GPU Nuclear

GPU Nuclear Corporation
One Upper Pond Road
Parsippany, New Jersey 07054
201-316-7000
TELEX 136-482
Writer's Direct Dial Number:

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5000-88-1605

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Gentlemen:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Docket No. 50-219
Plan for Detecting/Mitigating Intergranular
Stress Corrosion Cracking (IGSCC) in Reactor
Coolant System Piping
License No. DPR-16
Supplemental Information

Reference: GPUN Letter 5000-88-1480, 2/16/88
GPUN Letter 5000-88-1532, 4/5/88
NRC Letter, 5/26/88

On June 28, 1988 GPUN management representatives met with the NRC staff to discuss the Oyster Creek IGSCC inspection/stress improvement plans for the 12R outage. In addition to the plant specific 12R workscope and the basis for the plan, GPUN also presented its milestones for IGSCC mitigation from 10R up to and including the 14R (1992) outage.

Briefly, GPUN stated that its program responds to an industry concern, but also at the same time focused on plant specific conditions. Where we have detected IGSCC, we have inspected a substantial portion of the affected system. In the Recirculation system, we have inspected all the inspectable welds which represent 72% of the total number of welds. We have detected cracking in 3 (3% of total welds, 4.6% of the inspected welds). In the Isolation Condenser system, we have detected IGSCC in about 22% of the welds outside the drywell, after inspecting 98% of the welds, and have not detected IGSCC in the piping inside the drywell after inspecting about 41% of the total welds or 55% of the inspectable welds. Even with this positive history, GPUN has still taken a proactive approach to minimize the potential for IGSCC (10R Water Quality Program, Hydrogen Water Chemistry for 12R). Also, GPUN has implemented an inspection program which places uninspected/inspectable welds as the first priority, but within our goal to minimize personnel exposure (ALARA).

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As a result of these discussions, the NRC staff has requested supplemental information in order to review the Oyster Creek 12R Inspection/Stress Improvement Plan. Since this request included specific and distinct items, we have elected to restate each request and provide our response accordingly as an attachment.

Even though this response provides information which is similar to the GL 88-01 request, we wish to restate that this letter is not our response to GL 88-01. GPUN will submit a separate submittal within the 180 days allotted to the licensees. We trust this letter, with our previous letters and two meetings, clarifies the basis for our 12R IGSCC inspection plans. In the event any further comment or questions arise, please contact Mr. M. W. Laggart at (201)316-7968.

Very truly yours,

R. F. Wilson
Vice President
Technical Functions

RFW/DJ/pa(7032f)

cc: Mr. William T. Russell, Administrator
Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA. 19406

NRC Resident Inspector
Oyster Creek Nuclear Generating Station
Forked River, N.J. 08731

Mr. Alex Dromerick
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

ATTACHMENT

OYSTER CREEK
IGSCC INSPECTION/STRESS IMPROVEMENT PLANS
SUPPLEMENTAL INFORMATION

1a. NRC Request: Provide a comparison of the Oyster Creek Program by outage (12R, 13R, 14R) versus the requirements of Generic Letter 88-01.

GPUN Response: Tables 1, 2 and 3 provide the status of the uninspected welds for the O.C. Program by outage for Category "G" welds. Tables 4, 5 & 6 provide the comparison between Generic Letter 88-01 and the GPUN program for 12R, 13R and 14R. These tables show that after the 12R outage, a total of 155 welds remain to be inspected for IGSCC. This number is reduced to 106 after 13R and 93 after 14R. These 93 welds are all located in the reactor water clean-up system outside the second isolation valve.

b. NRC Request: Provide previous inspection results (10R and 11R) and sample size.

GPUN Response: Tables 7 and 8 provide the inspection results and sample size.

2. NRC Request: What compensatory measures will O.C. take for welds not inspected by 12R?

GPUN Response: In the Reactor Water Clean Up (RWCU) system outside containment, there are 34 welds located in an area called the "valve nest", 16 of which are inside the second isolation valve. Three welds on each side of the second isolation valve (total = 6) were inspected in 10R. The valve nest is located in a loft above the 51' elevation floor. There are no floor drains, only an access hole in the floor of the loft; therefore, leakage would flow to the floor below through the access hole. An operator tours the area and checks for leakage once each day.

