Environmental Health Tracking: From Vision to Data to Action

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Centers for Disease Control and Prevention

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Agenda

- Why keep track of things?
- The concept of indicators
- Key examples of tracking
- EPHT at CDC: An Assessment
- A Vision for the Future

Why keep track of things?

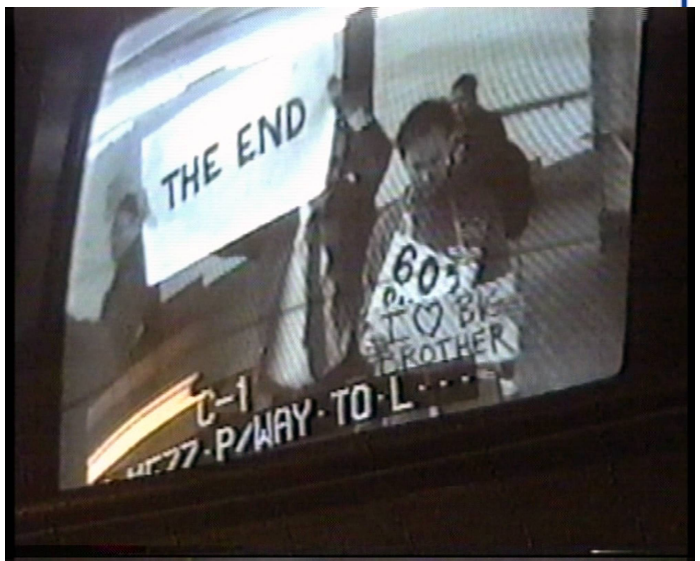
- To know what's going on
- To focus public and policymaker attention on important issues
- To define information needs
- To monitor progress toward specific goals
- To guide action

ASSESSMENT

ASSURANCE

POLICY DEVELOPMENT

Surveillance



Surveillance

Tracking: Definition (Pew, 2000)

"Tracking" is synonymous with the CDC's concept of public health surveillance, which is defined as "the ongoing, systematic collection, analysis and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know"

Tracking: Definition (CDC, 2004)

EPHT is the ongoing collection, integration, analysis interpretation, and dissemination of data from environmental hazard monitoring, and from human exposure and health effects surveillance.

Indicators : Definition

- An indicator is a quantitative or qualitative variable that can be measured and that, when observed periodically, demonstrates trends.

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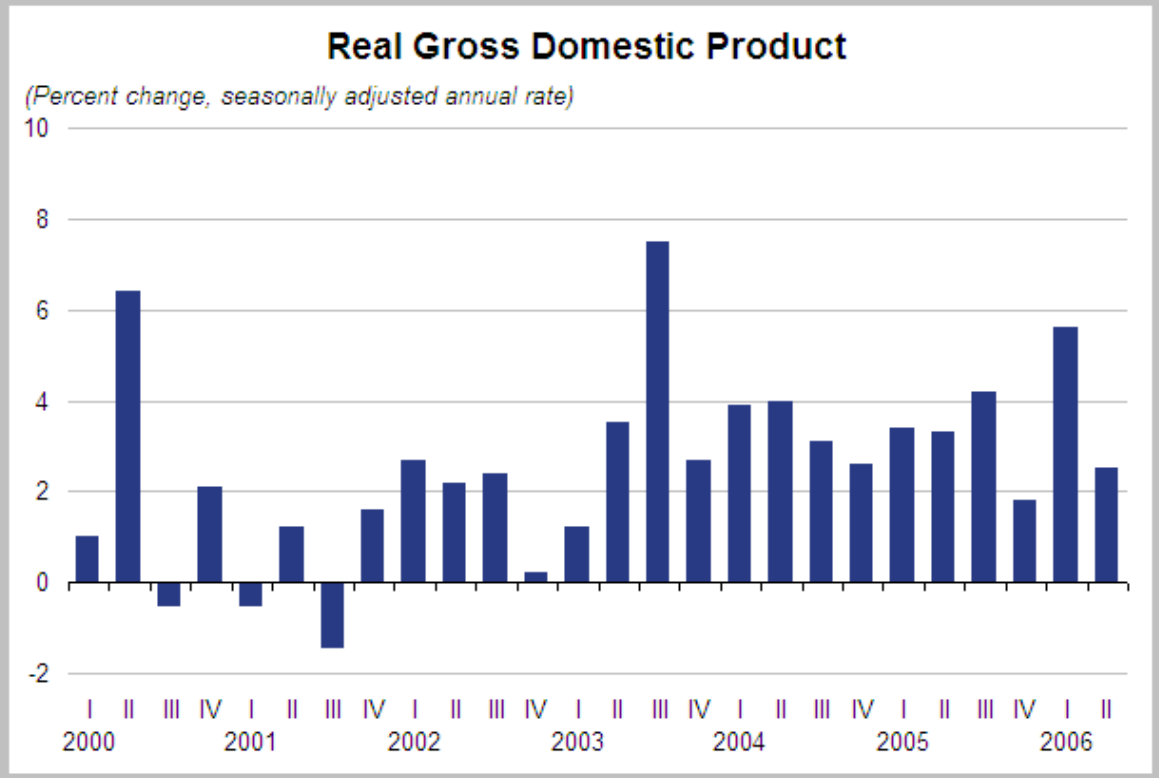
Characteristics of Effective Indicators

- **Relevant:** they show you something about the system that you need to know.
- **Easy to understand**, even by non-experts.
- **Reliable:** you can trust the information that the indicator is providing.
- Based on **accessible data**.

Source: Sustainable Measures

Gross Domestic Product



U.S. Bureau of Economic Analysis

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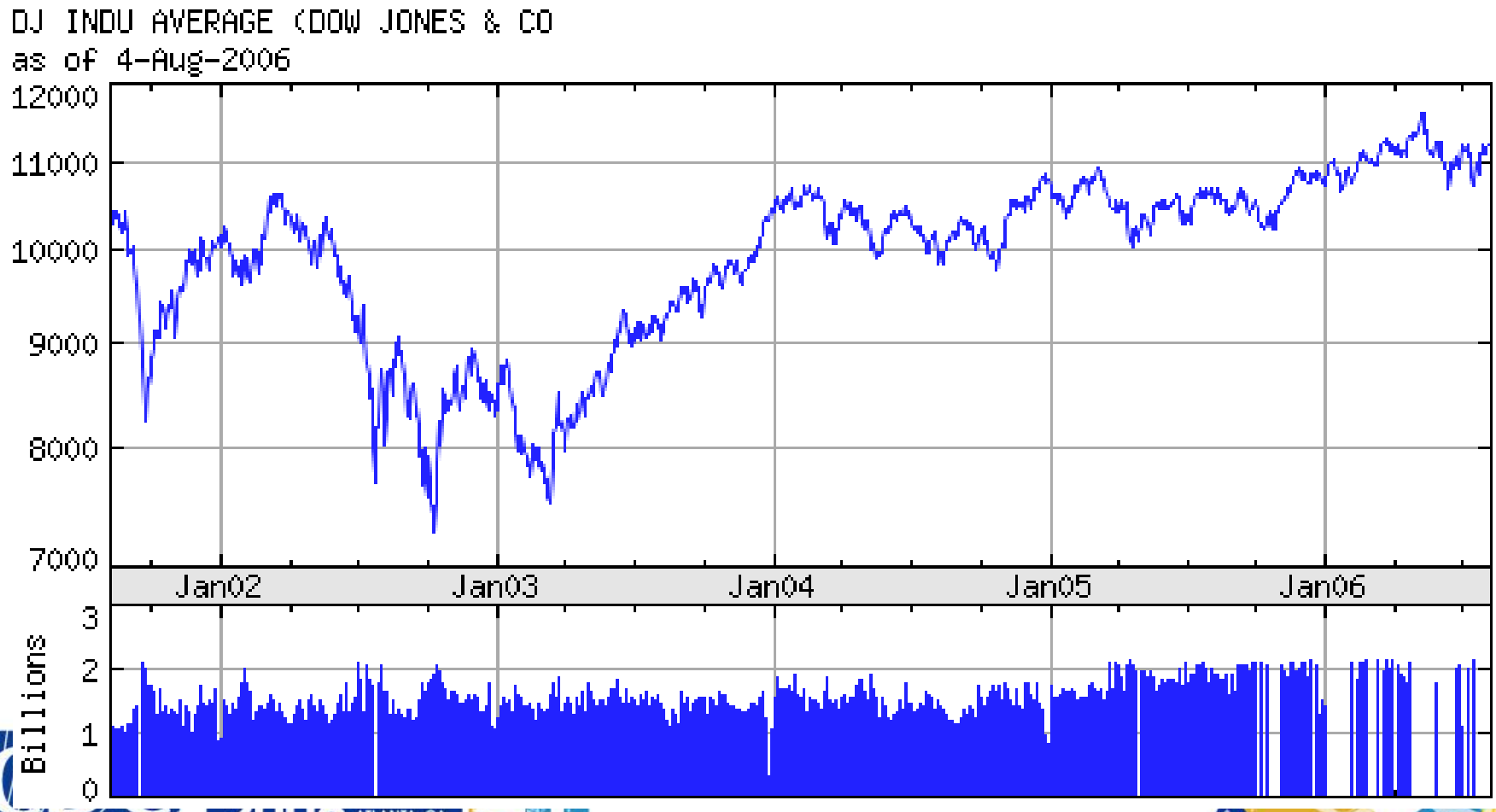
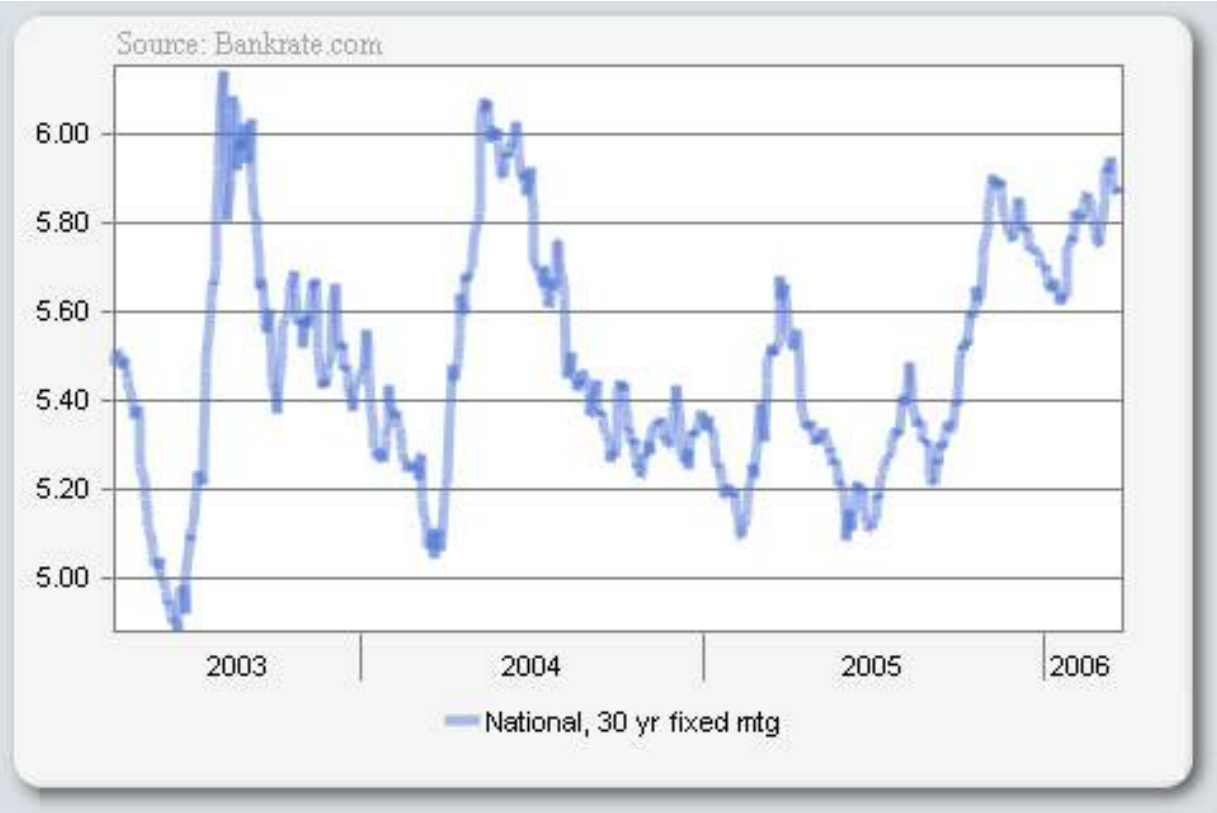
Dow Jones Industrial Average

