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Using the EPRI Risk-Informed ISI Methodology on Piping Systems in Forsmark 3

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SSM Perspective

Background

In the SSM regulation SSMFS 2008:13, it is stated that the selection of locations for inspection of mechanical components shall be based upon the risk for core damage or the risk of release of radioactive substances. Both qualitative and quantitative measures of the relative risk are allowed to be used. So far only the PWRs in Sweden are using a quantitative procedure to evaluate the risk whereas all the BWRs are using a qualitative risk procedure based upon the so-called damage index and consequence index.

All Nuclear Power Plants in Sweden have a fairly detailed PSA analyses and it is now of interest to find out if such PSA analyses can assist the selection of piping components for inspection also for BWRs. The EPRI-procedure is a semi-quantitative methodology which uses the PSA information together with the assessment of the failure potential from different degradation mechanisms to perform a risk evaluation.

Objectives of the project

The principal objective of the project is to use the EPRI procedure for risk-informed In-Service Inspection to select piping components for inspection and compare the outcome with the presently used qualitative risk procedure on Forsmark 3.

Results

Five piping systems in Forsmark 3 were chosen for the pilot study, main steam 311, feedwater line 312, residual heat removal 321, low pressure injection 323 and the condensate system 462. The results of the risk ranking show a general similarity between the EPRI procedure and the present qualitative risk procedure. Certain differences have been found, for example:

- No pipe system were assigned high consequence (consequence index 1) with the qualitative risk procedure whereas several pipe segments using the EPRI procedure were ranked to be high consequence based on the plant PSA analysis.

- In system 462, several pipe segments had a potential for Flow Accelerated Corrosion (FAC) which together with the consequence ranking were categorized as high risk. The same segments were outside the scope of the present qualitative risk procedure because the segments were located outside the containment in areas where no consequence index are defined.

Effects on SSM supervisory and regulatory task
The results of this project will be used by SSM in the improvement of the selection procedure for locations of inspection of piping components.

Project information
Project leader at SSM: Björn Brickstad
Project number: SSM 2009/1641
Project Organization: EPRI has managed the project with Patrick O'Regan as the project manager. Jan Lötman and his co-workers at Forsmarks Kraftgrupp AB have supplied plant information to the project with the help of Johan Sandstedt, Risk Pilot AB for the PSA input.

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1 Introduction

1.1 Objective

The objective of this project is a pilot plant demonstration of the EPRI RI-ISI Methodology to selected systems at Forsmark, Unit 3 (F3). As described in section 2, five systems were selected for evaluation. These systems were selected because they allow this project to focus on a number of issues of interest in developing a RI-ISI methodology and RI-ISI program. This includes the following:

- Several different types of degradation may be identified,
- Several different types of “consequence of failure” may be identified,
- Different types of safety systems are evaluated
- Non-safety systems are evaluated

Using the results of this application, insights and comparisons between SKIFS and the EPRI methodologies’ are provided including the following:

- Consequence of pressure boundary failure (PBF) as described in Section 3.14.
- Degradation mechanism evaluation as described in Section 4.8.
- Risk ranking as described in Section 5.
- Element selection for inspection as described in Section 6.
- Risk impact as described in Section 7.

An overview of both the EPRI and SKIFS methodologies are provided in the following sections.

1.2 Overview of EPRI RI-ISI Methodology

The EPRI Risk-informed inservice inspection (RI-ISI) methodology [1] was developed as an alternative to deterministic ISI programs. The EPRI RI-ISI methodology, which is depicted in Figure 1, is implemented by following a six step process:

1. Definition of RI-ISI program scope.
2. Failure Mode and Effects Analysis (FMEA) of Pipe Segments.
    a. Evaluation of consequences of pipe failures.
    b. Evaluation of pipe failure potential.
3. Characterization of risk segments.
4. Inspection element selection.
5. Evaluation of risk impact of changes to the inspection program.
6. Incorporation of long term RI-ISI program.

The first step is to decide on the scope of the RI-ISI program. Options include:

- Large scope applications that include Safety Class 1, 2, and 3 and other piping systems important to safety;
- Selection of one or more Classes of piping (e.g. reactor coolant pressure boundary), or
- Selection of one or more individual piping systems.

It is assumed that any piping or systems not selected for the RI-ISI program scope will be retained within the current plant inservice inspection program. An additional decision that must be made to set the scope of the RI-ISI program is to decide whether piping systems and degradation mechanisms covered within other inspection programs, will be incorporated into the RI-ISI program, or left unchanged. Those augmented inspection programs that may be typically subsumed are discussed in more detail in Section 6.5 of Reference [1].

The second step is to perform an FMEA of the piping systems within the RI-ISI program scope. In Figure 1, this step is broken down into four distinct sub-steps as this is where most of the resources are applied in developing and implementing a RI-ISI program. The FMEA is normally performed on a system by system basis and leads to the definition of piping segments that have common potential for failure and common consequence potential. Segments with the same failure potential and same consequence potential are combined into risk segments in step 3.

While the analysis is conducted on a segment basis, it is for ease of use rather than being a technical component of the analyses. As such, differences in segment definition or segment boundary definition will have no impact on the final results for applications using the EPRI RI-ISI methodology.

The consequences of pipe rupture are measured in terms of the conditional probability of core damage given a pipe rupture (CCDP) and the conditional probability of large early release given a pipe rupture (CLERP). These measurements require quantitative risk estimates obtained from the plant specific PSA models available for the given plant. Application of this step is further discussed in Section 3 of this report.

In a similar fashion, failure potential of each pipe location needs to be assessed in terms of the relative potential for pipe rupture. By evaluating physical conditions needed for various degradation mechanisms to be operative against plant-specific operating and material conditions, failure potential can be correlated to quantitative estimates of pipe rupture frequency derived from service experience. Application of this step is further discussed in Section 4 of this report.

As discussed previously, piping segments with the same failure potential and consequence potential are defined as “risk segments.”

Pipe elements (e.g. welds) within each segment are candidate locations to be selected for the inspection program based on the risk characterization of the segment to which each element belongs. In step 3, each segment is placed onto the appropriate place on the EPRI segment risk characterization matrix as described in Figure 2 based on three broad categories of failure potential (high, medium, or low) and four broad categories of consequence potential (high, medium, low, or none). Based on the combination of failure potential and consequence categories, each location on the risk matrix is assigned to one of three broad risk regions that are correlated to ranges of absolute levels of core damage frequency (CDF) and large early release frequency (LERF). Application of this step is further discussed in Section 5 of this report.

In step 4, the revised set of inspection requirements is defined. Specific locations on the risk matrix are selected for the inspection program based on the segment's risk ranking and a set of practical considerations that bear on the feasibility and effectiveness of the specific inspection. For those locations selected for NDE inspections, the inspections are focused on the type of degradation mechanism identified in step 2. The ability to focus the examination on specific damage mechanism(s) enhances the effectiveness of the retained inspections.

As a final analysis step, it must be shown that the changes in risk due to changes in the inspection program do not pose a significant risk impact as determined by changes in CDF or LERF. The EPRI approach to RI-ISI has been designed to ensure that risk impacts associated with enhancements to the inspection program, such as those that will be brought about by focusing inspections on high and medium risk locations, and those from gearing the examinations to those damage mechanisms most likely to be observed, will exceed any risk increases associated with eliminating inspections from current deterministic based programs. Hence, significant adjustments to the locations that were initially selected, in order to demonstrate that risk impact requirements are not exceeded, are not anticipated. Nonetheless, in this step, it must be confirmed that the initial selection of elements for the RI-ISI program does not produce an unfavorable and unacceptable risk impact.

1.3 Overview of SKIFS Methodology

The SKIFS approach is very similar to EPRI's in that both consequence and degradation is evaluated and then welds are ranked in a risk matrix (see Figure 3). As shown in Figure 3, the EPRI and SKIFS matrices are mirror images of each other. This is because the SKIFS consequences are ranked from left to right as High (1), Medium (2) and Low (3) where as the EPRI ranking in Figure 2 is just the opposite. This has no technical impact, only visual effects. The following summaries the SKIFS evaluation steps:

- Consequence index (KI) is determined based on proximity of piping to the reactor vessel and isolation valves. Section 3.14 describes the criteria in more detail where the results of both the EPRI and SKIFS evaluations are compared.

- Degradation potential or damage index (SI) is determined based on degradation mechanism potential and mechanical fatigue. Section 4.8 describes the criteria in more detail where the results of both the EPRI and SKIFS evaluations are compared.

- Inspection groups are determined using the risk matrix in Figure 3. Section 5 describes the criteria in more detail where the risk ranking results for both EPRI and SKIFS are compared.

- Elements are selected for inspection. Sections 5 and 6 describe the criteria in more detail where the results for both EPRI and SKIFS are compared.

This study is based upon F3 implementation of SKIFs guidance as well as other consideration as documented in the PMT program and provided in Reference 6.

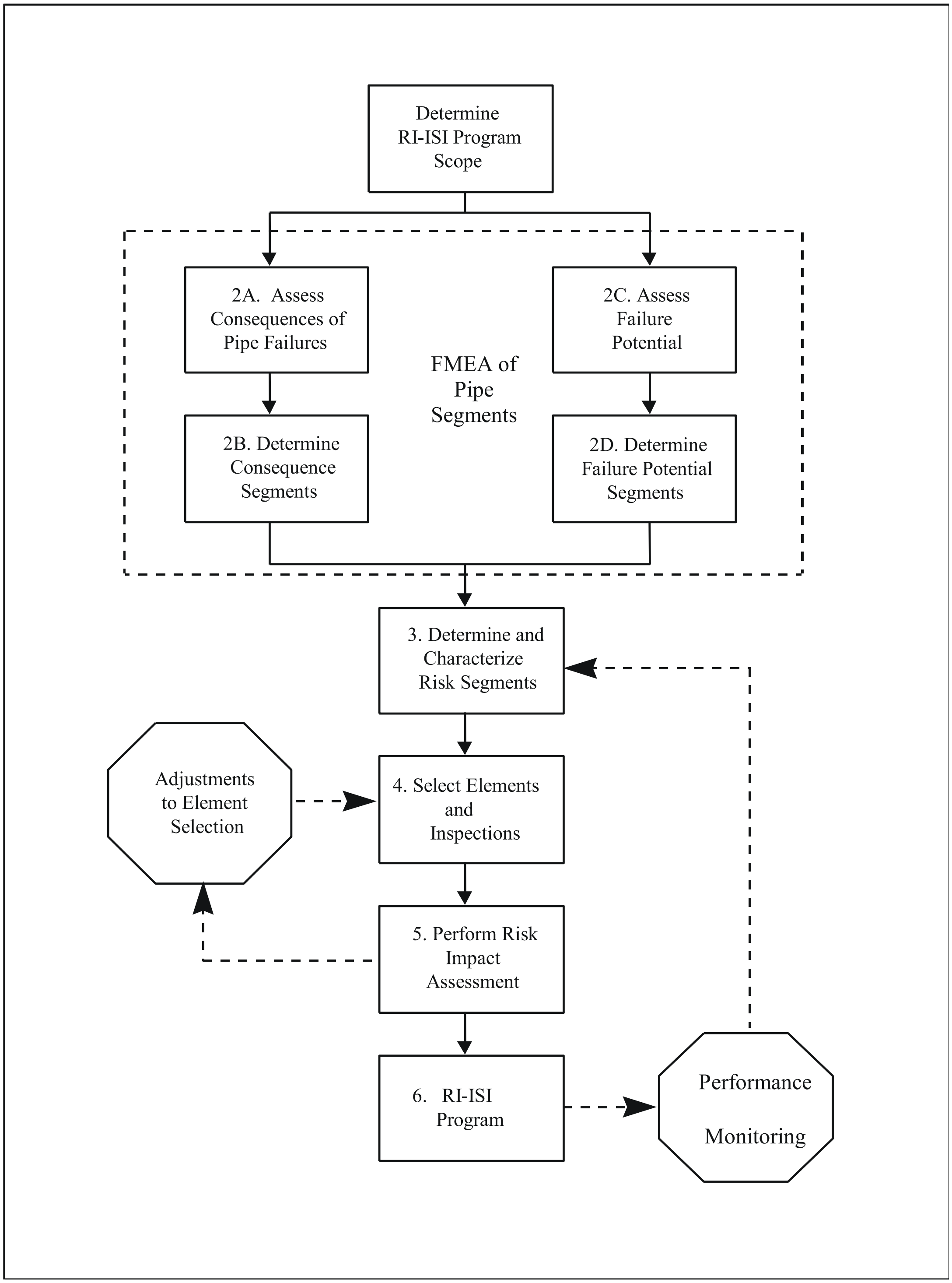


Figure 1: Overview of the EPRI RI-ISI Methodology

POTENTIAL FOR PIPE RUPTURE PER DEGRADATION MECHANISM SCREENING CRITERIA	CONSEQUENCES OF PIPE RUPTURE IMPACTS ON CONDITIONAL CORE DAMAGE PROBABILITY AND LARGE EARLY RELEASE PROBABILITY			
	NONE	LOW	MEDIUM	HIGH
HIGH FLOW ACCELERATED CORROSION	LOW Category 7	MEDIUM Category 5	HIGH Category 3	HIGH Category 1
MEDIUM OTHER DEGRADATION MECHANISMS	LOW Category 7	LOW Category 6	MEDIUM Category 5	HIGH Category 2
LOW NO DEGRADATION MECHANISMS	LOW Category 7	LOW Category 7	LOW Category 6	MEDIUM Category 4

Figure 2: EPRI Matrix for Segment Risk Characterization

		Consequence Index (KI)		
		1	2	3
Damage Index (SI)	I	Inspection Group A	Inspection Group A	Inspection Group B
	II	Inspection Group A	Inspection Group B	Inspection Group C
	III	Inspection Group B	Inspection Group C	Inspection Group C

Note that in practice there is also a “None” consequence index utilized by SKIFS similar to EPRI

Figure 3: SKIFS Risk Matrix

2 Evaluation Scope

This scope of this study encompasses five systems and is based upon F3 implementation of SKIFs guidance as well as other consideration as documented in the PMT program and provided in Reference 6.

The systems selected for the F3 pilot study and reasons for selecting these systems are provided below:

- 311 “Main Steam” from the reactor vessel to the 421 system in the Turbine Building
  - Postulated failures may result in a LOCA event
  - Postulated failures may result in a plant transient
  - Piping located inside and outside containment
  - High pressure / temperature steam environment
  - Normally operating system
  - Safety related and non safety related system

- 312 “Feedwater Lines” from the 463 system in the Turbine Building to the reactor vessel
  - Postulated failures may result in a LOCA event
  - Postulated failures may result in a plant transient
  - Piping located inside and outside containment
  - High pressure / temperature water environment
  - Normally operating system
  - Safety related and non safety related system

- 321 “Residual Heat Removal” a closed loop system that takes suction from the reactor vessel and returns to the reactor through the 312 system injection path
  - Postulated failures may result in a plant transient
  - Postulated failures may impact mitigative (standby low pressure portion of system) equipment
  - Piping located inside and outside containment
  - Portions of system experience a high pressure / temperature water environment
  - Portions of system experience a low pressure / temperature water environment
  - Portion of system normally operating
  - Portion of system normally in standby
  - Safety related and non safety related system

- 323 “Low Pressure Injection” takes water from the suppression pool and injects into the reactor vessel
  - Postulated failures may impact mitigative (standby ECCS function) equipment
  - Piping located inside and outside containment
  - Low pressure / temperature water environment
  - System normally in standby
  - Safety related system

- 462 “Condensate” takes water from the condenser hot well and supplies the feedwater system (312) via system 463
  - Postulated failures may result in a plant transient
  - Piping located outside containment
  - Moderate pressure / temperature water environment
  - System normally operating
  - Non-safety related system

3 Consequence Evaluation

The methodology details used in this consequence evaluation of the five Forsmark 3 systems is contained in Reference 1.

3.1 Forsmark 3 PSA

The Forsmark 3 power operation PSA includes both Level 1 and 2 models, which allows core damage frequency (CDF) and large early release frequency (LERF) to be estimated. The list of initiating events includes internal transients and several loss of coolant accidents (LOCA) both inside containment and outside containment. Internal flood and fire initiating events are also included in the model. The following summarizes the power operation PRA results:

Table 1: Forsmark Evaluation Scope

Initiating Event Group	CDF	LERF
All Internal Events (Transient, LOCA)	1.7E-5	2.9E-8
Internal Flood Events	3.3E-8	NA (1)
Internal Fire Events	1.8E-7	NA (1)
External Events	8.7E-6	3.1E-9

(1) Not calculated, but $LERP_{)CD} < 0.1$

Forsmark 3 also has a shutdown model, which is capable of estimating CDF for internal initiating events. This model includes several human induced LOCA events identified from evaluating outage test & maintenance activities. Pipe breaks are not modeled, but these are judged to be much less likely during shutdown and to support outage risk management, it is the human induced events that are important to evaluate. The estimated CDF for a typical refueling outage is on the order of 5E-5/year.

3.2 Configurations, Impact Group and Consequence Rank

The applicable configurations and consequence evaluation impact groups for each system during power operation are identified below per the requirements of the EPRI RI-ISI Methodology:

Table 2: System Configurations and Evaluation Group

System	Configurations (Impact Group)
311 – Main Steam	Operating (initiating event evaluation)
312 – Main Feedwater	Operating (initiating event evaluation)
321 – Residual Heat Removal (high pressure)	Operating (initiating event evaluation) (1)
321 – Residual Heat Removal (low pressure)	Standby (loss of mitigation evaluation) except RCPB (2)
323 – Low Pressure Injection	Standby (loss of mitigation evaluation) except RCPB
462 – Condensate	Operating (initiating event evaluation)

(1) The high pressure RHR system is normally operating to support the chemical inspection (cleanup) function. This system is also credited in the PSA model as supporting the heat removal function.

(2) The low pressure RHR system is normally isolated from the reactor coolant system and used during plant shutdown when going to cold shutdown. This system is not credited in providing a mitigative function in the Forsmark 3 power operation PSA model (heat removal function). However, LOCA initiators due to loss of pressure boundary integrity in this system are evaluated and included in the power operation PSA model.

The applicable impact group evaluations are further summarized below for each system:

Table 3: Applicable Evaluation Groups

System	Initiating Event Evaluations	Loss of Mitigation Evaluations
311 – Main Steam	LOCA, ILOCA, I2LOCA	Not Applicable (1)
312 – Main Feedwater	LOCA, ILOCA, I2LOCA	Not Applicable (1)
321 – RHR (high pressure)	LOCA, ILOCA, I2LOCA	Not Applicable (1)
321 – RHR (low pressure)	LOCA, ILOCA, I2LOCA	Shutdown (2)
323 – LPI	LOCA, PLOCA, P2LOCA	Standby – suction line from suppression pool Demand – pipe discharge piping
462 – Condensate	TF	Not Applicable (1)

(1) Pressure boundary failure during mitigation exposure time is unlikely, given that failure did not cause an initiating event. Initiating event evaluation is bounding.

(2) Since the low pressure RHR train is not credited in the power operation PSA (i.e. low or no consequence of failure), it is evaluated during the plant shutdown configuration when it may be demanded to respond to events that could occur during shutdown.

LOCA = pressure boundary failure in piping connected to the reactor that is not isolable or isolated

ILOCA = isolable pressure boundary failure with normally open valve connected to reactor. Examples of ILOCA pipe segments are pipe segments located upstream of normally open feedwater (312) check valves VA3, VB3, VC3 and VD3.

PLOCA = potential LOCA requires rupture of normally closed valve between reactor and piping. Examples of PLOCA pipe segments are pipe segments located upstream of normally closed LPI (323) check valves VA5, VB5, VC5 and VD5.

I2LOCA = similar to ILOCA except that 2 normally open valves are available to isolate the pipe failure. Examples of I2LOCA pipe segments are pipe segments located upstream of normally open feedwater (312) check valves VA2 and VC2. These pipe segments are also upstream of normally open check valves VA3, VB3, VC3 and VD3.

P2LOCA = similar to PLOCA except that 2 normally closed valves must rupture. Examples of P2LOCA pipe segments are pipe segments that are upstream of normally closed LPI (323) outside containment MOV VA4, VB4, VC4, and VD4. These pipe segment are also upstream of normally closed valves VA5, VB5, VC5 and VD5.

TF = total loss of feedwater initiating event

Standby = pipe failure is postulated to occur with the system in standby, in this case, resulting in a forced plant shutdown (e.g. Technical Specification limitation).

Demand = pipe failure postulated to occur during an independent system demand (e.g. during a LOCA demand).

Once the applicable configuration and impact group has been determined, the plant-specific PSA can be used to determine a consequence rank. The consequence ranking philosophy is summarized as follows:

High Consequence: Pressure boundary failures resulting in events that are important contributors to plant risk and/or pressure boundary failures which significantly degrade the plant's mitigative ability.

Low Consequence: Pressure boundary failures resulting in anticipated operational events and/or pressure boundary failures which do not significantly impact the plant's mitigative ability.

Medium Consequence: This category is included to accommodate pressure boundary failures which fall between the high and low rank.

None Consequence: This category includes failures that have no affect on risk; an example is "abandoned-in-place" piping.

The ranges used to quantitatively define each category are shown below.

Consequence Category	Corresponding CCDP Range	Corresponding CLERP Range
HIGH	CCDP > 1E-4	CLERP > 1E-5
MEDIUM	1E-6 < CCDP ≤ 1E-4	1E-7 < CLERP ≤ 1E-5
LOW	CCDP ≤ 1E-6	CLERP ≤ 1E-7

3.3 Initiating Event Evaluation

Initiating event CCDP (conditional core damage probability) and CLERP (conditional large early release probability) are key inputs to assessing the consequences of pressure boundary failures. The following lists the initiating event results from the F3 PSA model:

Table 4: Initiating Event CCDP & CLERP

Initiating Event	CCDP	CLERP	Consequence
TF – Loss of Feedwater and Main Condenser	8.9E-6	2.1E-8	Medium
TT – Loss of Main Condenser	8.0E-6	2.1E-8	Medium
TS – Scram	7.9E-6	2.1E-8	Medium
S2 – Small LOCA (311, 312, 321, 323)	1.0E-5	2.2E-8	Medium
S1 – Medium LOCA (311, 312, 321, 323)	1.4E-3	3.1E-7	High
A – Large LOCA (311, 312, 321, 323)	3.2E-4	1.0E-7	High

As shown, per the EPRI RI-ISI methodology, medium and large LOCA is a High Consequence and small LOCA is Medium Consequence. Pipe sizes are defined in the Forsmark 3 PSA based on success criteria impact. As shown below, the number of auxiliary feedwater (327, AFW) trains required for successful inventory control determines the upper bound for small LOCA. In the case where AFW does not succeed, the reactor must be depressurized for a small LOCA to allow inventory control with the low pressure injection (LPI) system. The upper bound break size for medium LOCA or the lower bound break size for large LOCA is determined by that break size that guarantees depressurization by the break itself.

Table 5: Success Criteria used to Determine LOCA Break Size

Initiating Event	AFW	Reactor Depressurization for LPI
S2 – Small LOCA	1 of 4	Yes
S1 – Medium LOCA	2 of 4	Yes
A – Large LOCA	2 of 4	Guaranteed Success

Other success criteria such as reactivity control and heat removal are the same for all LOCA initiators in the Forsmark 3 PSA.

The break sizes also depend on whether the break occurs on top of the reactor vessel (steam) or on the bottom of the reactor vessel (water) or in between. The Forsmark 3 PSA considers three potential locations (1) Top (2) Middle and (3) Bottom as summarized below:

Table 6: LOCA Locations and Sizes

System	Location	S2	S1	A
311 – Main Steam	Top	< 169 mm	NA	≥ 169 mm
312 – Feedwater	Middle	< 94 mm	94 to 208 mm	≥ 208 mm
321 – RHR	Middle	< 94 mm	94 to 208 mm	≥ 208 mm
323 – LPI	Middle	< 94 mm	94 to 208 mm	≥ 208 mm
462 – Condensate	LOCA initiating events do not apply			

3.4 Isolable LOCA (ILOCA) and Potential LOCA (PLOCA) inside Containment

Reactor coolant piping failures beyond the 1st isolation valve will have a lower CCDP and CLERP than piping failures that result directly in a LOCA event. This is because in order for the LOCA event to occur, failure of at least one valve must also occur. At Forsmark 3 most of these valves are welded to the containment penetration. The weld associated with the isolation valve being welded to penetration could be conservatively counted with the LOCA group from a pipe break frequency perspective, but from an element selections perspective, it is not conservative. This is because the weld could be chosen during element selection instead of a weld from the LOCA group which has a higher risk. Thus, these welds will be assigned to the appropriate ILOCA or PLOCA category.

Table 7: ILOCA and PLOCA inside Containment

Isolable/Potential LOCA	Valve Failure Probability (1)	LOCA CCDP (2)	CCDP (3)	Consequence (4)
311 ILOCA (VB1)	1.5E-3	1.4E-3	2.1E-6 (5)	Medium
312 ILOCA (VA3 or VD3)	2.4E-3	1.4E-3	6.7E-6 (6)	Medium
312 ILOCA (VA13)	1.5E-4	1.4E-3	2.1E-7 (7)	Medium
321 ILOCA (VB2) [HP, Suction]	2.4E-3	1.4E-3	3.4E-6 (8)	Medium
321 ILOCA (feedwater VA3 or VD3)	2.4E-3	1.4E-3	6.7E-6 (6)	Medium
321 PLOCA (VC50) [LP, Suction]	6.5E-3	1.4E-3	9.1E-6 (8)	Medium
323 PLOCA (VA5)	1.4E-3 (9)	1.4E-3	2.0E-6 (8)	Medium

ILOCA = normally open valve fails to automatically isolate (MSIVs, FW check valve, RHR)
PLOCA = normally closed valve ruptures or spuriously opens

(1) Valve failure probabilities are from Forsmark 3 PSA
(2) S1 CCDP is used since it is controlling
(3) CCDP = Valve Failure Probability * $CCDP_{)LOCA}$. The actual value used in this analysis for all ILOCA and PLOCA inside containment is the F3 PSA value of 1.1E-5 (see IL_S1_312VAD3 and IL_S1_312VA13), which accounts for loss of feedwater.
(4) CLERP is not controlling based on Section 3.3. Also, if isolation success is assigned to TF it is controlling with 9E-6 CCDP.
(5) A_312VAD3 used (CCDP=4.1E-5, CLERP=7.9E-9)
(6) There are 2 feedwater check valves that can fail, thus CCDP includes factor of 2. Also, A_312VAD3 used (CCDP=4.1E-5, CLERP=7.9E-9) to be consistent with the F3 PSA
(7) S1_312VA13 used (CCDP=1.1E-5, CLERP=1.2E-9)
(8) CCDP=1E-5, CLERP=2.2E-8 used to simulate loss of feedwater consistent with the F3 PSA
(9) Check Valve Rupture from NUREG/CR-6928 is 2.96E-8/hr, which suggests failure probability may be on the order of 2.6E-4 [MOV Rupture is 3.34E-9/hr from NUREG/CR-6928]

There are also some pipe segments that require failure of two normally open isolable valves, in series, to cause an unisolable LOCA (I2LOCA), which are obviously Low Consequence based on the above. The following summarizes:

- Upstream of 312 VA2 and VC2 (only one weld in each line) requires one of the prior 312 check valves to fail. Thus, these welds would be expected to be low consequence except that at F3 loss of feedwater is always assumed; thus CCDP=1.0E-5, CLERP=1.2E-9 is used.

- Upstream of 321 VB13 and VD13 require one of the prior 312 check valves to fail. Thus, these welds would be expected to be low consequence (CCDP<1E-6 and CLERP<1E-7).

There are also some pipe segments that require passive failure of one valve that is normally closed and isolation failure of one valve that is normally open to cause an unisolable LOCA (PILOCA), which are obviously a Low Consequence based on the above. The following summarizes:

- Upstream of 321 VC13 requires one of the prior 312 check valves to fail to close and passive failure of the normally closed MOV VC13.

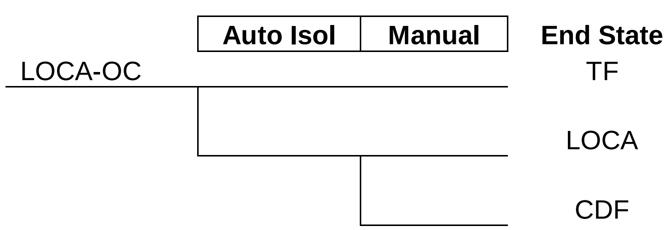
3.5 Isolable LOCA (ILOCA) and Potential LOCA (PLOCA) outside Containment

Piping failures that result in a LOCA outside containment are different from piping failures that result in a LOCA inside containment for two primary reasons:

(1) For piping located outside containment, the CCDP can be equal to the CLERP for the failure to isolate case, and

(2) Spatial impacts outside containment due to the break can be more significant than inside containment. For example, failure to isolate and / or control the break flow will result in loss of the suppression pool outside containment.

The F3 PSA models these “LOCA outside containment” initiating events as follows:



Where:

“Auto Isol” models automatic isolation of the break outside containment. The “Success Case” transfers to the loss of feedwater (TF) model.

“Manual” models operator actions to isolate the break before the suppression pool is lost. The “Success Case” transfers to the LOCA model. Failure to manually isolate results in core damage (CDF).

For each “LOCA outside containment” initiating event, the Forsmark 3 PSA calculation of CDF and LERF includes the sum of the above three sequences or models where as the EPRI RI-ISI methodology would determine the controlling case as a reasonable approximation. The EPRI RI-ISI methodology was established as an order of magnitude approach that would be easy to apply and has been demonstrated to be reasonable. The Forsmark 3 PSA calculation is more quantitatively complete and will be used in this evaluation since this level of detail is available from the F3 PSA.

The following table summarizes the evaluation of the Forsmark 3 “LOCA outside containment” initiating events and the resulting consequence ranking. As can been seen in this table, there are five occurrences of a High consequence ranking. For the first three occurrences, the ranking is due to the CLERP being the controlling impact. That is, if the piping was ranked solely on the basis of CCDP, the piping would be a medium consequence rank (i.e. CCDP < 1E-04). For the last two occurrences, the high consequence rank is due to both the CCDP (> 1E-04) and CLERP (> 1 E-05) criteria being exceeded. In all cases, using the SKIFs methodology, this piping would be ranked a medium consequence (i.e. KI=2).

Table 8: ILOCA and PLOCA outside Containment between Penetration and Outside Valve

ILOCA-OC and PLOCA-OC	F3 Initiator	CCDP	CLERP	Consequence
311 ILOCA-OC (main path)	Y311VA3	6.3E-5	5.4E-5	High
311 ILOCA-OC (startup path)	Y311VA52	8.2E-5	7.4E-5	High
312 ILOCA-OC (main path)	Y312VA1	8.8E-6	5.7E-8	Medium
312 ILOCA-OC (AFW path)	Y327VA4	1.0E-4	9.3E-6	Medium
321 ILOCA-OC (HP, Suction)	Y321VB3	6.4E-5	5.5E-5	High
321 ILOCA-OC (HP, Supply)	Y321VB12	1.7E-5	7.4E-6	Medium
321 PLOCA-OC (LP, Suction)	Y321VA51	1.5E-4	1.4E-4	High
321 PLOCA-OC (LP, Supply)	Y321VA12	1.4E-5	4.6E-6	Medium
323 PLOCA-OC	Y323VA4	1.1E-4	8.8E-5	High

ILOCA-OC applies to welds between containment penetration and outside isolation valve
PLOCA-OC applies to welds between containment penetration and outside isolation valve

Piping segments beyond the outside containment isolation valve have another isolation valve thus lowering the likelihood of an unisolated break, which tends to lower the frequency of core damage and large early release. The following table summarizes key initiating event results for this piping included in the Forsmark 3 PSA.

Table 9: ILOCA and PLOCA beyond Outside Valve

I2LOCA-OC and P2LOCA-OC	F3 Initiator	CCDP	CLERP	Consequence
311 I2LOCA-OC	Y311_1	1.6E-5	7.5E-6	Medium
311 I2LOCA-OC (startup path)	Y311_2	9.4E-6	7.4E-7	Medium
312 I2LOCA-OC (main path)	Y312	8.7E-6	2.2E-8	Medium
312 I2LOCA-OC (AFW path)	Y327A1	9.4E-5	1.9E-7	Medium
321 I2LOCA-OC (HP, Suction)	Y321_2	1.7E-5	7.3E-6	Medium
321 I2LOCA-OC (HP, Supply)	Y321_1	1.7E-5	7.3E-6	Medium
321 P2LOCA-OC (LP, Suction)	Y321_4	1.4E-5	4.5E-6	Medium
321 P2LOCA-OC (LP, Supply)	Y321_3	1.4E-5	4.5E-6	Medium
323 P2LOCA-OC	Y323A1	1.8E-5	3.3E-7	Medium
323 P3LOCA-OC	Y323A2	1.7E-5	1.8E-7	Medium

I2LOCA-OC applies to welds beyond outside containment isolation valve (2 open valves)
P2LOCA-OC applies to welds beyond outside containment isolation valve (2 closed valves)
P3LOCA-OC applies to welds beyond outside containment isolation valve (3 closed valves)

3.6 Spatial and Internal Flooding

The Forsmark reactor building has four quadrants with one ECCS train in each quadrant (322, 323, and 327). Thus, flooding in one quadrant will impact one of the four ECCS trains, but would not impact the other three trains. In addition, suction line breaks off the suppression pool would flood a single quadrant and equalize with the suppression pool at a high enough level to allow success of the other three trains. Thus, it can be concluded that breaks in the 323 system (low pressure injection) will only result in loss of the equipment in the quadrant with the break.

The RHR (321) system is different because it is located at a higher elevation and does not propagate to the corner rooms. Thus, breaks in RHR are assumed to disable only the RHR function.

Main steam (311) and feedwater (312) pass through the reactor building, but this room is sufficiently isolated such that propagation impacts on ECCS are not likely. Primary propagation is into the turbine building where there is no safety equipment. Since the Forsmark 3 PSA treats all breaks as a loss of feedwater and main condenser, there would be no additional major spatial impacts from these breaks.

The condensate system (462) is located in the turbine building and its failure results in a loss of feedwater initiating event. Since there is no safety equipment in the turbine building and feedwater and main condenser are the primary systems dependent on the turbine building, there are no additional impacts.

