POLICY ISSUE
INFORMATION

July 22, 2002 SECY-02-0139

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: PLAN FOR RESOLVING POLICY ISSUES RELATED TO LICENSING NON-LIGHT WATER REACTOR DESIGNS

PURPOSE:

To provide the Commission a status report on issues with potential policy implications related to licensing non-light water reactor designs and the staff's plans for seeking Commission guidance and resolving these issues.

BACKGROUND:

The current regulations have been developed over the past 40 years and reflect the experience gained from many years of light water reactor (LWR) design and operation. The regulations contain many provisions of a generic nature (independent of reactor technology), but also contain provisions that are specific to LWR design and technology. The regulations have served as the underlying basis for licensing the current generation of plants as well as certifying the Advanced Boiling Water Reactor (ABWR), System 80$^+$ and AP-600. In the past, when NRC has reviewed or licensed non-LWR designs (e.g., Ft. St. Vrain, Clinch River Breeder Reactor) it was necessary for the staff to determine the applicability of the regulations to these designs and the need for exemptions and/or additional requirements to address the unique aspects of these designs. These determinations were made on a case-by-case basis and were implemented by exemptions and/or license conditions, to address those areas where the current regulations did not apply. Accordingly, it is possible to review and license future plants, regardless of the technology, using a similar case-by-case approach; however, this may not be the most efficient or effective approach for non-LWRs, particularly if there are to be more than one of a kind.

To facilitate licensing of new reactor designs substantially different than current generation LWRs, the Commission has encouraged interactions between NRC and designers at the preapplication stage to identify early in the process, key safety and licensing issues and a path

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to their resolution. The results of such interactions could then be used by the staff and the designers as guidance in the preparation and review of an actual application. Recently, with the renewed interest in future plant licensing, the staff began the AP-1000 design certification review and has interacted with Exelon and the Department of Energy (DOE) to identify key issues related to the pebble bed modular reactor (PBMR) and an approach for their resolution. In addition, General Atomics (GA) has expressed interest in conducting pre-application activities on their gas turbine modular helium reactor (GT-MHR), a 600 Mwt high temperature gas-cooled reactor (HTGR), and DOE is considering licensing issues in their Generation IV reactor development program.

The pre-application activities conducted to date have involved discussions on specific plant designs and have also identified topics of a generic nature. For example, in October 2001, the staff provided the Commission a status report (SECY-01-207) on legal and financial issues with policy implications resulting from the PBMR preapplication work, but which are also generic in nature. Likewise the staff has identified certain topics resulting from the technical review of the PBMR. These include technical issues which affect NRC's infrastructure and research needs (which is the subject of a separate paper)and issues which may have generic policy implications for other HTGRs (e.g., GT-MHR) as well as other non-LWR designs (which is the subject of this paper). Subsequently, the staff has had interactions with the Nuclear Energy Institute (NEI) regarding the possible development of a generic (technology-neutral) risk-informed, performance-based framework for future plant licensing. NEI recently submitted a white paper (letter dated May 7, 2002, to Chairman Meserve) on this topic for Commission consideration. Finally, the staff is also considering how to bring greater coherence into our regulatory programs, including the regulation of future plants.

As a result of the above, the staff believes that it is appropriate that reactor design-related policy issues with potential generic implications, resulting from the technical portion of the PBMR preapplication review, be provided to the Commission for guidance so as to facilitate the reviews of other non-LWRs (e.g., GT-MHR) and to aid in determining to what extent, if any, generic, risk-informed and performance-based requirements should be developed for those plants. The items identified as policy issues are those that affect traditional approaches to achieving safety, such as defense-in-depth, and those related to the application of existing Commission policies and practices to non-LWRs. It is also likely that the resolution of these policy issues will affect the viability of certain future non-LWR designs and will need to be addressed in establishing regulatory requirements for those designs, regardless of whether the requirements are established on a technology specific basis or technology neutral, such as suggested by NEI. It is recognized, however, that no decision has been made regarding the need for a generic licensing approach for future plants and that the number and type of future non-LWR plant applications is uncertain (e.g., Exelon's recent decision to phase out the PBMR preapplication activities). Nevertheless, the establishment of guidance in key areas early will benefit all stakeholders by improving the effectiveness, efficiency and predictability of the review process.

