

# WATER AGENCIES' STANDARDS

## Design Guidelines for Water, and Sewer Facilities

### SECTION 9.3 NOISE CONTROL GUIDELINES

#### 9.3.1 PURPOSE

The purpose of this section is to provide general guidelines for noise control. These design criteria should be considered in the appropriate stage of the design submittals for a pipeline project.

#### 9.3.2 STANDARD TERMS AND DEFINITIONS

Wherever technical terms occur in these guidelines or in related documents, the intent and meaning shall be interpreted as described in Standard Terms and Definitions.

#### 9.3.3 GENERAL

It is the responsibility of the user of these documents to make reference to and/or utilize industry standards not otherwise directly referenced within this document. The Engineer of Work may not deviate from the criteria presented in this section without prior written approval of the Agency's Engineer.

#### 9.3.4 GUIDELINES

This section defines the codes, standards, reports, and design aids to be used in the design of water facility structures.

The noise design guidelines outlined in Attachment 9.3-1 define the minimum technical requirements to be used by the DESIGN CONSULTANT for the design, material and equipment selection, construction, startup operations and maintenance considerations to control noise from individual pieces of equipment or individual units within the pumping station or other water facilities, at the facility boundary and in the community. Any deviations from the requirements of these noise Guidelines must be completely justified and explicitly requested by the DESIGN CONSULTANT. Agency approval of all such deviations is required.

#### 9.3.5 DESIGN PHASE

Facility compliance with these noise Guidelines must begin in the initial stages of the design. Paragraphs 2 and 4 of Appendix 9.3-1 addresses noise control for the design phase.

##### A. General Facility Design:

The DESIGN CONSULTANT prepares facility designs that result in an operating pumping station in compliance with all local, state and federal noise regulations. Compliance is ensured through the submittal of BODR plans and specifications to the Agency for review and approval. Facility noise predictions are developed during the engineering design phase to predict the pumping station noise levels (at personnel frequented locations), facility boundary line noise levels, and (where appropriate) community noise levels. The sound pressure levels of completed facilities during their operation are guaranteed by the DESIGN CONSULTANT to be within

permissible limits of these Guidelines, including a pump station at facility boundary and community sound pressure levels due to facility operations. Locations where noise level limits cannot feasibly be met are identified by the DESIGN CONSULTANT and brought to the attention of the Agency.

**B. General Equipment Design:**

Noise generated by equipment, valves, piping, prime movers and other noise sources is determined and noise information updated during the design period. Updated noise data is incorporated into the facility noise model and properly evaluated by the DESIGN CONSULTANT to avoid the need for corrective noise attenuation measures after completion of facility construction.

**9.3.6 PRECONSTRUCTION PHASE**

The DESIGN CONSULTANT conducts an ambient noise survey during project design so that existing noise levels within the planned facility boundaries, at facility boundary lines and, where appropriate, in the community can be considered and incorporated into the design of the facility. The ambient noise survey is discussed in paragraph 5 of Appendix 9.3-1 and shall be conducted in accordance with the methods described in Paragraphs 7.4 and 7.5 of Appendix 9.3-1. Ambient noise measurements are made at the same locations approved by the Agency and modeled in the design phase.

**9.3.7 MAINTENANCE CONSIDERATIONS**

The DESIGN CONSULTANT takes care in preparing the design, specification and implementation of noise control measures and devices so that maintenance and safety issues are adequately considered. Maintenance and safety issues are discussed in paragraph 8 of Appendix 9.3-1.

**Attachment 9.3-1**  
**Noise Control Guidelines**

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**1 SCOPE**

The Guidelines define the minimum technical requirements to be used for design, material and equipment selection, construction, startup operations and maintenance considerations to control noise from individual pieces of equipment or individual units within the facility, at the facility boundary and in the community. Any deviations from the requirements of this noise Guideline must be completely justified and explicitly requested and approvals obtained from the Agency.

**2 REFERENCES**

2.1 Noise Regulations

This Guideline includes references to the following noise regulations:

1. California Administrative Code, Title 8, Group 15, Article 105, "Control of Noise Exposure."
2. County of San Diego Code of Regulatory Ordinances, Chapter 4, Sections 36.401-36.443, "Noise Abatement and Control."
3. City of Jurisdiction's Municipal Code for "Noise Abatement and Control."

