



## How to assess the probabilistic safety and reliability of combined nuclear-chemical plants?

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Global economic trends are focused on the reduction of CO<sub>2</sub> emissions wherever possible. Although electricity production is often considered its main source, most of the CO<sub>2</sub> emitted to the atmosphere comes from the industrial heat used in chemical processes. To overcome this issue, the implementation of nuclear High Temperature Gas-cooled Reactors (HTRs) within the chemical plants is considered. Integration of the nuclear and non-nuclear units raises a question on how to assess the probabilistic safety and reliability of such combined nuclear-chemical (Nuc-Chem) facilities.

In general, two alternatives of the safety assessment process can be considered: (a) separation of analysis for the nuclear and chemical plants reviewed by different regulatory bodies, and based on separate safety reports, where the impact of the near plants is treated as a set of specific external hazards, or (b) integration of the procedure, where the licensed plant is defined as a combined Nuc-Chem facility and the decision is made by a joint committee including nuclear and chemical experts based on integrated risk assessment.

Recently, the latter was proposed for application within the Polish chemical plants that are planned to be equipped with HTGRs [1]. A general framework for such analysis of the Nuc-Chem facilities has been defined concerning the different levels of advancement of the nuclear Probabilistic Safety Assessment (PSA) and the chemical Quantitative Risk Assessment (QRA) methodology. The idea was to take advantage of using the specific techniques for the nuclear and chemical plants. According to this approach, at the first stage both installations must be analysed separately, while the second phase is devoted to including all the interfaces. This also means that various advancement levels of PSA and QRA in specific aspects of risk analysis can cause some issues. On the other hand, it is a consequence of the specialization of both methods, which gives some advantages as well. The general framework proposed in this work proceeds according to the following steps:

1. Identification of postulated initiating events (PIE) for both nuclear and chemical plants.
2. Identification of systems, structures, and components (SSC) affected by the PIE immediately or with delay.
3. Identification of all possible interactions between the nuclear and chemical SSCs, including:
  - internal interactions within nuclear plant,
  - internal interactions within chemical plant,
  - directional nuclear → chemical interactions.
  - directional chemical → nuclear interactions.
4. Specification of the time frames for the Nuc-Chem facility to remain in certain conditions.
5. Identification of all safety functions to be performed in each of the time frames and calculation failure probability.

The analytical process is shown in Fig. 1 and can be implemented using the Dynamic Bayesian Networks. This concept has many advantages, among which the most important is possibility of modelling of a wide spectrum of failures sequences, including both nuclear and chemical parts of the installation, in response to the initiating event that occurred in one of them. Several benefits of the postulated approach to the Nuc-Chem can be emphasised, three of which are dominant:

- Reduced uncertainty of the unanticipated protection failure scenarios due to the knowledge gained from modelling nuclear-chemical interfaces and external hazards, including their cascades and correlations.
- Improved risk-informed decision-making, preventing acceptance of decisions optimized for a single part (nuclear or chemical) of the Nuc-Chem facility that would adversely affect the risk measures of the other.
- Increased potential for multi-parameter optimisation of the production processes in terms of the reliability, availability, and maintainability aspects when jointly considered for both nuclear and chemical plants.

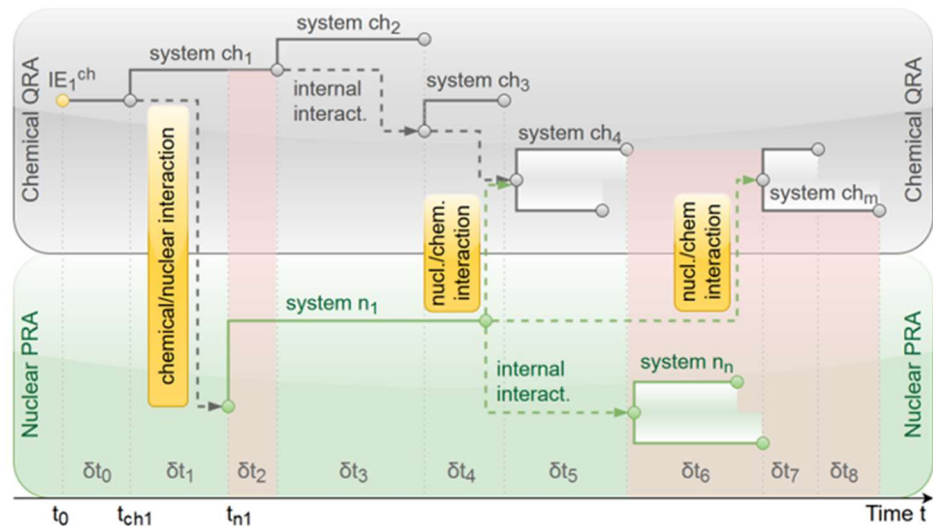


Fig. 1. Integration of chemical QRA and nuclear PRA studies within the risk assessment framework for nuclear-chemical plants: IE – Postulated Initiating Event;  $n_i$  –  $i$ -th nuclear system,  $ch_j$  –  $j$ -th chemical system,  $\delta t_i$  –  $i$ -th time-frame.

#### References:

- [1]. K. Kowal, S. Potemski, Probabilistic safety and reliability studies toward licensing and deploying HTGR technology in the Polish chemical industry, Nuclear Engineering and Design 424 (2024) 113244, <https://doi.org/10.1016/j.nucengdes.2024.113244>

## 45<sup>th</sup> ESReDA GA and the election of a new Board of Directors 30 MAI 2024, University of Bilbao (ESPAGNE)



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ESReDA held its 45<sup>th</sup> Ordinary General Assembly on the 30 May, in the University of Bilbao (Spain), during the 64<sup>th</sup> ESReDA Seminar events. The periodic renewal election of the BoD was conducted, and the new BoD composition is given in the following.

