Entergy	CONDITION REPORT	CR-IP2-2001-10525

Originator: MALONE, HAZEL **Originator Phone:** 0
Originator Site Group: IP2 ENG P&C-Code Programs Staff **Operability Required:** Y
Supervisor Name: SCHWARTZ, GEOFFREY **Reportability Required:** N
Discovered Date: 10/31/2001 00:00 **Initiated Date:** 10/31/2001 00:00

Condition Description:

CR Date: 10/31/2001 12:33
CR Entered Date: 10/31/2001 14:21
UT inspections were performed on sections of Crossunder piping as the result of a pinhole leak found on the MSR21A inlet piping during the cycle (see CR# 200103681). Areas on the expansion joints and piping upstream of MSR21A show measured thickness below or close to allowable minimum wall (0.247") based on UT results taken during the mid-cycle outage. The cause of these thinned areas is believed to be Flow Accelerated Corrosion (FAC). It is recommended that these areas be repaired at this time. Design Engineering has been notified and temporary repair of thinned areas are being performed. See drawings attached for location of thinned area and the mearsured thickness readings of these areas.

Immediate Action Description:

Evaluated thinned areas and worked with Design Engineering to develop temporary repair for degraded areas.

Suggested Action Description:

EQUIPMENT:

Tag Name	Tag Suffix Name	Component Code	Process System Code
21AMSR			MS

REFERENCE ITEMS:

Type Code	Item Desc
CR	200103681
CR	200103681
CR	200110521
CR	200110526
DETECTION	SI
LOCATION	Turbine
WON	01-23886
WON	01-23886 Y
WON	01-24370
WON	01-24370 Y

TRENDING (For Reference Purposes Only):

Trend Type	Trend Code
PR	PR-CORROSION & EROSION (ALL WALL-THINNING PROCESSE
OR	OR-DESIGN ENGINEERING
EQ	EQ-AH
KA	KA-IN

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 1

	Site	Group	Name
Assigned By:	IP2	CA&A Staff	E-CAPTAIN, CRS
Assigned To:	IP2	ENG P&C-Code Programs Mgmt	Azevedo,Nelson F
Subassigned To :	IP2	ENG P&C-Code Programs Staff	MALONE, HAZEL

Originated By:	E-CAPTAIN, CRS	11/1/2001 00:00:00
Performed By:	Azevedo,Nelson F	11/29/2001 00:00:00
Subperformed By:	MALONE, HAZEL	11/26/2001 00:00:00
Approved By:		
Closed By:	E-CAPTAIN, CRS	11/29/2001 00:00:00

Current Due Date: 12/01/2001 **Initial Due Date:** 12/01/2001

CA Type: DISP - CORR ACTION

Plant Constraint: NONE

CA Description:

Please evaluate to determine apparent cause and recommend corrective actions. (cbh)

CA REFERENCE ITEMS:

Type Code	Description
CRS ID	254719

Response:

Subresponse :

11/09/2001 Assigned to: MALONE, HAZEL Status: Closed + Approved

Action Requsted: Hazel, please evaluate this SL2 and provide corrective actions as required. Nelson
Assignee Response: See SL Report

Reviewer Comment:
Although this CR was classified as an SL2, the wall thinning detected during the mid-cycle inspection was a result of Flow Accelerated Corrosion (FAC) which is a well understood degradation mechanism and it is well modeled in industry and in IP2 FAC analysis. No causal factors or any other evaluation was perfformed on this CR because it was considered provide no additional value to this already, well understood phenomena. Based on this, it is requested that this CR be downgraded to an SL3 and closed as such.

Nelson Azevedo
11/29/01
Significance Level 3 Report
UT inspections were performed on the 26.5" ID vertical riser section of crossunder piping leading to MSR21A as the result of a pinhole leak which occurred in this section during the cycle (See CR# 200103681). Results of the UT inspections performed found an additional thinned area on the same expansion joint containing the pinhole leak and a thinned area on a pup piece adjacent to that expansion joint (See attachment for locations of thinned areas). The thinned areas found measured below or close to allowable minimum wall thickness (See wear rate/structural evaluation for each component inspected for details).