To provide the Commission with an early indication of the scope and nature of the technical related policy issues, it was decided to provide this information paper at this time to be followed later with a policy paper containing recommendations for Commission action. This is consistent with the Commission's April 1, 2002, Staff Requirements Memorandum (SRM) which requested that the staff engage the Commission early on policy issues associated with new reactor designs. Finally, it should be noted that issues pertaining to security requirements for future plants are not included in this paper, but rather will be addressed in a future amendment to SECY-02-0104, "Plan for the Comprehensive Review of Safeguards and Security Programs for NRC-Licensed Facilities and Activities," dated June 14, 2002.

DISCUSSION:

This paper discusses the technical-related policy issues resulting from the PBMR preapplication activities to date that may have generic application to other non-LWR designs. These issues result from the approach to safety taken on the PBMR which emphasizes prevention of radionuclide releases and proposes to use probabilistic risk assessment (PRA) in the design process to a greater extent than current generation LWRs. It is likely that other future non-LWR designs (e.g., GT-MHR) will also follow a similar approach and, thus, early discussion and resolution of these issues can facilitate future non-LWR reactor activities.

The approach to safety taken on the PBMR can be summarized as follows. Key to the PBMR safety case is the prevention of fuel damage. For the PBMR, it is claimed that the fuel (small ceramic coated fuel particles) can withstand very high temperatures without significant release of radionuclides. Accordingly, it is claimed that by retaining the radionuclides within the fuel, the traditional approach to defense-in-depth can be modified such that a conventional pressure-retaining low-leakage reactor containment structure (such as is provided on current LWRs) is not necessary and that the emergency planning zones around the plant can be significantly smaller than for current generation LWRs. Fundamental to evaluating the above claims are the approach and criteria that lead to the selection of events to be considered in the design and for emergency planning purposes and the accident source terms used in the analysis. The proposed method for PBMR uses probabilistic criteria to select events for consideration in the design and, in conjunction with accident scenario specific source terms and dose limits, to demonstrate the acceptability of the plant design. The safety classification of systems, structures and components, as well as the application of the single failure criterion, are also different from conventional practice. This also affects the traditional approach to defense-in-depth by utilizing probabilistic criteria as a substitute for certain defense-in-depth attributes (e.g., single failure criterion).

Although the technical foundation for the proposed approach has not been fully developed, reviewed or accepted, it nevertheless has reached a stage where the policy issues associated with its application can be developed and discussed. These policy issues can be categorized as those of an overarching nature with the potential to affect many aspects of plant design and those of a more specific technical nature affecting a limited portion of the design. The overarching issues relate to implementation of the Commission's expectations for future plants to achieve a higher level of safety, to the defense-in-depth philosophy and to the fact that many of the efforts to develop future plant designs, including the PBMR, are international efforts, including design, manufacturing, research and development and marketing. The three overarching policy issues are as follows:

- How should the Commission's expectations for enhanced safety be implemented for future non-LWRs?
- Should specific defense-in-depth attributes be defined for non-LWRs?
- How should NRC requirements for future non-LWR plants relate to international safety standards and requirements?

The four policy issues of a more specific technical nature are as follows:

- To what extent should a probabilistic approach be used to establish the plant licensing basis?

- Under what conditions, if any, should scenario-specific accident source terms be used for licensing decisions regarding containment and site suitability?

- Under what conditions, if any, can a plant be licensed without a pressure-retaining containment building?

- Under what conditions, if any, can emergency planning zones be reduced, including a reduction to the site exclusion area boundary?

In addition to providing guidance to facilitate the review of non-LWRs, resolution of the above issues will also affect both industry's and NRC's research plans and needs. For example, if plant and scenario-specific accident source terms are acceptable, then broad scope source term research programs may be necessary to be able to predict the timing, magnitude and nature of the source terms.

Each of the above issues is discussed in separate attachments to this paper with emphasis on the underlying considerations and previous Commission work in these areas.

