DOCKET FILE

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Docket No. 50-410

NOV 20 1972

Niagara Mohawk Power Corporation
ATTN: Mr. Thomas J. Brosnan
Vice President and Chief Engineer
300 Erie Boulevard West
Syracuse, New York 13202

RE: Nine Mile Point-2 Nuclear Power Plant

Gentlemen:

The Commission's Regulatory Staff has completed a review of fuel densification and its effect on reactor operation including transients and postulated loss-of-coolant accidents. The Staff's investigations and conclusions are reported in "Technical Report on Densification of Light Water Reactor Fuels" dated November 14, 1972, a copy of which is enclosed for your information and guidance. This report concludes that densification of fuel may occur and that the resulting formation of fuel column gaps should be anticipated in all light water reactor fuels. The report also provides the essential elements to be included in calculational models used to account for the effects of fuel densification.

The Regulatory Staff believes that the fuel in the subject facility(s) is susceptible to densification. Therefore, we request that you provide the necessary analyses and other relevant data for determining the consequences of densification and the effects on normal operation, anticipated transients, and accidents, including the postulated loss-of-coolant accident, using the guidance provided in the enclosed report. If the analyses indicate that changes in design or operating conditions are necessary to maintain required margins, you should submit proposed changes and operating limitations with the analyses.

In order that the Regulatory Staff can conduct an expeditious and orderly review of these matters, we request that you submit the analyses and additional information within 45 days from the date of this letter.

It is requested that this information be provided with one signed original and thirty-nine additional copies. If your submittal is for more than one unit, a total of sixty copies is needed.

Sincerely,

A. Giambusso

A. Giambusso, Deputy Director
for Reactor Projects
Directorate of Licensing

Enclosure: See next page

CB

Enclosure:
Technical Report on Densification
(November 14, 1972)

cc w/o enclosure:
LeBoeuf, Lamb, Leiby & MacRae
ATTN: Arvin E. Upton, Esq.
1821 Jefferson Place, N. W.
Washington, D. C. 20036

cc w/enclosure:
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120 East Second Street
Oswego, New York 13126

Docket File

NOV 10 1972

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Niagara Mohawk Power Corporation
ATTN: Mr. Thomas J. Brosnan
Vice President and Chief Engineer
300 Erie Boulevard West
Syracuse, New York 13202

Gentlemen:

In order that we may continue our review of your application for a license to construct the Nine Mile Point Nuclear Station Unit 2 (NMPNS-2) additional information is required. The information requested is described in the enclosure and pertains to the areas of Reactor Coolant System, Containment, Radioactive Waste Systems, Unit 2 Safety Analysis, Equipment Design Criteria and Quality Assurance.

The questions in the enclosure have been grouped by sections that correspond to the relevant sections of the NMPNS-2 Preliminary Safety Analysis Report. In addition these questions are numbered in seriatim with previous requests for information.

For combustible gas control in the containment, you have submitted the Containment Atmosphere Dilution (CAD) system as the primary method of control. This is not acceptable for new plants such as Nine Mile Point 2. You should propose and describe a system that meets the guidelines of Safety Guide 7. The CAD system, however, is acceptable as a backup system; therefore, several questions have been addressed to the CAD system in this connection.

In order to maintain our licensing review schedule, we will need a completely adequate response to all enclosed questions by January 10, 1973. Please inform us within 7 days after receipt of this letter of your confirmation of the schedule date or the date you will be able to meet. If you cannot meet our specified date or if your reply is not fully responsive to our request it is highly likely that the overall schedule for completing the licensing review for the project will have to be extended. Since reassignment of the staff's efforts will require completion of the new assignment prior to returning to this project, the extent of the extension will most likely be greater than the delay in your response.

OFFICE ▷						
SURNAME ▷						
DATE ▷						

NOV 1 1972

Please contact us if you have any questions regarding the information requested.

Sincerely,

Original signed by:
Roger S. Boyd

Roger S. Boyd, Assistant Director
for Boiling Water Reactors
Directorate of Licensing

cc: LeBoeuf, Lamb, Leiby
& MacRae
ATTN: Arvin E. Upton, Esq.
1821 Jefferson Place, N. W.
Washington, D. C. 20036

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Please contact us if you have any questions regarding the information requested.

Sincerely,

Roger S. Boyd, Assistant Director
for Boiling Water Reactors
Directorate of Licensing

cc: H. Gearin
V. Benaroya
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G. Lainas
D. Reiff
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REQUEST FOR ADDITIONAL INFORMATION

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION-2

DOCKET NO. 50-410

4.0 Reactor Coolant System

4.10 Describe the protective features provided to prevent loss of the LPCI pumps and other engineered safety features due to possible internal flooding of the lower level of the secondary containment.

4.11 Justify by analysis the statement that the NPSH guidelines of Safety Guide 1 are met for the LCPI and other engineered safety feature pumps.

5.0 Containment

5.1 In the event of inadvertently isolating the Reactor Building Closed Loop Cooling Water (RBCLCW), discuss the following functional loss and effects of these losses:

(a) penetration coolers and effect on the limiting design condition for the penetrations;

(b) drywell coolers and the effect of the containment environment (pressure and temperature);

(c) recirculation pump coolers and the effect on the recirculation pumps.

5.2 Describe how the operability of the shear valve for isolating the TIP System guide tube is demonstrated or assured.

5.3 Provide the analysis which demonstrates and supports your statement in Section 7.2.4.3 that the guidelines of AEC Safety Guide 11 are met. Analyze the pressure and temperature response in the event of failure of an instrument line, and relate this to the structural capability of the secondary containment and the subcompartments housing the instrument lines.

