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DIVISION OF RADIATION, TRANSPORT AND WASTE SAFETY

RADIATION SAFETY STANDARDS COMMITTEE

(RASSC)

Thirty-seventh Meeting

24-27 November 2014

IAEA HEADQUARTERS, VIENNA, AUSTRIA
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Radiation Safety Standards Committee (RASSC) – Thirty-seventh Meeting

Boardroom M2, M Building

24-25 November 2014

MINUTES

R1 - Opening of the Meeting

The meeting was opened by Mr M. Pinak (SH-RSM), who welcomed all participants to Vienna. Mr Pinak noted that the three general safety guides that support the International Basic Safety Standards covering protection of workers, protection of patients and protection of the public and environment would all be considered at this meeting. He also highlighted the discussion in the joint session on the draft safety guide “A General Framework for Radiological Environmental Impact Assessment and Protection of the Public” (DS427), for which a number of issues relating to potential exposures and protection of flora and fauna need further discussion.

Mr Pinak referred to the other important agenda items. The project on foodstuffs and drinking water, undertaken in cooperation with FAO, WHO and NEA, is coming to an end and the TECDOC that summarizes the conclusions and recommendations of the Working Group is being finalized. The control of contaminated non-food commodities, an issue that has been highlighted following the Fukushima Daiichi accident, will also be considered during the meeting.

Since the publication of the WHO Handbook on Indoor Radon and the inclusion of requirements on control of radon in homes in the revised International Basic Safety Standards (BSS), there has been increased recognition in many Member States of the need to identify and remedy situations of high indoor radon concentrations. Consequently, the Topical Session will be devoted to this issue, with presentations by the relevant International Organizations and a number of Member States. This will be followed by a discussion on how some of the more important components of a national radon action plan might be implemented.

Mr Pinak thanked all members and observers for their valuable contribution to the work of RASSC, highlighting in particular his commitment to work in close cooperation with the International Organizations and Member States to ensure harmonization in the application of radiation protection standards.

A minute of silence was observed for Mr David Byron who passed away on 3 November following a serious illness. Mr Byron formerly represented the Food and Agriculture Organization of the United Nations at RASSC and was a member of the BSS Secretariat responsible for the revision of the International Basic Safety Standards.
R2 - Chairman's Remarks

Mr G. Massera thanked Mr Pinak for his introductory comments. He expressed a particular welcome to the new RASSC member Mr Majerus from Luxembourg and acknowledged replacement representatives for this meeting from Australia, Canada, France, India and the European Commission (EC). Apologies were received from Algeria, Austria, Burkina Faso, China, Denmark, Egypt, Finland, Indonesia, Indonesia, Lithuania, Luxembourg, Namibia, New Zealand, Pakistan, the International Electrotechnical Commission (IEC), the International Radiation Protection Association (IRPA), the International Standards Organization (ISO) and the Pan American Health Organization (PAHO).

R3 - Adoption of the Agenda

The agenda was adopted without any change.

R4 - Administrative Arrangements

Mr T. Colgan drew attention to the location of the emergency exits, introduced the administrative support staff for the meeting and summarized the administrative arrangements.

R5 - Chairman's Report of RASSC 36

No written comments were received on the draft Chairman’s report of the previous RASSC meeting, or on the joint session with the Nuclear Security Guidance Committee. The Chairman’s Report was approved.

R6 - Actions arising from RASSC 36

Mr Colgan reported that all action items arising from the RASSC 36 meeting had been addressed. Specifically, two safety standards and two DPPs approved for submission to the Commission on Safety Standards (CSS) were endorsed at the CSS meeting held 3-5 November 2014. Furthermore, the five safety standards that were approved for submission to Member States for comment were issued with various deadlines up to the end of January 2015. The draft resolution on the establishment of revised maximum limits for the exclusion of small quantities of nuclear material from the application of the Vienna Conventions on nuclear liability was approved by the Board of Governors at its meeting on 20 November 2014. Action items in relation to foodstuffs and drinking water, non-food commodities and the attribution of radiation effects were agenda items that would be further considered at this meeting.

R7 - Safety Standards for Approval

R7.1 Draft Safety Guide: Radiation Safety in Medical Uses of Ionizing Radiation (DS399)
The draft safety guide, which is a revision of *Radiological Protection for Medical Exposure to Ionizing Radiation* (Safety Guide RS-G-1.5) and includes material from three IAEA safety reports *Applying Radiation Safety Standards in Radiotherapy* (Safety Report 38), *Applying Radiation Safety Standards in Diagnostic Radiology and Interventional Procedures using X Rays* (Safety Report 39) and *Applying Radiation Protection Standards in Nuclear Medicine* (Safety Report 40) was presented by Ms J. Vassileva.

The DPP was initially approved in 2005 but development of the revised safety guide was delayed pending approval of the associated requirements in the BSS. A revised DPP was approved in 2012. Development of the text was undertaken in close cooperation with PAHO and WHO, both of whom are potential cosponsors of the safety guide, along with ILO. Ms Vassileva outlined the structure and content of the draft safety guide, which provides guidance on how to apply the requirements in the BSS to the medical uses of radiation and referred to the decision to include a chapter on general recommendations for radiation protection and safety in medical uses of ionizing radiation, followed by three parallel chapters dealing respectively with diagnostic radiology and image-guided interventional procedures, nuclear medicine and radiotherapy.

A number of comments were made in support of the document, noting that it was both comprehensive and complete. Despite the need for repetition, there was also strong support for the three parallel chapters as the audience for each is different. The WHO thanked the Secretariat for the strong collaboration in the preparation of the draft text and highlighted the urgent need in Member States for this guidance.

The United States raised the issue of radiation protection in the use of radiation in veterinary medicine and asked whether it would be helpful to add additional material on this topic to DS399. It was noted that radiation is widely used in veterinary medicine for the diagnosis and treatment of household pets, farm animals and thoroughbred high-value animals. While many state-of-the-art facilities for this work have become available in recent years, exposures also take place in less ideal facilities where the potential for accidental overexposure of workers and of the public is high. It was also noted that when household pets undergo a nuclear medicine procedure and are returned to their owners, there can be issues, akin to those that apply to comforters and carers in the case of patients, which need to be considered.

