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

# Newsletter

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## Special Issue: Wildefire Risk Management

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*Mohamed Eid*
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Critical wildfires were the major natural hazard threating the EU and the Mediterranean, during the last month (July 2023). Almost 260 000 ha have been already burnt in the EU since January 2023. Critical fires have spread in Italy, Algeria, Tunisia, and Greece causing human casualties and massive environmental and economic damage, according to the monitoring reports of the Joint Research Centre (JRC) through the European Forest Fire Information System in the EU's Copernicus Emergency Management Service.

ESReDA sheds the light in the Newsletter on the EU efforts in reinforcing its Wildfire Risk Management process across Europe. ESReDA presents the following two articles relative to EU efforts, entitled: "Cross-sector dialogue for Wildfire Risk Management" and "How do wildfires threaten critical infrastructure and vice versa?".

The first article gives an overview of the Support Action Firelogue as one of the most promising EU multidisciplinary actions.

The second article examines in more details the dialectic between man-made infrastructure and nature-made infrastructure considering the risk of exposure to wildfires.

Given that the resilience of man-made and the nature-made assets can't be examined separately, wildfire risk management should be thought globally.

## Cross-sector dialogue for Wildfire Risk Management

*Firelogue Coordination, Fraunhofer INT*

*Dr. Claudia Berchtold, Senior Researcher, Fraunhofer Institute for Technological Trend Analysis (INT)*

An overall rise in global temperatures and an increasing number of extreme weather events have characterized the beginning of the 21st century. News broadcasts are filled with reports of devastating wildfires across Europe, wreaking havoc not only on vegetation and forested lands and leading to cast ecological destruction and air pollution but have also cause considerable economic losses in agriculture and other businesses as well as leading to increased loss of lives of first responders and regular citizens.

In order to properly respond to the current trend of increasing wildfires across Europe, a careful examination of the root causes and issues in necessary. Weather records show a trend towards longer, hotter and dryer seasons and environmental studies show the deteriorating status of European flora and fauna due to the uncharacteristic weather conditions. Together with an ever-increasing expansion of human life into nature, the conditions are perfect for more intense and devastating wildfires across Europe and beyond. Effective wildfire risk management (WFRM) requires accepting the complexity of these causes, as well as the diverse interdependencies that connect them.

The EU Coordination and Support Action Firelogue (Cross-sectoral dialogue for Wildfire Risk Management) recognizes precisely these challenges and understands that an effective and timely response requires a systems approach that looks at societal and economic systems nested within the natural systems. Approaching the issue form a variety of viewpoints is essential and an inevitable step to adapting to the current wildfire trend.

By first identifying the large and diverse number of stakeholders affected by wildfires, Firelogue hopes to find not only conflicting interests between the individual groups, but also synergies that can be used to build upon and establish cooperation in the future. In a second step, those stakeholder groups are invited to take part in five thematic Working Groups (WGs) created by Firelogue. With a focus on Environment/Ecology, Civil Protection, Insurance, Infrastructure and Society, WG members come together in different formats (workshops, webinars, etc) to discuss current WFRM policies and their (lack of) effectiveness, as well as possible recommendations for future policies. Central points of focus are

*Maike Overmeyer, Researcher, Fraunhofer Institute for Technological Trend Analysis (INT)*

(perceived) injustices of these policies and how they might hinder the successful implementation and consequently efficient fire prevention and response.

By engaging in an open discussion within and across the working groups, Firelogue wants to develop new and just recommendations that will feed into a roadmap for 2030 and beyond. By including a wide range of interested parties and creating spaces for an open and fair exchange of ideas and opinions, the recommended WFRM solutions will be more inclusive and fitting to today's and tomorrow's challenges, paving the way for increased acceptance across Europe.

The work conducted in the Firelogue Working Groups is complemented by the support given to other relevant EU projects. In particular, the three Innovation Actions funded under the same call as Firelogue (SILVANUS, TREEADS and FIRE-RES) work in close cooperation with the Firelogue partners to find synergies between the projects and support each other in their efforts. Together with other Horizon 2020 projects related to wildfires, DG ECHO initiatives like the Knowledge Networks and already existing WFRM networks, Firelogue is actively working to establish a network of projects and activities across Europe. By bringing projects together and once again offering them the space and opportunity to exchange views and ideas, as well as discuss challenges and risks, Firelogue wants to solidify a mutually beneficial cooperation among the projects and a long-lasting network of project partners.

