UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND - REGION I
5 POST OFFICE SQUARE – SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES PURSUANT TO THE CLEAN WATER ACT (CWA)

NPDES PERMIT NO.: **NH0001465**

PUBLIC COMMENT PERIOD: **April 18, 2014 – June 17, 2014**
June 17, 2014 – July 22, 2014

PUBLIC NOTICE NO.: **NH – 002 - 14**

NAME AND ADDRESS OF APPLICANT:

Public Service of New Hampshire (PSNH)
P.O. Box 330
Manchester, NH 03105-0330

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Merrimack Station
97 River Road
Bow, NH 03301

SIC CODE: **4911 - Electric Power Generation** NAICS Code(s): **221112**

RECEIVING WATER: **Merrimack River (Hydrologic Basin Code: 01070002)**

CLASSIFICATION: **Class B**

CURRENTLY EFFECTIVE PERMIT ISSUED: **June 25, 1992**

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1.0 Summary of Proposed Action

Proposed Action

Pursuant to 40 C.F.R. § 124.14, the Region 1 office of the United States Environmental Protection Agency (referred to either as Region 1 or the Region) is reopening the public comment period for certain provisions of the Draft National Pollutant Discharge Elimination System (NPDES) Permit that the Region issued to Public Service of New Hampshire's (referred to either as PSNH, the Permittee or the Company) Merrimack Station power plant (hereinafter as either Merrimack Station, the Station or the Facility) on September 30, 2011. Region 1 is re-opening the comment period because information, data and/or arguments submitted during the initial comment period, as well as information gathered by the Region during or since the initial comment period, appear to raise substantial new questions with regard to certain permit requirements. *See* 40 C.F.R. § 124.14(b). Furthermore, Region 1 is proposing to revise these particular permit requirements in response to this new information and has prepared a Revised Draft Permit so that the public may review and comment on the revisions. *See* 40 C.F.R. §§ 124.14(a)(2), (b) and (c).

The September 2011 Draft Permit included technology-based requirements limiting pollutant discharges from Merrimack Station's flue gas desulfurization (FGD) system based on Region 1's site-specific, Best Professional Judgment (BPJ) application of the Best Available Technology economically achievable (BAT) standard. *See* 33 U.S.C. § 1311(b)(2)(A); 40 C.F.R. § 125.3(a)(2)(iv) and (v), (c). Specifically, for the 2011 Draft Permit, Region 1 determined on a BPJ basis that the BAT for controlling FGD wastewater discharges at Merrimack Station was a particular combination of physical/chemical and biological treatment technologies. In light of new information obtained during or after the comment period, Region 1 is now revising this BPJ determination of the BAT, along with various permit requirements associated with it.

The particular provisions of the September 2011 Draft Permit now being reconsidered and revised are the effluent limits and reporting requirements for Outfall 003C at Part I.A.4 and for Outfall 003A at Part I.A.2. Region 1 has prepared a Revised Draft Permit and this Fact Sheet that includes certain changes to these provisions from the September 30, 2011, Draft Permit. In addition, the Region has compiled the administrative record associated with this action and is making it available for public review either on Region 1's website or in person at Region 1's offices in Boston, MA. The Agency is now seeking comment on the Revised Draft Permit provisions as well as on Region 1's analysis supporting the revisions.

Consistent with 40 C.F.R. §§ 124.14(a)(2) and (c), and as indicated above, Region 1 is re-noticing only certain provisions of the Draft Permit and is not seeking additional comment on the Draft Permit's other provisions. *See* 40 C.F.R. §§ 124.14(a)(2), (b) and (c). (The comment period on the 2011 Draft Permit extended five months, from September 30, 2011, to February 28, 2012.) Region 1 will, however, consider and respond to any significant comments on other provisions of the Draft Permit if the comments raise issues that are inextricable from issues raised by the Region's revised BPJ determination of the BAT for controlling FGD wastewater discharges and/or the Region's Revised Draft Permit requirements.

The September 2011 Draft Permit also included condition I.A.2, which sets water quality and technology-based effluent limits for pollutant discharges from the slag settling pond. The determination of several water quality-based permit requirements was based on the discharge of pollutants in FGD wastewater into the slag settling pond. Because condition I.A.2 was informed by the potential discharge of FGD wastewater into the slag settling pond, and this scenario would be altered by the revised BAT determination, Region 1 is also proposing to revise some aspects of that provision at this time. This is discussed in Section 5.2 of this Fact Sheet.

Region 1 is reopening the public comment period on certain revised provisions of Merrimack Station's Draft Permit under 40 C.F.R. §§ 124.14(a) and (b) and has determined that applying the procedures of 40 C.F.R. § 124.14(a) could expedite the decision-making process. The Region has decided that this is the case because numerous complex and conflicting comments have been submitted by a variety of interested persons about what technology or combination of technologies should be determined to be the BAT for controlling Merrimack Station's FGD wastewater discharges. Using the procedures of § 124.14(a) may expedite the decision-making process by applying procedures to ensure that interested persons submit information in a timely way and have an opportunity to review and respond to the submissions by other persons, if they wish to do so.

Under 40 C.F.R. § 124.14(a)(1), the following procedures will apply for the re-opened comment period:

> … all persons, including applicants, who believe [the revised conditions of the] … draft permit … [are] inappropriate … must submit all reasonably available factual grounds supporting their position, including all supporting material, by a date, not less than 60 days after public notice …, set by the Regional Administrator. Thereafter, any person may file a written response to the material filed by any other person, by a date, not less than twenty days after the date set for filing of the material, set by the Regional Administrator.

Id. **The first stage of the newly re-opened comment period will extend two months (60 days) from issuance date of the Revised Draft Permit.**

Region 1 currently deems this to be an adequate comment period based on the following considerations: (1) this is a re-opened comment period, so that interested persons have already had an ample opportunity to learn about the issues raised by the permit and submit comments during the original lengthy (five-month) comment period (i.e., commenters should not be "starting from scratch"); (2) only a specific, narrow portion of the Draft Permit is being revised at this time and new comments are limited to those related to these revisions (*see* 40 C.F.R. §§ 124.14(a)(2) and (c)); (3) only a specific, narrow aspect of the Region's BAT determination for controlling FGD wastewater discharges is being revised (the revised determination retains the same physical/chemical treatment components as part of the BAT, but replaces biological treatment with vapor compression evaporation (VCE) and crystallizer technology); and (4) interested persons already had one opportunity to comment on VCE technology because the Region discussed it as a possible BAT option in the Fact Sheet issued in support of the 2011 Draft Permit. Any person may ask that the 60-day comment period be extended, but a part of any such request will need to demonstrate why such an extension would be necessary (i.e., why the 60 days would not provide a reasonable opportunity to comply with the provisions of 40 C.F.R. § 124.14(a)(1)).

In addition, consistent with 40 C.F.R. § 124.14(a)(1), Region 1 will provide **an additional 35-day comment period – extending from the close of the first comment period described above – during which any interested person may file a written response to the material filed by any other person**. Although the regulations require a minimum period of 20 days for such responsive comments, Region 1 concluded that it would be reasonable to round that time period up to one full month (i.e., 30 days) and add five more days to allow the Region time to assemble the public comments and make them available on the Region's website at http://www.epa.gov/region1/npdes/merrimackstation/index.html. At the same time, Region 1 does not feel that any further time should be needed, given the limited scope of this particular comment period (i.e., interested persons are permitted to file comments that respond to submissions by other persons during the initial, already targeted comment period). As before, any request for an extension of time will need to demonstrate why this 35-day period does not provide a reasonable opportunity to provide comments and an extension is needed.

Relevant Background Information Regarding Merrimack Station's Draft Permit

The Outfall 003C requirements in the Draft Permit for Merrimack Station, issued on September 30, 2011 (hereinafter, 2011 Draft Permit), were imposed under CWA §§ 301(b)(1)(C), and 401(a)(1) and (d), and were developed using BPJ. *See* 33 U.S.C. § 1342(a)(1)(B); 40 C.F.R. § 125.3(c)(2). While the Region considered a variety of technological and operational alternatives as possible BAT options, Region 1 ultimately set limits for the FGD wastewater based on the use of the Station's "primary treatment system" for FGD wastewater plus an added biological treatment stage. *See* Attachment E of Region 1's September 2011 Fact Sheet, titled "Determination of Technology-Based Effluent Limits for the Flue Gas Desulfurization Wastewater at Merrimack Station in Bow, New Hampshire" (hereinafter, 2011 Fact Sheet, Attachment E).

Before issuing the 2011 Draft Permit, Region 1 learned that PSNH was considering installing VCE technology to enable it to run its wet FGD scrubber system without needing to discharge any wastewater to the Merrimack River. *See* 2011 Fact Sheet, Attachment E, p. 21. After the 2011 Draft Permit was issued, Region 1 learned that PSNH had, of its own accord, installed and begun operating an FGD secondary wastewater treatment system (SWWTS) consisting of a falling-film evaporator (or brine concentrator) and forced circulation crystallizers capable of operating as a zero liquid discharge (ZLD) system. PSNH completed installation and has been operating this system since June 2012. Richard Roy, PSNH and Patricia Scroggin, Burns & McDonnell, "The Thermal ZLD Experience for FGD Wastewater at PSNH's Merrimack Station" November 2013, International Water Conference (IWC) 13-47 (hereafter, Roy and Scroggin, 2013). Basically, "[e]vaporators and crystallizers operate by transferring latent heat from condensing steam across a tube surface to cause a liquid at its boiling temperature to partially vaporize." Shaw, William A., Benefits of evaporating FGD purge water, POWER Magazine, March 15, 2008 (hereinafter, Shaw, 2008). The SWWTS system at Merrimack Station results in condensed vapor or distillate streams and solid waste.

Having learned that Merrimack Station was operating a SWWTS system for treating FGD wastewater, Region 1 endeavored to obtain additional information about Merrimack Station's system and VCE systems generally. As part of this effort, on February 7, 2013, Region 1 sent PNSH an information request letter pursuant to CWA § 308. PSNH responded to Region 1 with a letter dated March 26, 2013 (hereinafter, March 2013 CWA § 308 Response), which is partially designated as confidential business information (CBI) by PSNH.

In Region 1's BPJ analysis for the September 2011 Draft Permit, Region 1 evaluated VCE and determined that:

> [i]t simply is not clear at the present time whether or not this technology is feasible for application at Merrimack Station. EPA is continuing to review information characterizing operational factors and pollutant removal efficacy for vapor compression evaporation and depending on the results of further evaluation of this technology, EPA could potentially find it to be part of the BAT for Merrimack Station for the final NPDES permit.

In an earlier report from October 2010, PSNH raised a number of questions and concerns about using VCE technology for treating FGD wastewater, but also noted that a number of plants had begun using VCE technology for that purpose. *See* 2011 Fact Sheet, Attachment E, pp. 20-21. Yet, at the time of the Draft Permit, Region 1 reported having received information that PSNH was considering the potential for using VCE at Merrimack Station, but that the company had not as of that time submitted a modified permit application proposing to use the technology.

After issuing the Draft Permit, Region 1 received a number of comments on the suitability of VCE for Merrimack Station during the public comment period. Region 1 has also gathered additional information in response to those comments. After considering all this material in connection with an evaluation of the BAT factors specified in the statute and regulations, *see* 33 U.S.C. § 1314(b)(2)(B) and 40 C.F.R. §§ 125.3(c)(2) and (d)(3), Region 1 has concluded, based on its BPJ, that the combined primary and secondary FGD WWTS currently operating at the Facility is the BAT for treating the FGD wastewater generated *at Merrimack Station*. This is a site-specific, case-by-case determination based on the facts at Merrimack Station and this determination neither applies to nor establishes that this technology is that BAT at any other facility or group of facilities.

As a result of this revised BAT determination, and the resulting revisions to certain Draft Permit conditions, Region1 has decided to exercise its discretionary authority pursuant to 40 C.F.R. § 124.14(b)(3) to re-notice for public review and comment those Revised Draft Permit conditions and the analysis supporting them. While Region 1 may not have needed to re-notice these permit provisions as a matter of law, the Region has the discretionary authority to take this action and has decided to do so to be sure that interested parties have an adequate chance to comment on these issues. Furthermore, Region 1 is hopeful that its analysis in support of the Final Permit will benefit from the Agency's consideration of any new public comments. Region 1 will consider the comments received during the comment period and then prepare final permit conditions and written responses to all significant comments. Interested parties do not need to re-submit any comments or materials that they already submitted to Region 1 during the previous comment period on the Draft Permit.

In accordance with 40 C.F.R. § 124.10, Region 1 has notified PSNH and other interested parties of its decision to re-notice **Parts I.A.2 and I.A.4** of the Draft Permit. The Region is also making new administrative record materials available for review and comment, to the extent that they relate to the re-noticed permit provisions. While the Region is only re-noticing particular provisions of the Draft Permit for public comment, the entire permit and administrative record will also be available for review so that reviewers can examine the pertinent issues within the full context of the permit as they see fit.

Basis for Re-Drafted Permit Conditions

As stated above, the Region is specifically re-noticing as draft permit conditions for public comment those conditions that were based on Region 1's determination that biological treatment technology is a component of BAT, namely Parts I.A.4 and indirectly I.A.2. The rationale for these now re-drafted permit conditions, including the Region's BAT determination for Merrimack Station's FGD wastewater, is presented in detail in Section 4 this Fact Sheet.

In taking the current action, there are a number of additional documents that the Region has considered since it issued the 2011 Draft Permit. These additional documents have been added to the administrative record for this permit and may be reviewed at Region 1's offices in Boston, upon request or at http://www.epa.gov/region1/npdes/merrimackstation/index.html.

2.0 Type of Facility, Discharge Location, and Quantity of Wastes

Merrimack Station is a 520-megawatt (MW) fossil fuel electrical generation facility. The Station generates electricity by means of two coal-fired steam turbine units (producing 470 MW) and two oil-fired combustion turbines units (50 MW). Unit No. 1 generates at a rated capacity of 120 MW and began operation in 1960, while Unit No. 2 generates at a rated capacity of 350 MW and began operation in 1968.

In the past, the Station has been a "base-load" facility, with an average yearly capacity utilization rate of around 75 percent. In recent years, however, the Facility's capacity utilization has been significantly lower, at around 30 percent. Blackman, Jeremy, "PSNH loses more customers to lower-priced competitors," Concord Monitor, July 16, 2013. *See also* 12/13/13 Email from John Moskal, Region 1 to Sharon DeMeo, Region 1, including graphs of capacity factors for Units 1 and 2 at Merrimack Station from 2007 through 2013. This is the result of lower prevailing prices for natural gas having rendered older, less efficient coal-burning plants, such as Merrimack Station, less competitive within New England relative to natural gas-burning plants. As a result, coal-burning plants have lost market share to the region's natural gas-burning facilities.

Merrimack Station discharges pollutants to, and withdraws water for cooling from, the Hooksett Pool section of the Merrimack River. The Station discharges various pollutants, including heat, to the river. Currently, steam turbine condenser waste heat is rejected to the river by means of a once-through cooling water system. Water for this cooling system is withdrawn from the river by the Station at a maximum rate of approximately 256 million gallons per day (MGD) through two cooling water intake structures and the heated water is then discharged back to the river through a 4000 foot long cooling canal. The pollutant discharges to the river from the Station include the following:

- once-through cooling water;
- slag sluice water;
- intake screen wash water;
- low volume waste (equipment and floor drains, chemical drains, polisher regeneration, demineralizer regeneration, miscellaneous tank drains);
- intake bay dewatering and deicing;
- ash landfill leachate;
- metal cleaning waste; and
- storm water.

For information regarding the type and quantity of wastes, fluids, or pollutants which are proposed to be, or are being, treated, stored, disposed of, injected, emitted, or discharged, as well as the amount of cooling water withdrawn by the Facility's cooling water intake structures, *see* Section 5 of the 2011 Fact Sheet. In addition, the site plan showing the location of the outfalls and a schematic drawing of the flow of water at the Facility, including the various discharges, is presented on Attachments B and C of the 2011 Fact Sheet, respectively. Finally, the cooling water intake issues are discussed primarily in Attachment D of the 2011 Fact Sheet.

In its 2010 supplement to its 1997 Permit Application, PSNH requested that the renewed Merrimack Station NPDES permit contain limits and conditions authorizing the discharge to the Merrimack River of wastewater from the Facility's newly installed wet FGD scrubber system. The original construction plans called for the treated effluent from the wastewater treatment system to be discharged into the river. PSNH decided to reconfigure the system during the early part of construction due to its concern about potential permit and litigation issues. This redesign eliminated the need for the discharge of FGD WWTS effluent to the river. As explained in this Fact Sheet for the Revised Draft Permit, Region 1 has determined, based on BPJ, that the Facility's current primary and secondary FGD WWTS is now considered the BAT for removing pollutants from the Station's FGD wastewater.

3.0 Receiving Water Description

As discussed in the 2011 Fact Sheet, the Merrimack River is classified by the State of New Hampshire as a Class B water body. Receiving waters designated as Class B in New Hampshire pursuant to RSA 485-A:8 are considered "… as being acceptable for fishing, swimming and other recreational purposes and, after adequate treatment, for use as water supplies."

Section 303(d) of the CWA requires states to identify those water bodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and, as such, require the development of total maximum daily loads (TMDL).

Merrimack Station withdraws from and discharges into a segment of the Merrimack River called Hooksett Pool. This is an approximately 5.8-mile portion of the river bounded to the north by Garvins Falls Dam and to the south by Hooksett Dam. Merrimack Station is located roughly mid-way between the two dams. The NHDES Water Division classifies a section in the upper reach of Hooksett Pool (3.476 miles) that is impaired for dissolved oxygen (D.O.) concentration and saturation. For other sections of the Pool, there is insufficient data to make aquatic life assessment determinations.

In addition, the Merrimack River is considered not to support fish consumption due to elevated mercury levels caused primarily by atmospheric deposition (mercury is not listed on the Section 303(d) list because a TMDL has been developed). *See* Northeast Regional Mercury TMDL, approved by EPA in 2007, at http://www.neiwpcc.org/mercury/mercury-docs/FINAL%20Northeast%20Regional%20Mercury%20TMDL.pdf.

4.0 Basis of Permit Limits

4.1 Background

4.1.1 Merrimack Station's FGD Scrubber System

As discussed in the 2011 Fact Sheet, Attachment E, the combustion process at coal-fired plants such as Merrimack Station generates a variety of air pollutants that are emitted from the facility's smoke stacks. At Merrimack Station flue gas passes through air pollution control equipment that includes selective catalytic reduction systems to reduce nitrogen oxides emissions and two electrostatic precipitators to reduce particulate matter emissions.

