

4. Surveys

4.1 Introduction

Chapter 3 outlined the problems with a small number of events. This showed that there was limited knowledge about laser radiation issues and laser displays amongst enforcing officers. Laser display companies were perhaps using this, but were also unable to demonstrate that the displays they were putting on were safe, and venue managers generally assumed that the laser display companies knew their business. In order to acquire a better understanding of the magnitude of this problem, surveys were carried out of the three identified groups. It was recognised that some groups would be more forthcoming with information than others.

4.2 Enforcing Officers

Local authorities are the enforcing authority for safety legislation at most entertainment venues and this function is normally performed by Environment Health Officers. Therefore, the Chartered Institute of Environmental Health was approached for support for a survey of Chief Officers. A questionnaire (Appendix C) was prepared using multiple choice, closed and open questions, and peer reviewed before distribution by the Epidemiology Group at NRPB. It was then sent to all pre-April 1996 local authorities (483) on the UK mainland and Northern Ireland. The respondents were at either Principal or Chief Environmental Health Officer level. Therefore, it can be assumed that the respondent either was fully aware of the experience and training requirements of their staff or were in a position to acquire such information.

4.2.1 Number of Laser Displays

Out of 483 local authorities canvassed, 277 sent replies, although one was anonymous. This represents a return of 57.3%. Of these 277 returns, 92 (33.2%) had dealt with laser displays in the preceding twelve months, covering 244 identified uses of lasers. The anonymous reply had not dealt with a laser display. The distribution of replies by county is presented in Table 4.1. The distribution of the number of displays dealt with is shown in figure 4.1 and tabulated by type in table 4.2

Table 4.1 Distribution of Questionnaire Replies by County

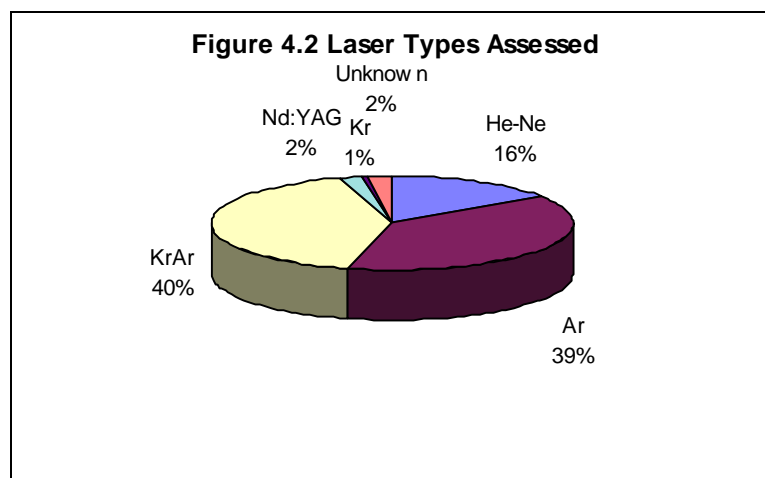
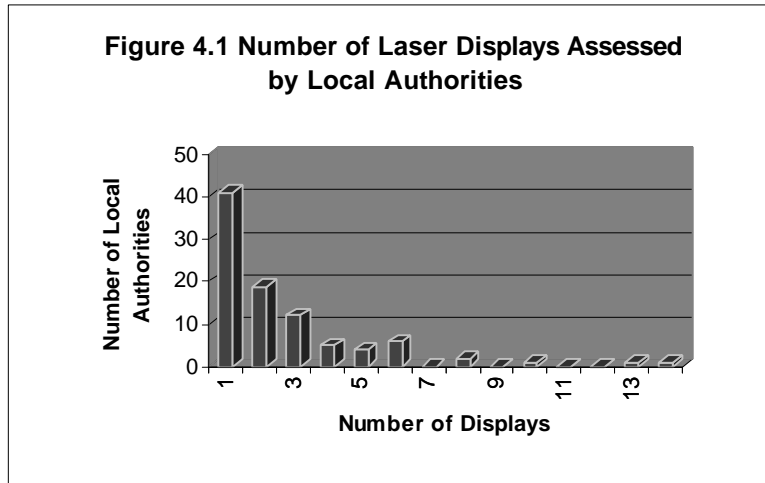
County	Replies/No. of Districts	No. of Laser Displays	County	Replies/No. of Districts	No. of Laser Displays
Avon	4/6	6	Humberside	5/9	0
Beds	2/4	0	Kent	8/14	3
Berkshire	4/6	1	Lancs	9/14	5
Borders	1/4	0	Leics	6/9	3
Bucks	4/6	13	Lincs	4/7	6
Cambs	2/6	1	Lothian	2/4	6
Central	2/3	0	Merseyside	3/5	1
Cheshire	5/8	3	Mid Glamorgan	3/6	0
Cleveland	2/4	0	Norfolk	5/7	10
Clwyd	4/6	1	N Yorks	4/8	1
Cornwall	3/6	1	Northants	4/7	2
Cumbria	2/6	2	N Ireland	10/26	3
Derbyshire	7/10	2	Northumberland	6/6	2
Devon	9/10	5	Notts	2/8	2
Dorset	4/8	0	Oxon	4/5	6
Dumfries	1/4	0	Powys	3/3	0
Durham	5/8	0	Shropshire	5/6	4
Dyfed	5/6	6	Somerset	2/5	1
E Sussex	6/7	23	S Glamorgan	2/2	2
Essex	9/14	17	S Yorks	1/4	0
Fife	1/3	0	Staffs	7/9	8
Gloucs	2/6	0	Strathclyde	6/19	4
Grampian	3/5	0	Suffolk	5/7	3
Greater London	17/33	48	Surrey	9/11	10
G Manchester	5/10	4	Tayside	3/5	0
Gwent	3/5	1	Tyne & Wear	3/5	0
Gwynedd	1/5	0	Warwickshire	4/5	3
Hampshire	7/13	2	W Glamorgan	2/4	0
Hereford	6/9	2	W Midlands	5/7	9
Herts	3/10	2	W Sussex	5/7	2
Highland	3/8	0	W Yorks	3/5	3
			Wiltshire	4/5	4

