The Effectiveness of Radiation Protection Training in Industrial Radiography

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The 2nd EAN Workshop "Good Radiation Protection Practices in Industry and Research" noted that there was scope for improvement in the optimisation of radiation protection in industrial radiography through, amongst other things, improvements in worker training. The first step in bringing about improvement, however, is to identify the areas of weakness or potential weakness. This paper explores this issue from the perspective of both "trainer" and "observer".

NRPB is involved both in the direct provision of training and in advising on training requirements within the industry. NRPB also acts as Radiation Protection Adviser to organisations undertaking industrial radiography and as such is in a good position to observe the impact and effectiveness of the training being provided. Our experience in the UK is that a significant amount of radiation safety training is available and is undertaken. Some of this training is very good and some poor but there is a fundamental weakness in that a lack of understanding both at the worker level, and at the level of Radiation Protection Officer, pervades. This results in potentially hazardous working practices. While recorded serious incidents in industrial radiography are rare, the lack of understanding of the hazard and of the practical application of the ALARA principle results in potentially hazardous working practices.

TRAINING PROVISION IN THE UK

In the UK the Ionising Radiations Regulations 1999 require that employers ensure that all employees engaged in work with ionising radiation are given "appropriate" training in radiation protection. However, while there is general guidance on what constitutes appropriate training there are no nationally agreed standards with respect to the provision of radiation protection training within the different sectors of industry, although there is an element of custom-and-practice. In many cases employer discretion applies.

The Non-Destructive Testing (NDT) industry in the UK is, on the whole, well organised with a number of training schemes for NDT personnel. The two major schemes are the PCN (Personnel Certification in Non-Destructive Testing) and the ASNT (American Society of Non-Destructive Testing). The ASNT scheme, which is administered in the UK by the North Atlantic Section of ASNT, provides certification to the internationally accepted ANSI standard. It is an employer based scheme in which the employer determines the level of training required; invariably this reflects the specific radiation application within the organisation. By contrast, the PCN scheme is individual, rather than employer, based with certification having a 5-year validity regardless of whether or not the radiographer changes employers. This scheme complies with the European standard for certification bodies and offers examinations covering the main NDT methods and radiation safety in accordance with the relevant international standards for NDT personnel qualification and certification. Examination papers are set and marked centrally and examinations are carried out at accredited test centres.

Common to both the above schemes is the fact that radiation safety is just one component of a comprehensive scheme which aims to provide all necessary training in NDT Techniques as well as addressing safety issues. A radiographer pursuing PCN certification is required to attend a PCN approved training centre to obtain radiation safety training (both at the worker and RPO level). Radiographers following the ASNT scheme may also obtain training at recognised training centres but it is not essential to follow that route.

In addition to dedicated training schools within the industry, there are a number of other organisations within the UK, including NRPB, which offer radiation safety training for industrial radiographers. NRPB offers basic radiation awareness courses for radiographers as part of it's scheduled portfolio of courses and offers customised courses on demand for individual organisations. However, the throughput on our courses is low and we are unlikely to establish a strong foothold in this area since, unlike the other main training

providers, we do not provide training in NDT technique. The total number of industrial radiographers in the UK (registered as classified workers) has remained relatively constant over the past three years at around 3,500. Assuming that this is a representative figure, the statistics provided by the main trainers suggest that a significant percentage of practising radiographers have received formal training at some time.

OBSERVATIONS

The principle of ALARA is not confined to the achievement of dose reduction. Ideally, ALARA should be a way of thinking and to promote ALARA is to promote an understanding of the practical relevance of the concept. As such it should be the focus of any training in radiation protection and if that training were to be fully effective the application of ALARA would be carried through in day to day working practices. Our observations, both in terms of working practices and the general nature of training provided is that this is not the case.

