Dominion Nuclear Connecticut, Inc.
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Dominion®

January 11, 2008

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2378

Serial No.: 07-0834B
NLOS/MAE: R0
Docket No.: 50-423
License No.: NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING
STRETCH POWER UPRATE LICENSE AMENDMENT REQUEST
RESPONSE TO QUESTIONS CSGB-07-0010 AND CSGB-07-0011

Dominion Nuclear Connecticut, Inc. (DNC) submitted a stretch power uprate license amendment request (LAR) for Millstone Power Station Unit 3 (MPS3) in letters dated July 13, 2007 (Serial Nos. 07-0450 and 07-0450A), and supplemented the submittal by letters dated September 12, 2007 (Serial No. 07-0450B) and December 13, 2007 (Serial No. 07-0450C). The NRC staff forwarded requests for additional information (RAIs) in October 29, 2007 and November 27, 2007 letters. DNC responded to the RAIs in letters dated November 19, 2007 (Serial No. 07-0751) and December 17, 2007 (Serial No. 07-0499). The NRC staff forwarded an additional RAI in a December 14, 2007 letter. The response to questions CSGB-07-0010 and CSGB-07-0011 of this RAI is provided in the attachment to this letter.

The information provided by this letter does not affect the conclusions of the significant hazards consideration discussion in the December 13, 2007 DNC letter (Serial No. 07-0450C).

Should you have any questions in regard to this submittal, please contact Ms. Margaret Earle at 804-273-2768.

Sincerely,

Gerald T. Bischof
Vice President Nuclear Engineering

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Gerald T. Bischof, who is Vice President Nuclear Engineering of Dominion Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 11TH day of January, 2008.

My Commission Expires: May 31, 2010.

Vicki L. Hull
Notary Public

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140842
My Commission Expires May 31, 2010

Commitments made in this letter: None

Attachment

cc: U.S. Nuclear Regulatory Commission
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NRC Senior Resident Inspector
Millstone Power Station

Director
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Monitoring and Radiation Division
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ATTACHMENT

<u>LICENSE AMENDMENT REQUEST</u>

<u>STRETCH POWER UPRATE LICENSE AMENDMENT REQUEST</u>

<u>RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION</u>

<u>RESPONSE TO QUESTIONS CSGB-07-0010 AND CSGB-07-0011</u>

MILLSTONE POWER STATION UNIT 3
DOMINION NUCLEAR CONNECTICUT, INC.

Steam Generator Integrity & Chemical Engineering Branch

CSGB-07-0010 (2.1.8-1)

The flow accelerated corrosion (FAC) program at MPS incorporates years of field data including wear rates and actual thickness measurements under current operating conditions. Under SPU conditions, however, MPS does not have data to inform the CHECWORKS model. Since the accuracy of the CHECWORKS program is dependent on field data, there is a potential that the changes in process variables (temperature, velocity, moisture content) resulting from SPU will lead to an unanticipated wear rate and therefore under-prediction of component thickness loss. How does the MPS3 FAC program account for this potential effect? How is the license renewal aging management program for FAC impacted by this potential effect? Identify the components that are expected to experience the greatest increase in wear as a result of power uprate and discuss the relative reduction in service life for those components. In addition, discuss any changes made to the MPS3 FAC program (i.e., criteria used for selecting components for inspection following the power uprate, criteria for repair and replacement, increased inspection scope, etc.) due to power uprate conditions.

DNC Response

The FAC Program at Millstone Power Station Unit 3 (MPS3) continually incorporates field data into CHECWORKS and monitors the actual wear rates and thicknesses against the predicted wear. This activity ensures CHECWORKS predictions are checked constantly against field data. The CHECWORKS model has been updated based on the SPU heat balance to reflect the SPU thermodynamic and flow conditions.

A comparison of pre-SPU and post-SPU predictions has been made to evaluate the impact of the SPU on FAC wear rates. The following table shows the percent change in predicted wear rate for a series of selected components. The results range from a slight decrease to an increase of as high as approximately 32 percent.

However, the percent change in wear rate is a relative consideration. For example, a component on a line could exhibit an increase in wear rate of approximately 32 percent due to the SPU. However, if the absolute wear rate was small or if the component had a high margin, the impact of the 30 percent change is minimal.