5.4 Provide a description of the instrumentation systems included in your design for remote monitoring of operational occurrences and post-accident conditions within the primary containment. Provide an analysis to show that these systems provide appropriate information for operational occurrences and for the full spectrum of postulated accidents.

5.5 Identify those containment isolation valves and air actuated valves that have valve seats or diaphragms of a resilient material and describe the service characteristics and experience of the resilient material. Describe material for seats and the qualification tests performed to validate its use in accident environment.

5.6 The isolation valves on the fuel pool circulating pump influent lines for the MSL IV Water Seal System are not included in Table 7.2-1. Correct this omission. Review Table 7.2-1 for other possible omissions, and update the information as necessary.

5.7 Provide the method for converting closing times listed as "standard" on Table 7.2-1 to real times.

5.8 Clarify the inconsistency of the primary containment valves listed as Quality Group C in Table 7.2-1, and as Quality Group D in Figure 10.6-1. Note that these valves and the line which forms an extension of containment must as a minimum be Quality Group B.

5.9 Exceptions to General Design Criteria (GDC) 55, 56 and 57 are described in various sections of the PSAR. Tabulate all the exceptions to GDC 55, 56 and 57, and provide the basis and justification for their acceptability. (For example, the RHR bypass to suppression pool and RCIC turbine exhaust use simple check valves outside of the primary containment only, and engineered safety feature pump suction lines do not have internal containment isolation valves.)

5.10 Secondary containment is maintained at a pressure of 1/4 inch water gauge negative. Describe in further detail than that stated in Section 5.3.4 (p. 5.3-7) how this pressure is controlled and how local variations due to winds and other influences outside the building are considered in the system design.

5.11 In Fig. 5.3-2 the provisions of cross connecting piping to cool the charcoal adsorber of the inactive train are shown. Describe the air flow thru the fixed bleed to the adsorber and show by the results of your analysis that adequate cooling of the charcoal adsorber is assured.

5.12 Describe the system and methods undertaken to assure the maintenance of sufficient pneumatic pressure in the drywell floor seals.

5.13 We will need documentation of the results of confirmatory tests for the resilient (EPDM) floor seal material. Provide the results of the tests, particularly those tests with respect to seal lifetime.

5.14 Identify the "other potential bypass" leak paths between the drywell and suppression pool which you consider to be negligible as stated in Section H 3.15. Supplement your description with drawings of those paths that are specially sealed. Include a plan view of the floor seal showing sections of the seal at peripheral interfaces.

5.15 Describe in further detail the inspection, testing, and surveillance procedures which will detect possible leakage from the drywell to the suppression chamber through downcomers, sump at pedestal base, drywell head, etc., as well as vacuum breakers. Include in the description the sensitivity of these tests for local and overall measurements of leakage, the bases for these procedures, the frequency of testing and the acceptance criteria.

5.16 Describe your analysis and the methods employed for estimating leakage across the drywell floor. Clarify the basis for assuming "zero leakage" through the floor seals.

5.17 Additional information in connection with the design, analysis, and operation of the vent system check valves (vacuum breakers) is required:

a. Provide the analysis of the vacuum breakers operation and response characteristics, considering the two (2) valves in series, including the influence of:

(i) valve interaction with respect to the size of the intermediate chamber between the valves (response of downstream valve), and

(ii) depressurization capability with respect to the response time of the valves in series.

b. Discuss the basis upon which the number and size of vacuum breakers were determined.

c. Describe the arrangement of valves that assures that flutter of the upstream valve will not unseat the downstream valve. Indicate on valve drawings which should be provided, the exact position of the valves with respect to the horizontal level and the controls and tolerances on this installation. Drawings should include a description of the seat material, need for lubricants, and the system for position indicators and alarms.

d. Discuss the reliability of the valves for opening or closing.

(i) Include estimates of inertial forces on critical parts of the valve assembly, such as when the valve impacts against the stopper during operation and describe the consequences of these forces (shaft/bearing assembly damage, vibration) for potential damage.

(ii) Discuss the precautions taken to insure that no debris will enter the air piston chamber during testing of the valves. Describe in further detail the three-way pneumatic valve arrangement that is intended to prevent both check valves from opening concurrently.

5.18 Describe the seat material used for all containment isolation and vacuum breaker valves utilizing resilient type seats. Describe the capability of these valves to withstand an accident environment and describe any actual tests which would demonstrate this capability.

5.19 Analyze the maximum bypass area for the complete spectrum of primary system ruptures which would not result in a drywell pressure greater than design.

5.20 Describe in further detail your method of analysis and the margin for determining the maximum upward floor deck differential pressure (set point at 3 psid, but limited to 10 psid before lift of floor).

5.21 Describe your method of analysis to show that the maximum external loading on the drywell will not exceed the design collapse pressure. Discuss the selection and sizing of protective devices as related to the analysis.

5.22 Discuss the model for analyses of water oscillations in the downcomer during a small break, in connection with the potential to open the series of vacuum breakers and create bypass area.

5.23 Discuss in further detail than that presented in Section 5.4.9 the capabilities of the spray systems to further mitigate the effects of suppression pool bypassing.

