TECHNICAL EVALUATION REPORT ON
RESPONSE FROM
GPU NUCLEAR CORPORATION
TO GENERIC LETTER 88-01
PERTAINING TO THE
OYSTER CREEK NUCLEAR GENERATING PLANT

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REVISED
FINAL

TECHNICAL EVALUATION REPORT ON RESPONSE FROM GPU NUCLEAR CORPORATION TO GENERIC LETTER 88-01 PERTAINING TO THE OYSTER CREEK NUCLEAR GENERATING PLANT

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ABSTRACT

This report contains an evaluation of the licensee (GPU Nuclear Corporation) submittal for Oyster Creek Nuclear Generating Station which was submitted in response to the NRC Generic Letter 88-01 in which GPUN was requested to: (1) Furnish their current plans relating to piping replacement and other measures to mitigate IGSCC, inspection, repair, and leakage detection. (2) Indicate whether they plan to follow the NRC Staff positions, or propose alternative measures. GPUN's plans are evaluated in Section 2 of this report in terms of compliance to NRC Staff positions. Section 3 contains an evaluation of Alternative Positions concerning inspection of portions of the RWCU, inspection of stress-improved welds, and changing the Technical Specification on ISI.

SUMMARY

The Licensee, GPU Nuclear Corporation, submitted a response to the NRC Generic Letter 88-01. GPUN's response pertaining to the austenitic stainless steel piping in the Oyster Creek Nuclear Generating Station (a BWR nuclear power plant) was evaluated in terms of: (1) Their previous and planned actions to mitigate IGSCC to provide assurance of continued long-term service. (2) Their Inservice Inspection (ISI) Program. (3) Their Technical Specifications pertaining to ISI and their plans to ensure that leakage detection will be in conformance with the NRC Staff position. (4) Their plans to notify the NRC of significant flaws identified (or changes in the condition of the welds previously known to be cracked) during inspection and evaluation of such flaws.

GPUN accepts and endorses 7 of the 13 NRC Staff positions which are outlined in Generic Letter 88-01, accepts 5 others with provisions (some acceptable, some unacceptable), and did not indicate acceptance/rejection of one. GPUN has utilized several of the recommended mitigating actions including partial replacement, stress improvement, and weld overlays. They plan additional piping replacement and stress improvement treatments. In addition GPUN plans to implement HWC.

GPUN performed inspections during Refueling Outages No. 11 and No. 12 that conform with current NRC Staff positions on methods and personnel. They presented inspection schedules for Refueling Outages No. 13 and No. 14. Their schedules incorporate reductions in frequency of inspections due to implementation of HWC. They also incorporate reductions due to an alternate position on inspection of welds of certain IGSCC Classifications.

GPUN presented alternative positions concerning inspection of portions of the RWCU, inspection of stress-improved welds, and changing the TS on ISI. These positions are evaluated in Section 3 of this report.

CONTENTS

1. INTRODUCTION

Intergranular stress corrosion cracking (IGSCC) near weldments in Boiling Water Reactor (BWR) piping has been occurring for almost 20 years. Substantial efforts in research and development have been sponsored by the BWR Owners Group for IGSCC Research, and the results of this program, along with other related work by vendors, consulting firms and confirmatory research sponsored by the NRC, have permitted the development of NRC Staff positions regarding the IGSCC problems. The technical basis for NRC Staff positions is detailed in Reference 1, and further background is provided in Reference 2.

The results of these research and development programs prompted the NRC to issue Generic Letter 88-01 (see Reference 3) requesting all licensees of BWR's and holders of construction permits to:

(1) Furnish their current plans relating to piping replacement, inspection, repair, and leakage detection.

(2) Indicate whether they:
    (a) Plan to follow the staff positions, or
    (b) Propose alternative measures.

Specifically, Generic Letter 88-01 stated that an acceptable licensee response would include the following items:

(1) Current plans regarding pipe replacement and/or other measures taken or to be taken to mitigate IGSCC and provide assurance of continued long-term piping integrity and reliability.

(2) An inservice inspection (ISI) program to be implemented at the next refueling outage for austenitic stainless steel piping.

(3) A change to the Technical Specifications to include a statement

in the section on ISI that the inservice inspection program for piping will be in conformance with the staff positions on schedule, methods and personnel, and sample expansion.

(4) Confirmation of plans to ensure that the Technical Specification related to leakage detection will be in conformance with the Staff position on leak detection.

(5) Plans to notify the NRC, in accordance with 10CFR50.55a(o),of any flaws identified that do not meet IWB3500 criteria of Section XI of the ASME Code for continued operation without evaluation, or a change found in the condition of the welds previously known to be cracked, and an evaluation of the flaws for continued operation and/or repair plans.

This report contains a technical evaluation of the response which GPU Nuclear Corporation (hereafter called GPUN) submitted in response to the NRC Generic Letter 88-01 pertaining to the Oyster Creek Nuclear Generating Station (hereafter called Oyster Creek).

2. EVALUATION OF RESPONSE TO GENERIC LETTER 88-01

This evaluation consisted of a review of the response to NRC Generic Letter 88-01 of January 25, 1988 by GPUN pertaining to Oyster Creek to determine if their performance and plans are in conformance with the NRC Staff positions or if proposed alternatives are acceptable. Proposed inspection schedules and amendments to the Technical Specification were included in the review.

2.1 Documents Evaluated

Review was conducted on the information pertaining to Oyster Creek

provided by the Licensee in the following documents.

(1) "Oyster Creek Nuclear Generating Station (OCNGS), Docket No. 50-219, Response to Generic Letter 88-01," GPU Nuclear Corporation, One Upper Pond Road, Parsippany, New Jersey 07054, August 12, 1988.

(2) "Oyster Creek Nuclear Generating Station (OCNGS), Docket No. 50-219, IGSCC Inspection Plan - RWCU," GPU Nuclear Corporation, One Upper Pond Road, Parsippany, New Jersey 07054, November 16, 1989.

(3) "Oyster Creek Nuclear Generating Station (OCNGS), Docket No. 50-219, (Revised Response to Generic Letter 88-01)," GPU Nuclear Corporation, One Upper Pond Road, Parsippany, New Jersey 07054, January 31, 1989.

(4) "Oyster Creek Nuclear Generating Station (OCNGS), Docket No. 50-219, IGSCC Inspection Plan - RWCU, GPU Nuclear Corporation, One Upper Pond Road, Parsippany, New Jersey 07054, February 21, 1990.

Hereafter, in this report, these documents will be referred to as GPUN Submittals No. 1, No. 2, No. 3, and No. 4, respectively, and collectively as the GPUN Submittals.

Note that GPUN Submittal No. 1 was prepared in August, 1988 (about one and one-half years ago). At that time, Refueling Outages No. 10 and No. 11 were completed, while Refueling Outages No. 12 and No. 13 were still in the future (scheduled for 1988 and 1989, respectively), and GPUN's plans as reported in GPUN Submittal No. 1 reflect the status at the completion of Refueling Outage No. 12. GPUN Submittal No. 3 is a revision of GPUN Submittal No. 1 and was prepared prior to Refueling Outage No. 13 (scheduled for 1989). This report, therefore,

which is based primarily on GPUN Submittals No. 1 and No. 3 (GPUN Submittals No. 4 is an updating of GPUN Submittal No. 2 and these submittals deal only with the portion of the RWCU that is outboard of the containment isolation valve), treats Refueling Outage No. 13 as a future outage and the refueling outages prior to that as past outages.

2.2 Review of GPUN's Responses to Staff Positions and Implementation of Those Positions.

The GPUN Submittals did not specifically state acceptance or rejection of the 13 NRC Staff positions pertaining to materials, processes, water chemistry, weld overlay, partial replacement, stress improvement of cracked weldments, clamping devices, crack evaluation and repair criteria, inspection methods and personnel, inspection schedules, sample expansion, leak detection, and reporting requirements. However, the GPUN positions on most of these items were implied in discussions in the GPUN Submittal No. 1, and these positions are presented in Table 1.

