CHAIRPERSON'S SUMMARY

International Experts Meeting on Assessment and Prognosis in Response to a Nuclear or Radiological Emergency

20-24 April 2015, Vienna

INTRODUCTION

This is the ninth International Experts Meeting (IEM) organized under the IAEA Action Plan on Nuclear Safety. The purpose of the meeting is to discuss issues, challenges and solutions related to the assessment and prognosis process in response to a nuclear or radiological emergency. The meeting builds upon and complements earlier IEMs that touched upon many of the same issues within the context of their topics.

The importance of the subject matter, which addresses both technical issues and effectiveness of communications efforts, is underlined by the fact that the IEM has attracted over 200 participants from 64 Member States and 4 international organizations. In addition, the organizers have used the meeting as an opportunity to involve as many young professionals as possible as part of the IAEA's programme of capacity building. The IEM provided a unique opportunity to bring to bear a wide range of expertise and diverse viewpoints on assessment and prognosis issues.

A particular focus of the IEM is the expanded role of IAEA in assessment and prognosis during nuclear or radiological emergencies. Prior to 2011, the role of IAEA covered four aspects of nuclear and radiological response: (1) notification and exchange of official information though officially designated contact points; (2) provision of timely, clear, and understandable public information; (3) provision and facilitation of international assistance upon request; and (4) coordination of interagency response. The IAEA role did not include the provision of a prognosis of the potential evolution of the accident or assessment of its possible consequences.

The collective experience in responding to the Fukushima Daiichi NPP accident showed that many different messages were reaching the public and various governments, and that there was no clear international mechanism for either harmonization of messages or dissemination of key information upon which assessments and prognoses could be performed. There was also no source for a global authoritative view of the results of assessments and prognoses. The availability and access to information, often by third parties, as well as the availability of assessment tools in emergency organisations around the world, provided information to the public far beyond the accident state or areas of direct radiological impact. This information was not always consistent. Tools to provide a common operating picture and joint messaging can improve both transparency and confidence in information provided by appropriate/established authorities.

As part of the IAEA Action Plan on Nuclear Safety, and subsequent General Conference resolutions, Member States have charged the IAEA to "…provide Member States, international organisations, and the general public with timely, clear, factually correct, objective, and easily understandable information during a nuclear emergency…based on

evidence, scientific knowledge and the capabilities of Member States." The IAEA work is designed to complement, not duplicate or replace, long-standing national responsibilities to respond to emergencies and protect the public. Member States also intended the work of the IAEA to take advantage of the existing capabilities of some Member States.

DISCUSSION ISSUES

Assessment and Prognosis terminology

IEM9 brought together a wide range of expert practitioners from the field of assessment and prognosis, and discussions at the meeting indicated a correspondingly wide range of meaning and uses for the terms. IAEA presented its intended use of the term *assessment*, as an evaluation of the planned and implemented protective actions and other response actions to determine if they are in broad compliance with the IAEA safety standards. IAEA presented its use of the term *prognosis*, as a bounding estimate of how the emergency may progress. A common definition is important to set the stage for IAEA engagement with Member States, and to provide clear expectations to all involved parties.

The discussions at the meeting also highlighted that the objectives of assessment and prognosis, and the types of needed assessment and prognosis, change during the course of a response to an emergency and also with respect to the type of an emergency. For example, in early phases of a response, assessment of nuclear power plant conditions relies upon pre-existing operator training and knowledge of safety systems and plant behaviour, and associated emergency action levels. If a General Emergency condition is predicted, immediate close-in evacuation is often the indicated protective action, and the Emergency Director of the operator can make a fully informed recommendation to authorities based only on plant status (without dose assessment or monitoring results). In the early phase of an emergency, prognoses and protective actions need to be frequently reviewed and updated as plant conditions change.

