Indiana Department of Environmental Management

Alcoa Warrick LLC, NPDES IN 0001155
NPDES Permit Issued December 20, 2018
Fact Sheet Excerpt of 316(b) provisions (includes changes made in the Post-Public Notice Addendum)

6.3.2 Clean Water Act Section 316(b) Cooling Water Intake Structure(s) (CWIS)

A. Introduction

In accordance with 40 CFR 401.14, the location, design, construction and capacity of cooling water intake structures of any point source for which a standard is established pursuant to section 301 or 306 of the Act shall reflect the best technology available for minimizing adverse environmental impact.

The EPA promulgated a Clean Water Act (CWA) section 316(b) regulation on August 15, 2014, that establishes standards for cooling water intake structures. 79 Fed. Reg. 48300-439 (August 15, 2014) [also referred to as the "Final Rule"]. The regulation establishes best technology available standards to reduce impingement and entrainment of aquatic organisms at existing power generation and manufacturing facilities and it became effective on October 14, 2014. The regulation is applicable to point sources with a cumulative design intake flow (DIF) greater than 2 MGD where 25% or more of the water withdrawn is used exclusively for cooling purposes.

Impingement is the process by which fish and other aquatic organisms are trapped and often killed or injured when they are pulled against the CWIS's outer structure or screens as water is withdrawn from a water body. Entrainment is the process by which fish larvae and eggs and other aquatic organisms in the intake flow enter and pass through a CWIS and into a cooling water system, including the condenser or heat exchanger, which often results in the injury or the death of the organisms. (see definitions at 40 CFR § 125.92(h) and (n)).

The Alcoa Warrick facility's design intake flow rate is 576 MGD. Therefore, since the facility has a DIF greater than 2 MGD, and because the percentage of flow used at the facility exclusively for cooling is greater than 25%, the facility is required to meet the BTA standards for impingement mortality and entrainment, including any measures to protect Federally-listed threatened and endangered species and designated critical habitat established under 40 CFR 125.94(g).

In addition to 40 CFR § 122.21(r)(2) through r(8) NPDES application requirements, Alcoa is also required to submit § 122.21(r)(9) through (13) because the actual intake flow (AIF) is greater than 125 MGD. Alcoa submitted their 316(b) application in a letter dated January 31, 2018.

A complete copy of Alcoa's 316(b) application will be provided upon request.

A copy of the 316(b) application was sent to the Bloomington Field Office of the U.S. Fish and Wildlife on March 6, 2018. Comments were received from Mr. Daniel W. Sparks of U.S. Fish and Wildlife on June 1, 2018 and are discussed in the sections below.

Much of the factual information below was taken, sometimes directly, from the 316(b) application submitted by the facility.

B. Cooling Water Intake Structure Data

The coal fired steam electric generating facility (the Alcoa Warrick power plant or AWPP), which generates almost all of the power used at the Alcoa Warrick LLC smelter and rolling mill, is owned and operated by Alcoa Power Generating Inc. (referred to as "APGI" in this document).

AWPP is a four-unit, 823-megawatt (MW), coal-fired power plant. The facility uses once-through (open-cycle) condenser cooling with the Ohio River as the source and receiver of cooling water. APGI wholly owns three of the four generating stations, which were placed into service in the early 1960s. The largest unit, Unit 4, is jointly owned by APGI and Southern Indiana Gas and Electronic Company d/b/a Vectren Energy Delivery of Indiana, Inc., a utility company. AWPP is a base-load industrial boiler station that generates continuous electricity throughout the year to supply power to the Alcoa Warrick LLC manufacturing facility. In addition to electrical power, the power plant also provides potable water, steam, and high temperature water across the plant. These services are critical to the various production processes throughout the Warrick Operations manufacturing facility. Further, during 2017, approximately 26% of the capacity from the AWPP was sold into the market. (Page 20, Alcoa Corporation (2018) Form 10-K Annual Report 2017, retrieved from http://investors.alcoa.com/sec-filings)

The AWPP is immediately upstream of the Newburgh Lock and Dam on the Ohio River.

The AWPP cooling water intake structure (CWIS), located parallel with the shoreline of the Ohio River, consists of an intake inlet channel, six intake bays, six flow-through traveling water screens, and eight circulating water pumps. The intake inlet channel, consisting of nine concrete caissons on each side, is approximately 120 feet long and 40 feet wide at the entrance. A floating, grated trash boom is employed at the entrance of the intake canal to physically exclude large debris from damaging the traveling screens.

An aerial view of the facility is shown above in Figure 1 of this Fact Sheet.

The traveling water screens are 10-foot wide with 1/4-inch, woven-wire mesh. Behind the traveling screens are eight circulating water pumps. Two pumps are nominally rated at 86,000 gpm each, and six pumps are nominally rated at 42,000 gpm each. When head loss from operating all eight pumps at once is accounted for, the DIF is 400,000 gpm or 576 MGD.

The AWPP uses a fish and debris collection and return system at its CWIS. The organisms and debris are washed down from the traveling screens to a rectangular open sluice to an open channel that discharges to the Ohio River 350 feet downstream of the CWIS intake.

The minimum effective submergence depth of the intake canal was estimated to be approximately 32 feet, based on the flat pool and the crest height of the Newburgh Lock and Dam. Based on the design intake rate of 576 MGD and the minimum submergence depth, the maximum velocity in the intake channel is calculated at 0.7 feet per second (fps) and the maximum design through screen velocity was calculated to be 0.74 feet per second (fps).

Intake flows for the once-through cooling system were estimated using discharge rates in lieu of intake flow. Hourly discharge rates were obtained for the 5-year period of January 1, 2010, through December 31, 2014. The maximum intake rate recorded was 576 MGD which is the design intake flow based on the existing pumps, piping etc. The Intake Structure was initially designed to have a maximum capacity of 610 MGD.

Based on the 5-year period of January 1, 2010, through December 31, 2014, the actual intake flow (AIF) at AWPP is calculated as 518.0 MGD. This time period was selected because it is most representative of the intake flows when the smelter is in full operation.

The average monthly AIF ranged from 473.7 MGD in February to 575.3 MGD in August. The average daily intake rates were 488.8 MGD in the spring (March through May), 556.9 MGD in the summer (June through August), 543.5 MGD in the fall (September through November), and 482.5 MGD in the winter (December, January, and February). Diel variation in the intake flow rates (i.e., hourly intake rate measurements) did not exist because AWPP is a baseload facility.