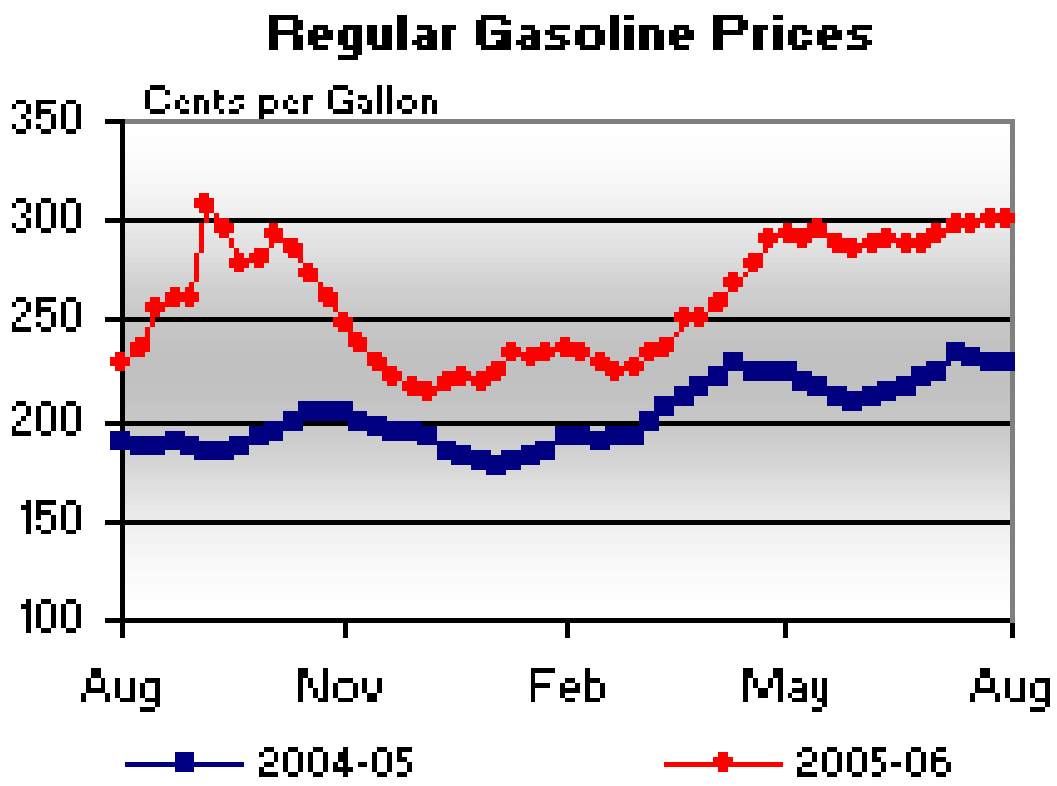


Mortgage Rates

30-yr Fixed Mortgage Rate Trend, 2003 – 06



Price of Gasoline



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Bad News from Prudhoe Bay (again)…

…and the Indicators

washingtonpost.com

BP Shutdown Puts Pressure on Gas Prices

By MARY PEMBERTON
The Associated Press
Tuesday, August 8, 2006; 8:36 AM

ANCHORAGE, Alaska -- The fast rise in oil prices after BP's announcement that it was shutting down one of its biggest oil fields for repairs that could take months appeared to have leveled off Tuesday morning.

Oil prices fell in several markets, but the price was still more than $1 above

Detroit Free Press

MICHIGAN BUSINESS

BP repair to hit state drivers in wallet

AAA says gas costs could rise again

August 8, 2006

BY ALEJANDRO BODIPO-MEMBA AND ANGELA TABLAC
FREE PRESS BUSINESS WRITERS

Michigan's average gas price, which hit a record of $3.12 a gallon Monday, is likely to top $3.20, as oil giant BP said the nation's largest oil field in Prudhoe Bay, Alaska, would be shut down for "weeks or months" for pipeline repairs.

The shutdown, after leaks blamed

Los Angeles Times latimes.com

Oilfield Closure to Hit Pumps

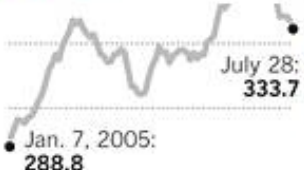
A shutdown in Alaska will affect refiners in Western states, but it's not clear how badly. Pessimists say gas could reach $4 a gallon.

By Elizabeth Douglass, Times Staff Writer
August 8, 2006

The potentially lengthy closure of a key Alaskan oilfield sent crude oil prices soaring Monday, as experts warned that the disruption could result in higher gasoline prices in California and other Western states dependent on Alaskan oil.

Analysts said it was too early to say how much pump prices would rise, but the most pessimistic predicted $4-a-gallon gas.

VIDEO
Alaskan Oil Field Shutdown
(AP)
Aug. 7, 2006



GRAPHIC
Another blow at the pump
August 8, 2006
click to enlarge

Temperature

Details for Wednesday Aug, 9

Monday 8/7

Wednesday Day

Humid with intervals of clouds and sun; an afternoon thunderstorm

High	92°F
RealFeel®:	103°F

View the Hour-By-Hour™ Forecast

Winds:	ENE at 4mph
Wind Gusts:	9 mph
Max UV Index:	High (6)
Thunderstorm Probability:	75%
Amount of Precipitation:	0.15in
Amount of Rain:	0.15in
Amount of Snow:	0.00in
Hours of Precipitation:	1 Hrs
Hours of Rain:	1 Hrs
Hours of Sun:	13.0 Hrs

Wednesday Night

Partly cloudy and humid

Low:	73°F
RealFeel®:	77°F

View the Hour-By-Hour™ Forecast

Winds:	SE at 4mph
Wind Gusts:	9 mph
Min UV Index:	N/A
Thunderstorm Probability:	29%
Amount of Precipitation:	0.00in
Amount of Rain:	0.00in
Amount of Snow:	0.00in
Hours of Precipitation:	0 Hrs
Hours of Rain:	0 Hrs
Hours of Dark	11 Hrs

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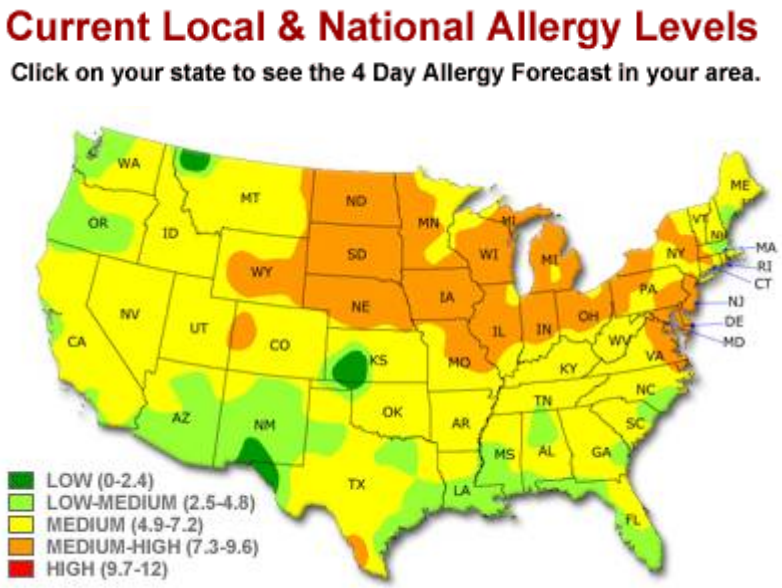
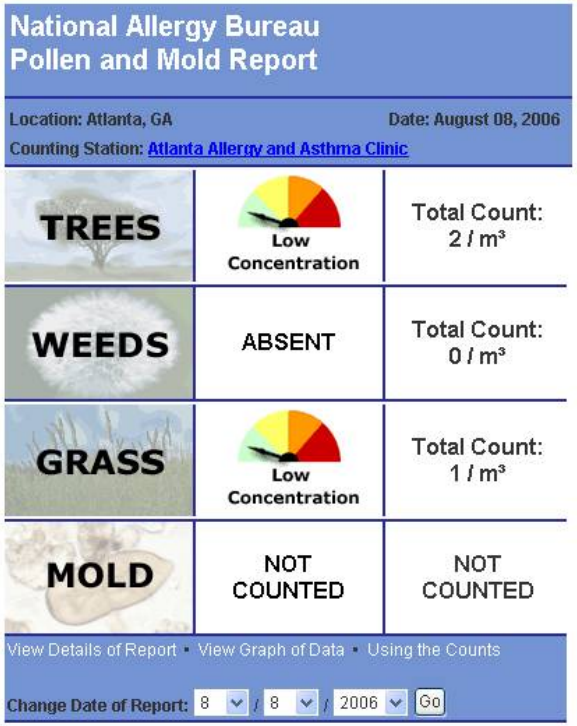
Pollen Counts



Source: www.pollen.com



Source: www.aaaai.org

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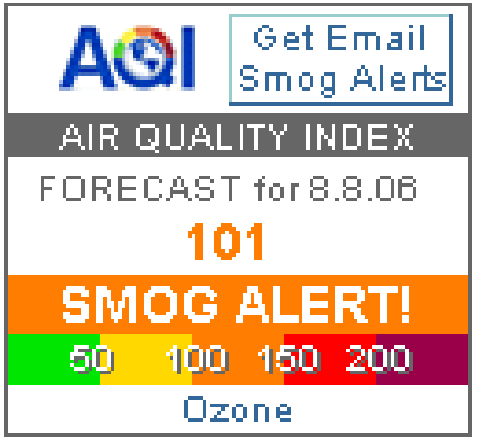
Air Quality

EPA's Air Quality Index

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*...air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Atlanta's AQI: 8/8/06



CDC Centers for Disease Control and Prevention

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Key Examples of Tracking

- CDC: National Exposure Report
- EPA: American's Children and the Environment
- Border 2012: Environmental Indicators
- Sustainability Indicators
- Redefining Progress: The Genuine Progress Indicator
- America's Best Colleges

