Highlights of the Technical Meeting on the Implementation and Integration of Accident Management Guidelines and Interface with Emergency Preparedness and Response

Nadine Roussel as the chairperson of the meeting
Vienna International Centre, Austria
29 September 2017
- International Session -

Nadine Roussel as the chairperson of the meeting
Meeting highlights

• Opening and International Session:
  
  • IS-1: Experience from the INEX5 exercise on interfaces between accident management and emergency preparedness and response
  • IS-2: HERCA-WENRA approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident
  • IS-3: PWROG Severe Accident Management Guidelines – Development and Status
  • IS-4: The approach of the IAEA for conducting accident assessment during a nuclear emergency
  • IS-5: Aspects of the interface between Severe Accident Management and Emergency Preparedness and response
Meeting highlights

• Experience from the INEX5 exercise (22 countries) in 2015-2016:

  – Purpose: provide a basis for enhancing national and international emergency management arrangements related to notification, communication and interfaces

  – Decision-making under uncertain or unknown circumstances is foreseen in the EP&R for 76% country and about 87% among them is a pre-established approach.

  – Key role of real time information exchange platforms in improving cross-border coordination

  – Important to have predict tools to estimate the moment of delayed releases
Meeting highlights

• HERCA-WENRA approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident:
  
  – Although several neighboring countries can be affected by the same accident, criteria for implementing protective actions can be different in different countries.
  
  – To improve:
    • build a mutual understanding environment among neighboring countries
    • develop procedures to exchange information during the preparation phase and response phase
    • establish coherent protective actions among neighboring countries during the early phase of a nuclear accident
    • improve coordination for further protective actions beyond the early phase
  
  – Purpose:
    • harmonization of preparation of protective Actions in Europe
  
  – But recommendations should be based on realistic assessment, should be pragmatic and should take into account public communication consequences.
Meeting highlights

• PWROG Severe Accident Management Guidelines – Development and Status:

  – Two versions of updated generic SAMG, one intended for use by US plants and one tailored for International PWRs including loss of d.c. power and/or instrumentation, long term loss of a.c. power, multiple unit severe accidents, accidents in the fuel pool, accidents from shutdown initial plant conditions (Post-Fukushima additional areas)

  – Improvement of usability and readability, especially the diagnostic process diagram

  – Improvements including some guidance for role and responsibilities, especially for Emergency Director, and specific guidance and procedures for a comprehensive accident management capability.

  – TSC has not a sufficiently broad point of view to make some decisions such as implementing venting actions.
Meeting highlights

• The approach of the IAEA for conducting accident assessment during a nuclear emergency:

  – Development of specialized processes, procedures and operational tools by IAEA Incident and Emergency Centre: they are based on IAEA safety standards and avoid unnecessary requests for technical data

  – Implementation of customized assessment tools: example Reactor, Emergency Response Action, Radiological Source, Dose assessment tools

  – Emergency classification: methodology for SAM using critically safety functions with technology specific instructions (Function normal, degraded, failure, no information available)

  – Clear technical message with numbers and figures with red/orange/green so that everybody can see what is safe or not.
Meeting highlights

• Aspects of the interface between Severe Accident Management and Emergency Preparedness and response:
  – Findings among different NPPs and drills: limited interface between SAMG and ERO.
  – ERO should predict source term, and its probability, include also changes in risk (usually radiation protections actions only based on measurements)
  – SAMG should mention and take into account the estimated consequences on the parallel ER actions to protect the public
  – Training should not be only focused on specific guidelines, but should include severe accident physical phenomenon aspects; it will develop the ability to take into account unexpected development of the accident (not in the pre-calculated scenario done by designers)
  – Long term accident management consequences should be considered
- Technical Session 1 -

Thomas Steinrötter as the chairperson of Technical Session 1
Meeting highlights

• Four presentations in Technical Session 1
• 1st presentation by Ms. Nadine Roussel (EDF): “EPR/SAMG: EDF current organization and prospects”
  – Overview regarding the National Crisis Organization of France was given (two emergency officer are available).
  – Structure of EDF Emergency Response Organization (ERO) has been presented.
  – Task of the Rapid Nuclear Response Force (FARN) was presented. It is a resource of the national crisis organization of the Nuclear Fleet. FARN performs both prevention and mitigation under SA conditions.
  – EOPs measures are lost when entering into SAM.
  – SAM actions are grouped into immediate actions and delayed actions (actions with analyses).
  – A diagnosis and a prognosis of the plant behaviour is accomplished during severe accident.
  – A flow chart how to perform a delayed action in SAM has been shown.
  – Measures for external hazards beyond the design were presented.
  – Prospects like multi-units simulation of extreme situations, DSAL (device to manage on-field actions), and MRT (Tactical Approach, Decision Making Process) were explained.
Meeting highlights

