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Noise in the United Kingdom printing industry: then and now

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ABSTRACT

Over 2 million people in the United Kingdom (UK) are exposed to potentially harmful workplace noise levels. There are about 130,000 employees in the UK printing industry many of whom have traditionally worked in noisy environments. Anecdotal evidence suggests there is a widely held belief that the issue of noise is no longer a problem in the UK printing industry. Noise measurement and exposure data from the industry, gathered by the Health & Safety Executive (HSE) in 2010 and 2011 to inform new and updated industry specific guidance, would suggest otherwise. This paper compares and discusses the noise levels in the industry around the time of the introduction of the Control of Noise at Work Regulations 2005 and the preceding Noise at Work Regulations 1989. Both sets of regulations were born of European Union Directives requiring equivalent basic laws throughout the Union on protecting workers from the risks caused by noise. The 2005 regulations introduced lower noise exposure action values than those in the 1989 regulations. The paper identifies the noisy and quiet processes at both points in time and also looks at some of the changes in the industry that have affected the noise levels and exposures.

Keywords: Noise, Exposure, Printing   I-INCE Classification of Subjects Number(s): 60

1. INTRODUCTION

Hearing damage caused by exposure to noise is permanent and incurable. In noisy industries workers are at risk of going deaf due to exposure to harmful noise levels. But the United Kingdom's (UK) Health & Safety Executive's (HSE) experience is that the issue of noise in the workplace is often thought of as 'dealt with'.

Between 1985 and 1994, HSE collected and studied noise data from the UK printing industry, a time period spanning the introduction of the Noise at Work Regulations 1989 (1). The purpose was to inform industry specific guidance. On the 6th April 2006 the 1989 regulations were superseded by the Control of Noise at Work Regulations (CoNaWR) 2005 (2). The CoNaWR 2005 were born of a European Union Directive (3) and introduced lower noise exposure action values than those in the previous Noise at Work Regulations, requiring equivalent basic laws throughout the Union on protecting workers from the risks caused by noise.

Following the introduction of the CoNaWR 2005 regulations, HSE set about revising its industry specific guidance, including that for the printing industry. Between March 2010 and July 2011, eight different printing premises volunteered their sites to HSE for workplace noise investigations, via the British Printing Industries Federation (BPIF) and the Newspaper Publishers Association (NPA). These measurements included personal dosimetry (where noise exposure meters are fitted to workers to monitor noise exposures throughout the day) and spot measurements (short duration measurements at fixed locations around a premises using a sound level meter). Discussions also took place with employees and managers to gather information on the machinery and its associated documentation.

2. BRIEF OVERVIEW OF THE DIFFERENT PRINTING PROCESSES

There are six main printing processes, distinguished by the method of image transfer and by the general type of image carrier employed. Image transfer can be direct or indirect (commonly known as 'offset'). Presses can be sheet fed (individual sheets of substrate) or web fed (reels of substrate). With direct printing, the image is transferred directly from the image carrier to the substrate. With indirect, or offset printing, the image is first transferred from the image carrier to a blanket cylinder and then to

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the substrate. Image carriers (or plates) can generally be classified as one of four types: relief (the image or printing area is raised above the non-image areas), planographic (the image and non-image areas are on the same plane, defined by differing physiochemical properties), intaglio (the non-printing area is at a common surface level with the substrate while the printing area, which consists of minute etched or engraved wells of differing depth and/or size, is recessed), and screen (the image is transferred to the substrate by pushing ink through a porous mesh which carries the pictorial or typographic image). The six major print processes and their associated image carrier types are:

1. Lithography (off set / planographic)
2. Flexography (direct / relief)
3. Gravure (direct / intaglio) – also sometimes referred to as roto-gravure
4. Letterpress (direct / relief)
5. Screen printing (direct)
6. Digital printing

3. METHOD

3.1 Data Collection: 1985 to 1994

In the nine year period from 1985 to 1994, data on noise levels in the printing industry were gathered through a combination of workplace noise measurements and company risk assessments. These historic data are reported in this paper. It is worth noting that during this data collection period the Noise at Work Regulations 1989 were introduced.

