

From: Glenda Jackson
To: Peter Rabideau
Date: 10/2/01 3:28PM
Subject: Fwd. Re: Section I - Annual Fees - SECY on Exelon PBMR white papers

Pete,

Please see attached WP file for my suggested changes to this latest version

>>> Peter Rabideau 10/02/01 10:39AM >>>
fyi please review and provide any comments.

CC: Charlotte Turner

B/35

From: Diane Jackson
To: Geary Mizuno, Martin O'Neill, Peter Rabideau
Date: 10/1/01 9.15PM
Subject: Re: Section I - Annual Fees - SECY on Exelon PBMR white papers

Pete -

Similar to your request, OGC has an issue that is staff-identified and should not be under the "Commission guidance requested" section. OGC has already sent their position to the Commission and recieved an answer back Is this true for your issue as well?

I have have made a new section that is just a discussion of the issue with asking for guidance (since guidance was already given) I can move it to that section if the situation is the same. Please let me know.

Also, OGC has requested a clarification in your section They would like to make sure it is clear that the entire annual fee (if given one license) would start with the first module, and not be pro-rated if all modules are not built/operating. I added one sentence to address this request. It is highlighted in blue. Please let me know if this is acceptable to you

Attached is the whole SECY so you can see the new sections in the cover letter. This includes a new SUMMARY section

Please let me know by COB Tuesday.

Thanks - Diane

>>> Peter Rabideau 10/01/01 03 43PM >>>
Diane,

Comments on the draft paper.

1. Commission paper, last paragraph of the BACKGROUND section. Delete the bullet "Commencement of Annual Fees".
2. Attachment to Comm paper, page 1, first paragraph, next to last sentence: In the phrase "...multiple reactors (Items H 2., H.3 , I 2 , and K) ", delete "I 2.,".

>>> Diane Jackson 09/27/01 04:15PM >>>

Please find attached Section I on Annual Fees for the SECY on Exelon white papers. Also attached is the full document which includes any comments received to date. Please provide comments by COB on Monday October 1.

Thank you for your efforts -
Diane

CC: Amy Cubbage; Marsha Gamberoni

October 1, 2001 (1:08PM)

FOR The Commissioners
FROM: William Travers
 Executive Director for Operations

SUBJECT: LEGAL AND FINANCIAL ISSUES RELATED TO EXELON'S PEBBLE BED
 MODULAR REACTOR (PBMR)

PURPOSE:

To inform the Commission of the staff assessment of the Exelon Generation (Exelon or the preapplicant) proposals on legal and financial issues and to seek Commission guidance for those areas where the staff does not have clear guidance

BACKGROUND.

Exelon is considering pursuing a combined license (COL) and design certification for the Pebble Bed Modular Reactor (PBMR) design. The PBMR is a set of modular, high temperature, helium-cooled reactors. Each PBMR module contains its own reactor and power conversion system to produce approximately 100-116 MWe. The preapplicant defines a PBMR "facility" as up to ten reactors or modules operated from one control room. The preapplicant plans to operate the PBMR as a merchant plant. Merchant plants are owned and operated by independent power producers and generate electricity expressly for sale on the open, wholesale electricity market at market price.

DISCUSSION:

In a letter dated December 5, 2000, Exelon expressed interest in preapplication activities. In a meeting with the staff on April 30, 2001, the staff began its preapplication review. As part of the meeting, Exelon discussed legal and financial issues that Exelon believes merits special consideration due to the unique nature of a modular design, gas-cooled reactor design, or operation as a merchant plant. By letter dated May 10, 2001, Exelon submitted nine white papers requesting an agency response on the multiple legal and financial issues. The nine white papers addressed requirements on:

- Operator staffing
- Fuel cycle impacts
- Financial qualifications
- Decommission funding
- Minimum decommissioning costs
- Antitrust review
- Number of licenses
- Annual fees
- Financial protection

CONTACT: Diane Jackson, NRR/NRLPO, 301-415-8548

The Commissioners

2

Amy Cabbage, NRR/NRLPO, 301-415-2875

The Commissioners

3

The preapplicant is currently performing a detailed feasibility study of the licensibility of the PBMR. If the results are favorable, Exelon intends to seek licensing and operation of a PBMR facility as a merchant power plant in the United States. The preapplicant believes that the proposed white papers identify regulations that could pose undue and unintended burden when applied to gas-cooled reactors, modular facilities or merchant plants. The preapplicant believes that certain regulations were not designed for and do not contemplate gas-cooled modular facilities being operated as merchant plants. Attached is the staff's assessment on the preapplicant's proposals. Exelon plans to use the response from this Commission paper as part of their feasibility study that will assist them in the decision to proceed with licensing in the United States. Exelon will make their decision in December 2001 - January 2002.

In addition to addressing the proposals by Exelon, the staff identified a corresponding issue to Exelon's proposal to issue a single license for a PBMR facility. The issue is:

- Application of License Life for One Combined License with Multiple Reactors

The discussion of this issue is located in the attachment section that assesses Exelon's proposal on the number of licenses.

Further, the staff seeks Commission guidance on three policy issues identified by the staff regarding the licensing of multiple, small reactors (i.e., modular reactor) or combined licenses. The following issues are also discussed in the attachment:

- Duration of Design Approval
- Commencement of Annual Fees
- Testing of New Design Features

SUMMARY.

This paper informs the Commission of the staff's response to the preapplication review of Exelon's PBMR white paper issues and requests guidance on several staff-identified policy issues regarding licensing multiple, small reactors or combined licenses. Attached is the detailed discussion for each of these issues.

The staff would like to inform the Commission of the following conclusions:

1. Operator Staffing in 10 CFR 50.54(m)

The regulations do not address the possibility of having 3 or more reactors controlled from one control room. The staff agrees with the preapplicant that it will need to address the safety implications to justify that more than two reactors can be adequately controlled from one control room. Further, to allow the preapplicant's proposal for an alternate level of operator staffing per unit, an exemption to the current regulations will be necessary.

2. Fuel Cycle Impacts: Tables S3 and S4 in 10 CFR 50.51 and 50.52

The Commissioners

4

For other-than-light-water reactor applicants, the staff is open to reviewing design-specific environmental impacts. The impacts should be discussed in a manner similar to that presented in 10 CFR 51.51 and 51.52. The fuel cycle and transportation impacts could be different for non-light water reactors (LWRs) than those codified in 10 CFR Part 51; absent a rule, these would have to be adjudicated for each application.

3. Fuel Cycle Impacts: Waste Confidence Act in 10 CFR 50.23

It appears that a PBMR facility would be within the scope of the generic determination in Section 51.23(a). With respect to the Department of Energy's (DOE) acceptance of PBMR spent nuclear fuel, Exelon should enter into discussions with DOE, as appropriate.

4. Financial Qualifications in 10 CFR 50.33(f)

A change in the regulations would be required to allow non-utility plants be given the same status as utilities and be exempted from submitting detailed financial qualifications information. The staff believes it is premature to categorize any applicant with "assets or parental guarantees" before examining such assets or parental guarantees. The staff finds that the regulations governing financial qualifications adequately fulfill NRC requirements to establish reasonable assurance that financial resources will be available to safely operate nuclear facilities.

5. Decommission Funding Requirements in 10 CFR 50.75

The preapplicant is proposing to seek a license as a non-utility, which according to the regulations, provides them other options, but not the sinking fund option. The proposed payment scheme by Exelon will not provide the same assurances necessary for decommissioning funding.

6. Minimum Decommissioning Cost Requirements in 10 CFR 50.75(c)

The staff is willing to accept a minimum decommissioning cost estimate specifically for the PBMR, subject to review and adequate technical justification.

7. Antitrust Review Requirements in 10 CFR 50.33a

The ability of the NRC to except certain applicants for new nuclear generating facilities from the NRC's antitrust review requirements will be addressed separately by the Office of the General Counsel.

8. Number of Licenses in 10 CFR 50.10 and Application of License Life for One Combined License (COL) with Multiple Reactors in 10 CFR 52

Congress did not specifically address the prospect of combining the individual COLs for multiple reactor modules into a single combined COL. Nevertheless, there appears to be nothing in the legislative history of the AEA which unequivocally precludes the possibility

The Commissioners

5

that the Commission may, under the authority of Section 161.h. and 10 CFR § 50.52, combine into a single license the individual Part 52 COLs for reactor modules of a substantially similar design co-located at a single site. If the Commission considers pursuing this possibility, then it should also consider rulemaking to clarify: (i) the nature of reactor modules and modular designs whose licensing may be combined under the authority of Section 161.h and Section 50.52; and (ii) the process for making findings under 10 CFR 52.103(g) for reactor modules (and possibly the process for NRC staff inspection and publication of notices concerning completed Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) in 10 CFR § 52.99).

