DOCKETED

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5.7 Noise

This section presents the noise impact assessment related to the Pecho Energy Storage Center (Pecho/PESC). Section 5.7.1 discusses the fundamentals of acoustics. Section 5.7.2 describes the affected environment, including baseline noise level survey methodology and results. Section 5.7.3 presents an environmental analysis of the construction and operation of the energy storage center and associated facilities. Section 5.7.4 discusses cumulative effects. Section 5.7.5 discusses mitigation measures. Section 5.7.6 presents applicable laws, ordinances, regulations, and standards (LORS). Section 5.7.7 presents agency contacts, and Section 5.7.8 presents permit requirements and schedules. Section 5.7.9 contains the references used to prepare this section.

5.7.1 Fundamentals of Acoustics

Acoustic values can be described in terms of noise or sound. **Sound** is generated by pressure fluctuations in the air. **Noise** is genially defined as any “unwanted” sound and is therefore based on human perception, but the terms noise and sound are often used interchangeably. Sound propagation involves three principal components: a noise source, a person or a group of people, and the transmission path. While two of these components, the noise source, and the transmission path are easily quantified (i.e., by direct measurements or through predictive calculations), the effect of noise on humans is the most difficult to determine due to the varying responses to the same or similar noise patterns and therefore it is difficult to predict a response from one individual to another.

Noise and noise levels are used to describe ambient levels perceived by off-site receptors, while sound and sound emissions describe acoustic energy emitted by activities/equipment associated with the project. The level of noise is related to its magnitude, which is referred to as **sound pressure level (SPL)** and is measured in units called **decibels (dB)**. The higher the decibel value, the louder the sound. Decibels are calculated as a logarithmic function of the measured SPL in the air to a reference effective pressure, which is considered the hearing threshold, or:

$$SPL = 20 \log_{10} (P_e/P_o)$$

where: P_e = measured effective pressure of sound wave in micropascals (µPa), and

P_o = reference effective pressure of 20 µPa.

Noise data and analysis are primarily given in terms of **frequency** distribution. The levels are grouped into **octave bands**. Typically, the center frequencies for each octave band are 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hertz (Hz). The human ear responds to the pressure variations in the atmosphere that reach the eardrum. These pressure variations are composed of different frequencies that give each sound we hear its unique character.

Due to the complexity of human ear functions, the measurement of different noise sources does not always correspond to relative loudness or annoyance. It is common practice to sum sound levels over the entire audible spectrum (i.e., 20 Hz to 20,000 Hz) to give an overall sound level, but human hearing varies in sensitivity depending on the frequency of the sound. Specifically, the human ear is most responsive to sound with the 1,000 Hz to 6,000 Hz frequency range. To account for the response of humans, it is common to use the “***A-weighted***” sound level (noted in units of **dBA**) in evaluating noise sources and their effects on a human since it models how the human ear responds to noise levels in the sensitive frequencies outlined above. Typical sound pressure levels of common noise sources are presented in Table 5.7-1.

Table 5.7-1: Sound Pressure Levels of Typical Sounds Sources

Activity / Sound	Sound Pressure Level (dBA)
Air Raid Siren at 50 feet (ft)	120
Jackhammer at 15 meters (m)	95
Loud Shout	90
Heavy Truck at 15 m	85
Vacuum Cleaner at 3 m	70
Automobile (100 kilometers per hour (km/hr) at 30 m	65
Normal Conversation at 1 m	60
Quiet Living Room	40
Soft Whisper at 2 m	35
Unoccupied Broadcast Studio	28
Threshold of Hearing	0

Source: Harris 1991

Since the decibel scale is logarithmic, a sound that is twice the sound pressure level as another will be 3 decibels (3 dB) higher. A change of 3 dBA is generally barely perceptible by humans, while a 5 dBA change is perceptible, and a 10 dBA increase is perceived as a doubling of the sound pressure level. (Cowan 1994)

Measured SPL data collected during a typical noise study consists of the following noise parameters:

- L_{eq} – The SPL averaged over the measurement period; this parameter is the continuous steady SPL that would have the same total acoustic energy as the real fluctuating noise over the same time.
- L_{max} – The maximum SPL for the sampling period.
- L_{min} – The minimum SPL for the sampling period.
- L_n – The SPLs that were exceeded *n* percent of the time during the sampling period. For example, L_{90} is the level exceeded 90 percent of the time, L_{50} is exceeded 50 percent of the time, and L_{10} is exceeded 10 percent of the time.

The SPL averages were calculated using the following formula:

$$\text{Average SPL} = 10\ \text{Log}\ \frac{\sum_{i=1}^{N} 10^{(SPL_i/10)}}{N}$$

where: N = number of observations
SPL = individual SPL in data set

Some noise sources and industrial activities are inherently likely to give rise to tonal noise, otherwise known as a "***pure tone***". Pure tones are more noticeable than broadband noise and therefore be more intrusive. The Identification of pure tones can be quantified by using the method developed in Annex D of ISO 1996:2007(E). This method identifies a pure tone using the time-average sounds pressure level in the one-third-octave band equal to or exceeding the time-averaged sound pressure levels of both adjacent one-third-octave bands in accordance with the following:

- 15 dB in low-frequency bands (25 Hz to 125 Hz)
- 8 dB in middle-frequency bands (160 Hz to 400 Hz)
- 5 dB in high-frequency bands (500 Hz to 10,000 Hz)

Environmental noise levels vary over time and are described using an overall sound level known as the **L_{eq}**, or equivalent sound pressure level. The L_{eq} is the energy averaged continuous sound pressure level which has the same total energy as the time-varying noise level over a stated time. The day-night average sound level (**L_{dn}**) is a common metric in evaluating sound impacts to noise sensitive receptors. The L_{dn} is the 24-hour average SPL calculated with a 10 dBA "penalty" added to nighttime hours (10 p.m. to 7 a.m.). This is done to evaluate potential human response in residential land uses where humans are more sensitive to nighttime noise impacts. The equation for L_{dn} is:

$$L_{dn} = 10\ \log \frac{15 \times 10^{\frac{L_d}{10}} + 9 \times 10^{\frac{L_n+10}{10}}}{24}$$

where: L_d = daytime L_{eq} for the period 0700 to 2200 hours
L_n = nighttime L_{eq} for the period 2200 to 0700 hours

The L_{dn} can be calculated based on the overall average sound average (L_{eqdn}) and as a percentile such as the L_{90} (L_{90dn}). The sound pressure levels of typical noise environments are presented in Table 5.7-2.

The EPA has recommended an outdoor L_{dn} of 55 dBA for residential and farming areas (EPA, 1974). For industrial areas, an L_{eq} of 70 dBA is suggested. The Department of Housing and Urban Development (HUD) recommended goal for exterior noise levels is not to exceed an L_{dn} of 55 dBA. In contrast to EPA's recommendation, the HUD recommendation for exterior noise is 65 dBA measured as L_{dn} (HUD 2009).

Table 5.7-2: Sound Pressure Levels of Typical Environments

Activity / Sound	Sound Pressure Level (dBA)
Rock Concert	110
Subway Platform with Passing Train	100
Sidewalk with Passing Heavy Truck or Bus	90
Sidewalk by Typical Highway	80
Sidewalk of Typical Road with Passing Traffic	70
Typical Urban Area	60 – 70
Typical Suburban Area	50 – 60
Quiet Suburban Area at Night	40 – 50
Typical Rural Area at Night	30 – 40
Quiet Living Room	40
Isolated Broadcast Studio	20 - 30

Source: Harris 1991.

Generally, the noise assessment carried out is completed on locations where it is expected noise effects from the Project activities can affect humans. Specific study areas have been identified as being representative of all sensitive receptors, which could be affected by noise emissions associated with project activities.

5.7.2 Affected Environment

5.7.2.1 Local Land Use and Noise Sources

The Project site is on a mostly flat plain at an elevation of approximately 60 feet (ft) with a rapid uphill change moving toward the south toward Cerra Cabrillo and Hollister Peak. Hollister Peak is a summit of over 1,400 ft, with a gradual uphill slope to the north of the Project. The Project area is sparsely populated with some residential land use accessed from roadways. The Project site land use is primarily undeveloped and unoccupied on private land. Because noise attenuates with distance, the impact area for this noise study included receptors located within 1 mile of the Project.

Existing sources of noise in the Project area include California State Road 1 traffic noise, local agricultural noise, local roadway noise, distant firearm noise from the San Luis Obispo Sportsmen's Association, and sounds of nature typical to the area.

The receptors most sensitive to noise typically include residences, hospitals, schools, parks, and churches. These receptors are identified as noise sensitive areas (NSAs). The closest NSAs are residences and trails surrounding Cerro Cabrillo of the Morro Bay State Park, no other NSA’s are located within 1 mile of the Project.

5.7.2.2 Ambient Noise Survey

5.7.2.2.1 Noise Measurement Procedures

Noise levels were measured at seven locations at or near the Project boundaries from July 10 through July 11, 2021. The primary baseline monitoring location collected area-wide sound data for 25 hours that was representative of the Project area. Additional individual measurements allow for baseline data to be collected at or near existing sensitive receptors most likely to be affected by the Project during the daytime and at night. Noise measurements were collected at five of the off-site monitoring locations during the morning, afternoon, and nighttime. A sixth location consisted of only a daytime measurement as this location was located inside the State Park – which would not be affected during nighttime due to the park hours of sunrise to sunset. The daytime and nighttime measurements were collected for a minimum of 15 minutes to collect noise levels representative of the existing environment as determined by the on-site noise specialist. The monitoring locations, dates, and sample type are presented in Table 5.7-3. These locations along with the current plot plan and noise sensitive receptors are presented in Figure 5.7-1.