3.2 Data Collection: 2010 to 2011

During the eight site visits to different printing premises around the UK, data were gathered on the current noise levels and exposures in the workplace. The collection method included discussions with employees and managers, investigating the machinery and its associated documentation, plus workplace noise and noise exposure measurements. Two methods of noise measurement were used:

1. Logging personal dosimeters/dose badge (Figures 1 and 2)
2. Hand-held sound level meter with frequency analysis capabilities (Figure 3)

Figure 1. Dosimeter

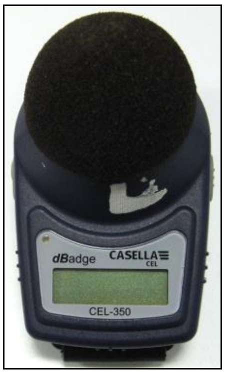

Figure 2. Dose badge

Figure 3. Sound level meter

The dosimeters and dose badge provided personal noise exposures of workers whilst the sound level meter was used for spot measurements. All three devices logged two key information sets:

- A-weighted equivalent continuous level (L_{Aeq}), used to calculate the daily personal noise exposure over a full working day ($L_{EP,d}$)
- C-weighted instantaneous peak levels (L_{Cpk}), used to assess risks from single noise events such as ‘bangs’ and ‘crashes’.

The collected L_{Cpk} data showed no hazard from the instantaneous levels and was not used in further analysis.

4. RESULTS: WHAT THE NUMBERS SAY

The data were recorded as noise levels, L_{Aeq}, and noise exposures, $L_{EP,d}$. Comparisons were made for each parameter between the 1985 to 1994 data and the 2010 to 2011 data in the form of frequency distribution plots. The plots are shown in Figures 4 and 5. The total number of data points for each data set is shown in brackets.