- 2nd presentation by Mr. Geun-Sun Auh (KINS): “Accident Management and Emergency Preparedness of Korea in Regulatory Perspective”
  - Measures realized to respond to Fukushima Dai-chi accident for Korean NPPs were presented. The emergency response organization was explained and the stress tests for all NPPs were mentioned.
  - The rulemaking for Accident Management Plan (AMP) was presented. Definition of AMP has been done by Nuclear Safety Act. Preventive and mitigative measures are demanded. Safety targets were presented for site boundary, environment, and health objective. The definition of the conditions relevant for preventive and mitigative measures were explained. Amendments on the Nuclear Safety Act have been presented. The requirements are formulated in several articles.
  - Base for the handling of EPR is the IAEA document GSG-2. Generic criteria are applied and were presented. Both urgent and long-time actions are applied.
  - Several topics regarding SAMGs and EPR have been presented for discussion.
Meeting highlights

• 3rd presentation by Mr. Oleksii Dybach (SSTC NRS): “Consideration of the Radiological Consequences of Severe Accident Management Strategies in the NPP Emergency Plan”
  – Results of the estimation of radiological consequences of filtered containment venting has been shown, a comparison unfiltered and filtered containment venting was given, the effectiveness of filtered containment venting could be shown, MELCOR-RODOS calculations have been done.
  – Application of the ALARA principle: Prediction of doses for both plant personnel and public. For mitigative measures done by the plant personnel for a SB LOCA, the doses of the personnel were calculated by MicroShield and InterRAS. Calculation of the doses to the public estimated by Rodos/HotSpot/MACCS has been shown. A total collective dose to the public and personnel has been calculated for different times and the minimum of the collective dose has been identified.
  – Results of on-site dose rate assessment for the installing of mobile equipment in case of a SBO has been shown.
Meeting highlights

• 4th presentation by Mr. Muhammad Afzal Nagrah (PNRA): “Interface between Severe Accident Management Program and Emergency Preparedness at Nuclear Power Plants (Regulatory Overview)”
  – Current status of NPPs in Pakistan is: 4 units at CNPG and 1 unit at KANUPP.
  – Preventive and mitigative measures shall be implemented in the plants; the implementation of SEOPs and SAMGs is underway in all units.
  – On-site Emergency Response Organization consists in Pakistan of both permanent members and temporary members.
  – Currently a structured interface between SAMGs and EPR is not available; an example for a possible interface was presented.
  – Key features of current actions as well as future considerations has been summarized.

• General conclusions from Technical Session 1
  – Different status of implementation of SAMGs and EPR can be recognized in the countries.
  – Differences in the organizational structure of SAM, interface to EPR, and EPR are also the result of the general organization of the countries.
  – Relevance regarding long term accident management measures.
- Technical Session 2 -

Robert Prior as the chairperson of Technical Session 2
Meeting Summary – Contents

Technical session 2: Summary of Presentations:
• List of presentations
• 1 summary slide per presentation
  – (Summaries are mine, and not taken from the abstracts as such. Maybe authors should approve them??)
• (7 slides)

Technical Session 2: Meeting Discussion Points:
• Main areas of discussion, (presentation mainly initiating discussion is identified) sorted into following categories:
  – Roles and Responsibilities in SAMG (inc Decision Making Authority)
  – Exercises, drills and training
  – Equipment and Hardware
  – Other
• (4 slides)
Meeting Summary –
Technical Session 2 (1)

Technical session 2 presentations:

TS2-1 Mr Alexander Suslov (National Research Centre “Kurchatov Institute”, Russia): Development and implementation of severe accident management guidances for Russian VVER NPPs and interface of SAMGs with emergency preparedness and response procedures.

TS2-2 Mr Miroslav Trnka (Dukovany NPP, Czech Republic): Accident Management and Emergency Preparedness and Response at the Dukovany NPP.

TS2-3: Mr Peter Devitt (Canadian Nuclear Safety Commission, Canada): Implementation SAMG and Integration with Emergency Response in Canada.

TS2-4: Mr Yasser Mohamed (Egyptian Atomic Energy Authority, Egypt): Integration Methodology of the Emergency Response in Egypt.


TS2-6: Mr Ken Stenman (OKG AB, Sweden): Different types and levels of decision.
Mr. Suslov presented the history and current status of SAMG for VVER plants in Russia, noting that the SAMG approach is based on the original WOG model, but has been updated (or in progress) to address issues such as spent fuel pool accidents and severe accidents occurring from shutdown conditions. He described SAMG validation performed at Balakovo VVER-1000 and how lessons learned had been fed back in the form of guideline improvements. SAMG user training was also described.

He also presented the overall approach to EPR, including classification criteria, structure of ERO groups involved in SAMG, and staffing of the Accident Management Group.

