

NUCLEAR REGULATORY COMMISSION

(10 CFR Part 50)

DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Fracture Toughness Requirements for Nuclear Power Reactors

AGENCY: U.S. Nuclear Regulatory Commission

ACTION: Final rule

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its regulations specifying fracture toughness and material surveillance program requirements for nuclear reactors to permit greater flexibility in meeting certain of these requirements and to simplify others by substituting references to National Standards that have already been incorporated by reference into the NRC's Regulations.

EFFECTIVE DATE:

FOR FURTHER INFORMATION CONTACT: Dr. P. N. Randall, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, 301-443-5997.

SUPPLEMENTARY INFORMATION: On March 28, 1979, the Nuclear Regulatory Commission published in the FEDERAL REGISTER (44 FR 18513) proposed amendments to its regulations, 10 CFR Part 50, "Licensing of Production and Utilization Facilities," which would amend Appendix G, "Fracture Toughness Requirements," with regard to material toughness requirements for bolts,

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and would amend Appendix H, "Reactor Vessel Material Surveillance Program Requirements," with regard to the location and method of attachment of surveillance capsule holders in the reactor vessel. Interested persons were invited to submit written comments by May 14, 1979. There were four adverse comments. All of them opposed adoption of the proposed rule on the grounds that the accident at Three Mile Island Unit 2 on March 28, 1979 had demonstrated that there should be no relaxation of regulatory requirements. None of the comments addressed the specific technical issues covered by the proposed rule. In response to these comments, the Commission has no reason to believe that the investigation of that accident will raise any question about these technical issues. Furthermore, the Commission believes that the proposed amendments will not reduce present safety margins. Therefore, after consideration of the comments, the Commission has adopted the amendments to Appendices G and H, 10 CFR Part 50, described below. The language of the amendments is unchanged from that of the proposed rule.

In Appendix G to 10 CFR Part 50, paragraph IV.A.4 contains requirements for the material toughness of bolts that are very similar to present ASME Code requirements. Paragraph IV.A.4 is deleted, and paragraph IV.A.3 is revised to add language requiring compliance with the pertinent ASME Code requirements for bolts. As an additional revision of paragraph IV.A.3, the requirements for piping, pumps and valves are clarified by referencing a different paragraph in the ASME Code than is presently referenced. This newly referenced paragraph contains the specific fracture toughness requirements for those components.

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In Appendix H to 10 CFR Part 50, paragraph II.C.2 is revised in two respects. The prohibition against attachment of surveillance capsules to the vessel wall is deleted because, for some vessel designs, the advantages of attachment to the wall (fewer problems in achieving the desired lead factor and the structural integrity of the capsule holder) outweigh the disadvantage of concern for vessel integrity. Language is added to require that, if capsule holders are attached to the vessel wall, the attachments must meet ASME Code requirements for construction and inspection of permanent structural attachments to reactor vessels.

The fixed limits on lead factor (the ratio of neutron flux at the capsule to the maximum flux at the vessel inner wall) of greater than 1 but less than 3 are deleted. Enforcement of the present requirement would require modification of certain designs that have satisfactorily met all surveillance and structural requirements in service. Safety concerns are satisfied by retention of the general requirement on lead factor.

Copies of the abstract of comments and staff response, and copies of the value/impact analysis supporting the rule, are available for public inspection at the Commission's Public Document Room at 1717 H Street, N.W., Washington, D.C. Single copies may be obtained on request from the Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20550, Attention: P. N. Randall.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and sections 552 and 553, title 5 of the United States Code, the following amendments to 10 CFR Part 50 are published as a document subject to codification.

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1. Appendix G to 10 CFR Part 50 is amended by deleting paragraph IV.A.4 and revising paragraph IV.A.3 to read as follows:

IV. Fracture Toughness Requirements

A. * * *

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3. Materials for piping, pumps, and valves shall meet the requirements of paragraph NB-2332 of the ASME Code. Materials for bolting and other fasteners shall meet the requirements of paragraph NB-2333 of the ASME Code.

2. Appendix H to 10 CFR is amended by revising paragraph II.C.2. to read as follows:

II. Surveillance Program Criteria

* * * * *

- C. The Surveillance program shall meet the following requirements:

* * * * *

2. Surveillance specimen capsules shall be located near the inside vessel wall in the beltline region, so that the specimen irradiation history duplicates to the extent practicable, within the physical constraints of the system, the neutron spectrum, temperature history, and maximum neutron fluence experienced by the reactor vessel inner surface. If the capsule holders are attached to the vessel wall or to the vessel cladding, construction and inservice inspection of the attachments and attachment welds shall be done according to the requirements for permanent structural attachments to reactor vessels given

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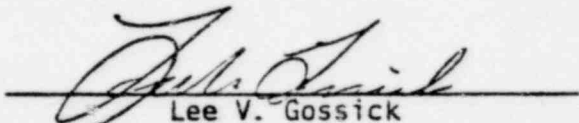
in the ASME Code,² Sections III and XI. The design and location of the capsules shall permit insertion of replacement capsules. Accelerated irradiation capsules may be used in addition to the required number of surveillance capsules specified in paragraph II.C.3.