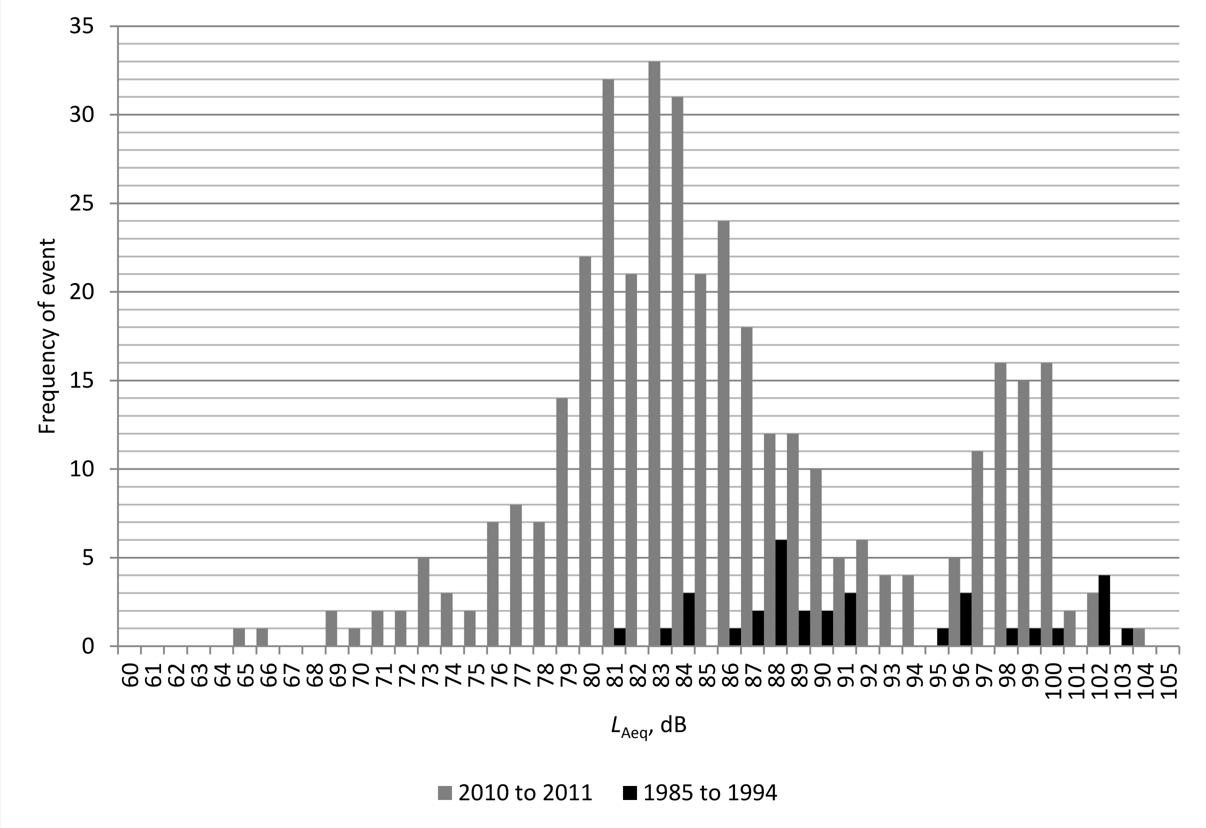

Figure 4. Frequency distribution for L_{Aeq}, 2010 to 2011 (379) vs 1985 to 1994 (33)

From Figure 4 it is possible to see that for both data sets there are two distinct regions where the frequency distribution is populated. Taking the median L_{Aeq} the data indicate that reductions of around 6 dB have been achieved, from 90 dB to 84 dB. The 2010 to 2011 results in the higher 95-105 dB range are attributable to just one of the eight sites visited. This particular site had two old printing presses shoehorned back-to-back into a reverberant building creating an excessively noisy work environment. The presence of data in the 95-105 dB range for 1985 to 1994, from multiple sites, would suggest that high noise levels existed in the industry in the 1985 to 1994 period, but were not necessarily typical.

