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RULE TITLE: Noise Control Regulations for Industry and Commerce

NOTICE FILED DATE: 05/30/2024

RULE SUMMARY: Amend Division 35 Noise Control Regulations to allow solar energy generation facilities to demonstrate compliance with noise regulations in the same manner as allowed for wind electrical generation facilities.

RULE TEXT:

(1) Standards and Regulations:

(a) Existing Noise Sources. No person owning or controlling an existing industrial or commercial noise source shall cause or permit the operation of that noise source if the statistical noise levels generated by that source and measured at an appropriate measurement point, specified in subsection (3)(b) of this rule, exceed the levels specified in Table 7, except as otherwise provided in these rules.

(b) New Noise Sources:

(A) New Sources Located on Previously Used Sites. No person owning or controlling a new industrial or commercial noise source located on a previously used industrial or commercial site shall cause or permit the operation of that noise source if the statistical noise levels generated by that new source and measured at an appropriate measurement point, specified in subsection (3)(b) of this rule, exceed the levels specified in Table 8, except as otherwise provided in these rules. For noise levels generated by a wind or solar energy facility of any size and any associated equipment or machinery, subparagraph (1)(b)(B)(iii) applies.

(B) New Sources Located on Previously Unused Site:

(i) No person owning or controlling a new industrial or commercial noise source located on a previously unused industrial or commercial site shall cause or permit the operation of that noise source if the noise levels generated or indirectly caused by that noise source increase the ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour, or exceed the levels specified in Table 8, as measured at an appropriate measurement point, as specified in subsection (3)(b) of this rule, except as specified in subparagraph (1)(b)(B)(iii).

(ii) The ambient statistical noise level of a new industrial or commercial noise source on a previously unused industrial or commercial site shall include all noises generated or indirectly caused by or attributable to that source including all of its related activities. Sources exempted from the requirements of section (1) of this rule, which are identified in subsections

(5)(b)–(f), (j), and (k) of this rule, shall not be excluded from this ambient measurement.

(iii) For noise levels generated or caused by a wind or solar energy facility:

(I) The increase in ambient statistical noise levels is based on an assumed background L50 ambient noise level of 26 dBA or the actual ambient background level. The person owning the wind or solar energy facility may conduct measurements to determine the actual ambient L10 and L50 background level.

(II) The “actual ambient background level” is the measured noise level at the appropriate measurement point as specified in subsection (3)(b) of this rule using generally accepted noise engineering measurement practices.

Background noise measurements shall be obtained at the appropriate measurement point, and for wind energy facilities synchronized with wind speed measurements of hub height conditions at the nearest wind turbine location. “Actual ambient background level” does not include noise generated or caused by the proposed wind or solar energy facility.

(III) The noise levels from a wind or solar energy facility may increase the ambient statistical noise levels L10 and L50 by more than 10 dBA (but not above the limits specified in Table 8), if the person who owns the noise sensitive property executes a legally effective easement or real covenant that benefits the property on which the wind or solar energy facility is located. The easement or covenant must authorize the wind or solar energy facility to increase the ambient statistical noise levels, L10 or L50 on the sensitive property by more than 10 dBA at the appropriate measurement point.

(IV) For purposes of determining whether a proposed wind energy facility would satisfy the ambient noise standard where a landowner has not waived the standard, noise levels at the appropriate measurement point are predicted assuming that all of the proposed wind facility’s turbines are operating between cut-in speed and the wind speed corresponding to the maximum sound power level established by IEC 61400-11 (version 2002-12). These predictions must be compared to the highest of either the assumed ambient noise level of 26 dBA or to the actual ambient background L10 and L50 noise level, if measured. The facility complies with the noise ambient background standard if this comparison shows that the increase in noise is not more than 10 dBA over this entire range of wind speeds.

(V) For purposes of determining whether an operating wind energy facility complies with the ambient noise standard where a landowner has not waived the standard, noise levels at the appropriate measurement point are measured when the facility’s nearest wind turbine is operating over the entire range of wind speeds between cut-in speed and the wind speed corresponding to the maximum sound power level and no turbine that could contribute to the noise level is disabled. The facility complies with the noise ambient background standard if the increase in noise over either the assumed ambient noise level of 26 dBA or to the actual ambient background L10 and L50 noise level, if measured, is not more than 10 dBA over this entire range of wind speeds.

(VI) For purposes of determining whether a proposed wind energy facility would satisfy the Table 8 standards, noise levels at the appropriate measurement point are predicted by using the turbine’s maximum sound power level following procedures established by IEC 61400-11 (version 2002-12), and assuming that all of the proposed wind facility’s turbines are operating at the maximum sound power level.

(VII) For purposes of determining whether an operating wind energy facility satisfies the Table 8 standards, noise generated by the energy facility is measured at the appropriate measurement point when the facility’s nearest wind turbine is operating at the wind speed corresponding to the maximum sound power level and no turbine that could contribute to the noise level is disabled.

(c) Quiet Areas. No person owning or controlling an industrial or commercial noise source located either within the boundaries of a quiet area or outside its boundaries shall cause or permit the operation of that noise source if the statistical noise levels generated by that source exceed the levels specified in Table 9 as measured within the quiet area and not less than 400 feet (122 meters) from the noise source.

(d) Impulse Sound. Notwithstanding the noise rules in Tables 7 through 9, no person owning or controlling an industrial or commercial noise source shall cause or permit the operation of that noise source if an impulsive sound is emitted in air by that source which exceeds the sound pressure levels specified below, as measured at an appropriate measurement point, as specified in subsection (3)(b) of this rule:

(A) Blasting. 98 dBC, slow response, between the hours of 7 a.m. and 10 p.m. and 93 dBC, slow response, between the

hours of 10 p.m. and 7 a.m.

(B) All Other Impulse Sounds. 100 dB, peak response, between the hours of 7 a.m. and 10 p.m. and 80 dB, peak response, between the hours of 10 p.m. and 7 a.m.

(e) Octave Bands and Audible Discrete Tones. When the Director has reasonable cause to believe that the requirements of subsection (1)(a), (b), or (c) of this rule do not adequately protect the health, safety, or welfare of the public as provided for in ORS Chapter 467, the Department may require the noise source to meet the following rules:

(A) Octave Bands. No person owning or controlling an industrial or commercial noise source shall cause or permit the operation of that noise source if such operation generates a median octave band sound pressure level which, as measured at an appropriate measurement point, specified in subsection (3)(b) of this rule, exceeds applicable levels specified in Table 10.

