March 18, 2005

Mr. Michael R. Kansler, President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: RELAXATION OF FIRST REVISED ORDER ON REACTOR VESSEL NOZZLES, INDIAN POINT NUCLEAR GENERATING UNIT NO. 3 (TAC NO. MC3195)

Dear Mr. Kansler:

In a letter dated May 19, 2004, as supplemented on August 23, 2004, and January 18, 2005, Entergy Nuclear Operations, Inc. (the licensee), submitted requests for relaxation regarding the inspection of reactor pressure vessel (RPV) head and penetration nozzles at Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and 3). The relaxations were requested from the interim inspection requirements in the Nuclear Regulatory Commission's (NRC's) First Revised Order Modifying Licenses, EA-03-009, dated February 20, 2004 (First Revised Order).

The NRC staff has reviewed the licensee's requested relaxation to implement certain alternatives to the requirements of the First Revised Order at IP3. Specifically, the licensee proposed: (1) relaxation from the inspection coverage for the nondestructive examination (NDE), using ultrasonic testing (UT) techniques, of 5 RPV head penetration nozzles, that are limited by a threaded section that is slightly less than the 1-inch lower boundary limit specified in Section IV.C.5.(b)(i), (2) relaxation from the inspection coverage requirements for a bare metal visual (BMV) examination of the RPV head surface, as specified in Section IV.C.(5)(a), and (3) relaxation from the frequency requirements of paragraph IV.C.(5)(a) or paragraph IV.C.(5)(b) for RPV head and head penetration inspections. The results are provided in the enclosed safety evaluation (SE). On October 15, 2004, the NRC staff previously evaluated the relaxation request for IP2 and authorized the proposed alternative inspection for all future bare-metal visual examinations performed per Section IV, paragraph C.(5)(a), of the First Revised Order, for the RPV head at IP2.

For the examination coverage regarding the 5 RPV penetration nozzles, the NRC staff has concluded for IP3 that the proposed alternative examinations provides reasonable assurance of the structural integrity. Further inspections of these nozzles in accordance with paragraph C.(5)(b) of Section IV of the First Revised Order would result in hardship without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), and in accordance with Section IV, paragraph F, of the First Revised Order, the NRC staff authorizes the proposed alternative inspection for the 5 RPV penetration nozzles at IP3 for the life of the Order, subject to the condition specified in the SE.

For the BMV examination coverage of the head surface, the NRC staff has concluded that the proposed alternative examination provides reasonable assurance of the structural integrity of the RPV head, penetration nozzles, and welds. Further inspections of the RPV head in accordance with Section IV, paragraph C.(5)(a) of the First Revised Order would result in hardship without a compensating increase in the level of quality and safety. Therefore,

pursuant to 10 CFR 50.55a(a)(3)(ii), and in accordance with Section IV, paragraph F, of the First Revised Order, the NRC staff authorizes the proposed alternative inspection for all future BMV examinations performed per Section IV.C.(5)(a) of the First Revised Order for the RPV head at IP3.

For the frequency requirements of paragraph IV.C.(5)(a) or paragraph IV.C.(5)(b) for RPV head and head penetration inspections, the NRC staff concludes that the licensee's proposed alternative examination of the 40 vessel head penetration (VHP) nozzles at IP3 provides an acceptable level of quality and safety. Therefore, pursuant to to10 CFR 50.55a(a)(3)(i), and in accordance with Section IV, paragraph F, of the First Revised Order, the staff authorizes the proposed alternative inspection for the 40 VHP nozzles at IP3 during the 3R13 Refueling Outage. The staff also considers this approach acceptable for the duration that IP3 remains in the "moderate" susceptibility category, as identified in the First Revised Order .

If you should have any questions, please contact Patrick Milano at 301-415-1457.

