Appendix K

Noise Technical Report

Hydrogen Energy California Project

Noise Evaluation Study

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EXECUTIVE SUMMARY

A Noise Technical Report was prepared by Alliance Acoustical Consultants (AAC) on the entire Hydrogen Energy California (HECA) Project in Kern County, California. The goals of the study were to investigate the construction and operations noise environment; primarily with respect to off-site community receptors and secondarily, with respect to on-site worker health and safety concerns. The goals of the evaluation were to (a) predict future noise conditions associated with the Project; (b) support the Application for Certification (AFC) documentation to the California Energy Commission (CEC); and (c) contribute to noise control strategies, as needed, for the Fluor design to reduce expected noise-related impacts to being less than significant for the Project development.

Given the relatively long distances to the nearest noise-sensitive receptors, construction noise analysis results indicate that noise from construction activities at the Project Site would not be expected to exceed the Kern County General Plan requirements of 65/45 A-weighted sound pressure level (dBA) day-night average sound level (L_{dn}) (exterior/interior) at any of the nearby receptor locations. Thus, construction noise, although potentially audible at times, would be considered to be a less-than-significant impact.

Using reference data for similar equipment, vendor-supplied noise level information, and/or industry-accepted estimation techniques, the proposed Project equipment noise level emissions were determined. These predicted equipment levels were conservatively modeled to synthesize the expected future noise conditions for the power Project site and surrounding community areas. The modeling results for the plant were compared to the Project criteria to assess potential off-site impacts to community receptors.

The Base Case modeling results indicated problems with meeting some of the Project noise requirements at all sensitive receptor locations. A set of reasonable and effective noise control methods were applied to selected noise sources to arrive at a balanced treatment package for lowering the overall plant noise emissions into the community.

The currently configured Project Site layout should include these recommended noise control design features such that off-site compliance with CEC noise impact criterion and the Kern County Noise Element can be ensured. Please see the accompanying summary table (next page) for the compliant results and the highlights of the assumed treatments.

These features will also help with on-site worker exposure concerns. Some areas within the process and power generation units of the Project, however, will need to be regulated for appropriate worker health and safety regarding prudent noise exposures. This regulation can be accomplished via appropriate administrative controls regarding time spent around the noisiest equipment, as well as promoting the use of qualified hearing protection devices.

The noise control treatments identified in this initial evaluation study should be refined during the course of more detailed engineering, such that the as-built installation maintains the expected overall noise emissions and achieves the desired noise compliance.

Following Project start-up and commissioning, it is recommended that a compliance verification noise level measurement survey be conducted to assess the as-built noise environments, to fine-tune worker exposure parameters (i.e., the allowable time in one or more noisy areas), and to

verify equipment supply commitments. This survey will also satisfy a condition of approval that is routinely part of the CEC's permitting for the AFC process.

Summary of Future Operation Noise Evaluation

Location	Distance from Project Site (feet)		Design Goal, CEC's late-night L_{90} + 5 dB, dBA	Predicted A-weighted Sound Pressure Level (SPL) (dBA)	
	from nearest boundary	from site centroid		Base Case 1, (with comparison to design goal)	Noise Control Case 1, (with comparison to design goal)
Off-site receptors					
LT1	2,762	4,849	40	44 (+4)	37 (-3)
ST1	6,718	9,810	29	35 (+6)	29 (+0)
ST2	9,307	11,441	34	33 (-1)	27 (-7)
ST3	9,464	11,001	38	34 (-4)	29 (-9)
On-site/boundary receptors					
Northwest corner	–	2,810	–	59	54
North	–	1,557	–	60	56
North-northeast corner	–	2,477	–	57	49
East	–	2,809	–	57	47
Southeast corner	–	3,099	–	55	47
South	–	1,539	–	64	58
Southwest corner	–	2,859	–	66	58
West	–	2,493	–	65	59

Notes:
– = not applicable
CEC = California Energy Commission
dB = decibel
dBA = A-weighted sound pressure level
L_{90} = Noise level equaled or exceeded 90 percent of a stated time.

Noise Reduction Measures (far right column) include:

- Putting open-top enclosures on selected non-enclosed compressors
- Putting open-top enclosures on the non-enclosed expanders
- Noise abatement for various noise sources associated with the gasifiers.
- Low-noise procurement or shrouded or blanketed pump trains
- Low-noise procurement or shrouded or blanketed blowers and dust handlers
- Lower-noise cooling tower cells
- Use stack silencer on HRSG exhaust
- Use stack silencer on LMS100® SCR exhaust
- Use inlet silencer on LMS100® air inlet
- Specify low-noise casing on LMS100® SCR body

1.0 INTRODUCTION AND GOALS

Hydrogen Energy International LLC (HEI or Applicant) is jointly owned by BP Alternative Energy North America Inc, and Rio Tinto Hydrogen Energy LLC. . HEI is proposing to build an Integrated Gasification Combined Cycle (IGCC) power generating facility called Hydrogen Energy California (HECA or the "Project") in Kern County, California. The Project will produce electricity while substantially reducing greenhouse gas emissions by capturing carbon dioxide (CO_2) and transporting it for enhanced oil recovery (EOR) and sequestration. .

The 315-acre Project Site is located approximately 6.5 miles west of the outermost edge of the city of Bakersfield and 2 miles northwest of the unincorporated community of Tupman in western Kern County, California, as shown in Figure 2-1, Project Vicinity Map. The Project Site is adjacent to an oil producing area known as the Elk Hills Oil Field Unit.

This Noise Technical Report was initiated as part of Fluor Corporation's Preliminary Engineering Design effort that is supporting the Project's permitting and environmental impact review and assessment. Specifically, the environmental impact documentation will be part of the Application for Certification (AFC) to the California Energy Commission (CEC). This assessment is being coordinated by URS Corporation with technical support from Kimley-Horn and Associates, Inc. Besides being a technical contribution to the URS/Kimley-Horn AFC documentation, this Noise Technical Report is intended to serve as part of Fluor's Basis of Design documentation for the Project.

Alliance Acoustical Consultants (AAC) performed the Noise Technical Report reported herein, drawing on valuable information contained in Project documents generated by Fluor, URS, and Kimley-Horn. This study was undertaken to investigate the construction and operations noise environment; primarily with respect to off-site community receptors and, secondarily, with respect to on-site worker health and safety concerns. The goals of the evaluation were to (a) predict future noise conditions associated with the Project; (b) support the AFC documentation to the CEC; and (c) contribute to noise control strategies, as needed, for the Fluor design to reduce expected noise-related impacts to being less than significant for the Project.

The remainder of this report is organized as follows: Section 2 provides background information on the Project setting. Section 3 explains the pertinent noise descriptors and Section 4 summarizes the existing conditions. Section 5 discusses the applicable noise criteria. Construction-related noise is summarized in Section 6. The Project operations noise analysis and evaluation methods; along with the modeling procedures, inputs, and assumptions, are presented in Sections 7 and 8. Predicted future condition results are provided in Section 9, the noise control features for the Project are highlighted in Section 10, and a summary of the Noise Technical Report is in Section 11. A list of Technical References used for this study follows the main text. The Kern County Noise Element and computer modeling inputs are in the attachments.

2.0 SETTING

The Project Site is in a sparsely populated area of unincorporated west-central Kern County. The general area is shown in Figure 1. The Project is at an approximate latitude of 35°18' North and longitude 119°23' West. Surrounding land uses include Limited Agricultural, Exclusive

Agricultural, and Natural Resources. Noise sensitive receptors are located approximately 2,800 feet to 2.0 miles from the Project Site.

Figure 1
General Location of the HEI Power Project

Source: Yahoo Maps and Alliance Acoustical Consultants, Inc., 2008

In this study, analyses were performed on the entire Project, including the:

- Feedstock Material Handling Systems
- Feedstock Grinding and Slurry Preparation
- Processed Material Handling Systems
- Air Separation Unit (ASU)
- Gasification Unit
- Power Blocks
- Acid Gas Removal (AGR) Unit
- Sulfur Recover Unit (SRU)
- Sour Shift, Mercury Removal, and Sour Water Stripping Systems
- CO_2 Compression Systems
- Tail Gas Treatment Unit
- Plant Cooling
- Water Treatment Plant

- Site Support Systems and Utilities

3.0 NOISE DESCRIPTORS

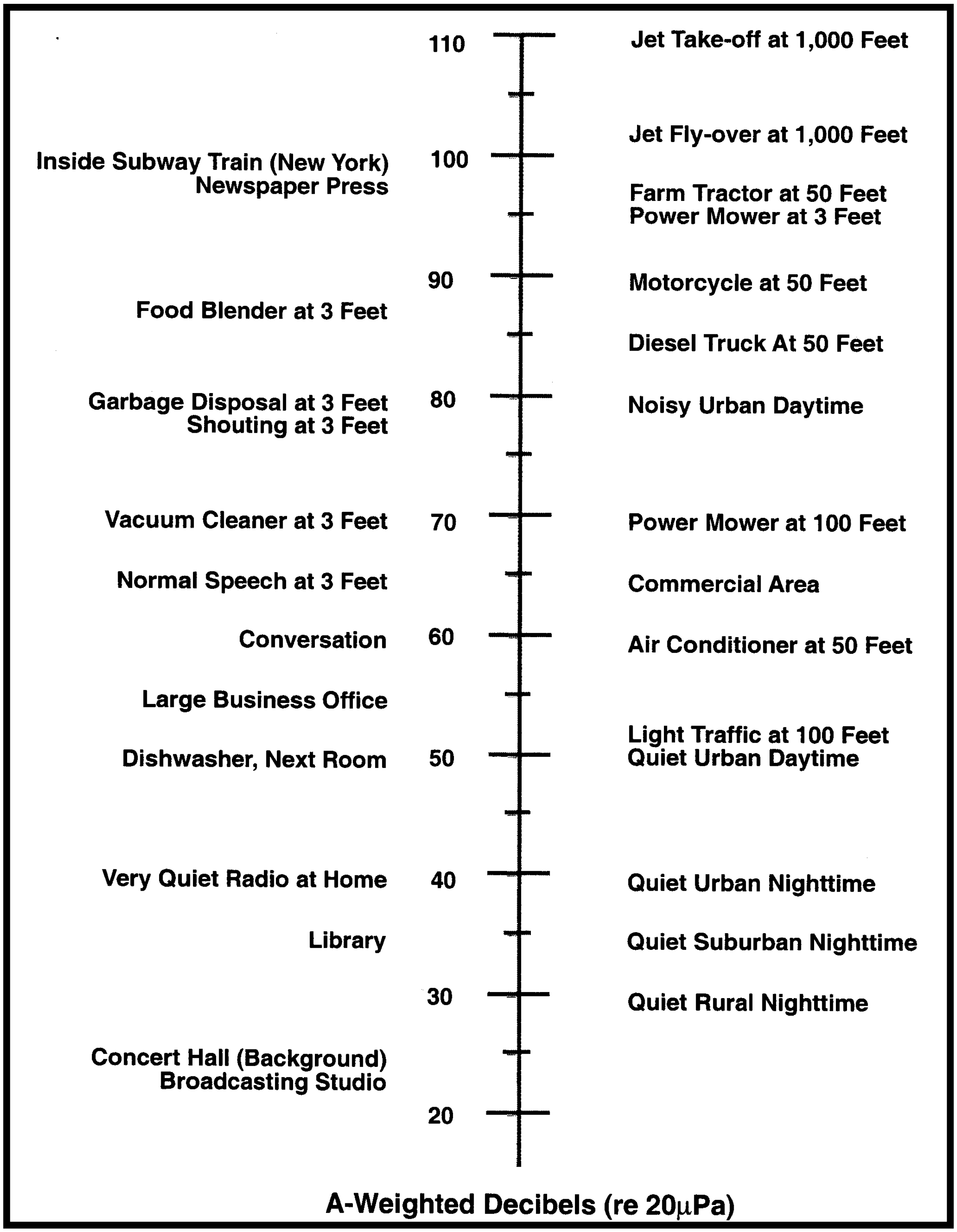
To assess sound levels and noise impacts, several descriptors and metrics are used by the acoustical industry. Noise is usually defined as unwanted sound because it interferes with speech communication and hearing, or is otherwise annoying. Under certain conditions, noise may cause hearing loss, interfere with human activities at home and work, and in various ways, may affect people's health and well-being.

The decibel (dB) is the accepted standard unit for measuring sound levels because it accounts for the large variations in sound pressure amplitude. All noise levels in this study are relative to the industry-standard reference value of 20 micropascals. When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal in a manner corresponding to the way the human ear perceives sound. The A-weighted noise level has been found to correlate well with people's judgments of the “noisiness” of different sounds and has been used for many years as a measure of community and industrial noise (Harris 1998). The A-weighted sound level is denoted as “dBA” or “dB(A).”

Since most people do not routinely work with decibels or A-weighted sound levels, it is often difficult to appreciate what a given sound pressure level (SPL) number means. To help relate noise level values to common experience, Figure 2 illustrates typical A-weighted sound pressure levels for various everyday indoor and outdoor noise sources.

In addition to the frequency characteristics, the human response to noise levels varies with the sound’s distribution in time. When sound is measured for distinct time intervals, the statistical distribution of the overall sound level can be obtained for that period. The energy-equivalent sound level (denoted L_{eq}) is the most common parameter associated with such measurements. The L_{eq} metric is a single-number noise descriptor that represents the energy-average sound level over a given time period, where the actual sound level varies with time.

Figure 2
Typical A-weighted Sound Levels for Various Noise Sources



Although the A-weighted scale and the energy-equivalent metric are commonly used to quantify the range of human response to individual events or general community sound levels, the degree of annoyance or other response effects also depends on several other perceptibility factors, including:

- Ambient (background) sound level
- General nature of the existing conditions (quiet, rural vs. busy, urban settings)
- Difference between the magnitude of the sound event level and the ambient
- Duration of the sound event
- Seasonality (e.g., likelihood of being indoors/outdoors and/or having windows open/closed)
- Number of event occurrences and their repetitiveness
- Time-of-day that the event occurs

Other temporal noise metrics include statistical sound levels, denoted L_n, where 'n' is the percent of time during the sample period that the noise value is exceeded; for example, outdoor noise criteria often deal with the L_{50} and L_{10} levels[1].

L_{max} and L_{min} are also common noise descriptors. These are the maximum and minimum noise levels, respectively, over a given time period. With respect to the statistical sound level notation, L_{max} and L_{min} can also be represented as L_0 (i.e., the level never exceeded during the sample) and L_{100} (the level always exceeded), respectively.

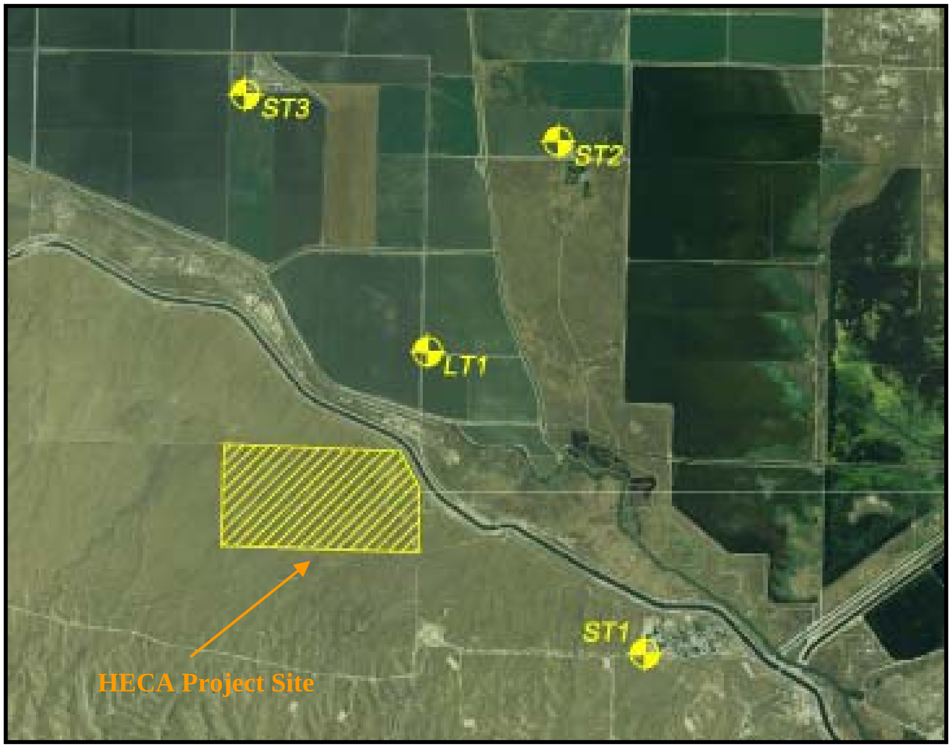
Lastly, the day-night sound level (L_{dn}) is most commonly used to relate noise exposure over a 24-hour period. The L_{dn} noise metric provides a 24-hour average of A-weighted noise levels at a particular location, with a nighttime adjustment, which reflects increased sensitivity to noise during these times of the day. Specifically, L_{dn} adds a 10 dB penalty for any sounds occurring between the hours of 10:00 p.m. to 7:00 a.m. In California, a modification of the L_{dn} metric is often used. This additional 24-hour metric is known as the Community Noise Equivalent Level (CNEL) and is aimed at evaluating noise levels in residential communities. The CNEL is similar to the L_{dn}, but differs in that a 5 dB evening penalty is also applied to sounds that occur between 7 p.m. and 10 p.m. In a large percentage of cases for general community noise, the L_{dn} and CNEL are within 1 dB of each other and can be considered as equivalent.

