	S

a) See notes below concerning problems of measurement and comparability.

Environmental concern and policy relevance: human activities lead to emissions and accumulation of toxic substances in environmental media and living species and present danger to human and ecosystem health. A number of international agreements extend to the control of toxic substances (e.g. 1989 Basel Convention on hazardous wastes). Agenda 21 also refers to the safer use of toxic chemicals and the management of hazardous waste.

Indicators of environmental pressures: the large number of toxic substances necessitates a selection based on risk assessments and quantities of individual substances. To the extent that such selections already exist, they could be examined for their relevance to performance reviews. Two major types of toxic substances could be considered: heavy metals and organic compounds, including pesticides. Currently, no internationally agreed list of substances with appropriate weighting factors exists. Indicators relate therefore to the consumption of selected individual toxic substances. Among heavy metals, consumption of lead, cadmium, mercury and nickel can be traced. Among organic substances, the consumption of pesticides is a first step towards a more comprehensive indicator. It is, however, important to recognise the differences among pesticides concerning toxicity, persistence and mobility. A less direct but more readily measurable, indicator of potential toxic contamination is the generation of hazardous waste.
Data availability: data on the apparent consumption of pesticides (measured in tonnes of active ingredients) exist for a number of countries (Source: OECD) although problems of international comparability remain significant; there are data on the use of lead for many OECD countries (Source: OECD); information on the use of cadmium, mercury and nickel is more scattered. Data are available on the generation of hazardous waste (Source: OECD).

Indicators of environmental conditions: indicators concerning the condition of toxic contamination of the environment should show ambient concentrations of the various toxic substances in different environmental media and living species.
Data availability: short-run data availability confines empirical evaluations at the international level to indications of concentrations of key heavy metals in inland waters (Source: OECD).

Indicators of societal responses: many of society's responses concerning toxic contamination consist of regulations concerning notification, treatment and use of toxic substances. Typically, such responses are difficult to reflect in concise and internationally comparable indicators. A first choice to measure society's response are the changes in toxic contents of products and production processes, although such an indicator would need further elaboration. A more specific response concerning soil is society's actions and decisions to identify, assess and clean up contaminated sites. An associated indicator is the percentage of rehabilitated areas in the total area identified as contaminated. Another partial but measurable indicator is the market share of unleaded petrol.
Data availability: In the short run, only data the on market share of unleaded petrol are available.

Issue 6: Urban Environmental Quality

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Urban air emissions: SOx, NOx, VOC*	M
O Traffic density	S/M
O Degree of urbanisation	S/M
Environmental conditions:	
● *Exposure of population to:*	
-air pollutants	M
-noise	S
● *Ambient water conditions in urban areas*	M
O Concentration of air pollutants	S
Societal responses:	
O Changes in green space as a percentage of total urban area/total urban population	M/L
O Regulations on emissions and noise levels for new cars	M
O Expenditure on water treatment and noise abatement	S/M

Environmental concern and policy relevance: an increasing part of the population of OECD countries is living in urban areas. Most pollution sources are found in or near urban areas, and other forms of environmental degradation also tend to occur with greatest severity in urban areas. As a result of the combination of these factors, the greatest potential for human exposure to deteriorating environmental conditions occurs in urban areas.

The promotion of sustainable human settlements, in particular urban ones, is an item explicitly considered in Agenda 21.

Indicators of environmental pressures: in principle, most environmental pressures apply, although at an urban scale. As the first choice for indicators, it is proposed to focus on key environmental pressures, i.e., air emissions (NOx, SOx, particulates, CO) and noise. Noise, which can be considered both a pressure and a condition, is dealt with under environmental conditions. These proximate pressure indicators are accompanied by selected indicators of indirect pressures such as traffic density (measured e.g. through car holdings per capita) and the degree of urbanisation (measured e.g. through percentage of population living in cities with more than 1 million inhabitants).

Data availability: for emissions, data availability at the international level is constrained by the need to collect information at the urban level. Data on traffic density is readily available for country averages and for many individual cities (Source: OECD). Information on the degree of urbanisation can be obtained from other international sources.

Indicators of environmental conditions: indicators of urban environmental conditions cut across the various media. They include the quality of urban air, drinking water, ambient surface and ground water. Whereas the quality of drinking water is an important factor in the urban quality of life, it only partly reflects environmental conditions as high-quality tap water can simply reflect an efficient treatment system. First choice indicators of environmental conditions relate to the exposure of population to air pollution and to noise. The quality of ambient surface and ground water is also a first choice indicator. It reflects environmental conditions and, often, the pre-treatment quality of drinking water.

Data availability: internationally comparable data exist for concentrations of major air pollutants (Source: OECD) but information on exposure is more scattered. Additional efforts of data collection are also needed to obtain comprehensive information on ambient water quality in urban areas.

Indicators of societal responses: indicators of societal responses to urban environmental problems cut through the whole range of measures so that there is no single first choice indicator. Key areas for indicators are traffic (regulations on emissions and noise levels for new cars) and green space (with changes in green space compared to total urban area). Expenditure on noise abatement and water treatment complete the picture.

Data availability: due to definitional problems, data on green space is not available in an internationally comparable form. Information on car regulations and expenditure should be available with some additional effort.

Issues 7 and 8: Biological Diversity and Landscape

Summary of indicators

Indicator	Measurability
Environmental pressures:	
● ***Habitat alteration and conversion of land from its natural state***	L
○ Land use changes	S
○ Introduction of new genetic material and species	L
Environmental conditions:	
● ***Threatened or extinct species as a share of known species***	S
Societal responses:	
● ***Protected areas as a percentage of total area by ecosystem type***	S L
○ Protected species as a percentage of threatened species	M/L

Environmental concern and policy relevance: biological diversity can be defined as the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

The broad and complex nature of biodiversity would, ideally, suggest a treatment at three different levels:
a) the ecosystem level, dealing with the combination of physical and biological elements; b) the population or species level dealing with the change in the number of species due to alteration of living conditions by man; c) genetic diversity within species.

One of the major outcomes of the United Nations Conference on Environment and Development in 1992 was the signing of the Convention on Biological Diversity by over 150 governments.

Landscape: Specific types of human land use, such as certain agricultural practices, road and house building, hydropower projects, drainage of wetland, forestry and mining may pose a threat to ecosystems, and thus a form of environmental pressure on landscape. In addition, landscape can be seen as a part of environmental quality as such, important to humans for ethical, aesthetic and cultural reasons. Thus, degradation of landscape entails both a loss of naturalness and historic cultural values. So far, no internationally agreed definition of landscape exists and no attempt has been made to develop landscape indicators in this report.

Indicators of environmental pressures: three types of pressures on biodiversity have been identified: physical ones (e.g. habitat alteration); chemical ones (e.g. exposure to contaminants); biological ones (e.g. release of alien species, fishing). The main chemical pressures are covered by issue 3,4 and 5. Some of the biological pressures are captured in issues 10 and 11, some of the physical pressures appear, for example, in issue 13. Here, indicators are focused on additional physical and biological pressures. Indicators of habitat alteration and the conversion of land from its natural state would reflect such pressures. Increasing use of land for agricultural purposes is suggested as a measurable proxy for environmental pressure.
Data availability: there are internationally comparable data on land use changes (Source: FAO, OECD).

Indicators of environmental conditions: the most frequently used indicator of the state of biodiversity is the number of threatened or extinct species over the number of known species.
Data availability: International data exist for threatened or extinct species as a percentage of known species (Source: OECD).

Indicators of societal responses: responses to protect biodiversity and landscape include measures to protect areas, ecosystems and species and to create biosphere reserves representative of different ecosystems. The suggested indicators of societal responses are therefore the size of protected areas by type of ecosystem and the number of protected species.
Data availability: Information on the number and extent of protected areas is available (Source: IUCN) but comparability is not sufficient to provide coverage of different types of ecosystems. Data development work is also necessary to quantify the share of protected species.

Issue 9: Waste

Summary of indicators

Indicator	Measurability
Environmental pressures:	
● ***Waste generation:***	
– *municipal waste*	S
– *industrial waste*	S
– *nuclear waste*	S
– *hazardous waste*	S/M
Environmental conditions: Not applicable	
Societal responses:	
● ***Waste minimisation efforts***	L
O Charges for waste disposal	M
O Expenditure on waste collection and treatment	S
O Waste recycling and recovery rates	S

Environmental concern and policy relevance: different types and quantities of solid waste are generated by human activities in OECD countries: municipal waste (mainly from households), industrial waste, nuclear waste and other types including waste from energy production, agricultural production, mining, and demolition as well as dredge spoils and sewage sludge. The quantity of wastes produced in OECD countries has been steadily increasing. Wastes have potential impact on human health and the environment, and waste management issues are at the centre-stage of many countries' environmental concerns.

Several international agreements and rules exist for the transfrontier movements of hazardous waste: Directives of the European Community, OECD Decisions and Recommendations, the Lomé IV Convention and the Basel Convention. Management of solid waste and sewage is also an item explicitly considered in Agenda 21, endorsed by UNCED in Rio de Janeiro in 1992.

Indicators of environmental pressures: waste presents a potential environmental pressure for soil, water, air and landscape. The actual environmental pressure depends, however, almost exclusively on the waste handling and deposition practices. Any indicator on the amounts of waste generated is therefore only a first approximation of environmental pressure and more information will be needed on the actual environmental pressure. In addition, the composition of waste will influence its potential environmental impacts. Total amounts of waste generated should therefore be broken down by principal source, i.e., municipal, industrial and nuclear waste. It should be noted that the indicator on "generation of hazardous waste" is present both under the "waste" issue and the issue on toxic contamination.

Data availability: waste generation by major source can be evaluated for most OECD countries (Source: OECD). Many uncertainties concerning the quality of waste data and their international comparability do remain, however.

Indicators of environmental conditions: waste acts as a pressure on the environment; no indicators of environmental conditions can therefore be directly associated with the issue "waste". Changes in environmental conditions due to waste are reflected in various other issues such as toxic contamination (Issue 5) or landscape (Issue 7).

Indicators of societal responses: society's responses have been mainly directed towards the collection, treatment and disposal of waste. Increasingly, waste management efforts are aiming at waste minimisation. This is reflected in the first-choice indicator. Charges for waste disposal are an indicator for an instrument to incite waste minimisation. Total expenditure on waste collection, treatment and disposal provides a general indication of society's financial efforts to deal with waste. Indicators on rates of waste recycling and recovery and charges for waste disposal complete the picture.

Data availability: data on waste recycling and recovery are available at the international level (Source: OECD), although further efforts will be necessary to complete international coverage and comparability.

Issue 10: Water Resources

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Intensity of use of water resources*	S
○ Share of discharged waste water in rivers	M/L
Environmental conditions:	
● *Frequency, duration and extent of water shortages*	M
Societal responses:	
● *Water prices and user charges for waste water treatment as percentage of cost*	M

Environmental concern and policy relevance: fresh water resources are of major environmental and biological importance because water is a basic support element for human life and ecosystems. Water withdrawal can be a major pressure on freshwater resources: in more arid regions, water resources may at times be limited to an extent where the demand for public water supply, agricultural purposes or industrial processes can be met only by going beyond a sustainable use of the resource in terms of quantity and possibly of quality. Information available for OECD countries suggests that water withdrawal has increased over the past two decades, contributing both to quantity and quality problems of water supply. Although the quality and quantity aspects of freshwater resources are interlinked, the present issue deals primarily with the quantity aspect of the resource.

The protection and the preservation of fresh water resources is an item explicitly considered in Agenda 21, endorsed by UNCED in Rio de Janeiro in 1992.

Indicators of environmental pressures: a necessary condition for sustainable use of water resources is that the withdrawal of water does not exceed the renewal of the stocks over an extended period. An indicator tracing the intensity of the use of water resources is therefore the appropriate measure. This indicator would be defined as the (gross or net) withdrawal of water resources, divided by the renewal of water resources. As opposed to net withdrawal, gross withdrawal accounts for total water withdrawal without deducting water that is reinserted into the natural environment after use. Whereas the use of a figure representing net withdrawals focuses on the quantitative side of water use, the use of gross withdrawals has a qualitative component: even if water is reinserted into the natural environment, it tends to be of inferior quality after use.

At the same time, it must be kept in mind that a measure of intensity based on a national average may be misleading, in particular for large countries: major differences in regional water use may not be adequately reflected in the national indicator.

Data availability: information on the intensity of the use of water resources is available for most OECD countries (Source: OECD).

Indicators of environmental conditions: water resources are characterised by a significant variance of stocks, during different times of the year as well as between different years. These variations are likely to affect water quality and ecological equilibria. An indicator to measure these variations would take into account the duration and the extent of a shortage of water supply. At its extremes, in the form of droughts and floods, the question of regularity also presents a specific dimension of environmental risks.

Data availability: none of the indicators of environmental conditions are immediately available at international level.

Indicators of societal responses: society's efforts to reduce unsustainable water use consist of either measures constraining the quantities of water available or measures increasing the price of water to encourage efficient use. The price of water and the charges for waste water treatment are therefore proposed as suitable indicators. Put in relation to actual cost of water treatment and supply, the resulting ratio gives an indication of the direct accountability of consumers of water for the use of the natural resource.
Data availability: data on water prices and user charges are only partly available (Source: OECD) and need further development.

Issue 11: Forest Resources

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Short-run sustained yield/actual harvest*	S/M
Environmental conditions:	
● *Area/volume and distribution of forests*	S
O Share of disturbed/deteriorated forest in total forest area	M/L
Societal responses:	
O Percentage of harvest area successfully regenerated (incl. natural regeneration) or afforested	M/L
O Percentage of protected forest area in total forest area	M

Environmental concern and policy relevance: forests are among the most diverse and widespread ecosystems on earth. Forest resources have many functions: they provide timber; they provide ecosystem services including regulation of soil, air and water quality; they provide recreation benefits; they are a reservoir for biodiversity and act as a carbon sink. There is general concern over human impact on forest health and the natural processes of forest growth and regeneration.

Combatting deforestation to preserve soils, water, air and biological diversity is an item explicitly considered in Agenda 21, endorsed by UNCED in Rio de Janeiro in 1992.

Indicators of environmental pressures: the harvest rate set by any country is a function of the size of its forests, the proportion of the forest area dedicated to timber production, the productivity of the forest and the age class structure of the forest, and management objectives and sustained yield policies of the country. The indicator relating sustained yield to actual harvest expresses the relative balance between forest growth and harvest, considering forest characteristics such as age classes. The sustained yield in North America would reflect aggregate allowable annual cut, and in other OECD countries could reflect current growth rates or increments of forest estate.

Data availability: information on short run sustained yield is available for many OECD countries, or can be derived with standard formulas.

Indicators of environmental conditions: the state of forest resources can be represented through a measure of total forest area or volume. This information can be supplemented by more precise indicators incorporating species groups, maturity classes, and rates of disturbance by natural and anthropogenic forces such as forest fires.

Data availability: data on the area, volume and distribution of forests and the types of disturbance are readily available (Source: OECD/FAO/UN-ECE).

Indicators of societal responses: a major societal response to preserve forest resources relates to the efforts of regeneration and afforestation of harvested areas. The protection of forest areas is also an element in the overall conservation effort although it applies at least equally to concerns about the loss of biodiversity.

Data availability: data on total protected forest areas are available for a significant number of countries, although a breakdown by IUCN category necessitates additional data development work. Similarly, more data development is needed before efforts of regeneration and afforestation can be presented in an internationally comparable way.

Issue 12: Fish Resources

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Fish catches*	S
Environmental conditions:	
● *Size of spawning stocks*	M
O Overfished areas	M/L
Societal responses:	
O Number of stocks regulated by quotas	M
O Expenditure for fish stock monitoring	M/L

Environmental concern and policy relevance: by the end of the 1980s, marine fisheries yielded between 80 and 90 million tonnes of fish, with an overall trend that has been increasing by over 40 percent during the past two decades. Many of the more valuable fish stocks are overfished, and the steady trend towards increased global fish landings is achieved partly through exploitation of new and/or less valuable species. Coastal development has also turned out to be a significant pressure on fish stocks. Over-exploitation can be found both with freshwater and marine fish stocks. As with other natural resources, the quality of fish resources (existence of diseases, contamination etc.) is in itself an important factor for the quantity of the resources. The current issue on fish resources focuses on marine fish resources but extends to freshwater fish resources. Stocks associated with aquaculture are, however, explicitly excluded from current considerations.

The protection and sustainable management of oceans to prevent over-fishing and degradation of coastlines and coral reefs are items explicitly considered in Agenda 21, endorsed by UNCED in Rio de Janeiro in 1992. In addition, there are a number of international agreements such as those reached under the Northwest Atlantic Fisheries Organization.

Indicators of environmental pressures: OECD countries play an important role in world fisheries and the trend in national fish catches is a primary indicator for the pressure exerted on fish stocks. As it is difficult to allocate fish stocks to national boundaries, it is not possible to calculate ratios of sustainable use (fish catches over growth of stock) on a national basis. Nonetheless fisheries and environment remain relevant topics for environmental performance reviews. Where national quotas exist, fish catches can be related to them to get an indicator of potential over-exploitation.

Data availability: fish catches and production data are available at significant detail and for most OECD countries (Source: OECD/FAO).

Indicators of environmental conditions: the size of spawning stocks is a relevant indicator for environmental conditions if it can be related to a measure of sustainability. Defining and measuring sustainability remains, however, a difficult task. A different indicator would present overfished areas, although this indicator needs further elaboration. Again, it is difficult to associate fish stocks with a particular country.

Data availability: data on the size of major fish populations exist but are scattered across national and international sources.

Indicators of societal responses: a comprehensive indicator for countries' efforts to protect fish stocks would include information on the various types of expenditure for this purpose as well as information on restrictions on landings of fish. Supplementary indicators for societal responses include expenditure for the monitoring of fish stocks. Other responses such as the use of environmentally friendly fish-catching methods are important but difficult to make operational in a single indicator.

Data availability: no data are readily available on the expenditure for the protection of fish stocks.

Issue 13: Soil Degradation (Erosion and Desertification)

Summary of indicators

Indicator	Measurability
Environmental pressures:	
● *Erosion risk: potential and actual use of soil for agriculture*	L
O Land use changes	S
Environmental conditions:	
● *Degree of top soil losses*	M
Societal responses:	
● *Rehabilitated areas*	M/L

Environmental concern and policy relevance: desertification and erosion are processes of physical land degradation caused by human impact and by changes in climate. Soil erosion arises when the rate of new soil formation is inferior to soil losses. When soil quality and moisture content decline, a productive semi-arid region can be converted into a desert, a process known as desertification. The environmental problems of erosion and desertification are large. Seventy percent of the world's drylands are already affected by degradation. This is one quarter of the world's land. Although the problem is most severe in the developing world, a number of OECD countries are equally affected. Soil degradation is not limited to physical degradation but encompasses problems such as toxic contamination, excess nutrients, salinisation and acidification. These problems of soil quality are dealt with under the respective issues.

The promotion of sustainable land management practices to prevent erosion and soil degradation as well as combatting desertification and drought are two prominent items in Agenda 21, endorsed by UNCED in Rio de Janeiro in 1992.

Indicators of environmental pressures: primary factors in erosion and desertification are unsustainable land use, including farming and grazing. Land use changes as for instance from forest to agriculture, could therefore be a meaningful, though general, indicator for the danger of erosion and desertification. A more specific indicator would be the comparison between potential and actual use of land for agricultural purposes. To the extent that the actual use of land for agriculture exceeds the carrying capacity of land, this provides an indication for the risk of erosion and soil degradation.

Data availability: data on the actual use of land are available throughout OECD countries (Source: OECD). Information on the risk of erosion and on potential use of land is still very scarce and does not permit indicator development in the short run.

Indicators of environmental conditions: the degree and extent of erosion is best indicated through the degree and extent of top soil losses, terrain deformation and overblowing.

Data availability: at present, data on the degree and extent of soil degradation are available but not at a national level (WRI, International Soil Reference and Information Centre).

Indicators of societal responses: it is difficult to pinpoint all specific efforts to combat erosion and desertification. One relevant and measurable effort to counter soil degradation is the size of rehabilitated areas; it is suggested as a first-choice and though general indicator in this context which would need further specification. Indicators could also be developed related to best management practices in agriculture.

Data availability: data on rehabilitated areas are at present not available at the international level.

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General Indicators, Not Attributable to Specific Issues

Summary of Indicators

Indicator	Measurability
Environmental pressures:	
● *Population growth and density*	S
● *GDP growth*	S
● *Industrial production*	S
● *Energy supply*	
● *Structure of energy supply*	S
● *Road traffic volumes*	S
● *Road vehicle stock*	
● *Agricultural production*	S
Societal responses:	
● *Environmental expenditure*	M
● *Public opinion*	S
O Pollution abatement and control expenditure	S

Indicators of environmental pressures: general indicators of environmental pressures consist mainly of indicators of indirect pressures (background indicators). The indicators presented here are the ones most commonly used and readily available at the international level. The main function of these indicators is to provide contextual information – a key feature of environmental performance reviews. Achievements in pollution reduction, for example, must be seen in the context of economic growth: assessments will differ when reductions in pollution are achieved during periods of weak or declining economic activity rather than during phases of strong economic growth.

Data availability: most data for these indicators are accessible without difficulty for a large number of OECD countries.

Indicators of societal responses: two major general indicators of societal responses are suggested: a) environmental expenditure at the national level and for broad economic sectors (public sector, business sector, households): although expenditure, when considered by itself, does not provide any information on the state of the environment, it is a useful indicator for the financial efforts undertaken by society to mitigate or abate pollution; b) public opinion on environmental issues: this indicator aims at capturing one of the major factors in triggering societal responses by government, business and households. A third, more general, area suggested for indicator development is environmental information: examples of these societal responses are the introduction of eco-labels or regular reports on the state of the environment.

Data availability: many OECD countries collect data on environmental expenditure, although they are often limited to pollution abatement and control activities. Such data have been compiled by OECD. Similarly, information on public opinion in Member countries is available from OECD. At OECD level, no comprehensive and internationally comparable information exists currently as to the use of eco-labels.

