



# European Safety and Reliability Association

# Newsletter

<http://www.esrahomepage.org>

April 2004

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## ESRA NEWS

### Letter from the Chairman



*Carlos Guedes Soares*  
*IST – Portugal*

This issue of the Newsletter brings changes to the Editorial Board. During the last 3 years, we have had the contribution of Stein Hauge and Snorre Sklet as Newsletter Editors and I would like to express our thanks to them and to the Editorial Board that was in place for that period, for their excellent performance in having the Newsletters ready on time.

During the last year, professional pressures have created difficulties for the Newsletters to be ready on time and for the Newsletter Editors to continue in their function. Therefore, at the June 2003 ESRA General Assembly the change in Newsletter team was announced, and a new Editorial Board has been formed and is in place since the beginning of 2004.

This is the first issue they have produced and I hope that the Newsletter is able to regain its regularity in published, becoming a useful reference for the Safety and Reliability community.

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## CONTENTS

ESRA NEWS.....	1
Letter from the Chairman .....	1
FEATURES .....	2
Nuclear safety in Slovenia - the world smallest nuclear country.....	2
Risk Analysis Sober Minded Contemplated.....	3
SAFETY AND RELIABILITY NETWORKS .....	4
The PRISM Network Contact No. G1RT-CT-2001-05029 .....	4
SAFETY AND RELIABILITY EVENTS .....	5
11 <sup>th</sup> International Symposium - Loss Prevention and Safety Promotion in the Process Industries .....	5
ESRA INFORMATION .....	6

During 2003, it has been decided to move from the usual paper format of the Newsletter to the electronic version and we hope that this new format will be an important step towards an easier distribution of the Newsletter.

The Newsletter is aimed at being a living instrument for the Safety and Reliability community and therefore I hope that ESRA members will take the initiative to contribute with feature articles and with useful information for the members. The proposed contributions can be delivered to any member of the Editorial Board.

# FEATURES

## Nuclear safety in Slovenia - the world smallest nuclear country



Marko Cepin

“Jozef Stefan” Institute - Slovenia

### Introduction

Slovenia is the world smallest country considering ones with operating nuclear power plants (NPPs). It occupies 20256 km<sup>2</sup> of territory and counts nearly 2 millions of inhabitants. Its nuclear energy comes from a Krsko NPP, which is one unit plant with a two loop PWR (pressurised water reactor) operating commercially from the year 1983. The production of electricity is around 5 TWh per year, which represents approximately 40% of total electricity consumption.

### Status of Nuclear Safety

The high level of nuclear safety in Slovenia is proved by a number of facts among which the following are emphasised.

The Convention on Nuclear Safety is in force in Slovenia, which signed the Convention (1994) and ratified it in the parliament years ago (published 1996).

The primary responsibility for nuclear safety is born by the Krsko NPP, which is independently supervised by the regulatory body (i.e. Slovenian Nuclear Safety Administration - SNSA) on all matters connected with safety. The designated technical support organisations, e.g. the Jozef Stefan Institute, independently assist and advise the Krsko NPP and the SNSA. The Jozef Stefan Institute also conducts the Postgraduate Programme of Nuclear Engineering in collaboration with the Faculty for Mathematics and Physics at the University of Ljubljana. The Krsko NPP was designed, built and tested in accordance with the US AEC (Atomic Energy Commission, from 1975 a NRC - nuclear regulatory commission) design and safety criteria.

The Krsko NPP operates in accordance with the Updated Safety Analysis Report (USAR), which complies with US NRC RG 1.70, Standard Format and Content of Safety Analysis Report for NPPs and IAEA Safety Series no. 34. It is regularly updated according to a written review procedure and is approved by the regulatory body.

A major plant modernisation programme with the steam generators exchange, power increase and safety upgrading took place in the year 2000 and was subjected to a comprehensive licensing process. All the safety analyses were done in compliance with US

NRC RG 1.70 and the plant documentation was modified accordingly.