Using the DIF, the proportion of the Ohio River withdrawn by the CWIS ranges from 0.3 percent in February, March, and April to 1.8 percent in September. The 7-day, 10-year low flow in the Ohio River at AWPP is estimated at 11,000 cfs.

AWPP uses 91% of the water withdrawn from the Ohio River for condenser cooling. The remaining 9% is used for auxiliary equipment cooling. Water reuse does not occur at AWPP.

C. Source Water Biological Characterization

Numerous water quality and biological studies have been conducted by ORSANCO as well as the facility for the Newburgh Pool of the Ohio River where the facility is located.

A more detailed discussion of these reports are available in the 316(b) application submitted by Alcoa. A complete copy of Alcoa's 316(b) application will be provided upon request.

The ORSANCO pool reports for 2007 and 2012 rated the Newburgh Pool as meeting it's aquatic life use designations with an overall rating as 'Very Good' in both survey years.

D. Species Abundance Near CWIS

Data were retrieved from ORSANCO from 2003 to 2015 to characterize the fish community in the Ohio River and at the Newburgh Lock and Dam (ORSANCO, 2015b). A total of 60,060 fish representing 142 fish species were collected in the Ohio River at the 20 sampling locations from 2003 to 2015 (Figure 4-1). At the Newburgh Lock and Dam, located approximately 2 RM downstream from AWPP, 2,881 fish representing 111 fish species were collected (Figure 4-2). The most abundant species collected in the combined Ohio River samples and at Newburgh Lock and Dam were channel catfish (*Ictalurus punctatus*), freshwater drum (*Aplodinotus grunniens*), gizzard shad (*Dorosoma cepedianum*), sauger (*Sander canadensis*), smallmouth buffalo (*Ictiobus bubalus*), river carpsucker (*Carpiodes carpio*), and bluegill (*Lepomis macrochirus*). Species composition at the Newburgh Lock and Dam was also similar among the most abundant species.

Sampling of the Ohio River fish community was also conducted in the vicinity of AWPP during June, August, and October 2005 as part of the impingement study at AWPP (EA, 2007).

Electrofishing and seining yielded a total of 49 taxa and 4,733 individuals (Table 4-2). Electrofishing and seining combined was numerically dominated by emerald shiner (*Notropis atherinoides*) (58 percent), gizzard shad (8 percent), freshwater drum, quillback (*Carpiodes cyprinus*), and *Carpoides* species (each 4 percent); and sauger and river carpsucker (each 3 percent). The combined catch was dominated in terms of biomass by small mouth buffalo (37 percent), river carpsucker (10 percent), common carp (*Cyprinus carpio*), and flathead catfish (*Pylodictis olivaris*) (each 8 percent), bigmouth buffalo (*Ictiobus cyprinellus*) (7 percent), black buffalo (*Ictiobus niger*) (6 percent), channel catfish (4 percent), and quillback, freshwater drum and gizzard shad (each 3 percent). Electrofishing was dominated by gizzard shad (24 percent) and quillback (14 percent). Other common species included freshwater drum and river carpsucker (each 8 percent), emerald shiner (7 percent), white bass (*Morone chrysops*)(6 percent), and smallmouth buffalo (5 percent). Seining was dominated numerically by emerald shiner, accounting for 81 percent of the total catch. No state or federally listed species were collected.

E. Impingement and Entrainment at AWPP

<u>Impingement of Species at AWPP</u>

Three factors tend to influence the probability of individuals of a particular fish species to be impinged on water intake screens.

(a) Fish species or life stages of species that exhibit schooling behavior and generally reside in the water column are the more likely to be impinged than species or life stages that congregate on or near the bottom, or near shoals and reefs.

(b) Fish species that are relatively abundant, in addition to residing in the water column, have a higher likelihood of being impinged.

(c) Fish species that prefer habitat similar to the habitat in which a cooling water intake structure is built will likely have higher impingement rates that those that do not.

Species of the Clupeidae family (gizzard shad), some shiner and minnow species, young-of-year channel catfish, and freshwater drum are examples of species that exhibit one or more of these behaviors or habitat preferences for part or all of their lifecycle.

Gizzard shad and freshwater drum are typically the most frequently impinged fish species in the Ohio River.

Two impingement studies have been completed at AWPP and a collaborative impingement characterization study was conducted at 15 power plants located along the Ohio River. These studies identify the species and life stages most susceptible to impingement.

Results of the two impingement studies at AWPP are summarized below.

Impingement sampling was conducted weekly at AWPP from November 30, 1976, to December 30, 1977.

A total of 36,246 fish were collected during the study period. Three species accounted for greater than 97 percent of the total impingement: gizzard shad, freshwater drum, and skipjack herring (*Alosa chrysochloris*). Gizzard shad was the most dominant, comprising 69.0 percent of the fish impinged, followed by freshwater drum (20.8 percent) and skipjack herring (7.5 percent) (Table 4-3). The majority of the fish were small. Of the impinged fish, 98.8 percent were under 16 cm in length. The estimated number of fish impinged during the study period was 435,806 individuals.

The estimated number of impinged fish for 1 year was 401,690 individuals.

Impingement sampling was also completed weekly at AWPP for 52 consecutive weeks from June 2005 through June 2006 (EA, 2007).

Table 4-4 below presents the results of that study.

The impingement sampling in 2005 through 2006 yielded 11,860 fish and shellfish representing 25 taxa and 19 species of fish. Impingement (by number) was dominated by clupeids (gizzard shad, threadfin shad and Unidentified Dorosoma sp.)(79.7 percent) and freshwater drum (17.8 percent), collectively accounting for 97.5 percent of the impinged fish (Table 4-4). Gizzard shad alone accounted for 77.9 percent of the total impingement by number and 80.7 percent of the biomass. Freshwater drum was the second most commonly impinged species and comprised 17.8 percent of the total impingement. Recreationally important species such as catfish (blue, channel and flathead), bass (white and striped), bluegill, and sauger were rare to uncommon. Unionid mussels and crayfish accounted for 0.3 percent and 0.2 percent of the catch, respectively. No State- or federally listed species were impinged during the study.