Figure 5 Summary of Short-Term Indicators[a] by Environmental Issue[b]

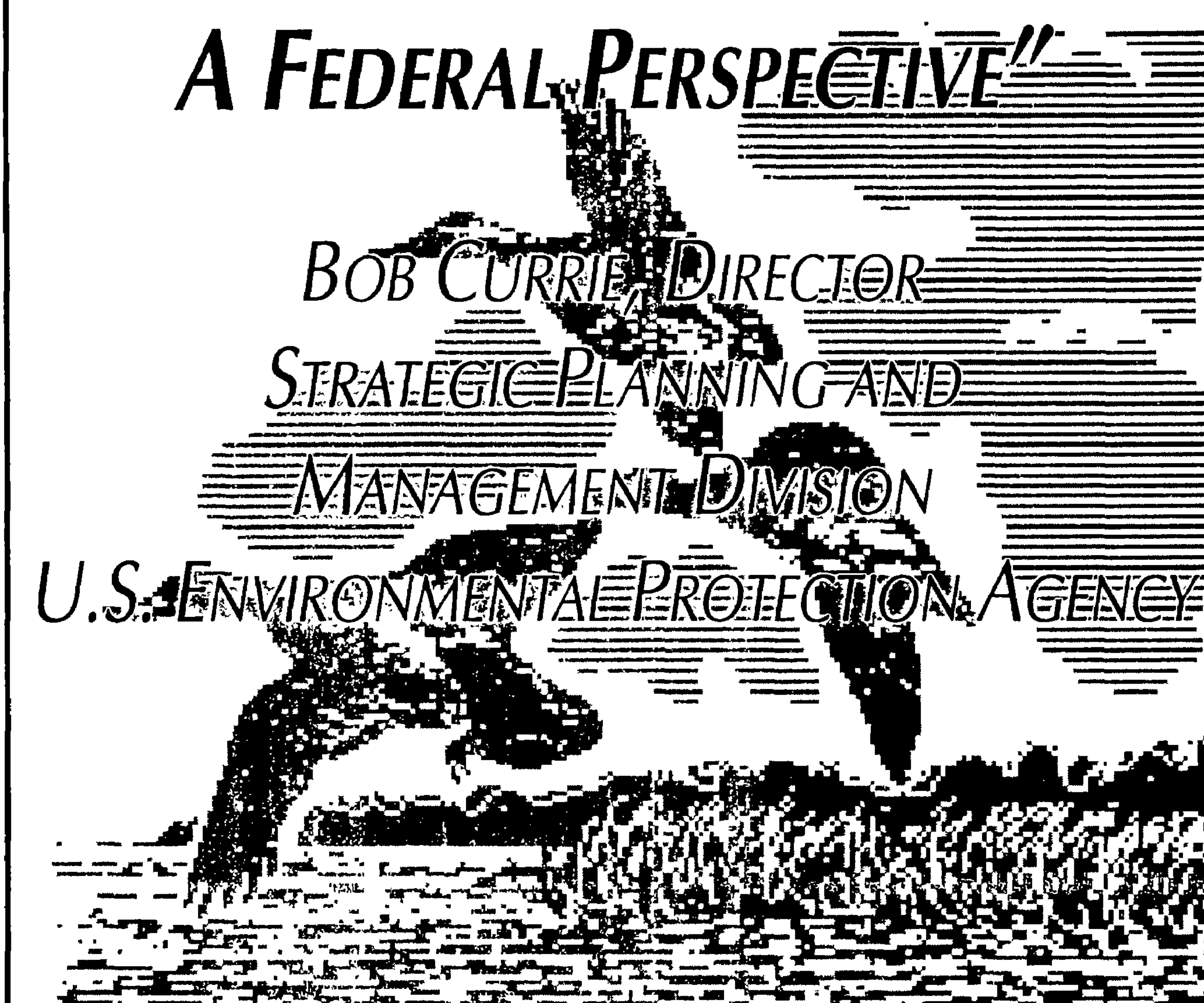
Issues	PRESSURE Indicators of environmental pressures	STATE Indicators of environmental conditions	RESPONSE Indicators of societal responses
1. Climate change	Emissions of CO_2	Atmospheric concentrations of greenhouse gases Global mean temperature	Energy intensity
2. Stratospheric ozone depletion	Apparent consumption of CFCs	Atmospheric concentration of CFCs	
3. Eutrophication	Apparent consumption of fertilizers, measured in N,P	BOD, DO, N and P in selected rivers	% of population connected to waste water treatment plants
4. Acidification	Emissions of SOx and NOx	Concentrations in acid precipitations (pH, SO_4, NO_3)	Expenditure for air pollution abatement
5. Toxic contamination	Generation of hazardous waste	Concentration of lead, cadmium, chromium, copper in selected rivers	Market share of unleaded petrol
6. Urban environmental quality		Concentrations of SO_2, NO_x, particulates in selected cities	
7&8 Biological diversity and landscape	Land use changes	Threatened or extinct species as % of known species	Protected areas as % of total area
9. Waste	Generation of municipal, industrial, nuclear, hazardous waste	not applicable	Expenditure on waste collection and treatment Waste recycling rates (paper and glass)
10. Water resources	Intensity of use of water resources		
11. Forest resources		Area, volume and distribution of forests	
12 Fish resources	Fish catches		
13. Soil degradation (desertification and erosion)	Land use changes		
14. General indicators, not attributable to specific issues	Population growth and density GDP growth Industrial and agric. production Energy supply and structure Road traffic and vehicle stock	not applicable	Pollution abatement and control expenditure Public opinion on the environment

a) Only indicators which are available in the short term at international level are shown in this table. See Chapter 3 for other indicators. This table identifies key elements of indicators: at this point, no normalisation with respect to GDP, population, etc. is suggested. See Chapter 3 on use of indicators for a discussion.

b) For a brief discussion of each individual issue, see Chapter 3.

5

PRESENTATION OVERHEADS FROM "HOW DOES IT ALL FIT: *A FEDERAL PERSPECTIVE*"



BOB CURRIE, DIRECTOR
STRATEGIC PLANNING AND MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

National Meeting on Environmental Indicators

New Orleans, Louisiana
February 2-4, 1994

What Progress Has Been Made

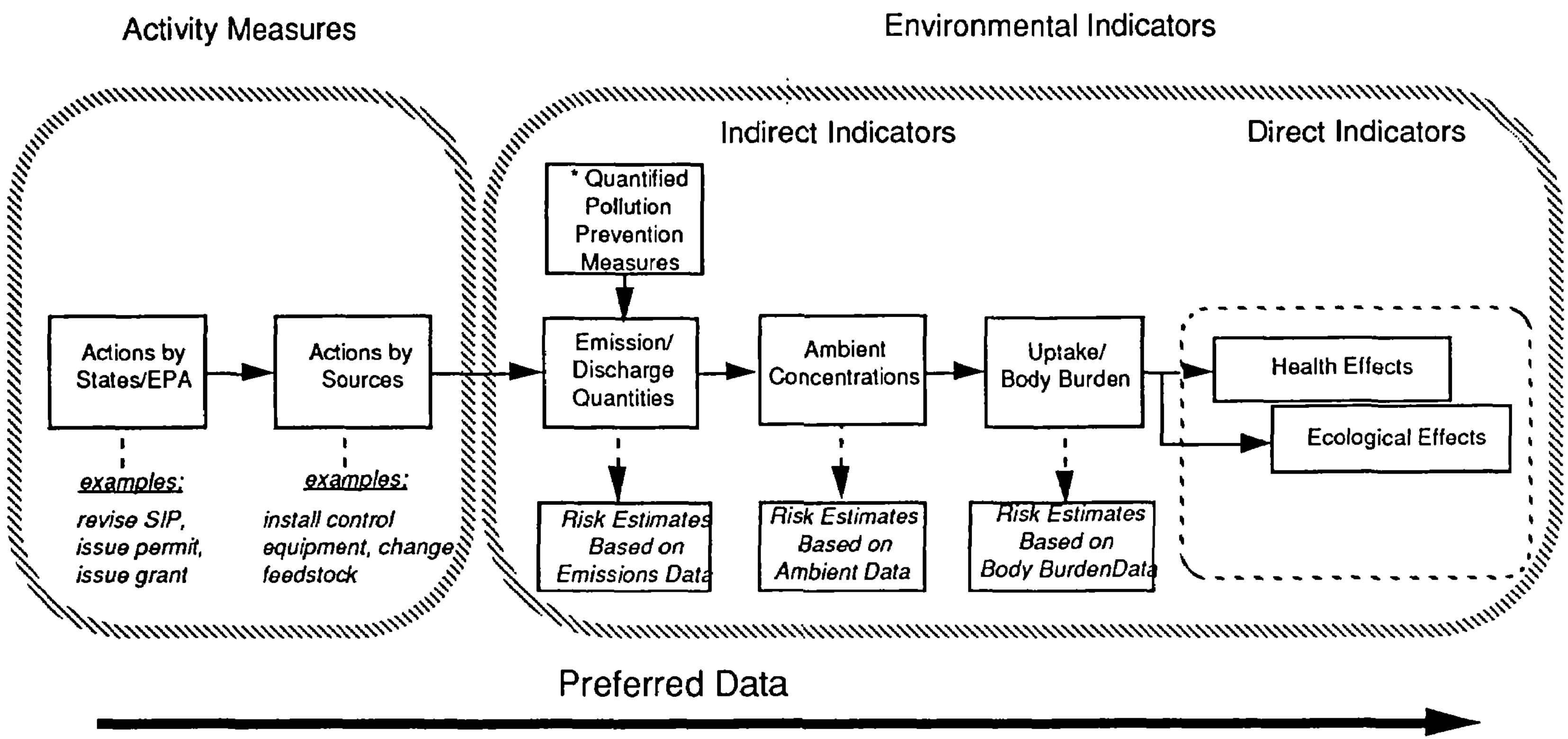
Environmental Indicators Have Been Important Tools For Several Decades

- Simple - Visibility, Noise, Fish Kills, Burning Rivers
- Improved - Criteria Air, Water Chemistry
- New Directions - Biological Diversity, Health and Ecological Effects

Increasing Capability To Define Environmental Status

- Parts per trillion
- Land cover
- Watersheds
- River reach
- Per Capita
- Loadings
- Biological Survey
- OECD Country Survey

A Continuum Of Information Available



Activity Measures and Environmental Indictors are both Important

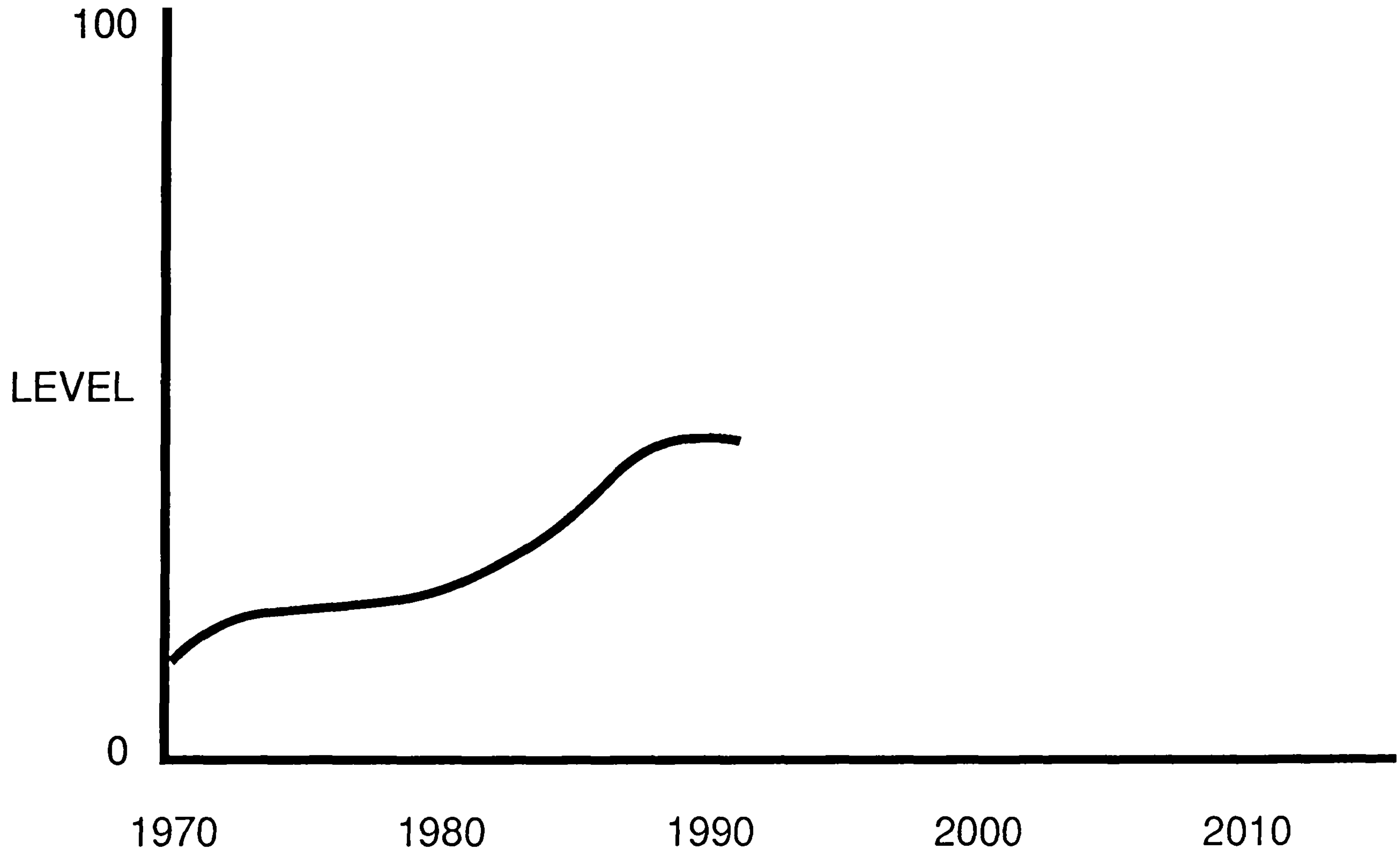
General Agreement

Environmental Indicators Are Critical Tools

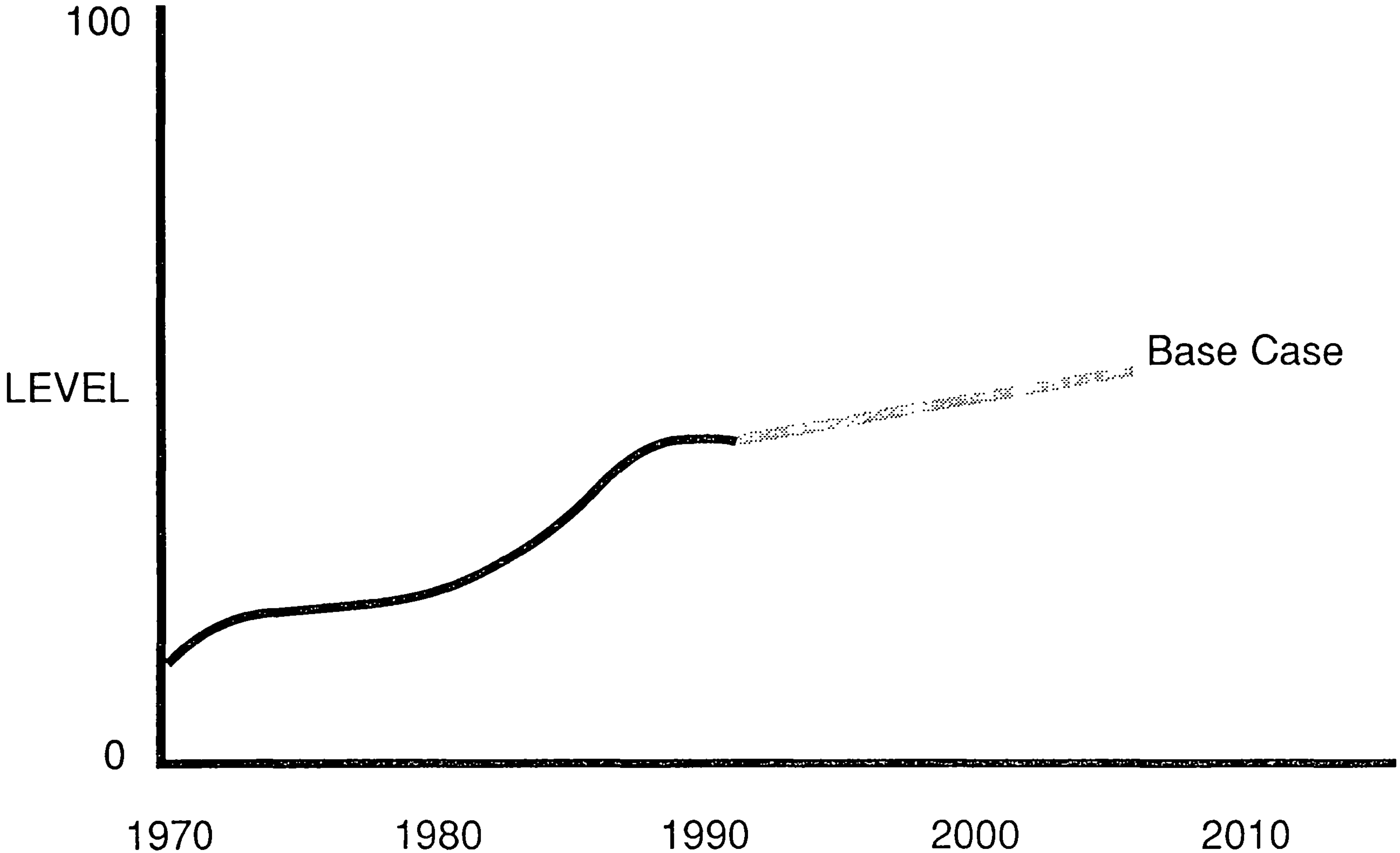
- Identification of Problems
- Measuring Status and Trends
- Geographic Targeting
- Resource Allocation ---------Planning
- Communication --Up, Down, and Sideways
- Assessing Strategy Effectiveness
- Selecting Between Alternative Strategies
- Setting Environmental Goals

