ACTIVE NOISE CONTROL AT THE O.H.S.C. CO-GEN FACILITY

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1 Introduction

Complaints about noise from the co-generation facility at the Ottawa Health Sciences Centre, OHSC, started when the unit went into operation in 1992. Owned and operated by TransAlta Energy Corporation, the non-utility power generating station supplies power and steam to the OHSC, and is located about 400m from a quiet residential area. Although active noise cancellation, in the past, has been applied with limited success for mitigating outdoor noise problems, AERCOUSTICS Engineering Limited designed and installed such a system in the summer of 1994, overcoming significant engineering constraints to complete a successful execution of this technology. Active noise cancellation is well suited to mitigating low frequency pure tone noise problems where sound is used to cancel the offending noise electronically by generating a mirror image or out of phase sound signal. The combination of noise and anti-noise results in an energy efficient solution that is one-fifth the cost of traditional silencer baffles.

2 Noise Source Description

AERCOUSTICS Engineering Limited was retained by the TransAlta Energy Corporation in 1993, to mitigate excessive low frequency noise from high speed operation of two wet surface air condensing or WetSAC, fans. These fans are axial, 26 ft. in diameter, have flow rates of 1,000,000 cubic feet per minute; the 15-foot exhaust stack is constructed of a stiff, lightweight quarter-inch fibreglass shroud. The low frequency noise was a result of a 23.8 Hz pure tone due to the bladepass frequency of the WetSAC exhaust fan(s). The resulting 23.8 Hz pure tone is evident in the exhaust sound spectra and in the sound radiated by the excitation of the stiff, lightweight shroud which radiates sound efficiently in this frequency range.

3 Permanent System Design And Installation

A permanent active noise control system 1 was engineered in the spring of 1994 and integrated into the overall operation at the OHSC facility that same summer. These include custom designed, innovative and unique loudspeakers as per Figure 1, and microphones which were both manufactured in Canada. They were designed to operate year round in the very humid WetSAC fan area over a temperature range of -40 to +40 °C.

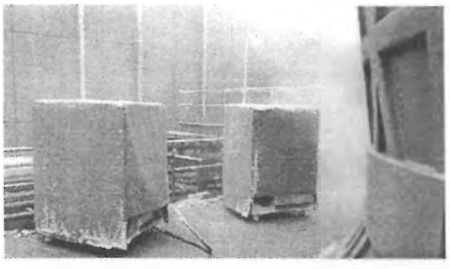

FIGURE 1: Active System Transducers. Speakers designed to withstand hostile environment.

Kevlar diaphragm loudspeakers are housed in heated enclosures built to withstand the hostile outdoor environment. Each loudspeaker system was designed and specifically tuned to the frequency range of interest to meet a target sound level of 125 dB at 1m at 24Hz. In total, two sets of four loudspeaker enclosures housing 16 18-inch drivers were placed circumferentially around each respective WetSAC fan to optimize cancellation. The active noise controller was designed to ensure that the offending noise source and cancellation sources are in anti-phase at the 23.8 Hz cancellation frequency. The system requires an absolute frequency reference for reliable operation which is supplied by a tachometer mounted at the fan drive shaft. There are also two reference microphones mounted on each fan shroud which provide the amplitude and phase reference of the fan noise. An error microphone mounted on each pair of loudspeakers monitors the amplitude and phase of the signal from the canceling noise source. The loudspeaker output amplitude is modulated with up to 9000 Watts of available amplifier power to optimize cancellation of the fan low frequency noise.

4 Active Noise Control System Performance

Sound measurements performed around the perimeter of the plant typically indicate an 11 dB reduction (as high as 17 dB measured) at 23.8 Hz as per Figure 2. This is about twice the reduction possible through the traditional methods previously mentioned. The AERCOUSTICS active noise cancellation system has been operating reliably since August, 1994, and there have been no noise complaints since its installation.

5 References

1. Nelson, P.A., and Elliott, S.J., "Active Control of Sound" *Academic Press Limited*, 1993.

NOTES: This project won the 1995 Award of Excellence as selected by the Association of Consulting Engineers of Canada and the Canadian Consulting Engineer Magazine.

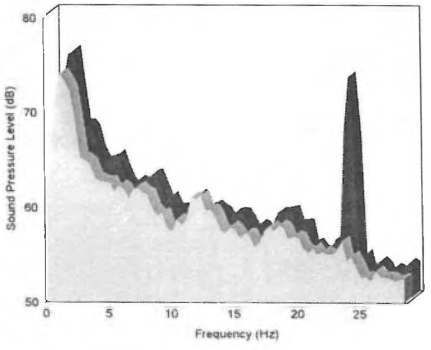

FIGURE 2: Narrowband spectra illustrating the reduction of the 23.8 Hz low frequency pure tone by up to 17 dB within the residential community.

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