SAUDI BINLADIN GROUP
OPERATION & MAINTENANCE

SBG O&M NOISE CONTROL PROCEDURES

SAUDI BINLADIN O&M SAFETY DEPARTMENT

SCOPE

This Noise Control Plan details prevention and management measures for noise and vibration associated with SBG O&M activities. It defines mitigation measures to control of the noise impacts of maintenance activities on potentially affected receivers, and contingency measures that may be implemented if complaints are received.

OBJECTIVES

- Comply with all statutory requirements.
- Avoid or minimize adverse noise impacts from maintenance through maintenance methodology and appropriate management measures.
- To minimize the generation of noise and vibration from maintenance activities which could affect working personnel.
- To minimize the generation of noise and vibration from maintenance activities which could affect neighboring residences, Base personnel and associated building occupants and other community members.
- Establish and maintain good relations with the community and neighboring operations.

According to the ILO, noise is defined as: “all sound which can result in hearing impairment or be harmful to health or otherwise dangerous.” It is worth noting that noise is commonly defined as “unwanted sound”, and indeed this definition can be found on the European Agency for Safety and Health at Work (EU OSHA) website. From a health and safety perspective this definition is incorrect and misleading. It makes no difference whether a sound is wanted or unwanted; if exposure is significant then risk of hearing damage exists. The risk to hearing created by the noise generated by an orchestra is considered in the same way.

INTRODUCTION

Long term and frequent exposure to loud noise can permanently damage a person's hearing, possibly resulting in deafness.

Acute short term hearing loss can result from exposure to an instantaneous loud noise eg. an explosion. This may also have a long-term affect.

- Damage from excess noise can occur by
- Failing to recognize hazardous noise
- Not using suitable hearing protection
- Wearing hearing protection incorrectly
- Using faulty or damaged hearing protection
- Failing to wear hearing protection in designated areas

DEFINITIONS

Hazardous noise in relation to hearing loss means noise that exceeds the exposure standard for noise in the workplace.

Exposure standard for noise is LAeq,8h of 85 dB(A) or an LC, peak of 140 dB(C). There are two parts to the exposure standard for noise because noise can either cause gradual hearing loss over a period of time or be so loud that it causes immediate hearing loss.

Nuisance Noise is that which is perceived as annoying, irrespective of daily exposure.

Administrative Noise Control Measures are work systems designed to substantially reduce noise exposure. Examples are job rotation, job redesign or rosters which are designed to reduce exposure to noise.

Audiometric Testing is the testing and measurement of the hearing threshold levels of each ear of a person by means of pure tone air conduction threshold tests.

Engineering Noise Control Measures is any engineering procedure that reduces the sound level either at the source of the noise or in its transmission, but does not include the use of administrative noise control measures or personal hearing protectors.

Ototoxic substance is one that can cause hearing loss or exacerbate the effects of noise on hearing. They consist of industrial chemicals and some medications. Ototoxic substances absorbed into the bloodstream may damage the cochlea in the inner ear and/or the auditory pathways to the brain, leading to hearing loss and tinnitus. Hearing loss is more likely to occur if a worker is exposed to both noise and ototoxic substances than if exposure is just to noise or ototoxic substances alone

Hand-arm vibration is vibration transmitted to the hand and arm during the operation of hand-held power tools and hand-guided equipment, or holding materials being processed by machines.

Plant is any machinery, equipment, appliance, implement or tool, and anything fitted or connected to them.

PROCEDURE

HAZARD IDENTIFICATION

Hazardous noise can affect an individual's hearing and can make it difficult to hear sounds necessary for working safely e.g. warning signals and communication. It is essential that all sources of noise hazards are identified within the workplace by following a risk management approach. Appropriate controls should be developed to reduce the risk of the hazard on workers who are likely to be exposed to the noise hazard.

