OCCUPATIONAL EXPOSURE TO LOW FREQUENCY NOISE

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Introduction. The concern of occupational exposure to noise is generally concentrated on the possibility of hearing loss [1]. However acoustic phenomena do not only impinge on, or via, the auditory system. Vibroacoustic disease (VAD), a whole-body pathology, is caused specifically by long-term (years) exposure to low frequency noise (LFN) (≤500 Hz, including infrasound) [2]. Clinically, the hallmark of VAD is thickening of cardiovascular structures, namely cardiac valves and pericardium [3] To date, VAD and LFN have been investigated within the aeronautical industry [1,2,4,5]. Other professionals exposed to LFN may be at risk for developing LFN-induced pathology and VAD. Within the aeronautical industry, unmonitored LFN leads to increased absenteeism, lower productivity, higher risk of on-the-job accidents/incidents, and early disablity retirement [4,6]. The same may be occuring within other occupational settings. This report describes the low frequency distributions of acoustical environments sampled within several non-aeronautical occupational settings, in order to determine if there should be a concern that other noise-exposed professionals may develop LFN-induced pathology. **Methods.** Previous studies show that acoustic environments of commercial airliners, particularly cockpits, are rich in LFN [7], and are conducive to the development of VAD [5]. Thus, the 1/3 octave band frequency spectra of the various locations were analyzed comparatively to the cockpit of the Airbus-340. Noise was evaluated in the following locations: a) cockpit of commercial aircraft [7], b) textile factory, c) cement factory, d) bar, and e) photocopy room of administrative offices. Sound pressure levels (in dBA and dBLin) were measured with a modular precision sound level meter (Bruel & Kjaer, 2231, Denmark). Frequency spectra were obtained using a real-time frequency analyzer (Hewlett Packard, 3569 A, USA) in 1/3 octave frequency bands (from 6.3 Hz to 20000 Hz). Microphone calibration was achieved with a 250 Hz pistonphone (Bruel & Kjaer, 4228, Denmark) to a sound pressure level of 124 dB re: 20 μPa. To expand the lower limiting frequency, a 1/2 inch microphone (Bruel & Kjaer, 4165, Denmark) was attached with a coupler (Bruel & Kjaer, UC5265, Denmark), thus permitting the measurements to begin at 1.6 Hz. **Results.** Table I shows the dB-level measurements obtained at all locations. Fig. 1 shows the frequency distribution in the 1-6-500 Hz range in all locations. The bar and cement factory seem to be the environments with the overall highest levels of LFN. Below 5 Hz, infrasound levels of the photocopy room seem to be comparable with those in the cockpit. Above 50 Hz,

Table 1. dB-levels measured with (dBA) and without (dBLin) "A" weighting.

Location	DBA	dBLin
A340 Cockpit	72.1	83.2
Textile Factory	89.3	90.9
Cement Factory	96.6	104.5
Bar	98.4	104.4
Office Photocopy Room	63.4	83.0

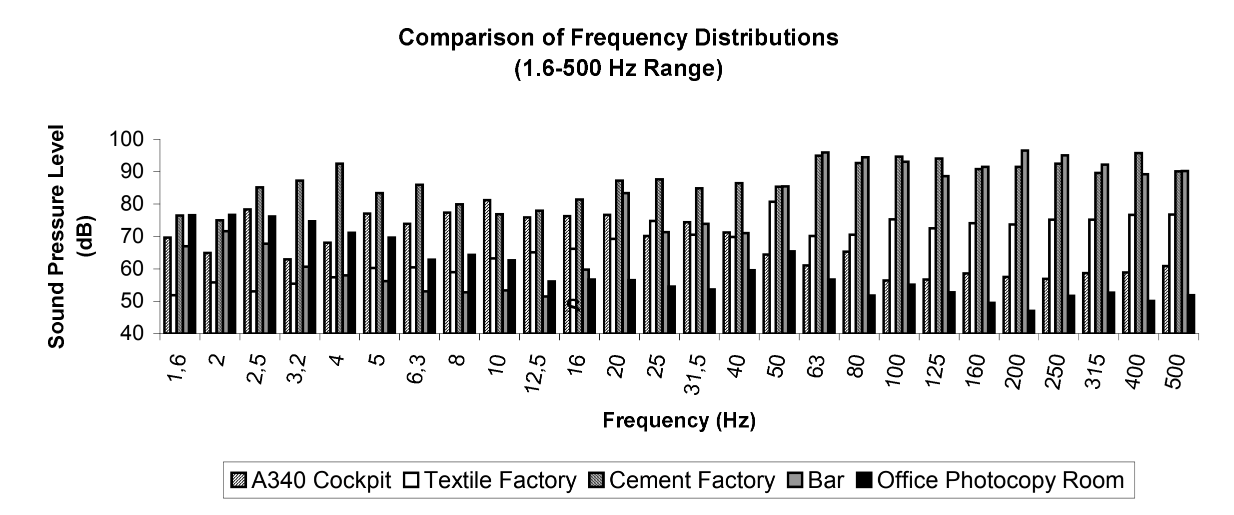

Fig. 1. Frequency distributions, within the 1.6-500 Hz range of the occupational environments.

both factories and the bar have higher levels than in the cockpit. dBA levels differ greatly from dBLin levels because the A-weighting network de-emphasizes acoustic phenomena that occurs at frequencies <500 Hz.

Discussion. The results herein demonstrate that there should, indeed, be a concern for individuals who work in noisy environments outside the aeronautical industry. Both factories and the bar possess acoustical environments that are subtantially richer in LFN than the cockpit. Since these are occupational environments, a significant amount of time is spent by these professionals exposed to this agent of disease. The higher levels of infrasound found in the cockpit, when compared to the passenger cabin, are thought to be responsible for the aceleration of the pericardial thickening in pilots as opposed to flightcrew [5,7]. Therefore, cement factory workers may also be at risk for developing VAD, especially given the LFN levels at 2.5-6.3 Hz and >20 Hz. In conclusion, despite the abundance of occupational environments that possess significant amounts of LFN, LFN-induced pathology is currently ignored by current regulations and guidelines. Professionals employed in textile and cement factories, as well as in bars, are at risk for developing VAD.

Keywords: vibroacoustic disease, legislation, infrasound, factory, bar, cockpit

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