In 2006, the New Hampshire legislature enacted RSA 125-0:11-18, which required PSNH to install and operate a wet flue gas desulfurization (FGD) system at Merrimack Station to reduce air emissions of mercury and other pollutants.[1] PSNH was required to have the wet FGD system fully operational by July 1, 2013, "*contingent upon obtaining all necessary permits and approvals* from federal, state, and local regulatory agencies and bodies." RSA 125-O:13(I) (emphasis added). *But see also* RSA 125-O:17(I) (variances). Consistent with this contingency, PSNH stated the following in a submission to the New Hampshire Public Utility Commission (NHPUC) in support of its request to recover the costs of its wet FGD scrubber system through a temporary Energy Service rate:

> [t]he legislature recognized that in order for the Company to install and operate the Scrubber, it would first need to obtain various permits and approvals to do so. As a result, the legislature made the July 1, 2013 operational deadline for the Scrubber contingent upon the receipt of those approvals . . . . RSA 125-O:13(I), which contains this contingency, states that "The owner shall install and have operational scrubber technology to control mercury emissions at Merrimack Units 1 and 2 not later than July 1, 2013. The achievement of this requirement is contingent upon obtaining all necessary permits and approvals from federal, state, and local regulatory agencies and bodies . . . ." This clearly provides that the Scrubber must be installed and operational no later than July 1, 2013 *only* if the Company has all of the necessary permits and approvals to do so by that date.

PSNH, "Memorandum of Public Service Company of New Hampshire on Wastewater Permitting Issues Associated with the Scrubber," (Investigation of Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250) (March 19, 2012) (hereinafter, March 2012 Submission to the NHPUC), p. 4 (Italics in original).[2] S*ee also In re Stonyfield Farm, Inc. & a.*, 159 N.H. 227, 229 (2009) (New Hampshire Supreme Court pointing out the same).

The legislation also expressed the New Hampshire legislature's desire to realize the air quality benefits of a wet FGD scrubber system at Merrimack Station – in other words, to reduce the Facility's harmful emissions of mercury to the air – sooner than the July 2013 date to the extent practicable, and created economic incentives to encourage Merrimack Station to better that date. RSA 125-O:11(IV); RSA 125-O:13(III); RSA 125-O:16. Indeed, to encourage the soonest possible reduction in Merrimack Station's air emissions of mercury, the state law created a sliding scale of economic incentives with increasing benefits to the company for earlier reduction of those emissions through operation of the FGD scrubbers. *See* RSA 125-O:16(I)(a).[3]

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[1] Title X Public Health Chapter 125-O Multiple Pollutant Reduction Program, Sections 125-O:11 – 125-O:18. *See* http://www.gencourt.state.nh.us/rsa/html/x/125-o/125-o-mrg.htm.

[2] This document can be found at http://www.puc.nh.gov/Regulatory/CASEFILE/2011/11-250/LETTERS-MEMOS-TARIFFS/11-250%202012-03-19%20PSNH%20MEMORANDUM%20ON%20PERMITTING%20ISSUES.PDF.

[3] Key parts of the state statute read as follows:

> 125-O:16 Economic Performance Incentives.
> I.(a) The department shall issue to the owner early emissions reduction credits in the form of credits or fractions thereof for each pound of mercury or fraction thereof reduced below the

According to PSNH, "to incent the most expeditious installation and operation of the Scrubber, the Legislature enacted RSA 12-O:16, which provides Economic Performance Incentives for mercury reductions which are achieved prior to July 1, 2013. Because the Scrubber was placed into service in September, 2011, the Company will earn these incentives . . ." March 2012 Submission to the NHPUC, p. 4.

4.1.2 Wastewater from FGD Systems

Coal combustion generates a host of air pollutants which enter the flue gas stream and are emitted to the air unless an air emissions control system is put in place. The wet FGD scrubber system works by contacting the flue gas stream with a liquid slurry stream containing a sorbent (typically lime or limestone). The contact between the streams allows for a mass transfer of contaminants from the flue gas stream to the slurry stream.

Coal combustion generates acidic gases, such as sulfate, which become part of the flue gas stream. Not only will the liquid slurry absorb sulfur dioxide and other sulfur compounds from the flue gas, but it will also absorb other contaminants from the flue gas, including particulates, chlorides, volatile metals - including arsenic (a metalloid), mercury, selenium, boron, cadmium, and zinc - total dissolved solids (TDS), nitrogen compounds and organics. Furthermore, the liquid slurry will also readily absorb hydrochloric acid, which is formed as a result of chlorides in the coal. The limestone in the slurry also contributes iron and aluminum (from clay minerals) to the FGD wastewater. The chloride concentration and clay inert fines of the FGD slurry must be controlled through a routine wastewater purge to minimize corrosion of the absorber vessel materials. Depending upon the pollutant, the type of solids separation process and the solids dewatering process used, the pollutants may partition to either the solid phase (i.e., FGD solids) or the aqueous phase.

PSNH installed a limestone forced oxidation scrubber system and produces a saleable commercial-grade gypsum byproduct (e.g., wallboard). While this reduces the quantity of solid waste requiring disposal, the gypsum cake typically must be rinsed to reduce the level of chlorides in the final product. Besides the scrubber purge waste stream, gypsum processing generates additional wastewater requiring treatment prior to reuse or discharge.

Many of the pollutants found in FGD wastewater pose the potential for risk of harm to the environment and human health. These pollutants can occur in quantities (i.e., total mass

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> baseline mercury emissions, on an annual basis, in the period prior to July 1, 2013. Ratios of early reductions credits to pounds of mercury reduced shall be as follows: 1.5 credits per pound reduced prior to July 1, 2008; 1.25 credits per pound for reductions between July 1, 2008 and December 31, 2010; and 1.1 credits per pound for reductions between January 1, 2011 and July 1, 2013.

RSA O-125:16(I)(a). *See also* RSA O-125:16(I)(b) ("Early emissions reduction credits are not sellable or transferable to non-affected sources; however, upon the July 1, 2013 compliance date, the owner may request a one-for-one conversion of early emissions reduction credits to over-compliance credits.").

released) and/or concentrations that cause or contribute to in-stream excursions of EPA-recommended water quality criteria for the protection of aquatic life and/or human health. In addition, some pollutants in the FGD wastewater present a particular ecological threat due to their tendency to persist in the environment and bioaccumulate in organisms. For example, arsenic, mercury and selenium readily bioaccumulate in exposed biota.

4.1.3 NPDES Permitting of FGD Wastewater Discharges

Polluted wastewater from FGD scrubber systems cannot be discharged to waters of the United States, such as the Merrimack River, unless in compliance with the requirements of the federal Clean Water Act, 33 U.S.C. §§ 1251 *et seq.* (CWA), and applicable state laws. More specifically, any such discharges must comply with the requirements of a NPDES permit. *See* 33 U.S.C. §§ 1311(a) and 1342(a).

As will be discussed in detail below, discharges of wastewater from an FGD scrubber system to a water of the United States must satisfy federal technology-based treatment requirements as well as any more stringent state water quality-based requirements that may apply. While EPA has promulgated National Effluent Limitation Guidelines (NELGs) which set technology-based limits for the discharge of certain pollutants by facilities in the Steam Electric Power Generating Point Source Category, *see* 40 C.F.R. Part 423, these NELGs do not yet include best available technology (BAT) limits for certain pollutants of concern in FGD wastewater. In the absence of applicable NELGs for FGD wastewater, technology-based limits are developed by EPA (or state permitting authorities administering the NPDES permit program) on a Best Professional Judgment (BPJ), case-by-case basis. 33 U.S.C. § 1342(a)(1)(B); 40 C.F.R. § 125.3(c) ("Where promulgated effluent limitations guidelines only apply to certain aspects of the discharger's operation, or to certain pollutants, other aspects or activities are subject to regulation on a case-by-case basis in order to carry out the provisions of the Act.").

On June 7, 2013, EPA headquarters proposed revised NELGs for the Steam Electric Power Generating Point Source Category (hereinafter, Proposed Steam Electric NELGs). *See* 78 Fed. Reg. 34,432 (June 7, 2013). If finalized, the new NELGs would update effluent guidelines that have been in place since 1982, reflecting technology improvements in the steam electric power industry over the last three decades. The proposal includes a range of options to reduce pollutants of concern such as mercury, arsenic, lead, and selenium that are released into America's waterways by coal ash, air pollution control waste (including from FGD scrubber systems), and certain other waste streams from steam electric power plants. Under the proposal, new requirements for existing power plants would be phased in between 2017 and 2022. If finalized, the new NELGs would replace the BPJ, case-by-case approach for developing technology-based requirements for these wastewater streams. Until the new NELGs become effective, however, EPA continues to develop BAT limits for FGD scrubber wastewater on a BPJ, case-by-case basis to facilities such as Merrimack Station.

4.1.4 Determination of BAT for Controlling FGD Wastewater for 2011 Draft Permit

For the 2011 Draft NPDES Permit for Merrimack Station, Region 1 evaluated eleven candidate technologies to determine the BAT for treating wastewater from the Station's FGD system. At that time, Region 1 determined, based on its BPJ, *see* 40 C.F.R. §§ 125.3(a)(2)(iv) and (v), (c)(3), that the Station's newly installed primary treatment system[4] for handling wastewater from the FGD system, coupled with biological treatment, constitutes the BAT for limiting the discharge of certain FGD wastewater pollutants at Merrimack Station. S*ee* Region 1's 2011 Fact Sheet, Attachment E.

In determining effluent limits for FGD wastewater from Merrimack Station, Region 1 used the best available information to specify permit limits that, consistent with the capabilities of the BAT, were appropriately stringent but not infeasible. Certain of these limits were based on statistical analyses of self-monitoring data collected by plant staff at two Duke Energy power plants that use similar physical/chemical and biological treatment, the Allen and Belews Creek Stations, as well as certain data collected during a study of the Belews Creek treatment system conducted by the Electric Power Research Institute (EPRI).

In addition to the sources described above, Region 1 also considered information presented by the Permittee. Specifically, in PSNH's December 3, 2010, Report, which the Company submitted in response an Region 1's information request under CWA § 308(a), PSNH identified the concentrations of pollutants that it predicted would be present in the discharge from the new Merrimack Station FGD wastewater treatment system. *See* Merrimack Station NPDES Administrative Record (AR) #43.

In addition, as mentioned above, Region 1 also evaluated VCE treatment technology, an emerging method of treating FGD wastewater. *See* Region 1's 2011 Fact Sheet, Attachment E, pp. 20-22. Region 1 described PSNH's assessment of VCE technology, as provided to the Region, and explained that the company identified a number of potential concerns and reservations about relying upon such technology at Merrimack Station. *Id.*, pp. 20-21. Region 1, itself, also noted a number of possible concerns or difficulties with regard to the advisability and feasibility of using VCE at Merrimack Station, including the costs that it would entail. *Id.*, pp. 21-22. At the same time, however, Region 1 also noted that VCE could be compatible with the existing Merrimack Station operation (e.g., age of Merrimack Station would not preclude the use of VCE; proposed physical/chemical treatment could be used together with VCE). *Id.*, p. 22. Furthermore, Region 1 noted that it had recently learned that PSNH was itself further considering the use of VCE treatment technology for its FGD wastewater to achieve a "zero liquid discharge" so that it could operate its FGD scrubbers without needing an NPDES permit to authorize direct discharges to the Merrimack River. *Id.*, p. 21. *See also* AR# 638 and AR# 303.

Ultimately, the Region concluded that:

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[4] The primary treatment system at Merrimack Station consists of flocculation, clarification, filtration and an Enhanced Mercury and Arsenic Removal System (EMARS). The primary treatment is also referred to as "physical/chemical treatment".

> In light of all of the above, EPA has concluded that it cannot based on current information determine this technology to be the BAT for treating FGD wastewater at Merrimack Station. It simply is not clear at the present time whether or not this technology is feasible for application at Merrimack Station. EPA is continuing to review information characterizing operational factors and pollutant removal efficacy for vapor compression evaporation and depending on the results of further evaluation of this technology, EPA could potentially find it to be part of the BAT for Merrimack Station for the final NPDES permit.

Id., p. 22. Thus, Region 1 explained that it was continuing to evaluate VCE – as was PSNH – and that this technology could be part of the BAT for the final permit.

4.2 Legal Requirements and Context

The 1982 NELGs established effluent limitations based on the best practicable control technology currently available (BPT) standard for the "catch-all" category of "low-volume wastes." *See* 40 CFR §423.11(b). *See also* 33 U.S.C. § 1311(b)(1)(A). Low volume wastes include a variety of types of wastewater from power plants, including the wastewater from wet scrubber air pollution control systems (i.e., FGD scrubber systems). The 1982 rulemaking did not, however, establish BAT standards for FGD wastewater because EPA lacked the data necessary to characterize the pollutant loadings from these systems and, thus, to set a national standard. *See* the Development Document for Effluent Limitations Guidelines and Standards and Pretreatment Standards for the Steam Electric Power Generating Point Source Category (EPA 440/1-82/029), November 1982 (1982 Development Document), at page 248 (noting that "[a]dditional studies will be needed to provide this data and to confirm the current discharge practices in the industry").[5] Accordingly, EPA determined that BAT standards for FGD wastewater were outside the scope of the rulemaking and explicitly reserved the development of such standards for a future rulemaking. *See* 47 Fed. Reg. 52,290, 52,291 (Nov. 19, 1982) (preamble to Final Rule for 1982 Steam Electric NELGs); 1982 Development Document, pp. 3, 7.

While the CWA provides that existing facilities were to satisfy BPT standards by no later than July 1, 1977, 33 U.S.C. § 1311(b)(1)(A), a facility's discharges of toxic pollutants and nonconventional pollutants were to satisfy more stringent BAT standards by no later than March 31, 1989. *See* 33 U.S.C. § 1311(b)(2)(A), (C), (D) and (F); 40 C.F.R. § 125.3(a)(2)(iii), (iv) and (v). EPA regulations state that "where promulgated effluent limitations guidelines only apply to certain aspects of the discharger's operation, or to certain pollutants, other aspects or activities are subject to regulation on a case-by-case basis to carry out the provisions of the Act." 40 C.F.R. § 125.3(c)(3). The 1982 NELGs only established BPT limits for TSS, pH, oil and grease and PCB in low-volume wastes. Here, Region 1 is establishing BAT limits for a number of other pollutants of concern in Merrimack Station's FGD wastewater (including mercury, selenium, and

[5] This document can be found at http://water.epa.gov/scitech/wastetech/guide/steam-electric/upload/Steam-Electric_DD_1982.pdf.

arsenic) for which there are no currently applicable BAT-based NELGs. As a result, it is appropriate to develop such limits on a case-by-case, BPJ basis. *See* 2011 Fact Sheet, Attachment E, pp. 6-7.

The BAT standard is set forth in CWA § 301(b)(2)(A), 33 U.S.C. § 1311(b)(2)(A), and applies to many of the pollutants in Merrimack Station's FGD wastewater, which include both toxics (e.g., mercury, arsenic, selenium) and non-conventional pollutants (e.g., nitrogen). *See* 33 U.S.C. § 1311(b)(2)(A) & (F); 40 C.F.R. §§ 125.3(a)(2)(iii) – (v). *See also* 33 U.S.C. § 1314(b)(2). The BAT standard requires achievement of:

> effluent limitations . . . which . . . shall require application of *the best available technology economically achievable . . ., which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants*, as determined in accordance with regulations issued by the [EPA] Administrator pursuant to section 1314(b)(2) of this title, which such effluent limitations shall require the elimination of discharges of all pollutants if the Administrator finds, on the basis of information available to him . . . that such elimination is technologically and economically achievable . . . as determined in accordance with regulations issued by the [EPA] Administrator pursuant to section 1314(b)(2) of this title . . ..

33 U.S.C. § 1311(b)(2)(A) (emphasis added). In other words, the BAT standard requires EPA to set effluent discharge limits corresponding to the use of the best pollution control technologies that are technologically and economically achievable and will result in reasonable progress toward eliminating discharges of the pollutant(s) in question, which will include eliminating such discharges if doing so would be achievable. Thus, in a given case, the BAT standard might or might not result in limits prohibiting the discharge of certain pollutants.

According to the CWA's legislative history, the starting point for identifying the "best available technology" refers to the "single best performing plant in an industrial field" in terms of its capacity to reduce pollutant discharges. *Chemical Manufacturers. Ass'n v. U.S. Envtl. Prot. Agency*, 870 F.2d 177, 239 (5th Cir. 1989) (*citing* Congressional Research Service, *A Legislative History of the Water Pollution Control Act Amendments of 1972* at 170 (1973) (hereinafter, 1972 Legislative History) at 170).[6] Thus, EPA need not set BAT limits at levels that are being met by

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[6] *See also Texas Oil*, 161 F.3d at 928, *quoting Chemical Manufacturers.*, 870 F.2d at 226; *Kennecott v. U.S. Envtl. Prot. Agency*, 780 F.2d 445, 448 (4th Cir. 1985) ("In setting BAT, EPA uses not the average plant, but the optimally operating plant, the pilot plant which acts as a beacon to show what is possible."); *American Meat*, 526 F.2d at 463 (BAT "should, at a minimum, be established with reference to the best performer in any industrial category"). According to one court:

> [t]he legislative history of the 1983 regulations indicates that regulations establishing BATEA [i.e., best available technology economically achievable, or BAT] can be based on statistics from a single plant. The House Report states:
>
> > It will be sufficient for the purposes of setting the level of control under available technology, that there be one operating facility which demonstrates that the level can be achieved or that there is

most or all the dischargers in a particular point source category, as long as at least one demonstrates that the limits are achievable. *Id.* at 239, 240. This comports with Congressional intent that EPA "use the latest scientific research and technology in setting effluent limits, pushing industries toward the goal of zero discharge as quickly as possible." *Kennecott*, 780 F.2d 445, 448 (4th Cir. 1984), *citing* 1972 Legislative History at 798. *See also Natural Resources Defense Council*, 863 F.2d at 1431 ("The BAT standard must establish effluent limitations that utilize the latest technology."). While EPA must consider the degree of pollutant reduction achieved by the available technological alternatives, the Agency is not required to consider or determine the extent of water quality improvement that will result from such reduction.[7]

Available technologies may also include viable "transfer technologies" – that is, a technology from another industry that could be transferred to the industry in question – as well as technologies that have been shown to be viable in research even if not yet implemented at a full-scale facility.[8] When EPA bases BAT limits on such "model" technologies, it is not required to "consider the temporal availability of the model technology to individual plants," because the BAT factors do not include consideration of an individual plant's lead time for obtaining and installing a technology. *See Chemical Manufacturers*, 870 F.2d at 243; *American Meat Inst. v. U.S. Envtl. Prot. Agency*, 526 F.2d 442, 451 (7th Cir. 1975).