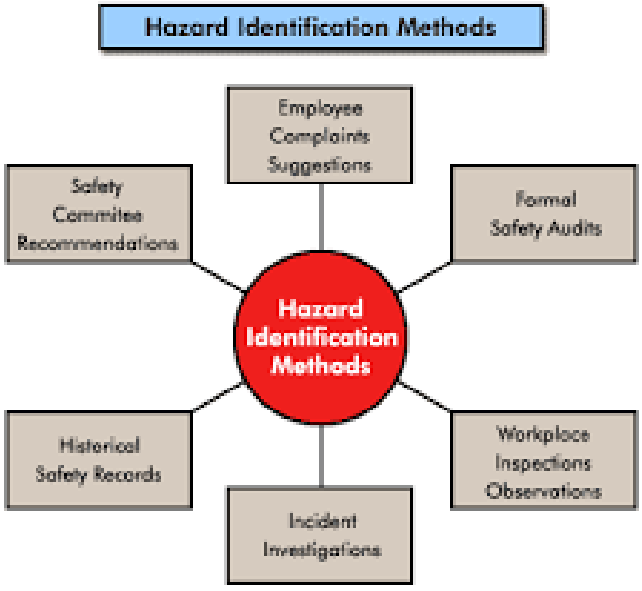
Potential noise hazards can be identified from:

a) Information from manufacturers and suppliers who have a legal responsibility to provide appropriate information regarding the noise output of plant and equipment. Any information provided by a manufacturer or supplier is to be held by the work unit which has control of the area or plant to which it relates. This information is to be made available to workers within this area.

b) Direct observation, inspections and records. Workplace inspections, audits, walkthrough surveys and direct observation of work tasks being performed will assist in the identification of potential noise hazards. These inspections should be carried out in consultation between Managers and workers.

c) Consultation with the workforce

d) Hazard/Incident reports



RISK MANAGEMENT

A 'Yes' to any of the following indicates the need to carry out a noise assessment if exposure to the noise cannot be immediately controlled.

- Is a raised voice needed to communicate with someone about one meter away?
- Do your workers notice a reduction in hearing over the course of the day? (This may only become noticeable after work, for example, needing to turn up the radio on the way home).
- Are your workers using noisy powered tools or machinery?
- Are there noises due to impacts (such as hammering, pneumatic impact tools) or explosive sources (such as explosive powered tools, detonators)?
- Are personal hearing protectors used for some work?
- Do your workers complain that there is too much noise or that they can't clearly hear instructions or warning signals?
- Do your workers experience ringing in the ears or a noise sounding different in each ear?
- Do any long-term workers appear to be hard of hearing?
- Have there been any workers' compensation claims for noise-induced hearing loss?
- Does any equipment have manufacturer's information (including labels) indicating noise levels equal or greater than any of the following?
- 80 dB(A) LAeq, T (T= time period over which noise is measured)?
- 130 dB(C) peak noise level?
- 88 dB(A) sound power level?
- Do the results of audiometry tests indicate that past or present workers have hearing loss?

KEY ISSUES AND RISKS

During SBG O&M works, nearby building structures (and their occupants) may be affected by related noise and vibration.

This Noise & Vibration Management Plan details a range of mitigation measures designed to prevent the following risks from occurring:

- Noise and vibration affecting nearby properties.
- Vibration affecting site structures including heritage listed items and adjacent facilities.
- Complaints from adjacent community and neighbouring maintenance sites.

Acoustical wall and ceiling panels can be constructed of many different materials and finishes. The ideal acoustical panels are those without a face or finish material that interferes with the acoustical infill or substrate. Fabric covered panels are one way to maximize the acoustical absorption. The finish material is used to cover over the acoustical substrate. Mineral fiber board is a commonly used acoustical substrate. Finish materials often consist of fabric, wood or metal. Fabric can be wrapped around substrates to create what is referred to as a "pre-fabricated panel" if laid onto a wall, and require no modifications. Such fabrics are generally acoustically 'transparent, meaning that they do not impede a sound wave.