#### The composition of the BoD elected in 2022:

President	: Mohamed Eid	(FR)
Vice President	: Claude Degrave	(FR)
General Secretary	: Antonio Guillèn	(SP)
Treasurer	: Micaela Demichela	(IT)



Antonio J. Guillén  
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Members	Nicolas Dechy	(FR)
	Siegfried Eisinger DNV	(NO)
	Karol Kowal	(PL)
	Kaisa Simola	(NL)
	John Stoop	(NL)
	Inga Šarūnienė	(LT)
	Tomasz Nowakowski	(PL)

**The composition of the new BoD elected in 2024:**

President	: Mohamed Eid	(FR)
Vice President	: Vytis Kopustinskas	(IT)
General Secretary	: Antonio Guillén	(SP)
Treasurer	: Micaela Demichela	(IT)



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Members:	Julien Baroth	(FR)
	Manuel Chiachio	(SP)
	Alaa Chateaneuf	(FR)
	Nicolas Dechy	(FR)
	Siegfried Eisinger	(NO)
	Tomasz Nowakowski	(PL)
	John Stoop	(NL)



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ESReDA would like to gratefully thank Kaisa Simola, Claude Degrave, and Inga Šarūnienė for the precious contributions and infallible support over many long years.

As for Karol Kowal who is staying active in ESReDA community, ESReDA wishes to get him back in the BoD once again, soon.

ESReDA would equally thank all ESReDA members for the active contributions and support which are the real reasons for ESReDA ever lasting success.

## Forthcoming ESReDA Seminars

### The 65<sup>th</sup> ESReDA Seminar



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#### 65<sup>th</sup> ESReDA Seminar

**From risk imagination to safety intervention - Managing risks with knowledge, 14-15 November 2024, National Center for Scientific Research “Demokritos”, Athens, Greece**

ESReDA’s ‘Risk, Knowledge, Management’ (RKM) project group (PG) addresses the intricate relationships between risk, knowledge and management, aiming to find new ideas for preventing accidents and improving safety management with better use of knowledge. The RKM PG organises the 65th ESReDA seminar to foster an exchange of ideas and expert debate. The National Centre of Scientific Research Demokritos in Athens will provide the forum.

ESReDA’s “Risk, Knowledge, Management” (RKM) project group (PG) addresses the intricate relationships between risk, knowledge and management, aiming to find new ideas for preventing accidents and improving safety management with better utilization of knowledge. The RKM PG wishes to organize the 65th ESReDA seminar to foster an exchange of ideas and experts’ debates. The NCSR Demokritos in Athens will provide the forum.

The 65th ESReDA Seminar follows the successful 58th ESReDA Seminar on “Using Knowledge to Manage Risks and Threats: Practices and Challenges”, organized by JRC Institute of Energy (Petten, the Netherlands) and held virtually in June 2021 during Covid-19 pandemic period.

Though we are told we live and work in “information and knowledge” society, preventing accidents and enhancing resilience, through the use of relevant safety knowledge and expertise is not granted and requires continuous efforts to overcome the hurdles in an “age of uncertainty”.

The main objective of this forthcoming seminar is to identify the enablers and barriers to the production of knowledge concerning safety risks and resilience and to its effective use in decision-making and other management and operational activities. The key problematic question we will ask is: “What do a management team, a regulator and a front-line worker need to know and is able to use to manage risks effectively?”.

The purpose of the seminar is to reflect upon the following topics:

- Organisational characteristics that promote the ability to invest in identifying new threats, in imagining risks in a context of uncertainty.
- Tools and frameworks that facilitate evidence-based decision-making and effective safety interventions.
- Individual and collective capabilities and non-technical skills relevant to the sharing of information (including inconvenient truths) between the sharp end of operations and the blunt end where systems are designed; plans, schedules and standards are established, trade-offs are made, and resources are allocated.
- Anticipating and managing the information and knowledge that will be needed at different stages of the system life cycle, evidencing the added value of building synergy between safety and knowledge management.
- Recognising and rewarding the diverse types of expertise needed to identify early warning signs, interpret observations, analyse data, communicate information, and preserve knowledge.
- Specific challenges to ensure that valid information, relevant knowledge, ‘proofs’ but also ‘doubts’ are available to regulators, the justice system, the media, and the public.
- Technological innovation for risk knowledge management to improve safety and resilience analysis.
- Democratisation of knowledge through participatory approaches and accessibility of information to non-specialists
- Combination and usage of distributed knowledge in complex risk scenarios for crisis management.
- The importance and the role of technology to analyse and to manage adequately risk knowledge as well as to communicate it effectively.
- The role of culture in risk management and the importance of risk communication.

The 65th ESReDA seminar will be a forum for exploring the above mentioned and other related questions. We aim to discuss theories, concepts, and experiences of enhancing the use of knowledge for better risk analysis, management and governance. Authors are invited to present their research and operational proposals and raise challenges, but also to discuss successes and failures in enhancing risk management through better use of risk knowledge. We want to encourage new ideas, scientific papers, conceptual papers, case studies and cross-sectoral and inter-disciplinary research on the theme of challenges and practices for using knowledge in risk and resilience analysis, management, and governance. This seminar will bring together researchers, practitioners, specialists and decision-makers to discuss strategies and practical experiences.

### **ESReDA Project Group on Risks, Knowledge and Management**

In 2020, ESReDA launched a project group to address the relationships between risks, knowledge and management. The scope defined is of interest to system designers, operators, managers, maintenance, lawyers, insurers, regulators, and many others working on safety and security including natural hazard management. The scope covers the safety, reliability and security related to multiple hazards and threats (natural, high-risk industry, critical infrastructure, communication and transport systems over different territories etc.) involving all stakeholders (public, operators, regulators and government).

