UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RE: ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT IMPORTANT TO SAFETY

YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-29

1.0 INTRODUCTION

Equipment which is used to perform a necessary safety function must be demonstrated to be capable of maintaining functional operability under all service conditions postulated to occur during its installed life for the time it is required to operate. This requirement, which is embodied in General Design Criteria (GDC) 1 and 4 of Appendix A and Sections III, XI, and XVII of Appendix B to 10 CFR Part 50, is applicable to equipment located inside as well as outside containment. More detailed requirements and guidance relating to the methods and procedures for demonstrating this capability for electrical equipment have been set forth in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment" (which supplements IEEE Standard 323 and various NRC Regulatory Guides and industry standards), and "Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors" (DOR Guidelines).

2.0 BACKGROUND

On February 8, 1979, the NRC Office of Inspection and Enforcement (IE) issued to all licensees of operating plants (except those included in the systematic evaluation program (SEP)) IE Bulletin (IEB) 79-01, "Environmental Qualification of Class 1E Equipment." This Bulletin, together with IE Circular 78-08 (issued on May 31, 1978), required the licensees to perform reviews to assess the adequacy of their environmental qualification programs.

On January 14, 1980, NRC issued IEB 79-01B which included the DOR Guidelines and NUREG-0588 as attachments 4 and 5, respectively. Subsequently, on May 23, 1980, Commission Memorandum and Order CLI-80-21 was issued and stated that the DOR Guidelines and portions of NUREG-0588 form the requirements that licensees must meet regarding environmental qualification of safety-related electrical equipment in order to satisfy those aspects of 10 CFR Part 50, Appendix A, GDC 4. Supplements to IEB 79-01B were issued for further clarification and definition of the staff's needs. These supplements were issued on February 29, September 30, and October 24, 1980.

In addition, the staff issued orders dated August 29, 1980 (amended in September 1980) and October 24, 1980 to all licensees. The August order required that the licensees provide a report, by November 1, 1980, documenting the qualification of safety-related electrical equipment. The October order required the establishment of a central file location for the maintenance of all equipment qualification records. The central file was mandated to be established by December 1, 1980. The staff subsequently issued a Safety Evaluation Report (SER) on environmental qualification of safety-related electrical equipment to Yankee Atomic Electric Company (the licensee) on April 20, 1981. This SER directed the licensee to "either provide documentation of the missing qualification information which demonstrates that safety-related equipment meets the DOR Guidelines or NUREG-0588 requirements or commit to a corrective action (requalification, replacement, etc.)." The licensee was required to respond to NRC within 90 days of receipt of the SER. In response to the staff SER issued in 1981, the licensee submitted additional information regarding the qualification of safety-related electrical equipment. This information was evaluated for the staff by Franklin Research Center (FRC) in order to: 1) identify all cases where the licensee's response did not resolve the significant qualification issues, 2) evaluate the licensee's qualification documentation in accordance with established criteria to determine which equipment had adequate documentation and which did not, and 3) evaluate the licensee's qualification documentation for safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. A Technical Evaluation Report (TER) was issued by FRC on May 28, 1982. A Safety Evaluation Report was subsequently issued to Yankee Atomic Electric Company on December 16, 1982 with the FRC TER as an attachment.

A final rule on environmental qualification of electric equipment important to safety for nuclear power plants became effective on February 22, 1983. This rule, Section 50.49 of 10 CFR Part 50, specifies the requirements to be met for demonstrating the environmental qualification of electrical equipment important to safety located in a harsh environment. In accordance with this rule, equipment for Yankee may be qualified to the criteria specified in either the DOR Guidelines or NUREG-0588, except for replacement equipment. Replacement equipment installed subsequent to February 22, 1983 must be qualified in accordance with the provisions of 10 CFR 50.49, using the guidance of Regulatory Guide 1.89, unless there are sound reasons to the contrary.

