TETRA TECH EC, INC.

April 2, 2012

Mr. Donald Dahl
U.S. EPA New England
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Subject: Northeast Gateway Energy Bridge L.P. (CAA Permit No. RG1-DPA-CAA-01) Clarification of Manufacturer Statements on Burner Lightings, Proposed Operating Restrictions for Diesel Engines, and Revised 1-hour SO_2 Impacts

Dear Mr. Dahl:

Tetra Tech EC, Inc. (Tetra Tech) has prepared and submits this letter addressing remaining issues for the Northeast Gateway Deepwater Port (Port) air permit modification on behalf of Northeast Gateway Energy Bridge, L.P. (NEG). In a letter dated August 19, 2011, and in a subsequent meeting held with you on August 30, 2011, NEG proposed the following commitments:

- NEG will use a fuel oil with a maximum sulfur content of 1.0% during burner lightings in the main boilers. Based on an analysis of fuel availability at various ports around the world, NEG considers this to be the lowest sulfur content fuel that is reliably available and suitable for burner lightings, and therefore constitutes BACT.
- NEG requested a modification of the proposed short-term limit in the amount of fuel oil used for burner lightings. The modified limit would be 800 kg per vessel per hour, rather than the previously proposed limit of 1,400 kg per boiler per three-hour period, equivalent to 2,800 kg per vessel per three-hour period.
- NEG proposed restricting the diesel engines GE1 and GE2 to emergency use only while at the Port, and that they be removed from the air permit.

In response to these proposed changes, EPA made the following comments:

- The statement NEG provided from the boiler manufacturer, MHI, intended to support NEG's position that distillate fuels (which are widely available with sulfur contents less than 1.0%) could not be used for burner lightings, was unclear as whether lighter fuels actually could be used for that purpose. EPA requested an additional statement clarifying that the use of distillate fuel was infeasible for burner lightings, and whether it was infeasible for technical reasons or economic reasons.
- The diesel engines GE1 and GE2 cannot be removed from the air permit, but EPA would accept the proposal to restrict them to emergency-only use. In exchange, EPA agreed to remove the short term emission limits for these units. (However, EPA still requested that NEG provide potential emissions from the engines, for the purpose of determining facility-wide potential to emit.) EPA also requested that NEG propose permit language defining the emergency conditions under which the engines would operate.

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- EPA requested that NEG conduct dispersion modeling to show compliance with the new 1-hour ambient air quality standard for SO_2. EPA agreed that no modeling would be required for NO_2 or $PM_{2.5}$, because short-term and long-term NO_x and $PM_{2.5}$ emissions would not increase as a result of the proposed modifications (see table on next page).

This letter and included attachments provide NEG's response to EPA's comments.

Clarification of Manufacturer Statement Regarding Burner Lightings

NEG has obtained a new letter from the boiler manufacturer, MHI, dated March 7, 2012, clarifying the restrictions on the use of lighter-grade distillate fuels in the main boilers. A copy of this new statement from MHI is included as Attachment A to this letter. According to the new statement from MHI, the boilers, burners and associated piping are designed to burn higher-viscosity grades of fuel (IFO grades between 380 and 180) and boil-off gas, either as single fuels, or simultaneously in combination. Higher viscosity fuel must be heated before it can be pumped, and the burners are designed to use steam for fuel atomization. In the event of a dead-ship condition, meaning that the steam plant is cold, no steam is available to heat the fuel oil or to atomize it. In this limited case, a back-up system is provided to start the boilers using a lighter fuel oil, which does not require heat or atomizing steam. This system has only been designed for use in a dead-ship condition. Lighter fuels (marine diesel or gas oil) can only be used when the boiler is in manual control mode, because no fuel/air ratio settings are available that would allow automatic control by the ship's burner control system. Switching to manual boiler control for the purpose of burner lightings during cargo delivery is not technically feasible due to the other demands placed on the ship's crew for the safe operation of the regasification process.

