

Recent Tasks of the OECD Nuclear Energy Agency Working Group WGRISK – An Overview

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PSAM 16
Honolulu, HI, USA; June 26 to July 1, 2022

Introduction to OECD/NEA WGRISK

- Main objective of the CSNI Working Group on Risk Assessment (WGRISK) is to advance the understanding and utilization of probabilistic safety assessment (PSA = PRA) in improving the safety of nuclear installations in member countries
- PSA is a necessary and useful complement to traditional deterministic safety analysis
- WGRISK carries out various activities
 - Exchange risk related information between experts in member countries
 - Advance the use of these tools and approaches for improving safety
- WGRISK reports can be found at:
<https://www.oecd-nea.org/nsd/docs/indexcsni.html>

Introduction to WGRISK Tasks (1)

- Recently completed activity
 - WGRISK(2017)2: Comparative Application of Digital I&C Modelling Approaches for PSA (DIGMAP) – in publication
- Actually ongoing tasks
 - WGRISK(2019)1: Dynamic PSA Methodologies – Preparing for the Future (separate presentation)
 - WGEV/WGRISK(2019)2: Combinations of External Hazards – Hazard and Impact Assessment and PSA for Nuclear Installations (separate presentation)
 - **WGRISK(2020)1: PSA for Reactors of a Singular Design**

Introduction to WGRISK Tasks

- Actually ongoing tasks (contd.)
 - WGRISK(2021)1: Use and Development of Probabilistic Safety Assessment in Member and Non-member Countries – Status Report
 - WGRISK(2021)2: DIGMORE – A Realistic Comparative Application of DI&C Modelling Approaches for PSA

- Actually started tasks
 - WGRISK(2022)1: Treatment of Uncertainties for Novel Aspects of Risk Analyses
 - WGRISK(2022)2: Level 3 PSA Modelling Benchmark

PSA for Reactors of a Singular Design (1)

- Use of PSA for risk assessment and safety improvements of NPPs has provided significant benefits over the past decades
- However, significant challenges arise in in conducting PSA for reactors of singular designs with the need to consider
 - Novel design features
 - Lack of operating experience and data
 - New materials, processes or phenomena
- “Reactors of singular designs” can include research reactors, demonstration reactors, prototype reactors, first of a kind (FOAK) reactors, small modular reactors (SMRs), and to some extent also Generation IV reactors of singular designs

PSA for Reactors of a Singular Design (2)

- Joint WGRISK and IAEA symposium on PSA for reactors of singular designs hosted by ONR in Liverpool (UK) in June 2022
- Task / Symposium overall objectives
 - Sharing knowledge and experience related to challenges of conducting PRA for reactors of singular designs
 - Fostering discussion in the international PSA community
- Scope: all PSA aspects
 - From small-scale probabilistic investigations and risk-informed applications up to full-scope PSA
 - Covering Level 1 to 3 PSA
 - For all plant operational states (POS)
 - Covering plant internal events and risk aggregation from internal and external hazards



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PSA for Reactors of a Singular Design (3)

- Topics addressed
 - Experience of conducting PSA for reactors of singular designs (including supporting analysis)
 - Differences and challenges of PSA for singular design reactors compared to classic PSA (including supporting analysis)
 - Operational experience from reactors of singular designs
 - Lessons learned and recommendations for development of PSA and use of risk-informed decision-making processes for reactors of singular designs
- Focus of the symposium presentations
 - PSA for research reactors – 4 presentations
 - Methodologies and experiences from conducting PSA for unique reactor designs – 8 presentations
 - Challenges for unique reactor PSA – 6 presentations

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PSA for Reactors of a Singular Design (4)

- Expected results: common understanding of possible benefits and application areas, challenges, and possible solution paths in the field of PSA for reactors of singular designs
- Key topics for PSA for reactors of singular designs
 - DSA vs PSA ordering, confirmatory vs setting requirements
 - Risk metrics
 - Initiating events
 - Uncertainties (data, systems design)
 - Reliability data for new SSCs including passive systems
 - Code qualification / validation
 - Human reliability, manning levels, etc.
 - Digital I&C
 - Application/implementation of PSA in conceptual vs final design
- Output: CSNI Report summarizing key differences and challenges for PSA for reactors of singular designs, providing recommendations for follow-up activities

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DIGMORE (1)

