

Summary and Recommendations

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1. Workshop objectives and programme

The theme of the workshop was the control of exposures received by workers from natural radiation sources. Specifically, workplace exposures from NORM (i.e. industrial materials such as ores and scales containing Naturally Occurring Radioactive Material) and from radon were considered. For completeness, occupational exposures (to aircrew) from cosmic rays were also described, but were not within the main scope of the workshop.

The objectives of the Workshop were to consider the following questions:

- How can the commitment to radiation protection be encouraged and increased?; and
- how should exposure management (for NORM and radon in the workplace) be improved?

As with previous workshops, half the programme time was devoted to Working Group discussions and report backs, so that all participants could consider these objectives, contribute to discussions, and formulate the final recommendations of the Workshop.

In total, there were 23 invited oral presentations, as well as a number of poster presentations, organised under the following titles:

- introduction and setting the scene;
- increasing the commitment to radiation protection; and
- managing exposures from radon and NORM.

The introductory session provided an overview of currently available data on workplace exposures to natural sources, and the EC and IAEA approaches to controlling these sources were described. In addition, a series of issues and questions, arising from the main objectives, were introduced for participants to consider throughout the remainder of the workshop. Two afternoon sessions were set aside for Working Group discussions, based on the following four topic areas:

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- types of regulation and the optimisation of protection;
 - communication and stakeholder involvement;
 - practical management of radon exposures; and
 - practical management of NORM exposures.

The reports from these groups were presented and discussed on the final day, from which the key findings and recommendations from the workshop were derived.

Individual presentations (papers and slides) are available to download from the EAN website (<http://ean.cepn.asso.fr>) From these, and the discussions that followed, a number of significant themes and issues emerged, and these are described below.

2. Themes and issues arising

2.1 Radon

- It is very well known in radiation protection that radon is the biggest contributor to population exposure. Despite this, it seems to have been given rather a low priority as a source of occupational exposure. Throughout the Workshop, the size of this radiation protection challenge was made clear. In the introduction, it was suggested that as many as one million workers could be affected, although other participants considered this an overestimate. In other presentations, there were examples of individual doses as high as 100 mSv/y. Whatever criteria are considered – number of affected workplaces; number of exposed workers; collective or individual dose – radon is the dominant occupational source.
- Protection from Radon is based on the principle of intervention¹, implemented through the setting of (optimised) national Action Levels. Although this is a less rigorous system of control than is applied to other occupational sources (even NORM), the Workshop accepted that this was a pragmatic way of dealing with the worst affected workplaces. It was also noted that almost all EU Member States have issued regulations based on this approach.
- Despite the above, it would seem that the actual "success rate" is, in most cases, extremely poor. Regulations exist, but the level of compliance (and hence the degree to which exposures are controlled) is low. Various reasons were suggested, but it was clear that many employers were either ignorant of the problem, or else insufficiently motivated to take action. It was clear from the workshop that improved methods of communication, especially in respect of health risks from radon, were an important first step. Various national strategies were presented, and much can be learned from the experience gained. There was broad support for both emphasising the health risk to workers, and for comparing radon against other well-known hazardous agents in the workplace.

¹ This applies to homes and workplaces. But workplaces that cannot meet the intervention criteria are then considered "practices".

- In addition, measures to encourage remedial actions are needed. Various strategies were discussed, but it was clear that the resources of radiation protection regulators are, in most cases, incapable of meeting such needs, either in terms of communication or enforcement. The need to involve the wider Health and Safety community, as well as other relevant bodies was clear. To achieve this, it was felt that a national commitment to controlling radon at work was needed.
- It was noted that radon is also a major public exposure issue, and indeed many of the points raised have relevance to the implementation of controls in homes.
- There was some discussion, but no overall consensus, on the ICRP proposals to expand the concept of dose constraints to cover planned, emergency and existing exposure situations (and thereby moving away from the concept of intervention through radon action levels). It was noted that this would place more emphasis on optimisation, however there were concerns that, in the case of radon, this would be even more difficult to implement than the current system.

