[7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

[NRC-2017-0151]

RIN 3150-AK07

Reactor Vessel Material Surveillance Program

AGENCY: Nuclear Regulatory Commission.

ACTION: Direct final rule.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is amending the reactor vessel material surveillance program requirements for commercial light-water power reactors. This direct final rule revises the requirements associated with the testing of specimens contained within surveillance capsules and reporting the surveillance test results. This direct final rule also clarifies the requirements for the design of surveillance programs and the capsule withdrawal schedules for surveillance capsules in reactor vessels purchased after 1982. These changes reduce regulatory burden, with no effect on public health and safety.

DATES: This direct final rule is effective February 1, 2021, unless significant adverse comments are received by November 2, 2020. If this direct final rule is withdrawn as a result of such comments, timely notice of the withdrawal will be published in the **Federal Register.** Comments received after this date will be considered if it is practical to do so, but the NRC is able to ensure consideration only for comments received on or before

this date. Comments received on this direct final rule will also be considered to be comments on a companion proposed rule published in the Proposed Rules section of this issue of the **Federal Register.**

ADDRESSES: Please refer to Docket ID NRC-2017-0151 when contacting the NRC about the availability of information for this action. You may obtain publicly-available information related to this action by any of the following methods:

- *Federal Rulemaking website:* Go to *https://www.regulations.gov* and search for Docket ID NRC-2017-0151. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: *Carol.Gallagher@nrc.gov*. For technical questions, contact the individuals listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.

- *NRC's Agencywide Documents Access and Management System (ADAMS):* You may obtain publicly-available documents online in the ADAMS Public Documents collection at *https://www.nrc.gov/reading-rm/adams.html.* To begin the search, select "ADAMS Public Documents" and then select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, at 301-415-4737, or by e-mail to *pdr.resource@nrc.gov*. For the convenience of the reader, instructions about obtaining materials referenced in this document are provided in the "Availability of Documents" section.

- *Attention:* The PDR, where you may examine and order copies of public documents is currently closed. You may submit your request to the PDR via email at *PDR.Resource@nrc.gov* or call 1-800-397-4209 between 8:00 a.m. and 4:00 p.m. (EST), Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Stewart Schneider, Office of Nuclear Material Safety and Safeguards, 301-415-4123, e-mail: *Stewart.Schneider@nrc.gov,* or On Yee, Office of Nuclear Reactor Regulation, telephone: 301-415-1905, e-mail: *On.Yee@nrc.gov.* Both are staff of the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

SUPPLEMENTARY INFORMATION:

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I. Obtaining Information and Submitting Comments

A. Obtaining Information

Please refer to Docket ID NRC-2017-0151 when contacting the NRC about the availability of information for this action. You may obtain publicly-available information related to this action by any of the following methods:

- *Federal Rulemaking website:* Go to *https://www.regulations.gov* and search for Docket ID NRC-2017-0151.
- *NRC's Agencywide Documents Access and Management System (ADAMS):*

You may obtain publicly-available documents online in the ADAMS Public Documents collection at *https://www.nrc.gov/reading-rm/adams.html.* To begin the search, select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's PDR reference staff at 1-800-397-4209, at 301-415-4737, or by e-mail to *pdr.resource@nrc.gov*. For the convenience of the reader, instructions about obtaining materials referenced in this document are provided in the "Availability of Documents" section.

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B. Submitting Comments

Please include Docket ID NRC-2017-0151 in your comment submission.

The NRC cautions you not to include identifying or contact information that you do not want to be publicly disclosed in your comment submission. The NRC will post all comment submissions at *https://www.regulations.gov* as well as enter the comment submissions into ADAMS. The NRC does not routinely edit comment submissions to remove identifying or contact information.

If you are requesting or aggregating comments from other persons for submission to the NRC, then you should inform those persons not to include identifying or contact information that they do not want to be publicly disclosed in their comment submission. Your request should state that the NRC does not routinely edit comment submissions to remove such information before making the comment submissions available to the public or entering the comment into ADAMS.

II. Procedural Background

Because the NRC anticipates that this action will be non-controversial, the NRC is using the "direct final rule process" for this rule. The direct final rule will become effective on February 1, 2021. However, if the NRC receives significant adverse comments on this direct final rule by November 2, 2020, then the NRC will publish a document that withdraws this action and will subsequently address the comments received in a final rule as a response to the companion proposed rule published in the Proposed Rule section of this issue of the **Federal Register**. Absent significant modifications to the proposed revisions requiring republication, the NRC will not initiate a second comment period on this action.

A significant adverse comment is a comment where the commenter explains why the rule would be inappropriate, including challenges to the rule's underlying premise or approach, or would be ineffective or unacceptable without a change. A comment is adverse and significant if:

(1) The comment opposes the rule and provides a reason sufficient to require a substantive response in a notice-and-comment process. For example, a substantive response is required when:

(a) The comment causes the NRC to reevaluate (or reconsider) its position or conduct additional analysis;

(b) The comment raises an issue serious enough to warrant a substantive response to clarify or complete the record; or

(c) The comment raises a relevant issue that was not previously addressed or considered by the NRC.

(2) The comment proposes a change or an addition to the rule, and it is apparent that the rule would be ineffective or unacceptable without incorporation of the change or

addition.

(3) The comment causes the NRC staff to make a change (other than editorial) to the rule.

For detailed instructions on filing comments, please see the **ADDRESSES** section of this document.

