ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Tuesday, April 16, 2013 4:35 PM
To: Snyder, Amy
Cc: Gleaves, Bill; HOLM Jerald (EXTERNAL AREVA); GUCWA Len (EXTERNAL AREVA)
Subject: NRC Question on SGTR During April 2nd Public Meeting
Attachments: Response to NRC Question on SGTR Analysis.docx

Follow Up Flag: Follow up
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Amy,
Attached is a response to a question posed during the SGTR analysis discussion at the public meeting on Tuesday, April 2nd. Please forward to Joe Donoghue and other NRC staff members attending this meeting.

Thanks,
Dennis

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From: HOLM Jerald (External RS/NB)
Sent: Tuesday, April 16, 2013 8:33 AM
To: WILLIFORD Dennis (RS/NB)
Cc: GUCWA Len (External RS/NB); VANCE Brian (RS/NB)
Subject: NRC Question on SGTR

Dennis

In the NRC meeting on the SGTR analysis (April 2, 2013) Joe Donohgue asked a question that we were not able to answer. We indicated in the meeting that we would provide a response. A non-proprietary response to his question is attached. Please forward this to the NRC to provide to Joe Donoghue.

Thanks

Thanks

Jerry Holm

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Hearing Identifier: AREVA_EPR_DC_RAIs
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From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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Response to NRC Question on SGTR Analysis.docx	278798	

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NRC Meeting to Discuss RAI 403 and SGTR Re-Analysis – April 2, 2013

Question from the NRC Staff (Joe Donoghue) on the SGTR re-analysis presentation (Slide 15 - shown below as Figure 1) regarding decrease in the affected SG pressure between approximately 10,500 and 11,500 seconds.

AREVA Response:

The NRC question pertains to the limiting Steam Generator Tube Rupture (SGTR) overfill analysis no-Loss-of-Offsite Power (LOOP) scenario that is mitigated by the operator cycling the PSRVs.

The PSRV cycling by the operator provides rapid primary depressurization and by about 5,000 seconds the primary pressure crosses over the affected SG pressure and continues to decrease (see Figure 1). The higher ΔP between the affected SG and the RCS causes reverse flow through the break (see Figure 2) from the ruptured SG to the RCS during this period. With the continued mass flow to the RCS the affected SG boiler region level decreases (see Figure 3).

The SG fluid in direct contact with the tubes tends to track the tube temperature. The water just above the tubes is warmer and the water in the upper portion of the SG tends to contain saturated steam. When the SG is mostly full, the colder water at the bottom will remain in place due to higher density (see Figures 4, 5 & 6). The upper boiler/plenum/separator will tend to be two-phase (see Figures 7 and 8). Thus, there is saturated steam in the upper-middle portion of the SG. The saturated liquid layer on top effectively makes an insulating layer between the steam above and the subcooled liquid in the tube region. As the level in the SG drops due to flow from the affected SG to the RCS, the saturated liquid layer becomes progressively thinner. This behavior can be observed from the boiler region top node void fraction plot (Figure 6), which leaves only one region of water between the tubes and the saturated steam. As the SG level drops, steam in the upper portion of the affected SG boiler region comes in contact with the U-tubes causing a rapid drop in pressure as the steam condenses..

In effect, the establishment of this coupling between the RCS and the SG accelerates the pressure decrease in the affected SG starting at about 10,500 seconds and continuing until approximately 11,500 seconds (see Figure 1). As equilibrium between the primary and the secondary pressures is achieved, cessation of break flow occurs and the event is terminated upon attaining a controlled state.

