Paper 13

When Is It Reasonably Practicable to Provide a Shielded Enclosure?

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1 Introduction

The UK Health & Safety Executive (HSE) is generally responsible for enforcing health & safety legislation in the workplace. Specific legislation is usually introduced to address the control of particular hazards. The Ionising Radiation Regulations 1985 (IRR85) are concerned with the control of the use of ionising radiations in the workplace. The IRR85 are based on the recommendations of International Commission on Radiological Protection publication ICRP26, and largely implement the Council Directive 80/836/Euratom (BSS80). The IRR85 are in the process of being revised to bring them in line with ICRP60 and the Revised Basic Safety Standard Directive 96/29/Euratom (BSS96). However, there will be no changes which will fundamentally alter the UK approach on ALARA to the use of ionising radiation for the purposes of industrial radiography for non destructive testing (NDT) purposes.

HSE receives summaries of the doses of ionising radiations received by designation radiation workers ("classified persons"). This information is collated in the Central Index of Dose Information (CIDI). The doses reported to CIDI received by industrial radiographers has not decreased in line with the decrease in almost all other industrial groups including those in the nuclear industry. Although CIDI cannot clearly distinguish between radiographers working in shielded enclosures and those working under site radiography conditions, it is clear that the main problem is with site radiography where exposures are not always being kept as low as reasonably achievable.

HSE's concern was reinforced to some extent by the death of an industrial radiographer in 1992, He had worked for over 15 years as an industrial radiographer (mainly under site radiography conditions) and it was decided that his death was related to a radiation induced illness.

2 Enclosure Radiography

Regulation 6 of the IRR85 requires the employer to take all necessary steps to restrict so far as *reasonably practicable* the extent to which persons are exposed to ionising radiation. (ALARP). The term *reasonably practicable* is defined by case law in the UK, and hence is used in the IRR85 in preference to ALARA, but the two terms are synonymous for the purposes of this paper..

Regulation 6(2) further stresses the importance of ALARA by requiring the provision and use of engineering controls, design features, safety features and warning devices to restrict exposure whenever these are reasonably practicable, in preference to systems of work (Reg. 6(3)).

In the case of industrial radiography, the IRR85 clearly require the provision and use of a purpose made facility whenever this is reasonably practicable. Hence, in most premises where readily moveable articles are radiographed, a permanent shielded enclosure should be provided for such work. The design & construction of the walls of the enclosure should be sufficient to encompass the whole of the controlled area (in general an area where dose rate may exceed 7.5 microSv h^{-1}). Generation of X-rays (and ideally exposure of sealed sources) should be mechanically or electrically interlocked with any door such that exposure is prevented or terminated if the door is opened. Effective warnings should be given to persons prior to and during generation of X-rays or exposure of sources. Alarms and emergency stops should be provided in case a person be shut inside an enclosure.

Further details of the current UK standards for demonstration of compliance with ALARP may be found in the Approved Code of Practice (ACoP) supporting the IRR85.

Despite the provision of engineering controls, design features, safety features and warning devices, there are occasionally incidents involving the exposure of persons whilst using enclosures for radiography. These are usually caused by inadequate maintenance of the safety features and disregard for rules of operation. However, radiography in an enclosure is inherently safer than radiography without the use of an enclosure, and is the preferred way for employers to demonstrate compliance with the IRR85.

3 Site Radiography

"Site radiography" is simply radiography not being carried out in a shielded enclosure as detailed above, for example, radiography in an open engineering workshop. The practice is only acceptable when it is *not* reasonably practicable to provide a shielded enclosure.

Examples of situations where the provision and/or use of an enclosure may not be justified may include: the inspection of very large fabricated items such as pressure vessels, aircraft; the examination of final "tie-in" welds on pipework on a construction site; the radiographic examination of oil and gas pipelines welded "in-situ" (but *not* the examination of individual lengths of pipe); the inspection of safety critical items of in-situ plant for testing purposes where dismantling would present additional safety implications.

However, the question to be asked is: "Is it reasonable to move it to an enclosure?". If the answer is "yes", then it is difficult for the employer to justify the use of site radiography.

The site radiography work must still be carried out in such a way as the employer can demonstrate compliance with Reg. 6 ALARP, by the use of design (e.g. local shielding) and safety features and warning devices, but the scope for their provision and use is much more limited compared with an enclosure as described in section 2 above. There is usually a much greater reliance on systems of work, with associated problems of (lack of) compliance driven by human factors such as time pressures.