and Measuring Environmental Progress

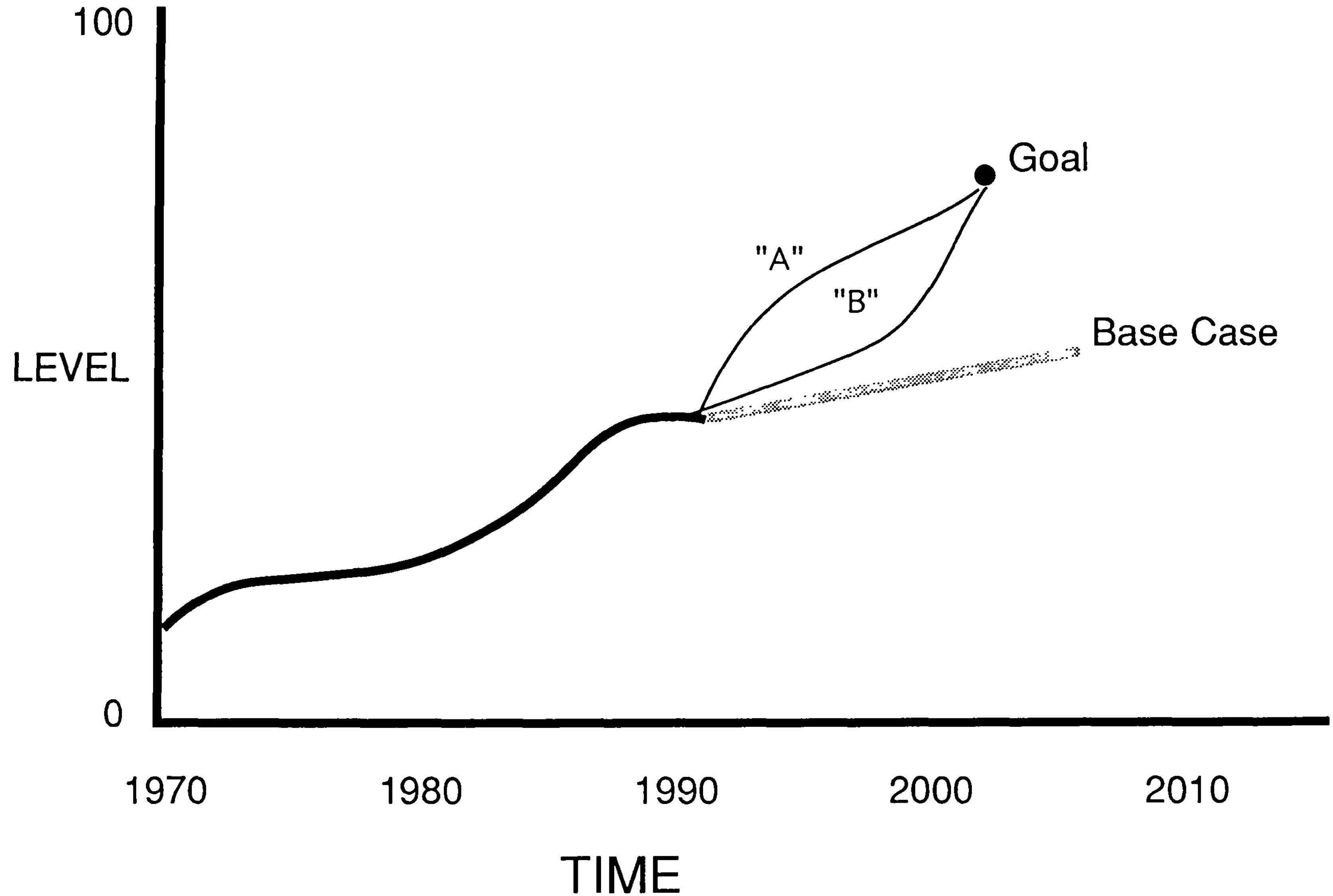
Status And Trends



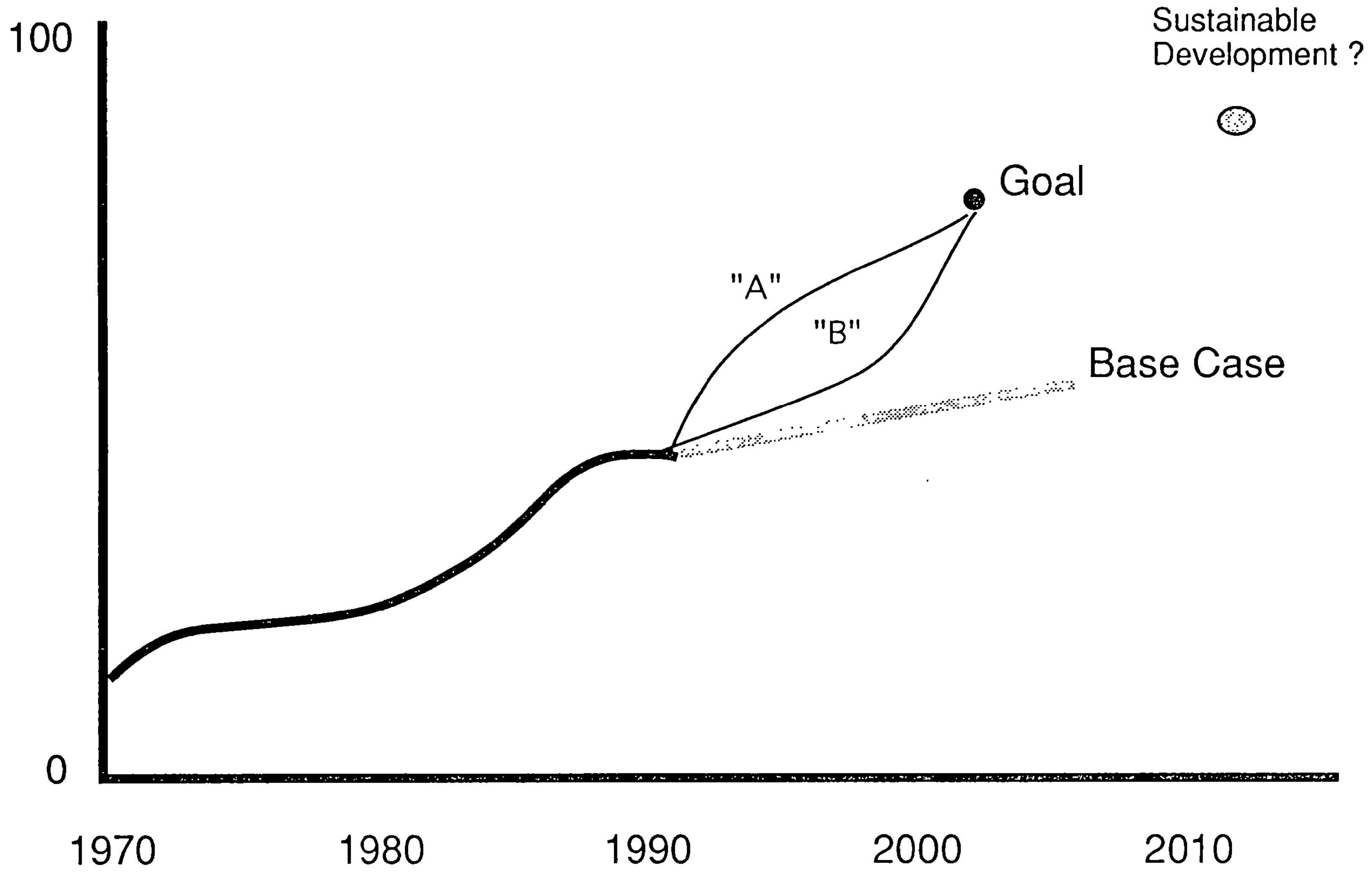
Projecting Future Trends



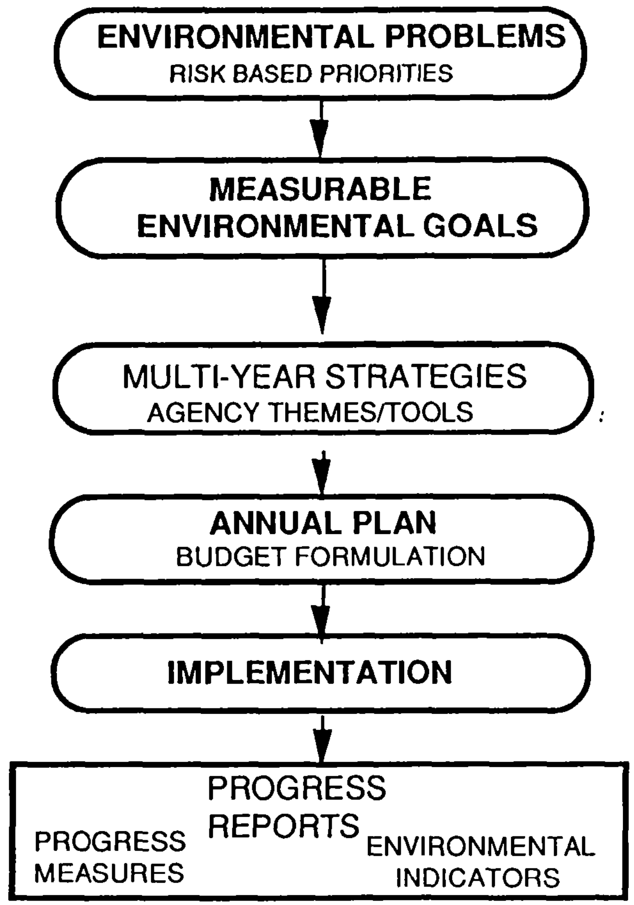
Progress Towards Goals And Selection Of Strategies



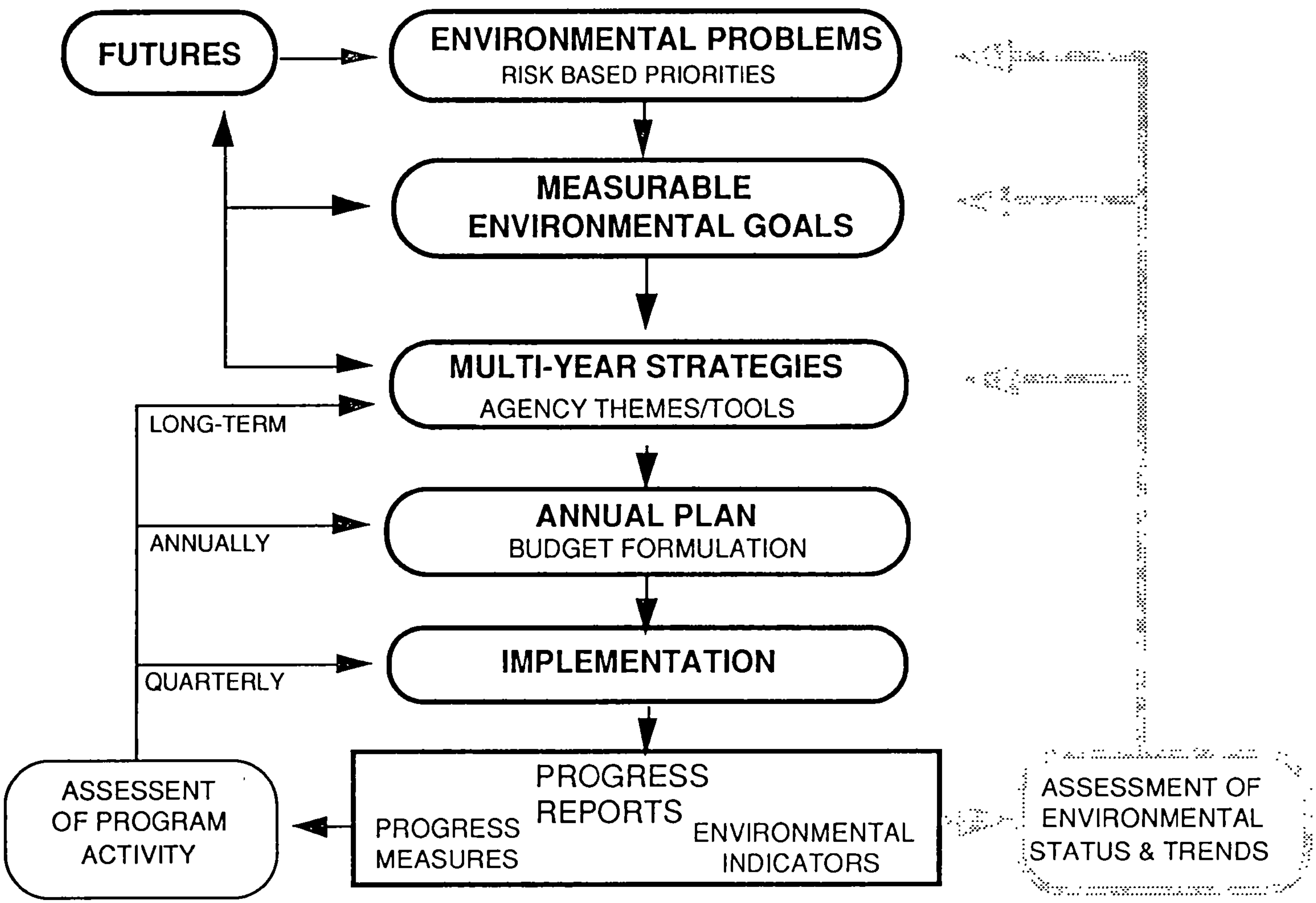
Moving Towards Sustainable Development



There Is A "Model" For Putting It All Together



It Is Only A Model If We Don't Make It Run



Questions We Need To Address

Where are we going?

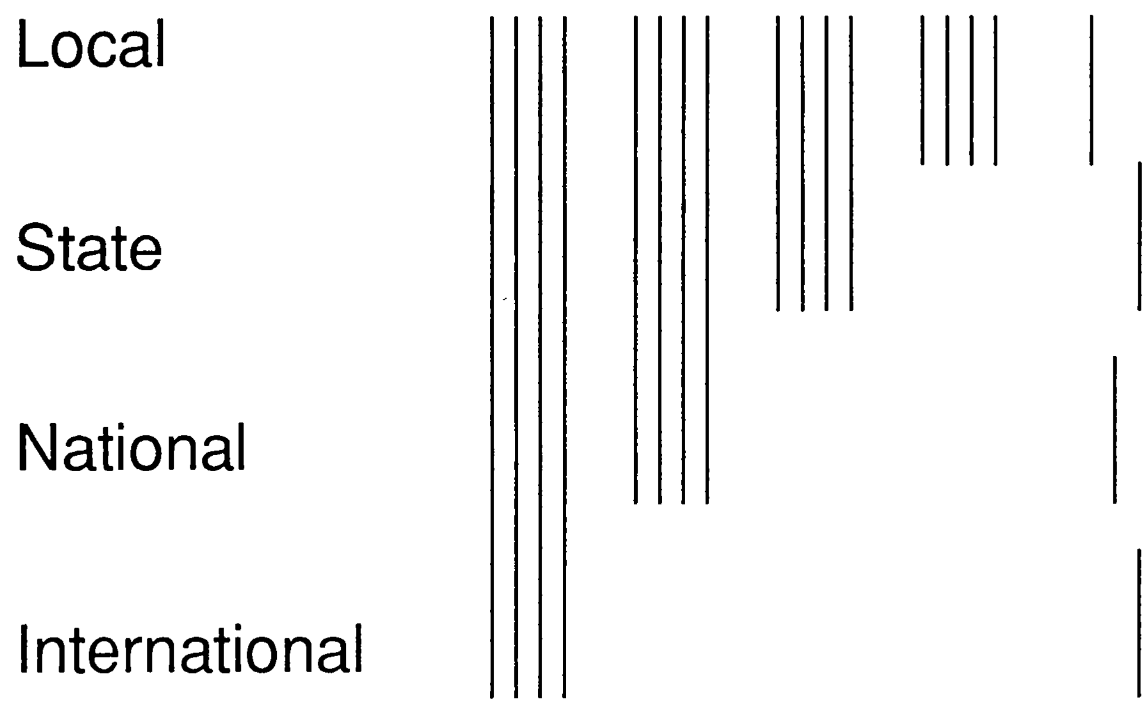
Where have we been?

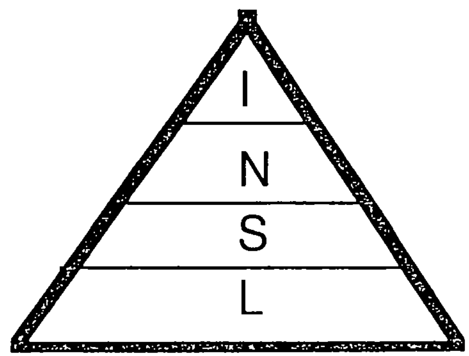
How well are we doing compared to--------------?

Are there other factors that are causing changes?

What is the "appropriate" environmental indicator?

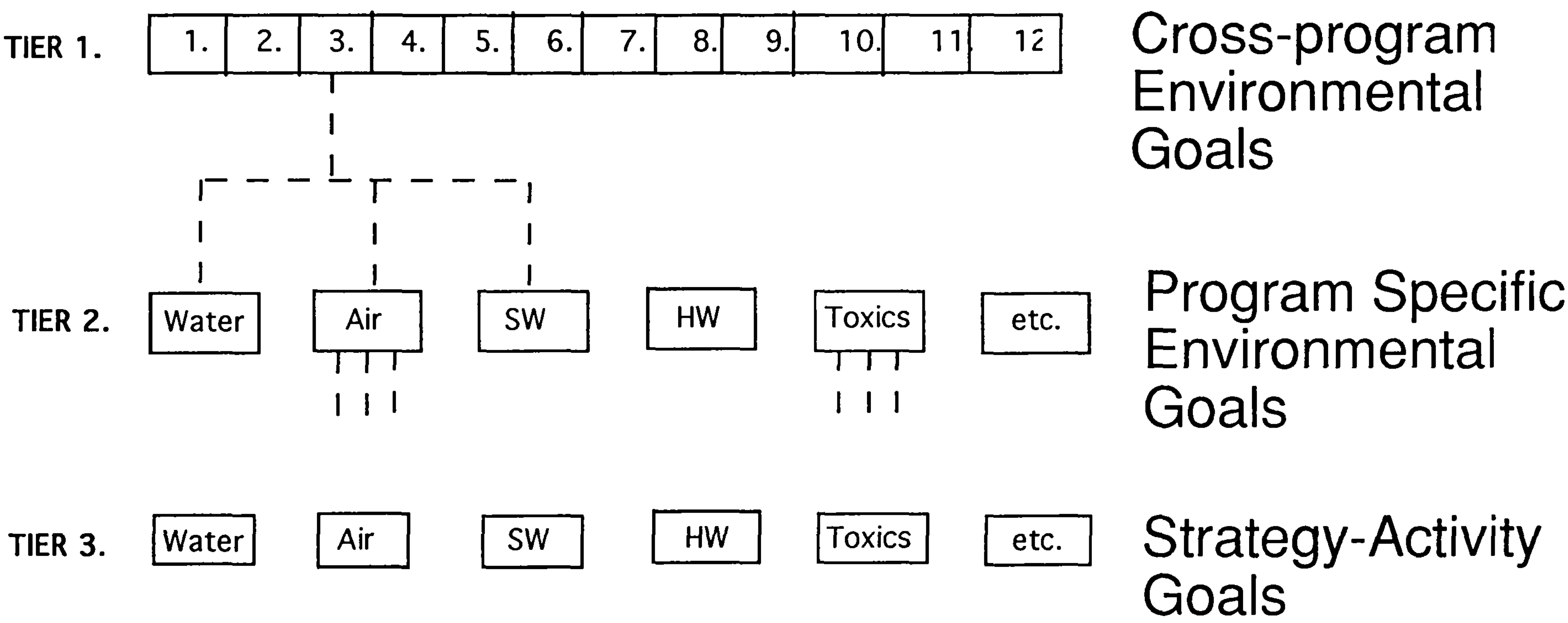
Is There A Concept Of Core Data ?





Different Levels Of Goals Need To Be Considered

Hierachy of Environmental Goals



EPA Project To Set National Environmental Goals

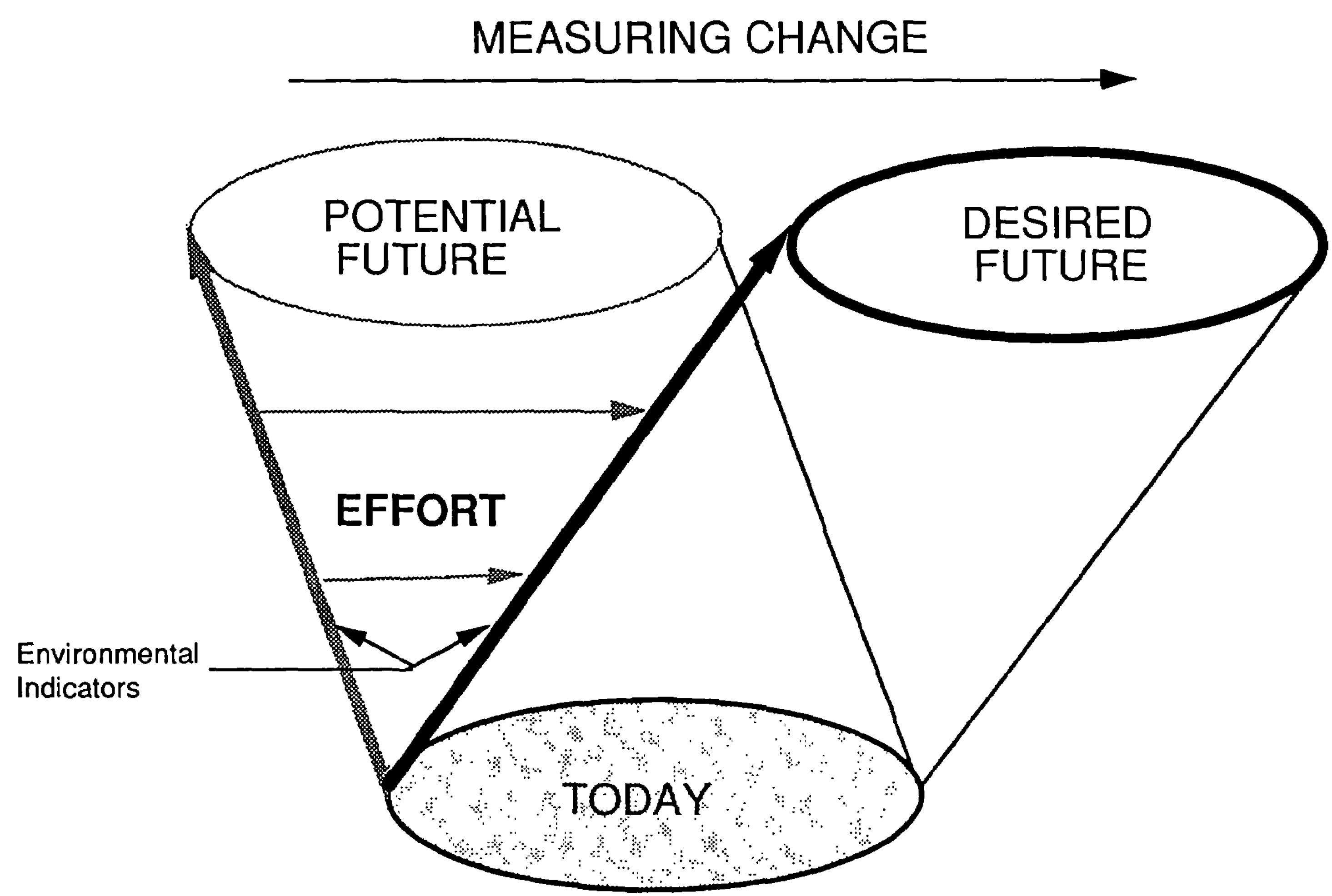
- Have begun to hold public meetings in each of the 10 regions.
- State, industy and NGOs will be part of the process.
- First round, identify the issues.
- Second round discuss MEASURABLE environmental goals.

  Costs, strategies, and agencies part of the discussion

- Process needs to proceed at a regional and state level.

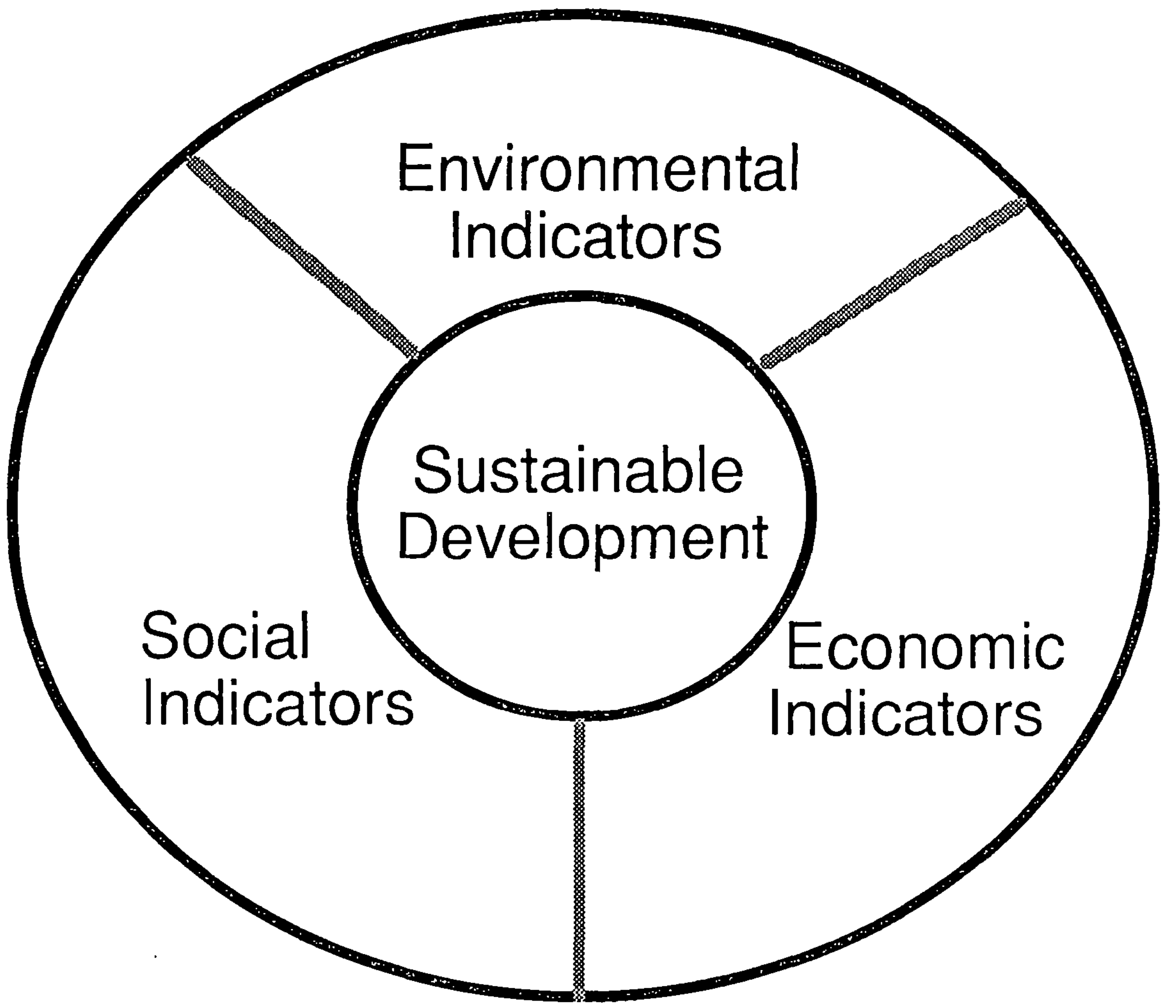
A critical process to provide a focus for indicator selection.