Risk management integrates all activities and disciplines related to assessment, identification of early warning signs and emerging risks, foresight, investigation of events and lessons to be learned, management of barriers and lines of defence, reliability, and change of policies and culture. In this context, the keyword knowledge defines the main topic of the project: the endeavour to use knowledge to improve the management and governance of risks (from design to operation and dismantling/decommissioning).

**The Seminar is jointly organised by ESReDA and NCSR DEMOKRITOS.**

**Location:**

National Centre of Scientific Research DEMOKRITOS, Athens, Greece. Patriarchou Grigoriou and Neapoleos str. 15310, Agia Paraskevi.

The program will soon be available on ESReDA site. The call for papers with more practical details is available on ESReDA website following link:

[https://www.esreda.org/event/65th-esreda-seminar-november-14th-15th-2024-ncsr-demokritos-athens-greece/?instance\\_id=62](https://www.esreda.org/event/65th-esreda-seminar-november-14th-15th-2024-ncsr-demokritos-athens-greece/?instance_id=62)

## The 66<sup>th</sup> ESReDA Seminar



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### 66<sup>th</sup> ESReDA Seminar

**Transformative safety and resilience models in a smart digital and sustainable world**  
**May 22th - 23th, 2025, University of Salento, Italy**

#### **Brief description**

Several factors are contributing to increase dynamism and complexity of current approaches to prevent accidents and to guarantee business continuity: one critical factor to evaluate is the massive diffusion of digital technologies, which is forcing the adoption of new models to prevent accidents and to support more effective resilience models. Briefly, from one side, digitalization is characterized by a transformative potential mainly oriented to improve operational performance, reduce accidents and increase system reactivity through several ways. One example could be related to the enabling effectively the potential of acquiring in real time and huge quantity of safety data – also related to early warning signals – which will be treated and analysed by AI models for extracting knowledge to prevent accidents. New risk management models and approaches are, thus, required. Moreover, from another side, digitalization is the source of new emerging risks, e.g. due to the massive use of intelligent robotics systems interacting directly with humans (like collaborative robots), to the use of decision support systems (e.g. based on algorithmic management) that provide automatic feedback to humans, e.g. workers as well as safety managers and/or analysts.

Similar conditions could be outlined in the resilience field, where digital technologies are contributing to increase also forecast capabilities and preparedness in complex systems, like critical infrastructures and complex organizations, thus transforming traditional approaches, tools and organizational models. Digital technologies could help to apply more proactive methods, e.g. to predict insight of what in the process can go wrong because of internal or external disruptive disturbance. In addition, the increasing attention towards sustainability issues is transforming safety and resilience approaches by adding new factors and impacts to be evaluated in an effective and holistic way.

Knowledge and experiences about these topics will be shared in a seminar organized by ESReDA and University of Salento from 22th to 23th May 2025 in Lecce (Italy). This seminar is aimed at addressing current and future challenges, tools and new approaches for accompanying the digital and the sustainable transformation in safety and resilience models applied in complex systems.

The first call for paper will be available on [ESReDA](https://www.esreda.org) website by the beginning of October 2024.



### The 64<sup>th</sup> ESReDA Seminar



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### 64<sup>th</sup> ESReDA Seminar on Digital Maintenance in the Digital Twin Era.

30-31 May 2024, Universidad de Deusto, Bilbao – Spain.

**Digital Twins (DT) technology** has become indispensable for understanding and deciphering the utility of current developments, unlocking the potential of digital transformation.

It operates like the keystone in an arch, seamlessly bringing together diverse elements of digital technologies and modeling techniques. This synergy creates a unified structural entity, crucial in the emergence of new and complex System of Systems (SoS) structures.

One of the most significant areas where this transformation is expected to make waves is **Digital Maintenance**. Analyzing how maintenance can benefit from this evolution is essential. The advent of new technologies has made the maintenance landscape more intricate, requiring efficient management of vast information and predictive alarms within dynamic schedules.

However, the complexity of the maintenance management process often hampers the technology's impact on organizations. Conventional maintenance practices persist, causing delays in embracing digitalization and hindering the expected return on investment for companies undergoing the digital transformation effort.

Furthermore, **the role of individuals in the context of maintenance digitalization** is critical. Embracing digital transformation offers an opportunity for human evolution, leveraging the expertise and experience of employees in the new digital environment. This provides a competitive edge in driving innovation and technological progress.

Join us at the 64th ESReDA seminar, where researchers, practitioners, and experts from various disciplines converge to share insights and advancements in the realm of digital maintenance and its relationship with digital twins, complex systems, and human resources. Topics include, but are not limited to:

1. Advancements of Digital Twins in Complex Systems Generation.
2. Current Barriers in Implementing Technologies for Real Maintenance Evolution.
3. The Role of Human Resources in the Context of Digital Maintenance and Digital Twins.

**Bilbao, Spain**, hosted the 64th ESReDA Seminar on **May 30th and 31st, 2024**. Nestled along the Nervión River, Bilbao seamlessly blends rich history with cutting-edge architecture, epitomized by the iconic Guggenheim Museum designed by Frank Gehry. Participants will have the chance to immerse themselves in the lively Old Town, savor exquisite Basque cuisine, and explore a city that exudes charm at every turn. Join us for an event that marries knowledge exchange with the cool vibe of Bilbao.

**The 64<sup>th</sup> ESReDA Seminar final proceedings is in processing and will be soon issued.**





## The 64<sup>th</sup> ESReDA Seminar - DOCTORAL WORKSHOP



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### 64<sup>th</sup> ESReDA Seminar on Digital Maintenance in the Digital Twin Era.

#### DOCTORAL WORKSHOP PLUS SESSIONS OF EXPERTS AS A FORMULA FOR SUCCESS AT THE 64TH ESREDA SEMINAR IN BILBAO

30-31 May 2024, Universidad de Deusto, Bilbao – Spain.

