

OECD/NEA Working Group on Risk Assessment (WGRISK) – Overview of Recent PSA Activities

**Vinh N. Dang, PSI
Marina Röwekamp, GRS
Attila Bareith, NUBIKI**

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The Working Group on Risk Assessment (WGRISK)

OECD Nuclear Energy Agency **Member Countries + Invitees & Observers**

Reports to and assists the Committee on the Safety of Nuclear Installations (CSNI)

Scope: PSA and risk assessment of nuclear facilities

Aims: support and enhance the use of PSA to improve the safety of nuclear installations, from their design and operation to their end-of-life cycle

1982-1998

- fundamental risk assessment **methodologies**,
- **First PSA studies** and other firsts
- subsequent **extension of PSA study scope**: hazards, operational states, levels/risk metrics



1999-present

- methods, data, tools, implementation, application of results
- use of PSA in **safety management and nuclear safety regulation = risk-informed decision-making**
- *new and advanced reactors*
- *PSA in design and licensing*

as Principal Working Group No. 5

as WGRISK

Outline

Objective: Present highlights from recently completed WGRISK tasks and preview upcoming reports from our on-going work

- **Overview of WGRISK activities**
- Recently completed (4 of 6)
 - **Status of PSA** in WGRISK participating countries
 - **Combinations of external hazards**: from hazard assessment to PSA
 - Benchmark of **consequence codes for Level 3 PSA**
 - PSA for **reactors of singular designs** (new and advanced reactors)
- **Outlook (coming soon)**

All references listed in paper and in presentation. Preprints are available.

WGRISK Overview

WGRISK Overview	Status of PSA	Use and Development of PSA as of 2024 in WGRISK participating countries	Preprint 
	Methods, data, studies and results	Hazard assessment and PSA for combinations of external hazard with the WG on External Events (WGEV)	Preprint (survey, task) 
		Dynamic PSA – Preparing for the future	Preprint
		Benchmark of consequence codes for Level 3 PSA	Preprint * 
		<i>DIGMORE Digital I&C Modelling for PSA</i>	Upcoming
		<i>Application of operating experience from the OECD/NEA Database Projects to PSA **</i>	Upcoming
	New and advanced reactors	Proc. Symposium on PSA for Reactors of Singular Designs	Downloadable 
		Treatment of uncertainties for novel aspects of risk analyses	Preprint
		<i>Passive systems performance and reliability with the WG on Analysis and Management of Accidents (WGAMA)</i>	Upcoming

* State of practice (2022) downloadable

** ICDE (CCFs), FIRE (fire incidents records), CODAP (components opex, degradation, ageing)

Status of PSA in the countries – the “Use and Development of PSA”

Periodic compilation / summary of roundtable

- 22 countries in the latest version

✓ New and updated PSA studies

✓ Development of methods and data

✓ Results of studies

✓ Applications for safety management and RIDM

- More applications of PSA in all responding countries

- Notably new is the use of PSA in design and licensing of new reactors

- Increased breadth and depth of the PSA scope

- See also: Gordon, Dang, and Roewekamp, **“Safety Goals and Risk Metrics in Probabilistic Safety Assessment: An International Overview...”**, **PSAM18, JO322**, drawn from this report

NEA CSNI/WGRISK, “Use and Development of Probabilistic Safety Assessment: An Overview of the Status as of 2024”, NEA/CSNI/R(2025)15, preprint.

Status of PSA in the countries – the “Use and Development of PSA” Responses to the survey

Belgium
Canada
China
Czech Republic
Finland
France
Germany
Hungary
India
Japan
Republic of Korea

Republic of Korea
Netherlands
Poland
Romania
Slovakia
Spain
Sweden
Switzerland
Chinese Taipei
United Kingdom
United States of America

Combinations of External Hazards

Survey

- (1) **regulatory** framework and environment
- (2) **terminology**
- (3) hazard **identification** and **screening**
- (4) hazard **assessment**
- (5) plant **response and fragility** analysis,
- (6) **modelling** of accident sequences induced by combinations of external hazards,
- (7) **risk quantification**, and
- (8) ongoing **developments and studies** (these also point to other specific challenges)