* * * * *

(Secs. 103, 104, 161i, Pub. Law 83-703; '68 Stat. 936, 937, 948 (42 U.S.C. 2133, 2134, 2201(i)); Sec. 201, Pub. Law 93-438, 88 Stat. 1242, as amended (42 U.S.C. 5841).)

Dated at Washington, DC this 13th day of September 1979.

For the Nuclear Regulatory Commission



Lee V. Gossick
Executive Director for Operations

²Defined in paragraph II.A of Appendix G to 10 CFR Part 50.

VALUE/IMPACT STATEMENT ON LIMITED REVISION OF APPENDICES G AND H,
FRACTURE TOUGHNESS AND SURVEILLANCE PROGRAM REQUIREMENTS

I. The Proposed Action

A. Description

Three detailed technical requirements in Appendices G and H are being revised to delete restrictions that now appear unnecessary.

1. Material toughness requirements for bolting are being deleted from the regulation, and ASME Code requirements are referenced instead.
2. The specific limits on lead factor (the ratio of neutron flux at the surveillance capsule to that at the vessel wall at the peak fluence location) are being deleted.
3. The prohibition of attachment of surveillance capsule holders to the vessel wall is being deleted, but a requirement is being added which directs that such attachment be treated by ASME Code rules for construction and inspection of attachments.

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B. Need for Proposed Action

The three technical requirements that are being revised by these amendments were part of a larger package of revisions, which have been in preparation for some time. The need for changes had been identified in the course of more than 5 years of use of Appendices G and H. In the case of item 1, above, ASME Code requirements have now been written which parallel those in the regulation and which we will reference to avoid duplication. In the case of item 2, there is no safety consideration that requires exact limits on lead factor, thus we plan to delete the requirement, because it affects design considerations. In the case of item 3, we have concluded that the restriction can safely be lifted to permit more flexibility in design, provided ASME Code rules are followed as to the other details of construction and to inspection procedures.

The reason for separating the three items from the complete package of revisions is to speed up the amendment process and thereby save staff time in review of OL license applications. As the following value/impact statement shows, there are a number of such reviews to be completed in the coming year.

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It is expected that exemptions may be requested in many cases, and it is to avoid the need to grant such exemptions to requirements that we are in the process of revising that has prompted the proposed action.

Value/Impact Statement

A. Manpower Savings

The limited revision of Appendices G and H can be accomplished (with a 45 day public comment period), about a year earlier than the complete revision. To quantify the estimates of savings in staff time for OL reviews, schedules were prepared for the two options. About 15 plants in the OL review stage will be affected. The estimated total manpower saving is about 20 man weeks for DSS review and management personnel, about 12 man weeks for NRC project and legal staff, and about 75 man weeks for applicants' assembly and evaluation of the information necessary to address compliance with Appendices G and H for these items. Should staff positions or staff appearance be required to address these items at hearings, an additional 4 man-weeks for preparation and participation will be required per plant for NRC staff.

We also estimate that implementation of the proposed limited revisions to Appendices G and H would result in the NRC having to grant from 2 to 4 fewer exemptions per plant. Projecting OL work over the next 12 to 15 months indicates that 30 to 60 fewer

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exemptions will be required if the limited revision of Appendices G and H is accomplished promptly.

There should be little impact on the applicants' schedules for either of the proposed options.

With regard to the exposure of plant personnel to radiation, the addition of a specific requirement for inspection of the capsule holder attachments may impact some licensees, depending on what their past practices have been. However, the requirement put in these amendments does not go beyond present ASME Code requirements.

B. Safety Considerations

It is our opinion that the changes proposed for Appendix G, paragraphs IV.A.3 and 4 have no safety impact, because they incorporate existing ASME Code rules that are identical to those deleted from Appendix G for bolts over 4 inch diameter, as reactor head bolts are.

We believe that the deletion of the requirement for specific limits on lead factor from Appendix H, paragraph II.C.2, is justified based on information gained from operating experience. Sufficient data from plant surveillance programs have been

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generated and adequate radiation damage estimating techniques are available (Regulatory Guide 1.99) to provide information to compensate for relatively small inaccuracies that may result from higher lead factors and to ensure that adequate safety margins are maintained.

Additionally, the restriction against welded attachment to the vessel wall can be eliminated, provided adequate precautions are taken in the design and fabrication of the welded attachment. We have reviewed several OL applications that incorporate welded attachments to the vessel wall and have concluded that the attachments do not cause degradation of the vessel. Implementation of the indicated ASME Code rules will provide reasonable assurance that the vessel will maintain adequate safety margins.