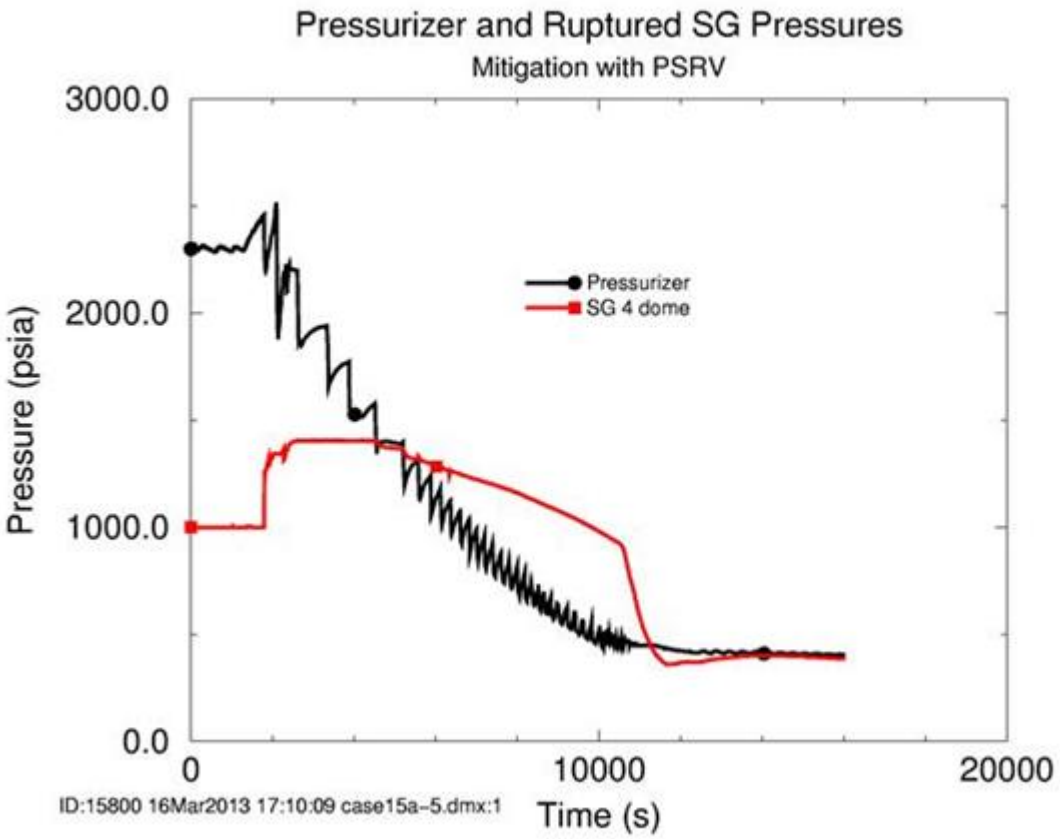

Figure 1 SGTR Overfill – Pressurizer and Affected SG Dome Pressures

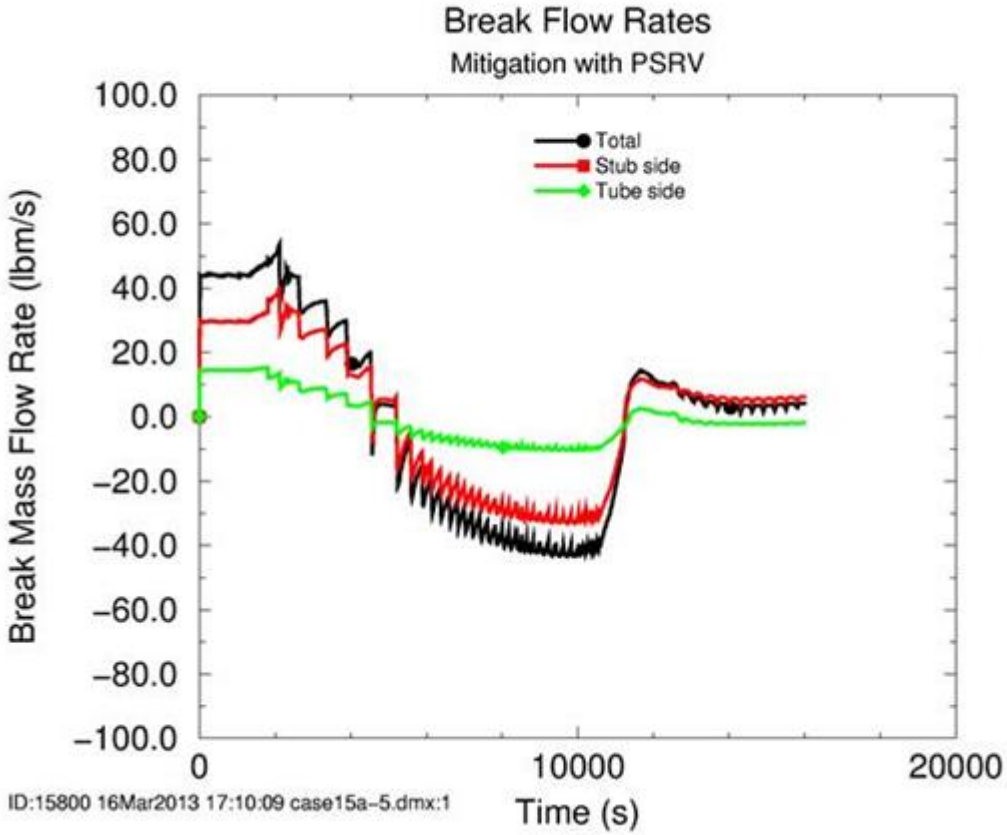