2.2 NORM

- Unlike radon, a harmonised approach to the control of occupational exposures from NORM has been mostly lacking. As a result, progress has been slow and the situation has been rather fragmented. Even basic data, such as the number of exposed workers, and the range of doses received, are still quite scarce. The best current estimate, as summarised in the SMOPIE project, is that approximately 100,000 workers could be affected.
- The Workshop was, however, encouraged by a number of quite recent developments, including international guidance from IAEA, new national regulations and guidance on NORM, and research work such as the SMOPIE project commissioned by EC. These developments have helped define a number of key factors in the control of work activities involving NORM, i.e.:
- NORM is widespread, and not all work activities can or should be subject to regulatory control. The use of a 1 mSv/y reference level (for workers and other persons), for determining when a work activity should be regulated, seems appropriate and is now widely adopted;
- Application of this dose criterion should be based on realistic assessments of the doses that are likely to be received. Doses estimated from exposure models are often grossly pessimistic, and estimates based on actual measurements in the workplace are preferred. From these, it is then possible to compile more accurate lists of NORM materials, industries and processes that may require regulation.
- Although many NORM industries know little about radiation protection, they are often familiar with worker protection from a wider industrial hygiene perspective. The two approaches are complimentary, and compliance with traditional health and safety controls may be sufficient to ensure that radiation exposures are also adequately controlled. Even where this is not the case, any additional radiation

protection controls should, where practicable, follow the industrial hygiene ethos. In particular, a graded approach to regulation is recommended, whereby controls are applied according to the risks to workers, and reflect the practicalities of the industries concerned.

- Despite these developments, the workshop identified a number of areas where further progress was needed. In particular:
- There remain significant uncertainties around the dose coefficients used to calculate doses from intakes of NORM. In many cases, the radionuclides are contained within inert particles, the bio kinetics of which are not well defined. Further uncertainties are associated with the way in which daughter products are assumed to behave following an intake.
- Air sampler design is driven by industrial hygiene considerations, which do not always match the needs of radiation protection. This was considered in some detail in the SMOPIE report, and the recommendations in terms of improved air sampler design need to be taken forward.
- There is still reluctance in some NORM industries to acknowledge the radiation protection issues, often because they see no benefit in doing so. It was considered that the radiation protection community needs to make more effort to establish an open dialogue with industry and gain their trust.
- Despite worker protection being one of the main themes of the Workshop, there was actually very little information presented on this subject. It was hoped that the future NORM network, sponsored by EC, would be able to provide this type of information.
- The introduction of controls on NORM has also had a large impact in terms of how the by-products, residues and wastes are viewed. In a number of cases, previously unregulated materials are now firmly categorised as radioactive waste. Some of these materials are produced in huge quantities, and the use/disposal of residues is a major issue for a number of NORM industries.

3. Recommendations

Each working group produced conclusions and recommendations, and gave a report back on the final day of the workshop. The output of the Working Groups was collated by the EAN coordinators, to produce the formal recommendations of the Workshop, as listed below.

3.1 Recommendation #1: National action plans for radon

National Authorities should develop long-term action plans for addressing occupational radon exposures. These plans should include:

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- goals and targets;
 - identification of stakeholders and contributors, assignment of responsibilities, and co-ordination of national authorities and resources;
 - strategies, methods and tools for measuring radon levels, and for taking remedial actions; and
 - audits and reviews of the implementation of the plan.

The radiation protection community (e.g. regulators, advisory bodies, research establishments, etc) should acknowledge the assistance that other stakeholders can provide, and actively seek to develop links and working relationships, for example, with:

- the wider Health and Safety Community;
- employer and employee organisations;
- insurance/legal sectors with an interest in occupational liability and compensation;
- the building and real-estate industries; and
- the media, and those with expertise in communication.

Public sector employers should be expected to lead by example in terms of implementing national plans.

3.2 Recommendation #2: Communicating the occupational radon risk

The effective provision of information on health risks from radon exposure, in a non-technical way, is essential to express the scale of the problem and the need for remedial action. Suggested approaches include:

- quantifying the risk of cancer from workplace exposures, for example in terms of the number of fatal lung cancers predicted per year in each country or region;
- providing a comparison of these health risks, for example by including radon in a “Top 10” of hazardous (carcinogenic) workplace agent; and
- associated risks, such as from compensation claims, may also help persuade employers that action should be taken.

It is recommended that National Authorities (as part of Action Plans) and also the EC should pursue this.

