

International Atomic Energy Agency

International Conference on topical issues in Nuclear Safety

3-6 September 2001- Vienna, Austria

Topical issue 1: Risk-informed decision making

Views of the French Nuclear Safety Authority on risk-informed approaches and on the use of Probabilistic Safety Assessment

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1. INTRODUCTION

- There is a trend to encourage use of Probabilistic Safety Assessment in view of supporting decision-making for nuclear safety
- France has not a reputation for extensive use of PSA
- However France is using PSAs for nearly 20 years, has a large experience of them and is aware of their limitations
- This makes French regulator modest in the use of PSA
- This presentation will discuss the use of PSA, in relation with safety objectives, i.e., for France, improving safety

2. Benefit of PSA for Regulatory decision-making

2.1 Factors favourable for the development of high quality PSAs in France

- France has now a large experience in using PSA
 - *Relying on a very large data base (more than 1000 operating reactor-years)*
- Several factors have contributed to high quality PSA in France
 - *high amount of data due to the standardisation of French reactors*
 - *numerous simulator experiments to collect data on human factors*
 - *components considered in a high level of detail*
 - *all operating states of plants taken into account (including shutdown)*
 - *PSA developed independently by utility (EDF) and regulator (Technical Support Organisation IPSN)*
 - *mutual review of the independent PSAs*

2. Benefit of PSA for Regulatory decision-making

2.2 PSA as a valuable tool for decision-making

- PSA have been used successfully in France
 - *to complement the deterministic demonstrations in design and operational issues*
 - *for prioritisation of safety issues*

... thus improving safety
- Some example of use:
 - *reassessment of the list of multiple failure events*
 - *identification of dominant sequences during safety reassessment*
 - *verification of appropriateness of Operating Technical Specifications*
 - *assessment of risk in case of non conformance discovery*
- French Regulator decided in 1999 to set up a Basic Safety Rule on PSA methodology, which is nearly drafted

3. PSA limitations

3.1 Reasons for using PSA with care

- Experience in using PSA emphasises the need for being well aware of their limitations in order not to lose the benefit of their use
- Some key elements which can contribute to limit use of PSA:
 - *The variability of the results which depend highly on input data and modelling (Cf. past French - Belgian comparison)*
 - *PSA input data relies on experience feedback, i.e. on the past:*
 - *it is difficult with PSA to anticipate new safety issues*
 - *data reliability on very low failure rate components has low significance*
 - *PSA level 2 results are less reliable than level 1 due to remaining uncertainties in modelling physical behaviour following core damage*

3. PSA limitations

3.2 "Risk-informed" does not signify relying on PSA exclusively (1)

- There seem to be a commonly accepted equivalence between "use of PSA" and "risk-informed approaches"
- "Risk-informed" concept should not be restricted to the use of PSAs
- For instance PSA do not properly deal with organizational issues, safety culture issues, unexpected events

e.g. in France:

Le Blayais NPP flooding,

Dampierre organizational problems,

Cattenom multiple fuel leakage

PSA limitations

3.2 "Risk-informed" does not signify relying on PSA exclusively (2)

- It can also be considered that a "risk-informed approach is used when:
 - *selecting postulated initiating events, as done in deterministic safety case*
 - *identifying sources of danger from experience feedback*
 - *assessing organizational concerns*
- There is a need to maintain constant questioning attitude and to critically consider PSA results

4. PSA and Safety Objectives

4.1 Discussion on constraints (1)

- General safety objectives are set by the Regulator and, in France, definition of the corresponding technical solutions rely mainly on discussion between utility and safety bodies:
 - *enables a continuous improvement of safety*
 - *prevents from regulatory rigidity*
- With a general aim for improving safety, use of PSA is encouraged for that goal and not to reduce regulatory requirements

4. PSA and Safety Objectives

4.1 Discussion on constraints (2)

- Should PSA used for any "regulatory burden" reduction or "risk-neutral" decision making, caution is required:
 - *demonstration of regulatory compliance has to be made by utility and not justification of requirement by the regulator*
 - *pursuant to safety culture principles, cautious approach should prevail regarding safety concerns*
 - *any reduction should be reviewed by taking into account its consequences on the overall safety case*

4. PSA and Safety Objectives

4.2 Probabilistic safety criteria

- Even when safety objectives are met, the technical solutions for achieving them are to be debated
- Setting strict limits for probabilistic criteria is not appropriate and raises the following observations:
 - *risk-acceptance is not a merely technical issue*
 - *given the high dependence of PSA results on model used and input data, it is difficult to set strict limits to be respected in safety demonstrations*
 - *a perverse effect of setting limits has to be considered: once the limit is proven to be respected, utility may lack the incentive to improve safety, even when it could be done at low additional cost*

5. Conclusion

- France has acquired a valuable experience in development and use of PSAs and consider them as useful for improving safety, but:
 - *PSA users should always remain aware of their limitations*
 - *Risk-informed decision making also rely on other approaches than PSA*
- It is not the role of Regulator to encourage use of PSA in view of reducing constraints
- PSA should mainly be used for relative quantification rather than absolute consideration (fixed criteria)
- International guidance related to PSA should:
 - *make aware of problems in using absolute criteria*
 - *help to the development of high quality PSA*
 - *not impose direction for use of PSA (national responsibility)*