(B) One-third Octave Band. No person owning or controlling an industrial or commercial noise source shall cause or permit the operation of that noise source if such operation generates a median one-third octave band sound pressure level which, as measured at an appropriate measurement point, specified in subsection (3)(b) of this rule, and in a one-third octave band at a preferred frequency, exceeds the arithmetic average of the median sound pressure levels of the two adjacent one-third octave bands by:

(i) 5 dB for such one-third octave band with a center frequency from 500 Hertz to 10,000 Hertz, inclusive. Provided: Such one-third octave band sound pressure level exceeds the sound pressure level of each adjacent one-third octave band; or

(ii) 8 dB for such one-third octave band with a center frequency from 160 Hertz to 400 Hertz, inclusive. Provided: Such one-third octave band sound pressure level exceeds the sound pressure level of each adjacent one-third octave band; or

(iii) 15 dB for such one-third octave band with a center frequency from 25 Hertz to 125 Hertz, inclusive. Provided: Such one-third octave band sound pressure level exceeds the sound pressure level of each adjacent one-third octave band;

(iv) This rule shall not apply to audible discrete tones having a one-third octave band sound pressure level 10 dB or more below the allowable sound pressure levels specified in Table 10 for the octave band which contains such one-third octave band.

(2) Compliance. Upon written notification from the Director, the owner or controller of an industrial or commercial noise source operating in violation of the adopted rules shall submit a compliance schedule acceptable to the Department. The schedule will set forth the dates, terms, and conditions by which the person responsible for the noise source shall comply with the adopted rules.

(3) Measurement:

(a) Sound measurements procedures shall conform to those procedures which are adopted by the Commission and set forth in Sound Measurement Procedures Manual (NPCS-1), or to such other procedures as are approved in writing by the Department;

(b) Unless otherwise specified, the appropriate measurement point shall be that point on the noise sensitive property, described below, which is further from the noise source:

(A) 25 feet (7.6 meters) toward the noise source from that point on the noise sensitive building nearest the noise source;

(B) That point on the noise sensitive property line nearest the noise source.

(4) Monitoring and Reporting:

(a) Upon written notification from the Department, persons owning or controlling an industrial or commercial noise source shall monitor and record the statistical noise levels and operating times of equipment, facilities, operations, and activities, and shall submit such data to the Department in the form and on the schedule requested by the Department. Procedures for such measurements shall conform to those procedures which are adopted by the Commission and set forth in Sound Measurement Procedures Manual (NPCS-1);

(b) Nothing in this rule shall preclude the Department from conducting separate or additional noise tests and measurements. Therefore, when requested by the Department, the owner or operator of an industrial or commercial noise source shall provide the following:

(A) Access to the site;

- (B) Reasonable facilities, where available, including but not limited to, electric power and ladders adequate to perform the testing;
- (C) Cooperation in the reasonable operation, manipulation, or shutdown of various equipment or operations as needed to ascertain the source of sound and measure its emission.
- (5) Exemptions: Except as otherwise provided in subparagraph (1)(b)(B)(ii) of this rule, the rules in section (1) of this rule shall not apply to:
- (a) Emergency equipment not operated on a regular or scheduled basis;
 - (b) Warning devices not operating continuously for more than 5 minutes;
 - (c) Sounds created by the tires or motor used to propel any road vehicle complying with the noise standards for road vehicles;
 - (d) Sounds resulting from the operation of any equipment or facility of a surface carrier engaged in interstate commerce by railroad only to the extent that such equipment or facility is regulated by pre-emptive federal regulations as set forth in Part 201 of Title 40 of the Code of Federal Regulations, promulgated pursuant to Section 17 of the Noise Control Act of 1972, 86 Stat. 1248, Public Law 92-576; but this exemption does not apply to any standard, control, license, regulation, or restriction necessitated by special local conditions which is approved by the Administrator of the EPA after consultation with the Secretary of Transportation pursuant to procedures set forth in Section 17(c)(2) of the Act;
 - (e) Sounds created by bells, chimes, or carillons;
 - (f) Sounds not electronically amplified which are created by or generated at sporting, amusement, and entertainment events, except those sounds which are regulated under other noise standards. An event is a noteworthy happening and does not include informal, frequent, or ongoing activities such as, but not limited to, those which normally occur at bowling alleys or amusement parks operating in one location for a significant period of time;
 - (g) Sounds that originate on construction sites.
 - (h) Sounds created in construction or maintenance of capital equipment;
 - (i) Sounds created by lawn care maintenance and snow removal equipment;
 - (j) Sounds generated by the operation of aircraft and subject to pre-emptive federal regulation. This exception does not apply to aircraft engine testing, activity conducted at the airport that is not directly related to flight operations, and any other activity not pre-emptively regulated by the federal government or controlled under OAR 340-035-0045;
 - (k) Sounds created by the operation of road vehicle auxiliary equipment complying with the noise rules for such equipment as specified in OAR 340-035-0030(1)(e);
 - (l) Sounds created by agricultural activities;
 - (m) Sounds created by activities related to the growing or harvesting of forest tree species on forest land as defined in subsection (1) of ORS 526.324.
- (6) Exceptions: Upon written request from the owner or controller of an industrial or commercial noise source, the Department may authorize exceptions to section (1) of this rule, pursuant to rule 340-035-0010, for:
- (a) Unusual and/or infrequent events;
 - (b) Industrial or commercial facilities previously established in areas of new development of noise sensitive property;
 - (c) Those industrial or commercial noise sources whose statistical noise levels at the appropriate measurement point are exceeded by any noise source external to the industrial or commercial noise source in question;
 - (d) Noise sensitive property owned or controlled by the person who controls or owns the noise source;
 - (e) Noise sensitive property located on land zoned exclusively for industrial or commercial use.

[NOTE: View a PDF of referenced documents and tables by clicking on "Tables" link below.]

STATUTORY/OTHER AUTHORITY: ORS 467

STATUTES/OTHER IMPLEMENTED: ORS 467.030



OAR 340-035-0035

Table 7

Existing Industrial and Commercial Noise Source Standards Allowable Statistical Noise Levels in Any One Hour

7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
L ₅₀ – 55 dBA	L ₅₀ – 50 dBA
L ₁₀ – 60 dBA	L ₁₀ – 55 dBA
L ₁ – 75 dBA	L ₁ – 60 dBA



OAR 340-035-0035

Table 8

New Industrial and Commercial Noise Source Standards Allowable Statistical Noise Levels in Any One Hour

7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
L ₅₀ – 55 dBA	L ₅₀ – 50 dBA
L ₁₀ – 60 dBA	L ₁₀ – 55 dBA
L ₁ – 75 dBA	L ₁ – 60 dBA



OAR 340-035-0035
Table 9
Industrial and Commercial Noise Source
Standards for Quiet Areas
Allowable Statistical Noise Levels in Any One Hour

	7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
L ₅₀	50 dBA	45 dBA
L ₁₀	55 dBA	50dBA
L ₁	60 dBA	55dBA



OAR 340-035-0035
Table 10
Median Octave Band Standards
For Industrial and Commercial Noise Sources
Allowable Octave Band Sound Pressure Levels

Octave Band Frequency (Hz)	7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
31.5	68	65
63	65	62
125	61	56
250	55	50
500	52	46
1000	49	43
2000	46	40
4000	43	37
8000	40	34

Sound Measurement Procedures Manual

NPCS - 1



State of Oregon
Department of
Environmental
Quality

REVISION RECORD

INSTRUCTIONS FOR USE: All revisions of this manual will be numbered to assure each manual holder that he has received all revisions. The date and initials of the person inserting revisions to the manual should be entered on this revision record opposite the appropriate revision number. If the sequence is broken, copies of the missing revisions may be requested from the Noise Control Section.