3.3 Recommendation #3. Communication/compliance strategies

Experience in the effectiveness of different strategies used in radon action programmes is growing. These include advertising through various media, leaflets, websites, targeted mailshots, “roadshows” and inspection campaigns. There are

many lessons to be learned, and it is recommended that this experience is analysed and shared. It is recommended that the EC consider:

- commissioning research on the effectiveness of different regulatory enforcement strategies, so that national resources can be used in the most effective manner; and
- developing a website that provides information on radon/NORM risks, as well as communication and protection strategies, as a resource to assist Member States in implementing National Action Plans.

National Authorities should also pay more attention to this subject, especially with a view to developing mutual trust with other stakeholders, for example by:

- engaging with credible, local information sources (e.g. medical or public health professionals) to ensure a common message;
- setting up stakeholder panels, national forums, etc.;
- making greater use of communication experts; and
- review the effectiveness of their own strategies and sharing this information with others.

3.4 Recommendation #4: Targeting radon action

Radon action in workplaces needs to be prioritised, to ensure that the greatest benefit is obtained from limited resources. To help achieve this, it is recommended that:

- EC should be asked to clarify the scope of BSS Title VII, so that all Member States are clearly advised as to which type of workplaces it applies to (at present some Member States just regulate certain types of workplace (e.g. underground mines, show caves, water treatment plants, some spas), while in others the regulatory system applies to all workplaces); and
- Regulatory Authorities should identify the methods by which they can best identify priority workplaces, for example by mapping radon-prone areas, by considering specific types of workplaces/work activities, and taking account of occupancy rates. The aim then is to develop regulatory programmes and measurement protocols to encourage radon surveys in these priority workplaces. As well as determining the need for remedial action in specific workplaces, Regulatory Authorities should seek to collate the results to provide a better national picture of the situation.

3.5 Recommendation #5: Radon in new workplaces

Enforcing radon protection (construction) standards in new buildings represents a long-term (and very cost effective solution) to the problem. Some national standards do exist, but in many cases this is only applied as guidance.

National Authorities are encouraged to set and enforce radon protection standards for new (priority) workplaces, and to periodically review progress in terms of the number of workplaces subject to these standards.

3.6 Recommendation #6: The regulation of NORM

Credible and effective regulation of NORM industries requires a graded approach that recognises existing controls for other hazards. Regulatory Authorities should ensure that the regulatory system applied to NORM:

- focuses on significant doses; and
- acknowledges existing regulatory controls (e.g. from an industrial hygiene perspective), where these contribute also to radiation protection.

To assist in the above, Regulatory Authorities are also encouraged to:

- maintain up-to-date lists of materials and processes for which regulatory controls have been/are considered necessary; and
- promote communication between different regulatory bodies, or different divisions within the same overall body, i.e. where they have an overlapping interest in controls related to worker protection.

3.7 Recommendation #7: The SMOPIE recommendations

The SMOPIE report recommendations were endorsed by the Workshop, and follow-up actions are recommended. In particular:

- ICRP is requested to review the applicability of existing dose coefficients to natural radionuclides in NORM. Depending on the outcome of this review, the Commission is requested to consider a possible revision, or expansion, of their recommendations. In particular, the issues to be addressed include the lung solubility classification of radionuclides, the intake of radionuclides contained within inactive carrier particles, and the rate of radon emanation from such particles; and
- air sampler manufacturers and users should note the recommendations for the development of new devices, in particular the need for reliable thoracic samplers for radiation protection use.

3.8 Recommendation #8: Further guidance for NORM users

Practical guidance for NORM users has started to appear: the Safety Reports issued by IAEA, and the SMOPIE report, are especially acknowledged. Further work is, however, still recommended, and the NORM network being proposed by the EC might address this. In particular:

- further exploration of the use of activity concentration values (Bq/g) as a practical means of indicating the need for certain actions or controls is recommended. These levels should be related to specific industrial processes, and be derived from workplace measurements and operating experience;
- a graded approach to exposure assessment, as recommended in the SMOPIE report, is supported, but needs to be tested in practice and, if necessary developed further;
- more guidance on radiation protection monitoring and control in specific NORM industries is still required; and
- training and awareness material for workers should be developed.