4.3 Availability of VCE/Crystallizer Technology

EPA has reported that "[m]echanical evaporators in combination with a final drying process can significantly reduce the quantity of wastewater pollutants and volume discharged from certain process operations at various types of industrial plants, including steam electric power plants, oil refineries, and chemical plants." Technical Development Document for the Proposed Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, EPA-821-R-13-002, April 2013 (hereinafter, 2013 TDD), p. 7-13.[9] Evaporation technology has been used for decades by the power industry to eliminate cooling tower blowdown and demineralizer wastewater. *Id*. *See also* Shaw, 2008.

> sufficient information and data from a relevant pilot plant or semi-works plant to provide the needed economic and technical justification for such new source.

Ass'n of Pacific Fisheries v. U.S. Envtl. Prot. Agency, 615 F.2d 794, 816-17 (9th Cir. 1980) (*quoting* 1972 Legislative History at 170).

7 *See, e.g.*, *American Petroleum*, 858 F.2d at 265–66 ("Because the basic requirement for BAT effluent limitations is only that they be technologically and economically achievable, the impact of a particular discharge upon the receiving water is not an issue to be considered in setting technology-based limitations.").

8 These BAT principles, arising out of the CWA's legislative history, have repeatedly been upheld by the courts. *E.g., American Petroleum Inst. v. U.S. Envtl. Prot. Agency*, 858 F.2d 261, 264–65 (5th Cir. 1988); *Pacific Fisheries*, 615 F.2d at 816–17; *BASF Wyandotte Corp. v. Costle*, 614 F.2d 21, 22 (1st Cir. 1980); *American Iron*, 526 F.2d at 1061; *American Meat*, 526 F.2d at 462.

9 This document can be found at http://water.epa.gov/scitech/wastetech/guide/steam-electric/upload/Steam-Electric_TDD_Proposed-rule_2013.pdf.

In addition to these uses of evaporative treatment technologies, there are also seven known VCE systems currently being used specifically for FGD wastewaters, *one of which is currently operating at Merrimack Station*. An eighth VCE system is under construction. *See* 78 Fed. Reg. 34452 (Proposed Rule); Marlett, J. Michael, "Flue Gas Desulfurization (FGD) Evaporator Operation Report, ENEL Brindisi," International Water Conference (IWC) paper #12-25 (Marlett, 2012); Nebrig H.A., Teng, Xinjun, and Downs, David, "Preliminary Assessment of a Thermal Zero Liquid Discharge Strategy for Coal-Fired Power Plants," IWC 11-36 (Nebrig et. al., 2011); HPD, Project Profile / FGD Zero Liquid Discharge System (AR #22 and AR #136); Personal communication, Michael Marlett, Aquatech and Sharon DeMeo, Region 1, January 8, 2014.

In the preamble to EPA's Proposed Steam Electric NELGs, the Agency stated:

> EPA identified two U.S. plants [(one of which is Merrimack Station)] and four Italian plants that treat FGD wastewater using vapor-compression evaporation. A third U.S. plant is currently installing a vapor-compression evaporation treatment system; it is scheduled to be operational by the end of 2013.

78 Fed. Reg. 34452 (June 7, 2013) (Proposed Rule). Region 1 also notes that there is an additional system treating FGD wastewater in China. Nebrig et. al., 2011. "The thermal ZLD in China's coal-fired power plant has been in operation to treat FGD wastewater since 2009. This ZLD system is unique because it does not include a brine concentrator, but applies a 4-stage crystallizer." *Id*.

The third U.S. facility mentioned above is Duke Energy's Mayo Plant, located near Roxboro, North Carolina. That facility is currently in the process of installing a VCE system to treat up to 370 gpm of FGD waste water. The new system will replace the current settling pond and bioreactor. The change in treatment is intended to address water quality impacts to the receiving water, Mayo Lake. After a thorough evaluation of options, Duke Energy selected a partial ZLD system consisting of two evaporators (falling film and forced circulation) that will result in a concentrated brine solution that, similar to Iatan Station, will be mixed with fly ash prior to disposal in the facility's on-site landfill. *See* Lowenberg, et. al., Zero-Liquid Discharge System at Duke Energy Mayo Plant, IWC 12-16.

The ZLD system at Iatan Station (although no crystallizer is used) was completed in 2010. *See* Burns & McDonnell, Green to the Max Zero Liquid Discharge for Iatan 2, 2011 No.3, p. 15-16. In addition, the ZLD systems at five of the six power plants in Italy using VCE and crystallizer technology were supplied and installed by Aquatech and all but two of these have been operating for more than 5 years.[10] *See* Marlett, 2012. *See also* Personal communication, M. Marlett, Aquatech and S. DeMeo, Region 1, January 8, 2014. Furthermore, the station in Monfalcone,

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[10] The five Italian facilities are Fusina Power Plant, Torrevaldaliga Nord Power Plant, Sulcis Power Plant, La Spezia plant and Brindisi Sud Power Plant. "Fusina is not running due to commercial contracts they have in place. Sulcis is not running because they are not generating any feed water." 1/23/14 (6:35 PM) Email from Michael Marlett, Aquatech, to Sharon DeMeo, Region 1.

Italy, which also uses VCE technology, began operating mid 2008. The system, designed and supplied by HPD "is performing as designed and running on a continuous basis." HPD, Project Profile / FGD Zero Liquid Discharge System (AR #22 and AR #136).

The use of VCE and crystallizer technology in a number of industrial wastewater treatment settings, including for treating FGD wastewater at a number of steam electric power plants, demonstrates that VCE and crystallizer treatment technology is *generally* available for handling FGD wastewater at steam electric power plants. It does not, however, demonstrate *by itself* that the technology is available for the industrial category as a whole. More importantly for this BPJ determination, it also does not by itself demonstrate the technology's availability for Merrimack Station, in particular. In other words, VCE and crystallizer systems might be technologically and economically available for certain facilities, but not for the industrial category as a whole or for the individual facility that is the subject of a BPJ determination.

To the extent that VCE and crystallizer systems are able to achieve ZLD operations, they are the best performing treatment systems for the purpose of reducing discharges of pollutants to the Nation's waters. In other words, these systems make the greatest "… *further progress toward the national goal of eliminating the discharge of all pollutants* …." 33 U.S.C. § 1311 (b)(2)(A). This by itself does not, however, establish that this technology is the "best available technology economically achievable" either for the industry as a whole or for the individual facility that is the subject of a BPJ determination. As mentioned above, the technology might not be economically or technologically available for the industrial category as a whole or for an individual facility that is the subject of a BPJ determination. Furthermore, as discussed further below, the CWA specifies a variety of factors, such as cost and non-water environmental effects, that must be considered before determining the BAT. *See* 33 U.S.C. § 1314(b)(2)(B); 40 C.F.R. § 125.3(d)(3).

Yet, as described in this Fact Sheet, PSNH began installation of a VCE and crystallizer system at Merrimack Station in 2011 and has been operating the completed system since at least June 2012. PSNH did this without being compelled to do so by the requirements of an NPDES permit.[11] Again, this does not demonstrate that the technology is available for the steam electric power plant industrial category as a whole. These facts do, however, establish, in effect, "a

[11] Region 1 recognizes that because Merrimack Station installed "wet" FGD scrubbers that produce a wastewater stream incorporating pollutants, such as mercury and arsenic, removed from the Facility's air emissions, the Facility could not lawfully operate the FGD scrubbers unless it either had an NPDES permit authorizing wastewater discharges to the Merrimack River or it had a way to eliminate such discharges. Nevertheless, as discussed above, the Facility was not compelled by state law to operate the FGD system until it had obtained all necessary permits. By finding a way to operate the scrubbers without wastewater discharges, PSNH accelerated reductions of its emissions of air pollutants and, as described above, qualified for economic incentives provided by the state legislation. It also demonstrated, at least on an initial basis, that technology is available to eliminate FGD wastewater discharges at Merrimack Station. PSNH was not legally required to install VCE/crystallizer treatment and eliminate FGD wastewater discharges; *it chose to do so*. Indeed, it appears that PSNH's technological approach offered a "win/win/win" response to the Facility's pollution control problems: it accelerated reductions in the Facility's emissions of air pollution without merely converting them into pollutant discharges to the Merrimack River, it enabled the Station to comply with the CWA, and allowed the Station to realize economic incentives offered by state law.

rebuttable presumption" that VCE and crystallizer technology is available *for Merrimack Station* (i.e., it is technologically and economically achievable for the Facility). This presumption might possibly be overcome, if, for example, the facts indicated that despite initial installation and operation of the technology, its use raised long-term operational costs to an extent that it was rendered unavailable, or that experience with the technology ultimately revealed technological problems undermining its viability over the long-term. These issues are further discussed below.

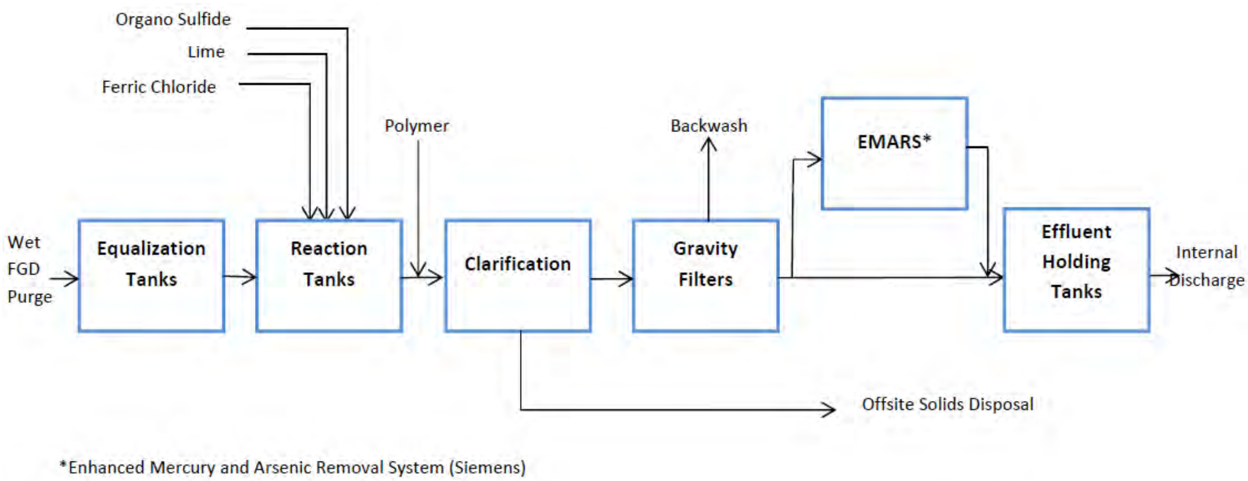
4.4 BAT for FGD Wastewater at Merrimack Station

4.4.1 The Primary and Secondary Wastewater Treatment Systems Currently In Use at Merrimack Station

Plants striving to maximize removals of mercury and other metals, such as Merrimack Station, often include sulfide addition (e.g., organosulfide) as part of the physical/chemical treatment process. Adding sulfide chemicals in addition to the alkali can provide even greater reductions of heavy metals due to the very low solubility of metal sulfide compounds, relative to metal hydroxides. In addition, "[p]lants can add ferric (or ferrous) chloride to the precipitation system to co-precipitate additional metals and organic matter. The ferric chloride also acts as a coagulant, forming a dense floc that enhances settling of the metals precipitate in downstream clarification stages." 2013 TDD, p. 7-5.

At the time the September 2011 Draft Permit was issued, PSNH was completing the installation of a physical/chemical treatment system (also referred to as Merrimack Station's "primary treatment system" elsewhere in this Fact Sheet) to remove pollutants from the wastewater generated by the Station's wet FGD scrubber system. Merrimack Station's primary treatment facility utilizes, among other techniques, the chemical addition treatment processes identified above. Specifically, the Facility's primary treatment system consists of a series of reaction tanks in which chemicals are added to convert soluble metals to insoluble metal hydroxide or sulfide compounds. These compounds then precipitate out of solution and are removed as solid waste. Merrimack Station's primary treatment system includes the following operations in sequence: equalization; reaction tank #1 (includes the addition of hydrated lime for pH adjustment, soda ash and organosulfide); reaction tank #2 (where ferric chloride is added); polymer addition; clarification; pH adjustment with hydrochloric acid; gravity filtration; and a series of proprietary filter cartridges containing adsorbent media targeted specifically for the removal of mercury and arsenic (also referred to as the "polishing step" or the Enhanced Mercury and Arsenic Removal System ("EMARS")). Figure 1 shows the process flow of the originally designed physical/chemical treatment system. PSNH designed, financed and, for the most part, constructed the primary treatment system without first discussing with Region 1 whether this WWTS would fully satisfy technology-based and water quality-based standards. *See* 2011 Fact Sheet, Attachment E, p. 5.

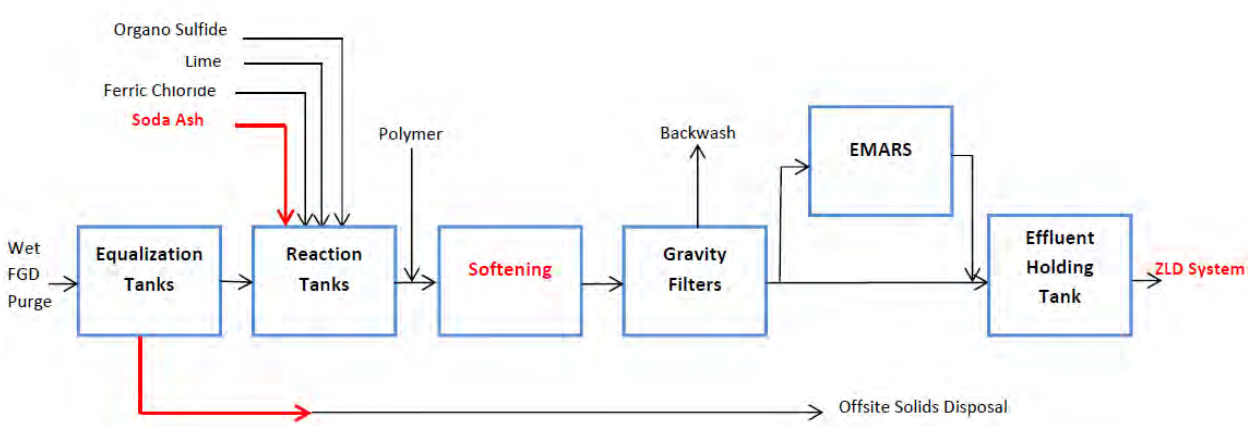
Figure 1 – FGD Primary Treatment System Process Flow Diagram



Roy and Scroggin, 2013.

Several minor changes were made to this design with the addition of the secondary treatment system (discussed below), including the addition of soda ash to the reaction tanks and a different holding tank configuration to accommodate pH adjustment in series. Figure 2 shows that the clarifier of the primary treatment system was converted to a lime/soda ash softener. With softening, the predominant calcium chloride salts are replaced with less soluble sodium chloride salts. The resulting solid waste does not contain hygroscopic salts that require special processing to reduce absorption of moisture from the atmosphere. *Id.* *See also* Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013.

Figure 2 – Modified FGD Primary Treatment System Process Flow Diagram



Roy and Scroggin, 2013.

In late May 2011, PSNH informed Region 1 that the Company was further evaluating the possibility of using additional treatment technology – specifically, vapor compression evaporation (VCE) – to further reduce the amount of FGD wastewater generated by the Station and potentially achieve a zero liquid discharge (ZLD) treatment system. *See* AR #638 and AR #303. *See also* 2011 Fact Sheet, Attachment E. p. 21. As discussed in the Fact Sheet for the Draft Permit, PSNH had previously evaluated VCE for treatment of FGD wastewater but, taking into account the pollutant concentrations expected in Merrimack Station's specific FGD wastewater and the relative newness of this application of the technology, concluded that VCE was not the BAT for the Facility or at least that it had insufficient information to assess the feasibility or advisability of using VCE to treat the Station's FGD wastewater. *See* 2011 Fact Sheet, Attachment E, pp. 20-21. *See also* PSNH's December 3, 2010 letter in response to Region 1's October 29, 2010 CWA § 308 information request (AR #43). As of the time that Region 1 issued the Draft Permit – i.e., September 30, 2011 – the Region was not aware of PSNH reaching any new conclusions about using VCE technology at Merrimack Station.

Then, as a result of comments submitted during the public comment process for the Draft Permit, Region 1 learned that PSNH had decided to install and operate a VCE system, including crystallizers, as part of a "secondary wastewater treatment system" at Merrimack Station. In other words, the new system would be in addition to the physical/chemical "primary treatment system" discussed above. Nevertheless, during the comment period, a number of parties submitted conflicting comments on the suitability of VCE for Merrimack Station.

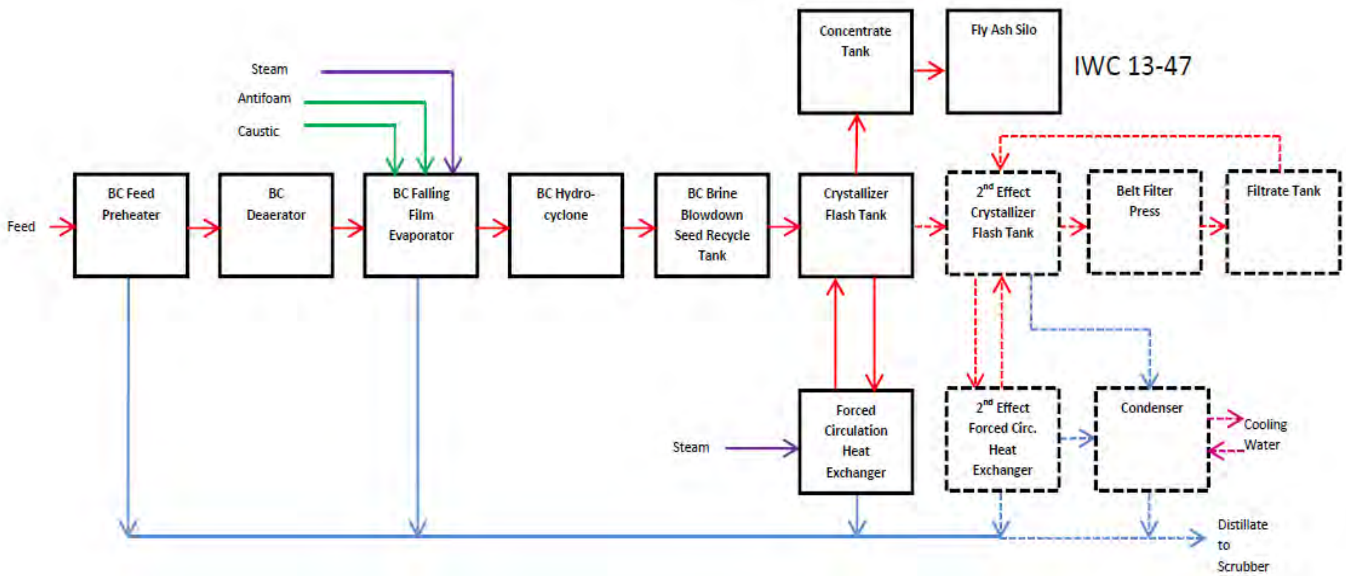
In light of these developments, Region 1 requested that PSNH discuss its use of the added technology at Merrimack Station with Region 1's NPDES permit writers. The Region explained that it wanted to learn from PSNH about its experience in operating the technology at Merrimack Station. *See* Region 1's CWA § 308 information request dated February 7, 2013 (hereinafter, February 7, 2013 CWA § 308 Information Request), p. 1. PSNH declined the Region's request, however. *Id.* Similarly, PSNH declined Region 1's request to conduct a site visit to see and learn about the Facility's VCE system. *Id.* Therefore, to garner more information about PSNH's new VCE and crystallizer technology, Region 1 subsequently issued PSNH the February 7, 2013 CWA § 308 Information Request pursuant to Section 308(a) of the CWA. More recently, the Region learned that Merrimack Station has been operating the complete SWWTS since June 2012. Roy and Scroggin, 2013.

