

## AIR QUALITY ANALYSIS METHODOLOGY

### Purpose

The purpose of this document is to describe the methodology used to analyze the potential air quality impacts of the proposed project. The analysis allows a conclusion to be reached about the possible significance of project air emissions. Project activities that affect air quality are divided into two main categories, construction and operation, because each of these categories is subject to different regulations and emission limits.

The description of methodology in this document is organized according to the following analytical sequence:

- Identify sources of emissions
- Describe source activities and parameters
- Assemble emission factors
- Compute emissions
- Identify emission thresholds and determine significance

### Identify sources of emissions

The construction of a project facility is separated into the following activities:

- Site grading
- Pad construction
- Trenching and utility installation
- Access road construction
- Shelter placement
- General construction activities

The potential maximum amount of equipment that would emit air pollutants is identified within each construction activity. For example, site grading would require the use of the following types of equipment:

- Grader
- Dozer
- Integrated tool carrier
- End dump truck
- Water truck
- Equipment delivery truck
- Construction worker light truck

The construction worker light truck accounts for emissions generated by commuting back and forth between home and the site. Similar commuting emissions are calculated for the trips of workers visiting the site for operations like generator testing and maintenance.

Besides the small contribution of the worker commute to operation emissions, the other source of operation emissions is the weekly test of the emergency standby engine.

### Describe source activities and parameters

Each type of offroad equipment is specified in terms of maximum or full load power (e.g., horsepower or kilowatts), type of fuel (e.g., diesel or gasoline), and example manufacturer and model (e.g., Caterpillar 14G grader). The activity of each type of offroad equipment is described in terms of the potential maximum values of the following variables:

- number of pieces of specified type

- hours worked per day
- number of days worked to complete the activity

Similarly, the activity of each type of onroad equipment is described in terms of the potential maximum values of the following variables:

- capacity (e.g., 10 cubic yards for gravel truck)
- one-way distance for each trip
- number of trips per day
- number of days worked by each piece.

#### Assemble emission factors

An emission factor is the quantitative amount of pollutant that is emitted per unit time or per unit energy. Example units for emission factors include grams per horsepower-hour, pounds per hour, and grams per mile. Emission factors are usually available for the following five criteria pollutants:

- nitrogen oxides (NO<sub>x</sub>)
- reactive organic compounds (ROC), also known as volatile organic compounds (VOC), or reactive organic gases (ROG)
- particulate matter with aerodynamic diameter smaller than or equal to 10 micrometers (PM<sub>10</sub>)
- sulfur oxides (SO<sub>x</sub>)
- carbon monoxide (CO)
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Emission factors for each type of equipment are assembled from Caterpillar, the United States Environmental Protection Agency, the South Coast Air Quality Management District, and other sources.

#### Compute emissions

The daily emission rate of a criteria pollutant from each offroad equipment type is computed as the product of the emission factor (e.g., grams per horsepower-hour), the horsepower rating, number of pieces of the equipment type, and number of hours of use per day. Similarly, the daily emission rate of a criteria pollutant from each onroad equipment type is computed as the product of the emission factor (e.g., grams per mile), number of one-way miles per trip (times two for round trip), number of pieces of the equipment type, and number of trips per day. If the different equipment types within an activity (e.g., site grading) were to operate simultaneously, then the daily emissions rates for the equipment types would be summed to obtain the total daily emission rate. Constraints on space to operate and noise level in this project will limit the use of construction equipment to one major piece (e.g., dozer) at a time. Hence, the maximum daily emission rate for the site would be the maximum of the different equipment rates.

The total emission for the project of a criteria pollutant from each equipment type is computed as the product of the daily emission rate and the number of days of work. The emissions for the different equipment types listed for an activity are summed to obtain the total for the activity. The emissions for the different activities are summed to obtain the total for the project.

The computation of PM<sub>10</sub> emissions accounts for exhaust emissions from mobile construction equipment, fugitive emissions from construction activities, and exhaust emissions from the emergency generator engine, which is a stationary source.

### Identify emission thresholds and determine significance

The analysis depends not only on site characteristics, but also on different rules and requirements in the various Air Quality Management Districts and Air Pollution Control Districts. Each air pollution control agency may publish quantitative emission rate thresholds that act as significance criteria. Separate emission rate thresholds may also be specified to define significance for construction as compared to operations. Thresholds may be specified in terms of daily emission rates in pounds per day, quarterly rates in tons per quarter, or 12-month rates in tons per year (i.e., not calendar year).

