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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
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IE Supplement No. 2 to Bulletin 79-01B: ENVIRONMENTAL QUALIFICATION OF CLASS 1E EQUIPMENT

Enclosed are the generic questions and answers which resulted from NRC/Licensee meetings in NRC Regional Offices during the week of July 14, 1980 regarding environmental qualification of Class 1E equipment in use at power reactor facilities. These answers address specific questions asked during the meetings. Due to the generic nature of some of these questions, the staff is issuing them as a bulletin supplement. The regional meetings highlighted the fact that in some cases, the scope and depth of the 79-01B review was not clear to licensees. Therefore, these answers may affect your 79-01B submittal. These submittals are required by a separate order to be completed by November 1, 1980.

Some answers given in Supplement No. 1 to IEB-79-01B are superseded by these answers. For example, in Bulletin Supplement No. 1, issued on February 29, 1980, the answer to question No. 5 specified that TMI lessons learned equipment was not included in the review. However, due to the extension of the response date from April 14, 1980 to November 1, 1980, this equipment is now being addressed since its installation is either complete or required before the issuance of the February 1, 1981 SER. (See Question No. 21 of this Supplement.)

No specific response is requested by this Supplement; however, all answers contained in the enclosure to this Supplement should be carefully reviewed and considered for applicability in your response to IEB 79-01B.

IE Bulletin No. 79-01B was issued under a blanket GAO clearance (B180225 (R0072); clearance expired July 31, 1980) specifically for identified generic problems. Supplement No. 2 to Bulletin 79-01B is for information, hence no GAO clearance is required.

Enclosures:
1. Generic Questions and Answers to IEB-79-01B and Memorandum and Order (CLI-80-21) dated May 23, 1980

Q.1 Define the scope of review with respect to the June 1982 deadline. What is required beyond the June 1982 date for qualification?

By June 30, 1982, all safety-related electrical equipment potentially exposed to a harsh environment in nuclear generating stations, licensed to operate on or before June 30, 1982, shall be qualified to either the DOR guidelines or NUREG-0588 (as applicable). Safety-related electrical equipment are those required in bringing the plant to a cold shutdown condition and to mitigate the consequences of the accident. The qualification of safety-related electrical equipment to function in environmental extremes, not associated with accident conditions, is the responsibility of the licensee to evaluate and document in a form that will be available for the NRC to audit. Qualification to assure functioning in mild environments must be completed by June 30, 1982.

The qualification schedules for consideration of the dynamic loading of safety-related equipment (electrical and mechanical) and the environmental qualification review of mechanical equipment are being developed. It is the intention of the staff to initiate this effort as soon as possible.

Q.2 Clarify the required submittal dates for ORs, NTOLs, and CPs. What about OLs whose 100% license is not expected by June 1982?

A.2 The required schedule for submitting information in response to the Commission Order and Memorandum (CLI-80-21) is provided below. Plants who have received an operating license, either for full or limited power operation, are required to meet the schedule for operating reactors. Plants who have committed, to the NRC, to meet schedules in advance of those provided below are required to meet that commitment. In all cases, plants are required to have their equipment fully qualified to the applicable standards either by June 30, 1980, or by the time the operating license is granted, whichever comes later.

<u>Operating Reactors and NTOL</u> (operating license expected by February 1, 1981)

- Submittal to be received no later than November 1, 1980

<u>OLs</u> (operating license expected by June 30, 1982)

- Submittal to be received no later than 4 months prior to issuance of operating license

<u>OLs and CPs</u> (operating license expected after June 30, 1982)

- Submittal to be received no later than 6 months prior to issuance of operating license.

Q.3 Define the requirements and applicable criteria for ORs, NTOLs, and OLs. Specifically address the NTOLs whose CP SER is prior to July 1974 and after July 1974. Can a CP whose SER is prior to 1974 use the DOR guidelines?

A.3 Table 1 describes the application of each document. All operating reactors as of May 23, 1980, will be evaluated against the DOR guidelines. In cases where the DOR guidelines do not provide sufficient detail, but NUREG-0588 Category II does, NUREG-0588 will be used.

