ILLINOIS POWER COMPANY

U-0377
L30-81 (12-03)-6

500 SOUTH 27TH STREET, DECATUR, ILLINOIS 62525

December 3, 1981

Mr. James R. Miller, Chief
Standardization & Special Projects Branch
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

RECEIVED
DEC 4 1981
U.S. NUCLEAR REGULATORY COMMISSION

Dear Mr. Miller:

Clinton Power Station Unit 1
Docket No. 50-461

Attached are details related to the following items which were discussed with D. Terao, Mechanical Engineering Branch, during a meeting on December 1, 1981, to resolve issues for the Clinton SER:

ISSUES

NSSS Generic Pipe Break Criteria

Steady State Vibration Acceptance Criteria

Mark III Hydrodynamic Loads Resolution

SRSS Combination of Dynamic Responses

Modelling of NSSS Equipment for Hydrodynamic Loads

The above are considered by the NRC and IP to be confirmatory, in that the approaches are correct, but that further detailed information is to be submitted to the NRC.

Sincerely,

G.E. Stuller for J.D. Geier

J.D. Geier
Manager, Nuclear Station Engineering

Attachments

cc: J.H. Williams, NRC Clinton Project Manager
H.H. Livermore, NRC Resident Inspector
D. Terao, NRC MEB

B001
S1/1

Issue

NSSS generic pipe break criteria.

(NRC has revised the Standard Review Plan (3.6.2) to require that evaluation of potential pipe breaks must utilize 2.4Sm, rather than 3.0Sm contained in previous Standard Review Plan and used by GE.

Response

This item was discussed at IP/S&LONRC (MEB) meetings in March and April, 1981. FSAR Section 3.6.2 was completely rewritten for these meetings to include the GE criteria. These criteria were essentially equivalent to those used for Grand Gulf. MEB accepted these criteria for GG and agreed to consider our revised FSAR subsections at the April meeting. They were submitted in Amendment 4, May, 1981.

Action Required

IP to provide additional justification for use of 3.0Sm.

Issue

Steady state vibration acceptance criteria.

(Provide an example of how stresses are determined. Justification of the $\pm$ 10,000 psi stress amplitude as an acceptance levelmust be provided.)

Response

The method of determining stresses was resolved in S&L/IPC/NRC (MEB) meetings in March and April, 1981. There was disagreement on the peak stress that could be allowed. NRC desired 50% of the ASME, Section III, Appendix I, allowable. We held that 80% of the code allowable was adequately conservative.

Action Required

IPC is analyzing piping to determine if use of 50% will result in any design changes. IPC will use (justify) design at 50% level. If any problems arise which require greater than 50%, the specific items will be resolved to NRC's satisfaction.

Issue

Mark III hydrodynamic loads resolution

(NRC wnats an acceptable load definition. This has been submitted by GE in GESSAR II, Appendix 3B. Containment Systems Branch has several problems with the definition. Once NRC and GE come to an agreement on the load definition(s) NRC will issue a NUREG. Then, each plant will have to be compared with the NUREG requirements to determine if its design is adequate to withstand the defined loads.)

Response

When GE and NRC have reached an agreement on the load definition(s), IPC will determine the extent to which it fits CPS, and will ensure that the FSAR reflects the appropriate definition.

Action Required

Upon receipt of the NUREG (NRC's load definition) IPC will have the CPS design compared with it to determine if we comply. If there are areas where we do not comply, we will change or prepare a justification for deviation.

Issue

SRSS combination of dynamic responses.

Response

Structural Mechanics Associates is doing a study for the MK III Owners SRSS Sub group, of which IPC is a member. This study is scheduled to be presented to the NRC on 12-16-81.

Action Required

GE Co./SMA - transmit study report to NRC 11-25-81, for their review prior to the 12-16-81 presentation.

Issue

[There are two parts to this issue. D. Terao of MEB suggested we split the question into 98a and 98b.]

(This is a generic issue involving GE's need to provide information on modelling of asymmetric LOCA loads, and their effects on various portions of the NSSS e.g. RPV level, core supports & other internals, CRD's, etc.)

Response

GE is developing the generic description for the NSSS analysis, similar to what S&L developed in response to MEB(DSER) Q#67B, item 5. (see attached)

Action Required

Obtain from GE the generic writeup on aymmetric LOCA loads and submit to NRC, after reaching agreement on content. Expect GE infor mid 82.

ATTACHMENT TO #98b

MEB (DSER) ITEM NO. 67B (Cont'd)

Item 3

Breaks of concern are shown in the following figures:

a. Steam line B3.6-6, B3.6-7, B3.6-8, and B3.6-9

b. Feedwater B3.6-1 and B3.6-2

c. Recirculation B3.6-18

Evaluations for these loads will be covered in Sections 3.6 (Pipe Rupture), 3.8 (Structures) and 3.9 (Mechanical Components). These evaluations will be available upon completion of the new loads program. The break analyses are discussed in 6.2.1.2.

