Proceedings of the Institute of Acoustics

NOISE IN THE WORKPLACE - ELECTRICITY GENERATION AND SUPPLY

W. Lambie

South of Scotland Electricity Board (SSEB)

1. INTRODUCTION

1.1 The Electricity Supply Industry in Scotland differs from the Industry in England and Wales in that the two Scottish Boards are "all-purpose" or "vertically-integrated". In terms of noise this means that in our relatively small Boards we have to cope with the full range of noise problems that other Boards meet separately.

1.2 The South of Scotland Electricity Board, soon to be privatised as Scottish Power, is the larger of the two Scottish Boards, employing about 11,500 staff in:- three Nuclear Power Stations, five Fossil-Fuelled Power Stations, two Hydro Groups, one Gas Turbine Installation; and operating about 30,000 km of overhead lines, 54,000 km of underground cables and 37,000 sub-stations. About half of the total staff work in Distribution& Supply from Area Offices and Service Centres. SSEB also operate a Training Centre, a research and Development Centre and Central MaintenanceWorkshop.

2. THE NOISE PROBLEM

2.1 Power Stations

2.1.1 Noise Levels. Until a few years ago it was assumed that noise problems in SSEB were confined, in the main, to power stations where noise reduction in plant items seemed to have been given little prominence at the design stage even in fairly modern plant. This can be demonstrated by comparing the noise levels in the Turbine Hall of Power Station 'A' fully commissioned in 1955 and demolished in 1976 and Power Station 'B' a newer Power Station (Table 1). Turbine Halls are generally more noisy than Boiler Houses although noise from individual plant items and high pressure steam/water leaks can create problems.

2.1.2 Exposure. Staff in power stations, for noise exposure considerations can be divided into two main groups viz. those who operate the plant and those who maintain or service it. Maintenance and service staff may be allocated jobs in any part of the power station and these jobs may take anything from a few hours to a few weeks. Maintenance/service staff may even be transferred, at a moments notice, from longer term work to emergency jobs during the course of the longer term work.

Noise exposure will obviously depend on the work location and does not, at present, figure in work allocation. Daily exposure to noise could be difficult to estimate for this group of staff and assessment by the use of personal dosemeters may not provide an accurate picture. Operation staff, on the other hand, are more likely to be allocated duties in fixed areas of the plant, e.g. main plant, coal pulverising plant, ash plant, water treatment plant etc. Exposure to noise of operating staff may be more easily established.

2.2 Transmission

2.2.1 Noise Levels. In comparison with generation activities, noise in Transmission operations does not create too many problems. However one area of difficulty is that of staff who may be working in the vicinity of air blast circuit breakers. These circuit breakers rely on a short duration (2/3 milliseconds) blast of compressed air (350 psi) to extinguish the arc created when opening the contacts on load. Noise levels associated with the operation have been measured at 128-150 dBA at 4 m distance. Of the 37,000 substations mentioned earlier, 121 contain air blast circuit breakers and any new substations will contain much less noisy SF_6 switchgear.

Circuit breakers are normally operated from remote switching stations and any staff working in the vicinity of the circuit breaker will be given an audible warning that switching is about to take place. The switchgear can, however, operate automatically without warning to clear fault conditions and this can lead to problems.

Staff working in substations can be surrounded by uninsulated conductors at very high voltage. Staff safety is assured by adherence to very rigid safety rules. In these conditions staff never work unaccompanied on the principle that the accompanying person can alert his colleague if there were to be an unwitting encroachment of safety clearance distances. It is our opinion that there is a greater risk from a person not being able to hear a warning if he was wearing ear protection than from a circuit breaker operating under fault conditions at the time he was in the vicinity of the circuit breaker.

The only other significant noise problem in Transmission is that of air compressor noises and this problem can be resolved.

2.3 Distribution

2.3.1 Noise Levels. Until a few years ago we had not considered that there were noise problems associated with our distribution activities, but a successful claim against us then from a cable jointer who claimed that he suffered a hearing loss condition from the use of an air compressor and jack hammer during road opening operations convinced us otherwise.

We have, since this incident, carried out a few noise surveys and the measurements shown in Table 2 will give an idea of the problems in Distribution activities. Although most of the noise problems are associated with roadworks, it must be remembered that these are of short duration. For example it was calculated that the cable jointer mentioned above was exposed to compressor/jack hammer noise for only about 20 minutes/day.

3. PREVENTIVE MEASURES

3.1 Problems relating to noise were being considered in the Electricity Supply Industry (ESI) in the early 1960s. A number of papers were published and symposia organised. The protection of employees exposed to air blast circuit breakers was considered. The I Mech. E published a paper on "Noise from Power Plant Equipment".

Noise surveys were commenced in SSEB power stations in 1966 and in 1970 the ESI consultative machinery recommended the purchase of posters urging the use of ear muffs.

A Noise Working Party was formed in SSEB in February 1972 and their first job (almost) was to study the Department of Employment "Code of Practice for Reducing the Exposure of Employed Persons to Noise". A copy of a SSEB leaflet was issued to all employees, and a start made to the production of a Generation Code of Practice. This was issued in 1975 and it is interesting to note that the COP dealt only with the reduction of exposure of personnel and that reduction of existing noise levels was deemed to be outside the scope of the Code of Practice.