The 64th ESREDA Seminar plus Doctoral workshop, which took place on May 30th-31st, 2024 at the University of Deusto in Bilbao, Spain, focused on digital maintenance in the era of digital twins. The technical committee, led by Dr. Antonio Guillen, Dr. Aitor Goti, Drs Manuel and Juan Chiachio, Dr Antonio Sanchez and Prof. Adolfo Crespo considered necessary to have a common room for the exchange of experiences and expectations of young researchers and expert practitioners.

The seminar plus workshop was attended by over 60 people and explored the challenges and opportunities associated with integrating new technologies, such as digital twins, into traditional maintenance practices. It brought together researchers and practitioners from various fields to share their insights on how to overcome these challenges. The seminar covered topics such as digital twins, complex systems, and human resources.



The seminar aimed to bring together researchers, practitioners, and experts from various disciplines to share their insights and advancements in the realm of digital maintenance and its relationship with digital twins, complex systems, and human resources. The event intended to provide a vision of digital maintenance once the foundational technologies (AI, predictive analytics, digital twins, IoT, cloud/edge/fog computing, etc.) had reached a sufficient degree of maturity. This vision facilitated drawing conclusions on the approaches needed to overcome current barriers that limited the full development of digital maintenance, particularly in assets and systems with a low level of digitization. During the seminar, participants had the opportunity to share experiences in applying different

technologies to improve maintenance, review the state of the art of these technologies, and evaluate their real impact on organizations and the evolution of their maintenance models.

As well, the doctoral workshop delved into the intricacies of digital twinning, encompassing both theoretical underpinnings and practical applications. It provided a rigorous exploration of the field, ranging from fundamental concepts and diverse applications to advanced computational techniques and probabilistic treatments.

The fascinating seminar plus workshop will result in a series of proceedings of the presentations that took place in Bilbao last June. The process of elaboration of these proceedings will activate in September and the proceedings will be published during autumn.

## The 63<sup>rd</sup> ESReDA Seminar

### Resilience assessment: Methodological challenges and applications to critical infrastructures 25-26 October 2023, JRC, Ispra – Italy.



Chairwoman

Kristine VLAGSMA  
(European Commission,  
Joint Research Centre)

Research in resilience of infrastructure systems has been constantly increasing during the last decade and is expected to grow further. Resilience applications in technical systems domain have evolved most significantly during the last two decades and the term resilience has already been transferred to the policy domain, as the Directive on the Resilience of Critical Entities (CER Directive) went into force in January 2023 and replaced the Critical Infrastructure Directive, published in 2008.

Two fundamental points in resilience domain to be addressed by the Seminar are:

- The methodological development of resilience assessment from a conceptual framework to modelling approaches.
- The metrics for resilience assessment and development of quantitative tools for decision making.

The 63<sup>rd</sup> ESReDA seminar explored these points and other related questions. We discussed theories, concepts, and experiences of resilience assessment methodologies and applications.

Authors were invited to present their proposals and discuss successes and/or failures and to identify future needs in resilience research. We wanted to encourage new ideas, scientific papers, conceptual papers, case studies and cross-sectoral research on this topic with examples and applications of infrastructures exposed to both technological and natural threats, hazards.

The seminar brought together some 50 researchers, practitioners, and decision-makers. While some 25 papers and invited keynotes were presented.



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## The 62<sup>nd</sup> ESReDA Seminar

### The 62<sup>nd</sup> ESReDA Seminar on Managing the unexpected: designing systems to embrace disorder for increasing asset reliability

April 12<sup>th</sup> – 13<sup>rd</sup>, 2023, University of Twente, the Netherlands [62<sup>nd</sup> ESReDA Seminar](#)

Dealing with complex systems has certain characteristics that require consideration to be managed successfully. Understanding and dealing with unexpected events and the unknown are major challenge in asset management.

Unexpected drifts from normal working conditions pose several concerns about the decrease in safety levels as well. Despite the enormous changes and developments in the industry in the last decades as ‘an unprecedented fusion between and across digital, physical, and biological technologies’, approaches for



Alberto Martinetti



guaranteeing comparable safety and reliability improvement do not evolve quickly enough to offer adequate solutions in managing the mentioned complexity.

Complex assets require a different approach to dealing with unpredictable events and disorder. Consequently, it appears necessary, during the design phase of a complex system, to use tools and techniques for both withstanding stress and becoming stronger but without the necessity of predicting every circumstance. Reliability professionals are in need for 'antifragile' methods for embracing disruptive situations and unknowns.

The seminar was attended by more than 20 experts from academia and industry. They discussed the application of concepts, the state of the art and current developments in contingency management in complex systems, as well as new techniques and methodologies and their strengths, weaknesses and uncertainties to improve reliability.



## ESReDA members' running projects

### Medelia Chair: Probabilistic fatigue analysis of steel structures



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The ageing of structures in France and around the world means that plant managers have to choose between several scenarios: extending their service life on an unchanged basis, repairs, reinforcements, or even complete replacement. The financial stakes are often very high, given manufacturing and construction costs, as well as operating losses during shutdowns. As a result, plant managers need as much information as possible to assess the residual service life and level of risk associated with each of the above scenarios.

In this context, the Medelia Chair, sponsored by SPRETEC [1] (Artelia Group [2]), created by the Foundation Grenoble INP [3], aims to improve the safety and durability of hydraulic structures. It will focus on the study of steel welded connections in non-standard engineering structures such as hydroelectric power plants and dams. The Chair's researchers will be working on new fatigue calculation methods to improve models for predicting the service life of structures. This work will enable more accurate estimates of damage and service life, helping managers to make informed decisions.

Julien Baroth, associate Pr. at Grenoble-Alpes Univ., co-holder of this chair, has recently presented it during the 63th ESReDA seminar in the JRC Ispra (IT), he will contribute to the project group « Resilience Assessment of Critical Infrastructure ».

