APPENDIX F
Noise Control Requirements

The following is taken from *Ambient Sound Survey and Noise Impact Evaluation* report prepared by Hoover & Keith Inc (2009). The following measures are requirements of the project to keep the compressor station and temporary compressor station noise levels at less than significant levels.

8.0 NOISE CONTROL REQUIREMENTS – STATION

The following section provides recommended noise control measures and equipment noise specifications along with other assumptions that may affect the noise generated by the facility.

8.1 Compressor Building

Building Structure

- As a minimum, walls/roof should be constructed with exterior steel of 18 gauge and interior layer of 6-inch thick unfaced mineral wool (e.g., 6.0-8.0 pcf uniform density) covered with a 24 gauge perforated liner. Thermal insulation, such as "R-19", should not be used as a substitute for the 6.0-8.0 pcf material.
- Personnel entry doors should have a minimum STC-36 sound rating and could include door glazing if a 2' x 2' maximum view port is employed (e.g., 1/2 inch thick laminated glazing or double pane safety glass). Doors should seal well with the doorframe and be self-closing.
- No windows, skylights or louvers should be installed. No ridge vent shall be permitted. x All voids and openings in the building walls resulting from penetrations should be patched and well sealed.

As a minimum, each roll-up door should be a 22 gauge insulated type design (e.g., 22 gauge exterior with a 24 gauge backskin with insulation core) and should be completely weather stripped.

Building Ventilation

- The building ventilation system should be designed to properly ventilate (and cool) the building and equipment during maximum outside ambient temperatures with all personnel and equipment doors closed. Personnel and/or equipment doors should only be opened during maintenance activities.

The A-wt. sound level for each ventilation inlet should not exceed **50 dBA** at **50 feet** from the building penetration (i.e., inlet louver, acoustic inlet hood, etc.). The A-wt. sound level for each ventilation exhaust outlet should not exceed **50 dBA** at **50 feet** from the building penetration (i.e., exhaust louver, exhaust hood, etc.). Each ventilation inlet and exhaust outlet shall assume that the following sound pressure levels exist inside the compressor building at and adjacent to the ventilation equipment:

SPLs per Octave-Band Center Freq. & A-Wt. Level

31.5	63	125	250	500	1000	2000	4000	8000	dBA
90	98	98	98	100	98	95	95	90	**103**

The ventilation system inlet and exhaust systems shall be designed to control interior building sound paths from the inlet and exhaust flow paths, interior building sound paths across ventilation system components (i.e., ducting break-in noise, etc.,) and sound that is generated by ventilation equipment (i.e., supply fans, exhaust fans, louvers, tempering coils, etc).

8.2 Engine Exhaust Systems

The exhaust system for the proposed compressor engine should provide the following dynamic insertion loss (DIL) values at the rated operating conditions:

DIL Values in dB per Octave-Band Center Freq. for Exhaust System

31.5	63	125	250	500	1000	2000	4000	8000
22	30	38	44	46	46	44	34	27

The following are other items associated with the exhaust system that should be addressed:

- Exhaust piping (including the mixing tube) located between the building and SCR/oxidation catalyst housing should be completely covered with an acoustical lagging consisting of a heavy-gauge steel jacketing (min. 18 gauge) along with a 3-inch thick inner layer of mineral wool or ceramic fiber insulation (6-8 pcf density).

The expansion joint/flanges between the mixing tube and SCR/oxidation catalyst housing should be covered with a with a removable/reusable acoustical blanket material. The blanket material typically consists of a core of 2-inch thick needled fiber mat (6.0-8.0 pcf density) and a liner material of mass-loaded vinyl (1.0-1.25 psf surface weight) that is covered with a coated fiberglass cloth. The inner layer of insulation should be covered with a stainless steel mesh instead of coated fiberglass cloth.

8.3 Engine Air Intake Systems

The most effective and recommended method to silence the engine air intake system is to employ an absorptive-type silencer in-line with the air intake piping (i.e., inside the building) with the air intake filter located outside of the building. The following are the recommended DIL values for the "in-line" air intake silencer:

DIL Values in dB per Octave-Band Center Freq. (in Hz) for In-Line Silencer

31.5	63	125	250	500	1000	2000	4000	8000
3	8	14	24	30	30	30	30	20

An example of an "in-line" silencer that could be employed is a Universal Model SU5 Absorptive Silencer. The air intake filter should meet the following DIL values:

DIL Values in dB per Octave-Band Center Freq. (in Hz) for Air Intake Filter

31.5	63	125	250	500	1000	2000	4000	8000
2	4	8	12	15	20	20	20	15

Note: These DIL values are assumed to be typical for an air intake filter.

8.4 Unitized Engine Jacket Water / Auxiliary Water Coolers

The A-wt. sound level of each jacket-water cooler for the proposed compressor unit should not exceed **65 dBA** at a distance of **50 feet** from the unit perimeter at the rated operating conditions (i.e., all fans and motors in operation), which is equivalent to a sound power level (PWL) of approximately **97-98 dBA**. The cooler supplier should provide the A-wt. sound level and the unweighted octave-band SPLs at **50 feet** from the cooler with all fans/motors operating. Nonetheless, the cooler fan tip speed should not exceed 9,000 fpm with V-Belt drive.

