United States Nuclear Regulatory Commission

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NUREG-2236
Volume 2

Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models-Duane Arnold

Appendices D to E

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NUREG-2236
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Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models-Duane Arnold

Appendices D to E

Manuscript Completed: May 2019
Date Published: October 2020

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ABSTRACT

This report extends the work documented in NUREG-2187, “Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Byron Unit 1,” issued January 2016, to the Duane Arnold Energy Center. Its purpose is to produce an additional set of best estimate thermal-hydraulic calculations that can confirm or enhance specific success criteria for system performance and operator timing found in the agency’s probabilistic risk assessment tools. Along with enhancing the technical basis for the agency’s independent standardized plant analysis risk (SPAR) models, these calculations are expected to be a useful reference to model end users for specific regulatory applications.

This report first describes major assumptions used in this study. It then discusses the major plant characteristics for the Duane Arnold Energy Center, in addition to the MELCOR model used to represent the plant. Finally, the report presents the results of MELCOR calculations for selected initiators and compares these results to SPAR success criteria, the licensee’s success criteria, or other generic studies.

The study results provide additional timing information for several probabilistic risk assessment sequences, confirm many of the existing SPAR modeling assumptions, and give a technical basis for a few specific SPAR modeling changes, including the following potential changes:

- Degraded high-pressure injection and relief valve Criteria (non-anticipated transient without scram): A single control rod drive pump injecting at the postscram increased injection rate is sufficient for reactor pressure vessel (RPV) water inventory makeup. Additionally, two control rod drive pumps injecting at the postscram injection rateprovide enough makeup to the RPV to facilitate a cooldown of the RPV to cold shutdown conditions. This increased injection is currently not queried in the SPAR models but could be added.

- Mitigating strategies usage: If diverse and flexible coping strategies (FLEX) are not available, success of long-term cooling for these scenarios is only possible with both anticipatory venting and condensate storage tank (CST) availability. Currently, CST availability is not queried in the SPAR models. This could be added for scenarios for which no alternate injection is available. For loss-of-offsite-power scenarios, FLEX injection led to success in all scenarios that gave FLEX credit. Given the ability of FLEX to prevent core damage, this confirms that the SPAR models should have FLEX equipment added.

- Emergency core cooling system injection following containment failure or venting: Depending upon the size of containment failure, wetwell and drywell pressure will fall, potentially to the point of allowing high-pressure injection restart following its loss. This action could be added to the SPARmodels.

- Safe and stable end-state considerations: If the CST is unavailable, the long-term availability of high-pressure injection is questionable at best. CST should be queried when high-pressure injection systems are the source of long-term makeup. Additionally, increased postscram control rod drive hydraulic system injection is adequate for makeup. This increased injection is a candidate for inclusion in the SPAR model. Depressurizing when reaching the heat capacity limit curve is important, since the rateof

seal leakage, as well as the rate of injection, is pressure dependent. This depressurization is a candidate for consideration in the SPAR models.

FOREWORD

The U.S. Nuclear Regulatory Commission (NRC) uses its standardized plant analysis risk (SPAR) models to support many risk-informed initiatives. A number of processes ensure the fidelity and realism of these models, including cross-comparison with industry models, review and use by a wide range of technical experts, and confirmatory analysis. This report—prepared by the staff of the Office of Nuclear Regulatory Research, in consultation with the staff of the Office of Nuclear Reactor Regulation; experts from Energy Research, Inc. and Idaho National Laboratory; and the agency's senior reactor analysts—represents a major confirmatory analysis activity.

Probabilistic risk assessment (PRA) models for nuclear power plants rely on underlying modeling assumptions known as success criteria and sequence timing assumptions. These criteria and assumptions determine what combination of system and componentavailabilities will lead to postulated core damage, as well as the timeframes during which components must operate or operators must take particular actions. This report investigates certain thermal-hydraulic aspects of a particular SPAR model (which is generally representative of other models within the same class of plant design), with the goal of further strengthening the technical basis for decisionmaking that relies on the SPAR models. This report augments the existing collection of contemporary Level 1 PRA success criteria analyses and, as such, supports (1) maintaining and enhancing the SPAR models that the NRC develops, (2) supporting the NRC's risk analysts when addressing specific issues in the accident sequence precursor program and the significance determination process, and (3) informing other ongoing and planned initiatives. This analysis employs the MELCOR computer code and uses a plant model developed for this project.

The analyses summarized in this report provide the basis for confirming or changing success criteria in the SPAR model for the Duane Arnold Energy Center. Based on further evaluation, these results could apply to similar plants, while future analyses could apply to other design classes, as occurred in the past (see NUREG-2187, "Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Byron Unit 1," issued January 2016). The staff expects to continue its focus on confirming success criteria and other aspects of PRA modeling using its state-of-the-art tools (e.g., the MELCOR computer code) as it develops and improves its risk tools.

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ABBREVIATIONS AND ACRONYMS

ac	alternating current
ADAMS	Agencywide Documents Access and Management System
ADS	automatic depressurization system
AIP	alternate injection procedure (EOP)
ANS	American Nuclear Society
AOP	abnormal operating procedure
ASP	accident sequence precursor
ATWS	anticipated transient without scram
BWR	boiling-water reactor
C	Celsius
CD	core damage
CDF	core damage frequency
CDS	condensate system
CFR	*Code of Federal Regulations*
CRDHS	control rod drive hydraulic system
CST	condensate storage tank
DAEC	Duane Arnold Energy Center
dc	direct current
ECCS	emergency core cooling system
ED	emergency depressurization
EDG	emergency diesel generator
ELAP	extended loss of ac power
EOP	emergency operating procedure
ESF	engineered safety feature
ESFAS	engineered safety features actuation system
F	Fahrenheit
FLEX	diverse and flexible coping strategies
FSG	FLEX support guideline
HCL	heat capacity limit
HCV	hardened containment vent
HCVS	hardened containment vent system
HPCI	high-pressure coolant injection
HPI	high-pressure injection
IORV	inadvertent open relief valve
IPE	individual plant examination
ISG	interim staff guidance
LCO	limiting condition for operation
LOCA	loss-of-coolant accident
LOCHS	loss of condenser heat sink

LODCA	loss of vital dc bus A
LODCB	loss of vital dc bus B
LOIAS	loss of instrument air system
LOMFW	loss of main feedwater
LOOP	loss of offsite power
LOOPGR	loss of offsite power grid related
LOOPPPC	loss of offsite power plant centered
LOOPWR	loss of offsite power weather related
LORWS	loss of river water system
LPCI	low-pressure coolant injection
LPCS	low-pressure core spray
LPI	low-pressure injection
MAAP	modular accident analysis program
MFW	main feedwater
MLOCA	medium loss-of-coolant accident
MSIV	main steam isolation valve
MSL	main steamline
NCV	noncited violation
NEI	Nuclear Energy Institute
NPSH	net positive suction head
NRC	U.S. Nuclear Regulatory Commission
PB	Peach Bottom
PCPL	primary containment pressure limit
PCS	power conversion system
PCT	peak clad temperature
PID	proportional-integral-derivative
PRA	probabilistic risk assessment
RCIC	reactor core isolation cooling
RCS	reactor coolant system
RHR	residual heat removal
RPS	reactor protection system
RPV	reactor pressure vessel
RWCU	reactor water cleanup
SAMP	severe accident management procedure
SBO	station blackout
SC	success criterion/criteria
SDP	significance determination process
SEP	site emergency plan
SFP	spent fuel pool
SLC	standby liquid control
SLOCA	small loss-of-coolant accident

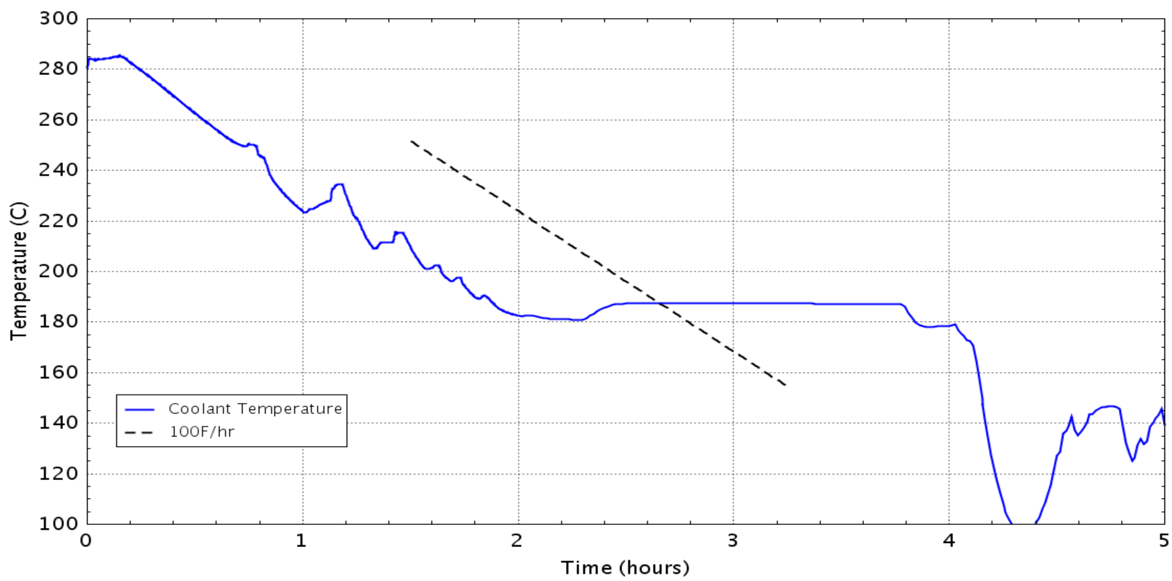
SNL	Sandia National Laboratories
SP	suppression pool
SPAR	standardized plant analysis risk
SRV	safety/relief valve
TAF	top of active fuel
TRANS	transient
UFSAR	updated final safety analysis report
UHS	ultimate heat sink
WW	wetwell

APPENDIX D
DETAILED CHAPTER 4 ANALYSIS RESULTS

DETAILED CHAPTER 4 ANALYSIS RESULTS

D.1 LOOP Scenarios

D.1.1 Case 1: LOOPGR-38-9, AC Loss at t=0, RCIC Loss at 4 hrs., CST Available, Perform Required Venting Only



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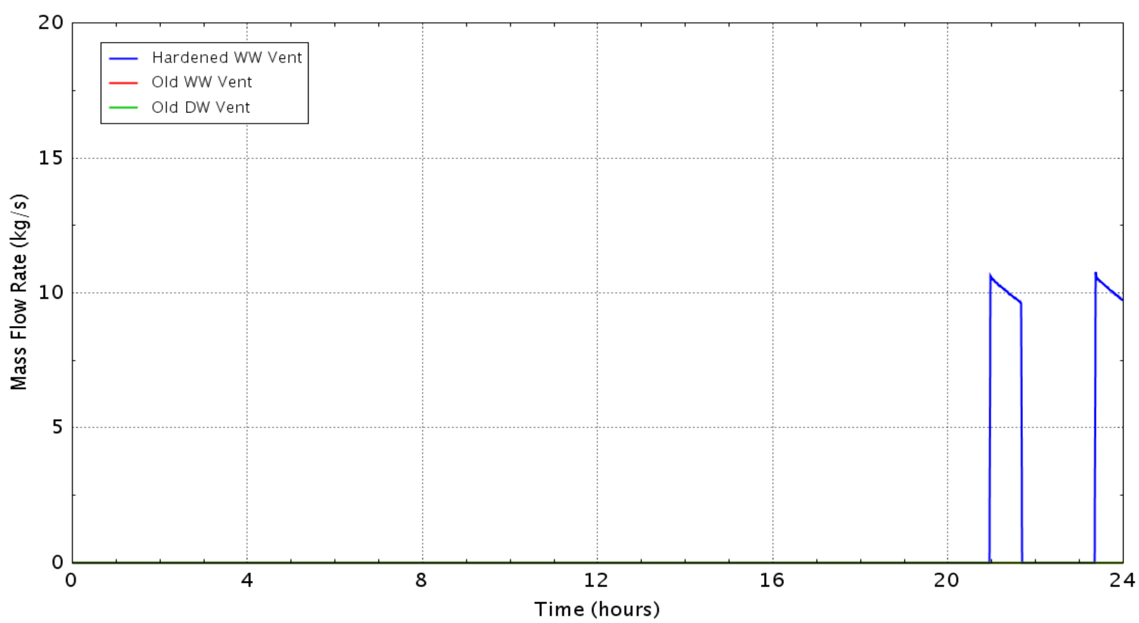

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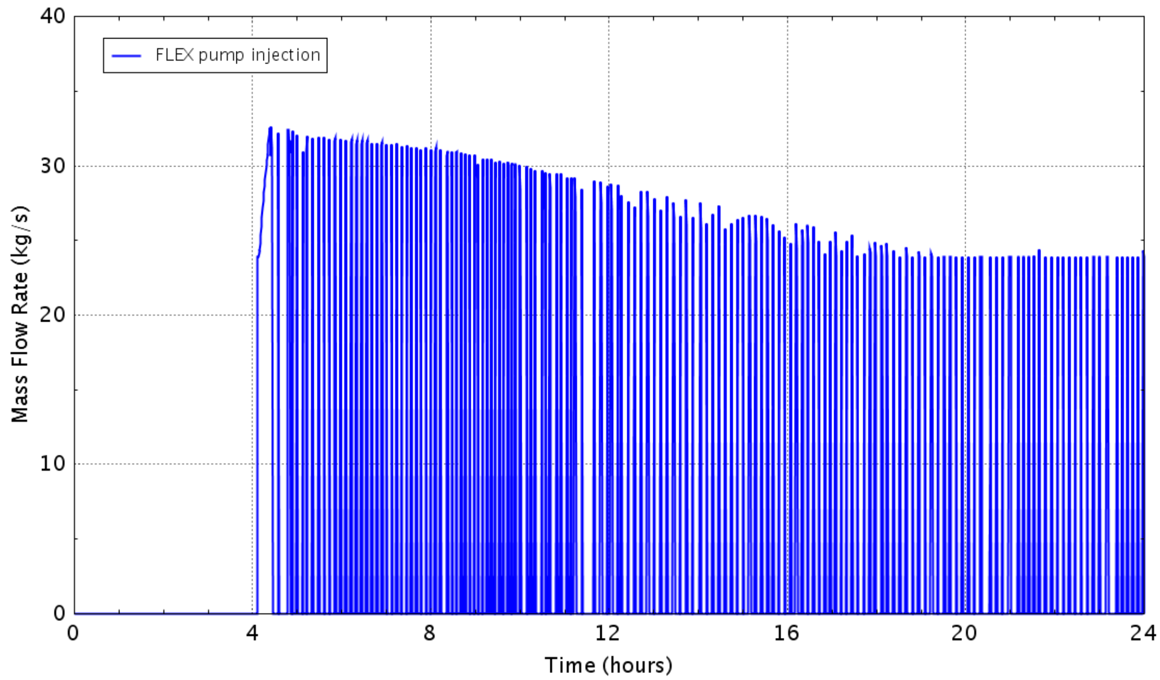

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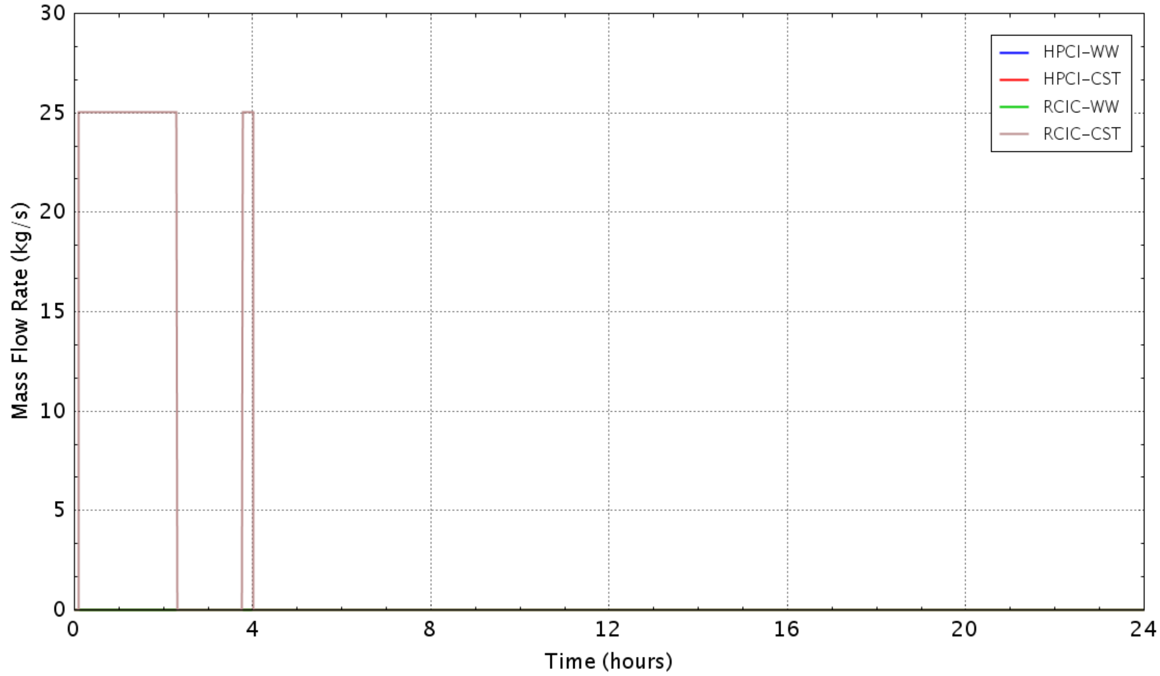

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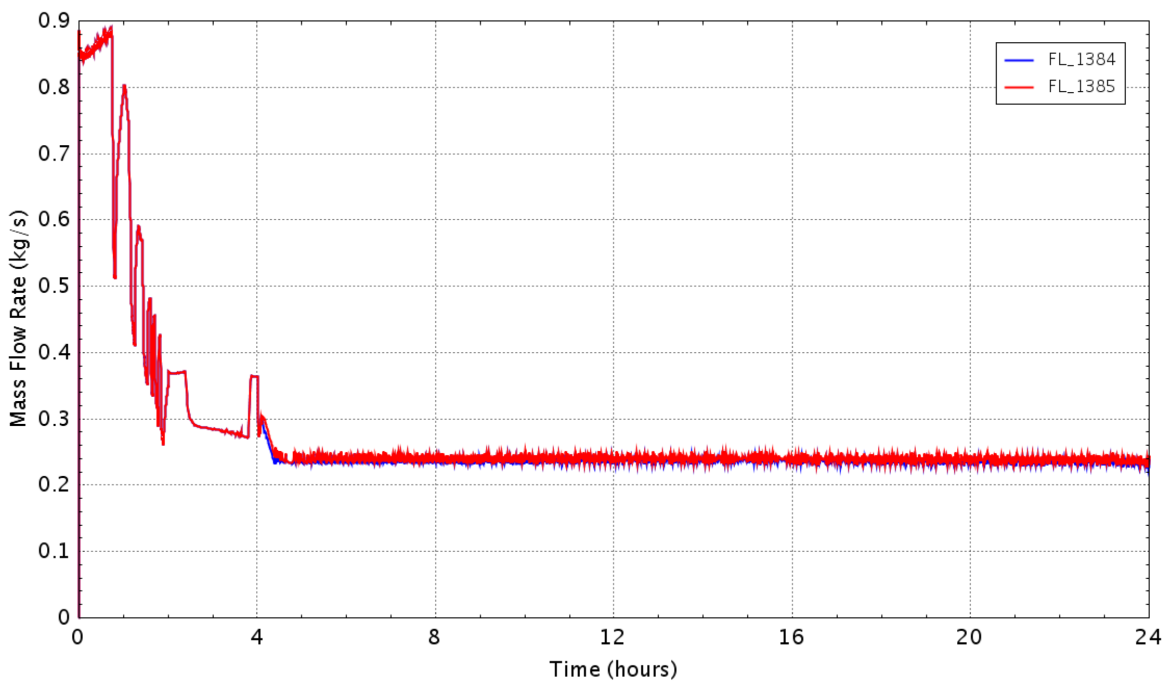

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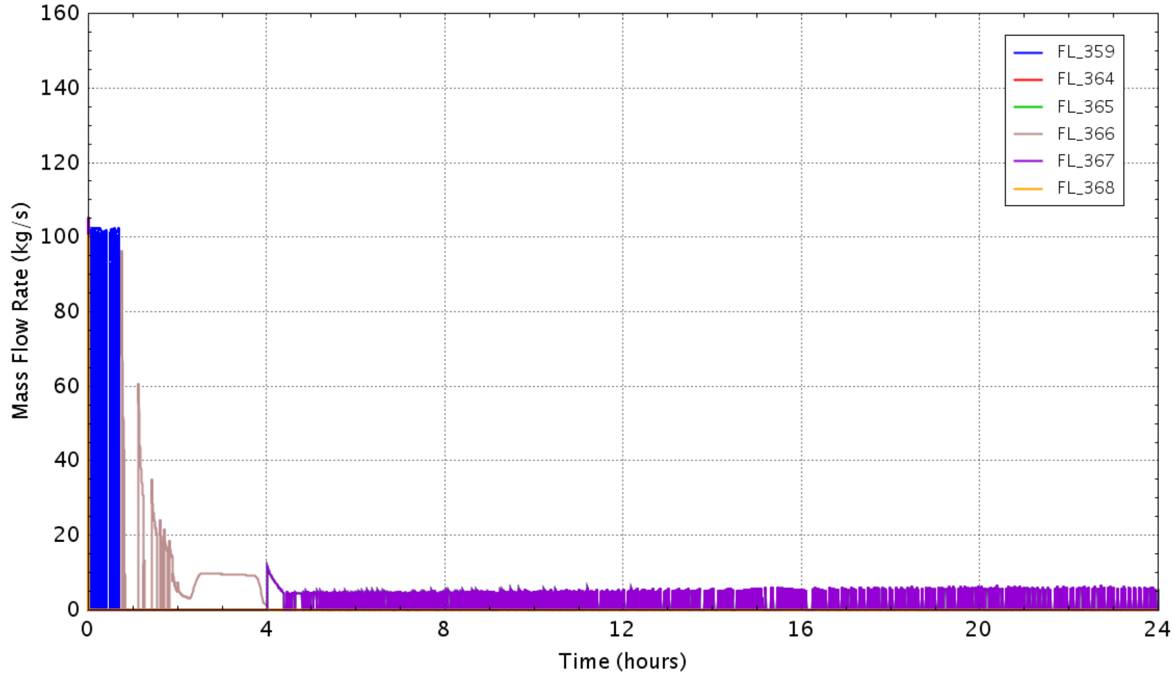

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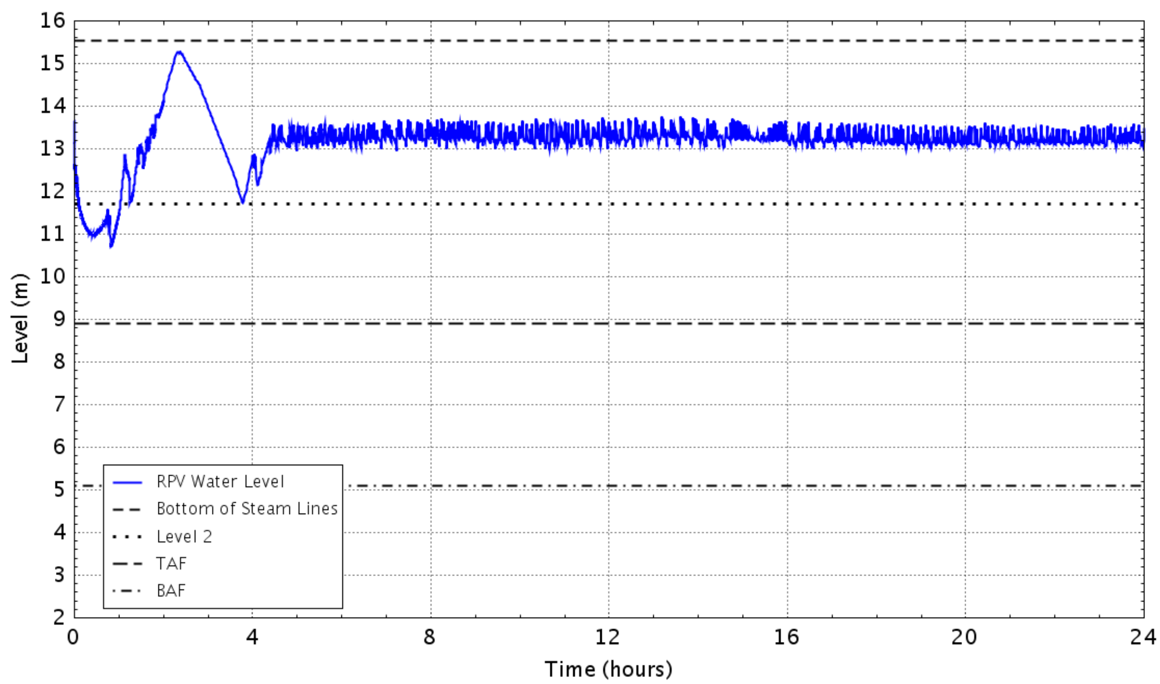

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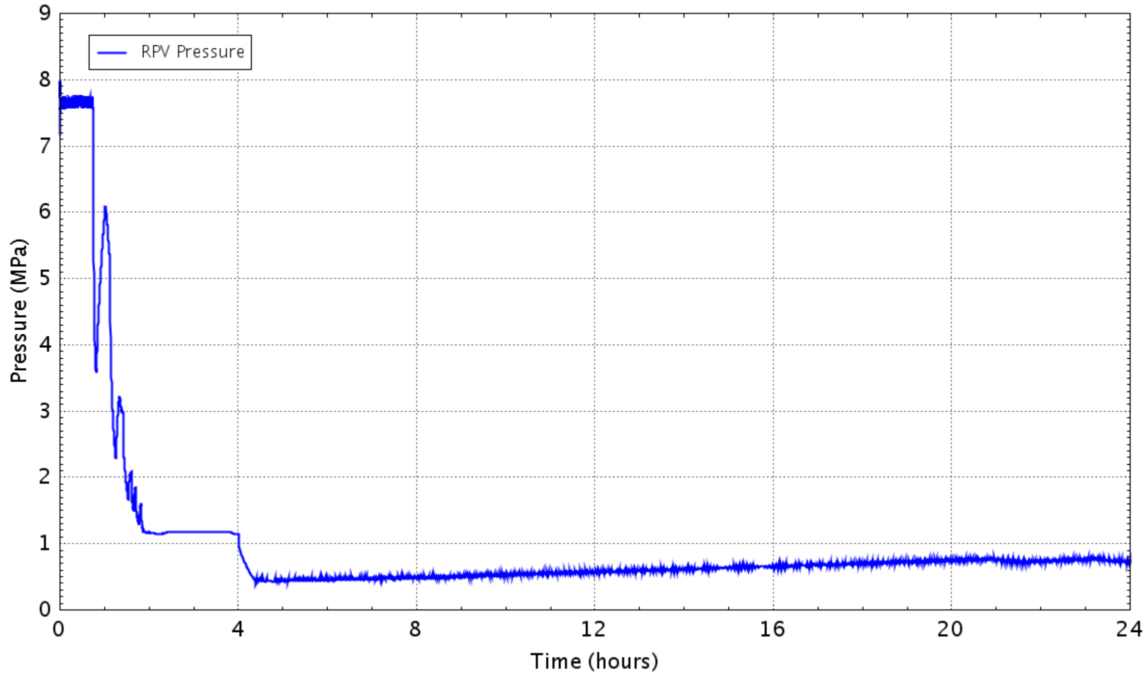

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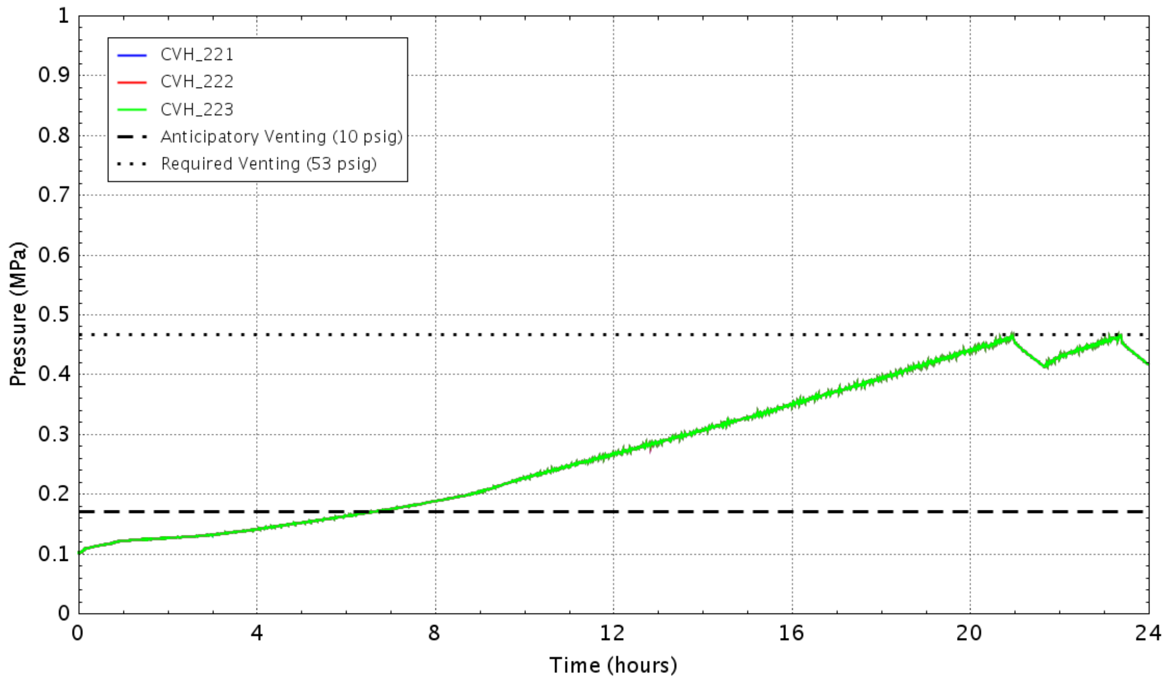

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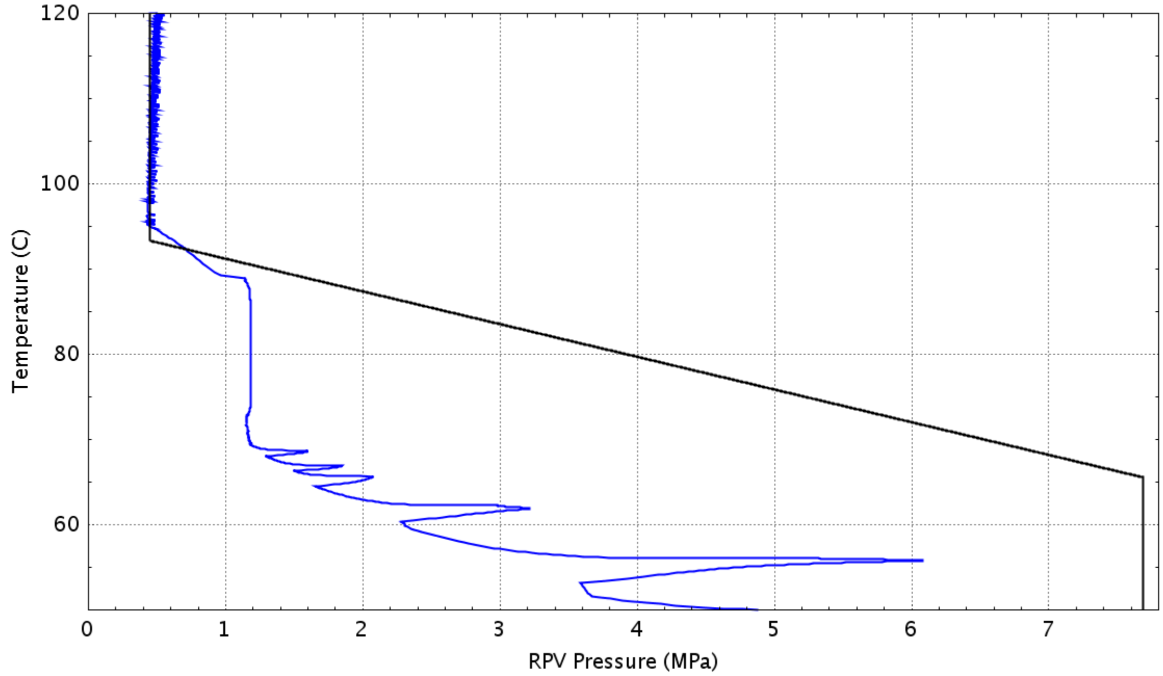

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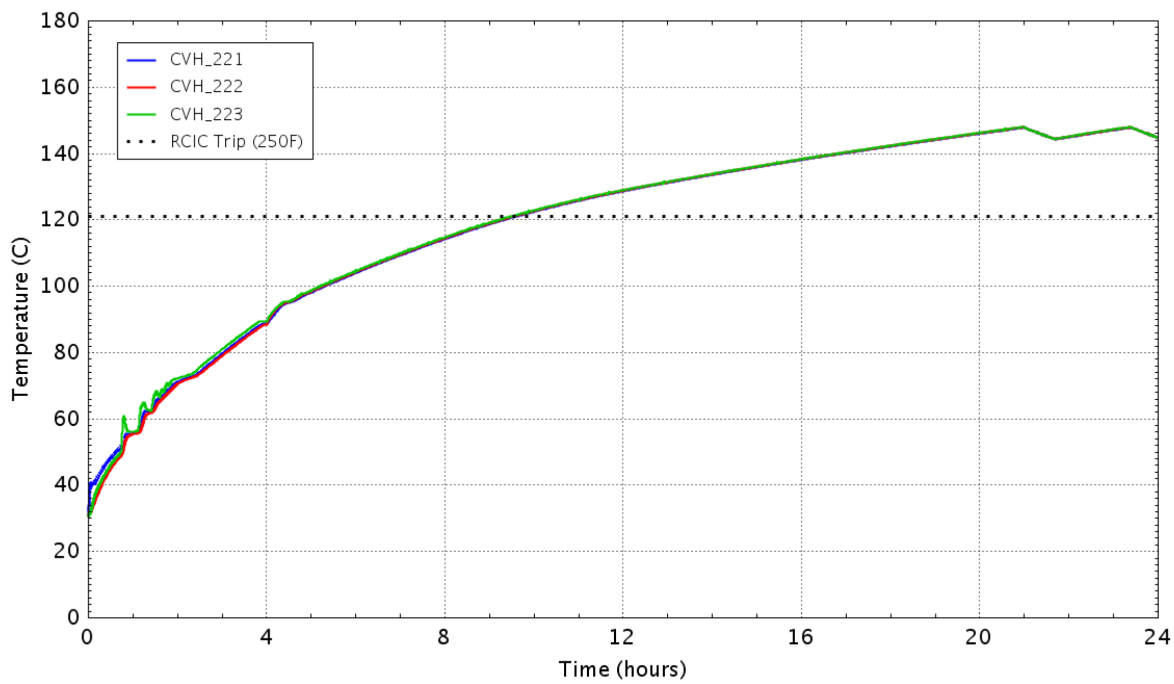

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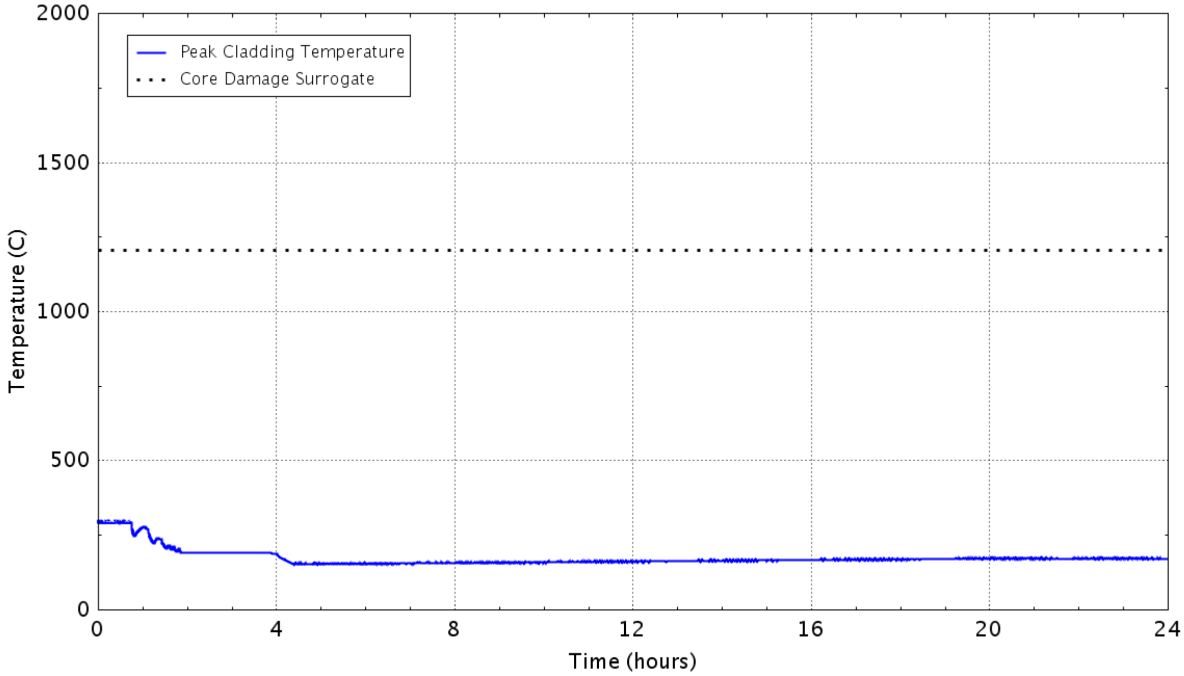

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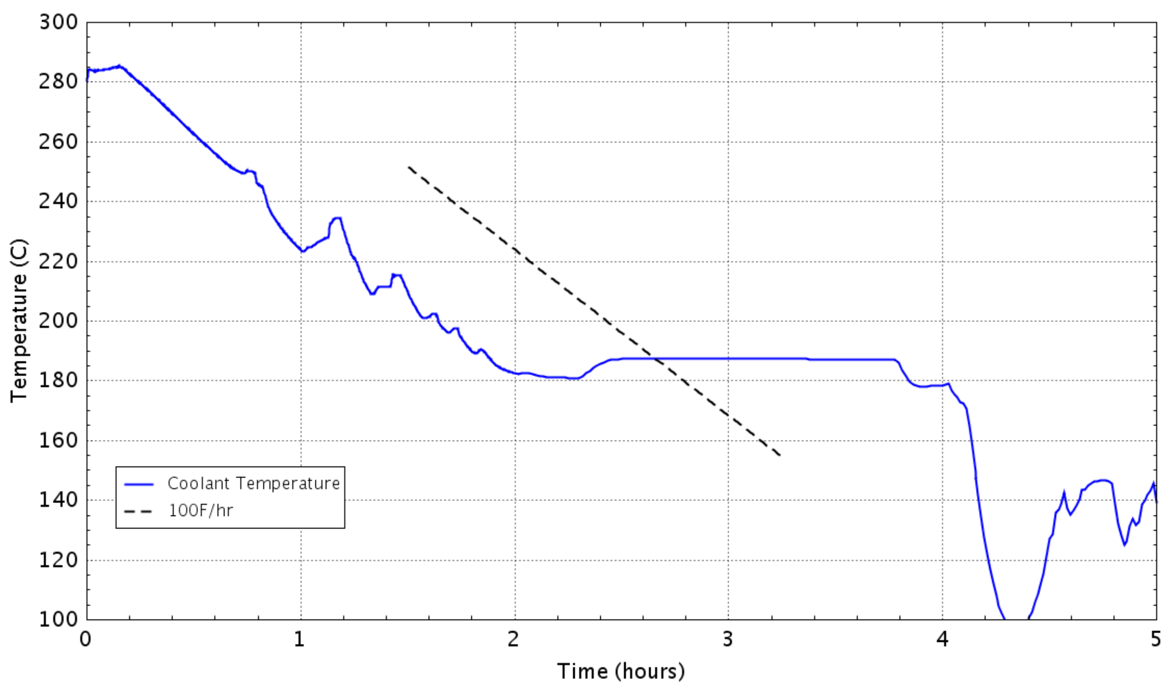

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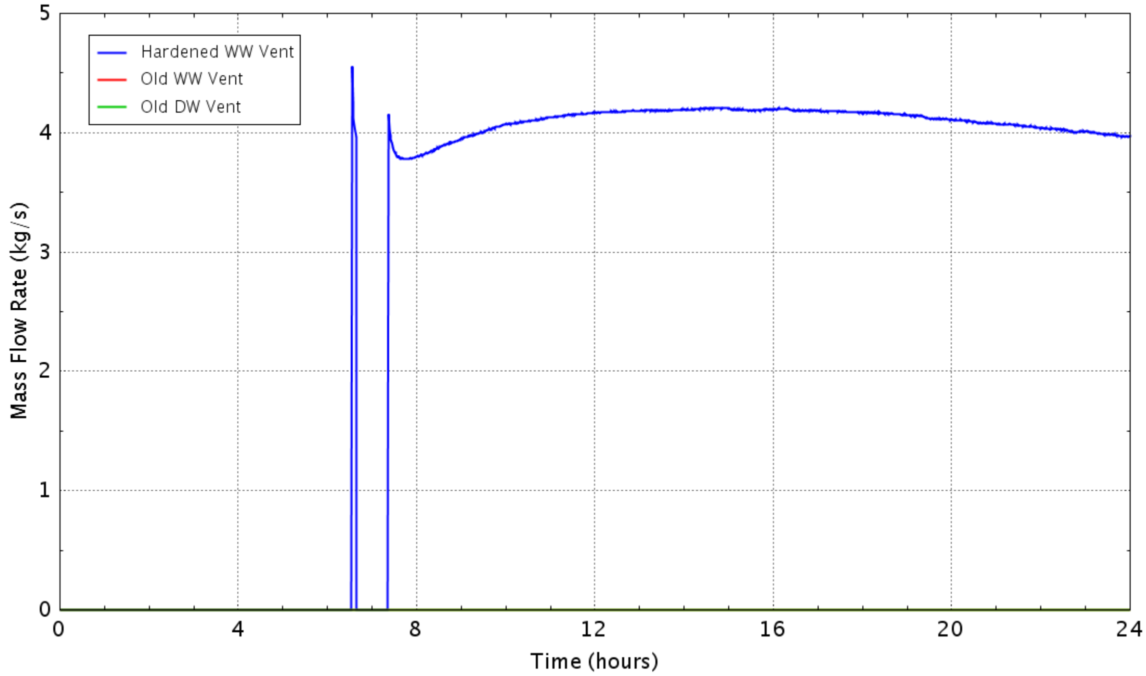