III. Background

A. Description of a Reactor Vessel Material Surveillance Program

The reactor vessel and its internal components support and align the fuel assemblies that make up the reactor core and provide a flow path to ensure adequate heat removal from the fuel assemblies. The reactor vessel also provides containment and a floodable volume to maintain core cooling in the event of an accident causing loss of the primary coolant. It is a cylindrical shell with a welded hemispherical bottom head and a removable hemispherical upper head. Some vessel shells were fabricated from curved plates that were joined by longitudinal and circumferential welds. Others were manufactured using forged rings and, therefore, only have circumferential welds that join the rings. These plate and forging materials are referred to as base metals. Maintenance of the structural integrity of the reactor vessel is essential in ensuring plant safety, because there is no redundant system to maintain core cooling in the event of a vessel failure.

One characteristic of reactor vessel steels is that their material properties change as a function of temperature and neutron irradiation. The primary material property of interest for the purposes of reactor vessel integrity is the fracture toughness of the reactor vessel material. Extensive experimental work determined that Charpy impact energy tests, which measure the amount of energy required to fail a small material

specimen, can be correlated to changes in fracture toughness of a material. Thus, the Charpy impact specimens[1] from the beltline[2] materials (i.e., base metal, weld metal, and heat-affected zone) became the standard to assess the change in fracture toughness in ferritic steels.

The fracture toughness of reactor vessel materials decreases with decreasing temperature and with increasing irradiation from the reactor. The decrease in fracture toughness due to neutron irradiation is referred to as "neutron embrittlement." The fracture toughness of reactor vessel materials is determined by using fracture toughness curves in the American Society of Mechanical Engineers (ASME) Code, which are indexed to the reference temperature for nil-ductility transition (RT_{NDT}), as specified in ASME Boiler and Pressure Vessel Code, Section II, "Materials." To account for the effects of neutron irradiation, the increase in RT_{NDT} is equated to the increase in the 30 ft-lb index temperature from tests of Charpy-V notch impact specimens irradiated in capsules as a part of the surveillance program. The surveillance program includes Charpy impact specimens of the base and weld metals for the reactor vessel in each surveillance capsule. These surveillance capsules are exposed to the same operating conditions as the reactor vessel, and because the capsules are located closer to the reactor core than the reactor vessel inner diameter, the surveillance specimens are generally exposed to higher neutron irradiation levels than those experienced by the reactor vessel at any given time.

As a result of the surveillance capsule's location within the reactor vessel, the test specimens generally reflect changes in fracture toughness due to neutron embrittlement in advance of what the reactor vessel experiences and provide insight to

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1 A Charpy impact specimen is a bar of metal, or other material, having a V-groove notch machined across the 10 mm thickness dimension.

2 A definition of the beltline or beltline region is provided in appendix G to 10 CFR part 50.

the future condition of the reactor vessel. Therefore, the NRC instituted reactor vessel material surveillance programs as a requirement of appendix H, “Reactor Vessel Material Surveillance Program Requirements” (appendix H), to part 50 of title 10 of the *Code of Federal Regulations* (10 CFR), “Domestic Licensing of Production and Utilization Facilities,” so that the placement and testing of Charpy impact specimens in capsules between the inner diameter vessel wall and the core can provide data for assessing and projecting the change in fracture toughness of the reactor vessel.

The purpose for requiring a reactor vessel material surveillance program is to monitor changes in the fracture toughness properties in the beltline region of the reactor vessel and to use this information to analyze the reactor vessel integrity. Surveillance programs are designed not only to examine the current status of reactor vessel material properties but also to predict the changes in these properties resulting from the cumulative effects of neutron irradiation.

The determination as to whether a commercial nuclear power reactor vessel requires a material surveillance program under appendix H to 10 CFR part 50 is made at the time of plant licensing under 10 CFR part 50 or 10 CFR part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.” If this surveillance program is required, it is designed and implemented at that time using the existing requirements. Certain aspects of the program, such as the specific materials to be monitored, the number of required surveillance capsules to be inserted in the reactor vessel, and the initial capsule withdrawal schedule were designed for the original licensed period of operation (i.e., 40 years). The editions of the ASTM International (ASTM) E 185, which are incorporated by reference in appendix H to 10 CFR part 50, recommend three, four, or five surveillance capsules to be included in the design of reactor vessel material surveillance programs for the original licensed period of operation, based on the

irradiation sensitivity of the material used to fabricate the reactor vessel.[3] Most plants have included several additional surveillance capsules beyond the number recommended by ASTM E 185. These capsules are referred to as "standby capsules." The surveillance program for each reactor vessel provides assurance that the plant's operating limits (e.g., the pressure-temperature limits) continue to meet the provisions in Appendix G of ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," as required by appendix G, "Fracture Toughness Requirements," to 10 CFR part 50. The program also provides assurance that the reactor vessel material upper shelf energy meets the requirements of appendix G to 10 CFR part 50. These assessments are used to ensure the integrity of the reactor vessel.

In addition to the Charpy impact specimens for determining the embrittlement in the reactor vessel, the surveillance capsules typically contain neutron dosimeters, thermal monitors, and tension specimens.[4] Surveillance capsules may also contain correlation monitor material, which is a material with composition, properties, and response to radiation that have been well characterized. The overall accuracy of neutron fluence measurements is dependent upon knowledge of the neutron spectrum. Therefore, a variety of neutron detector materials (dosimetry wires) are included in each surveillance capsule and used in the determination of neutron fluence for the vessel. The thermal monitors that are placed in the capsules (e.g., low-melting-point elements or eutectic alloys) are used to identify the irradiated specimen's maximum exposure temperature.