A meeting was held with each licensee of plants for which a TER had been prepared for the staff by FRC in order to discuss all remaining open issues regarding environmental qualification, including acceptability of the environmental conditions for equipment qualification purposes, if this issue had not yet been resolved. On January 17, 1984, a meeting was held to discuss Yankee's proposed method to resolve the environmental qualification deficiencies identified in the December 16, 1982 SER and May 28, 1982 FRC TER. Discussions also included Yankee Atomic Electric Company's general methodology for compliance with 10 CFR 50.49, and justification for continued operation for those equipment items for which environmental qualification is not yet completed. The minutes of the meeting and proposed method of resolution for each of the environmental qualification deficiencies are documented in the March 5, April 5, and July 16, 1984 submittals from the licensee.

3.0 EVALUATION

The evaluation of the acceptability of the licensee's electrical equipment environmental qualification program is based on the results of an audit review performed by the staff of: (1) the licensee's proposed resolutions of the environmental qualification deficiencies identified in the December 16, 1982 SER and May 28, 1982 FRC TER; (2) compliance with the requirements of 10 CFR 50.49; and (3) justification for continued operation (JCO) for those equipment items for which the environmental qualification is not yet completed.

3.1 Proposed Resolutions of Identified Deficiencies

The proposed resolutions for the equipment environmental qualification deficiencies, identified in the December 16, 1982 SER, and the FRC TER enclosed with it, are described in the licensee's March 5, April 5, and July 16, 1984 submittals. During the January 17, 1984 meeting with the licensee, the staff discussed the proposed resolution of each deficiency for each equipment item identified in the FRC TER and found the licensee's approach for resolving the identified environmental qualification deficiencies acceptable. The majority of deficiencies identified were documentation, similarity, aging, qualified life and replacement schedule. All open items identified in the SER dated December 16, 1982 were also discussed and the resolution of these items has been found acceptable by the staff with the exception of the inside and outside containment (vapor container) pressure/temperature service conditions.

3.1.1 Pressure/Temperature Profiles Inside Containment

In its April 5, 1984 letter, the licensee submitted an analysis of the containment temperature response following a LOCA. This analysis is a reconstruction of the worst case LOCA analysis presented in the Integrated Plant Safety Assessment Report (IPSAR) and was done to show the impact of using more realistic assumptions on the containment temperature response. As a result of our review, we noted that the method of calculating the effective outside heat transfer coefficient (OHTC) was not sufficiently conservative. The licensee submitted a reanalysis in its December 7, 1984 letter taking into account our concern.

The licensee used the CONTEMPT-LT/026 computer code for the analyses presented in its May 5 and December 7, 1984 letters. By matching the results of a calculation in the IPSAR the licensee demonstrated the acceptability of using CONTEMPT-LT/026, even though it is a slightly different version of the CONTEMPT-LT code used by the staff, which is CONTEMPT-LT/028. The IPSAR provides the staff's Safety Evaluation Report on SEP Topics VI-2.D and VI-3. The containment temperature profile calculated by the staff is presented in Figure 1 of the licensee's December 7, 1984 letter (attached to this evaluation), and is labeled "LLL".

The licensee used the mass and energy release data from the IPSAR and modeled condensing heat transfer to passive heat sinks inside containment in accordance with the guidance in NUREG-0588. We find the licensee's approach acceptable.

The major differences between the licensee's analyses for environmental qualification and that presented in the IPSAR are in the internal representation of heat sinks and the value of OHTC used to calculate heat loss to the atmosphere. The licensee presented a more detailed listing of the internal heat sinks that are actually available in the containment. They include concrete walls, major structural steel, deck plate and grating, reactor cavity liner steel, and crane and support columns. Based on our review of this information, we concur with the licensee that the heat sink listing is appropriate for use in containment analysis.