LEGEND

- MONITORING LOCATOINS

ROUTE

- PREFERRED ROUTE
- ALTERNATE 1
- ALTERNATE 2
- PECHO SITE

REFERENCE(S)
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
HYDROSTOR, INC.

PROJECT
PECHO ENERGY STORAGE CENTER

TITLE
NOISE MONITORING LOCATIONS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	10/7/2021
DESIGNED	MR
PREPARED	MR
REVIEWED	GM
APPROVED	DS

PROJECT NO.	CONTROL	REV.	FIGURE
21465954	-	A	**5.7-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25mm

Table 5.7-3: Monitoring Locations Included in the Baseline Noise Study

Site	Geographic Coordinates		Monitoring Dates	Sample Type
	Latitude	Longitude		
PECHO-1	35.356506	-120.801269	July 10-11, 2021	15-minute minimum daytime/nighttime
PECHO-2 Daytime	35.361540	-120.808770	July 10-11, 2021	15-minute minimum daytime
PECHO-2 Nighttime	35.361737	-120.810712	July 11, 2021	15-minute minimum nighttime
PECHO-3	35.354584	-120.787192	July 10-11, 2021	15-minute minimum daytime/nighttime
PECHO-4	35.361141	-120.803521	July 10-11, 2021	15-minute minimum daytime/nighttime
PECHO-5	35.375677	-120.847864	July 10-11, 2021	15-minute minimum daytime/nighttime
PECHO-6	35.348149	-120.808589	July 11, 2021	15-minute minimum daytime
PECHO-7	35.354016	-120.797249	July 10 to 11, 2021	25-hour continuous monitoring

The monitoring duration is dependent on the complexity of the noise environment being monitored. The more complex the environment, the longer the preferred duration of the measurement, and the less complex the environment, the less the monitoring duration. Daytime noise environments are typically more complex than nighttime environments due to human activities that generate noise. The minimum background measurement period outlined in ANSI/ASA S12.9-2013 is 10 minutes (ANSI/ASA 2013). The project area was of minimal complexity, with only local traffic noise being the primary noise source, therefore all measurements were taken for a minimum of 15 minutes to collect representative noise levels of these locations. In addition, measurements at multiple locations provide a better description of area-wide noise baseline levels than longer measurements at fewer locations over a similar timeline

Measurement techniques set forth by the ANSI S12.9-2013/Part 3, 2013, were used and included using a Type - 1 sound level meter set to the slow response mode to obtain consistent, integrated, A-weighted SPLs. Concurrent one-third octave band frequencies were also measured at all sites. The octave band data from each monitoring site were measured and stored during each monitoring period. The SPL data were analyzed in both dB and dBA. The higher the decibel value, the louder the sound.

The noise monitoring equipment used during the study included:

- Larson Davis Model 824 and 831 Precision Integrating Sound Level Meters with Real-Time Frequency Analyzers
- Larson Davis Model PRM902 Microphone Preamplifier
- Larson Davis Model 2560 Pre-polarized ½-inch Condenser Microphone
- Windscreen, tripod, and various cables
- Larson Davis Model CAL200 Sound Level Calibrator (CAL200), 94/114 dB at 1,000 Hz

Monitoring was conducted using the sound level meter mounted on a tripod at a minimum height of 1.5 meters (5 feet) above grade. A windscreen was used since measurements were taken outdoors. The windscreen protects the microphone from interference from wind up to a constant wind speed of 12 miles per hour (mph). Measurements were not collected if wind gusts continually exceeding 12 mph were observed. The microphone was positioned so that a random incidence response was achieved. The sound level meter and octave band analyzer were calibrated immediately before and just after each sampling period using the CAL200 to provide a quality control check of the sound level meter's operation during monitoring.

The operator recorded detailed field notes during monitoring that included major noise sources in the area. The Larson Davis sound level meters comply with Type I – Precision requirements set forth for sound level meters and one-third octave filters. Calibration reports for the Larson Davis Sound Level Meters can be found in Appendix 5-7A. Weather data from the closest airport was downloaded for the time when monitoring was completed. The data shows that there were no weather events (rain, excessive wind, or high humidity) that would have interfered with noise monitoring during the field campaign. Weather data from the monitoring period from the nearest reporting airport can be found in Appendix 5.7.

5.7.2.2.2 Existing Baseline Environment

Noise levels in the area of the Project are variable; the major noise sources included traffic on California State Road 1, which included truck traffic, typical sounds of nature, and transmission line. Monitoring locations were selected based on two goals. Measurements were collected as either short-term (approximately 15 minutes in duration at six locations) or long-term (25 hours in duration at one location). In general, the 25-hour measurement represents the entire spectrum of area-wide noise levels, and the individual location short-term measurements represent noise levels at NSAs. A summary of all measurements can be found in Table 5.7-4.

5.7-4: Noise Summary Table Baseline Ambient Sound Pressure Levels Observed at the Pecho Site July 2021

Monitoring Location	Date	Time	Start Time (HH:MM)	Sound Pressure Levels (dBA) L_{Min}	L_{max}	L_{10}	L_{50}	L_{90}	L_{eq}	L_{90dn} [a]	L_{eqdn} [b]	Observations
Site 1: Farming Residences	11-Jul-21	Morning	10:07	35.7	61.3	49.8	45.5	41.3	46.6			Highway noise. Distant gunshots from range.
	11-Jul-21	Afternoon	14:04	38.0	60.6	48.7	45.1	42.6	46.2			Highway noise. Distant gunshots from range. Plane overhead.
	10-Jul-21	Nighttime	22:29	36.7	56.6	51.3	47.9	44.1	48.5	50.3	54.7	Dogs nearby, insects. Highway noise. Plane overhead.
Site 2: Quintana Road	11-Jul-21	Morning	10:47	41.3	71.4	59.2	54.3	51.1	56.3			Sheep. Highway noise. Distant gunshots. Birds. Bicycles.
	10-Jul-21	Afternoon	15:55	45.0	71.9	58.4	55.5	52.4	56.2			Highway noise, birds, rooster, distant gunshots.
	11-Jul-21	Nighttime	0:39	36.9	65.4	47.0	39.5	38.4	45.5	51.3	56.0	Transmission line cracking. Slight hum from generator of RV. Highway noise - sporadic.
Site 3: Canet Road	11-Jul-21	Morning	11:19	41.2	67.8	57.1	54.3	50.6	54.7			Highway noise. Hawk in nearby tree. Insects, birds. Distant gunshots. Local cars.
	10-Jul-21	Afternoon	16:28	42.3	72.4	56.1	53.1	50.3	54.1			Highway noise, neighborhood residents, wind in trees. Local cars.
	11-Jul-21	Nighttime	1:08	33.7	64.7	48.1	40.7	39.3	45.8	50.2	55.1	Birds. Morro Bay - distant cars. Owls. Insects. Limited highway noise.
Site 4: Adobe Road	11-Jul-21	Morning	10:27	41.1	65.4	53.7	51.0	48.4	52.5			Birds in trees. Distant gunshots. Highway noise. Helicopter.
	10-Jul-21	Afternoon	16:57	44.1	68.1	54.1	51.0	48.8	52.9			Highway noise, distant gunshot noise. Birds.
	10-Jul-21	Nighttime	23:02	37.2	61.0	50.0	46.0	42.5	47.3	50.6	55.1	Highway noise. Insects. Motorbikes.
Site 5: Radcliff Avenue	11-Jul-21	Morning	9:36	46.5	72.9	55.8	53.3	50.9	54.2			Transmission line cracking. Highway noise. Birds. Local traffic.
	10-Jul-21	Afternoon	17:34	45.8	65.0	55.6	54.0	52.1	54.4			Transmission line cracking. Highway noise. Birds. Local traffic.
	11-Jul-21	Nighttime	0:00	47.4	57.1	51.4	50.0	49.0	50.2	56.0	57.5	Transmission line cracking. Highway noise. Insects.
Site 6: Quarry Trail End	11-Jul-21	Daytime	12:29	37.6	61.4	46.4	43.4	40.8	44.7			Wind in grasses. Highway noise. Distant gunshots. Plane overhead. Insects, birds.
Long Term Monitoring	10-Jul-21 to	Continuous	12:00	29.6	85.9	51.9	42.0	39.4	47.6	43.0	48.8	Highway noise. Farming pickup trucks. Distant gunshots.
	9-Jul-21											
Kern County General Plan, Chapter 3 Noise Element - exterior noise at residential receptor											65.0	

Source: Golder 2021

[a] Calculated using the daytime L_{90} and the nighttime L_{90}

[b] Calculated using the daytime L_{eq} and the nighttime L_{eq}

5.7.3 Long-Term Monitoring

The long-term monitoring site was located on the Project site along the northern property boundary. Sounds of nature (birds and insects, etc.), traffic along California State Road 1, and farm equipment noise were the observed sounds during the study.

The L_{eq} and L_{90} measured at the Long-term Site were 47.6 and 39.4 dBA, respectively, and the L_{dn} was as an L_{eq} and an L_{90} was 48.8 dBA and 43.0 dBA respectively. Figure 5.7-2 is a graph of the L_{eq} and L_{90} sound pressure levels during the study. The difference between the L_{eq} and L_{90} was caused by transient noises such as traffic along California State Road 1 and Farm equipment/trucks at the beginning of the monitoring. Table 5.7-5 shows the measured hourly noise levels from the 25-hour location along with summary metrics and averages.

