Seminar 3 – Radiation Protection, Environment and EP & R – Session 1

Chaired by Y. Balashevska (SSTC NRS) / H. Thielen (GRS)

10:00 - 10:30 | No. 301

Benchmarking on Assessment of Radiological Consequences (BARCO): First Results and further Challenges

Y. Kyrylenko (SSTC NRS), F. Rocchi (ENEA), A. Slavickas (LEI), M. Ilvonen (VTT) and H. Tielen (GRS)

The aim of this presentation is to report about the first outcomes of the BARCO Project, a joint work conducted by the radiation consequences assessment experts from five European TSOs – Ukraine, Italy, Finland, Lithuania, and Germany.

In a broad context, benchmarking is a complicated process tool aimed at obtaining a measure demonstrating the best performance (methodology, approach, procedure etc.) achieved in a particular sphere. Benchmarking is especially important for the activities based on complex program tools application, calculation experience, and mainly tacit knowledge.

Under BARCO project, benchmarking is considered as a quality management tool aimed at a comparative analysis of modeling packages for emergency preparedness and response, and from this angle benchmarking should be considered as a technique for evaluation of existing gaps in the modeling, use of meteorological data and other databases by experts, and approaches to the interpretation of results over distance.

This benchmarking was launched as a contrast and a complimentary activity to the EP&R exercises performed regularly which, however, do not pay enough attention to the data analysis from the scientific point of view, but focus on the country’s response instead. In light of the severity of the possible radiological impact of an emergency, understanding of the strengths and limitations of various calculation codes, methodologies and approaches in the neighboring countries is of utter importance.

The information presented in this report provides results obtained under the first task of benchmarking, where the assessment of the off-site consequences of an accident at “the NPP” was performed for the territory of Ukraine. For the single initial data (grid, time, scenario etc.) the experts used their routine tools (VALMA, ARANO, and RODOS) and acted according to the rules of the benchmarking, implying using only available instruments as much as it is possible during a real emergency.

The expected outcomes of the project are the exchange of experience in modeling, providing recommendations regarding use of various approaches and navigating in the diversity of databases, enhancement of the capabilities of ETSON members in the assessment of radiological consequences, and bonding the international EP&R community.

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Assessment of airplane crash accident on RBMK type reactor building after plant final shutdown (43)

V. Ragaisis (LEI), T. Kaliatka (LEI), P. Poskas (LEI) and A. Kaliatka (LEI)

Nuclear Power Plants (NPPs) with RBMK reactors have been designed in late sixties - early seventies. NPPs with RBMK reactors have been build entirely in the European part of the former Soviet Union. After collapse of Soviet Union, RBMK reactors become in possession of Russian Federation, Lithuania Republic and Ukraine Republic. Construction of only two RBMK reactor’s blocks were finished and put into operation after Chernobyl accident in 1986: Ignalina-2 and Smolensk-3.

Accidental crash of airplane has been considered in the licensing of NPPs for several decades. However, according to the estimated frequencies of crashes, only crashes of small airplanes and/or military airplanes were generally considered. Requirements for considering of an aircraft crash were not imposed on any of RBMK reactor. There were no such regulatory requirements at the time when plants were developed, and no such requirements were introduced by the regulatory bodies later on.

In the aftermath of the September 11, 2001 terrorist attack on the United States it became apparent that a nuclear power plants must be designed sufficiently robust to resist impact from large civilian airliners. According to the Western European Nuclear Regulators’ Association position, established in 2013, a crash of a heavy airplane should be considered in the design of all new reactors regardless of the estimated probability of the event and the air corridors above. The United States Nuclear Regulatory Commission requires to perform a design-specific assessment of the impact of a large, commercial aircraft on a new nuclear power reactor. Airplane crash on nuclear facility cannot be longer considered with a high degree of confidence as being extremely unlikely to arise.

A nuclear or radiological emergency at the nuclear facility with significant release of radioactive material to the environment can cause radiation induced health effects as well as economic and sociological consequences affecting the public. A basis for establishing arrangements for preparedness and response is a hazard assessment. The IAEA general safety requirements define that such hazard assessment shall include consideration of events that could affect the facility or activity, including events of very low probability and events not considered in the design.

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The presentation considers the state of NPP with RBMK type reactor(s) after their final shutdown and during certain decommissioning stages, hazards arising and discusses methodology for the assessment of radiological consequences to the public in the event of a large commercial airplane crash on RBMK type reactor building. The described methodology was applied for the evaluation of radiological consequences from airplane crash at Ignalina NPP site where plant with two RBMK-1500 type reactors being under decommissioning.

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Intercomparison of RASCAL 4.3 and IdX Radiological Consequences for a Severe Accident at the Spent Fuel Pool of the Krško NPP

A. Guglielmelli (ENEA), A. Cervone (ENEA) and F. Rocchi (ENEA)

The Division for Nuclear Safety, Security and Sustainability (SICNUC) of ENEA is actively committed since several years to develop, increase and apply its capabilities in the field of Emergency Preparedness and Response (EP&R) with the aim to provide technical support to the national stakeholders in case of severe accidents. In the Response field of the EP&R activities, one of the approaches currently investigated to evaluate the Radiological Consequences (RC) makes use of so-called “fast-running” codes, which provide answers in a few minutes with a minimum amount of information, for example using Gaussian puff/plume models. However, to provide a reliable RC assessment, especially far away from the source, it is necessary to make use of codes based instead on Eulerian or Lagrangian atmospheric dispersion models. Aim of this paper is to perform an intercomparison of the RC due to a hypothetical Severe Accident (SA) at the Krško NPP Spent Fuel Pool (SFP) between RASCAL 4.3 (Metereology module, Gaussian), developed by US-NRC, and IdX (Eulerian), developed and owned by IRSN, atmospheric dispersion codes. It is assumed that the difference in the RC results is mainly attributable to the use of different atmospheric dispersion models and wheater data. The Source Term chosen for the analysis is a typical one for a Severe Accident sequence at a Krško-like SFP with some simplified assumptions based on both 24 hours of emission time and only two radionuclides released (i.e., Cs-137 and I-131) into the atmosphere. The date of emission start for the radioactive release was previously determined as one of the most conservative in terms of RC impact on Italy in a range of ten years (i.e., 2002-2011). The RASCAL 4.3 and IdX weather information is updated every hour and three hours, respectively. The consequences on the Italian territory in terms of I-131 committed equivalent thyroid dose and Cs-137 total ground deposition are finally investigated and compared.

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Investigation of radionuclides in North of Europe in June 2020

J.-J. Ingremeau (IRSN)

During the second half of June 2020, small quantities of artificial radionuclides (60Co, 134Cs, 137Cs, 103Ru, 106Ru, 141Ce, 95Nb, 95Zr) have been detected in northern Europe (Finland, Sweden, Estonia), the source of the release being unknown. The measured values were close to detection limits and didn't represent any health issue. This paper presents the investigations performed at IRSN in order to identify the source location and the origin of the release. Using inverse modelling techniques, the most probable source location has been determined together with an estimation of the source magnitude. Additional investigations have been performed in order to determine from which type and part of a nuclear installation the release could come from. If no certainty is achievable, the most probable source is a spent primary ion exchange resin. This detection has also been compared to previous similar ones. Finally, some hypothesis.