The majority of fish collected were young-of-the-year (YOY) and age 1. A total of 48 percent of the impinged fish were classified as YOY, while only 0.5 percent of the fish were greater than 160 millimeters (mm). More than 90 percent of the Ictiobinae (suckers and buffaloes), skipjack herring, unidentifiable shad and unidentifiable Morone spp. were YOY, and 76 percent of the freshwater drum were YOY. Forty percent of the gizzard shad collected were YOY, while most of the gizzard shad between YOY and those greater than 160 mm were probably Age 1 fish.

Table 4-4: 2005 – 2006 Impingement Study Results at Alcoa Warrick Power Plant

Species	Number of Individuals		Mass (grams)	
	Number	Percent	Kilograms	Percent
Blue catfish	1	0.01	0.009	0.01
Bluegill	17	0.14	0.237	0.27
Channel catfish	16	0.13	0.365	0.42
Crayfish	28	0.24	--	--
Emerald shiner	5	0.04	0.005	0.01
Flathead catfish	4	0.03	0.12	0.14
Freshwater drum	2115	17.83	11.739	13.59
Gizzard shad	9241	77.92	69.708	80.73
Largemouth bass	1	0.01	0.215	0.25
Longear sunfish	2	0.02	0.003	0
Northern madtom	1	0.01	0.004	0
River carpsucker	2	0.02	0.043	0.05
Sauger	6	0.05	0.116	0.13
Silver chub	1	0.01	0.017	0.02

Species	Number of Individuals		Mass (grams)	
	Number	Percent	Kilograms	Percent
Skipjack herring	73	0.62	0.729	0.84
Striped bass	7	0.06	0.468	0.54
Threadfin shad	13	0.11	0.095	0.11
Unid carpiodes	3	0.03	0.074	0.09
Unid dorosoma	123	1.04	0.074	0.09
Unid ictiobinae	17	0.14	0.013	0.02
Unid morone	121	1.02	0.149	0.17
Unionoid mussel	42	0.35	--	--
White bass	17	0.14	2.126	2.46
White perch	3	0.03	0.032	0.04
Yellow bass	1	0.01	0.007	0.01
Total Impingement	**11,860**	**100**	**86.35**	**100**
Total Fish Species	**19**			

Source: EA, 2007

Entrainment of Species at AWPP

The susceptibility of fish eggs and larvae to entrainment was qualitatively assessed into three categories (high, moderate, low) based on the physical attributes of the Ohio River in the vicinity of the AWPP CWIS; egg, larvae, and juvenile sizes; reproductive strategy; and other key early life history characteristics.

Table 4-7 below provides a summary of the desktop analysis and key life history characteristics of the eight most dominant species. The desktop assessment indicates that bluegill and channel catfish were considered to have low susceptibility. Bluegills are lithophils, spawning on rock or gravel in nests that are guarded by the male parent, which keeps the early life stages confined to a relatively small area. Channel catfish are speleophils, spawning in holes or crevices that are guarded by the male parent, which keeps the early life stages confined to a relatively small area.

River carpsucker, sauger, and smallmouth buffalo were considered to have moderate susceptibility because they are lithopelagophils, open substratum spawners with no parental care and pelagic larvae. These species have a preferred spawning substratum of clean sand, rock, or gravel.

Gizzard shad, freshwater drum, and emerald shiner were considered most susceptible to entrainment because they are pelagophils and relatively indiscriminant broadcast spawners (Table 4-7). These species are considered the most susceptible to entrainment because these species spawn in open-water, and the planktonic eggs and larvae have no characteristics that would deter them from being pulled into the CWIS along with the water in which they reside.

Fish reproduction in the Ohio River is expected to occur from March through September (Table 4-7). Peak abundance and reproduction generally occurs during the spring and summer. Egg recruitment (the process of getting from an egg to YOY) peaks in the early spring for most species, while larval recruitment occurs between late spring and early summer.

Based on the ichthyoplankton entrainment data collected from March 22 to August 2, 1979, at AWPP, peak periods of larval recruitment and abundance occurred in May and June, with the highest abundance of carpsuckers or buffaloes (*Carpiodes* spp. or

Ictiobus spp.) in May and the highest abundance of shad and herring (*Dorosoma* spp. or *Alosa* spp.) species in June.

Table 4-7: Early Life History Information of Most Abundant Species and Susceptibility to Entrainment

Common Name	Spawning Period	Eggs			Average Size (total length in mm)		Reproductive Guild and Key Early Life History Information	Susceptibility to Entrainment
		Size (mm)	Demersal	Adhesive	Larval	Juvenile		
Bluegill	Late May to early August (peaking in June) at water temperatures between 20 and 26 °C	1.2–1.4	X	X	2.0–6.0	13 to 75-100	Litho-Psammophil. Males build and guard nests in 2- to 3-foot deep water near shores over sand and gravel.	Low
Channel catfish	Late spring or early summer at temperatures between 16 and 24 °C	3.5–4	X	X	15 to 250–405	9.8-15	Speleophil. Males build nests under banks or logs, or on open bottoms, which can be in water ranging from several inches to several feet deep. The female lays a gelatinous mass in the nest containing between 8,000 and 15,000 eggs. Males guard and fan water over nest during incubation and stay with young after hatching.	Low
Emerald shiner	May to July at water temperatures between 20 to 23 ºC	3–3.3	X		4.0–6.0	15-30	Pelagophil. Pelagic, broadcast spawner. Spawns from May to mid-August at 2 to 6 meter depths. Eggs hatch on the bottom in 24 to 36 hours. No parental care is given by the adults.	High
Freshwater drum	June and July when water temperatures reach 18 ºC	1.2–1.7			3.2–4.4	15 to 250–300	Pelagophil. Pelagic, broadcast spawner. Eggs drift on the surface of the water until they hatch, approximately 2 weeks later. No parental care is given by the adults.	High
Gizzard shad	April to June with a range from mid-March to late August	0.8–1.1	X	X	3.0–8.0	25 to 179–279	Pelagophil. Pelagic, broadcast spawner. High fecundity and spawns multiple times per season. Eggs sink slowly towards the bottom or drift with the current, adhering to any surface encountered. Eggs hatch within 3-4 days. No parental care is given by the adults.	High
River carpsucker	April and late May at water temperatures between 21 and 24 °C	1.7–2.1	X	X	5.0–6.1	23 to 218–263	Lithopelagophil. Spawn in large groups in flowing water. Eggs are pelagic, broadcasted on the bottom over silt or sand substrate. No parental care is given by the adults.	Moderate
Sauger	March to May	1.0–1.8	X	X	4.6–9.6	18 to 130–223	Lithopelagophil. Strongly adhesive eggs are broadcast over coarse substrates in mainstem river channels and tailwaters below dams. Females lay between 15,000 and 40,000 eggs when water temperatures are near10 °C. Eggs hatch after approximately 10 days. No parental care is given by the adults. Larvae are transported downstream by current flow.	Moderate
Smallmouth buffalo	April and May at water temperatures between 13.9 to 21.1 °C.	1.6–2.4	X	X	5.0–9.0	30 to 400–450	Lithopelagophil. Spawning takes in areas of moderate flow in shallow water. Eggs are scattered over weeds and gravel bottoms and hatch in 1 to 2 weeks. No parental care is given by the adults.	Moderate