Item 4

Evaluations are presented (or will be presented if under preparation) in appropriate Subsections of 3.6, 3.8, and 3.9. Those under preparation will be available upon completion of the new loads program.

Item 5

The starting point for all the annulus pressurization analyses performed as part of the design of the biological shield wall and piping within the biological shield annulus is the thermal-hydraulic analysis that determines the pressures vs. time within the annulus as the results of postulated pipe ruptures. These analyses are discussed in detail in Subsections 6.2.1.2.1.2, 6.2.1.2.2.2 and 6.2.1.2.3.2. The FSAR discusses the analysis of the reactor recirculation outlet line break and the feedwater line break.

The general arrangement of the biological shield annulus and enclosed major piping is shown in Figures 6.2-55 through 6.2-59. The analytical models are discussed in Subsection 6.2.1.2.3.2 and shown graphically in Figures 6.2-21, 6.2-22, 6.2-85 and 6.2-86. The mathematical model data is presented in Table 6.2-14 and Tables 6.2-21 through 6.2-23. The mass/energy release rates are determined by the method described in GE document APED-4827 and tabulated in Tables 6.2-41 and 6.2-42. These analyses were performed using the RELAP4 and WARLOC computer codes as discussed in Subsection 6.2.1.2.3.2. The results of the analyses are shown as pressure-time histories for the various spatial modes in Figures 6.2-23 through 6.2-54 and 6.2-87 through 6.2-93.

MEB (DSER) ITEM NO. 67B (Cont'd)

A sensitivity analysis has been performed to demonstrate the adequacy of these analyses the details of which are discussed in FSAR Subsection 6.2.1.2.3.2.

An axisymmetric finite element model of the reactor pressure vessel, shield wall and pedestal has been used to calculate responses of these structures to the pressure loads discussed in Subsection 6.2.1.2.3 2.

The computer program DYNAX, described in Appendix C, has been used to calculate dynamic responses through direct numerical integration. Separate analyses are performed for each postulated break. The pressure time histories are applied at the modes as equivalent nodal force time histories. The responses are calculated using the unbalanced pipe break pressure loads within the shield wall annulus.

Acceleration response spectra developed through the use of structural response time histories and the computer program RSC, described in Appendix C, or response time histories are used directly in analyzing piping systems excited by the annulus pressurization loads through the supports and anchors which are attached to the pedestal, shield wall or the RPV.

The computer program used in the piping analysis (except for recirculation and main steam piping due to the AP loads is PIPSYS (Appendix C) for both response spectra, and multiple acceleration time history methods of analysis. Modeling of the piping system is the same as that explained in Subsection 3.7.3.1.1.

The responses from the computer program RELAP4 provide an input for the analysis of RPV and internals. This input consists of the non-axisymmetric RPV and shield wall pressure time-histories. The time histories of the jet thrust and impingement forces, and the pipe whip restraint loads are computed as described in Section 3.6. These pressure and force time-histories are converted to equivalent beam nodal force histories using the GEAPL computer program and used as input to a beam model for response determination using the SAP4G program. The results of this beam analysis are used for analysis and code evaluation of the RPV internals. In addition, the pressure and force histories are also represented by Fourier Series for use in the ASHSD computer program which analyzes the shell model of the RPV and internals plus the pedestal and shield wall. The output consists

MEB (DSER) ITEM NO. 67B (Cont'd)

of loads for use in Code evaluation of the RPV stresses in accordance with the load combination table. Acceleration response spectra are also obtained from the output acceleration time-histories for analysis of recirculation and main steam piping. The computer program PIPSYS is used for analysis of these piping, which are modelled as explained in Subsection 3.7.3.3.1.2.

The computer programs GEAPL, ASHSD, and PIPSYS will be described in the Subsection 3.9.1.2 after completion of the annulus pressurization analyses.

Item 6

Dynamic response of active components attached to piping systems are evaluated as part of load case 10, Table A3.9-6.

Item 7

Functional capability requirements, while not specifically addressed in detail, are noted in note 1 of Table A3.9-6.

NSSS Response

Asymmetric load analysis will be submitted after the new loads analysis in January 1982.

Issue

Modelling of NSSS equipment for hydrodynamic loads. (This portion of the issue is the need to show that the CPS design can withstand the asymmetric LOCA loads).

Response

IPC will submit results of analyses as listed in the response to MEB(DSER) #67B (attached).

Action Required

IPC to submit "New Loads" amendment to FSAR upon receipt of acceptable "New Loads" analyses report.

