

AFFIRMATION VOTE

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RESPONSE SHEET

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TO: SAMUEL J. CHILK, SECRETARY OF THE COMMISSION

FROM: COMMISSIONER GILINSKY

SUBJECT: SECY-81-603B - PROPOSED RULEMAKING, "ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT FOR NUCLEAR POWER PLANTS"

APPROVED  DISAPPROVED \_\_\_\_\_ ABSTAIN \_\_\_\_\_  
NOT PARTICIPATING \_\_\_\_\_ REQUEST DISCUSSION \_\_\_\_\_

COMMENTS:

The date for final environmental qualification should be the end of the first refueling outage after March 1982. The second refueling outage could extend final qualification for a plant to March 31, 1985.

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SECRETARIAT NOTE: PLEASE ALSO RESPOND TO AND/OR COMMENT ON OGC/OPE MEMORANDUM IF ONE HAS BEEN ISSUED ON THIS PAPER.

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NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

Environmental Qualification of Electric Equipment  
for Nuclear Power Plants

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed Rule.

SUMMARY: The Nuclear Regulatory Commission is proposing to amend its regulations applicable to nuclear power plants to clarify and strengthen the criteria for environmental qualification of electric equipment. Specific qualification methods currently contained in national standards, regulatory guides, and certain NRC publications for equipment qualification have been given different interpretations and have not had the legal force of an agency regulation. The proposed rule would codify these environmental qualification methods and clarify the Commission's requirements in this area.

DATES: Comment period expires (60 days after publication in the Federal Register). Comments received after \_\_\_\_\_ will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments received on or before this date.

ADDRESSES: Written comments and suggestions may be mailed to the Secretary of the Commission, Attention: Docketing and Service Branch, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, or hand-delivered to the Commission's Public Document Room at 1717 H Street NW.,

Washington, D.C., between the hours of 8:30 a.m. and 4:45 p.m. on normal work days.

FOR FURTHER INFORMATION CONTACT: Satish K. Aggarwal, Office of Nuclear Regulatory Research, Electrical Engineering Branch, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Telephone (301)443-5946.

SUPPLEMENTARY INFORMATION: Nuclear power plant equipment important to safety must be able to perform the safety functions throughout its installed life. This requirement is embodied in General Design Criteria 1, 2, 4, and 23 of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities"; in Criterion III, "Design Control," and Criterion XI, "Test Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50; and in 10 CFR 50.55a(h), which incorporates by reference IEEE 279-1971,<sup>1,2</sup> "Criteria for Protection Systems for Nuclear Power Generating Stations." This requirement is applicable to equipment located inside as well as outside the containment.

The NRC has used a variety of methods to ensure that these general requirements are met for electric equipment important to safety. Prior to 1971, qualification was based on the fact that the electric components were of high industrial quality. For nuclear plants licensed to operate after 1971, qualification was judged on the basis of IEEE 323-1971. For plants whose Safety Evaluation Reports were issued since July 1, 1974, the Commission has used Regulatory Guide 1.89, "Qualification of Class IE

<sup>1</sup>Incorporation by reference approved by the Director of the Office of Federal Register on January 1, 1981.

<sup>2</sup>Copies may be obtained from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, N.Y. 10017.

Equipment for Light-Water-Cooled Nuclear Power Plants," which endorses IEEE 323-1974,<sup>2</sup> "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," subject to supplementary provisions.

Currently, the Commission has underway a program to reevaluate the qualification of electric equipment important to safety in all operating nuclear power plants. As a part of this program, more definitive criteria for environmental qualification of electric equipment have been developed by the NRC. A document entitled "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors" (DOR Guidelines) was issued in November 1979. In addition, the NRC has issued NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," which contains two sets of criteria: the first for plants originally reviewed in accordance with IEEE 323-1971 and the second for plants reviewed in accordance with IEEE 323-1974.

