Health and Safety Executive **Information Document**
HSE 634/8
Part 1

THE PROTECTION OF OPERATORS OF DIRECT PRESSURE BLASTING EQUIPMENT FROM NOISE

NOISE EXPOSURE

1 This document contains internal guidance, covering both noise and dust exposure, which has been made available to the public. The guidance is considered good practice but is not compulsory. You may find it useful in deciding what you must do to comply with the law. However, the guidance may not be directly applicable in all circumstances and any queries should be directed to the appropriate enforcing authority.

2 Exposure to loud noise can cause irreparable hearing damage. The Noise at Work Regulations 1989 (NAW Regulations) place responsibilities on employers, employees, and people who make and supply noisy machinery. At the workplace, primary responsibility lies with the employer to take action where noise exposure is likely to be at or above any of the 3 'action levels'. Two of the action levels are values of 'daily personal exposure to noise' and these depend on the noise level in the working areas and how long people spend in them during the day. The first action level is a daily personal exposure to noise of 85 dB(A) and the second level is a daily personal exposure to noise of 90 dB(A). There is also a peak action level which depends on the maximum pressure reached by the sound wave. The Regulations set this at 200 pascals.

3 Reducing noise at source is the best way to reduce the exposure of workers to loud noise and so protect their hearing. Employers have a general duty to reduce the risk of hearing damage to the lowest level reasonably practicable (NAW Regulations, regulations 6 and 7).

4 HSE publishes a range of guidance including some free leaflets IND(G)75(L) Introducing the Noise at Work Regulations: a brief guide to new requirements for controlling noise at workplaces and IND(G)99(L) Noise at work: advice for employees.

5 There are 3 distinct groups of persons exposed to noise emanating from the direct pressure blast process. They are:

(1) the kettle operator (kettleman);

(2) the blasting operator (nozzleman); and

(3) others working in the vicinity of blasting operations.

Measures to reduce the exposure to noise of each group are set out at paragraphs 6-8.

The kettleman

(4) The compressors powering the system should be provided with suitable enclosures which should be well maintained and in place. Such enclosures are widely available and, provided the noise reduction measures are well maintained and properly used, they are effective.

(5) The compressors should be sited away from the kettleman's work station so as to minimise their contribution to noise exposure.

(6) The exhaust port (dump valve) used for the release of compressed air from the kettle prior to re-filling with abrasive should be fitted with a silencer or alternatively the exhaust air should be ducted to a remote position via an over-sized hose. **This is the single most significant improvement that can be made to reduce the kettleman's noise exposure.**

(7) A noise assessment by a competent person is required under NAW Regulations, regulation 4 to determine the noise exposure levels. If the daily exposure is 85 dB(A) - first action level - ear protectors should be provided to employees who ask for them (regulation 8(1)). If the daily exposure is 90 dB(A) or above, all workers exposed to the noise should be provided with ear protection (regulation 8(2)). Such an assessment should include information on suitable ear protection, required by the kettleman and should take account of possible noise exposure from any communication headset device in use. If a communication system is in use between blasters and kettleman, an assurance needs to be sought that the headset on which it is based has the required level of passive attenuation to ensure the noise level inside the earcup does not exceed 80 dB(A). Also, the noise level generated by speech communication needs to be controlled so that the level inside the earcup does not exceed 85 dB(A).

(8) All equipment should be properly maintained and be in a state of good repair. All compressed air leaks from pipework, couplings or valves should be repaired. Leaks from around the rubber popper valve seal in the hemispherical lid of the kettle are particularly important.

The nozzleman

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(1) Where reasonably practicable, 'quiet blasting nozzles' should be used. The internal diameter of these nozzles increases along their length, allowing for a decrease in air velocity, without a decrease in grit velocity. The lower air velocities are associated with lower noise levels.

(2) Helmets should comply with current standards in respect of the noise level generated by the breathing air supply, which should not exceed 80 dB(A), under conditions specified in the standard (see ID Part 2 paras 17-21).