4.0 EXISTING CONDITIONS (FROM KIMLEY-HORN)

Kimley-Horn conducted an ambient noise monitoring survey on 4 and 5 March 2008 to measure and document the existing noise environments in areas around the Project Site. A total of four noise-sensitive receptors were identified that may be exposed to sound level increases as a result of the Project. These receptors and the associated noise measurement locations are shown in Figure 3 and are summarized below (source: Kimley-Horn):

[1] The L_{50} level is the statistical indicator of the time-varying noise signal that is exceeded 50% of the time (during each sampling period); that is, half of the sampling time, the changing noise levels are above this value and half of the time, they are below it. This is called the "median sound level." The L_{10} level, likewise, is the value that is exceeded 10% of the time (i.e., near the maximum) and this is often known as the "intrusive sound level."

Figure 3
Pertinent Community Receptor Locations



Source: Kimley-Horn, 2008

LT1: This location is north-northeast of the site; approximately 0.5 mile from the nearest Project boundary. There is one single-family home located nearby the measurement location, which was in the front yard of the residence at 1004 Tupman Road. The primary noise source for LT1 was traffic on Tupman Road. Agricultural equipment was also documented operating periodically throughout the measurement period.

ST1: This location is approximately 1.3 miles from the SE corner of the site. The Elk Hills Elementary School buildings are located near the measurement location, which was in an open area on school grounds at 501 Kern Street. The primary noise source for ST1 was traffic on Tupman Road and Kern Street. Other sources included children at the school playground during the daytime and animal noise during the nighttime hours.

ST2: There are two single-family homes on the south side of Station Road at 8229 Station Road and 6122 Tule Park Road located near the measurement location, which is approximately 1.8 miles from the northeast corner of the site. Station Road was documented as the primary noise source for these residences. An irrigation pump was noted as operating during the daytime hours.

ST3: This location is north of the site; approximately 1.8 miles from the northwest corner of the site. There are two single-family homes located near the measurement location. The measurement was conducted in an open area at 7345 Adohr Road. The primary noise source for ST3 was traffic on Adohr Road. Agricultural equipment was also documented operating periodically.

Other sources relevant to each of the measurement locations included activities at residences and aircraft over-flights. Overall, these site are very quite during the evening and nighttime hours with typical late-night L_{90} levels in the range of 25 to 36 dBA.

5.0 NOISE CRITERIA

Loud noise can be annoying and it can have negative health effects (USEPA 1978). The effects of noise on people fall into three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, learning
- Physiological effects such as startling and hearing loss (both temporary and permanent)

In most cases, environmental noise produces effects in the first two categories only. However, unprotected workers in some industrial work settings may experience noise effects in the last category.

Federal and local governments have established noise guidelines and regulations for protecting citizens from potential noise-related impacts; hearing damage; and from various other adverse physiological, psychological, and social effects associated with noise. These pertinent guidelines and regulations are discussed below.

5.1 Federal Criteria

U.S. Environmental Protection Agency (USEPA). Guidelines are available from the USEPA (1978) to assist state and local government entities in development of state and local laws, ordinances, regulations, and standards (LORS) for noise. Because there are local standards that have been adopted and that apply to this Project (see below), these USEPA guidelines are for informational purposes only.

Occupational Safety & Health Administration (OSHA). In the U.S., worker noise exposure limits are regulated by OSHA under the Occupational Safety and Health Act of 1970[2]. The noise exposure level of workers is limited to 90 dBA, over a time-weighted average (TWA) 8-hour work shift to protect hearing[3]. If there are workers exposed to a $TWA_{8\text{-hr}}$ above 85 dBA (i.e., the OSHA Action Level), then the regulations call for a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage prevention. A summary table of pertinent limits and parameters follows.

[2] OSHA noise regulations are established in Code of Federal Regulation (CFR) Title 29, Part 1910-G, Section 1910-95, “Occupational Noise Exposure”.

[3] In practice, workers are routinely exposed to varying noise levels for their 8-hour shift. So, to compute the entire shift’s time-weighted-average (higher level means shorter duration and vice versa), the other key component of worker noise exposure – the exchange rate – comes into play. The exchange rate is simply the decibel trade-off factor for exposure duration. Under OSHA regulations, the exchange rate is 5 dB. Thus, for every 5 dB increase in sound level, the allowable exposure duration is halved (i.e., 90 dB(A) for 8 hours, 95 dB(A) for 4 hours, 100 dB(A) for 2 hours, etc.).

Table 1
Summary of Pertinent Worker Noise Exposure Parameters

Maximum Permitted Daily Duration, hours (for 100 percent dose)	OSHA Limits (90 dBA criterion and 5 dB exchange rate)
8	90
4	95
2	100
1	105
½	110
¼	115

Notes:
OSHA = Occupational Safety & Health Administration
dB = decibel
dBA = A-weighted sound pressure level

Given previous experience at similar chemical processing, air separation, and combined-cycle power facilities, on-site noise levels during normal operations are expected to be generally in the range of 70 to 85 dBA. The relatively few areas that may be above 85 dBA will be posted as high noise level areas and hearing protection will be required therein. The power Project will implement a hearing conservation program for applicable employees and maintain $TWA_{8\text{-hr}}$ exposure levels below 90 dBA.

5.2 California Criteria

State of California. The California Environmental Quality Act (CEQA) requires that significant environmental impacts be identified and that such impacts be eliminated or mitigated to the extent feasible. Section XI of Appendix G of CEQA Guidelines (California Code Regulations, Title 14, Appendix G) sets forth some characteristics that may signify a potentially significant impact. Specifically, a significant effect from noise may exist if a project would result in:

1. Exposure of persons to, or generation of, noise levels in excess of standards established in the local General Plan or noise ordinance, or applicable standards of other agencies.
2. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
3. Substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
4. Substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

California Energy Commission (CEC). For power plants in California over 50 MW (nominal production capacity), the CEC is the lead agency for implementation of the above CEQA standards. The Commission has determined that a potential for a significant noise impact (point 3 above) exists where the noise of the project plus the background exceeds the background by 5 dB or more at the nearest sensitive receptor, including those receptors that are considered a minority population. Staff considers it reasonable to assume that an increase in background noise levels up to 5 dB in a residential setting is insignificant and that an increase of more than

10 dB is clearly significant (Baker 1999, 2007). For the intermediate situation, an increase between 5 and 10 dB should be considered adverse, but may be either significant or insignificant, depending on the particular circumstances of a case. Factors to be considered in determining the significance of an adverse impact include:

- Resulting noise level
- Duration and frequency of the noise
- Number of people affected
- Land use designation of the affected receptor sites
- Public concern or controversy (as demonstrated at workshops or hearings or by correspondence)

For noise from construction activities, the CEC usually considers a project to be in CEQA compliance if:

- Construction activity is temporary
- Use of heavy equipment and noisy activities is limited to daytime hours
- All industry-standard noise abatement measures are implemented for noise producing equipment

Cal/OSHA. The California Department of Industrial Relations, Division of Occupational Safety and Health, enforces California Occupational Safety and Health Administration (Cal/OSHA) regulations (found in Title 8 of the California Code of Regulations [CCR], General Industrial Safety Orders, Article 105, Control of Noise Exposure, § 5095, *et seq*.]. These California worker protection regulations are the same as the federal OSHA regulations described above.

California Vehicle Code. Noise limits for highway vehicles are regulated under the California Vehicle Code, § 23130 and § 23130.5. The limits are enforceable on the highways by the California Highway Patrol and by the County Sheriff Department.

5.3 Local Criteria

The California State Planning Law (California Government Code § 65302(f)) requires that all cities, counties, and entities (such as multi-city port authorities) prepare and adopt a General Plan to guide community change. In the case of the Project, the pertinent entity is the County of Kern.

Kern County. The County of Kern adopted their current General Plan, including the Noise Element, in June of 2004. In the introduction for the Noise Element of the Kern County General Plan, Section 3.1, states:

> *"The major purpose of the Noise Element is to: (1) establish reasonable standards for maximum desired noise levels in Kern County, and; (2) develop an implementation program which could effectively deal with the noise problem."…."Of primary importance in controlling noise in Kern County is protection of the public health, particularly insuring against hearing loss resulting from community noise. Next in importance is minimization of adverse effects of noise on the economic well-being of the community, and third,*

minimization of annoyance caused by noise. Good land use planning should be employed to insure that the quality of the noise environment in Kern County does not deteriorate, and whenever practical be improved."

Section 3.2 establishes the following general goals for noise in the county:

> *"Ensure that residents of Kern County are protected from excessive noise and that moderate levels of noise are maintained."*
>
> *"Protect the economic base of Kern County by preventing the encroachment of incompatible land uses near known noise producing roadways, industries, railroads, airports, oil and gas extraction, and other sources."*

To implement these two goals, Section 3.2 later states:

> *"Implementation Measures…*
>
> *F) Require proposed commercial and industrial uses or operations to be designed or arranged so that they will not subject residential or other noise sensitive land uses*[4] *to exterior noise levels in excess of 65 dB LDN and interior noise levels in excess of 45 dB LDN."*

The entire Kern County Noise Element is provided in Attachment A.

Because of the weighting and averaging nature of the L_{dn} metric, a constant noise source would produce an L_{dn} approximately 6 dB higher than its 24-hour L_{eq}. Therefore, constant, 24-hour noise sources producing exterior noise levels up to 59 dBA L_{eq} would yield an L_{dn} value of 65 dBA and are, thus, compatible with residential land uses.

In reviewing the Kern County Ordinance Code (including Section 8.36 "Noise Control"), there are no specific noise limits for stationary or temporary construction noise sources which are applicable to this Project.

5.4 Summary of Noise Design Goals and Criteria

Generally, the design basis for noise control is the minimum, or most stringent, noise level required by any of the applicable LORS. As previously discussed, the Kern County exterior L_{dn} limit is 65 dBA, which is functionally equivalent to a 24-hour, constant-source L_{eq} of 59 dBA. With the very low nighttime ambient L_{90} levels (in the range of 25 to 36 dBA), the CEC criterion for 24-hour operations are much more stringent than the County Code. Therefore, noise from this Project is evaluated against the CEC limit, where the Project noise level is considered insignificant if it does not exceed the ambient background noise level by 5 dB or more at the pertinent noise-sensitive receptors as shown on Table 2, Summary of Noise Design Goals.

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[4] The Noise Element defines sensitive land uses as: residential areas, schools, convalescent and acute care hospitals, parks and recreational areas, and churches.

Table 2
Summary of Noise Design Goals

Location	Ambient Background Noise Level, L_{90}, dBA (per Kimley-Horn survey)	Project Design Noise Levels Needed for CEC Compliance (dBA)*
LT1	36	40
ST1	25	29
ST2	30	34
ST3	34	38

Notes:
* Since the Project, under normal operations, would be a constant aggregated noise source, its noise emission metrics would be the same, i.e., L_{min}=L_{90}=L_{eq}=L_{10}=L_{max}.
CEC = California Energy Commission
dBA = A-weighted sound pressure level

6.0 CONSTRUCTION-RELATED NOISE

6.1 Main Facility Construction

The Project construction process will be expected to generate noise during the following phases:

- Site Preparation
- Excavation
- Foundation Placement
- Plant and Building Construction
- Exterior Finish and Cleanup

Equipment utilized during the construction process will differ from phase to phase. In general, heavy equipment (bulldozers, dump trucks, and concrete mixers) will be used during excavation and concrete pouring activities. Most other phases involve the delivery and erection of the building components. The installation of piles (driven, augered, or vibrated) for some foundations may be needed on the Project, but insufficient information is available at this stage of Project development to ascertain if and what type of piling may be employed.

Noise levels of construction equipment typically utilized for this type of project are presented in Table 3, Individual Equipment Noise Levels Generated by Project Construction. It is important to note that the equipment presented herein is not used in every phase of construction. Further, equipment used is not generally operated continuously, nor is the equipment necessarily operated simultaneously.

Table 3
Individual Equipment Noise Levels Generated by Project Construction

Equipment Type	Equipment Noise Level at 50 feet, dBA	Estimated Equipment Noise Level at Each Receptor Location[a], dBA			
		Receptor LT1 (2,760 feet [0.5 mi] NNE of Project) *Atten[b]=35 dB*	Receptor ST1 (6,720 feet [1.3 mi] SE of Project) *Atten[b]=43 dB*	Receptor ST2 (9,300 feet [1.75 mi] NE of Project) *Atten[b]=45 dB*	Receptor ST3 (9,460 feet [1.8 mi] N of Project) *Atten[b]=46 dB*
Trucks	88	53	45	43	42
Crane	83	48	40	38	37
Roller	74	39	31	29	28
Bulldozers	85	50	42	40	39
Pickup Trucks	60	25	17	15	14
Backhoes	80	45	37	35	34
Jack Hammers	88	53	45	43	42
Pile Drivers	101	66	58	56	55
Rock Drills	98	63	55	53	52
Pneumatic Tools	85	50	42	40	39
Air Compressor	81	46	38	36	35
Compactor	82	47	39	37	36
Grader	85	50	42	40	39
Loader	85	50	42	40	39

Sources: EPA, 1971; FTA, 2006; and Alliance Acoustical Consultants, Inc., 2008
Notes:
a. Distances shown are from the nearest site boundary line to each receptor location. This analysis assumes that an example piece of any given type of construction equipment could be, as a worst case, at or near any site boundary line during the various Project construction phases.
b. This is the attenuation due to distance for sound propagating from 50' from each equipment type to the nearest indicated receptor location.
dB = decibel
dBA = A-weighted sound pressure level
mi = mile
N = north
NE = northeast
NNE = north-northeast
SE = southeast

Site-average sound levels for each phase of construction (from EPA 1971, FTA 2006, and AAC 2008) are presented in Table 4, Aggregate Estimated Noise Levels Generated by Phase for the Project Construction Activities. This analysis takes into account the expected number of construction equipment items, their nominal usage factors, and the average sound emissions factor for each. The highest site-average sound levels (89 to 91 dBA) are associated with Foundation and Site Clearing phases of the construction schedule[5].

[5] Excluding consideration for pile installation which is indeterminant at this time.

Table 4
Aggregate Estimated Noise Levels Generated by Phase for the Project Construction Activities

Equipment Type	Equipment Noise Level at 50 feet (dBA)	Estimated Equipment Noise Level at Each Receptor Location[a] Leq/Ldn[b] (dBA)			
		Receptor LT1 (4,850 feet [0.9 mi] NNE of Project) *Atten[c]=40 dB*	Receptor ST1 (9,810 feet [1.9 mi] SE of Project) *Atten[c]=46 dB*	Receptor ST2 (11,440 feet [2.2 mi] NE of Project) *Atten[c]=47 dB*	Receptor ST3 (11,000 feet [2.1 mi] N of Project) *Atten[c]=47 dB*
Site Clearing	91	51/57	45/51	44/50	44/50
Excavation	83	43/49	37/43	36/42	36/42
Foundation	89	49/55	43/49	42/48	42/48
Pile Installation[d]	101	61/67	55/61	54/60	54/60
Building Construction	80	40/49	34/40	33/39	33/39
Finishing	60	20/26	14/20	13/19	13/19

Sources: EPA, 1971; FTA, 2006; and Alliance Acoustical Consultants, Inc., 2008

Notes:

a. Distances shown are from the Project construction activity centroid to each receptor location. This analysis, which differs slightly from the equipment analysis, assumes that the aggregation of construction equipment for each phase would be, on average, at the centroid of the Project Site during the overall construction schedule.

b. An Ldn calculation was made by adding 6 dB to the receptor Leq value under the worst-case premise of 24-hour construction at a constant level of activity. See also Section 2.10 for further information on Project Construction .

c. This is the attenuation due to distance for sound propagating from 50' from each phase's equipment aggregation to the nearest indicated receptor location. Note that this analysis only considers spherical spreading loss and no other attenuation effects.

d. Pile installation is a sub-set of the Foundation Phase and would only be expected to last two to four months within the overall Foundation Construction Phase.

dB = decibel
dBA = A-weighted sound pressure level
mi = mile
N = north
NE = northeast
NNE = north-northeast
SE = southeast

The noise levels presented in Tables 3 and 4 use the equipment-specific and phase-aggregate sound levels, respectively, at 50 feet from the construction activity to predict the noise levels at the nearest noise sensitive receptor locations that surround the Project Site. Noise associated with the construction of the Project will be attenuated by a variety of mechanisms. The most significant of these is the diversion of the sound waves with distance (attenuation by divergence). In general, this mechanism results in a 6 dB decrease in the sound level with every doubling of distance from the source. For example, the 84 dBA average sound level associated with site clearing (Table 4) will be attenuated to 78 dBA at 100 feet, 72 dBA at 200 feet, and to 66 dBA at 400 feet. Attenuation for atmospheric absorption or ground effects were not included in the construction noise analysis to allow for a conservative worst-case analysis. The small number of noise-sensitive receptors in the vicinity of the Project are located approximately 2,800 feet to 2.0 miles from the nearest areas of future construction activity.