To correctly interpret the CHECWORKS results to determine the actual impact of the SPU, the following factors were considered in conjunction with the percent change in wear rate:

- Absolute current wear rate.
- Actual measured component thickness.
- Design margin (difference between the measured component thickness and minimum allowable thickness)

While the table presents data for individual components, entire lines were assessed. When selecting inspection locations for the next outage, DNC will consider lines with the highest vulnerability based on the above discussion. Additional inspection coverage will be considered for lines that indicate a significant change in predicted wear rates. The license renewal aging management program is not impacted by SPU other than increased monitoring to the end of the component life.

The power uprate parameters have already been built into the CHECWORKS model based on the expected power uprate Heat Balance. The post performance test at 100% power will allow adjustments to the theoretical heat balance values. The CHECWORKS SFA (Steam/Feedwater Application) database will be updated at the implementation of the modification, and used for future monitoring.

The additional coverage will be implemented based on the CHECWORKS trending and MFAC (Millstone Flow Accelerated Corrosion) wear calculations for non-CHECWORK modeled lines and components in scope to the FAC program. Since these lines and components have already been reviewed to the power uprate theoretical heat balance model, impacted coverage components are already identified for wall thickness examinations. Future trending will be addressed as part of the overall program reviews required in accordance with EPRI NSAC 202L (Recommendations for An Effective Flow-Accelerated Corrosion Program) guidelines.

The FAC program has reviewed the effect of the proposed SPU on the FAC analysis for the plant and has concluded that changes in the plant operating conditions on the FAC analysis have been reasonably addressed. It has also been demonstrated that the updated analyses will accurately predict the loss of material by FAC and ensure timely repair or replacement of degraded components following implementation of the SPU.

For a comparison of predicted and measured wall thickness at current plant conditions, and wear rate comparison pre and post power uprate See Table 2.1.8-2 of the licensing report (Attachment 6 of MPS3 SPU licensing amendment request dated July 13, 2007).

Comparison of Predicted and Measured Wall Thickness at Current Plant Conditions (100% Power)												
Fluid Parameters and Wear Rate Comparison-Pre and Post Power Uprate												
Wear Rate Analysis Run Definition Name	**CHECWORKS Component Name**	**Component Geometry Type**	**Temperature (deg F)**		**Velocity (ft/sec)**		**Quality**		**Wear Rate (mils/year) ***		**Impact of Power Uprate on Predicted Wear Rate (% Change)**	**Notes**
			Current	**SPU**	**Current**	**SPU**	**Current**	**SPU**	**Current**	**SPU**		
BLOWDOWN TO CONTROL VALVE.	053-006	45 Elbow	544.3	544	1.229	1.228	0	0	0.004	0.004	0.0	Line is constructed of chrome-moly
	050-008 US	Pipe	544.3	544	1.229	1.228	0	0	0.001	0.001	0.0	
BLOWDOWN FROM CONTROL VALVE TO BLOWDOWN TNK	050-028	Pipe	319.8	319.8	20.424	20.424	0.282	0.281	0.006	0.006	0.0	All components with the exception of the nozzle are chrome-moly
	057-018	Nozzle	319.8	319.8	8.643	8.643	0.282	0.281	1.053	1.053	0.0	
BLOWDOWN TANK DRAIN TO CONTROL VALVE	058-002 US	Pipe	307.4	307.4	1.212	1.213	0	0	0.960	0.959	-0.1	
	058-027	90 Elbow	307.4	307.4	2.212	1.213	0	0	1.315	1.315	0.0	
BLOWDOWN TANK DRAIN FROM CONTROL VALVE TO CONDENSER	058-048	Nozzle	215.8	215.6	16.363	16.253	0.097	0.097	0.766	0.767	0.1	
2ND POINT HEATER TO CONDENSATE HEATER	033-002	90 Elbow	360.2	365.5	8.107	8.829	0	0	4.507	4.708	4.5	
	034-019	Pipe	360.2	365.5	8.107	8.829	0	0	3.898	4.071	4.4	
CONDENSATE HEADER FROM 2ND POINT HEATER TO FEEDWATER PUMP SUCTION	035-007	90 Elbow	361.1	366.5	8.837	9.61	0	0	6.861	7.149	4.2	
	035-024	Pipe	361.1	366.5	8.837	9.61	0	0	4.080	4.251	4.2	
CONDENSATE - 3RD POINT HEATER TO 2ND POINT HEATER	031-004	90 Elbow	321.5	326.6	8.157	8.878	0	0	4.081	4.021	-1.5	
	031-029 US	Pipe	321.5	326.6	7.909	8.609	0	0	3.462	3.411	-1.5	
CONDENSATE - 4TH POINT HEATER TO 3RD POINT HEATER UPSTREAM OF HEATER DRAIN LINE TEE	029-003	90 Elbow	284.2	288.1	7.718	8.368	0	0	5.002	5.224	4.4	
	030-002 DS	Pipe	284.2	288.1	7.718	8.368	0	0	3.650	3.812	4.4	