Project emission rates are compared with the threshold emission rates. If the project does not exceed a threshold emission rate, then the project is concluded to cause no significant impact on air quality.

## NOISE ANALYSIS METHODOLOGY

### 1.0 Introduction

A noise analysis was conducted for the Level 3 Communications project in order to evaluate compliance with local noise standards. The analysis was conducted for all of the sites in California. The analysis included a review of the local noise standards applicable to each project site and calculation of noise levels.

### 2.0 Assumptions

#### 2.1 Background Noise Levels

Because of the number of the sites involved and in order to simplify the analysis, background noise levels (ambient) for each site were established from published average background noise levels for areas based on land use (Schomer and Associates, 1991). These background levels were developed using monitoring studies performed in the Chicago area and conducted in a variety of land use settings that included the following:

<u>Area Land Use Description</u>	<u>Background Ambient Noise Level (dBA)</u>	
	<u>Nighttime – L<sub>an</sub> (10p.m.-7a.m.)</u>	<u>Daytime - L<sub>ad</sub></u>
1. Noisy commercial and industrial	59	69
2. Moderate commercial and industrial, and noisy residential	52	60
3. Quiet commercial and industrial, and moderate residential	47	52
4. Quiet residential	41	46
5. Very quiet, sparse suburban or rural	35	40

The generic background data provided in the reference were by whole octave bands, from 31 to 8000 Hz. The background octave band levels were combined into an overall A-weighted L<sub>eq</sub> level for each type of land use by applying the A-weight factors to each octave band level and then logarithmically adding the octave bands together. These combined overall L<sub>eq</sub> levels, presented above, were used in the assessment. The A-weighting factors, by octave band, are provided below.

Octave Band	A-weight (dB)
31	-39.4
63	-26.2
125	-16.1
250	-8.6
500	-3.2
1000	0
2000	+1.2
4000	+1.0
8000	-1.1

The land use category for each site was established based on observations made during the site investigation.

## 2.2 Construction Equipment Noise Levels

Noise level data for a variety of construction equipment were evaluated. The data were obtained from *Noise from Construction Equipment and Operations, Building Equipment and Home Appliances* (EPA, 1971). It was assumed for all sites, based on the referenced document, that the loudest equipment to be used in the proposed project has a rating of 84 dBA at 50 feet.

### Operational Noise

The generators are assumed to operate only during daytime hours (usually 7 a.m. to 7 p.m.) and for a maximum of 30 minutes during any day.

## 3.0 Significance Criteria

Significance criteria were determined based on the applicable local noise standard for each project site. The standards were obtained either through personal communication with public employees/officials, or the town/city zoning code or other published information. This included standards for construction and operational noise where applicable.

## 4.0 Analysis Methodology

Construction and operation noise were calculated using a conservative approach where only the attenuation associated with distance (spreading of the sound wave) was considered. No credit was taken for any atmospheric absorption or attenuation which may be provided by natural or man-made barriers (e.g., intervening terrain, buildings). Attenuation with distance was calculated using the expression:

$$L_f = L_i - [20 \log_{10} (D/D_r)]$$

where:

$L_f$  = Final noise level

$L_i$  = Initial source noise level

$D$  = Distance from source

$D_r$  = Reference distance from source

Distances to the nearest receptors were obtained during the site investigations. Source noise levels for the construction equipment were obtained from the literature as described previously. Noise level data for the generator mechanical and exhaust noise were obtained from the manufacturer. At each site, the noise levels were extrapolated to the nearest receptor based on the above expression in order to arrive at a construction and operation noise level.

Compliance with the applicable threshold was then made by evaluating each noise source level at the receptor. In cases where the standard threshold required compliance with a one-hour  $L_{eq}$  level, the source level at the receptor was weighted equally with the daytime background ambient noise level, each for one half hour, and then compared to the threshold. When the standard specified an  $L_{dn}$  or CNEL level, the 1 hour  $L_{eq}$  level was used in a 24-hour time-weighted average with both daytime and nighttime ambient levels.