Sincerely,

/RA/

Cornelius F. Holden, Director
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-286

Enclosure: Safety Evaluation

cc w/encl: See next page

pursuant to 10 CFR 50.55a(a)(3)(ii), and in accordance with Section IV, paragraph F, of the First Revised Order, the NRC staff authorizes the proposed alternative inspection for all future BMV examinations performed per Section IV.C.(5)(a) of the First Revised Order for the RPV head at IP3.

For the frequency requirements of paragraph IV.C.(5)(a) or paragraph IV.C.(5)(b) for RPV head and head penetration inspections, the NRC staff concludes that the licensee's proposed alternative examination of the 40 vessel head penetration (VHP) nozzles at IP3 provides an acceptable level of quality and safety. Therefore, pursuant to to10 CFR 50.55a(a)(3)(i), and in accordance with Section IV, paragraph F, of the First Revised Order, the staff authorizes the proposed alternative inspection for the 40 VHP nozzles at IP3 during the 3R13 Refueling Outage. The staff also considers this approach acceptable for the duration that IP3 remains in the "moderate" susceptibility category, as identified in the First Revised Order .

If you should have any questions, please contact Patrick Milano at 301-415-1457.

Sincerely,

/RA/

Cornelius F. Holden, Director
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELAXATION OF FIRST REVISED ORDER MODIFYING LICENSES, EA-O3-009

EXAMINATION COVERAGE FOR REACTOR PRESSURE VESSEL

HEAD AND PENETRATIONS NOZZLES

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-286

1.0 INTRODUCTION

On February 20, 2004 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML040220181), the Nuclear Regulatory Commission (NRC) issued the First Revised NRC Order Modifying Licenses, EA-03-009 (First Revised Order), requiring specific examinations of the reactor pressure vessel (RPV) head and vessel head penetration (VHP) nozzles of all pressurized-water reactor (PWR) plants. Section IV, paragraph F, of the First Revised Order states that requests for relaxation of the Order associated with specific penetration nozzles will be evaluated by the NRC staff using the procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) in accordance with Section 50.55a(a)(3) of Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.55a(a)(3)). Section IV, paragraph F, of the Order states that a request for relaxation regarding inspection of specific nozzles shall address the following criteria: (1) the proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety, or (2) compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

For Indian Point Nuclear Generating Unit No. 3 (IP3) and similar plants that were determined to have a moderate susceptibility to primary water stress-corrosion cracking (PWSCC) in accordance with Section IV, paragraph A and B, of the First Revised Order, the following inspections shall be performed such that at least the requirements of paragraph IV.C.(5)(a) or paragraph IV.C.(5)(b) are performed each refueling outage:

(a) Bare metal visual [BMV] examination of 100% of the RPV head surface (including 360E around each RPV head penetration nozzle). For RPV heads with the surface obscured by support structure interferences which are located at RPV head elevations downslope from the outermost RPV head penetration, a bare metal visual inspection of no less than 95 percent of the RPV head surface may be performed provided that the examination shall include those areas of the RPV head upslope and downslope from the support structure interference to

identify any evidence of boron or corrosive product. Should any evidence of boron or corrosive product be identified, the licensee shall examine the RPV head surface under the support structure to ensure that the RPV head is not degraded.

(b) For each penetration, perform a nonvisual NDE [nondestructive examination] in accordance with either (i), (ii), or (iii):

(i) Ultrasonic testing of the RPV head penetration nozzle volume (i.e., nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or bottom of the nozzle if less than 2 inches [See Figure IV-1]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis.) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2). In addition, an assessment shall be made to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.

(ii) Eddy current testing or dye penetrant testing of the entire wetted surface of the J-groove weld and the wetted surface of the RPV head penetration nozzle base material from at least 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-3]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-4).

(iii) A combination of (i) and (ii) to cover equivalent volumes, surfaces and leak paths of the RPV head penetration nozzle base material and J-groove weld as described in (i) and (ii). Substitution of a portion of a volumetric exam on a nozzle with a surface examination may be performed with the following requirements:

1. On nozzle material below the J-groove weld, both the outside diameter and inside diameter surfaces of the nozzle must be examined.

