United States
Environmental Protection
Agency New England

One Congress Street, Suite 1100
Boston, MA 02203



# FACT SHEET

## Dominion Energy Brayton Point, LLC

## Closed Cycle Cooling Tower and Unit 3 Dry Scrubber/Fabric Filter Projects

**1 Brayton Point Road**
**Somerset, MA 02726**

## EPA Draft Permit Number 052-120-MA13

## Acronyms and Abbreviations

| | |
|---|---|
| BACT | Best Available Control Technology |
| BTU | British thermal unit |
| CAA | Clean Air Act |
| CaO | Lime reagent |
| CEM | Continuous Emission Monitor |
| CFR | Code of Federal Regulations |
| CPA | Comprehensive Plan Approval |
| CO | Carbon Monoxide |
| DS | Dry Scrubber |
| DEP | Massachusetts Department of Environmental Protection |
| EPA | Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESP | Electrostatic Precipitators |
| FF | Fabric Filter |
| FWS | US Fish and Wildlife Service |
| GHG | Greenhouse Gas |
| MM | million |
| MMBtu | Million british thermal units |
| NAAQS | National Ambient Air Quality Standards |
| NMCPA | Non-Major Comprehensive Plan Approval |
| NSR | New Source Review |
| $NO_2$ | Nitrogen Dioxide |
| NPDES | National Pollutant Discharge Elimination System |
| PAC | Powder Activated Carbon |
| $PM_{2.5}$ | Particulate Matter – 2.5 microns |
| $PM_{10}$ | Particulate Matter – 10 microns |
| ppm | Parts per million |
| PSD | Prevention of Significant Deterioration |
| PTE | Potential to emit |
| SCR | Selective Catalytic Reduction |
| $SO_2$ | Sulfur Dioxide |
| tpy | tons per year |
| TDS | Total dissolved solids |

# I GENERAL INFORMATION

| | |
|---|---|
| **Name of Source:** | Dominion Energy Brayton Point, LLC |
| **Location:** | 1 Brayton Point Road,<br>Somerset, MA 02114 |
| **Applicant's Name and Address:** | Dominion Energy Brayton Point, LLC<br>1 Brayton Point Road,<br>Somerset, MA 02114 |
| **Application Prepared By:** | Epsilon Associates, Inc.<br>3 Clock Tower Place, Suite 250<br>Boston, MA 02114 |
| **Draft PSD Permit Number:** | 052-120-MA13 |
| **EPA Contact:** | Brendan McCahill<br>Air Permits, Toxics, and Indoor Programs Unit (CAP)<br>(617) 918-1652 |

On August 28, 2008, Dominion Energy Brayton Point, LLC (Dominion) filed a Prevention of Significant Deterioration (PSD) permit application with the Environmental Protection Agency Region 1 office (EPA), the "Aug. 2008 PSD application." On January 9, 2009, Dominion filed a supplement to that application to address gaps EPA had identified in the original submission, the "Jan. 2009 supplemental." A copy of the application is attached, including the supplement which completed the application. Dominion proposes to install two natural draft cooling towers at its Brayton Point facility in Somerset, Massachusetts. The cooling towers are intended to comply with the requirements of a Federal National Pollutant Discharge Elimination System (NPDES) permit. In addition, Dominion proposes to install a dry scrubber (DS) control system on its existing unit # 3 boiler. The dry scrubber is intended to meet the requirements of a Massachusetts Department of Environment Protection (DEP) regulation for the control of sulfur dioxide (SO2). Finally, Dominion proposes to install additional Powder Activated Carbon (PAC) injectors on the Unit #3 boiler to further reduce Mercury (Hg) emissions from the facility.

EPA proposes to approve Dominion's application and to issue a PSD permit for the proposed changes to the Brayton Point facility. This document serves as the fact sheet as

required by 40 CFR part 124-Procedures for Decision Making and explains the legal and factual basis for EPA's draft permit.

Please note that this project is also subject to the Massachusetts DEP's Comprehensive Plan Approval (CPA) requirements under the state regulations at 310 Code of Massachusetts Regulations (CMR) 7.02. The DEP intends to issue a CPA that regulates all pollutants affected by the proposed project including the pollutants regulated under the PSD permit.

Dominion must comply with the Federal PSD permit and the DEP's CPA requirements. However, EPA has worked closely with the DEP to ensure this PSD permit does not conflict with the DEP's CPA requirements.

## II. Project Location

Dominion's Brayton Point facility is located in Somerset, MA about 50 miles south of Boston and 13 miles east of Providence, R.I. The station is situated east of the Taunton River, west of the Lee River, north of Mount Hope Bay. The station can be seen south of US-195 when travelling east just before Fall River.

EPA has designated the southeast portion of Massachusetts including Somerset, MA as attainment/unclassified for the following national ambient air quality standards (NAAQS): nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), carbon monoxide (CO), particulate matter – 10 microns or less in size ($PM_{10}$), particulate matter – 2.5 microns or less in size ($PM_{2.5}$) and lead. EPA has also designated southeastern Massachusetts as a moderate non-attainment area under the 8-hour ground level ozone NAAQS.