8.5 Unitized Gas Aftercoolers

The A-wt. sound level of each gas aftercooler should not exceed **65 dBA** at a distance of **50 feet** from the unit perimeter at the rated operating conditions (i.e., all fans and motors in operation), which is equivalent to a sound power level (PWL) of approximately **97-98 dBA**. The cooler supplier should provide the A-wt. sound level and the unweighted octave-band SPLs at **50 feet** from the cooler with all fans/motors operating. Nonetheless, the cooler fan tip speed should not exceed 9,000 fpm with V-Belt drive.

8.6 Aboveground Gas Piping

The results of our analysis indicate that the aboveground piping should not need to be acoustically insulated.

8.7 Dehydration System

As a minimum, it is assumed that the dehydration system regeneration gas heater will be designed and specified to meet an A-Wt. sound level of **60 dBA** at **50 feet** from the heater perimeter at the rated maximum operating conditions (includes any noise radiated from the heater stack opening). A "low noise" box-type burner assembly shall be utilized.

8.8 Field Gas Regulators

Pressure reducing valves should be capable of meeting a sound level requirement of **85 dBA** (i.e., typically **3 feet** from piping downstream of valve).

8.9 Miscellaneous Equipment

Gas Blowdown Silencers (i.e., unit piping purge/unit blowdown): These silencers should not exceed **60 dBA** at **300 ft**. (as measured 5 ft. above the ground), and to meet this noise goal, the "effective length" of the silencer section for the unit blowdown silencer would typically be 20 feet.

Starting Air / Starting Gas Vent Silencer: It is recommended that these sound sources are silenced to **50 dBA** at **300 ft**. (as measured 5 ft. above the ground).

Fuel Gas Skids: It is recommended that any fuel gas skids be designed with regulators that can achieve **85 dBA** at **3 ft**. for the worst case design conditions (i.e., anticipated maximum pressure drop and flow across the regulator valve).

Station Standby Generator: It is recommended that any standby generator should not exceed **60 dBA** at **100 ft**. from the auxiliary building at rated operating conditions. This sound

specification includes, but is not limited to, the following noise sources associated with the generator: (1) noise of the engine-generator that penetrates the auxiliary building, (2) noise of the exterior jacket/auxiliary water cooler, (3) noise of the engine exhaust (hospital/critical grade muffler should be employed), and (4) noise of the air intake system. It is further recommend that this potential noise source and noise control measures be further analyzed when additional information is available during the detailed design phase.

9.0 NOISE CONTROL REQUIREMENTS – TEMPORARY RENTAL COMPRESSOR UNIT

The following section provides recommended noise control measures and equipment noise specifications along with other assumptions that may affect the noise generated by the temporary rental compressor unit.

9.1 Partial Enclosure or Partial Barrier

A partial enclosure (i.e., Wildcat Building) may be utilized to reduce the temporary compressor unit noise to the adjacent NSAs. A Wildcat Building generally encloses the entire package and the engine driven cooler air enters through right angle passages and exhausts through the building roof.

Alternatively, a three sided absorptive barrier could possibly be utilized, noting that additional information on the proposed rental unit as well as package orientation is required for a final determination. Although there are several types of barrier materials that could be employed, the barrier system could be constructed of a Type LSE Noise Barrier Wall System, as fabricated/supplied by Sound Fighter Systems. This type of noise barrier could be the most cost effective system and it is designed with a 100% sound-absorbing interior surface (i.e., barrier surface that faces the compressor equipment). In order for the barrier to be effective, it is necessary that it is located in close proximity to the noise producing equipment. The Sound Fighter barrier system also includes options for single and double personnel doors that can be incorporated into the barrier layout as desired. Individual sections of the Sound Fighter barrier system can be removed to facilitate major maintenance if necessary.

As an alternative, the barrier system could be constructed with a 4-inch thick metal panel system designed with a sound-absorptive surface that faces the equipment. For example, the metal panels could be fabricated with a 12 or 14-ga. galvanized steel outer shell and an insulating fill (e.g., 8.0 pcf mineral wool) covered with a 22-ga. perforated galvanized steel interior liner.

9.2 Engine Exhaust System

The exhaust system for the proposed compressor engine should include a muffler system that provides the following dynamic insertion loss (DIL) values at the rated operating conditions:

DIL Values in dB per Octave-Band Center Freq. for Exhaust Muffler System

31.5	63	125	250	500	1000	2000	4000	8000
12	18	22	26	30	30	30	30	22

The exhaust muffler shall include 3 chambers.

9.3 Engine Air Intake System

A standard engine mounted air inlet filter may be utilized.

9.4 Engine Driven Vertical JW/AW/Gas Aftercooler

The A-wt. sound level of each of the engine driven vertical cooler should not exceed **66 dBA** at a distance of **50 feet** from the cooler at the rated operating conditions, which is equivalent to a sound power level (PWL) of approximately **98-99 dBA**. The cooler fan tip speed would not be expected to exceed 9,500 fpm to meet this noise requirement.

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