Chapter C3: National Extrapolation of Baseline Losses

Introduction

In this chapter the case study results detailed in *Chapter C2: Summary of Case Study Results* are used to develop EPA's estimates of baseline losses from impingement and entrainment (I&E) at in-scope facilities nationwide. The case study losses are extrapolated to national losses, by waterbody type, using two methods. The first method uses data on average daily flow to capture the stress level the facility places on the environment. The second method uses data on angling activity near the facility to capture the level of demand for the fishery. A combination of these national loss estimates is then used to develop EPA's best estimates of baseline losses by waterbody type.

Chapter Contents

C3-1 Extrapolation

To compare benefits to costs for a national rulemaking such as the 316b Phase II existing facility rule, national estimates of both costs and benefits must be determined. This chapter describes the methods EPA used to estimate national baseline losses due to I&E. These baseline losses are then used to estimate national benefits in *Chapter C4: Benefits*.

Baseline losses are very site-specific. This limited EPA's options for developing national-level baseline loss estimates from a diverse set of 550 in-scope entities. Time, resources, and data limited the number of case studies that could be performed for proposal, so to interpret these cases in a national context, the Agency identified a range of settings that reflect the likely losses at a given type of facility (and its key stressor-related attributes) in combination with the characteristics of the waterbody (receptor attributes) in which it is located. Losses can thus be defined by the various possible combinations of stressor (facility) and receptor (waterbody, etc.) combinations.

Ideally, case studies would be selected to represent each of these "loss potential" settings and then could be used to extrapolate to facilities with similar cooling water intake structures. However, data limitations and other considerations precluded EPA from developing enough case studies to reflect all loss potential settings. Data limitations also made it difficult to assign facilities to the various loss potential categories.

Based on the difficulties noted above, EPA adopted a more practical, streamlined extrapolation version of its preferred approach, since this is the only feasible approach available to the Agency. To develop a feasible, tractable manner for developing national baseline loss estimates from a small number of case study investigations, EPA made its national extrapolations on the basis of a combination of three relevant variables:

- the volume of water (operational flow) drawn by a facility;
- the level of recreational angling activity within the vicinity of the facility; and
- the type of waterbody on which the facility is located. Extrapolations were then made across facilities according to their respective waterbody type.

The first of these variables – operational flow (measured as millions of gallons per day, or MGD) – reflects the degree of stress caused by a facility. The second variable – the number of angler days in the area (measured as the number of recreational angling days within a 120 mile radius) – reflects the degree to which there is a demand (value) by local residents to use the fishery that is impacted. The third variable – waterbody type (e.g., estuary, ocean, freshwater river or lake, or Great Lakes) – reflects the types, numbers, and lifestages of fish and other biological receptors that are impacted by the facilities. Accordingly, the extrapolations based on these three variables reflect the key factors that affect losses: the relevant stressor, the biological receptors, and the human demands for the natural resources and services impacted.

C3-1.1 Consideration of Volume of Water (Flow)

The flow variable the Agency developed for each facility is the flow at the facility (in MGD) divided by the total flow for all facilities located on the same type of waterbody. Thus, this flow index is the facility's percentage share of the total flow at all facilities in its waterbody type. Since this flow index has a value between 0 and 1, dividing the baseline loss at a case study site by the flow index yields an estimate of the total baseline loss at all facilities drawing cooling from the same type of waterbody.

The MGD levels used to calculate the flow index are based on average operational flows as reported by the facilities in the EPA 316(b) Detailed Questionnaire and Short Technical Questionnaire responses, or through publically available data.

C3-1.2 Consideration of Level of Recreational Angling

The angler day variable the Agency used is an index based on results from the U.S. Fish and Wildlife Survey as part of its *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (U.S. DOI, 1997). These data were interpreted within a GIS-based approach to estimate the level of recreational angling pursued by populations living within 120 miles of each facility.

