Entergy

Entergy Nuclear Northeast
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249
Tel 914 734 6700

Fred Dacimo
Site Vice President
Administration

March 30, 2005
NL-05-040

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

SUBJECT: Indian Point Nuclear Generating Unit 3
Docket No. 50-286
NRC First Revised Order EA-03-009; Revised Relaxation Request for Inspection of IP3 Reactor Pressure Vessel Head

REFERENCES:

1. Entergy letter NL-04-060; "NRC First Revised Order EA-03-009, Relaxation Requests for Inspection of Reactor Pressure Vessel Heads", dated May 19, 2004.
2. Entergy letter NL-05-010; "Reply to RAI Regarding Indian Point 3 Relaxation Requests", dated January 18, 2005.
3. NRC letter; "Relaxation of First Revised Order on Reactor Vessel Nozzles, Indian Point Nuclear Generating Unit 3 (TAC MC3195)", dated March 18, 2005.

Dear Sir:

Entergy Nuclear Operations, Inc (Entergy) is submitting a revision to a relaxation request previously approved by NRC. The affected relaxation request is Attachment 1 of Reference 1, as supplemented by Reference 2. The NRC approval is documented in Section 2.0 of the Safety Evaluation Report (Reference 3).

The relaxation involves non-destructive examination (NDE) of the nozzle region below the J-groove weld. Due to the physical dimensions of the nozzles and the presence of a threaded region at the bottom of the nozzles, relaxation is needed regarding the requirement in the First Revised Order EA-03-009, section IV.C.5 (b). Entergy originally requested that the relaxation be applicable to five penetrations specified in Reference 1. These affected penetrations were identified based on fabrication drawings for the reactor pressure vessel head. Based on actual inspections and measurements performed during the current refueling outage that commenced on March 11, 2005, Entergy has identified additional penetrations for which relaxation will be required. Additionally, revised data on one of the penetrations previously approved for relaxation of the inspection requirements is being provided based on actual field conditions determined during the current refueling outage.

A101

The revised relaxation request identifying the effected penetrations, is provided in Attachment 1. This relaxation request is required to support startup from the current refueling outage, with entry into Mode 2 anticipated for April 4, 2005. One new commitment is made in this letter, see attachment 2. If you have any questions or require additional information, please contact Mr. Patric W. Conroy at 914-734-6668.

Sincerely,

[original signed by J. Comiotes for F. Dacimo]

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

cc: Mr. Patrick D. Milano, Senior Project Manager
Project Directorate I,
Division of Reactor Projects I/II
U.S. Nuclear Regulatory Commission
Mail Stop O 8 C2
Washington, DC 20555

Mr. Samuel J. Collins
Regional Administrator
Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Resident Inspector's Office
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 337
Buchanan, NY 10511

Mr. Paul Eddy
NYS Department of Public Service
3 Empire Plaza
Albany, NY 12223

The revised relaxation request identifying the effected penetrations, is provided in Attachment 1. This relaxation request is required to support startup from the current refueling outage, with entry into Mode 2 anticipated for April 4, 2005. One new commitment is made in this letter, see attachment 2. If you have any questions or require additional information, please contact Mr. Patric W. Conroy at 914-734-6668.

Sincerely,

For

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

cc: Mr. Patrick D. Milano, Senior Project Manager
Project Directorate I,
Division of Reactor Projects I/II
U.S. Nuclear Regulatory Commission
Mail Stop O 8 C2
Washington, DC 20555

Mr. Samuel J. Collins
Regional Administrator
Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Resident Inspector's Office
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 337
Buchanan, NY 10511

Mr. Paul Eddy
NYS Department of Public Service
3 Empire Plaza
Albany, NY 12223

ATTACHMENT 1 TO NL-05-040

REVISED RELAXATION REQUEST FOR IP3 REGARDING ULTRASONIC TESTING
OF REACTOR PRESSURE VESSEL HEAD NOZZLES
IN ACCORDANCE WITH FIRST REVISED NRC ORDER EA-03-009, SECTION IV. F.

A. ASME COMPONENTS AFFECTED

Component Number: B4.12

Description: Reactor Pressure Vessel (RPV) Head Penetration Nozzles (36 locations)

Code Class: 1

B. REQUIREMENTS OF FIRST REVISED NRC ORDER EA-03-009

Section IV.C.5 (b)(i) of the Order (Reference 1) requires ultrasonic testing (UT) over a specified volume of RPV head penetration nozzles. The lower boundary of the inspection volume must be: "... 2 inches below the lowest point at the toe of the J-groove weld .... OR ***1.0 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."