5.24 Provide in further detail an evaluation of the adequacy of the CAD system to function as a backup system for the control of combustible gases as follows:

a. Identify the purge flow rate, and time at which purging is to be initiated to limit containment pressure to values substantially below design and still minimize resultant radiological doses.

b. Provide the bases for a 7-day purge time at 8% oxygen concentrations.

c. The potential of oxygen stratification following a LOCA is assumed unlikely based on test results from the containment system experiment performed by Battelle Northwest (Ref. page 5.4-11). Discuss the similarities and differences between test and containment conditions which allow use of test data to support containment mixing.

d. Provide the temperature history of the containment structure, suppression pool, and drywell and wetwell atmosphere which might induce convective circulation for the long term following an accident. Provide the basis for which the temperature profiles were determined.

e. Describe why, as shown in Figure 5.4-1, the radiolytic hydrogen generation rate for the drywell exceeds that of the suppression pool after the earlier period of the LOCA.

f. For the analyses of containment combustible gas mixture, it was assumed that water sprays were actuated 10 min. after the Design Basis Accident (DBA). Depressurization was promoted, thereby opening up the vacuum breakers for mixing up hydrogen, oxygen and nitrogen. Explain in further detail (p. 5.4-11) how this assumption of operation of the RHR spray, "not a required system", is conservative with respect to the local accumulation of potentially combustible gas mixtures.

g. State the assumptions employed for calculation of oxygen concentration shown in Figure 5.4-2. (On p. 5.4-14 only the hydrogen concentration assumptions were stated and those for oxygen were implied. Results of computations should be in accord with the guidelines of Safety Guide 7.)

h. Describe the sampling equipment and related principles of operation, equipment qualification, time to sample or monitor, location of sampling points in containment, location where measurement/readout is made, sampling errors and stratification considerations.

i. Discuss the potential for stratification of hydrogen leakage from the drywell into the reactor building or compartments. Discuss the need for positive mixing of the atmosphere in the reactor building of compartments to prevent the formation of localized combustible gas mixtures.

5.25 Give the operating restrictions and bases for venting the drywell and torus atmospheres under normal drywell purging procedures. Discuss the frequency of venting anticipated for normal operating conditions, the approximate volume released and any special area controls or monitoring procedures imposed during this event. Identify the routes available for exhausting the drywell atmosphere and the bases for selecting one route over another.

5.26 To demonstrate the capability for safe and orderly shutdown of the plant with the suppression pool as the only heat sink for decay heat removal, analyze the temperature response of the suppression pool during a loss of offsite power with only Class I equipment available. Discuss the effects of suppression pool limitations on the NPSH requirements of the RHR pump and limitations of condensing capability of the suppression pool due to high temperature.

5.27 Pressure buildup inside containment may be caused by excessive pneumatic line leakage or line failure. Describe the methods and basis for distinguishing this mode from other forms of pressure buildup that may occur, such as that from steam leakage.

5.28 Analyze, in more detail than that described in Section 12.5.2, the effects of main steam line and feedwater line pipe breaks on the enclosing structures located external to the drywell. Discuss the pressure effects for the spectrum of pipe breaks and the effects of pipe whip and missiles for these lines and any other pressure containing lines located in these enclosures outside the drywell. Describe the means provided for the detection and isolation of these pipe breaks. Indicate on the arrangement drawings the main steam line routing from the reactor vessel to the turbine.

5.29 Discuss the effects of potential loss-of-coolant accidents occurring within the sacrificial shield area. Specifically, consider the effects of pipe whip and steam jet impingement on the shield and reactor vessel support structure and any subsequent consequences to the primary containment and standby core cooling systems.

5.30 Discuss the methods and accuracy with which containment free volume are calculated. Describe any tests or other means by which the containment free volume will be verified.

5.31 With regards to question 5.29 above, provide a description of the analysis that was done to determine the resultant pressure of pipe breaks occurring within the sacrificial shield. Describe the computer program and assumptions used in the calculations. We will need the resultant pressure response and the blowdown rate and energy as a function of time. In addition, provide the bases for the blowdown of whether homogeneous flow was assumed through the vents and whether choked flow was adequately considered in determining the venting rate.

9.0 RADIOACTIVE WASTE SYSTEMS

9.1 Provide the following:

(a) the basis for the reactor water isotope concentrations listed in Table 9.5-1 including a description of the mathematical model utilized to determine the concentrations;

(b) the P&I diagrams for the liquid and gaseous radwaste systems;

(c) the rated capacities for the liquid radwaste system evaporators, demineralizers and filters;

(d) the basis for the decontamination factors indicated for the liquid radwaste equipment including applicable operating experience;

(e) a tabulation of the expected releases of liquid waste to the environment in curies per year per isotope;

(f) the number of charcoal adsorbers, the weight of charcoal per adsorber and the major dimensions of the adsorbers;

(g) the estimated radioactive releases from the mechanical vacuum pump;

(h) a description of the solid radwaste equipment and the solid radwaste storage facilities including their location on an arrangement drawing.

9.2 Identify the release point for the liquid radwaste system on a plot plan of the site.

9.3 In Figure 9.4-1, "Flow Diagram - Gaseous Radwaste System," provide information on flow rates, activity in curies per time period, and composition of the offgas stream at the inlet and outlet of the major process equipment.

9.4 Clarify whether it is intended to operate the offgas system utilizing two parallel trains. The test mentions "that, in effect two parallel offgas trains are provided." It appears that some components, such as the recombiners, have 100% redundancy, while other components, particularly the adsorbers, have no redundancy.

9.5 Indicate all potentially radioactive gaseous release points, including ventilation releases, on a plot plan.

9.6 Demonstrate that those radwaste components whose failure would result in calculated potential exposures in excess of 0.5 rem whole body at the site boundary meet the requirement of Quality Group "C."

