ILLINOIS POLLUTION CONTROL BOARD
July 8, 2021

IN THE MATTER OF:	)	
	)	
PETITION OF EMERALD POLYMER ADDITIVES, LLC, FOR AN ADJUSTED STANDARD FROM 35 ILL. ADM. CODE 304.122(b)	)	AS 19-2
	)	(Adjusted Standard- Water)
	)	
	)	

OPINION AND ORDER OF THE BOARD (by J. Van Wie)

On April 3, 2019, Emerald Polymer Additives, LLC (Emerald) filed a petition requesting that the Board renew an adjusted standard previously granted to its chemical manufacturing facility in Henry, Marshall County, Illinois (facility), formerly operated by Emerald Performance Materials, LLC. *See* Petition of Emerald Performance Materials, LLC from 35 Ill. Adm. Code 304.122, AS 13-2 (September 28, 2012). Emerald seeks an adjustment from the Board's total ammonia nitrogen effluent standard applicable to the facility's wastewater treatment plant discharge. *See* 35 Ill. Adm. Code 304.122(b).

On July 19, 2019, the Illinois Environmental Protection Agency (Agency or IEPA) recommended that the Board deny the petition. *See* 415 ILCS 5/28.1 (2018); 35 Ill. Adm. Code 104.416.

Based on the record before it, the Board finds that Emerald has not provided sufficient justification for three of the four factors required for issuance of an adjusted standard pursuant to Section 28.1 of the Environmental Protection Act (Act) (415 ILCS 5/28.1 (2018)). The Board denies Emerald's petition for an adjusted standard from the Board's ammonia effluent limitation.

In this opinion, the Board first provides the procedural background before addressing the legal framework for an adjusted standard. The Board then summarizes the factual background, the previous Board proceedings, and the current applicable standard. After providing Emerald's originally proposed standard, the Board summarizes the Agency's recommendation to deny the petition and the public comments on the petition. The Board then discusses the issues presented, including compliance alternatives considered by Emerald, and statutory factors before reaching its conclusion.

PROCEDURAL BACKGROUND

On April 3, 2019, Emerald filed a petition for an adjusted standard (Pet.) accompanied by twelve exhibits:

Board's April 16, 2015 Opinion and Order in AS 13-2 (Ex. 1).
Board's December 1, 2016 Opinion and Order in AS 13-2 (Ex. 2).
NPDES Permit No. IL0001392 dated September 28, 2016 (Ex. 3).
Annual summaries of Emerald-Henry Plant DMR Data (2013 through 2018) (Ex. 4).

Emerald's Annual Update Reports pursuant to AS 02-05 and NPDES Permit (Ex. 5).
Emerald's Annual Update Reports pursuant to AS 13-2 and NPDES Permit, including the Brown & Caldwell Technical Memorandum dated April 13, 2018 (Ex. 6).
Emerald's letters to the Illinois Environmental Protection Agency with whole effluent toxicity test results (Ex. 7).
Violation Notice No. W-2013-50153 and associated documentation (Ex. 8).
Violation Notice No. W-2015-50227 and associated documentation (Ex. 9).
Violation Notice No. W-2019-50007 (Ex. 10).
Block Flow Diagram of Wastestream Sources and WWTF (Ex. 11).
Affidavit of Galen Hathcock (Ex. 12).

On April 3, 2019, Emerald requested the Board incorporate the records of AS 02-5 and AS 13-2 into this docket.

On April 10, 2019, Emerald published notice of the filing of the Petition by advertisement in the Henry News-Republican, a newspaper of general circulation in Henry, Illinois. On April 22, 2019, Emerald filed the certificate of publication of notice. On May 30, 2019, the Board accepted Emerald's petition for hearing, and granted Emerald's motion to incorporate the records of AS 02-5 and AS 13-2.

On May 16, 2019, the Agency filed a motion for a 60-day extension of the deadline to file a recommendation. In an order dated May 20, 2019, the Hearing Officer granted the motion and extended the deadline to July 19, 2019.

On July 19, 2019, the Agency filed its recommendation (Rec.) that the Board deny Emerald's petition for an adjusted standard.

On August 6, 2019, discovery commenced.

On December 20, 2019, the Agency moved to compel discovery of financial documents from three entities that, together with Emerald, acted as a "cash pool hub," such that many expenses of these four entities were paid out of a single pool of money. On December 20, 2019, Emerald moved to exclude this same information. On December 30, 2019, Emerald responded to the Agency's motion. On December 31, 2019, the Agency responded to Emerald's motion. On January 6, 2020, the Hearing Officer denied Emerald's motion and granted the Agency's motion, compelling production of these financial documents.

On December 30, 2019, the Agency moved to use evidence depositions as evidence at the hearing. On January 3, 2020, Emerald opposed the Agency's motion. On January 6, 2020, the Hearing Officer granted the Agency's motion, permitting use of the evidence depositions.

On December 30, 2019, Emerald filed prehearing testimony of Galen Hathcock, with seven exhibits and Houston Flippin, with three exhibits.

On January 8, 2020, Emerald moved to treat certain information as non-disclosable. On January 8, 2020, the Hearing Officer granted Emerald's motion.

The first hearing was held on January 14 and 15, 2020 in Lacon, Illinois. The second hearing was held on February 3 and 4, 2020 in Springfield, Illinois. Emerald offered several Petitioner's Hearing Exhibits (PHX) into evidence. Emerald also offered a standing objection to testimony related to the financial information compelled by the Hearing Officer. Argument on this issue was reserved for post-hearing briefs. 1/14/20 Tr. 65-66.

Simultaneous briefs and responses were submitted on March 11 and 25, 2020, respectively.

LEGAL FRAMEWORK FOR AN ADJUSTED STANDARD

Petition and Published Notice of Filing

The Act and the Board's procedural rules provide that a petitioner may request, and the Board may grant, an environmental standard that is different from the generally applicable standard that would otherwise apply to the petitioner. This is called an adjusted standard. The general procedures that govern an adjusted standard proceeding are found at Section 28.1 of the Act and Section 104 Subpart D of the Board's procedural rules. 415 ILCS 5/28.1 (2018); 35 Ill. Adm. Code 104.400 et seq.

The Board's procedural rules specify the required contents of a petition for an adjusted standard. *See* 35 Ill. Adm. Code 104.406, 104.416. Once a petition for an adjusted standard is filed, the Agency must file its recommendation with the Board. *See* 415 ILCS 5/28.1(d)(3) (2018); 35 Ill. Adm. Code 104.416. The adjusted standard proceeding is adjudicatory in nature and is not subject to the rulemaking provisions of the Act or the Illinois Administrative Procedure Act (5 ILCS 100/1-1, et seq. (2018)). *See* 415 ILCS 5/28.1(a) (2018); 35 Ill. Adm. Code 101.202 (defining "adjudicatory proceeding").

Section 28.1(d)(1) of the Act (415 ILCS 5/28.1(d)(1) (2018)) and Section 104.408(a) of the Board's procedural rules (35 Ill. Adm. Code 104.408(a) (quoting the Act)) require the adjusted standard petitioner to publish notice of filing the petition by advertisement in a newspaper of general circulation in the area likely to be affected by the proposed adjusted standard. Under those provisions, publication must take place within 14 days after the petition is filed. The newspaper notice must indicate that any person may cause a public hearing to be held on the proposed adjusted standard by filing a hearing request with the Board within 21 days after publication. *See* 415 ILCS 5/28.1(d)(1) (2018); 35 Ill. Adm. Code 104.408(b).

Standard of Review and Burden of Proof

Emerald seeks an adjusted standard from the Total Ammonia Nitrogen rules of general applicability at 35 Ill. Adm. Code 304.122(b). Pet. at 12. In determining whether to grant an adjusted standard, the Board must determine whether the petitioner has adequately proved the four factors of Section 28.1(c) of the Act:

1) factors relating to that petitioner are substantially and significantly different from the factors relied upon by the Board in adopting the general regulation applicable to the petitioner;

2) the existence of those factors justifies an adjusted standard;

3) the requested standard will not result in environmental or health effects substantially and significantly more adverse than the effects considered by the Board in adopting the rule of general applicability; and

4) the adjusted standard is consistent with any applicable federal law.

415 ILCS 5/28.1(c) (2018); *See* Pet. at 32-33; Rec. at 16.

Once granted, the adjusted standard, instead of the rule of general applicability, applies to the petitioner. *See* 415 ILCS 5/28.1(a) (2018); 35 Ill. Adm. Code 101.202, 104.400(a). In granting adjusted standards, the Board may impose conditions as may be necessary to accomplish the purposes of the Act. *See* 415 ILCS 5/28.1(a) (2018); 35 Ill. Adm. Code 104.428(a).

The burden of proof in an adjusted standard proceeding is on the petitioner. *See* 415 ILCS 5/28.1(b), (c) (2018); 35 Ill. Adm. Code 104.426. However, Section 304.122(b) does not specify the level of justification that must be met by a petitioner for an adjusted standard. 35 Ill. Adm. Code 304.122(b). So, Section 28.1 of the Act requires that the petitioner justify an adjusted standard consistent with Section 27(a) of the Act. 415 ILCS 5/27(a), 28.1 (2018). In both a general rulemaking and a site-specific rulemaking, "the Board shall take into account the existing physical conditions, the character of the area involved, including the character of surrounding land uses, zoning classifications, the nature of the existing air quality, or receiving body of water, as the case may be, and the technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution." 415 ILCS 5/27(a) (2018).

FACTUAL BACKGROUND

Ownership of Facility

Emerald owns and operates the "specialty chemical" portion of a facility located at 1550 County Road 1450 N., Henry, Marshall County. Pet. at 14. Emerald primarily produces rubber accelerators, including the chemical mercaptobenzothiazole (MBT).[1] *Id.* at 15. Emerald also produces antioxidants for the rubber, lubricant, and plastics industries. *Id.* at 15. Another portion of the facility is a poly-vinyl chloride (PVC) resin production plant, which is now owned and operated by Mexichem Specialty Resins, Inc. (Mexichem). *Id.* at 15. The specialty chemical plant and the PVC resin production plant are collectively referred to as the Henry Plant. *Id.*

[1] Approximately 73% of Emerald's plant production is MBT. Pet. at 15-17.

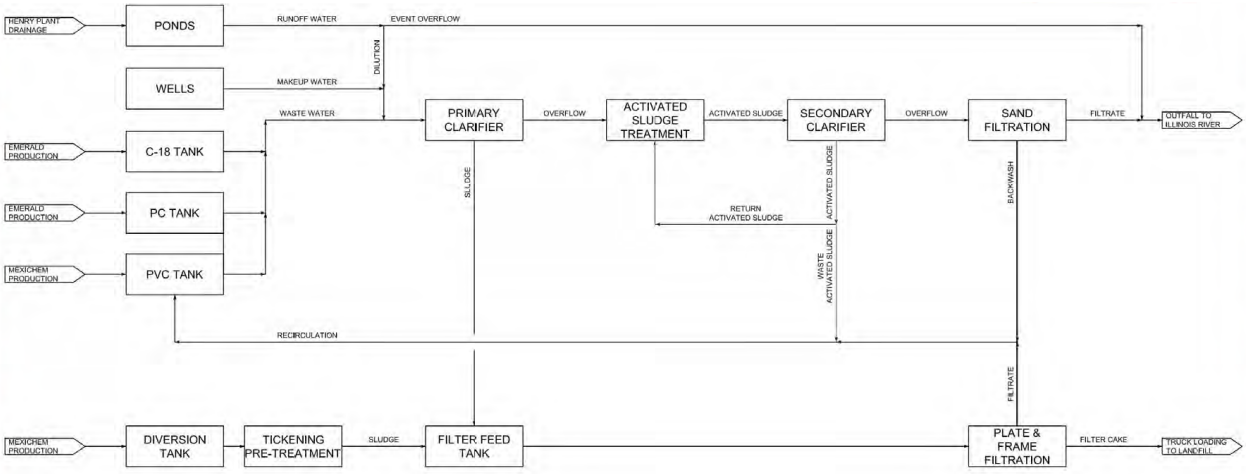
The Henry Plant was originally built and owned by B.F. Goodrich Company. *Id.* at 14. In 1993, B.F Goodrich divested its Geon Vinyl Division and formed the Geon Company (Geon) as a separate publicly held company to own and operate the PVC portion of the Henry Plant. *Id.* at 14. In 2000, Geon consolidated with M.A. Hanna Company to form Poly One, which was then bought out by current owner/operator, Mexichem. *Id.* at 14. In 2001, B.F. Goodrich sold the remainder of the plant to Noveon, Inc. (Noveon). *Id.* at 14. In 2006, Noveon sold its portion of the Henry Plant to Lubrizol Company, which sold it to Emerald Performance Materials, LLC (EPM). *Id.* at 14. In 2016, EPM transferred its portion of the Henry Plant to the current owner/operator, Emerald. *Id.* at 14.

Despite these changes in corporate ownership, both the specialty chemicals and the PVC resin portions of the Henry Plant have remained largely unchanged, with only limited curtailment and replacement of individual products. *Id.* at 15.

Wastewater Treatment System

Emerald owns and operates the wastewater treatment plant (WTP) at the Henry Plant that continues to treat the wastewater from Emerald's production processes and Mexichem's wastewater pursuant to a service agreement. *Id.* at 15.

Emerald provided a flowchart of the current layout of the WTP below:



See PHX 7. Mexichem's waste enters the WTP in the PVC equalization tank (PVC Tank) and is mixed with the Emerald waste from the C-18 Tank and the PC Tank. This mixed waste stream then flows through the Primary Clarifier, Activated Sludge Treatment, Secondary Clarifier, and Sand Filtration before being discharged into the Illinois River. Emerald states that the operation of the Henry Plant's WTP has not changed substantially since the Board granted an adjusted standard in AS 13-2. Emerald maintains that "MBT continues to be present at sufficient quantities in the PC tank and the primary clarifier so that single-stage nitrification cannot occur in the bioreactors." Pet. Br. at 27. Mexichem does not have a separate permit or adjusted standard for its waste, and is not a party to these proceedings.

Discharge from the Henry Plant's Treatment Facility

The Henry Plant's WTP discharges treated effluent through a high-rate, multiport diffuser into the Illinois River. Pet. at 7. The WTP's effluent contains ammonia as a result of degradation of the amines in the raw production process wastewater during the treatment process. *Id.* at 17. Additionally, the MBT in Emerald's effluent inhibits the growth of nitrifying bacteria, which most wastewater treatment plants use to remove ammonia from their discharge.

Emerald asserts that the ammonia levels in the WTP effluent is not directly related to the influent ammonia because of very low levels of ammonia in the raw wastewater. *Id*. at 17. However, Emerald notes that the source of the ammonia in the Henry Plant effluent is the presence of amines (organic nitrogen[2]) in the raw wastewater. *Id*. at 17. These amines are converted to ammonia nitrogen in the wastewater treatment process due to lack of nitrification. *Id*. at 17. Here, Emerald and its predecessors have maintained that the presence of MBT[3] in Emerald's wastewater inhibits the growth of nitrifying bacteria, which is essential for nitrification[4] to occur for removing ammonia from their discharge. *Id*. at 17. Among the ten different products made by Emerald, MBT is present in four: BBTS, MBDS, OBTS, and 50% MBT. Ag. Br. 16, *citing* 1/14/20 Tr. at 33. Emerald maintains that "MBT continues to be present at sufficient quantities in the PC tank and the primary clarifier so that single-stage nitrification cannot occur in the bioreactors." Pet. Br. at 27.