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[3] The requirements in appendix H to 10 CFR part 50 are based, in part, on the information contained within ASTM E 185-73, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels;" ASTM 185-79, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels;" and ASTM E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," which are incorporated by reference.

[4] Tension specimens have a standardized sample cross-section, with two shoulders and a gage (section) in between.

B. Current Requirements under Appendix H to 10 CFR Part 50

Appendix H to 10 CFR part 50 requires light-water nuclear power reactor licensees to have a reactor vessel material surveillance program to monitor changes in the fracture toughness properties of the reactor vessel materials adjacent to the reactor core in the beltline region. Unless it can be shown that the end of design life neutron fluence is below certain criteria, the NRC requires licensees to implement a materials surveillance program that tests irradiated material specimens that are located in surveillance capsules in the reactor vessels. The program evaluates changes in material fracture toughness and thereby assesses the integrity of the reactor vessel. For each capsule withdrawal, the test procedures and reporting requirements must meet the requirements of ASTM E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Reactor Vessels," to the extent practicable for the configuration of the specimens in the capsule.

The design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of ASTM E 185 that is current on the issue date of the ASME Code to which the reactor vessel was purchased. Later editions of ASTM E 185, up to and including those editions through 1982, may be used. Appendix H to 10 CFR part 50 specifically incorporates by reference ASTM E 185-73, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels;" ASTM E 185-79, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," and ASTM E 185-82. In sum, the surveillance program must comply with ASTM E 185, as modified by appendix H to 10 CFR part 50. The number, design, and location of these surveillance capsules within the reactor vessel are established during the design of the program, before initial plant operation.

Appendix H to 10 CFR part 50 also specifies that each capsule withdrawal and subsequent test results must be the subject of a summary technical report to be submitted to the NRC within one year of the date of capsule withdrawal, unless an extension is granted by the Director, Office of Nuclear Reactor Regulation. The NRC uses the results from the surveillance program to assess licensee submittals related to pressure-temperature limits under appendix G to 10 CFR part 50 and to assess pressurized water reactor licensee's compliance with either § 50.61, "Fracture toughness requirements for protection against pressurized thermal shock events," or § 50.61a, "Alternate fracture toughness requirements for protection against pressurized thermal shock events."

C. The Need for Rulemaking

When appendix H to 10 CFR part 50 was established as a requirement (38 FR 19012; July 17, 1973), limited information and data were available on the subject of reactor vessel embrittlement. Thus, appendix H to 10 CFR part 50 required the inclusion of a comprehensive collection of specimen types representing the reactor vessel beltline materials in each surveillance capsule. Since 1973, a significant number of surveillance capsules have been withdrawn and tested. Analyses of these results support reconsidering the specimen types required for testing, and the required time for reporting the results from surveillance capsule testing. One outcome of this effort was that some specimen types were found to contribute to the characterization of reactor vessel embrittlement, while others did not. Therefore, the NRC determined that these latter types were unnecessary to meet the objectives of appendix H to 10 CFR part 50 and should no longer be required. Revising appendix H to 10 CFR part 50 to address this situation reduces the regulatory burden on licensees of data collection, with no effect on public health and safety.

In 1983, appendix H to 10 CFR part 50 was revised to require licensees to submit test results to the NRC within one year of the date of capsule withdrawal, unless an extension is granted by the Director, Office of Nuclear Reactor Regulation (48 FR 24008; May 27, 1983). As stated in the 1983 rulemaking, the reason for the requirement was the need for timely reporting of test results and notification of any problems. At that time, there was a limited amount of data from irradiated materials from which to estimate embrittlement trends of reactor vessels at nuclear power plants, making it important to receive timely reporting of test results.

Licensees that participate in an integrated surveillance program have found it challenging to meet this one-year requirement. This is related to the fact that an integrated surveillance program requires coordination among the multiple licensees participating in the program.[5] A significant number of test specimens have been analyzed since 1983, the results of which support a reduced need for prompt reporting of the test results. Based on this, the NRC has determined that the reporting requirement in appendix H to 10 CFR part 50 should be revised. Extending the reporting period allows for more time for licensee coordination and should help eliminate the need for licensees to prepare and submit extension requests and for the NRC to review such requests. This revision has no effect on public health and safety.

D. Regulatory Basis to Support Rulemaking

In January 2019, the Commission issued Staff Requirements Memorandum (SRM)-COMSECY-18-0016, "Request Commission Approval to Use the Direct Final

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[5] Appendix H to 10 CFR part 50 permits the use of an integrated surveillance program (ISP) as an alternative to a plant-specific surveillance program. In an ISP, the representative materials chosen for surveillance of a reactor vessel are irradiated in one or more other reactor vessels that have similar design and operating features. The data obtained from these test specimens may then be used in the analysis of other plants participating in the program.

Rule Process to Revise the Testing and Reporting Requirements in 10 CFR Part 50, Appendix H, Reactor Vessel Material Surveillance Program Requirements (RIN 3150-AK07)," approving publication of the supporting regulatory basis and use of the direct final rule process. On April 3, 2019, the NRC issued the regulatory basis which provides an in-depth discussion on the technical merits of this rulemaking (84 FR 12876).[6] The regulatory basis includes additional information on the regulatory framework, types of reactor vessel material surveillance programs, regulatory topics that initiated this rulemaking effort, and options to address these topics. The regulatory basis shows that there is sufficient justification to proceed with rulemaking to amend appendix H to 10 CFR part 50 to reduce certain test specimens and extend the period to submit surveillance capsule reports to the NRC. In addition, in SRM-COMSECY-18-0016, the Commission directed the staff to clarify the requirements for the design of surveillance programs and the withdrawal schedules for reactor vessels purchased after 1982. These revisions will not establish any additional requirements for the current fleet of operating reactors.