The Facility's SWWTS consists of two distinct stages or "effects." The first effect involves the use of "a vapor compression driven falling film evaporator followed by a steam driven forced circulation evaporator" to concentrate the effluent from the primary treatment system. *Id*. The falling-film evaporator (or brine concentrator) and the forced circulation crystallizer generate a concentrated brine solution and relatively clean distillate and condensate streams. "The concentrated reject stream from the crystallizer would be stored and used as a wetting agent for the fly ash generated onsite and landfilled offsite." *Id*.

As another option to wetting fly ash, the second effect uses an additional forced-circulation crystallizer to further process the concentrated brine solution into a salt cake that can be hauled off-site for disposal and a condensate stream. "This operational mode allowed for the mechanical mixing of brine with flyash, brine transport and flyash disposal." *Id*.

Both the distillate from the brine concentrator (84,600 gpd) and the condensate from the crystallizers (10,800 gpd) are reused as FGD make-up water. Industrial Wastewater Indirect Discharge Request Application for Lowell Regional Wastewater Utility, July 11, 2001, Figure 2. *See also* Roy and Scroggin, 2013. Figure 3 below shows the process flow diagram of the secondary treatment system.

Figure 3 – FGD Secondary Treatment System Process Flow Diagram



Id. Generally, the secondary treatment system was designed to treat an approximate 65 gallons per minute (gpm) flow of FGD wastewater containing 10,000 parts per million (ppm) chloride. The maximum flow rates for the first effect were guaranteed by the supplier and "based upon the fly ash silo total ash wetting requirements." *Id*. Roy and Scroggin report that all contractual process guarantees were met or exceeded, including those for distillate quality and minimum treatment rates. *Id*.

A consultant investigating issues for the New Hampshire Public Utilities Commission (NHPUC) described the secondary treatment system as follows:

> [t]his system is designed to … [receive] the effluent from the EMARS waste treatment system and further reduce it. Phase 1 of the secondary wastewater treatment system reduces the volume of water to 0-5 gpm through concentration and crystallization and the effluent can be recycled into the process. In Phase 2, which involves an additional crystallizer step and dewatering, the liquid effluent is reduced to zero, resulting in nothing being discharged into the river. The output of this secondary wastewater system also reduces the solid effluent to an amount that can be disposed of in a licensed landfill.

Jacobs Consultancy, "New Hampshire Clean Air Project Final Report," prepared for NHPUC, September 10, 2012, p. 57. Therefore, when operating as designed, the current treatment technology at Merrimack Station (i.e., the combined primary and secondary wastewater treatment systems) is a true zero liquid discharge ("ZLD") treatment system.[12]

Prior to February 2012, PSNH hauled wastewater from the FGD primary treatment system to several local publically owned treatment works ("POTWs"), where it was discharged to the headworks of each treatment plant prior to discharge to each facility's receiving waters. After Merrimack Station began operating the brine concentrator component of the SWWTS in February 2012, *see* Roy and Scroggin, 2013, PSNH began hauling concentrated brine wastewater to local POTWs for disposal. In other words, this brine wastewater was produced after Merrimack Station treated FGD wastewater in the primary treatment system and the first stage of the secondary treatment system. *See* Table 4-1 below.

The second crystallizer component (i.e., the second effect) of the SWWTS began operation in June 2012. Roy and Scroggin, 2013. Nevertheless, PSNH reported sending distillate to the Hooksett Wastewater Treatment Facility for disposal in September and October 2012.[13] Region 1 initially thought that PSNH had stopped hauling treated FGD wastewater off-site for disposal after October 2012 but the Region later learned that this was not the case. This confusion resulted from PSNH's unilateral decision to discontinue submitting the monthly reports regarding off-site disposal that were required by Region 1's March 22, 2012 CWA § 308(a) information request. The Region thought that the lack of report submissions indicated that off-site disposal had ceased, but in August 2013, PSNH informed Region 1 that it had continued sending wastewater (from the primary and secondary treatment systems) to area POTWs for disposal during 2013. In response to various informal requests for information concerning such off-site disposal, the company declined to provide certain information requested by the Region. *See* Personal communication, Allan Palmer, PSNH and John King, Region 1, August 13, 2013 (AR #1029). As a result, on November 8, 2013, Region 1 sent PSNH another information request letter under CWA § 308(a).

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[12] If the distillate and/or condensate streams were to be reused as boiler make-up water, for example, the system would not be considered a true ZLD system because, ultimately, boiler blowdown would be discharged to the receiving water. In addition, if the brine concentrate and/or salt cake is mixed with fly ash and disposed of in the Facility's on-site landfill, the system would also not be considered a true ZLD system because the leachate from the landfill would ultimately discharge to the Merrimack River. This concept is explained in the 2013 TDD, p. 7-14:

> The condensed vapor (i.e., distillate water) can be recycled back to the FGD process, used in other plant operations (e.g., boiler make-up water), or discharged. If the plant uses the distillate for other plant operations that generate a discharge stream (e.g., used as boiler make-up and ultimately discharged as boiler blowdown), then the FGD process/wastewater treatment system is not truly zero discharge. Therefore, operating a vapor-compression evaporation system does not guarantee that the FGD process/wastewater treatment system achieves zero discharge.

[13] According to analytical reports, approximately 24,000 gallons and 296,000 gallons of distillate were sent to the Hooksett Wastewater Treatment Facility in September and October 2012, respectively.

Table 4-1 presents information PSNH has submitted to date regarding the FGD wastewater that it has had hauled off-site to local POTWs.

Table 4-1 FGD Wastewater Hauled from Merrimack Station - Including Certain Data[14]

Year	Month	Date Sampled	Source	Volume (gallons)	Destination[15]	Hg (ng)	Se (µg)	As (µg)
2011	November			642,000	**S. Portland**			
				535,500	**Attleboro**			
2011	December	5-Dec	Treat Tank	NA		6.7	89	< 10
2011	December	7-Dec	Treat Tank	NA	NA	5.6	120	4.03
				240,000	**S. Portland**			
				89,700	**Attleboro**			
				755,200	**Lowell**			
2012	January	5-Jan	Treat Tank			10.5	74	4.98
		22-Mar (reanalyzed)		NR	Franklin		68.9	8.51
			Treat Tank	NR	Hooksett			
			Treat Tank	NR	Allenstown			
2012	January	26-Jan	Treat Tank	32,017	Hooksett	12.2	104	9.56
				112,180	**Hooksett**			
			Treat Tank	110,967	Allenstown			
				142,834	**Allenstown**			
				282,492	**S. Portland**			
				1,255,000	**Lowell**			
				240,000	**Attleboro**			
				8,000	**Franklin**			
2012	February	2-Feb	Treat Tank	128,307	Hooksett	36	121	12.1
				548,942	**Hooksett**			
			Treat Tank	16,000	Franklin			
			Stream A	95,495	Lowell			
			Stream B	6,800	Lowell			
				94,800	**Lowell**			

[14] The "Treat Tank," "Final Effluent" and "Stream A" wastestreams are synonymous. They refer to wastewater taken from after the primary treatment system. Stream B is wastewater from the evaporator of the secondary treatment system. The Combination Wastewater (Comb WW) consists of salt cake filter press "spray wash water,""blowdown" from the crystallizer, and possibly "a certain amount of Stream B." *See* Personal communication between Allan Palmer, PSNH, and Sharon DeMeo, Region 1, January 31, 2014. PSNH collected one sample of each wastestream type hauled per month and reported those results to each municipality. Therefore, PSNH has considered the results of the one sampling event to be representative of all shipments that month. "NR" = not reported.

[15] For towns in bolded text, volumes of wastewater reported are based on a separate spread sheet supplied by PSNH.

			Treat Tank	118,466	Allenstown			
2012	February	9-Feb	Treat Tank	47,999	Allenstown	20.9	82.2	<7.5
				360,816	**Allenstown**			
2012	February	15-Feb	Stream B	NR	Lowell	45.8	498	49.4
				14,084	**S. Portland**			
				24,006	**Attleboro**			
2012	March	2-Mar	Final Effluent	140,890	Hooksett	17.2	109	8.12
			Final Effluent	NR	Franklin			
				0	**Franklin**			
			Final Effluent	191,915	Allenstown			
			Final Effluent	NR	Lowell			
2012	March	14-Mar	Stream B	NR	Lowell	61.2	587	37.7
				55,042	**Lowell**			
			Distillate	NA	Lowell	<0.5	0.71	<0.15
				8,000	**Attleboro**			
				14,084	**S. Portland**			
2012	August	1-Aug	Stream B	48,000	Lowell	34	NR	<29.9
2012	August	16-Aug	Distillate	NA	Lowell	<200	22	6
2012	September	6-Sep	Distillate	24,000	Hooksett	<200	20	6
2012	October	18-Oct	Distillate	296,000	Hooksett	<200	2	<1
2013	January	26-Jan	Stream A	72,000	Lowell	41.3	44.5	<1.5
			Stream A	80,010	Hooksett			
			Stream A	64,000	Allenstown			
2013	January	18-Jan	Stream B	120,000	Lowell	203	NR	13
			Stream B	14,012	S. Portland			
2013	February	4-Feb	Stream B	144,000	Lowell	79.6	NR	15.1
			Stream B	8,000	S. Portland			
2013	February	16-Feb	Stream A	186,000	Hooksett	NR	51.7	<7.5
			Stream A	106,000	Allenstown			
2013	March	6-Mar	Stream B	112,000	Lowell	80.8	NR	26.6
2013	June	3-Jun	Stream B	40,000	Lowell	157	NR	<7.5
2013	August	7-Aug	Stream B	120,000	Lowell	33.9	NR	20
2013	November	27-Nov	Stream B	64,000	Lowell	50.1	NR	13.2
2013	December	19-Dec	Comb WW	16,000	Lowell	<25	NR	29.9
2014	January	29-Jan	Comb WW	48,000	Lowell	25.5	NR	28.8
2014	February	not sampled	Blowdown from evap & crystallizer	72,000	Lowell	NR	NR	NR
2014	March	not sampled	Blowdown from evap & crystallizer	144,000	Lowell	NR	NR	NR

Data Sources for Table 4-1: PSNH's May 7, 2012, response to Region 1's March 22, 2012, CWA § 308(a) information request letter; PSNH's December 6, 2013, response to Region 1's November 8, 2013, CWA § 308(a) information request letter (hereinafter, December 2013 CWA § 308 Response); and emails from A. Palmer to S. DeMeo dated 1/31/14, 2/24/14, 3/28/14 and 4/9/14.

PSNH was asked to provide the reason(s) for each off-site shipment. *See* Region 1's November 8, 2013 CWA § 308(a) information request letter. Instead, PSNH responded with the following general statement for all occurrences:

> [i]n each case, it was a business decision reached after consideration of multiple factors that may have included continued optimization of the secondary wastewater treatment system ("SWWTS") or individual components of that system; necessary adjustments based on fuel blends, load changes on either unit, or changes in chemistry due to Absorber optimization; operation of individual components or a combination of components of the SWWTS; operational constraints (other than the SWWTS); maximizing systemic Station operation when generating for a short time period.

December 2013 CWA § 308 Response. In summary, this response indicates that in each case PSNH sent FGD wastewater for off-site disposal due to a business decision based upon the company's consideration of a variety of different factors.

Thus, despite having installed a ZLD treatment system, PSNH has periodically continued hauling FGD wastewater off-site for disposal. Moreover, PSNH has indicated that it wishes to be authorized to discharge its FGD wastewater to the Merrimack River after treating it only with its primary physical-chemical treatment system. *See* Comments of Public Service Company of New Hampshire on EPA's Draft National Pollutant Discharge Elimination System Permit No. NH0001465 for Merrimack Station, February 28, 2012, (hereinafter, 2012 PSNH Comments on Draft Permit), n. 87, p. 150. *See also* AR #638. Yet, Region 1 also notes that in support of PSNH's then pending energy service rate application, William H. Smagula, PSNH's Director of Generation, stated the following to the NHPUC: "[t]he secondary wastewater treatment system [SWWT] is a technology that will be used on a permanent basis to complement the primary treatment system." Public Service Company of New Hampshire, Docket No. DE 11-250, Data Request STAFF-01, 12/30/2011, Q-STAFF-001.

4.4.2 BAT Determination

As detailed above and in the 2011 Fact Sheet, Att. E, p. 10, the CWA requires EPA to consider a number of factors in developing BAT limits. Generally, these factors relate to technological issues, cost and non-water quality environmental effects. *See* 33 U.S.C. § 1314(b)(2)(B); 40 C.F.R. § 125.3(d)(3).

The statute sets up a loose framework within which EPA is to take account of the BAT factors. 2011 Fact Sheet, Att. E, pp. 10-11. As one court explained:

> [i]n enacting the CWA, 'Congress did not mandate any particular structure or weight for the many consideration factors. Rather, it left EPA with discretion to decide how to account for the consideration factors, and how much weight to give each factor.'

BP Exploration & Oil, Inc. v. U.S. Environmental Protection Agency, 66 F.3d 784, 796 (6th Cir. 1995), *citing Weyerhauser v. Costle*, 590 F.2d 1011, 1045 (D.C. Cir. 1978) (citing Senator Muskie's remarks about CWA § 304(b)(1) during debate). Comparison between the factors is not required, merely their consideration. *Weyerhauser*, 590 F.2d at 1045 (explaining that CWA § 304(b)(2) lists factors for EPA "consideration" in setting BAT limits, in contrast to § 304(b)(1)'s requirement that EPA *compare* "total cost versus effluent reduction benefits" in setting *BPT* limits). While each statutory factor must be considered, the Agency has "considerable discretion in evaluating the relevant factors and determining the weight to be accorded to each in reaching its ultimate BAT determination." *Texas Oil and Gas v. EPA*, 161 F.3d 923, 928 (5th Cir. 1998), *citing Natural Resources Defense Council v. EPA*, 863 F.2d 1420, 1426 (9th Cir. 1988). *See also Weyerhauser*, 590 F.2d at 1045 (stating that in assessing BAT factors, "[s]o long as EPA pays some attention to the congressionally specified factors, [CWA § 304(b)(2),] on its face lets EPA relate the various factors as it deems necessary").

Ultimately, when setting BAT limits, EPA's consideration of the required factors is governed by a reasonableness standard. *BP Exploration*, 66 F.3d at 796, *citing American Iron & Steel Institute v. U.S. Environmental Protection Agency*, 526 F.2d 1027, 1051 (3d Cir. 1975), *modified in other part*, 560 F.2d 589 (3d Cir. 1977), *cert. denied*, 435 U.S. 914 (1978); *Chemical Manufacturers Ass'n v. U.S. Environmental Protection Agency*, 870 F.2d 177, 250 n. 320 (5th Cir. 1989) (*citing* Congressional Research Service, *A Legislative History of the Water Pollution Control Act Amendments of 1972* (1973), at 170) (in determining BAT, "[t]he Administrator will be bound by a test of reasonableness.")). As one court summarized it, "[s]o long as the required technology reduces the discharge of pollutants, our inquiry will be limited to whether the Agency considered the cost of technology, along with other statutory factors, and whether its conclusion is reasonable." *Pacific Fisheries,* 615 F.2d at 818.

With regard to technological issues, EPA takes a number of considerations into account in determining the BAT. For example, EPA compares the pollutant removal capabilities of the candidate technologies. As mentioned above, as a starting point, the BAT is supposed to be the most effective treatment technology for reducing pollutant discharges. EPA also takes into account (1) the engineering aspects of the application of various types of control techniques, (2) the process or processes employed by the point source category (or individual discharger) for which the BAT limits are being developed, (3) process changes that might be necessitated by using new technology, and (4) the extent to which the age of equipment and facilities involved might affect the introduction of new technology, its cost and its performance. *See* 33 U.S.C. § 1314(b)(2)(B); 40 C.F.R. §§ 125.3(c)(2) and (d)(3)(i).

EPA also considers the cost of implementing a treatment technology when determining the BAT. *Id.* CWA §§ 301(b)(2) and 304(b)(2) require "EPA to set discharge limits reflecting the amount of pollutant that would be discharged by a point source employing the best available technology that the EPA determines to be *economically feasible* . . .." *Texas Oil and Gas*, 161 F.3d at 928 (emphasis added). *See also* 33 U.S.C. § 1314(b)(2)(B) (when determining BAT, EPA must consider the "cost of achieving such effluent reduction"); 40 C.F.R. § 125.3(d)(3)(v) (same). The United States Supreme Court has stated that treatment technology that satisfies the CWA's BAT standard must "represent a commitment of the maximum resources economically possible to the ultimate goal of eliminating all polluting discharges." *EPA v. Nat'l Crushed Stone Ass'n*, 449 U.S. 64, 74 (1980). *See also BP Exploration*, 66 F.3d at 790 ("BAT represents, at a minimum, the best economically achievable performance in the industrial category or subcategory."), *citing Natural Resources Defense Council*, 863 F.2d at 1426.

The Act gives EPA "considerable discretion" in determining what is economically achievable. *Natural Resources Defense Council*, 863 F.2d at 1426, *citing American Iron & Steel*, 526 F.2d at 1052. It does not require a precise calculation of the cost of complying with BAT limits. EPA "need make only a reasonable cost estimate in setting BAT," meaning that it must "develop no more than a rough idea of the costs the industry would incur." *Id. Rybachek v. U.S. Environmental Protection Agency*, 904 F.2d 1276, 1290–91 (9th Cir. 1990); *Chemical Manufacturers*, 870 F.2d at 237–38. Moreover, CWA § 301(b)(2) does not specify any particular method of evaluating the cost of compliance with BAT limits or state how those costs should be considered in relation to the other BAT factors; it only directs EPA to consider whether the costs associated with pollutant discharge reduction are "economically achievable." *Chemical Manufacturers.*, 870 F.2d at 250, *citing* 33 U.S.C. § 1311(b)(2)(A). Similarly, CWA § 304(b)(2)(B) requires only that EPA "take into account" cost along with the other BAT factors. *See Pacific Fisheries*, 615 F.2d at 818.

