UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

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Docket No. 50-293

21 JUN 1979

Boston Edison Company M/C Nuclear
ATTN: Mr. G. Carl Andognini, Manager
Nuclear Operations Department
800 Boylston Street
Boston, Massachusetts 02199

Gentlemen:

Enclosed is IE Bulletin No. 79-02 Revision No. 1, which requires action by you with regard to your power reactor facility(ies) with an operating license or a construction permit.

Should you have any questions regarding this Bulletin or the actions required by you, please contact this office.

Sincerely,

for Robert T. Carlson
Boyce H. Grier
Director

Enclosures:
1. IE Bulletin No. 79-02
(Revision No. 1)
2. List of IE Bulletins Issued
in Last Twelve Months

cc w/encls:
P. J. McGuire, Pilgrim Station Manager
A. Z. Roisman, Natural Resources Defense Council

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ENCLOSURE 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

PIPE SUPPORT BASE PLATE DESIGNS USING CONCRETE EXPANSION ANCHOR BOLTS

Description of Circumstances:

Since the issuance of IE Bulletin 79-02 on March 8, 1979, IE inspection experience and many inquiries from licensees indicate that additional information and clarification is needed. This revision is intended to serve that purpose. None of the requirements of the original Bulletin have been deleted, and the due date for completion of the requested actions (July 6, 1979) has not been changed. The following text supersedes the text of Bulletin 79-02. Changes from the original text are identified by lines in the margin. The purpose of this revision is to identify acceptable ways of satisfying the Bulletin requirements. *

While performing inservice inspections during a March-April 1978 refueling outage at Millstone Unit 1, structural failures of piping supports for safety equipment were observed by the licensee. Subsequent licensee inspections of undamaged supports showed a large percentage of the concrete anchor bolts were not tightened properly.

Deficiency reports, in accordance with 10 CFR 50.55(e), filed by Long Island Lighting Company on Shoreham Unit 1, indicate that design of base plates using rigid plate assumptions has resulted in underestimation of loads on some anchor bolts. Initial investigation indicated that nearly fifty percent of the base plates could not be assumed to behave as rigid plates. In addition, licensee inspection of anchor bolt installations at Shoreham has shown over fifty percent of the bolt installations to be deficient.

Vendor Inspection Audits by NRC at Architect Engineering firms have shown a wide range of design practices and installation procedures which have been employed for the use of concrete expansion anchors. The current trends in the industry are toward more rigorous controls and verification of the installation of the bolts.

The data available on dynamic testing of the concrete expansion anchors show fatigue failures can occur at loads substantially below the bolt static capacities due to material imperfections or notch type stress risers. The data also show low cycle dynamic failures at loads below the bolt static capacities due to joint slippage.

* Lines indicate changes to previous edition

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Action to be Taken by Licensees and Permit Holders:

This Bulletin addresses those pipe support base plates that use concrete expansion anchor bolts in Seismic Category I systems as defined by Regulatory Guide 1.29, "Seismic Design Classification" Revision 1, dated August 1973 or as defined in the applicable FSAR. For older plants where Seismic Category I requirements did not exist at the time of licensing it must be shown that piping supports for safety related systems, as defined in the Final Safety Analysis Report, meet design requirements.

The revision is not intended to penalize licensees who have already completed some of the Bulletin requirements. In those instances in which a licensee has completed action on a specific item and the Bulletin revision provides more conservative guidance, the licensee should explain the adequacy of the action already performed. It should be reiterated that the purpose of the Bulletin actions are to assure operability of Seismic Category I piping systems in the event of a seismic event.

1. Verify that pipe support base plate flexibility was accounted for in the calculation of anchor bolt loads. In lieu of supporting analysis justifying the assumption of rigidity, the base plates should be considered flexible if the unstiffened distance between the member welded to the plate and the edge of the base plate is greater than twice the thickness of the plate. It is recognized that this criterion is conservative. Less conservative acceptance criteria must be justified and the justification submitted as part of the response to the Bulletin. If the base plate is determined to be flexible, then recalculate the bolt loads using an appropriate analysis ~~which will account for the effects of shear - tension interaction, minimum edge distance and proper bolt spacing.~~ If possible, this is to be done prior to testing of anchor bolts. These calculated bolt loads are referred to hereafter as the bolt design loads. A description of the analytical model used to verify that pipe support base plate flexibility is accounted for in the calculation of anchor bolt loads is to be submitted with your response to the Bulletin.

