

ENCLOSURE 2

MFN 14-015

NEDO-31758-A, "GE Marathon Control Rod Assembly," October 1991

Non-Proprietary Information— Class I (Public)

IMPORTANT NOTICE

This is a non-proprietary summary of NEDE-31758P-A.

NEDO-31758-A

Class I

October 1991

GE NUCLEAR ENERGY

GE MARATHON CONTROL ROD ASSEMBLY



GE Nuclear Energy

***175 Currier Avenue
San Jose, CA 95125***

Non-Proprietary Information – Class I (Public)
NEDO-31758-A

NOTICE

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

July 1, 1991
MFN 118-91

Ms. J. S. Charnley, Manager
Fuel Licensing
General Electric Company
175 Curtner Avenue
San Jose, California 95125

Dear Ms. Charnely:

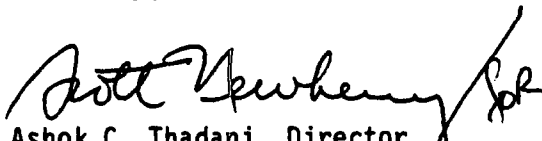
SUBJECT: ACCEPTANCE FOR REFERENCING OF TOPICAL REPORT NEDE-31758P,
"GE MARATHON CONTROL ROD ASSEMBLY" (TAC NO. 77255)

We have reviewed the subject topical report of January 1990, and the responses to requests for additional information of September 14, 1990, February 20, 1991, and June 19, 1991. We conclude that NEDE-31758P provides an acceptable basis for the mechanical design for boiling water reactor (BWR) control rods. The enclosure to this letter provides our safety evaluation report (SER) which details the basis and limitations of our approval. Our evaluation applies only to matters described in the topical report.

In accordance with procedures established in NUREG-0390, "Topical Report Review Status," we request that General Electric Company publish accepted versions of this topical report, proprietary and non-proprietary, within 3 months of receipt of this letter. The accepted versions shall include an "A" (designating accepted) following the report identification symbol.

If our acceptance criteria or regulations change in a manner that would invalidate our conclusions as to the acceptability of the report, applicants referencing this topical report will be expected to revise and resubmit their respective documentation, or submit justification for the continued applicability of the topical reports without revising their respective documentation.

Sincerely,


Ashok C. Thadani, Director
Division of Systems Technology
Office of Nuclear Reactor Regulation

Enclosure:
NEDE-31758P Evaluation

ENCLOSURE

SAFETY EVALUATION REPORT
"GE MARATHON CONTROL ROD ASSEMBLY"
GENERAL ELECTRIC COMPANY
NEDE-31758P

1.0 INTRODUCTION

The General Electric Company (GE) has submitted to the U.S. Nuclear Regulatory Commission (NRC) the Topical Report NEDE-31758P, "GE Marathon Control Rod Assembly," (Ref. 1) for the staff to review. The Marathon control rod is designed to be compatible with or to replace the currently approved GE control rods. The Marathon control rod has a higher worth and a higher burnup level than current rods which should yield a longer lifetime. The absorber material in the Marathon control rod design includes boron carbide (B_4C) and hafnium.

2.0 EVALUATION

The NRC contractor, Pacific Northwest Laboratory (PNL) assisted the staff in reviewing the Marathon control rod. PNL has provided a technical evaluation report (TER) of June 19, 1991 (Attachment 1). The contractor concluded that the GE Marathon control rod design as described in NEDE-31758P is acceptable for licensing applications if GE performs a surveillance program on control rods to monitor and confirm the control rod performance. The staff concurred with the PNL assessment that the GE proposed surveillance (Ref. 2) of April 10, 1991 was inadequate. The NRC staff transmitted to GE a staff position (Attachment 2) on the surveillance of Marathon control rods, including experiences regarding failure data for control rods. In a letter of June 19, 1991, from J.S. Charnley to the NRC (Ref. 3), GE proposed a modified surveillance program for Marathon control rods (Attachment 3).