Table 4.2 Breakdown of Laser Displays Dealt with by Local Authorities

No. of Displays	No. of LAs	Perm. Indoor	Perm. Outdoor	Temp. Indoor	Temp. Outdoor
1	41	7	1	16	18
2	19	13	1	14	10
3	12	10	0	17	10
4	5	0	1	8	11
5	4	7	2	8	3
6	6	5	0	18	10
7	0	0	0	0	0
8	2	3	0	10	3
9	0	0	0	0	0
10	1	0	0	10	0
11	0	0	0	0	0
12	0	0	0	0	0
13	1	0	0	12	1
14	1	0	0	13	1

58 local authorities (63.0% of those who had dealt with laser displays) provided information on the type of lasers used and this data is presented in figure 4.2. It was recognised that the detailed information relating to particular events may not have been available. However, it could also be concluded that, in some cases, the local authority may not have requested the relevant information at the time.

It can be seen that the majority of lasers displays make use of argon or krypton/argon lasers. The neodymium:YAG laser has just started to appear but, with the smaller size and lower electrical power requirements for diode-pumped Nd: YAG laser than for the gas laser, is likely to increase in popularity. It was interesting that the He-Ne laser still figured highly. It is assumed that these were mainly installed in smaller venues.



4.2.2 Level of Expertise

The local authorities were asked to judge their level of expertise in dealing with laser displays. They were asked to initially indicate how many staff they had within each of the three categories: No experience; Basic knowledge; and Experienced. Many respondents just ticked the boxes rather than entering numbers. To assist with classifying staff into the three groups 6 questions were provided. Answers to the questions were not required but several forms were returned with answers. None of these had completely correct answers.

The data from the self-assessment of expertise is presented in Table 4.3, divided into those who had dealt with laser displays in the preceding twelve months and those who had not. Where boxes were ticked instead of a number provided, the tick was replaced by 1. Therefore, this data may represent an underestimate of the actual number of individuals.

Table 4.3 Level of Expertise in Local Authorities for Dealing with Laser Displays

Category	Dealt with Laser Displays in Preceding 12 Months?		Total
	No	Yes	
No experience	138	46	184
Basic Experience	102	73	175
Experienced	4	11	15

At the time of the survey the current guidance from the Health and Safety Executive was PM19. Therefore, respondents were asked to report on their familiarity with the document and whether they had a copy of it.

