Are these topics sufficient relative to staff position on PFM, Yes, No, Partial								
Report	**Models**	**Inputs**	**Uncertainties**	**V&V**	**Convergence**	**Sensitivity studies**	**Input Importance**	**Other Risk arguments**
MRP-105	Partial	Partial	Partial	Partial	No	Partial	No	No
MRP-116	Partial	No	Partial	Partial	No	Partial	No	No
MRP-362, Rev. 1	Yes	Yes	Partial	Partial	no	Yes	Partial	No
MRP-335, Rev. 3-A	Partial	Partial	Partial	Partial	No	Partial	No	No
MRP-395	Partial	Partial	Partial	Partial	One paragraph	Yes, but limitations	No	Yes, but not acceptable (1) ignore leakage through weld (2) ignore BAC

Point of note: Looking at MRP-395 RPVH probabilistic model - Section 4 points you to MRP-335R1 and MRP-375 for details of model. MRP-375 has a description of the model in appendix A, but says its only adapted from MRP-373, which is a butt weld model for MSIP - MRP-335R1 says the RPVHPN model is derived from DM model in appendix A of MRP-335. Where do i find the full details of the code used for MRP-395 and RPVHPN

MRP-105 Comments								
Comment	**Models**	**Inputs**	**Uncertainties**	**V&V**	**Convergence**	**Sensitivity studies**	**Input Importance Quantification**	**Other Risk arguments**
1	Unclear how deterministic models compare to probabilistic models	No discussion on why certain distributions were chosen	Some discussion on Weibull and crack growth uncertainty	Details of MRPERCRD unclear - Staff requested user manual but it was not provided,	Never mentioned	Limited cases done based on variations in Weibull, crack growth, inspection and temp	Never determined what's driving the problem directly	Never mentioned
2	pc-Crack used for deterministic and MRPERCRD used for probabilistic - same models?	Why are some constant and some random?	Most uncertain parameters have standard Dev, but no discussion of basis	No mention of validation or verification, QA, etc. Some benchmarking and case studies presented - basis for inputs unknown		The reasoning for the choices of parameters modified in unclear		
3	Report says, built-in crack inspection POD curves - what are they, what are the basis?	Report states user has many options for inputs, but gives no basis for chosen inputs	Chpt 7 and 8 on PFM results never mentions uncertainty	NRC tried to confirm results with in-house P-CRDM code, but struggled to get similar results due to lack of understanding of MRPERCRD tech basis				

MRP-116 Comments								
Comment	**Models**	**Inputs**	**Uncertainties**	**V&V**	**Convergence**	**Sensitivity studies**	**Input Importance Quantification**	**Other Risk arguments**
1	SRRA basis was used - NRC SE on topic - full distribution of CGR was used	Attempts were made to calibrate to VC Summer - 7.06 initiation adjustment factor - whats the impact of this assumption	Basis for distributions never discussed	Some benchmarking against VC summer done	No discussions	Studies on ISI accuracy and frequency - what about drivers to the problem?	None	Uses RG1.174 acceptance criteria with a CCDP value of 0.003 - no basis
2	WRS model assumed constant - some discussion on WRS, but no idea what value was used in the analyses - Table 3-1 points back to MRP-112 - Figure 3-5 from that doc has some WRS - was that used?	Table 3-1 and 4-1 - inputs - not clear the basis for distributions or values for inputs - example chose "Hoop/Axial fatigue stress range - points to MRP-109, 112 - after searching through those documents, no idea what values were used	Only discusses uncertainties in initiation CGR, geometry, but not WRS, loads, other material properties - no idea what values were chosen for analysis	Code changed from SRRA since SRRA had no PWSCC initiation model… what other changes were made? PRAISE was mentioned many times, was that used also?… how was that V&V?		Three constant WRS cases run… changed leak probabilities by three orders of magnitude. But no real discussion		No other risk arguments (Defense in depth, SF, monitoring) per RG1.174 are included
3	Initiation model similar to that in WCAP-14572 Supp 1 (and WCAP-14901 Rev 0 - I think this is Weibull), but that says.. In common with the pc-PRAISE code, Supplement 1 to WCAP-14572 does not address fatigue crack initiation except In an indirect manner by conservatively assuming that initiated cracks are present at the beginning of plant operation. The limitations of this approach to fatigue crack initiation are addressed below. The effects of crack initiation can conservatively be estimated by assuming one flaw per weld at the start of plant operation.	No actual inputs described anywhere in the document. Points to a variety of references, but no clue what actual input values were used						