Table 5.7-5: Summary of Long-term Sound Pressure Levels (dBA)

Date	Time	L_{10}	L_{50}	L_{90}	L_{eq}
Saturday, July 10, 2021	12:00	65.4	53.0	49.4	60.8
	13:00	45.4	42.8	40.3	43.4
	14:00	43.7	41.8	40.5	42.2
	15:00	42.6	40.8	39.7	41.2
	16:00	44.1	40.8	39.3	42.0
	17:00	42.4	40.5	39.2	40.8
	18:00	43.4	40.7	39.4	41.4
	19:00	48.3	41.1	39.2	44.2
	20:00	41.6	39.1	37.8	39.7
	21:00	41.1	38.1	37.0	39.1
	22:00	42.5	39.3	38.3	40.8
	23:00	38.8	36.5	35.5	37.1
Sunday, July 11, 2021	0:00	36.4	34.5	33.8	35.1
	1:00	34.9	33.0	32.2	33.5
	2:00	35.4	33.2	32.5	34.3
	3:00	34.8	33.5	32.8	33.9
	4:00	36.6	34.8	34.1	35.4
	5:00	43.5	38.5	36.5	40.4
	6:00	42.1	38.5	36.7	39.7
	7:00	40.0	36.7	34.7	37.7
	8:00	39.6	35.8	33.7	37.0
	9:00	41.2	36.8	34.9	38.5
	10:00	45.6	41.1	37.6	42.8
	11:00	43.6	39.8	37.8	40.9
	12:00	41.6	39.0	37.4	39.6
Average		51.9	42.0	39.4	42.8
Daytime (7:00 am–10:00 pm)		53.7	43.4	40.7	43.8
Nighttime (10:00 pm–7:00 am)		39.6	36.4	35.2	40.3
L_{dn}				43.0	48.8

Source: Golder 2021

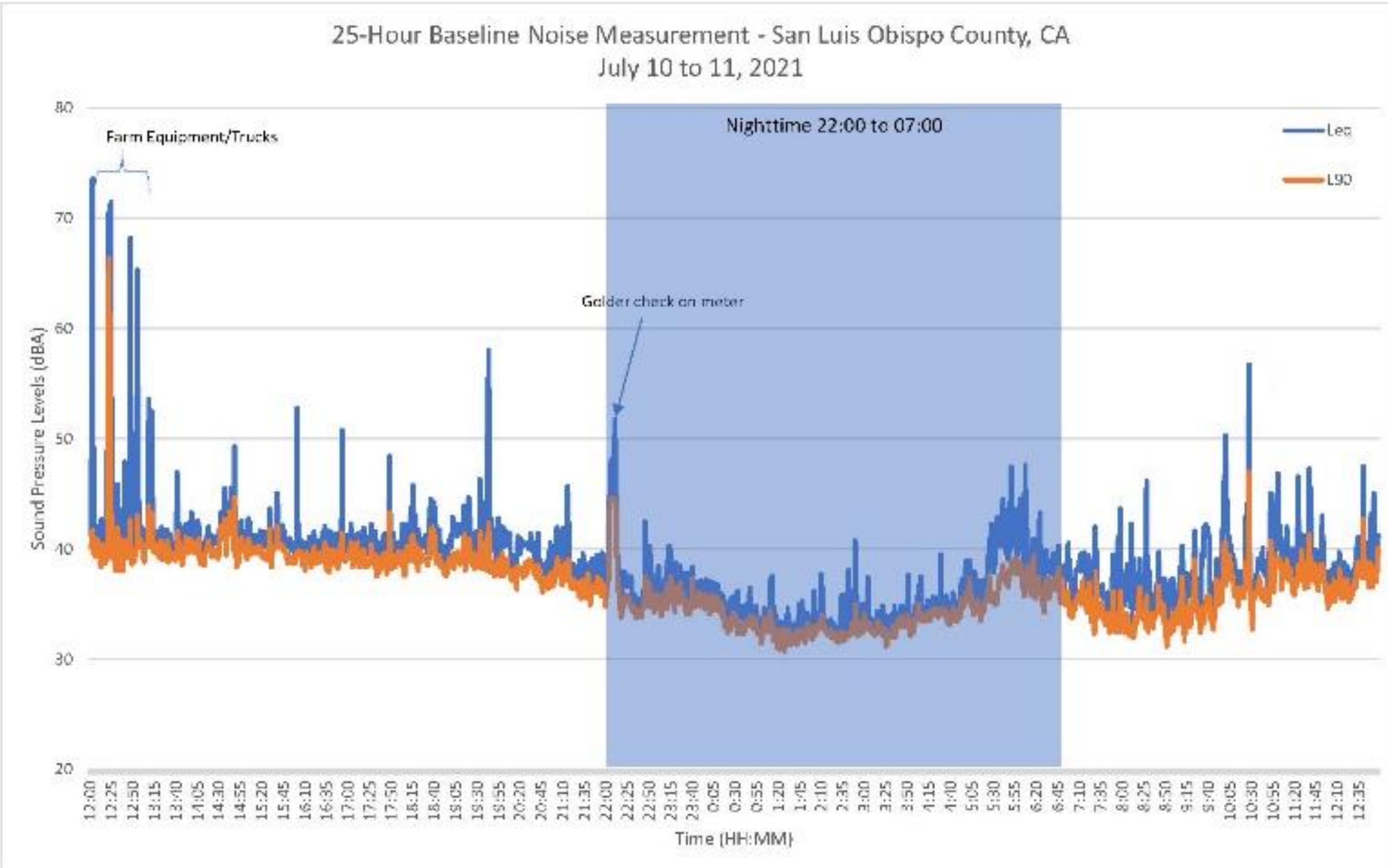

Figure 5.7-2 Baseline Noise Measurement (25-Hour)

Pecho Energy Storage Center

5.7.4 Short-Term Monitoring

Vehicle traffic along California State Road 1 is the major noise source in the area and was generally greater during the daytime than during the nighttime as anticipated. The daytime L_{eq} ranged from a low of 44.7 dBA at Site 6 to a maximum of 56.3 dBA at Site 2. The nighttime L_{eq} ranged from a low of 45.5 dBA at Site 2 to a high of 50.2 dBA at Site 5.

The sound level that is exceeded 90 percent of the time (L_{90}) is commonly used when comparing noise monitoring results between locations. This excludes most transient and intermittent noise sources, such as traffic noise, airplane noise, birds chirping, etc. The L_{90} is better used to compare measurements between sites where transient noises may vary greatly. The daytime L_{90} ranged from a low of 40.8 dBA at Site 6 to a maximum of 52.4 dBA at Site 2. The nighttime L_{90} ranged from a low of 38.4 dBA at Site 2 to a high of 49.0 dBA at Site 5.

The day-night average (L_{dn}) sound pressure levels that are used to account for the potential sensitivity to nighttime noise at residential receptors ranged from 37.7 dBA at Site 4 to 41.3 dBA at Site 3. Highway traffic noise was audible at all locations and was louder during the daytime than at night as traffic levels decreased. Transmission line corona noise was a continuous noise source observed at Site 5 and was more pronounced during the nighttime when there was less traffic and wind noise.

5.7.4.1 Site-1 – Short Term Monitoring Location

This site is located along San Luisito Creek Road a quarter of a mile northwest of the center of the Project on the farmland. Vehicular traffic along California State Road 1, sounds of nature (i.e., birds, insects, etc.), and distant gunshot noises from a local range were the common noise sources observed during the study.

Overall, the noise levels at this site were consistent during the daytime and at night. The daytime L_{eq} was 46.2 dBA during the afternoon and 46.6 dBA in the morning. The nighttime L_{eq} was 48.5 dBA and the calculated L_{eqdn} was 54.7 dBA. The L_{90} used to compare inter-site readings was 41.3 dBA in the morning and 42.6 dBA in the afternoon. The nighttime L_{90} was 44.1 dBA and the calculated L_{90dn} was 50.3 dBA.

5.7.4.2 Site-2 – Short Term Monitoring Location

This site is located northwest of the Project along Quintana Road near the residential receptors. Sounds of nature, California State Road 1, and local traffic were the noise sources observed during the study.

Overall, the noise levels at this site were greater during the daytime. The daytime L_{eq} was 56.3 dBA in the morning and 56.2 dBA during the afternoon. The nighttime L_{eq} was 45.5 dBA and the calculated L_{eqdn} was 56.0 dBA. The L_{90} used to compare inter-site readings was 51.1 dBA in the morning and 52.4 dBA in the afternoon. The nighttime L_{90} was 38.4 dBA and the calculated L_{90dn} was 51.3 dBA.

5.7.4.3 Site-3 – Short Term Monitoring Location

This site is east of the Project along Canet Road located near residential receptors. Vehicular traffic along California State Road 1, distant gunshots and sounds of nature were sources observed during the study.

Noise levels at this site were greater during the daytime. The daytime L_{eq} was 54.7 dBA in the morning and 54.1 dBA during the afternoon. The nighttime L_{eq} was 45.8 dBA and the calculated L_{eqdn} was 55.1 dBA. The L_{90} used to compare inter-site readings was 50.6 dBA in the morning and 50.3 dBA in the afternoon. The nighttime L_{90} was 39.3 dBA and the calculated L_{90dn} was 50.2 dBA.

There was more transient noise from California State Road 1 during the daytime when compared to the nighttime.