## III. Facility Description

Brayton Point is a 1,600 megawatt fossil-fueled power station. The Station has three coal-fired units (Units 1-3), and one oil- and natural gas-fired unit (Unit 4). In addition, the station includes an aboveground fuel oil storage tank farm and associated piping transfer systems, a coal storage pile and coal handling equipment, a marine fuel receiving terminal, a wastewater treatment system, active and closed landfills for wastewater treatment system solids, and electric switching and transmission equipment.

The proposed natural draft cooling towers project will be located in the northwestern portion of Brayton Point's facility. The Unit # 3 DS project will be located immediately south of Unit #3.

## IV. Proposed Project

Description of boilers

Brayton point has four electric generating units. Each unit includes a boiler that produces steam and a steam turbine that generates the electricity. During operation, large draft fans at each unit take in ambient air and direct into the unit's boiler. The ambient air mixes with the fuel and then the mixture is burned. The combustion gases are ducted through emission control equipment and discharged into the atmosphere through stacks.

The wall of each boiler is made up of rows of ducts containing boiler water or feedwater. The combustion of the fuel heats the feedwater in the boiler to produce steam. The steam, which is now under high pressure and temperature, is directed to the steam turbine. The steam turbine is divided into a high-pressure section and a low-pressure section. The steam from the boiler first enters and expands into the high-pressure turbine section. After the steam exists from the high-pressure turbine, it flows back to the reheater section of the boiler where the temperature of the steam is raised again. The reheated steam then enters and expands into the low-pressure turbine section. The exhaust steam from the low-pressure turbine now enters the condensers. Cooling water from the bay condenses the exhaust steam back into water. The cooled water is pumped back to the boilers completing the cycle of powering the turbines.

Brayton Point requires large amounts of cooling water to operate the condensers. The facility currently draws its cooling water from the Mount Hope Bay. The water is pumped to the condensers, cools the steam back into water, and returns to Mount Hope Bay. However, this "once through" cooling system meant that large amounts of now heated cooling water is returned directly to the Bay with adverse affects to the Bay's ecosystem.

In place of the once through cooling system, Dominion will now install and operate a "closed loop" cooling system. Dominion will now pump the warm water leaving the condensers to two new large natural draft cooling towers. The water will be allowed to cascade down into a water collection system. Cool outside air entering from below the towers mixes and cools the water as it cascades down. The now cooled water is then pumped back to the condensers.

Cooling Towers

Dominion plans to build and operate the natural draft cooling tower(s) on an approximately ten-acre portion of the northwest corner of the facility. The tower(s) will be approximately 500 feet tall, and approximately 220 feet diameter at the exhaust exit. Each tower has a maximum water circulation rate of approximately 400,000 gallons per minute.

To support the towers, Dominion will install new water storage basins, relocate an existing wastewater treatment system, and install new piping to convey the cooling water to and from the new cooling towers.

During the mixing of the air and cooling water, a very small fraction of the water will exit the towers as drift droplets. Those drift droplets will contain dissolved solids (e.g., salts), which could become $PM_{2.5}$ or $PM_{10}$ emissions when the water evaporates.

Dry Scrubber

To comply with state requirements for the control of $SO_2$ emissions, Dominion proposes to install a DS/Fabric Filter (FF) control system. The DS/FF systems are widely used in the coal-fired power plant industry to reduce $SO_2$ emissions from the combustion of coal. Dominion will install the DS/FF system on the Unit #3 boiler.

The DS system removes $SO_2$ from the flue gas using a lime reagent (CaO). The lime reagent is injected into the flue gas as a fine mist. The reagent then reacts with the $SO_2$ following these chemical reactions:

$Ca(OH)2 + SO2 \Rightarrow CaSO3 \cdot ½H2O + ½H2O$ (dominant reaction)
$CaSO3 \cdot ½H2O + ½O2 + 1½H2O \Rightarrow CaSO4 \cdot 2H2O$ (minimal CaSO3 available)

The treated flue gas is ducted to the FF where the dry reaction byproducts are captured and removed from the flue gas. These byproducts include unreacted calcium hydroxide, calcium sulfite, calcium sulfate, lime grit, and fly ash. Dominion proposes to recycle a portion of the solids back to the DS system. The recycled solids contain un-reacted CaO that can remove additional $SO_2$ from the flue gas. Dominion will then duct the scrubbed flue gas through the existing Unit No. 3 stack and into the atmosphere.

In addition to the $SO_2$ emission control system, Dominion is proposing to increase the efficiency of its mercury removal systems. Dominion currently uses a powder activated

carbon (PAC) injection system to reduce Hg emissions from the combustion of coal. The gas phase mercury in the flue gas contacts and attaches to the surface of the PAC. The PAC is then collected by an electrostatic precipitator (ESP) which is particulate control device.

Dominion currently injects PAC upstream of the existing ESP on Unit #3. Dominion proposes to install the additional PAC injection point upstream of the proposed DS/FF. Once completed, Dominion expects this new PAC injection point to become the primary injection point for Unit #3.