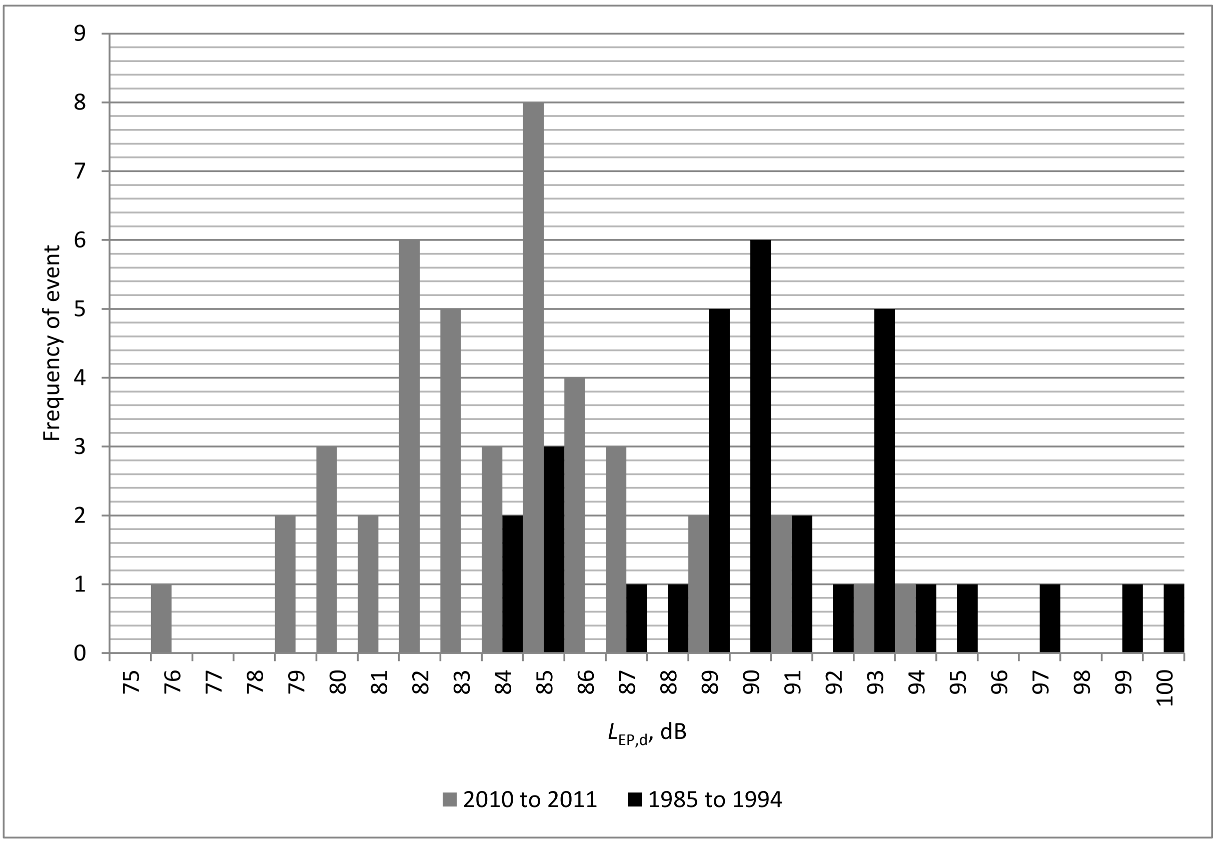

Figure 5. Frequency distribution for $L_{EP,d}$, 2010 to 2011 (43) vs 1985 to 1994 (31)

From Figure 5, the median $L_{EP,d}$ noise exposures indicate that reductions in personal noise exposure of around 6 dB have been achieved, from 90 dB to 84 dB. In the period 1985 to 1994 a print industry worker was likely to have an $L_{EP,d}$ in the region of 89-93 dB, whereas now it is more likely to be in the region of 82-86 dB. The lower end of this range is above the lower exposure action value of 80 dB $L_{EP,d}$ in the CoNaWR 2005. The higher end of this range is above the upper exposure action value of 85 dB $L_{EP,d}$ but below the limit value of 87dB $L_{EP,d}$ in the CoNaWR 2005.

The reductions in noise levels and noise exposures are clearly visible when both the recent and historic data are plotted as cumulative distributions (Figures 6 and 7).

In Figures 6 and 7 the cumulative distribution data make a clear shift from the earlier, but higher, 1985 to 1994 data set to the later, and lower, 2010 to 2011 data set. The jagged shape of the earlier data set in Figure 6 is attributable to the low sample number (sample size 33). The same may also be said for both data sets in Figure 7 with populations of 31 and 43. Of particular note in Figure 7 is the change in shape of the curve, indicating for the newer data set a much lower percentage of high level noise exposures compared to the older data set.