Area Affected by Discharge

Following treatment, the wastewater is discharged through the high rate multi-port diffuser at Outfall 001 to the Illinois River pursuant to NPDES Permit No. IL0001392. Pet. at 19. The Illinois River is formed at the junction of the Kankakee and Des Plaines Rivers near Joliet, Illinois, and runs 273 miles (primarily west and south) to the Mississippi River, near Grafton, Illinois, which is a few miles upstream from St. Louis. *Id*. at 19-20. The Henry Plant is located on the west bank of the Illinois River between river mile 198 and 199. *Id*. at 20.

The United States Geological Survey (USGS) has operated a gauging station near Henry, Illinois since October 1981 (USGS Gage 05558300). *Id*. at 20. The river has a drainage area of approximately 13,544 square miles at Henry and an annual mean flow of 16,200 cubic feet per

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[2] Brown and Caldwell noted that "most of the effluent ammonia discharge originates as influent organic nitrogen that is bio-hydrolized to ammonia during the treatment provided in the onsite wastewater treatment facility." Brown and Caldwell explained that inhibition of nitrification in the wastewater treatment facility is attributable largely to MBT in the wastewater. *See* AS 13-2 (April 16, 2015) at 11.

[3] Emerald's accelerator production at Henry Plant utilizes MBT as the key intermediate (73% of total plant production). MBT-based accelerators have been used in the rubber industry for well over 50 years and are the most common type of accelerator. Pet. at 15.

[4] Biological nitrification is a process in which *Nitrosomonas* bacteria oxidize ammonia to nitrite and *Nitrobacter* bacteria oxidize nitrite to nitrate. In the single-stage process, nitrification and carbonaceous oxidation (BOD removal) occur within the same biological reactor.

second (cfs) for water year 2018, and 15,550 cfs for water years 1982-2018. *Id*. at 20. For water year 2018, the annual 7-day minimum flow was 3,176 cfs. *Id*. at 20.

At Henry, the river is approximately 875 feet wide with an average depth of 11 feet and an approximate maximum depth of 18 feet. *Id*. at 20. The Illinois State Water Survey reported an annual 7-day, 10-year low flow for the river at Henry of 3,400 cfs in 1988. *See* Map-4-Spoon-River-Region-1988 at http://hdl.handle.net/2142/100100 (last visited Mar. 25, 2019).

Emerald's daily monitoring report (DMR) data shows that for calendar years 2013 through 2018, the effluent from the Henry Plant has had an ammonia concentration ranging from 1.0 to 160.0 milligrams per liter (mg/L). Pet. at 21. The only exceedance of a daily maximum ammonia concentration limit occurred on January 23, 2013, when the measured concentration of 160.0 mg/L exceeded the AS 02-05 maximum limit of 155.0 mg/L. *Id*. at 21. As Emerald explained in response to a violation notice from the Agency, the error range of the EPA test method was such that the test result was statistically compliant with the maximum limit. *Id*. at 21. Since the adoption of the 140.0 mg/L daily maximum concentration limit and the 1,633 pounds per day (lbs/day) daily maximum load limit in AS 13-2, Emerald has reported no exceedances of those limits based on sampling five times per week. *Id*. at 21-22. Likewise, the sampling from 2015-2018 shows no exceedances of the 30-day average limits for concentration or load of ammonia established in AS 13-2. *Id*. at 22.

SUMMARY OF PREVIOUS BOARD PROCEEDINGS REGARDING THE HENRY PLANT

Over the past twenty-eight years, the owner/operators of the Henry Plant have sought and obtained relief from the applicable ammonia effluent limits (35 Ill. Adm. Code 304.122(b)), in the context of an NPDES permit renewal,[5] variance proceeding[6] and adjusted standard proceedings.[7] The Board granted the most recent adjusted standard in 2016 with conditions, including a 5-year sunset condition.[8] *See* AS 13-2.

Previous Adjusted Standard

On September 28, 2012, EPM requested the Board renew an adjusted standard from the total ammonia nitrogen as nitrogen standard as previously granted to its facility's wastewater treatment plant in November 2004. *See* Petition of Noveon, Inc. for an Adjusted Standard from 35 Ill. Adm. Code 304.122, AS 02-5 (Nov. 4, 2004) (Noveon); 35 Ill. Adm. Code 304.122(b).

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[5] The Board upheld the Agency's determination to include an ammonia effluent limit in the NPDES permit for the Facility. *See* Noveon, Inc. f/k/a BF Goodrich Corp. (Henry Facility) v. IEPA, PCB 91-17 (Sept. 16, 2004).

[6] The Board granted a motion to withdraw the petition for a variance. *See* Noveon, Inc. f/k/a BF Goodrich Corp. (Henry Facility) v. IEPA, PCB 92-167 (June 20, 2002).

[7] *See* Noveon, AS 2-5; EPM, AS 13-2.

[8] The AS 13-2 order and opinion provided a summary of the PCB 91-17, PCB 92-167, and AS 2-5 dockets and subsequent compliance efforts and investigation of alternative treatments, which are incorporated as part of this order. EPM, AS 13-2, slip op. at 15-33 (April 16, 2015).

On December 1, 2016, pursuant to Section 28.1 of the Act (415 ILCS 5/28.1 (2018)), the Board granted EPM an adjusted standard from 35 Ill. Adm. Code 304.122(b). Under this adjusted standard, the total ammonia nitrogen effluent standard at 35 Ill. Adm. Code 304.122(b) did not apply to the discharge of effluent into the Illinois River from the facility. Instead, the facility's effluent for total ammonia nitrogen had to comply with a daily maximum of 140 mg/L and 1633 lbs/day, as well as a 30-day average of 110 mg/L and 841 lbs/day.

This adjusted standard took effect on April 16, 2015, expired on April 16, 2020, was extended to July 31, 2021, and was subject to the following conditions:

a. EPM must continue to maintain the high-rate, multi-port diffuser for the discharge into the Illinois River to achieve an effluent dispersion necessary to meet the applicable ammonia nitrogen water quality standards at the edge of the mixing zone and zone of initial dilution (ZID).

b. EPM must maintain the following ammonia reduction measures: replacement of the BBTS Wet Scrubber with a dust collector; and upgrade of instrumentation for the acetonitrile recovery column.

c. EPM must investigate new production methods and technologies that generate less ammonia and nitrification inhibitors in Emerald's discharge. The nitrification inhibitors such as MBT are the chief cause of inhibiting nitrification in the treatment system which allows for ammonia to discharge.

d. EPM must investigate new treatment technologies and evaluate implementation of new and existing treatment technologies based on current plant conditions.

e. By April 16, 2018, EPM must investigate and submit to the Agency the following studies:

    i) A study evaluating the use of granulated activated carbon to treat the polymer chemicals tank wastewater before it combines with non-polymer chemicals tank waste water to determine if this treatment alternative effectively removes inhibitors, including MBT, which would then allow for biological treatment. The study must include a technical feasibility evaluation and an economic reasonableness analysis;
    ii) A study evaluating the technical feasibility and the economic reasonableness of a spray irrigation program. The studies must include an evaluation of compliance with the applicable design standards for slow rate land application of treated wastewaters (35 Ill. Adm. Code 372); and
    iii) A study evaluating the addition of water from the Illinois River to the wastewater to determine the potential for subsequent single-stage nitrification in light of the potential dilution. The study must include a technical feasibility evaluation and an economic reasonableness analysis.

f. EPM must prepare and submit to the Agency annual reports summarizing its activities to comply with paragraphs 2(c) through 2(e).

g. If, upon review of the annual reports required by condition 2(f), the Agency determines that new technology to treat ammonia is available that is economically reasonable and technically feasible, the Agency may petition the Board to modify the relief granted by this order.

h. EPM must operate in full compliance with the Clean Water Act, its National Pollutant Discharge Elimination System permit, the Board's water pollution regulations, and any other applicable requirement.

As the successor owner and operator, Emerald has operated under this adjusted standard since the Henry Plant was transferred to it from EPM in 2016.

CURRENT GENERALLY APPLICABLE STANDARDS

Section 301.345 of the Board's water pollution regulations provides as follows:

> 'Population Equivalent' is a term used to evaluate the impact of industrial or other waste on a treatment works or stream. One population equivalent is 100 gallons (380 liters) of sewage per day, containing 0.17 pounds (77 grams) of BOD5 (five-day biochemical oxygen demand) and 0.20 pounds (91 grams) of suspended solids. The impact on a treatment works is evaluated as the equivalent of the highest of the three parameters. Impact on a stream is the higher of the BOD5 and suspended solids parameters. 35 Ill. Adm. Code 301.345.

Section 304.122 of the Board's effluent standards provides in its entirety that:

a) No effluent from any source which discharges to the Illinois River, the Des Plaines River downstream of its confluence with the Chicago River System or the Calumet River System, and whose untreated waste load is 50,000 or more population equivalents shall contain more than 2.5 mg/L of total ammonia nitrogen as N[itrogen] during the months of April through October, or 4 mg/L at other times.

b) Sources discharging to any of the above waters and whose untreated waste load cannot be computed on a population equivalent basis comparable to that used for municipal waste treatment plants and whose total ammonia nitrogen as N[itrogen] discharge exceeds 45.4 kg/day (100 pounds per day) shall not discharge an effluent of more than 3.0 mg/L of total ammonia nitrogen as N[itrogen].

c) In addition to the effluent standards set forth in subsections (a) and (b) of this Section, all sources are subject to Section 304.105. 35 Ill. Adm. Code 304.122; *See* Pet. at 11.

35 Ill. Adm. Code 304.122.

EMERALD'S PROPOSED ADJUSTED STANDARD

Emerald seeks to renew its current adjusted standard granted in AS 13-2 with certain modifications. Emerald proposes to retain the same total ammonia nitrogen as nitrogen (NH_3-N) effluent concentration limits (140 mg/L daily maximum, 110 mg/L 30-day average) granted in AS 13-2, as well as many of the operational and reporting requirements. The proposed new modifications include:

- a 25 percent decrease of the daily and 30-day NH_3-N loading limits (lbs/day) from those granted in AS 13-2;
- implementation of the Process Improvement Project Plan dated February 2020 ;
- monitoring of the Illinois River to demonstrate compliance with the General Use ammonia water quality standards; and
- a 5-year sunset provision that extends the requested relief by 3 years upon timely filing of a new petition. Pet. Br. at 50-52.

Other than evaluation of process improvements and optimization of existing WTP processes to promote nitrification, Emerald's proposed adjusted standard does not require the installation of any additional treatment alternatives to reduce its NH_3-N discharge.

EFFORTS TO ACHIEVE COMPLIANCE AND ALTERNATIVES

Emerald states that many alternatives have been evaluated over the last twenty plus years in order to comply with the ammonia nitrogen as N effluent limits. Pet. at 33. These efforts included evaluation of process changes, pretreatment alternatives, treatment alternatives and post-treatment alternatives. *Id*. Emerald argues that the Board must grant the requested adjusted standard because none of the alternatives evaluated are both economically reasonable and technically feasible, and the relief requested will not result in any adverse environmental impact or present any ill effects upon human health. *Id*. at 33-34. Emerald's positions on these alternatives are addressed more fully below.

SUMMARY OF AGENCY'S RECOMMENDATION

The Agency recommends that the Board deny Emerald's proposed adjusted NH_3-N effluent standard because Emerald has not met its burden of proof necessary to obtain an adjusted standard. Rec. at 25. Specifically, the Agency argues that Emerald's request must be denied because: the factors relating to both Emerald's influent and toxic effluent are not substantially and significantly different from the factors relied upon by the Board in adopting the rule of general applicability; the petition fails to show adequate justification for the adjusted standard; Emerald's toxic effluent negatively impacts the Illinois River; and Emerald's proposed adjusted standard limits are arbitrary. Ag Br. at 7, 17, 30 and 33. Were the Board to decide to grant the adjusted standard, the Agency recommends a number of conditions that address lower NH_3-N effluent limits and installation of additional treatment measures. These conditions are addressed below.

SUMMARY OF PUBLIC COMMENTS

Four outside parties offered public comment regarding this proposed adjusted standard. Sierra Club and Mr. Richard Pinneo offer comments against granting an adjusted standard. The Chemical Industry Council of Illinois ("CICI") and Teamster Local Union No. 627 offer comments in favor of granting an adjusted standard. Each comment is addressed below.

Sierra Club

Sierra Club offers comments in support of the Agency's recommendation to deny the adjusted standard. Sierra Comment at 1-2. Sierra Club notes that there are wildlife refuges down river of the Henry Plant and that Emerald should comply with its obligations under the Clean Water Act. Where an adjusted standard is granted, Sierra Club states that it should be for a time period of no more than five years and should require that Emerald present a report no later than six months before its next NPDES permit expires showing that:

- the mixing zone is as small as practicable considering more advanced treatment at both the Emerald facility and the Mexichem Specialty Resins, Inc. plant;
- the discharge will not, alone or in combination with other pollutant loadings, harm mussels or other sensitive species in the Illinois River; and
- the discharge will not cause or contribute to violations of dissolved oxygen standards and has been designed to reduce as much as possible the nitrate loading to the Illinois River and downstream waters.

Id. at 2.

Sierra Club also asserts that Emerald has failed to meet its burden proof that: (1) the factors relevant to its petition are substantially and significantly different from what the Board contemplated during promulgation of the current standard, and (2) cost considerations support an adjusted standard. *Id*. at 7-13. Further Sierra Club argues that the proposed adjusted standard poses a significant environmental risk and a permanent adjusted standard may be inconsistent with applicable federal law. *Id*. at 13-15.

Richard Pinneo

Mr. Pinneo, a degreed chemical engineer, offers comments against granting Emerald an adjusted standard and argued that Emerald should not discharge high concentrations of biologically resistant chemicals into the Illinois River. Mr. Pinneo asserts that Emerald has not provided sufficient information in support of its claims that alternative treatment options are economically unreasonable. Mr. Pinneo further approves of Emerald's stated efforts to look at process changes to reduce MBT discharges, but argues that Emerald would not have an incentive to continue this if it received a permanent adjusted standard. Finally, Mr. Pinneo suggests that Emerald should be required "to evaluate and re-evaluate their manufacturing processes and treatment and potential pretreatment processes until the discharge is no longer toxic except for toxicity related to Total Dissolved Solids (TDS)."

Chemical Industry Council of Illinois (CICI)

Emerald is a long-time member of the CICI. The CICI states that "there is no question that the unique circumstances at Emerald's facility warrant an adjusted standard under Section 28.1." The CICI reiterates Emerald's argument that granting the adjusted standard will not result in any negative impact on the environment. The CICI supports its comment, stating that the segment of the Illinois River where the Henry Facility discharges is not listed as impaired for ammonia or dissolved oxygen. Further, CICI refers to Emerald's tests as showing no violation of water quality standards and no toxicity outside its approved Zone of Initial Dilution.

Teamsters Local Union No. 627

The Teamsters comment that there are fifty members working at the Henry Facility. The Teamsters also state that the workforce and management of the Henry Facility are working very closely to come up with a solution for the problem of the ammonia adjusted standard.