This excellent spatial separation discussed above at F3 can also be confirmed by looking at the contribution from internal flooding and fires in Section 3.1. As shown in the following table, all internal flooding initiating event CCDP and CLERP results indicate a Medium Consequence.

Table 10: Forsmark 3 Selected Internal Flood Initiating Event CCDP and CLERP

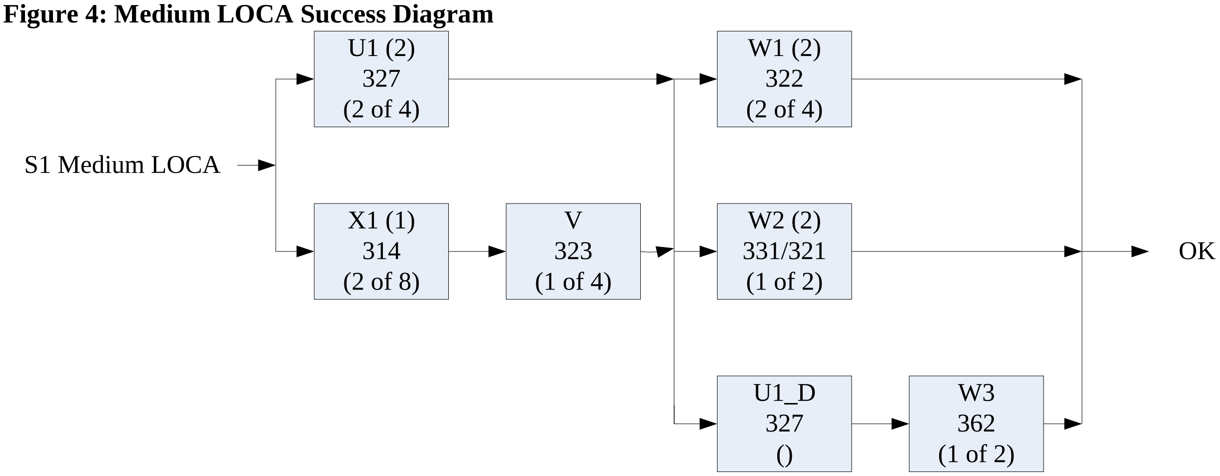
Flood Initiating Event	IEF	CCDP	CLERP	Flood Source	Flood Impacts
O_3.B006 [corner room]	3.5E-5	1.37E-05	2.16E-08	322, 323, 327	322, 323, 327
O_3.B007 [corner room]	3.5E-5	1.38E-05	2.14E-08	322, 323, 327	322, 323, 327
O_3.B008 [corner room]	1.2E-4	2.18E-05	2.26E-08	322, 323, 327	322, 323, 327
O_3.B009 [corner room]	3.5E-5	2.18E-05	2.26E-08	322, 323, 327	322, 323, 327
O_3.B018 [LP RHR]	7.0E-5	8.68E-06	2.12E-08	321	321
O_3.B019 [HP RHR]	7.0E-5	9.41E-06	2.13E-08	321, 331	321, 331
O_3.B019-735 [HP RHR]	3.5E-5	9.41E-06	2.13E-08	321, 331	321, 331

The CCDP for turbine building floods range from 9E-6 to 2E-5 consistent with the CCDP for total loss of feedwater.

3.7 Success Criteria

The Forsmark 3 PSA was reviewed to ensure that the underlying success criteria for accident sequence modeling are understood. The following provides a simplified success diagram for the medium LOCA (S1) initiating event:

Figure 4: Medium LOCA Success Diagram



327 = AFW (High Pressure Makeup)
314 = Safety relief valves (also there is a dedicated relief backup)
323 = Low pressure ECCS Injection
322 = Suppression pool cooling
331/321 = RHR (2 pumps) with RHR heat exchanger or cleanup heat exchanger (331)
362 = containment vent (rupture disc and manual path)

The following summarizes how the above success criteria changes for small and large LOCA:

- Large LOCA (A) is the same as S1 except that the X1 (1) depressurization function is not required because by definition the break is large enough to guarantee depressurization

- Small LOCA (S2) is the same as S1 except that only 1 of 4 trains of 327 is required instead of 2 of 4.

The success criteria for the loss of feedwater (TF) initiating event is not significantly different than small LOCA since the 327 system is required and then the 323 system with depressurization if all 327 trains fail. This can be seen from reviewing the CCDP results for TF (9E-6) and S2 (1E-5) in Section 3.3. The following summarizes additional observations from this review:

- Not shown in Figure 4 above is the reactivity control function (rod insertion). The failure probability of this function is ~2.6E-6, which leads to core damage. ATWS mitigation capabilities at F3 including manual actions to inject boron are not presently credited in the PSA.

- Vapor suppression function and mitigation of its failure is also not shown in Figure 4. This is usually a highly reliable function especially when mitigation (e.g., with containment sprays) is credited.

- Also not shown in Figure 4 are details such as common cause failures, including an instrument leg purge system that is required, otherwise loss of instrumentation results in loss of ECCS injection. These single element cutsets (e.g., 30322V_05__AMLAA-ALL) dominate the CCDP for S1 (314, depressurization is dependent on instrument leg cooling for medium LOCA).

3.8 Loss of Mitigation (Standby Systems)

As described in Section 3.2, the following evaluations are required for systems in standby during power operation:

- Low pressure RHR (321) is not credited in the PSA, but the most likely time to have a pressure boundary failure would be during system line-up at relative high pressure and temperature when proceeding to cold shutdown. This demand configuration is evaluated in the F3 PSA as initiating events (Y321-3 and Y321-4).

- Low pressure injection (323) suction piping from the suppression pool to the pump is normally pressurized by the suppression pool volume. It is assumed that this piping ruptures during system standby with an all year exposure time and then the plant must perform a controlled shutdown (initiating event). A review of the internal flooding CCDP for the corner rooms in Section 3.6 confirms that the F3 PSA assumes a loss of feedwater for all spatial initiating events. Also, the LOCA outside containment (e.g., Y323A2) has a similar CCDP.

- Low pressure injection (323) return to the reactor vessel from the pump to the reactor is assumed to fail during a demand. Note that portions of this piping may also see suppression pool pressure, but this piping is typically designed for higher pressure than the suction piping; it is assumed more likely to fail during an actual pump start demand pressure transient than while the system is in standby.

3.8.1 RHR (321) Low Pressure Train

The F3 PSA modeling of LOCA outside containment initiating events in this system assumes the pipe breaks with the reactor coolant isolation valves open and then they have to close. Although this modeling assumes the reactor is at normal operating conditions, which is conservative, this provides a good starting point to assess CCDP and CLERP because the high pressure system in normally in operation and the low pressure system is aligned during shutdown (190 C and 1.3 MPa). As shown in Section 3.5 (see Table 9), this system would have a Medium consequence (Y321-3 and Y321-4).

3.8.2 Low Pressure Injection (323) Suction Piping

Because failure of this piping in the standby configuration results in only loss of one train of 323 and does not cause a direct initiating event, the CCDP can be estimated by considering two situations:

1. A controlled shutdown with loss of one train of 323. This CCDP should be less than the TF initiator for several reasons. First, feedwater is available and second, reactivity control is essentially guaranteed success since there is no direct immediate demand. Thus, the CCDP is expected to be in the low 1E-6 or even less than 1E-6 (Medium to Low Consequence). Since the F3 PSA assumes loss of feedwater, the F3 CCDP is conservatively high (see internal flood CCDP in Section 3.6 and LOCA event Y323A2).

2. If an accident demand of the system occurs during the controlled shutdown, a typical lookup table application of *EPRI TR-112657* (section 3.3.3.2) would be as follows; where unreliable isolation would apply to the case where the suction MOV is likely to be flooded before operators can detect and isolate the break (limited time before MOV is flooded):

Table 11: Typical Lookup Table Application for 323 Suction Piping

Case	Frequency Challenge	Isolation	Backup Trains	Exposure	CCDP	Rank
Reliable Isolation	1E-2/yr	Success (0.99)	327 + 323	2.7E-3	<1E-6	Low
		Failure (1E-2)	327		<1E-6	Low
Unreliable Isolation	1E-2/yr	NA (1.0)	327	2.7E-3	<1E-6	Low

EPRI TR-112657 section 3.3.3.2 includes 3 factors in establishing consequence:

- Frequency of Challenging System: ~1E-2/yr for LOCA, stuck open SRV. The 323 system is unlikely to be challenged; 1E-2 is conservative relative to a real demand.

However, Forsmark, Unit 1 (F1) has had an event that challenged the 323 system during a loss of offsite power; even this event was determined to be less than 1E-2/year.

- Number of Backup Mitigation Trains Available: three trains each of 327 and 323 are potentially available if one quadrant is assumed flooded. Isolation failure is assumed to result in loss of 323 if 327 fails because blow down into suppression pool is required with a 323 suction line unisolated (unanalyzed, conservative assumption and already low CCDP). If it is assumed that 2 of 4 AFW are required and one is spatially affected by the event, then success criteria changes to 2 of 3. Failure of 2 trains of 327 should have ~1E-3 probability. Failure of 3 trains of 323 should have ~1E-4 probability.

- Exposure Time: 24 hours for accident demand during controlled shutdown or converting 24 hours to years results in 2.7E-3

Although the above evaluation indicates that a Low Consequence is justifiable for the 323 suction piping, LOCA outside containment modeling in the F3 PSA for this system (past three isolation valves) is 1.7E-5 (Y323A2). This was determined to be too conservative given that three valves need to fail and this value does not contain the frequency of challenge in the CCDP. As a result, this piping from the suppression pool up to the pump discharge check valve is probably a low consequence. Since internal flooding results (Section 3.6) also indicate a medium consequence (assumes plant trip, loss of feedwater etc), this analysis assigned the medium consequence even though it is judged to potentially be very conservative.

3.8.3 Low Pressure Injection Discharge Piping

As described previously, the most likely time for this piping to fail is during a demand such as surveillance testing or an actual accident demand. Since failure during testing would not create a direct initiating event and operators are directly involved with testing and would likely ensure reliable isolation, these scenarios have been shown to be of low consequence unless the event can cause an automatic initiating event and impact normal operating systems (e.g., offsite power, feedwater, etc). Thus, the accident demand is typically evaluated for this piping. A typical lookup table application of *EPRI TR-112657 section 3.3.3.2* would be as follows; where unreliable isolation would apply to the case where operators have no detection, guidance or time to trip the pump and or isolate the event:

Table 12: Typical Lookup Table Application for 323 Discharge Piping

Case	Frequency Challenge	Isolation	Backup Trains	Exposure	CCDP	Rank
Reliable Isolation, Testing	1E-2/yr	Success (0.99)	327+323	0.25	<1E-6	Low
		Failure (1E-2)	327		<1E-6	Low
Reliable Isolation, No Test	1E-2/yr	Success (0.99)	327+323	1	<1E-6	Low
		Failure (1E-2)	327		<1E-6	Low
Unreliable Isolation, Testing	1E-2/yr	NA (1.0)	327	0.25	2.5E-6	Med
Unreliable Isolation, No Test	1E-2/yr	NA (1.0)	327	1	1E-5	Med

EPRI TR-112657 section 3.3.3.2 includes 3 factors in establishing consequence:

- Frequency of Challenging System: ~1E-2/yr for LOCA, stuck open SRV. The 323 system is unlikely to be challenged; 1E-2 is conservative (see above).

- Number of Backup Mitigation Trains Available: three trains each of 327 and 323 are potentially available if one quadrant is assumed flooded. Isolation failure is assumed to result in loss of 323 if 327 fails because blow down into the suppression pool is required with 323 unisolated (unanalyzed, conservative assumption and already low CCDP). If it is assumed that 2 of 4 AFW are required and one is spatially affected by event, then success criteria changes to 2 of 3. Failure of 2 trains of 327 should have ~1E-3 probability. Failure of 3 trains of 323 should have ~1E-4 probability.

- Exposure Time: 0.25 is used for piping that sees quarterly testing and 1.0 is used for piping downstream of the outside containment isolation MOV as it does not see quarterly testing pressure challenge

The above lookup table results were validated by EPRI during pilot applications and a number of follow-on applications using plant specific PSA calculations. PSA equipment is set to failure in the PSA model to simulate impacts of pipe failure and spatial impacts. Quantification of the PSA model with these failures provides a new CDF. The CCDP can be calculated with the following equation:

CCDP = [CDF (impact from PBF) – CDF (Baseline)] * [Exposure Time]

When the pipe segment failure has a straightforward impact that can be simulated by a single component modeled in the PSA, the risk achievement worth (RAW) importance for that component can be used to calculate CCDP as follows:

CCDP = [RAW-1] * CDF (Baseline) * [Exposure Time]

Based on the above, the system discharge piping beyond the pump discharge check valve should be a low consequence if the break is isolable, which is expected to be the case. However, LOCA outside containment modeling needs to also be considered. Although the present modeling in the F3 PSA indicates this piping is a Medium Consequence (Y323A2), these CCDPs do not account for the frequency of challenge (F3 PSA assumes all valves are open due to a challenge and then the pipe fails). As a result, the CCDP for Y323A2 could be a low consequence when calculated taking into account of the frequency of challenge. However, F3 PSA does not model the rupture of the two valves between the reactor vessel and the piping outside containment as an initiating event, which could be a medium consequence. Since there is no analysis to support a low consequence, the medium consequence is retained (assumed).

3.9 Combination Impact (Initiator and mitigation)

This evaluation in *EPRI TR-112657* ensures that available backup trains are appropriately considered when the pipe break initiating event has additional impacts on mitigation systems besides the initiating event itself. The LOCA and LOCA outside containment modeling in the F3 PSA already considers these impacts in calculating CDF and LERF as described in previous sections. Therefore this has already been accounted for in the previous evaluations.

3.10 Containment Performance

In determining the consequence rank using the EPRI methodology, the CLERP criteria for High and Medium Consequence is an order of magnitude lower than CCDP. Thus, one approach is to show that there is always a 0.1 probability between CCDP and CLERP (defined as $LERP_{)CD}$, large early release probability given core damage) except for the case of LOCA outside containment where CCDP may be equal to or close to CLERP. This simplifies the evaluation allowing primary focus on CCDP. The F3 PSA calculates both CDF and LERF for initiating events; the results are summarized below:

- As described in Section 3.1, total CDF and LERF calculations demonstrate a $LERP_{)CD}$ less than 0.1.
- The basic initiating events described in Section 3.3 have a $LERP_{)CD}$ less than 0.1.
- LOCA outside containment evaluations have to consider the fact that CCDP may be equal to or close to CLERP for the isolation failure case. This is considered in the evaluation of LOCA outside containment consequences in Section 3.5.

3.11 Shutdown Configurations

The initial consequence evaluation using the EPRI methodology is performed for the power operation configuration, which is expected to dominate the consequences. However, the shutdown configurations must be evaluated qualitatively or with a plant specific shutdown PSA if available. The following provides an example qualitative evaluation.

Table 13: Shutdown Evaluation

System	Power Operation	Shutdown
311 – Main Steam	Initiating event and already medium & high	The system is not available or depended upon during cold shutdown. Power operation envelopes.
312 – Feedwater 462 - Condensate	Initiating event and already medium & high	The system is not operating during shutdown and is usually not depended upon for mitigation. Condensate could be used, but the likelihood of feedwater piping failures during less severe shutdown conditions is judged less likely. Power operation envelopes.
321 – RHR [high pressure system]	Initiating event and already medium & high	The system is already analyzed as operating during power operation. Exposure time is reduced for shutdown operation as compared to at-power operation. During shutdown, the system operates at reduced temp & pressure reducing the likelihood of pipe failure given its previous success at power. Power operation envelopes.
321 – RHR [low pressure system]	Standby and medium to low consequence	The system is in standby during power operation. Operates in shutdown cooling mode during shutdown and should be evaluated, particularly the low consequence segments.
323 – Low Pressure Injection	Standby and medium to low consequence	The system is in standby during shutdown and maintenance unavailability is typically higher. Although redundancy in reactor makeup could be affected if this system failed, power operation should envelope.

The one system that could be more important from a qualitative evaluation of the systems in the table above is the low pressure RHR train that is in standby during power operation and becomes an operating system during shutdown. However, the F3 PSA already conservatively analyzes breaks in this system as occurring during power operation with the valves open similar to a demand during shutdown. Thus, what is judged to be an important configuration for this system is already evaluated although it may be somewhat conservative.

In addition, plant specific shutdown risk management procedures ensure that there is sufficient redundancy for accident mitigation (e.g., DRIFTKRITERIA F3-DO08-101). For example, a review of the F3 shutdown PSA indicates that safety trains A and C may be taken out of service during the outage leaving trains B and D available. Similarly, trains B and D can be in planned maintenance with trains A and C available.

F3 also has a shutdown PSA model that includes human induced LOCA initiating events, but not pipe breaks, which are less likely during shutdown conditions. From a risk management perspective, the Forsmark 3 shutdown PSA correctly focuses on the human induced events. A review of the F3 shutdown PSA was performed to determine whether the LPI (323) system consequence could be affected:

- The total LOCA frequency is on the order of 1E-2/outage.

- If two trains are assumed to be in maintenance and a third fails on demand (RI-ISI evaluation) flooding the corner room, this would leave another corner room available with mitigation equipment (two trains including one each of 327 and 323).

- A combination of initiating event challenge (1E-2) and availability of two backup mitigation equipment trains (327 and 323) indicates a low CCDP on the order of 1E-6.

- Based on F3 PSA, losing water outside containment during a LOCA is most important, but this failure is dominated by operator action failures.

3.12 External Events

Again, the initial consequence evaluation is developed using the power operation internal events PSA, which includes transients and LOCA initiators relevant to the analysis of pressure boundary failures in systems. Previous generic and plant-specific evaluations of the impact of external events such as fires and seismic have concluded that they are unlikely to impact the consequence rank for the following reasons:

- Normally operating systems are already analyzed as initiating events with 1.0 frequency; external event causes of failure are much less likely.

- External events present a new initiating event challenge to standby systems. However, the frequency of challenge is usually much lower. Backup trains may be affected by the external event, but usually not all backup trains. As can be seen from the CDF and LERF results in Section 3.1 and CCDP results for internal floods in Section 3.6, there is physical separation between the four safety trains. Exposure time is unchanged.

Seismic and other external hazards are screened because if they impact a safety train they are likely to impact all trains as a result of common cause. A review of the F3 fire PSA results indicate that fire initiating events are on the order of 1E-4/yr or less and CCDP is on the order of 1E-4 or less except for the control room fire.

Based on the above, it is expected that the CCDP for a standby system due to an external event challenge would be at most a medium consequence; a high consequence is very unlikely. Thus, any additional reviews should focus on pipe segments determined to be a low consequence from the initial evaluation using the internal events PSA model. Consistent with previous RI-ISI applications, a review of the F3 low consequence segments did not identify a need to adjust their consequence ranks.

Consequence ranking of the Condensate system is even less likely to be impacted by consideration of external events. This is because its reliability is most likely controlled by factor other than pressure boundary integrity (e.g. loss of offsite power due to seismic, high winds, etc.).

3.13 Consequence Evaluation Results

Table 14 provides a list of F3 initiating events and their resulting CCDP and CLERP, which were an important input to developing the consequences. The following summarizes the naming convention for initiating events:

I = Initiating Event
L = LOCA
A = Large LOCA
S1 = Intermediate LOCA
S2 = Small LOCA
311 = System (similar for 312, 321 and 323)
Y = LOCA outside containment
O = Internal Flood

Table 15 summarizes the consequence evaluation results from this evaluation. There is one pipe segment (line TNE-1 in the 321 system) not listed in Table 15 that is assigned a "None" consequence in the database. This line is downstream of relief valve VA34 in the 321 system. This piping would not normally be in scope and is included due to personnel safety, which is not in the scope of this evaluation (personnel safety risk is not being evaluated and this piping could be added regardless of methodology used to asses reactor safety; therefore there is no change as a result of this evaluation). The following summarizes the Table 15 column headings:

Consequence Segment: a piping segment within a system with the same consequence as analyzed in this section. Each weld in the analysis scope (Appendix A) is assigned to a consequence segment.

Description: brief description of the segment.

Line Size (mm): this is the piping nominal pipe size in millimeters, which affects the consequences because of LOCA size.

Location: the segment can be located inside containment (Cont), outside containment (OC) or the suppression pool area (SP), which also affects the consequence.

Config: identifies the normal system or normal segment configuration analyzed for power operation where "O" indicates operating and "S" indicates standby.

Mitigation Impact: describes the impact of segment failure on accident mitigation systems that would otherwise be used to mitigate the pipe failure. In the case of F3, the PSA initiating event identified in this column contains the necessary impacts; there was no need to identify additional impacts.

CCDP: conditional core damage frequency for the segment as evaluated in this section.

CLERP: conditional large early release frequency for the segment as evaluated in this section.

Rank: consequence rank for the segment based on CCDP and CLERP and criteria described at the end of Section 3.2.

Appendix A contains a complete list of welds in the scope of this evaluation with the applicable consequence segment identified in Table 15.

3.14 Comparison Summary

This section provides insights gained in application of the EPRI RI-ISI methodology, use of the F3 PSA and a comparison to the SKIFs approach. The SKIFS methodology includes identification of Consequence Index (KI of 1, 2 or 3), which is similar in concept to the EPRI methodology's identification of Consequence Rank (High, Medium, Low). Both consequence schemes are used in a risk matrix, which is also similar in concept between the two methodologies and is described in Section 5.

The EPRI consequence is determined from the F3 PSA using CCDP and CLERP as described in Section 3.1. The following describes the criteria for determining SKIFS consequence index (KI) at F3 (PMT-2004, Piping and Components translated from Swedish to English).

KI = 1

- Applies to large (>100 mm) piping below the core (e.g., external recirculation piping), which does not apply to F3 because of internal main circulation pumps. Thus, there are no welds at F3 categorized as KI=1 (high consequence).

KI = 2

- Rupture or leakage in piping from reactor vessel to second valve that closes automatically on pipe rupture and leakage flow > 45 kg/s. (45 kg/s corresponds to the flow of saturated water from a pipe with ID > 39 mm or steam from a pipe with ID > 75 mm, according to SKI report 2003:2). For comparison, this is a Medium to Large LOCA in the F3 PSA, which is a high consequence using the EPRI methodology.

- Devices ≥DN50, pressurized with reactor water, that are part of the containment integrity.

- Devices ≥DN50, pressurized with reactor water, that are within 5 m from the containment isolation valves.

- Devices ≥DN50, pressurized with reactor water, where indirect consequences can lead to failure to meet single failure criteria.

KI = 3

- Rupture or leakage in piping from reactor vessel to second valve that closes automatically on pipe rupture and leakage with a flow >22.5-45 kg/s. (Corresponds to the flow of saturated water from a pipe with ID 19-39 mm or steam from a pipe with ID 54-75 mm, according to SKI report 2003:2). For comparison, this is Medium LOCA in the F3 PSA, which is a high consequence using the EPRI methodology.

- Other devices ≥DN50 pressurized with reactor water [that could lead to isolation or scram].

- [Devices ≥DN50, that are not assigned KI=1-2, but are required for scramming the reactor, residual heat removal or maintaining the containment integrity.]

KI = None
Parts that do not fall into categories KI=1, 2 and 3.

Based on a review of the risk matrix and the resulting inspection requirements, it could be envisioned that a KI=1 is similar to the EPRI High Consequence, KI=2 is similar to the EPRI Medium Consequence and KI=3 is similar to the EPRI Low Consequence. However, as described above the criteria for determining consequence rank can be different from the EPRI approach. The following comparative insights are provided relative F3 implementation of both methods for the 5 systems in the scope of this evaluation:

- None of the F3 scope piping has the highest Consequence Index, KI=1 (all piping segments have KI = 2 or 3 or Blank). Yet, the EPRI methodology identifies several pipe segments as a HIGH consequence. This includes piping in the 311, 312, 321 and 323 systems directly connected to the reactor vessel that is not isolable. The CCDP in the F3 PSA is relatively high for this piping in comparison to all other piping in the scope of this evaluation and the CCDP exceeds the EPRI criteria for a High Consequence.

  Also, certain piping outside containment between the penetration and the first isolation valve outside containment in the 311, 321 and 323 systems was determined to have a High consequence as a result of exceeding the EPRI CLERP criteria. There is one isolation valve inside containment and CCDP becomes Medium, but this piping failure causes containment bypass and the CLERP results in a High consequence. Note that the 312 system has 2 check valves inside containment, which reduces the probability of an unisolable LOCA outside containment such that the CLERP for this system is Medium. The following “Consequence Segments” in Table 15 apply:

  311-C-3A (1 weld) [CLERP=5.4E-5]
  311-C-3B (1 weld) [CLERP=5.4E-5]
  311-C-3C (1 weld) [CLERP=5.4E-5]
  311-C-3D (1 weld) [CLERP=5.4E-5]
  311-C-4E (1 weld) [CLERP=7.4E-5]
  321-C-3E (1 weld) [CLERP=5.5E-5]
  321-C-3F (1 weld) [CLERP=5.5E-5]

321-C-3G (1 weld) [CLERP=1.4E-4]
323-C-3A (1 weld) [CLERP=8.8E-5]
323-C-3B (1 weld) [CLERP=8.8E-5]
323-C-3C (1 weld) [CLERP=8.8E-5]
323-C-3D (1 weld) [CLERP=8.8E-5]

- At the other extreme is piping with a KI = 3 or blank (blank fields in the database were assigned a None consequence), which is similar to a Low consequence rank, which was also reviewed for comparative insights.

  311 System – all piping segments identified as Low using the EPRI methodology were also identified as KI=3 or None, which is considered the same as low.

  311 System – a KI=3 or Blank (None) is assigned to segments identified as Medium consequence using the EPRI methodology. It appears that piping considered small LOCA (S2) is assigned a low consequence per SKIFS versus medium consequence per EPRI. All piping assigned to consequence segment 311-C-6E is assigned KI=3 and portions of piping assigned to consequence segments 311-C-5E are assigned KI=3. Small diameter piping in segments 311-C-1, 1E, 2E, 5E and 6E have no KI assigned (None)

  312 System – no segments were identified as Low using the EPRI methodology. Three segments assigned a Medium consequence (312-C-5, 6, and 2G) have a KI = 3 or Blank assigned to portions of these segments.

  321 System – three segments (321-C-2B, 2C and 2D) identified as Low using the EPRI methodology were assigned a KI=2.

  321 System – several segments assigned a Medium consequence (321-C-1, 4B, 4C, 4E and 4G) have a KI=3 or Blank assigned to portions of these segments.

  323 System – the low consequence segments using the EPRI methodology have a blank KI (None) with the exception of one weld.

  323 System – several segments assigned a Medium consequence (323-C-4A through 4D, 5A through 5D and 6A through 6D) have a KI = 3 assigned to portions of these segments.

  462 System – the system was assigned a Medium consequence using the EPRI methodology; this system in not in SKIFS requirements scope.

To further explain the insights gained from this effort, Table 16 summarizes the SKIFS consequence index criteria to CCDP using F3 PSA. As shown, using the PSA and EPRI approach may result in some different rankings.

F3 PRA insights:

Small LOCA is a Medium consequence in the F3 PSA, which could be used to distinguish between KI=2 (small LOCA) and KI=1 (larger than small LOCA) if SKIFS implementation changes are considered at F3.

Medium LOCA CCDP is higher than large LOCA CCDP, thus it should not be assumed that an increase in size by itself is an increase in consequence.

Spatial impacts on consequence assignment using the EPRI methodology were not important because of the 4 train design and spatial separation at F3. This may or may not be true for other units. This appears consistent with SKIFS implementation at F3. However, the SKIFS criteria for indirect effects is solely addressed under KI=2 where as the EPRI methodology allows these impacts along with the CCDP/CLERP valves, to determine the consequence rank. This could also be important for other units with less spatial separation.

Instrument leg purge system modeling (e.g., 30322V_05__AMLAA-ALL) is an important contributor to medium LOCA.

LOCA outside containment in the 323 system is modeled in the F3 PSA as occurring during an accident demand when all the valves are open. The CCDP used in this analysis did not contain the frequency of challenge, which would have lowered the CCDP from medium to low consequence. However, the F3 PSA does not model the discharge piping beyond the pump check valve as an interfacing LOCA initiating event (passive failure of the two valves between the RPV and low pressure design piping outside containment). These initiators could be added to the F3 PSA and could be medium consequence, which is assumed for now (321 low pressure system should also be considered).

F3 PSA potential conservatisms were noted that could influence the EPRI methodology results:

- SCRAM initiating event (TS) CCDP is essentially the same as loss of feedwater (TF) apparently due to the result of conservative modeling resulting in a Medium consequence. This was determined to mostly be due to support system dependencies (AC power and heat removal).

- All successfully isolated breaks are assigned to loss of feedwater event (TF), which guarantees a Medium consequence. However, turbine trip and scram initiating event CCDP is also a medium consequence.

- Potential LOCA events are analyzed in the F3 PSA as if the valve is already open and must close on demand. This in combination with the above conservatism could result in a LOW consequence being quantified as Medium. This is judged to be very conservative for the 323 low pressure systems upstream of the pump discharge check valve as the suction path is connected to the suppression pool (not the reactor).

- ATWS mitigation capabilities (boron injection) are not credited. This was determined to have small impact due to the importance of support system dependencies (AC power and heat removal).

Generally, these conservatisms are not significant if they move piping from Low to Medium consequence and there is no degradation mechanism. This is because a medium consequence with no degradation mechanism results in a low risk rank and the inspection program (number of selections) is not affected. For example, the medium consequence assigned to the 323 suction piping was identified in this analysis as potentially conservative, but all these welds ended up being risk category 6 (no degradation mechanism) which is a low risk rank. Thus, there is no impact on element selection. In the unlikely case there is also a degradation mechanism (risk category 5) and a potentially low consequence weld is selected, even though this would actually be a low risk weld being inspected, at least this inspection would be an "inspection for cause" (degradation mechanism) inspection.