Cause of wear is believed to be the result of Flow Accelerated Corrosion (FAC). FAC is the process whereby the protective oxide layer on carbon steel piping is dissolved by flowing water or wet steam which results in the wearing away of the underlying metal. Main Steam exhausted from the High Pressure Turbine enters the Crossunder piping as a wet steam, that can contain as much as 20% moisture. This wet steam mixture combined with the high fluid velocity and high temperature of this piping system can result in extremely high wear rates and establishes Crossunder piping as one of the most susceptible systems to FAC. Though the IP2 FAC program history shows that all crossunder piping was completely weld overlaid with Stainless Steel to prevent wear, certain areas near expansion joints were not weld overlaid due to restrictions on welding near the expansion joints links (dogbones). Certain areas near these expansion joint dogbones may have been consequently left as Carbon Steel due to these restrictions and are still vulnerable to the effects of FAC. The leak that occurred during the cycle 15, as well as the thinned areas found during the mid-cycle outage were all located in the vicinity of the expansion joints. Thinned areas located during the mid cycle inspection will be temporarily repaired externally per WO# 01-23886 until they can be visually inspected internally during the 2002 refueling outage and permanently repaired. Internal inspections are recommended to determine the location of the expansion dogbones and also to locate areas not weld overlayed that may need repair. Internal inspections of crossunder piping will be added to the scope of the 2002 refueling outage as part of the FAC outage inspection scope (see FAC Master Inspection List for details) and may include inspection of parallel trains or similar expansion joint areas.
Permanent repair of thinned areas will be performed under work order 01-24370. Methods of permanent repair as well as expansion joint replacement options should be researched and planned for accordingly prior to the outage to ensure proper scheduling.

- -

Thinned areas located during the mid cycle inspection will be temporarily repaired externally per WO# 01-23886 until they can be visually inspected internally during the 2002 refueling outage and permanently repaired. Internal inspections are recommended to determine the location of the --- see attachment for rest ---

Closure Comments:

reject per CAG quality review

Attachments:

Subresp Description
11/09/2001 Assigned to: MA

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 2

	Site	Group	Name
Assigned By:	IP2	CA&A Staff	E-CAPTAIN, CRS
Assigned To:	IP2	ENG P&C-Code Programs Mgmt	Azevedo,Nelson F
Subassigned To :			

Originated By:	E-CAPTAIN, CRS	12/4/2001 00:00:00
Performed By:	Azevedo,Nelson F	12/4/2001 00:00:00
Subperformed By:		
Approved By:		
Closed By:	Azevedo,Nelson F	12/4/2001 00:00:00

Current Due Date: 12/06/2001 **Initial Due Date:** 12/06/2001

CA Type: DISP - CORR ACTION

Plant Constraint: NONE

CA Description:

reject per CAG quality review

Downgraded from SL2 to SL3 per Joe Barlok. Due date changed to 12/6/01...12/4/01 MK

CA REFERENCE ITEMS:

Type Code	Description
CRS ID	260983

Response:

Significance Level 3 Report
UT inspections were performed on the 26.5" ID vertical riser section of crossunder piping leading to MSR21A as the result of a pinhole leak which occurred in this section during the cycle (See CR# 200103681). Results of the UT inspections performed found an additional thinned area on the same expansion joint containing the pinhole leak and a thinned area on a pup piece adjacent to that expansion joint (See attachment for locations of thinned areas). The thinned areas found measured below or close to allowable minimum wall thickness (See wear rate/structural evaluation for each component inspected for details).

Cause of wear is believed to be the result of Flow Accelerated Corrosion (FAC). FAC is the process whereby the protective oxide layer on carbon steel piping is dissolved by flowing water or wet steam which results in the wearing away of the underlying metal. Main Steam exhausted from the High Pressure Turbine enters the Crossunder piping as a wet steam, that can contain as much as 20% moisture. This wet steam mixture combined with the high fluid velocity and high temperature of this piping system can result in extremely high wear rates and establishes Crossunder piping as one of the most susceptible systems to FAC. Though the IP2 FAC program history shows that all crossunder piping was completely weld overlaid with Stainless Steel to prevent wear, certain areas near expansion joints were not weld overlaid due to restrictions on welding near the expansion joints links (dogbones). Certain areas near these expansion joint dogbones may have been consequently left as Carbon Steel due to these restrictions and are still vulnerable to the effects of FAC. The leak that occurred during the cycle 15, as well as the thinned areas found during the mid-cycle outage were all located in the vicinity of the expansion joints. Thinned areas located during the mid cycle inspection will be temporarily repaired externally per WO# 01-23886 until they can be visually inspected internally during the 2002 refueling outage and permanently repaired. Internal inspections are recommended to determine the location of the expansion dogbones and also to locate areas not weld overlayed that may need repair. Internal inspections of crossunder piping will be added to the scope of the 2002 refueling outage as part of the FAC outage inspection scope (see FAC Master Inspection List for details) and may include inspection of parallel trains or similar expansion joint areas.
Permanent repair of thinned areas will be performed under work order 01-24370. Methods of permanent repair as well as expansion joint replacement options should be researched and planned for accordingly prior to the outage to ensure proper scheduling.