The Secretariat noted that the use of radiation for the diagnosis and treatment of animals is not a “medical exposure” as defined in the IAEA safety standards. As such, it would not be appropriate to include additional material on this topic in DS399. Given the complexity of the issue and the fact that the associated technology is developing at a fast pace, RASSC agreed that guidance on the use of
radiation in veterinary medicine should be developed. RASSC also noted that a number of regulatory bodies have already developed Codes of Practice, or similar guidance, on this issue.

RASSC approved DS399 for submission to Member States for comment and, in addition, requested the Secretariat to prepare a DPP on radiation safety in veterinary medicine for future consideration.

**Action:** The Secretariat to submit DS399 to Member States for comment.

**Action:** The Secretariat to develop a DPP for guidance on radiation safety in veterinary medicine.

R8 - Control of Foodstuffs and Drinking Water Contaminated as a Result of a Nuclear or Radiological Emergency

*R8.1 Report of the Technical Meeting held 8-12 September 2014*

Mr I. Gusev reported on the technical meeting “Harmonization of Reference Levels for Foodstuffs and Drinking Water Contaminated Following a Nuclear Accident” which was held at the IAEA Headquarters in Vienna on 8-12 September 2014 under the chairmanship of Ciara McMahon (Ireland). The meeting was attended by 45 experts from 37 Member States of the IAEA, as well as observers from the FAO and WHO.

The purpose of the technical meeting was to provide guidance on the development of an IAEA Technical Document (TECDOC) on the control of foodstuffs and drinking water contaminated as a result of a nuclear or radiological emergency, which the IAEA was requested to prepare by the Radiation Safety Standards Committee (RASSC) at its 35th meeting in November 2013. The TECDOC does not apply to the response and controls put in place during the emergency exposure situation but rather to the longer-term post-accident radionuclide concentrations that are used once the emergency has been declared as ended to ensure that food and drinking water consumed in the affected area and food exports from the affected area are suitable for public consumption.

Mr Gusev summarized the main issues identified during the meeting as follows:

- Most Member States use existing international criteria for the control of contaminated foodstuffs and drinking water, in particular the WHO Guidelines on Drinking Water Quality and the Codex Alimentarius values for international trade;

- Lack of consistency across international standards causes confusion. In particular, the different dose criteria for drinking water established by the WHO (0.1 mSv) and the IAEA (1 mSv) are not well understood;

- Many Member States have a poor infrastructure for food monitoring and assessment;
• Controls on the radionuclide concentration in foodstuffs and drinking water should only be applied where they can make a meaningful reduction in dose and there is a positive cost/benefit in implementing and maintaining controls;

• In Europe, a main concern is the different criteria to be applied in the EU for an accident taking place within the EU and an accident taking place in another State. In Latin America, control of natural radioactivity in groundwater is an issue for many States;

• For certain population groups, wild foods are an important contributor to the diet and it is not clear how consumption can/should be controlled;

• There is no clear view as to how the variability in diet can be accounted for in establishing national standards;

• The difference between emergency exposure situations and existing exposure situations is not always well understood;

• Any differences between national standards and standards for imported food established by the Codex Alimentarius could be difficult to explain to consumers;

• The conservatism of existing standards was noted: actual doses are normally considerably lower than those predicted.

The meeting welcomed the development of a TECDOC to support the development of national standards. A clear definition of terminology used in the TECDOC was considered essential. Three methodologies for deriving the radionuclide concentrations from the dose criteria were considered. Following discussion, it was agreed that the TECDOC should propose the simple methodology, based on the approach of the Codex Alimentarius, as a first step. It was also concluded that for import/export of food, the recommended national levels should be no lower than Codex Alimentarius values unless there is good evidence that the fraction of food imported from the affected countries is different than the assumed 10% used in calculating the guideline levels in the Codex Alimentarius.

Importantly, the meeting agreed on the use of an annual dose criterion of 1 mSv as specified in the IAEA Basic Safety Standards. The discussion on the duration of the derived activity concentrations in foodstuffs and drinking water concluded that these could be in place for as long as significant residual levels of radionuclides remain present in the environment but that changing the reference levels too frequently, for example to reflect reductions caused by radioactive decay or changes in the national diet, could lead to confusion. In practice, national reference levels might be in place even
though actual assessments of dose to the public indicate that the mean internal dose to the public is far less than 1 mSv/year.

The FAO thanked the Secretariat for organizing a very useful meeting.

**R8.2 Review of TECDOC “Long Term Issues related to the Control of Foodstuffs and Drinking Water Contaminated as a Result of a Nuclear or Radiological Emergency”**

Mr I. Gusev summarized the structure and content of the draft TECDOC, a copy of which was posted on the RASSC website in advance of the meeting. The TECDOC is based on the discussions that took place and the recommendations made at the Technical Meeting (see agenda item R8.1).

Because of the large variability that exists in national and regional diets, as well as in the percentage of the diet that is imported, the establishment of activity concentrations to be applied worldwide is not considered realistic. Instead, a framework is provided to allow States to develop their own national values with a fall-back position that, if they do not wish to do so, they should consider adopting the Codex Alimentarius guideline levels as national values.

The TECDOC summarizes the current international standards that apply to the control of radioactivity in foodstuffs and drinking water and the circumstances to which each applies. Based on the recommendations of the Technical Meeting, terms used in the TECDOC are clearly defined. A number of examples of national approaches following past nuclear accidents are included and a “frequently asked questions” section has been developed.

The NEA acknowledged the work undertaken by the Secretariat and supported the approach of allowing maximum flexibility in responding to emergencies on a case-by-case basis. The NEA considered that the TECDOC would be very useful for decision-makers. RASSC members commented that the assumption that 10% of the diet would be contaminated to the maximum concentrations was highly pessimistic.

Mr Gusev noted that many useful comments on the TECDOC had already been received and confirmed that the draft text would remain open for comment up to 19 December 2014.