2.2 Noise Standards

This Guideline contains references to the following noise standards:

1. American National Standards Institute (ANSI) S1.4, Specification for Sound Level Meters
2. American National Standards Institute (ANSI) S1.11, Specification for Octave Band and Fractional-Octave Band Analog and Digital Filters
3. American National Standards Institute (ANSI) S1.13, Measurement of Sound Pressure Levels in Air
4. American National Standards Institute (ANSI)
5. S1.25, Specification for Personal Noise Dosimeters
6. American National Standards Institute (ANSI) S1.40, Specifications for Acoustical Calibrators

**3 GENERAL**

3.1 Definitions

1. Noise - unwanted sound.
2. Sound pressure - small oscillatory pressure variations above and below ambient atmospheric pressure that produce the auditory sensation of sound (in  $N/m^2$ , where 1 Newton/meter<sup>2</sup> = 1 pascal [Pa]).
3. Sound pressure level - 20 times the common logarithm of the ratio of measured sound pressure over the reference sound pressure, expressed mathematically in decibels (dB), as follows:

$$\text{Sound pressure level (dB)} = 20 \text{ LOG}_{10} \left[ \frac{\text{Measured Sound Pressure}}{\text{Reference Sound Pressure}} \right];$$

Where the reference sound pressure = 20 micropascal (20  $\mu$ Pa).

4. A-weighting - an acoustic frequency adjustment to a sound pressure level, which simulates the sensitivity of human hearing. An A-weighted sound pressure level (dBA) results from either manually or electronically applying the frequency dependent A-weighting factors.
5. Noise level, sound level or overall sound level - the single number A-weighted sound pressure level as read on a sound level meter set to A-weighting. This level is also the energy sum of the A-weighted sound pressure level spectrum.
6. Overall sound pressure level - the single number unweighted sound pressure level as read on a sound level meter set to linear. This level is also the energy sum of the sound pressure level spectrum.
7.  $L_{eq}$  - the equivalent continuous sound level or energy average sound level over a set period of time (usually one hour).
8. TWA - the 8-hour time-weighted averaged occupational noise exposure level.
9. Octave band - the interval between two frequencies having a ratio of 2 to 1.

## 4 DESIGN PHASE

### 4.1 General Facility Design

1. The DESIGN CONSULTANT prepares facility designs that result in operating facilities that comply with all local, state and federal noise regulations. Compliance is ensured through the submittal of plans, specifications and quarterly summary reports for review and approval. The sound pressure levels of completed facilities during their operation are guaranteed by the DESIGN CONSULTANT to be within permissible limits of this Guideline, including in-facility, facility boundary and community sound pressure levels due to facility operations. Locations where the noise level limits cannot feasibly be met are identified and brought to the attention of the Agency.

#### 4.1.2 Facility Noise Modeling

Facility noise predictions are developed during the engineering design phase to predict the in-facility noise levels (at personnel frequented locations and work stations), facility boundary line noise levels, and (where appropriate) community noise levels.

1. For small facilities with only a few (<10) potentially noisy items of equipment, simple spreadsheet-type calculations may be used to predict the composite facility generated noise.
2. For larger facilities with several (10 or more) items of potentially noisy equipment, a facility noise computer model is used to calculate the composite facility generated noise.
3. Noise modeling formulas and software are based on industry-accepted practices for source noise prediction, noise propagation and noise attenuation analysis.

4. Equipment Noise Data
  - a. For potentially noisy equipment, either the octave band sound pressure levels at a specific distance from the noise source (usually one meter for smaller items and at least one major equipment dimension away for larger equipment) or the octave band sound power levels are obtained and carefully reviewed by the DESIGN CONSULTANT. Both the overall level (dBA) and octave band levels for the preferred octave band frequencies of 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz are determined for each piece of potentially noisy equipment. This information is to be estimated during the preliminary engineering phase and updated throughout the detailed design phase, as equipment selection becomes more definite.
  - b. Plan and elevation coordinates are identified for each item of potentially noisy equipment and used as source locations in the noise model.
  - c. Plan and elevation coordinates are identified for each sensitive receptor location and used as receiver locations in the noise model.
5. Where individual pieces of equipment meet a specified noise level limit but are to be located near other noisy equipment, the combined sound pressures are additive. In this case, individual equipment noise level limits must be reduced sufficiently to achieve the employee location noise limit (e.g., 85 dBA TWA for 8-hour exposure).
6. Noise model verification is undertaken by the DESIGN CONSULTANT to ensure that modeled distance versus noise attenuation between facility noise sources and community receiver locations, atmospheric absorption attenuation with distance, noise barrier attenuation and any other excess attenuation factors are consistent with published acoustical data and that the model is calibrated to accurately account for noise level differences at the noise sources, at the facility property lines and at the community sensitive receptor locations.
7. Facility noise levels are predicted and used when addressing the following considerations relevant to facility design:
  - a. The technical and economic feasibility of selecting low noise equipment designs and their effect on in-facility, facility boundary line and community noise levels.
  - b. Any requirement for additional noise abatement measures to comply with regulated and noise limits.
  - c. Locations of in-facility areas that cannot be designed with adequate feasible noise controls and therefore must be designated as high noise areas requiring the use of personal hearing protection and/or noise shelters.
  - d. The number of employees potentially affected by excessive noise exposure, without and with the implementation of noise controls.

- e. The management of employee tasks so that their TWA noise exposure is deemed acceptable by Cal-OSHA.
- f. The influence of noise controls on facility operation and maintenance.