2.2.1 Conclusion on GPUN's Responses to NRC Staff Positions

An examination of Table 1 shows that GPUN indicated acceptance of seven of the 13 NRC Staff positions, acceptance with provisions of five of the 13 NRC Staff positions, and did not indicate endorsement/rejection of one of the NRC Staff positions (i.e., clamping devices). Additionally, GPUN Submittal No. 1 interpreted the scope of Generic Letter 88-01 to exclude the welds in the RWCU that are outboard of isolation valves. Although this interpretation was altered in GPUN Submittal No. 3, an alternative position concerning inspection of those welds is presented in GPUN Submittal No. 3.

Table 1

Summary of GPUN's Responses to Staff Positions

Staff Position	GPUN Accepts NRC Staff Position	GPUN Has/ Will Applied In Past	GPUN Has/ Will Consider for Future Use
1. Materials	yes	yes	yes
2. Processes	yes	yes	yes
3. Water Chemistry	yes	no(a)	yes(a)
4. Weld Overlay	yes	yes	NI
5. Partial Replacement	yes	yes	yes
6. Stress Improvement of Cracked Weldments	yes(b)	yes	yes(b)
7. Clamping Devices	NI	NI	NI
8. Crack Evaluation and Repair Criteria	yes	yes	yes
9. Inspection Method and Personnel	yes(c)	see (c)	yes
10. Inspection Schedule	yes(d)	see (d)	yes(d)
11. Sample Expansion	yes(b)	-	yes(b)
12. Leak Detection	yes(b)	-	yes(b)
13. Reporting Requirements	yes(b)	-	yes(b)

(a) Implemented improvements in water chemistry beginning in 1984. HWC scheduled for implementation following R.O. No. 12.

(b) Provisions applied. See later discussion.

(c) Current methods and personnel qualified per NUREG 0313, Rev. 2, but GPUN claims inspection methods and personnel were also qualified since 1983, but in their latest submittal they did not claim credit for those inspections.

(d) Applies 50% credit for HWC, and has reduced schedule on selected welds. GPUN presented an alternative proposal concerning inspection of welds in RWCU that is outboard of the second isolation valve. In addition, GPUN proposed statement that of compliance with Generic Letter 88-01 should be included in the Inservice Inspection Program rather than in the Technical Specification.

NI Not indicated.

2.3 GPUN's Examination Schedule

The year (but not month within the year) of each of four refueling outages was listed in GPUN Submittal No. 1. These outages are listed in Table 2 of this report. Note that all of these inspections have already occurred, although the results of Refueling Outage No. 13 were not reported in the GPUN Submittals. The dates of Refueling Outages beyond that of Refueling Outage No. 13 were not disclosed in the GPUN Submittals.

Table 2

Dates of Refueling Outages

Outage	Year
Refueling Outage # 10	1983/84
Refueling Outage # 11	1986
Refueling Outage # 12	1988
Refueling Outage # 13	1989

2.4 Review of GPUN's Previous Inspection Program, Previous Mitigating Actions, and Current Classification of Welds

GPUN Submittal No. 1 and GPUN Submittal No. 3 each list a total of 473 welds that are covered in the scope of NUREG 0313, Revision 2 and Generic Letter 88-01. Of these, according to GPUN Submittal No. 3, 26 are uninspectable and are not discussed in this section (see Section 2.5.4 for a discussion of uninspectable welds). According to GPUN Submittal No. 1, 54 welds were uninspectable prior to actions taken during Refueling Outage No. 12. Previous actions include inspections, application of IHSI (induction heating stress improvement, repair of cracked welds with overlays, partial replacement, and improvement of water chemistry. These actions are discussed in greater detail in the following sections.

2.4.1 Current IGSCC Classifications and Number of Welds

The 473 welds are divided among six piping systems as shown in Tables 3 through 5. The current number of welds (actually the number following Refueling Outage No. 12) classified in each IGSCC category is contained in GPUN Submittal No. 3 along with plans for inspections during future refueling outages. These classifications and inspection plans are discussed in later sections of this report.

2.4.2 Previous and Current Inspection Programs

A total of 190 welds were examined during the 1983/84 outage (Refueling Outage No. 10). During Refueling Outage No. 11, a total of 166 welds were examined. During Refueling Outage No. 12, a total of 142 welds were examined. Summaries of those inspections, showing the number of welds examined and the number of cracks found in each system, is contained in Tables 3, 4, and 5.

Table 3

Summary of 1983 (Refueling Outage # 10) and 1984
Inspections and Mitigating Actions[a,b]
(from GPUN Submittal No. 1)

System	No. of Welds	Number Inspct.	No. of Cracks	Mitigating Actions
Recir.	64	31	0	
CS	22	3	0	
SDC	14	2	0	
RWCU	142	8	0	
IC-1	40	19	0	
IC-2	129	127	28[c]	Repair cracked welds (O.L. 18, replace 9 with spool piece change out)
CH	8	0	0	
Totals	419	190	28	

Notes:

(a) This table does not include 54 un-inspectable welds.

(b) The numbers in this column were obtained from Sections 1.2.1 and 2 of GPUN Submittal No. 1. Numbers reported in Table 3 of GPUN Submittal No. 1 are slightly different.

(c) One crack indication was originally interpreted as a root geometry indication and re-interpreted when that weld was re-examined during R.O. # 11.

Explanation of abbreviations

Recir. Recirculation System
CS Core Spray System
SDC Shutdown Cooling System
RWCU Reactor Water Clean-Up System
IC-1 Isolation Condenser System - inside drywell
IC-2 Isolation Condenser System - outside drywell
CH Closure Head Welds

Table 4

Summary of 1986 (Refueling Outage # 11) Inspections and Mitigating Actions[a,b] (From GPUN Submittal No. 1)

System	Welds	Number Inspct.	No. of Cracks	Mitigating Actions
Recir.	64	64[c]	3	IHSI 64 welds. 2 of 3 cracks repaired with O.L.
CS	22	16[e]	0	
SDC	14	6[e]	0	
RWCU	142	10[e]	0	
IC-1	40	12[e]	0	
IC-2	129	58[d]	1[f]	Crack repaired with O.L.
CH	8	0	0	
Total	419	166	4	

Notes:

(a) This table does not include 54 un-inspectable welds.

(b) Numbers in this table were obtained from Table 4 and Sections 1.2.1 and 2 of GPUN Submittal No. 1. Numbers reported elsewhere in Section 1.2.1 and Table 3 in GPUN Submittal No. 1 are slightly different.

(c) Inspections were performed following IHSI treatments.

(d) Includes overlayed welds and un-repaired cracked weld.

(e) Includes 2 CS, 2 SDC, 2 RWCU, and 4 IC-1 previously inspected welds.

(f) Same indication that was mis-interpreted during R.O. # 10.

Explanation of abbreviations

Recir. Recirculation System
CS Core Spray System
SDC Shutdown Cooling System
RWCU Reactor Water Clean-Up System
IC-1 Isolation Condenser System - inside drywell
IC-2 Isolation Condenser System - outside drywell
CH Closure Head Welds

Table 5

Summary of 1988 (Refueling Outage # 12) Inspections and Mitigating Actions (From GPUN Submittal No. 3)

System	Welds	Number Inspct.	No. of Cracks	Mitigating Actions
Recir.	89[a]	67[b]	3	Machine C-loop safe-ends, SI, inspect.
CS	26	9	0	SI on 23 welds - includes 4 welds on 2 safe-ends[c].
SDC	14	3	0	
RWCU	147[d]	10	0	
IC	189[e]			
(In Containment)		14	0	SI on 14 welds - includes 4 welds on 2 safe-ends[c].
(Outside Cont.)		37	3	O.L of 3 cracked welds.
CH	8	2	0	
Total	473	142	6	

Notes:

(a) Includes 5 uninspectable casting-to-casting welds.

