



Noise mapping in paper mills

Introduction

This information sheet (**which is only available on the Internet**) has been produced by the Paper and Board Industry Advisory Committee (PABIAC) to help employers and employees understand their legal duties under the Noise at Work Regulations 1989 (the Noise Regulations) to reduce the risk and injury to employees' hearing. PABIAC involves representatives from the trades unions, employer's organisations and the Health and Safety Executive (HSE). The committee was formed in 1979 to advise the Health and Safety Commission on health and safety issues relating to the manufacture of paper and board.

To successfully implement noise control measures, it is first necessary to obtain information about the noise levels to which employees are exposed, ie to make a noise assessment. Specific advice on this is given in the PABIAC information sheet *Noise assessments in paper mills*,¹ which fits into the binder *Guide to managing health and safety in paper mills*.² In this (noise mapping) information sheet, more detailed advice is given on the use of the noise mapping technique to identify the source of noise and the exposure levels at different locations within the workplace.

What is noise mapping?

In an area such as a machine hall there are a number of closely placed noise sources such as vacuum pumps, couch rolls, air and steam valves etc. Each makes a contribution to the overall sound pressure level (noise level) at a given position. The technique of noise mapping is simply a way of taking measurements at predetermined positions identified by applying a 1 m grid to the floor plan. These measurements are then displayed on the floor plan to produce a contour map (see Figure 1).

Noise mapping may be performed by capable in-house staff using readily available integrating sound level meters which can be hired or purchased. The exercise involves minimal time and cost.

How does noise mapping help?

By generating a contour map illustrating the distribution of noise, employers are provided with a graphical representation of sound pressure levels, ie the level of noise, within the workplace and can more readily calculate the noise exposure that employees undertaking tasks at particular locations are likely to be exposed to. The map can also be used to:

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- identify plant creating particularly high sound pressure levels which may be amenable to noise reduction at source;
- locate the cause of high sound pressure levels which may be some distance from the source. It may be necessary to pursue this in more detail using a measure of sound intensity;
- monitor noise emission from machines or processes to highlight the need for maintenance or repair, eg wear in bearings of defective valves;
- identify low-noise corridors so that the movement of people within the building can be organised to reduce unnecessary exposure;
- check ear protection zones and monitor the use of ear protection;
- for maximum benefit, the noise map can be overlaid onto existing building plans which show the location of emergency exits, fire points etc, and can be located at the entrance for employees and visitors to see.

Case study

PM6 machine hall was mapped by one of the mill's noise assessors using a 1 m square floor plan. The sound level meter was recalibrated before and after use. The exercise took 28 hours to complete, in multiples of 4-hour blocks and other available time.

The measurements identified for the first time several areas of reflected sound from walls. A large area was defined around the couch and press section where sound pressure levels exceeded 90 dB(A). It was also identified that the dry end alarm was emitting 122 dB(A). This was reset to 105 dB(A) in the short term with a view to replace this single alarm with a number of suitably positioned lower sound level alarms.

Do I need a noise map?

Noise maps are not necessarily needed for all parts of the mill. The more complex the workplace and the larger the number of possible noise sources, the more likely it is that you will need a map to quantify and identify sources and manage employees' exposure to noise.

What measurements are needed?

Noise contour maps can be displayed as emission profiles on a floor plan using two measures:

- sound pressure level - the quantity of sound energy at a particular location after being reflected by building and machine surfaces; or
- sound intensity - a measure of the quantity and direction of acoustic energy flowing from a source.

Using sound pressure level as the measure to produce noise emission profiles is more straightforward, but due to the diffuse nature of the sound field with no obvious directional characteristics, it is more difficult to analyse the results to identify the source of high sound pressure levels.

Sound intensity measurements include information on the directional properties of noise emission which can be used to calculate the sound emission from a specific part of the machine or process. The technique allows the identification of problem areas while the machine is running; it is not necessary to sequentially switch component parts on/off. This information can then be used in calculations to design absorbing treatment and as a diagnostic aid to identify increased noise emission levels due to wear.