In the context of considering cost, EPA *may* also consider the relative "cost-effectiveness" of the available technology options. The term "cost-effectiveness" has been used in multiple ways. From one perspective, the most cost-effective option is the least expensive way of getting to the same (or nearly the same) performance goal. From another perspective, cost-effectiveness may refer to a comparative assessment of different options' cost per some unit of performance (e.g., dollars per unit of pollutant removed).

In its discretion, EPA might decide that either or both of these approaches to cost-effectiveness analysis would be useful in determining the BAT in a particular case. Alternatively, EPA might reasonably decide that neither was useful. For example, the former approach would not be helpful in a case in which only one technology even comes close to reaching a particular performance goal. Moreover, the latter approach would not be helpful where a meaningful cost-per-unit-of-performance metric cannot be developed, or where there are wide disparities in the performance of alternative technologies and those with lower costs-per-unit-of-performance fail to reach some threshold of necessary performance.

Finally, the courts, including the United States Supreme Court, have consistently read the statute and its legislative history to indicate that while Congress intended EPA to consider cost in setting BAT limits, it did not require the Agency to perform some type of cost-benefit balancing. *E.g., Nat'l Crushed Stone*, 449 U.S. at 71 ("Similar directions [to those for assessing BPT under CWA § 304(b)(1)(B)] are given the Administrator for determining effluent reductions attainable from the BAT *except that in assessing BAT total cost is no longer to be considered in comparison to effluent reduction benefits*.") (emphasis added and footnote omitted); *Texas Oil & Gas*, 161 F.3d at 936 n.9 (petitioners asked court "to reverse years of precedent and to hold that the clear language of the CWA (specifically, 33 U.S.C. § 1314(b)(2)(B)) requires the EPA to perform a cost-benefit analysis in determining BAT. We find nothing in the language or history of the CWA that compels such a result"); *Reynolds Metals Co. v. U.S. Environmental Protection Agency*, 760 F.2d 549, 565 (4th Cir. 1985) (in setting BAT limits, "no balancing is required – only that costs be considered along with the other factors discussed previously"), *citing Nat'l Ass'n of Metal Finishers v. U.S. Environmental Protection Agency*, 719 F.2d 624, 662–63 (3rd Cir. 1983).

In addition to technological and cost considerations, EPA must also consider the non-water quality environmental effects (and energy effects) of using the technologies in question. *See* 33 U.S.C. § 1314(b)(2)(B); 40 C.F.R. § 125.3(d)(3). Again, the CWA gives EPA broad discretion to decide how to evaluate these non-water quality and energy effects and weigh them with the other BAT factors. *Rybachek*, 904 F.2d at 1297, *citing Weyerhauser*, 590 F.2d at 1049–53. In addition, the statute also authorizes EPA to consider any other factors that it deems appropriate. 33 U.S.C. § 1314(b)(2)(B).

(i) Age of the equipment and facilities involved

As previously discussed, PSNH recently installed an FGD system for the removal of pollutants, principally mercury, from the Station's flue gas. In order to treat the wastewater generated from the FGD system and gypsum processing, PSNH installed primary and secondary wastewater treatment systems. The primary treatment system mainly removes solids by chemical precipitation, while the secondary treatment system is a two-stage system which uses a brine concentrator and crystallizers that generate a salt cake and reusable distillate/condensate streams.

At the time of the 2011 Draft Permit, Region 1 concluded "… that the age of Merrimack Station would neither preclude nor create special problems with using vapor compression evaporation technology." 2011 Fact Sheet, Attachment E, p. 22. In other words, the age of Merrimack Station does not impact the wastewater characteristics, the processes in place, or the Station's ability to install VCE technology. This conclusion has been verified by the subsequent installation and operation of the SWWTS since June 2012 at Merrimack Station. The age of the Facility also does not have a significant effect on the cost of the treatment system, as the FGD system and associated wastewater treatment equipment are all relatively new, and PSNH has already installed the SWWTS at Merrimack Station in advance of this permit determination.

(ii) Process employed and process changes

Region 1 also considered potential process issues with the use of VCE technology for the 2011 Draft Merrimack Station Permit, stating the following:

> Specifically, EPA has considered engineering and process concerns related to the potential use of vapor compression technology, and whether it might necessitate any changes in Merrimack Station's primary production process or other pollution control processes. While effective vapor compression evaporation will require control of water chemistry and may necessitate pretreatment of the wastewater, EPA finds that use of vapor compression evaporation would not interfere with, or require changes to, the facility's other pollution control processes or its primary process for generating electricity. EPA also concludes that vapor compression evaporation technology can be utilized together with physical/chemical treatment.

2011 Fact Sheet, Attachment E, p. 22. Again, this determination has been confirmed with the subsequent installation and operation of the SWWTS since June 2012 at Merrimack Station.

(iii) Engineering aspects of the application of various types of control techniques

Region 1 has not identified any engineering aspects of the application of VCE and crystallizer technology that would preclude or significantly restrict its use at Merrimack Station. As discussed in the 2011 Fact Sheet, Attachment E, physical/chemical treatment is frequently used to treat FGD wastewater and PSNH decided to use it for Merrimack Station's primary FGD wastewater treatment system. In addition, VCE and crystallizer technology has also been used by power plants to treat FGD wastewater, albeit less commonly than physical/chemical treatment, and PSNH decided to use VCE and crystallizer technology as Merrimack Station's secondary wastewater treatment system. PSNH has installed and commenced operation of both the primary and secondary FGD wastewater treatment systems.

Consideration of Public Comments Opposing Use of VCE Technology at Merrimack Station Because of Engineering Considerations

During the public comment period for the 2011 Draft Permit, Region 1 received comments expressing concern about its determination that VCE technology *could potentially* be the BAT for treating Merrimack Station's FGD wastewater, depending on the nature of any additional information collected during the permit development process. The comments regarding engineering concerns are summarized and discussed below.

1) Some commenters stated that the VCE system at Merrimack Station is not equivalent to the only other known VCE process installed for FGD wastewater in the U.S., which is at Kansas City Power & Light's Iatan Station in Weston, Missouri (Iatan).

Region 1 acknowledges that there are several differences between the Iatan VCE system and the system installed at Merrimack Station. Iatan has 1) a brine concentrator, but no crystallizers, 2) fly ash that is conditioned with concentrated brine solution and disposed of in an on-site landfill, and 3) a different primary coal source. Nevertheless, despite these differences, the most salient fact is that both the Iatan and Merrimack Station facilities have been able to apply VCE technology in a particular way to treat their respective FGD wastewaters.[16] In other words, while there are differences between the two facilities, the fact remains that both use VCE technology.

While there may be differences between the VCE systems at different facilities because certain site specific considerations are taken into account when designing a VCE system to treat a particular FGD wastewater, [17] this does not mean that every VCE system is distinct in every respect from every other VCE system, or that the experience at one facility could never be applied (in whole or in part) to another facility. There are essential commonalities between the VCE systems now being used at various power plants to treat their FGD wastewater.

Region 1 regards the fact that a number of power plants are using VCE and crystallizer technology to achieve ZLD of their FGD wastewater to support the view that such systems are the best performing technology for reducing FGD wastewater pollutant discharges.[18] It also supports the view that, in general, this technology is available within the industry. At the same time, site-specific analysis would be needed to determine whether this technology is available for any particular facility. Yet, there is little question that the technology is available for Merrimack Station because it has already been installed there and is operating. As previously discussed, this does not, however, mean that VCE and crystallizer technology is necessarily the BAT for Merrimack Station. Region 1 must consider a number of factors specified in the CWA and EPA regulations before making that determination.

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[16] At both Merrimack and Iatan, the ZLD systems were designed by Burns & McDonnell and installed by Aquatech.

[17] The need to evaluate site-specific conditions is not unique to VCE technology (with or without crystallizers). Site-specific considerations also must be taken into account when designing physical/chemical treatment systems. As an engineer at HPD (a business unit of Veolia Water Solutions & Technologies) has explained with regard to physical/chemical treatment systems for FGD wastewater:

> FGD is an evaporative process, so it concentrates these impurities. The wastewater from gypsum dewatering will have a pollutant content that depends mostly on the type of coal burned, the efficiency of the unit's electrostatic precipitator (ESP), the level and type of impurities in the makeup water, the amount of heavy metals and impurities in the limestone, and the choice of gypsum dewatering equipment. A good understanding of these parameters is necessary to properly design an effective FGD purge water treatment system.

Shaw, 2008.

[18] Of course, as explained previously, qualifying as the best performing technology for removing pollutants does not necessarily mean this technology would be the BAT for either the industry as a whole or any individual facility. The full array of BAT factors (e.g., cost, non-water environmental effects, etc.) must be considered before determining the BAT. Region 1's analysis for Merrimack Station is presented in this document.

Having said all that, Region 1 again notes that there are seven known VCE systems currently operating, and one more being installed, to treat FGD wastewaters. As mentioned previously, Aquatech installed five VCE systems (with crystallizers) at various plants in Italy. (The system at the Brindisi power plant in Italy was evaluated in particular by EPA during the recent Steam Electric NELG rulemaking.[19]) Aquatech notes that the chemical components of the FGD wastewater varied among the five plants, mostly due to variations in "the composition of the coal burned and the limestone used to scrub the flue gas." Marlett, 2012. Generally, the type of coal burned can also affect the FGD wastewater flow rate. Coal with high sulfur and/or chlorides can increase the volume of wastewater generated by the FGD system due to the need for increased blowdown rates. *See* Steam Electric Power Generating Point Source Category: Final Detailed Study Report, EPA 821-R-09-008, October 2009, p. 4-15.[20] Each facility's system has been designed based on that facility's site-specific conditions and dynamics. Accordingly, thorough site-specific chemistry and mass balance evaluations are necessary to develop an effective system for a particular power plant. Ultimately, as one Aquatech official has explained, "[e]ach plant has a custom-designed treatment train." Global Water Intelligence, "From zero to hero – the rise of ZLD," Vol 10, Issue 12, (December 2009). At the same time, Aquatech has explained that for these systems, the "[c]riteria for design were that the system could handle varying chemistries, [and] had high reliability …." Marlett, 2012.

Region 1finds that while Merrimack Station's SWWTS shares certain characteristics with Iatan's system, it more closely resembles the systems operating in Italy. Like the Merrimack system, the Italian ZLD systems include physical/chemical pretreatment, brine concentrators and forced circulation evaporators (i.e., crystallizers).

2) Some commenters stated that corrosive wastewater requires use of exotic construction materials. Otherwise, the facility would need to frequently incur the cost of replacement parts, labor, and downtime for repairs. Furthermore, the systems used to control corrosivity require extensive and continual maintenance.

The chlorides in FGD wastewater can be extremely corrosive, especially in high concentrations. In the United States, FGD scrubbers are generally constructed of alloys that are designed to withstand a chloride concentration of 20,000 parts per million (ppm) or more. 2013 TDD, p. 6-2. Likewise, FGD treatment systems are built to withstand the corrosive nature of the effluent. Specifications for VCE and crystallizer equipment should include high grade, corrosion resistant alloys and materials such as Hastelloy,[21] rubber-coated steel, duplex stainless steel, palladium-alloyed titanium and high nickel-chrome-molybdenum alloys. PSNH reports that corrosion

[19] EPA conducted a site visit, sampling events and data analysis of the Brindisi VCE and crystallizer system to support its consideration of option 5 of the proposed Steam Electric NELG. 2013 TDD, p. 3-12.

[20] This document can be found at http://water.epa.gov/scitech/wastetech/guide/steam-electric/upload/Steam-Electric_Detailed-Study-Report_2009.pdf.

[21] Hastelloy is "[a] superalloy made predominantly of nickel and various percentages of other elements. Hastelloy is designed to withstand high-temperature and high-stress environments in which corrosion-resistance is paramount to performance." Found at http://www.toolingu.com/definition-200315-83167-hastelloy.html

resistant materials are used for the SWWTS at Merrimack Station. March 2013 CWA § 308 Response (partially designated as CBI by PSNH). At the 2013 IWC, Patricia Scroggin indicated that Burns and McDonald spent "a lot of time on materials research" for the Merrimack Station secondary treatment system and ended up using alternative materials that resulted in a "six digit" cost savings to the company. Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013.

Moreover, scale and corrosion can be controlled through process design. As one authority has explained:

> Seeding a falling-film evaporator avoids deposition of calcium salts on the tube surfaces of a brine concentrator... [and e]liminating the mist from the vapor separated by a falling-film evaporator dries the input to the compressor, reducing the potential for corrosion and erosion.

Shaw, 2008. In addition, this author further explained that:

> [t]he feed is typically acidified to eliminate residual alkalinity, and a deaerator is included to remove CO_2 and dissolved oxygen from the feed. That reduces the potential for corrosion and scaling in the evaporator vessel.

Id. The crystallizer may also be equipped with a mist eliminator to protect the compressor from corrosion and erosion. Furthermore, "[t]he high velocity of the brine and the suppression of boiling in the tubes [of a forced-circulation crystallizer] prevent scale from forming on the crystallizer's tube surfaces." *Id*.

Just as its SWWTS uses corrosion resistant materials, Merrimack Station has also used process design measures to control scale and corrosion and can continue to do so in the future. March 2013 CWA § 308 Response (partially designated as CBI by PSNH). *See also* Roy and Scroggin, 2013; Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013. Merrimack has a seeded system, mist eliminator, de-aerator and forced-circulation crystallizer. *Id*. Thus, the corrosiveness of FGD wastewater presents certain challenges to a treatment system, but there are ways to address these challenges and Merrimack Station has already done so for its SWWTS. Obviously, doing so was neither economically nor technologically infeasible.

3) Some commenters expressed concern that mercury may be re-emitted to the ambient air or concentrated in the plant if the distillate streams are reused. Further, concern was expressed that bromide in the coal or added for mercury control could also end up in the ambient air or distillate.

Region 1 found little information regarding the fate of mercury during the VCE process. Some, however, "theorize that mercury stays with the salts…." Nebrig et. al., 2011. Moreover, "[l]imited tests show that mercury has little chance to escape through the deaerator vent if the brine concentrator is operated at 1 atm." *Id*.

While recognizing the limited information on this point, Region 1 expects that the majority of mercury captured by the FGD scrubber is removed in the primary wastewater treatment system prior to entering the VCE system. As previously described, the primary wastewater treatment system at Merrimack Station includes sulfide addition and the EMARS (or "polishing step"). Both of these components of the primary FGD wastewater treatment system are targeted specifically to remove additional mercury from the FGD effluent. Richard Roy of PSNH confirmed that there is "little cycling up" of metals because the vast majority of metals are captured in the primary treatment system and hauled to an off-site commercial landfill. Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013.

Prior to completion of the FGD system, PSNH identified the concentrations of pollutants that it predicted would be present in the discharge from the new Merrimack Station FGD primary wastewater treatment system. PSNH projected that its proposed primary treatment system would achieve a mercury limit of 14 ng/L. Since that time, Region 1 has obtained mercury data from eight samples of wastewater from the primary treatment system. This data shows mercury at low levels; averaging19 ng/L.[22] This amount of mercury, even if all of it was re-emitted to the ambient air, would be a tiny fraction (< 0.003 %) of the total mercury previously released to the atmosphere in the Station's flue gas but which is now captured by the FGD scrubber and removed using the primary wastewater treatment system.[23] *See* AR #1031 for rough calculation.

Region 1 has reviewed PSNH's March 2013 CWA § 308 Response (partially designated as CBI by PSNH). Based on this review, the Region's evaluation indicates that bromide will not be a problem.

4) A commenter suggested that a major ZLD system failure might result if FGD wastewater is not successfully crystallized, resulting in sludge that would be difficult to remove, handle and dispose of.

Region 1 understands that VCE and crystallizer systems are complex and that system adjustments may be required based on site-specific variables. In the event that FGD wastewater is not successfully crystallized, facilities have several options for managing the brine solution, including sending it back through the physical/chemical treatment process, mixing it with fly ash, spray drying it, or hauling it to an off-site disposal location. Personal communication, M. Marlett, Aquatech, and S. DeMeo, Region 1, January 8, 2014. *See also* 2013 TDD, p. 7-16. That said, the comment identifies no particular reason to expect that crystallization will not be

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[22] Eight samples of wastewater from after the primary treatment system were analyzed from 12/5/2011 to 8/7/2013. Results ranged between 5.6 ng/L to max 41.3 ng/L mercury, with an average of 19 ng/L.

[23] Before the FGD Scrubber was operational, NHDES determined that 189 pounds/year mercury was emitted from Merrimack Station based on coal data from 2003-2005. NHDES, Final Determination of the Baseline Mercury Input Including Responses to Comments, June 28, 2011, p. 10. "Initial emission performance results indicate a reduction of 97% to 98% for mercury emissions…." Angela Neville, "TOP PLANT: Merrimack Station's Clean Air Project, Bow, New Hampshire," POWER Magazine, October 1, 2012.

successful, and the Region expects it will be successful. Any treatment system, including physical/chemical treatment, could potentially experience problems or malfunctions and having contingency plans ready to implement in the face of such issues is sound practice. Region 1 recognizes that some types of systems are more complex and may be more prone to difficulties than others, but these differences are a matter of degree, and we have not seen evidence establishing that VCE and crystallizer technology is prohibitively prone to debilitating malfunctions.

5) Some commenters urged that there are many operational difficulties and uncertainties with ZLD technology and that much of this uncertainty is due to the complex composition of FGD wastewater primarily due to variability in coal and limestone sources.

With any newly installed, complex technology, adjustments in chemistry and operational parameters are likely to be required over time to optimize performance. Region 1 expects that PSNH's engineers have had to perform numerous adjustments in response to Merrimack Station's site-specific conditions, including the charactieristics of its coal and limestone. Nevertheless, Merrimack Station has been operating all or part of its SWWTS for its FGD wastewater since June 2012. Certainly, continued adjustments are expected during the life of the system. As operators gain confidence and experience, however, the Region expects that they will be better able to make process adjustments in response to system changes, such as variations in limestone and coal sources. *See* Personal communication, M. Marlett, Aquatech and S. DeMeo, Region 1, January 8, 2014. Other facilities using ZLD technology have also, no doubt, had to make adjustments to optimize handling of their FGD wastewater.

For example, Aquatech has reported identifying, and successfully addressing, various maintenance issues for the ZLD system at the plant in Brindisi, Italy. These issues have been described as follows:

> [t]he major maintenance issue of the … Brindisi plant has been the hydroclone and the small lines discharging concentrate. This has been addressed and resolved by adding additional flushing points and the ability to disassemble the small lines. This is still an area where operators are practicing vigilance. The BC had one issue with a bearing failure and that caused a significant amount of downtime for the repair. During startup, the Belt Filter Press had issues with platen seals. In addition there have been instances of premature fouling and scaling of the feed preheater. During the transition to steady state operation, the dryness of the filter cake was not acceptable. This was resolved by the increase in drying time of the cake.