In developing the index, EPA used a GIS analysis to identify counties where any portion of the county is within a 120-mile radius of each facility. EPA then defined the area for each facility to include the county the facility is located in and any other county with at least 50 percent of its population residing within 120 miles of the facility. In total, EPA identified 2,757 counties that were within the 120-mile radius of at least one in-scope facility.

Using estimates of angling activity by state, EPA then estimated angling activity levels for each county within the 120-mile area. The type of angling days estimated for each county are based on the angling categories defined in the 1996 survey and the type of waterbody where the facility's cooling water intake structures are located. For facilities located on freshwater streams, rivers, and lakes (not including the Great Lakes), EPA estimated the total number of freshwater angling days. For facilities located on an ocean, estuary, or tidal river EPA estimated the total number of saltwater angling days. For facilities located on one of the Great Lakes, EPA estimated the total number of Great Lakes angling days.

EPA then summed angling days across all counties in a facility's area to yield estimated angling days in the area near the facility. For each type of angling, EPA estimated angling days by county residents as a percentage of the state angling days by residents 16 years and older reported in the 1996 survey. Angling days in each state were partitioned into days by urban anglers and days by rural anglers based on the national percentages reported in the 1996 survey.[1] EPA then used these state urban and rural angling days to estimate the number of angling days in each county within the 120-mile radius of an in-scope facility.

EPA used the following formula to calculate angling days for urban counties within a 120-mile radius of each in-scope facility:

$$\text{Urban County Angling Days} = \text{State Urban Angling Days} \times \frac{\text{Urban County Population Within 120 Mile Radius}}{\text{State Urban Population}}$$

EPA used a similar formula to the one above for calculating rural county angling days within a 120-mile radius of each in-scope facility.

[1] For example, the 1996 national survey found that 58.8% of anglers in the U.S. came from urban areas. So for each state, EPA assigned 58.8% of the total freshwater angling days reported in the survey to the state's urban angling days and 41.2% to the state's rural angling days. Similar calculations were performed for saltwater angling and Great Lakes angling.

EPA determined urban and rural population by state by summing the 1999 county populations for the state's urban and rural counties respectively. EPA determined each county's urban/rural status using definitions developed by the U.S. Department of Agriculture (U.S. DOI, 1997).

Once total angling days were estimated, EPA calculated an angling index value for each facility. Like the flow index, the angling index is a measure of the facility's percentage share of the total angling days estimated at all in-scope facilities located on a similar waterbody. This index value provides an indication of the relative level of angling activity at each facility compared to other in-scope facilities on the same type of waterbody. Since angling index also has a value between 0 and 1, dividing the baseline loss at a case study site by the angling index yields a second estimate of the total baseline loss at all facilities drawing cooling from the same type of waterbody.

C3-1.3 Consideration of Waterbody Type

a. Estuaries

National baseline losses for estuaries are based on the Salem and Tampa Bay case studies. The case study results are extrapolated to other facilities on the basis of regional fishery types, to reflect the different types of fisheries that are impacted in various regions of the country's coastal waters. EPA used the estimated baseline losses from the four Tampa Bay facilities to extrapolate losses to all in-scope estuarine facilities in Gulf Coast states that were not included in the Tampa Bay case study. Likewise, the estimated baseline losses at the Salem facility were used to extrapolate to all in-scope estuarine facilities in states that are not on the Gulf Coast and that were not included in the Salem, Brayton Point, Contra Costa, or Pitsburgh case studies (note that the Salem results used for the extrapolation differ from the case study results presented above in order to reflect losses without a screen currently in place at the facility). Ideally, a West Coast facility would have served as the basis of extrapolation to estuarine facilities along the Pacific Coast, but EPA could not develop a suitable case study for that purpose in time for this proposal. EPA intends to develop such a western estuary case study and report its findings in an anticipated forthcoming Notice of Data Availability.