The use of preventative measures, mitigation strategies, and emergency preparedness and response actions all bear upon accident progression, and combine to ensure defence-in-depth of public protection. The data needed for assessment and prognosis for emergency response is different to the data needed for mitigation (such as severe accident management guidelines). The IAEA assessment and prognosis efforts are focused on data required to support off-site emergency activities (e.g., protective actions). Inherent conservatisms in approach, and the uncertainties in analyses, need to be put into context for decision-makers as well as the public.

In later phases of response, after the emergency phase is over, assessment of long-term health and environmental needs becomes important. Such a situation is underway with ongoing evaluations in the Chernobyl area and by the Fukushima Health Management Survey, which will provide valuable insights to inform the design of future assessment activities related to public health actions. Additional considerations come into play for such situations, such as the movement of contamination into previously unaffected areas due to seasonal flooding, river transport, etc. Long term assessment and prognosis with combined environmental modelling, sampling, and computational tools can be very valuable to plan optimal recovery and decontamination activities.

The objectives of assessment and prognosis will differ for the accident state, neighbouring states, unaffected states, and amongst international organisations. More work is warranted to identify, understand and explain any instances where the IAEA's definitions of assessment and prognosis, presented above, may not be consistent with all of these objectives. It is a reality that many countries and organisations will likely conduct their own assessments and prognoses if a significant accident occurs. IAEA is uniquely positioned to help harmonize efforts and give voice to the global community in a manner that assists the accident state authorities. Joint exercises as part of preparedness activities provide an opportunity to explore these interfaces and objectives.

Use of information technology and treatment of uncertainties

A recurring theme of IEM9 was the expected difficulty of reconciling results from multiple assessment sources – whether from different users with the same models, or from different models for source term, plume development, meteorology, deposition, and concentration-dose conversion.

Probabilistic Safety Assessment (PSA) is often used for pre-accident assessment and its use during an emergency needs to take full consideration of its limitations. There is a high variance of results of PSA, and PSA are dependent upon system assumptions that may not be valid for a degraded facility. Users of codes need to be trained not only in the code but also in the underlying technical issues associated with the type of facility and accident. Providing PSA information to decision makers can detract from the protection of the public. Simple explanations are all that is needed for most decisions (for example, is the food safe, or not safe, to eat).

There are significant capabilities (codes and databases) available to perform a credible prognosis and assessment of all phases of a nuclear emergency. The sustainability and practicality of those platforms, and their ability to handle and reduce large sets of collected data while providing the level of simplicity needed for emergency management will be a growing challenge. The pace of change in information technology tools is very high, and can outpace the training of users. Additionally, a wide range of technical disciplines are necessary to address emergency management needs. Frequent use of the applicable codes is beneficial during the preparedness stage and through exercises.

IEM9 presenters described several codes, and noted international efforts to compare code results, expand availability of source terms, and increase access to meteorological data. There are projects being run internationally to compare dose assessment codes including RASCAL, RODOS, and others. The code user's input assumptions are a major factor in the differences in code outputs. Such cooperative efforts at the international level improve the codes, help train users and build capacity, and increase the likelihood of reliable and consistent accident prognosis by separate entities. Further training and user forums for code use, which pull in multiple technical disciplines, would be very beneficial for the international response community.

The level of complexity of assessment and prognoses should be commensurate with the potential radiological health impacts of the given event. Graded approach is applied in

performing assessment and prognosis. Most large-scale emergencies will need a sophisticated assessment and prognosis. Many organisations have the capability to pull in expertise (technical support organizations, vendors, atmospheric modelling centres) as assessment and prognosis activities increase in complexity.

Harmonization of approaches and international guidance

IAEA safety standards and guidance documents (for example, GS-R Part 7) take into account the ICRP recommendations (specifically ICRP 103) but are not always identical. International, regional and national level documents (for example, the Nordic Flagbook and USA EPA-400 Protective Action Guidelines) can also have differences. Different standards or dosimetry techniques, used either in different areas or by different agencies for the same areas, could make public safety messaging inconsistent and difficult. This underscores the importance of IAEA's efforts to coordinate with the accident state prior to release of information in an emergency. Similarly, neighbouring countries may want to have pre-established arrangements to coordinate emergency management messaging.