Workshop

- ✓ **PSA experience in modelling of combined hazards in several countries**
- ✓ **No new, specific modelling methods required**
 - Managing the number of additional sequences sometimes an issue
 - “Generic” event trees for hazards and bounding sequences is an effective approach
- ✓ **Risk quantification methods and formalisms from current EE PSAs are generally applicable**
- **Convolution of multivariate hazard and fragilities**
- **Aggregation of risks from correlated hazards and those from single hazards**

Survey report: NEA/CSNI/R(2024)4

Workshop/Task report: NEA/CSNI/R(2025)1 both available as preprints

Benchmark of Consequence Modelling for Level 3 PSA

Benchmark case

- Generic, fictional radiological release (simple stack release, flat terrain);
- Source term: Xe-133 (gas), I-131 (aerosol), Cs-137 (aerosol), 1-hour release;
- 12 meteorological cases (Pasquill stability class A–F, with/without rain);
- 14 logarithmically spaced distances along plume axis (183 m to 100 km).

Iterative clarification during benchmark and 3 calc. rounds to reduce user effect

Main outcomes of interest

1. Atmospheric dispersion
2. Dose assessment
3. Risk assessment

✓ Atmospheric dispersion:

- **Unstable** meteorological conditions **strong alignment** (agreement) of models
- **Stable** : **divergence and sensitivity** to model-specific parametrizations

✓ Dose divergences:

- **long-term ground shine** $\leq$ **environ. treatments**
- **Ingestion** $\leq$ **complexity of models**

✓ Risk outcomes : largest ranges

- integrate differences over dispersion, dose, and risk models.
- modelling team X model-specific risk factors

“Benchmark of Consequence Codes for Level 3 PSA”,
NEA/CSNI/R(2026)10, preprint

Benchmark of Consequence Modelling for Level 3 PSA

Modelling Teams and Models Used
(Appendix B)

Team	Software tool, version Developer
KAERI, Korea	MACCS 4.2 Developer: Sandia National Laboratories
UKHSA, UK	PACE 4.0 Developer: UKHSA (Radiation Assessments Department) (Charnock, et al., 2020)
NRG, NL	NUDOS2, 2022.3 Developer: NRG
DAE, India	COSYMA, EUR-18824, 2001
JAEA, Japan	Software tool: OSCAAR Developer: Japan Atomic Energy Agency
NRA, Japan	MACCS2-NRA Developer: MACCS2 (version 1.12) developed by Sandia National Laboratories and modified by NRA Japan (version 2018)

Team	Atmos- pheric dispersion model	Dry deposition model	Wet deposition model	Cloud gamma model	Ground gamma model	Inhalation dose model	Ingestion dose model	Early health effects model	Late health effects model

Proc. Symp. on PSA for Reactors of Singular Designs, June 2022

Background:

Lack of a broad-based, international body of experience codified in diverse standards to support the implementation and use of PSA.

- ✓ Participant consensus: **significant benefits** from PSA for reactors and facilities of singular design
- ✓ **risk-informing design: developing the PSA iteratively with the design** (in addition to use of PSA to confirm or verify the compliance of a design against risk targets)
- ✓ **Current PSA methodologies generally applicable**
 - resources and guidance to support the development of PSAs (listed in summary/proceedings)

□ Key technical challenges

- **initiating event** identification and quantification
- development of **data for novel SSCs** or SSC deployed into new environments
- qualification and validation of **codes** (thermal-hydraulic “transient” & severe accident codes)
- **human reliability analysis**: digital or remote control rooms, long time windows
- **passive systems reliability.** => subsequently addressed in WGRISK/WGAMA/EASI-SMR March 2026 WS

“Joint NEA – IAEA International Symposium on Probabilistic Safety Assessment for Reactors of Singular Designs”, NEA/CSNI/R(2024)3, www.oecd-nea.org/jcms/pl_119375

Coming soon and the current programme of work

Activities to be completed soon

- DIGMORE – A realistic comparative application of DI&C Modelling Approaches for PSA – final report of the exercise (benchmark) in preparation
- Passive Systems Performance and Reliability
 - March 2026 WS, Paris: Workshop Summary and Task Report
- Application of OpEx from the OECD/NEA Database Projects to PSA
 - May 2026 WS, GRS, Garching: Workshop Summary and Task Report