Because of the nature of construction noise and with common fluctuations in the background noise level, construction activity would be occasionally discernable at the nearest receptors. Given some occasional atmospheric conditions, construction noise could also be discernable at the receptors located farther from the Project Site because of inversion effects. Under certain circumstances, the construction noise could be a source of annoyance to noise-sensitive individuals. However, under the premises discussed in Section 5.2, these results would adhere to the less-than-significant criterion of the CEC.

Nighttime construction activities are not planned for this Project, but may be needed to meet the construction schedule. However, if nighttime construction is needed, the Project will limit noisy construction activities to daytime hours in order to minimize nighttime noise levels to the extent practical. Thus, noise from construction activities at the Project Site would not be expected to exceed the Kern County General Plan requirements of 65/45 dBA L_{dn} (exterior/interior) at any of the nearby receptor locations and construction noise would be also considered to be a less-than-significant impact per the Kern County Noise Element.

6.2 Linear Facility Construction

Construction for Project-related linear facilities (i.e., the water and natural gas supply pipelines) will be located farther away from noise-sensitive receptors as compared to the Project Site construction operation. Linear facility construction noise may be audible during the short periods that the linear construction operation is nearest to these receptors. Because of the short-term nature of the linear construction operation, pipeline construction noise will be less than significant and will diminish once the pipeline construction operations move away from the individual receptors.

6.3 Special Construction Activities

During final construction, a method used to clean piping and testing called "steam blows" creates substantial noise. A steam blow results when high-pressure steam is allowed to escape into the atmosphere through the steam piping to clean the piping. A series of short steam blows, lasting 2 or 3 minutes each, would be performed several times daily over a period of 2 or 3 weeks. Steam blows are necessary after erection and assembly of several piping and tubing systems to forcibly blow out accumulated dirt, rust, scale, and construction debris. The construction steam blows prevent this unwanted material and debris from entering the downstream process equipment.

Steam blows can produce noise as loud as 130 dBA at a distance of 100 feet. The resultant sound level at the nearby receptors would range from 86 to 103 dBA. Table 5, Estimated Worst-case Steam Blow Noise Levels, summarizes the potential, worst-case noise levels at each receptor location. To minimize these short-term, temporary noise impacts, the exhaust piping would be equipped with silencers that would reduce noise levels by 20 dBA to 30 dBA at each receptor location.

Table 5
Estimated Worst-case Steam Blow Noise Levels

Receptor	Estimated Distance to Future Project Steam Blow	Potential Steam Blow Noise Level (dBA)	Reduced Steam Blow Noise Level (dBA)
LT1	4,850 feet [0.9 mi]	96	66 to 76
ST1	9,810 feet [1.9 mi]	90	60 to 70
ST2	11,440 feet [2.2 mi]	89	59 to 69
ST3	11,000 feet [2.1 mi]	89	59 to 69

Sources: Kimley-Horn, 2008 and Alliance Acoustical Consultants, Inc, 2008
Notes:
a. Distances shown are from the Project centroid to each receptor location.
b. This is the attenuation due to distance for sound propagating from 100' from a given steam blow to the nearest indicated receptor location.
dBA = A-weighted sound pressure level
mi = mile

In general, steam blow events will be short-term, intermittent, and temporary and are, therefore, not considered to result in significant impacts.

6.4 Post-Commissioning Maturation Phase Noise

As described in AFC Section 2.6.4. Commissioning, the major process units will be commissioned sequentially. For this Project, the power block will be commissioned about 6 months ahead of the gasification block. The commissioning for the project will require four distinct phases: (1) Combined Cycle Unit Commissioning on Natural gas; (2) Commissioning of the auxiliary Simple Cycle CTG on NG; (3) Gasification Block and Balance of Plant (BOP) Commissioning Combined Cycle Block; and (4) Commissioning on Hydrogen-Rich Fuel. The steps involved in the commissioning of these four phases are given in AFC Sections 2.6.4.1 to 2.6.4.4.

As described in AFC Section 2.10 Facility Reliability, the startup and commissioning period of the power plant (CTG, ASU, process block and BOP, IGCC) is expected to be completed within one year from mechanical completion. Commercial operation will start when the commissioning and startup activities are completed and the licensor/contractor guarantees and milestones have been achieved. The ramp-up period to maturity is estimated to be 3 years from the start of commercial operation. The hydrogen-rich fuel availability for mature operation is estimated to be greater than 80 percent. The power availability for mature operation is estimated to be greater than 90 percent.

While considerable data exists on commissioning periods on power generation involving natural gas, and mature operation is reached within a few months for NGCC type systems, the power generation involving hydrogen-rich fuel from solid feedstock such as petroleum coke or coal requires a longer ramping duration due to the shakedown periods involved in the various technologies employed in the process block; in particular, the solid feedstock gasification. For this reason, the process block will have an availability much less than 80 percent during the first

3 years.

After the one-year initial Startup and basic Commissioning Phase, there will be multiple gasifier starts per year. These will occur over the lifespan of the Project, and therefore, can be considered as part of the ‘normal’ operations of the Project, from a noise standpoint. Consequently, these gasifier (and related systems) startup noise sources will need noise control treatments such that their contribution to the overall plant noise profile is no greater than the contributions from the plant equipment and systems that are operating between gasifier starts. That is, steam or gas discharges, by-pass valves, eductor systems, atmospheric vents, increased flaring rates, and the like that will be utilized beyond the initial startup efforts will have noise reduction features (such as casing treatments, lagging, and discharge silencers) to keep the Project’s aggregate sound energy at or below the level needed to comply with the Project noise goals.

With this general noise control philosophy for the Project equipment and systems (as detailed in Table 10), the aggregate noise emissions into the adjacent community should be comparable between the post-Commissioning Maturation Phase and the ‘normal’ Operations Phase, discussed below.

6.5 Summary of Construction, Startup, and Commissioning Noise

Short-term noise levels during construction activities will not be significant due to the following factors:

- The distance separating the residential areas from the site will result in substantial attenuation of construction noise. As shown in Tables 3 and 4, construction sound levels will often be below measured ambient levels (even while neglecting excess ground attenuation effects).
- The construction equipment will not normally be operating simultaneously.
- During construction activities, there will be periods of time when no equipment will be operating, and when noise will be near or below ambient levels.
- To reduce construction noise to the greatest extent possible and practical, functional mufflers will be maintained on construction equipment.

The sound levels presented in Tables 3, 4, and 5 are those which will be experienced by people outdoors. A building provides significant attenuation for those who are indoors. Sound levels can be expected to be up to 27 dBA lower indoors, with windows closed. Even in homes with the windows open, indoor sound levels can be reduced by up to 17 dBA (EPA 1978).

7.0 PROJECT NOISE ANALYSIS AND EVALUATION METHODS

To evaluate the additional sound sources from the proposed power generation equipment, a proprietary computerized noise prediction program was used to simulate and model the equipment noise emissions throughout the area. The modeling program uses industry-accepted propagation algorithms based on American National Standards Institute (ANSI) and International

Organization for Standards (ISO)[6]. The calculations account for classical sound wave divergence (spherical spreading loss with adjustments for source directivity from point sources) plus attenuation factors due to air absorption, appropriate ground effects, and barrier/shielding[7].

Calculations were performed using octave band sound power levels (abbreviated PWL or L_w) as inputs from each noise source. The computer outputs are in terms of octave band and overall A-weighted noise levels (sound pressure levels, abbreviated SPL or L_p) at discrete receptor positions or at grid map nodes (in preparation for computing a contour map). The output listing is ranked by relative noise contribution from each noise source. This model has been validated over the years via noise measurements at several operating plants that had been previously modeled during the engineering design phases. The comparison of modeled predictions versus actual measurements has consistently shown close agreement.

The Project Site plan and process area drawings were used to establish the position of the noise sources and other relevant physical characteristics of the site. Receptor locations were found using Project environmental documentation provided by URS, Kimley-Horn, and Fluor. With this information[8], the source locations and receptor locations were translated into input x, y, z coordinates for the noise modeling program.

8.0 PROJECT OPERATIONS MODELING PROCEDURES, INPUTS, AND ASSUMPTIONS

For conservatism, and as is standard practice in the description of environmental noise, the modeling assumed stable atmospheric conditions suitable for reproducible measurements (under “standard-day” conditions of 59 degrees Fahrenheit (°F) and 70 percent relative humidity), that are favorable for propagation. These inherent conservative factors and assumptions result in a noise model that will tend to be biased to higher predicted values than would be expected in the actual environment around the Project.

All currently planned, continuous-operation equipment items that were deemed to be significant noise sources at the Project were included in the noise model. The major process areas of the Project include the Air Separation Unit (ASU), the Feed Handling Unit, the Gasification Island, the Gas Treating Unit, the Sulfur Recovery and Tail Gas Treatment Unit, the Power Block, and General Facilities (such as cooling, utilities, and auxiliary/support systems). Within these overall units, the set of modeled sources included:

- Power Block Cooling Towers and Air Separation Unit (ASU) Cooling Towers
- Main Power Block – “F class,” combined-cycle, outdoor installation
  (Gas Turbine + Steam Turbine + Heat Recovery Steam Generator [HRSG])

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[6] Algorithms and methods for this program are included in the ISO 9613, ISO 1913 (Part 1), ANSI 126, or ISO 3891 standards.

[7] Given the rural, agricultural setting, a reasonable factor for long-range propagation over acoustically soft surfaces was used in the far-field calculations (after Harris, 1998).

[8] Drawings used: URS/Kimley-Horn aerial drawing, May, 2008; Fluor drawing SK-250-0002, "Preliminary Emission Sources Plot Plan”, rev. 0 (received March 21, 2008) and rev. 1 (received May 29, 2008).

- Secondary Power Block – "LMS100® class," simple-cycle, outdoor installation (Gas Turbine + Selective Catalytic Converter)
- GTG and Steam Turbine Generator (STG) Main Transformers, plus several facility auxiliary transformers
- Cooling Tower Main Water Pumps and Motors
- Boiler Feed Water Pumps and Motors
- ASU systems[9] (primarily an outdoor installation)
- ASU vents
- Material Handling Systems, including crushers, conveyors, and transfer towers
- Flares and process vents
- Syngas and Tail Gas Compressors and Blowers
- Acid Gas and Tail Gas Burners
- Various sources in the Gasification Areas
- Slurry Feed systems, as radiated from Slurry Feed building walls
- Grinding Mill systems, as radiated from Mill building walls
- Various significant pump systems (over 25 hp each)

The power Project was assumed to operate 24 hours per day at its design capacity, which means its noise output will be constant, regardless of time-of-day (and, thus, the statistical sound levels will all be the same – that is, $L_{100}=L_{90}=L_{50}=L_{10}=L_{0}=L_{eq}$). Given the early stages of the Project, only limited vendor data is available for use as noise model inputs. Therefore, every effort was made to use noise emission values that were obtained from equipment vendors on previous design efforts for similar IGCC plant configurations. As secondary information sources, model inputs derived from generic industry reference information and estimation techniques were used (such as Miller 1978; Beranek 1988, 1992; and Elliot 1989).

No special noise control options were initially assumed. These "standard-design" levels from the significant noise sources were converted into sound power levels (in decibels re 1 pico Watt) to serve as the initial inputs for the noise modeling program. Major buildings and structures were included as barriers to account for propagation losses due to shielding between a given noise source and a receptor location. However, for conservatism, low-lying buildings/structures (such as power distribution centers or compressor enclosures) were neglected for providing shielding benefits. Any temporary feedstock piles were also neglected for shielding benefits.

These initially-assumed (nominal) sound emissions values, given in Attachment B, were modeled to calculate the expected noise levels at the established four off-site receptor locations. The modeled off-site receptor locations were the same as the ambient measurement locations used by Kimley-Horn (see Section 4 and Figure 3).

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[9] Major equipment inside for the ASU would include ~70,000 hp main air compressor, ~15,000 hp booster air compressor, ~38,000 hp N_2 compressor, and related support pumps, valves, and other systems.

9.0 FUTURE CONDITIONS MODELING RESULTS

9.1 Nominal Base Case Results

The noise model was run for a nominal, Base Case Project configuration; that is, assuming the "typical" noise emissions for the proposed types and sizes of industrial process equipment. The dominant noise sources for the Base Case configuration (at the closest, off-site receptor, LT1) included HRSG and selective catalytic reduction (SCR) exhaust stack exits, ASU-related compressor packages, feedstock material handling buildings with major equipment inside (Grinding/Milling buildings, Slurry Feed building, and Transfer Towers), Sulfur Recovery Unit (SRU) burners, the Power Block and ASU cooling towers, and several large water-handling pumps. The results of the Base Case modeling were compared to the Kern County Noise Element Standards and the CEC's impact criterion; as discussed below.

9.1.1 Base Case Results Compared to Kern County Standards

For the Base Case scenario, all locations were well within the Kern County exterior and interior L_{dn} standards (<65 and <45 L_{dn}, respectively). This is due to the large propagation distances from the Project Site to the remote receptor locations which yielded Project-only exterior contributions to the L_{dn} environment of between 39 and 50 dBA. When combined with the measured or estimated existing L_{dn} contributions, the total, future L_{dn} is predicted to be no higher than 61 dBA (driven by the existing conditions, not the power Project).

For the Kern County interior standards of <45 L_{dn}, a similar calculation was performed with a nominal industry value for sound reduction between the exterior environment and the interior setting. Assuming a nominal exterior-to-interior reduction factor of 17 dB, even with windows open (EPA 1978), the Project-only interior contributions to the L_{dn} environment would be between 22 and 33 dBA. When combined with the estimated existing interior environments, the total, future interior L_{dn} is predicted to be typically around 30 dBA and no higher than 44 dBA (note: this value is controlled by the existing conditions and not from the Project contributions). The results at all four receptor locations are below the 45 L_{dn} Kern County limit. The predicted Project noise contributions are summarized with respect to the Kern County Noise Element standards in Tables 6a (exterior) and 6b (interior).