The accident prevention as the main safety priority is achieved through the use of reliable equipment and very well trained plant personnel, who operate through approved procedures. The personnel is committed to the safety culture and is keeping in mind the reduction of risk to the lowest practicable level. The plant specific full scope simulator, which is located on-site, supports their training.

Activities connected with the probabilistic safety assessment (PSA) were initiated well before the regulatory demand in year 1991, which required performing PSA by employing Individual Plant Examination (IPE) and IPE for external events (IPEEE). Afterwards, the PSA was performed, which consists of: internal events level 1 and 2, seismic events level 1 and 2, internal flooding, internal fire, other external events and shutdown PSA performed as Outage Risk Assessment and Management. Today's PSA is updated on yearly basis considering the plant current status. The application of PSA and Outage Risk Assessment Management is important as a support for a detailed planning and scheduling of maintenance, test and modification activities.

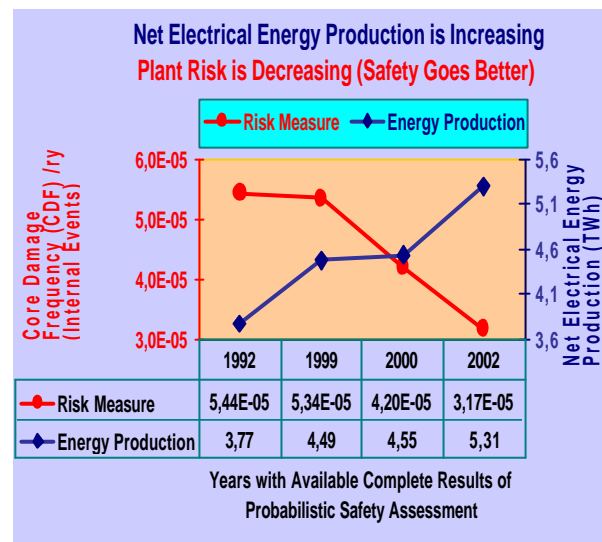


Figure: More and safer electrical energy is coming from the Krsko NPP. The risk measure is represented by the core damage frequency for internal events taken from the results of probabilistic safety assessment. The energy production is represented by the net electrical energy production.

A number of international missions, which are connected to nuclear safety, take place regularly. E.g. ICISA (International Commission for Independent Safety Analysis) in year 1992, Operational Safety Assessment and Review Team (OSART) in year 1993, WANO (World Association of Nuclear Operators) in year 1995, ASSET (Assessment of Safety Significant Events Team) in 1996, IPERS (International Peer Review Service) in 1997 and 1998, IRRT (International Regulatory Review Team) in year 1999 and IPSART (International Probabilistic Safety Assessment Review Team) in year 2000, OSART in year 2003, to address selected ones. All missions are mentioned individually in annual nuclear safety reports issued by the SNSA. Common to all

missions is a fact that their conclusions prove and improve the high level of NPP safety in Slovenia.

Results of an international project supported by European Commission under the PHARE program on geophysical research in the surroundings of the Krsko NPP show that no fault traces were found close to or at the surface. Measurements in the surroundings of Krsko NPP down to depths of 2 km showed that no major seismogenic features intersect the site of the Ksko NPP.

### **Future of Nuclear Safety**

Keeping the nuclear safety at a high level is an expensive and a complex process. The primary goal of this process is to ensure that facing with a free, i.e. deregulated market on electricity, will not decrease the high level of nuclear safety. As the current price of a kWh of electricity produced in Krsko NPP is much lower than the price of electricity produced in thermal power plants, the situation within the borders of Slovenia does not seem to be critical.

As the Krsko NPP has collected 20 years of commercial operation, more emphasis is to be placed to the safety of radioactive waste in future, although ensuring safety of the radioactive waste is less complex than ensuring safety of an operating NPP. The temporary storage of the high level and the low and intermediate level radioactive waste is at the Krsko NPP site and is of sufficient capacity for the following years. Technically and scientifically the disposal of radioactive waste shall not be problematic, but getting an agreement with the public will require high attention.