BOARD DISCUSSION

As noted by both Emerald and the Agency, the Board has granted an adjusted standard from the NH_3-N effluent limitations for the Henry Plant discharge multiple times over the last twenty-plus years – most recently in 2016. In the previous AS proceedings, based on the record of each proceeding, the Board found that the chemical characteristics of the wastewater treated in the Henry Plant's WTP was substantially different than wastewaters of other industries and publicly-owned treatment works (POTWs) considered by the Board in adopting the generally applicable NH_3-N limits because of the presence of MBT, which is a nitrification inhibitor. The Board found that it had not considered the manufacturing processes at the Henry Plant or the effects of MBT on nitrification when it promulgated Section 304.122(b). EPM, AS 13-2, slip op. at 40-41(April 16, 2015). Additionally, the Board found that the Henry Plant's discharge of ammonia did not have an adverse environmental impact beyond the mixing zone in the Illinois River and that no treatment alternative was both economically reasonable and technically feasible.

However, in the instant proceeding, both Emerald and the Agency have submitted new information regarding treatment alternatives, treatment cost, operational and process information, and WTP monitoring data. While Emerald maintains that the record continues to support its request for relief, the Agency argues that the new information supports a denial.

In the following sections, the Board determines whether Emerald has adequately proven that its proposed adjusted standard satisfies each of the Section 28.1(c) factors. Specifically, the Board addresses whether Emerald has demonstrated that:

1. factors relating to Emerald are substantially and significantly different from the factors relied upon by the Board in adopting Section 304.122 of the Board's regulations. 415 ILCS 5/28.1(c)(1) (2018); 35 Ill. Adm. Code 304.122;
2. the substantially different factors justify an adjusted standard by considering the technical feasibility and economic reasonableness of the various treatment

alternatives evaluated by Emerald and recommended by the Agency. 415 ILCS 5/28.1(c)(2);
3. the granting of the requested relief would result in environmental or health effects substantially or significantly more adverse than those considered by the Board in adopting the generally applicable effluent standard under 35 Ill. Adm. Code 304.122. 415 ILCS 5/28.1(c)(3); and
4. the requested relief is consistent with any applicable federal law. 415 ILCS 5/28.1(c)(4).

Substantially Different Factors – Section 28.1(c)(1) of the Act

Section 28.1(c)(1) of the Act requires Emerald to demonstrate that "factors relating to that petitioner are substantially and significantly different from the factors relied upon by the Board in adopting the general regulation applicable to the petitioner." 415 ILCS 5/28.1(c) (2018); 35 Ill. Adm. Code 104.426.

Emerald's Position

Emerald argues that the factors relied upon by the Board in adopting Rule 406 (now 35 Ill. Adm. Code 304.122) were substantially different from the factors applicable to the NH_3-N discharge from the Henry Plant's WTP. Pet. 31-32. Emerald states that the Board's NH_3-N effluent standard is based on two factors: the ability to cost-effectively treat ammonia and the desire to address dissolved oxygen (DO) concerns in the Illinois River. *Id*. at 30, *citing* R72-4 (Nov. 8, 1973) (Final Opinion). Emerald argues that, as applied to its discharge, numerous investigations "have established that there are no alternatives that are both technologically feasible and economically reasonable to achieve the ammonia reduction necessary to comply with 35 Ill. Adm. Code 304.122(b)." Pet. at 30. Regarding DO concerns, Emerald notes that the NH_3-N effluent limit is intended to address DO sags (low DO levels) in the receiving stream believed to be caused by ammonia nitrogen discharges. However, DO sags were later determined to be caused primarily by sediment oxygen demand. *Id.* at 30, *citing* Ex. 1, 40-41. Emerald asserts that NH_3-N discharged at the levels requested by Emerald will have minimal, if any, impact upon the level of DO in the Illinois River. *Id*. at 31. Thus, Emerald concludes that "the factors relied upon by the Board in adopting what is now 35 Ill. Adm. Code 304.122 were substantially different" from those factors applicable to the facility. *Id*. at 31.

Agency's Position

The Agency states that the Board relied on two factors in adopting the generally applicable standard: "(1) the impact of ammonia nitrogen in wastewater discharges on dissolved oxygen demand in the receiving stream, and (2) [the] technology present in 1974 [that] allowed dischargers to treat their effluent to meet the 3 mg/L limit." Rec. at 20, *citing* Pet. at 30. The Agency states that the Emerald facility's treatment process "generates large amounts of ammonia nitrogen during secondary treatment because of the presence of degradable organic nitrogen compounds." Rec. at 20. The Agency further states that the presence of MBT inhibits nitrification, causing ammonia nitrogen released during the wastewater treatment process to remain in the effluent. *Id*., *citing* Pet., Exh. 1 at 5-6. Thus, the Agency notes that the Board has previously held that Petitioner's discharge has unique characteristics, making the Henry Plant

unable to achieve nitrification and different from other industries and POTWs. Ag. Br. at 7, *citing* Pet. Ex. 1 at 40.

However, the Agency argues that the Board's previous finding is no longer sustainable for the following reasons:

- the ammonia-laden waste stream from Mexichem, which is treated by Emerald's WTP, is substantially and significantly similar to any other waste stream in Illinois;
- the effluent from the Henry Plant's secondary clarifier is substantially and significantly similar to any other treatment facility in Illinois;
- treatment options considered by Emerald indicate technically feasible alternatives are available for incremental or total removal of NH_3-N from Emerald's toxic effluent; and
- treatment options not considered by Emerald also show technically feasible alternatives are available for incremental or total removal of NH_3-N from Emerald's effluent. Ag. Br. at 7, 9, 10, 13.

Discussion

As noted above, Emerald argues that the operation of the Henry Plant's WTP has not changed substantially since the Board granted an adjusted standard in AS 13-2. Emerald maintains that "MBT continues to be present at sufficient quantities in the PC tank and the primary clarifier so that single-stage nitrification cannot occur in the bioreactors." Pet. Br. at 27.

The Agency, on the other hand, argues for the Board to not follow the Board's previous finding that Emerald's discharge is substantially and significantly different from the factors relied upon by the Board in adopting the rule of general applicability. IEPA Resp. Bf. at 4. The Agency argues that the Board should deny the adjusted standard petition because: "(1) the new facts of this case make [Emerald's] reliance on AS 02-5 and AS 13-2 improper considering the law of the case doctrine; (2) adjusted standards are not granted to manage another entity's waste; (3) [Emerald] needs a compliance schedule and not an adjusted standard; and (4) [Emerald] does not provide the best degree of treatment." *Id*. at 3-4.

Emerald and the Agency disagree on whether either Mexichem's effluent before treatment or Emerald's secondary clarifier effluent are substantially and significantly similar to other waste streams in Illinois. Each party's argument regarding this issue is addressed below.

Mexichem's Effluent Before Treatment

Agency's Argument. The Agency argues that Mexichem's wastewater influent, treated by Emerald, is substantially and significantly similar to any other waste stream in Illinois. Ag. Br. at 7. Emerald accepts Mexichem's waste stream, which contributes ammonia and nitrogen compounds to the Henry Plant before it is mixed with the Emerald's wastewater containing MBT. *Id*. The Agency states that the amount of NH_3-N coming from Mexichem may be calculated knowing the flow rates and concentrations. *Id.* at 8. Since Mexichem does not contribute MBT to the Henry Plant, the Agency contends that Emerald could treat the Mexichem influent prior to entering Emerald's WTP (PVC tank) to reduce or eliminate NH_3-N. *Id.* The

Agency contends, "having Mexichem feed its waste stream, that contains the same constituent for which Petitioner claims to need an adjusted standard, into Petitioner's waste stream is virtually unheard of in Illinois." *Id.* The Agency maintains that Emerald is not providing best degree of treatment when accepting ammonia discharge from Mexichem and allowing ammonia to be washed into the Illinois River under an adjusted standard. Ag. Res. Br. at 7-8. In sum, the Agency argues that the facts in the record do not excuse Emerald "from accepting ammonia and nitrogen compounds from Mexichem, mixing those compounds with nitrification inhibitors, then claiming there's nothing that can be done about the ammonia in Petitioner's effluent." *Id.* at 7.

Regarding the cost of treating Mexichem's waste stream, the Agency notes, "Mexichem pays (i.e. credits) Petitioner nearly $2 million a year to treat its wastewater." Ag. Br. at 8, *citing* 1/14/20 Tr. at 61, IEPA Ex. 9A p. 56-59, Ex. 9B. Emerald prorates the costs to treat Mexichem's waste stream based on the actual cost of operation of waste treatment. The Agency contends that Emerald has created a marketable competitive advantage with its adjusted standard by accepting Mexichem's waste. Ag. Res. Br. at 7. While Emerald receives nearly $2 million per year in credits to treat Mexichem's wastewater, Mexichem gets to discharge its ammonia into the Illinois River without a permit under the adjusted standard. *Id.* at 7, *citing* 1/14/20 Tr. at 61, IEPA Ex. 9A p. 56-59, Ex. 9B.

Emerald's Response. Emerald responds that Mexichem's wastewater being combined with Emerald's wastewaters should not be a reason to deny the requested relief. Pet. Res. Br. at 5. Emerald notes that separate nitrification of the PVC tank has been evaluated previously in AS 02-5 by Mr. Flippin "who concluded that, by itself, this alternative would not achieve compliance with applicable limits and was economically unreasonable." *Id., citing* 2/4/20 Tr. at 21 (Flippin); AS 02-5, PHX 7, 26 (Flippin Written Testimony) and PHX 11, Figure 5. Emerald contends that treating the PVC tank wastewater (Mexichem influent) would require an entirely separate treatment train and incur associated expenses. Pet. Res. Br. at 5.

Further, Emerald asserts that combining Mexichem's waste stream with its wastewater is advantageous because it provides a consistent base flow roughly four times that of Emerald's and dilutes the MBT concentration in Emerald's waste streams. *Id*. at 5-6. Further, Emerald argues that combining Mexichem's and Emerald's wastewaters was not intended to avoid regulation since the Henry Plant's present configuration predates the adoption of Section 304.122(b) by many years. *Id.* at 5-6. The adjusted standard should not be denied simply because the Henry Plant continues to treat two waste streams, as it has always done. *Id*. at 6.

Discussion. Mexichem's wastewater stream enters the WTP system through the PVC Tank. *See* PHX 7. After equalization, the effluent from the PVC tank combines with Emerald's wastewaters streams from PC Tank (containing MBT) and C-18 Tank before entering the WTP's primary clarifier. A recent in-plant monitoring of NH_3-N shows the daily influent and effluent loadings of NH_3-N and total kjeldahl nitrogen[9] (TKN). PHX 12 at 4.

[9] TKN represents the total concentration of organic nitrogen and ammonia nitrogen.

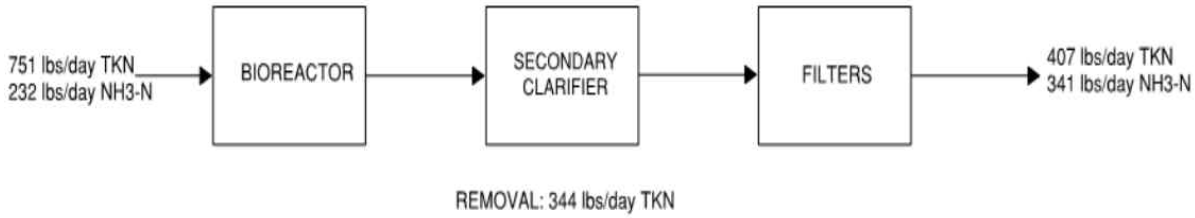


Figure 1. Average TKN Removal Across Emerald WWTP

Further, the in-plant monitoring indicates that the PVC Tank (primarily Mexichem's wastewater plus tertiary filter backwash water and sludge dewatering filtrate) discharged on average 524 lbs/day TKN and 230 lbs/day NH_3-N, while the PC Tank (Emerald's wastewater) discharged, on average, 227 lbs/day TKN and 2 lbs/day NH3-N. *Id.* Thus, NH_3-N contributed 44 percent of the TKN in wastewater from the PVC, and 30 percent of TKN in the combined wastewater. As noted by the Agency, if not for mixing with Emerald's wastewater containing nitrification inhibitor, MBT, Mexichem's wastewater could have been treated to meet the NH_3-N effluent limit using the existing WTP's single-stage nitrification. As shown in Figure 1 above, the WTP discharges larger amount of NH_3-N (341 lbs/day) into the Illinois River than the amount (232 lbs/day) entering the plant.

In effect, by combining PVC Tank effluent with Emerald's wastewater containing MBT, Emerald is allowing almost 230 lbs/day of NH_3-N to be washed through the WTP into the Illinois River. This amount, which constitutes about 30 percent of the TKN loading to the WTP, is not insignificant by any means. Further, as argued by the Agency, Mexichem is paying over $2 million (in credits) to Emerald for treating its wastewater that is not being treated for NH_3-N under Emerald's adjusted standard. Further, the record shows that neither Mexichem's effluent nor the effluent from the PVC Tank contain MBT; and thus, either effluent could be treated to remove NH_3-N. 1/14/20 Tr. at 192-193, 1/15/20 Tr. at 150. As such, effluent from Mexichem or the PVC Tank is substantially similar to other waste streams in Illinois that are treated for NH_3-N.

While Emerald continues to argue that separate treatment will not achieve full compliance and is not economically reasonable, the requested relief is about 46 times the effluent limit. The Board recognizes that two separate entities are responsible for the NH_3-N discharge from the WTP. Further, determining economic reasonability of any viable treatment options must consider that the two dischargers share responsibility for the noncompliance with the NH_3-N effluent standard.

Emerald's Secondary Clarifier Effluent

Agency's Argument. The Agency contends that the WTP's secondary clarifier effluent is similar to any other treatment facility, i.e., the effluent is amenable to tertiary treatment for removal of NH_3-N. Ag. Br. at 9. The Agency notes that "there is no more MBT in Petitioner's waste stream after its secondary clarifier." *Id., citing* 1/14/20 Tr. at 68-69, 84, 1/15/20 Tr. at 143-144, IEPA Ex. 15, IEPA Ex. 18 p. 42-43. Thus, after the secondary clarifier, the effluent does not have nitrifying inhibition. *Id., citing* 1/15/20 Tr. at 158. The Agency maintains that

Emerald can install tertiary nitrification after the secondary clarifier to meet the NH_3-N effluent standard at 35 Ill. Adm. Code 304.122. Ag. Br. at 10. The Agency notes that two other industrial dischargers, the ExxonMobil and Citgo refineries, with previous adjusted standards implemented tertiary nitrification technologies to achieve compliance with the NH_3-N effluent standard. Ag. Rep. Br. at 6.