**R9 - Request from the Commission on Safety Standards**

**R9.1 RASSC to prepare a policy/position paper on the UN General Assembly deliberation on the attribution of radiation effects and inference of risk and possible implications for the safety standards**

The discussion was introduced by the Chairman, Mr G. Massera who referred to the initial submission from Argentina and the additional material provided by Belgium and Canada. Mr Massera
reminded the meeting that the report from UNSCEAR was not yet published and that RASSC had previously agreed to commence work only when the report was published. UNSCEAR confirmed that it was finalizing two reports: one on uncertainties, which it hoped to publish in 2014 and one on attribution of radiation effects which was scheduled for publication in early- to mid-2015.

Belgium referred to its submission on this topic, noting its position that we cannot protect only from those risks that are well defined. There is considerable uncertainty about radiation effects, specifically at low doses below 100 mGy and it is important to adopt a precautionary approach. It is also necessary to consider sub-groups of the population who may be at increased risk and not base our protection solely on risks to the general population.

The United States proposed the establishment of a RASSC working group to work with the Secretariat to develop a draft response to the CSS for consideration at a future RASSC meeting. They also suggested that RASSC working groups might also be useful for progressing some of the priority issues for the current term. Other members suggested that, if such a working group were to be established, it might be appropriate to include representatives from both UNSCEAR and the ICRP. It was agreed that the Secretariat would consider this request and the matter would be discussed again before the end of the meeting (see agenda item 14.1).

Some RASSC members considered that the request from the CSS was not absolutely clear; while the submission from Argentina is a very good summary of the current situation, the problem to be addressed is not well defined. In particular, it is not clear if RASSC is being asked to advise on the need to adopt a different approach to managing the risks associated with individual doses below 100 mGy or if this is simply an issue of communication of the associated risks.

R10 - Proposal from the Russian Federation in Relation to Contaminated Non-Food Commodities

R10.1 Secretariat recommendation on the development of guidance on the control of contaminated non-food commodities

Mr I. Gusev reported on the work that has been undertaken to date to develop guidance on the control of contaminated non-food commodities. He referred to requirement 5.22 of the BSS that places the responsibility on Member States to develop “specific reference levels for exposure due to radionuclides in commodities such as construction material, food, feed and drinking water, each of which shall typically be expressed as, or based on, an annual effective dose to the representative person generally that does not exceed a value of about 1 mSv”.

Mr Gusev reported briefly on the Surface Dose Quantification (SUDOQU) model developed by RIVM in the Netherlands for estimating doses from surface-contaminated non-food commodities. The
model is based on the surface area that is contaminated and uses only three scenarios: surface areas typically the size of a laptop, a table-top and a carpet. The model considers exposure scenarios for both non-radiological workers and consumers and takes into account several removal processes (e.g. resuspension, wipe-off) by which contamination levels are reduced over time.

Isodose curves have been developed that allow estimation of individual doses in terms of \( \mu \text{Sv per year per Bq/cm}^2 \). As an example, the annual dose to dock workers handling crates with surface beta gamma contamination of 4 Bq/cm\(^2\) (0.4 Bq/cm\(^2\) for alpha contamination) is from a few tens of \( \mu \text{Sv} \) per year up to about 100 \( \mu \text{Sv} \) per year, depending on the radionuclide. The model developers recognize that there will be some specific exposure scenarios that will need separate calculations.

Mr Gusev identified the following important points that need to be considered in developing guidance:

- The BSS exemption values are not appropriate for two reasons: they have been developed for volumetric contamination and are based on a dose criterion of 10 \( \mu \text{Sv} \) per year;

- For international trade, it may be necessary to consider only longer lived radionuclides;

- In applying the 1 mSv criterion in the BSS, should multiple exposure scenarios be considered;

- It is not clear how to deal with specific cases, such as exposure of children, that are not covered by the SUDOQU approach;

- The guidance to be developed needs to be applied by non-experts such as exporters, importers and customs inspectors and for that reason needs to be simple and easy to follow.

RASSC welcomed the development of guidance on surface-contaminated commodities and was in general agreement with the approach of using a model such as SUDOQU, which provides a likely range of values rather than an individual value for different scenarios. However, RASSC pointed out that volumetric contamination, where the radionuclides are an integral part of the commodity in question, is a longer term concern and should not be disregarded. The Secretariat remarked that, in the aftermath of the Chernobyl accident, efforts to reach agreement on a harmonized set of activity concentrations to be applied to contaminated non-food commodities in international trade were not successful; the work undertaken led to the development of the safety guide *Application of the Concepts of Exclusion, Exemption and Clearance* (RS-G-1.7), which was not the original intention.

Belgium noted that, for international trade, the generic criteria applied by the importing country should be independent of whether or not a nuclear or radiological emergency had taken place. As
such, it might be necessary to consider short-lived radionuclides in the assessment. Belgium also supported the view that guidance needed to be simple and easy to implement, recognizing that ideally it should be applied initially by the exporting State to avoid items being refused entry and subsequently returned by the importing State. Korea raised the issue of contaminated balancing water in ships and noted that this was an issue in the aftermath of the Fukushima Daiichi accident.

RASSC requested that guidance should also cover items that were accidentally contaminated; the United States gave an example of equipment that was used by a camera crew working in Japan immediately after the Fukushima Daiichi accident that was found to be contaminated when the crew returned to the US. It was suggested to undertake a review of what national standards currently exist for such situations. RASSC also noted that decontamination is a realistic and straightforward option for surface-contaminated items and that the guidance should address this in terms of approaches, costs, doses to workers and management of any waste that might be generated. Measurement protocols are also important and need to be included.

RASSC supported a continuation of the work already started, in line with the recommendations of the International Experts Meeting “Radiation Protection after the Fukushima Daiichi Accident: promoting confidence and understanding” held in February 2014. The means of progressing this work was also discussed under Any Other Business (agenda item R14.1).

R11 - Topical Session: Radon Exposure in Homes: should it be regulated?