A thesis began in November, directed by Julien Baroth, 3SR [4], and Rafael Estevez, SIMAP [5], same university, with doctoral student Kamal Harb, entitled "Probabilistic fatigue analysis of mechanically-welded steel structures".



- [1] <https://www.spretec.fr/>
- [2] <https://www.arteliagroup.com/>
- [3] <https://fondation-grenoble-inp.fr/en/>
- [4] <https://3sr.univ-grenoble-alpes.fr/en/3sr-lab>
- [5] <https://simap.grenoble-inp.fr/en/about-simap>



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## Horizon EU Project: BAG-INTEL

### An intelligent system for improved efficiency and effectiveness of the customs control of passenger baggage from international flight arrivals

By Klaudia dos Santos, BAG-INTEL's Communication and Dissemination Lead, Martel Innovate

Today, we also shed light on [BAG-INTEL](#), a 36-month Horizon Europe Research and Innovation Action in the domain of border security, which kicked off in September 2023. The project brings together a diverse team of 24 partners from 8 European countries, including industrial players, universities and research organizations, consultancy and advisory firms, ministries, and customs, tax, and civil authorities, who have come together to develop innovative tools, which will increase the effectiveness and efficiency of baggage customs controls at airports without the need of involving extra human resources.

#### Context and operational scenario

While the security scanning of outgoing luggage is well-developed, the customs scanning of incoming luggage is not full-fledged. The utilization of external data for luggage risk assessment is also not exploited to its full potential for customs controls. Furthermore, the current state-of-the-art in luggage reidentification has several drawbacks:

Tags must be manually placed in or on the suspect luggage and then removed before the traveller leaves the customs area following the manual inspection of their luggage to ensure they do not face another inspection the next time they travel with the same bag.

The smugglers may realize their luggage has been tagged and remove the tags before entering the customs area, thereby hindering the reidentification and capturing process.

While some airports apply radio-frequency identification (RFID) tagging for the customs reidentification of luggage, the RFID tags might damage the bag during their removal.

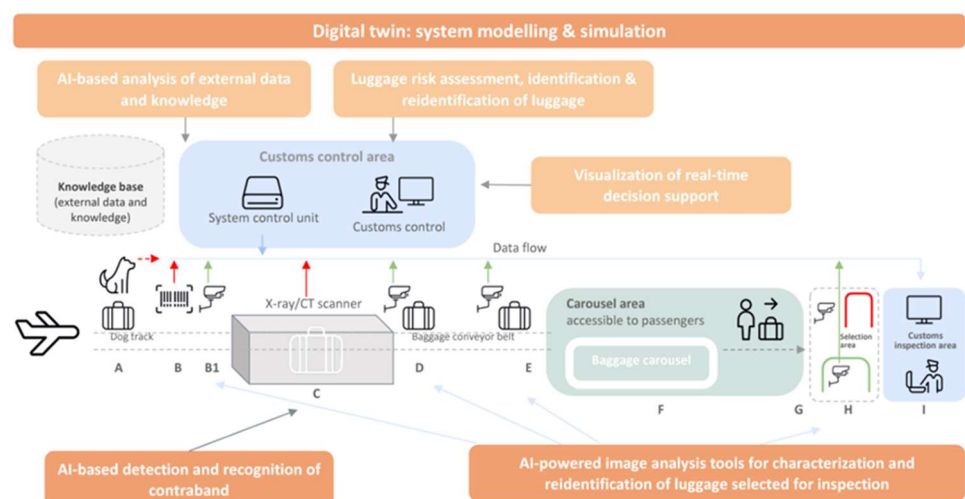
The current process has a relatively high operational and maintenance cost due to the manual labor involved, as well as an environmental impact caused by the production and immediate disposal of tags.

#### The BAG-INTEL solution

Addressing the limitations and drawbacks of the current processes, BAG-INTEL aims to enhance the effectiveness of the customs control of passenger baggage through several features and capabilities, including:

- an AI-powered functionality for enhanced contraband detection in X-ray scanning of incoming luggage,
- an AI-powered risk assessment based on external data analysis,
- an AI-camera-based end-to-end reidentification of luggage, and
- a digital twin for system visualization and performance optimization.

The '**BAG-INTEL system overview**' shown in Figure 1 illustrates the solution under development.



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Upon flight arrival, as the incoming luggage is unloaded and placed on the conveyor belt, the customs risk of each piece of baggage is assessed using AI-supported tools under the supervision of the customs control officer(s). The applied risk indicators come from 4 sources:

1. The external data and knowledge, such as the Passenger Name Record and the databases of Law Enforcement Agencies, which record suspicious travel patterns and links to organized crime.
2. An X-ray/CT scanner with absorption sensing and object recognition in the scanning image, which will be trained to detect various kinds of contraband.
3. The customs control officer(s) who may notice suspicious content, which has not been flagged by the scanner.
4. The dog handler input (if the customs team applies a sniffer-dog track before the X-ray/CT scanner).

The risk indicator data from all sources is then integrated into an overall risk assessment, based on which a decision whether the luggage should be manually inspected is taken.

