

## MEMORANDUM

Date: June 16, 2016

To: Richard Kessel, MATEP

From: Richard Lampeter, INCE, Epsilon Associates, Inc.

**Subject: Response to Comments from Acentech – MATEP MassDEP Sound Level Analysis Relating to the Mosaic Building**

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In response to Acentech's comments to MATEP's draft air quality permit, Epsilon has supplemented its predicted future sound levels at the new residential building, RTH Mosaic on the Riverway (the "Mosaic building"), specifically with respect to the Massachusetts Department of Environmental Protection's (MassDEP) Noise Policy, solely for illustration purposes. This memorandum differs from our noise memorandum dated December 2, 2015, which focused on illustrating compliance with Boston Air Pollution Control Commission ("BAPCC") (not MassDEP) noise standards. This memorandum, however, makes use of the data included within our December 2 memorandum in connection with our supplementation of the MassDEP Noise Policy analysis.

### **Findings**

The supplemental analysis demonstrates that the predicted sound levels at the Mosaic building resulting from the Combined Heat and Power Facility Upgrade Project (sometimes referred to as the "Project") in combination with existing equipment at MATEP will comply with the MassDEP Noise Policy even when using more conservative background data as Acentech suggested. This conclusion accounts for (1) upper-floor locations at the Mosaic building, (2) existing MATEP sound levels, (3) expected future Project noise levels, and (4) ambient sound measurements taken during a period when minimal equipment was operating at MATEP (again, conservatively). The details of this evaluation are presented herein.

### **Mosaic Building Sound Level Measurement Program – MassDEP Noise Policy**

#### ***Program Parameters***

To quantify existing nighttime background and current operational levels from MATEP at and around the Mosaic building at upper-floor locations, supplemental sound level measurements were made in November 2015 for purposes of our December 2 memorandum evaluating the

BAPCC limit. Those measurements were made at three (3) locations, as shown in Figure 1 overlaid upon an aerial photograph of the study area, and as described in Table 1 below. Location 18 is consistent with previous measurement programs employed to demonstrate MATEP's compliance with the MassDEP Noise Policy, while Locations 18A and 18B are newer locations originally measured in November 2015. Location 18 was retested in November 2015 to ensure conformance and consistency with previous results, while Locations 18A and 18B were selected to better understand the sound dynamics at two different upper-floor locations at the Mosaic building.

**Table 1: MATEP Sound Level Measurement Locations**

Location	Description
18	Rooftop of the Brigham & Women's Hospital parking garage to the southwest of the MATEP facility, across Francis Street (southern corner of the garage). This is the site of the previous test performed to mimic upper floor locations of the Mosaic building which was not under construction in 2014.
18A	Tenth floor of the Mosaic building currently under construction and across the street from Location 18. Representative of upper-floor residential units facing MATEP across from the approximate center of the facility. This floor was chosen based on discussion with the Consigli representative as residential space is not planned for floors above the tenth floor.
18B	Eleventh floor open mechanical space of the Mosaic building currently under construction near the Fenwood Rd. / Binney St. intersection.

Background and operational sound pressure level measurements were performed at all three locations with landowner permission, using one Larson Davis Model 831 Sound Level Analyzer, equipped with a half-inch condenser microphone and a foam windscreen, tripod-mounted at a relative height of five feet. This instrumentation meets the "Type 1 - Precision" requirements set forth in American National Standards Institute (ANSI) S1.4 for acoustical measuring devices. The meter was equipped with an internal one-third octave band filter and set to log statistical parameters for each 20-minute measurement period, including the  $L_{eq}$ ,  $L_{max}$ ,  $L_{10}$ ,  $L_{50}$ , and  $L_{90}$ . The measurement equipment was calibrated in the field before and after the surveys with the manufacturer's acoustical calibrator which meets the standards of IEC 942 Class 1L and ANSI S1.40-1984. The equipment has also been calibrated and certified as accurate to standards set by the National Institute of Standards and Technology by an independent laboratory within the past 12 months.