5.7.4.4 Site-4 – Short Term Monitoring Location

This site is along Adobe Road north-northwest of the Project, about 300 feet from a residential receptor. Sounds of nature and traffic along California State Road 1, and local cars were noise sources observed during the measurements.

Overall, the noise levels at this site were variable during the daytime and more constant at night. The daytime L_{eq} was 52.5 dBA during the morning and 52.9 dBA in the afternoon. The nighttime L_{eq} was 47.3 dBA and the calculated L_{eqdn} was 55.1 dBA. The L_{90} used to compare inter-site readings was 48.8 dBA in the morning and 48.8 dBA in the afternoon. The nighttime L_{90} was 42.5 dBA and the calculated L_{90dn} was 50.6 dBA.

There was more transient noise from California State Road 1 during the daytime when compared to the nighttime.

5.7.4.5 Site-5 – Short Term Monitoring Location

This site is located west-northwest of the Project near the intersection of Hillcrest Drive and Radcliff Avenue in a residential neighborhood close to a transmission line pathway. Highway traffic, local car traffic, sounds of nature (birds and insects, etc.), and transmission line corona were sources observed during the study.

Overall, the noise levels at this site were constant during the daytime and night. The daytime L_{eq} was 54.2 dBA during the morning and 54.4 dBA in the afternoon. The nighttime L_{eq} was 50.2 dBA and the calculated L_{eqdn} was 57.5 dBA. The L_{90} used to compare inter-site readings was 50.9 dBA in the morning and 52.1 dBA in the afternoon. The nighttime L_{90} was 49.0 dBA and the calculated L_{90dn} was 56.0 dBA.

Daytime and nighttime noise levels were greatly influenced by the consistent sound of the transmission line with transient noise (mostly vehicle traffic) more common during the daytime measurements.

5.7.4.6 Site-6 – Short Term Monitoring Location

This site is located about 0.7 miles southwest of the Project along the Quarry trail of Morrow Bay State Park. Sounds of nature and wind-generated noises were the observed sounds during the study.

The L_{eq} and L_{90} observed during the daytime measurement were 44.7 dBA and 40.8 dBA, respectively. There was no nighttime measurement performed or L_{dn} calculated as the trails are closed during nighttime hours. Therefore, there are no receptors to be affected during the night at this location.

5.7.5 Environmental Analysis

Noise will be produced during the construction and operation of the project. Potential noise impacts from construction and operation activities are assessed in this subsection.

5.7.5.1 Significance Criteria

Following the California Environmental Quality Act guidelines (Title 14, California Code of Regulations [CCR], Appendix G, Section XI), the project would cause a significant impact if it would result in the following:

- Exposure of people to noise levels above standards established in the local General Plan or noise ordinance
- Exposure of people to excessive ground-borne noise levels or vibration
- Substantial permanent increase in ambient noise levels in the project vicinity
- Substantial temporary or periodic increase in ambient noise levels in the project vicinity

The design basis for noise control is the most stringent (lowest), noise level required by any of the applicable LORS. Therefore, noise from the project is evaluated against San Luis Obispo County standards outlined in the Noise Element. The county has prohibited noise within sensitive land uses in Project impact areas as not to exceed 65 dBA as an L_{dn} in areas of outdoor activity and not to exceed 45 dBA as an L_{dn} within interior living spaces.

The California Energy Commission (CEC) staff has previously stated that an increase in background noise levels up to 5 dBA in a residential setting is insignificant; an increase of more than 10 dBA is generally considered significant; and an increase between 5 and 10 dBA may be either significant or insignificant, depending on the particular circumstances of the project. The CEC staff also has concluded that construction noise is typically insignificant if the construction activity is temporary if noisy construction activities are limited to daytime hours, and if all feasible noise abatement measures are implemented for noise-producing equipment.

5.7.5.2 Construction Impacts

5.7.5.2.1 Center Construction Noise

Construction of the PESC is expected to be typical of other conventional power plants in serval aspects including the schedule, equipment used, and other types of activities. In addition to these aspects, there will be a-typical construction phases similar to a small mine or quarry including the removal and hauling of overburden and the digging/drilling of shafts similar to that of a mine. The noise level will vary during the construction period depending on the construction phase. For this study, the period of construction where the most equipment has been planned to be operating at the same time was analyzed as the worst case (loudest) period of construction. This timeline was construction months 15 to 18 and included both surface and cavern work.

Because specific information on types of construction equipment is not available at this point in project development, information from similarly sized industrial projects was used. The source of data used in determining impacts included vendor-supplied noise source data, field data collected by Golder, and U.S. Environmental Protection Agency (EPA) noise studies. In the 1970s, the U.S. EPA Office of Noise Abatement and Control had previously developed sound levels from individual pieces of construction equipment (EPA 1971). While some data represents sound levels for equipment more than 40 years old, they would be considered conservative as newer equipment would run much quieter. Sound levels of more modern construction equipment have evolved toward quieter designs to protect operators from exposure to high noise levels.

The number of pieces of equipment and schedule (usage rates) has been estimated and incorporated into this study.

5.7.5.2.2 Construction Noise Impact Methodology

The construction noise impact evaluation of the Project was performed using CadnaA, an environmental noise propagation computer program that was developed to assist with noise propagation calculations for major noise sources and projects. For this analysis, the major noise sources modeled are associated with Project construction activities between months 15 and 18 when the most construction equipment will be operating at the same time and is estimated to have the highest noise impacts from the construction phase. This includes both surface and cavern work and includes 108 pieces of construction equipment operating.

Noise sources are entered as octave band SPLs. Coordinates for sources and receptors, either rectangular or polar, can be specified by the user. All noise sources are assumed to be area sources can be simulated by several point sources located in a defined area. As construction equipment is often mobile and no permanent equipment will be utilized, this is the best means of representing construction noise sources. Sound propagation is calculated by accounting for hemispherical spreading and three other user-identified attenuation options: atmospheric attenuation, path-specific attenuation, and barrier attenuation. Atmospheric attenuation is calculated using the data specified in the International Standards Organization Attenuation of Sound During Propagation Outdoors, Part 1: Calculations of the Absorption of Sound by the Atmosphere [International Standard Organization (ISO) 1993]. Path-specific attenuation can be specified to account for the effects of ground, vegetation, foliage, and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Attenuation due to barriers can be specified by giving the coordinates of the barrier. Barrier attenuation is calculated by assuming a defined barrier perpendicular to the source-receptor path. Total and A-weighted SPLs are calculated.

The model predicted the maximum noise levels produced by the Project using expected noise sources from surface and cavern noise sources. The noise sources include heavy equipment operations, loading and unloading of material, and on-site large and medium-sized vehicle traffic noise. The sources were modeled using an expected operational usage factor and do not include any periodic startup or shutdown noises.

Table 5.7-6 lists the configuration of the calculation parameters used to complete noise modeling for the Project.

Table 5.7-6: Noise Model Configuration Parameters

Parameter	Model Setting	Description/Notes
Standards	ISO 9613 only	All sources and attenuators are treated as required by the cited standard.
Source directivity	Horizontal area sources	No directivity was applied to modeled sources.
Ground absorption	1.0	Soft ground appropriate for the current and future area which is comprised of boreal forest and soil covered terrain
Temperature/humidity	20°C / 70% relative humidity	Assumed weather conditions
Wind conditions	Default ISO 9613 – moderate inversion condition	The propagation conditions in the ISO standard are valid for wind speeds between 4 and 18 km/hr; all points are considered downwind.
Terrain	Existing terrain considered	Existing ridgeline and changes in elevation in the impact area will affect sound propagation
Reflections	1	One reflection is taken into account as mirror image sources from reflecting structures.
Construction Operations	Daytime Only	Minimal construction activities are anticipated during nighttime hours and on weekends. Anticipated work during nighttime hours and weekends is limited to rock handling on the surface from the continual operations of the underground workings.
Noise Mitigation	None	The model does not include the planned natural buffers or existing foliage that will remain during project operations.

Sound pressure levels, noise source data, and usage rates input into the model are presented in Table 5.7-7. General compliance with OSHA regulations requires that heavy equipment outlined in the table is typically required to use backup alarms as a worker health and safety measure. Such alarms were not included in this study.