Representatives from the Innovation Actions and projects are encouraged to be part of the Firelogue Working Groups. Their contributions not only include their professional knowledge, insight and experiences into the topic of WFRM but also the results and research within their projects. Bringing these project results into the discussion can ensure that they will be part of the roadmap and recommendation to the EU Commission, thus helping to ensure their longevity and sustainability.

### Firelogue Facts

Name: Cross-sector dialogue for Wildfire Risk Management
Start/End date: November 2021 – October 2024
Budget: €3.26 million
Coordinator: Fraunhofer Institute for Technological Trend Analysis (INT), Germany
Partners: 15 Partners from 9 European countries
Call: Horizon 2020 LC-GD-1-1-2020 Preventing and fighting extreme wildfires with the integration and demonstration of innovative means
Grant agreement ID: 101036534
Website: http://www.firelogue.eu
Contact: info@firelogue.eu

## How do wildfires threaten critical infrastructure and vice versa?

*WG Infrastructure, FIRELOGUE H2020 project*

*Danai Kazantzidou-Firtinidou*
*Civil Engineer, senior researcher, Center for Security Studies (KEMEA), Greece*

Wildfires pose a significant threat to critical infrastructure and, vice versa, critical infrastructure may also threaten wildlife assets, adversely acting as a source of fire. This complex relationship between wildfire and critical infrastructure highlights the importance of understanding the interdependencies and implementing effective strategies to mitigate these risks.

Firstly, wildfires can directly affect critical infrastructure, causing damage and disruption to essential services. Power lines and substations are particularly vulnerable to wildfires, as intense heat and flames can damage or destroy equipment, leading to power outages. This can have a cascading effect on other interconnected critical infrastructure assets or sectors, such as communication networks, refineries, and transport systems, which rely on a stable power supply to function effectively. In addition to the impact to the societal well-being, this can hamper coordination and communication between emergency responders and hinder overall response and recovery efforts.

Wildfires can also damage or destroy transportation infrastructure, including roads, bridges, and railways. This can hamper emergency response efforts, making it difficult for firefighters and other first responders to access affected areas. In addition, the destruction of transportation infrastructure can impede the evacuation of residents and the delivery of essential supplies and resources. Wildfires can also threaten water supply infrastructure such as reservoirs, pipelines, and treatment plants. When wildfires occur in watersheds, they can cause soil erosion and sedimentation, which can degrade water

quality and increase the risk of flooding. This can affect the availability of clean water for drinking, firefighting, and other critical needs.

*Dr Nikolaos Kalapodis Forester, senior researcher, Center for Security Studies (KEMEA), Greece*

On the other hand, critical infrastructure can also pose threat to wildlife, by causing fire ignition, exacerbating intensity, and spread of wildfires. For example, power lines and electrical equipment can act as ignition sources, especially during periods of high winds or when equipment is not adequately maintained. Vegetation and fuel management at the proximity of exposed infrastructure assets is of primary importance for reducing fire ignition from sparks and flaming particles coming from infrastructure's malfunctioning or misuse. Aging and poor maintenance of infrastructure assets is an aggravating parameter to these accidents and radical measures of shutting down infrastructure's operation (e.g. electricity cut-offs in California, road blocking) are often implemented without necessarily accounting for all stakeholders interests and needs.

To address all these challenges, it is essential to adopt a holistic approach that integrates wildfire risk management (IWFRM) into the planning, design and maintenance of critical infrastructure, accounting for all justice dimensions. This includes implementing measures such as fuel breaks (as a pre-suppression fuels treatment strategy), landscape fuel treatment aiming to protect existing or new infrastructures assets (reducing fuel load and therefore fire hazard, reducing the continuity of fuels distribution and the extent of homogeneous fuel types), defensible space zones, improving building codes and standards for wildfire-resistant construction, and enhancing the resilience of infrastructure to withstand and mitigate the impacts of wildfires. Moreover, participatory processes during land planning and management will allow for the promotion of equity accounting for all actors' interests, as well as for the attentive selection and preparation of site for infrastructure development and safe maintenance.

To effectively address the interdependencies between wildfires and critical infrastructure, improved coordination and collaboration between stakeholders is essential. This involves working with utilities, emergency management agencies, land management agencies and other relevant stakeholders to develop integrated strategies and response plans that address both the wildfire threat to critical infrastructure and the potential impact of critical infrastructure on wildlife through wildfires. Meanwhile, the spatial distribution of infrastructure assets in wildland areas may be positively exploited for wildfire management from the use of monitoring and early warning systems to allowing timely response.

