



**NARSIS**

**New Approach to Reactor Safety Improvements**

## **WP6: Dissemination and Communication activities**

### **Del6.16 – Education and training materials**



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PU	Public	<b>X</b>
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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## **1 Executive Summary**

This report lists and describes the education and training materials prepared for the NARSIS Workshop “Training on Probabilistic Safety Assessment for Nuclear Facilities” hold on September 2-5, 2019 at the Warsaw University of Technology in Poland.

These materials are public and can be downloaded from the NARSIS website.

## 2 Introduction

The NARSIS project pursues dissemination and communication activities. Some of the missions of these activities are (i) to raise awareness of the project and ensure widespread dissemination, exploitation, take up in practice and mainstreaming of the project research and results and (ii) to provide a continuous resource for communities (scientific, professionals, etc.) involved in Nuclear Safety-related issues and risk management. In order to fulfil these objectives, the organisation of two international workshops has been planned: one at project mid-course and another one at the end of the project as workshops are a good knowledge dissemination means.

The [NARSIS Workshop “Training on Probabilistic Safety Assessment for Nuclear Facilities”](#) was the first workshop organised in that context. The workshop was held on September 2-5, 2019 at the Warsaw University of Technology in Poland. It was structured with a Summer School-type format targeting students and young researchers. Its aim was to introduce the State-of-the-Art Probabilistic Safety Assessment (PSA) methods and tools dedicated for nuclear installations by providing background and understanding of modern PSA approach. Its main objectives were (i) to reinforce the concepts involved in nuclear safety and (ii) to contribute to a growing awareness on the current needs for improved nuclear safety.

As part of this workshop, NARSIS Partners prepared education and training materials adapted to the workshop’s target audience (Master and PhD students, young professionals, people starting a career in various field of PSA for nuclear facilities). This report lists and describes these materials.

### 3 Education and training materials

Keynotes, specialized lectures and lectures were proposed within the framework of the workshop as well as a short practical session on the basic Bayesian network theory.

All the content presented below are available to download on the NARSIS Website:

<http://www.narsis.eu/page/warsaw-workshop-education-and-training-materials>

#### 3.1 Lectures, Keynotes and Specialized lectures

##### Lectures

The lectures were structured around the Work Packages (WPs) activities of the Project with two collective lectures prepared per WP.

NARSIS Project WPs	Lectures' Title and Authors
<b>WP1: External Hazards Characterization</b>	Introduction to external hazard events - Background, parameters, and interactions J. Daniell (KIT)
	Modelling external hazards: <ul style="list-style-type: none"> <li>➤ Extreme value modelling H. Winter (EDF Energy UK)</li> <li>➤ Example of application of the French directive for Basic Nuclear Installations (BNI) V. Bacchi (IRSN)</li> </ul>
<b>WP2: Fragility assessment of main NPPs critical elements</b>	Identification of critical elements within NPPs (screening and ranking methods) A. Volkanovski & A. Prošek (JSI)
	Methods for the derivation of fragility functions P. Gehl (BRGM), K. Kowal & S. Potempski (NCBJ), M. Marcilhac-Fradin & Y. Guigueno (IRSN), I. Zentner (EDF) and M.C. Robin-Boudaoud & M. Pellissetti (FRAMATOME)
<b>WP3: Integration and safety analysis</b>	Latent weaknesses and root causes in the feedback of operating experience programmes M. Dusic (NUCON)
	Uncertainties and risk integration J. Rohmer (BRGM), V. D. Mohan, S. Abrishami, P. J. Vardon (TU DELFT), P. Gehl (BRGM), P. van Gelder, Eric Chojnacki (IRSN)
<b>WP4: Applying and comparing various safety assessment approaches on a virtual reactor</b>	Metamodels for reducing computational costs in probabilistic safety analyses J. Rohmer (BRGM), C. Feau (CEA), G. Rastrello (CEA), I. Zentner (EDF)
	Severe accident assessment with uncertainty and sensitivity analysis L. Štrubelj (GEN Energija)

<b>WP5: Supporting Tool for Severe Accident Management</b>	Severe accident phenomenology and management principles of severe accident risk analysis P. Darnowski & P. Mazgaj (WUT)
	Principles of severe accident risk analysis I. Bašić (APOSS)

### **Keynotes & Specialized Lectures**

In addition to lectures, the following keynotes and specialised lectures were also proposed:

- **Safety vs Security** – B. Bazargan-Sabet (BRGM)
- **Risk Assessment Using Bayesian Approach** – A. Gupta (CNEFS)
- **Nuclear Power Plant Accidents** – A. Duchac (IAEA)
- **PSA: Main Elements and Role** – I. Vrbanic (APOSS)
- **Human Factors** – J. Johnson (FORATOM)

### **3.2 Practical session**

This session covered some basic Bayesian network theory, provided an example problem, and partly solved it in the software program “Netica”. The exercise and solution files are provided.

## **4 Conclusions**

The education and training materials presented in this report is available through the NARSIS website and the NARSIS Consortium intends to distribute them widely.

These education and training efforts will be further strengthened with the Final Workshop planned at the end of the project (around May/June 2021). The audience will be stakeholders and people from regulation in order to obtain feedbacks on NARSIS outcomes.