Looking At The Future



5-15

Broadening The Range Of Indicator Analysis



Significant Challenges Still Remain

What are the possible set of environmental indicators we all can use?

How can they be best collected?

How should data be displayed -- issues of aggregation?

What are the barriers that need to be addressed?

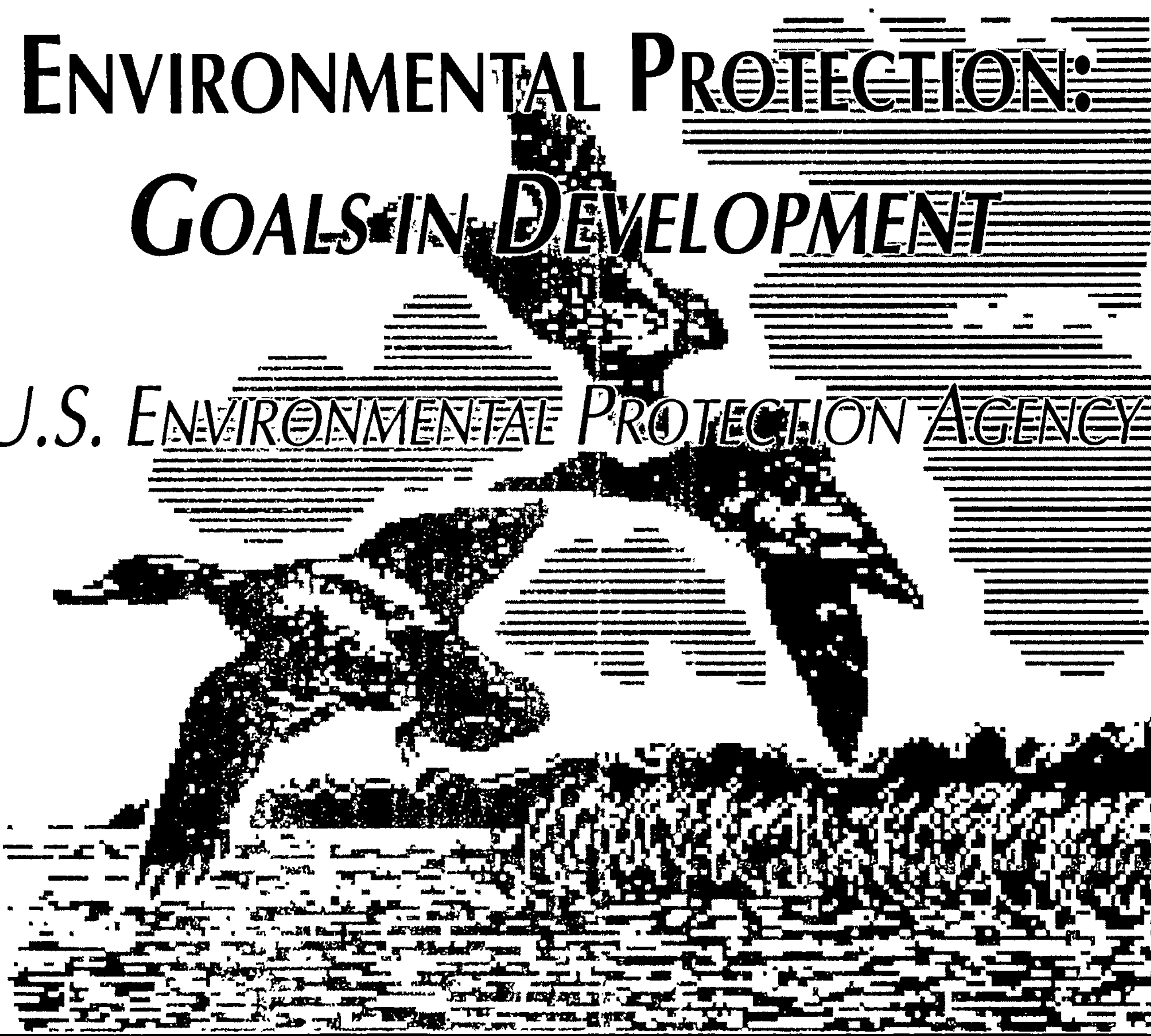
Is there a role for state, regional, and national "environmental report cards"?

Where do we need to go over the next year?

6

SETTING NATIONAL GOALS FOR ENVIRONMENTAL PROTECTION: *GOALS IN DEVELOPMENT*

U.S. ENVIRONMENTAL PROTECTION AGENCY



SETTING NATIONAL GOALS
FOR
ENVIRONMENTAL PROTECTION

Goals in Development -- For Public Review and Discussion

United States Environmental Protection Agency

January 12, 1994

Contents

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13 Improved Understanding of the Environment 29

Introduction

By launching the National Environmental Goals Project, the Environmental Protection Agency has signalled its commitment to action and accountability on behalf of our shared environment.

The project is designed to produce by Earth Day in April 1995 a set of ambitious, realistic and measurable environmental goals to be achieved by early in the next century. Administrator Carol Browner has made successful completion of this task a top priority because she believes that government action must be linked to measurable indicators of environmental improvement, and that setting goals will inspire cooperation and action by all Americans.

Environmental goals must not only be grounded in the best science and analysis available, but should also reflect the visions, hopes and expectations of all the nation's citizens and organizations. What are our most important problems, and what are we willing to do to resolve them?

To generate broad national input into the process, EPA is sponsoring a series of public meetings around the country in the first half of 1994. Then, between June 1994 and April 1995, goals will be developed, reviewed by the public in a second round of meetings, finalized and released. This report is intended to provide a starting point for our engagement with the public about what our goals might look like.

The federal government is not alone in this endeavor. A number of states are also developing environmental goals. At the 1992 U.N. Conference on Environment and Development, the community of nations agreed to develop goals and plans for sustainable development, and Canada, Norway, New Zealand, the Netherlands, and several other countries are already well along in that process. The Clinton Administration is committed to learning from these efforts and moving forward to fashion an agenda for our nation's environmental future. This project is the first step in that process.

Because EPA shares responsibility for environmental protection with other federal, state and local government agencies, we are seeking their participation. The goals will not be limited to any agency's statutory obligations. Indeed, the goal-setting process should help us assess the adequacy of our statutes and regulations for sustainable development, and it will provide a more coherent basis for conducting a results-oriented dialogue with the Congress.

The project is being coordinated with the President's Council on Sustainable Development to ensure that the goals announced on Earth Day 1995 reflect America's expectations for *both* a healthy environment and a vibrant economy.

Ultimately, the goals will contain three "tiers" of measurable targets. Insofar as possible, Tier 1 goals will specify a condition of the environment the nation is seeking to achieve by a certain year. Tier 2 objectives will specify reductions in pollutant loadings or other source-related causes that must be achieved to reach a Tier 1 goal. Tier 3 "action targets" will identify the specific work that EPA and others must complete to accomplish the overall goal.

The three tiers of goals will provide direction for the design of more effective, efficient government and private programs to fulfill national priorities. They will improve communication between the Executive branch, the Congress, businesses, environmental advocates, the public and other nations about what our environmental policies are designed to accomplish, what kinds of choices we are making, and whether our strategies are working. The goals, together with our Congressional mandates, will "drive" EPA's planning, management and budgeting.

This report. To help get the public dialogue going, EPA drafted goal statements for thirteen environmental issues we judge to be of paramount national importance, and for which EPA has significant federal responsibility. They include: clean surface waters, clean air and healthy ecosystems; global climate change and stratospheric ozone depletion; cleanup and prevention of wastes and other toxic contaminants; safe food, drinking water, indoor air and workplaces; and better environmental information for everyone.

The draft goals and accompanying information are presented on the following pages. We may add or delete goal topics after the public disussions and interagency deliberations. For example, should we have a separate goal for conservation of water and other natural resources that could be achieved through recycling and waste minimization?

The goal statements are unfinished -- they are intended to represent the kind of "outcome" goals we want to develop. As you will see, many of them do not yet contain explicit measurable targets. We will prepare more precise targets as we proceed. EPA is looking forward to your help in developing them.

Guiding Principles for EPA

One	**Ecosystem protection** and **sustainable development** go hand-in-hand. The point is not to choose between environmental and economic or social goals, but to practice all forms of enterprise in ways that remain environmentally supportable over time.
Two	**Environmental justice** is a foremost national value. The distribution of environmental risk is important as well as its level. No specific group should be more at risk or environmentally constrained than are other groups due to factors beyond their control.
Three	**Pollution prevention** is the preferred approach to environmental protection. It is generally less expensive and complex than is treatment or cleanup. Preventive behavior on the part of citizens is as much a key to environmental health as it is to medical health. In the prevention mode, EPA is as much an enabler as an enforcer.
Four	The **full use of science** in making strategic decisions for environmental protection is essential. Science must be viewed as an impartial resource, and the use of existing data is important as well as the generation of new information. Research need not achieve certainty to be useful.
Five	**Building partnerships** among all agencies and levels of government and between public and private groups is essential to achievement of a healthy environment. Partnerships should go beyond cooperation and coordination to collaboration -- to yield programs and results that individual groups cannot by themselves achieve.
Six	An **outcome orientation** has more value to achieving goals than procedural compliance. The question is not how many permits we have issued, fines levied, or brochures printed. The point is whether our air, water and land are getting and staying cleaner.

Goals in the Laws Administered by EPA

Thirteen major statutes form the legal basis for the programs of the Environmental Protection Agency. Several of them contain explicit environmental goals.

- The Pollution Prevention Act states that it is the policy of the United States that "pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner." *No environmental goals.*

- The Clean Air Act gives states *specific deadlines for meeting the air quality standard (up to 20 years (or 2010) for ozone in Los Angeles) and requires states and the Federal government to make constant progress in reducing emissions.* It requires technology controls on air toxics to be achieved within 10 years of enactment (2000). It requires *a permanent 10 million ton reduction in sulfur dioxide emissions from 1980 levels and a 2 million ton reduction in nitrogen oxides from 1980 levels.* It establishes dates for phasing out ozone-depleting substances: *2000 for CFCs, halon and carbon tetrachloride; 2002 for methyl chloroform; 2030 for HCFCs.*

- The Clean Water Act. *"The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective...*
  (1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;
  (2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;
  (3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited..."

- The Ocean Dumping Act declares that "it is the policy of the United States to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." *No environmental goals.*

- The Safe Drinking Water Act directs EPA to develop national drinking water regulations for public water systems, underground injection control regulations to protect underground sources of drinking water, and groundwater protection grant programs for the administration of sole-source aquifer demonstration projects and for wellhead protection programs. *No environmental goals.*

- The Solid Waste Disposal Act and Resource Conservation and Recovery Act. "The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment." *No environmental goals.*

- The Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites. The 1986 amendments to the Superfund law required EPA to begin physical, on-site cleanup of at least 175 new (after 1986) sites by 1989, and at another 200 sites within the following two years. There are no deadlines for finishing this work. *No environmental goals.*

- The Emergency Planning and Community Right-to-Know Act requires local planning to cope with chemical emergencies and ensures that responsible officials are provided with information from local businesses about their activities involving hazardous chemicals. The Act mandates the development of a national inventory of releases of toxic chemicals from manufacturing facilities. The purpose of the Toxics Release Inventory is to provide information to the general public about chemicals to which they may be exposed. *No environmental goals, although EPA uses the TRI to implement its "33/50 Program," in which industry is challenged to voluntarily reduce releases and transfers of 17 high priority chemicals by 33% by 1992 and by 50% by 1995.*

- The Toxics Substances Control Act states that "authority over chemical substances and mixtures should be exercised in such a manner as not to impede unduly or create unnecessary economic barriers to technological innovation while fulfilling the primary purpose of this Act to assure that such innovation and commerce in such chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment." *No environmental goals.*

- The Federal Insecticide, Fungicide, and Rodenticide Act was enacted by Congress "to regulate the marketing of economic poisons and devices, and for other purposes." *No environmental goals.*

- The Environmental Research, Development, and Demonstration Authorization Act authorizes all EPA's research and development programs. *No environmental goals.*

- The National Environmental Education Act. The stated policy is "to establish and support a program of education on the environment...through activities in schools, institutions of higher education and related educational activities, and to encourage postsecondary students to pursue careers related to the environment." *No environmental goals.*

- The National Environmental Policy Act. The purposes are: "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality...It is the continuing responsibility of the Federal Government...to improve and coordinate Federal plans, functions, programs, and resources *to the end that the Nation may--*

  (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

  (2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

  (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

  (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

  (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

  (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

1 Clean Surface Waters

Goal

All the lakes, rivers and bays of the United States will be clean and safe for human recreation and they will support healthy and edible fish, shellfish and wildlife. By ____, at least X percent of the surface waters of the United States will fully meet standards set by the states to protect aquatic life and human health. *(For drinking water, see goal #10)*

Background

States roughly estimate that well over half of the lakes, rivers and coastal waters that they assessed in 1991-92 fully met their "fishable and swimmable" standards.

Pollution enters the nation's waters from point sources, nonpoint sources and air deposition. Point sources are distinct "points" of concentrated pollution, such as pipes from factories and sewage plants, which may contain toxic substances, bacteria, viruses, acids, oxygen-demanding compounds, and nutrients.

Pollutants carried in runoff from "nonpoint sources" account for more of the nation's remaining water quality problems than point sources. Rainwater carries sediment, animal wastes, and agricultural chemicals from farms, cities and suburbs, highways, construction sites and logged areas into nearby streams. Agriculture is the most commonly reported nonpoint source category.

Another source of water pollution is polluted air -- for example, acid rain. Toxic substances, nutrients and oxygen-demanding compounds may also enter the water from the air. Principal sources of air-deposited pollutants are power plants, industrial facilities, motor vehicles, and windblown chemicals from farms.

EPA's Roles

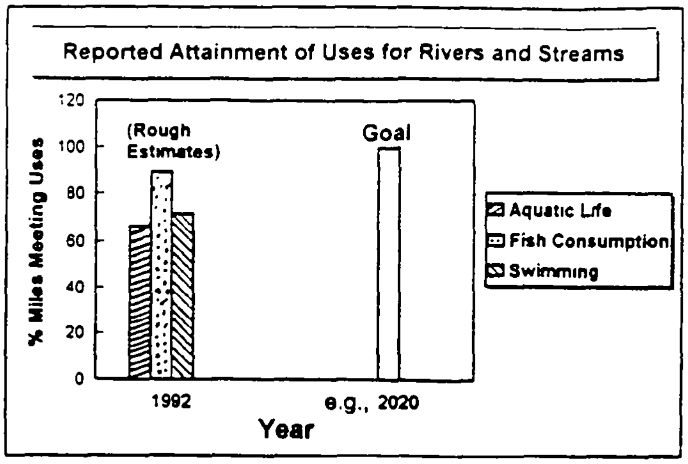
Under the Clean Water Act, EPA works with states and municipalities to control all types of water pollution. In most cases, states determine the "designated uses" of their waters (usually swimming, habitat for fish and other aquatic life, or agricultural and industrial uses) and set water quality standards to protect these uses. EPA regulates (or gives authority to states to regulate) the amount of pollution that point sources can discharge. EPA provides scientific criteria for these limits, backs up states with inspections and legal enforcement, and helps fund state and municipal water quality programs, including sewage treatment plant construction. To reduce pollution from nonpoint sources, EPA provides grants and loans through states to farmers, municipalities and others to facilitate their adoption of "best management practices" to control the runoff of pollutants.

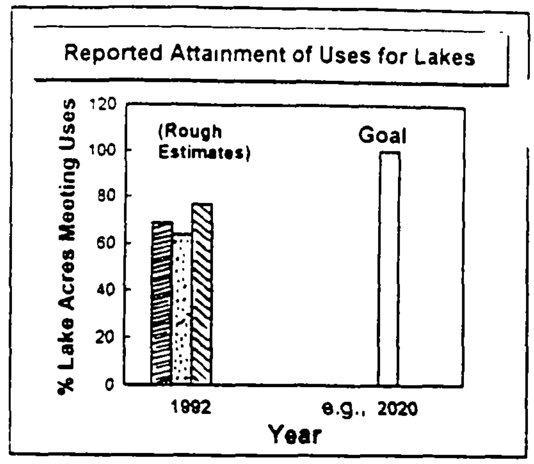
EPA is accelerating work to diminish air deposition. New regulations affecting power plants and motor vehicles will reduce emissions of pollutants that acidify and deplete oxygen in water. EPA also is coordinating intensive efforts to restore high-value, threatened waters, including the Great Lakes, the Chesapeake Bay, and the Gulf of Mexico. The comprehensive, watershed protection approach to managing these waters and the land surrounding them is now being encouraged throughout the country.

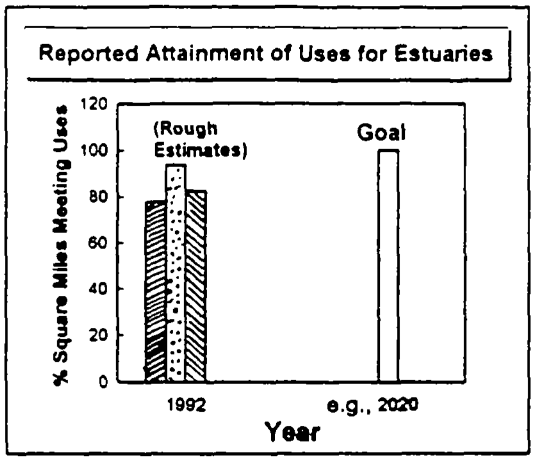
Roles of Others

EPA has delegated responsibility to most states for setting standards and issuing and enforcing permits. Municipalities also have important roles, especially in operating sewage treatment plants and requiring industries to "pre-treat" pollutants before they are discharged into sewers. State and local governments usually also have the lead roles in assessing nonpoint source pollution and correcting it with technical assistance from federal agencies.

Numerous federal and state agencies are responsible for managing fish and aquatic wildlife. In particular, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the National Park Service work with EPA and state programs to protect water quality. The Department of Agriculture is assuming a growing role in working with farmers to prevent water pollution from cropland and livestock.







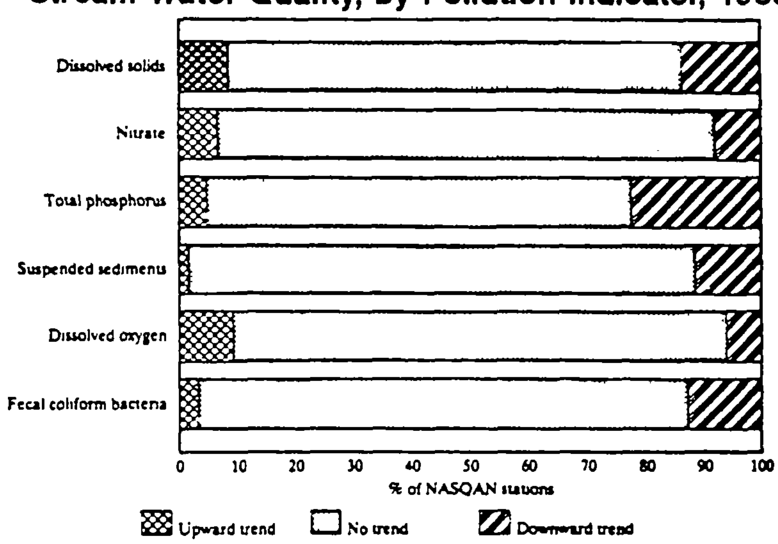
Source: USEPA Office of Water, 1993

Statistical Quality: Relative, qualitative information not currently consistent enough for year-to-year comparisons.

Scientific Validity: Poor to Fair due to state-to-state differences.

Areas the indicator Does Not Address: Coverage is limited. In 1992, assessments covered 21% of river and stream miles, 46% of lake acres and 74% of estuary square miles in the U.S. The assessed waters are likely not representative of all waters in the U.S. Also, not all states are using biological techniques and thus are likely not detecting some problems.

Stream Water Quality, by Pollution Indicator, 1980-1989



Source: DOI/USGS. National Water Summary (1993).

Statistical Quality: Extensive efforts have been carried out to assure the best possible statistical quality in these measurements, including selection of the best possible underlying data at USGS stations, advanced statistical analysis techniques, and good quality laboratory practices.
Scientific Validity: Each of these water quality parameters is associated with aspects of water contamination by well-known cause and effect relationships that are documented in the scientific literature.
Areas the Indicator Does Not Address: There exist other additional aspects of water contamination that are not reflected in this set of parameters, for example contamination by heavy metals or pesticides. Although data of the latter type may be available selectively, a national synthesis is not possible with this set of measurements.

2 Clean Air

Goals

The entire nation will have healthy air that meets all Federal Air Quality Standards. By the year 2000, the number of areas not meeting air quality standards will be reduced from 190 to 15. These areas will have healthy air by 2010. Visibility in the eastern U.S. will improve by 25 percent by 2005. Air in scenic areas with poor visibility at present will be increasingly clear, and there will be no worsening of visibility in currently clear scenic areas, such as National Parks.

Background

Air pollution threatens the health and welfare of people and ecosystems in many areas of the country. Ozone at ground level, particulate matter, carbon monoxide, sulfur oxides, and nitrogen oxides cause a variety of human health problems ranging from eye and throat irritation to permanent lung damage. Lead in the air can cause brain damage, especially in children. Sulfur oxides and nitrogen oxides combine with water vapor to form acid rain, which harms lakes, streams, and forests, while ground-level ozone damages forests and crops.