<u>Rev. No.</u>	<u>Date Inserted</u>	<u>Initials</u>
1.	<u>4-30-74</u>	<u>JH</u> 3-22-1974
2.	<u>8-16-74</u>	<u>JH</u> 4.5.6 # 314
3.	<u>11-25-74</u>	<u>NT</u> NPCS - 10-1 12-3
4.	<u>8-27-76</u>	<u>JH</u> EQC Amendments
5.	<u>5-6-83</u>	<u>JQ</u> EQC Amendments
6.	_____	_____
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19.	_____	_____

FOREWORD

The Sound Measurement Procedures Manual has been prepared to specify the equipment to be used and the procedures to be followed when measuring environmental noise. The procedures established in the manual, when carefully followed, will ensure that the noise readings obtained are accurate, will support enforcement action, and aid in reducing environmental noise.

The scope of this manual includes industrial noise, commercial noise, noise from races and racetracks, noise from public roads and ambient noise measurements. Individual motor vehicle noise measurements are covered in a separate manual.

The objective of the manual is to establish procedures to implement the provisions of the Environmental Quality Commission. Further, if the practices and procedures herein are adhered to, the result will be a uniform enforcement program which will accomplish the intent of the Legislature and fulfill the Commission's responsibility under ORS Chapter 467.

Office of the Administrator
Air Quality Control Division
Department of Environmental Quality

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CHAPTER 1

INTRODUCTION

Policy

- 1.1.1 The Department of Environmental Quality, through the Noise Pollution Control Section shall establish a noise measurement program to implement the laws and regulations applying to environmental noise.
- 1.1.2 The Noise Pollution Control Section shall be responsible for the conformity of environmental noise measurement.
- 1.1.3 This manual contains procedures for the Noise Pollution Control Section, and all other persons taking environmental noise measurements. Guidance is provided in the "Comments".

1.2 Authority

Statutory and administrative law governing authority to the guidance and direction contained in the following sources:

- a. Oregon Revised Statutes, Chapter 467, Sections 467.010, 467.020, 467.030, 467.040, 467.050, 467.990.
- b. Oregon Administrative Rules, Chapter 340, Division 35, Department of Environmental Quality.

Instruments and Training

- 1.3.1 Specific requirements for instruments and personnel are defined under procedure manual, Noise Pollution Control Section - 2, Requirements for Sound Measuring Instruments and Personnel.

CHAPTER 2

INSTRUMENTATION

Sound Level Meters

The specifications for sound level meters (SLM) are defined in manual Noise Pollution Control Section (NPCS-2) Requirements for Sound Measuring Instruments and Personnel. The minimum meter required is a Type II as defined by American National Standard Institute Number S1.4-1971.

2.2

Accessories

The minimum accessories shall be a windscreen and an acoustically coupled calibrator.

Comment: Additional accessories that have been found to be valuable in gathering data are tabulated below:

- (1) Noise data forms
- (2) Clipboard
- (3) Tripod
- (4) Wind meter
- (5) Sling psychrometer
- (6) Screwdriver
- (7) Spare batteries
- (8) Watch with sweep second hand or digital equivalent

Tape Recorders and Level Recorders

Recording systems shall conform to NPCS-2.

Comment: The recording system should be able to duplicate the measurements as taken in the field. For tape recorders, a table of frequency response tolerances is given in SAE standards. Graphic level recorder systems standards are also described in the manual.

Octave Band Filter Sets

The octave band filter sets shall be those defined in NPCS-2.

Comment: These sets may either be integral to a sound level meter or they may be a separate piece of equipment.

Special Study Instruments

Comment: In some instances, special types of equipment may be found to be useful in studying a noise problem. The Department has several specialized noise instruments to be used in study situations. These instruments include a random noise generator, a loud speaker system, and a one-third octave band filter set.

One-Third Octave Band Filter Sets

The one-third octave band filter sets shall be those defined in NPC-2.

Comment: These sets may be integral to a sound level meter or they may be a separate piece of equipment. Sets shall contain the preferred one-third octave band filters.

Impulse Meters

Impulse meters shall be those defined in NPC-2.

Comment: These meters are integral to some Type I precision sound level meters set for a peak unweighted response. Blasting impulse noise is measured on a standard Type I or Type II meter set to the "C" weighting scale and the "SLOW" dumping response.

CHAPTER 3

INSTRUMENT CALIBRATION

General

All types of sound level meters shall be field calibrated immediately prior to use, using the procedures described in the factory instruction manual.

Battery Check

Batteries in both the meter and the calibrator shall be checked before calibration.

Instrument Calibration

The instrument shall be set to the correct level range, weighting scale and meter response. The calibrator shall be placed on the microphone of the meter. The output indicated on the meter shall then be adjusted to the correct calibration level.

Annual Calibration

Within a year prior to use, each sound level meter, including octave band filter and calibrator, shall receive a laboratory calibration in accordance with the manufacturer's specifications. This calibration shall be traceable to the National Bureau of Standards.

Comment: An inspection label may be attached to each instrument set to determine when the calibration was performed.

CHAPTER 4

ENVIRONMENTAL NOISE MEASUREMENT

4.1 Application

This chapter applies to ambient measurements, noise emissions from industrial facilities, and commercial facilities, and to ambient noise limits from motor vehicles. Individual motor vehicle noise measurements, airports and racetracks are covered in separate manuals.

- 4.1.2 Persons selected to measure environmental noise shall meet the requirements of NPCS-2 Requirements for Sound Measuring Instruments and Personnel.

Site Selection

- 4.2.1 The measurement location shall be at any point, no more than 25 feet from the noise sensitive building where the noise level is generally greatest, as illustrated in Figure 4-1.

If the noise sensitive building is closer than 25 feet from the property line, the measurement location shall be at any point on the property line, providing it is no more than 25 feet from the building, or at any other point within the noise sensitive property no more than 25 feet from the noise sensitive building, wherever the noise level is generally greatest, as illustrated in Figure 4-2. For any measurement, sound reflective surfaces shall not be closer than 10 feet from the measurement point.

Comment: Sound reflective surfaces do not include trees, shrubs, hedges or other vegetation.

Comment: Measurements for noise sensitive property on which the noise sensitive building lies within 10 feet of the noise sensitive property line may require sound level projection techniques described in 4.8 of the manual.

Equipment Set-Up

- 4.3.1 The sound level meter or microphone, either hand held or placed on a tripod, shall be 4 feet or more above the ground or floor surface.

- 4.3.2 Comment: A microphone extension cable may be used in areas where accessibility is difficult. Example: Changes in ground elevation, reflective surfaces, height or source or receiver.



