Commissioning , Construction & Development Management Services

Mr. Serio Mendoza
Planning Director Town of Munster
Town of Munster
1005 Ridge Road
Munster, IN 46321

Re: Powers Health Sound Study

Dear Mr. Mendoza,

During our meeting on September 18th at Community Hospital, where the CoGen Plant would be located, we discussed the difficulty of studying due to the ambient sound being almost or exceeding the 55 dba the proposed equipment would create. It was agreed that the best way to demonstrate this would be to take decibel readings at 3 different times throughout the day. The information below is the readings that were taken on September 19th. These readings were recorded using an Aicevoos AS-KS Digital Sound Level Meter.

Point of Reading	**4:00 am**	**11:00 am**	**7:00 am**
Edge of the proposed wall	55 dBa	62 dBa	62 dBa
33' from wall	53 dBa	58 dBa	60 dBa
83' from wall	52 dBa	58 dBa	56 dBa
133' from wall	50 dBa	61 dBa	59 dBa
183' from wall	50 dBa	58 dBa	58 dBa
Curb	53 dBa	63 dBa	66 dBa

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The data shows that the dBa levels exceed 55 during the day and are slightly below 55 during the night. The proposed equipment is expected to produce 55 dBa at 33 feet from the enclosure, not accounting for the additional noise reduction from the CMU and masonry wall that will be built around the equipment.

I hope this answers all your questions and if you require additional information, please feel free to contact me.

Sincerely,

Andrew E Qunell, LEED AP BD+C, QCxP

President

VRQ LLC

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LETTER OF TRANSMITTAL

Transmittal No. CH-009
Date: 08-16-2024
Attention: Michael Farley
Re: Community T0094

To: Bernhard TME

WE ARE SENDING YOU: ☒ Attached ☐ Under Separate Cover via ____, the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples

☐ Specifications ☐ Copy of Letter ☐ Change Order ☐ _CAD FILE_____

Item	Copies	Description
1	1	Sound calculation for Avus1600e

MEANS OF TRANSMISSION:

☒ Email ☐ Hard Copy ☐ Cloud Storage Link ☐ Other:_____

These are transmitted as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ for review and comment ☐ _____

REMARKS:

Please see PDF in email.

COPY TO: WHE File **SIGNED:**

If enclosures are not as noted, kindly notify us at your earliest convenience.

Calculation of sound pressure level avus1600e in standard 55dB(A) Container

Sound pressure level at 10m total in dB(A)	**52,67**

Sound rating at inlet/outlet of air duct with engine noise				
Frequency band [Hz]	Air-bone noise engine [dB] LW	attenuation values inlet & outlet air silencer[dB]	muffled value[dB] LW	muffled value in dB(A) LW(A)
63,00	73,36	6,00	67,36	41,15
125,00	79,86	16,00	63,86	47,68
250,00	78,08	28,00	50,08	41,41
500,00	79,11	50,00	29,11	25,86
1000,00	78,06	50,00	28,06	28,06
2000,00	77,36	50,00	27,36	28,56
4000,00	84,46	37,00	47,46	48,42
8000,00	86,66	23,00	63,66	62,52
		Total noise level	70,16	62,88
		Sound pressure level at 10m	42,16	34,88

Sound rating at outer Container walls				
Frequency band [Hz]	Air-bone noise[dB] LW	transmission loss values Container (standard)[dB]	muffled value [dB] LW	muffled value in dB(A) LW(A)
63,00	84,00	27,00	57,00	30,79
125,00	90,50	25,00	65,50	49,32
250,00	90,00	34,00	56,00	47,33
500,00	93,00	44,00	49,00	45,75
1000,00	92,50	44,00	48,50	48,50
2000,00	91,80	50,00	41,80	43,00
4000,00	99,20	49,00	50,20	51,16
8000,00	101,40	48,00	53,40	52,26
		Total noise level	66,93	57,54
		Sound pressure level at 10m	38,93	29,54