- -

Thinned areas located during the mid cycle inspection will be temporarily repaired externally per WO# 01-23886 until they can be visually inspected internally during the 2002 refueling outage and permanently repaired. Internal inspections are recommended to determine the location of the expansion dogbones and also to locate areas not weld overlayed that may need repair. Internal inspections of crossunder piping will be added to the scope of the 2002 refueling outage as part of the FAC outage inspection scope (see FAC Master Inspection List for details) and may include inspection of parallel trains or similar expansion joint areas.
Permanent repair of thinned areas will be performed under work order 01-24370. Methods of permanent repair as well as expansion joint replacement options should be researched and planned for accordingly prior to the outage to ensure proper scheduling.

Subresponse :

Closure Comments:

N/A

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 3

	Site	Group	Name
Assigned By:	IP2	CA&A Staff	E-CAPTAIN, CRS
Assigned To:	IP2	ENG SYS-Balance of Plant Staff	Ray,Bryan J
Subassigned To :			

Originated By: E-CAPTAIN, CRS 11/1/2001 00:00:00
Performed By: Ray,Bryan J 11/3/2001 00:00:00
Subperformed By:
Approved By:
Closed By: Ray,Bryan J 11/3/2001 00:00:00

Current Due Date: 11/08/2001 **Initial Due Date:** 11/08/2001
CA Type: CRS - FYI
Plant Constraint: NONE
CA Description:
For your information on equipment with your system.

CA REFERENCE ITEMS:

Type Code	Description
CRS ID	254720

Response:

Subresponse :

Closure Comments:
N/A

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 4

	Site	Group	Name
Assigned By:	IP2	CA&A Staff	E-CAPTAIN, CRS
Assigned To:	IP2	ENG P&C-Code Programs Mgmt	Azevedo,Nelson F
Subassigned To :			

Originated By: E-CAPTAIN, CRS 12/4/2001 00:00:00
Performed By: Azevedo,Nelson F 2/1/2002 00:00:00
Subperformed By:
Approved By:
Closed By: Azevedo,Nelson F 2/1/2002 00:00:00

Current Due Date: 02/17/2002 **Initial Due Date:** 02/17/2002

CA Type: CR CLOSURE REVIEW

Plant Constraint: NONE

CA Description:
Follow up on corrective action assignments

CA REFERENCE ITEMS:

Type Code	Description
CRS ID	261193

Response:
Since the corresponding ICAs have been adequately implemented, this CR is ready for closure.

Subresponse :

Closure Comments:
N/A

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 5

	Site	Group	Name
Assigned By:	IP2	ENG P&C-Code Programs Mgmt	Azevedo,Nelson F
Assigned To:	IP2	ENG P&C-Code Programs Staff	MALONE, HAZEL
Subassigned To :			

Originated By:	Azevedo,Nelson F	12/4/2001 00:00:00
Performed By:	MALONE, HAZEL	1/18/2002 00:00:00
Subperformed By:		
Approved By:		
Closed By:	Azevedo,Nelson F	1/18/2002 00:00:00

Current Due Date: 01/18/2002 **Initial Due Date:** 01/18/2002

CA Type: PERFORM CA

Plant Constraint: NONE

CA Description:

Add internal inspection of MSR vertical risers to FAC Master Inspection List (MIL) for 2002 refueling outage.

CA REFERENCE ITEMS:

Type Code	Description
CRS CLASS	1
CRS ID	261191

Response:

Internal inspection of 21A&B, 22A&B and 23A&B MSR vertical risers will be added to FAC Master Inspection List (MIL) for 2002 refueling outage. Final MIL is due for release 1/31/2002

Subresponse :

Closure Comments:

Please reflect the fact that the inspection locations have been added to the inspection list even though the final list will not be issued until 1/31/02.

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 6

	Site	Group	Name
Assigned By:	IP2	ENG P&C-Code Programs Mgmt	Azevedo,Nelson F
Assigned To:	IP2	ENG P&C-Code Programs Staff	MALONE, HAZEL
Subassigned To :			

Originated By:	Azevedo,Nelson F	12/4/2001 00:00:00
Performed By:	MALONE, HAZEL	1/18/2002 00:00:00
Subperformed By:		
Approved By:		
Closed By:	Azevedo,Nelson F	1/18/2002 00:00:00

Current Due Date: 01/18/2002 **Initial Due Date:** 01/18/2002

CA Type: PERFORM CA

Plant Constraint: NONE

CA Description:

Research methods of permanent repairs for previously temporary repaired areas of crossunder piping. Also, research the cost and resource information for the replacement of crossunder expansion joints to determine if this option is practicable.