The Yankee containment does not have active heat removal systems, such as containment sprays and fan coolers, to remove energy from the containment. Heat transfer that occurs across the containment boundary to the atmosphere is the only means available for post-LOCA energy removal from the containment. The licensee has shown that radiant heat transfer from the containment structure is an important factor in assessing the containment temperature response. In the IPSAR, radiant heat transfer was neglected for conservatism; however, its contribution to overall heat transfer from the containment structure can be significant. In its April 5, 1984 letter, the licensee calculated an effective outside heat transfer coefficient of 3.2 Btu/hr-ft^2-°F for an assumed surface temperature of 180°F. In our review, we found that the methodology used to calculate radiant heat transfer was not sufficiently conservative. Therefore, the licensee revised its calculation of radiant heat transfer to include radiation emitted from the containment surface, direct solar radiation, indirect solar radiation, and terrestrial radiation from the surroundings. From a parametric study involving a range of containment surface temperature, outside air temperature and view factor for terrestrial radiation, the licensee calculated an effective OHTC of 2.08 Btu/hr-ft^2-°F. Using this OHTC value, along with the 1979 ANS decay heat rates without the 2-sigma uncertainty, the revised heat sinks in its April 5, 1984 letter, the mass and energy release data in the IPSAR, the computer code CONTEMPT-LT/026, the licensee calculated a containment Case 1. The licensee proposes to use this temperature profile for equipment qualification.

We have evaluated the licensee's overall containment analysis, including assumptions, methodology, and input data. Based on our evaluation of the information presented in the licensee's April 5 and December 7, 1984 letters, we find the proposed temperature profile acceptable for use in equipment qualification.

3.1.2 Pressure/Temperature Profiles Outside Containment

The staff has reviewed the licensee's submittals relating to environmental qualification of equipment outside of containment. The licensee has evaluated the effect or equipment of breaks outside of containment in the following systems:

1. Charging/letdown system,
2. Main feedwater,
3. Main steam system,
4. Steam generator blowdown system, and
5. Steam heating system.

The plant is required to demonstrate environmental qualification of electrical equipment required to attain and maintain hot shutdown. A discussion of the staff's review and conclusions regarding those results are provided below:

3.1.2.1 Charging/Letdown Line Breaks

The licensee reported that the charging line contains fluid at a nominal operating temperature of 120°F; the charging flow rate is normally 20 to 30 gpm. The charging pumps are positive displacement pumps so that flow would increase only slightly in the event of a charging line break. Further, the licensee stated that the temperature of the fluid in the letdown line is 150°F with flow equivalent to that of the charging pumps.

The licensee stated that a charging line break could adversely affect only the hot leg injection valves and the three charging pumps. Therefore, one of the three low pressure and high pressure safety injection (LPSI and HPSI) pump trains, and one of the two motor driven emergency feedwater (EFW) pumps, in other areas, could be used to shut down the plant. While proceeding to shutdown, one of the eight full-capacity groups of pressurizer heaters could be connected to the emergency power system in order to provide for control of pressure in the primary system in the event all three charging pumps are disabled. Once the system pressure is reduced from the operating pressure of 2000 psig to below approximately 1560 psig, the HPSI/LPSI ECCS trains can begin to inject water into the primary system and can continue this throughout the cooling process until hot shutdown is achieved. Therefore, single active failure of a safety injection train, or of a motor-driven EFW pump train or of a full capacity group of pressurizer heaters will not affect the ability of the plant to achieve hot shutdown. We find this to be acceptable.

3.1.2.2 Main Feedwater System Breaks

A main feedwater line break outside of the turbine building and not within another building will not produce a harsh environment nor affect equipment required to mitigate this accident.