b. Rivers and Lakes

EPA combined rivers, lakes, and reservoirs into one class of freshwater-based facilities (the Great Lakes were considered separately and are not included in this group). The waterbody classifications for freshwater streams/rivers and lakes/reservoirs were grouped together for the extrapolation because of the similar ecological and hydrological characteristics of freshwater systems used as cooling water. The majority of these hydrologic systems have undergone some degree of modification for purposes such as water storage, flood control, and navigation. The degree of modification can range from very minor to quite dramatic. A facility in the lake/reservoir category may withdraw cooling water from a lake that has been reclassified as a reservoir due to the addition of an earthen dam, or from a reservoir created by the diversion of a river through a diversion canal for use as a cooling lake. The species composition and ecology of these two waterbodies may vary greatly. While the ecology of river systems and lakes or reservoirs is considerably different, structural modifications can make these two classifications may be quite similar ecologically, depending on the waterbody in question. For example, many river systems, including the Ohio River, are now broken up into a series of navigational pools controlled by dams that may function more like a reservoir than a naturally flowing river.

Baseline I&E losses in the Ohio case study were based on 29 in-scope facilities in the Ohio River case study area. In the results presented below, EPA used the estimated losses at these 29 facilities to extrapolate to an estimate of national losses at all in-scope facilities on other freshwater rivers, lakes, and reservoirs that were not included in the Ohio or Monroe case studies. The extrapolations were performed using both the flow and angling indices.

Because of the large number of facilities in the Ohio study and their proximity to each other, EPA used a slightly different method to estimate angling activity at these facilities. Rather than calculating the angling days within the 120-mile radius of each individual facility, EPA instead summed the angling days in all counties within 120 miles of any of the 29 Ohio facilities and divided this by the number of angling near any freshwater facility nationwide. Essentially, this method treats the 29 Ohio facilities as one large facility for the purposes of calculating an angling index. This eliminates the problem of multiple-counting of angling days in counties that occurs because the Ohio facilities are so close to each other.

c. Oceans and Great Lakes

Oceans and Great Lakes estimates were based on extrapolations from the Pilgrim and J.R. Whiting facility case studies, respectively. For these two facilities (and their associated waterbody types), the valuation method applied by EPA in the national extrapolations was based on the Habitat-based Replacement Cost (HRC) approach, which reflects values for addressing a much greater number of impacted species (not just the small share that are recreational or commercial species that are landed by anglers). For example, at JR Whiting, the benefits transfer approach developed values for recreational angling amounted to only 4% of the estimated total impingement losses, and reflected only 0.02 % of the age 1 fish lost due to impingement. At Pilgrim, the benefits transfer approach reflected recreational losses for only 0.5 % of the entrained age 1 equivalent fish at that site. Because the Agency was able to develop HRC values for these sites and recreational fishery impacts were such a small part of the impacts, EPA extrapolated only based on HRC estimates and used only the flow-based (MGD) index for oceans and the Great Lakes.

In the results presented below, EPA used the estimated baseline losses from the Pilgrim facility to extrapolate losses to all in-scope ocean facilities with the exception of Seabrook, which has an off-shore intake and represents itself. Likewise, the estimated baseline losses at the J.R. Whiting facility were used to extrapolate to all in-scope Great Lakes facilities that were not included in the J.R. Whiting case study with the exception of the Monroe facility, which represents itself. The extrapolations were performed using both the flow and angling indices.

C3-1.4 Flow and Angling Indices

The results of the index calculations for operational flow and angling effort used for extrapolating case study baseline losses to national baseline losses for all in-scope facilities are reported in Table C3-1.

Table C3-1: Flow and Angling Indices

Waterbody Type	Based on	Normalized MGD	Percentage of In-Scope Angling Base
Estuary-N. Atlantic	Salem (without screens)	4.39%	2.10%
Estuary-S. Atlantic	4 Tampa Bay facilities	19.24%	20.28%
Freshwater systems	29 Ohio River facilities	9.30%	12.34%
Great Lake	JR Whiting	3.92%	13.89%
Ocean	Pilgrim	3.42%	6.54%

Source: U.S. EPA analysis, 2002.

