Comments on NUREG-1560 (Draft) "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance"

by

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I. Introduction

In November 1988, the Nuclear Regulatory Commission (NRC) issued the Generic Letter 88-20[1] requesting that all licensees perform an Individual Plant Examination (IPE) to identify any plant specific vulnerabilities to Severe Accidents. In response to this NRC request, the NRC staff received 75 IPE submittals for 108 nuclear power plants. The NRC reviewed these IPE submittals with the objective of gaining perspectives on (a) improvements made to individual plants as a result of their IPEs and collective results of the IPE program, (b) Plant specific design and operational features and modeling assumptions that significantly affect the estimation of the core damage frequency (CDF), and Containment Performance, and (c) the Quality of the IPEs with respect to their potential role in Risk-Informed regulations.

The perspectives gained by the staff in the above areas were documented in NUREG 1560[2] and published for public comment in October 1996. This paper discusses the comments generated by Northeast Utilities PRA program on this report.

II. Area of Focus for Comments

NUREG 1560 consists of 5 parts and contains 18 chapters. These 18 chapters discuss NRC perspectives in the following key areas:

- Impact of the IPE program on Reactor Safety,
- Reactor and Containment Design and Operational Features,
- IPEs with respect to Risk-Informed Regulations, and
- Other additional objectives such as Safety Goal Implications, Impact on the Station Blackout Rule on CDF, NUREG-1150 perspectives).

While each of the areas provides significant data or insights to PRA professional, NU chose to focus its comments on chapters that discuss IPEs with respect to Risk-Informed regulations and the staff discussions on how IPEs compare with Quality PRAs. The reason for our choice of focus is as follows.

The NRC Policy on PRA[3] states the following:

"The use of PRA Technology should be increased in all regulatory matters to the extent supported by the state-of-the-art in PRA Methods and Data in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy."

NUREG 1560 may be viewed as the staff's perception of the state-of-the-art in PRA methods, and to that extent, conveys the Technical Basis of future Regulatory Guides and the Standard Review Plan.

In summary, NU chose to comment on the chapters which focus on Quality PRAs and Risk-Informed Regulations since (a) the contents on the other chapters is primarily a compilation of facts from many IPEs , and (b) the contents of the chosen area has a significant impact on the future of PRA technology and viability of PRA applications.

Specifically, Chapters 6, 14, 15, and 8 were the focus of our comments.

III. Comments: Summary

The perspectives and insights published in NUREG 1560 report are based on a review of 75 IPEs. The document is a major step forward towards PRA applications to support nuclear power plants. It is extremely informative and puts to rest many controversial issues which inhibited growth of PRA into regulatory applications. The report has used many IPE insights to identify strengths and weaknesses of IPEs and delineated in detail how IPEs differ from the expected Quality PRAs. This discussion will provide unambiguous guidance to the PRA practitioner on methods that are acceptable. Overall, the NUREG 1560 is an excellent overview of the state-of-the-art of the IPEs.

While the technical contribution made by this report to the PRA discipline is tremendous, it could be improved. When evaluating strengths and weaknesses of PRA, the report maintained a negative focus. Based on the theme and content of Chapters 14 and 15, it appears significant efforts were expended to document "Why PRAs/IPEs cannot be used for Regulatory Related Applications" rather than to find "How PRAs can be used to support Regulatory Related Applications." Due to this negative focus, NUREG 1560 fails to explore the many areas in which the IPEs can be used "As is." To this extent, efforts expended to generate NUREG 1560 failed to exploit the strengths of PRA and falls short in its mission to support the Commission PRA goals.

This paper will highlight the strengths of PRA that are recognized in NUREG1560 and will demonstrate how integration of (a) the recognized strengths of existing PRAs, (b) the key elements of the EPRI PSA Application Guide[4] and the Standard Review Plan (SRP)[5] (Draft), and (c) the adequacy of order of magnitude type comparisons for many applications can be used to allow "As Is" PRAs for several regulatory related uses while the quality of models is upgraded.