### ***Existing Background Sound Levels***

In order to replicate the more conservative MassDEP noise analysis advocated by Acentech (i.e., one that minimizes any contributions from existing MATEP equipment), we used the

background sound levels obtained in November 2015 for the BAPCC noise evaluation. To recap how we obtained those background levels, the operation of the plant was configured to minimize MATEP contributions in the direction of the Mosaic building using a technique similar to that employed during the May 2014 background measurement program described in the October 2015 Sound Level Assessment Report. Background sound level measurements were made during the quietest nighttime hours on Tuesday, November 24, 2015 between 12:15 a.m. and 1:50 a.m.

A summary of the nighttime background sound levels at each location measured on November 24, 2015 is presented in Table 2 below.

**Table 2: Measured Background Sound Levels**

Loc.	Start Time	L <sub>eq</sub>	L <sub>90</sub>	L <sub>90</sub> Sound Pressure Level by Octave-Band Center								
				Frequency (Hz)								
				31.5	63	125	250	500	1k	2k	4k	8k
		dBA	dBA	dB	dB	dB	dB	dB	dB	dB	dB	dB
18	1:28 AM	60	60	69	64	67	62	57	55	47	37	26
18A	12:16 AM	60	59	64	60	62	60	57	55	48	38	28
18B	12:45 AM	60	59	64	61	62	60	57	54	49	38	25

### ***Observations Regarding Existing Background Sound Levels***

At Location 18, the dominant sound source was venting from the southeast corner of the parking garage used by Brigham & Women’s Hospital and Massachusetts Mental Health Center. Additional sound sources included mechanical noise from the direction of the Beth Israel Deaconess Medical Center building on Brookline Avenue, and to a lesser degree, mechanical noise from the direction of the MATEP roof.

At Location 18A the primary sound source was rooftop mechanical equipment, some of which could be attributed to MATEP. Additional sources included a hum from a broken construction light and an occasional vehicle on the local streets. At Location 18B the primary sound source was rooftop mechanical equipment which included MATEP and the Brigham and Women’s Shapiro building. At times, a backup alarm unrelated to MATEP was faintly audible as well.

### ***Current Operational Sound Levels***

To capture typical sound levels resulting from normal, ordinary course operation of the MATEP facility, measurements were made during the quietest nighttime hours on Wednesday, November 25, 2015 between the hours of 12:15 a.m. and 2:30 a.m. under operational conditions

which were comparable to those measured during the May 2014 operational measurement program described in the October 2015 Sound Level Assessment Report.

A summary of the current operational sound levels at each location measured on November 25, 2015 is presented in Table 3 below.

**Table 3: Measured Current Operational Sound Levels**

Loc.	Start Time	L <sub>eq</sub>	L <sub>90</sub>	L <sub>90</sub> Sound Pressure Level by Octave-Band Center Frequency (Hz)								
				31.5	63	125	250	500	1k	2k	4k	8k
				dB	dB	dB	dB	dB	dB	dB	dB	dB
18	2:09 AM	63	62	67	66	67	64	60	57	51	43	27
18A	12:16 AM	63	62	63	62	63	63	60	58	51	42	28
18B	1:27 AM	63	63	63	63	64	62	61	58	52	41	26

### ***Observations Regarding Current Operational Sound Levels***

At Location 18, significant sound sources included venting from the southeast corner of the parking garage (Brigham & Women's Hospital and Massachusetts Mental Health Center) and MATEP rooftop equipment. During parts of the measurement period, a truck hauling a dumpster was active in the parking garage and idling outside of the garage on Fenwood Road.

At Location 18A, the primary sound source was rooftop mechanical equipment, some of which could be attributed to MATEP. Additional sources included a hum from a broken construction light and an occasional vehicle on local streets.

At Location 18B, the primary sound source was rooftop mechanical equipment from the direction of MATEP. Additional sound sources included rooftop mechanical from Brigham and Women's, and an occasional vehicle on local streets.

The MATEP stack was not identified as a contributing noise source at any of the measurement locations.