Emerald's Response. Emerald responds that the Agency's argument not only overstates the data, but also misunderstands what distinguishes Emerald from other plants. Pet. Br. at 6. Emerald maintains that the Henry Plant is different because of the presence of MBT in the PC tank and the primary clarifier effluent to prevent single-stage nitrification in the secondary bioreactors. Emerald notes that MBT is a powerful nitrification inhibitor that can inhibit nitrification at low concentrations of about 3 mg/L making single-stage nitrification impossible. *Id., citing* AS 02-5, PHX 9 (article by Hockenbury, Table II). Regarding the secondary clarifier effluent, Emerald maintains that from 2016 through 2019 there have been about 200 detections of MBT and 46 of those exceeded 3 mg/L. Pet. Br. at 28. Further, most of the "detections over 3 mg/L occurred during 2018 when BBTS[10] was produced at record levels." *Id.* Emerald argues that the Board agreed in the previous adjusted standards that Emerald's effluent was substantially and significantly different from other treatment facilities because single-stage nitrification was not possible due to the presence of MBT in the primary clarifier effluent. *Id.* at 6-7, *citing* AS 2-5 and 13-2.

Discussion. As noted by Emerald, the Board did find in previous adjusted standards that Emerald's wastewater discharge differs substantially and significantly from the discharge of other industries and POTWs due to the presence of MBT. However, as noted by the Agency, the Board must consider any new information regarding the treatability of the wastewater discharge to meet the NH_3-N standards. The primary purpose of revisiting the requested relief is to evaluate new information developed since the grant of the previous adjusted standard in 2015. In this regard, Emerald, in response to Board questions, submitted MBT sampling data for effluents from both primary and secondary clarifiers. 3/6/20 Pet. Ans. at 8, App. D. As noted by Emerald, the primary clarifier effluent monitoring data for the last 4 years (2016-2019) show MBT levels that are significantly higher than the nitrification inhibition threshold of 3 mg/L indicating single-stage nitrification is not possible. However, as argued by the Agency, the MBT levels in the secondary clarifier effluent during the same period is below the 3 mg/L threshold for the most part, suggesting a potential for tertiary nitrification.

A review of the secondary clarifier MBT sampling data (2016-2019) indicates that there were 46 samples exceeding the 3 mg/L (nitrification inhibition threshold) out of approximately 1,470 samples. Further, 43 of the 46 exceedances occurred in 2018. These exceedances in 2018 were mostly clustered around 3 time periods as follows: 22 between Apr 1 - May 4; 7 between Jul 23 - Aug 16; and 7 between Nov 10 - Nov 19. There were 3 exceedances in 2017 and none in 2016 or 2019. Although Emerald contends that tertiary nitrification is not an option based on the exceedances in 2018 due to record level production of BBTS in that year, the overall

[10] BBTS is N-tert-Butyl 2-Benzothiazolesulfenamidea, a rubber vulcanization accelerator. BBTS contains a high level of MBT, which inhibits single-stage nitrification.

secondary clarifier effluent MBT data supports the Agency's recommendation that Emerald needs to consider tertiary nitrification as a compliance option.

As noted above, more than 97% of the secondary clarifier MBT sample values were below the inhibition threshold. Further, Emerald states that since September 2018 it has made additional process changes that decreased the loss of BBTS into the treatment system by almost 80%, achieving additional reductions in MBT lost from the BBTS process. 3/6/20 Pet. Ans. at 4, *citing* PHX 16. Since the process changes, there were no exceedances of the nitrification inhibition threshold in the secondary clarifier effluent. Also, Emerald plans to implement a Process Improvement Project Plan (PIP) to further reduce discharge of MBT. Thus, even if production levels were higher in the future, Emerald could consider tertiary nitrification as an option to reduce its NH_3-N discharge.

Section 28.1(c)(1) Finding

Emerald's argument that the Henry Plant is different from other industrial dischargers because NH_3-N removal is not possible with single-stage nitrification is no longer valid. As noted by the Agency, other industrial dischargers have employed tertiary nitrification to comply with the NH_3-N limits. Further, most of the alternatives evaluated by Emerald's consultant, Houston Flippin (Mr. Flippin), involve tertiary treatment. Thus, the Board sees no reason to continue to consider Emerald's discharge as substantially and significantly different from other industrial dischargers and no such different factors justify an adjusted standard.

Factors Justify Adjusted Standard (415 ILCS 5/28.1(c)(2))

Over the last 20 years, Emerald's predecessors have evaluated a number of alternative treatment technologies to reduce the NH_3-N discharge from the Henry Plant. *See* AS 02-5; AS 13-2. Instead of reviewing technologies evaluated in the previous proceedings, this discussion will focus on technologies evaluated in the instant proceeding. In this proceeding, Emerald evaluated a total of eight alternative treatment options to reduce NH_3-N from Emerald's WTP discharge into the Illinois River for technical feasibility and economic reasonableness.

Recommended and Evaluated Treatment Alternatives

Initially, as required under AS 13-2 Condition 2(e), Emerald evaluated three treatment options:

- granulated activated carbon (GAC);
- spray irrigation; and
- river water dilution.

See PHX 11.

Later, in response to the Agency's recommendation, Emerald submitted a report from Mr. Flippin updating conceptual level designs and cost estimates for five additional treatment alternatives considered most likely to be effective, as well as further analysis of spray irrigation:

- ozonation;

- alkaline stripping;
- tertiary nitrification;
- breakpoint chlorination; and
- ion exchange.

See PHX 12 (Flippin Report) at 5.

These additional alternatives involve further treating the plant's final effluent from the tertiary sand filters because, according to Mr. Flippin, treating final effluent would be the most economical and reliable process for NH_3-N removal at the Emerald's WTP. PHX 9 at 18.

In addition to the alternatives evaluated by Emerald, the Agency asserted that several options not considered by Emerald may be technically feasible for partial or total removal of NH_3-N from the Henry Plant's discharge. Ag. Br. at 13. These include:

- running reactions further;
- removal of MBT from Emerald's waste stream using hydrogen peroxide or soybean peroxidase;
- tertiary nitrification using refurbished biotreaters or baffled systems;
- separate treatment of MBT waste streams; and
- combination of treatment alternatives.

The treatment alternatives evaluated by Emerald, as well as those recommended by the Agency are summarized in the following sections. These summaries are followed by a discussion of Emerald's and the Agency's positions regarding technical feasibility and economic reasonableness of the treatment alternatives and the Best Degree of Treatment (BDT).

Treatment Alternatives Evaluated by Emerald

For evaluating technical feasibility of treatment alternatives, Mr. Flippin relied on a conceptual design final effluent waste load which addressed a number of chemical and physical parameters, including a design average wastewater flow of 0.52 million gallons per day (MGD), and NH_3-N waste load of 341 lbs/day. PHX 12. at 6. Regarding economic reasonableness of the treatment alternatives, Emerald relied on the Association for the Advancement of Cost Engineering (AACE) Class 5 cost estimates. Mr. Flippin explained that a "Class 5 estimate is considered to be a conceptual level estimate and is performed when 0 to 2% of the design has been completed. Accuracy for a Class 5 estimate is expected to fall between -50 % to +100% of the cost." PHX 11, Attach. at 13. Usually, Class 5 estimates are used to prepare planning level cost scopes or evaluation of alternative schemes.

A brief summary of all eight treatment alternatives is provided below.

Granular Activated Carbon (GAC). Mr. Flippin evaluated pretreatment of Emerald's wastewater at the PC Tank and C-18 Tank using GAC to remove the nitrification inhibitor, MBT, from Emerald's effluent. PHX 11 at 1. The removal of MBT would make the combined wastewater from Emerald and Mexichem amenable for NH_3-N removal by nitrification in the existing secondary bioreactor. Mr. Flippin noted that application of GAC prior to mixing of

Emerald's effluent with the PC Tank effluent would be the most economical and efficient way to remove MBT, because that location represents the highest concentration of MBT and lowest concentration of chemical oxygen demand (COD). 4/2/20 Tr. at 42, *See also* Pet. Res. Br. at 25, *citing* 2/4/20 Tr. at 40.

Emerald notes that controlled, laboratory level "bench-scale" testing indicates that GAC would sufficiently reduce MBT concentrations to allow the microorganisms in the plant wastewater treatment system to achieve adequate nitrification. Pet. Bf. at 38. However, Emerald contends that application of GAC as a pretreatment alternative is cost prohibitive. *Id*.

Relying on the Class 5 cost estimates, Mr. Flippin estimates the capital cost for GAC to be approximately $5.3 million and an annual operation and maintenance (O&M) cost between $3.1 to $4.2 million. PHX 11, Attach. A at 14-15. These costs translate to an average cost of $14 per pound of NH_3-N removed from the waste stream, which is about 20 times higher than the costs incurred by POTWs in Illinois and 11 times higher than the average NH_3-N removal cost of POTWs nationwide. *Id.* at 15. Based on these cost estimates, Emerald argues that GAC is economically unreasonable. Pet. Rep. Bf. at 38.

The Agency criticizes this analysis, because it evaluates GAC at only one point on the combined effluent from the C-18 tank and the PC tank prior to mixing with the PVC tank effluent. Ag. Rep. Bf. at 10. The Agency argues that evaluation of GAC at other locations of the treatment plant with different constituents in the wastewater could have greatly affected the performance of the GAC. *Id*. at 10-11, *citing* 1/15/20 Tr. at 170-171.

Spray Irrigation. Emerald, based on its initial evaluation, asserted that spray irrigation (land application) of the Henry Plant's WTP final treated effluent is not a technically feasible option for two reasons. First, Emerald asserts that there is no "symbiosis between wastewater treatment operations and the agricultural needs for nitrogen amendments." PHX 11 at 2. Emerald notes that since the mass of ammonia in the final effluent is not constant, frequent analysis and adjustment of the land application rate would be required to meet the nitrogen requirements of the crops. *Id.*

Second, Emerald notes that the Part 372 regulations for land application referenced in Condition 2(e) of AS 13-2 address land application of treated domestic wastewater. As such, those regulations do not allow land application of Emerald's industrial treated effluent. *Id.* Even if land application is allowed, Emerald notes that it only applies during the active growing season and would limit land application to about 180 days in Illinois. For the remaining period, the final treated effluent would have to be discharged into the Illinois River. *Id.* at 3.

This option was further evaluated by Mr. Flippin in response to the Agency's recommendation, indicating that Emerald could use 80 acres of adjacent land it owns to "grow a salt tolerant, high nitrogen uptake hay (e.g., Bermuda grass) which would exert a nitrogen uptake of approximately 350 pounds per acre per year." *See* Flippin Report, PHX 12 at 10. This nitrogen loading equates to an average flow of 160,000 gallons per day (gpd) (30 percent of the average final effluent flow) during a 9-month period when the ground is thawed. Due to high total dissolved solids (TDS) content, the final effluent would have to be diluted with 360,000 gpd

of clarified river water prior to irrigation to minimize salt impacts on plant growth and associated nitrogen uptake. *Id.* The implementation of this option would be contingent on Emerald being granted a permit to withdraw river water, as well as discharge solids from a river water clarifier back to the river. *Id.*

The Agency contends that Mr. Flippin concluded that spray irrigation is not a feasible option without conducting a detailed analysis because Emerald owns only 80 acres of land. Ag. Br. at 11. The Agency notes that land application is a common practice in Illinois, and, in most cases of industrial spray irrigation, the permittee does not own the land. Ag. Bf. at 11. There are over 100 operating permits for land application of industrial sludge within Illinois, including one for a facility under the same category as Emerald for spray irrigation of wastewater. *Id.* at 11-12. While not addressing the issue of land acreage, Emerald notes that among the number of industrial sludge permits issued in Illinois, the Agency identified only one organic chemical plant spray irrigation system. Pet. res. Br. at 26. Emerald further explains that the chemical plant does not truly dispose of its wastewater through spray irrigation because the wastewater is collected a drain tile system and discharged thru a permitted outfall. *Id*., *citing* 2/3/20 Tr. at 70.

The Class 5 cost estimates for land application for removing 23% of the daily average NH_3-N discharge are a capital cost of $6.0 million, and O&M cost of $0.39 million. Based on 10 years financing at 4 percent interest and no salvage value, the total (capital plus O&M) present worth cost is estimated to be $9.2 million. *Id.* at 11. Based on these cost estimates, Emerald argues that spray irrigation not only would fail to meet regulatory limits for NH_3-N but is also economically unreasonable. Pet. Br. at 45.

River Water Dilution (RWD). Emerald's consultant evaluated treatment of plant wastewater via river water dilution at a laboratory level "bench scale." This alternative involves diluting the primary clarifier effluent with river water from the Illinois River to provide a dilution stream to the wastewater. The river water will be pumped to the aeration basin at approximately 7 MGD to dilute MBT levels so nitrification can be achieved in the secondary bioreactor. PHX 11, Attach. A at 15. While the bench scale testing results indicated that nitrification could be achieved if the plant wastewater were diluted by 90% with river water, the results might not be sustainable at full-scale due to fluctuations in MBT levels and the need to maintain reactor temperature at levels conducive to biological treatment. *Id.* Additionally, Emerald asserts that river water dilution is not economically reasonable, as the overall estimated cost is 40 times higher than the costs incurred by POTWs in Illinois and 21 times higher than the average cost of POTWs nationwide. Pet. Br. at 41, *citing* PHX 9. Thus, Emerald concludes that the river water dilution alternative is not technically feasible or economically reasonable.

In this regard, the Agency argues that Emerald's conclusions of technical infeasibility of the treatment options are based on insufficient evaluations. Ag. Br. at 10, *citing* 1/14/20 Tr. at 194. The Agency maintains that river water dilution could be done seasonally to achieve incremental improvements in NH_3-N discharge when there was ample temperature. *Id., citing* 1/15/20 Tr. at 8-9. Emerald maintains that the river water dilution is not economically reasonable due to its high cost and negative environmental side-effects. Pet. Res. Br. at 25.

Ozonation. Ozonation is a treatment process in which ozone is used to oxidize NH_3-N to Nitrate-N with caustic addition to neutralize acid formed as a reaction byproduct. PHX 12 at 6. Mr. Flippin notes that the demonstrated reduction of NH_3-N is about 55 percent at an initial pH 11 and final pH 7.66. Thus, the resulting effluent NH_3-N level would be an order of magnitude higher than the regulatory limits. *Id.* The cost estimates for ozonation include a capital cost of $22 million, annual O&M cost of $0.96 million, and total present worth cost of $30 million. *Id.* at 11. The present worth cost translates to $44 per pound of NH_3-N removed. *Id*. at 11. Emerald asserts that ozonation is technically infeasible and economically unreasonable because it is unable to achieve ammonia removal beyond 55 percent, unable to meet the NH_3-N limits, and has the highest cost per pound of ammonia removal. *Id.* at 11 and Pet. Br. at 42-43.

Alkaline Stripping. Alkaline stripping involves the addition of a caustic agent to raise the pH of filtered effluent to 11.5 before it passes through a packed-media air stripping column where ammonia would be stripped and removed through off-gas. PHX 12 at 7. The pH of the effluent from the column would be lowered to 8.5 using sulfuric acid prior to discharge into the Illinois River. *Id.* at 7-8. The off-gas from the stripper is scrubbed using an acid scrubber to remove ammonia as a liquid waste, which must be disposed of off-site. *Id.* at 7. Mr. Flippin notes that while alkaline stripping can provide up to 95 percent removal of effluent NH_3-N, the process may not comply with the regulatory effluent limits. *Id.* The cost estimates for alkaline stripping include a capital coat of $7.3 million, annual O&M cost of $1.4 million, and total present worth cost of $19 million. *Id.* at 11. The present worth cost translates to $16 per pound of NH_3-N removed. Emerald asserts that alkaline stripping is economically unreasonable due to the high cost. Pet. Br. at 36.