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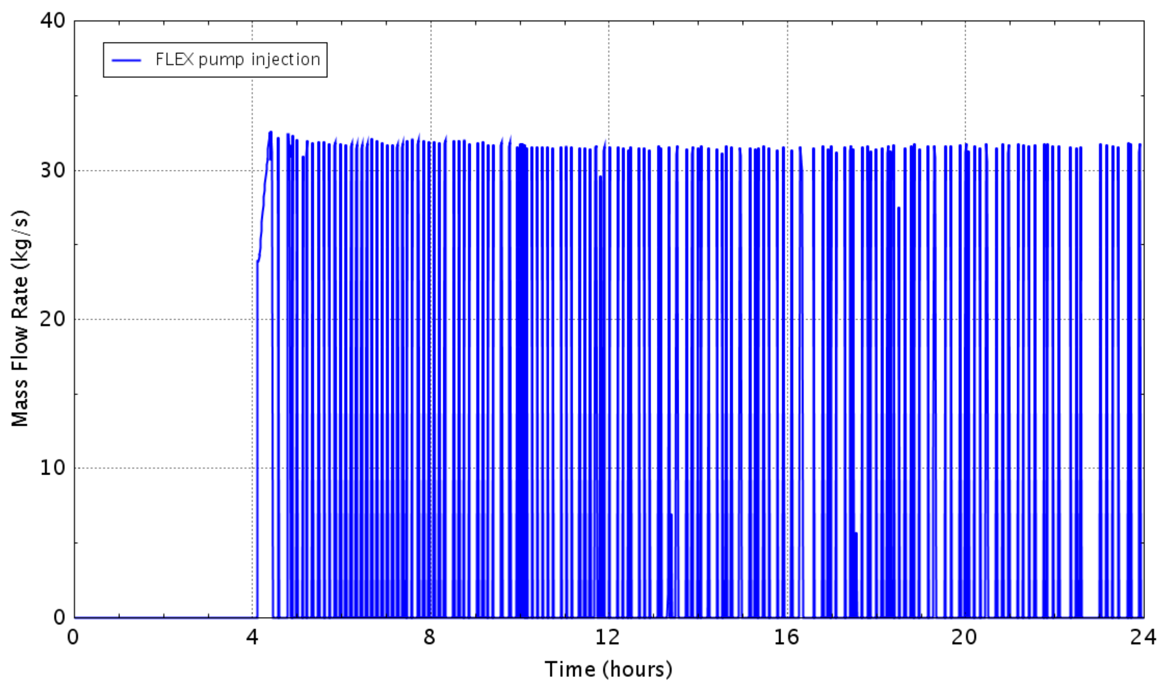

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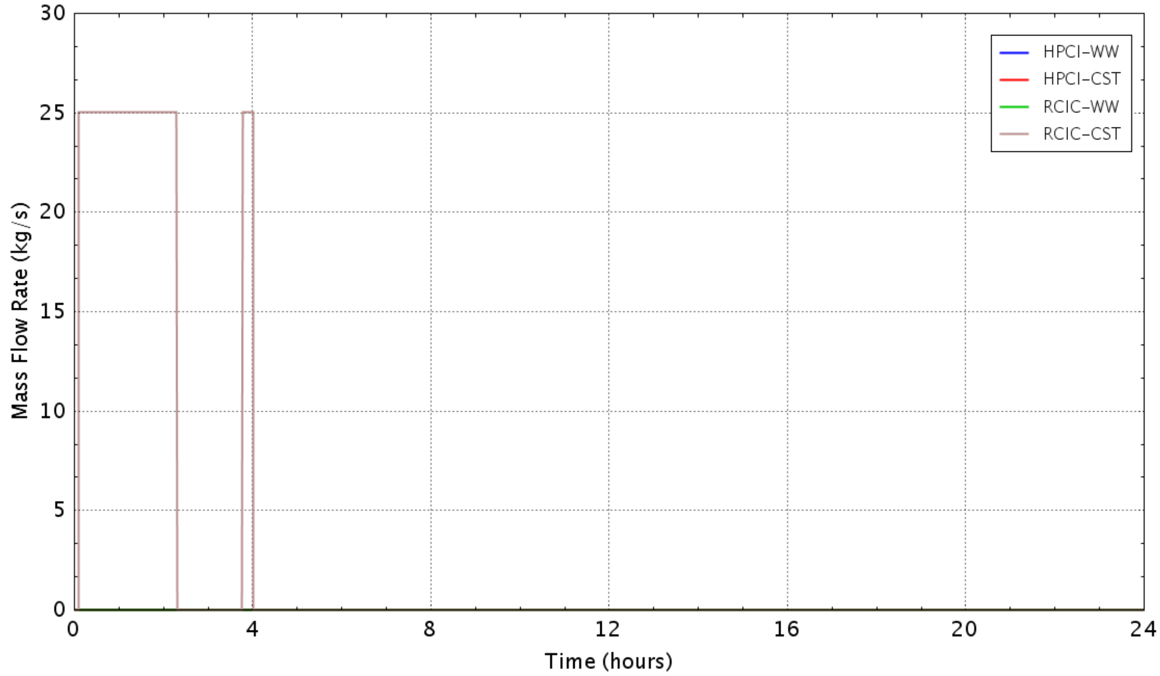

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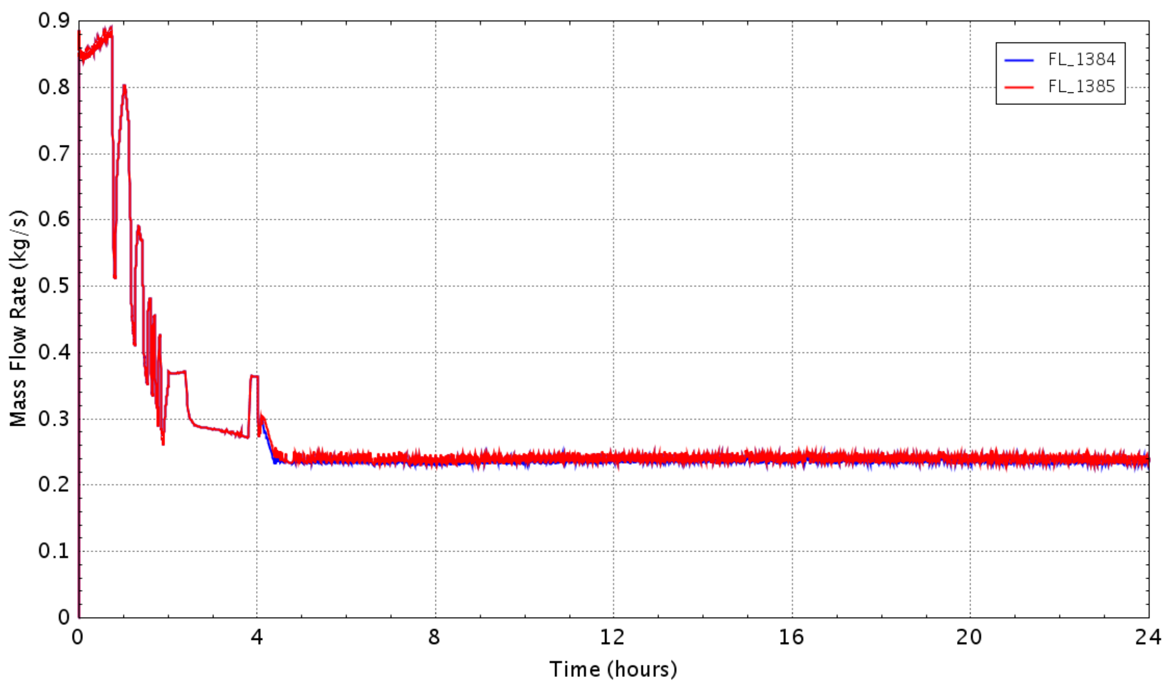

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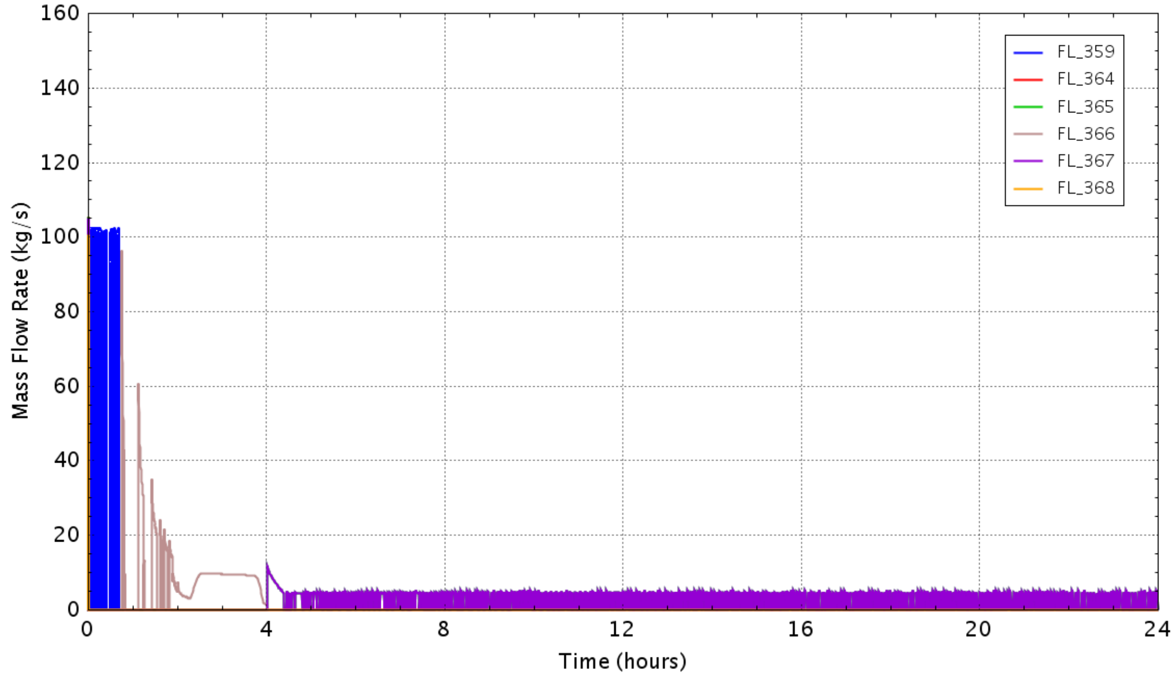

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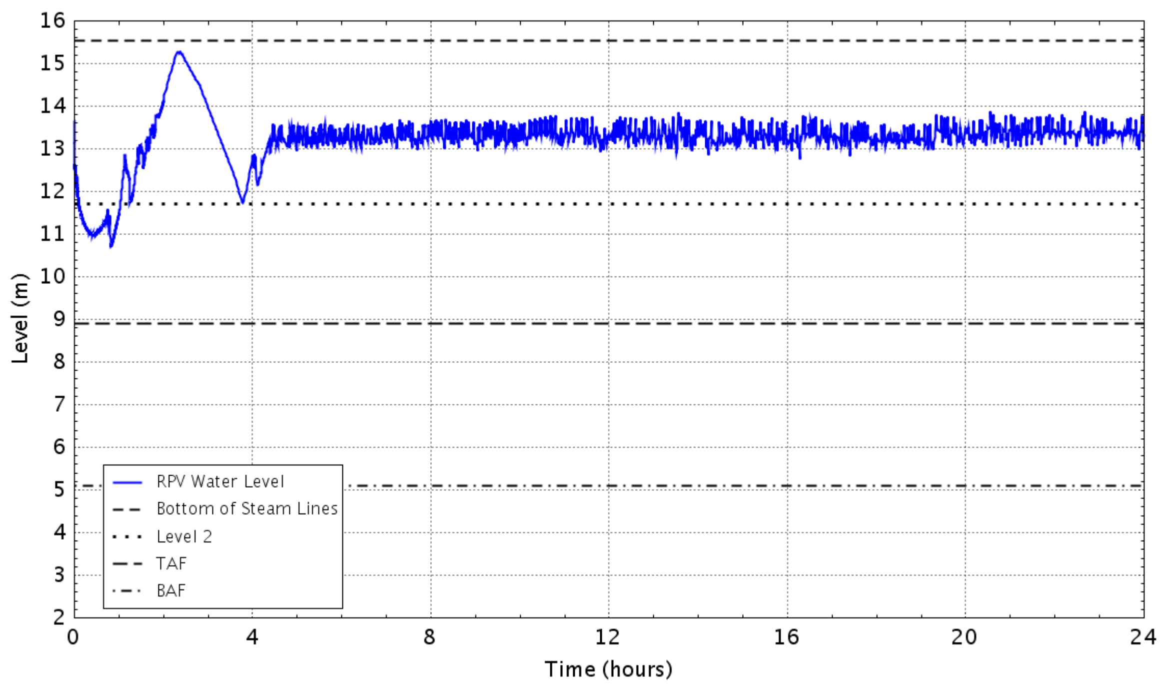

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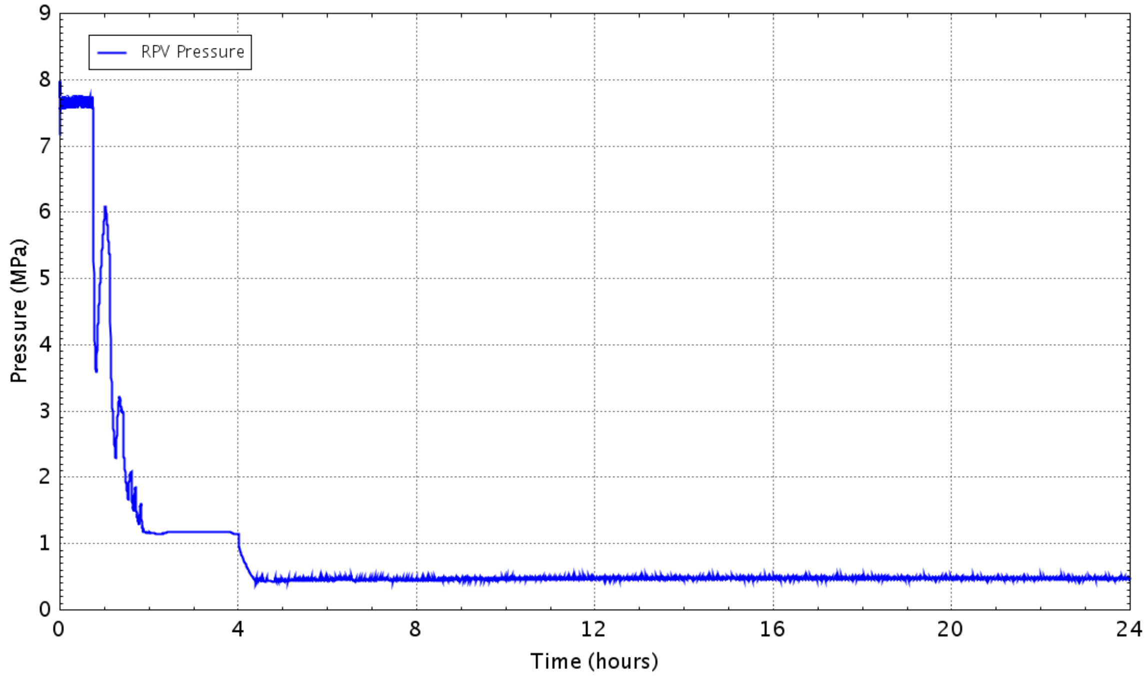

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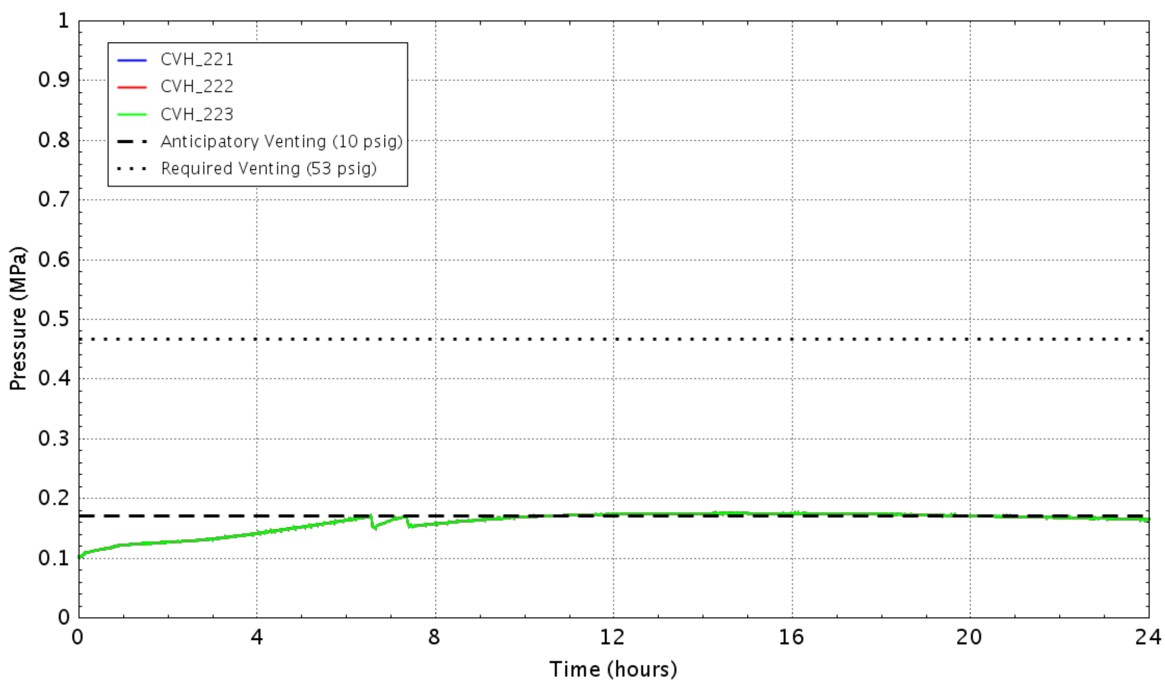

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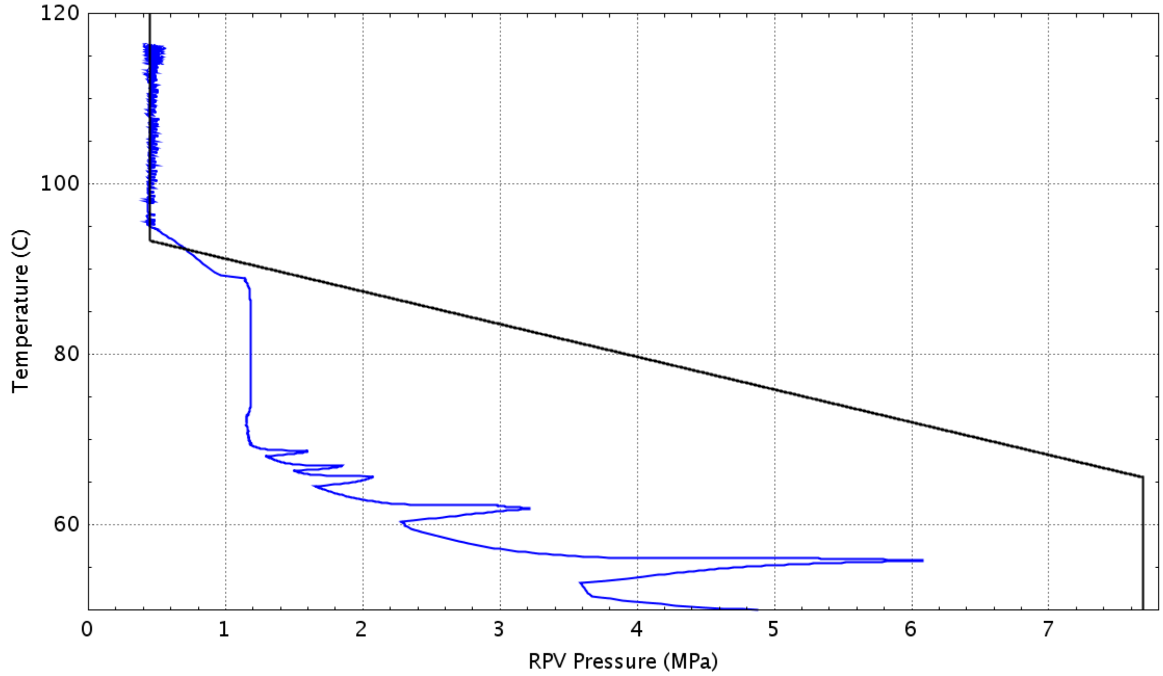

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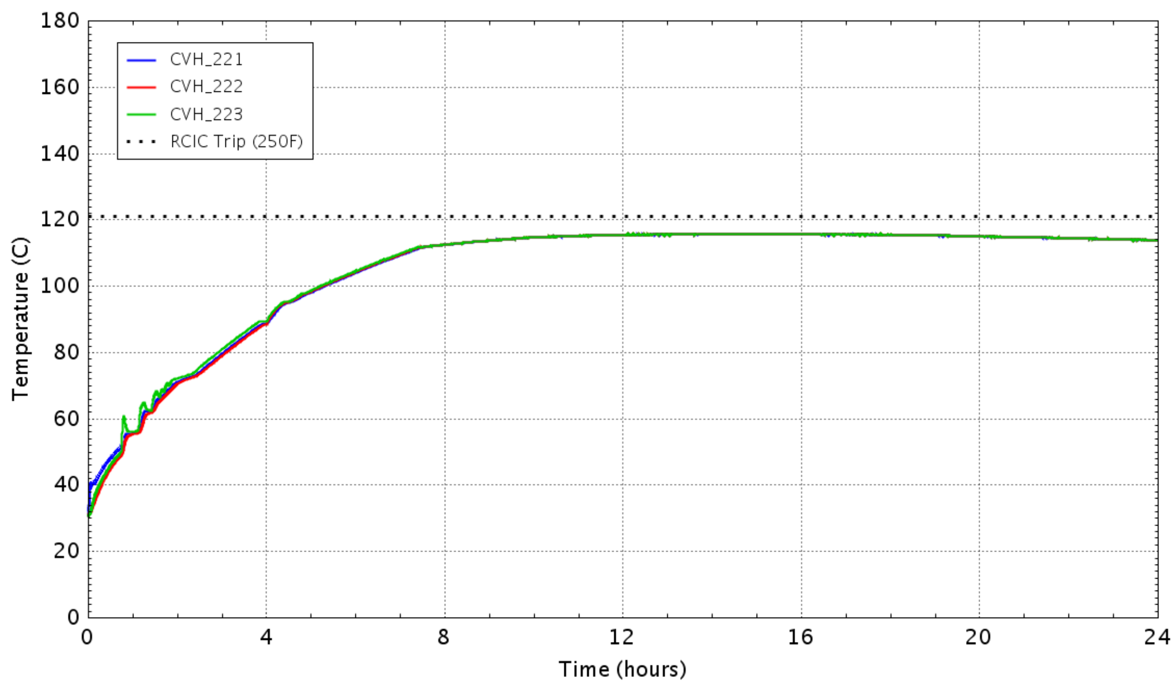

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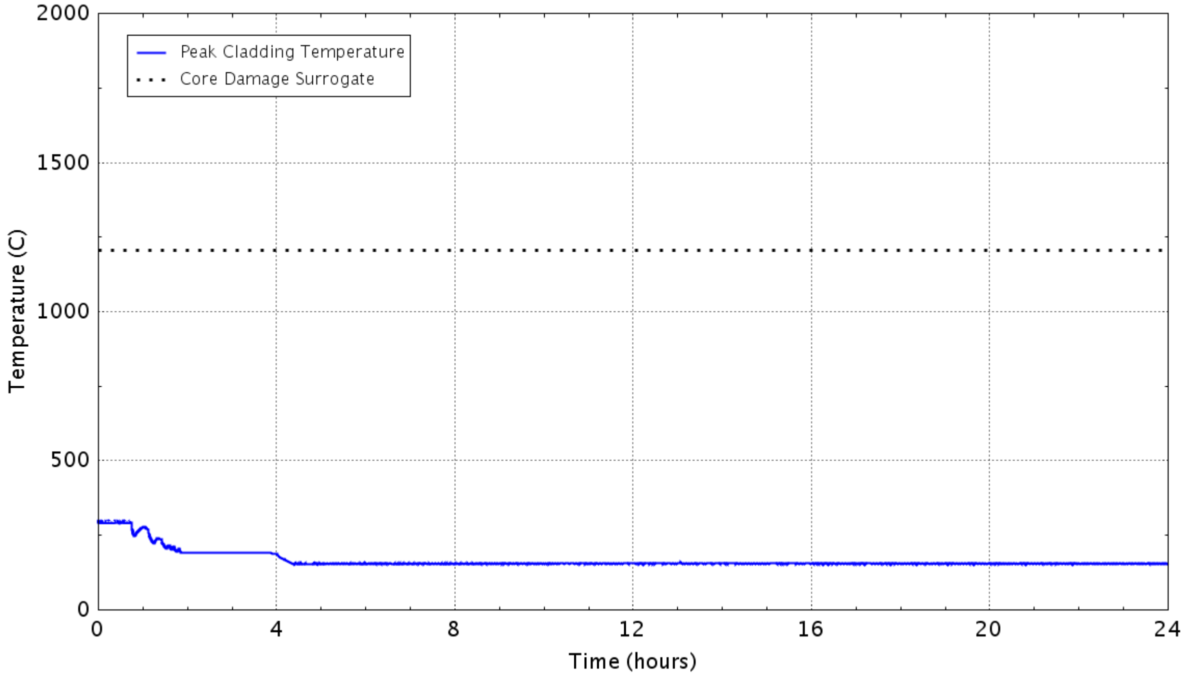

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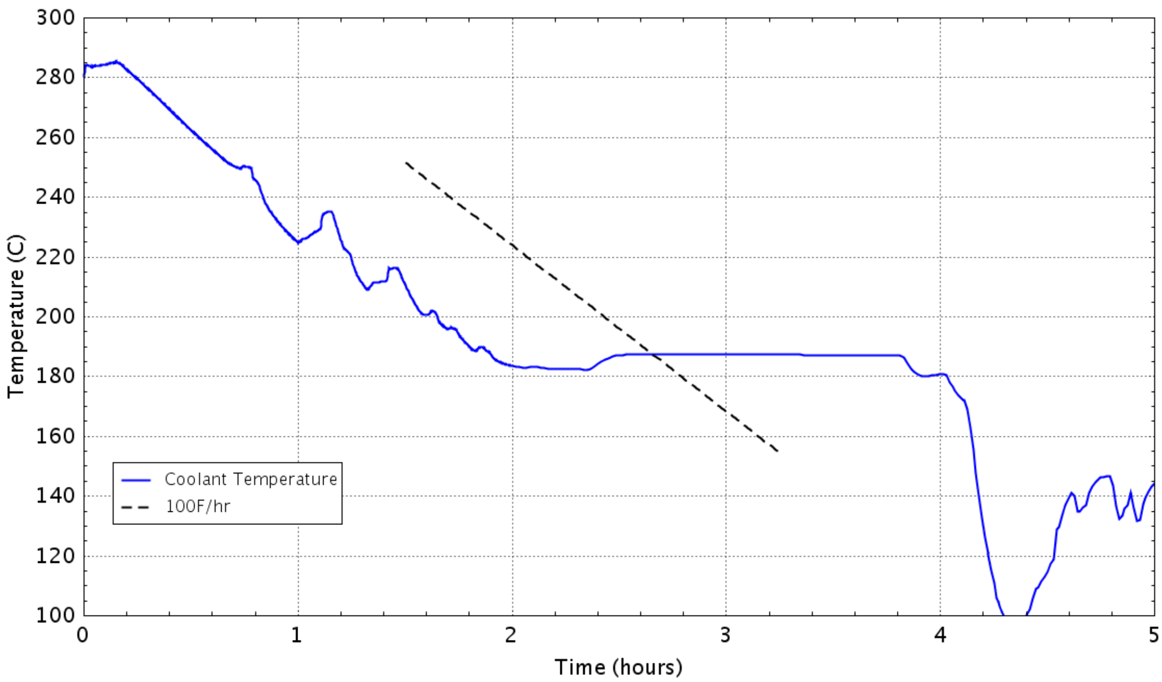

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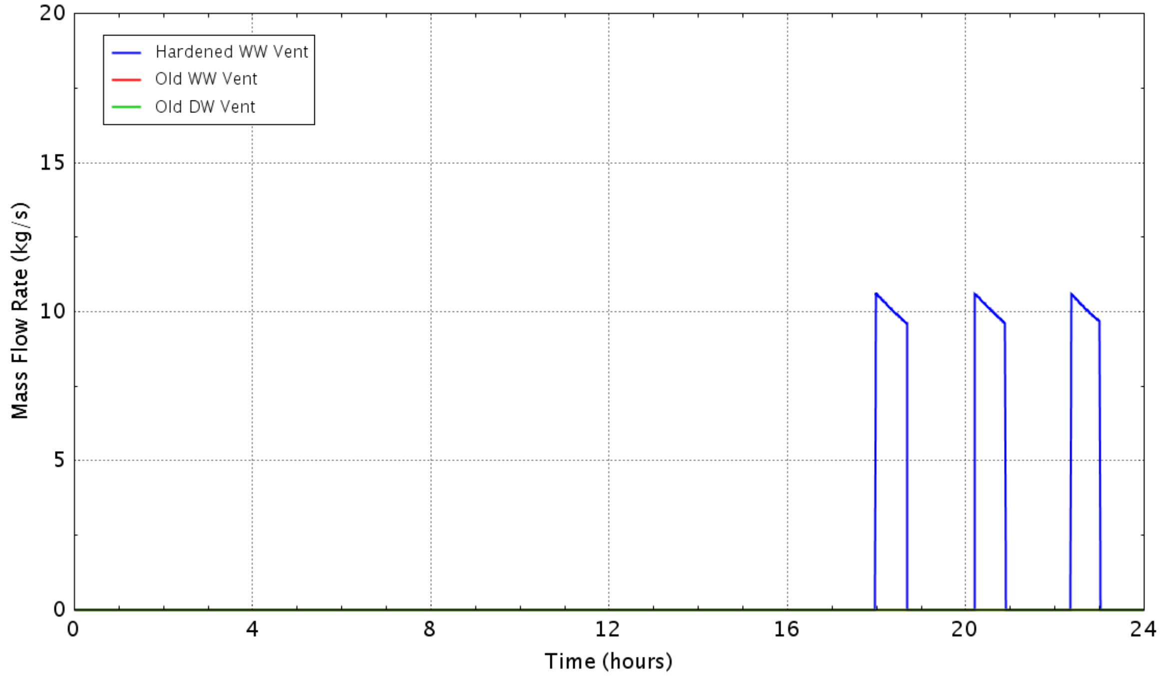

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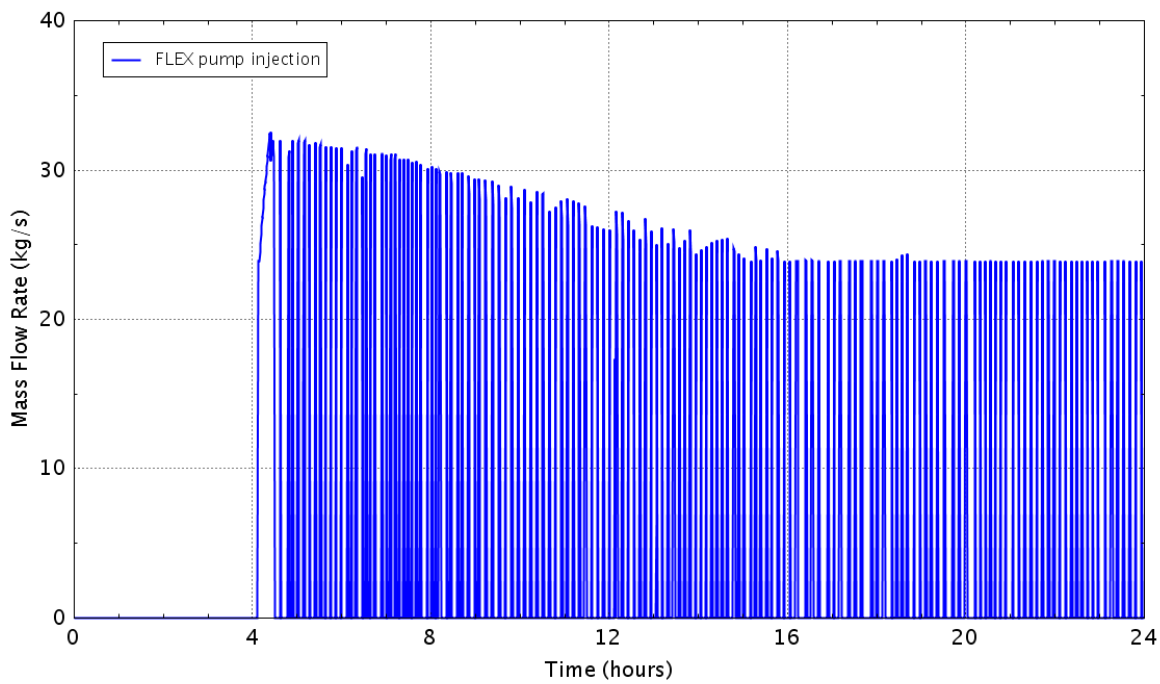

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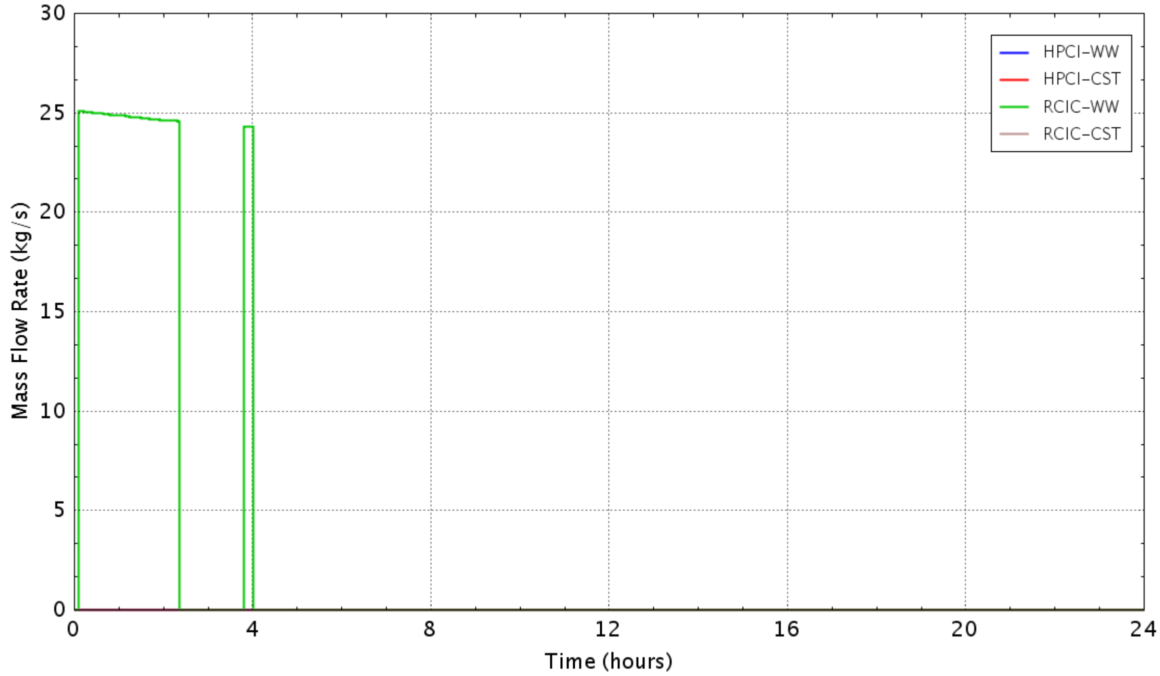

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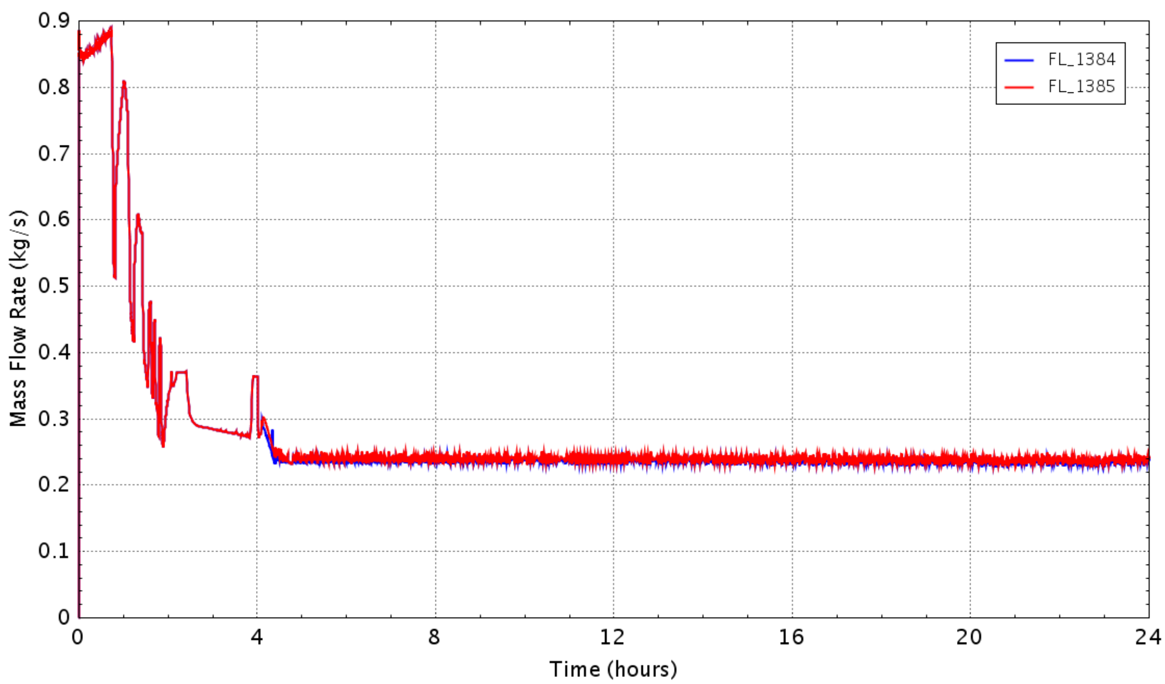

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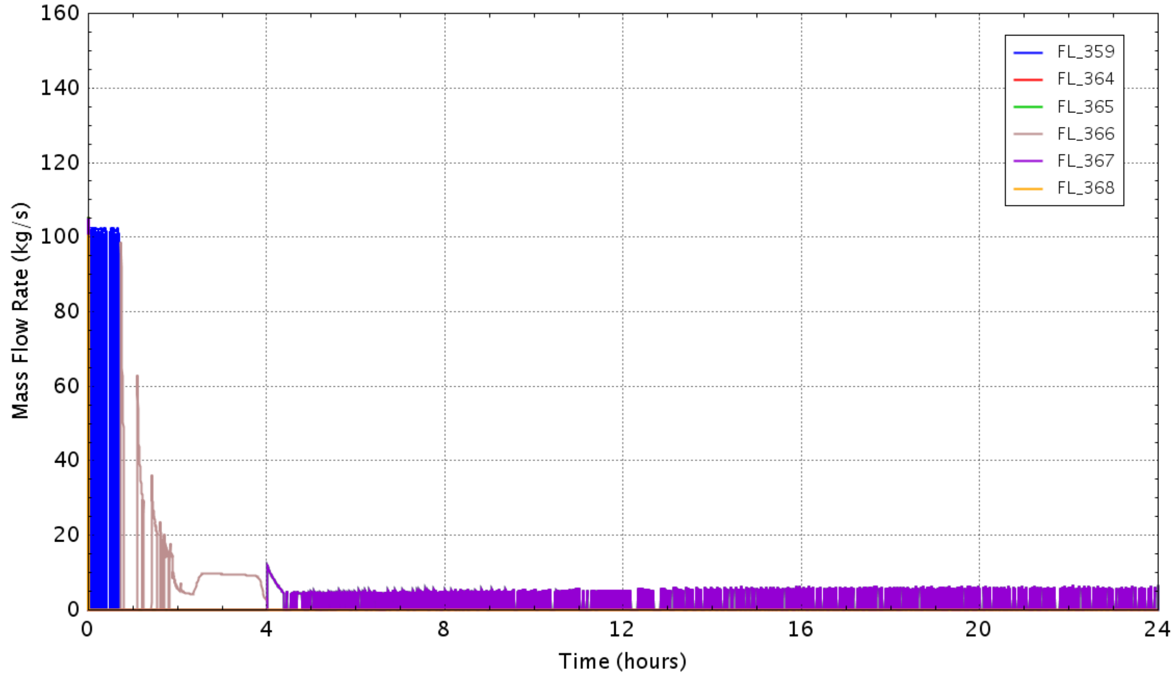

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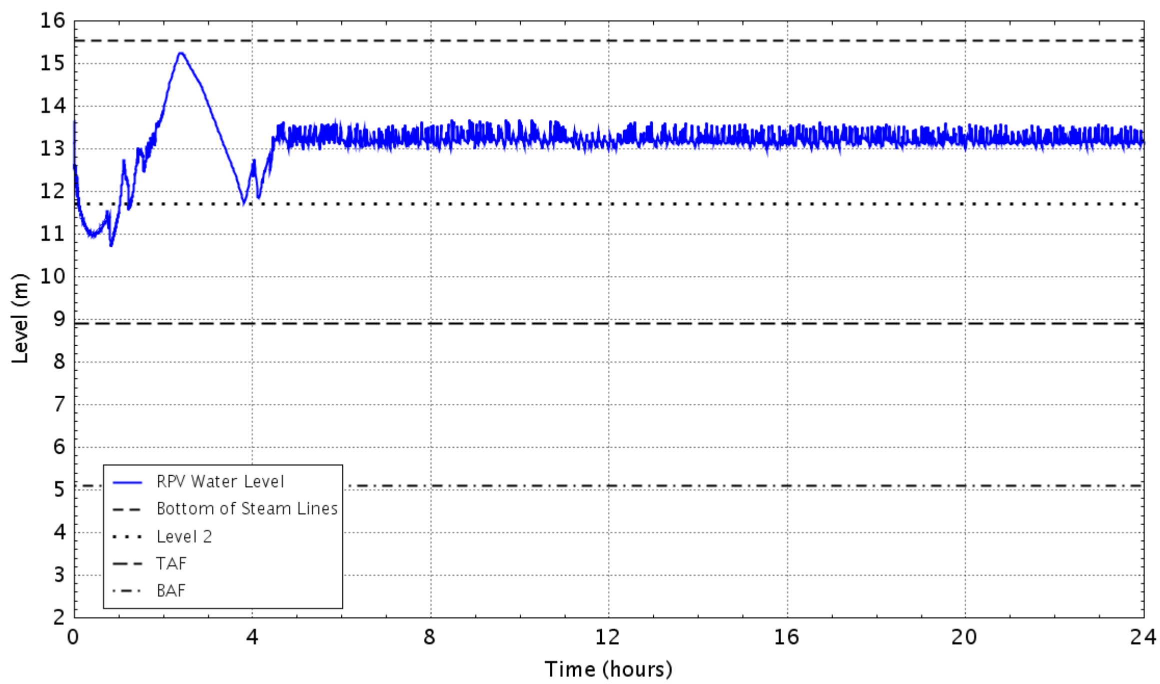