The emissions of all these pollutants, except nitrogen oxides, have been reduced substantially over the past twenty years. Lead emissions reductions have been especially dramatic--98 percent since 1970. Nonetheless, EPA's most recent information indicates that 54 million people live in counties where federal air quality standards are still violated for one or more of the six pollutants.

Air pollution from factories, motor vehicles, and other sources also reduces visibility throughout many urban areas. Pollutants such as sulfur dioxide and particulate matter can reduce visibility hundreds of miles from their sources. Sulfur dioxide from power plants is the primary cause of poor visibility in the eastern United States, while carbon particles play an important role in the northwest.

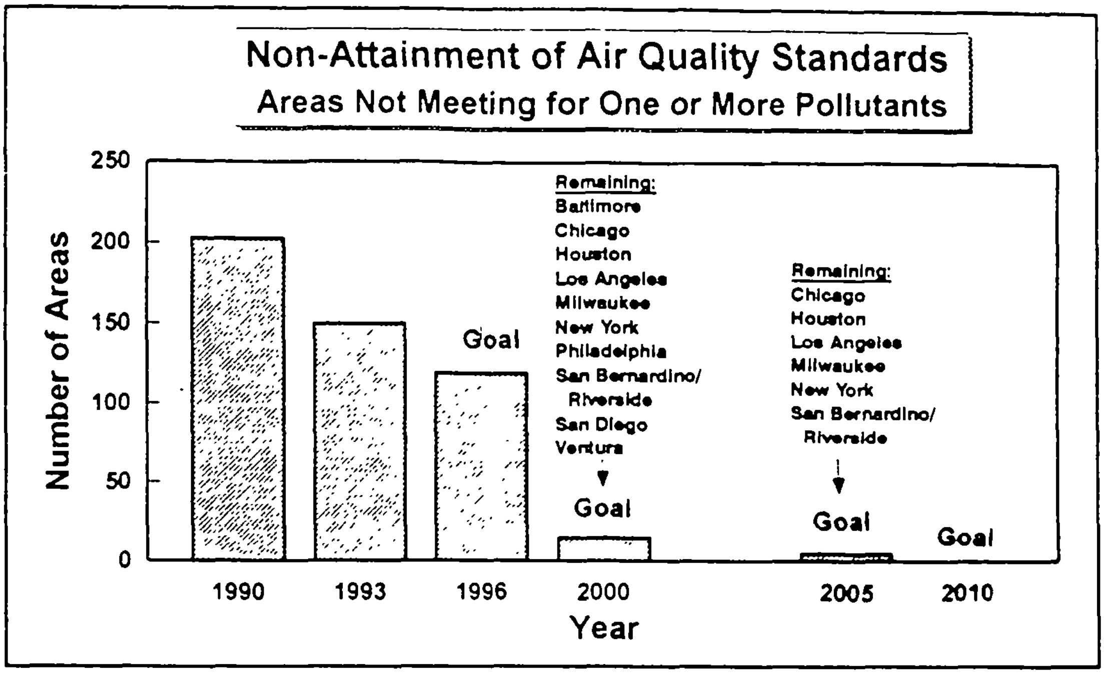
EPA's Roles

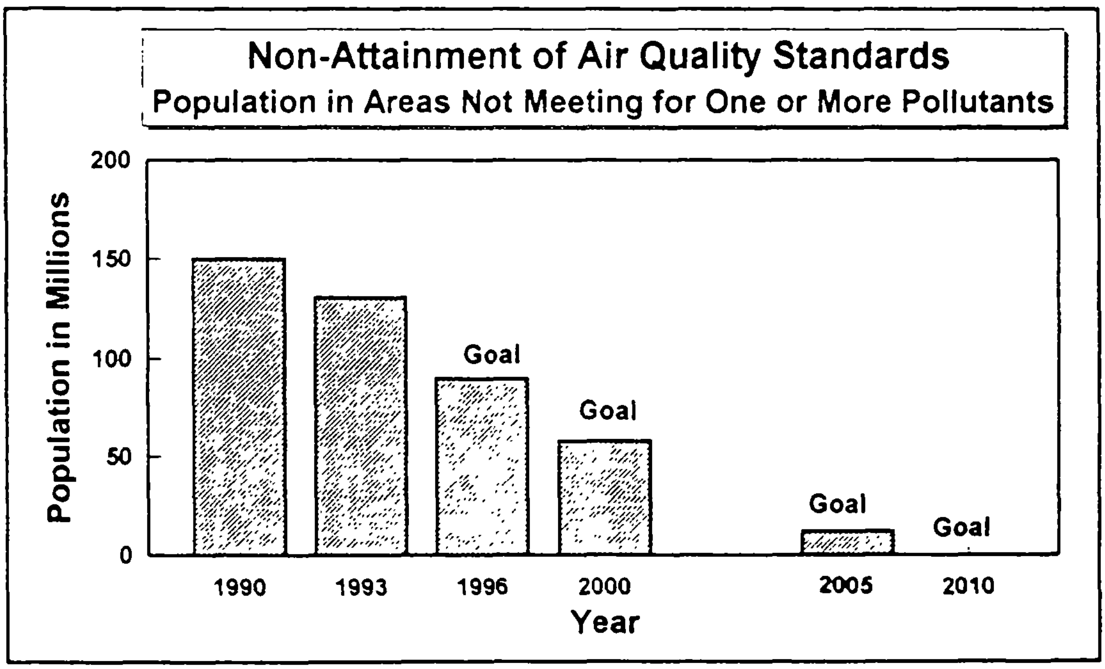
EPA has established "National Ambient Air Quality Standards" (NAAQS) for six air pollutants that are believed to pose the greatest threats to human health and welfare: ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead. By law, NAAQS are set so that attainment of the standards protects human health and welfare.

Prior to 1990, EPA's efforts to enhance visibility focused on controlling air pollutants to meet the NAAQS and conducting enhanced reviews of major new pollution sources locating in clean areas. The Clean Air Act Amendments of 1990 strengthen EPA's role by establishing an acid rain program that will further reduce emissions of sulfur oxides and nitrogen oxides. The Amendments give EPA direction to address impairment of visibility caused by long-range transport of pollutants to scenic areas, such as National Parks and National Wilderness Areas.

Roles of Others

The Clean Air Act assigns to the states the basic responsibility for ensuring compliance with the NAAQS. Each state develops a plan to meet the NAAQS. Once EPA approves the plan, the state is responsible for enforcing it. States frequently assign significant responsibilities for implementing their plans to local air and transportation agencies. Citizens may sue to enforce any part of the approved plan.





Source: USEPA, Office of Air Quality Planning and Standards, 1993

Statistical Quality and Validity: Good, based on established quality assurance program and public review of data, which is collected under standardized monitoring and measurement methodology.

3 Stratospheric Ozone Layer Protection

Goals

The United States will be the world leader in reducing or eliminating all substances that harm the stratospheric ozone layer that shields the earth from harmful ultraviolet rays. Concentrations of chlorine and bromine in the stratosphere will be reduced to pre-Antarctic ozone hole levels as soon as possible. By the end of 1995, the U.S. will halt production and use of most ozone-depleting products. The U.S. will assist other countries in eliminating these substances worldwide.

Background

The stratospheric ozone layer shields the earth from harmful ultraviolet radiation. Increasing concentrations of man-made chemicals such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform are breaking down the ozone layer. These chemicals are released from refrigerators, air conditioners and certain industrial processes. As a result, more ultraviolet radiation reaches the earth's surface, where it causes skin cancers, immune deficiencies, other adverse effects on human health, and damage to crops and ecosystems.

In response to worldwide concerns about stratospheric ozone depletion, many nations have worked to reduce production and use of ozone-depleting substances. The United States was an early leader in these efforts, banning non-essential use of chlorofluorocarbons as aerosol propellants in 1978. The Vienna Convention of 1985 stated an international goal of reducing use of ozone-depleting substances. Countries signing the 1987 Montreal Protocol committed to reducing their use by 50 percent by 1998. More ambitious goals were advanced in the London Amendments of 1990, which called for a complete phaseout of many ozone-depleting substances by 2000.

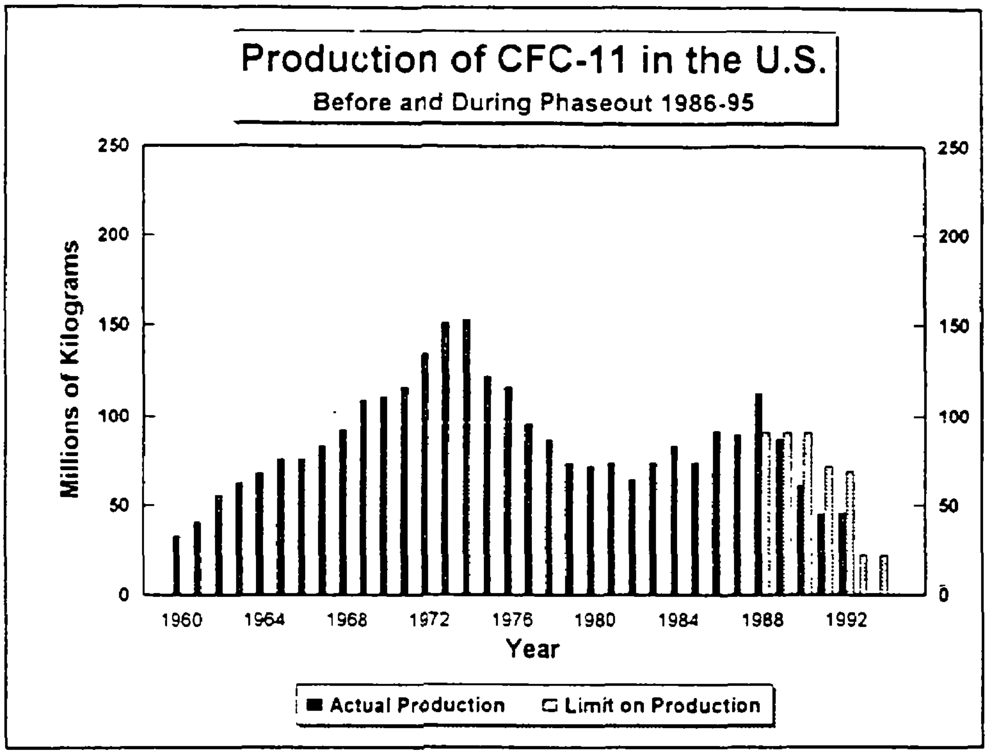
The Clean Air Act Amendments of 1990 directed EPA to implement a national production phaseout of most ozone-depleting substances by 2000. This phaseout schedule, while consistent with the London Amendments, includes more stringent interim reduction goals. In February 1992, the President called for an accelerated phaseout of these chemicals, based on evidence that stratospheric ozone was thinning faster than anticipated. The United States is now committed to halting production of most ozone-depleting substances by the end of 1995.

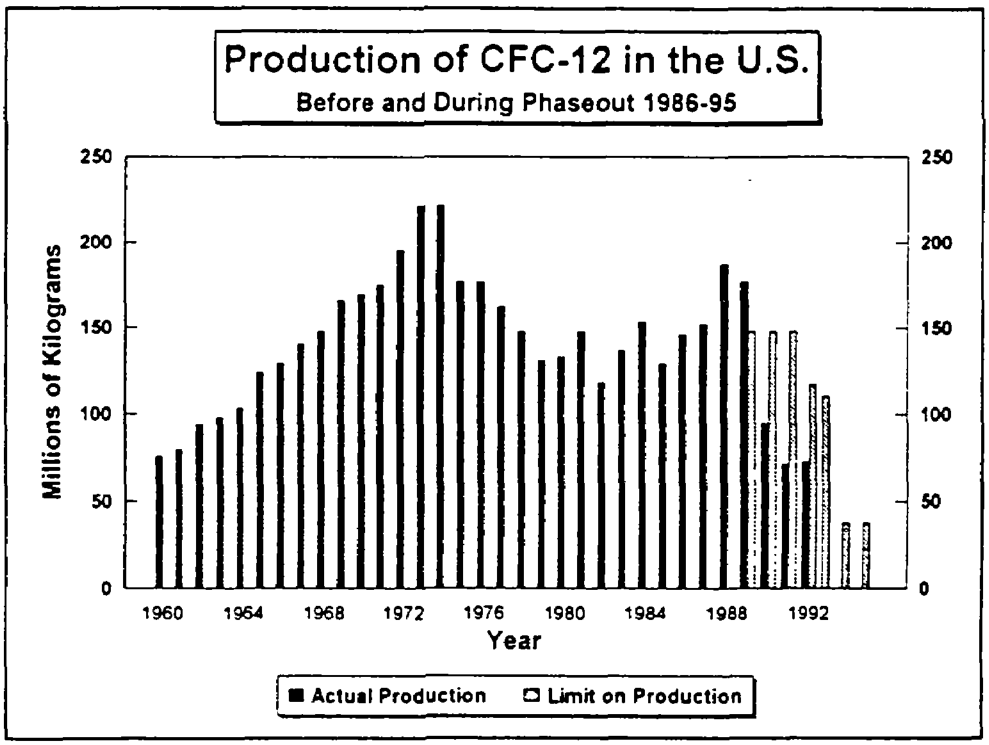
EPA's Roles

EPA administers a tracking system to ensure that producers and importers of ozone-depleting substances comply with the national schedule. To facilitate the economic adjustment that the phaseout requires, EPA allows producers to transfer their rights to manufacture these substances to other producers, but only if the transfer results in diminished production. EPA is developing a national recycling program for CFCs used in refrigerators and air conditioners, and has banned intentional releases of these chemicals. At the international level, EPA assists developing countries in eliminating ozone-depleting substances and using substitutes.

Roles of Others

A worldwide phaseout of ozone-depleting substances will require the cooperation of all countries. The Department of State has the lead role in negotiating international agreements on this and other international environmental issues. The National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Department of Energy and EPA have all contributed to international scientific efforts to improve understanding of stratospheric ozone depletion. Private industry also has a critical role in developing substitutes for ozone-depleting substances.





Source: International Trade Commission, 1993

Statistical Quality: Good, based on established quality assurance program and standardized collection methods used by the International Trade Commission in obtaining data provided from U.S. manufacturers of industrial CFCs.
Scientific Validity: Poor, as a direct indicator of state of the atmospheric ozone layer; fair to good as an indicator of lower tier environmental management objectives stated in terms of reduction of industrial production of CFCs.
Areas the Indicator Does Not Address: Does not estimate the amount of CFCs released into the atmosphere over time.

4 Climate Change Risk Reduction

Goals

By 2000, we will reduce U.S. greenhouse gas emissions to 1990 levels, while at the same time increasing economic efficiency, productivity and employment. In the longer run, we will reduce greenhouse gas emissions to below 1990 levels to stabilize greenhouse gas concentrations. We will reduce atmospheric methane concentrations to the lowest economically-feasible levels by 2000.

Background

The "greenhouse effect" occurs as certain gases in the atmosphere trap heat from the sun and warm the earth. Atmospheric concentrations of these gases are rising, largely as a result of human activities. Scientific evidence indicates that increasing levels of greenhouse gases will raise global temperatures, which could have harmful consequences for people and ecosystems, including sea level rise, increased droughts and storms, altered precipitation patterns, changes in agricultural yields, and extinctions of species that cannot adapt to the changes.

The largest human contributions to greenhouse gas emissions are from burning fossil fuels for electricity, transportation and industrial processes. Other contributors include deforestation, livestock production, and rice cultivation. These activities have added substantially to natural levels of carbon dioxide, methane, and nitrous oxide. People also have added synthetic greenhouse gases to the atmosphere, most notably chlorofluorocarbons. The U.S. accounts for about one-fifth of annual worldwide emissions of all greenhouse gases.

EPA's Roles

In 1992, the U.S. ratified the Framework Convention on Climate Change. This treaty establishes commitments and procedures for international cooperation to improve the science and undertake efforts both to mitigate and adapt to climate changes. EPA provides leading analytical support to the U.S. team negotiating rules and future modifications to the Framework Convention. The Convention requires each signing country to inventory its greenhouse gas emissions and develop a plan to reduce them. In 1993, the U.S. adopted a Climate Change Action Plan (CCAP), in which EPA plays a leading role. The CCAP encourages voluntary actions, such as EPA's "Green Lights" program which enlists private and public partners to reduce power consumption by installing energy-efficient lighting. Other voluntary programs include reducing emissions from landfills, gas pipelines, fertilizer and pesticide applications, and by increased recycling.

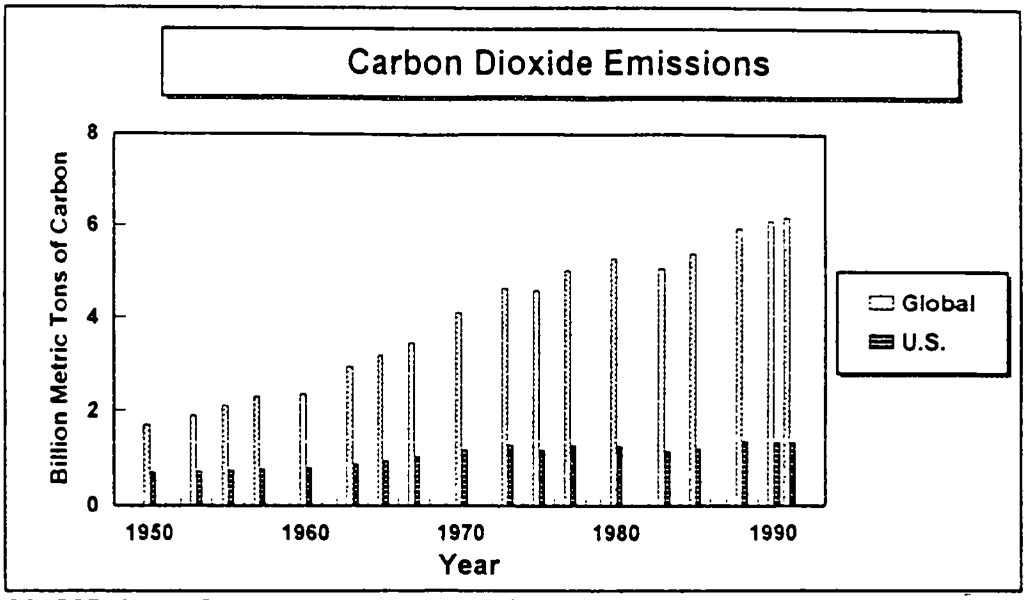
EPA regulates some greenhouse gas emissions. EPA currently is implementing a national phaseout of chlorofluorocarbons, which also destroy the stratospheric ozone layer. EPA also sponsors research on climate change, its causes and potential effects, ways to reduce greenhouse gas emissions, and strategies for reducing its impacts.

Roles of Others

Several federal agencies provide assistance for climate change mitigation efforts in other countries. EPA and the Department of Energy (DOE) spearhead assistance to help developing countries inventory their greenhouse emissions and analyze emissions reduction and adaptation policies. EPA, the Forest Service, and the Agency for International Development help other countries develop forest conservation and management programs.

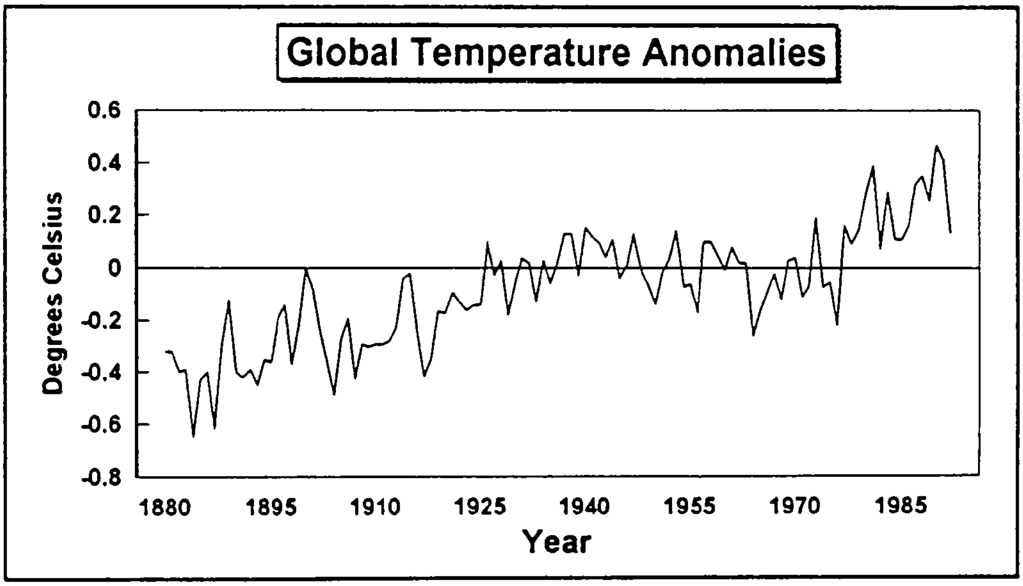
DOE has the lead role in promoting energy efficiency and developing energy sources that do not require fossil fuel combustion. The Department of Transportation implements legislation that will the improve energy efficiency of automobiles and public transit. EPA, DOE, NASA, the National Oceanic and Atmospheric Administration, U.S. Geological Survey and Department of Agriculture all sponsor research on climate change.

Several states and municipalities address climate change by promoting energy efficiency, planting trees and planning land uses so as to minimize the future impacts and reduce greenhouse gas contributions. Private firms and citizens contribute by making energy efficient household, workplace, and transportation choices, and by planting trees.



SOURCE: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory

Data Quality: Global CO_2 estimates were derived primarily from questionnaires to UN member countries Where official data were not available estimates were based on expert opinion and ancillary data sources. Experts consider the data to be within 10% of the true value U S estimates were derived primarily from Energy Information Agency questionnaires to U.S energy companies The data comes close to being a complete census



Source: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, 1993

Data Quality: Temperature anomalies represent departures from the "normal temperature" averages over a base period (usually from 1950 to 1980) These anomalies are derived from surface temperature records from instruments. These records are considered to be high quality. Due to the placement of measurement sites, the measurements may have an urban warming temperature bias of about 0 1 degree Centigrade.