There are 78 welds located in the RWCU heat exchanger room which is accessed through a labyrinth. Operations checks the clean up area once each day. Additionally, temperature indication for this room is provided via a control room recorder and its associated alarm. The readout is monitored and recorded every 4 hours. The alarm set point for this monitor is 180°F. We estimate that a 1 gpm leak, which would come from a crack length much less than the critical length, would create an alarm in ≤ 4 hours if the ventilation system is not in service or ≤ 80 hours if it is. We would expect the ventilation exhaust radiation monitors would alarm well before the temperature monitor would alarm since the ventilation system exhausts to the stack. Additionally, the Radiological Controls program places continuous air monitors (CAMS) in various areas throughout the reactor building. History with these CAMS has shown they are very sensitive to small increases in reactor building airborne activity which would accompany a primary coolant leak.

Nuclear Safety Analysis Committee (NSAC) Report No. NSAC-110(3-87) shows that a 0.1 gpm leak from a high temperature and pressure line is visible, even with insulation above the leak. The Isolation Condenser system is located on the 75' and 95' elevation of the reactor building. These elevations are toured by operations once per shift. Additional specific valves and associated piping on these elevations are inspected for visible leaks during these tours, except for a section of piping (three welds) that goes through the CRD rebuild room which is checked once per day. Most of the piping is covered with calcium silicate insulation, except for the valves which are wrapped with blankets. Again, NSAC-110(3-87) shows that a 0.1 gpm leak is visible. This leak rate is substantially lower than the expected leak rate from a crack that is less than the critical crack length.

We also note that the leak found during the 10R outage was detected during a pressure test for IC tube integrity. The portion of the system containing the leaking weld (the crack was about 0.5" long on the OD) was on the 75' elevation and was not included in the inspection boundary for the test (the condensers are on the 95' elevation). The leak was noticed by a worker on the 75' elevation when the pressure was at 500 psi with ambient temperature water. We consider that at operating pressure and temperature, about twice that at which the leak was noticed, leakage from the piping will be readily detectable.

For welds located inside penetrations, all of which will be replaced or clad in 13R, we will perform visual inspections for leakage during 12R and Cycle 12 (if access to the drywell is required for other reasons). Response 3 addresses leak detection for piping inside containment (recirc, core spray, RWCU, shutdown cooling, isolation condenser, and closure head piping).

3. NRC Request: Does the O.C. Leakage Detection System meet the intent of GL 88-01?

GPUN Response: The NRC Staff position in GL 88-01 is that leakage detection systems should be in conformance with position C of Regulatory Guide 1.45 "Reactor Coolant Pressure Boundary Leakage Detection Systems" or as otherwise previously approved by the NRC.

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 the containment 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.

The NRC Staff position was further amplified in GL 88-01 by additional criteria as follows:

a. 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 with fixed-measurement-interval methods, the level should be monitored at approximately 4-hour intervals or less.

b. Unidentified leakage should include all leakage other than:

   (1) 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

(2) 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.

c. For plants operating with an 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.

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.

4. NRC Request: Provide a commitment to perform a sample expansion for 12R by category in accordance with GL 88-01 categories "A-F".

GPUN Response: GL 88-01 requires sample expansion if indications of IGSCC are detected in the initial sample. The additional sample size should be equal to that of the initial sample of the category of weld in which IGSCC is detected, irrespective of sample and pipe size. If IGSCC is detected in the second sample, all welds in that category should be inspected. The sample expansion requirements of GL 88-01 will be met as modified herein:

a) Recirculation System Safe Ends

If cracking is detected in the C loop safe end welds (2 safe ends) in 12R, all sixteen remaining safe end welds (8 safe ends) will be inspected in 12R. If cracking is detected in the inlet safe end welds (4 safe ends) in 13R, all eight remaining outlet safe end welds (4 safe ends) will be inspected in 13R.

b) <u>Isolation Condenser piping outside second valve</u>

Should IGSCC be detected in this portion of this system in the initial sample (10%), we will perform inspection on an additional 10% of the welds in the same category(ies) in which IGSCC was detected. If IGSCC is found in the second sample, we will inspect all the remaining welds in that category.