Finally, there is some value in the elimination of the requirement for a maximum lead factor of three and elimination of the restriction on welded attachments, because this action may, in some instances, increase the level of system integrity. This conclusion is supported by recent operating experience on reactors in which the capsule holders were mechanically supported from a flange area to comply with the restriction against welding and still provide the required lead factor. Fluid flow between the capsule and the capsule holder tube during plant

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operation caused the holder tube to fail from vibration, and pieces of the capsule dropped into the vessel. This resulted in shutdown of several plants. The amount of radiation exposure that repair crews would have incurred in rebuilding the attachments precluded continuing the irradiation surveillance program at those plant sites.

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ABSTRACT OF COMMENTS AND STAFF RESPONSE

1. Glenn G. Sherwood, General Electric Company, San Jose, CA:

"...We concur in the proposed changes and have no other comments at this time."

Staff Response

None.

2. Sister Mary Stephen McBride, Villa Teresa, Harrisburg, PA:

"...I strongly urge the Commission to write stricter rules for all nuclear plants throughout the United States, and not to relax the rules as stated in the Federal Register of March 28, 1979.

"The Three Mile Island accident should serve as a must to impose constant surveillance and strong regulation in this regard from the Nuclear Regulatory Commission."

3. Sister Mary Ann Davis, Harrisburg, PA:

"...I am opposed to any and all proposed regulations which in any way, by exception or otherwise, permit greater flexibility in meeting any standards related to public health or safety. As a citizen, I do not agree with lessening any restrictions in requirements. In fact, I believe the TMI accident proves the need for more, not less, regulation of nuclear production facilities."

4. Roger L. Justice, Doylestown, PA:

"...In view of the recent incident at the Three Mile Island nuclear power plant in nearby Middletown, PA, I strongly urge the Commission not adopt the proposed rule of Docket 7590-01-M and reexamine any relaxation of requirements regarding safety control mechanisms in the usage of nuclear power. The reported series of failures in the control of the cooling and retention systems at Three Mile Island, as well as apparent human error, point up the fact that until greater experience is gained in dealing with nuclear reactors, there should be no relaxation of standards. In fact, the Three Mile Island incident suggests that additional instrumentation and building and equipment design changes are needed to provide more rapid assessment of the reactor's condition in run-away situations."

5. John C. Andrews, Richmond, VA:

"...I am in no respect interested in streamlining the nuclear licensing and operating procedures; the safety factors must approach the absolute to the maximum extent feasible; the cost factors are not relevant. At certain points of cost, other technologies become feasible; therefore,

the energy will, ultimately, be available. As to your notice on p. 18513, I submit that your proposal to amend Appendix H is sound, as it apparently protects the vessel integrity. However, your proposal to amend Appendix G, to the extent that it is a less safe but cost beneficial change, is certainly unconscionable."

Staff Response

These four comments are sufficiently similar that the same response can be made to all of them. All four comments opposed adoption of the proposed rule on the grounds that the accident at Three Mile Island Unit 2 (TMI-2), which occurred on the date of publication of the proposed rule, had demonstrated that there should be no relaxation of the regulations governing nuclear power plants nor any increase in flexibility permitted in evaluating conformance to the regulations.

None of the comments addressed the specific technical issues covered by the proposed rule, namely, the material toughness requirements for bolts and the location and method of attachment of material surveillance capsules in the reactor vessel. The staff has no reason to believe that the investigation of the TMI-2 incident will raise any question about either of these issues.

With regard to the general admonition expressed in the comments, the staff believes that the rule changes will not reduce present safety margins, as explained in the V&I/Impact Statement and in the Federal Register Notice. Therefore, the staff regards these four comments as not significant.

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14 Sept. 79
PDR

NOTE TO: Document Control
Room 016

POOR ORIGINAL

FROM: Pryor N. Randall
Structures and Components Standards Branch/DES/SD

Please place the attached document in the PDR using the following file and
file points:

PDR File
(Select One)

Related Documents
(Enter if appropriate)

Proposed Rule (PR) _____
Reg. Guide _____
Draft Reg. Guide _____
Petition (PRM) _____
Effective Rule (RM) _____

ACRS Minutes No. _____
Proposed Rule (PR) _____
Draft Reg. Guide _____
Reg. Guide _____
Petition (PRM) _____
Effective Rule (RM)
Federal Register Notice
SD Task No. SC 820-1
NUREG Report _____
Contract No. _____

Value Impact Statement and
Abstract of Comments and Staff
Response

Subject: Limited Revision of 10 CFR 59
Appendices G+H, "Fracture
Toughness Requirements for
Nuclear Power Reactors

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