The commitment to strict codes, standards and rules, the policy of being internationally assessed and compared with, the specific geographic location and very good infrastructure keep Slovenia to remain and expand as an interesting regional centre for exchange of information on nuclear safety in Europe.

### **Risk Analysis Sober Minded Contemplated**



*Theo Logtenberg*  
*The Netherlands Society for Risk Analysis and Reliability*

#### **Introduction**

Last year a report of the Netherlands Ministry of Environment was issued with a title that is rather difficult to translate into English, but it comes close to: risk analysis “sober minded” contemplated. The report was brought to the attention of our society for risk analysis and reliability. The title was such that eyebrows were raised and questions came up like: didn't we do so? However, the content of the report

was found highly interesting and for the board of the society reason to inform the members and to plan a discussion meeting. Another reason was the often-heard remark: the Netherlands has gone too far with its risk approach.

### **Information transferred to the members of the society**

In order to have the basic thoughts as expressed in the report an interpretation was made by two members of the board and transferred to the members as a starting point for the discussion during a regular meeting.

The report provides in the first place a retrospective of the  $10^{-6}$  norm as stated by the Ministry of Environment. The norm relates to the maximum value for individual risk for a person who remains during 24 hours per day at a certain distance of a hazardous operation and moreover that person is unprotected.

Apart from the set value of the norm, the starting point is that all citizens should have an equal protection. However, in practice this is not reached. A number of problems are mentioned in the report such as the probability of contamination by the Legionella bacteria, the release of the gas Radon in newly built houses, the dangers of LPG (Liquefied Petroleum Gas) and the risks of the main airport in the Netherlands Amsterdam/Schiphol. With respect to Radon and Legionella the number of death cases is higher than caused by large accidents. The calculated risk for Schiphol airport is higher than the norm. The cause of the deviations from the norm is attributed for example to financial constraints or the adequacy of the risk comparison.

The report also mentions the difference between what is called different approaches of risk; one approach is by the “constructivists” and another by the “objectivists”. The last group are the ones that simply calculate the risk according to accepted models and available data, the first group is of the opinion that in the judgement of risks social and psychological aspects also should play a role, which is not taken into account by the objectivists.

The report suggests a solution in which for different types of risks different strategies can be applied. This is indicated as the “risk ladder”.

The step to be used in the risk ladder depends on the complexity, controversies and uncertainty. The first step represents the classical  $10^{-6}$  approach.

The second step includes, in the case that the costs for safety are found to be too high, a historical analogy in the decision process. The safety reduction and the costs in other cases are to be weighed.

The third step starts from a debate with all involved parties. This step is reached if other aspects than probability and severity play a role in the risk judgement.

With a high uncertainty about the magnitude of the risk the fourth step is to be chosen. The two parties, politics and society, should then have input in the

decision process. The role of the scientist is then changed from advisor to facilitator.

### Statements

The way to more soberness in the risk analysis is portrayed in a number of statements. These are:

Risk cannot only be presented by objective measurable properties of systems.

Risk is a social construct that could be determined by qualitative factors and social psychological properties.

A universal yardstick for quantifying risk does not exist. A choice for a yardstick always implies a choice for normative starting points, context and values.

Risks cannot be compared in a simple way.

Risk assessments are uncertain in a way; the uncertainty varies strongly from inexactness via unreliable to absolute ignorance.

Risks can be characterised by means of limited criteria; often is mentioned the following criteria: 'probability', severity, and magnitude of adverse consequences, uncertainty, present everywhere (scale, space and time), persistency, irrevocable, time of latency, unfairness, capacity to raise social unrest.

### Discussion meeting

In order to inform the members of the society in more depth about the statements in the report five speakers were asked to give their opinion about this other way of thinking of quantifying risks.

Firstly, a general introduction was given by a representative of the institute (RIVM is the advisory body for the ministry of environment) that issued the report. Apart from the examples given above it was mentioned that complex environmental problems could not be solved by the classical risk approach. Furthermore a change in risk thinking can be noticed with respect to: acceptance of involuntarily exposure, uncertainties and a cost benefit analysis and how do we weigh the risk of Radon against the risk of high voltage lines? In fact what the report does is nothing more than an extension of the current policy with a number of steps when dealing with risks.