Our past history with IGSCC has shown that detecting IGSCC in this system is not an indication that cracking exists in other systems and vice-versa. Therefore, we do not consider that detecting IGSCC in this system necessitates additional inspections in the remaining systems, providing no IGSCC is detected in the other systems in their initial inspections. Sample expansion for the remaining systems is discussed in c) and d) below.

c) <u>RWCU Pipi[illegible]</u>

In 12[illegible] plan to inspect 10 previously uninspected welds, all inside contai[illegible]. Should we detect IGSCC in the initial sample, we will inspect an additional 10. Seven will be inside containment; three will be outside containment and inside the second containment isolation valve. Should IGSCC be detected in the second sample, we will inspect the 10 remaining uninspected welds inside the second valve. Inspecting the welds, in the sequence noted, will assure the integrity and reliability of the safety-related portion of the RWCU system piping.

Outside containment, there are 34 welds located in the "valve nest." The average dose/weld for insulation removal, weld crown reduction, and inspection is estimated to be 8.5 Man-Rem. The remaining 78 welds to the 200°F transition are located in the RWCU heat exchanger room. The average dose/weld in this room is estimated to be 2.5 Man-Rem. The dose estimates do not include scaffolding work; additionally, most of the insulation on this piping contains asbestos.

Based on the dose rates these areas, performing inspections on the 13 uninspected welds inside the second valve would entail at least 108 Man-Rem. Performing inspections on the 96 welds outside the second valve would entail approximately 345 additional Man-Rem. We consider that the compensatory measures identified in Response 2 for RWCU piping are adequate and justified by the exposures involved with inspections should no cracking be found in 12R or 13R inside the second valve. Should cracking be detected inside the second valve, we will inspect welds, as identified above, in a sequence intended to minimize exposures but assure the integrity of the safety-related portion of the system.

d. <u>Remaining Welds (Recirculation, Core Spray, Shutdown Cooling, Isolation Condenser Inside Drywell, and Closure Head Piping).</u>

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.

As previously discussed in our May 26 and June 28 meetings, we consider that the inspections performed in 10R, to IEB 82-03, were adequate. As such, Category D welds include those that were inspected in 10R but not re-inspected in 11R to GL 84-11.

TABLE 1

STATUS OF UNINSPECTED WELDS
AFTER 12R

SYSTEM	TOTAL WELDS	UNINSPECTABLE WELDS (NOTE 1)	UNINSPECTED INSPECTABLE WELDS REMAINING
RECIRCULATION	89	25	0
SHUTDOWN COOLING	11	0	5
CORE SPRAY	26	4	9
RWCU			
° INSIDE 2ND VALVE			
° INSIDE DRYWELL	35	5	7
° OUTSIDE DRYWELL	16	0	13
° OUTSIDE 2ND VALVE	96	0	93
ISOLATION CONDENSER			
° INSIDE 2ND VALVE	58	18	9
° OUTSIDE 2ND VALVE	131	2	13
CLOSURE HEAD	8	0	6
TOTAL	470	54	155

NOTE 1: RECIRCULATION: 5 CASTING-TO-CASTING WELDS, 20 SAFE END WELDS (5 SAFE END TO PIPE/FITTING WELDS INSPECTED FROM ONE SIDE ONLY) DUE TO SAFE END AS-WELDED OD CLADDING.

RWCU: 5 WELDS IN PENETRATIONS

ISOLATION CONDENSER: 8 WELDS IN PENETRATIONS, 4 FLUED HEAD-TO-VALVE WELDS, 2 CASTING-TO-CASTING WELDS, 2 SADDLE WELDS (OUTSIDE), 4 SAFE END WELDS DUE TO AS-WELDED OD CLADDING

CORE SPRAY: 4 SAFE END WELDS DUE TO AS-WELDED OD CLADDING.

TABLE 2

STATUS OF UNINSPECTED WELDS
AFTER 13R

SYSTEM	TOTAL WELDS	UNINSPECTABLE WELDS (NOTE 1)	UNINSPECTED INSPECTABLE WELDS REMAINING
RECIRCULATION	89	25	0
SHUTDOWN COOLING	11	0	0
CORE SPRAY	26	4	0
RWCU			
° INSIDE 2ND VALVE			
° INSIDE DRYWELL	35	5	0
° OUTSIDE DRYWELL	16	0	13
° OUTSIDE 2ND VALVE	96	0	93
ISOLATION CONDENSER			
° INSIDE 2ND VALVE	50	10	0
° OUTSIDE 2ND VALVE (NOTE 2)	97	0	0
CLOSURE HEAD	8	0	0
TOTAL	430	44	106

NOTE 1: RECIRCULATION: 5 CASTING-TO-CASTING WELDS, 20 SAFE END WELDS (5 SAFE END TO PIPE/FITTING WELDS INSPECTED FROM ONE SIDE ONLY) DUE TO SAFE END AS-WELDED OD CLADDING.
RWCU: 5 WELDS IN PENETRATIONS
ISOLATION CONDENSER: 4 FLUED HEAD-TO-VALVE WELDS, 2 CASTING-TO-CASTING WELDS, 4 SAFE END WELDS DUE TO AS-WELDED OD CLADDING
CORE SPRAY: 4 SAFE END WELDS DUE TO AS-WELDED OD CLADDING.

