UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

In the Matter of)
) Docket 50-219
JERSEY CENTRAL POWER & LIGHT COMPANY)

STATEMENT ON THE REVIEW OF THE INITIAL DECISION

INTRODUCTION

The pertinent Commission regulations (Sections 50.34 and 50.35) are plainly written on three premises:

1. A nuclear power plant design will not ordinarily be complete at the construction permit stage.

2. What is required at that stage is sufficient information as to the basic engineering criteria for the plant to permit a finding that there is "reasonable assurance" that the plant described can be built and operated safely at the proposed site.

3. Definitive Commission approval of particular plant features will generally be granted only at a later stage when much greater design detail is available. This will ordinarily take place on the filing of the final safeguards summary report and of the request for an operating license.

The Commission's regulations do not, and in the nature of the case could not, spell out the precise degree of design detail required for issuance of a construction permit. However, it is noteworthy that the Board

in its Initial Decision nowhere suggests that the detail submitted in this proceeding was less complete than that submitted in other proceedings. It is also noteworthy that both the Regulatory Staff and the Advisory Committee on Reactor Safeguards considered the evidence adequate for a finding of "reasonable assurance" of safety. Finally, it is pertinent that to the extent that the Staff and the ACRS had questions about specific points they both thought that these questions could best be resolved in the course of detailed design.

In a word, the Commission's regulations as applied up to now adapt the timing of safety reviews to the realities of the plant design process. A basic difficulty with the Initial Decision is that it does not recognize these realities. A second basic difficulty is that the further procedures called for by the decision are inconsistent with the orderly administration of the Commission's safety responsibilities.

Two questions then are posed by the Initial Decision and the Staff's petition for review:

1. Will the degree of design detail required in connection with an avowedly provisional construction permit be based on a normal sequence of plant design work?

2. When it appears that sound engineering solutions are available but that some plant features will require further review, will this further review follow the orderly procedure of staff analysis, ACRS consideration

and, where appropriate, hearing before a Licensing Board, all based on the detailed design?

DISCUSSION

The briefs of the Staff and of the Applicant contain thorough analyses of the questions raised by the Licensing Board, of the evidence bearing on these questions, and of the intent of the Commission's regulations relating to construction permits. No purpose would be served by repeating that discussion in detail. However, the main question raised by the Initial Decision relates to the design of the core, and it may be useful to examine the Board's approach to this question in terms of the steps taken in the normal design procedure.

Core Design Procedure

1. Preliminary Design

The steps in defining the reference core available for Commission review at the construction permit stage, can be described as follows:

1. The customer specifies the desired power level.

2. Past designs and current plant performance are reviewed to determine required key performance characteristics such as heat liberation rates. It should be emphasized that the heat generation and heat transfer characteristics of the proposed Oyster Creek core have been determined in continuous power operation in Dresden and other reactors and in experimental tests in those reactors and in other facilities.

3. At this stage margins are provided both in the design of the core and in equipment such as the coolant recirculation pumps to assure that the initially selected performance characteristics can be realized in operation without compromising safety. These margins consider not only steady state reactor heat output but transient operating conditions, and they make allowance for measurement uncertainties.

4. The present General Electric approach to design of a core is to build it up out of modules -- each containing four fuel bundles, a control blade, and a control drive. More or less fuel rods per bundle determine heat transfer area. More or less U-235 enrichment determines reactivity lifetime. More or less boron carbide tubes per blade provide more or less reactivity control. The drives differ from plant to plant only in minor detail, reflecting gradual improvements based on experience.

5. This, then, tells the designer how big to make the core and the required size of the pressure vessel. It also determines basic requirements for related safety apparatus. The long delivery time of major plant components such as the vessel and the coolant recirculation pumps require that overall core size and the principal core performance characteristics be fixed early in the project schedule, as long as 18 to 24 months prior to fixing fuel details.

This is the first phase of core design and it is at this step that there are developed what the Commission's regulations call for, namely "....the

principal .... engineering criteria for the design ....". These criteria and the major features of the proposed design have been presented by the Applicant. The record includes a statement of the thermal criteria for core design, a description of the proposed core performance characteristics, and a preliminary safety evaluation. A reference core is described in terms of core and fuel configuration, physical dimensions, and principal materials. Estimated core performance is presented in terms of heat output, steam flow, coolant recirculation flow, power density, core voids, power peaking factors, and nuclear reactivity characteristics.

In addition to enabling the designer to specify and to order long lead time components, the reference core available at the construction permit stage serves several functions:

First, it identifies performance levels.

Second, it permits analysis of potential accidents and their consequences.

Third, it permits the designer and the safety reviewers to determine the basic requirements for core protection devices, and to identify any questions as to the need for special devices beyond those normally provided.

Fourth, it permits a determination that criteria for thermal margins, such as burnout ratio, can be met in the detailed fuel design.

It is the burnout ratio which principally concerned the Licensing Board. The criterion itself, 1.5, has already been approved for Big Rock

Point and for Dresden. Nor is there any question that at steady state operation at rated power, the burnout ratio of the Oyster Creek core will be at least 2.15. The central issue raised by the Board relates to the burnout ratio during transients -- and even more narrowly to some measurement uncertainty as to meeting the 1.5 criterion in transients terminated by the neutron flux scram set at a trip point of 1.2 times rated power.

In the accumulated years of General Electric reactor operating experience, no transient has approached this overpower condition. Moreover, the brief of the Applicant points out that the burnout ratio resulting from a reactor scram cannot generally be equated with a burnout ratio at steady state overpower. The brief also points out the numerous elements of conservatism employed in the burnout calculations. The operating and experimental data and the conservative calculation methods clearly indicate large margins against the occurrence of fuel damage due to overheating.