(b) Includes three cracked welds. Initial inspection of 6 IGSCC Category welds revealed two cracks. Sample expansion of an additional 6 welds revealed one crack. Inspection sample then expanded to all IGSCC Category C welds. Post-SI inspections of safe-ends not included in this total.

(c) Post-SI inspections applied to safe-end welds and a sampling of other welds.

(d) Includes 5 uninspectable welds inside penetrations.

(e) Isolation Condensor contains 16 uninspectable welds: 8 welds inside penetrations, 4 flued head-to-valve welds, 2 casting-to-casting welds, 2 saddle welds.

Explanation of abbreviations

Recir. Recirculation System
CS Core Spray System
SDC Shutdown Cooling System
RWCU Reactor Water Clean-Up System
IC Isolation Condenser System
CH Closure Head Welds

2.4.3 GNUP's Proposed Acceptance of 1983/84 and 1986 Inspections

The 1986 inspections were performed by GE using manual and automated techniques. Both the procedures and personnel qualified at the EPRI Center under the NRC/BWROG/EPRI Coordination Plan.

GPUN Submittal No. 1 claims that procedures and personnel used for the 1983/84 inspections were also qualified and that those inspections should be accepted for purposes of classifying welds into the various IGSCC categories and developing their future inspection programs. The basis of this claim, as stated in GPUN Submittal No. 1, is summarized below.

The 1983/84 inspections were performed by Magnaflux personnel (qualified at Battelle Columbus Laboratories) using manual techniques (also qualified at Battelle Columbus Laboratories and further qualified to the procedure on site at Oyster Creek).

A table which compares some aspects of the two techniques was included in the GPUN Submittal No. 1. Search units of 45° and 60° were used in both tests, but different search speeds and search unit overlap were different in the two tests as shown below.

	Maximum Search Speed	Minimum Search Unit Overlap
1983/84	6 in./sec	25%
1986	3 in./sec	50%

GPUN stated that even though the 1983/84 and 1986 techniques

were not identical, the results were consistent and that 98% of the repeated examinations from 1983/84 were confirmed during 1986 as not having IGSCC indications. In addition, GPUN claimed that the results of inspections in 1983/84 were conservatively interpreted so that in cases where NDE could not clearly distinguish between IGSCC cracks and geometric causes, they conservatively interpreted the indications to be caused by cracks.

To support these claims, GPUN presented a table which compares the results of 97 inspections in 1983/84 that were repeated in 1986 to illustrate this claim. Cracks were reported in 1983/84 in 18 of the 97 welds inspected. Since these welds were repaired with weld overlays, a comparison of 1983/84 and 1986 inspection results is not possible. Of the remaining 79 welds, 77 were reported as un-cracked in both inspections. Two welds (NG-C-23 and NE-1-27) were reported as un-cracked in 1983/84 and cracked in 1986, although the GPUN Submittal No. 1 stated that indications were found in 1983/84 that were attributed to root geometry in those two welds.

Subsequently, following conversations with the NRC Staff, GPUN withdrew its request to take credit for inspections performed prior to Refueling Outage No. 11. (See page 16 of GPUN Submittal No. 3).

2.4.4 Stress Improvement

During Refueling Outage No. 11, the 64 inspectable welds in the Recirculation System were stress improved using the induction heating stress improvement (IHSI) process. All 64 welds were inspected following the stress improvement.

During Refueling Outage No. 12, the C-loop safe-ends in

the Recirculation System were machined and Stress Improved. In addition, Stress Improvement Treatments were applied to 24 welds in the Core Spray System (including 4 welds on 2 safe-ends) and 14 welds in the Isolation Condenser System (including 4 welds on 2 safe-ends). Post-treatment inspections were applied to all of the safe end-welds that were treated with Stress Improvement, but only a sampling of the other SI-treated welds were given post-treatment inspections. GPUN's position on inspection of Stress Improved welds is discussed in Section 3.3 of this report.

2.4.5 Weld Overlays

During the 1984 inspection of 127 welds in the Isolation Condenser (performed because a leak occurred in that system), 28 indications were found. One of the indications was incorrectly interpreted as a root-geometry indication. The other 27 were repaired: nine of the 27 were replaced through spool change out, and 18 of the 27 were repaired with full structural weld overlays. During the Refueling Outage No. 11 inspection, it was determined that the 28th indication was caused by a crack rather than root geometry and it was repaired with a full structural weld overlay.

As mentioned above, the 64 stress improved welds in the Recirculation System were inspected following the IHSI treatments. Three cracks were found during those inspections. Two of these were repaired using full structural weld overlays. The other was evaluated (using the approach recommended in NUREG 0313, Revision 3, in draft form at that time), and it was determined that crack did not need to be repaired at that time.

During Refueling Outage No. 12, inspections revealed

cracks in three welds in the portion of the Isolation Condenser System outside of containment. One of these had been previously inspected (during Refueling Outage No. 11), and the other two had not been previously inspected. Weld overlays were applied to repair the three cracked welds.

2.4.6 Water Chemistry

GPUN has taken a number of actions at Oyster Creek to improve water chemistry including implementation of EPRI water chemistry guidelines, establishment of a new chemistry Laboratory with state-of-the-art equipment for analyses, and plugging a large number of leaking condenser tubes (no condenser tube leaks were found in the next refueling outage). These efforts resulted in substantial improvements in water conductivity.

2.4.7 Evaluation and Recommendations

A considerable number of mitigating treatments have been applied at Oyster Creek by GPUN. Most of these treatments have followed guidelines presented in Generic Letter 88-01. The exceptions consist of several welds that were treated with Stress Improvement. Although these treatments were in compiance with recommendations of Generic Letter 88-01, several of these welds were not given post-treatment inspections. GPUN's position regarding these treatments is discussed in Section 3.3 of this report.

Guidelines presented in Section 5.2.1 of NUREG 0313, Revision 2 state that inspections performed after September, 1985 in conformance with the NRC/BWROC/EPRI Coordination Plan are acceptable. Since the 1986 inspections at Oyster Creek were qualified in accordance with those guidelines, acceptance

of the 1986 (Refueling Outage No. 11) is recommended.

On the other hand, the inspections performed at Oyster Creek prior to that time were not similarly qualified. The inspection procedure applied in 1983/84 was less conservative than that used in 1986 (higher search speeds and less search unit overlap). Furthermore data presented by GPUN to show conservative interpretation of indications and consistent results between the two inspection techniques seem inconclusive, lacking in statistical significance, and not borne out by the misinterpretation of the indications in Welds NG-C-23 and NE-1-27. Initially, GPUN claimed credit for inspections performed prior to the establishment of current guidelines for inspections (i.e., the NDE Coordination plan agreed upon by NRC, EPRI, and BWROG, as upgraded in September 1985) Subsequently, GPUN altered its position and agreed not to apply credit to those early inspections. Acceptance of GPUN's new position is recommended since this new position conforms with the guidelines of Generic Letter 88-01 and NUREG 0313, Revision 2.

2.5 Current Plans for Mitigating Actions

Mitigating actions planned for Refueling Outages Nos. 13 and 14 include partial replacement and stress improvement of numerous inspectable welds (summarized in Table 6), implementation of hydrogen water chemistry, and application of several activities to uninspectable welds as summarized in Table 7. These measures are discussed below in greater detail.