CDC's National Exposure Report

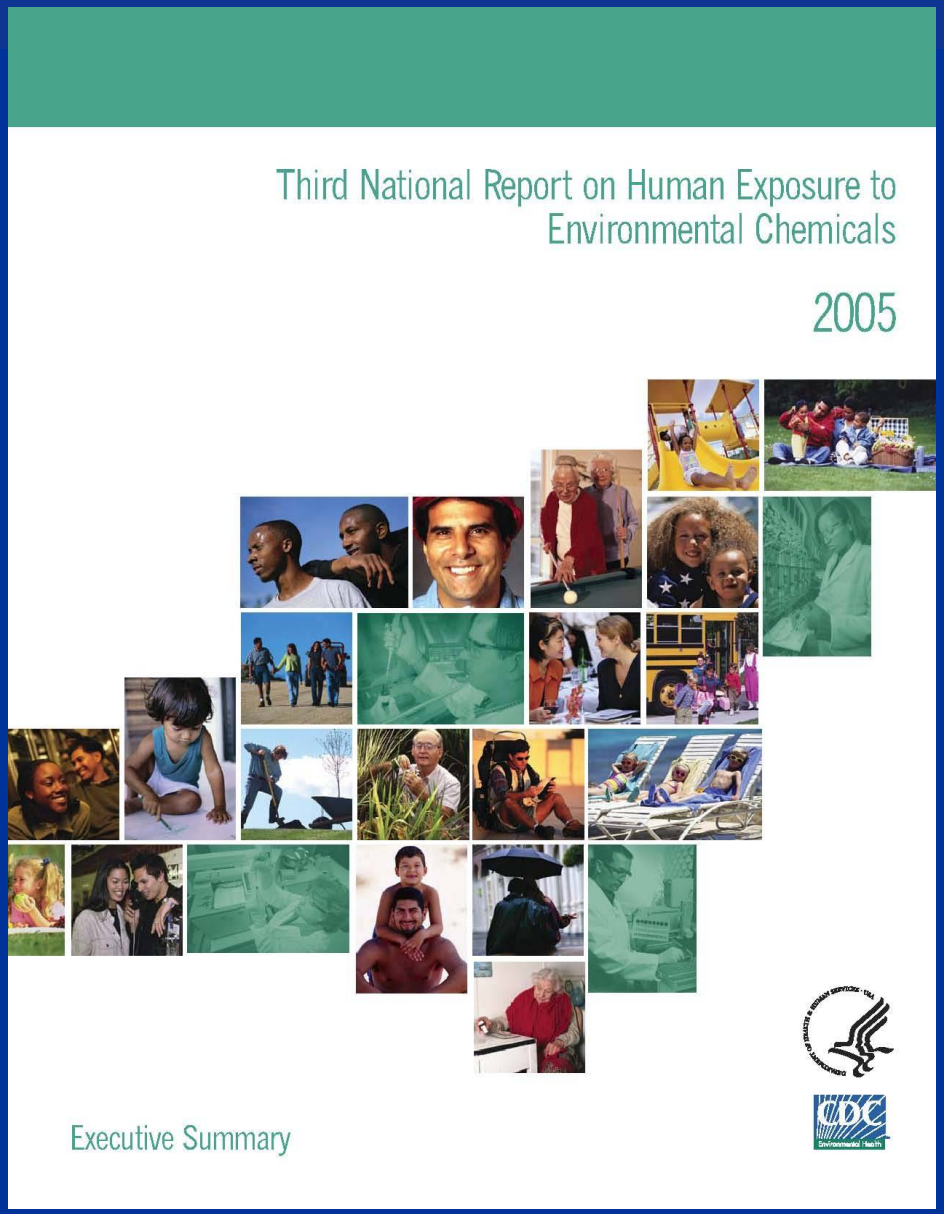
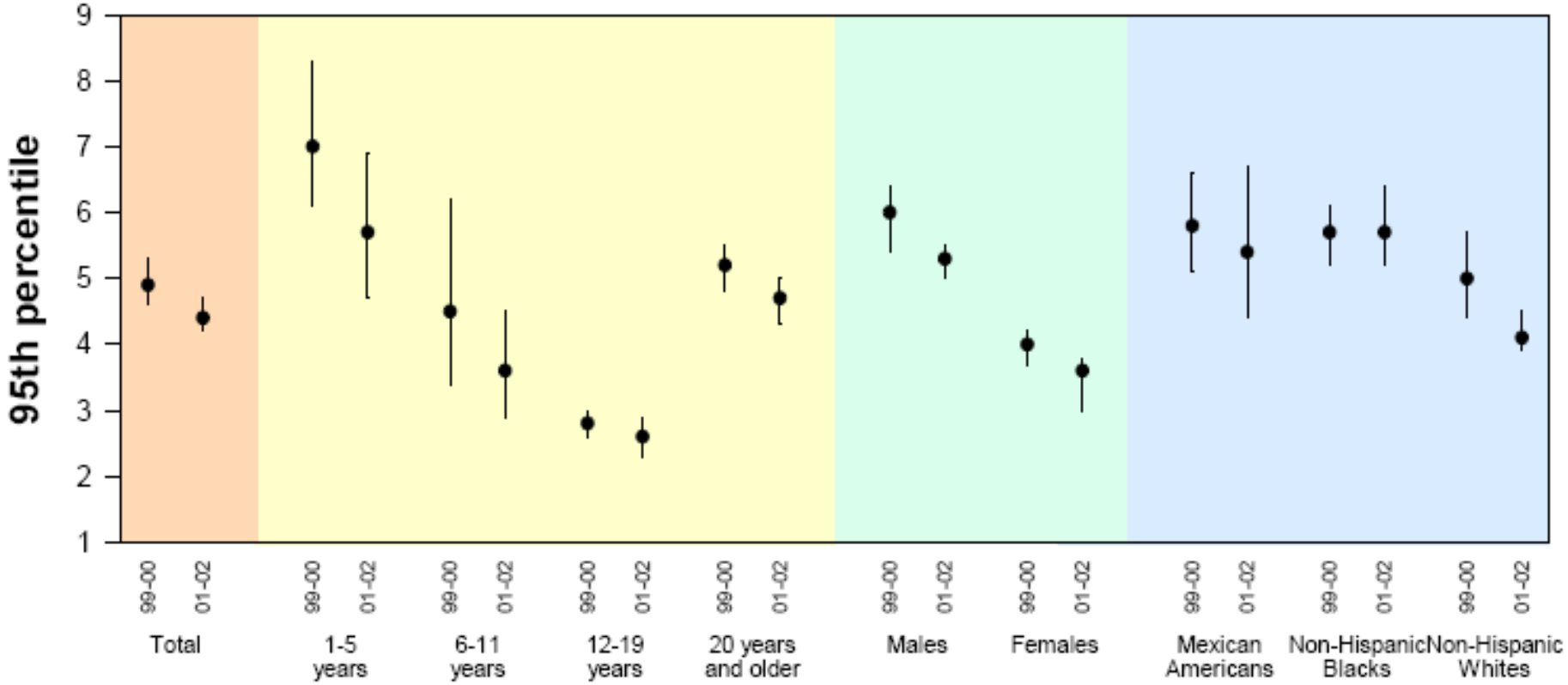


Table of Contents

- Metals
- Tobacco Smoke
- Dioxins, PDBs, PCBs
- Phthalates
- Phytoestrogens
- Various Pesticides, Herbicides & Insecticides

Lead in Blood (µg/dl)



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Lead in Blood (µg/dl)

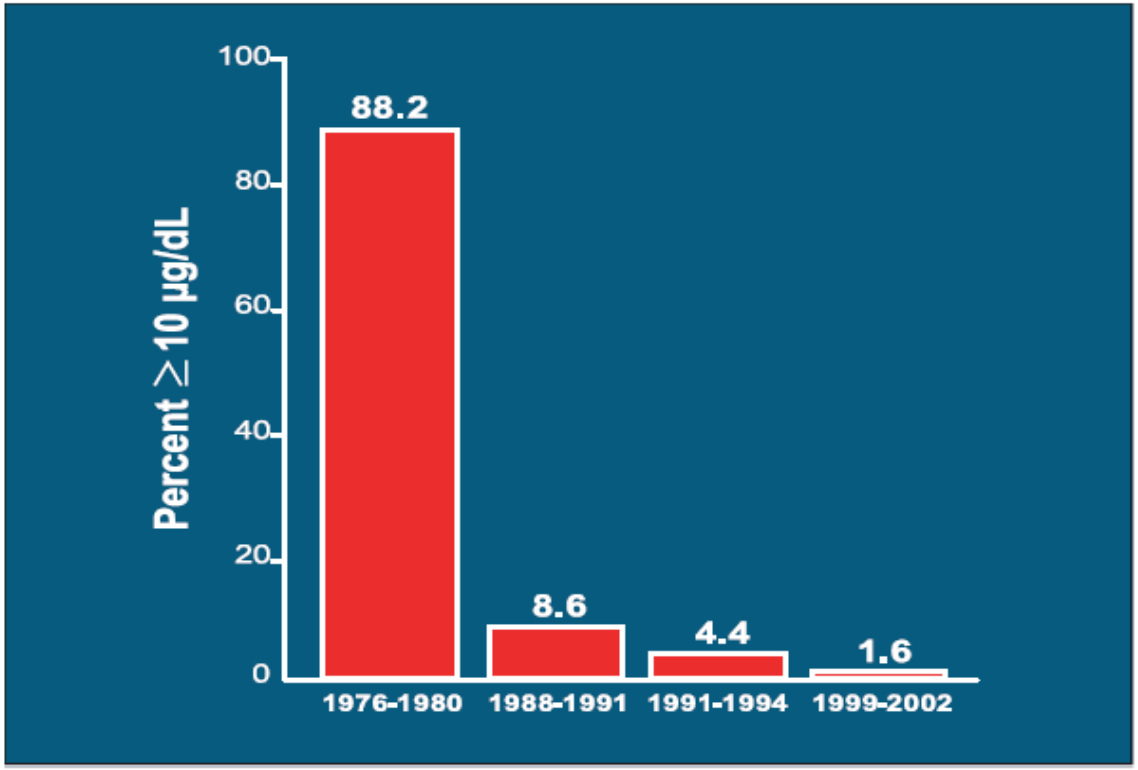

Figure 1. Percentage of children 1-5 years old in the U.S. population with elevated blood lead levels (≥µg/dL)

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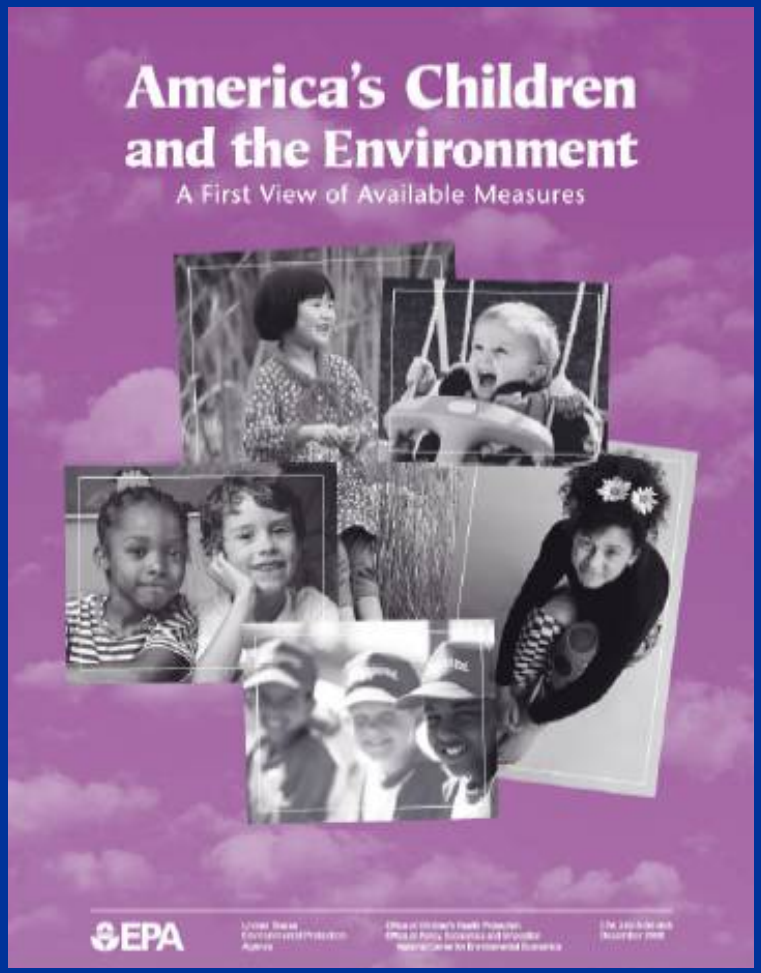
Key Features of the National Exposure Report

- Extremely rigorous laboratory measurements
- Limited to descriptive data; explicitly NOT analytical epidemiology
- Includes ethnic and racial stratification
- Presentation (printed and web) is accessible, attractive and readable (if technical)