How should I go about obtaining a noise map?

Noise mapping should be undertaken by people who:

- are either from within or outside the mill organisation, although the Management of Health and Safety at Work Regulations 1999 require preference to be given to competent employees;
- have access to a suitable integrating sound level meter and are competent to use it;
- are able to develop computer graphics for display of data;
- have or can be provided with a good working knowledge of the mill process and relevant safe systems of work.

Where sound intensity measurements are required, specialists trained in the use of more sophisticated measurement equipment may be needed. Where it is necessary to seek professional help from a consultant to make sound intensity measurements, interpret the results and advise on the application of noise control measures, the free HSE leaflet *Need help on health and safety?*³ provides useful guidance.

What would a typical map look like?

Figure 1 shows the side elevation of a paper-making machine with an overlaid contour map of the sound pressure emission profiles and illustrates the distribution of sound/noise from the machine.

Figures 2 and 3 are plan diagrams showing the distribution of sound pressure radiating into the area at the side of the press section of a paper-making machine. Figure 3 identifies the distribution of sound pressure for a particular problematic frequency.

How can I use this information?

The information in these examples of mapping could be used to:

- control or restrict the occupancy of particular areas in the vicinity of the machine, such as the area around the couch roll identified in Figures 2 and 3;
- identify noise-generating components or process stages from the overall noise levels in the machine hall;
- design noise-control measures;
- provide information for the purchase of equipment emitting lower noise levels;
- provide a baseline measure of emission for comparison with future measurements to identify wear and the need for maintenance.

The information from these maps also illustrates how noisy components can be identified, particularly where there is no facility to operate individual parts of the paper-making machine on their own.

For example, the area within grid references 6 to 8 and S5 to S7 in Figures 2 and 3 illustrates the high level of noise in the vicinity of the couch roll. Figure 3 shows that this high noise level is characterised by a dominant frequency which in turn shows the knock-on effect the couch roll has in other areas by structure-borne transmission of vibration. This information is also necessary for the design of noise control, such as active noise control.

Noise contour maps of the whole machine hall would provide useful information on areas of lower noise exposure. These areas can often be used as preferred access routes for employees to avoid unnecessary exposure to noise.

References and further reading

- 1 *Noise assessments in paper mills* PBIS1 HSE Books 2000

- 2 *Guide to managing health and safety in paper mills*
HSE Books 1997 ISBN 0 7176 1313 5
- 3 *Need help on health and safety?* INDG322 HSE
Books 2000
- 4 *Reducing noise at work. Guidance on the Noise at
Work Regulations 1989* HSE Books 1998
ISBN 0 7176 1511 1
- 5 *Protection of hearing in the paper and board
industry* HSE Books 1988 ISBN 0 11 883971 3
- 6 *Sound solutions: Techniques to reduce noise at
work* HSG138 HSE Books 1995 ISBN 0 7176 0791 7
- 7 *Introducing the Noise at Work Regulations: A brief
guide to the requirements for controlling noise at
work* INDG75(rev) HSE Books 1989

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

Further advice

The Institute of Acoustics, 77A St Peter's Street, St. Albans, Herts AL1 3BN Tel: 01727 848195

The Association of Noise Consultants, 6 Trap Road, Guilden Morden, Nr Royston, Herts SG8 0JE. Tel: 0176 385 2958

National Examining Board in Occupational Safety and Health, Dominus Way, Meridian Business Park, Leicester LE3 2RP Tel: 0116 263 4700

British Institute of Occupational Hygiene, Suite 2, Georgian House, Great Northern Road, Derby DE1 1LT Tel: 01332 298087

Further information

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA. Tel: 01787 881165 Fax: 01787 313995. Website: www.hsebooks.co.uk

HSE priced publications are also available from good booksellers.