In summary, **BAG-INTEL aims to enhance customs control processes so that more contraband is detected and the cases of unnecessary manual inspections not leading to finding contraband decrease.** The objective is to reduce false positives and flag only the pieces of luggage, which contain contraband. Because the manual inspections will focus on all, and only, suspect bags, more contraband will be captured without the need to involve extra human resources in the process. Furthermore, **the proposed AI-camera-based luggage reidentification is non-intrusive, eliminating the drawbacks of currently used methods.**

The 1<sup>st</sup> Newsletter is available at the following link:

<https://preview.mailerlite.io/preview/722703/emails/112712910042563859>

Project website: [www.bag-intel.eu](http://www.bag-intel.eu)

email: [info@bag-intel.eu](mailto:info@bag-intel.eu)

[LinkedIn](#)

X: [@BAGINTEL](#)

Project videos: [www.bag-intel.eu/videos](http://www.bag-intel.eu/videos)

**BAG-INTEL**

**Type of action: HORIZON-RIA**

**Call: HORIZON-CL3-2022-BM-01**

**Topic: HORIZON-CL3-2022-BM-01-04**

**Grant Agreement No.: 101096649**

<https://www.bag-intel.eu/>

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## ESReDA Project Groups – News



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### ESReDA Project group on Resilience Assessment of Critical Infrastructure

The ESReDA project group on Resilience Assessment of Critical Infrastructure, active since June 2023, has organised two special sessions at the ESREL 2024 conference, held in Cracow, June 23-27, 2024. The special sessions are focused on resilience assessment in electricity sector (session 1) and critical infrastructures in general (session 2). The eight papers submitted are authored by the ESReDA members: JRC, University of Nottingham, Kaunas University of Technology & 'Horia Hulubei' National Institute of Physics and Nuclear Engineering (the latter two applied for ESReDA membership in 2023) and ESReDA partners: University College Dublin, German Aerospace Centre, ETH Zurich.



## ESReDA Project group on Resilience Engineering and Modelling of Networked Infrastructure

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University of Nottingham,  
UK

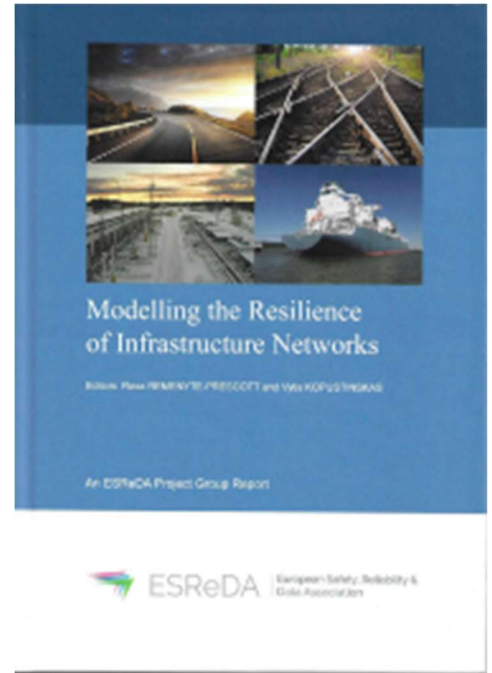
John Andrews  
University of Nottingham,  
UK

Findings from the project group have been published in a book entitled “Modelling the Resilience of Infrastructure Networks”, edited by Rasa Remenyte-Prescott and Vytis Kopustinskas.

This book is a selection of contributions written by members of the Project Group and concentrates on the themes of transportation and utilities. The papers intend to provide an insight into the state of the art of resilience modelling with a focus on Networked systems. The book is aimed at both an industrial and academic readership with interests in the resilience of engineering systems.

We would like to thank the authors for their contributions to this publication, and our colleagues at DNV for their practical support with printing and distribution.

For information on how to purchase a copy please contact [ajguillen@us.es](mailto:ajguillen@us.es) ESReDA General Secretary, Antonio J. Guillén (Ingeman, Spain).



## ESReDA RKM project group: Risk, Knowledge, and Management

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The Risk Knowledge and Management Group is continuing its activities. During the last group meeting on the 22<sup>nd</sup> of February 2023 there was a shift-over of the Group Leader from Eric Marsden to Myrto Konstantinidou and an updating on the status of the discussion papers.

Currently, we have 14 discussion papers under preparation and another 6 under discussion. One is ready to be published in June 2023 and the rest will be published eventually until February 2024. The first one is entitled “Delegation of safety oversight” and it has been prepared by Eric Marsden. We are also planning to host a workshop and ESReDA Seminar in 2024, probably in Athens.

Delegation of safety oversight is a discussion paper on Risk, Knowledge and Management (RKM). It aims to share information on ongoing work undertaken in the context of the RKM project group.

The Delegation of Safety Oversight can directly be obtained from Eric Marsden ([eric.marsden@foncsi.org](mailto:eric.marsden@foncsi.org)).

## ESReDA community recommended books



### Managing the Risks of Organizational Accidents<sup>1</sup>

Written By James T. Reason  
Recommended by Franck Verschueren

Born on May 1, 1938, James T. Reason is a distinguished psychologist known for his extensive and important work on human error and organizational safety. He graduated from the University of Manchester in 1962 and served as a professor there from 1977 until his retirement in 2001.

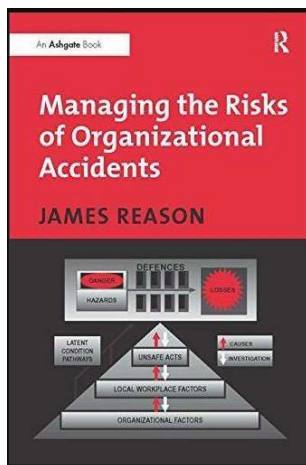
Frank Verschueren

<sup>1</sup> <https://doi.org/10.4324/9781315543543>, e-Book, Pages272, Taylor Francis edition:  
<https://www.taylorfrancis.com/books/mono/10.4324/9781315543543/managing-risks-organizational-accidents-james-reason>



Reason is renowned for developing the Swiss Cheese Model, a conceptual framework for understanding how accidents occur due to multiple layers of defence failing sequentially

This book written by James Reason is without discussion a phenomenal work that digs into the causes and prevention of major accidents in high-technology systems<sup>2</sup>, e.g. the so-called Seveso industries in Europe. COMHA in the UK. This makes the book very important for Risk Management.



Reason's risk analysis concepts like latent conditions, active failures, and the Swiss Cheese Model are very adequately explained in the book. As such the book gives already a comprehensive framework<sup>3</sup> for improving safety management systems

Moreover, as Reason proposes a solution in a set of common principles to understand and limit the occurrence of such major accidents. So you have not only a description of problems but you are getting solutions as well!