Table 5.7-7: Construction Noise Source Data

Equipment ID	Location	Number Used	Usage Rate (Hr/day)	Source Height (m)	Levels at Octave Band Centre Frequencies									dBA	dB	Source
					31.5	63	125	250	500	1000	2000	4000	8000			
Surface Work - Months 15 to 18																
Diesel Generators (60 KW/100 HP))	General	10	8	1		103	111	106	99	99	94	89	85	103.6	112.5	Noise from Construction, EPA 1971 (Const_8)
Pick-up Trucks (150 HP)	General	22	4	2	67	72	86	92	98	99	98	94	88	103.9	104.1	Field Measurement 12/20/11 @ Wolf Creek_gbm
Crawler Dozer (120 HP)	Civil	2	4	2		103	115	106	107	103	101	97	87	109.1	116.5	Vendor Supplied - Cat_D10/D11/D7 LGPa
Backhoe (120 HP)	Civil	15	4	2	68	81	93	97	99	100	100	94	88	105.0	105.7	Excavator - Komatsu PC 300, Field Measurement
Grader (160 HP)	Civil	5	4	2		103	115	106	107	103	101	97	87	109.1	116.5	Cat 14M Grader
Wheel Loader (120 HP)	Civil	1	4	2		102	110	101	102	99	93	89	82	103.7	111.7	Cat 988 Wheel Loader
Crawler Loader (120 HP)	Civil	11	4	2		102	110	101	102	99	93	89	82	103.7	111.7	Cat 988 Wheel Loader
Scraper (270 HP)	Civil	8	4	2		107	104	102	103	100	97	95	97	105.3	110.4	Noise from Construction, EPA 1971 (Const_4)
Roller (100 HP)	Civil	9	4	2	70	87	99	106	111	113	108	101	93	115.6	116.5	Cat CS76 Compactor
Pile Driver Hammer (250 HP)	Civil	2	4	2	131	132	127	116	119	122	124	117	110	127.5	135.5	Edison Electric Institute, 1984
Crane (200 HP)	Turbine Hall	2	4	2		112	119	117	115	110	105	99	93	115.6	122.4	Noise from Construction, EPA 1971
Welder (50 HP)	Turbine Hall	4	6	1		103	111	106	99	99	94	89	85	103.6	112.7	Noise from Construction, EPA 1971
Crane (200 HP)	Spheres	2	8	2		112	119	117	115	110	105	99	93	115.6	122.4	Noise from Construction, EPA 1971
Welder (50 HP)	Spheres	4	6	1	131	103	111	106	99	99	94	89	85	103.6	112.7	Noise from Construction, EPA 1971
Cavern Work - Months 15 to 18																
Drill Rig (675 HP)	Cavern	3	11	2	118	115	112	114	112	109	108	106	98	115.2	121.2	Bluewater Drill Rig Ops
30 Ton Crane (173 HP)	Cavern	3	4	2		112	119	117	115	110	105	99	93	115.6	122.3	Noise from Construction, EPA 1971
Water Pumps, 6" 58 HP	Cavern	3	11	1	95	96	97	98	97	99	96	92	86	102.8	105.3	Devon Project - Circ Pump, 55 kW
Track Hoe (187 HP)	Cavern	1	4	2		112	119	117	115	110	105	99	93	115.6	122.3	Noise from Construction, EPA 1971
Dump Truck (370 HP)	Cavern	1	4	2			119	116	113	110	106	102		115.2	121.6	Noise from Construction, EPA 1971

5.7.5.2.3 Modeling Results

Modeling results are summarized in Table 5.7-8 and illustrated in Figure 5.7-3. The modeling results show that noise propagation is affected by changes in terrain to the south and southeast causing varying noise levels at increasing distances from noise sources and not affected very much by the terrain in the remaining directions

The daytime construction noise impacts at the 23 identified NSAs ranged from a high of 60 dBA at NSA 01 to a low of 41 dBA at NSA 13. The highest contributor to the modeled noise level at NSA 01 was pile driver operations during surface work. The maximum calculated L_{dn} was recalculated by adding the modeled construction noise levels to the daytime baseline L_{90} and is 58 dBA an NSA 01, which is below California State standard of an L_{dn} of 65 dBA. There are no local limits for construction noise as long as it occurs during the daytime hours as outlined in San Luis Obispo County Code, Title 23, Chapter 6, Section 42 (SLO 1988, Rev.2019).

5.7.5.2.4 Construction Vibration

Vibrations could occur during large equipment operations, pile driving, drilling, compacting, and blasting. Vibrations will be limited to normal construction hours (during the daytime) and will be of short duration; therefore, no mitigation is required.

5.7.5.2.5 Worker Exposure to Noise

Worker exposure levels during the construction of the PESC will vary depending on the phase of the project and the proximity of the workers to the noise-generating activities. The project will develop a Hearing Protection Plan, which complies with California Division of Occupational Safety and Health (Cal/OSHA) requirements. This Hearing Protection Plan will be incorporated into the project construction Health and Safety Plan. The plan will require appropriate hearing protection for workers and visitors throughout the construction period.

5.7.5.3 Operational Impacts

5.7.5.3.1 Worker Exposure

Based on the noise levels of the indoor components of the PESC, it is highly likely that hearing protection will be required in the Turbine Hall building. At this stage of the project, vendor equipment has not been specified and vendor noise specifics/guarantees are unknown. Given an indoor environment and the expected size of the equipment, near-field maximum noise levels of 90 dBA at 3 feet could be exceeded.

Based on the noise levels of outdoor components, worker exposure to elevated noise levels in the outdoor environment will be limited to periods of time while working directly on, or next to noise generating equipment, if at all. Additionally, because there are no permanent or semi-permanent workstations located near any piece of noisy outdoor equipment, no visiting worker's time-weighted average exposure to noise should routinely approach the level allowable under Occupational Safety and Health (OSHA) standards (29 Code of Federal Regulations 1910.95).

Signs requiring the use of hearing protection devices will be posted in all areas where noise levels commonly exceed 85 dBA, such as inside acoustical enclosures. The project will comply with applicable Cal/OSHA requirements. Outdoor levels throughout the plant will typically range from 90 dBA near certain equipment to roughly 65 dBA in areas more distant from any major noise source. Therefore, noise impacts to visiting workers during operation will be less than significant.

Table 5.7-8: Modeled and Predicted Construction Noise Levels at Residential Receptors

Site [c]	Representative Land Use	A- Weighted Sound Levels (dBA)					
		Baseline		Modeled [a]	Predicted [b]		
		L_{90}, Day	L_{90}, Night		Day	Night	L_{dn}
24-Hour	Onsite	41	35	69	69	35	67
Site 1	Agricultural	43	44	63	63	44	61
Site 2	Residential	52	38	44	53	38	52
Site 3	Residential	51		48	53	39	52
Site 4	Residential	49	43	51	53	43	53
Site 6	State Park	41	41	49	49	41	50
NSA 01	Residential	41	35	60	60	35	58
NSA 02	Residential	41	35	57	57	35	55
NSA 03	Residential	41	35	54	55	35	53
NSA 04	Residential	41	35	49	50	35	48
NSA 05	Residential	51	39	49	53	39	52
NSA 06	Residential	51	39	49	53	39	52
NSA 07	Residential	51	39	43	51	39	51
NSA 08	Residential	51	39	40	51	39	50
NSA 09	Residential	41	35	38	43	35	44
NSA 10	Residential	41	35	40	43	35	44
NSA 11	Residential	41	35	36	42	35	43
NSA 12	State Park	41	41	48	49	41	50
NSA 13	Residential	41	41	33	41	41	47
NSA 14	Residential	43	44	34	43	44	50
NSA 15	Residential	52	38	45	53	38	52
NSA 16	Residential	52	38	42	53	38	52
NSA 17	Residential	52	38	40	53	38	51
NSA 18	Residential	52	38	44	53	38	52
NSA 19	Residential	52	38	45	53	38	52
NSA 20	Residential	49	43	50	53	43	53
NSA 21	Residential	49	43	44	50	43	51
NSA 22	Residential	41	35	37	42	35	44
NSA 23	Residential	41	35	41	44	35	44

Source: Golder Associates Inc, 2021.

[a] Modeled noise generated by proposed center operations configuration calculated by the noise model Cadna A.
[b] Predicted impacts were calculated by logarithmically adding the modeled impacts to the baseline measurements.
[c] Baseline from the most comparable monitoring locations used for NSA baseline.

LEGEND

MONITORING LOCATOINS

NOISE SENSITIVE AREA

NOISE CONTOURS

- 30 dBA
- 35 dBA
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA

PECHO SITE

REFERENCE(S)
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
HYDROSTOR, INC.

PROJECT
PECHO ENERGY STORAGE CENTER

TITLE
CONSTRUCTION NOISE MODELING IMPACTS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	10/7/2021
DESIGNED	MR
PREPARED	MR
REVIEWED	GM
APPROVED	DS

PROJECT NO.	CONTROL	REV.	FIGURE
21465954	-	A	5.7-3

PATH: G:\GIS\Sites\MorroBay_Rosmond\Maps\Noise\Pecho\5.7-3 CONSTRUCTION NOISE MODELING IMPACTS.mxd

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5.7.5.3.2 Transmission Line and Switchyard Noise Levels

One of the electrical effects of high-voltage transmission lines is corona. Corona is the ionization of the air that occurs at the surface of the energized conductor and suspension hardware attributable to very high electric field strength at the surface of the metal during certain conditions. Corona may result in radio and television reception interference, audible noise, light, and the production of ozone. Corona is generally a principal concern with transmission lines of 345 kilovolts (kV) and greater and with lines that are at higher elevations. Corona noise is also generally associated with foul weather conditions. Existing audible noise associated with the transmission lines in the area will be of the same magnitude upstream and downstream of the PESC. Because the PESC design voltage is 230 kV, it is expected that no corona-related design issues will be encountered, and any related impacts will be less than significant and temporary during foul weather events.

5.7.5.3.3 Plant Operational Noise Modeling

The operation of the PESC is expected to be typical of other power plants with major noise generating equipment located indoors including schedule, equipment used, and other types of activities. A noise model of the proposed Pecho was developed by Golder.

Operational Noise Impact Methodology

The general methodology used in evaluating the operational noise is outlined in section 5.7.3.2.1. For this analysis, all major noise sources will be modeled as operating during a normal fully operational scenario. No shutdown, start-up, or emergency operations were considered. All noise sources are assumed to be point sources; area sources can be simulated by several point sources located in a defined area. Indoor noise sources are modeled at the outer face of the structure as vertical or horizontal area sources.

The model predicted the maximum noise levels produced by the Project using expected noise sources from indoor and outdoor sources. The sources were modeled using an expected operational usage factor of 100 percent. This is a conservative assumption as there are different operational cycles where some equipment will be operating while other equipment will be shut down.