New tasks

- Dynamic PSA – Preparing for the future (*preprint available*)
 - ➡ Dynamic PSA Benchmark and Guidance/Practice
 - ➡ Topical Opinion Paper

Getting information

The “working methods” of WGRISK

- ✓ Surveys
- ✓ Workshops and Specialist Meetings
- ✓ Comparative analyses and benchmarking (increasingly)
- ✓ Technical reports, state-of-the-art reports, technical opinion papers
- ✓ Cooperation with other working groups

If you are in one of the countries that are members of or participating in the

- Committee on the Safety of Nuclear Installations (CSNI),
- Committee on Nuclear Regulatory Activities (CNRA)
- And their working groups

Contact the NEA Secretariat (Yuji Kumagai) with one of the authors in copy

- ☐ To request our preprints and other reports
- ☐ To participate in our task groups, which are open to organizations within the member and participating countries.

From 2027

WGRISK Chair: Josh Gordon (UK ONR)

Vice-chairs: Attila Bareith (NUBIKI), V.N. Dang (PSI)

WGRISK Reports

- NEA CSNI/WGRISK, ***“Use and Development of Probabilistic Safety Assessment: An Overview of the Status as of 2024”***, NEA/CSNI/R(2025)15, www.oecd-nea.org/nsd/docs/indexcsni.html, OECD NEA, Paris (in publication 2026).
- J. Gordon, V. N. Dang and M. Roewekamp. ***“Safety Goals and Risk Metrics in Probabilistic Safety Assessment: An International Overview from the OECD NEA CSNI WGRISK”***, PSAM18 JO322 (*this conference*)
- NEA CSNI/WGEV and WGRISK. ***“Combinations of External Hazards – A Survey on Hazard and Impact Assessment and Probabilistic Safety Analysis (PSA) for Nuclear Installations”***, NEA/CSNI/R(2024)4, www.oecd-nea.org/nsd/docs/indexcsni.html, OECD NEA, Paris (in publication 2026).
- NEA CSNI/WGEV and WGRISK ***“Proc. of the Int’l Workshop on the Safety Assessment of Nuclear Installations for Combinations of External Hazards”***, NEA/CSNI/R(2025)1, www.oecd-nea.org/nsd/docs/indexcsni.html, OECD NEA, Paris (in publication 2026).
- NEA CSNI/WGRISK. ***“Dynamic PSA Methodologies – Preparing for the Future”***, NEA/CSNI/R(2025)14, www.oecd-nea.org/nsd/docs/indexcsni.html, OECD Publishing, Paris (in publication).
- NEA CSNI/WGRISK. ***“Joint NEA – IAEA International Symposium on Probabilistic Safety Assessment for Reactors of Singular Designs”***, NEA/CSNI/R(2024)3, www.oecd-nea.org/jcms/pl_119375, OECD NEA, Paris (2026).
- NEA CSNI/WGRISK. ***“Treatment of Uncertainties for Novel Aspects of Risk Analyses”***, NEA/CSNI/R(2025)20, www.oecd-nea.org/nsd/docs/indexcsni.html, OECD NEA, Paris (in publication 2026).
- NEA CSNI/WGRISK. ***“Benchmark of Consequence Codes for Level 3 PSA”***, NEA/CSNI/R(2026)10, www.oecd-nea.org/nsd/docs/indexcsni.html, OECD NEA, Paris (in publication) 2026.
- NEA CSNI/WGRISK. ***“Status of Practice for Level 3 Probabilistic Safety Assessments”***, NEA/CSNI(2018)1, www.oecd-nea.org/jcms/pl_19842, OECD NEA, Paris (2022).

- References in dark blue – download links
- Light blue – in publication: contact the NEA Secretariat (yuji.kumagai@oecd-nea.org) or the authors.
- Index of CSNI reports: www.oecd-nea.org/nsd/docs/indexcsni.html



Thank you for
your attention!

NEA Secretariat

Yuji.Kumagai@oecd-nea.org

vinh.dang@psi.ch

marina.roewekamp@grs.de

bareith@nubiki.hu