Key Principles and Practices for Performing Benefit-Cost Analysis at EPA

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Chris Dockins, PhD
National Center for Environmental Economics

The opinions and statements here are those of the author and do not necessarily represent the views of the US Environment Protection Agency.

Outline

- Role and purpose of economic analysis
- Estimating Benefits and Costs
- Key issues:
  - Baseline
  - Discounting
  - Presenting Results

National Center for Environmental Economics

- Located within the Office of Policy in the Administrator's Office
  - Over 20 Ph.D.-level environmental economists
- Produce economic reports and guidelines
- Provide guidance and support for conducting benefit-cost and other economic analyses
- Promote consistency in preparing and presenting economic information

Many Decision Making Criteria

- Policy Priorities
- Statutory instruction
- Institutional Feasibility
- Technical Feasibility
- Enforceability
- Ethics
  - Distributive Justice
  - Environmental Justice
- Sustainability
- Benefits and Costs (Economic Efficiency)

Why do Economic Analysis?

- The Regulatory Flexibility Act of 1980; as amended by the Small Business Regulatory Enforcement Fairness Act of 1996
  - For rules with a significant economic impact on a substantial number of small entities, must consider flexible regulatory options that minimize adverse economic impacts on small entities.
- The Unfunded Mandates Reform Act of 1995
  - For rules with Federal mandates, must consult with state, local, tribal governments and select the least costly, most cost-effective, or least burdensome alternative, or explain why another was chosen
- The Paperwork Reduction Act of 1995
  - Includes requirements for Information Collection Requests
- Regulatory Right-to-Know Act (2001)
  - Benefits and costs of Federal rules (a) in the aggregate (b) by agency and agency program; and (c) by major rule.

Why do Economic Analysis?

- EO 12866- Regulatory and Planning Review (1993), as amended by EO 13563 - Improving Regulation and Regulatory Review (2011): For regulatory actions >$100m annually, assess all costs and benefits of regulatory alternatives including quantifiable and qualitative measures and choose alternative that maximizes net benefits, considering distributional and equity effects

- EO 12898 – Federal Actions to Address Environmental Justice in Minority and Low-Income Populations (1994): Identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority, low income, and Tribal and indigenous populations.

- EO 13045 – Protection of Children from Environmental Health & Safety Risks (1997): Evaluate the health or safety effects of planned regulations on children.

- E.O. 13132 – Federalism (1999): Consult with state and local governments on rules that may affect them.

- E.O. 13175 – Consultation and Coordination with Indian Tribal Governments (2000): Have "an accountable process to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications"

- E.O. 13211 – Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use (2001): Prepare a Statement of Energy Effects

Why do Economic Analysis?

- Economic analysis can inform the policy decision (as allowed by statute) by answering at least three questions
  - Is it theoretically possible for the "gainers" from the policy to fully compensate the "losers" and still remain better off? (i.e., positive net benefits)
  - Who are the gainers and losers from the policy and associated economic changes?
  - How did a particular group, especially a group considered to be disadvantaged, fare as a result of the policy change?

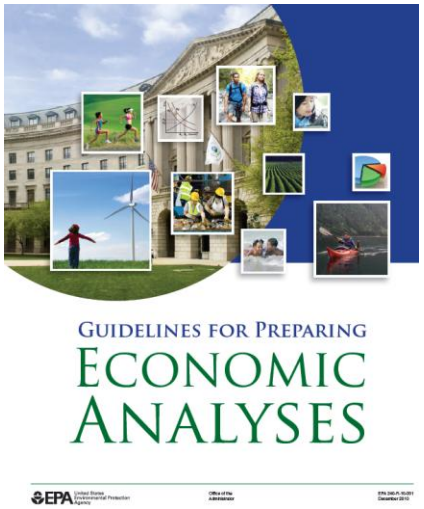
Why do Economic Analysis?