#### 4.1.3 In-Facility Non-Industrial Area Noise Planning

1. The DESIGN CONSULTANT designs interior work spaces so that the noise from internal systems and exterior facility noise does not exceed the nonindustrial work area noise limits on Table 1 of this appendix. Architectural acoustic treatments to interior walls, floors, ceilings and special window treatments are considered. In addition, appropriate acoustical and vibration isolation of internal building noise and vibration sources are considered by the DESIGN CONSULTANTS.

#### 4.1.4 In-Facility Occupational Noise Exposure Planning

1. The DESIGN CONSULTANT, in consultation with Agency's staff, estimates operator and maintenance personnel work locations. They also estimate the normal and worst-case durations at the estimated work locations.
2. The DESIGN CONSULTANT determines area noise levels for all employee frequented areas and occupied locations that might contribute to the TWA noise exposure of personnel.
3. Facility employee TWA noise exposures are predicted by DESIGN CONSULTANT for three conditions:
  - a. Facility design with standard equipment.
  - b. Conservative facility design featuring quiet equipment or equipment with noise control options to achieve a maximum combined equipment noise level of 85 dBA at or beyond a distance of 1 meter (3 feet) from any equipment surface.
  - c. Optimized facility design with equipment only having sufficient design noise controls to achieve the state-mandated employee TWA noise exposure compliance. This is more a function of employee position and duration than limiting equipment noise levels. It may require an iterative computational process and may allow higher equipment noise levels. The most recent version of the Cal-OSHA requirements governs in all cases of occupational noise exposure computation.
4. The DESIGN CONSULTANT compares the predicted number of employees with excessive TWA noise exposures for this three-part noise exposure analysis and submits the findings to the Agency for review and comment.

#### 4.1.5 Boundary Line and Community Noise Planning

Sound levels at or beyond facility boundary lines conform to the noise limits of Table 2 or Table 3 of this appendix, depending on the facility proximity to City and County land use. The noise limits of the most recent codes of the City of Jurisdiction and/or County of San Diego govern their respective land use jurisdictions.

1. Areas in which the sound is expected to be tonal require the allowable overall sound level limit for that area to be reduced by 5 dBA. A tonal sound is one where the sound in a narrow band (1 octave or less wide) is more than 5 dB higher than the level in both of the adjacent side bands.
2. For facility design noise control, the following strategic order of priority is used:
  - a. When practical, noisy equipment is located in more remote areas of the unit or facility, where personnel and community noise exposure is reduced due to distance.
  - b. Where feasible, equipment that conforms to the noise limits described in this Guideline without add-on external acoustical enclosures, silencers, lagging, etc., is selected.
  - c. Equipment that can be externally treated with acoustical enclosures, silencers, lagging, etc., is selected.
3. Noise attenuation treatments or controls, in addition to those furnished by equipment suppliers, are provided to ensure that the completed project equipment, operating individually, collectively, or in groups, conforms to the noise limits of this Guideline.
4. A noise compliance summary report that includes equipment type, manufacturer, operating characteristics, location and predicted noise levels is submitted quarterly to the Agency. The first summary report is developed early during the preliminary engineering phase and includes the most recent available data. This preliminary data is updated periodically during the engineering design phase until the final design data is firm. Calculations or computer model input data used to predict sound pressure levels at the facility boundary lines and in the community is included in the quarterly summary reports. This requirement may be adjusted by the Agency based on the location of the pump station and sound receptors.
5. Design information is submitted to potential equipment suppliers, including a copy of this noise Guideline and applicable sound pressure level limits. An equipment noise data sheet is also provided the bidding equipment suppliers. The noise data sheet indicates the free-field noise level limit at a specified distance, as determined by the DESIGN CONSULTANT, provides space for the bidder to list its guaranteed specified distance equipment noise levels (overall A-weighted and octave band sound pressure levels) and the associated noise control costs for:
  - a. Standard equipment package
  - b. Optional Quiet design@ version of equipment
  - c. Equipment with supplier add-on noise controls (acoustical enclosures, upgraded silencers, etc.)
6. Equipment noise data sheets must be completed by bidding equipment suppliers for each type of potentially noisy equipment and returned with their bids.

## 4.2 General Equipment Design

1. Noise generated by equipment, piping, prime movers and other noise sources is determined and noise information upgraded during the project design. Updated noise data is incorporated into the facility noise model and properly evaluated to avoid the need for corrective measures to attenuate noise after completion of facility construction.
2. Standard designs that do not conform to the requirements of this Guideline may be brought into compliance by a combination of:
  - a. Replacement with "quiet" designs
  - b. Use of acoustical enclosures
  - c. Use of acoustical (or thermal) lagging
  - d. Use of upgraded silencers
  - e. Use of other appropriate noise control methods.
3. The design of acoustical controls is considered with and conforms to thermal design requirements.