Figure 2 SGTR Overfill – Break Flow Rates

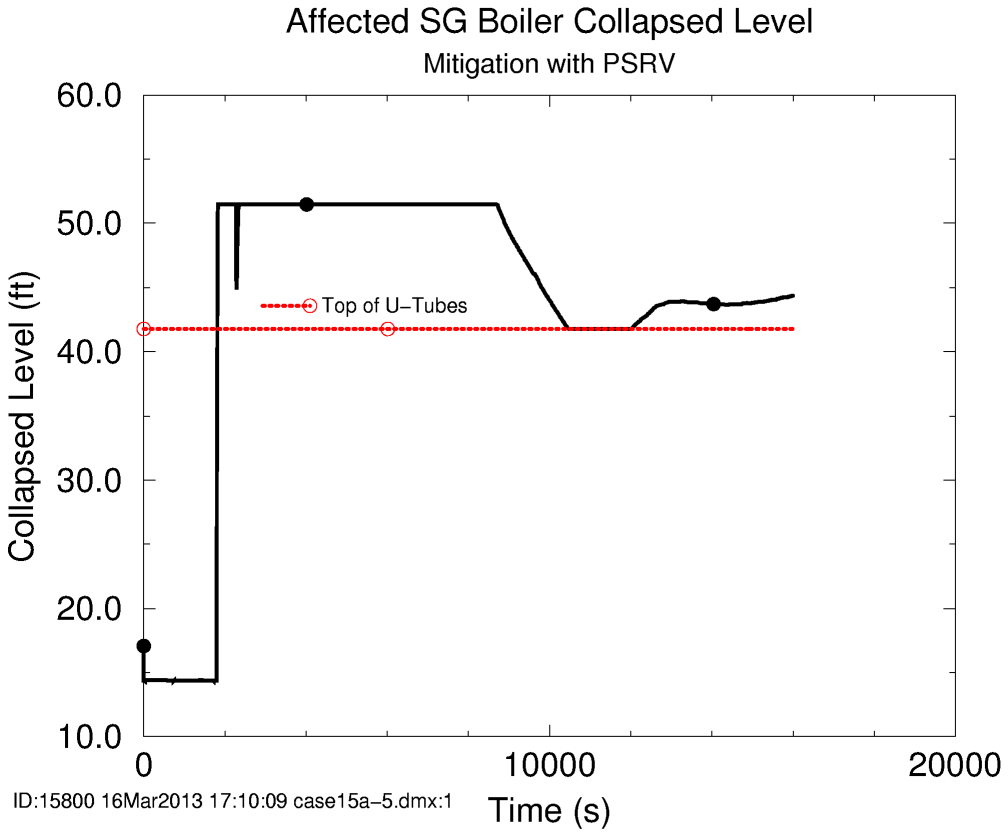

Figure 3 SGTR Overfill – Affected SG Boiler Region Liquid Level

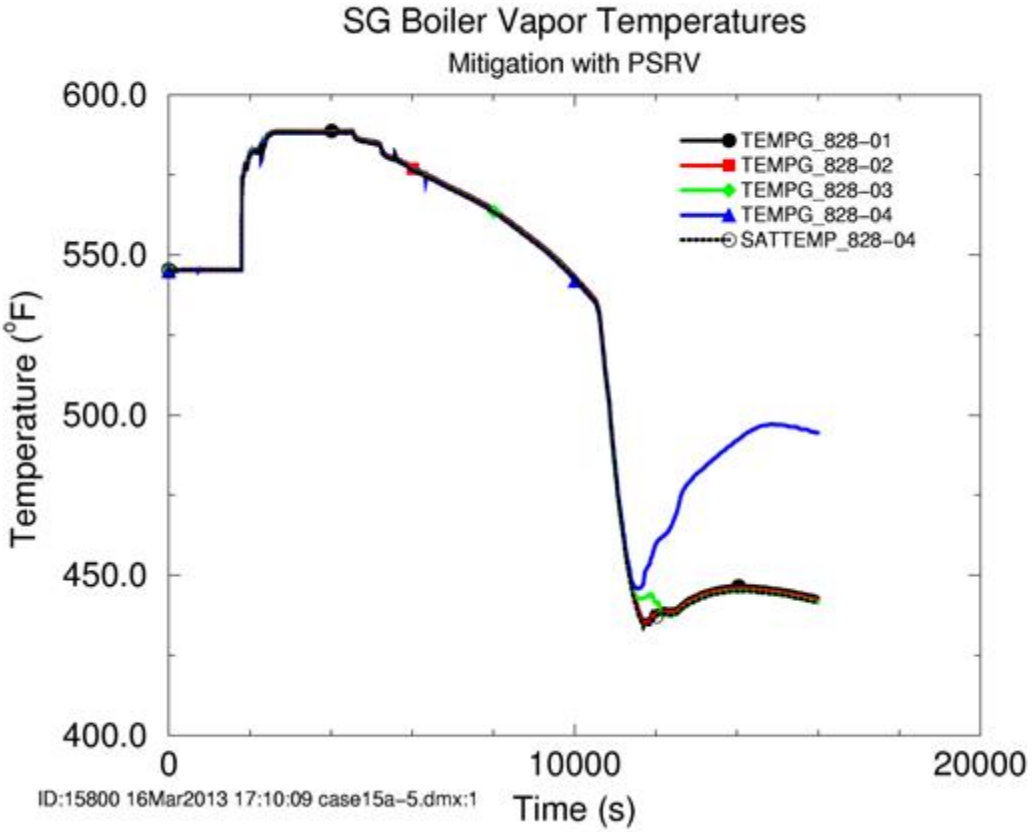