FUTURE WORK:

Although the above issues have been raised in the context of current non-LWR preapplication activities, several have been considered in previous Commission work on advanced reactors, including HTGRs and other non-LWRs, as well as in other countries. Accordingly, the staff will build upon this previous work as well as additional information that may be available in developing recommendations for Commission consideration. Specifically, the following will be considered:

- The Commission's policy and previous guidance on advanced reactors and on using risk information in regulatory programs.

- The approach and rationale used in licensing Ft. St. Vrain.

- The preapplication reviews conducted in the late 1980s and early 1990s, on the DOE sponsored MHTGR and other advanced designs and the evolutionary and advanced LWR certification reviews.

- Previous ACRS views and recommendations on these issues.

- Technical information to be submitted by Exelon in closeout of the PBMR preapplication activities (e.g., a report on containment).
- Work in other countries and international organizations (e.g., the European Union, the International Atomic Energy Agency, the Nuclear Energy Agency).

- Information provided in future interactions on the proposed NEI regulatory framework, GT-MHR or other future plant activities.

The staff plans to engage stakeholders on these issues prior to providing recommendations to the Commission. This will include additional discussions with ACRS, conduct of at least one public workshop and solicitation of public comments on draft recommendations. The staff plans to provide a final paper to the Commission in December 2002. This paper will describe the staff evaluation associated with each issue, options for resolution along with advantages and disadvantages, stakeholder feedback and recommendations for Commission consideration.

COORDINATION:

The Office of the General Counsel has no legal objection. The contents of this paper have been discussed with ACRS and ACRS views were provided in a letter dated June 17, 2002, to Chairman Meserve (Attachment 8). The staff concurs with the ACRS views and this paper has been modified to reflect their views.

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Attachments:
1. Expectations for Safety
2. Defense-in-Depth
3. International Safety Requirements
4. Event Selection and Safety Classification
5. Licensing Source Term
6. Containment vs. Confinement
7. Emergency Preparedness
8. ACRS Letter to Chairman Meserve, dated June 17, 2002

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EXPECTATIONS FOR SAFETY

Policy Issue: How should the Commission's expectations for enhanced safety be implemented for future non-LWRs?

Discussion: In the Commission's 1985 Severe Accident Policy Statement, 50FR32138, the Commission stated its expectation that new plants are to achieve a higher standard of severe accident safety performance than prior designs. This was followed in 1986 by the Commission's Advanced Reactor Policy Statement, 52FR24643, in which the Commission states its expectation that advanced reactors will provide enhanced margins of safety and/or utilize simplified, inherent, passive, or other innovative means to accomplish their safety functions. In addition, the Commission stated in the Advanced Reactor Policy Statement that it expects, as a minimum, at least the same degree of protection of the public and the environment that is required for current generation LWRs and that advanced reactor designs will comply with the Commission's Safety Goal Policy Statement. For the advanced LWRs the above policies were implemented by applicants mainly by providing simplified or passive safety systems (including scaled facility testing to demonstrate performance) and by providing features to improve the prevention and mitigation of severe accidents. The staff implemented the policies by performing confirmatory experimental and analytical work to confirm plant performance and by developing criteria for assessing the performance of those designs under severe accident conditions. These criteria were provided to the Commission for review and were codified in the design certification process for the evolutionary and advanced LWRs (e.g., SECY-93-092).

Given the limited experience and larger uncertainties associated with non-LWR technologies, it is appropriate to determine how the Commission wishes to implement the above policies for non-LWRs. Accordingly the staff plans to seek guidance on implementation of the Commission's expectations contained in the Severe Accident and Advanced Reactor Policy Statements.

Specifically the staff plans to consider what criteria should be developed for non-LWRs to ensure the Commission's expectations are met. Factors to be considered include:

- what risk goals and metrics are appropriate?
- the cumulative effect of a larger population of NPPs and multiple units on a site.
- what severe accident preventive and mitigative criteria should be applied?

Also, other factors are to be considered as potential mechanisms for increasing the level of confidence associated with new non-LWRs by reducing the uncertainty associated with non-LWR technologies and compensating for the lack of operating experience as compared to LWRs. These factors include:

- when should a prototype or demonstration plant be required (including consideration of the requirements in 10 CFR 52 and the changes proposed in SECY-02-0077)?
- when should initial startup testing be used to demonstrate safety (including consideration of the requirements in 10 CFR 52 and the changes proposed in SECY-02-0077)?
- how should safety margins be specified to provide a higher level of confidence and what should this level of confidence be?