Consider working practices. In our role as Radiation Protection Adviser we are able to observe first-hand general patterns of work and the impact and effectiveness of training being provided. In many cases this is through routine visits to companies to review and advise on radiation protection standards, but an important contribution to our overall picture is information gained from dealing with minor incidents and infringement of regulatory requirements. All these point to some key areas of weaknesses in radiation protection practice. Lack of, or inadequate dose-rate monitoring is well documented as an area of inadequacy in industrial radiography and cited as a contributory factor in probably the majority of incidents. However, rather than dealing with specifics, it is more constructive from the point of view of this debate to categorise the general areas of weakness.

i) Although, if asked, most trained radiographers can state what the acronym ALARA stands for, and in discussion would argue that that is what they are trying to achieve, there is little real understanding of the practical relevance of the concept. The understanding among employers seems to be that provided worker doses are below the dose limits then everything is satisfactory and ALARA has been achieved.

ii) In some cases there is a real lack of awareness and understanding of the radiation hazard presented. This is well-illustrated by an incident involving a stuck-out source in a gamma compound where two trained radiographers refused to enter the facility to assist with the recovery because of they were "scared" of the radiation.

iii) There is a suggestion from the observation of the working practices of some employers that provided all steps have been taken to ensure radiation protection of <u>others</u> then that is satisfactory. A common example of this is the establishment of very large controlled areas during site radiography using natural boundaries eg perimeter fences to demarcate the area. A typical argument in defence of this is that natural boundaries require less supervision, that all "others" are kept out and only NDT personnel will be within the area. This points to a lack of understanding of the significance and function of the controlled area and an assumption that warning signs etc are not necessary for the safety of the NDT personnel. A significant number of radiographer overexposures have resulted from the lack of adequate safety and warning systems; incidents involving non-NDT personnel are rare.

iv) The adoption of recognised Quality Assurance schemes such as ISO 9000 has had a positive effect on the general standard of record-keeping within the large NDT organisations. Such schemes provide a framework for the retention and auditing of records along with a requirement for demonstration of safety compliance. In some cases, however, while the paperwork may be in place little or no attention is paid to the contents , which again points to the lip-service which is paid to the ALARA principle. For example, appropriately retained dose records but no-one reviewing the doses recorded, good records of maintenance undertaken but on inspection, poorly maintained equipment.

v) The role of the client impacts on working practices. It has long been recognised that commercial pressures placed on the client companies can be significant and impact the way in which the NDT companies operate. These pressures are confined not just to costs and timescale but also in terms of dictating to the NDT company how the work is carried out. For example, some companies will dictate the isotope and maximum activity, precluding the use of x-radiography on site. One company in NRPB's experience went to considerable effort and expense to purchase a "small controlled area" system. This purchase was based on radiation protection considerations but to date the company has not used the system due to the fact that clients will not permit its use on site. The system incorporates selenium-75; due to the relatively low output, compared to iridium-192, exposure times tend to be longer, which is not tolerated by clients. This lack of knowledge and understanding on behalf of the client is something which, to date, has not been fully addressed.

CONCLUSIONS

The conclusion drawn from the evidence summarised above is that within the NDT industry within the UK there is a good infrastructure for the provision of training in radiation protection and most industrial radiographers undergo some training at some point. However, the effectiveness of this training in terms of encouraging ALARA as a method of working is questionable. It is suggested that the reasons for this are as follows:

i) The lack of nationally agreed standards which will satisfy what is considered to be "adequate" radiation protection training within the NDT industry. In recent years there has been a move to greater consistency between the two main training schemes, but until there is a national standard that employers are required to comply with, employer discretion will always result in variations in the depth and quality of training provided for the radiographers.

ii) Lack of understanding of radiation protection issues on the behalf of client companies.

iii) It is probably fair to say that those providing training are doing the best they can with the support and facilities at their disposals. However, the training "packages" are incomplete. While there are agreed syllabus for the basic awareness and RPO levels of training, moves to bring about similar improvements with regard to available training material have not been that successful. For example, in recent years NRPB has, at the request of the NDT industry, put considerable effort into putting together a standard set of course notes. While these have been welcomed and endorsed by key personnel, there continues to be great difficulty in promoting their adoption and use by trainers. There is no guidance for trainers on the depth of coverage, and required emphasis, of syllabus material or on the objectives (or content) or written examinations. Examination questions, and model answers, are often technically inaccurate

iv) In the main those providing radiation protection training for industrial radiographers are not radiation protection professionals. While this in itself should not necessarily be a problem (effective radiation protection training for any discipline requires a practical knowledge of the work in question) the trainers are often not up to date in radiation protection thinking and tend to adhere to the "spirit" of old philosophies eg maximum permissible dose. Radiation protection training is often mixed with training in NDT technique, the result being that key radiation protection issues are obscured. There is bias towards unnecessary scientific and technical aspects which distracts from the key issue of ALARA and its practical consequence. There is a real need to address this bias and get back to basics.