Table 4.4 Familiarity with HSE PM19

Category	Dealt with Laser Displays in Preceding 12 Months?		Total
	No	Yes	
Never heard of it	50	9	59
Know of its existence	159	45	204
Seen forms provided by laser companies	29	35	64
Working knowledge	31	55	86
Detailed knowledge	5	8	13

It was interesting that the number of people who considered themselves experienced at assessing laser displays was more than those who considered that they had a detailed knowledge of PM19.

When asked if they had a copy of PM19, 87.7% of the respondents said that they did. This is broken down into 88.0% of those who had not dealt with a laser display and 96.7% of those who had. The latter group consisting of three local authorities who had dealt with a laser display, without a copy of PM19, although it was not possible to judge whether they felt they had the expertise anyway or were using some other document to assess the display against.

4.2.3 External Assistance

It had been recognised from the author's own experience that local authorities commonly bring in expertise from third parties to assist when necessary. This would be particularly cost-effective for a local authority which may encounter one, or a few, laser displays per year. Therefore, the questionnaire asked who the local authority would turn to for further advice. Six options were given plus an "other". Respondents were encouraged to tick all that applied. The data is presented in Tables 4.5 and 4.6.

Table 4.5 Where would you go for further assistance?

Category	Dealt with Laser Displays in Preceding 12 Months?		Total (out of 277)
	No (out of 185)	Yes (out of 92)	
Other local authority (LA)	129 (69.7%)	40 (43.5%)	169 (61.0%)
Chartered Institute of Environmental Health (CIEH)	70 (37.8%)	20 (21.7%)	90 (32.5%)
Health and Safety Executive (HSE)	164 (88.6%)	77 (83.7%)	241 (87.0%)
NRPB	74 (40.0%)	43 (46.7%)	117 (42.2%)
Loughborough University (LU)	9 (4.9%)	10 (10.9%)	19 (6.9%)
Consultants	24 (13.0%)	17 (18.5%)	41 (14.8%)

All local authorities provided an answer to these questions. Only one said that they would not seek any external advice, citing the Building Control section of the authority as their point of reference. It is not known if the officers in Building Control seek external advice in this instance.

Table 4.6 Specified replies to “Other”

Category	No. displays in 12 months	Who else did they specify?
Other University	0 3	CIEH, HSE LA, CIEH, HSE, NRPB, LU, Consultant
Health & Safety Agency Northern Ireland	0	LA
Building Control	3 1	Consultant None
Laser Display Company	13	LA, HSE
Institute of Lighting Engineers	0	LA, HSE
Royal Environmental Health Institute of Scotland	0 0	LA, CIEH, HSE, NRPB LA, HSE
As Appropriate	0	LA, CIEH, HSE, NRPB, LU, Consultant

Perhaps the most significant answer here was the local authority who used a laser display company to provide them with consultancy support and the number of laser displays assessed on behalf of that local authority (13). From the experience shown in chapter 3, questions must be raised on the competence of the laser display company to provide such advice.

4.2.4 Training

The preceding sections suggest that the necessary expertise to assess laser displays does not exist in most local authorities. As has already been stated, it is valid for local authorities to bring in external assistance when required. Indeed, this may be the most efficient and cost-effective use of limited resources within local authorities. However, the questionnaire asked if local authorities required training and, if so, to what level and in what format.

236 of the 277 respondents (85.2%) said that they would like some form of training for their staff. Of these, 149 (out of 185) had not dealt with a laser display in the previous twelve months and 87 (of 92) had. Of those that said they did not need training 36 had not dealt with a laser display and 5 had.

The levels of training suggested were:

- Overview seminar (up to 2 hours)
- Basic awareness (1 day)
- Working knowledge (2 days)
- Detailed knowledge (4 days)

There was also the option to tick "I do not have enough knowledge to judge". A number of respondents used this box in addition to other boxes. The number of ticks for each option is presented in Table 4.7.