C3-1.5 Waterbody Considerations

EPA further tailored its extrapolation approach to base monetized baseline loss (and benefits) estimates on available data for similar types of waterbody settings. Thus, for example, the case study results for the Salem facility (located in the Delaware Estuary) and the Tampa facilities are applied (on a per MGD and angling day index basis) only to other facilities located in estuary waters. Likewise, results from Ohio River facilities are applied to inland freshwater water cooling water intake structures (excluding facilities on the Great Lakes), and losses estimated for the Pilgrim plant are applied to facilities using ocean waters at their intakes, and results for J.R. Whiting are used for the Great Lakes facilities.

As noted above, EPA grouped the waterbody classifications for freshwater rivers and lakes/reservoirs for the extrapolation based on similar ecological and hydrological characteristics of freshwater systems used as cooling water. The majority of these hydrologic systems have undergone some degree of modification for purposes such as water storage, flood control, and navigation. Structural modifications can make these freshwater waterbody types quite similar ecologically. For example, many river systems, including the Ohio River, are now broken up into a series of navigational pools controlled by dams that may function more similarly to a reservoir than a naturally flowing river.

The natural species distribution, genetic movement, and seasonal migration of aquatic organisms that may be expected in a natural system is affected by factors such as dams, stocking of fish, and water diversions. Since the degree of modification of inland waterbodies and the occurrence of fish stocking could not be determined for every cooling water source, EPA grouped the waterbody categories “freshwater rivers” and “lakes/reservoirs” were grouped together.

The facilities chosen for extrapolation are expected to have relatively average losses per MGD and angling day index, for their respective waterbody types. Losses per MGD and angling day index are not expected to be extremely high or low relative to other facilities. EPA was careful not use facilities that were unusual in this regard. Salem is located in the transitional zone of the estuary, a lesser productive part of the estuary.

C3-1.6 Advantages and Disadvantages of EPA's Extrapolation Approach

The use of flow and angler day basis for extrapolation has some practical advantages and basis in logic; however, it also has some less than fully satisfactory implications. The advantages of using this extrapolation approach include:

- The methods are easily implemented because the extrapolation relies on waterbody type, angler demand, and MGD data that are available or easily estimated for all in-scope facilities.
- Selectively extrapolating case study results to facilities on like types of waterbodies reflects the type of aquatic setting impacted, which is intended to capture the number and types of species impacted by I&E at such facilities (i.e., impacts at facilities on estuaries are more similar to impacts at other estuary-based cooling water intake structures than they are to facilities on inland waters).
- Flow in MGD is a useful proxy for the scale of operation at cooling water intake structures, a variable that typically will have a large impact on baseline losses and potential regulatory benefits.
- While there may be a high degree of variability in the actual losses (and benefits) per MGD across facilities that impact similar water bodies, the extrapolations are expected to be reasonably accurate on average for developing an order-of-magnitude national-level estimate of benefits. There is no systematic upward or downward bias to these estimates.
- The recreational participation level (angler days) variable provides a logical basis to reflect the extent of human user demands for the fishery and other resources affected by I&E.
- The national benefit estimates are not biased in either direction.

Some of the disadvantages of the use of extrapolating results on the basis of waterbody type, recreational angling day data, and operational flows (MGD) include:

- The approach may not reflect all of the variability that exists in I&E impacts (and monetized losses or benefits) within waterbody classifications. For example, within and across U.S. estuaries, there may be different species, numbers of individuals, and life stages present at different cooling water intake structures.
- The approach may not reflect all of the variability that exists in I&E impacts (and monetized losses or benefits) across operational flow levels (MGD) at different facilities within a given waterbody type.

Extrapolating to national baseline losses according to flow (MGD), angling levels, and waterbody type, as derived from estimates for a small number of case studies, may introduce inaccuracies into national estimates. This is because the three variables used as the basis for the extrapolation (MGD, recreational angling days, and waterbody type) may not account for all of the variability expected in site-specific benefits levels. The case studies may not reflect the average or "typical" cooling water intake structures impacts on a specific waterbody (i.e., the extrapolated results might under- or overstate the physical and dollar value of impacts per MGD and fishing day index, by waterbody type for a specific facility). The inaccuracies introduced to the national-level estimates by this extrapolation approach are of unknown magnitude or direction (i.e., the estimates may over- or understate the anticipated national-level benefits); however, EPA has no data to indicate that the case study results are atypical for any of the waterbody types analyzed or that they are in any way biased.