For other enquiries ring HSE's InfoLine Tel: 08701 545500, or write to HSE's Information Centre, Broad Lane, Sheffield S3 7HQ. Website: www.hse.gov.uk

This leaflet was prepared by the Paper and Board Industry Advisory Committee and has been agreed by the Health and Safety Commission. It contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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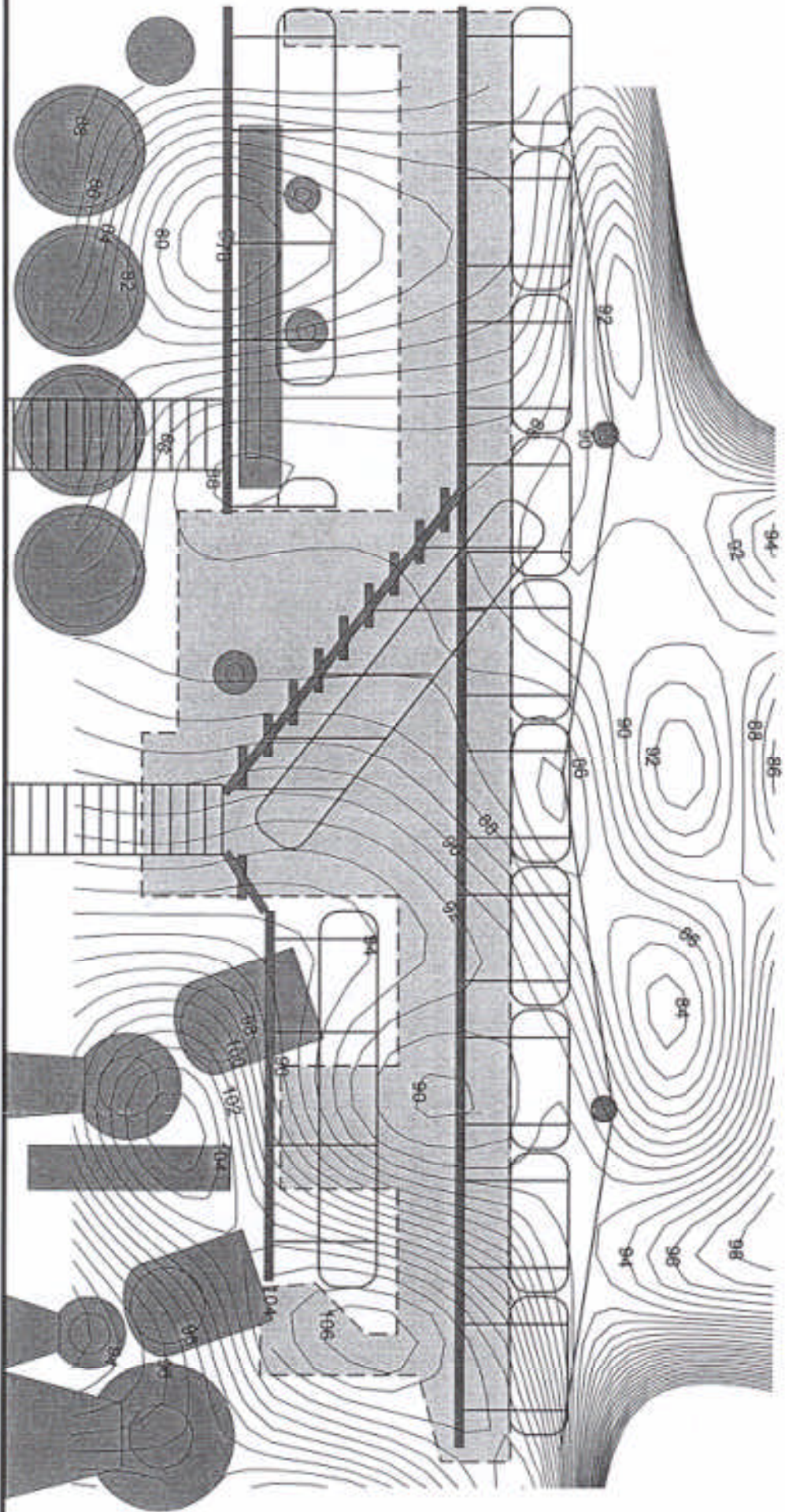