Table 14: Forsmark 3 Power Operation PSA Initiating Events

Initiating Event	CCDP	CLERP
IL__A_311_1	3.07E-04	9.55E-08
IL__A_312_1	3.07E-04	9.55E-08
IL__A_312VAD3	4.10E-05	7.93E-09
IL__A_312VBC3	4.10E-05	7.93E-09
IL__A_314_1	3.07E-04	9.55E-08
IL__A_323A1	3.33E-04	9.97E-08
IL__A_323B	3.21E-04	9.74E-08
IL__A_323C	3.10E-04	9.57E-08
IL__A_323D	3.10E-04	9.57E-08
IL__A_354_1	4.42E-05	8.50E-09
IL__A_354_2	4.42E-05	8.50E-09
IL_S1_312_1	1.37E-03	3.10E-07
IL_S1_312_2	1.38E-03	3.10E-07
IL_S1_312_3	1.38E-03	3.10E-07
IL_S1_312VA13	1.12E-05	1.22E-09
IL_S1_312VAD3	1.02E-05	1.22E-09
IL_S1_312VBC3	1.02E-05	1.22E-09
IL_S1_312VC13	1.12E-05	1.22E-09
IL_S1_321_1	1.37E-03	3.10E-07
IL_S1_321_2	1.37E-03	3.10E-07
IL_S1_321_3	1.37E-03	3.10E-07
IL_S1_321VAD3	1.02E-05	1.22E-09
IL_S1_321VBC3	1.02E-05	1.22E-09
IL_S1_323A1	1.37E-03	3.10E-07
IL_S1_323A2	1.37E-03	3.10E-07
IL_S1_323B	1.37E-03	3.10E-07
IL_S1_323C	1.37E-03	3.10E-07
IL_S1_323D	1.37E-03	3.10E-07
IL_S1_327A	1.38E-03	3.10E-07
IL_S1_327B	1.38E-03	3.10E-07
IL_S1_327C	1.38E-03	3.10E-07
IL_S1_327D	1.38E-03	3.10E-07
IL_S1_354_1	4.46E-05	8.50E-09
IL_S1_354_2	4.42E-05	8.50E-09
IL_S2_311_1	9.97E-06	2.16E-08
IL_S2_311_2	9.97E-06	2.16E-08
IL_S2_312_2	1.00E-05	2.16E-08
IL_S2_312_3	1.00E-05	2.16E-08
IL_S2_312_4	9.97E-06	2.16E-08
IL_S2_312VA13	1.10E-05	2.16E-08
IL_S2_312VC13	1.10E-05	2.16E-08
IL_S2_313	9.97E-06	2.16E-08
IL_S2_314_1	9.97E-06	2.16E-08
IL_S2_314_2	9.97E-06	2.16E-08
IL_S2_321_1	9.97E-06	2.16E-08
IL_S2_321_2	1.00E-05	2.16E-08
IL_S2_321_3	1.00E-05	2.16E-08

Initiating Event	CCDP	CLERP
IL_S2_321VAD3	9.22E-06	2.16E-08
IL_S2_321VBC3	9.22E-06	2.16E-08
IL_S2_323A2	1.00E-05	2.16E-08
IL_S2_327A	1.00E-05	2.16E-08
IL_S2_327B	1.00E-05	2.16E-08
IL_S2_327C	1.00E-05	2.16E-08
IL_S2_327D	1.00E-05	2.16E-08
IL_S2_351_1	1.00E-05	2.16E-08
IL_S2_351_2	1.00E-05	2.16E-08
IL_S2_354_1	9.69E-06	2.35E-08
IL_S2_354_2	9.68E-06	2.35E-08
ILY_A_311_1	1.62E-05	7.52E-06
ILY_A_311VA3	6.25E-05	5.38E-05
ILY_A_311VA4	6.25E-05	5.38E-05
ILY_A_311VC3	6.25E-05	5.38E-05
ILY_A_311VC4	6.25E-05	5.38E-05
ILY_A_312	8.73E-06	2.15E-08
ILY_A_312VA1	8.76E-06	5.70E-08
ILY_A_312VC1	8.76E-06	5.70E-08
ILY_A_323A1	1.75E-05	3.33E-07
ILY_A_323A2	1.74E-05	1.84E-07
ILY_A_323B1	1.41E-05	3.36E-07
ILY_A_323B2	1.39E-05	1.85E-07
ILY_A_323C1	2.25E-05	1.90E-07
ILY_A_323C2	2.24E-05	3.92E-08
ILY_A_323D1	2.25E-05	1.90E-07
ILY_A_323D2	2.24E-05	3.92E-08
ILY_A_323VA4	1.05E-04	8.78E-05
ILY_A_323VB4	1.02E-04	8.78E-05
ILY_A_323VC4	1.10E-04	8.76E-05
ILY_A_323VD4	1.10E-04	8.76E-05
ILY_A_354_1	9.23E-06	2.32E-08
ILYS1_312	8.73E-06	2.15E-08
ILYS1_312VA1	8.76E-06	5.70E-08
ILYS1_312VC1	8.76E-06	5.70E-08
ILYS1_321_1	1.67E-05	7.32E-06
ILYS1_321_2	1.67E-05	7.32E-06
ILYS1_321_3	1.37E-05	4.47E-06
ILYS1_321_4	1.37E-05	4.47E-06
ILYS1_321VA12	1.38E-05	4.57E-06
ILYS1_321VA51	1.51E-04	1.42E-04
ILYS1_321VB12	1.67E-05	7.36E-06
ILYS1_321VB3	6.35E-05	5.41E-05
ILYS1_321VD12	1.67E-05	7.36E-06
ILYS1_321VD3	6.35E-05	5.41E-05
ILYS1_327A1	9.35E-05	1.93E-07
ILYS1_327A2	9.26E-05	1.78E-07

Initiating Event	**CCDP**	**CLERP**
ILYS1_327B1	2.21E-05	1.87E-07
ILYS1_327B2	2.13E-05	1.71E-07
ILYS1_327C1	2.24E-05	3.98E-08
ILYS1_327C2	2.18E-05	2.43E-08
ILYS1_327D1	2.24E-05	3.98E-08
ILYS1_327D2	2.18E-05	2.43E-08
ILYS1_327VA4	1.02E-04	9.27E-06
ILYS1_327VB4	3.04E-05	9.26E-06
ILYS1_327VC4	3.09E-05	9.11E-06
ILYS1_327VD4	3.09E-05	9.11E-06
ILYS1_354_1	9.31E-06	1.06E-07
ILYS2_311_1	1.62E-05	7.52E-06
ILYS2_311_2	9.44E-06	7.38E-07
ILYS2_311VA52	8.24E-05	7.37E-05
ILYS2_312	1.24E-09	2.15E-08
ILYS2_321_1	1.67E-05	7.32E-06
ILYS2_321_2	1.67E-05	7.32E-06
ILYS2_321_3	1.37E-05	4.47E-06
ILYS2_321_4	1.37E-05	4.47E-06
ILYS2_323A1	1.75E-05	3.33E-07
ILYS2_323A2	1.74E-05	1.84E-07
ILYS2_323B1	1.41E-05	3.36E-07
ILYS2_323B2	1.39E-05	1.85E-07
ILYS2_323C1	2.25E-05	1.90E-07
ILYS2_323C2	2.24E-05	3.92E-08
ILYS2_323D1	2.25E-05	1.90E-07
ILYS2_323D2	2.24E-05	3.92E-08
ILYS2_327A1	9.26E-05	1.93E-07
ILYS2_327A2	9.26E-05	1.78E-07
ILYS2_327B1	2.14E-05	1.87E-07
ILYS2_327B2	2.13E-05	1.71E-07
ILYS2_327C1	2.18E-05	3.98E-08
ILYS2_327C2	2.18E-05	2.43E-08
ILYS2_327D1	2.18E-05	3.98E-08
ILYS2_327D2	2.18E-05	2.43E-08
ILYS2_351C	2.35E-05	1.15E-06
ILYS2_351D	2.35E-05	1.15E-06
ILYS2_351VC3	3.50E-04	3.28E-04
ILYS2_351VD3	3.50E-04	3.28E-04
ILYS2_354_1	1.05E-05	1.26E-06
ITF_________	8.88E-06	2.12E-08
ITS_________	8.01E-06	2.12E-08
ITT_________	7.94E-06	2.12E-08
O_3.B002	8.68E-06	2.12E-08
O_3.B002-327D	8.84E-06	2.12E-08
O_3.B003	8.72E-06	2.12E-08
O_3.B003-733	8.72E-06	2.12E-08

Initiating Event	**CCDP**	**CLERP**
O_3.B003-735	8.72E-06	2.12E-08
O_3.B004	8.72E-06	2.12E-08
O_3.B004-327D	9.48E-06	2.14E-08
O_3.B004-723	8.78E-06	2.12E-08
O_3.B004-733	8.72E-06	2.12E-08
O_3.B004-735	8.72E-06	2.12E-08
O_3.B005	9.24E-05	1.76E-07
O_3.B006	1.37E-05	2.16E-08
O_3.B007	1.38E-05	2.14E-08
O_3.B008	2.18E-05	2.26E-08
O_3.B009	2.18E-05	2.26E-08
O_3.B018	8.68E-06	2.12E-08
O_3.B019	9.41E-06	2.13E-08
O_3.B019-735	9.41E-06	2.13E-08
O_3.B020	8.70E-06	2.12E-08
O_3.B021	9.41E-06	2.13E-08
O_3.B101	9.24E-05	1.76E-07
O_3.B102	1.50E-05	2.15E-08
O_3.B103	2.18E-05	2.26E-08
O_3.B104	2.18E-05	2.26E-08
O_3.B105	1.29E-05	2.14E-08
O_3.B106	1.28E-05	2.14E-08
O_3.B107	1.36E-05	2.16E-08
O_3.B108	1.36E-05	2.16E-08
O_3.B110	9.41E-06	2.13E-08
O_3.D001a	8.68E-06	2.12E-08
O_3.D001a/b/c	8.68E-06	2.12E-08
O_3.D001c	8.68E-06	2.12E-08
O_3.D001c/D3	8.68E-06	2.12E-08
O_3.D002	2.10E-05	2.59E-08
O_3.D003	8.68E-06	2.12E-08
O_3.D005	2.09E-05	2.59E-08
O_3.D101	2.10E-05	2.59E-08
O_3.HA005	1.67E-05	2.70E-08
O_3.HA008	8.78E-06	2.12E-08
O_3.HA016	2.98E-05	2.22E-07
O_3.HA017	2.33E-05	4.37E-08
O_3.HB005	1.67E-05	2.70E-08
O_3.HB008	8.71E-06	2.12E-08
O_3.HB014	8.68E-06	2.12E-08
O_3.HB016	2.36E-05	8.85E-08
O_3.HB016-733	2.36E-05	8.85E-08
O_3.HB017	2.24E-05	4.22E-08
O_3.KC005	1.62E-05	2.70E-08
O_3.KD004	1.62E-05	2.70E-08
O_3.KD005	8.68E-06	2.12E-08

Table 15: Consequence Evaluation Segments and Results

Consequence Segment	Description	Line Size (mm)	Location	Config	Mitigation Impact	CCDP	CLERP	Rank
311-C-1	GBA-1 through 4 Small LOCA	< 169	Cont	O	S2_311_1	1.0E-05	2.20E-08	Medium
311-C-1A	GBA-1 from RPV to VB1	600 to 50	Cont	O	S1_311_1	1.4E-03	3.10E-07	High
311-C-1B	GBA-2 from RPV to VB2	600 to 50	Cont	O	S1_311_1	1.4E-03	3.10E-07	High
311-C-1C	GBA-3 from RPV to VD1	600 to 50	Cont	O	S1_311_1	1.4E-03	3.10E-07	High
311-C-1D	GBA-4 from RPV to VD2	600 to 50	Cont	O	S1_311_1	1.4E-03	3.10E-07	High
311-C-2A	GBA-1 from VB1 to Pen	600	Cont	O	A_312VAD3	4.1E-05	7.90E-09	Medium
311-C-2B	GBA-2 from VB2 to Pen	600	Cont	O	A_312VAD3	4.1E-05	7.90E-09	Medium
311-C-2C	GBA-3 from VD1 to Pen	600	Cont	O	A_312VAD3	4.1E-05	7.90E-09	Medium
311-C-2D	GBA-4 from VD2 to Pen	600	Cont	O	A_312VAD3	4.1E-05	7.90E-09	Medium
311-C-3A	GBA-1 from Pen to VA3	600	OC	O	Y311VA3	6.3E-05	5.40E-05	High
311-C-3B	GBA-2 from Pen to VA4	600	OC	O	Y311VA4	6.3E-05	5.40E-05	High
311-C-3C	GBA-3 from Pen to VC3	600	OC	O	Y311VC3	6.3E-05	5.40E-05	High
311-C-3D	GBA-4 from Pen to VC4	600	OC	O	Y311VC4	6.3E-05	5.40E-05	High
311-C-4A	HBB-1 from VA3	600	OC	O	Y311_1	1.6E-05	7.50E-06	Medium
311-C-4B	HBB-2 from VA4	600	OC	O	Y311_1	1.6E-05	7.50E-06	Medium
311-C-4C	HBB-3 from VC3	600	OC	O	Y311_1	1.6E-05	7.50E-06	Medium
311-C-4D	HBB-4 from VC4	600	OC	O	Y311_1	1.6E-05	7.50E-06	Medium
311-C-1E	GBA-5 downstream VB50	150, 50	Cont	O	S2_311_1	1.0E-05	2.20E-08	Medium
311-C-2E	GBA-5 between VB50 & VB51	150 & less	Cont	O	S2_311_2	1.0E-05	2.20E-08	Medium
311-C-3E	GBA-5 from VB51 to Pen	150	Cont	O	S2_311_2	1.0E-05	2.20E-08	Medium
311-C-4E	GBA-5 from Pen to VA52	150	OC	O	Y311_VA52	8.2E-05	7.40E-05	High
311-C-5E	NCD-2 & HBC-1 from VA52 to VA6	150 & less	OC	O	YS2_311_2	9.4E-06	7.40E-07	Medium
311-C-6E	HAB-1 from VA6	100 & less	OC	O	YS2_311_2	9.4E-06	7.40E-07	Medium
311-C-3E1	GBA-5 between VA38 & VB39	50	Cont	O	311_I3LOCAS2	<1E-6	<1E-7	Low
311-C-7E	HAB-2 MSIV inside Cont	50 & less	Cont	O	312_IPLOCAS2	<1E-6	<1E-7	Low
311-C-8E	HMB-2 & HAC-1 MISV outside Cont	50 & less	OC	O	312_IPLOCAS2	<1E-6	<1E-7	Low
311-C-9E	NCD-1 downstream VA83	150 & less	OC	S	311_PYS2_311_1	<1E-6	<1E-7	Low
312-C-1A	GMA-1 from RPV to VA3	300	Cont	O	S1_312_1	1.4E-03	3.10E-07	High
312-C-1B	GMA-2 from RPV to VB3	300	Cont	O	S1_312_1	1.4E-03	3.10E-07	High
312-C-1C	GMA-2 from RPV to VC3	300	Cont	O	S1_312_1	1.4E-03	3.10E-07	High
312-C-1D	GMA-1 from RPV to VD3	300	Cont	O	S1_312_1	1.4E-03	3.10E-07	High
312-C-2A	GMA-1 from VA3/VD3 to VC2	450 & less	Cont	O	A_312VAD3	4.1E-05	7.90E-09	Medium
312-C-2B	GMA-2 from VB3/VC3 to VA2	450 & less	Cont	O	A_312VAD3	4.1E-05	7.90E-09	Medium
312-C-3A	GMA-1 from VC2 to Pen	450	Cont	O	312 I2LOCA	1.0E-05	1.20E-09	Medium
312-C-3B	GMA-2 from VA2 to Pen	450	Cont	O	312 I2LOCA	1.0E-05	1.20E-09	Medium
312-C-4A	GMA-1 from Pen to VC1	450	OC	O	Y312_VC1	8.8E-06	5.70E-08	Medium

Consequence Segment	Description	Line Size (mm)	Location	Config	Mitigation Impact	CCDP	CLERP	Rank
312-C-4B	GMA-2 from Pen to VA1	450	OC	O	Y312_VA1	8.8E-06	5.70E-08	Medium
312-C-5	FAC-1 upstream VA1 & VC1	450 & less	OC	O	Y312	8.7E-06	2.20E-08	Medium
312-C-6	FAC-2 upstream VA12 & VC12	150 & less	OC	O	YS1_327A1	9.4E-05	1.90E-07	Medium
312-C-1E	GMA-3 from AFW to VC13	100	Cont	O	S1_312_3	1.4E-03	3.10E-07	High
312-C-1F	GMA-4 from AFW to VA13	100	Cont	O	S1_312_2	1.4E-03	3.10E-07	High
312-C-2E	GMA-3 from VC13 to Pen	100	Cont	O	S1_312VA13	1.1E-05	1.20E-09	Medium
312-C-2F	GMA-4 from VA13 to Pen	100	Cont	O	S1_312VC13	1.1E-05	1.20E-09	Medium
312-C-3E	GMA-3 from Pen to VC12	100	OC	O	YS1_327VA4	1.0E-04	9.30E-06	Medium
312-C-3F	GMA-4 from Pen to VA12	100	OC	O	YS1_327VA4	1.0E-04	9.30E-06	Medium
312-C-2G	LDB-1 & GMA-5 to VA2 and VC2	50 & less	Cont	O	S2_312_4	1.0E-05	2.20E-08	Medium
321-C-1	GMA-1, 3, 4, 5 Small LOCA	< 94	Cont	O	S2_321_1	1.0E-05	2.20E-08	Medium
321-C-1A	GMA-1 between VC16 and RPV	100 & less	Cont	O	S1_321_1	1.4E-03	3.10E-07	High
321-C-1B	GMA-1 Between VB13 & VC18/VC16	150 & less	Cont	O	S1_321VBC3	1.0E-05	1.2E-09	Medium
321-C-1C	GMA-1 between VC13 & VC18/312	150 & less	Cont	O	S1_321VBC3	1.0E-05	1.2E-09	Medium
321-C-1D	GMA-2 between VD13 & 312	150 & less	Cont	O	S1_321VAD3	1.0E-05	1.2E-09	Medium
321-C-1E	GMA-3 from RPV to VD2	200	Cont	O	S1_321_1	1.4E-03	3.10E-07	High
321-C-1F	GMA-4 from RPV to VB2	200	Cont	O	S1_321_1	1.4E-03	3.10E-07	High
321-C-1G	GMA-5 from RPV to VC50	200	Cont	O	S1_321_1	1.4E-03	3.10E-07	High
321-C-2B	GMA-1 from VB13 to Pen	150	Cont	O	321 I2LOCA	<1E-6	<1E-7	Low
321-C-2C	GMA-1 from VC13 to Pen	150	Cont	S	321 PILOCA	<1E-6	<1E-7	Low
321-C-2D	GMA-2 from VD13 to Pen	150	Cont	O	321 I2LOCA	<1E-6	<1E-7	Low
321-C-2E	GMA-3 from VD2 to Pen	200	Cont	O	321 ILOCA	1.0E-05	2.20E-08	Medium
321-C-2F	GMA-4 from VB2 to Pen	200	Cont	O	321 ILOCA	1.0E-05	2.20E-08	Medium
321-C-2G	GMA-5 from VC50 to Pen	200	Cont	S	321 PLOCA	1.0E-05	2.20E-08	Medium
321-C-3B	GMA-1 from Pen to VD12	150	OC	O	Y321VD12	1.7E-05	7.40E-06	Medium
321-C-3C	GMA-1 from Pen to VA12	150	OC	S	Y321VA12	1.4E-05	4.60E-06	Medium
321-C-3D	GMA-2 from Pen to VB12	150	OC	O	Y321VB12	1.7E-05	7.40E-06	Medium
321-C-3E	GMA-3 from Pen to VB3	200	OC	O	Y321VB3	6.4E-05	5.50E-05	High
321-C-3F	GMA-4 from Pen to VD3	200	OC	O	Y321VD3	6.4E-05	5.50E-05	High
321-C-3G	GMA-5 from Pen to VA51	200	OC	S	Y321VA51	1.5E-04	1.40E-04	High
321-C-4B	FMB-4,5,6 from VB12/VD12 to pumps	200 & less	OC	O	Y321_1	1.7E-05	7.30E-06	Medium
321-C-4C	MMB-4 & MMB-5 from pump to VA12	200 & less	OC	S	Y321_3	1.4E-05	4.50E-06	Medium
321-C-4E	FMB-1,2,3 from VB3/VD3 to pumps	200 & less	OC	O	Y321_2	1.7E-05	7.30E-06	Medium
321-C-4G	MMB-3 from VA51 to Pump	200 & less	OC	S	Y321_4	1.4E-05	4.50E-06	Medium
323-C-1A	GMA-1 from RPV to VA5/VA30	250 & less	Cont	O	S1_323A1	1.4E-03	3.10E-07	High
323-C-1A1	GMA-1 between VA30 & VA31	100	Cont	S	323_PLOCA (1)	1.0E-05	2.20E-08	Medium
323-C-1A2	GMA-1 downstream VA31, HMB-5	100	Cont	S	323_P2LOCA (1)	<1E-6	<1E-7	Low

Consequence Segment	Description	Line Size (mm)	Location	Config	Mitigation Impact	CCDP	CLERP	Rank
323-C-1A3	HMB-5 downstream VA31 SP	100	SP	S	323_P2LOCA (1)	<1E-6	<1E-7	Low
323-C-1B	GMA-2 from RPV to VB5	250	Cont	O	S1_323A	1.4E-03	3.10E-07	High
323-C-1C	GMA-3 from RPV to VC5	250	Cont	O	S1_323A	1.4E-03	3.10E-07	High
323-C-1D	GMA-4 from RPV to VD5	250	Cont	O	S1_323A	1.4E-03	3.10E-07	High
323-C-2A	GMA-1 from VA5 to Pen	250	Cont	S	323_PLOCA	1.0E-05	2.20E-08	Medium
323-C-2B	GMA-2 from VB5 to Pen	250	Cont	S	323_PLOCA	1.0E-05	2.20E-08	Medium
323-C-2C	GMA-3 from VC5 to Pen	250	Cont	S	323_PLOCA	1.0E-05	2.20E-08	Medium
323-C-2D	GMA-4 from VD5 to Pen	250	Cont	S	323_PLOCA	1.0E-05	2.20E-08	Medium
323-C-3A	GMA-1 from Pen to VA4	250	OC	S	Y323VA4	1.1E-04	8.80E-05	High
323-C-3B	GMA-2 from Pen to VB4	250	OC	S	Y323VB4	1.1E-04	8.80E-05	High
323-C-3C	GMA-3 from Pen to VC4	250	OC	S	Y323VC4	1.1E-04	8.80E-05	High
323-C-3D	GMA-4 from Pen to VD4	250	OC	S	Y323VD4	1.1E-04	8.80E-05	High
323-C-4A	HMB-1 from VA4 to VA3	250	OC	S	Y323A1	1.8E-05	3.30E-07	Medium
323-C-4B	HMB-2 from VB4 to VB3	250	OC	S	Y323B1	1.4E-05	3.40E-07	Medium
323-C-4C	HMB-3 from VC4 to VC3	250	OC	S	Y323C1	2.3E-05	1.90E-07	Medium
323-C-4D	HMB-4 from VD4 to VD3	250	OC	S	Y323D1	2.3E-05	1.90E-07	Medium
323-C-5A	HMB-1 from VA3 to pump	250 & less	OC	S	Y323A2	1.8E-05	1.80E-07	Medium
323-C-5B	HMB-2 from VB3 to pump	250 & less	OC	S	Y323B2	1.4E-05	1.90E-07	Medium
323-C-5C	HMB-3 from VC3 to pump	250 & less	OC	S	Y323C2	2.2E-05	3.90E-08	Medium
323-C-5D	HMB-4 from VD3 to pump	250 & less	OC	S	Y323D2	2.2E-05	3.90E-08	Medium
323-C-6A	PNB-5 pump suction	400 & less	OC	S	Y323A2	1.8E-05	1.80E-07	Medium
323-C-6B	PNB-6 pump suction	400 & less	OC	S	Y323B2	1.4E-05	1.90E-07	Medium
323-C-6C	PNB-7 pump suction	400 & less	OC	S	Y323C2	2.2E-05	3.90E-08	Medium
323-C-6D	PNB-8 pump suction	400 & less	OC	S	Y323D2	2.2E-05	3.90E-08	Medium
462	Condensate System	Various	OC	O	TF	8.9E-06	2.1E-08	Medium

(1) This path can be open to support vessel level control during plant startup. However, operators will be alerted to isolate the valves if there were piping leaks during this configuration. Given this reliable operator action and short exposure time in this configuration, the consequence is low.

Table 16: Comparison of SKIFS Consequence Index to CCDP

KI	Category	Sub-Category	PSA Characterisation	CCDP	Rank
1	Large piping below the core >100 mm	-	Large LOCA	>1E-4	High
2	Piping from RPV to second valve (water ID > 39 mm, Steam ID > 75 mm)	Up to first valve	Large LOCA	3E-4	High
			Medium LOCA	1E-3	High
			Small LOCA	1E-5	Medium
		Between 1st and 2nd valve	Isolable or Potential LOCA Inside	<1E-4	Medium
			Isolable or Potential LOCA Outside Containment	<1E-4	Medium or High (1)
	≥DN50 pressurized & part of containment integrity	-		<1E-4	Medium
	≥DN50 within 5 m from containment isolation valves	-		<1E-4	Medium
	≥DN50 Indirect consequence can lead to single failure criteria fail	-		<1E-4	Medium
3	Piping from RPV to second valve (water ID > 19-39 mm, Steam ID > 54-75 mm)	Up to first valve	Very Small LOCA	1E-5	Medium
		Between 1st and 2nd valve	Isolable or Potential LOCA	<1E-4	Medium
	≥DN50 that could lead to isolation or scram	-	Scram	8E-6	Medium
	≥DN50, that are not assigned KI=1-2	-	At least 2 isolation valves	<1E-6	Low
None	Do not fall into categories KI=1, 2 and 3	-	May be initiating event	~1E-6	Low

(1) LERF is greater than 1E-5 for certain system configurations

KI = 1 (comparison to EPRI is High Consequence with CCDP > 1E-4)

- Applies to large (>100 mm) piping below the core (e.g., external recirculation piping), which does not apply to F3 because of internal main circulation pumps. Thus, there are no welds at F3 categorized as KI=1 (high consequence).

KI = 2 (Comparison to EPRI is Medium Consequence with CCDP between 1E-6 and 1E-4)

- Rupture or leakage in piping from reactor vessel to second valve that closes automatically on pipe rupture and leakage flow > 45 kg/s. (45 kg/s corresponds to the flow of saturated water from a pipe with ID > 39 mm or steam from a pipe with ID > 75 mm, according to SKI report 2003:2). For comparison, this is a Medium to Large LOCA in the F3 PSA, which is a high consequence using the EPRI methodology.

- Devices ≥DN50, pressurized with reactor water, that are part of the containment integrity.

- Devices ≥DN50, pressurized with reactor water, that are within 5 m from the containment isolation valves.

- Devices ≥DN50, pressurized with reactor water, where indirect consequences can lead to the single failure criteria fail.

KI = 3 (Comparison to EPRI is Low Consequence with CCDP < 1E-6)

- Rupture or leakage in piping from reactor vessel to second valve that closes automatically on pipe rupture and leakage with a flow >22.5-45 kg/s. (Corresponds to the flow of saturated water from a pipe with ID 19-39 mm or steam from a pipe with ID 54-75 mm, according to SKI report 2003:2). For comparison, this is Medium LOCA in the F3 PSA, which is a high consequence using the EPRI methodology.

- Other devices ≥DN50 pressurized with reactor water [that could lead to isolation or scram].

- [Devices ≥DN50, that are not assigned KI=1-2, but are required for scramming the reactor, residual heat removal or maintaining the containment integrity.]

KI = None (Comparison to EPRI is a Very Low or None Consequence with CCDP < 1E-6)
Parts that do not fall into categories KI=1, 2 and 3.

4 Failure Potential Evaluation

The RI-ISI degradation evaluation is documented in this section and the resulting degradation mechanisms (DM) are summarized in Table 17 and in Appendix A for each applicable weld.

Table 17: Failure Potential Assessment Summary

System	Thermal Fatigue		Stress Corrosion Cracking				Localized Corrosion			Flow Sensitive	
	TASCS	TT	IGSCC	TGSCC	ECSCC	PWSCC	MIC	PIT	CC	E-C	FAC
311											
312			✓								
321		✓	✓								
323		✓	✓								
462											✓

4.1 Background

4.1.1 Degradation Mechanism Summary

Failure potential is determined by identifying those degradation mechanisms that may be potentially operative at each assessed weld. The degradation mechanisms to be assessed are and described in the following paragraphs:

TASCS	Thermal Stratification, Cycling, Striping
TT	Thermal Transient
IGSCC	Intergranular Stress Corrosion Cracking
TGSCC	Transgranular Stress Corrosion Cracking
ECSCC	External Chloride Stress Corrosion Cracking
PWSCC	Primary Water Stress Corrosion Cracking
MIC	Microbiologically-Influenced Corrosion
PIT	Pitting
CC	Crevice Corrosion
E-C	Erosion-Cavitation
FAC	Flow-Accelerated Corrosion

Thermal Fatigue

Mechanism Description:

Thermal fatigue can occur as a result of alternating stresses caused by thermal cycling of a component resulting in accumulated fatigue usage and leading to crack initiation and growth.

Attribute Criteria:

Austenitic and carbon steel piping segments with operating temperatures less than 270 and 220°F (132 and 104°C), respectively, are not susceptible to degradation by thermal fatigue. Piping segments having operating temperatures greater than these values are evaluated for the potential for degradation from thermal transients and thermal stratification, cycling, and striping as indicated in the following:

> Thermal Transients:
>
> Areas considered susceptible to thermal fatigue include pipe segments where there is relatively rapid cold (hot) water injection with delta temperature greater than 150°F (84°C) for carbon steel pipe and 200°F (111°C) for austenitic steel pipe. When these temperature changes are exceeded, additional evaluations can be performed to determine if delta temperature is greater than delta temperature allowable based on more realistic estimates of temperature and anticipated number of cycles.
>
> Thermal Stratification Cycling and Striping:
>
> Areas where there can be leakage past valves separating hot and cold fluids and regions where there might be intermittent mixing of hot and cold fluids caused by fluid injection are considered to be susceptible to degradation from thermal fatigue. Exceptions are for pipe segments where the pipe diameter is 1 inch (DN 25) or less, or the slope of the segment is 45° or more from the horizontal. When these criteria are exceeded, additional evaluations can be performed to determine if the maximum delta temperature is greater than 50°F (28°C) or the Richardson number is greater than 4.0.

Stress Corrosion Cracking (SCC)

Stress corrosion cracking encompasses several mechanisms as are discussed below.

Intergranular Stress Corrosion Cracking (IGSCC)

Mechanism Description:

IGSCC results from a combination of sensitized materials (caused by a depletion of chromium in regions adjacent to the grain boundaries in weld heat-affected zones), high stress applied and residual welding stresses, and a corrosive environment (high level of oxygen or other contaminants).

Attribute Criteria:

BWRs: Piping within the scope of the RI-ISI evaluation is typically compared to piping included in the existing plant IGSCC inspection program. Options include USNRC Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping" or EPRI BWRVIP-075. Piping in the RI-ISI evaluation scope should be identified as susceptible to IGSCC for the purpose of RI-ISI evaluation if it is inspected as part of the existing plant IGSCC inspection program.

PWRs: Welds and heat-affected zones in wrought austenitic steel PWR piping having high dissolved oxygen content and stagnant flow (e.g., stagnant, oxygenated borated water systems) are considered susceptible to degradation from IGSCC. Welds in materials considered to be resistant to sensitization from welding (see NUREG-0313, Rev. 2) are not susceptible to degradation from IGSCC.

Transgranular Stress Corrosion Cracking (TGSCC)

Mechanism Description:

TGSCC is stress corrosion cracking that occurs through the grains of the material and usually occurs in the presence of halogens and sulfides. It is not necessarily associated with a particular metallurgical condition, such as grain boundary sensitization, but is affected by high local residual stresses, such as caused by welding or local cold work.

Attribute Criteria:

In both BWR and PWR plants, austenitic stainless steels are susceptible to TGSCC in the presence of chlorides and oxygen. Nickel alloy and low alloy steels generally pit in the presence of chlorides and oxygen. Low alloy and carbon steels can crack by TGSCC in sulfur bearing environments, such as hydrogen sulfide. However, this environment is not of general interest to light water reactors.

External Chloride Stress Corrosion Cracking (ECSCC)

Mechanism Description:

The electrochemical reaction caused by a corrosive media upon a piping system.

Attribute Criteria:

Austenitic steel piping and welds are considered susceptible to chloride corrosion cracking when exposed to chloride contamination (from insulation, brackish water, or concentration of fluids containing chlorides), temperatures greater than 150°F (66°C), and tensile stresses.

Primary Water Stress Corrosion Cracking (PWSCC)

Mechanism Description:

PWSCC occurs when high-temperature primary water is the corrosive medium and is present in combination with a susceptible material and high tensile stress.

Attribute Criteria:

Piping and attachments (e.g., thermowells) are considered susceptible to PWSCC when they are fabricated from mill annealed Alloy 600 (A82 and A182) that is cold worked or cold worked and welded without subsequent stress relief, exposed to primary water, and operate at temperatures in excess of 570°F (299°C).

The attribute criteria specified for PWSCC in this section are applicable to PWRs. The susceptibility to corrosion cracking from PWSCC is covered for BWRs in the section on IGSCC.

Localized Corrosion

Local corrosion encompasses several mechanisms as are discussed below.

Microbiologically Influenced Corrosion (MIC)

Mechanism Description:

Microbes, primarily bacteria, have been found to cause widespread damage to low alloy and carbon steels. Similar damage has also been found at welds and heat-affected zones for austenitic stainless steels.

Attribute Criteria:

Areas considered susceptible to degradation from MIC are piping components with fluids containing organic material or with organic material deposits. The most vulnerable components are raw water systems, storage tanks, and transport systems. Systems with low to intermittent flow conditions, temperatures less than 150°F (66°C), and pH below 10 are primary candidates.

Pitting (PIT)

Mechanism Description:

Pitting corrosion is a form of localized attack on exposed surfaces with greater corrosion rates at some locations than at others. High local concentrations of impurity ions, such as chlorides and sulfates, tend to concentrate in oxygen depleted pits, giving rise to a potentially concentrated aggressive solution in this zone.

Attribute Criteria:

All structural materials are potentially susceptible to pitting, including austenitic stainless steels, nickel alloys and carbon and low alloy steels. It can occur in low flow or stagnant regions in components, or within crevices, in these materials. Susceptibility to pitting is a strong function of oxygen level and chloride level concentration.

Crevice Corrosion (CC)

Mechanism Description:

Crevice corrosion is the electrochemical reaction caused by an oxygenated media within a piping system.

Attribute Criteria:

Regions containing crevices (narrow gaps) that can result in oxygen depletion and a relatively high concentration of chloride ions or other impurities are considered susceptible to crevice corrosion cracking.

Flow Sensitive (FS)

These mechanisms consist of Flow Accelerated Corrosion (FAC) and Erosion-Cavitation (E-C).

Erosion-Cavitation

Mechanism Description:

This degradation mechanism represents degradation caused by turbulent flow conditions, which erode (wear away the metal) the pipe wall by cavitation. Cavitation damage is the result of the formation and instantaneous collapse of small voids within fluid subjected to rapid pressure and velocity changes as it passes through a region where the flow is restricted (e.g., a valve, pump, or orifice).

Attribute Criteria:

Regions where $(p_d - p_v)/ \Delta p < 5$, and $V > 30$ feet per second (9.1m/s) and fluid temperature < 250°F (121°C) are considered susceptible to degradation from erosion-cavitation. Where p_d is the static pressure downstream of the cavitation source (e.g. pump, valve, orifice), p_v is the vapor pressure, Δp is the pressure differential across the unit, and V is the flow mean velocity at the inlet of the unit. All pressures are gauge pressures.

The susceptible region might extend a distance equal to approximately 5D downstream of a pump, flow orifice, throttling valve, pressure-reducing valve, or other potential sources of cavitation.

Standard reducers do not create the potential for erosion degradation. Regions where flow occurs for less than 100 hours per year are not considered to be susceptible to erosion-cavitation degradation.

Flow-Accelerated Corrosion (FAC)

Mechanism Description:

FAC is a complex phenomenon that exhibits attributes of erosion and corrosion in combination. Factors that influence whether FAC is an issue is velocity, dissolved oxygen, pH, moisture content of steam, and material chromium content.

Attribute Criteria:

Carbon steel piping with chromium content greater than 1 percent and austenitic steel piping are not susceptible to degradation from FAC. Piping within the scope of the RI-ISI evaluation is compared to piping included in the existing plant FAC inspection program.

EPRI report NSAC/202L, "Recommendations for an Effective Flow-Accelerated Corrosion Program", provides the general guidelines for the identification and inspection of components subject to FAC degradation.

4.1.2 Degradation Mechanism Categories

The EPRI RI-ISI classification scheme for assignment of segments to the three general classes of failure potential is depicted in Table 18.

Table 18: Criteria for Ranking of Pipe Rupture Potential

Pipe Rupture Potential	Expected Leak Conditions	Degradation Mechanisms To Which The Segment is Susceptible
HIGH	Large	Flow Accelerated Corrosion (FAC)
MEDIUM	Small	Thermal Fatigue Stress Corrosion Cracking (IGSCC, TGSCC, PWSCC, ECSCC) Localized Corrosion (MIC, Crevice Corrosion and Pitting) Erosion-Cavitation
LOW	None	No Degradation Mechanisms Present

The logic of this classification scheme is very straightforward and practical. If there is no known damage mechanisms present in the piping, the potential for pipe rupture is classified as low. In this case there is high confidence that the potential for rupture due to any known damage mechanism can be ruled out. The potential for pipe ruptures would in this case be determined solely by the likelihood of occurrence of severe loading conditions in excess of the pipe segment capacity. Another possibility is the occurrence of a pipe rupture due to some heretofore unknown damage mechanism, although this is considered unlikely for the reasons detailed below.