- Successfully completed task “Comparative Application of Digital I&C Modelling Approaches for *PSA* (DIGMAP)” has been successfully completed
- New task “DIGMORE – A Realistic Comparative Application of DI&C Modelling Approaches for *PSA*” to support improving probabilistic assessment by providing guidance for *PSAs* with respect to DI&C systems (including relevant hardware and software aspects)
- Major goals of DIGMORE:
 - Getting an in-depth understanding of possible impacts of interactions within entire DI&C architectures on *PSA* models
 - Consider, various backup features for critical safety functions, impact of malfunctions of priority modules/logics and accident sequences
 - Compare the results from DIGMAP and DIGMORE
 - Give recommendations for the development of *PSA* models for DI&C

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DIGMORE (2)

- Steps of the DIGMORE task
 - Specification of a reference taking into account the entire architecture of the DI&C system
 - Development and description of individual DI&C models
 - Discussion and comparison of the DI&C models in the frame of task workshops considering typical characteristics of DI&C systems, e.g. software and hardware, fault-tolerant techniques, network communication, and automatic testing based on experience from DIGMAP
 - Establishing guidance for PSA with respect to DI&C systems
- Task results will be published as CSNI Task Report

Use and Development of PSA – Status Report (1)

- WGRISK routinely shares information regarding PSA methodologies used to identify NPP risk contributors and assess their importance and applications of PSA results
- Status report on use and development of PSA approx. every 5 years
- Actual update covers the following topics
 - PSA framework and environment
 - Safety goals, criteria, and risk metrics
 - Status and scope of ongoing PSA studies in different countries
 - PSA methods, tools, and data
 - Notable results from PSAs
 - PSA applications and risk-informed decision-making
 - Future developments and research
 - International activities

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Use and Development of PSA – Status Report (2)

- Task status and further steps
 - Started in late 2021 a template structure with topics and aspects to be covered in detail has been distributed in spring 2022
 - Responses are expected in fall 2022
 - Summaries of member states answers to be prepared
 - Draft report with conclusions for approval by WGRISK and CSNI
- Output: CSNI Task Report in 2024

Recently Started Tasks (1)

- WGRISK(2022)1: Treatment of Uncertainties for Novel Aspects of Risk Analyses
 - WGRISK identified the potential benefits of assessing established tools for treating uncertainty for novel aspects of risk analyses
 - Task being started in summer 2022 will cover
 - ❖ Overview of tools, research, or applications related to treatment of completeness, modelling, and parametric uncertainties in PSA
 - ❖ Identifying decision-making cases where the specific methods for treating uncertainties provided additional insights to a decision or the lack of methods posed challenges
 - ❖ Identifying practical challenges
 - ❖ Developing a preliminary outline of an application benchmark as groundwork for a potential follow-on WGRISK task

Recently Started Tasks (2)

- WGRISK(2022)1: Treatment of Uncertainties for Novel Aspects of Risk Analyses (contd.)
 - Task conclusions mainly based on the results of a WGRISK member country survey and follow-on workshops
 - Task Technical Note summarizing task survey results
 - Final output: CSNI Report in 2025 documenting task results and providing recommendations for future activities

Recently Started Tasks (3)

- WGRISK(2022)2: Level 3 PSA Modelling Benchmark
 - One aspect of PSA is the evaluation of offsite consequences
 - Models for offsite consequence analysis In recent years new and modernized Level 3 PSA tools have been developed
 - Need to understand capabilities of new/modernized Level 3 PSA tools and uncertainties and provide a forum for discussion between national experts
 - Task objectives
 - ❖ Provide a forum for discussion and understanding of impacts of consequence modelling techniques and assumptions
 - ❖ Better understand uncertainties in the models in relation to uncertainties in the overall PSA
 - ❖ Better understand and tolerate differences in various (national) models

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Recently Started Tasks (4)

- WGRISK(2022)2: Level 3 PSA Modelling Benchmark (contd.)
 - Task is being started in summer 2022
 - Three task phases:
 - ❖ Definition of benchmark problems by participants
 - ❖ Benchmark calculations
 - ❖ Comparison of benchmark results and drawing conclusions through task workshops
 - Final output: CSNI Task Report in 2025

Outlook

- WGRISK Technical Discussion in 2023:
 - Progress in SFP PSA since 2015 Technical Discussion or
 - Novel passive safety functions and their reliability
- Additional topics for future work
 - PSA-informed fault tolerance analysis
 - Modelling of the use of portable/mobile (“FLEX”) equipment within PSA
 - Risk assessment for fuel cycle facilities (FCF)
 - PSA for SMRs
 - Lesson learned from HRA implementation in PSA.

Thank you for your attention!

For further questions, please contact
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