IV. Comments on Specific Report Sections

Comments on "Table 6.1- Accident Sequence Analysis," Section 14.3.2 "Accident Sequence Analysis" and Section 15.2.2 "Accident Sequence Analysis"

Lack of tolerance for conservative success criteria, requirements to perform additional calculations to support realistic success criteria, and requirements to credit mitigating systems are the key areas discussed under accident sequence analysis. For example, if a plant had the capability to inject into a Steam Generator using the fire water system, and procedures existed to perform that task, under IPEs, licensees had the choice of either crediting or not crediting this capability in the PRA model. Under the Quality requirements, the licensees may be required to credit these systems in the PRA modeling and perform calculations to support their use.

The motivation for these "Quality" requirements can be understood when one thinks of variability of the results of similar plants. From a regulatory perspective, comparison of PRAs or importance parameters derived from these PRAs can be cumbersome due to

the lack of consistency. For example, for plants with similar ECCS systems, the Risk Achievement Worth (RAW) value of the Accumulators may be a 1.01 or 5 depending upon the use of Design Basis analysis or Best Estimate analysis for establishing success criteria.

Model inconsistencies have been recognized as a road block to the enhanced use of PRA. To that extent, this deficiency needs to be addressed. However, this weakness should not prevent use of current models for regulatory related applications. Industry need to acknowledge that PRA models will have the following limitations until this weakness is corrected:

1. Plant to plant comparisons need to factor in the inconsistencies in success criteria, and
2. If a PRA application relies on the relative ranking of importance parameters such as RAW or Fussel-Vesely (FV), or critical decisions are based on a comparison of importance parameters against a set threshold value, then, these conservatisms need to be tracked and the results reviewed in light of those conservatisms.

In summary, as demonstrated during the implementation of the Maintenance Rule which heavily relied on importance parameters, these inconsistencies can be overcome to achieve the desired overall results.

The report has already identified inadequate treatment of phenomenological impacts such as "NPSH problems," "Strainer Clogging," and "Harsh Environment" as a deficiency of "As Is" PRAs. It is difficult to argue that "As Is" PRAs model these accurately. It is also impossible to argue that these phenomena have insignificant impacts on the PRA model and the numbers generated by that model. In fact, our experiences at times have demonstrated the phenomena such as NPSH, can have a profound impact on PRA modeling. Other phenomena that may be inadequately addressed in PRAs are MOV Pressure Locking/Thermal Binding, and Water Hammer. However, one needs to be careful in coupling these phenomena to "Quality" PRA requirements. These issues are fundamentally issues of "inadequate design," not poor PRA presentation of the plant. The inherent nature of the PRA (using operating experience to enhance the model) has to be recognized and factored in to the regulatory use and regulatory requirements on the PRA models. As plants continue to operate, other phenomena which are not known yet, may show themselves. That is even if a nuclear plant operates without any changes to the Designs or Procedures, discovery of phenomena due to operating events may cause significant changes in the calculated CDF. This dynamic aspect must be factored in to any regulated PRA applications or requirements.

The requirement should be to address these via timely Model Enhancements when these phenomena reveal themselves, or accommodate them via uncertainty and sensitivity analysis found significant for specific applications.

Comments on Section 15.2.3 "Systems Analysis"

In comparison of the IPEs to Quality PRAs in the area of Systems Analysis, the commission pointed out the lack of calculational support for eliminating support system

dependencies and equipment survivability in harsh environment as an issue. In addition, in the discussions on the weaknesses of Sequence Quantifications, use of the MAAP code has been identified as a weakness. Obviously, this weakness begs the question on the need for additional calculations, and if such calculations are needed, the quality and rigor of the calculations needed.

