COMMENTS ON NUREG-1560, "INDIVIDUAL PLANT EXAMINATION PROGRAM: PERSPECTIVES ON REACTOR SAFETY AND PLANT PERFORMANCE"

BWR OWNERS' GROUP
Integrated Risk Based Regulations Committee

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SUMMARY

The BWR Owners' Group (BWROG) has reviewed the Draft NUREG-1560, Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance and offers comments on the document for the use and consideration of the authors. The NUREG is a very comprehensive compilation of the findings and results of analyses from 75 IPEs covering 108 nuclear power plants representing different plant designs. There are extensive comparisons between the IPEs from the different plants. In addition, there are comments on the differences in the IPE results. There is some attempt to rationalize the different results. A primary concern of the BWROG is that the IPEs that were reviewed in the NUREG were performed over a period of many years, some completed as long as 8 years ago. They therefore represent a snapshot not characteristic of many of the plants today. There have been changes in plant configurations, operating procedures, and training as well as extensive examinations and responses during the SER proceedings. These changes have impacted the results of subsequent revisions of many IPEs. There also have been numerous improvements in analysis tools, data, training, and in maintenance and inspection programs. These improvements have changed and improved the IPEs/PSAs. Finally, the IPE submittals do not lend themselves to providing some of the information that the authors attempt to compare.

The goal of the GL 88-20 IPE program as initiated was to fulfill several objectives. However, the NUREG concentrates on the expectation that each plant would identify plant specific "vulnerabilities". Since this term was not defined in GL 88-20, a large variability between PSAs occurred in characterizing vulnerabilities.

As a result of the above considerations, the BWROG feels that the NUREG presents a wealth of data. Future study of the NUREG by each plant will help enhance future revisions of their PSAs, but it is not an appropriate document for use in establishing policy or procedures on an industry-wide basis. The addition of a Table listing each IPE reviewed for the NUREG, the dates of the IPEs, and any supplemental information included in the review would be helpful in understanding many of the implications drawn from the study and limitations on those implications.

The development of PSA models in response to GL 88-20 has served as a catalyst to promote a different perspective of safety, therefore satisfying the stated goals of GL 88-20. The BWROG feels that the differences between results from the different plant PSAs are appropriate and not surprising, considering the long time span involved between the IPEs used in the study and the many fundamental differences in the plants' designs even within BWR vintages. These differences do not prevent the PSAs from being valid for use in risk management decisions by individual plants. There is currently underway a BWROG program with most BWRs participating for peer review of BWR PSAs that will

help improve both the quality and uniformity of the current and future revisions of PSAs. This peer review recognizes the uniqueness of the plants and will further assess the validity of PSAs for use as part of the decision process for testing, maintenance, and training programs.

INTRODUCTION

The membership of the BWR Owners' Group Integrated Risk Based Regulation (BWROG IRBR) Committee welcomes the opportunity to comment on draft NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance, Summary Report". Prior to, and subsequent to the individual IPE submittals the IRBR Committee has discussed and collected detailed information regarding the similarities and differences between the physical attributes of the BWRs, modeling, and assumptions found in the IPEs/PSAs. We believe the BWROG, whose typical membership consists of individuals directly involved with the development of the IPEs, provides a perspective beyond that cited in the NUREG because of the detailed knowledge our membership possesses of plant-specific IPE models.

The BWROG is providing comments addressing issues or generalizations that characterize the fleet of BWR equipment and IPE representation of that equipment. Comments highlighting the general and broad perspective are supplemented by specific comments in the attachment.

These comments provide the following information regarding NUREG-1560:

- Background
- Purpose and Benefits
- Vulnerabilities
- Actions and Changes since original IPE submittals
- Use of IPE/PSA for Regulation
- Quality of IPE/PSA
- Use of NUREG-1560 as Basis for Regulatory Action

BACKGROUND

Response to the IPE Generic Letter 88-20 has served as a catalyst to develop PSA expertise at many utilities. This introduction of PSA processes at utilities has promoted a different perspective, from a narrow DBA focus to one that views safety, reliability, and operational decisions in an integrated, probabilistic fashion. This new perspective has continued after the submittal of the IPEs and is, in many cases, integrated into the decision processes at the utilities.