By its Memorandum and Order CLI-80-21 dated May 23, 1980, the Commission directed the staff to proceed with a rulemaking on environmental qualification of safety-grade equipment and to address the question of backfit. The Commission also directed that the DOR Guidelines and NUREG-0588 form the basis for the requirements licensees and applicants must meet until the rulemaking has been completed. This proposed rule is generally based on the requirements of the Division of Operating Reactors (DOR) Guidelines and NUREG-0588.

The Commission's Memorandum and Order CLI-80-21 directed that the environmental qualification of electric equipment in operating nuclear power plants be completed by June 30, 1982. However, on September 23,

deadline. The proposed rule covers the same...  
CLI-80-21 and implements SECY-81-486 by incorporating the extension dates  
recommended by the Chairman in his memorandum dated September 30, 1981.

Included in the proposed rule is a requirement that  
each holder of or each applicant for a license to operate  
a nuclear power plant is required to identify and qualify  
the electric equipment needed to complete one path of  
achieving and maintaining a cold shutdown condition.

The scope of the proposed rule does not include all electric equip-  
ment important to safety in its various gradations of importance. It  
includes that portion of equipment important to safety commonly referred  
to as "Class 1E" equipment in IEEE national standards and some additional  
non-Class 1E equipment and systems whose failure under extreme environ-  
mental conditions could prevent the satisfactory accomplishment of safety  
functions by accident-mitigating equipment.

Included in the proposed rule are specific technical requirements  
pertaining to (a) qualification parameters, (b) qualification methods,  
and (c) documentation. Qualification parameters include temperature,  
pressure, humidity, radiation, chemicals, and submergence. Qualification  
methods include (a) testing as the principal means of qualification and  
(b) analysis and operating experience in lieu of testing. The proposed  
rule would require that the qualification program include synergistic  
effects, aging, margins, radiation, and environmental conditions. Also,  
a record of qualification must be maintained. Regulatory Guide 1.89 is  
being revised to describe methods acceptable to the NRC for meeting the  
provisions of this proposed rule and to include a list of typical equip-  
ment covered by it; a draft of the proposed revision is being published  
for public comment concurrently with the proposed rule.

Also included in the proposed rule is a requirement, which is con-  
sistent with Commission Memorandum and Order, CLI-80-21, for submission  
of an analysis by licensees to ensure that the plant can be safely operated

The Commission specifically requests comment on this  
proposed additional requirement.

pending completion of the environmental qualification of electric equipment. The Commission expects that, for each of the currently operating power plant, this analysis and its evaluation by the NRC staff will be completed well in advance of the effective date of this rule. If the licensees of operating power plants fail to provide these analyses in a timely manner, the Commission expects the NRC staff to take the appropriate steps to require that the information be provided and to enforce compliance with this requirement. This requirement has been included in this proposed rule to provide a regulatory basis for enforcement.

NRC will generally not accept analysis in lieu of testing. Experience has shown that qualification of equipment without test data may not be adequate to demonstrate functional operability during design basis event conditions. Analysis may be acceptable if testing of the equipment is impractical because of size, or limitation due to the state of the art. The proposed rule takes into consideration the prior qualification history of the operating power plants. <sup>FOR EXAMPLE,</sup> ~~The proposed rule, there-~~ ~~fore,~~ recognizes that for those plants which are not committed to either IEEE 323-1971 or IEEE 323-1974 for equipment qualification, and have been tested only for high temperature pressure, and steam, some equipment may not need to be tested again to include other service conditions such as radiation and chemical sprays. The qualification of equipment for these service conditions may be established by analysis.

The proposed rule would require that each holder of an operating license provide a list of electric equipment previously qualified based on testing or analysis, or a combination thereof, and a list of equipment that has not been qualified. ~~The unqualified equipment must be qualified by testing or by analysis based on testing, or it must be replaced. These~~

lists and the schedule for completion of equipment, qualification would have to be submitted within 90 days after the effective date of this rule. However, this time period will be adjusted during the final rule making process to allow reasonable time for licensees to evaluate NRC's safety reviews that are currently underway.

The proposed rule will codify the Commission's current requirements for the environmental qualification of electric equipment. Upon publication of a final rule, the DOR guidelines and NUREG-0588 will be withdrawn.