## V. Current Permits

Dominion's Brayton Point facility is currently not subject to any state or Federal PSD or nonattainment NSR permit for major sources.

## VI. PSD Review

As mentioned, EPA has classified eastern Massachusetts a *moderate nonattainment area* for ground level ozone and *attainment* for all other criteria pollutants. The classifications are located in 40 CFR 81.322.

Before March 2003, EPA delegated the Federal PSD program at 40 CFR 52.21 to the Massachusetts DEP. Under the terms of the delegation agreement, the DEP issued PSD permits to sources in Massachusetts. However, in March 2003, Massachusetts returned the PSD program to EPA. Since this time, EPA has issued PSD permits in Massachusetts. The DEP continues to administer its state permitting regulations and issue CPAs to sources in Massachusetts. Typically, sources that are subject to the Federal PSD program are also subject to the state permitting program.

The PSD regulations require major new stationary sources or major modifications to an existing major stationary source to undergo a PSD review and to receive a PSD permit before commencing construction.

40 CFR 52.21 (b) (1) of the Federal PSD regulations defines a major stationary source as any 28 designated stationary source categories with potential emissions of 100 tons per year or more of any criteria pollutant, or any other stationary source with potential emissions of 250 tons per year or more of any criteria pollutant.

40 CFR 52.21 (b)(2) defines a major modification as "any physical change in or change in method of operation of a major stationary source that would result in: a significant

emissions increase of a regulated NSR pollutant; and a significant net emissions increase of that pollutant from the major stationary source."

40 CFR 52.21(b)(23) defines the "significant" emission rate for the each regulated NSR pollutant.

If the permitting authority determines that a new stationary source or new modification is subject to the PSD program, the source must apply for and obtain a PSD permit that meets regulatory requirements including:

- Best Available Control Technology (BACT) that requires sources to minimize emissions to the greatest extent possible;
- An ambient air quality analysis to ensure that all the emission increases do not cause or contribute to a violation of any applicable PSD increment or NAAQS;
- An additional impact analysis to determine the direct and indirect effects of the proposed source on industrial growth in the area, soil, vegetation and visibility; and
- Public comment including an opportunity for a public hearing.

## VII. PSD Applicability

### Overview

To determine if the proposed projects are subject to PSD review, Dominion first determined if the existing Brayton Point facility is a major stationary source. Brayton Point is a fossil fuel power plant with a heat input of over 250 million British Thermal Units per Hour (MMBtu/hr). Fossil-fuel fired facilities with heat inputs greater than 250 MMBtu/hr are one of the 28 designated source categories listed in the Federal definition for major stationary source. If Brayton Point's PTE exceeds 100 tpy, it meets the definition of "major stationary source" under the federal PSD program. Potential emissions or PTE as defined in 40 CCR 52.21(b)(4) is the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Recent emission estimates for Brayton Point show that its PTE well exceeds the 100 tpy threshold level for all the criteria pollutants. See e.g. Table 2-2 in sec. 2-4 Jan 2009 supp. Therefore, the Brayton Point facility is a major stationary source.

The Dominion application contains two concurrent but separate and severable projects: the natural draft cooling towers and the DS/FF $SO_2$ system. Dominion is also installing additional PAC injectors for the control of Hg emissions upstream of the new FF. If the combined net emission increase from a project exceeds the PSD program's significance

levels for any

pollutant, the project is a major modification and subject to the PSD program requirements.

EPA relied on Dominion's application to determine the net emission increase from each project. Dominion followed the procedures in 40 CFR 52.21(a)(2)(iv)( *f* ): "Hybrid test for projects that involve multiple types of emission units." The actual-to-potential test in 40 CFR 52.21(a)(2)(iv)( *d* ) is applied to the cooling tower project, and the actual-to-projected-actual test in 50 CFR 52.21(a)(2))(iv)( *c* ) is applied to the Unit 3 DS/FF project.

**Projected Emission Increase: Cooling Towers**

Dominion followed the applicability procedures in 52.21(a)(2)(iv)(d) "actual-to-potential test for projects that only involve the construction of a new emission(s) unit" to determine the emission increase from the cooling towers. Dominion determined the difference between the potential emissions or potential to emit (PTE) of the cooling towers as defined in (b)(4) of this section and the baseline actual emissions as defined in (b)(48)(iii) for the cooling towers. Baseline actual emissions are the actual emissions from an emission unit before a physical or operational change and means "the average rate, in tons per year, at which the unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 5-year period immediately preceding" the operational change. 40 CFR 52.21(b)(48)(i). Since these are new emission units, the actual emission baseline for the cooling towers is zero. Potential emissions or PTE is defined as the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Dominion used EPA's AP-42 emission factors and emission guidance documents to calculate the PTE for the cooling towers. Table 1 provides the results of the actual-to-potential emission calculations for the cooling towers.