C. PROPOSED ALTERNATIVE

Entergy Nuclear Northeast, Inc (Entergy) proposes to define the lower boundary of the inspection volume for the affected RPV head penetration nozzles as: "***to the top of essentially the start of the threaded region, which varies for each nozzle,*** 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."

D. REASON FOR RELAXATION REQUEST

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

E. JUSTIFICATION

The design of the RPV head penetration nozzles (see Figure 1-1) includes a threaded section, approximately ¾ inches long, at the bottom of the nozzles. At 36 locations (nozzles numbers are listed in Table 1 and as shown in Figure 1-2) the dimensional configuration is such that the distance from the lowest point at the toe of the J-groove weld to the bottom of the scanned region (essentially the start of the threaded region) is less than the 1-inch lower boundary limit specified in section IV.C.5 (b) of the First Revised Order. Since UT and ECT results would not be meaningful in the threaded region, Entergy proposes that the lower boundary of the inspection extend essentially to the start of the threaded region for UT. ECT scanning, as listed in Table 1, obtained greater than 1" coverage on the ID surface of the nozzle tube below the lowest point at the toe of the J-groove weld with no relevant indications noted. Leakage path assessments were performed and no leakage was noted.

Entergy has confirmed through analysis that the operating stress levels (including all 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 except for penetration #71. Table 1 lists: (a) the penetrations affected by the relaxation request; (b) the extent of UT and ECT scanning below the lowest point at the toe of the J-groove weld; (c) the "angle of incidence"; and (d) the operating stresses.

In addition Entergy has complied with the requirement for determining if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head. This determination was made by the bare metal visual examination at the top of the RPV head surface that includes inspection 360^{O} around each of the head penetration nozzles, augmented by a UT examination of the interference fit zone for evidence of leakage.

The following sections provide additional information in specific areas to justify this request.

1. Summary of Stress Analysis

Extensive analyses were done for the Indian Point 2 (IP2) RPV top head. Finite element analyses were performed for the IP2 top head configuration by Dominion Engineering and Structural Integrity Associates. These calculations addressed weld residual stresses and applied stresses for the limiting nozzles at IP2, under several repair scenarios. Entergy / Structural Integrity Associates has compared the head design geometries and operating conditions of Indian Point 3 (IP3) to those analyzed for IP2, and have determined that the analyzed results for IP2 are applicable and bounding for IP3. This conclusion is based on the fact that head geometries for IP2 are similar to IP3's and in some cases even more limiting than the corresponding IP3 geometries for top head penetrations. In particular, the head geometries for the two units are essentially identical in major dimensions, (i.e., head thickness, diameter, and CRDM tube diameter and wall thickness). The materials for both reactor heads are the same. The weld joint geometries are slightly more severe for IP2, in that the J-groove weld leg for IP2 is typically larger and therefore has more volume than IP3's at the limiting nozzle locations. Since welding residual stress is driven to a great extent by the volume of weld metal through the cooling process, residual stresses for the IP3 welds are expected to be comparable to, if not less than, those at IP2. This conclusion is valid for the original as-designed J-groove welds.

The stress analysis of the nozzles established two general trends: (1) predicted welding residual stresses in the nozzle tend to increase for nozzles that are further from the center of the head, and (2) predicted welding residual stresses in the nozzle tend to increase with increasing nozzle yield strength. In order to conservatively bound both of these effects, the most peripheral nozzle geometry in the IP2 / IP3 heads (48.8^{O} angle of incidence between the nozzle centerline and the head inside surface) was modeled and a nozzle yield strength of 63.0 ksi (highest reported yield strength for any IP2 or IP3 nozzles) was used. The angle of incidence between the nozzle centerline and the head inside surface is essentially the same for both the IP2 and IP3 outer-most nozzles.

The finite element analysis includes 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 provided the operating condition stress levels and distribution effects of welding residual stresses, hydrostatic testing, and steady state operating pressure and temperature. Hoop stress results of the performed analysis of original welding plus operating loads for the 36 RPV penetration nozzles are summarized on Table 1.