At this stage no comparable documents were considered to be necessary for Transmission and Distribution functions.

3.2 The Generation Code of Practice requires that persons be nominated and trained to take the following actions detailed in the Code of Practice.

(i) The identification and marking of areas where ear protection is required.

(ii) The issue of ear defenders and training in their use.

(iii) Limiting time in an area where ear protection is inadequate.

(iv) Provision of messing areas outwith the working area where necessary.

(v) The keeping of records of noise problem areas and the control measures.

(vi) Information to all employees on the hazards of exposure to noise.

The Code of Practice requires each employee to:-

(i) Use and observe measures adopted for noise exposure control.

(ii) Use ear protectors as instructed.

The Code of Practice requires that a plan of each floor area be produced identifying the noise levels and these plans be updated annually and when significant new noise sources or patterns occurred (e.g. steam leaks).

In most power stations these plans were encapsulated and mounted at job issue points.

The Code of Practice also requires warning notices to be mounted at entry points to noisy areas and at any barriers erected to mark areas where new noises have developed.

3.2 Transmission/Distribution. Following the successful claim again the Board by a cable jointer, a Code of Practice was issued in 1985 covering these activities.

4. SUCCESS OR FAILURE?

4.1 If this is to be measured in terms of early awareness of the problem, effective action to reduce noise, education of staff on the damage to hearing from noise, issue and use of ear protection and the number of claims for hearing damage then each deserve separate consideration:

4.2 Awareness. Records show that an interest was being taken in SSEB on the effect of noise on hearing in early 1963 when a number of papers from both within and outwith the ESI were being studied. A Noise Working Party was set up in advance of the Department of Employment noise code and this Working Party which became a permanent committee in 1975 has maintained an active interest in Government and EEC proposals.

4.3 Reduction of Noise at Source. Power stations require a wide variety of plant items from many suppliers to be assembled into a fully integrated complex installation. The drive has always been aimed at lowest cost output, i.e. the most efficient plant using the cheapest available fuel with the minimum manpower (power stations are normally decommissioned because they are out of date and not because they are worn out). In this drive for efficiency it would seem that reduction in noise of source has been given little consideration if Table 1 can be used as a basis for judgement (newer power station are, of course, much larger and operate at very much advanced steam conditions).

4.4 Instruction and Training. When the Department of Employment issued their Code of Practice in 1972, an SSEB leaflet was prepared and issued to all power station staff. In 1975, when the SSEB Generation noise COP was issued, it contained a requirement that "all staff who may be exposed to high noise levels should be made acquainted with the hazards involved". Since then, although no centrally organised training has been offered posters and films have been issued or made available to location managers.

4.5 Provision and use of Ear Defenders. SSEB have never restricted the issue of protective equipment to staff. Any employee who feels that he needs an item of protective equipment is given it. Superimposed on this policy is the guidance given in various Codes of Practice, Manuals and Work Instructions on what protective equipment should be worn/used. The SSEB Generation Noise COP requires that staff who may work in the area of noisy plant be issued with ear protectors.

Very little has been done over the years in the way of enforcement of use of protective equipment. The use of such equipment has been left, by and large, to the employee and his manager. No employee has been dismissed for refusing to wear protective equipment and disciplinary action is not common. It is not a condition of employment that employees wear/use protective equipment.

Although we have no recent figures on the extent to which protective equipment is used a snap survey was carried out in 1981 at one of our power stations and the results are shown in Table 3. It is interesting to note that only 47% of employees who should have been wearing ear protection were doing so.

The question of whether or not the wearing/use of protective equipment should be made a condition of employment was considered by the National Consultative Machinery in 1981 and rejected in favour of the issue of a leaflet reminding the staff that they may be prosecuted if they failed to co-operate in this regard.

Considering the few prosecutions taken by the HSE this would seem to have been a rather empty threat.

Line managers who complain that they have to spend an inordinate amount of their time trying to understand and comply with a proliferation of safety-related legislation and the ever-present threat of enforcement action if they miss something or get it wrong are very critical of what they perceive as a very weak attitude by the HSE towards enforcement of Sections 7 & 8 of the Health and Safety at Work Act.

4.6 Claims for Hearing Damage. Table 4 summarises the claims history in SSEB. These claims are considered by a small group which meets about five times a year. Although the SSEB has been self insured since 1981 the claims are handled by the Insurance Company to which we paid premiums before that date. In deciding whether a claim is justified the following items are taken into consideration.

(i) Did the alleged damage occur before 1963 (the year of knowledge)?

(ii) Did the alleged damage occur after 1975 (when the SSEB COP was issued)?

(iii) The noise survey of the work location.

(iv) The type of employment of the claimant.

If the claimant has had no other employers, is suffering from noise-induced hearing loss, and was employed in a noisy area i.e. 8 hr Leq of 90 dBA between 1963 and 1975 then the claim is settled. If on the other hand, the claimant has had a number of employers the amount of contribution is tempered by other considerations such as load factor of the power station. Claims are settled, wherever possible, in accordance with the Iron Trades Insurance Group scales.