Table 6a
Summary of Project Base Case Noise Contributions Relative to Kern County Noise Element Standards (Exterior)

Location [column 1]	Kern County Noise Element EXTERIOR Standards, L_{dn} [column 2]	Existing EXTERIOR L_{dn} Environment [column 3]	Predicted Project L_{eq} Contributions, Base Case 1, SPL dBA [column 4]	Predicted Project L_{dn} Contributions, Base Case 1 [column 5][a]	Total, future calculated L_{dn} (existing plus Proj.) [column 6][b]	Compliance?[c] [column 7]
LT1	65	61[d]	44	50	61[f]	Yes
ST1	65	41[e]	35	41	44	Yes
ST2	65	47[e]	33	39	48	Yes
ST3	65	46[e]	34	40	47	Yes

Notes:

a. Using 24 hourly L_{eq} values to calculate the equivalent L_{dn} metric, assuming continuous operations at steady-state, design conditions.

b. Summing sound levels from column 3 plus column 5.

c. That is, is column 6 less than column 2?

d. Calculated L_{dn}.

e. Estimated L_{dn} from short-term data from Kimley-Horn.

f. Result is completely controlled by existing noise environment.

dBA = A-weighted sound pressure level

L_{dn} = day-night average sound level

L_{eq} = energy-equivalent sound level

SPL = Sound Pressure Level

Table 6b
Summary of Project Base Case Noise Contributions Relative to Kern County Noise Element Standards (Interior)

Location [column 1]	Kern County Noise Element INTERIOR Standards, L_{dn} [column 2]	Existing INTERIOR L_{dn} Environment[a] [column 3]	Predicted Project EXT. L_{dn} Contributions, Base Case 1 [column 4][b]	Predicted Project INT. L_{dn} Contributions, Base Case 1 [column 5][c]	Total, future calculated L_{dn} (existing plus Proj.) [column 6][d]	Compliance?[e] [column 7]
LT1	45	44	50	33	44[f]	Yes
ST1	45	24	41	24	28	Yes
ST2	45	30	39	22	31	Yes
ST3	45	29	40	23	30	Yes

Notes:

a. Applying -17 dB to results from Table 6a above.

b. Using results of column 5 from Table 6a above.

c. Applying -17 dB to column 4.

d. Summing sound levels from column 3 plus column 5.

e. That is, is column 6 less than column 2?

f. Result is completely controlled by existing noise environment.

dB = decibel

dBA = A-weighted sound pressure level

L_{dn} = day-night average sound level

9.1.2 Base Case Results Compared to CEC Standards

For the two closest community receptors (Locations LT1 and ST1), the aggregate noise emissions (without any assumed noise control treatments) from the complete power project were above the indicated CEC late-night L_{90} standards for the Base Case. This was primarily due to the very low ambient noise conditions at these receptor locations. The farthest community receptors (Locations ST2 and ST3) met the CEC standards for the Base Case scenario.

The largest nighttime overage (+6 dB) was shown to be at Location ST1 since it has the lowest late-night L_{90} value, from which the CEC criterion level is established. Location LT1, the closest receptor to the site, was predicted to be +4 dB relative to the CEC standard. The other two receptor locations were predicted to have Base Case noise contributions that would be under the CEC's L_{90} + 5 dB criterion, since they are both on the order of 11,000 feet (over 2 miles) from the Project centroid.

These Base Case results, shown for the analyzed receptors, are summarized in Table 7.

Table 7
Summary of Project Base Case Noise Contributions Relative to CEC Noise Impact Criteria Guidelines

Location	Distance from Project Site (feet)		Design Goal[a], Project contributions to meet CEC's late-night standard (dBA)	Predicted Project A-weighted Sound Pressure Level contributions, Base Case 1 (dBA)	Comparison to Design Goal
	From nearest boundary	From site centroid			
Off-site receptors					
LT1	2,762	4,849	40	44	4 dB over
ST1	6,718	9,810	29	35	6 dB over
ST2	9,307	11,441	34	33	1 dB under
ST3	9,464	11,001	38	34	4 dB under
On-site/boundary receptors					
Northwest corner	–	2,810	–	59	Not applicable
North	–	1,557	–	60	Not applicable
North-northeast corner	–	2,477	–	57	Not applicable
East	–	2,809	–	57	Not applicable
Southeast corner	–	3,099	–	55	Not applicable
South	–	1,539	–	64	Not applicable
Southwest corner	–	2,859	–	66	Not applicable
West	–	2,493	–	65	Not applicable

Notes:
a. From Section 5.4 (Table 2).
– = not applicable
CEC = California Energy Commission
dB = decibel
dBA = A-weighted sound pressure level

9.2 Noise Control Case 1 Results

Since nighttime exceedances are predicted at one or more receptor locations per the CEC guidelines, noise control measures are indicated to ensure complying with this criterion during ongoing power Project operations. Note that the Base Case Project design already met the Kern County Noise Element limits, so treatment measures were evaluated with respect to meeting the CEC standard, which is the more stringent standard in this case.

To address the plant-controlled noise exceedances, the ranked listing of noise contributors was studied to evaluate which set of equipment should have noise control options applied for an efficient mix of noise reduction treatments. Then, an iterative process of reducing the highest contributors, via the effective application of noise control treatments was performed. This took the form of making reasonable adjustments to the input noise levels to account for such treatments as installing silencers on inlets/ exhausts or using low-noise equipment. This process was continued to achieve an efficient, cost-effective, and reasonably-achievable[10] mix of noise course characteristics that will result in predicted compliance at all receptor locations.

This mixture of treatments included the specification of known low-noise designs for some equipment items, using available noise control technologies (such as stack silencers), and applying external treatments such as enclosures or noise control panels on selected building walls. This mix of noise reduction measures focused on the following generalized treatments:

- Putting open-top enclosures on selected non-enclosed compressors
- Putting an open-top enclosure on the (non-enclosed) expander
- Noise abatement for various noise sources associated with the gasifiers.
- Low-noise procurement or shrouded or blanketed pump trains
- Low-noise procurement or shrouded or blanketed blowers and dust handlers
- Lower-noise cooling tower cells
- Use stack silencer on HRSG exhaust
- Use stack silencer on LMS100® SCR exhaust
- Use inlet silencer on LMS100® air inlet
- Specify low-noise casing on LMS100® SCR body
- Use silencers on selected gas and steam vents to atmosphere

The results of the Noise Control Case 1 modeling were compared to the Kern County Noise Element Standards and the CEC's impact criterion, as discussed below.

[10] Assessment of achievability was based on reduction experience efforts on similar industrial projects.

9.2.1 Noise Control Case 1 Results Compared to Kern County Standards

As noted above, the Project is predicted to comply with the Kern County standards for the Base Case scenario, so reduction measures are not needed for these criteria. The Noise Control Case 1 modeling results, however, are presented relative to the Kern County Noise Element for information and completeness, as follows in Tables 8a and 8b.

Table 8a
Summary of Project Noise Control Case 1 Noise Contributions Relative to Kern County Noise Element Standards (Exterior)

Location [column 1]	Kern County Noise Element EXTERIOR Standards, L_{dn} [column 2]	Existing EXTERIOR L_{dn} Environment [column 3]	Predicted Project L_{eq} Contributions, N.C. Case 1, SPL dBA [column 4]	Predicted Project L_{dn} Contributions, N.C. Case 1 [column 5][a]	Total, future calculated L_{dn} (existing plus Proj.) [column 6][b]	Compliance?[c] [column 7]
LT1	65	61[d]	37	43	61[f]	Yes
ST1	65	41[e]	29	35	42	Yes
ST2	65	47[e]	27	33	47[f]	Yes
ST3	65	46[e]	29	35	46[f]	Yes

Notes:

a. Using 24 hourly Leq values to calculate the equivalent Ldn metric, assuming continuous operations at steady-state, design conditions.
b. Summing sound levels from column 3 plus column 5.
c. That is, is column 6 less than column 2?
d. Calculated Ldn.
e. Estimated Ldn from short-term data from Kimley-Horn.
f. Result is completely controlled by existing noise environment.

dBA = A-weighted sound pressure level
L_{dn} = day-night average sound level
L_{eq} = energy-equivalent sound level
N.C. = Noise Control
SPL = Sound Pressure Level

Table 8b
Summary of Project Noise Control Case 1 Noise Contributions
Relative to Kern County Noise Element Standards
(Interior)

Location [column 1]	Kern County Noise Element INTERIOR Standards, L_{dn} [column 2]	Existing INTERIOR L_{dn} Environ-ment[a] [column 3]	Predicted Project EXT. L_{dn} Contributions, N.C. Case 1 [column 4][b]	Predicted Project INT. L_{dn} Contributions, N.C. Case 1 [column 5][c]	Total, future calculated L_{dn} (existing plus Proj.) [column 6][d]	Compliance?[e] [column 7]
LT1	45	44	43	26	44[f]	Yes
ST1	45	24	35	18	25	Yes
ST2	45	30	33	16	30[f]	Yes
ST3	45	29	35	18	29[f]	Yes

Notes:
a. Applying -17 dB to results from Table 8a above.
b. Using results of column 5 from Table 8a above.
c. Applying -17 dB to column 4.
d. Summing sound levels from column 3 plus column 5.
e. That is, is column 6 less than column 2?
f. Result is completely controlled by existing noise environment.

dBA = A-weighted sound pressure level
L_{dn} = day-night average sound level
N.C. = Noise Control

9.2.2 Noise Control Case 1 Results Compared to CEC Standards

With receptor Location ST1 as the critical location for achieving compliance with CEC standards (i.e., having the highest value over its associated design goal), the iterative process of reducing the highest contributors focused on a 6 dB reduction at ST1. Similar reductions were also predicted for the other community receptor locations as shown in Table 9 for Noise Control Case 1.

Table 9
Summary of Project Noise Control Case 1 Noise Contributions Relative to CEC Noise Impact Criteria Guidelines

Location	Distance from Project Site (feet)		Design Goal[a], Project contributions to meet CEC's late-night standard (dBA)	Predicted Project A-weighted Sound Pressure Level contributions, Noise Control Case 1 (dBA)	Comparison to Design Goal
	From nearest boundary	From site centroid			
Off-site receptors					
LT1	2,762	4,849	40	37	3 dB under
ST1	6,718	9,810	29	29	at goal
ST2	9,307	11,441	34	27	7 dB under
ST3	9,464	11,001	38	29	9 dB under
On-site/boundary receptors					
Northwest corner	–	2,810	–	54	Not applicable
North	–	1,557	–	56	Not applicable
North-northeast corner	–	2,477	–	50	Not applicable
East	–	2,809	–	50	Not applicable
Southeast corner	–	3,099	–	48	Not applicable
South	–	1,539	–	58	Not applicable
Southwest corner	–	2,859	–	58	Not applicable
West	–	2,493	–	59	Not applicable

Notes:
a. From Section 5.4, Table 2.
– = not applicable
CEC = California Energy Commission
dB = decibel
dBA = A-weighted sound pressure level

With the selected design features for controlling Project noise emissions, all pertinent receptor locations are predicted to be at or below the design goal needed to achieve compliance with the CEC nighttime standard.

After the results for the discrete receptor locations were predicted, the same modeling process was used to calculate power plant noise levels at regularly-spaced grid points. From these grid results, a noise level contour map was generated for the Noise Control Case 1 scenario. This contour map is a plot of constant, A-weighted sound levels in 5 dB increments for just the plant noise sources and is shown in Figures 4 and 5.

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Figure 4
Noise Level Contour Map for Noise Control Case 1

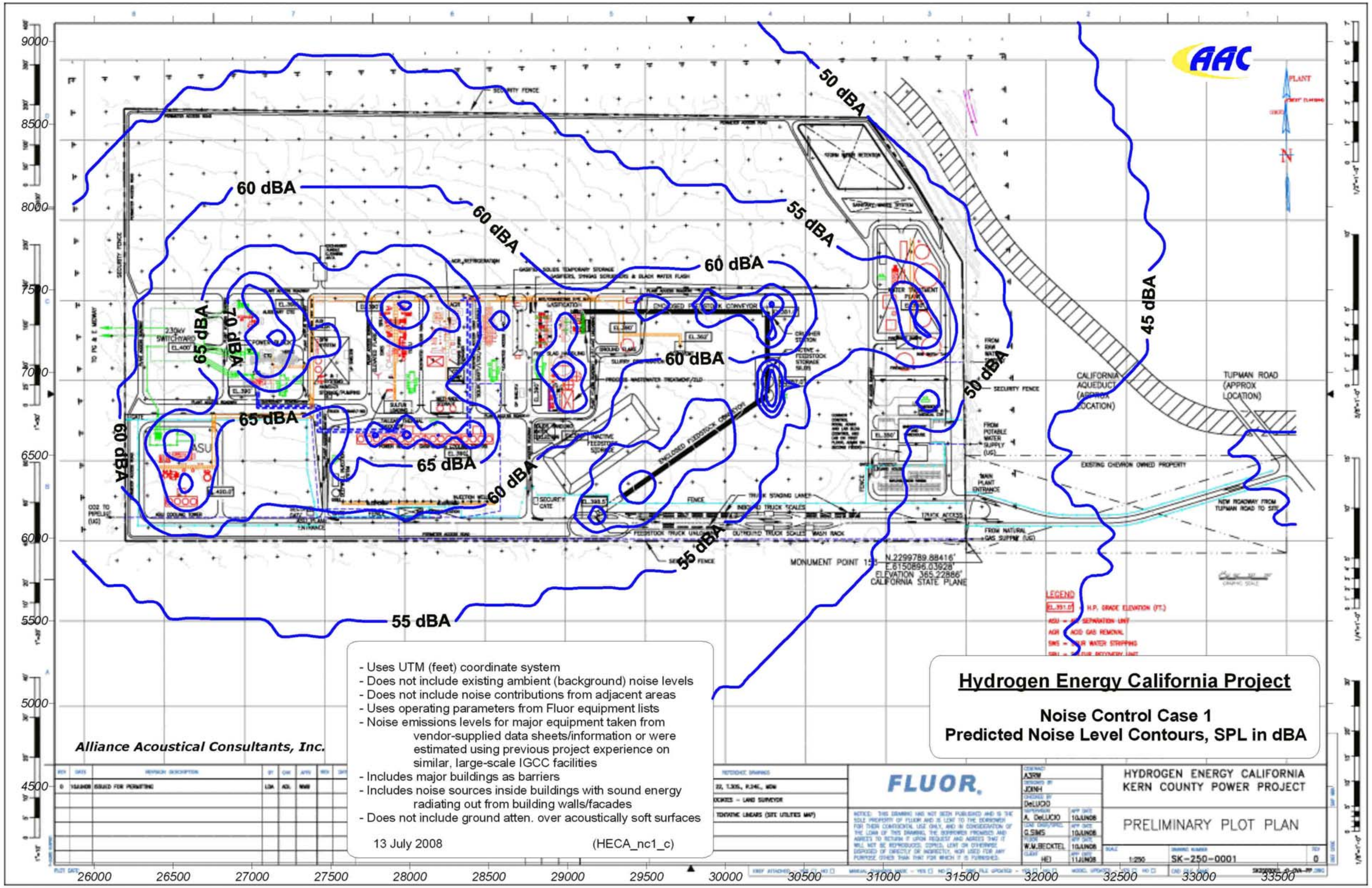

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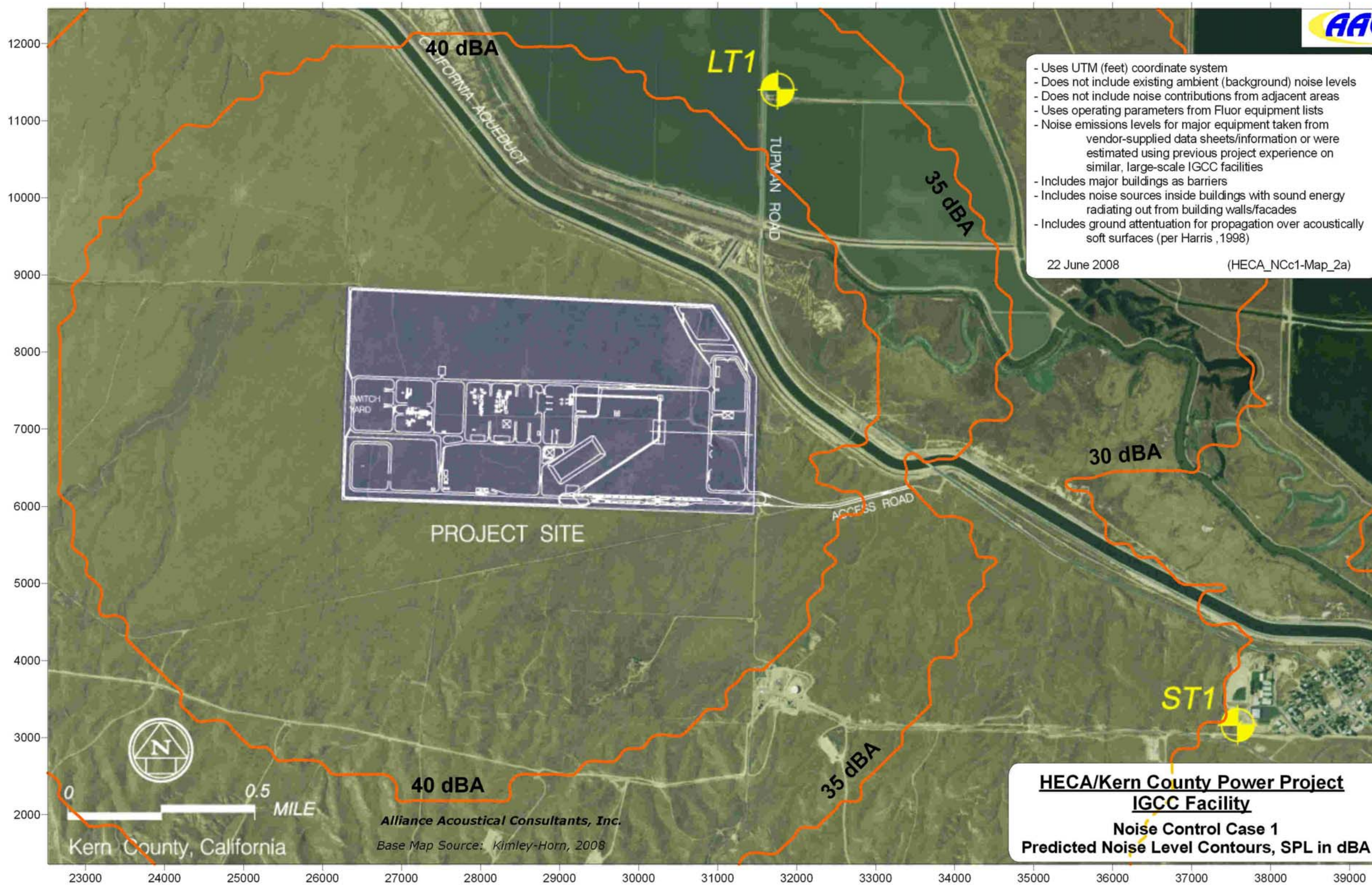
Figure 5
Noise Level Contour Map for Noise Control Case 1



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10.0 NOISE CONTROL DESIGN FEATURES

The effective noise reduction treatments that were used in the compliant plant design model are a combination of vendor specification limits, acoustical designs in specific systems, and/or external treatments on selected equipment items or systems. The originally assumed noise emissions values and the subsequent noise reduction features are summarized in Table 10.