A main feedwater line break inside the turbine building (TB) may affect EFW flow indication equipment. However, flow can be determined, indirectly, by observation and maintenance of level in the steam generators. Further, a main feedwater line break, either inside or outside of the TB may be mitigated by means of one of the two motor-driven EFW pumps which are located in a separate area, the primary auxiliary building (PAB). The feedwater provided is taken from the demineralized water storage tank with an alternate supply from the primary water storage tank. The EFW may be supplied via the normal feedlines, or alternatively, via the steam generator blowdown lines. The charging pumps may be connected to emergency power by remote manual operation of

circuit breakers. Therefore, even with a single active failure at least two of the three charging pump trains may be employed to maintain the level of the water in the primary system. The HPSI/LPSI pump trains may be used for this purpose once the primary system pressure has been reduced from the operating value (2000 psig) to a value below 1560 psig. Therefore, a single active failure, consisting either of a loss of a charging pump train or safety injection pump train or EFW pump train will not affect the ability of the plant to achieve hot shutdown. We find this to be acceptable.

3.1.2.3 Main Steam Line Breaks

A steam line break has the same results as a feedwater line break and is mitigated in similar fashion. We find this to be acceptable.

3.1.2.4 Steam Generator Blowdown Line /Breaks

A steam generator blowdown line break will result in slow blowdown of one steam generator into the nonshielded portion of the PAB. The resultant harsh environment may adversely affect the two motor-driven EFW pump trains and two of the three charging pumps, leaving one charging pump, the three HPSI/LPSI trains and the emergency boiler feed pump (EBFP) available to shut the plant down. A single failure may eliminate either the remaining charging pump, the EBFP or one HPSI/LPSI train. Loss of the charging pump in accordance with the single failure criterion would require use of the eight groups of pressurizer heaters and a HPSI/LPSI train for pressure control and maintenance of primary system water level. Loss of the EBFP in accordance with the single failure criterion would require EFW supply by a HPSI/LPSI train, while loss of one HPSI/LPSI train would have no effect whatsoever, since two HPSI/LPSI trains would still be available. We find this to be acceptable.

3.1.2.5. Steam Heating Line Breaks

(A) The licensee stated that steam heating line breaks in the PAB or in the switchgear room (SWGR) in the TB would not cause the reactor or the turbine to trip nor cause actuation of the reactor protection system. Therefore, in accordance with the provisions of Paragraph B.3.b(1) of BTP ASB 3-1 of Standard Review Plan (SRP) Section 3.6.1, "Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment" we conclude that offsite power is not assumed to be unavailable for shutdown in the event of steam heating line failures in these areas. In such cases, shutdown may be effected by use of normal equipment such as main feedwater system, condensate system, turbine generator bypass and other nonsafety-related systems. However, for breaks in steam heating lines in the PAB and SWGR, the following analyses show that hot shutdown may be attained and maintained with safety-related equipment with the exception of the pressurizer heaters which have been found acceptable for use in plant shutdown.

(1) In the Primary Auxiliary Building

A steam heating line failure in the shielded portion of the PAB could disable the three charging pumps, leaving the two emergency motor-driven feedwater pumps, the EBFP and three HPSI/LPSI trains available for use in bringing the plant to hot shutdown.

Primary system pressure control may be effected by maintaining one full capacity group of pressurizer heaters on the offsite or onsite power source, as desired when the primary system is at a pressure in excess of the shutoff head of a HPSI/LPSI train. One HPSI/LPSI train can be employed to maintain primary system water level and pressure once the pressure has been reduced to below 1560 psig. EFW may be provided by one of the three EFW pumps. Single active failure of either one of the three HPSI/LPSI trains, or one of the three EFW trains or even of one group of pressurizer heaters would not compromise the ability of the plant to attain hot shutdown (there are a total of eight groups of pressurizer heaters available for pressure control).

A steam heating line failure in the nonshielded portion is bounded by the effect of a steam generator blowdown line break cited above in section 3.1.2.4.

We find the results of a steam heating line break either in the shielded or unshielded portion of the PAB to be acceptable.