It was highlighted that public protective measures implemented in response to an emergency will always be a national level responsibility. However, internationally focused efforts to support the harmonization of response actions would be useful to avoid or explain situations where neighbouring countries (or even countries far from the accident state) are recommending actions that conflict with the response actions of the accident state.

Protocols and tools to exchange information during emergencies

Regardless of the geographical location of an accident, it is reasonable to expect that organizations with advanced assessment and prognosis capabilities, or particularly relevant technical expertise, will be performing such activities. Recognizing this reality, a pre-planned approach for these organizations to obtain key information to support assessment needs will help to manage reconciliation of differences and facilitate appropriate communications.

IAEA can provide reliable information and data, supplied by the accident state, to other Member States. This will reduce the impact of multiple information requests upon the accident state. IAEA should ensure their assessment and prognosis program supports this objective. Guidance on reconciling differences, and protocols for source term estimation, will help ensure that the parties that cooperate in such sharing arrangements are viewed as trusted sources of information.

To accomplish this expanded role, IAEA would need to work with Member States to develop a predetermined set of key plant assessment parameters (dynamic data) and common situational awareness criteria (vital ground truth data), sufficient for a third party State to perform a high level assessments. Some regions mentioned efforts, such as one by the Heads of the European Radiological Protection Competent Authorities (HERCA) and Western European Nuclear Regulators Association (WENRA), to collect information and data in a standardized format. The Emergency Preparedness and Response Information Management System (EPRIMS) has been established by the IAEA to develop these capabilities, but it is not complete or populated at this time. IAEA has efforts to leverage other sources of internal

IAEA information and regional information to reduce the burden on Member States to populate EPRIMS.

The types of information and parameters needed to support a prognosis is more difficult to pre-define than the parameters for assessment. Mechanisms such as the Radiation Assistance Network (RANET) may provide a path to leverage advance capabilities, or to access situation-specific information on short notice. Continued IAEA engagement with Member States is planned and will help further define a process to support prognostic evaluations outside the accident state.

Radiological emergencies resulting from a nuclear security event

Protection of the public is the common, overarching goal of safety and security activities. However, the interfaces between nuclear safety and nuclear security have been evolving. Several recent emergency preparedness exercises in Member States have explored the role of security considerations and provided valuable insights on the nuclear safety and nuclear security interface, and how contingency planning can work in concert with emergency planning. In general, more entities (particularly government assets) are involved for nuclear security events, which have short time-scales, and consequently there are different coordination, interface, and command-and-control issues. These can significantly affect joint prioritization and decision-making activities otherwise assigned to emergency response officials. Individual Member States have developed requirements and guidance, and there is some applicable IAEA guidance. Security-driven response activities can introduce special information sharing considerations, can affect the ability of the emergency response field teams to perform actions in a timely manner, can change the nature of possible off-site protective actions, can often bring in different government response assets and authorities than accident-driven events, and can introduce new disciplines such as attribution via nuclear forensic techniques. The ongoing development of the system of nuclear security guidance by the IAEA, and continued exercises to explore the nuclear safety and nuclear security interface, will broaden the sharing of lessons on how this will affect emergency preparedness and response activities.

Capacity building and informing Member States

Capacity building for Member States in the area of assessment and prognosis is an important issue. The harmonization of international messaging to the public can be achieved if all Member States are fully knowledgeable of the global assessment and prognosis process, expected outputs and the capabilities which are available through the IAEA. For Member States without assessment and prognosis capabilities for nuclear or radiological emergencies, it would be useful to enhance their arrangements through capacity building so that they are better able to understand assessment and prognosis outputs produced not only by the IAEA but by other Member States.