ATTACHMENT TO #98b

MEB (DSER) ITEM NO. 67B (Cont'd)

Item 3

Breaks of concern are shown in the following figures:

a. Steam line B3.6-6, B3.6-7, B3.6-8, and B3.6-9

b. Feedwater B3.6-1 and B3.6-2

c. Recirculation B3.6-18

Evaluations for these loads will be covered in Sections 3.6 (Pipe Rupture), 3.8 (Structures) and 3.9 (Mechanical Components). These evaluations will be available upon completion of the new loads program. The break analyses are discussed in 6.2.1.2.

Item 4

Evaluations are presented (or will be presented if under preparation) in appropriate Subsections of 3.6, 3.8, and 3.9. Those under preparation will be available upon completion of the new loads program.

Item 5

The starting point for all the annulus pressurization analyses performed as part of the design of the biological shield wall and piping within the biological shield annulus is the thermal-hydraulic analysis that determines the pressures vs. time within the annulus as the results of postulated pipe ruptures. These analyses are discussed in detail in Subsections 6.2.1.2.1.2, 6.2.1.2.2.2 and 6.2.1.2.3.2. The FSAR discusses the analysis of the reactor recirculation outlet line break and the feedwater line break.

The general arrangement of the biological shield annulus and enclosed major piping is shown in Figures 6.2-55 through 6.2-59. The analytical models are discussed in Subsection 6.2.1.2.3.2 and shown graphically in Figures 6.2-21, 6.2-22, 6.2-85 and 6.2-86. The mathematical model data is presented in Table 6.2-14 and Tables 6.2-21 through 6.2-23. The mass/energy release rates are determined by the method described in GE document APED-4827 and tabulated in Tables 6.2-41 and 6.2-42. These analyses were performed using the RELAP4 and WARLOC computer codes as discussed in Subsection 6.2.1.2.3.2. The results of the analyses are shown as pressure-time histories for the various spatial modes in Figures 6.2-23 through 6.2-54 and 6.2-87 through 6.2-93.

MEB (DSER) ITEM NO. 67B (Cont'd)

A sensitivity analysis has been performed to demonstrate the adequacy of these analyses the details of which are discussed in FSAR Subsection 6.2.1.2.3.2.

An axisymmetric finite element model of the reactor pressure vessel, shield wall and pedestal has been used to calculate responses of these structures to the pressure loads discussed in Subsection 6.2.1.2.3.2.

The computer program DYNAX, described in Appendix C, has been used to calculate dynamic responses through direct numerical integration. Separate analyses are performed for each postulated break. The pressure time histories are applied at the modes as equivalent nodal force time histories. The responses are calculated using the unbalanced pipe break pressure loads within the shield wall annulus.

Acceleration response spectra developed through the use of structural response time histories and the computer program RSC, described in Appendix C, or response time histories are used directly in analyzing piping systems excited by the annulus pressurization loads through the supports and anchors which are attached to the pedestal, shield wall or the RPV.

The computer program used in the piping analysis (except for recirculation and main steam piping due to the AP loads is PIPSYS (Appendix C) for both response spectra, and multiple acceleration time history methods of analysis. Modeling of the piping system is the same as that explained in Subsection 3.7.3.1.1.

The responses from the computer program RELAP4 provide an input for the analysis of RPV and internals. This input consists of the non-axisymmetric RPV and shield wall pressure time-histories. The time histories of the jet thrust and impingement forces, and the pipe whip restraint loads are computed as described in Section 3.6. These pressure and force time-histories are converted to equivalent beam nodal force histories using the GEAPL computer program and used as input to a beam model for response determination using the SAP4C program. The results of this beam analysis are used for analysis and code evaluation of the RPV internals. In addition, the pressure and force histories are also represented by Fourier Series for use in the ASHSD computer program which analyzes the shell model of the RPV and internals plus the pedestal and shield wall. The output consists

MEB (DSER) ITEM NO. 67B (Cont'd)

of loads for use in Code evaluation of the RPV stresses in accordance with the load combination table. Acceleration response spectra are also obtained from the output acceleration time-histories for analysis of recirculation and main steam piping. The computer program PIPSYS is used for analysis of these piping, which are modelled as explained in Subsection 3.7.3.3.1.2.

The computer programs GEAPL, ASHSD, and PIPSYS will be described in the Subsection 3.9.1.2 after completion of the annulus pressurization analyses.

Item 6

Dynamic response of active components attached to piping systems are evaluated as part of load case 10, Table A3.9-6.

Item 7

Functional capability requirements, while not specifically addressed in detail, are noted in note 1 of Table A3.9-6.

NSSS Response

Asymmetric load analysis will be submitted after the new loads analysis in January 1982.