Proposed Conditions for Emergency Operation of Emission Units GE1 and GE2

NEG proposes to limit the operation of emission units GE1 and GE2 to emergency situations only while moored at the Port. These units will not be operated for commercial purposes while at the Port. Emergency operation of GE1 or GE2 will be for the sole purpose of ensuring that the ship maintains electrical power in the event of a malfunction with the main boilers or steam turbine generators. NEG also proposes to limit emergency operation of GE1 and GE2 such that the maximum hourly operation for GE1 and GE2 together shall not exceed 100 hours on a 12-month rolling average basis for the Port.

NEG proposes modifying the definition of "emergency situation" in Section IV of the air permit to read as follows by adding a clause 3:

Emergency situation An event resulting in:

1. The failure of normal natural gas/boil off gas (BOG) service to B1, B2, and GE2 and not due to an intentional or negligent act, or omission on the part of the Permittee; or
2. The need for emergency pumping of water for either fire protection or flood relief; or
3. The need for operation of units GE1 or GE2, which may include such events as the loss of flame in one or both main boilers, the malfunction of a steam turbine generator, or the detection of unstable electrical load by the ship's computer.

Revised Dispersion Modeling for 1-hour SO_2

Additional dispersion modeling has been completed to demonstrate compliance with the 1-hour SO_2 National Ambient Air Quality Standard. The modeling methodology and results are detailed in Attachment B to this letter.

Revised Facility-Wide Potential Emissions

The following table summarizes the total potential emissions from the NEG Port for: 1) the current effective permit (RG1-DPA-CAA-01) dated May 14, 2007, 2) the permit modification application of October 2008 for limited use of 1.5% sulfur IFO during burner lightings and for a larger auxiliary boiler Aux2 on third generation vessels, and 3) the revisions to that modification application requested in this letter: 1.0% sulfur IFO for burner lightings, and restriction of the auxiliary generators GE1 and GE2 to 100 hours of emergency operation (with a revised potential CO emission rate for GE2).

	Total Potential Emissions (tons per year)		
Pollutant	**Current permit**	**October 2008 modification application**	**April 2012 revisions letter**
NO_x	49	49	43.8
CO	99	99	99.0
VOC	16.1	16.1	16.0
PM_{10}	20.6	21.6	20.9
$PM_{2.5}$	NA	21.4	20.2
SO_2	4.9	26.1	16.1

Summary of Proposed Modifications to Permit Language

In Attachment C NEG provides suggested changes to portions of the permit to reflect the limited use of fuel oil for main boiler burner lightings, the addition of the third generation auxiliary boiler Aux2, and the change in operation restrictions for GE1 and GE2.

Please feel free to contact Ernest Ladkani of Excelerate Energy at 832-813-7687 or me at 617-803-7809 if you have any questions.

Sincerely,

Tetra Tech EC, Inc.

Keith H. Kennedy

Keith H. Kennedy
Senior Consultant

Attachments

ATTACHMENT A

MHI LETTER ON OIL USE FOR BURNER LIGHTINGS

MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

7 March, 2012

Attn : Mr. Fred Van Nimmen
LNG Fleet Manager
EXMAR Shipmanagement n.v.

Re : Mitsubishi Maine Boiler for your LNG Carriers

Dear Sir,

We would like to express our sincere thanks for continuous cooperation extended to us. Regarding fuel application for subjected Boiler, please be informed as follow ;

Boilers burner and piping are designed to burn high viscosity (IFO 380-180) fuel oil and boil off gas only, either as single fuels or simultaneous in combination.
Only lighter fuels (marine diesel or gas oil) can be used for start-up of the boiler only.
In case of dead ship (start-up the steam plant from cold condition), there is no heating medium for heavy fuel oil nor atomizing steam.
So, lighter fuels (marine diesel or gas oil) is only available to start up the boiler.
However, normally air compressor for atomizing air and fuel oil pump does not have enough capacity for 100% load and also manual operation is available due to no fuel/air ratio setting for lighter fuels (marine diesel or gas oil).
Therefore, lighter fuels (marine diesel or gas oil) can not be used for main fuel with existing system.

