12.0 NOISE

12.1 INTRODUCTION

This chapter describes the existing temporary and permanent noise and vibration within Pacific Gas and Electric Company's Windsor Substation Project area and evaluates the potential temporary and permanent noise-related impacts associated with project construction and operation. The potential noise impacts from both construction and operation will be less than significant. Noise reduction measures described in Section 12.5 Avoidance and Protection Measures will further reduce already less-than-significant impacts.

12.2 METHODOLOGY

Evaluation of potential noise and vibration impacts resulting from project construction, operation and maintenance activities involved reviewing codes and planning requirements from the Town of Windsor, characterizing the existing noise environment of the area, and projecting the effects of noise source levels from construction, operation and maintenance of the substation and associated reconductoring work.

12.3 EXISTING CONDITIONS

12.3.1 Regulatory Background

The Town of Windsor currently does not have an ordinance directly regulating construction noise. However, the Town of Windsor General Plan 2015 (General Plan) Noise Element does describe allowable community noise levels for land use within the Town. According to the General Plan, the normally acceptable limit for noise emitted in a low-density residential area is up to 60 A-weighted decibels (dBA) Community Noise Equivalent Level (CNEL)[1]. To achieve this CNEL, the allowable limit of continuous noise is 53 dBA.

The General Plan further states that a CNEL of 70 dBA or less is "conditionally acceptable" for planning purposes within all residential areas. As such, a CNEL of 70 dBA or less should be considered acceptable for construction related noise in the same areas.

12.3.2 Existing Noise Levels

To determine the existing noise levels in the project area, noise measurements were taken via a statistical community noise monitor (Larsen-Davis Model 820) for seven continuous days over weekend and weekday periods at the center of the front of the proposed substation site. The measurements were collected to serve as a reference to assess the effects of the project on sensitive receptors (e.g., residences and schools) in the area of the proposed substation. Noise

[1] CNEL incorporates an additional 5 dBA penalty between 7:00 p.m. and 10:00 p.m. into the Day Night Sound Level (L_{dn}), the 24-hour average metric for noise exposure to address increased sensitivity to noise during evening hours. The L_{dn} and CNEL descriptors vary only about 0.3 dB in practice and are typically used interchangeably for planning purposes.

measurements collected on April 15, 2009 through April 22, 2009 revealed a CNEL level of 58.4 dBA and Day Night Sound Level (L_{dn}) of 58.2 dBA.

12.3.2.1 *Airport Noise Contribution*

According to General Plan Figure 7.5, the project area lies just outside the 55 dBA CNEL isopleths for the Projected Noise Contours resulting from the operation of the Charles M. Schulz Sonoma County Airport. This is consistent with the *Sonoma Marin Area Rail Transit (SMART) Project Environmental Impact Report,* which measured the L_{dn} for the project vicinity to be 58 dBA.

The SMART Project sound measurement (58 dBA) is also consistent with the General Plan predicted normally acceptable limit for noise emitted for the location (60 dBA or less).

12.3.2.2 *Sensitive Receptors*

Noise-sensitive receptors are those facilities (i.e. residential areas, hospitals, schools, performance spaces, offices, etc.) or locations of activities for which noise may cause unusual annoyance, disturbance, or loss of business (e.g., commercial activities with heavy telephone use for which a quiet environment is required).

The nearest sensitive receptor to the substation site is a group of single-family houses approximately 200 feet west of the closest of the three proposed transformer banks. These dwellings lie on the west side of the Northwestern Pacific Railroad (NWPRR) SMART passenger train right-of-way. There are no other sensitive receptors in the immediate area of the proposed substation.

Vacant land to the northeast and directly east of the substation site is zoned Light Industrial.

12.4 IMPACTS

12.4.1 Significance Criteria

Standards of significance were derived from Appendix G of the CEQA Guidelines.
Impacts to noise levels may be considered significant if they result in any of the following environmental effects:

- 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
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
- A substantial temporary increase or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

12.4.1.1 ***Construction Significance Criteria***

12.4.1.1.1 Noise

While the Town of Windsor does not have stated limits for duration and amplitude of construction-related noise, it is assumed that most local agencies require that construction contractors utilize available noise suppression devices and techniques to minimize disturbance to nearby residences and businesses due to construction activities.

Significance criteria for construction-related noise are not currently established because of the temporary nature of noise generated by construction activities. However, as stated above, according to the Town of Windsor General Plan Noise Element, a CNEL level of 70 dBA is considered "conditionally acceptable" for residential areas. Construction noise producing a daytime hourly Energy Equivalent Level ($L_{eq)}$ under 70 dBA would, as such, be considered acceptable.

12.4.1.1.2 Vibrations

Most local agencies have not established specific significance criteria for construction vibration. Some generic guidelines for Human Annoyance due to vibration are outlined in Table 12-1.