## Maintenance modelling and power plant reliability & RAM models

Henk Wels

*Consultant, The Netherlands*

Since 1988 at DNV legacy companies KEMA and NRG we have been modelling conventional power plants as well as other infrastructures. The parameters of interest were RAM, with R = Reliability (does not fail often), A = Availability (it's there when you need it) and M = Maintainability (easy to repair). While due to having access to failure information from dedicated databases as well as using failure and maintenance information from projects, a RAM model never was that difficult. We have applied RAM specification in order to have an optimum plant right from the begin of operation and were successful in that. The model, usually on the basis of a Reliability Block Diagram producing system states such as full outage, 10 %, 20 %, etc. outages resulted in predictions for new buildings, life extensions, focus on dominant components and subsystems, gave quantitative decision material for spares, etc. I'll come to the underlying data for such models later. However, the quantitative relation between failures (CM) and preventive maintenance (PM) always has been clouded. We started using simplified bathtub curves given by 3 straight lines (teething troubles, midlife, ageing) with a component As Good As New (AGAN) after failure. However, the basis for AGAN except for print cards, components with strong degradation processes, etc. was meagre and not according to practice at power plants. At plants components are inspected, degradation is removed (or not), and components are repaired rather than replaced. Furthermore, the optimum replacement times were often at the start of ageing.

An interesting next step was application of engineering judgement for steam turbines of degradation trajectories (therefore a p-F curve) and varying the overhaul interval together with a probability of detection of the degradation and subsequent removal of degradation. Failures were thought to occur if degradation was not detected before overhauling or if shock types of failures would occur. As steam turbines in principle should show little degradation, overhauling steam turbines to improve reliability shows only a weak and large optimum interval. There is also a case for no overhauling at all.

It was therefore a pleasure that as the result of long term good relations with vgbe, that the vgbe 444 R&D project could be carried out aimed at modelling and estimating maintenance efficiency from

practice data at power plants. The project results are published in vgbe Energy Journal 5 – 2023. Essentially using the failure rates derived from the raw data in vgbe's KISSY database as well as from PM and CM information from 4 partner utilities, ARA = Arithmetic Reduction of Age models were used to investigate the relation between PM and CM maintenance. In ARA, the coefficients ρ PM and ρ CM for life reduction at overhauls and repair are calculated from the failure data and therefore AGAN of As Bad As Old ABAO does not need to be postulated. Yet it was found that the results were much more dependent on the ageing coefficient β than on ρ. Differences in failure intensity α between plants were substantial showing the need to model plant specific preferably.

The 444 R&D projects showed also that there are many cases without ageing and with improvement of components over long periods that are reasonably well predicted choosing a ABAO model with a β. The choice for β is underpinned by checking time between failures in terms of a Fix Efficiency Factor FEF when times between failures are increasing. Some 190+ time series from vgbe's KISSY were investigated covering 224 coal-fired, lignite-fired and gas fired (CCGT) plants together with plant specific PM and CM information from 18 coal fired and CCGT plants of our utility partners. It led to ρ, α, β and FEF distributions all duly documented.

As DNV is involved in the OREDA databases, we asked access to the raw OREDA failure information in order to calculate maintenance efficiencies in line with Haugen et al. Using degradation trajectory types, we were able to access the failure rate if NO PM maintenance would be carried out for gas turbines, pumps and other components, also duly reported in the vgbe 444 R&D projects. The full vgbe 444 R&D projects report at the moment is only available to vgbe, DNV and the utility partners that have invested in the project.

As we could analyse much earlier using the information from the Dutch failure database from Sep, which was stopped due to liberalization in the 90-ties, "humps" can be seen in the curve for the cumulative failures as a function of time. These "humps" seem to be caused by the occurrence of unexpected failure mechanisms that are not immediately resolved. As the "humps" point to proper root cause analysis of specific failures as well as spoiling to have precise coefficients for ρ, β, etc. over long periods of time, they should be prime targets for analyzing how to have better plants in new R&D projects.