Figure 4-1 Measurement Point 25 Feet From Building

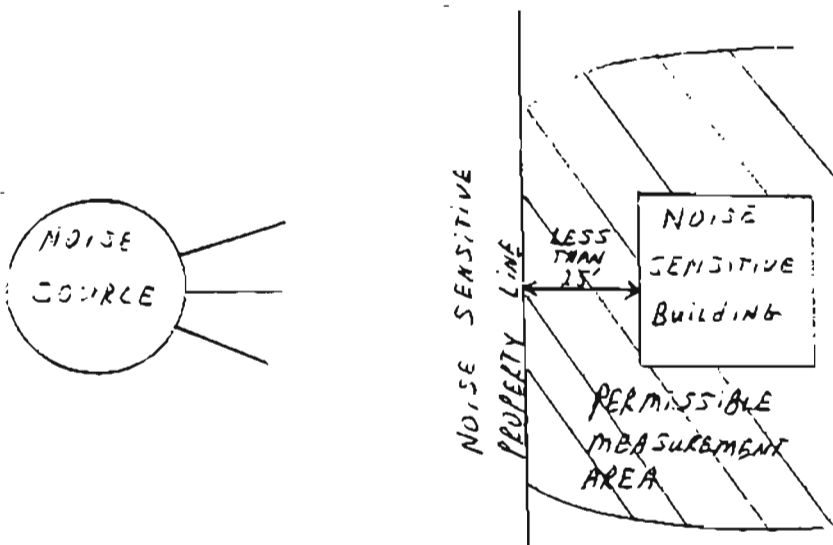


Figure 4-2 Measurement Point on Property Line

Instrument Calibration and Battery Check

- 4.4.1 Refer to Chapter 3 of NPCCS-1 for instructions.

Noise Level Measurements

- 4.5.1 **Comment:** That information and data submitted to the Department should be recorded on Forms NPCCS-4 and NPCCS-5 as shown in Figure 4-3 and Figure 4-5, or on forms approved in writing by the Department.

4.5.2 Weather Conditions

- a. The wind speed and direction shall be determined before measurements are taken and recorded on a form. Measurements shall not be taken when the wind speed exceeds 10 mph. The sound level meter windscreen shall always be installed on the microphone while taking measurements.
- b. The relative humidity may be determined for the time measurements are taken. Measurements shall not be taken when precipitation affects results.

Comment: Measurements may be taken when the ground is wet if the readings are not influenced by motor vehicle tire noise on wet pavement.

- c. **Comment:** The barometric pressure has an effect on the calibration level of most calibrators. This effect is usually small but can introduce some error under very low atmospheric pressure conditions or at high elevations. Typically no correction is needed at elevations below 2,000 feet. Above 2,000 feet elevation, the manufacturers correction factor must be applied to the instrument during calibration.

4.5.3 Determination of Meter Speed

- a. **Comment:** The "FAST" meter speed is used for sounds of an essentially continuous nature. This speed is such that the indication instrument attains its final reading in approximately 0.2 seconds. In general, the "FAST" meter is used where meter fluctuations do not exceed 3 dB, or where the meter is required to follow fast changes in level such as an automobile or aircraft pass-by measurements.

- b. Comment: The "SLOW" meter speed is used for sounds where the noise level fluctuates by + or - 3 dB and meter variations make the instrument display unreadable. The slower action of the meter provides an averaging effect that is helpful in measuring sounds of a rapidly varying nature or of low frequencies. However, for a noise pulse of 0.5 second duration, such a meter will typically read 2 to 6 dB low. It is not satisfactory for measuring intermittent sounds.

4.5.4 "A" Weighting Scale Measurements

Comment: Maximum noise level measurements with the "A" network weighting scale are taken with the sound level meter switched to the "A" network per the manufacturer's instructions. The meter must be properly positioned with respect to the noise source per the manufacturer's instructions. Information and data taken during the measurements should be recorded on Form NPCS-4 or equivalent as shown in Figure 4-3.

4.5.5 Statistical Noise

Comment: The statistical noise level is that noise level exceeded a stated percentage of the time. An $L_{10} = 65$ dBA means that in any consecutive 60 minute period of the day 65 dBA is equalled or exceeded only 10% of the time, or for a total of 6 minutes. Several procedures are in use by the Department to determine statistical noise levels and other methods may be approved in writing from the Department. Three acceptable procedures to determine the statistical noise level are presented in Section 6 of this Chapter. Information and data taken during the measurements should be recorded on Form NPCS-10-1 or equivalent as shown in Figure 4-9. Statistical calculations can be carried out on Forms NPCS-10-2 and NPCS-10-3 and should be summarized in "L" terminology on Form NPCS-4. An example of a completed Form NPCS-4 is presented in Figure 4.4.

4.5.6 Ambient Noise Determination

Comment: The ambient noise level is a composite of sounds from many sources near and afar. As the ambient noise level will be compared to the noise level with the source included in any consecutive 60 minute period, it is important that data is obtained in time periods of interest during the day and also both the week and

the weekend to obtain data which are representative. It is also important to note that the data must be taken without emphasis on either noise peaks or unusual quiet.

Measurements should not be taken in weather conditions which may create a bias in the data. Wet streets or snow accumulations could bias the data unless these conditions are typical for the community.

Measurements should be made at least at several appropriate locations within the sampling area under consideration. Measurements should be made randomly in the sense that each location and each sampling time has the same chance of being sampled and that the selection of any one factor in no way influences the choice of another. Measurements should be made on at least three separate days.

The ambient statistical noise levels obtained or predicted with the noise source in question operating, should include all noises generated by that source. This may include such sources as increased motor vehicle traffic noise, safety warning device noise, and other sounds that may be exempted from the rules due to other considerations.

Procedures to determine the L_{10} and L_{50} , statistical noise levels are presented in Section 6 of this Chapter. Information and data taken during the measurements should be recorded on Form NPC5-4 or equivalent as shown in Figure 4-4.

4.5.7 Octave Band Noise Measurement

Octave band noise measurements shall be made on an octave band frequency analyzer per document NPC5-2, Requirements for Sound Measuring Instruments and Personnel.

Comment: Octave band sound pressure levels may be measured in the same manner as the "A" weighting scale measurements, except that the octave band filters shall be used in place of the "A" weighting network. Information and data taken during the measurements should be recorded on Form NPC5-5 or equivalent as shown in Figure 4.5. An example of a completed form NPC5-5 is presented in Fig. 4-6.

4.5.8 Tape Recording

Comment: Tape recording of the noise and a calibration signal is optional. The tape recorder system must conform to the specifications defined in document NPC5-2 Requirements for Sound Measuring Instruments and Personnel.

4.5.9 One-Third Octave Band Noise Measurement

One-third octave band noise measurements shall be made on a one-third octave band frequency analyzer per document NPC5-2, Requirements for Sound Measuring Instruments and Personnel.