Table 12-1: Vibration Criteria for Human Annoyance

Vibration Type and Duration	Vibration Limit
Sustained (>1 hour per day)	0.01 inches per second RMS[1]
Transient (<1 hour per day)	0.03 inches per second RMS
Transient (<10 minutes per day)	0.10 inches per second RMS

Source: Harris, C.M., 1997.
[1]RMS Root of the Mean Squared

Vibration levels from tamping activities are expected to generate vibration levels of 0.03 inch/second peak particle velocity at 50 feet. These levels are highly dependent on the soil type at the construction site and type of equipment used. Since vibration levels exceeding 0.01 inch/second for an aggregate period of more than one hour per day could cause some persons to become annoyed, tamping operations could, under some circumstances, temporarily impact persons in buildings within 50 feet of construction equipment. Persons in buildings further than 50 feet away from the construction site should not be impacted by construction vibrations.

12.4.1.2 ***Operations and Maintenance***

The applicable limits for the Town of Windsor result in an absolute sound limit of 60 dBA CNEL at the substation boundary. As mentioned, this results in a maximum continuous allowable level of 53 dBA, and project operations and maintenance with levels of 53 dBA or less would be considered less than significant.

12.4.1.3 *Corona Noise*

Corona is a phenomenon associated with all energized transmission lines. Under certain conditions, the localized electric field near an energized conductor can be sufficiently concentrated to produce a tiny electric discharge that can ionize air close to the conductors. This partial discharge of electrical energy is called corona discharge, or corona. Several factors, including conductor voltage, shape and diameter, and surface irregularities such as scratches, nicks, dust, or water drops can affect a conductor's electrical surface gradient and its corona performance. Corona is the physical manifestation of energy loss, and can transform discharge energy into very small amounts of sound, radio noise, heat, and chemical reactions of the air components.

Transmission lines can generate a small amount of sound energy during corona activity. This audible noise from the line can barely be heard in fair weather conditions on higher voltage lines. During wet weather conditions, water drops collect on the conductor and increase corona activity so that a crackling or humming sound may be heard near the line. This noise is caused by small electrical discharges from the water drops. Corona is usually not a design issue for power lines rated at 230 kV and lower voltages. The conductor size selected for the project's power line is of sufficient diameter to lower the localized electrical stress on the air at the conductor surface and would further reduce already low conductor surface gradients so that little or no corona activity would exist under most operating conditions.

Using computer modeling software developed by the Bonneville Power Administration (BPA), audible noise values can be calculated for transmission lines experiencing corona activity. As noise associated with corona activity is not usually an issue for power lines less than 230 kV, noise values were calculated assuming a 230 kV transmission line. This modeling indicates that, during wet weather conditions, audible noise levels of approximately 46.6 to 49.6 dBA would occur within the right-of-way (ROW) for a similar transmission line loop operating at 230 kV. As the project power line will ultimately operate at 115 kV, actual audible noise levels from corona activity will be less than those modeled. These calculated levels are below those required by the Town of Windsor (55 dBA) as well as the U.S. Environmental Protection Agency (EPA) outdoor activity noise guideline of 55 dBA and are similar to the range of audible noise levels measured in general rain conditions (41-63 dBA.) Under fair weather conditions, the calculated audible noise levels of approximately 21.6 to 24.6 dBA within the ROW for a similar transmission line loop operating at 230 kV are below the sound level for a library (35 dBA). Audible noise will decrease with distance away from the proposed transmission line loop. Due to all of these factors, impacts from corona noise would be less than significant for a line operating at 115 kV or under.

12.4.2 Construction

12.4.2.1 *Noise*

Construction of a substation of this size involves use of limited heavy construction equipment for grading, gravel delivery, concrete installation, and placement of main transformers, high-voltage towers, and buss work. The resulting sonic environment is characterized by short-term noise levels.

Reconductoring at the 12kV level is generally a less heavy-duty and less concentrated form of construction than is substation construction. Noise created at any location during this rapidly-progressing work is comparatively brief. As such, even though the proximity of receivers is closer than for station construction, the sonic effect of the construction is less.

Proposed pieces of construction equipment and the typical A-weighted noise levels associated with their use (as measured at 50 feet) are presented in Table 12-2.

Assuming a scenario under which multiple pieces of the loudest equipment are used, reasonable upper-bound noise levels (based on distance to nearest receptor) due to construction activities were predicted using methods recommended by the Federal Transit Administration (FTA) 2006 Guidelines. Table 12-3 summarizes the results of this analysis.

Given residential areas are approximately 200 feet west of the substation, a maximum L_{eq} of 70 dBA should result from construction activities. This is within the allowable range for daytime noise for a residential area. Therefore, station construction impacts will be less than significant.

The short duration of construction noise at any given site along the reconductoring path should result in hourly L_{eq} levels less than 70 dBA even in instances where instantaneous levels could be as high as 85 dBA during periods of up to a few minutes, such as augering a hole for pole replacement. Therefore, reconductoring construction impacts will be less than significant.