Sincerely yours,

I. Uchida, Manager

Marine Boiler Designing Section

MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

Marine Machinery & Engine Division
Power Systems
Mitsubishi Heavy Industries, LTD.
Nagasaki Shipyard & Machinery works

ATTACHMENT B

DISPERSION MODELING ANALYSIS FOR 1-HOUR SO_2 CONCENTRATIONS

Overview

The dispersion modeling analysis presented in the October 2008 Application for Minor Source Air Permit Modification (2008 Modification Application) has been updated to evaluate the Northeast Gateway (NEG) impacts relative to the new NAAQS for 1-hour SO_2. As previously described to EPA (September 9, 2011 Tetra Tech EC (Ted Guertin) email to EPA Region 1 (Brian Hennessey)) and subsequent telephone correspondence, the methodology for the updated analysis is consistent with the methodology presented in the 2008 Modification Application, with the following exceptions.

Since operation of auxiliary generators GE1 and GE2 will be limited to 100 hours per year, the emission rates used for the engine generators for the 1-hour SO_2 modeling are based on equivalent average annual emission rates. This assumption is consistent with EPA guidance for intermittent sources (see Attachment 3, page 11, of EPA's March 24, 2011 EPA memorandum *Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards*). The EPA guidance indicates that compliance demonstrations for 1-hour SO_2 NAAQS be based on emissions scenarios that are continuous enough to contribute significantly to the annual distribution of maximum daily 1-hour concentrations. While the NEG engines are not technically designated as "emergency" engines, they will be limited by permit to operate no more than 100 hours per year, and actual operations will likely be significantly less. To be conservative, instead of eliminating these intermittent sources completely, they were modeled with equivalent average annual emission rates, which is consistent with the guidance.

To address EPA concerns regarding the calculation of overwater mixing heights, an additional fixed mixing height value of 25 meters was considered in the OCD modeling. This mixing height value was evaluated along with the calculated mixing heights and the other fixed mixing height values of 38, 50, 100, 150, and 300 meters for overwater meteorological conditions. These fixed mixing height values were inserted in the over water meteorological databases for each of the five years modeled.

Vessel Emissions

Maximum emission rates for SO_2 are provided in Table B-1 for each of the main boilers, the auxiliary boiler, and the auxiliary generator. Stack exhaust parameters have not changed from the modeling conducted for the 2008 Modification Application so they are not presented here. The emissions data are provided for two different and very conservative operations scenarios for each of the two buoys.

- **Case 1:** First Generation Vessels/Maximum Load Case — Both main boilers operated with maximum allowable oil firing of 800 kg/hr per vessel (each boiler at 400 kg/hr), with the remaining operating time on natural gas at maximum load (224 MMBtu/hr); diesel-fired generator at approximately 95% load (3,650 kW) for up to 100 hours per year.
- **Case 2:** Third Generation Vessels/Maximum Load Case — Each main boilers operated with maximum allowable oil firing of 400 kg/hr per boiler, with the remaining operating time on natural gas at maximum load (224 MMBtu/hr); gas-fired auxiliary boiler at maximum load (157 MMBtu/hr); gas-fired generator at approximately 95% load (3,650 kW) for up to 100 hours per year.

Table B-1. Maximum SO_2 Emission Rates (g/sec)

SOURCE	Case 1	Case 2
SBBOILERB	3.91	
PORTBOILERB	3.91	
GENERATORB	0.03 *	
SBBOILERA(1)	3.91	
PORTBOILA(1)	3.91	
GENERATORA(1)	0.03 *	
SBBOILERB2		3.91
PORTBOILERB2		3.91
AUXBOILB2		0.0116
GENERATORB2		0.0015 *
SBBOILERA2(1)		3.91
PORTBOILA2(1)		3.91
AUXBOILA2(1)		0.0116
GENERATORA2(1)		0.0015 *

* Equivalent annual emission rate based on 100 hours per year operation (100/8760 x maximum hourly emission rate).

Background Air Quality

The measured ambient air quality data used to determine background air quality for 1-hour SO_2 was based on the most recent 3 years (2008 – 2010) of available data. To assess compliance with the SO_2 standard, the selected background concentrations are determined from measurements collected at the Long Island MA station (site#25-009-0019) and are based on the 3 year average of the 99th percentile design values for 1-hour average background. Use of the 3 year average value is consistent with the SO_2 standard. Table B-2 provides a summary of 2008 - 2010 air quality data and the selected background concentrations for the pollutants being evaluated.