IV. Discussion

The purpose of this action is to reduce the regulatory burden on reactor licensees and the NRC that is associated with test specimens contained within surveillance capsules and the reporting of surveillance test results, with no effect on public health and safety. This action also clarifies the requirements for the design of surveillance programs and the withdrawal schedules for reactor vessels purchased after 1982. The NRC has determined that the following revisions to appendix H to 10 CFR part 50

[6] A subsequent notification was published on April 12, 2019 (84 FR 14845), to correct the ADAMS accession number for the regulatory basis.

achieve the goal of reducing regulatory burden. These revisions do not establish any additional requirements for the current fleet of operating reactors.

1. Heat-Affected Zone Specimens

The editions of ASTM E 185 incorporated by reference in appendix H to 10 CFR part 50 specify that the surveillance test specimens shall include base metal, weld metal, and heat-affected zone materials. Heat-affected zone specimens were first required in reactor vessel material surveillance programs in 1966 (ASTM E 185-66, "Recommended Practice for Surveillance Tests on Structural Materials in Nuclear Reactors"). Cracks in heat-affected zone material had been observed to cause the failure of components in non-nuclear applications, and from early research, these failures were in heat-affected zone materials with high hardness measurements, which is associated with low fracture toughness.

The heat-affected zone has been shown to exhibit superior fracture toughness compared to the base metal. In addition, test results from surveillance specimens have shown significant scatter of the heat-affected zone Charpy test data because of the inhomogeneous nature of the heat-affected zone material. This was the basis for eliminating the requirement for heat-affected zone specimens after the 1994 edition of ASTM E 185; thus, it is no longer prudent to require the inclusion or testing of heat-affected zone materials.

For these reasons, the NRC is revising appendix H to 10 CFR part 50 to make optional the requirement to include or test heat-affected zone specimens as part of the reactor vessel material surveillance program. For existing capsules that are currently in the reactor vessel, licenses can continue their practice to test the heat-affected zone

specimens. For new and reconstituted capsules[7] that may be inserted into the reactor vessel in the future, licensees are no longer required to have heat-affected zone specimens in the capsules but could choose to continue this practice. This revision has no effect on public health and safety.

2. Tension Specimens

The editions of ASTM E 185 currently incorporated by reference in appendix H to 10 CFR part 50 specify the following with respect to tensile testing:

(1) For unirradiated material, tension specimens shall be tested for both the base and weld material at specified temperatures.

(2) For irradiated material, tension specimens shall be included for both the base and weld material and tested at specified temperatures.

(3) Tensile testing shall be conducted in accordance with ASTM Method E 8, "Methods of Tension Testing of Metallic Materials," and ASTM E 21, "Recommended Practice for Elevated Temperature Tension Tests of Metallic Materials."

The variation of tensile properties (e.g., yield strength, tensile strength, and elongation) with test temperatures is established by testing tension specimens over a range of temperatures. Performing tensile tests before and after irradiation permits quantification of the hardening effect due to irradiation using the change in yield strength. Tensile data provide an indication of the radiation-induced strength property changes in the reactor vessel material and serve as a consistency check relative to Charpy data.

Past experience and test results have demonstrated that the differences in the test temperatures specified in ASTM E 185 can be small, which could yield small

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[7] A reconstituted capsule contains specimens from previously tested capsules.

differences in tensile properties and redundant tensile information. Eliminating one test temperature and testing at room temperature and service temperature at all irradiation levels, allows for the comparison of the change in strength properties due to irradiation and temperature.

For these reasons, the NRC is revising appendix H to 10 CFR part 50 to require the inclusion or testing of only one tension specimen at room temperature and one tension specimen at service temperature, for all materials and irradiation levels as part of the reactor vessel material surveillance program. This reduces the number of tension specimens required in new and reconstituted surveillance capsules and for testing in existing surveillance capsules. For existing capsules that are currently in the reactor vessel, licensees can continue their practice of testing the tension specimens in accordance with ASTM E 185. For new and reconstituted capsules that may be inserted into the reactor vessel in the future, licensees could choose to continue this practice. This revision has no effect on public health and safety.

3. Correlation Monitor Material

Correlation monitor material is a well characterized reactor vessel material that has been included in many surveillance capsules. Correlation monitor material is selected so that it has a comparable composition and processing history to the reactor vessel material. The purpose of a correlation monitor material in a surveillance capsule is to provide reference data for comparison to the established trends for the correlation monitor material.

The editions of ASTM E 185 currently incorporated by reference in appendix H to 10 CFR part 50 specify that it is optional to include correlation monitor material in surveillance capsules. These editions of ASTM E 185 do not explicitly indicate whether correlation monitor material shall be tested if it was optionally included in a surveillance

capsule. Therefore, it is ambiguous whether correlation monitor material testing is required even though it is optional to include this material in surveillance capsules. In practice, the testing of correlation monitor material has demonstrated variability in the measured material properties of the correlation monitor material, which has limited the practical use of the data.

For these reasons, the NRC is revising appendix H to 10 CFR part 50 to clarify that testing of correlation monitor material is optional when included in existing, new, and reconstituted surveillance capsules. This revision has no effect on public health and safety.