Therefore, it must be emphasized that a review of the snapshot in time given in the IPE documents alone (and as documented in NUREG-1560) cannot give a true measure of the improvements in safety that have been achieved by the IPE program and the follow-on efforts of the individual utilities.

The primary goal of the of the IPE Program, as stated in the EXECUTIVE SUMMARY was for licensees to "identify plant specific vulnerabilities to severe accidents that could be fixed with low-cost improvements." The apparent purpose of the NUREG-1560 was to review and compare all of the IPEs that have been submitted to the NRC over a time period extending back approximately eight years. This report is the culmination of an extensive effort to compare the submitted IPEs for content and results. The report concentrates an undue amount of space to the vulnerabilities reported by some of the plants, and therefore inappropriately emphasizes the aspect of vulnerabilities over the other objectives of GL 88-20. It is important to note (as NUREG-1560 does) that the original stated goals of the Generic Letter 88-20 included four other expected benefits:

1. Support for licensing actions,
2. License renewal,
3. Risk management, and
4. Integrated safety assessment.

All of these objectives were an integral part of the analysts consideration during the development of plant-specific IPEs, and therefore conclusions regarding these other important aspects of safety perspective are worth equal or more attention.

NRC conclusions cited in NUREG-1560 that should be important in future planning and uses of PSA include the following:

- Information from the IPEs/PSAs can be used to support a diversity of activities such as plant inspections, accident management strategies, maintenance rule implementation, and risk-informed regulation.
- Most of the IPE results are likely to fall below the quantitative health objectives. However, based on extrapolating the NUREG-1150 results, a few plants may approach the early health objective.

Although the NUREG 1560 document is a competent and thorough study, there are some areas that are not consistent and which pose problems in utilizing the study for future plant improvement and utilization of the IPE/PSAs. The following are some comments from the members of the BWROG Committee for Integrated Risk Based Regulation.

PURPOSE AND BENEFITS

The report should emphasize that it is a survey of the results of the IPE submitted over a period of many years. The IPEs were performed somewhat in isolation at each plant due to the learning curve and the time frame required for IPE. Also, utilities were given considerable leeway in responding to GL 88-20 in the scope and the depth of analysis. Therefore, the results of the IPEs reflect the differences in plant design and operation, the developing technology of PSA and the variability of analysis scope and methods. Those underlying studies were originally an attempt at "updating" WASH- 1400 to determine operational risk across the nuclear industry. However, it was concluded that broad application of results was not possible after study of five individual nuclear plants. Each

IPE is a snapshot of both the state of the technology of PSA and a particular plant's equipment, procedures, and training at the time the IPE was performed. Some differences in results also reflect the disparate views and multiple approaches of PSA practitioners. This variability in PSA practice reflects to some degree the state of the technology of PSA, a state that continues to evolve as experience is gained. Results of subsequent examinations can be expected to differ from those presented in the IPEs as PSA methodology and data evolve and the improvements identified in the IPEs are implemented at each site.

Despite the recognition that IPEs may not meet the NRC definition of a state-of-the-art PSA in some areas, the NRC in NUREG-1560 recognizes that the IPEs were valuable for a large number of applications. These include the following:

- Accident Management -- IPEs provide a framework for developing comprehensive and structured accident management plans.
- Maintenance Rule -- The IPEs/PSAs can be used by the NRC and licensees to support implementation of the maintenance rule.
- Risk-Informed Regulation -- The IPEs represent a substantial investment by the licensees and the potential use of IPEs in risk-informed regulation is of considerable importance.
- P. 8-21 -- The models used in the licensees' PSAs and the results of those analyses can be used to support PSA activities.