* + Shows an increase in wear rate
- Shows a decrease in wear rate

Comparison of Predicted and Measured Wall Thickness at Current Plant Conditions (100% Power)

Fluid Parameters and Wear Rate Comparison-Pre and Post Power Uprate

Wear Rate Analysis Run Definition Name	CHECWORKS Component Name	Component Geometry Type	Temperature (deg F)		Velocity (ft/sec)		Quality		Wear Rate (mils/year) *		Impact of Power Uprate on Predicted Wear Rate (% Change)	Notes
			Current	SPU	Current	SPU	Current	SPU	Current	SPU		
CONDENSATE - 4^{TH} POINT HEATER TO 3^{RD} POINT HEATER DOWNSTREAM OF HEATER DRAIN LINE TEE	029-009	90 Elbow	277.2	281.5	8.041	8.746	0	0	3.823	4.024	5.3	
	03-011DS	Pipe	277.2	281.5	7.797	8.48	0	0	3.243	3.414	5.3	
CONDENSATE - 5TH POINT HEATER TO 4^{TH} POINT HEATER	026-004	90 Elbow	219.6	222.9	7.841	8.495	0	0	4.831	5.100	5.6	
	028-017 DS	Pipe	219.6	222.9	7.481	8.106	0	0	3.169	3.346	5.6	
CROSSUNDER	077-026	90 Elbow	375.9	382	20.955	21.66	0.866	0.868	9.609	9.730	1.3	
	077-041 US	Pipe	375.9	382	20.794	21.503	0.866	0.868	4.246	4.298	1.2	
EXTRACTION - 2^{ND} POINT (FROM MAIN STEAM & REHEAT TO END POINT HEATERS)	005-026	90 Elbow	369.2	375.6	38.217	39.745	0.869	0.87	6.353	6.591	3.7	
	005-051 US	Pipe	369.2	375.6	38.217	39.745	0.869	0.87	4.313	4.474	3.7	
EXTRACTION 5^{TH} POINT (FROM LOW PRESSURE TURBINES TO 5^{TH} POINT HEATERS)	014-020 US	Pipe	228.4	232.6	1.311	2.017	0.956	0.951	3.891	4.225	8.6	
	014-023	45 Elbow	228.4	232.6	0.072	0.105	0.956	0.951	2.788	3.668	31.6	
EXTRACTION - 6^{TH} POINT (FROM LOW PRESSURE TURBINES TO 6^{TH} POINT HEATERS)	109-004 DS	Pipe	160.4	163.7	0.029	0.036	0.925	0.923	2.891	3.369	16.5	
	109-008	45 Elbow	160.4	163.7	0.031	0.038	0.925	0.923	4.004	4.668	16.6	
FEEDWATER PUMP TO FIRST POINT FEEDWATER HEATERS	037-021	90 Elbow	363	368.4	17	18.49	0	0	8.745	9.085	3.9	
	037-009 US	Pipe	363	368.4	15.694	17.069	0	0	7.192	7.472	3.9	

* + Shows an increase in wear rate

- Shows a decrease in wear rate

Comparison of Predicted and Measured Wall Thickness at Current Plant Conditions (100% Power)