Comment: One-third octave band sound pressure levels may be measured in the same manner as the "A" weighting scale measurements, except that the one-third octave band filter shall be used in place of the "A" weighting network. Information and data taken during the measurements should be recorded on form NPC5-29 or equivalent as shown in Figure 4-7. An example is shown in Figure 4-8.

4.5.10 Impulse Measurements

Impulse measurements shall be made on meters per document NPC5-2, Requirements for Sound Measuring Instruments and Personnel. Impulse sound pressure levels are to be taken with the meter set to the linear unweighted scale with the peak detector circuit engaged for unweighted (dB) impulse measurements. For "C" weighted (dBC) impulse measurements the meter is set to the "C" weighting scale and the meter speed is set to the "SLOW" damping response.

Comment: Information and data should be recorded on Form NPC5-4 or equivalent as shown in Figure 4-3. An example of a completed form is presented in Figure 4-4.

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File _____

County _____

SOURCE _____

BY _____

DATE _____

SHEET _____

COMPLAINANT _____

COMPLAINT DATE _____

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM		
MIC		
FLTR		
CAL		
Windscreen ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct

Measurement Position	Meter Fast/Slow	A Scale	C Scale	Linear Scale	L ₁	L ₁₀	L ₅₀	Peak Impulse

Comments _____

Form NPC-4

INSTRUMENT SET-UP
CHECK-OFF LIST

- Site Selection
- SIM Position
- Battery Check
- Calibration Adjustment
- Wind Below 10 MPH
- Humidity Below 95%
- Windscreen

1. Days of Operation

- A. Mon. - Fri.
- B. Mon. - Sat.
- C. Mon. - Sun.

2. Time of Operation

- A. 8 a.m. - 5 p.m.
- B. _ a.m. - _ p.m.

3. Number of Shifts

- A. One
- B. Two
- C. Three

4. Distance from Receiver to
source _____ feet.

5. Visibility to Source

- A. Direct _____
- B. Hill or Barn _____
- C. Trees _____
- D. Other _____

6. Zoning

- A. Residence _____
- B. Plant or Facility _____

7. Who came first?

- A. Residence...Date _____
- B. Plant or Facility _____

8. Petition Submitted

- A. Yes... Number _____
- B. No

SKETCH OF MEASUREMENT SITE AND SOURCE

REVERSE SIDE FORM NPC-4
FIGURE 4-3

NPC-4

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File Industry

County Multnomah

SOURCE Oregon Paving Co.

BY C.M. Sroka

1000 SE 101st, Portland

DATE 6/6/74

Rock crusher

SHEET 1/2

COMPLAINANT Mr. Eastland

155 SE Millman Dr, Portland

COMPLAINT DATE 5/10/74

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM	GR	15458
MIC	GR	
FLTR		
CAL	GR	1547
	Del	1210
Windscreen <input checked="" type="checkbox"/> ON <input type="checkbox"/> OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct
1:45p	✓	114	67	51	29	—	0.5	W

Measurement Position	Meter Fast/Slow	A Scale	C Scale	Linear Scale	L ₁	L ₁₀	L ₅₀	Peak Impulse
1	fast	78		85				106
2	fast				79	75	70	

Comments An occasional bus or truck; ambient noise without crusher operating is 51-57 dBA.

INSTRUMENT SET-UP
CHECK-OFF LIST

- Site Selection
- SLM Position
- Battery Check
- Calibration Adjustment
- Wind Below 10 MPH
- Humidity Below 95%
- Windscreen

1. Days of Operation

- Mon. - Fri.
- Mon. - Sat.
- Mon. - Sun.

2. Time of Operation

- 8 a.m. - 3 p.m.
- 10 a.m. - 9 p.m.

3. Number of Shifts

- One
- Two
- Three

4. Distance from Receiver to source 300-350 feet.

5. Visibility to Source

- Direct _____
- Hill or Barn _____
- Trees _____
- Other _____

6. Zoning

- Residence _____
- Plant or Facility _____

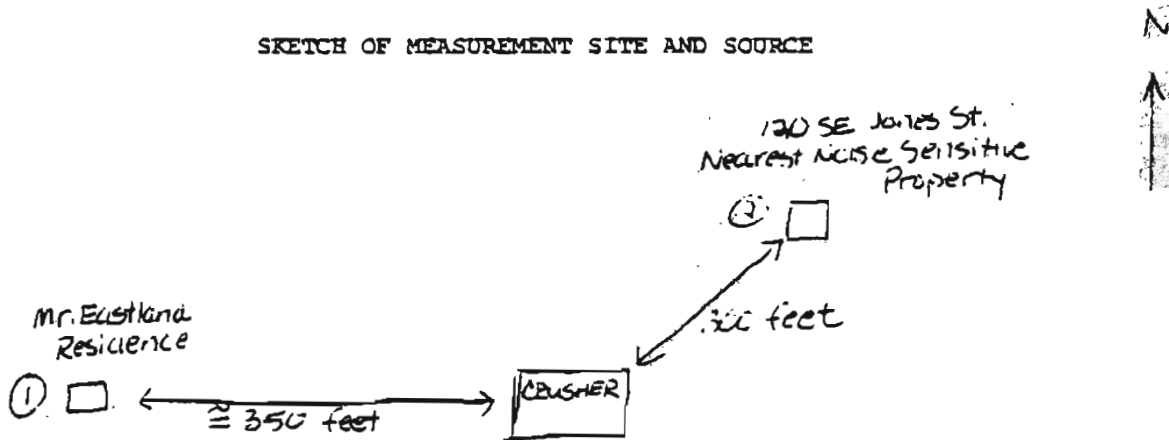
7. Who came first?

- Residence...Data _____
- Plant or Facility _____

8. Petition Submitted

- Yes... Number 300 sq ft
- No

SKETCH OF MEASUREMENT SITE AND SOURCE



Example Form NPC5-4
Figure 4-4 REVERSE SIDE FORM

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File _____

County _____

SOURCE _____

BY _____

DATE _____

SHEET _____ / _____

COMPLAINANT _____

COMPLAINT DATE _____

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM		
MIC		
FLTR		
CAL		
Windscreen ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct

Position	Fast/Slow	A Scale	Lin. Scale	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz

Comments _____

Form NPC5-5
Figure 4-5

NPCS-5

INSTRUMENT SET-UP
CHECK-OFF LIST

- Site Selection
- SLM Position
- Battery Check
- Calibration Adjustment
- Wind Below 10 MPH
- Humidity Below 95%
- Windscreen

1. Days of Operation
 - A. Mon. - Fri.
 - B. Mon. - Sat.
 - C. Mon. - Sun.
2. Time of Operation
 - A. 8 a.m. - 5 p.m.
 - B. _ a.m. - _ p.m.
3. Number of Shifts
 - A. One
 - B. Two
 - C. Three
4. Distance from Receiver to source _____ feet.
5. Visibility to Source
 - A. Direct _____
 - B. Hill or Barn _____
 - C. Trees _____
 - D. Other _____
6. Zoning
 - A. Residence _____
 - B. Plant or Facility _____
7. Who came first?
 - A. Residence...Date _____
 - B. Plant or Facility _____
8. Petition Submitted
 - A. Yes... Number _____
 - B. No

