Report on the Questionnaires on

Occupational Exposure in Industrial Radiography

Executive Summary

As part of the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR) project, the Working Group on occupational exposures and radiation protection of personnel in industrial radiography (WGIR) was formed in 2010 to undertake 3 years of activity focussed on improving the implementation of occupational radiation protection in industrial radiography (IR).

One of the first tasks of the WGIR was to perform a survey to gain insight into occupational radiation protection in IR around the world. Three different questionnaires were distributed to: individual industrial radiographers (operators), non-destructive testing (NDT) companies, and national or state radiation protection regulatory bodies. The questionnaires were distributed widely over an approximate one year period (mid-2010 to mid-2011), primarily using industry and NDT society contacts of WGIR members and using IAEA contacts with regulatory bodies.

Responses were received from: 432 industrial radiographers from 31 countries and employed by approximately 150 different NDT companies; 95 NDT companies from 29 countries; and 59 regulatory bodies.

Because of the nature of the distribution of the questionnaires to individual industrial radiographers and to NDT companies, it is likely that those approached represent the better end of the practice spectrum. Hence, it is recognised that the survey results cannot purport to be truly representative of the worldwide practice of industrial radiography and all results must be interpreted with this caution. Further, many of the questions involved a radiographer or a company assessing their own habits or performance, and hence are subject to distortions of perception versus reality, thus placing a further caveat on those results. The distribution of the regulatory body questionnaire was systematic – contact was attempted for all IAEA Member States. Notwithstanding the above caveats, useful insight into current radiation protection practice in industrial radiography was gained.

The need for radiation protection training in industrial radiography appears to be well accepted, with a reported high prevalence of initial theoretical and practical training. The use of refresher radiation protection training could, however, be improved – only two-thirds of regulatory bodies required such training.

Accidents, near misses and deviations from normal practice are widely recognized as being a characteristic of industrial radiography, and the results of this survey provide such confirmation – they do occur. It is likely that the derived rates of occurrence from the survey (e.g. 0.04 accidents per radiographer per 5 years) are an underestimate. The rates estimated from the radiographer data were higher than the estimates based on company data, suggesting that what happens “in the field” may not necessarily be reflected in the company reporting, and is even less likely to be reflected in the regulatory body reporting. Means for minimizing the likelihood of incidents remains a priority.

The survey showed that the use of collimators in gamma radiography and diaphragms in X-ray radiography, and the general use of survey meters, whilst high, was not as high as it should be. Further, about one-half of the radiographers and the NDT companies reported that on-site radiography was being performed without the presence of the radiation protection officer (RPO), and hence without the benefit of the specific radiation protection expertise.

Almost all regulatory bodies required the use of a warning system to prevent entry to the radiography site. The results of the survey suggest that communication between the NDT company and the client (who is receiving the on-site radiography services) is less than desirable. Less than half of the regulatory bodies require the client to inform the NDT company about conditions on the site that might affect the safety of other workers on site. This was then reflected in practice where 30% of NDT companies reported that their clients were not always providing information about other interfering activities on site.

The majority of regulatory bodies had regulatory performance requirements for the safety of sources and exposure devices, and for periodic inspections/tests and maintenance to verify compliance with those standards. Almost all NDT companies reported performing preventative maintenance.

High percentages of both the NDT companies and the regulatory bodies were performing inspections of the radiographers at work. Both announced and unannounced inspections were being used. The results suggest that a radiographer could expect to be inspected at least twice a year by their NDT company and about once or twice a year by the regulatory body. The five most common shortcomings for the NDT company inspections were: no proper use of collimators, dose rate at the boundary of the work site not within limits set, no proper use of survey meters, no pre-operation specific equipment checks being performed, and poor operator knowledge of procedures. For the regulatory body inspections, the five most common shortcomings were: no proper use of survey meters, no proper warning system to prevent entry to the work site, poor emergency preparedness, no proper use of alarm systems, and dose rate at the boundary of the work site not within limits set.

Radiation sources used for industrial radiography purposes have high radiation outputs and are potentially very hazardous. Incidents do occur and it is essential that systems are in place for emergency preparedness and response, in particular an emergency plan.

Almost all regulatory bodies stated that they require NDT companies to have an emergency plan; 95% of NDT companies stated that they had an emergency plan; and over 90% of radiographers stated that their NDT company had an emergency plan for site radiography. The role of the radiographer in an emergency is crucial. Almost 90% of radiographers reported that they had received training for the roles and responsibilities of radiographers in the emergency plan; and, over 90% of NDT companies stated that their emergency plan had been discussed with their radiographers and over 80% of NDT companies reported that they provided specific training on emergency preparedness and response. The last figure reflects the practice that some countries have requirements to use specialist persons in emergency roles, and hence specific training for radiographers in this role is not seen as appropriate.

Reported individual monitoring data for 2009 from the radiographer questionnaire and the regulatory body questionnaire gave average annual effective dose estimates for industrial radiographers of 3.4 and 2.9 mSv, respectively. Approximately 2% of industrial radiographers received an annual effective dose in 2009 that exceeded the dose limit of 20 mSv. From the data submitted, the estimate (at the 95% level) of the mean occupational effective dose per exposure was 4.8 ± 2.3 μSv per exposure. There was no correlation between the annual effective dose in 2009 and the radiographers' radiographic workload in 2009, emphasizing that occupational radiation protection in industrial radiography is not being effectively optimized.

In summary, the survey results indicate that there is a need for improved implementation of the radiation protection principle of optimization of protection and safety. To this end, the results from the survey are being used to design the ISEMIR international database that will be used by end-users to improve their implementation of optimization in occupational radiation protection in industrial

radiography, and to develop a “roadmap” tool that enables NDT companies to assess their own performance in radiation protection against accepted practice.

The WGIR would like to thank sincerely the many individual industrial radiographers, NDT company personnel, and regulatory body staff who responded to the questionnaires. Without their time and input this survey would not have been possible.