INDUSTRIAL RADIOGRAPHY AND THE RECOMMENDATIONS FROM THE 2nd EAN WORKSHOP

P Shaw[1], *P Crouail*[2], *J Croft*[3] *and C Lefaure*[2]

1. *NRPB Northern Centre, Leeds, UK*
2. *CEPN, Fontenay aux Roses, Paris, France*
3. *NRPB, Chilton, Didcot, Oxon, UK*

INTRODUCTION

The history of the European ALARA Network and the recommendations from the 2nd Workshop[1] have already been summarised by the organisers of this Workshop. The purpose of this presentation is to consider these recommendations in terms of the aims and objectives of this, the 5th EAN workshop. Consequently, the format of this presentation will reflect the four main themes of the workshop sessions. From this, a series of questions are posed that (hopefully) will be addressed in the presentations that follow.

SETTING THE SCENE

Non destructive inspection of metal fabrications by industrial radiography is a long-established and widespread practice. Despite the periodic promotion of alternative NDT techniques, this situation is expected to be the case for the foreseeable future. Radiography is undertaken with either x-ray apparatus or gamma sources. Of the gamma sources, iridium-192 has, to date, been the most common radionuclide, the range of gamma energies emitted making it suitable for the inspection of a wide variety of metal thicknesses. Less common is the use of cobalt-60 (higher gamma energy, used for thicker components), and ytterbium-169 (lower energy, thinner components). Recently, selenium-75 is being actively promoted as an alternative source.

Where practicable, radiography is expected to be carried out in dedicated facilities (radiography enclosures or compounds) in which effective engineering controls, safety and warning systems are installed. However, in the case of large fabrications that cannot usually be transported to, or accommodated in, a radiography enclosure, radiography is carried out *in situ*, a procedure known as site or open shop radiography. For this type of work, effective engineering controls are not usually practical, and there is much more reliance on safe working procedures.

There are no comprehensive data on the number of radiography companies or radiography compounds within the European Community as a whole. In Spain, some 130 organisations are listed as undertaking industrial radiography[2] and, in NRPB's experience, a similar number of organisations exists in the UK.

More information is available on the number of radiography employees, principally through national dose records (all site radiographers and most compound radiographers are expected to be subject to individual dosimetry). Records from Spain(3) and the UK(4) indicate that the number of radiographers in each country is in the range 3000 to 5000. In France(5) the figure for non nuclear industries as a whole is above 20 000, of which a few thousand are estimated to be industrial radiographers. . From this, the total number of radiographers in Europe (including prospective Member States) is estimated to be of the order of 40 to 50 thousand. Although this is only a fraction of the total number of radiation workers (for example, in the UK it is less than 10%(4) of the total), the numbers become much more significant when occupational exposures close to, or above, dose limits are considered. In France last year(6), 50 industrial radiographers received doses above 20 mSv (40% of all cases). In 1999 in the UK(4), 8 radiographers exceeded 20 mSv (20% of all cases), and 5 radiographers exceeded 50 mSv (100% of all cases). The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) periodically reviews all sources of world-wide exposure. In its last report, covering 1990-1994(7), the average annual exposure of the measurably exposed workers in industrial radiography was 3.17 mSv, which may be compared to 3.10 mSv for the whole of the nuclear fuel cycle. The figures also reflected the relatively high percentage of workers with doses in the upper dose bands.

According to UNSCEAR(7), some 40% of all reported accidents with clinical consequences involved industrial radiography. The French Curie Institute Pathology Unit has developed a significant international reputation for dealing with radiation casualties(8). Since 1951, of the 211 cases treated from the non nuclear industry, 149 (70%) were associated with gamma radiography (a figure equivalent to 38 % of all occupational cases). Such high doses are almost always the result of accidents, and the reporting of industrial radiography accidents has been a regular feature of the EAN Newsletter(9,10,11,12,13). In the UK, of the first 100 non-nuclear incidents reported from the IRID database(14), 39% were associated with industrial radiography, a trend that has continued.

The above data on worker doses and accident rates show why industrial radiography was given prominence in the recommendations arising from the 2nd EAN Workshop. Specifically, it represents a practice with perhaps the greatest potential for improving both the understanding and application of the ALARA principle. The recommendations for improvements in industrial radiography arising from the 2nd Workshop may be grouped into 3 categories, namely radiography equipment, safety culture and management, and worker training. Consequently, these form the main themes of the subsequent sessions of this workshop. The issues associated with each of these themes, presented as a series of questions, are considered below.

IMPROVEMENTS IN EQUIPMENT USED IN INDUSTRIAL RADIOGRAPHY

There was a perception from participants of the 2nd Workshop[(1)] that the design of radiography equipment had not progressed at the same rate as other technologies. It was suggested that the European Commission should support work improving the robustness of source control mechanisms and to investigate the viability of fail-safe source return sensors/detectors. Equally important is the need to keep the effectiveness of such equipment under review[(2)]. From this, the following questions arise:

- Which organisations are actively involved in the development of equipment (including monitoring equipment)?
- What improvements have been made since the 2nd Workshop, and what improvements are planned?
- How do these improvements contribute to ALARA (what are the benefits and how are these quantified); what are the costs?
- Is new equipment readily adopted by the radiography industry?
- How important is it to regularly review and maintain equipment?
- What is the role of regulatory bodies in this area?

RADIATION SAFETY CULTURE AND MANAGEMENT

The 2nd Workshop identified that actions were needed to improve radiological safety awareness as part of an overall approach to safety, and that co-operation with professional bodies and industry group organisations may be productive. Inherent in this issue is the communication and perception of risk, and the workshop suggested that these were at the heart of acceptance and implementation of radiation protection. Consequently, it was recommended that the EC should support the provision of easily understood information to various audiences, including workers. Finally, at the workshop there were suggestions that the nature of radiographic work was not conducive to establishing a safety culture, and that accidents were probably under-reported as a result[(15)]. From these issues, the following questions arise in this workshop:

- The ALARA concept is a regulatory requirement: why does it not appear to be a prominent issue in industrial radiography? What influence do each of the stakeholders (industry, regulators, experts and clients) have in this respect?
- How can co-operation with professional bodies and industry group organisations work in practice, and what might it achieve?
- What are the practical pressures that exist in the radiography industry, and how do they affect the establishment of a safety culture?
- Are accidents under reported? If yes, how is it possible to improve reporting and feedback analysis?

TRAINING IN RADIATION PROTECTION

The 2nd Workshop recommended that the EC takes steps to encourage an improved and coherent standard of training in industrial radiography, and that it would be effective to co-operate with both national professional bodies and recognised accrediting organisations. The Workshop also issued a general recommendation to the EC, encouraging the establishment of both occupational dose and accident databases, plus feedback mechanisms (lessons learnt) in Member States. Such feedback provides a practical input to training and, for this workshop, the following questions arise:

- What are the current requirements for training of industrial radiographers in radiation protection in different countries? What, if any, systems of accreditation exist for such training?
- How might an improved and coherent standard of training and refresher training be encouraged both within and outside Europe? What actions have been taken, and what actions are planned, in this respect?
- Are national dose/accident databases available (or being developed), and do they allow the analysis of sector-specific trends and lessons learned from accidents?
- What feedback mechanisms exist, and do they improve the awareness of workers? How do we ensure that such databases/mechanisms are compatible within the EU?

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