Dr. Robert C. Mecredy
Vice President, Nuclear Operations
Rochester Gas and Electric Corporation
89 East Avenue
Rochester, NY 14649

February 25, 1999

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE R.E. GINNA NUCLEAR POWER PLANT IPEEE SUBMITTAL (TAC NO. M83624)

Dear Dr. Mecredy:

Based on our ongoing review of the Ginna Individual Plant Examination of External Events (IPEEE) submittal, we have developed the enclosed request for additional information (RAI). The RAIs are related to the seismic and fire analyses in the IPEEE. There are no RAIs related to the high winds, floods, and other external events. The RAIs were developed by our contractors, Brookhaven National Laboratories and Sandia National Laboratories, and were reviewed by the "Senior Review Board" (SRB). The SRB is comprised of RES and NRR staff and RES consultants (Sandia National Laboratories) with probabilistic risk assessment expertise for external events.

The NRC review of the internal flooding analysis for Ginna, that is now due to be submitted in February, is being reviewed separately from the IPEEE review. Therefore, any RAIs associated with the internal flooding review will be transmitted separately.

A draft of this RAI was e-mailed to your staff on February 12, 1999, for the purpose of making a determination as to when you would be able to respond to the RAI. This was discussed with your staff on February 22, 1999, and considering the upcoming refueling outage and other activities within your organization, it was agreed that you could respond to this request within 120 days of the date of this letter.

Sincerely,
ORIGINAL SIGNED BY:

Guy S. Vissing, Senior Project Manager
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-244

Enclosure: RAIs

cc w/encl: See next page

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cc:

Peter D. Drysdale, Sr. Resident Inspector
R.E. Ginna Plant
U.S. Nuclear Regulatory Commission
1503 Lake Road
Ontario, NY 14519

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. F. William Valentino, President
New York State Energy, Research,
and Development Authority
Corporate Plaza West
286 Washington Avenue Extension
Albany, NY 12203-6399

Charles Donaldson, Esquire
Assistant Attorney General
New York Department of Lalw
120 Broadway
New York, NY 10271

Nicholas S. Reynolds
Winston & Strawn
1400 S Street N.W.
Washington, DC 20005-3502

Ms. Thelma Wideman, Director
Wayne County Emergency Management
Office
Wayne County Emergency Operations Center
7336 Route 31
Lyons, NY 14489

Ms. Mary Louise Meisenzahl
Administrator, Monroe County
Office of Emergency Preparedness
111 West Falls Road, Room 11
Rochester, NY 14620

Mr. Paul Eddy
New York State Department of
Public Service
3 Empire State Plaza, 10th Floor
Albany, NY 12223

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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Sincerely,

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Guy S. Vissing, Senior Project Manager
Project Directorate I-1
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Enclosure: RAIs

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REQUEST FOR ADDITIONAL INFORMATION ON

THE R.E. GINNA NUCLEAR POWER PLANT IPEEE SUBMITTAL

A. Seismic

1. The Ginna IPEEE submittal (Section 2 System Analysis) states that "Rather than performing a system analysis to define the scope of the review, this assessment includes all safety related components in the plant." Success path logical diagrams (SPLDs) and success paths as described in EPRI NP-6041 are not developed in the Ginna IPEEE.

   Of the equipment included for assessment, fifty two (52) items were identified in the. IPEEE process as "SMA Mechanical and Electrical Equipment Outliers." However, no further actions are planned for 38 of the 52 outliers that are not related to A-46 closeout. These 38 equipment outliers include those related to the safety injection (SI) system, the residual heat removal (RHR) system, and the component cooling water (CCW) system. The plant's ability to safely shutdown under small loss-of-coolant accident (LOCA) conditions may be questionable without these systems.

   Although the inclusion of all safety-related components seems to provide a bigger equipment list, it cannot provide the valuable insights a structured evaluation using success paths can provide. For example, the impact of the failure of the above systems cannot be assessed without the help of defined success paths.

   As stated in EPRI NP-6041, a primary purpose of a seismic margin review is to identify any "weak links" which might limit the plant's shutdown capability. The approach used in a margin review is to demonstrate that a reliable operational sequence exists to shutdown and maintain the plant in a safe shutdown condition for a minimum of 72 hours. To achieve this purpose, the establishment of a preferred and an alternative success path, with one capable of handling a small LOCA, are recommended in the Electric Power Research Institute (EPRI) margin method. According to NUREG-1407 (Section 3.2.5), the NRC panel that reviewed the EPRI methodology recommended that "a reasonably complete set of potential success paths be set down initially, rather than a very small number, since limiting the number of success paths too quickly can prevent the identification of some plant-level high confidence of low probability of failure (HCLPF) insights, and can mask plant differences regarding defense-in-depth." The development of success paths for plant evaluation is therefore an important part of the margin method. According to EPRI NP-6041, the selection of the success paths is a joint responsibility of the plant operators, system engineers, and seismic capability engineers.