   It has been noted that the schedule for analytical work on base plate flexibility for some facilities extends beyond the Bulletin reporting time frame of July 6, 1979. For those facilities for which an anchor bolt testing program is required (i.e., sufficient QC documentation does not exist), the anchor bolt testing program should not be delayed.

2. Verify that the concrete expansion anchor bolts have the following minimum factor of safety between the bolt design load and the bolt ultimate capacity determined from static load tests (e.g. anchor bolt manufacturer's) which simulate the actual conditions of installation (i.e., type of concrete and its strength properties):

a. Four - For wedge and sleeve type anchor bolts,

b. Five - For shell type anchor bolts.

The bolt ultimate capacity should account for the effects of shear-tension interaction, minimum edge distance and proper bolt spacing.

If the minimum factor of safety of four for wedge type anchor bolts and five for shell type anchors can not be shown then justification must be provided.

3. Describe the design requirements if applicable for anchor bolts to withstand cyclic loads (e.g. seismic loads and high cycle operating loads).

4. Verify from existing QC documentation that design requirements have been met for each anchor bolt in the following areas:

   (a) Cyclic loads have been considered (e.g. anchor bolt preload is equal to or greater than bolt design load). In the case of the shell type, assure that it is not in contact with the back of the support plate prior to preload testing.

   (b) Specified design size and type is correctly installed (e.g. proper embedment depth).

   If sufficient documentation does not exist, then initiate a testing program that will assure that minimum design requirements have been met with respect to sub-items (a) and (b) above. A sampling technique is acceptable. One acceptable technique is to randomly select and test one anchor bolt in each base plate (i.e. some supports may have more than one base plate). The test should provide verification of sub-items (a) and (b) above. If the test fails, all other bolts on that base plate should be similarly tested. In any event, the test program should assure that each Seismic Category 1 system will perform its intended function.

   The preferred test method to demonstrate that bolt preload has been accomplished is using a direct pull (tensile test) equal to or greater than design load. Recognizing this method may be difficult due to accessibility in some areas an alternative test method such as torque testing may be used. If torque testing is used it must be shown and substantiated that a correlation between torque and tension exists. If manufacturer's data for the specific bolt used is not available, or is not used, then site specific data must be developed by qualification tests.

   Bolt test values of one-fourth (wedge type) or one-fifth (shell type) of bolt ultimate capacity may be used in lieu of individually calculated bolt design loads where the test value can be shown to be conservative.

The purpose of Bulletin 79-02 and this revision is to assure the operability of each seismic Category I piping system. In all cases an evaluation to confirm system operability must be performed. If a base plate or anchor bolt failure rate is identified at one unit of a multi-unit site which threatens operability of safety related piping systems of that unit, continued operation of the remaining units at that site must be immediately evaluated and reported to the NRC. The evaluation must consider the generic applicability of the identified failures.

Appendix A describes two sampling methods for testing that can be used. Other sampling methods may be used but must be justified. Those options may be selected on a system by system basis.

Justification for omitting certain bolts from sample testing which are in high radiation areas during an outage must be based on other testing or analysis which substantiates operability of the affected system.

Bolts which are found during the testing program not to be preloaded to a load equal to or greater than bolt design load must be properly preloaded or it must be shown that the lack of preloading is not detrimental to cyclic loading capability. If it can be established that a tension load on any of the bolts does not exist for all loading cases then no preload or testing of the bolts is required.

If anchor bolt testing is done prior to completion of the analytical work on base plate flexibility, the bolt testing must be performed to at least the original calculated bolt load. For testing purposes factors may be used to conservatively estimate the potential increase in the calculated bolt load due to base plate flexibility. After completion of the analytical work on the base plates the conservatism of these factors must be verified.

For base plate supports using expansion anchors, but raised from the supporting surface with grout placed under the base plate, for testing purposes it must be verified that leveling nuts were not used. If leveling nuts were used, then they must be backed off such that they are not in contact with the base plate before applying tension or torque testing.

Bulletin No. 79-02 requires verification by inspection that bolts are properly installed and are of the specified size and type. Parameters which should be included are embedment depth, thread engagement, plate bolt hole size, bolt spacing, edge distance to the side of a concrete member and full expansion of the shell for shell type anchor bolts.