5 Ecological Protection

Goal

We will improve the overall ecological health of the environment by protecting the physical, chemical and biological components and processes of ecosystems. We will maintain and restore representative examples of ecosystems, habitat types and habitat connections across landscapes, and biological communities. We will ensure viable populations of native plants and animals, well distributed throughout their range, and the genetic variability within those populations.

Background

Biological diversity is the variety of life on earth, essential for sustaining life and the well-being of people. It includes ecosystem diversity, species diversity, and genetic diversity.

An ecosystem is an area's plants, animals, nonliving elements such as minerals and air, and the interactions among them. *Ecosystem diversity* provides habitats for a variety of species and makes possible a range of important natural functions, from local temperature moderation by forests to water purification by wetlands. *Species diversity* is the variety of living things that inhabit the earth's ecosystems. *Genetic diversity* is the variation among individual plants or animals of a particular species. Genetically diverse species are more likely to survive diseases and environmental changes. Genetic diversity also provides benefits to humans, such as new varieties of plants that can be useful in agriculture.

Biodiversity conservation requires protection of habitats and maintenance of healthy populations in these habitats. Almost all natural environments in the U.S. have been degraded by human activities. Even in the few remaining pristine habitats, biodiversity is reduced by the loss or degradation of adjoining habitats, which may eliminate animals that require large territories and allow invasion of non-native species. Global climate change is thought by many scientists to be another threat to biodiversity because it may significantly alter existing natural habitats.

EPA's Roles

EPA's primary role in protecting habitats is to regulate pollution. EPA oversees establishment of water quality standards that protect aquatic organisms. EPA can ban or regulate pesticides that harm ecosystems. EPA regulates air pollutants that cause acid rain, which damages forests and lakes, and it also regulates other air pollutants that harm habitats, such as toxic chemicals and ground-level ozone.

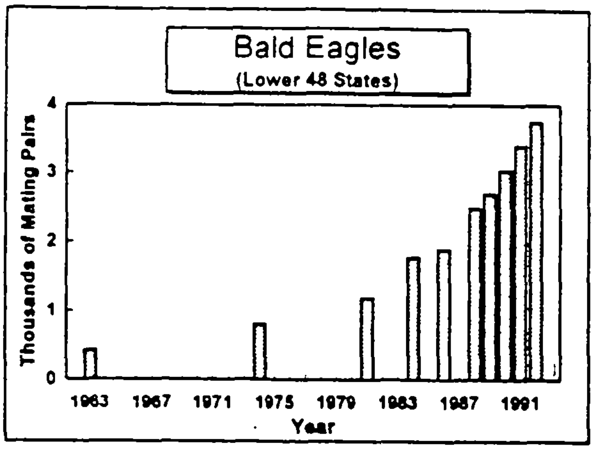
EPA and the Army Corps of Engineers regulate dredging and filling of wetlands, which are among the most productive habitats. Under the National Environmental Policy Act, EPA reviews federally-supported activities to make sure they cause no unreasonable harm to the environment.

EPA's Science Advisory Board concluded that losses of habitat and biological diversity are among the most important ecological threats facing the U.S. EPA now is developing a strategy to do a better job in protecting habitats. As part of this effort, EPA and other agencies have developed the Environmental Monitoring and Assessment Program that will make available better information about the condition of the nation's ecosystems. This program will aid in identifying important habitats that need protection.

Roles of Others

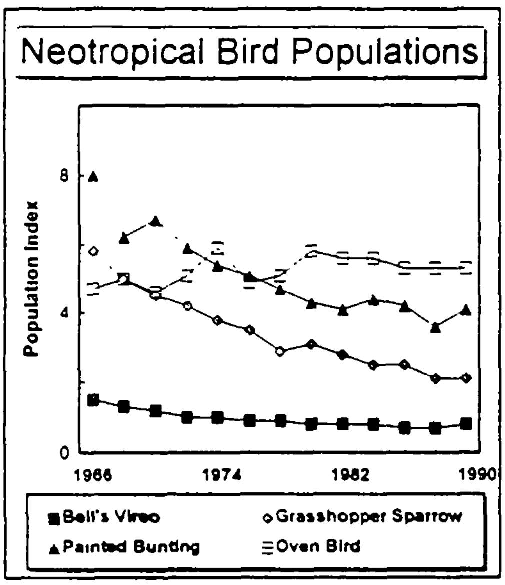
While EPA has the lead federal role in protecting wetlands, waters and air, other agencies have primary responsibilities for managing land. The National Park Service, the Forest Service, the Bureau of Land Management, and the Bureau of Reclamation manage parks, wildlife refuges, and other areas to preserve habitats. The Fish and Wildlife Service (USFWS) is responsible for designating threatened and endangered species and developing recovery plans for them.

All 50 states have endangered species laws and state forest and park systems. States have natural resource inventory programs to identify threatened species and important habitats for preservation. Non-governmental organizations also have important roles. The Nature Conservancy, for example, purchases important habitats to ensure their long-term preservation.



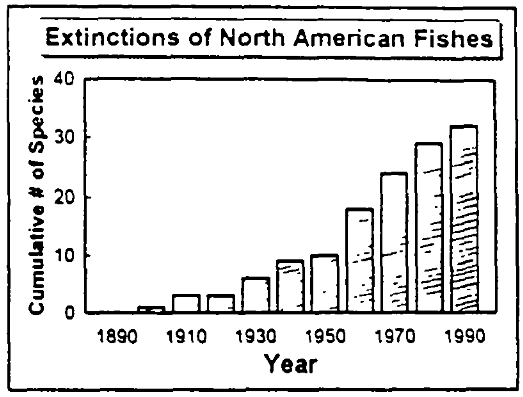
Source: U.S. Fish and Wildlife Service, 1993

Data Quality: This is the best available data but much of it is generated by States using different sampling methods. The estimates are considered conservative in that they may under-count the actual number of breeding pairs.
Scientific Validity: Top predators such as Bald Eagles are generally believed to serve as a useful indicator of the condition of the food chain.



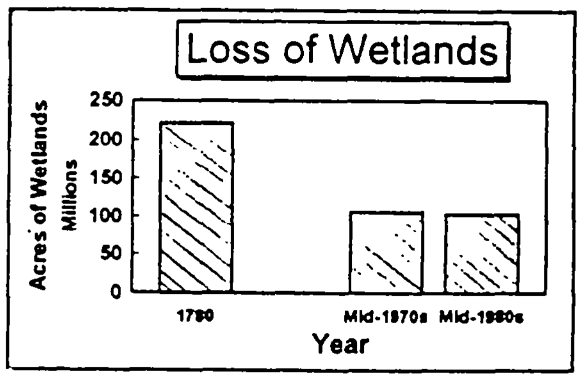
Source: U.S. Fish and Wildlife Survey, 1993

Statistical Quality: Good. Survey of migration routes yields data on 300-400 species. Errors occur but a data quality assurance program is in place.
Scientific Validity: Good for population trends in species that can be observed in the field during daylight hours and from roadside observation sites. Therefore, for some species, it may not adequately reflect the effects of changes in difficult to reach habitats.
Areas the Indicator Does Not Address: Covers North American migratory birds daytime activities only. Nocturnal activities and migratory movements are not covered at present.



Source: Miller, R.R. and J.E. Williams, 1989 *Extinctions of North American Fishes During the Past Century.* Fisheries 14:22-38

STATISTICAL QUALITY: Fair, should be used as a lower bound only, since the strength of the evidence was evaluated before including any species as a confirmed extinction. The historical accuracy of the data may be poor on the x-axis since the date for which an extinction is considered confirmed may lag the actual extinction by decades.
SCIENTIFIC VALIDITY: Limited, because it cannot always historically distinguish between species that died out due to non-environmental factors and/or natural causes, and species which became extinct due to adverse environment or habitat.
AREAS THE INDICATOR FAILS TO ADDRESS. Does not provide data on species population trends an changes in habitat which may cause population los.



Source: US Fish and Wildlife Service, 1993

STATISTICAL QUALITY: Good. Data are based on a stratified random sample of 4 mi^2 areas within defined physiographic regions, and sample sizes are based on the expected wetlands acreage contained historically in each region. Errors do exist, but a data quality control program is in place.
SCIENTIFIC VALIDITY: Trend measurements are valid for long term estimates mainly, as the study results are produced once per decade; the most recent report gives estimates for the mid-eighties.
AREAS THE INDICATOR FAILS TO ADDRESS. Coverage on quality of wetlands is not as comprehensive as the inventory reporting. However, certain regions of interest are getting increased coverage.

6 Prevention of Wastes and Harmful Chemical Releases

Goals

We will reduce and seek to eliminate releases of toxic chemicals by industrial facilities, even as industrial production increases.

By ____, *releases* of toxic chemicals from industrial facilities to the air, water, and land will be reduced by __ %. By ____, *generation* of wastes (prior to recycling, treatment or disposal) from industrial facilities will be reduced by __ %. By ____, the nation's municipal wastes will be reduced by 25% through source-reduction or recycling. By 1998 all solid and hazardous waste disposal facilities will be regulated by a permit program. By 2010, releases of hazardous air pollutants from major sources will be reduced so that the maximum individual lifetime risk of cancer from exposure to them is less than one in a million and other health and environmental risks are also reduced.

Background

Harmful chemicals can contaminate the environment during their manufacture, use, and disposal. Wastes are released directly to the air and water, injected into disposal wells, buried in landfills, or sent to treatment plants. In 1991, U.S. manufacturing facilities reported that 4.43 billion pounds of toxic chemicals were released to the environment or transferred to other locations. In addition to the problems posed by toxic wastes, these chemicals sometimes contaminate workplaces and homes during their actual use.

The conventional approach to preventing harm from toxic chemicals is to control their treatment and disposal, which sometimes simply move pollution from one part of the environment to another. A preferred approach is to produce and use less harmful chemicals so that products are safer and less waste is produced. By minimizing wastes, pollution prevention can increase the efficiency of raw material use and reduce the need for costly treatment and disposal. Over 1000 industrial firms in the U.S. have made voluntary commitments to reduce releases and transfers of 17 toxic chemicals. The federal government's objectives are reductions of 33 percent from 1988 levels by 1992 (this target was achieved in 1991), and 50 percent by 1995.

EPA's Roles

Under the Toxic Substances Control Act, EPA regulates the manufacture, use, and disposal of toxic chemicals. The Federal Insecticide, Fungicide and Rodenticide Act and the Federal Food, Drug and Cosmetic Act regulate pesticides. Other statutes establish limits on toxic substances in air and water and establish requirements for safe disposal of solid and hazardous wastes.

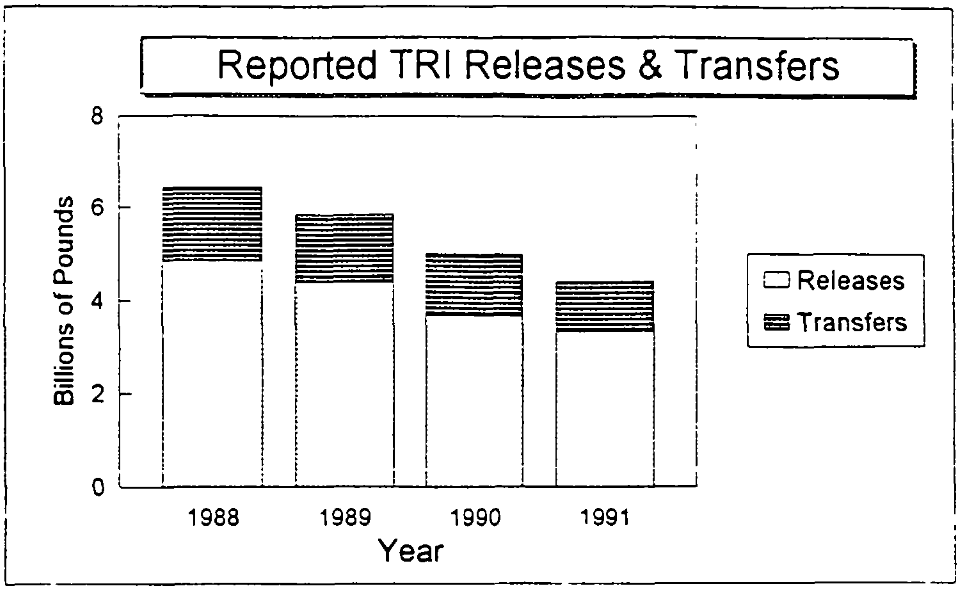
EPA makes information about uses and releases of toxic chemicals available through the Toxics Release Inventory (TRI). The 1990 Pollution Prevention Act, establishes pollution prevention as a national objective and expands TRI reporting requirements. The Act also directs EPA to promote pollution prevention by disseminating information on prevention opportunities and giving technical assistance grants to states.

Roles of Others

Many companies are improving waste management practices and using safer chemicals, more efficient processes, modified equipment and reformulated products. Several states have adopted pollution prevention programs. Industrial firms annually report their toxic chemical uses, releases and transfers.

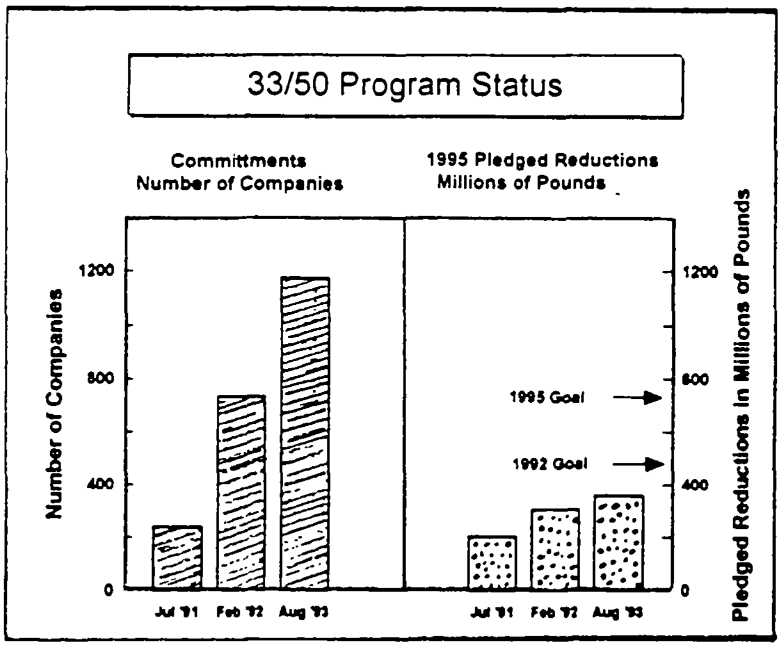
Other federal agencies also have important roles in promoting pollution prevention. Federal actions include research, technical assistance, and procurement specifications to encourage government purchases of products that are recycled or recyclable or contain minimal toxic substances.

The public also has important responsibilities, since some types of toxic releases come from consumer products. People can purchase non-toxic products, dispose of toxic products properly, and use information in the TRI to work with local industries to reduce the use and release of toxic chemicals.



Source: USEPA Office of Pollution Prevention and Toxics, 1993

Data Quality: Based upon self-reported estimates of releases and transfers from specific manufacturing facilities in standard industrial code (SIC) categories 20-39 with ten or more employees that process or use more than threshold quantities of listed chemicals. Companies develop and submit their estimates and certify to their completeness. Although the TRI includes over 82,000 reports from approximately 23,000 facilities, it captures only a portion of all toxic chemical releases nationwide. For example, the mining and energy production sectors are not included. TRI reports reflect releases of chemicals, not exposure of the public or the environment to these chemicals.



Source: USEPA Office of Pollution Prevention and Toxics, 1993

Data Quality: Based upon voluntary self-reported estimates of releases and transfers for 17 priority chemicals from companies agreeing to participate in the 33/50 Program. Companies or their contractors do the reporting (government agencies do not collect the data at the facilities).

7 Cleanup of Contaminated Sites

Goals

We will make continuous progress in identifying and cleaning up contamination at sites where hazardous materials threaten human health and plant and animal life.

We will clean up 650 *abandoned* hazardous waste sites by the year 2000. We will reduce the greatest risks to human health and the environment from *active* hazardous waste facilities by taking action to control contaminant releases. We will clean up an average of 20,000 leaking underground storage tanks each year, or 120,000 tanks between 1995 and 2000.

Background

For decades, commerce has routinely generated wastes that are flammable, corrosive, reactive, radioactive or toxic. Accidental release or improper handling of these hazardous wastes endangers the environment and the health of people in nearby communities, especially when rain or wind carries hazardous materials into the water, air, and groundwater supplies.

A major source of contamination is abandoned hazardous waste dumps. Currently operating hazardous waste facilities may also pollute if they are improperly designed or managed. Municipal landfills contaminate surrounding areas when toxic chemicals in household and commercial wastes escape from them. At some of these polluted sites, wastes have accumulated for decades.

Leaks from storage tanks containing gasoline, oil, and other hazardous materials also have contaminated many areas. There are 1.3 million underground storage tanks (USTs) used by gas stations, large trucking fleets, bus depots, and government facilities, of which an estimated15 to 25 percent are leaking.

Sites with radioactive contamination include federally-operated research and weapons facilities, some nuclear power plants, and Superfund sites.

EPA's Roles

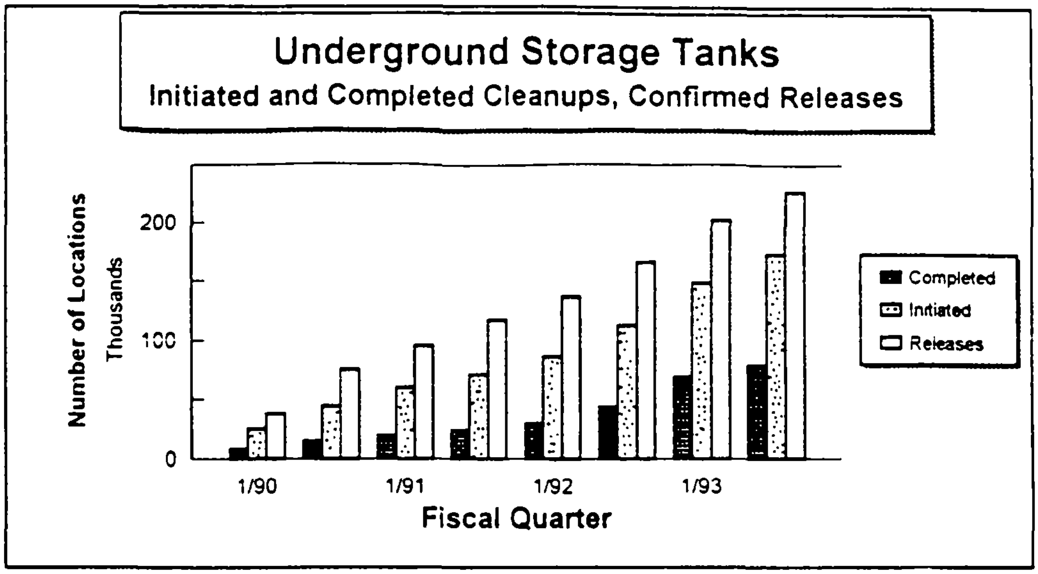
Under the Resource Conservation and Recovery Act, EPA regulates the generation, transport, and management of hazardous waste, and requires waste facilities to identify and clean up all their releases.

Cleanups of hazardous waste contamination at abandoned or bankrupt facilities are regulated under "Superfund" (the Comprehensive Environmental Response, Compensation and Liability Act). Superfund sites that pose the most serious long-term threats are placed on EPA's National Priorities List, which now includes over 1200 sites. Cleanup has been completed at 217 of them. When a site poses an immediate threat, EPA takes emergency action to reduce the danger, such as providing bottled water when drinking water is contaminated. EPA pays for cleanup costs when those responsible for the contamination cannot be identified or cannot pay. EPA also provides technical assistance, enforcement support, and some funding to state and local governments for handling leaks from underground storage tanks. EPA currently is developing requirements for cleanup of sites contaminated with radioactive material.

Roles of Others

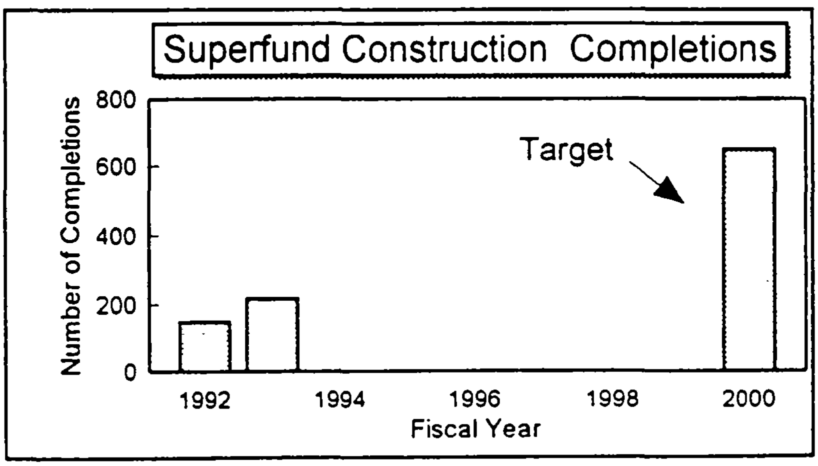
Where possible, parties responsible for contaminating Superfund sites must either clean up the site or reimburse EPA for its cleanup costs. Releases from active hazardous waste facilities must be cleaned up by their owners. Similarly, UST owners are liable for cleaning up contamination from leaking tanks or for reimbursing EPA. Liability for paying the costs of cleanup has recently been a strong deterrent to careless waste disposal in the United States.

About one-third of the states have assumed responsibility for cleanups at operating hazardous waste facilities. States also have primary responsibility for administering cleanups of contamination from USTs. In addition, states, local governments, and Indian tribes may lead Superfund cleanup efforts or cooperate with EPA to clean up a site. Citizens also have important roles in working with EPA to design cleanup strategies for contaminated sites in their communities.



Source: USEPA, Office of Solid Waste and Emergency Response, 1993.

Statistical Quality: The statistical quality is considered to be good.
Scientific Validity: Not a scientific measurement.
Areas the indicator Does Not Address: This is a quantitative measure that records program activity over time. The measure does not directly address the impact on the environment of releases from underground storage tanks.



Source: USEPA, Office of Solid Waste and Emergency Response,1993.