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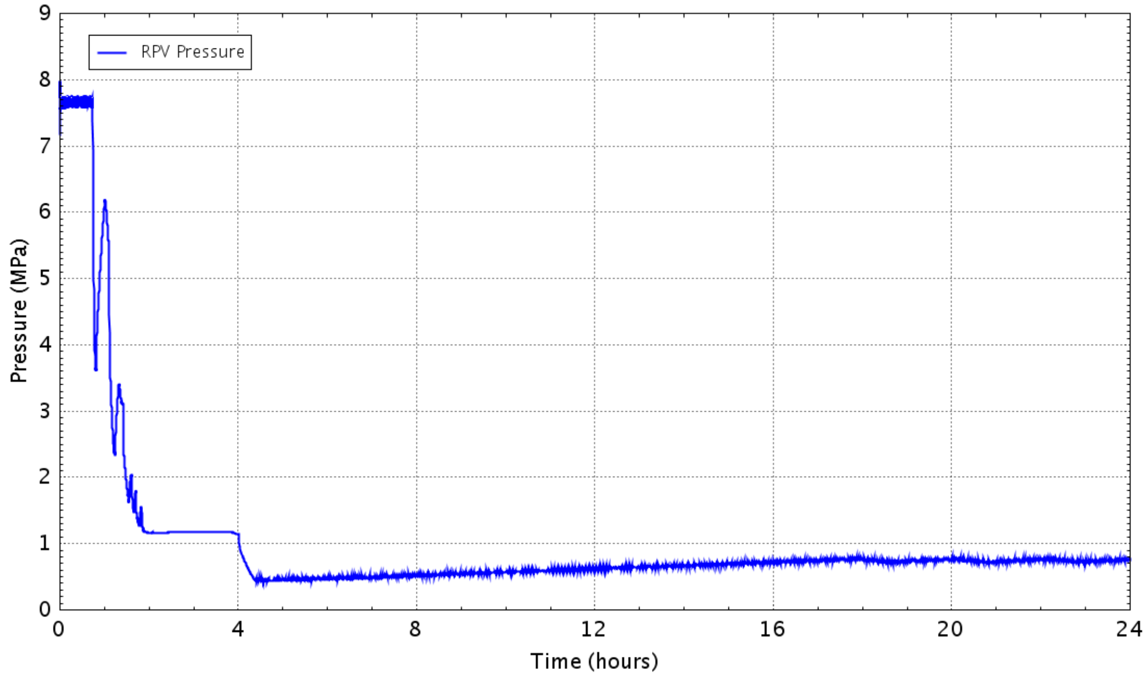

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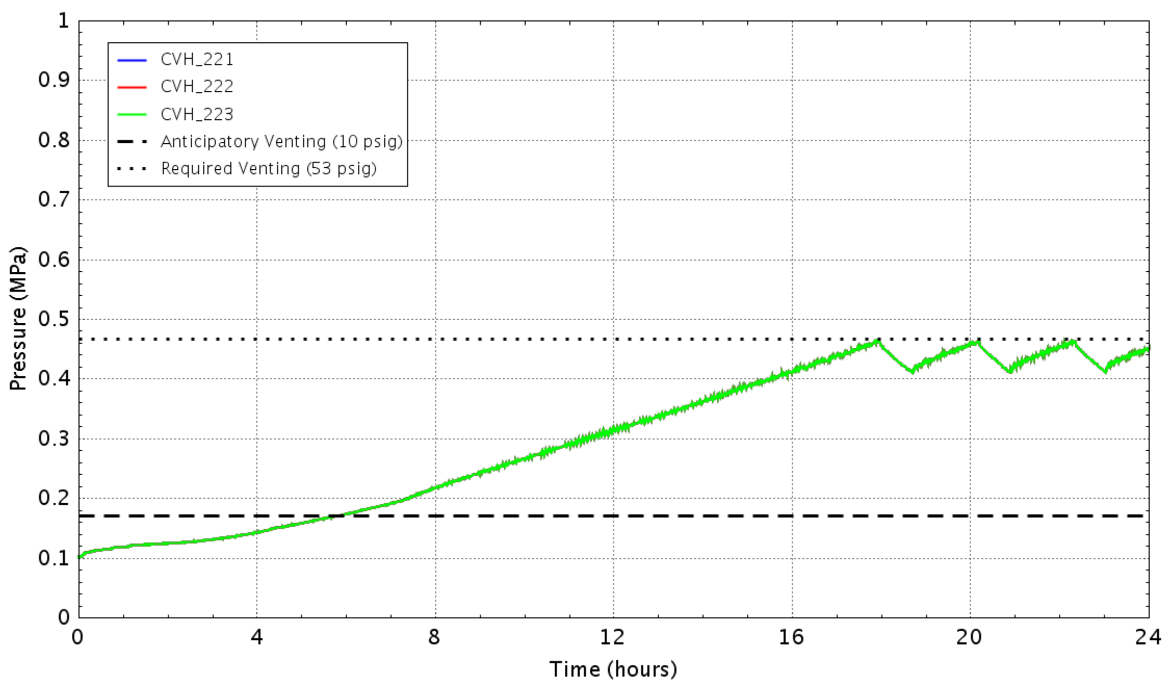

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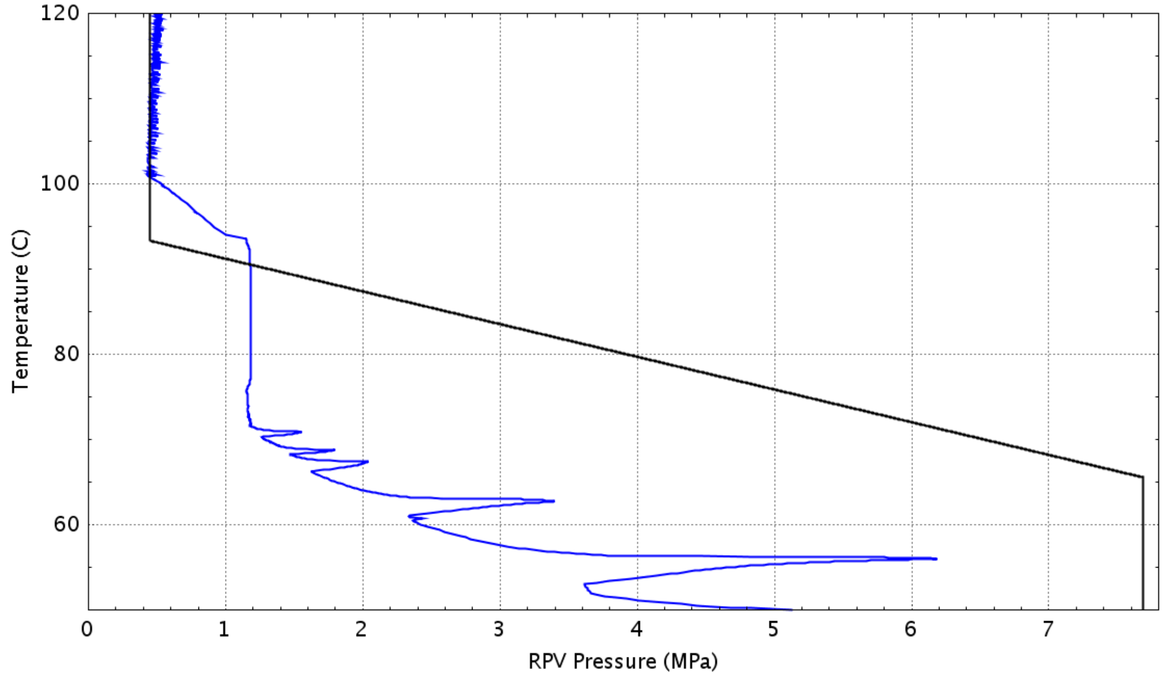

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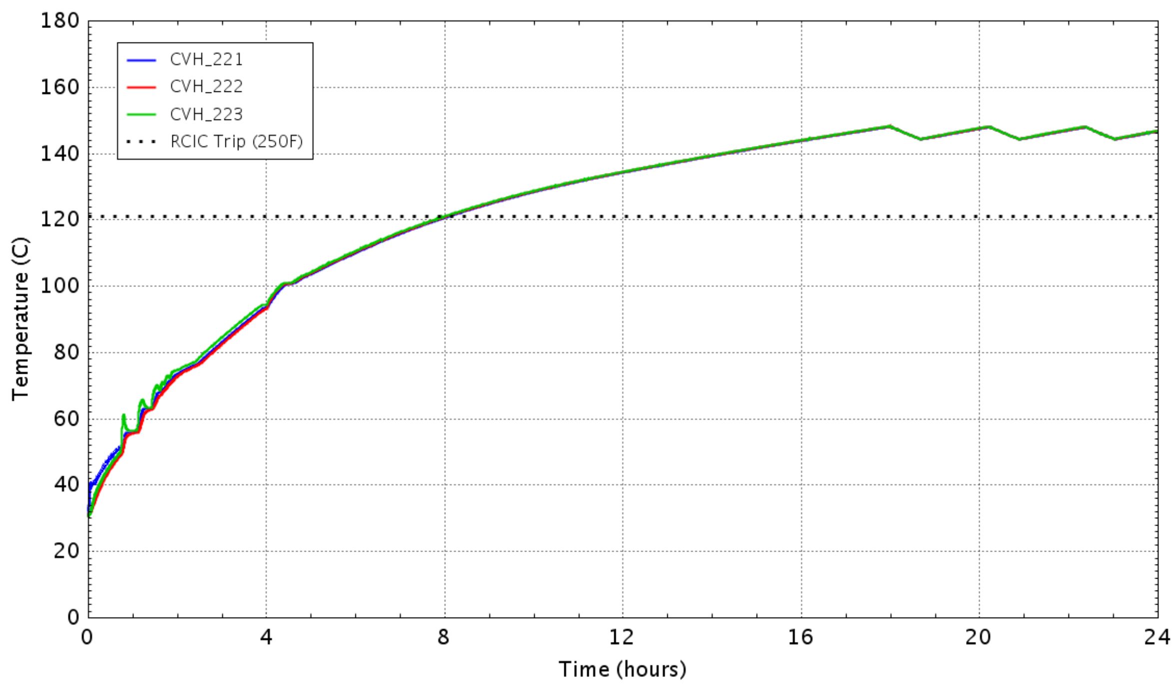

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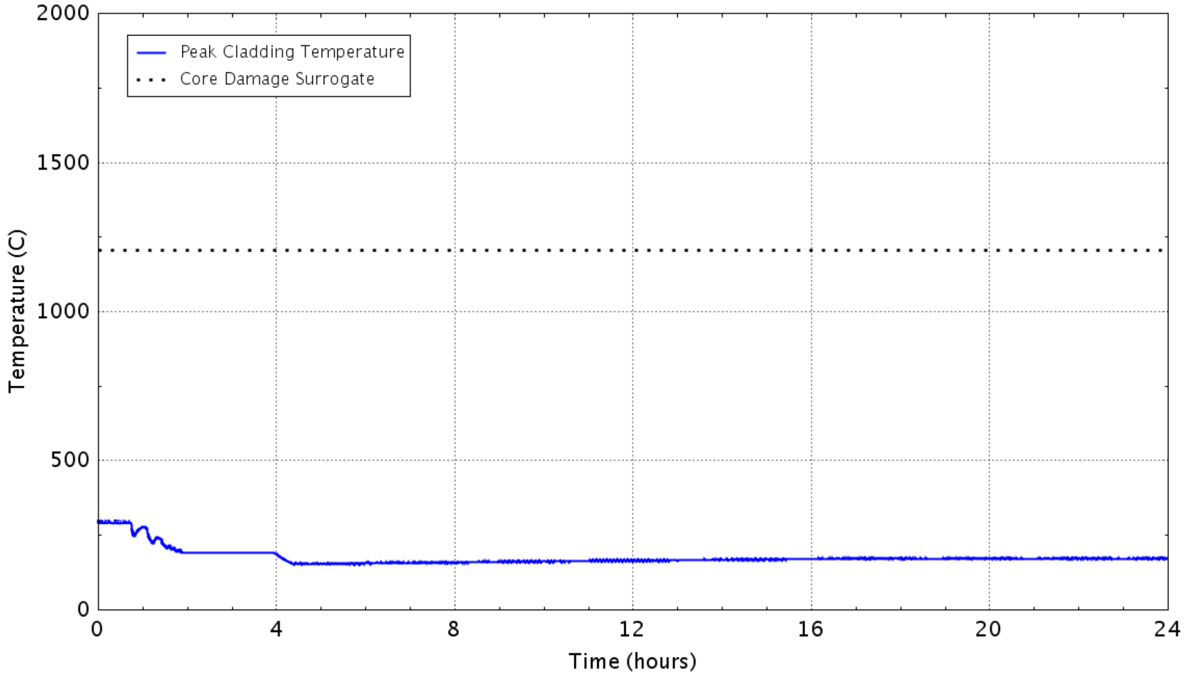

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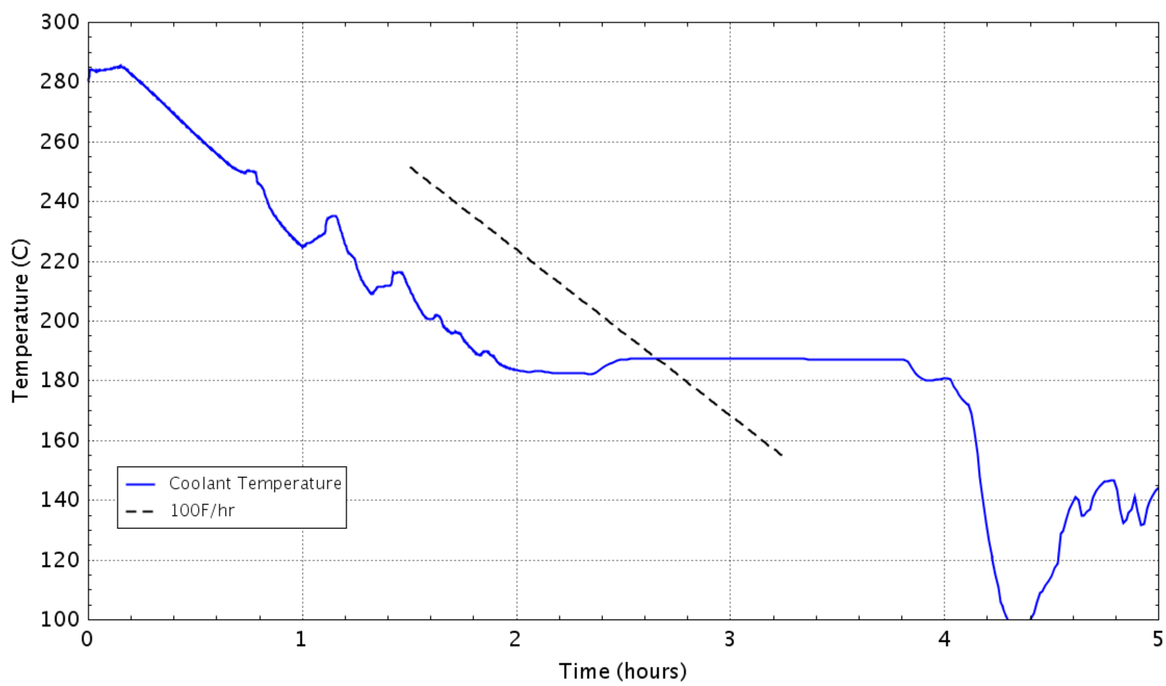

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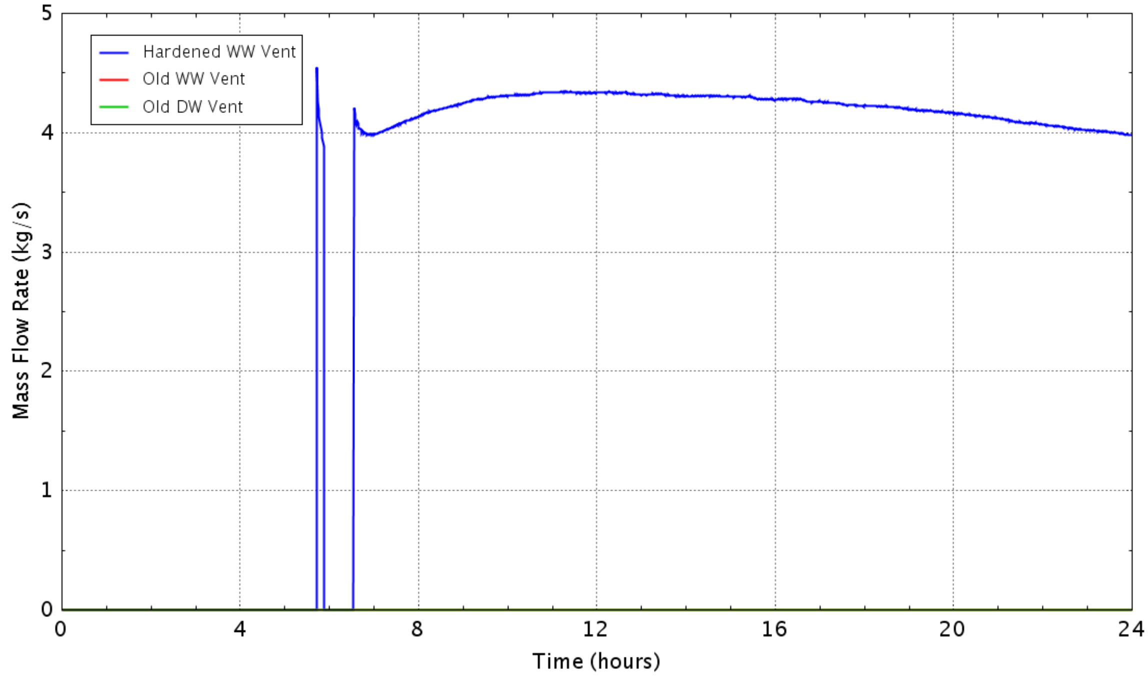

Figure D - 38 Flow rate of the containment vents

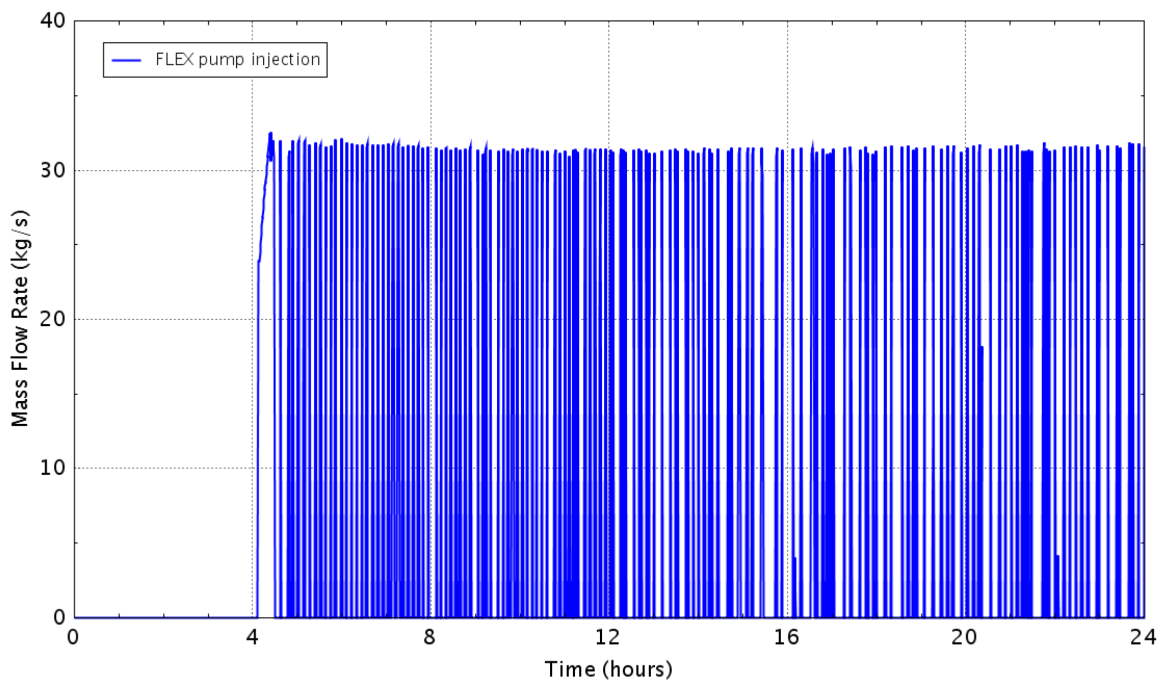

Figure D - 39 Flow rate of the FLEX pump

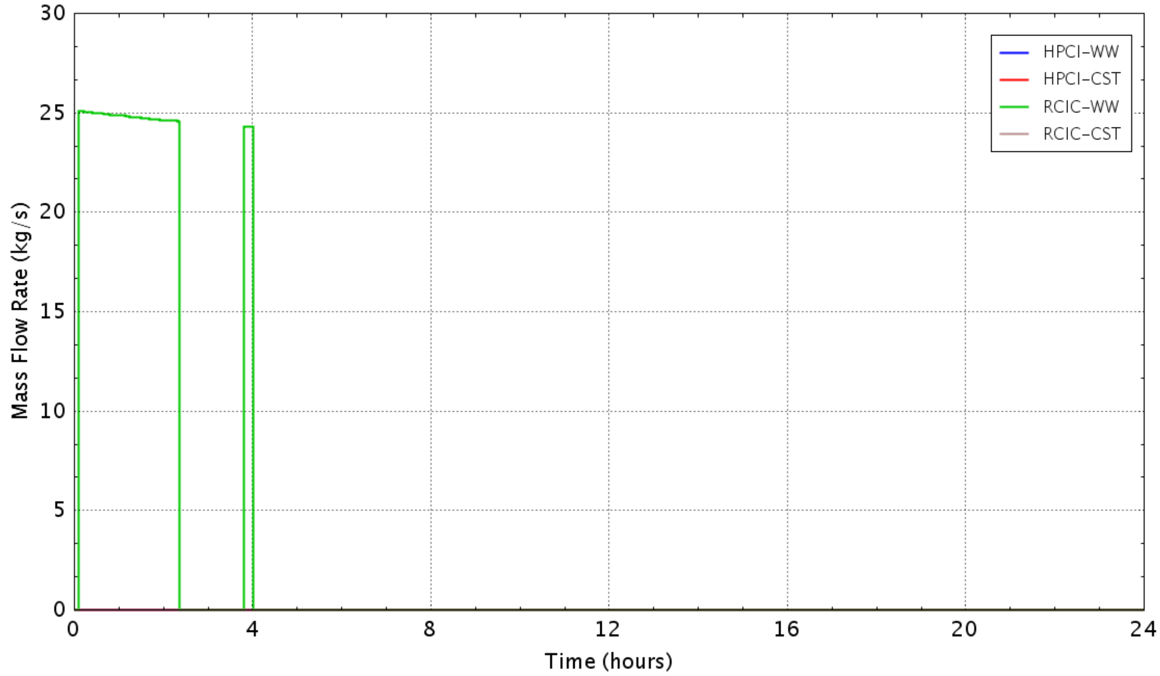

Figure D - 40 Flow rate of the HPCI/RCIC pumps

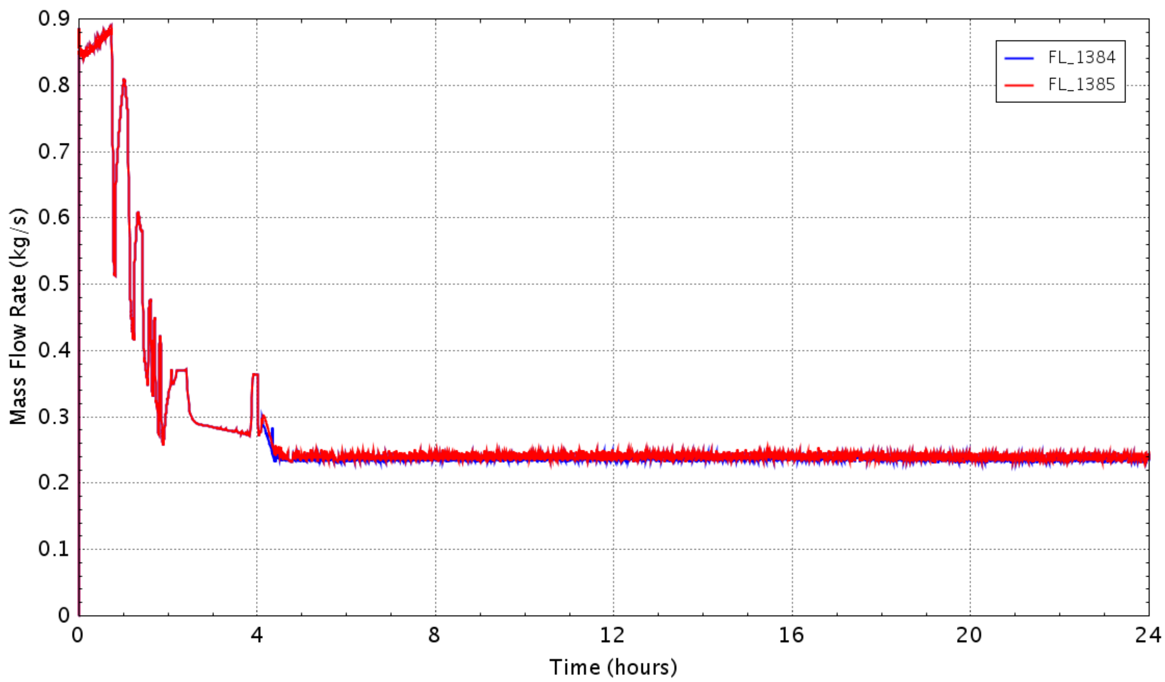

Figure D - 41 Flow rate of the recirculating pump seal leakage

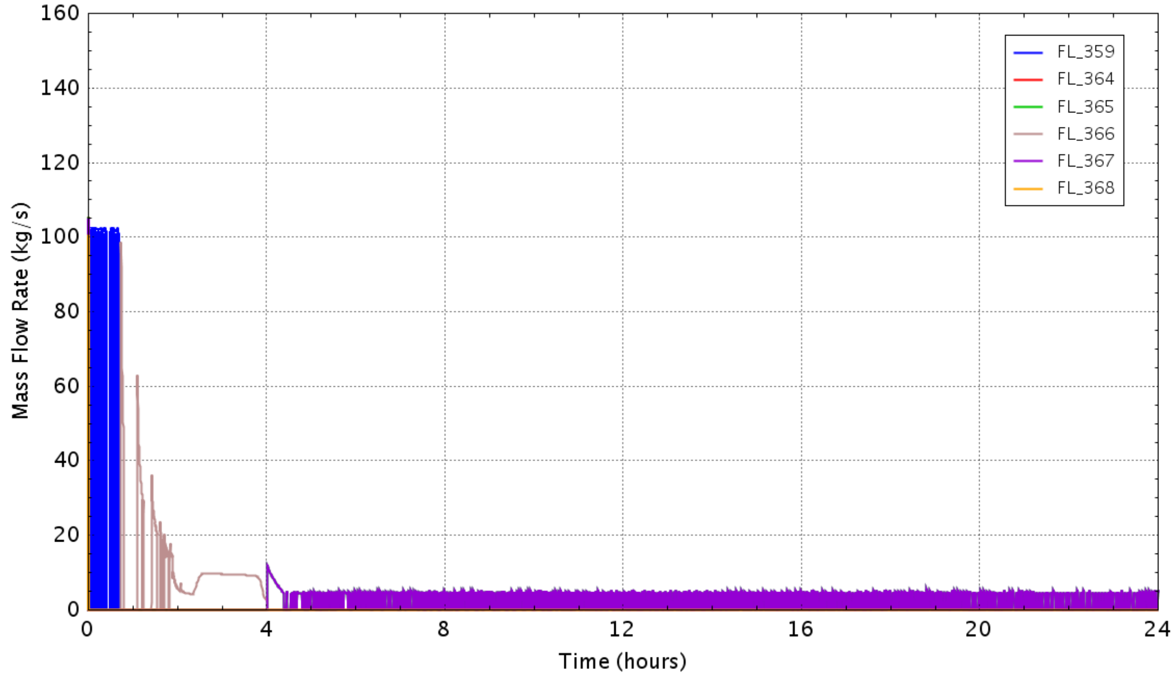

Figure D - 42 Flow rate of the SRVs

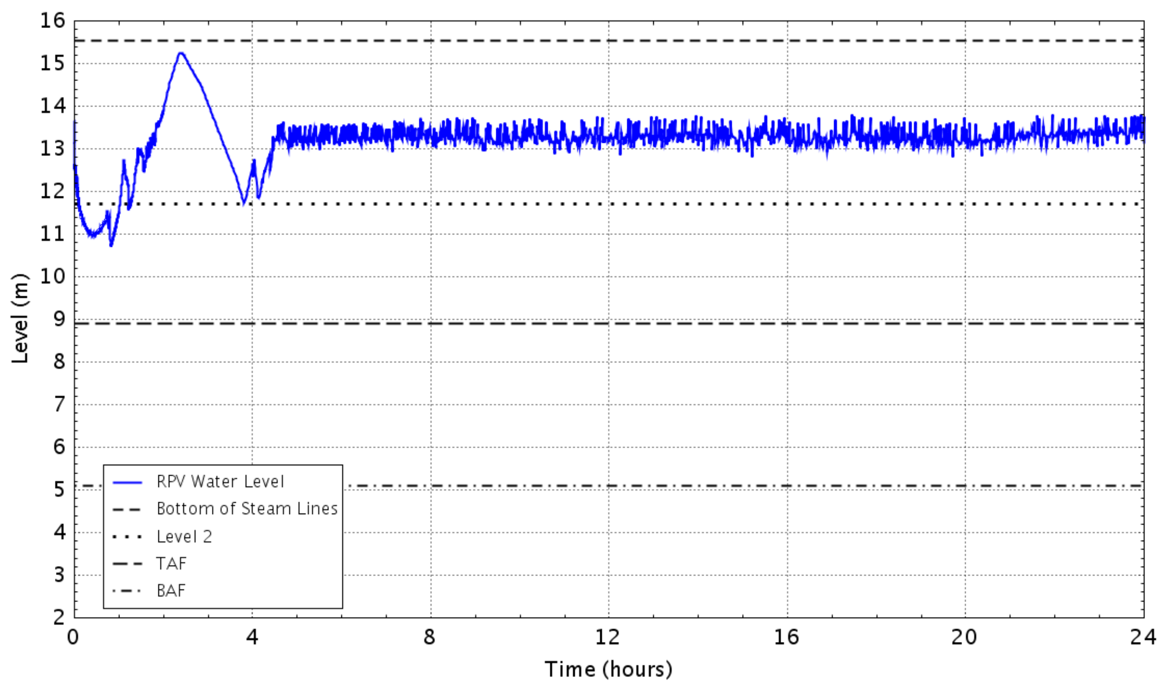

Figure D - 43 RPV down comer water level

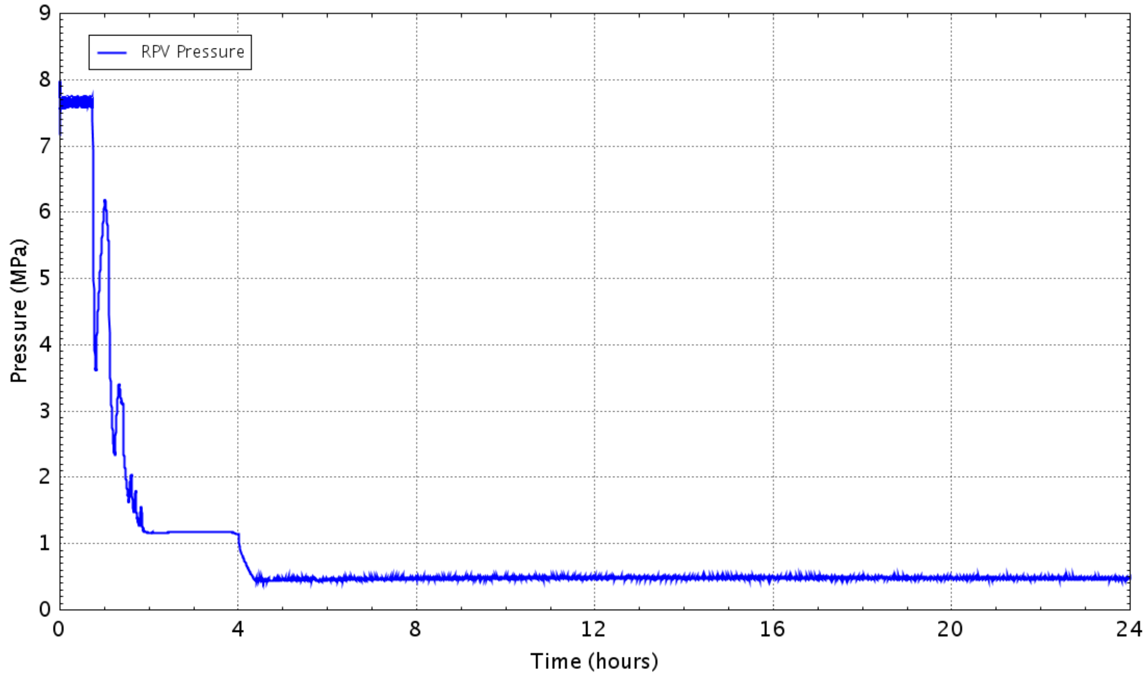

Figure D - 44 Pressure in theRPV

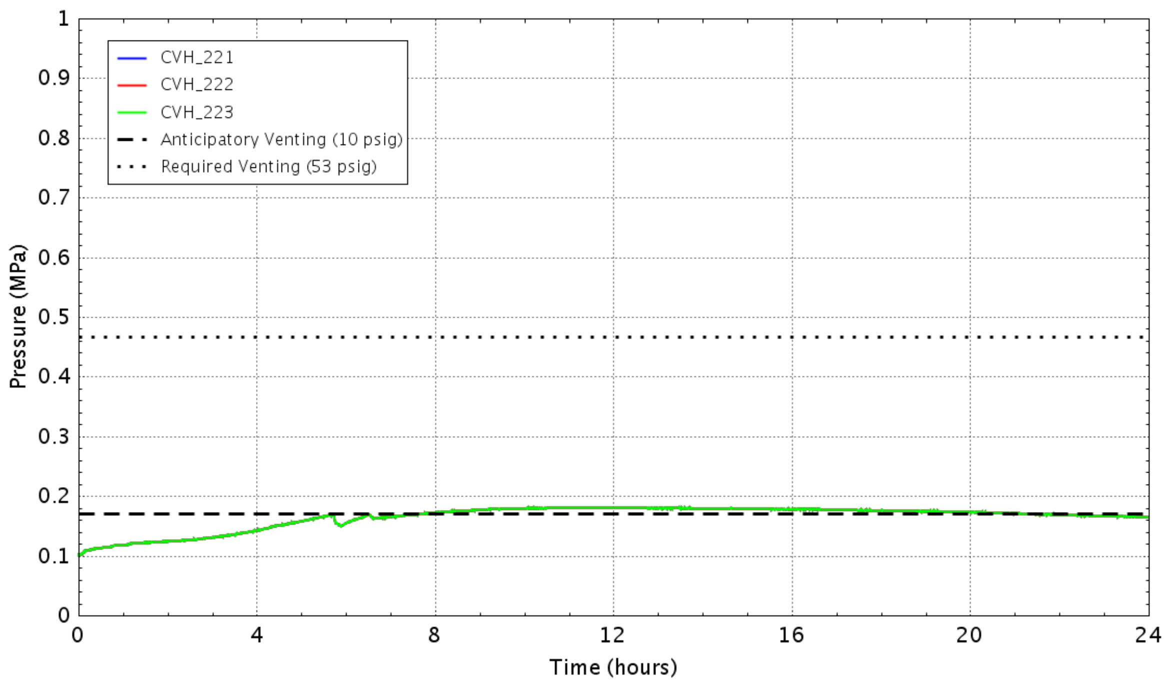

Figure D - 45 Pressure in the wetwell

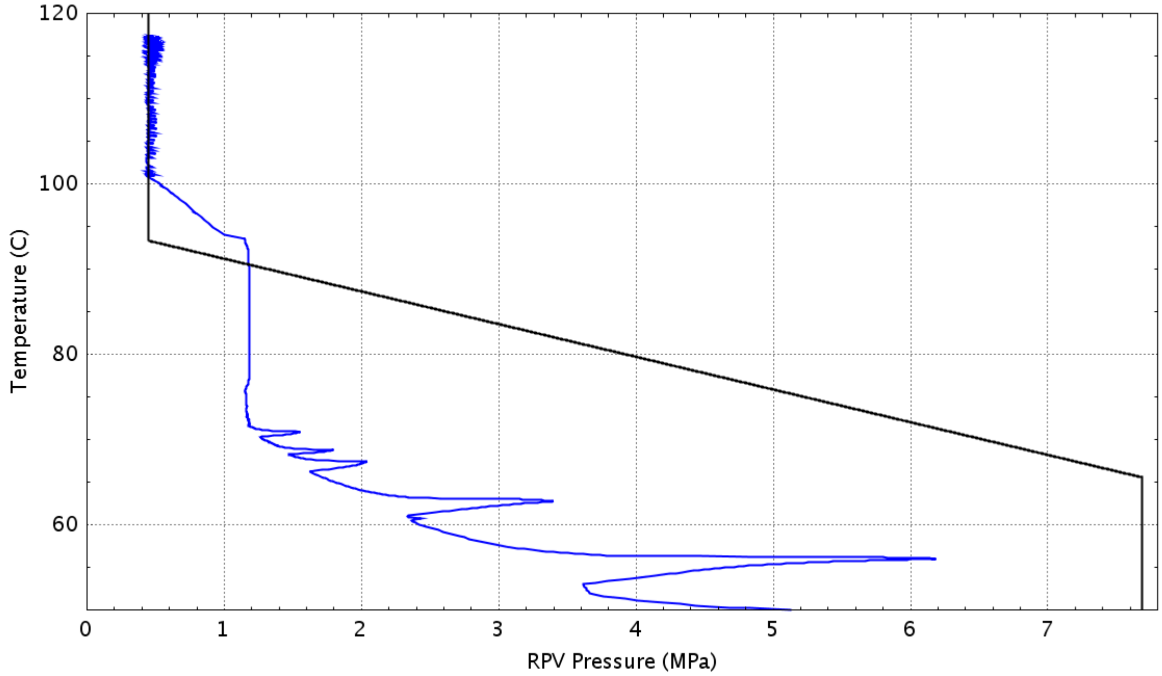

Figure D - 46 Plant status relative to the HCL curve (Graph 4 of the EOPs)

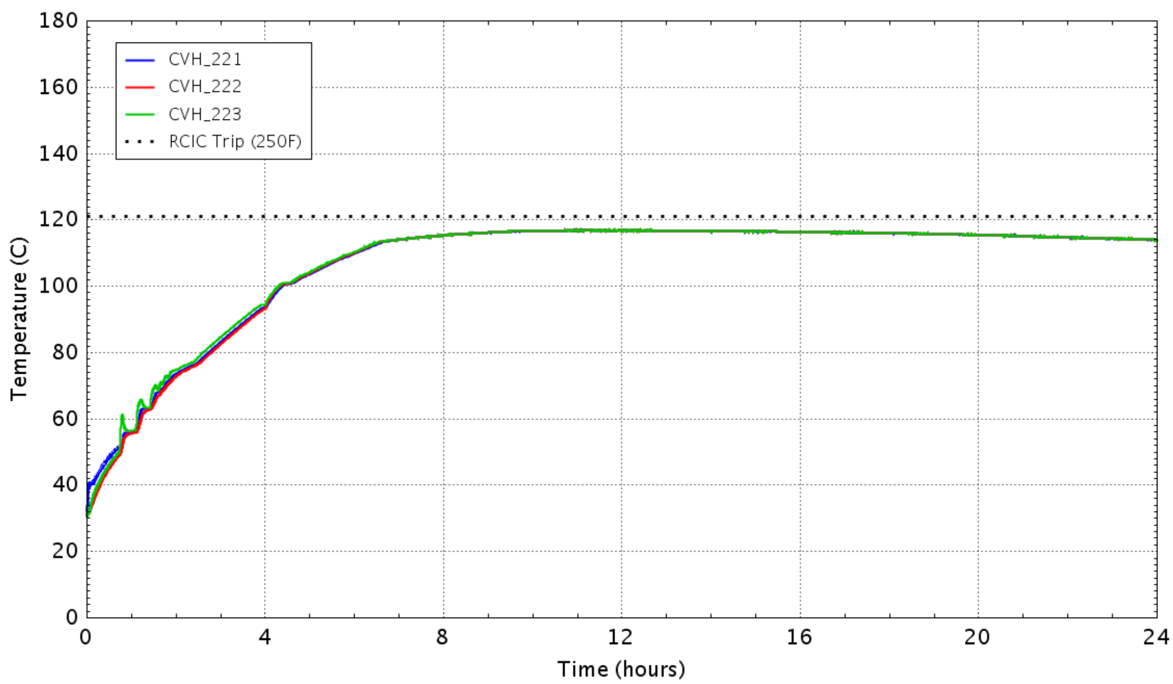

Figure D - 47 Water temperature in the wetwell

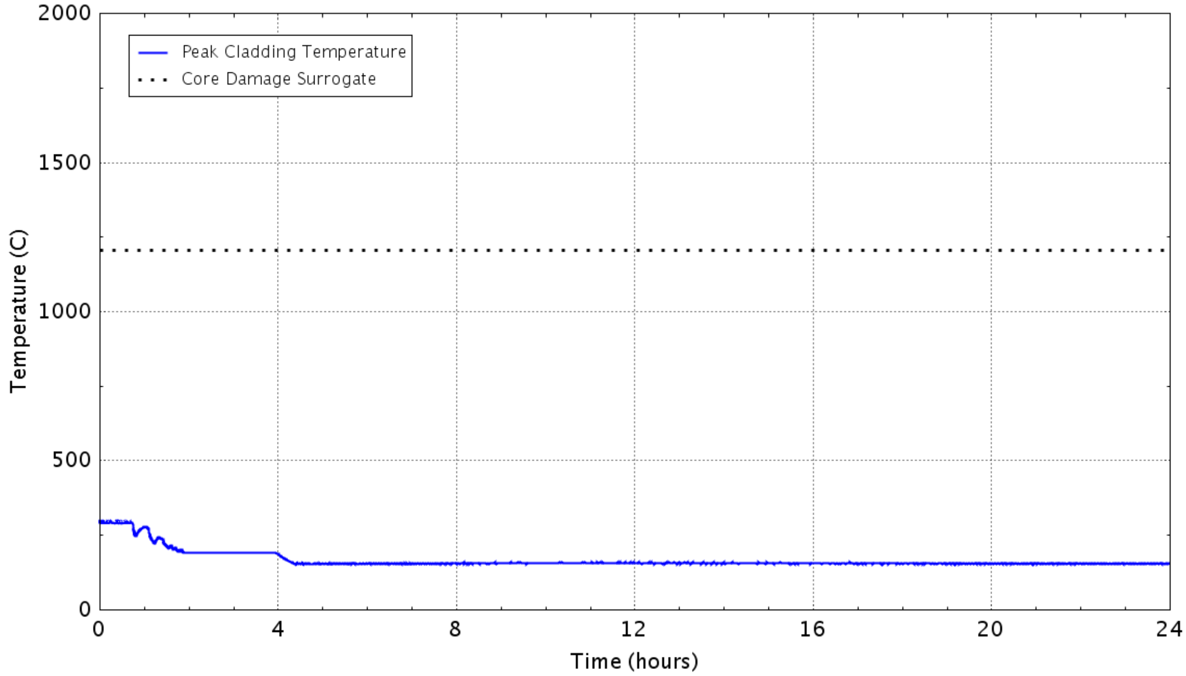

Figure D - 48 Peak temperature of the fuel cladding as a function of time

D.1.5 Case 5: LOOPGR-38-9, AC Loss at t=0, RCIC Loss at 8 hrs., CST Available, Perform Required Venting Only