2. Crack Growth Calculation

For penetration #71 the maximum inspectable length of 0.45 inches below the J-groove weld was inspected by ultrasonic methods. This inspection limitation is due to the dimensions of the as-built Reactor Vessel head and penetration. The stress at the limit of inspectability location is 31.8 ksi. The inspection included both ultrasonic (UT) and eddy current (ECT) from the tube ID side. Note that the eddy current examination on the tube ID extended to 1.15" below the J-groove weld and no indications were detected. A leakage path assessment was also performed with no leakage noted. In the flaw evaluation, an axial crack was assumed to start at the bottom of the nozzle on the downhill side and to extend axially to the inspection boundary of 0.45 inches. The hypothetical flaw was assumed to be through wall for the entire axial extent even thought the ECT data on the ID showed no cracking. The actual dimension from the lower edge of the J-groove weld to the bottom of the CRDM tube is 1.47 inches. The fracture mechanics evaluation was performed using a PWSCC crack growth rate derived from MRP-55. The results show that the crack would require about 2.5 EFPY to grow to the bottom of the J weld. The penetration will be inspected again in 3R14 which is scheduled in approximately 2 years (Spring 2007). This penetration was also inspected in 3R12 (Spring 2003) with no indications noted.

Previously a crack growth evaluation was performed using the method of MPR-55 for crack growth caused by primary water stress corrosion cracking at a head temperature of 592 degrees F for penetrations 74 through 78 and evaluated by NRC (Reference 2). 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. 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 Reference 1. An initial hypothetical flaw was assumed to exist with a worst-case orientation (axial) and flaw growth occuring in a single direction towards the J-groove weld. Because the location of the hypothetical flaw is in the threaded region, at least 0.96 inches from the J-groove weld, the weld residual stresses are also negligible. The evaluation confirmed that the hypothetical flaw would not grow to the J-groove weld over at least 4 years of operation. 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". Refer to the attached Figure 1-1 for the location of these dimensions on the penetration nozzles.

Entergy recognizes that the NRC staff has not yet made a final determination on the acceptability of MRP-55. Should the staff determine the crack growth formula used by Entergy is unacceptable, Entergy will revise the analysis that justifies relaxation of the First Revised Order within 30 days after the NRC advises Entergy of an NRC approved crack growth formula. If the revised analysis shows that the crack growth acceptance criteria are exceeded prior to the then current operating cycle, this relaxation would be considered rescinded and written justification for continued operation shall be submitted to the NRC within 72 hours. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, Entergy will submit the revised analysis for NRC review within 30 days. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the next operating cycle, Entergy shall confirm that the analysis was performed in a letter to the NRC within 30 days. Any crack growth analyses performed for RPV head inspections after the NRC advises Entergy of an NRC approved crack growth formula shall use that formula.

3. Funnels and Other Penetrations

There are 5 nozzles (nos. 74, 75, 76, 77, and 78) equipped with retaining collar/guide funnels which are welded to the bottom of the nozzles on the OD side. Removal of the guide funnels would require use of the Electrical Discharge Machining (EDM) process. It would take approximately 24 hours to set up the equipment, and approximately 22 hours to cut out all 5 guide funnels and re-install. 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. It is estimated that the total radiation exposure for the removal and reinstallation activities would be about 6 rem.

Since Entergy performs the non-visual NDE examinations with a combination UT and 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 OD guide funnels will not increase the NDE examination coverage or accuracy. Furthermore, removal of these guide funnels, as identified above, is a labor intensive activity and the additional stay-times by personnel in the radiation field required to perform the removal and reinstallation tasks represent a hardship without a compensating increase in the effectiveness of the non-visual NDE examination.

The remaining penetrations are open-hole penetrations or penetrations that contain thermal sleeves. Based on the configuration and the as fabricated Reactor Vessel Head condition no further examinations could be done due the interference from the threaded end of the CRDM tube.

4. Surface Examination of Threads

The inspection methods and results performed during Refueling Outage 3R12 in April 2003 were submitted in Entergy's letter to NRC, NL-03-098, dated June 12, 2003. The non-visual NDE portion of the examination for the referenced five penetration nozzles (i.e., 74, 75, 76, 77, and 78) 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 axial coverage with this probe assembly extended down to approximately 0.75 inches from the bottom of the nozzle (for the UT exam) and down to approximately 0.25 inches from the bottom of the nozzle (for the ECT surface exam). Meaningful UT data below approximately 0.75 inches was limited by signal dispersion in the threaded region. Meaningful ECT data below approximately 0.25 inches was also limited because the eddy current coil tends to lose contact with the examination surface as it reaches the lead-in chamfer region (see attached Figure 1-1). As discussed above, the hardships in removing the guide funnels welded to the bottom of the nozzles precludes examination of the OD wetted surface areas of the nozzle tubes.