When the pipe segment has been identified as having the conditions necessary for one or more well defined damage mechanisms, the likelihood of pipe rupture is obviously higher. This is because the presence of damage mechanisms may lead to pipe failures directly, or they can reduce the capacity of the pipe segment to withstand transient and severe piping loads if and when they occur. Hence, on a qualitative basis it is clear that the presence of conditions necessary for piping damage mechanisms would lead to a higher rate of occurrence of pipe failures and ruptures than the case where no such conditions are present, all other factors being equal. These considerations led to three natural categories of pipe failure potential.

It is also possible that a pipe segment, subject to a degradation mechanism with a moderate break potential, may be moved into the high category if the pipe segment is known to be subject to water hammer loads with no mitigation actions being implemented.

The degradation mechanisms to be assessed and explicit criteria for this assessment are provided in Reference 1, and repeated in Table 19 of this report. In the following sections, the criteria outlined in Table 19 are used to assess the potentially active degradation mechanisms for all piping within the scope of this application at F3.

The degradation mechanism (DM) evaluation of in-scope piping is provided in the following sections (on a per system basis).

4.2 Main Steam (311)

4.2.1 System Description

The Main Steam (MS) System is designed to conduct high quality steam from the reactor vessel to various steam driven components. The system consists of four main steam lines (DN600) from the reactor through containment penetrations to system 412 which ultimately connect to the main turbine, smaller bore piping (DN150) from each main steam line which connects to a common header (GBA-5 and HBC-1) which then penetrates containment and then to system 412 and finally some other small bore piping (DN50) connected to each of the main steam isolation valves.

4.2.2 Materials and Conditions

Per Reference [6], materials for the main steam system piping consists of carbon steel and operating temperature is 547°F (286°C). Per Reference [7], the system is operated consistent with the EPRI water chemistry guidelines [8] ensuring high purity fluid conditions and parameters are maintained.

4.2.3 Degradation Mechanism Evaluation

Checklists applying the criteria of Reference 1 (Table 19) to all piping runs in the main steam system are given in Table 20. A summary of the evaluation of each degradation mechanism for the conditions existing in the main steam system is given below. The information on which all evaluations are based is obtained from References [6, 7, 8, 9], unless noted otherwise. A complete list of in-scope welds in the main steam system, matched with their potential degradation mechanism(s), is provided in Appendix A.

The main steam system was evaluated for normal operating conditions as well as conditions of heatup/cooldown, and plant trips. All other system transients are either mild or slow-acting with respect to steam temperature (not a TT instigator and no other mechanisms apply) or are emergency/faulted events which as discussed in [1] are not part of the RI-ISI evaluation process.

Thermal Fatigue (TF)

Thermal Stratification, Cycling and Striping (TASCS)
The in-scope piping is not susceptible to TASCS since the conditions for hot/cold fluid mixing do not exist in these lines.

Thermal Transient (TT)
The in-scope piping is not susceptible to TT during heatup/cooldown since the main steam system is warmed up /cooled down slowly and there are no interactions with other systems that can cause significant hot / cold interactions.

Stress Corrosion Cracking (SCC)

Intergranular Stress Corrosion Cracking (IGSCC)
Most of the in-scope piping is not susceptible to IGSCC due to the piping being carbon steel and the high quality of the chemistry controlled reactor grade water present in all runs [7]. Six welds were identified as SCC per the SKIFs program (HAB-2-43-WS4, HAB-2-43-WS9, HAB-2-44-S10, HAB-2-44-WS9, HAC-1-37-W1 and NCD-1-33-W17). Additionally three welds (HMB-2-36-S1, HMB-2-36-S11 and HMB-2-36-S6) have an assigned SI =1 which are stainless steel. Application of NUREG-0313/BWRVIP-072 criteria would not identify these welds as IGSCC due to line size exemption (i.e. less than 4 NPS (100DN)).

Transgranular Stress Corrosion Cracking (TGSCC)
The in-scope piping is not susceptible to TGSCC due to the subject piping being carbon steel and the high quality of the chemistry controlled reactor grade water present in all runs [7].

External Chloride Stress Corrosion Cracking (ECSCC)
The in-scope piping is not affected by this degradation mechanism due to the subject piping being carbon steel [6].

Primary Water Stress Corrosion Cracking (PWSCC)
The in-scope piping is not affected by this degradation mechanism as this mechanism applies to pressurizer water reactors (PWR).

Localized Corrosion

Microbiologically Influenced Corrosion (MIC)
The in-scope piping is not susceptible to MIC due to the high operating temperature of this system [6].

Pitting (PIT)
The in-scope piping is not susceptible to PIT due to the high quality of the chemistry controlled reactor grade water present in all runs [7].

Crevice Corrosion (CC)
There are no thermal sleeves located in the in-scope piping. As such, crevice corrosion is not applicable to the in-scope piping [10].

Flow Sensitive (FS)

Erosion-Cavitation (E-C)
Erosion-cavitation is not applicable to the in-scope piping as the operating temperature exceeds 250^{o}F (121°C).

Flow Accelerated Corrosion (FAC)
The RI-ISI methodology points to the existing plant FAC program for identifying the number, location and frequency of inspection for this mechanism. Per [11], the Main Steam system is not susceptible to FAC and therefore no inspections have been identified.

4.3 Feedwater Lines (312)

4.3.1 System Description

The Feedwater Lines consists of two trains which are fed from the discharge of the high pressure heaters through the containment penetration area and into containment. Inside the containment, each train splits in two and injects into the reactor vessel at four RX nozzles. Prior to entering containment, both trains of the Feedwater Lines joined into a common header which then splits and feeds two trains of system 327. System 327 is the auxiliary feedwater system.

During normal operation / startup / shutdown, water is supplied to the Feedwater Lines from the feedwater system (463). In response to plant trips, if the Feedwater Lines are isolated water is provided to the reactor via other systems which do not interact with the Feedwater lines. Thus, there is no concern of mixing or injection of relatively colder water on hot Feedwater Line piping.

However, the RHR system (312), whose high pressure circuit provides a reactor water purification (clean-up) function, does interact with the Feedwater Lines downstream of Valve VC2. This interaction occurs during start-up as well as during full power operation.

4.3.2 Materials and Conditions

Per Reference [6], materials for the Feedwater Lines piping consists mostly of stainless steel and a limited amount of carbon steel and the maximum operating temperature is 419°F (215°C). Per Reference [7], the system is operated consistent with the EPRI water chemistry guidelines [8] ensuring high purity fluid conditions and parameters are maintained.

While the maximum operating temperature is 419°F (215°C) as noted above, the temperature and flow conditions for this piping is a function of whether the plant is at full power of some phase of plant start-up or shutdown.

During plant start-up (e.g. zero to four percent power), flow is provided to the two lines (DN100) that lead to the auxiliary feedwater system (327) through common header valve VA23 and then trainwise valves VA12 and VC12. Temperature through these lines can be as high as 266°F (130°C). Above four percent power, the aforementioned valve is isolated and flow is through the two main lines via valves VA1 and VC1. At full power, operating temperature can be as high as 410°F (210°C) [12].

4.3.3 Degradation Mechanism Evaluation

Checklists applying the criteria of Reference 1 (Table 19) to all piping runs in the Feedwater Lines system are given in Table 21. A summary of the evaluation of each degradation mechanism for the conditions existing in the Feedwater Lines system is given below. The information on which all evaluations are based is obtained from References [6, 7, 8 & 13], unless noted otherwise or above. A complete list of in-scope welds in the feedwater system, matched with their potential degradation mechanism(s), is provided in Appendix A.

The Feedwater Lines system was evaluated for normal operating conditions as well as conditions of heatup/cooldown, and plant trips. All other system transients are either mild or slow-acting with respect to feedwater temperature (not a TT instigator and no other mechanisms apply) or are emergency/faulted events which as discussed in [1] are not part of the RI-ISI evaluation process. Where transients in other systems affect the in-scope piping (e.g. RHR high pressure circuit connection downstream of VA2), these transients are also evaluated.

Thermal Fatigue (TF)

Thermal Stratification, Cycling and Striping (TASCS)

Feedwater Piping to the AFW (327) Connections – This portion of the Feedwater Lines is utilized during plant start-up (i.e. up to four percent power). Above four percent power, valve VA23 is closed and feedwater flow to the reactor vessel is through the main lines via valves VA1 and VC1. Per References [12, 13], all flow through to these lines is from the high pressure preheaters. There is no other flow into the Feedwater Lines from other systems and as such no mixing of hot and cold fluid. Plant procedures require that temperatures are maintained uniform and gradually increased (decreased) during plant start-up (shutdown). Additionally, there are no branch connections located so that turbulent penetration is not a concern. As such, these lines are not considered susceptible to TASCS.

Feedwater Piping from System 463 to the Reactor Vessel – This portion of the Feedwater Lines is utilized during plant start-up (i.e. above four percent power) and during normal plant operation. Feedwater flow is from the high pressure perheaters through valves VA1 and VC1 into the containment and ultimately to the four feedwater nozzles. There is no other flow into the main Feedwater Lines from other systems and as such no mixing of hot and cold fluid (except for the RHR which is discussed below. Plant procedures require that temperatures are maintained uniform and gradually increased (decreased) during plant start-up (shutdown). Additionally, there are no branch connections located so that turbulent penetration is not a concern. As such, these lines are not considered susceptible to TASCS.

Feedwater Piping Near the RHR Connection – The RHR system connects to the Feedwater Lines at two locations. The high pressure circuit of the RHR system is connected to the Feedwater Lines downstream of valve VC2. This connection provides for the return of purified reactor water through the RHR system, to the RHR/Feedwater connection and then to the reactor vessel. This portion of the RHR system is utilized during plant start-up, power operation and shutdown for purification purposes (e.g. reactor water clean-up). Prior to entering the feedwater Lines, the water is heated to a temperature close to the Feedwater Lines temperature using either system 331 heat exchangers, the RHR heat exchanger (EB2) or a combination. The low pressure circuit is connected to the Feedwater Lines downstream of valve VA2. This system is not in use during start-up or power operation.

Per plant procedures, water being supplied to the Feedwater Lines through the RHR connection is controlled so that the temperature is controlled to be closely matched to Feedwater Line temperatures. Thus, there is no mixing of fluids at significantly different temperatures.

However, there is the potential that if the RHR (or system 331) is inadvertently isolated, and then after some amount time is restarted, relatively colder RHR water could interact with relatively hotter Feedwater. Based of F3 operating experience, this event has not occurred with any significant frequency. Additionally, a thermal mixing device is provided at this location. This device assures that RHR and feedwater fluid are mixed so that stratification does not occur. This device is also of benefit during normal operation of there is a mismatch between RHR and Feedwater temperature. Because of the above, the interaction between the RHR system and the Feedwater Lines do not result in a TASCS concern.

Thermal Transient (TT)

Feedwater Piping to the AFW (327) Connections – Per References [12, 13], all flow through these lines comes from the high pressure preheaters. Per plant procedure and physical connections (i.e. no other systems connected to these lines for in-flow purposes), there is no rapid mixing of hot and cold water. As such, these lines are not considered susceptible to TT.

Feedwater Piping from System 463 to the Reactor Vessel – Per References [12, 13], all flow through these lines comes from the high pressure preheaters. Per plant procedure and physical connections (i.e. no other systems connected to these lines for in-flow purposes, except for RHR discussed below), there is no rapid mixing of hot and cold water. Based on industry operating experience, there has been some cracking in feedwater nozzles caused by thermal cycling under extended low power operation (see NUREG-0619). Per discussion with plant personnel [20], this phenomena is potentially applicable in the nozzles themselves but does not extend to the feedwater piping.

Feedwater Piping Near the RHR Connection – As discussed above, a thermal mixing device is provided at this location. This device assures that any mismatch in temperature between the RHR and feedwater fluid are adequately mixed so that thermal shock does not occur at this location or downstream of this location.

Stress Corrosion Cracking (SCC)

Intergranular Stress Corrosion Cracking (IGSCC)
The in-scope piping that is carbon steel is not susceptible to IGSCC. Per the F3 ISI program, sixteen of the stainless steel welds are assigned susceptibility to SCC. Eleven are assigned a Stress Index (SI) of I (highest susceptibility) while six welds are assigned a SI of II (medium susceptibility) [6]. Application of NUREG-0313/BWRVIP-072 criteria identified eight of the eleven SI=1 welds as IGSCC Category D and three of the eleven as exempt due to line size (i.e. less than 4 NPS (100DN)). For the six SI=2 welds, application of NUREG-0313/BWRVIP-072 criteria identified four welds as IGSCC Category D and two welds as exempt due to line size (i.e. less than 4 NPS (100DN)). Additionally, application of NUREG-0313/BWRVIP-072 criteria identified ten welds as IGSCC Category D that were not identified via the SKIFs methodology. However, each of these welds were identified as SI=1 due to mechanical fatigue.

Transgranular Stress Corrosion Cracking (TGSCC)
The in-scope piping is not susceptible to TGSCC due to the high quality of the chemistry controlled reactor grade water present in all runs [7, 8].

External Chloride Stress Corrosion Cracking (ECSCC)
The in-scope piping is not affected by this degradation mechanism based upon a review of plant service experience, the piping being located indoors and the plant insulation material being consistent with Reg. Guide 1.36 criteria [5].

Primary Water Stress Corrosion Cracking (PWSCC)
The in-scope piping is not affected by this degradation mechanism due to the fact that this mechanism only applies to PWR plants.

Localized Corrosion

Microbiologically Influenced Corrosion (MIC)
The in-scope piping is not susceptible to MIC due to the high operating temperature of this system.

Pitting (PIT)
The in-scope piping is not susceptible to PIT due to the high quality of the chemistry controlled reactor grade water present in all runs [7, 8].

Crevice Corrosion (CC)
There are no thermal sleeves located in the in-scope piping. There is however, a thermal mixing tee at the Feedwater to RHR connection. Given the high quality reactor grade water and that the piping at these locations is stainless steel, per the criteria of Reference [14], crevice corrosion is not applicable.

Flow Sensitive (FS)

Erosion-Cavitation (E-C)
Erosion-cavitation is not applicable to the in-scope piping as there are no cavitation sources and operating temperature exceeds 250^{o}F (121^{o}C).

Flow Accelerated Corrosion (FAC)
The RI-ISI methodology points to the existing plant FAC for identifying the number, location and frequency of inspection for this mechanism. Per [11], the Feedwater Lines are not susceptible to FAC and therefore no inspections have been identified.

4.4 Residual Heat Removal (321)

4.4.1 System Description

The RHR system consists of a high pressure circuit and a low pressure circuit. The high pressure circuit operates during start-up, normal operation and shutdown. The high pressure circuit interacts with system 331 and the Feedwater Lines (312). System 331 provides a reactor water purification (clean-up) function. Water from system 331 returns to the RHR system downstream of valve 321-VB26. This water is then returned to the reactor via the feedwater system downstream of valve 312-VC2. Water may also return to the reactor via the feedwater system downstream of valve 312-VA-2.

The low pressure circuit is not normally operating. During a demand it takes suction from system 323 (LP ECC) and after going through its heat exchangers (321-EA1) discharges to the Feedwater Lines downstream of valve 312-VA2.

4.4.2 Materials and Conditions

Per Reference [6], materials for the RHR system piping consists entirely of stainless steel and the maximum operating temperature range from 180°C (356°F) to 286°C (547°F). Per Reference [7], the system is operated consistent with the EPRI water chemistry guidelines [8] ensuring high purity fluid conditions and parameters are maintained.

While the maximum operating temperature is 286°C (547°F) as noted above, the temperature and flow conditions for this piping is a function of whether the plant is at full power or some phase of plant start-up or shutdown.

As with plant operation, during plant start-up (e.g. zero to four percent power), flow is provided to system 331 for purification purposes. Flow from system 331 is pre-heated prior to its return to the RHR system.

4.4.3 Degradation Mechanism Evaluation

Checklists applying the criteria of Reference 1 (Table 19) to all piping runs in the RHR system are given in Table 22. A summary of the evaluation of each degradation mechanism for the conditions existing in the RHR system is given below. The information on which all evaluations are based is obtained from References [6, 7, 8 & 15], unless noted otherwise or above. A complete list of in-scope welds in the feedwater system, matched with their potential degradation mechanism(s), is provided in Appendix A.

The RHR system was evaluated for normal operating conditions as well as conditions of heatup/cooldown, and plant trips. All other system transients are either mild or slow-acting with respect to feedwater temperature (not a TT instigator and no other mechanisms apply) or are emergency/faulted events which as discussed in [1] are not part of the RI-ISI evaluation process.

Where transients in other systems affect the in-scope piping (e.g. system 331 return to RHR high pressure circuit), these transients are also evaluated.

Thermal Fatigue (TF)

Thermal Stratification, Cycling and Striping (TASCS)

High Pressure Circuit – This portion of the RHR system is utilized during plant start-up (i.e. up to four percent power) as well as during normal plant operation. Per References [12, 15], the RHR system is in continuous operation and the only potential for mixing of hot and cold water would be due to its interaction with system 331. There is the potential that water from the 331 system could enter the RHR system (downstream of valve 321-VB26) at differing temperatures thereby potential allowing stratification or cycling. However, these temperature differences are administrative controlled and there exists a mixing tee at this location which acts to alleviate this phenomena. As such, these lines are not considered susceptible to TASCS.

Low Pressure Circuit – Per Reference [15], this circuit is in standby during plant start-up and normal operation. Other than for low temperature shutdown or testing conditions, this system does not operate or interact with any other system. During the initiation of shutdown cooling, there a brief amount of time where a low condition as valve VA9 is opened only 25 percent allowing hot reactor water to mix with colder RHR water [21]. However, mixing of hot and cold water is not a concern because it occurs very infrequently (e.g. only during system start-up) and for limited duration. That is, the RHR system quickly reaches reactor coolant temperature. As such, these lines are not considered susceptible to TASCS.

Thermal Transient (TT)

High Pressure Circuit – Under normal operating conditions (normal power operation and shutdown evolutions), there are no rapid changes in temperatures of water injection from other systems [15]. However, there is the potential that either the RHR system or System 331 could inadvertently be isolated. In the case of the RHR system, if the system was inadvertently isolated, allowed to cooldown and then restarted, there is the potential for the hot water on cold piping scenario. For example, upon restart of the RHR system, hot water from the reactor could interact with relatively cold RHR piping. Per Reference [16], this scenario has occurred a number of times at Forsmark. For this scenario, RHR close to the reactor (e.g. inside containment) is assumed to remain close to reactor temperature while RHR piping further removed from the reactor (e.g. outside containment) is assumed to cool. Thus upon RHR re-start, this piping will see a thermal shock. For this TT is assigned for a portion of the RHR piping outside containment.
As to system 331, if it where to isolate or fail to pre-heat water prior to injection into the RHR system, there would be the potential for hot and cold water interaction. However, a mixing tee exists (321-1) at this intersection of the RHR and 331 system. The mixing tee assures that water of differing temperatures are mixed prior to entering the RHR system thereby alleviating this concern. As such, these lines are not considered susceptible to TT.

Low Pressure Circuit – Per reference [15], this is in standby during plant start-up and normal operation. Other than for low temperature shutdown or testing conditions, this system does not operate or interact with any other system. Therefore as discussed above [21], rapid injection of hot water onto cold or cold water onto hot piping is not a concern because reactor water is gradually introduced (i.e. Valve VA9 limited to 25 percent open), it occurs very infrequently (e.g. during an accident demand) or does not occur (e.g. testing is done at relatively cold temperatures). As such, these lines are not considered susceptible to TT.

Stress Corrosion Cracking (SCC)

Intergranular Stress Corrosion Cracking (IGSCC)
All of the in-scope piping is stainless steel. Per the F3 ISI program [6], 221 of the RHR welds were identified as susceptible to SCC (102 with SI=I and 119 with SI=II). Application of NUREG-0313/BWRVIP-072 criteria identified 140 welds as IGSCC Category D. Most welds that are not identified as IGSCC per the NUREG criteria are in the standby low pressure circuit due to the piping not being exposed to reactor coolant at high operating temperature. There are also a number of welds that are exempt per NUREG line size criteria (i.e. less than 4 NPS (100DN)).

Transgranular Stress Corrosion Cracking (TGSCC)
The in-scope piping is not susceptible to TGSCC due to the high quality of the chemistry controlled reactor grade water present in all runs [7, 8].

External Chloride Stress Corrosion Cracking (ECSCC)
The in-scope piping is not affected by this degradation mechanism based upon a review of plant service experience, the piping being located indoors and the plant insulation material being consistent with Reg. Guide 1.36 criteria [5].

Primary Water Stress Corrosion Cracking (PWSCC)
The in-scope piping is not affected by this degradation mechanism due to the fact that this mechanism only applies to PWR plants.

Localized Corrosion

Microbiologically Influenced Corrosion (MIC)
The in-scope piping is not susceptible to MIC due to the high operating temperature of this system (high pressure circuit) and the chemistry controlled reactor grade water for both the high and low pressure circuits [7, 8].

Pitting (PIT)
The in-scope piping is not susceptible to PIT due to the high quality of the chemistry controlled reactor grade water present in all runs [7, 8].

Crevice Corrosion (CC)
There are thermal sleeves (mixing tees) at three locations within the in-scope piping. These are 321-, 321-2 and 321-3. Given the high quality reactor grade water and that the piping material is stainless steel; per the criteria of Reference [14], crevice corrosion is not applicable.

Flow Sensitive (FS)

Erosion-Cavitation (E-C)

Erosion-cavitation is not applicable to the in-scope piping as there are no cavitations sources and the operating temperature exceeds 250^{o}F (121^{o}C) for the high pressure circuit. For the low pressure circuit, cavitation sources do not exist and the operating time for this system is very short (e.g. only periodic testing and shutdown).

Flow Accelerated Corrosion (FAC)

The RI-ISI methodology points to the existing plant FAC for identifying the number, location and frequency of inspection for this mechanism. Per [11], the RHR system is not susceptible to FAC and therefore no inspections have been identified.

4.5 Low Pressure Injection (323)

4.5.1 System Description

The Low Pressure Injection system consists of four trains which individually take suction from the suppression pool and discharge individually to the reactor pressure vessel. For each train, there is a test loop which sends recirculation flow directly back to the suppression pool (i.e. bypassing the rector pressure vessel).

There are no significant inter-connections between the Low Pressure Injection system and others systems. For example, as seen with the Feedwater Lines or the RHR system.

This system is normally in standby and only actuates under demand situation (e.g. ECC actuation) or during normal periodic testing (e.g. flow back to the suppression pool).

4.5.2 Materials and Conditions

Per Reference [6], materials for the LP ECC system piping consists of stainless steel with maximum operating temperatures ranging from 20°C (68°F) to 286°C (547°F). Per Reference [7], the system is operated consistent with the EPRI water chemistry guidelines [8] ensuring high purity fluid conditions and parameters are maintained. For example, the suction source is the suppression pool.

While the maximum operating temperature is 286°C (547°F) as noted above, the system is normally in a standby condition. As such, actual normal operating conditions are function of proximity to the reactor vessel (i.e. a heat source) versus piping away from the reactor vessel (e.g. near the suppression pool).

In general, only that piping close to the reactor pressure vessel experiences temperature significantly higher than ambient temperatures. That is, except during accident conditions, which as noted in Reference [1], are not applicable to the RI-ISI evaluation process.

4.5.3 Degradation Mechanism Evaluation

Checklists applying the criteria of Reference [1] (Table 19) to all piping runs in the Low Pressure Injection system are given in Table 23. A summary of the evaluation of each degradation mechanism for the conditions existing in the Low Pressure Injection system is given below. The information on which all evaluations are based is obtained from References [6, 7, 8 & 16], unless noted otherwise or above. A complete list of in-scope welds in the Low Pressure Injection system, matched with their potential degradation mechanism(s), is provided in Appendix A.

While the Low Pressure Injection was evaluated for normal plant operating conditions as well as conditions of heatup/cooldown, and plant trips, because it is a system that is not normally in operation, these conditions have little bearing on the Low Pressure Injection system's failure potential. Additionally, because of the Low Pressure Injection system configuration and lack of interaction with other systems, transients in other systems do not affect the in-scope Low Pressure Injection piping as they may in other systems (e.g. RHR high pressure circuit connection downstream of Feedwater VA2).

Thermal Fatigue (TF)

Thermal Stratification, Cycling and Striping (TASCS)

Piping near the Connections to the Reactor Pressure Vessels – This portion of the Low Pressure Injection system experiences temperatures from as low as ambient temperature to a maximum operating temperature of 286°C (547°F) due to its proximity to the reactor pressure vessel. As with the reactor pressure, this piping is slowly heated up and cooled down during plant start-up and shutdown evolutions. During normal plant operation, this piping, like the reactor pressure vessels is maintained uniform and at steady state conditions. Additionally, as this piping does not interact with other systems (i.e. no inflows / outflows), there is no mixing of hot and cold fluids. As such, these lines are not considered susceptible to TASCS.

Piping Remote from the Connections to the Reactor Pressure Vessels – Due to the lack of a heat source, the normally operating temperature of this portion of the Low Pressure Injection system is consistent with ambient temperature (e.g. less than 65°C (150°F)). Additionally, as this piping does not interact with other systems (i.e. no inflows / outflows), there is no mixing of hot and cold fluids. As such, these lines are not considered susceptible to TASCS.

Thermal Transient (TT)

Piping near the Connections to the Reactor Pressure Vessel – As discussed above, this system, and this portion of Low Pressure Injection piping in particular, is in standby during normal plant operation. That is, except during accident conditions, which as noted in Reference [1], are not applicable to the RI-ISI evaluation process, there is no flow through these lines. Except as noted below there are no connections to other systems, therefore no possibility for the injection of hot or cold fluid onto most of the in-scope Low Pressure Injection piping.
Per reference [22], Procedure DI-3005 directs the operator to manually open 323 VA30 and VA31 on high level (H1). These valves are then closed when the reactor level reaches normal (H0). Plant experience has been that this occurs 5-6 times per start-up. As this occurs in response to alarms, it is difficult to control flow (e.g. low flow rate to minimize thermal shock). Because of this scenario, a small portion of the 323 system is considered susceptible to TT. Other piping within the 323 system is not considered susceptible to TT.

Piping Remote from the Connections to the Reactor Pressure Vessel – As discussed above, due to the lack of a heat source, the normally operating temperature of this portion of the Low Pressure Injection system is consistent with ambient temperature (e.g. less than 65°C (150°F)). Additionally, as this piping does not interact with other systems (i.e. no inflows / outflows), there is no injection of hot fluid onto this relatively cold piping. As such, these lines are not considered susceptible to TT.

Stress Corrosion Cracking (SCC)

Intergranular Stress Corrosion Cracking (IGSCC)
All of the in-scope piping is stainless steel. Per the F3 ISI program, twelve welds are identified as susceptible to IGSCC. Ten are assigned a Stress Index (SI) of I (highest susceptibility) while two welds are assigned a SI of II (medium susceptibility) [6]. Application of NUREG-0313/BWRVIP-072 criteria would identify eight welds as IGSCC Category D. The differences are mostly due to the piping not being exposed to reactor coolant at high operating temperature which excludes this piping as being IGSCC per the NUREG criteria.

Transgranular Stress Corrosion Cracking (TGSCC)
The majority of the Low Pressure Injection piping is at ambient or near ambient temperature and would therefore screen out based on temperature (i.e. less than 66°C (150°F)). The piping close to the reactor may exceed this temperature criterion but would still screen based upon the high quality of the chemistry controlled reactor grade water present in all runs [7, 8]. As such, the Low Pressure Injection system is not susceptible to TGSCC.

External Chloride Stress Corrosion Cracking (ECSCC)
The in-scope piping is not affected by this degradation mechanism based upon a review of plant service experience, the piping being located indoors and the plant insulation material being consistent with Reg. Guide 1.36 criteria [5].

Primary Water Stress Corrosion Cracking (PWSCC)
The in-scope piping is not affected by this degradation mechanism due to the fact that this mechanism only applies to PWR plants.

Localized Corrosion

Microbiologically Influenced Corrosion (MIC)
The in-scope piping near the reactor pressure vessel is not susceptible to MIC due to the high operating temperature. The piping further away from the reactor pressure vessel may not meet this temperature criterion but would still screen based upon the high quality of the chemistry controlled reactor grade water present in all runs [7, 8]. As such, the Low Pressure Injection system is not susceptible to MIC.

Pitting (PIT)
The in-scope piping is not susceptible to PIT due to the high quality of the chemistry controlled reactor grade water present in all runs [7, 8].

Crevice Corrosion (CC)
Per Reference [10], there are no thermal sleeves located in the in-scope piping. As such, crevice corrosion is not applicable.

Flow Sensitive (FS)

Erosion-Cavitation (E-C)
Erosion-cavitation is not applicable to the in-scope piping as there are no cavitation sources and the amount of time this system is in operation very limited (i.e. only operated during periodic testing).

Flow Accelerated Corrosion (FAC)
The RI-ISI methodology points to the existing plant FAC for identifying the number, location and frequency of inspection for this mechanism. Per [11], the Low Pressure Injection system are not susceptible to FAC and therefore no inspections have been identified.

4.6 Condensate (462)

4.6.1 System Description

The Condensate System takes suction from the condenser raising the temperature of the fluid via low pressure heaters that discharge to system 463 through the high pressures heaters which feed the Feedwater Lines that ultimately penetrate containment and feed the reactor pressure vessel. The system consists of three pump trains which feed multiple heaters that raise the fluid temperature prior to discharging to system 463. The system is in various stages of operation during plant start-up, normal power operation and plant cooldown/shutdown.

In addition to preheating the system fluid prior to discharging to system 463, strict water quality controls are in place to limit impurities [13].

4.6.2 Materials and Conditions

Per Reference [17] material for the Condensate piping consists of carbon steel. Per Reference [7], the system is operated consistent with the EPRI water chemistry guidelines [8] ensuring high purity fluid conditions and parameters are maintained.

The temperature and flow conditions for this piping is a function of whether the plant is at full power or some phase of plant start-up or shutdown. At normal operation, the exit flow from heaters EA1, which discharges to system 463, is 48°C (118°F). [18].

4.6.3 Degradation Mechanism Evaluation

Checklists applying the criteria of Reference 1 (Table 19) to all piping runs in the Condensate system are given in Table 24. A summary of the evaluation of each degradation mechanism for the conditions existing in the Condensate system is given below. The information on which all evaluations are based is obtained from References [6, 7, 8 & 13], unless noted otherwise or above. A complete list of in-scope welds in the Condensate system, matched with their potential degradation mechanism(s), is provided in Appendix A.

The Condensate Lines system was evaluated for normal operating conditions as well as conditions of heatup/cooldown, and plant trips. All other system transients are either mild or slow-acting with respect to Condensate temperature (not a TT instigator and no other mechanisms apply) or are emergency/faulted events which as discussed in [1] are not part of the RI-ISI evaluation process. As Condensate is a non safety-related safety, it is not depended upon to provide a safety function during abnormal or accident conditions.

Thermal Fatigue (TF)

Thermal Stratification, Cycling and Striping (TASCS)

Per plant procedure, temperatures are maintained uniform and gradually heated up during plant start-up and gradually cooled down during plant cooldown/shutdown. There are no significant interactions with other systems where significantly hotter or colder water is provided to the Condensate system.

There are however, bypass lines around the heaters and therefore there is the potential to have mixing of fluid at different temperature where the main line and the bypass line re-connect. Based on Reference [18], the temperature difference at the connect point downstream of 424 EA1 is only 4°C or 7°F (KA504 – KA503). For heater EA1, the temperature difference at the connection point is only 15°C or 27°F (KA506/KA507 – KA505). Per the EPRI RI-ISI criteria, neither of these temperature differences are a concern from a TASCS perspective.

Thermal Transient (TT)

As discussed above, temperatures are maintained uniform and gradually heated up during plant start-up and gradually cooled down during plant cooldown/shutdown. There are no significant interactions with other systems where significantly hotter or colder water is provided to the Condensate system. As such, the Condensate system is not considered susceptible to TT.

Stress Corrosion Cracking (SCC)

Intergranular Stress Corrosion Cracking (IGSCC)
The in-scope piping is carbon steel and therefore is not susceptible to IGSCC [17].

Transgranular Stress Corrosion Cracking (TGSCC)
The in-scope piping is carbon steel and therefore is not susceptible to TGSCC [17].

External Chloride Stress Corrosion Cracking (ECSCC)
The in-scope piping is carbon steel and therefore is not susceptible to ECSCC [17].

Primary Water Stress Corrosion Cracking (PWSCC)
The in-scope piping is not affected by this degradation mechanism due to the fact that this mechanism only applies to PWR plants.

Localized Corrosion

Microbiologically Influenced Corrosion (MIC)
The in-scope piping is not susceptible to MIC due to constant flow and high purity water in this system.

Pitting (PIT)
The in-scope piping is not susceptible to PIT due to the constant, high flow of high quality reactor grade water present in all runs.

Crevice Corrosion (CC)
There are no thermal sleeves located in the in-scope piping, therefore, crevice corrosion is not applicable [10].

Flow Sensitive (FS)

Erosion-Cavitation (E-C)
Erosion-cavitation is not applicable to the in-scope piping as there are no cavitation sources.

Flow Accelerated Corrosion (FAC)
The RI-ISI methodology points to the existing plant FAC for identifying the number, location and frequency of inspection for this mechanism. Per [11], there are several locations within the Condensate System potentially susceptible to FAC. As such, portions of the system are considered susceptible to FAC.

4.7 Service History Review

The service history review of in-scope piping and F3 operating experience was conducted in did not identify any required changes to the degradation mechanism assignments [16].

4.8 Comparison Summary

Both the SKIFS and EPRI methodologies rank failure potential according to likelihood of the piping being exposed to some type of stressor (e.g. degradation). In simple terms, low stress results in a low failure potential (e.g. SI III) for SKIFS while high stress results in a high failure potential (SI I). In the EPRI approach, FAC is typically the reason piping is assigned to the high failure potential rank. In contrast, FAC is typically not assessed as part of the SKIFs process as systems susceptible to FAC are not within the scope of SKIFs.

Appendix A of this report contains the results, on a per weld basis of the three main steps of the RI-ISI process. That is, consequence assessment, failure potential assessment and risk ranking. It also contains the SKIFS data for KI, SI and Inspection Group as well as other data.

To further explain the insights gained from this effort, Tables 25 has been developed. In Table 25, the degradation mechanisms identified for each system is listed for each methodology and the final column identifies insights from this comparison. Key methodology differences that impact the risk ranking of welds (see Section 5) are described below.

