UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

FEB 02 1994

Mr. Eric Strader
930 Roseland
Kalamazoo, Michigan 49001

Dear Mr. Strader:

In your letter to the Nuclear Regulatory Commission (NRC) of January 10, 1994, you expressed concerns about the ability of safety systems to function during accident conditions. In particular, you made reference to Information Notices 92-81 and 93-33 pertaining to environmental qualification of electric cables and to Generic Letter 89-10 pertaining to operation of safety-related motor-operated valves (MOVs), and you questioned actions being taken by the NRC to address problems that have been identified in these areas.

First, in the way of background information, the NRC communicates information to the owners and operators of commercial nuclear power plants (otherwise known as licensees) in several ways. Information notices (INs) are issued to inform licensees of new developments or events that may be relevant to operating reactors and that could have a negative impact on plant safety. The information contained in an IN is not necessarily applicable to all plants, and the information is often very preliminary and may require further research or review by the NRC. An IN can usually be issued within a couple of weeks. When the NRC determines that specific actions are required by many (or all) licensees to address a particular issue, a generic letter (GL) or a bulletin is typically issued. For example, a GL could be used to resolve an issue that was initially discussed in an IN if the NRC determines that licensees need to take specific actions. Issuing a GL is quite a lengthy and involved process, normally taking 12 to 18 months. When licensee actions are more urgently required, the NRC will issue an emergency bulletin or an emergency generic letter in a few days.

The NRC's specific requirements for environmental qualification of electric equipment are stated in Title 10 of the Code of Federal Regulations, Section 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants" (see enclosure). With regard to electric equipment in general, the NRC requires that accident mitigating equipment that must function in a harsh environment following an accident be "qualified" for the harsh environment that is postulated. The equipment qualification process involves type testing of the component to be qualified which includes preaging, radiation exposure, and exposure to the postulated environmental conditions (temperature, pressure, humidity, chemical spray, etc). Preaging is exposing the equipment to a high-temperature environment for a calculated period of time, based on the currently accepted model for aging of electric equipment. The ability of the component to function during this type testing process forms the basis for equipment qualification. Type testing that does not identically model the postulated environment or the equipment to be qualified must be accompanied by a rigorous analysis that fully establishes equipment qualification. The NRC has performed detailed inspections at each

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of the operating commercial nuclear power plants to ensure that the equipment qualification requirements have been properly implemented.

In environmental qualification testing, the actual component to be used in the plant is not tested. The testing involves severe temperatures and pressures which could degrade the equipment by the end of the test, making it unsuitable for installation in a plant, even if it passes the qualification test. New equipment of the same manufacturer and model number is used in the plant. Quality assurance requirements ensure that the components installed are the same as the component tested.

The Sandia National Laboratories (SNL) tests discussed in Information Notices 92-81 and 93-33 indicate that some components that are relied upon during a design-basis event may not remain functional for the full 40-year life of the power plants. While this may present a long-term safety concern, we have determined that there is no immediate safety concern because: (1) the test results are considered to be of most concern with cables installed in containment; (2) the test results would apply to a relatively small number of safety-related cables in containment; (3) cables in containment have been in service for less than 40 years; (4) during plant operation, the temperatures in containment are typically below the values used in the SNL tests; (5) the probability of a design-basis event is low; and (6) there are uncertainties in estimating cable life based on the current model for aging of electric equipment. However, we felt that it was important for licensees to be aware of the SNL test results and, therefore, we issued INs 92-81 and 93-33.

Qualification testing is not an exact science, and the process includes many conservative assumptions. In fact, the process may be too conservative, resulting in excessive costs with no concurrent improvement in safety. The NRC has initiated a major research program to learn more about the aging of electric equipment and to ensure that current qualification practices are both sufficient and warranted. We will address any qualification issues that are uncovered by this ongoing research. Pending the completion of our research activities in this area, we believe that the qualification practices coupled with the NRC inspections that have been performed in the past provide adequate assurance of public health and safety.

In response to deficiencies that have been identified concerning the design and operation of safety-related motor-operated valves, the NRC has asked licensees to take certain specific actions to resolve this issue (GL 89-10). Further, the NRC engages in an inspection program to ensure that the safety-related MOVs in nuclear power plants are capable of performing their safety functions. An average of three inspections will be performed at each nuclear plant site to ensure that the recommendations of GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," are implemented. Nuclear plant licensees must meet a June 28, 1994, deadline to satisfy the GL 89-10 program or may request an extension if they meet stringent guidelines. NRC inspections have shown that most of the critical MOVs have already been satisfactorily tested and modified as necessary to ensure proper operation. These inspections have not revealed a significant number of problems with the electric cabling associated with the MOVs, even when the MOVs are tested under

design-basis conditions. Nonetheless, any and all safety issues (such as undersized electric cabling) will be aggressively pursued as they are identified to ensure that safety-related MOVs will operate as designed.

Hopefully, our explanation of INs 92-81 and 93-33 and of GL 89-10 has allayed your specific concerns. However, should you have any further questions or concerns that you would like to discuss with us, please call Mr. George Hubbard at (301) 504-2870 regarding environmental qualification of electric equipment, or call Mr. George Johnson at (301) 504-3303 regarding MOVs (your collect call will be accepted).