America's Children and the Environment



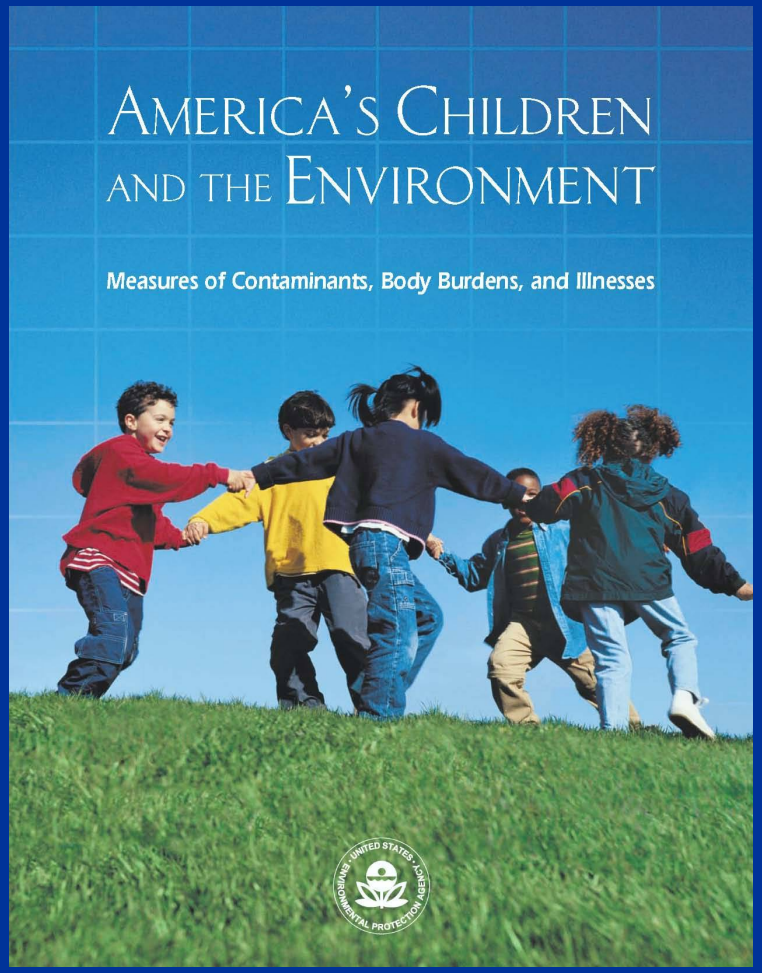


Table of Contents

Part 1: Environmental Contaminants . . . . . .
- Outdoor Air Pollutants . . . . . .
- Indoor Air Pollutants . . . . . .
- Drinking Water Contaminants . . . . . .
- Pesticide Residues . . . . . .
- Land Contaminants . . . . . .
- References . . . . . .

Part 2: Body Burdens . . . . . .
- Concentrations of Lead in Blood . . . . . .
- Concentrations of Mercury in Blood . . . . . .
- Concentrations of Cotinine in Blood . . . . . .
- References . . . . . .

Part 3: Childhood Illnesses . . . . . .
- Respiratory Diseases . . . . . .
- Childhood Cancer . . . . . .
- Neurodevelopmental Disorders . . . . . .
- References . . . . . .

Part 4: Emerging Issues . . . . . .
- Mercury in Fish . . . . . .
- Attention-Deficit/Hyperactivity Disorder . . . . . .
- References . . . . . .

Part 5: Special Features . . . . . .
- Lead in California Schools . . . . . .
- Pesticides in Minnesota Schools . . . . . .
- Birth Defects in California . . . . . .
- References . . . . . .

Future Directions . . . . . .

Glossary of Terms . . . . . .

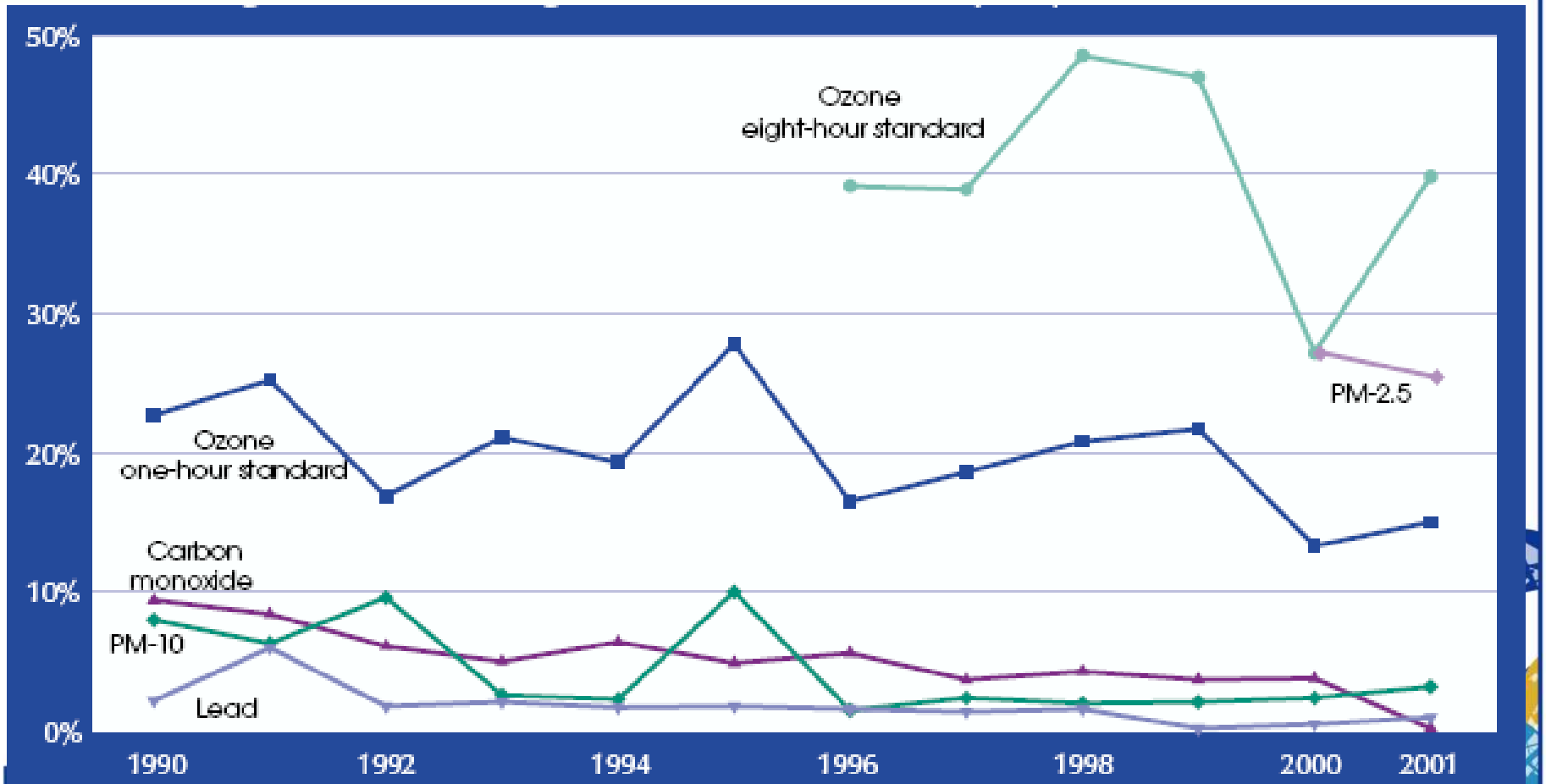
Appendix A: Data Tables . . . . . .

Appendix B: Data and Methods . . . . . .

Appendix C: Environmental Health Objectives in Healthy People 2010

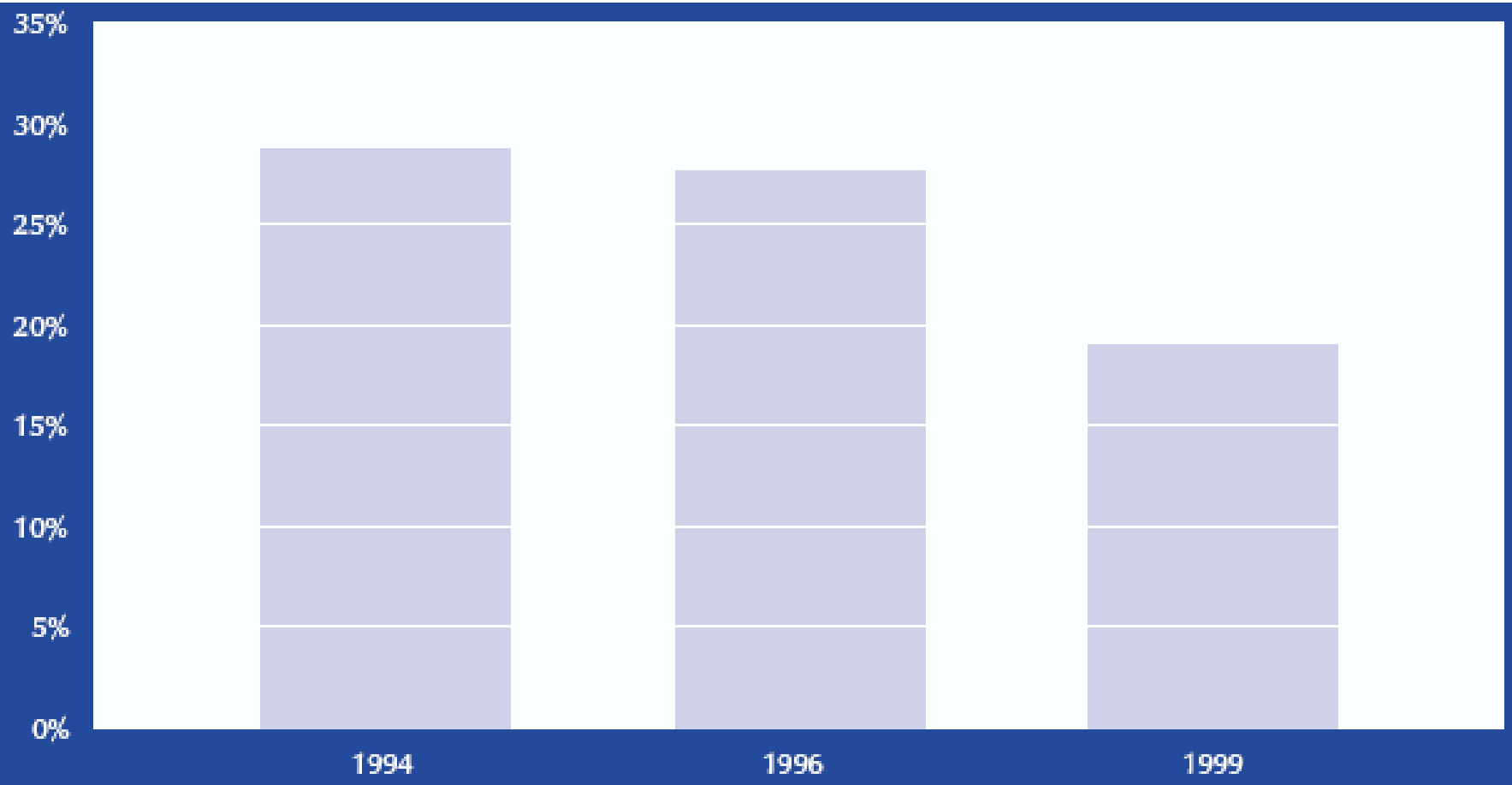
Appendix D: Environmental Health Objectives in EPA's Strategic Plan . .