Reductions in cost of technology have allowed noise control technology to be used not only in performance facilities and recording studios, but also in noise-sensitive small businesses such as restaurants. Acoustically absorbent materials such as fiberglass duct liner, wood fiber panels and recycled denim jeans serve as artwork-bearing canvasses in environments in which aesthetics are important. Using a combination of sound absorption materials, arrays of microphones and speakers, and a digital processor, a restaurant operator can use a tablet computer to selectively control noise levels at different places in the restaurant: the microphone arrays pick up sound and send it to the digital processor, which controls the speakers to output sound signals on command.

KEY LEGISLATION /STANDARDS

General Guidelines and Standards:

- NSW EPA Interim Construction Noise Guideline
- NSW OEH Assessing vibration – a technical guideline
- AS 1055.1-1997 Acoustics – Description and measurement of environmental noise – General Procedures
- AS 1055.2-1997 Acoustics – Description and measurement of environmental noise – Application to specific situations
- AS 2436 (1981) Guide to Noise Control on Maintenance Sites.

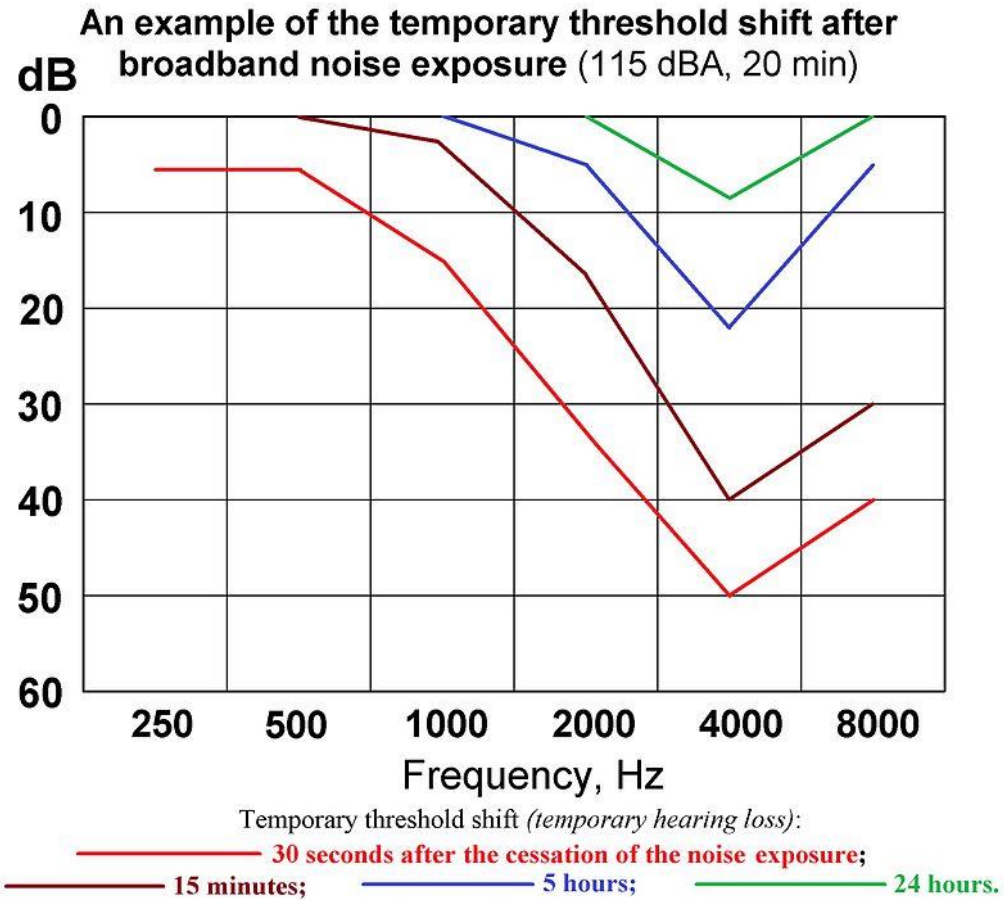
Fixed sound sources must be treated differently than moving sources. In the former case, the listener is normally defined while for moving sources it is not. Historically, regulations were enforced by the subjective judgment of an enforcing officer. With the advent of sound measuring equipment, the judgment can be based on measured sound levels. Most comprehensive noise ordinances contain four types of provisions.

