Strål
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Swedish Radiation Safety Authority

Operational use of PSA – An Authority Perspective

PSAM Topical on Practical Use of Probabilistic Safety Assessment in Operations
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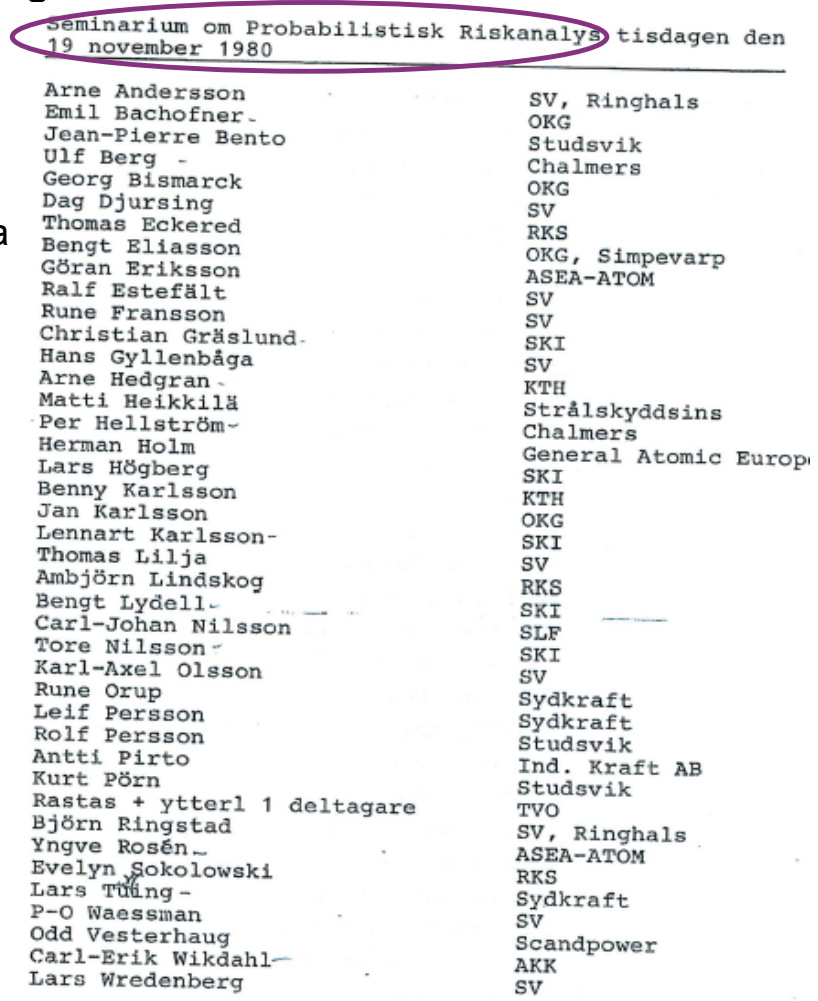
Per Hellström, SSM (Swedish Radiation Safety Authority), Sweden

"*What has been will be again, / what has been done will be done again; / there is nothing new under the sun*."

- Some statements on use of PRA:
  - Prioritisation of safety improvements
  - Selection and verification of design options
  - PRA can be used to illustrate the single failure criteria and provide input to design solutions
  - Experience follow-up
  - PRA models are seen as important for conclusions about occurred events
  - Basis for training and emergency planning
  - Optimisation of surveillance intervals and repair criteria (AOT´s)
  - PRA system should be further developed and refined to always be available as a tool
  - The analysis process itself is of large value for competence development
  - PRA must always be kept updated and checked against operational experience