9.7 Describe the facility design and operational features concerning the liquid and gaseous releases from the station to assure meeting the numerical values listed in (proposed) Appendix I to 10 CFR 50.

14.0 Unit 2 Safety Analysis

14.1 An analysis of the containment pressure transient in the post-LOCA period has been presented in Section 14 of the PSAR for one postulated accident situation. The short term and the long term containment pressure transients are described. Analysis of the rapid (few seconds duration) depressurization of the containment after the peak pressure is reached (at approximately 100 seconds into the post-LOCA period, see Figure 14.6-7) has not been adequately presented. More information is needed to substantiate the rapid depressurization claimed to occur as a result of the condensation of steam on the coolant exiting from the break. Provide the following information making reference where applicable to the Table of information requested in question 14.2:

a. The analytical model, including assumptions and appropriate mathematical development, used to obtain the time dependent depressurization of the containment following the short-term blowdown but prior to the long-term pressure transient. (This is represented just after peak pressure in the containment is reached and occurring around 100 seconds after LOCA occurs.)

b. A discussion of the phenomena involved and the experimental evidence available to support the analytical method used to model the condensation of saturated (or superheated) steam on the flowing coolant surface. Cite heat transfer coefficients and/or film coefficients used.

c. By appropriately small time increments, provide a listing of parameters and their values to illustrate this rapid depressurization of the containment. Include: flow rate at pipe break, fluid temperature (at break), fluid liquid (condensing) surface area or its effective area, containment pressure, partial pressures in containment, containment air and vapor temperatures, air and vapor content in containment, vent flow rate, wetwell pool and atmospheric temperatures and pressure, and other parameters as appropriate. If suitable for clarification of the analysis, plots of the parameters versus time is an accepted alternative to the tabular arrangement suggested.

d. Describe the phenomena and evidence to support the sudden pressure and temperature transient at 600 seconds into the accident for case B, 1 RHR pump and HPCS operating without containment spray.

14.2 The attached Table lists certain information that is required to allow us to perform an independent assessment of the containment pressure response analysis. Provide the required information shown in the attached Table or reference as appropriate.

TABLE

I. General Information

A. Drywell

1. Internal design pressure, psig
2. External design pressure, psig
3. Design temperature, °F
4. Free volume, ft^3
5. Design leak rate (drywell and wetwell), %/day-psi

B. Wetwell

1. Internal design pressure, psig
2. External design pressure, psig
3. Design temperature, °F
4. Air volume, minimum, ft^3

   maximum, ft^3
5. Water volume, minimum, ft^3

   maximum, ft^3
6. Water surface area, minimum, ft^2

   maximum, ft^2
7. Water depth, minimum, ft

   maximum, ft

C. Vent System

1. Number of vent pipes
2. Diameter of bent pipes, ft
3. Diameter of vent header, ft
4. Number of downcomers
5. Diameter of downcomers, ft

6. Downcomer submergence, minimum, ft

   maximum, ft

7. Vent system resistance factors and basis for selection

8. Dimensional layout of vent system

9. Number of vacuum breakers

10. Flow area of vacuum breaker, ft^2

11. Vacuum breaker system resistance factors and basis for selection

12. Pressure differential at which vacuum breakers open, psi

D. Spray System

1. Number of pumps for spray system

2. Capacity of each pump, gpm

3. Spray flow rate for drywell, minimum, lb/hr

   maximum, lb/hr

4. Spray flow rate for wetwell, minimum, lb/hr

   maximum, lb/hr

5. Spray inlet temperature, °F

6. Spray efficiency, %

E. Recirculation Heat Exchangers (long term phase)

1. Number and type of heat exchangers for spray system

2. Heat transfer area of each heat exchanger, ft^2

3. Overall heat transfer coefficient of each heat exchanger,

   $Btu/hr\text{-}ft^2\text{-}°F$

4. Secondary coolant flow rate for each heat exchanger, lb/hr

5. Secondary coolant inlet temperature, °F

F. Structural Heat Sinks

1. Number and type of heat sinks

2. Heat transfer area (each), ft^2

3. Thickness, ft

4. Material and properties:

   thermal conductivity, Btu/hr-ft^2-°F/ft

   specific heat, Btu/lb-°F

   density, lb/ft^3

II. Assumptions for Accident Analysis

The following information should be provided for both the recirculation line break and main steam line break inside containment. Appropriate variations in parameter values should be selected to result in a conservative containment pressure response analysis.

A. Reactor Coolant System (initial conditions)

1. Reactor power level, MWt

2. Average coolant pressure, psig

3. Average coolant temperature, °F

4. Mass of reactor coolant (liquid), lb

5. Mass of reactor coolant (steam), lb

6. Energy of reactor coolant (liquid), Btu

7. Energy of reactor coolant (steam), Btu

8. Volume of water in reactor vessel, ft^3

9. Volume of steam in reactor vessel, ft^3

10. Volume of water in recirculation loops, ft^3

B. Drywell (initial conditions)

1. Pressure, psig

2. Temperature, °F

3. Relative humidity, %

C. Wetwell (initial conditions)

1. Pressure, psig
2. Air temperature, °F
3. Water temperature, °F
4. Relative humidity, %
5. Air volume, ft^3
6. Water volume, ft^3
7. Downcomer submergence, ft

D. Recirculation Loop Break Analyses

1. Effective total break area, ft^2
2. Blowdown and post-blowdown (about 10^6 seconds) mass release rate (lb/sec) and enthalpy of mass (Btu/lb) as function of time in table format.

