

RULEMAKING ISSUE
(Notation Vote)

July 7, 2004

SECY-04-0115

FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations /rRA/

SUBJECT: RULEMAKING PLAN TO INCORPORATE FIRST REVISED ORDER EA-03-009
REQUIREMENTS INTO 10 CFR 50.55A

PURPOSE:

To request Commission approval of a rulemaking plan to incorporate into 10 CFR 50.55a the reactor pressure vessel (RPV) head and associated head penetration inspection requirements contained in First Revised Order EA-03-009, dated February 20, 2004 (Order).

BACKGROUND:

All domestic pressurized water reactors (PWRs) have penetrations in the RPV head for control rod drive mechanisms and some have penetrations for instrumentation systems. Nickel-based alloys (e.g., Alloy 600) are used in the penetration nozzles and related welds. Primary coolant water and the environmental conditions within the reactor coolant system (RCS) can cause cracking of these nickel-based alloys via primary water stress corrosion cracking (PWSCC). In early 2001, inspections of the RPV head nozzles at Oconee Nuclear Station, Units 2 and 3, identified circumferential cracking of the nozzles above the J-groove weld, which joins the nozzle to the RPV head. Circumferential cracking above the J-groove weld is a safety concern because of the possibility of a nozzle ejection if the circumferential cracking is not detected and repaired. In early 2002, following inspection of leaking nozzle penetrations, the licensee for the Davis-Besse Nuclear Power Station reported finding a cavity in the RPV head on the downhill side of one of the nozzles. The cavity was apparently caused by boric acid erosion/corrosion resulting from leakage of reactor coolant from a crack in the nozzle. These events are significant because ejection of a nozzle or failure of the RPV boundary from head corrosion would challenge safety systems.

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The Nuclear Regulatory Commission (NRC) has taken several actions to address the issue of RPV head penetration leakage and the potential for degradation of the low-alloy steel head by boric acid corrosion. These actions include issuance of Bulletin 2001-01, on August 8, 2001; Bulletin 2002-01, on March 18, 2002; and Bulletin 2002-02, on August 9, 2002. Because current regulations do not adequately address the inspection of these components, the NRC issued Order EA-03-009 on February 11, 2003, and subsequently First Revised Order EA-03-009 (Order) on February 20, 2004. Order EA-03-009 as well as the First Revised Order required PWR licensees to determine the degradation susceptibility category of their reactor and, based on that susceptibility, to implement specific inspections of the RPV head and associated penetration nozzles. The Order provides reasonable assurance that cracks in the CRDM penetration welds will be detected before they can grow through-wall and significantly leak or grow to a length in which the pressure boundary is challenged, and that plant operations therefore do not pose an undue risk to public health and safety.

In the Order, the NRC established a means of ranking the susceptibility to PWSCC of the head and penetration nozzles. The ranking is determined by an empirical calculation based on effective full-power years of operation and the respective RPV head temperatures for those years of operation. To date, the susceptibility model in the Order has correlated well with operational data and it is considered to be an effective tool to prioritize inspection requirements and efficiently optimize the use of licensee and NRC inspection resources. Order EA-03-009 was issued as an interim measure until inspection requirements could be incorporated into NRC regulations.

DISCUSSION:

The NRC staff believes that the Order is not an appropriate regulatory tool for long-term regulation in this area and that the requirements of the Order should be codified into NRC regulations. The benefits of codifying the requirements contained in the Order are that they will be located in 10 CFR 50.55a along with similar requirements and thus will provide licensees with a single source of RPV head and head penetration inspection requirements. The rulemaking process will also provide an opportunity for stakeholder input on the inspection requirements of the Order and provide regulatory stability for long-term inspection management of these issues. Consequently, the staff is pursuing rulemaking activities to incorporate the inspection requirements of the Order into 10 CFR 50.55a.