Marlett, 2012. Thus, Aquatech has identified and resolved a variety of issues as the treatment system went through its startup phase.

One can also reasonably expect that as operational experience treating FGD wastewater with VCE and crystallizer systems grows, the lessons learned at particular facilities will be applied to minimize future problems at those facilities and other facilities. For example, one could expect that to some degree, Aquatech will apply lessons learned at its installations in Italy to its system at Merrimack Station.

Roy and Scroggin (2013) reported several challenges for Merrimack Station's FGD wastewater treatment system that were overcome using tighter process control. First, high pH of the wastewater in the evaporator caused "volcanic" foam upsets that were resolved by careful control of the pH and discontinuing use of the antifoaming agent in the evaporator (still used in the crystallizer). Second, solid-phase sulfates were accumulating in the heat exchanger, deaerator, and evaporator. The engineering/vendor team made several modifications to the system to optimize the process, including removal of much of the sulfates prior to softening. Third, varying the constituents in the incoming fuel affects the quantity of the salt cake generated. The quantity (and quality) of salt cake affects the amount of solids that can be processed through the indexing belt filter over a given period of time. A plant wide material and water balance resulted in process optimization for the entire FGD wastewater treatment system. "The project overcame many challenges through teamwork and close cooperation between end user, engineer, and equipment supplier, resulting in a highly flexible solution which in essence advanced the technology in a comprehensive system-wide manner. Roy and Scroggin, 2013. *See also* Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013.

Finally, while variable coal and/or limestone quality may pose challenges for VCE and crystallizer technology, it may also pose challenges for other types of pollution control technologies. Thus, careful process control and the ability to make adjustments based on site-specific conditions and performance are important for many types of pollution control processes.

(iv) Cost of achieving effluent reductions

Region 1 is proposing revised technology-based requirements for Merrimack Station's new NPDES permit to govern the facility's FGD wastewater. The new requirements are based on a revised BAT determination which, in turn, is based on the power plant's currently-in-place primary and secondary FGD wastewater treatment systems. As explained above, the primary system relies on physical/chemical treatment, including the EMARS filtration or "polishing" equipment, whereas the secondary treatment system has two stages and uses VCE and crystallizer technology.

PSNH installed and began operating the various components of these treatment systems at Merrimack Station across a number of months: primary treatment system operations began in September 2011; the first stage of the secondary system began operations in March 2012; and the second stage of the secondary system commenced operations in June 2012. Thus, Merrimack Station began using the complete FGD wastewater treatment system, including the second stage of the secondary system, in June 2012. Roy and Scroggin, 2013. The full treatment system is capable of treating and reducing the wastewater to the extent that no wastewater discharge is needed and only a relatively small volume of distillate/condensate is produced which can be used as make-up water in the FGD scrubbers (i.e., it is a ZLD system).[24]

PSNH's successful, voluntary installation and operation of this FGD wastewater treatment system evidences that using this combination of technologies was not cost-prohibitive for Merrimack Station. This is a significant fact for this site-specific, BPJ determination of the BAT for controlling FGD wastewater at Merrimack Station. It does *not*, however, mean that VCE and crystallizer technology would necessarily be affordable for any other individual power plant or for the steam electric power plant industrial category as a whole. Region 1's site-specific BAT determination for the Merrimack Station permit neither analyzes nor applies to any other facility or to the industrial category as a whole.

After initially indicating to Region 1 (in 2010) that significant further evaluation of VCE technology would be needed prior to determining if VCE should be applied at Merrimack Station, (AR #40), PSNH later decided (in 2011) to install and use VCE as part of its secondary FGD wastewater treatment system (in conjunction with its previously installed primary treatment system). The circumstances surrounding PSNH's decision to install this system included the following: (1) state law required operation of the FGD scrubbers by July 1, 2013, but only if Merrimack Station had obtained all necessary permits, RSA 125-O:13(I);[25] (2) PSNH could qualify for economic incentives provided under the New Hampshire statute if it brought the FGD scrubber online and achieved mercury emission reductions before July 1, 2013, RSA 125-O:16(I)(a); (3) the sooner PSNH cut its mercury emissions, the greater the economic incentives it could realize under the statute, *id.*; (4) if the FGD system generated wastewater discharges requiring authorization from an NDPES permit, PSNH anticipated that Region 1's NPDES permitting process – including potential litigation with environmental groups over any permit that the Region might issue that allowed FGD wastewater discharges – would significantly delay Merrimack Station from commencing FGD scrubber operations and prevent it from bettering the July 1, 2013, deadline; and (5) in the absence of an NPDES permit allowing FGD wastewater discharges before the statutory deadline, PSNH would either have to forego the state economic incentives or have in place a method of managing the FGD wastewater without direct discharges to the Merrimack River so that it could lawfully commence FGD scrubber operations.

In order to manage the FGD wastewater without direct discharges, Merrimack Station would

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[24] In explaining that a certain amount of water vapor is emitted to the atmosphere from the FGD scrubber, Richard Roy from PSNH stated, during the 2013 IWC, that ZLD really did not mean there is no liquid discharge but that "the only place we are able to discharge water is up the chimney…that's our discharge permit." Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013.

[25] The state statute reads, in pertinent part, as follows:

> [t]he owner shall install and have operational scrubber technology to control mercury emissions at Merrimack Units 1 and 2 no later than July 1, 2013. The achievement of this requirement is contingent upon obtaining all necessary permits and approvals from federal, state, and local regulatory agencies and bodies ….

RSA 125-O:13(I).

need either to collect and haul the FGD wastewater for off-site disposal or employ a "zero discharge" treatment technology. As it has turned out, Merrimack Station has employed both approaches: first, it completed the primary treatment system and the first stage of the secondary system by September 2011 and March 2012, respectively, and began hauling treated FGD wastewater off-site for disposal; and, second, it completed the second stage of the secondary treatment system in June 2012 so that it could operate on a ZLD basis. *See* Testimony of William H. Smagula, Director of Generation for PNSH, before the NHPUC, Docket No. DE 11-250, June 15, 2012, p. 10-11 ("The [secondary treatment system] will take the treated effluent from the [primary treatment system] and produce a clean water stream which is recycled into the station for reuse, with any remaining dry solids collected for disposal at a permitted landfill . . . . In summary, no NPDES permit changes were needed for the Clean Air Project.").[26] Even after June 2012, PSNH has at times continued to truck treated FGD wastewater off-site for disposal at various municipal sewage treatment plants.

PSNH could have delayed operation of the FGD scrubbers while NPDES permitting issues were worked out, but it evidently made sense for the company to take the steps needed to eliminate FGD wastewater discharges so that it could bring the FGD scrubbers online well before July 1, 2013, and maximize access to the economic incentives. *See* 2012 PSNH Comments on Draft Permit, n. 68, p. 123 ("the law provides numerous incentives to PSNH if its FGD system is operational prior to 2013"). *See also* March 2012 Submission to the NHPUC, p. 4 (According to PSNH, "to incent the most expeditious installation and operation of the Scrubber, the Legislature enacted RSA 12-O:16, which provides Economic Performance Incentives for mercury reductions which are achieved prior to July 1, 2013. Because the Scrubber was placed into service in September, 2011, the Company will earn these incentives ....").[27]

EPA regards a facility's regulatory compliance costs attributable to a set of effluent limitations to be the costs that the facility would incur to install and operate plant upgrades needed to comply with those limitations. In other words, a facility's cost of achieving effluent reductions required by an Agency rule or permit under the CWA are the *incremental* costs (i.e., costs beyond the cost

[26] *See also* September 2012 Jacobs Consultancy Report for the NHPUC, p. 57 ("PSNH believed adding the discharge to the NPDES permit would be an extremely long process, possibly taking many years, due to the statutory requirements regarding public involvement. PSNH also believed there would be litigation challenges by one or more of the environmental groups that could prevent the start up of the scrubber and render the Merrimack Power Plant useless for years. Consequently, to avoid further potential litigation and possibly years of delay in placing the unit into operation, PSNH elected to install the secondary wastewater treatment system. As previously mentioned the output of this secondary system, as designed, reduces the liquids effluent to zero, resulting in nothing being discharged into the river and reduces the solid effluent to a minimum that can be disposed of in existing licensed landfills. The original construction plans had the treated water from the wastewater treatment system discharging into the river. PSNH had to reconfigure the system due to permit and litigation issues during the early part of the system construction. This redesign eliminated the need for the discharge portion to the river. All discharge from the original engineering design now enters the secondary system. The wastewater treatment system that now includes the primary and secondary wastewater treatment works together to have true zero liquid discharge in conjunction with the wet scrubber.")

[27] Early operation of the FGD scrubber also, of course, had the salutary effect of speeding reductions in Merrimack Station's emissions of harmful air pollutants, such as mercury.

of its existing wastewater treatment practices) that a plant would incur to meet the new requirements. When a plant already has technology that enables it to meet EPA's effluent limits, the cost of installing and operating the preexisting technology are not compliance costs associated with the later adopted requirements. The logic behind this approach is straightforward: when a facility is using a technology installed prior to a rule or permit imposing the requirement, the costs associated with that technology cannot reasonably be attributed to that rule or permit.

For example, EPA explained in the preamble to the Proposed Rule for the new Steam Electric Power Plant NELGs:

> [a] portion of the steam electric industry has already implemented processes or treatment technologies that serve as the basis for the regulatory options considered for the proposed rule; as a result, these facilities would not incur costs to comply with the proposed rule, or would incur costs lower than they would be if the processes/technologies had not already been implemented. In such cases, EPA assigned no compliance cost associated with the discharge of that particular wastestream other than compliance monitoring costs.

78 Fed. Reg. 34,481 (June 7, 2013) (Proposed Rule, Steam Electric NELGs). Similarly, in the Technical Development Document supporting the Proposed Rule for the Steam Electric NELGs, EPA explained that:

> [f]or plants currently treating the FGD wastewater using one-stage chemical precipitation, anoxic/anaerobic biological treatment, or vapor-compression evaporation systems, EPA did not estimate compliance costs for the specific pieces of equipment that are already operating at the plant. For example, . . . if a plant operates a one-stage chemical precipitation system for the treatment of FGD wastewater that includes all the steps included as the basis for the technology option other than sulfide precipitation, then EPA would include capital costs for the plant to install a reaction tank and sulfide chemical feed system and operating and maintenance costs for the amount of sulfide added to the system on a yearly basis. The compliance costs for all other pieces of equipment for the system would be set to zero.

2013 TDD, p. 9-11. *See also id.* at p. 9-26.

EPA has also followed this approach in other previous CWA rulemakings. For example, in assessing the economic achievability of NELGs for indirect discharges from hazardous waste landfills, EPA took into account the current performance of existing wastewater treatment technology. EPA estimated pollutant reductions by determining the difference between the current performance of the landfill industry and the expected performance after installation of the BPT/BAT/PSES treatment technology. Under this analysis:

> [f]acilities whose current discharges were not meeting the concentrations proposed . . . were projected to incur costs as a result of compliance with this guideline. A facility which did not have the [proposed] BPT treatment technology in-place was costed for installing the [proposed] BPT technology. A facility already having [the proposed] BPT treatment technology in-place, but not currently meeting the proposed limits, was costed for system upgrades where applicable.

63 Fed. Reg. 6425, 6448 (Feb. 6, 1998) (Proposed Rule) (Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards for the Landfills Point Source Category). All of the indirect discharging hazardous waste landfills in EPA's survey of the industry were expected to already be in compliance with the baseline treatment standards established for indirect dischargers. EPA therefore projected that there would be no costs associated with compliance with the proposed regulation. *See id.* at 6447-6448; TDD for Final Rule, NELGs for Landfills Point Source Category, p. 9-7.[28] *See also* 77 Fed. Reg. 29,168, 29,181 - 29,182 (May 16, 2012) (Final Rule, Effluent Limitations Guidelines and New Source Performance Standards for the Airport Deicing Category) (estimated cost for compliance with the Rule based on incremental costs to facilities when existing practices would not lead to compliance with the regulatory option under consideration); 66 Fed. Reg. 65,266, 65,323 (Dec. 18, 2001) (Final Rule, National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities) (for facilities already planning to install the "Best Technology Available" prior to promulgation of the new regulations, the cost of such technology installation is not part of the cost of compliance with the new regulations).

Similarly, in *Texas Oil & Gas*, 161 F.3d at 929-936, the United States Court of Appeals for the Fifth Circuit upheld an EPA economic achievability analysis which supported effluent limitations prohibiting certain pollutant discharges and in which EPA determined that the cost of compliance with the limitations was minimal because the "reinjection" technology chosen by the Agency as the BAT reflected what was already current practice at the vast majority of covered facilities. More specifically, EPA found that, due to a combination of factors, the vast majority of the coastal oil and gas facilities covered by its rulemaking (and by EPA Region 6's General Permit) already used reinjection technology that allowed them to achieve zero discharge of the pollutants at issue (e.g., produced water). As a result, EPA found that such already compliant facilities would not incur additional compliance costs due to the Agency's BAT-based zero pollutant discharge limits. 161 F.3d at 931-932, 934.

In the present case, Merrimack Station has already installed and is operating the technologies that Region 1 has determined on a site-specific, BPJ basis are the BAT for controlling FGD wastewater at the Facility. Specifically, as explained in this Fact Sheet, the Region has determined that the Facility's existing primary FGD wastewater treatment system (which includes physical/chemical treatment components and the EMARS system) combined with its existing secondary FGD wastewater treatment (which includes the two-stage evaporation system

[28] For the same reason, EPA projected that there would be no additional pollutant reduction benefits associated with compliance with the proposed regulation. *See id.* at 6449.

which can be operated to achieve ZLD) are the BAT. PSNH voluntarily decided to install and commence operations of the primary and secondary FGD wastewater treatment systems, including the ZLD components. Installing this wastewater treatment system was not required by Region 1 at the time. (Doing so did, however, enable Merrimack Station to begin operating its FGD scrubbers without needing an NPDES permit, which both accelerated reductions in the Facility's air pollutant emissions and maximized its qualification for the state law economic incentives that rewarded expedited cuts in the Facility's air emissions of mercury, in particular. *See* RSA 125-O:11(IV).) By continuing to use this treatment system at Merrimack Station, the Facility will be able to comply with the Revised Draft Permit's requirements based on this technology. Therefore, PSNH will incur no additional costs to comply with the BAT-based requirements in the Revised Draft Permit. (This is, of course, an entirely site-specific determination applicable to Merrimack Station and not to other facilities.) In other words, the costs of complying with the Revised Draft Permit (including both capital and O&M costs) of physical/chemical treatment together with softening and VCE processes are considered zero because these technologies are already in operation at Merrimack Station, as described above, and were not installed due to this BAT determination. In addition, the Facility would also be able to comply with the limitations and conditions in the 2011 Draft Permit, which were based on the use of physical/chemical and biological treatment, using its current VCE technology. Therefore, the cost of complying with the BAT determination in the 2011 Draft Permit would also be considered zero.

Additional Discussion of Cost

Although PSNH's cost to install and operate the primary and secondary wastewater treatment systems are not attributable to Region 1's revised BAT determination for Merrimack Station's control of FGD wastewater, the Region analyzed and considered these costs and provides additional information regarding them below.

For the purpose of the 2011 Draft Permit, EPA estimated that the capital cost of installing the primary treatment system, together with the VCE system, would be approximately $27,949,000. *See* 2011 Fact Sheet, Attachment E, p. 22. More recently, Region 1 received information stating that PSNH had spent approximately $36.4 million to put the secondary wastewater treatment system in place ($32.6 million for installing the VCE and crystallizer technology and $3.8 million for a soda ash softening process that provides pretreatment to the system). Jacobs Consultancy, "New Hampshire Clean Air Project Final Report," prepared for NHPUC, September 10, 2012, p. 57 ("PSNH elected to install a secondary wastewater treatment system for $36.4M.").[29]

[29] In order to put these costs into context, the Region notes that it received information that this system is considered a component of PSNH's larger FGD Scrubber/Clean Air Project, and that PSNH was able to use certain reserves or contingency money from the budget of that project to fund the SWWTS without any budget increase. *Id*., p. 35-36; Conservation Law Foundation, Comments on Draft NPDES Permit No. NH0001465 for PSNH's Merrimack Station, February 28, 2012 (CLF Comments, 2012), p. 32. Pursuant to an investigation recently conducted at the direction of the NHPUC as part of its assessment of PSNH's request that it be allowed to recover the costs of its FGD Scrubber/Clean Air Project through an energy service rate, it was reported that the total cost of the FGD Scrubber/Clean Air Project was updated to $422 million, a decrease from the estimated $430 million that we noted

Annual O&M costs for the primary and secondary WWTS's include costs associated with operating labor, maintenance labor, maintenance materials, chemical purchase, energy requirements, compliance monitoring, sludge transportation, sludge disposal, and impoundment operation. *See* 2013 TDD, p. 9-21. *See also* 78 Fed. Reg. 34481 (Proposed Steam Electric NELG's). For the September 2011 Draft Permit, EPA estimated that annual O&M costs for the primary system alone (without the EMARS technology) would be approximately $430,000 per year. *See* 2011 Fact Sheet, Attachment E, p. 22. With the EMARS technology, the O&M costs for the primary system would be somewhat greater. Annual O&M costs estimated for the primary treatment system together with VCE would be approximately $1,524,000 per year.[30] *Id.* at p. 28. Based on these figures, a reasonable estimate of the O&M costs for the VCE treatment equipment alone would be approximately $1,100,000 ($1,524,000 - $430.000 = $1,094,000; rounded to $1,100,000).

After learning that PSNH had installed the secondary wastewater treatment system (SWWTS) at Merrimack Station, Region 1 sent PSNH an information request pursuant to CWA § 308(a) asking, among other things, "[w]hat was the total operating and maintenance (O&M) cost associated with the SWWTS that PSNH incurred from September 28, 2011 through the end of 2012?" February 7, 2013 CWA § 308 Information Request. In response, PSNH did not provide the Region with a figure. The company indicated that it does not track SWWTS O&M costs separately. March 2013 CWA § 308 Response (partially designated as CBI by PSNH). Although PSNH did provide a cost per pound for SWWTS salt cake disposal, it did not provide figures for other O&M costs. Based on this value, Region 1 estimates that the cost of salt cake disposal from the SWWTS is less than $100,000 per year. This value is a small component of the estimated total O&M cost of $1,100,000 per year for the SWWTS. *Id*. See also AR #1037 and #1003 (CBI information redacted). In sum, the best information that Region 1 currently has about O&M costs for the existing primary and secondary FGD WWTS at Merrimack Station are the figures stated above.