- what research should be done by the applicant and/or NRC to establish confidence in performance and safety margins?

It is recognized that the resolution of this issue may influence the resolution of other issues discussed in this paper.

DEFENSE-IN-DEPTH

Policy Issue: Should specific attributes for defense-in-depth be defined for future plants?

Discussion: The defense-in-depth (DID) philosophy has been a fundamental part of NRC's safety philosophy for many years. Although no specific regulation or policy statement has been developed to define it in quantitative terms, its implementation has traditionally involved employing multiple barriers to radiation release, providing both preventive and mitigative features to cope with postulated accidents and not relying on a single element of plant design, construction, maintenance, or operation to provide safety. A short definition of DID was provided in the Commission's March 11, 1999, White Paper on Risk-Informed and Performance-Based Regulation as follows:

> "Defense-in-depth is an element of the NRC's Safety Philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility. The defense-in-depth philosophy ensures that safety will not be wholly dependent on any single element of the design, construction, maintenance, or operation of a nuclear facility. The net effect of incorporating defense-in-depth into design, construction, maintenance, and operation is that the facility or system in question tends to be more tolerant of failures and external challenges."

With the emphasis of future designs on the prevention of fuel damage, non-traditional implementation of DID is being proposed (e.g., no pressure-retaining containment building). In addition, the purpose of DID has been the subject of discussion, particularly in the context of risk-informing the regulations. The nature of the discussions has involved whether DID should be employed only to account for uncertainties (traditionalist approach) or should it, at least in part, also be employed in the form of some fundamental requirements, regardless of uncertainties (structuralist approach). The ACRS, in a May 19, 1999, letter to Chairman Jackson, provided a discussion of the two approaches that contains many useful insights. Accordingly, for future non-LWRs, where the experience base is lower and the uncertainties larger, the issue is whether more specific DID attributes should be defined that address, quantitatively or qualitatively, items such as:

- balance between accident prevention vs. mitigation
- multiple barriers to release of radioactive material
- emergency preparedness
- reliability, redundancy, diversity, independence of safety system
- role of risk information in the implementation of DID
- role of time as a line of defense
- use of inherent/passive features

Also, a more comprehensive statement regarding the role of DID in addressing uncertainties should be considered.

In addressing this issue, the work by others (e.g., IAEA, ACNW) will be considered and discussed. It is also recognized that resolution of this issue may influence the resolution of other issues (e.g., containment vs. confinement).

INTERNATIONAL SAFETY REQUIREMENTS

Issue: How should NRC requirements for future non-LWR plants relate to international safety standards and requirements?

Discussion: Other countries have had experience with non-LWRs and some continue to operate such plants and perform research and development on these technologies. Examples include the U.K. which operates 14 advanced gas reactors and Japan which recently began operation of a 30 Mwt HTGR research reactor. Both the IAEA and the European Union have active programs on HTGR safety and development.

Additionally, many future reactor design and development efforts are being conducted via international partnerships. This has been the case with the PBMR and GT-MHR and will likely be the case on other future efforts. The international efforts have involved design, manufacturing, research and development and marketing. With these international efforts comes the possibility to harmonize, as much as possible, the licensing requirements. For NRC purposes, the international efforts represent an opportunity to build upon work done by others and to benefit from their experience. Accordingly, in addressing this issue the staff plans to consider the advantages and disadvantages of:

- NRC utilizing international safety standards and requirements where possible
- NRC engagement in international activities to help develop expertise when needed
- Harmonization of requirements with other countries reviewing these designs

Such an approach would contribute to consistency among countries in licensing non-LWRs by utilizing common standards and requirements, where possible, facilitate bringing international expertise to our regulatory decision-making, particularly in areas not currently a part of NRC's infrastructure or covered by NRC regulation, and facilitate dissemination of NRC's expertise to other countries.

EVENT SELECTION AND SAFETY CLASSIFICATION

Issue: To what extent should a probabilistic approach be used to establish the licensing basis?