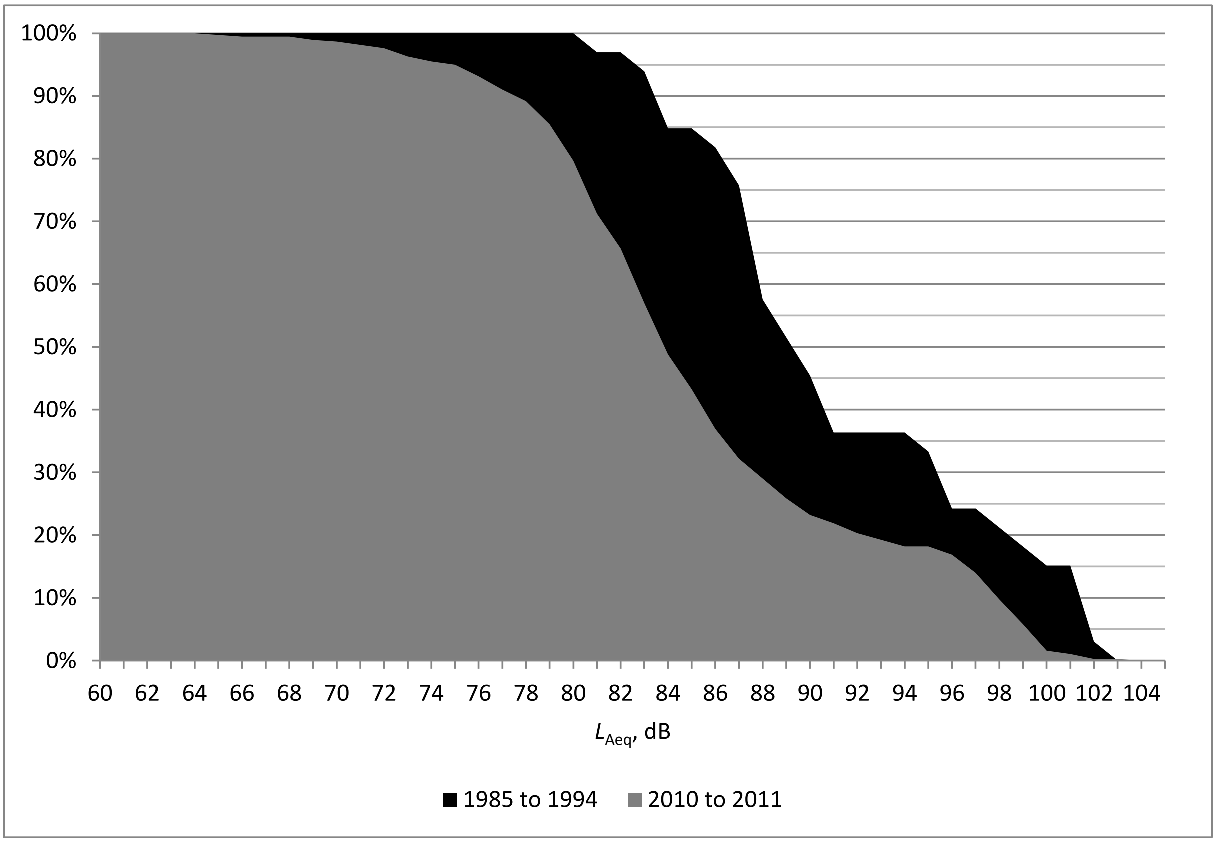

Figure 6.Cumulative distribution for L_{Aeq}

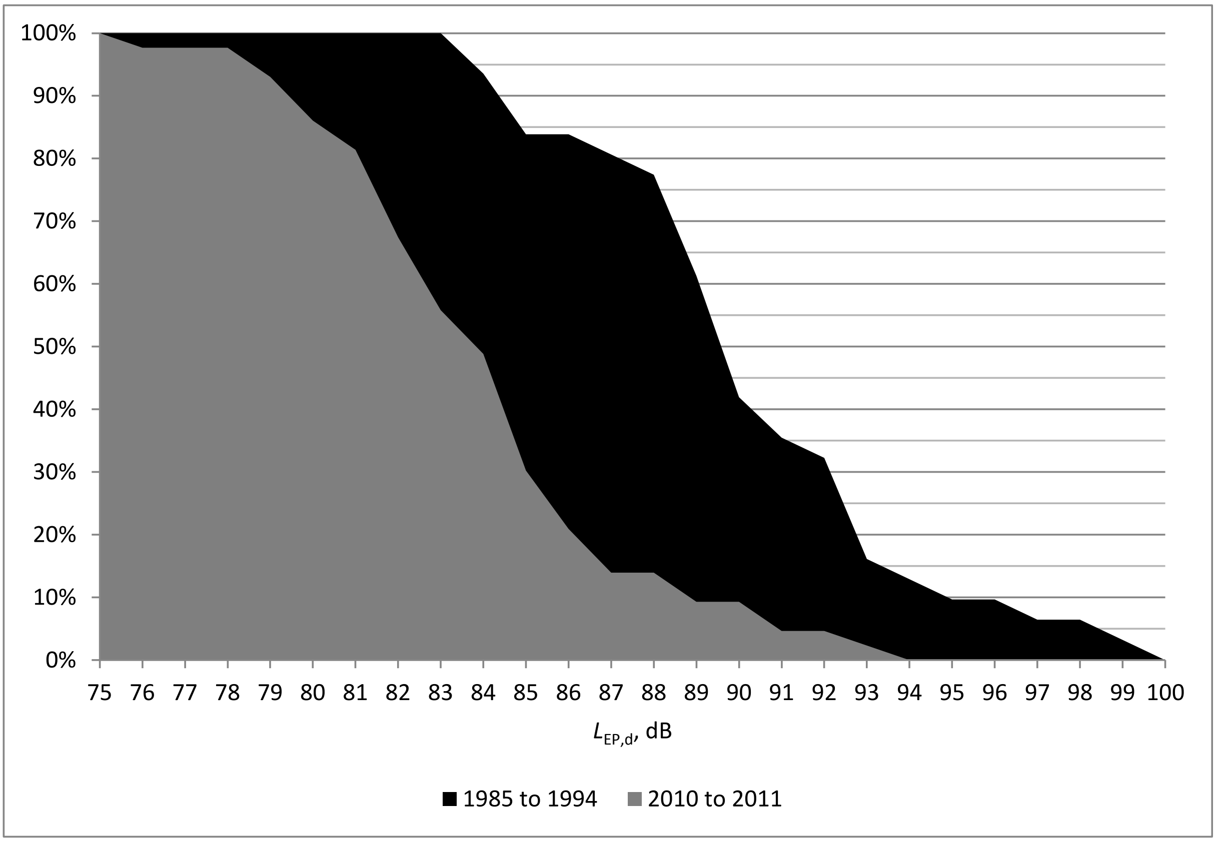

Figure 7.Cumulative distribution for $L_{EP,d}$

5. DISCUSSION

5.1 Noise Sources: 1985 to 1994

The majority of L_{Aeq} data were gathered in press halls either at operator consoles or between the print heads of the machines, all of which were of the web fed offset variety (lithographic). A number of different machine manufacturers were identified: Harris, Mueller, Fairchild, L&M, Goss, Baker Perkins, Crabtree/Vickers. The Harris and Mueller were most prevalent in the typical noise range of 85-91 dB whilst the Baker, Perkins and Crabtree/Vickers were most prevalent in the high noise range of 95-105 dB. Operations associated with noise levels below 85 dB were guillotining or with print machines that had received some form of noise control, for example shielding or enclosure of the noisy components.

The personal noise exposure data ($L_{\mathrm{EP,d}}$) came exclusively from press halls. Most noticeable was the inclusion of gravure presses, not seen at all in the L_{Aeq} noise level data. The $L_{\mathrm{EP,d}}$ noise exposure range associated with gravure presses was 84-91 dB. The rest of the $L_{\mathrm{EP,d}}$ noise exposure data was for web fed offset processes and was in the range 84-100 dB.

5.2 Noise Sources: 2010 to 2011

By the year 2010 some noise sources were still recognisable; others simply didn’t exist 25 years earlier. Three examples of common noise problems, and their control, are discussed; compressed air leakage, lack of maintenance, and the installation and design of machinery. Data collection for 2010 to 2011 was, where possible, carried out in all areas of all eight sites visited. This included, but was not limited to, areas or activities detailed in Table 1.