The term of operation for a single combined COL would be limited to 40 years from the date of issuance of the COL. Sequential 40-year terms for each reactor module is not possible inasmuch as only a "single license" would be issued under Section 161.h. The legislation recently submitted by the Commission addressing the matter of 40-year terms would permit the 40-year term of operation to commence upon the Commission making the initial 10 CFR 52.103(g) finding, but would not permit sequential 40-year terms.

9. Annual Fee requirements in 10 CFR Part 171

The CFO plans to include in the FY 2002 fee rulemaking revisions to Part 171 to specifically authorize annual fees to be charged to facilities licensed under Part 52, to clarify that our annual fee is charged per license, not per unit, and to establish when NRC would begin to charge an annual fee to a person holding a Part 52 combined license. Until a final decision is made on the number of modules that will be allowed under a single license, and NRC receives more data from Exelon and is in a better position to make the appropriate preliminary determinations about what kind of regulatory oversight the proposed design will likely require, no recommendations on establishing a new license fee category for modular reactors are offered.

10. Financial Protection Requirements in 10 CFR Part 140

The Commission has previously stated its position, in two separate letters, on the application of Price-Anderson financial protection requirements to multiple modular reactor units co-located at a single site. See Letter from Dennis K. Rathbun (Director of Congressional Affairs, NRC) to U.S. Senator Frank Murkowski, dated July 26, 2001, ADAMS ML012110067; and Letter from Dennis K. Rathbun (Director of Congressional Affairs, NRC) to U.S. Senator Jeff Bingaman, dated July 26, 2001, ADAMS ML012130057.

The staff seeks Commission guidance on the following recommendations:

1. Duration of Design Approval for a Modular Reactor Design in 10 CFR 52

The staff recommends that the Commission not issue a single combined license for multiple modules (nuclear reactors), or condition the license so that the design can be re-reviewed after a 5-year duration without the constraints of the backfit requirement in 10 CFR 50.109.

The Commissioners

6

2. Commencement of Annual Fee in 10 CFR 52

For a Part 52 combined license, the staff contemplates assessing the annual fee only after construction is complete, all regulatory requirements have been met, and the Commission has authorized operation of the facility.

3. Testing of New Design Features in 10 CFR Part 52

The staff recommends that all testing determined to be necessary to demonstrate that PBMR safety systems or components will perform as predicted in the final safety analysis report be completed prior to issuance of a combined license.

COORDINATION.

The Office of the General Counsel has reviewed this paper and has [. . . no legal objection]

William D. Travers
Executive Director
for Operations

Attachment: Staff Assessment of Exelon's Legal and Financial White Papers

ATTACHMENT

Staff Assessment of Exelon's Legal and Financial White Papers

As part of the preapplication review, Exelon Generation (Exelon or the preapplicant) has submitted nine white papers on selected legal and financial issues for Commission response. The preapplicant is currently performing a detailed feasibility study of the licensibility of the PBMR. If the results are favorable, Exelon intends to seek licensing and operation of a PBMR facility as a merchant power plant in the United States. The preapplicant has identified several regulations that could pose undue and unintended burden when applied to gas-cooled reactors, modular facilities or merchant plants. The preapplicant believes that certain regulations were not designed for and do not contemplate gas-cooled modular facilities being operated as merchant plants. Exelon will use the responses to these white papers as part of their feasibility study. Further, the staff also requests Commission guidance for several staff-identified issues related to Part 52 licensing procedures or licensing small, multiple reactors (Items H 2, H.3, I.2, and K). The issues and regulations addressed in this paper include the following:

- A. Operator Staffing Requirements in 10 CFR 50.54(m)
- B. Fuel Cycle Impacts: Tables S3 and S4 in 10 CFR 50.51 and 50.52
- C. Fuel Cycle Impacts: Waste Confidence Act in 10 CFR 50.23
- D. Financial Qualifications in 10 CFR 50.33(f)
- E. Decommission Funding Requirements in 10 CFR 50.75
- F. Minimum Decommissioning Cost Requirements in 10 CFR 50.75(c)
- G. Antitrust Review Requirements in 10 CFR 50.33a
- H. License Issues
 - 1. Number of Licenses in 10 CFR 50.10
 - 2. Application of License Life for One Combined License with Multiple Reactors in 10 CFR 52
 - 3. Duration of Design Approval for a Modular Reactor Design in 10 CFR 52
- I. Annual Fee Issues:
 - 1. Annual Fee requirements in 10 CFR Part 171
 - 2. Commencement of annual fee in 10 CFR 52
- J. Financial Protection Requirements in 10 CFR Part 140
- K. Testing of New Design Features in 10 CFR Part 52

Discussion of these issues are on the following pages, including a brief summary of the issue, current regulations, preapplicant's positions, discussion of the staff considerations and a conclusion or proposed recommendation.

The Commissioners

8

A. Operator Staffing

Issue

Should a PBMR facility be allowed to control more than two reactors from one control room and be allowed to operate with a control room staffing complement that is less than that currently required by regulations?

Current Regulations

The NRC has established the requirements for control room staffing in 10 CFR 50.54(k) and (m). The first part, 10 CFR 50.54(k) states, "An operator or senior operator licensed pursuant to part 55 of this chapter shall be present at the controls at all times during the operation of the facility."

Three parts of 10 CFR 50.54(m) relate to this operator staffing issue. The first is 10 CFR 50.54(m)(2)(i) which states, "Each licensee shall meet the minimum licensed operator staffing requirements in the following table:." The table includes one, two or three nuclear units; one, two or three control rooms; with the minimum number of operators and senior operators for each applicable combination, but only addresses the number of units per control room to two.

The second related part is 10 CFR 50.54(m)(2)(iii) which states, "When a nuclear power unit is in an operational mode other than cold shutdown or refueling, as defined by the unit's technical specifications, each licensee shall have a person holding a senior operating license for the nuclear unit in the control room at all times. In addition to this senior operator, for each fueled nuclear power unit, a licensed operator or senior operator shall be present at the controls at all times."

Finally, the third related part is 10 CFR 50.54(m)(2)(iv) which states, "Each licensee shall have present, during alteration of the core of a nuclear power unit (including fuel loading and transfer), a person holding a senior operator license or a senior operator license limited to fuel handling to directly supervise the activity and, during this time, the licensee shall not assign other duties to this person."

In addition to 10 CFR 50.54, NUREG-0800, Standard Review Plan 13.1.2, Section II.B 3 states that staffing should follow the staff positions of Three Mile Island (TMI) Action Plan items I.A.1.1 and I.A.1.3 of NUREG-0737 as follows:

"a. A shift supervisor with a senior reactor operator's license, who is also a member of the station supervisory staff, shall be on site at all times when at least one unit is loaded with fuel.

b. In addition to the licensed personnel specified in 10 CFR 50.54(m), as a minimum, an auxiliary operator (nonlicensed) shall be assigned to each reactor and an additional auxiliary operator shall be assigned for each control room for an operating reactor."

The Commissioners

9

Additionally, TMI Action Plan item I.A 1.1 discusses the need for engineering expertise on shift in the position of a shift technical advisor.

Preapplicant's Position

The PBMR is proposed to have multiple reactors (up to ten) controlled from one control room. Each reactor has its own power conversion system. The preapplicant has not yet determined the appropriate number of operators that would be required to operate multiple reactors from one control room. However, the preapplicant believes that since the PBMR is a passive plant that does not require early operator intervention to mitigate accidents, the staffing level should be less than that indicated in 10 CFR 50.54(m) for one or two units.

The regulation does not contain any staffing requirements for more than two units at a site with a common control room. The preapplicant proposes to justify the licensed operator staffing requirements for three or more PBMR modules at a site with a common control room.

The preapplicant proposes to request an exemption on the minimum staffing requirements and location of the Senior Reactor Operators and Reactor Operators required by 10 CFR 50.54(m). Additionally, the preapplicant will request exemptions from 10 CFR 50.54(m) in the design certification to avoid duplicate reviews for subsequent PBMRs.

Discussion

To allow an alternate level of operator staffing, an exemption to the regulation would need to be justified by Exelon. For the PBMR, the staff has identified a number of issues that will need to be addressed in justifying an alternate operating staffing level when they submit an application.

In its white paper proposal, the preapplicant did not include 10 CFR 50.54(k) in its list of staffing issues. The staff's issue with 10 CFR 50.54(k) is the interpretation of the phrase, "at the controls," as it might relate to one operator controlling multiple reactors in a PBMR. The staff expects Exelon to address the safety implications for being "at the controls." This would include justifying the extent of sharing controls. Exelon would need to address the safety implications of whether the controls were manipulated from one display panel for several reactor modules that may require an operator to change displays to view and manipulate the control of another reactor or if each reactor's controls were located on separate panels that may require the operator to physically move some distance from one reactor's controls to another reactor's controls. The justification must address the precise definition of "at the controls."