v) Even where the trainers and the training materials are to a reasonably good standard the method of presentation of the training conventionally used does not promote "awareness" or an understanding of <u>why</u> there is a need to work in accordance with specified procedures. It is considered that a key factor here is the nature of the audience. In almost 100% of cases industrial radiographers attending for radiation protection training will have some (possibly significant) work experience; the nature of the work is such that setting up controlled areas, daily maintenance

of equipment, the use of barriers and warning signs, interlocked facilities are all (even if not fully adhered to) integral to daily tasks. There is little to be gained from telling a basic level radiographer that all these are required, as far as he is concerned that is an accepted fact. What is needed is an understanding of why. In turn this will encourage understanding of the actions required when things go wrong.

SUGGESTIONS FOR IMRPOVEMENT

The adoption of a nationally agreed standard in the UK for radiation protection training in industrial radiography would undoubtedly help to reduce the inconsistencies in the approach to training and help ensure a common goal. At the present time there is no "push" from the Regulators to enforce any such standard , so perhaps the best that can happen is that standards suggested by, for example, NRPB become adopted over a period of time. However, this is a general issue and is perhaps the subject of another debate.

There is a need for greater awareness on behalf of the client companies with respect to the radiation protection issues faced by NDT companies. Client companies either need to be competent to discuss radiation protection issues with radiographers, or they need to accept the work proposals from radiographers without question. This matter is perhaps best addressed by the professional bodies within the Health & Safety professions.

Points (iii) – (v) in the preceding section relate to the content, format and delivery of available training and in our experience there is now a need to view these aspects from a different perspective, specifically to consider the benefits of a train-the-trainer approach and to re-think the manner of course presentation.

The concept of "train-the-trainer" is not new. It has increasingly become recognised as one method of maximising and extending available resources but it has not to date been deemed to be a necessary approach within the UK given that training resources <u>are</u> available. However, as is evidenced by the discussions above, while those resources are not limited in practical terms they are perhaps, in reality, limited or at least not maximised in terms of radiation protection expertise.

In the UK, NRPB is only ever going to have limited scope to influence radiation protection standards via direct training of radiographers. However, we are uniquely placed to provide training courses for existing trainers within the industry. We could provide instruction in radiation protection, course material (which could then be used by the trainers), guidance on presentation of the syllabus material and guidance on, and questions for, examinations. Subsequent auditing of training provision would be an essential component of the loop. Tentative discussions with representatives from the two main training schemes suggest that this is an option that could be pursued.

Most formal training courses are a mixture of oral presentations and practical exercises and all competent presenters will claim to encourage discussion and participation from the audience. However, our experience (both as observers and trainers) is that there is a tendency to present material in a "set" sequence (suggested by the syllabus), use very standard examples to illustrate key points and, as mentioned above, to apply inappropriate emphasis to certain aspects of the syllabus. What is needed, is a "shake-up" in style and a shifting of emphasis back to basics; over the past twelve months we have been experimenting with course style in order to try and achieve this.

Our approach has been to put the onus on the students, right at the beginning of the course, to determine for themselves the nature and magnitude of the hazard, the steps required to restrict exposure during routine work, actions required to prevent accidents occurring and to minimise the consequences of accidents should they occur. In other words the training is modelled on risk assessment and therefore has running through it continued consideration of the ALARA principle and its practical relevance. The result is a course that is essentially a series of exercises interspersed with lecture material, rather than the reverse. The key message to get across is that in any situation the appropriate course of action is dependent on the circumstances, consequently an understanding of the basic principles is essential. The format works at both the worker and the RPO level.

The feedback from our rather limited experience has been positive. However, it should be noted that the success, or otherwise, of delivering a training course in this manner is heavily dependent on the experience and ability of the presenters. Central to the effectiveness is the ability to direct the focus of the course and cover all the required syllabus material while still maintaining a high degree of flexibility.

SUMMARY

Even within a country with a good radiation protection infrastructure and plentiful training resources the effectiveness of radiation protection training for industrial radiographers can be questionable. This could be addressed by encouraging a "back-to-basics" message to trainers and perhaps a review of the targeting of training to ensure that all relevant parties have the necessary understanding of the subject.