The staff considers rulemaking to be the most expeditious route to codify the inspection requirements. However, because the existing requirements of the Order are considered adequate to protect public health and safety, the NRC could delay rulemaking pending development of additional information from operating experience, industry-developed analysis, or revision of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code. Coordinating with industry and the ASME could save staff resources but would extend the time before the inspection requirements are incorporated into NRC regulations.

In considering the various industry and staff efforts ongoing to resolve this issue, the staff developed three options for proceeding with rulemaking. These options are described in the following paragraphs.

Option 1: Codify the inspection requirements of the Order into 10 CFR 50.55a and continue to work with ASME in the longer-term.

The first option is to initiate rulemaking to incorporate the inspection requirements of the Order into 10 CFR 50.55a. Rulemaking would provide regulatory stability by codifying the Order and would allow stakeholder input on the inspection requirements of the Order. This option would implement the alternative of the high-priority recommendation of the Davis-Besse Lessons Learned Task Force Report, Item 3.3.4.(8). Item 3.3.4(8) recommended that the NRC encourage changes to the ASME Code requirements for inspection of the RPV head and penetrations of PWRs or, alternatively, revise 10 CFR 50.55a. The staff is coordinating with industry and the ASME to change the Code requirements for these components. Because the staff expects it will be a year before an ASME Code case is ready for staff review and agreement on appropriate inspection requirements based on ASME and industry information may not be reached in a timely manner, this option is considered to be the most expeditious means of codifying the inspection requirements of the Order.

This option would be expected to be completed in March of 2006. If insights are gained from industry during the rulemaking process which cause the staff to change the technical basis for this rulemaking, the schedule could be revised.

Option 2: Work with industry to develop new inspection requirements suitable for incorporation into 10 CFR 50.55a.

The second option is to continue working with industry to develop inspection requirements that reflect the body of information developed by industry in coordination with ongoing research activities in the Office of Nuclear Regulatory Research (RES) and then incorporate a suitably revised set of inspection requirements into NRC regulations at a later time. RES has been coordinating with industry to evaluate the degradation susceptibility model, RPV penetration crack growth rates, and head degradation rates to determine realistic and conservative inspection requirements. In Materials Reliability Program document, MRP-110, submitted April 14, 2004, industry provided the staff with extensive information for this issue. Industry expects to provide their recommendations for inspection requirements by the end of Summer 2004. This option would be expected to be completed in February 2007.

This option might result in a more realistic set of inspection requirements and a reduction in the burden imposed by the inspection requirements in the Order that would be incorporated under Option 1. Because stakeholders would participate in the rulemaking process, public confidence would be increased. Additional time and agency resources will be needed to evaluate the industry-developed information, therefore, Option 2 results in a longer schedule than Option 1. However, Option 1, once complete, is anticipated to require changes subsequent to staff and industry agreement on a revised inspection plan.

Option 3: Evaluate RPV inspection requirements of an upcoming ASME Code Case or revision of the ASME Code for incorporation into 10 CFR 50.55a.

The third option is to wait until ASME publishes a Code Case or revises the ASME Code, evaluate the acceptability of the inspection requirements, and initiate rulemaking to incorporate the revised requirements into 10 CFR 50.55a. The staff expects that it will be approximately one year before ASME publishes a Code Case and longer for the ASME to revise the Code to include requirements for RPV head and penetration inspections. Additional time will be needed for the staff to review the acceptability of the ASME revisions and incorporate suitably revised requirements into NRC regulations. Option 3 would increase public confidence because the ASME Code is widely recognized as a consensus standard and has long been a part of NRC regulations and because the rulemaking process would allow public comment on incorporation of the Code requirements. Publishing of a Code Case is expected by July 2005 and rulemaking is expected to be complete in February 2007. It should be recognized that once a Code Case is complete, the NRC can approve use of it on an individual plant basis, thereby making it viable prior to completion of rulemaking. This option may obviate the need to revise the rule developed under Option 1 in order to later address industry-developed information but requires time before being implemented.