(3) Assessment of the ear protection required for the operators should be on the basis of the noise levels generated in the vicinity of the blaster's head and no allowance should be made for any attenuation provided by the helmet. This is because there are no requirements in present standards dealing with the construction of blasting helmets relating to their noise attenuating properties.

(4) The table below can be used in the short term as a generic assessment of noise. It is a noise spectra built up from a range of noise measurements performed on DPB operations. It indicates the likely exposure of shotblasting operators to noise and will assist in the consequent selection of suitable ear protection using the guidance available.

Octave Band Centre Frequency Hz	63	125	250	500	1,000	2,000	4000	8000
Octave Band Leq dB(Lin)	110	107	108	112	118	122	125	122

(5) Communication headsets based on hearing protectors are commonly used by blasting teams. The hearing protectors used should be selected so as to reduce the above blasting spectra to at least 80 dB(A) at the ear. The level of speech generated noise inside the earcup of the headset should then be controlled so as not to exceed 85 dB(A).

(6) Microphones on such systems should be voice activated so that they only transmit noise when required and do not continuously transmit blasting noise to others on the system.

Others Working in the Vicinity of Blasting Operations

7 Fortunately, the nature of the process generally keeps other people at a safe distance from such operations, and directly transmitted noise from blasting is not normally a major problem. The high frequency noise generated is often controlled by distance and by naturally occurring barriers such as the dock side or ship's hull. Problems may arise from poor selection of ventilating fans or shot recovery systems. Roots blowers on recovery systems can create extensive noise affected zones, and if used will require effective noise control measures to be taken.

Maintenance of equipment

8 Particular emphasis should be placed on the need for efficient maintenance of any item supplied to control noise or to protect against it. The standards of maintenance are often poor. The Noise at Work Regulations, regulation 10(1)(b) requires maintenance of both plant and ear protection equipment. The maintenance programme also needs to include the machinery and blasting equipment.

Instruction and Training of Workers

9 Employers should provide adequate information, instruction and training about the risks to hearing, what employees should do to minimise the risk, how employees can obtain ear protection (if they are exposed to 85 - 90 dB(A)) and their obligations under NAW Regulations (regulation 11). Ear protection zones should be marked with notices, as far as is reasonably practicable, where daily exposure is 90 dB(A) or above. All workers who enter an ear- protection zone should use ear protection.

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Part 2

PROTECTION OF OPERATORS OF DIRECT PRESSURE BLASTING EQUIPMENT FROM DUST

DUST EXPOSURE

1 Personal exposure of blasting operators to dust during shotblasting in the shipbuilding SHIP-REPAIRING and fabrication industries will vary greatly. The levels of dust in air encountered will depend on the material being blasted, the blasting medium, and the extent to which the process is enclosed. For example, potential exposures of almost 2,000 mg/m3 of respirable dust, and over 6,000 mg/m3 total inhalable dust, have been measured during internal blasting of freshwater tanks on a ship. The conventional approach to the protection of blasters has been through the provision of a blaster's helmet, which provides respiratory protection. However, in some cases very high levels of total inhalable dust have been measured inside helmets.

2 Workers on tasks associated with the blasting, for example kettlemen, may have lower, but possibly significant, exposures if measures to control the spread of dust from the process are inadequate.

3 Workers should not be exposed to substantial concentrations of airborne dust of any kind. The General Approved Code of Practice (ACoP) to The Control of Substances Hazardous to Health Regulations 1994 (COSHH) (see ID paragraph 26 reference 1) states that a substantial concentration of dust should be taken as 10 mg/m^3 (8-hour time weighted average (8-hr TWA)) of total inhalable dust; or 5 mg/m^3 (currently under review) (8-hr TWA) of respirable dust. Invariably the direct pressure blasting process releases dust into the atmosphere in excess of these levels, and action is required to control exposure.

4 The COSHH assessment for the operation should identify if any specific airborne contaminants are present, for example metals, metal oxides, silica. Exposure of workers to each contaminant should be controlled within the occupational exposure limit if one is set (see paragraph 26 reference 2).

5 The Control of Substances Hazardous to Health Regulations, regulation 4(1) and schedule 2 (see paragraph 26 reference 1) specify that sand or other substances containing free silica must not be used as an abrasive in direct pressure blasting apparatus.