(2) In the Turbine Building (TB)

(a) Switchgear Room

The only location in the TB with steam heating lines in which a mild environment has to be maintained is the SWGR. The SWGR contains two unit heaters, each supplied by a 1 inch steam line. The licensee noted that only a slight rise in temperature and humidity would occur in the SWGR, even if one steam line did rupture. This conclusion was based upon the assumption that the independent SWGR ventilation system, consisting of a 30,000 CFM fan located in an adjacent equipment room, would continue to operate. In addition, the licensee installed an excess flow check valve in each steam supply line, in order to prevent a break of this sort from adversely affecting the SWGR environment. Moreover, in accordance with the provisions of paragraph 3 of appendix B to BTP ASB 3-1, breaks in lines 1 inch in diameter (nominal size) and smaller do not need to be considered in the spectra of possible line breaks.

In view of the foregoing, we find the effects of a steam heating line break in the SWGR to be acceptable.

(b) Other Areas in the Turbine Building

Other areas of the TB contain steam heating lines; these areas also contain main steam and/or main feedwater lines. Breaks in main steam and main feedwater lines bound those in steam heating lines and, therefore, the analyses of the effects of the steam heating lines in those areas are not required.

We find the results of a steam heating line break in other areas (i.e., areas other than the SWGR which was discussed previously) of the TB to be acceptable.

(B) In the Diesel Generator Building

In a September 26, 1985 letter, the licensee stated that a steam heating line break in the Diesel Generator Building (DGB) could lead to an automatic plant trip. In accordance with the provisions of SRP section 3.6.1, the staff assumes in its analysis that a loss of offsite power occurs in conjunction with a single active failure. These conservative assumptions for this event could result in loss of the three 480 Volt emergency buses (including safety injection), the non-emergency 480 Volt and 2400 Volt non-emergency buses, due to the assumed loss of offsite power, and the steam-driven auxiliary feedwater pump due to the assumed single active failure.

To mitigate the consequences of this postulated scenario, Yankee committed in its September 26, 1985 letter to install excess flow check valves in the steam heating lines to the DGB. This action does not in itself provide the assurance required to provide protection for this postulated event, since the valves to be installed, and the steam heating lines themselves are not safety-related equipment.

To provide assurance of plant safety for this postulated event, two additional features of the Yankee plant provide additional defense in depth. The first is the stability of the grid around the Yankee site. In its 25 years of operation, all offsite power has been lost only once. This was November 8, 1965, during the Northeast blackout. This history provides an extremely high reliability figure for the offsite power system.

A second feature is the Safe Shutdown System (SSS) that provides a dedicated shutdown system for Appendix R concerns (fire protection) and alternate shutdown capability for seismic and tornado concerns under the SEP. NUREG-0825, "Integrated Plant Safety Assessment, Systematic Evaluation Program, Yankee Nuclear Power Station" dated June 1983, provides the following description of the SSS:

"The function of the Hot Shutdown System (HSS) is to remove decay heat and maintain primary inventory following any event that disables all other means of performing these functions. In order to remove decay heat, the HSS must have the capability to add feedwater to at least one steam generator, and to vent steam to the atmosphere from the same steam generator. The HSS will have the capability to remove decay heat from all four (4) steam generators even though only one (1) is required. In order to maintain primary inventory, the HSS must have the capability to add water to the primary system.

"Prior to placing the HSS into operation, the following events are assumed to have occurred:

1. initiating event, i.e., seismic or tornado,
2. reactor shutdown or scram, and all control rods inserted,
3. reactor coolant pressure boundary and secondary heat sink boundary have been established,
4. a loss of all off-site and on-site AC power has occurred or been caused,
5. all other means of adding water to the steam generators and primary system have been rendered inoperable.

"Following this series of events, the HSS is manually placed into operation.

"DESIGN BASES ASSUMPTIONS

1. System is designed to remain functional and operational after a seismic event.
2. System is adequately protected against tornado wind loadings and postulated missiles.
3. System must be operable within 30 minutes following the event which disables all other cooling systems.
4. System must be capable of operating for three (3) days without bringing in additional makeup water or diesel fuel.
5. System designed to supply 200 gpm at 1200 psig (see Note 1); 150 gpm to the steam generators and 50 gpm to the primary system.
6. System is independent of all other systems except the fire system (fire tank water supply), the reactor coolant pressure boundary and the secondary heat sink pressure boundary.
7. Single failure criteria does not apply since multiple failures have already been assumed."