Percentage of children living in countries in which air quality standards were exceeded



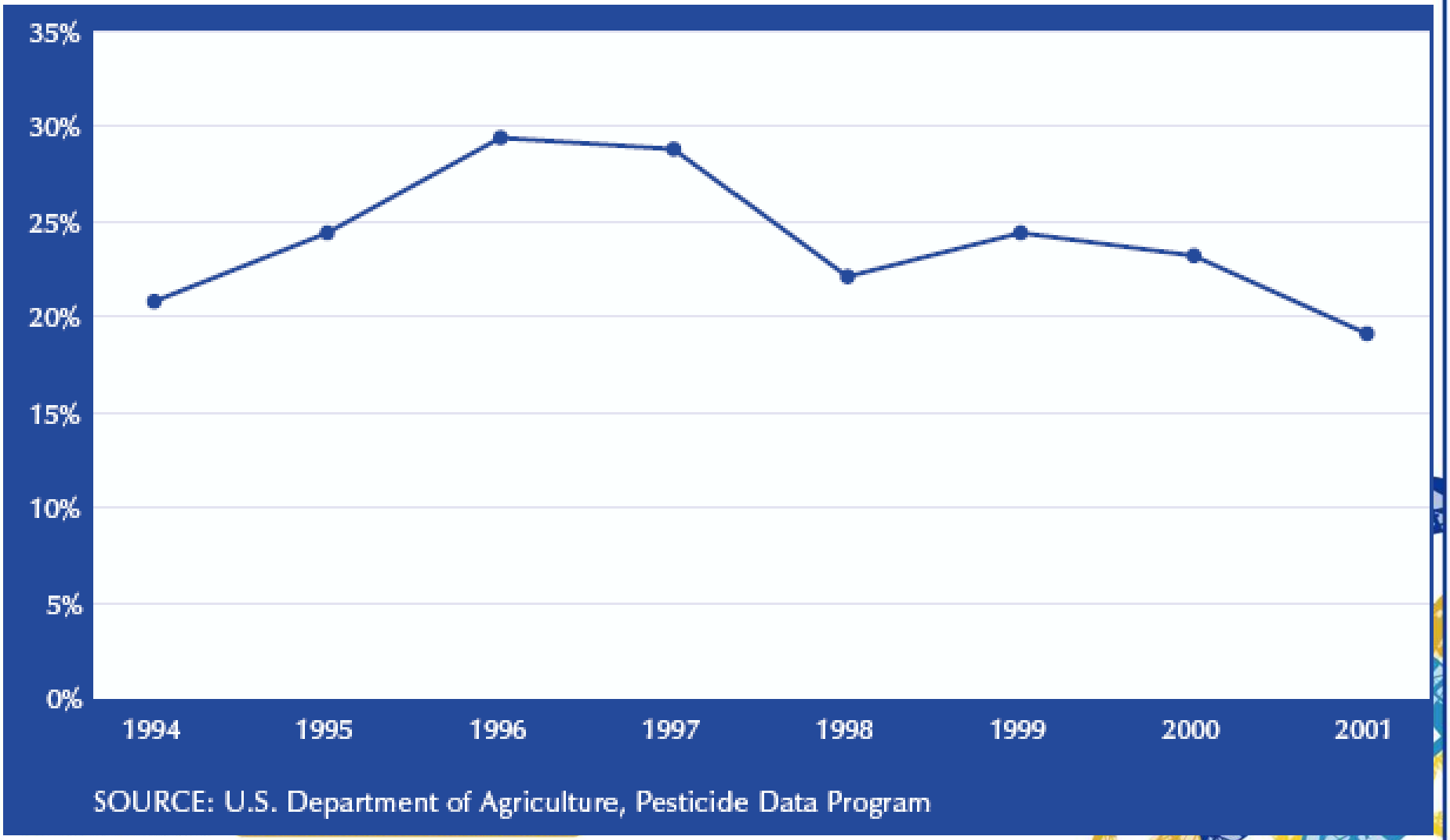
SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System

Percentage of homes with children under 7 where someone smokes regularly



SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division, Surveys on Radon Awareness and Environmental Tobacco Issues

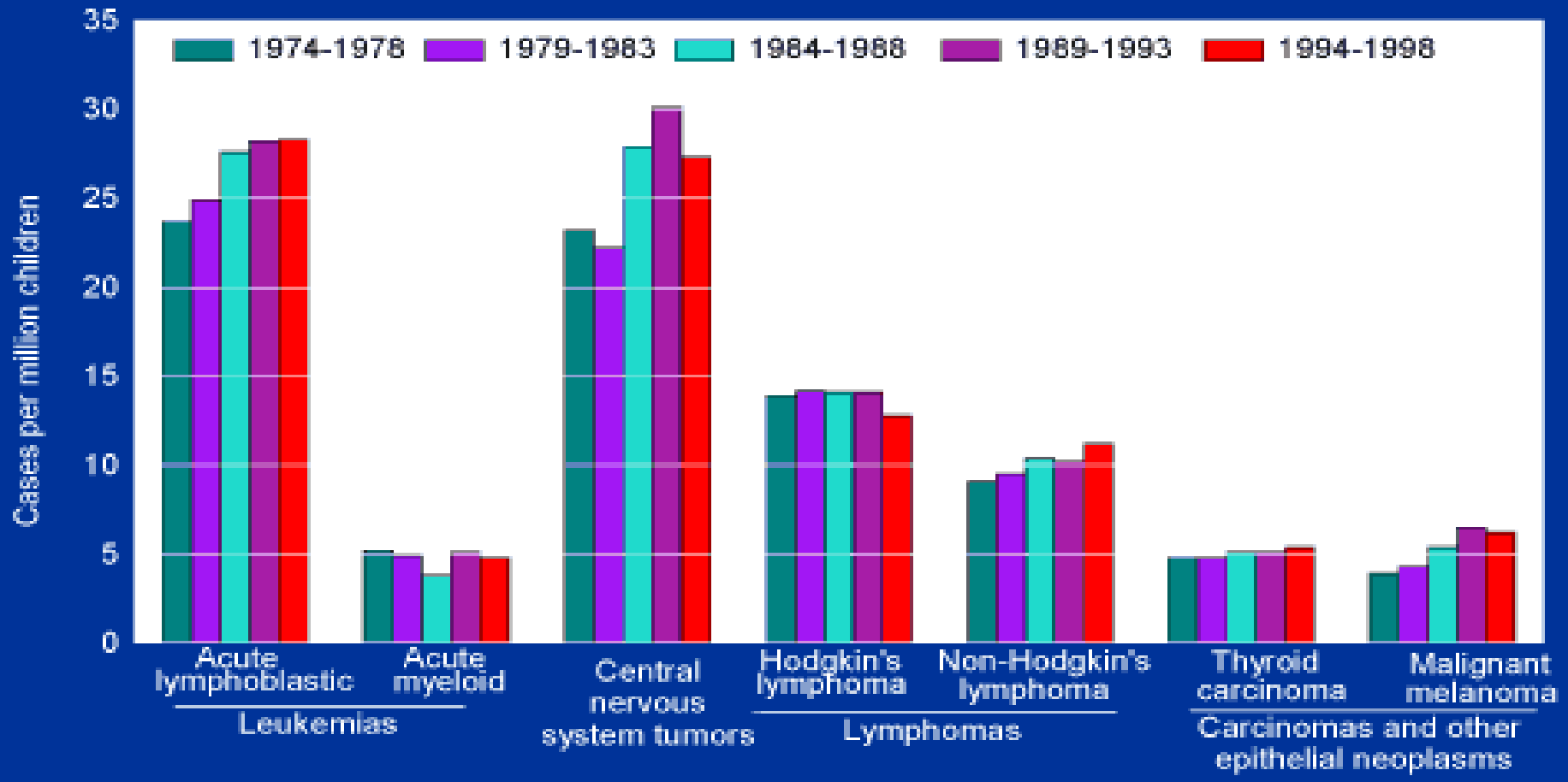
Percentage of fruits, vegetables, and grains with detectable residues of organophosphate pesticides



Cancer Incidence by Type

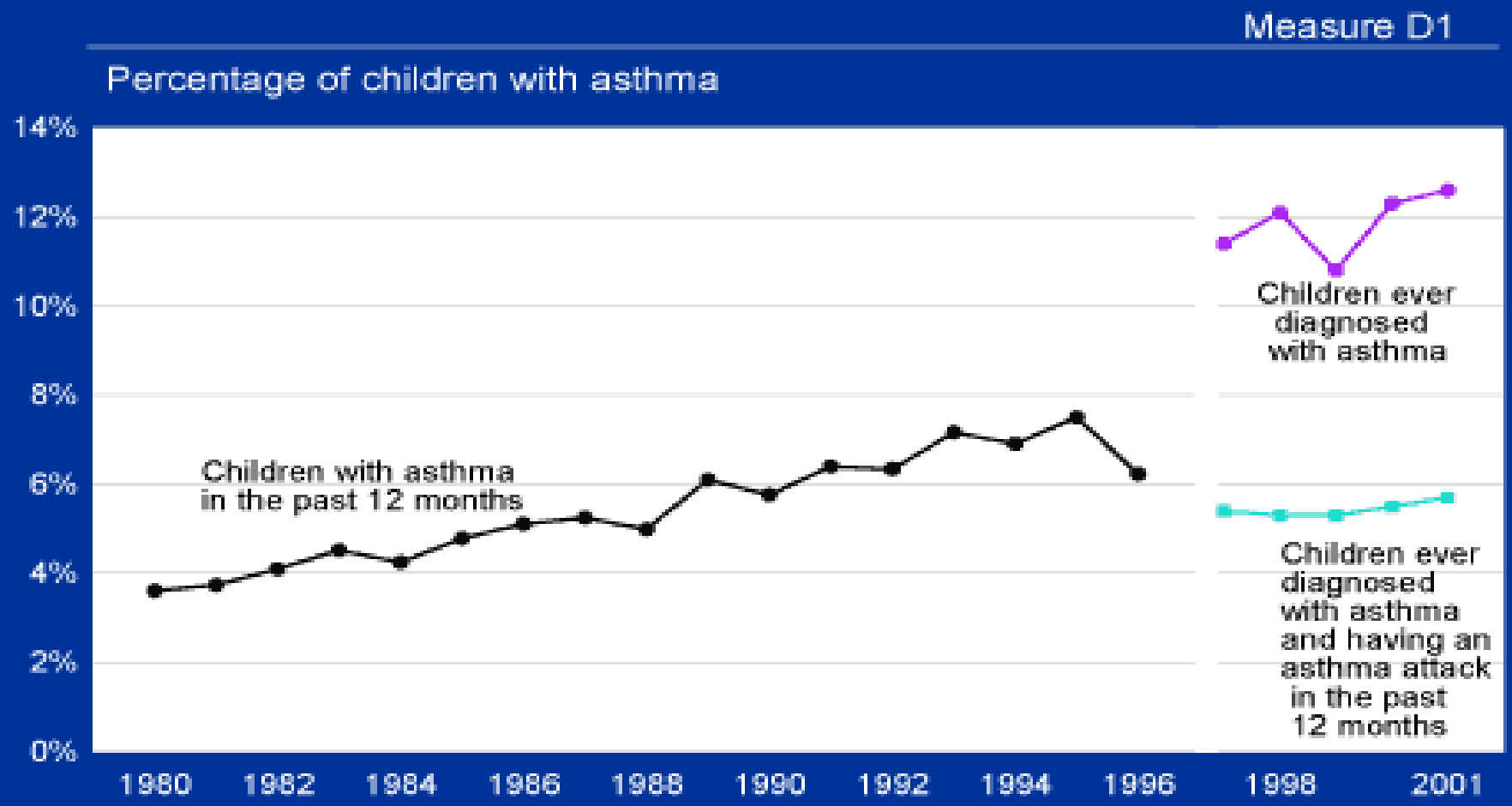
Measure D6a

Cancer incidence for children under 20 by type



SOURCE: U.S. Environmental Protection Agency, 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens, and Illnesses. www.epa.gov/envirohealth/children

Prevalence of Asthma

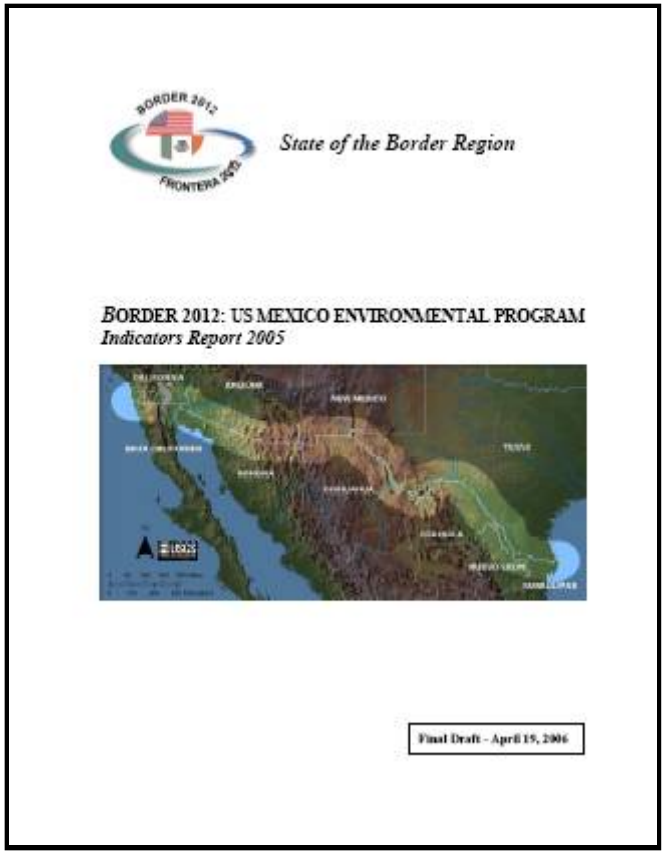


SOURCE: U.S. Environmental Protection Agency, 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens, and Illnesses. www.epa.gov/envirohealth/children