If piping systems 2 1/2-inch in diameter or less were computer analyzed then they must be treated the same as the larger piping. If a chart analysis method was used and this method can be shown to be highly conservative, then the proper installation of the base plate and anchor bolts should be verified by a sampling inspection. The parameters inspected should include those described in the preceding paragraph. If small diameter piping is not inspected, then justification of system operability must be provided.

5. All holders of operating licenses for power reactor facilities are requested to complete items 1 through 4 within 120 days of date of issuance of the Bulletin. No extension of time to complete action requested in Bulletin 79-02 is granted by issuance of this revision of the Bulletin. (Due Date - July 6, 1979) A reactor shutdown is not required to be initiated solely for purposes of this inspection above. However, it is expected that testing of otherwise inaccessible supports will be performed during the earliest extended outage following Bulletin issuance. It is also expected that testing of anchor bolts in accessible areas in operating plants will be performed within the reporting interval. In the event the required testing is not completed at the time of the initial report, on or about July 6, 1979, the licensee should justify system operability and therefore continued plant operation based upon the results of testing completed.

   Maintain documentation of any sampling inspection of anchor bolts required by item 4 on site and available for NRC inspection. Report in writing within 120 days of date of Bulletin issuance, to the Director of the appropriate NRC Regional Office, completion of your verification and describe any discrepancies in meeting items 1 through 4 and, if necessary, your plans and schedule for resolution. For planned action, a final report is to be submitted upon completion of your action. A copy of your report(s) should be sent to the United States Nuclear Regulatory Commission, Office of Inspection and Enforcement, Division of Reactor Operations Inspection, Washington, D.C. 20555. These reporting requirements do not preclude nor substitute for the applicable requirements to report as set forth in the regulations and license.

6. All holders of construction permits for power reactor facilities are requested to complete items 1 though 4 for installed pipe support base plates with concrete anchor bolts within 120 days of date of issuance of the Bulletin. No extension of time to complete action requested in Bulletin 79-02 is granted by issuance of this revision of the Bulletin. For pipe support base plates which have not yet been installed, document your actions to assure that items 1 though 4 will be satisfied. Maintain documentation of these actions on site and available for NRC inspection. Report in writing within 120 days of date of Bulletin issuance, to the Director of the appropriate NRC Regional Office, completion of your review and describe any discrepancies in meeting items 1 though 4 and, if necessary, your plans and schedule for resolution. A copy of your report should be sent to the United States Nuclear Regulatory Commission, Office of Inspection and Enforcement, Division of Reactor Construction Inspection, Washington, D.C. 20555.

Approved by GAO B180225 (R0072); clearance expires 7/31/80. Approval was given under a blanket clearance specifically for identified generic problems.

Attachment:
1. Appendix A

APPENDIX A

SAMPLING METHODS

Item 4 of this Bulletin states that for anchor bolt testing purposes a sampling program is acceptable. Two sampling methods are discussed below, but other methods may be used if justified.

a. Test one bolt on each plate as originally recommended in Bulletin No. 79-02. If the test fails, all other bolts on that base plate should be similarly tested. A high failure rate should be the basis for increased testing.

b. Randomly select and test a statistical sample of the bolts to provide a 95 percent confidence level that less than 5 percent defective anchors are installed in any one seismic Category I system. The sampling program should be done on a system by system basis.

ENCLOSURE 2

LISTING OF IE BULLETINS
ISSUED IN LAST TWELVE MONTHS

Bulletin No.	Subject	Date Issued	Issued To
78-10	Bergen-Paterson Hydraulic Shock Suppressor Accumulator Spring Coils	6/27/78	All BWR Power Reactor Facilities with an OL or CP
78-11	Examination of Mark I Containment Torus Welds	7/24/78	BWR Power Reactor Facilities with an OL for action: Peach Bottom 2 and 3, Quad Cities 1 and 2, Hatch 1, Monticello and Vermont Yankee. All other BWR Power Reactor Facilities with an OL for information
78-12	Atypical Weld Material in Reactor Pressure Vessel Welds	9/29/78	All Power Reactor Facilities with an OL or CP
78-12A	Atypical Weld Material in Reactor Pressure Vessel Welds	11/24/78	All Power Reactor Facilities with an OL or CP
78-12B	Atypical Weld Material in Reactor Pressure Vessel Welds	3/19/79	All Power Reactor Facilities with an OL or CP
78-13	Failures In Source Heads of Kay-Ray, Inc., Gauges Models 7050, 7050B, 7051, 7051B, 7060, 7060B, 7061 and 7061B	10/27/78	All General and Specific Licensees with the subject Kay-Ray, Inc. Gauges
78-14	Deterioration of Buna-N Components In ASCO Solenoids	12/19/78	All GE BWR Facilities with an OL (for action), and all other Power Reactor Facilities with an OL or CP (for information)