The HSS has a dedicated diesel generator which provides electrical power to dedicated primary and secondary makeup pumps. Water is taken from the fire water storage tank, and is pumped through independent, seismically qualified piping. Primary makeup ties into the normal charging piping for loop 4. Secondary makeup is piped to the blowdown piping to provide makeup for any or all steam generators.

In the staff's judgement, the use of excess flow check valves, the proven stability of the Yankee grid, and the SSS provide adequate assurance that the Yankee plant can be safely shut down for a postulated steam heating line break in the DGB.

Therefore, we find acceptable the effect of steam heating line breaks in the PAB, DGB, and TB.

3.2 Discussion and Conclusions

In this review, the licensee is not required to protect cold shutdown equipment nor to attain cold shutdown. Therefore, only equipment needed to attain and maintain hot shutdown has been considered. In addition, it is noted that Yankee Atomic Electric Company had the option of either qualifying the equipment required for hot shutdown to conform with the environment resulting from a high energy line break in the area surrounding the equipment or to show that the equipment affected by such a line break is not required in bringing the plant to hot shutdown. The licensee chose the latter course.

We have reviewed the licensee's submittals and concluded that the licensee is able to attain and maintain hot shutdown for high energy line breaks outside containment, as noted in the discussion in the sections above. The licensee's approach to identifying the equipment required to be environmentally qualified is acceptable.

3.3 Other Identified Deficiencies

The approach described by the licensee for addressing and resolving the other deficiencies identified in the December 16, 1982 SER includes replacing equipment, performing additional analyses, utilizing additional qualification documentation beyond that reviewed by FRC, obtaining additional qualification documentation and exempting some equipment from qualification, e.g., located in the mild environment. We discussed the proposed resolutions in detail on an item by item basis with the licensee during the January 17, 1984 meeting. Replacing or exempting equipment, for an acceptable reason, are clearly acceptable methods for resolving environmental qualification deficiencies. The more lengthy discussions with the licensee concerned the use of additional analyses and documentation. Although we did not review the additional analyses or documentation, we discussed how the analysis was being used to resolve deficiencies identified in the FRC TER and the content of the additional documentation in order to determine the acceptability of these methods. The licensee's equipment environmental qualification files will be audited by the staff during follow-up inspections to be performed by Region I, with assistance from IE Headquarters and NRR staff as necessary. Since a significant amount of documentation has already been reviewed by the staff and FRC, the primary objective of the file audit will be to verify that it contains the appropriate analyses and other necessary documentation to support the licensee's conclusion that the equipment is

qualified. The inspections will verify that that licensee's program for surveillance and maintenance of environmentally qualified equipment is adequate to assure that this equipment is maintained in the as-analyzed or tested condition. The method used for tracking periodic replacement parts, and implementation of the licensee's commitments and actions, e.g., regarding replacement of equipment, will also be verified.

Based on our discussions with the licensee and our review of its submittal, we find the licensee's approach for resolving the identified environmental qualification deficiencies acceptable.

3.4 Compliance With 10 CFR 50.49

In its March 5, and July 16, 1984 submittals, the licensee has described the approach used to identify equipment within the scope of paragraph (b)(1) of 10 CFR 50.49, safety-related equipment relied upon to remain functional during the following design basis events. The licensee states that flooding and environmental effects resulting from all postulated design-basis events documented in the Yankee Final Hazards Summary Report including loss of coolant accidents and main steam line breaks inside containment (vapor container) and high energy line breaks outside containment were reviewed in the identification of safety-related electrical equipment which was to be environmentally qualified. The flooding and environmental effects resulting from high-energy line breaks (HELB) outside containment were also considered in the identification of this equipment. Therefore, all design basis events including accidents at Yankee were considered in the identification of electrical equipment within the scope of paragraph (b)(1) of 10 CFR 50.49.