CONTROL BY MEANS OTHER THAN RPE

6 Alternative methods of surface cleaning which do not generate high levels of dust, are to be used if reasonably practicable, for example, wet blasting and ultra high pressure water jetting. Dust must be controlled as far as reasonably practicable by means other than personal protective equipment (PPE). At very high dust levels it may be impossible to adequately control inhalation exposure by the use of respiratory protective equipment (RPE) alone.

7 There are difficulties with fully controlling exposure by means of ventilation because of the volume of air used in the blasting process. For smaller items, booths are available which separate the worker from the process. Large blasting booths and ventilated enclosures should be designed so that there is directional movement of air across the worker from the back to the front, or from side to side. To prevent the spread of dust, booths and enclosures should have an inward air velocity of at least 2 ms-1 across openings away from the immediate blasting area. In the immediate blasting area there should be no gaps which will allow the escape of dust which may be at a greater velocity than the inward air current.

8 The principle for dust control in confined areas should be to produce a flow of dusty air away from the worker, with dust laden air extracted as close as possible to the work.

CONTROL USING BLASTING HELMETS AND OTHER RESPIRATORY PROTECTIVE EQUIPMENT

9 The use of RPE should only be considered after all other reasonably practicable control measures are in place. When comparing the relative costs of engineering control and PPE long-term costs should be used. Each item of RPE is comparatively inexpensive to buy, but replacement and maintenance costs must be added. Each situation will be different but, over time, the cost of RPE may be similar to the cost of engineering control. General advice on control of dust exposure is given in the publications at paragraph 26 references 3 and 4.

10 Blasting helmets are an essential method of protection in many situations and should be selected carefully. Equipment should be suitably robust for the job being done and kept well maintained. For hired equipment, records of maintenance should be available to users and should be examined.

11 Shotblasting helmets are not suitable for protection against non-dust hazards or oxygen deficiency. This is especially important in confined spaces. Entry into confined spaces should be subject to a system of work which ensures the absence of other inhalation risks. A permit to work may be necessary.

12 Helmets and hoses should be part of complete assemblies of equipment which have been tested in combination and are CE marked or HSE approved. Users should also ensure that the equipment offers **adequate** protection against the dust from the process in the concentrations generated. That is to say, the equipment should reduce exposure to levels required by the COSHH Regulations. Manufacturers will indicate the designed level of protection offered but this is a

maximum figure which may not be achieved in practice. As a safety margin equipment should give a maximum protection several times higher than the dust levels expected.

13 Blasting helmets come under the Personal Protective Equipment (EC Directive) Regulations 1992. Further information can be obtained from local trading standards officers or the Department of Trade and Industry, 3rd Floor, 151 Buckingham Palace Road, London, SW1 W9SS, telephone 0171 215 1427. CE equipment will usually be tested to BS EN 271 (paragraph 26 reference 5) and should be marked.

14 HSE approved helmets and hoses should have been tested to HSE's TM 14/7.29 protocol and be marked. They are listed in an HSE publication (paragraph 26 reference 6). This approval applies only to equipment purchased before 1 July 1995 but the equipment may still be used provided it is suitable for the task and is in good condition.

15 Control of exposure of ancillary workers is more likely to be achievable without resort to RPE, but it may be necessary for part of the time. If RPE is required then in most cases the choice will be between filtering face piece (FFP), half-mask, or ventilated visor respirators. These types of respirator give similar levels of protection. Ventilated visor respirators, with or without an integral helmet, have the advantages of greater protection from higher-performance models (if required) and greater comfort over the work period. Further guidance on the choice of respiratory protective equipment may be found in references 7 and 8 (paragraph 26).

16 The actual performance of all respiratory protective equipment will be affected by a number of workplace factors:

(1) RPE should be well maintained and fit properly;

(2) appropriate training should be given;

(3) good quality air should be supplied to air-fed equipment; and

(4) allowance should be made for strenuous work which may reduce protection.