He noted that initiation of the BDBA AM procedures/guidelines was added as a criterion for EP classification.
Mr. Trnka presented the history, development and new work performed for EOP, SAMG and associated procedures and guidelines for the VVER plants in Czech Republic (Temelin and Dukovany). New work includes development of DAM (Diverse Accident Mitigation) equipment procedures, update of SAMG, and development of Extensive Damage Mitigation Guidelines (EDMG), together with integration of the different procedures and guidelines.

He also described plant hardware modifications already completed (e.g., IVR, PARs, SBO diesels), in progress (e.g. independent RCS depressurisation method, long term heat sink) and mobile equipment implementation (e.g. portable I&C devices, mobile diesels).

Other aspects of emergency response, including temporary connection points, phones and communications fire water and fuel trucks, and the offsite ECC and mobile ECC were also described. The approach to training and exercises for the different staff involved in the on-site emergency response were described.
Mr Devitt presented Regulations and Fukushima Action Items related to SAMG and Emergency Response in Canada. He went on to describe the CANDU SAMG basis, structure and entry and exit conditions. He described both issues and good practices identified during the SAMG implementation phase. Issues included instrumentation survivability and performance during severe accident, control room habitability, SAMG user understanding of severe accident behaviour, and roles and responsibilities between TSC and control room. Good practices included responding rapidly to identified issues, (“FLEX”) equipment use, containment pressure relief evaluations and documentation QA improvements. He concluded by describing ERO organisation and responsibilities and exercises performed.
Mr. Mohamed described the new law regarding nuclear regulation which has established the regulatory organisations in Egypt, in preparation for a proposed first NPP. The roles and responsibilities of the two national organisations the Egyptian Atomic Energy Authority (EAEA) and the Egyptian N/R Regulatory Authority (ENRRA) in Emergency Response were described. Emergency Command Centre, emergency response categories and tools, equipment and processes for responding to a radiological event were also described. Development activities in progress include those related to procedures and communications.
Ms. Hayashi described her experience of the Fukushima accident as a local inhabitant shortly prior to joining Tepco. She went on to describe her work after joining, focussing on lessons learned from the accident and improvements made, especially in terms of lines of communication between the four main groups involved in the emergency response: the control room, TSC, headquarters and offsite organisations. By identifying issues during the accident, lessons learned and potential improvements, she described the improvements made to the interfaces between the groups in three important areas:

- **Interface MCR-TSC**
- **Interface TSC and headquarters**
- **Interface TSC and offsite organisations**
Mr. Stenman presented the original vs. new draft of NS-G-2.15 discussion of decision making in SAMG, noting that the new version appeared to allow rather more flexibility. He argued that not all decisions are of the same type, or have the same potential consequences. Currently most SAMG approaches require the ED to authorise new actions, but this can overload the ED, and also, for some decisions, he may not have the appropriate knowledge. Once in SAMG, different levels of decision could be considered, with the decision authority allocated to the operations, TSC or ED, depending on the nature of the decision and its possible consequences.
Roles and Responsibilities (including decision making)

• Decision making authority and roles of Control Room, TSC and Emergency Director
  – Extensively discussed
  – (2.3 Devitt) noted occurrences of disagreement between control room and TSC regarding appropriate strategies
  – (2.6 Stenman) Should a more ”graded approach” to decision making be adopted, assigning different types of decision to MCR, TSC and ED, depending on the nature of the decision and on the potential to impact off-site response?
Exercises, drills and training

• (2.3 Devitt) Learning lessons from reviews and drills concerning both:
  – issues (e.g. instrumentation, MCR habitability,..)
  – Good practices (e.g.; addressing issues, assessing containment pressure relief capacity, documentation QA, EME (« FLEX ») equipment etc.

• In exercises and drills, difficulty in integrating SAMG exercises with ERO (Emergency Response) exercises:
  – (2.1 Suslov), (2.3 Devitt) drills to test/train SAMG are usually of different type to those for testing offsite Emergency Response since the purpose of SAMG is to avoid/minimize releases whereas for EPR, it is to protect public once releases have occurred. Difficulty to integrate the two.

• (2.3 Devitt) Should SAMG users be more highly trained on severe accident phenomenology and event progression? More drills?
Equipment and Hardware

• (2.2 Trnka) Use of a mobile equipment « Technical Specification » (addressing requirements for storage, testing, maintenance etc.) represents a good practice even if such document is not formally part of plant Tech. Specs.

• (2.2 Trnka) Similarly, prepared portable devices for locally monitoring instrumentation.
Others

• (2-1 Suslov) As a general principle, SAMG are intended to cover, to the extent possible, all possible situations using a symptom based approach (i.e. without cutoff of specific low frequency scenarios), in contrast with plant design/upgrade approaches which may permit such exclusion.