CA REFERENCE ITEMS:

Type Code	Description
CRS CLASS	1
CRS ID	261192

Response:

There have been many different methods used to permanently repair these areas of crossunder piping. The following are descriptions of these methods:

1. Welding under expansion dogbones
One option of repair that has been performed at plants such as Surry is to remove the expansion dogbones, perform Stainless steel cladding to expose piping underneath and replace dogbones. Advantages to this repair method are that the entire area would be protected (including area under dogbones) and thinned areas of piping can be brought back up to nominal thickness by the overlay. Disadvantages to this repair is that it is not a recommended repair method of Westinghouse because it may jeopardize the flexibility of the expansion joint and that extra time will be needed to perform the engineering to analyze this concern.

2. Stainless Steel Tubing Repair
This repair option was used at St. Lucie Unit 1 & 2 to repair eroded area under dogbones. A stainless steel piece of tubing was placed next to the dogbones and welded in place. The tubing was then deformed to ensure a secure fit up to the dogbone (see attachment for details). Advantages to this repair are that there is no welding to the dogbone and no arc strikes on the dogbone as recommended by Westinghouse. Disadvantage to this repair is that if there is not a consistent bond between the tubing and the dogbone, steam can still get into that area and erode the piping underneath.

3. Stainless Steel Covering over dogbones
During the last CHECWORKs Users Group (CHUG) meeting (January 14&15, 2002), it was mentioned the Point Beach has welded stainless steel covers over the dogbones in their crossunder piping. At this time, Point Beach FAC engineer has provided no additional information.

4. Welding on Outside of crossunder piping
A 1995 letter to Westinghouse on the subject of repairing eroded areas of crossunder piping from the outside yield the following response:

These eroded areas beneath the expansion joint link (dogbones) can be repaired from the outside of the pipe. The eroded area beneath the link should be ground out and weld repaired using 309 stainless as per PS 600374 for the first few passes to provide an erosion resistant inner surface. The remaining cavity should be built-up with carbon steel weld material as per PS 600945 Part 1-1-1-B. Post weld heat treatment should not be performed for any of the above welding processes.

The expansion joint link should not be subjected to any arc strikes during the welding process. It is recommended that a copper backing plate be placed between the link and the area of repair to protect the link during welding.

A carbon steel backing plate can be welded over the repaired area on the outside diameter of the pipe, if desired. This welding should be performed to PS 600945 1-1-1-B. No PWHT is to be performed.

Advantages of this repair are that it is a recommended repair from the expansion joint vendor (Westinghouse) and that it would restore original pipe thickness. Would need to obtain welding procedure from Westinghouse if similar procedure is not available.

Replacement of Expansion Joint sections (21A & 21B Vertical Risers) was also investigated for this RES. At the time of this response, Westinghouse (Siemens) had not replied with an estimate for replacing both 21A and 21B vertical risers. The following information was provided from proposals of IP3 1997 Crossunder replacement of their 31A and 31B vertical risers and IP2 1995 Crossunder replacement of 32"expansion joints under the HP turbine.

IP2 32" Expansion Joints under HP Turbine (1995)
- o Material cost - $24,160 (8, 32" Plates of 1-1/4 Chrome)
- o Heat Treatment of 32" Expansion Joints - $17,086.76 (15 days to perform)

IP3 31A & 31B Vertical Riser Replacement (1997)
- o Lump sum quote for design/engineering of all MSR vertical risers and --- see attachment for rest ---

Subresponse :

Closure Comments:

N/A

Attachments:

Resp Description

There have been many different

Entergy	CORRECTIVE ACTION	CR-IP2-2001-10525

CA Number: 7

	Site	Group	Name
Assigned By:	IP2	ENG P&C-Code Programs Mgmt	Azevedo,Nelson F
Assigned To:	IP2	ENG P&C-Code Programs Staff	MALONE, HAZEL
Subassigned To :			

Originated By: Azevedo,Nelson F 1/18/2002 00:00:00
Performed By: MALONE, HAZEL 1/18/2002 00:00:00
Subperformed By:
Approved By:
Closed By: Azevedo,Nelson F 1/18/2002 00:00:00

Current Due Date: 01/18/2002 **Initial Due Date:** 01/18/2002

CA Type: PERFORM CA

Plant Constraint: NONE

CA Description:
Please reflect the fact that the inspection locations have been added to the inspection list even though the final list will not be issued until 1/31/02.

CA REFERENCE ITEMS:

Type Code	Description
CRS CLASS	1
CRS ID	270378

Response:
Internal inspections of 21A&B, 22A&B and 23A&B MSR vertical risers have been added to FAC Master Inspection List (MIL) for the 2002 refueling outage. The final MIL is due for release 1/31/2002

Subresponse :

Closure Comments:
N/A