The issue related to 10 CFR 50.54(m)(2)(i) is twofold. First, the Minimum Requirements table only considers up to two nuclear power units controlled from one control room. The regulations do not address the possibility of having three or more reactors controlled from one control room. The preapplicant proposes to justify operator staffing requirements for three or more PBMR reactor modules with a common control room. The staff agrees with the preapplicant that it will need to address the safety implications to justify that more than two reactors can be adequately

The Commissioners

10

controlled from one control room. The staff would need to perform an individual assessment of the justification. The second issue with the table is the number of operators required per unit per control room. The preapplicant believes it to be excessive, even for the first two PBMR modules, based on the passive nature of the plant that does not require operator intervention to mitigate accidents. The staff might agree, but Exelon will have to justify that position also. The issue related to 10 CFR 50.54(m)(2)(iii) is similar to that with 10 CFR 50.54(k) requiring the operator to be "at the controls," but contains the additional requirement that the statement is "for each fueled nuclear power unit."

The final staffing issue related to 10 CFR 50.54 is in regard to 10 CFR 50.54(m)(2)(iv), which addresses supervision during core alterations. The issue has to do with the last phrase in the requirement, "..., the licensee shall not assign other duties to this person." It is the staff's understanding that the PBMR is designed to continually be replenished with fuel from the top while used fuel is removed from the bottom; that is, the core is being altered continuously. Based on 10 CFR 50.54(m)(2)(iii), the staff would expect a senior reactor operator to be in the control room to supervise the continuous activity with no other duties. Exelon will need to justify the safety basis of this regulation for the PBMR. This justification will need to include not being assigned other operator duties for a given reactor module or supervision of core alteration activities for other reactor modules.

Lastly, the staff believes the staffing-related issues in the Standard Review Plan are applicable to the PBMR and expects Exelon to address them in the application.

Conclusion

The regulations do not address the possibility of having 3 or more reactors controlled from one control room. The staff agrees with the preapplicant that it will need to address the safety implications to justify that more than two reactors can be adequately controlled from one control room.

An exemption to the regulations would be necessary for an alternative level of operator staffing for the PBMR. In the application, Exelon must provide adequate justification for the proposed staffing level. The key to justification of all of the above issues is a detailed function and task analysis followed by performance demonstrations on a control room simulator or control room prototype of all activities expected of the operators in normal, abnormal, emergency and accident conditions. To accomplish this Exelon first needs to develop its concept of operations considering the following as a minimum:

- Role of the operator - Is the operator to be an active participant in reactor operation or a passive monitor/trouble shooter?
- Level of automation - Is the system to be fully automatic, fully manual or some combination? What is the degree of automation desired?
- Modes of operation - What modes of operation will be required of the system (e.g., cold shutdown, hot standby, normal operation, refueling, etc.)?
- Multiple Module Control - What is the goal? How many modules should be controlled per

The Commissioners

12

B. Environmental Impacts of the Fuel Cycle and Transportation : 10 CFR Part 51, Tables S-3 and S-4

Issue

Should a non-LWR applicant be allowed to submit plant-specific or design specific environmental impact information?

Current Regulations

In accordance with 10 CFR 51.41, 51.45, 51.50, 52.17(a)(2), and 52.79(a)(2), an applicant should provide sufficient information in an environmental report prepared for a construction permit, early site permit, or combined license, regarding any applicable environmental impacts associated with all stages of production and transportation of reactor fuel. Light-water power reactor applicants are expected to rely on the regulatory framework at 10 CFR 51.51 and 51.52, and are only expected to supplement those findings with site-specific information where the results are different or information on issues that were not generically resolved.

Preapplicant's Position

The preapplicant proposes to identify the environmental impacts attributable to the fuel cycle and transportation for a set of modular reactors that constitute a PBMR nuclear power plant. The preapplicant suggests that the impacts are expected to be generic for all PBMR nuclear power reactors, therefore, on that basis the preapplicant proposes that the results should form the underlying bases for rulemaking. The preapplicant proposes that rulemaking be initiated to create tables similar to 10 CFR Part 51, Tables S-3 and S-4, for the PBMR or that the issue be generically resolved for the PBMR during a design certification rulemaking.

Discussion

The PBMR is not a light-water power reactor. For other-than-light-water reactor applicants, the environmental impacts should be discussed in a manner similar to that presented in 10 CFR 51.51 and 51.52, the information would serve as a starting point for the NRC independent assessment and should be submitted in sufficient detail to provide information on the cumulative, environmental, socioeconomic, and human health impacts associated with the fuel cycle and transportation. The NRC conducts an environmental review for early site permit and combined license applications; the results of the review are published in an environmental impact statement.

A number of issues that are not unique to a specific site have been considered generically with the results of the impact assessment codified in NRC regulations. NRC regulations address the uranium fuel cycle environmental impacts for light-water power reactors in 10 CFR 51.51, Table S-3, and transportation of fuel and waste impacts for light-water power reactors in 10 CFR 51.52, Table S-4. The fuel cycle and transportation impacts could be different for non-light-water power reactors than those codified in 10 CFR Part 51; absent a rule, these

The Commissioners

13

would have to be adjudicated for each application.

Independent of issues raised by the preapplicant, the NRC staff has a rulemaking initiative underway to revise Tables S-3 and S-4 found in 10 CFR 51.51 and 51.52. As that initiative matures and as part of the rulemaking process, a proposed rule will be published in the Federal Register for public comment and interested parties will have ample opportunity to share their views with the NRC. The preapplicant could use the current rulemaking forum to present the underlying technical bases to support a more expansive rule change to incorporate the PBMR or other technology, however, the NRC may elect to maintain the narrower scope of the rule change to resolve the limited elements originally envisioned. The Unified Agenda of Federal Regulatory and Deregulatory Actions contains information regarding NRC's rulemaking activities. A semi-annual regulatory agenda was last issued on May 14, 2001 (66 FR 26602). Separate from the current rulemaking initiative, interested parties have an alternate mechanism to petition the NRC for rulemaking in accordance with 10 CFR 2.802 and the NRC can consider experience in determining when it elects to undertake another rulemaking.

The preapplicant's suggestion that the design certification rulemaking for a PBMR could serve as a platform for the resolution of the attendant generic environmental impacts may devalue a rule by too narrow a circumscription for a particular technology. For example, the current 10 CFR Part 51 regulation considers light-water power reactors as a class of plant; it does not differentiate between a pressurized water reactor (PWR) or a boiling water reactor (BWR), or the recently-approved designs under Part 52. The PBMR could be considered part of a class of other-than-light-water power reactors that could have a similar challenge (e.g., Gas Turbine-Modular Helium Reactor) and similar interest for a regulatory solution. In addition, different parts of the regulations are involved (i.e., Parts 51 and 52); a change to a generic rule concomitant with a new rule governing a specific design could unnecessarily complicate a design certification rulemaking.

Conclusion

For other-than-light-water reactor applicants, the staff is open to reviewing design-specific environmental impacts. The impacts should be discussed in a manner similar to that presented in 10 CFR 51.51 and 51.52, the information would serve as a starting point for the NRC independent assessment and should be submitted in sufficient detail to provide information on the cumulative, environmental, socioeconomic, and human health impacts associated with the fuel cycle and transportation. The fuel cycle and transportation impacts could be different for non-LWRs than those codified in 10 CFR Part 51; absent a rule, these would have to be adjudicated for each application.

The NRC has only limited experience in licensing other-than-light-water power reactors, at this time all operating power reactors are light-water reactors. Inasmuch as the PBMR is a prospective design, the staff believes that any effort to undertake a generic rulemaking on these issues is premature. If the NRC gains experience in the issues associated with the PBMR or other non-light-water power reactor designs through a design certification process or an adjudicatory proceeding (e.g., early site permit), only then should the staff consider whether it

The Commissioners

14

has sufficient information to proceed with a generic regulatory solution. Otherwise, the limited resources available would be diverted from the resolution of generic environmental issues for (1) the light-water power reactor designs already approved and available for reference in a combined license application and (2) elements that still require adjudication on an early site permit application.

The Commissioners

15

C. Environmental Impacts of the Fuel Cycle and Transportation : Waste Confidence Rule

Issue

Would PBMR spent fuel fall within the scope of the NRC's Waste Confidence Rule?

Current Regulations

The NRC's Waste Confidence Rule is codified at 10 CFR 51.23. Section 51.23(a) states:

The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least thirty years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor fuel at its spent fuel storage basin or offsite spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within thirty years beyond the licensed life for operation of any reactor to dispose of commercial high-level waste and spent fuel originating in such reactor and generated up to that time.