Table 1

Cooling towers: Actual-to-Potential applicability test

| Pollutant | Baseline Actual Emissions | Projected Actual Emissions | Emissions Increase |
|---|---|---|---|
| Carbon Monoxide | 0 | None expected | None expected |
| Nitrogen oxides | 0 | None expected | None expected |
| Sulfur dioxide | 0 | None expected | None expected |
| Volatile organic compounds | 0 | None expected* | None expected* |
| Filterable PM | 0 | 389 | 389 |
| Filterable PM10 | 0 | 389 | 389 |
| Filterable PM2.5 | 0 | 389 | 389 |
| Total PM | 0 | 389 | 389 |
| Total PM10 | 0 | 389 | 389 |
| Total PM2.5 | 0 | 389 | 389 |
| Lead | 0.0 | None expected | None expected |
| Fluorides | 0 | None expected | None expected |
| Sulfuric Acid Mist | 0 | None expected | None expected |
| Hydrogen sulfide, total reduced sulfur, Reduced sulfur compounds | 0 | None expected | None expected |
| Other NSR Pollutant | 0 | None expected | None expected |

* some small amount of VOC could be emitted from stripping naturally-occurring volatile organics from the circulating water.

In calculating the emission increase from the cooling towers, Dominion is required to include emission increases from the facility's boilers if the cooling towers would allow the boilers to increase operations. However, Dominion and staff from EPA Region 1's NPDES program note that the existing once-through cooling system does not restrict the facility's current operations. Therefore, the proposal to install the cooling tower as part of a closed-loop cooling system will not increase operations or increase emissions from the facility's boilers.

**Projected emission increase: DS/FF Project**

As previously described, the DS/FF project is a physical change to the Unit #3 boiler at Brayton Point. Dominion applied the 52.21(a)(2)(iv)(c) "actual-to-projected-actual applicability test for projects that only involve existing emission unit(s)" to determine the emission increase from the DS/FF project. Dominion calculated the difference between the "baseline actual emissions" from the Unit 3 boiler before the installation of the DS/FF and the "projected actual emissions" that the Unit #3 after the DS/FF is installed. 40 CFR 52.21(b)(41) and (48).

As previously described, baseline actual emissions are the actual emissions from an electric utility steam generating unit before a physical or operational change and meaning the average rate, in tons per year, at which the unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 5-year period immediately preceding the operational change. 40 CFR 52.21(b)(48)(i). The regulations also allow PSD permit applicants to select different 24-month periods for different pollutants depending on operations from the facility. Dominion used the actual emissions selected from January 2003 through December 2004 for NOx and $SO_2$, and January 2006 through December 2007 for all other pollutants to determine baseline actual emissions.

The projected actual emission rate is the maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 10 years (12-month period) following the date the unit resumes regular operation after the project. In determining the projected actual emissions, the owner or operator of the source must consider all relevant information, including but not limited to historical operational data, the company's expected business activity, and the company's highest projections of business activity. 40 CFR 52.21(b)(41). Dominion stated that its emission projections rely on historical data, company projections, and compliance plans under the Massachusetts 7.29 Emission Control Plan Regulations. Dominion noted that reductions in $SO_2$, fluorides, and sulfuric acid mist are based on reductions from the installation of the DS. Reductions in NOx are based on projections for operation using the previously permitted and installed selective catalytic reduction system. In addition, Dominion does not believe that the DS/FF project will create any incentives or remove any barriers that would cause an increase in the utilization rate on unit #3. Therefore, in accordance to 40 CFR 52.21(b)(41)(ii)(c), Dominion excluded from its projections the increased utilization due to product (electricity) demand growth. Table 2 contains the results of the projected actual emissions calculations for the DS/FF project.

## Table 2

### DS/FF Projected Actual Emissions Calculation Results

| Pollutant | Baseline Actual Emissions | Projected Actual Emissions | Emissions Increase |
|---|---|---|---|
| Carbon Monoxide | 1,268 | 1,268 | 0 |
| Nitrogen oxides | 6,167 | 1,300 | -4,867 |
| Sulfur dioxide | 16,294 | 1,485 | -14,809 |
| Volatile organic compounds | 50.4 | 50.9 | 0.5 |
| Filterable PM | 134 | 186 | 52 |
| Filterable PM10 | 134 | 186 | 52 |
| Filterable PM2.5 | 134 | 186 | 52 |
| Total PM | 670 | 464 | -206 |
| Total PM10 | 670 | 464 | -206 |
| Total PM2.5 | 670 | 464 | -206 |
| Lead | 0.0 | 0.0 | 0.0 |
| Fluorides | 111 | 78 | -33 |
| Sulfuric Acid Mist | 78 | 55 | -23 |
| Hydrogen sulfide, total reduced sulfur, Reduced sulfur compounds | none expected | none expected | None expected |
| Other NSR Pollutant | none expected | none expected | None expected |