Fluid Parameters and Wear Rate Comparison-Pre and Post Power Uprate

Wear Rate Analysis Run Definition Name	CHECWORKS Component Name	Component Geometry Type	Temperature (deg F)		Velocity (ft/sec)		Quality		Wear Rate (mils/year) *		Impact of Power Uprate on Predicted Wear Rate (% Change)	Notes
			Current	SPU	Current	SPU	Current	SPU	Current	SPU		
FEEDWATER FROM HP FEEDWATER HEATER TO STEAM GENERATOR	041-004	90 Elbow	436.4	442.7	12.069	13.15	0	0	8.606	9.664	12.3	
	039-048 US	Pipe	436.4	442.7	11.162	12.162	0	0	6.944	7.799	12.3	
HEATER DRAINS HEADER UPSTREAM OF CONTROL VALVE	015-033 DS	Pipe	373.4	380.3	22.607	24.671	0	0	3.685	3.746	1.7	
	015-044	90 Elbow	373.4	380.3	8.657	9.447	0	0	3.388	3.444	1.7	
HEATER DRAINS HEADER DOWNSTREAM OF CONTROL VALVE	015-022	Pipe	364.7	370.6	29.839	31.605	0.011	0.012	4.813	5.122	6.4	
	015-062	90 Elbow	364.8	370.7	9.803	10.863	0.011	0.012	7.244	7.707	6.4	
2ND POINT HEATER DRAIN TO 3RD POINT HEATER UPSTREAM OF CONTROL VALVE	017-026	Pipe	328.5	334.5	15.074	16.45	0	0	3.279	3.196	-2.5	
	018-002	90 Elbow	328.5	334.5	6.668	7.276	0	0	3.219	3.218	0.0	
2ND POINT HEATER DRAIN TO 3RD POINT HEATER DOWNSTREAM OF CONTROL VALVE	016-026	90 Elbow	321.8	327.2	7.586	8.378	0.008	0.009	0.032	0.033	3.1	Entire line is constructed of chrome-moly
3RD POINT HEATER DRAIN TO 4TH POINT HEATER UPSTREAM OF CONTROL VALVE	019-030 US	Pipe	286.7	292.1	17.276	18.899	0	0	4.100	4.375	6.7	
	020-003	90 Elbow	286.7	292.1	7.518	8.225	0	0	4.086	4.360	6.7	

* + Shows an increase in wear rate
- Shows a decrease in wear rate

Comparison of Predicted and Measured Wall Thickness at Current Plant Conditions (100% Power)												
Fluid Parameters and Wear Rate Comparison-Pre and Post Power Uprate												
Wear Rate Analysis Run Definition Name	**CHECWORKS Component Name**	**Component Geometry Type**	**Temperature (deg F)**		**Velocity (ft/sec)**		**Quality**		**Wear Rate (mils/year) ***		**Impact of Power Uprate on Predicted Wear Rate (% Change)**	**Notes**
			Current	**SPU**	**Current**	**SPU**	**Current**	**SPU**	**Current**	**SPU**		
3RD POINT HEATER DRAIN TO 4TH POINT HEATER DOWNSTREAM OF CONTROL VALVE	019-036	90 Elbow	286.7	292.1	4.867	5.324	0	0	3.065	3.360	9.6	
	020-018 DS	Pipe	286.7	292.1	4.795	5.246	0	0	2.615	2.867	9.6	
5TH POINT HEATER DRAIN TO CONDENSER UPSTREAM OF CONTROL VALVE	514-013	Pipe	169.4	173.8	10.6	11.591	0	0	3.646	3.927	7.7	
5TH POINT HEATER DRAIN TO CONDENSER DOWNSTREAM OF CONTROL VALVE	514-017 US	Pipe	169.4	173.8	5.177	5.661	0	0	0.016	0.018	12.5	Entire line is constructed of chrome-moly
6TH POINT HEATER DRAIN TO CONDENSER	516-017	90 Elbow	155.2	158.4	3.105	3.4	0	0	6.480	7.118	9.8	
	516-015 DS	Pipe	155.2	158.4	1.97	2.157	0	0	2.868	3.150	9.8	
4TH POINT HEATER DRAIN TO HEATER PUMP	021-002	90 Elbow	260.8	266.3	3.285	3.598	0	0	3.436	3.782	10.1	
	021-027 US	Pipe	260.8	266.3	3.285	3.598	0	0	2.321	2.556	10.1	
HEATER DRAIN PUMP HEATER DRAIN LINE TO CONDENSATE	022-051	Pipe	261.5	267	5.412	5.928	0	0	3.212	3.536	10.1	Most of this line has been replaced with chrome-moly
MOISTURE SEPARATOR DRAIN PUMP SUCTION/ DISCHARGE	070-011	90 Elbow	369	375.5	7.01	7.53	0	0	1.023	1.065	4.1	
	072-012 DS	Pipe	368	374.4	3.024	3.248	0	0	0.253	0.268	5.9	
MOISTURE SEPARATOR REHEATER TO MSR DRAIN TANK	074-093	90 Elbow	368	374.4	2.659	2.856	0	0	2.354	2.485	5.6	
	074-094	Pipe	368	374.4	2.659	2.856	0	0	1.590	1.679	5.6	