TABLE 1
REQUIREMENTS

ORs	OLs		CPs
DOR GUIDELINES	CP SER Before 7/1/74	CP SER After 7/1/74	
USE NUREG-0588 AS NECESSARY	NUREG-0588(CAT.II)	NUREG-0588(CAT.I)	NUREG-0588(CAT.I) or NEW RULE WHEN IN EFFECT
REPLACEMENT COMPONENTS USE NUREG-0588 (CAT.I)			

All plants licensed after May 23, 1980, shall conform to NUREG-0588. In accordance with Regulatory Guide 1.89, all such operating licenses for facilities whose construction permit SER is dated July 1, 1974 or later, are to be reviewed against IEEE Std. 323-1974. Thus, for these licensees, the operating license applicant is to qualify equipment to the Category I column in NUREG-0588. For operating licenses issued after May 23, 1980, whose construction permit SER is dated before July 1, 1974, the operating license applicant is to qualify equipment to at least Category II column of NUREG-0588; unless the licensee made commitment in the construction permit record to use the 1974 standard, or unless the operating licensee application record indicates that the 1974 standard is to be used, in such cases Column I of NUREG-0588 is to be used.

While there are differences between the Category II column of NUREG-0588 and the DOR guidelines, the differences are in details and in the optional part of the documents. The minimum requirements set forth by these documents are general and compatible. Thus, the minimum standards set by either of the two documents are equally applicable to ORs and NTOLs.

Q.4 Clarify the reporting requirements for LERs with respect to Part 50.55e vs 79-01B.

Are only those items, known to be unqualified, immediately reportable? Are items, for which there are no data or for which there are insufficient data, open items to be resolved, but are not immediately reportable?

A.4 The requirement for reporting in IEB 79-01B does not change the reporting requirements defined in the license conditions. In general, CPs should report via 50.55e. Operating plants should use the LER.

When a determination has been made that reasonable assurance does not exist to ensure that the Class IE electrical equipment component(s) can perform their safety-related function, that is reportable. Inadequate or no data are factors in this determination. The time and technical judgements required to make the determination should be based on the significance of this specific equipment, components, and the discrepancies.

Q.5 How does the "Q" list review interface with the EQB effort? Can the NRC provide more specific guidance on how to pick out the required safety-related equipment?

A.5 The "Q" list provides a source from which the required equipment may be selected. The information required to be submitted by November 1, 1980, is for safety-related electrical equipment potentially exposed to a harsh environment resulting from an accident. Safety-related equipment are those required to help bring the plant to cold shutdown and to mitigate the accident (LOCA, HELB inside or outside containment). "Mitigate" includes safety-related functions such as containment isolation, and prevention of significant release of radioactive material.

In order to "pick out" the safety-related equipment, the licensee should generate a list of safety functions typically performed by plant safety systems. Examples are listed in Table II. For each safety function identified in Table II, list the systems, subsystems, or components assumed available in the plant FSAR or emergency procedures to perform that function during a LOCA or any HELB inside or outside containment. If a plant specific safety function not listed in Table II is identified, that function and the corresponding systems or equipment to perform the function should be added to the licensee's list.

The systems and equipment identified above should be included regardless of the original classification when the plant received its operating license; i.e., some control grade equipment will probably be named in emergency procedures. However, if plant emergency procedures specify a preferred mode of accident mitigation involving equipment recognized by the licensee as unlikely to meet environmental qualification criteria, an alternate mode of performing the safety function and qualifiable equipment may be identified. In such cases, the emergency procedures must clearly indicate how the

operator is to use environmentally qualified safety-related display instrumentation to diagnose failure to perform such safety functions.

Plant emergency procedures typically include provisions for the operator to sample or monitor radioactivity levels or combustible gas levels, to confirm that valves are in the correct position, to monitor flow or temperature, etc. Some of these functions are essential for correct operator action, to mitigate accidents, and prevent radioactive releases. When this is the case, the radiation sensors, valve position indicators, pressure transmitters, thermocouples, etc., should be qualified to function in the relevant accident environment.

Licensees should, therefore, review their emergency procedures to determine the electrical components needed to perform the functions of Safety-Related Display Information, Post Accident Sampling and Monitoring, and Radiation Monitoring. When equipment implied by the emergency procedures is not listed, justificiation must be provided that failure of such equipment would not prevent accident mitigation or release of radioactivity.

