A “road map” and an international database – tools to assist in the implementation of optimization of occupational radiation protection in industrial radiography

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Abstract

The results of the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR) worldwide survey on current occupational radiation protection in industrial radiography are being used to develop the ISEMIR international database and a “road map”.

The “road map” is a software tool that will enable NDT companies to assess their own performance in radiation protection against accepted practice. A NDT company would answer the questions in the road map, based on current practice in their company. The response to each question is then scored by comparing it with a measure of good practice. Different weightings are applied to questions, depending on their relative importance. The scores are summed and the results presented to the user, including a graphical schematic that gives a quick visual overview of how the NDT company compares with current good practice. Areas that have been identified as being below par could then be addressed by the NDT company to improve occupational radiation protection in their facility. The road map tool will be available on the ISEMIR pages of the IAEA’s ORPNET website at: http://www-ns.iaea.org/tech-areas/communication-networks/norp/isemir-web.htm

The ISEMIR international database is being developed to provide a tool that can be used by end-users to improve their implementation of optimization in occupational radiation protection in particular targeted areas, including industrial radiography. For each participating NDT company, the database will contain anonymized data on individual industrial radiographers, including their occupational doses, radiographic workloads, level of NDT training, radiation protection training, sources used, percentage of site radiography, use of collimators and survey meters, and number of incidents. The metric for assessing optimization of radiation protection will be occupational dose per radiographic exposure. NDT facilities will be able to benchmark their own facility and individual radiographers’ performances against global or regional data. The industrial radiography section of the database will also have a module devoted to incidents – accidents, near misses and deviations from normal – and will provide information, examples and analyses that should lead to a reduction in the occurrence of incidents in industrial radiography.

Once developed, NDT facilities all around the world will be encouraged to actively participate in the database to enable it to become a viable tool for implementing optimization of occupational radiation protection.

Keywords: Occupational radiation protection, industrial radiography

1 Introduction

As described in the companion paper [1], the results of the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR) worldwide survey on current occupational radiation protection in industrial radiography showed that significant occupational doses do occur, accidents do happen, and the variation in occupational dose per radiographic exposure is considerable. In short, there is a need for considerable improvement in occupational radiation protection, especially in the implementation of optimization of protection. To this end, the results of the survey are being used by the Working Group on Industrial Radiography (WGIR) to develop two tools that aim to help practitioners in the field of industrial radiography – namely, the ISEMIR international database and the so-called "road map". Each of these will be described, in turn, in this paper.

2 The "road map"

The experiences of designing and distributing the questionnaire addressed to the NDT companies, and then analysing the responses naturally led to the idea of a "road map" – a software tool that will enable NDT companies to assess their own performance in radiation protection against accepted practice.

Reflecting its heritage in the NDT company questionnaire, the road map is divided into 4 sections, namely:

1. Qualifications & training of industrial radiographers in radiation protection;

2. Learning from incidents (deviations from normal, near misses and accidents);

3. Systems and procedures in place for safe operation;

4. Emergency Preparedness and Response.

In each of these sections there are a series of questions addressing particular aspects of each of these topics. A representative from a NDT company would answer the questions in the road map, based on current practice in that company. The response to each question is then scored by comparing it with a measure of good practice. The measure for good practice, for each question, is based either on the relevant third quartile value from the distribution of responses from the survey or on a value given in an international standard. Different weightings are applied to questions, depending on their relative importance, as established by an international group of experts.

As an example, Table 1 lists five questions, in the section on "Systems and procedures in place for safe operation", on the individual monitoring that is being provided to the industrial radiographers that work for the NDT company, and includes illustrative responses from a hypothetical NDT company. As can be seen from Table 1, the good practice answer to all questions, based on the survey results, is "yes". Further, different weightings are applied to different questions – for example, the provision of an active dosimeter is rated as very important and hence a relative weighting of 3, while the presence of a vibrating alarm is rated less important and assigned a relative weighting of 1. Relative weighting values for the various questions have yet to be finalized.