Discussion: The approach proposed by Exelon for the PBMR for the selection of events and event scenarios to be considered in the design and for emergency planning purposes relies heavily on a probabilistic approach. This contrasts to the approach used currently on LWRs which relies on a largely deterministic set of design basis events (many of which were selected to bound a range of events), supplemented by risk insights. The PBMR approach is very similar to that proposed in the late 1980s as part of a preapplication review of a modular high temperature gas-cooled reactor (MHTGR) sponsored by DOE. The approach establishes three frequency categories for events and event scenarios (along with existing dose criteria for public protection for each category) and then proposes to use a probabilistic risk assessment (with consideration of uncertainties) to determine which events (or event scenarios) fall within each category.

The three frequency categories for events are:

- Anticipated Operational Occurrences (AOO)
- Design Basis Events (DBE) and
- Emergency Planning Basis Events (EPBE)

For the PBMR, these three categories are defined as follows:

Anticipated Operational Occurrences

Anticipated Operational Occurrences are those conditions of normal operation which are expected to occur one or more times during the life of the plant (a plant can be up to 10 modules and Exelon's approach considered the cumulative effect of 10 modules in assessing what events fall within the three categories). Using a design lifetime of 40 years, a lower boundary for the AOO region of 2.5×10^{-2} per plant year was proposed. For this region, 10 CFR 50, Appendix I was proposed as the applicable acceptance criteria as it specifies the guidance on dose limits to assure that releases of radioactive material to unrestricted areas during normal reactor operations, including AOOs, are maintained As Low As Reasonable Achievable (ALARA).

Design Basis Events

Design Basis Events encompass releases that are not expected to occur during the lifetime of one nuclear power plant. The frequency range covers events that are expected to occur during the lifetime of a population (several hundred) of nuclear power plants; and therefore a lower boundary of 10^{-4} per plant year was proposed. For this region, 10 CFR 50.34(a)(1) was proposed as the quantitative dose guidance (25 rem TEDE) for accidental releases for siting a nuclear power plant to ensure that the surrounding population is adequately protected.

Emergency Planning Basis Events

Emergency Planning Basis Events are improbable events that are not expected to occur during the lifetime of several hundred nuclear power plants. This is to assure that the risk to the public from low probability events is acceptable, and that adequate emergency planning is developed to protect the public from undesirable exposure to radiation for improbable events. The frequency cutoff implicit in the acute fatality risk goal in NUREG-0880 was proposed as the lower boundary of the EPBE region(i.e., 5×10^{-7} per plant year). The EPA Protective Action Guidelines (PAGs) were proposed as the dose guidelines for the EPBE region.

The systems, structures and components (SSCs) needed to ensure the dose criteria are met are then considered safety related; however, only DBEs (and not AOOs or EPBEs) were to be considered in determining the safety classification of SSCs.

The above approach represents a departure from current practice in that heavy reliance is placed on the use of probabilistic analysis and criteria in the selection of events and event scenarios, thus making PRA quality, completeness and treatment of uncertainties a fundamental underpinning of the licensing basis.

To arrive at a recommendation on the policy issue, the staff will consider the following:

- What are the implications of heavy reliance on probabilistic information to establish the licensing basis for new plant designs considering:
  - large uncertainties (i.e., limited experience base and data)?
  - PRA quality, completeness and documentation?

- What should be changed in our traditional method of event selection (e.g., considering operating experience, use of bounding events to envelop scenarios, etc.)?

- Assuming probabilistic analysis is an acceptable approach, what criteria should be applied for the selection of events and event scenarios to be considered in the design and for emergency planning purposes and for safety classification of systems, structures and components considering
  - risk metrics?
  - treatment of uncertainties?
  - confidence level desired?
  - cost-benefit?

The concept of using a probabilistic approach to define events or event scenarios to be considered in the design was proposed in the late 1980s for the MHTGR. The staff reviewed this approach (in conjunction with reviews of the MHTGR and three other designs - PIUS, PRISM and CANDU 3) and proposed in SECY-93-092 an approach that was deterministically-based, supplemented by PRA information. The Commission, in an SRM dated July 30, 1993, approved the staff recommendation. However, given the Commission's recent emphasis on and experience with risk-informed and performance-based regulation, the staff proposes to revisit this issue.