The licensee's approach for identifying equipment within the scope of paragraph (b)(1) is in accordance with the requirements of that paragraph, and therefore acceptable.

The method used by the licensee for identification of electrical equipment within the scope of paragraph (b)(2) of 10 CFR 50.49, nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, is summarized below:

1. A list was generated of safety-related electric equipment as defined in paragraph (b)(1) of 10 CFR 50.49 required to remain functional during or following design-basis events such as loss of coolant accidents and main steam line breaks inside containment and HELB outside containment. A system analysis was performed to identify the set of electrical equipment which the system required in order to perform its design basis safety function. The list was based on reviews of Technical Specifications, Emergency Operating Procedures, Plant Piping and Instrumentation Drawings (P&ID), the Final Hazards Summary Report for Yankee, and schematics and electrical one line diagrams and control logic diagrams; and

2. The elementary wiring diagrams of the safety-related electrical equipment identified in Step 1 were reviewed to identify any auxiliary devices electrically connected directly into the control or power circuitry of the safety-related equipment (e.g., automatic trips) whose failure due to postulated environmental conditions could prevent the required operation of the safety-related equipment; and

3. The operation of the safety-related systems and equipment were reviewed to identify any directly mechanically connected auxiliary systems with electrical components which are necessary for the required operation of the safety-related equipment (e.g., cooling water or lubricating systems). This involved the review of P&ID, component technical manuals, and/or systems descriptions in the Final Hazards Summary Report; and

4. Nonsafety-related electrical circuits indirectly associated with the electrical equipment identified in Step 1 by common power supply or physical proximity were considered by a review of the original electrical design including the use of applicable industry standards (e.g., IEEE, NEMA, ANSI, UL, and NEC) and the use of properly coordinated protective relays, circuit breakers, and fuses for electrical fault protection.

The licensee states that the results of the above review indicated that no additional electrical equipment was identified which was not previously included on the "Master List." Therefore, the list of electrical equipment provided in its March 5, 1984 submittal is judged by the licensee to address all electrical equipment within the scope of paragraph (b)(2) of 10 CFR 50.49.

We find the methodology used by the licensee is acceptable since it provides reasonable assurance that equipment within the scope of paragraph (b)(2) of 10 CFR 50.49 has been identified.

With regard to paragraph (b)(3) of 10 CFR 50.49, the licensee evaluated existing system arrangements and identified equipment for the five types of variables defined in Regulatory Guide (RG) 1.97, Rev. 3. A report outlining the results of the review, schedules for modifications where necessary, and justification of deviations not requiring modifications has been submitted to the NRC for approval. Since the report dealing with RG 1.97 instrumentation is still under review by the staff, some of the equipment identified in the report has not been added to the 10 CFR 50.49 scope. However, some of the equipment items jointly within the scope of NUREG-0737 and RG 1.97 have been included in the 10 CFR 50.49 scope. When the RG 1.97 report and equipment lists contained therein have been finalized and accepted by the staff, appropriate equipment not already in the 10 CFR 50.49 scope will be added in accordance with the RG 1.97 implementation schedule.

We find the licensee's approach to identifying equipment within the scope of paragraph (b)(3) of 10 CFR 50.49 acceptable since it is in accordance with the requirements of that paragraph.

4.0 CONCLUSIONS

Based on the above evaluation, we conclude the following with regard to the qualification of electric equipment important to safety within the scope of 10 CFR 50.49.

- Yankee Atomic Electric Company's electrical equipment environmental qualification program complies with the requirements of 10 CFR 50.49.

- The proposed resolutions for each of the environmental qualification deficiencies identified in the December 16, 1982 SER and FRC TER are acceptable.

5.0 ACKNOWLEDGEMENTS

This SE was prepared by P. Shemanski, C. Y. Li, N. Wagner and J. Clifford.

Dated:

Figure 1 of YAEC letter December 7, 1984
Containment Analysis Temperature Results
(SR No. 84-139)