Figure 4 SGTR Overfill – Affected SG Boiler Steam Temperatures

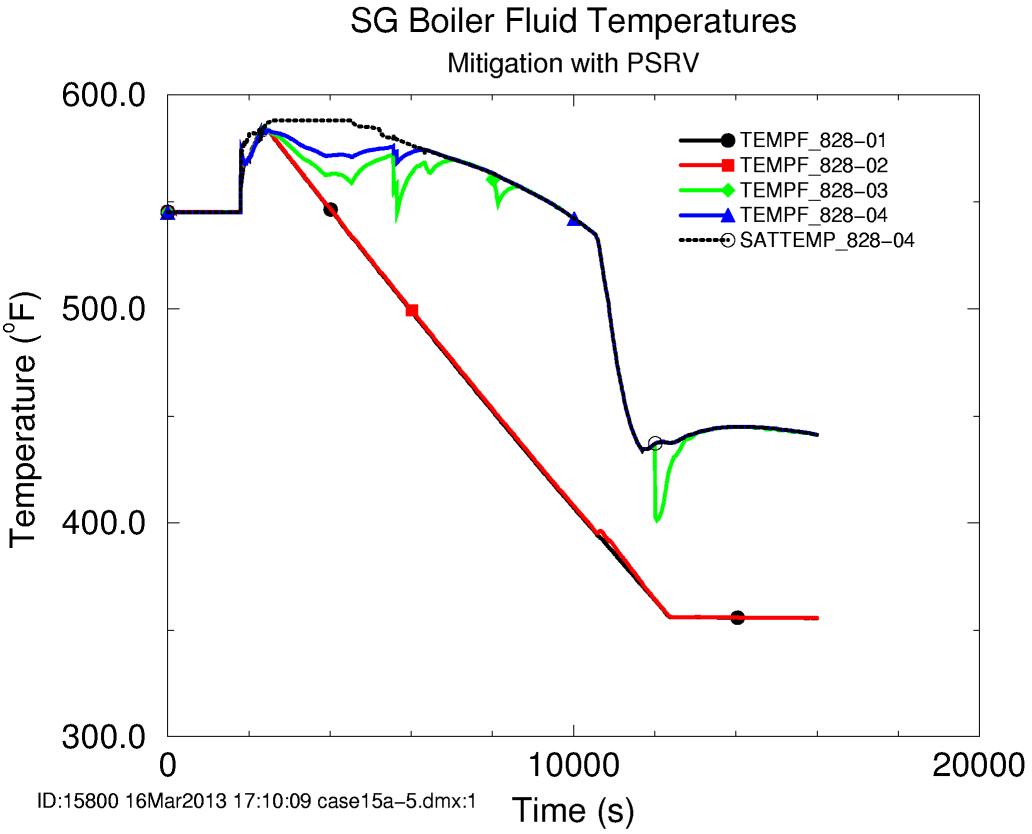

Figure 5 SGTR Overfill – Affected SG Boiler Fluid Temperatures