R11.1 Presentations from International Organizations

Mr F. Shannoun presented on behalf of UNSCEAR. Radon is the largest and most variable source of natural exposure, representing of the order of 50% of the worldwide collective dose. Typical outdoor concentrations are 10 Bq/m$^3$ (range: 1-100 Bq/m$^3$) and typical indoor concentrations are 30 Bq/m$^3$ (range: 10-1000 Bq/m$^3$). However, in some areas of the world much higher individual concentrations have been recorded both outdoors and indoors. High background areas include parts of Czech Republic, Finland, Germany, Iran, Norway, Spain, Sweden and Switzerland, among others.

UNSCEAR reviews are based on official national data. Mr Shannoun emphasized that many countries have provided very little information and he encouraged the submission of “grey” literature, such as conference papers, so that dose assessments can be improved. Currently only a few countries have statistically valid data as many of the datasets are biased through focus on high-risk areas. Mr Shannoun also suggested the need for greater focus on collective dose i.e. areas with low average radon concentrations but a high population may have a higher collective dose than other areas with higher radon concentrations but a low population.
The expected increase in the dose-conversion factors will increase the importance of radon as a contributor to the worldwide collective dose. Currently UNSCEAR is working on a simpler questionnaire for electronic data collection and improving the knowledge of exposure due to radon will be a future priority.

Mr J.-F. Lecomte presented on behalf of ICRP. He summarized the current approach of ICRP in removing the distinction between practices and intervention, replacing that system by three exposure situations: planned, existing and emergency. Exposure due to radon in homes is managed as an existing exposure situation – the source cannot be changed and therefore it is possible to reduce the exposure only by controlling or modifying the exposure pathway. In line with the System of Radiological Protection developed by the ICRP, all actions must be both justified and optimized but dose limits do not apply.

In managing exposure due to radon, it is important to firstly characterize the source i.e. who is exposed, where and when are they exposed and what is the level of their exposure. Most exposures are at low to moderate concentrations, but even at these levels an increased risk has been demonstrated. The ICRP philosophy when dealing with radon is to apply a graded approach and to address both the highest exposures and the global (societal) risk. Strategies to reduce radon exposure must take into account the national situation and other public health priorities.

The ICRP now recommends that the same reference level of 300 Bq/m³ be applied to all indoor environments. Mr Lecomte also referred to the different approaches for developing dose conversion factors (to convert Bq/m³ to mSv). Using an approach based on epidemiology, an average radon concentration of 300 Bq/m³ in a home equates to an annual dose of about 10 mSv; on the other hand, using a dosimetric approach the corresponding annual dose is about 18 mSv. This latter figure is expected to be confirmed and published shortly.

Ms E. van Deventer presented on behalf of WHO, which commenced work on radon in 1979 through its regional European office. The International Radon Project was initiated in 2005, culminating in the publication in 2009 of the WHO Handbook on Radon. In recent years, WHO has included radon in its programmes of indoor air quality and its housing and health guidelines. Radon in drinking water is also discussed in the WHO Guidelines for Drinking-water Quality (2011).

It is estimated that there are approximately 100,000 deaths worldwide annually from radon, representing about 7% of all lung cancer cases. There is limited, though inconsistent, evidence of other cancer risks due to radon. In addition, it is established that radon is much more likely to cause lung cancer in people who smoke, or who have smoked in the past, than in lifelong non-smokers. WHO recommends a reference level of 100 Bq/m³ because there is no evidence of a threshold below
which there is no risk and because most radon-related lung cancer deaths are associated with low / moderate concentrations. However, if this value cannot be implemented due to country-specific factors, then the reference level should not exceed 300 Bq/m$^3$.

Ms van Deventer compared radon concentrations and ensuing doses to other radiation risks from other radiation sources. She also compared radon risk to other public health risks, such as those from communicable diseases (e.g. HIV, malaria), non-communicable diseases (e.g. heart attacks and cancers) and from accidents (e.g. drowning and traffic accidents). The statistics vary quite considerably geographically and according to risk factors. Such comparisons help to focus public health programmes in individual countries. Data for the incidence and mortality of specific cancers also show wide regional variability, with additional variability between males and females. Taken together, these data allow the importance of lung cancers due to radon to be put into perspective.

Mr T. Boal presented on behalf of IAEA. The Agency’s mandate to develop safety standards, and to provide for their implementation, is enshrined in Article 3 of its Statutes. Control of radon in homes is addressed in the BSS and a safety guide *Protection of the Public against Exposure Indoors due to Radon and Other Natural Sources of Radiation* has been prepared jointly with the WHO. Training materials are currently being developed and these will be made available to all Member States in due course.

For the 2014-2015 business cycle, the Agency is supporting a regional project on the development of radon action plans in the European region (Project RER9127) as well as national surveys in Albania and Montenegro. A national project to develop a radon action plan for Serbia has recently been agreed and will commence in early 2015. The Agency has previously organized regional training courses in Indonesia and Thailand for States in Asia and the Pacific, including a measurement inter-comparison programme. More recently, a training course was organized in Argentina for States in Latin America and the Caribbean. Some small bilateral projects on radon are currently being supported in Africa by the Department of Technical Cooperation.

The United States referred to the presentation by WHO and suggested that the data on comparative risks should be used by the IAEA in prioritizing and focusing its radon programme.

*R11.2 Presentations from Member States*

Ms A. Canoba presented the current situation in Argentina. A national survey started in the 1980s and measurements were undertaken in homes, public buildings and other workplaces. The work in relation to homes focused on the main cities and potential high risk areas such as regions where uranium mining was carried out. A total of 3,170 homes were surveyed with a combination of
integrated and screening measurements; the average radon concentration was 49 Bq/m$^3$ with only a few measurements exceeding 300 Bq/m$^3$. The current reference level for homes defined in national legislation is 400 Bq/m$^3$. The equilibrium factor was measured in over 200 homes and an average value of 0.36 was derived.