LICENSING SOURCE TERM

Issue: Under what conditions, if any, should scenario-specific accident source terms be used for licensing decisions regarding containment and site suitability?

Discussion: Current LWRs use site specific parameters (e.g., exclusion area boundary) and a predetermined source term into containment to analyze the effectiveness of the containment and site suitability for licensing purposes. These source terms are described in documents TID-14844 and NUREG-1465 and are based upon enveloping the fission product releases that would be predicted to occur given a core melt accident. On the other hand, future plants, particularly non-LWRs, propose not to use a predetermined source term for assessing the effectiveness of plant mitigation features or site suitability, but rather to use plant specific-accident source terms corresponding to each of the AOOs and DBEs defined for the plant. Such an approach puts a burden on the applicant and staff to understand the fission product release characteristics and uncertainties associated with a variety of accident scenarios. Also, the LWR source terms represent a composite of a number of LWR core melt scenarios and bound a number of accident scenarios. Therefore, the dependence of the analysis on precisely understanding the fission product release characteristics of individual accident scenarios is reduced. However, it should also be mentioned that a limited number of scenario-specific source terms are used in LWR licensing (e.g., reactivity insertion accidents).

In developing a recommendation on this issue the staff will assess:

- what was done on previous reviews of non-LWR designs?

- what would be necessary to establish the basis for a scenario-specific approach?
- how should uncertainties be taken into account?
- how should NRC regulate fuel fabrication/quality to ensure adequate fuel performance (fission product release characteristics) over the life of the plant?

The above issue has been addressed in previous staff work on advanced reactors. A recommendation was provided for Commission consideration in SECY-93-092 that recommended that scenario-specific (mechanistic) source terms be allowed provided there is a sufficient understanding of fuel performance, fission product behavior and accident selection to bound uncertainties. The Commission, in a July 30, 1993, SRM, approved the staff recommendation. The current staff work is related to whether any modification in this approach is warranted.

It should be recognized that this issue is closely related to the event selection issue as well as to the issue of containment vs. confinement.

CONTAINMENT VS. CONFINEMENT

Issue: Under what conditions, if any, can a plant be licensed without a pressure-retaining containment building?

Discussion: The proposed PBMR design includes a reinforced concrete building structure that houses the reactor vessel, the power conversion unit (i.e., helium turbine and generator) and connecting piping. The reactor and power conversion unit are partially below grade in concrete silos, which in turn are enclosed in the reinforced concrete building structure. This building is filled with air during normal operation and maintained at a slightly negative pressure (with filtered exhaust) but is not a pressure-retaining building (like LWR containments). Such a building is typically called a confinement building, and has been used on a licensed HTGR in the U.S. (Ft. St. Vrain) as well as on gas-cooled reactors operated in other countries (e.g., Germany, U.K.) In the event of a leak of the helium coolant, the building is designed to vent excess helium to the atmosphere and, if electric power is still available, maintain negative pressure inside the building. In effect, the design modifies the traditional leaktight barrier defense-in-depth approach to one that puts a greater reliance on the first barrier (fuel integrity).

To arrive at a recommendation on the above policy issue, the staff will consider the following:

- Plant performance (including uncertainties) during normal, anticipated design basis and beyond design basis events and the role of containment vs. confinement in meeting acceptance criteria, reducing risk and facilitating emergency actions and plant recovery

- the need for containment vs. confinement to achieve an appropriate balance in plant design and operation between accident prevention and mitigation, and

- the role of containment vs. confinement in maintaining public confidence.

It is recognized that plant performance under accident conditions is highly dependent upon fuel performance and that uncertainties in fuel performance and quality over the life of the plant need to be considered. In addition, plant performance is also dependent upon other technical aspects of plant design, (e.g., reactor pressure vessel integrity, material behavior at high temperature) which also need to be considered.

As stated in SECY-93-092, the staff had previously proposed an approach for containment that focused on functional performance, rather than prescriptive design criteria. The Commission, in a July 30, 1993, SRM approved the staff proposal, with the addition of an air ingress event to the MHTGR proposed accidents to be considered. The current staff work will focus on whether the previous position should be modified.