2. On nozzle material above the J-groove weld, surface examination of the inside diameter surface of the nozzle is permitted provided a surface examination of the J-groove weld is also performed.

In addition, for those plants in the Moderate category, the requirements of paragraph IV.C.(5)(a) and paragraph IV.C.(5)(b) shall each be performed at least once over the course of every 2 refueling outages.

Footnote 3 of the Order provides specific criteria for examination of repaired VHP nozzles.

By letter dated May 19, 2004, as supplemented on August 23, 2004, and January 18, 2005 (ADAMS Accession Nos. ML041460199, ML042590198, and ML050260293), Entergy Nuclear Operations, Inc. (Entergy, or the licensee) requested relaxation to implement three alternatives to the requirements of Section IV, paragraph C.(5)(a) and C.(5)(b) of the First Revised Order for RPV head penetration nozzles at IP3. The specific relaxation requests were provided in 3 separate attachments to the May 19 application and are discussed below.

2.0 ATTACHMENT 1: RELAXATION REQUEST REGARDING ULTRASONIC TESTING OF RPV HEAD NOZZLES

2.1 First Revised NRC Order Requirements for Which Relaxation is Requested

The licensee has requested relaxation from Section IV, paragraph C.(5)(b)(i) of the First Revised Order. The specific relaxation is identified below:

2.2 Licensee's Proposed Alternative

The licensee seeks relaxation wherein the inspection coverage for the NDE, using ultrasonic testing (UT) techniques, of 5 RPV head penetration nozzles at IP3 is limited by a threaded section that is slightly less than the 1-inch lower boundary limit specified in Section IV.C.5.(b)(i) of the First Revised NRC Order. The licensee stated that relaxation was requested from Section IV.C.(5)(b)(i) for inspection coverage from 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2 in the May 19 application).

The licensee proposed to define the lower boundary of the inspection volume of the 5 affected RPV head penetration nozzles as: "to the top of the threaded region, which is nominally 0.96 inch below the lowest point at the toe of the J-groove weld ... including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater."

2.3 Reason for Relaxation Request

The licensee stated the proposed alternative provided an acceptable level of quality and safety.

2.4 Licensee's Basis for Proposed Alternative

The licensee stated that the design of the RPV head penetration nozzles at IP3, includes a threaded section, approximately 3/4-inch long, at the bottom of the nozzles. The licensee stated that at 5 locations (nozzles nos. 74, 75, 76, 77, and 78), the dimensional configuration is such that the distance from the lowest point at the toe of the J-groove weld to the top of the threaded region is slightly less than the 1-inch lower boundary limit specified in Section IV.C.5(b)(i) of the First Revised Order. The licensee stated that UT results would not be meaningful in the threaded region, and therefore, proposed that the lower boundary of the UT inspection extend to the top of the threaded region. These nozzles are the outer-most nozzles at an angle of 48.8E of the incidence between the nozzle centerline and the head inside surface.

The licensee stated that it confirmed through analysis that the operating stress levels (including residual and normal operation stresses), in the region at and below the proposed lower boundary limit of the inspection volume, are less than 20 ksi tension. In addition, the licensee stated that it would comply with the requirement for determining if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head. This determination is made by the BMV examination at the top of the RPV head surface that includes inspection 360E around the head penetration nozzles.

2.5 Evaluation

The NRC staff's review of this request was based on criterion (2) of paragraph F of Section IV of the Order, which states:

> [C]ompliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Within the context of the licensee's proposed alternative examination of the RPV head penetration nozzles, the licensee has demonstrated the hardship that would result from implementing examinations to the bottom end of these nozzles. The licensee identified the hardship by stating the design of the RPV head penetration nozzles includes a threaded section, approximately 3/4 inches long, at the bottom of the nozzles. At 5 locations (nozzles 74, 75, 76, 77, and 78) the dimensional configuration is such that the distance from the lowest point at the toe of the J-groove weld to the top of the threaded region is slightly less than the 1-inch lower boundary limit specified in Section IV.C.5(b)(i) of the First Revised Order. UT in this threaded region would not provide meaningful results.