Table 1. Examples of work areas and activities where data were collected during 2010 to 2011

Gluing	Baling	Guillotining
Winding	Cut ‘n’ crease	Lithographic printing
Enclosing	Flexographic printing	Dispatch
Laminating	Gravure printing	Foiling
Silk screen printing	Finishing	Reel stands

5.2.1 Compressed Air Leakage

The spot measurements revealed the chief culprit of avoidable noise in a work environment was compressed air leakage. Compressed air is used extensively in modern printing processes, and, unchecked, can add a large amount of high frequency noise to a work place. Several examples were encountered during the eight site visits, three of which are shown in Figures 8, 9 and 10. Noise level L_{Aeq} data showed that the leaky air could add up to 5 dB to the local working environment, an unnecessary addition.

Figure 8. Leaky air line

Figure 9. Leaky air nozzle

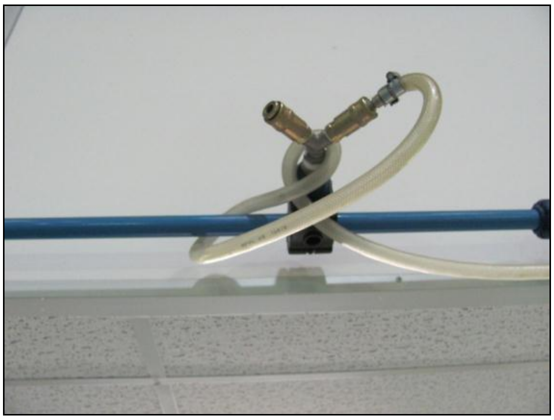

Figure 10. Leaky air attachment point

5.2.2 Lack of Maintenance

A lack of simple maintenance was also a major contributor to avoidable noise in the work environment. One example, shown in Figures 11 and 12, was the cover of a waste chute on a press. The press was fully powered down and undergoing cleaning maintenance, but the waste chute was still powered. At ground level, a panel covering part of the chute was rattling; closer inspection of the panel revealed it was missing two fixing bolts. Replacing the missing bolts and fixing the panel in position would reduce the rattling from the panel. Moreover, turning off the waste chute when it is not in use would help reduce general noise levels.