Argentina applies a dose conversion factor of 4 WLM corresponding to 20 mSv in regulated workplaces such as uranium mines. In non-regulated workplaces, where exposure due to radon is adventitious, the reference level for radon of 1,000 Bq/m$^3$. Radon concentrations above these values have been identified in some tourist caves and health spas and in a gold mine (with concentrations up to 13,000 Bq/m$^3$). Currently the Autoridad Regulatoria Nuclear has no legal basis for controlling these workplaces. Ms Canoba underlined the importance of ensuring that any actions to reduce radon concentrations are justified. She highlighted the challenges from the construction of energy efficiency homes, the importance of effective risk communication strategies and the need for inter-comparison exercises for the region. Ms Canoba also informed the Committee that Argentina will be carrying out a revision of its national standards in the near future following recommendations of international organizations such as the IAEA, WHO and ICRP.

Mr A. Kalaiziovski presented the current situation in Australia. A national survey of 3300 homes carried out in the 1990s found an average of 11 Bq/m$^3$ with less than 1% of homes exceeding the national action level of 200 Bq/m$^3$. Reasons for the low levels include the use of non-permeable membranes for rising damp and termite control, the tendency to elevate homes to prevent flooding, the preponderance of homes constructed of timber in some regions, and that the vast majority of homes do not have basements or cellars. A national radon map has been developed and is published on the ARPANSA website. Some regions with higher-than-average radon concentrations have been identified in the south-east of the country and some follow-up radon measurement work is planned in these communities.

Australia has four operating uranium mines. In underground mining situations, radon contributes to about 30% to 50% of the total dose received (based on ICRP65 conversion convention). However, the average doses are low and the increase in the dose-conversion factor is unlikely to have a serious impact on work practices. From a survey conducted in 1995, a total of 14 tourist caves have time-weighted annual average radon concentrations above 1000 Bq/m$^3$. The average dose is 0.95 mSv and the highest is 9 mSv. No specific regulations to control radon are in place but there is an ongoing programme of monitoring and dose assessment.

Ms. M.H. Marechal presented the current situation in Brazil, which has a very varied geology, including extensive uranium deposits, and wide climate variability. Currently the way homes are
being used is changing, with lower ventilation rates and air conditioning. A number of regional surveys have been carried out by the Comissão Nacional de Energia Nuclear (CNEN), which has 10 different institutes involved in regulatory activities and research in different parts of the country. In urban areas, radon concentrations are generally low, but concentrations up to a few thousand Bq/m³ have been identified in the uraniferous area of Poços de Caldas in the state of Minas Gerais. It is not known if high indoor radon concentrations also exist in other areas with similar geology.

While radon is not specifically mentioned in national legislation, existing regulations can be applied to chronic exposure situations. Currently a reference level of 300 Bq/m³, corresponding to an annual dose of 10 mSv, is recommended. Brazil is presently collecting all the available radon data with a view to possibly undertaking a national radon survey but the scale of the work is daunting with 50 million homes and a surface area of 8.5 Mkm². Particular challenges relate to standardizing procedures, quality control of measurements and the establishment of local partnerships. Brazil is committed to following the recommendations of international organizations such as the IAEA, WHO and ICRP and to continue its assessment of exposure due to radon.

Mr M. Kardan presented the current situation in Iran. Radon measurements have been carried out in several cities in Iran and concentrations above 1,000 Bq/m³ have been found Ramsar and Ardabil. In tourist caves the radon concentrations vary widely due to differences in geology and ventilation conditions. Seasonal variability is also observed. Iran is in the process of planning a population-weighted national survey involving 25,000 to 35,000 homes in order to establish the national reference level. A geographical-based survey with radon measurements being carried out in up to 110,000 homes is also being considered. There are important challenges related to the training of staff, quality assurance and regional roll-out.

In the city of Ramsar, high radium concentrations up to 260,000 Bq/kg in soil result in both high gamma radiation levels and high radon concentrations throughout the city. A detailed gamma dose rate map has been developed with 10% of the measurements exceeding a dose rate of 1µSv/h, up to a maximum of 30 µSv/h. Work is continuing to establish the distribution of radon in homes. The most recent information points to about 30% of the homes having radon concentrations above 300 Bq/m³; the highest individual measurement is 10,000 Bq/m³. In some instances the building materials are the cause of both high gamma dose rates and high indoor radon concentrations as local water with high radium concentrations is used to manufacture the concrete used in house construction. Mr Kardan highlighted the need to develop remediation strategies that are low cost and result in minimum disruption.
Ms. N. Pungut presented the current situation in Malaysia, which is a country of uniform temperature and high humidity. The main building materials are wood and brick, with many homes built with a combination of both. Indoor radon concentrations are generally very low, not exceeding a few tens of Bq/m$^3$, and no radon prone areas have been identified. However, the number of measurements to date is not large and so it is too soon to draw firm conclusions.

Radon measurements have also been carried out in a former tin mining area and in a granitic area where there are elevated uranium and thorium concentrations in the soil. The maximum concentrations found are 140 Bq/m$^3$ in homes and 360 Bq/m$^3$ in workplaces. Work is also being undertaken to identify building materials with elevated concentrations of natural radionuclides and future outreach to the building sector is being considered. Despite the low levels found to date, Malaysia’s Atomic Energy Licensing Board is developing an indoor radon awareness programme for the public and other stakeholders and some radon measurements in schools are planned.

Mr S. Kiselev presented the current situation in the Russian Federation, where radon is the principal source of radiation exposure of the public and 1% of the population receives annual doses from radon above 10 mSv. The first radon programme to assess and reduce public exposure to natural radiation sources commenced in 1994 at both the federal and regional level. National standards, which apply to both radon and thoron, were developed with action levels (in terms of EEC) of 200 Bq/m$^3$ for existing homes and public places and 300 Bq/m$^3$ for existing workplaces. The standards for new construction are both lower by a factor of two. National standards also exist for the radon flux from a building site and for the natural radionuclide content of building materials.