Exercises

In discussing the above issues, the participants in the IEM discussed the need to increase the frequency and opportunities to exercise the international response. This would allow all organizations who would be expected to respond to a nuclear or radiological emergency, both

the accident state and the remaining international community, to practice the established data exchange framework and create the necessary synergy amongst the international community. Regularly exercises with the whole community would assist in developing a more complete understanding of the impacts the international community would have on the accident state, what support the international community has to offer, would identify any gaps and overlaps in international guidance and doctrine, would provide a more accurate picture of the full international response capabilities, and would determine any necessary advancements necessary to achieve a more harmonized collective international response.

To ensure continuity and consistency is applied to international response strategy, it is important to exercise a variety of response scenarios, to include nuclear power plant safety and security events, nuclear materials and fuel facilities-based events. Exercising a diverse range of nuclear and radiological emergency scenarios will promote consistency, and will also enable the community to draw distinctions between the different types of events, determine how these differences effect the established data and exchange protocols, and allow the international community to apply any consistent customization if appropriate. Opportunities to widen the number and types of exercise participation should be sought. This will allow partnerships to develop, at the preparedness stage, between organisations that will be tasked to respond to an emergency.

NEXT STEPS

- *From a review of the current global nature of the nuclear and radioactive industry, the availability of information and tools, and the expectations of officials in Member States and the public, it is clear that, like in 2011, many organisations will be performing their own assessments and prognoses of a significant nuclear or radiological emergency that occurs anywhere. Providing these organisations with a common operating picture, opportunities to interact with each other, and tools to ensure unity of effort, is in the best interest of the national and international emergency management community.*

- *Efforts need to continue to provide a common understanding of the objectives of assessment by IAEA and third party (non-impacted) Member States, and to communicate those objectives. These objectives should recognize and not impinge upon the roles and responsibilities of the accident state and potentially impacted states, with respect to the activities they engage in to protect their public. Where different standards are referenced (such as protective actions), the harmonization of messaging becomes particularly important for public understanding.*

- *Currently, tools to provide information and technical data to IAEA and to third party Member States through IAEA in advance of an accident are under development. Having timely and accurate input information is essential for quality, clarity, and consistency of assessments. More IAEA and Member State engagement is needed on the types of information to be provided and maintained. These engagements should be informed by the objectives of*

the assessments by IAEA and non-impacted Member States. Procedures and specific agreements would help communications and manage expectations.

- *To support consistent and quality prognosis being performed by multiple organisations, guidance and procedures should be put in place stating what type and how information related to dynamic parameters will be shared in an emergency. Information to support prognosis during emergency conditions is hard to predict and share in advance, but it needs to be timely, needs to be sufficient to evaluate critical safety functions at a high level, and needs to account for the rapidly unfolding nature of many emergencies.*

- *Wherever two or more organizations plan to conduct assessment and prognosis of the same event and provide information to affected audiences (governments, media, private entities, and the public), resources and mechanisms to provide accurate, coordinated, timely, and accessible information should be established and practiced. The importance of harmonized messaging was underscored by the accident at the Fukushima Daiichi NPP in 2011.*

- *Sharing data and information will not be sufficient to achieve the objectives of assessment and prognosis. Technical expertise spanning many disciplines will always be needed to interpret and add perspective to results. Work needs to be done, for example through wider exercise participation, to improve capacity to leverage expertise and to ensure expert-to-expert relationships exist at the preparedness stage.*

- *Exercise programs will be critical for setting clear expectations and establishing strong relationships between counterparts. Additional opportunities for cooperation during exercises should be sought, including opportunities for broader participation (ideally, reflecting those that would take on roles in a real event). This should include emergencies triggered by nuclear security events to explore interfaces between contingency planning and emergency planning. It would be worthwhile to have an "unaffected" Member State participate in an exercise and seek assessment and prognosis information from IAEA.*

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