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MAY 18 1981

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MEMORANDUM FOR: B. H. Grier, Director, Region I
J. P. O'Reilly, Director, Region II
J. G. Keppler, Director, Region III
K. V. Seyfrit, Director, Region IV
R. H. Engelken, Director, Region V

FROM: E. L. Jordan, Deputy Director, Division of Resident and Regional Reactor Inspection, IE

SUBJECT: RESPONSE TO IEB 79-26, "BORON LOSS FROM BWR CONTROL BLADES"

Item 4 of Revision 1 of the subject bulletin requested that BWR licensees provide a report of control blade examination results to us by April 15, 1981. These reports have been received in the regional offices.

With exception of the Monticello submittal, all reports from the BWR licensees are copies of GE prepared documents reporting on GE's destructive examination of a Vermont Yankee control blade. Copies of these reports have been provided directly to NRR by GE. Therefore, the regions should not transmit a copy of these submittals to headquarters.

We expect that Northern States Power Company will be submitting a specific report for a Monticello control blade. In this case we request that Region III forward a copy for subsequent review by NRR.

As implied above, this is to confirm that technical review and evaluation of these reports will be performed by the Core Performance Branch of NRR. Therefore, the regions need only confirm licensee submittal of a report for satisfactory implementation of Item 4 of IEB 79-26 Revision 1 issued August 29, 1980.

Edward L. Jordan, Deputy Director
Division of Resident and Regional
Reactor Inspection, IE

cc: J. H. Sniezek, IE
R. L. Spessard, RIII
W. S. Little, RIII
R. O. Meyer, NRR

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CONTACT: C. J. DeBevec, IE
49-24870

IE:REB IE:REB IE:RRRI:DD
BBGrier WRMills ELJordan

Chuck

GENERAL ELECTRIC

NUCLEAR POWER SYSTEMS DIVISIO

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125
MC 682, (408) 925-3732

MFN-066-81
RLG-047-81

April 8, 1981

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Dr. William V. Johnston, Chief
Core Performance Branch

Gentlemen:

SUBJECT: BORON LOSS FROM BWR CONTROL BLADES

References:
1) "Control Blade Examination Results And Response To Item 4 Of IE Bulletin 79-26," NEDE-24325-P, Class III (Company Proprietary), March 1981
2) "Evaluation of Control Blade Lifetime With Potential Loss of B_4C," (Supplement 1), NEDE-24226-1-P, Class III (Company Proprietary), March 1981
3) "Evaluation of Control Blade Lifetime With Potential Loss of B_4C," NEDE-24226-P, Class III (Company Proprietary), December 1979.

This letter transmits twenty (20) copies of References 1 and 2. These reports present information to satisfy the requirements of Item 4 in IE Bulletin 79-26, Revision 1, for General Electric (GE) operating Boiling Water Reactors (BWRs) listed in Table 1-1 in Reference 1.

References 1 and 2 provide the results of post-irradiation examinations which have been performed since the publication of Reference 3. A boron depletion model has also been developed, as described in Reference 1. The boron depletion model is shown in References 1 and 2 to be in good agreement with control blade post-irradiation examination data from four different BWR plants.

General Electric believes that the information presented in References 1 and 2, along with the information previously submitted in Reference 3, shows that the thirty-four percent (34%) average depletion burnup replacement criterion is conservative, predictable, and applicable to the GE operating BWRs listed in Table 1-1 in Reference 1.

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PDR

References 1 and 2 contain information which General Electric Company customarily maintains in confidence and withholds from public disclosure. The information has been handled and classified as proprietary to General Electric as indicated in the attached affidavit, and we hereby request that NEDE-24325-P and NEDE-24226-1-P be withheld from public disclosure in accordance with provisions of 10CFR2.790.

Question or comments regarding this matter should be directed to Dr. L. M. Zull of my staff at (408) 925-5599.

Very truly yours,

R. L. Gridley, Manager
Fuel and Services Licensing

RLG:hjr/64-5

Attachments

cc: T. A. Ippolito, NRC
E. L. Jordon, NRC

GENERAL ELECTRIC COMPANY

AFFIDAVIT

I, Glenn G. Sherwood, being duly sworn, depose and state as follows:

1. I am, Manager General Electric Company, and have been delegated the function of reviewing the information described in paragraph 2 which is sought to be withheld and have been authorized to apply for its withholding.