Table 5.7-9 lists the configuration of the calculation parameters used to complete noise modeling for the Project.

Table 5.7-9: Noise Model Configuration Parameters

Parameter	Model Setting	Description/Notes
Standards	ISO 9613 only	All sources and attenuators are treated as required by the cited standard.
Source directivity	Chimney	Directivity is only applied to stack exhaust in the vertical direction.
Ground absorption	1.0	Soft ground appropriate for the current and future area which is comprised of boreal forest and soil covered terrain
Temperature/humidity	20°C / 70% relative humidity	Assumed weather conditions
Wind conditions	Default ISO 9613 – moderate inversion condition	The propagation conditions in the ISO standard are valid for wind speeds between 4 and 18 km/hr; all points are considered downwind.
Terrain	Existing terrain considered	Existing ridgelines and changes in elevation in the impact area will affect sound propagation
Reflections	1	One reflection is taken into account as mirror image sources from reflecting structures.

Parameter	Model Setting	Description/Notes
Operations	Continuous	Continuous operations during the daytime and at night
Noise Mitigation	Building insertion loss for interior noise sources. Pump set barriers near the eastern boundary	Assumed metal sandwich-style building material with insulation, 7.5 inches thick. Assumed metal roll-up 24’ x 24’ garage doors. Barriers along northern, eastern, and southern sides of specified pump sets at a height of 13 ft (4 meters)

Sound pressure levels, noise source data, and usage rates input into the model are presented in Table 5.7-10.

Table 5.7-10: Operations Noise Source and Reduction Indicies Data

Equipment ID	Location	Type	Number Used	Source Height (m)	Levels at Octave Band Centre Frequencies									dBA	dB	Source
					31.5	63	125	250	500	1000	2000	4000	8000			
LP Compressor - 45,740 kW	Interior	Mechanical	4	2		91	101	113	124	129	130	131	129	136.7	135.6	Turbo Compressor train 9,966 kW
IP Compressor - 22,840 kW	Interior	Mechanical	4	2	107	103	108	107	105	108	113	110	103	116.9	117.2	BOG Compressor from Floridian LNG
HP Compressor - 22,630 kW	Interior	Mechanical	4	2		91	94	101	101	102	104	100	91	108.5	108.9	Siemens Compressor STC-SV 11,404 kW
Compressor Aux 560 kW	Interior	Mechanical	4	2	104	100	105	104	102	105	110	107	100	113.9	114.2	Recip. 200 kW air comp,Devon Pike 2 Project
Inlet Air w/ Silencer	Exterior	Mechanical	4	2	112	115	115	99	93	94	97	90	78	103.2	118.2	GE Power_200 MW_7FA05_0315
Exhaust Duct	Exterior	Mechanical	4	2	110	109	103	97	92	85	83	79	74	94.5	111.5	GE Data 27 Jul 01 Letter
Exhaust Stack	Exterior	Mechanical	4	2	132	128	122	121	118	115	104	88	69	119.5	132.3	GE Power_200 MW_7FA05_0315
LP Turbine	Interior	Mechanical	4	2	124	124	120	119	117	112	106	103	102	118.0	127.6	LP Turbine Black & Veatch
IP Turbine	Interior	Mechanical	4	2	124	124	120	119	117	112	106	103	102	118.0	127.6	LP Turbine Black & Veatch
HP Turbine	Interior	Mechanical	4	2	124	124	120	119	117	112	106	103	102	118.0	127.6	LP Turbine Black & Veatch
Thermal Fluid Pump 1361 kW, 836 m3/hr	Exterior	Mechanical	4	2	93	94	95	97	97	100	97	93	87	103.6	105.2	Guyer, 2013 An Introduction to Sound Level Data
Cooling Circ Pump-charge 1010 kW, 5,460 m3/hr	Exterior	Mechanical	2	2	99	100	101	102	101	103	100	96	90	106.8	109.3	Devon Project - HP BFW Pump, 1,100 kW
Cooling Circ Pump - discharge 53 kW, 291 m3/hr	Exterior	Mechanical	4	2	95	96	97	98	97	99	96	92	86	102.8	105.3	Devon Project - Circ Pump, 55 kW
Comp. Air Dryer Package 253 kW	Exterior	Mechanical	1	1	104	107	107	104	101	97	94	91	83	103.2	111.7	Compressed air dryer, coal project
Hot Tank Transfer Pump 1361 kW, 836 m3/hr	Exterior	Mechanical	2	2	99	100	101	102	101	103	100	96	90	106.8	109.3	Devon Project - HP BFW Pump, 1,100 kW
Transformer 350/420 MVA	Exterior	Electrical	2	2	101	107	109	104	104	98	93	86	79	104.3	112.6	FPL Data (Tom Joseph)
Transformer 15/20 MVA	Exterior	Electrical	4	2	93	99	101	96	96	90	85	80	74	96.4	104.7	Devon Project - Transformer 10 MW
Transformer 125 MVA	Exterior	Electrical	8	2	99	105	107	102	102	96	91	82	77	102.3	110.6	FPL Data
Motor - 50 MW Synchronous 1800 rpm, 13.8 kV	Interior	Electrical	8	2	97	99	101	101	101	101	101	98	91	106.6	108.9	Calculated based on Bies and Hansen, 2003 Table 11.25
Generator 100 MW Synchronous 3600 rpm, 13.8 kV	Interior	Electrical	4	2	97	99	101	101	101	101	101	98	91	106.6	108.9	Calculated based on Bies and Hansen, 2003 Table 11.26
Noise Reduction Indicies																
Turbine Hall Roof							15	20	28	37	43	40			32.0	VDI 2571
Turbine Hall Walls							20	29	43	48	56	57			41.0	VDI 2571
Turbine Hall Garage Door							14	16	20	25	29	23			25.0	VDI 2571

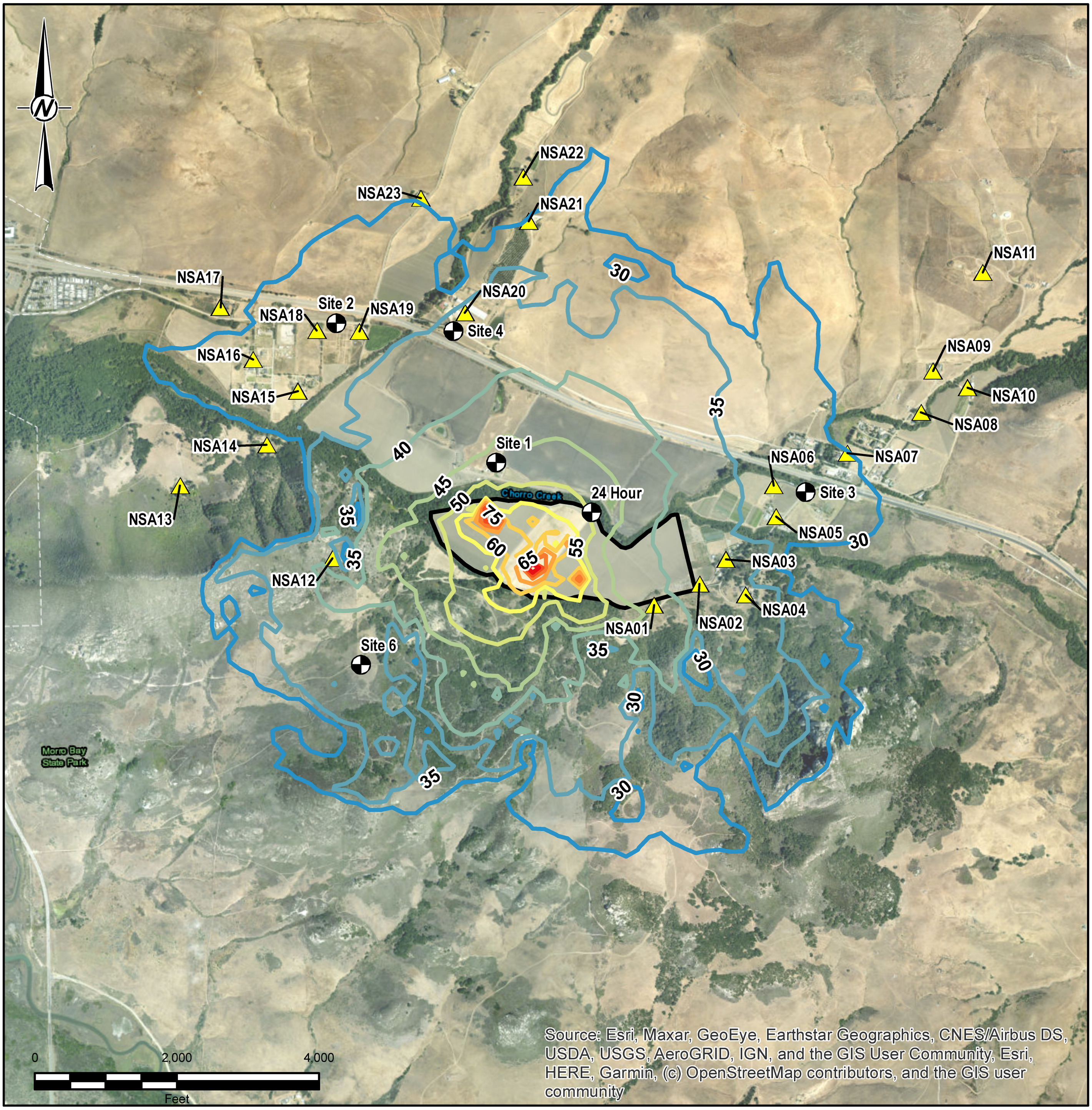
Modeling Results

Modeling results are summarized in Table 5.7-11 and illustrated in Figure 5.7-4. The modeling results show that noise propagation is affected by changes in terrain to the south and southeast causing varying noise levels at increasing distances from noise sources and is not affected by the terrain in the remaining directions. It is also affected by on-site barriers, buildings, and tanks some of which are sources themselves but also act as barriers to noise propagation

The daytime noise impacts at the 23 identified NSAs range from a high of 44 dBA at NSA 01 to a low of 19 dBA at NSA 014. The highest contributors to the modeled noise level at NSA 01 were the makeup pump set and the cold thermal fluid pump set.

