Memo

MAY 18 1970

P. A. Morris, Director
Division of Reactor Licensing

INDIAN POINT II - DOCKET NO. 50-247

The enclosed review is submitted for inclusion in your report to the ACRS.

Original signed by
E. G. Case
Edson G. Case, Director
Division of Reactor Standards

DRS:SEB:MD

Enclosure:
Review - Indian Point II

cc w/encl:
R. DeYoung, DRL
R. Boyd, DRL
D. Muller, DRL
K. Kniel, DRL

Distribution:
Suppl.
DR Reading
DRS Reading
SEB Reading
M. Dunenfeld
M. Rosen
E. Case

8111140313 700518
CF ADOCK 05000247
CF

OFFICE ▶	DRS:SEB	DRS:SEB	DRS:K DIR			
SURNAME ▶	Dunenfeld:kjb	Rosen	Case			
DATE ▶	5/14/70	5/14/70	5/15/70			

INDIAN POINT II

POWER DISTRIBUTION MONITORING AND CONTROL

The measures provided in the Indian Point II power plant to monitor the power level, maintain the power distribution within design limits and detect incipient violations of local power limits are essentially the same as for the R. E. Ginna and H. B. Robinson power plants. We believe these measures are adequate to protect against a loss of the operating margin to thermal limits.

Axial Power Distribution

We are in agreement with the applicant's position that the problems of monitoring and control of the power distribution axially and in the x-y plane can be treated separately. In the axial direction the reactor may be subject to divergent xenon oscillations. In view of this, it is assumed that axial power tilts can occur, and definite provision is made to detect and control differences in the percent of the total power generated in the top and bottom of the core. The detection provision consists of split out-of-core detectors, for which data correlations relating their readings to axial peaking factors have and will continue to be established. The control provision consists of part length control rods. The General Design Criteria specify automatic protective action in the event of control system malfunction, to limit fuel damage to acceptable levels. The automatic protection for Indian Point II is designed for no damage: in fact, it is designed to avoid exceeding design peaking factors at full power. To accomplish this, the overtemperature ΔT and overpower ΔT trip set points are automatically reduced 2% for every percent the axial offset measured by out-of-core detectors exceeds 20%. The axial offset is the difference in the measured fraction of the total power generated in the upper and lower halves of the core. The reactor would scram at full power from the overpower and overtemperature trips when the axial offset exceeds about 25%. There is also an automatic turbine runback which reduces power when the axial offset exceeds 20%, but this is not protective grade.

Choice of the 20% axial offset point to initiate reduction of the ΔT trips is based on the Westinghouse correlation between offset and axial peaking factors. We believe this correlation is presently well enough known to prevent axial design peaking factors from being exceeded. Additional data for this correlation is being obtained at Ginna and will be obtained during Point Beach, Robinson, and Indian Point II startup tests. We therefore believe the system of detection and control of axial power distribution provided for Indian Point II is satisfactory. This conclusion assumes a technical specification for movable in-core detectors, similar to Robinson and Point Beach, which we plan to require for Indian Point II. We believe this requirement is necessary to assure proper periodic (monthly) calibration of the axial offset of the out-of-core detectors.

X-Y Power Distribution

Provision was earlier made for the control of xenon oscillations in the x-y plane in Indian Point II, through the use of eight x-y rods.

On the strength of experiments performed in the Connecticut Yankee reactor, Westinghouse now claims that the reactor will be stable against x-y xenon oscillations, for the expected range of the BOL moderator temperature coefficient, and has removed the x-y rod requirement (The rods are reassigned back to control banks). The applicant has stated he will conduct a startup experiment to show x-y xenon stability at BOL. The stability margin increases from BOL as the moderator temperature coefficient becomes more negative. If the startup test does not demonstrate stability, the applicant is committed to operate with inserted control rods, or add fixed or burnable poison shims sufficient to assure stability through reduction of the moderator temperature coefficient, or operate at reduced power levels.

In the absence of x-y xenon instability, the only clearly known way to obtain power tilts or maldistributions in the x-y plane is through control rod misalignments. It is the applicant's position that he will know of such an occurrence by means of nuclear and process information displayed in the control room and by core thermocouples and in-core movable detectors. We do not agree completely with this because (1) the center rod is not observable with the nuclear (out-of-core detector) information, and might escape detection if it drifted in slowly, (2) because there are no technical specification requirements for this detectability with the process information, or for the in-core thermocouples, and (3) because the movable in-core detectors may not be in service (although available).

The applicant's analysis of the consequences of any completely misaligned control rod, however, indicate core limits would not be exceeded in steady-state operation at rated power. The consequences are less severe than for power plants such as Ginna because of the configuration of the permissible bank at full power. Further, there should be less danger of complete misalignment than in Ginna because it is specified that the permissible insertion of the last control bank at full power is 32%, not 100% as in Ginna.

The applicant's conclusion is that x-y power tilts cannot occur without ample knowledge that something is wrong. While we may not agree completely, we agree the consequences of a rod misalignment do not result in core damage. We therefore accept the contention that automatic protection against x-y power tilts is not required.

In addition to the provisions required for power maldistribution detection, control and protection, a limited number of fixed in-core neutron detectors have been included in the Indian Point II design. Such detectors have also been included in the Point Beach and H. B. Robinson power plants. The fixed in-core detector system consists of eight flux thimbles located symmetrically (radially and axially) throughout the core. Each thimble will have four miniature detectors (small argon filled, highly enriched U^{235} fission chambers) with a sensitive length of about one inch and will be about 0.15 inch diameter, maximum. Individual detectors have a design limit of about 3×10^{21} nvt.

The detectors will provide input to the computer only. Each detector is scanned at a normal interval of 8 seconds. The readings for each detector are time averaged for one minute, producing a value for all calculations performed by the computer, which include:

a. Mean power level seen by each detector string

b. Axial offset seen by each string

c. Core mean power level

d. Core mean axial offset

e. Radial quadrant tilt factors for the eight quadrants which describes the tilted power distribution curve for each detector string

The computer prints out alarm messages whenever:

a. Any of the 8 mean power levels exceeds its limit

b. Any of the 8 radial tilting factors exceeds its limit

c. Any of the 8 axial offsets exceeds its limit

d. The core mean axial offset exceeds its limit

We do not disagree with the applicant's position that the fixed in-core detector system is not required for the safety of the power plant, but believe it will be a valuable adjunct to the required system, and encourage the applicant in its maintenance and use.