Table 3 provides the total emission increase for the two projects

**Table 3.**

**Total Emissions Increase for the Cooling Tower and DS/FF Projects**

| Pollutant | Baseline Actual Emissions | Projected Actual Emissions | Emissions Increase |
|---|---|---|---|
| Carbon Monoxide | 1,268 | 1,268 | 0 |
| Nitrogen oxides | 6,167 | 1,300 | -4,867 |
| Sulfur dioxide | 16,294 | 1,485 | -14,809 |
| Volatile organic compounds | 50 | 50.5 | 0.5 |
| Filterable PM | 134 | 575 | 441 |
| Filterable PM10 | 134 | 575 | 441 |
| Filterable PM2.5 | 134 | 575 | 441 |
| Total PM | 670 | 853 | 183 |
| Total PM10 | 670 | 853 | 183 |
| Total PM2.5 | 670 | 853 | 183 |
| Lead | 0.0 | 0.0 | 0.0 |
| Fluorides | 111 | 78 | -33 |
| Sulfuric Acid Mist | 78 | 55 | -23 |
| Hydrogen sulfide, total reduced sulfur, Reduced sulfur compounds | None expected | None expected | None expected |
| Other NSR Pollutant | None expected | None expected | None expected |

The table shows that the two projects result in a significant emission increase for total and filterable-only $PM_{10}$ and $PM_{2.5}$ emissions and are subject to PSD program review for those pollutants. EPA has reviewed Dominion's emissions information and concurs with Dominion's findings.

## VIII. PSD Program Requirements

The PSD program requires the applicant to demonstrate that the natural draft cooling towers and DS and PAC systems will incorporate air pollution control technologies representative of BACT, and that the resulting emissions will not cause or contribute to a violation of applicable ambient air quality standards or PSD allowable increments. The applicant is also required to assess the project's impacts on soils, visibility and secondary growth.

The complete list of applicable Federal PSD program regulations is shown below:

1. 40 CFR 52.21(j) Control Technology Review (Best Available Control Technology)
2. 40 CFR 52.21(k) Source Impact Analysis (Air Quality Impact Assessment)
3. 40 CFR 52.21(l) Air Quality Models
4. 40 CFR 52.21(m) Air Quality Analysis
5. 40 CFR 52.21(n) Source information
6. 40 CFR 52.21(o) Additional Impact Analysis
7. 40 CFR 52.21(p) Federal Class I Area Impacts (Air Quality Impact Assessment)

## IX. BACT

As required by the Federal PSD program at 40 CFR 52.21(j)(2) and (3), Dominion is required to apply BACT to the $PM_{10}$ and $PM_{2.5}$ emission increase from the cooling towers and DS and PAC systems. BACT is defined as, *an emissions limitation... based on the maximum degree of reduction for each pollutant subject to regulation under [the Clean Air] Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems and techniques... for control of such pollutant.* 40 CFR 52.21(b)(12); Clean Air Act (CAA) 169(3).

In making its BACT determination, EPA follows the five step "top-down" methodology for determining BACT:

1. **Identify all control technologies.** Identify all potentially available control options, including inherently lower emitting processes and practices, add-on control equipment, or combination of inherently lower emitting processes and practices and add-on control equipment.
2. **Eliminate technically infeasible options**. Eliminate technically infeasible options based on physical, chemical, or engineering principles.
3. **Rank remaining control technologies by control effectiveness**. Rank the remaining control options by control effectiveness (i.e., expected emission reduction).
4. **Evaluate most effective controls and document results**. Determine the economic, energy, and environmental impacts of each option on a case-by-case basis. Eliminate options that are not achievable considering these impacts.

5. **Select the BACT**. Select the highest-ranked (most effective) option not eliminated as BACT and develop an emissions limitation based on the selected option.

**Dominion BACT Analysis**

Dominion provided a BACT analysis in Section 4 of the August 2008 PSD application which was enhanced in the January 2009 supplemental. Dominion conducted a separate BACT analysis for PM emission emitted from the cooling tower and the DS system. The two analyses concluded that:

- BACT for the cooling towers is drift eliminators with a 0.0005% drift rate; and
- BACT for the Unit #3 boiler is the use of fabric filter with felted bags achieving a total $PM_{10}/PM_{2.5}$ emission rate of 0.025 lbs/MMBtu and a filterable-only $PM_{10}/PM_{2.5}$ emission rate of 0.010 lbs/MMBtu.

The following provides a summary of the BACT analyses.

Cooling Tower

As mentioned previously, the PM emissions emitted from the cooling towers result from a portion of the cooling water becoming entrained in the air stream and carried out of the tower as "drift" droplets. The particulate matter in the drift droplets are then classified as PM emissions.

In its analysis, Dominion reviewed the following control options:

- Air Cooled Condensers
- Once-Through Cooling (existing configuration)
- Fresh Water
- Mechanical Draft Cooling Towers.
- Reduction in Cycles of Concentration.
- Reduction in Air Velocity
- Drift Eliminators

Dominion determined that the following options are technically infeasible:

- **Once-Through Cooling**. Brayton Point Station currently uses once-through cooling to reject the heat into the waters of Mount Hope Bay. The Station is under EPA and DEP Orders to discontinue once-through cooling. The use of once-through cooling is technically infeasible because it would violate the Orders.