The second speaker was from the ministry of environment and he mentioned the felt tension between spatial planning and external safety. Choices have to be made how to use the scarce space in the Netherlands. This requires a more straightforward responsibility and the norms should possibly less strictly apply. The discussion about social risk concentrates more and more on measures for aid and aftercare. The own responsibility is often mentioned as well. He considered the report an important step to more transparency in the policy for spatial planning. Members of the society remarked that the ministry clearly gives more emphasis to the interest of a certain group than to the interest of an individual. It was acknowledged that this was the case to a certain extent, but also should be remarked that a lot was done with respect to individual risk and that now the

point was reached how to weigh the advantages for the society against the disadvantages of some individuals.

A representative of the Netherlands gas transport services company presented a practical example concerning the difficulty with probabilistic risk assessment. He stressed that the sensitivity of the starting points have much influence on the outcome of the calculations. Especially he mentioned the consequences of the probability of ignition given a release. The company differed greatly with the ministry what figures to use and consequently the risk of gas pipelines.

As Schiphol was mentioned in the report as a problem area also a representative of the ministry for transport was invited to give his view on the matter. He mentioned that in order to fulfil the required norm of  $10^{-6}$  more dedicated calculation procedures were applied. With respect to the group risk a causal model was worked out. It is usable to map all influential factors but seems to be not usable for the determination of the group risk related to the number of airplane movements. The power of the new model is that scenarios can be analysed better and that effective measures can be taken to reduce and to be prepared to certain risks.

### Who would like to comment?

The report and the presentations of the speakers as well as the remarks of the members of the society make it clear that risk calculation has come into discussion and that a sort of confusion is emerging. What is the position of the risk analyst, what models to be used, what weighing factors are to be applied? The discussion will continue and the members of ESRA are kindly invited to give their scientific or practical opinion on the matter.

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## SAFETY AND RELIABILITY NETWORKS

### The PRISM Network Contact No. G1RT-CT-2001-05029



*Zoe Nivolianitou*

*National Centre for Scientific Research 'Demokritos',  
Greece*

Safety in the process industries has improved greatly over the last 20 to 30 years through improvements in hardware and the implementation of Safety Management systems. Whilst further improvements in these fields will continue the rate of improvement

is likely to be slower than in the past. For this reason the industry is increasing the effort devoted to 'Human Factors' in the expectation that an improved understanding of the interaction between man and the technical systems essential to the industry will lead to further significant improvements in the safety.

To assist the process industries in improving both its understanding of and application of human factors the European Process Safety Centre has linked up with leading operating companies, consultancies and research institutes in Europe to create the PRISM network. (Process Industries Safety Management). This is a 'Thematic Network', which has been established with financial support from the European Union Department for Research and Development under its Programme for Competitive and Sustainable Growth.

### **The Objective of PRISM**

"The improvement of safety in the European process industries through raising awareness of, and sharing experience in, the application of human factors approaches. In addition the network aims to stimulate the development and improvement of human factor approaches in order to address industry-relevant problems in batch and continuous process industries." The network, which will last for 3 years already has the support of over 40 organisations from 14 countries in Europe and is open to any company, research organisation or individual with an interest in this exciting topic. Through a mixture of conventional meetings, this web-site and its discussion groups we plan to create a world-wide network of companies & individuals who are interested in improving safety through an improved understanding of Human Factors.

So how will PRISM operate? It is recognised that the field of Human Factors is a very broad one and for this reason four separate 'Focus Groups' have been established within the network.

These will cover:

- cultural and organisational factors;
- optimising human performance;
- human factors in high demand situations;
- human factors as part of the engineering design process.

All of the deliverables of the Network will be tailored to provide practical guidance on good human factors as an aid for the process industries.

To find-out more, explore this website [www.prism-network.org](http://www.prism-network.org) Registration will enable you to obtain all the material exchanged at PRISM seminars and take part in discussion groups.