RECOMMENDATION:

Because of the need to provide regulatory stability for the inspection requirements of the RPV head and penetrations, the staff recommends Option 1. This option implements the alternative described in recommendation 3.3.4(8) of the Davis-Besse Lessons Learned Task Force Report.

Incorporating the inspection requirements of the Order into NRC regulations allows public comment on the inspection requirements and will codify NRC actions taken to address this issue in a timely manner. A rulemaking plan for this recommended option is attached.

RESOURCES:

NRR expects that 3.0 FTE will be needed over the period of late FY 2004 into FY 2006 for the rulemaking in accordance with the attached plan. These resources are included in NRR's budget.

COORDINATION:

The Office of the General Counsel has reviewed this Commission paper and has no legal objection.

The Office of the Chief Financial Officer has reviewed this Commission paper for resource implications and has no objection.

/RA/

Luis A. Reyes
Executive Director
for Operations

Attachment: Rulemaking Plan

Rulemaking Plan, 10 CFR 50.55a Codes and standards

Regulatory Issue:

To protect the public from failures of the reactor pressure vessel (RPV) head and penetration nozzles, Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), which is incorporated into NRC regulations by 10 CFR 50.55a, "Codes and standards," specifies that inspections of the RPV head need only include a visual check for leakage on the insulated surface or surrounding area. Operating experience has shown that these inspections may not detect small amounts of leakage from an RPV head penetration with cracks extending through the nozzle or the J-groove weld. Such leakage can create an environment that leads to circumferential cracks in RPV head penetration nozzles and/or corrosion of the RPV head.

On February 11, 2003, the NRC issued Order EA-03-009, "Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," which modified operating power reactor licenses to require specific inspections of the RPV head and associated penetration nozzles at pressurized water reactors (PWRs). Initial responses to the Order inspection requirements have been noted in several relaxation requests and inspection reports. Industry representatives through the Materials Reliability Program (MRP) provided input to support alternative inspection programs through various public meetings and in document MRP-95, "Materials Reliability Program: Generic Evaluation of Examination Coverage Requirements for the Reactor Pressure Vessel Head Penetration Nozzles," (ML032740424), in September 2003. In response to internal review and stakeholder input, the NRC issued First Revised Order EA-03-009, on February 20, 2004, (Order) which refined the inspection requirements of Order EA-03-009 by taking into account lessons learned from inspections performed since February 2003.

The NRC staff believes that the Order is not an appropriate regulatory tool for long-term regulation in this area and that the requirements of the Order should be codified into NRC regulations. The staff's reasons for this conclusion are that regulations should, when possible, be a complete set of requirements for licensees to follow and that rulemaking provides an opportunity for public comment. Consequently, the staff, in parallel with efforts to revise the ASME Code, is pursuing rulemaking activities to incorporate the inspection requirements of First Revised Order EA-03-009 (Order) into 10 CFR 50.55a. The rulemaking process will allow stakeholder input on the inspection requirements of the Order and provide regulatory stability for long-term inspection management of these issues.

The experience at Davis-Besse and the discovery of leaks and nozzle cracking at other plants reinforce the need for effective inspections of the RPV head and penetration nozzles. The absence of an effective inspection regime could, over time, result in unacceptable circumferential cracks in RPV head penetration nozzles or in the degradation of the RPV head by corrosion from leaks in the reactor coolant pressure boundary. These degradation mechanisms increase the probability of a loss of reactor coolant pressure boundary event through ejection of a nozzle or other rupture of the RPV head. The result of this rulemaking would be the codification of inspection requirements to provide reasonable assurance that

reactor pressure vessel head and penetration nozzles are maintained in a condition that will not adversely affect public health and safety.

Existing Regulatory Framework:

Section XI of the ASME Code, which is incorporated by reference in NRC regulations by 10 CFR 50.55a, "Codes and standards," currently specifies that inspections of the RPV head need only include a visual check for leakage on the insulated surface or surrounding area. In addition, the inspection requirements of the Order were made part of the licenses for PWR licensees but those requirements have not yet been made part of Chapter 10 of the Code of Federal Regulations.