From the Executive Summary, it could be inferred that the identification of plant vulnerabilities was the dominant interest of the study. However, the appreciation of severe accident processes and understanding of the most likely severe accidents at a particular site are equally valid in developing and enhancing safety culture. The process of developing the models has and continues to be valuable. It is the systematic examination and understanding process of PSA that is its strength. Most BWR plants have identified improvements in equipment, procedures, and training. Clearly the IPE process has improved operational plant safety.

The IPEs were requested by the NRC and specified to be submitted in a "uniform" format per the guidance document, NUREG-1335. The IPE submittals were tailored specifically to that format. Therefore, there may not be sufficient information in the IPE submittals alone to support the generalizations and comparisons now attempted in NUREG-1560 regarding plant comparisons, vulnerabilities, and inferences regarding quality. Specifically, it would seem prudent to avoid misinterpretations by providing the specific NRC assumptions used in extrapolating IPE submitted words to the construction of the comparisons among plant results in NUREG-1560. These assumptions would include the following:

- How the definition of core damage for each plant affects its results (including credit for recovery)
- What the relationship of containment event treatment is to the CCFP, the early releases, and other measures of risk.

- What the correlation is between each IPE submittal result for early and late releases and their definition of "early" and "late"
- How the treatment of multiple containment failure modes affects the assignment of the allocation of failure modes in comparisons (e.g., shell melt through following wetwell failure)
- Defining the treatment of dynamic containment failure modes and their associated failure location as it relates to inferences about failure location and timing.

In the Foreword, a statement is made that the NRC is to "publish a ..... document highlighting the significant safety insights resulting from this program and showing how the safety of reactors has been improved by the IPE initiative." It is suggested that this report fulfills that recommendation. This was a scope decision by the review team and, clearly, it was necessary to make such a decision. However, some of the IPEs reviewed were more than eight years old and many have been updated one or more times. The effects and information that were gained by the NRC's request for additional information and issuance of the SERs to each plant are not included as part of this report (see page 1-3 of the report). In addition the information contained in the IPEEE submittals as well as the review and question process that this submittal is undergoing has not been included either. This is all part of the IPE process initiated under Generic Letter 88-20 and its various supplements. It would seem that much of the IPE effect on reducing risk that the authors of the NUREG were looking for was not treated. Therefore, the report is incomplete and could be misleading in its conclusions and information.

It is judged that an appropriate conclusion of this effort would evaluate the efficacy of the driving force for the individual plant examination, (i.e., that there may be unique plant features that require a plant specific examination to place these features in the proper risk context). From the Draft NUREG-1560 results, apparently there are three general conclusions that can be reached:

- Plants are diverse in their design, procedures, and training. This is reflected in the spread in the risk estimates
- In general, plants are shown to have a high level of safety.
- PSAs in their present state are adequate for use in risk based management of individual plant decision making processes.

VULNERABILITIES & CROSS APPLICABILITY OF IPE/PSAs

Generalization About Variability

The NUREG-1560 study has made some generalizations regarding PSA differences; however, there does not appear to be any evidence that an analysis of plant and procedural differences among Mark I plants was made to correlate results versus these differences. Therefore, the following statements would appear to be unsupported:

".....variability in the results is observed for plants with similar design. In addition, although much of the variability is expected (as a result of differences in the plant design

and operation), some variability is not supported by the differences in plant characteristics."

The degree to which a search for variability associated with plant design differences has been made is questionable. Tables for BWRs; Table 11.6, 11.8, and 11.11; state that "Important design features, operator actions, and model assumptions" are identified. However these are lumped together, not associated with a number of plants, and in fact, identify very few items that are "model assumptions". As is well known, substantial differences in PSA results occur because of BOP and support system design despite similarities in NSSS design. Therefore, it is judged that there is no basis in NUREG-1560 to assert that the observed variability is anything but dominated by plant differences in design, procedures, and training.

The BWROG PSA Peer Review Certification Process which has observed that because of the strong dependence of PSA on plant specific support system effects, it is not surprising that large differences can exist among "similar" plants with "similar" NSSS designs.