The result of the generic determination in Section 51.23(a) is that there is no need to consider the environmental impacts of the onsite storage of spent fuel (in environmental reports, environmental impact statements, environmental assessments, or other analyses), for the period *following the anticipated expiration of the license*, in reactor and independent spent fuel storage facility licensing proceedings. However, Section 51.23(c) requires that environmental impacts *during the term of the reactor operating license or a license for an Independent Spent Fuel Storage Installation (ISFSI)* be considered in a licensing proceeding.

Preapplicant's Position

The preapplicant would like to clarify that long-term onsite storage of spent fuel beyond the licensed lifetime of the PBMR is not a concern under the NRC Waste Confidence Rule codified at 10 CFR 51.23. The Waste Confidence Rule, as revised, reflects the Commission's generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least thirty years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor fuel at its spent fuel storage basin or offsite spent fuel storage installations. The preapplicant noted that the Waste Confidence Rule does not distinguish between types of spent fuel. Additionally, in making its findings in support of the Waste Confidence Rule, the Commission explicitly considered non-LWR fuel, including fuel from gas-cooled reactors. Accordingly, the preapplicant believes that the Waste Confidence Rule is broad enough to encompass fuel irradiated in a gas-cooled reactor like a PBMR. The preapplicant also maintains that the

The Commissioners

16

Department of Energy (DOE), under the Nuclear Waste Policy Act (NWPA), is responsible for disposal of spent nuclear fuel (SNF)

Discussion

The Commission's Waste Confidence Rule, as codified at 10 CFR 51.23, is based on findings contained in the Commission's Waste Confidence Decision (WCD). The Commission issued its initial WCD on August 31, 1984 (49 FR 34658). This decision was intended to provide an assessment of the degree of assurance available that radioactive waste can be safely disposed of, to determine when such disposal or offsite storage would be available, and to determine whether radioactive waste can be safely stored onsite past the expiration of existing facility licenses until offsite disposal or storage is available. The Commission reevaluated its initial WCD in 1990 and affirmed, with some modifications, the findings of the original decision. See 55 FR 38474 (September 18, 1990). The Commission also modified Section 51.23 to conform the regulation to the revised findings. 55 FR 38472 (September 18, 1990). On December 6, 1999, the Commission issued a status report on the WCD which concluded that "[t]he Commission is of the view that experience and developments since 1990 confirm the Commission's 1990 Waste Confidence findings" (64 FR 68005).

The WCD contains five findings. In brief, these findings are that there is reasonable assurance that (1) safe disposal of radioactive waste and spent fuel in a mined geologic repository is technically feasible; (2) one or more geologic repositories will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor license to dispose of high level waste (HLW) and SNF, (3) HLW and SNF will be managed safely until sufficient repository capacity is available to assure the safe disposal of all high-level waste and spent fuel, (4) if necessary, the SNF can be stored safely and without significant environmental impacts for at least 30 years beyond the reactor license expiration at either an onsite or offsite storage facility, and (5) safe independent onsite or offsite storage capacity will be available if needed.

The bases for Findings 1, 2, and 5 apply to all reactor types, and therefore, are not considered to be significant issues relative to the applicability of the WCD to PBMR facilities. As the WCD applies directly to a PBMR, Findings 3 and 4 are the most pertinent. In formulating Finding 3, the Commission considered the technical feasibility of using both wet and dry storage. Because of the form of the PBMR SNF, the preapplicant has stated that dry storage would be used. Although the basis for Finding 3 considered primarily light water reactor (LWR) spent fuel, the basis does reference several reports that considered dry cask storage of spent fuel from gas-cooled reactors. These reports include "Dry Storage of Spent Nuclear Fuel, A Preliminary Survey of Existing Technology and Experience" (NUREG/CR-1223, 1980) and A. B. Johnson et al., "Behavior of Spent Nuclear Fuel and Storage System Components in Dry Interim Storage" (PNL-4189, Rev.1, August 1982).

The first report (NUREG/CR-1223) was a survey of the then-existing technology and experience with the dry storage of spent fuel. The report describes the experience with the dry storage of irradiated graphite fuel at the Irradiated Fuel Storage Facility at the Idaho National Engineering

The Commissioners

17

Lab (INEL). The graphite fuel to be stored included fuel from the high temperature gas reactors at Peach Bottom I (Core 2) and Fort St Vrain, as well as irradiated fuel from the Rover Nuclear Rocket Program. The report also discusses the experience with the storage of Peach Bottom I (Core 1) graphite fuel and Fermi I blanket sodium fuel in dry storage at the Idaho Chemical Processing Plant at INEL. For both of these storage alternatives, the report noted that there were no unusual or significant unexpected occurrences during the period of operation.

The second report (PNL-4189, Rev 1) discusses the dry storage experience with gas-cooled reactor spent fuel, including graphite fuel, and concludes that "[a]t all the operating facilities..., dry storage operations have been successful, with low radiation doses and no serious operational problems" (at page xii). One of these facilities was a vault to store pebble-bed gas-cooled test reactor fuel at Julich (FRG). The report also concludes that all types of irradiated reactor fuel have been shipped and handled under dry conditions

In addition to these two reports, the Commission, in its discussion of the safety of dry storage in the initial WCD, specifically referenced the DOE comments on the successful storage of reactor fuel from a sodium cooled graphite research reactor and from the Fort St. Vrain High Temperature Gas Reactor prototype facility. In response to these comments, the Commission stated that it was "...confident that dry storage in installations can provide continued safe storage of spent fuel at reactor sites for at least 30 years after expiration of the operating license" 49 FR 34658, 34663 (August 31, 1984).

The staff notes that although Exelon has not submitted cask designs or information on potential accidents associated with PBMR fuel storage, there do not appear to be any technically insurmountable issues. Since the original WCD, there has been a significant increase in knowledge and experience regarding the design and performance of dry casks. Designs of ISFSIs consider accident scenarios such as natural disasters and incorporate security and safeguard features. In addition, any potential long-term environmental impacts could be managed through the cask design process and compliance with the Commission's regulations, with potential environmental impacts being evaluated as part of future licensing actions.

In the Commission's 1990 reevaluation of the initial WCD, the Commission revised Finding 4 to indicate that spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation, including *the term of a revised or renewed licenses* (emphasis added). In regard to dry storage, the revised Finding 4 reflected the Commission's conclusion that: (1) the material degradation processes of spent fuel in dry storage are well understood, (2) dry storage systems are simple, passive, and easily maintained, (3) both the NRC and dry storage operators have gained experience with dry storage which confirms the Commission's 1984 conclusions, and (4) the Commission maintains regulatory authority over any spent fuel installation. See 55 FR 38474, 38509 (September 18, 1990).

The NRC staff evaluation that formed the basis for the reevaluation of the initial WCD cited the Environmental Assessment for 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste" (NUREG-1092), as support for its

The Commissioners

18

reaffirmation for Finding 4 (NRC Staff Waste Confidence Review Group's Final Waste Confidence Decision Review, 1990). The Environmental Assessment found that passive dry storage technologies are supported by experience from almost 40 years of dry storage of spent nuclear fuel, beginning with the extended vault and drywell tests conducted by INEL in 1964 on liquid metal fast breeder reactor fuel and twelve years of research into passive dry storage technology in the United States and abroad. U.S. research conducted by INEL includes operations began in 1971 with dry well storage of gas-cooled reactor fuel and vault storage of gas-cooled reactor fuel in 1975. The Environmental Assessment also included a statement that the Commission made in response to the authorization proceedings on the Nuclear Waste Policy Act, that "...the Commission believes the information is sufficient to reach a conclusion on the environmental effects of dry storage. All areas of safety and environmental concern (e.g., maintenance of systems and components, prevention of material degradation, protection against accidents and sabotage) have been addressed and shown to present no more potential for adverse impact on the environment and the public health than the storage of spent fuel in water pools"(at II-7).

As noted above, Exelon also discusses DOE's responsibility to accept irradiated PBMR fuel under the NWPA. Because more detail on the actual design of the proposed PBMR facility is necessary, it is difficult to predict whether the proposed facility would produce a different volume of spent fuel than a typical LWR. In terms of the WCD's consideration of the need for a second repository generally, the 1990 reevaluation noted that "[s]ince Congress specifically provided in the NWPA for a first repository, and required DOE to return for legislative authorization for a second repository, the Commission believes that Congress will continue to provide institutional support for adequate repository capacity" (55 FR 38474, 38508). This statement would seem to encompass any capacity concerns with a PBMR or other nuclear reactor facility in terms of the Commission's WCD. However, with respect to DOE's acceptance of PBMR SNF, Exelon should enter into discussions with DOE, as appropriate.