## 4.3 Equipment Purchase

1. Individual pieces of equipment conform to guaranteed noise limits provided on noise data sheets.
2. Where individual pieces of equipment meet a specified noise level limit but are to be located near other noisy equipment, the combined sound pressures are additive. In this case, individual equipment noise level limits are reduced sufficiently to achieve the desired location noise limit (e.g., 85 dBA).
3. If sound pressure levels and measurement positions are different from the standard conditions normally shown on the noise data sheet, such information is specified by the bidder.
4. Where relevant, the following information is provided to bidding equipment suppliers:
  - a. Site conditions, including prevailing wind speeds and directions, size and locations of existing buildings, and size and locations of groves of trees, walls and other visual barriers.
  - b. Frequented locations of operating and maintenance personnel.
  - c. Other structures and adjacent equipment that may affect the operating sound pressure level of Supplier's equipment.
5. If a supplier's optional noise controls, which could be built into its equipment, would generate excessive costs, the DESIGN CONSULTANT notifies Agency's staff and they jointly determine which is more economical and practical:
  - a. Acceptance of the equipment with the optional built-in noise control measures, or
  - b. Selecting add-on noise attenuation treatments (enclosures, silencers, lagging, etc.) external to equipment.

## **5 PRECONSTRUCTION PHASE**

### **5.1 Ambient Noise Survey**

1. A noise survey is conducted during project design so that existing noise levels within the planned facility boundaries, at facility boundary lines and, where appropriate, within the community can be considered and incorporated into the design of the facility. The ambient noise survey is conducted in accordance with the methods in subsections 7.4 and 7.5 of this appendix. Ambient noise measurements are made at the same locations approved by Agency's staff and modeled in the design phase.
2. All instrumentation is calibrated before each series of measurements in accordance with ANSI S1.40 and has valid annual calibration certification. Sound measurement instrumentation must conform to the ANSI S1.4, S1.11 and S1.13 standards.
3. The preconstruction baseline noise survey is conducted by a qualified DESIGN CONSULTANT member or an Agency-approved acoustical consultant.

## **6 CONSTRUCTION PHASE**

### **6.1 Inspections**

The construction phase include DESIGN CONSULTANT or approved acoustical consultant quality control monitoring and inspections to ensure that design noise control principals and practices are carefully followed and that noise controls are properly implemented by the respective contractors and subcontractors.

### **6.2 Construction Noise Monitoring**

1. The Contractor plans, oversees or undertakes all construction activities so as to comply with the applicable noise regulations. Construction noise is monitored during the construction phase so that construction noise within the community does not exceed the limits of this Guideline. Construction noise monitoring is conducted in accordance with the methods in subsections 7.4 and 7.5 of this noise design Guideline.
2. Construction noise monitoring is conducted by a qualified member of the Contractor's team or an acoustical consultant approved by the Agency.
3. The Contractor keeps noise monitoring logs, along with notations of construction activities and times during the noise measurements, which are available for periodic inspection by the Agency.

## **7 POST-CONSTRUCTION OPERATIONAL COMPLIANCE CONFIRMATION**

### **7.1 Compliance Confirmation**

1. An operating facility noise survey, consisting of in-facility noise measurements, facility boundary line noise measurements and, where appropriate, community location noise measurements, is conducted following facility startup.
2. A written report detailing the results of the noise surveys and any needed corrective measures is submitted to the Agency.

3. Corrective actions are provided by the DESIGN CONSULTANT or an approved acoustical consultant to bring project site into compliance with this noise Guideline.

## 7.2 Noise Survey After Facility Startup – General

1. During the operating facility noise survey conducted after startup, the facility equipment is in normal operation mode with the highest practical load condition up to a full rated load.
2. The survey is conducted by a qualified, approved acoustical consultant, preferably the same person(s) who conducted the preconstruction noise survey.
3. The survey is performed to demonstrate that the completed facility's equipment, operating individually, in groups, or collectively, conform to the in-facility, facility boundary line and community location requirements of this noise Guideline.
4. If a particular piece of equipment does not meet its guaranteed noise specification limit, as submitted on its noise data sheet, a noise test is required of the equipment supplier and appropriate corrective actions or noise mitigation measures taken at the supplier's expense.
5. To the extent possible, ANSI S1.13 standards of noise measurement apply.

## 7.3 In-Facility Noise Surveys

A facility nonindustrial area noise survey, a facility equipment noise survey and an employee noise exposure survey are conducted by the DESIGN CONSULTANT or approved acoustical consultant after facility startup.

### 7.3.1 Facility Non-Industrial Area Noise Survey

The facility non-industrial area noise survey measures sound pressure levels for at least 15 minutes at several locations in each of the room or location not classified as industrial, such as those typified in Table 1. The noise measurements are taken during a period when the area is not occupied or visited by facility personnel. The results of the area noise survey are compared with the area noise limits on Table 1 and included in the operational facility noise report.