On p xii, the NUREG states, "Further, the support system designs and dependency of front-line systems on support systems vary considerably among the plants. That variation explains much of the variability observed in the IPE's results." P. 3-2 claims, "Plant-specific support system design and operation (versus NSSS design) drives most of variability." These sentences imply that results variance is principally due to design differences. However, elsewhere, in other chapters, the variance is explained as due to a mixture of several things:

a) P. xii and xiii: "The variation in the CDFs is primarily driven by a combination of the following factors: plant design differences, variability in modeling assumptions, and differences in data values."
b) P. 3-20, "Generally, plant design and operational features have a larger impact on the SBO CDF than do modeling characteristics, but no single factor dominates."
c) P. 3-23, "The ATWS results are affected more by modeling assumptions than by plant-specific design features."
d) On p. 4-27, "The low early structural failures for ice condensers relative to the other- PWRs appear to be driven more by analysis assumptions than by plant features."
e) P. 5-1 notes, "Of particular concern is the degree of variability in the quantification of similar human actions across different plants."

Additional Specific Comments

Part I, Executive Summary, page xii, last paragraph, sentence that reads, "As shown in Figure E.1, the CDFs for many BWR plants are actually higher than the CDFs for many PWR plants. Referring to the six BWR plants as "many BWR plants" imply more overlap than there really is.

Part 1, Chapter 2, page 2-14, third full paragraph, first sentence. The reference to "later" BWRs is confusing because it seems to imply that "later" BWRs may have an a.c. independent HPCI system.

Part 1, Chapter 3, page 3-29, RCIC bullet at bottom of page. In most instances, differences in the modeling of RCIC trips and loss of RCIC due to suppression pool temperature are based on procedures. At some plants, the operators are instructed to trip RCIC on a suppression pool temperature of 185 degrees F. The variability in the PSAs comes less from analyst practices than from plant procedures and design.

Part 2, Chapter 9, page 9-24, Section 9.3.1.3, second paragraph. The description of implementing a cross-tie capability for batteries is inaccurate. The cross-tie capability existed prior to the IPE/PSA. The IPE/PSA simply included the capability as it existed in the plant design and procedures at the time the model was developed.

Part 3, Chapter 11, page 11-40, Section 11.2.3.2, first paragraph. The discussion of cross-tying the HPCS diesel generator to either the Division 1 or 2 emergency buses is misleading. For instance, at one plant, the HPCS bus can be cross-tied to either the Division 1 bus or the Division 2 bus and some pump loads can be supplied. At another plant, the HPCS bus can only be cross-tied by design and procedure to the Division 2 bus. By procedure, only valve manipulations can be performed.

Vulnerabilities

Variability's in plant design, procedures, and training substantially impact the distribution of results to the degree that a "vulnerability" is unique and applicable to only the specific plant or site.

The over emphases on the search for vulnerabilities and the imply applicability to other plants in NUREG-1560 appears to mimic a design basis philosophy to issue resolution. The strength of a probabilistic process lies in the analysis of plant-specific issues and their resolution, plant-specifically (not generically)

There are numerous erroneous claims of general applicability of vulnerabilities and insights.

a) P. 2-2, for BWR's "..... no common vulnerabilities are identified, but,....some of the vulnerabilities can be considered applicable to many BWR's." If those vulnerabilities were indeed, applicable to many plants, it would be expected that they would have been reported in the IPE results of many plants. Part of this difference is due to the plants' different interpretation of what constitutes "vulnerability".
b) P. 2-2, it is noted that one licensee identified RPV level control as an important operator action and a vulnerability, and, "This issue is likely to be important at all BWR's." Again, this is an individual plant assessment concern..
d) P. 3-30, "Most of the improvements were identified by only one licensee, but they could be implemented at the other plants as well." They should not be implemented, without full assessment of induced competing risks

and the expenditure of resources required that may far outweigh any safety benefit to be gained

c) P. 4-4, "However, hydrogen combustion is found to be important to the probability of late failure in Mark III containments." The table on p. 4-6 states, "Hydrogen burns are found to be important in some Mark III IPE's."