C3-2 Results of National Benefits Extrapolation

EPA developed estimates of national benefits attributable to the proposed rule in two main stages. In the first stage, national baseline losses were estimated. The methods used for this analysis are detailed above and the results are presented below. In the second, EPA applied the expected reductions under several regulatory options to the national baseline loss estimates to calculated expected benefits of the rule. EPA's benefits estimates are presented in *Chapter C4: Benefits*.

C3-2.1 Case Study Baseline Losses

In the first step of the baseline loss extrapolation, EPA used the baseline losses (dollars per year) derived from the analysis of facilities examined in the case studies. In some instances, the case study facilities had already implemented some measures to reduce impingement and/or entrainment. In such cases, baseline losses as appropriate to the national extrapolation were estimated using data for years prior to the facilities' actions (e.g., based on I&E before the impingement deterrent net was installed at J.R. Whiting). These pre-action baselines provide a basis for examining other facilities that have not yet taken actions to reduce impingement and/or entrainment. Baseline losses at the selected case study facilities are summarized in Table C3-2.

Table C3-2: Baseline Losses from Selected Case Studies (in thousands, $2001)

Case Study	Impingement			Entrainment		
	Low	Mid	High	Low	Mid	High
Salem	$528	$704	$879	$16,766	$23,657	$30,548
Brayton Point	$9	$450	$890	$235	$14,261	$28,288
Contra Costa	$2,666	$5,726	$8,785	$6,413	$13,630	$20,847
Pittsburgh	$10,096	$22,268	$34,440	$19,166	$40,760	$62,354
4 Tampa Bay Facilities	$801	$809	$817	$20,007	$20,454	$20,901
29 Ohio Facilities	$3,452	$4,052	$4,652	$9,257	$9,584	$9,912
Monroe	$742	$3,190	$5,639	$1,307	$7,604	$13,902
JR Whiting	$358	$797	$1,235	$42	$873	$1,703
Pilgrim Nuclear	$4	$256	$507	$642	$4,960	$9,279
Seabrook Nuclear	$3	$4	$5	$142	$229	$315

Source: U.S. EPA analysis, 2002.

C3-2.2 Extrapolation of Baseline Losses to All Facilities Using Flow Index

In the second step, EPA extrapolated the baseline dollar loss estimates from the case study models to all 539 facilities that responded to the Agency's facility survey by dividing the estimated dollar losses at baseline per unit flow by the sum of the index of operational flow for each non-case study facility. This extrapolation was done by source waterbody type. This resulted in a national estimate of baseline monetizable losses for all 539 responding facilities as summarized in Table C3-3.[2]

Table C3-3: Baseline Losses Extrapolated to All In-Scope Facilities Using MGD Only[a] (in thousands, $2001)