2. The information sought to be withheld is:

   1) "Control Blade Examination Results And Response To Item 4 of IE Bulletin 79-26," NEDE-24325-P, Class III (General Electric Company Proprietary Information), March 1981.

   2) "Evaluation of Control Blade Lifetime With Potential Loss of B_4C," (Supplement 1), NEDE-24226-1-P, Class III (General Electric Company Proprietary Information), March 1981.

3. In designating material as proprietary, General Electric utilizes the definition of proprietary information and trade secrets set forth in the American Law Institute's Restatement Of Torts, Section 757. This definition provides:

   > "A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business and which gives him an opportunity to obtain an advantage over competitors who do not know or use it.... A substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring information... Some factors to be considered in determining whether given information is one's trade secret are: (1) the extent to which the information is known outside of his business; (2) the extent to which it is known by employees and others involved in his business; (3) the extent of measures taken by him to guard the secrecy of the information; (4) the value of the information to him and to his competitors; (5) the amount of effort or money expended by him in developing the information; (6) the ease or difficulty with which the information could be properly acquired or duplicated by others."

4. Some examples of categories of information which fit into the definition of proprietary information are:

   a. Information that discloses a process, method or apparatus where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information consisting of supporting data and analyses, including test data, relative to a process, method or apparatus, the application of which provide a competitive economic advantage, e.g., by optimization or improved marketability;

c. Information which if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality or licensing of a similar product;

d. Information which reveals cost or price information, production capacities, budget levels or commercial strategies of General Electric, its customers or suppliers;

e. Information which reveals aspects of past, present or future General Electric customer-funded development plans and programs of potential commercial value to General Electric;

f. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection;

g. Information which General Electric must treat as proprietary according to agreements with other parties.

5. In addition to proprietary treatment given to material meeting the standards enumerated above, General Electric customarily maintains in confidence preliminary and draft material which has not been subject to complete proprietary, technical and editorial review. This practice is based on the fact that draft documents often do not appropriately reflect all aspects of a problem, may contain tentative conclusions and may contain errors that can be corrected during normal review and approval procedures. Also, until the final document is completed it may not be possible to make any definitive determination as to its proprietary nature. General Electric is not generally willing to release such a document to the general public in such a preliminary form. Such documents are, however, on occasion furnished to the NRC staff on a confidential basis because it is General Electric's belief that it is in the public interest for the staff to be promptly furnished with significant or potentially significant information. Furnishing the document on a confidential basis pending completion of General Electric's internal review permits early acquaintance of the staff with the information while protecting General Electric's potential proprietary position and permitting General Electric to insure the public documents are technically accurate and correct.

6. Initial approval of proprietary treatment of a document is made by the Subsection Manager of the originating component, the man most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within the Company is limited on a "need to know" basis and such documents at all times are clearly identified as proprietary.

7. The procedure for approval of external release of such a document is reviewed by the Section Manager, Project Manager, Principal Scientist or other equivalent authority, by the Section Manager of the cognizant Marketing function (or his delegate) and by the Legal Operation for technical content, competitive effect and determination of the accuracy of the proprietary designation in accordance with the standards enumerated above. Disclosures outside General Electric are generally limited to regulatory bodies, customers and potential customers and their agents, suppliers and licensees only in accordance with appropriate regulatory provisions or proprietary agreements.

8. The documents mentioned in paragraph 2 above have been evaluated in accordance with the above criteria and procedures and have been found to contain information which is proprietary and which is customarily held in confidence by General Electric.

9. The documented mentioned in paragraph 2 above provide the results of post-irradiation examinations performed by General Electric of control blades from General Electric Boiling Water Reactors (BWRs). A boron depletion model developed by General Electric is also described.

10. The information to the best of my knowledge and belief, has consistently been held in confidence by the General Electric Company, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties have been made pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

11. Public disclosure of the material sought to be withheld is likely to cause substantial harm to the competitive position of the General Electric Company and deprive or reduce the availability of profit-making opportunities because:

    a. It was developed with the expenditure of substantial resources exceeding $800,000 by GE and the U.S. operating plants listed in Table 1-1 in Reference 1 in paragraph 2 above.

    b. The resources dedicated to this effort were those of the General Electric Company.

    c. Public availability of the material would allow domestic and foreign competitors, including competing BWR suppliers, to obtain the capability to perform control blade calculations and evaluations for control blades in GE BWR plants at no cost which General Electric developed at substantial cost. Use of this material would provide competitors a competitive advantage over General Electric by allowing competitors to offer control blade calculations and evaluations at lower cost than General Electric.