Table 4.7 Training Requirements

Category	Dealt with Laser Displays in Preceding 12 Months?		Total (out of 277)
	No (out of 185)	Yes (out of 92)	
Overview seminar	40 (21.6%)	12 (13.0%)	52 (18.8%)
Basic awareness	102 (55.1%)	57 (62.0%)	159 (57.4%)
Working knowledge	61 (33.0%)	53 (57.6%)	114 (41.2%)
Detailed knowledge	9 (4.9%)	11 (12.0%)	20 (7.2%)
I do not know enough to judge	21 (11.4%)	4 (4.3%)	25 (9.0%)

Four local authorities identified a need for training at all four levels, thirteen identified a need at three levels (11 at the lower three and 2 at the upper three). This simple analysis shows that there is a desire for training from local authority staff. However, it is recognised that this may be positively biased. The wish to pay for, and spare the time to attend, training may not be borne out in practice.

The questionnaire asked which format the respondent would like to see the training take: formal lectures only; lectures supported by syndicate exercises; or a workshop (worked examples with demonstrations). 231 replies were received and many specified more than one choice of format. Since many local authorities suggested they required several levels of training, this is reasonable. The counts were as follows: formal lectures only - 27; lectures supported by syndicate exercises - 61; and workshop - 173. This is based on an equal cost for all options and the bias is perhaps as expected. The respondents were then asked to choose again if the cost was weighted 1:1.5:2 for the three options. 168 replies were received to this, again with several local authorities choosing more than one option. The counts were shifted towards the lectures only as follows: formal lectures only - 33; lectures supported by syndicate exercises - 63; and workshop - 88. Although it was not possible to identify this from the data, it is possible that the bias towards the workshop option would have come from more experienced staff who had attended training in a similar format.

The next question considered how far the respondent would be prepared to send their staff for training and to put these in order of preference. Options given were:

1. Anywhere in UK
2. A regional centre - eg Glasgow, Leeds or Oxford
3. Up to 100 miles
4. Up to 50 miles
5. Within the County of this local authority only.

It may be expected that all respondents would choose option 5. However, from the author's experience of training, more experienced staff tend to prefer to be trained with personnel from outside their immediate work environment. This also has the benefit of being remote from the disruptions of the office.

There were 234 replies to this question (giving at least one preference). The data is presented in Table 4.8.

Table 4.8 Preferred distances to travel for training

Option	1st	2nd	3rd	4th	5th
1	0 (0%)	0	0	6	125
2	41 (17.5%)	20	25	81	0
3	28 (12.0%)	14	90	34	0
4	48 (20.5%)	110	19	0	0
5	117 (50.0%)	13	7	11	6

Members of the Chartered Institute of Environmental Health have a Continuous Professional Development (CPD) scheme (CIEH 1996). Although there is currently no requirement for formal examinations following training, a question was asked to determine if the respondents felt that any training should be followed by a formal examination. 63 of the 236 respondents who required training said yes (26.7%). These were roughly equally divided between those who had dealt with laser displays in the preceding twelve months (29) and those who had not (34). Of these 63, 62 answered yes to the question on whether the examination should be accredited. Eleven chose more than one of the options. The data is presented in Table 4.9. Those respondents who replied "other" did not specify any of the given options. Generally, the written answer given by these respondents suggested that they did not have a preference or the accreditation should be given by whoever gives the training. One respondent was more specific and suggested the Royal Environmental Health Institute of Scotland.

Table 4.9 Preference for Accreditation Body for Examination

Category	Dealt with Laser Displays in Preceding 12 Months?		Total (out of 62)
	No (out of 34)	Yes (out of 28)	
Chartered Institute of Environmental Health	18 (52.9%)	7 (25.0%)	25 (40.3%)
Health and Safety Executive	8 (23.5%)	6 (21.4%)	14 (22.6%)
NRPB	12 (35.3%)	13 (46.4%)	25 (40.3%)
Loughborough University	3 (8.8%)	0 (0%)	3 (4.8%)
Other	2 (5.9%)	4 (14.3%)	6 (9.7%)

4.2.5 Specific Comments

Six of the 277 respondents made specific comments on the returned questionnaires:

“Hands on experience with practical procedures is important.”