The engineering criteria for the Oyster Creek core design were originally developed for the Dresden reactor and have evolved through succeeding boiling water reactors. These criteria have undergone numerous detailed reviews by the Regulatory Staff and the ACRS and in several public hearings. The approximately 9-1/2 reactor years of safe operation accumulated by General Electric boiling water reactors attest to the adequacy of the margins used in design.

In a word, the reference core submitted in the preliminary hazards summary report and the related analyses of limiting accidents were more than adequate for determination of "reasonable assurance" of safety. Greater detail is not required for fundamental safety evaluations, as the Staff and ACRS concluded, and such detail is not normally available until after a time-consuming process of detail design.

2. Detail Design

A crucial point here is that there is latitude to vary a number of equipment features to limit transient effects in the core. There is also flexibility in detailed fuel design to assure meeting the thermal margins defined for the reference core.

(a) Core Control and Protection Systems. It is normal practice to provide core protection against reactor transients by interlocks and by automatic control equipment. For example, core protection upon loss of all pumps is assured by adjusting flywheel inertia in the pumping system to sustain flow for several seconds while the reactor heat is dissipated. Additional devices can be provided in the course of detailed design if necessary. For example, additional protection against fuel overheating due to operator error at low recirculating flow can be provided by addition of an interlock.

The details of core design and the details of control system and protective equipment are developed through a series of studies which are interdependent and time consuming. Less elaborate calculations are performed

prior to the construction permit application, of course, to assure the specification of equipment operable within appropriate safety limits. Moreover, provision is made in the basic plant layout to permit incorporation of additional safety devices.

However, detailed design work on the totality of control and protective devices cannot reasonably be expected to be complete at the construction permit stage. In normal course, it will not even be complete within 180 days of a decision on a construction permit application. It is notable that neither the Staff nor the ACRS thought that any degree of design detail beyond that presented in the preliminary safeguards summary report was necessary for a determination of "reasonable assurance" of safety.

(b) Detailed Fuel Design. Because of the margins used in the basic design of the core and of equipment and because of the flexibility available in control and protective equipment, all previous General Electric reactors have attained rated output within the design criteria identified at the construction permit stage. It has never been necessary to change the fuel heat transfer characteristics. Nevertheless, it is possible in the course of detailed fuel design to provide additional assurance of meeting defined thermal margins by adjusting the fuel heat transfer surface. This can be done by changing the number and diameter of rods without affecting vessel size.

However, the final selection of parameters within the basic fuel modules (such as rod diameter and enrichment, number of fuel rods per bundle, and number of boron carbide containing tubes per control blade) takes much time, requires the use of elaborate computer codes, and involves considerable expense. A variety of alternate adjustments are examined to arrive at an economic optimum. Analyses are carefully scheduled, to avoid the need for recomputation, so that the more complex and costly final confirmatory analyses are performed only after the minute details of fuel and control blade design have been established. This kind of work cannot possibly be completed at the construction permit stage, and neither the Staff nor the ACRS thought it was necessary for safety judgments.

Timing of Safety Reviews

The net of the foregoing is that the rational way to resolve any uncertainties about meeting the burnout ratio criterion during transients in the Oyster Creek core is in the course of detailed design -- detailed design not only of the core but of the related safety apparatus. Neither the Staff nor the ACRS thought that there was any substantial question as to whether the criterion can be met. Any question as to whether it has in fact been met can best be decided by the Commission when the detailed design is available for review.

Most of the other design issues on which the Licensing Board has requested further evidence were first identified by the Staff and by ACRS.

In all cases they thought that these issues should be resolved in the review of the detailed design.

It should be emphasized that none of these issues are at a point of no return. Thus failure to satisfy the Commission on the burnout ratio would only have the effect of shortening core lifetime; it would not, contrary to the Board's opinion, affect the ability of the plant to attain rated power. Again, provision is being made in the plant to accommodate any additional systems which may be required to respond to Staff and ACRS concerns.

The Commission has heretofore adapted the timing of its safety reviews to the design process. It has examined a plant design in two stages--the stage where basic engineering criteria have been formulated and the stage of detail design. Detailed design data are made available to the Staff as the work proceeds. Specific problems are informally discussed between the Applicant and the Staff as the design progresses, and Staff comments are factored into the design. The definitive Staff analysis and the ACRS consideration take place when adequate confirmatory detail is available, and when an application for an operating license has been filed. This is clearly the effective way of conducting safety reviews.

Moreover, the regulatory scheme contemplates an orderly progression of the review process from Staff analysis, to ACRS examination, to

hearing by a Licensing Board (if a hearing is required or is determined to be appropriate). The Initial Decision would short circuit this process. It apparently proposes to consider further, and perhaps dispose of a series of questions -- most of them initially raised by the Staff and the ACRS -- without benefit of prior Staff and ACRS examination. It proposes to do this in the face of the Staff and ACRS judgment that these are matters for resolution when a detailed design is available.

What would be the effect of Licensing Board determinations on these points? Will determinations favorable to the Applicant preclude further examination by the Staff and ACRS? If there are determinations adverse to the Applicant, will Applicant be precluded from seeking further consideration by the Staff and ACRS?

Questions of this kind point up the incongruity of the Licensing Board's proposed procedure in this case. The procedure would not only upset the orderly course of design work but the orderly process of Commission review. Surely this is not the role envisioned for Licensing Boards in the 1962 amendments.

CONCLUSION

The Staff's exceptions to the Initial Decision should be granted, and the requirement of the Initial Decision calling for submission of additional technical information to the Board within 180 days should be eliminated.

March 26, 1965

Respectfully submitted,

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