Glenn G. Sherwood, being duly sworn, deposes and says that he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at San Jose, California, this 8 day of APRIL, 1981.

Glen G. Sherwood
General Electric Company

STATE OF CALIFORNIA)
COUNTY OF SANTA CLARA) ss:

Subscribed and sworn before me this 8 day of APRIL 1981.

OFFICIAL SEAL
KAREN S. VOGELHUBER
NOTARY PUBLIC - CALIFORNIA
SANTA CLARA COUNTY
My Commission Expires Dec. 21, 1984

Karen S. Vogelhuber
NOTARY PUBLIC IN AND FOR SAID
COUNTY AND STATE

GGS:hjr/222-5

Chuck

Northern States Power Compa

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-6071

D. E. Gilberts
Senior Vice President
Power Supply

May 1, 1981

Mr. James G. Keppler
Director, Region III
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Dear Mr. Keppler:

MONTICELLO NUCLEAR GENERATING PLANT

Docket No. 50-263 License No. DPR-22

Status on IE Bulletin No. 79-26, Revision 1

NSP has received confirmation of completion of the destruction examination of Monticello's most highly exposed control blade at Vallecitos. A report of the results of the examination has been issued and is expected to be received by NSP the week of May 4, 1981. NSP's response will be issued within two weeks of receipt of the report.

If additional information is required, please communicate directly with plant management.

Yours truly,

D E Gilberts

D. E. Gilberts
Senior Vice President
Power Supply

cc: Mr. C. H. Brown
Mr. G. Charnoff
NRC Office of Inspection and Enforcement
Washington, D. C. 20555

DEG:nk

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PDR/LPDR

SSINS No.: 6820
Accession No.:
~~8006190042~~

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

August 29, 1980

IE Bulletin No. 79-26 Rev. 1

BORON LOSS FROM BWR CONTROL BLADES

Description of Circumstances:

The General Electric Company (GE) has informed us of a failure mode for control blades which can cause a loss of boron poison material. Hot cell examinations of both foreign and domestic blades have revealed cracks near the upper end of stainless steel tubing and loss of boron from the tubes. The cracks and boron loss have so far been confined to locations in the poison tubes with more than 50 percent Boron-10 (B^{10}) local depletion. Observed crack sizes range from a quarter to a half inch in length and from one to two mils in width.

GE has postulated that the cracking is due to stress corrosion induced by solidification of boron carbide (B_4C) particles and swelling of the compacted B_4C as helium and lithium concentrations grow. Once primary coolant penetrates the cladding (i.e., the cracking has progressed through the cladding wall and the helium-lithium pressures are sufficient to open the crack), boron is leached out of the tube at locations with more than 50 percent B^{10} local depletion (local depletion is considered to be twice the average depletion). It was further found with similar cracking but with less than 50 percent local depletion of B^{10}, that leaching did not occur even though primary coolant had penetrated the cladding.

The cracking and boron loss shorten the design life of the control blade. According to the GE criteria the end of design life is reached when the reactivity worth of the blade is reduced by 10 percent, which corresponds to 42 percent B^{10} depletion averaged over the top quarter of the control blade. Because of the leaching mechanism, GE has reduced the allowance for B^{10} depletion averaged over the top quarter of the control blade from the 42 percent value to 34 percent.

The safety significance of boron loss is its impact on shutdown capability and scram reactivity. Although shutdown capability is demonstrated by shutdown margin tests after refueling, the calculated control blade worths used in the tests are based on the assumption that no boron loss has occurred. Reduction in scram reactivity due to boron loss could increase the severity of Critical Power Ratio (CPR) reductions during the plant transients and could increase the consequences of control rod drop accidents.

Because the locations of limiting Linear Heat Generation Rate (LHGR), CPR, and Average Planar LHGR (APLHGR) are not in controlled cells, local power limit monitoring is not affected by boron loss.

GE has evaluated the potential effect of boron loss on shutdown capability, CPR reduction and the consequences of control rod drop accidents. GE's evaluation is based on the hot cell result that no boron loss is observed until 50 percent local B^{10} depletion is attained. For each B_4C tube, complete loss of B_4C was assumed when the calculated B^{10} depletion exceeded 50 percent locally. For any blade expected to reach a B^{10} depletion greater than 34 percent during a cycle, GE assumed a B^{10} depletion distribution typical of blades at the previously defined end of design life.