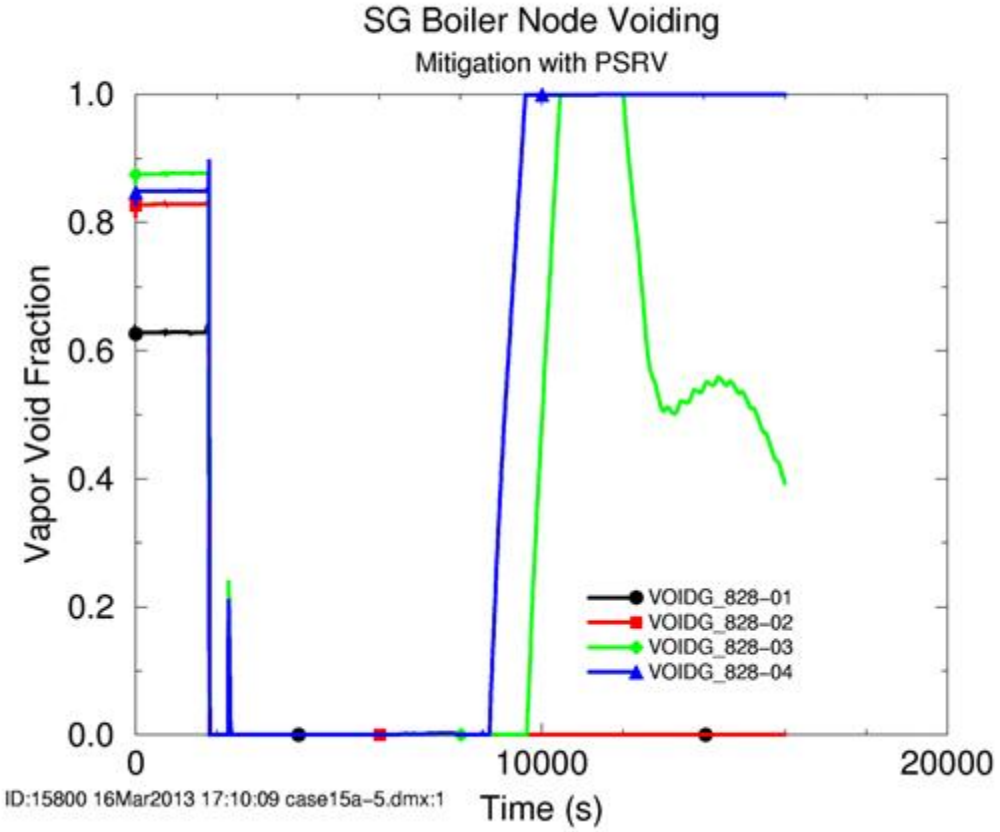

Figure 6 SGTR Overfill – Affected SG Boiler Void Fraction

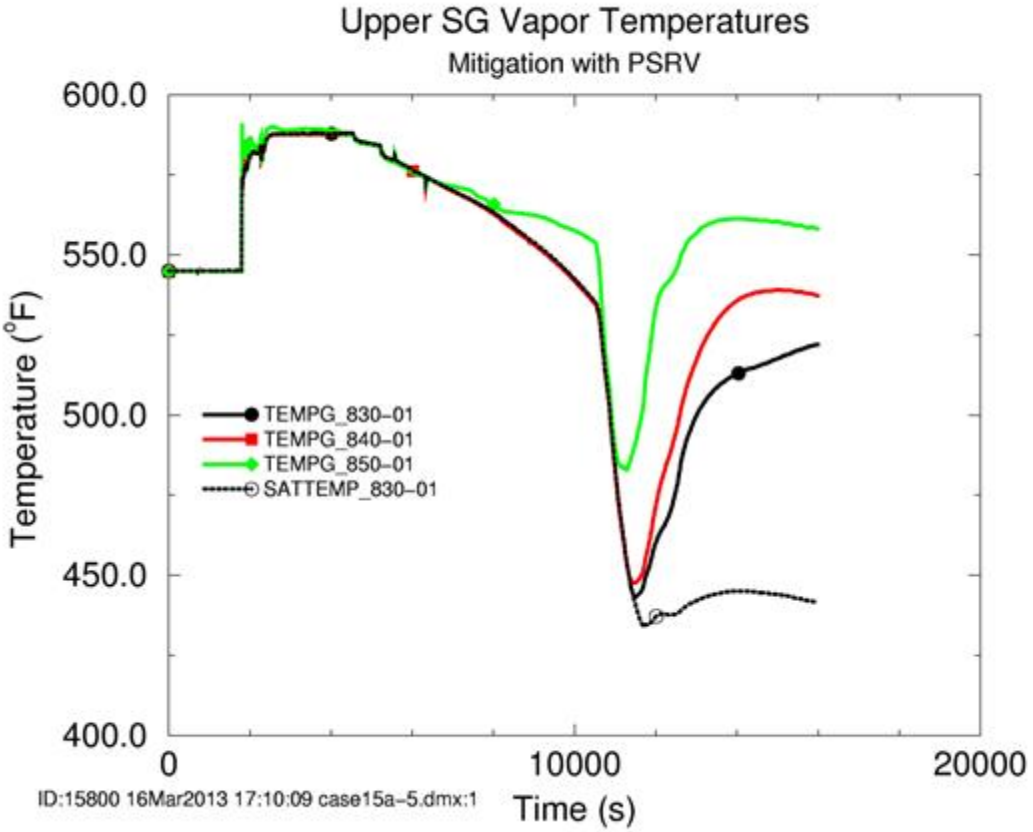