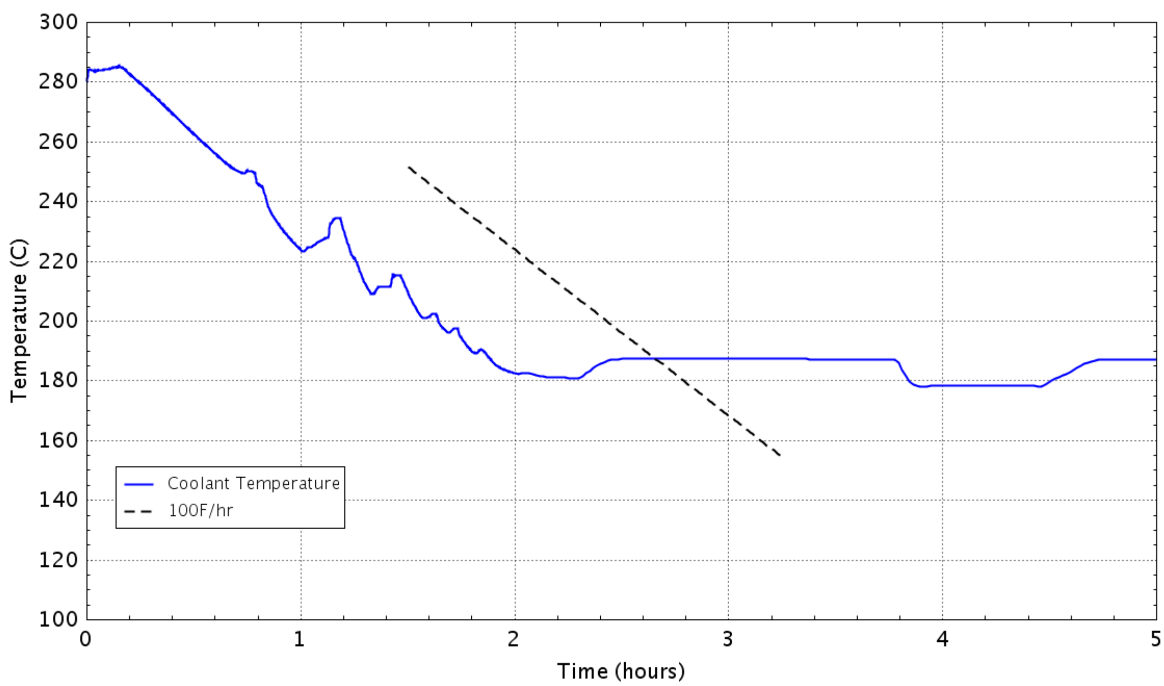

Figure D - 49 RPV cooldown rate

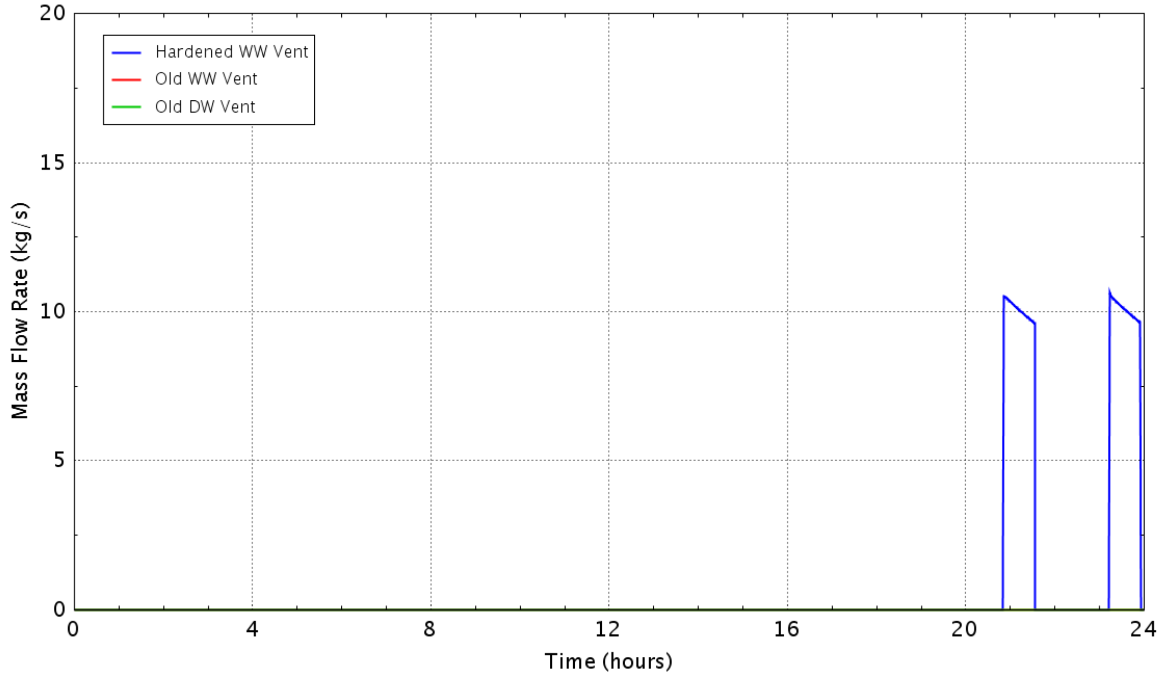

Figure D - 50 Flow rate of the containment vents

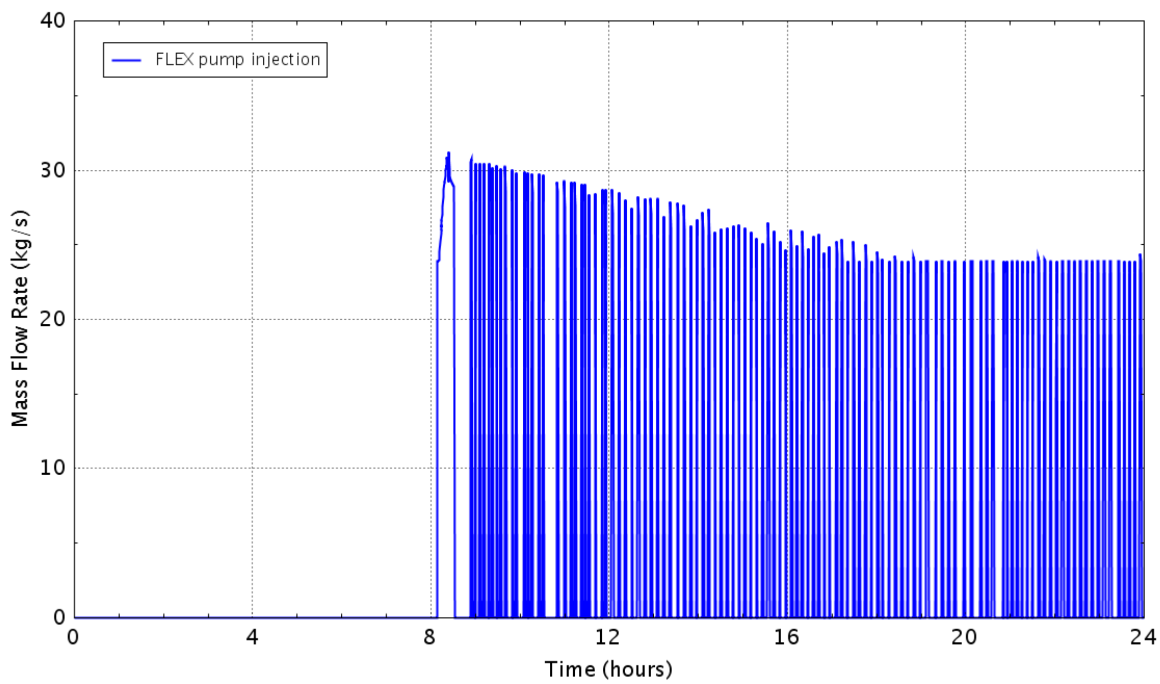

Figure D - 51 Flow rate of the FLEXpump

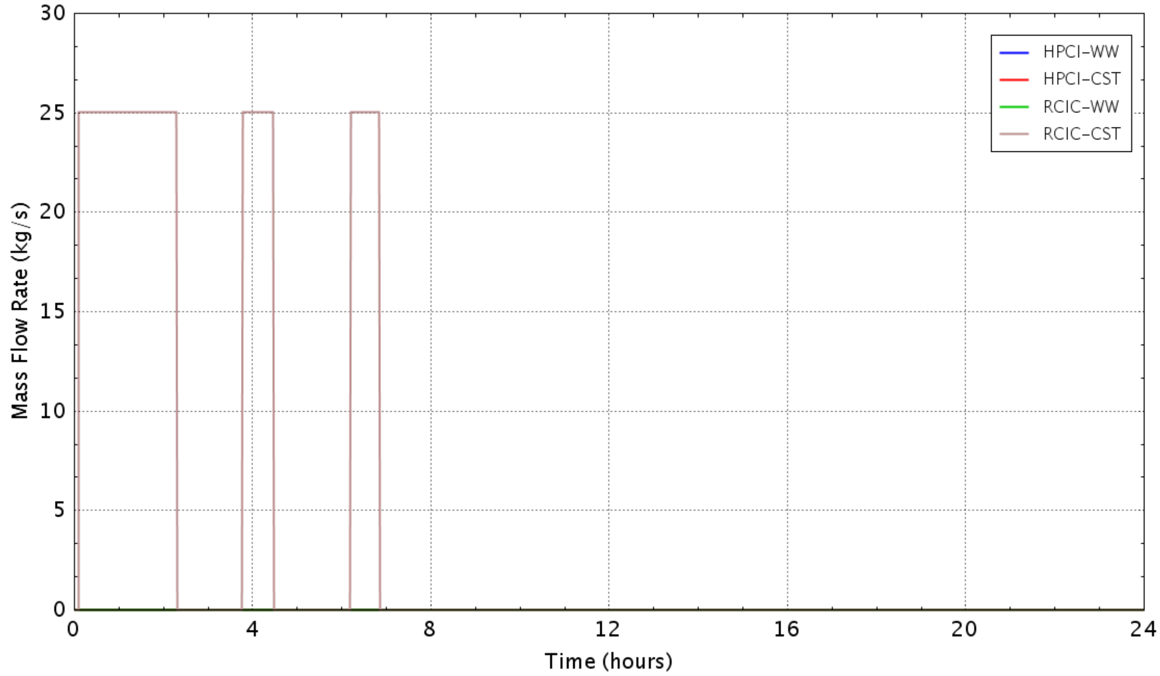

Figure D – 52 Flow rate of the HPCI/RCIC pumps

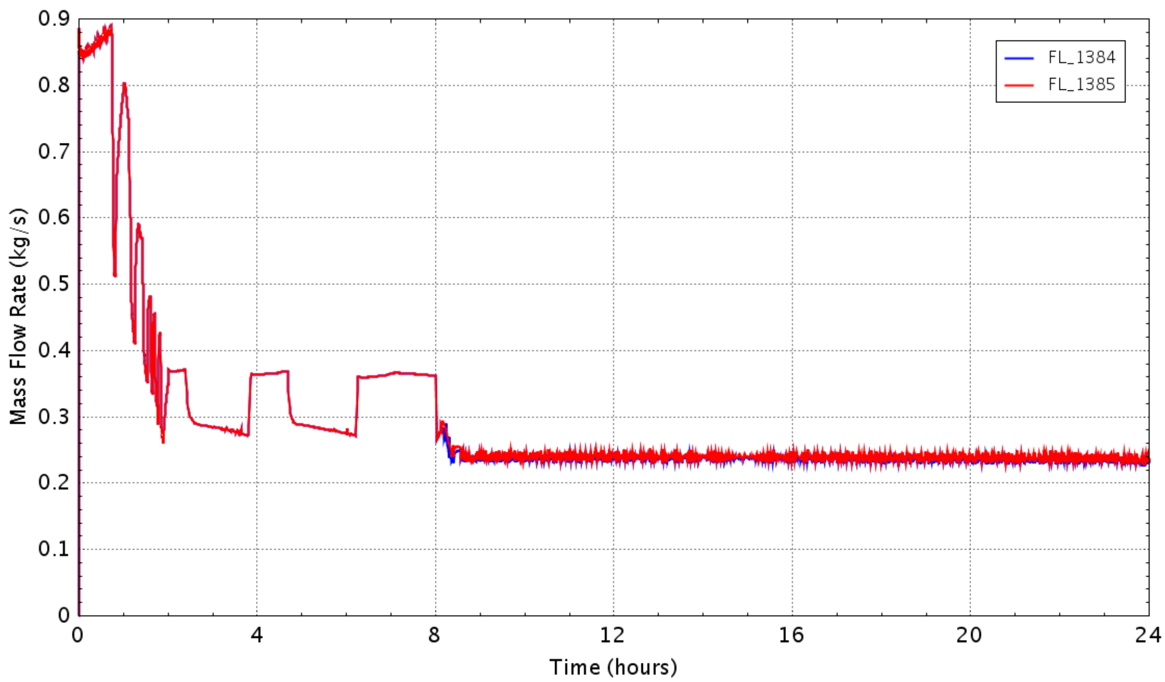

Figure D – 53 Flow rate of the recirculating pump seal leakage

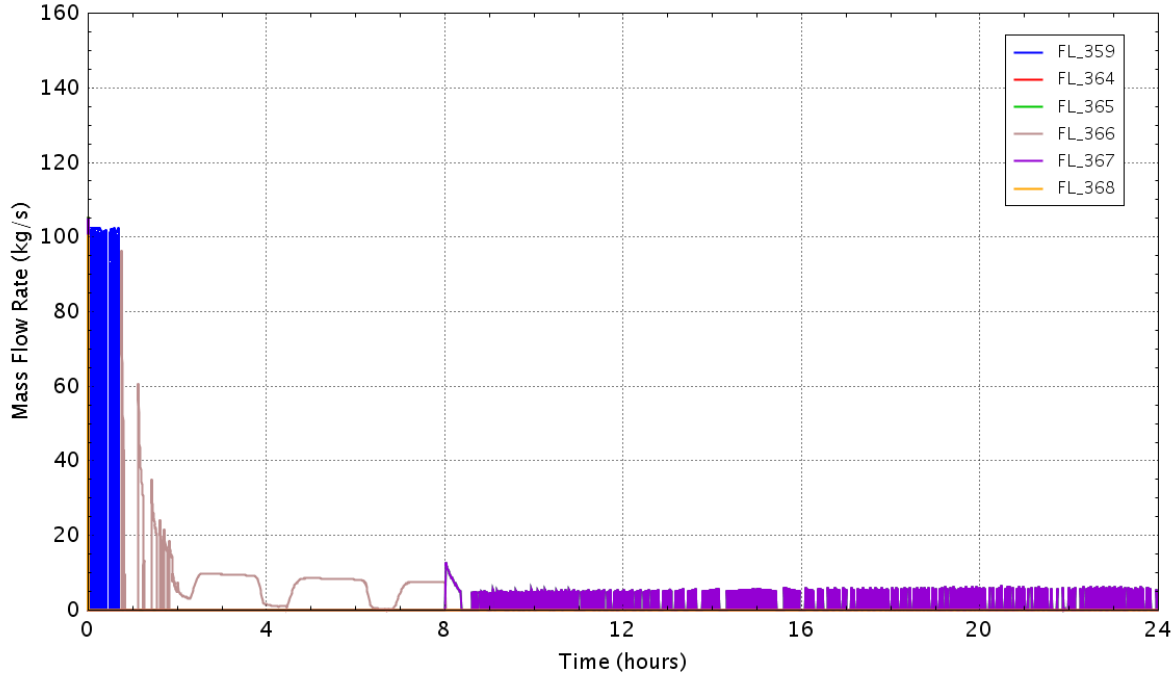

Figure D - 54 Flow rate of the SRVs

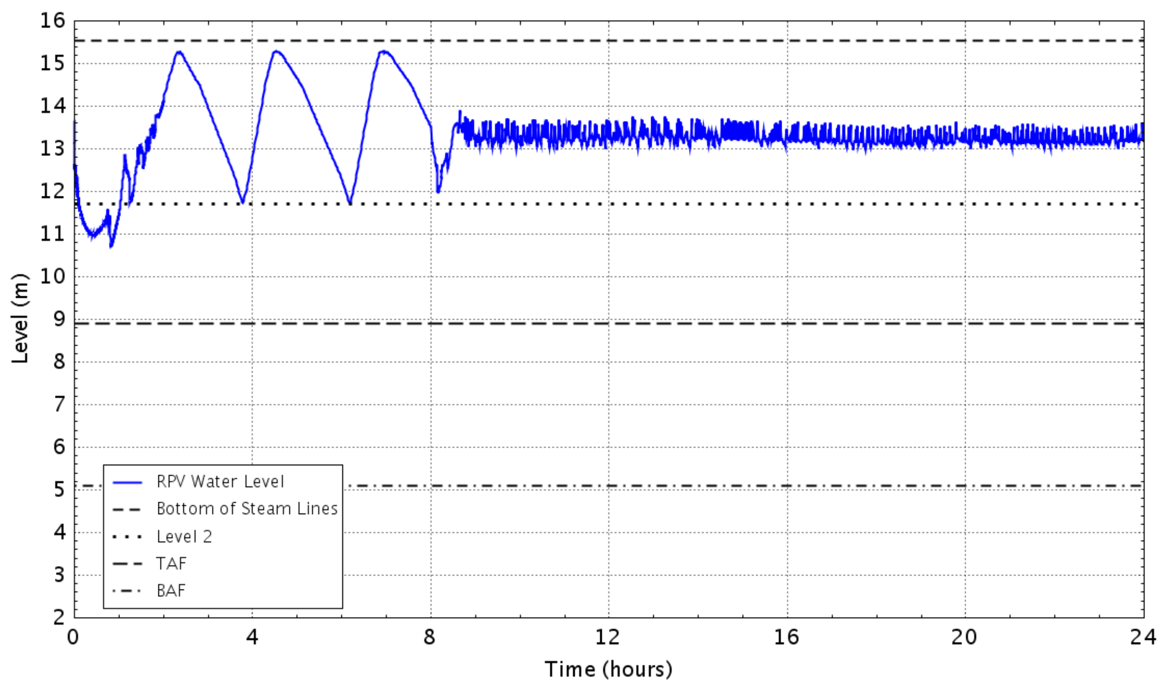

Figure D - 55 RPV down comer water level

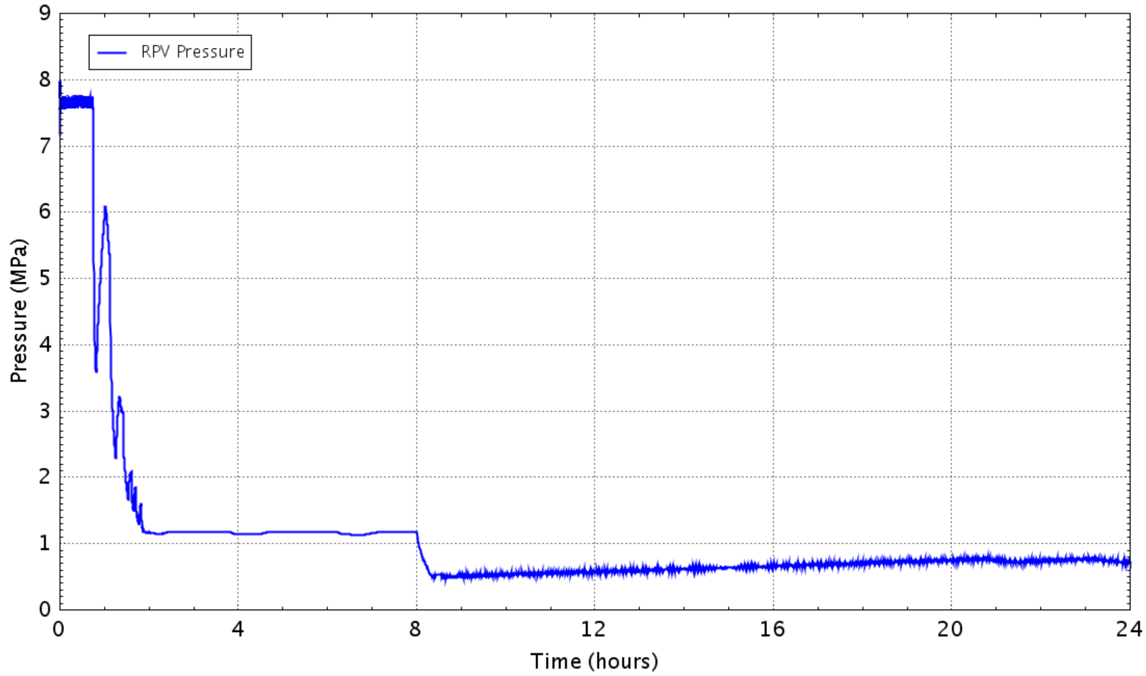

Figure D - 56 Pressure in theRPV

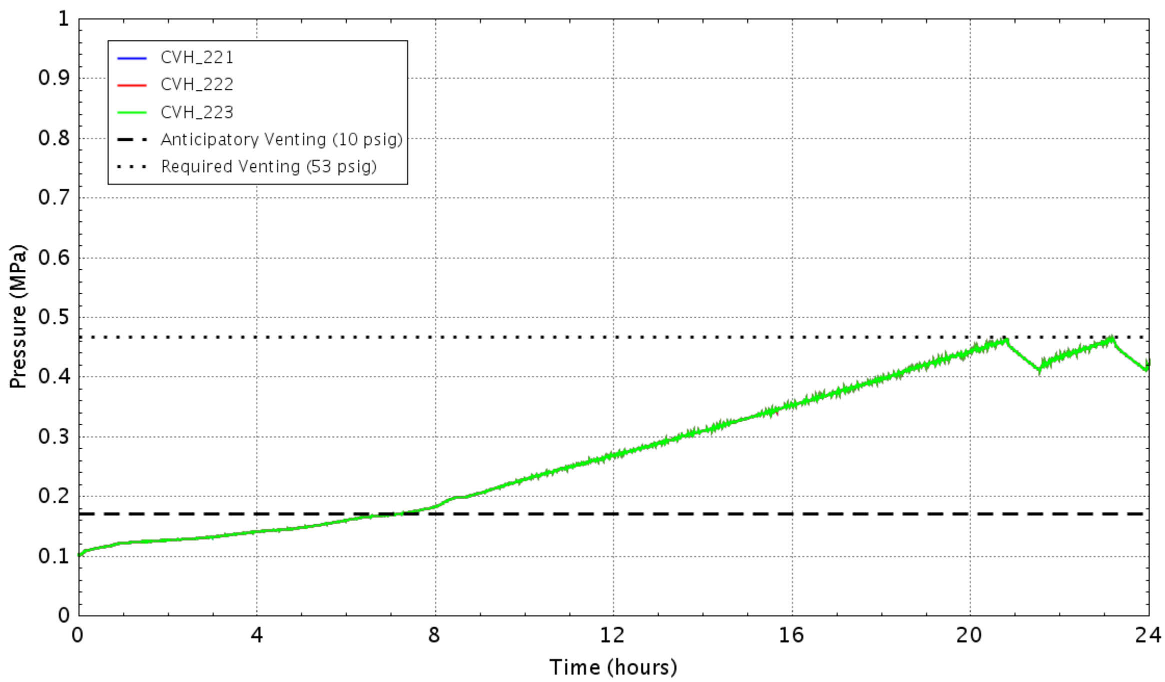

Figure D - 57 Pressure in the wetwell

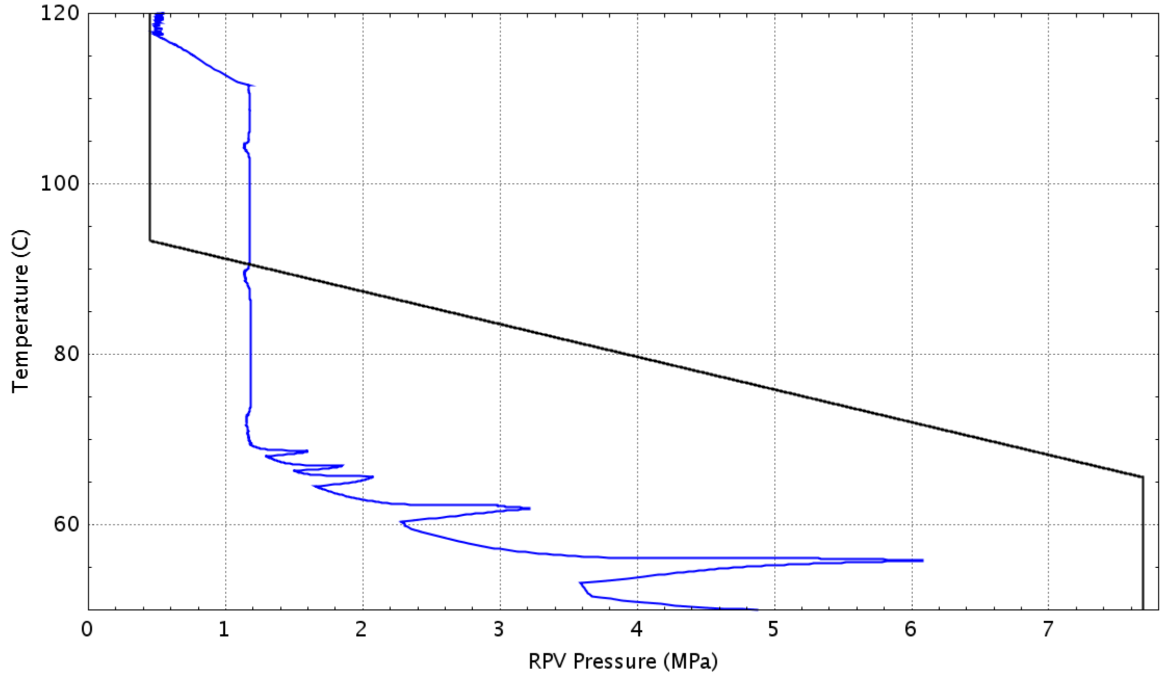

Figure D - 58 Plant status relative to the HCL curve (Graph 4 of the EOPs)

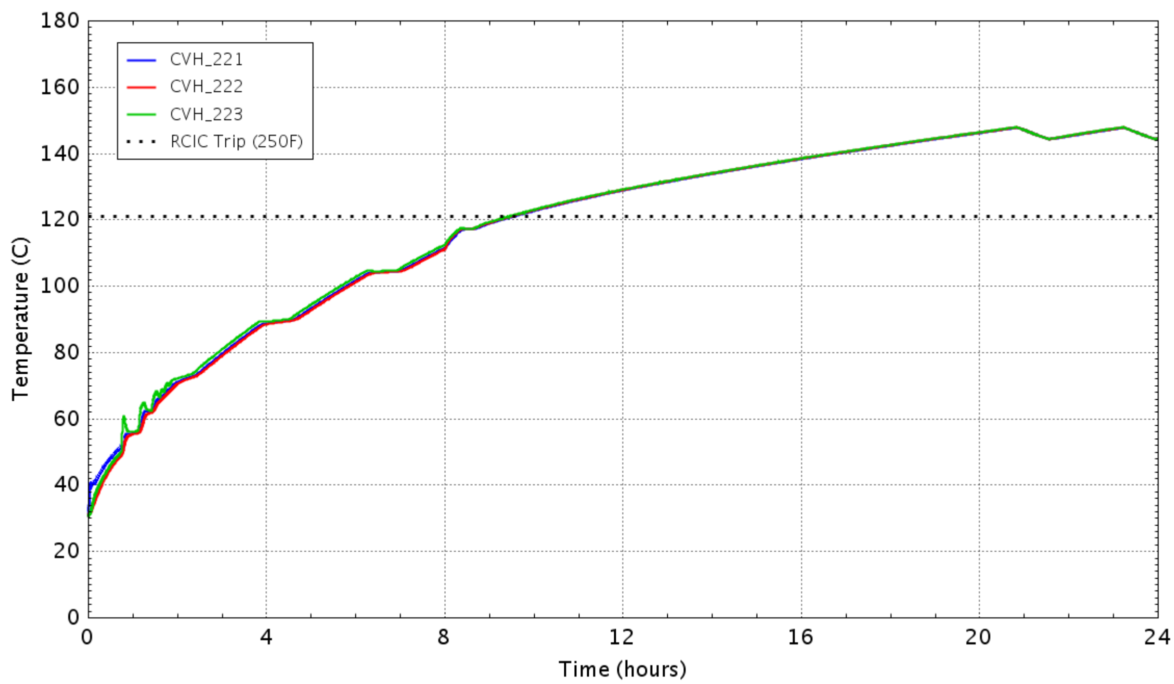

Figure D - 59 Water temperature in the wetwell

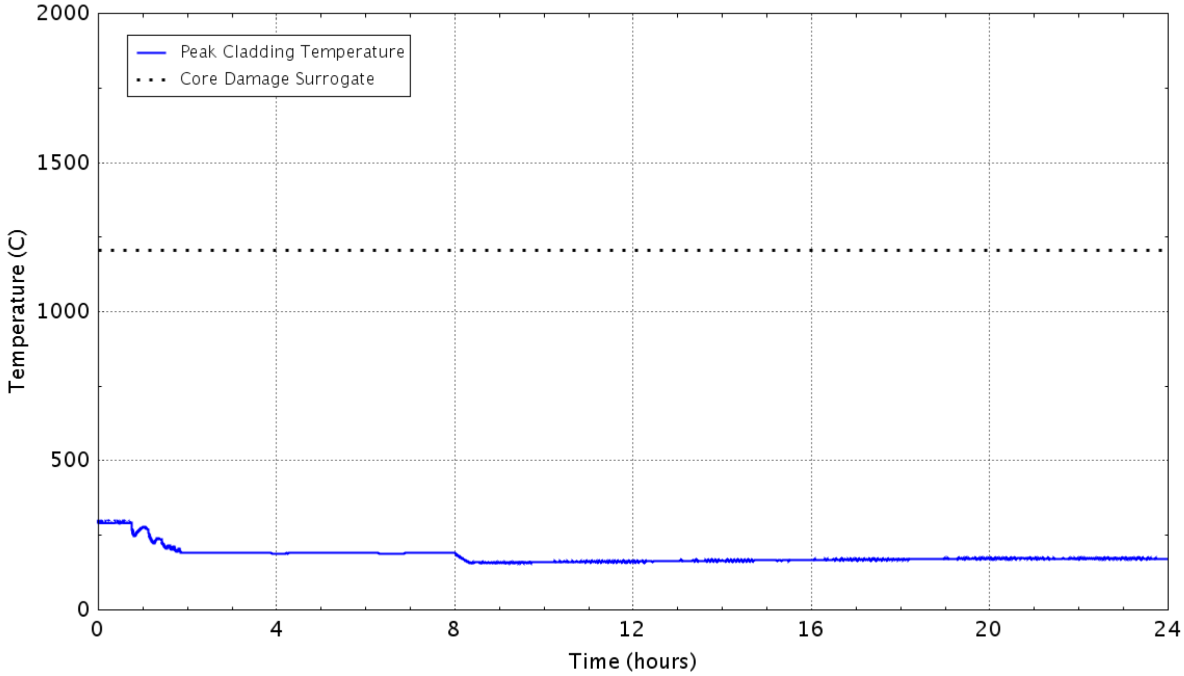

Figure D - 60 Peak temperature of the fuel cladding as a function of time

D.1.6 Case 6: LOOPGR-38-9, AC Loss at t=0, RCIC Loss at 8 hrs., CST Available, Perform Anticipatory Venting