Facility	Case Study	Impingement			Entrainment		
		Low	Mid	High	Low	Mid	High
Estuary - Non Gulf							
Salem	Delaware	$528	$704	$879	$16,766	$23,657	$30,548
Brayton Point	Brayton	$9	$450	$890	$235	$14,261	$28,288
Contra Costa	California	$2,666	$5,726	$8,785	$6,413	$13,630	$20,847
Pittsburgh	California	$10,096	$22,268	$34,440	$19,166	$40,760	$62,354
All Other In-Scope	---	$11,167	$14,875	$18,583	$354,346	$499,991	$645,636
Total (78 In-Scope Facilities)	---	*$24,467*	*$44,022*	*$63,578*	*$396,925*	*$592,298*	*$787,672*
Estuary - Gulf Coast							
4 Tampa Facilities	Tampa Bay	$801	$809	$817	$20,007	$20,454	$20,901
All Other In-Scope	---	$3,361	$3,395	$3,429	$83,982	$85,857	$87,732
Total (30 In-Scope Facilities)	---	*$4,162*	*$4,204*	*$4,247*	*$103,989*	*$106,311*	*$108,633*
Freshwater							
29 Ohio Facilities	Ohio	$3,452	$4,052	$4,652	$9,257	$9,584	$9,912
Monroe	Monroe	$742	$3,190	$5,639	$1,307	$7,604	$13,902
All Other In-Scope	---	$33,317	$39,111	$44,906	$89,348	$92,514	$95,679
Total (393 In-Scope Facilities)	---	*$37,511*	*$46,353*	*$55,196*	*$99,911*	*$109,702*	*$119,493*
Great Lake							
JR Whiting	JR Whiting	$358	$797	$1,235	$42	$873	$1,703
All Other In-Scope	---	$8,774	$19,523	$30,271	$1,025	$21,385	$41,745
Total (16 In-Scope Facilities)	---	*$9,132*	*$20,319*	*$31,506*	*$1,067*	*$22,257*	*$43,448*
Ocean							
Pilgrim Nuclear	Pilgrim	$4	$256	$507	$642	$4,960	$9,279
Seabrook Nuclear	Seabrook	$3	$4	$5	$142	$229	$315
All Other In-Scope	---	$110	$6,886	$13,662	$17,290	$133,676	$250,062
Total (22 In-Scope Facilities)	---	*$118*	*$7,146*	*$14,174*	*$18,074*	*$138,865*	*$259,656*
All In-Scope Facilities							
Total (539 In-Scope Facilities)	**---**	**$75,388**	**$122,045**	**$168,701**	**$619,966**	**$969,434**	**$1,318,902**

[a] Baseline losses are estimated based on survey data from 539 in-scope facilities and include baseline closures.

Source: U.S. EPA analysis, 2002.

[2] Data from the 316(b) questionnaire were available for 539 of the estimated 550 in-scope facilities. EPA presents sample-weighted benefits estimates in Chapter C4 that reflect baseline losses and benefits at all 550 in-scope facilities. Un-weighted benefits estimates are presented in Appendix C1.

C3-2.3 Extrapolation of Baseline Losses to All Facilities Using Angling Index

In the third step, the Agency extrapolated the baseline dollar loss estimates from the case studies to all in-scope facilities in the database by dividing baseline losses from the case study models by the sum of the angling index values for all non-case study facilities. This was done by source waterbody type. The calculation of the index is described above. The results are summarized in Table C3-4.

Table C3-4: Baseline Losses Extrapolated - Angling Days Only[a] (in thousands, $2001)