Conclusion

The Commission, in reaching the various WCD findings that formed the basis for its Waste Confidence Rule in 10 CFR 51.23, specifically considered spent fuel similar to that which would be used at a PBMR facility. Therefore, it appears that a PBMR facility would be within the scope of the generic determination in Section 51.23(a). The staff notes that although Exelon has not submitted cask designs or information on potential accidents associated with PBMR fuel storage, there do not appear to be any technically insurmountable issues. Since the original WCD, there has been a significant increase in knowledge and experience regarding the design and performance of dry casks. Designs of ISFSIs consider accident scenarios such as natural disasters and incorporate security and safeguard features. In addition, any potential long-term environmental impacts could be managed through the cask design process and compliance with the Commission's regulations, with potential environmental impacts being evaluated as part of future licensing actions. With respect to DOE's acceptance of PBMR SNF, Exelon should enter into discussions with DOE, as appropriate.

The Commissioners

19

D. Financial Qualifications

Issue

Can a group of non-utility plants be given the same status as utilities and be exempted from submitting detailed financial qualifications information?

Current Regulations

10 CFR 50.2 defines an electric utility as "any entity that generates or distributes electricity and which recovers the cost of this electricity, either directly or indirectly, through rates established by the entity itself or by a separate regulatory authority." It is possible to submit an application for a new facility either under Part 50 or Part 52 of the regulations. In either case, a non-utility applicant would be required to submit financial qualifications information as stated in 10 CFR 50.33(f). However, an applicant that is an electric utility is not required to provide the same information, because its financial qualifications are presumed.

Preapplicant's Position

The preapplicant states the requirement to submit detailed financial qualifications under Section 50.33(f) of 10 CFR, to be burdensome and un-warranted for applicants that have assets or parental guarantees. For the first PBMR application, the preapplicant proposes to submit estimates for the total construction costs and annual operating costs for each of the five years of operation of the entire PBMR facility and source of funds to cover such operating costs as required by Appendix C of Part 50. The preapplicant also proposes that rulemaking be initiated to define in Section 50.33(f) that a new category of merchant generating companies (non-utilities) have the same status as utilities if it satisfies certain criteria

Discussion

The NRC issued the Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance, NUREG-1577, Rev 1, March 1999, to describe the process it uses to review the financial qualifications and methods of providing decommissioning funding assurance required to fulfill the financial qualifications required in 10 CFR 50.33(f). Under these requirements, the NRC staff is obligated to conduct a financial qualifications review for each license application. This review is performed regardless of how many reactors are included in each license.

The regulations in 10 CFR 50.2 state the definition of a utility. If an applicant does not fulfill the definition of an electric utility, it is deemed to be a non-utility. There are no other categories under which staff conducts a financial qualifications review. Utilities use rate base rate of return, which provides for a more stable and regular income. Non-utilities face more competition in the marketplace than utilities.

All the financial information required to fulfill 10 CFR 50.33(f) is information that the applicant will

The Commissioners

20

have at its disposal. The NRC seeks to review that financial information in order to have reasonable assurance that the facility will have the resources to operate safely. The staff believes it is premature to categorize any applicant with "assets or parental guarantees" before examining such assets or parental guarantees.

Conclusion

A change in the regulations would be required to allow non-utility plants be given the same status as utilities and be exempted from submitting detailed financial qualifications information. The staff believes it is premature to categorize any applicant with "assets or parental guarantees" before examining such assets or parental guarantees. The staff finds that the regulations governing financial qualifications adequately fulfill NRC requirements to establish reasonable assurance that financial resources will be available to safely operate nuclear facilities.

The preapplicant has not provided sufficient justification in its proposal that rulemaking be initiated to redefine 10 CFR 50.33(f). This regulation is able to govern multiple modules as described by the preapplicant for the PBMR, because the regulation governs licenses, and not individual or multiple facilities.

The Commissioners

21

E. Decommissioning Funding

Issue

Can a non-utility utilize an alternative method for decommissioning funding, such as partial prepayment

Current Regulations

10 CFR 50.75 contains the requirements to provide decommissioning funding assurance. The regulations provide for six methods of providing decommissioning assurance. These are sinking fund, prepayment, corporate parent guarantee, surety bonds, contracts, and a combination of the foregoing. Utilities are licensees that are rate-regulated and may opt to use any of the six methods. Non-rate-regulated licensees, such as a merchant plant operator, may not use a sinking fund method, but are allowed to use any of the others. The only notable exception to all of the above is for a power reactor licensee that has the full faith and credit backing of the United States government. This option entails a statement of intent containing a cost estimate for decommissioning, and indicating that funds for the decommissioning will be obtained when necessary.

Preapplicant's Position

Most non-rate-regulated licensees have used the prepayment option for decommissioning funding. The preapplicant states that 100% prepayment for new plants might jeopardize the economic viability of any new plant to be operated on a merchant basis because of the higher present worth of the prepayment relative to other funding mechanisms which allow payments at a later time. The preapplicant is inquiring whether some other funding arrangement, authorized under 10 CFR 50.75(e), may be feasible for a PBMR operated as a merchant plant. For example, the preapplicant proposed to accumulate funding at an accelerated rate. At the time of the first application, Exelon would like to propose an alternate decommissioning funding method for the PBMR that could involve a partial payment of the total decommissioning cost estimate and annual contributions over the next 20 years. The preapplicant believes that the NRC can grant an exemption from Section 50.75(e)(1) to permit this alternative funding approach (or another new alternative method). The preapplicant suggested this alternative funding but has not yet decided on an alternative funding method. If the NRC is conceptually opposed to the use of partial prepayment with accelerated funding over 20 years, the preapplicant would like to know as soon as possible. The preapplicant also proposes that rulemaking be initiated to modify Section 50.75(e)(1) to explicitly authorize the use of the to-be-proposed alternative funding method.

Discussion

The intent of this regulation is to provide assurance that decommissioning funding is available, particularly in the event of a permanent shutdown of the plant prior to the expiration of the license. The preapplicant is proposing to seek a license as a non-utility or a non-rate-regulated

The Commissioners

22

entity. As a non-utility, according to the regulations, all other options are available, but not the sinking fund option. The preapplicant's proposal is a form of a sinking fund. The staff does not believe that the preapplicant's proposal provides the same level of assurance as other funding options available to non-rate-regulated entities. Thus, the staff believes that the preapplicant's proposed method is not consistent with current requirements. Further, an exemption to use a sinking fund is likely to be difficult to justify technically since they do not have a rate base rate of return (i.e., guaranteed rate base) that is inherent for an utility.

However, as noted in the staff's recommendation in Item F, "Decommissioning Cost Estimate," of this paper, Exelon would be able to use an adequately justified site-specific estimate for decommissioning its Pebble Bed Module Reactor. Depending on the timing of decommissioning for the modules, Exelon could conceivably have up to 100 years to decommission its facility (i.e. 40 years operation, (not counting any license renewal subsequently approved by the NRC) plus 60 years deferred dismantlement as allowed in 10 CFR 50.75). Because Exelon's decommissioning cost estimate would be based on a site-specific study, the staff interprets 10 CFR 50.75(e)(1)(i) (the pre-payment option) to allow Exelon to take the 2% real earnings credit for as long as the 100 year period, depending on the timing of each module's final decontamination schedule, and the schedule of cash flows necessary to accomplish final decommissioning if outlined specifically in the site-specific estimate. The present value of even a relatively large decommissioning cost, when discounted back at 2% real rate of return, should not be very large and should thus require a relatively non-onerous initial deposit.

Conclusion

The preapplicant is proposing to seek a license as a non-utility, which according to the regulations, provides them other options, but not the sinking fund option. The proposed payment scheme by Exelon will not provide the same assurances necessary for decommissioning funding. However, the staff interprets the regulation, using the pre-payment option, to allow the preapplicant to use a site-specific decommissioning cost estimate and take the 2% real earning credit for possibly 100 years. This would provide the preapplicant with an option that would require a relatively non-onerous initial deposit.

The Commissioners

23

F. Minimum Decommissioning Cost Requirements

Issue

Can a PBMR licensee submit decommissioning cost estimates specifically for a PBMR and on a per module basis?

Current Regulations

10 CFR 50.75(c) regulates the amount of minimum decommissioning funds that are required of BWRs and PWRs through a minimum decommissioning funds equation. There is no formula specifically dealing with gas-cooled reactors. However, the regulations allow for the use of a site-specific estimate which may be substituted for the generic formulas.

Preapplicant's Position

The current regulations specify decommissioning cost estimates for BWRs and PWRs but not for gas-cooled reactors. The design of a PBMR is significantly different from the design of a BWR or PWR. As a result, the preapplicant believes the cost estimates are not appropriate for a PBMR module or facility. The preapplicant proposes that the first PBMR application include a decommissioning cost estimate specifically for a PBMR. Additionally, the preapplicant proposes that the cost estimate apply to a single module since the construction of the modules may be staggered.

Discussion

The staff is in agreement with the preapplicant that there are no regulations that specifically deal with minimum decommissioning cost estimates for gas cooled reactors.

Conclusion

Staff is willing to accept a minimum decommissioning cost estimate specifically for the PBMR, subject to review and adequate technical justification.

