

Back-Up Safety Alarms Minimize Environmental Noise Exposure and Focus Warning Signals

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The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) is concerned with occupational hazards, including excessive noise levels. OSHA reports that every year, approximately 30 million people in the U.S. are exposed to hazardous noise in the workplace. It specifically identifies the construction industry as a major source of noise exposure.

MSHA (the U.S. Mine Safety and Health Administration) code sets out specific criteria for the use of reversing alarms. Alarms need to "comply with noise-levels, but be audible above surrounding noise." However, MSHA seeks to enforce the installation of "warning device(s) that give an audible alarm when in reverse" on all mobile equipment.

In the U.K., noise is increasingly becoming a significant issue in the assessment of acceptable working environments. Enforced by the U.K.'s Health and Safety Executive, the Control of Noise at Work Regulations were introduced for all industry sectors in April 2006. As a result, many local authorities are insisting on the submission of noise and vibration surveys and assessing the potential impact of noise generated during both operational and construction phases.

As these examples suggest, there is a significant growth in 'noise-awareness.' Large vehicles are at a particular disadvantage where these issues are concerned. In addition to operating sounds, reversing alarm noise is a contributory factor to overall noise emissions. Penalties for noise-level violations are severe. Title 42 of the United States Code (dealing with noise pollution) can incur a \$50,000 per day fine for non-compliance.

Back-Up Alarm Function. The primary problem posed by traditional back-up alarms is that they emit narrowband sounds, which can be masked by other emissions. They are frequently ambiguous and therefore hazardous to those in a vehicle's immediate vicinity.

From a safety perspective, three parts of the frequency spectrum need to be heard simultaneously, to accurately locate a sound's source. At low frequencies of about 1 kHz and below, the brain can tell the timing difference between a sound's arrival at one ear and then the other.

This leaves a cone of confusion as to the sound's location (see Figure 1). The cone of confusion is affected by the presence of medium and high frequencies. Above around 3 kHz, it is possible for the brain to sense the intensity difference of the sound at each ear. At frequencies of 5 kHz and above, the brain can determine if a sound is located to

the front or behind the head. With sufficient spectral content the brain can pin-point the sound source to within 5 degrees.

bbs-tek® Alarm Systems. The most appropriate reversing solution is found in broadband sound – as it encompasses a wider spectrum. Brigade Electronics' bbs-tek broadband alarms provide a unique solution to the difficulty of giving the location of a sound source. In comparison to conventional back-up alarms, bbs-tek is equally as effective at alerting the listener to the presence of the reversing vehicle. As the multi-frequency range of the system spans from 400 Hz to over 8 kHz, the sound emitted is locatable and directional.

When in motion, a bbs-tek alarm provides a "white noise" hissing sound. This translates as 'shhh!' in directly audible terms. By localizing the noise emission, the alarm sound is only audible in the immediate vicinity of danger as shown in Figure 2. In addition, the effects of broadband over narrowband sound are much safer aurally.

Narrowband sound is more annoying

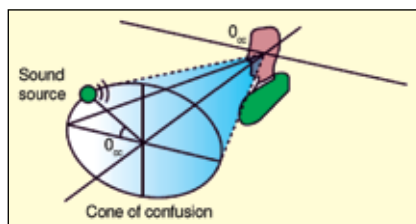


Figure 1. Directional sensitivity of human hearing to a sound source.

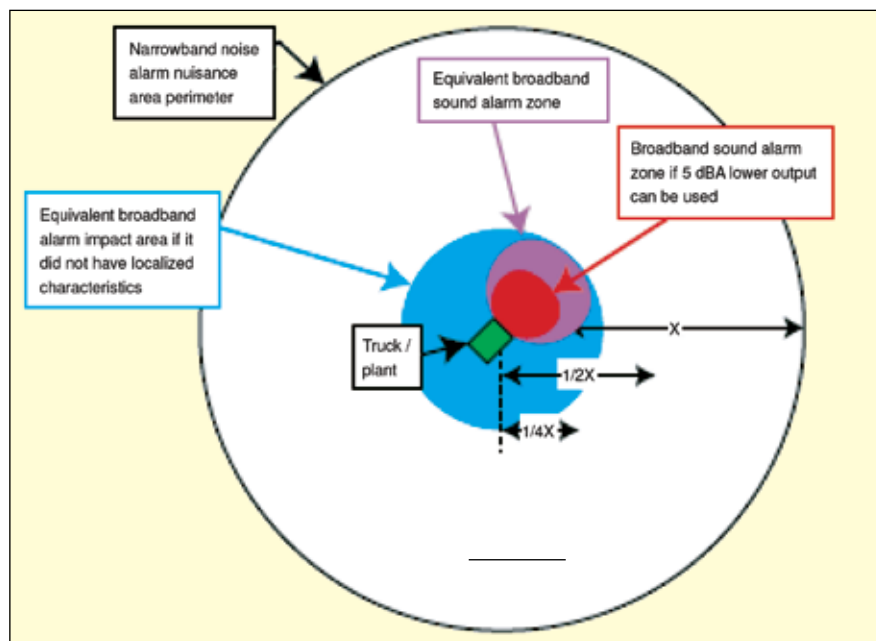


Figure 2. Plan view of alarm sound emissions.