Key Features of America's Children and the Environment

- Provides indicators of exposure, body burden, and disease
- Notes "related measures" but does not attempt to link these indicators
- Relatively narrow toxicologic model
- Includes ethnic and racial stratification
- Includes emerging and state-specific "features"
- Presentation (printed and web) is accessible, attractive and readable

U.S.-Mexico Border 2012
Environmental Indicators Report


State of the Border Region

BORDER 2012: US MEXICO ENVIRONMENTAL PROGRAM
Indicators Report 2005

Final Draft - April 19, 2006

http://www.epa.gov/r6border/indicators.htm

TABLE OF CONTENTS

Report Overview 3
US-Mexico Border Region 6
Water 8
Air 11
Land 14
Emergency Preparedness and Response 17
Environmental Compliance 19
About the Indicator Development Process 22
Future Direction 23

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Linking Indicators to Public Health Goals

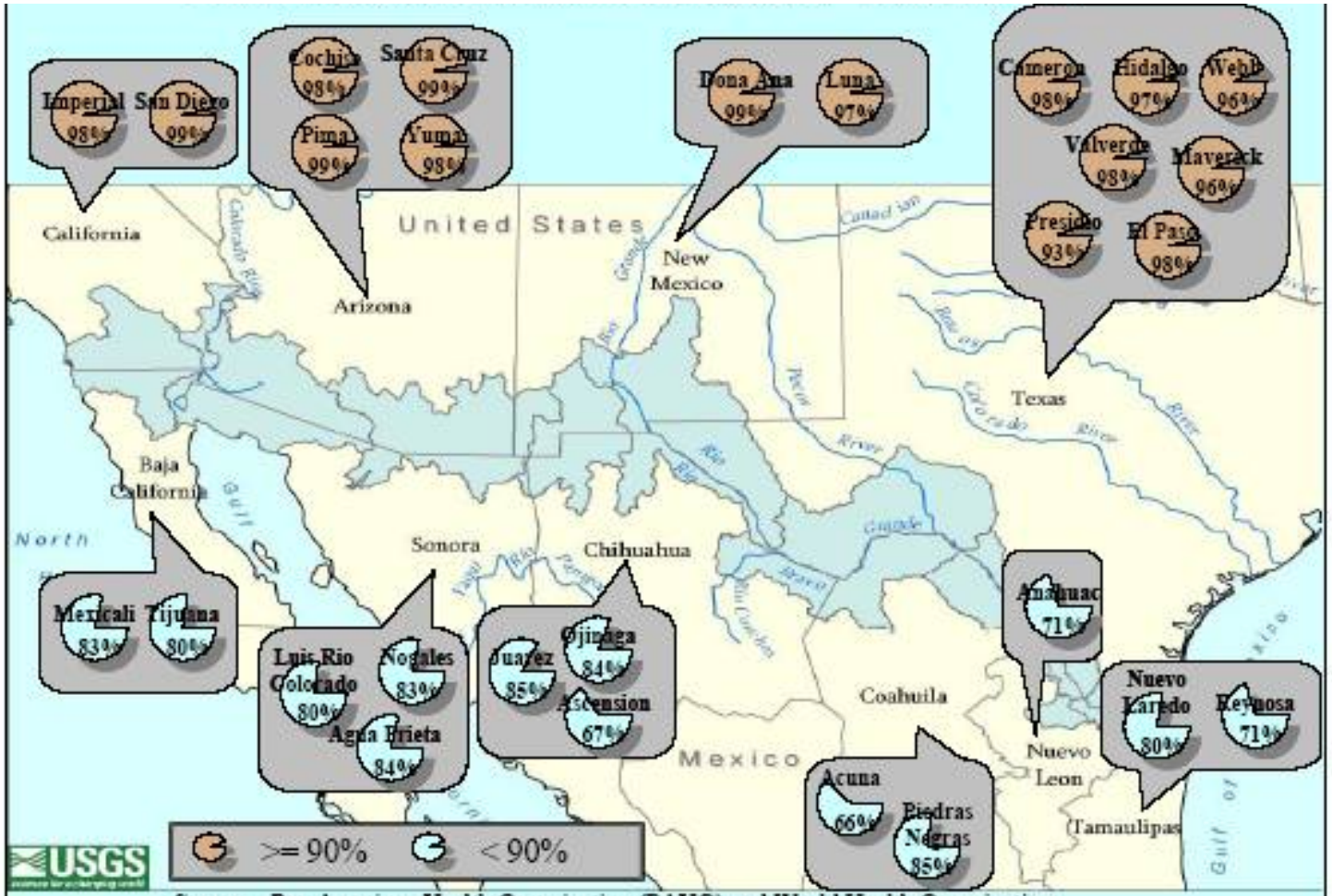
Border 2012 Goals

1. Reduce water contamination
2. Reduce air pollution
3. Reduce land contamination
4. Improve environmental health
5. Reduce exposure to chemicals
6. Improve environmental performance

Water Indicators

- Percentage of households in the US-Mexico border region with access to piped water
- Percentage of households in the US-Mexico border region with access to sewerage service
- Number of wastewater treatment plants and installed capacity in the Mexican side of the border region
- Rates of reported water-borne diseases in the California and Arizona border region

% of Households in the U.S.-Mexico Border Region with Access to Piped Water (2000)



Source: Pan American Health Organization (PAHO) and World Health Organization (WHO). Basic Indicators 2003. Health Situation in the United States - Mexico Border. http://www.fep.paho.org/english/publicaciones/IndBas2003/IndBas2003.pdf

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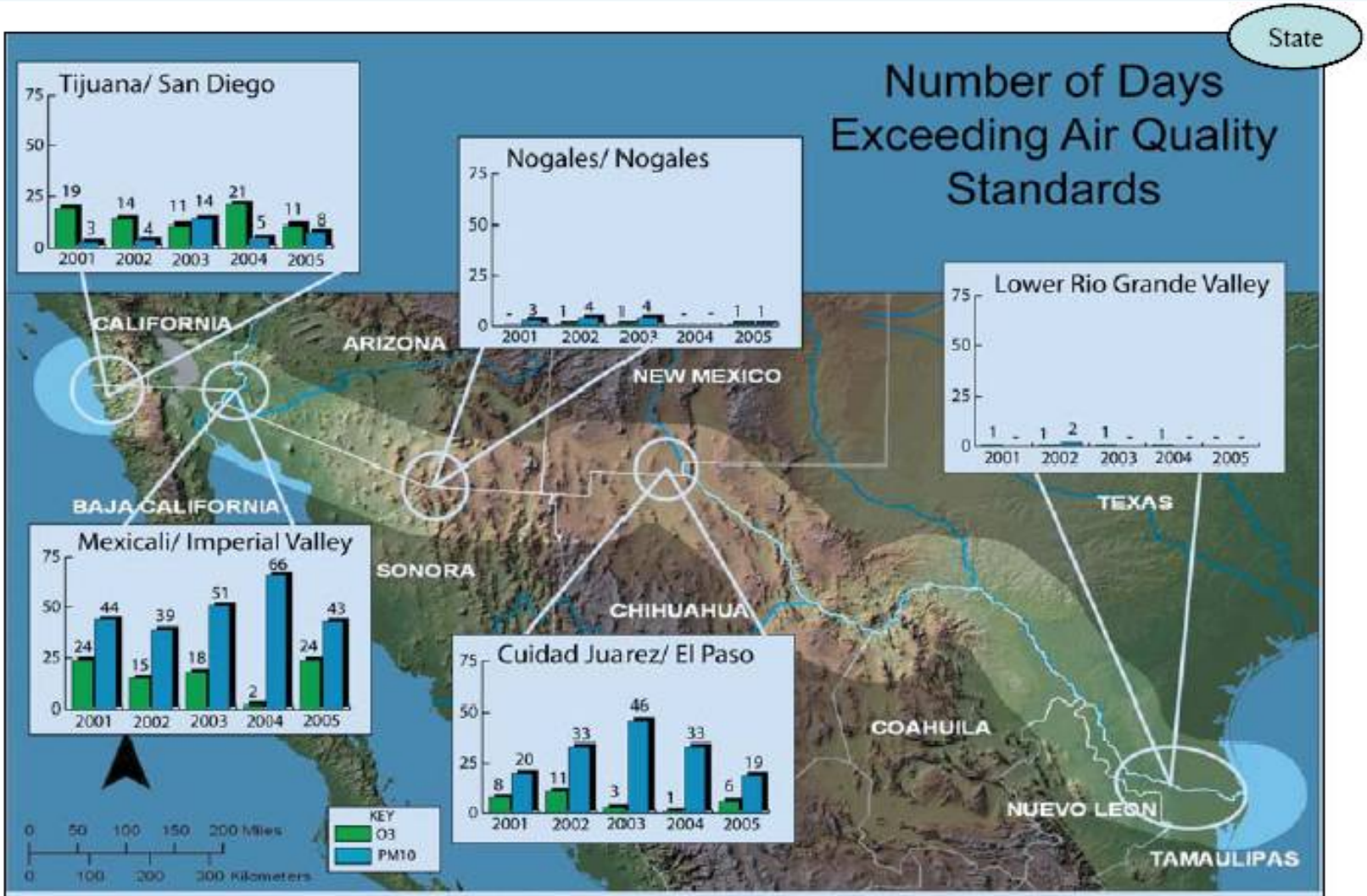
Air Indicators

- Number of days exceeding air quality standards
- Ozone concentration in the border region
- Particulate matter (PM10) concentrations in the border region
- Prevalence of physician-diagnosed asthma

