

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: 8th International Conference on Probabilistic Safety Assessment
and Management
Project Nos. 20.06002.01.352 and 20.06002.01.332
AI No. 20.06002.01.352.616

DATE AND PLACE: May 14–18, 2006
New Orleans, Louisiana

AUTHOR(S): Roland Benke, Osvaldo Pensado, and Razvan Nes
Center for Nuclear Waste Regulatory Analyses (CNWRA)

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BACKGROUND AND PURPOSE OF MEETING/TRIP:

To support decision making and program management, this biannual conference offers a forum to exchange information in the use of probabilistic methods in multiple fields, such as civil, chemical and aerospace engineering, nuclear reactor safety, and hazardous waste disposal. Staff attended the conference to present papers and to stay current on new techniques in probabilistic safety assessment. Electronic proceedings for papers presented at the conference are available from the ASME press and in a book of abstracts.

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

The topical areas included Aerospace, Chemical Process Industry, Construction–Systems and Structures, Electric Power and Nuclear Systems, Emergency Management, Environmental, Finance and Banking, Human Reliability, Information Technology, Medical and Health, Modeling Tools and Techniques, Organization and Management, Risk Communication, Risk-Informed Decision Making, Security, and Transportation. Although the methods vary among applications, many of the issues and models are common.

A significant component of the conference was the topic of nuclear power and nuclear systems. The papers presented activities related to level 1 and level 2 probabilistic risk assessments at various nuclear power plants in the world and covered topics in risk-assessment of severe accidents, probabilistic safety assessment updates, and source term assessments for outage periods. Also, consideration was given to treatment of low probability events such as aircraft crashes, fires, flooding, and earthquakes. With respect to seismic analysis, the questions of interest included analysis of accident progression and source terms, power plant design criteria, and accident sequence at multiunit sites.

The topic of risk-informed decision making was an important component of the conference. Papers included case examples on cost-benefit analyses and the use of the precautionary principle, risk-informed regulations, and regulatory decisions. The conference included several papers on the topic of high-level waste management. B. Leslie of the U.S. Nuclear Regulatory Commission (NRC) presented two papers on the use of risk-insights to support regulatory decisions in the high-level waste management program in the United States. T. Ghosh (NRC) discussed a novel approach based on strategic partitioning of input and output in a performance

assessment model to perform sensitivity analyses. The technique is general, but was presented in the context of high-level waste management. As part of the activities by CNWRA staff, R. Benke delivered a paper on consequence sensitivity analysis to support a risk-informed review of a preclosure safety analysis of a potential high-level waste repository in the United States. He also presented a paper discussing a safety assessment tool for nuclear fuel handling facilities. Under the topic of model and data uncertainty, R. Nes discussed how conservatism in model parameters affects the ranking of influential parameters.

Another important topic was modeling tools and techniques. A number of case examples were presented considering binary decision diagrams, Bayesian methods for reliability, dynamic modeling, network diagrams, probabilistic safety assessment tools, and Monte-Carlo simulation of accident risk. Among the activities by CNWRA staff, O. Pensado presented a paper on methodologies to identify non-monotonic trends in sensitivity analyses. Current trends in reliability modeling include the consideration of multiple system states, as opposed to the traditional binary (on-off or safe-fail) state, and dynamic modeling to track the system evolution as a function of time. Numerous papers were devoted to present case studies of mature methodologies and to share insights on challenges experienced.

Several other presentations and papers were given on topics relevant to NRC. J. Mitchell (NRC) presented the use of uncertainty information in level 3 probabilistic risk assessment calculations. Probabilistic consequence calculations were performed using the NRC MACCS2 code, which is also being used by the U.S. Department of Energy (DOE) for its preclosure safety analysis of a potential high-level waste repository at Yucca Mountain, Nevada. G. Holahan (NRC) discussed progress in the extended application of probabilistic risk assessment for nuclear power plants. G. Perry (NRC) presented a process for risk-informed decision-making. The process includes the use of templates to ensure that the risk estimates, uncertainties, and assumptions are fully defined, documented, and communicated to NRC decision makers. Guidance was presented for decision makers on how to consider the relative importance, validity, and reliability of quantitative risk estimates in conjunction with other, qualitative, safety-related factors. As part of NRC investigations on several methods for obtaining risk insights for digital systems, T. Hilsmeier (NRC) described NRC research and preliminary results for developing probabilistic risk assessment modeling of digital instrumentation and control systems for nuclear power plants.

In addition, the status of the System Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) software development was discussed by W. Galyean (Idaho National Laboratory). The NRC SAPHIRE software is widely used for fault tree and event tree analysis. SAPHIRE capabilities have been expanded in response to advances in the state-of-the-art of probabilistic risk assessment. S. Hess (Electric Power Research Institute) presented a paper by K. Canavan and J. Gaertner (Electric Power Research Institute) on software under development to assist in the documentation and maintenance of probabilistic risk assessments, where assumptions and simplifications are closely tied to the probabilistic risk assessment model.

The conference also included papers on health care applications of probabilistic risk assessment methodologies. Because of the conference location in New Orleans, a significant emphasis was given to the topic of emergency management and emergency response.

IMPRESSIONS/CONCLUSIONS:

Attendance at the conference was useful because it allowed CNWRA staff to remain current with the use and development of probabilistic safety assessment methodologies. The conference afforded an excellent forum for the exchange of technical ideas and regulatory perspectives.

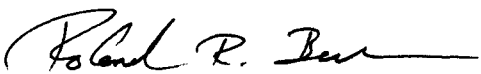
PROBLEMS ENCOUNTERED: None

PENDING ACTIONS: None.

RECOMMENDATIONS:


Participation in future Probabilistic Safety Assessment and Management conferences is highly recommended. The next conference is scheduled for 2008 in Hong Kong. It will be preceded by a workshop on probabilistic safety assessment methods in Taiwan. Currently, conference plans include consideration of papers in high-level waste management and decommissioning. It is recommended that CNWRA staff contribute and participate in the organization of the conference.

SIGNATURES AND DATE:



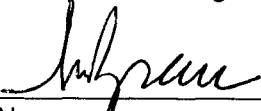
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Senior Research Engineer

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O. Pensado
Senior Research Engineer

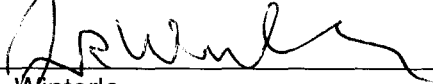
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R. Nes
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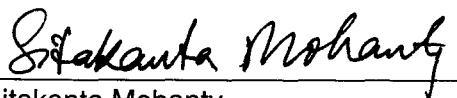
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