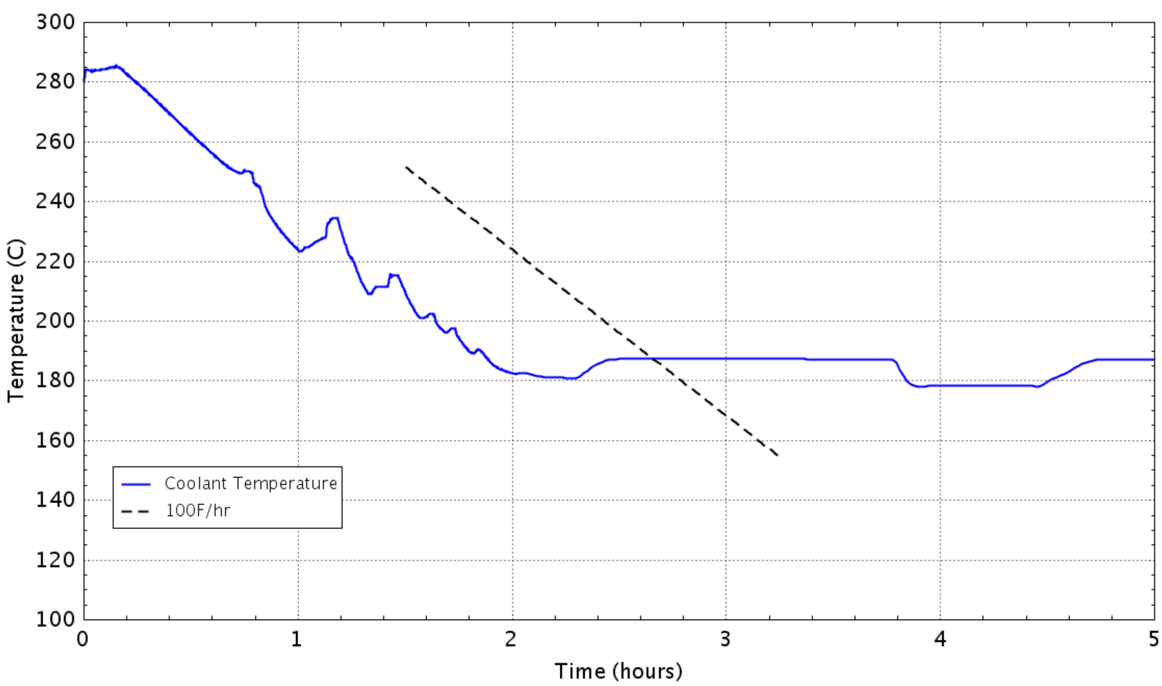

Figure D - 61 RPV cooldown rate

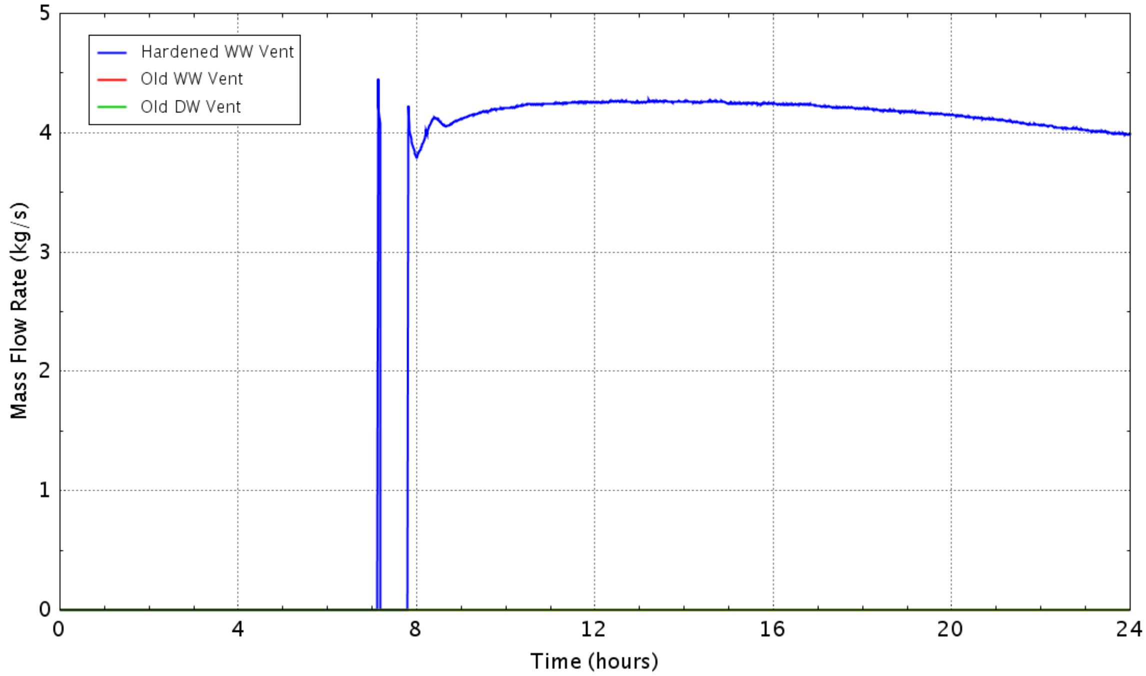

Figure D - 62 Flow rate of the containment vents

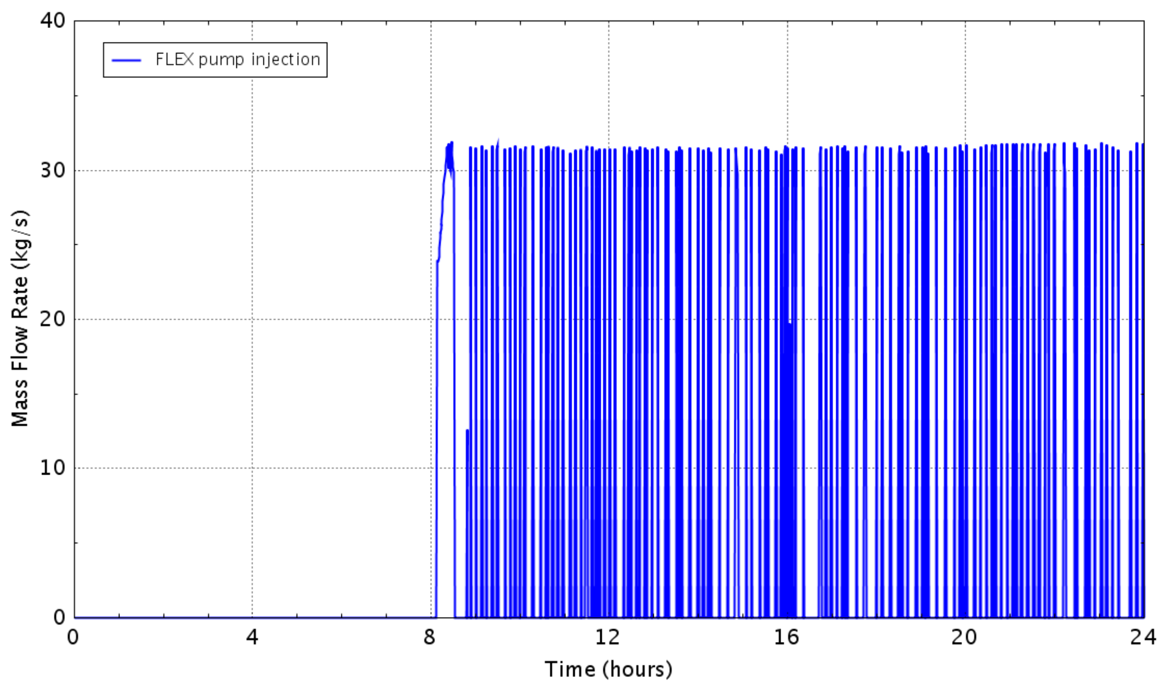

Figure D - 63 Flow rate of the FLEXpump

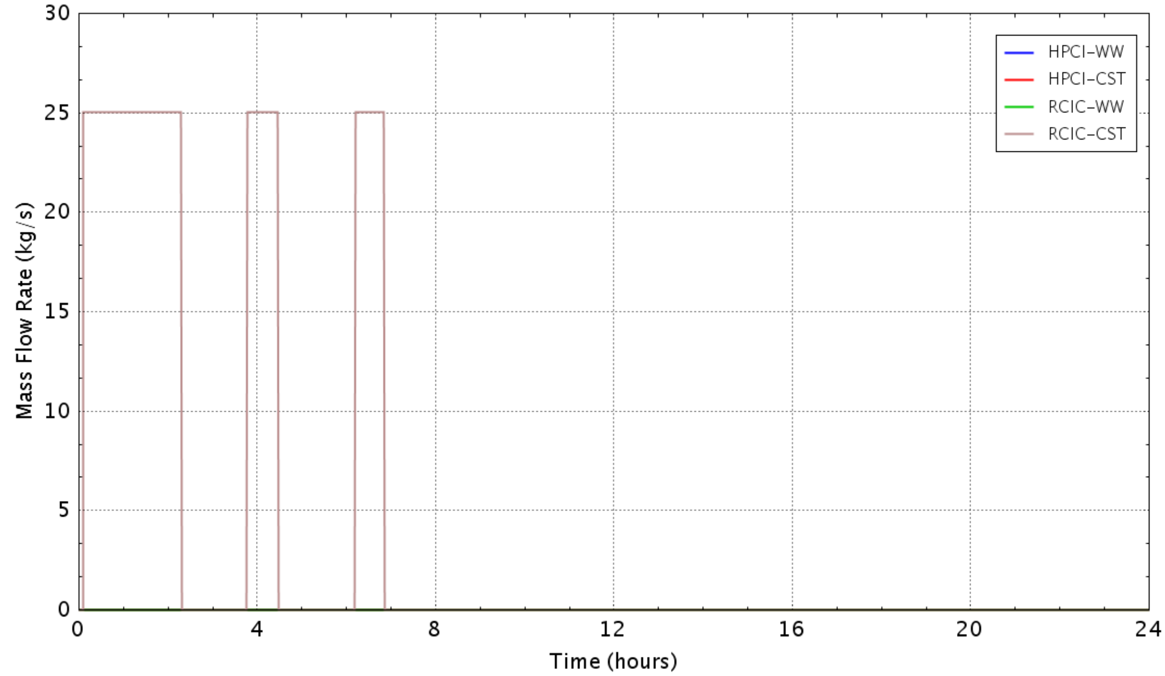

Figure D – 64 Flow rate of the HPCI/RCIC pumps

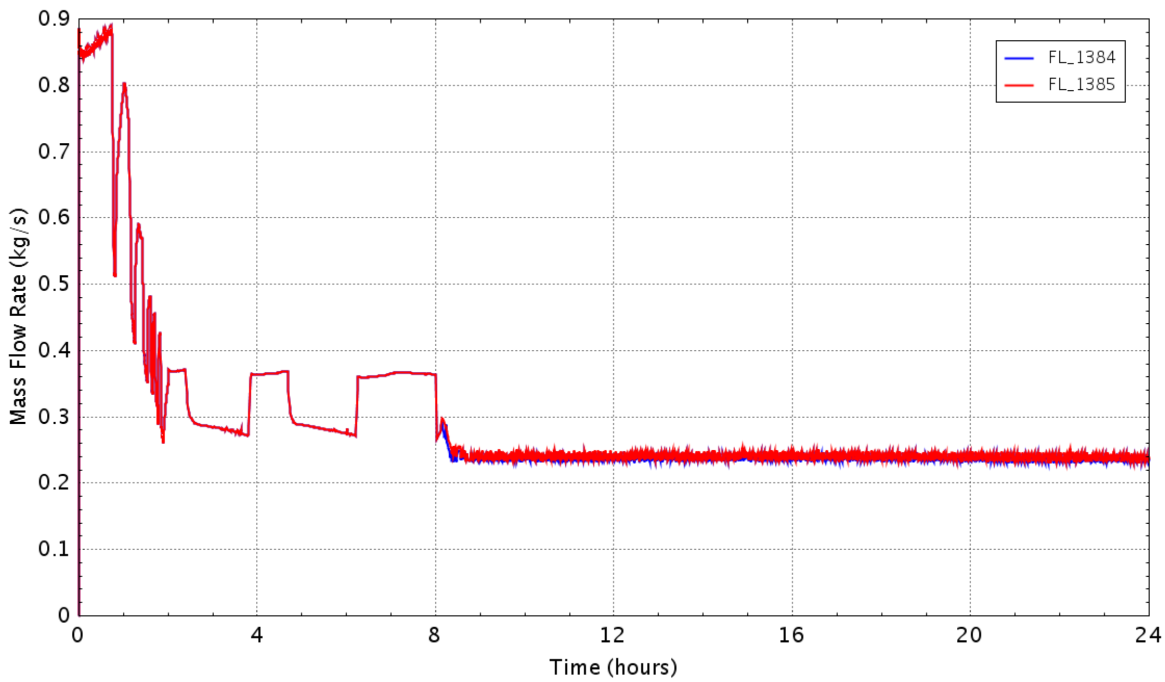

Figure D - 65 Flow rate of the recirculating pump seal leakage

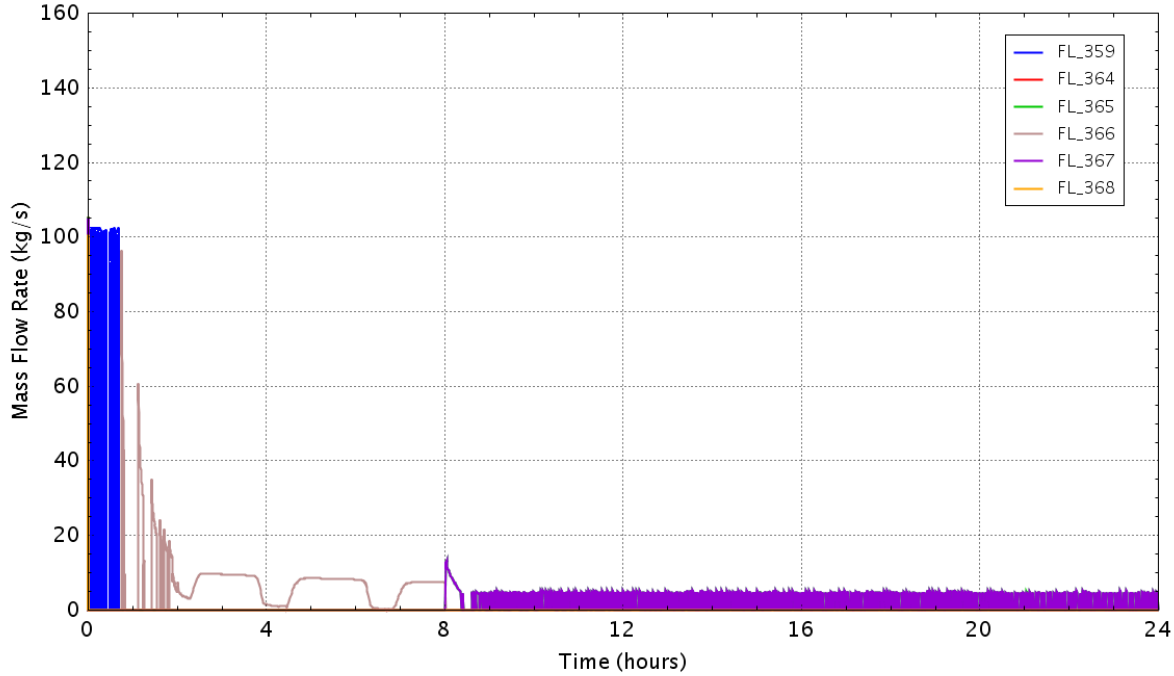

Figure D - 66 Flow rate of the SRVs

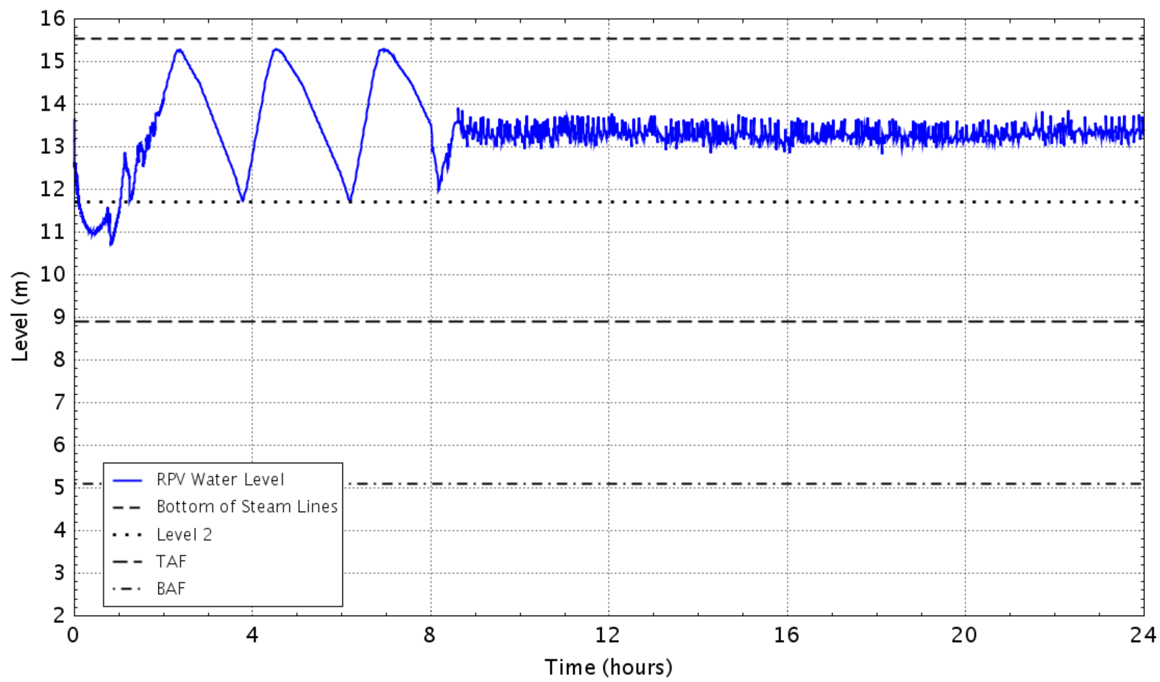

Figure D - 67 RPV down comer water level

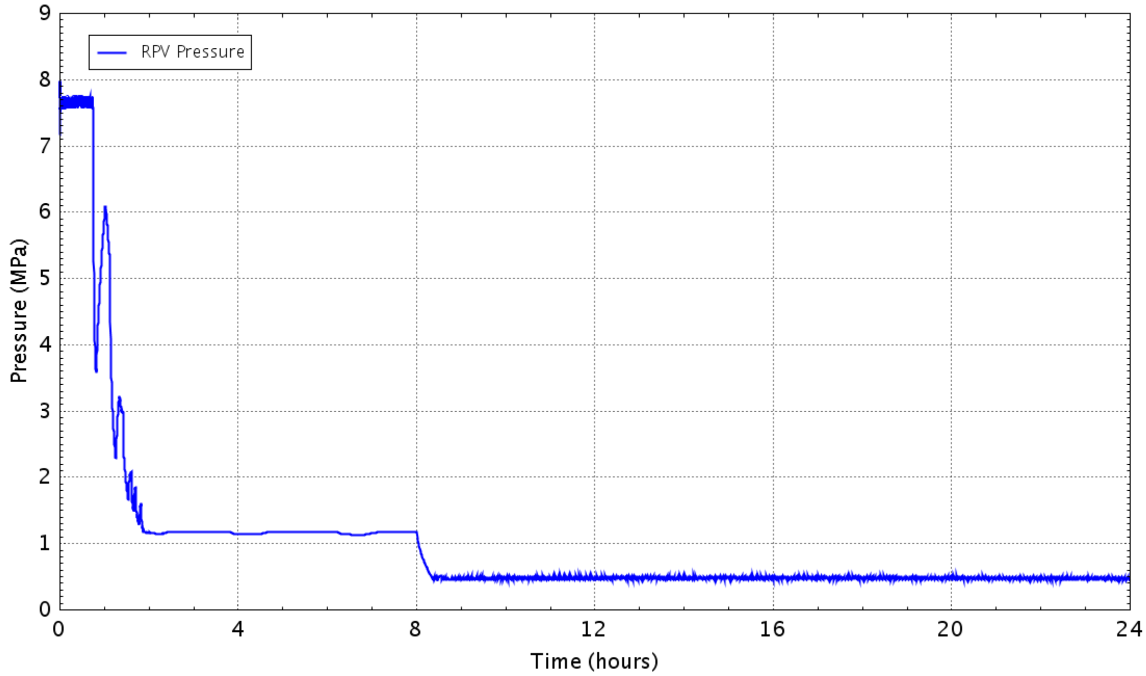

Figure D - 68 Pressure in theRPV

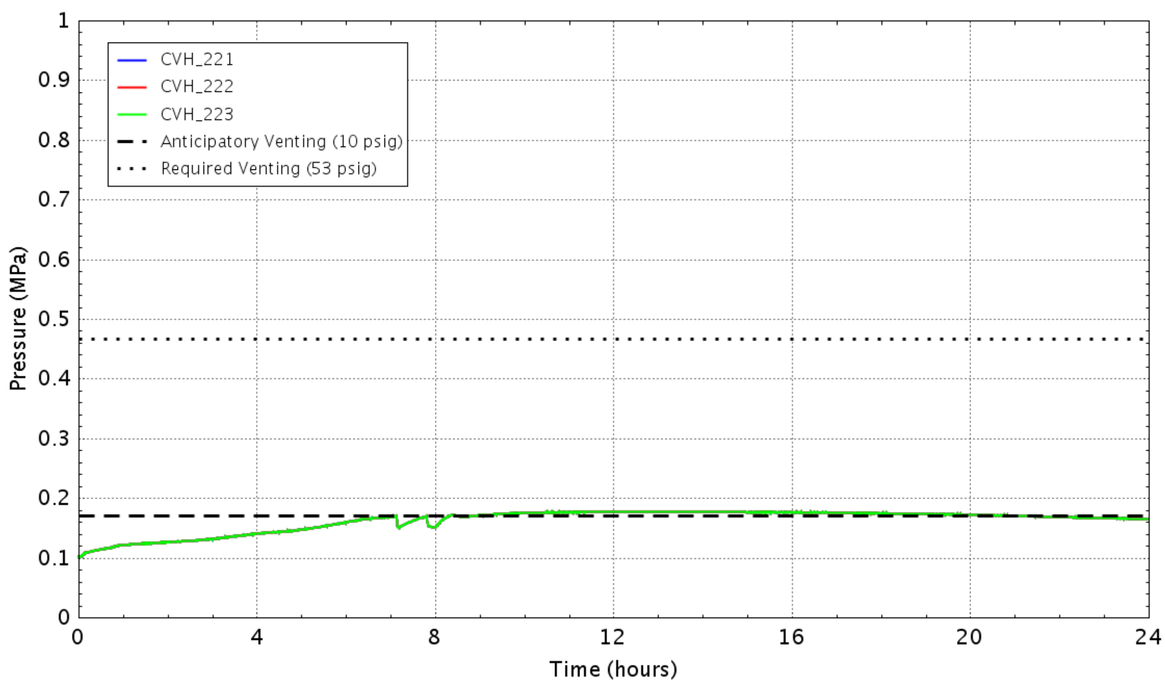

Figure D - 69 Pressure in the wetwell

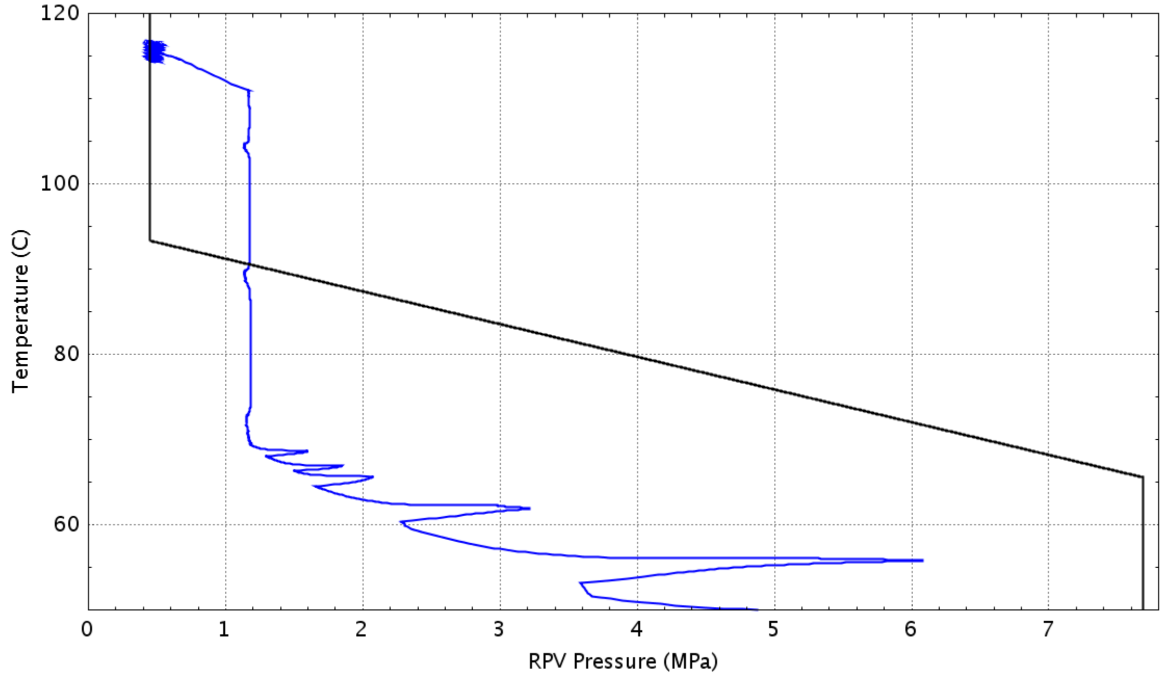

Figure D - 70 Plant status relative to the HCL curve (Graph 4 of the EOPs)

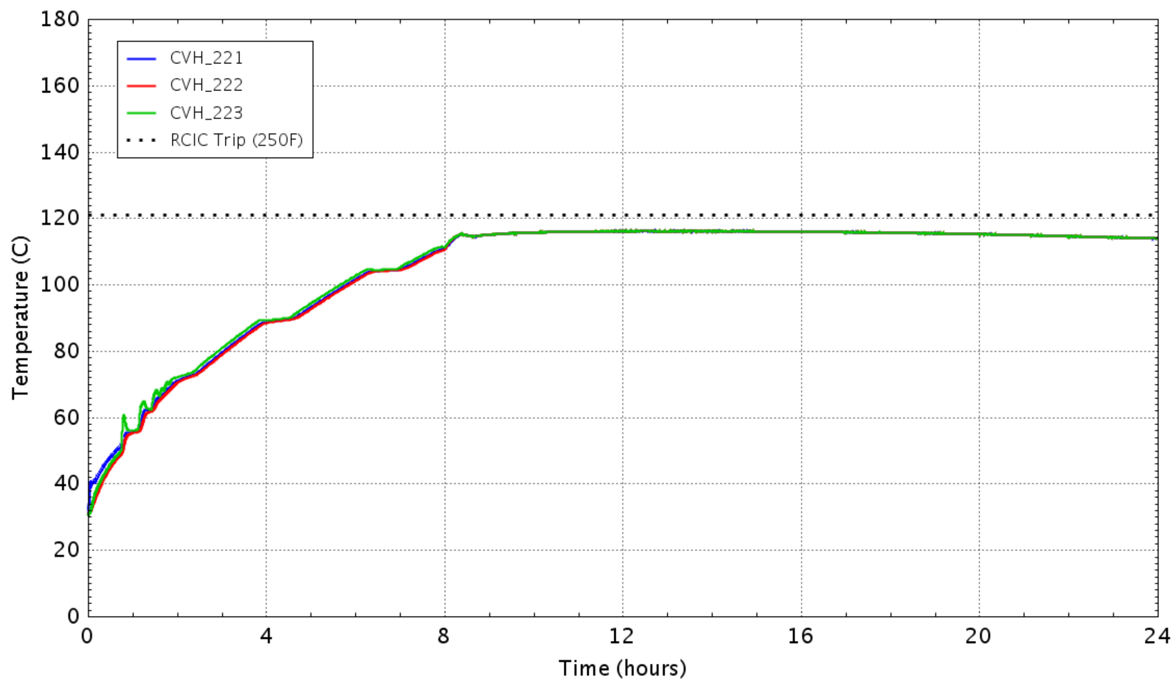

Figure D - 71 Water temperature in the wetwell

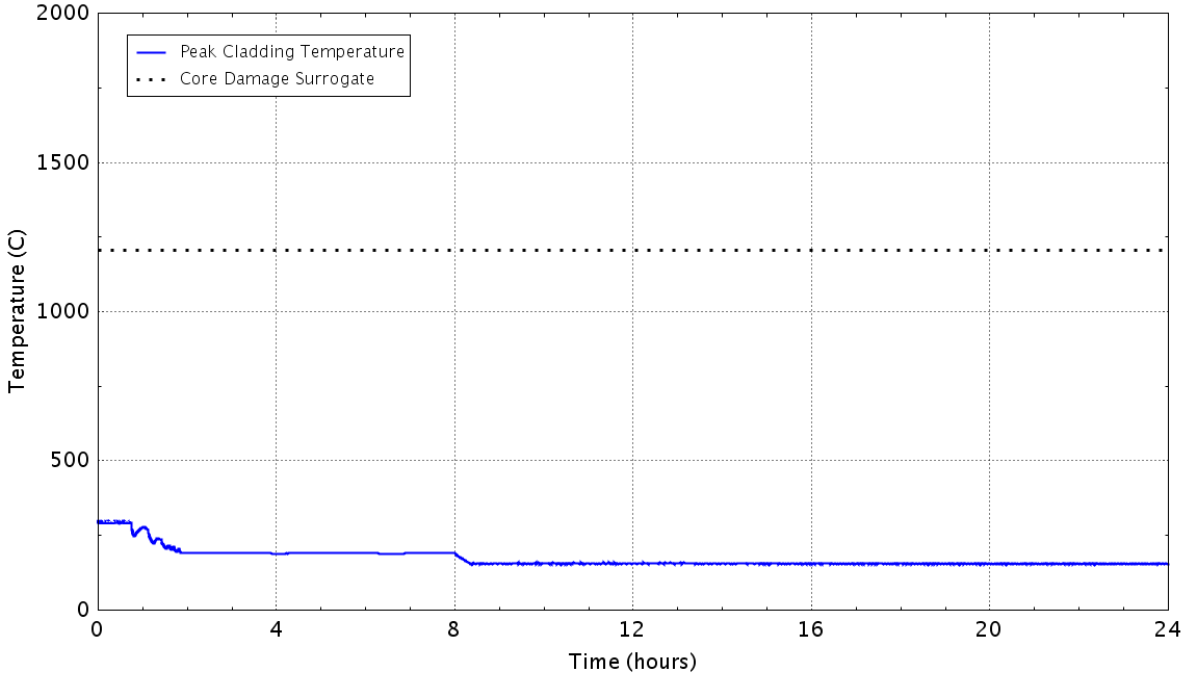

Figure D - 72 Peak temperature of the fuel cladding as a function of time

D.1.7 Case 7: LOOPGR-38-9, AC Loss at t=0, RCIC Loss at 8 hrs., CST Unavailable, Perform Required Venting Only

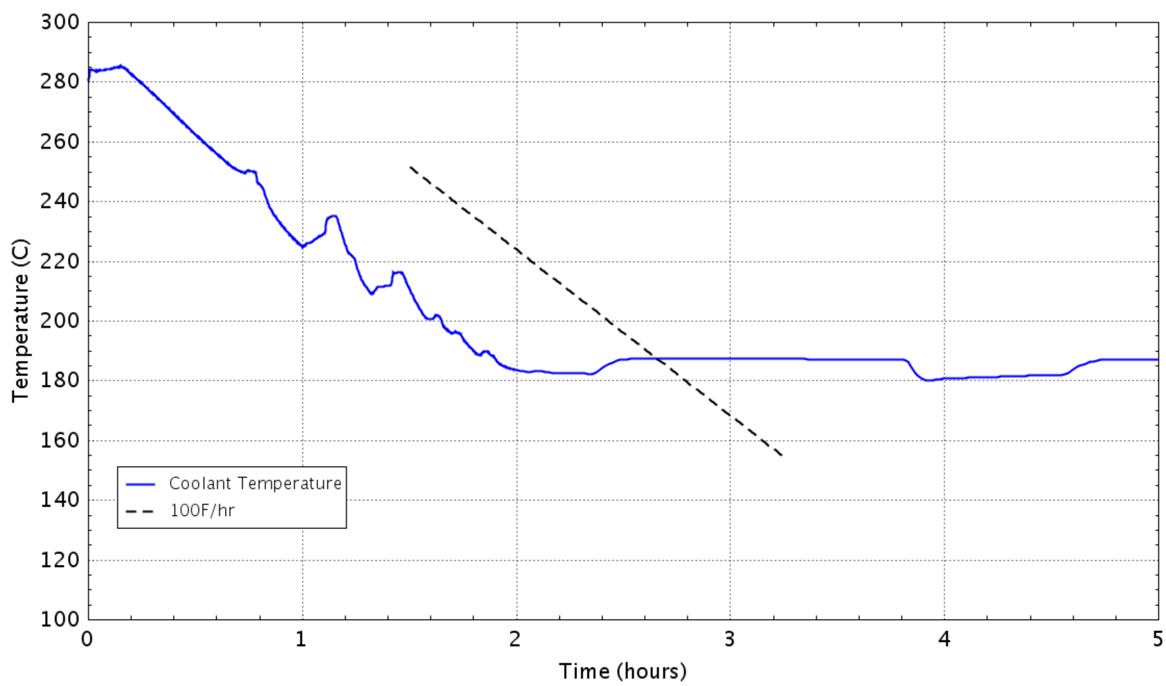

Figure D - 73 RPV cooldown rate

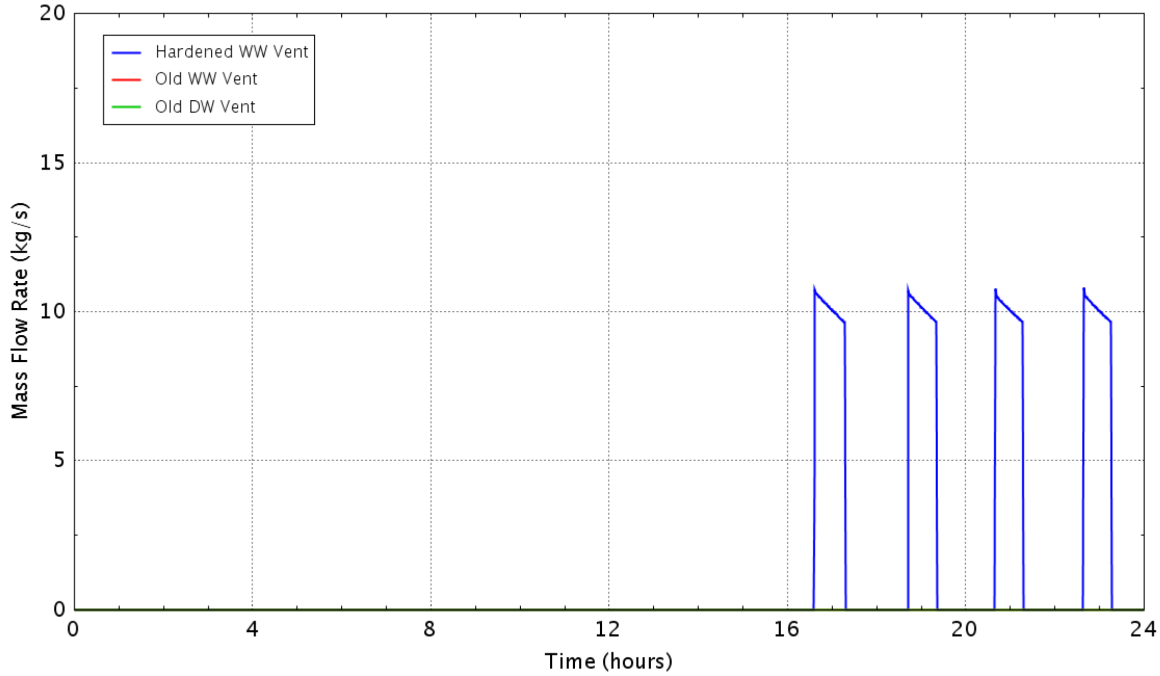

Figure D - 74 Flow rate of the containment vents

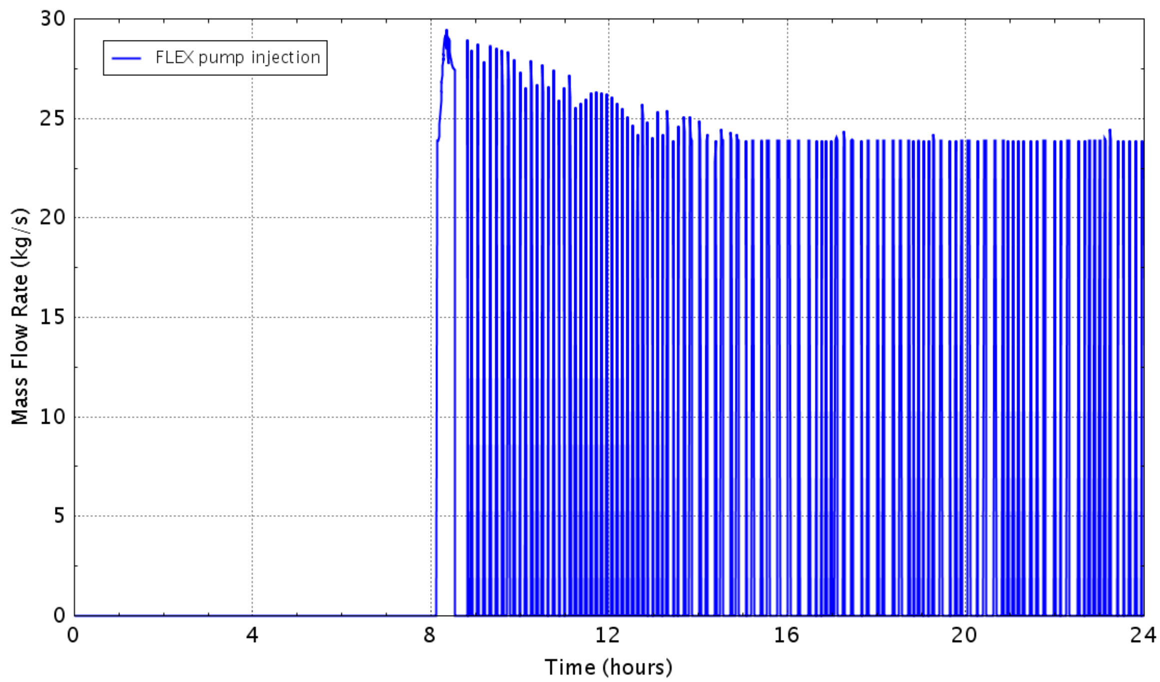

Figure D - 75 Flow rate of the FLEXpump

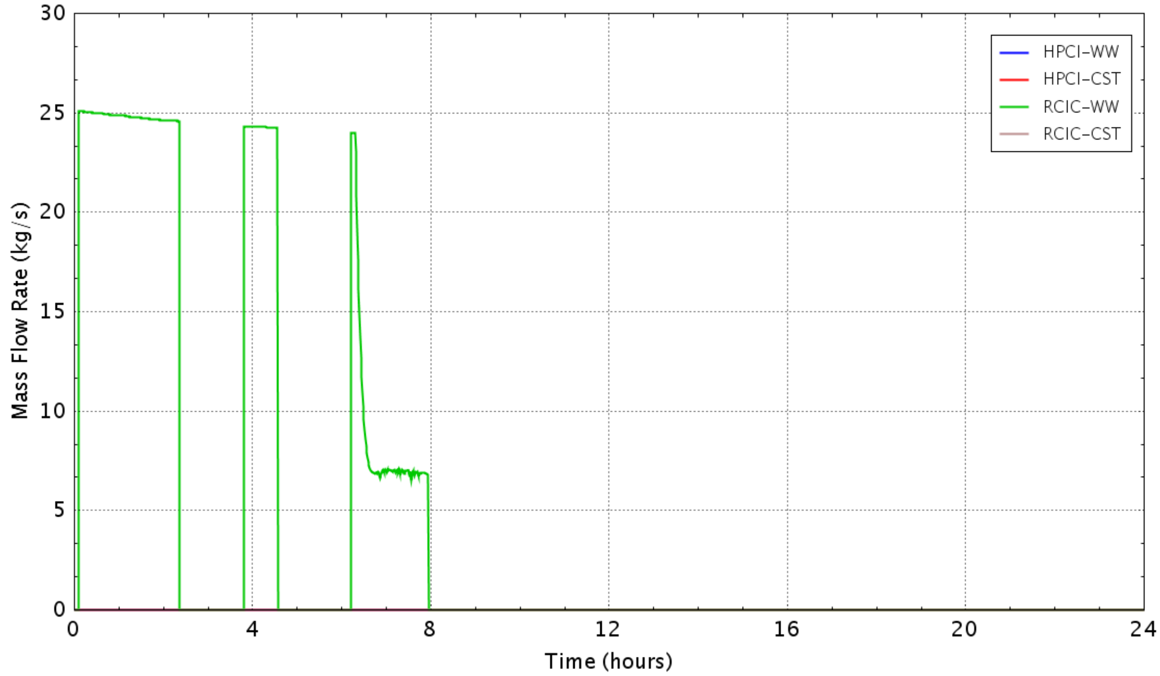

Figure D - 76 Flow rate of the HPCI/RCIC pumps

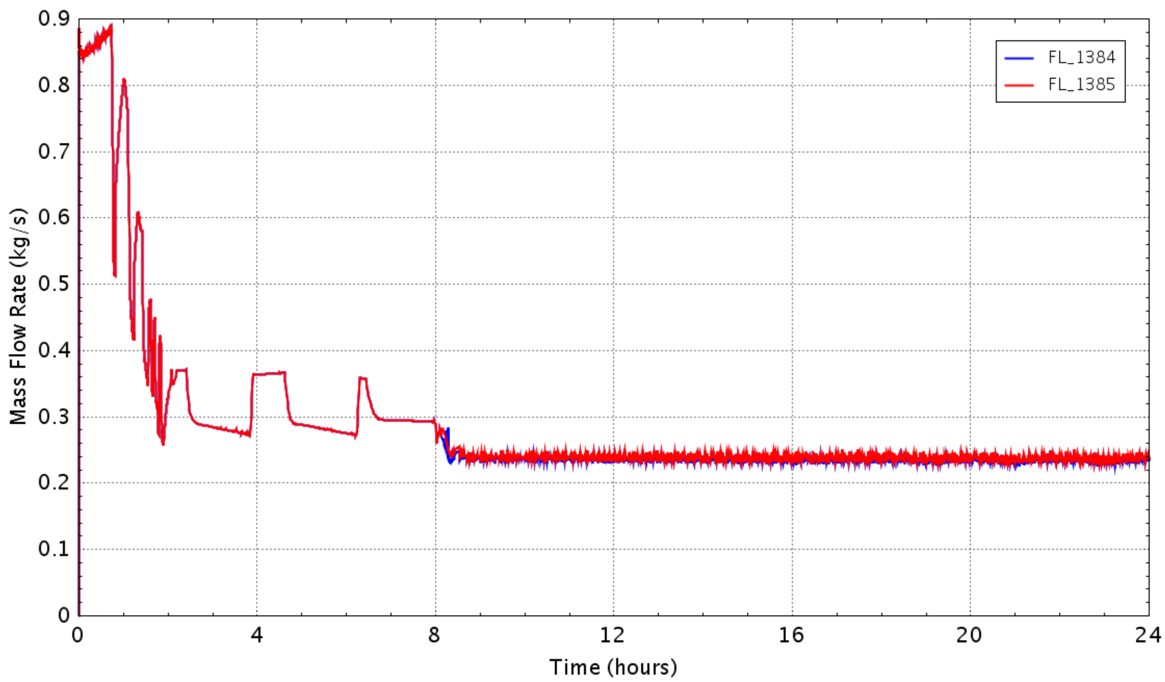

Figure D - 77 Flow rate of the recirculating pump seal leakage

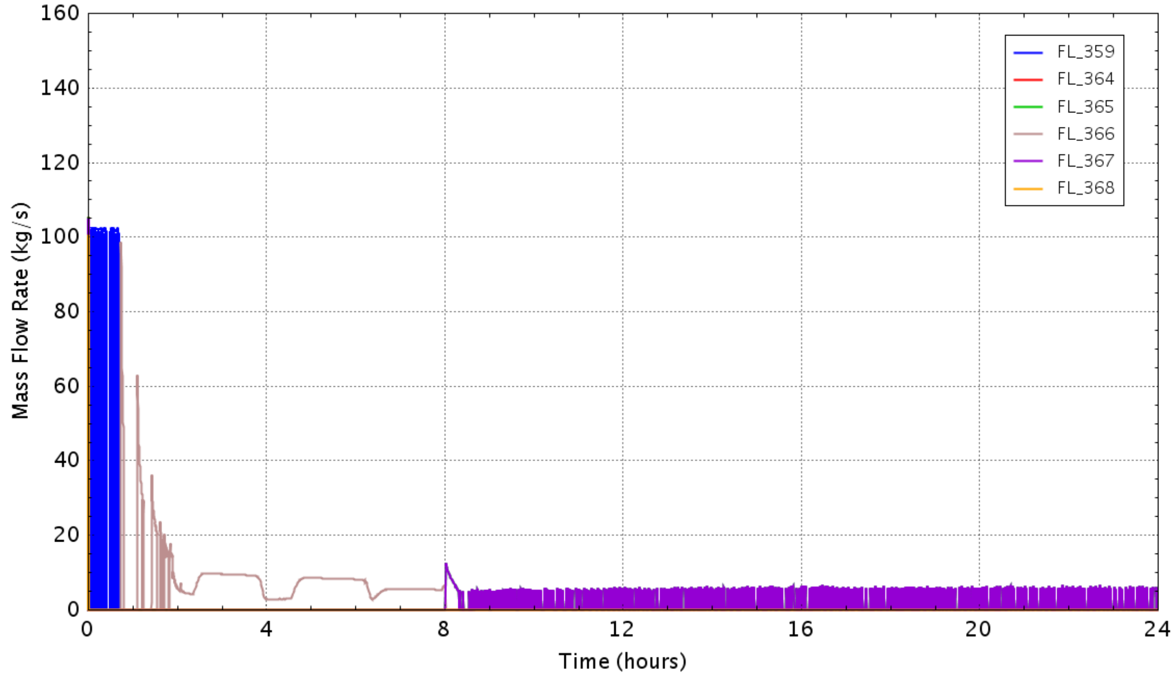

Figure D - 78 Flow rate of the SRVs

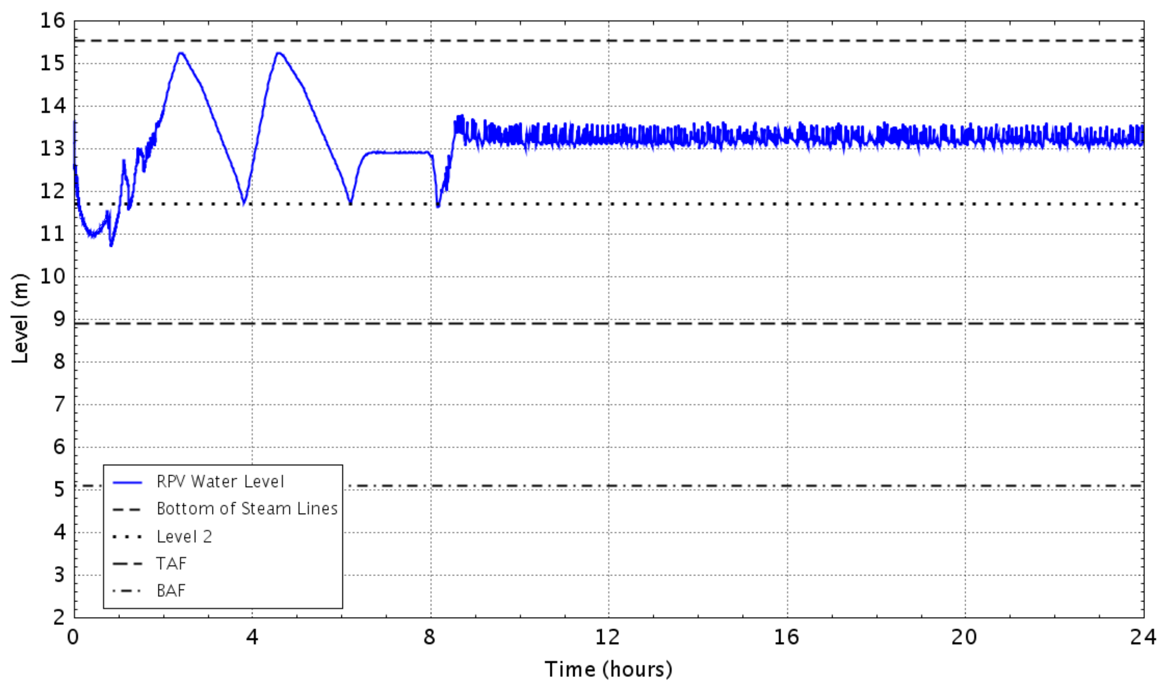

Figure D - 79 RPV down comer water level

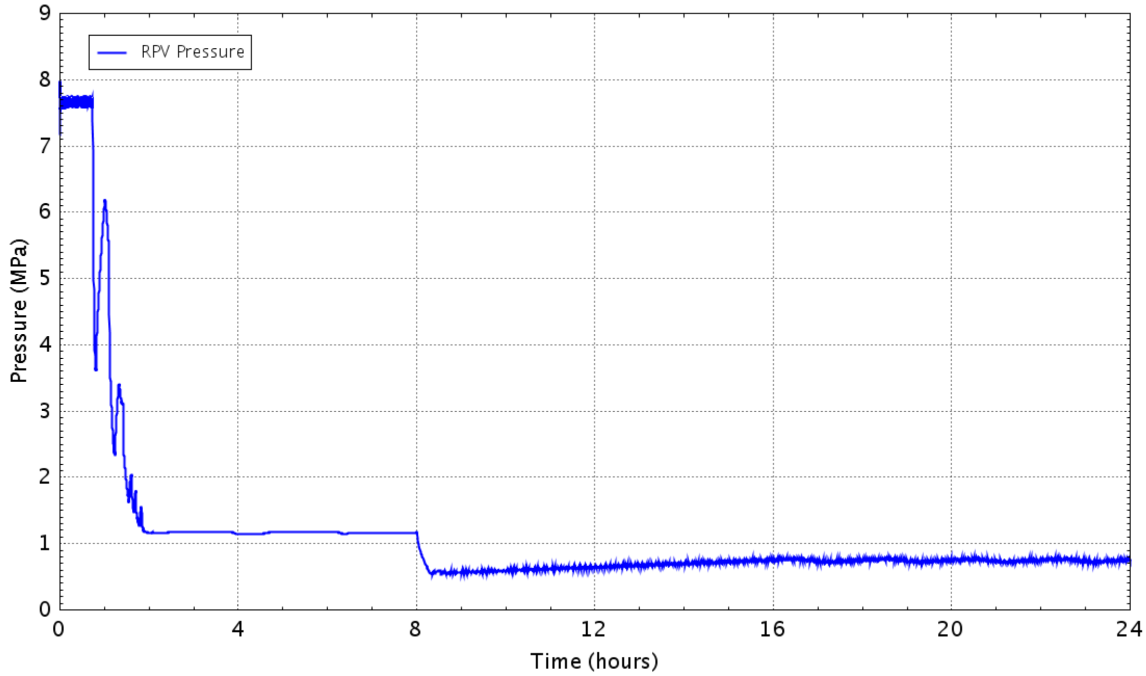

Figure D - 80 Pressure in the RPV

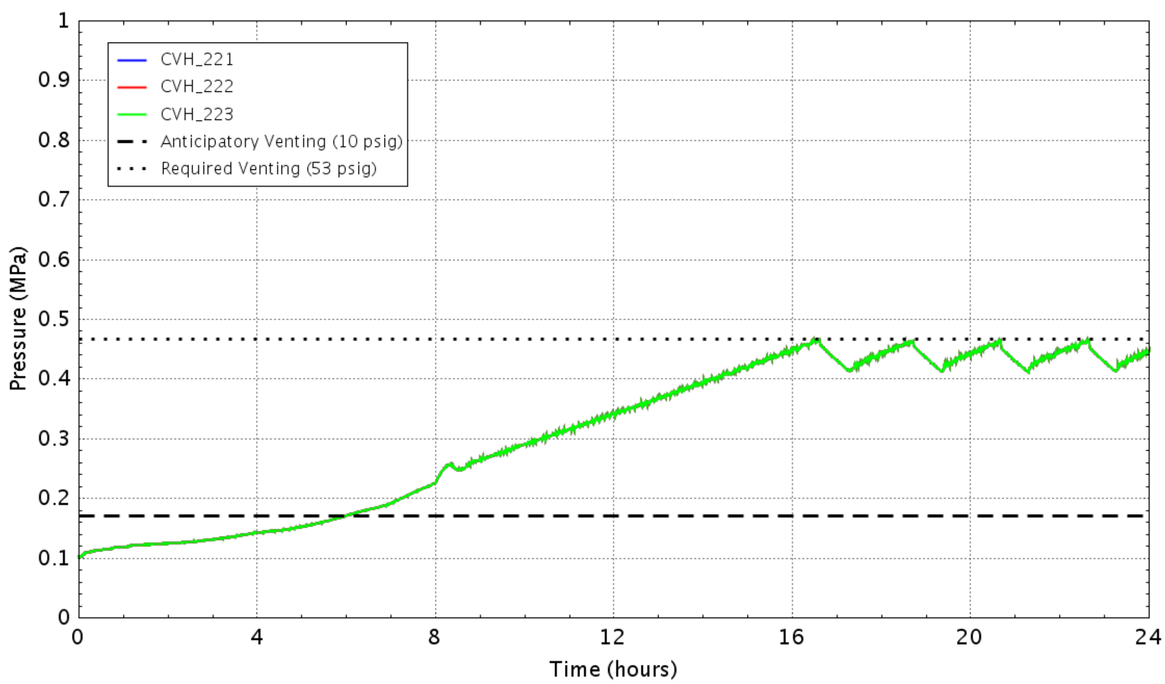

Figure D - 81 Pressure in the wetwell

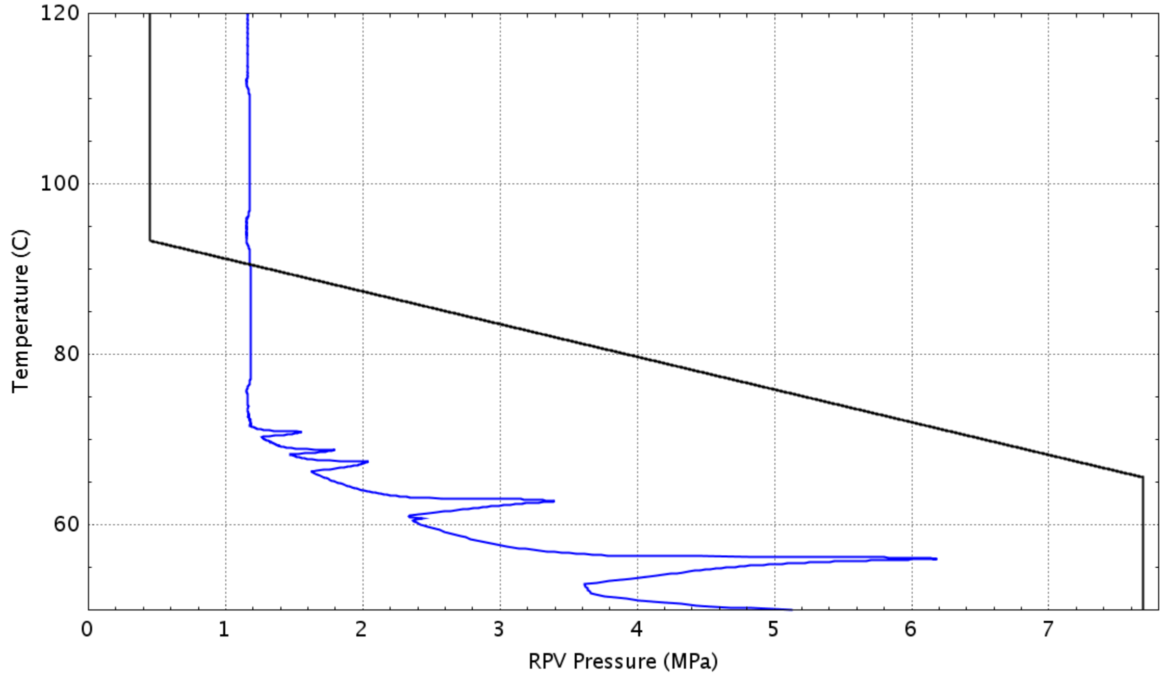

Figure D - 82 Plant status relative to the HCL curve (Graph 4 of the EOPs)

