

Estimating the Co-Benefits of Clean Energy Policies

CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool: **How COBRA Works**

Air Quality | Human Health | Societal Benefits



State and Local
Energy and Environment Program





What is COBRA?



- The CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool is a peer reviewed screening tool that inexpensively and quickly estimates the air quality, human health, and associated economic impacts of various state- and county-level emission reduction scenarios.
 - The model estimates and maps the health effects and related economic value of the effects by county for state, region, U.S.
- COBRA is based on rigorous methods used by EPA health benefits assessments and adapted for use as a screening model.
- COBRA enables users to obtain a first order approximation of costs and benefits of different emission scenarios that can be used to narrow a long set of promising options to a smaller list which can be evaluated using more sophisticated air quality models.



How Does COBRA Work?

Users enter emissions change(s) and discount rate for 2016, 2023 or 2028

- PM_{2.5}, SO₂, NO_x, NH₃, VOCs

COBRA:

Quantifies Changes in Air Quality

- Uses a simple air quality model, the Source Receptor (S-R) Matrix, to estimate effects of changes on ambient particulate matter.

Calculates Change in Health Outcomes

- Uses "canned" concentration response functions to link the changes in particulate matter to epidemiological studies¹

Calculates Monetary Value

- Uses "canned" values based on willingness-to-pay, cost of illnesses, value of a statistical life and direct medical costs.

Outputs = Tables and maps of illnesses and deaths avoided and the related economic value.

¹ COBRA excludes benefits beyond particulate matter-related ones and may be conservative in that respect.





Human Health Effects in COBRA



- COBRA estimates the number of health incidences avoided AND the related economic value for the following:
 - Adult Mortality,
 - Infant Mortality,
 - Non-fatal Heart Attacks,
 - Respiratory Hospital Admissions,
 - Cardiovascular-related Hospital Admissions,
 - Acute Bronchitis,
 - Upper Respiratory Symptoms,
 - Lower Respiratory Symptoms,
 - Asthma Exacerbations (attacks, shortness of breath, & wheezing),
 - Asthma Emergency Room visits,
 - Minor Restricted Activity Days,
 - Work Loss Days



Economic Values of Effects in 2023: Unit Values



Health Incident Avoided	Economic Value (2017\$)	
	3% discount rate	7% discount rate
Adult Mortality	\$9,748,682	\$8,682,996
Infant Mortality	\$10,866,012	\$10,866,012
Non-Fatal Heart Attacks	\$39,174 – \$309,825	\$37,038 - \$297,494
Hospital Admissions	\$17,655 - \$47,581	\$17,655 - \$47,581
Asthma ER Visits	\$457 - \$547	\$457 - \$547
Acute Bronchitis	\$550	\$550
Respiratory Symptoms	\$24 - \$38	\$24 - \$38
Asthma Exacerbations	\$66	\$66
Minor Restricted Activity Days	\$78	\$78
Work Loss Days	\$178	\$178



Economic Values of Effects: Sources



Health Incident Avoided	Source of Value
Adult Mortality	VSL*
Infant Mortality	VSL*
Non-Fatal Heart Attacks	Cost of Illness (COI) = Direct medical costs, opportunity cost (OC)
Hospital Admissions	COI = Hospital charges, OC
Asthma ER Visits	COI = Costs to the hospital
Acute Bronchitis	WTP = Coughing and chest tightness (CT) or restricted activity day
Respiratory Symptoms	WTP = Symptoms such as coughing, head/sinus congestion, eye irritation, CT, coughing up phlegm, and/or wheeze
Asthma Exacerbations	WTP = Bad asthma day
Minor Restricted Activity Days	WTP = Combination of coughing, throat congestion, and sinusitis
Work Loss Days	WTP = Median annual earnings divided by (5 × 52)

For more background on the VSL, see:

<https://www.epa.gov/environmental-economics/mortality-risk-valuation>



Strengths of COBRA

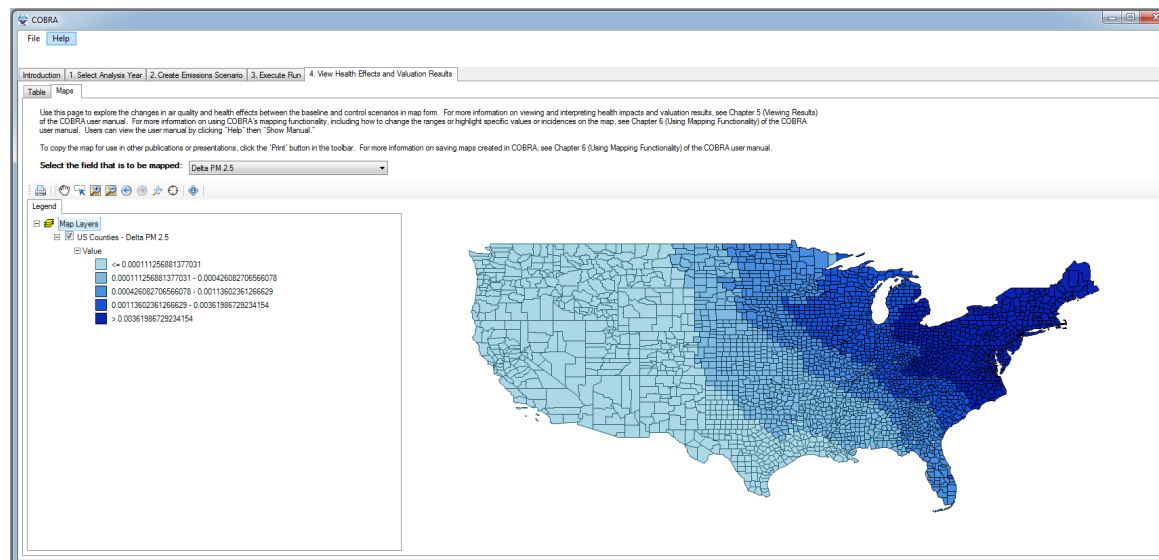


- Enriches discussion of co-benefits and supports a balanced decision-making process that considers both the potential costs and benefits of policy choices.
- Easy-to-Use screening tool
 - Requires minimal inputs
 - Includes “canned” equations and approaches generally consistent with EPA practices
 - Detailed User’s Guide describes all assumptions and equations
- Flexible for User
 - Can enter data for a single county, statewide, group of counties, outside of state, and/or group of states
 - Can enter reductions in absolute terms or as percentage change
 - Can import custom databases on emissions, population, and disease incidence, which allows the user to vary time timeframe for analysis
 - Can import custom equations (C-R functions, economic values)
 - Can save scenarios to reuse or modify later

Strengths of COBRA



- Inexpensive (free!) compared to rigorous air quality models
 - Results from COBRA approach have fared well in informal comparisons;
 - Enables analysts to narrow a list of options at no/low cost and then devote resources to analyzing only those options with the best prospects using more expensive air quality models.
- Quick to generate results
- Mapping of results facilitates visualization of impacts
 - Provides very localized health effects and valuations: county level





Limitations of COBRA



- EPA is a free, screening tool not a highly sophisticated model.
 - Air Quality (AQ) model is “quick and dirty”
 - COBRA is best used as screening tool, followed up with comprehensive AQ analysis and health impact assessment
 - Does not address cap issues
 - Relies upon inputs generated elsewhere
 - Assumptions about statewide % reductions may be an oversimplification
- While there are limitations that users should understand, technical peer reviewers found COBRA to be “a valuable model that produces a screening tool that can contribute to policy analysis and public dialogue.”



How can I learn more?

Visit Our Website to find all of the documentation for COBRA and to download the model:

<https://www.epa.gov/cobra>

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