TETRA TECH

June 18, 2013

Mr. James Belsky, Permit Chief
MassDEP Northeast Region
205B Lowell Street
Wilmington, MA 01887

Re: Second Supplement to Major Comprehensive Plan Application – Salem Harbor Redevelopment (SHR) Project (Transmittal Number X254064) Additional Information Regarding Noise Control and Ammonia Release Analysis

Dear Mr. Belsky:

This additional information is being submitted to complete our Second Supplement to the Major Comprehensive Plan Application (MCPA) submitted on December 21, 2012. This information is being submitted on behalf of Footprint Power Salem Harbor Development LP ("Footprint"). This additional information includes: (1) information with respect to the costs and benefits of alternative noise mitigation techniques, and (2) update of the accidental release analysis for ammonia to reflect minor changes to the site layout.

Evaluation of Alternative Noise Mitigation Techniques

An analysis of alternative noise mitigation techniques has been undertaken for the SHR facility. At each of fourteen noise receptors, various alternative noise mitigation measures have been evaluated with respect to a "Reference" design. The "Reference" design is not the proposed facility design, but is a more of a "standard" design for this type of facility with less acoustic mitigation than is included in the proposed design. This is done in order to show the significant amount of mitigation included in the proposed facility design compared to a more "standard" design for this type of facility.

The "Reference" design consists of:

- Acoustically treated buildings over the CTGs and STGs
- Acoustic barriers on both sides of the HRSGs
- The 12' GE intake duct silencers
- Low noise GSU transformers
- ACC meeting 51 dBA @ 400'
- Stack silencers

The analysis then considered four incremental mitigation options over the "Reference" design.

Option 1: Utilize acoustic buildings to house HRSG units; use GE 16' silencers for the engine combustion air intake ducts; provide acoustic louvers on the south side of the ACC.

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Option 2: Option 2 is the proposed SHR facility design. In addition to Option 1, Option 2 includes acoustic inlet plenums upstream of the filter houses and replaces the GE 16’ intake silencers with the GE 12’ intake silencers; use of ultra-low noise GSU transformers. Note, with this option the GE acoustic weather hoods on the filter house face openings are not required.

Option 3: In addition to Option 2: Enhance the CTG and STG building walls to provide an acoustic performance of STC57.

Option 4: In addition to Option 2: Increase the attenuation of the stack silencers by 6 dBA.

These are also described in Table 1.

TABLE 1 Details of Reference Design and Noise Mitigation Options

Major Project Component	**Reference Design**	**Option 1**	**Option 2**	**Option 3**	**Option 4**
CTG Power Train	Acoustic Buildings	Acoustic Buildings	Acoustic Buildings	**Increase Building STC**	Acoustic Buildings
HRSG	Acoustic Barriers/ No Roof	**Acoustic Buildings**	Acoustic Buildings	**Increase Building STC**	Acoustic Buildings
STG	Acoustic Buildings	Acoustic Buildings	Acoustic Buildings	**Increase Building STC**	Acoustic Buildings
CT Inlet Filter House	GE 12 ft Silencers	**GE 16 ft Silencers**	**GE 12 ft Silencers With Acoustic Inlet Plenums**	GE 12 ft Silencers With Acoustic Inlet Plenums	GE 12 ft Silencers With Acoustic Inlet Plenums
Stack	Silencers	Silencers	Silencers	Silencers	**Increase Attenuation 6 dBA**
GSU Transformer	Low Noise Transformers	Low Noise Transformers	Ultra-Low Noise Transformers	Ultra- Low Noise Transformers	Ultra- Low Noise Transformers
ACC	51 dBA @ 400 ft	**51 dBA @ 400 ft with Acoustic Louvers**	51 dBA @ 400 ft with Acoustic Louvers	51 dBA @ 400 ft with Acoustic Louvers	51 dBA @ 400 ft with Acoustic Louvers

Table 2 presents a summary of the noise level changes/benefits and associated costs of four noise mitigation options.