The national average radon concentration in the Russian Federation is 53 Bq/m$^3$ with the highest values observed in the low population density regions of the far south-east of the country. When the radon measurement data are weighted by population, the highest collective dose is received in the western (European) part of the country. Follow-up targeted surveys are now being carried out but these are hampered by the lack of public awareness. Mr Kiselev also spoke about the Oktyabrysky village in the radon prone area in close vicinity to the uranium mining and milling facilities in the Zabaikalskii region (far-eastern part of the country). Outdoor radon concentrations were in the range of 14-50 Bq/m$^3$ and individual doses from radon were in the range 16 to 85 mSv/y. Corrective actions were unsuccessful and all the inhabitants were subsequently relocated to new apartments in the nearest town, Krasnokamensk (3 km from the village), by the State Corporation ROSATOM, the owner of the mining and milling facilities.

The Russian Federation is now commencing a new phase of its radon programme “Radon 2”. The main challenges to be addressed are seen as the low public awareness on radon issues, a lack of
infrastructure for implementation of radon corrective measures in dwellings and public buildings, the absence of educational and training programs for building professionals to implement appropriate preventive and corrective measures and a low rate of business and private parties' involvement in providing commercial radon services.

Mr J. Pule presented the current situation in South Africa, where current legislation controls exposure due to radon in workplaces, but not in homes. However, lack of regulatory control of uranium and gold in the early years of mining activities has resulted in extensive radioactive contamination of the environment, including continuous deposition of radioactive dust, tailings material run-off onto public land and discharges of radioactively contaminated effluents into the environment. In many instances, this mine waste is readily accessible to the public. In some instances, homes are built directly on or close to mine tailings and the waste material is also used as the construction material for homes. A survey focused on one high risk area measured radon in 2,000 homes and found that 1% exceeded 400 Bq/m$^3$. In some homes the concentration was up to 2,000 Bq/m$^3$ and there were also high doses from gamma radiation. Because of the lack of regulatory infrastructure, these homes are managed on a case-by-case basis.

South Africa has noted the international shift towards a stringent approach to managing exposure due to radon in homes and is currently updating its legislation in line with the BSS to address the national situation. High radon exposures in homes are known to exist, but the extent of the problem has not yet been quantified. Controls will also be introduced on the radium-226 content of building materials. Reference levels being considered are 200 Bq/m$^3$ for new homes and 300 Bq/m$^3$ for existing homes. Challenges include implementation of a national measurement programme to identify radon prone areas and funding of corrective actions in these areas.

Ms A. Al Shehhi presented the current situation in the United Arab Emirates. The national regulatory body, FANR, has recently developed a new Regulation 19 on the management of existing exposure situations, which covers radon in workplaces, homes and buildings with high occupancy rates by the public. A number of previous studies have shown relatively low levels of radon in homes in Sharjah and Abu Dhabi.

Recently some elevated concentrations of radium (up to 20 Bq/l) in deep groundwater, which is used primarily for public swimming pools and to irrigate public areas, have been identified. Given that it is common to have water wells inside homes, FANR is working with the Abu Dhabi Environment Agency to assess the potential for high radon concentrations in a planned new residential complex in Al Ain city, Abu Dhabi. FANR is currently developing a common understanding of the problem among governmental and public stakeholders as part of the decision-making process.
**R11.3 Panel Discussion**

The expert panel consisted of Ms. A. Canoba (Argentina), Mr W. Ringer (Austria), Ms T. Perko (Belgium), Ms K. Petrova (Czech Republic) and Mr. P. Strand (Norway, Chair).

Mr Strand opened the discussion by noting the high degree of consensus and harmonization among international organizations on the approach to managing high radon concentrations in homes. While there is a diversity in approaches among Member States, this is to be expected because national solutions need to take account of national priorities, which are often driven by national values, culture and economics. He also noted that success is possible only through working with others in society.

As part of a broad discussion the following points were made

- At the early stage, a radon action plan is primarily a radiation protection issue. However, once the national survey is completed and the situation is well defined, the public health and building aspects are more important. Ultimately, high radon concentrations in homes are a building design and control problem;
- In terms of national strategies, the key participants are those agencies responsible for radiation protection, public health and building standards. Practical experience has shown the importance of one leader/coordinator to assign responsibilities and ensure clarity of message;
- More and more it is important to link radon to other environmental programmes such as those dealing with indoor air quality and energy efficiency;
- People understand public health, but they don’t necessarily understand radiation protection. We need to communicate with them in terms they understand;
- Scientific information will not persuade people to act – they must be directly involved in resolving the problem;
- The national radon programmes in Europe have suffered from low to moderate effectiveness because of poor communication with the public and with building professionals;
- Some of the key problems with many current communication programmes are
  - They are too short in duration – they need to be maintained over several years;
  - They should target specific population groups, not the general public;
  - They focus too much on knowledge and too little on encouraging action;
  - The timing of the programme is not always optimum;
  - Funding for remediation work is not in place;
- Public engagement is poor.

- We know and understand the problem, but as professionals we do not have an effective strategy to fix the problem;

- The current scientific debate about the dose conversion factor needs to be resolved as it hinders communication of the risks with the public;

- In areas with high outdoor radon concentrations, of which there are many throughout the world, the ability to remediate homes with high radon concentrations indoors is limited;

- It is important to differentiate between voluntary and involuntary risks. For this reason, relocation of householders may not be an appropriate or acceptable response, even if individual doses exceed those for which evacuation would be carried out in the event of a nuclear accident;

- It is not clear who is responsible for deciding on and implementing controls in situations where children are exposed to high radon concentrations at school;

- Building controls, both on the building techniques used and on the radionuclide content of building materials, are appropriate in areas where high radon concentrations indoors might otherwise be expected. We take a similar approach for areas with high potential for earthquakes, flooding etc., so why should it not also be the case for radon;

- There were mixed experiences on the benefits of requiring disclosure of radon concentrations at the time of home sales, but this was considered as being appropriate for regulation;

- Radon should not be treated as a stand-alone issue, but considered along with other public health risks in a country.

In conclusion, there were many different and varying views expressed, based very much on national experiences. A clear view emerged that radon exposure in homes should not be regulated in the same way as, for example, we regulate occupational exposure to radon in uranium mines. However, regulating certain components of a national radon action plan, for example building codes for new homes, can be beneficial. But the ultimate success of a national radon action plan will be influenced more by effective communication of the problem and by including radon in other national programmes such as those dealing with indoor air quality and energy efficiency.