Table 1 An example of questions from the "road map" on the topic of individual monitoring, with illustrative responses from a hypothetical NDT company.

Question	NDT company answer	Score	*Good practice answer*	*Relative weighting*
With regard to individual monitoring, does your Company provide its radiographers with active individual dosimeters?	Yes	3.0	*Yes*	*3*
With regard to individual monitoring, does your Company provide its radiographers with Passive individual dosimeters?	Yes	2.0	*Yes*	*2*
Are the active individual dosimeters equipped with Visual alarms	Yes	1.0	*Yes*	*1*
Are the active individual dosimeters equipped with Audible alarms	Yes	1.0	*Yes*	*1*
Are the active individual dosimeters equipped with Vibrating alarms	No	0.0	*Yes*	*1*

The scores for each section are summed and the results are presented to the user, including a graphical schematic that gives a quick visual overview of how well the NDT company compares with current good practice. Figure 1 illustrates this for a hypothetical NDT company, where it is evident that the company is deficient in their systems and procedures for safe operation and in learning from incidents. Areas that have been identified as being below par could then be addressed by the NDT company to improve occupational radiation protection in their facility.

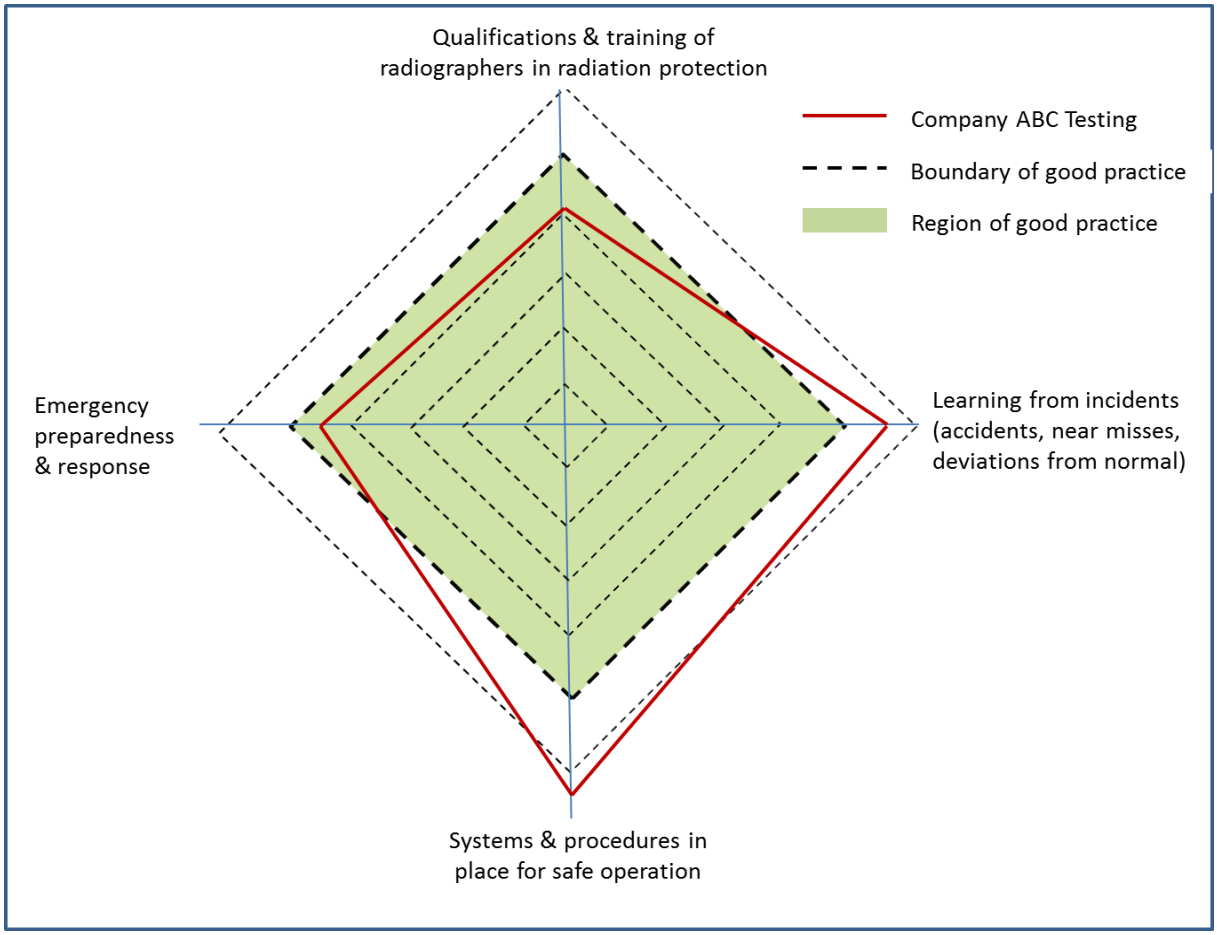

Figure 1 Overview of the assessment of a hypothetical NDT company as determined by the road map, highlighting that the company has deficiencies in the areas of systems and procedures for safe operation and learning from incidents.

The road map tool will be available on the ISEMIR pages of the IAEA's ORPNET website at: http://www-ns.iaea.org/tech-areas/communication-networks/norp/isemir-web.htm

3 ISEMIR international database

There are some areas in medicine, industry and research where radiation uses can lead to significant occupational exposures, both in normal operations and in accident situations. But detailed information at the operational level is lacking. On the other hand, experience in another sphere, namely that of nuclear power plant operators, has shown through the Information System on Occupational Exposure (ISOE) network that a database containing operational occupational doses at a detailed level is very helpful for: comparing doses for specific occupations/functions; assessing the impact of radiation protection actions; and for following dose trends. In other words, a carefully designed database can be an effective tool for the implementation of optimization of occupational radiation protection.