Tertiary Nitrification. This treatment process involves biological nitrification of the secondary clarifier effluent to convert NH_3-N to Nitrate-N. Mr. Flippin proposes to add rotating biological contactors (RBCs) to achieve nitrification. The fixed film media of the RBCs provide for growth of heterotrophic and nitrifying bacteria necessary for biological nitrification. PHX 12 at 8. Also, sodium hydroxide would be added to satisfy the alkalinity demand. The excess bacteria that sloughs off the fixed film would be filtered by downstream rotary disk filters, as well as the existing downstream tertiary sand filters. Mr. Flippin states that as long as MBT levels are less than 3 mg/L in the secondary clarifier effluent, tertiary nitrification should be capable of achieving compliance with effluent NH_3-N limits. *Id.* However, because the Emerald plant is subject to upsets periodically due to the poorly degradable nature of the compounds in the process wastewater, a pilot-scale demonstration would be required to prove the reliability of this treatment process. *Id.* The cost estimates for tertiary nitrification include a capital cost of $10 million, annual O&M cost of $0.74 million, and total present worth cost of $17 million. *Id.* at 11. The present worth cost translates to $14 per pound of NH_3-N removed. *Id*. at 11. Although tertiary nitrification using RBCs represents the second lowest unit cost for ammonia removal, Emerald maintains that it is economically unreasonable because the unit cost is more than 8 times the median unit costs reported by the National Association of Clean Water Agencies ("NACWA") for ammonia treatment at other facilities. Pet. Br. at 33, *citing* PHX 9.

The Agency argued "where there's no MBT after the secondary clarifier, nitrification can be achieved," and recommended two tertiary nitrification options that are addressed below. Ag. Br. at 9.

Breakpoint Chlorination. This treatment process involves the addition of chlorine gas to the tertiary sand filter effluent to oxidize NH_3-N to nitrogen gas. Sodium hydroxide is added to provide alkalinity to neutralize the acid byproduct. Mr. Flippin notes that breakpoint chlorination can achieve compliance with the NH_3-N regulatory limits. PHX 12 at 8. However, due to significant increase in effluent salt content (>70%) and potential formation of chlorination byproducts, the effluent "could adversely impact the effluent aquatic toxicity and jeopardize compliance with the effluent acute toxicity criterion." *Id.* Further testing would be required to address this uncertainty. Also, since oxidation is non-selective, the process consumes large amounts of chlorine and alkalinity to meet oxidation demand of BOD and COD. *Id.* The cost estimates for breakpoint chlorination include a capital cost of $4.1 million, annual O&M cost of $2.5 million, and total present worth cost of $24 million. *Id.* at 11. The present worth cost translates to $20 per pound of NH_3-N removed. Emerald states breakpoint chlorination is not economically reasonable due to extreme negative environmental side-effects and the relative cost compared to NACWA ammonia removal costs. Pet. Br. at 42, *citing* PHX 12 at 11.

Ion Exchange. Like alkaline stripping, ion exchange concentrates the ammonia-nitrogen in the final effluent into a smaller waste stream requiring off-site disposal. PHX 12 at 9. A hydrogen-based cation exchange resin is recommended for removing ammonia (NH4+) and other cations from the tertiary sand filter effluent. *Id*. Mr. Flippin notes that ion exchange can achieve compliance with the effluent NH_3-N regulatory limits. *Id*. However, the disposal of spent regenerant (ammonium chloride) at approximately 4,500 gallons per day could become an issue. *Id.* The cost estimates for ion exchange include a capital coat of $6 million, annual O&M cost of $1 million, and total present worth cost of $14 million. *Id.* at 11. The present worth cost translates to $14 per pound of NH_3-N removed. *Id*. at 11. Emerald states that ion exchange is economically unreasonable since it is costlier than tertiary nitrification or alkaline stripping. Pet. Br. at 38.

Other Treatment Alternatives. Emerald notes that over the years Mr. Flippin has evaluated a number of treatment alternatives, including the ones summarized above, to reduce the NH_3-N discharge from the Henry Plant. Emerald maintains that all of the alternatives evaluated by Mr. Flippin were rejected as not technically feasible, not economically reasonable or both. Pet. Br. 45-47.

Additionally, in response to the Agency's testimony, Emerald notes that separate nitrification of PC Tank effluent (Mexichem's wastewater) was investigated by Mr. Flippin in 2004 and he found it to be economically unreasonable. Pet. Br. at 45, *citing* AS02-5, PHX 7, 26 and PHX 11. Now, Emerald asserts that "treating the PVC tank wastewater is not tertiary nitrification, but instead would require Emerald to build an entirely separate treatment train and incur associated expenses." *Id.* at 46, *citing* 2/4/20 Tr. at 20-21, 96- 98). Emerald states that the comingling of Emerald's wastewater with Mexichem's wastewater is beneficial because Mexichem's wastewater provides a consistent base flow roughly four times that of Emerald's, as well as diluting the concentration of MBT in Emerald's wastewater. *Id*. at 46.

Treatment Alternatives Recommended by the Agency

As noted above, the Agency contends that several treatment options not considered by Emerald may be technically feasible to reduce NH_3-N discharge from the Henry Plant. Each of these options are summarized along with Emerald's response.

Running Reactions Further. The Agency contends that MBT could be eliminated from the waste stream if Emerald drives its reactions to completion. Ag. Br. at 13, *citing* IEPA Ex. 18 at 19, 1/15/20 Tr. at 146, 148-149. The Agency notes that Emerald has been able to react out all of the MBT in the past resulting in no MBT the waste stream. *Id., citing* IEPA Ex. 18 at 19. The Agency maintains that if Emerald achieves its goal of replicating the process of reacting all MBT with the rest of its products, Emerald would have the ability to nitrify and remove ammonia in its waste treatment system. *Id. citing* IEPA Ex. 18 at 20, 54-55. Thus, the Agency asserts that claims of Emerald and its predecessors over the last 20 years that there was no way to avoid MBT in Emerald's waste streams are incorrect. Ag. Bf. at 13.

Emerald responds by noting that most chemical reactions simply cannot be run to completion to eliminate all waste streams because the reaction equilibrium constant does not change in a closed system. Pet. Res. Br. at 23, *citing* 2/4/20 Tr. at 100-102. Emerald notes that while complete elimination of MBT is not possible, source reduction has been practiced at the Henry Plant for a long time to reduce MBT in waste streams. *Id*. at 23. Emerald notes that it has made significant strides in the last 18 months with process improvements to reduce MBT and is hopeful that the PIP will lead to further reductions. *Id*. at 23. However, Emerald maintains that reductions achieved to date are insufficient to assure compliance with the Section 304.122(b) limits. *Id*., *citing* 1/14/20 Tr. at 101. *Id*. at 23.

Removal of MBT using Hydrogen Peroxide or Soybean Peroxidase. The Agency states that hydrogen peroxide, an oxidizing agent, can be injected into Emerald's waste stream to remove the MBT. Ag. Br. at 13, *citing* 2/3/20 Tr. at 267, 2/4/20 Tr. 61-62, and IEPA Ex. 19 at 2. Further, noting the MBT is a sulfide, the Agency notes that it has permitted ExxonMobil to use hydrogen peroxide injections as part of its treatment to break down sulfides. *Id.* at 14, *citing* 2/3/20 Tr. at 38-42, 256-260, IEPA Ex. 20. Additionally, the Agency notes that soybean peroxidase (SBP), an oxidoreductase enzyme extracted from the soybean seed coat, has been found to be a suitable enzyme for the peroxidase-catalyzed conversion of the aromatic thiol, MBT. *Id.* at 14, *citing* IEPA Ex. 19 at 1. The Agency states that an enzyme-based method's advantages include high specificity for the target pollutant, high efficiency in pollutant removal, lower cost, and ease of handling and storage of the enzyme. *Id.* at 14. Thus, removal of MBT using hydrogen peroxide or SBP would allow single-stage nitrification for reducing NH_3-N discharge.

Emerald responds by noting that Mr. Flippin had evaluated the use of hydrogen peroxide in 2004 using batch treatability testing. Pet. Res. Br. at 27. Emerald notes that those tests found that the rate of biological nitrification was slower compared to an uninhibited system indicating that bio-inhibitors were still present. *Id*., *citing* AS 02-5, PHX 7, 19-20. Emerald notes that the Agency's interest in MBT removal with oxidizing agents was based on testimony from Mark Winters concerning a test conducted by a supplier trying to sell a catalyst to Emerald. *Id.* at 28.

Emerald contends that no conclusions can be drawn from that test because it was conducted with only a single duplicate without recording the sample volume or pH. *Id.* at 28. Further, Emerald notes that one of the treated samples even had a higher MBT concentration than the untreated sample and the duplicate result was not within the expected error range. *Id.* at 28.

Emerald contends that a large amount of hydrogen peroxide would be required because it will not selectively oxidize MBT. *Id*. citing 2/4/20 Tr. at 106 and 109. Additionally, regarding use of hydrogen peroxide in a refinery, Emerald asserts that unlike sulfide, which is an inorganic constituent with a double negative charge that is readily oxidizable in water, MBT is an organosulfur compound. *Id.* at 29. Finally, Emerald states that the SBC enzyme used successfully in the laboratory study may not be effective in a wastewater system due to factors including temperature, pH or various ions and chemicals present in the wastewater. *Id*., *citing* 2/4/20 Tr. at 119-120.

Tertiary Nitrification - Refurbished Bioreactors. The Agency notes that Emerald has four biotreater tanks with capacities of 360,000, 360,000, 440,000 and 1.4 million gallons. Ag. Br. at 14, *citing* 1/14/20 Tr. at 27. At present, Emerald has only one operational biotreater. The Agency contends that Emerald could modify one of its biotreaters by introducing fixed fill media and rerouting a pipe from the end of the secondary clarifier back through a modified biotreater to achieve tertiary nitrification. *Id.* at 15, *citing* 1/14/20 Tr. at 193, IEPA Ex. 18 at 51-52. The Agency maintains that tertiary nitrification of ammonia has been done at almost every industrial and municipal facility in Illinois with BOD and ammonia in their discharge. *Id., citing* 1/15/20 Tr. at 155, 2/3/20 Tr. at 97. The Agency states that even if Emerald goes ahead with its multi-year plan to refurbish the three unused biotreater tanks to provide backup capacity, once refurbished, the biotreaters would be available for tertiary nitrification. *Id.* at 15. Additionally, the Agency notes that Emerald could purchase an additional biotreater for tertiary nitrification. *Id*. at 16.

Emerald states that the Agency's idea of using existing biotreaters for tertiary nitrification "over-simplifies the wastewater treatment process and fails to take into account several additional costs, including the media needed to achieve nitrification, as well as the cost to pump effluent from the secondary clarifier and the cost to install the same alkalinity addition system needed for the RBCs alternative." Pet. Br. at 35, *citing* 2/4/20 Tr. at 23-24. Emerald also notes that the existing bioreactors would likely require installation of a steam addition. *Id*. Emerald argues that the Agency did not consider the additional cost when recommending the use of the existing biotreaters. *Id*. at 62.

Tertiary Nitrification – Baffled System. In addition to using bioreactors for tertiary nitrification, the Agency also recommends that Emerald evaluate the use a baffled system to divide the biotreaters into two halves to achieve secondary treatment in one half to remove MBT, and then run the waste stream on the other half to achieve tertiary nitrification. Ag. Br. at 15. The Agency notes that the baffled system has been used in several systems throughout Illinois, including in ExxonMobil Joliet refinery to achieve the ammonia limits of 35 Ill. Adm. Code 304.122(b). *Id.*

Emerald states, based on Mr. Flippin's testimony, that the baffled system is not technically feasible because the placement of a watertight wall to divide a bioreactor would affect the structural integrity of the bioreactor. Pet. Br. at 36. Emerald notes that the bioreactors at the Henry Plant were not built to support an interior wall. *Id*., *citing* 2/4/20 Tr. at 27-30. Emerald contends that any movement of the baffle wall may lead to collapse of the tank. *Id.* Emerald asserts that the baffle wall is not an option. *Id*. at 37.

Separate Treatment of MBT Waste Stream. The Agency notes that among the ten different products made by Emerald, MBT is present in four: BBTS, MBDS, OBTS, and 50% MBT. Ag. Br. 16, *citing* 1/14/20 Tr. at 33. The Agency states that Emerald could separate the waste streams for the products using MBT by re-piping and treat the rest of its waste stream with no MBT for ammonia. *Id., citing* 1/15/20 Tr. at 148.

Emerald states that the Agency's suggestion is not based on engineering proof that separation of waste streams would work in practice. Pet. Res. Br. 26. Emerald notes that Mr. Flippin evaluated a similar idea of separating effluent from PVC Tank and found that it would not achieve regulatory limits and be economically reasonable. *Id.* at 26-27. Emerald maintains that there is no evidence to support a finding that this alternative would be technically feasible or economically reasonable. *Id*. at 26-27.

Combination of Treatment Alternatives. Finally, the Agency states that Emerald should also consider evaluating the application of a combination of alternatives like tertiary nitrification, land application, and GAC to achieve the NH_3-N limits. Ag. Br. at 17. The Agency notes that Emerald has not evaluated the possibility of combinations of treatment options. *Id., citing* 1/14/20 Tr. at 89-90.

Emerald notes that Mr. Flippin considered the application of "end-of-pipe alternatives in combination, but decided against it because it would only make the unit cost of treatment higher." Pet. res. Br. at 30, *citing* 1/14/20 Tr. at 133. Emerald argues that by using a combination of alternatives it would need to build more than one separate treatment system, including separate capital and operating costs. *Id*.

Improvements in Process Changes. In addition to the alternative treatments raised by the parties, improvements in process changes were required by Conditions 2(c) and (d) of AS 13-2. Emerald states that it made several process changes between September 2018 and February 2019 that resulted in a decrease in the loss of BBTS into the treatment system by almost 80%.[11] 3/6/20 Pet. Res. To Board Questions at 4, PHX 16. These changes included "upgrades to computer hardware and software that facilitated improved process control, increasing the reaction temperature leading to drier and larger particles which enhanced BHS filtration efficiency and improvements to the BHS filter cleaning and process itself." *Id*. Also, in the fall of 2019, additional changes were made to the BBTS and OBTS processes. While these changes resulted in additional reductions in MBT loss from BBTS, there was no improvement in losses

[11] While the past efforts of Emerald and its predecessors to reduce MBT and TKN have been summarized in previous adjusted standard Board opinions (AS 02-5 and AS 13-2), only the improvements made since the grant of AS 13-2 are summarized and discussed in this section.

from OBTS. *Id*. Also, in Emerald's waste stream going into the PC Tank, the average TKN decreased from 287 lbs/day in 2011 to 227 lbs/day for March-August 2019, and the average NH_3-N decreased from 8 lbs/day to 2 lbs/day over the same period. *Id*. at 4-5. However, Emerald states that it has not been able to correlate source reduction efforts with effluent ammonia concentrations or the decrease in nitrogen with any of the process changes. *Id*. at 5.