The phenomenon of concern is PWSCC, which typically initiates in the areas of highest stress. The area of RPV head penetration nozzles that has the highest residual stress is the area adjacent to the J-groove attachment weld. Therefore, it is most likely that PWSCC will initiate in an area adjacent to the J-groove attachment weld.

The licensee proposed to examine the minimum distance of the nozzle base material below the J-groove attachment weld as follows.

Nozzles 74, 75, 76, 77, and 78 will be examined to the top of the threaded region, which is nominally 0.96 inch below the lowest point at the toe of the J-groove weld. The licensee's proposed minimum inspection distance of the nozzle base material below the attachment weld is supported by the licensee's analysis which demonstrated that no flaw below that portion of the nozzle identified above would propagate to a level adjacent to the J-groove weld within the next operating period. In its letter dated January 18, 2005, responding to an NRC request for additional information (RAI), the licensee stated that a crack growth evaluation was performed using the methods of Electric Power Research Institute (EPRI) Report, "Material Reliability Program (MRP) Crack Growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP-55), Revision 1," for crack growth caused by PWSCC at a head temperature of 592 EF. The nozzle is an open-ended tube so that the operating pressure and temperature are essentially the same at both the inside and outside surface of the tube. The licensee stated for purposes of this analysis, a conservatively high hoop stress of 30 ksi was assumed, as compared to the calculated stresses of less than 20 ksi as noted in the First Revised NRC Order EA-03-009. An initial hypothetical flaw is assumed to exist with a worst-case orientation (axial) and flaw growth occurs in a single direction toward the J-groove weld. Because the location of the hypothetical flaw is in the threaded region, at least 0.96 inch from the J-groove weld, the weld residual stresses are negligible. The analysis concluded that the crack growth in a 4-year operating period is approximately 0.54 inch, well within the minimum dimension of 0.96 inch to the closest point of the J-groove weld. Therefore, the hypothetical flaw would not grow to the J-groove weld over at least 4 years of operation. The licensee stated the weld geometry dimensions are taken from the IP3 plant specific drawing (IP3V-0439-1680) entitled: "Indian Point Unit 3, RVH Penetration Inspection, Interface Dimensions."

Based upon the information above, the NRC staff finds the licensee's crack growth evaluation to be acceptable. The licensee's assumed hoop stresses used in the calculation were conservative as compared to the calculated stresses of less than 20 ksi, and the assumed crack will not grow into the weld within one cycle of operation.

The licensee's analysis used the crack growth formula in MRP-55. However, the NRC staff has not yet made a final determination on the acceptability of this industry report. Should the staff determine the crack growth formula used by the licensee to be unacceptable, the licensee will be required to revise its analysis to incorporate an acceptable crack growth formula as described below.

If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the First Revised NRC Order within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If the licensee's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, the licensee shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, the

licensee shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for this and future cycles for RPV head penetrations must be based on an acceptable crack growth rate formula.

The licensee also provided a finite element analysis that included the simulation of the weld deposition for the J-groove weld buttering and the subsequent stress relief of the head and buttering, in addition to the J-groove welding. The results of this analysis provide the operating condition stress levels and distribution effects of welding residual stresses, hydrostatic testing, and steady state operating pressure and temperature. The licensee provided hoop stress results of the performed analysis of original welding plus operating loads for the five (5) RPV penetration nozzles. The results are summarized below:

Nozzle Numbers	Operating Hoop Stress (psi)	Location
74, 75, 76, 77, 78	9,786	Downhill side at 0.96" below the lowest point at the toe of the J-groove weld.
74, 75, 76, 77, 78	-1,170	Uphill side at 5.476" below the lowest point at the toe of the J-groove weld.