- Economic analysis can inform the public even when it can't be used in setting a standard
  - What are the positive and negative consequences and how important are they?
  - How does this regulation compare to others (in EPA and elsewhere)?

- Economic analysis can also be an organizing framework
  - Enumeration of positive and negative consequences, mutually exclusive and exhaustive
  - Even if we cannot estimate benefits in quantitative or monetary terms, the impacts can be described coherently

Components in an Economic Analysis

- Statement of Need for Policy Action
- Policy options
- Industry profile
- **Benefit-cost analysis**
  - Benefits analysis
  - Cost analysis
  - Comparison of costs and benefits (net benefits)
- Cost effectiveness analysis
- **Distributional analysis**
  - Economic impact analysis
  - Equity analysis



Statement of Need for Regulation

- Define the Problem
  - What are the pollutants and sources?
  - What are the human exposures and risks?
- Determine Market or Institutional Failure(s)
  - Externalities
  - Market Power
  - Information Asymmetry
- Justify the Need for Federal Action
  - Why a federal action rather than actions by private or other public sector entities?

Efficiency and Benefit-Cost Analysis

- Adam Smith showed that the private market can allocate and distribute resources efficiently. Inefficient users of resources go out of business.

Adam Smith (1723-1790)

- Problem:
  - We cannot package clean air or clean water – they are public goods.
  - How can we apply the discipline of the private market to publicly provided or mandated commodities?

Efficiency and Benefit-Cost Analysis

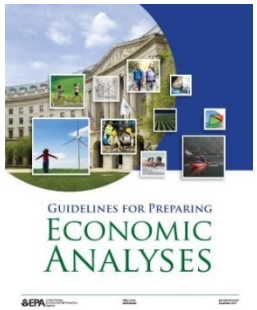
- BCA simulates the private market test for public goods: Is society as a whole, better off with the regulatory action?
  - BCA quantifies all of the benefits and costs of producing environmental protection.
  - Consistent with private markets, the efficient outcome is the option that maximizes net benefits.

- BCA is, therefore, an ***efficiency*** test for the production of environmental protection.
  - It generally says very little about equity and fairness.

Analyzing Benefits

- The benefits analysis is an attempt to capture and describe all positive effects of the regulation
- Same "rules" as used in the private market – individual willingness to pay for the commodity
  - Benefits are determined by how those who are affected value them - analysts do not assign values
- Benefits of a policy are the sum of each individual's willingness to pay for the policy