ACTIONS AND CHANGES SINCE ORIGINAL IPE SUBMITTALS

Because of the extensive modeling changes undergone by many utility PSAs following the IPE submittals, it is judged inappropriate to draw conclusions regarding the state of the PSA models and their results in 1997, based on the submittals of 1992.

The decision to use only initial IPE submittals as the basis for the review is inconsistent with the purpose of the NUREG study to determine the success of the objectives of the IPE program. This scope decision by the review team limited the findings to the initial findings of the various utilities as they completed their IPEs. These IPEs were performed over a period of eight years and were performed in relative isolation at various times in the development of PSA technology. To correctly reflect insights from IPE's requires consideration of supplementary submittals, as well. Most plants that have submitted IPEs have undergone extensive questioning and revision of documentation in order to obtain SERs from the NRC. These supplementary submittals may have changed the outcome of the analyses and this study is not complete without incorporation of the additional information.. Many utilities have updated their PSAs one or more times in response to plant design and procedure changes. It was, of course, necessary for the review team to select a cut-off point, but this limitation contributes to differences in the plant analyses' results.

Comparison of the IPEs identifies numerous differences in modeling and the outcome as reflected in the bottom-line CDFs. The report makes note of many of these details, particularly in the human reliability area. The following is a sampling of these details and some of the reasons:

The NUREG identifies numerous ways in which the IPEs differ and Section 5.1 indicates that despite different HRA approaches, a relatively small set of important operator actions were discovered. It should be pointed out that all are actions for which no automatic back-up exists, and that this is one criterion for selection of "important" human actions.

Consistent with comments above reflecting the general state of the art of PSA and the extended period over which they were performed, it is not surprising that HRA results differ among plants/studies. A number of BWROG member utilities are now undertaking a structured peer review of their current PSAs. It was discovered during these reviews that while HEP values may appear to vary widely, upon further investigation it was found that such variations reflect more on the way the HEPs are segmented or broken up than variation in the actions themselves. When consistent definitions are applied in HRA more consistent HEPs result.

The variability of HEP values noted in Figure 5.1 should also be credited to the variability of EOPs themselves. For example, BWR EOPs at some sites do not require the inhibition and later un-inhibition of ADS during transients. Removal of these steps from EOPs removes these HEPs

The discussion of Section 5.3.1 implies that all HRA approaches used to date are deficient. This discussion is consistent with that in NUREG-6350 "A Technique for Human Error Analysis ATHEANA". This sentiment is also reflected in the Executive Summary of NUREG-1560 (page xviii) which states that "An HEP is only valid to the extent that a correct and thorough application of HRA principles has occurred." However, the Summary also states that there is little evidence that the HRA quantification method has a major impact on the PSA results. Likewise, elsewhere in the Executive Summary a statement is made, "Only a few specific human actions are consistently important for either BWRs or PWRs." Thus, the impact of HRA on PSA can best be described as indeterminate. However, in many sections of the report there is an implication that additional work and additional research are needed (i.e., Section 8.5). The BWROG believes that HRAs have been done adequately for the purpose of current applications. As the state of the technology improves, this area will be updated to those technology standards. The report should reflect that (as it does in some places) and remove wording from those portions of the report that imply differently. HRA is portrayed as a "wild card" which none the less seems to have little effect on results. The arguments put forth in the draft NUREG-1560 suggests that minimal time be spent on future improvement and refinement of HRA because the time spent will not change the results very much. This is also the only way such widely varying HRA results can be described as "reasonably similar" in Section 5.4.

