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SUBJECT: Forwards rept summarizing separate impacts of power uprate & increased core flow on three limiting reload events for Unit 2,Cycle 7.

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Director of Nuclear Reactor Regulation
Attention: Mr. C. L. Miller, Project Director
Project Directorate I-2
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
POWER UPRATE DELTA ANALYSES
PLA-4063 FILES R41-2/P88 **Docket No. 50-388**

Dear Mr. Miller:

Earlier this year in response to a request from Messrs. T. Collins and M. Razzaque, PP&L committed to provide a report summarizing the separate impacts of Power Uprate and Increased Core Flow on three limiting reload events for Unit 2 Cycle 7. Enclosed please find the subject report.

Any questions on this information should be directed to Mr. R. Sgarro at (215) 774-7914.

Very truly yours,

R. G. Byram

Enclosure

cc: NRC Document Control Desk (original)
NRC Region I
Mr. G. S. Barber, NRC Sr. Resident Inspector - SSES
Mr. R. J. Clark, NRC Sr. Project Manager - Rockville

This report discusses the separate effects of power uprate and increased core flow on the following three analyses:

1) Generator Load Rejection w/o Bypass (GLRWOB)
2) Feedwater Controller Failure (FWCF)
3) Overpressure Protection Analysis (i.e., MSIV closure)

The change in critical power ratio (ΔCPR) for the GLRWOB and FWCF events and the peak pressure for the overpressurization event are shown. Each event was analyzed for the following three initial conditions:

1) Non-Power Uprate Analytical Conditions, 100 mlb/hr core flow; power, pressure, setpoints, and other system parameters are based on pre-power uprate analytical conditions.

2) Power Uprate Analytical Conditions, 100 mlb/hr core flow.

3) Power Uprate Analytical Conditions, 108 mlb/hr core flow.

All cases utilize an End-of-Cycle, All-Rods-Out condition. The results are shown in Tables 1, 2, and 3. The following discussion presents the major factors affecting the trends.

The GLRWOB ΔCPR is lower at power uprate analytical conditions than at the Non-Power Uprate analytical conditions because the turbine control valve closure time is shorter for the non-power uprate conditions. The initial valve position governs how long it takes for the turbine control valve to close. At uprated power the valve is opened further initially.

The increased core flow GLRWOB case has a larger ΔCPR than the case at 100 mlb/hr (both cases for uprated power conditions) because the higher core flow results in an axial power shape that is shifted toward the top of the core. With an initial axial power shape shifted toward the top of the core, the control rods entering the core from the bottom are not as effective in limiting the rapid power increase.

The FWCF ΔCPR is higher at the power uprate analytical conditions for two reasons. First, the same "% of rated" maximum feedwater runout flow was used for both the power uprate and non-power uprate calculations. Since the absolute value of the power uprate rated feedwater flow is higher than the non-power uprate value, the absolute value of the maximum feedwater runout flow is also higher for power uprate. Second, the power uprate initial conditions are closer to turbine control valves wide open (VWO) conditions. As a result, the pressure increase and, hence, the power rise just prior to the turbine trip, are more severe due to VWO conditions for the power uprate case. This causes the ΔCPR for the pre-trip portion of the event to be larger. Therefore, the total ΔCPR is larger for the power uprate case.

The increased core flow FWCF case has a larger ΔCPR than the case at 100 mlb/hr (both cases for uprated power conditions) because the higher core flow results in an axial power shape that is shifted toward the top of the core. With the initial axial power shape shifted toward the top of the core, control rods entering the core from the bottom are not as effective in limiting the rapid power increase.

The power uprate overpressurization analysis results in a relatively large increase in the maximum pressure over the non-power uprate case. This increase is largely due to: 1) the changed safety relief valve banking including an increased trip setpoint for the first bank, 2) the increased power (and, hence, steam flow) which causes a more severe pressurization transient, and 3) the increased initial pressure which results in an increased peak pressure. The increased core flow case resulted in a minor additional increase in pressure due to the axial power shape shift as previously discussed for the GLRWOB and FWCF events.

The above results illustrate the separate effects of power uprate and increased core flow. The major contributors to the differences in the results have been identified and discussed. The results exhibit trends consistent with established sensitivity studies for the PP&L methodology.

Table 1 **GLRWOB Results**	
Case	ΔCPR
Non-Power Uprate, 100 mlb/hr	.27
Power Uprate, 100 mlb/hr	.26
Power Uprate, 108 mlb/hr	.28

Table 2 **FWCF Results**	
Case	ΔCPR
Non-Power Uprate, 100 mlb/hr	.20
Power Uprate, 100 mlb/hr	.22
Power Uprate, 108 mlb/hr	.25

Table 3 **Overpressure Protection Results****	
Case	Max Pressure* (psig)
Non-Power Uprate, 100 mlb/hr	1346
Power Uprate, 100 mlb/hr	1368
Power Uprate, 108 mlb/hr	1369

*Relative to 1375 psig criterion.
**All cases used 6 SRVs out of service.