The NEA reflected on the discussions and suggested the establishment of a communication forum between International Organizations and Member States on issues such as data collection and interpretation, definition of radon prone-areas etc. Mr Lazo gave as an example the work carried out by the International System of Occupational Exposure (ISOE), jointly operated by the NEA and IAEA, which provides a forum for radiation protection professionals from nuclear electricity utilities and national regulatory authorities worldwide to share dose reduction information and operational experience to improve the optimisation of worker radiological protection at nuclear power plants.
R12 - Status Report on Documents under Development

R12.1 Draft Safety Requirements: Leadership and Management for Safety (DS456)

Ms H. Rycraft, who has replaced Mr P. Gest as Technical Officer, introduced the draft safety requirements. The document was posted for Member States comment in September 2013 and 484 comments received. These were considered by a Consultants’ Meeting in February 2014, with 285 comments accepted fully or in part and 199 rejected.

The document was then submitted for internal review and the need for further changes was identified, relating to responsibility for safety; redundancy of some items between the chapter “responsibility” and the chapter “management for safety”; and the need to address some of the lessons learnt from the Fukushima Daiichi accident as identified in the IEM 5 report.

The text has now been updated and will be submitted for comment to the Safety Standard Committees in early 2015. Publication is expected in 2016.

R13 - Reports from International Organizations

Written submissions were received from International Organizations in advance of the meeting and were made available on the RASSC website. No oral presentations were made and there were no specific questions on the available reports.

The NEA informed the meeting that the Seventh Asian Regional Workshop on the Evolution of the System of Radiological Protection will be held in Tokyo, Japan on 8-9 January 2015. In addition, the NEA report on the state-of-the art in the science of radiological protection will be published shortly.

The WHO mentioned its successful cooperation with the IAEA in the areas of emergency preparedness and response, medical exposures and radon, as well as in the implementation of the BSS.

R14 - Closing of the Meeting

R14.1 Any Other Business – the Establishment of RASSC Working Groups

The Secretariat referred to the previous discussions and proposed that two electronic working groups of RASSC members and observers be established. One group would address the request from the CSS to provide advice on the implications for the safety standards of the UNSCEAR report on the attribution of radiation risk while the second working group would be responsible for assisting the Secretariat to develop guidance in relation to the control of contaminated non-food commodities.
RASSC agreed with the proposal to establish the two working groups and that they should work primarily by e-mail.

**Action:** The Secretariat to invite RASSC members and observers to nominate experts to both electronic working groups, with a deadline for nominations of 16 January 2015.

*R14.2 Dates of Future Meetings*

The next RASSC meeting (RASSC 38) will take place during the week 22-26 June 2015.

*R14.3 Conclusions of the Meeting*

The Chairman Mr Massera highlighted the important issues that had been discussed and thanked RASSC members and observers for their active involvement in the meeting. He thanked all the participants in the Topical Session for the interesting and varied presentations. Finally, Mr Massera referred to the RASSC working groups that were to be established and encouraged maximum participation to allow the work of RASSC to progress in an effective manner.

*R14.4 Closing*

The meeting was closed by the Chairman, Mr G. Massera.
MINUTES OF THE JOINT NUSSC/RASSC/WASSC SESSION

Nuclear Safety Standards Committee (NUSSC) – Thirty-eighth meeting

Radiation Safety Standards Committee (RASSC) – Thirty-seventh Meeting

and

Waste Safety Standards Committee – Thirty-eighth meeting

Boardroom A, M Building

26-27 November 2014

Will be prepared as a separate report.
ANNEX I
List of Actions

RASSC

Action R7: The Secretariat to submit DS399 to Member States for comment.

Action R7: The Secretariat to develop a DPP for guidance on radiation safety in veterinary medicine.

Action R14.1: The Secretariat to invite RASSC members and observers to nominate experts to both electronic working groups, with a deadline for nominations of 16 January 2015.
ANNEX II

Agenda

Radiation Safety Standards Committee (RASSC) – Thirty-seventh Meeting

Boardroom M2 – M Building

24-25 November 2014

10:00 – Monday 24 November 2014

R1. Opening of Meeting M. Pinak, SH-RSM
R2. Chairman’s Comments G. Massera
R3. Adoption of the Agenda G. Massera
R4. Administrative Arrangements T. Colgan
R5. Chairman’s Report of RASSC 36 G. Massera
R6. Actions Arising from RASSC 36 T. Colgan

R7. Safety Standards for Approval

R7.1 DS399 Draft Safety Guide: Radiation Safety in Medical Uses of Ionizing Radiation (revision of RS-G-1.5 and combination with Safety Report Series No. 38, 39 and 40) For approval for submission to Member States J. Vassileva

R8. Control of Foodstuffs and Drinking Water Contaminated as a Result of a Nuclear or Radiological Emergency

R8.1 Report of the Technical Meeting held 8-12 September 2014 For information I. Gusev
R8.2 Review of TECDOC “Long Term Issues related to the Control of Foodstuffs and Drinking Water Contaminated as a Result of a Nuclear or Radiological Emergency” For discussion I. Gusev

R9. Request from the Commission on Safety Standards

Submissions received from Belgium and Canada have been circulated to RASSC members. The UNSCEAR Report on attribution of radiation effects has not yet been published. Discussion will focus on how the progress this matter prior to the next meeting of RASSC

R9.1 RASSC to prepare a policy/position paper on the UN General Assembly deliberation on the attribution of radiation effects and inference of For discussion G. Massera
risk and possible implications for the safety standards

R10. Proposal from the Russian Federation in Relation to Contaminated Non-Food Commodities

A discussion document will be made available on the RASSC website in advance of the meeting

R10.1 Secretariat recommendation on the development of guidance on the control of contaminated non-food commodities

For discussion and approval

I. Gusev

R11. Topical Session: Radon Exposure in Homes: should it be regulated?