4. Thermal Monitors

ASTM E 185-82 specifies that the surveillance capsules shall include one set of temperature monitors (also known as “thermal monitors”) that are located within the capsule where the specimen temperature is predicted to be the maximum, and additional sets of temperature monitors may be placed at other locations to characterize the temperature profile. The standard specifies reporting of the temperature monitor results and an estimate of the maximum capsule exposure temperature.

Irradiation temperature is one of the parameters that is closely correlated with the effects of neutron embrittlement of reactor vessel steels, with lower embrittlement measured at higher irradiation temperatures within a range close to the standard operating temperature of 288 degrees Celsius (550 degrees Fahrenheit). Therefore, knowledge of the irradiation temperature history of surveillance capsules is important to ensure that the surveillance data are properly interpreted and do not portray a non-conservative estimate of the reactor vessel neutron embrittlement.

Temperature monitors are targeted to melt at specific temperatures, normally somewhat higher than the planned operating temperature, to identify the highest

temperature seen by the surveillance capsule. The monitors provide an indication of whether the melt temperature was reached but they do not provide a time-based exposure history of the monitor.

Several factors can complicate the interpretation of the information from temperature monitors. The first complication arises when the surveillance capsule experiences a short duration thermal transient that increases the coolant inlet temperature. This could result in a positive indication from the temperature monitors, which is insignificant to the overall exposure conditions of the surveillance capsule. A second complication is caused by possible interpretation issues, where apparent melting of the temperature monitors is caused by long-term exposure of the monitor to temperatures near, but below, its melting point.

For these reasons, the NRC is revising appendix H to 10 CFR part 50 to make optional the requirement to include or evaluate temperature monitors as part of the reactor vessel material surveillance program. For existing capsules that are currently in the reactor vessel, licensees can continue their practice of evaluating the temperature monitors. For new and reconstituted capsules that may be inserted into the reactor vessel in the future, licensees are no longer required to include temperature monitors in the capsules but could choose to continue this practice. As an alternative to these temperature monitors, an estimate of the average capsule temperature during full power operation for each reactor fuel cycle will provide the irradiation temperature history of the surveillance capsule. This revision has no effect on public health and safety.

5. Surveillance Test Results Reporting

Appendix H to 10 CFR part 50 currently requires that within one year of the date of the surveillance capsule withdrawal, a summary technical report be submitted to the

NRC that contains the data required by ASTM E 185, and the results of all fracture toughness tests conducted on the beltline materials in the irradiated and unirradiated conditions, unless an extension is granted by the Director, Office of Nuclear Reactor Regulation.

This one-year requirement in appendix H to 10 CFR part 50 became effective on July 26, 1983 (48 FR 24008), with the primary purpose of timely reporting of test results and notification of any problems determined from surveillance tests. This was important because there was a limited amount of available data from irradiated materials from which to estimate embrittlement trends. An extensive amount of embrittlement data has been collected and analyzed since this time, the results of which support the reduced need for prompt reporting of the test results.

Licensees participating in an integrated surveillance program have found it challenging to meet the one-year requirement to submit a report following each capsule withdrawal. In an integrated surveillance program, the representative materials chosen for a reactor are irradiated in one or more other reactors that have similar design and operating features. The data obtained from these test specimens may then be used in the analysis of other plants participating in the program. Implementation of the integrated surveillance program requires significant coordination among the multiple licensees participating in the program. Historically, these licensees have requested a 6-month extension to this reporting requirement and, to date, the Director of the NRC Office of Nuclear Reactor Regulation, has granted them. Furthermore, as surveillance capsules remain in the reactor vessel to support operation through 60 years and 80 years, longer periods of radioactive decay may be needed before the capsules can be shipped to testing facilities. Licensees may find it burdensome to meet the one-year reporting requirement under these circumstances.

For these reasons, the NRC is revising appendix H to 10 CFR part 50 to increase the time given to licensees to submit a summary technical report of each capsule withdrawal and the test results from 1 year to 18 months. This revision has no effect on public health and safety.

6. Design of the Surveillance Program

Appendix H to 10 CFR part 50 is also being revised to clarify the edition of ASTM E 185 that is required for a reactor vessel purchased after 1982. Currently, there is the potential to misinterpret the regulation as requiring the use of an edition of ASTM E 185 that is not incorporated by reference in appendix H to 10 CFR part 50. Therefore, the NRC is revising appendix H to 10 CFR part 50 to clarify that for reactor vessels purchased after 1982, the design of the surveillance program and the withdrawal schedule must meet the requirements of ASTM E 185-82 (i.e., the latest edition of ASTM E 185 that is incorporated by reference in appendix H to 10 CFR part 50).

License Renewal and Subsequent License Renewal

Surveillance programs that include the withdrawal schedule required by appendix H to 10 CFR part 50 were originally established and designed for the initial 40-year operating license of a nuclear power plant. The objective of this program during extended plant operations[8] remains the same as it was during the initial 40-year operating license, which is to continue monitoring changes in fracture toughness of the reactor vessel materials to ensure the integrity of the reactor vessel. This direct final rule

[8] The period beyond the original license of a nuclear power plant (i.e., during license renewal to operate for 60 years and potentially during subsequent license renewal to operate for 80 years).

does not revise appendix H to 10 CFR part 50 with respect to surveillance capsule withdrawal schedules during extended plant operation.

New Reactors

New light-water nuclear power reactor designs are substantially similar to operating reactors with regard to the relevant considerations for establishing adequate surveillance programs under appendix H to 10 CFR part 50. These similarities include proposed materials, fabrication methods, and operating environments. The proposed withdrawal schedules from ASTM E 185 are constructed to provide early evidence of material behavior which is of particular interest for a new or novel design with little or no operating experience. Consequently, the NRC is not revising appendix H to 10 CFR part 50 to address new light-water nuclear power reactor designs separately from existing reactors.