EMERGENCY PREPAREDNESS

Issue: Under what conditions, if any, can emergency planning zone be reduced, including a reduction to the site exclusion area boundary?

Discussion: It has been proposed by Exelon that the PBMR design has sufficient fission product retention capability that the emergency planning zone (EPZ) can be reduced from 10 miles (typical for LWRs) to the exclusion area boundary for the site (assumed to be 400 meters for analysis purposes). As discussed previously, the proposed licensing basis events for the PBMR include a set of emergency planning basis events that are to be used to test the fission product retention capability of the plant for emergency planning purposes. As defined by Exelon, these events are in the frequency range of 10^{-4}/plant-yr to 5×10^{-7}/plant-yr and are to be evaluated using mean values of frequency and consequences so that the dose to an individual at the exclusion area boundary is less than the EPA-PAGS. The foundation for this approach has not been fully developed, reviewed or accepted; however, the issues it raises are clear. In effect, the PBMR proposal would eliminate the need for offsite emergency notification and drills although there would be guidance kept onsite that could be used to facilitate ad hoc protective measures, if deemed necessary. The PBMR proposal seeks to establish a probabilistic cutoff (using the safety goal early fatality quantitative health objective) for events that need to be considered for emergency planning purposes. This differs from the basis used to establish the current 10 mile EPZ for LWRs in that the full range of accidents were considered and a 10 mile distance chosen as the point where doses to the public large enough to cause early fatalities rapidly diminish.

To arrive at a recommendation on the policy issue, the staff will consider the following:

- Should there be minimum requirements for emergency evacuation as part of the defense-in-depth philosophy, regardless of plant design or projected risk and if so, what should they be?
- To what extent should probabilistic criteria be used to define the events to be considered for emergency planning and if so, what should they be?
- Are projected doses to individuals that are less than the EPA-PAGs sufficient to use as criteria to establish the EPZ?
- What demonstration of plant performance, if any, would be necessary to find such a proposal acceptable?

It is recognized that the resolution of this issue is related to the issues associated with event selection as well as predicted plant performance, including fuel performance and fuel quality over the life of the plant, projected fission product source terms for various accident scenarios, and how to account for uncertainties due to the lack of operating experience as compared to current LWRs.

Previously, in SECY-93-092, the staff had assessed the issue of emergency planning and did not recommend any generic policy or regulation changes. Rather, EP for each advanced design would be reviewed on a case-by-case basis. The Commission, in a July 30, 1993 SRM, stated that it was premature to reach a conclusion on emergency planning for advanced reactors, but requested the staff remain open to suggestions to simplify EP requirements for reactors designed with greater safety margins. Additionally, the staff was requested to submit to the Commission recommendations for proposed technical criteria and methods to use to justify simplification of existing EP requirements.

In SECY-97-020, the staff provided the results of the evaluation of emergency planning for evolutionary and advanced reactors. That evaluation focused on the evolutionary and passive advanced light water reactor designs because of the availability of design and risk assessment data and because applicants were pursuing certification of these designs. The staff concluded that the rationale upon which emergency preparedness for current reactor designs is based, that is, potential consequences from a spectrum of accidents, is appropriate for use as the basis for emergency preparedness (EP) for evolutionary and passive advanced LWR designs and is consistent with the Commission's defense-in-depth philosophy. In order to justify changes to the EP basis, the staff believes that several issues would need to be addressed; (1) the probability level, if any, below which accidents will not be considered for EP, (2) the use of increased safety in one level of the defense-in-depth framework to justify reducing requirements in another level, and (3) the acceptance of such changes by the Federal, State and local agencies responsible for emergency planning as well as other stakeholders.

The staff still considers emergency preparedness an essential part of the NRC "defense-in-depth" philosophy even for new plants that are designed to reduce the risk from severe accidents. Notwithstanding the need to consider potential consequences from a spectrum of accidents, a design's ability to prevent the significant release of radioactive material, or to provide a long delay time preceding a release for all but the most unlikely events should be reflected in any decision on relaxing emergency planning requirements. In addition, the public perception of risk from nuclear power plant accidents may be a factor. Therefore, the projected dose should not be the only factor considered as the basis for relaxing emergency planning.