   The Ginna USI A-46 report, that was submitted as part of the IPEEE submittal, shows a single success path. It includes the use of the chemical and volume control system (CVCS) for reactor coolant system (RCS) inventory control and secondary auxiliary feedwater (SAFW) for decay heat removal. Since this path may not be able to handle a small LOCA condition, another success path for a small LOCA condition needs to be established.

(a) *Please follow the method described in EPRI NP-6041 to develop a success path that can handle a small LOCA. Please identify the front line and support systems required for the four safety functions identified in the EPRI report (i.e., reactor reactivity control, RCS pressure control, RCS inventory control, and decay heat removal). Please identify and discuss any "weak links" in the success path (e.g., the impact of the Mechanical and Electrical Equipment Outliers, shown in Table 3 of the IPEEE submittal, on the success paths). Please describe the analysis performed in the Systematic Evaluation Program (SEP) for the systems that are weak links in the success path.*

(b) *Please address the non-seismic failure and human action issues associated with the success paths as requested in EPRI NP-6041 and Section 3.2.5.8 of NUREG-1407.*

2. For the success path selected for USI A-46, the auxiliary feedwater (AFW) source seems to be from the service water (SW) system. It is not clear whether there are condensate storage tanks associated with the AFW or the SAFW system and whether these tanks are included in the equipment list for seismic assessment.

   Please describe the seismic capabilities of these tanks if they are included in the list; or, if they are not included in the equipment list, describe the equipment, procedures, and operator actions required to assure proper isolation of these systems such that feedwater is not lost through failed tanks.

3. The Ginna IPEEE submittal described the seismic evaluation of the Ginna IPEEE program as being consistent with a reduced-scope evaluation via the Seismic Margins Methodology, in that all safety-related equipment was evaluated using the Gilbert SSE floor response spectra which were generated based on the 0.2g Regulatory Guide (RG) 1.60 spectrum ground input. In cases where an item of safety-related equipment was found to be rigid, the calculated factor of safety from its anchorage evaluation was reduced by 1.5 (equivalent to increasing the zero period acceleration (ZPA) from 0.2g to 0.3g). Furthermore, the submittal compared the 0.2g RG 1.60 spectrum with the 0.3g NUREG/CR-0098 spectrum for rock (the IPEEE seismic input designated for Ginna) and characterized the two spectra as being similar and differing by less than 20% for frequencies below 10 Hz. However, for frequencies higher than 10 Hz, the comparison shows that the 0.2g RG 1.60 spectrum decreases more rapidly relative to the 0.3g NUREG/CR-0098 spectrum with a difference between the two as much as 50%.

   To assist our evaluation, please provide the following information:

   (a) *A list of all equipment which was evaluated for seismic adequacy using the ZPA of the floor response spectra (i.e., assumed to be rigid) and reduced by 1.5 in the calculated factor of safety for IPEEE screening.*

(b) *A detailed quantitative discussion on how the seismic capacities (in terms of HCLPF) for the safety-related equipment items with frequencies between 10 Hz and the ZPA were determined.*

B. Fire

1. It is unclear how room-to-room fire scenarios were treated in the Ginna IPEEE analysis. Section 3.1 of the submittal indicates that fire areas were screened individually according to the FIVE (Reference 1) criteria (i.e, the area contains no Appendix R equipment, and a fire in the area would not cause a demand for safe shutdown). This section also indicates that fire compartments were further screened if they had no credible potential for fire spreading to other fire compartments. While the submittal indicates that the qualitative screening conformed with Phase I of the FIVE methodology, fire propagation potential between fire compartments is reviewed in the FIVE methodology during the Fire Compartment Interaction Analysis (FCIA). The submittal does not indicate that the FIVE FCIA criteria were used to determine if fire propagation between fire zones was possible.

   The submittal does provide qualitative criteria for grouping plant locations, but it is unclear that this approach has adequately treated room-to-room fire scenarios. One of the cited criteria indicates that plant locations were grouped together when a physical barrier (not necessarily fire-rated) separates the subject locations from the rest of the plant and there is a significant time delay for fire propagation from the subject locations to other adjacent locations. In addition, the submittal indicates that one consideration for determining the importance of a location was whether it contains a sufficient amount of combustible material that, if ignited, could potentially propagate to adjacent zones. The basis for making these judgments is not provided. Further, it is not clear that the analysis has adequately considered the potential that active fire barrier elements (e.g., normally open fire doors, ventilation dampers, etc) might fail to activate, or that passive fire barriers (e.g., various fire barriers both rated and unrated and barrier penetration seals) might be challenged by local concentrations of flammable materials. Finally, it is not clear that the analysis has considered the potential for the spread of smoke and heat from one compartment to another in addition to the consideration of actual fire spread.