- **Fresh Water**. The use of water with lower solids content would reduce particulate emissions from the cooling towers. There is, however, no adequate supply of fresh water available. Historically, Brayton Point used some fresh water obtained from the Town of Somerset. However, this was discontinued to allow more fresh water use for Somerset residents. The quantities of fresh water needed to provide cooling to the station (up to 70 million gallons per day) exceed the volume that could be legally withdrawn from any nearby freshwater source. This technical difficulty precludes the successful use of fresh water as a control option.

- **Reduction in Cycles of Concentration**. Dominion intends to maintain approximately 1.5 cycles of concentration in the cooling tower circulating water. Reducing the cycles of concentration would reduce the salinity in the circulating water, which would in turn reduce particulate emissions. However, Dominion maintains that decreasing the cycles of concentration would increase the total water discharge into from Mount Hope Bay. The increase water discharge would increase the thermal discharge to Mount Hope Bay above what is allowed in Brayton Point Station's NPDES permit.

Dominion then rated and evaluated the remaining control options.

Air-cooled condensers: As the name suggests, air-cooled condensers use air to cool the steam in the boiler. The technology would essentially replace the current water-cooled condensers. The technology would replace the need for any water from Mount Hope Bay. The technology would also eliminate any drift that results in PM emissions. However, Dominion eliminated the option based on its higher installation cost and energy usage and the likelihood that the additional land area needed for air-cooled condensers would simply not be available or would lead to unacceptable wetlands impacts.

Mechanical-draft cooling towers: Mechanical-draft cooling towers use large rotating blades to draw air into the cooling towers versus a natural draft set up by the size and configuration of towers. The towers would also use drift eliminators similar to the proposed towers. Dominion excluded the option based on its higher installation and operational cost with no significant difference in total PM emissions.

Reduction in air velocity: Reducing the velocity of the air mixing with the cooling water would reduce droplet formation and PM emissions. However, the method to reduce air velocity while maintaining proper water cooling is the construction of larger cooling towers. Dominion excluded the larger towers based on higher cost and greater visibility impacts, while only providing marginal reductions in PM emissions.

Drift Eliminators: Drift eliminators are installed above the area where the air mixes with the cooling water. They create a long "tortuous" path for the air to pass through. This longer path allows the water droplets to lose velocity and to fall back into the tower. In general, efficiency increases with greater depth of the eliminators resulting in a longer tortuous path. However, increasing the depth of the eliminators produces increased "back pressure," that is, the pressure required to push the air through the eliminators. After a certain depth, the towers would not produce enough upward draft to overcome the back pressure. Dominion's analysis concluded that a drift rate lower than 0.0005% is not practical.

In summary, Dominion's proposed BACT for the natural draft cooling towers is drift eliminators achieving a drift rate of 0.0005%. The drift rate is based on vendor guarantees and recent BACT determinations made on mechanical draft cooling towers controlled using drift eliminators.

The drift eliminator's drift rate and emission limits will apply at all times while the cooling towers are in operation.

EPA reviewed Dominion's analysis and agrees with its results. Therefore, EPA's proposed BACT for the natural draft cooling towers is drift eliminators achieving a drift rate of 0.0005%. In addition, EPA will limit the total $PM_{2.5}$ and $PM_{10}$ emissions from each cooling tower to the following:

- 24-hour average – 1066 pounds

Finally, to ensure compliance with the daily and yearly cooling tower emission rates, EPA proposes to limit the total dissolved solids in the circulating water flow and blowdown to 52,250 parts per million by weight.

EPA's BACT decisions for the cooling towers are based on section 4 of Dominion's August 2008 PSD application, the BACT analysis contained in January 2009 supplemental, and EPA's expertise.

**Unit #3 Dry Scrubber/Fabric Filter**

As previously described, Dominion is proposing to install two control systems, the DS and additional PAC injectors, onto the existing Unit #3 boiler itself. Both control systems inject materials into the flue gas that could increase the total PM emissions from the unit #3 boiler.

Dominion's analysis reviewed the following particulate matter control options:

- Fabric filter, specifically two varieties:
  - with felted bags
  - with coated bags
- Electrostatic precipitator, specifically three varieties:
  - Wet electrostatic precipitator
  - Dry electrostatic precipitator
  - Membrane wet electrostatic precipitator
- Fabric filter with wet electrostatic precipitator in series
- Electrostatic fabric filter
- Electro-catalytic oxidation
- Wet scrubber
- Cyclone or multiclone collector
- Side stream separator

Dominion's analysis did not consider options to reduce PM emissions through the use of combustion control. The analysis concluded that the PM emission increase resulted from the operation of the DS system and PAC injectors and not due to any physical or operational change to the unit #3 boiler itself. EPA proposes that a BACT decision that requires the installation of state-of-the-art add-on controls represents BACT for the Unit #3 boiler.

