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Ken Peters
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W3F1-2004-0058

July 27, 2004

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Response to NRC Bulletin 2004-01 Regarding Inspection of Alloy 82/182/600 Materials Used In Pressurizer Penetrations and Steam Space Piping Connections
Waterford Steam Electric Station, Unit 3
Docket No. 50-382

REFERENCES:

1. NRC letter dated May 28, 2004, *NRC Bulletin 2004-01: Inspection of Alloy 82/182/600 Materials Used In the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors*

Dear Sir or Madam:

On May 28, 2004, the Nuclear Regulatory Commission (NRC) issued NRC Bulletin 2004-01, *Inspection of Alloy 82/182/600 Materials Used In the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors*. The NRC requested that all pressurized water reactor addressees provide description of their pressurizer heater and steam space penetrations and inspection plans for the forthcoming and subsequent refueling outages.

The Waterford Steam Electric Station, Unit 3 (Waterford 3) response to the bulletin is provided in Attachment 1 to this submittal. Please note, Entergy is planning to weld repair/replace the Waterford 3 Alloy 600 pressurizer heater sleeves and remaining Alloy 600 small bore instrument penetrations using Alloy 690 materials during the upcoming refueling outage 13. The response to NRC Bulletin 2004-01 includes new commitments as summarized in Attachment 2.

If you have any questions or require additional information, please contact Steve Bennett at 479-858-4626.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on July 27, 2004.

Sincerely,

KJP/sab

Attachments:

1. Response to Bulletin 2004-01, Inspection of Alloy 82/182/600 Materials Used In Pressurizer Penetrations and Steam Space Piping Connections

2. List of Regulatory Commitments

cc: Dr. Bruce S. Mallett
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Attachment 1

W3F1-2004-0058

Response to Bulletin 2004-01, Inspection of Alloy 82/182/600 Materials Used In Pressurizer Penetrations and Steam Space Piping Connections

Waterford Steam Electric Station, Unit 3
Response to Bulletin 2004-01,
Inspection of Alloy 82/182/600 Materials Used In Pressurizer Penetrations and Steam Space Piping Connections

On May 28, 2004, the Nuclear Regulatory Commission (NRC) issued Bulletin 2004-01, *Inspection of Alloy 82/182/600 Materials Used In the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors.* The 60-day response to the bulletin for Waterford Steam Electric Station, Unit 3 (Waterford 3) is provided below.

NRC Request 1(a): *A description of the pressurizer penetrations and steam space piping connections at your plant. At a minimum, this description should include materials of construction (e.g., stainless steel piping and/or weld metal, Alloy 600 piping/sleeves, Alloy 82/182 weld metal or buttering, etc.), joint design (e.g., partial penetration welds, full penetration welds, bolted connections, etc.), and, in the case of welded joints, whether or not the weld was stress-relieved prior to being put into service. Additional information relevant with respect to determining the susceptibility of your plant's pressurizer penetrations and steam space piping connections to PWSCC should also be included.*

Entergy Response to Request 1(a): The Waterford 3 pressurizer is a low alloy steel vessel with the shell and top head internally clad with stainless steel and the bottom head clad with a Ni-Cr-Fe alloy. The pressurizer is furnished with seven instrument nozzles, three safety relief nozzles, a spray nozzle, and 30 heater sleeves. The small bore instrument nozzles and heater sleeves are welded to the inside of the pressurizer and allowed to thermally expand radially through the vessel wall as the RCS heats up. The following tables provide the pressurizer heater, water space, and steam space penetration descriptions for Waterford 3.

Penetration/ Description (#)	Penetration or Attachment	Joint Design	Filler Material	Stress Relief?
Heater Sleeves 1-1/4" to vessel (29)	A-600 sleeve to CS vessel.	Partial Penetration	I-82 weld	Cladding Yes J-Weld No
Sleeve to Heater.	A-600 sleeve to SS Heater.	Fillet	I-82	No
Heater Sleeve 1-1/4" w/Heater Removed (1) Sleeve Plugged.	A-600 sleeve remnant to CS vessel.	Partial Penetration	I-82 weld	Cladding Yes J-Weld No
	I-152 Weld Pad to CS Vessel and A-690 Plug & Weld Dam.	Weld pad Partial Penetration	I-152	No