Equipment now indicated in emergency procedures in response to TMI-2 Lessons Learned should be listed. Equipment which is or will be installed due to TMI Lessons Learned should be addressed similar to other existing safety-related equipment (e.g., saturation meter, sump level indicators, torus water volume, etc.).

The licensee should document anticipated service conditions in every portion of the plant where the environment could be influenced by the accident or its consequences. These service conditions should also be correlated with the safety-related systems and subsystems identified above. Whenever an item of safety-related equipment may be located in an environment outside the range of normal conditions, due to the harsh environment resulting from the accident, and the equipment is needed to mitigate the consequences of the accident, place it on the list of equipment in a potentially hostile environment. Conclusions which show that equipment is unqualified should include a basis for continued plant operation.

TABLE II

TYPICAL EQUIPMENT/FUNCTIONS NEEDED FOR MITIGATION OF A LOCA OR MSLB ACCIDENT

Engineered Safeguards Actuation
Reactor Protection
Containment Isolation
Steamline Isolation
Main Feedwater Shutdown and Isolation
Emergency Power

Emergency Core Cooling
Containment Heat Removal
Containment Fission Product Removal
Containment Combustible Gas Control
Auxiliary Feedwater
Containment Ventilation
Containment Radiation Monitoring
Control Room Habitability Systems (e.g., HVAC, Radiation Filters)
Ventilation for Areas Containing Safety Equipment
Component Cooling
Service Water
Emergency Shutdown
Post Accident Sampling and Monitoring
Radiation Monitoring
Safety Related Display Instrumentation

(1) These systems will differ for PWRs and BWRs and for older and newer plants. In each case, the system features which allow for transfer to recirculation cooling mode and establishment of long-term cooling with boron precipitation control are to be considered as part of the system to be evaluated.

(2) Emergency shutdown systems include those systems used to bring the plant to a cold shutdown condition following accidents which do not result in a breach of the reactor coolant pressure boundary together with a rapid depressurization of the reactor coolant system. Examples of such systems and equipment are the RHR system, PORVs, RCIC, pressurizer sprays, chemical and volume control system, and steam dump systems.

(3) More specific identification of these types of equipment can be found in the plant emergency procedures.

Q.6 NUREG-0588 was issued for comment. Will any changes impact the requirements established by the Commission memorandum and order? Will the daughter standards referenced be corrected/changed?

A.6 The requirement established by the Commission memorandum and order will not change as a result of comments on NUREG-0588. No substantive changes are anticipated in NUREG-0588 or in referenced daughter standards. A revision is anticipated, making corrections.

Q.7 Can IEEE Std. 650 (Standards for Qualification of Class IE static battery chargers and invertors for nuclear power generating stations) be used for qualifying the balance of plant components which are not exposed to harsh environments?

A.7 The methods and procedures relating to design stress analysis, aging of electrical/electronic components and the stress test identified in this standard are acceptable for qualifying the balance of plant components which are not exposed to harsh environments:

Q.8 Provide the staff's definition of "central location" for qualification documentation. What documentation is expected to be maintained? Will it be acceptable to maintain summary test reports at the utility central file and provide a reference to the NSSS Vendor's file for the actual test reports? Does NRC require test reports to be submitted to support qualification?

A.8 The central location should be at the utilities corporate headquarters or plant site. Both the DOR guidelines and NUREG-0588 specify that sufficient information must be available to verify that the safety-related electrical equipment has been qualified in accordance with the guidance and requirements. Details for the information and documentation required for type tests, operating experience, analysis, and extrapolation of test data from operating experience are provided in Section 5 of NUREG-0588 and Section 8 of IEEE Std. 323-74.

The staff will accept summary test reports maintained at the utility's central file which reference the actual test reports and data available in a single location at the NSSS vendor's facility. The Licensee/ Applicant must make the determination that necessary information and documentation, to support qualification of equipment, is in conformance with DOR guidelines and NUREG-0588. This vendor information file must be maintained current, auditable and available throughout the life of the referencing plant.

Test reports are not required to be submitted. Test report references must be included in the plant submittals and these reports must be available for staff review on demand.

Q.9 The staff was directed to codify, by Technical Specification, some of the requirements of the Order. Can you give some of the details of this requirement, how the staff expects to meet this directive and when?