### 7.3.2 Equipment Noise Survey

The in-facility equipment noise survey measures sound pressure levels as follows:

1. Sound readings are to be taken 1 meter (3 feet) horizontally in all four directions from major equipment surfaces and at a distance of 1.5 meters (5 feet) above the ground, platform, or floor level.
2. If the equipment has a highly directional sound field (i.e., a stronger sound radiation in one or more directions), readings are taken at several locations (all 1 meter [3 feet] from the piece of equipment) to establish the directivity pattern of the noise source.
3. Working areas above, below, or adjacent to equipment normally occupied or frequented by personnel, such as platforms, are measured.

4. Sound readings are taken in control rooms and offices at normal work stations.
5. All sound pressure level readings include the overall sound level in dBA and the octave band sound pressure levels at the nine preferred octave band frequencies of 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz. All instrumentation is calibrated just before each series of measurements in accordance with ANSI S1.40 and has valid annual calibration certification. Sound measurement instrumentation must conform to the ANSI S1.4, S1.11 and S1.13 standards.

#### 7.3.3 Employee Noise Exposure Survey

1. On two consecutive workdays during the operating facility noise survey conducted after startup, the DESIGN CONSULTANT or approved acoustical consultant equips each facility employee exposed directly to facility industrial equipment noise with an audiometric dosimeter that complies with the most recent ANSI S1.25 requirements for monitoring occupational noise exposure.
2. Before receiving an installed dosimeter, employees are instructed in the purpose of the survey and the proper wearing of a dosimeter, and are asked to cooperate in the compliance survey by avoiding unnecessary noise producing activities, including shouting, whistling, hitting or bumping the microphone.
3. The employee noise exposure survey is conducted by an acoustical consultant or a certified industrial hygienist, each of which must have prior experience in performing this type of survey.

#### 7.4 Facility Boundary Line Survey

1. The facility boundary line survey measures the overall sound level (dBA) and the nine preferred octave band sound pressure levels at the same boundary line locations approved and modeled in the design phase, including the locations used in the preconstruction noise survey. Include any additional locations which may have become important since the design phase noise modeling and preconstruction noise survey. All instrumentation is calibrated just before each series of measurements in accordance with ANSI S1.40 and has valid annual calibration certification. Sound measurement instrumentation conforms to the ANSI S1.4, S1.11 and S1.13 standards.
2. Hourly average, maximum,  $L_{10}$ ,  $L_{50}$  and  $L_{90}$  noise readings are taken for at least a 24-hour period and at least one full day removed from any holiday or weekend day.
3. If highly directional noise sources are present, additional boundary line readings are taken to establish the directional noise pattern.

#### 7.5 Community Noise Survey

If residences are within 150 meters (500 feet) of any facility boundary line, readings similar to those required under section 7.4 of this appendix are taken at nearby representative residential locations.

#### 7.6 Reporting Noise Survey Results

The DESIGN CONSULTANT or approved acoustical consultant prepares and submits an operational facility noise report summarizing the following:

1. In-facility results including the nonindustrial area and industrial equipment noise survey results and the employee noise exposure results.
2. Facility boundary line noise survey results.
3. Community locations noise survey results.

Any noncompliance with the requirements of this Guideline is highlighted along with recommended measures to achieve full compliance.

## 8 MAINTENANCE CONSIDERATIONS

Care is given to the design, specification and implementation of noise control measures and devices so that maintenance and safety issues are adequately considered.

### 8.1 Maintenance Issues

Ease of maintenance and housekeeping is considered by the DESIGN CONSULTANT in locating noise control systems and acoustically treated equipment within the facilities.

Ease of removal and reinstallation of noise control systems is given a high priority by the DESIGN CONSULTANT in the design and selection process so that equipment maintenance can be performed with minimal difficulty and the noise control systems remain effective over time.

Thermal issues are duly considered by the DESIGN CONSULTANT to avoid operational difficulties and equipment temperature problems where noise control systems are used. Robust noise control systems, with long life expectancies, are investigated to reduce untimely replacement costs.

**Table 1**  
**Noise Level Limits for Non-industrial Facility Work Areas**

<b>NonIndustrial Facility Work Area<sup>1</sup></b>	<b>L<sub>eq</sub>(15 min) Sound Level, dBA</b>
Warehouses	65
Control Rooms	60
Open Offices	55
Laboratories	50
Administrative Areas:	
- Receptionist, General Secretarial	50
- Conference Rooms, Private Offices	45

1. Noise limits apply to work space while unoccupied but with normal ventilation and exterior noises.

**Table 2**  
**Sound Level Limits at or Beyond Facility Boundary Lines**

Receptor Land Use Zone <sup>1</sup>	L <sub>eq</sub> (1h) Sound Level <sup>2</sup> , dBA		
	7am-7pm	7pm-10pm	10pm-7am
1. Residential: - All R-1	50	45	40
2. Residential: - All R-2	55	50	45
3. Residential: - R-3, R-4 and all other Residential	60	55	50
4. All Commercial:	65	60	60
5. Manufacturing, Industrial, Agricultural, Extractive Industry	75	75	75
6. All Residential Zones due to Facility Construction (Note 1 does not apply)	75	no const. allowed	no const. allowed

1. The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts.
2. The requirements of more restrictive City of Jurisdiction or County of San Diego codes apply.