In the past, when there were questions on some of these issues, PRA had the freedom to use engineering judgment to decide without resorting to expensive quality calculational aids. Since the PRAs were not regulated this was not a problem. For IPEs this was not a problem since the overall intent was vulnerability identification. For example, a licensee had the option of not modeling HVAC, if the HVAC failure probability was negligible in comparison to the front-line system failure probability and we had knowledge that the HVAC system had sufficient redundancy. There was no requirement to perform detailed heat up calculations. Obviously, since engineering judgment was used in elimination of HVAC, it needs to be identified as a key uncertainty that need to be re-visited in regulatory applications. In certain applications that are focused on HVAC (e.g.: Maintenance Rule), it may be extremely important to re-visit this assumption and perform calculations if necessary.

However, such requirements for additional detailed calculations must be focused, selective, and application specific. Also, as mentioned before, there are many PRA applications, where this weakness will not affect the results or conclusions.

Comments on "Table 6.1- Data Analysis Key Characteristics," Section 14.3.4 "Data Analysis," and Section 15.2.4 "Data Analysis"

The PRA technology derives its strength over classical safety analysis techniques due to its ability to combine the continuously compiling operating experiences (data) with the design and operational features to determine the actual impact of nuclear plant on public health and safety. To that extent Data Analysis and Collection is a critical task. The quality of how this task is conducted can be a cornerstone of a "Quality PRA." The staff has recognized the critical nature of this aspect and has communicated its significance by creating stringent requirements that a "Quality PRA" must abide by. However, the requirement stated have the following specific shortcomings:

1. It does not recognize the quality requirements for data between "Risk Significant" versus "Non-Risk Significant" components. For example, a distinction needs to be made between efforts expended to collect and analyze data to calculate "Emergency Diesel Fails to Start" versus data analysis and collection requirements on "Check Valve of a Redundant/Diverse line failure to Open,"

2. In distinguishing quality requirements, it does not account for the failure rate. The failure rates will also determine the adequacy of data, need for plant specific or generic data, and the availability of data. These need to be considered in specifying requirements. For example, the failure rate for a "Pump Failure to Run" and " a Contact Pair Spurious Closure" need to be different. For the former, plant specific data may be adequate, available, and most appropriate. For the latter, plant specific data may not be appropriate, available, or adequate.

3. It Ignores the realities of the quality of available data sources. Unlike requirements on such things as Success Criteria and Systems Modeling, requirements on data, in some ways, apply to the past. The quality of data accumulated in the pre 10CFR 50.65 era is not thorough. This whole section needs to be rewritten recognizing this dimension of Data. In order for PRAs to be viable, these requirements need to be viable as well as technically sound.

4. Quality requirements for data do not recognize the difference in applications. Many PRA applications (e.g., Justification for Continued Operations), as will be demonstrated later, can be adequately supported with failure probabilities that are reasonable (accurate to the single significant digit or order of magnitude for a small subset of basic events).

5. Key characteristics in Table 6.1 are unnecessarily prescriptive. For example, rather than requiring reasonable failure probabilities calculated using acceptable methods, these characteristics dictate data collection and quantification methods. Statements such as those requiring inclusion of "ALL" incidents overlook the licensee burden and appear not to be in line with the Commissioner's comments on the PRA policy. Data collection should be consistent with the law of diminishing returns. It may take 10% of the effort to collect data on components contributing to 90% of the plant CDF/risk, and 90% of the effort on the remaining 10% of the CDF/risk.

Overall, these sections need to be re-visited in light of NRC responses to PRA Policy Statement (page 19 of NRC Responses to Comments)[3] which stated the following:

".....The Commission Agrees that it should make every effort to avoid any unnecessary regulatory burden in connection with collecting reliability and unavailability data. Specific comments on the types of data that should or should nor be collected will be addressed in connection with propose data collection requirements when they are published for comment....."

Also, Commissioner's comments on NRC PRA Policy need to be re-visited. In SECY-95-126, (June 30, 96)[3] the commissioners included the following comment on the PRA policy.

".....The staff should give careful consideration to data requirements for each proposed regulatory application so as to avoid unnecessary burdens on licensees....."