While the NH_3-N effluent levels have been significantly lower in late 2019, they are not due to source reduction alone but likely reflect a big downturn in MBT-related production in 2019. *Id*. Emerald intends to continue process improvements at the Henry Plant by implementing a 4-year PIP. Emerald has proposed that the PIP be included as a condition of the adjusted standard. Pet. Br. at 54-55.

While the Agency recognizes some of Emerald's efforts to control MBT, it notes that Emerald did not have Mr. Flippin evaluate internal process improvements. Ag. Br. at 12, *citing* Tr. January 14, 2020 at 189. The Board notes that although it took more than three years after the grant of the adjusted standard in AS 13-2, Emerald did make several process changes to BBTS and OTBS resulting in significant reduction of the BBTS losses.

Technical Feasibility and Economic Reasonableness of Treatment Alternatives

Emerald admits that some of the eight treatment alternatives evaluated by Mr. Flippin are technically feasible even though it contends that all eight are economically unreasonable. Pet. Br. at 32. The Agency asserts that all eight treatment alternatives evaluated by Mr. Flippin are technically feasible for reducing the NH_3-N discharge from the Henry Plant to meet the Board's effluent standard. Ag. Br. at 10-11, *citing* 1/14/20 Tr. at 194. The Agency further argues that Emerald has not demonstrated that "there is no possible way [that is] economically reasonable" to implement the best degree of treatment alternatives. Ag. Br. at 17.

Technical Feasibility

Emerald's Position. Emerald's counsel admitted, "Emerald and its predecessors have always acknowledged that there are treatment alternatives that are technically feasible." 2/4/20 Tr. 138-139. The technically feasible alternatives that have the potential to achieve the regulatory limits include: GAC, tertiary nitrification, breakpoint chlorination, and ion exchange. PHX 11 at 2, PHX 12 at 8-9.

Of these, Emerald notes that breakpoint chlorination poses potential environmental concerns due to the formation of chlorinated organics. Pet. Br. at 41, *citing* 1/14/20 Tr. at 149. Also, ion exchange would increase the toxicity of Emerald's effluent due to the addition of salts. *Id.* at 38, *citing* 2/4/20 Tr. at 50.

Additionally, Mr. Flippin indicated that ozonation, alkaline stripping and spray irrigation (land application) are technically feasible to reduce NH_3-N discharges, but may not achieve compliance with regulatory limits. PHX 12 at 6, 7 and 10. While alkaline stripping comes close to achieving the regulatory limit with 95% reduction, the Mr. Flippin notes that ozonation has demonstrated reduction of only 55%. *Id*. Like ion exchange, both alkaline stripping and

ozonation suffer from salt addition. *Id*. Also, with spray irrigation an average flow of 160,000 gpd (30 percent of the average final effluent flow) may be treated over a 9-month period when the ground is thawed. PHX 12 at 10-11. Further, because spray irrigation requires 360,000 gpd of clarified river water for dilution to lower salt content, it is feasible only if Emerald is granted a permit to withdraw river water, as well as discharge solids from the river water clarifier back to the river. *Id.* Finally, Emerald contends that river dilution of primary clarifier effluent is technically infeasible because the required dilution of 90% might not be sustainable at full-scale due to fluctuations in MBT levels and the need to maintain reactor temperature levels. PHX 11 at 3-4 and Pet. Br. at 41.

Agency's Position. As noted above, the Agency asserts that all six tertiary treatment alternatives evaluated by Mr. Flippin are technically feasible for reducing NH_3-N discharge from the Henry Plant to meet the Board's effluent standard. Ag. Br. at 10, *citing* 1/14/20 Tr. at 194. Additionally, the Agency states that GAC could be used as a treatment to aid in removing nitrification inhibition and river dilution could be employed seasonally to reduce ammonia discharge. Ag. Br. at 10-11. Further, the Agency contends that sodium peroxidase, hydrogen peroxide treatments, or any combinations thereof would also provide feasible and reasonable treatment alternatives. Ag. Res. Br. at 11. The Agency maintains that Emerald's focus on internal process improvement, initiated in 2018, ignores the full consideration of the above approaches, or combinations thereof, to meet the NH_3-N effluent standard. *Id*. at 9. The Agency states that the "plethora of options available to Petitioner are staggering." *Id*. at 11. Although Illinois EPA will not design the Henry Plant for Petitioner, Illinois EPA prefers some form of tertiary nitrification (e.g. refurbished existing biotreaters, a baffled system, a new tank, a baffled rectangular tank, a rotating biological contactor) as a technically feasible and economically reasonable treatment for Petitioner." Ag. Res. Br. at 11.

Discussion and Findings. As noted above, the evidence presented by Emerald indicates that several treatment alternatives evaluated in this proceeding are technically feasible to reduce the NH_3-N discharge from the Henry Plant's WTP.[12] Emerald's counsel admitted, "Emerald and its predecessors have always acknowledged that there are treatment alternatives that are technically feasible." 2/4/20 Tr. 138-139. Thus, the question is not whether there are technically feasible treatment alternatives for the Henry Plant. Rather, the question is which of the treatment alternatives would be most effective. The efficacy of the various treatment alternatives evaluated in this proceeding are summarized in Table 1.

[12] The Board recognizes that Emerald has raised certain environmental concerns associated with some of the alternative technologies. These issues will be addressed under the environmental impact section of this opinion.

Table 1

Treatment Alternative	Achieve Regulatory Limits?	Average NH_3-N Removal (lbs/ day)	Percent NH_3-N Removal
AS 13-2 Condition 2(e) Alternatives (PHX 11) **Pretreatment to Reduce Nitrification Inhibition**			
Granulated Activated Carbon (GAC)	Yes	-	-
River Water Dilution	No	-	-
Flippin Report Alternatives (PHX 12) **Tertiary Treatment to Reduce NH_3-N**			
Ozonation	No	188	55
Alkaline Stripping	No	324	95
Tertiary Nitrification	Yes	331	97
Breakpoint Chlorination	Yes	331	97
Ion Exchange	Yes	331	97
Land Application/ Spray Irrigation	No	77	23

Among the pretreatment alternatives, the Board finds the use of GAC to remove the nitrification inhibitor from Emerald's effluent (PC Tank and C-18 Tank) is technically feasible.[13]

Regarding end of pipe tertiary treatment to reduce NH_3-N in the secondary clarifier effluent, the Board finds tertiary nitrification, breakpoint chlorination and ion exchange to be technically feasible for achieving the NH_3-N regulatory limits. Additionally, the Board finds alkaline stripping to be technically feasible alternative that achieves significant reduction of NH_3-N discharge (95%) even though it may not meet the NH_3-N limits.

The Board finds ozonation and spray irrigation to be technically feasible options if they are used in combination with another alternative due to their lower NH_3-N removal efficiencies.

The Board agrees with Emerald that the river water dilution of primary clarifier effluent is not a technically feasible option due to concerns about the large volume of dilution water required, fluctuations in MBT levels, and the need to maintain reactor temperature levels.

In sum, the Board finds that several alternatives evaluated by Emerald are technically feasible to reduce NH_3-N discharge from the Henry Plant's WTP into the Illinois River. Further, the Board agrees with the Agency that other technologies not considered by Emerald may also be

[13] As noted by Emerald, GAC treatment would allow single-stage nitrification of the combined wastewater from Emerald and Mexichem in the existing secondary bioreactor to achieve the NH_3-N limit.

technically feasible to reduce NH_3-N discharge from the Henry Plant's WTP. However, the information in the record is not adequate for the Board to make a finding if one or more of the options mentioned by the Agency would also be technically feasible for implementation at the Henry Plant without further evaluation.

Economic Reasonableness

The economic reasonableness of the treatment alternatives has been the primary factor for Emerald and its predecessors for seeking relief from the Board's NH_3-N effluent limits. *See* AS 02-5 and AS 13-2. As in previous dockets, Emerald argues that none of the alternatives evaluated in this proceeding are both technically feasible and economically reasonable. Pet. Bf. at 3. The Agency, on the other hand, argues that economic reasonableness by itself is not a factor in the required level of justification to obtain an adjusted standard under Section 28.1(c) of the Act. Ag. Br. at 17. The Agency asserts that Emerald must demonstrate that "there is no possible way [that is] economically reasonable" to implement the best degree of treatment alternatives, or any combinations thereof. *Id*.

Emerald's Position. Emerald notes that Section 27 of the Act requires the Board to consider several factors, including technical feasibility and economic reasonableness of reducing a particular type of pollution. Pet. Br. at 29, *citing* 415 ILCS 27(a). Emerald contends that while it has addressed each of the Section 27 factors, the hearings in this proceeding dealt mainly with issues concerning technical feasibility and economic reasonableness of the treatment alternatives. As noted above, while admitting that several alternative technologies are technically feasible, Emerald asserts that none of the evaluated alternatives are economically reasonable.

Emerald states that the economic reasonableness factor is essentially a cost/benefit test that involves measuring the cost of implementing pollution control technology against the benefit to the public in reducing pollution. *Id.*, *citing* EPA v. Pollution Control Board, 308 Ill. App. 3d 741, 751 (2d Dist. 1999); Central Illinois Light Co. v. Pollution Control Board, 159 Ill. App. 3d 389, 394-95 (1987). Further, Emerald argues that economic reasonableness must be based on the cost of compliance with respect to the environmental impact and not an affected entity's ability to afford compliance. *Id*., *citing* In the Matter of: Proposed Site-Specific Rule Change for Reilly Chemical Corp., Granite City Facility: 35 Ill. Adm. Code 307.1102, R88-9, slip op. at 6 (Oct. 18, 1989). This approach, Emerald maintains, is consistent with USEPA's analysis of economic impact of regulatory requirements. *Id.* at 30, *citing* New Source Review Workshop Manual, DRAFT, p. B.31 (USEPA October 1990). Thus, Emerald argues that economic reasonableness must be evaluated by considering three factors:

- the estimated costs of ammonia treatment alternatives and the unit cost of NH_3-N reduction;
- the environmental benefits resulting from the projected NH_3-N reduction; and
- any negative impacts to the environment from implementing any of the treatment alternatives.

Id. at 30.

Based upon Mr. Flippin's evaluation of the eight treatment alternatives summarized above, including the treatment efficacy and cost estimates, Emerald asserts that all eight alternatives are economically unreasonable. Pet. Br. at 32 citing PHX 11 and 12. Mr. Flippin asserts that these are all economically unreasonable because of the high estimated capital and operating costs, minimal environmental benefit due to reduction of NH_3-N, and the negative side-effects associated with increased salt loading to the Illinois River. *Id*.

Agency's Position. The Agency argues that Emerald must demonstrate that "there is no possible way [that is] economically reasonable" to implement the best degree of treatment alternatives, or any combinations thereof. Ag. Br. at 17. The Agency raises several arguments concerning economic reasonableness of the treatment alternatives:

- Class 5 cost estimates are too imprecise;
- the fair market value of a treatment alternative must be economically reasonable;
- Emerald never asked Mr. Flippin to evaluate how to reduce MBT;
- NACWA surcharge rates are not a proper yardstick for economic reasonableness, as total capital cost should be used over unit cost;
- Emerald has not demonstrated that the costs are substantially and significantly different than the costs of treatment the Board initially considered to promulgate the effluent limit; and
- Emerald should have considered alternate funding sources to finance alternative treatment options.

These arguments are summarized along with Emerald's responses in the following sections.

Imprecise cost estimates. The Agency contends that Emerald's consultant produced imprecise cost estimates by relying on AACE's Class 5 cost estimates when evaluating the costs of six end-of-pipe treatment options. Ag. Br. at 18, citing 1/14/20 Tr. at 138, 199. The Agency notes, "AACE describes a Class 5 cost estimate as a 'ratio ,' 'ballpark,' 'blue sky,' 'seat-of-pants,' 'ROM,' 'idea study,' 'prospect estimate,' 'concession license estimate,' 'guesstimate,' and 'rule-of-thumb.'" *Id., citing* 1/14/20 Tr. at 200, IEPA Ex. 17. Further, the Agency notes that a Class 5 cost estimate considers a design completion of approximately 0% to 2% of an entire design project and the accuracy of the Class 5 cost estimate is typically a range of minus 50% to plus 100%. *Id., citing* 1/14/20 Tr. at 138, 180, IEPA Ex. 17.

The Agency contends a Class 5 estimate is the least accurate of all the classes of AACE cost estimates. *Id*. at 18. Thus, many organizations and companies have determined that Class 5 estimates cannot be classified in a conventional and systemic manner. *Id., citing* 1/14/20 Tr. at 179, 195, IEPA Ex. 17 and Ex. 12. The Agency notes that POTWs seeking loans from the State's Revolving Loan Program start by submitting a loan application, which includes a Class 3 cost estimate for the project. *Id.* at 29. This estimate would be revised to Class 1 prior to bidding. *Id*. at 29. While Mr. Flippin provided his best guesstimate on the potential costs of the six end-of-pipe treatment alternatives, the Agency argues that those cost estimates do not adequately prove that the alternatives are economically unreasonable because of the imprecise nature of the Class 5 estimates. *Id*. at 19.

Emerald argues that Flippin's Class 5 cost estimates are precise. Pet. Br. at 17. Emerald contends that Mr. Flippin's clients rely on his estimates prepared in a similar manner to Emerald's estimates that have proven accurate within 10%. *Id., citing* 1/14/20 Tr. at 217. Further, Mr. Flippin's cost estimates are similar to the estimates he prepared for AS 13-2 that the Agency did not object to, and the Board "found acceptable to conclude that none of the alternatives was [*sic*] economically reasonable." *Id.* 18, *citing* AS 13-2, Opinion at 56.

Fair market value. The Agency argues that the fair market value must be economically reasonable because the treatment alternatives evaluated in this proceeding for NH_3-N removal are all extremely common technologies. Ag. Br. at 19. Further, the Agency contends that it has adopted design criteria for most of the alternatives in the 1990s. *Id., citing* 35 Ill. Adm. Code 370. Even if Emerald's cost estimates are considered accurate, the Agency maintains that Emerald "failed to provide the Board with evidence on why the fair market value of these six proposed end-of-pipe solutions are not economically reasonable." *Id.* The Agency contends that Emerald's argument that NH_3-N removal is economically unreasonable goes against the Board's conclusions in promulgating the NH_3-N effluent standard. *Id*.

Emerald responds that there is no evidence in the record to support the Agency's assertion that the Board must consider fair market value of the treatment alternatives. Pet. res. Br. at 19. Emerald asserts that only single-stage nitrification is commonly used in Illinois. *Id*. Additionally, the Agency has not established design standards under Part 370 for breakpoint chlorination, ozonation, ion exchange and tertiary nitrification. *Id., citing* 2/3/20 Tr. at 27-29. Even if the alternatives were common, Emerald argues that it is not clear what the Agency means when it asks why the fair market value of the alternatives are not economically reasonable. *Id.*

Emerald's consultant. The Agency states that Emerald's consultant, Mr. Flippin, did what he was asked to do, which was "to look at six end-of-pipe, one-size-fits-all solutions (i.e. not any small-scale combination of treatment alternatives that would cumulatively result in compliance) and conclude they are too expensive." Ag. Br. at 20, *citing* 1/14/20 Tr. at 188-189. The Agency contends that Emerald never asked Mr. Flippin to evaluate how to reduce MBT in the BBTS process, MBDS process, OBTS process, or MBT process. *Id., citing* 2/4/20 Tr. at 60-61. Further, the Agency notes that although Mr. Flippin testified that "some people" may consider parts of the cost estimates as Class 4, Mr. Flippin's scope of work, as well as his October 2019 report, clearly describes his cost estimates as Class 5 estimates. *Id.* 20-21, c*iting* 1/14/20 Tr. at 137, 177-178, IEPA Exh. 13B.