The Topical Session will take place on Tuesday 25 November. A separate agenda is being prepared

R11.1 Presentations from International Organizations
R11.2 Presentations from Member States
R11.3 Panel discussion

R12. Status Report on Documents under Development

R12.1 DS456 Draft Safety Requirements: Leadership and Management for Safety (also to NUSSC, TRANSSC, WASSC and NSGC)

For information

H. Rycraft

R13. Reports from International Organizations

Reports from International Organizations will be posted on the RASSC website in advance of the meeting. These will be open for discussion, but no formal presentations are envisaged

R13.1 Food and Agriculture Organization of the United Nations (FAO)
C. Blackburn
R13.2 International Labour Organization (ILO)
S. Niu
R13.3 Pan American Health Organization (PAHO)
P. Jimenez
R13.4 United Nations Environment Program (UNEP)
M. Crick
R13.5 United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)
M. Crick
R13.6 World Health Organization (WHO)
M. Perez
R13.7 European Commission (EC)
S. Mundigl
R13.8 Nuclear Energy Agency / Organization for Economic Co-operation and Development (NEA/OECD)
E. Lazo
R13.9 European Nuclear Installation Safety Standards Initiative (ENISS)
B. Lorenz
R13.10 International Commission on Radiological Protection (ICRP)
C. Clement
R13.11 International Radiation Protection Association (IRPA)
R. Czarwinski
R13.12 International Source Suppliers and Producers Association (ISSPA)
W. Fasten
R13.13  International Standards Organization (ISO)  A.Rannou
R13.14  World Nuclear Association (WNA)  B.Shah
R13.15  International Electrotechnical Commission (IEC)  P. Chiaro

R14.  Closing of the Meeting

R14.1  Any other business  G. Massera
R14.2  Dates of Future Meetings  T. Colgan
R14.3  Conclusions of the Meeting  G. Massera
R14.4  Closing  M. Pinak

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<tr>
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<tbody>
<tr>
<td>CSS 37</td>
<td>20-22 April 2015</td>
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<td>CSS 38</td>
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<td>NUSSC 39</td>
<td>29 June – 3 July 2015</td>
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TOPICAL SESSION

Tuesday 25 November 2014

Radon Exposure in Homes: should it be regulated?

Presentations from International Organizations (09:15 – 10:30)

UNSCEAR’s Worldwide Radon Exposure Survey and Regions of Highest Exposure
Ferid Shannoun

The ICRP Philosophy on Managing Natural Radiation Sources, including Radon Exposure in Homes
Jean-Francois Lecomte

WHO’s Perspective on Radon Risks in Comparison with Other Radiation and Public Health Risks
Emilie van Deventer

Current IAEA Work Programme on Radon in Homes
Trevor Boal

Presentations from Member States (11:00 – 12:45)

Residential Radon Situation in Argentina
Analia Canoba

Exposure to Radon and Radon Progeny in Australia – An Overview
Alex Kalaiziovski

Radon in Homes in Brazil
Maria Helena Marechal

Radon in Homes in Iran
Mohammad Kardan

Indoor Radon in Malaysia
Noraisah Pungut

Current Radon Regulation in the Russian Federation: State of Affairs and New Challenges
Sergey Kiselev

Radon in South African Homes and Future Regulatory Framework
John Pule

Existing Exposure Situations in the UAE: The Radon Issue
Aayda Al Shehhi

Panel Discussion (14:15 – 17:00)

Panel Members: Analia Canoba (Argentina), Wolfgang Ringer (Austria), Tanja Perko (Belgium), Karla Petrova (Czech Republic) and Per Strand (Norway, Chair).
ANNEX III

List of Participants

The Committee

Argentina
Mr Gustavo Massera (Chair)

Australia
Mr Alex Kalaiiovski

Belgium
Mr Lodewijk Van Bladel

Brazil
Ms Maria Helena Da Hora Marechal

Canada
Ms Caroline Purvis (alternate)

Croatia
Ms Ivana Kralik

Czech Republic
Ms Karla Petrova

France
Mr Philippe Bérard (alternate)
Mr Jean-François Lecomte (alternate)

Germany
Mr Manfred Helming

Hungary
Mr Arpad Vincze

India
Mr R.K. Gopalakrishnan

Iran
Mr Mohammad Kardan

Ireland
Ms Barbara Rafferty

Israel
Mr Jean Koch

Italy
Mr Luciano Bologna

Japan
Ms Naoko Ishikawa

Kenya
Mr Joseph A.W. Maina

Korea, Republic of
Mr Sae-Yul Lee

Malaysia
Ms Noraisha Pungut

Netherlands
Ms Miriam Tijsmans

Norway
Mr Gunnar Saxebo

Poland
Ms Agnieszka Jaworska-Sobczak

Romania
Mr Sorin Mancas

Russian Federation
Mr Sergey Mikheenko

Slovakia
Mr Vladimir Jurina

Slovenia
Ms Nina Jug

South Africa
Mr John Pule

Spain
Ms Carmen Alvarez

Sweden
Ms Ann-Christin Haegg

Switzerland
Mr Andreas Leupin

United Arab Emirates
Ms Aayda Al Shehhi

United Kingdom
Ms Susan McCready-Shea

United States of America
Ms Laura Dudes

Advisors

Germany
Ms Annemarie Schmitt-Hannig

Italy
Ms Assunta Principe

Japan
Mr Isao Kawaguchi
Mr Nobuyuki Sugiura
Mr Hirokazu Tachikawa

United States of America
Mr Vincent Holahan
### United Nations Organizations

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<tr>
<th>Organization</th>
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<tr>
<td>FAO</td>
<td>Mr Carl Michael Blackburn</td>
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<td>ILO</td>
<td>Mr Tasos Zodiates (alternate)</td>
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<td>UNSCEAR</td>
<td>Mr Malcolm Crick</td>
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<td>Mr Ferid Shannoun</td>
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<td>Ms Maria del Rosario Perez</td>
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<td>Ms Emilie van Deventer</td>
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### International Organizations

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<tr>
<td>EC</td>
<td>Mr Mr Ivo Alehno (alternate)</td>
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### Other Organizations

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<td>Mr Christopher Clement</td>
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<td>Mr Wolfgang Fasten</td>
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<td>Ms Binika Shah</td>
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