TABLE 2 - Summary of Noise Mitigation Benefits and Costs

Noise Receptor	Reference Design Max Noise Level (Amb. + Project) (dBA)	Increase over Background Noise Level (dBA)	Resulting Changes in Predicted Noise Level (dBA) (Compared with Reference Design and Background)							
			Option 1		Option 2		Option 3		Option 4	
			Compared to Reference Design	Compared to Background	Compared to Reference Design	Compared to Background	Compared to Reference Design	Compared to Background	Compared to Reference Design	Compared to Background
ST - 1	51	+4	-2	+2	-2	+2	-2	+2	-2	+2
ST - 2	54	+12	-4	+8	-8	+4	-9	+3	-8	+4
ST - 3	47	+8	-4	+4	-4	+4	-5	+3	-4	+4
ST - 4	50	+11	-4	+7	-6	+5	-6	+5	-6	+5
ST - 5	49	+10	-4	+6	-4	+6	-5	+5	-4	+6
ST - 6	39	+3	-1	+2	-1	+2	-1	+2	-1	+2
ST - 7	45	+6	-3	+3	-3	+3	-4	+2	-3	+3
ST - 8	40	+2	-1	+1	-1	+1	-1	+1	-1	+1
ST - 9	47	+8	-3	+5	-3	+5	-3	+5	-3	+5
ST - 10	46	+10	-4	+6	-4	+6	-4	+6	-4	+6
ST - 11	44	+5	-3	+2	-3	+2	-3	+2	-3	+2
ST - 12	43	+2	-1	+1	-1	+1	-1	+1	-1	+1
WITI -1	42	+2	-1	+1	-1	+1	-1	+1	-1	+1
WITI -2	39	+5	-1	+4	-1	+4	-1	+4	-1	+4
Incremental Cost		-	$8,799,200.		$12,388,100.		$16,244,900.		$14,324,100.	
Selected for Project?		NO	NO		**YES**		NO		NO	

Notes: 1. GSU transformer costs are not considered;
2. GE inlet silencer costs are not considered;
3. In Option 2, no credit has been included for deleting the GE acoustic weather hood on the filter face opening.

As can be seen from Table 2, the Reference design results in some increases in the ambient levels by more than 10 dBA, and design Option 1 results in all increases above the ambient level being within 10 dBA. While we understand that a 10 dBA increase is technically acceptable, we believe that it is appropriate to achieve a higher level of reduction and so have adopted the noise mitigation measures identified in Option 2.

Specifically these Option 2 mitigation measures proposed for the SHR Facility are:

- Acoustic buildings on the CTGs, STGs, and HRSGs
- GE 12' silencers in the combustion air intake ducts
- Acoustic plenums upstream of the intake filter houses
- Silencers in the stacks
- Ultra low noise transformers
- Acoustic louvers on the south side of the 51 dBA @ 400' rated ACC

Option 2 results in a maximum increase above ambient at any of the sensitive receptors by at most 6 dBA.

Option 3 (increasing the building wall and roof assembly acoustic performance), when compared with Option 2, results in only a 1 dBA decrease at 4 receptors, and provides no improvement at the other 10 receptors. This minor decrease in noise for Option 3 adds $3.8 million to the capital cost and is not considered to be warranted.

Option 4 (increasing the stack silencing), when compared with Option 2, actually provides no reduction in noise level at any of the receptors so it was not selected.

We have also examined if it is feasible to meet a maximum increase of 10 dBA at the property line of the facility. The closest property line is toward the Harbor, at a distance of approximately 275 feet from the closest edge of the ACC. The only feasible way to meet 10 dBA at this property line would be to construct a large permanent sound wall along the Harbor side of the ACC. However, this would significantly restrict the air flow to the ACC and present a major technical issue in terms of ACC performance. The ACC already has obstructions to air flow from proposed facility structures towards the north and west, and construction of a large permanent sound wall on the Harbor side would result in obstacles to air flow on three sides of the ACC. Therefore, it is concluded that meeting 10 dBA at the property line along the Harbor is not practical and is unnecessary based on measurements taken at Marblehead and on Winter Island, as the noise levels for the receptors in the harbor (boats) will be comparable to or lower than the noise experienced by boaters from the existing facility.