The most important example in my opinion is the safety culture he promotes and discusses in Chapter 9 ("Engineering a safety culture", page 191 – 221) of his book.

The essential aspects of Reason's concept of safety culture are (inform yourself - > consequently see that people report (also bad news !) -> so everybody can learn (learning organisation) -> have therefore a just culture (opposite to blaming and a link to psychological safety) – and last aspect : to execute -> make it a flexible culture (adapt to new ideas and be able to change processes and systems).

Reason convincingly arguments that the same general principles and management techniques are applicable across various domains of major hazards sectors<sup>4</sup>, including nuclear power plants, oil exploration, chemical processes, and transportation. This gives his work a very broad applicability.

Moreover he emphasizes the importance of understanding human and organizational factors (HOF) in accident causation<sup>5</sup>.

And last but not least, Reason has provided practical tools and techniques for managing these risks.

Well known are

- His "Swiss Cheese Model" one of the first models that explained how accidents are occurring
- His introduction of "Latent failures"<sup>6</sup> in addition of active errors
- His HFACS technique that is focused on finding not only active but also latent failures
- His "Error Management concepts", that help to reduce error traps
- His "System(ic) Approach" to human error, meaning that he is considering the whole system especially including organizational factors that contribute to or facilitate human errors

What makes it a very pragmatic book !!

### **Frank Verschueren:**

MSc in chemical Engineering, 4 years Research in Catalytic reactions, Management functions, 18 years in Research, Production, Projects, Logistics, Operational, Quality, Technical support and in several sectors: non-ferrous and mining, Printing, Automotive  
Belgian Federal Process Safety Inspector Major Hazards (Seveso industry) for 20 years: Inspections, audits, accident investigations (mainly with fatalities).  
Specialised on mobbing and other psychological complaints

<sup>2</sup> This was my job and stays my passion.

<sup>3</sup> Framework ("HOFFRAM", Human and Organizational Framework) that I am developing in ESReDA projects.

<sup>4</sup> This was my working domain as (now retired) Belgium federal Seveso inspector.

<sup>5</sup> Feedback experience from my former inspection work for the Belgium Government and my on-going research at [ESReDA](#)

<sup>6</sup> Latent failures are rather vicious as they lay hidden and dormant inside the system or process but if present latent failures can trigger active failures and therefore create incidents and accidents even major ones!

Editor of inspection instruments (checklist on dangerous chemical agents, inspection instruments on Human Factors, and on Safety Governance)  
Conducting research on Accident investigation with the JRC agency.  
Presentations on events (industrial communities, unions) and courses in universities (accident investigation, reactor safety)  
ESReDA project member (“Foresight in Safety”, “Risk Knowledge and Management”) with focus on Organizational Factors and Human Factors.  
Member of Energy Institute (London, UK) in HOFCOM (Human and Organizational Factors Committee).  
Leader of the expert-group on “Safety and Security” in the Royal Flemish Engineers Association (Antwerp, Belgium)



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**From Risk to Resilience:  
Towards Sustainable Development for All in a COVID-19 Transformed World**  
**Global Platform for Disaster Risk Reduction- UN DRR**  
**Proceedings of the Seventh Session, Bali, Indonesia, 23-28 May 2022**

The Seventh Session of the Global Platform for Disaster Risk Reduction (GP2022) was a decisive moment for re-thinking our approach to managing risk. It was the first such gathering since the beginning of the COVID-19 pandemic and, despite the challenges, the Global Platform, which took place in a hybrid format, saw a record level of participation, with 5,000 participants from a total of 185 countries. It was also the most inclusive and accessible Global Platform to date, with over 200 persons with disabilities participating in person.

The outcomes of the Global Platform are captured in The Bali Agenda for Resilience. Its seven recommendations call to first, reconfiguring risk governance to ensure that management of risk is a shared responsibility across sectors. Second, funding for disaster risk reduction to be written into laws and included in integrated national financing frameworks. Third, it calls upon governments to honour the COP26 Glasgow commitments to drastically enhance financing for adaptation and resilience. Fourth, it calls for empowering those most at risk under the motto of “nothing about us without us”. Fifth, it expresses support for the call by the United Nations Secretary-General that early-warning systems cover every person on Earth within five years. Sixth, that the world applies the lessons of the pandemic to build back better, greener, and equitable. Seventh, that all Member States, regional organizations, and stakeholders robustly engage in the Midterm Review of the implementation of the Sendai Framework.

*(extracted from the introduction of Mme Mami Mizutori, Special Representative of the UN Secretary-General for Disaster Risk Reduction)*

Proceedings are available for downloading at:

<https://www.undrr.org/media/83505/download?startDownload=true>

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**Reliability of Nuclear Power Plants Methods, Data and Applications**

**Edited by André Lanoy, Abdelkhalak El Hami**

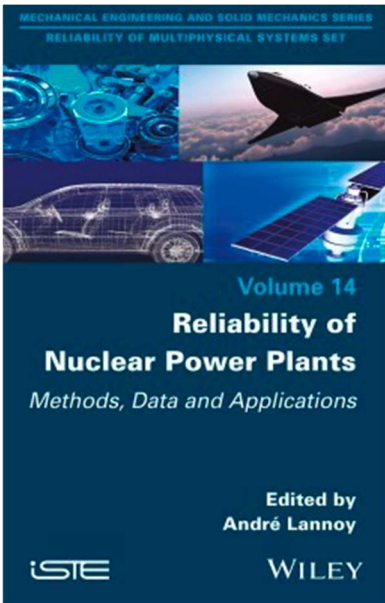


ESReDA Honoray President  
Jean-François Raffoux

Since the 1970s, the field of industrial reliability has evolved significantly, in part due to the design and early operation of the first-generation nuclear power plants.