Analyzing Benefits



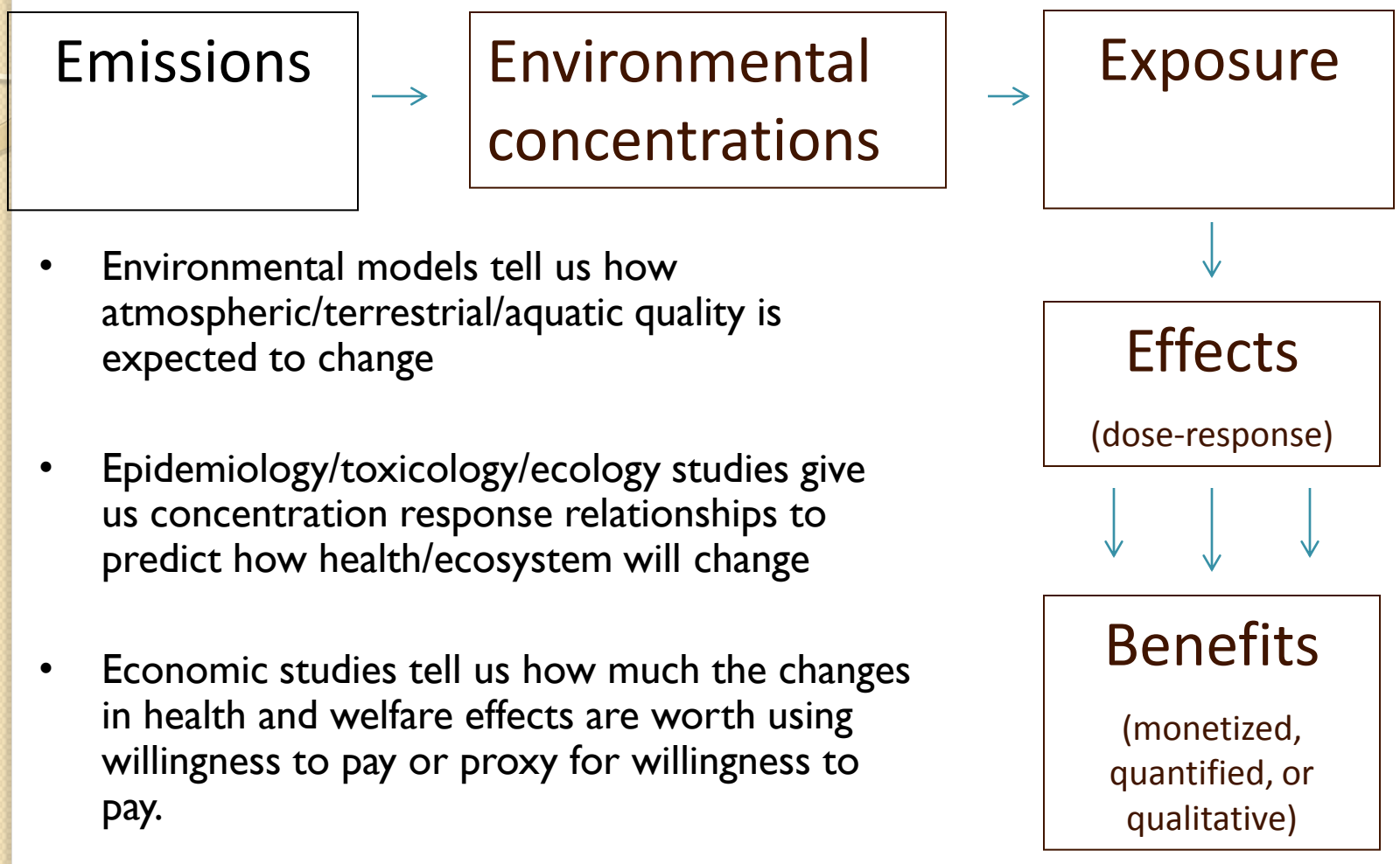
- The Agency guidance focuses on consistency on our approach to benefits analysis
  - Does not emphasize specific values for particular types of benefits
  - Valuing changes in mortality risk is an exception

- Economists will usually look in the economics literature for estimates that are similar to what EPA needs for benefits valuation and then adapt them
  - This is called benefits transfer and the Agency does have best practices for benefits transfer

