

## **OPERATIONAL NOISE EMISSIONS TEST PROTOCOL**

### **BP CHERRY POINT COGENERATION PROJECT** Blaine, Washington

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#### **1.0 INTRODUCTION**

The purpose of this procedure is to define how the noise emissions of the Cherry Point Cogeneration Project will be evaluated relative to a set of pre-determined plant-only design goals once the facility is operational.

#### **2.0 GENERAL METHODOLOGY**

The plant has been specifically designed to produce a sound level at the nearest sensitive receptors that is generally comparable to or even below the pre-existing environmental sound level at each location. The total measured level at any of the criterion points is unlikely to be directly indicative of the sound emissions exclusively due to the facility since the measurements will contain a significant amount of background noise. Consequently, the procedure seeks as a primary methodology to demonstrate that the plant-only design limits have not been exceeded by comparing the total levels measured with the plant operating to the ambient levels measured at the same locations prior to construction. In general, if the new total sound levels at the designated receptor locations with the facility in operation are no more than 5 dBA higher than the average levels measured during the background survey then the noise emissions of the facility shall be considered satisfactory.

However, if this simple approach - which is predicated on the assumption that the background sound level has not increased at any of the locations during the intervening time between the two surveys - does not yield a conclusive result or ostensibly indicates that facility noise may be above the design goals, an alternative methodology following ISO 6190 (Ref. 1) shall be used to calculate the plant-only contribution.

#### **3.0 MEASUREMENT LOCATIONS**

Measurements shall be made at the following five locations illustrated in Figures 1 and 2:

- Intersection of Bay Road and Blaine Road (Position 10)
- Intersection of Jackson Road and Helweg Road (Position 9)
- 100 ft. West of (Rear of) Birch Bay Community Church (Position 7)
- Blaine Road 1800 ft. N. of Grandview Road at Gate "BL-2" (Position 13)
- Cottonwood Beach – At Retaining Wall Fence in Rear of 4961 Morgan Drive

At each of these locations the microphone of the sound level meter shall be mounted at least 5 feet above local grade and not closer than 20 feet to any potentially reflective vertical surface, such as a building or solid fence.

#### 4.0 COMPLIANCE CRITERIA

The performance of the facility shall first be evaluated using Compliance Criterion A outlined below. If this simple approach yields an unclear result or ostensibly indicates that the facility noise may be above design goals, then Compliance Criterion B shall be employed.

##### 4.1 Compliance Criterion A

With the exception of Position 13, the sound levels in Table 4.1.1 are 5 dBA higher than the average nighttime or 24 hour L90 levels that were measured at each receptor during the pre-construction background sound level survey conducted in April and May of 2004 (Ref. 2). Consequently, these levels represent acceptability thresholds for the new total environmental sound level with the plant in operation - assuming no increase in background noise. Measured levels equal to or less than these values under the relevant wind conditions will directly indicate that facility noise is in full compliance with the design goals and has not increased the pre-existing background level by more than 5 dBA.

**Table 4.1.1** *Acceptable Overall Environmental Sound Levels During Steady State Plant Operation*

Location	Acceptable Total Sound Levels (Background Noise Plus Plant Noise) During Steady State, Base Load Operation, dBA	
	Wind from SW Quadrant	All Other Wind Directions
Position 7	<b>49.4</b>	
Position 10	<b>46.7</b>	<b>43.2</b>
Position 9	<b>47.5</b>	
Position 13	<b>54.4</b> (Absolute Level, Not Related to Pre-existing Ambient)	
Cottonwood Beach	<b>45.3</b>	<b>38.1</b>

##### 4.2 Compliance Criterion B

Since the total measured sound level at each receptor location is going to be highly dependent on the level of background noise (unrelated to the facility) that is present at the time of testing, it is conceivable that the values in Table 4.1.1 might be exceeded entirely because of an increase in environmental noise rather than due to excessive facility noise. If levels greater than those in Table 4.1.1 are consistently measured at any compliance location then a more involved evaluation procedure based on ISO 6190 shall be carried out to determine the plant-only contribution (exclusive of any background noise) at that receptor(s).

In brief, the ISO procedure involves measuring the noise emissions of the facility at a distance of approximately 200 m, where plant noise is much more prominent relative to the background, and then extrapolating this result to the actual receptor point of interest.

The allowable plant-only design goal levels developed from the pre-construction survey are tabulated below.

**Table 4.2.1** *Plant-Only Noise Emissions Design Goals*

Location	Allowable Plant-Only Noise Levels During Steady State, Base Load Operation, dBA	
	Wind from SW Quadrant	All Other Wind Directions
Position 7	<b>47.7</b>	
Position 10	<b>45.0</b>	<b>41.5</b>
Position 9	<b>45.8</b>	
Position 13	<b>54.4</b>	
Cottonwood Beach	<b>43.6</b>	<b>36.4</b>

The above levels are associated solely with the cogeneration project during normal full load operation and are exclusive of any noises caused by other sources. If the ISO 6190 extrapolation methodology indicates that noise due solely to the plant is equal to or less than the values in Table 4.2.1 then facility noise shall be considered acceptable.