Table B-2. Ambient Air Monitoring Data and Selected Background Concentrations

Pollutant	Monitor	Avg. Time	Units	NAAQS	2008 Conc	2009 Conc	2010 Conc	Background Concentration
SO_2	Long Island Boston Harbor	1-Hour (99th%)	ppm	0.075	0.019	0.014	0.011	0.015 (39.3 $\mu g/m^3$)

Note: Ambient monitoring at Long Island site was suspended in May, 2011. Therefore, 2010 is the last year with a complete data set.

OCD Model Results

Table B-3 presents the maximum predicted impact concentrations for 1-hour SO_2. Consistent with EPA guidance, this concentration is based on the 5-year average of the highest first high (H1H) values, for comparison with the corresponding significant impact level (SIL).The worst case impacts occur at a distance of 500 meters from the project (just outside the safety zone). Maximum predicted impact concentrations are well under the corresponding SIL at the shoreline receptors. Maximum impacts were predicted under the assumed fixed 38 meter overwater mixing height conditions. However, the maximum concentrations predicted with fixed mixing height data were similar in magnitude to the concentrations predicted with the calculated mixing height meteorological data.

Since maximum predicted Project impact concentrations for 1-hour SO_2 are greater than the corresponding SIL, a cumulative modeling analysis with other emissions sources in the area was conducted for this pollutant and averaging period.

Table B-3. Maximum Predicted 1-Hour SO_2 Impacts for NEG

Year	Operating Scenario Case	Receptor	Deg	Dist. From Loc B Km	East Coord	North Coord	Averaging Period	Maximum Concentration ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)
2000-2004	Case 1	#36	360	0.5	48.58	21.73	1- HOUR	158.3	7.8	NA

Note: The maximum predicted project impact concentration is based on the 5-year average of the highest first high values.

Cumulative Source Modeling

As stated above, cumulative modeling was conducted for 1-hour SO_2 concentrations. Since the Project is a minor source and is located in the Massachusetts Bay, 13 miles (21 kilometers) from the nearest land (Gloucester, Massachusetts), the EPA (Brian Hennessey, 9/23/08 telephone conversation) has indicted that cumulative modeling should be conducted with just the Neptune Deepwater Port emission sources. The Neptune Deepwater Port is also to be located in the Massachusetts Bay, approximately 8 kilometers from the Northeast Gateway project site. Emissions parameters for Neptune were determined from their May 2006 Minor Source Air Permit Application and were presented in Table 7-6 of NEG's 2008 Modification Application.

Cumulative modeling was conducted for each year in the 5 year meteorological data base, and for both the overwater calculated and fixed mixing height scenarios. Table B-4 presents the results of the cumulative modeling analysis. Consistent with EPA guidance, the total predicted impact concentration is based on the 5-year average of the highest fourth high (H4H) concentrations which are equivalent to the 99th percentile design values. Maximum predicted cumulative impact concentrations (Northeast Gateway plus Neptune) are summed with ambient background concentrations for comparison with the National Ambient Air Quality Standards (NAAQS). As shown on the table, total impact concentrations plus background are below the NAAQS for 1-hour SO_2. Therefore, compliance is demonstrated. All electronic OCD modeling files will be provided to EPA upon request.

Table B-4. Cumulative Modeling Impact Results for 1-Hour SO_2

Pollutant / Averaging Period	Years	Operating Scenario Case	Receptor	Deg	Dist. From Loc B (km)	Maximum Predicted Concentration Northeast Gateway + Neptune ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
SO_2 / 1-HR	2000-2004	Case 1	#36	360	0.5	129.2	39.3	168.5	196

Note: The maximum predicted cumulative impact concentration is based on the 5-year average of the highest fourth high (99th percentile design) values.

ATTACHMENT C

SUGGESTED CHANGES TO PERMIT

NEG suggests the following revisions to the permit to reflect the limited use of fuel oil for main boiler burner lightings, the addition of the third generation auxiliary boiler Aux2, and the change in operation restrictions for GE1 and GE2.