<u>Degradation Severity</u>

As mentioned above, SKIFS utilizes the three degradation categories (I, II, III similar to High, Medium, Low) for SCC where as the EPRI approach would categorize this as Medium and if the piping is resistant material it would be categorized as Low. However, the EPRI approach also points to the IGSCC augmented program; differences between this program (NUREG-0313/BWRVIP-075) and SKIFS is discussed below. SKIFS also has three degradation categories for mechanical fatigue (MF), which is discussed below.

<u>Mechanical Fatigue</u>

One of the key insights from this review is that SKIFs methodology includes mechanical fatigue (MF) in its failure potential ranking and also its risk ranking. Mechanical fatigue evaluations in these instances are based upon design basis loadings and stresses. This is somewhat consistent with the original ASME philosophy.

The EPRI RI-ISI does not include mechanical fatigue, as part of its failure potential assessment scheme. This is documented in Reference 1 and is based on three factors. First, a review of service experience has shown that failures do not occur at locations of high stress per the design stress reports. Secondly, by the very nature of meeting the allowable stress values, these locations are not expected to fail due to loading conditions contained in the design stress reports. And finally, failures typically occur due to phenomena not accounted for in the design stress reports (e.g. SCC).

However, there is a point of consistency in that during the element selection process, absent other considerations (e.g. severity of degradation, dose, and access), stress report results and stress discontinuities can be used to preferentially select inspection locations.

NUREG-0313/BWRVIP-075

Although somewhat consistent, NUREG-0313 and SKIFS have somewhat different philosophies with respect to program scope and selection of locations for inspections. The scope of piping contained within the NUREG-0313 program is stainless steel piping (≥ 4 NPS) exposed to reactor water at operating temperature greater than 200F (93C). From a F3 perspective, this would allow smaller bore piping to be excluded. This would also allow most of the RHR low pressure circuit to be considered not susceptible to SCC as it is in standby and isolated from reactor coolant during normal power operation. Another difference is that NUREG-0313 classifies in-scope piping as either resistant or not resistant to SCC. SKIFs ranks the piping as susceptible to SCC with three damage indices (SI I, II or III).

Appendix A contains two columns which summarize the application of NUREG-0313/BWRVIP-075 criteria to F3. The column entitled "0313_075 identifies each weld that would be considered susceptible to IGSCC. NUREG-0313/BWRVIP-075 assigns a category ranging from A to G. Because there has been no cracking experienced and stress improvement techniques have not been utilized, when IGSCC is identified, only Category D is applicable to F3.

The column entitled "Basis" identifies the reasons for the determination of when IGSCC is not applicable. These are listed below:

1) material is carbon steel and therefore IGSCC is not applicable
2) Line size is less than 4 NPS (100DN), per NUREG-0313/BWRVIP-075, lines sizes below this value are not included within the IGSCC program
3) Per NUREG-0313/BWRVIP-075, piping needs to experience reactor coolant at a temperature above 200F (93C) during power operation. Thus, piping that does not experience reactor coolant above this temperature during power operation are not considered susceptible to IGSCC.
4) Weldments with carbon content ≤ 0.035 percent are considered resistant to IGSCC.

Table 19: Degradation Mechanism Criteria and Susceptible Regions

Degradation Mechanism		Criteria	Susceptible Regions
TF	TASCS	–NPS $>$ 1 inch (DN25), and –pipe segment has a slope $<$ 45° from horizontal (includes elbow or tee into a vertical pipe), and • potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or • potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or • potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or • potential exists for two phase (steam/water) flow, or • potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and –calculated or measured $\Delta T > 50$°F (28°C), and –Richardson number $>$ 4.0	Nozzles, branch pipe connections, safe ends, welds, heat affected zones (HAZs), base metal, and regions of stress concentration
	TT	operating temperature $>$ 270°F (132°C) for stainless steel, or operating temperature $>$ 220°F (104°C) for carbon steel, and potential for relatively rapid temperature changes including, cold fluid injection into hot pipe segment, or hot fluid injection into cold pipe segment, and • $\lvert\Delta T\rvert > 200$°F (111°C) for stainless steel, or • $\lvert\Delta T\rvert > 150$°F (84°C) for carbon steel, or • $\lvert\Delta T\rvert > \Delta T$ allowable (applicable to both stainless and carbon)	

Table 19 (continued)

Degradation Mechanism		Criteria	Susceptible Regions
SCC	IGSCC (BWR)	–evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01	Welds and HAZs
	IGSCC (PWR)	– austenitic stainless steel (carbon content ≥ 0.035%), and –operating temperature > 200°F (93°C), and –tensile stress (including residual stress) is present, and –oxygen or oxidizing species are present <u>OR</u> –operating temperature < 200°F (93°C), the attributes above apply, and –initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present	
	TGSCC	– austenitic stainless steel, and –operating temperature > 150°F (66°C), and –tensile stress (including residual stress) is present, and –halides (e.g., fluoride or chloride) are present, and –oxygen or oxidizing species are present	Base metal, welds, and HAZs

Table 19 (continued)

Degradation Mechanism		Criteria	Susceptible Regions
SCC (cont.)	ECSCC	– austenitic stainless steel, and –operating temperature > 150°F (66°C), and –tensile stress is present, and –an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36, OR -austenitic stainless steel, and -tensile stress is present, and an outside piping surface is exposed to wetting from concentrated chloride-bearing environments (i.e., sea water, brackish water, or brine)	Base metal, welds, and HAZs
	PWSCC	–piping material is Inconel (Alloy 600), and –exposed to primary water at T > 570°F F (299°C), and –the material is mill-annealed and cold worked, or cold worked and welded without stress relief	Nozzles, welds, and HAZs without stress relief
LC	MIC	–operating temperature < 150°F (66°C), and –low or intermittent flow, and –pH < 10, and –presence/intrusion of organic material (e.g., Raw Water System), or –water source is not treated with biocides, or	Fittings, welds, HAZs, base metal, dissimilar metal joints (for example, welds and flanges), and regions containing crevices
	PIT	–potential exists for low flow, and –oxygen or oxidizing species are present, and –initiating contaminants (e.g., fluoride or chloride) are present	

Table 19 (concluded)

Degradation Mechanism		Criteria	Susceptible Regions
LC (cont.)	CC	–crevice condition exists (i.e., thermal sleeves), and –operating temperature $>$ 150°F (66°C), and –oxygen or oxidizing species are present	
FS	E-C	–cavitation source, and –operating temperature $<$ 250°F F (121°C), and –flow present $>$ 100 hrs./yr., and –velocity $>$ 30 ft./sec.(9m/sec.), and –$(P_d - P_v) / \Delta P < 5$	Fittings, welds, HAZs, and base metal
	FAC	–evaluated In accordance with existing plant FAC program	per plant FAC program

Table 20: Main Steam (311) Degradation Evaluation Checklists

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
TASCS-1	*nps > 1 inch (DN25), and*	☒	☐	☐	☐	
TASCS-2	*pipe segment has a slope < 45° from horizontal (includes elbow or tee into a vertical pipe), and*	☒	☐	☐	☐	Horizontal runs
TASCS-3-1	*potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Per system operating procedures, the system is slowly heated up and cooled down.
TASCS-3-2	*potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Leakage, if any, would be out of the system. Therefore, no mixing of hot/cold fluid in the main steam scope.
TASCS-3-3	*potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or*	☐	☒	☐	☐	All runs are normally flowing or no potential for cycling exists.
TASCS-3-4	*potential exists for two phase (steam / water) flow, or*	☐	☒	☐	☐	System contains steam only.
TASCS-3-5	*potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and*	☐	☒	☐	☐	System contains steam only.
TASCS-4	*Calculated or measured ΔT > 50°F (28°C),, and*	☐	☐	☒	☐	
TASCS-5	*Richardson number > 4.0*	☐	☐	☒	☐	
In conclusion, the main steam system is not susceptible to TASCS.						
TT-1-1	*Operating temperature > 270°F (132°C)for stainless steel, or*	☐	☐	☐	☒	
TT-1-2	*Operating temperature > 220°F (104°C)for carbon steel, and*	☒	☐	☐	☐	
	potential for relatively rapid temperature changes including					
TT-2-1	*cold fluid injection into hot pipe segment, or*	☐	☒	☐	☐	No connection to/from cold sources
TT-2-2	*hot fluid injection into cold pipe segment, and*	☐	☒	☐	☐	No connection to/from hot sources
TT-3-1	*$\lvert\Delta T\rvert$ > 200°F (111°C) for stainless steel, or*	☐	☐	☐	☒	
TT-3-2	*$\lvert\Delta T\rvert$ > 150°F (84°C) for carbon steel, or*	☐	☐	☒	☐	
TT-3-3	*$\lvert\Delta T\rvert$ > ΔT allowable (applicable to both stainless and carbon)*	☐	☐	☒	☐	
In conclusion, the main steam system is not susceptible to TT.						
IGSCC-B-1	*Evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01*	☐	☒	☐	☐	Most of the system consists of carbon steel piping, therefore IGSCC is not applicable. For the SKIFs approach, 6 welds identified and for the NUREG-0313 approach, no welds identified due to the line size exemption.
In conclusion, some of the main steam system is susceptible to IGSCC, as discussed above.						
IGSCC-P-1	*Austenitic stainless steel (carbon content ≥ 0.035%), and*	☐	☐	☐	☒	This assessment criteria is only applicable to pressurized water reactors (PWRs).
IGSCC-P-2	*Operating temperature > 200°F (93°C), and*	☐	☐	☐	☒	
IGSCC-P-3	*tensile stress (including residual stress) is present, and*	☐	☐	☐	☒	
IGSCC-P-4	*oxygen or oxidizing species are present*	☐	☐	☐	☒	
	OR					
IGSCC-P-5	*Operating temperature < 200°F (93°C), the attributes above apply, and*	☐	☐	☐	☒	
IGSCC-P-6	*initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the main steam system.						

Table 20: Main Steam (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
TGSCC-1	*Austenitic stainless steel, and*	☐	☒	☐	☐	Carbon steel piping, therefore TGSCC is not applicable.
TGSCC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
TGSCC-3	*tensile stress (including residual stress) is present, and*	☐	☐	☒	☐	
TGSCC-4	*halides (e.g., fluoride or chloride) are present, and*	☐	☐	☒	☐	
TGSCC-5	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the main steam system.						
ECSCC-1	*Austenitic stainless steel, and*	☐	☒	☐	☐	Carbon steel piping, therefore ECSCC is not applicable.
ECSCC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
ECSCC-3	*tensile stress is present, and*	☐	☐	☒	☐	
ECSCC-4	*an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36*	☐	☐	☒	☐	
	OR					
ECSCC-5	*Austenitic stainless steel, and*	☐	☒	☐	☐	Carbon steel piping, therefore ECSCC is not applicable.
ECSCC-6	*tensile stress is present, and*	☐	☐	☒	☐	
ECSCC-7	*an outside piping surface is exposed to wetting from concentrated chloride bearing environments (i.e., sea water, brackish water or brine)*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the main steam system.						
PWSCC-1	*piping material is Inconel (Alloy 600), and*	☐	☐	☐	☒	This mechanism is only applicable to pressurized water reactors (PWRs).
PWSCC-2	*exposed to primary water at T $>$ 570°F (299°C), and*	☐	☐	☐	☒	
PWSCC-3-1	*the material is mill-annealed and cold worked, or*	☐	☐	☐	☒	
PWSCC-3-2	*cold worked and welded without stress relief*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the main steam system.						
MIC-1	*Operating temperature $<$ 150°F (66°C), and*	☐	☒	☐	☐	> 150F during normal operation
MIC-2	*low or intermittent flow, and*	☐	☐	☒	☐	
MIC-3	*pH $<$ 10, and*	☐	☐	☒	☐	
MIC-4-1	*presence/intrusion of organic material (e.g., raw water system), or*	☐	☐	☒	☐	
MIC-4-2	*water source is not treated with biocides*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the main steam system.						
PIT-1	*potential exists for low flow, and*	☐	☒	☐	☐	Constant, high flow during normal operation
PIT-2	*oxygen or oxidizing species are present, and*	☐	☐	☒	☐	
PIT-3	*initiating contaminants (e.g., fluoride or chloride) are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the main steam system.						

Table 20: Main Steam (concluded)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
CC-1	*crevice condition exists (i.e., thermal sleeves), and*	☐	☒	☐	☐	Per [10], thermal sleeves do not exist in the main steam system.
CC-2	*Operating temperature > 150°F (66°C), and*	☐	☐	☒	☐	
CC-3	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the main steam system.						
E-C-1	*Cavitation source, and*	☐	☒	☐	☐	No sources (e. throttling valve, orifices) present
E-C-2	*Operating temperature < 250°F (121°C), and*	☐	☒	☐	☐	In addition to the above, the operating temperature for this system is very high (547°F (286°C).
E-C-3	*flow present > 100 hrs./yr., and*	☐	☐	☒	☐	
E-C-4	*velocity > 30 ft./sec. (9m/sec.), and*	☐	☐	☒	☐	
E-C-5	$(P_d - P_v) / \Delta P < 5$	☐	☐	☒	☐	
In conclusion, this mechanism is not active in this system.						
FAC-1	*Evaluated in accordance with existing plant FAC program*	☐	☒	☐	☐	No main steam piping within the F3 FAC Program
In conclusion, this mechanism is not active in the main steam system.						

Table 21: Feedwater Lines (312) Degradation Evaluation Checklists

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
TASCS-1	*nps $>$ 1 inch (DN25), and*	☒	☐	☐	☐	
TASCS-2	*pipe segment has a slope $<$ 45° from horizontal (includes elbow or tee into a vertical pipe), and*	☒	☐	☐	☐	Horizontal runs
TASCS-3-1	*potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Per system operating procedures, the system is slowly heated up and cooled down. Mixing tee, provided for uniform temperature distribution at that location, and downstream of that location.
TASCS-3-2	*potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Leakage, if any, would be out of the system. Therefore, no mixing of hot/cold fluid in the Feedwater Lines scope.
TASCS-3-3	*potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or*	☐	☒	☐	☐	All runs are normally flowing or no potential for cycling exists.
TASCS-3-4	*potential exists for two phase (steam / water) flow, or*	☐	☒	☐	☐	System contains water only.
TASCS-3-5	*potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and*	☐	☒	☐	☐	No branch connection where turbulent penetration would be relevant.
TASCS-4	*Calculated or measured $\Delta T > 50$°F (28°C),, and*	☐	☐	☒	☐	
TASCS-5	*Richardson number $>$ 4.0*	☐	☐	☒	☐	
In conclusion, the Feedwater Lines are not susceptible to TASCS.						
TT-1-1	*Operating temperature $>$ 270°F (132°C)for stainless steel, or*	☒	☐	☐	☐	
TT-1-2	*Operating temperature $>$ 220°F (104°C)for carbon steel, and*	☒	☐	☐	☐	
	potential for relatively rapid temperature changes including					
TT-2-1	*cold fluid injection into hot pipe segment, or*	☐	☒	☐	☐	No connection to/from cold sources, except at mixing tee which prevents this mechanism from being operative.
TT-2-2	*hot fluid injection into cold pipe segment, and*	☐	☒	☐	☐	No connection to/from cold sources, except at mixing tee which prevents this mechanism from being operative.
TT-3-1	*$/\Delta T/ >$ 200°F (111°C) for stainless steel, or*	☐	☐	☒	☐	
TT-3-2	*$/\Delta T/ >$ 150°F (84°C) for carbon steel, or*	☐	☐	☒	☐	
TT-3-3	*$/\Delta T/ > \Delta T$ allowable (applicable to both stainless and carbon)*	☐	☐	☒	☐	
In conclusion, the Feedwater Lines are not susceptible to TT.						
IGSCC-B-1	*Evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01*	☒	☒	☐	☐	For the Carbon steel piping, IGSCC is not applicable. The stainless steel piping, IGSCC is applicable to 16 welds per the F3 ISI program and 12 welds per NUREG-0313.
In conclusion, for a portion of the Feedwater Lines, IGSCC is potentially operative.						
IGSCC-P-1	*Austenitic stainless steel (carbon content $\geq$ 0.035%), and*	☐	☐	☐	☒	This assessment criteria is only applicable to pressurized water reactors (PWRs).
IGSCC-P-2	*Operating temperature $>$ 200°F (93°C), and*	☐	☐	☐	☒	
IGSCC-P-3	*tensile stress (including residual stress) is present, and*	☐	☐	☐	☒	
IGSCC-P-4	*oxygen or oxidizing species are present*	☐	☐	☐	☒	
	OR					

Table 21: Feedwater (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
IGSCC-P-5	*Operating temperature < 200°F (93°C), the attributes above apply, and*	☐	☐	☐	☒	
IGSCC-P-6	*initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the Feedwater Lines.						
TGSCC-1	*Austenitic stainless steel, and*	☒	☒	☐	☐	A portion of the system contains Carbon steel piping and therefore TGSCC is not applicable. A larger portion of the system contains stainless steel and the following evaluation is applicable.
TGSCC-2	*Operating temperature > 150°F (66°C), and*	☒	☐	☐	☐	
TGSCC-3	*tensile stress (including residual stress) is present, and*	☒	☐	☐	☐	
TGSCC-4	*halides (e.g., fluoride or chloride) are present, and*	☐	☒	☐	☐	Per References [7, 8]
TGSCC-5	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Feedwater Lines.						
ECSCC-1	*Austenitic stainless steel, and*	☒	☒	☐	☐	A portion of the system contains Carbon steel piping and therefore ECSCC is not applicable. A larger portion of the system contains stainless steel and the following evaluation is applicable.
ECSCC-2	*Operating temperature > 150°F (66°C), and*	☒	☐	☐	☐	
ECSCC-3	*tensile stress is present, and*	☒	☐	☐	☐	
ECSCC-4	*an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36*	☐	☒	☐	☐	Reference [5]
	OR					
ECSCC-5	*Austenitic stainless steel, and*	☒	☒	☐	☐	A portion of the system contains Carbon steel piping and therefore ECSCC is not applicable. A larger portion of the system contains stainless steel and the following evaluation is applicable.
ECSCC-6	*tensile stress is present, and*	☒	☐	☐	☐	
ECSCC-7	*an outside piping surface is exposed to wetting from concentrated chloride bearing environments (i.e., sea water, brackish water or brine)*	☐	☒	☐	☐	Per reference [16]. In addition piping located indoors
In conclusion, this mechanism is not active in the Feedwater Lines.						
PWSCC-1	*piping material is Inconel (Alloy 600), and*	☐	☐	☐	☒	This mechanism is only applicable to pressurized water reactors (PWRs).
PWSCC-2	*exposed to primary water at T > 570°F (299°C), and*	☐	☐	☐	☒	
PWSCC-3-1	*the material is mill-annealed and cold worked, or*	☐	☐	☐	☒	
PWSCC-3-2	*cold worked and welded without stress relief*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the Feedwater Lines.						

Table 21: Feedwater (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
MIC-1	*Operating temperature $<$ 150°F (66°C), and*	☐	☒	☐	☐	> 150F during normal operation
MIC-2	*low or intermittent flow, and*	☐	☐	☒	☐	
MIC-3	*pH $<$ 10, and*	☐	☐	☒	☐	
MIC-4-1	*presence/intrusion of organic material (e.g., raw water system), or*	☐	☐	☒	☐	
MIC-4-2	*water source is not treated with biocides*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Feedwater Lines.						
PIT-1	*potential exists for low flow, and*	☐	☒	☐	☐	Constant, high flow during normal operation or during start-up and shutdown.
PIT-2	*oxygen or oxidizing species are present, and*	☐	☐	☒	☐	
PIT-3	*initiating contaminants (e.g., fluoride or chloride) are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Feedwater Lines.						
CC-1	*crevice condition exists (i.e., thermal sleeves), and*	☐	☒	☐	☐	Thermal sleeves do not exist in the Feedwater Lines. The mixing tees were evaluated in the text and shown not be a crevice corrosion concern.
CC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
CC-3	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Feedwater Lines.						
E-C-1	*Cavitation source, and*	☐	☒	☐	☐	No sources (e. throttling valve, orifices) present. Flow control valves are not considered cavitation sources unless plant-specific experience dictates otherwise.
E-C-2	*Operating temperature $<$ 250°F (121°C), and*	☐	☒	☐	☐	In addition to the above, the operating temperature for this system is very high 419°F (215°C).
E-C-3	*flow present $>$ 100 hrs./yr., and*	☐	☐	☒	☐	
E-C-4	*velocity $>$ 30 ft./sec. (9m/sec.), and*	☐	☐	☒	☐	
E-C-5	*$(P_d - P_v) / \Delta P < 5$*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Feedwater Lines.						
FAC-1	*Evaluated in accordance with existing plant FAC program*	☐	☒	☐	☐	No Feedwater Lines piping within the F3 FAC Program
In conclusion, this mechanism is not active in the Feedwater Lines.						

Table 22: RHR (321) Degradation Evaluation Checklists

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
TASCS-1	*nps $>$ 1 inch (DN25), and*	☒	☐	☐	☐	
TASCS-2	*pipe segment has a slope $<$ 45° from horizontal (includes elbow or tee into a vertical pipe), and*	☒	☐	☐	☐	Horizontal runs
TASCS-3-1	*potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Per system operating procedures, the system is slowly heated up and cooled down. Flow from the 331 system enters via a mixing tee which would alleviate any stratification and cycling concerns See text with respect to starting the low pressure circuit.
TASCS-3-2	*potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	The are no valves connecting RHR system to others that would allow mixing of fluids at different temperatures
TASCS-3-3	*potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or*	☐	☒	☐	☐	All runs are normally flowing or no potential for cycling exists. The low pressure circuit is isolated from any heat source (e.g. reactor) during normal operation.
TASCS-3-4	*potential exists for two phase (steam / water) flow, or*	☐	☒	☐	☐	System contains water only.
TASCS-3-5	*potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and*	☐	☒	☐	☐	System contains water only.
TASCS-4	*Calculated or measured $\Delta T >$ 50°F (28°C),, and*	☐	☐	☒	☐	
TASCS-5	*Richardson number $>$ 4.0*	☐	☐	☒	☐	
In conclusion, the RHR system is not susceptible to TASCS. Note: the above evaluation applies to the high pressure circuit of the RHR system. The low pressure circuit of the RHR system is bounded by the above evaluation.						
TT-1-1	*Operating temperature $>$ 270°F (132°C)for stainless steel, or*	☒	☐	☐	☐	
TT-1-2	*Operating temperature $>$ 220°F (104°C)for carbon steel, and*	☐	☐	☐	☒	
	potential for relatively rapid temperature changes including					
TT-2-1	*cold fluid injection into hot pipe segment, or*	☐	☒	☐	☐	No connection to/from cold injection sources
TT-2-2	*hot fluid injection into cold pipe segment, and*	☐	☒	☐	☐	No connection to/from hot injection sources
TT-3-1	*$\lvert \Delta T \rvert >$ 200°F (111°C) for stainless steel, or*	☐	☐	☒	☐	
TT-3-2	*$\lvert \Delta T \rvert >$ 150°F (84°C) for carbon steel, or*	☐	☐	☐	☒	
TT-3-3	*$\lvert \Delta T \rvert > \Delta T$ allowable (applicable to both stainless and carbon)*	☐	☐	☒	☐	
In conclusion, the RHR system is not susceptible to TT.						
IGSCC-B-1	*Evaluated in accordance with existing plant IGSCC program*	☒	☐	☐	☐	Some piping (221 welds) has been identified as susceptible to IGSCC per the F3 ISI program while 140 welds are identified per NUREG-0313 criteria.
In conclusion, portions of the RHR system are susceptible to IGSCC.						
IGSCC-P-1	*Austenitic stainless steel (carbon content $\geq$ 0.035%), and*	☐	☐	☐	☒	This assessment criteria is only applicable to pressurized water reactors (PWRs).
IGSCC-P-2	*Operating temperature $>$ 200°F (93°C), and*	☐	☐	☐	☒	
IGSCC-P-3	*tensile stress (including residual stress) is present, and*	☐	☐	☐	☒	
IGSCC-P-4	*oxygen or oxidizing species are present*	☐	☐	☐	☒	
	OR					

Table 22: RHR (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
IGSCC-P-5	*Operating temperature < 200°F (93°C), the attributes above apply, and*	☐	☐	☐	☒	
IGSCC-P-6	*initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the RHR system.						
TGSCC-1	*Austenitic stainless steel, and*	☒	☐	☐	☐	
TGSCC-2	*Operating temperature > 150°F (66°C), and*	☒	☐	☐	☐	
TGSCC-3	*tensile stress (including residual stress) is present, and*	☒	☐	☐	☐	
TGSCC-4	*halides (e.g., fluoride or chloride) are present, and*	☐	☒	☐	☐	Per Reference [7, 8]
TGSCC-5	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the RHR system. Note: the above evaluation applies to the high pressure circuit of the RHR system. The low pressure circuit of the RHR system is bounded by the above evaluation.						
ECSCC-1	*Austenitic stainless steel, and*	☒	☐	☐	☐	.
ECSCC-2	*Operating temperature > 150°F (66°C), and*	☒	☐	☐	☐	
ECSCC-3	*tensile stress is present, and*	☒	☐	☐	☐	
ECSCC-4	*an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36*	☐	☒	☐	☐	Reference [5]
	OR					
ECSCC-5	*Austenitic stainless steel, and*	☒	☐	☐	☐	
ECSCC-6	*tensile stress is present, and*	☒	☐	☐	☐	
ECSCC-7	*an outside piping surface is exposed to wetting from concentrated chloride bearing environments (i.e., sea water, brackish water or brine)*	☐	☒	☐	☐	Piping located indoors
In conclusion, this mechanism is not active in the RHR system. Note: the above evaluation applies to the high pressure circuit of the RHR system. The low pressure circuit of the RHR system is bounded by the above evaluation.						
PWSCC-1	*piping material is Inconel (Alloy 600), and*	☐	☐	☐	☒	This mechanism is only applicable to pressurized water reactors (PWRs).
PWSCC-2	*exposed to primary water at T > 570°F (299°C), and*	☐	☐	☐	☒	
PWSCC-3-1	*the material is mill-annealed and cold worked, or*	☐	☐	☐	☒	
PWSCC-3-2	*cold worked and welded without stress relief*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the RHR system.						

Table 22: RHR (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
MIC-1	*Operating temperature $<$ 150°F (66°C), and*	☐	☒	☐	☐	> 150F during normal operation
MIC-2	*low or intermittent flow, and*	☐	☐	☒	☐	
MIC-3	*pH $<$ 10, and*	☐	☐	☒	☐	
MIC-4-1	*presence/intrusion of organic material (e.g., raw water system), or*	☐	☐	☒	☐	
MIC-4-2	*water source is not treated with biocides*	☐	☐	☒	☐	
Piping in the high pressure circuit is not susceptible to MIC due to the high operating temperature. Piping in the low pressure circuit which operates at lower temperatures, is not considered susceptible due to the high water chemistry controls and the lack of industry service experience with this mechanism in these types of systems. In conclusion, this mechanism is not active in this system.						
PIT-1	*potential exists for low flow, and*	☒	☐	☐	☐	Constant, high flow during normal operation for the high pressure circuit. Low pressure circuit is in standby.
PIT-2	*oxygen or oxidizing species are present, and*	☒	☒	☐	☐	References [7, 8] yes for HP circuit and no for LP circuit
PIT-3	*initiating contaminants (e.g., fluoride or chloride) are present*	☐	☒	☐	☐	References [7, 8] no for both HP & LP circuits
In conclusion, this mechanism is not active in the RHR system.						
CC-1	*crevice condition exists (i.e., thermal sleeves), and*	☐	☒	☐	☐	Per Reference [14]
CC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
CC-3	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the RHR system.						
E-C-1	*Cavitation source, and*	☐	☒	☐	☐	No sources (e. throttling valve, orifices) present
E-C-2	*Operating temperature $<$ 250°F (121°C), and*	☐	☐	☒	☐	
E-C-3	*flow present $>$ 100 hrs./yr., and*	☐	☐	☒	☐	
E-C-4	*velocity $>$ 30 ft./sec. (9m/sec.), and*	☐	☐	☒	☐	
E-C-5	*$(P_d - P_v) / \Delta P < 5$*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in this system.						
FAC-1	*Evaluated in accordance with existing plant FAC program*	☐	☒	☐	☐	No RHR piping within the F3 FAC Program
In conclusion, this mechanism is not active in the RHR system.						

Table 23: LPI (323) Degradation Evaluation Checklists

Degradation Mechanism Assessment Worksheet						
No.	***Attributes to be Considered***	***Yes***	***No***	***N/C***	***N/A***	***Remarks***
TASCS-1	*nps $>$ 1 inch (DN25), and*	☒	☐	☐	☐	
TASCS-2	*pipe segment has a slope $<$ 45° from horizontal (includes elbow or tee into a vertical pipe), and*	☒	☐	☐	☐	Horizontal runs exist
TASCS-3-1	*potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	This system is only operated during accident conditions (e.g. ECC actuation) or periodic testing. It is not connected to other systems that would allow mixing of hot & cold fluid.
TASCS-3-2	*potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Leakage, if any, would be into the Low Pressure Injection system and would not be cyclic.
TASCS-3-3	*potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or*	☐	☒	☐	☐	
TASCS-3-4	*potential exists for two phase (steam / water) flow, or*	☐	☒	☐	☐	System contains water only.
TASCS-3-5	*potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and*	☐	☒	☐	☐	Piping configurations do not exist where turbulent penetration could be operative (e.g. branch connections on a run pipe containing high pressure/high flow).
TASCS-4	*Calculated or measured $\Delta T > 50$°F (28°C),, and*	☐	☐	☒	☐	
TASCS-5	*Richardson number $>$ 4.0*	☐	☐	☒	☐	
In conclusion, the Low Pressure Injection system is not susceptible to TASCS. Note: the above evaluation applies to that portion of the system near the reactor pressure vessel. Piping located remote from the reactor pressure is bounded by the above evaluation.						
TT-1-1	*Operating temperature $>$ 270°F (132°C)for stainless steel, or*	☒	☐	☐	☐	Only for piping near the reactor pressure vessel
TT-1-2	*Operating temperature $>$ 220°F (104°C)for carbon steel, and*	☐	☐	☐	☒	
	potential for relatively rapid temperature changes including					
TT-2-1	*cold fluid injection into hot pipe segment, or*	☐	☒	☐	☐	Due to the standby nature of this system and that there are no connections to or from cold sources other than for accident conditions.
TT-2-2	*hot fluid injection into cold pipe segment, and*	☒	☒	☐	☐	Due to the standby nature of this system and that there are no connections to or from cold sources other than for accident conditions. Except for that portion that drain this vessel when H1 alarm.
TT-3-1	*$\lvert\Delta T\rvert >$ 200°F (111°C) for stainless steel, or*	☐	☐	☒	☐	
TT-3-2	*$\lvert\Delta T\rvert >$ 150°F (84°C) for carbon steel, or*	☐	☐	☐	☒	
TT-3-3	*$\lvert\Delta T\rvert > \Delta T$ allowable (applicable to both stainless and carbon)*	☐	☐	☒	☐	
In conclusion, the Low Pressure Injection system is not susceptible to TT except for that portion that serves to drain the vessel when a high level alarm (H1) is received. Note: the above evaluation applies to that portion of the system near the reactor pressure vessel. Piping located remote from the reactor pressure is bounded by the above evaluation.						
IGSCC-B-1	*Evaluated in accordance with existing plant IGSCC program*	☒	☐	☐	☐	Some piping (12 welds) has been identified as susceptible to IGSCC per the F3 ISI program while 8 welds are identified due to NUREG-0313 criteria.
In conclusion, some piping has been identified as susceptible to IGSCC.						

Table 23: LPI (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
IGSCC-P-1	*Austenitic stainless steel (carbon content ≥ 0.035%), and*	☐	☐	☐	☒	These assessment criteria are only applicable to pressurized water reactors (PWRs).
IGSCC-P-2	*Operating temperature > 200°F (93°C), and*	☐	☐	☐	☒	
IGSCC-P-3	*tensile stress (including residual stress) is present, and*	☐	☐	☐	☒	
IGSCC-P-4	*oxygen or oxidizing species are present*	☐	☐	☐	☒	
	OR					
IGSCC-P-5	*Operating temperature < 200°F (93°C), the attributes above apply, and*	☐	☐	☐	☒	
IGSCC-P-6	*initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the Low Pressure Injection system.						
TGSCC-1	*Austenitic stainless steel, and*	☒	☐	☐	☐	
TGSCC-2	*Operating temperature > 150°F (66°C), and*	☒	☐	☐	☐	Only for that portion of piping near the reactor pressure vessel.
TGSCC-3	*tensile stress (including residual stress) is present, and*	☒	☐	☐	☐	
TGSCC-4	*halides (e.g., fluoride or chloride) are present, and*	☐	☒	☐	☐	Per References [7, 8]
TGSCC-5	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, the Low Pressure Injection system is not susceptible to TGSCC. Note: the above evaluation applies to that portion of the system near the reactor pressure vessel. Piping located remote from the reactor pressure is bounded by the above evaluation.						
ECSCC-1	*Austenitic stainless steel, and*	☒	☐	☐	☐	
ECSCC-2	*Operating temperature > 150°F (66°C), and*	☒	☐	☐	☐	
ECSCC-3	*tensile stress is present, and*	☒	☐	☐	☐	
ECSCC-4	*an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36*	☐	☒	☐	☐	Reference [5]
	OR					
ECSCC-5	*Austenitic stainless steel, and*	☒	☐	☐	☐	
ECSCC-6	*tensile stress is present, and*	☒	☐	☐	☐	
ECSCC-7	*an outside piping surface is exposed to wetting from concentrated chloride bearing environments (i.e., sea water, brackish water or brine)*	☐	☒	☐	☐	Piping located indoors
In conclusion, this mechanism is not active in this system.						
PWSCC-1	*piping material is Inconel (Alloy 600), and*	☐	☐	☐	☒	This mechanism is only applicable to pressurized water reactors (PWRs).
PWSCC-2	*exposed to primary water at T > 570°F (299°C), and*	☐	☐	☐	☒	
PWSCC-3-1	*the material is mill-annealed and cold worked, or*	☐	☐	☐	☒	
PWSCC-3-2	*cold worked and welded without stress relief*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to this system.						