## **5.0 INSTRUMENTATION**

An ANSI Type 1 precision integrating sound level meter, fitted with a foam microphone windscreen, shall be used to make the measurements. The instrument shall be field calibrated just prior to the measurements and checked for drift at the conclusion of the survey. If the post-calibration check shows a drift of more 0.5 dB the measurements shall be repeated. The meter shall have been laboratory calibrated within the 12 month period preceding the survey. Calibration certificates shall be appended to the test report.

## **6.0 CONDITIONS DURING MEASUREMENTS**

### **6.1 Weather Conditions**

Acceptable weather conditions for the survey shall consist of wind speeds of 11 mph or less and no precipitation. Exceptional or unusual air temperatures or relative humidity conditions should be avoided.

Along with temperature and relative humidity, the wind speed and direction during the survey period shall be monitored in 5 minute intervals on a continuous basis by the permanent weather station on the BP refinery site for later correlation to individual sound measurements. BP shall provide the weather data in a timely manner and in electronic format after the survey has been completed. Wind speed and direction shall also be measured with a hand-held anemometer and recorded at each measurement location.

### **6.2 Plant Operating Conditions**

The cogeneration facility shall be operating under steady state, base load conditions during all measurements; i.e. all three combustion turbines and the steam turbine shall be operating at or near (within 10%) of normal base load for the ambient temperature conditions that are occurring at the time of the sound test. A DCS trend record of the unit loads vs. time shall be obtained from a plant operator and included in the survey report.

### **6.3 Refinery Operating Conditions**

Operational activities at the refinery shall be recorded by BP during the survey and a copy of the operator's log or a summary of the log shall be provided in a timely manner following the field survey. The date and time of any unusual operating conditions, such as major equipment outages and flaring, shall be recorded.

## **7.0 MEASUREMENT PROCEDURE**

Since the total sound level at any given receptor location will consist of essentially constant facility noise superimposed on a time-varying background level of similar or greater magnitude, long-term measurements are unnecessary and actually detrimental to the purpose of differentiating facility noise from the general background level. The longer the measurement duration the more extraneous noise from cars passing by, dogs barking, or planes flying over becomes incorporated into the result and the less it represents operational noise from the plant. In general, a constant noise source can be accurately and sufficiently measured in a few seconds and all of the common measurement descriptors (average, min/max, statistical percentiles, etc.) all collapse to a single value.

With a view towards minimizing the unwanted effects of unrelated environmental noise and to maintain consistency and comparability with the background measurements (which were measured in terms of 15 minute L90 levels), the noise emissions of the facility shall also be measured in 15 minute L90 samples. The L90 statistical, the level that is exceeded 90% of the measurement period, tends to filter out sporadic noise events, such as occasional car passes, and yields a value that represents the quiet lulls between such events.

A minimum of three non-consecutive L90 (15 min) samples shall be obtained at each location while the plant is operating at base load. All of the samples measured under a similar wind direction category shall be arithmetically averaged to yield a single result for comparison to Compliance Criterion A in Section 4.1. It is not inherently necessary to measure the plant under more than one wind condition.

Observations shall be made and noted of the general noise environment and audible sounds at each location. These shall include the identification and qualitative description of noticeable noise sources (e.g., traffic, the cogeneration facility, aircraft, nearby industry, etc.). Measurements may be paused and restarted for any obviously disrupting noises not associated with the facility, or they may be discarded and repeated from the beginning at the test engineer's discretion.

If the secondary evaluation technique based on ISO 6190 is required shorter duration measurements, such as Leq(15 s) samples, may be used.

## **8.0 REPORTING**

At the conclusion of the survey a report shall be prepared summarizing the results of the measurements and stating whether the facility noise levels are at, above or below the design goal levels.

If it becomes necessary to adopt the alternative ISO 6190 analytical approach to develop a clearer result, all assumptions and procedures associated with this methodology shall be fully explained in the test report such that the procedure could be repeated if necessary.

## **9.0 REFERENCES**

1. ISO 6190:1988 (E) *Acoustics – Measurement of sound pressure levels of gas turbine installations for evaluating environmental noise – Survey method*, International Organization for Standardization, Geneva, Switzerland, 1988.
2. Hessler, D. M., Report 1696-040704-A, *Pre-Construction Ambient Sound Level Survey, BP Cherry Point Cogeneration Project*, Hessler Associates, Inc., May 2004.