Penetration/ Description (#)	Penetration or Attachment	Joint Design	Filler Material	Stress Relief?
RC317A 6" Safety Relief Nozzle.	CS Nozzle to CS Vessel.	Full Penetration	E-8018	Yes
	CS Nozzle to SS Safe-End.	Butt Weld	I-82 weld w/I-182 butter at nozzle.	Butter Yes
				Butt Weld No
RC317B, 6" Safety Relief Nozzle.	CS Nozzle to CS Vessel.	Full Penetration	E-8018	Yes
	CS Nozzle to SS Safe-End.	Butt Weld	I-82 weld w/I-182 butter at vessel.	Butter Yes
				Butt Weld No
Spare 6" Nozzle.	CS Nozzle to CS Vessel.	Full Penetration	E-8018	Yes
	CS Nozzle to SS Safe-End.	Butt Weld	I-82 weld w/I-182 butter at vessel.	Butter Yes
				Butt Weld No
4" Spray Nozzle. (Nozzle contains A-600 Thermal Sleeve)	CS Nozzle to CS Vessel.	Full Penetration	E-8018	Yes
	CS Nozzle to SS Safe-End.	Butt Weld	I-82 weld w/I-182 butter at vessel.	Butter Yes
				Butt Weld No
RC1TE0101, 1" Water Space Temperature Nozzle.	A-600 Nozzle to CS vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel	Butter Yes
				J-Weld No
	SS Safe-End to A-600 nozzle.	Butt Weld	I-182	No
	CS weld build-up.	Weld Pad	E-8018	Yes
RC312, 3/4" Bottom Head Level Tap Nozzle to Safe-End	A-600 Nozzle to CS Vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel.	Butter Yes
				J-Weld No
	SS Safe-End to A-600 Nozzle.	Butt Weld	I-82 or I-182	No
RC315, 3/4" Bottom Head Level Tap Nozzle to Safe-End	A-600 Nozzle to CS Vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel.	Butter Yes
				J-Weld No
	SS Safe-End to A-600 Nozzle.	Butt Weld	I-82 or I-182	No

Other Non-A600 Penetrations				
Penetration/ Description (#)	**Penetration or Attachment**	**Joint Design**	**Filler Material**	**Stress Relief?**
RC310, 3/4" Steam Space Pressure Tap Nozzle. (half nozzle repair)	A-600 nozzle remnant to vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel.	Butter Yes J-Weld No
	A-690 Replacement Nozzle to CS Vessel.	Weld Pad Partial Penetration	A-52 or A-152 or both.	No
	A-690 Nozzle to SS piping.	Socket Weld	A-52 or A-152 or both	No
RC313, 3/4" Steam Space Pressure Tap Nozzle. (half nozzle repair)	A-600 nozzle remnant to vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel.	Butter Yes J-Weld No
	A-690 Replacement Nozzle to CS Vessel.	Weld Pad Partial Penetration	A-52 or A-152 or both.	No
	A-690 Nozzle to SS Safe-End.	Butt Weld	A-52 or A-152 or both	No
RC311, 3/4" Steam Pressure / Level Nozzle. (half nozzle repair)	A-600 nozzle remnant to vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel.	Butter Yes J-Weld No
	A-690 Replacement Nozzle to CS Vessel.	Weld Pad Partial Penetration	A-52 or A-152 or both.	No
	A-690 Nozzle to SS piping.	Socket Weld	A-52 or A-152 or both	No
RC314, 3/4" Steam Pressure / Level Nozzle. (half nozzle repair)	A-600 nozzle remnant to vessel.	Partial Penetration	I-82 weld w/I-182 butter at vessel.	Butter Yes J-Weld No
	A-690 Replacement Nozzle to CS Vessel.	Weld Pad Partial Penetration	A-52 or A-152 or both.	No
	A-690 Nozzle to SS Safe-End.	Butt Weld	A-52 or A-152 or both	No

NRC Request 1(b): *A description of the inspection program for Alloy 82/182/600 pressurizer penetrations and steam space piping connections that has been implemented at your plant. The description should include when the inspections were performed; the areas, penetrations and steam space piping connections inspected; the extent (percentage) of coverage achieved for each location which was inspected; the inspection methods used; the process used to resolve any inspection findings; the quality of the documentation of the inspections (e.g., written report, video record, photographs); and, the basis for concluding that your plant satisfies applicable regulatory requirements related to the integrity of*

pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections were found, indicate what follow-up NDE was performed to characterize flaws in the leaking penetrations.