LISTING OF IE BULLETINS
ISSUED IN LAST TWELVE MONTHS (CONTINUED)

Bulletin No.	Subject	Date Issued	Issued To
79-01	Environmental Qualification of Class IE Equipment	2/8/79	All Power Reactor Facilities with an OL, except the 11 Systematic Evaluation Program Plants (for action), and all other Power Reactor Facilities with an OL or CP (For Information)
79-01A	Environmental Qualification of Class 1E Equipment (Deficiencies in the Environmental Qualification of ASCO Solenoid Valves)	6/6/79	All Power Reactor Facilities with an OL or CP
79-02	Pipe Support Base Plate Design Using Concrete Expansion Anchor Bolts	3/8/79	All Power Reactor Facilities with an OL or CP
79-03	Longitudinal Weld Defects in ASME SA-312 Type 304 Stainless Steel Pipe Spools Manufactured by Youngstown Welding and Engineering Company	3/12/79	All Power Reactor Facilities with an OL or CP
79-04	Incorrect Weights for Swing Check Valves Manufactured by Velan Engineering Corporation	3/30/79	All Power Reactor Facilities with an OL or CP
79-05	Nuclear Incident at Three Mile Island	4/1/79	All Babcock and Wilcox Power Reactor Facilities with an OL, Except Three Mile Island 1 and 2 (For Action), and All Other Power Reactor Facilities With an OL or CP (For Information)

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LISTING OF IE BULLETINS ISSUED IN LAST TWELVE MONTHS (CONTINUED)

Bulletin No.	Subject	Date Issued	Issued to
79-05A	Nuclear Incident at Three Mile Island - Supplement	4/5/79	Same as 79-05
79-06	Review of Operational Errors and System Mis-alignments Identified During the Three Mile Incident	4/11/79	All Pressurized Water Power Reactor Facil-ities with an OL Except B&W Facilities (For Action), All Other Power Reactor Facil-ities with an OL or CP (For Information)
79-06A	Same Title as 79-06	4/14/79	All Westinghouse Designed Pressurized Power Reactor Facil-ities with an OL (For Action), and All Other Power Reactor Facilities with an OL or CP (For Information)
79-06A (Revision 1)	Same Title as 79-06	4/18/79	All Westinghouse Designed Pressurized Power Reactor Facil-ities with an OL (For Action), and All Other Power Reactor Facilities with an OL or CP (For Information)
79-06B	Same Title as 79-06	4/14/79	All Combustion Engineering Designed Pressurized Power Reactor Facilities with an OL (For Action), and All Other Power Reactor Facilities with an OL or CP (For Information)
79-07	Seismic Stress Analysis of Safety-Related Piping	4/14/79	All Power Reactor Facilities with an OL or CP

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LISTING OF IE BULLETINS
ISSUED IN LAST TWELVE MONTHS (CONTINUED)

Bulletin No.	Subject	Date Issued	Issued to
79-08	Events Relevant to Boiling Water Power Reactors Identified During Three Mile Island Incident	4/14/79	All BWR Power Reactor Facilities with an OL (For Action), All Other Power Reactor Facilities with an OL or CP (For Information)
79-09	Failures of GE Type AK-2 Type Circuit Breaker in Safety Related Systems	4/17/79	All Power Reactor Facilities with an OL or CP
79-10	Requalification Training Program Statistics	5/11/79	All Power Reactor Facilities with an OL
79-11	Faulty Overcurrent Trip Device in Circuit Breakers for Engineered Safety Systems	5/22/79	All Power Reactor Facilities with an OL or CP
79-12	Short Period Scrams at BWR Facilities	5/31/79	All GE BWR Facilities with an OL