MRP-362 Rev1 comments								
Comment	**Models**	**Inputs**	**Uncertainties**	**V&V**	**Convergence**	**Sensitivity studies**	**Input Importance Quantification**	**Other Risk arguments**
1	Toughness, resistance, strength with aging models well defined. Details of J-integral model in appendix	Inputs were very vague in R0, but improved after much discussion with NRC	Model uncertainty not addressed	Not discussed, but alternate calculations were performed by Emc2 during development of N838	not discussed	Sensitivity studies on toughness, aged strength, etc in Appendix	not really discussed, but only a few main inputs	not discussed
2	Could have looked at alternate models - was done by Emc2/NRC	Basis for most distribution inputs and fits in appendix	Input uncertainty addressed	Code based on praise, which has been benchmarked with xLPR - but no idea of V&V for modified code	Sampling and probabilistic structure of code is not documented	Most came after discussions from NRC/Emc2		
3		Input modified after discussions with NRC/ Emc2				Emc2 also did sensitivity studies to build confidence		

MRP-335 R3 Comments								
Comment	**Models**	**Inputs**	**Uncertainties**	**V&V**	**Convergence**	**Sensitivity studies**	**Input Importance Quantification**	**Other Risk arguments**
1	No modeling of boric acid corrosion was used.	Wall thicknesses were not varied.	No uncertainties were given for the final results	Verification and Validation discussed for some modules and inputs	No discussions	Some sensitivity studies provided	None	Uses RG1.174 acceptance criteria - no basis
2	WRS model did not cover the range of possible weld residual stresses.	An unusual temperature distribution was used, with a normal distribution over the range of temperatures as opposed to bimodal temperature distribution over hot and cold leg temperatures.	Uncertainties in several inputs were not quantified.	No independent peer reviews of the codes were performed				No other risk arguments (Defense in depth, SF, monitoring) per RG1.174 are included
3	Initiation models use Weibull distributions from previous initiations. This does not take the changes in the numbers of susceptible heads into account nor the effects of site-specific issues such as heat-to-heat variability or surface conditioning in crack initiation.			Some effort at validating inputs, with notable gaps				

MRP-395 & 375 comments									
Comment	**Models**	**Inputs**	**Uncertainties**	**V&V**	**Convergence**	**Sensitivity studies**	**Input Importance Quantification**	**Other Risk arguments**
1	Built on MRP-105 model with known outstanding NRC concerns about the MRP-105 model.	Crack growth rate uses a log-triangular distribution to reach high confidence in covering the all of the mean crack growth rates, but then uses a "local crack growth rate variability" term (fudge factor) to somehow modify the distribution. Then there is a claim that all laboratory data points are included. This does not show the distribution of rates, how they are sampled or the impact of the local crack growth rate variability term and how it allows coverage of all crack growth rate data.	Address uncertainty entirely through the Weibull intercept parameter. However with the variations in the Weibull parameter, there was no discussion on how uncertainty is carried forward through the analysis.	Benchmarking to MRP-105, a known probabilistic analyses for which the NRC did not find acceptable, is not acceptable.	One paragraph on convergence work with one figure.	PLUS- Evaluated different Weibull crack initiation parameters		Truncation used with no basis provided on CGRs
2	Model built on MRP-335 Rev.1 which had not been reviewed and approved by the NRC. Also includes assumption that bare metal visuals would address any boric acid corrosion activities, and therefore do not need to be modeled. An assumption the NRC has consistently stated as being unacceptable.	Use of a variable term for POD of an initial missed flaw had a limited if any discussion. However previously noted as being a key to obtain results that required volumetric inspections on a 2.25 RIY basis.				Some sensitivity study variability was limited. For example for what value of UT or BMV POD where the results show an unacceptable leakage or ejection rate would show how much margin is available to address POD uncertainty. However by just varying 10% does not give an effective sensitivity analysis for this parameter.		Plant experience has demonstrated that there is a low probability of leakage overall considering the possibility of through-weld cracking. Furthermore, any leaks that might occur due to through-weld PWSCC that is not detectable via the periodic volumetric examinations of the nozzle tube are expected to be relatively small. Such small leak rates are unlikely to be sufficient to produce the amount of local cooling necessary for substantial boric acid corrosion to occur. NRC - There is no mechanism that prohibits cracks from growing from the weld material into the nozzle. 1/3 of the leaks were from the weld material.