How the Regulatory Problem Will Be Addressed by Rulemaking:

The NRC staff proposes to specify the appropriate inspection requirements through revision of 10 CFR 50.55a(g)(6)(ii) by the addition of a paragraph (D) Reactor Vessel Head Inspections.

Paragraph 50.55a(g)(6)(ii) states: "The Commission may require the licensee to follow an augmented inservice inspection program for systems and components for which the Commission deems that added assurance of structural reliability is necessary."

The proposed 10 CFR 50.55a(g)(6)(ii)(D) will include the inspection requirements of the Order, as amended, for use in the Code of Federal Regulations. Although a strict codification of the requirements of the Order would not be a backfit, the staff expects that the requirements may be modified as a result of the rulemaking process and therefore will treat this rulemaking as a backfit necessary for adequate protection of public health and safety.

Rulemaking Options:

The staff has developed three options for rulemaking to provide long-term inspection requirements for the RPV head and head penetrations.

Option 1: Codify the inspections requirements of the Order into 10 CFR 50.55a and continue to work with ASME in the longer-term.

This option would, in the near-term, codify the requirements of the Order and implement the alternative of the high-priority recommendation of Item 3.3.4.(8) in the Davis-Besse Lessons Learned Task Force Report. Item 3.3.4(8) recommended that the NRC encourage changes to the ASME Code requirements for inspection of the RPV head and penetrations of PWRs or, alternatively, revise 10 CFR 50.55a. As recommended in the Davis-Besse report, the staff will continue to coordinate with the ASME to change the Code requirements for these components and will endorse a revised 10 CFR 50.55a, as appropriate, via rulemaking. This option would allow stakeholder input on the specifics of the inspection requirements in the Order during the rulemaking process and thereby increase public confidence and would provide regulatory stability by codifying the Order. This option would be expected to be completed in March 2006.

Option 2: Work with industry to develop new inspection requirements suitable for incorporation into 10 CFR 50.55a.

In April 2004, industry provided the staff with an extensive amount of theoretical and experiential information regarding RPV head corrosion and head penetration cracking. Industry expects to provide the staff information for a final safety assessment and proposed inspection requirements by the end of September 2004. Industry is also providing this information to the ASME for development of a code case.

This option might result in a more realistic set of inspection requirements and a reduction in the burden imposed by the inspection requirements in the Order that would be incorporated into the Option 1 rulemaking. Because stakeholders would participate in the rulemaking process, public confidence would be increased. Option 1, once complete, is anticipated to require changes subsequent to staff and industry agreement on a revised inspection plan. This option may reduce the possibility that additional rulemaking would be needed in light of industry-developed information. However, time and agency resources will be needed to evaluate the industry-developed information and will result in a longer schedule than in Option 1.

Option 3: Evaluate RPV inspection requirements of an upcoming ASME Code Case or revision of the ASME Code for incorporation into 10 CFR 50.55a.

The third option is to wait until ASME publishes a Code Case or revises the ASME Code, evaluate the acceptability of the inspection requirements, and initiate rulemaking to incorporate the revised requirements into 10 CFR 50.55a. Option 3 would increase public confidence because the ASME Code is widely recognized as a consensus standard and has long been a part of NRC regulations and because the rulemaking process would allow public comment on incorporation of the Code requirements. An ASME Code Case is expected to be published by the end of July 2005 with rulemaking complete in February 2007. This option may obviate the need to revise the rule developed under Option 1 in order to later address industry-developed information but will result in a longer schedule because of the need to wait for the publication of the Code Case.

Recommended Approach:

Although the staff identified three rulemaking options, the staff recommends Option 1 as the most expeditious method to codify the inspection requirements of the Order. The other options are viable but would likely be completed later because the initiation of rulemaking is dependent on completion of ongoing actions of industry or revision of the ASME Code. Therefore, the staff has prepared a rulemaking plan for Option 1 and projected schedules for Options 2 and 3.