**Table 3**  
**Sound Level Limits at or Beyond Facility Boundary Lines**

Receptor Land Use Zone <sup>1</sup>	L <sub>eq</sub> (1h) Sound Level <sup>2</sup> , dBA	
	7am-10pm	10pm-7am
1. Residential density less than 11 dwellings: R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-88, S-90, S-92, R-V, and R-U	50	45
2. Residential density equal to or greater than 11 dwellings: R-RO, R-C, R-M, C-30, S-86	55	50
3. S-94 and all other Commercial:	60	55
4. M-50, M-52, M-54	70	70
5. S-82, M-58, and all other Industrial	75	75
6. All Residential Zones due to Facility Construction. (Note 1 does not apply)	75	no const. allowed

1. The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts.
2. The requirements of more restrictive City of Jurisdiction or County of San Diego codes apply.

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<b>3. NOISE DATA SOURCE:</b> <input type="checkbox"/> Noise Measurement Tests (check all that apply): <input type="checkbox"/> Loaded <input type="checkbox"/> Identical Equipment <input type="checkbox"/> Unloaded <input type="checkbox"/> Similar Equipment <input type="checkbox"/> Noise Calculation (Attach) <input type="checkbox"/> Catalog Data																																																																																																																											
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<b>4. NOISE LEVELS</b> <table border="1" style="width:100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="3" style="writing-mode: vertical-rl; transform: rotate(180deg);">OCTAVE BAND CENTER FREQ [Hz]</th> <th>A</th> <th>B-1</th> <th>B-2</th> <th>B-3</th> <th>C-1</th> <th>C-2</th> <th>C-3</th> <th rowspan="3" style="writing-mode: vertical-rl; transform: rotate(180deg);">OBCF [Hz]</th> </tr> <tr> <th>Equipment Noise Level Allotment</th> <th colspan="3">Maximum RMS Sound Pressure Level (Lp) in dB re: 20 µPa at 1 meter(s)</th> <th colspan="3">Maximum Sound Power Level (Lw) in dB re: 1 picowatt (10<sup>-12</sup> watt)</th> </tr> <tr> <th>Maximum RMS Lp at 1 meter(s)</th> <th>Standard Equipment</th> <th>With Special Design</th> <th>Added Acoustic Treatment</th> <th>Standard Equipment</th> <th>With Special Design</th> <th>Added Acoustic Treatment</th> </tr> </thead> <tbody> <tr><td>31.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>31.5</td></tr> <tr><td>63</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>63</td></tr> <tr><td>125</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>125</td></tr> <tr><td>250</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>250</td></tr> <tr><td>500</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>500</td></tr> <tr><td>1000</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1000</td></tr> <tr><td>2000</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2000</td></tr> <tr><td>4000</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>4000</td></tr> <tr><td>8000</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>8000</td></tr> <tr><td>Overall dB(Lin)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>dB(Lin)</td></tr> <tr><td>Overall dB(A)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>dB(A)</td></tr> </tbody> </table>		OCTAVE BAND CENTER FREQ [Hz]	A	B-1	B-2	B-3	C-1	C-2	C-3	OBCF [Hz]	Equipment Noise Level Allotment	Maximum RMS Sound Pressure Level (Lp) in dB re: 20 µPa at 1 meter(s)			Maximum Sound Power Level (Lw) in dB re: 1 picowatt (10 <sup>-12</sup> watt)			Maximum RMS Lp at 1 meter(s)	Standard Equipment	With Special Design	Added Acoustic Treatment	Standard Equipment	With Special Design	Added Acoustic Treatment	31.5								31.5	63								63	125								125	250								250	500								500	1000								1000	2000								2000	4000								4000	8000								8000	Overall dB(Lin)								dB(Lin)	Overall dB(A)								dB(A)
OCTAVE BAND CENTER FREQ [Hz]	A		B-1	B-2	B-3	C-1	C-2	C-3	OBCF [Hz]																																																																																																																		
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<b>INSTRUCTIONS:</b> 1. Buyer fills in Sections 1 and 4-A. 2. Bidder fills in Secs. 2, 3, 4-B, 4-C, and Sections 5-10, plus Sheet 2 if tested.	<b>EQUIPMENT NOISE DATA SHEET</b>	SHEET	OF	JOB NUMBER																																																																																																																							
		1	2																																																																																																																								
		DOCUMENT NUMBER		REV																																																																																																																							

SKETCH OF TEST EQUIPMENT LAYOUT AND NOISE MEASUREMENT LOCATIONS:

NOTE: Noise measurement distances are from the nearest major equipment surface.