The Commissioners

24

G. Antitrust Review Authority

Issue

Can the NRC except a non-utility group of plants or merchant plants from the antitrust review?

Current Statutory Provisions and Regulations

The NRC's antitrust responsibilities are set forth in Section 105 of the Atomic Energy Act (AEA) of 1954. Section 105c, which was amended in 1970, requires the NRC to conduct an antitrust review of applications for construction permits or combined operating licenses, seek the advice of the Attorney General in conducting this review, and provide an opportunity for members of the public to request a hearing. Section 105c prescribes the specific process for conducting a precensuring antitrust review and making findings as to whether activities under the license would create or maintain a situation inconsistent with antitrust laws. Pursuant to 10 CFR 50.33a, prospective applicants must submit the required antitrust review information to the NRC at least nine months prior to the application for a construction permit or combined license. This information, which is set forth in Appendix L to 10 CFR part 50, includes detailed transmission, distribution, and business planning information. Under section 105c.(7) of the Act, the NRC has the authority, subject to the approval of the Attorney General, to determine that the issuance of certain classes or types of licenses "would not significantly affect the applicant's activities under the antitrust laws," and therefore, to except such applicants from the NRC's antitrust review requirements. The NRC also has the authority, under section 105c (6) of the Act, to issue a license with appropriate antitrust conditions, based on the findings of the antitrust review.

Preapplicant's Position

Pursuant to Section 105c of the AEA, NRC is required to determine whether activities under the license would create or maintain a situation "inconsistent with the antitrust laws." In some instances, these reviews and associated hearings have resulted in imposing various antitrust conditions in the license. These conditions often involved access to transmission. The preapplicant believes that the antitrust provisions have limited applicability in the modern electric industry and serve no useful purpose with respect to the proposed operation of the nuclear reactor as a merchant plant. Recognizing the current status of competition in the electric utility industry and the competitive realities surrounding the operation of a merchant nuclear plant, the NRC should make a determination that merchant plant applicants that meet certain criteria (e.g., exempt wholesale generators (EWGs) or generators authorized to sell power wholesale at market-based rates) are excepted from NRC antitrust review.

The preapplicant proposes that the NRC initiate a proceeding, and seek approval from the Attorney General, to define a new category of merchant generating companies (non-utilities) and except them from antitrust reviews. The preapplicant also proposes that rulemaking be initiated to not subject newly-defined "merchant plants" to an antitrust review. Exelon is working with the Nuclear Energy Institute (NEI) to support the creation of the excepted class for merchant plants.

The Commissioners

25

Conclusion

The ability of the NRC to except certain applicants for new nuclear generating facilities from the NRC's antitrust review requirements will be addressed separately by the Office of the General Counsel.

The Commissioners

26

H. License Issues

H.1 Number of Licenses for Modular Reactors

H.2 Application of License Life for One Combined License with Multiple Reactors

Issue

Can one combined operating license be issued for multiple PBMR module reactors co-located at a single site? If so, how should the license life be applied?

Current Statutory Provisions and Regulations

Section 103 of the Atomic Energy Act of 1954, as amended (AEA), provides, in pertinent part:

a. The Commission is authorized to issue licenses to persons applying therefor to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export under the terms of an agreement for cooperation arranged pursuant to Section 123, utilization or production facilities for industrial or commercial purposes. Such licenses shall be issued in accordance with the provisions of Chapter 16 and subject to such conditions as the Commission may by rule or regulation establish to effectuate the purposes and provisions of this Act.

b. The Commission shall issue such licenses on a nonexclusive basis to persons applying therefor (1) whose proposed activities will serve a useful purpose proportionate to the quantities of special nuclear material or source material to be utilized; (2) who are equipped to observe and who agree to observe such safety standards to protect health and to minimize danger to life or property as the Commission may by rule establish, and (3) who agree to make available to the Commission such technical information and data concerning activities under such licenses as the Commission may determine necessary to promote the common defense and security and to protect the health and safety of the public. All such information may be used by the Commission only for the purposes of the common defense and security and to protect the health and safety of the public.

Each such license shall be issued for a specified period, as determined by the Commission, depending on the type of activity to be licensed, but not exceeding forty years, and may be renewed upon the expiration of such period.

Section 161 h. of the AEA provides that the Commission may:

The Commissioners

27

consider in a single application one or more of the activities for which a license is required by this Act, combine in a single license one or more of such activities, and permit the applicant or licensee to incorporate by reference pertinent information already filed with the Commission;

Section 185.b. of the AEA states:

After holding a public hearing under section 189a (1)(A), the Commission shall issue to the applicant a combined construction and operating license if the application contains sufficient information to support the issuance of a combined license and the Commission determines that there is reasonable assurance that the facility will be constructed and will operate in conformity with the license, the provisions of this Act, and the Commission's rules and regulations. The Commission shall identify within the combined license the inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that, if met, are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of this Act, and the Commission's rules and regulations. Following issuance of the combined license, the Commission shall ensure that the prescribed inspections, tests, and analyses are performed and, prior to operation of the facility, shall find that the prescribed acceptance criteria are met. Any finding made under this subsection shall not require a hearing except as provided in section 189a (1)(B).

10 CFR § 50.52 provides:

The Commission may combine in a single license the activities of an applicant which would otherwise be licensed severally.

10 CFR 52.103(g) provides:

Prior to operation of the facility, the Commission shall find that the acceptance criteria in the combined license are met. If the combined license is for a modular design, each reactor module may require a separate finding as construction proceeds.

Preapplicant's Position

The definition of a "utilization facility" in Section 101 of the AEA is broad and could be

The Commissioners

28

interpreted as including a set of integrated reactor modules. In 10 CFR 50.2, a "utilization facility" is defined as "any nuclear reactor". Under this section, each module could be classified as a "nuclear reactor." However, the AEA, as well as the implementing regulations in 10 CFR 50.10(a), make it unlawful for a person to possess or use a utilization facility except as authorized by a license that has been issued by the Commission. Neither the AEA nor NRC regulations require that each utilization facility have a separate license. The preapplicant believes that the Commission could, consistent with the language of both Section 101 of the AEA and 10 CFR 50.10, issue a single license for multiple modules (reactors).

The preapplicant asserts that issuing a single license for multiple PBMR modules would have several beneficial effects. First, issuance of a single license for multiple modules (i.e., reactors) would enable the modules to be treated legally, as well as practically, as a single nuclear facility (e.g., for Price-Anderson and annual fees and operating staffing purposes). Further, issuance of a single license for a facility consisting of multiple modules would have other benefits, such as promoting administrative efficiency and standardization among modules. The preapplicant proposes that the first PBMR application will seek a single license for a set of multiple modules (reactors). Additionally, the preapplicant proposes that rulemaking be initiated to clarify that a "set" of modules may be treated as a single nuclear facility for licensing and "other purposes."

Discussion

Section 161.h authorizes the Commission to combine into a "single license" the activities for which a license is required by the AEA. The legislative history of the AEA shows that Congress intended Section 161.h to allow the Commission the discretion to issue a single license which combines into one license what would otherwise require many separate licenses for the essentially integrated activity of power generation at a single facility, for example, licenses authorizing operation as well as licenses for the possession and use of byproduct materials, and licenses authorizing possession and use of special nuclear materials for that facility. The construction and operation of power reactor modules of substantially similar design, co-located at the same site in a power station specifically designed for such reactor modules, arguably could be viewed as sufficiently similar to what Congress had in mind (i.e., combining licenses), such that Section 161.h might form a defensible legal basis for combining individual COLs for such reactor modules into a single combined COL.

It is not clear that a single combined COL would confer all of the benefits anticipated by Exelon. (e.g., a single Price Anderson application and annual fee). Additionally, the term of operation for a single combined COL would be limited to 40 years from the date of issuance of the COL. Sequential 40-year terms for each reactor module is not possible inasmuch as only a "single license" would be issued under Section 161.h. The legislation recently submitted by the Commission addressing the matter of 40-year terms would permit the 40-year term of operation to commence upon the Commission making the initial 10 CFR 52.103(g) finding, but would not permit sequential 40-year terms.

Conclusion

The Commissioners

29

Congress did not specifically address the prospect of combining the individual COLs for multiple reactor modules into a single combined COL. Nevertheless, there appears to be nothing in the legislative history of the AEA which unequivocally precludes the possibility that the Commission may, under the authority of Section 161.h and 10 CFR § 50.52, combine into a single license the individual Part 52 COLs for reactor modules of a substantially similar design co-located at a single site. If the Commission considers pursuing this possibility, then it should also consider rulemaking to clarify: (i) the nature of reactor modules and modular designs whose licensing may be combined under the authority of Section 161.h and Section 50.52; and (ii) the process for making findings under 10 CFR 52.103(g) for reactor modules (and possibly the process for NRC staff inspection and publication of notices concerning completed ITAAC in 10 CFR § 52.99).