So far for modelling the PM – CM maintenance relation. I have mentioned the vgbe KISSY database on power plant failures before. International utilities supply their unavailability information on the plant as a total to this database which can be assessed for on-line analysis when reporting to this database. The vgbe also makes an overview report on a yearly basis. A substantial part of the utilities also supplies more detailed information subsystem and component failures based on a 3 letter KKS coding system which is also reported on a yearly basis. However, this report does not contain the typical RAM parameters of interest to reliability engineers. The raw failure data were therefore analysed in the 2013 vgbe R&D 361 project to derive failure rates, repair times, ageing coefficients etc. per plant per subsystem using data over the period 2002 – 2011. As more recent data became available from the vgbe 444 project, it was decided to update the 361 analyses using the 2009-2020 failure data. With DNV having delivered the final report to vgbe early 2023, vgbe is to make the report available as a common vgbe – DNV report at the vgbe web shop soon. It will contain on a subsystem level failure rate, repair time etc. as well as for Pareto dominant components a set of standard plots showing how failure rates, repair times and forced unavailability change with age of the plant, number of operating hours and starts per year. The KISSY database is to be extended with a reliability module hopefully as per 2023 and a proper specification of the software for such a model has started.

It does not pay to gather detailed information for every subsystem in a plant as one needs to know the capacity and number of components in each plant etc. and not all subsystems are dominant with RAM. Yet the underlying DNV spreadsheets allow calculating even if no details are present on a 1 or 2 letter KKS detail level. Component failures based on other more detailed databases should add up to the vgbe KISSY subsystem level. Using engineering judgement, KISSY can also be used to assess RAM on component level for instance for step-up transformers or turbine feed water pumps. Redundant subsystems always are a little troublesome as utilities only report outages of the plant. At redundant systems such outages occur for instance due to common cause failures of components. Therefore, estimating common cause failure coefficients is a standard reporting feature in the common vgbe – DNV report. Similar for the fraction of failures at a specific KKS-code larger than say 8 or 24 hrs. This fraction gives clues about the feasibility to apply spare parts as evidently inserting spares take time. It is part of the input for detailed spare part modelling using Monte Carlo analysis such as for instance at GT blading.

In short: modelling of systems using RBDs is rather straightforward. Component and subsystem failure rates and repair times can be derived from databases such as vgbe's KISSY database. When available, ORAP, EPRI, Nerc Gads etc. should also be consulted. RBDs should be able to model system states such as total outage, partial outage (10%, 20%, etc. loss) and calculate both the frequency and duration of such system states. The RBDs can be made a function of time using Monte Carlo modelling and the vgbe – DNV

report gives clues what βs are reasonable for such time series. The models are very valuable for newbuilding, life extension purposes, etc. The quantitative relation between PM and CM maintenance still has not been completely solved however an important step forward was made. The quantitative relation can be improved using ARA and FEF models, ρ-coefficients, β's etc. Of prime importance is information from maintenance databases discussed with plant maintenance engineers and explained using this information

**Editor Note:**

See also Henks C. Wels book on: Failures and Forced Unavailability of Power Plants

The book is derived from earlier papers presented at ESReDA, PGMON, VGB working groups and other committees and projects when working with KEMA and its legacy companies and departments NRG, DNV GL and DEKRA.

The book contains a small failure rate & repair time database as well as a description of E-planning in the Netherlands from the 60-ties until now. Available at VGB website.

## Past ESReDA Seminars

### The 62nd ESReDA Seminar

Alberto Martinetti
*University of Twente, the Netherlands*

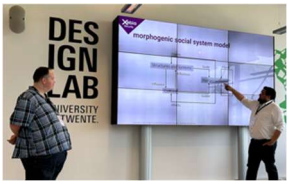
**The 62nd ESReDA Seminar on Managing the unexpected: designing systems to embrace disorder for increasing asset reliability**

**April 12th – 13rd, 2023, University of Twente, the Netherlands 62nd 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 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.

### The 61st ESReDA Seminar

**The 61st ESReDA Seminar on Advances in Modelling to Improve Network Resilience**

**22-23 September 2022, Torino, Italy. 61st ESReDA Seminar**

Climate change and the delays in adopting the necessary measures to manage it is increasing the number of disrupting events triggered by natural events. Sudden failures or gradual deterioration of system components due to natural events can bring to malfunctions, loss of containment and disruptions, whole likelihood is going to increase in the next future.

Micaela Demichela
*Politecnico di Torino, Italy*

In recent years several methodologies and techniques have been proposed, able to take into account explicitly and in realistic way NaTech events, able to support the decision making in terms of prevention, protection, adaptation and management. NaTech events have also another dimension to be considered, that is the territorial one, again in terms of prevention, management, and resilience.