(v) Non-water quality environmental impacts (including energy requirements)

Finally, Region 1 considered the non-water quality environmental impacts and energy

for the purpose of the Draft Permit. Jacobs Consultancy, "New Hampshire Clean Air Project Final Report," prepared for NHPUC, September 10, 2012, p. 35-36; 2011 Fact Sheet, Attachment E, p 28. (In Region 1's February 7, 2013 CWA § 308 Information Request, we asked PSNH whether it sought, or is currently seeking, recovery of SWWTS costs as part of its energy service rate approval application before the NHPUC. PSNH declined to answer, however, stating that this information is irrelevant to Region 1's BAT determination. March 2013 CWA § 308 Response (partially designated as CBI by PSNH).) For comparison, if the cost of adding the SWWTS was $36.4 million, it would represent 8.6% of FGD Scrubber/Clean Air Project's total cost. CLF proposes a different comparison, stating that the annual cost of the VCE system would comprise only 1.5% of the estimated annual operating revenue of the Facility. If the latter claim is correct, this would represent only a small fraction of Merrimack Station's operating revenue. CLF Comments, 2012, p. 36.

[30] Region 1 notes that included with their comments on the 2011 Draft Permit, EPRI estimates the O&M costs for physical/chemical treatment alone would be approximately $1,000,000 per year.

requirements associated with the primary and secondary FGD wastewater treatment systems at Merrimack Station, including solids generation, air emissions, sound emissions, and visual effects. To Region 1's current knowledge, there is nothing about either the primary or secondary FGD wastewater treatment systems that is likely to generate any significant adverse non-water quality environmental effects at Merrimack Station.

Solids Generation

At the time of the Draft Permit, EPA estimated that physical/chemical treatment alone at Merrimack Station would generate approximately 1,976 tons of solids per year for off-site disposal. *See* 9/16/11 (09:57 AM) Email from Ronald Jordan, EPA Headquarters, to Sharon DeMeo, Region 1, "Non-water quality environmental impacts for FGD wastewater treatment options" (9/16/11 Email from Ron Jordan) (AR #117). Comparatively, EPRI estimated that the physical/chemical treatment system at Merrimack Station would generate approximately 5,000 tons of solids per year. *See* EPRI, Comments on the Draft Determination of Technology-Based Effluent Limits for the Flue Gas Desulfurization Wastewater at Merrimack Station in Bow, New Hampshire (EPRI Comments, 2012), February 27, 2012, Table 6, p. A-10. Based on more recent calculations using a maximum flow of 70 gpm instead of an average flow of 35 gpm, Region 1 estimates that Merrimack Station could generate up to 6,100 tons of solids per year.[31]

Region 1 then developed an estimate of the additional amount of solids that would be generated from the SWWTS at Merrimack Station. Based on reviewing waste manifests, Region 1 estimates that Merrimack Station's secondary treatment system generates an average of 4.1 tons of salt cake solid waste per day or 1,507 tons per year. March 2013 CWA § 308 Response, Attachment 6 (non-hazardous manifests) (not designated as CBI). The Region notes that this amount reflects the Facility's relatively low capacity factor during this time period and it would likely be higher with greater Facility operations.[32] In addition, the PSNH manifests for salt cake may not have included the additional solids generated by the added softening step that is used prior to the vapor compression evaporator. Using the sludge factors used by EPA in the 2013 TDD, Region 1 estimated the maximum amount of softening sludge and crystallizer sludge that could be generated by Merrimack Station. Using a maximum flow of 70 gpm, Merrimack Station is estimated to generate 15,768 tons of sludge/year from softening and 5,255 tons of sludge/year from the crystallizer.[33] *See* 2013 TDD, p. 12-12.

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[31] Assuming a maximum flow of 70 gpm, Region 1 determined the annual sludge generation (tons/year) using the following equation: sludge generation rate (0.24 tons per day per gallon per minute of FGD wastewater flow) x FGD wastewater flow (70 gpm) x 365 days/year. *See* 2013 TDD, p. 12-12.

[32] While the capacity factors at the few remaining coal-burning power plants in New England may well experience short-term fluctuations going forward, Region 1 does not expect significantly greater operations overall in light of current patterns and trends in relative fuel prices and coal-burning power plant operations in New England. *See,* e.g., Bruce Mohl, "Coal, Oil Stage Comeback," *Commonwealth Magazine* (January 9, 2014); *12/13/13* Email from John Moskal, Region 1, to Sharon DeMeo, Region 1 ("Updated Capacity Factor graphs for Merrimack Station"); Bruce Mohl, "Goodbye Coal," *Commonwealth Magazine* (March 14, 2012).

[33] Region 1 determined the annual sludge generation (tons/year) using the following equations:

Based on the values discussed above, Region 1 estimates that Merrimack Station could generate at most approximately 21,000 tons of solids per year from its secondary FGD wastewater treatment system.

Yet, even if the additional solids generated with the use of the SWWTS amounts to a maximum 21,000 tons per year, this would still be a relatively small percentage increase in the amount of solids generated at the site overall. With its comments on the 2011 Draft Permit for Merrimack Station, CLF submitted a consultant's report which estimates that a total of approximately 281,000 tons of solids are generated at Merrimack Station each year. *See* CLF Comments, 2012 Exhibit 2 (report by John Koon of John H. Koon & Associates). This estimate is based on information provided by PSNH to calculate the amount of gypsum and ash generated at the plant. The amount of gypsum (187,000 tons/year) was determined using the FGD limestone feed rate at design capacity (17.4 tons/hour), extended to an annual basis and applying the Station's 2011 capacity factor. The amount of ash generated was determined by considering the amount of coal burned.

> According to the permit application for the FGD system installation, the station burns 1,256,896 tons/yr of coal which has an ash content of 7.3 - 7.6%. This calculates to an annual ash generation rate of 94,566 tons/yr. (PSNH 2007).

CLF Comments, 2012, Exhibit 2, p. 13. Region 1 agrees that while this estimate is only an approximate value, it nevertheless helps to place the estimated amount of solids generated by the SWWTS into some type of larger context. The generation of a maximum 21,000 tons of solids per year from the use of Merrimack Station's SWWTS would amount to approximately 7.5% of the total amount of solids generated at the plant.[34]

As a result, Merrimack Station is expected to generate up to approximately 21,000 tons of added solids per year utilizing VCE and crystallizer technology. In Region 1's judgment, this is a relatively small increase in the total volume generated at the site.

Based on comments received during the 2011 Draft Permit public comment period, Region 1 also considered that solid waste generated from some FGD ZLD systems may contain hygroscopic salts which could contaminate landfill leachate and increase the cost of disposal.

> The characteristics of the salts formed in the crystallizer depend on the crystallization

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Softening Sludge (tons/year) = Softening Sludge Factor (51.43 lb/hr-gpm) × FGD Wastewater Flow (70 gpm) × (1 ton/2,000 lb) × 24 hr/day × 365 day/year
Crystallizer Sludge (tons/year) = Crystallizer Sludge Factor (17.14 lb/hr-gpm) × FGD Wastewater Flow (70 gpm) × (1 ton/2,000 lb) × 24 hr/day × 365 day/year

[34] The Region also notes that John Koon reported that the SWWTS at Merrimack Station will produce an additional 5,000 tons of solids per year. CLF Comments, 2012, Exhibit 2, p. 13. Compared to the 281,000 tons of solids per year hauled off-site, "wastewater treatment operations [SWWTS]…might result in an increase of solids generated at the Merrimack site of 1.8%." *Id*.

> process picked. With a fully softening process, the salt is mainly composed of sodium chloride, which is not hygroscopic. The ZLD's in Italy and China generate this kind of salt.
>
> A partially softened process generates salt with a hygroscopic nature, as it is composed mainly of calcium chloride hydrate. A nonsoftened process produces a similar salt that is composed mainly of calcium chloride and magnesium chloride hydrate. Both salts tend to melt down in a short period of time (minutes to hours).

Nebrig et. al., 2011. Roy and Scroggin report that the FGD wastewater at Merrimack Station is partially softened and neutralized with lime and soda ash at the end of the facility's primary wastewater treatment system. In effect, calcium ions are replaced by sodium ions and the resulting solid phase sodium sulfate is removed as settleable solids. Therefore, only the remaining liquid-phase sulfates are softened, resulting in the need to dispose of mainly sodium chloride. Although the wastewater is "partially" softened, in this case the result is a stable solid salt cake that can be disposed of in a commercial landfill. The solid salt cake generated does not contain hygroscopic salts that require special processing to reduce absorption of moisture from the atmosphere. Personal communication, M. Marlett, Aquatech, and S. DeMeo, Region 1, January 8, 2014.

Energy Requirements

Generally, multiple effect crystallizers like the one at Merrimack Station conserve energy compared to single effect crystallizer. *Id*. In addition, energy efficiency has been engineered into the SWWTS in certain areas. For example, cooled ZLD distillate from both the evaporator and crystallizers is used as the cooling water source for the second effect condenser. "Not only did this eliminate an additional service water use for the cooling of the crystallizer distillate, the warmed distillate enhances wet FGD operation." Roy and Scroggin, 2013. *See also* Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013. Further, the primary condenser was removed from service because instead of condensing the first effect vapor, the vapor was used as a heating element for the second effect. Therefore, the second effect uses less energy. *Id*.

For the 2011 Draft Permit, physical/chemical treatment is estimated to require approximately 339,017 kW-hr/year (339 MW-hr/year) of electricity. *See* 9/16/11 Email from Ron Jordan. Comparatively, EPRI estimates that Merrimack Station's physical/chemical treatment system uses 500,000 kW-hr/year (500 MW-hr/year). *See* EPRI Comments, 2012, Table 6, p. A-10.

In response to the Region's request for information regarding the energy demand of the secondary wastewater treatment system, PSNH stated a "contractually guaranteed value." 12/20/12 (09:46 AM) Email from Linda Landis, Senior Counsel, PSNH, to Mark Stein, Region 1 (designated as CBI) (redacted copy at AR #897). Region 1 asked again via the February 7, 2013 CWA § 308 Information Request for actual energy use figures but PSNH indicated that it could not provide that information. March 2013 CWA § 308 Response (partially designated as CBI by

PSNH). Considering the Station is rated at 440 MW (or a maximum 3,854,400 MW-hr/year at full load), the contractually guaranteed energy demand value for the SWWTS is a tiny fraction of the total energy generated at the Station. CLF's consultant, John Koon, came to a similar conclusion, estimating that the additional energy needed for VCE (17,000 MW-hr/year) amounts to 0.8 percent of the total energy generated at the site (based on generation of 2,800,000 MW-hr/year). CLF Comments, 2012, Exhibit 2, p. 13.

Air Emissions

While some indirect air emissions could potentially be attributed to the energy needed to operate the FGD wastewater treatment systems, in Region 1's judgment any such incremental air emissions would be relatively insignificant. Specifically, they will be insignificant relative both to Merrimack Station's overall energy production and air emissions as well as to regional energy production and air emissions.

Region 1 estimated that Merrimack Station would generate an average of 4 million tons of CO_2 per year if the plant ran at near full capacity. *See* AR #881 and #1032 (CBI information redacted from AR #1032). Using EPA air market data from 2011 – 2013 for each Unit, the Region chose the highest (most conservative) value of tons of CO_2 generated per MW-hr (in 2011, Unit 1 generated 1.09 tons CO_2/MW-hr) to calculate the amount generated from the SWWTS-dedicated boiler. *Id*. Considering the contractually guaranteed energy demand value for the SWWTS, the total amount of CO_2 generated by using this system is a tiny fraction of the total amount that the Facility generates (<1%). *Id*. *See also* March 2013 CWA § 308 Response (partially designated as CBI by PSNH). Likewise, the emission rates for SO_2 and NO_x associated with running the SWWTS will be a similarly small percentage of the overall plant emissions.

Moreover, it should be understood that any such incremental emissions would not represent an increase to the status quo. Rather, they would represent a relatively small reduction in (or offset against) the extent to which the FGD scrubber system reduces the Facility's emissions of harmful air pollutants. In other words, while the FGD scrubber system substantially reduces Merrimack Station's emissions of harmful air pollutants, those reductions might be marginally less because of the energy requirements of the treatment system needed for the FGD wastewater. The FGD wastewater treatment system is needed to avoid a result in which the wet FGD scrubber system merely converts air pollution emissions into direct discharges of water pollution.

Sound Emissions and Visual Effects

Sound emissions could be a concern if the VCE and crystallizer equipment is located very near to sensitive receptors (e.g., residences). Noise comes principally from pump operation, equipment rotation and the flow across valves. Personal communication, M. Marlett, Aquatech and S. DeMeo, Region 1, January 8, 2014. In this case, the SWWTS is housed within a building on the Station property and sound emissions should have little effect on the surrounding community. Likewise, Region 1 does not expect that the added building housing the SWWTS to present an unacceptable visual impact, given that Merrimack Station is already a huge industrial facility with large buildings, tall smoke stacks and electrical transmission lines on the site.

4.4.3 Conclusion

As previously discussed, in the absence of applicable effluent limitation guidelines based on the best available technology (BAT) standard, a permitting authority must establish BAT effluent limits based on its best professional judgment (BPJ). During the development of the 2011 Draft Permit for Merrimack Station, Region 1 determined that physical/chemical treatment in combination with biological treatment constituted the BAT for controlling Merrimack Station's FGD wastewater discharges. Consequently, the Region proposed effluent limits to be applied at Outfall 003C consistent with these treatment technologies.

However, Region 1 subsequently learned, as described in this Fact Sheet, that along with the physical/chemical treatment system, PSNH began installation of a secondary, VCE and crystallizer system at Merrimack Station in 2011. Region 1 also learned that PSNH has been operating the completed systems since at least June 2012.[35] As previously described, this combined (i.e., primary and secondary) wastewater treatment system is capable of eliminating any direct liquid discharge of pollutants to the Merrimack River, though it will generate solid waste and distillate/condensate streams. As the system is designed, the solid waste is hauled for off-site disposal and the distillate/condensate streams can be used as FGD scrubber make-up water.

In consideration of the appropriate factors, as discussed in detail above, Region 1 has revised its site-specific, BPJ-based BAT determination. *See* CWA § 304(b)(2); 40 C.F.R. §§ 125.3(c)(2) and 125.3(d)(3); 45 Fed. Reg. 68333. The Region now determines that Merrimack Station's existing primary FGD wastewater treatment system (which includes physical/chemical treatment components and the EMARS system) combined with its existing secondary FGD wastewater treatment (which includes the two-stage evaporation system which can be operated to achieve ZLD) are the BAT.

[35] As previously stated, PSNH voluntarily decided to install and commence operations of the primary and secondary FGD wastewater treatment systems, including the ZLD components. Installing this wastewater treatment system was not required by Region 1 at the time. (Doing so did, however, enable Merrimack Station to begin operating its FGD scrubbers without needing an NPDES permit and maximize qualification for the state law economic incentives for expedited cuts in Merrimack Station's mercury air emissions.) By continuing to use this treatment system at Merrimack Station, the Facility will be able to comply with the Revised Draft Permit's requirements based on this technology.

5.0 Re-Noticed Draft Permit Conditions

5.1 Removal of Outfall 003C in Draft Permit Based on Revised BAT Determination

In this Revised Draft Permit, Region 1 is proposing to remove Outfall 003C. Presently, Merrimack Station has already installed and is operating the technologies (i.e., primary and secondary wastewater treatment systems) that Region 1 has determined on a site-specific, BPJ basis are the BAT for the controlling FGD wastewater at the Facility. These technologies are capable of eliminating the direct discharge of pollutants, as discussed above. Consistent with this BAT determination, the permit precludes FGD wastewater discharges to the Merrimack River. Removing outfall 003C from the permit would accomplish this result by removing from the permit any authorization to discharge FGD wastewater directly to the river.

While the treatment system could be operated as a ZLD, in practice, Merrimack Station has for various business reasons opted at times to collect treated FGD wastewater and ship it off-site for indirect discharge through various municipal wastewater treatment plants. The facility has collected this wastewater after treatment in the primary (physical/chemical) treatment system, after treatment in the primary system and the first stage of the secondary system (i.e., the brine concentrator), and more recently "blowdown" from the crystallizer and equipment maintenance wash water. Although, the volume and frequency of shipments have declined significantly since the system began operating, it is unclear why PSNH would need to continue hauling wastewater.[36] Region 1 notes that the Italian plants with VCE and crystallizer technology, as discussed earlier, do not discharge or haul wastewater from their facilities (i.e., they are true ZLD systems) and the systems are reported to be working properly. *See* Personal communication, Leonardo Arrighi, ENEL and S. DeMeo, Region 1, February 7, 2014.

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[36] Within the last seven months, PSNH has hauled a total of 344,000 gallons of FGD wastewater and FGD-related wastewater from Merrimack Station for offsite disposal, as shown in Table 4-1 above. In its November 8, 2013 CWA § 308(a) information request letter, Region 1 asked PSNH to explain the reason(s) for each off-site shipment going forward. Instead, PSNH responded with the following general statement applicable to all occurrences:

> [i]n each case, it was a business decision reached after consideration of multiple factors that may have included continued optimization of the secondary wastewater treatment system ("SWWTS") or individual components of that system; necessary adjustments based on fuel blends, load changes on either unit, or changes in chemistry due to Absorber optimization; operation of individual components or a combination of components of the SWWTS; operational constraints (other than the SWWTS); maximizing systemic Station operation when generating for a short time period.

December 2013 CWA § 308 Response. From this response – i.e., that each case of offsite disposal reflects a business decision based upon the consideration of an unspecified combination of potential factors – Region 1 has not been able to discern the precise or most important reasons for PSNH's periodic decisions to dispose of FGD wastewater offsite.

Region 1 has also reviewed the limited data available for the Facility's off-site shipments of FGD wastewater. Based on that review, the Region is concerned about the presence of pollutants that present a particular ecological threat due to their tendency to persist in the environment and bioaccumulate in organisms. Such pollutants include arsenic, mercury and selenium. This data is presented in Table 4-1 above. It is unclear whether these pollutants receive any treatment at the POTWs. These constituents are generally expected to pass through a typical municipal sewage treatment plant. 78 Fed. Reg. 34477 (June 7, 2013) (Table VIII-3). Ultimately, until EPA promulgates new categorical pretreatment standards, the sewage treatment plants accepting this wastewater will have to ensure that any necessary pretreatment requirements are in place, which may include local limits, and PSNH will need to comply with them. *See* 33 U.S.C. § 1317(b), (c) and (d); 40 C.F.R. Part 403. *See also* 78 Fed. Reg. 34438, 34477 - 34478, 34540 - 34543 (June 7, 2013) (Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category; Proposed Rule) (pretreatment standards). [37]

Another potential alternative means by which Merrimack Station could choose to comply with the new proposed permit conditions would be to use the wastewater, after treatment in the primary and secondary treatment systems, to wet (or "condition") its fly ash for disposal in a landfill. The Region believes that this is a viable option given that PSNH reports that the system was designed to do so and that it has disposed of conditioned fly ash at an off-site landfill in the past.[38] Roy and Scroggin, 2013. *See also* Sharon DeMeo, Region 1, notes on IWC-13-47 presentation, November 19, 2013.