Types of Benefits

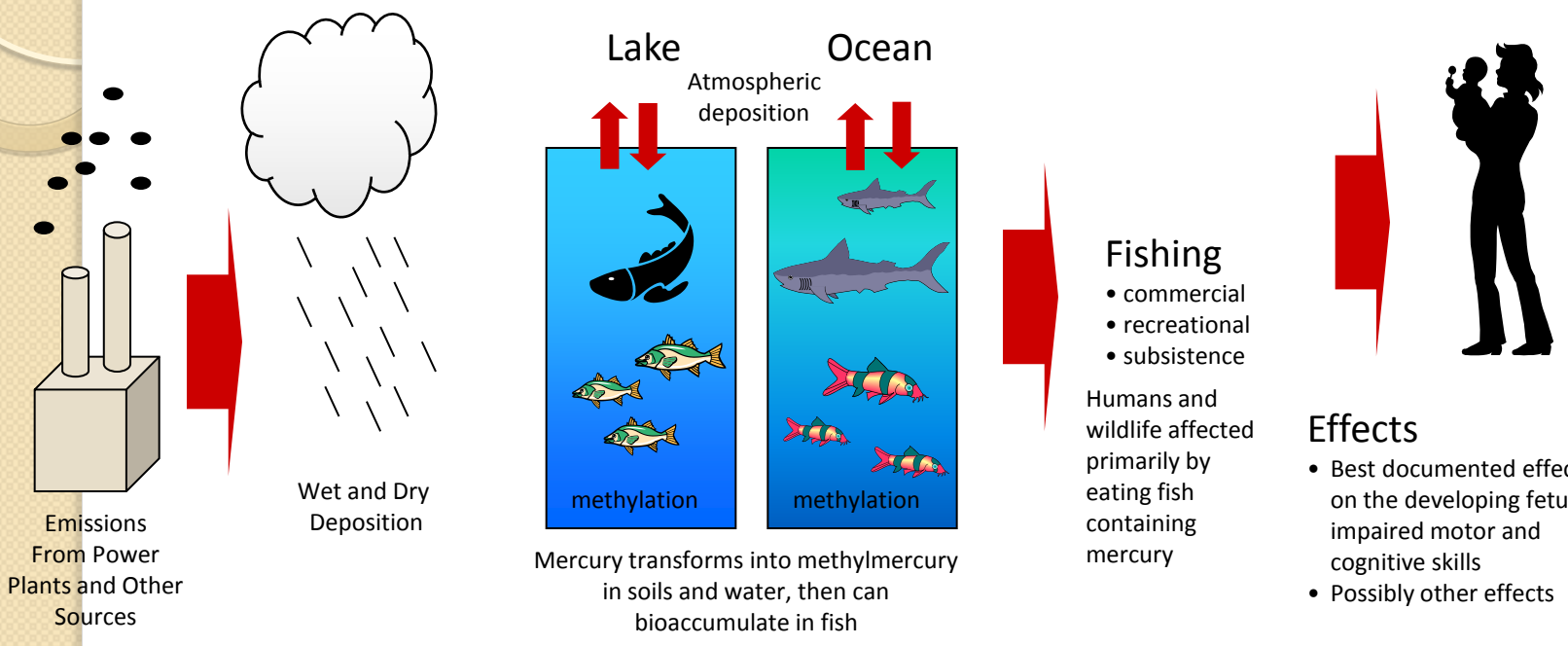
Benefit category	Examples	Commonly-used economic valuation methods
Mortality & morbidity risk	Reduced risk of ▪ Cancer fatality ▪ Acute fatality ▪ Cancer ▪ Asthma ▪ Nausea	➢ Averting behaviors ➢ Hedonics ➢ Stated preference
Market products	▪ Food ▪ Fuel ▪ Timber	➢ Production function
Recreation activities & aesthetics	▪ Wildlife viewing ▪ Fishing ▪ Swimming ▪ Hiking ▪ Scenic views	➢ Production function ➢ Averting behaviors ➢ Hedonics ➢ Recreation demand ➢ Stated preference
Valued ecosystem functions	▪ Climate moderation ▪ Flood moderation ▪ Pollination by wild species ▪ Water filtration	➢ Production function ➢ Averting behaviors ➢ Stated preference
Nonuse values	Relevant species, communities, or ecosystems	➢ Stated preference

Damage Function Approach



- Environmental models tell us how atmospheric/terrestrial/aquatic quality is expected to change
- Epidemiology/toxicology/ecology studies give us concentration response relationships to predict how health/ecosystem will change
- Economic studies tell us how much the changes in health and welfare effects are worth using willingness to pay or proxy for willingness to pay.

Damage Function Approach



Emissions and Speciation → **Atmospheric Transport and Deposition** → **Ecosystem Transport, Methylation, and Bioaccumulation** → **Consumption Patterns** → **Health Effects**

Estimate Willingness to Pay for reduced risk of health effects → **Aggregate valuation estimates for benefits analysis**

Social costs

- Social Costs
  - Negative effects on social welfare
  - The sum of the opportunity costs incurred by society because of a new regulation or policy;
  - Opportunity costs are the value of the goods and services lost by society resulting from the use of resources to comply with and implement the regulation, and from reductions in output.