E. Main Steam Line Break Analysis

1. Effective total break area, ft^2
2. Blowdown and post-blowdown (about 10^6 seconds) mass release rate (lb/sec) and enthalpy of mass (Btu/lb) as function of time in table format.

F. Energy Sources

1. Decay heat rate (Btu/sec) as function of time in table format. (Justify if different from values of ANS-5)
2. Primary system sensible heat rate (Btu/sec) to the containment as function of time in table format.
3. Metal water reaction heat rate as a function of time, Btu/sec
4. Heat rate from other sources as a function of time, Btu/sec

G. Containment Cooling Parameters

1. Pressure or time when containment cooling system is initiated
2. Spray flow rate for drywell, lb/hr
3. Spray flow rate for wetwell, lb/hr
4. Number of containment cooling system heat exchangers

(Table Cont'd)

II. Structural Heat Sink Heat Transfer Coefficients

Show heat transfer coefficients between heat sinks and containment (drywell and wetwell) atmosphere, as a function of time, that were used in the analysis. Substantiate their values by reference to experimental data, correlations and/or equations.

III. Results of Accident Analysis

A. Plot as a function of time for a time period of at least 10^6 seconds the results of the analysis for each accident case:

1. Drywell pressure, psig
2. Drywell temperature, °F
3. Wetwell pressure, psig
4. Wetwell air temperature, °F
5. Wetwell water temperature, °F
6. Vent flow, lb/sec
7. Specific volume of vent flow, ft^3/lb

B. Tabulate the following parameters for each accident case:

1. Maximum drywell pressure, psig
2. Time of maximum drywell pressure, sec
3. Mass of water and steam released into drywell at time of maximum drywell pressure, lb
4. Energy released into drywell at time of maximum drywell pressure, Btu
5. Maximum drywell atmosphere temperature, °F
6. Total mass of water and steam released into drywell, lb
7. Total energy released into drywell, Btu
8. Maximum wetwell pressure, psig
9. Time of maximum wetwell pressure, sec
10. Mass of water, steam and air transferred into wetwell at time of maximum wetwell pressure, lb
11. Energy transferred into wetwell at time of maximum wetwell pressure, Btu
12. Maximum wetwell atmosphere temperature, °F

(Table Cont'd)

13. Maximum wetwell water temperature, °F

14. Total mass of water, steam and air transferred into wetwell, lb

15. Total energy transferred into wetwell, Btu

16. Maximum pressure differential between drywell and wetwell, psi

17. Time of maximum pressure differential between drywell and wetwell, sec

C EQUIPMENT DESIGN CRITERIA

C.1 Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping

C.1.1 Section C.8.2 indicates that the design criteria for pipe whip protection will conform with ANS-20 code. The ANS-20 Working Group (Protection Against Pipe Whip) has not published any criteria as yet and there are more than one draft version available. Provide the criteria to be used for locations of postulated pipe breaks to be used in the analysis of protection against pipe whip. Also provide the following:

(a) The measures taken to protect against pipe whip.

(b) A description of dynamic analysis methods and procedures for pipe whip protection design.

(c) The systems (or portions of system) in which design basis piping breaks are postulated to occur.

C.2 Seismic Design Input Criteria

C.2.1 The Frequency Response Method as indicated in Section C.7.1.1 for developing floor response spectra is not acceptable. Provide the response spectra derived from the actual or synthetic earthquake time motion records used for design. It should envelope the site seismic design response spectra appropriate for Nine Mile Point. Provide a comparison, for all the damping values that are used in the design, of the response spectra derived from the time history and the site seismic design response spectra. Provide the system period intervals at which the spectra values were calculated and the criteria to demonstrate that these intervals are small enough to produce sufficiently accurate response spectra.

C.2.2 Provide a list of all soil-supported Category I and Category II structures, including the depth of soil over bedrock for each structure listed.

C.2.3 If a simplified lumped mass and soil spring approach is used to characterize soil structure interaction submit justification of the lumped mass technique for soil sensitive sites. The use of equivalent soil springs for the seismic system mathematical models may produce a pronunced filtering of the ground motion response amplitude and response frequencies due to sensitive soil parameters. Provide the basis for the use of a lumped parameter mathematical model with equivalent soil springs in lieu of a finite element model (or equivalent method including the use of parametric studies

which evaluate possible variations in the in situ soil properties (e.g., moduli, density, and stress level).

C.2.4 Provide the criteria for considering the two horizontal and one vertical components of ground motions in the seismic system analysis of structures, piping systems and various components.

C.3 Seismic System Analysis

C.3.1 Provide the stress and deformation criteria that will be used to consider the differential seismic movement of interconnected components between floors.

C.3.2 Describe the method employed to consider the torsional modes of vibration in the seismic analysis of the Category I building structures. If static factors are used to account for torsional accelerations in the seismic design of Category I structures, justify this procedure in lieu of a combined vertical, horizontal, and torsional multimass system dynamic analysis. In addition, provide justification for not including torsional degrees of freedom in the seismic analysis.

C.3.3 Provide the dynamic methods and procedures used to determine Category I structure overturning moments including a description of the procedures used to account for soil reactions and vertical earthquake effects.

C.3.4 Describe the analysis procedure followed to account for the damping in different elements of the model of a coupled system including the criteria used to account for composite damping in a coupled system with different elements.

C.3.5 Provide the damping values used for soil in the seismic analysis which considers soil structure interaction.

C.4 Seismic Subsystem Analysis

C.4.1 The criteria for combining modal responses (shears, moments, stresses, deflections, and/or accelerations) where modal frequencies are closely spaced and a response spectrum modal analysis method is used should be provided.