The ISEMIR international database is being developed to provide a web-based tool that can be used by end-users to improve their implementation of optimization in occupational radiation protection in particular targeted areas. One of the targeted areas is industrial radiography, and the ISEMIR database will have a section dedicated to industrial radiography. The following describes the ISEMIR database in more detail as it applies to the industrial radiography section.

The structure of the database is based around individual NDT companies. In designing the database it was important to avoid collecting unnecessary data but, at the same time, to ensure that there would be sufficient resolution to allow useful analysis and hence provide the information to then help improve the implementation of optimization in occupational radiation protection. In other words, the database has to contain as much information about the factors that could influence the occupational dose of an individual industrial radiographer as possible, without tipping the balance to make participation in the database an unattractive time consuming burden.

Each participating NDT company will provide a company profile, including the sources used and company procedures and training relating to radiation protection, and information on individual industrial radiographers in the company, including their occupational doses, their role, radiographic workloads, level of NDT training, radiation protection training, sources used, percentage of site radiography, use of collimators, use of survey meters, and the number of accidents, near misses and deviations. Data will be entered annually, with an additional option of monthly data for occupational doses and radiographic workloads. Individuals and facilities will be anonymised in the database.

The purpose of the ISEMIR database is not to assess compliance with occupational dose limits, but rather to be an active tool for assessing the level of implementation of the radiation protection principle of optimization of protection at a given NDT company. Therefore there needs to be a means for assessing the effectiveness of the optimization, and the metric to be used will be the dose per radiographic exposure. This metric can then be determined for any combination of the aforementioned personnel attributes – role, level of NDT training, radiation protection training, sources used, percentage of site radiography, use of collimators, use of survey meters, and the number of accidents, near misses and deviations.

Global and regional analyses will provide statistics on the relationships between occupational dose per radiographic exposure and the personnel attributes. For example, using the limited data from the survey Figure 2 shows estimates of mean occupational dose per radiographic exposure when performing industrial radiography with X-ray units, as a function of whether diaphragms or collimators are always, sometimes or never used.