Subjective Emission These regulations allow an official to decide if the output of a sound source is acceptable without recourse to sound measurements and without regard to the presence of a specific listener. Regulations with plainly audible terms on public property as a criterion are examples.

Subjective Immission These regulations allow an official to decide if the sound received by a listener is acceptable without recourse to sound measurements and without regard for the specific sound power generated by the source. Regulations with plainly audible or noise disturbance terms on private property as a criterion are examples.

Objective Emission These regulations require an official to measure the output of a sound source to determine whether it is acceptable without regard to the presence of a specific listener. Regulations with specific maximum sound output levels for motor vehicles are examples.

Objective Immission These regulations require an official to measure the sound received by a listener to determine whether it is acceptable without regard to the specific sound power generated by the source. Regulations with maximum allowable sound levels on property lines are examples.



ROLES AND RESPONSIBILITIES

MANAGERS

· Managers of SBG O&M should give purchasing preferences to goods that do not exceed the general 85dB(A) limit or 50dB(A) for office and computing equipment. Where there is only one supplier and the noise emission of the goods is unacceptable, managers should place the onus on the supplier to provide and install acoustic insulation.

· Managers of SBG O&M should ensure that all statutory requirements are complied with and a noise management implementation plan is developed.

· SBG O&M Staff must be made aware of control measures implemented to reduce exposure to noise and be encouraged to cooperate in using agreed safe work practices.

· Managers of SBG O&M should ensure that workers receive appropriate training and education on the risks of exposure to noise and the appropriate control measures.

· Managers of SBG O&M should implement a comprehensive personal hearing protection program, including the selection of personal hearing protectors, and instruction of Workers in their correct use and maintenance.

· Managers of SBG O&M must ensure that identified workers attend audiometric monitoring.

SUPERVISORS

Supervisors have a responsibility to ensure that staff wear prescribed hearing protection and to provide an example to other staff by wearing hearing protection themselves when in designated areas.

SAFETY STAFF

Staff must wear hearing protection in all areas where it is required and sign-posted.

· SBG O&M safety staff are required to co-operate with Supervisors and Managers in terms of implementation of this procedure, as well as work in a manner consistent with safe working practices.