V. Section-by-Section Analysis

The following paragraphs describe the specific changes being made by this direct final rule.

Appendix H to Part 50—Reactor Vessel Material Surveillance Program Requirements

Section III. Surveillance Program Criteria

This direct final rule revises paragraph III.B.1 to clarify the design of surveillance programs and the capsule withdrawal schedules for reactor vessels purchased after 1982 and to include information regarding the use of optional provisions. This direct final

rule also adds new paragraph III.B.4 that makes optional certain aspects of ASTM E 185.

Section IV. Report of Test Results

This direct final rule revises the timeframe for the submission of a summary technical report from 1 year to 18 months.

VI. Regulatory Flexibility Certification

Under the Regulatory Flexibility Act (5 U.S.C. 605(b)), the NRC certifies that this direct final rule does not have a significant economic impact on a substantial number of small entities. This direct final rule affects only the licensing and operation of nuclear power plants. The companies that own these plants do not fall within the scope of the definition of "small entities" set forth in the Regulatory Flexibility Act or the size standards established by the NRC (§ 2.810).

VII. Regulatory Analysis

The NRC has prepared a regulatory analysis for this direct final rule. The analysis examines the costs and benefits of the alternatives considered by the NRC. Based on the analysis, the NRC concludes that this action is cost beneficial and reduces the regulatory costs for reactor licensees and the NRC for an issue that is not significant to safety. This issue is not significant to safety because this direct final rule reduces the testing of some specimens and eliminates the testing of other specimens that were found not to provide meaningful information to assess the integrity of the reactor vessel. Also, extending by 6 months the period for submitting the report of test results to the

NRC is not significant to safety. This is because the increase in neutron fluence over 6 months is very small, and therefore the projected increase in embrittlement for the 6-month period would also be very small. This small impact, in conjunction with the margin of safety that is inherent in the pressure-temperature limit curves, minimizes any impact due to the 6-month increase.

VIII. Backfitting and Issue Finality

The NRC's backfitting provisions for holders of construction permits, and applicants and holders of operating licenses and combined licenses, appear in § 50.109, "Backfitting" (the Backfit Rule). Issue finality provisions, which are analogous to the backfitting provisions in § 50.109, appear in § 52.63, "Finality of Standard Design Certifications;" § 52.83, "Finality of Referenced NRC Approvals; Partial Initial Decision on Site Suitability;" § 52.98, "Finality of Combined Licenses; Information Requests;" § 52.145, "Finality of Standard Design Approvals, Information Request;" and § 52.171, "Finality of Manufacturing Licenses; Information Requests."

This direct final rule: (1) provides licensees with a nonmandatory relaxation from the current 1 year following a capsule withdrawal to 18 months to submit surveillance capsule test results, and (2) reduces testing requirements by amending the NRC's regulations in appendix H to 10 CFR part 50. Because these changes are nonmandatory, licensees have the option to comply with the revised requirements for testing certain surveillance capsule specimens or for extending the allowable period for submitting surveillance test results to the NRC (i.e., licensees can continue to submit surveillance capsule test results within one year of the date of capsule withdrawal). Therefore, this direct final rule does not constitute backfitting or raise issue finality concerns.

IX. Cumulative Effects of Regulation

Cumulative effects of regulation (CER) consists of the challenges licensees may face in addressing the implementation of new regulatory positions, programs, and requirements (e.g., rulemaking, guidance, generic letters, backfits, inspections). The CER may manifest in several ways, including the total burden imposed on licensees by the NRC from simultaneous or consecutive regulatory actions that can adversely affect the licensee's capability to implement those requirements, while continuing to operate or construct its facility in a safe and secure manner.

The goals of the NRC's CER effort were met throughout the development of this action. The NRC has engaged external stakeholders at public meetings held during the development of the regulatory basis and this direct final rule. A public meeting was held on June 1, 2017, to provide an opportunity for the exchange of information on the scope and related costs and benefits associated with this action. Feedback obtained at this meeting was used in developing the regulatory basis and regulatory analysis. A second public meeting was held on April 30, 2019, to provide information on the status and scope of this direct final rule, and to discuss implementation and CER. Summaries of both public meetings are available in ADAMS, as provided in the "Availability of Documents" section of this document.

X. Plain Writing

The Plain Writing Act of 2010 (Pub. L. 111-274) requires Federal agencies to write documents in a clear, concise, and well-organized manner. The NRC has written this document to be consistent with the Plain Writing Act as well as the Presidential

Memorandum, “Plain Language in Government Writing,” published June 10, 1998 (63 FR 31883).

XI. Environmental Impact—Categorical Exclusion

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission’s regulations in 10 CFR part 51, subpart A, that the direct final rule will not have a significant effect on the quality of the human environment and, therefore, an environmental impact statement is not required. The principal effect of this direct final rule is to amend the reactor vessel materials surveillance program requirements for commercial light-water power reactors. Specifically, it amends the requirements associated with the testing of specimens contained within surveillance capsules and reporting the surveillance test results.