SKETCH OF MEASUREMENT SITE AND SOURCE

FIGURE 4-5
REVERSE SIDE FORM NPC5-5

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOUND PRESSURE LEVEL DATA SHEETS

File Industry

County Lane

SOURCE Sam's Sawmill
1200 East Road
Eugene

BY ICJR - GCS

DATE 4/27/74

SHEET 1 / 1

COMPLAINANT Mrs. Ed. Jones
100 North St., Eugene

COMPLAINT DATE April 19, 1974

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM	G.R. 1033	220 1521
MIC	G.R.	
FLTR	G.R.	220
CAL	G.R.	302
Windscreen: ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct
3:40 am	OK	114	67	51	57	-	4	W
4:07 am	OK	114.0						

Position	Fast/Slow	A Scale	Lin. Scale	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
1	S	47	63	55	55	54	54	50	44	38	25	20

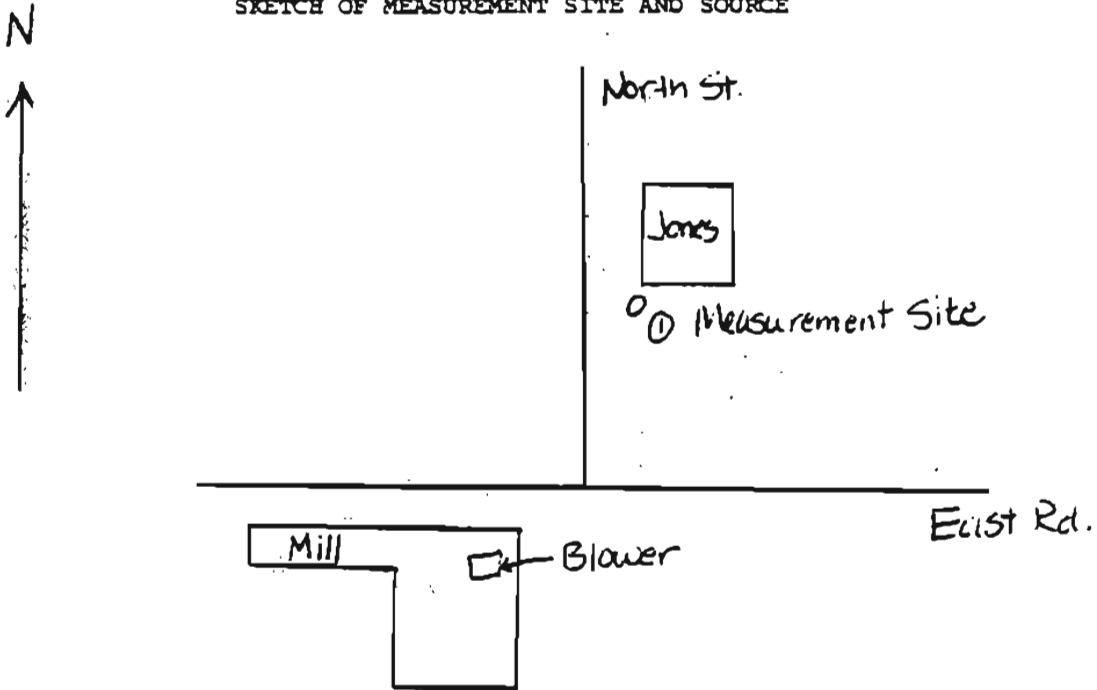
Comments Measurements taken during "blower"
operation. Readings taken from
3:51 through 4:02 pm.

INSTRUMENT SET-UP
CHECK-OFF LIST

- Site Selection
- SLM Position
- Battery Check
- Calibration Adjustment
- Wind Below 10 MPH
- Humidity Below 95%
- Windscreen

1. Days of Operation
 - A. Mon. - Fri.
 - B. Mon. - Sat.
 - C. Mon. - Sun.
2. Time of Operation
 - A. 8 a.m. - 3 p.m.
 - B. 9 a.m. - 4 p.m.
3. Number of Shifts
 - A. One
 - B. Two
 - C. Three
4. Distance from Receiver to source ≈ 300 feet.
5. Visibility to Source
 - A. Direct X
 - 3. Hill or Barn _____
 - C. Trees _____
 - D. Other _____
6. Zoning
 - A. Residence X
 - 3. Plant or Facility _____
7. Who came first?
 - A. Residence... Date 1952
 - B. Plant or Facility _____
8. Petition Submitted
 - A. Yes... Number _____
 - B. No

SKETCH OF MEASUREMENT SITE AND SOURCE



Example Form NPCS-5
Figure 4-6
REVERSE SIDE OF FORM

DEPARTMENT OF ENVIRONMENTAL QUALITY

1/3 OCTAVE BAND DATA SHEET

File _____

County _____

SOURCE _____

BY _____

DATE _____

SHEET _____

COMPLAINANT _____

COMPLAINT DATE _____

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM		
MIC		
FLTR		
CAL		
Windscreen ON OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct

PREFERRED CENTER FREQUENCIES FOR 1/3 OCTAVE BANDS

Position	Lin. Scale	20 Hz	25 Hz	30 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz
Position	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10,000	12,500

Comments _____

Figure 4-7 Form NPC-29

DEPARTMENT OF ENVIRONMENTAL QUALITY

1/3 OCTAVE BAND DATA SHEET

I+c

File NP-ABC LUMBER

County Coos

SOURCE ABC LUMBER CO.
1000 "F" ST.
COOS BAY, OR

BY B. HAMMON

DATE 9-18-81

COMPLAINANT MR. JOE SMITH
1245 "D" ST., COOS BAY
 COMPLAINT DATE 9-16-81

INSTRUMENTATION		
EQT	TYPE	SERIAL
SLM	B-K 2209	396472
MIC	B-K 4145	311347
FLTR	B-K 1618	923111
CAL	B-K 4220	376062
MAG TAPE	B-K 7003	704619
Windscreen <input checked="" type="checkbox"/> ON <input type="checkbox"/> OFF		

Time	Bat. Ck.	Cal. dB	°F dry bulb	°F wet bulb	% RH	Press. mm Hg	Wind mph	Wind Direct
2:00 PM	✓	124.0	66°	PARTLY CLOUDY			4-6	SW
3:10 PM	✓	124.0	69°	"			2-4	"

PREFERRED CENTER FREQUENCIES FOR 1/3 OCTAVE BANDS

Position	Lin. Scale	20 Hz	25 Hz	30 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz
1	70	58	60	59	58	59	60	59	59	58	57	56	54	52	51

Position	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000		
1	50	48	46	45	53	43	41	40	40	37	38	36	37	32	28

Comments SAMPLE TAKEN 2:13 TO 2:35 PM PDT. PRIMARY
IS A LARGE SAW. PRODUCES WH NE IN 1250 HZ.
BAND

4.6 Statistical Noise Level Calculations

4.6.1 Hand Sample Method (Comment)

- a. For this method use forms NPC-10-1, NPC-10-2, and NPC-10-3 as shown in Figures 4-9 through 4-11 or equivalent.
- b. Perform a short noise survey to determine the approximate range of sound levels produced by the noise source being investigated. Enter the approximate high and low noise levels as well as the central tendency on form NPC-10-1. Use the minimum and maximum sound levels and the table at the back-bottom of form NPC-10-1 to estimate the minimum number of good sound samples needed to be taken from the source in question. For example, in Figure 4-12 the noise varied from a high of approximately 67 dBA to a low of 61 dBA. This is a 6 dBA variation. The table on NPC-10-1 indicates that a minimum of 132 good readings needs to be taken.