4 Other influencing factors

4.1 Notification of site radiography work to HSE

HSE has recognised the higher risk associated with site radiography, and has introduced procedures within the legislative framework which requires the employer to notify HSE of certain information at least 7 days in advance of new site radiography work. This information consists of: a brief description of the work to be carried out, particulars of the source(s) of ionising radiation, date and approximate time and duration of work, the location of the premises, and the person responsible for supervising the work.

There are two reasons for requiring notification of site radiography work: firstly, inspectors cannot inspect unless they know where and when the work is taking place. Secondly, it helps to establish a planning regime in the minds of both client and contractor to identify the risks and co-operate effectively to manage the contract so appropriate ALARA control measures are implemented.

Arrangements are in place to deal with emergency requests for waiver from the 7 day notification requirement. Both NDT contractor and client must have a reasonable explanation for seeking such a waiver - poor planning is *not* a reason!

4.2 Client Responsibilities

A great deal of site radiography work in the UK is sub-contracted by the client to an NDT specialist company. The IRR85 does not directly apply to the client, since the client is not usually carrying out "work with ionising radiation".

However, the client has responsibilities under the Management of Health & Safety at Work Regulations 1992 (HSWR92), implemented as part of the Framework Directive. Regulation 3(1)(b) requires the client to "....assess the risks to the health & safety of persons not in his employment arising out of or in connection with the conduct by him of his undertaking.". Regulation 9 requires employers sharing a workplace to co-operate with each other to ensure compliance with the MHSWR92. Because of the severity of the risk when NDT work is carried out under site radiography conditions, the use of ionising radiations must be fully addressed by both client and contractor. Clearly, an option is to remove the NDT work to a purpose made enclosure belonging either to the client or the NDT contractor, thus removing the risks associated with site radiography. An even better option is to consider the adoption of alternative NDT techniques, where appropriate, which removes the risks from ionising radiation altogether e.g. ultrasonic, magnetic particle inspection, dye penetrant.

Often, NDT techniques are specified as part of the original contract; these are often influenced in turn by insurance companies who may have an underwriting influence in quality assurance programmes associated with the testing work. Therefore clients must liaise with NDT specifiers to ensure that radiography is only used where

it is absolutely necessary, hence influencing ALARA by minimising the frequency of use of ionising radiations, and encouraging the use of enclosures whenever possible.

4.3 Economic influences

Site radiography in compliance with the IRR85 and ALARA principles will usually involve detailed planning (7 day notification period to HSE), careful timetabling (work is usually carried out in the quiet hours when only essential employees are on the premises, and is therefore restrictive), and delays before results of NDT tests are available, hence delaying the QA process.

Movement of the NDT work to an enclosure presents considerable economic advantages to both client and NDT contractor. An enclosure facility can be incorporated into or close to the production facility. Radiography can be carried out as soon as it is required; there are no requirements for planning for notification purposes, nor to wait until the quiet hours. Feedback on for example, weld quality can be very rapid, allowing remedial actions to be initiated without waiting for an entire day's production to be scrapped or reworked!

4.4 ALARA in practice

The costs of providing an enclosure facility for radiography on engineering components is typically of the order of £50,000, depending very much on the size of the enclosure and sophistication of engineering controls.

Debate on ALARA issues associated with potential radiation detriment can become a complex area of discussion between enforcer and employer, especially if the employer is not otherwise very involved in radiation protection issues. Instead, it has found to be useful to persuade employers to develop or use enclosure facilities on the basis of economic factors and planning/ timetabling flexibility.

HSE has assembled a dossier containing case studies of the provision of enclosure facilities at client's premises. It has sometimes not been necessary to quantify the economic benefits since flexibility of working practices is often sufficient payback to justify the construction of an enclosure.

However, some installations have been costed in a more quantitative manner. For example, the payback period for a very extensive and sophisticated enclosure installation costing approx. £400,000 was estimated to be 2 years, mainly due to a productivity increase of 30% associated with flexibility of working and more immediate feedback into production control from the NDT inspection. No longer is it necessary to re-work an entire batch of products from a particular welding station the next day, since QA results are now available within a matter of 30 minutes or so.

5 Conclusion

Both client and NDT contractor have responsibilities under UK legislation when considering industrial radiography as an NDT technique. The UK legislative approach associated with site radiography can successfully influence employers to adopt enclosures for radiography work on engineering components, as a safer alternative to site radiography.

Whilst conventional ALARA assessments in terms of radiation detriment may not be conclusive, economic factors associated with the convenience of the provision of an enclosure are often very persuasive.

References

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The views expressed are those of the author, and not necessarily those of the Health & Safety Executive.