The amendments to appendix H to 10 CFR part 50 that revise the surveillance requirements for testing specimens add optional provisions that would need to be adopted by individual licensees. In order to adopt these optional provisions, licensees would need to either submit a license amendment or determine whether the optional provisions can be implemented under 10 CFR 50.59, “Changes, tests and experiments.” When the 10 CFR 50.59 regulation was promulgated in 1999, the Commission concluded that there would be no significant impact on the environment for the types of changes to a nuclear power plant’s licensing basis that a licensee could make under this provision without NRC review. If a license amendment is required to be submitted, the environmental impacts of that future license amendment would be evaluated by the NRC staff as part of the review of the license amendment request. The amendments to appendix H to 10 CFR part 50 that revise the recordkeeping and reporting requirements are categorically excluded under 10 CFR 51.22(c)(3)(ii) and (iii). The NRC has also

determined that this action would involve no significant change in the types or amounts of any effluents that may be released offsite; no significant increase in individual or cumulative occupational radiation exposure; and no significant increase in the potential for or consequences from radiological accidents. In addition, the NRC has determined that there are no significant impacts to biota, water resources, historic properties, cultural resources, or socioeconomic conditions in the region. As such, there are no extraordinary circumstances that would preclude reliance on this categorical exemption. Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with revising the reporting requirement under appendix H to 10 CFR part 50.

XII. Paperwork Reduction Act

The burden to the public for the information collection is estimated to be reduced by 78 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Further information about information collection requirements associated with this direct final rule can be found in the companion proposed rule published elsewhere in this issue of the **Federal Register**.

This direct final rule is being issued prior to approval by the Office of Management and Budget (OMB) of these information collection requirements, which were submitted under OMB control number 3150-0011. When OMB notifies us of its decision, we will publish a document in the **Federal Register** providing notice of the

effective date of the information collections or, if approval is denied, providing notice of what action we plan to take.

Send comments on any aspect of these information collections, including suggestions for reducing the burden, to the Information Services Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington DC 20555-0001, or by e-mail to *INFOCOLLECTS.RESOURCE@NRC.GOV;* and to OMB Office of Information and Regulatory Affairs (3150-0011), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW Washington, DC 20503; e-mail: *oira_submission@omb.eop.gov.*

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

XIII. Congressional Review Act

This direct final rule is a rule as defined in the Congressional Review Act (5 U.S.C. 801-808). However, the Office of Management and Budget has not found it to be a major rule as defined in the Congressional Review Act.

XIV. Compatibility of Agreement State Regulations

Under the "Policy Statement on Adequacy and Compatibility of Agreement State Programs," approved by the Commission on June 20, 1997, and published in the **Federal Register** (62 FR 46517; September 3, 1997), this rule is classified as

compatibility “NRC.” Compatibility is not required for Category “NRC” regulations. The NRC program elements in this category are those that relate directly to areas of regulation reserved to the NRC by the Atomic Energy Act of 1954, as amended, or the provisions of 10 CFR chapter I, and although an Agreement State may not adopt program elements reserved to the NRC, it may wish to inform its licensees of certain requirements via a mechanism that is consistent with a particular State’s administrative procedure laws, but does not confer regulatory authority on the State.

XV. Voluntary Consensus Standards

The National Technology Transfer and Advancement Act of 1995 (Pub. L. 104-113) requires that Federal agencies use technical standards that are developed or adopted by voluntary consensus standards bodies unless using such a standard is inconsistent with applicable law or otherwise impractical. In this direct final rule, the NRC is amending the reactor vessel materials surveillance program requirements to reduce the regulatory burden for an issue that is not significant to safety associated with the testing of surveillance capsule specimens and reporting the surveillance test results. It also clarifies the requirements for the design of surveillance programs and the withdrawal schedules for reactor vessels purchased after 1982. Specifically, this direct final rule allows licensees to reduce the testing of some specimens and eliminates the testing of other specimens that were found not to provide meaningful information to assess the integrity of the reactor vessel. It also extends by 6 months the period for licensees to submit the report of test results to the NRC. The increase in neutron fluence over 6 months is very small, and therefore the projected increase in embrittlement over this period would also be very small. This small impact, in conjunction with the margin of safety which is inherent in the pressure-temperature limit

curves, minimizes any impact due to the 6-month increase. This action does not constitute the establishment of new conditions on the ASTM standards that are currently incorporated by reference in appendix H to 10 CFR part 50 nor a standard that contains generally applicable requirements. This action maintains the use of the ASTM standards that are currently incorporated by reference in appendix H to 10 CFR part 50 but makes optional certain aspects of the ASTM standards that have been determined not to be necessary for the safe operation of nuclear power plants.

XVI. Availability of Documents

The documents identified in the following table are available to interested persons through one or more of the following methods, as indicated.

DOCUMENT	ADAMS ACCESSION NO. / WEB LINK / *FEDERAL REGISTER CITATION*
ASME Boiler and Pressure Vessel Code, Section II, “Materials”	https://www.asme.org
ASTM E 185-73, “Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels”	https://www.astm.org
ASTM 185-79, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels”	https://www.astm.org
ASTM E 185-82, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels”	https://www.astm.org
ASME Boiler and Pressure Vessel Code, Section XI, Appendix G, “Rules for Inservice Inspection of Nuclear Power Plant Components”	https://www.asme.org
Federal Register notification—"Part 50 Final Rule–Licensing of Production and Utilization Facilities; Fracture Toughness and Surveillance Program Requirements,” July 17, 1973	38 FR 19012
Federal Register notification—"10 CFR Part 50 Final Rule, Fracture Toughness Requirements	48 FR 24008