These nozzles are the outer-most nozzles and have a 48.8E angle of incidence between the nozzle centerline and the head inside surface.

The NRC staff finds the licensee's analysis acceptable because the results show the operating hoop stresses are below the 20 ksi threshold stress. It is believed that the cracks will not initiate if the available stresses are below the threshold stress of 20 ksi.

In its January 18, 2005, letter, the licensee stated that the 5 nozzles are equipped with retaining collar/guide funnels which are welded to the bottom of the nozzles on the OD side. The licensee intends to perform the non-visual NDE with a combination UT and eddy-current testing (ECT) probe from the inside of the nozzle tube (a single probe assembly that contained a pair of transducers for the UT examination and an eddy current coil for the ECT examination). Removal of these outside diameter (OD) guide funnels will not increase the NDE examination coverage or accuracy. The licensee stated that removal of the guide funnels would require the use of the electrical discharge machining (EDM) process. It would take approximately 24 hours to set up the EDM equipment and approximately 22 hours to cut out all 5 thermal sleeves/guide funnels and reinstall them. The replacement guide funnels would have to be fabricated to match the as-built configuration of the nozzle since these are not the standard size. After the inspections, the replacement guide funnels would be installed by welding. The licensee estimated that the total radiation exposure for the removal and reinstallation activities would be about 6 rem. The licensee did not consider liquid penetrant examinations of the threaded areas because it would require removal of the guide funnels, which would incur excessive radiation exposure to the NDE personnel as discussed above.

The licensee also stated that they will comply with the requirement for determining if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head.

This determination will be made by the BMV examination at the top of the RPV head surface that includes inspection 360E around the head penetration nozzles.

2.6 Conclusion

The NRC staff concludes that the licensee's proposed alternative examination of the 5 RPV penetration nozzles (74, 75, 76, 77, 78) from 0.96 inch below the lowest point at the toe of the J-groove weld, which is the top of the threaded region, provides reasonable assurance of the structural integrity of the RPV head, RPV penetration nozzles, and welds. Further inspections of these RPV penetration nozzles in accordance with paragraph C.(5)(b) of Section IV of the First Revised Order would result in hardship without a compensating increase in the level of quality and safety. Therefore, pursuant to10 CFR 50.55a(a)(3)(ii), and in accordance with Section IV, paragraph F, of the First Revised Order, the NRC staff authorizes the proposed alternative inspection for the 5 RPV penetration nozzles at IP3 for the life of the Order, subject to the following condition:

> If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the First Revised Order dated February 20, 2004, within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If the licensee's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, the licensee shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, the licensee shall, within 30 days submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for this and future cycles for RPV head penetration nozzles must be based on an acceptable crack growth rate formula.

The NRC staff notes that the evaluations performed above were done for the IP2 RPV head. The licensee stated that the design for IP3 is identical and the same restrictions encountered at IP2 can be anticipated at IP3. If the restrictions encountered in the IP3 inspection are more restrictive than the approved relaxation, the licensee will need to submit a new relaxation request for IP3.

3.0 ATTACHMENT 2: BMV EXAMINATION OF RPV HEAD

3.1 First Revised NRC Order Requirements for Which Relaxation is Requested

The licensee has requested relaxation from Section IV, paragraph C.(5)(a) of the First Revised Order. The specific relaxation requested is identified below.

3.2 Licensee's Proposed Alternative

The licensee seeks relaxation from the requirements for a bare metal visual examination of the RPV head surface at Indian Point Generating Unit 3, as specified in Section IV.C.(5)(a) of the Order. This section states in part:

> Bare metal visual examination of 100 percent of the RPV head surface (including 360E around each RPV head penetration nozzle). For RPV heads with the surface obscured by support structure interferences which are located at RPV head elevations downslope from the outermost RPV head penetration, a bare metal visual inspection of no less than 95 percent of the RPV head surface may be performed...