- Simplest case examines real resource compliance costs
  - Engineering - purchase, installation, operation, maintenance, productivity changes, changing inputs, waste management, etc.
  - Administrative
  - Government regulatory

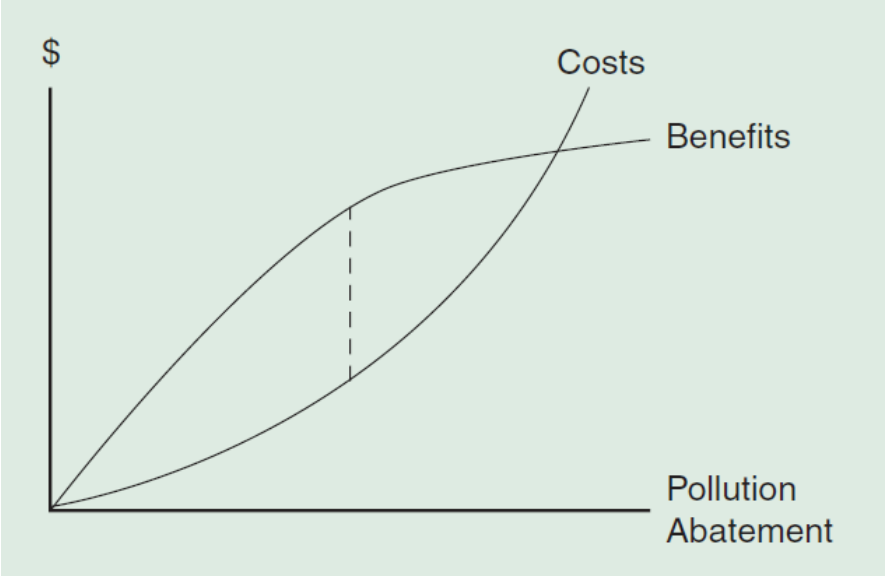
- More sophisticated cases also examine other effects (e.g., behavioral effects, impact on price and quantity)

Comparing Benefits and Costs

- Economic efficiency is assessed using net benefits

  Net Benefits = Benefits – Costs

- A rule may have several options where benefits exceed costs.
- The efficient solution is the one that maximizes the net benefits.
- The efficient solution is generally <u>not</u>
  - where total benefits equal total costs
  - where the benefit/cost ratio is maximized
  - where benefits are maximized