   Please clarify the bases used to assess the potential for cross-zone spreading of fire, heat, and smoke. Please provide an analysis for all fire areas of the effect on fire-induced core damage frequency (CDF) that includes consideration of the failure potential of active barrier components such as doors and dampers. Please provide an analysis of the potential for cross-zone fire propagation for high hazard areas such as the turbine building, diesel generator room, switchgear rooms, and lube oil storage areas that includes consideration of the potential to challenge passive fire barrier elements.

2. The Ginna fire IPEEE submittal indicates that cable wrap was credited in the quantitative assessments, but the treatment that was given is not clear and may have led to "double counting" of suppression effectiveness. It is also not clear if this approach was used in the screening analyses as well. Section 3.3.4 (Assumption 2) indicates that "a probability of 0.15 was assigned to the failure of cable wrap to account for the probability that a fire is not suppressed within the one hour time frame associated with the fire rating of the cable wrap." This description implies that the

modeling of the cable wrap failure implicitly credits fire suppression in the quantitative screening of fire zones that contain the wrap. In the detailed fire PRA evaluations, an additional independent credit for fire suppression efforts would result in double counting suppression efforts.

Please indicate if fire suppression was credited in fire scenarios where cable wrap was independently credited as protecting critical cables. If there are any such scenarios, reevaluate the core damage frequency either (1) assuming that the 0.15 barrier failure probability fully credits suppression, or (2) assuming an independent suppression credit and that the cable wrap fails with a probability of 1.0 for all fires lasting greater than 1 hour.

3. The 19 fire zones remaining after the qualitative and quantitative screening phases of the Ginna fire assessment were subjected to further detailed evaluation including the analysis of fire propagation and suppression. Actual fire modeling using the FIVE methodology or other techniques was not performed. Instead, probabilities for fire propagation were assigned based primarily upon physical separation of equipment. However, it is not clear upon what basis these judgments were made.

For example, in the analysis of the Auxiliary Building Operating Level (ABO, Page 3-14) "a 0.01 probability was assigned that a fire occurring in the vicinity would disable both CCW pumps, and a 0.99 probability was assigned that one CCW pump, in addition to one AC power electrical division, would be disabled." It is not clear that this assumption is well founded. The submittal states the two CCW pumps are located within 9 feet of each other, and that there are cables in conduits in the area. Presumably, loss of the cables may lead to loss of the second pump. Further, the fact that the fire source appears to be the CCW pumps themselves, there would be a significant potential for large fires to occur. Given a large fire, 9 feet of spatial separation would likely not prevent thermal damage to the second pump, its power cables, or its control cables. This is one specific example where the assumed damage probabilities may be optimistic.

For other fire areas, from the description of fire scenarios presented in the submittal, it appears that fires that are not suppressed were assumed to damage all the equipment in a fire zone. If the fire was suppressed, some level of damage was assumed to occur, and it appears that in many cases suppressed fires were assumed to damage just one electrical division. The submittal states that this is conservative since for many fire scenarios only a portion of components relying on the electrical division would be disabled. In general, this approach is acceptable if the critical set of components and cables are relatively far apart, and therefore, it will take a long time for a fire to damage them. On the other hand, if the key cables and components are close together, critical damage may occur before successful suppression.

Please provide a general description of how the fire damage assumed for each of the fire scenarios considered in the detailed analyses was determined. Include a description of the criteria used to determine the radius of the damage caused by suppressed fires and the timing of component damage. Also indicate to what extent the actual location of critical cables and components was verified and

considered in the damage assessment. For suppressed fires, indicate if any time was assumed for the suppression of the fire and if this time impacted the assumed damage.

4. Transient combustible fires were not analyzed separately in the Ginna fire assessment. The submittal states that during the development of the fire frequencies, transient combustibles were grouped with the type of component that was primarily damaged by or exposed to the fire. Thus, the submittal states that the impact and consequences of transient combustible fires are accounted for in the modeled component fires, and no separate evaluation of transient fires was necessary.

   Based on the limited description in the submittal, it is unclear if the methodology accounts for transient fires at all critical locations in the plant. Specifically, it is unclear if a portion of the frequency of transient fires was accounted for in the evaluation of cable fires. Please provide a more detailed description of how the transient fire frequency was included in the analysis including a description of how the frequency was partitioned and the types of components assumed damaged or exposed to the transient fires. If cables were not in the list of components damaged or exposed to the transient fires, provide a separate assessment of transient-induced fire scenarios involving cables in the unscreened fire zones containing cables.

5. Two fire zones (IBN-1 and IBS-1) are identified in the submittal which are not listed as being either qualitatively or quantitatively screened. Since the results of a detailed fire PRA evaluation for these fire zones are also not given in the submittal, the importance of these two fire zones is unknown.