OCTAVE BAND CENTER FREQUENCY [Hz]	RMS SOUND PRESSURE LEVEL (Lp) AT NOTED MEASUREMENT LOCATIONS, dB re: 20 µPa								Maximum RMS Lp* per Octave Band (Transfer to Sheet 1-Col. B)
	Location 1 at _____ meters	Location 2 at _____ meters	Location 3 at _____ meters	Location 4 at _____ meters	Location 5 at _____ meters	Location 6 at _____ meters	Location 7 at _____ meters	Location 8 at _____ meters	
31.5									
63									
125									
250									
500									
1000									
2000									
4000									
8000									
OVERALL dB (LIN)									
OVERALL dBA									

\* Maximum octave band sound pressure level (Lp) for all locations.

REFERENCES AND COMMENTS:

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INSTRUCTIONS: Bidder sketches equipment and noise measurement locations, then fills in noise data under location columns and Sheet 1-Col. B.

**EQUIPMENT NOISE TEST DATA SHEET**

SHEET <b>2</b>	OF <b>2</b>	JOB NUMBER
DOCUMENT NUMBER		REV

PES-N&V-02-MH(7/98)

REVISEMENTS	NO	DATE	BY	CK	APP	DESCRIPTION	REVISEMENTS	NO	DATE	BY	CK	APP	DESCRIPTION		
1.		Client: <b>CITY OF SAN DIEGO WATER DEPARTMENT</b> Equip. Type: <b>Centrifugal pump</b> Equip. Item No. <b>SD-CP-07A/B/C/D</b>						Site: <b>North Side Pump Station</b> Service: <b>Potable water distribution</b> No. Required: <b>4</b>							
2.		Manufacturer: <b>XYZ Pump Company</b> Model: <b>KX-500-1800</b> Size: <b>3500 gpm</b> RPM: <b>1800</b> HP: <b>500</b>						Style: <b>Centrifugal</b> Driver: <b>TEFC Motor</b>							
3. NOISE DATA SOURCE:							NOISE MEASUREMENT CONDITIONS:								
<input type="checkbox"/> Noise Measurement Tests (check all that apply): <input type="checkbox"/> Loaded <input type="checkbox"/> Identical Equipment <input type="checkbox"/> Unloaded <input type="checkbox"/> Similar Equipment <input type="checkbox"/> Noise Calculation (Attach) <input checked="" type="checkbox"/> Catalog Data							<input type="checkbox"/> Free Field      Describe: _____ <input type="checkbox"/> Reverberant <input checked="" type="checkbox"/> Semi-reverberant <input type="checkbox"/> Other      Describe: _____								
4. NOISE LEVELS															
		A		B-1		B-2		B-3		C-1		C-2		C-3	
		Equipment Noise Level Allotment		Maximum RMS Sound Pressure Level (Lp) in dB re: 20 µPa at 1 meter(s)						Maximum Sound Power Level (Lw) in dB re: 1 picowatt (10 <sup>-12</sup> watt)					
OCTAVE BAND CENTER FREQ [Hz]	Maximum RMS Lp at 1 meter(s)		Standard Equipment	With Special Design	Added Acoustic Treatment		Standard Equipment	With Special Design	Added Acoustic Treatment		OBCF [Hz]				
31.5	93		84	81	88						31.5				
63	91		86	84	87						63				
125	89		88	85	86						125				
250	85		90	86	85						250				
500	79		87	84	80						500				
1000	74		88	81	74						1000				
2000	70		86	79	71						2000				
4000	67		82	76	67						4000				
8000	67		80	70	65						8000				
Overall dB(Lin)	97		96	92	93						dB(Lin)				
Overall dB(A)	82		93	87	82						dB(A)				
5. Brief description of Special "Noise Control" Design and/or Added Acoustical Treatment : _____ Special Design: <b>Quiet casing and coupling design</b> Added Acoustical Treatment: <b>Inlet and discharge pipe lagging to headers</b> Any Other Means: _____															
6. Additional cost(s) for Special Design and/or Added Acoustical Treatment(s), respectively, as bid. Special Design: <b>\$650 per unit</b> Added Acoustical Treatment: <b>\$225 per unit</b> Any Other Costs: _____															
7. Special equipment noise characteristics (tonal pitch, directional, impulsive, etc.) : _____ _____ _____															
8. Sound Pressure Levels (Lp) are to be measured per ANSI-S1.13 - "Measurement of Sound Pressure Levels in Air" and recorded on Sheet 2, along with equipment sketch and test locations. If a different method and/or if catalog data are used, describe and fully reference: <b>Pump Catalog with documented noise data - Catalog No. P9602</b>															
9. Notes, Comments and/or Exceptions: _____ _____ _____															
10. Noise Emission Guarantee: We guarantee that the noise emission from an operating unit of the above equipment, as bid, will not exceed the overall A-weighted sound level or the linear octave band levels stated under Column 4-A, at the specified distance. Signature: <u>W. E. Agree</u> Date: <b>7/15/98</b>															
INSTRUCTIONS:				<b>EXAMPLE NOISE DATA SHEET</b>				SHEET OF		JOB NUMBER					
1. Buyer fills in Sections 1 and 4-A. 2. Bidder fills in Secs. 2, 3, 4-B, 4-C, and Sections 5-10, plus Sheet 2 if tested.								1 2		112233-90000					
								DOCUMENT NUMBER		REV					
								SD-NSPS-00-ME-10		0					