Facility	Case Study	Impingement			Entrainment		
		Low	Mid	High	Low	Mid	High
Estuary - Non Gulf							
Salem	Delaware	$528	$704	$879	$16,766	$23,657	$30,548
Brayton Point	Brayton	$9	$450	$890	$235	$14,261	$28,288
Contra Costa	California	$2,666	$5,726	$8,785	$6,413	$13,630	$20,847
Pittsburgh	California	$10,096	$22,268	$34,440	$19,166	$40,760	$62,354
All Other In-Scope	---	$23,840	$31,755	$39,671	$756,471	$1,067,399	$1,378,327
Total (78 In-Scope Facilities)	---	*$37,139*	*$60,903*	*$84,667*	*$799,050*	*$1,159,706*	*$1,520,363*
Estuary - Gulf Coast							
4 Tampa Facilities	Tampa Bay	$801	$809	$817	$20,007	$20,454	$20,901
All Other In-Scope	---	$3,148	$3,180	$3,212	$78,664	$80,421	$82,177
Total (30 In-Scope Facilities)	---	*$3,949*	*$3,989*	*$4,029*	*$98,672*	*$100,875*	*$103,078*
Freshwater							
29 Ohio Facilities	Ohio	$3,452	$4,052	$4,652	$9,257	$9,584	$9,912
Monroe	Monroe	$742	$3,190	$5,639	$1,307	$7,604	$13,902
All Other In-Scope	---	$23,203	$27,238	$31,273	$62,224	$64,429	$66,633
Total (393 In-Scope Facilities)	---	*$27,396*	*$34,480*	*$41,564*	*$72,787*	*$81,617*	*$90,447*
Great Lake							
JR Whiting	JR Whiting	$358	$797	$1,235	$42	$873	$1,703
All Other In-Scope	---	$2,220	$4,940	$7,660	$259	$5,411	$10,564
Total (16 In-Scope Facilities)	---	*$2,578*	*$5,737*	*$8,895*	*$301*	*$6,284*	*$12,267*
Ocean							
Pilgrim Nuclear	Pilgrim	$4	$256	$507	$642	$4,960	$9,279
Seabrook Nuclear	Seabrook	$3	$4	$5	$142	$229	$315
All Other In-Scope	---	$54	$3,402	$6,750	$8,543	$66,047	$123,551
Total (22 In-Scope Facilities)	---	*$62*	*$3,662*	*$7,262*	*$9,326*	*$71,236*	*$133,145*
All In-Scope Facilities							
Total (539 In-Scope Facilities)	**---**	**$71,125**	**$108,771**	**$146,418**	**$980,137**	**$1,419,718**	**$1,859,300**

[a] Baseline losses are estimated based on survey data from 539 in-scope facilities and include baseline closures.

Source: *U.S. EPA analysis, 2002.*

C3-2.4 Average of Flow-Based and Angling-Based Losses

As a fourth step, EPA calculated the average baseline losses of the flow-based results and the angling-based results. This develops results that reflect an equally-weighted extrapolation measure of each case study facility's baseline loss, based on it's percent share of flow and recreational fishing relative to all in-scope facilities in each waterbody type. The results of this average are reported in Table C3-5.

Table C3-5: Baseline Losses Extrapolated to All In-Scope Facilities - Means of MGD and Angling[a] (in thousands, $2001)

Facility	Case Study	Impingement			Entrainment		
		Low	Mid	High	Low	Mid	High
Estuary - Non Gulf							
Salem	Delaware	$528	$704	$879	$16,766	$23,657	$30,548
Brayton Point	Brayton	$9	$450	$890	$235	$14,261	$28,288
Contra Costa	California	$2,666	$5,726	$8,785	$6,413	$13,630	$20,847
Pittsburgh	California	$10,096	$22,268	$34,440	$19,166	$40,760	$62,354
All Other In-Scope	---	$17,503	$23,315	$29,127	$555,409	$783,695	$1,011,981
Total (78 In-Scope Facilities)	---	*$30,803*	*$52,463*	*$74,122*	*$597,988*	*$876,002*	*$1,154,017*
Estuary - Gulf Coast							
4 Tampa Facilities	Tampa Bay	$801	$809	$817	$20,007	$20,454	$20,901
All Other In-Scope	---	$3,255	$3,288	$3,321	$81,323	$83,139	$84,955
Total (30 In-Scope Facilities)	---	*$4,055*	*$4,097*	*$4,138*	*$101,330*	*$103,593*	*$105,856*
Freshwater							
29 Ohio Facilities	Ohio	$3,452	$4,052	$4,652	$9,257	$9,584	$9,912
Monroe	Monroe	$742	$3,190	$5,639	$1,307	$7,604	$13,902
All Other In-Scope	---	$28,260	$33,175	$38,089	$75,786	$78,471	$81,156
Total (393 In-Scope Facilities)	---	*$32,453*	*$40,417*	*$48,380*	*$86,349*	*$95,660*	*$104,970*
Great Lake							
JR Whiting	JR Whiting	$358	$797	$1,235	$42	$873	$1,703
All Other In-Scope	---	$5,497	$12,231	$18,966	$642	$13,398	$26,154
Total (16 In-Scope Facilities)	---	*$5,855*	*$13,028*	*$20,201*	*$684*	*$14,271*	*$27,858*
Ocean							
Pilgrim Nuclear	Pilgrim	$4	$256	$507	$642	$4,960	$9,279
Seabrook Nuclear	Seabrook	$3	$4	$5	$142	$229	$315
All Other In-Scope	---	$82	$5,144	$10,206	$12,916	$99,861	$186,806
Total (22 In-Scope Facilities)	---	*$90*	*$5,404*	*$10,718*	*$13,700*	*$105,050*	*$196,401*
All In-Scope Facilities							
Total (539 In-Scope Facilities)	**---**	**$73,257**	**$115,408**	**$157,559**	**$800,051**	**$1,194,576**	**$1,589,101**