- I. PROJECT DESCRIPTION—Please update this section to reflect that three generations of EBRV are now in operation. Suggested language follows: *NEG LLC's NEG consists of two subsea Submerged Turret Loading™ (STL™) buoys, each with a flexible riser assembly and a manifold connecting the riser assembly, via a flow line, to the subsea Pipeline Lateral. NEG LLC uses a fleet of specially designed Energy Bridge™ Regasification Vessels (EBRV) to deliver liquid natural gas (LNG) to NEG. EBRVs are purpose-built LNG tankers that incorporate onboard equipment for the regasification of LNG and delivery of high-pressure natural gas. Three generation of EBRVs are in service. All three generations include two main boilers, each with a heat capacity of 224 million British thermal units per hour (MMBtu/hr). During transport, the main boilers produce steam for steam turbines that propel the vessels through the water. While moored NEG, the main boilers provide steam used to vaporize the LNG. Second and third generation vessels include an auxiliary boiler (100 MMBtu/hr for second generation, and 157 MMBtu/hr for third generation) allowing an increased regasification rate. Finally, all three generations of EBRV include an auxiliary generator engine (rated at 3,840 kW for first generation vessels, and 3,860 kW for second and third generations). The generator engines will be limited to emergency-only use while moored at NEG.*

- II. EQUIPMENT LIST—Please make the following changes:

  - Revise the description of B1 and B2 to note that they are natural gas-fired boilers with limited use of fuel oil for burner lightings.

  - Update the table to include the 157 MMBtu/hr natural gas-fired boiler Aux2, which is present only on 3rd generation vessels.

  - Revise the unit descriptions to note that emission units B1 and B2 are present on 1st, 2nd, and 3rd generation vessels; and that GE2 is present on 2nd and 3rd generation vessels.

- IV. DEFINITIONS—Please modify the definition of "emergency situation" as suggested in this letter.

- V.A Emission Limits—Please make the following changes:

  - Delete the short term emission limits for GE1 and GE2, listed under conditions V.A.3 and V.A.4.

  - Add short term emission limits for the third generation auxiliary boiler, Aux2 [0.018 lb/MMBtu or a maximum of 2.8 lb/hr whichever is more stringent].

- V.B. Operational Limits—Please make the following changes:

  - Add a condition limiting the sulfur content of fuel oil used in the main boilers to 1.0% by weight.

- Add a condition or conditions limiting the use of fuel oil in the main boilers to:
    - 800 kg per vessel per one-hour period;
    - 9,600 kg per vessel per 24-hour period; and
    - 640,000 kg per 12-month rolling period for the entire facility.
- Add Aux2 to the list of units required to install, operate and maintain an SCR in condition V.B.1.
- Add a limitation for the maximum total heat input to Aux2.
- Reduce the hourly limitation for GE1 and GE2 in condition V.B.6 from 370 hours to 100 hours on a 12-month rolling average basis.
- Delete the requirement that diesel fuel shall not exceed 1% of the heat input to GE2 in condition V.B.8. [NEG is requesting that the requirement to install a non-resettable diesel fuel meter for GE1 and GE2 be eliminated in condition VI.B.3.b, in favor of tracking kW-hrs and hours of operation for GE1 and GE2.]
- Add a condition requiring GE2 to operate only in natural gas mode (which uses diesel fuel oil only as a pilot fuel, equal to approximately 1% of total heat input).

- VI.A.1 Operator Inspection Plan—Please modify the requirement for a specific emission inspection procedure in condition VI.A.1.a.iv, and for preventive or corrective maintenance procedures or practices in condition VI.A.1.a.v, so that they apply only to units B1, B2, Aux1, and Aux2, and do not apply to units GE1 and GE2.