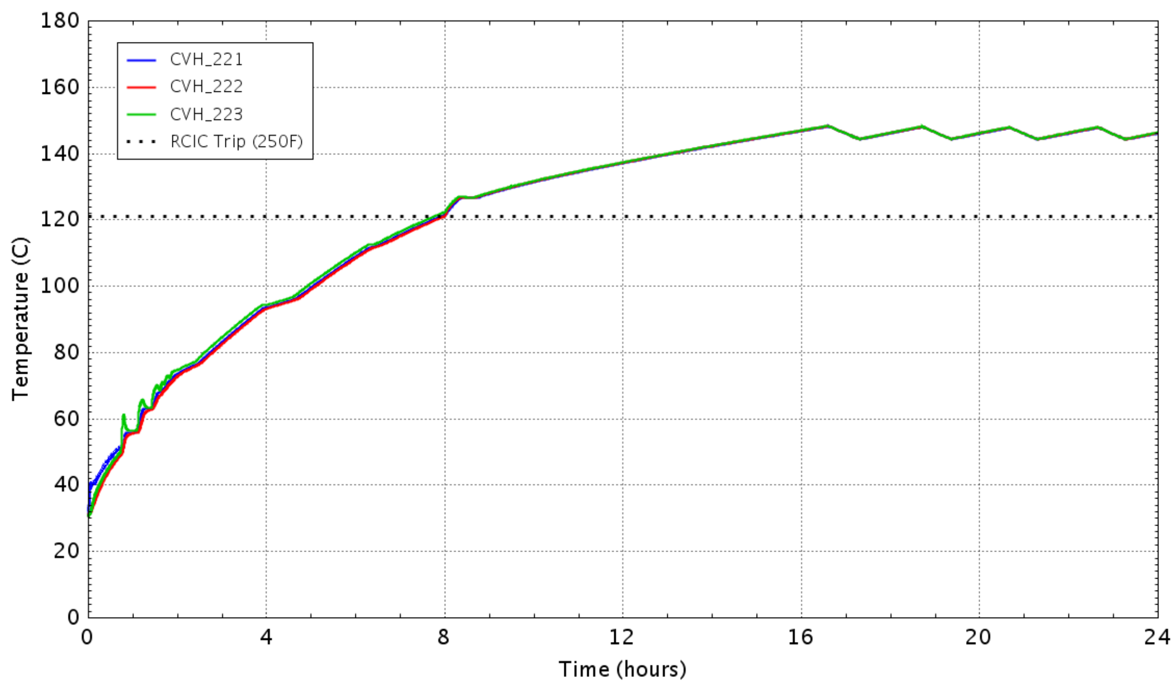

Figure D - 83 Water temperature in the wetwell

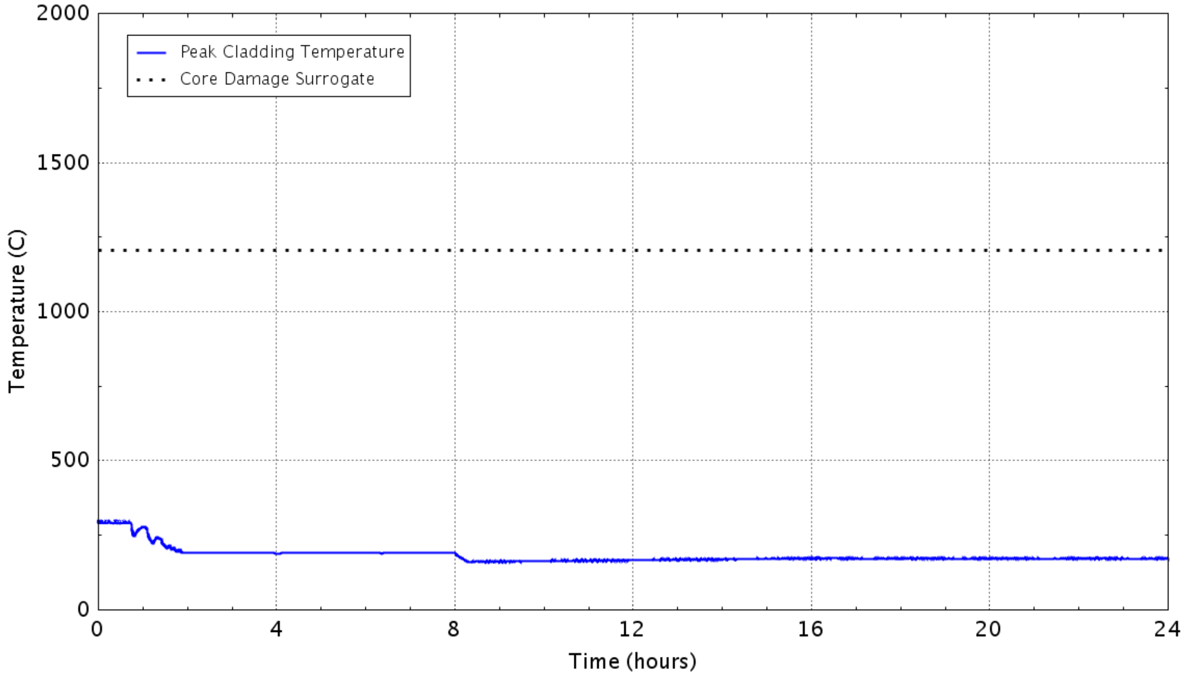

Figure D - 84 Peak temperature of the fuel cladding as a function of time

D.1.8 Case 8: LOOPGR-38-9, AC Loss at t=0, RCIC Loss at 8 hrs., CST Unavailable, Perform Anticipatory Venting

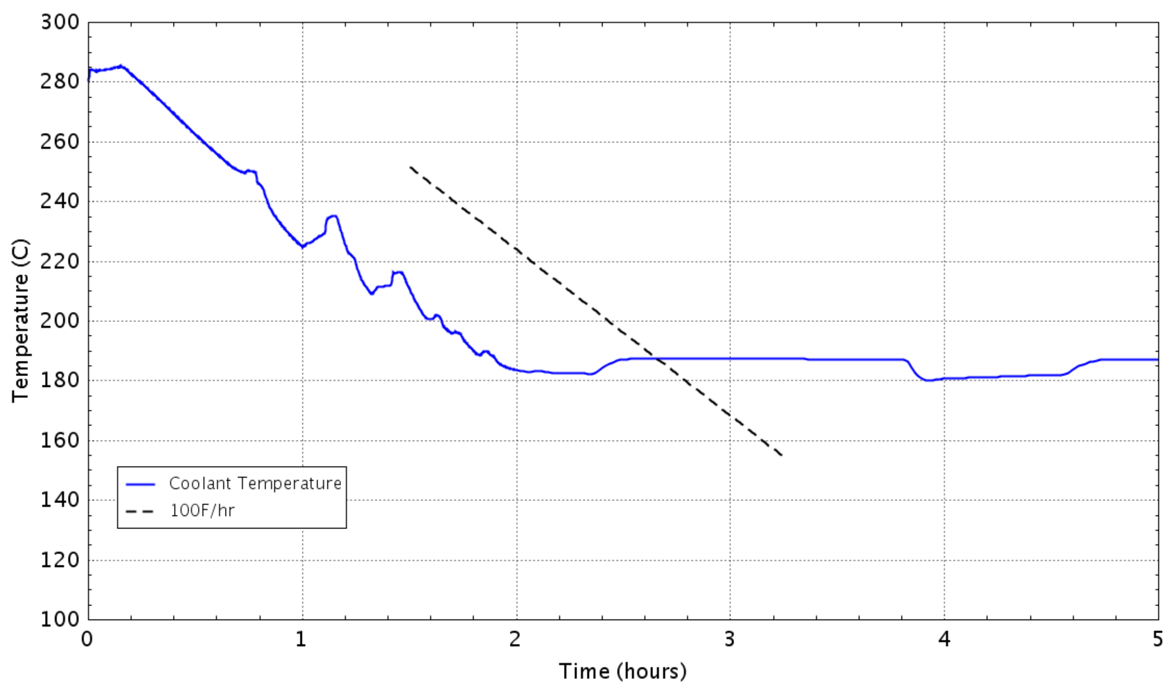

Figure D - 85 RPV cooldown rate

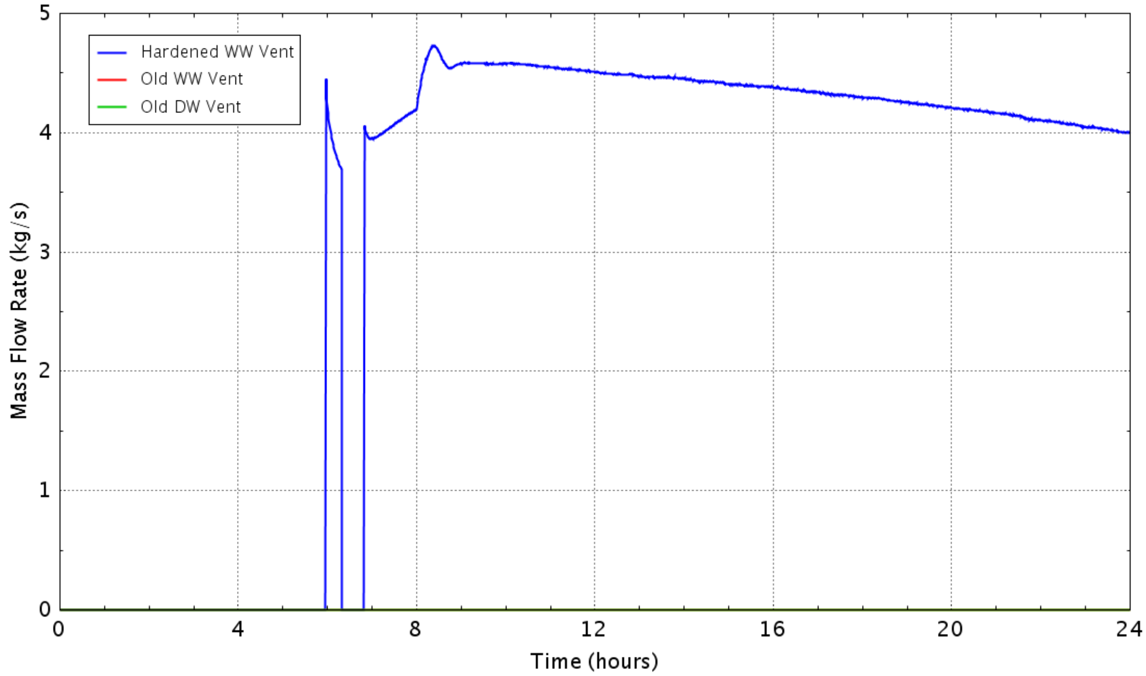

Figure D - 86 Flow rate of the containment vents

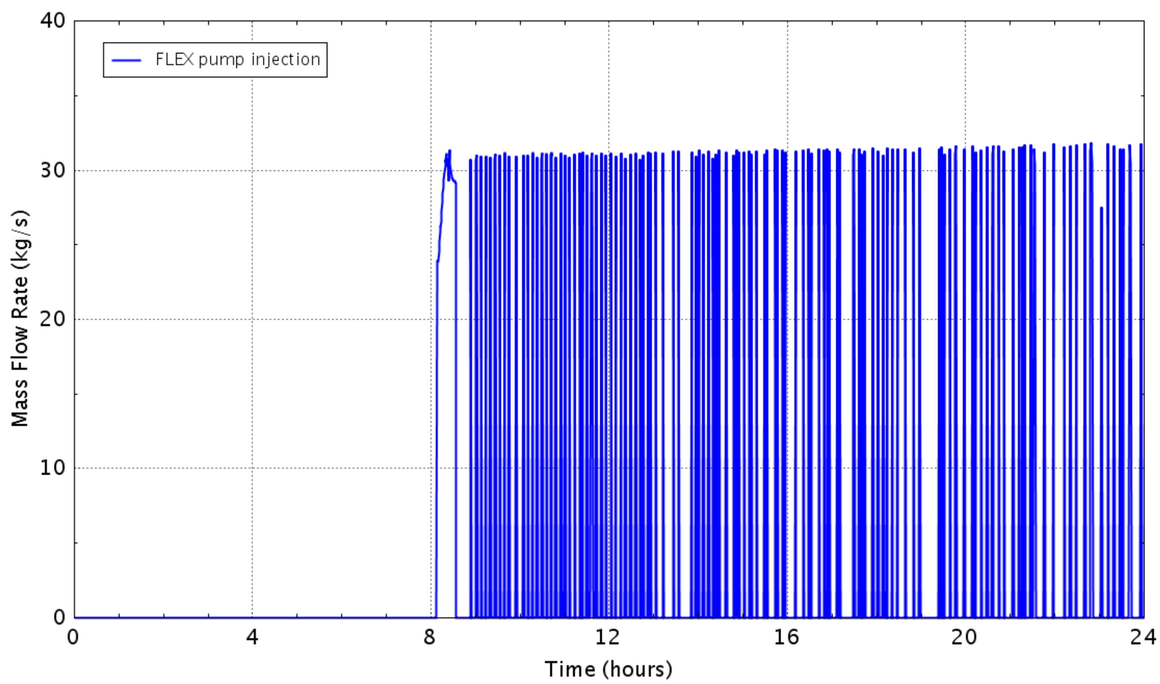

Figure D - 87 Flow rate of the FLEXpump

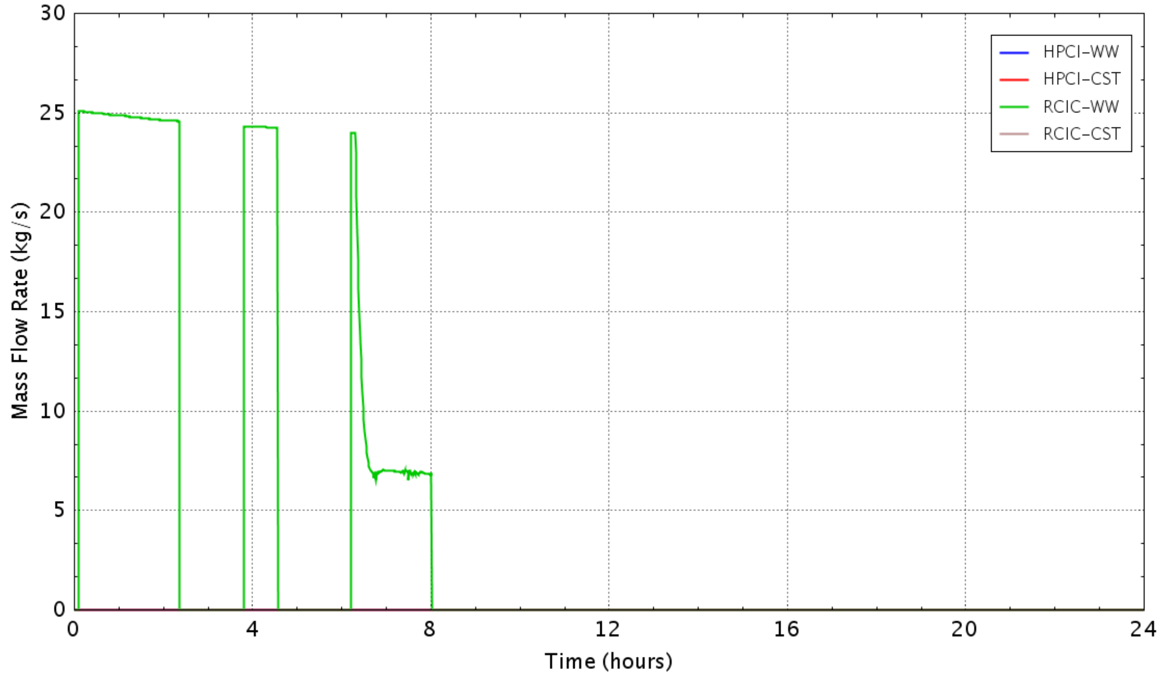

Figure D - 88 Flow rate of the HPCI/RCIC pumps

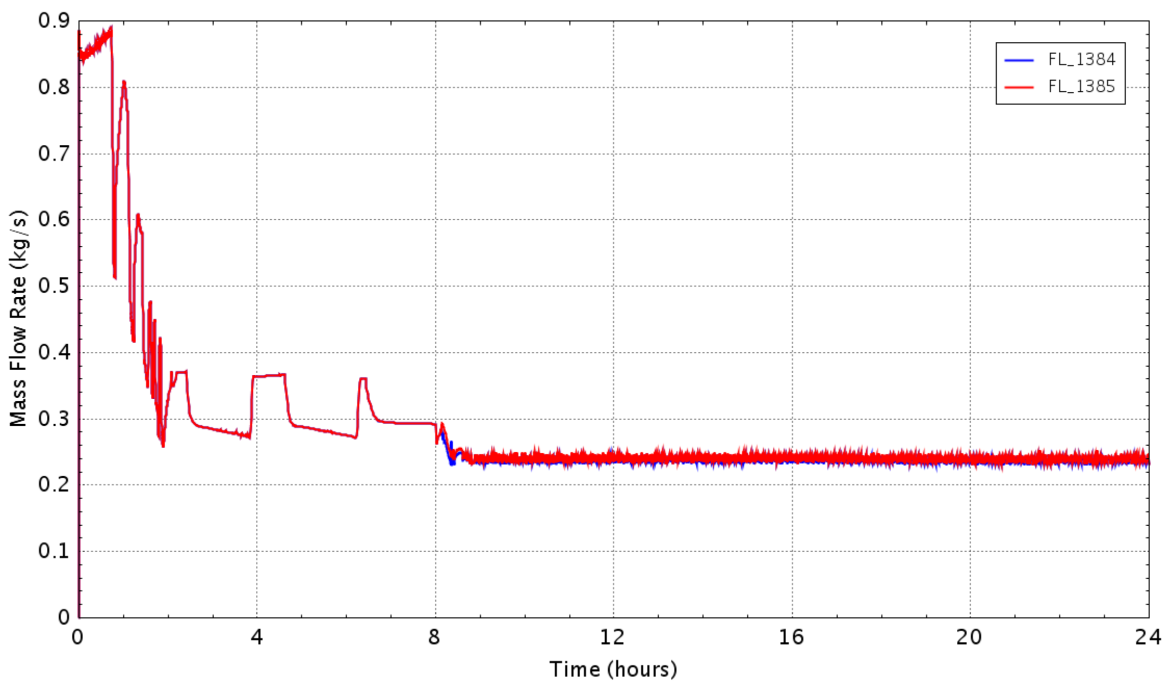

Figure D - 89 Flow rate of the recirculating pump seal leakage

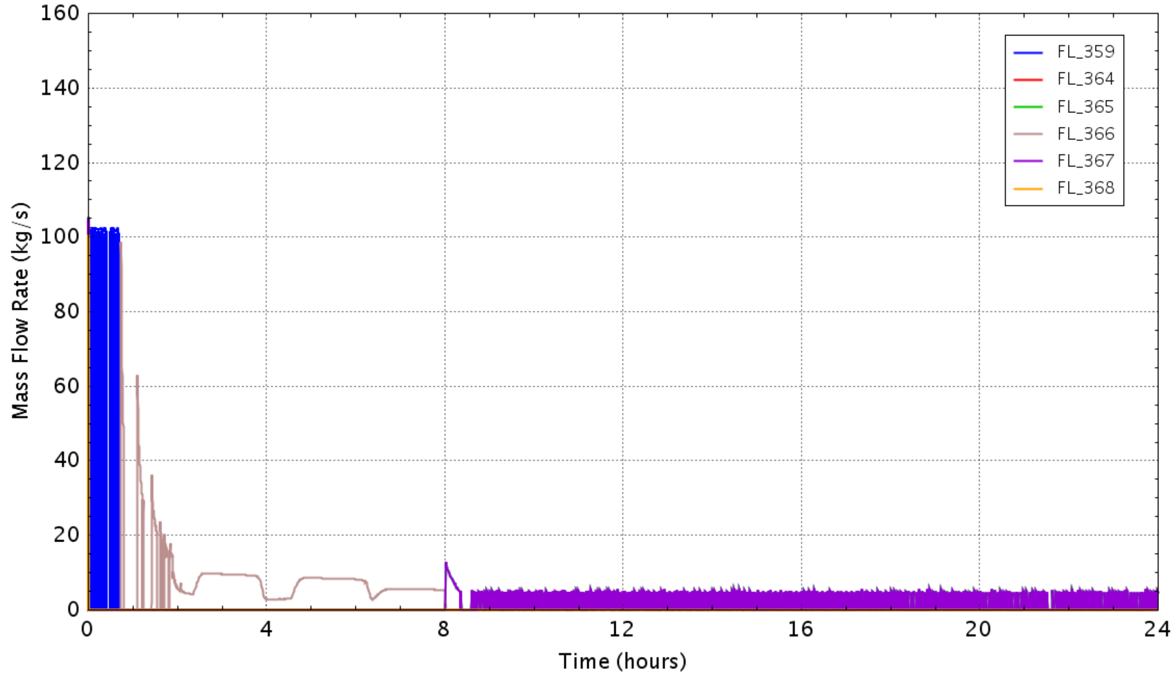

Figure D - 90 Flow rate of the SRVs

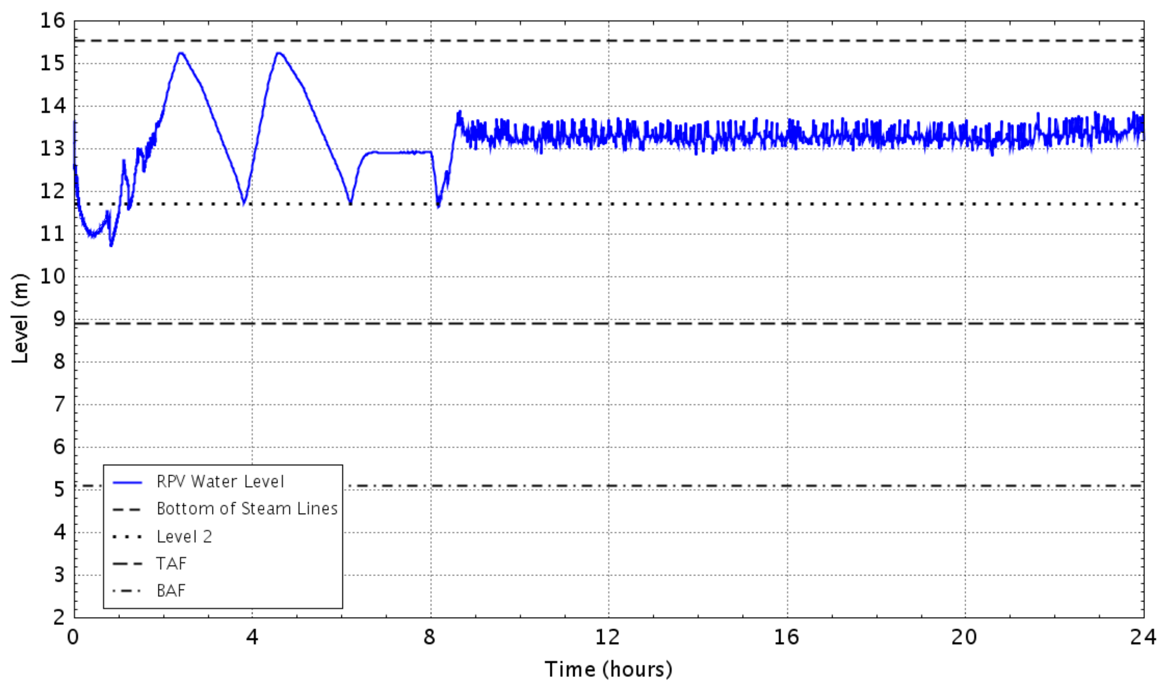

Figure D - 91 RPV down comer water level

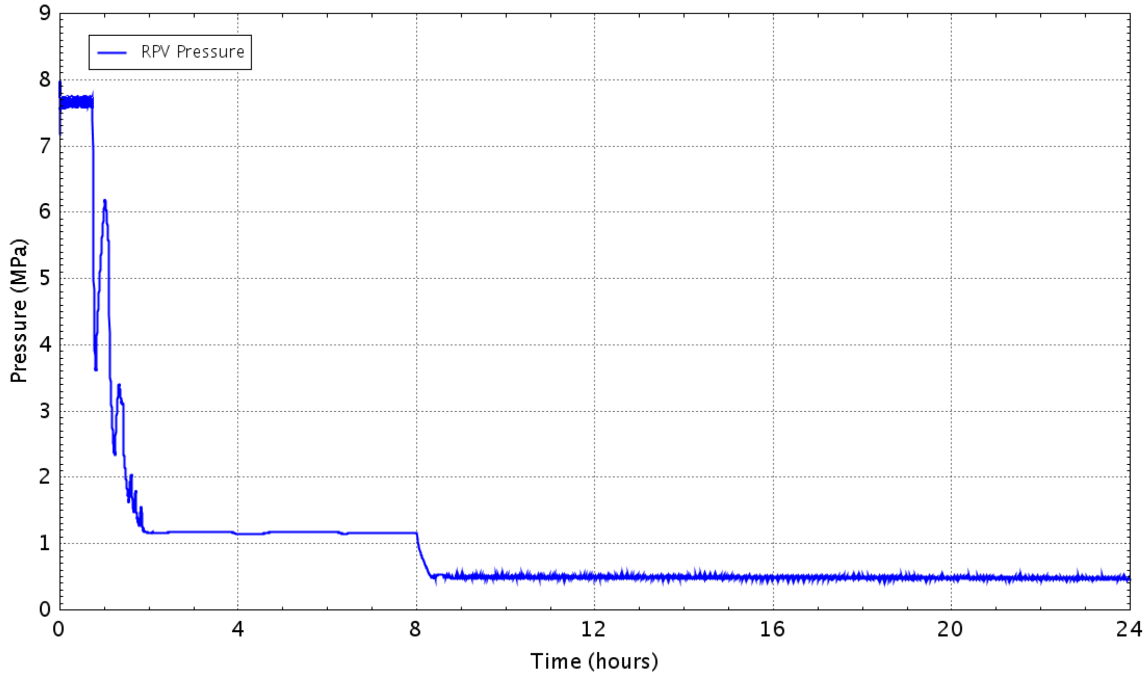

Figure D - 92 Pressure in the RPV

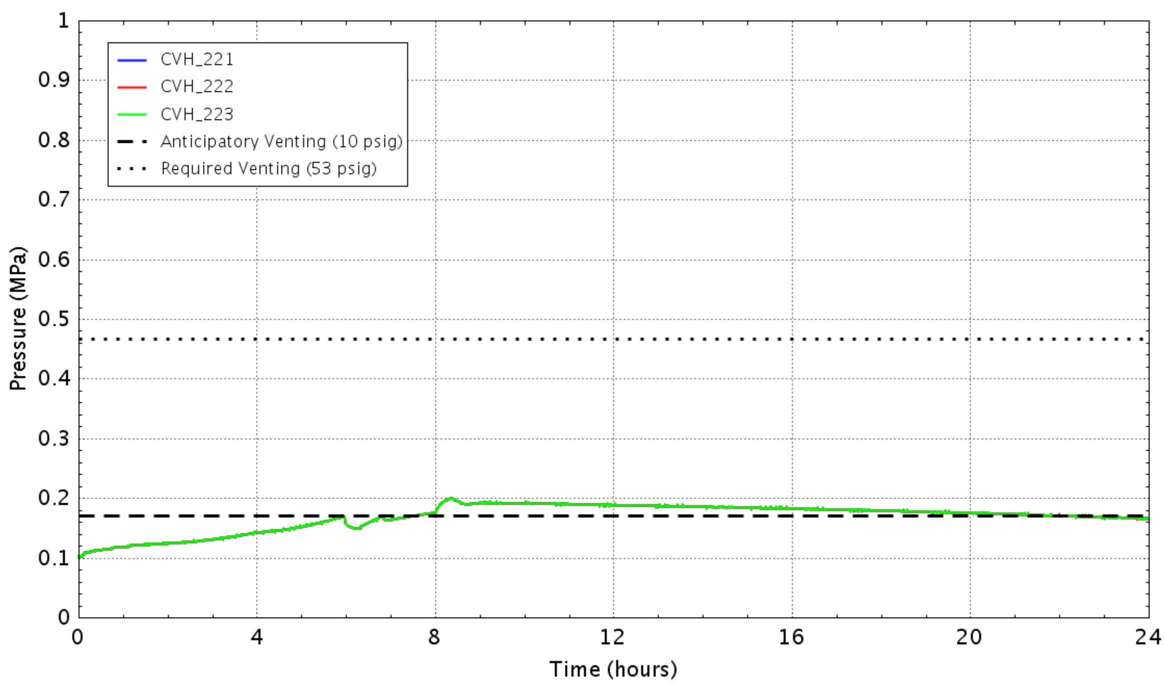

Figure D - 93 Pressure in the wetwell

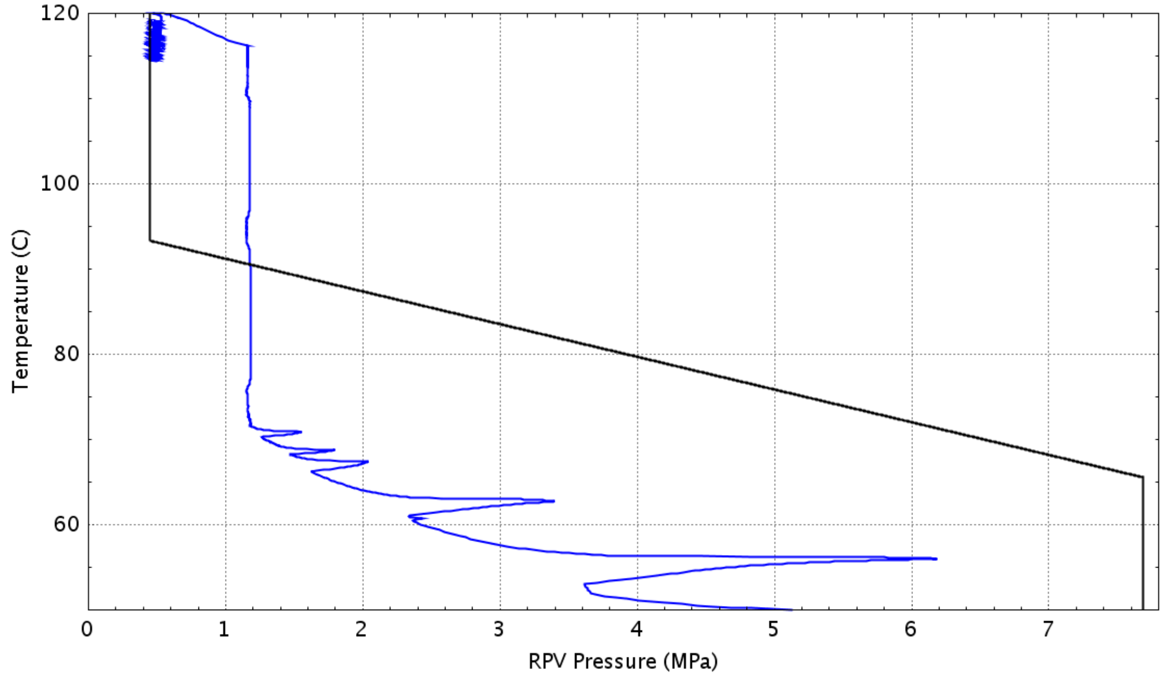

Figure D - 94 Plant status relative to the HCL curve (Graph 4 of the EOPs)

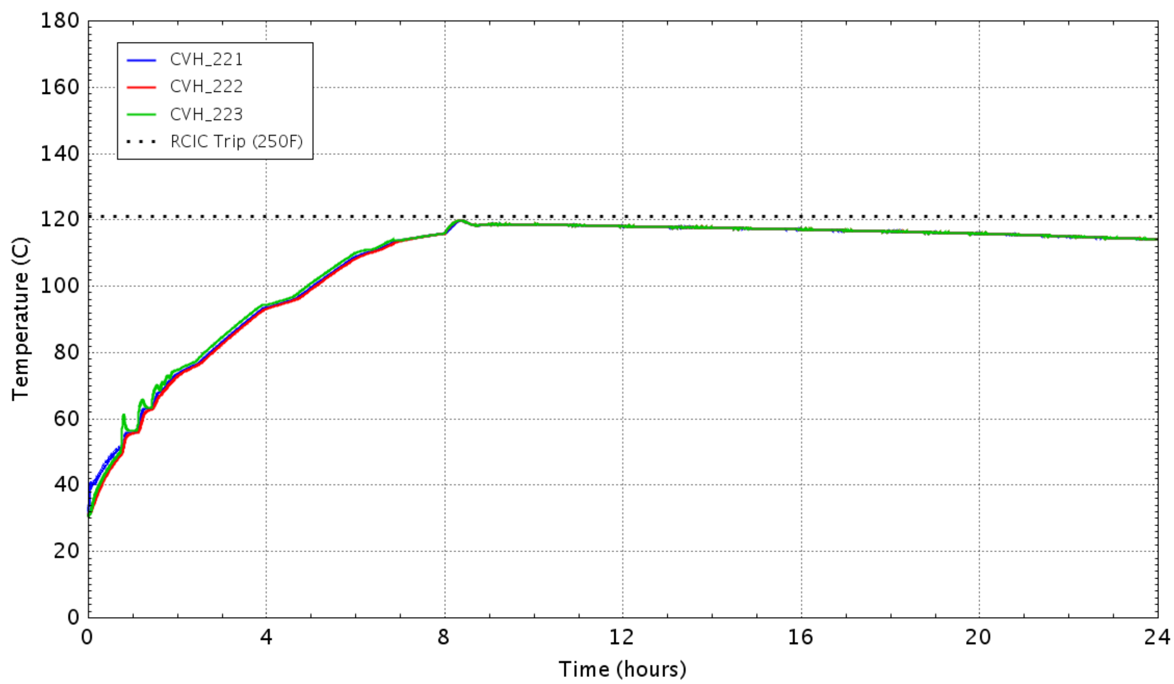

Figure D - 95 Water temperature in the wetwell

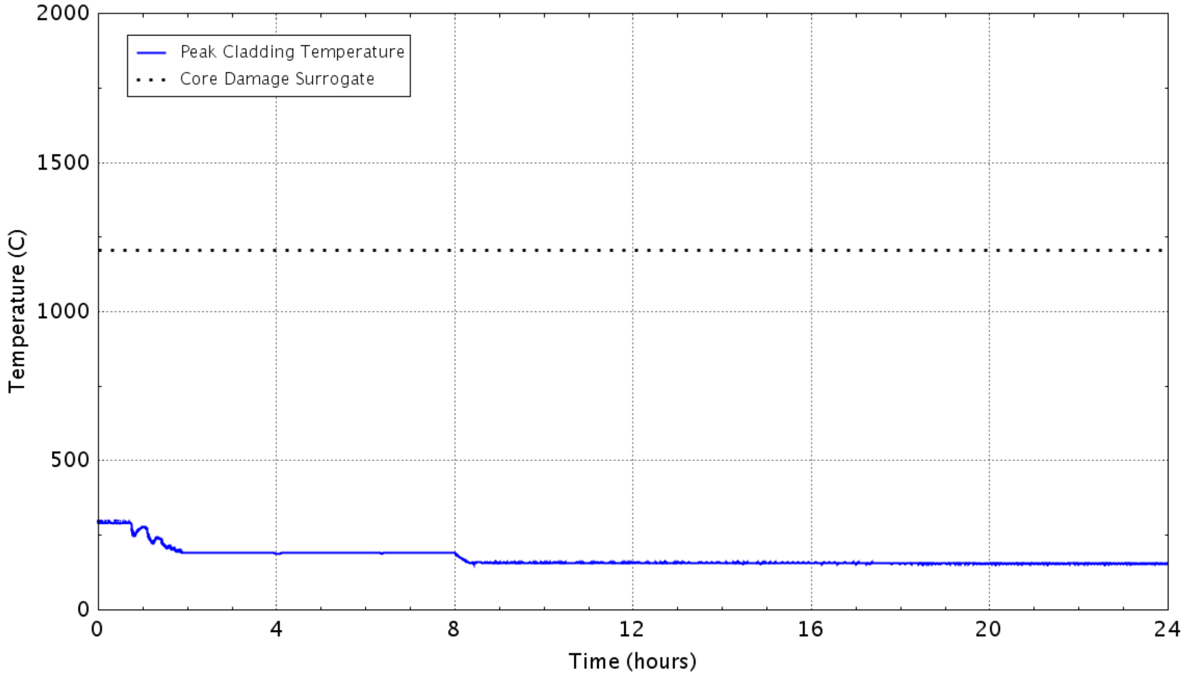

Figure D - 96 Peak temperature of the fuel cladding as a function of time

D.1.9 Case 9: LOOPGR-38-9, AC Loss at t=0, RCIC Available Indefinitely, CSTAvailable, Perform Required Venting Only