Table 23: LPI (concluded)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
MIC-1	*Operating temperature $<$ 150°F (66°C), and*	☒	☐	☐	☐	Piping near the reactor pressure vessel is above 66C (150F) during normal operation. However, piping located remote from the reactor pressure vessel will be below this value.
MIC-2	*low or intermittent flow, and*	☒	☐	☐	☐	
MIC-3	*pH $<$ 10, and*	☐	☐	☒	☐	
MIC-4-1	*presence/intrusion of organic material (e.g., raw water system), or*	☐	☐	☒	☐	
MIC-4-2	*water source is not treated with biocides*	☐	☐	☒	☐	
Piping near the reactor is not susceptible to MIC due to the high operating temperature. Piping further away from the reactor, at lower temperatures, are not considered susceptible due to the high water chemistry controls and the lack of industry service experience with this mechanism in these types of systems. In conclusion, this mechanism is not active in this system.						
PIT-1	*potential exists for low flow, and*	☒	☐	☐	☐	
PIT-2	*oxygen or oxidizing species are present, and*	☒	☐	☐	☐	
PIT-3	*initiating contaminants (e.g., fluoride or chloride) are present*	☐	☒	☐	☐	Due to water chemistry controls in place.
In conclusion, this mechanism is not active in this system.						
CC-1	*crevice condition exists (i.e., thermal sleeves), and*	☐	☒	☐	☐	Per [10], thermal sleeves do not exist in the low pressure injection system.
CC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
CC-3	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in this system.						
E-C-1	*Cavitation source, and*	☐	☒	☐	☐	No sources (e. throttling valve, orifices) present
E-C-2	*Operating temperature $<$ 250°F (121°C), and*	☐	☐	☒	☐	
E-C-3	*flow present $>$ 100 hrs./yr., and*	☐	☐	☒	☐	
E-C-4	*velocity $>$ 30 ft./sec. (9m/sec.), and*	☐	☐	☒	☐	
E-C-5	*$(P_d - P_v) / \Delta P < 5$*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in this system.						
FAC-1	*Evaluated in accordance with existing plant FAC program*	☐	☒	☐	☐	No low pressure injection piping within the F3 FAC Program
In conclusion, this mechanism is not active in this system.						

Table 24: Condensate (462) Degradation Evaluation Checklists

Degradation Mechanism Assessment Worksheet						
No.	***Attributes to be Considered***	***Yes***	***No***	***N/C***	***N/A***	***Remarks***
TASCS-1	*nps $>$ 1 inch (DN25), and*	☒	☐	☐	☐	
TASCS-2	*pipe segment has a slope $<$ 45° from horizontal (includes elbow or tee into a vertical pipe), and*	☒	☐	☐	☐	Horizontal runs
TASCS-3-1	*potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Per system operating procedures, the system is slowing heated up and cooled down.
TASCS-3-2	*potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or*	☐	☒	☐	☐	Given the piping layout and connections, not possible to have significant mixing of hot/cold fluid in the in scope piping.
TASCS-3-3	*potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or*	☐	☒	☐	☐	All runs are normally flowing or no potential for cycling exists.
TASCS-3-4	*potential exists for two phase (steam / water) flow, or*	☐	☒	☐	☐	System contains water only.
TASCS-3-5	*potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and*	☐	☒	☐	☐	No branch connections where turbulent penetration could be operative given the condensate system pressure and temperatures.
TASCS-4	*Calculated or measured $\Delta T > 50$°F (28°C),, and*	☐	☐	☒	☐	
TASCS-5	*Richardson number $>$ 4.0*	☐	☐	☒	☐	
In conclusion, the Condensate system is not susceptible to TASCS.						
TT-1-1	*Operating temperature $>$ 270°F (132°C)for stainless steel, or*	☐	☐	☐	☒	
TT-1-2	*Operating temperature $>$ 220°F (104°C)for carbon steel, and*	☐	☒	☐	☐	
	potential for relatively rapid temperature changes including					
TT-2-1	*cold fluid injection into hot pipe segment, or*	☐	☐	☒	☐	
TT-2-2	*hot fluid injection into cold pipe segment, and*	☐	☐	☒	☐	
TT-3-1	*$\lvert\Delta T\rvert >$ 200°F (111°C) for stainless steel, or*	☐	☐	☐	☒	
TT-3-2	*$\lvert\Delta T\rvert >$ 150°F (84°C) for carbon steel, or*	☐	☐	☒	☐	
TT-3-3	*$\lvert\Delta T\rvert > \Delta T$ allowable (applicable to both stainless and carbon)*	☐	☐	☒	☐	
In conclusion, the Condensate system is not susceptible to TT.						
IGSCC-B-1	*Evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01*	☐	☒	☐	☐	Carbon steel piping, therefore IGSCC is not applicable.
In conclusion, the Condensate system is not susceptible to IGSCC.						
IGSCC-P-1	*Austenitic stainless steel (carbon content $\geq$ 0.035%), and*	☐	☐	☐	☒	This assessment criteria is only applicable to pressurized water reactors (PWRs).
IGSCC-P-2	*Operating temperature $>$ 200°F (93°C), and*	☐	☐	☐	☒	
IGSCC-P-3	*tensile stress (including residual stress) is present, and*	☐	☐	☐	☒	
IGSCC-P-4	*oxygen or oxidizing species are present*	☐	☐	☐	☒	
	OR					
IGSCC-P-5	*Operating temperature $<$ 200°F (93°C), the attributes above apply, and*	☐	☐	☐	☒	
IGSCC-P-6	*initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the Condensate system.						

Table 24: Condensate (continued)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
TGSCC-1	*Austenitic stainless steel, and*	☐	☒	☐	☐	Carbon steel piping, therefore TGSCC is not applicable.
TGSCC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
TGSCC-3	*tensile stress (including residual stress) is present, and*	☐	☐	☒	☐	
TGSCC-4	*halides (e.g., fluoride or chloride) are present, and*	☐	☐	☒	☐	
TGSCC-5	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Condensate system.						
ECSCC-1	*Austenitic stainless steel, and*	☐	☒	☐	☐	Carbon steel piping, therefore ECSCC is not applicable.
ECSCC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
ECSCC-3	*tensile stress is present, and*	☐	☐	☒	☐	
ECSCC-4	*an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36*	☐	☐	☒	☐	
	OR					
ECSCC-5	*Austenitic stainless steel, and*	☐	☒	☐	☐	Carbon steel piping, therefore ECSCC is not applicable.
ECSCC-6	*tensile stress is present, and*	☐	☐	☒	☐	
ECSCC-7	*an outside piping surface is exposed to wetting from concentrated chloride bearing environments (i.e., sea water, brackish water or brine)*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Condensate system.						
PWSCC-1	*piping material is Inconel (Alloy 600), and*	☐	☐	☐	☒	This mechanism is only applicable to pressurized water reactors (PWRs).
PWSCC-2	*exposed to primary water at T $>$ 570°F (299°C), and*	☐	☐	☐	☒	
PWSCC-3-1	*the material is mill-annealed and cold worked, or*	☐	☐	☐	☒	
PWSCC-3-2	*cold worked and welded without stress relief*	☐	☐	☐	☒	
In conclusion, this mechanism is not applicable to the Condensate system.						
MIC-1	*Operating temperature $<$ 150°F (66°C), and*	☒	☐	☐	☐	
MIC-2	*low or intermittent flow, and*	☐	☒	☐	☐	Constant, high flow system with reactor grade water
MIC-3	*pH $<$ 10, and*	☐	☐	☒	☐	
MIC-4-1	*presence/intrusion of organic material (e.g., raw water system), or*	☐	☐	☒	☐	
MIC-4-2	*water source is not treated with biocides*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Condensate system.						
PIT-1	*potential exists for low flow, and*	☐	☒	☐	☐	Constant, high flow during normal operation
PIT-2	*oxygen or oxidizing species are present, and*	☐	☐	☒	☐	
PIT-3	*initiating contaminants (e.g., fluoride or chloride) are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Condensate system.						

Table 24: Condensate (concluded)

Degradation Mechanism Assessment Worksheet						
No.	**Attributes to be Considered**	**Yes**	**No**	**N/C**	**N/A**	**Remarks**
CC-1	*crevice condition exists (i.e., thermal sleeves), and*	☐	☒	☐	☐	Per [10], thermal sleeves do not exist in the condensate system.
CC-2	*Operating temperature $>$ 150°F (66°C), and*	☐	☐	☒	☐	
CC-3	*oxygen or oxidizing species are present*	☐	☐	☒	☐	
In conclusion, this mechanism is not active in the Condensate system.						
E-C-1	*Cavitation source, and*	☐	☒	☐	☐	No sources (e. throttling valve, orifices) present
E-C-2	*Operating temperature $<$ 250°F (121°C), and*	☐	☐	☒	☐	
E-C-3	*flow present $>$ 100 hrs./yr., and*	☐	☐	☒	☐	
E-C-4	*velocity $>$ 30 ft./sec. (9m/sec.), and*	☐	☐	☒	☐	
E-C-5	$(P_d - P_v) / \Delta P < 5$	☐	☐	☒	☐	
In conclusion, this mechanism is not active in this system.						
FAC-1	*Evaluated in accordance with existing plant FAC program*	☒	☐	☐	☐	Portion of the Condensate system is within the F3 FAC Program
In conclusion, this mechanism is potentially active in portions of the Condensate system.						

Table 25: Failure Potential Insights

System	EPRI	SKIFs	Insights
311	None - 353	SI-I = 3 welds SI-II (SCC) = 6 welds SI-II (MF) = 53 welds None = 291 welds	• See discussion on MF. • Appendix A provides a comparison to NUREG-0313 for IGSCC
312	IGSCC – 22 welds None = 124 welds	SI-I (SCC) = 11 welds SI-I (MF) = 10 welds SI-II (SCC) = 6 welds SI-II (MF) = 18 welds None = 101 welds	• See discussion on MF. • Appendix A provides a comparison to NUREG-0313 for IGSCC
321	IGSCC = 138 welds IGSCC,TT = 2 welds TT = 28 welds None = 250 welds	SI-I (SCC) = 102 welds SI-II (SCC) = 119 welds SI-II (MF) = 2 welds SI-III (SCC) = 2 welds None = 193 welds	• See discussion on MF. • Appendix A provides a comparison to NUREG-0313 for IGSCC
323	IGSCC = 8 welds TT = 14 welds None 516 welds	SI-I (SCC) = 10 welds SI-II (SCC) = 2 welds None = 526 welds	• See discussion on MF. • Appendix A provides a comparison for IGSCC • TT identified on drain line used to respond to vessel level excursions
462	FAC = 10 segments None – remaining segments	FAC = 10 segments None remaining segments	• Consistent with previous experiences

5 Risk Ranking

The EPRI and SKIFS risk matrices are provided in Section 1 and shown below for comparison. As shown, they are very similar except the SKIFS consequence rank is left to right High (1), Medium (2), Low (3) and None versus the EPRI consequence from left to right is None, Low, Medium and High. This has no technical impact, only visual effects. For example, the SKIFS high risk cells (Inspection Group A) is in the top left corner versus the top right for the EPRI matrix (H). As described previously in Sections 3.14 and 4.8, there are differences in the criteria for establishing consequences and degradation potential, which will result in differences in the risk ranking described in this section.

Figure 5: EPRI and SKIFS Risk Matrix

EPRI Risk Matrix

		Consequence Rank			
		None	Low	Med	High
DM Potential	High	L	M	H	H
	Med	L	L	M	H
	Low	L	L	L	M

SKIFS Risk Matrix

		Consequence Index (KI)			
		1	2	3	None
Damage Index (SI)	I	A	A	B	C
	II	A	B	C	C
	III	B	C	C	C

The resulting EPRI RI-ISI risk ranking from this evaluation is provided in Figure 6 with a comparison to SKIFS. The number of welds is shown for each system, and then in brackets, the number of selections required by each methodology is also shown. Section 6 summarizes the percentage selection requirements for each methodology.

Note that the condensate system (462) is not in the SKIFS scope; it is also not in the ASME Section XI scope and therefore is usually not considered in a RI-ISI application in the USA as well as other countries (e.g. Spain). However, as demonstrated by this analysis, the risk associated with the majority of this system is low (e.g. low or medium consequence and low failure potential). The exception to this is that portion of the system potentially susceptible to flow accelerated corrosion, FAC. For that portion of the system, with a medium consequence of failure, and susceptible to FAC, the risk can be high per the EPRI risk matrix. Inspection selection and requirements for FAC are discussed in Section 6.

Also, a sensitivity case with no MF influence on the SKIFS ranking is considered at the end of this section.

Figure 6: Risk Ranking Results

EPRI Risk Ranking Results

		Consequence Rank			
		None	Low	Med	High
DM Potential	High	311 - 0 312 - 0 321 - 0 323 - 0 462 - 0	311 - 0 312 - 0 321 - 0 323 - 0 462 - 0	311 - 0 312 - 0 321 - 0 323 - 0 462 - Yes	311 - 0 312 - 0 321 - 0 323 - 0 462 – 0
	Med	311 - 0 312 - 0 321 - 0 323 - 0 462 - 0	311 - 0 312 - 0 321 - 1 323 - 10 462 - 0	311 - 0 312 - 14 [2] 321 - 157 [16] 323 - 2 [1] 462 - 0	311 - 0 312 - 8 [2] 321 - 10 [3] 323 - 10 [3] 462 - 0
	Low	311 - 0 312 - 0 321 - 5 323 - 0 462 - 0	311 - 153 312 - 0 321 - 12 323 - 0 462 - 0	311 - 117 312 - 102 321 - 201 323 - 477 462 - Yes	311 - 82 [9] 312 - 20 [2] 321 - 32 [4] 323 - 39 [4] 462 - 0

SKIFS Risk Ranking Results

		Consequence Index (KI)			
		1	2	3	None
Damage Index (SI)	I	311 - 0 312 - 0 321 - 0 323 - 0 462 - 0	311 - 0 312 - 21 [21] 321 - 15 [15] 323 - 10 [10] 462 - 0	311 - 0 312 - 0 321 - 87 [18] 323 - 0 462 - 0	311 - 3 312 - 0 321 - 0 323 - 0 462 - 0
	II	311 - 0 312 - 0 321 - 0 323 - 0 462 - 0	311 - 32 [4] 312 - 22 [3] 321 - 20 [2] 323 - 2 [1] 462 - 0	311 - 8 312 - 0 321 - 59 323 - 0 462 - 0	311 - 19 312 - 2 321 - 42 323 - 0 462 - 0
	III	311 - 0 312 - 0 321 - 0 323 - 0 462 - 0	311 - 118 312 - 62 321 - 89 323 - 74 462 - 0	311 - 110 312 - 30 321 - 88 323 - 414 462 - 0	311 - 63 312 - 7 321 - 18 323 - 38 462 - 0

Note: The number in brackets indicates the required element selections described in the next section

The Risk Ranking results per system and risk group is summarized in the following table:

System	EPRI			SKIFS		
	High	Med	Low	High (A)	Med (B)	Low C
311	0	82	271	0	32	321
312	8	34	102	21	22	103
321	10	189	219	15	107	296
323	10	41	487	10	2	526
462	Yes	0	Yes	0	0	0
Total	**28**	**346**	**1079**	**46**	**163**	**1246**

Note: EPRI and SKIFS weld count excludes condensate system (462)

A sensitivity case with no MF influence on the SKIFS ranking is considered at the end of this section.

<u>High Risk Comparison</u>

The above table indicates a higher number of High Risk welds for SKIFS versus EPRI. The differences are due to differences in the criteria that determines the consequence and degradation ranks as described in Sections 3.14 and 4.8. The following provides additional comparisons:

- 312 (feedwater) – the EPRI High Risk welds include the four vertical lines up to the reactor vessel nozzle (Risk Category 2). These lines are high consequence because they are unisolable LOCA breaks and they are medium DM because they have degradation potential (IGSCC). These 8 welds are Inspection Group A using the SKIFS methodology, which is also a high risk. The following summarizes the SKIFS results:

# of welds	Inspection Group	SI	KI
8	A (H=High)	SCC I (H= High)	2 (M=Medium)

<u>Differences:</u>

EPRI high consequence versus SKIFS medium consequence

EPRI medium DM versus SKIFS high DM

		Consequence Rank		
		Low	Med	High
DM Potential	High		0	0
	Med			8
	Low			

		Consequence Index		
		1	2	3
DM Index	I		8	
	II			
	III			

- 312 (feedwater) – SKIFS Inspection Group A to EPRI results are summarized below where EPRI results are high, medium and low risk:

# of welds	KI	SI	EPRI DM	EPRI Cons	EPRI RC
8	2 (M)	SCC I (H)	IGSCC (M)	High	2 (High)
3	2 (M)	SCC I (H)	IGSCC (M)	Medium	5 (Medium)
10	2 (M)	MF I (H)	None (L)	Medium	6 (Low)

<u>Differences:</u>
SCC I high DM for SKIFS versus EPRI medium DM (3 welds)
Mechanical fatigue (MF) high DM for SKIFS versus EPRI low DM (10 welds)

		Consequence Rank		
		Low	Med	High
DM Potential	High		0	0
	Med		3	8
	Low		10	

		Consequence Index		
		1	2	3
DM Index	I		21	
	II			
	III			

- 321 (RHR) – the EPRI High Risk welds include high consequence welds (unisolable LOCA breaks) with IGSCC degradation potential. These 10 welds are Inspection Group A (3) and Inspection Group B (4) and Inspection Group C (3) using the SKIFS methodology. The following summarizes the comparisons:

# of welds	EPRI DM	SKIFS Inspection Group	SKIFS DM	SKIFFS KI
3	IGSCC	A	SCC I	2 (Medium)
4	IGSCC	B	SCC II	2
3	IGSCC	C	III	2

<u>Differences:</u>
EPRI high consequence versus SKIFS medium consequence
EPRI medium IGSCC assignment versus SKIFS high, medium and low DM

		Consequence Rank		
		Low	Med	High
DM Potential	High		0	0
	Med			10
	Low			

		Consequence Index		
		1	2	3
DM Index	I		3	
	II		4	
	III		3	

- 321 (RHR) – Below is the comparison of SKIFS Inspection Group A to EPRI results:

# of welds	SKIFS KI	SKIFS DM	EPRI DM	EPRI Cons	EPRI RC
3	2	SCC I	IGSCC	High	2
1	2	SCC I	None	High	4
6	2	SCC I	IGSCC	Medium	5
5	2	SCC I	None	Medium	6

<u>Differences:</u>
IGSCC was not assigned to six welds for the EPRI approach as per NUREG-0313/BWRVIP-075 criteria, piping needs to experience reactor coolant at a temperature above 200F (93C) during normal power operation. These welds were assessed as not experiencing reactor coolant above this temperature during normal power operation.
EPRI high consequence versus SKIFS medium consequence
EPRI medium IGSCC assignment versus SKIFS

		Consequence Rank		
		Low	Med	High
DM Potential	High		0	0
	Med		5	2
	Low		6	4

		Consequence Index		
		1	2	3
DM Index	I		15	
	II			
	III			

- 323 (Low Pressure Injection) – the EPRI High Risk welds include high consequence welds (unisolable LOCA breaks or a break outside containment between penetration and isolation valve) with a medium DM due to IGSCC or TT degradation potential. These 10 welds are Inspection Group A (4) and Inspection Group B (2) and Inspection Group C (4) using the SKIFS methodology. The following summarizes the SKIFS results:

# of welds	EPRI DM	Inspection Group	SI	KI
4	IGSCC	A (H)	SCC I (H)	2 (M)
2	IGSCC	B (M)	SCC II (M)	2 (M)
2	IGSCC	C	III	2 (M)
2	TT	C	III	2 (M)

<u>Differences:</u>
EPRI high consequence versus SKIFS medium consequence
EPRI medium IGSCC and TT assignment versus SKIFS SI (I, II, III)

		Consequence Rank		
		Low	Med	High
DM Potential	High		0	0
	Med			10
	Low			

		Consequence Index		
		1	2	3
DM Index	I		4	
	II		2	
	III		4	

- 323 (Low Pressure Injection) – the SKIFS Inspection Group A (H) are also EPRI high risk as shown below:

# of welds	KI	SI	EPRI DM	EPRI Cons	EPRI RC
4	2 (M)	SCC I (H)	IGSCC (M)	High	2 (H)
6	2 (M)	SCC I (H)	None (L)	High	4 (M)

<u>Differences:</u>
EPRI high consequence versus SKIFS medium consequence
EPRI medium IGSCC assignment versus SKIFS

		Consequence Rank		
		Low	Med	High
DM Potential	High		0	0
	Med			4
	Low			6

		Consequence Index		
		1	2	3
DM Index	I		10	
	II			
	III			

- 462 (Condensate) –Results of the risk ranking review identified that only those segments potentially susceptible to FAC, are of interest from a risk perspective. That is, the system is low risk if FAC is not included. As discussed above, the Condensate is not typically included in a RI-ISI program. Reasons for this include that plants have regulatory or plant mandated inspection programs (also known as augmented programs) for this mechanism. Additionally, if FAC is not considered or operable, the consequence of failure of this piping would result in a plant transient which is typically a low consequence rank and therefore low risk per the EPRI RI-ISI methodology.

<u>Conclusions</u>
Differences in the criteria used to assign consequence (Section 3.14) and degradation potential (Section 4.8) result in differences in risk ranking. The following summarizes key differences and their impact:

- Mechanical Fatigue - one of the key insights from this risk ranking review is that SKIFs methodology includes mechanical fatigue (MF) in its failure potential ranking and thus its risk ranking. Mechanical fatigue evaluations in these instances are based upon design basis loadings and stresses. This is somewhat consistent with the original ASME Section XI philosophy. The EPRI RI-ISI does not include mechanical fatigue, as part of its failure potential assessment scheme. This is documented in Reference 1 and is based on three factors. First, a review of service experience has shown that failures do not occur at locations of high stress per the design stress reports. Secondly, by the very nature of meeting the allowable stress values, these locations are not expected to fail due to loading conditions contained in the design stress reports. And finally, failures typically occur due to phenomena not accounted for in the design stress reports (e.g. SCC). A sensitivity case was considered where the SKIFS risk ranking was completed without MF (SI was revised to III for all MF). The following table summarizes the results:

System	EPRI			SKIFS with MF			SKIFS without MF		
	High	Med	Low	High (A)	Med (B)	Low C	High (A)	Med (B)	Low C
311	0	82	271	0	32	321	0	0	353
312	8	34	102	21	22	103	11	4	129
321	10	189	219	15	107	296	15	107	296
323	10	41	487	10	2	526	10	2	526
462	Yes	0	Yes	0	0	0	0	0	0
Total	**28**	**346**	**1079**	**46**	**163**	**1246**	**36**	**113**	**1304**

As shown, the number of High (A) risk welds was reduced in the Feedwater (312) system and the number of Medium (B) risk welds was reduced in both the Main Steam (311) and Feedwater (312) systems. There was no change to the RHR (321) and Low Pressure Injection (323) systems. Note that this would impact element selection and risk impact for the 311 and 312 systems.

- IGSCC - Although somewhat consistent, NUREG-0313 and SKIFS have somewhat different philosophies with respect to program scope and selection of locations for inspections. The scope of piping contained within the NUREG-0313 program is stainless steel piping ($\geq$ 4 NPS, 100DN) exposed to reactor water at operating temperature greater than 200F (93C). From a F3 perspective, this would allow smaller bore piping to be excluded. This would also allow most of the RHR low pressure circuit to be considered not susceptible to SCC as it is in standby and isolated from reactor coolant during normal power operation. Another difference is that NUREG-0313 classifies in-scope piping as either resistant or not resistant to SCC. SKIFs ranks the piping as susceptible to SCC with three damage indices (SI I, II or III). Sensitivity cases are provided in the risk impact assessment Section 7.

6 Element Selection

The EPRI element selection requirements are summarized below with a comparison with SKIFS:

- High Risk Welds – EPRI requires 25% selection. SKIFS requires 100% (Inspection Group A) per 10-year interval or more frequently as determined by fracture mechanics

- Medium Risk Welds – EPRI requires 10% selection. SKIFS requires at least 10% inspection for Inspection Group B. At Forsmark 3, 20% from Damage Index I and 10% from Damage Index II and III per interval were selected. Again, the interval can be less than 10-years as determined by fracture mechanics. The 20% sample must change every interval (there is a requirement of 5 intervals); the 10% sample can remain the same each interval.

- Low Risk Welds – EPRI requires 0% selection. SKIFS (Inspection Group C) – inspection requirements are moved to the owner define programs, as applicable

Additionally as discussed in Section 4 and 5, treatment of IGSCC is different between the SKIFS approach and applications in the US. Table 26 provides the inspection requirements as defined in NUREG-0313 and BWRVIP-075.

The Element Selection requirements based on the above per system and risk category is summarized in the following table (IGSCC is treated similar to other degradation mechanism; for example 25% of high risk and 10% of medium risk):

System	EPRI			SKIFS		
	High	Med	Low	High (A)	Med (B)	Low C
311	0	9	0	0	4	0
312	2	4	0	21	3	0
321	3	20	0	15	20	0
323	3	5	0	10	1	0
462	Yes (1)	0	0	0	0	0
Total	**8**	**38**	**0**	**46**	**28**	**0**

(1) Ten segments (areas) identified by the F3 FAC Program (Reference 11)

The welds selected for both methods are documented in Appendix A. The selection process was made to maximize the risk covered by the SKIFS approach (higher CCDP chosen when applicable) and minimize the risk covered by the EPRI approach (lower CCDP chosen when applicable). This will result in a slightly conservative estimate of the risk impact in changing from SKIFS to EPRI.

In addition, to ensure a direct comparison between the EPRI RI-ISI methodology and SKIF, it is necessary to exclude augmented programs and inspections being performed beyond the minimum set of required (regulation/code). For example, if the inspections could be made by the plant irrespective of methodology, they are not included in the risk impact assessment. The following summarizes:

- SKIFs does not define a minimum requirement for inspection of inspection group C, rather it refers any inspection requirements to an Owner defined inspection program. This is conceptually similar to the EPRI RI-ISI methodology which does not require volumetric inspection of risk category 6 and 7 (Low Risk) piping but does continue leakage/pressure testing, as applicable.

- Additional inspections may be chosen by the plant in inspection group C (or any group for that matter) to address uncertainties, defense-in-depth, personnel safety etc. These are all legitimate options with any RI-ISI methodology where the plant always has this option to add inspections above the minimum requirements. For example, F3 includes 10% of inspection Group C welds within containment.

- FAC inspections (identified in the condensate system 462) are not included in the risk impact assessment consistent with the EPRI RI-ISI methodology, which requires a FAC program to address plant nuclear safety, economics and personnel safety. The RI-ISI methodology intent is not to change this program, but to acknowledge a good program is necessary. Thus, there is no change in risk.

Table 26: IGSCC Inspection Strategy [NUREG-0313/BWRVIP-075]

Category	Weld Description	Existing GL 88-01 Inspection Frequency [NURGE-0313]	BWRVIP-075 Revised Inspection Frequency (Notes 1 & 2)			Notes
			NWC	HWC	NMCA	
A	Resistant Materials	25% every 10 years, at least 12% in 1st 6 years	B-F = 25% every 10 years B-J = 10% every 10 years	All Welds 10% every 10 years	All Welds 10% every 10 years	3
B	Non-Resistant Materials Stress Improved Within 2 years of Operation	50% every 10 years, at least 25% in 1st 6 years	Plants Not Complying with BWRVIP-61			4
			25% every 6 years	25% every 10 years	10% every 10 years	
			Plants Complying with BWRVIP-61			
			25% every 10 years	10% every 10 years	10% every 10 years	
C	Non-Resistant Materials Stress Improved After 2 years of Operation	All within 2 cycles of SI, then all every 10 years, at least 50% within 1st 6 years	Plants Not Complying with BWRVIP-61			4
			50% every 10 years	25% every 10 years	10% every 10 years	
			Plants Complying with BWRVIP-61			
			25% every 10 years	10% every 10 years	10% every 10 years	
D	Non-Resistant Materials, No Stress Improvement	Every 2 refueling Cycles	100% every 6 years	100% every 10 years	100% every 10 years	N/A
E	Cracked - Reinforced by Weld Overlay	Every 2 refueling Cycles	25% every 10 years	10% every 10 years	10% every 10 years	5
E	Cracked - Mitigated by Stress Improvement	Every 2 refueling Cycles	100% every 6 years	100% every 10 years	100% every 10 years	6
F	Cracked - Inadequate or No Repair	Every Refueling Outage	100% Every Refueling Outage			N/A
G	Non-Resistant, Not Inspected	Every Refueling Outage	100% Every Refueling Outage			N/A

Notes:

1. Where examination sample is less than 100 percent every outage, at least half of the sample population is required to be inspected during the first 60 percent of the interval.

2. If any new cracking is detected, or if crack growth is found, the sample size will be expanded to a sample equal to the size of the initial sample. If cracking is detected in the additional sample, all remaining Category welds will be examined. Sample expansion can be limited, with technical justification provided to the NRC staff, to the system or type component (i.e., safe-end to nozzle) in which flaws were detected. However, the expanded sample size should include a number equal to the original sample or otherwise include all the welds within the system or component type to which the expansion is being limited.

3. Category B-J welds can be inspected with a scope of 10 percent every 10 years when a second mitigator is applied. The acceptable second mitigator is heat sink welding (HSW), mechanical stress improvement process (MSIP), induction heating stress improvement (IHSI) and/or hydrogen water chemistry (HWC). A licensee will need to pursue changes from existing10 CFR 50.55a requirements as an alternative for Category B-J and B-F welds pursuant to 10 CFR 50.55a(a)(3). These inspections may be credited toward ASME Section XI requirements; however, inspections of those welds outside the GL 88-01 scope are not affected and are not to be included in any request for relief or alternative based on the BWRVIP-75 report or the associated NRC staff's safety evaluation. During the selection of locations for inspection, consideration should be given regarding locations where IGSCC could be accelerated by crevice corrosion or thermal fatigue. In addition, locations having attributes that would promote IGSCC should have higher priority for inspection. The attributes to be considered are: high carbon or low ferrite content, crevice or stagnant flow condition, evidence of weld repair, surface cold work, and high fit-up, residual and operating stresses.

4. Plants that used IHSI to mitigate IGSCC, and comply with the recommendations of the BWRVIP-61 report (i.e. properly applied SI and qualified UT), may utilize the BWRVIP-75 report's proposed inspection criteria.

5. After three successive satisfactory inspections (once every two refueling cycles) with no indication of crack growth or new cracking found, the Category E welds repaired by weld overlay using resistant materials may be inspected at a frequency of 25 percent of the population in 10 years under NWC, and 10 percent in 10 years when HWC and/or NMCA is implemented.

6. After four successive satisfactory inspections (once two refueling cycles) where no indication of crack growth or new cracking is found, and for plants that are in compliance with the recommendations of the BWRVIP-61 report (i.e. properly applied SI and qualified UT), the stress improved Category E welds with previously active cracks may be inspected at the Category D weld schedule.

7 Risk Impact Assessment

7.1 Methodology

The EPRI methodology requires that a risk impact assessment is conducted to show that the change in risk in going from the existing ISI program to RI-ISI program meets the delta risk acceptance criteria summarized below:

- Each System: any increase in risk must be < 1E-7 for CDF and < 1E-8 for LERF

- Total for all Systems: any increase in risk must be < 1E-6 for CDF and < 1E-7 for LERF

For the analysis of F3, the change in risk is estimated as the difference between SKIFS and the EPRI RI-ISI Methodologies.

The change in CDF (ΔR_{CDF}) is estimated based on the equation presented below. This equation applies to a group of piping welds within a system whose failure is assumed to result in similar consequences based on break location (i.e., same $CCDP_c$), and are susceptible to the same degradation mechanisms (i.e., same PF_f and POD_e / POD_r). A description of the risk impact parameters used in the analysis is provided below.

$$\boldsymbol{\Delta R_{CDF} = CCDP_c * PF_f * [(POD_e * N_{efc} - POD_r * N_{rfc})]}$$

Risk Impact Parameters

$CCDP_c$	conditional core damage probability consequence estimate based on the break location identified for the specific group of welds
PF_f	piping failure frequency estimate based on the failure potential rank of the degradation mechanisms identified for the specific group of welds
POD_e	probability of detection in the existing 4th interval ISI Program for the specific degradation mechanisms identified
POD_r	probability of detection in the replacement RIS_B Program for the specific degradation mechanisms identified
N_{efc}	number of inspection locations in the consequence *c* and failure frequency *f* categories associated with the existing 4th interval ISI Program
N_{rfc}	number of inspection locations in the consequence *c* and failure frequency *f* categories associated with the replacement RIS_B Program

The change in LERF (ΔR_{LERF}) is estimated by substituting the conditional large early release probability (CLERP) for CCDP in the above equation. In addition, the analysis is performed both with and without taking credit for enhanced inspection effectiveness due to an increased POD. The failure frequencies and probability of detection factors are dependent upon the damage mechanisms and corresponding failure potential rank identified for each piping weld location (see Table below).

Failure Frequencies and PODs

<table>
<tr><th rowspan="2">Damage[1] Mechanisms</th><th colspan="3">Failure Potential Rank[2]</th><th rowspan="2">Failure Frequency[3]</th><th colspan="3">POD Improvement Factors[3]</th></tr>
<tr><th>High</th><th>Medium</th><th>Low</th><th>ISI</th><th>RI-ISI</th><th>None</th></tr>
<tr><td>FAC</td><td>✓</td><td></td><td></td><td rowspan="2">2E-06</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td></tr>
<tr><td>WH[5]</td><td>✓</td><td></td><td></td></tr>
<tr><td>TASCS</td><td></td><td>✓</td><td></td><td rowspan="11">2E-07</td><td rowspan="2">0.3[4]</td><td rowspan="2">0.9[4]</td><td rowspan="11">0.5</td></tr>
<tr><td>TT</td><td></td><td>✓</td><td></td></tr>
<tr><td>IGSCC</td><td></td><td>✓</td><td></td><td rowspan="9">0.5</td><td rowspan="9">0.5</td></tr>
<tr><td>TGSCC</td><td></td><td>✓</td><td></td></tr>
<tr><td>ECSCC</td><td></td><td>✓</td><td></td></tr>
<tr><td>PWSCC</td><td></td><td>✓</td><td></td></tr>
<tr><td>MIC</td><td></td><td>✓</td><td></td></tr>
<tr><td>PIT</td><td></td><td>✓</td><td></td></tr>
<tr><td>CC</td><td></td><td>✓</td><td></td></tr>
<tr><td>E-C</td><td></td><td>✓</td><td></td></tr>
<tr><td>NONE</td><td></td><td></td><td>✓</td><td>1E-08</td><td>0.5</td><td>0.5</td><td>0.5</td></tr>
</table>

Notes for Table

1. DMs are defined and described in Section 4.

2. Each piping weld is assigned a failure potential rank based on the specific DMs identified at the location and the relative probability they present for causing a pipe rupture.