Seminarium om Probabilistisk Riskanalys tisdagen den 19 november 1980

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Emil Bachofner	OKG
Jean-Pierre Bento	Studsvik
Ulf Berg	Chalmers
Georg Bismarck	OKG
Dag Djursing	SV
Thomas Eckered	RKS
Bengt Eliasson	OKG, Simpevarp
Göran Eriksson	ASEA-ATOM
Ralf Estefält	SV
Rune Fransson	SV
Christian Gräslund	SKI
Hans Gyllenbåga	SV
Arne Hedgran	KTH
Matti Heikkilä	Strålskyddsins
Per Hellström	Chalmers
Herman Holm	General Atomic Europ
Lars Högberg	SKI
Benny Karlsson	KTH
Jan Karlsson	OKG
Lennart Karlsson	SKI
Thomas Lilja	SV
Ambjörn Lindskog	RKS
Bengt Lydell	SKI
Carl-Johan Nilsson	SLF
Tore Nilsson	SKI
Karl-Axel Olsson	SV
Rune Orup	Sydkraft
Leif Persson	Sydkraft
Rolf Persson	Studsvik
Antti Pirto	Ind. Kraft AB
Kurt Pörn	Studsvik
Rastas + ytterl 1 deltagare	TVO
Björn Ringstad	SV, Ringhals
Yngve Rosén	ASEA-ATOM
Evelyn Sokolowski	RKS
Lars Tuing	Sydkraft
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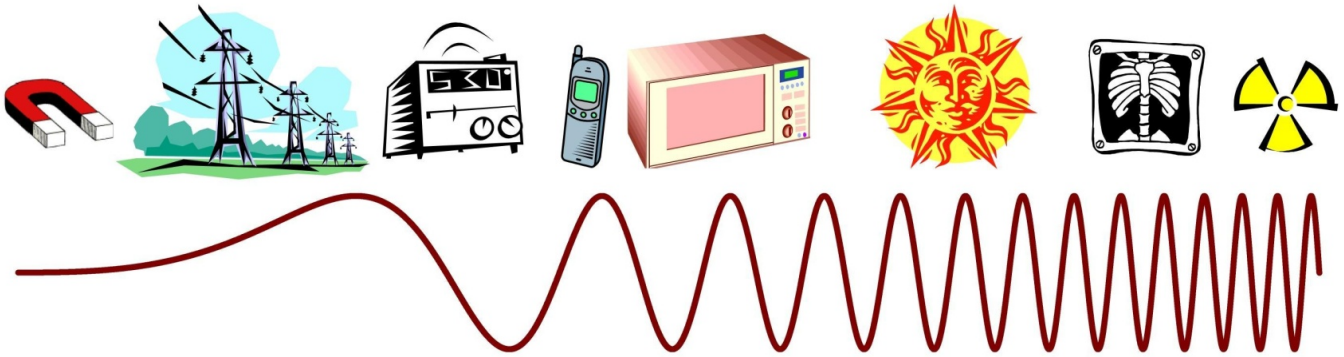
Carl-Erik Wikdahl	AKK
Lars Wredenberg	SV

SSM radiation safety responsibility covers the entire electro-magnetic spectrum



ELEKTROMAGNETISKA FÄLT				OPTISK STRÅLNING			JONISERANDE STRÅLNING	
Statiska fält	Lågfrekventa fält	Radiovågor	Mikrovågor	Infrarött	Ljus	Ultra-violett	Röntgen	Gamma

0 Hz 50 Hz 300 kHz 100 MHz 300 MHz 300 GHz 500 THz 10^{15} Hz 10^{19} Hz

Swedish nuclear facilities

Reactors to be closed down 2017-2020

BWR (ASEA-Atom)

PWR (Westinghouse)

Other installations

Forsmark NPP

SFR

1988 Final storage
Low/intermediate waste
To come spent fuel storage – SKB method

Studsvik

Research reactors closed

Westinghouse SE

Fuel manufacturing

m/s Sigrid

Transportation

Oskarshamn NPP

Barsebäck NPP

Closed

CLAB

Central intermediate Spent fuel storage

Assumptions for this presentation

- Operation refer either to Licensee or the authority´s operation
- Use of PSA refer to the use of any information in the PSA, from data collected and used as input to develop the PSA model to the various outputs (results) that can be produced
  - Reliability data, logic, attribute information etc.
  - Calculated frequencies, conditional probabilities, importance factors etc.