MRP-167 – Simulation Results

Table 6-3
Results of the Monte Carlo Simulations: Base Cases for Inspection Programs with Periodic Bare Metal Visual Examinations

Category	Case No.	Case Description: Code	Case Description: Cycle Length (yrs)	Case Description: BMV Interval (cycles)	Case Description: SV During Non-BMV Outages?	Case Description: UT Base Metal Exams?	Average Head Rupture Frequency (per year)	Peak Head Rupture Frequency (per year)
BMV Inspections Every Other Outage	7	3/F/0	1.5	2	No	*No*	8.7E-07	4.3E-06
	8	3/F/1	1.5	2	No	*Every 10 years (7 cycles)*	4.7E-07	4.4E-06
	9	3/F/2	1.5	2	No	*Every 5 years (3 and then 4 cycles)*	2.9E-07	5.2E-06
	10	3/T/0	1.5	2	Yes	*No*	3.2E-07	3.8E-06
	11	3/T/1	1.5	2	Yes	*Every 10 years (7 cycles)*	1.2E-07	9.0E-07
	12	3/T/2	1.5	2	Yes	*Every 5 years (3 and then 4 cycles)*	< ~1.0E-07	9.0E-07
	13	4/F/0	2.0	2	No	*No*	6.0E-06	2.5E-05
	14	4/F/1	2.0	2	No	*Every 10 years (5 cycles)*	2.7E-06	2.0E-05
	15	4/F/2	2.0	2	No	*Every 5 years (2 and then 3 cycles)*	1.5E-06	2.2E-05
	16	4/T/0	2.0	2	Yes	*No*	1.8E-06	1.1E-05
	17	4/T/1	2.0	2	Yes	*Every 10 years (5 cycles)*	9.2E-07	8.9E-06
	18	4/T/2	2.0	2	Yes	*Every 5 years (2 and then 3 cycles)*	6.6E-07	8.4E-06

CCDP of 1 assumed

MRP-167 Summary

Table 2-1
Summary of Results of Probabilistic Calculations for Basic Inspection Plan Options

Basic Inspection Plan No.	Time-Averaged Head Rupture Frequency (per year) per Section 6*: 18-month Cycle	Time-Averaged Head Rupture Frequency (per year) per Section 6*: 24-month Cycle	Inspection Plan Options	Case Designations per Section 6: 18-month Cycle	Case Designations per Section 6: 24-month Cycle
1	4.5E-07	not run	BMV every 3rd RFO, SV** in off RFOs	22	not run
2	8.7E-07	9.6E-07	BMV every 2nd RFO (ASME CC N-722)	7	13b***
3	3.2E-07	1.0E-06	Alternate BMV and SV**, no UT	10	16b
4	<1E-07	<1E-07	BMV Every RFO, no UT or SV	1	4
5	3.7E-07	9.5E-07	UT every 10 years, SV** every RFO	32	35b
6	4.7E-07	4.7E-07	UT every 10 years, BMV every other RFO	8	14b***
7	<1E-07	<1E-07	UT every 10 years, BMV every RFO	2	5

*Results are acceptable per 1E-6 per year acceptance criterion for CDF given assumption of CCDP of 1.0.
**Results for CDF values for SV cases depend on SV sensitivity assumed.
***As discussed in Sections 2.2 and 6.5.6, modest additional credit for the benefit of the inverted BMN geometry in reducing the wastage rate (compared to an upright nozzle geometry) was taken in Cases 13b and 14b versus the base case assumptions of the probabilistic wastage model.