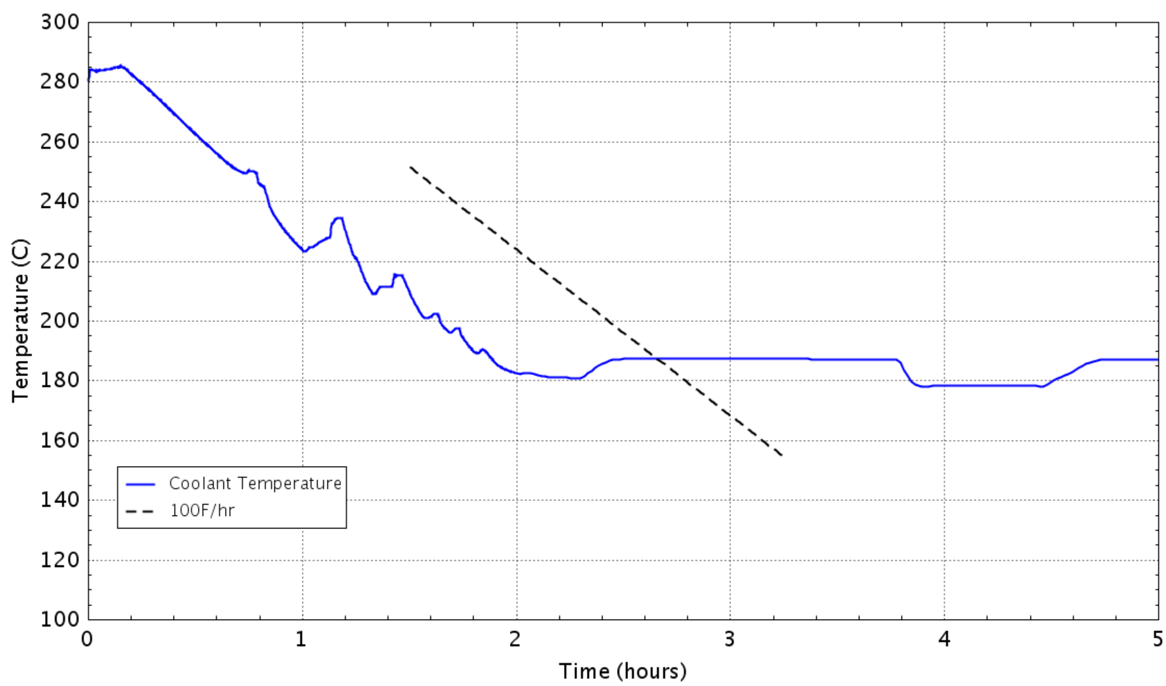

Figure D - 97 RPV cooldown rate

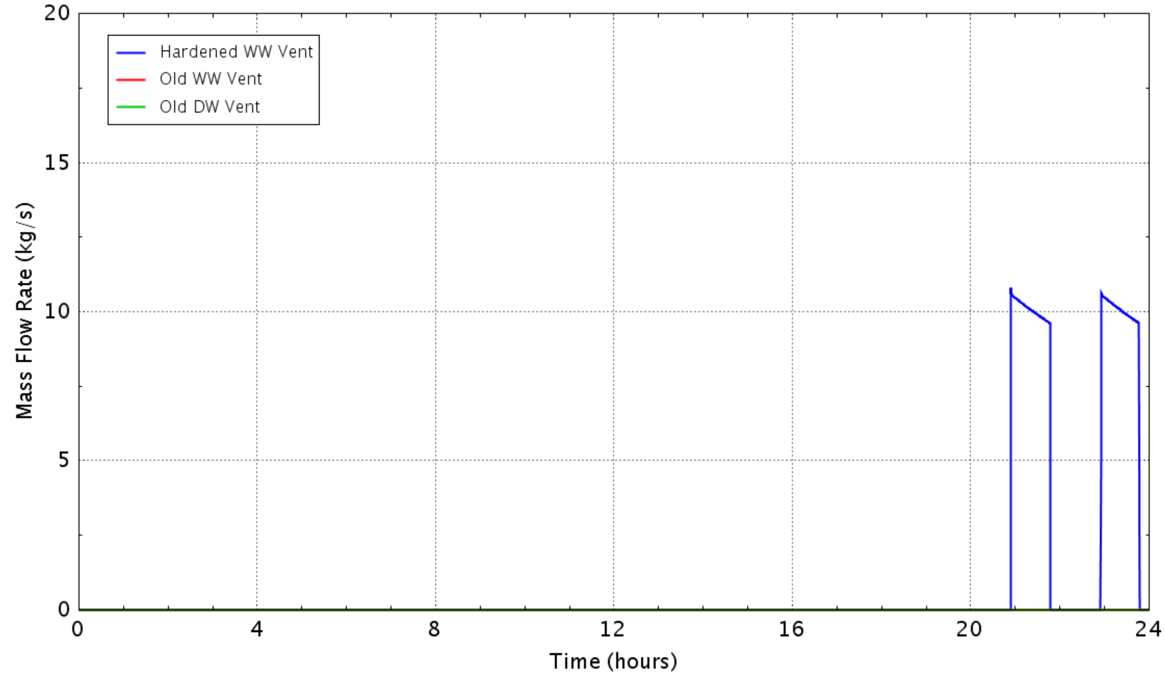

Figure D - 98 Flow rate of the containment vents

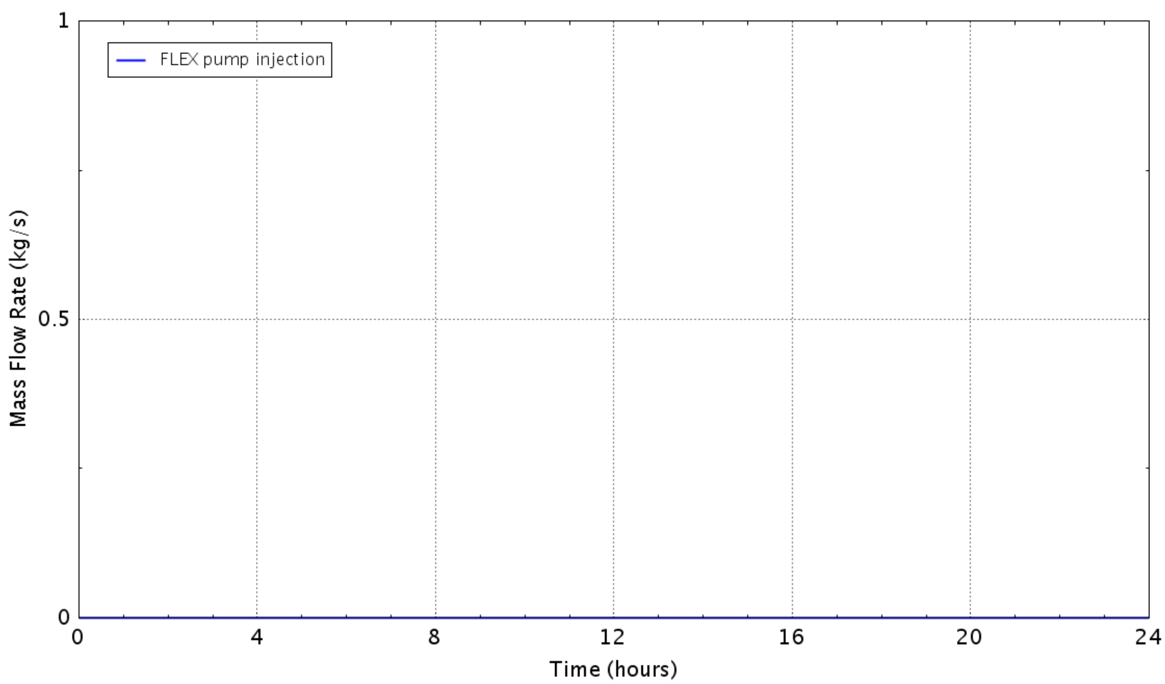

Figure D - 99 Flow rate of the FLEXpump

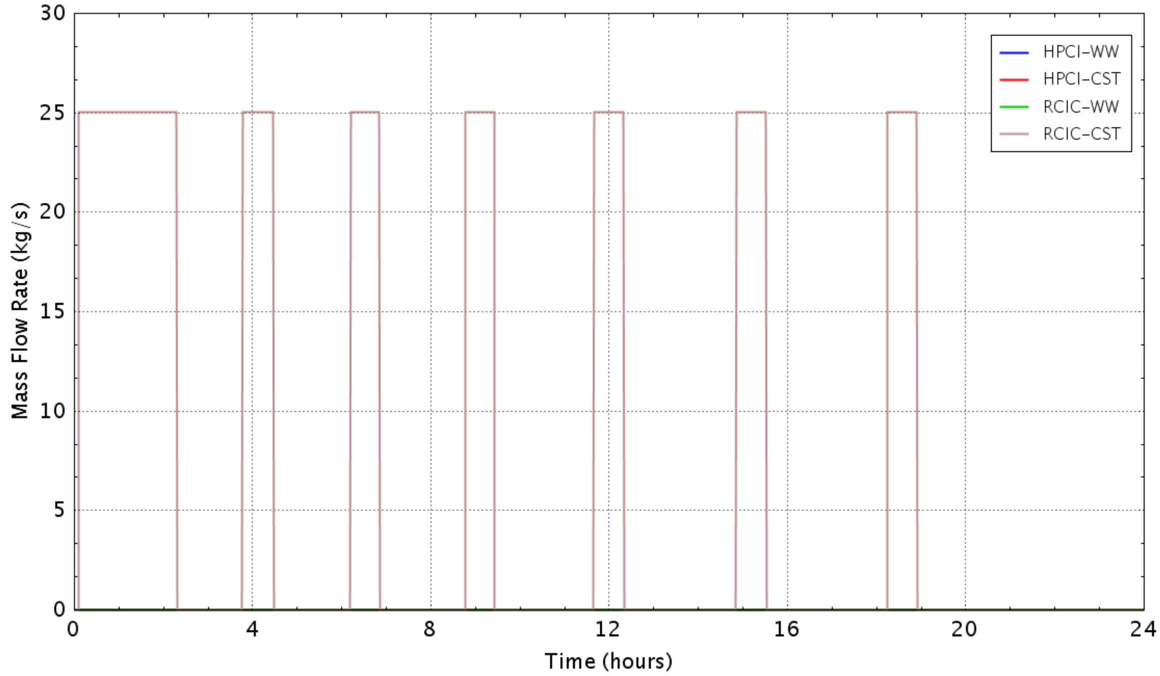

Figure D - 100 Flow rate of the HPCI/RCIC pumps

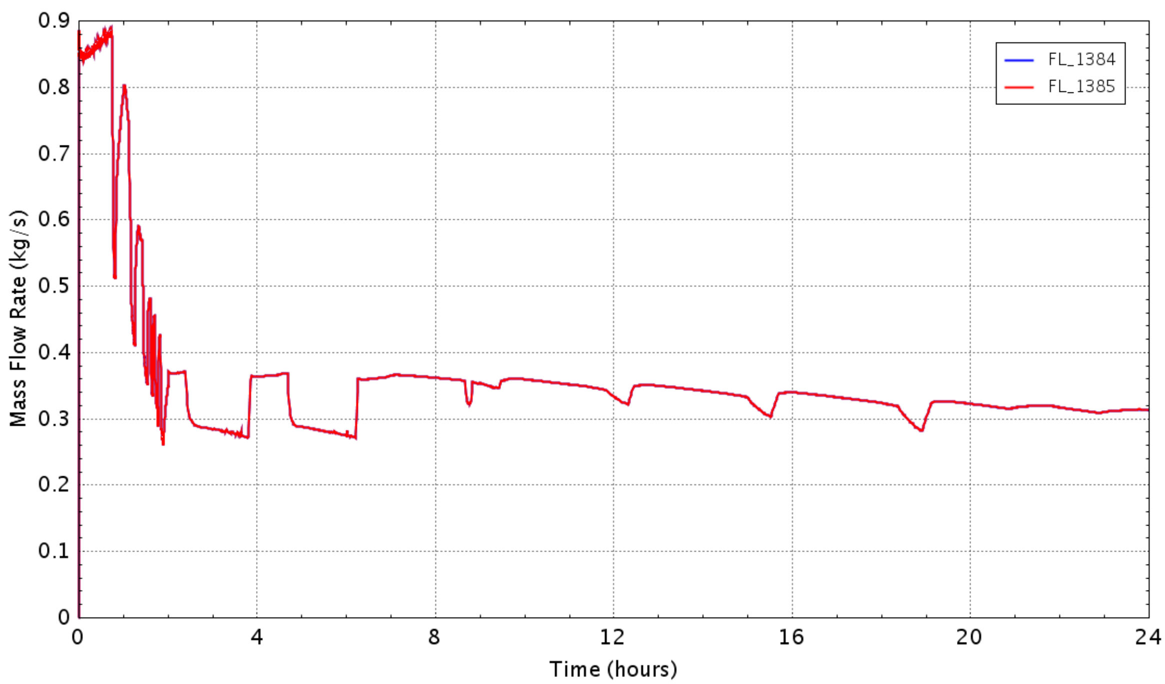

Figure D - 101 Flow rate of the recirculating pump seal leakage

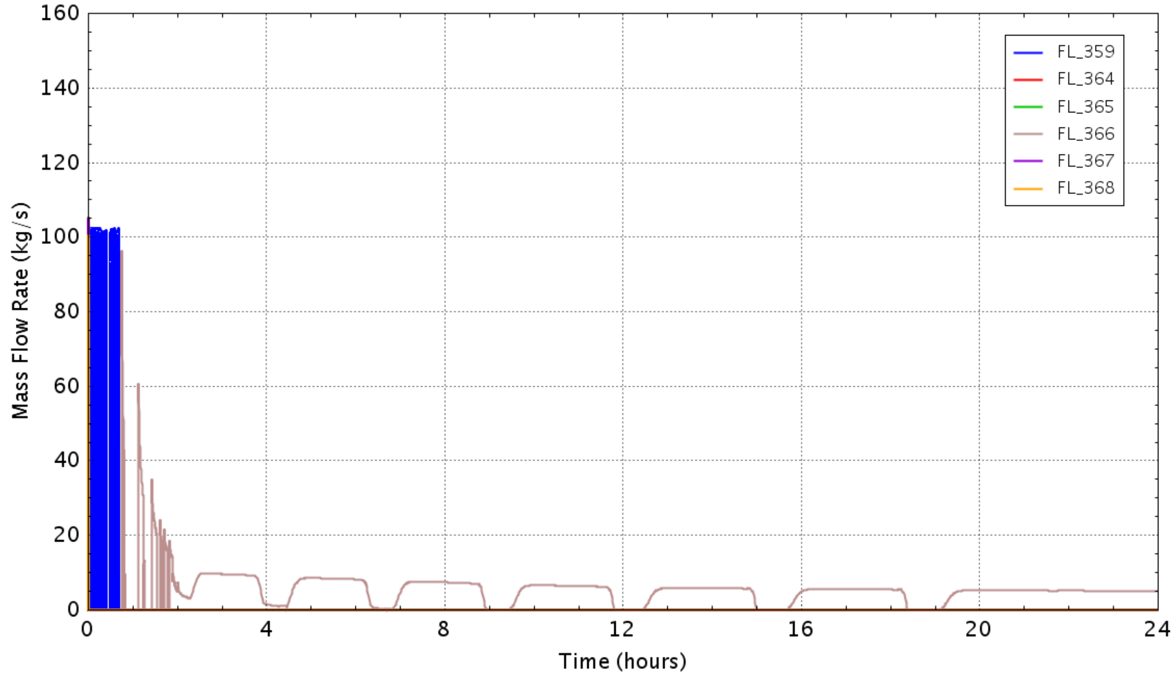

Figure D - 102 **Flow rate of the SRVs**

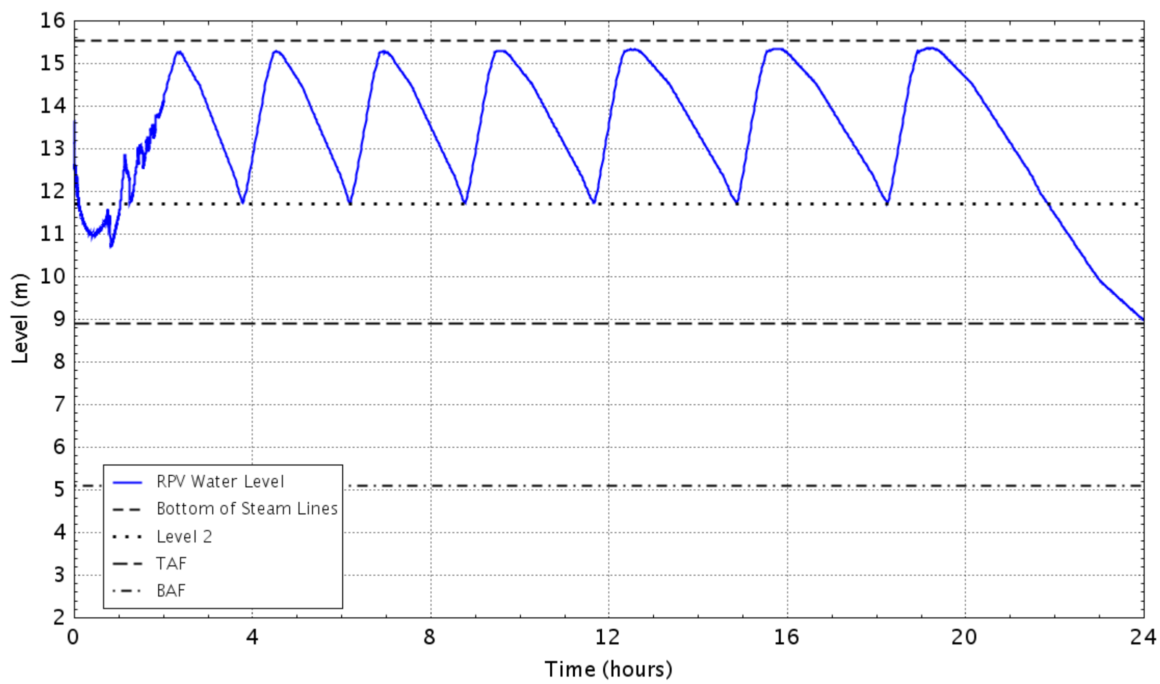

Figure D - 103 **RPV down comer water level**

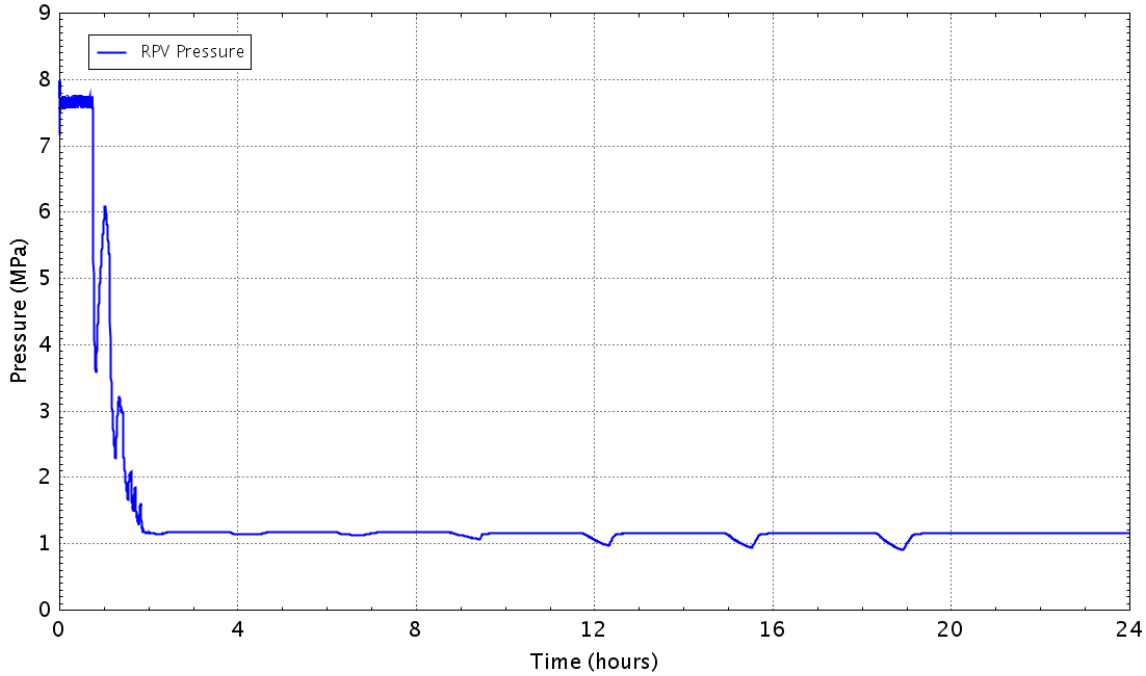

Figure D - 104 Pressure in theRPV

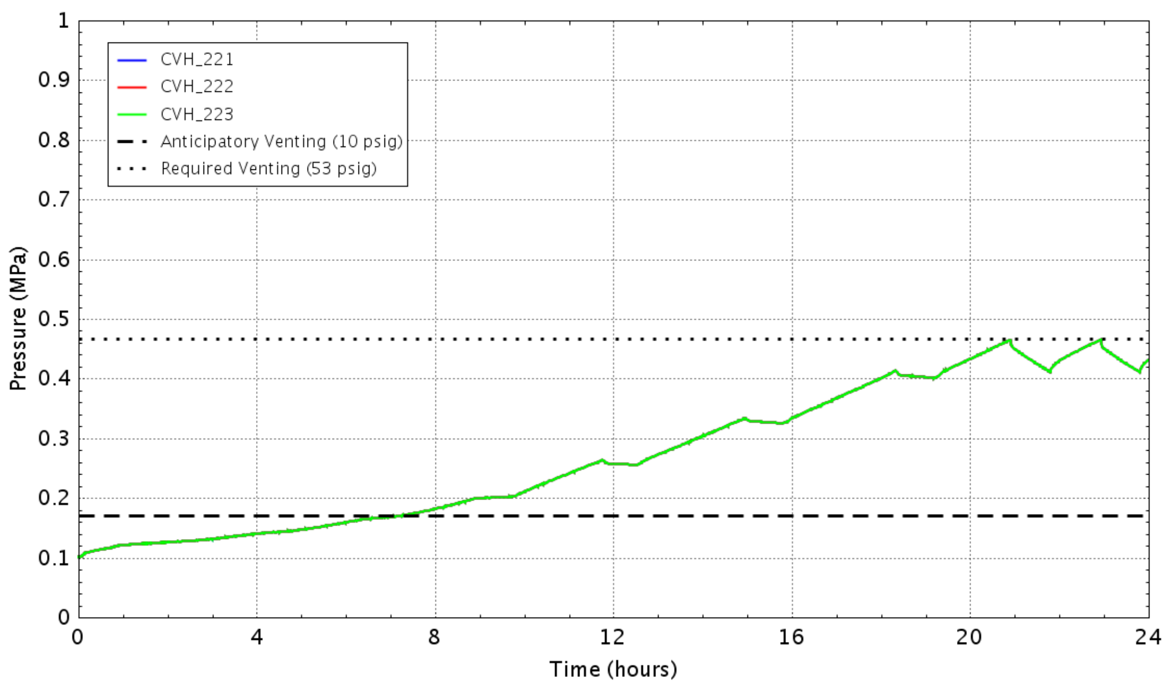

Figure D - 105 Pressure in the wetwell

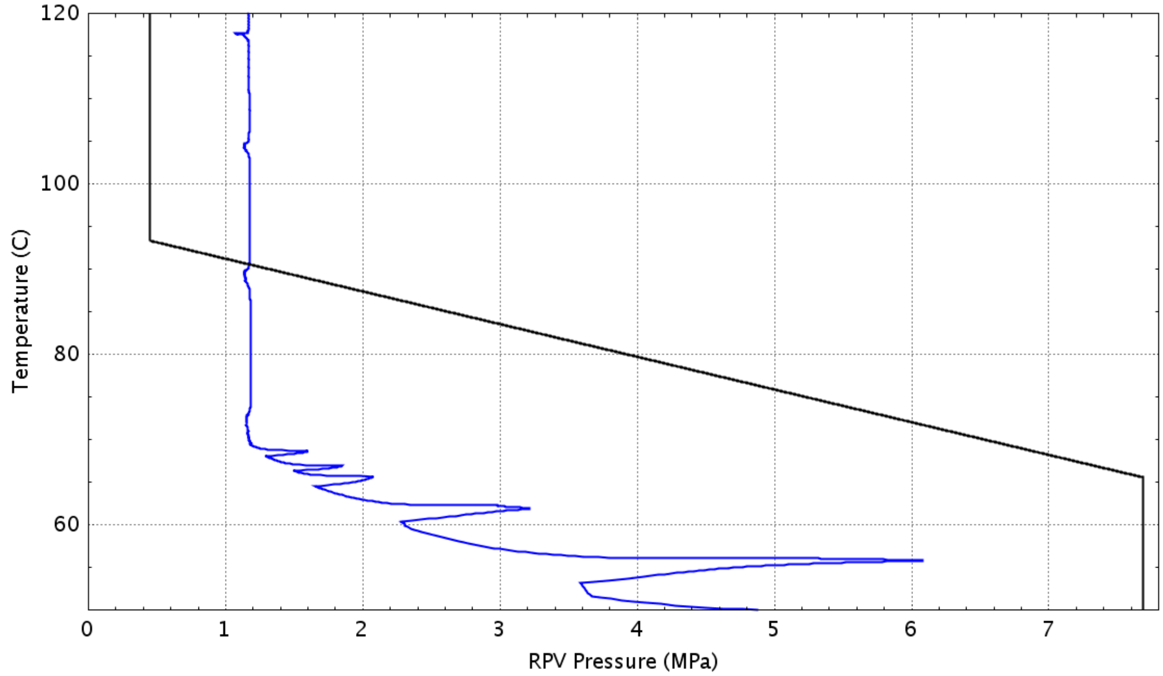

Figure D – 106 Plant status relative to the HCL curve (Graph 4 of the EOPs)

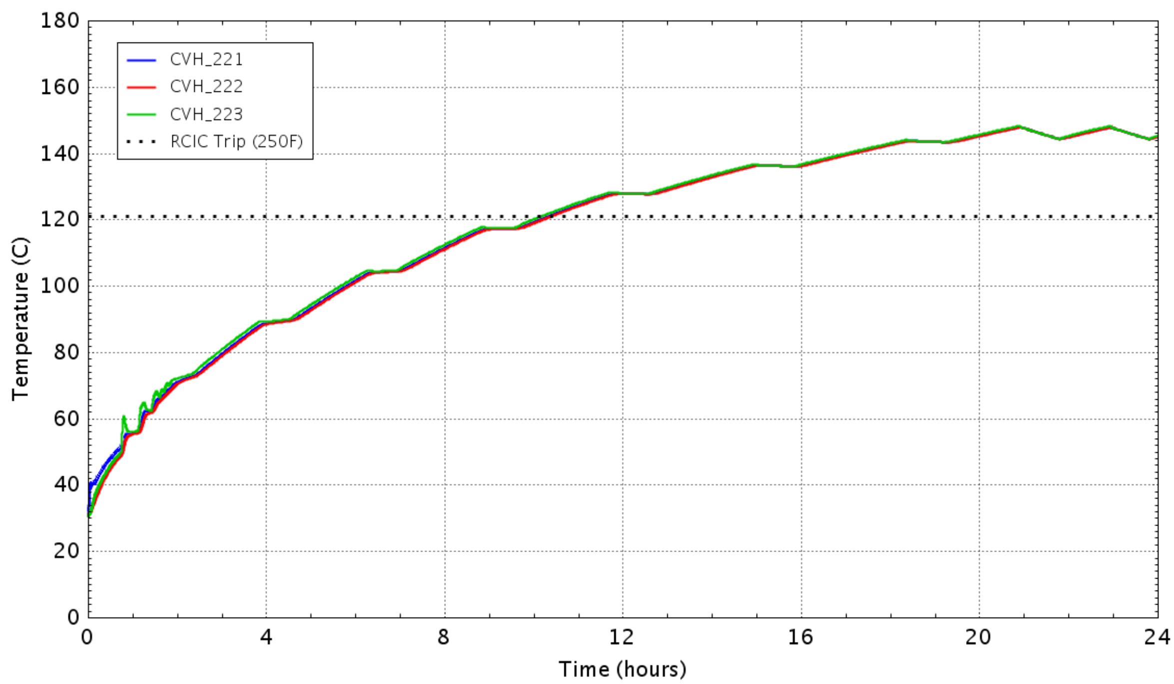

Figure D - 107 Water temperature in the wetwell

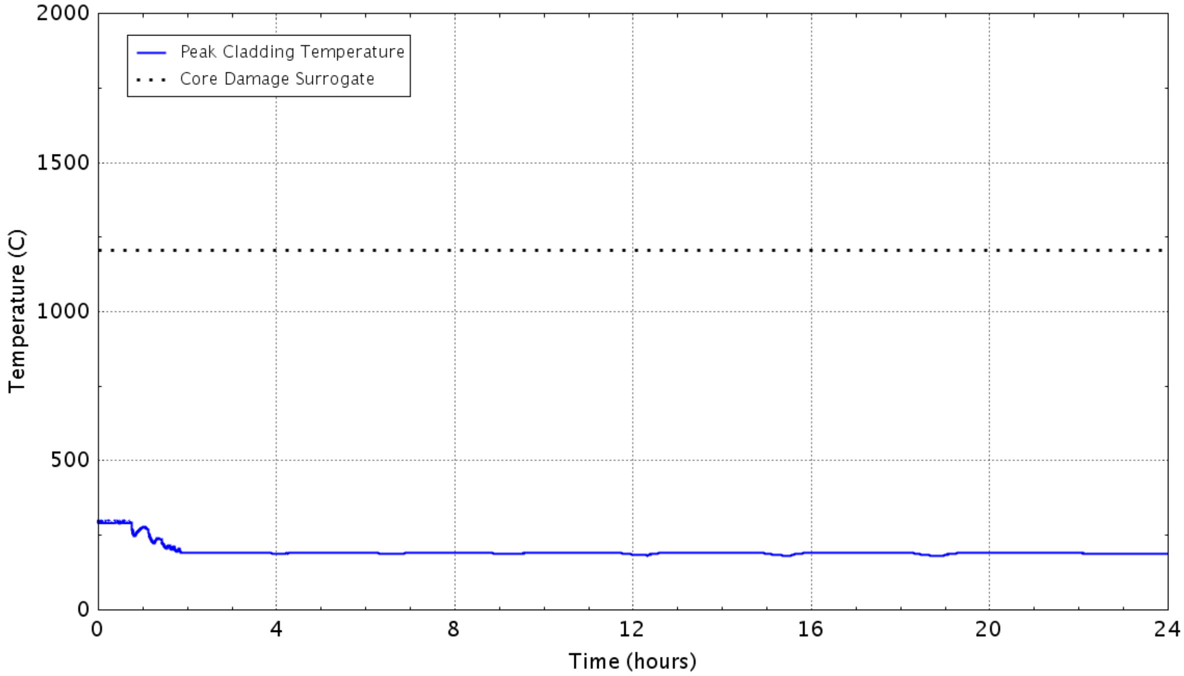

Figure D – 108 Peak temperature of the fuel cladding as a function oftime

D.1.10 Case 10: LOOPGR-38-9, AC Loss at t=0, RCIC Available Indefinitely, CST Available, Perform Anticipatory Venting