Figure 1 Contour map of sound pressure superimposed onto diagram of press

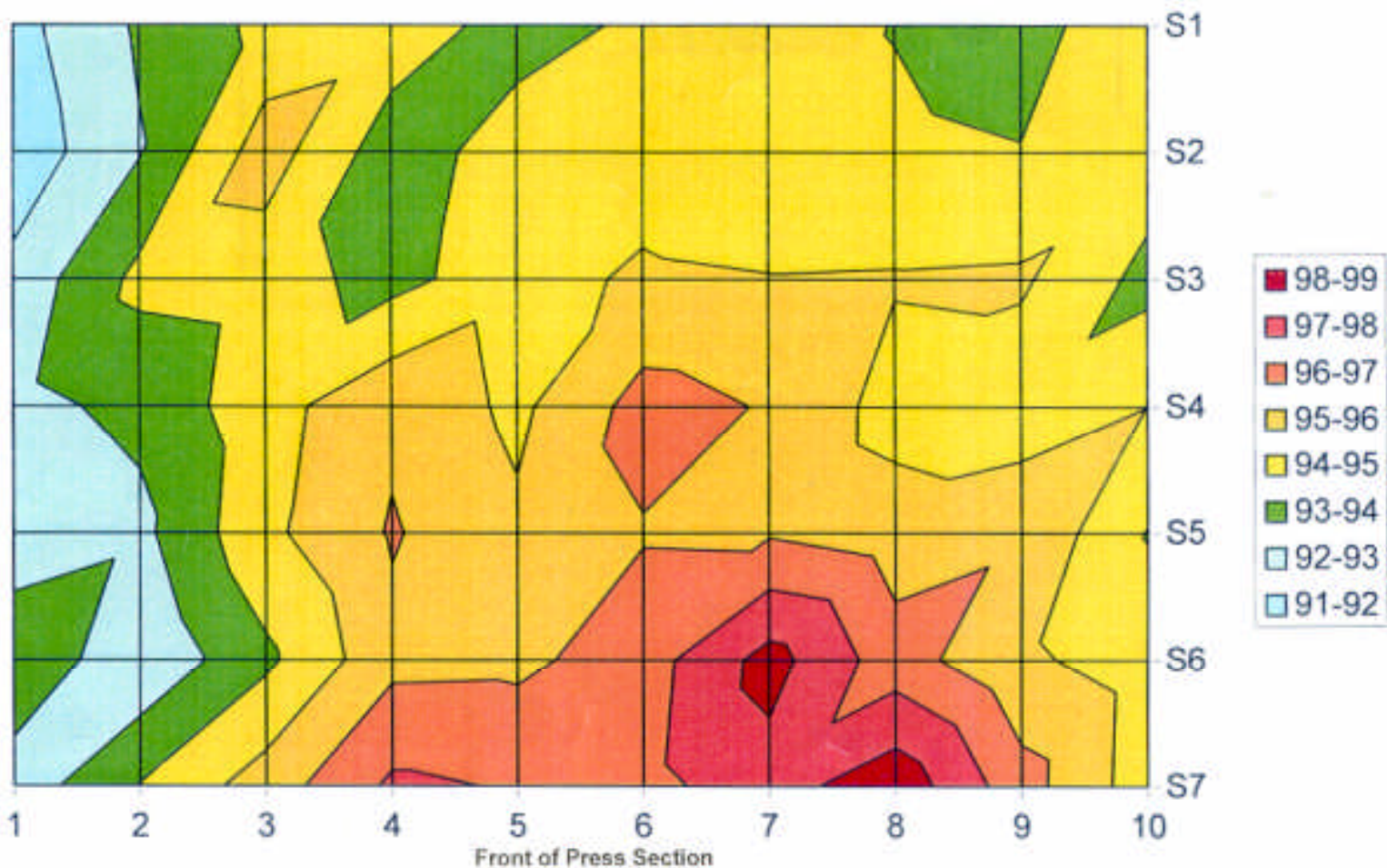


Figure 2 A-weighted SPL Plan