The inspection methods and results performed during the present Refueling Outage 3R13 included no less than 95% bare metal visual (BMV) examination (including 360^{O} around all penetrations) and NDE of 51 penetrations. The NDE portion of the examination used a Trinity probe assembly for thermal sleeve penetrations and a 7010 probe for open-hole penetrations. The NDE probes contain transducers to complete ultrasonic (UT), leakage path assessments and an eddy current (ECT) for the surface examination. The coverage is provided in Table 1. Meaningful UT data could not be achieved below the threaded area on the OD of the tube (Figure 1-1). In all cases the ECT was completed > 1" on the tube ID and this data is provided in Table 1.

Based on these non-visual NDE inspections and coupled with the remote bare metal visual (BMV) examination of the top surface of the vessel head performed in 3R12 in 2003 and 3R13 in 2005, Entergy has concluded that there were no signs of reactor pressure vessel head degradation or primary water stress corrosion cracking of the Alloy 600 penetration nozzles.

F. DURATION OF RELAXATION

Entergy requests relaxation of this requirement for all inspections, performed in accordance with the First Revised Order EA-03-009, where ultrasonic examination and eddy current techniques are used to inspect the 36 affected RPV head penetration nozzles inspected.

G. ATTACHMENTS TO RELAXATION REQUEST

Table 1: Geometry and Stress Data

Figure 1-1: IP3 RPV Head Penetrations – Nozzle Weld Detail

Figure 1-2: IP3 RPV Head Penetrations - Nozzle Location Map

H. REFERENCES

1. NRC Letter dated February 20, 2004, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors"

2. NRC Letter dated March 18, 2005, "Relaxation of First Revised Order on Reactor Vessel Nozzles, Indian Point Nuclear Generating Unit No. 3 (TAC No. MC 3195)"

Table 1 Geometry and Stress Data

Penetration Note 1	UT Exam Coverage, OD Note 2		ECT Exam Coverage, ID Note 3	Angle of Incidence (degrees)	Operating Stress, psi	
	Downhill	Uphill			Downhill	Uphill
7	0.93	1.81	1.67	11.4	13597	- 38193
10	0.89	2.21	1.59	16.2	13597	- 38193
16	0.97	2.37	1.63	18.2	13597	- 38193
22	0.85	2.33	1.71	23.2	13597	- 38193
24	0.85	2.77	1.59	23.2	13597	- 11176
38	0.69	3.01	1.47	30.2	16038	- 11176
39	0.89	3.17	1.59	30.2	13597	- 11176
40	0.81	3.13	1.51	30.2	13597	- 11176
41	0.81	3.41	1.51	30.2	13597	- 11176
42	0.77	3.37	1.51	30.2	16038	- 11176
43	0.77	3.17	1.47	30.2	16038	- 11176
44	0.65	3.21	1.47	30.2	16038	- 11176
47	0.73	3.69	1.39	33.9	16038	- 11176
48	0.73	3.65	1.47	33.9	16038	- 11176
49	0.81	3.89	1.51	33.9	13597	- 11176
50	0.77	3.69	1.51	35.1	16038	- 11176
52	0.69	3.73	1.43	35.1	16038	- 11176
53	0.77	3.85	1.51	35.1	16038	- 11176
55	0.73	3.93	1.51	35.1	16038	- 11176
56	0.73	3.97	1.43	35.1	16038	- 11176
57	0.97	3.77	1.75	35.1	13597	- 11176
60	0.85	3.77	1.67	36.3	13597	- 11176
61	0.73	3.77	1.51	36.3	16038	- 11176
62	0.73	4.09	1.55	38.6	16038	- 11176
65	0.73	4.41	1.39	38.6	16038	8161
66	0.85	4.29	1.63	38.6	13597	8161
67	0.65	4.13	1.43	38.6	16038	- 11176
68	0.81	4.01	1.63	38.6	13597	- 11176
70	0.81	4.89	1.47	44.3	13597	8161
71	0.45	5.13	1.15	44.3	31818	8161
73	0.81	5.29	1.47	44.3	13597	8161
74 75 76 77	Penetrations 74 through 77 were not reinspected during the Spring 2005 refueling outage (3R13) but will be inspected in the next refueling outage scheduled for Spring 2007 (3R14). The data and analysis provided in relaxation request dated May 19, 2004 (NL-04-060) as supplemented by letter dated January 18, 2005 (NL-05-010) remain unchanged. The operating stress for these penetrations was 9,786 psi on the downhill side (based on the drawing dimension of 0.96" below the lowest point of the toe of the J-groove weld) and -1,170 psi on the uphill side (5.476" below the lowest point of the toe of the J-groove weld).					
78	0.76	5.20	1.67	48.8	16038	8161