Based on these evaluations GE arrived at the following conclusions:

(a) Control rod drop accident consequences are not sufficiently sensitive to small reductions in scram reactivity to be affected by boron loss before the end of design life of the blades involved.

(b) If no more than 26 percent of the control blades have experienced a 10 percent reduction in projected worth taking boron loss into consideration, there is a negligible effect on transient CPR reduction and MCPR limits.

(c) If any control blades have experienced more than 10 percent reduction in projected worth, taking boron loss into consideration, the shutdown margin should be demonstrated to be at least the sum of the shutdown

margin required by Technical Specifications plus an increment sufficient to account for the potential for boron loss.

We have examined the bases for GE's conclusions, including the hot cell tests and the calculational assumptions. The preferred action is to replace all blades expected to have greater than 34 percent B^{10} depletion averaged over the upper one-fourth of the blade. However, based on our review we believe the relation between boron loss and B^{10} depletion (i.e., the observations to date show that boron loss does not occur until 50 percent local depletion of B^{10}) is sufficiently understood to justify BWR operation on an interim basis provided the following actions have been taken by licensees.

Action to be taken by Licensees:

For all BWR power reactor facilities with an operating license:

1. The operating history of the reactor is to be reviewed to establish a record of the current B^{10} depletion averaged over the upper one-fourth of the blade for every control blade; the record is to be maintained on a continuing basis. This action is required on all reactors whether shutdown for refueling or operating.

2. Identify any control blades predicted to have greater than 34 percent B^{10} depletion averaged over the upper one-fourth of the blade by the next refueling outage.

   a. Describe your plans for replacement of identified control blades.

   b. Describe measures which you plan to take justifying continued operations until the next refueling specifically addressing (1) any blade with greater than 42 percent depletion averaged over the upper one-fourth of the blade; and (2) the condition where you find greater

than 26 percent of the control blades calculated to have greater than 34 percent depletion averaged over the upper one-fourth of the blade.

3. At the next cold shutdown or refueling outage, conduct shutdown margin tests to verify that:

   a. full withdrawal of any control blade from the cold xenon-free core will not result in criticality; and

   b. compliance with the shutdown margin requirement in a manner that accommodates the boron loss phenomenon (i.e., by including a plant specific increment in the shutdown margin that takes the potential loss of boron from control blades identified from evaluation of Item 1 into consideration).

4. Perform a destructive examination of the most highly exposed control blade at the end of the next cycle and provide results of the examination within one calendar year after removal of the blade. The results to be reported should include:

   a. Tube number or identification.

   b. The elevation of each crack in the tubing. R1

   c. The calculated B^{10} depletion versus elevation for each tube.

   d. The measured B^{10} loss versus elevation for each tube.

   e. The maximum local depletion for tubes have no cracks.

   f. The maximum local depletion for tubes having no loss of boron.

Alternately, the results of a destructive examination of a blade of similar fabrication and operational history may be provided no later than April 15, 1981. If the highest local B^{10} depletion is less than 50 percent, this examination can be deferred until the next refueling and the examination results provided within one calendar year of the removal of the blade. R1

5. Submit within 45 days of the date of issuance of this Bulletin, a written report of the findings as to Items (1) and (2). For facilities in a refueling outage, and all other facilities at their next refueling outage, submit the written report on Item (3) within 30 days after plant startup following the outage. A written report on Item (4) is requested within one year after removal of a control blade for destructive examination.

Reports should be submitted to the Director of the appropriate NRC Regional Office and a copy should be forwarded to the NRC Office of Inspection and Enforcement, Division of Reactor Operations Inspection, Washington, D.C. 20555

For all BWR facilities with a construction permit and all other power reactor facilities with an operating license or construction permit, this Bulletin is for information only no written response is required.

Approved by GAO, B180225 (R0072); clearance expires July 31, 1980. (Application for renewal pending before GAO.) Approval was given under a blanket clearance specifically for identified generic problems.

IE Bulletin No. 79-26 Rev. 1
August 29, 1980

Enclosure

RECENTLY ISSUED
IE BULLETINS

Bulletin No.	Subject	Date Issued	Issued To
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
80-15	Possible Loss Of Hotline With Loss Of Off-Site Power	6/18/80	All nuclear facilities holding OLs
80-14	Degradation of Scram Discharge Volume Capability	6/12/80	All BWR's with an OL