MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Office of Air Quality Assessments

1111 East Main Street, Richmond, VA 23219
22nd Floor **804/698-4000**

To: Laura Corl, Air Permit Manager (TRO)

From: Office of Air Quality Assessments (AQA)

Date: April 29, 2020

Subject: PSD Air Quality Analyses – Norfolk Naval Shipyard Combined Heat and Power Plant

---

I. Project Background

The Norfolk Naval Shipyard (NNSY) owns and operates a full-service ship repair and overhaul facility for United States Navy ships and submarines in Portsmouth, Virginia. NNSY is proposing to construct a new natural gas and fuel oil fired combined heat and power plant (CHP) to provide electricity and process steam to its existing facility. The proposed plant will consist of the following equipment: two 7 megawatts (MW) dual-fuel (natural gas or ultra-low sulfur diesel [ULSD]) fired turbines, two natural gas-fired heat recovery steam generators (HRSG), three dual-fuel (natural gas or ULSD) fired boilers, one Tier 2 diesel-fired black start emergency generator with a 460-gallon belly tank, one 550,000-gallon diesel fuel tank, one air-cooled condenser, and a 2.1 MW steam turbine.

NNSY is a major stationary source under 9 VAC 5 Chapter 80, Article 8 (Prevention of Significant Deterioration (PSD)) of the Commonwealth of Virginia Regulations for the Control and Abatement of Air Pollution. The proposed CHP has the potential to emit one or more regulated pollutant equal to or greater than their applicable PSD significant emission rate. In addition, the proposed CHP has the potential to emit greenhouse gas (GHG) emissions equal to or greater than 75,000 tons per year (TPY) carbon dioxide equivalent (CO_2e). The pollutants subject to PSD review are particulate matter having an aerodynamic diameter equal to or less than 10 microns (PM-10), particulate matter having an aerodynamic diameter equal to or less than 2.5 microns (PM-2.5), and greenhouse gases (GHGs). As a result, PSD regulations require an air quality analysis be performed that demonstrates that the projected air emissions from the

proposed facility will neither cause or significantly contribute to a violation of any applicable National Ambient Air Quality Standard (NAAQS) or PSD increment. In addition, PSD regulations require that additional impact analyses for vegetation, soil, growth, and visibility be conducted.

An analysis of the project's impact on air quality and air quality related values (AQRVs) in any affected Class I area may also be required, contingent upon input from the Federal Land Managers (FLMs). The National Park Service (NPS), the United States Forest Service (USFS), and the United States Fish and Wildlife Service (FWS) each stated that an AQRV analysis was not required since the project is not expected to show any significant additional impacts to AQRVs. Therefore, only a Class I area analysis to assess compliance with the Class I PSD increments is required.

The following is a summary of the AQA's review of the required air quality analyses for the proposed CHP for both Class I and Class II PSD areas. The worst-case impacts from all operating loads, including startup and shutdown operations, are presented in this memorandum.

II. Modeling Methodology

The air quality modeling analysis conforms to 40 CFR Part 51, Appendix W - Guideline on Air Quality Models and was performed in accordance with approved modeling methodology. The air quality model used was the most recent version of the AERMOD modeling system (Version 19191). The AERMOD modeling system is the preferred EPA-approved regulatory model for near-field applications and is also contained in Appendix W of 40 CFR Part 51. AERMOD was also used as a preliminary screening model to determine the need for more detailed PSD increment modeling in the Class I area.

Additional details on the modeling methodology are available in the applicant's April 2020 air dispersion modeling report.

III. Modeling Results

A. Class II Area - Preliminary Modeling Analysis

A preliminary modeling analysis for criteria pollutants was conducted in accordance with PSD regulations to predict the maximum ambient air impacts. The preliminary analysis modeled emissions from the proposed facility only to determine whether the impacts were above the applicable significant impact levels (SILs). For those pollutants for which maximum predicted impacts were less than the SIL, no further analyses was required (i.e., predicted maximum impacts less than SILs are considered insignificant and of no further concern). For impacts predicted to be equal to or greater than the SIL, a more refined air quality modeling analysis (i.e., full impact or cumulative impact analysis) is required to assess compliance with the NAAQS and PSD increment.

Table 1 shows the maximum emissions across all load and fuel-burning scenarios that were modeled with the minimum exit velocity and temperature expected from any of the individual flues exhausted through the proposed facility's common, multi-flue stack. Table 2 below shows the maximum predicted ambient air concentrations.