NOTES FOR TABLE ONE:

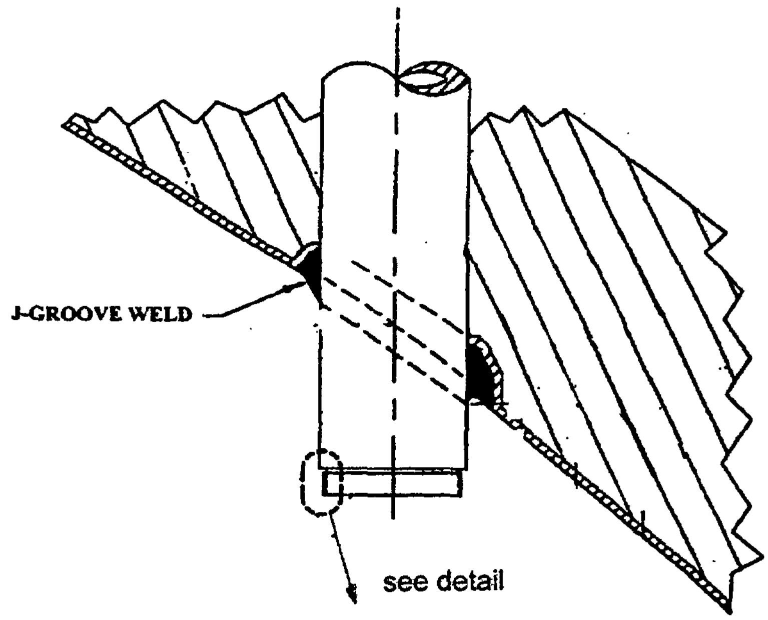
1. Penetrations 74 through 78 have guide funnels installed.

2. See Figure 1-1, Dimension A. UT inspection extends from the bottom of the J-groove weld to the top of the threaded region.

3. See Figure 1-1, Dimension B. ECT inspection extends from the bottom of the J-groove weld to the top of chamfer region.