The licensee proposes to perform a BMV examination of no less than 95 percent of the RPV head surface at IP3. The licensee stated that the small area not being inspected is partially obscured by a reflective metal insulation (RMI) support ring located downslope from the outermost RPV head penetrations.

3.3 Reason for Relaxation Request

The licensee stated that compliance with the specified requirement (100% of the RPV head surface) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.4 Licensee's Basis for Proposed Alternative

The licensee stated that the RPV head insulation package in IP3 consists of RMI panels supported above the RPV head surface such that remote visual devices can be used to perform the BMV examination, without removing the RMI. The licensee stated the outer wall of the RMI package, which includes the RMI support ring, rests on the RPV head downslope of the outermost penetration nozzles. Although this RMI support ring provides structural support for the other panels in the insulation package, the licensee stated it may not be considered as a "support structure" as intended in Section IV.C.(5)(a) of the First Revised Order. The licensee is, therefore, requesting a relaxation for the BMV examination to cover less than 100 percent of the RPV head, but at least 95 percent, consistent with the Order, based on interference from this insulation components.

The licensee stated that it will inspect the upslope and downslope of the interference and, if evidence of boron or corrosive product is identified, the examination will be expanded to cover the affected area under the interference. The RMI support ring does not prevent the inspection of 360E around the VHP nozzles.

The licensee stated that although the RMI support ring is removable, the other components of the insulation package supported by the support ring and the control rod drive mechanism cooling shroud would have to be removed first. The licensee stated that this is a significant labor-intensive task. The licensee estimated that the dose to personnel removing and reinstalling the shroud and insulation would be approximately 3.5 man-rem for IP3. The licensee stated that additional stay-times in the radiation field required to perform the removal

and reinstallation task represents a hardship without a compensating increase in the effectiveness of the BMV examination.

3.5 Evaluation

The NRC staff's review of this relaxation request was based on criterion (2) of paragraph F of Section IV of the Order, which states:

> [C]ompliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Within the context of the licensee's proposed alternative examination of the VHP nozzles, the licensee has demonstrated the hardship that would result from implementing BMV examinations of 100 percent of the RPV head surface.

The licensee proposed to perform a BMV examination of no less than 95 percent of the RPV head surface. The small area not being inspected is partially obscured by the RMI package including the support ring located downslope from the outermost RPV head penetrations. The licensee stated that this RMI support ring provides structural support for the other panels in the insulation package. The licensee submitted a relaxation request because it was uncertain if the RMI support ring could be considered a "support structure" as intended in Section IV.C.(5)(a) of the First Revised Order. The licensee requested a relaxation for the BMV examination to cover less than 100 percent of the RPV head, but at least 95 percent consistent with the Order, based on interference from this insulation component.

The licensee stated that although the RMI support ring is removable, other components of the insulation package supported by the support ring and the control rod drive mechanism cooling shroud would have to be removed first. In response to an RAI, the licensee submitted a letter dated August 23, 2004, which provided the removal/reinstallation sequence of the insulation package. The licensee stated that the removal sequence is as follows:

1. Build scaffolding around the Reactor Pressure Vessel (RPV) Head.
2. Unbolt CRDM cooling shroud bolts (18 bolts at the base of the shroud support ring).
3. Install rigging.
4. Lift the shroud approximately 4 feet high and maintain for the whole evolution.
5. Establish laydown area for insulation panels.
6. Remove D4 panel sections (total 18 panels).
7. Remove D3 panel sections (approx. 24 panels).
8. Remove D2 panel sections (approx. 24 panels).
9. Remove D1 panel sections (approx. 24 panels).
10. Reverse the sequence for reinstallation of the entire insulation support package.