Table 5.7-11: Modeled Operational Noise Levels at Residential Receptors

Site	Land Use	Modeled Results (dBA)
Site 1	Agricultural	47
Site 2	Residential	31
Site 3	Residential	31
Site 4	Residential	35
Site 6	State Park	36
NSA 01	Residential	44
NSA 02	Residential	42
NSA 03	Residential	40
NSA 04	Residential	36
NSA 05	Residential	34
NSA 06	Residential	33
NSA 07	Residential	29
NSA 08	Residential	27
NSA 09	Residential	26
NSA 10	Residential	26
NSA 11	Residential	24
NSA 12	State Park	37
NSA 13	Residential	23
NSA 14	Residential	19
NSA 15	Residential	32
NSA 16	Residential	30
NSA 17	Residential	29
NSA 18	Residential	31
NSA 19	Residential	32
NSA 20	Residential	35
NSA 21	Residential	31
NSA 22	Residential	24
NSA 23	Residential	29



LEGEND

MONITORING LOCATOINS

NOISE SENSITIVE AREA

NOISE CONTOURS

- 30 dBA
- 35 dBA
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA
- 75 dBA
- 80 dBA
- PECHO SITE

REFERENCE(S)
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
HYDROSTOR, INC.

PROJECT
PECHO ENERGY STORAGE CENTER

TITLE
OPERATIONAL NOISE MODELING IMPACTS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	10/25/2021
DESIGNED	MR
PREPARED	MR
REVIEWED	GM
APPROVED	DS

PROJECT NO.	CONTROL	REV.	FIGURE
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5.7.5.3.4 Tonal Noise

It is understood that tonal noise can be more of a nuisance to off-site receptors than broadband noise sources. At the nearby residential locations, no significant tones were identified in the baseline noise measurements, and none are anticipated from Project operations. However, audible tones are not impossible because certain sources within the plant (such as the combustion turbine inlets, transformers, and pump motors) have been known to sometimes produce significant tones mostly during start-up. Pecho will anticipate the potential for audible tones in the final design specifications of the plant's equipment and will take necessary steps to prevent sources from emitting tones that might be disturbing at the nearest receptors. Tonal noise issues are rare with similar type projects and, when evident, can be mitigated to reduce these sources of noise.

5.7.5.3.5 Ground and Airborne Vibration

The project consists of four , 100-MW (nominal) power blocks. Each power block will contain a motor-driven air compressor drivetrain, heat exchangers, and an air turbine generator, and their ancillary equipment. Each power block will share a common set of thermal storage tanks (hot and cold) as well as the air storage cavern. Such equipment is not known to cause off-site ground vibration nor airborne low-frequency noise (LFN) during normal operations. LFN is possible during startup conditions when turbines and motors can spin at a certain frequency causing LFN, but these instances are rare and occur for a very short duration (several minutes). Unlike a typical power plant, there is no combustion, lessening the possibility of LFN issues.

The Project anticipates the potential for low-frequency noise in the design and specification of the project equipment and will take necessary steps to prevent ground or airborne vibration impacts. The equipment that would be used in the project is well balanced and is designed to produce very low vibration levels throughout the life of the project. An imbalance could contribute to ground and airborne vibration levels in the vicinity of the equipment. Typically, vibration-monitoring systems are installed and are designed to ensure that the equipment remains balanced. Should an imbalance occur, the event would be detected, and the equipment would automatically shut down. Given these protective measures, impacts related to ground and airborne vibrations will be less than significant.

5.7.6 Cumulative Effects

As shown in Table 5.7-12, the predicted impacts were calculated by logarithmically adding operational modeled results to baseline daytime and nighttime sound levels at monitoring locations and at the seventeen additional NSAs identified in the Project impact area.

The predicted L_{dn} impact levels at the off-site sensitive receptor locations range from a high of 52 dBA at NSA 15 and NSA 19 to a low of 43 dBA at several NSAs. The maximum predicted difference in L_{dn} (Predicted L_{dn} value – Baseline L_{dn}) at a sensitive receptor is 2 dBA at NSA 01. NSA 02 is the only other site predicted to have an increase of baseline at 1 dBA.

Table 5.7-12: Modeled and Predicted Noise Levels at Boundary and Residential Receptors

Site [c]	Representative Land Use	A- Weighted Sound Levels (dBA)							
		Baseline			Modeled [a]	Predicted [b]			
		L_{90}, Day	L_{90}, Night	L_{dn} (L_{eq})		Day	Night	L_{dn}	L_{dn} Difference[c]
24-Hour	Onsite	41	35	49	50	50	50	56	7
Site 1	Agricultural	43	44	55	47	48	49	55	0
Site 2	Residential	52	38	56	31	52	39	51	0
Site 3	Residential	51	39	55	31	51	40	50	0
Site 4	Residential	49	43	55	35	49	43	51	0
Site 6	State Park	41	41	49	36	42	42	48	0
NSA 01	Residential	41	35	49	44	46	45	51	2
NSA 02	Residential	41	35	49	42	44	43	49	1
NSA 03	Residential	41	35	49	40	44	41	48	0
NSA 04	Residential	41	35	49	36	42	39	46	0
NSA 05	Residential	51	39	55	34	51	40	51	0
NSA 06	Residential	51	39	55	33	51	40	51	0
NSA 07	Residential	51	39	55	29	51	40	50	0
NSA 08	Residential	51	39	55	27	51	40	50	0
NSA 09	Residential	41	35	49	26	41	36	43	0
NSA 10	Residential	41	35	49	26	41	36	43	0
NSA 11	Residential	41	35	49	24	41	36	43	0
NSA 12	State Park	41	41	49	37	42	42	49	0
NSA 13	Residential	41	41	49	23	41	41	47	0
NSA 14	Residential	43	44	55	19	43	44	50	0
NSA 15	Residential	52	38	56	32	52	39	52	0
NSA 16	Residential	52	38	56	30	52	39	51	0
NSA 17	Residential	52	38	56	29	52	39	51	0
NSA 18	Residential	52	38	56	31	52	39	51	0
NSA 19	Residential	52	38	56	32	52	39	52	0
NSA 20	Residential	49	43	55	35	49	43	51	0
NSA 21	Residential	49	43	55	31	49	43	51	0
NSA 22	Residential	41	35	49	24	41	36	43	0
NSA 23	Residential	41	35	49	29	41	36	44	0

Source: Golder 2021.

[a] Modeled noise generated by proposed center operations configuration calculated by the noise model Cadna A.

[b] Predicted impacts were calculated by logarithmically adding the modeled impacts to the baseline measurements.

[c] Baseline from the most comparable monitoring locations used for NSA baseline.

[d] Predicted Ldn - Baseline Ldn, if result less than zero, corrected to zero.

CEC considers an increase to baseline L_{dn} of 5 dBA or less as insignificant and an increase of 10 dBA or more to be significant. Based on these criteria, Pecho will have no significant impacts on the closest 23 NSA's. This suggests the overall impact from the Project will be limited.

Outdoor conversations may experience mild annoyance when ambient noise levels are above 55 dBA; levels above 65 dBA are considered significant interference to conversations held outdoors (EPA 1974). The San Luis Obispo County noise standard is a daytime (7:00 am to 10:00 pm) hourly equivalent sound level (L_{eq}) of 50 dBA and a nighttime hourly L_{eq} of 45 dBA. If the measured ambient noise is greater than the standard, then the applicable standard is adjusted to be the ambient noise level plus 1 dB.

The predictive noise model suggests that noise generated by Project operations will be below these levels at the nearest residential receptors during both daytime, when outdoor activities are more likely, and nighttime hours. Therefore, no adverse impacts to outdoor activities from Project operations are expected. There were several NSAs that had predicted impacts greater than 50 dBA. This was due to ambient noise generated by California State Road 1 and the proximity to these NSAs. The modeled project operations had a marginal effect on the predicted impacts at these locations and did not cause there to be an exceedance of the 1 dBA adjusted ambient noise levels.

Homes have an average effective sound attenuation of 15 dBA between the outdoors and indoors (EPA 1974). The highest predicted daytime outdoor sound levels were 52 dBA at several NSAs and 45 dBA at NSA 01 at night. The predicted indoor sound levels from the Project would be 37 dBA and 34 dBA during the daytime and at night. This is below the EPA's guideline of 45 dBA for interior spaces of sensitive receptors and the county's indoor noise limits of 40 dBA during the daytime and 35 dBA at night.

5.7.7 Mitigation Measures

In addition to the operational attenuation measures incorporated into the design and discussed above, Pecho proposes to implement the following measures to minimize any potential noise impacts.

5.7.7.1 Noise Hot Line

The Applicant will establish a telephone number for use by the public to report any significant undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours per day, the project owner will include an automatic answering feature with date and time stamp recording to answer calls when the phone is unattended. This telephone number will be posted at the project site during construction in a manner visible to passersby. This telephone number will be maintained during the life of the project .