FIGURE 1-1

IP3 RPV Head Penetrations – Nozzle Weld Detail



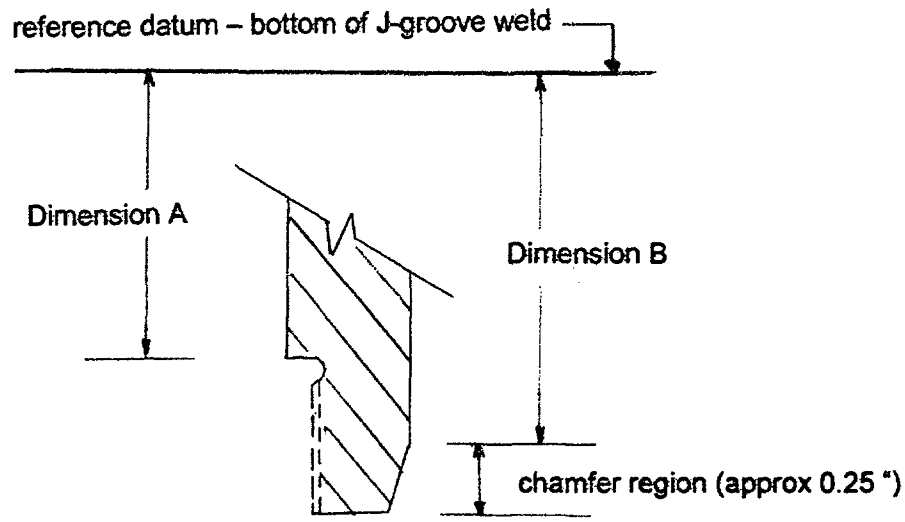
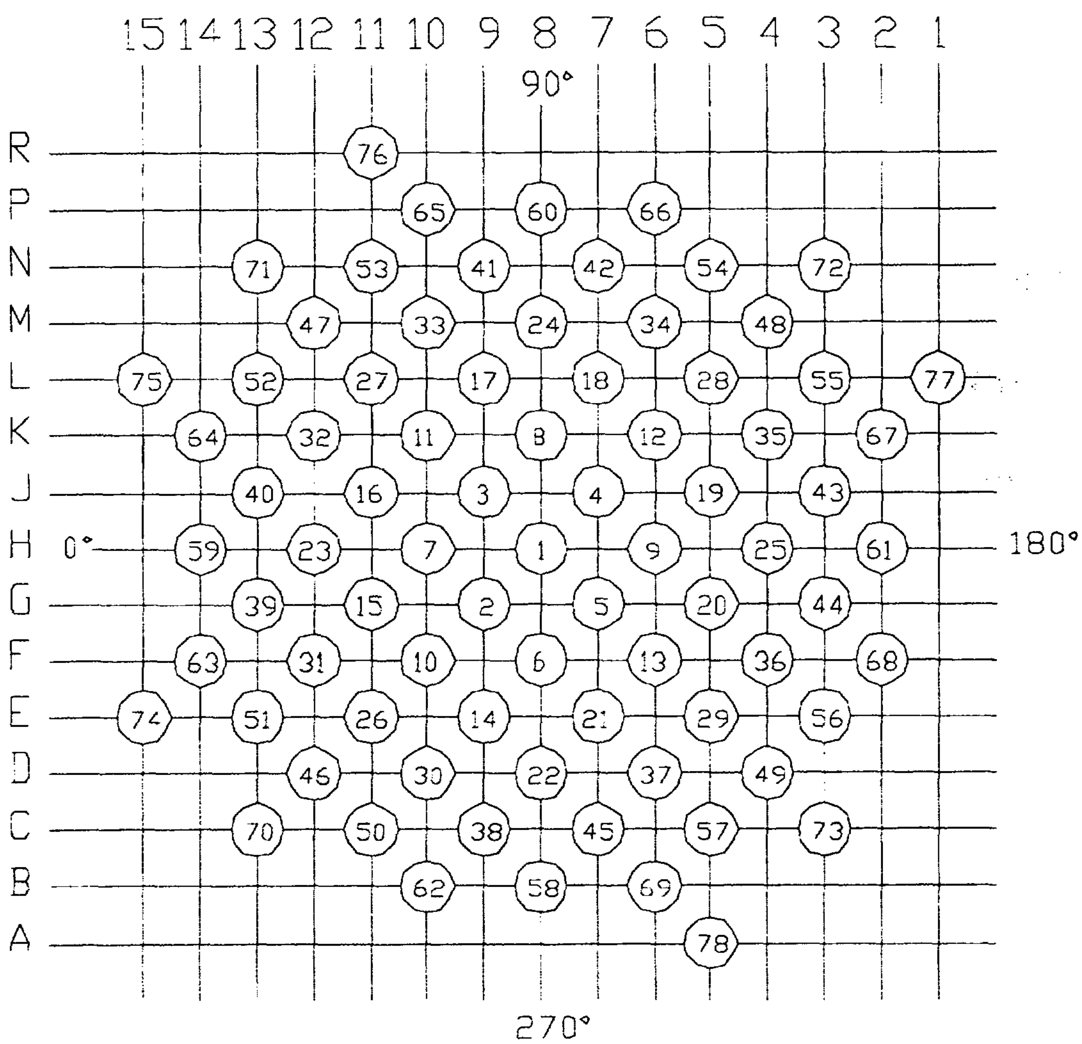


FIGURE 1-2

IP3 RPV Head Penetrations – Nozzle Location Map



List of Commitments

Number	Commitment
NL-05-040-1	Entergy recognizes that the NRC staff has not yet made a final determination on the acceptability of MRP-55. Should the staff determine the crack growth formula used by Entergy is unacceptable, Entergy will revise the analysis that justifies relaxation of the First Revised Order within 30 days after the NRC advises Entergy of an NRC approved crack growth formula. If the revised analysis shows that the crack growth acceptance criteria are exceeded prior to the then current operating cycle, this relaxation is considered rescinded and written justification for continued operation shall be submitted to the NRC within 72 hours. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, Entergy will submit the revised analysis for NRC review within 30 days. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the next operating cycle, Entergy shall confirm that the analysis was revised in a letter to the NRC within 30 days. Any crack growth analyses performed for RPV head inspections after the NRC advises Entergy of an NRC approved crack growth formula shall use that formula.