The general requirements for seismic and dynamic qualification for electric equipment are contained in the General Design Criteria. Pending development of specific requirements in this area, the general requirements will continue to apply. NRC is considering expansion of the scope of this proposed rule to include additional electric equipment important to safety. This matter will be the subject of a future rulemaking.

#### Paperwork Reduction Act

The proposed rule contains recordkeeping requirements that are subject to review by the Office of Management and Budget (OMB). As required by P.L. 96-511, this proposed rule will be submitted to OMB for clearance of the recordkeeping requirements.

#### Regulatory Flexibility Statement

In accordance with the Regulatory Flexibility Act of 1980, 5 U.S.C. 605(b), the Commission hereby certifies that this rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. This proposed rule affects the method of qualification of electric equipment by utilities. Utilities do not fall within the

definition of a small business found in Section 3 of the Small Business Act, 15 U.S.C. 632. In addition, utilities are required by Commission's Memorandum and Order CLI-80-21, dated May 23, 1980, to meet the requirements contained in the DOR "Guidelines for Evaluating Environmental Qualification of Class 1E Electric Equipment in Operating Reactors," (November 1979) and NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," which form the basis of this proposed rule. Consequently, this rule codifies existing requirements and imposes no new costs or obligations on utilities.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and section 553 of title 5 of the United States Code, notice is hereby given that adoption of the following amendment to 10 CFR Part 50 is contemplated.

#### 10 CFR Part 50

1. The authority citation for 10 CFR Part 50 reads as follows:  
AUTHORITY: Secs. 103, 104, 161, 182, 183, 189, 68 Stat. 936, 937, 948, 953, 954, 955, 956, as amended (42 U.S.C. 2133, 2134, 2201, 2232, 2233, 2239); secs. 201, 202, 206, 88 Stat. 1243, 1244, 1246 (42 U.S.C., 5841, 5842, 5846), unless otherwise noted. Section 50.78 also issued under Sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Sections 50.80-50.81 also issued under Sec. 184, 68 Stat. 954, as amended; (42 U.S.C. 2234). Sections 50.100-50.102 issued under Sec. 186, 68 Stat. 955; (42 U.S.C. 2236). For Purposes of Sec. 223, 68 Stat. 958, as amended; (42 U.S.C. 2273); § 50.54 (i) issued under Sec. 161i, 68 Stat. 949; (42 U.S.C. 2201(i)), §§ 50.70, 50.71 and 50.78 issued under Sec. 161o, 68 Stat. 950, as amended; (42 U.S.C. 2201(o)) and the Laws referred to in Appendices.



2. A new § 50.49 is added to read as follows:

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

(a) Requirements for seismic and dynamic qualification of electric equipment are not included in this section.

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

(c) Electric equipment and systems covered by this section include electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal or that are otherwise essential in preventing significant release of radioactive material to the environment. Included is equipment (1) that performs the above functions automatically, (2) that is used by the operator to perform these functions manually, and (3) whose failure can prevent the satisfactory accomplishment of one or more of the above safety functions. *also included in equipment needed to complete one path of achieving and maintaining a cold shutdown condition*

(d) The applicant or licensee shall prepare a list of all electric equipment covered by this section and maintain it in an auditable forms. This list of equipment must, as a minimum, include:

(1) The performance characteristics and structural integrity requirements under conditions existing during normal and abnormal operation and during design basis events and afterwards and the lengths of the periods during which the integrity must be maintained.

(2) The range of 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, and the predicted variations of these environmental conditions with time at the location where the equipment must perform as specified in accordance with paragraphs (d)(1) and (2) of this section.

(e) The electrical equipment qualification program must include the following:

(1) Temperature and Pressure. The time-dependent temperature and pressure at the location of the equipment must be established for the most limiting of the applicable postulated accidents and must be used as the basis for the environmental qualification of electric equipment.

(2) Humidity. Time-dependent variations of relative humidity during normal operation and design basis events 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 and the dose and dose rate of the radiation environment expected during normal operation over the installed life of the equipment plus the radiation environment associated with the most severe design basis event 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.