Sincerely,

Thomas E. Murley

Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

Enclosure: 10 CFR 50.49

(3) Those fire protection features, including alternative shutdown capability, involving installation of modifications requiring plant shutdown shall be implemented before the startup after the earliest of the following events commencing 9 months or more after the date of the NRC staff Fire Protection Safety Evaluation Report accepting or requiring such features:

(i) The first refueling outage;

(ii) Another planned outage that lasts for at least 60 days; or

(iii) An unplanned outage that lasts for at least 120 days.

(4) Those fire protection features involving dedicated shutdown capability requiring new buildings and systems shall be implemented within 30 months of NRC approval. Other modifications requiring NRC approval prior to installation shall be implemented within 6 months after NRC approval.

(e) Nuclear power plants licensed to operate after January 1, 1979, shall complete all fire protection modifications needed to satisfy Criterion 3 of Appendix A to this part in accordance with the provisions of their licenses.

45 FR 76602

§ 50.49 Environmental qualification of electric equipment important to safety for nuclear power plants.

(a) Each holder of or each applicant for a license to operate a nuclear power plant shall establish a program for qualifying the electric equipment defined in paragraph (b) of this section.

(b) Electric equipment important to safety covered by this section is:

(1) Safety-related electric equipment.[3] This equipment is that relied upon to remain functional during and following design basis events to ensure (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition, and (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the 10 CFR Part 100 guidelines. Design basis events are defined as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions (i) through (iii) of this paragraph.

(2) Nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions specified in subparagraphs (i) through (iii) of paragraph (b)(1) of this section by the safety-related equipment.

48 FR 2729

(3) Certain post-accident monitoring equipment.[4]

(c) Requirements for (1) dynamic and seismic qualification of electric equipment important to safety, (2) protection of electric equipment important to safety against other natural phenomena and external events, and (3) environmental qualification of electric equipment important to safety located in a mild environment are not included within the scope of this section. A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences.

48 FR 2729

(d) The applicant or licensee shall prepare a list of electric equipment important to safety covered by this section. In addition, the applicant or licensee shall include the information in paragraphs (d)(1), (2), and (3) of this section for this electric equipment important to safety in a qualification file. The applicant or licensee shall keep the list and information in the file current and retain the file in auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for future use to permit verification that each item of electric equipment is important to safety meets the requirements of paragraph (j) of this section.

53 FR 19240

(1) The performance specifications under conditions existing during and following design basis accidents.

(2) The voltage, frequency, load, and other electrical characteristics for which the performance specified in accordance with paragraph (d)(1) of this section can be ensured.

(3) The environmental conditions, including temperature, pressure, humidity, radiation, chemicals, and submergence at the location where the equipment must perform as specified in accordance with paragraphs (d)(1) and (2) of this section.

48 FR 2729

(e) The electric equipment qualification program must include and be based on the following:

(1) *Temperature and Pressure.* The time-dependent temperature and pressure at the location of the electric equipment important to safety must be established for the most severe design basis accident during or following which this equipment is required to remain functional.

(2) *Humidity.* Humidity during design basis accidents must be considered.

(3) *Chemical Effects.* The composition of chemicals used must be at least as severe as that resulting from the most limiting mode of plant operation (e.g., containment spray, emergency core cooling, or recirculation from containment sump). If the composition of the chemical spray can be affected by equipment malfunctions, the most severe chemical spray environment that results from a single failure in the spray system must be assumed.

(4) *Radiation.* The radiation environment must be based on the type of radiation, the total dose expected during normal operation over the installed life of the equipment, and the radiation environment associated with the most severe design basis accident during or following which the equipment is required to remain functional, including the radiation resulting from recirculating fluids for equipment located near the recirculating lines and including dose-rate effects.

48 FR 2729

(5) *Aging.* Equipment qualified by test must be preconditioned by natural or artificial (accelerated) aging to its end-of-installed life condition. Consideration must be given to all significant types of degradation which can have an effect on the functional capability of the equipment. If preconditioning to an end-of-installed life condition is not practicable, the equipment may be preconditioned to a shorter designated life. The equipment must be replaced or refurbished at the end of this designated life unless ongoing qualification demonstrates that the item has additional life.

(6) *Submergence* (if subject to being submerged).

(7) *Synergistic Effects.* Synergistic effects must be considered when these effects are believed to have a significant effect on equipment performance.

(8) *Margins.* Margins must be applied to account for unquantified uncertainty, such as the effects of production variations and inaccuracies in test instruments. These margins are in addition to any conservatisms applied during the derivation of local environmental conditions of the equipment unless these conservatisms can be quantified and shown to contain appropriate margins.

(f) Each item of electric equipment important to safety must be qualified by one of the following methods:

(1) Testing an identical item of equipment under identical conditions or under similar conditions with a supporting analysis to show that the equipment to be qualified is acceptable.

(2) Testing a similar item of equipment

[3] Safety-related electric equipment is referred to as "Class 1E" equipment in IEEE 323-1974. Copies of this standard may be obtained from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017.

[4] Specific guidance concerning the types of variables to be monitored is provided in Revision 2 of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident." Copies of the Regulatory Guide may be purchased through the U.S. Government Printing Office by calling 202-275-2060 or by writing to the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082.

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*see previous concurrence

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