Rule Plan

Codify the inspections requirements of the Order into 10 CFR 50.55a and continue to work with ASME in the longer-term. (Option 1)

Codifying the inspection requirements of the Order maintains safety, provides regulatory stability, and allows public comment on the inspection requirements. This option would impose a similar burden on licensees as the inspection requirements of the Order because it would continue to require inspections of the RPV head and head penetrations to be performed at

similar intervals and of similar types as in the Order. This Option would maintain the increase in burden over the requirements that were in place before the Order was issued.

Although this action is an adequate protection backfit, a regulatory analysis would be prepared to identify the cost of the inspection requirements to the public. It is likely that the environmental impact evaluation would result in a determination of no environmental impact because the requirements of the rule would be similar to those of the Order and because the required actions result in little or no change to the environment. Approximately 3 FTE over a 2-year period will be required to implement this rulemaking.

Alternatives:

The principal alternative to rulemaking has been employed. Order EA-03-009 and the First Revised Order established interim inspection requirements. The process of rulemaking will further the NRC goal of increasing public confidence and will further regulatory stability. The final rule will continue to provide reasonable assurance of adequate protection of public health and safety.

Impact on Licensees:

The impact of this rulemaking on licensees is similar to the requirements of the Order. In the Order, licensees were required to implement an ongoing inspection program of the RPV head and head penetrations at specified intervals. This rulemaking would result in a continuing inservice inspection program for RPV head and associated penetrations with inspections performed at specific intervals and of a specific type similar to those of the Order. The rulemaking will continue to provide reasonable assurance of adequate protection of public health and safety as was provided by the Order.

Benefits:

The primary benefit of this rulemaking will be to codify appropriate inservice inspection requirements for PWR RPV head and associated penetrations in order to prevent unacceptable degradation of the reactor pressure vessel head by corrosion and unacceptable cracks in RPV head penetrations. Codifying the requirements will provide a complete set of inspection requirements in one place.

Other benefits of this rulemaking will be to improve regulatory stability, increase public confidence, and maintain public health and safety.

Office of General Counsel (OGC) Legal Analysis:

The proposed rule would revise 10 CFR 50.55a(g)(6)(ii) to incorporate the inspection requirements contained in the Order. The staff must consider the following regarding this proposed rule:

1. The technical basis (TB) for this proposed rule is that existing requirements do not assure public health and safety from the potential consequences of RPV head and penetration corrosion and leakage. Therefore, the inspection requirements of the proposed rule are

necessary for protection of public health and safety. The TB of the proposed rule is the same as the basis for the Order and will be a part of the statement of considerations (SOC).

2. The proposed rule will require preparation of an environmental assessment, as it appears that there are no categorical exclusions in 10 CFR 51.22(c) which apply to this rulemaking.

3. Although the proposed rule will codify the inspection requirements of the Order, those requirements may be changed during the rulemaking process and thus may be a backfit per 10 CFR 50.109(a)(1). However, pursuant to paragraph 50.109(a)(4), a backfit analysis need not be performed because the proposed rule is necessary for adequate protection of public health and safety. A documented evaluation of this determination will be performed as required by paragraph 50.109(a)(4).

4. The rule will not be a "major rule" under the Small Business Regulatory Enforcement Fairness Act, inasmuch as the rule is unlikely to result in a \$100 million impact on nuclear power plant licensees. Because the rule is not a major rule, the mandated 60-day period prior to effectiveness of a major rule is not applicable and the normal 30-day period for effectiveness in the Administrative Procedures Act applies.

5. The proposed rule may require licensees to generate and maintain records or submit reports related to the implementation of the inspection requirements. If the proposed rulemaking involves new record keeping and reporting requirements, a review by the Office of Management and Budget will be required for purposes of the Paperwork Reduction Act.

In conclusion, OGC has determined that there are no known bases for legal objection to the contemplated rulemaking.

Category of Rule:

Although the rulemaking is expected to cost licensees the same as under the Order, it will cost licensees more than the inspection requirements that existed before the Order. The staff has made initial estimates and does not consider this rulemaking to be a major rule.