The term of operation for a single combined COL would be limited to 40 years from the date of issuance of the COL. Sequential 40-year terms for each reactor module is not possible inasmuch as only a "single license" would be issued under Section 161.h. The legislation recently submitted by the Commission addressing the matter of 40-year terms would permit the 40-year term of operation to commence upon the Commission making the initial 10 CFR 52.103(g) finding, but would not permit sequential 40-year terms.

H.3 Duration of Design Approval for a Modular Reactor Design

Issue

If a single combined license is issued for multiple PBMR module reactors, what should be the effective duration of the PBMR design approval?

Discussion

Item H 2, "License Life Application of One Combined License for Multiple Reactors," of this paper discussed if the NRC were to issue a single combined license for multiple PBMR modules. It concludes that the 40-year duration of one combined license for multiple reactors co-located on one site would begin on the date of issuance of the license (for all of the nuclear reactors), regardless of the subsequent date of authorization to operate each nuclear reactor module. This issuance of a single combined license for multiple PBMR modules would grant the licensee approval to initiate construction of a PBMR anytime throughout the 40-year duration of the license. Therefore, the effective duration of the PBMR design approval is also 40 years. This licensing action would conflict with the Commission's current policy on duration of design approvals.

The NRC has issued many preliminary and final design approvals under Appendix O to Part 52 and, prior to 1989, under Part 50. Since 1978, these design approvals were issued with a duration of 5 years (see "Policy Statement on Standardization of Nuclear Power Plants," dated August 31, 1978, 43 FR 38954). In the same Federal Register Notice, the concept of a manufacturing license is discussed. The manufacturing licensing concept involves submittal of an application for a number of identical nuclear power plants which would be manufactured at

The Commissioners

30

one location and moved to a different location for operation. The number of units specified in the license would be that number whose start of manufacture can practically begin within a 10 year period commencing on the date of issuance of the manufacturing license. However, in no event will the number be in excess of ten. The manufacturing license requires the plant design to be updated no later than 5 years after its initial approval. The number of units specified in the license will be reduced if the plant design incorporates a reference system design whose term of approval ends sooner than the approval periods associated with the manufacturing license.

In 1989, the Commission decided to grant a duration of 15 years for a standard design certification issued under Subpart B of Part 52 (see 10 CFR 52.55(a), "Duration of Certification"). However, the Commission did not change its policy for issuance of design approvals under Appendix O.

The current process in 10 CFR Part 52 for issuing a combined license does not designate a duration for a reactor design approval after the issuance of the combined license. For a single reactor plant or a single power block with 2 or 3 reactors, this question is not an issue. The reactor plant or power block is constructed following the issuance of the combined license. However, for modular reactors that were approved under the one license, a reactor could be built at any time after the issuance of the combined license. The preapplicant envisions a possible scenario whereby one module could be constructed at the beginning of the COL and construction of additional modules could be staggered over the license life in response to power demands. The question arises whether the NRC should allow a reactor design to be built at any time during the 40 year license life without reconsideration of the design acceptability.

The NRC did not envision the delayed construction of multiple reactors that is possible under the PBMR licensing plan. If a licensee was allowed to build multiple reactors at anytime during the 40 year license life, subsequent reactors may not meet new regulations and regulatory guidance issued after or incorporate lessons learned from operation of the initial reactor. Additionally, the staff would not have the opportunity to re-evaluate the design at the 5 year interval that was envisioned for design approvals.

Recommendation

In order to resolve this concern, the NRC staff recommends that the Commission not issue a single combined license for multiple modules (nuclear reactors), or condition the license so that the design can be re-reviewed after a 5-year duration without the constraints of the backfit requirement in 10 CFR 50.109.

The Commissioners

31

I. Annual Fee Issues**I.1 Annual Fee Assessment****I.2 Commencement of Annual Fees**Issue

How should annual fees be assessed for a set of modular reactors that constitute a PBMR facility? When should annual fees commence for a facility that has been issued a combined operating license?

Current Statutory Provisions and Regulations

The Omnibus Budget Reconciliation Act of 1990, as amended, (OBRA) requires that the NRC assess annual fees, and that the fees be established through rulemaking. The statute establishes two standards for the annual charges: Fees charged must be "fair and equitable" in allocating the "aggregate amount of charges" among licensees, and, "to the maximum extent practicable," fees charged must have "a reasonable relationship to the cost of providing regulatory services and may be based on the allocation of the Commission's resources among licensees or classes of licensees."

The NRC's annual fee regulations, 10 CFR Part 171, cover annual fees associated with Part 50 licenses, but do not specifically cover annual fees associated with combined licenses issued under Part 52. Additionally, neither Part 52 nor Part 171 addresses when NRC would begin to charge annual fees to a person holding a Part 52 combined license. Prior to the issuance of any Part 52 combined license, Part 171 should be modified to specifically establish the annual fee requirements for these licensees.

Currently, 10 CFR 171.15(a) states that, "Each person licensed to operate a power, test, or research reactor . . . shall pay the annual fee for each unit for each license held." Prior to the final FY 1999 fee rule, 10 CFR 171.15(a) stated that, "Each person licensed to operate a power, test, or research reactor shall pay the annual fee for each unit for which the person holds an operating license." Currently, a separate license is issued for each unit and accordingly an annual fee is assessed per license. A modification to Part 171 is needed to clarify that the annual fee for operating power reactors is charged per license, not per unit.

Preapplicant's Position

The current provision of 10 CFR 171.15(a) that each person licensed to operate a power reactor shall pay an annual fee for each unit for each license, means that the NRC could impose a separate fee for each PBMR module. Therefore, the annual fee for a 10-module PBMR facility would be greatly disproportionate to the annual fee for an equivalent sized BWR or PWR. This could place a modular reactor design at a competitive disadvantage with other designs and act as a deterrent to the development of modular reactors. The NRC has commented that "the Commission has determined that the bulk of its licensee-related activities have and will continue

The Commissioners

33

annual fee amount for the power reactor class by the number of operating power reactor licenses. The staff currently anticipates that up to ten Pebble Bed modules could be allowed under a single license. Therefore, with the above revisions to Part 171, a license authorizing operation of a PBMR would be subject to an annual fee comparable to the annual fee being charged for a Part 50 operating license, regardless of the number of modules at the site, unless a revision to Part 171 is made to establish a specific annual fee schedule for a PBMR license. The annual fee would apply to the use of the license (i.e., assessed for the first reactor module); not pro-rated to the percentage reactor modules in operation.

However, if the agency decides to issue a separate license for each PBMR module or if the agency's regulatory oversight necessary for the PBMR is significantly different than other operating power reactors the Commission could initiate a Part 171 rulemaking to create a separate fee class for small modular design reactors. With respect to the agency's regulatory oversight, annual fees for a given class of licenses are based on NRC's budgeted costs allocated to the class for generic activities and other costs not recovered under 10 CFR Part 170. At this time, it is not entirely clear whether the agency's generic and other efforts to regulate a PBMR will be significantly different from its regulation of other types of operating power reactors. NRR has provided some indication that it is unlikely that the generic regulatory oversight of PBMRs will be significantly different from that of existing reactors. Depending on how the regulatory efforts differ and the magnitude of the NRC resources, a separate class of licensees could be established.

While a PBMR license potentially having up to 10 modules might have the largest megawatt output capacity compared to all existing reactors, historically, the limits of that capacity have not been a consideration in determining the annual fee amount. This is because the NRC has found no necessary relationship or predictive trend between the thermal megawatt rating of a power reactor and NRC regulatory costs. In addition, the NRC does not consider the economic advantages or disadvantages of possessing a license when assessing annual fees.

In summary, costs must be assessed in a "fair and equitable" manner and, "to the maximum extent practicable", reflect a "reasonable relationship" between the fees charged and the services rendered. Thus, if the NRC's regulatory costs for PBMR's are approximately the same as existing power reactors and the license includes multiple modules, the PBMR annual fee would be of the same magnitude as existing power reactors. However, if the NRC's regulatory costs are significantly lower or higher than those for other types of operating reactors or if a separate license is issued for each module, the Commission could establish a separate license fee class.

Recommendation

The CFO plans to include in the FY 2002 fee rulemaking revisions to Part 171 to specifically authorize annual fees to be charged to facilities licensed under Part 52, to clarify that our annual fee is charged per license, not per unit, and to establish when NRC would begin to charge an annual fee to a person holding a Part 52 combined license. Until a final decision is made on the number of modules that will be allowed under a single license, and NRC receives more data

The Commissioners

34

from Exelon and is in a better position to make the appropriate preliminary determinations about what kind of regulatory oversight the proposed design will likely require, no recommendations on establishing a new license fee category for modular reactors are offered.