2.5.1 Hydrogen Water Chemistry

The use of hydrogen water chemistry (HWC) will commence

Table 6

Plans for Future Mitigating Actions[a,b]

System	No. of Unmitigated Welds	Action Planned	No. to be Treated in Indicated Outage R.O.#13	R.O.#14
Recir.	16	Stress improvement[c]	8	8
CS	21[d]	Stress improvement[c]	3	0
SDC	14	Stress improvement[c]	14	0
RWCU	46	Partial replacement	4	0
IC-1	40[d]	Stress improvement[e]	10	14
		Partial replacement	4	0
IC-2	107	Partial replacement	see Note (f)	0
CH	8	Partial replacement	8	0

Notes:

(a) See Table 3, 4, or 5 for explanation of abbreviations of Systems.

(b) This table excludes 26 uninspectable welds (see Table 7) and 96 welds in the RWCU that are outboard of the second isolation valve (see Section 3 of this report).

(c) SI treatments will be followed by UT inspection.

(d) Includes 18 welds in CS and 9 welds in IC-1 classified as IGSCC Category C/D or C/G. It is presumed these welds were SI-treated but did not receive post-treatment inspections.

(e) Only welds > 12 inch diameter will be inspected following the application of stress improvement.

(f) The number of welds that are shown to be replaced in IC-2 was not actually given in the GPUN Submittals, but it includes all condensate piping and the portion of the steam piping from the 75' elevation up to the first weld on the 95' elevation.

Table 7

Plans for Uninspectable Welds

System	No. of Welds	Description	Action Planned	No. to be Treated in Indicated Outage R.O.#13	R.O.#14
Recir.	5	Casting-to-casting welds	Visual inspection while pressure testing	All 5, but date(s) not given	
RWCU	5	Dry well penetrations	Apply corrosion resistant cladding followed by visual inspection while pressure testing	5	0
IC-1	8	Weld penetrations	Remove	8	0
IC-2	2	Saddle welds	Replace or clad with resistant material	2	0
	4	Flued head-to-valve welds	Replace or clad with resistant material	4	0
	2	Casting-to-casting welds	Replace or clad with resistant material	2	0

Explanation of abbreviations

Recir. Recirculation System
CS Core Spray System
RWCU Reactor Water Clean-Up System
IC-1 Isolation Condenser System - inside drywell
IC-2 Isolation Condenser System - outside drywell

following Refueling Outage No. 12 (January, 19[illegible]. It is anticipated that this will reduce the susceptibility to IGSCC throughout the Recirculation System, the Reactor Water Cleanup System, the Isolation Condenser up to the second isolation valve, and for 9 of 14 welds in the Shutdown Cooling System.

2.5.2 Piping Replacement

An extensive program for piping replacement is planned at Oyster Creek during Refueling Outage No. 13 as shown in Table 6. Of particular significance, are the plans for the Isolation Condenser piping outside of the drywell: all condensate piping outside the drywell to the containment penetrations and the portion steam piping from 75' elevation up to the 95' elevation is scheduled for replacement with corrosion-resistant materials during Refueling Outage 13. In addition, four welds in the Reactor Water Cleanup System, four welds in the Isolation Condenser (inside of the drywell), and all eight of the Closure Head welds are scheduled for replacement during Refueling Outage No. 13.

2.5.3 Stress Improvement

As shown in Table 6, at the completion of Refueling Outage No. 14 most inspectable, corrosion-susceptible welds inside of the drywell that have not been replaced or overlayed (except for the Reactor Water Cleanup System) will have been mitigated by stress improvement. Twenty-two welds in the Core Spray System will be stress improved during Refueling Outage No. 12. A total of 28 welds in the Shutdown Cooling System, the Reactor Water Cleanup System, and in the Isolation Condenser (inside of the drywell) will be stress improved during Refueling Outage No. 13. During Refueling Outage No. 14, the final unmitigated welds inside of the drywell

in the Isolation Condenser will be stress improved.

It should be noted, however, that while GPUN plans extensive use of stress improvement treatments, they plan to perform post-treatment inspections only on those welds that are greater than 12 inches in diameter. This position, which is an alternate to the position outlined in Generic Letter 88-01 and NUREG 0313, Revision 3, is discussed in Section 3 of this report.

It should also be noted that 20 safe-end welds in the Recirculation System which were considered in GPUN Submittal No. 1 as uninspectable are considered in GPUN Submittal No. 3 as inspectable. As previously discussed, four of those welds were machined, Stress Improved, and inspected during Refueling Outage No. 12. Concerning the remaining 16 welds, the following statements are contained in GPUN Submittal No. 3:

> ... during 12R, both 'C' loop recirculation safe-ends were SI'd and inspected. The effort required to perform this included machining the OD cladding required to perform this finish and contour adequate for performing UT for IGSCC. Then stress improving followed by a post process UT inspection. The inspection area included the nozzle to safe-end weld (the safe-end side of that weld, and the nozzle side of that weld for a distance of 1T into the nozzle from the weld centerline) and the safe end-to-pipe weld. These welds contained no indications of IGSCC."
>
> "We expect that treating these two safe ends during 12R provided much needed, useful information for stress improving future outages. Knowledge of the radiological

environment and lessons leaned during the 12R outage will enable us to more efficiently perform this work in the future. We expect that time and exposure savings would be substantial. Since no indications of IGSCC were found in the C-loop safe ends in 12R, we consider that these results coupled with the implementation of HWC in Cycle 12 provides adequate assurance that cracks will not initiate/grow in the other eight safe ends."

"... the remaining safe-ends in A, B, D, and E loops of the recirculation system will be stress improved and post process inspected in 13R and 14 R. The four vessel inlet safe ends will be stress improved and inspected during 13R, and the four vessel outlet nozzles will be stress improved and inspected when the system is chemically decontaminated during 14R. The decon techniques will not reduce radiation levels at vessel inlet nozzles."

2.5.4 Plans for Uninspectable Welds

Plans for the 26 uninspectable welds at Oyster Creek are summarized in Table 7. Note that by the completion of Refueling Outage No. 14, mitigating treatments will have been applied to all of the uninspectable welds except for five casting-to-casting welds in the Recirculation System. GPUN's plans for these five welds is to visually inspect them during pressure testing in lieu of ultrasonic testing.

2.5.5 IGSCC Classifications of Welds
(Following Refueling Outage No. 12)

Following the inspections and the mitigating actions described above for Refueling Outage No. 12, the classifications of

the welds in the various systems into the various IGSCC categories are shown in Table 8.

GPUN also provided the expected IGSCC classifications of welds following Refueling Outage No. 12, but these are not reproduced in this report because, as discussed later in this report, their inspection schedules planned for Refueling Outage No. 12 (which affect those classifications) are inadequate and should be changed.

It may be noted by reference to Table 8 that some welds are classified as IGSCC Category C/D and others as IGSCC Category C/G. Explanations of these classifications are not provided, but it is presumed in this report that the welds so classified were those welds that were not given post-SI inspections.

2.5.6 Evaluation of Conformance to Staff Positions and Recommendation

The classifications of welds into the various IGSCC categories are correctly applied, provided that those welds classified as IGSCC Category C/D are treated as IGSCC Category D and that those welds classified as IGSCC Category C/G are treated as IGSCC Category G. Furthermore, extensive mitigating efforts are planned during Refueling Outages No. 13 and 14. Acceptance of GPUN's plan for future mitigating actions is, therefore, recommended, except for GPUN's position on post-treatment inspection of welds treated with IHSI (which is discussed in Section 3 of this report) provided that inspections schedules adhere to requirements of Generic Letter 88-01 and NUREG 0313, Revision 2.