The analysis found that the following options were technically infeasible:

- **Membrane wet electrostatic precipitator**. This is an emerging technology that is not demonstrated-in-practice for this application. Ohio University researchers have performed industrial-scale tests of a wet electrostatic precipitator that uses polypropylene membranes instead of metal to reduce corrosion and improve long-term performance. No utility-scale demonstrations have been performed and the performance for PM2.5 control has not been evaluated.

- **Electrostatic fabric filter**. This is an emerging technology that is not demonstrated-in-practice for this application. The use of a combination of electrostatic precipitation and fabric filtration has been tested on a cyclone boiler firing subbituminous coal[1], and similar technology is being marketed by GE Energy[2]. The lack of operating experience would add significant uncertainty to the air pollution retrofit project, as would the need to coordinate its installation and operation with the dry scrubber. Also, it is not clear that this technology would provide any emissions reduction beyond the proposed case.

- **Electro-catalytic oxidation**. This is an emerging technology that is not demonstrated-in-practice for this application. Powerspan Corporation describes the Electro-Catalytic Oxidation (ECO) process as a multi-pollutant control system consisting of an oxidation reactor followed by an absorber and wet electrostatic precipitator. A demonstration project was conducted on a slipstream of an Ohio coal boiler, funded in part by the Ohio Coal Development Office and the Ohio Air Quality Development Authority. Dominion does not consider this emerging technology an acceptable alternative to the proposed dry scrubber for SO2 control, and it offers no apparent advantages over traditional wet ESPs for particulate control. The technical challenges associated with scale-up of this emerging technology are significant.

[1] "Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector Technology" (DOE/NETL-2007/1255, February 2007).
[2] http://www.gepower.com/prod_serv/products/particulate_matter/en/max9/index.htm

The analysis then ranked the remaining technologies according to their control efficiency. The two options with the highest efficiencies were FF using felted bags in series with wet ESP and FF using felted bags operating alone. Dominion excluded FF installed with a wet ESP system from further review based on the significantly higher incremental costs associated with the installation of a wet ESP.

In summary, Dominion's proposed BACT for the Unit #3 boiler installed with a DS and additional PAC injectors is a FF using felted bags achieving the following emission rates:

| | |
|---|---|
| Total $PM_{10}$ emissions: | 0.025 lbs/MMBtu (141.4 lbs/Hr) |
| Total $PM_{2.5}$ emissions: | 0.025 lbs/MMBtu (141.4 lbs/Hr) |
| | |
| Filterable $PM_{10}$ emissions: | 0.010 lbs/MMBtu (56.6 Lbs/Hr) |
| Filterable $PM_{2.5}$ emissions: | 0.010 lbs/MMBtu (56.6 Lbs/Hr) |

The BACT emission limits apply at all times while the unit #3 boiler is operating.

EPA has reviewed Dominion's analysis and agrees with its results. Therefore, EPA's proposed BACT for the Unit #3 boiler installed with a DS and additional PAC injectors is a FF using felted bags achieving the following emission rates:

| | |
|---|---|
| Total $PM_{10}$ emissions: | 0.025 lbs/MMBtu (141.4 lbs/Hr) |
| Total $PM_{2.5}$ emissions: | 0.025 lbs/MMBtu (141.4 lbs/Hr) |
| | |
| Filterable $PM_{10}$ emissions: | 0.010 lbs/MMBtu (56.6 Lbs/Hr) |
| Filterable $PM_{2.5}$ emissions: | 0.010 lbs/MMBtu (56.6 Lbs/Hr) |

EPA required Dominion to express BACT in terms of filterable-only PM emission limits and total PM (i.e., filterable and condensable) emission limits. The filterable-only PM emission limits provide a more accurate estimate on the performance of the FF. The total PM emission limits ensure that the ambient air quality impacts from the boiler are evaluated and meet all federal air quality standards. Both the total and filterable PM BACT emission rates are based on vender guarantees and recent BACT determinations for similar sources.

EPA's BACT decision for Unit #3 is based on a review of the information provided in section 4 of Dominion's August 2008 PSD application, the BACT analysis contained in January 2009 supplemental, and EPA's expertise.

## X. Monitoring

Cooling Towers:

The proposed BACT drift rate for the drift eliminators was determined by the drift eliminator vendor using a small scale laboratory testing method that is the testing standard for the industry. EPA does not know of a large scale test method that can be used to accurately measure the efficiency of drift eliminators installed in large structures like the control towers proposed by Dominion.

As an alternative, EPA is proposing to require Dominion to calculate the drift eliminator dimensions needed to meet the 0.0005% drift rate using the industry standard testing methodology and to provide this information to EPA before commencing construction.

In addition, to show compliance with the cooling tower's 24-hour PM emission rate, EPA is proposing that Dominion continuously monitor the following parameters:

- gallons per minute circulating water flow;
- drift rate; and
- solids concentration in the circulating water flow or blowdown.

EPA proposes to monitor the gallons per minute of circulating water through the use of pump output curves. Dominion will establish these curves using curves supplied by the pump manufacturer or by determining the amount of water flow for a given pump output rate. Once the curves are established, pump output rates can directly correlated to gallons of water circulating. This is a widely accepted methodology used in EPA's NPDES permits.