### **Contact Details**

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## **SAFETY AND RELIABILITY EVENTS**

### **11<sup>th</sup> International Symposium - Loss Prevention and Safety Promotion in the Process Industries**

#### **Loss Prevention 2004**

**31 May - 3 June 2004, Prague, Czech Republic**

The Symposium will be held in the Prague Congress Centre - PCC. Registration Form for Participation and Accommodation is available on [www.lossprevention.cz](http://www.lossprevention.cz) and in the printed 2nd Circular.

#### **Address and Contacts to Organising Committee**

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Mobil: +420. 607 671 866  
E-mail for all organisational matters: [pche@csvts.cz](mailto:pche@csvts.cz)  
[www.lossprevention.cz](http://www.lossprevention.cz)

#### **ESREL 2004**

**14 – 18 June 2004 - Hotel Inter-Continental Berlin, Germany**

The objective of the joint PSAM 7 – ESREL '04 Conference is to provide a forum for the presentation and discussion of the latest developments in methodology and application of probabilistic and reliability methods in various industries. Innovations in methodology as well as practical applications in the areas of probabilistic safety assessment and of reliability analysis are presented and discussed during the conference.

Registration Form for Participation and Accommodation is available on [www.psam7.org/](http://www.psam7.org/).

#### **ESREL 2005**

**27 – 30 June 2005 – Tri City, Poland**

**Conference Website:**

<http://esrel2005.am.gdynia.pl>



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# ESRA INFORMATION

## 1 Membership

### 1.1 National Chapters

- French Chapter
- German Chapter
- Italian Chapter
- Polish Chapter
- Portuguese Chapter
- Spanish Chapter
- UK Chapter

### 1.2 Professional Associations

- The Danish Society of Risk Assessment, Denmark
- SRE Scandinavia
- ESReDA, France
- French Institute for Mastering Risk, France
- ESRA Germany
- The Netherlands Society for Risk Analysis and Reliability (NVRB)
- Polish Safety & Reliability Association, Poland
- Asociación Española para la Calidad, Spain
- The Safety and Reliability Society, UK

### 1.3 Companies

- TAMROCK Voest Alpine, Austria
- ARC Seibersdorf Research GmbH, Austria
- VTT Manufacturing Technology, Finland
- Bureau Veritas, France
- Commissariat à l'Energie Atomique, France
- INRS, France
- Total, France
- GRS, Germany
- VEIKI Institute for Electric Power Research Co., Hungary
- Autostrade, S.p.A, Italy
- D'Appolonia, S.p.A, Italy
- IB Informatica, Italy
- TECSA, S.p.A, Italy
- SINTEF Industrial Management, Norway
- Central Mining Institute, Poland
- Transgás - Gás Natural, Portugal
- Companhia Portuguesa de Produção Electrica, Portugal
- Caminhos de Ferro Portugueses, Portugal
- IDEKO Technology Centre, Spain
- TNO Defence Research, The Netherlands
- HSE - Health & Safety Executive, UK
- Railway Safety, UK
- W.S. Atkins, UK

### 1.4 Educational and Research Institutions:

- University of Innsbruck, Austria
- Université Libre de Bruxelles, Belgium
- University of Mining and Geology, Bulgaria
- École de Mines de Nantes, France
- Université de Bordeaux, France
- Université de Technologie de Troyes, France
- Technische Universität Muenchen, Germany
- Technische Universität Wuppertal, Germany

- National Centre for Scientific Research 'Demokritos', Greece
- Politecnico di Milano, Italy
- University of Rome "La Sapienza", Italy
- Università Degli Studi di Pavia, Italy
- Università Degli Studi di Pisa, Italy
- Technical University of Delft, The Netherlands
- NTNU, Norway
- Gdansk University, Poland
- Gdynia Maritime University, Poland
- Institute of Fundamental Technological Research, Poland
- Technical University of Wrocław, Poland
- Instituto Superior Técnico, Portugal
- Universidade de Coimbra, Portugal
- Universidade de Minho, Portugal
- Universidade Nova de Lisboa, Portugal
- University Politechnica de Bucharest, Romania
- University of Strathclyde, Scotland
- "Jozef Stefan Institute", Slovenia
- Universidad D. Carlos III de Madrid, Spain
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- Universidad de Las Palmas de Gran Canaria, Spain
- Universidad Politecnica de Madrid, Spain
- Universidad Politecnica de Valencia, Spain
- Consejo Superior de Investigaciones Científicas, IMAFF, Spain
- Lulea University, Sweden
- City University London, UK
- University of Bradford, UK
- University of Portsmouth, UK