C.4.2 The criteria that will be employed to account for the torsional effects of valves and other eccentric masses (e.g., valve operators) in the seismic piping analyses should be provided.

C.4.3 With respect to Category I piping buried or otherwise located outside of the containment structure, the seismic design criteria and methods employed to assure that allowable piping and structural stresses are not exceeded due to differential movement at support points, at containment penetrations, and at entry points into other structures should be described.

C.4.4 The evaluation performed to account for the seismic motion of Category II piping systems in the seismic design Category I piping and the interface between Category I and II should be described.

C.4.5 The criteria employed to determine the field location of seismic supports and restraints for Category I piping, piping system components, and equipment, including placement of snubbers and dampers should be provided. The procedures followed to assure that the field location and the seismic design of these supports and restraining devices are consistent with the assumption made in the dynamic seismic analyses should be described.

C.4.6 If static loads equivalent to the peak of the floor spectrum curve or less are used for the seismic design of components, equipment and piping, justify the use of peak spectrum values by demonstrating that the contribution of all significant dynamic modes of response under seismic excitation have been included. Provide justification for considering a factor of 1.30 in the simplified analysis of equipment by demonstrating that the contribution of all significant dynamic modes of response under seismic excitation have been included.

C.5 Seismic Instrumentation Program

C.5.1 The locations of peak motion recorders are inadequate to determine the typical response of components and equipment. Describe the supporting instrumentation such as peak recording accelerographs and peak deflection recorders, to be installed on selected Category I components which will provide data for verification of calculated seismic responses of Category I components and equipment.

C.5.2 Provide the plan for the utilization of the data obtained from the seismic instrumentation to verify the initial seismic design analysis of the facility.

C.6 Seismic Design Control

C.6.1 Sections D.12 and E.3 of the PSAR states that the Quality Assurance Program that will be provided will conform to the provisions of the 10 CFR 50 Appendix B. Verify that appropriate seismic input data derived from seismic system and subsystem analyses are included in this program and are correctly specified to the manufacturer of Category I components and equipment to constructors of other Category I structures and systems. The responsible design groups or organizations that will verify the adequacy and validity of the analyses and tests employed by manufacturers of Category I components and equipment and constructors of Category I structures and systems should be identified. A description of the review procedures employed by each group or organization should be included.

C.7 Dynamic System Analysis and Testing

C.7.1 Identify whether Nine Mile Point 2 is considered the prototype plant. If the elements of the intended pre-operational vibration testing program differ substantially from the requirements of Safety Guide 20 submit the basis and justification for these differences.

C.7.2 Provide a description of the dynamic system analysis methods and procedures that will be used to confirm the structural design adequacy of the reactor coolant system (unaffected loop) and the reactor internals (including fuel element assemblies, control rod assemblies and drives) under the LOCA loading.

C.7.3 Provide a description of the piping operational test program that will be used to verify that the piping and piping restraints within the reactor coolant pressure boundary have been designed to withstand dynamic effects resulting from transient conditions. Identify the specific transients such as pump trips, valve closures, etc. that will be performed during these tests. Include a description of the acceptance criteria (e.g., acceptable amplitude of vibration) that will be used during the test program to confirm the structural design of the piping and piping components.

C.7.4 Identify the analytical methods used to evaluate stresses of Category I structures and components (e.g. elastic or inelastic) including a discussion of their compatibility with the type of dynamic system analyses. If inelastic component stress analyses and inelastic design stress limits are used in conjunction with an elastic dynamic system analysis provide the bases upon which design procedures may be justified.

C.7.5 Submit a list of computer programs that will be used in dynamic and stress analyses to determine mechanical loads and deformations of Seismic Category I structures, components and equipment. In each program, include a brief description of the theoretical basis, the assumptions and references used, and the extent of its application, (e.g., as summarized in the computer program abstract).

C.7.6 Describe the design control measures as required by 10 CFR 50 Appendix B that will be employed to demonstrate the applicability and validity of the above computer programs by any of the following criteria or procedures (or other equivalent procedures).

(a) The computer program is a recognized program in the public domain, and has had sufficient history of use to justify its applicability and validity without further demonstration. The dated program version that will be used, the software or operating system, and the computer hardware configuration must be specified to be accepted by virtue of its history of use.

(b) The computer program's solutions to a series of test problems have been demonstrated to be substantially identical to those obtained by a similar, independently written program in the public domain. To justify the acceptance of the computer program the test problems should be demonstrated to be similar to or within the range of applicability for the problems analyzed by the computer program.

(c) The program's solutions to a series of test problems are substantially identical to those obtained by hand calculations or from accepted experimental test or analytical results published in technical literature. The test problems should be demonstrated to be similar to the problems analyzed to justify acceptance of the computer program.

C.7.7 Provide a summary comparison of the results obtained from each computer program with either the results derived from a similar program in the public domain, as used for C.7.6 (b) above, on a previously approved computer program or results from the test problems as used for C.7.6 (c) above. Include typical static and/or dynamic response loading, stress, etc. comparisons preferably in graphical form, as examples.

C.8 ASME Code Class 2 and 3 Components

C.8.1 Identify all design stress limits which allow inelastic deformation (or are comparable to the faulted design limits defined in ASME Section III for Class 1 components). Provide a brief description of the design procedures that will be used in such cases.