Air silencer with air fan noise				
Frequency band[Hz]	supply air fan[dB] LW	attenuation values inlet & outlet air silencer[dB]	muffled value[dB] LW	muffled value in dB(A) LW(A)
63,00	86,63	3,00	83,63	57,42
125,00	88,63	5,00	83,63	67,45
250,00	88,35	10,00	78,35	69,68
500,00	86,38	16,00	70,38	67,13
1000,00	84,83	18,00	66,83	66,83
2000,00	82,83	15,00	67,83	69,03
4000,00	79,53	11,00	68,53	69,50
8000,00	75,53	7,00	68,53	67,39
		Total noise level	87,53	76,79
		Sound pressure level at 10m	59,53	48,79

Sound pressure level at 10m dual circuit radiator	49,00	dB(A)

Exhaust Silencer						
Frequency band [Hz]	exhaust noise[dB] LW	attenuation values	attenuation values	attenuation values	muffled value [dB] LW	muffled value in dB(A) LW(A)
63,00	113,9	18	4	0	91,9	65,69
125,00	119,8	28	6	0	85,8	69,62
250,00	111,9	35	9	0	67,9	59,23
500,00	104,5	40	14	0	50,5	47,25
1000,00	97,1	35	28	0	34,1	34,1
2000,00	96,8	32	25	0	39,8	41,002
4000,00	94	26	12	0	56	56,964
8000,00	83,9	24	8	0	51,9	50,755
				Total noise level	92,8687154	71,58085913
				Sound pressure level at 10m	64,8687154	43,58085913

Frequency band [Hz]	Air-bone noise engine [dB]	Air-bone noise engine to Silencer
63	84,00	73,36
125	90,50	79,86
250	90,00	78,08
500	93,00	79,11
1000	92,50	78,06
2000	91,80	77,36
4000	99,20	84,46
8000	101,40	86,66

Frequency band [Hz]	Air-bone noise air fan [dB]	Air-bone noise air fan to Silencer
63	99,00	86,63
125	101,00	88,63
250	102,00	88,35
500	102,00	86,38
1000	101,00	84,83
2000	99,00	82,83
4000	96,00	79,53
8000	92,00	75,53

Weighting factors at the individual frequencies dB in dB(A)	
Hz	dB
63	-26,21
125	-16,18
250	-8,67
500	-3,25
1000	0,00
2000	1,20
4000	0,96
8000	-1,15

Sound absorption coefficient Measured values	
Hz	α
63	0,35
125	0,35
250	0,47
500	0,74
1000	0,84
2000	0,84
4000	0,90
8000	0,90

Area container walls 9,6m Contai	133,00	m^3
Area container walls 12m Contai	162,00	m^2
Area container walls 15m Contai	198,00	m^2

Decibel (Loudness) Comparison Chart

Here are some interesting numbers, collected from a variety of sources, that help one to understand the volume levels of various sources and how they can affect our hearing.

Environmental Noise	
Weakest sound heard	0dB
Whisper Quiet Library	30dB
Normal conversation (3-5')	60-70dB
Telephone dial tone	80dB
City Traffic (inside car)	85dB
Train whistle at 500', Truck Traffic	90dB
Subway train at 200'	95dB
Level at which sustained exposure may result in hearing loss	*90 - 95dB*
Power mower at 3'	107dB
Snowmobile, Motorcycle	100dB
Power saw at 3'	110dB
Sandblasting, Loud Rock Concert	115dB
Pain begins	*125dB*
Pneumatic riveter at 4'	125dB
Even short term exposure can cause permanent damage - Loudest recommended exposure WITH hearing protection	*140dB*
Jet engine at 100', Gun Blast	140dB
Death of hearing tissue	180dB
Loudest sound possible	194dB

OSHA Daily Permissible Noise Level Exposure	
Hours per day	Sound level
8	90dB
6	92dB
4	95dB
3	97dB
2	100dB
1.5	102dB
1	105dB
.5	110dB

.25 or less	115dB

Perceptions of Increases in Decibel Level	
Imperceptible Change	1dB
Barely Perceptible Change	3dB
Clearly Noticeable Change	5dB
About Twice as Loud	10dB
About Four Times as Loud	20dB

Sound Levels of Music	
Normal piano practice	60 -70dB
Fortissimo Singer, 3'	70dB
Chamber music, small auditorium	75 - 85dB
Piano Fortissimo	84 - 103dB
Violin	82 - 92dB
Cello	85 -111dB
Oboe	95-112dB
Flute	92 -103dB
Piccolo	90 -106dB
Clarinet	85 - 114dB
French horn	90 - 106dB
Trombone	85 - 114dB
Tympani & bass drum	106dB
Walkman on 5/10	94dB
Symphonic music peak	120 - 137dB
Amplifier rock, 4-6'	120dB
Rock music peak	150dB