### ***Modeled Sound Levels Resulting from the Project***

A detailed discussion of the primary components of the new turbine installation, their associated reference sound level data, and the modeling methodology can be found in Section 6.0 of the City of Boston Sound Level Assessment Report for the Combined Heat and Power Facility Upgrade Project, dated October 1, 2015. Modeling receptors were added to the CadnaA noise

model<sup>1</sup> to represent the two sound level measurement locations (18A and 18B) described in Table 1. Since the October 2015 report, the model has been revised to include a stage two gas compressor and an associated extension of the noise wall at MATEP.

The results of the sound level modeling for the Project are presented in Table 4 at each of the three discrete receptor locations (18, 18A, and 18B) and assume that all equipment<sup>2</sup> associated with the new turbine is operating simultaneously. Project-only sound levels from the proposed equipment at each modeling location are expected to range from 55 to 58 dBA.

**Table 4: Project-Only (New Turbine and Related Equipment Only) Sound Level Modeling Results**

Location	dBA	Sound Levels [dB] per Octave-Band Center Frequency [Hz]								
		32	63	125	250	500	1k	2k	4k	8k
		dB	dB	dB	dB	dB	dB	dB	dB	dB
18	58	72	68	64	58	54	51	46	49	42
18A	55	69	66	61	56	53	49	43	46	37
18B	57	67	65	61	56	54	51	46	45	38

Notes:

1. A safety factor of 3 dBA was included (3 decibels added to predicted sound level) to account for any tolerances and uncertainty in the referenced sound level data used as input.

### ***MassDEP Noise Policy Evaluation of Future Sound Levels Based on Above Data***

For purposes of evaluating the MassDEP Noise Policy, future worst-case sound levels are replicated by combining the predicted Project sound levels (Table 4) with the current operational sound levels (Table 3) and comparing the resulting values with the existing background sound levels (Table 2). These totals and the corresponding increases are shown in Table 5. The increase over background at these receptors during nighttime conditions is predicted to range from 3 to 5 dBA, which is within the MassDEP Noise Policy limit of 10 dBA.

<sup>1</sup> CadnaA is a noise calculation software package developed by DataKustik GmbH which incorporates the ISO 9613-2 international standard for sound propagation (Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation).

<sup>2</sup> Equipment modeled includes the turbine air inlet, enclosure discharge vent, gas compressors, seal air fan, and ventilation exhaust fan.

**Table 5: MassDEP Noise Policy Evaluation - Broadband**

Receptor ID	Background Sound Level <sup>1</sup>	Current Operational Sound Level	Modeled New Project Sound Level <sup>1</sup>	Combined Current + Project Sound Level	Increase Over Background <sup>2</sup>	Limit Met?
	dBA	dBA	dBA	dBA	dBA	
18	60	62	58	63	3	YES
18A	59	62	55	63	4	YES
18B	59	63	57	64	5	YES

1. 3 dB safety factor included in modeled new project-only sound levels
2. Calculation of increase over background performed using data rounded to the nearest whole decibel.

The Project also does not create or exacerbate any existing “pure tones”<sup>3</sup> as defined by the MassDEP Noise Policy at the three modeled receptor locations. This is shown in Table 6, which presents the predicted combined ‘Project + Current Operation’ future sound levels on an octave-band basis.

**Table 6: MassDEP Noise Policy Evaluation - Octave-Band**

Location	Sound Levels [dB] per Octave-Band Center Frequency [Hz]								
	32	63	125	250	500	1k	2k	4k	8k
18	73	70	69	65	61	58	52	50	42
18A	70	67	65	64	61	59	52	47	38
18B	68	67	66	63	62	59	53	46	38

### Conclusions

When the sound levels associated with the Project and related equipment are added to the current background and operational sound levels, the increase in the broadband sound level over a conservatively measured background sound level as advocated by Acentech is well below

<sup>3</sup> According to the MassDEP Noise Policy, a “pure tone” condition exists when the sound pressure level of any octave band is at least 3 dB greater than the sound pressure levels in each of the two adjacent octave bands.

the MassDEP limit of 10 dBA. In addition, no "pure tones" as defined by MassDEP are predicted at any of the three locations. In other words, the Project is expected to comply with the MassDEP Noise Policy at the Mosaic building even where the analysis is based upon much more conservative background data as advocated by Acentech.



MATEP Boston, Massachusetts