C.9 Components Not Covered by ASME Code

C.9.1 With respect to the stress limits used in the design of Core Support Structures for Faulted Conditions (Ref. Table C-9 in the PSAR), provide the criteria which will be used when an inelastic component analysis results in deformations which invalidate the corresponding elastic system dynamic analysis. As an alternative, verify that the stress limits in Table C-9 will be applied according to the requirements contained in the proposed Appendix F, "Rules for Evaluation of Faulted Conditions" to ASME Section III Code.

C.10 Seismic Design of Category I Instrumentation and Electrical Equipment

C.10.1 Clarify whether the seismic design criteria in Section C.7.1.4 are applicable to Category I electrical equipment as well as Category I mechanical equipment. Indicate the extent of compliance with the seismic qualification procedures and documentation requirements of IEEE Std. 344 1971.

C.10.2 Single-axis and multi-axes testing as well as random testing, sine beat testing, and continuous sinusoidal testing were all mentioned in Section C.7.1.4. Identify the conditions under which each type of testing input will be used.

C.10.3 Provide the analyses, testing procedures, and seismic restraint measures employed to establish the seismic design adequacy of Category I electrical equipment supports such as cable trays, battery racks, instrument racks, and control consoles under the conditions of possible seismic loading amplification of floors to which frames and racks that support electrical equipment are attached. Specify the criteria and verification procedure employed to account for the possible amplified design loads (frequency and amplitude) for vendor-supplied components.

C.11 Design of Reactor Coolant Pressure Boundary Components

C.11.1 The list of transients provided for components of the Reactor Coolant Pressure Boundary (RCPB) does not appear complete. Provide the information outlined in subsection 5.2.1 (5) of the proposed Standard Format and Content document, February, 1972, for RCPB components within the scope of PSAR Section C.7.

C.11.2 The information provided in the PSAR identifies only the active components of the reactor coolant system.* Provide a list of all active components of the Reactor Coolant Pressure Boundary.*

C.11.3 Provide the stress or deformation limits to be used for pumps and valves within the reactor coolant pressure boundary, under emergency and faulted conditions.

C.11.4 Identify all reactor coolant pressure boundary components whose design is based on experimental stress analyses (Appendix II of the ASME Code, Section III) and provide a summary of the analytical and experimental testing procedures to be used to demonstrate compliance with the code. Submit a brief description of the mathematical or test models to be used and the methods of calculations or tests.

C.11.5 The stress criteria for the design of Class 2 and 3 components is not definitive enough to allow evaluation (Section C.5.2.3, C.6.2, C.8.1 and Table C-19). Provide the following criteria:

a. Stress limits for active and inactive components that will be designed in accordance with the design by analysis procedures for upset and emergency operating condition categories of NB-3200. Include the faulted stress limits which will be used for components of the main steam and feedwater faulted load combination (N + SSE + DBA).

b. Pressure rating factors that will be used for active and inactive component designed in accordance with NC-3511, ND-3511 and the use of manufacturer's maximum pressure ratings for upset and emergency operating condition categories. Include the faulted factors which will be used for components of the main steam line and feedwater faulted loading combinations (N + SSE + DBA).

*SAR definition.

C.11.6 Provide the criteria that will be used for the faulted operating condition for dynamic system and component stress analysis.

C.11.7 Provide information which indicates that all codes and code cases shown in Table C-14, C-2a and C-2b to which components will be designed will meet 10 CFR 50.55 (a) with regard to editions, effective addenda and applicability of code case effective dates.

Certain code cases listed in the Tables are not acceptable. Among these are 1331, 1358, 1412, 1414, and 1423. Case 1514 may be used provided additional criteria provided in AEC 10 CFR 50 Appendix G (soon to be issued) are met. It is noted that many of the listed cases in the Tables have been annulled. Use of effective cases, current addenda and editions must meet 10 CFR 50.55 (a).

D.0 QUALITY ASSURANCE

D.1 Indicate the size of the Niagara Mohawk Power Corporation (NMPC) Quality Assurance (QA) staff for various stages of design and construction of Nine Mile Point-2 (NMP 2). Indicate the number of NMPC field QA personnel to be located at the jobsite and at NMPC Headquarters.

D.2 Section D.2.1 is too generalized as to the duties of the Manager of Quality Assurance and those of the NMPC QA staff. Provide a list of the specific duties of these persons.

D.3 Describe the qualifications required by NMPC for those personnel responsible for implementing the QA Programs in NMPC, Stone & Webster Engineering Corporation (S&W), and General Electric Company (GE).

D.4 Modify organizational charts Figs. D.2-1, D.3-1 and D.4-1 to more clearly indicate the lines and areas of responsibility, authority and communications within each company, and among NMPC, S&W, and GE. Include in associated discussion a clearer description of the communication and technical direction interfaces between NMPC, S&W and GE organizations, with special emphasis given to QA/QC interfaces.

D.5 Provide a tabular list of the principal titles of the QA procedures, policies, and instructions contained in the NMPC QA Manual and in the S&W and GE Manuals. Briefly summarize the purpose and content of these documents. List and discuss the purpose of any other QA manuals applicable to this project.

D.6 Describe how the NMPC QA Manual and those of S&W and GE are reviewed, approved, revised, distributed and controlled. Indicate how it is assured that the appropriate departments and organizations properly implement these documents.

D.7 Discuss in greater detail the scope and depth of design review and specification review performed by NMPC personnel and describe the nature of involvement of NMPC's QA/QC personnel in such review. Similarly, for S&W and GE describe the nature and extent of involvement of the QA/QC personnel from these companies during the design review, specification review, and procurement document review.