Basic principles for SSM oversight

- Maintaining an up-to-date picture of the safety status at each licensee and reactor
- Early awareness of degrading safety culture
- Focus on high level issues
  - But spot checks made on detailed level
- Priority / focus based on safety importance
- Robustness (important to be aware about conditional probabilities)
- Focus on internal processes and internal control of the licensee
  - Example recurring meetings with Licensee PSA groups

Responsibility for PSA models

- Utilities are responsible for development of the PSA models
- SSM has access to the utility's models
  - Yearly deliverables
- SSM can run own analyses or extract data for regulatory purposes using the utility's models

Purpose with PSA

- Base line PSA
  - Show that plant is safe enough – meet a safety goal
  - Balanced design – avoids dominant contributors
  - Provides information about strengths / weaknesses – basis for prioritisation of improvement areas

- Applications
  - Graded approach – support use of resources commensurate with risk decrease / safety increase
  - Specific use of risk information to choose between options with different cost and that are associated with different risk reduction / safety increase.
    - Reporting levels, inspection, maintenance.

Requirements for PSA at Licensees

- Must:
  - Be realistic
  - Cover both core damage and radioactive release to environment
  - Cover all modes of operation
  - Cover all events, which can lead to radioactive release to environment
  - Be up-to-date with the plant
  - Consider uncertainties
- Should (‘must’ in practice):
  - Be used to assess events from operational experience
  - Be used to assess plant changes

In new regulations (work in progress) Guidance on evaluation with probabilistic methods

- Basic application / use of PSA

  - Identification of strengths and weaknesses and their relative importance to support evaluation and prioritisation of options for improvements in the protection of the public and the environment against exposure to ionizing radiation eventually resulting in a balanced risk profile without cliff-edge effects.

New regulations will be more clear about expected uses of PSA results 1(2)

- Informing of education and training programs,
- Identification of scenarios to support development of accident management instructions,
- Informing of programmes for maintenance, inspection and operability readiness testing,
- Evaluation of the safety importance for Structures, Systems and Components.

Expected uses of PSA results 2(2)

- Support to an overall view and prioritisation of radiation safety issues,
- Inform the preparation and scheduling control of work in the plant.
- Inform evaluation of Tech. Specs. Criteria (AOTs etc.)
- Support for justification that requirements to design are met, e.g. single failure criteria, separation, diversity, grace time.
- Support to the interpretation of ”reasonably achievable” in meeting design requirements.

Actual uses of PSA at Licensees

- Evaluation of plant changes (including SAR and Tech. Spec. changes)
  - Independent core cooling design options
  - Notifications – on a case by case basis
  - Technical specification changes - Allowed outage times, test intervals (RI-ISI)
  - Exemptions to technical specifications
- LER reporting - Risk Follow-up
- Refuelling /shutdown (specific) PSA for planning
- Internal use at Licensees to support investigations on a wide variety of issues including SSM decisions
  - The information in the PSA not only the qualitative and quantitaitive results
  - Information such as location of equipment and cable routing and attributes about equipment design in support of separation and diversity issues

Examples of use of risk information at SSM

- Prioritisation of oversight activities – type of oversight, scope and frequency
- Prioritisation of oversight findings
- Prioritisation of reported events
- Prioritisation of open issues (similar to NRC generic issues)
- PSA results can be part of SSM prioritization and assessment

Summary / Conclusions

- Requirement that the plant shall be analysed with both deterministic and probabilistic methods
  - However, no formal requirement for applications where probabilistic methods (PSA) are used
- Guidance to requirements indicate many potential uses of PSA
- SSM expect that risk insights (PSA based) are used by licensees to prioritise efforts, inform decision making
  - In principle requirement that safety issues shall be informed by both deterministic and probabilistic methods ->
  - Interpretation is that SSM actually requires use of PSA in relevant cases
  - Probabilistic arguments can play a major role for the overall assessment by SSM
- Communication of the interpretation of results including uncertainties is very important

- Thank you for listening
- Questions?