Emerald states that it "is investigating ways to further reduce levels of MBT, TKN and ammonia precursors in the Henry Plant wastewater," and reiterates Mr. Flippin's experience, but does not otherwise address the Agency's contention that Emerald never asked Mr. Flippin to evaluate how to reduce MBT in the BBTS process, MBDS process, OBTS process, or MBT process. Pet. Res. Br. at 22.

NACWA surcharge rates. The Agency argues that Mr. Flippin improperly used the NACWA surcharge rates for NH_3-N removal as a cost comparison yardstick for economic reasonableness. Ag. Br. at 21. The Agency notes that these NACWA surcharge rates represent the increment on top of the rates of regular domestic sewage. Further, the Agency notes that

Emerald did not provide information as to whether the POTWs reporting the surcharge "received grants or loans to fund parts of the industrial ammonia reduction projects and to what degree the POTW's payments towards those projects (i.e. the persons within the POTW's service area) contributed to and/or offset the overall project costs thereby reducing the surcharge rates on the industrial NACWA member." *Id.* at 22, *citing* 1/14/20 Tr. at 207. Thus, the surcharge rate fails to account for the cost of regular-strength domestic sewage treatment to the underlying domestic populations. *Id.* at 22.

Emerald argues that it is appropriate to use the NACWA surcharge for determining the economic reasonableness of treatment alternatives. The surcharge, Emerald notes, represents an estimate of the costs for treating each extra pound of NH_3-N over and above the base load of NH_3-N. Pet. Res. Br. at 16, *citing* 1/14/20 Tr. at 142. Emerald notes that the treatment alternatives would impose costs beyond primary and secondary treatment, so the costs are directly comparable to the NACWA surcharge rates. *Id*. at 16.

The Agency notes that the NACWA surcharge rates only account for one year. Ag. Br. at 21, *citing* 1/14/20 Tr. at 206. The rates fail to show whether any future fluctuations "similar to the 2%-3% increases POTWs will enact over the length of a loan from Illinois EPA's State Revolving Loan Program." *Id.* at 22, *citing* 1/14/20 Tr. at 284-85. The Agency also questions Emerald's use of the median NACWA surcharge rate in terms of dollar per pound of NH_3-N removed instead of the average or maximum rates. *Id.* Regarding the use of median surcharge, Emerald notes that the difference between the average cost of $1.60 and the median of $1.50 per pound NH_3-N removed is not materially different. Pet. Res. Br. at 16, *citing* 1/14/20 Tr. at 142.

Further, the Agency argues that "the highest NACWA surcharge figure of $5.03 per pound must also, at a bare minimum, be economically reasonable" because Emerald did not provide a ceiling cost in dollars per pound of ammonia removed that would be economically unreasonable. Ag. Br. at 23*, citing* 1/14/20 Tr. at 142, 204, IEPA Ex. 16. Emerald asserts that there is no precedent "that the Board has *ever* required a petitioner to prove the precise dividing line between what cost is reasonable and what cost is not." Pet. Res. Br. at 19. Emerald notes that instead of creating a bright line rule, "the Board merely declares that the alternatives are economically reasonable or not." *Id., citing* In the Matter of: Proposed Site-Specific Rule Change for Reilly Chemical Corp., Granite City Facility: 35 Ill. Adm. Code 307.1102, R88-9, slip op. at 8 (Oct. 18, 1989). Emerald notes that the highest surcharge figure of $5.03 is not reliable because the methodology of its calculation is uncertain, and it was about three times higher than the *highest* reported TKN surcharge. *Id., citing* 1/14/20 Tr. at 142-144.

Total capital cost versus unit cost. The Agency asserts that Emerald's use of dollar per pound estimates to determine economic reasonableness for industrial wastewater treatment is problematic. The Agency argues that economic reasonableness must be based on the total cost and not cost per pound. Ag. Br. at 23-24, *citing* 1/15/20 Tr. at 193-194, 2/3/20 Tr. at 247-248. The Agency states that Emerald's estimated capital costs are comparable or lower than the capital costs expended by Illinois POTWs for projects involving treatment of NH_3-N. *Id.* at 28-29, *citing* IEPA Ex. 1.

Emerald rejects the Agency's position. Emerald argues that the Agency's position has nothing to do with Emerald's request. Pet Res. Br. at 14. Emerald maintains that the total cost approach where capital costs of alternatives are compared with the capital costs of POTWs has no meaning when evaluating NH_3-N reduction if most of those POTWs costs being incurred are to reduce pollutants other than NH_3-N. *Id., citing* 2/4/20 Tr. at 44-47. In contrast, Emerald contends that unit cost represents the very nature of a cost/benefit analysis and not considering unit cost would be contrary to law. *Id., citing EPA*, 308 Ill. App. 3d at 751.

Further, Emerald argues that the Agency's preference for the use of total capital costs rather than the present worth costs is contrary to the evidence in the record. Pet. Res. Br. at 15. Emerald notes that the Agency acknowledged that both capital costs and operating costs should be considered when determining economic reasonableness. *Id., citing* 1/15/20 Tr. 79-80. In this regard, the present worth cost represents "how much money would be needed today to fund *both capital costs and annual operating costs*." *Id., citing* 1/14/20 Tr. at 140.

How to evaluate economic reasonableness. As an initial matter, the Agency states that the cost of treatment becomes a factor in an adjusted standard only if Emerald is able to demonstrate that costs are substantially and significantly different than the costs of treatment that the Board initially considered when promulgating the NH_3-N effluent limit. Ag. Br. at 24. In this regard, the Agency contends that Emerald has not presented any "evidence that the cost of treating its toxic effluent, or common influent from Mexichem, for ammonia nitrogen is higher than the costs expended by a statistically significant sample of Illinois POTWs or, and more relevantly, other industrial dischargers." *Id.* at 24.

In response, Emerald maintains that a comparison of the capital cost estimates of the treatment alternatives with the POTWs' capital costs would not be meaningful because POTWs' capital costs included many elements unrelated to ammonia control. Pet. Res. Br. at 15. Emerald argues that tertiary nitrification represents an increase in unit cost above single stage nitrification because its only purpose is to remove NH_3-N. Pet. Res. Br. at 17, *citing* 2/4/20 Tr. at 19. Also, Emerald notes that Mr. Flippin made a comparison of costs incurred at three other industrial projects on an oxygen equivalent basis in response to Board questions. *Id*. This comparison shows that the estimated treatment costs for Emerald's lowest cost alternative was 4.3 to 5.7 times higher than other industrial facilities incurred. *Id., citing* 3/6/20 Pet. Res. to Board Questions, Appendix E at 2-4.

While the term "economic reasonableness" is not defined in the Act or the Board's regulations, the Agency notes that the Board has applied an economic reasonableness standard in a variety of cases by determining whether the implementation of a particular control technology or compliance with a rule is economically reasonable under the Board's mandate to take economic reasonableness "into account" under Section 27(a) of the Act. Ag. Bf. at 24-25. The Agency contends that although the Board has relied on a cost per pound yardstick in certain cases involving air pollution, the Board has not limited itself to that yardstick to establish economic reasonableness of a technology. *Id.* at 26.

First, the Agency notes that the Second Appellate District of Illinois has stated that the Board should consider any "non-speculative, tangible benefits of installing the subject

technology." *Id.* at 26, *citing* EPA v. PCB, 308 Ill. App. 3d 741, 751 (2d Dist. 1999). Emerald responds by noting that the Agency's suggestion to consider non-speculative benefits of NH_3-N treatment does not explain the benefits of such treatment. Pet. Res. Br. at 8. Here, Emerald argues that the ammonia discharge "is not causing environmental harm, but additional treatment risks detriments from increased salt loading." *Id*.

Next, the Agency notes that the compliance costs and the environmental harm addressed by the control technology must be evaluated in the context of "other operating costs and other environmental problems addressed by existing operations." Ag. Bf. at 26, *citing* Central Ill. Light Co. v. PCB, 159 Ill. App. 3d 389 (3d Dist. 1987) (CILCO). In this regard, Emerald argues that the Agency's position is not supported by CILCO. Pet. Res. Br. at 9, *citing* CILCO, 159 Ill. App. 3d at 389. Emerald argues that Mr. Flippin's evaluation is consistent with CILCO's holding that "the compliance costs for the petitioner need to be compared to compliance costs for others and to 'how serious [the environmental] problem is in comparison to other environmental problems.'" *Id., citing* CILCO, 159 Ill. App. 3d at 394-95. Emerald further reiterates its position that economic reasonableness is essentially "a cost/benefit analysis that has involved measuring the cost of implementing pollution control technology against the benefit to the public in reducing pollution." Pet. Res. Br. at 7, *citing* Env'l Protection Agency v. Pollution Control Board, 308 Ill. App. 3d 741, 751 (2d Dist. 1999) (hereafter, "EPA").

Additionally, the Agency asserts that the Board has considered the affordability or economic impact to be "an appropriate factor to consider in determining whether the implementation of a particular technology can be considered economically reasonable." *Id*., *citing* In the Matter of: Proposed Amendments to Clean Construction or Demolition Debris Fill Operations (CCDD): Proposed Amendments to 35 Ill. Adm. Code 1100, R12-9, February 2, 2012, *affirmed* County of Will v. Pollution Control Bd., 2019 IL 122798 (Ill. Sup. Ct. 2019).

Emerald contends that the Agency's assertions regarding consideration of "affordability" in adopting the clean construction and demolition debris ("CCDD") regulations is untrue. Pet. Res. Br. at 9. Emerald states that the Supreme Court's decision that the Board's balancing of groundwater monitoring costs versus environmental benefits was not arbitrary and capricious did not make "any reference to the financial statements or financial condition of any particular company and whether or not any company could afford to monitor groundwater." *Id.* at 9-10, *citing* County of Will v. Pollution Control Board, 2019 IL 122798, ¶¶ 59-61 (2019). Additionally, Emerald argues that an individual company's ability to afford a treatment alternative should not be a factor to determine economic reasonableness because the Agency did not provide a rational approach to evaluate "affordability," and it could create an uneven playing field between different regulated entities. *Id.* at 10.

Lastly, the Agency contends that adequate investigation of whether alternative methods of partial compliance "may be a factor in the overall assessment of economic reasonableness." *Id*., *citing* In The Matter Of' The Petition Of The City of Havana For A Site-Specific Rule-Making Rule Change To The Combined Sewer Overflow Regulations, R88-25 (February 22, 1990). Emerald responds that Mr. Flippin evaluated alternatives that achieve partial compliance like ozonation, alkaline stripping and spray irrigation. Pet. Res. Br. at 7.

Funding from other sources. The Agency asserts that instead of relying on cost estimates reported by NACWA, Emerald could have considered alternative funding sources to finance NH_3-N treatment, including Emerald's parent company,[14] Mexichem, or a long-term loan. Ag. Bf. at 28.

First, the Agency states that Emerald could get funding from its parent company to pay for the treatment costs. Ag. Br. at 27. The parent company "serves as a "pooled cash" hub for four subordinate entities, including Emerald. *Id.* The Agency argues that Emerald's Parent would pay for the technically feasible treatment alternatives if compelled by the Board. *Id.* at 27-28, *citing* IEPA Ex. 10 at 14-15. Further, the Agency maintains that "[a]ny liability which may ultimately be incurred with respect to this case will not have a material effect on the combined financial position or operations of Petitioner." *Id.* at 28, *citing* IEPA Ex. 11A Note L, IEPA Ex. 11B Note J, IEPA Ex. 11C Note J. The Agency contends that if Emerald sought an interest free loan from its parent company and the dollar per pound analysis is spread over a span of 20-year loan, every alternative would be affordable. *Id.* at 23.

Even though Emerald's parent company pays all the bills at the Henry Plant, the Agency asserts that Emerald "has never submitted a capital improvement proposal, aimed at fixing the ammonia issues at the Henry Plant, to Petitioner's Parent for consideration." *Id.* at 28, *citing* IEPA Ex. 10 at 40. Emerald responds that getting funding from the parent would still incur the opportunity cost of not employing capital elsewhere that must be accounted in the cost of ammonia treatment. Pet. Res. Br. at 18

Second, the Agency argues that Emerald should consider additional funding from Mexichem to offset large capital improvement costs because Emerald treats Mexichem's waste stream. Ag. Br. at 28, *citing* 1/14/20 Tr. at 66, 201. In response, Emerald states that the "question is not who pays how much of the cost. The question is whether the total cost of pollution reduction to all who may contribute is unreasonable in light of the benefits." Pet. res. Br. at 19, *citing EPA*, 308 Ill. App. 3d at 751.

Finally, the Agency states that Emerald could rely on loans for funding, noting that many POTWs obtain low-interest 20-year loans from the State's Revolving Loan Program. Ag. Bf. at 29. Emerald argues that the Agency's assertions regarding "the use of private loans or interest-free loans make no sense" because use of such funding assumes "that economic reasonableness only considers the cost to Emerald." Pet. Res. Br. at 18. Regarding the use of a longer financing period of 20 years, Emerald notes that Mr. Flippin "estimated costs by evaluating the capital costs and operating costs over a 10- year or 20-year horizon." *Id., citing* PHX 12, 11 (Table 2 note b); 3/6/20 Emerald Res. Board Questions, Appendix E, 4 (Table 4, note).

Discussion and Finding. As noted above, the economic reasonableness of the treatment alternatives was a major consideration in granting the previous adjusted standards for NH_3-N discharge from the Henry Plant. In the previous adjusted standards, the Board has relied on the

[14] At the time of briefing, Emerald's parent company was owned by an investment firm, American Securities, that owns a portfolio of $10 to $14 billion in revenues. Ag. Br. at 27, *citing* IEPA Ex. 10 at 9-10.

comparison of the present worth cost estimates for the treatment alternatives for the Henry Plant with the cost of implementing single-stage nitrification to evaluate the economic reasonableness. The present worth cost estimates for the eight alternatives evaluated in the instant proceeding are summarized in Table 2, below.