Number of Days Exceeding Air Quality Standards

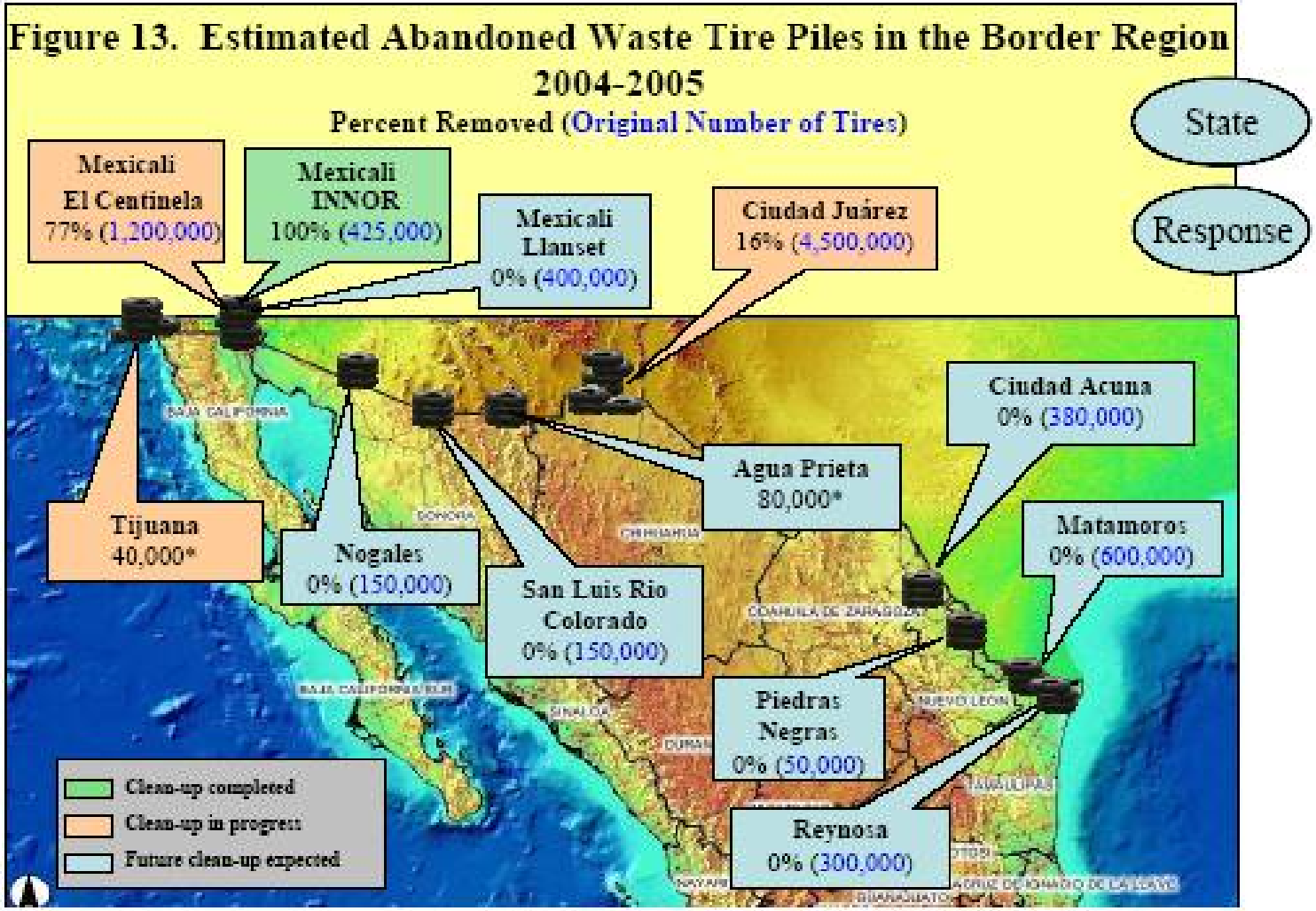


Source: US EPA Air Quality System (AQS) Database. Number of days any one monitor exceeded 8-hour standard for ozone (0.08 ppm) or 24-hour US standard (150 µg/m3) for PM10. The US and MX have the same ozone standard but different PM10 24 hour average standards. "-" indicates no exceedance or 'was not measured'.

Land Indicators

- Estimated abandoned waste tire piles in the border region
- Amount of pesticide use in the US-Mexico border region
- Number of farmworkers trained in safe pesticide use in the US side of the border region
- Cumulative number of farmworkers trained in safe pesticide use in the border region

Abandoned Waste Tire Piles



* Estimates on original number of tires piles are not available. Number removed is shown.

Confronting imperfect data

"Given the challenges involved in developing indicators for the border region, this initial report presents information on a limited number of indicators, representing specific objectives under each goal. As data comparability improves among the multiple data sources and data availability increases for the region, future reports will continue to improve upon the content and detail of this effort."

"The report attempts to present binational border-wide indicators. However, in some instances, this was not possible and proxy indicators were used. In this regard, the intent of the report is to aid in identifying gaps in order to work towards acquiring more comparable data, thus enabling the development of more meaningful indicators. These indicators together represent the initial set of border indicators that will continue to be refined and expanded over time."

Key Features of *Border Environmental Indicators Report*

- Links indicators to measurable public health goals
- Includes data acknowledged to be suboptimal
  - Imperfect data quality and/or proxy indicators
  - Intended to stimulate better data collection and call attention to the issue
- Presentation (printed and web) is accessible, attractive and readable

Sustainability Indicators

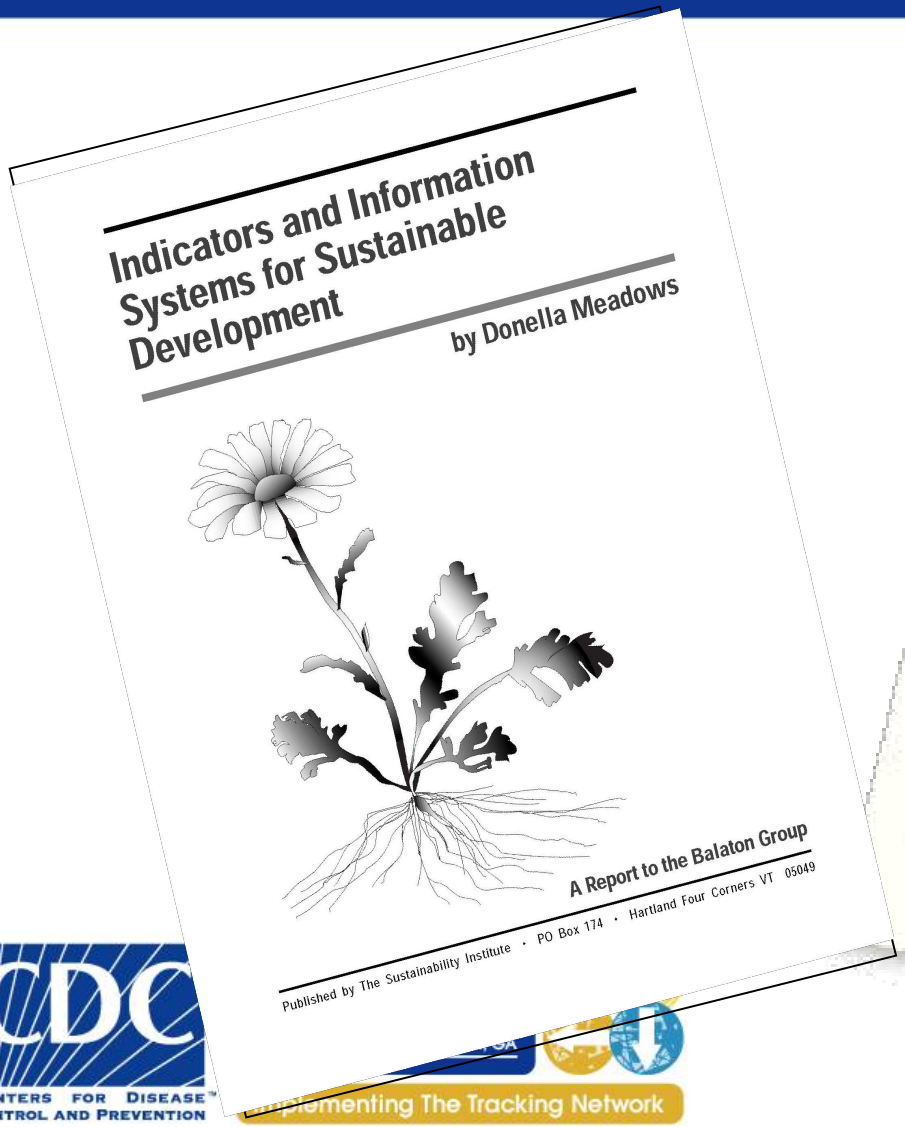
- Sustainability: "the persistence over an apparently indefinite future of certain necessary and desired characteristics of the sociopolitical system and its natural environment"

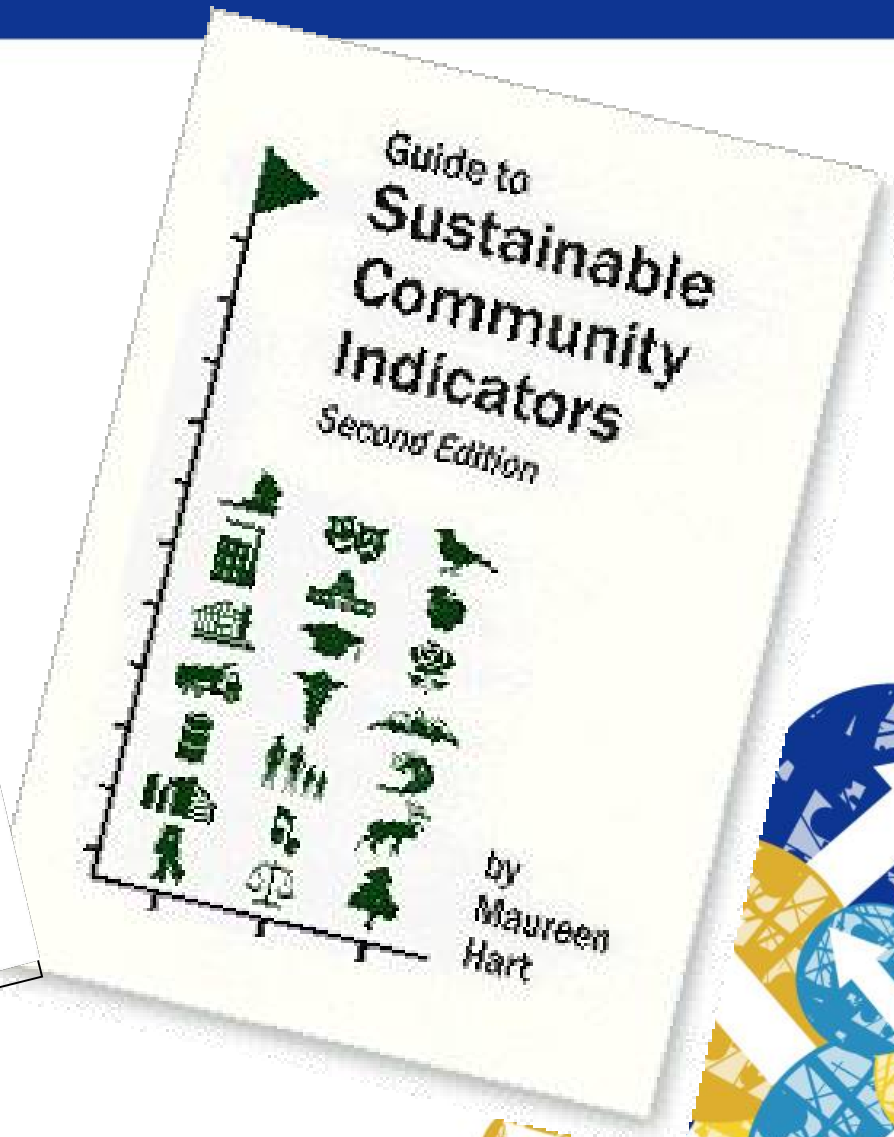
  Robinson et al. Defining a sustainable society: Values, principles and definitions. *Alternatives* 1990;17:36-46.

- Sustainable development: Development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."

  Brundtland Commission, 1987

Sustainability Indicators





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Sustainability Indicators: Typology

Domain-based
- Environment
- Economy
- Society

Goal-based
- Carrying Capacity
- Basic Human Needs
- Social Well-Being
- Economic Prosperity
- Participation in Governance

Sectoral
- Housing
- Welfare
- Recreation
- Transportation
- Environment
- Economic Development

Issue-based
- Urban Sprawl
- Solid Waste Management
- Crime and Safety
- Job Creation
- Industrial Pollution

Causal Conditions
- Air Quality
- Unemployment
- Human Health

Stresses
- Automobile Use
- Inadequate Education
- Air Quality

Responses
- High Occupancy Vehicle Lanes
- Special Training Programs
- Pollution Warnings

Maclaren VW. Urban sustainability reporting. *J Am Planning Assoc* 1996;62(2):184-203.