The table on NPC-10-1 is designed to give an acceptable statistical confidence in the L_{10} and L_{50} noise level. For determining the L_1 noise level with confidence or for more complex noise sources, more noise samples than indicated in the table may be necessary.

- c. Record the noise levels in dBA on Form NPC-10-1 at five second intervals, at ten second intervals, or at fifteen second intervals. An example of such a measurement is presented in Figure 4-12. Note any unusual activity from the noise source in question. Also indicate all external or extraneous noise sources which may contaminate the noise reading. Examples include sounds from passing vehicle traffic and aircraft. The sound readings associated with these external sources will not be included in the statistical noise level calculations. If external sounds contaminate the measurements for a significant amount of time, it may be necessary to conduct the survey during a period of the day in which these other sources are absent or quieter.
- d. Using Form NPC-10-2, tally the recorded noise levels in 1 dBA increments as the example shows in Figure 4-13. Record on NPC-2 only those sound levels which are legitimately associated with the source in question, ignoring all other contaminating sound levels.

In the "Number of Readings" column, sum the total readings at each dBA level. Using the "Number Greater Than" column, calculate the number of readings taken that are greater than each particular level. For example, in Figure 4-13 there are no readings greater than 74 dBA, hence the "Number Greater Than" is zero. There is one reading taken at a level greater than 73 dBA, and three (1 plus 2) readings greater than 72 dBA.

The percent greater than (% Greater Than) column contains the statistical percent for each dBA level. The percent is calculated by dividing the numbers in the "Number Greater Than" column by the total number of readings times 100. For example, the percent of 73 dBA is calculated as $(1/194) \times 100 = 0.5\%$, and the percent at 72 dBA is $(3/194) \times 100 = 1.5\%$.

- e. Using Form NPCS-10-3, the dBA levels versus the "percent greater than" numbers are plotted. An example of this is shown in Figure 4-14.

From the resulting graph, the statistical noise level at any required percentage may be found. For example, the L_{50} and L_{10} are found to be 63 dBA and 66 dBA, respectively. Note that a normalized or randomly varying noise source will result in a straight line when plotted on form NPCS-10-3.
- f. The results from the statistical survey are then summarized on form NPCS-4 (see Figure 4-4). On the back of NPCS-4 a sketch of the measurement site should be drawn.
- g. A typical noise survey will require approximately 20 minutes of measuring to record the required number of samples at a 5-second sample interval. However, the noise standards for industrial and commercial noise sources (OAR 340-35-035) are specified for a one-hour (60 minute) period. Therefore, the noise investigator must ensure that the noise survey represents sounds that are typical of a full 60-minute operation of the noise source. If the source significantly changes its operation for the remainder of the hour, it is recommended that a full 60 minutes of samples are measured and recorded for the statistical analysis.
- h. The documentation of the L_1 statistical noise level is often better accomplished by the "time above" method. For noise sources that operate for a short period of time at a constant sound level, an accurate determination of the L_1 noise level can be determined by measuring the total amount of time the noise source operates in a one-hour period. If

the source operates for a period of 36 seconds or greater within the hour (but less than 6 minutes), then the L_1 is equal to the measured noise level. If the source operates for 6 minutes or more during the hour, then the measured level is the L_{10} statistical noise level.

4.6.2 Noise Exposure Counter or Monitor Method

Comment: Statistical noise levels may be obtained through the use of several commercially designed devices that sample and classify the data.

4.6.3 Programmable Calculator Method

Comment: The noise staff of the Department has developed a program to calculate statistical noise levels on a Wang 600 series programmable calculator. This method will digitally make the necessary calculations after the analog noise data has been converted to digital data. As this method is specialized to the Department's facilities, it will not be presented here. A complete explanation of the method and program listing is on file at the Department in Manual NFCS-22, Analysis of Ambient Noise with the Wang 600 Series Programmable Calculator.

SOURCE: ACME WOOD PRODUCTS INC. DATE: 9-16-81

1581 S.W. 76TH (DEBARKER, SAW CHIPPER) BY: GTW

MEASUREMENT SITE: SITE 1, MR & MRS. JONES' NSP COUNTY: MULT.

1576 S.W. 76TH, PORTLAND SHEET: 2 / 4

Time	Calibration dB	F dry bulb	F	Press. mm Hg.	Wind MPH	Wind direct.	INSTRUMENTATION		
							EQU	TYPE	SERIAL
1410	✓ 114.0				0-5	NW	SLM	GR 1365	12345
1515	✓ 114.0				2-6	NW	MIC	1"	
~ Range of Noise: <u>Hi 67</u> dBA <u>Low 61</u> dBA <u>Central Tend. 63</u> dBA							CAL	GR 1987	1790
Start Time: <u>1420 PDT</u> Sample Interval: <u>(5)</u> 10 15 seconds							WINDSCREEN <input checked="" type="checkbox"/> ON <input type="checkbox"/> OFF		

DATA POINTS	SOUND PRESSURE LEVEL dBA					
1 - 6	65	63	62	61	64	65
7 - 12	63	61	65	CAR	CAR	64
13 - 18	63	62	70	65	63	62
19 - 24	70	62	DOG	64	63	61
25 - 30	62	63	63	61	67	67
31 - 36	TRUCK →	T	T	64	66	65
37 - 42	62	63	64	63	62	64
43 - 48	63	63	64	63	73 R	62
47 - 54	63	63	65	62	64	63
55 - 60	61	64	65	63	63	65
61 - 66	65	66	64	61	62	66
67 - 72	60	61	63	63	64	70
73 - 78	72	61	73 R	74 R	64	64
79 - 84	63	62	60	65	62	64
85 - 90	61	62	67	63	JET	JET →
91 - 96	JET	JET	65	64	64	64
97 - 102	70 R	63	64	63	62	65
103 - 108	66	65	66	62	64	63
109 - 114	64	64	62	63	65	64
115 - 120	64	67	63	64	DOG	DOG
121 - 126	65	66	67	64	66	69
127 - 132	69	CAR	CAR	63	66	64

Note: See back for the minimum number of samples. Indicate all missing data points and give an explanation. **NPCS-10-1**