A.9 The staff has proposed to the Commission changes to the Technical Specifications (e.g., Appendix A Section 6.10 of the license) which require the establishment and maintenance of a centrally located file which will contain the information necessary to verify the qualification adequacy of all safety-related electrical equipment.

Q.10 With respect to the NRC data base, how will utilities address and obtain information from it?

A.10 The industry access method for the data base will be addressed in the final stages of system development. This information should be available by mid-1981. Licensees will be informed at that time.

Q.11 How should submittals containing data and qualification information be submitted? What format should we use if we have several facilities at different stages (OR, NTOL, CP)?

A.11 The qualification information and data should be submitted with the appropriate officer's notarized sworn statements. The format for the data should be in accordance with the format provided in I&E Bulletin 79-01B or the letters provided to the plants in the SEP program. Either format is acceptable.

Q.12 Is testing required of equipment which completes its safety-related function within the first minute(s) of a LOCA or HELB? (E.g., nuclear instrumentation or other instruments providing RPS inputs, isolation valves, etc.)

A.12 The staff does not require that the nuclear instrumentation and its associated components be environmentally qualified for a LOCA or HELB. The nuclear instrumentation system is used for transient conditions but is not required for a LOCA or HELB.

The staff does require that equipment designed to perform its safety-related function within a short time into an event be qualified for a period of at least 1 hour in excess of the time assumed in the accident analysis. The staff has indicated that time is the most significant factor in terms of the margins required to provide an acceptable confidence level that a safety-related function will be completed. Our judgment of at least 1 hour is based on the acceptance of a type test for a single unit and the spectrum of accidents (small and large breaks) bounded by the single test. Also see answer to question 21.

Q.13 Testing is currently being performed on some equipment, and contracts have been issued for testing additional equipment specifying conformance to IEEE Std 323-1971. For sequential testing, how do we factor in aging? If early test failure occurs due to "non E-Q" mechanisms, can the test be extrapolated using analytical methods?

A.13 Sequential testing requirements are specified in NUREG-0588 and the DOR guidelines. Licensees must follow the test requirements of the applicable document.

1. If the test has been completed without aging in sequence, justification for such a deviation must be submitted.

2. If testing of a given component has been scheduled but not initiated, the test sequence/program should be modified to include aging.

3. Test programs in progress should be evaluated regarding the ability to comply by incorporating aging in the proper sequence. These would then fall in the first or second category.

When a failure occurs due to a non-EQ related mechanism, acceptability of analysis to extrapolate the test data would be dependent on several considerations (e.g., the specific function being demonstrated, the

failure mechanism, when the failure occurred, etc.), may be very difficult to achieve. If such a failure occurs it may be more prudent to correct the failure and continue with the test.

Q.14 What is the definition of harsh environment? How are the environmental profiles defined outside containment?

A.14 Harsh environment is defined by the limiting conditions, as specified in IE Bulletin 79-01B, resulting from the entire spectrum of LOCAs HELBs. Specifically, the harsh environment from a LOCA considers the worst parameters resulting over the spectrum of postulated break sizes, break locations and single failures. Similarly, the HELBs inside and outside of containment consider the spectrum of breaks including main steam and feedwater line breaks. The parameters to be considered are: temperature, pressure, humidity, caustic spray, radiation, duration of exposure, aging and submergence. Mechanical and flow-induced vibrations and seismic effects will be considered separately.

Environmental profiles for HELB outside of containment have not been generically established due to the uniqueness of each facility. Service conditions for areas outside containment exposed to a HELB must be evaluated on a plant-by-plant basis. Each of the parameters listed above must be considered. Acceptable engineering methods should be used for this calculation. Temperature and pressure history may be available from earlier HELB evalations. The radiation source terms are discussed under Question 18 below. Further guidance for selecting the piping systems and conducting the review are delineated in Regulatory Guide 1.46 and Standard Review Plans 3.6.1 and 3.6.2.

Q.15 The DOR Guidelines and NUREG-0588 give time and temperature parameters. Can we use different values of these parameters? Will plant-specific profiles still be with the guidance provided?

Q.15 For minimum high temperature conditions in pressure-suppression-type containments, we do not require that 340 F for 6 hours be used for BWR drywells or that 340 F for 3 hours be used for PWR ice condenser lower compartments. These values are a screening device, per the Guidelines, and can be used in lieu of a plant-specific profile, provided that expected pressure and humidity conditions as a function of time are accounted for.