Finally, under Section 15.2.4, the staff has summarized many deficiencies in the data without mention of any strengths of data or failure probabilities. The "As is" PRAs have key strengths that need to identified. For example, many PRAs have calculated reasonable values for Transient Frequencies. Another strength could be "In most cases the calculated system failure probabilities are reasonable and consistent with operating experience." Many such strengths can be delineated and documented when one perceives that failure probabilities need to be "Expected values for future" rather than "Averages values for the Past."

Comments on "Table 6.1- HRA Key Characteristics," Section 14.3.5 "Human Reliability Analysis," and Section 15.2.5 "Human Reliability Analysis"

The Human Reliability Analysis (HRA) was an area that received significant scrutiny during the IPE reviews. The capability of Human Error Probabilities (HEPs) to drive the bottom line CDF, the variability of methods, and the tolerance of the methods to the biases of the analysts contributed to this scrutiny.

Table 6.1, Section 14.3.5 and section 15.2.5 identify the key characteristics, the quality requirements, and the quality of IPEs with respect to Quality PRAs in the HRA area. As Table 1 reveals, several deficiencies identified resulted from the inconsistent methods. It is acknowledged that the IPEs resulted in maturity of the technology and did identify several significant weakness in HRA modeling (e.g., accommodating dependencies between HEPs). The following observations are noted:

1. Limiting restoration to LOSP, PCS, DC Buses, and Emergency Diesels is not necessary. If plant specific or generic data can support it, PRAs should be able to credit restoration of other components.

2. Requirements to perform detailed HRA on all Operator Actions that are not truncated needs to be re-visited. The objective is to prevent undue biases in different applications.

3. Sophistication of the methods required should not overlook the overall nature and data availability for calculating HEPs.

4. Future work in this area needs to be geared towards achieving consistency. New methods do not necessarily lead to better HRAs.

Comments on Sections 8.5 "Areas of Research"

NUREG 1560 (Section 8.5) identifies that human actions are important contributors and states that there are considerable uncertainties associated with determining HEPs. As the solution, research on developing of an improved method to address HRA has been identified. Two comments are noted here: (I) Almost every PRA analyst will agree with the report that HEPs are important contributors to CDF with considerable uncertainty. However, one should question whether this uncertainty is associated with lack of "Methods" or "Data". In implementation of HRA and in attempts to generate HEPs with low uncertainties, "Data" rather than "Methods" are limiting. Availability of several "Acceptable Methods" rather than lack of "Acceptable Methods" contribute to the variabilities and uncertainties in HEPs, (ii) Many HRA methods that are in place tend to overlook an important element in the definition of the "Basic Event" in fault trees. When PRAs were performed to support WASH-1400[6], in deciding how to define basic events, or to what level the components need to be broken down, "Availability of Data" was used as guide. For example, even though a pump may consist of hundred components (nuts, bolts, keys, shafts,..), rather than attempting to sum up the individual failure probabilities, pump failure rates are calculated from operating experience data.

Similarly, while breaking up HEPs to its constituent parts will assist in understanding HEPs, for the purpose of quantification, a low level detail may be more appropriate.

Comments on Section 8.7.3 "Risk Informed Regulation"

As pointed out in this section, NUREG 1560 has compiled a vast amount of information derived from IPEs that will be useful in future Risk Informed applications by licensees. A few statements in Section 8.7.3 have no valid technical basis, they oppose rather than support the NRC PRA Overall Mission Policy, and are counteractive to Public Health and Safety.

".....As the IPEs represent a substantial investment by the licensees, the potential use IPEs in risk-informed regulation is of considerable importance....."

Almost every PRA application, as the calculation technologies develop, has shown that use of Risk-Based techniques results in enhancement of public health and safety (e.g:, CEOG Tech Spec AOT Extension Studies[7], CEOG Transition Risk studies[8], MP3/WOG Risk Based ISI Study[9]). It is this contribution to safety that should drive Risk-Informed regulations. On the other hand, it is acknowledged that overlooking PRA insights has consistently resulted in significant resource expenditures in areas that are of essentially zero significance to public health and safety.