Table 2

Treatment Alternative	**Capital Cost $ million**	**Annual O&M Cost $ million**	**Present Worth (Cap+O&M) $/lb NH_3-N Removed**	**Present Worth (Cap+O&M) $/lb NH_3-N Removed**
AS 13-2 Condition 2(e) Alternatives (PHX 11)				**From AS 13-2**
Granulated Activated Carbon (GAC)	5.3	4.2 (Virgin carbon) 3.1 (Regenerated carbon)	14	
River Water Dilution	23	4.4	28	
Flippin Report Alternatives (PHX 12)				
Ozonation	22	9.6	44	18.89
Alkaline Stripping	7.3	1.4	16	20.47
Tertiary Nitrification	10	0.74	14	
Breakpoint Chlorination	4.1	2.5	20	12.48
Ion Exchange	6	1.0	12	6.62
Land Application	6	0.39	33	

The present worth costs per pound of NH_3-N removed reported by Mr. Flippin ranges from $12 for ion exchange to $44 for ozonation. He compared the above present worth cost estimates with the 2017 NACWA median unit cost of $1.53/lb of NH_3-N removed at 12 POTWs. PHX 12 at 1-2. Thus, the cost of NH_3-N treatment at the Henry Plant would range from 8 to 28 times the cost of NH_3-N removal at POTWs. Mr. Flippin notes that while the NACWA cost includes annual operation and maintenance, they do not include capitalized present work costs. *Id.* at 2. So, this cost difference may be somewhat inflated. However, Mr. Flippin asserts that the capital cost is properly excluded because at POTWs "the same pieces of equipment contribute to treatment of all four components (flow, BOD, TSS and NH_3-N). In the Emerald plant, the costs described herein are focused entirely on NH_3-N removal, and therefore, delineation of capitalized present worth costs are straightforward." *Id.* Finally, Emerald states that the above cost estimates are similar to the estimates prepared for AS 13-2, which the Board "found acceptable to conclude that none of the alternatives was [*sic*] economically reasonable". Pet. Res. Br. at 18 citing AS 13-2, Opinion at 56.

While the Board recognizes that the comparison of the present worth costs with the POTWs' unit costs of NH_3-N removal was considered in AS 13-2 for evaluating economic reasonableness, such a comparison may not be appropriate in light of the new information

presented in the instant proceeding. *See* City of Chicago v. People of Cook County, 133 Ill.App.3d 435, 440-41, 478 N.E.2d 1369, 1373-74 (1st Dist. 1985) ("administrative agencies . . . [are] free to change [their] standards so long as such changes are not arbitrary and capricious."). As noted by the Agency, other industrial dischargers have employed tertiary treatment to comply with the NH_3-N limits. Further, all six end-of-pipe alternatives evaluated by Mr. Flippin involve tertiary treatment. Thus, Emerald's comparison of the cost of tertiary treatment alternatives with the cost of secondary single-stage nitrification at POTWs is inappropriate. As argued by the Agency, a more valid comparison of Emerald's costs would be with the costs of other industrial facilities.

In this regard, the Board asked Emerald to provide cost estimates for NH_3-N removal at other industrial facilities. 1/14/20 Tr. 227. Emerald submitted treatment costs incurred by a food production facility and two diary facilities, noting that Emerald's lowest cost alternative is 4.3 to 5.7 times higher than the cost of the other industrial facilities. 3/6/20 Pet. Res. Board Questions, Appendix E Tables 2 and 3. The ExxonMobil and Citgo refineries implemented tertiary nitrification to achieve the NH_3-N limit, indicating tertiary treatment for NH_3-N removal is economically reasonable for facilities unable to achieve single-stage nitrification.[15] For these reasons, the Board finds that there are economically reasonable treatment alternatives to meet the 3 ml/L NH_3-N standard.

Section 28.1(c)(2) Finding

The Board finds that Emerald has not met its burden of demonstrating that substantially and significantly different factors from those considered by the Board in promulgating Section 301.345 of the Board's water pollution regulations justify an adjusted standard. The above analyses show that alternative treatment options to meet the 3 ml/L NH_3-N standard are technically feasible and economically reasonable.

Impact on the Environment or Health (415 ILCS 5/28.1(c)(3)

Emerald's Position

Emerald asserts that granting the adjusted standard will not result in any adverse environmental impact. Pet. at 28. Emerald notes that the primary reason for the Board's NH_3-N limitations under 35 Ill. Adm. Code 304.122 was because of "the belief that larger municipal POTW dischargers were contributing to low DO levels (sags) in the Illinois River." *Id.* This belief, Emerald contends, was later refuted when it was discovered that the DO sags were occurring because of sediment oxygen demand and not due to large POTW discharges. *Id*., *citing* Ex. 1, 40-41, Pet. Br. at 24. Emerald asserts that the Illinois River is currently not listed as impaired for DO (or ammonia) and the Henry Plant discharge does not have a quantifiable impact on the DO in the Illinois River. Pet. at 28 and Pet Br. at 24-25.

[15] The record does not include the treatment costs of these facilities.

Additionally, Emerald notes that the quarterly NH_3-N monitoring in the Illinois River from 2007 through 2015 shows compliance with both the acute and chronic NH_3-N water quality standards at the edge of the approved ZID and mixing zones. *Id.* Further, Emerald contends that the results of the WET testing conducted in 2011, 2012 and 2017 show that the Henry Plant's discharge is acceptable under the NPDES permit threshold, which considers an acute LC_{50}[16] greater than 2.1% to be acceptable. In this regard, Emerald notes that test results estimate LC_{50} values for the test organisms (*pimephales promelas*, fathead minnow, and *ceriodaphnia dubia*, water flea) ranging from 3.78% to 31.86%. *Id.* at 29 *citing* Ex. 7.

Finally, Emerald asserts that most of the end-of-pipe NH_3-N treatment alternatives evaluated would increase salt in Emerald's discharge that is more persistent in the environment and can add to toxicity. Pet. Br. at 24. Thus, Emerald maintains, "[all] the new evidence subsequent to the issuance of the adjusted standard in AS 13-2 confirms that no adverse environmental impact, including harm to aquatic life, will result from the granting of the requested adjusted standard." *Id.* at 25.

Agency's Position

The Agency disagrees with Emerald's conclusions on environmental impact. The Agency voices concerns about the WET of the Henry Plant's effluent noting the likely aquatic life toxicity of substances other than NH_3-N. Rec. at 23. Here, the Agency refers to substances identified by Emerald that inhibit nitrification that may pose a threat to aquatic life. While the results of a 2017 WET test show an acceptable LC_{50} result of 3.87% with mixing, the Agency notes this level of LC_{50} value, is presently not found at any facility in Illinois. Ag. Br. at 31. The Agency also argues that a mixing zone should not be allowed for the Henry Plant because Emerald is not providing the best degree of treatment. Rec. at 24. Further, the Agency notes that Emerald has presented several treatment alternatives capable of achieving significant reduction of NH_3-N. Regarding Emerald's contention of negative impact of salt loading associated with the treatment alternatives, the Agency notes that Emerald declined to have Mr. Flippin evaluate such impacts. Ag. Br. at 32. Thus, the Agency requests that the Board require Emerald to implement NH_3-N reductions rather than granting the relief requested by Petitioner.

Discussion

Emerald has neither shown that granting the adjusted standard would not have adverse environmental consequences, nor provided any quantifiable adverse environmental impacts of installing tertiary treatment alternatives. Pet. resp. Br. at 2-3.

As in AS 13-2, Emerald asserts that the Henry Plant complies with the ammonia water quality standards at the edge of the mixing zone established in the facility's NPDES permit. Emerald notes that the multi-port diffuser continues to achieve the effluent dispersion necessary to meet both the acute and chronic water quality standards at the edge of the ZID and mixing zone. Pet. at 29, 32. The Board notes that the quarterly water quality monitoring results from

[16] "LC_{50}" is the lethal concentration level sufficient to kill 50% of the test organisms.

2007 to 2015 support Emerald's assertions regarding compliance with the NH_3-N water quality standards in the Illinois River. Pet. 28, Exh. 5.

However, the Board notes that the provision of the mixing zone and ZID for the Henry Plant discharge is contingent upon Emerald providing BDT. *See* 35 Ill. Adm. Code 302.102. Without a mixing zone or ZID, Henry Plant's discharge under the proposed adjusted standard would most likely contribute to an exceedance of the NH_3-N aquatic life water quality standards. *See* 35 Ill. Adm. Code 302.210. The Section 28.1(c)(3) arguments of both Emerald and the Agency hinge on whether Emerald is providing BDT and may use a mixing zone to determine water quality. So, we must address the BDT issue.

Best Degree of Treatment (BDT)

The Board has explained the relationship between BDT and mixing zone provisions under the Board rules in the previous adjusted standards granted to the owners of the Henry Plant. *See* Noveon, slip op at 19-20 (Nov. 4, 2004); EPM, slip op at 55 (Apr. 16, 2015). Essentially, 35 Ill. Adm. Code 302.102(g) and (h) allow a discharger to use mixing as a means of compliance with the Board's water quality standards if a mixing zone is defined in the NPDES permit. Further, Section 302.102(a) states that a mixing zone is available only where the discharger has made every effort to comply with Section 304.102, which requires all dischargers to provide BDT. 35 Ill. Adm. Code 304.102(a). Finally, Section 304.102(a) specifies that BDT must be consistent with technological feasibility, economic reasonableness and sound engineering judgment. *Id*. Given this overlap of relevant factors, BDT is addressed concurrently with the technological feasibility and economic reasonableness analysis for Section 28.1(c)(3) of the Act. 415 ILCS 5/28.1(c)(3).

In AS 13-2, considering technological feasibility, economic reasonableness and sound engineering judgment in accordance the provisions of Sections 304.102(a) and 302.102(a), the Board found that Emerald's multi-faceted approach, plus the conditions of the adjusted standard, provided the BDT at the Henry Plant. EPM, slip op at 55 (Apr. 16, 2015). In this proceeding, Emerald maintains that it is providing BDT at the Henry Plant, while the Agency argues that Emerald is not.

Emerald's Argument. Emerald asserts that the record "overwhelmingly demonstrates that Emerald still applies the best degree of treatment." Pet. Br. at 50. Even though the Henry Plant does not achieve nitrification to remove NH_3-N, Emerald notes the plant is designed and operated in a manner compatible with 35 Ill. Adm. Code 370.920, 370.1210 and the Ten State Standards to grow ammonia-degrading bacteria in order to nitrify ammonia. *Id.* at 48-49. Thus, Emerald argues that the WTP provides the form of treatment the Board considered in adopting the rule of general applicability for industrial facilities in R71-2. *Id.* at 48. However, Emerald argues that the main reason the plant does not achieve nitrification is due to the presence of MBT, which inhibits nitrifying bacteria. *Id.* at 49.

Emerald states that it has evaluated and implemented several process changes and waste reduction measures over the years. *Id*. at 13. These changes have reduced TKN from 494 to 227

lbs/day, and NH_3-N from 62 to 2 lbs/day in Emerald's PC tank between 2002 and 2019. 3/6/20 Pet. Res. To Board Questions at 5, PHX 16.

However, Emerald admits that the source reduction efforts have not come close to complying with the 3 mg/L limit NH3-N standard, and it has not been able to correlate source reduction efforts with effluent ammonia concentrations. Thus, Emerald concludes that evidence in the present record demonstrates that "no treatment alternative is both technologically feasible and economically reasonable." *Id.* at 50. Thus, Emerald asserts that BDT is being provided at the Henry Plant.

Agency's Argument. The Agency argues that Emerald is not providing BDT at the Henry Plant. Ag. Br. at 31-32. The Agency maintains that the petitioner "has presented alternatives that achieve 100% or less ammonia reduction" and "has the tools available to eliminate ammonia nitrogen concentration in its toxic effluent but overtly fails to act." *Id.* at 32. Further, the Agency asserts that Emerald is not providing BDT by accepting NH_3-N laden wastewater from Mexichem at the front end and washing it through the plant into the Illinois River at the back end. Ag. Res. Br. at 7-8. In this regard, the Agency states that Emerald "must either pretreat the incoming stream or flip the off switch." *Id.* at 8. Further, the Agency notes that Emerald's "claim that the Henry Plant meets USEPA's Best Available Technology (BAT) Economically Available for Organic Chemical, Plastics, and Synthetic Fibers Industrial Category is not applicable because those regulations do not address NH_3-N." Ag. Res. Br. at 10.

Additionally, the Agency asserts that Emerald's secondary clarifier effluent is no different from any other industrial facility that has biological treatment because it no longer has nitrifying inhibition due to MBT. *Id.* In this regard, the Agency contends that Emerald's "toxic effluent could be compared to municipal wastewater after the secondary clarifier because Petitioner has no nitrifying inhibition." *Id*. Thus, the Agency argues that Emerald has multiple options including some types of tertiary nitrification that are technically feasible, and economically reasonable to remove excess NH_3-N from its effluent. *Id.* at 11. The Agency concludes, "[i]n contrast to previous proceedings, the record in the instant case establishes that there is no MBT in Petitioner's final effluent, nitrification of the final effluent is possible and requiring Petitioner to utilize treatment to comply with the regulatory standard is the same as requiring any other facility on the Illinois River to do the same." *Id.*

Discussion and Finding. As noted in the AS 13-2, the Board recognizes that the Henry Plant has achieved significant reductions of ammonia in its effluent over the last twenty years through a combination of strategies. EPM, slip op at 56 (Apr. 16, 2015). Emerald proposes conditions that require it to continue some of the measures (high-rate, multi-port diffuser and air pollution control equipment) required under AS 13-2, along with the implementation of a 4-year PIP. However, given the new information in the record and as addressed in the preceding section, the Board finds that Emerald has not met its burden of demonstrating the technological feasibility, economic reasonableness and sound engineering judgment of its current treatment. Thus, the Board finds that these measures do not represent the BDT for the Henry Plant.

Section 28.1(c)(3) Finding

The Board finds that Emerald has not demonstrated that it is providing BDT. So, Emerald may not rely on the mixing zone or ZID to argue that granting the adjusted standard will not result in any adverse environmental impact. Therefore, based on the record, the Board finds that Emerald has not met it burden of demonstrating that granting the adjusted standard will not result in any adverse environmental impact.

Consistent with Federal Law (415 ILCS 5/28.1(c)(4))

Emerald states, and the Agency does not contest, that the proposed adjusted standard would be consistent with federal law.[17] Emerald Bf. at 25. There is no federal counterpart to the Illinois effluent criterion for ammonia for the Illinois River. 35 Ill. Adm. Code 304.122(b). In addition, Emerald notes that the Board has found the two earlier adjusted standards were consistent with federal law. Therefore, the Board finds that the proposed adjusted standard would be consistent with federal law.

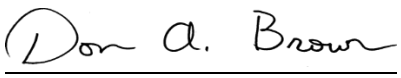
CONCLUSION

The Board has found that Emerald has failed to demonstrate that its proposed adjusted standard has satisfied factors 1-3 of Section 28.1(c) of the Act. Therefore, for the above reasons, the Board denies Emerald's request for an adjusted standard.

IT IS SO ORDERED.

Section 41(a) of the Environmental Protection Act provides that final Board orders may be appealed directly to the Illinois Appellate Court within 35 days after the Board serves the order. 415 ILCS 5/41(a) (2018); *See* also 35 Ill. Adm. Code 101.300(d)(2), 101.906, 102.706. Illinois Supreme Court Rule 335 establishes filing requirements that apply when the Illinois Appellate Court, by statute, directly reviews administrative orders. 172 Ill. 2d R. 335. The Board's procedural rules provide that motion for the Board to reconsider or modify its final orders may be filed with the Board within 35 days after the order is received. 35 Ill. Adm. Code 101.520; *See* also 35 Ill. Adm. Code 101.902, 102.700, 102.702.

I, Don A. Brown, Clerk of the Illinois Pollution Control Board, certify that the Board adopted the above opinion and order on July 8, 2021, by a vote of 4-0.



Don A. Brown, Clerk
Illinois Pollution Control Board

[17] The public comments of the Sierra Club allege that an adjusted standard that does not expire may be inconsistent with applicable federal law, but offered no analysis in support. Sierra Club Comment at 15