The aim of the seminar was thus to discuss the state of the art and on-going developments in the NaTech risk assessment techniques and methodologies and to discuss their strength, weakness, and uncertainties in the assessment of the safety and resilience of complex systems.

## The 60th ESReDA Seminar

### The 60th ESReDA Seminar on Advances in Modelling to Improve Network Resilience, 4-5/5/2022, Grenoble, France



Rasa Remenyte-Prescott
Kate Sanderson
John Andrews
*Univ. of Nottingham, UK*




Christophe Berenguer,
Sylvie Perrier,
Jean-Marc Tacnet
Julien Baroth
*Univ.Grenoble Alpes, FR*

The seminar has been organized by the University Grenoble Alpes under the Risk@UGA Idex project framework and hosted by Grenoble INP ENSE3. It has been a forum for exploring issues related to engineering resilience against different threats, such as failures of aging infrastructure, natural disasters and climate change, intentional attacks (cyber-security and terrorism), and emerging threats, met by different industries, critical infrastructures and urban settlements. This seminar closed a 3 years project group "Resilience Engineering and Modelling of Networked Infrastructure", managed by the University of Nottingham, particularly J. Andrews and R. Remenyte-Prescott (in the center of the group picture). Contributions have covered a wide range of topics concerning several stakeholders, from practitioners to researchers (industrialists, regulators, safety boards, universities, R&D organisations, engineering contractors and consultants, training specialists) who presented their work in sessions about resilience of Electrical Networks, transport networks and Smart Cities, Infrastructure Networks… Theories, concepts, and experiences of methods for improved network resilience have been discussed. Authors have been invited to present their research and experience and discuss challenges in enhancing resilience through modelling. Papers have been published soon in JRC Technical Notes.

The proceedings can be downloaded here.

## Forthcoming event: 63rd ESReDA Seminars

## The 63rd ESReDA Seminar

*Chairwoma*
*Kristine VLAGSMA*
*(European Commission, Joint Research Centre)*

*Organiser*
*Vytis Kopustinskas*

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

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 63rd ESReDA seminar will be a forum for exploring these points and other related questions. We aim to discuss theories, concepts, and experiences of resilience assessment methodologies and applications. Authors are invited to present their proposals and discuss successes and/or failures and to identify future needs in resilience research. We want to encourage new ideas, scientific papers, conceptual papers, case studies and cross-sectoral research on this topic with examples and applications of infrastructures

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exposed to both technological and natural threats, hazards. This seminar will bring together researchers, practitioners, and decision-makers.

Extended abstracts are an alternative to full papers. An extended abstract should be at least one page in length, and it should include a list of most relevant references (5 or 6). Both extended abstracts and full papers will be published in the Seminar proceedings.

Key dates and seminar details are on ESReDA webpage. https://www.esreda.org/events/

## The 64th ESReDA Seminar

*Organiser*
*Aitor Goti*
*Associated Professor*
*Univesidad de Deusto*
*Bilbao (Spain)*
*aitor.goti@deusto.es*

**Digital Maintenance in the Digital Twin Era. May 2024, Universidad de Deusto, Bilbao – Spain.**

The study of the digital transformation in the context of industry and infrastructure is highly topical and interesting. One of the business areas where this transformation is expected to be most significant is maintenance. It is, therefore, important to analyse how maintenance can benefit from this transformation, how to do it and why the real transformation of maintenance in organizations might not be progressing at the anticipated pace.

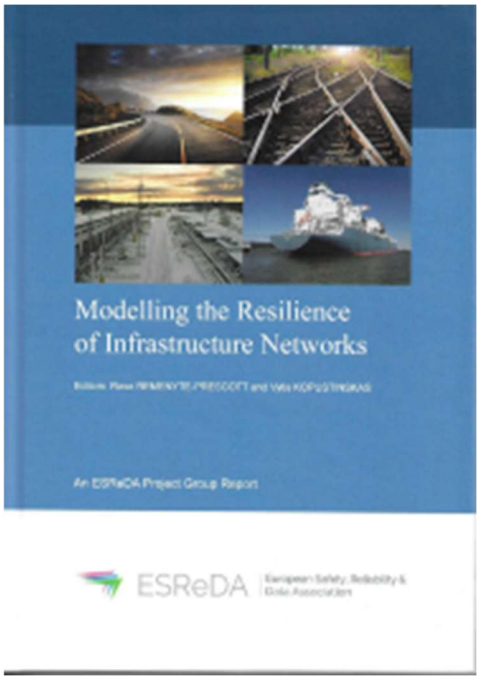
This seminar aims to bring together researchers, practitioners, and experts from various disciplines to share their insights and advancements in the realm of digital maintenance and its relationship with digital twins, complex systems, and human resources. The event intends to provide a vision of digital maintenance once the foundational technologies (AI, predictive analytics, digital twins, IoT, cloud/edge/fog computing, etc.) have reached a sufficient degree of maturity. This vision should facilitate drawing conclusions on the approaches needed to overcome current barriers that limit the full development of digital maintenance, particularly in assets and systems with a low level of digitization. During the seminar, participants will have 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.
**The call for papers will soon be available on ESReDA website.**

