

# Chapter C7: Conclusions

EPA evaluated the impacts of I&E using facility-generated data at nine CWIS along a 500-mile stretch of the Ohio River, (spanning from the western portion of Pennsylvania, along the southern border of Ohio, and into eastern Indiana). The results were then extrapolated to the 20 other facilities along this stretch of the river that are in scope of the § 316(b) Phase II rule (a total of 29 facilities) as well as an additional 19 facilities that are out of scope.

To estimate I&E impacts for the Ohio, EPA evaluated the available I&E biological monitoring data at the nine case study facilities (W.C. Beckjord, Cardinal, Clifty Creek, Kammer, Kyger Creek, Miami Fort, Philip Sporn, Tanners Creek, and WH Sammis). The I&E results were extrapolated to the remaining in-scope facilities to derive an I&E baseline for all facilities subject to the proposed rule. Additional extrapolations were made to out-of-scope facilities so that total I&E could be estimated as well. The extrapolations were made on the basis of relative operating size (operating MGD) and by river pool (Hannibal, Markland, McAlpine, New Cumberland, Pike Island, and Robert C. Byrd pools).

The results indicate that impingement at all facilities (in scope and out of scope) causes the mortality of approximately 11.6 million age 1 equivalent fish per year, or 15,500 pounds of lost fishery yield annually (Table C3-29). For entrainment, the results indicate that all facilities combined (in-scope and out-of-scope) cause the mortality of approximately 24.5 million age 1 equivalent fish per year, representing nearly 40,000 pounds of lost fishery yield annually (Tables C3-30).

For in-scope facilities only, the results indicate that impingement causes the mortality of approximately 11.3 million age 1 equivalent fish per year, or nearly 15,000 pounds of lost fishery yield annually (Table C3-31). EPA estimates that entrainment at in scope facilities results in the loss approximately 23 million age 1 equivalent fish per year or 39,000 pounds of lost fishery yield annually (Table C3-32).

In addition to estimating the physical impact of I&E in terms of numbers of fish lost because of the operation of all in-scope and out-of-scope CWIS in the Ohio River case study area, EPA also examined the estimated economic value of the I&E losses. The economic value of these losses is based on benefits transfer based values applied to losses to the recreational fishery, nonuse values, and the partial value of forage species impacts (measured as partial replacement costs or fishery production foregone). Chapter C4 provides an indication of the estimated cumulative economic value associated with I&E at all in-scope and out-of-scope CWIS in the case study area based on data available for the nine case study facilities and extrapolated to the other facilities on the basis of flow and river pool.

EPA also developed a random utility model (RUM) to provide primary estimates of the recreational fishery losses associated with I&E in the Ohio River case study area (Chapter C5). These primary research results supplement the benefits transfer estimates derived in Chapter C4. As shown in Chapter C5, the RUM estimate of recreation-related fishery losses at in scope facilities is approximately \$8.1 million per year (I&E combined).

In Chapter C6, results for the RUM analysis (Chapter C5) were merged with the benefits transfer-based estimates (Chapter C4) in a manner that avoids double counting. Results indicate that baseline losses at in scope facilities amount to between \$3.4 million and \$4.6 million per year for impingement. Entrainment-related baseline losses at in scope facilities amount to between \$9.1 million and \$9.7 million per year.

EPA also estimated the economic benefits of a range of I&E reductions (Chapter C6). The estimates economic benefits of the proposed rule are \$1.7 million to \$2.3 million per year for a 50% impingement reduction and \$7.3 million to \$7.8 million per year for a 10% reduction in entrainment (all in \$2000).

The Ohio River case study is intended to reflect the level of I&E, and hence the benefits associated with reducing I&E impacts, for CWIS along major rivers of the United States. However, there are several factors that suggest that the Ohio River case study findings may be a worse case scenario in terms of estimating the benefits of the proposed regulation at facilities along major inland rivers of the United States. These factors include the following:

- ▶ The I&E data developed by the facilities were limited to one year only, and are from 1977 (nearly 25 years ago). The fact that the data are so old, and pertain to a period of time when water quality in the case study area was worse than it is currently, suggests that the numbers of impinged and entrained fish today (the regulatory baseline) would be

appreciably higher than observed in the data collection period. In addition, the reliance on a monitoring period of one year or less implies that the naturally high variability in fishery populations is not captured in the analysis, and the results may reflect a year of above or below average I&E.

- ▶ The Ohio River is impacted by numerous significant anthropogenic stressors in addition to I&E. The river's hydrology has been modified by a series of 20 dams and pools, and the river also has been impacted by municipal and industrial wastewater discharges along this heavily populated and industrialized corridor. To the degree to which these multiple stressors were atypically extensive along the Ohio River (in 1977) relative to those along other CWIS-impacted rivers in the United States (in 2002), the case study will yield smaller than typical I&E impact estimates.
- ▶ The Ohio River is impacted by cumulative effects of I&E over time and across a large number of CWIS. The case study segment of the river has 29 facilities that are in scope for the Phase II rulemaking, plus an additional 19 facilities that are out of scope. Steam electric power generation accounted for 5,873 MGD of water withdrawal from the river basin, amounting to more than 90 percent of the total surface water withdrawals according to 1995 data from USGS.

Because of these circumstances on the Ohio River, the results EPA obtained for this case study probably are not a representative basis for evaluating I&E and regulatory benefits on other inland rivers. In fact, the limited and outdated nature of the I&E data suggests that the results obtained for the case study probably underestimate the current losses attributable to I&E along the Ohio River, and thus underestimate the benefits of the proposed Phase II rule.

In interpreting the results of this case study analysis, it is important to bear in mind that the valuation of I&E losses is complicated by the lack of market value for forage species, which comprise a large proportion of total losses at Ohio River facilities. Forage species have no direct market value, but are nonetheless a critical component of aquatic food webs. EPA included forage species impacts in its economic benefits calculations, but because techniques for valuing such losses are limited, the final estimates underestimate the full ecological and economic value of these losses. In addition, the several limitations in the I&E data available for Ohio River facilities and the many stressors that affect the river suggest that the results obtained by EPA underestimate the benefits of the rule relative to current Ohio River conditions. Therefore, the results are also likely to appreciably underestimate the benefits of I&E reductions at other inland river facilities.