

# Chapter C4: Benefits

## INTRODUCTION

Using the national baseline loss estimates reported in *Chapter C3: National Extrapolation of Baseline Losses*, EPA estimated the potential national benefits of each regulatory option by applying a set of estimated percent reductions to baseline losses. The estimates were developed using sample weights based on the sampling design for the 316(b) questionnaires. These weights were used to generate benefits estimates for all 550 in-scope facilities based on the baseline losses for 539 in-scope facilities for which questionnaire data was available. Estimates of benefits for only the 539 in-scope facilities can be found in the *Appendix to Chapter C1*.

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The percent reduction in baseline losses for each facility reflects EPA’s assessment of (1) regulatory baseline conditions at the facility (i.e., current practices and technologies in place), and (2) the percent reductions in impingement and entrainment that EPA estimated would be achieved at each facility that the Agency believes would be adopted under each regulatory option.

## C4-1 OPTIONS WITH BENEFIT ESTIMATES

EPA estimated benefits for the following six options. These options include:

- ▶ **Option 1:** Track I of the waterbody /capacity-based option;
- ▶ **Option 2:** Track I and II of the waterbody /capacity-based option;
- ▶ **Option 3:** (the Agency’s proposed rule), impingement and entrainment controls everywhere with exceptions for low-flow facilities on lakes and rivers;
- ▶ **Option 3a:** impingement and entrainment controls everywhere with no exceptions;
- ▶ **Option 4:** requires all Phase II existing facilities to reduce intake capacity commensurate with the use of closed-cycle, recirculating cooling systems; and
- ▶ **Option 5:** requires that all Phase II existing facilities reduce intake capacity commensurate with the use of dry cooling systems.
- ▶ **Option 6:** similar to Option 1, but requires reduction commensurate with the use of closed-cycle, recirculating systems for all facilities on estuaries, tidal rivers, and oceans

A complete description of the options detailed in the following tables can be found in *Chapter A1: Introduction and Overview* of this Economic and Benefits Analysis (EBA). Benefits detailed in this chapter are the flow-weighted average reductions across all facilities in each water body category for each regulatory option.. See *Chapter C3: National Extrapolation of Baseline Losses* for a discussion on the methodology used to extrapolate benefits.

## C4-2 IMPINGEMENT REDUCTIONS AND BENEFITS

Table C4-1 presents the percentage reductions in impingement that are expected to occur under the six options listed above and Table C4-2 presents the benefit value associated with those reductions.

Waterbody Type	Baseline Impingement Loss	Percentage Reductions						
		Option 1	Option 2	Option 3	Option 3a	Option 4	Option 5	Option 6
Estuary - Non-Gulf	\$57,802	64.4%	47.5%	33.2%	25.5%	41.4%	97.5%	84.4%
Estuary - Gulf	\$4,098	63.2%	45.9%	27.1%	30.0%	45.3%	96.7%	79.4%
Freshwater	\$40,813	47.2%	47.2%	47.2%	46.6%	58.9%	98.0%	47.7%
Great Lake	\$31,506	80.0%	80.0%	80.0%	77.0%	88.6%	96.3%	80.0%
Ocean	\$15,136	72.8%	59.0%	50.1%	46.5%	58.9%	87.6%	77.7%
<b>Total</b>	<b>\$149,356</b>							

Source: U.S. EPA analysis, 2002.

