

Committee on the Safety of Nuclear Installations (CSNI)

Working Group on External Events (WGEV)

John A. Nakoski, WGEV Chair

5th NRC Probabilistic Flood Hazard Assessment Workshop
19 February 2020

WGEV Administration

- **WGEV Chair:** John A. Nakoski (NRC, USA)
- **WGEV Bureau:** Vincent Rebour (IRSN, France), Gernot Thuma (GRS, Germany), ShiZhong Lei (CNSC, Canada), Min Kyu Kim (KAERI, South Korea)
- **WGEV Participants from:**
 - Belgium (BelV), Canada (CNSC), Czech Republic (SUJB), Finland (STUK), France (IRSN, EdF), Germany (GRS), Japan (NRA), Netherlands (ANVS), Poland (PPA), Romania (CNE), South Korea (KAERI), Sweden (SSM), Switzerland (ENSI), United States (NRC, DOE, EPRI)
 - European Commission, International Atomic Energy Agency, and World Metrological Organization
- **NEA Technical Secretariat:** Marina Demeshko
- **Established in 2014**
- **Meets twice a year**

Severe Weather and Storm Surge

Proceedings published – NEA/CSNI/R(2017)13 (16 April 2018)

Key Messages:

- There is a need to improve reliability of information and understanding of boundary conditions for hazard analysis
- Data is sparse
 - Use simulation (needs to be validated)
 - Other data sources to extend available data
- Paleodata and historical data is important, but challenging to use
- Uncertainties need to be better understood and quantified
 - Be aware of the uncertainties and take them into account
- Fragility information for infrastructure is a key knowledge gap
 - Interface between insights gained from hazards assessment and application of those insights in a PRA
- Climate change is introducing new challenges that require new approaches and models

Approaches for Screening External Hazards

NEA/CSNI/R(2018)7 (April 2019) – Examination of Approaches for Screening External Hazards to Nuclear Power Plants

- Effective screening of hazards promotes an efficient modelling practice for risk assessment

Key Messages:

- There is a need to screen and group hazards
- Develop and use lists of generic hazards and initiating events
- Group considering facility type, hazard frequency, facility impacts, and consequences
- Potential Issues with existing screening approaches
 - Varying definitions
 - Reliance on deterministic technical bases
 - Lack of consideration of uncertainty
 - Absence of physic-based information integrated into statistical models
 - Lack of supporting rationale behind screening criteria

Riverine Flooding (1 of 4)

NEA/SEN/SIN/WGEV(2018)1 – Survey Topical Report in final publication

Workshop Highlights:

- Challenging to bridge the gap between hydrologists and regulatory decision-makers
- Need correct and reliable weather forecasting for flooding
- Historic information, paleodata, and simulations can supplement the instrumental data
 - Difficult to incorporate into the existing hazard assessment framework
- Challenging to treat uncertainties
- Assessment of impact should consider more than flood level (associated effects)

Riverine Flooding (2 of 4)

Proceedings in publication – NEA/SEN/SIN/WGEV(2018)13

Workshop Highlights:

- Need rigorous understanding for fragility of facilities to strengthen protective measures technical bases
- Nature of flooding hazards and associated plant impacts challenge PSA methods
- Time consuming calculations, characterization of probability distributions, and dependent input parameters challenge PFHA methodology
- Need to balance consideration of the spectrum of associated effects from flooding and the information necessary to support decision-making
- The concept of a “dry site” needs to be reconsidered

Riverine Flooding (3 of 4)

Proceedings in publication – NEA/SEN/SIN/WGEV(2018)13

Workshop Conclusions and Recommendations:

- Share information between nuclear and non-nuclear organizations as well as with neighboring countries
- Augment temporally and spatially sparse historical data with simulations and other information
- Further work is needed to understand how metrics, such as a selected value for annual exceedance frequency, can be used in regulatory decision making

Riverine Flooding (4 of 4)

Proceedings in publication – NEA/SEN/SIN/WGEV(2018)13

Workshop Conclusions and Recommendations:

- Uncertainties with data and modelling need to be better understood and quantified
 - Decision makers should be aware of the uncertainties and take them appropriately into account
- Develop new approaches and models to identify and address the challenges introduced by climate change
- The workshop demonstrated that:
 - It is important for the nuclear and meteorological communities to work together
 - Subject matter expert co-operation, including non-nuclear experts, is important as well as regional co-operation to share experience and data

Ongoing Activities (1 of 2)

- **Concepts and Definitions for Protective Measures in Response to External Flooding Hazards**
 - Survey responses provided to WGEV writing group (January 2019)
 - Guidance for writing group and assessment of survey responses (March 2019)
 - Preparation of initial draft report - June 2019
 - Final report – June 2020
- **Benchmark on Hazard Frequency and Magnitude Model Validation for External Events**
 - Finalization of the benchmark specification – November 2018
 - Gather input from benchmark participants – July 2019
 - Final Report – December 2020
 - For more information contact Curtis Smith (Curtis.Smith@inl.gov) or Vincent Rebour (Vincent.Rebour@irsn.fr)

Ongoing Activities (2 of 2)

- **High winds and tornadoes**
 - Survey responses – February 2020
 - Preparation of initial draft report – June 2020
 - Final report – December 2020
 - Workshop – September 2021
- **Combinations of External Hazards**
 - Hazards and Impact Assessment and Probabilistic Safety Analysis for Nuclear Installations (joint project of WGEV and WGRISK)
 - Kick-off meeting – February 2020
 - Survey responses – September 2020
 - Preparation of initial draft report – July 2021
 - Final survey response report – May 2022
 - Joint WGEV/WGRISK workshop – Fall of 2022

Potential Future Activities

- **Improving understanding and application of uncertainty in hazards assessment and decision-making – under development**
- **Topical discussions – next WGEV meeting topics**
 - Space weather
 - Improving data sources for hazards assessment



Thank you for your attention!