view of area in front of press section

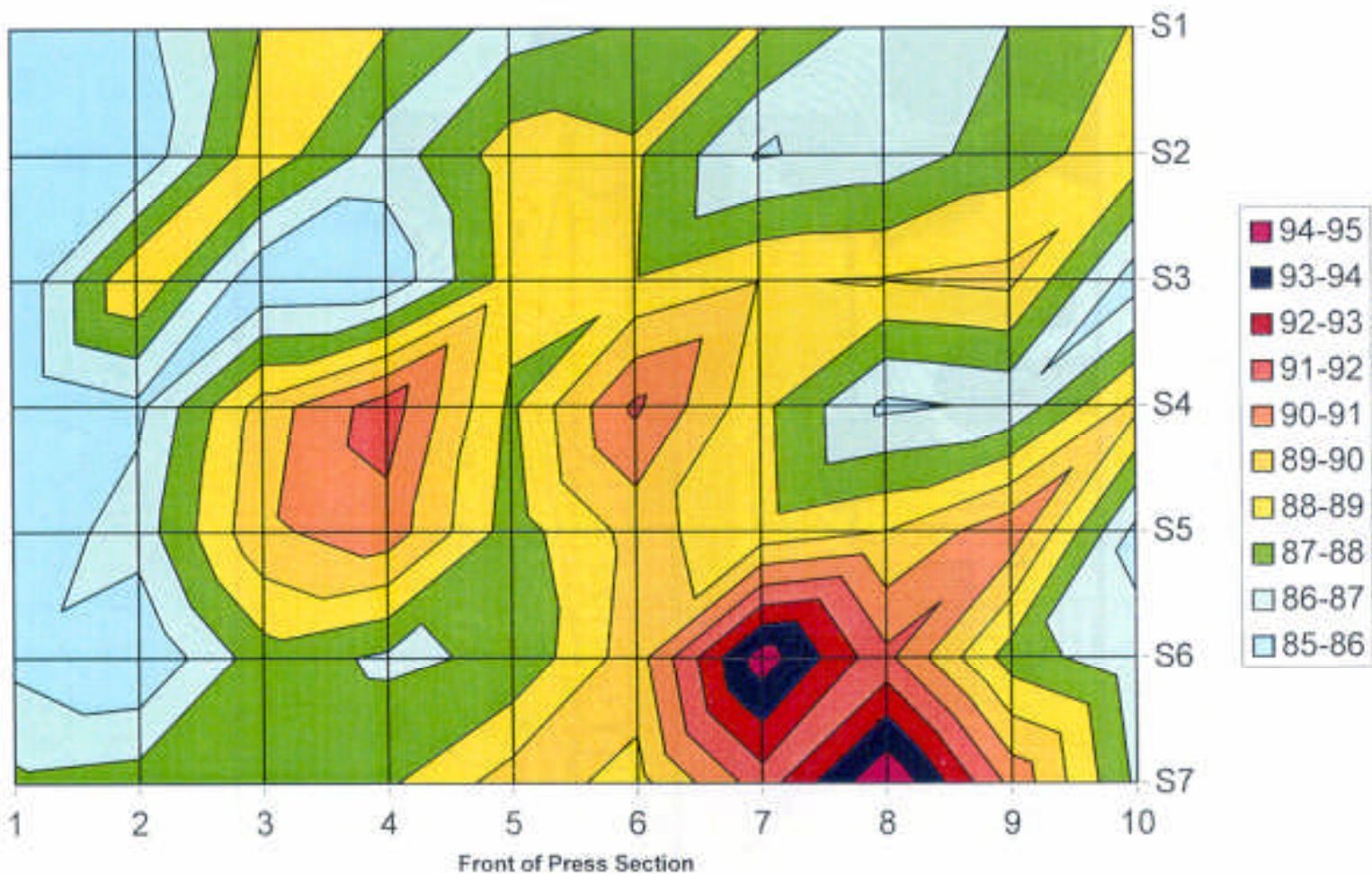


Figure 3 1600 Hz SPL Plan view of area in front of press section