3. Failure frequency and the probability of detection improvement factors for the existing ISI and replacement RI-ISI Programs are addressed.

4. These POD improvement factor values are only used when TT and TASCS are identified alone or in combination. These factors are based on an expanded examination volume (e.g. including the counterbore) and enhanced inspection effectiveness (e.g. training for craze cracking due to thermal fatigue rather than typical planar flaws). If the expanded examination volume and / or applicable training are already in place for the existing ISI program, then there should not be a difference in POD improvement factor values between the existing ISI program and the RI-ISI program. This is the position that has been taken for the other types of degradation and the no degradation case where both the ISI and RI-ISI cases use a POD improvement factor value of 0.5.

5. Water hammer is a dynamic loading condition not a degradation mechanism. The susceptibility of each piping system to water hammer in the RIS-ISI Program scope is determined based upon a plant’s operating experience with this phenomenon. If a piping segment is judged to be susceptible to water hammer based on prior operating experience, any inspection locations with a failure potential rank of “Medium” are upgraded to “High”.

Conditional Risk Estimates – Estimated Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) values can be used in the analysis if available. Bounding values of the highest estimated CCDP and CLERP may be used if specific estimates are unavailable. The CCDP and CLERP values used to assess risk impact for F3 were determined based upon pipe break location and Section 3 of this report.

Additional Inputs – Other inputs and factors applied in the conduction of the quantitative analysis are described below.

- The usage of enhanced PODs in the analysis is limited to those cases where only Thermal Stratification, Cycling and Striping (TASCS) and/or Thermal Transients (TT) are identified at an inspection location.

- Only those inspection locations that received a volumetric examination are included in the count (credited) in the risk assessment. Inspection locations previously subjected to a surface examination only were not considered in accordance with Section 3.7.1 of Reference [1]. This was not a consideration in the F3 analysis since there are no external surface only exams being conducted.

7.2 Risk Analysis and Results

The following table summarizes the risk impact of changing from SKIFS to EPRI methodology. This is based on element selection criteria described in Section 6 for SKIFS and EPRI, which is different (e.g., EPRI chooses 25% of high risk versus SKIFS selection of 100%). This risk impact also treats IGSCC as just another degradation mechanism as described in Section 6 (e.g., for EPRI risk impact, 25% of high risk and 10% of medium risk were chosen). Additional sensitivities on this assumption is described later in this section.

System	Delta CDF	Delta LERF
311 - Main Steam	-1.67E-12	-1.45E-12
312 - Feedwater	8.80E-10	1.94E-13
321 - RHR	-2.30E-12	5.72E-12
323 - Low Pressure Injection	2.93E-10	6.29E-14
462 - Condensate	0.00E+00	0.00E+00
Total	**1.17E-09**	**4.53E-12**

As shown, there is a very small risk reduction for the 311 system and a very minor increase for the other systems. All of the results are very small risk changes.

As described in the previous section, only the change in risk must be demonstrated as insignificant. There is no requirement to estimate absolute risk values as this is generally acknowledged to be much more uncertain than simply estimating a change in risk. In fact, for these reasons the EPRI methodology even includes qualitative methods for evaluating the change in risk, where appropriate.

As described in Section 6, risk calculations are based on element selections maximizing the risk impact of changing from SKIFS to EPRI methodology. It is also based on the following:

- Inspection intervals are assumed not to be changing. It is recognized that the present SKIFS intervals are sometimes shorter based on lack of analysis for degradation mechanisms. It is possible that inspecting more frequent than every 10 years could be reducing risk however there is the potential that if a flaw is missed on first inspection it could be missed on second inspection unless new or different techniques are used.

- There are no outside diameter inspections that are surface exam only at F3. Otherwise, consistent with RI-ISI they would not be credited in the risk impact assessment. For some pipe-to-valve locations, inside diameter PT exams are conducted in lieu of UT and are credited in the analysis.

- Due to the negligible contribution to plant risk, inspection of risk category 6 and 7 welds do not have to be included in the change in risk assessment per the EPRI RI-ISI methodology.

Sensitivity cases were evaluated to investigate the following cases:

- In the US, the IGSCC program for BWRs is an augmented program that is not changed by the risk informed ISI program. Thus, a sensitivity case was analyzed where EPRI IGSCC selection were set equivalent to SKIFS. This effectively makes the delta risk for IGSCC weld selection 0.0. As shown in the following table there is a very small reduction in risk calculated.

System	Delta CDF	Delta LERF
311 - Main Steam	-1.67E-12	-1.45E-12
312 – Feedwater	3.98E-11	7.87E-15
321 – RHR	-1.94E-11	-2.47E-12
323 - Low Pressure Injection	-1.48E-10	-3.48E-14
462 – Condensate	0.00E+00	0.00E+00
Total	**-1.29E-10**	**-3.94E-12**

- The EPRI IGSCC selections for NUREG-0313 Category D welds were set to 100% to be consistent with what would be required in the US. As shown in the following table there is a very small reduction in risk calculated.

System	Delta CDF	Delta LERF
311 - Main Steam	-1.67E-12	-1.45E-12
312 - Feedwater	-9.25E-12	-1.28E-15
321 - RHR	-1.04E-09	-8.18E-11
323 - Low Pressure Injection	-5.47E-10	-1.23E-13
462 - Condensate	0.00E+00	0.00E+00
Total	**-1.60E-09**	**-8.33E-11**

8 Summary

The objective of this project was a pilot plant demonstration of the EPRI RI-ISI Methodology to selected systems at Forsmark, Unit 3 (F3). This scope of this study encompasses five systems and is based upon F3 implementation of SKIFs guidance as well as other consideration as documented in the PMT program.

As described in section 2, five systems were selected for evaluation. These systems were selected because they allow this project to focus on a number of issues of interest in developing a RI-ISI methodology and RI-ISI program. This includes the following:

- Several different types of degradation may be identified,
- Several different types of "consequence of failure" may be identified,
- Different types of safety systems are evaluated
- Non-safety systems are evaluated

Using the results of this application, insights and comparisons between SKIFS and the EPRI methodologies' are provided including the following:

- Consequence of pressure boundary failure (PBF) as described in Section 3.14.
- Degradation mechanism evaluation as described in Section 4.8.
- Risk ranking as described in Section 5.
- Element selection for inspection as described in Section 6.
- Risk impact as described in Section 7.

References

1. EPRI TR-112657, “Revised Risk-Informed Inservice Inspection Evaluation Procedure,” Final Report, Revision B-A, December 1999.

2. Forsmark 3 PRA Risk Spectrum Model F3-A0838

3. Forsmark 3 P&IDs for System 311, 312, 321, 323 and 462
   AA 150 501 “311 Main Steam” Rev 14
   AA 150 502 “312 Feedwater” Rev 10
   AA 150 507 “321 RHR” Rev 15
   AA 150 509 “323 LPI” Rev17
   SLF17895 “462 Condensate” Rev 28

4. Forsmark 3 Isometrics for System 311, 312, 321, 323 and 462

5. Technical Requirements for Thermal Insulation of Piping and Components, TRM 13 B ASEA-ATOM, 31-1-1979.

6. F3 ISI database, excel spreadsheet including material and operating temperature

7. Processkemiska Specifikationer Forsmark 3, FT-R95-275, Revision 4.03.

8. EPRI water chemistry guidelines

9. F3-GK-020, 2008-03, “Ångsystem” 2005

10. F3DC/Löt, Location of mixing device / thermal sleeves

11. Forsmark 3 – “Värdering av rörsystem med avseende på FAC och annan corrosion”, FM-2008-0129, Revision 1.

12. e-mail from Jan Lötman to P O’Regan, “Info about Startup and Shutdown, dated 26 January, 2009.

13. F3 – GK – 018, 2008-03, “Kondensat- och matarvattensystem” 2005

14. EPRI TR-1011945, “Enhanced Crevice Corrosion Criteria in RI-ISI Evaluation,” dated November, 2005.

15. F3 – GK – 009, 2007-09, “Resteffektkylning” 2005

16. e-mail from Jan Lötman to P O’Regan, “Service history review”

- E-mail J Lötman to P O'Regan, "Subject: SV: 091109 - Löt comments - Forsmark 3 RI ISI Pilot Report_Rev re", dated November 20, 2009

17. F3 – GK – 008, 2008-01, "Härdkylsystem" 2005

18. Material information for Condensate system

19. e-mail from Jan Lötman to P O'Regan, "Forsmark 3 – Mixing of water in system 462, dated 6 May, 2009.

20. RI-ISI Review meeting, 11-9-2009

21. e-mail from Jan Lötman to P O'Regan, "F3 – When is system 321 low pressure taken into operation, dated 16 September, 2009

22. e-mail from Jan Lötman to P O'Regan, "RPV level during startup, dated 15 September, 2009