5.7.7.2 Noise Complaint Resolution

Throughout project construction and operation, the project owner will document, investigate, evaluate, and attempt to resolve all legitimate project-related noise complaints. The Applicant or authorized agent will do the following:

- Use the Noise Complaint Resolution Form typically suggested by CEC or a functionally equivalent procedure to document and respond to each noise complaint.
- Attempt to contact the person(s) making the noise complaint within 24 hours.
- Investigate to attempt to determine the source of noise related to the complaint.
- If the noise complaint is legitimate, take all feasible measures to reduce the noise at its source.

5.7.7.3 Construction Hours

The Project will follow the San Luis Obispo County Municipal Code, Title 23 Coastal Land Use Ordinance, Chapter 6 Operational Standards, there is an exception for construction noise if the work takes place between the hours of 7 a.m. and 10 p.m. on weekdays and between the hours of 8 a.m. and 5 p.m. on weekends.

5.7.7.4 Noise Barriers for Pump Sets

Due to the proximity of NSA 01 to the eastern Project property line, the following pump set included a 13 ft barrier along the northern, eastern, and southern sides of the pump set area in the operational noise model. The pump sets included equipment tag numbers and descriptions are the 20P-205 A – B Make-up Pumps.

The barrier attenuation assumes that the barriers reduce sound levels through the barrier to the point of being insignificant and that the sound levels at the off-site receptors consist of noise that has diffracted around the barriers.

5.7.8 Laws, Ordinances, Regulations, and Standards

The Laws, Ordinances, Regulations, and Standards (LORS) discussed in this section were used to evaluate the Project’s noise impacts during construction and operation and are discussed briefly in previous subsections. A summary of the LORS is presented in Table 5.7-13 below.

Table 5.7-13: Summary of LORS for Noise

LORS	Jurisdiction	Requirements	Agency	Section
EPA Noise Control Act, 1972	Federal	Guidelines for state and local Governments	EPA	5.7.6.1.1
Occupational Health and Safety Act of 1970	Federal	Exposure of workers over 8-hour shift limited to 90 dBA	OSHA	5.7.6.1.2
Cal/OSHA, Title 8 CCR Article 105 Sections 095 et seq.	State	Exposure of workers over 8-hour shift limited to 90 dBA	Cal/OSHA	5.7.6.2.1
California Vehicle Code Sections 23130 and 23130.5	State	Regulates vehicle noise limits on California highways.	Caltrans, California Highway Patrol, and the County Sheriff's Office	5.7.6.2.2
San Luis Obispo County, Title 23 Land Use Ordinance, Chapter 6 Operational Standards	Local	Exterior daytime noise limit of 50 dBA and a nighttime limit of 45 dBA as an hourly $L_{eq.}$ Maximum sound level limits are 70 dBA during the daytime and 65 dBA at night.	San Luis Obispo County	5.7.6.3
San Luis Obispo County, Title 23 Land Use Ordinance, Chapter 6 Operational Standards	Local	There is an exception to construction noise if the hours are limited between 7:00 a.m. to 9:00 p.m. on weekdays and 8:00 a.m. to 5:00 p.m. on weekends.	San Luis Obispo County	5.7.6.3
San Luis Obispo County, Title 23 Land Use Ordinance, Chapter 6 Operational Standards	Local	Exterior daytime noise limit of 40 dBA and a nighttime limit of 35 dBA as an hourly $L_{eq.}$ Maximum sound level limits are 60 dBA during the daytime and 55 dBA at night.	San Luis Obispo County	5.7.6.3

5.7.8.1 Federal LORS

5.7.8.1.1 EPA

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) administrator established the Office of Noise Abatement and Control (ONAC) to carry out investigations and studies on noise and its effect on public health and welfare. Through ONAC, the EPA coordinated all Federal noise control activities; but in 1981 the federal government concluded that noise issues were best regulated at the state and local level. While there are no federal, state, or local standards that apply to the Project, EPA has developed noise level guidelines requisite to protect public health and welfare against hearing loss, annoyance, and activity interference. These noise levels are contained in the EPA document "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." One of the purposes of this document was to provide a basis for state and local governments' judgments in setting standards. The document identifies a 24-hour exposure level of 70 dB as the level of environmental noise that will prevent any measurable hearing loss over a lifetime. Likewise, levels of 55 dB outdoors and 45 dB indoors are identified as preventing activity interference and annoyance. These levels of noise are considered those that will permit spoken conversation and other activities such as sleeping, working, and recreation, which are part of the daily human condition (EPA 1974).

The U.S. Department of Housing and Urban Development (HUD) has promulgated noise criteria and standards "to protect citizens against excessive noise in their communities and places of residence." These criteria relate to short-term and day-night average SPLs.

The equivalent SPL (L_{eq}) is the equivalent constant SPL that would be equal in sound energy to the varying SPL over the same period. The day-night average sound level (L_{dn}) is the 24-hour average SPL calculated with a 10 dBA "penalty" added to nighttime hours (10 p.m. to 7 a.m.). This is done because residential land uses are more sensitive to nighttime noise impacts. The equation for L_{dn} is:

$$L_{dn} = 10 \log \frac{15 \times 10^{\frac{L_d}{10}} + 9 \times 10^{\frac{L_n+10}{10}}}{24}$$

Where: L_d = daytime L_{eq} for the period 0700 to 2200 hours
L_n = nighttime L_{eq} for the period 2200 to 0700 hours

The EPA recommends an outdoor L_{dn} of 55 dBA for residential and farming areas. For industrial areas, an L_{eq} of 70 dBA is suggested. The HUD-recommended goal for exterior noise levels is not to exceed an L_{dn} of 55 dBA. However, the HUD standard for exterior noise is 65 dBA measured as L_{dn}. Without numerical noise limits, an L_{dn} of 55 dBA as recommended by EPA and HUD provides a recommended and conservative outdoor noise level for comparison of noise levels of the Project.

5.7.8.1.2 Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) regulates onsite noise levels. The permissible exposure level to noise for workers is 90 dBA over an 8-hour time-weighted average (TWA) work shift, to protect hearing (29 Code of Federal Regulations 1910.95). If an employee is exposed to greater than 85 dBA as an 8-hour TWA, then a hearing conservation program will be implemented and will ensure exposure levels remain below 90 dBA 8-hour TWA through engineering controls or personal protective equipment (PPE).

5.7.8.2 State LORS

5.7.8.2.1 Cal/OSHA

Cal/OSHA has the same regulations as the federal OSHA regulations outlined previously. The regulations are contained in Title 8, California Code of Regulations, General Industrial Safety Orders, Article 105, Control of Noise Exposure.

5.7.8.2.2 California Vehicle Code

Noise limits are enforceable on highways by the California Highway Patrol (CHP) and county sheriffs' offices. They are regulated under California Vehicle Code, Sections 23130 and 23130.5.

5.7.8.3 Local LORS

Guidelines for the Preparation and Content of Noise Elements of the General Plan published by the California Office of Noise Control in 1976 is a mandatory element of California Government Code Section 65302 (f)). San Luis Obispo County has several ordinances applicable to the project from a noise standpoint.

San Luis Obispo County Code, Title 23, Chapter 6, Section 42 – Exceptions to Noise Standards

This chapter exempts construction noise hours from the Noise Standards in sections 44 through 50 as long as the work is performed between to 7:00 a.m. to 9:00 p.m. on weekdays and 8:00 a.m. to 5:00 p.m. on weekends.

San Luis Obispo County Code, Title 23, Chapter 6, Section 44 - Exterior Noise Level Standards

The San Luis County Code, Title 23, Chapter 6 Operational Standards, Section 44 – Exterior Noise Level Standards establishes noise performance standards for proposed industrial sites in San Luis Obispo County. The chapter states that such projects must not subject noise sensitive land uses to exterior noise levels above:

- an hourly L_{eq} of 50 dB(A) during the daytime (7 a.m. to 10 p.m.) and 45 dB(A) at nighttime (10 p.m. to 7 a.m.).
- a maximum sound level of 70 dB(A) during the daytime and 65 dB(A) at nighttime.
- an adjusted limit of 1 dBA above baseline if baseline measurement exceeds the above limits.
- an adjusted limit of 5 dBA below the above limits for "simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises."

San Luis Obispo County Code, Title 23, Chapter 6, Section 46 - Interior Noise Level Standards

The San Luis County Code, Title 23, Chapter 6 Operational Standards ,Section 46 – Interior Noise Level Standards establishes noise performance standards for proposed industrial sites in San Luis Obispo County. The chapter states that such projects must not subject noise sensitive land uses to exterior noise levels above:

- an hourly L_{eq} of 40 dB(A) during the daytime and 35 dB(A) at nighttime.
- a maximum sound level of 60 dB(A) during the daytime and 55 dB(A) at nighttime.
- an adjusted limit of 1 dBA above baseline if baseline measurement exceeds the above limits.

- an adjusted limit of 5 dBA below the above limits for “simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.”

5.7.9 Agencies and Agency Contacts

No agencies were contacted directly to specifically discuss project noise.

5.7.10 Permits and Permit Schedule

5.7.11 References

American National Standards Institute (ANSI), American National Standard (ASA). S12.9-2013 (Part 3) (1993 and Revised 2013). Quantities and Procedures for Description and Measurement of Environmental Sound – Part 3: Short-Term Measurements with an Observer Present.

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