Entergy Response to Request 1(b):

Waterford 3 RCS/Pressurizer Inspection Program - At Waterford 3, Entergy utilizes Engineering Procedure NOECP-107, *Administrative Control of BACC Program*, to facilitate inspections concerned with Alloy 600 primary water stress corrosion cracking (PWSCC). The procedure contains guidance for inspection of the specific heater sleeves and small bore pressurizer instrument nozzles that are susceptible to PWSCC. The procedure identifies the inspection programs that exist to perform walkdowns to identify boric acid in the plant. These include the ASME Section XI, Generic Letter 88-05, Alloy 600 locations and others. For Alloy 600 nozzles, the procedure requires a bare metal visual inspection 360 degrees around the nozzles. Insulation is either removed or repositioned to allow 360 degree visual inspection and there are no small bore pressurizer penetrations where insulation interference exists to prevent the intended inspection. Large bore steam space nozzles which are located on the top of the pressurizer have been inspected during RF-09, RF-10, RF-11, and RF-12 when insulation was removed. Boric acid residue or other evidence of leakage has not been observed at any large bore nozzle or pressure boundary weld to date.

Other program controls include the Waterford 3 ASME Section XI Inservice Inspection programs (CEP-ISI-001, CEP-PT-001 and NOECP-253) which include the examination of welds, rigid restraints and pressure boundaries of components and piping on Class 1, 2 and 3 systems. The weld and rigid restraint examinations are performed during the specified periods. The system pressure tests of piping are performed during regular intervals of every refueling outage for Class 1 piping and once a period for Class 2 and 3 piping systems.

During refuel outages, site personnel perform inspections to identify boric acid residue, including work in and around the RCS, to document any leakage including signs of boric acid deposits. If boric acid residue is observed at an Alloy 600 nozzle it is documented in a Condition Report. Other locations where boric acid residue is observed are documented and evaluated per UNT-006-031, *Inspection and Evaluation of Boric Acid Corrosion*, and evaluated for repair. Each leak path evaluation is assigned an evaluation number and tracked to resolution.

Generic Letter (GL) 88-05, *Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants*, required four areas to be considered for ensuring that licensees boric acid inspection processes were adequate to identify reactor coolant pressure boundary (RCPB) leakage that could degrade carbon steel piping and components. The Waterford 3 Boric Acid Corrosion Control Program includes UNT-007-027, *Control of Boric Acid Corrosion on the Reactor Coolant System*, implements the Generic Letter 88-05 requirements and is enhanced by UNT-006-031.

Small bore full penetration welds that connect safe ends to Alloy 600 nozzles, and small bore fillet welds which connect piping or instruments to the safe ends of pressurizer nozzles have not been specifically identified for inspection on a refueling outage basis. However, the walkdowns associated with the Alloy 600 and boric acid program would typically identify boric acid residue at these locations because the end of the nozzles are only a few inches

from the external surface of the pressurizer, and removal or repositioning of the insulation to allow visual examination of the nozzle/vessel interface would also expose the end of the nozzle and the associated welds. Waterford 3 has not identified boric acid residue at any nozzle to safe end or nozzle to connected piping weld to-date.

Previous Waterford 3 Pressurizer Inspection Findings and Repairs - During refueling outage 9 in the spring of 1999, Waterford 3 inspected the pressurizer heater sleeves and instrument nozzles, as well as all hot leg instrument nozzles for evidence of leakage due to Alloy 600 PWSCC. As a result of the inspection, it was found that two of the pressurizer top head instrument nozzles (connected to valves RC-310 & RC-311) were found to be leaking as well as three hot leg instrument nozzles. As a result of the findings, the visual inspection was expanded to all pressurizer penetrations, steam generator primary side penetrations, and other RCS hot and cold leg nozzles. Because the leakage was associated with Alloy 600 instrument nozzles and was consistent with other industry experience identified as PWSCC of Alloy 600 materials, no additional NDE was performed. No other nozzles were found to be leaking. The two pressurizer nozzles were repaired by partial penetration half nozzle repairs using Alloy 690 nozzle and weld materials.

During refueling outage 10 in the fall of 2000, bare metal visual inspection of the RCS small bore Alloy 600 penetrations was again performed. The inspection revealed that pressurizer heater sleeve F4 had RCS boric acid residue and the sleeve was plugged with Alloy 690 material. No additional NDE was performed. In addition, during refueling outage 10, the remaining two Alloy 600 top head pressurizer instrument nozzles (connected to valves RC-313 & RC-314) were proactively repaired using half nozzle repairs similar to that performed in refueling outage 9.

During refueling outage 11 in the spring of 2002 bare metal visual inspection of the RCS small bore Alloy 600 penetrations was again performed. No evidence of RCS leakage was observed on any small bore Alloy 600 nozzle or heater sleeve and no repairs were implemented.

During refueling outage 12 in the fall of 2003 bare metal visual inspection of the RCS small bore Alloy 600 penetrations was again performed. The inspection revealed that pressurizer heater sleeves (C-1 and C-3) had boric acid residue. Ultrasonic and ID eddy current examination of the two sleeves was performed and the flaws were determined to be axially oriented, which is typical of PWSCC. The two heater sleeves were repaired using second generation Mechanical Nozzle Seal Assemblies (MNSA-2).