PES-N&V-01-MH(7/98)

REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION			
1.		Client: <b>CITY OF SAN DIEGO WATER DEPARTMENT</b> Equip. Type: <b>Centrifugal pump</b> Equip. Item No. <b>SD-CP-07A/B/C/D</b>						Site: <b>North Side Pump Station</b> Service: <b>Potable water distribution</b> No. Required: <b>4</b>								
2.		Manufacturer: <b>XYZ Pump Company</b> Model: <b>KX-500-1800</b> Size: <b>3500 gpm</b> RPM: <b>1800</b> HP: <b>500</b>						Style: <b>Centrifugal</b> Driver: <b>TEFC Motor</b>								
3.		<b>NOISE DATA SOURCE:</b> <input type="checkbox"/> Noise Measurement Tests (check all that apply): <input type="checkbox"/> Loaded <input type="checkbox"/> Identical Equipment <input type="checkbox"/> Unloaded <input type="checkbox"/> Similar Equipment <input type="checkbox"/> Noise Calculation (Attach) <input checked="" type="checkbox"/> Catalog Data						<b>NOISE MEASUREMENT CONDITIONS:</b> <input type="checkbox"/> Free Field Describe: _____ <input type="checkbox"/> Reverberant <input checked="" type="checkbox"/> Semi-reverberant <input type="checkbox"/> Other Describe: _____								
4.		<b>NOISE LEVELS</b>														
		<b>A</b>		<b>B-1</b>		<b>B-2</b>		<b>B-3</b>		<b>C-1</b>		<b>C-2</b>		<b>C-3</b>		
		Equipment Noise Level Allotment		Maximum RMS Sound Pressure Level (Lp) in dB re: 20 µPa at ___1___ meter(s)						Maximum Sound Power Level (Lw) in dB re: 1 picowatt (10 <sup>-12</sup> watt)						
OCTAVE BAND CENTER FREQ [Hz]		Maximum RMS Lp at ___1___ meter(s)		Standard Equipment		With Special Design		Added Acoustic Treatment		Standard Equipment		With Special Design		Added Acoustic Treatment		OBCF [Hz]
31.5		93		84		81		88								31.5
63		91		86		84		87								63
125		89		88		85		86								125
250		85		90		86		85								250
500		79		87		84		80								500
1000		74		88		81		74								1000
2000		70		86		79		71								2000
4000		67		82		76		67								4000
8000		67		80		70		65								8000
Overall dB(Lin)		97		96		92		93								dB(Lin)
Overall dB(A)		82		93		87		82								dB(A)
5.		Brief description of Special "Noise Control" Design and/or Added Acoustical Treatment : _____ Special Design: <b>Quiet casing and coupling design</b> Added Acoustical Treatment: <b>Inlet and discharge pipe lagging to headers</b> Any Other Means: _____														
6.		Additional cost(s) for Special Design and/or Added Acoustical Treatment(s), respectively, as bid. Special Design: <b>\$650 per unit</b> Added Acoustical Treatment: <b>\$225 per unit</b> Any Other Costs: _____														
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9.		Notes, Comments and/or Exceptions: _____ _____ _____														
10.		<b>Noise Emission Guarantee:</b> We guarantee that the noise emission from an operating unit of the above equipment, as bid, will not exceed the overall A-weighted sound level or the linear octave band levels stated under Column 4-A, at the specified distance. Signature: <u>W. E. Agree</u> Date: <b>7/15/98</b>														
<b>INSTRUCTIONS:</b>		<b>EXAMPLE NOISE DATA SHEET</b>						SHEET OF		JOB NUMBER						
1. Buyer fills in Sections 1 and 4-A. 2. Bidder fills in Secs. 2, 3, 4-B, 4-C, and Sections 5-10, plus Sheet 2 if tested.								1 2		112233-90000						
								DOCUMENT NUMBER			REV					
								SD-NSPS-00-ME-10			0					

PES-N&V-01-MH(7/98)

### 9.3.8 REFERENCE

- A. Should the reader have any suggestions or questions concerning the material in this section, contact one of the member agencies listed.
- B. The publications listed below form a part of this section to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said publications unless otherwise called for. The following list of publications, as directly referenced within the body of this document, has been provided for the users convenience. It is the responsibility of the user of these documents to make reference to and/or utilize industry standards not otherwise directly referenced within this document.
  - 1. Water Agencies' Standards (WAS):
    - a. Design Guidelines:

END OF SECTION