[a] Baseline losses are estimated based on survey data from 539 in-scope facilities and include baseline closures.

Source: U.S. EPA analysis, 2002.

C3-2.5 Best Estimates

In the fifth step, EPA selected the set of extrapolation values the Agency believes are the most reflective of the baseline loss scenarios for each waterbody type. For estuaries and freshwater facilities, EPA used the midpoint of its loss estimates of I&E at the case study facilities, and then applied the average of the MGD- and angler-based extrapolation results. This provides estimates of national baseline losses that reflect the broadest set of values and parameters (i.e., the full range of loss estimates, plus the application of all three extrapolation variables).

For oceans and the Great Lakes, EPA developed national-scale estimates using its HRC-based loss estimates. These HRC estimates are most appropriate because these HRC values are more comprehensive than the values derived using the more traditional benefits transfer approach. The HRC estimates cover losses for a much larger percentage of fish lost due to I&E, whereas the benefits transfer approach addressed losses only for a small share of the impacted fish. Since recreational fish impacts were an extremely small share of the total fish impacts at these sites, EPA extrapolated the HRC findings using only the MGD-based index (i.e., the angler-based index was not relevant).

The results of EPA's assessment of its best estimates for baseline losses due to I&E are shown in Table C3-6.

Table C3-6: Best Estimate Baseline Losses[a, b] (in thousands, $2001)

Facility	Case Study	Impingement	Entrainment
Estuary - Non Gulf			
Salem	Delaware	$704	$23,657
Brayton Point	Brayton	$450	$14,261
Contra Costa	California	$5,726	$13,630
Pittsburgh	California	$22,268	$40,760
All Other In-Scope	---	$23,315	$783,695
Total (78 In-Scope Facilities)	---	*$52,463*	*$876,002*
Estuary - Gulf Coast			
4 Tampa Facilities	Tampa Bay	$809	$20,454
All Other In-Scope	---	$3,288	$83,139
Total (30 In-Scope Facilities)	---	*$4,097*	*$103,593*
Freshwater			
29 Ohio Facilities	Ohio	$4,052	$9,584
Monroe	Monroe	$3,190	$7,604
All Other In-Scope	---	$30,891	$73,069
Total (393 In-Scope Facilities)	---	*$38,133*	*$90,258*
Great Lake			
JR Whiting	JR Whiting	$1,235	$1,703
All Other In-Scope	---	$30,271	$41,745
Total (16 In-Scope Facilities)	---	*$31,506*	*$43,448*
Ocean			
Pilgrim Nuclear	Pilgrim	$507	$9,279
Seabrook Nuclear	Seabrook	$5	$315
All Other In-Scope	---	$13,662	$250,062
Total (22 In-Scope Facilities)	---	*$14,174*	*$259,656*
All In-Scope Facilities			
Total (539 In-Scope Facilities)	**---**	**$142,656**	**$1,378,359**

[a] Baseline losses are estimated based on survey data from 539 in-scope facilities and include baseline closures.
[b] Facilities in bold, were used for extrapolation.

Source: U.S. EPA analysis, 2002.

REFERENCES

U.S. Department of the Interior (U.S. DOI), Fish and Wildlife Service, and U.S. Department of Commerce (U.S. DOC), Bureau of the Census. 1997. *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.