“I have attended a number of training events on display lasers. Usually the physics and technology is taught very well but the organisers have a very poor understanding of the role of inspectors and the application of the

law. The status of PM19 and the role of BS or ISO Standards is also misunderstood. EHOs do not normally have to make PM19 calculations themselves. I would, however, welcome a course which helped in the interpretation of calculations and demonstrated clear pitfalls. I would be very disappointed by another course where the role of the law and the enforcer was misunderstood.”

“A formal examination would put the price up too much.”

“The need to use expertise is too infrequent - training would be out of date too quickly.”

“Would not be able to justify training in our own district - possibly as part of a Liaison Group involving other local authorities.”

“Level of use of lasers in the types of premises currently in use in this District doesn’t justify specialist training. I buy in expertise where needed and we are happy to admit we don’t know it all! Our premises are changing and so will our training needs.”

In summary, these comments support the argument for third-party assistance rather than specific training courses for some local authorities. However, they also suggest that training which has been provided may not be meeting the needs of the local authorities.

4.3 Venue Managers and Laser Display Companies

The questionnaire to the Environmental Health Officers provided a reasonable response. It was considered important to balance these views with those from the entertainment industry. A questionnaire was prepared to assess the knowledge of venue managers, laser display companies and anyone else involved in the industry. This was included with the December 1995 edition of *Disco International* (O’Hagan et al, 1995) along with a supporting article. A copy of the questionnaire is included as Appendix D. Approximately 8000 copies of the magazine were distributed. No replies were received. There are probably a number of reasons for this, including: suspicion of officialdom, lack of interest, concern over the use of the information, and the requirement to pay return postage or fax costs. Although a reply-paid option had been suggested, the editorial management of the magazine were reluctant to use valuable space for this.

Subsequent to the questionnaire, working relations were developed with a number of laser display companies which allowed measurement techniques to be developed, as described later. Attempts to audit chains of night-clubs on behalf of the holding companies met with a poor response. Most of the data presented in later chapters has been obtained through involvement with the local authorities.

An impromptu survey was carried out of a number of the more established laser display companies during a meeting held at NRPB on 8 January 1997 to launch the Health and Safety Executive’s new guidance, HS(G)95 (HSE 1996a). Ten companies provided replies. Their estimate of the number of fixed and temporary installations taking place in a twelve month period was 554. Those completing the survey considered that they represented about 50% of the market, suggesting about 1100 installations per year. When this figure is compared with the results from the EHO questionnaire (277 laser displays for 57.3 % of the local authorities) this suggests that either the non-responding EHOs are assessing a higher proportion of laser displays or that a significant number are not being assessed. It could also be concluded that the laser display companies are over-estimating the number of installations they undertake per year.

4.4 Training Courses

The enforcing officers had identified a need for training and the data from chapter 3 suggests that both the laser display companies and venues/promoters would also benefit. The case for training the staff from the laser display companies is clear: competent staff should be employed. However, for both the enforcing officers and the venues/promoters the cost of training (and the development of that training through practical experience) needs to be balanced against the benefits of using third parties to provide the detailed assessment.

A one day course will cost the actual course fee, travel and subsistence and time away from work. There will

also be a need for further commitment to ensure that the participant applies the knowledge gained and retains any competence. A laser display operator should apply the knowledge on a regular basis and hopefully provide a return on the investment in a reasonably short time. However, for the enforcing officer and venue/promoter, the knowledge may be of benefit in the short term, especially if the purpose of attending the training course was to gain sufficient knowledge to assess a specific event, but of less practical use at other times if the training is not reinforced.

The use of a specialist consultant to provide advice to a local authority for each laser event may be cost effective if the number of events per year is small. Working alongside a consultant may also be an effective means of training an enforcing officer. Another factor which needs to be considered is that the enforcing officer is also likely to be involved with other aspects of the event, such as food safety, hygiene and other health and safety issues. There may also be different parts of the local authority involved with the event where entertainment licensing is covered by someone other than the Environmental Health Officer. A consultant may be able to provide the liaison between the relevant parties and, through experience, know the right questions to ask and, more importantly, know that the answers to these questions are correct.

NRPB and Loughborough University first offered a training course on “Laser Safety in the Entertainment Industry” in August 1994. This was intended as a one-day awareness course for enforcing officers, venue managers, promoters and laser display companies. It was recognised that enforcing officers would have a reasonable appreciation of health and safety, and possibly entertainment, legislation. However, they were unlikely to have much knowledge about the technical aspects of laser displays.