For a Part 52 combined license, the staff contemplates assessing the annual fee only after construction is complete, all regulatory requirements have been met, and the Commission has authorized operation of the facility.

The Commissioners

35

J. Financial Protection

Issue

Should Price-Anderson financial protection requirements be applied to each modular reactor unit or to the entire PBMR "facility?"

Current Statutory Provisions and Regulations

The Price-Anderson Act, which is contained in Section 170 of the AEA (42 U.S.C. § 2210), is implemented by the NRC via its 10 CFR Part 140 regulations. The Price-Anderson Act contains three distinct elements or components. First, it establishes a ceiling on the aggregate damage award for nuclear tort claims that can be imposed against an entity involved in the use or handling of radioactive material. Second, it indemnifies any entity exposed to potential liability for activity resulting in a nuclear incident, even if the entity did not directly participate in the activity. Third, it establishes an indemnification scheme through which the federal government requires entities involved in nuclear activities to obtain private insurance to a certain level; the federal government pays all public liability claims above that liability ceiling.

With respect to the third component, the Price-Anderson indemnification scheme, section 170b. of the Act establishes that the amount of primary financial protection required for *facilities* designed for producing substantial amounts of electricity and having a rated capacity of 100,000 electric kilowatts [100 MWe] or more must be equal to the maximum amount of commercially and reasonably available nuclear liability insurance, which is currently \$200 million. 42 U.S.C. § 2210b (1). Primary financial protection may include private insurance, private contractual indemnities, self insurance, other proof of financial responsibility, or some combination thereof. *Id.* In addition, section 170b. requires licensees of such *facilities* to participate in an industry retrospective rating plan, or secondary layer of protection, which provides for the assessment of additional deferred premiums in the event that the public liability from a nuclear incident exceeds or appears likely to exceed the level of primary financial protection required of the licensee involved in the nuclear incident. *Id.* The total amount of financial protection presently available under the Act from both the primary and secondary layers is approximately \$9.7 billion [the primary layer of \$200 million plus a secondary layer of approximately \$9.5 billion, based upon a maximum retrospective premium of \$88.095 million per nuclear incident per nuclear facility].

The NRC's implementing regulations impose these financial protection requirements on each *nuclear reactor* a licensee is authorized to operate. 10 CFR 140.11. A "nuclear reactor" is defined as "any apparatus, other than an atomic weapon, designed or used to sustain nuclear fission in a self-supporting chain reaction." 10 CFR 140.3(f). The maximum amount of the standard deferred premium that may be charged *per nuclear incident* is \$88.095 million [\$83.9 million plus a maximum 5% surcharge assessed under subsection 170o(1)(E) of the Act] for each facility [nuclear reactor] for which the licensee is required to maintain the maximum amount of primary financial protection, but no more than \$10 million *per year*. 10 CFR 140.11(a)(4).

The Commissioners

36

Preapplicant's Position

The requirement in 10 CFR 140.11 that each nuclear reactor have financial protection has significant implications for modular facilities. Without relief, the preapplicant states that 10 ten-module facilities would assume secondary financial liability roughly equal to the entire financial protection that is available under Price-Anderson today. This result would be contrary to the intent of the Price-Anderson Act in spreading the risk of liability across the industry.

Although 10 CFR 140.11 requires financial protection requirements on each "nuclear reactor," the AEA requires each "license" to have a condition requiring a "licensee" to maintain financial protection. Section 170(b) of the AEA requires each licensee to have primary financial protection for facilities and to have secondary financial protection for facilities designed for a rated capacity of 100 megawatts or more.

The preapplicant maintains that the NRC has the authority to grant Exelon an exemption from 10 CFR 140.11 for the first PBMR application, so that the PBMR facility is treated as an equivalent-sized LWR. The preapplicant argues that its potential liability for retrospective premiums, in the event of an accident at another plant, should not be substantially higher than the liability of an equivalent-sized LWR, merely because a modular design is used rather than a large LWR design. In the application, the preapplicant states that it will show that the risks of a severe accident at a 10-module PBMR facility are less than the risks of a severe accident at a LWR. Therefore, the risk that another nuclear plant will incur retrospective liability under the Price-Anderson Act as a result of an accident at the PBMR facility is less than the risk of such liability from an accident at a LWR. In the first application, the preapplicant also proposes to provide additional support for an exemption, including providing a technical justification for the exemption based upon a comparison of the risks of a PBMR facility and an LWR. The preapplicant also proposes that rulemaking be initiated to state that financial protection requirements apply to a licensee for a nuclear facility and define that a facility may include multiple reactor modules at a site. The definition of utilization facility and nuclear reactor in 10 CFR 50.2 should also be amended to include multiple reactor modules co-located on one site. The preapplicant suggests that the total size of each modular nuclear reactor facility be limited to no more than 1500 MWe. Such a limit provides reasonable basis for rulemaking by placing a modular nuclear facility on a equivalent footing with a current LWR for purposes of the Price-Anderson Act.

Conclusion

The Commission has previously stated its position, in two separate letters, on the application of Price-Anderson financial protection requirements to multiple modular reactor units co-located at a single site. See Letter from Dennis K. Rathbun (Director of Congressional Affairs, NRC) to U.S. Senator Frank Murkowski, dated July 26, 2001, ADAMS ML012110067; and Letter from Dennis K. Rathbun (Director of Congressional Affairs, NRC) to U.S. Senator Jeff Bingaman, dated July 26, 2001, ADAMS ML012130057.

K. Testing of New Safety FeaturesIssue

Should a combined license (COL) be issued prior to the completion of all testing that is necessary to demonstrate the performance of safety systems and components?

Discussion

The preapplicant set forth its licensing plan for the PBMR in a letter dated May 25, 2001 (ADAMS ML011520314). In that plan, the preapplicant assumed that a full-scale prototype of the PBMR will be built in South Africa and that all demonstration testing will be performed on that prototype. The preapplicant also assumed that it will receive a COL for the first PBMR prior to completion of demonstration testing on the prototype plant. Furthermore, the preapplicant stated that completion of prototype testing is not required prior to issuance of a combined license.

The Commission reformed its licensing process for commercial nuclear power plants with the issuance of 10 CFR Part 52 in 1989. One of the principal issues in the development of Part 52 was the inclusion of requirements to demonstrate the performance of new or innovative safety features for advanced designs prior to licensing (see 54 FR 15372 published April 18, 1989). These requirements may be met with either separate effects tests, prototype tests, or a combination of tests, analyses, and operating experience [see 10 CFR § 52.47(b)(2)]. The basis for these requirements comes from lessons learned by the NRC staff during the licensing of nuclear power plants under 10 CFR Part 50. One example is the development of emergency core cooling system (ECCS) requirements. For a few early plants, operation was allowed with an ECCS whose approval was based mainly on analysis and design review. Later testing found that the ECCS in those plants might not work as designed and called into question the analytical methods used to predict what would happen in a loss-of-coolant accident. As a result, modifications to operating plants were required and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems (ECCS) for Nuclear Power Reactors," was codified to require comparison to applicable experimental data (see NUREG/BR-0175, "A Short History of Nuclear Regulation"). Therefore, based on this experience, the NRC decided to require proof of performance for new safety features prior to licensing nuclear plants under 10 CFR Part 52.

The determination of what tests, if any, are needed to demonstrate the acceptability of the PBMR design will be made during the combined license review. In a letter dated August 23, 2001 (ADAMS ML011910207) the staff stated that, consistent with 10 CFR § 52.79(b) and § 50.34(b) requirements, Exelon's application for a combined license must include sufficient information to demonstrate that PBMR safety features will perform as predicted in the final safety analysis report. This determination may begin during the pre-application review for PBMR but won't be resolved until the final design is completed. The staff may also decide to perform some confirmatory testing. However, any confirmatory testing performed either by Exelon or the staff may not need to be completed prior to issuance of the combined license. A discussion of the process for deciding what testing is necessary for advanced reactor designs is

The Commissioners

38

in SECY-91-074, "Prototype Decisions for Advanced Reactor Designs," dated March 19, 1991 (ADAMS ML003707900).

The NRC staff is concerned that if necessary testing is performed after issuance of the COL, information obtained from those tests could affect the acceptability of the design. If testing is necessary to demonstrate the acceptability of the PBMR design, then it would be prudent for Exelon and the NRC to agree upon the test program scope and objectives prior to performing any separate effects, prototype, or demonstration testing, and prior to constructing any facility for such purposes. Also, the test program and its implementation, as well as those aspects of the design and construction of the test facilities critical to achieving the test program objectives, must comply with the applicable requirements of Appendix B to 10 CFR Part 50.

Recommendation

In order to resolve the NRC staff's concern, it is recommended that all testing determined to be necessary to demonstrate that PBMR safety systems or components will perform as predicted in the final safety analysis report be completed prior to issuance of a combined license.