Both the  $L_{dn}$  and CNEL are composites of 24-hour noise levels which penalize evening (7p.m.-10p.m.) and nighttime noise to account for the greater sensitivity of receptors at those times; these are defined below:

$L_{dn}$  The  $L_{dn}$  is defined as the day-night noise level. It is the A-weighted sound level over a 24-hour period with an additional 10 dB penalty imposed on noise occurring between 10 p.m. and 7 a.m.

CNEL The CNEL is defined as the community noise equivalent level. The CNEL was developed in California for evaluating noise levels in residential communities. The CNEL is similar to the  $L_{dn}$ , but adds an additional 5 dB penalty to noise occurring between 7 p.m. and 10 p.m.

The derived expressions for  $L_{eq}$ ,  $L_{dn}$ , and CNEL, used in the analyses, are as follows:

$$L_{eq} = 10 \cdot \log \frac{[10^{(L_{ad}/10)} + 10^{(L_{ad}/10)} + 10^{(L_f/10)}]}{2}$$

$$L_{dn} = 10 \cdot \log \frac{[10^{(L_{ad}/10)} + 10^{(L_{ad}/10)} + 10^{(L_f/10)}]}{2} + \frac{[9 \cdot 10^{(L_{an} + 10)/10}] + [14 \cdot 10^{(L_{ad}/10)}]}{24}$$

$$CNEL = 10 \cdot \log \frac{10^{(L_{ad}/10)} + 10^{(L_{ad}/10)} + 10^{(L_f/10)}}{2} + \frac{[9 \cdot 10^{(L_{an} + 10)/10}] + [3 \cdot 10^{(L_{ad} + 5)/10}] + [11 \cdot 10^{(L_{ad}/10)}]}{24}$$

## 5.0 Findings

The results of the analysis are discussed in the noise checklist for each site.

## 6.0 Design Features

Where needed, special design features would be incorporated to assure compliance with the standard. One or more of the following features would be incorporated as required.

### Construction

- Limit the size of diesel powered equipment. Noise produced by construction equipment is usually dictated by the horsepower rating of the diesel engine. Limiting the size of the engines will result in lower offsite noise levels.
- Increase the distance of construction activities from the receptors. Increasing the distance separating the construction site from the receptors will take advantage of the noise attenuation associated with distance.
- Lease specially-muffled pieces of heavy construction equipment.

### Operation

- Increase the distance of the generators from the receptors. Increasing the distance separating the construction site from the receptors will take advantage of the noise attenuation associated with distance.

- Increasing the insulating and/or transmission loss properties of the enclosures to be used on the generators will result in lower sound levels

**CALCULATION OF COMBINED EXHAUST AND MECHANICAL  
NOISE FOR EACH GENERATOR WITHOUT NOISE ATTENUATION**

**Total Noise Level 300 KW Generator**

*Ne = Exhaust Noise Level @ 50 ft (dBA) =* N/A  
*Nm – Mechanical Noise Level @ est=50 ft (dBA) =* N/A  
*Ntot = Data provided by MFR =* **84**

**Total Noise Level 400 KW Generator**

*Ne = Exhaust Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 90  
*Nm = Mechanical Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 82  
*Ntot = 10\*log(10^(Ne/10) + 10^(Nm/10)) =* **91**

**Total Noise Level 800 KW Generator**

*Ne = Exhaust Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 92  
*Nm = Mechanical Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 88  
*Ntot = 10\*log(10^(Ne/10) + 10^(Nm/10)) =* **93.5**

**Total Noise Level 1250 KW Generator**

*Ne = Exhaust Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 95  
*Nm – Mechanical Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 88  
*Ntot = 10\*log(10^(Ne/10) + 10^(Nm/10)) =* **95.8**

**Total Noise Level 1750 KW Generator**

*Ne = Exhaust Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 95  
*Nm = Mechanical Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 92  
*Ntot = 10\*log(10^(Ne/10) + 10^(Nm/10)) =* **97**

**Total Noise Level 2000 KW Generator**

*Ne = Exhaust Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 96  
*Nm – Mechanical Noise Level @ 49.2 feet (est=50 ft) (dBA) =* 92  
*Ntot = 10\*log(10^(Ne/10) + 10^(Nm/10)) =* **97.5**

Use 98 dba