Sources: Balon, 1981; Becker 1983; Boschung and Mayden, 2004; Bozek et al., 2011; MDC, 2015; ODNR, 2015 (a, b, c); Pflieger, 1997; Ross, 2001; Simon, 1999; Smith 2002.

Entrainment Characterization Study

As required under the 316(b) rule, entrainment sampling was conducted biweekly (twice per month) during the biologically productive period (March to October) over a 2-year period from June 2015 to June 2017. The first year of sampling (Year 1) started in June 2015 with sampling occurring from June through October 2015 and then March to May 2016. The second year of sampling (Year 2) started in June 2016 with sampling occurring from June through October 2016 and then March to May 2017. Each sample collection event was conducted over a 24-hour period with samples collected every 6 hours for a total of four samples per event.

The estimated annual entrainment ranged from 335,444,966 to 331,449,276 for Year 1 and Year 2, respectively.

Post yolk sac larvae was the most dominant life stage for both years, accounting for 83.6 percent of the total in Year 1, and 77.1 percent of the total in Year 2. A total of 20 fish taxa were collected over the 2-year study. Freshwater drum was the most dominant taxa for both years, accounting for 53 percent of the total in Year 1, and 47.8 percent of the total in Year 2. Other dominant taxa in Year 1 included carpsucker/buffalo (15.5 percent), herrings (Clupeidae) (13.6 percent), and gizzard shad (5.0 percent). Other dominant taxa in Year 2 included Asian carp (38.8 percent), Cypriniformes (5.5 percent), paddlefish (1.8 percent), and herrings (1.6 percent). If the invasive Asian carp larvae are removed from the annual entrainment estimates, the adjusted annual entrainment is estimated to be 332,909,308 and 202,973,042 for Year 1 and 2, respectively.

Peak abundances occurred during both years in May and June. These two months accounted for 87 percent of the entrainment in Year 1 and 71 percent of the entrainment in Year 2. All life stages were collected during each of the diel periods (morning, afternoon, evening and night). A higher abundance of eggs, yolk sac larvae, and juveniles were collected at night for both years. Only yolk sac/post yolk sac larvae in Year 2 had higher abundances in the evening, with the majority of these being Asian carp larvae.

Eggs in Year 1 of the entrainment characterization study were not identified to a particular taxon. However, in Year 2, eggs were either unidentifiable or identified as freshwater drum. Eggs identified as freshwater drum were collected in June in relatively high abundance. The majority of unidentifiable eggs collected during this 2-year study are likely those of freshwater drum because it is a pelagophil, a species that broadcasts eggs at the water surface with no parental care.

The most dominant larval and juvenile species entrained during the 2-year study (in order of dominance) were: freshwater drum, Asian carp, carpsucker/buffalo, herring (Clupeidae), and carp/minnows (Cyprinidae). Asian carp was the second most collected taxa in the 2-year entrainment study. Asian carp were collected in higher abundances in Year 2 when compared to Year 1 and accounted for 65.7 percent of the yolk sac larvae, 68.3 percent of the yolk sac/post yolk sac larvae, and 32.9 percent of the post yolk sac larvae in Year 2. Based on entrainment, impingement, and electrofishing data at AWPP, the most common carpsucker/buffalo species are river carpsucker and smallmouth buffalo; the most common herring species are gizzard shad and skipjack herring; and the most common cyprinids are emerald shiner and common carp. Their susceptibility to entrainment is primarily due to their reproductive strategy. All of these species are either pelagophils or litho/phytopelagophils, species that provide no parental care, and either broadcast eggs at the water surface or over vegetative or coarse substrates.

The annual entrainment results of this study are similar in abundance and species composition to the entrainment study conducted in 1979. Although Year 1 and 2 annual entrainment estimates of this study (335,444,966 and 331,449,276 individuals, respectively) are higher than the 1979 study (214,871,013 individuals), the overall sampling period per year for this study (March-October) was longer than in 1979 study (March 22 to August 2), which would likely explain the higher estimated annual entrainment.

F. Protected Species Susceptible to Impingement and Entrainment

The Final Rule requires that facilities identify all federally listed threatened and endangered species and designated critical habitat that are present in the “action area.” The “action area,” as defined by the USFWS and NMFS under Section 7, includes all areas that may be directly or indirectly affected by the operation of a facility’s CWIS and not merely the immediate area involved in the action; this is because the USFWS and NMFS consider that the effects of CWIS can extend well beyond the footprint of the CWIS.

One federally listed and one State-listed species were identified in the 316(b) application as having the potential to be found in the vicinity of the AWPP CWIS (see Table 4-8 below). Sheepnose mussel (*Plethobasus cyphyus*) is the only federally listed endangered species and was identified as potentially occurring in Warrick County, Indiana. Spottail darter (*Etheostoma squamiceps*) was the only State species of concern identified as potentially occurring in Warrick County, Indiana. The Indiana Natural Heritage Data Center lists the spottail darter as a classification S2/S3 (imperiled in state/rare or uncommon in state). See Table 4-8 below from the 316(b) application.

