

ON THE RELATIONSHIP BETWEEN REGULATORY ISSUES AND
PROBABILISTIC RISK ASSESSMENTS*

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The objective of this study was to obtain some perspective on the characteristics and the relative number of regulatory issues that are PRA related, i.e., can be effectively addressed by plant specific PRA studies. It was also aimed at developing approaches to resolution of regulatory issues as part of plant specific PRAs.

Several ongoing NRC programs include a number of safety-related issues which are applicable to operating plants. A number of these issues include aspects that strongly interact with items addressed in PRA studies. The resolution of several generic issues using PRA studies has already started.(1). A review of over 335 issues included in three NRC programs was conducted(2):

- Generic Issue Program(3) (GI)
- Systematic Evaluation Program(4) (SEP)
- TMI Action Plan(5) (TMI).

The review identified 240 items related to PRA, 120 of which were judged to have significant effect on core damage frequency. It is believed that these items can be effectively treated in a PRA study that includes internal and external events, as can be seen from Table 1.

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Views expressed in this paper do not necessarily represent official NRC policy.

Table 1 Relationship Between Regulatory Issues and Various Scopes of PRA Studies

NRC Program	Type of Issue ^(*)					Qualitative Effect on Core Damage Frequency	
	Internal Events		External Events	Consequences Containment	S and C S and P		Non PRA N
	S ₁	S ₂	P	C			
Generic Issue (GI)	14	-	7	-	4	High Moderate Low	
	14	1	1	4	8		
	7	23	3	6	8		42
Systematic Evaluation (SEP)	13	-	7	-	2	High Moderate Low	
	9	2	3	2	3		
	1	3	4	1	1		4
TMI Action Plan (TMI)	21	-	-	1	1	High Moderate Low	
	28	2	-	1	2		
	12	20	-	5	3		45
Total of Significant Issues	99	5	18	6	20	Moderate or High	
Total of Issues Judged Unimportant	20	46	7	12	12	91	Low

(*)

- N - There is no relation with a PRA study.
- S₁ - There is a definitive relation to PRAs treating internal events. PRA capability at treating the issue is well established.
- S₂ - Same as S₁ except that the issue is not easily treated by methodologies presented in the PSA Procedures Guide⁽⁶⁾.
- P - There is a definitive relation to PRAs treating external events.
- C - There is a definitive relation to PRAs treating physical phenomena, containment response and ex-plant consequences.

The prioritization of issues according to their effect on core damage frequency (see Table 1) was based on judgment as explained in Reference 2. We compared our judgment with the results of the systematic prioritization of the same issues presented in Reference 3; agreement was obtained in more than 80% of the cases.

Another relationship of interest is shown in Table 2. It indicates that regulatory issues are amenable to treatment within a PRA study in various areas and affect the determination of:

- Initiating Events and their frequencies (IE)
- System Success Criteria (SS)
- Accident Sequences Event Trees (ET)
- Fault Trees for systems and choice of failure data (FT)
- Human Performance Analysis and quantification (HE)
- System Interaction Analysis (SI).

The number of issues related to HE and SI is substantial. A regular PRA study will not necessarily address them unless special modeling for their treatment is incorporated.

The above grouping corresponds to definitive steps which ought to be performed when a PRA study is conducted. Thus, the categorization helps in advance planning on issues that need to be modeled at each step of a plant specific PRA. This subject was treated in the PSA Procedures Guide⁽⁶⁾.

In reference 1, the regulatory issues were divided into three categories:

- a) Issues that can provide input to a PRA study. Technical resolution of these issues is in progress. If pertinent information is developed and incorporated in PRA, it could affect the results of a PRA study. Thirty-four issues were assigned to this category.

Table 2 Relationship Between Regulatory Issues and Various PRA Fields

NRC Program	Interaction with PRA Areas						Qualitative Impact on Risk
	Init. Event IE	Succ. Crit. SS	Event Tree ET	Fault Tree FT	Human Error HE	Syst. Inter. SI	
Generic Issue (GI)	7	-	8	14	2	6	High
	10	1	5	13	3	5	Moderate
	10	8	7	17	2	3	Low
Systematic Evaluation (SEP)	8	1	6	12	2	10	High
	9	1	1	6	1	4	Moderate
	5	1	1	4	1	2	Low
TMI Action Plan (TMI)	10	7	15	17	13	13	High
	8	4	9	18	19	7	Moderate
	4	6	7	15	13	6	Low
Total	52	14	44	80	40	45	High and Moderate

- b) Issues that can benefit from a PRA study without special modeling. A regular plant specific PRA will resolve these issues. Twenty-nine issues were judged to be in this group.
- c) Issues that can benefit from a PRA study if they are specially modeled. This may require adding to the PRA specific accident sequences, failure modes or dependence modeling, in order to obtain significance or technical resolution of these issues. A list of 80 issues is given in the PSA Procedures Guide⁽⁶⁾. It should be noted that issues may appear in more than one category.

In summary, several classifications of regulatory issues with respect to the conduct of PRA were presented. It is found that PRA could be a significant step in the further resolution of over 100 current regulatory issues. However, additional modeling is required to incorporate them in plant specific PRAs.

References

1. "Probabilistic Risk Assessment (PRA) Reference Document," USNRC, NUREG-1050, September 1984.
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5. "NRC Action Plan Developed as a Result of the TMI-2," USNRC, NUREG-0660, May 1980.
6. I.A. Papazoglou et al., "Probabilistic Safety Analysis Procedures Guide," NUREG/CR-2815, September 1983.

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