133 - 138	63	66	65	64	63	66
139 - 144	62	63	65	64	63	64
145 - 150	64	64	65	66	62	64
151 - 156	66	63	68	63	63	63
157 - 162	62	63	64	63	63	62
163 - 168	63	65	64	62	63	68
169 - 174	← COMPLAINT TALKING →			64	61	
175 - 180	63	63	63	64	63	65
181 - 186	64	61	61	BIRDS →	B	63
187 - 192	64	63	64	62	65	64
193 - 198	62	64	63	62	64	62
199 - 204	CAR	CAR	63	64	60	63
205 - 210	64	62	62	TRUCK →	T	T
211 - 216	T	T	T	63	64	64
217 - 222	69	63	65	63	65	63
223 - 228						
229 - 234						
235 - 240						
241 - 246						
247 - 252						
253 - 258						
259 - 264						
265 - 270						
271 - 276						
277 - 282						
283 - 288						
289 - 294						
295 - 300						
301 - 306						
307 - 312						
313 - 318						
319 - 324						
325 - 330						
331 - 336						

Maximum - Minimum Levels (difference in range)

0-8	9	10	11	12	13	14	15	16	17	18	19	20	21
132	138	174	210	246	288	336	384	438	498	558	618	684	756

Minimum Number "Good" Samples

Additional data

NPCS-10-1

4.8.1 Point Source

Comment: The sound pressure level at a point r feet from a point source can be calculated from a sound pressure level measurement at a point r_0 feet from the point source using the following equation:

$$SPL = SPL_0 - 20 \log (r/r_0)$$

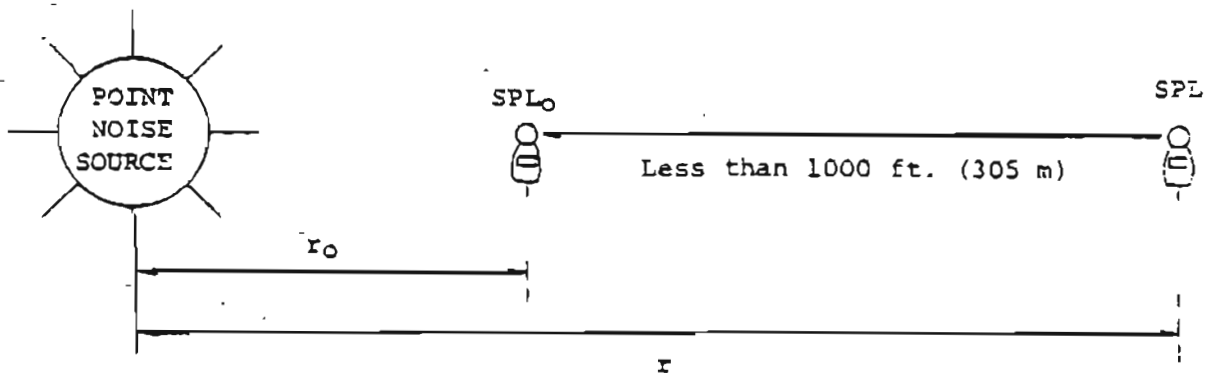
where:

SPL = sound pressure level at r feet from the source.

SPL_0 = sound pressure level at r_0 feet from the source. Note that r_0 is a reference distance and that the distance r is always greater than r_0 . The point r_0 must be in the far field of the source.

Figure 4-15 illustrates a point source, such as an industrial site, and the distance at which the measurement SPL_0 is taken and the distance where the required level, SPL is needed.

This projection technique is applicable only if the distance between r and r_0 is less than 1000 feet. This projection technique should be used only when it is not practical to make a sound pressure level reading at r .



SOUND LEVEL ADJUSTMENT WITH DISTANCE

FIGURE 4-15

4.8.2 Line Source

Comment: The sound pressure level at a point r feet from a line source can be calculated from a sound pressure level measurement at a point r_0 feet from the line source using the following equation:

$$\text{SPL} = \text{SPL}_0 - 10 \log (r/r_0)$$

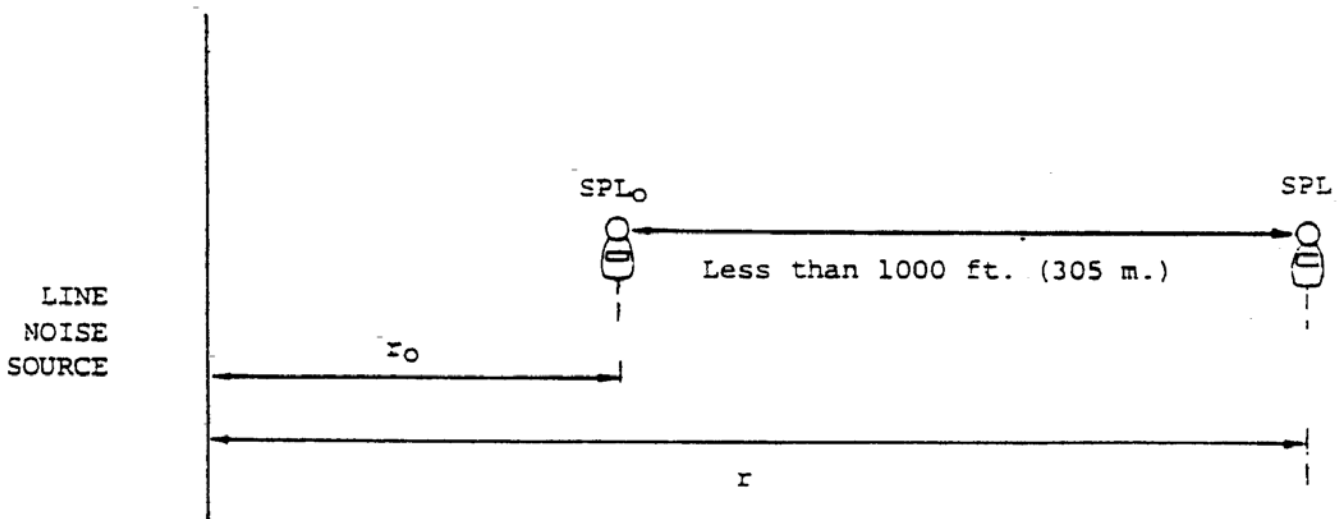
where:

SPL = sound pressure level at r feet from the source.

SPL_0 = sound pressure level at r_0 feet from the source. Note that r_0 is a reference distance and that the distance r is always greater than r_0 . The point r_0 must be in the far field of the source.

Figure 4-16 illustrates a line source, such as a highway with closely spaced moving vehicles, and the distance at which the measurement, SPL_0 , is taken and the distance where the required level SPL is needed.

This projection technique is applicable only if the distance between r and r_0 is less than 1000 feet. This projection technique should be used only when it is not practical to make a sound pressure level reading at point r .



LINE NOISE SOURCE DISTANCE ADJUSTMENT

FIGURE 4-16