

Emission Reduction Benefit Metrics: Tools for Decision Making & Project Evaluation

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- 1) US EPA Rulemaking & Benefit Metrics**
 - a) Regulatory Impact Analysis

- 2) Social Cost of Greenhouse Gases (GHGs)**
 - a) Monetary Benefits of CO₂, CH₄, and N₂O Reductions

- 3) Diesel Emissions Quantifier (DEQ) Health Benefits Module**
 - a) Monetary Benefits of PM_{2.5} Reductions

Background – Regulatory Impact Analysis at EPA



- EPA has conducted credible, science-based regulatory impact analyses (RIA) for many years for national rulemakings
 - RIA's quantify monetized costs and benefits
- Monetized benefits typically far outweigh the costs
 - From 2004 to 2014, EPA's rulemakings have yielded between \$193-\$848 billion in annualized benefits compared to \$47-\$62 billion in annualized costs (source: OMB, 2016; https://www.whitehouse.gov/sites/default/files/omb/infoereg/2015_cb/2015-cost-benefit-report.pdf)
 - Human health benefits include reductions in premature mortality risk and a number of reduced morbidity impacts
- Benefits from EPA's National Clean Diesel rulemakings are expected to outweigh costs by 18-to-1 by 2030
 - Includes regulations on light and heavy duty vehicles, locomotive and marine engines, and ocean-going vessels



- **Purpose** – The Social Cost of GHGs (SC-GHGs) are estimates of the monetary value of climate impacts associated with marginal changes in GHG emissions in a given year (e.g., 1 MT in a given year).
 - Values exist for CO₂, CH₄ and N₂O.
- **Application** – Used to estimate the global climate benefits of federal rulemakings (e.g., EPA/DOT GHG & CAFE standards).



Methodology

- *Damage Estimate* - Future global climate change damages including: changes in net agricultural productivity, human health, and property damages from increased flood risk.
- *Emissions Timing* - Year of GHG release/reduction key to impact/benefit estimation as it is based on the present value of climate damages over time.
- *Discount Rate* – To reflect uncertainty, four “co-equal” SC-GHG values are used based on different discounting rate assumptions (to represent how damages are valued over time).
- *Limitations*
 - Very likely underestimates damages due to incomplete capture of catastrophic & non-catastrophic impacts;
 - Treatment of adaptation & technological change;
 - Uncertainty in the extrapolation of damages due to high temperatures;
 - Assumptions regarding risk aversion.

Example: SC-CO₂ Values



Table 8-5 Social Cost of CO₂, 2012 – 2050^a (in 2013\$ per Metric Ton)

CALENDAR YEAR	DISCOUNT RATE AND STATISTIC			
	5% Average	3% Average	2.5% Average	3% 95 th percentile
2012	\$12	\$36	\$58	\$100
2015	\$12	\$40	\$62	\$120
2020	\$13	\$46	\$68	\$140
2025	\$15	\$51	\$75	\$150
2030	\$18	\$55	\$80	\$170
2035	\$20	\$60	\$86	\$180
2040	\$23	\$66	\$92	\$200
2045	\$25	\$70	\$98	\$220
2050	\$29	\$76	\$100	\$230

Note:

^a The SC-CO₂ values are dollar-year and emissions-year specific and have been rounded to two significant digits. Unrounded numbers from the current SC-CO₂ TSD were adjusted to 2013\$ and used to calculate the CO₂ benefits.

Diesel Emission Quantifier (DEQ) PM2.5 Monetary Health Benefits



- **Purpose** – DEQ Health Benefits Module uses “benefit-per-ton” (BPT) values to estimate the monetized health benefits of diesel PM2.5 emission reduction options including: exhaust aftertreatment, engine replacement and/or fuel switching.
- **Application** – Used to evaluate the benefits of Diesel Emissions Reduction Act (DERA) grant proposals and selected projects.

Diesel PM2.5 Health Benefits (cont.)



- **Methodology**
 - *Data Sources* – BPT based on data derived from National Emissions Inventory (NEI), National Air Toxics Assessment (NATA), and the Environmental Benefits Mapping & Analysis Program (BenMAP).
 - *Benefit Valuation* – BPT values based on avoided incidences of: premature mortality, chronic & acute bronchitis, upper & lower respiratory symptoms, asthma exacerbation, nonfatal heart attacks, hospital admissions, emergency room visits, work loss days and minor restricted-activity days.
 - *Limitations*
 - Benefits can only be distributed in up to five counties per project.
 - Results only available for counties within the contiguous 48 states.
 - Considered inadequate for SIP planning or credit calculation purposes due to a range of uncertainties.

Example: On-Highway PM2.5 Benefits



County	State	2000 Population	Emissions input (tons/yr)	County area (hectares)	Benefit values (\$/ton)
Inyo	California	17,945	10	10,000	89,000
Alpine	California	1,208	0.57	730	153,000
Sierra	California	3,555	1.3	960	160,000
Mariposa	California	17,130	4.3	1,500	460,000
San Francisco	California	776,733	260	47	2,500,000
Orange	California	2,846,289	400	800	2,900,000

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