GE did not believe that fast neutron flux exposure contributed significantly to early control rod cracking, but their proposed surveillance is designed to investigate this effect and to detect material failure in control rods within

a 15% range of the depletion of the lead Marathon control rod. The staff finds the proposed surveillance to be responsive to staff concerns and therefore acceptable.

3.0 CONCLUSIONS

The staff has reviewed the mechanical design for the GE Marathon control rod described in NEDE-31758P and finds it acceptable for licensing applications.

The GE surveillance will consist of two parts, the control cell core (CCC) design and the non-control cell core design. For non-CCC operation, the lead depletion control rod will be examined. For CCC operation, the lead rod and three additional rods that are within 15 percent of the depletion of the lead rod will be inspected during each refueling outage to confirm the lifetime criterion. GE defines the analytical end of life as a 10 percent reduction in cold reactivity worth in any 1/4 axial segment relative to the initial undepleted state of the original equipment control rod. This definition is standard and thus acceptable. Furthermore, during the last refueling outage before the end of life of the lead rod, GE will examine the lead rod and four additional rods that are in CCC locations and within 15 percent of the estimated fast fluence of the lead rod.

Based on industry operating experience with cracked control rods, the staff concludes that this GE surveillance program for lead control rods and non-lead control rods in CCC operation, should detect any control rod cracks before they propagate to a degree that could cause a loss of insertion capability or substantial reduction in rod worth due to control material leaching. Thus, the surveillance program is acceptable.

GE proposes to evaluate design changes to the Marathon control rod by performing a surveillance program that provides for up to four lead surveillance rods to be inserted into a reactor if the design change conforms to the General Design criteria cited in Reference 1. GE has committed to provide to the NRC a design description and the documentation of its

evaluation for lead control rods in this program. The staff finds this commitment acceptable.

4.0 REFERENCES

1. General Electric Company, "GE Marathon Control Rod Assembly," NEDE-31758P, January 1990.
2. Letter from J.S. Charnley (GE) to NRC, "Lead Marathon Control Rod Surveillance Program," April 10, 1991.
3. Letter from J.S. Charnley (GE) to NRC, "Marathon Control Rod Surveillance," June 19, 1991.

1. Summary

This report describes the design of the GE Marathon control rod and demonstrates how the Marathon design complies with the proposed control rod licensing acceptance criteria. This control rod is designed to be compatible with BWR/2-4 D-lattice, BWR/4-5 C-lattice, and BWR/6 S-lattice configurations, and is suitable as a direct replacement for any of the current GE control rod assemblies. The form, fit and function of the Marathon design are identical to any of the control rod designs it replaces.

The design descriptions and analyses demonstrate that the Marathon design satisfies the performance and licensing acceptance criteria for use as a direct replacement for currently used control rod assemblies. Compliance with the licensing basis has been demonstrated.

2. Design Description

The Marathon control rod is illustrated in Figure 2-1. The essential difference between the Marathon control rod and the most recent preceding approved design, the Duralife-230, is the replacement of the absorber tube and sheath arrangement with an array of square tubes, which results in reduced weight and increased absorber volume. In addition, the full length tie rod used in previously approved designs is replaced with a segmented tie rod, which also reduces weight.

The square tubes are fabricated from a high purity stabilized Type-304 stainless steel that provides high resistance to irradiation-assisted stress corrosion cracking. This material provides extra ductility margin to accommodate boron-carbide (B_4C) swelling. The square absorber tubes each have four lobes to allow adjacent tubes to be welded to each other. The absorber tubes are welded lengthwise to form the four wings of the control rod. Each wing is comprised of either 14 or 17 absorber tubes. The absorber tubes each act as an individual pressure chamber for the retention of helium. The region between each pair of square tubes is filled with helium and sealed top and bottom by welding. The four wings are then welded to the tie rod to form the cruciform-shaped member of the control rod.