NOTES:

- One-third of the total power of a 75-piece orchestra comes from the bass drum.
- High frequency sounds of 2-4,000 Hz are the most damaging. The uppermost octave of the piccolo is 2,048-4,096 Hz.
- Aging causes gradual hearing loss, mostly in the high frequencies.
- Speech reception is not seriously impaired until there is about 30 dB loss; by that time severe damage may have occurred.
- Hypertension and various psychological difficulties can be related to noise exposure.

- The incidence of hearing loss in classical musicians has been estimated at 4-43%, in rock musicians 13-30%.

Statistics for the Decibel (Loudness) Comparison Chart were taken from a study by Marshall Chasin , M.Sc., Aud(C), FAAA, Centre for Human Performance & Health, Ontario, Canada. There were some conflicting readings and, in many cases, authors did not specify at what distance the readings were taken or what the musician was actually playing. In general, when there were several readings, the higher one was chosen.

Noise Sources and Their Effects

Noise Source	Decibel Level	comment
Jet take-off (at 25 meters)	150	Eardrum rupture
Aircraft carrier deck	140	
Military jet aircraft take-off from aircraft carrier with afterburner at 50 ft (130 dB).	130	
Thunderclap, chain saw. Oxygen torch (121 dB).	120	Painful. 32 times as loud as 70 dB.
Steel mill, auto horn at 1 meter. Turbo-fan aircraft at takeoff power at 200 ft (118 dB). Riveting machine (110 dB); live rock music (108 - 114 dB).	110	Average human pain threshold. 16 times as loud as 70 dB.
Jet take-off (at 305 meters), use of outboard motor, power lawn mower, motorcycle, farm tractor, jackhammer, garbage truck. Boeing 707 or DC-8 aircraft at one nautical mile (6080 ft) before landing (106 dB); jet flyover at 1000 feet (103 dB); Bell J-2A helicopter at 100 ft (100 dB).	100	8 times as loud as 70 dB. Serious damage possible in 8 hr exposure
Boeing 737 or DC-9 aircraft at one nautical mile (6080 ft) before landing (97 dB); power mower (96 dB); motorcycle at 25 ft (90 dB). Newspaper press (97 dB).	90	4 times as loud as 70 dB. Likely damage 8 hr exp
Garbage disposal, dishwasher, average factory, freight train (at 15 meters). Car wash at 20 ft (89 dB); propeller plane flyover at 1000 ft (88 dB); diesel truck 40 mph at 50 ft (84 dB); diesel train at 45 mph at 100 ft (83 dB). Food blender (88 dB); milling machine (85 dB); garbage disposal (80 dB).	80	2 times as loud as 70 dB. Possible damage in 8 h exposure.
Passenger car at 65 mph at 25 ft (77 dB); freeway at 50 ft from pavement edge 10 a.m. (76 dB). Living room music (76 dB); radio or TV-audio, vacuum cleaner (70 dB).	70	Arbitrary base of comparison. Upper 70s are annoyingly loud to some people.
Conversation in restaurant, office, background music, Air conditioning unit at 100 ft	60	Half as loud as 70 dB. Fairly quiet

Quiet suburb, conversation at home. Large electrical transformers at 100 ft	50	One-fourth as loud as 70 dB.
Library, bird calls (44 dB); lowest limit of urban ambient sound	40	One-eighth as loud as 70 dB.
Quiet rural area	30	One-sixteenth as loud as 70 dB. Very Quiet
Whisper, rustling leaves	20	
Breathing	10	Barely audible

[modified from **http://www.wenet.net/~hpb/dblevels.html**] on 2/2000. SOURCES: Temple University Department of Civil/Environmental Engineering (www.temple.edu/departments/CETP/environ10.html), and *Federal Agency Review of Selected Airport Noise Analysis Issues*, Federal Interagency Committee on Noise (August 1992). Source of the information is attributed to *Outdoor Noise and the Metropolitan Environment*, M.C. Branch et al., Department of City Planning, City of Los Angeles, 1970.