### 1.5 Associate Members

- Nuclear Consultants International, South Africa
- University of Florida, USA

## 2 ESRA Officials

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### 3 Management Board

The Management Board is composed of the ESRA Officers plus one member from each country, elected by the direct members that constitute the National Chapters.

#### 3.1 Conference Standing Committee

This committee aims at establishing the general policy and format for the ESREL Conferences, building on the experience of past conferences, and to support the preparation of ongoing conferences. The members are one leading organiser in each of the ESREL Conferences.

#### 3.2 Publications Standing Committee

This committee has the responsibility of interfacing with Publishers for the publication of Conference and Workshop proceedings, of interfacing with Reliability Engineering and System Safety, the ESRA Technical Journal, and of producing the ESRA Newsletter.

## 4 Technical Committees

### 4.1 Offshore Safety

Chairman: B. Leira, NTNU, Norway  
E-mail: [Bernt.Leira@marin.ntnu.no](mailto:Bernt.Leira@marin.ntnu.no)

#### 4.1.1 WG on Quantitative Risk Assessment

Chairman: V. Trbojevic, Risk Support, UK  
E-mail: [vmt@risk\\_support.co.uk](mailto:vmt@risk_support.co.uk)

#### 4.1.2 WG on Structural Reliability

Chairman: B. Leira, NTNU, Norway  
E-mail: [Bernt.Leira@marin.ntnu.no](mailto:Bernt.Leira@marin.ntnu.no)

### 4.2 Safety of Maritime Transportation

Chairman: C. Guedes Soares, IST, Portugal  
E-mail: [guedess@mar.ist.utl.pt](mailto:guedess@mar.ist.utl.pt)

### 4.3 Reliability of Mechanical Components

Chairman: G.I. Schuëller, University of Innsbruck, Austria  
E-mail: [G.I.Schueller@uibk.ac.at](mailto:G.I.Schueller@uibk.ac.at)

### 4.4 Uncertainty and Sensitivity Analysis

Chairman: A. Saltelli, JRC, ISPRA, Italy  
E-mail: [andrea.saltelli@jrc.it](mailto:andrea.saltelli@jrc.it)

### 4.5 Human Factors

Chairman: E. Fadier, INRS, France  
E-mail: [fadier@inrs.fr](mailto:fadier@inrs.fr)

### 4.6 Monte-Carlo Simulation

Chairman: Pierre E. Labeau, Université Libre de Bruxelles, Belgium  
E-mail: [pelabeau@ulb.ac.be](mailto:pelabeau@ulb.ac.be)

### 4.7 Dependability Modelling

Chairman: Yves Dutuit, Université de Bordeaux, France  
E-mail: [dutuit@hse.iuta.u-bordeaux.fr](mailto:dutuit@hse.iuta.u-bordeaux.fr)

### 4.8 Maintenance Modelling and Applications

Chairman: Enrico Zio, Politechnic of Milan  
Email: [enrico.zio@polimi.it](mailto:enrico.zio@polimi.it)



ESRA is a non-profit international organization for the advance and application of safety and reliability technology in all areas of human endeavour. It is an “umbrella” organization with a membership consisting of national societies, industrial organizations and higher education institutions. The common interest is safety and reliability.

For more information about ESRA, visit our web page at <http://www.esrahomepage.org>.

For application for membership of ESRA, please contact the General Secretary Palle Christensen, E-mail: [palle.christensen@risoe.dk](mailto:palle.christensen@risoe.dk)

Please submit information to the ESRA Newsletter to any member of the Editorial Board.