Part 1, Chapter 3, page 3-33, second paragraph. Some plants do not credit HPCS as a successful injection system for ATWS because the plant emergency instructions at the time called for the operators to terminate HPCS injection if HPCS initiated. Also, the feedwater runback for at least one plant is unique among the other BWR/6 plants. This plant design runs back feedwater to zero flow into the RPV. The operators cannot override the signal and must wait until the valves are fully closed to restore feedwater. There is less dependency on analyst biases than there is on actual plant design differences to the assumptions used to construct the PSA models.

Part 1, Chapter 5, page 5-3, ATWS discussion. Instead of trying to describe separate human actions during ATWS and looking for dominant actions, the discussion should center on the fact that automatic functions are largely bypassed and operator actions globally become important in responding to an ATWS event. Many of the human actions have dependencies upon each other and looking at single human actions may not be appropriate for ATWS.

Part 1, Chapter 5, page 5-6, Table 5.2. Instead of saying, "...did not take credit for HPCS," it should say that plant procedures instruct operators to terminate HPCS injection during an ATWS.

P. 5-15 claims that, regarding licensees' treatment of human error probabilities, "...several either failed to consider context or dependency at all or at least failed to provide any evidence that they did so..." Plants that received that criticism in their SER's have submitted revised HRA's. Therefore, it is misleading to state this.

USE OF IPE/PSA FOR REGULATION

The executive summary states (p. xviii) that, "... before an IPE/PSA can be used beyond its original purpose... the quality of the IPE/PSA will need to meet standards." It should be pointed out that currently a plethora of PSA approaches exist, and that "quality" and "standards" for PSA are only in the most rudimentary form. While it is agreed that "quality" is desired, the definition of "quality" is far from complete. Waiting until perfect "quality" of PSA is achieved before utilizing the results is impractical. The existing IPEs or PSAs supplement the basis of compliance with such regulatory requirements as the Maintenance Rule and G. L. 89-10 valve ranking, despite the lack of "quality" guidelines for these applications. It is expected that "quality" and "standardization" will evolve, not through apriori definition, but through frequent, repeated application and peer review of PSAs.

In Section 6.4 as well as some other locations in the report there is an implication that the only way we can compare to the "Safety Goal" is to have a Level 3 PSA. Such a PSA was never mandated, requested or suggested by the NRC and there are a number of ways to compare to the Safety Goal other than having a Level 3 PSA. The NUREG could address how the NRC and the Industry (there are several EPRI documents and other Papers, Positions, and reports) have defined or linked the NRC "Safety Goals" in terms of Level 1 and Level 2 surrogate indicators.

QUALITY OF IPE/PSA AND APPLICATION.

It appears that NUREG-1560 in Chapter 6 and 14 has taken a very narrow view of what a "quality" PSA is. This narrow definition is acknowledged by NUREG-1560 to encompass a "state of the art" PSA. It also appears to be defined for the purpose of an abstract PSA performed for the sole purpose of calculating public risk. However, since no PSA currently exists that meets these requirements, it may be appropriate to refer to it as a "beyond the state of the art" PSA. Nonetheless, the cited "requirements" for PSA should not be referred to as requirements for a "quality" PSA. The word "quality" is judged to have a spectrum of applicable definitions that can vary from the most restrictive, e.g., the "beyond state of the art" requirements to requirements that are closer to those met in a "good" IPE.

The attributes of a "quality PSA" that are proposed in Chapter 14 of NUREG-1560 have not undergone a cost benefit evaluation. They are proposed attributes that are in many cases beyond that which have been applied to any PSA. Therefore, Chapter 14 cannot be used as asserted in p. 8-20:

> "Chapter 15 compares the IPE results to the attributes of a quality PSA defined in Chapter 4, discussing areas where the analysis is incomplete or inadequate."

Chapter 14 defines, as stated by NUREG-1560, the state of the art. This does not mean that attributes that are not at, or even beyond the state of the art, are inadequate.

In addition, the NUREG-1560 assertion appears to overlook the fact that in many cases PSA inputs will be used as complementary information to support deterministic information in PSA applications. They are quite adequate for that purpose on a plant by plant basis and application-specific basis.