Table 8

Classification of and Inspection Plans for Inspectable Welds[a,b]
(Following Refueling Outage No. 12 per GPUN Submittal No. 3)

A. IGSCC Classification of Welds

	Number of Welds of Indicated IGSCC Category									
System	A	B	C	C/D	C/G	D	E	F	G	Total
Recir.	0	0	62	0	0	0	6	0	16	84
CS	0	0	5	10	8	2	0	0	1	26
SDC	0	0	0	0	0	9	0	0	5	14
RWCU	0	0	0	0	0	20	0	0	26	46
IC-1	0	0	4	5	4	17	0	0	14	44
IC-2	0	0	0	0	0	59	22	0	48	129
CH	0	0	0	0	0	2	0	0	6	8
Total	0	0	71	15	12	109	28	0	116	351

B. Inspection Requirements (GPUN interpretation of NUREG 0313, Rev. 2.)

	Number of Welds of Indicated IGSCC Category									
System	A	B	C	C/D	C/G	D	E	F	G	Total
Recir.	0	0	1	0	0	0	3	0	16	20
CS	0	0	2	10	8	2	0	0	1	23
SDC	0	0	0	0	0	9	0	0	5	14
RWCU	0	0	0	0	0	5	0	0	23	28
IC-1	0	0	2	5	4	7	0	0	10	28
IC-2	0	0	0	0	0	12	6	0	14	32
CH	0	0	0	0	0	0	0	0	0	0
Total	0	0	5	15	12	35	9	0	69	145

C. Number of Welds Scheduled for Inspection During R.O. No. 13

	Number of Welds of Indicated IGSCC Category									
System	A	B	C	C/D	C/G	D	E	F	G	Total
Recir.	0	0	1	0	0	0	3	0	8	12
CS	0	0	0	0	8	0	0	0	1	9
SDC	0	0	0	0	0	9	0	0	5	14
RWCU	0	0	0	0	0	0	0	0	23	23
IC-1	0	0	0	0	0	4	0	0	10	14
IC-2	0	0	0	0	0	0	2	0	14	16
CH	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	0	8	13	5	0	61	88

(a) These tables exclude 26 welds listed as uninspectable and 96 inspectable welds in the RWCU that are outboard of the second isolation valve. No explanation was provided for IGSCC classifications C/D and C/G.

(b) See Table 3, 4, or 5 for explanation of abbreviations.

2.6 Plans for Future Inspections

2.6.1 GPUN's Interpretation of Inspection Requirements

The requirements for the number of welds of each IGSCC category at Oyster Creek to be inspected, based on GPUN's interpretation of the NRC Staff position on inspection schedules as delineated in Generic 88-01 and NUREG 0313, Revision 2, is contained in GPUN Submittal No. 3 and summarized in Table 8 of this report. These numbers take into account the following items:

(1) Previous inspections that have been performed since the inspection programs have utilized currently acceptable methods and personnel (i.e., in accordance with the NRC/EPRI/BWROG Coordination plan as modified in September, 1985). For example, 58 of the 62 IGSCC Category C welds in the Recirculation System were inspected during Refueling Outage No. 12.

(2) The mitigating actions planned for Refueling Outage No. 13 as given in Table 6. For example, inspections are not planned for welds that are scheduled for removal or replacement. GPUN expects to implement an extensive piping replacement (especially in the Isolation Condenser outside of the drywell) during Refueling Outage No. 13. These welds will become IGSCC Category A welds and will be inspected in the future in accordance with IGSCC Category A inspection requirements.

(3) Allowances for reduced inspection frequency due to implementation of Hydrogen Water Chemistry (HWC). Specifically, inspection frequency requirements have

been reduced by a factor of two for welds of certain IGSCC categories in the Recirculation System and the RWCU. GPUN cited experience by EPRI and other utilities (i.e., Dresden 2 and Peach Bottom 3) to show that substantial reduction of IGSCC crack initiation and propagation results when HWC is implemented. Based on this experience, and the expected implementation of HWC during the start up following Refueling Outage No. 12, GPUN's position is that of a 50% reduction in the number of inspections for selected welds in some of the piping.

2.6.2 GPUN's Positions Concerning Inspection Schedules

The number of welds of each IGSCC category in each piping system at Oyster Creek scheduled for inspection during Refueling Outages No. 13 and No. 14 is contained GPUN Submittal No. 3, although the identifications of the specific welds to be inspected was not provided. Summaries of GPUN's plans are shown (in a somewhat modified format compared with the format used in the GPUN Submittal No. 3) in Table 8 of this report. Note that this table shows the inspection plans on both a system-by-system basis as well as a IGSCC category-by-IGSCC category basis. A comparison of the inspection frequencies planned with inspection frequencies required (as interpreted by GPUN) can readily be made using Table 8. Note that such a comparison shows that the proposed percentage of welds scheduled for inspection during Refueling Outages No. 13 is far less than GPUN's interpretation of Generic Letter 88-01 requirements. In part, the reduction in inspection frequency proposed by GPUN is due to a reduction in the inspection frequency of welds that have been stress improved. The basis of this reduction is discussed in Section 3 of this report. Reasons for reductions of welds in other

categories were not given.

2.6.3 Sample Expansion

GPUN's position on sample expansion complies with the NRC Staff position as detailed in Generic Letter 88-01 with the following provisions:

(a) Recirculation System Safe-Ends: "If cracking is detected in the inlet safe-end welds in 13R, all eight remaining outlet safe-end welds will be inspected in 13R."

(b) Isolation Condenser Piping Outside Second Isolation Valve: "If indications of IGSCC are detected in the initial sample, the additional sample size will be approximately equal to that of the initial sample of the category of weld in which IGSCC was detected, but limited to the Isolation Condenser System outside the second isolation valve. If IGSCC is detected in the second sample, all welds in that category will be inspected within the Isolation Condenser System outside the second isolation valve."

(c) RWCU Piping:
"Because the RWCU system is the only system (excluding the Isolation Condenser System outside the second isolation valve) which will not be stress improved, it will be treated for sample expansions separately. Sample expansions will be limited to those welds inside the second CIV."

"Further, the RWCU outboard of the second containment isolation valve was deferred from the 12 R inspection

plan, and sample expansion pending the development of a separate inspection plan no later than six months from the 12R restart."

(d) Remaining Welds (Recirculation, Core Spray, Shutdown Cooling, Isolation Condenser Inside Drywell, and Closure Head Piping:

"We will meet the sample expansion requirements of GL 88-01. That is, for each category of weld, we will inspect an equal number of welds in the second sample and, if cracking is detected in the second sample, all remaining welds in the applicable category will be inspected."

2.6.4 Evaluation of GPUN's Positions and Inspection Schedules

Pertaining to GPUN's position concerning of Generic Letter 88-01 requirements for inspection schedules: some portions of their position are acceptable and some are unacceptable as stated below:

GPUN's position on inspection of welds that are scheduled for replacement is acceptable, so acceptance of this portion of GPUN's position is recommended.

GPUN's position on taking credit for inspections performed during Refueling Outage No. 11 and Refueling Outage No. 12 (but not for Refueling Outage No. 10) is acceptable, so acceptance of this portion of GPUN's position is recommended.

GPUN may be justified in taking a 50% reduction in inspection frequency on certain welds after (but not before) it has been established that the implementation

of HWC has produced water chemistry that is effective in mitigating IGSCC. Clearly, this was not established at the time of preparation of GPUN Submittal No. 3 since that document was prepared at about the same time that implementation of HWC was scheduled. Thus, GPUN's proposed reduction in inspection frequency based on anticipated implementation of HWC should be rejected. GPUN should re-submit their request after they establish (to the satisfaction of the NRC Staff) that implementation of HWC has produced water chemistry that is effective in mitigating IGSCC.