In general, the containment temperature and pressure conditions as a function of time should be based on analyses in the FSAR. However, these conditions should bound those expected for coolant and steam line breaks inside the containment with due consideration of analytical uncertainties. The steam line break condition should include superheated conditions: the peak temperature, and subsequent temperature/ pressure profile as a function of time. If containment spray is to be used, the impact of the spray on required equipment should be accounted for.

The adequacy of a plant-specific profile is dependent on the assumption and design considerations at the time the profiles were developed. The DOR guidelines and NUREG-0588 provide guidance and considerations required to determine if the plant-specific profiles encompass the LOCA and HELB inside containment.

Q.16 Could you elaborate on what the staff expects with regard to quality assurance?

If parts or subcomponents are purchased from a vendor who does not have a quality assurance program, can it be qualified to meet IEEE Std. 323-74 requirements?

A.16 The QA programs should accommodate any increased scope due to the new environmental qualification documentation requirements. Procedures incorporated by the licensee for data acquisition should be documented and available for staff review upon request. Requirements for QA programs are provided in Part 50, Appendix B, of the Code of Federal Regulations.

Part 50, Appendix B of the Code of Federal Regulations states that the applicant/licensee shall be responsible for the establishment and execution of quality assurance programs. Specifically in purchasing parts or components, it is the responsibility of the licensee/applicant to ensure that the applicable quality assurance procedures for their plant are met.

In determining the qualification status of existing equipment purchased from a vendor, where a QA program did not exist, the utility should consider the following:

1. The complexity of design, complexity of manufacturing process, and end use.

2. Past performance of vendor.

3. Past operating history of products, especially similar products, made by vendor.

4. Procedures, equipment, and results of environmental qualification testing relative to those for other equipment for which a QA program was applied.

Q.17 Define the requirements for "replacement parts." Are they the same for "spare" parts? Clearly discuss the alternatives for existing inventories of parts/components. If equipment is ordered to meet IEEE Std. 323-1974 standard but lead time exceeds June 1982, can we use IEEE Std. 323-1971 qualified components in the interim?

A.17 The requirements for "replacement" and "spare" parts are the same for the purposes of complying with the Commission order and

memorandum. After May 1980, all parts used to replace presently installed parts shall be qualified to Category I of NUREG-0588 "unless there are sound reasons to the contrary." Nonavailability and/or the fact that the part to be used as a replacement is a spare part purchased prior to May 23, 1980, and is in stock are among the factors to be considered in weighing whether there are "sound reasons to the contrary." All replacement parts shall as a minimum conform to the requirements described in the answer to question 3. Justification for deviation from Category I or NUREG-0588 shall be documented by the licensee and records shall be available for audit, upon request by the NRC.

Q.18 DOR Guidelines, NUREG-0588 and NUREG-0578, define or give guidance for calculating radiation source terms. However, since one is more restrictive than the other, which do we use?

A.18 Both the DOR guidelines and NUREG-0588 are similar in that they provide the methods for determining the radiation source term when considering LOCA events inside containment (100% noble gases/50% iodine/1% particulates). These methods consider the radiation source term resulting from an event which completely depressurizes the primary system and releases the source term inventory to the containment.

NUREG-0578 provides the radiation source term to be used for determining the qualification doses for equipment in close proximity to recirculting fluid systems inside and outside of containment as a result of LOCA. This method considers a LOCA event in which the primary system may not depressurize and the source term inventory remains in the coolant.

NUREG-0588 also provides the radiation source term to be used for qualifying equipment following non-LOCA events both inside and outside containment (10% noble gases/10% iodine/0% particulates).

When developing radiation source terms for equipment qualification, the licensee must ensure consideration is given to those events which provide the most bounding conditions. The following table summarizes these considerations:

	LOCA	NON-LOCA HELB
Outside Containment	NUREG-0578 (100/50/1 in RCS)	NUREG-0588 (10/10/0 in RCS)

Inside Containment	Larger of	
	NUREG-0588 (100/50/1 in containment)	NUREG-0588 (10/10/0 in RCS)
	or	
	NUREG-0578 (100/50/1 in RCS)	

Q.19 Can gamma equivalents be used rather than beta exposure for radiation qualification?