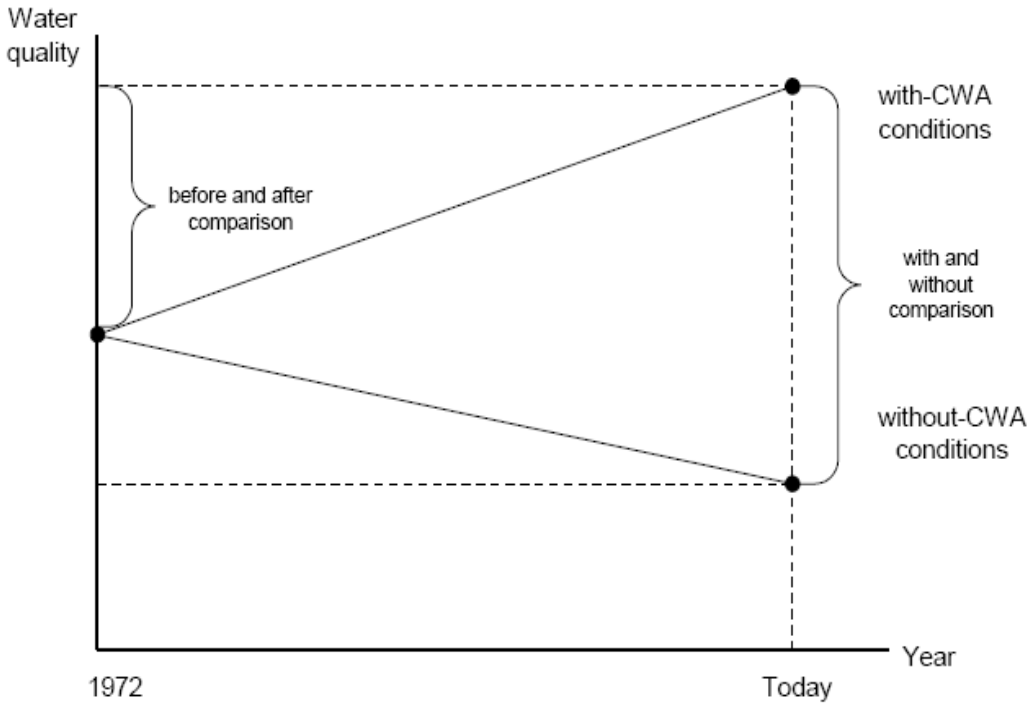
Distributional analysis

- Distributional analyses complement benefit-cost analysis
  - Assessment of the effects of the policy action across people, communities, age groups, industries, small businesses, etc.
  - *Economic Impacts Analysis* is often used specifically for impacts on industry, governments, and non-profit groups
- Provides information to the decision-maker and public about who will be affected by the policy action
  - Certain groups or industries or types of businesses may warrant special consideration
  - Knowing who is affected by a policy action is essential for determining when such consideration should be granted

Defining Baselines

- The state of the world in the absence of regulation
- Need to compare the world <u>with</u> the regulation vs. the world <u>without</u> the regulation.

- Multiple baselines might be needed
- But costs and benefits must be compared against the same baseline



Discounting

Benefits and costs occur at different times.

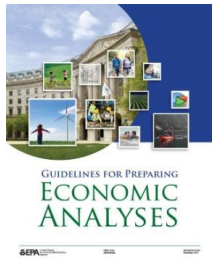
Discounting is the mathematical calculation of the net present value of benefits, costs, and net benefits

EPA has guidance on

- Intra-generational (conventional) discounting
  - benefits and costs occur within approximately one generation
  - 3% and 7%
- Inter-generational (long-term) discounting
  - effects occur over multiple generations and hundreds of years
  - requires different approaches with rates generally lower

- We must discount costs and benefits at the same rate.

Presenting Results



EPA's *Economics Guidelines* contain recommendations for presenting benefits and costs.

Emphasis on showing what could and could not be quantified

Part A: Overview of benefits			
Benefits	**Effect can be Quantified?** (put in numeric terms)	**Effect can be monetized?** (put in dollar terms)	**More information** (e.g., reference to section of the economic analysis)
Improved Human Health			
• **Reduced incidence of adult premature mortality** from exposure to $PM_{2.5}$	√	√	e.g., see section 5.2 of the economic analysis
• **Reduced incidence of fetal loss** from reduced exposure to disinfection byproducts	√	--	*Notes and reference to section of the economic analysis*
• *Unquantified human health benefit with a brief description*	--	--	*Notes and reference*
Improved Environment			
• **Fewer fish killed** from reduced nutrient loadings into waterways	√	√	*Notes and reference*
• **Improved timber harvest** from lower tropospheric ozone concentrations	√	√	*Notes and reference*
• *Other Environmental Benefit with a brief description*	--	--	*Notes and reference*
Other Benefits			
• **Fuel savings** from improved efficiency in automobiles and light trucks	√	√	*Notes and reference*
• *Other benefit with a brief description*	--	--	*Notes and reference*

Information

Chris Dockins, PhD
Senior Economist
National Center for Environmental Economics
US EPA

Dockins.chris@epa.gov
202-566-2286

National Center for Environmental Economics
www.epa.gov/economics

- EPA *Guidelines for Preparing Economic Analyses*
- Handbooks and references for performing economic analysis
- Reports, working papers, Regulatory Impact Analyses, and other economics references documents