Table 1
Modeled Emission Rates

Model ID	Description	PM-10 Hourly Emission Rate (lb/hr)	PM-10 Annual Emission Rate (TPY)	PM-2.5 Hourly Emission Rate (lb/hr)	PM-2.5 Annual Emission Rate (TPY)
COMSTK	Common Turbine/Boiler Stack	7.4057	32.4369	7.4057	32.4369
BSTART1[(1)]	Black Start Engine	4.4866E-02	0.1965	4.4866E-02	0.1965

[(1)] Emission rates assume one hour of operation in a 24-hour period.

Table 2
Class II Preliminary Modeling Analysis Results versus Significant Impact Levels

Pollutant	Averaging Period	Maximum Predicted Concentration From Proposed Facility ($\mu g/m^3$)	Class II Significant Impact Level ($\mu g/m^3$)
PM-10	24-hour	1.13	5
PM-10	Annual	0.12	1
PM-2.5	24-hour	1.00[(1)]	1.2
PM-2.5	Annual	0.11[(1)]	0.2

[(1)] Includes the contribution from secondary PM-2.5 formation.

The modeling results for PM-10 (24-hour and annual averaging periods) were less than the applicable SILs. Therefore, a full NAAQS and PSD increment analysis for this pollutant and averaging periods was not required. In addition, the project's air quality impact, when added to existing background air quality, would not alter the current attainment status for this pollutant and averaging periods. Additionally, the proposed facility's increment consumption for PM-10 and its averaging periods is not expected to cause or contribute to any increment violation.

As shown in Table 1, the modeling results for PM-2.5 (24-hour and annual averaging periods) were less than the recommended SIL values contained in the U.S. Environmental

Protection Agency's April 17, 2018 *Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program*. However, a full impact analysis was conducted for PM-2.5 (24-hour and annual averaging periods) because the provisions of the PM-2.5 SILs in 40 CFR 51.166(k)(2) and 52.21(k)(2) were vacated in January 2013 and the DEQ does not currently have state-specific SILs for the purpose of excluding a project from performing a full impact analysis.

B. Class II Area – Cumulative Impact Modeling Analysis

The cumulative impact analysis consisted of separate analyses to assess compliance with the NAAQS and the Class II PSD increment for PM-2.5 for the applicable averaging periods. It is important to note that the cumulative impact modeling results (both NAAQS and PSD increment) can sometimes be less than the "source only" modeling results in Table 2 of this memorandum. This is due to the fact that source only modeling uses the maximum concentration to determine significance, whereas the cumulative modeling results reflect the form of the air quality standard. For example, the following criteria must be met to attain the NAAQS:

- PM-2.5 (24-hour) - To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed the standard.
- PM-2.5 (annual) - To attain this standard, the 3-year average of the weighted annual mean PM-2.5 concentrations from single or multiple community-oriented monitors must not exceed the standard.

NAAQS Analysis

The NAAQS analysis included emissions from the proposed source and representative ambient background concentrations of PM-2.5. Emissions from existing nearby sources are represented by the monitored background concentration. The monitor is located in close proximity, approximately 3 miles north of the NNSY. The results of the analysis are presented in Table 3 and demonstrate compliance with the applicable NAAQS.

Table 3
NAAQS Modeling - Cumulative Impact Results

Pollutant	Averaging Period	Total Modeled Concentration ($\mu g/m^3$)	Ambient Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM-2.5	24-hour	0.71[(1)]	13	13.71	35
PM-2.5	Annual	0.11[(1)]	6.7	6.81	12

[(1)] Includes the contribution from secondary PM-2.5 formation.

PSD Increment Analysis

The 24-hour and annual PM-2.5 PSD increment analysis included emissions from the proposed source. Table 4 below presents the results of the analysis and shows that the 24-hour and annual PM-2.5 concentrations were below their applicable PSD increment.

Table 4
PSD Increment Modeling - Cumulative Impact Results

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)
PM-2.5	24-hour	1.08[(1)]	9
PM-2.5	Annual	0.12[(1)]	4

[(1)] Includes the contribution from secondary PM-2.5 formation.

NAAQS and PSD Increment Analyses Conclusions

Based on DEQ's review of the NAAQS and PSD increment analyses, assuming DEQ's regional office processing the permit application approved all of the emission estimates and associated stack parameters for the modeled scenarios, the proposed CHP does not cause or significantly contribute to a predicted violation of any applicable NAAQS or Class II area PSD increment.