Table 4-8: Protected Species in Warrick County, Indiana, Potentially Susceptible to Impingement and Entrainment

Common Name	Scientific Name	Status[a]	Potential to Occur in the Vicinity of the CWIS	Susceptibility	
				Impingement	Entrainment
Spottail darter	*Etheostoma squamiceps*	S2/S3	Unlikely - Inhabits small to medium size streams of low to moderate gradient. Demersal spawner with males defending nests. Spawning occurs in March and April beneath flat rocks in pools or riffles with slow current. Not collected in ambient, impingement or entrainment studies at AWPP.	No	No
Sheepnose mussel	*Plethobasus cyphyus*	FE	Unlikely – Inhabits shallow, sandy or gravelly areas of medium to large sized rivers with moderate to strong current.	Low; Glochidia attached to fish host	No

Source: Bandoli et al., 1991; Kuehne and Barbour, 1983; Page, 1974; Page, 1985; Sietman, 2003; USFWS, 2012

(a) S2/S3 = imperiled in state/rare or uncommon in Indiana; FE = Federally Endangered

U.S. Fish and Wildlife Service Comments

As stated previously, comments were received from Mr. Daniel W. Sparks of the U.S. Fish and Wildlife Service by email on June 1, 2018.

Mr. Sparks commented that there are 3 species of federally listed freshwater mussels known to occur within a few miles of the AWPP CWIS.

Many freshwater mussels have a very unique life cycle that includes female mussels releasing glochidia, very early lifestage mussels, into the water column or directly onto fish so that they might attach to the adult fish's gills, fins, and/or scales. The glochidia are attached for typically 10 days to a month or so depending on the species of mussel.

Mr. Sparks raised concerns about impacts to fish populations that host glochidia for threatened and endangered mussel species.

Specifically, Mr. Sparks raised concerns about the fat pocketbook (Potamilus capax) mussel whose host fish is the freshwater drum, the sheepnose (Plethobasus cyphus) mussel whose only confirmed host fish is the sauger and the rabbitsfoot (Theliderma cylindrical) mussel whose host fish are several species of shiners .

G. Best Technology Available (BTA) Determination

Impingement BTA:

The Final Rule requires that existing facilities subject to the rule must comply with one of the following seven options:

1. Operate a closed-cycle recirculating system as defined by the Final Rule (at §125.92)
2. Operate a CWIS that has a maximum design through-screen design intake velocity of 0.5 fps;
3. Operate a CWIS that has an actual through-screen intake velocity of 0.5 fps;
4. Operate an offshore velocity cap that is a minimum of 800 feet offshore;
5. Operate a modified traveling screen that the Director determines meets the definition of the rule (at §125.92(s)) and that the Director determines is BTA for impingement reduction;
6. Operate any other combination of technologies, management practices, and operational measures that the Director determines is BTA for impingement reduction; or
7. Achieve the specified IM performance standard of less than 24 percent.

Alcoa has chosen impingement mortality option 5, **modified travelling screens**, for compliance with the impingement mortality standard.

The overall life cycle (NPV) project cost for this technology was estimated to be $10.4 million in 2017 dollars. The social costs were estimated to range from $6.2 to $9.7 million in 2017 dollars, depending upon the discount rate used.

Modified traveling screens are a commercially successful fish collection, handling, and return technology. Ristroph screens collect and return impinged organisms to the source waterbody, but they do not reduce the number of organisms impinged.

New traveling screens would need to be installed since the existing screens are not suited for retrofitting with buckets. The new screens would be equipped with a modified bucket system and a low-pressure spray that would gently wash the collected fish out of the buckets and into a separate fish return trough. The return discharge would be routed away from the CWIS to prevent secondary flow circulation and re-impingement.

The modified traveling screens would be continually rotated while the plant is in operation, which represents a change in historical operation of this equipment.

A more complete description of the fish handling and return system that would be installed at AWPP is included in the 316(b) application materials.

IDEM concurs that the selection of modified traveling screens qualifies as BTA to reduce impingement mortality.

Entrainment BTA:

For existing facilities, EPA did not identify any single technology or group of technology controls as available and feasible for establishing national performance standards for entrainment. Instead, EPA's regulations require the permitting agency to make a site-specific determination of the best technology available standard for entrainment for each individual facility. *See* 40 CFR § 125.94(d).

EPA's regulations put in place a framework for establishing entrainment requirements on a site-specific basis, including the factors that must be considered in the determination of the appropriate entrainment controls. These factors include the number or organisms entrained, emissions changes, land availability, and remaining useful plant life as well as social benefits and costs of available technologies when such information is of sufficient rigor to make a decision. These required factors are listed under 40 CFR § 125.98(f)(2).

EPA's regulations also establish factors that may be considered when establishing site-specific entrainment BTA requirements, including: entrainment impacts on the waterbody, thermal discharge impacts, credit for flow reductions associated with unit retirements, impacts on reliability of energy delivery, impacts on water consumption, and availability of alternative sources of water. (*Id*. § 125.98(f)(3))

The information provided in the 316(b) application materials 122.21(r)(9) though (r)(12) addresses the 'may' and 'must' factors in detail. Table 1: Evaluation of Must and May Factors for the Entrainment Mortality Reduction Technologies is presented below and is taken from the executive summary submitted with the application. Table 1 summarizes the pertinent information IDEM used in evaluating the 'must' and 'may' factors.

Additional discussion of the three most viable technologies including the selected BTA Alternative, their social benefits/costs as well as a discussion on organisms impacted, including federally listed species follows:

Organisms Impacted: Based on the entrainment characterization study conducted from June 2015 to June 2017 (report (r)(9)), the estimated annual entrainment range was 335.5 million and 331.4 million for year 1 and 2, respectively. Freshwater drum dominated the taxa for both years, accounting for 53 and 48%, respectively. Other dominant taxa included carpsucker/buffalo (Carpiodes spp./Ictiobus spp.) (15.5% in year 1); Clupeidae herrings (13.6% and 1.6%); Gizzard Shad (5% in year 1); asian carp (39% in year 2); Cypriniformes (6% in year 2).

These estimated annual numbers and species of organisms entrained at AWPP are consistent with the predicted entrainment susceptibility of species presented in Table 4-7 above.

As discussed previously, many freshwater mussels have a very unique life cycle that includes female mussels releasing glochidia, very early lifestage mussels, into the water column or directly onto fish so that they might attach to the adult fish's gills, fins, and/or scales. The glochidia are attached for typically 10 days to a month or so depending on the species of mussel.

US F&WS, Mr. Sparks has raised concerns about three species of endangered mussels known to be in the vicinity of the CWIS, as well as impacts to fish populations that host glochidia for these mussel species. Specifically, the fat pocketbook (Potamilus capax) mussel whose host fish is the freshwater drum, the sheepnose (Plethobasus cyphus) mussel whose only confirmed host fish is the sauger and the rabbitsfoot (Theliderma cylindrical) mussel whose host fish are several species of shiners .