Accidental Release Analysis for Ammonia

The accidental release analysis for ammonia has been updated for the minor changes to the facility layout. An update of Appendix G of the December 21, 2012 MCPA is attached. The dike size has been decreased from 23 feet by 19 feet to 21 feet by 18 feet. The predicted concentrations are all less than those presented in the December 21 MCPA.

If you have any questions, please contact either me at (617) 803-7809 or George Lipka at (617) 443-7568.

Sincerely,

Keith H. Kennedy
Senior Consultant – Energy Programs

Attachment

Appendix G Update - EVALUATION OF WORST CASE AMMONIA RELEASE

The SHR Facility will use a 19% solution of aqueous ammonia for the SCR systems, which are pollution control devices located in the turbine HRSGs for reduction of NO_x emissions. The 19% aqueous ammonia will be stored in an above-ground 34,000 gallon steel tank. The storage tank will be a vertical cylindrical tank, with a diameter of 12 feet and a height of approximately 40 feet.

The tank will have single wall construction, which provides for more effective monitoring and reparability than a double wall tank. The tank, as well as ammonia transfer pumps, valves and piping will be located within a concrete containment structure (dike) which will be designed to contain 110% of the volume of the tank. The dike will be 21 feet by 18 feet and have 15 foot high walls to provide the necessary containment. The dike will be constructed so that the floor of the dike will be 4 feet below grade and the top of the dike walls will be 11 feet above grade. In order to minimize the exposed surface area of any aqueous ammonia that enters the diked area, passive evaporative controls (polyethylene balls or equivalent) will be installed to reduce the surface area by 90%. In order to further mitigate the potential impacts of an accidental ammonia release, the entire tank and diked area will be located within an enclosure 24 feet long, 19 feet wide, and 45 feet high. The walls of the structure will be fully sealed, and the only ventilation for the structure will be by means of roof vents.

The aqueous ammonia storage tank will be constructed in accordance with the Massachusetts Department of Public Safety requirements for storage tanks greater than 10,000 gallons containing material other than water. The dike wall and enclosure surrounding the tank will decrease the risk of damage to the tank caused by accidental vehicle contact.

Transfer from ammonia delivery trucks to the storage tank will take place within a contained concrete storage tank unloading pad with drainage design such that any spills during ammonia delivery will drain into the diked containment area. Delivery trucks will be required to have fast-acting shutoff valves in the unlikely event that a leak or other problem should arise. A hose from the top of the tank connected back to the truck will return displaced vapor to the truck, or an equivalent method for control of transfer losses will be used. The storage tank will be equipped with level monitoring instrumentation that will be continuously monitored in the control room. In the event that the tank level approaches an overfill condition during filling, a high level alarm will sound, initiating an immediate response to the situation.

Ammonia in aqueous solution is volatile, and the accidental release of this material would result in some release of ammonia to the ambient air. Therefore, a worst-case accidental release scenario was performed to evaluate the potential health impacts of such a release. The release scenario assumed a release of the entire contents of the tank into the diked containment area, and conservatively evaluated the air quality impacts of such a release at the nearest projected controlled access perimeter (PACP) (approximately 230 feet from the ammonia storage area).

The ammonia emissions resulting from a hypothetical worst-case release scenario were calculated using the Areal Locations of Hazardous Atmospheres (ALOHA) model, which demonstrates that no locations outside the PCAP would be exposed to concentrations above 25 ppm. This model was developed by the EPA and the National Oceanic and Atmospheric Administration, and is included as a prescribed technique under the EPA Risk Management Program (RMP) guidance. The ALOHA model ammonia release emissions were calculated with the inputs specified below.

- Volume of 19% Aqueous Ammonia released: 34,000 gallons.