".....For example, this report identifies an IPE weakness in over-reliance on Generic Data. This area, therefore, be examined in greater detail if an IPE/PRA were to be used for regulatory purposes other than GL 88-20....."

This sentence may be interpreted to mean that until "Quality PRA" requirements are fully met PRAs cannot be used any regulatory purposes. If that is the case, "As is" PRAs are inappropriate to support such rules as 10CFR 50.65 (Maintenance Rule), and Technical Specification changes. Such an interpretation is counter productive and is not supportive of the PRA Policy that looks to enhance use of PRA in regulation commensurate with the State-of-the-art of Technology. As discussed in a different section of this report state-of-the-art PRA models, recognized weaknesses, and tools to deal with the those weakness delineated in the Standard Review Plan makes the "As Is" PRAs applicable for a wide variety of applications while "Quality PRA Requirements" are phased in.

The report should clarify this statement.

Overall Comments on Sections 15.2.1-15.2.6

Chapter 15 of NUREG 1560 is entitled "Comparison of IPEs to a Quality PRA." It discusses in detail how the "As Is" PRAs do or do not meet the "Quality PRA." Table 1 summarizes observations made in Chapter 15 in a tabular form.

The deficiencies identified in the "As is" PRAs can be grouped into three key categories:

1. Weaknesses of "As Is" PRAs due to inconsistent methods used,

2. Perceived weaknesses due to limited information reviewed to the regulators during the IPE reviews, and
3. Deficiencies in methods uncovered due to maturity of the technology.

These explicitly identified deficiencies will be of value to the licensees in that they will provide unambiguous guidance towards developing quality PRAs. However, note that information provided in Chapter 15 does very little in identifying strengths of "As Is" PRAs. When licensees incorporate insights from many Owner Group studies that are currently underway[10, 11, 12], most deficiencies of category 1 above will be eliminated.

V. Use of PRAs while Improving Quality

Each PRA application deals with a unique set of parameters associated with the nuclear power plant. For example, in the use of PRA to review the public heath and safety impact associated with a design deficiency, only a subset cutsets affected by the design deficiency may be of interest. Upon close examination, the PRA analyst may find that the on-line PRA model identifies all these cutsets. On the other hand, an MOV prioritization effort may need to include the whole PRA model and other aspects such as Shutdown and External Events that are beyond the model.

The requirements of "Quality" need to recognize the variability of the parameters by PRA application type and relate that variability to the known strengths and weaknesses of PRA.. The purpose of this section is to show that once this variability is recognized the state-of-the-art methods and processes can be used to allow use of "As Is" PRAs in some regulatory applications. Several key elements of this state-of-the-art methods and processes as:

(i) "As Is" PRA Model
(ii) Strengths/Weakness of PRAs documented in NUREG 1560
(iii) Qualitative Guidance provided in PSA Applications Guide
(iv) Six Elements in the Standard Review Plan

Use of PRA in "Justification for Continued Operation (JCO)" is selected as the example application to demonstrate the point. If a licensee is confronted with a non-conforming condition of a safety related component, it may face two alternatives: (a) an immediate plant shutdown, or (b) addressing the issue in the next plant shutdown. In the use of PRA into this, two critical values that need to be compared are: (a) transition risk, and (b) increased risk of operating the plant with the non-conforming condition for several months. Use of the key principles in the PSA Application guide (e.g.: Scope assessment) which includes mapping of affected parameters to PRA model will reveal that the quantification needs to focus on several core-damage cutsets associated with that degraded component. Therefore, the known weaknesses of the technology (HRA, CCF Modeling, Data) can be investigated with respect to these several cutsets only. Since the focus is limited to several cutsets, review of the results in light of known weaknesses of technology will become a manageable task for the licensees. The other PRA task in this application will be to generate the magnitude of the transition risk. For this application, most likely, the order of magnitude of the transition risk may be adequate. The major source of uncertainty in the analysis may be the limited capability

to quantify all elements of transition risk and the analyst may decide to overcome this uncertainty by considering the calculated transition risk as a lower bound in the decision making.