Under this approach, the conditioned fly ash would be disposed of at either an on-site or an off-site landfill. Any such landfill disposal would need to comply with any applicable legal requirements. Moreover, any discharges of landfill leachate containing pollutants from the FGD wastewater would need to meet any effluent limits applicable to such discharges. For example, although PSNH indicated it would not do so, if Merrimack Station proposed collecting and discharging such landfill leachate to its onsite settling pond prior to discharge to the Merrimack River, then Region 1 would anticipate imposing effluent limits on the leachate discharges at the

[37] EPA's proposed Steam Electric NELGs include categorical pretreatment limitations for new and existing FGD wastewater sources discharging to local sewage treatment plants. For existing facilities, EPA proposed that the pretreatment limitations found at 40 C.F.R. §§ 423.16 and 423.17 would "apply to pollutants in FGD wastewater generated on or after a date determined by the control authority that is as soon as possible beginning July 1, 2017." 78 Fed. Reg. 34460 – 34461, 34541 (June 7, 2013) (Proposed Rule). Prior to the applicability of the new categorical pretreatment standards, FGD wastewater delivered to a municipal sewage treatment plant would be subject to local pretreatment program requirements, including any local limits developed to prevent pass through of, and/or interference with, the treatment plant. *See* 40 C.F.R. § 403.5(c); 78 Fed. Reg. 34460, 34543.

[38] "The concentrated reject stream from the crystallizer would be stored and used as a wetting agent for the fly ash generated onsite and landfilled offsite." Roy and Scroggin, 2013. In addition, the maximum flow rate for the first effect of the SWWTS was guaranteed by the supplier and "based upon the fly ash silo total ash wetting requirements." *Id*. Furthermore, "[b]ecause the fly ash silo was located near the generating unit with road access between the unit and the new ZLD building, all piping between the fly ash silo and ZLD building was accomplished using underground trenching or routed through new or existing buildings" *Id*.

point of discharge to the settling pond (i.e., prior to the wastewater commingling with other wastewaters discharged to the pond). The Region would need to determine appropriate technology-based limits either on a BPJ basis or by applying any applicable effluent guidelines. *See* 78 Fed. Reg. 34,457-34,463 (June 7, 2013) (Proposed Rule). In addition, water quality-based limits for the slag settling pond (outfall 003A) may also be necessary based on an antidegradation review. Region 1 welcomes public comments recommending what limits should be applied to any such leachate discharges containing pollutants from the treated FGD wastewater.

In the future, Merrimack Station could potentially use this multi-faceted approach to comply with the proposed NPDES permit conditions precluding the Facility from directly discharging its FGD wastewater to the Merrimack River. Under all of the three scenarios – (1) operating the SWWTS as a true ZLD system that eliminates wastewater discharges by enabling reuse of the distillate in the FGD scrubbers, (2) hauling wastewater for disposal at municipal wastewater treatment plants,[39] or (3) using treated FGD wastewater for ash conditioning prior to landfilling – Merrimack Station would have no direct discharges of FGD wastewater to the Merrimack River. In the latter two cases, there could be *indirect* contributions of the treated wastewater to the river subject to applicable requirements for pretreatment or landfill disposal and leachate discharge, as the case may be. In light of these three viable approaches to managing FGD wastewater without directly discharging it to the Merrimack River, Region 1 is proposing to remove Outfall 003C from the Facility's NPDES Permit. This change is reflected in the Revised Draft Permit.

The Region also considered assigning discharge permit limits for the distillate and condensate streams of the SWWTS. Under this approach, the distillate/condensate streams could be discharged to the Merrimack River, subject to applicable effluent limits. Region 1 ultimately determined, however, that this approach was not consistent with the BAT standard because the existing FGD WWTS is capable of achieving zero liquid discharge (e.g., reusing these streams as FGD scrubber water).

For this approach, however, Region 1 considered the idea of permit limits for specific pollutants based on the levels of these pollutants found in the distillate/condensate from the power plant located in Brindisi, Italy, and put forward in the proposed Steam Electric NELG. The Agency explained that:

> [i]n April 2011, EPA conducted a three-day sampling episode at Enel's Federico II Power Plant (Brindisi), located in Brindisi, Italy. The purpose was to characterize untreated FGD scrubber purge and treated FGD wastewater from an FGD wastewater treatment system consisting of chemical precipitation followed by mechanical vapor-compression evaporation.

[39] From reviewing information from hauled wastewater disposal reports, the Region learned that PSNH is now collecting equipment wash water from the crystallizer filter press and crystallizer "blowdown". It is unclear to Region 1 why the filter press equipment wash water is not recycled back into the treatment process along with the filtrate or why the second effect crystallizer is not utilized.

> The mechanical vapor-compression evaporation system used a falling-film brine concentrator to produce a concentrated wastewater stream and a reusable distillate stream. The concentrated wastewater stream was further processed in a forced-circulation crystallizer, in which a solid product was generated along with a reusable condensate stream.

2013 TDD, p. 3-12. Although the Brindisi FGD treatment plant is operated as a ZLD system, EPA determined that "[t]he plant could choose to discharge both the brine concentrator and the crystallizer condensate streams, together or separately." 2013 TDD, p. 10-14 n. 93. On this basis, the Agency included possible VCE-based effluent limits for distillate and condensate in the proposed Steam Electric NELGs. These proposed limits were determined based on averages of three days of data for the distillate and condensate streams from the Brindisi plant. See Table 5-1 below.

The Region has determined, however, that it would not be appropriate to use the Brindisi data documented in the proposed Steam Electric NELG as the basis for limits for Merrimack Station because the latter facility is capable of operating without any discharge and, therefore, the BAT standard calls for permit requirements requiring "zero discharge." Furthermore, using the Brindisi facility data to set specific effluent limits for Merrimack Station distillate/condensate would be inappropriate because the former does not have Merrimack's EMARS technology for removing mercury from the treated FGD wastewater. Specifically, in PSNH's December 3, 2010 Report, submitted to Region 1 in response to an information request under CWA § 308(a), PSNH identified the concentration of mercury that it predicted would be present in the discharge from Merrimack Station's primary FGD wastewater treatment system, including the EMARS step. PSNH predicted that the proposed treatment system could achieve a mercury limit of 14 ng/L, which would ultimately result in a BPJ-based limit lower than the proposed limit based on the data from the Brindisi facility. Thus, Merrimack Station is capable of achieving lower pollutant levels in its condensate and distillate streams than the Brindisi facility and any permit effluent limits would need to reflect that. In any event, both facilities are capable of operating as ZLD systems and Region 1 is proposing to eliminate authorization of FGD wastewater discharges from Outfall 003C in Merrimack Station's permit based on its determination of the BAT for the Facility. This will, of course, obviate the need for setting permit effluent limits for such discharges.

In addition to the Brindisi data, Region 1 also considered information presented by the Permittee. Specifically, PSNH submitted four sets of data from sampling the secondary treatment system's distillate stream. The following table shows the difference between the effluent limitations for the VCE and crystallizer distillate streams from the proposed Steam Electric NELGs and the Merrimack Station distillate samples. *See* 78 Fed.Reg. 34,490 and 34,534 (June 7, 2013).

Table 5-1 Effluent Limitations for FGD after VCE from Proposed Steam Electric NELGs Compared to Merrimack Station Distillate Samples

		Proposed Limits after Chemical Precipitation and VCE/Crystallizer		**Merrimack Station Distillate Sampling Results**			
Pollutant	Units	Daily Max	Monthly Ave	3/4/12	8/16/12	9/6/12	10/18/12
Arsenic	µg/L	4 = DL	*	<0.15	6	6	<1
Mercury	ng/L	39	24	<0.50	<200	<200	<200
Selenium	µg/L	5 = DL	*	0.71	22	20	2

* monthly average limitation is not established when the daily maximum limitation is based on the detection limit.

The current Merrimack Station Draft Permit limit for mercury is 14 ng/L. This limit was based on the level of treatment that PSNH projected would be provided by Merrimack Station's physical/chemical treatment with the added EMARS step. Region 1 determined that this was also a valid limit to use after biological treatment, which was the BAT proposed for the 2011 Draft Permit. With regard to the data submitted by PSNH, the Region does not consider four days of data sufficient to determine the permit limits for Merrimack Station's distillate/condensate streams. Furthermore, the <200 ug/L value reported for mercury is too high to be useful for permit limit determination.

In any event, Region 1 is not proposing an option that would include discharge limits for the distillate/condensate streams. This wastewater is relatively clean and can be recycled back to the FGD scrubber without difficulty. PSNH has been doing so since September 2012 (PSNH reports hauling distillate on only two occasions (August and September, 2012) since the SWWTS has been operational). If the Permittee decides to use the distillate/condensate as a water source for another process(es) other than the FGD scrubber (e.g., boiler make-up), the Region would need to consider if pollutants in the distillate/condensate would be detected in any discharges from that process(es) (e.g., boiler blowdown) and potentially develop appropriate NPDES discharge limits.

5.2 Removal of Certain Limits for Outfall 003A

Outfall 003A is the sampling location for the slag settling pond. The slag settling pond currently receives bottom ash transport wastewater, storm water, boiler blow-down, treated chemical metal cleaning effluent, and other miscellaneous and low volume wastes. PSNH initially indicated that it intended to direct Merrimack Station's FGD wastewater to the slag settling pond. As a result, the 2011 Draft Permit included various requirements based on the addition of FGD wastewater to the slag settling pond. These permit conditions included reporting requirements for chloride as well as reporting requirements and effluent limits for aluminum, arsenic, mercury and selenium at Outfall 003A based on water quality considerations. These permit requirements were informed by the 2010 NH DES antidegradation analysis, which accounted for the addition of FGD wastewater into the slag settling pond.

PSNH subsequently changed its approach to managing the FGD wastewater with the installation of the secondary FGD wastewater treatment system and Merrimack Station is presently operating its wet FGD scrubber system without any discharges of FGD wastewater to the pond. Based on the Region's revised BAT determination, PSNH is expected to continue operating in this manner. Therefore, Region 1 re-evaluated the basis of the water quality-based limits for Outfall 003A mentioned above and found that there is no reasonable potential to violate water quality standards for these pollutants. *See* AR #1086 (data and calculations). Based on this evaluation, Region 1 is removing these permit requirements from the Revised Draft Permit. This means that discharges of FGD wastewater to the Merrimack River via the slag settling pond will not be authorized under the new permit. Region 1 welcomes comments regarding this revision.

In addition, Region 1 re-evaluated the basis of the water quality-based copper limits for Outfall 003A and found that there is no reasonable potential to violate water quality standards for copper. *Id*. Region 1, therefore, proposes removing the copper discharge limitations from Outfall 003A[40] of the Revised Draft Permit. The anti-backsliding regulations at 40 C.F.R. § 122.44(l)(1) allow for this change when "circumstances on which the previous permit was based have materially and substantially changed since the time the permit was issued and would constitute cause for permit modification or revocation and resissuance under § 122.62." *See* 40 CFR 122.62(a)(2). The "circumstances" that have changed include: 1) the Region has a performed a more robust statistical reasonable potential analysis (AR #1086); and 2) the 2011 Draft Permit includes technology-based copper limits for metal cleaning waste at Outfall 003B, upstream of the slag settling pond.

Region 1 is not altering the remaining requirements for Outfall 003A for purposes of the Revised Draft Permit. The Region has not, however, made decisions about these permit conditions for purposes of the Final Permit. Region 1 will consider public comments already submitted concerning these Draft Permit requirements as it makes its decisions about the Final Permit's conditions. The Draft Permit's technology-based draft permit limits for TSS and O&G pertain to the low volume and ash transport waste streams entering the slag settling pond. *See* 2011 Fact Sheet. Despite the fact that the FGD wastewater will not be discharged to the settling pond, Region 1 is not revising the Draft Permit's flow limits for Outfall 003A because 1) the volume removed from the pond for scrubber make-up water has been reduced[41] and 2) the proposed contribution of FGD wastewater (0.07 MGD average and 0.10 MGD maximum) to the pond is eliminated. Therefore, there should be little change in the expected flow from the slag settling pond compared to the permitted limit (5.3 MGD average monthly limit, 13 MGD maximum

[40] The 2011 Draft Permit includes technology-based copper limits for metal cleaning waste at Outfall 003B, upstream of the slag settling pond.

[41] PSNH needs to remove less water from the slag settling pond for use as FGD scrubber make-up water because up to 95,000 gpd of distillate/condensate from the SWWTS is reused for scrubber make-up water.

daily limit). In addition, the water quality-based requirement to monitor and report pH is continued from the existing permit.

6.0 Endangered Species Act (ESA)

Section 7(a) of the Endangered Species Act of 1973, as amended, grants authority to, and imposes requirements upon, federal agencies regarding the potential effects of their actions on endangered or threatened species of fish, wildlife, or plants ("listed species") and any habitat of such species that has been designated as critical (a "critical habitat"). The ESA requires every federal agency, in consultation with and with the assistance of the Secretary of Interior or Commerce, to insure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The U.S. Fish and Wildlife Service (USFWS) typically administers Section 7 consultations for fresh water species, while the National Marine Fisheries Service (NMFS) administers consultations for marine species and anadromous fish.

At the time it issued the Draft Permit, Region 1 concluded that the proposed permitting action would have no effect on either any listed species or the critical habitat of any listed species. This conclusion was based on the Region's review of current protected species information provided by NMFS and USFWS (collectively referred to as "the Services") to assess the possible presence of listed species in the Hooksett Pool area of the Merrimack River, the section of the river that would be affected by the permitting action. From this review, Region 1 concluded that there are no federally-listed endangered or threatened species present in that area of the river. As Region 1 indicated in the 2011 Fact Sheet (p. 57), it will seek the Services' concurrence with its conclusions under the ESA. Region 1 is not altering its conclusions in light of the proposed changes to the Draft Permit that are reflected in the Revised Draft Permit because the Revised Draft Permit conditions will not result in any effect on any listed species or the critical habitat of any listed species, because, as stated above, there are no federally-listed endangered or threatened species present in that area of the river. As stated previously, Region 1 will seek the Services' concurrence with its conclusion on these issues prior to issuing a Final Permit.

7.0 Essential Fish Habitat (EFH)

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801 et seq. (1998)), EPA is required to consult with NOAA Fisheries if actions that EPA funds, permits, or undertakes may adversely impact any essential fish habitat such as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. § 1802 (10)). Section 6.0 of the 2011 Fact Sheet identifies that anadromous Atlantic salmon (*Salmo salar*) are the only federally-managed species believed to be present within the Hooksett Pool of the Merrimack River and provides a detailed discussion of the Station's impacts to the Atlantic salmon's EFH.

In the 2011 Fact Sheet (p. 57), Region 1 concluded that the Draft Permit's conditions and limitations will adequately protect all aquatic life, including Atlantic salmon, the only species in this segment of the Merrimack River with an EFH designation. The Region further concluded that the Draft Permit's conditions will minimize impacts from the Facility to the EFH species, its habitat and forage, to the extent that no significant adverse impacts are expected and no further impact mitigation is warranted. Region 1 has also considered the new conditions proposed in the Revised Draft Permit and believes that its earlier conclusions, as stated above, still hold true. Should adverse impacts to EFH be detected as a result of this permit action, or if new information is received that changes the basis for Region 1's conclusions, the Region will contact NMFS and the EFH consultation will be re-initiated.

8.0 Monitoring and Reporting

As discussed above, Outfall 003C was a discharge point in the 2011 Draft Permit from which FGD wastewater was to enter the slag settling pond. Because the Revised Draft Permit proposes to eliminate Outfall 003C, it also proposes to eliminate any reporting and monitoring requirements associated with that outfall.

In addition, Outfall 003A is associated with the discharge of wastewater from the slag settling pond to the Merrimack River via the Station's discharge canal. Because the Revised Draft Permit would eliminate FGD wastewater discharges to the slag settling pond, the Region is proposing to remove the monitoring and reporting requirements related to FGD wastewater from Outfall 003A. These permit conditions included reporting requirements for chloride as well as reporting requirements and effluent limits for aluminum, arsenic, copper, mercury and selenium.

9.0 State Certification Requirements

EPA may not issue a permit unless the state water pollution control agency with jurisdiction over the receiving water(s) either certifies that the effluent limitations and/or conditions contained in the permit are stringent enough to assure, among other things, that the discharge will not cause the receiving water to violate state's surface water quality regulations or waives its right to certify as set forth in 40 C.F.R. §124.53. *See also* 33 U.S.C. § 1341(a)(1).

In the 2011 Fact Sheet, Region 1 explained that it had requested a CWA § 401(a)(1) certification by the state pursuant to 40 C.F.R. §§ 124.53 and 124.55, and expected that the state would certify the Draft Permit conditions. The state will be deemed to have waived its right to certify unless certification is received within 60 days of receipt of this request unless the Regional Administrator finds that unusual circumstances require a longer time.

The Region has also considered the new conditions in the Revised Draft Permit and concluded that they, too, will satisfy state water quality standards. Therefore, the Region has again requested a CWA § 401(a)(1) certification from the state, and again the Region expects that the state will certify the conditions of the Revised Draft Permit.

Reviews and appeals of limitations and conditions attributable to State certification shall be made through the applicable procedures of the State and may not be made through the applicable procedures of 40 C.F.R. Part 124.

10.0 Comment Period, Public Hearing, and Procedures for Final Decisions

All persons, including applicants, who believe that any provision of these draft permit conditions is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the U.S. EPA, Office of Ecosystem Protection, Industrial Permits Branch, 5 Post Office Square, Suite 100, Boston, Massachusetts 02109-3912. As explained farther above, there will be a two stage comment period for the Revised Draft Permit. In the first stage, interested persons may comment on the revised permit conditions and the analysis supporting them. In the second stage, interested persons may respond to submissions of other commenters. In reaching a final decision on the Revised Draft Permit conditions, the Region 1 will respond to all significant comments and make these responses available to the public at Region 1's Boston office.

Following the close of the comment period, and after the public hearing if one is held, Region 1 will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days of Region 1's serving notice of the final permit decision, any interested person may submit a petition for review of the permit to EPA's Environmental Appeals Board to review any condition of the permit decision. See 40 C.F.R. § 124.19(a)(3).

11.0 Region 1 Contact Information

Additional information concerning these Revised Draft Permit conditions may be obtained between the hours of 9:00 A.M. and 5:00 P.M., Monday through Friday (excluding holidays) from the Region 1 contact below:

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April 2014 **Ken Moraff, Director**
Date: **Office of Ecosystem Protection**
U.S. Environmental Protection Agency