• (2.1 Suslov) More reference to the onsite recovery tools and procedures (e.g; the EOP and SAMG) should be made in Emergency Planning documents to help ERO staff to understand likely plant conditions and chosen recovery methods.

• (2.1 Suslov) In SAMG where releases are used as a guideline entry condition, the setpoints need to be consistent with Emergency Plan categorisation/action levels.
- Technical Session 3 -

Peter Devitt as the chairperson of Technical Session 3
Meeting highlights

• TS3-1: Optimization of the Severe Accident Management in German NPPs after the Fukushima-Daiichi Accident
• TS3-2: Accident Management and Emergency Response in China
• TS3-3: Status of SAMGs and EPR in Turkey
• TS3-4: Emergency Preparedness and Response – A Confirmed Approach to Accident Management Support
• TS3-5: Accident Management at Paks NPP
• TS3-6: Implementation of SAMGs in Emergency Preparedness and Response at Cernavoda NPP
Meeting highlights: TS3-1

- After the events at Fukushima, the German NPPs were subjected to both a national and European wide stress test
- Prior to Fukushima there was no SAMG concept and only limited systems to mitigate severe accidents
- New safety requirements for German NPPs were published in 2012
- SAMG was developed for all sites
- Equipment was added to all sites
  - Two diesel generators
  - Mobile pumps to provide cooling to the core and spent fuel pools
- **Two handbooks of mitigative severe accident measures**
  - General strategies for non-SAMG staff
  - Additional information and computational aids for SAMG staff
- **TSC diagnoses cooling & containment functions every 15-30 min**
Meeting highlights: TS3-2

• Three organizations involved in emergency response
  – Safety bureau: civilian accidents
  – China Atomic Energy Authority: industrial military accidents
  – Chinese army: nuclear weapons

• Four different severity ratings depending on the number of deaths, injuries, and cost: Special Serious, Heavy Serious, Serious, General

• More than 30 national nuclear rescue teams

• Major exercise in 2009 and 2015 each involved 6000 participants

• Provinces are to conduct full scale drills every 2-4 years

• Question was asked how can number of deaths be used to rate an accident if cancer deaths come later

• Response was that the scale applies to multiple industries not just nuclear, and it refers to immediate fatalities
Meeting highlights: TS3-3

• Two nuclear plants planned in Turkey: Akkuyu and Sinop
  – Construction preparation licensing on-going for Akkuyu

• Turkey has a disaster and emergency response which is not limited to nuclear accidents (AFAD)

• The Turkish Atomic Energy Authority (TAEK) has their emergency response centre which works with AFAD

• While Turkey does not yet have a reactor, AFAD and TAEK have done emergency response and atmospheric modeling simulations for nearby reactors
  – Metsamor (Armenia), Cernavoda (Romania), Kozolduy (Bulgaria)

• Question was ask what regulations will be used once the reactor is constructed

• Response was that international standards (e.g. IAEA) would be used with regulations from the builder’s country (i.e. Russia) to fill in any gaps
Meeting highlights: TS3-4

• Bruce Power has worked to strengthen off-site response
  – Emergency mitigating equipment
  – Data sharing with key parties (regulator, provincial government)
  – Off-site gamma monitoring
  – Alert FM (radio message to key employees)

• Developed a regional committee to improve communication between emergency services (e.g. fire departments, first aid)

• Provide provincial response authorities with five potential severe accident scenarios to aid in developing response plans

• Looking to develop 3-D modeling of the site
Meeting highlights: TS3-5

• The emergency response organization (ERO) command section for emergency response is in contact with both operators and the technical support section (TSC)

• The TSC contains
  – Head
  – Unit supervisor on standby
  – Analyzer with pre-run severe accident assessments
  – Unit supervisor for the accident unit or plant supervisor if all units are affected
  – Member of the restoration team

• **TSC evaluates the priorities and based on the priorities, chooses a severe accident guideline to implement, considering available equipment, parameters, and potential positive and negative consequences**

• Ultimate authority rests with the head of the ERO
Meeting highlights: TS3-6

- Cernavoda implemented the SAMG program in 2011, which was based on the generic CANDU SAMG developed by the CANDU Owners Group (COG)
  - Updated in 2015 based on another COG project to account for multiple units and lessons learned from Fukushima
- The technical support group (TSG) recommends SAMG strategies, but the responsibility to implement them rests with the shift manager and the MCR staff
- Two training programs developed: one for SAMG users and one for non-SAMG users
- SAMG user training is refreshed every 2-3 years
- TSG teams are cycled through drills to ensure everyone gets experience
- Physical improvements in response to Fukushima include portable diesel generators and diesel pumps, installation of PARs, filtered venting, and fixed gamma monitors
Thank you for your attention!