   Please indicate if these two fire zones were screened or subjected to a detailed fire scenario evaluation. Provide descriptions for any fire scenarios modeled for these fire zones and list the estimated core damage frequencies.

6. NUREG-1407 (Reference 2), Section 4.2 and Appendix C, and GL 88-20, Supplement 4 (Reference 3), request that documentation be submitted with the IPEEE submittal with regard to the FRSS (Reference 4) issues, including the basis and assumptions used to address these issues, and a discussion of the findings and conclusions. NUREG-1407 also requests that evaluation results and potential improvements be specifically highlighted. Control system interactions involving a combination of fire-induced failures and high probability random equipment failures were identified in the FRSS as potential contributors to fire risk.

   The issue of control systems interactions is associated primarily with the potential that a fire in the plant (e.g., the MCR) might lead to potential control systems vulnerabilities. Given a fire in the plant, the likely sources of control systems interactions are between the control room, the remote shutdown panel, and shutdown systems. Specific areas that have been identified as requiring attention in the resolution of this issue include:

   (a) Electrical independence of the remote shutdown control systems: The primary concern of control systems interactions occurs at plants that do not provide independent remote shutdown control systems. The electrical independence of the remote shutdown panel and the evaluation of the level of indication and control of remote shutdown control and monitoring circuits need to be assessed.

(b) Loss of control equipment or power before transfer: The potential for loss of control power for certain control circuits as a result of hot shorts and/or blown fuses before transferring control from the MCR to remote shutdown locations needs to be assessed.

(c) Spurious actuation of components leading to component damage, loss-of-coolant accident (LOCA), or interfacing systems LOCA: The spurious actuation of one or more safety-related to safe-shutdown-related components as a result of fire-induced cable faults, hot shorts, or component failures leading to component damage, LOCA, or interfacing systems LOCA, prior to taking control from the remote shutdown panel, needs to be assessed. This assessment also needs to include the spurious starting and running of pumps as well as the spurious repositioning of valves. It does appear that the assessment has included this aspect of the concern.

(d) Total loss of system function: The potential for total loss of system function as a result of fire-induced redundant component failures or electrical distribution system (power source) failure needs to be addressed.

Please describe your remote shutdown capability, including the nature and location of the shutdown station(s), as well as the types of control actions which can be taken from the remote panel(s). Describe how your procedures provide for transfer of control to the remote shutdown station(s). Provide an evaluation of whether loss of control power could occur prior to transferring control to the remote shutdown location and identify the risk contribution of these types of failures (if these failures are screened, please provide the basis for the screening).

7. The submittal indicates that the "automatic fire detection and suppression systems at Ginna were assumed to be installed per design specifications, following the National Fire Protection Association (NFPA) and NRC guidelines." The submittal also states that fire protection systems were assumed to be maintained regularly and that generic failure rates were used in the analysis. It is not clear that these assumptions were verified.

   Please verify that the automatic fire suppression systems at Ginna are, in fact, designed and maintained according to NFPA standards.

8. The Ginna fire IPEEE submittal identifies one plant improvement planned for implementation and five additional plant modifications that were being considered. It is not clear if these improvements and modification were credited in the analysis, and whether or not the changes have been, or will be, implemented.

Please provide the current status of these planned and proposed plant modifications and indicate whether or not the changes have been credited in the analysis.

9. Both manual actuation of automatic fire suppression systems and manual fire suppression were modeled for selected fire scenarios in the Ginna fire assessment. In some scenarios, failure of automatic fire suppression, failure to manually initiate automatic suppression systems, and failure to manually suppress the fire were modeled. The submittal does not address the potential for dependent failure of both automatic and manual suppression systems (e.g., common mode failures related to a common water source).

   Please indicate if dependent failures between the automatic and manual suppression systems were considered in the assignment of the suppression probabilities. Also indicate if dependencies between the failure of personnel to manually initiate an automatic suppression system and failure of personnel to manually suppress a fire were considered. Indicate if dependent failures that would cause the failure of an automatic suppression system to actuate and also prevent manually initiating the system were considered in the analysis.

References

1. EPRI, "Fire-Induced Vulnerability Evaluation (FIVE) ," EPRI TR-100370, April 1992.

2. J. Chen, et al., "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities," NUREG-1407, United States Nuclear Regulatory Commission, June 1991.

3. "Independent Plant Examination for External Events (IPEEE) for Severe Accident Vulnerabilities - 10CFR 50.54(f)," Generic Letter 88-20, Supplement No. 4, United States Nuclear Regulatory Commission, June 1991.

4. J. Lambright, et al., "Fire Risk Scoping Study: Investigation of Nuclear Power Plant Fire Risk, Including Previously Unaddressed Issues," NUREG/CR-5508, prepared for the United States Nuclear Regulatory Commission, January 1989.