# ESReDA Project Groups - News

Rasa Remenyte-Prescott
*University of Nottingham, UK*

John Andrews
*University of Nottingham, UK*

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



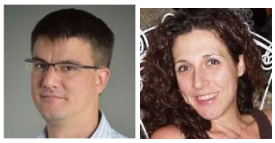

Findings from the project group have been published in a book entitled "Modelling the Resilience of Infrastructure Networks", edited by Rasa Remenyte-Prescott and Vytis Kopustinskas.

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 ESReDA General Secretary, Antonio J. Guillén (Ingeman, Spain).

**Book Purchase Order is joint to the newsletter**



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

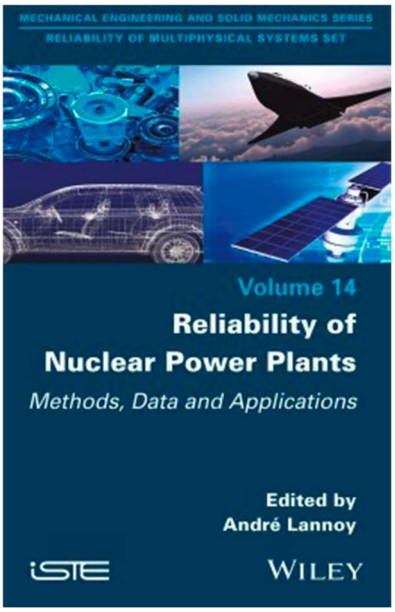
The Risk Knowledge and Management Group is continuing its activities. During the last group meeting on the 22nd of February 2023 there was a shift-over of the Group Leader from Eric Marsden to Myrto Konstantinidou and an updating on the status of the discussion papers. Currently, we have 14 discussion 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.

## ESReDA community recommended books

*ESReDA*
*Honoray President*
Jean-François Raffoux

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

***Abdelkhalak El Hami***




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.

## Forthcoming Conferences & Seminars

### Asset Performance Conference: 25 & 26 October 2023 in Antwerp, Belgium

Asset Performance is an initiative of BEMAS, Belgian Maintenance Association vzw-asbl, a not-for-profit organisation for professionals in maintenance & asset management. We help asset intensive organisations on the road to world class maintenance and management of technical equipment and infrastructure. BEMAS counts more than 585 member companies. BEMAS organizes more than 150 seminars and training courses every year. BEMAS is a valued member of EFNMS. More information on www.bemas.org.

Conference Registration is open here: https://www.assetperformance.eu/

### Sustainable and Digital Innovation in Engineering Asset Management. July 3 - 5, 2024, Lisbon, Portugal

CONGREGA 2024 seeks to push the boundaries of SUSTAINABLE AND DIGITAL INNOVATION in Lusophone (Portuguese-speaking) and Hispanophone (Spanish-speaking) countries and communities spread across Europe, the Americas, Africa, Asia and Oceania.

It is expected to gather over 300 delegates to share state-of-the-art knowledge in research and applications of advanced management and digital and deep-tech solutions enabling excellence in ENGINEERING ASSET MANAGEMENT.

https://congrega.eu

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.

**ESReDA: European Safety, Reliability & Data Association**
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**Contact ESReDA** | info@esreda.org

ESReDA European Safety, Reliability & Data Association

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* ESReDA Project Group on "Resilience Engineering and Modelling of Networked Infrastructure" has successfully published its final report. The report title is "Modelling the Resilience of Infrastructure Networks", ©2021 by ESReDA, IBSN 978-2-930928-11 (EAN IBSN 9782930928111).

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