D.8 Describe the policy governing design review meetings and discuss the bases for deciding whether formal design review meetings are required. Describe the role of QA/QC personnel relative to participation in formal design reviews.

D.9 Does NMPC plan a hold or control point system for design review and calculation review. Describe the system as well as the nature of involvement of NMPC, S&W, and GE relative to the system.

D.10 Describe the policy and system for defining and identifying important design and other technical interfaces, and for controlling for adequacy at such interfaces.

D.11 Describe the policy in effect for resolving differences among contractors should these occur.

D.12 Describe the nature and extent of involvement of NMPC's QA in pre-bid award surveys, review of request-for-bid packages, determination of qualified suppliers, evaluation of bids, and post-bid debriefing sessions.

D.13 Discuss in greater detail than provided in D.2.11 the content of the Systems Test and Acceptance Guide.

D.14 Describe your system for communicating information concerning abnormal experiences at other facilities, including AEC's "Reactor Operating Experience Reports" (ROE's) and "Reactor Construction Experience Reports" (RCE's) to the appropriate design, construction and operating organizations and for assuring that the experience embodied in these reports are considered in the program efforts.

D.15 Provide additional information on NMPC's direct role relative to assuring acceptable fuel for this plant. Discuss in greater depth the quality assurance programs and quality control checks that are designed to assure the mechanical integrity of your fuel over its anticipated lifetime including the design review effort, review and audit of quality assurance measures, and your planned inspections of the fuel upon delivery. Indicate how your QA program with respect to fuel design and fabrication will minimize possible failures from clad hydriding, clad collapse and UO_2 - clad interaction. Describe the efforts to apply the principles and practices of statistical quality control, reliability, and other recognized good practice in this area.

D.16 Recent experience indicates that the bodies of valves and other cast components important to nuclear safety may have areas where the wall thickness may be less than the specified value. Describe the Quality Control Procedures that you have and are using to verify wall measurements to demonstrate that the components meet design requirements.

D.17 Describe the role and system of NMPC and that of GE and S&W in complying with AEC's Codes and Standards Rule and AEC's Deficiencies Reporting Rule.

D.18 Describe the procedural measures implemented by NMPC, GE, and S&W to assure that design drawings, specifications, and field changes are reviewed by QA/QC personnel. Describe the scope and depth of the review performed by QA/QC personnel. Does this review include the evaluation of design characteristics of changes made to determine whether they can be inspected and controlled?

D.19 Describe the system for keeping the as-built drawing file up-to-date.

D.20 Expand the discussion relative to "Control of Purchased Material, Equipment and Services" to address fully each element of Criterion VII of Appendix B to 10 CFR 50. Discussion should include source evaluation and selection, along with a discussion of the documentary evidence required at the site (prior to installation or use) to assure that delivered product conforms to procurement requirements.

D.21 Describe the role of the QA staff of NMPC, GE and S&W in assuring that adequate identification and control procedures are invoked to provide assurance that unacceptable items will not be incorporated into the plant.

D.22 With regard to "Test Control":

a. Describe the role of NMPC and its major contractors to assure that testing of materials, components, systems and assemblies at vendor and supplier shops are performed in accordance with documented and approved test procedures. What involvement do the QA personnel of NMPC and its major contractors have with the planning, including procedures, and implementation of these tests?

b. Provide flow diagrams to illustrate control exercised over test procedures for their preparation, review, approval, implementation, and for final review of test results.

D.23 With regard to "Control of Measuring and Test Equipment", describe the calibration policy, schedule, and system planned for the plant site during the construction phase. What is the role of the QA personnel relative to the calibration program? Provide examples of the known and widely accepted standards that will be implemented for the calibration of plant instrumentation.

D.24. With regard to "Nonconforming Material, Parts, and Components", describe the process for assuring timely notification of all affected parties of those cases where repair, rework, and/or reduction of requirements is anticipated. Describe the policies and steps established to assure that appropriate organizations evaluate discrepant and unacceptable materials or components and decide proper disposition.

D.25 Describe the organizational arrangements for evaluation, the membership and duties of review boards (if there are to be such), and the level of management which is to be made cognizant of the actions taken in this area.

D. 26 With regard to "Corrective Action", describe whether documented procedures exist to cover this area. Discuss the involvement of NMPC's line organizations, QA staff, and top management in the review and approval functions pertinent to corrective action measures.

D.27 With regard to "Records":

a. Summarize the records retention policy for both the construction and operational periods. Include by general category the duration of record retention and location of records. Indicate how NMPC will conform in all respects to Criterion XVII of Appendix B to 10 CFR 50.

b. Describe the system for ready identification and timely retrieval of those detailed information records which support the above records and which may be maintained by a contractor or subcontractor.

D.28 With regard to "Audits", describe the nature and extent of the audit program planned by NMPC and by S&W and GE during the design and construction phase. Describe the estimated frequency of audits over various home office and plant activities, and describe those audits which are to be performed by Committees versus those to be performed by NMPC Quality Assurance Group. Describe the audit reporting policy, followup responsibility, and provisions for review of audit reports by top management of NMPC.

D.29 Describe in greater detail the policy regarding, and nature of audits performed on vendors of safety-related components. Specifically, do these audits consist of audits of management systems, records, QA/QC manuals, processes, and activities?

D.30 Inasmuch as NMPC will also operate the Fitzpartick plant, indicate whether NMPC's QA/QC personnel for NMP 2 will also have duties with respect to the Fitzpartick plant. If so, describe the nature of the interface effort and the manpower allocations of the QA/QC staffs to preclude dilution of effort.