The licensee estimates that the dose to personnel removing and reinstalling the shroud and insulation would be approximately 3.5 man-rem for IP3. The licensee stated in their response to the RAI that the RPV head surface that is obscured by the support ring is calculated at less than 5%, with the inspection access from the upslope and downslope sides. Therefore, the planned inspection will cover at least 95% of the RPV head surface.

The licensee stated that it will inspect the upslope and downslope of the interference and, if evidence of boron or corrosive product is identified, the licensee will examine the RPV head surface under the support structure to ensure that the RPV head is not degraded. This is consistent with the requirements of Section IV.C.(5)(a) of the First Revised Order.

The licensee stated during the prior BMV inspection (in April 2003), inspection coverage was 100% because a plant modification was implemented, which replaced the originally installed Kaylo Block permanent insulation with the new RMI panels. The area under the new RMI support ring was previously cleaned and inspected with satisfactory results.

The safety issues that are addressed by the inspections mandated by the First Revised Order are degradation (corrosion) of the low-alloy steel RPV head, and reactor coolant pressure boundary integrity. Based upon the above information, the alternative BMV examination proposed by the licensee, provides reasonable assurance of the structural integrity of the RPV head, control rod drive mechanism (CRDM) nozzles, and welds.

3.6 Conclusion

The NRC staff concludes that the licensee's proposed alternative examination of the RPV head provides reasonable assurance of the structural integrity of the RPV head, CRDM nozzles, and welds. Further inspections of the RPV head in accordance with Section IV, paragraph C.(5)(a) of the First Revised Order would result in hardship without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), and in accordance with Section IV, paragraph F, of the First Revised Order, the staff authorizes the proposed alternative inspection for all future BMV examinations performed per Section IV.C.(5)(a) of the First Revised Order for the RPV head at IP3.

4.0 ATTACHMENT 3: INSPECTION OF RPV AND PENETRATION NOZZLES

4.1 First Revised NRC Order Requirements for Which Relaxation is Requested

The licensee has requested relaxation from Section IV, paragraph C.(5)(a) and C.(5)(b) of the First Revised NRC Order. The specific relaxation requested is identified below.

4.2 Licensee's Proposed Alternative

The inspection requirements for a moderate category plant are specified in Section IV.C.(2) of the First Revised Order which states:

> For those plants in the Moderate category, RPV head and head penetration inspections shall be performed such that at least the requirements of paragraph IV.C.(5)(a) or paragraph IV.C.(5)(b) are performed each refueling outage. In addition the requirements of paragraph IV.C.(5)(a) and paragraph IV.C.(5)(b) shall each be performed at least once over the course of every 2 refueling outages.

Paragraph IV.C.(5)(a) specifies BMVI examination requirements of the RPV head surface, and paragraph IV.C.(5)(b) specifies requirements involving nonvisual NDE of the VHP nozzles.

The licensee proposes to perform NDE inspection during the 3R13 Refueling Outage at IP3 of those VHP nozzles that were not inspected during the 3R12 Refueling Outage. The scope of coverage includes 37 nozzles that were not inspected plus 3 nozzles that were partially inspected. The nozzles that received partial coverage were S/N's 6, 65, and 66. The licensee stated that a BMV examination will be performed during the 3R13 Refueling Outage, even though the BMV examination was previously completed in 3R12.

4.3 Reason for Relaxation Request

The licensee stated the proposed alternative provides an acceptable level of quality and safety.

4.4 Licensee's Basis for Proposed Alternative

The licensee stated that during the previous RPV head inspection for IP3 in the spring of 2003 (3R12), it performed a BMV examination of 100% of the RPV head surface and nonvisual NDE inspection of approximately one-half of the penetration nozzles. The licensee stated that since IP3 remains in the "Moderate" category, only one inspection type (BMV or non-visual NDE) needs to be performed each outage, as long as each type is performed at least once over the course of every 2 refueling outages. Since non-visual NDE was completed on 38 nozzles during Refueling Outage 3R12, the licensee proposed to inspect the remaining 40 nozzles in the next Refueling Outage 3R13. The licensee considers the intent of the First Revised Order is satisfied by performing NDE of nozzles at least once every other outage for a Moderate category plant. In addition, the licensee also proposed to perform a BMV inspection of the RPV head in refueling outage 3R13.