Topics covered in the training included:

- The Use of the Laser
- Details of Laser Display Systems
- Laser Radiation Hazards
- Associated Hazards
- Legislation, Standards and Guidance
- Risk Assessment.

An important aspect of any training course is the feedback received. This is both in the form of experience of the participants and formal reviews. Participants were asked to assess each presentation and provide supporting comments. They were also asked to assess the course overall.

The general comments suggested that the course had provided a useful introduction. However, a number of participants considered that some topics would benefit from a workshop format. Most of the participants asked to be involved with further research into a methodology for assessing laser displays.

Most of the participants on the courses were either enforcing officers or venue managers. It was proving very difficult to attract participants from the laser display community. The conclusions to be drawn from this could include that they considered they did not need the training, the training was not appropriate, or they were not prepared to accept training from persons outside of their industry.

The one day awareness course was obviously meeting some of the needs of the enforcement officers and venue management. These were likely to be persons who wanted an overview of laser displays and sufficient expertise to know when to call in external assistance. This was borne out by requests for advice from the course participants when laser displays required assessment in their geographical areas. The next level to consider was the group who wanted to assess most displays themselves but still be able to appreciate their limitations. This would also hopefully appeal to managers and staff from laser display companies.

In 1996 a series of one day awareness courses were run followed by a one day workshop on assessing laser displays. Four such pairs of courses were run throughout the year and, for the first time these attracted participants from the laser display industry. The loan of laser display equipment and the informal input from the industry assisted greatly in developing a successful training strategy. The introductory day was run essentially the same as the previous courses but the second day included a greater degree of participation, including an assessment of a display using the then Health and Safety Executive guidance, PM 19 (HSE 1980).

Written comments to support numerical assessments suggested that assessing exposure to the laser beam was the greatest concern for the course participants. This is despite this aspect of laser safety being covered by many standard texts and considered by many professionals to be well understood (see Chapter 2). All participants expressed a desire for a methodology for assessing laser displays.

4.5 Summary

It has been possible to get quite a good overview of the current situation regarding local authorities but the laser display industry itself is more guarded.

The large return rate for the local authority questionnaire is likely to be because of the general acceptance of NRPB as an independent organisation which provides assistance to local authorities, for example on radon assessments. The number of laser displays seen by local authorities is smaller than expected. Even if the number seen (244) is multiplied up for the number of local authorities who did not respond ($\times 483/277$) this only represents 425 laser displays per year. Even when taking into account that the local authority is not the only enforcing body, this must be an underestimate. However, the questionnaire would not take into account the number of fixed laser display installations under the local authority's control if they had been installed more than twelve months prior to completion of the questionnaire.

The most significant finding from the local authority questionnaire is the limited capability, within the local authorities who replied, to assess laser displays. Only 15 persons were considered to be experienced in assessing laser safety at such events. It is accepted that many local authorities seek further advice when necessary but it is likely that many rely on the expertise of the laser companies. It is particularly interesting that one local authority stated that they use a laser display company to advise them. This particular local authority had dealt with thirteen laser displays in the previous twelve months.

The lack of response from the other side of the industry was disappointing. Some of the reasons are suggested above. However, it does raise the question of how many venues suspect that their laser safety may not pass scrutiny.

The training courses have provided direct contact with a large number of persons involved across the industry from enforcing officers to laser display operators. The value in understanding the technology and the safety issues is ably demonstrated by the end-of-course assessment questionnaires. Written comments and informal discussions suggested that an assessment methodology was required and specific guidance on how to assess the laser radiation hazard. It is significant that many enforcing officers followed up the training with requests for support to assist with laser entertainment events. This demonstrated that the enforcing officers did not feel

that the level of training was sufficient to allow them to assess laser displays alone. Due to resource constraints it was not possible to comply with every request, demonstrating the importance of developing a methodology which could at least be used by enforcing officers and others. Such a methodology could assist the person with the first stage of the safety assessment and perhaps identify the point at which further advice should be sought. In essence, they are seeking a practical guidance document which goes further than the limited formal guidance currently available.