NOTE 2: ISOLATION CONDENSER-4 PENETRATIONS REPLACED DELETING 8 UNINSPECTABLE WELDS-ALL PIPING ON 75' ELEVATION REPLACED WITH RESISTANT MATERIAL (75 WELDS REMOVED AND 41 INSTALLED).

TABLE 3

STATUS OF UNINSPECTED WELDS
AFTER 14R

SYSTEM	TOTAL WELDS	UNINSPECTABLE WELDS (NOTE 1)	UNINSPECTED INSPECTABLE WELDS REMAINING
RECIRCULATION	89	25	0
SHUTDOWN COOLING	11	0	0
CORE SPRAY	26	4	0
RWCU			
° INSIDE 2ND VALVE			
° INSIDE DRYWELL	35	5	0
° OUTSIDE DRYWELL	16	0	0
° OUTSIDE 2ND VALVE	96	0	93
ISOLATION CONDENSER			
° INSIDE 2ND VALVE	50	10	0
° OUTSIDE 2ND VALVE	97	0	0
CLOSURE HEAD	8	0	0
TOTAL	430	44	93

NOTE 1: RECIRCULATION: 5 CASTING-TO-CASTING WELDS, 20 SAFE END WELDS (5 SAFE END TO PIPE/FITTING WELDS INSPECTED FROM ONE SIDE ONLY) DUE TO SAFE END AS-WELDED OD CLADDING.
RWCU: 5 WELDS IN PENETRATIONS
ISOLATION CONDENSER: 4 FLUED HEAD-TO-VALVE WELDS, 2 CASTING-TO-CASTING WELDS, 4 SAFE END WELDS DUE TO AS-WELDED OD CLADDING
CORE SPRAY: 4 SAFE END WELDS DUE TO AS-WELDED OD CLADDING.

TABLE 4

Reactor Water Clean-up System

Inside 2nd CIV: Total welds = 51, Uninspectable welds = 5
Outside 2nd CIV: Total welds = 96, Uninspectable welds = 0

	Category of Welds Before 12R							Inspections
	A	B	C	D	E	F	G	12R
Per GL 88-01								
inside 2nd CIV	0	0	0	10	0	0	36	41
outside 2nd CIV	0	0	0	0	0	0	96	96
Per GPUN Plan								
inside 2nd CIV	0	0	0	16	0	0	30	10
outside 2nd CIV	Not in GPUN Plan							

	Category of Welds Before 13R							
	A	B	C	D	E	F	G	13R
Per GL 88-01								
inside 2nd CIV	0	0	0	46	0	0	0	11
outside 2nd CIV	0	0	0	96	0	0	0	25
Per GPUN Plan								
inside 2nd CIV	0	0	0	26	0	0	20	10
outside 2nd CIV	Not in GPUN Plan							

	Category of Welds Before 14R							
	A	B	C	D	E	F	G	14R
Per GL 88-01								
inside 2nd CIV	4	0	0	42	0	0	0	10
outside 2nd CIV	0	0	0	96	0	0	0	25
Per GPUN Plan								
inside 2nd CIV	4	0	0	29	0	0	13	20
outside 2nd CIV	Not in GPUN Plan							

TABLE 5

Isolation Condenser Piping Outside 2nd CIV

Total Welds = 131
Uninspectable Welds = 2

	Category of Welds Before 12R							Inspections
	A	B	C	D	E	F	G	12R
Per GL 88-01	0	0	0	40	19	0	70	101
Per GPUN Plan	0	0	0	93	19	0	17(1)	19
	Category of Welds Before 13R							
	A	B	C	D	E	F	G	13R
Per GL 88-01	0	0	0	110	19	0	0	59
Per GPUN Plan	0	0	0	97	19	0	13	10
	Category of Welds Before 14R							
	A	B	C	D	E	F	G	14R
Per GL 88-01	41	0	0	44	10	0	0	29
Per GPUN Plan	41	0	0	44	10	0	0	7

(1) All welds are the result of partial piping replacement implemented in 10R.