4.5 Evaluation

The NRC staff's review of this request was based on criterion (1) of paragraph F of Section IV of the First Revised Order, which states:

> The proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety.

Within the context of its proposed alternative examination of the VHP nozzles, the licensee has demonstrated that performing non-visual NDE on the 40 penetration nozzles and performing a BMV inspection of the RPV head will provide an acceptable level of quality and safety.

The phenomenon of concern is PWSCC, which typically initiates in the areas of highest stress. The area of VHP nozzles that has the highest residual stress is the area adjacent to the J-groove attachment weld. Therefore, it is most likely that PWSCC will initiate in an area adjacent to the J-groove attachment weld.

The licensee stated that for the upcoming refueling outage 3R13, IP3 will remain in the Moderate category. Section IV.C.(2) of the First Revised Order states the following:

> For those plants in the Moderate category, RPV head and head penetration inspections shall be performed such that at least the requirements of paragraph IV.C.(5)(a) or paragraph IV.C.(5)(b) are performed each refueling outage. In

addition the requirements of paragraph IV.C.(5)(a) and paragraph IV.C.(5)(b) shall be performed at least once over the course of every 2 refueling outages.

Paragraph IV.C.(5)(a) specifies BMV examination requirements of the RPV head surface, and paragraph IV.C.(5)(b) specifies requirements involving nonvisual NDE inspection of the VHP nozzles.

The licensee stated that during the previous RPV head inspection for IP3 in the spring of 2003 (3R12), it performed BMV examination of 100% of the RPV head surface and non-visual NDE inspection of 41 penetration nozzles. The non-visual NDE portion of the examination was performed using a single probe assembly that contained a pair of transducers for the UT examination and an eddy current coil for the ECT surface examination.

The licensee proposed to inspect the remaining 37 nozzles that did not receive a non-visual NDE plus the 3 nozzles that only received partial coverage non-visual NDE during the next Refueling Outage 3R13. In addition, to ensure an effective assessment of the overall condition of the RPV head, the licensee proposed to also perform the BMV inspection of the RPV head in Refueling Outage 3R13.

The NRC staff reviewed the licensee's letter to the NRC dated June 12, 2003, (NL-03-098), "Reactor Vessel Head Inspection Results; Indian Point 3, Spring 2003 Refueling Outage". The licensee's inspection results of the 100% BMV examination concluded there were no indications of degradation of the VHPs or wastage of the vessel head base metal surface. The results of the supplemental non-visual NDE examinations performed on the 41 VHP nozzles and the adjacent J-groove welds concluded there were no defects which would be indicative of PWSCC of the Alloy 600 material.

Based upon the information above, the NRC staff finds that the licensee's proposed alternative examination is acceptable since it provides reasonable assurance of the structural integrity of the RPV head, VHP nozzle penetrations, and welds. The staff also finds the licensee's proposed alternative satisfies the First Revised Order requirement to perform NDE of nozzles at least once every other outage for a Moderate category plant. The staff finds that the licensee's proposed alternative provides an acceptable level of quality and safety, and that this relaxation may, therefore, be granted pursuant to 10 CFR 50.55a(a)(3)(i).

4.6 Conclusion

The NRC staff concludes that the licensee's proposed alternative examination of the 40 V HP nozzles at IP3 provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), and in accordance with Section IV, paragraph F, of the First Revised Order, the staff authorizes the proposed alternative inspection for the 40 VHP nozzles at IP3 during the 3R13 Refueling Outage. The staff also considers this approach acceptable for the duration that IP3 remains in the "moderate" susceptibility category, as identified in the First Revised Order .

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