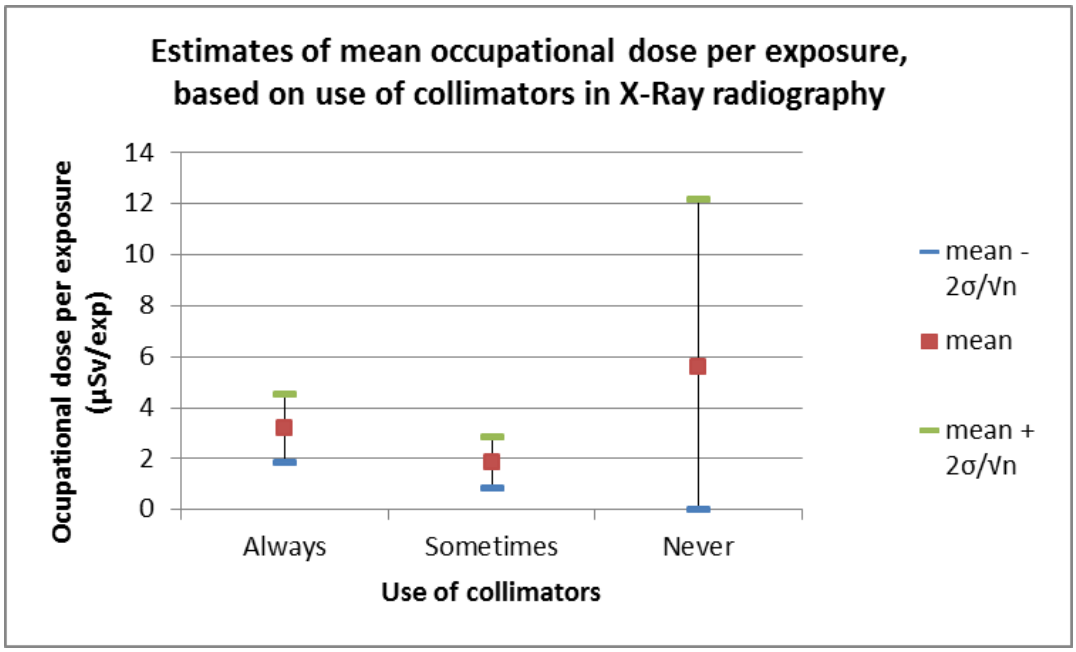

Figure 2 Estimates from the ISEMIR survey [1] of mean occupational dose per radiographic exposure when performing industrial radiography with X-ray units, as a function of the use of collimators or diaphragms (always, sometimes or never).

NDT companies will be able to benchmark their own facility and individual radiographers' performances against global or regional data and identify areas for improvement and corrective actions that should lead to an improvement.

The industrial radiography section of the database will also have a module devoted to incidents – accidents, near misses and deviations from normal. This module is intended to be a tool to provide information that should lead to a reduction in the occurrence of incidents in industrial radiography. Its features will include examples of incidents for training; the ability to search for incidents related to a given factor, such as cause, equipment, conditions; provision of details on actual corrective actions implemented; and promotion of lessons learned.

The ISEMIR database is being developed in 2012 and, once tested, NDT companies all around the world will be encouraged to actively participate in the database to enable it to become a viable tool for implementing optimization of occupational radiation protection in industrial radiography.

4 Conclusion

Using the results of the ISEMIR world-wide survey of occupational radiation protection in industrial radiography, two tools to assist with improved implementation of the radiation protection principle of optimization of protection are being developed.

The road map is a software tool that will allow an NDT company to perform a self-assessment of its performance with respect to radiation protection against current good practice.

The ISEMIR international database is being developed to provide a tool that can be used by NDT companies to improve their implementation of optimization of occupational radiation protection in industrial radiography.

Once developed, NDT companies all around the world will be encouraged to actively participate in the database to enable it to become a viable tool for implementing optimization of occupational radiation protection.

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