- Surface Area of Ammonia “Puddle”: In the event of a leak of the entire contents of the storage tank into the containment area, the potential liquid surface area, excluding the footprint of the tank itself would be 265 square feet. The evaporative controls would reduce the exposed surface area to 26.5 square feet.
- Ambient Temperature: 103 degrees F. This is the maximum temperature recorded in Boston (Logan Airport) over the last 3 years (2009-2011). Use of the maximum temperature in the last three years is specified in EPA RMP guidance for evaluating accidental releases.
- Wind speed at 3 meter height: 0.85 meters/second. This is the minimum wind speed that can be input into ALOHA. The minimum wind speed is used since the NH_3 tank is within an enclosure and will not be subject to outdoor winds.
- Relative Humidity: 62%.This is the average relative humidity for Boston (Logan Airport) over the last 3 years (2009-2011).Use of the average relative humidity over the last three years is specified in EPA RMP guidance for evaluating accidental releases.

The ALOHA model results indicate a steady state release rate of ammonia from the diked area (within the enclosure) of 0.97 pounds per minute. The enclosure will mitigate the release of ammonia to the atmosphere, since the exchange of enclosure air with outdoor air is controlled by the building ventilation design. The enclosure will be designed with an air exchange rate of 4, meaning the flow rate of outdoor air into and out of the enclosure per hour will be four times the enclosure volume. [The air exchange rate multiplied by the building volume yields the flow rate of air both into and out of the building over a 1-hour period because as much air needs to come in as goes out to equalize the pressure.] For the ammonia enclosure design, an air exchange rate of 4 means that the volume of enclosure air exhausted to the atmosphere will be 914 actual cubic feet per minute (acfm). If the diked area releases ammonia at 0.97 pounds per minute, after about 45 minutes (if the release is not controlled) the ammonia concentration in the enclosure will be near equilibrium and the release rate of ammonia from the enclosure roof will approach 0.97 pounds per minute. In actuality, ammonia sensors in the enclosure will alert plant staff to a problem, and action to control a release to the dike can be taken before significant ammonia accumulates in the diked area.

In order to conservatively evaluate potential offsite consequences of an ammonia release, a continuous release of ammonia of 0.97 pounds per minute from the enclosure roof was evaluated with the AERMOD dispersion model. This is the same dispersion model used for the evaluation of air quality impacts from the facility exhaust stacks. The same AERMOD inputs and data-bases used for the stack modeling described in Section 6 of this application were used for the ammonia release analysis. A dense modeling receptor network at and near the PCAP was used to assess the maximum offsite ammonia concentrations. The enclosure exhaust parameters used were a 45 foot release height, from a roof vent with an area of 1 square foot exhausting 914 acfm at ambient temperature.

The concentrations of ammonia at the PCAP and nearby locations were evaluated in terms of the American Industrial Hygiene Association (AIHA) Emergency Response Planning Guideline Level 1 (ERPG-1) of 25 parts per million (ppm) by volume, and the ERPG-2 of 150 ppm. ERPG-1 is defined as maximum airborne concentration below which nearly all individuals could be exposed to for up to one hour without experiencing other than mild transient health effects and/or a clearly defined objectionable odor. ERPG-2 is defined as the maximum airborne concentration which it is believed that nearly all individuals could be exposed to for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair the ability to take self-directed protective action.

The results of the AERMOD Model indicate that in the event of a hypothetical worst-case release, the ammonia concentrations would be less than the ERPG-1 level of 25 ppm at all locations outside of the PCAP. Thus, the ammonia concentrations at all locations outside the PCAP would be well below the ERPG-2 level of 150 ppm. Table G-1 presents the results of the predicted 1-hour maximum concentrations of ammonia in the event of a worse case release from the storage tank. The results in Table G-1 are shown for the northern PCAP (worst case PCAP value), the west PCAP (worst case aside from north PCAP), the East PCAP, the South Essex Sewerage District and the nearest residence to the ammonia storage area (Fort Avenue, just east of Memorial Drive).

Table G-1 Summary of Worst-Case Release Scenario for Ammonia

Location	Distance From Ammonia Storage Enclosure (feet)	Ammonia Concentration (Maximum Hourly Value in ppm)	ERPG-1 (ppm)	ERPG-2 (ppm)
Power Plant North PCAP	230	20.2	25	150
Power Plant West PCAP	340	13.1	25	150
Power Plant East PCAP	450	4.4	25	150
Nearest Residence (Fort Avenue)	570	6.7	25	150
SESD	750	6.8	25	150