Table 12–2: Proposed Construction Equipment Types and Typical Noise Emission Levels

Equipment	Typical Noise Level 50 Feet from Source (dBA)
Backhoe	78
Concrete mixer truck[2]	76
Crane	81
Pick-up truck	55
Dump truck	76
Equipment/tool van[1]	55
Dozer	82
Water truck[2]	76
Grader	85
Rock transport[2]	76
Roller	80
Hole auger	84
Line truck and trailer[1]	55

Source: Federal Highway Administration (FHA), 2006.
[1] Based on noise level for pick-up truck
[2] Based on noise level for dump truck

Table 12-3: Predicted Construction-Related Noise Levels in Project Vicinity

Distance Between Source and Receiver (feet)	Geometric Attenuation (dBA)	Ground Effect Attenuation (dBA)	Calculated L_{max}* Sound Level (dBA)	Calculated L_{eq} Sound Level (dBA)
50	0	0	89	85
100	-6	-2	81	77
200	-12	-4	74	70
300	-16	-5	69	65
400	-18	-6	66	62
500	-20	-6	63	59
600	-22	-7	61	57
700	-23	-7	59	55
800	-24	-7	58	54
900	-25	-8	56	52
1000	-26	-8	55	51
1200	-28	-9	53	49
1400	-29	-9	51	47
1600	-30	-9	50	46
1800	-31	-10	49	45
2000	-32	-10	47	43
2500	-34	-10	45	41
3000	-36	-11	43	39

Note: Calculations based on FTA 2006 Guidelines. This calculation does not include the effects, if any, of local shielding from walls, topography, or other barriers that may further reduce sound levels.
* Maximum level of noise (L_{max})

12.4.2.2 *Vibration*

Given a 200-foot distance to the nearest sensitive receptor, the medium-duty nature of the construction of a substation, and the existing railroad right-of-way between the proposed substation and the residential area, the project will produce less-than-significant vibration-related impacts.

Similarly as above, the short duration of ground vibration-inducing activities during reconductoring construction renders these effects less than significant. The level of ground vibration considered tolerable over a 10-minute period is far above any level that could be produced by equipment used for 12 kV line construction.

12.4.3 Operations and Maintenance

Detailed SoundPLAN (Braunstein + Berndt GmbH) noise models were utilized to predict noise resulting from operation of a three-bank substation. Normal operation and maintenance in the three bank configuration will result in maximum constant sound levels of up to 48 dBA at the substation boundary. Sound levels of 40 to 45 dBA could be produced at the nearest receptors depending on the proximity of allowed development. Therefore, operation and maintenance related impacts will be less than significant.

12.5 AVOIDANCE AND PROTECTION MEASURES

12.5.1 Construction

While impacts associated with construction of the substation and reconductoring will be less than significant, PG&E will employ the following noise-reducing construction practices in an effort to further reduce noise produced by construction activities:

- Ensure that all equipment is equipped with mufflers that meet or exceed factory new equipment standards.
- Locate stationary equipment as far as practical from noise sensitive receptors.
- Limit unnecessary engine idling.
- Use equipment that is specifically designed for low noise emissions.
- Limit all construction activity to the hours of 7 a.m. to 7 p.m. Monday through Saturday, to the extent feasible. If nighttime work is needed because of clearance restrictions on the power line, PG&E will take appropriate measures to minimize disturbance to local residents, including contacting nearby residences to inform them of the work schedule and probable inconveniences.

12.5.2 Operations and Maintenance

Impacts from operations and maintenance will be less than significant and no mitigation is required.

12.6 REFERENCES

Bonneville Power Administration. 1977. *Description of Equations and Computer Program for Predicting Audible Noise, Radio Interference, Television Interference, and Ozone from A-C Transmission Lines*. Technical Report ERJ-77-167.

Electric Power Research Institute. 1982. *Transmission Line Reference Book: 345 kV and Above.* Second Edition.

EPA (U.S. Environmental Protection Agency). 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. No. 550/9-74-004, Washington, D.C.

Harris, C.M. 1997: *Handbook of Noise Control*, Second Edition. McGraw-Hill.

Pacific Gas & Electric. 2008. *Palermo-East Nicolaus 115KV Transmission Line Reconstruction Project Proponent's Environmental Assessment*.

Sonoma Marin Area Rail Transit. Final Environmental Impact Report, Section 3.7: Noise and Vibration. Online: http://www.sonomamarintrain.org/index.php/docs/eir/#FEIR. Site visited April 2, 2009.

Town of Windsor. General Plan 2015. 2005. Online: http://www.ci.windsor.ca.us/documentview.asp?did=95. Site visited April 2, 2009

U.S. Federal Transit Administration, Department of Transportation. FTA-VA-90-1003-06 May 2006. Online: http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf. Site visited April 2, 2009.