Table 10
Summary of Noise Control Project Design Features

Noise Source (Original Noise Emissions Rating)	Conceptual Noise Control Feature(s)
Power Block Cooling Tower [13 cell] (64 dBA at 400 feet from tower edge)	Reduced 4 dB to 60 dBA at 400 feet from tower edge. Tower vendors can use a combination of slower-speed fans with special blade design, low-noise drive systems, splash control features, and/or tower baffling materials.
ASU Area Cooling Tower	Reduced on a per-cell basis to be consistent with above reduction.
Main Power Island: F-class Gas Turbine, Steam Turbine, and HRSG	None indicated at this time, but adjustments may be needed during the detailed engineering design phase.
HRSG Stack Exit (alone) (60 dBA at 400 feet)	Reduced 10 dB to 50 dBA at 400 feet from stack base. Power Island vendor should use a stack silencer (either before or after the up-turn bend) to reduce HRSG stack noise.
Main Power Block Transformers (46 dBA at 400 feet or 59 dBA at 100 feet)	None indicated at this time.
Secondary Power Island: LMS100®-class Gas Turbine	Include additional 6 dB of silencing on air inlet (relative to nominal reduction for this class of turbine).
Secondary Power Island: Simple-cycle SCR and exhaust	(a). Include stack silencer for 10 dB reduction. (b). Specify SCR body design to achieve 10 dB reduction.
Secondary Power Block Transformers	Specify low-noise package (i.e., -10 dB relative to nominal noise emissions for this size transformer).
Selected Pump Trains (pump+motor) [for trains <100hp, PWLA should be <83; for trains between 150 and 750 hp, PWLA should be <91; and for trains >750hp, PWLA should be <96]	Reduced nominal noise emissions (shown inside [brackets] and relative to standard offerings) for each size pump train (motor plus pump). Can be accomplished via noise limit specification to equipment vendor (for a quiet design). Alternatives include the installation of an acoustical enclosure around the pump and drive mechanics or blanketing around the main rotating equipment.
Miscellaneous Rotating Equipment Trains (e.g., blowers, dust collectors, agitators, etc.) [investigate such sources > 83 PWLA for noise control]	Reduced 10 dB relative to nominal noise emissions for each size train (motor plus driven equipment item). Can be accomplished via noise limit specification to equipment vendor (for a quiet design). Alternatives include the installation of an acoustical enclosure around the item and drive mechanics or blanketing around the main rotating equipment.

Table 10
Summary of Noise Control Project Design Features

Noise Source (Original Noise Emissions Rating)	Conceptual Noise Control Feature(s)
Material Handling Structures (including Truck Dumping Area, Transfer Towers, Feedstock Silo Building, Slurry Prep Building, Slag Handling Building, and Crushing/Milling Buildings)	Reduced noise emissions (relative to nominal designs) for sheet metal building with several openings such that they are ≤65 dBA at 50 feet from any building façade (to be verified during detailed design phase). Assumes acoustical panel specifications for building walls in the detailed design such that interior space noise levels are adequately absorbed and encased within the building shell to meet the assumed emissions levels.
Conveyors	None indicated at this time (assuming enclosed systems and provided vendors can supply noise-limited equipment such that they are ≤61 dBA at 50 feet).
Open Compressors and Expanders	Some Compressor Trains have 4-sided, open-topped enclosures in the current design. Remaining Compressor and Expander Trains above 500 hp or above 86 PWLA should be investigated for noise control such that they achieve noise reduction features for a nominal 15 dB reduction (relative to nominal designs).
Sulfur Recovery Unit Burners	Specify low-noise burners to equipment vendors or use noise control enclosures/plenums around burner systems.
Gasifiers	Specify low-noise fuel deliver systems (slurry injectors or fuel gas aspirators) or use noise control enclosures/plenums such that noise emissions are reduced to below 90 PWLA.
Ground Flare (mainly used for Gasifier startup)	None indicated at this time (provided vendors can supply equipment meeting Petrochem industry standards). (Assumes normal operations will be pilot flame only.)
Elevated Acid Gas Flare (mainly used for minimum heat rate disposal of acid gas; no startup flow)	None indicated at this time (provided vendors can supply equipment meeting Petrochem industry standards). (Assumes normal operations will be pilot flame only.)
Thermal Oxidizer (mainly used for Tail Gas Treating Tank vent discharges)	None indicated at this time (provided vendors can supply equipment meeting Petrochem industry standards). (Assumes normal operations will be 'low' flow; negligibly different than pilot flame only.)
Other Pump Sets (various)	Noise limit specification to equipment vendor; no more than 85 dBA at 3 feet.
Other Mechanical Equipment not specified above (various)	Noise limit specification to equipment vendor; no more than 85 dBA at 3 feet.
Other Electrical Equipment not specified above (various)	Noise limit specification to equipment vendor; no more than 85 dBA at 3 feet.
Building HVAC units and fans (various)	Noise limit specification to equipment vendor; no more than 85 dBA at 3 feet.

Notes:
ASU = Air Separation Unit
dB = decibel
dBA = A-weighted sound pressure level
hp = horsepower
HRSG = Heat Recovery Steam Generator
HVAC = heating, ventilation, and air conditioning

SCR = selective catalytic reduction

The above tabled noise control features are incorporated into the modeling results shown in Figures 4 and 5. All the noise control measures mentioned above for items or systems are seen to be technically feasible at this time.

These measures and features will be updated, refined, and confirmed during detailed design efforts to ensure both Project compliance and fit-for-purpose cost control. The Project is currently planning to use BP Group Engineering Technical Practices as part of the detailed design phase. The pertinent Practices include GP 14-01, "Guidance on Practice for Noise Control", and GP 14-011, "Guidance on Industry Standard for Noise Control". In the latter document, the per-item limit for noise emissions is 80 dBA at 1 m (3 feet); for use as the standard for equipment selection and procurement. Note that this level is 5 dB lower than is commonly used for large-scale industrial design efforts.

With this limit as a starting point and with the identified specifics noted in Table 10 above, the noise control design of the Project should provide a compliant environment at the pertinent off-site receptor locations. Further, this noise control strategy, coupled with a high degree of plant automation, should also achieve an acceptable work setting for on-site Project personnel with respect to occupational safety and health regulations for worker noise exposure[11].

Following the engineering and construction phases, the noise control design should be tested via a compliance verification field survey to measure the as-built Project noise emissions along the boundary and at selected off-site receptor locations.

11.0 CONCLUSION

The investigations and analyses indicate several key points and conclusions:

- The existing noise environment around the Project is a quiet, rural setting with sparsely-spaced residential uses. As such, significant increases in noise levels would be a considerable change to the acoustic environment of the area. Thus, the most restrictive noise design goals are using the CEC late-night increase of 5 dB above the existing L_{90} noise level standard. For these remote residential receptors, compliance with the Kern County Noise Element limits (exterior L_{dn} of 65 dBA and interior L_{dn} of 45 dBA) is easily achieved if the (more restrictive) CEC standards are met. The determining receptor location in meeting the CEC standard was ST1 and this location was used as the conservative design criterion for this Noise Technical Report.
- All currently planned, continuous-operation equipment items that were deemed to be significant noise sources at the Project Site were included in the noise model.
- A conservative methodology was used for modeling the future conditions from the power plant noise sources, including all material handling, process, and power generation equipment operating at full capacity at all times of the day and night.

[11] Per Title 8, California Code of Regulations, § 5095-5100 (Article 105) for Cal-OSHA and Title 29, Code of Federal Regulations, Part 1910 for U.S. OSHA.

- A standard design with nominal equipment configurations is calculated to be too noisy for compliance with CEC's nighttime standard. However, a reasonable and practical set of noise control features is shown to reduce the overall Project aggregate noise emissions such that compliance is predicted at the pertinent sensitive receptors during both the daytime and nighttime.

To ensure noise compliance, both to the letter and to the spirit of the CEC and Kern County noise standards, the currently planned, prudent amounts of equipment noise controls should be refined during the course of more detailed engineering, such that the as-built installation maintains the expected noise emissions and achieves the desired noise compliance.

A compliance verification noise level measurement survey is recommended following power plant startup and commissioning to assess the as-built noise environments, to fine-tune worker exposure parameters (i.e., the allowable time in one or more noisy areas), and to verify equipment supply commitments. This will also satisfy a condition of approval that is routinely part of CEC's permitting for the AFC process.

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Attachment A

Kern County General Plan

Originally Adopted, June 15, 2004

Noise Element

Chapter 3

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Noise Element

Chapter 3

3. NOISE ELEMENT

3.1 INTRODUCTION

The Noise Element is a mandatory element of the General Plan (California Government Code Section 65302 (f)). The State, recognizing the effects of noise upon people's health and well being, required that local jurisdictions prepare statements of policy indicating their intentions regarding noise and noise sources, establish desired maximum noise levels according to land use categories, set standards for noise emission from transportation facilities and fixed-point sources, and prepare a program for implementation of noise control measures. Noise Elements are prepared in accordance with Guidelines for the Preparation and Content of Noise Elements of the General Plan published by the California Office of Noise Control in 1976. Those Guidelines are found in Appendix A of the General Plan Guidelines prepared by the State Office of Planning and Research (OPR).

The major purpose of the Noise Element is to: (1) establish reasonable standards for maximum desired noise levels in Kern County, and; (2) develop an implementation program which could effectively deal with the noise problem.

Considerable research has been done to determine the effects of various sound pressure levels on human health and on the successful performance of various human activities. It is known that noises of 120 dB(A) and higher will cause ear pain in most people; much lower levels may have permanent adverse effects on hearing.

The federal standards for industrial safety regulate the amount of time workers may be exposed to sound levels above 90 dB(A). This level was selected on the assumption that inability to hear at frequencies above 2,000 Hz is unimportant to speech communication. Tests show, however, that hearing loss of this extent will have an adverse effect on hearing low-level conversation and on hearing ordinary speech in the presence of background noise levels which commonly occur in everyday listening conditions.

It is desirable to control ambient noise level to reduce the adverse effects of noise. Ambient noise is the all-encompassing noise associated with a given environment; it usually is a composite of sounds from many sources, near and far.

The U.S. Environmental Protection Agency and the California Department of Health have suggested standards for ambient noise. These suggestions have been utilized in developing noise standards in Kern County.

Of primary importance in controlling noise in Kern County is protection of the public health, particularly insuring against hearing loss resulting from community noise. Next in importance is minimization of adverse effects of noise on the economic well-being of the community, and third, minimization of annoyance caused by noise.

Good land use planning should be employed to insure that the quality of the noise environment in Kern County does not deteriorate, and whenever practical be improved. Where noise sensitive uses are proposed, appropriate noise control measures shall be required as a condition of approval for discretionary projects. Measures to control the quality of the noise environment could include architectural design to reduce noise impact, acoustical insulation of exterior walls and construction of sound barriers.

The following major noise sources were considered in the preparation of the Noise Element:

- Highways and freeways
- Primary arterial and major local streets
- Railroad operations
- Aircraft and airport operations
- Local industrial facilities
- Other stationary sources

Railroad noise, although louder than highway noise, generally affects smaller areas. Railroad yards and rail alignments adjacent to residential areas should have noise barriers. Acoustical noise barriers could reduce existing rail noise up to 20 dB (A).

Little can be done to control airport noise. Through Federal standards more rigid noise controls are being required on aircraft. By adjusting the times of arrival and departure, flight patterns, and the time of day that high noise levels occur, noise levels from airports can be made more tolerable.

Noise contours have been prepared for all airports in the County, major railroad and highways within urban areas. Airport noise contours should be used to determine where noise insulation might be required and are located in the Airport Land Use Compatibility Plan (ALUCP). Any new airport or airport extension will be required to provide estimates of noise impact in conjunction with the required Master Plan updates to the ALUCP. The highway noise contours are contained in Appendix G. Noise contours for Interstate 5; State Route 14, 33, 43, 58, 99, 119, 155, 166, 178, 184, 202, 204, 223, and 395 are shown in Appendix G. Noise contours for the AT & SF Railroad, Southern Pacific Railroad, and Sunset Railroad are shown in Appendix G. The highway and railroad contours are not intended to provide distinct boundaries between noise levels, but as approximations of noise levels that can serve as the basis for further studies. As these studies are completed, noise treatment may be needed to compensate for higher noise levels.

Definitions

1. Community Noise Equivalent Level (CNEL) — A measure of the cumulative noise exposure in the community, with greater weights applied to evening and nighttime periods. For CNEL calculations, day is defined as 7 a.m. to 7 p.m., and this period has a weighting factor of one; evening is 7 p.m. to 10 p.m. and has a weighting factor of three; and night is from 10 p.m. to

7 a.m. and has a weighting factor of ten. Noises occurring at night are given a substantially heavier weight, since for most people, this is the time when noise is most disturbing.

2. Day Night Average Sound Level, L_{dn} — The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period. Noise contours developed using CNEL and Ldn procedures will normally agree within one dB(A), which is an insignificant difference. The Ldn is a computational simplification of the CNEL.

3.2 NOISE SENSITIVE AREAS

The following noise sensitive land uses have been identified in the County:

- Residential areas
- Schools
- Convalescent and acute care hospitals
- Parks and recreational areas
- Churches

Goals

1) Ensure that residents of Kern County are protected from excessive noise and that moderate levels of noise are maintained.
2) Protect the economic base of Kern County by preventing the encroachment of incompatible land uses near known noise producing roadways, industries, railroads, airports, oil and gas extraction, and other sources.

Policies

1) Review discretionary industrial, commercial, or other noise-generating land use projects for compatibility with nearby noise-sensitive land uses.
2) Require noise level criteria applied to all categories of land uses to be consistent with the recommendations of the California Division of Occupational Safety and Health (DOSH).
3) Encourage vegetation and landscaping along roadways and adjacent to other noise sources in order to increase absorption of noise.
4) Utilize good land use planning principles to reduce conflicts related to noise emissions.
5) Prohibit new noise-sensitive land uses in noise-impacted areas unless effective mitigation measures are incorporated into the project design. Such mitigation shall be designed to reduce noise to the following levels:
    a) 65 dB $L_{\mathbf{dn}}$ or less in outdoor activity areas;
    b) 45 dB $L_{\mathbf{dn}}$ or less within interior living spaces or other noise sensitive interior spaces.
6) Ensure that new development in the vicinity of airports will be compatible with existing and projected airport noise levels as set forth in the ALUCP.

7) Employ the best available methods of noise control.
8) Enforce the State Noise Insulation Standards (California Administrative Code, Title 24) and Chapter 35 of the Uniform Building Code concerning the construction of new multiple-occupancy dwellings such as hotels, apartments, and condominiums.

Implementation Measures

The following are programs to be carried out by the Kern County to implement the goals and policies of the Noise Element.

A) Utilize zoning regulations to assist in achieving noise-compatible land use patterns.

B) Require proper acoustical treatment of transportation facilities, including highways, airports, and railroads.

C) Review discretionary development plans, programs, and proposals, including those initiated by both the public and private sectors, to ascertain and ensure their conformance to the policies outlined in this element.