TABLE 5

All Other Systems (*)

Total Welds = 167
Uninspectable Welds = 19

Category of Welds Before 12R

	A	B	C	D	E	F	G	Inspections 12R
Per GL 88-01	0	0	61	26	3	0	58	92
Per GPUN Plan	0	0	61	39	3	0	45	29

Category of Welds Before 13R

	A	B	C	D	E	F	G	13R
Per GL 88-01	0	0	92	53	3	0	0	52
Per GPUN Plan	0	0	92	33	3	0	20	44

Category of Welds Before 14R

	A	B	C	D	E	F	G	14R
Per GL 88-01	12	116	17	3	0	0	0	61
Per GPUN Plan	12	116	17	3	0	0	0	20

*This Table includes recirc (excluding safe ends), core spray (excluding safe ends), isolation condenser piping inside 2nd CIV (excluding safe ends), shutdown cooling and closure head piping.

TABLE 7
OYSTER CREEK
SAMPLE AND INSPECTION SIZE HISTORY
OUTAGE 10R

- REQUIRED INSPECTIONS PER IEB 82-03
  - RECIRCULATION SYSTEM ONLY
    - ORIGINALLY 16 WELDS
      - HIGH STRESS RULE INDICES
      - WELD REPAIRS PERFORMED DURING CONSTRUCTION
      - WELDS SIMILARLY LOCATED TO NMP-1 CRACKS
    - INCREASED TO 22 WELDS
      - ADDED ADDITIONAL WELDS REPAIRED DURING CONSTRUCTION
    - INCREASED TO 31 WELDS
      - DUE TO POSSIBLE IGSCC INDICATIONS OF 2 WELDS ADDED ALL SIMILARLY LOCATED WELDS AS 2 POSSIBLE INDICATIONS NOTED ABOVE.
    - NO INDICATIONS
- NORMAL ISI WELDS INSPECTED FOR IGSCC
  - 3 CORE SPRAY WELDS
    - NO INDICATIONS
  - 2 SHUTDOWN COOLING WELDS
    - NO INDICATIONS
- DISCOVERY OF THRU-WALL LEAK ON ISOLATION CONDENSER CONDENSATE PIPING OUTSIDE DRYWELL
  - 100% INSPECTION OF ISOLATION CONDENSER PIPE OUTSIDE DRYWELL
    - 27 IGSCC INDICATIONS
      - 18 WELD OVERLAY REPAIRED
      - 9 REPLACED WITH NEW MATERIAL
  - INSPECTED 19 ISOLATION CONDENSER WELDS INSIDE DRYWELL
    - NO INDICATIONS
  - 10 RWCU WELDS INSPECTED
    - 4 INSIDE DRYWELL
    - 3 INSIDE 2ND VALVE-OUTSIDE DRYWELL
    - 3 OUTSIDE 2ND VALVE-OUTSIDE DRYWELL
    - NO IGSCC INDICATIONS

TABLE 8
OYSTER CREEK
SAMPLE AND INSPECTION SIZE HISTORY
OUTAGE 11R

- INSPECTION CRITERIA GL 84-11
  - 64 RECIRCULATION WELDS INSPECTED
    - 3 IGSCC INDICATIONS
      - 2 WELD OVERLAY REPAIRED
      - 1 LEFT AS STRESS IMPROVED
  - 10 RWCU WELDS INSPECTED
    - NO IGSCC INDICATIONS
  - 6 SHUTDOWN COOLING WELDS INSPECTED
    - NO IGSCC INDICATIONS
  - 16 CORE SPRAY WELDS INSPECTED
    - NO IGSCC INDICATIONS
  - 12 ISOLATION CONDENSER WELDS INSIDE 2ND ISOLATION VALVE INSPECTED
    - NO IGSCC INDICATIONS
- ISOLATION CONDENSER OUTSIDE DRYWELL
  - INSPECTED 18 WELD OVERLAY REPAIRS FROM 10R
    - NO INDICATIONS
  - 20 ADDITIONAL WELDS INSPECTED
    - 1 IGSCC INDICATION (WELD OVERLAY REPAIR - 11R)
    - GEOMETRIC REFLECTOR IN 10R
    - 20 ADDITIONAL WELDS INSPECTED IN 10R WITH GEOMETRIC REFLECTORS
    - NO ADDITIONAL IGSCC FOUND