Figure 11. Press waste chute (rattling panel below at ground level beneath control box)

Figure 12. Waste chute panel missing two fixing bolts

5.2.3 Installation and Design

The $L_{EP,d}$ personal noise exposure data were generally split into three broad activities; press, reel stands, and post-press processing (gluing, folding, cutting, laminating, despatch etc). Reel stand noise exposure was variable and appeared dependent on a number of factors including how the press had been installed within the building, the age of the equipment and whether any additional noise controls were in place. For example, a relatively new installation, in a custom modified building with reel stands in acoustic enclosures (Figure 13), gave a reel hand a noise exposure of 76 dB $L_{EP,d}$. However, an old press with no acoustic treatment, in a reverberant space (Figure 14), gave a reel hand a noise exposure of 86 dB $L_{EP,d}$.

Figure 13. Reel stand where reel hand $L_{EP,d}$ is 76 dB

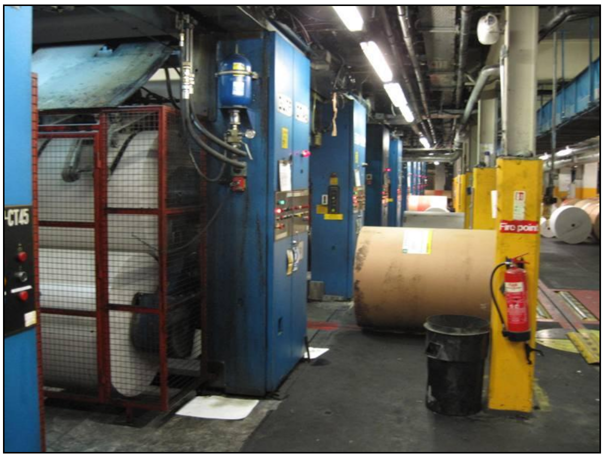

Figure 14. Reel stand where reel hand $L_{EP,d}$ is 86 dB

Noise exposures associated with post-press activities varied between 79 dB to 87 dB $L_{EP,d}$ and it didn't seem to matter if the activities were part of a full cycle from virgin paper to finished product, or were a single specialist activity at the premises. Noise exposures seemed to be dependent on individual machines being noisy, and the environment, rather than a particular process being inherently noisy. The comment "oh, that machine's always been a bit noisier than the others" was often heard muttered in the post-press environment during the eight site visits. One post-press process that stood out from the rest, with an excessive noise exposure of 93 dB $L_{EP,d}$, was the jet washing of silk screens. This process was carried out in a tiny, enclosed room, by one operator.

At seven of the eight sites visited, noise exposures due to the actual printing process ranged from 80 dB to 87 dB $L_{EP,d}$. The higher exposures were generally attributable to web fed tower presses, used for newspapers, telephone directories and the like. Noise exposures at the remaining site ranged from 89 dB to 94 dB $L_{EP,d}$. Again this was a tower press, but with poor noise control and in a reverberant building unsuited to many effective noise controls used in other premises.

6. FINAL REMARKS: IS IT QUIETER IN THE UK PRINTING INDUSTRY?

Noise levels in general have been reduced since the 1985 to 1994 period; people's exposures appear to be lower than they used to be. But why has this happened?

While some machinery remains noisy, people tend to work in the quieter areas. Real progress has also been made in making machines quieter, either at the design stage, which is preferable, or through added post-production controls. Some traditional pre-print processes are now electronic or computerised, instead of mechanical, ensuring some noisy processes have disappeared entirely.

But there has also been huge change in the printing industry since the 1980's and 1990's. The advent of direct mail has seen the growth of a whole new branch of the industry. Similarly, online form filling, for example, for passport applications, has also grown with the explosion of the internet. At the end of both of these processes, forms and advertising materials still need printing somewhere. And the machinery can still be noisy. Taken in context, the numerical data paint a rosier picture for noise in the UK printing industry today than a quarter of a century ago. But more could and should be done to select low noise machinery, design layouts to minimise noise exposures, maintain machinery in a low noise condition and manage hearing protection programmes.

REFERENCES

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