Waterbody Type	Baseline Impingement Loss	Benefits						
		Option 1	Option 2	Option 3	Option 3a	Option 4	Option 5	Option 6
Estuary - Non-Gulf	\$57,802	\$37,233	\$27,452	\$19,193	\$14,754	\$23,924	\$56,338	\$48,777
Estuary - Gulf	\$4,098	\$2,590	\$1,883	\$1,109	\$1,230	\$1,857	\$3,963	\$3,254
Freshwater	\$40,813	\$19,282	\$19,282	\$19,282	\$19,015	\$24,041	\$39,991	\$19,471
Great Lake	\$31,506	\$25,205	\$25,205	\$25,205	\$24,260	\$27,900	\$30,326	\$25,205
Ocean	\$15,136	\$11,020	\$8,923	\$7,587	\$7,034	\$8,912	\$13,265	\$11,763
<b>Total</b>	<b>\$149,356</b>	<b>\$95,330</b>	<b>\$82,744</b>	<b>\$72,375</b>	<b>\$66,294</b>	<b>\$86,633</b>	<b>\$143,883</b>	<b>\$108,470</b>

Source: U.S. EPA analysis, 2002.

### C4-3 ENTRAINMENT REDUCTIONS AND BENEFITS

Table C4-3 presents the percentage reductions in impingement that are expected to occur under the six options listed above and Table C4-4 presents the benefit value associated with those reductions.

Waterbody Type	Baseline Loss	Entrainment Percentage Reductions						
		Option 1	Option 2	Option 3	Option 3a	Option 4	Option 5	Option 6
Estuary - Non-Gulf	\$936,275	67.3%	59.3%	48.5%	47.3%	79.4%	97.5%	\$48,777
Estuary - Gulf	\$103,635	66.9%	52.3%	47.2%	47.8%	79.3%	96.7%	\$3,254
Freshwater	\$96,597	12.4%	12.4%	12.4%	44.2%	72.8%	98.0%	\$19,471
Great Lake	\$43,448	57.8%	57.8%	57.8%	57.8%	88.6%	96.3%	\$25,205
Ocean	\$277,269	72.9%	57.8%	44.1%	44.1%	72.8%	87.6%	\$11,763
<b>Total</b>	<b>\$1,457,225</b>							<b>\$108,470</b>

Source: U.S. EPA analysis, 2002.

Waterbody Type	Baseline Loss	Entrainment Benefit						
		Option 1	Option 2	Option 3	Option 3a	Option 4	Option 5	Option 6
Estuary - NonGulf	\$936,275	\$630,568	\$555,238	\$453,938	\$443,239	\$743,085	\$912,568	\$732,964
Estuary - Gulf	\$103,635	\$69,352	\$54,229	\$48,910	\$49,529	\$82,220	\$100,216	\$81,194
Freshwater	\$96,597	\$11,957	\$11,957	\$11,957	\$42,737	\$70,310	\$94,652	\$9,472
Great Lake	\$43,448	\$25,092	\$25,092	\$25,092	\$25,092	\$38,474	\$41,820	\$25,092
Ocean	\$277,269	\$202,116	\$160,288	\$122,351	\$122,351	\$201,983	\$242,989	\$201,983
<b>Total</b>	<b>\$1,457,225</b>	<b>\$939,085</b>	<b>\$806,803</b>	<b>\$662,248</b>	<b>\$682,949</b>	<b>\$1,136,073</b>	<b>\$1,392,246</b>	<b>\$1,050,705</b>

Source: U.S. EPA analysis, 2002.

## C4-4 CERTAINTY LEVELS ASSOCIATED WITH BENEFIT ESTIMATES OF VARIOUS OPTIONS

Table C4-5 presents information detailing differences in levels of uncertainty associated with the different options.