and can cause significant ear damage at excessive levels. Noise-Induced Hearing Loss (NIHL) can be caused by a one-time exposure to high sound levels as well as repeated exposure to lower sound levels. In addition, narrowband sound activates a reflex response between the ear and the brain. This invokes feelings of annoyance and fear, as the body prepares for danger.

Environmental Noise Exposure. The need to eliminate noise problems in general comes from a collective cause to protect the wider environment, or the 'commons.' This is a key concern of Noise Pollution Clearinghouse, a non-profit organization, based in Vermont, which lobbies for greater control of noise issues by reducing noise pollution at the source (see Figure 3). The organization agrees that narrowband back-up alarms are one of the major noise complaints in the U.S. today.

Les Blomberg, director of Noise Pollution Clearinghouse, emphasizes Brigade's contribution to the commons. "bbs-tek is significantly less intrusive in surrounding environments than narrowband back-up alarms," he says. "Our testing and analyses confirm that the bbs-tek provides a superior warning for those in the danger area. It is more easily located and less likely to experience interference from reflecting surfaces than narrowband back-up alarms. The daily intrusion into homes, quiet open spaces and the work place can be dramatically reduced by the substitution of narrowband back-up alarm technology with broadband alarms."

Case History 1. Grace Pacific Corporation (GPC), a paving contractor and materials producer based in Hawaii, found that its narrowband back-up alarms were a constant source of complaints from the neighboring community. The disturbances became so problematic, that extensions to the company's mining permits came under threat.

Following a successful meeting with

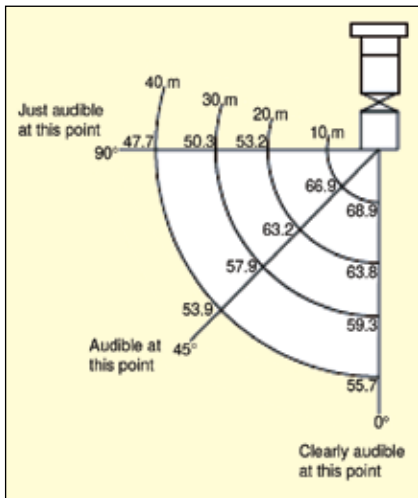


Figure 3. Polar diagram of sound levels from bbs-tek back-up alarm at the rear of a loading shovel (engine off, sound levels in dBA).

Brigade Electronics at a trade show in Las Vegas two years ago, GPC installed bbs-tek alarms on most of its quarry machine operations. Since then the company has not had a single noise complaint related to back-up alarms. In fact, local residents are so pleased

with the company's efforts; Grace Pacific Corporation has since received a "Good Neighbor Award" from a local homeowners' association.

GPC's equipment division director, Lorne Fleming, explains how bbs-tek alarms have provided a solution to a long-standing noise issue. "bbs-tek eliminates this dilemma between safety and noise pollution," she says. "We have had safety reviews with both MSHA and OSHA. Both organizations have been very impressed with the difference in the reduction of noise levels. We plan to install bbs-tek alarms on all our machines in the near future."

Case History 2. Another company that utilizes bbs-tek systems is Memphis Stone and Gravel (MS&G), based in Tennessee. The company first fitted bbs-tek alarms on its fleet of wheel loaders. New alarms were then installed on other mobile machinery – dozers, water wagons, as well as smaller equipment. 50% of all MS&G machinery has now been configured with bbs-tek alarms. "We aim to be proactive towards combating noise pollution," explains Alan Parks, company president. "Not just on our sites, but in any area in which we operate machinery,

we have found these alarms are a tangible way of taking a proactive stance."

The narrowband alarms used previously were of particular nuisance to a cross section of citizens. As suburban growth continues in Memphis, planning permission committees have become more stringent. Approval for quarrying, mining and building is required on both a local and state level. The initial phase takes into account the length of time a job site will last, and estimates potential impact on local communities. Concerns are expressed by those affected at this stage.

MS&G has found that its voluntary installation of bbs-tek alarms has greatly reduced local concerns about noise pollution. MS&G even has a policy of inviting both interested and affected parties to inspect the company's plant equipment, demonstrating to them the benefits of broadband sound over traditional back up alarms.

Please visit www.brigade-electronics.com for additional information on bbs-tek® alarms and the Brigade Electronics' product line. The author may be reached at: henry.morgan@brigade-electronics.com.