(5) Aging. Equipment qualified by test must, where practicable, be preconditioned by natural or artificial (accelerated) aging to its installed end-of-life condition. Electromechanical equipment must be operated to simulate the mechanical wear and electrical degradation expected during its installed life. Where preconditioning to a qualified life equal to the installed life is not possible, the equipment may be preconditioned to a shorter qualified life. The equipment must be replaced at the end of its qualified life unless ongoing qualification of prototype equipment naturally aged in plant service shows, by artificial aging and type testing, that the item has additional qualified life.

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

(7) Synergistic Effects. The preconditioning and testing of equipment must consider known synergistic effects when these effects are known to have a significant effect on equipment performance.

(8) Margins. Margins must be applied to account for production variations and inaccuracies in test instruments. These margins are in addition to margins applied during the derivation of the environmental conditions.

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

(1) Testing an identical item of equipment.

(2) Testing a similar item of equipment with a supporting analysis to show that the equipment to be qualified is acceptable.

(3) Experience with identical or similar equipment under similar conditions with a supporting analysis to show that the equipment to be qualified is acceptable.

(4) (i) By analysis, in lieu of testing, where type testing is precluded by the physical size of the equipment or by the state of the art.

(ii) By analysis in combination with partial type test data which adequately supports the analytical assumptions and conclusions, where the equipment purchase order was executed prior to May 23, 1980.

(g) If an item of electric equipment is to be qualified by test -

(1) The acceptance criteria must be established prior to testing.

(2) The tests must be designed and conducted to demonstrate that the equipment can perform its required function as specified in accordance with paragraph (d)(1) of this section for all conditions as specified in accordance with paragraphs (d)(2) and (3) of this section. The test profile (e.g., pressure, temperature, radiation vs. time) must include margins as set forth in paragraph (e)(9) of this section.

(3) The test profile must be either (i) a single profile that envelops the environmental conditions resulting from any design basis event during any mode of plant operation (e.g., a profile that envelops the conditions produced by the postulated spectrum of main steamline break (MSLB) and loss-of-coolant accidents (LOCA)) or (ii) separate profiles for each type of event (e.g., separate profiles for the MSLB accidents and for LOCAs).

(4) The same piece of equipment must be used throughout the complete test sequence under any given profile.

(h) Each holder of an operating license issued prior to (insert the effective date of this rule) must, by (insert a date 90 days after the effective date of this rule), identify the electric equipment already qualified <sup>TO THE PROVISIONS OF THIS RULE</sup> and submit a schedule for the testing or replacement of the remaining electric equipment. This schedule must establish a goal of final environmental qualification by the end of the second refueling

outage after March 31, 1982. The Director of Nuclear Reactor Regulation may grant requests for extensions of this deadline to a date no later than November 30, 1985, for specific pieces of equipment if such requests are filed on a timely basis and demonstrate good cause for the extension, such as procurement lead time, test complications, and installation problems. In exceptional cases, the Commission itself may consider and grant extensions beyond November 30, 1985 for completion of environmental qualification.

(i) Each licensee shall notify the Commission of any significant equipment qualification problem that may require extension of the completion date within 30 days of its discovery.

(j) For the continued operation of a nuclear plant, each holder of an operating license issued prior to the effective date of this rule shall perform an analysis to ensure that the plant can be safely operated pending completion of the environmental qualification. The detailed analysis for each equipment type with appropriate justification must be submitted to Director of Nuclear Reactor Regulation by (insert the effective date of the rule) and must include, where appropriate, consideration of:

(1) Accomplishing the safety function by some designated alternative equipment that has been adequately qualified and satisfies the single-failure criterion if the principal equipment has not been demonstrated to be fully qualified.

(2) The validity of partial test data in support of the original qualification.

(3) Limited use of administrative controls over equipment that has not been demonstrated to be fully qualified.

(4) Completion of the safety function prior to exposure to the ensuing accident environment and the subsequent failure of the equipment does not degrade any safety function or mislead the operator.

(5) No significant degradation of any safety function or misleading of the operator as a result of failure of equipment under the accident environment.