Toxics Analysis

The proposed CHP is not subject to the state toxics regulations at 9 VAC 5-60-300 et al. All potential sources of toxic air pollutants will be regulated by a National Emission Standard for Hazardous Air Pollutants (NESHAP). Therefore, a toxic pollutant modeling analysis was not conducted.

Additional Impact Analysis

In accordance with the PSD regulations, additional impact analyses were performed to assess the influence from the proposed facility on visibility, vegetation and soils, and air quality from secondary growth. These analyses are discussed below.

Visibility

Visibility in the area near the proposed facility will be protected by operational requirements, such as air pollution controls and stringent limits on visible emissions, which will be incorporated into its air permit.

Vegetation and Soils

An analysis to assess PM-10 and PM-2.5 impacts on vegetation and soils was conducted. The secondary NAAQS were used as the sensitive injury thresholds since there were no additional thresholds found in a literature review. The secondary NAAQS provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Table 5 shows the modeled PM-10 and PM-2.5 concentrations were below the respective secondary NAAQS. As a result, no adverse impacts on vegetation and soils are expected.

Table 5
Vegetation Sensitivity Impacts from the Proposed CHP

Pollutant	Averaging Period	Total Concentration* ($\mu g/m^3$)	Secondary NAAQS ($\mu g/m^3$)
PM-10	24-hour	23.13	150
PM-2.5	24-hour	13.71	35
PM-2.5	Annual	6.81	15

*Background concentration was included.

Growth

There will be some temporary jobs associated with construction activities and a few permanent jobs for the operation and maintenance of the CHP. It is expected the available construction force and individuals that already live in the area will fill those jobs. Therefore, it is anticipated that no new housing, commercial or industrial construction will be necessary to support the CHP. Further, the project will not result in any increase of production at the existing facility or require any significant increase in traffic activity.

Based on the growth expectations discussed above, no new significant emissions from secondary growth during the construction and operation phases of the CHP are anticipated.

C. Class I Area Modeling Analysis

The FLMs are provided reviewing authority of Class I areas that may be affected by emissions from a proposed source by the PSD regulations and are specifically charged with protecting the Air Quality Related Values (AQRV) within the Class I areas. The closest Class I area to the proposed facility is Swanquarter National Wildlife Refuge (SNWR). It is approximately 158 kilometer (km) from the proposed facility. The other Class I areas within 300 km of the proposed facility but located at a distance greater than 158 km are Shenandoah National Park and James River Face Wilderness Area. The NPS, the USFS, and the FWS each stated that an AQRV analysis was not required since the project is not expected to show any significant additional impacts to AQRVs.

An analysis to assess compliance with the Class I PSD increments for PM-10 and PM-2.5 was conducted. The emissions used in the Class I area modeling were the same as those used for the Class II area modeling. A preliminary modeling analysis for PM-10 and PM-2.5 was conducted to assess the maximum predicted ambient impacts at a distance of 50 km from the proposed facility. As shown in Table 6, the proposed facility's maximum predicted ambient impacts for PM-10 (24-hour and annual averaging periods) and PM-2.5 (24-hour and annual averaging periods) were less than the applicable Class I SILs. Therefore, the maximum predicted ambient impacts for the aforementioned pollutants and averaging periods are also expected to be less than the SILs at all Class I areas. SNWR is the nearest Class I area at 158 km downwind of the proposed facility. In addition, the nominal impacts at all Class I areas would not cause or contribute to any PSD increment violation.

Table 6
Summary of Maximum Predicted Concentrations at 50 km from the Proposed CHP

Pollutant	Averaging Period	Maximum Predicted Concentration From Proposed Facility at 50 km ($\mu g/m^3$)	Class I Significant Impact Level ($\mu g/m^3$)
PM-10	24-hour	0.057	0.3
PM-10	Annual	0.004	0.2
PM-2.5	24-hour	0.073[(1)]	0.27
PM-2.5	Annual	0.006[(1)]	0.05

[(1)] Concentration includes the contribution from secondary PM-2.5 formation.

Summary of Class I Area Analysis

Based on DEQ's review of the Class I area modeling analyses, the proposed CHP does not cause or significantly contribute to a predicted violation of any applicable Class I area PSD increment.

D. Other Modeling Considerations

Ozone

An assessment to estimate the impact on ozone from the facility's NO_X and VOC emissions was conducted. The conservatively calculated impact was approximately 0.178 parts per billion (ppb) of ozone. The monitored ozone design value for the area is approximately 64 ppb for the period 2016 through 2018. This results in a total design value equal to 64.178 ppb which is well below the 8-hour ozone NAAQS of 70 ppb.