Appendix A Weld Database

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	GBA-2	8	S1	50	Groove weld	None	311-C-3B	High	4	1	6.3E-05	5.4E-05			III	2	C		1
311	GBA-2	7	S8	150	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-5	21	S7	150	Groove weld	None	311-C-4E	High	4	1	8.2E-05	7.4E-05			III	2	C		1
311	GBA-1	1	S11	600	Pipe	None	311-C-1A	High	4	1	1.4E-03	3.1E-07	1	MF	II	2	B		1
311	GBA-1	1	S12	600	Pipe	None	311-C-1A	High	4	1	1.4E-03	3.1E-07	1	MF	II	2	B		1
311	GBA-1	1	S5	600	Pipe	None	311-C-1A	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-1	1	S6	600	Pipe	None	311-C-1A	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-1	1	W10	600	Pipe	None	311-C-1A	High	4	1	1.4E-03	3.1E-07	1	MF	II	2	B		1
311	GBA-2	6	S10	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	6	S5	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	6	S6	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	6	S9	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	S11	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	S12	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	S5	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	S6	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	S10	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	S5	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	S6	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	S9	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-1	3	W2	300	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	7	W3	300	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	12	W2	300	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	17	W2	300	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	S1	600	Pipe	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	S13	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	S8	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	W14	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	W2	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	W3	600	Pipe	None	311-C-1A	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-1	1	W32.3	600	Pipe	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	W4	600	Pipe	None	311-C-1A	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-1	1	W7	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	1	W9	600	Pipe	None	311-C-1A	High	4	1	1.4E-03	3.1E-07	1	MF	II	2	B		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	GBA-1	2	S1	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	2	S2	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	3	S4	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	3	W1	600	Groove weld	None	311-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-1	4	S1	600	Groove weld	None	311-C-3A	High	4	1	6.3E-05	5.4E-05			III	2	C		1
311	GBA-2	6	S1	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	6	S12	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	6	S13	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	6	W11	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	6	W2	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	6	W3	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	6	W32.4	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	6	W4	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	6	W7	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	6	W8	600	Pipe	None	311-C-1B	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-2	7	S1	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	7	S5	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	7	W2	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-2	7	W7	600	Groove weld	None	311-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	S1	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	S13	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	S8	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	W10	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	W2	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	W3	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	W32.2	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	W4	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	10	W7	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	10	W9	600	Pipe	None	311-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-3	11	S1	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	11	S2	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	12	S4	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	12	W1	600	Groove weld	None	311-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-3	13	S1	600	Groove weld	None	311-C-3C	High	4	1	6.3E-05	5.4E-05			III	2	C		1
311	GBA-4	15	S1	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	15	S12	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	15	W11	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	15	W2	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	GBA-4	15	W3	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	W32.1	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	15	W4	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	W7	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	15	W8	600	Pipe	None	311-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B		1
311	GBA-4	16	S1	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	16	S2	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	17	S4	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	17	W1	600	Groove weld	None	311-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		1
311	GBA-4	18	S1	600	Groove weld	None	311-C-3D	High	4	1	6.3E-05	5.4E-05			III	2	C		1
311	GBA-5	20	W27	10	Fillet weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	21	W11	10	Fillet weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	21	W4	10	Fillet weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	20	W30	15	Fillet weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-3	11	W3	25	Fillet weld	None	311-C-1	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-3	11	W4	25	Fillet weld	None	311-C-1	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	20	W26	25	Fillet weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	21	W10	25	Fillet weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	22	W1	25	Fillet weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	GBA-5	22	W6	25	Fillet weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08		MF	II	None	C		1
311	HAB-1	32	W14	25	Fillet weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07		MF	II	None	C		1
311	HBC-1	28	W2	25	Fillet weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	None	C		1
311	HBC-1	28	WS7	25	Fillet weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	None	C		1
311	NCD-2	30	W6	25	Fillet weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	None	C		1
311	GBA-1	3	S3	50	Groove weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-1	3	W6	50	Fillet weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-2	7	S4	50	Groove weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-2	7	W17	50	Fillet weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-3	12	S3	50	Groove weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-3	12	W6	50	Fillet weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-4	17	S3	50	Groove weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-4	17	W6	50	Fillet weld	None	311-C-1	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W10	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W11	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W13	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W14	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	W12	50	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	S10	50	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	GBA-5	22	S11	50	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	S12	50	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	S9	50	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	24	S1	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	24	S2	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	25	S1	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	26	S1	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	26	S2	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	27	S1	50	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	HBC-1	28	S4	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	29	S6	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	29	W1	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	29	W2	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	29	W3	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	29	W4	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	NCD-2	30	S1	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	NCD-2	30	S7	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	NCD-2	30	S8	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	NCD-2	30	W4	50	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	GBA-5	22	W3	100	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	W4	100	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	W5	100	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	W7	100	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	HAB-1	31	S14	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	S15	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	S5	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	S7	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W1	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W10	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W11	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W12	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W13	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W2	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W3	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W4	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W6	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	31	W9	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	S1	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	HAB-1	32	S10	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07		MF	II	3	C		1
311	HAB-1	32	S12	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	S4	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	S5	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07		MF	II	3	C		1
311	HAB-1	32	S6	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	S9	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	W11	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	W2	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	W3	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	W7	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	HAB-1	32	W8	100	Groove weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07			III	3	C		1
311	GBA-5	20	S24	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	S25	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	S28	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	S29	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	S3	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	S8	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	S9	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W1	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W15	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W2	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W4	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W5	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W6	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	20	W7	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	S1	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	S13	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	S2	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	S5	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	S6	150	Groove weld	None	311-C-3E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	S8	150	Groove weld	None	311-C-1E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	W3	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	21	W9	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	GBA-5	22	S2	150	Groove weld	None	311-C-2E	Med	6		1.0E-05	2.2E-08			III	2	C		1
311	HBC-1	28	S1	150	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	28	S6	150	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	28	W3	150	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1
311	HBC-1	28	W5	150	Groove weld	None	311-C-5E	Med	6		9.4E-06	7.4E-07			III	2	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	GBA-1	3	S5	600	Groove weld	None	311-C-2A	Med	6		4.1E-05	7.9E-09			III	2	C		1
311	GBA-2	7	S6	600	Groove weld	None	311-C-2B	Med	6		4.1E-05	7.9E-09			III	2	C		1
311	GBA-3	12	S5	600	Groove weld	None	311-C-2C	Med	6		4.1E-05	7.9E-09			III	2	C		1
311	GBA-4	17	S5	600	Groove weld	None	311-C-2D	Med	6		4.1E-05	7.9E-09			III	2	C		1
311	HBB-1	5	S1	600	Groove weld	None	311-C-4A	Med	6		1.6E-05	7.5E-06			III	2	C		1
311	HBB-1	5	W2	600	Groove weld	None	311-C-4A	Med	6		1.6E-05	7.5E-06			III	3	C		1
311	HBB-2	9	S1	600	Groove weld	None	311-C-4B	Med	6		1.6E-05	7.5E-06			III	2	C		1
311	HBB-2	9	W2	600	Groove weld	None	311-C-4B	Med	6		1.6E-05	7.5E-06			III	3	C		1
311	HBB-3	14	S1	600	Groove weld	None	311-C-4C	Med	6		1.6E-05	7.5E-06			III	2	C		1
311	HBB-3	14	W2	600	Groove weld	None	311-C-4C	Med	6		1.6E-05	7.5E-06			III	3	C		1
311	HBB-4	19	S1	600	Groove weld	None	311-C-4D	Med	6		1.6E-05	7.5E-06			III	2	C		1
311	HBB-4	19	W2	600	Groove weld	None	311-C-4D	Med	6		1.6E-05	7.5E-06			III	3	C		1
311	HAB-1	32	W13		Fillet weld	None	311-C-6E	Med	6		9.4E-06	7.4E-07		MF	II	None	C		1
311	HAB-2	43	WS6	10	Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	HAC-1	39	W1	10	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAB-2	41	W5	25	Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	HAB-2	43	WS2	25	Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	HAB-2	43	WS3	25	Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	HAB-2	43	WS7	25	Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	HAB-2	43	WS8	25	Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	HAC-1	37	W2	25	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAC-1	37	W3	25	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAC-1	37	W5	25	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAC-1	37	W6	25	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAC-1	37	W7	25	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAC-1	38	WS7	25	Fillet weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	GBA-5	23	S1	50	Groove weld	None	311-C-3E1	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	GBA-5	23	S2	50	Groove weld	None	311-C-3E1	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	GBA-5	23	S3	50	Groove weld	None	311-C-3E1	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	GBA-5	23	S6	50	Groove weld	None	311-C-3E1	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	GBA-5	23	W4	50	Groove weld	None	311-C-3E1	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAB-2	43	WS4	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		SCC	II	3	C		2
311	HAB-2	43	WS9	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		SCC	II	3	C		2
311	HAB-2	44	S10	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		SCC	II	3	C		2
311	HAB-2	44	WS9	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		SCC	II	3	C		2
311	HAB-2	40	S1	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	40	S4	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	40	S5	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	HAB-2	40	S8	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	40	W2	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	40	W3	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	40	W6	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	40	W7	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	S1	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	S6	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	W2	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	W3	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	W4	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	W7	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	41	W8	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	S1	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	S4	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	S5	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	S7	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	S8	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	WS2	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	WS3	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	42	WS6	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	43	S1	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	43	WS10	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	43	WS5	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	S1	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	S6	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	WS2	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	WS3	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	WS4	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	WS5	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	44	WS7	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	S1	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	S4	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	W2	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	W3	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	W5	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	W6	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	W7	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAB-2	45	W8	50	Groove weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07			III	3	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	HAC-1	37	W1	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07		SCC	II	3	C		2
311	HAC-1	37	S11	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	37	S16	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	37	S4	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	37	W10	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	37	W8	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	S1	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	S12	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	S5	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	S6	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS10	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS11	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS2	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS3	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS4	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS8	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	38	WS9	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	39	S6	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	39	W2	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	39	W3	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	39	W4	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HAC-1	39	W5	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	HMB-2	36	S1	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			I	None	C		2
311	HMB-2	36	S11	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			I	None	C		2
311	HMB-2	36	S6	50	Groove weld	None	311-C-8E	Low	7		1.0E-06	1.0E-07			I	None	C		2
311	NCD-1	33	W17	50	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07		SCC	II	3	C		2
311	NCD-1	33	S10	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	S19	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	S4	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	S8	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	S9	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W1	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W11	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W16	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W2	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W5	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W6	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W7	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	NCD-1	47	S3	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	S5	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	S7	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	S9	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	W2	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	W4	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	W6	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	W8	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S10	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S2	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S3	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S4	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S6	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S7	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	S8	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	W1	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	W11	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	W12	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	W13	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	W5	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	48	W9	100	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	33	S14	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W12	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W13	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	33	W15	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	3	C		1
311	NCD-1	34	S14	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	S2	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	S4	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	S6	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	S9	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W1	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W10	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W11	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W12	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W13	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W3	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W5	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	34	W7	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
311	NCD-1	34	W8	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	S16	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	S2	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	S3	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	S5	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	S8	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	W1	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	W4	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	W6	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	W7	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	47	W1	150	Groove weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	GBA-5	23	W5		Fillet weld	None	311-C-3E1	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	HAB-2	44	WS8		Fillet weld	None	311-C-7E	Low	7		1.0E-06	1.0E-07		MF	II	None	C		1
311	NCD-1	33	W3		Fillet weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
311	NCD-1	46	WS15		Fillet weld	None	311-C-9E	Low	7		1.0E-06	1.0E-07			III	None	C		1
312	GMA-1	11	B1-40	300	Pipe	IGSCC	312-C-1D	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-1	11	S3	300	Pipe	IGSCC	312-C-1D	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-1	13	B2-36	300	Pipe	IGSCC	312-C-1A	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-1	13	S3	300	Pipe	IGSCC	312-C-1A	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-2	15	B2-35	300	Pipe	IGSCC	312-C-1B	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-2	15	B3-35	300	Pipe	IGSCC	312-C-1B	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-2	17	B1-41	300	Pipe	IGSCC	312-C-1C	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-2	17	S2	300	Pipe	IGSCC	312-C-1C	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
312	GMA-1	11	B2-40	300	Groove weld	None	312-C-1D	High	4		1.4E-03	3.1E-07			III	2	C	A	4
312	GMA-1	11	B3-40	300	Pipe	None	312-C-1D	High	4		1.4E-03	3.1E-07			III	2	C	A	4
312	GMA-1	11	S2	300	Pipe	None	312-C-1D	High	4		1.4E-03	3.1E-07		MF	II	2	B	A	4
312	GMA-1	13	B1-36	300	Pipe	None	312-C-1A	High	4	1	1.4E-03	3.1E-07	1	MF	II	2	B	A	4
312	GMA-1	13	S4.R1	300	Pipe	None	312-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
312	GMA-2	15	B1-35	300	Pipe	None	312-C-1B	High	4	1	1.4E-03	3.1E-07	1	MF	II	2	B	A	4
312	GMA-2	15	B4-35	300	Pipe	None	312-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
312	GMA-2	17	B2-41	300	Pipe	None	312-C-1C	High	4		1.4E-03	3.1E-07		MF	II	2	B	A	4
312	GMA-2	17	S1	300	Pipe	None	312-C-1C	High	4		1.4E-03	3.1E-07	1	MF	II	2	B	A	4
312	GMA-2	17	S4.R1	300	Pipe	None	312-C-1C	High	4		1.4E-03	3.1E-07			III	2	C	A	4
312	GMA-3	18	S2	100	Groove weld	None	312-C-1E	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-3	18	S3	100	Groove weld	None	312-C-1E	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-3	18	W4	100	Groove weld	None	312-C-1E	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-3	18	W5	100	Groove weld	None	312-C-1E	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-3	19	S1	100	Groove weld	None	312-C-1E	High	4		1.4E-03	3.1E-07			III	2	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
312	GMA-4	20	S2	100	Groove weld	None	312-C-1F	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-4	20	S3	100	Groove weld	None	312-C-1F	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-4	20	W4	100	Groove weld	None	312-C-1F	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-4	20	W5	100	Groove weld	None	312-C-1F	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-4	21	S1	100	Groove weld	None	312-C-1F	High	4		1.4E-03	3.1E-07			III	2	C		3
312	GMA-1	9	S4	150	Pipe	IGSCC	312-C-2A	Med	5		4.1E-05	7.9E-09	0	SCC	II	2	B	D	
312	GMA-1	9	S6	300	Pipe	IGSCC	312-C-2A	Med	5	1	4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-1	9	S8	300	Pipe	IGSCC	312-C-2A	Med	5	1	4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-1	9	W10	450	Pipe	IGSCC	312-C-2A	Med	5		4.1E-05	7.9E-09		SCC	II	2	B	D	
312	GMA-1	9	W3	450	Pipe	IGSCC	312-C-2A	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-1	9	W5	450	Pipe	IGSCC	312-C-2A	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-1	9	W7	450	Pipe	IGSCC	312-C-2A	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-2	14	S4	200	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09		SCC	II	2	B	D	
312	GMA-2	14	S6	300	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-2	14	S8	300	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-2	14	W10	450	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09		SCC	II	2	B	D	
312	GMA-2	14	W3	450	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-2	14	W5	450	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-2	14	W7	450	Pipe	IGSCC	312-C-2B	Med	5		4.1E-05	7.9E-09	1	MF	I	2	A	D	
312	GMA-5	22	W10	50	Pipe	None	312-C-2G	Med	6		1.0E-05	2.2E-08	1	SCC	I	2	A		2
312	GMA-5	22	W7	50	Pipe	None	312-C-2G	Med	6		1.0E-05	2.2E-08	1	SCC	I	2	A		2
312	FAC-1	1	S2	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	1	S3	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	1	S6	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	1	S7	450	Pipe	None	312-C-5	Med	6		8.7E-06	2.2E-08		MF	II	2	B		1
312	FAC-1	1	W1	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	1	W4	100	Fillet weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	1	W5	100	Fillet weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	2	S1	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	2	S2	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	2	S3	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	3	S5	150	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	3	W1	150	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	3	W2	150	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	3	W3	150	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	3	W4	10	Fillet weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	None	C		1
312	FAC-1	4	S1	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	4	S2	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
312	FAC-1	4	S3	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	5	S2	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	5	S3	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	5	S6	100	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	5	S7	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-1	5	W1	450	Groove weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	3	C		1
312	FAC-1	5	W4		Fillet weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	None	C		1
312	FAC-1	5	W5	100	Fillet weld	None	312-C-5	Med	6		8.7E-06	2.2E-08			III	2	C		1
312	FAC-2	6	S12	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	S15	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	S18	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	S19	150	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	S20	150	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	S21	150	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	S9	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W10	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W11	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W13	150	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W14	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W16	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W17	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W2	10	Fillet weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	None	C		1
312	FAC-2	6	W3	10	Fillet weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	None	C		1
312	FAC-2	6	W4	10	Fillet weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	None	C		1
312	FAC-2	6	W5	10	Fillet weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	None	C		1
312	FAC-2	6	W7	150	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	6	W8	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	3	C		1
312	FAC-2	7	S1	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	2	C		1
312	FAC-2	7	S2	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	2	C		1
312	FAC-2	7	S8	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	2	C		1
312	FAC-2	8	S1	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	2	C		1
312	FAC-2	8	S2	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	2	C		1
312	FAC-2	8	S4	100	Groove weld	None	312-C-6	Med	6		9.4E-05	1.9E-07			III	2	C		1
312	GMA-1	9	B1-02	450	Pipe	None	312-C-2A	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-1	9	S1	450	Groove weld	None	312-C-3A	Med	6		1.1E-05	1.2E-09			III	2	C		1
312	GMA-1	9	S11	450	Pipe	None	312-C-4A	Med	6		8.8E-06	5.7E-07		MF	II	2	B		1
312	GMA-1	9	S12	150	Pipe	None	312-C-2A	Med	6		4.1E-05	7.9E-09	0	MF	II	2	B	A	4
312	GMA-1	9	S2	450	Groove weld	None	312-C-2A	Med	6		4.1E-05	7.9E-09			III	2	C	A	4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
312	GMA-1	10	S1	300	Groove weld	None	312-C-2A	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-1	10	S2	300	Groove weld	None	312-C-2A	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-1	10	S3	300	Groove weld	None	312-C-2A	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-1	11	S1	300	Pipe	None	312-C-2A	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-1	12	S1	300	Groove weld	None	312-C-2A	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-1	12	S2	300	Pipe	None	312-C-2A	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-2	14	B1-01	450	Pipe	None	312-C-2B	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-2	14	S1	450	Pipe	None	312-C-3B	Med	6		1.1E-05	1.2E-09		MF	II	2	B		1
312	GMA-2	14	S11	450	Pipe	None	312-C-4B	Med	6		8.8E-06	5.7E-07		MF	II	2	B		1
312	GMA-2	14	S12	200	Pipe	None	312-C-2B	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-2	14	S2	450	Pipe	None	312-C-2B	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-2	15	S2	300	Pipe	None	312-C-2B	Med	6		4.1E-05	7.9E-09	0	MF	II	2	B	A	4
312	GMA-2	15	W1	300	Groove weld	None	312-C-2B	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-2	16	S1	300	Groove weld	None	312-C-2B	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-2	16	S2	300	Groove weld	None	312-C-2B	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-2	16	S4	300	Pipe	None	312-C-2B	Med	6		4.1E-05	7.9E-09		MF	II	2	B	A	4
312	GMA-2	16	W21	300	Groove weld	None	312-C-2B	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-2	16	W3	300	Groove weld	None	312-C-2B	Med	6		4.1E-05	7.9E-09			III	2	C	A	4
312	GMA-3	18	S1	100	Groove weld	None	312-C-2E	Med	6		1.1E-05	1.2E-09			III	2	C		1
312	GMA-3	18	S6	100	Groove weld	None	312-C-3E	Med	6		1.0E-04	9.3E-06			III	2	C		1
312	GMA-4	20	S1	100	Groove weld	None	312-C-2F	Med	6		1.1E-05	1.2E-09			III	2	C		1
312	GMA-4	20	S6	100	Groove weld	None	312-C-3F	Med	6		1.0E-04	9.3E-06			III	2	C		1
312	GMA-5	22	S1	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	22	S12BT	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	22	S3	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	22	S5	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	22	S6	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	22	W2	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	22	W4	15	Fillet weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08		SCC	II	None	C		2
312	GMA-5	22	W8	50	Pipe	None	312-C-2G	Med	6		1.0E-05	2.2E-08	1	SCC	I	2	A		2
312	GMA-5	23	S1	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	23	S3	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	23	S6BT	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	23	W2	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	GMA-5	23	W4	15	Fillet weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08		SCC	II	None	C		2
312	LDB-1	24	S10	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	S11	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	S12	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
312	LDB-1	24	S2	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	S6	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	S8	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	S9	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	SV1	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	2	C		2
312	LDB-1	24	SV2	50	Groove weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	3	C		1
312	LDB-1	24	W5		Fillet weld	None	312-C-2G	Med	6		1.0E-05	2.2E-08			III	None	C		1
321	GMA-1	52	S3	100	Pipe	IGSCC	321-C-1A	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
321	GMA-1	54	S1	100	Groove weld	IGSCC	321-C-1A	High	2		1.4E-03	3.1E-07			III	2	C	D	
321	GMA-1	54	S6	100	Groove weld	IGSCC	321-C-1A	High	2		1.4E-03	3.1E-07			III	2	C	D	
321	GMA-3	42	B1-42	200	Pipe	IGSCC	321-C-1E	High	2		1.4E-03	3.1E-07			III	2	C	D	
321	GMA-3	42	B4-42	200	Pipe	IGSCC	321-C-1E	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
321	GMA-3	42	B5-42	200	Pipe	IGSCC	321-C-1E	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
321	GMA-3	43	S16	200	Pipe	IGSCC	321-C-1E	High	2		1.4E-03	3.1E-07		SCC	II	2	B	D	
321	GMA-3	43	S6	200	Pipe	IGSCC	321-C-1E	High	2		1.4E-03	3.1E-07		SCC	II	2	B	D	
321	GMA-4	41	S2	200	Pipe	IGSCC	321-C-1F	High	2		1.4E-03	3.1E-07		SCC	II	2	B	D	
321	GMA-4	41	S4	200	Pipe	IGSCC	321-C-3F	High	2		6.4E-05	5.5E-05		SCC	II	2	B	D	
321	GMA-1	52	B1-06	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	52	B2-06	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	52	S8	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	52	S9	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	53	S1	100	Pipe	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	53	W3	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	54	B1-08	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	54	B2-08	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	54	B3-08	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	54	B4-08	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	54	S2	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-1	54	S5	100	Groove weld	None	321-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	42	B2-42	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	42	B3-42	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	42	S5	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	42	S6	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	43	S1	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	43	S13	200	Groove weld	None	321-C-3E	High	4	1	6.4E-05	5.5E-05			III	2	C	A	4
321	GMA-3	43	S2	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-3	43	S4	200	Groove weld	None	321-C-1E	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-4	39	S2	200	Groove weld	None	321-C-1F	High	4		1.4E-03	3.1E-07			III	2	C	A	4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	GMA-4	39	S4	200	Groove weld	None	321-C-1F	High	4	1	1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-4	39	W3	200	Groove weld	None	321-C-1F	High	4	1	1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-4	40	S1	200	Pipe	None	321-C-1F	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-4	40	S2	200	Groove weld	None	321-C-1F	High	4		1.4E-03	3.1E-07			III	2	C	A	4
321	GMA-5	37	S2	200	Groove weld	None	321-C-1G	High	4		1.4E-03	3.1E-07			III	2	C		3, 4
321	GMA-5	37	S4	200	Groove weld	None	321-C-1G	High	4		1.4E-03	3.1E-07			III	2	C		3, 4
321	GMA-5	37	W3	200	Groove weld	None	321-C-1G	High	4		1.4E-03	3.1E-07			III	2	C		3, 4
321	GMA-5	38	S1	200	Groove weld	None	321-C-1G	High	4		1.4E-03	3.1E-07			III	2	C		3, 4
321	GMA-5	38	S2	200	Groove weld	None	321-C-1G	High	4		1.4E-03	3.1E-07			III	2	C		3, 4
321	GMA-5	38	S4	200	Groove weld	None	321-C-1G	High	4		1.4E-03	3.1E-07			III	2	C		3, 4
321	GMA-5	38	S6	200	Pipe	None	321-C-3G	High	4	1	1.5E-04	1.4E-04	1	SCC	I	2	A		3
321	FMB-1	1	B6-17	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	2	B6-11	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	2	A	D	
321	FMB-1	3	S11	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	3	S15	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	3	S16	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	3	S2	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	3	S3	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	3	S8	200	Pipe	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-1	3	W12	200	Pipe	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-1	3	W14	200	Pipe	IGSCC	321-C-4E	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-1	3	W5	200	Groove weld	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-1	3	W6	150	Groove weld	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-1	3	W7	200	Groove weld	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-1	3	W9	200	Pipe	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-2	9	S12	150	Groove weld	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-3	6	S12	150	Pipe	IGSCC	321-C-4E	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	S1	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	10	S11	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	S14	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	10	S5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	S8	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	W10	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	W12	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	W3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	W4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	W6	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	10	W7	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	FMB-4	10	W9	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06	1	SCC	I	3	B	D	
321	FMB-4	11	S1	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	11	S11	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	S14	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	11	S14	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	11	S5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	S8	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W10	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W12	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W6	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W7	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	11	W9	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	12	S1	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	S10	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	S11	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	S13	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	S3	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	S4	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	S7	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-4	12	W5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	12	W6	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	12	W8	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-4	12	W9	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	13	S11	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	13	S4	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	13	S5	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	13	S9	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	13	W10	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	13	W7	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	13	W8	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	14	S7	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	14	S9	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	14	W1	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	14	W2	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	14	W3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	14	W4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	FMB-5	14	W5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	15	S1	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-5	15	S4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	15	S7	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	15	W3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-5	15	W8	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	16	S2	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	16	S9	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	16	W10	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	16	W5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	16	W6	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	16	W7	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	16	W8	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	17	S3	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	17	S8	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	17	W1	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	17	W2	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	17	W4	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	17	W5	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	17	W6	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	17	W7	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	18	S3	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	18	W1	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	18	W2	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	19	S3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	19	S4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	19	S5	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	19	W1	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	19	W2	200	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	20	B3-10	150	Pipe	IGSCC	321-C-4B	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	2	A	D	
321	FMB-6	20	S1	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	2	B	D	
321	FMB-6	21	B2-15	150	Pipe	IGSCC	321-C-4B	Med	5	1	1.7E-05	7.3E-06	1	SCC	I	2	A	D	
321	FMB-6	22	S1	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	22	S11	100	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	22	S6	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	22	S8	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	22	W3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	22	W4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	FMB-6	22	W5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	22	W7	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	22	W9	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	23	S3	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	23	S5	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	23	S7	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	23	S8	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	23	W1	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	23	W2	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	23	W4	150	Pipe	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	II	3	C	D	
321	FMB-6	24	S4	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	24	W2	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	24	W3	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	24	W5	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	24	W6	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	FMB-6	24	W7	150	Groove weld	IGSCC	321-C-4B	Med	5		1.7E-05	7.3E-06		SCC	I	3	B	D	
321	GMA-1	51	B1-09	150	Pipe	IGSCC	321-C-1C	Med	5	1	1.0E-05	1.2E-09	1	SCC	I	2	A	D	
321	GMA-1	51	S1	150	Pipe	IGSCC	321-C-1C	Med	5	1	1.0E-05	1.2E-09	1	SCC	I	2	A	D	
321	GMA-1	52	S2	100	Pipe	IGSCC	321-C-1B	Med	5	1	1.0E-05	1.2E-09	1	SCC	I	2	A	D	
321	GMA-2	44	S4	150	Pipe	IGSCC	321-C-1D	Med	5		1.0E-05	1.2E-09		SCC	II	2	B	D	
321	GMA-2	44	S6	150	Pipe	IGSCC	321-C-3D	Med	5		1.7E-05	7.4E-06		SCC	II	2	B	D	
321	GMA-3	43	S7	200	Pipe	IGSCC	321-C-2E	Med	5		1.0E-05	2.2E-08		SCC	II	2	B	D	
321	GMA-4	41	S3	200	Pipe	IGSCC	321-C-2F	Med	5		1.0E-05	2.2E-08		SCC	II	2	B	D	
321	GMA-5	38	S5	200	Pipe	IGSCC	321-C-2G	Med	5		1.0E-05	2.2E-08		SCC	II	2	B	D	
321	FMB-1	1	B1-17	200	Pipe	IGSCC, TT	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	2	B	D	
321	FMB-1	2	B5-11	200	Pipe	IGSCC, TT	321-C-4E	Med	5		1.7E-05	7.3E-06		SCC	II	2	B	D	
321	FMB-1	1	B2-17	15	Fillet weld	TT	321-C-4E	Med	5	1	1.7E-05	7.3E-06		MF	II	None	C		2
321	FMB-1	1	B3-17	200	Pipe	TT	321-C-4E	Med	5	1	1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-1	1	B5-17	150	Groove weld	TT	321-C-4E	Med	5	1	1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-1	1	W1-17	25	Fillet weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	None	C		2
321	FMB-1	1	W2-17	25	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	None	C		2
321	FMB-1	2	B1-11	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-1	2	B3-11	200	Pipe	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-1	2	B4-11	15	Fillet weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	None	C		2, 4
321	FMB-1	2	W1-11	25	Fillet weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	None	C		2, 4
321	FMB-1	2	W2-11	25	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	None	C		2, 4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	FMB-2	7	S2	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	7	S3	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	7	S4	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	7	S5	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	7	W6	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	7	W7	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	7	W8	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	8	S1	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	S2	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	S3	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	S4	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	S5	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	W6	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	W7	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	4	W8	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	5	S1	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	5	S2	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	5	W4	150	Groove weld	TT	321-C-4E	Med	5		1.7E-05	7.3E-06			III	3	C	A	4
321	GMA-2	44	S5	150	Pipe	IGSCC	321-C-2D	Low	6		1.0E-06	1.0E-07		SCC	II	2	B	D	
321	FMB-1	1	B4-17	200	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-1	1	B7-17	10	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	None	C		2
321	FMB-1	2	B2-11	200	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-1	2	B7-11	25	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	None	C		2, 4
321	FMB-1	3	S1	200	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-1	3	W10	25	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-1	3	W4	15	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-2	8	S2	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	S14	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	S3	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	S4	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	S8	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	S9	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	W1	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	W2	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	W5	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-2	9	W6	15	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-2	9	W7	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	5	S3	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	FMB-3	5	W5	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S16	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S17	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06		MF	II	3	C	A	4
321	FMB-3	6	S19	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S21	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S3	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S4	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S8	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	S9	150	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	W1	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	W2	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	W5	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-3	6	W6	15	Fillet weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-3	6	W7	150	Groove weld	None	321-C-4E	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-4	10	W13	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-4	10	W18	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-4	10	W2	25	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-4	11	W13	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-4	11	W18	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-4	11	W2	25	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-4	12	W12	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-4	12	W2	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	13	W1	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	13	W2	25	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	13	W3	25	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	13	W6		Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	14	W6	10	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	14	W8	10	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	15	S10	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-5	15	S11	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-5	15	S12	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-5	15	S5	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-5	15	S9	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-5	15	W2	10	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-5	15	W6	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-6	16	S1	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	16	S3	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	16	S4	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	FMB-6	16	W11	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	16	W12	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	16	WS30	10	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-6	18	S5	200	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	18	W4	32	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-6	20	B1-10	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-6	20	B2-10	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	None	C		2, 4
321	FMB-6	20	WS8	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-6	21	B1-15	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-6	21	B1-16	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	21	B2-16	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	2	C	A	4
321	FMB-6	21	B3-15	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	None	C		2, 4
321	FMB-6	22	W2	10	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-6	23	W6	10	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-6	24	S8	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	FMB-6	24	W1	15	Fillet weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06		SCC	II	None	C		2
321	FMB-6	24	W10	150	Groove weld	None	321-C-4B	Med	6		1.7E-05	7.3E-06			III	3	C	A	4
321	GMA-1	47	S10	150	Pipe	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	47	S11	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	47	S2	150	Pipe	None	321-C-1B	Med	6		1.0E-05	1.2E-09		SCC	II	2	B		3
321	GMA-1	47	S3	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	47	S4	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	47	S6	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	47	S9	150	Pipe	None	321-C-3B	Med	6		1.7E-05	7.4E-06		SCC	II	2	B		3
321	GMA-1	47	S9	150	Pipe	None	321-C-3B	Med	6		1.7E-05	7.4E-06		SCC	II	2	B		3
321	GMA-1	47	W8	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	B1-07	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	B2-07	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	B3-07	100	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	S3	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	S6	150	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	S7	150	Pipe	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C		3, 4
321	GMA-1	48	W5	15	Fillet weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09		SCC	II	None	C		2, 3
321	GMA-1	49	S7	150	Pipe	None	321-C-3C	Med	6		1.4E-05	4.6E-06	1	SCC	II	2	B		3
321	GMA-1	51	B2-09	150	Groove weld	None	321-C-1C	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-1	51	B3-09	200	Groove weld	None	321-C-1C	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-1	51	S6	150	Groove weld	None	321-C-1C	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-1	51	S9	200	Groove weld	None	321-C-1C	Med	6		1.0E-05	1.2E-09			III	2	C	A	4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	GMA-1	51	W8	15	Fillet weld	None	321-C-1C	Med	6		1.0E-05	1.2E-09		SCC	II	None	C		2
321	GMA-1	52	W10	100	Groove weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-1	52	W1-06	10	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08			III	None	C		2, 4
321	GMA-1	52	W2-06	10	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08			III	None	C		2, 4
321	GMA-1	52	W4	25	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08		SCC	II	3	C		2
321	GMA-1	52	W7	25	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08		SCC	II	None	C		2
321	GMA-1	52	WS1	25	Fillet weld	None	321-C-1B	Med	6		1.0E-05	1.2E-09		SCC	II	None	C		2
321	GMA-2	44	B1-05	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	44	B2-05	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	44	W3	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	45	S1	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	45	S2	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	45	S3	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	45	W4	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	46	S2	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	46	S3	150	Groove weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09			III	2	C	A	4
321	GMA-2	46	W1	15	Fillet weld	None	321-C-1D	Med	6		1.0E-05	1.2E-09		SCC	II	None	C		2
321	GMA-3	43	W3	25	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08			III	None	C		2
321	GMA-3	43	W5	15	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08			II	None	C		2
321	GMA-4	41	W1	15	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08		SCC	II	None	C		2
321	GMA-5	38	W3	15	Fillet weld	None	321-C-1	Med	6		1.0E-05	2.2E-08			III	None	C		2
321	MMB-3	25	S11	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-3	25	S2	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06	1	SCC	I	2	A		3
321	MMB-3	25	S6	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-3	25	W10	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06	1	SCC	I	2	A		3
321	MMB-3	25	W3	25	Fillet weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-3	25	W4	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06	1	SCC	I	2	A		3
321	MMB-3	25	W5	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06	1	SCC	I	2	A		3
321	MMB-3	25	W7	100	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	III	2	C		3
321	MMB-3	25	W8	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-3	25	W9	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06	1	SCC	I	2	A		3
321	MMB-3	26	S2	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	26	S4	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	26	S5	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	26	S6	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	26	W1	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-3	26	W25	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-3	26	W26	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	MMB-3	26	W3	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	27	S1	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	27	S2	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	27	S3	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	27	S5	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	27	W4	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	27	W6	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	27	W7	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	27	W8	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	28	S19	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	S20	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	W1	50	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		2, 3, 4
321	MMB-3	28	W10	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	W11	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	W12	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	W14	25	Fillet weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-3	28	W2	50	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		2, 3, 4
321	MMB-3	28	W3	50	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		2, 3
321	MMB-3	28	W4	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	W5	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	28	W6	50	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		2, 3, 4
321	MMB-3	28	W7	50	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		2, 3, 4
321	MMB-3	28	W8	15	Fillet weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-3	28	W9	50	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		2, 3
321	MMB-3	29	S1	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	29	S4	200	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-3	29	W2	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	29	W3	200	Pipe	None	321-C-4G	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-3	25-F-189	39472	200/10	Groove weld	None	321-C-4G	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-4	30	S5	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-4	30	S6	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-4	30	W1	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-4	30	W2	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-4	30	W3	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-4	30	W4	15	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-4	31	S1	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-4	31	S2	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	MMB-4	31	S3	150	Pipe	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-4	31	S4	150	Pipe	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-4	32	S6	150	Pipe	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-4	32	S7	150	Pipe	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	I	3	B		3
321	MMB-4	32	S9	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-4	32	W1	32	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-4	32	W11	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-4	32	W2	15	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-4	32	W3	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-4	32	W4	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-4	32	W5	25	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-4	32	W8	15	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-5	34	S1	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	34	S26	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-5	34	S27	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	34	S28	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-5	34	S29	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-5	34	S30	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	34	S7	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	34	S8	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	34	W2	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	3	C		3
321	MMB-5	34	W4	15	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-5	35	S1	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	35	S2	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	35	S3	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	3	C		3, 4
321	MMB-5	36	S1	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-5	36	S5	150	Pipe	None	321-C-4C	Med	6		1.4E-05	4.5E-06	1	SCC	II	2	B		3
321	MMB-5	36	W2	150	Pipe	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	III	2	C		3
321	MMB-5	36	W3	150	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	MMB-5	36	W4	15	Fillet weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06		SCC	II	None	C		2, 3
321	MMB-5	36-F-157	13150	150/10	Groove weld	None	321-C-4C	Med	6		1.4E-05	4.5E-06			III	2	C		3, 4
321	GMA-1	47	S1	150	Pipe	None	321-C-2B	Low	7		1.0E-06	1.0E-07		SCC	II	2	B		3
321	GMA-1	49	S1	150	Pipe	None	321-C-2C	Low	7		1.0E-06	1.0E-07		SCC	II	2	B		3
321	GMA-1	49	S3	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	49	S4	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	49	S5	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	49	W2	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
321	GMA-1	49	W6	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	50	S1	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	50	S3	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	50	S4	150	Groove weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	GMA-1	50	W2	15	Fillet weld	None	321-C-2C	Low	7		1.0E-06	1.0E-07		SCC	II	None	C		2, 3
321	GMA-1	50	W5	150	Pipe	None	321-C-2C	Low	7		1.0E-06	1.0E-07			III	2	C		3, 4
321	TNE-1	33	S3	50	Groove weld	None	None	None	7		0.0E+00	0.0E+00			III	None	C		2
321	TNE-1	33	W1	50	Groove weld	None	None	None	7		0.0E+00	0.0E+00			III	None	C		2
321	TNE-1	33	W2	50	Groove weld	None	None	None	7		0.0E+00	0.0E+00			III	None	C		2, 4
321	TNE-1	33	W4	50	Groove weld	None	None	None	7		0.0E+00	0.0E+00			III	None	C		2
321	TNE-1	33	W5	50	Groove weld	None	None	None	7		0.0E+00	0.0E+00			III	None	C		2
323	GMA-1	32	S6	100	Pipe	IGSCC	323-C-1A	High	2		1.4E-03	3.1E-07		SCC	II	2	B	D	
323	GMA-1	32	W5	250	Pipe	IGSCC	323-C-1A	High	2		1.4E-03	3.1E-07	1	SCC	II	2	B	D	
323	GMA-1	34	B6-31	250	Pipe	IGSCC	323-C-1A	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
323	GMA-1	34	B3-31	250	Pipe	IGSCC	323-C-1A	High	2	1	1.4E-03	3.1E-07	1	SCC	I	2	A	D	
323	GMA-2	40	B4-29	250	Pipe	IGSCC	323-C-1B	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
323	GMA-2	40	B3-29	250	Pipe	IGSCC	323-C-1B	High	2		1.4E-03	3.1E-07	1	SCC	I	2	A	D	
323	GMA-3	42	B2-38	250	Pipe	IGSCC	323-C-1C	High	2		1.4E-03	3.1E-07			III	2	C	D	
323	GMA-4	44	B2-37	250	Pipe	IGSCC	323-C-1D	High	2		1.4E-03	3.1E-07			III	2	C	D	
323	GMA-1	35	S2	100	Pipe	TT	323-C-1A	High	2	1	1.4E-03	3.1E-07			III	2	C		3
323	GMA-1	35	S1	100	Pipe	TT	323-C-1A	High	2		1.4E-03	3.1E-07			III	2	C		3
323	GMA-1	32	S2	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-1	32	S3	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-1	32	S4	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-1	32	S7	250	Pipe	None	323-C-3A	High	4	1	1.1E-04	8.8E-05	1	SCC	I	2	A		3
323	GMA-1	33	B1-27	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-1	33	B2-27	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-1	33	S5	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-1	34	B1-31	250	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C		4
323	GMA-1	34	B2-31	200	Groove weld	None	323-C-1A	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-1	34	B7-31	250	Pipe	None	323-C-1A	High	4	1	1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	38	B2-21	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	38	S12	250	Pipe	None	323-C-3B	High	4	1	1.1E-04	8.8E-05	1	SCC	I	2	A		3
323	GMA-2	38	S2	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-2	38	S3	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-2	38	S4	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	38	W10	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	39	B1-21	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	GMA-2	39	S4	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	40	B1-29	250	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	40	B2-29	200	Groove weld	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-2	40	B5-29	250	Pipe	None	323-C-1B	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-3	41	S2	250	Groove weld	None	323-C-1C	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-3	41	S3	250	Pipe	None	323-C-1C	High	4	1	1.4E-03	3.1E-07	1	SCC	I	2	A		3
323	GMA-3	41	S4	250	Pipe	None	323-C-1C	High	4		1.4E-03	3.1E-07	1	SCC	I	2	A		3
323	GMA-3	41	S5	250	Pipe	None	323-C-1C	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-3	41	S6	250	Pipe	None	323-C-3C	High	4		1.1E-04	8.8E-05			III	2	C		3
323	GMA-3	42	B1-25	250	Groove weld	None	323-C-1C	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-3	42	B1-38	250	Groove weld	None	323-C-1C	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-3	42	B2-25	250	Groove weld	None	323-C-1C	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-3	42	S1	250	Groove weld	None	323-C-1C	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-4	43	S2	250	Groove weld	None	323-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-4	43	S3	250	Pipe	None	323-C-1D	High	4		1.4E-03	3.1E-07	1	SCC	I	2	A		3
323	GMA-4	43	S4	250	Pipe	None	323-C-1D	High	4		1.4E-03	3.1E-07	1	SCC	I	2	A		3
323	GMA-4	43	S5	250	Groove weld	None	323-C-1D	High	4		1.4E-03	3.1E-07			III	2	C		3
323	GMA-4	43	S6	250	Pipe	None	323-C-3D	High	4		1.1E-04	8.8E-05			III	2	C		3
323	GMA-4	44	B1-23	250	Groove weld	None	323-C-1D	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-4	44	B1-37	250	Groove weld	None	323-C-1D	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-4	44	B2-23	250	Groove weld	None	323-C-1D	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-4	44	S1	250	Groove weld	None	323-C-1D	High	4		1.4E-03	3.1E-07			III	2	C	A	4
323	GMA-1	35	S3	100	Pipe	TT	323-C-1A1	Med	5	1	1.0E-05	2.2E-08			III	2	C		3
323	GMA-1	35	S4	100	Pipe	TT	323-C-1A1	Med	5		1.0E-05	2.2E-08			III	2	C		3
323	GMA-1	35	S5	100	Pipe	TT	323-C-1A2	Low	6		1.0E-06	1.0E-07			III	2	C		3
323	HMB-5	36	W1	100	Groove weld	TT	323-C-1A2	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	36	W2	100	Groove weld	TT	323-C-1A2	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	36	W3	100	Groove weld	TT	323-C-1A2	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	36	W4	20	Fillet weld	TT	323-C-1A2	Low	6		1.0E-06	1.0E-07			III	None	C		2, 3
323	HMB-5	37	S1	100	Groove weld	TT	323-C-1A3	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	37	S2	100	Groove weld	TT	323-C-1A3	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	37	S21	100	Groove weld	TT	323-C-1A3	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	37	S22	100	Groove weld	TT	323-C-1A3	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	HMB-5	37	S3	100	Groove weld	TT	323-C-1A3	Low	6		1.0E-06	1.0E-07			III	None	C		3
323	GMA-1	32	S1	250	Groove weld	None	323-C-2A	Med	6		1.0E-05	2.2E-08			III	2	C	A	4
323	GMA-2	38	S1	250	Groove weld	None	323-C-2B	Med	6		1.0E-05	2.2E-08			III	2	C		3
323	GMA-3	41	S1	250	Groove weld	None	323-C-2C	Med	6		1.0E-05	2.2E-08			III	2	C		3
323	GMA-4	43	S1	250	Groove weld	None	323-C-2D	Med	6		1.0E-05	2.2E-08			III	2	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	HMB-1	6	S2	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	S8	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	W1	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	W3	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	W4	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	W5	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	W6	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6	W7	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7	S11	250	Pipe	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	7	S2	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7	S4	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7	S8	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	7	W1	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7	W10	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	7	W13	10	Fillet weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	None	C		2, 3
323	HMB-1	7	W3	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7	W5	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	7	W6	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	7	W7	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	7	W9	250	Groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	2	C		3
323	HMB-1	6-F-37	39600	250	Long. groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	6-F-37	39601	250	Long. groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7-F-37	7-01 50°	250	Long. groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7-F-37	7-01 90°	250	Long. groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7-F-37	7-02 50°	250	Long. groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-1	7-F-37	7-02 90°	250	Long. groove weld	None	323-C-4A	Med	6		1.8E-05	3.3E-07			III	3	C		3
323	HMB-2	14	S2	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	S8	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	W1	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	W3	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	W4	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	W5	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	W6	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14	W7	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	HMB-2	15	S11	250	Pipe	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15	S2	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	15	S4	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	15	S8	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15	W1	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	15	W10	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15	W13	10	Fillet weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	None	C		2, 3
323	HMB-2	15	W3	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	15	W5	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15	W6	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15	W7	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15	W9	250	Groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	14-F-37	39461	250	Long. groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	14-F-37	39492	250	Long. groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	15-F-37	15-01 50°	250	Long. groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15-F-37	15-01 90°	250	Long. groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-2	15-F-37	15-02 50°	250	Long. groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	2	C		3
323	HMB-2	15-F-37	15-02 90°	250	Long. groove weld	None	323-C-4B	Med	6		1.4E-05	3.4E-07			III	3	C		3
323	HMB-3	22	S2	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	S6	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	S8	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	W1	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	W3	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	W5	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	W7	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	WS12	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	WS13	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22	WS14	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23	S10	250	Pipe	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	23	S3	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23	S7	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	23	W1	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23	W12	10	Fillet weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	None	C		2, 3
323	HMB-3	23	W2	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	HMB-3	23	W4	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	23	W5	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	23	W6	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	23	W8	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	23	W9	250	Groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-3	22-F-37	39469	250	Long. groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	22-F-37	39500	250	Long. groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23-F-37	23-01 50°	250	Long. groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23-F-37	23-01 90°	250	Long. groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23-F-37	23-02 50°	250	Long. groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-3	23-F-37	23-02 90°	250	Long. groove weld	None	323-C-4C	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	S2	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	S6	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	S8	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	W1	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	W3	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	W4	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	W5	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	30	W7	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31	S10	250	Pipe	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	31	S3	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31	S7	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	31	W1	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31	W12	10	Fillet weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	None	C		2, 3
323	HMB-4	31	W13	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31	W14	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31	W2	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31	W4	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	31	W5	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	31	W6	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	31	W8	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	31	W9	250	Groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	2	C		3
323	HMB-4	30-F-37	10990	250	Long. groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	HMB-4	30-F-37	39477	250	Long. groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31-F-37	31-01 50°	250	Long. groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31-F-37	31-01 90°	250	Long. groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31-F-37	31-02 50°	250	Long. groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	HMB-4	31-F-37	31-02 90°	250	Long. groove weld	None	323-C-4D	Med	6		2.3E-05	1.9E-07			III	3	C		3
323	MMB-1	3	S5	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	S9	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	W1	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	W3	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	W4	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	W6	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	W7	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3	W8	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	S1	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	S10	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	S11	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	S13	100	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	S14	100	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	S2	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W12	100	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W15	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W16	15	Fillet weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	None	C		2, 3
323	MMB-1	4	W3	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W4	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W5	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W6	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W7	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W8	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4	W9	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	S10	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	S5	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	S6	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	S7	100	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	W1	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	W2	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	MMB-1	5	W3	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	W4	200	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	W8	100	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5	W9	100	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	S14	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	S3	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	S8	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W1	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W10	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W11	15	Fillet weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	None	C		2, 3
323	MMB-1	45	W2	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W4	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W6	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W7	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45	W9	250	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3-F-36	3-01 45°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3-F-36	3-01 90°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3-F-36	3-02 45°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	3-F-36	3-02 90°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45-F-36	45-01 15°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45-F-36	45-01 90°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45-F-36	45-02 15°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	45-F-36	45-02 90°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4-F-189	39539	200/10	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4-F-198	39539	250/20	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4-F-36	4-01 45°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	4-F-36	4-02 45°	250	Long. groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-1	5-F-189	39569	200/10	Groove weld	None	323-C-5A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	MMB-2	10	S14	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	S15	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	MMB-2	10	S16	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	S3	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W10	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W11	15	Fillet weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	None	C		2, 3
323	MMB-2	10	W4	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W5	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W6	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W7	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W8	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10	W9	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	S10	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	S4	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	S6	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	S9	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W1	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W12	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W2	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W3	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W5	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W7	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11	W8	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	S11	100	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	S12	100	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	S8	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	S9	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W1	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W10	100	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W13	15	Fillet weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	None	C		2, 3
323	MMB-2	12	W2	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W3	250	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W4	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W5	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W6	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12	W7	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	S10	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	S5	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	S6	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	S7	100	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	MMB-2	13	W1	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	W2	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	W3	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	W4	200	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	W8	100	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13	W9	100	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10-F-36	10-01 45°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10-F-36	10-01 90°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10-F-36	10-02 45°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	10-F-36	10-02 90°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11-F-36	11-01 45°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11-F-36	11-01 90°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11-F-36	11-02 45°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	11-F-36	11-02 90°	250	Long. groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12-F-189	39783	200/10	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	12-F-198	39783	250/20	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-2	13-F-189	39460	200/10	Groove weld	None	323-C-5B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	MMB-3	18	S10	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	S12	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	S17	15	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	MMB-3	18	S4	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	S8	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W1	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W11	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W13	15	Fillet weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	MMB-3	18	W14	15	Fillet weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	MMB-3	18	W2	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W3	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W5	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W6	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18	W7	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	MMB-3	18	W9	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	S3	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	S6	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	S7	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	W1	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	W2	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	W4	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19	W5	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	S11	100	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	S12	100	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	S8	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	S9	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W1	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W10	100	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W13	15	Fillet weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	MMB-3	20	W2	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W3	250	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W4	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W5	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W6	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20	W7	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	S10	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	S5	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	S6	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	S7	100	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	W1	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	W2	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	W3	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	W4	200	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	W8	100	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21	W9	100	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18-F-36	18-01 45°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18-F-36	18-01 90°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18-F-36	18-02 45°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	18-F-36	18-02 90°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	MMB-3	19-F-36	19-01 45°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19-F-36	19-01 90°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19-F-36	19-02 45°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	19-F-36	19-02 90°	250	Long. groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20-F-189	39467	200/10	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	20-F-198	39467	250/20	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-3	21-F-189	39468	200/10	Groove weld	None	323-C-5C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	S10	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	S12	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	S17	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	S18	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	S4	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	S8	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	W11	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	W14	15	Fillet weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	MMB-4	26	W2	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	W3	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	W5	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	W7	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26	W9	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	S3	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	S6	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	S7	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	W1	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	W2	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	W4	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27	W5	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	S11	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	S12	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	S8	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	S9	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W1	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W10	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	MMB-4	28	W2	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W3	250	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W4	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W5	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W6	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	W7	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28	WS13	15	Fillet weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	MMB-4	29	S10	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	S11	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	S5	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	S6	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	S7	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	W1	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	W2	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	W3	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	W4	200	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	W8	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29	W9	100	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26-F-36	26-01 15°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26-F-36	26-01 90°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26-F-36	26-02 15°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	26-F-36	26-02 90°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27-F-36	27-01 45°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27-F-36	27-01 90°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27-F-36	27-02 45°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	27-F-36	27-02 90°	250	Long. groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28-F-189	39475	200/10	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	28-F-198	39475	250/20	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	MMB-4	29-F-189	39476	200/10	Groove weld	None	323-C-5D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-5	1	B13	50	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		2, 3
323	PNB-5	1	B3	50	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		2, 3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	PNB-5	1	B8	50	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		2, 3
323	PNB-5	1	B9	25	Fillet weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	None	C		2, 3
323	PNB-5	1	S1	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	S10	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	S11	250	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	S12	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	S2	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	S5	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	W13	25	Fillet weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	None	C		2, 3
323	PNB-5	1	W14	15	Fillet weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	None	C		2, 3
323	PNB-5	1	W3	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	W4	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	W6	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	W7	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	W8	400	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	W9	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1	WS15	50	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		2, 3
323	PNB-5	1	WS16	50	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		2, 3
323	PNB-5	2	S10	300	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	S11	300	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	S2	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	S4	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	W1	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	W3	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	W5	350	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2	W7	15	Fillet weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	None	C		2, 3
323	PNB-5	1-F-203	39448	400/20	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1-F-204	39448	400/25	Groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1-F-274	39448	400/35	Long. groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1-F-41	39448	400	Long. groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	1-F-41	39449	400	Long. groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2-F-309	39479	350/30	Long. groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-5	2-F-40	39479	350	Long. groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	PNB-5	2-F-40	39480	350	Long. groove weld	None	323-C-6A	Med	6		1.8E-05	1.8E-07			III	3	C		3
323	PNB-6	8	B3	50	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		2, 3
323	PNB-6	8	B8	50	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		2, 3
323	PNB-6	8	B9	25	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	None	C		2, 3
323	PNB-6	8	S1	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	S10	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	S11	250	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	S12	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	S2	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	S5	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	W13	25	Fillet weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	None	C		2, 3
323	PNB-6	8	W14	15	Fillet weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	None	C		2, 3
323	PNB-6	8	W3	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	W4	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	W6	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	W7	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	W8	400	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	W9	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8	WS15	50	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		2, 3
323	PNB-6	8	WS16	50	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		2, 3
323	PNB-6	9	S10	300	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9	S2	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9	S4	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9	W1	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9	W3	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9	W5	350	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9	W7	15	Fillet weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	None	C		2, 3
323	PNB-6	9	WS9	300	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8-F-203	39661	400/20	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8-F-204	39661	400/25	Groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8-F-274	39661	400/35	Long. groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8-F-41	39661	400	Long. groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	8-F-41	39662	400	Long. groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9-F-	39692	350/30	Long. groove	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
		309			weld														
323	PNB-6	9-F-40	39692	350	Long. groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-6	9-F-40	39693	350	Long. groove weld	None	323-C-6B	Med	6		1.4E-05	1.9E-07			III	3	C		3
323	PNB-7	16	B1	50	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-7	16	B8	50	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-7	16	B9	25	Fillet weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-7	16	S1	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	S10	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	S11	250	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	S12	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	S2	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	S5	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	W13	25	Fillet weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-7	16	W14	15	Fillet weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-7	16	W3	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	W4	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	W6	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	W7	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	W8	400	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	W9	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16	WS15	50	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-7	16	WS16	50	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-7	17	S10	300	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17	S11	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17	S2	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17	S4	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17	W3	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17	W5	350	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17	W7	15	Fillet weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-7	17	WS9	300	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16-F-203	39463	400/20	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16-F-204	39463	400/25	Groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16-F-274	39463	400/35	Long. groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	16-F-41	39463	400	Long. groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
323	PNB-7	16-F-41	39494	400	Long. groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17-F-309	39464	350/30	Long. groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17-F-40	39464	350	Long. groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-7	17-F-40	39495	350	Long. groove weld	None	323-C-6C	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	B7	50	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-8	24	B8	50	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-8	24	B9	25	Fillet weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-8	24	S1	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	S10	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	S11	250	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	S12	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	S2	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	S5	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	W13	25	Fillet weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-8	24	W14	15	Fillet weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-8	24	W3	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	W4	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	W6	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	W7	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	W8	400	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	W9	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24	WS15	50	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-8	24	WS16	50	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		2, 3
323	PNB-8	25	S11	300	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25	S2	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25	S4	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25	W1	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25	W3	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25	W5	350	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25	W7	15	Fillet weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	None	C		2, 3
323	PNB-8	25	WS10	300	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24-F-203	39471	400/20	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24-F-204	39471	400/25	Groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24-F-	39471	400/35	Long. groove	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3

System	Segment	IsoId	Weld	DN	Description	RI-ISI DM	Consequence	Rank	RC	RI-ISI	CCDP	CLERP	SKIF	DM	SI	KI	KG	0313_075	Basis
		274			weld														
323	PNB-8	24-F-41	39471	400	Long. groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	24-F-41	39502	400	Long. groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25-F-309	39472	350/30	Long. groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25-F-40	39472	350	Long. groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
323	PNB-8	25-F-40	39503	350	Long. groove weld	None	323-C-6D	Med	6		2.2E-05	3.9E-08			III	3	C		3
462					31-462 SH1 VA35V1	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH1 VB36V1	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH1 424EA1	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 PB2	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 L43	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 L44	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 463L36	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 463L35	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 KD 302V1	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH2 RB907	FAC	462-C-1	Med	3		8.9E-06	2.1E-08							
462					31-462 SH1 remaining	None	462-C-1	Med	6		8.9E-06	2.1E-08							
462					31-462 SH2 remaining	None	462-C-1	Med	6		8.9E-06	2.1E-08							

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The Swedish Radiation Safety Authority has a comprehensive responsibility to ensure that society is safe from the effects of radiation. The Authority works to achieve radiation safety in a number of areas: nuclear power, medical care as well as commercial products and services. The Authority also works to achieve protection from natural radiation and to increase the level of radiation safety internationally.

The Swedish Radiation Safety Authority works proactively and preventively to protect people and the environment from the harmful effects of radiation, now and in the future. The Authority issues regulations and supervises compliance, while also supporting research, providing training and information, and issuing advice. Often, activities involving radiation require licences issued by the Authority. The Swedish Radiation Safety Authority maintains emergency preparedness around the clock with the aim of limiting the aftermath of radiation accidents and the unintentional spreading of radioactive substances. The Authority participates in international co-operation in order to promote radiation safety and finances projects aiming to raise the level of radiation safety in certain Eastern European countries.

The Authority reports to the Ministry of the Environment and has around 270 employees with competencies in the fields of engineering, natural and behavioural sciences, law, economics and communications. We have received quality, environmental and working environment certification.

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