Indeed, the needs of this sector have led to the development of specific and innovative reliability methods, which have since been taken up and adapted by other industrial sectors, leading to the development of the management of uncertainties and Health and Usage Monitoring Systems.

In this industry, reliability assessment approaches have matured. There are now methods, data, and tools available that can be used with confidence for many industrial



applications. The purpose of this book is to present and illustrate them with real study cases.

The book addresses the evolution of reliability methods, experience feedback and expertise (as data is essential for estimating reliability), the reliability of socio-technical systems and probabilistic safety assessments, the structural reliability and probabilistic models in mechanics, the reliability of equipment and the impact of maintenance on their behavior, human and organizational factors, and the impact of big data on reliability. Finally, some R&D perspectives that can be developed in the future are presented.

Written by several engineers, statisticians and human and organizational factors specialists in the nuclear sector, this book is intended for all those who are faced with a reliability assessment of their installations or equipment: decision-makers, engineers, designers, operation or maintenance engineers, project managers, human and organizational factors specialists, experts and regulatory authority inspectors, teachers, researchers, and doctoral students.

The book can be ordered [here](#).



Pierre Dersin

*Consultant en System Safety, Reliability, and Maintenance Modelisation & Analysis*

### **Modeling Remaining Useful Life Dynamics in Reliability Engineering, CRC Press, June 2023.**

**Pierre Dersin**

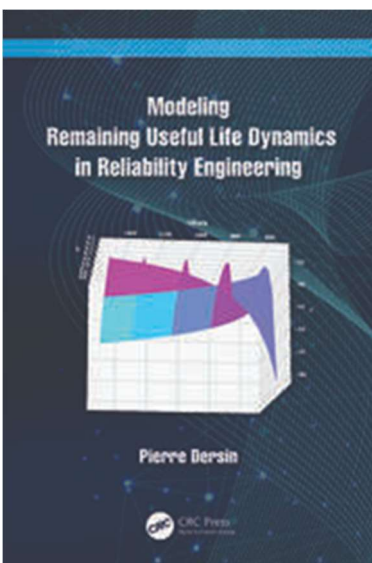
This book applies traditional reliability engineering methods to prognostics and health management, and specifically Remaining Useful Life (RUL) dynamics.

In the context of the digital transformation, the last two decades have witnessed a significant evolution in the theory and practice of industrial maintenance : information and communication technologies now make it possible to replace traditional maintenance ( i.e. scheduled preventive and corrective ) with predictive maintenance, based on estimation and prediction of individual asset state of health.

To that end, an invaluable decision support tool is the estimation of asset remaining useful life (RUL). RUL is a function of time ; it is also stochastic since it is affected by observation errors, variability of environmental conditions and mission profiles, and imperfect knowledge of degradation mechanisms . Taking that uncertainty into account is essential for sound risk management . Failing to do so will generally lead to inappropriate maintenance decisions.

Methods used to estimate RUL are numerous and diverse and, broadly speaking, fall into three categories: model-based, data-driven, and hybrid. The author starts by building on established theory and looks at traditional reliability engineering methods through their relation to Prognostics & Health Management (PHM) requirements and presents the concept of RUL loss rate. Following on from this, the author presents an innovative general method for defining a nonlinear transformation enabling the mean residual life (MRL) to become a linear function of time, which leads to explicit analytical results, for instance for RUL confidence intervals and RUL probability distribution.

He applies this method to frequently encountered time-to-failure distributions, such as Weibull, gamma and lognormal, and first-hitting times of stochastic processes such as the Wiener or gamma process, used to model degradations . Latest research results, including the author's (some of which were previously unpublished), are drawn upon and combined with very classical work. A complete chapter is devoted to the examination of the properties of the time transformation that allows for the linearization of the MRL. Statistical estimation techniques are then presented to estimate RUL from field data



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Finally the use the results for maintenance support and in particular predictive maintenance, is discussed. A risk-based method for predictive maintenance optimization is presented.

The book ends with suggestions for future research, including links with machine learning.

Industrial applications are described and every chapter is followed by a series of exercises.

The book is of interest to engineers, researchers and students in reliability engineering, prognostics and health management, and maintenance management.

<https://www.taylorfrancis.com/books/mono/10.1201/9781003250685/modeling-remaining-useful-life-dynamics-reliability-engineering-pierre-dersin>

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## Forthcoming Conferences & Seminars

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### **24th Lambda-Mu congress 14 to 17th October 2024, Bourges (France)**

#### ***Risk-related professions: keys to reindustrialisation and ecological transition.***

Every two years, the French scientific organisation IMDR (Institute for risk mastering and dependability) organizes the lambda-mu congress, which brings together 300 to 400 participants; They represent the different industrial sectors and the various risk professions inside organizations and their stake holders.

The 24th edition of the congress will be held in Bourges from 14 to 17 October 2024.

In the context of the issues related to climate change and the geopolitical situation, the congress invites representatives of the various risk professions to come and share their experiences, knowledge and skills to contribute to meet the challenge of reindustrialization and ecological transition.

For more information, visit the congress website: [www.imdr-lambdamu.eu](http://www.imdr-lambdamu.eu)

Papers are written and presented in French or in English



## **BEMAS Formation**

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For details: <https://www.bemas.org/en/trainings>

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ESReDA Members, you are kindly invited to contribute to the ESReDA newsletter sharing news, announcement of events, your experiences, ideas, etc. You are supposed to elaborate proposals to create new Project Groups, host ESReDA Seminars or initiate collaborative activities.

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**ESReDA: European Safety, Reliability & Data Association**

Association internationale sans but lucratif, régis par la loi Belge du 27 Juin 1921-Titre III (Registration N°: 0452522618 - Siret:E00005802)

Headquarter: ESReDA, rue Gachard 88 Bte 14, B-1050 Bruxelles, Belgium

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