Pertaining to GPUN's position concerning reduction of inspection frequency to lower levels than requirements of Generic Letter 88-01 (as interpreted by GPUN and discussed above):

As discussed in Section 3 of this report, rejection of GPUN's proposal to limit the number of post-treatment inspections of stress improved welds is recommended. Thus, it is further recommended that the corresponding reductions built into GPUN's proposed future inspection schedule should also be rejected. Welds that are classified as IGSCC Category C that have not been previously inspected should be reclassified as IGSCC Category G and inspected during the next outage (Refueling Outage No. 13). Similarly, welds that are classified as IGSCC Category C/D should be treated as IGSCC Category D, and inspections should be planned in accordance with Generic Letter 88-01 for IGSCC Category D welds.

The reductions in the frequency of inspections of welds classified as IGSCC Categories C, D, E, and G are not justified. The inspection schedules for these welds

should be revised in accordance with Generic Letter 88-01 for those categories.

It is especially further recommended that all IGSCC Category G welds should be inspected during the next refueling outage (Refueling Outage No. 13) as required by Generic Letter 88-01.

Pertaining to GPUN's position concerning the five casting-to-casting welds in the Recirculation System: GPUN is not justified in considering these welds as uninspectable. Techniques to inspect casting or welds metal (such as using L refractive waves) are available in the industry. Thus, rejection of GPUN's position on these welds is recommended, and GPUN should inspect these welds by Refueling Outage No. 14. Other aspects of GPUN's plans pertaining to uninspectable welds are acceptable, and their acceptance is recommended.

GPUN's position on sample expansion is unacceptable. Sample expansion should be based on the IGSCC categories rather than based on system. That is if crack(s) are found in welds of a given IGSCC category, an additional sample of approximately the same size should be inspected. Thus, rejection of GPUN's position on sample expansion is recommended, and it is further recommended that GPUN should amend their position to comply with guidelines presented in Generic Letter 88-01.

2.7 Changes in the Technical Specification Concerning ISI

GPUN proposed an alternate position to the NRC Staff position concerning a change to the Technical Specification. This alternate

position is discussed in Section 3 of this report.

2.8 Confirmation of Leak Detection in the Technical Specification

2.8.1 Conformance with Position C of Regulatory Guide 1.45

GPUN Submittal No. 1 contained the following statements.

"Leakage detection systems for Oyster Creek were reviewed by the NRC Staff during the Systematic Evaluation Program and the results were documented in Section 4.16.2 of Integrated Plant Safety Assessment Report for Oyster Creek, NUREG-0822 dated January, 1983. The actions identified in that report have been completed with the exception of the airborne particulate and gaseous radiation monitoring system (APGRMS). GPUN's recent submittal of July 1, 1988 states that installation of a new APGRMS will be completed during the operating cycle 12. The submittal also identifies that there are several leak detection methods available for unidentified leakage into the containment sump at Oyster Creek which operate on diverse principals."

"The normal method of monitoring unidentified leak rate is to obtain flow integrator readings from containments sump pump discharge every four hour period and calculate average flow rate. Approximately 1 gpm can be measured in a four hour interval. This methodology is identified in Oyster Creek Technical Specifications as the primary method of leakage measurement."

"When the flow integrator is not available, the average leakage rate can be calculated using the known volume

between the high and the low level alarms for the sump and the time required to fill the sump between these levels."

"A recorder available in the control room also provides continuous indication of an estimated unidentified leak rate to the containment sump by utilizing a differential pressure signal as a result of the sump level change. The sensitivity of the recorder is approximately 0.2 gpm."

"Additionally, a timer available in the 480 volt switch gear room provides the run time of the containment sump pumps. This run time along with the estimated flow rate of the sump pumps can provide approximate leak rates. This methodology is utilized every four hours during power operation."

"Also, an annunciator will alarm in the control room if the time to fill the containment sump is too short an interval. The time associated with this alarm is set to bring in the alarm if unidentified leak rate equals or exceeds 4 gpm."

"These methods provide quantitative indications of unidentified RCS leakage inside containment and also provide assurance that unidentified leakage can be detected and quantified during Cycle 12 operation pending operability of the new APGRMS".

2.8.2 Other Leak Detection Requirements

Generic Letter 88-01 states the following

"Plant shutdown should be initiated for inspection

and corrective action when, within any period of 24 hours or less, any leakage detection system indicates an increase in rate of unidentified leakage in excess of 2 gpm or its equivalent, or when the total unidentified leakage attains a rate of 5 gpm or equivalent, whichever occurs first. For sump level monitoring systems wit fixed-measurement-interval methods, the level should be monitored at approximately 4-hour intervals or less."

2. "Unidentified leakage should include all leakage other than: (a) leakage into closed systems, such as pump seal or valve packing leaks that are captured, flow metered, and conducted to a sump or collection tank, or (b) leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operations of unidentified leakage monitoring systems or not to be from a throughwall crack in the piping within the reactor coolant pressure boundary.

3. "For plants operating with any IGSCC Category D, E, F, or G welds, at least one of the leakage measurement instruments associated with each sump shall be operable, and the outage time for inoperable instruments shall be limited to 24 hours, or immediately initiate an orderly shutdown"

In addressing these requirements the GPUN Submittal No. 1 stated the following:

"By amendment 97 to Provisional Operating License No. DPR-16 for Oyster Creek, the limiting conditions for operation and surveillance requirements were authorized

for the Reactor Coolant System leakage. This amendment added two new definitions (identified and unidentified leakage) to TS Section 1.0; revised TS 3.3.D to include LCO's for the containment sump flow monitoring system and the equipment drain tank monitoring system; and added a new surveillance section TS 4.3.H. This amendment incorporated GPUN's response dated September 8, 1983, to IE Bulletin 82-03."

"On March 17, 1987, GPUN submitted Technical Specification Change Request #158 which adds additional conservatism to these requirements by proposing to limit the unidentified leakage for the Reactor Coolant System to a maximum leak rate increase of 2 gpm within any 24 hour period while operating at steady state power. As of this date, the NRC Staff has not completed their review of this proposed change. If approved, the TS would also address item 1 of the NRC Staff position."

The section on surveillance in the Technical Specification (Section 4.3.H) states:

"1. Unidentified leakage rate shall be calculated at least once every 4 hours."

"2. Total leakage rate (identified and unidentified) shall be calculated at least once every 8 hours."

"3. A channel calibration of the primary containment sump flow integrator and the primary containment equipment drain tank flow integrator shall be conducted at least once per 18 months."

2.8.3 Evaluation and Recommendation

GPUN's position on leakage complies with the NRC Staff position so acceptance of their position is recommended.

2.9 Plans for Notification of the NRC of Flaws

2.9.1 GPUN's Position

GPUN plans to notify the NRC of any flaws identified that do not meet IWB-3500 criteria of Section XI of the Code for continued operation without evaluation, or a change found in the condition of the welds previously known to be cracked, and our evaluation of the flaws for continued operation and/or repair plans. However, GPUN stated that the NRC review shall not be a constraint for restart of the plant.

2.9.2 Evaluation and Recommendation

GPUN's position is not in compliance with the NRC Staff position as delineated in Generic Letter 88-01. The NRC should approve the methodology and procedure before restart of the plant. Thus, rejection of GPUN's position is recommended. GPUN should revise its position to comply with the guidelines provided in Generic Letter 88-01 and NUREG 0313, Revision 2.

3. ALTERNATIVE POSITIONS

3.1 GPUN's Alternate Position Concerning Welds in the RWCU

3.1.1 GPUN's Position

GPUN, according to GPUN Submittal No. 1, considered the Reactor Water Cleanup (RWCU) piping outboard of the outermost Containment Isolation Valves to be outside of the scope of NRGEG 0313, Revision 2, and therefore, inspections will not be performed on these welds. Reasons given by GPUN are that a pipe rupture in that portion of the RWCU would not cause a safety hazard and inspection of that portion of the RWCU would cause excessive exposure to inspection personnel since it is a high radiation area. In support of these claims, GPUN Submittal No. 1 contained the following statements:

> "A pipe failure outboard of the outermost Containment Isolation Valves (CIV) would not have nuclear safety consequences. The effects of postulated pipe failures outside containment on equipment and structures necessary to shut down the reactor were evaluated as described in Section 3.6.2.6 of the FSAR. A double-ended rupture of the RWCU piping outside the outermost isolation CIVs would result in a low reactor coolant level and automatic isolation of the RWCU from the reactor. For this reason, there would be no compromise in the ability to safely shut down the reactor. The radiological releases for such a break would be within the secondary containment boundary and would not cause 10CFR20 limits to be exceeded."