Basis for Concluding that Your Plant Will Satisfy Applicable Regulatory Requirements:
Entergy has established an Alloy 600 nozzle inspection program, which is performed on a refueling outage basis in accordance with site procedures. In addition, the ISI program inspections, required by 10 CFR 50.55a and ASME Section XI, do support interval based piping integrity. Entergy has established RCS integrity program inspections that assure that pressure boundary leaks will be detected and repaired. Based on the ASME Code required inspections, the Alloy 600 program inspections, as well as the GL 88-05 inspections, Entergy has confidence that the Waterford 3 pressurizer nozzle inspections provide RCS integrity and meet all regulatory requirements applicable to integrity.

NRC Request 1(c): *A description of the Alloy 82/182/600 pressurizer penetration and steam space piping connection inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the areas, penetrations and steam space piping connections to be inspected; the extent (percentage) of coverage to be achieved for each location; inspection methods to be used; qualification standards for the inspection methods and personnel; the process used to resolve any inspection indications; the inspection documentation to be generated; and the basis for concluding that your plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections are found, indicate what follow-up NDE will be performed to characterize flaws in the leaking penetrations. Provide your plans for expansion of the scope of NDE to be performed if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.*

Entergy Response to NRC Request 1(c): Entergy at Waterford 3 will continue to perform bare metal visual inspections of pressurizer heater and steam space penetrations in accordance with Procedure NOECP-107 in future refueling outages for those penetrations that contain Alloy 600 material. Procedure NOECP-107 will be revised to include inspection of Alloy 600 pressurizer nozzle to safe end welds as well as large bore steam space welds. If leakage is found on Alloy 600 pressurizer heater sleeves, Entergy will perform additional NDE to characterize the degradation present in the leaking penetration in accordance with the January 30, 2004 Westinghouse Owners Group letter and NRC Bulletin 2004-01. Entergy is planning to weld repair/replace the Waterford 3 Alloy 600 pressurizer heater sleeves and remaining Alloy 600 small bore instrument penetrations using Alloy 690 materials during the upcoming refueling outage 13.

NRC Request 1(d) *In light of the information discussed in this bulletin and your understanding of the relevance of recent industry operating experience to your facility, explain why the inspection program identified in your response to item (1)(c) above is adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.*

Entergy Response to NRC Request 1(d): The proposed actions by Entergy for Waterford 3 meet the expectations requested by Bulletin 2004-01 and are considered appropriate for maintaining the integrity of Waterford 3's RCPB. Entergy's inspection program meets applicable regulatory requirements which pertain to Waterford 3.

NRC Request 2: *Within 60 days of plant restart following the next inspection of the Alloy 82/182/600 pressurizer penetrations and steam space piping connections, the subject PWR licensees should either:*

(a) submit to the NRC a statement indicating that the inspections described in the licensee's response to item (1)(c) of this bulletin were completed and a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary

of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found,

or

(b) if the licensee was unable to complete the inspections described in response to item (1)(c) of this bulletin, submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found. In addition, supplement the answer which you provided to item (1)(d) above to explain why the inspections that you completed were adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.

For lines attached directly to the pressurizer, with the exception of the surge line, the information requested in (1) and (2) above should be provided for any locations, including those remote from the pressurizer shell, which contain Alloy 82/182/600 materials which are exposed to conditions similar to those of the pressurizer environment.

Entergy Response to NRC Request 2: Entergy will submit the requested information within 60 days of plant restart from the Waterford 3 refueling outage in the spring of 2005 per NRC Bulletin 2004-01, Request 2.

Attachment 2

W3F1-2004-0058

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONT COMP	
Procedure NOECP-107 will be revised to include inspection of Alloy 600 pressurizer nozzle to safe end welds as well as large bore steam space welds.		X	Prior to Refuel Outage 13 (Spring 2005)
For Waterford 3, Entergy will perform bare metal visual inspections of pressurizer heater and steam space penetrations in accordance with NOECP-107 during future refueling outages for penetrations that contain Alloy 600 material.		X	Beginning Refuel Outage 13 (Spring 2005)
If leakage is found on Alloy 600 pressurizer heater sleeves, Entergy will perform additional NDE to characterize the degradation present in the leaking penetration in accordance with the January 30, 2004 Westinghouse Owners Group letter and NRC Bulletin 2004-01.		X	Conditional
Entergy will submit the requested information for NRC Request 2 to Bulletin 2004-01 for Waterford 3.	X		Within 60 days of plant restart following Refuel Outage 13