Table C4-5: Certainty of Benefits Estimates Associated with the Various Options		
Option	Characteristics / Assumptions	Certainty of Achieving Predicted Reductions and Benefits
Waterbody/ Capacity-Based Option (Allows two tracks)	<b>Option 1</b> assumes everyone will use Track 1	Very certain for the 51 facilities assumed to install cooling towers. Expected percentage reductions are within a limited range Less certain for other facilities as technology is unknown
	<b>Option 2</b> assumes that 20 sample facilities will use Track 2	Expected percentage reductions are within a limited range Less certain for other facilities as technology that would be chosen is unknown. Uncertainty due to assumptions about the number of facilities that may choose Track 2 instead of Track 1 Very certain for the 33 facilities assumed to install cooling towers.
<b>Proposed Rule (Option 3)</b>	impingement and entrainment controls everywhere with exceptions for low-flow facilities on lakes and rivers	Uncertain because the technologies chosen by facilities is unknown Number of facilities that would request alternative less stringent requirements based on costs is unknown. Number of facilities that would request alternative less stringent requirements based on benefits is unknown.
Impingement Mortality and Entrainment Controls Everywhere <b>(Option 3a)</b>	impingement and entrainment controls everywhere with no exceptions	Fairly certain, but the technologies chosen by facilities is unknown
All Cooling Towers <b>(Option 4)</b>	requires reduction commensurate with the use of closed-cycle, recirculating systems	Very certain for the 470 facilities installing wet cooling towers. Expected percentage reductions are within a limited range
Dry Cooling <b>(Option 5)</b>	requires reduction commensurate with the use of dry cooling systems	Extremely certain for the 539 facilities installing dry cooling
Waterbody-Based <b>(Option 6)</b>	Similar to Option1, but requires reduction commensurate with the use of closed-cycle, recirculating systems for all facilities on estuaries, tidal rivers, and oceans	Very certain for the 109 facilities assumed to install cooling towers. Expected percentage reductions are within a limited range Less certain for other facilities as technology is unknown

Source: U.S. EPA analysis, 2002.

### C4-5 BENEFITS ASSOCIATED WITH VARIOUS PERCENTAGE REDUCTIONS

In addition to percentage reductions by option, EPA developed a more generic illustration of potential benefits, based on a broad range (from 10 percent to 90 percent ) of potential reductions in impingement and entrainment. These results are shown in Table C4-6.

<b>Table C4-6: Summary of Potential Benefits Associated with Various Impingement and Entrainment Reduction Levels</b>		
<b>Reduction Level</b>	<b>Benefits (in thousands, \$2001)</b>	
	<b>Impingement</b>	<b>Entrainment</b>
10%	\$14,936	\$145,722
20%	\$29,871	\$291,445
30%	\$44,807	\$437,167
40%	\$59,742	\$582,890
50%	\$74,678	\$728,612
60%	\$89,613	\$874,335
70%	\$104,549	\$1,020,057
80%	\$119,484	\$1,165,780
90%	\$134,420	\$1,311,502

Source: U.S. EPA analysis, 2002.

### C4-6 BENEFITS ASSOCIATED WITH THE PROPOSED OPTION

Table C4-7 presents the benefits that would occur with various percentage reductions

<b>Table C4-7: Summary of Benefits from Impingement Controls Associated with the Proposed Rule (Option 3)</b>		
<b>Waterbody Type</b>	<b>Benefits (in thousands, \$2001)</b>	
	<b>Impingement</b>	<b>Entrainment</b>
Estuary - NonGulf	\$19,193	\$453,938
Estuary - Gulf	\$1,109	\$48,910
Freshwater	\$19,282	\$11,957
Great Lake	\$25,205	\$25,092
Ocean	\$7,587	\$122,351
<b>Total</b>	<b>\$72,375</b>	<b>\$662,248</b>

Source: U.S. EPA analysis, 2002.

Under today's proposal, facilities can choose the Site-Specific Determination of Best Technology Available in § 125.94(a) in which a facility can demonstrate to the Director that the cost of compliance with the applicable performance standards in § 125.94(b) would be significantly greater than the costs considered by EPA when establishing these performance standards, or the costs would be significantly greater than the benefits of complying with these performance standards. EPA expects that if facilities were to choose this approach, then the overall national benefits of this rule will decrease markedly. This is because under this approach facilities would choose the lowest cost technologies possible and not necessarily the most effective technologies to reduce impingement and entrainment at the facility.

The estimates that appear in this chapter are weighted estimates of benefits at all 550 in-scope facilities. The weights use are based on the sampling design for the 316(b) questionnaires. See the *Appendix to Chapter C1* for the benefit estimates on an unweighted basis.