From a regulator's standpoint, elements 1 and 3 of the Standard Review Plan have the intelligence to hone in on the areas that need attention prior to granting an approval. The draft Standard Review Plan (SRP) for use of PRA identifies a Six Element approach for the use Risk-Informed regulations. This six element approach is inventive in that it has created a method to use "As Is" PRAs effectively in regulatory related applications. The elements of this six element approach will make any limitations and weakness of PRA with respect to the application reveal itself. In the process, it will also highlight the areas, of uncertainty, the areas where sensitivities are needed. Owing to the thoroughness of the six element approach, the "As Is" PRAs can be used to review a wide variety of applications with a high degree of confidence on the results.

For example, element 1 of the SRP states that (a) the nature of the proposed change, and (b) how this change is modeled in the PRA needs to be reviewed. The reviewer has to accomplish this by identifying the elements of the PRA on which the proposed change is expected to have an impact, and to develop appropriate methods of mapping impact of the changes onto the PRA model elements. Under element 1, the reviewer establishes that the plant PRA is capable of reflecting the impact of the change.

Element 3 provides information on specific attributes of PRA (e.g. CCFs, HRA, Success Criteria...) that needs to be reviewed as part of the overall review.)
These steps will help the regulator hone in on key parameters associated with the PRA that are pivotal to the application under concern and help examine how the known strengths and weakness of PRAs may or may not affect the overall results.

VI. Recommendations

The NRC PRA Policy endorses enhanced use of PRA in regulatory applications to the extent supported by state-of-the-art methods. Since NUREG 1560 compiles the insights gained from review of 75 IPEs, one could imply that in some sense NUREG 1560 is a documentation of the state-of-the-art as reflected by IPEs. Therefore, a fair compilation of specific strengths as well as specific weaknesses should be the expectation from NUREG 1560. In typical reviews one expects a focus on weakness and suggestions for improvements. However, NUREG 1560 cannot be such a review since it formulates a technical basis future critical regulatory efforts. As demonstrated in Table 1, NUREG 1560 did not fairly treat (identify and document) strengths of PRA. For example, Some of the strengths of "As Is" PRAs that make them amenable to a multitude of Regulatory and Non-Regulatory applications are:

(i) Identifying most of the initiators that contribute to public health and safety.
(ii) Proper modeling of support system and front line system dependencies.
(iii) Reasonable estimates for Initiating Event Frequencies
(iv) Reasonable estimates for most failure rates.

We recommend that the staff add a section that identifies specific strengths of "As Is" PRAs and how these strengths, known weaknesses of PRA modeling, fundamental elements of the Standard Review Plan, and at times the need for comparison of only order of magnitude of CDFs may be combined to use "As Is" PRAs for a limited set of applications (e.g., Justification for Continued Operation). Such an acknowledgment of the capabilities of this technology will encourage the continued growth of the technology and additional investments in it by the industry.

VII. Conclusions

NUREG 1560 is a significant step toward Risk-Informed Regulation. It has documented the weaknesses of the "As Is" PRA models and has implicitly provided guidance on how to improve PRA models. By focusing on the positive aspects rather than a limited number of negatives that are inherent in an evolving technology, the current PRAs can be used for a wide variety of regulatory related applications. The known weaknesses of the PRA models will simply add to the burden of preparation and review of PRA related licensing requests. As the models are enhanced, this burden will gradually diminish.

VIII. References

1. Generic Letter 88-20, Supplement No. 1, "Initiation of the Individual Plant Examination for Severe Accident Vulnerabilities - 10CFR 50.54(f)," dated August 29, 1989.

2. NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," (Draft Report for Comment), October 1996.

3. SECY-95-126 "Final Policy Statement on the use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," Memorandum from James M. Taylor (EDO) to John C. Hoyle (Secretary)., June 30, 1995.

4. EPRI PSA Applications Guide, EPRI Report TR-105396, August 1995.

5. Draft Standard Review Plan for PRA Applications.

6. WASH-1400, "Reactor Safety Study," 1975.

7. "High Pressure Safety Injection System Technical Specification Modifications," CE-NPSD-1041-P, September 1996.

8. Development of Methodology for Evaluation of Transition Risk, CE-NPSD-1021, January 1997.

9. Application of Risk-Based Methodology to Piping In-Service Inspections, Topical Report WCAP -14572, 1996.

10. PSA Model Methodology and Results Comparison, Final Report, March 1997.

11. Comparison of PSA Inputs and Assumptions for CE PWRs, CE-NPSD-1029, April 1996.

12. BWROG PSA Peer Review Certification Implementation Guideline, December 1996.

TABLE 1: Summary of Comparison of IPEs to a Quality PRA

Area	Strengths	Weaknesses
1. Availability of guidance	The guidance provided in the following documents were followed: NUREG/CR-2300 NUREG/CR-2815 NUREG/CR-4550 NUREG-1335	Since NRC did not prescribe specific method in areas where wide range of views existed there are many inconsistencies in methods.
2. Depth of Review		Staff did not review details of the analysis (b).
3. Completeness (Inclusion of necessary elements of a PRA. Methods are acceptable to the staff)	NRC concluded that PRAs have included the necessary elements and that the methods are acceptable.	
4. Reasonableness of assumptions, boundary conditions, data/ Reasonableness of results.	Reasonableness of assumptions, boundary conditions, and data are identified as strength. NRC review assured that results are reasonable.	
5. Initiating events (Section 15.2.1)	Initiating Event analyses compare well to the attributes of Quality PRAs.	• Insufficient information provided to NRC on how the grouping was performed. • Treatment of Manual shutdowns varied amongst IPEs. • Variations in modeling of the LOCAs. • The modeling of the support system transient initiators is variable (e.g.: Control Room HVAC).
6. Accident Sequence Analysis Comparison (Section 15.2.2)	Majority of IPEs meet Quality requirements.	• Different definitions of core damage lead to inconsistent analysis. • Used different methods.

		• Success criteria that is too conservative. • Inappropriate use of MAAP code. • Treatment of Phenomenological differences is inadequate at times.
7. Systems Analysis (Section 15.2.3)	Majority of IPEs meet Quality Requirements	• Inadequate guidance provided. • CCFs for some passive components not modeled. • Elimination of some dependencies performed without adequate calculation support. • Doubtful whether equipment survival was properly documented.
8. Data Analysis (Section 15.2.4)	No strengths noted	• Plant specific data collection process was not documented. • Data analysis methods highly variable. • degree of plant specific data usage varies • Generic data: Highly reliable • Fails to recognize that CCFs are by nature, rare events that tends to have some plant specific features. • The approach used to eliminate inapplicable faults also need to consider possible undiscovered faults that are relevant to that particular plant.
9. Human Reliability Analysis (Section 15.2.5)	Most IPEs included Operator Actions that need to be included.	• Variety of Methods used. • Subjectivities and biases in results. • Technology is not mature. • Some IPEs did not include any pre-initiating events. • Dependencies between OA s overlooked. • Recovery actions that are not generally proceduralized credited. • Time available to perform actions may not have been always correct (specifically, the time at which

		the operator gets cued). • Repair of failed equipment credited.
10. Accident Sequence Quantification (Section 15.2.6)	Methods and computer codes used in the quantification process are adequate to treat the Boolean reduction process. Therefore, core damage frequencies are appropriately generated	• Quantification guidance for a quality PRA goes beyond that specified in NUREG 1335 (truncation values, incorporating recovery actions, estimating uncertainty, and performing sensitivities). • Difficult to determine how much compliance is there due to adequate details.