U.S. Cities with Sustainability Initiatives (partial list)

- Burlington
- Boston
- Cambridge
- Brookline
- New Haven
- Annapolis
- Milwaukee
- Cleveland
- Indianapolis
- Chattanooga
- Jacksonville
- Tampa
- Orlando
- Austin
- Boulder
- Scottsdale
- Portland
- Seattle
- San Jose
- Santa Barbara
- Santa Monica
- San Francisco
- Tucson
- Phoenix

San Francisco Sustainability Indicators (1 of 7)

INDICATOR	DESIRED DIRECTION
AIR QUALITY	
# existing buildings in Building Air Quality Alliance Program	UP
# people going to clinics for respiratory problems.	DOWN
% new cars registered in SF that are alternatively fueled	UP
BIODIVERSITY	
# volunteer hours dedicated to managing, monitoring, and conserving San Francisco's biodiversity.	UP
# square feet of natural areas cleared of invasive species.	UP
# indigenous native species planted in parks & natural areas.	UP
# species in Golden Gate Audubon Christmas bird counts	UP

San Francisco Sustainability Indicators (2 of 7)

INDICATOR	DESIRED DIRECTION
ENERGY, CLIMATE CHANGE AND OZONE DEPLETION	
Ratio of renewable to non-renewable energy consumption.	UP
Energy cost per tax dollar.	DOWN
FOOD AND AGRICULTURE	
Number of public agricultural gardens.	UP
Quantity of food and agricultural residuals recycled.	UP
Number of school, vocational and community education and training programs about sustainable agriculture and nutrition.	UP

San Francisco Sustainability Indicators (3 of 7)

INDICATOR	DESIRED DIRECTION
HAZARDOUS MATERIALS	
Difference between motor oil purchased in the City and the amount that is properly recycled or disposed.	UP
Equitable distribution of the hazardous material/waste exposure "load" throughout the City.	UP
Number of contaminated sites within City borders.	UP
Public awareness of hazardous materials/waste issues (especially proper use and disposal and knowledge of alternatives) as measured by annual survey.	UP
HUMAN HEALTH	
New cases of asthma.	DOWN
Number of people attending organized wellness classes.	UP
Participation in organized youth programs at city rec centers.	UP

San Francisco Sustainability Indicators (4 of 7)

INDICATOR	DESIRED DIRECTION
PARKS, OPEN SPACES AND STREETSCAPES	
Percentage of the population with a recreational facility and a natural setting within a ten-minute walk.	UP
Number of neighborhood green street corridors created/year.	UP
Number of volunteer hours/year on open space maintenance.	UP
Annual municipal expenditures on parks, open space, and streetscapes.	UP
SOLID WASTE	
Tons of waste landfilled/year.	DOWN
Recycling rate as a percentage of material generated.	UP
Percentage of residents, businesses, and institutions that participate in recycling programs.	UP

San Francisco Sustainability Indicators (5 of 7)

INDICATOR	DESIRED DIRECTION
TRANSPORTATION	
Auto registration.	DOWN
Parking-spot inventory.	DOWN
Muni ridership.	UP
Muni route running time on key routes.	DOWN
WATER AND WASTEWATER	
Per capita water consumption.	DOWN
Mass of pollutants in wastewater.	DOWN
Mass and frequency of combined sewer overflows.	DOWN
Recycled water use.	UP
Acres of habitat restored.	UP

San Francisco Sustainability Indicators (6 of 7)

INDICATOR	DESIRED DIRECTION
ECONOMY AND ECONOMIC DEVELOPMENT	
Number of enterprises adopting ISO 14000 standards.	UP
Number of neighborhoods with unemployment rates higher than the government-defined "full employment" rate.	DOWN
Difference between the highest neighborhood unemployment rate and the full employment rate.	DOWN
Number of manufacturers using recovered secondary materials as raw material.	UP
Percentage of people employed in SF who live in SF.	UP
ENVIRONMENTAL JUSTICE	
Mean income in historically disadvantaged communities.	UP
Proportion of pollution sources in historically disadvantaged communities with respect to other communities.	DOWN
Participation of historically disadvantaged communities as a whole in decision-making processes.	UP

San Francisco Sustainability Indicators (7 of 7)

INDICATOR	DESIRED DIRECTION
MUNICIPAL EXPENDITURES	
Number of items of legislation adopted by the Board of Supervisors that advance sustainability goals.	UP
Number of service providers and companies on Green Vendors list.	UP
Percent of budget allocated utilizing sustainability criteria.	UP
Percent of budget devoted to facility maintenance.	UP
PUBLIC INFORMATION AND EDUCATION	
Number of schools with environmental education in their curricula.	UP
Conservation and waste reduction as measured by per capita volume of garbage produced and electricity used.	DOWN
Number of volunteers on environmental projects.	UP

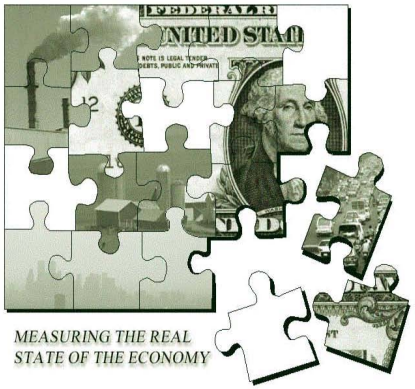
Key Features of Sustainability Indicators

- Aspirational
- Creative use of available data
- The *process* that identifies indicators is key
  - Strong leadership
  - Inclusive, participatory process
  - Outreach and dissemination strategy
- Only successful if used

Genuine Progress Indicator (GPI)

The Genuine Progress Indicator
1950-2002 (2004 Update)

Genuine Progress Indicator (GPI)



MEASURING THE REAL STATE OF THE ECONOMY

By Jason Venetoulis and Cliff Cobb

Sustainability Indicators Program
March 2004

REDEFINING PROGRESS
For People, Nature, and the Economy

www.RedefiningProgress.org

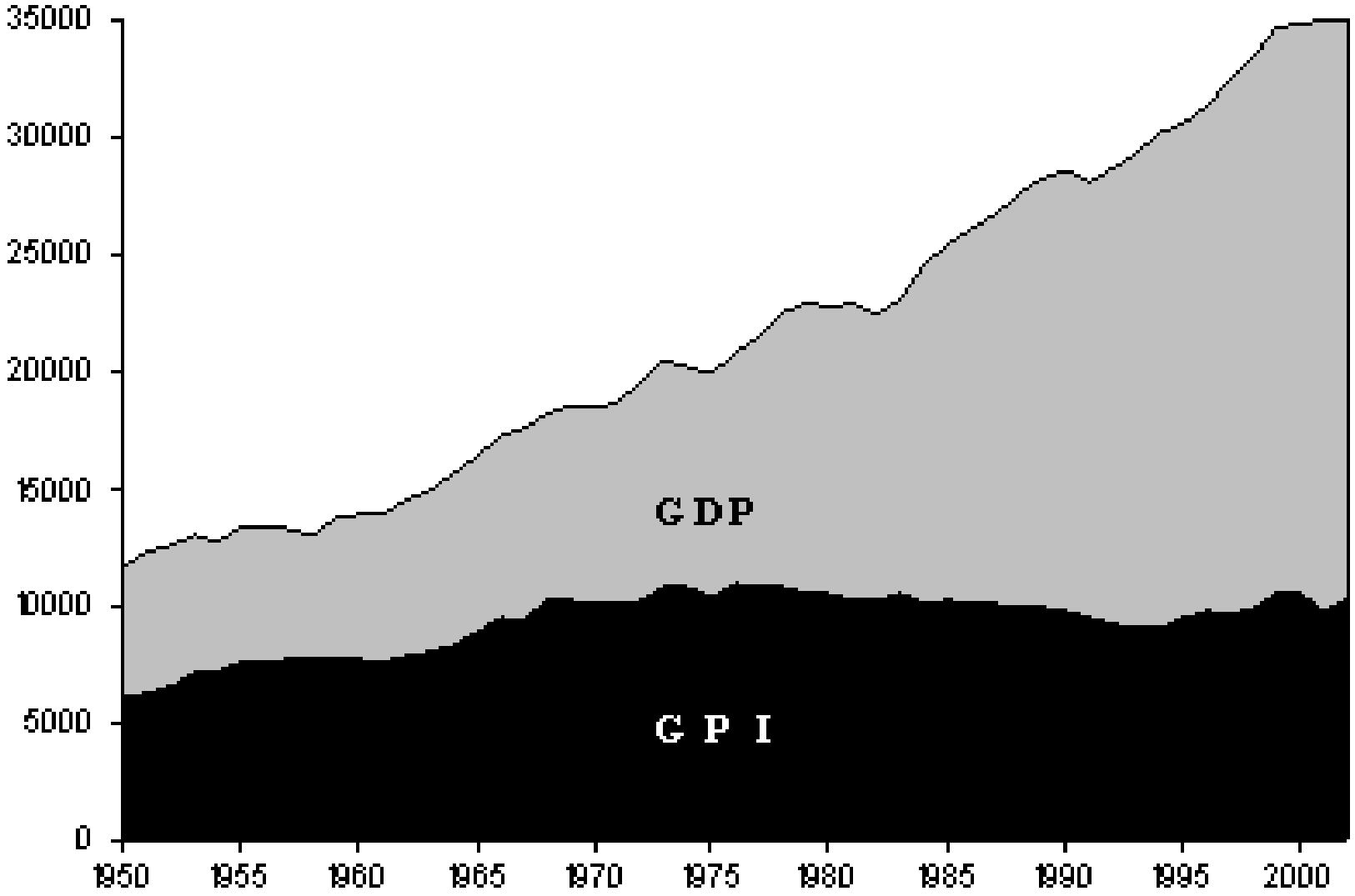
CDC
Centers for Disease Control and Prevention

TR
20
Impler

GPI: Components

- Crime & family breakdown
- Household & volunteer work
- Income distribution
- Resource depletion
- Pollution
- Long-term environmental damage
- Changes in leisure time
- Defensive expenditures
- Lifespan of consumer durables & public infrastructure
- Dependence on foreign assets

GPI: Trend


35000
30000
25000
20000
15000
10000
5000
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
GDP
GPI

Key Features of the GPI

- Strong values base
- Continually updated
- “Upstream” indicators
- Presentation (printed and web) is accessible, attractive and readable

U.S. News & World Report: *America's Best Colleges*

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

TRACKS 2006 ATLANTA, GA
Implementing The Tracking Network

Key Features of *America's Best Colleges*

- Highly visible
- Everybody pays attention

EPHT at Four Years of Age: How Have We Done?

- Scope of parameters tracked
- Efforts at data linkage
- Product delivered / health impact

Diseases Tracked

- Asthma
- Autism
- Behavioral Disorders
- Cancer
- Birth Defects
- Lupus
- MS / ALS

Diseases NOT Tracked (Partial List)

- Parkinsons disease
- Noise-induced hearing loss
- Depression
- Allergies
- COPD
- Attention Deficit Disorder
- Foodborne disease outbreaks
- Waterborne disease outbreaks
- CO poisoning
- Obesity
- Cardiovascular disease
- Hypertension
- Motor vehicle injuries
- Vector-borne diseases
- Workplace injuries
- Radiation injuries
- Pulmonary fibrosis
- Home falls
- Heat injuries

Exposures Tracked

- Traffic exhaust
- Lead
- Criteria air pollutants
- TCE and PCE
- PCBs
- Mercury
- Pesticides
- Other heavy metals

Exposures NOT Tracked (Partial List)

- GHG emissions
- Severe weather events
- Neighborhood walkability
- Access to parks
- Access to nature
- Access to mass transit
- Access to healthy food
- School environmental conditions
- Healthcare institution environmental conditions
- Housing conditions
- Green building rates
- Social capital
- Second-hand smoke
- Food allergens
- Mold
- Radon
- Asbestos

Conclusion…

- We need to look much more broadly at relevant exposures and diseases

Data Linkage

"A key distinction between EPHT and traditional surveillance is the emphasis on data integration across health, human exposure, and hazard information systems."

McGeehin et al., 2004

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

TRACKS 2006 ATLANTA, GA
Implementing The Tracking Network

Data Linkage

- Enables analytical epidemiological studies

BUT…

- Extremely difficult
- High opportunity cost
- Slows down success

Conclusion

- We need less emphasis on linkage

Product Delivered / Health Impact

- Isolated success stories
- Some data management procedures

Conclusion

- We need product
- We need it soon
- We need to document the public health value of our product

The Big Picture

- Tracking is absolutely essential
- It is at the heart of Environmental Public Health

Vision for the Future

The nation's

Environmental Health GNP

Vision for the Future (1)

- A process and a product that…
  - Lead and are aspirational
  - Include “upstream” and diverse parameters
  - Are useful for forecasting, not just backcasting
  - Use high-quality data but are not limited to high-quality data
  - Emerge and improve over time

Vision for the Future (2)

- A process and a product that…
  - Engage stakeholders
  - Effectively use partnerships
  - Emphasize information over research
  - Highlight health disparities

Vision for the Future (3)

- A process and a product that…
  - Yield accessible, attractive, and readable reports
  - Stimulate further data collection
  - Stimulate research
  - Impact policy
  - Improve public health

Thank you!