All three of these host species have a moderate (sauger) to high (freshwater drum and emerald shiners) susceptibility to entrainment. All three of these species are also susceptible to impingement at AWPP.

Measures that minimize impacts to the populations of these host fish species would also minimize impacts to these threatened and endangered mussel species.

Entrainment Reduction Technologies: As part of the 316(b) application, AWPP evaluated several technologies to reduce entrainment including mechanical draft cooling towers, fine mesh modified traveling screens, fine mesh cylindrical wedgewire screens and alternative sources of cooling water. Alternative sources of cooling water was not considered feasible because alternative sources are not available in the quantities needed.

The alternative with the greatest reduction in entrainment was mechanical draft cooling towers. The social costs for closed cycle cooling towers is estimated at $167M to $273M with an estimated entrainment reduction of 95%. Social benefits of this technology ranged from $0.6M to $2.7M. While it is technically feasible to install and use cooling towers, a retrofit of AWPP to cooling towers is considered difficult based on site specific engineering factors. Specific difficulties are summarized in the permit application. IDEM concurs with AWPP that the social costs and technical difficulty with installing cooling towers do not warrant the additional reduction in entrainment.

The alternative with the next highest reduction in entrainment was fine mesh wedgewire screens. For the wedgewire screen alternative, the 2.0 mm screen size was determined to be the most viable size based on the number of screens needed and resulting footprint. The social costs for 2.0 mm screens are estimated to range from $8.7M to $13.7M with an estimated entrainment reduction of 65%. Social benefits for wedgewire screens range from $0.4M to $2.5M. Operational challenges include debris and fouling issues, potential navigation hazards, potential 3 week shutdown of operations at AWPP for installation of the screens and negative impacts to Ohio River bottomland. Permitting is also identified as a significant potential issue with approval from US Coast Guard and USACE required to address environmental and navigation concerns. IDEM concurs with AWPP that permitting and operational issues with wedgewire screens are unknown but likely significant and that the potential 3 week plant shutdown for installing the screens as well as the additional social costs do not warrant the additional reduction in entrainment that would result from the use of wedgewire screens. This determination by IDEM is also based, in part, on the reduction in entrainment that would result from the installation of 0.5 mm fine mesh modified traveling screens.

The last major alternative that was evaluated was fine mesh modified traveling screens; the facility evaluated three different size fine mesh screens – 0.5 mm, 1.0 mm and 2.0 mm as well as maintaining the existing 0.25 – inch diameter screen size.

Of the screen sizes evaluated, a 0.5 mm screen size has the greatest impact on reducing entrainment. The 0.5 mm screen is expected to reduce entrainment by 50%. Entrainment reduction effectiveness is significantly reduced as screen size increases, with estimated entrainment reductions of 25% for a 1.0 mm screen size and 20% for a 2.0 mm screen size. Social costs for 0.5 mm fine screen are estimated at $6.2M to $9.7M. Social benefits are estimated at $0.02M to $0.8M. The permit application stated that there is not a significant difference in screen pricing for the varying fine mesh screen sizes (<2 mm).

As screen size is reduced, however, intake velocity at the screens is increased which will possibly increase the numbers of organisms impinged. Installation of new modified traveling screens with fish friendly return under the selected impingement control option may mitigate this impact.

Although the permit application states that installation of 0.5 mm fine screen is technically feasible, comments on the draft permit by AWPP raised concerns that fine mesh screens are not a proven technology and requested IDEM remove the requirement to install 0.5 mm screens. The permittee supported the draft permit requirement to further evaluate fine mesh screens as well as other possible technologies due to concerns about biological effectiveness and operational issues of the 0.5 mm screen size. The permittee also suggested that a pilot study may be needed to evaluate biological effectiveness and debris loading.

Selected BTA Alternative: Based on the information in the application materials and comments on the draft permit, IDEM believes installation of 0.5 mm fine mesh modified traveling screens provides the maximum reduction in entrainment warranted and is BTA for minimizing adverse environmental impact due to a combination of net social benefits and costs, operational and permitting issues as well as an ability to reduce impacts to fish species, including those fish species that may host glochidia for threatened and endangered mussels. The permit will require installation of the 0.5 mm fine mesh modified traveling screens within 3 years of the permit effective date.

In order to address concerns about biological effectiveness and operational costs, the permit will also; however, require AWPP to conduct a study within 6 months of the effective date of the permit that will evaluate different size mesh screens as well as any other technologies, including but not limited to a comprehensive re-evaluation of the wedgewire screen alternative. The goal of the study is to identify social costs and benefits and to minimize the adverse environmental impacts from both impingement and entrainment - most importantly to the fish species that host glochidia for threatened and endangered mussels.

With regard to the wedgewire screen alternative, while IDEM concurs with AWPP that permitting and operational issues with wedgewire screens are unknown but likely significant and that the potential 3 week plant shutdown for installing the screens as well as the additional social costs do not warrant the additional reduction in entrainment that would result from the use of wedgewire screens it should be noted that wedgewire screens have the benefit of significant reduction in entrainment (estimated 65% reduction). The net social costs and benefits are also similar to those of fine mesh screens, especially considering that impingement impacts are likely reduced with use of wedgewire screens. It is possible that IDEM's conclusions on wedgewire screens may change if a larger size fine mesh screen (or other technology) with a reduced biological effectiveness is proposed by the permittee.

A compliance schedule in the NPDES permit will require the study to be completed within 6 months of the effective date of the permit.

If the above study identifies significant operational issues, or different conclusions on biological effectiveness with 0.5 mm screens, the permittee may request, and IDEM may propose, a permit modification to require installation of an alternative screen size or technology.

In subsequent phone discussions and a follow-up email after the draft permit was public noticed, Mr. Sparks of US F&WS indicated that installation of 0.5 mm fine mesh screens (or larger size screens if warranted by further study and accepted by IDEM), would address concerns raised by US F&WS on threatened and endangered species.