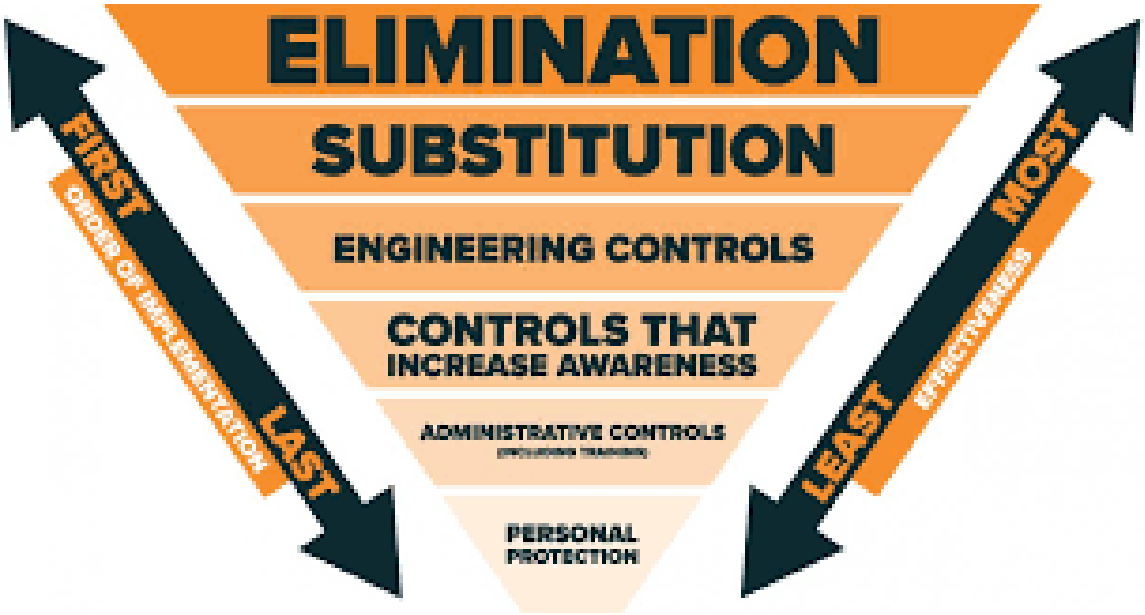
CONTROL MEASURES

There are several ways to limit your exposure to hazardous industrial noise. There is a hierarchy of controls which companies have to abide by if their employees are exposed to a hazardous amount of noise. First, the company can eliminate the noise source. If the noise source cannot be eliminated or switched out, the company must try to engineer that noise out. This process is called acoustic quieting.

Acoustic quieting is the process of making machinery quieter by damping vibrations to prevent them from reaching the observer. The company can isolate the certain piece of machinery by placing materials on the machine or in between the machine and the worker to decreases the signal intensity that reaches the workers ear.

Noise decreases as distance from its source increases. When two identical noise sources are side by side producing a recorded noise of, say, 100 dB(A) the reduction in noise from removing one of the noise sources is about 3 dB, resulting in 97 dB(A). When the distance to a noise source is doubled the recorded noise level is reduced by 6 dB, sometimes called the Rule of 6.

To decrease the employees exposure to hazardous, the company can take administrative controls limiting the employee's exposure time. This can be done by changing work shifts and switching employees out from the noise exposure area. Lastly, to decrease industrial noise exposure, Personal protective equipment should be used. There are several types of Earplug that can be used to attenuate the noise down to a safe level.



IMPLEMENTATIONS

Noise control is an active or passive means of reducing sound emissions, often for personal comfort, environmental considerations or legal compliance. Active noise control is sound reduction using a power source. Passive noise control is sound reduction by noise-isolating materials such as insulation, sound-absorbing tiles, or a muffler rather than a power source.

Active noise canceling is best suited for low frequencies. For higher frequencies, the spacing requirements for free space and zone of silence techniques become prohibitive. In acoustic cavity and duct based systems, the number of nodes grows rapidly with increasing frequency, which quickly makes active noise control techniques unmanageable. Passive treatments become more effective at higher frequencies and often provide an adequate solution without the need for active control. Sound is a pressure wave, which consists of alternating periods of compression and rarefaction. A noise-cancellation speaker emits a sound wave with the same amplitude but with inverted phase (also known as antiphase) to the original sound. The waves combine to form a new wave, in a process called interference, and effectively cancel each other out – an effect which is called destructive interference. Modern active noise control is generally achieved through the use of analog circuits or digital signal processing. Adaptive algorithms are designed to analyze the waveform of the background aural or nonaural noise, then based on the specific algorithm generate a signal that will either phase shift or invert the polarity of the original signal. This inverted signal (in antiphase) is then amplified and a transducer creates a sound wave directly proportional to the amplitude of the original waveform, creating destructive interference. This effectively reduces the volume of the perceivable noise. A noise-cancellation speaker may be co-located with the sound source to be attenuated. In this case it must have the same audio power level as the source of the unwanted sound. Alternatively, the transducer emitting the cancellation signal may be located at the location where sound attenuation is wanted (e.g. the user's ear). This requires a much lower power level for cancellation but is effective only for a single user.

EVALUATION OF INTRODUCED CONTROLS

Evaluation and assessment of any controls introduced must be undertaken in consultation between managers, supervisors and workers directly involved in the work area identified as possessing a noise hazard. The results of this assessment should be communicated to involved parties.

CONSULTATION

Consultation on noise hazards is to be undertaken between SBG O&M management, workers, Health & Safety Representatives and/or committees. This consultation is to occur:

a) As early as possible in the planning/design phase of the introduction of new or modified work areas, plant or practices and procedures, or in the review of existing noise management strategies.

b) When determining the approach and methods to be used in assessing noise hazards, and when decisions are being made on appropriate control measures.

c) When the effectiveness