The square tubes are circular inside and are loaded with either B_4C or hafnium. The B_4C is contained in separate capsules to prevent its migration. The capsules are placed inside the absorber tubes and are smaller than the absorber tube inside diameter, allowing the B_4C to swell before it makes contact with the absorber tubes, thereby providing improved resistance to stress corrosion. An empty tube may be used adjacent to the tie rods to achieve the desired reactivity worth. The combination of absorbers and absorber tubes used is based on the desired initial reactivity worth and the intended application. In addition, empty capsules may be used in the absorber tubes to provide a plenum for helium released during B_4C burnup. The B_4C capsules are fabricated from stainless steel tubing and have stainless steel caps attached by rolling the tubing into grooves in the caps. The capsules are loaded into the individual absorber tubes, which are then sealed at each end by welded end caps. The capsules securely contain the B_4C while allowing the helium to migrate through the absorber tube.

The Marathon control rod can be supplied with either the original velocity limiter design or the weight optimized design. The selection is based on the control rod assembly weight requirements. Other options include the use of wear pads instead of rollers, and an extended handle that facilitates handling of the control rod. The Marathon design is directly interchangeable with existing control assemblies.

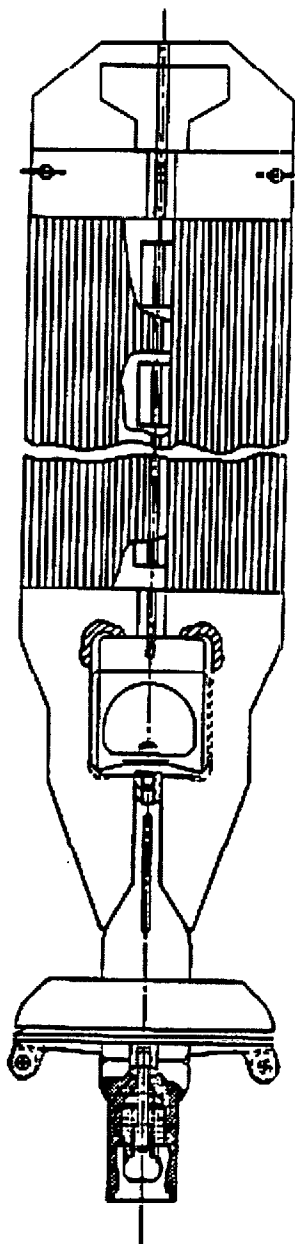


Figure 2-1 Illustration of Typical Marathon Control Rod

ENCLOSURE 3

MFN 14-015

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Jerald G. Head, state as follows:

- (1) I am the Senior Vice President, Regulatory Affairs of Licensing Regulatory Affairs of GE-Hitachi Nuclear Energy Americas LLC (GEH), 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 contained in NEDE-31758P-A, "GE Marathon Control Rod Assembly," October 1991. This is a legacy document which is considered proprietary in its entirety. The header of each page in this enclosure carries the notation "GEH Proprietary Information – Class III (Confidential) {3}." The notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.
- (3) In making this application for withholding and determination of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act (FOIA), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).
- (4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:
 - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over GEH and/or other companies. In this case, the information sought to be withheld is business-confidential information related to the GEH organization.
 - b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product. In this case, the information sought to be withheld is business-confidential information related to the GEH organization.

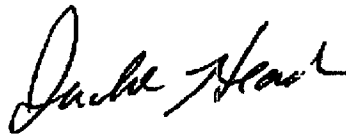
- c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, that may include potential products of GEH.
 - d. Information that discloses trade secret and/or potentially patentable subject matter for which it may be desirable to obtain patent protection.
- (5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to the NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary and/or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in the following paragraphs (6) and (7).
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements. In this case, the information sought to be withheld is business-confidential information related to the GEH organization.
- (8) The information identified in paragraph (2) above is classified as proprietary because it communicates sensitive business information regarding GEH Management and Oversight organization structures and philosophy. In this case, the information sought to be withheld is business-confidential information related to the GEH organization.

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. In this case, the information sought to be withheld is business-confidential information related to the GEH organization.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 28th day of March 2014.

A handwritten signature in black ink, appearing to read "Jerald G. Head", with a stylized flourish at the end.

Jerald G. Head
Senior Vice President Regulatory Affairs
GE-Hitachi Nuclear Energy Americas LLC