Table 1: Evaluation of Must and May Factors for the Entrainment Mortality Reduction Technologies

Technology Description	Estimated Entrainment Reduction	Impact of Changes in Particulate Emissions or Other Pollutants	Land Availability	Remaining Useful Plant Life	Quantified and Qualitative Social Benefits and Costs	Thermal Discharge Impacts	Impacts on Reliability	Impacts on Water Consumption	Availability of Water for Reuse as Cooling Water
Mechanical Draft Cooling Towers	Approximately 95% (based on a cycle of concentration of 3.0).	• Increase of 6.67 tons per year of PM emissions. • Increases in CO_2, SO_2 and NO_x of 52,400, 5.4 and 21.1 tons in a typical year, respectively	Sufficient space onsite makes this option technically feasible. However, significant challenges exist, including management of placing the cooling towers on an old landfill site.	Not a critical factor implementing this technology at AWPP at the time of this submittal.	• Social cost of $167M to $273M. • Social benefits of $0.6M to $2.7M. • Estimation of all of non-water quality social costs (PM emissions, fogging/ icing, safety, etc.) would only increase the social costs.	Discharge temperature and volume will be greatly reduced. However, benefits are not anticipated because the results §316(a) variance study demonstrates that the thermal discharge has not caused prior appreciable harm and does not prevent the protection and propagation of a balanced indigenous community.	• Full facility shutdown of 6-weeks during construction • Operational challenges during construction. • Plant output losses of 14.1 MW during the summer and 9.7 MW during the winter.	Increased water consumption of 567 gallons/MWh but not a significant impact to the Ohio River.	• Groundwater identified as most promising potential alternate water source for makeup water. New collector well with redundant supply pumps (if aquifer pump testing confirms feasibility) was included in the preliminary design. • The use of wastewater from the aluminum manufacturing plant and WWTPs were considered infeasible.

Technology Description	Estimated Entrainment Reduction	Impact of Changes in Particulate Emissions or Other Pollutants	Land Availability	Remaining Useful Plant Life	Quantified and Qualitative Social Benefits and Costs	Thermal Discharge Impacts	Impacts on Reliability	Impacts on Water Consumption	Availability of Water for Reuse as Cooling Water
Fine Mesh, Modified Traveling Screens	Based on site-specific data and survival from laboratory studies: • 0.5-mm mesh: 50% • 1.0-mm mesh: 25% • 2.0-mm mesh: 20% The actual mesh size used would need to be evaluated further if this technology is selected.	Not applicable.	Sufficient space onsite makes this option technically feasible.	Not a critical factor implementing this technology at AWPP at the time of this submittal.	• No significant difference in screen equipment pricing for the varying fine mesh sizes (≤2.0-mm). • Social cost of installing a modified traveling screen with a fish handling and return system (regardless of mesh size) is estimated to cost \$6.2M to \$9.7M. The incremental difference between 3/8-inch and fine mesh is approximately \$100,000. If existing condition is considered the baseline, then the social benefits range from \$0.02M to \$0.8M.	Not applicable. No change from existing condition.	Minor change from existing condition. Net additional parasitic load is 0.18 MW.	Not applicable. No change from existing condition.	• Infeasible. • No alternative water sources available with the capacity to supply the quantity of water necessary to meet the once-through system water demand • Significant water treatment would be required.

Technology Description	Estimated Entrainment Reduction	Impact of Changes in Particulate Emissions or Other Pollutants	Land Availability	Remaining Useful Plant Life	Quantified and Qualitative Social Benefits and Costs	Thermal Discharge Impacts	Impacts on Reliability	Impacts on Water Consumption	Availability of Water for Reuse as Cooling Water
Fine Mesh, Submerged Cylindrical, Wedgewire Screens	Based on site-specific data and laboratory studies: • 2.0-mm: 65%	Not applicable	• Land availability is not an issue. • Space in the Ohio River is limited because of the proximity to the navigation channel • 0.5-, and 1.0-mesh was considered technically infeasible.	Not a critical factor implementing this technology at AWPP at the time of this submittal.	• 0.5-mm mesh: Social cost of $17.4M to $27.4M. Social benefits of $0.6M to $2.9M. • 1.0-mm mesh: Social cost of $8.9M to $18.9M. Social benefits of $0.5M to $2.6M. • 2.0-mm mesh: Social cost of $8.7M to $13.7. Social benefits of $0.4M to $2.5M.	Not applicable. No change from existing condition.	• Uncertain. • Plant shutdown could occur in the winter from frazil ice. • Screen damage from commercial vessels could occur, impacting the ability to obtain sufficient cooling water. • Net additional parasitic load is 0.11 MW.	Not applicable. No change from existing condition.	• Infeasible. • No alternative water sources available with the capacity to supply the quantity of water necessary to meet the once-through system water demand • Significant water treatment would be required.

Technology Description	Estimated Entrainment Reduction	Impact of Changes in Particulate Emissions or Other Pollutants	Land Availability	Remaining Useful Plant Life	Quantified and Qualitative Social Benefits and Costs	Thermal Discharge Impacts	Impacts on Reliability	Impacts on Water Consumption	Availability of Water for Reuse as Cooling Water
Alternative Sources of Cooling Water	Entrainment reductions would be proportional to the reduction in intake flow. For cooling towers, the estimated reduction is 35 percent of the makeup water using the Newburgh WWTP. For screening systems, the estimated reduction is 0.8 percent of the DIF using the Newburgh WWTP.	Not applicable	Space would be required for long-distance supply pipelines from the alternate source water location to the power station. Space appears to be sufficient to run the supply and return lines, but the dense underground utilities may be problematic.	Not a critical factor implementing this technology at AWPP at the time of this submittal.	Water reuse and the use of wastewater for cooling tower makeup and the screening systems were determined to be infeasible. As such, social costs and social benefits were not prepared for water reuse and alternate sources for cooling water. Groundwater was identified as a potential alternate water source for makeup water to the cooling tower and included in the design basis.	Discharge temperature and volume will be greatly reduced. However, benefits are not anticipated because the results §316(a) variance study demonstrates that the thermal discharge has not caused prior appreciable harm and does not prevent the protection and propagation of a balanced indigenous community.	None anticipated.	Not applicable as water reuse and the use of wastewater for cooling tower makeup and the screening systems were determined to be infeasible.	Infeasible because there are no alternative water sources available that have the capacity to supply the quantity of water necessary to meet the once-through system water demand

H. Conclusion

For Alcoa Warrick LLC, IDEM has determined that the proposed modified traveling screens and fish return with a 0.5 mm fine mesh screen size represents the best technology available to minimize adverse environmental impact from impingement and entrainment in accordance with Section 316(b) of the federal Clean Water Act (33 U.S.C. section 1326).