D) Review discretionary development plans for proposed residential or other noise sensitive land uses in noise-impacted areas to ensure their conformance with the noise standards of 65 dB L_dn or less in outdoor activity areas and 45 dB L_dn or less within interior living spaces.

E) Review discretionary development plans to ensure compatibility with adopted Airport Land Use Compatibility Plans.

F) Require proposed commercial and industrial uses or operations to be designed or arranged so that they will not subject residential or other noise sensitive land uses to exterior noise levels in excess of 65 dB L_dn and interior noise levels in excess of 45 dB Ldn.

G) At the time of any discretionary approval, such as a request for a General Plan Amendment, zone change or subdivision, the developer may be required to submit an acoustical report indicating the means by which the developer proposes to comply with the noise standards. The acoustical report shall:

   a) Be the responsibility of the applicant.

   b) Be prepared by a qualified acoustical consultant experienced in the fields of environmental noise assessment and architectural acoustics.

   c) Be subject to the review and approval of the Kern County Planning Department and the Environmental Health Services Department. All recommendations therein shall be complied with prior to final approval of the project.

H) Encourage cooperation between the County and the incorporated cities within the County to control noise.

I) Noise analyses shall include recommended mitigation, if required, and shall:

   a) Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions.

b) Include estimated noise levels, in terms of CNEL, for existing and projected future (10 — 20 years hence) conditions, with a comparison made to the adopted policies of the Noise Element.

c) Include recommendations for appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element.

d) Include estimates of noise exposure after the prescribed mitigation measures have been implemented. If compliance with the adopted standards and policies of the Noise Element will not be achieved, a rationale for acceptance of the project must be provided.

J) Develop implementation procedures to ensure that requirements imposed pursuant to the findings of an acoustical analysis are conducted as part of the project permitting process.

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Attachment B

Noise Parameters Used as Modeling Inputs

Modeling units are in feet, using UTM-feet coordinate system from Fluor drawing SK-250-0002, "Preliminary Emissions Sources Plot Plan", Rev. A of 17 Mar 08

RECEPTORS	Location	X	Y	Z
On-site Locations	NW corner	26290	8764	385
	N	27902	8706	390
	NNE corner	30930	8600	390
	ENE corner	31499	7675	390
	E	31486	6735	390
	SE corner	31475	5930	390
	S	28120	6017	390
	SW corner	26240	6062	420
	W	26267	7505	400
	Centroid	28750	7420	390
Off-Site Receptors	LT-1	31728	11245	290
	ST-1	37627	3220	360
	ST-2	35186	16877	290
	ST-3	26694	18218	285

Notes:

E = east
ENE = east-northeast
N = north
NNE = north-northeast
NW = northwest
S = south
SE = southeast
SW = southwest
W = west

BARRIERS	Start X	Start Y	End X	End Y	Height
Feed Stock Silo_N	30188	7111	30339	7105	175
Feed Stock Silo_E	30339	7105	30331	6807	175
Feed Stock Silo_S	30331	6807	30181	6809	175
Feed Stock Silo_W	30181	6809	30188	7111	175
Medical Bldg_N	31077	6791	31199	6788	15
Medical Bldg_E	31199	6788	31198	6729	15
Medical Bldg_S	31198	6729	31077	6733	15
Medical Bldg_W	31077	6733	31077	6790	15
Warehouse/Maintenance_N	31075	6710	31273	6706	35
Warehouse/Maintenance_W	31273	6706	31271	6557	35
Warehouse/Maintenance_S	31271	6557	31069	6561	35
Warehouse/Maintenance_W	31069	6561	31074	6709	35
Admin Bldg_N	31071	6544	31250	6540	25
Admin Bldg_E	31250	6540	31246	6439	25
Admin Bldg_S	31246	6439	31070	6446	25
Admin Bldg_W	31070	6446	31072	6542	25

Notes:

Bldg = Building
E = east
ENE = east-northeast
N = north
NNE = north-northeast
NW = northwest
S = south
SE = southeast
SW = southwest
W = west

HECA Project Modeling Inputs - Base Case

No.	Area	Item	X	Y	Z	Dir'y	*notes*	*Octave Band Sound Power Levels, dB PWL*								*Overall*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*
1	AGR	CO_2 Compressor	28321	7049	398	3	40,250 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*
2	AGR	CO_2 Recycle Compressor	28217	7426	397	3	900 hp	97	101	101	100	99	96	92	89	*103.6*
3	AGR	Refrigerant Compressor A	28304	7325	397	3	2,500 hp - int	102	93	88	85	84	83	82	81	*90.6*
4	AGR	Refrigerant Compressor B	28303	7292	397	3	2,500 hp - int	102	93	88	85	84	83	82	81	*90.6*
5	AGR	Flash Gas Recycle Comp	28194	7338	397	3	800 hp - ext	97	101	101	100	99	96	92	89	*103.6*
6	AGR	Loaded Methanol Pump I	28310	7369	393	3	250 hp	94	96	97	97	97	94	91	88	*101.3*
7	AGR	Loaded Methanol Pump II	28230	7368	393	3	125 hp	89	91	92	92	91	88	85	82	*95.6*
8	AGR	Loaded Methanol Pump III	28249	7350	393	3	400 hp	94	96	97	97	97	94	91	88	*101.3*
9	AGR	Loaded Methanol Pump IV	28228	7319	393	3	300 hp	94	96	97	97	97	94	91	88	*101.3*
10	AGR	Lean Methanol Pump	28254	7292	393	3	2,000 hp	117	108	103	100	99	98	97	96	*105.6*
11	AGR	Reflux Pump Methanol/Water Separation	28227	7252	395	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
12	AGR	Syngas Turbo Expander	28287	7146	396	3	3,000 hp	117	108	103	100	99	98	97	96	*105.6*
13	ASU	Main Air Compressor Motor	26611	6582	435	3	70,000 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*
14	ASU	Main Air Compressor (MAC)	26567	6583	435	3	70,000 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*
15	ASU	Booster Air Compressor Motor	26469	6565	435	3	14,750 hp - per Project "C"	84	88	87	91	93	93	90	85	*98.3*
16	ASU	Booster Air Compressor (BAC)	26469	6587	435	3	15,000 hp - per Project "C"	84	88	87	91	93	93	90	85	*98.3*
17	ASU	Med Press Nitrogen Compressor Motor	26511	6573	435	3	37,500 hp - per Project "C"	102	98	103	105	108	110	106	99	*114.3*
18	ASU	Med Pressure Nitrogen Compressor	26510	6597	435	3	38,000 hp - per Project "C"	102	98	103	105	108	110	106	99	*114.3*
19	ASU	Expander	26549	6480	430	3	2,000 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
20	ASU	Dense Fluid Expander	26548	6447	429	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
21	ASU	Liquid Oxygen Pump 1	26610	6493	425	3	650 hp	94	96	97	97	97	94	91	88	*101.3*
22	ASU	Liquid Oxygen Pump 2	26667	6492	425	3	650 hp	94	96	97	97	97	94	91	88	*101.3*
23	ASU	ASU Cooling Water Pump 1	26582	6366	424	3	750 hp	94	96	97	97	97	94	91	88	*101.3*
24	ASU	ASU Cooling Water Pump 2	26605	6368	424	3	750 hp	94	96	97	97	97	94	91	88	*101.3*
25	ASU	ASU CCW Pump	26606	6345	424	3	150 hp	94	95	100	99	98	95	90	87	*102.4*
26	ASU	Auxiliary Cooling Water Pump	26587	6345	424	3	200 hp	94	95	100	99	98	95	90	87	*102.4*
27	ASU	ASU Cooling Tower, cells 1-4	26589	6302	445	3	4 cells	118	116	108	102	97	98	101	99	*107.8*
28	Common Cooling	Gasification Cooling Water Pump 1	28378	6679	395	3	750 hp	94	96	97	97	97	94	91	88	*101.3*
29	Common Cooling	Gasification Cooling Water Pump 2	28405	6677	395	3	750 hp	94	96	97	97	97	94	91	88	*101.3*
30	Common Cooling	Power Block Cooling Water Pump 1	28410	6695	395	3	2,500 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
31	Common Cooling	Power Block Cooling Water Pump 2	27958	6698	395	3	2,500 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
32	Common Cooling	Power Block Clsd Clg Water Pump	28011	6700	395	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
33	Common Cooling	Aux Cooling Water Pump	27982	6678	395	3	185 hp	94	95	100	99	98	95	90	87	*102.4*
34	Common Cooling	Gasification Clsd Clg Water Pump	28028	6677	395	3	150 hp	94	95	100	99	98	95	90	87	*102.4*
35	Common Cooling	HRSG FWH Recirculation Pumps	27594	7257	394	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
36	Common Cooling	Condensate Transfer Pump	27547	7231	393	3	75 hp	86	87	90	90	88	85	81	79	*92.8*
37	Common Cooling	Hotwell Pump	27600	7166	393	3	600 hp	94	96	97	97	97	94	91	88	*101.3*

HECA Project Modeling Inputs - Base Case

No.	Area	Item	X	Y	Z	Dir'y	*notes*	*Octave Band Sound Power Levels, dB PWL*								*Overall*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*
38	Common Cooling	Low Pressure Boiler FeedWater Pump	27599	7133	393	3	250 hp	94	96	97	97	97	94	91	88	*101.3*
39	Common Cooling	Process Intrmd Press BlrFdWtr Pumps	27494	7135	394	3	350 hp	94	96	97	97	97	94	91	88	*101.3*
40	Common Cooling	High Pressure Boiler FeedWater Pump	27461	7210	394	3	2,500 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
41	Common Cooling	Process High Press BlrFdWtr Pumps	27463	7271	394	3	4,000 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
42	Common Cooling	Power Block Cooling Tower, cells 1-4	27792	6633	415	3	4 cells	118	116	108	102	97	98	101	99	*107.8*
43	Common Cooling	Power Block Cooling Tower, cells 5-8	27991	6628	415	3	4 cells	118	116	108	102	97	98	101	99	*107.8*
44	Common Cooling	Power Block Cooling Tower, cells 9-12	28193	6625	415	3	4 cells	118	116	108	102	97	98	101	99	*107.8*
45	Common Cooling	Gasification Cooling Tower, cells 1-4	28392	6619	415	3	4 cells	118	116	108	102	97	98	101	99	*107.8*
46	Flaring	Thermal Oxidizer	27890	6965	555	0	from Project "A"	94	90	82	74	71	74	78	78	*83.8*
47	Flaring	Ground Flare Stack	29395	7208	470	0	from Project "A"	94	90	82	74	71	74	78	78	*83.8*
48	Flaring	Elev Acid Gas Flare Stack	27838	7060	590	0	not used - not normal operations	--	--	--	--	--	--	--	--	*--*
49	Gasification	Injector Cooling Water Pump 1	28976	7380	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
50	Gasification	Injector Cooling Water Pump 2	28977	7330	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
51	Gasification	Filter Feed Pumps	28973	7279	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
52	Gasification	Mill Discharge Tank Pumps	29037	7385	393	3	40 hp	86	87	90	90	88	85	81	79	*92.8*
53	Gasification	Slurry Booster Pump 1	28989	7295	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
54	Gasification	Slurry Booster Pump 2	28987	7245	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
55	Gasification	Slurry Charge Pump 1	28945	7040	393	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
56	Gasification	Slurry Charge Pump 2	28990	7248	393	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
57	Gasification	Quench Water Pump 1	29013	7022	393	3	350 hp	94	96	97	97	97	94	91	88	*101.3*
58	Gasification	Quench Water Pump 2	29021	7023	393	3	350 hp	94	96	97	97	97	94	91	88	*101.3*
59	Gasification	Settler Bottom Pump	28872	7112	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
60	Gasification	Settler Feed Pump	28871	7083	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
61	Gasification	Grey Water Pump 1	28946	7041	393	3	1,800 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
62	Gasification	Grey Water Pump 2	28946	7022	393	3	1,800 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
63	Gasification	Grinding Water Tank Pump 1	28999	6914	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
64	Gasification	Grinding Water Tank Pump 2	29029	6912	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
65	Gasification	Deaerator Bottoms Pump 1	29027	6863	393	3	100 hp	89	91	92	92	91	88	85	82	*95.6*
66	Gasification	Deaerator Bottoms Pump 2	28987	6863	393	3	100 hp	89	91	92	92	91	88	85	82	*95.6*
67	Gasification	Mill Discharge Tank Agitator	29019	7404	393	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
68	Gasification	Slurry Tank Agitator 1	28938	6996	400	3	325 hp	94	96	97	97	97	94	91	88	*101.3*
69	Gasification	Slurry Tank Agitator 2	28988	6983	400	3	325 hp	94	96	97	97	97	94	91	88	*101.3*
70	Gasification	ME Settler Rake	28821	7103	396	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
71	Gasification	Filtration Skid	28844	7040	394	3	250 hp	94	96	97	97	97	94	91	88	*101.3*
72	Gasification	Vacuum Pump Package	28818	7075	394	3	60 hp	86	87	90	90	88	85	81	79	*92.8*
73	Gasification	Slurry Prep Bldg	29090	7361	495	3	from Project "A"	114	104	94	87	80	71	69	73	*92.9*
74	Gasification	Gasifier 1	28894	7394	490	0	from Project "A"	117	110	105	100	97	96	96	97	*105.0*
75	Gasification	Gasifier 2	28893	7316	490	0	from Project "A"	117	110	105	100	97	96	96	97	*105.0*

HECA Project Modeling Inputs - Base Case

No.	Area	Item	X	Y	Z	Dir'y	*notes*	*Octave Band Sound Power Levels, dB PWL*								*Overall*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*
76	Gasification	Gasifier 3	28896	7238	490	0	Only 2 running; establishes loc'n	–	–	–	–	–	–	–	–	–
77	Mat'l Handling	Pneumatic Conveyor Blower	28954	6990	380	3	from Project "A"	108	101	96	91	88	87	87	88	*96.0*
78	Mat'l Handling	Impact Crusher	30274	7402	407	3	EPPENG with adjustment	105	105	103	101	100	98	92	85	*104.8*
79	Mat'l Handling	Belt Conveyor 1	29321	6252	420	3	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
80	Mat'l Handling	Belt Conveyor 2	29679	6487	490	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
81	Mat'l Handling	Belt Conveyor 3	30044	6736	560	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
82	Mat'l Handling	Belt Conveyor 4	30270	7230	375	3	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
83	Mat'l Handling	Belt Conveyor 5	30070	7402	375	3	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
84	Mat'l Handling	Belt Conveyor 6	29682	7415	440	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
85	Mat'l Handling	Belt Conveyor 7	29310	7424	500	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*
86	Mat'l Handling	Crusher Bldg	30275	7403	515	3	from Project "A"	129	119	109	103	95	86	84	88	*108.0*
87	Mat'l Handling	Feedstock Silo_N	30245	7121	532	3	from Project "A"	119	109	99	93	85	76	74	78	*98.0*
88	Mat'l Handling	Feedstock Silo_E	30348	6992	532	3	from Project "A"	119	109	99	93	85	76	74	78	*98.0*
89	Mat'l Handling	Feedstock Silo_S	30257	6793	532	3	from Project "A"	119	109	99	93	85	76	74	78	*98.0*
90	Mat'l Handling	Feedstock Silo_W	30167	6961	532	3	from Project "A"	119	109	99	93	85	76	74	78	*98.0*
91	Mat'l Handling	Feedstock Unloading Shed	29160	6161	407	3	EPPENG with adjustment	105	105	103	101	100	98	92	85	*104.8*
92	Mat'l Handling	Feedstock Transfer Tower 1	29432	6325	444	3	EPPENG with adjustment	113	113	111	109	108	106	100	93	*112.8*
93	Mat'l Handling	Feedstock Transfer Tower 2	29887	6629	532	3	EPPENG with adjustment	113	113	111	109	108	106	100	93	*112.8*
94	Mat'l Handling	Crushed Feedstock Transfer Tower 1	29875	7409	415	3	EPPENG with adjustment	113	113	111	109	108	106	100	93	*112.8*
95	Mat'l Handling	Crushed Feedstock Transfer Tower 2	29500	7411	465	3	EPPENG with adjustment	113	113	111	109	108	106	100	93	*112.8*
96	Mat'l Handling	Mat'l Handling Dust Collector 1	29155	6134	382	3	estimate	89	91	92	92	91	88	85	82	*95.6*
97	Mat'l Handling	Mat'l Handling Dust Collector 5	30326	7373	382	3	estimate	89	91	92	92	91	88	85	82	*95.6*
98	Mat'l Handling	Mat'l Handling Dust Collector 6	30232	7442	382	3	estimate	89	91	92	92	91	88	85	82	*95.6*
99	Mat'l Handling	Mat'l Handling Dust Collector 7	29149	7389	382	3	estimate	89	91	92	92	91	88	85	82	*95.6*
100	Mat'l Handling	Mat'l Handling Dust Collector 8	29150	7284	382	3	estimate	89	91	92	92	91	88	85	82	*95.6*
101	Mat'l Handling	Mat'l Handling Dust Collector 9	29125	7238	382	3	estimate	89	91	92	92	91	88	85	82	*95.6*
102	Power Block	GTG Transformer	26953	7225	402	3	from Project "A"	99	101	96	96	90	85	80	73	*96.4*
103	Power Block	GTG Air Inlet	27052	7178	420	3	from Project "A"	103	102	92	91	88	88	81	76	*94.6*
104	Power Block	GTG Generator	27090	7176	400	3	from Project "E"	107	114	105	94	95	92	96	99	*104.5*
105	Power Block	GTG Main Body	27129	7178	408	3	from Project "E"	117	114	104	100	94	92	92	90	*103.6*
106	Power Block	GTG Accessory Bay	27136	7224	400	3	estimate	114	111	110	107	105	105	101	99	*111.4*
107	Power Block	HRSG Transition	27199	7177	410	3	from Project "B"	110	103	99	92	84	82	72	60	*94.9*
108	Power Block	HRSG Main Body	27266	7176	430	3	from Project "A"	117	113	106	99	90	87	71	57	*102.3*
109	Power Block	HRSG Stack Exhaust	27334	7174	550	0	from Project "A"	117	119	119	112	101	87	72	67	*113.4*
110	Power Block	STG Main Body	27136	7035	425	3	from Project "D"	114	112	107	103	99	96	88	82	*105.4*
111	Power Block	STG Generator	27058	7038	420	3	from Project "D"	107	114	105	94	95	92	96	99	*104.5*
112	Power Block	STG Transformer	26952	7088	402	3	from Project "A"	99	101	96	96	90	85	80	73	*96.4*