BREATHING AIR

17 Breathing air should be supplied at the rate, or within the pressure range, recommended by the manufacturer. It should not be possible to adjust the air-flow outside the recommended range. Equipment should have a 'start of shift' flow indicator and/or an in-use low flow-rate warning device.

18 Compressors supplying breathing air should preferably be oil-less; usually of the rotary type. In practice, the same compressor is often used for both breathing and blasting air. There should be in-line filters or traps, particularly for oil mist and water. These should be kept drained and adequately maintained. If necessary some

equipment may be fitted with catalytic carbon monoxide filters, an alternative is to use a supply of medical grade air from cylinders.

19 BS 4275 (paragraph 26 reference 7) gives standards for breathing air quality. The following concentrations of contaminants should not be exceeded:

Carbon monoxide	5 ppm
Carbon dioxide	500 ppm
Oil mist	0.5 mg/m^3

The air must be free from all odour and contamination by dust, dirt or metallic particles and should not contain any other toxic or irritating ingredients. It should also be at a temperature which operators find comfortable.

20 BS 4275 is currently (1997) being revised. A European standard on breathing air quality, is being drawn up (pr EN 12021).

21 Advice on air quality testing is available in British Occupational Hygiene Society Technical Guide No 6 (paragraph 26 reference 9).

MAINTENANCE

22 Any engineering controls should be thoroughly examined and tested at suitable intervals. For ventilation systems the intervals should not be greater than 14 months. (See COSHH ACoP paragraphs 67-70 (paragraph 26 reference 1).

23 Respiratory protective equipment should be inspected each time it is used. Because of the harsh environment in which this equipment is used, frequent maintenance should be regarded as essential. Some components may wear out quickly and need repair or replacement, using the correct manufacturers approved spare parts. The COSHH Regulations require that RPE is thoroughly examined at suitable intervals. Typically, this would be monthly but may be more often if necessary. The interval should be laid down in the COSHH assessment. Examination should follow manufacturer's instructions and any faults identified should be corrected before it is used again. This should include all air-lines and the compressor, and a test of the quality of the supplied breathing air. Records of maintenance and air quality should be kept.

24 Employees should not be permitted to use their own equipment unless they can show that it is suitable, ie CE marked or approved as appropriate and is well maintained.

TRAINING

25 Users of RPE, including helmets should be trained in correct use according to the manufacturer's instructions. This should include how to fit and wear the equipment, and the limitations of its protection. Training in maintenance procedures should be given to whoever is to be responsible.

REFERENCES

26 1 Control of Substances Hazardous to Health Regulations 1994 and General Approved Code of Practice (L5) ISBN 0-7176-1308-9.

2 HSE Guidance Note EH 40 Occupational Exposure Limits 1997 (reviewed annually) ISBN (for 1997) is ISBN 0-7176-13151.

3 HSE Guidance Note EH 44 Dust: General principles of protection ISBN 0-11-885595-6.

4 HSE Guidance Note HS(G) 37 An introduction to Local Exhaust Ventilation ISBN 0-11-882134-2.

5 BS EN 271: 1995 Respiratory protective devices. Compressed air line or powered fresh air hose breathing apparatus incorporating a hood for use in abrasive blasting operations. Requirements, testing, marking.

6 Respiratory Protective Equipment 4th Edition (revised periodically) - legislative requirements and list of HSE approved standards and type approved equipment. ISBN 0-7176-1036-5.

7 British Standard BS 4275: 1974 Recommendations for the selection, use and maintenance of respiratory protective equipment.

8 HSE Guidance Note HS(G) 53 Respiratory protective equipment - a practical guide for users. ISBN 0-11-885522-0

9 British Occupational Hygiene Society Technical Note No 6 Sampling and Analysis of Compressed Air to be used for Breathing Purposes. Science Reviews Ltd. ISBN 0-905927-17-6.

Publications 1, 2, 3, 4, 6 and 8 are available from HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS, telephone 01787 881165, fax 01787 313995.

Publications 5 and 7 are available from the British Standards Institution 2 Park Street, London, W1A 2BS.

Publication 9 is available from the British Occupational Hygiene Society Georgian House Great Northern Road, Derby, DE1 1LT.

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