It is difficult to determine whether the SSEB Hearing Conservation Policy has been successful using the number of successful claims as a yard stick. Some basis for comparison is required and so far most industries have been (understandably) reticent in publishing figures.

5. THE FUTURE

Now that the new Regulations have been finally published the SSEB Noise Working Party are considering how much of our present system will meet the new requirements, what new approaches will be required and which of the new requirements will require to be discussed with the HSE to resolve apparent

difficulties in implementation. Even at this early stage (i.e. three weeks after publication of the Regulations) the Working Party have identified the following problem areas.

(i) Assessment. In power stations where staff do not work at fixed work stations (as in Manufacturing Industry) accurate assessments might be difficult to achieve. There are two approaches viz (1) with a knowledge of the noise geography of the Plant and plotting samples of operations staff movements average daily exposure levels can be calculated or, (2) by mounting a personal dosemeter exercise average daily exposure levels can be measured.

But are average daily exposure levels acceptable? And what about maintenance staff whose movements in and around noisy plant or areas are less predictable?

(ii) Assessment Records. There should be no problem in keeping assessment records but it is noted that unlike the asbestos and COSHH records there is no finite time over which records must be maintained. What happens to the records if the plant closes down?

(iii) Reduction of Risk of Hearing Damage. At which level of noise will it be determined that there will be risk? Is it the second action level? Or the first? Or at lower values than the first action level?

(iv) Reduction of noise exposure other than by the provision of personal ear defenders. Again, there seems to be two options viz by plant modification or by limiting the time of exposure. As reduction of exposure is expressed in terms of "reasonably practicable" then the equation of cost versus risk applies. What would be deemed to be reasonable cost? Assuming that all operations staff and all maintenance staff in a power station could be working in conditions in which the second action level is exceeded i.e. many at risk and the cost of engineering control of noise is a few million pounds would it be deemed reasonable to incur these costs. One HSE opinion is that if the costs of modification were of the order of a few percent of the capital cost of the installation then this would be reasonable. In power stations where the present day cost of a Turbine Hall could be of the order of £500m then remedial costs based on this opinion could be frightening. Another HSE source when asked to comment on this "few percentage" opinion reckoned that this should only be appropriate for new plant i.e. not applied retrospectively. We know that only the courts can decide on what is, or what is not, reasonably practicable but can we disregard the option of plant modification entirely, in favour of limiting time of exposure?

Even this option will be difficult and costly (and perhaps not reasonably practicable). If we consider the case of a repair to, say a valve in the vicinity of a boiler feed pump where the noise level is 99 dBs it would not be reasonable to change the maintenance crew at hourly intervals where ear defenders could provide adequate protection for one crew against damage.

(v) Ear Protection Zones. What happened to the consultative process on this item? We now have the situation where an assessment may have identified a small number of people whose daily exposure exceeds the second action level because they spend some time in the area and yet many more who spend less time in this area do not exceed the second action level. It seems a nonsense in these circumstances to impose an ear protection zone on the many.

The other Regulations are considered not to pose too many problems but a number of important answers as required in a very short time. It is hoped that enforcement officers, in view of the very short preparatory period, are not too heavy - handed in the first few months of 1990.

TABLE 1 Comparison of Selected Power Station Noise Levels

	Area	Maximum (dBA)	Average (dBA)
Power Station 'A' 1955	Turbo-Alternator	95	92
	Boiler House	89	84
	Boiler Feed Pumps	101	94
	Turbine Basement	102	94
Power Station 'B' 1989	Turbo-Alternator	105	96
	Boiler Feed Pumps	106.6	104
	Turbine Basement	96	92

TABLE 2 Distribution Noise Levels

Plant Item	Maximum (dBA)	Average (dBA)
Excavator JCB3C (in cab) Trench Digging		92
Trencher TS700 (1 m)	94	92
Grab Tipper (1 m) Lifting Earth		87
Compressor Hydrovane (1 m)	103	101
Spade Tool (Operator's Ear) Road Opening	102	98
Compacting Tool (Operator's Ear)		104
Spiking Gun (Operator's Ear)	132	
Portable Generator (at sides)		104

TABLE 3 Protection Equipment Survey - Power Station Number of Employees Questioned - 107

	Safety Helmet	Ear Defender	Eye Protection	Respiratory Protection	Hand Protection	Foot Protection	Total
1 Number of staff interviewed who should have been wearing protective equipment	97	98	30	11	86	104	426
2 Number of staff actually wearing protective equipment	77	43	13	4	81	90	308
Percentage 2 of 1	79	44	43	36	94	86	72

TABLE 4 Claims Summary

Total Number of Claims Received	245
Number of Claims from Power Station Staff	181
Number of Claims from Transmission/Distribution Staff	64
Number of Claims from Decommissioned Power Stations	120
Number of Claims from Presently Employed Staff	22
Number of Processed	71
Number of Nil Settlements	25