for Light-Water Nuclear Power Reactors," May 27, 1983	
Rulemaking for Appendix H to 10 CFR Part 50, "Reactor Vessel Material Surveillance Program Requirements—Regulatory Basis," April 2019	ML19038A477
Federal Register notification—"10 CFR Part 50, Reactor Vessel Material Surveillance Program: Regulatory Basis; Availability," April 3, 2019	84 FR 12876
Federal Register notification—"10 CFR Part 50, Reactor Vessel Material Surveillance Program: Regulatory Basis; Availability; Correction," April 12, 2019	84 FR 14845
ASTM E 185-66, "Recommended Practice for Surveillance Tests on Structural Materials in Nuclear Reactors"	https://www.astm.org
ASTM Method E 8, "Methods of Tension Testing of Metallic Materials,"	https://www.astm.org
ASTM E21 "Recommended Practice for Elevated Temperature Tension Tests of Metallic Materials."	https://www.astm.org
Summary of April 30, 2019, Public Meeting to Discuss the Status of the Appendix H, Reactor Vessel Material Surveillance Program Requirements Rulemaking	ML19127A050
Summary of June 1, 2017, Public Meeting to Discuss the Scope and Related Costs and Benefits Associated with the "Reactor Vessel Materials Surveillance Program Requirements" Proposed Rulemaking	ML17173A081
Staff Requirements Memorandum (SRM)-COMSECY-18-0016, "Request Commission Approval to Use the Direct Final Rule Process to Revise the Testing and Reporting Requirements in 10 CFR Part 50, Appendix H, Reactor Vessel Material Surveillance Program Requirements (RIN 3150-AK07)"	ML19009A517
Regulatory Analysis for the Direct Final Rule: Appendix H to 10 CFR Part 50—Reactor Vessel Material Surveillance Program Requirements, September 2020	ML20246G422

List of Subjects in 10 CFR Part 50

Administrative practice and procedure, Antitrust, Backfitting, Classified information, Criminal penalties, Education, Fire prevention, Fire protection, Incorporation

by reference, Intergovernmental relations, Nuclear power plants and reactors, Penalties, Radiation protection, Reactor siting criteria, Reporting and recordkeeping requirements, Whistleblowing.

For the reasons set forth in the preamble, and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and 5 U.S.C. 552 and 553, the NRC is adopting the following amendments to 10 CFR part 50:

PART 50—DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

1. The authority citation for part 50 continues to read as follows:

Authority: Atomic Energy Act of 1954, secs. 11, 101, 102, 103, 104, 105, 108, 122, 147, 149, 161, 181, 182, 183, 184, 185, 186, 187, 189, 223, 234 (42 U.S.C. 2014, 2131, 2132, 2133, 2134, 2135, 2138, 2152, 2167, 2169, 2201, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2239, 2273, 2282); Energy Reorganization Act of 1974, secs. 201, 202, 206, 211 (42 U.S.C. 5841, 5842, 5846, 5851); Nuclear Waste Policy Act of 1982, sec. 306 (42 U.S.C. 10226); National Environmental Policy Act of 1969 (42 U.S.C. 4332); 44 U.S.C. 3504 note; Sec. 109, Pub. L. 96-295, 94 Stat. 783.

2. In appendix H to part 50:

a. Revise paragraph III.B.1;

b. Add paragraph III.B.4; and

c. In paragraph IV.A, remove the phrase “one year” and add in its place the phrase “eighteen months”.

The revision and addition read as follows:

Appendix H to Part 50—Reactor Vessel Material Surveillance Program Requirements

* * * * *

III. * * *

B. * * *

1. The design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of the ASTM E 185 that is current on the issue date of the ASME code to which the reactor vessel was purchased; for reactor vessels purchased after 1982, the design of the surveillance program and the withdrawal schedule must meet the requirements of ASTM E 185-82. For reactor vessels purchased in or before 1982, later editions of ASTM E 185 may be used, but including only those editions through 1982. For each capsule withdrawal, the test procedures and reporting requirements must meet the requirements of the ASTM E 185 to the extent practicable for the configuration of the specimens in the capsule. If any of the optional provisions in paragraphs III.B.4(a) through (d) of this section are implemented in lieu of ASTM E 185, the number of specimens included or tested in the surveillance program shall be adjusted as specified in paragraphs III.B.4(a) through (d) of this section.

* * * * *

4. Optional provisions. As used in this section, references to ASTM E 185 include the edition of ASTM E 185 that is current on the issue date of the ASME Code to which the reactor vessel was purchased through the 1982 edition.

(a) *First Provision:* Heat-Affected Zone Specimens – The inclusion or testing of weld heat-affected zone Charpy impact specimens within the surveillance program as specified in ASTM E 185 is optional.

(b) *Second Provision:* Tension Specimens – If this provision is implemented, the minimum number of tension specimens to be included and tested in the surveillance program shall be as specified in paragraphs III.B.4(b)(i) and (ii) of this section.

(i) Unirradiated Tension Specimens – Two tension specimens from each base and weld material required by ASTM E 185 shall be tested, with one specimen tested at room temperature and the other specimen tested at the service temperature; and

(ii) Irradiated Tension Specimens – Two tension specimens from each base and weld material required by ASTM E 185 shall be included in each surveillance capsule and tested, with one specimen tested at room temperature and the other specimen tested at the service temperature.

(c) *Third Provision:* Correlation Monitor Materials – The testing of correlation monitor material specimens within the surveillance program as specified in ASTM E 185 is optional.

(d) *Fourth Provision:* Thermal Monitor – The inclusion or examination of thermal monitors within the surveillance program as specified in ASTM E 185 is optional.

* * * * *

Dated at Rockville, Maryland, this 24th day of September, 2020.

For the Nuclear Regulatory Commission.

/RA/

Annette Vietti-Cook,
Secretary for the Commission.