In contrast to the use of the word "quality" in Chapter 6 Part 1 and Chapter 14 (Volume 2), "quality" is used in Chapter 15 to represent a more global attribute of a PSA, one that encompasses degrees of quality and one that could be successful on several levels. This use of "quality" in Chapter 15 is consistent with what the Commissioners have stated in the PSA Policy Statement regarding PSA applications: The Commission will require PSA quality commensurate with the proposed application.

This indicates that different levels of PSA "quality" would be welcomed depending upon the application and weight of evidence that is needed from the PSA evaluation.

At the present time, the BWROG has an extensive program underway for most BWRs to establish quality criteria and methods for evaluating the PSAs against those criteria.

The Peer Review Certification Implementation Guidelines have been developed by the BWROG for use in providing additional assurance that the quality of a PSA is commensurate with the intended applications. The intent of the review process is to enhance the level of excellence by verifying accuracy, realism of analysis, completeness, and documentation.

The review process recognizes that quality is not a single attribute applied to applications. In some applications, the relative importance of systems or human actions is useful in prioritizing efforts. In others, absolute measures used as surrogates of public safety can be the important measures. Therefore the measure of quality uses a graded approach when assessing the usefulness of the PSA for applications.

The BWROG believes the Peer Review process is an appropriate method of addressing quality by using a process that distinguishes the necessary set of elements for various applications. Completeness, reproducibility of results, internal consistency, and documentation are all considered when assessing model impacts on potential applications.

On p. 6-12, the following sentence needs clarification: "Therefore, individuals who performed the PSA and other utility personnel are excluded from the peer review team." One interpretation is that other employees of the given utility are unsuitable "independent reviewers." Another interpretation would be that no employees of any utility should serve as reviewer's for any PSA. This statement is consistent with p. 14-66 where the following statement is made, "Similarly it is not appropriate for other utilities to perform the peer review." It would be appropriate to clarify the intention, and acknowledge that experienced PSA analysts working for utilities other than the one that performed the PSA would be excellent, independent reviewers. With regard to the adequacy of peer review:

- At the IPE submittal stage, IRG reviews supported by contractors and plant personnel as well as analysis performed a peer review based on procedures similar to the ones used for safety related calculations, independent verification, control of software, approvals, etc..
- At the present time the BWROG is conducting an extensive peer review of most BWR IPE/PSAs with team members from sister utilities and independent contractors. The BWROG PSA Peer Review Certification Pilot process has learned two valuable lessons that may be useful to the NRC in establishing their view of the state of the effort in assessing quality in PSAs. These two lessons are:

  (1) Utility representatives from sister utilities who are PSA experts in their own right tend to be quite knowledgeable regarding the pitfalls of PSA use and misuse in the utility environment.
  (2) There are extensive lessons to be shared about PSA processes, methods, and data that results from by the cross pollination of the PSA analysts from sister utilities reviewing the techniques of the host utility.

In summary, there are substantial benefits to be gained by encouraging the peer review team to include PSA experts from sister utilities. This will both enhance the review of the subject plant and further the general state of the technology through the sharing of superior approaches.

Chapter 6 discusses the authors' opinion of the features of a high-quality PSA. This includes such potentially costly and somewhat controversial features as full propagation of uncertainty through the CDF, containment performance, and fission product models. Also included is a requirement for consideration of "... the full range of views in the technical community regarding phenomena". The essential features required for an effective and practical PSA will continue to be the subject of discussion with the industry. The ideas presented in this NUREG for what constitutes a good PSA should be clearly stated as being one set of ideas.

USE OF NUREG-1560 AS A BASIS FOR REGULATORY ACTION

The BWROG suggests the following as an introduction and conclusion to the NUREG-1560:

"The information contained in this document should be viewed as useful insights that were derived from a detailed evaluation and comparison performed by the NRC on documents submitted by individual utilities over a period of approximately 5 years. This information may have since changed due to later analyses or it could be misinterpreted because of differences in terminology. Therefore the insights should be considered in this light."