Statistical Quality: The statistical quality is considered to be high.
Scientific Validity: Not a scientific measurement.
Areas the indicator Does Not Address: This is a quantitative measure that records program activity over time. The measure does not directly address the impact of superfund sites on the environment.

8 Prevention of Oil Spills and Chemical Accidents

Goal

We will enforce legislation and educate people so that the environment becomes much safer from the effects of oil spills and chemical accidents, and we will respond quickly to contain the damage from spills and accidents that do occur.

Background

Every day, oil and other hazardous substances are spilled or released into waterways, the air, and onto the ground. These pollutants frequently kill fish and wildlife. They also can injure nearby workers and residents, who may experience immediate problems ranging from mild skin irritation to fatal poisoning, or longer-term health problems, such as cancer and reproductive disorders.

Accidental releases of hazardous substances result from careless handling of petroleum, tank car derailments, trucking accidents, fires, leaks, and explosions. Some accidents have catastrophic consequences. In 1988, a refinery explosion in Norco, Louisiana killed seven people, injured 50, and forced the evacuation of 25,000 residents. In 1989, the supertanker Exxon Valdez spilled 10.9 million gallons of crude oil into Alaska's Prince William Sound, killing approximately 150,000 seabirds and an estimated 5,000 sea otters. Valuable fisheries were closed, and over 1,200 miles of shoreline were polluted with oil.

Reports of accidental releases have increased steadily in the last decade. The National Response Center and EPA regional offices received over 24,000 such reports in 1990, and over 40,000 reports in 1992.

EPA's Roles

One of EPA's most important roles is building state and local authorities' capabilities to prevent and respond successfully to accidents by providing technical assistance and funding for designing accident prevention programs and emergency response plans, and assisting them in responding to emergencies. EPA can direct responsible parties in the cleanup or do the work itself. EPA trains over 5,000 people each year for emergency response operations.

EPA requires certain facilities that store oil to prepare plans to prevent spills and now is developing additional rules that will require petroleum facilities to plan for cleanups of worst-case spills. EPA also is providing rules that will require facilities handling extremely hazardous substances to develop detailed plans for preventing, detecting, and minimizing accidental releases.

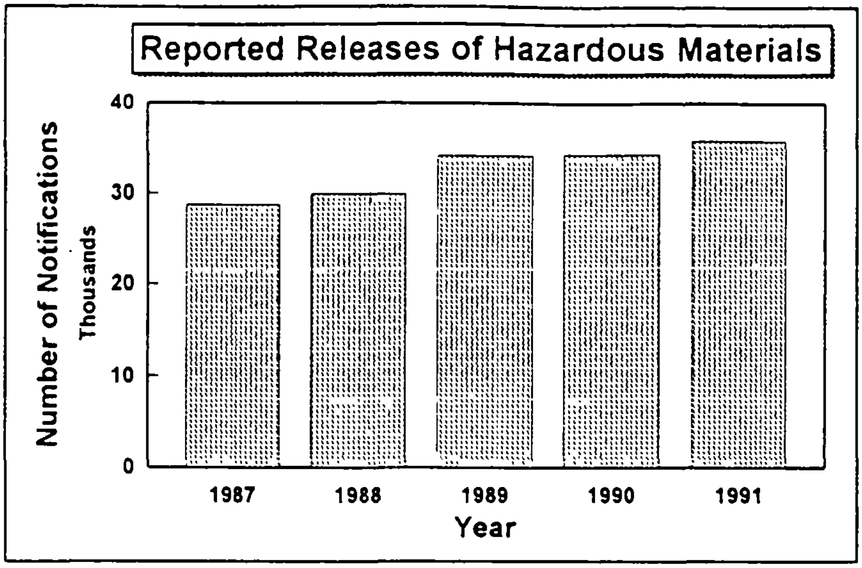
The federal government has established a National Contingency Plan, which sets procedures for responding to emergency releases and sets up a National Response Team, which coordinates preparation for and responses to accidents. When an emergency occurs inland and federal assistance is required, EPA deploys an On-Scene Coordinator to manage federal responses or monitor the cleanup. EPA also maintains the Environmental Response Team, a group of scientists and engineers that provides 24-hour technical expertise.

Roles of Others

State Emergency Response Commissions are responsible for appointing and supervising Local Emergency Planning Committees , which prepare and exercise local emergency response plans. Industrial facilities handling hazardous chemicals report information on the chemicals present at each facility, their hazards, how they are stored, and any releases. Operators of vessels or facilities containing a hazardous substance must notify the authorities when a release of a "reportable quantity" has occurred.

The party responsible for an accident is responsible for managing and paying for cleanup. State and local authorities usually do the actual cleanup work that cannot be managed adequately by the accountable parties.

The Department of Transportation is responsible for regulating the safe transportation of oil and hazardous substances. The Coast Guard deploys On-Scene Coordinators to handle emergencies in coastal areas and the Great Lakes.



Source: USEPA, Office of Solid Waste and Emergency Response, 1993

Data Quality: This data is consider to be of fair quality.

Scientific Validity: Not a scientific measure.

Areas the Indicator Does Not Address: This is a quantitative measure that records reported releases of hazardous materials over time. The measure does not directly measure the impact of these releases on the environment.

9 Safe Indoor Environments

Goals

We will ensure safer indoor environments for residential, work and recreational life. EPA will develop and implement strategies to minimize health risks from all indoor air contaminants, including radon, lead, asbestos and environmental tobacco smoke.

[Existing federal goals (in *Healthy People 2000)* include: 40% of homes will have been tested for radon and been found to pose minimal risk or been modied to reduce risk to health, 30 states will require prospective buyers be informed of lead paint and radon concentrations in buildings for sale, and testing for lead paint will have been performed in at least 50% of homes built before 1950.]

Background

Indoor pollution in homes, schools, offices, and other buildings is one of the most serious human health risks on the nation's environmental agenda. Levels of many harmful contaminants are frequently higher indoors than outside. Since people spend about 90 percent of their time inside buildings, the health threats often exceed the dangers from pollution outdoors.

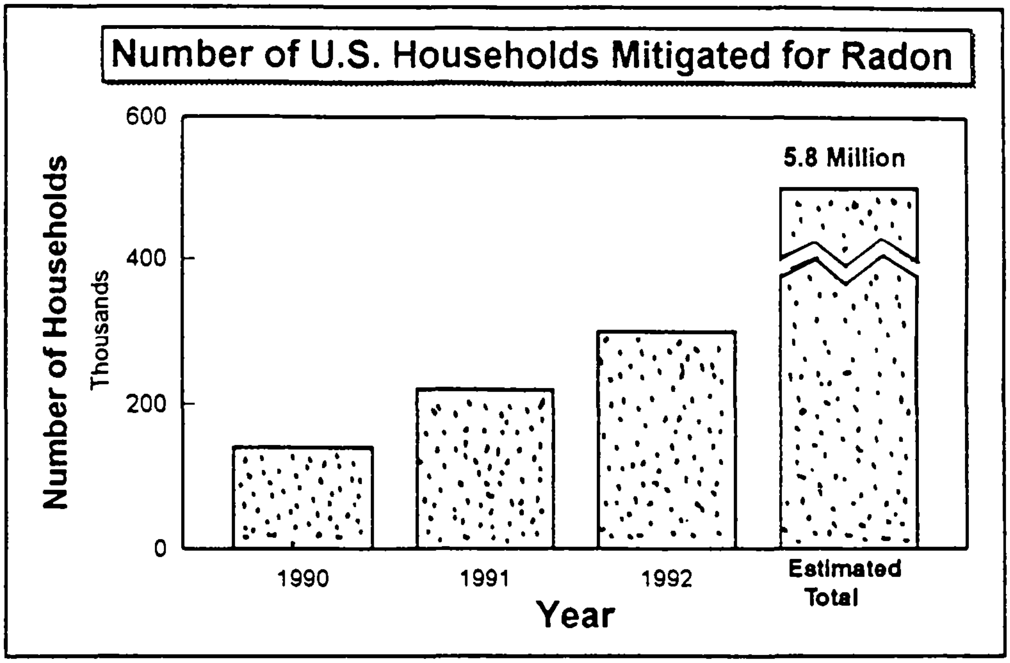
Indoor air pollution effects range from eye irritation to cancer and birth defects. Radon, a naturally-occurring radioactive gas that enters buildings from the ground, causes 7,000 to 30,000 lung cancer deaths each year. "Secondhand" tobacco smoke causes about 3,000 lung cancer deaths in non-smokers each year and causes serious respiratory problems in young children. Airborne fibers from asbestos cause cancer. Furniture, foam and pressed wood products release formaldehyde, an eye and respiratory irritant that may cause cancer. Many items commonly used in homes and offices--paints, solvents, cleansers, pesticides, dry cleaned clothes, and space heaters--release pollutants. Bacteria, fungi, viruses, and other biological pollutants can grow in moist indoor environments and spread through heating and cooling systems. Lead in paint and pipe solder, which causes brain and kidney damage and premature births, is a hazard in many buildings.

EPA's Roles

EPA has established a comprehensive program to address risks from indoor air pollution and other indoor hazards by focusing on development of partnerships to implement regulatory and non-regulatory programs. EPA has launched national campaigns to improve building operation and maintenance practices and otherwise address the major indoor risks. EPA provides step-by-step recommendations on testing for and managing radon, asbestos, and lead problems and has issued national recommendations for eliminating involuntary exposure to secondhand smoke. EPA provides grants to states for radon programs, and loans and grants to schools for asbestos inspection and removal. EPA trains and accredits professionals who inspect for and manage asbestos problems, and trains and evaluates contractors who diagnose and control radon and lead contamination. EPA has developed radon-resistant construction techniques that have already been used in hundreds of thousands of new homes. Under the Safe Drinking Water Act, EPA has banned the use in homes of pipes containing more than 8% lead solder.

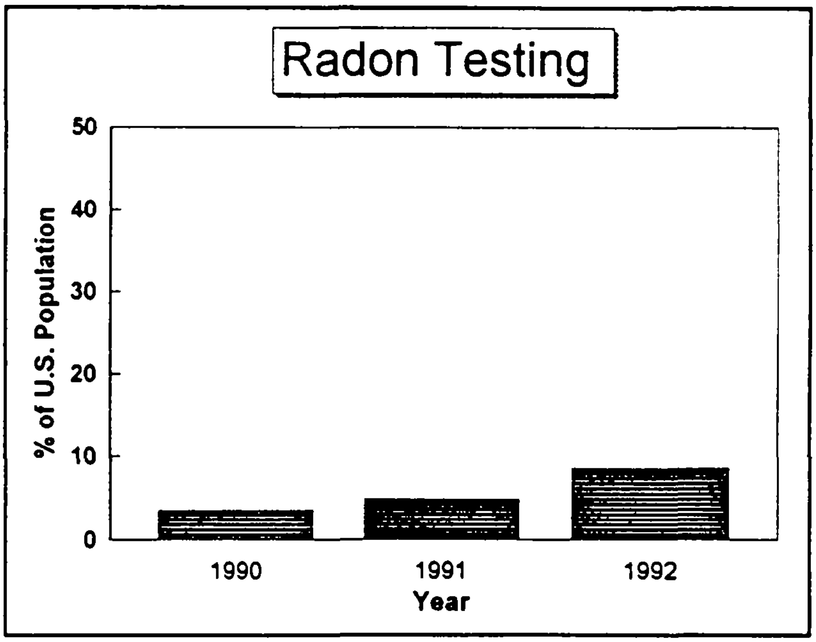
Roles of Others

Many private and public organizations are involved as partners with EPA. For example, the Consumer Product Safety Commission is engaged in work ranging from establishing limits on lead content in paint to research on indoor pollution from consumer products. The Department of Housing and Urban Development is the principal agency responsible for eliminating leaded paint in housing and has established limits for formaldehyde in pressed wood products in mobile homes. The Occupational Safety and Health Administration sets limits for chemicals used in the workplace. EPA collaborates with states and dozens of public health and consumer protection organizations to promote radon testing and mitigation, and to educate building owners and managers about good indoor air quality practices.



Source: USEPA Office of Air and Radiation, 1993

Data Quality: The quality is believed to be high. This is a quantitative measure that records program activity over time. The measure is not a scientific measure of the effects of radon upon human health.



Source: USEPA Office of Air and Radiation, 1993

Data Quality: The quality is believed to be high. This is a quantitative measure that records program activity over time. The measure is not a scientific measure of the effects of radon upon human health.

10 Safe Drinking Water

Goal

All Americans will have a safe source of drinking water. By ____, X percent of the population served by public water systems will drink water that meets EPA standards for contaminant levels.

Background

United States drinking waters are among the safest in the world. Once-common deadly waterborne diseases, such as typhoid fever and cholera, have almost been eliminated. Yet despite this progress, waterborne disease and chemical contamination remain a national concern. Microbiological contaminants, such as bacteria and viruses, are the most common problem. Between 1971 and 1988, reported waterborne diseases affected an average of 7,700 people per year. The 1993 disease outbreak in Milwaukee reportedly caused 370,000 people to become sick. Chemical contaminants, including lead, nitrates, fluoride, pesticides, radioactive materials, and disinfectants used in water treatment, also threaten people's health.

Public water systems serve an estimated 230 million Americans. Almost two-thirds of these people live in or near major metropolitan areas, where rivers and lakes are the principal water source. Underground aquifers are the source of water for most people living in other areas. Groundwater pollution comes from a wide variety of sources, including septic tanks, underground storage tanks, farms, and waste disposal sites. Rivers and lakes are polluted by industrial facilities, sewage treatment plants, runoff from farms and urban areas, and deposition of air pollutants. Drinking water treatment and delivery systems (pipes) also may inadvertently contaminate water with lead, disinfectants and their by-products, and fluoride.

Approximately 73 percent of public water systems meet all current standards and monitoring requirements. Small systems serving less than 3,300 people are responsible for most violations.

EPA's Roles

The Safe Drinking Water Act (SDWA) directs EPA to establish national drinking water standards, or "Maximum Contaminant Levels" (MCLs) and monitoring and testing requirements. If MCLs are exceeded, EPA requires public water systems to install treatment. Every public water supply system serving 25 or more people must meet these standards.

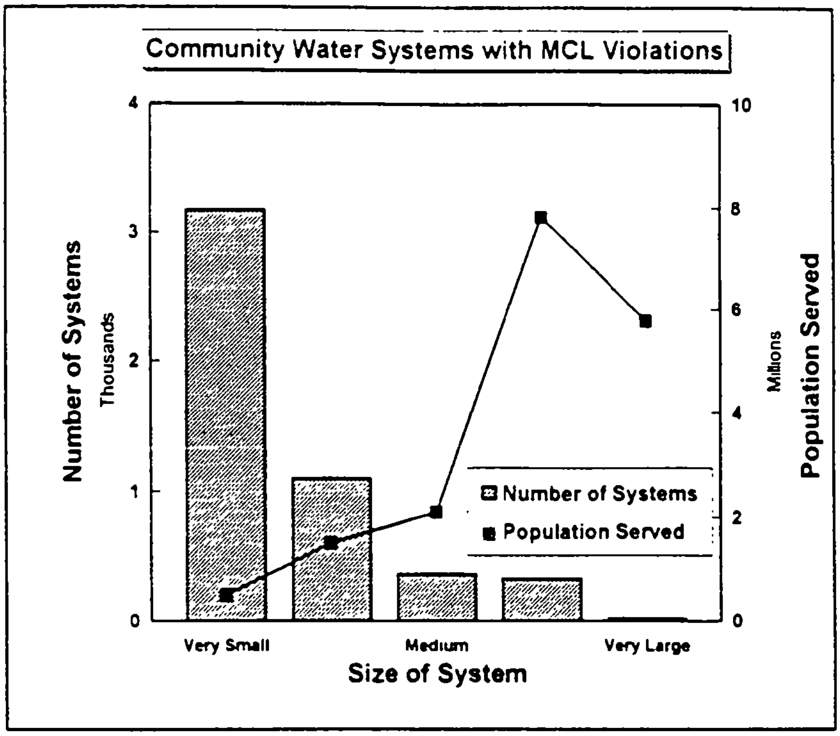
Amendments to the SDWA in 1986 required EPA to accelerate its establishment of drinking water standards. In 1986, national standards existed for 23 contaminants. EPA now regulates 84 contaminants and expects to have standards for 111 by the end of 1996. The amendments also banned future use of lead in public drinking water systems, required filtration and disinfection of most public water supplies, established a program to prevent contamination of areas around ground water wells, and tightened controls on injection of hazardous waste into underground disposal wells.

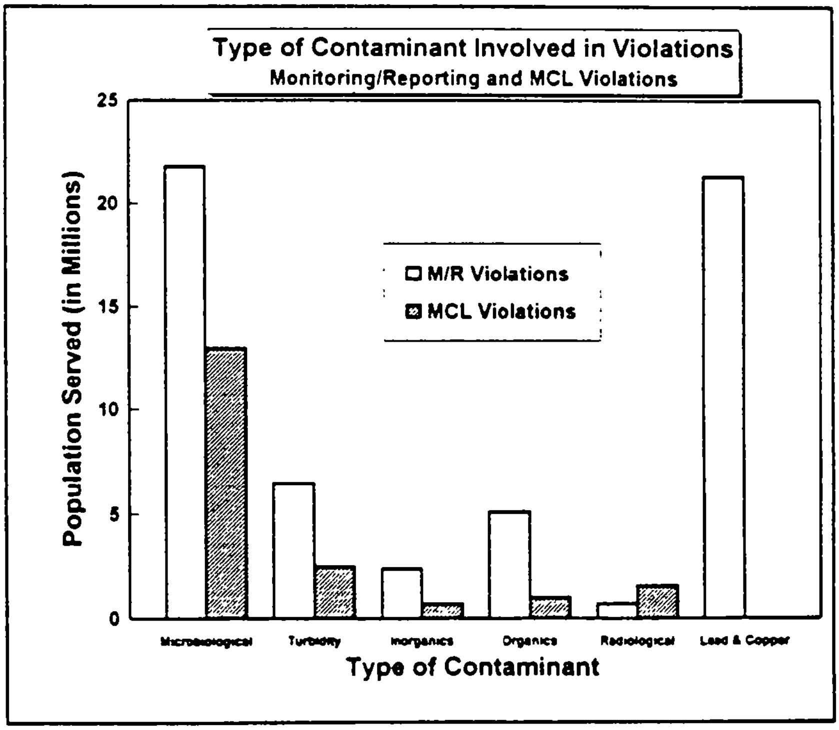
EPA must enforce the MCLs until states are qualified to do so. If a state cannot meet the requirements, EPA conducts the program. EPA also is authorized to take actions against public water systems when states are slow to enforce the law, or when a state asks EPA to act.

Roles of Others

Once a state adopts standards at least as strict as the national MCLs and is able to carry out adequate monitoring and enforcement, it is given primary enforcement authority for the drinking water program. Forty-nine states and 6 territories now have this authority.

Water suppliers are responsible for periodic testing of their water. They must report any violations of standards to the appropriate state agency and to the public through newspaper, television, or radio announcements. Public water systems currently in compliance with all standards may have to undertake new treatment technologies to meet the new standards being set under the 1986 amendments.





Source: USEPA National Public Water Supply Supervision Program, 1993

Statistical Quality: Data are based upon self-reporting of analytical results by regulated facilities and manual determinations by State of non-compliance. Quality of data reported to EPA varies by State.

Scientific Validity: Population served by non-complying public water systems is a good surrogate for potential exposure of users of public water systems to contaminants known to pose adverse health effects.

Areas the indicator Fails to Address: Does not address private wells and non-public water supplies. Also does not specifically address population with actual health effects from contaminants.

11 Safe Food

Goals

In cooperation with other federal agencies, we will fully protect the safety of our nation's food. We will ensure that all pesticides on food meet safety standards.

All pesticides that do not meet standards will be off the market by the year ____. EPA will seek the adoption of integrated pest management methods on 75 percent of America's farmland by the year 2000.

Background

Although the United States food supply is one of the safest in the world, some foods contain low levels of pesticide residues. Other toxic chemicals also can cause problems. Lead, for example, may enter food from glazes on ceramicware or from leaded crystal. Toxic chemicals and bacteria in water threaten the health of people who eat contaminated fish and shellfish. People who eat large amounts of locally-caught fish in polluted areas are particularly at risk. Infants and children are especially susceptible to poisoning by chemicals in food because they eat more food relative to their body weight.

EPA's Roles

Under the Federal Food, Drug and Cosmetic Act, EPA sets "tolerance" levels, or maximum legal limits, for pesticide residues in food and animal feed. Limits also are set for pesticides that can pollute waters and then appear in fish tissues. In setting these levels, EPA takes into account the potential threats to infants, children, and other groups who are at higher risk. EPA has approved about 300 pesticides for food uses; about 200 of them are commonly used in the U.S.

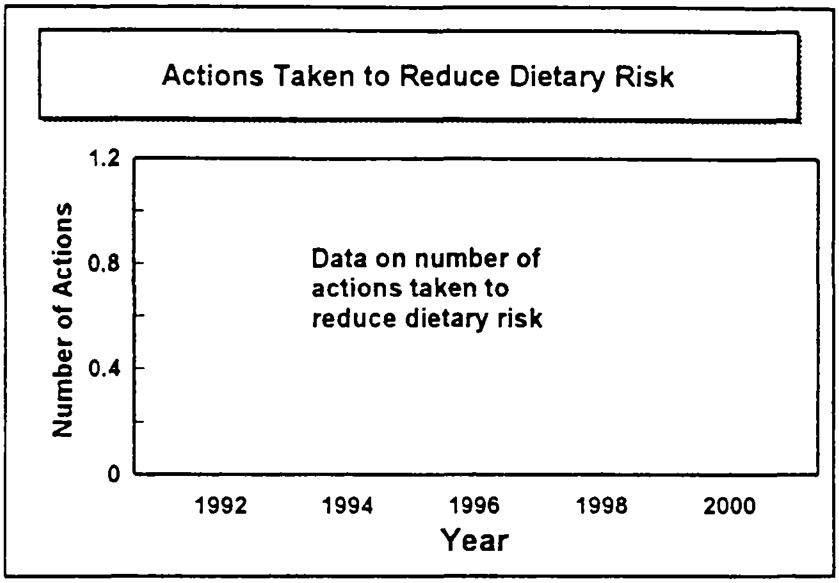
In addition to regulating new pesticides, EPA reviews existing pesticides that were approved before current scientific and regulatory standards were developed. In this "re-registration" process, new scientific data may be used to reduce tolerance levels, modify allowable uses of a pesticide, or ban it altogether.