HECA Project Modeling Inputs - Base Case

No.	Area	Item	X	Y	Z	Dir'y	*notes*	*Octave Band Sound Power Levels, dB PWL*								*Overall*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*
113	Power Block	LMS100® Air Inlet	27047	7365	415	3	from Project "E"	118	117	106	94	100	86	86	91	*105.1*
114	Power Block	LMS100® Main Body	27049	7419	405	3	from Project "E"	116	113	103	99	93	91	91	89	*102.6*
115	Power Block	LMS100® Generator	27050	7470	405	3	from Project "E"	106	113	104	93	94	91	95	98	*103.5*
116	Power Block	LMS100® SCR Body	27021	7444	418	3	from Project "E"	128	125	118	106	100	93	76	58	*113.3*
117	Power Block	LMS100® Stack Exhaust	26990	7444	450	0	from Project "E"	138	132	118	106	101	93	89	81	*118.2*
118	Power Block	LMS100® Transformer	26995	7520	402	3	from Project "E"	103	107	100	101	98	87	82	75	*102.0*
119	Power Block	LMS100® Fuel Gas Compressor	27091	7372	395	3	estimate	90	92	91	93	96	100	94	88	*103.4*
120	Shift/LTGC	Hot Process Condensate Pumps	28571	7357	393	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
121	Shift/LTGC	Contact Condenser Air Cooler	28536	7372	415	0	from Project "E"	98	95	85	78	72	63	56	48	*82.7*
122	Shift/LTGC	Regen Overhead Air Cooler	28531	7287	415	0	from Project "E"	98	95	85	78	72	63	56	48	*82.7*
123	SRU	SRU furnace 1	27908	7400	410	3	from Project "A"	103	104	113	111	104	97	95	96	*111.0*
124	SRU	SRU furnace 2	28004	7396	410	3	from Project "A"	103	104	113	111	104	97	95	96	*111.0*
125	SRU	HP Flare Knock-out Drum Pump	27875	7061	393	3	300 hp	94	96	97	97	97	94	91	88	*101.3*
126	TGTU	TGTU Treated Gas Compressor	28002	7191	397	3	1,200 hp	90	92	91	93	96	100	94	88	*103.4*
127	TGTU	Lean Amine Air Cooler	27948	7208	415	0	from Project "E"	98	95	85	78	72	63	56	48	*82.7*
128	Water Treat	Demin Water Pump	31101	7500	388	3	250 hp	94	96	97	97	97	94	91	88	*101.3*
129	Water Treat	Storm Water Sump Pump	31167	7499	388	3	75 hp	86	87	90	90	88	85	81	79	*92.8*
130	Water Treat	Sump Pump	31086	7392	388	3	75 hp	86	87	90	90	88	85	81	79	*92.8*
131	Water Treat	Water Treat Pumps	31166	7399	388	3	12 x 75 hp = 11 dB	97	98	101	101	99	96	92	90	*103.8*
132	Water Treat	R/O Feed Pump-1 stg	31193	7280	389	3	1,500 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
133	Water Treat	R/O Feed Pump-2 stg	31265	7262	389	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
134	Water Treat	Deep Well Injection Pump	27555	6409	390	3	2,000 hp - per Project "F"	117	108	103	100	99	98	97	96	*105.6*
135	ZLD	Vapor Compressor	28999	6907	397	3	500 hp	94	96	97	97	97	94	91	88	*101.3*
136	ZLD	Exhaust Fan	29032	6906	397	3	50 hp	86	87	90	90	88	85	81	79	*92.8*
137	ZLD	ZLD pumps	28998	6840	393	3	16 x 75 hp = 12 dB	98	99	102	102	100	97	93	91	*104.8*
138	ZLD	Drum Dryer	29031	6831	395	3	60 hp	86	87	90	90	88	85	81	79	*92.8*
139	Miscellaneous	Atmospheric Vent (service A)	28758	7412	450	0	estimate	110	103	98	93	90	89	89	90	*98.0*
140	Miscellaneous	Atmospheric Vent (service B)	28758	7412	450	0	estimate	110	103	98	93	90	89	89	90	*98.0*
141	Miscellaneous	Atmospheric Vent (service C)	28758	7412	450	0	estimate	110	103	98	93	90	89	89	90	*98.0*
142	Miscellaneous	Atmospheric Vent (service D)	28758	7412	450	0	estimate	110	103	98	93	90	89	89	90	*98.0*
143	Miscellaneous	Atmospheric Vent (service E)	28758	7412	450	0	estimate	110	103	98	93	90	89	89	90	*98.0*
144	Miscellaneous	Aux Transformer 01	27213	7002	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
145	Miscellaneous	Aux Transformer 02	27208	7028	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
146	Miscellaneous	Aux Transformer 03	27270	7050	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
147	Miscellaneous	Aux Transformer 04	28018	7050	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
148	Miscellaneous	Aux Transformer 05	28077	7026	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
149	Miscellaneous	Aux Transformer 06	28075	6999	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*

HECA Project Modeling Inputs - Base Case

No.	Area	Item	X	Y	Z	Dir'y	*notes*	*Octave Band Sound Power Levels, dB PWL*								*Overall*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*
150	Miscellaneous	Aux Transformer 07	28530	7112	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
151	Miscellaneous	Aux Transformer 08	28589	7087	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
152	Miscellaneous	Aux Transformer 09	28586	7060	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
153	Miscellaneous	Aux Transformer 10	28818	7126	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
154	Miscellaneous	Aux Transformer 11	28875	7103	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
155	Miscellaneous	Aux Transformer 12	28872	7077	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
156	Miscellaneous	Aux Transformer 13	30377	6877	368	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
157	Miscellaneous	Aux Transformer 14	30377	6853	368	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
158	Miscellaneous	Aux Transformer 15	30956	7609	348	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
159	Miscellaneous	Aux Transformer 16	30982	7605	348	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
160	Miscellaneous	Aux Transformer 17	31230	6838	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
161	Miscellaneous	Aux Transformer 18	31257	6834	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
162	Miscellaneous	Aux Transformer 19	28189	6745	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
163	Miscellaneous	Aux Transformer 20	28167	6744	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
164	Miscellaneous	Aux Transformer 21	27563	6550	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
165	Miscellaneous	Aux Transformer 22	27564	6532	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
166	Miscellaneous	Aux Transformer 23	26657	6699	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
167	Miscellaneous	Aux Transformer 24	26606	6697	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*
				Average height =	25.1 feet										**Total Plant PWL(A) =**	**126.7**

Notes:

--	=	not applicable	int	=	internal
~	=	approximately	LTGC	=	Low Temperature Gas Cooling
AGR	=	acid gas removal	Mat'l	=	material
ASU	=	air separation unit	MVA	=	mega volt-amps
Aux	=	auxiliary	N	=	north
CO_2	=	carbon dioxide	PWL	=	octave band sound power levels
dB	=	decibel	R/O	=	reverse osmosis
E	=	east	S	=	south
EPPENG	=	see References under 'Miller'	SCR	=	selective catalytic reduction
ext	=	external	SRU	=	sulfur recover unit
FWH	=		STG	=	steam turbine generator
GTG	=	Gas Turbine Generator	TGTU	=	Tail Gas Treating Unit
hp	=	horsepower	W	=	west
HRSG	=	heat recovery steam generator	ZLD	=	Zero Liquid Discharge

HECA Project Modeling Inputs – Noise Control Case 1

No.	Area	Item	X	Y	Z	Dir'y	*notes*	Octave Band Sound Power Levels, dB PWL								*Overall*	*Treated*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*	*with **
1	AGR	CO_2 Compressor	28321	7049	398	3	40,250 hp - per Project "C"	72	68	73	75	78	80	76	69	*84.3*	*
2	AGR	CO_2 Recycle Compressor	28217	7426	397	3	900 hp	82	86	86	85	84	81	77	74	*88.6*	*
3	AGR	Refrigerant Compressor A	28304	7325	397	3	2,500 hp - int	87	78	73	70	69	68	67	66	*75.6*	*
4	AGR	Refrigerant Compressor B	28303	7292	397	3	2,500 hp - int	87	78	73	70	69	68	67	66	*75.6*	*
5	AGR	Flash Gas Recycle Comp	28194	7338	397	3	800 hp - ext	82	86	86	85	84	81	77	74	*88.6*	*
6	AGR	Loaded Methanol Pump I	28310	7369	393	3	250 hp	84	86	87	87	87	84	81	78	*91.3*	*
7	AGR	Loaded Methanol Pump II	28230	7368	393	3	125 hp	79	81	82	82	81	78	75	72	*85.6*	*
8	AGR	Loaded Methanol Pump III	28249	7350	393	3	400 hp	84	86	87	87	87	84	81	78	*91.3*	*
9	AGR	Loaded Methanol Pump IV	28228	7319	393	3	300 hp	84	86	87	87	87	84	81	78	*91.3*	*
10	AGR	Lean Methanol Pump	28254	7292	393	3	2,000 hp	107	98	93	90	89	88	87	86	*95.6*	*
11	AGR	Reflux Pump Methanol/Water Separation	28227	7252	395	3	50 hp	86	87	90	90	88	85	81	79	*92.8*	
12	AGR	Syngas Turbo Expander	28287	7146	396	3	3,000 hp	102	93	88	85	84	83	82	81	*90.6*	*
13	ASU	Main Air Compressor Motor	26611	6582	435	3	70,000 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*	
14	ASU	Main Air Compressor (MAC)	26567	6583	435	3	70,000 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*	
15	ASU	Booster Air Compressor Motor	26469	6565	435	3	14,750 hp - per Project "C"	84	88	87	91	93	93	90	85	*98.3*	
16	ASU	Booster Air Compressor (BAC)	26469	6587	435	3	15,000 hp - per Project "C"	84	88	87	91	93	93	90	85	*98.3*	
17	ASU	Med Pressure Nitrogen Compressor Motor	26511	6573	435	3	37,500 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*	*
18	ASU	Med Pressure Nitrogen Compressor	26510	6597	435	3	38,000 hp - per Project "C"	87	83	88	90	93	95	91	84	*99.3*	*
19	ASU	Expander	26549	6480	430	3	2,000 hp - per Project "F"	102	93	88	85	84	83	82	81	*90.6*	*
20	ASU	Dense Fluid Expander	26548	6447	429	3	500 hp	79	81	82	82	82	79	76	73	*86.3*	*
21	ASU	Liquid Oxygen Pump 1	26610	6493	425	3	650 hp	84	86	87	87	87	84	81	78	*91.3*	*
22	ASU	Liquid Oxygen Pump 2	26667	6492	425	3	650 hp	84	86	87	87	87	84	81	78	*91.3*	*
23	ASU	ASU Cooling Water Pump 1	26582	6366	424	3	750 hp	84	86	87	87	87	84	81	78	*91.3*	*
24	ASU	ASU Cooling Water Pump 2	26605	6368	424	3	750 hp	84	86	87	87	87	84	81	78	*91.3*	*
25	ASU	ASU CCW Pump	26606	6345	424	3	150 hp	84	85	90	89	88	85	80	77	*92.4*	*
26	ASU	Auxiliary Cooling Water Pump	26587	6345	424	3	200 hp	84	85	90	89	88	85	80	77	*92.4*	*
27	ASU	ASU Cooling Tower, cells 1-4	26589	6302	445	3	4 cells	114	112	104	98	93	94	97	95	*103.8*	*
28	Common Cooling	Gasification Cooling Water Pump 1	28378	6679	395	3	750 hp	84	86	87	87	87	84	81	78	*91.3*	*
29	Common Cooling	Gasification Cooling Water Pump 2	28405	6677	395	3	750 hp	84	86	87	87	87	84	81	78	*91.3*	*
30	Common Cooling	Power Block Cooling Water Pump 1	28410	6695	395	3	2,500 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
31	Common Cooling	Power Block Cooling Water Pump 2	27958	6698	395	3	2,500 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
32	Common Cooling	Power Block Clsd Clg Water Pump	28011	6700	395	3	500 hp	84	86	87	87	87	84	81	78	*91.3*	*
33	Common Cooling	Aux Cooling Water Pump	27982	6678	395	3	185 hp	84	85	90	89	88	85	80	77	*92.4*	*
34	Common Cooling	Gasification Clsd Clg Water Pump	28028	6677	395	3	150 hp	84	85	90	89	88	85	80	77	*92.4*	*
35	Common Cooling	HRSG FWH Recirculation Pumps	27594	7257	394	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
36	Common Cooling	Condensate Transfer Pump	27547	7231	393	3	75 hp	76	77	80	80	78	75	71	69	*82.8*	*
37	Common Cooling	Hotwell Pump	27600	7166	393	3	600 hp	84	86	87	87	87	84	81	78	*91.3*	*
38	Common Cooling	Low Pressure Boiler FeedWater Pump	27599	7133	393	3	250 hp	84	86	87	87	87	84	81	78	*91.3*	*