Figure 7 SGTR Overfill – Affected SG Upper Region Fluid Temperatures

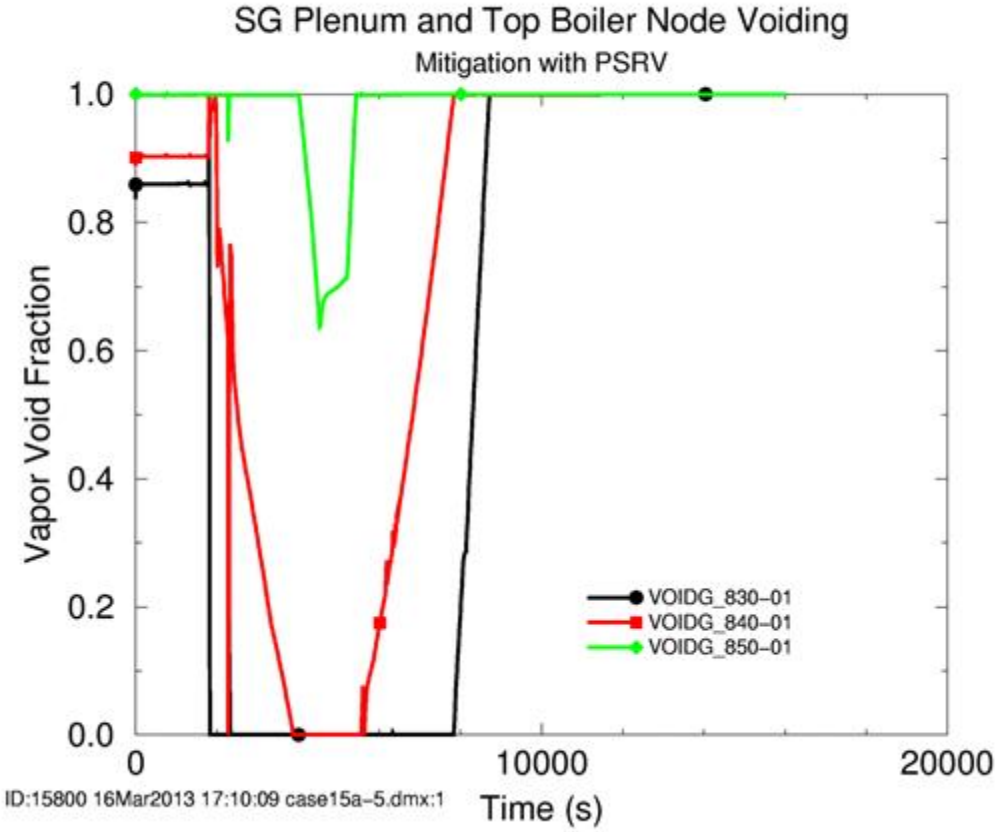

Figure 8 SGTR Overfill – Affected SG Upper Region Void Fraction