> "This piping is also a high radiation area. While decon

will reduce exposure, there would still be a lot of dose expended in prepping the welds, inspection, scaffolding, etc. The man-rem exposure for performing inspections and weld crown reduction (excluding scaffolding) is estimated at 343 man-rem w/o decon and 69 man-rem w/decon. Scaffolding and insulation removal and reinstalling is estimated at 200 man-rem w/o decon and 40 man-rem w/decon."

GPUN Submittal No. 2 adds the following additional information pertaining to their position on inspection of RWCU welds:

"We have determined from a review of the piping stress reports, piping fabrication and installation records: (a) The operational piping stresses are predominantly higher, approximately by a factor of 2, inboard of the second isolation valve. Therefore, welds residing inboard have a higher propensity for IGSCC than those outboard of the second valve. (b) There is no documentation that weld repairs exist within the welds outboard of the second valve which could increase the IGSCC sensitivity over those welds residing inboard of the second valve. (c) Also, there is no evidence of significant piping material chemistry differences between the piping inboard and outboard of the second isolation valve. Therefore, the propensity for IGSCC in regard to alloy composition is relatively the same."

"GPUN previously estimated man-rem exposures ... for insulation removal, weld crown reduction and inspections of the Category 'G' RWCU welds. Since GPUN is now planning chemical decontamination for 13R, we can expect a major reduction in the exposures. For example, the original dose estimate (345 man-rem) without

If these welds were fabricated to the same criteria as the outboard welds, then GPUN could classify these welds as representative of the IGSCC susceptible welds outboard of the second valve. UT of these welds between the valves, with an additional 10 welds outboard of the second valve, would provide a representative sample for the 13R IGSCC inspections."

"In response to the staff request, GPUN has reviewed the piping specification for the RWCU system, and has determined that all welds requires 100% radiography. Further, the piping and welds inboard of the first isolation valve were fabricated to ASME Section I, 1965 edition, and the piping and welds beyond the first valve were fabricated to ASA B31.1, 1955 edition."

"Based on these facts, our original proposal ... has merit. The RWCU welds within the IGSCC boundary are differentiated by their operational stresses. For example, those welds residing inboard of the second valve have a higher propensity for IGSCC than those outboard of the second valve, because the operational stresses are higher by a factor of two."

"However, in response to the Staff's generic concern for RWCU welds outside of the second valve, GPUN has opted to include 10 (approximately 10%) of the welds outboard of the second valve in the initial 13R UT inspection sample. If indications are characterized as IGSCC in this inspection sample, GPUN will approach the staff on their disposition and any plans for sample expansion."

"If no indications of IGSCC are found outside of the

decontamination could be reduced to approximately 70 man-rem. However, these estimates to perform inspections on the 96 RWCU welds outside the second valve are still significant, and do not include the dose from scaffolding work."

"Therefore, we believe it is prudent to implement an inspection program which includes a visual check for cracks in welds outboard of the second isolation valve and to ultrasonically examine these welds only in the event of cracking being detected in the more susceptible welds inboard of the second valve."

"Further, the results of our previous augmented examinations conducted during the 11R and 12R outages show no evidence of IGSCC inboard of the second valve. It is also noted, that for those welds examined, their operational stresses are in excess of two times that of the welds residing outboard of the second valve, specifically those high stress welds at the recirculation piping connection points. Therefore, should flaws be detected within the welds inboard of the second valve during examination of the initial inboard sample, a maximum of 10 percent of the welds outboard of the second valve that reside within the IGSCC boundary (operating temperature > 200°F; and pipe size > 4 inches) will be examined."

GPUN's position was subsequently altered as indicated in the following statements from GPUN Submittal No. 4:

"... The Staff requested that GPUN review the fabrication records to determine whether the welds between the first and second valves were radiographed during construction.

second isolation valve during 13R, there would be additional technical justification for our original plan ... We would then reinstate this inspection plan after the 13R outage. Therefore for post 13R required RWCU weld inspections, a visual check would be performed during the Hydro test of the welds outboard of the second isolation valve. UT examinations would be performed for those welds only in the event of IGSCC being detected in the more susceptible welds inboard of the second valve. For IGSCC detected within the welds inboard of the second isolation valve during examination of the initial inboard sample, a maximum of 10 percent of the welds outboard of the second valve that reside within the IGSCC boundary would be examined."

3.1.2 Evaluation and Recommendation

The NRC Staff, in the development of their position (i.e., that Generic Letter 88-01 applies to all BWR piping made of austenitic stainless steel that is four inches or larger in nominal diameter and contains reactor coolant at a temperature above 200°F during power operation regardless of Code classification), recognized that high radiation exposure to inspectors would result; however, despite this consideration, they imposed the requirement in Generic Letter 88-01 that the same inspection requirements should apply outboard of the isolation valve as those that apply inboard of the isolation valve. Since the time Generic Letter 88-01 was issued, the NRC Staff relaxed its position to permit a sampling plan to apply to the portion of the RWCU that is outboard of the second isolation valve. GPUN's plan for UT inspection of approximately 10% of the welds during Refueling Outage 13 is acceptable and in accordance with the sampling plan permitted by the NRC Staff. Thus,

acceptance of that portion of GPUN's position is recommended. However, GPUN's plans for inspections during subsequent refueling outages is not in accordance with the NRC Staff's modified position so rejection of that portion of GPUN's plan is recommended. GPUN should revise their long range plans (i.e., plans for inspections during Refueling Outage 14 and beyond) to inspect a sample of about 10% of the welds during each outage.

3.2 GPUN's Alternate Position Concerning ISI in the Technical Specification

3.2.1 GPUN's Position

GPUN's position is not to modify the Technical Specification to specifically delineate conformance concerning inservice inspection (ISI) because of the following reasons.

GPUN stated that changes to the Technical Specification should be viewed in light of the NRC Proposed Policy Statement on TS Improvements for Nuclear Power Reactors (52FR3788, 2/6/87), the intent of which is to improve nuclear safety through the development of more operator-oriented TS, improvement of TS Bases, reduction of action statement induced plant transients and more efficient use of NRC and industry resources. GPUN believes that a change to the TS concerning ISI would not support the Proposed Policy. Thus, in lieu of a TS change, GPUN proposes the inclusion of their statement of support of the NRC Staff position on ISI in their Inservice Inspection Program pending the final recommendation of the Technical Specifications Improvement program.

3.2.2 Evaluation and Recommendation

The reasons given by GPUN for not changing their Technical Specification have already been considered and discounted by the NRC Staff in the development of their position as delineated in Generic Letter 88-01. Furthermore, a statement in the alternative documents would not be as enforceable as a statement in the TS. Therefore, rejection of the GPUN position is recommended. It is further recommended that GPUN should amend the TS on ISI in accordance with Generic Letter 88-01 to include a statement that the ISI program will comply with the NRC Staff position on inspection scheduled, methods and personnel, and sample expansion.

3.3 GPUN's Alternate Position Concerning Inspections of Stress-Improved Welds

3.3.1 NRC Staff Position

Section 5.3.1.3 of NUREG 0313, Revision 2 states that an ultrasonic examination should be applied after SI treatment as part of the process.