HECA Project Modeling Inputs – Noise Control Case 1

No.	Area	Item	X	Y	Z	Dir'y	*notes*	Octave Band Sound Power Levels, dB PWL								*Overall*	*Treated*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*	*with **
39	Common Cooling	Process Intrmd Press BlrFdWtr Pumps	27494	7135	394	3	350 hp	84	86	87	87	87	84	81	78	*91.3*	*
40	Common Cooling	High Pressure Boiler FeedWater Pump	27461	7210	394	3	2,500 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
41	Common Cooling	Process High Press BlrFdWtr Pumps	27463	7271	394	3	4,000 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
42	Common Cooling	Power Block Cooling Tower, cells 1-4	27792	6633	415	3	4 cells	114	112	104	98	93	94	97	95	*103.8*	*
43	Common Cooling	Power Block Cooling Tower, cells 5-8	27991	6628	415	3	4 cells	114	112	104	98	93	94	97	95	*103.8*	*
44	Common Cooling	Power Block Cooling Tower, cells 9-12	28193	6625	415	3	4 cells	114	112	104	98	93	94	97	95	*103.8*	*
45	Common Cooling	Gasification Cooling Tower, cells 1-4	28392	6619	415	3	4 cells	114	112	104	98	93	94	97	95	*103.8*	*
46	Flaring	Thermal Oxidizer	27890	6965	555	0	from Project "A"	94	90	82	74	71	74	78	78	*83.8*	
47	Flaring	Ground Flare Stack	29395	7208	470	0	from Project "A"	94	90	82	74	71	74	78	78	*83.8*	
48	Flaring	Elev Acid Gas Flare Stack	27838	7060	590	0	not used - not normal operation	--	--	--	--	--	--	--	--	--	
49	Gasification	Injector Cooling Water Pump 1	28976	7380	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
50	Gasification	Injector Cooling Water Pump 2	28977	7330	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
51	Gasification	Filter Feed Pumps	28973	7279	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
52	Gasification	Mill Discharge Tank Pumps	29037	7385	393	3	40 hp	76	77	80	80	78	75	71	69	*82.8*	*
53	Gasification	Slurry Booster Pump 1	28989	7295	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
54	Gasification	Slurry Booster Pump 2	28987	7245	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
55	Gasification	Slurry Charge Pump 1	28945	7040	393	3	500 hp	84	86	87	87	87	84	81	78	*91.3*	*
56	Gasification	Slurry Charge Pump 2	28990	7248	393	3	500 hp	84	86	87	87	87	84	81	78	*91.3*	*
57	Gasification	Quench Water Pump 1	29013	7022	393	3	350 hp	84	86	87	87	87	84	81	78	*91.3*	*
58	Gasification	Quench Water Pump 2	29021	7023	393	3	350 hp	84	86	87	87	87	84	81	78	*91.3*	*
59	Gasification	Settler Bottom Pump	28872	7112	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
60	Gasification	Settler Feed Pump	28871	7083	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
61	Gasification	Grey Water Pump 1	28946	7041	393	3	1,800 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
62	Gasification	Grey Water Pump 2	28946	7022	393	3	1,800 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
63	Gasification	Grinding Water Tank Pump 1	28999	6914	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
64	Gasification	Grinding Water Tank Pump 2	29029	6912	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
65	Gasification	Deaerator Bottoms Pump 1	29027	6863	393	3	100 hp	79	81	82	82	81	78	75	72	*85.6*	*
66	Gasification	Deaerator Bottoms Pump 2	28987	6863	393	3	100 hp	79	81	82	82	81	78	75	72	*85.6*	*
67	Gasification	Mill Discharge Tank Agitator	29019	7404	393	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
68	Gasification	Slurry Tank Agitator 1	28938	6996	400	3	325 hp	84	86	87	87	87	84	81	78	*91.3*	*
69	Gasification	Slurry Tank Agitator 2	28988	6983	400	3	325 hp	84	86	87	87	87	84	81	78	*91.3*	*
70	Gasification	ME Settler Rake	28821	7103	396	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
71	Gasification	Filtration Skid	28844	7040	394	3	250 hp	84	86	87	87	87	84	81	78	*91.3*	*
72	Gasification	Vacuum Pump Package	28818	7075	394	3	60 hp	76	77	80	80	78	75	71	69	*82.8*	*
73	Gasification	Slurry Prep Bldg	29090	7361	495	3	from Project "A"	114	104	94	87	80	71	69	73	*92.9*	
74	Gasification	Gasifier 1	28894	7394	490	0	from Project "A"	102	95	90	85	82	81	81	82	*90.0*	*
75	Gasification	Gasifier 2	28893	7316	490	0	from Project "A"	102	95	90	85	82	81	81	82	*90.0*	*

HECA Project Modeling Inputs – Noise Control Case 1

No.	Area	Item	X	Y	Z	Dir'y	*notes*	Octave Band Sound Power Levels, dB PWL								*Overall*	*Treated*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*	*with **
76	Gasification	Gasifier 3	28896	7238	490	0	Only 2 running; establishes loc'n	–	–	–	–	–	–	–	–	–	–
77	Mat'l Handling	Pneumatic Conveyor Blower	28954	6990	380	3	from Project "A"	98	91	86	81	78	77	77	78	*86.0*	*
78	Mat'l Handling	Impact Crusher	30274	7402	407	3	EPPENG with adjustment	105	105	103	101	100	98	92	85	*104.8*	
79	Mat'l Handling	Belt Conveyor 1	29321	6252	420	3	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
80	Mat'l Handling	Belt Conveyor 2	29679	6487	490	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
81	Mat'l Handling	Belt Conveyor 3	30044	6736	560	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
82	Mat'l Handling	Belt Conveyor 4	30270	7230	375	3	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
83	Mat'l Handling	Belt Conveyor 5	30070	7402	375	3	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
84	Mat'l Handling	Belt Conveyor 6	29682	7415	440	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
85	Mat'l Handling	Belt Conveyor 7	29310	7424	500	0	EPPENG with adjustment	93	93	91	89	88	86	80	73	*92.8*	
86	Mat'l Handling	Crusher Bldg	30275	7403	515	3	from Project "A"	119	109	99	93	85	76	74	78	*98.0*	*
87	Mat'l Handling	Feedstock Silo_N	30245	7121	532	3	from Project "A"	109	99	89	83	75	66	64	68	*88.0*	*
88	Mat'l Handling	Feedstock Silo_E	30348	6992	532	3	from Project "A"	109	99	89	83	75	66	64	68	*88.0*	*
89	Mat'l Handling	Feedstock Silo_S	30257	6793	532	3	from Project "A"	109	99	89	83	75	66	64	68	*88.0*	*
90	Mat'l Handling	Feedstock Silo_W	30167	6961	532	3	from Project "A"	109	99	89	83	75	66	64	68	*88.0*	*
91	Mat'l Handling	Feedstock Unloading Shed	29160	6161	407	3	EPPENG with adjustment	95	95	93	91	90	88	82	75	*94.8*	*
92	Mat'l Handling	Feedstock Transfer Tower 1	29432	6325	444	3	EPPENG with adjustment	103	103	101	99	98	96	90	83	*102.8*	*
93	Mat'l Handling	Feedstock Transfer Tower 2	29887	6629	532	3	EPPENG with adjustment	103	103	101	99	98	96	90	83	*102.8*	*
94	Mat'l Handling	Crushed Feedstock Transfer Tower 1	29875	7409	415	3	EPPENG with adjustment	103	103	101	99	98	96	90	83	*102.8*	*
95	Mat'l Handling	Crushed Feedstock Transfer Tower 2	29500	7411	465	3	EPPENG with adjustment	103	103	101	99	98	96	90	83	*102.8*	*
96	Mat'l Handling	Mat'l Handling Dust Collector 1	29155	6134	382	3	estimate	79	81	82	82	81	78	75	72	*85.6*	*
97	Mat'l Handling	Mat'l Handling Dust Collector 5	30326	7373	382	3	estimate	79	81	82	82	81	78	75	72	*85.6*	*
98	Mat'l Handling	Mat'l Handling Dust Collector 6	30232	7442	382	3	estimate	79	81	82	82	81	78	75	72	*85.6*	*
99	Mat'l Handling	Mat'l Handling Dust Collector 7	29149	7389	382	3	estimate	79	81	82	82	81	78	75	72	*85.6*	*
100	Mat'l Handling	Mat'l Handling Dust Collector 8	29150	7284	382	3	estimate	79	81	82	82	81	78	75	72	*85.6*	*
101	Mat'l Handling	Mat'l Handling Dust Collector 9	29125	7238	382	3	estimate	79	81	82	82	81	78	75	72	*85.6*	*
102	Power Block	GTG Transformer	26953	7225	402	3	from Project "A"	99	101	96	96	90	85	80	73	*96.4*	
103	Power Block	GTG Air Inlet	27052	7178	420	3	from Project "A"	103	102	92	91	88	88	81	76	*94.6*	
104	Power Block	GTG Generator	27090	7176	400	3	from Project "E"	107	114	105	94	95	92	96	99	*104.5*	
105	Power Block	GTG Main Body	27129	7178	408	3	from Project "E"	117	114	104	100	94	92	92	90	*103.6*	
106	Power Block	GTG Accessory Bay	27136	7224	400	3	estimate	114	111	110	107	105	105	101	99	*111.4*	
107	Power Block	HRSG Transition	27199	7177	410	3	from Project "B"	110	103	99	92	84	82	72	60	*94.9*	
108	Power Block	HRSG Main Body	27266	7176	430	3	from Project "A"	117	113	106	99	90	87	71	57	*102.3*	
109	Power Block	HRSG Stack Exhaust	27334	7174	550	0	from Project "A"	107	109	109	102	91	77	62	57	*103.4*	*
110	Power Block	STG Main Body	27136	7035	425	3	from Project "D"	114	112	107	103	99	96	88	82	*105.4*	
111	Power Block	STG Generator	27058	7038	420	3	from Project "D"	107	114	105	94	95	92	96	99	*104.5*	
112	Power Block	STG Transformer	26952	7088	402	3	from Project "A"	99	101	96	96	90	85	80	73	*96.4*	
113	Power Block	LMS100® Air Inlet	27047	7365	415	3	from Project "E"	112	111	100	88	94	80	80	85	*99.1*	*

HECA Project Modeling Inputs – Noise Control Case 1

No.	Area	Item	X	Y	Z	Dir'y	*notes*	Octave Band Sound Power Levels, dB PWL								*Overall*	*Treated*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*	*with **
114	Power Block	LMS100® Main Body	27049	7419	405	3	from Project "E"	116	113	103	99	93	91	91	89	*102.6*	
115	Power Block	LMS100® Generator	27050	7470	405	3	from Project "E"	106	113	104	93	94	91	95	98	*103.5*	
116	Power Block	LMS100® SCR Body	27021	7444	418	3	from Project "E"	118	115	108	96	90	83	66	48	*103.3*	*
117	Power Block	LMS100® Stack Exhaust	26990	7444	450	0	from Project "E"	128	122	108	96	91	83	79	71	*108.2*	*
118	Power Block	LMS100® Transformer	26995	7520	402	3	from Project "E"	103	107	100	101	98	87	82	75	*102.0*	
119	Power Block	LMS100® Fuel Gas Compressor	27091	7372	395	3	estimate	80	82	81	83	86	90	84	78	*93.4*	*
120	Shift/LTGC	Hot Process Condensate Pumps	28571	7357	393	3	500 hp	84	86	87	87	87	84	81	78	*91.3*	*
121	Shift/LTGC	Contact Condenser Air Cooler	28536	7372	415	0	from Project "E"	98	95	85	78	72	63	56	48	*82.7*	
122	Shift/LTGC	Regen Overhead Air Cooler	28531	7287	415	0	from Project "E"	98	95	85	78	72	63	56	48	*82.7*	
123	SRU	SRU furnace 1	27908	7400	410	3	from Project "A"	103	104	113	111	104	97	95	96	*111.0*	
124	SRU	SRU furnace 2	28004	7396	410	3	from Project "A"	103	104	113	111	104	97	95	96	*111.0*	
125	SRU	HP Flare Knock-out Drum Pump	27875	7061	393	3	300 hp	84	86	87	87	87	84	81	78	*91.3*	*
126	TGTU	TGTU Treated Gas Compressor	28002	7191	397	3	1,200 hp	75	77	76	78	81	85	79	73	*88.4*	*
127	TGTU	Lean Amine Air Cooler	27948	7208	415	0	from Project "E"	98	95	85	78	72	63	56	48	*82.7*	
128	Water Treat	Demin Water Pump	31101	7500	388	3	250 hp	84	86	87	87	87	84	81	78	*91.3*	*
129	Water Treat	Storm Water Sump Pump	31167	7499	388	3	75 hp	76	77	80	80	78	75	71	69	*82.8*	*
130	Water Treat	Sump Pump	31086	7392	388	3	75 hp	76	77	80	80	78	75	71	69	*82.8*	*
131	Water Treat	Water Treat Pumps	31166	7399	388	3	12 x 75 hp = 11 dB	87	88	91	91	89	86	82	80	*93.8*	*
132	Water Treat	R/O Feed Pump-1 stg	31193	7280	389	3	1,500 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
133	Water Treat	R/O Feed Pump-2 stg	31265	7262	389	3	500 hp	84	86	87	87	87	84	81	78	*91.3*	*
134	Water Treat	Deep Well Injection Pump	27555	6409	390	3	2,000 hp - per Project "F"	107	98	93	90	89	88	87	86	*95.6*	*
135	ZLD	Vapor Compressor	28999	6907	397	3	500 hp	79	81	82	82	82	79	76	73	*86.3*	*
136	ZLD	Exhaust Fan	29032	6906	397	3	50 hp	76	77	80	80	78	75	71	69	*82.8*	*
137	ZLD	ZLD pumps	28998	6840	393	3	16 x 75 hp = 12 dB	88	89	92	92	90	87	83	81	*94.8*	*
138	ZLD	Drum Dryer	29031	6831	395	3	60 hp	86	87	90	90	88	85	81	79	*92.8*	
139	Miscellaneous	Atmospheric Vent (service A)	28758	7412	450	0	estimate with exhaust silencing	95	88	83	78	75	74	74	75	*83*	*
140	Miscellaneous	Atmospheric Vent (service B)	28758	7412	450	0	estimate with exhaust silencing	95	88	83	78	75	74	74	75	*83*	*
141	Miscellaneous	Atmospheric Vent (service C)	28758	7412	450	0	estimate with exhaust silencing	95	88	83	78	75	74	74	75	*83*	*
142	Miscellaneous	Atmospheric Vent (service D)	28758	7412	450	0	estimate with exhaust silencing	95	88	83	78	75	74	74	75	*83*	*
143	Miscellaneous	Atmospheric Vent (service E)	28758	7412	450	0	estimate with exhaust silencing	95	88	83	78	75	74	74	75	*83*	*
144	Miscellaneous	Aux Transformer 01	27213	7002	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
145	Miscellaneous	Aux Transformer 02	27208	7028	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
146	Miscellaneous	Aux Transformer 03	27270	7050	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
147	Miscellaneous	Aux Transformer 04	28018	7050	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
148	Miscellaneous	Aux Transformer 05	28077	7026	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
149	Miscellaneous	Aux Transformer 06	28075	6999	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	

HECA Project Modeling Inputs – Noise Control Case 1

No.	Area	Item	X	Y	Z	Dir'y	*notes*	Octave Band Sound Power Levels, dB PWL								*Overall*	*Treated*
								63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*PWL(A)*	*with **
150	Miscellaneous	Aux Transformer 07	28530	7112	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
151	Miscellaneous	Aux Transformer 08	28589	7087	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
152	Miscellaneous	Aux Transformer 09	28586	7060	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
153	Miscellaneous	Aux Transformer 10	28818	7126	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
154	Miscellaneous	Aux Transformer 11	28875	7103	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
155	Miscellaneous	Aux Transformer 12	28872	7077	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
156	Miscellaneous	Aux Transformer 13	30377	6877	368	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
157	Miscellaneous	Aux Transformer 14	30377	6853	368	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
158	Miscellaneous	Aux Transformer 15	30956	7609	348	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
159	Miscellaneous	Aux Transformer 16	30982	7605	348	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
160	Miscellaneous	Aux Transformer 17	31230	6838	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
161	Miscellaneous	Aux Transformer 18	31257	6834	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
162	Miscellaneous	Aux Transformer 19	28189	6745	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
163	Miscellaneous	Aux Transformer 20	28167	6744	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
164	Miscellaneous	Aux Transformer 21	27563	6550	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
165	Miscellaneous	Aux Transformer 22	27564	6532	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
166	Miscellaneous	Aux Transformer 23	26657	6699	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	
167	Miscellaneous	Aux Transformer 24	26606	6697	358	3	~15 MVA - per Project "B"	87	89	84	84	78	73	68	61	*84.4*	

**** items with an asterisk include noise control treatments (see list)*** *Avg ht =* 25.1 ft **Total Plant PWL(A) = 120.5**

Notes:

--	=	not applicable	int	=	internal
~	=	approximately	LTGC	=	Low Temperature Gas Cooling
AGR	=	acid gas removal	Mat'l	=	material
ASU	=	air separation unit	MVA	=	mega volt-amps
Aux	=	auxiliary	N	=	north
CO_2	=	carbon dioxide	PWL	=	octave band sound power levels
dB	=	decibel	R/O	=	reverse osmosis
E	=	east	S	=	south
EPPENG	=	see References under 'Miller'	SCR	=	selective catalytic reduction
ext	=	external	SRU	=	Sulfur Recover Unit
FWH	=		STG	=	steam turbine generator
GTG	=	Gas Turbine Generator	TGTU	=	Tail Gas Treating Unit
hp	=	horsepower	W	=	west
HRSG	=	heat recovery steam generator	ZLD	=	Zero Liquid Discharge

Noise Reduction Measures include:

- open-top enclosures on selected compressors and expander
- low-noise fuel-feed systems on gasifiers (slurry injectors and fuel gas aspirators)
- low-noise procurement or shrouded or blanketed pump trains, as appropriate
- low-noise procurement or shrouded or blanketed blowers and dust handlers, as appropriate
- lower-noise cooling tower cells
- use stack silencer on HRSG exhaust
- use stack silencer on LMS100® SCR exhaust
- use inlet silencer on LMS100® air inlet
- verify noise emissions from pertinent material handling sytems and conveyors
- ensuring acoustically-sealed façades for material handling structures
- specify low-noise burner systems, as needed, for SRU burners
- use of BP Engr'g Technical Practices for equipment specification