* + Shows an increase in wear rate
- Shows a decrease in wear rate

Comparison of Predicted and Measured Wall Thickness at Current Plant Conditions (100% Power)												
Fluid Parameters and Wear Rate Comparison-Pre and Post Power Uprate												
Wear Rate Analysis Run Definition Name	CHECWORKS Component Name	Component Geometry Type	Temperature (deg F)		Velocity (ft/sec)		Quality		Wear Rate (mils/year) *		Impact of Power Uprate on Predicted Wear Rate (% Change)	Notes
			Current	SPU	Current	SPU	Current	SPU	Current	SPU		
MOISTURE SEPARATOR REHEATER DRAIN TO REHEATER DRAINS TANK	064-002	45 Elbow	528.4	527.6	1.93	2.019	0	0	8.513	8.824	3.7	
	065-020 DS	Pipe	528.4	527.6	1.93	2.019	0	0	6.449	6.685	3.7	
DRAINS FROM REHEATER DRAIN TANKS UPSTREAM OF CONTROL VALVE	067-008 DS	Pipe	528.2	527.4	8.273	8.652	0.001	0.001	7.291	7.454	2.2	
	068-019	90 Elbow	528.5	527.7	3.281	3.433	0	0	4.936	5.117	3.7	
DRAINS FROM REHEATER DRAIN TANKS DOWNSTREAM OF CONTROL VALVE TO 1ST POINT FEEDWATER HEATERS	067-016 DS	Pipe	441	448.	11.98 2	11.362	0.13	0.12	2.327	2.594	11.5	
	067-060	90 Elbow	440.1	447.3	13.54 5	12.811	0.132	0.121	3.765	4.219	12.1	

* + Shows an increase in wear rate
- Shows a decrease in wear rate

Note: This Table's Current and SPU flow velocities are liquid film velocities (or the wet steam velocities in the liquid layers.

CSGB-07-0011 (2.1.8-2)

Increased secondary side flow rates will result in increased particulate matter in the steam generators (SG). CHECWORKS is unable to account for this material when analyzing FAC for the SG blowdown system. Are inspections of the SG blowdown system triggered solely by CHECWORKS, or is this system subject to inspections in a similar manner to "non-CHECWORKS modeled" systems as described in Section 2.1.8 of the SPU Licensing Report? If the SG blowdown system is treated as a "CHECWORKS modeled" system, describe why the inability of CHECWORKS to model increased particulate matter is acceptable.

DNC Response

The MPS3 FAC program also relies on the wall thickness examinations of the SG blowdown system.

Even though almost all of the blowdown piping at MPS3 is constructed of Cr-Mo material, operating experience at Millstone Power Station Unit 2 (MPS2), has shown only slight improvement on the in-service life from Cr-Mo material where particulate matter and not flow accelerated corrosion is the primary wear mechanism. This mechanism is most prevalent at and downstream of the MPS2 blowdown system throttle valves, and the header(s) to the blowdown tank, including the tank's stainless steel elbow(s) and inlet nozzles which have significant wear and are monitored and trended by ultrasonic testing (UT) examination.

MPS3, to date, has not seen the same particulate problem; however, the component line information, including valves are built into the CHECWORKs program to allow for the very same trending that has been established for MPS2. The component structural calculations (or wear calculations) that provide component remaining life, which are based on UT exams (i.e., field data) and not the CHECWORKS model, are also maintained in the Millstone FAC Application for trending purposes. Millstone looks at both the CHECWORKS model trending and Millstone FAC Steam Feedwater Application (SFA) component level wear calculations, which are viewed separately for all modeled systems. Any discrepancy where the Millstone FAC SFA components remaining life varies from the CHECWORKS model is resolved. If the model is not able to predict component life accurately as with the case of particulate impingement and cavitation, the wear calculation trending based on actual field data is used to direct future examination and or replacement of the component, as needed.

Note: For all non-modeled systems, the trending based on actual field data is retained in the Millstone FAC SFA application, while the supporting UT data is retained in the CHECWORKS application.