Section 5.3.1.7 of NUREG 0313, Revision 2 states that stress improved welds are considered to be Category G weldments until the post-SI inspection has been performed.
Section 5.3.2.1 of NUREG 0313, Revision 2 states that all IGSCC Category C welds should be inspected within two refueling cycles after the post-SI inspection, and every 10 years thereafter.

3.3.2 GPUN's Position

GPUN stated they consider that, for certain sizes of piping, performing stress-improvement (SI) without 100% immediate post-SI inspections is a prudent technical approach to mitigating IGSCC and that performing a 100% inspection over the following two outages is not warranted. GPUN presented a technical analysis to support this claim. The conclusion of that analysis is: if a crack will not grow to an unacceptable depth within an operating cycle in the as-welded condition, the same crack would not grow to an unacceptable depth within an operating cycle if stress improved.

In consequence of those technical analyses, GPUN considers it prudent, in view of ALARA considerations, to reduce the number of inspections of SI welds and to eliminate the post-treatment inspections of small diameter welds that are given SI treatments. GPUN also believes that it is prudent to perform SI on small diameter welds, even if that treatment is not followed by inspection because the SI treatment will provide an added measure of safety.

3.3.3 Evaluation and Recommendations

The NRC and GPUN positions are obviously in conflict. The results of extensive research programs have been incorporated into the development of the NRC Staff positions. Although, the GPUN position that it is prudent to perform SI on small diameter welds even though post-weld inspections are not performed is correct, these welds should be considered as IGSCC Category G welds, in conformance with the NRC position. Additionally, rejection of the GPUN position on reducing the inspection frequency of SI treated welds is recommended.

4. CONCLUSIONS AND RECOMMENDATIONS

GPUN has indicated that they endorse and accept several of the thirteen NRC Staff positions outlined in Generic Letter 88-01. In particular, they endorse those pertaining to materials, processes, water chemistry, weld overlay, partial replacement, and crack evaluation and repair criteria. They indicated that they also accept, with certain provisions (some acceptable and some unacceptable), the NRC Staff positions pertaining to inspection method and personnel, inspection schedule, sample expansion, leak detection, and reporting requirements.

GPUN has applied extensive mitigating treatments in the form of improved water chemistry, partial replacement, weld overlays, and stress improvements treatments. GPUN plans additional mitigating efforts during the next two refueling outages. Following these improvements, all welds (except for five welds between castings) inside of the drywell (except for the RWCU) will have been replaced, overlayed, or stress improved. Plans for the five casting-to-casting welds is to visually inspected them during pressure testing.

GPUN classified several welds as IGSCC Category C/D and several other welds as IGSCC Category C/G. No explanation of these classifications were provided, but it is presumed in this report that these are welds that were Stress Improved (SI) but not given post-SI inspections. This is acceptable, provided that they are treated as IGSCC Categories D and G for inspection purposes. GPUN's classifications of other welds is acceptable.

GPUN has adopted inspection methods and personnel that comply with the NRC Staff position (i.e., in accordance with the NRC/EPRI/BWROG Coordination Plan as upgraded in September, 1985), and performed inspections during Refueling Outages No. 11 and No. 12. An inspection program was presented for Refueling Outages No. 13 and No 14; however, the number of welds to be inspected is not in compliance with the NRC

Staff position. GPUN has applied reductions to the number of welds to be inspected because of: (1) anticipated implementation of HWC, (2) a position to decrease the number of inspections of stress improved welds, and (3) other unspecified reasons.

GPUN initially interpreted the scope of NUREG 0313, Revision 2 to exclude the welds in the RWCU that are outboard of the second isolation valve. In support of this action, GPUN presented reasons that: (1) this action would save considerable radiation exposure to inspection personnel and that it would cause no safety hazard, (2) stresses in the portion of the RWCU inboard of the second isolation valve are higher (so these welds are more likely to develop IGSCC), and (3) if IGSCC is found in welds in the portion of the RWCU that is inboard of the second isolation valve, inspections of the remaining portion of the RWCU would be undertaken. These reasons have, no doubt, been considered and discounted by the NRC Staff in the development of their positions.

GPUN subsequently revised its position on inspection of welds in the portion of the RWCU that is outboard of the second isolation valve, and they presented a plan to inspect approximately 10% of those welds during Refueling Outage No. 13. This is acceptable, but they stated that if no cracks are found that their position would revert to that originally stated during subsequent outages. Their position for Refueling Outage No. 14 is not acceptable.

GPUN declined to amend the Technical Specification on ISI to include a statement that the inservice inspection program for piping will be in conformance with the NRC Staff positions on schedule, methods and personnel. Rather they proposed an alternative position that such a statement would be incorporated into the Inservice Inspection Program. Such an alternative would not be as enforceable as a statement in the Technical Specification.

Leakage detection proposals presented by GPUN include provisions to

insure compliance with Position C of Regulatory Guide 1.45. They have previously proposed changes in the TS to ensure additional conservatism to leakage requirements, and requested delay of further changes pending the outcome of NRC review of that request.

As a result of this technical evaluation, the following recommendations are made.

(1) Acceptance of GPUN's classifications of welds provided that welds classified as IGSCC Category C/D and IGSCC Category C/G are treated as IGSCC Category D and IGSCC Category G, respectively, for inspection purposes.

(2) Acceptance of GPUN's plan for Refueling Outage No. 13 for UT inspection of 10% welds in that portion of the RWCU that is outboard of the isolation valves. However, rejection of GPUN's plans for Refueling Outage No. 14 is recommended. GPUN should revise its long range plans to include UT inspection during Refueling Outage No. 14 (and subsequent outages) to utilize a sampling plan similar to that planned for Refueling Outage No. 13.

(3) Rejection of GPUN's position to reduce the number of due to implementation of hydrogen water chemistry (HWC). GPUN should resubmit their proposal after they can demonstrate (to the satisfaction of the NRC Staff) the effectiveness of HWC to mitigate IGSCC at Oyster Creek.

(4) Rejection of GPUN's position to reduce inspections on SI-treated welds. GPUN should revise its inspection plan to adhere to the NRC Staff position on inspection schedules of SI-treated welds as delineated in Generic Letter 88-01.

(5) Rejection of GPUN's proposal to reduce inspection frequency

of welds classified as IGSCC Categories C, D, E, and G and IGSCC Categories C/D and C/G. GPUN should revise its inspection schedules for these in accordance with Generic Letter 88-01 as discussed in Section 2.6 of this report. Of particular concern: all IGSCC Category G welds should be inspected during Refueling Outage No. 13.

(6) Rejection of GPUN's position that five casting-to-casting welds in the Recirculation System are uninspectable welds. GPUN should apply techniques available in the industry as discussed in Section 2.6 of this report and inspect those welds no later than Refueling Outage No. 14.

(7) Rejection of GPUN's position on sample expansion. GPUN should revise its position so that sample expansion is based on guidelines provided in Generic Letter 88-01, i.e., when cracked welds are found, a new sample of welds (approximately the same size as the original sample) should be selected from welds of the same IGSCC category.

(8) Rejection of GPUN's position to include changes pertaining to ISI in the Inservice Inspection Program rather than to modify the Technical Specification on ISI.

(9) Rejection of GPUN's position on flaw evaluation. GPUN should revised its position as discussed in Section 2.9 of this report.

(10) Acceptance of the remaining portions of the GPUN Submittals.

5. REFERENCES

1. "Technical report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," NUREG 0313, Revision 2, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, January, 1988.

2. "Investigation and Evaluation of Stress-Corrosion Cracking in Piping of Light Water Reactor Plants," NUREG 0531, U. S. Nuclear Regulatory Commission, February, 1979.

3 "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," Generic Letter 88-01, U.S. Nuclear Regulatory Commission, January 25, 1988.