- VI.B.1 Emissions Monitoring for NO_x and CO—Please make the following changes:
    - Add Aux2 to the requirement to install, maintain and operate a gas analyzer for NOx and CO in conditions VI.B.1.a and VI.B.1.b.
    - Add Aux2 to the requirements to calculate monthly and annual emissions of NOx and CO in conditions VI.B.1.c and VI.B.1.e, respectively.
    - Add the following equation for NO_x emissions from Aux2 in condition VI.B.1.d: (fuel usage (kg)) x (0.052682 MMBtu/kg) x (0.018 lb/MMBtu) x (tons/2000 lbs)
    - Add the following equation for CO emissions from Aux2 in condition VI.B.1.f: (fuel usage (kg)) x (0.052682 MMBtu/kg) x (0.044 lb/MMBtu) x (tons/2000 lbs)
    - Add Aux2 to the equations for total NO_x and CO emissions in conditions VI.B.1.d and VI.B.1.f, respectively.
    - Correct the equation for CO emissions from GE1 in VI.B.1.f: the emission factor is listed incorrectly as 12.1 g/kW-hr, and should be changed to 3.34 g/kW-hr.

- Modify the equation for CO emissions from GE2 in VI.B.1.f by increasing the emission factor from 2.1 g/kW-hr to 3.3 g/kW-hr.

- VI.B.2 Emissions Monitoring for NO_x, CO, VOC, SO_2, PM_{10}—Please add Aux2 to the list of units to be included in the plan for monitoring operational parameters.

- VI.B.3.a Fuel Consumption—Please make the following changes:

  - Add Aux2 to the list of units required to install and operate natural gas flow meters under condition VI.B.3.a. Also, please double-check the regulatory reference to procedures in 40 CFR 60, Appendix A, which appears to be in error.

  - Add a condition requiring the installation and operation of fuel oil meters for units B1 and B2.

  - Remove the requirement to install and operate a diesel fuel meter for GE1 and GE2 under condition VI.B.3.b. Compliance with restrictions on operation and emissions from these units will be achieved by monitoring and recording kW-hrs and hours of operation.

- VI.C Performance Tests—Please make the following changes:

  - Add Aux2 to the list of units to be tested, and remove units GE1 and GE2, under condition VI.C.1.a.1.

  - Delete the test methods for PM_{10} and SO_2 from conditions VI.C.1.a.ii.D and VI.C.1.a.ii.F.

  - Since PM_{10} and SO_2 do not require testing, please delete them from the required contents of the test report under condition VI.C.1.a.v.A.

  - Add Aux2 to the list of units in condition VI.C.1.a.v.C.

  - Delete GE1 and GE2 from the list of units in condition VI.C.1.a.v.C, and delete the reference to gallons of diesel, which is only used in units GE1 and GE2

  - Delete condition VI.C.1.a.v.D.

  - Delete GE1 and GE2 from the list of units subject to subsequent performance tests under condition VI.C.1.b.i and VI.C.1.b.ii.

- VI.D Recordkeeping—Please make the following changes:

  - Add a condition or conditions requiring records to be kept of the quantity of fuel oil used by units B1 and B2.

  - Add Aux2 to the list of units required to keep records of BOG consumption, operating hours, exhaust temperature, and SCR inlet and outlet pressures under conditions VI.D.1.e, VI.D.1.i, VI.D.1.j, and VI.D.1.k, respectively.

- Delete condition VI.D.1.f, requiring records to be kept of the volume of diesel fuel consumed by GE1 and GE2.

- Add a requirement to keep records of hours of operation for GE1 and GE2.

- VII.D. Semi-annual Reporting—Please make the following changes:

  - Add Aux2 to the list of units required to include a summary of corrective maintenance under condition VII.D.3.a.

  - Delete GE1 and GE2 from the list of units required to include a summary of corrective maintenance under condition VII.D.3.a.

  - Add Aux2 to the list of units required to include total fuel consumption and hours of operation under condition VII.D.3.b.

  - Delete GE1 and GE2 from the list of units required to include total fuel consumption and hours of operation under condition VII.D.3.b.

  - Modify condition VII.D.3.c to require units GE1 and GE2 to include total kW-hr and hours of operation.

  - Add Aux2 to the list of units required to include a written statement showing actual emissions of NOx and CO under condition VII.D.3.d.

- VIII. GENERAL FACILITY REQUIREMENTS—Please make the following change:

  - Delete conditions VIII.D.iii and VIII.D.iv, which refer to the deleted short-term NOx emission limits for GE1 and GE2.