I. Permit Conditions

1. Schedule of Compliance: The below schedule of compliance is for installation of the selected BTA for both impingement and entrainment

   The permittee shall install a 0.5 mm fine mesh modified traveling screen at the facility CWIS as expeditiously as practicable but no later than the dates developed in accordance with the following schedule:

   a. As soon as practicable, but no later than six (6) months after the effective date of the permit, submit a report that will evaluate social benefits and costs for different size fine mesh modified traveling screens, as well as any other technologies that might be available, with the goal of identifying measures and screen mesh size that will minimize adverse environmental impacts from both impingement and entrainment - most importantly to the fish species that may host glochidia for threatened and endangered mussels. As part of the evaluation of other technologies, the report shall, at a minimum, also include a comprehensive re-evaluation of the wedgewire screen alternative, including biological effectiveness, social benefits and costs and permitting and operational issues with the wedgewire screen alternative. The permittee shall include a conceptual design of the selected measures in the report.

   b. As soon as practicable, but no later than eighteen (18) months after the effective date of the permit, complete detailed design of the 0.5 mm fine mesh modified traveling screen, including the fish return system.

   c. As soon as practicable but no later than twenty-four (24) months after the effective date of the permit, initiate construction of the 0.5 mm fine mesh modified traveling screen.

   d. As soon as practicable, but no later than thirty-six (36) months after the effective date of the permit, complete construction of the 0.5 mm fine mesh modified traveling screen.

   e. Within thirty (30) days of completion of construction, the permittee shall file with the Industrial NPDES Permits Section of Office of Water Quality (OWQ) a notice of installation for the 0.5 mm fine mesh modified traveling screen and a design summary of any modifications.

   f. The permittee shall submit a written progress report to the Compliance Data Section of the OWQ three (3) months from the effective date of this permit and every six (6) months thereafter until the requirements in the compliance schedule outlined above have been achieved. The progress reports shall include relevant information related to steps the permittee has taken to meet the requirements in the compliance schedule and whether the permittee is meeting the dates in the compliance schedule.

g. If the permittee fails to comply with any deadline contained in the foregoing schedule, the permittee shall, within fourteen (14) days following the missed deadline, submit a written notice of noncompliance to the Compliance Data Section of the OWQ stating the cause of noncompliance, any remedial action taken or planned, and the probability of meeting the date fixed for compliance.

2. In addition, the permittee shall comply with requirements below:

    1. In accordance with 40 CFR 125.98(b)(1), nothing in this permit authorizes take for the purposes of a facility's compliance with the Endangered Species Act.

    2. At all times properly operate and maintain the cooling water intake and associated equipment.

    3. Inform IDEM of any proposed changes to the CWIS or proposed changes to operations at the facility that affect the information taken into account in the current BTA evaluation.

    4. After installation of the 0.5 mm fine mesh modified traveling screen has been completed, the permittee shall conduct the impingement technology optimization study required by 40 CFR 125.94(c)(5) and 40 CFR 122.21(r)(6)(i). In preparation for this study, the permittee shall prepare and submit a draft impingement technology optimization study plan to IDEM for review and approval within sixteen (16) months of the effective date of the permit. The permittee shall submit the preliminary results of the first year of their optimization study with 90 days of completion of the first year of sampling. The permittee shall submit the final technology optimization study report, covering both year 1 and year 2 of sampling, within 120 days of completing the second year of sampling.

    5. In accordance with 40 CFR 125.97(c), the permittee must submit to the Industrial NPDES Permit Section IDEM-OWQ at OWQWWPER@idem.in.gov an annual certification statement signed by the responsible corporate officer as defined in §122.22 (see 327 IAC 5-2-22) subject to the following:

        a. If the information contained in the previous year's annual certification is still pertinent, you may simply state as such in a letter to IDEM and the letter, along with any applicable data submission requirements specified in this section shall constitute the annual certification.

        b. If you have substantially modified operation of any unit at your facility that impacts cooling water withdrawals or operation of your cooling water intake structures, you must provide a summary of those changes in the report. In addition, you must submit revisions to the information required at §122.21(r) of this chapter in your next permit application.

    6. Best technology available (BTA) determinations for entrainment mortality and impingement mortality at cooling water intake structures will be made in each

permit reissuance, in accordance with 40 CFR 125.90-98. The permittee shall submit all the information required by the applicable provisions of 40 CFR 122.21(r)(2) through (r)(13) with the next renewal application. Since the permittee has submitted the studies required by 40 CFR 122.21(r), the permittee may, in subsequent renewal applications pursuant to 40 CFR 125.95(c), request to reduce the information required, if conditions at the facility and in the waterbody remain substantially unchanged since the previous application so long as the relevant previously submitted information remains representative of current source water, intake structure, cooling water system, and operating conditions. Any habitat designated as critical or species listed as threatened or endangered after issuance of the current permit whose range of habitat or designated critical habitat includes waters where a facility intake is located constitutes potential for a substantial change that must be addressed by the owner/operator in subsequent permit applications, unless the facility received an exemption pursuant to 16 U.S.C. 1536(o) or a permit pursuant to 16 U.S.C. 1539(a) or there is no reasonable expectation of take. The owner or operator of a facility must submit its request for reduced cooling water intake structure and waterbody application information to IDEM at least two years and six months prior to the expiration of its NPDES permit. The permittee's request must identify each element in 40 CFR 122.21(r) that it determines has not substantially changed since the previous permit application and the basis for the determination. IDEM has the discretion to accept or reject any part of the request.

7. The discharge of intake screen backwash shall meet the Narrative Water Quality Limitations contained in Part I.B of the permit.

8. The permittee shall either conduct visual inspections or employ remote monitoring devices during the period the cooling water intake structure is in operation as required by 40 CFR 125.96(e). The permittee shall conduct such inspections at least weekly to ensure that any technologies operated to comply with § 125.94 are maintained and operated to function as designed including those installed to protect Federally-listed threatened or endangered species or designated critical habitat. Alternative procedures can be approved if this requirement is not feasible (e.g., an offshore intake, velocity cap, or during periods of inclement weather).

9. The permittee shall submit and maintain all the information required by the applicable provisions of 40 CFR 125.97.

10. All required reports shall be submitted to the IDEM, Office of Water Quality, NPDES Permits Branch, Industrial NPDES Permit Section at OWQWWPER@idem.in.gov.