Backfit Analysis:

The actions contained in this rulemaking may be a change from the requirements of the Order. Therefore, the proposed rule will be considered a backfit in accordance with NRC procedures. However, the required actions are considered necessary to ensure adequate protection of public health and safety. Failure of the RPV head or head penetrations could result in unacceptable challenges to the reactor safety systems that, combined with other failures, could lead to the release of radioactivity to the environs.

The staff considers this action to be an adequate protection backfit; therefore a cost/benefit analysis is not required. However, the staff will estimate the revised burden to licensees over the existing inspection requirements in the regulatory analysis for the rule.

Supporting Documents Needed:

An environmental assessment or, as appropriate, a determination of no environmental impact statement will be prepared as part of this rulemaking. If the rule contains reporting or record keeping requirements, an OMB clearance package will be prepared for submission to the Office of Management and Budget. A regulatory analysis will also be prepared.

Public/Industry Participation:

There was extensive public and industry participation via public meetings and licensee correspondence in response to Bulletins 2001-01, 2002-01, 2002-02, and Order EA-03-009. By the end of Summer 2004, the industry is expected to provide NRC revised basis and position documents for long-term inspection requirements of reactor pressure vessel heads and associated penetrations. Additionally, extensive public and industry comments are expected in response to this proposed rulemaking.

Resources:

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Schedule and Resources Option 1:

Rulemaking Timetable for RPV Head Inspection Rule 55.55a		
Milestones	Time to Complete	Estimated Date of Completion
Proposed Rulemaking Plan Package to Commission	2 months	6/04
Rulemaking Plan with Commission	2 months	8/04
Prepare Proposed Rule Package	4 months	12/04
Obtain Concurrences, ACRS Review, CRGR Approval	2 months	2/05
Proposed Rule Package with the Commission	2 months	4/05
Respond to SRM and Publish Proposed Rule	1 month	5/05
Public Comment Period Complete	75 days	8/05
Incorporate Public Comments/Draft Final Rule	1 month. (Note1)	9/05

Obtain Concurrences, CRGR Concurrence, ACRS Review	3 months	12/05
Final Rule Package to Commission	2 months	2/06
Publish Final Rule	1 month	3/06

Note 1: This estimate is based on model schedules contained in LIC-300. If extensive comments are received, the schedule will need to be modified.

Anticipated FTE Effort 3.0 FTE

Projected Schedule Option 2: Work with industry to develop new inspection requirements suitable for incorporation into 10 CFR 50.55a.

The schedule below is based on industry providing the information as expected and the staff completing an evaluation of that information approximately six months after receiving the industry information.

Rulemaking Timetable for RPV Head Inspection Rule 55.55a		
Milestones	Time to Complete	Estimated Date of Completion
Receipt of industry proposed inspection requirements	NA	9/04
Staff evaluation of industry proposed inspection guidance and supporting documentation	6 months	3/05
Proposed Rulemaking Plan Package to Commission	2 months	5/05
Rulemaking Plan with Commission	2 months	7/05
Prepare Proposed Rule Package	4 months	11/05
Obtain Concurrences, ACRS Review, CRGR Approval	2 months	1/06
Proposed Rule Package with the Commission	2 months	3/06
Respond to SRM and Publish Proposed Rule	1 month	4/06
Public Comment Period Complete	75 days	7/06
Incorporate Public Comments/Draft Final Rule	1 month	8/06

Obtain Concurrences, CRGR Concurrence, ACRS Review	3 months	11/06
Final Rule Package to Commission	2 months	1/07
Publish Final Rule	1 month	2/07

Projected Schedule Option 3: Evaluate RPV inspection requirements of an upcoming ASME Code Case or revision of the ASME Code for incorporation into 10 CFR 50.55a.

The ASME is expected to publish a Code Case in July 2005. The staff could begin rulemaking in August 2005 and the long-term inspection requirements could be incorporated into 10 CFR 50.55a as soon as February 2007.