A.19 Yes. Gamma equivalents may be used when consideration of the contributions of beta exposure have been included in accordance with the guidance given in the DOR guidelines and NUREG-0588. Cobalt 60 is one acceptable gamma radiation source for environmental qualification of safety-related equipment. Cesium 137 may also be used.

Q.20 If a piece of equipment will become submerged after completing its required action, must it be qualified for submergence?

A.20 If the equipment (1) meets the guiadance and requirements of the DOR guidelines or NUREG-0588 for the LOCA and HELB (small and large breaks) accidents and (2) licensees demonstrate that its failure will not adversely affect any safety-related function or mislead the operator after submergence, the equipment could be considered exempt from that portion (submergence) of qualification.

Q.21 What qualification is required of Reactor Pressure Vessel internal instrumentation (e.g., thermocouples) and new instruments required as the result of TMI Lessons Learned?

A.21 TMI Lessons Learned instrumentation will be considered in the February 1, 1981 SER. This equipment is subject to the same requirements as other safety-related electrical equipment. The guidance and requirements of NUREG-0588 referenced daughter standards, and Reg Guides will be used by the staff in assessing the adequacy of the qualification information. The in-core environment should consider the worst source term for radiation effects, the worst humidity for the corresponding temperature, and high temperatures consistent with that of a damaged core.

Q.22 Is qualification "by use" an acceptable method (e.g., CRDM's in BWRs)?

A.22 Qualification by use has limited application. Often the equipment has never seen the harsh environment and no conclusions can be drawn as to its operability in a harsh environment. Some qualification

based on operating experience is a recognized method subject to the requirements of NUREG-0588 and the Guidelines. Credit can be taken for the natural aging of the equipment and for the location of the equipment or other portions of the overall qualification information.

Q.23 How long should "long term" equipment be qualified for environmental qualification?

A.23 "Long term" for the purpose of qualifying equipment for a harsh environment is variable. A determination of "long term" for qualification of equipment should be based on the considerations listed below for each postulated accident scenario. Justification for the value used should be provided with the equipment qualification documentation.

1. The time period over which the equipment is required to bring the plant to cold shutdown and to mitigate the consequences of the accident.

2. The ability to change, modify or add equipment during the course of the accident or in mitigating its effects which will provide the same safety-related function.

Q.24 Why do we want component surface temperature rather than the bulk environment temperature?

A.24 Temperature measurements are required during the qualification testing to establish that the component was subjected to the most severe temperature environment postulated to occur. These temperature measurements are required to be made as close to the component surface as practicable to ensure that they are representative of the environment in which the component is tested. The surface temperature of the component, although not specifically required, is considered to be a conservative measurement of the test temperature environment.

RECENTLY ISSUED IE BULLETINS

Bulletin No.	Subject	Date Issued	Issued To
80-22	Automation Industries, Model 200-520-008 sealed-source connectors	9/11/80	All radiography licensees
79-26 Revision 1	Boron loss from BWR control blades	8/29/80	All BWR power facilities with an OL
80-20	Failures of Westinghouse Type W-2 Spring Return to Neutral Control Switches	7/31/80	To each nuclear power facility in your region having an OL or a CP
80-19	Failures of Mercury-Wetted Matrix Relays in Reactor Protective Systems of Operating Nuclear Power Plants Designed by Combustion Engineering	7/31/80	All nuclear power facilities having either an OL or a CP
80-18	Maintenance of Adequate Minimum Flow Thru Centrifugal Charging Pumps Following Secondary Side High Energy Line Rupture	7/24/80	All PWR power reactor facilities holding OLs and to those PWRs nearing licensing
Supplement 2 to 80-17	Failures Revealed by Testing Subsequent to Failure of Control Rods to Insert During a Scram at a BWR	7/22/80	All BWR power reactor facilities holding OLs
Supplement 1 to 80-17	Failure of Control Rods to Insert During a Scram at a BWR	7/18/80	All BWR power reactor facilities holding OLs
80-17	Failure of Control Rods to Insert During a Scram at a BWR	7/3/80	All BWR power reactor facilities holding OLs
80-16	Potential Misapplication of Rosemount Inc., Models 1151 and 1152 Pressure Transmitters with Either "A" or "D" Output Codes	6/27/80	All Power Reactor Facilities with an OL or a CP