The drift rate will be based on the BACT drift rate selected for the drift eliminators and will be monitored using bench testing information provided by the vendor.

EPA proposes to quantify the total dissolved solids (TDS) using a conductivity monitor. Conductivity is a measure of water's ability to conduct an electric current. Electrical conductivity of water is based on the concentration of dissolved salts in the water. Since electrical conductivity is directly proportional to the concentration of dissolved salts, monitoring electrical conductivity can monitor the salt concentration or the total dissolved salts circulating in the cooling towers.

To ensure the drift eliminators and cooling towers are properly maintained, EPA is also proposing to require Dominion to inspect the equipment on a quarterly and yearly schedule.

DS/FF System:

EPA proposes to determine initial compliance of the BACT emission limits using EPA test methods 40 CFR Part 51, Appendix M, Method 201 or 201A and Method 202. The date for completing the initial compliance date is longer in this PSD permit than what 40 CFR Part 60, Subpart Da requires for a coal-fired electric generating unit under EPA's New Source Performance Standards (NSPS). (Note that the addition of this pollution control equipment does not trigger the modification provisions of the NSPS.) Under the NSPS, new, modified, or reconstructed emission units, including electric generating units, must perform the initial compliance test no later than 180 days from achieving maximum production rate. This PSD permit allows Dominion a longer time to complete the initial compliance test. The longer time, allows Dominion to work through new equipment issues, is triggered when Dominion accepts ownership of the new pollution control equipment pursuant to the contract(s) with its vendor(s). However, in the event of a long contractual dispute, Dominion must complete the initial compliance test no later than 12 months from commencing startup of the DS/FF (since unit #3 is an existing unit, it is capable of maximum production regardless of whether the DS/FF can meet its maximum capacity).

The basis for the longer time is due to the several factors unique to the DS/FF project for unit #3. The DS/FF is a retrofit project at an existing emission unit which sometimes can cause unexpected delays during the shakedown period. With similar retrofits at other coal-fired electric generating emission units, Dominion has experienced significant delays with its vendors in meeting their contractual obligations, especially being able to meet the emission limits required by the contract. Similar issues with other new pollution control equipment have caused delays of almost 6 months before Dominion can take ownership of the pollution control equipment from its vendors. If similar issues arise during the installation process of the DS/FF on unit #3, a compliance test conducted within 180 days from initial startup may not be representative of future $PM_{10}$ and $PM_{2.5}$ emissions. Therefore, EPA is allowing Dominion for a longer time to conduct the initial compliance test than Agency has had in other PSD permits issued to sources within Massachusetts.

In addition, to determine on-going compliance with the BACT emission limits, EPA shall require Dominion to continuously monitor the following parameters:

- daily usage of lime reagent injected by the DS;
- daily usage of PAC used in the PAC injectors; and
- pressure drop across the FF.

In addition, EPA shall require Dominion to monitor the hourly heat input rate for unit #3 using 40 CFR Part 75 compliance requirements.

## XI. Source Impact Analysis

Please refer to Attachment I, memo from Brian Hennessey to Brendan McCahill dated January 22, 2009. For modeling impacts due to this permitting action, the emissions from the two projects were combined.

## XII. Additional Impact Analysis

Please refer to Attachment I, memo from Brian Hennessey to Brendan McCahill dated January 22, 2009. For modeling impacts due to this permitting action, the emissions from the two projects were combined.

## XIII. Endangered Species Act (ESA)

Section 7 of the ESA requires that certain federal actions such as federal PSD permits address the protection of endangered species in accordance with the ESA.

Please refer to Attachment II, Draft Memo from Donald Dahl to the Record, which explains EPA's analysis to date concerning the Agency's compliance with the ESA.

## XIV. Environmental Justice

EPA also considered whether the facility's emissions would have disproportionately high and adverse human health or environmental effects on minority or low-income populations. *See* Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Executive Order 12,898, 59 Fed. Reg. 7,629 (Feb. 16, 1994). Because the facility's emissions will not result in exceedance of either the NAAQS or a PSD increment, EPA concludes that the facility will not have

disproportionately high and adverse human health or environmental effects on minority or low-income populations.

## XV. Comment Period, Hearing and Procedures for Final Decisions

All persons, including applicants, who believe any condition of the Draft Permit 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 Brendan McCahill, U.S. Environmental Protection Agency, Office of Ecosystem Protection, Air Permits, Toxics and Indoor Air Programs, 1 Congress Street, Suite 1100, Attn. CAP, Boston, MA 02114-2023.

A public hearing will be held on the date stated in the public notice. In reaching a final decision of the Draft Permit, EPA will respond to all significant comments and make these responses available to the public at EPA's Boston office.

Following the close of the public comment period, and after the public hearing, the EPA 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 following the notice of the permit decision, any interested parties may submit a petition for review of the permit to EPA's Environmental Appeals Board consistent with 40 C.F.R. § 124.19.

## XVI. EPA Contacts

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

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