(k) The applicant for an operating license that is granted on or after the effective date of this rule, but prior to November 30, 1985, must perform an analysis to ensure that the plant can be safely operated pending completion of the environmental qualification in accordance with paragraph (j) of this section except that this analysis must be submitted to the Director of Nuclear Reactor Regulation for consideration prior to the granting of an operating license.

(1) A record of the qualification must be maintained in a central file to permit verification that each item of electric equipment covered by this section (1) is qualified for its application and (2) meets its specified performance requirements when it is subjected to the conditions predicted to be present when it must perform its safety function up to the end of its qualified life.

Dated at \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_, 1981.

For the Nuclear Regulatory Commission.

\_\_\_\_\_  
Samuel J. Chilk  
Secretary of the Commission

MEMORANDUM FOR: William J. Dircks, Executive Director  
for Operations

FROM: Samuel J. Chilk, Secretary

SUBJECT: STAFF REQUIREMENTS - SECY-81-603B -  
PROPOSED RULEMAKING, "ENVIRONMENTAL  
QUALIFICATION OF ELECTRIC EQUIPMENT FOR  
NUCLEAR POWER PLANTS"

The Commission in connection with its approval of SECY-81-603B has asked that the staff provide the following:

- a. The Commission is concerned that licensees may not have adequately responded to NRC's requests for licensee justification for continued operation.

In its May 23, 1980 Order, the Commission commented on previous ineffectual efforts against inadequate licensee responsiveness in the environmental qualification area. In this regard please provide the following:

- (1) A list of those power reactors that have provided adequate justification for continued operation.

(EDO) (SECY SUSPENSE: 2/1/82)

- (2) A list of those power reactors which have not provided adequate justification for continued operation.

(EDO) (SECY SUSPENSE: 2/1/82)

The staff is directed to propose measures to secure adequate justifications from those utilities

included in (2) by February 28, 1982. Issuance of orders should be considered.

- b. The Commission would like to know under what circumstances licensees are obligated to report to the NRC when equipment fails a qualification test. Does the staff believe that any additional reporting requirements are necessary in the equipment qualification area? For example, when would reporting such a failure come under requirements of 10 CFR Part 21.

(EDO) (SECY SUSPENSE: 2/1/82)

- c. An information paper summarizing the present understanding of which power reactors do or do not have the capability to go to cold shutdown on safety grade equipment. To the extent possible also provide a summary of the specific equipment that would have to be upgraded in order to allow individual plants to achieve cold shutdown with only safety grade equipment. (Reference USI on Residual Heat Removal Shutdown Requirements, Task A-31).

(EDO) (SECY SUSPENSE: 3/1/82)

- d. The staff should prepare a SECY paper discussing the enforcement actions the NRC should and could take if equipment covered by this rule is not



properly qualified for any reason, including improper maintenance and installation.

(EDO) (SECY SUSPENSE: 2/1/82)

- e. The staff proposed plan for equipment qualification, including seismic qualification of equipment in operating plants and an explanation of how the USI on Seismic Qualification of Equipment in Operating Plants (Task A-46) is to be included. (This may be provided in the redraft of SECY-81-504).

(EDO) (SECY SUSPENSE: 2/1/82)

cc: Chairman Palladino  
Commissioner Gilinsky  
Commissioner Bradford  
Commissioner Ahearne  
Commissioner Roberts  
Commission Staff Offices  
PDR (Advance Copy)  
DCS (016-Phillips)

"Commissioner Bradford believes that the proposed deadline (second refueling outage after March 31, 1982) for qualification is much too relaxed, given the fact that licensees and the NRC have been aware of the problems in this area since 1978. The proposed deadline extends as much as two and one-half years beyond the June 30, 1983 date by which the Atomic Industrial Forum concluded that nearly all electrical equipment could be qualified. Given the more generous deadline, he also believes that the rule should have contained requirements for seismic and dynamic qualification. While the general design criteria contain requirements in this area, clarification now would ensure that equipment to be replaced in the near term will not have to be ripped out in a few years because it was not properly seismically qualified."