EPA also provides scientific criteria to aid states in setting water pollution limits that protect fisheries and takes actions to prevent and clean up releases of hazardous substances that can contaminate fish. EPA is working with the U.S. Department of Agriculture to promote innovative agricultural techniques, such as "integrated pest management," that reduce the use of pesticides.

Roles of Others

The Food and Drug Administration (FDA) has the primary federal responsibility for protecting the Nation's food supply. FDA establishes safe levels for poisonous substances (other than pesticides) in foods. FDA enforces these limits as well as the pesticide tolerances set by EPA. FDA monitors all domestically produced and imported foods travelling in interstate commerce except meat, poultry, and some egg products which are monitored by the Department of Agriculture's Food Safety Inspection Service (FSIS). FDA also conducts the Total Diet Study, which measures the American consumer's daily intake of pesticides from foods that are bought in typical supermarkets and grocery stores, and prepared as they would be in a household setting. The study indicates that dietary levels of most pesticides--from all foods combined--are less than one percent of the maximum levels that EPA considers acceptable. FSIS annually conducts 10,000 to 20,000 analyses of pesticide residues on meat, poultry, and dairy products. Fewer than one percent of these tests show illegal residues.

States ensure the safety of food that is produced and sold within their boundaries. Some states have their own monitoring programs and regulations regarding residues of pesticides and other toxic chemicals on food that is produced and sold within state borders. States set water pollution limits to prevent contamination of fish and shellfish. States issue warnings to consumers not to eat fish or shellfish contaminated with toxic chemicals. If there is evidence of bacterial pollution, the state closes the waters to shellfishing.



Source: USEPA Office of Pesticides, 1993

Statistical Quality: Good. Data are based on measures of program activity.

Scientific Validity: Not a scientific measure.

Areas the Indicator Does Not Address: This is a quantitative measure that measure program activity. It does not measure the actual exposure to pesticides through diet, therefore it serves as one among several possible surrogate measures.

12 Worker Safety

Goal

In cooperation with other federal agencies, EPA will continuously reduce the number of workers facing unsafe exposures to harmful chemicals due to regular working conditions, and EPA will strive to reduce the rate at which chemical accidents occur in the workplace.

Background

The United States labor force now includes over 125 million people, and most spend a major portion of their day in the workplace. Premature deaths, diseases, and injuries resulting from workplace environmental conditions continue to be an important national problem. In 1986, it was estimated that each year 400,000 workers become ill from exposure to hazardous substances in the workplace and about 100,000 die prematurely from these exposures.

Agriculture workers are a particularly high-risk group. Many farm workers suffer health problems from handling pesticides, applying them, or working where they have been applied. These problems range from relatively minor short-term irritations of skin or eyes to fatal poisonings, and from cancer in workers to birth defects in their children. Industrial workplaces where hazardous chemicals are used also pose a broad range of potential threats to workers, who may be harmed by cumulative, day-to-day exposures to chemicals in work areas or by sudden, large exposures resulting from accidents.

EPA's Roles

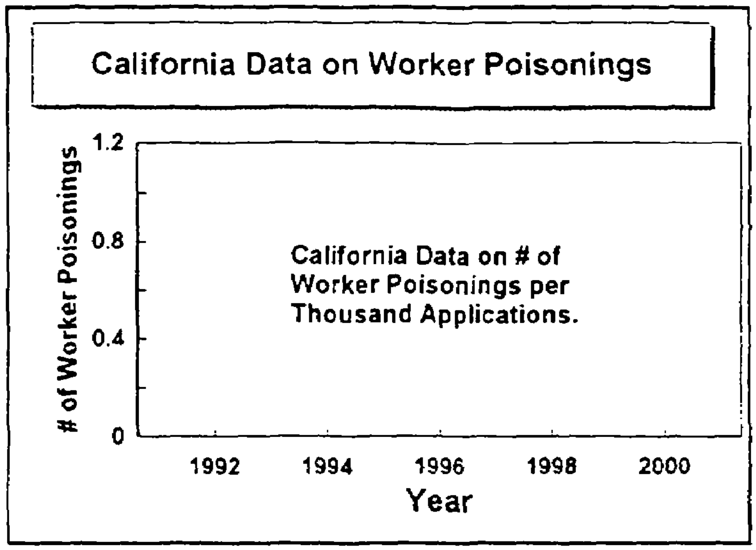
To protect workers on farms and in forests, nurseries and greenhouses against harm from pesticides, EPA has issued Worker Protection Standards that govern use of agricultural pesticides. The standards set specifications for the equipment used to apply pesticides, mandate protective clothing for workers, and establish minimum time intervals following pesticide applications before workers can enter a treated area. In addition, the standards require safety training for all workers who may come into contact with pesticides. EPA requires workers who handle or apply the most hazardous pesticides to receive more rigorous training and certification in proper pesticide use.

To protect workers against harm from industrial chemicals, EPA works with agencies such as the Occupational Safety and Health Administration (OSHA) to develop standards for safe levels of chemicals in the workplace. When a chemical poses significant health or environmental threats, EPA may restrict its use, require safety precautions, or ban it entirely.

Roles of Others

OSHA, part of the Department of Labor, has the primary federal role in reducing job-related injuries or deaths. To protect workers against harm from airborne chemicals in the workplace, OSHA has set permissible Exposure Limits for several hundred substances. OSHA also establishes rules for handling and storing hazardous chemicals in work areas and requires use of protective clothing and equipment to prevent worker exposure.

The states are responsible for running federally-approved certification and training programs for users of the most hazardous pesticides. State programs have certified over one million applicators. Health organizations ranging from federal agencies to local clinics work to ensure that medical practitioners are trained to recognize early effects of exposure and to warn workers if they have incurred health effects from pesticides.



Source: USEPA Office of Pesticides, 1993

Statistical Quality: Believed to be of fair quality. It is difficult to assess the relative amount of error due to underreporting by physicians and applicators.

Scientific Validity: Each case of poisoning is investigated by the county agricultural commission and is further verified by the California EPA.

Areas the Indicator Does Not Address: Does not give a direct measure of actual exposure of workers to pesticides, therefore it serves as one among several possible surrogate measures. Only California data are currently available.

13 Improved Understanding of the Environment

Goal

We will ensure that the public has access to good information about sources of pollution in their communities, how people and environmental systems respond to pollutants and other stresses, and what people can do to lower risks to their health and environment. We will inform the public about how the quality of the nation's environment is improving or worsening.

Background

Ignorance about environmental problems jeopordizes human health and the world's ecological balance. We must develop much better technical knowledge and skills to anticipate environmental problems, estimate their risks, and identify practical solutions. Improved understanding of environmental systems will enable us to determine acceptable exposures to and releases of pollutants, and measure the environmental benefits of risk management actions.

Better environmental protection requires public understanding, participation and support. A knowledgeable public can make environmentally-sound personal and business decisions, and is more likely to support use of public resources to manage important environmental problems. Public information also helps people handle environmental problems that the government has limited authority to control, such as radon and tobacco smoke in homes.

EPA's Roles

EPA conducts research in many fields, including environmental health, environmental technology, ecological systems, monitoring methods, and risk assessment. EPA research has served as the basis for regulations and policies for environmental protection.

EPA has started an Environmental Monitoring and Assessment Program to monitor the condition of the nation's ecological resources. Data from EMAP will indicate whether serious changes are occuring and help identify their causes.

EPA works with other federal and state agencies to produce reports on the status of the environment. For example, EPA makes information about releases of toxic chemicals available so that people can identify chemical releases from industrial plants in their community. The availability of this information gives industrial firms a strong incentive to reduce pollution.

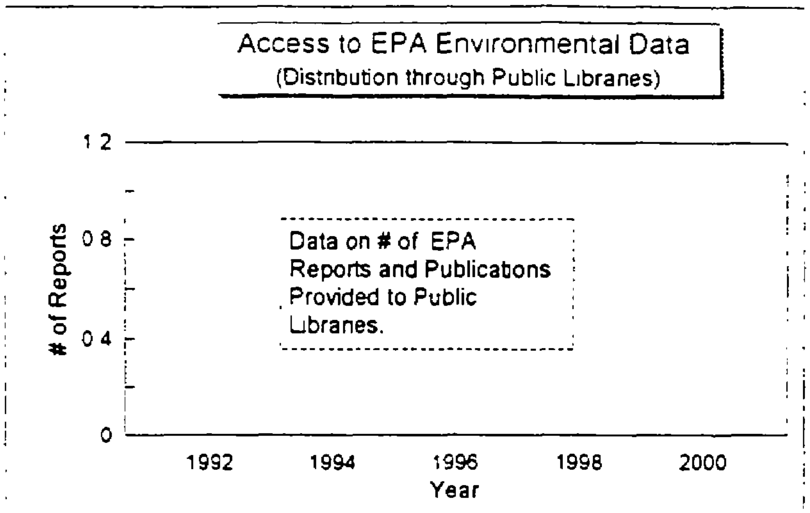
EPA distributes publications that provide information about environmental problems, the government programs that address them, and the actions people can take to reduce them. EPA also operates many telephone hotlines that provide the public with environmental information.

To promote environmental education, EPA trains environmental professionals, funds programs such as the national Environmental Education and Training Program and the Pollution Prevention Center to develop curricula and train teachers, and provides grants to support environmental education.

Roles of Others

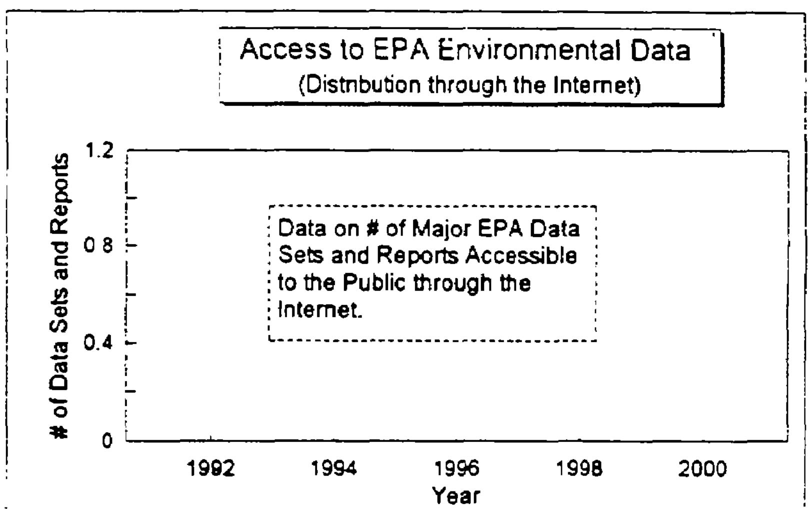
State and local governments have primary responsibility for education in the U.S., but the federal government also has important roles. The Department of Education has developed the "America 2000" strategy with goals that include becoming the the world leader in science by 2000. The Federal Coordinating Council on Science, Engineering and Technology is working to identify and assist U.S. government programs that will help train a work force ready for the upcoming environmental challenges. Various federal agencies are responsible for educating the public about environmental issues relevant to their programs. For example, the National Park Service educates visitors about the environments in National Parks. The Agriculture department, in partnership with state and local governments and land-grant universities, provides training in natural resources and environmental management in nearly every county.

Many private organizations provide educational materials ranging from magazines for children to fact sheets on specific environmental problems.



Source: USEPA Office of Administration and Resources Management, 1993

Data Quality: The statistical quality is considered to be high.
Scientific Validity: Not a scientific measurement. This is a quantitative measure that records program activity over time.
Areas the Indicator Does Not Address: The measure does not address the effectiveness of the accessed information in increasing understanding of the environment.



Source: USEPA Office of Information Resources Management, 1993

Data Quality: The statistical quality is considered to be high.
Scientific Validity: Not a scientific measurement. This is a quantitative measure that records program activity over time.
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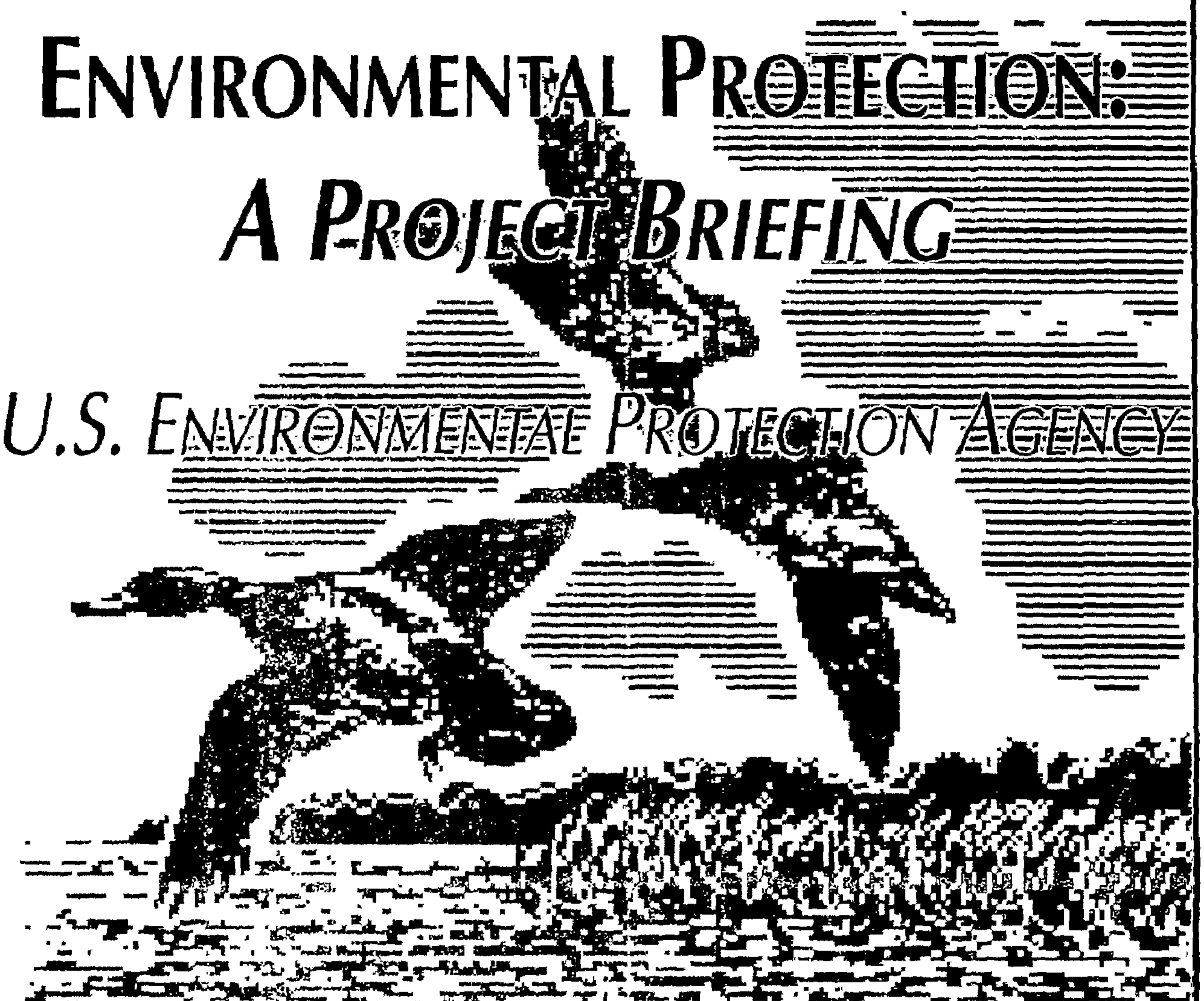
For further information, please contact

Mr. Derry Allen, Acting Director
Office of Strategic Planning & Environmental Data (2161)
U.S. Environmental Protection Agency
401 M St, SW
Washington, DC 20460
202/260-4028 FAX 202/260-0275

Mr. Peter Truitt, Goals Project Manager
Environmental Results Branch (2162)
U.S. Environmental Protection Agency
401 M St, SW
Washington, DC 20460
202/260-8214 FAX 202/260-~~4908~~ 4903

SETTING NATIONAL GOALS FOR ENVIRONMENTAL PROTECTION: A PROJECT BRIEFING



U.S. ENVIRONMENTAL PROTECTION AGENCY

Setting National Goals for Environmental Protection

- A Project Briefing -

January 12, 1994

Purpose of EPA's National Goals Project

- To state the environmental outcomes we are seeking in terms that are clear to the public.
- To engage stakeholders in the goal-setting process.
- To design goal-directed strategies.
- To develop indicators for measuring progress toward goal-attainment, evaluating strategies, and evaluating performance.

What Do We Mean by "Environmental Goals?"

- **Tier 1 goal:** *first*, the condition of the environment we ultimately are trying to achieve; *second*, the condition we are seeking to reach by a certain date, expressed in measurable terms if possible.

- **Tier 2 objective:** reductions in the causes or sources of problems encompassed by a Tier 1 goal, expressed in measurable terms.

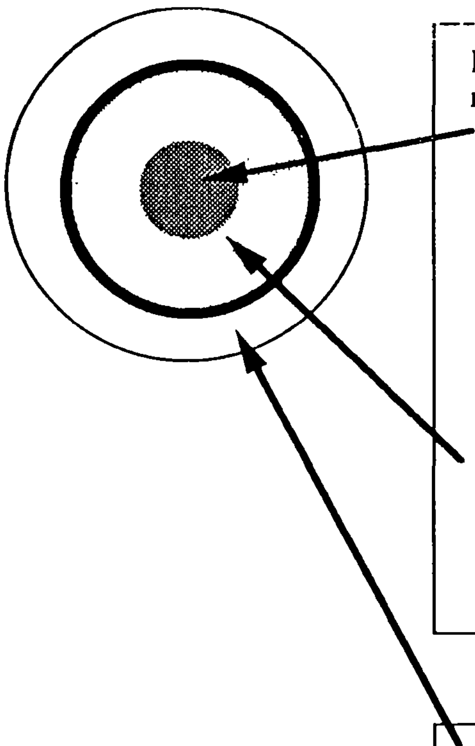
- **Tier 3 action target:** actions that governments and others will complete to achieve a Tier 2 objective -- and ultimately a Tier 1 goal.

Example: Clean Surface Waters

Tier 1: **All the lakes, rivers and bays of the United States will be clean and safe for human recreation and they will support healthy and edible fish, shellfish and wildlife. By ____, at least x percent of the surface waters will fully meet standards set by the states to protect aquatic life and human health.** Baseline: EPA estimates that y percent of the nation's waters currently support recreation and healthy aquatic communities.

Tier 2:	Estimated required reductions of nutrients, sediment and pesticides from agricultural sources.	Estimated required reductions of BOD, nutrients,sediment & high-risk toxics from urban stormwater and combined sewers.	Estimated required reductions of air-deposited nutrients and toxics.	Estimated required increase in riparian zones that are performing their natural ecosystem functions.	Estimated required increase in unobstructed river miles needed for passage of migratory fish.
Tier 3:	EPA actions - OW - OPPTS - OPPE DOI actions DOA actions • •	EPA actions - OW - OPPTS DOT actions CoE actions • • •	EPA actions - OW - OAR DOE actions DOT actions • • •	DOI actions DOA actions EPA actions DOD actions DOT actions • • •	DOI actions DOD actions EPA actions • • • • •

Three Categories of Environmental Goals



EPA has primary Federal responsibility

- Clean Air
- Clean Water
- Prevention of Toxic Releases
- Cleanup of Contaminated Sites
- Safe Drinking Water
- Protection of the Ozone Layer
- Improved Understanding of the Environment

EPA has partial but important responsibility

- Global Climate Change
- Ecological Protection
- Safe Food
- Worker Safety
- Safe Indoor Environment
- Prevention of Spills and Accidents

EPA's National Environmental Goals Project -- Other Agencies May Cooperate

Outside EPA's areas of responsibility

- Public Lands Management
- Infectious Diseases

Other Agencies' Goals Projects -- EPA Cooperating

PCSD's National Sustainable Development Goals?

The Public Meetings

Roundtables (one in each region) organized by Regions:

- 30 spokespersons from environmental groups, economic development groups, and state/local/tribal governments,
- senior government officials in the region and the Administrator (at most of them).
- Public invited, mostly as observers.
- Round One (Jan - April) will discuss public concerns, expectations, and possible goals).
- Round Two will discuss EPA's proposed goals.

Who Is Involved?

- **EPA Goals Leadership Team** (office directors, senior regional managers, state/tribal representatives) is "board of directors."
- **OPPE** is managing staffwork.
- **Programs** will help provide data, conduct analyses, draft goals.
- **Regions and states** will organize public meetings, help run them, and help develop and review goals.
- **Public** will identify goal topics and comment on proposed goals.
- **Other federal agencies** may join us.

The Goals Project is going to help set the direction of EPA's and the nation's environmental efforts, so obviously it is an extremely important undertaking. I look forward to working with you as we proceed.

-- Carol Browner

For further information, contact your AA/RA's office, or write or call:

Derry Allen, Acting Director
Office of Strategic Planning & Environmental Data (2161)
US Environmental Protection Agency
Washington, DC 20460
Phone: 202-260-4028 FAX: 202-260-0275

Peter Truitt, Project Manager
Strategic Planning & Management Division (2162)
US Environmental Protection Agency
Washington, DC 20460
Phone: 202-260-8214 FAX: 202-260-4903

Jay Benforado, Deputy Director
ORD/OSPRE
202-260-7669

Mike Cook, Director
OW/OWEC
202-260-5850

Dave Davis, Deputy Director
OW/OWOW
202-260-7166

Courtney Riordan, Director
ORD/OEPER
202-260-5950

Denise Graveline, Dep. Assoc. Admin
OCEPA
202-260-7963

Mark Greenwood, Director
OPPTS/OPPT
202-260-3810

Walt Kovalick, Act. Dep. Asst. Admin
OSWER
202-260-4610

Dick Sanderson, Director
OE/OFA
202-260-5053

David O'Connor, Assoc. Comptroller
OARM/OC
202-260-9674

Margo Oge, Director
OAR/ORIA
202-233-9320

Abby Pirnie, Director
OA/OCEM
202-260-8079

Stan Laskowski, DRA
Region 3
215-597-9814

Bill Hathaway, DRA
Region 6
214-655-2100