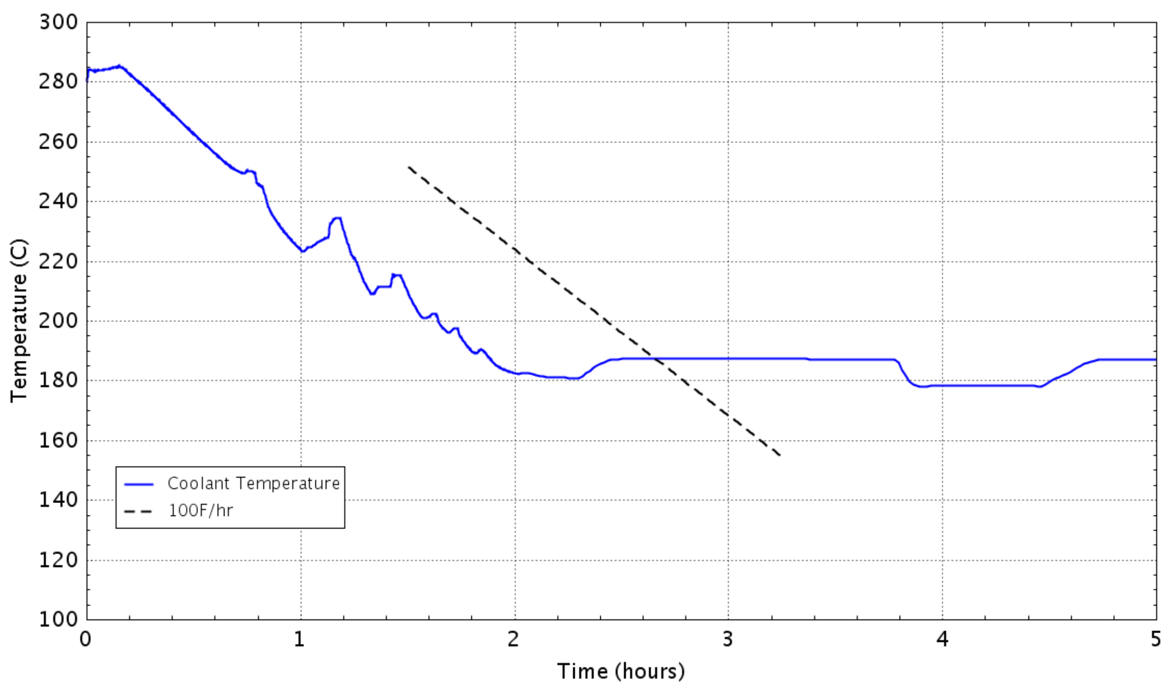

Figure D - 109 RPV cooldown rate

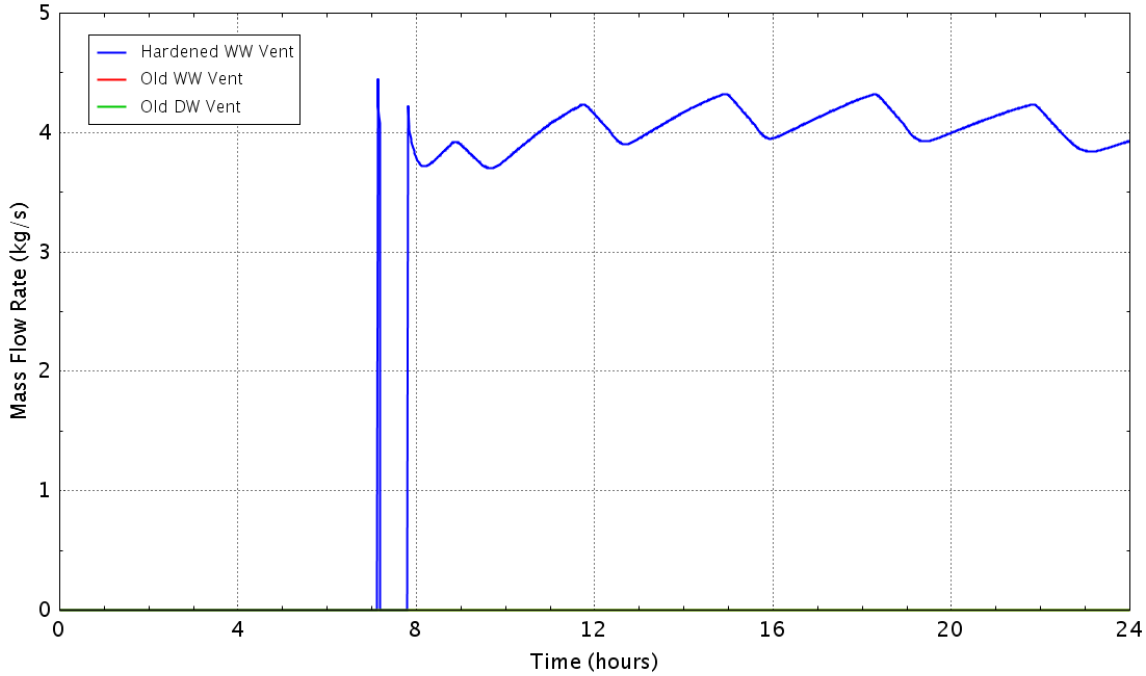

Figure D - 110 Flow rate of the containment vents

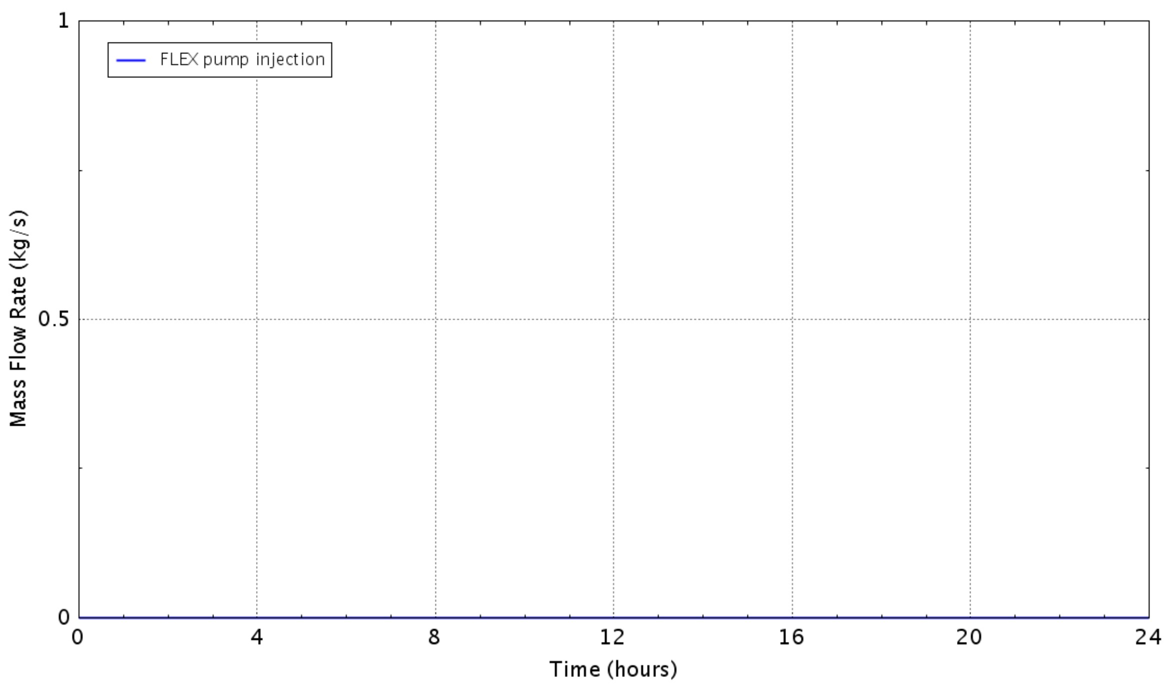

Figure D - 111 Flow rate of the FLEX pump

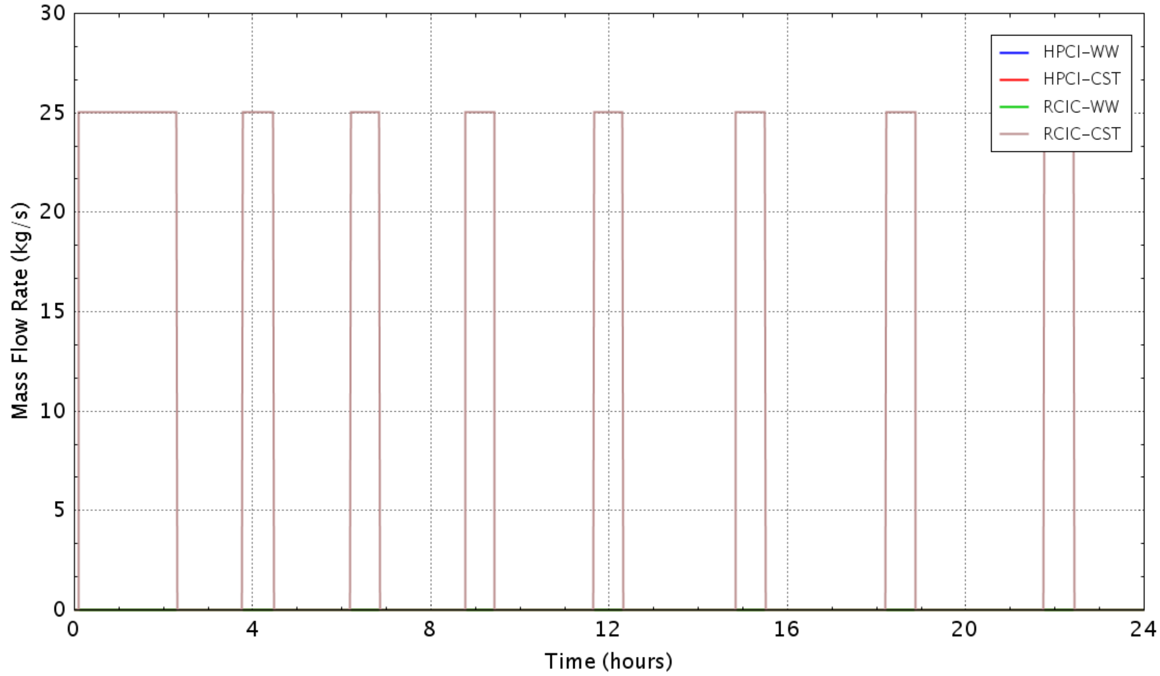

Figure D - 112 Flow rate of the HPCI/RCIC pumps

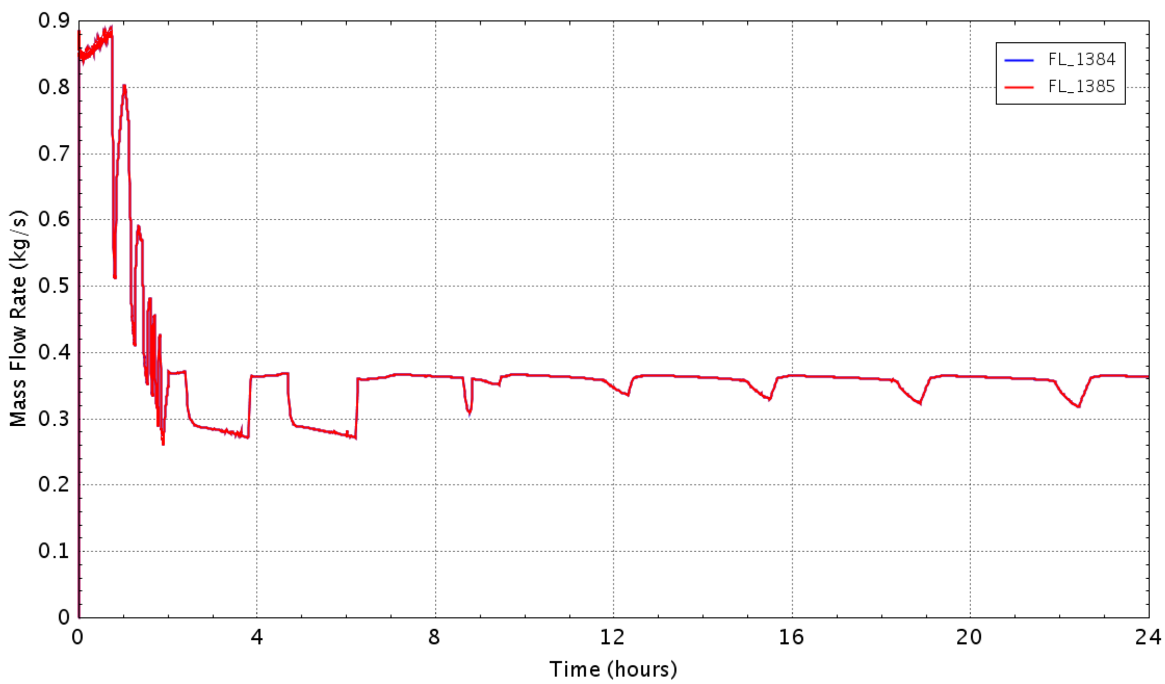

Figure D - 113 Flow rate of the recirculating pump seal leakage

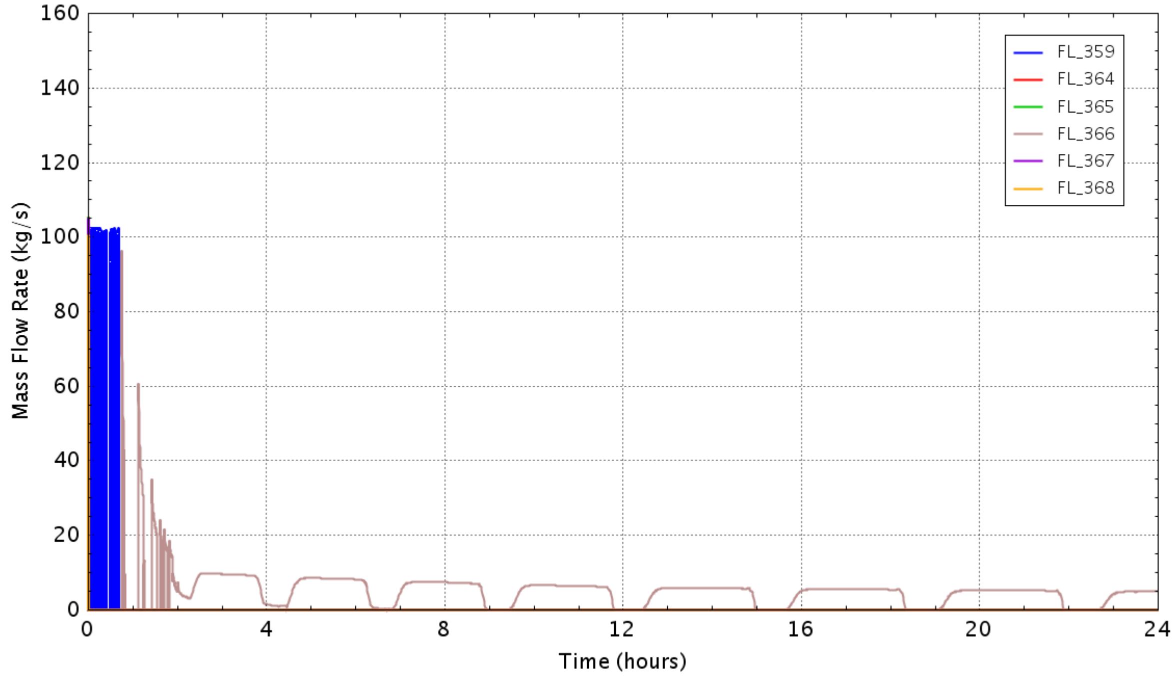

Figure D - 114 **Flow rate of the SRVs**

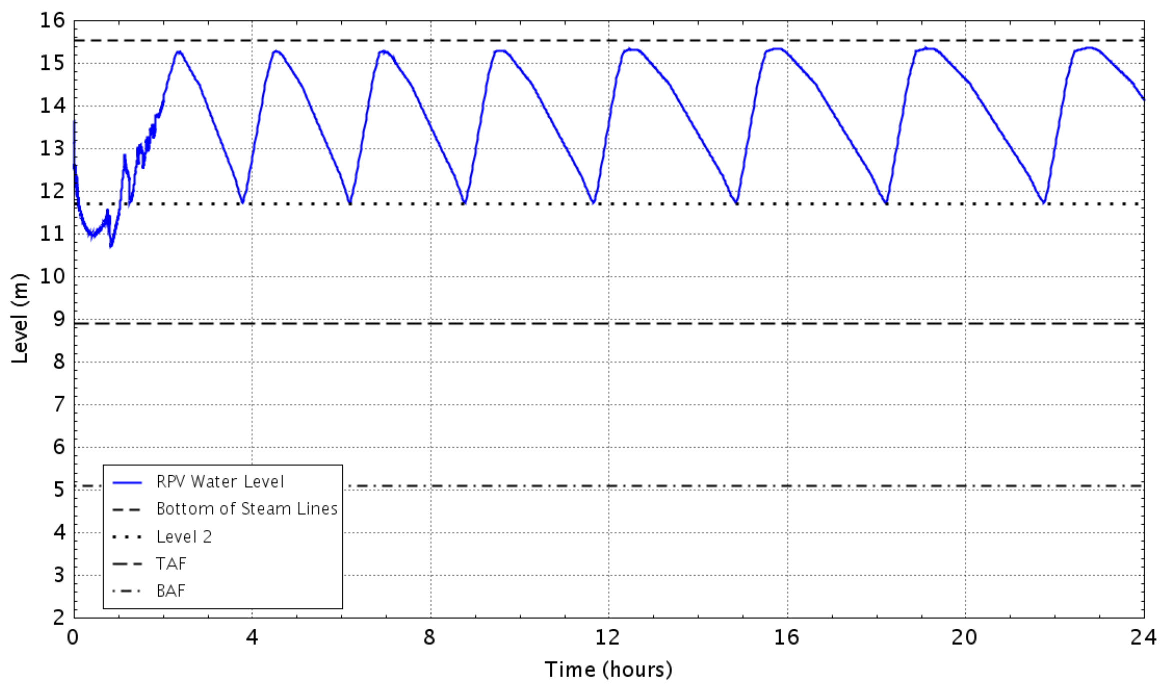

Figure D - 115 **RPV down comer water level**

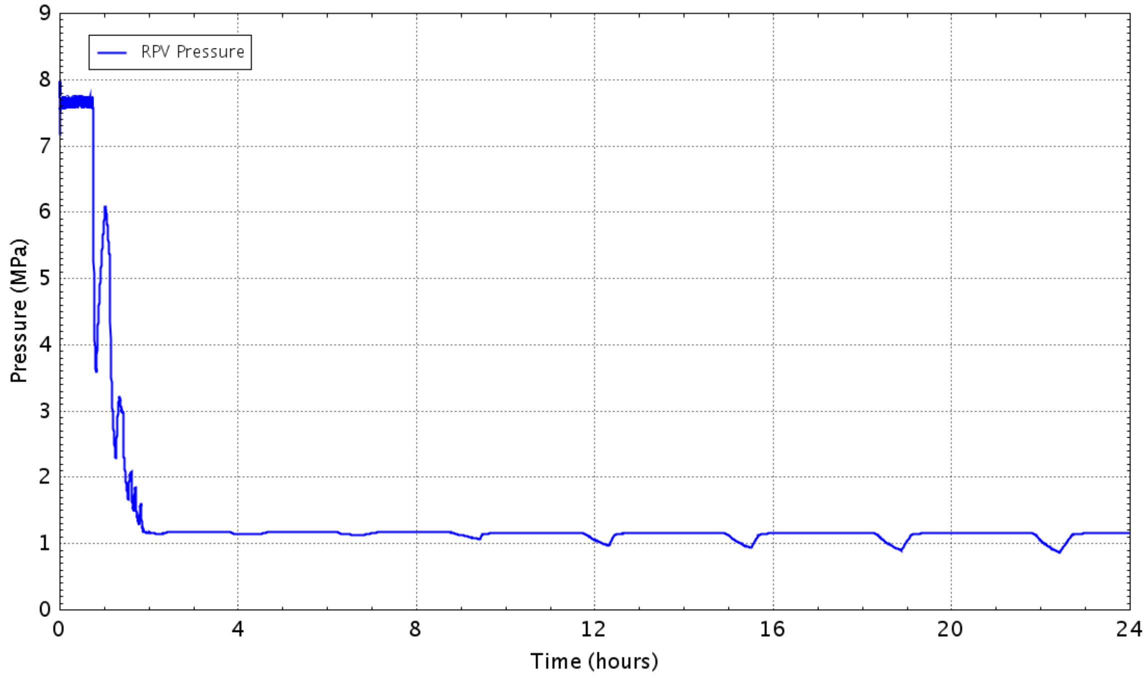

Figure D - 116 Pressure in theRPV

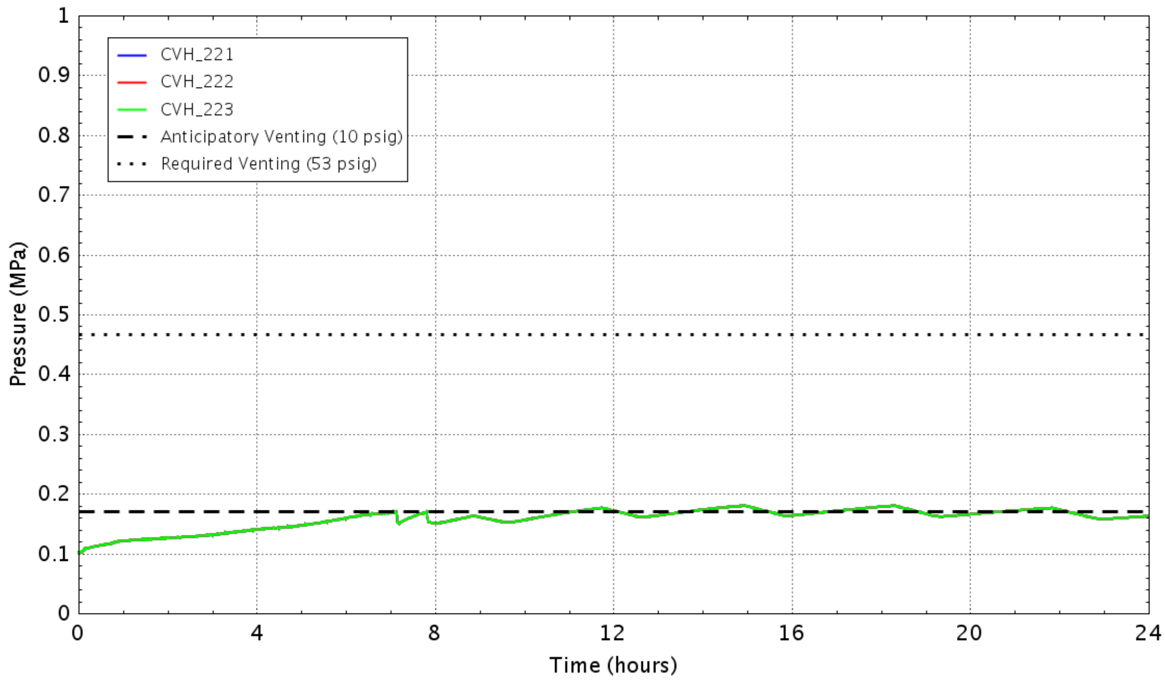

Figure D - 117 Pressure in the wetwell

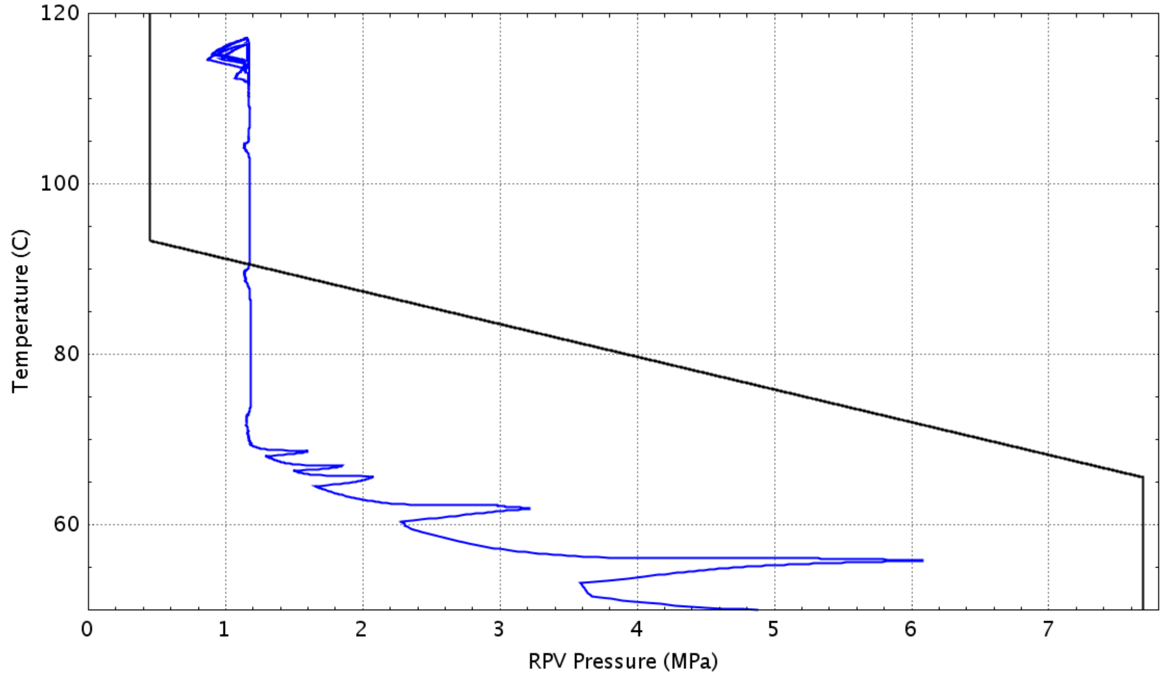

Figure D - 118 Plant status relative to the HCL curve (Graph 4 of the EOPs)

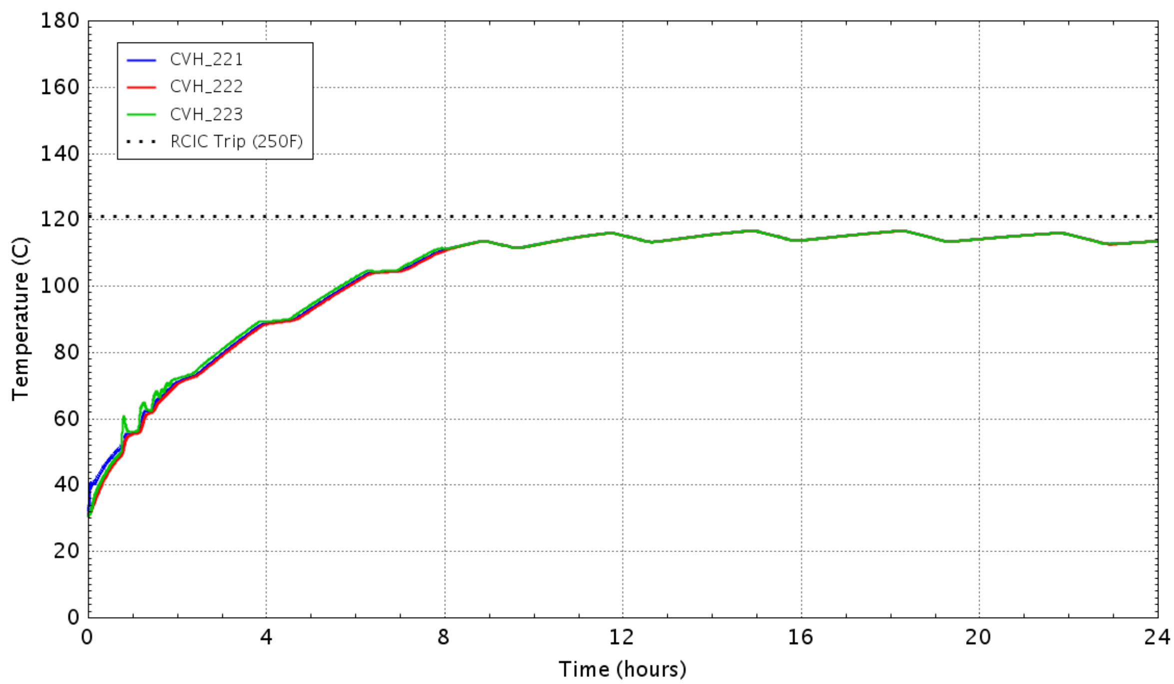

Figure D - 119 Water temperature in the wetwell

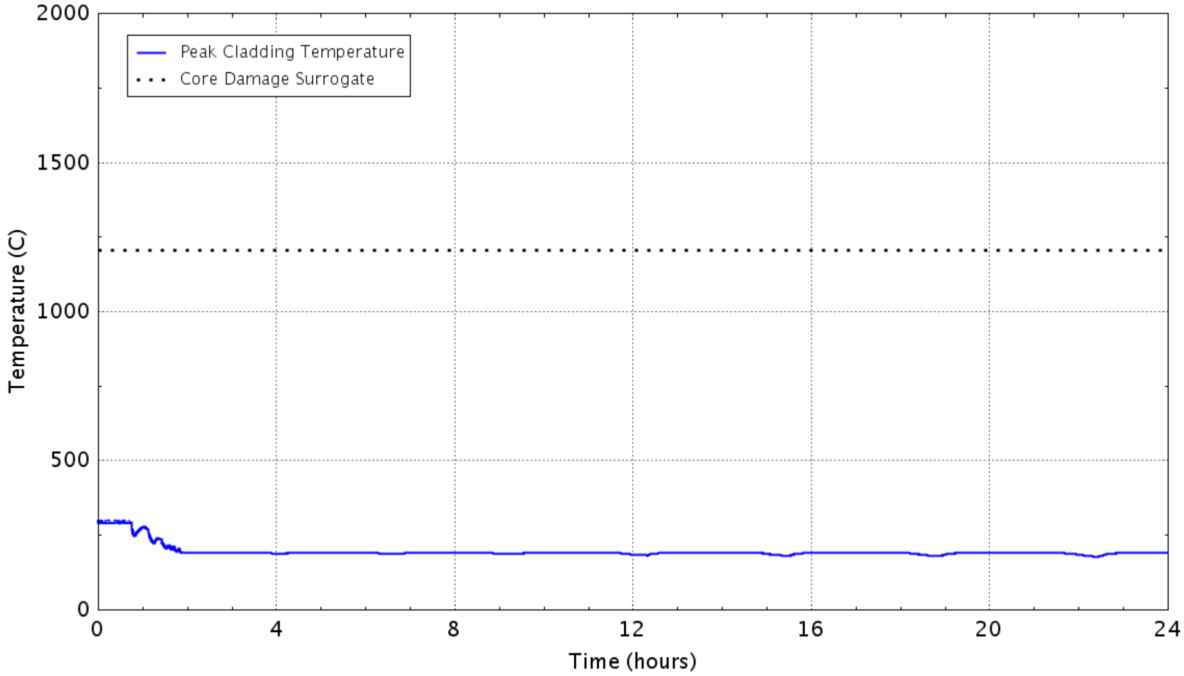

Figure D - 120 Peak temperature of the fuel cladding as a function of time

D.1.11 Case 11: LOOPGR-38-9, AC Loss at t=0, RCIC Available Indefinitely, CST Unavailable, Perform Required Venting Only

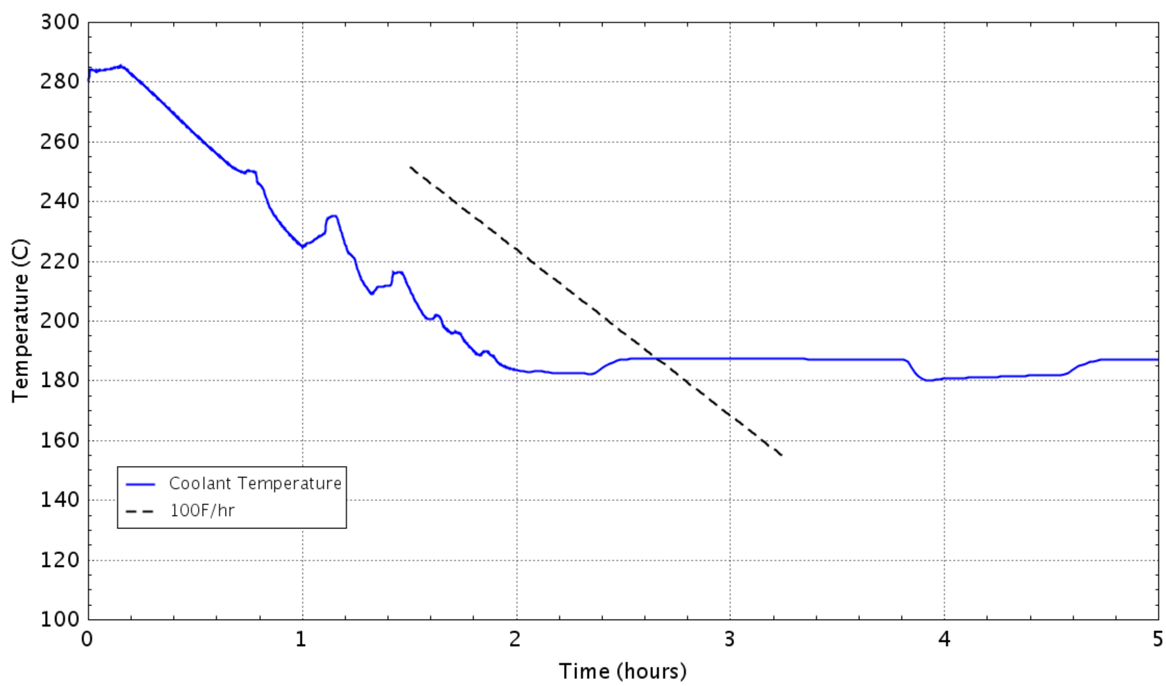

Figure D - 121 RPV cooldown rate

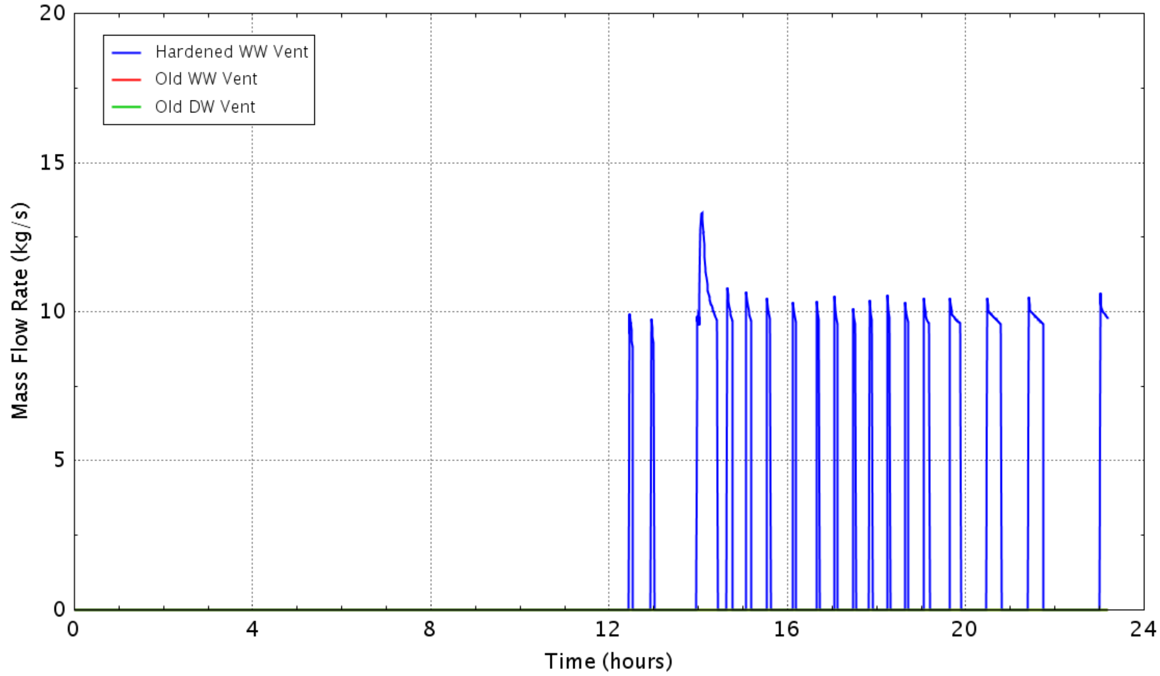

Figure D - 122 Flow rate of the containment vents

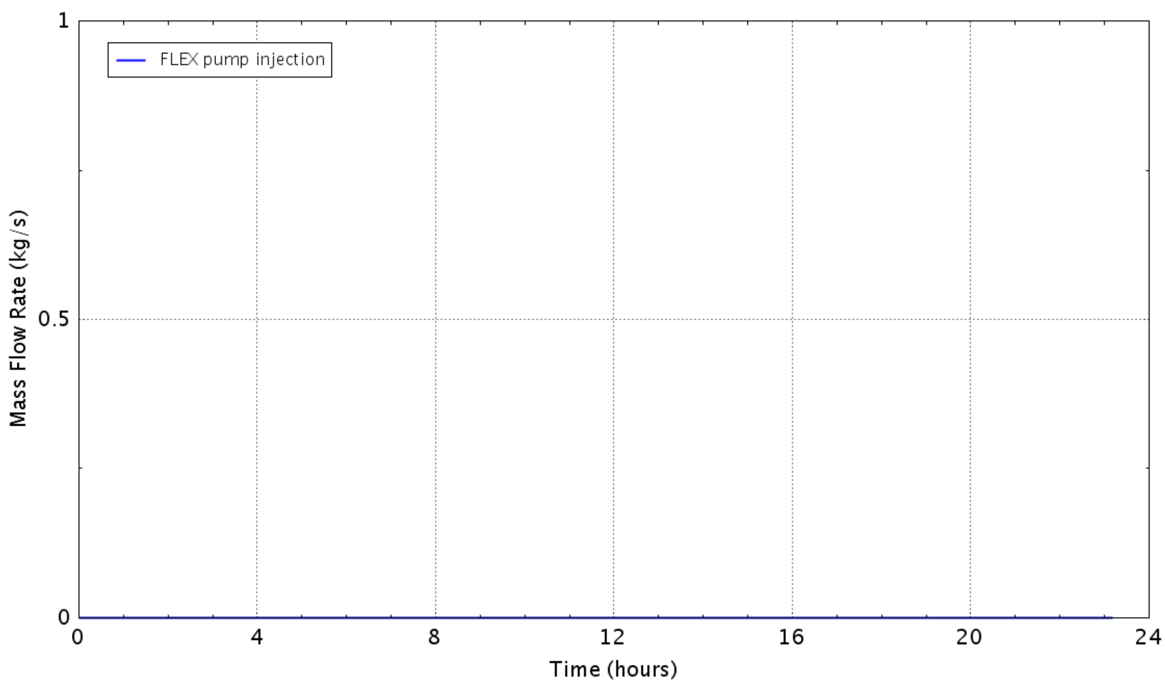

Figure D - 123 Flow rate of the FLEX pump

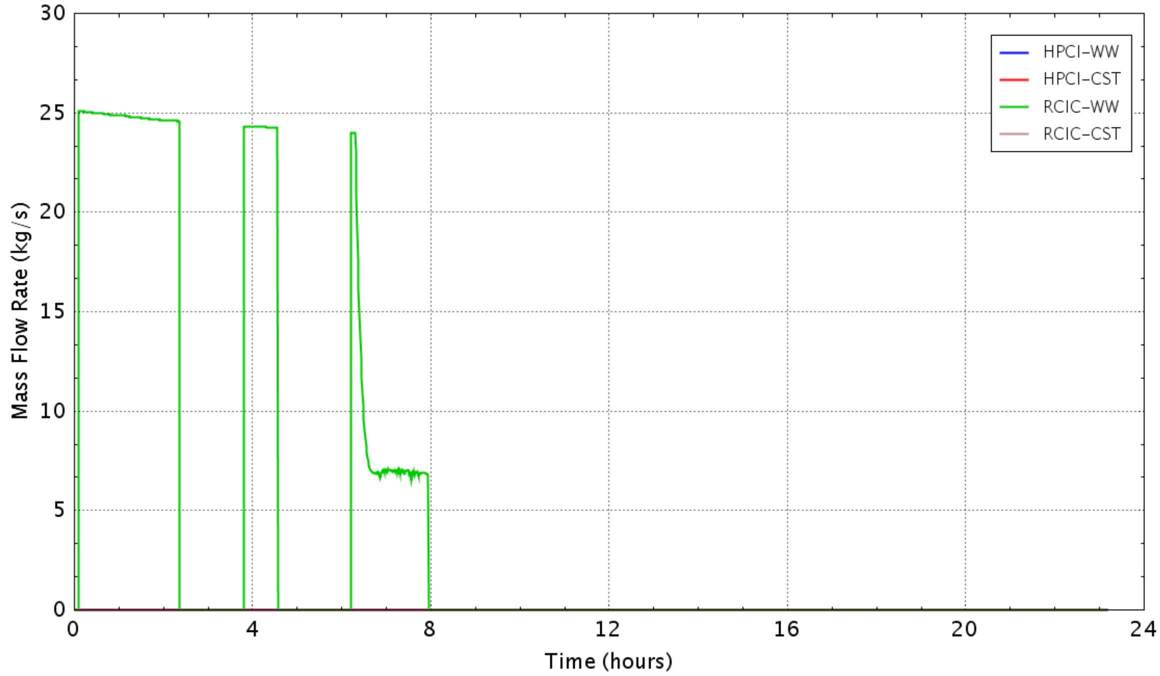

Figure D - 124 **Flow rate of the HPCI/RCIC pumps**

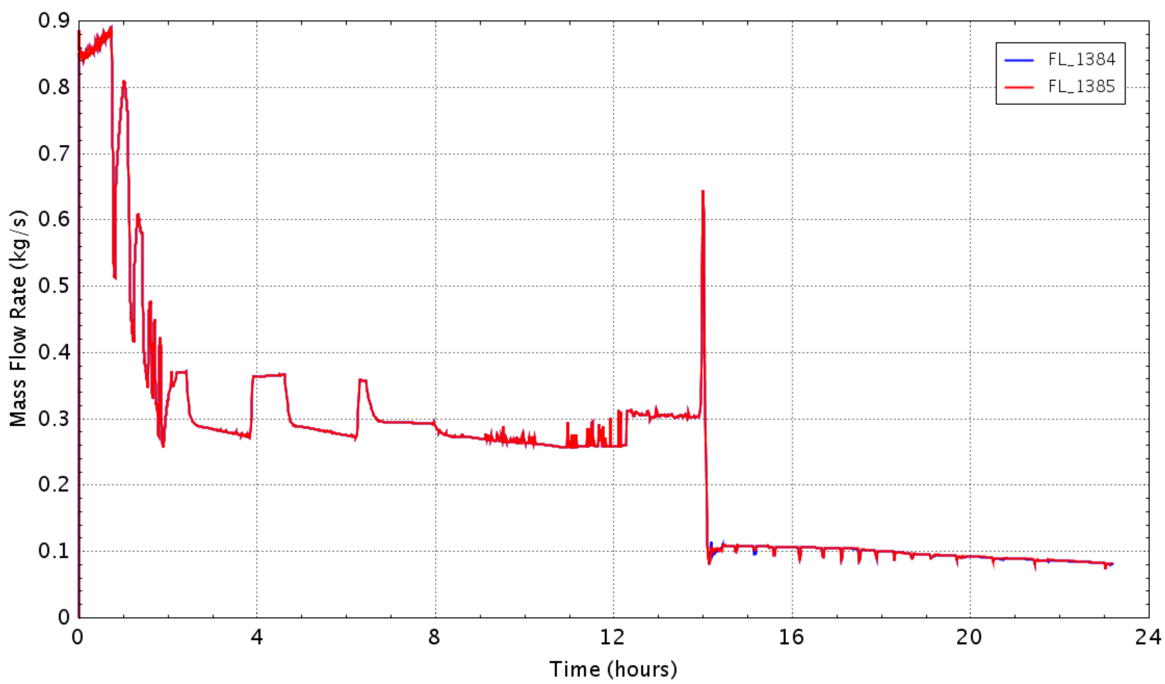

Figure D - 125 **Flow rate of the recirculating pump seal leakage**

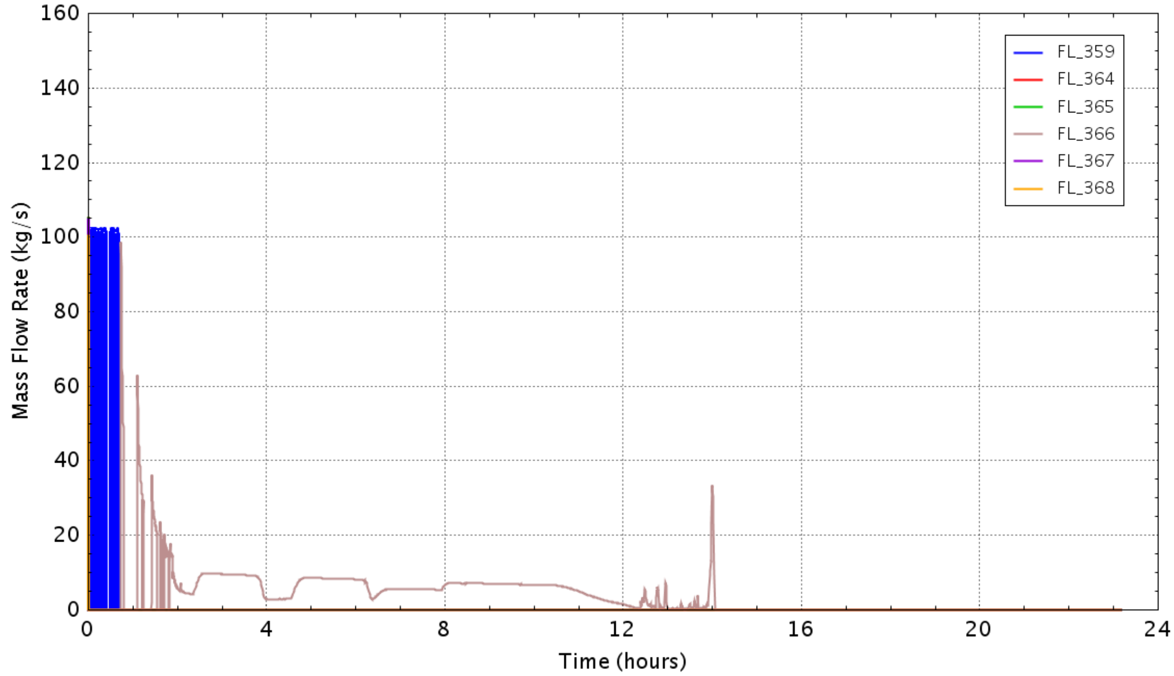

Figure D - 126 Flow rate of the SRVs

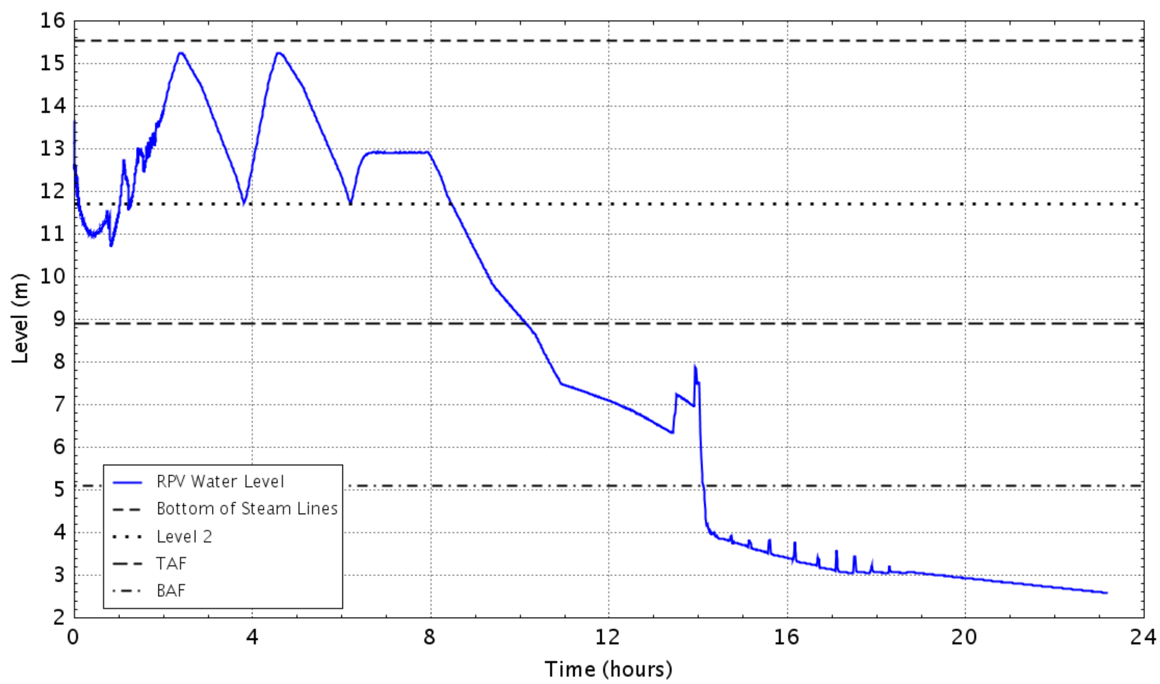

Figure D - 127 RPV down comer water level

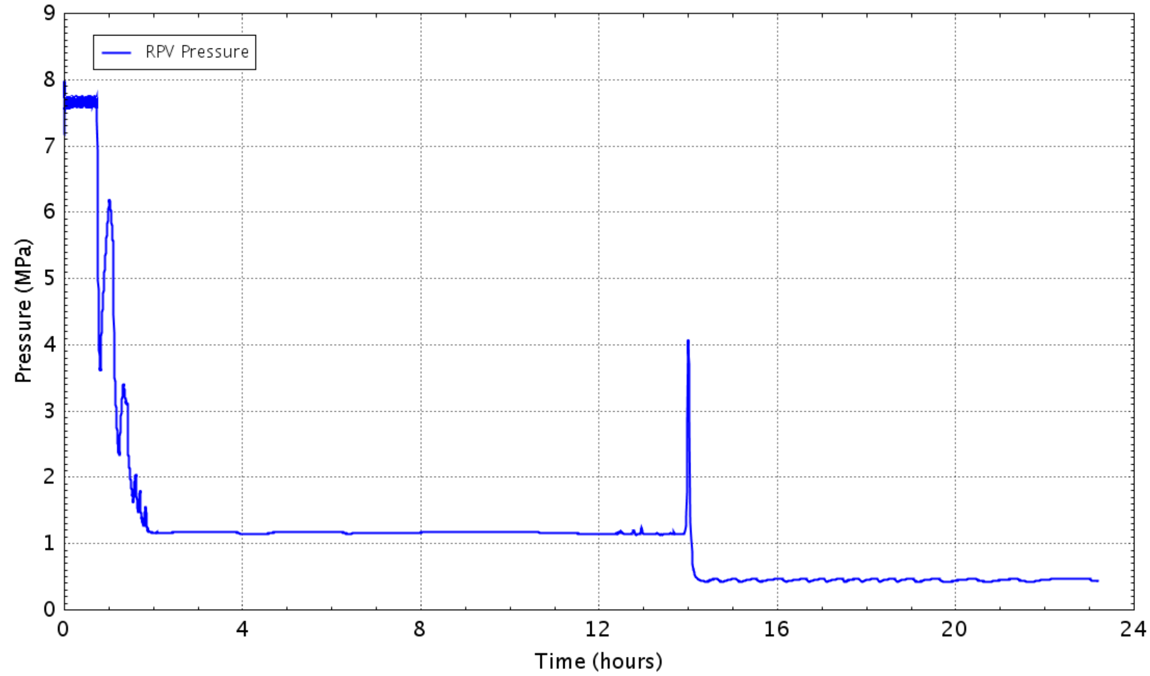

Figure D – 128 Pressure in theRPV

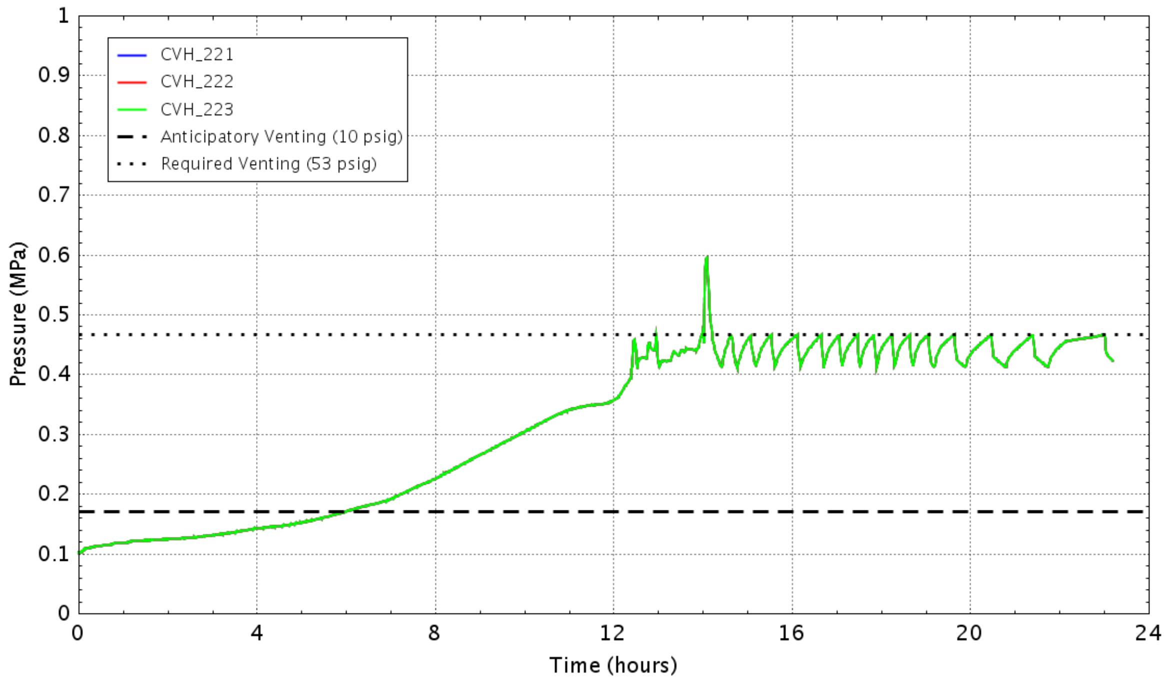

Figure D - 129 Pressure in the wetwell

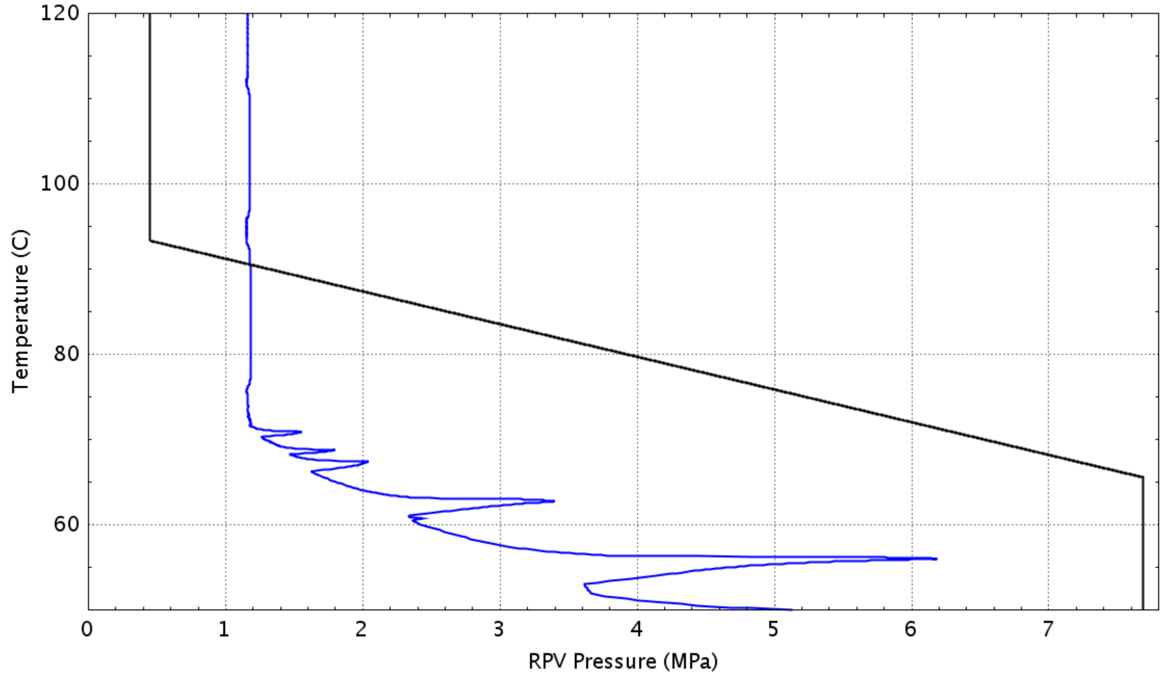

Figure D - 130 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

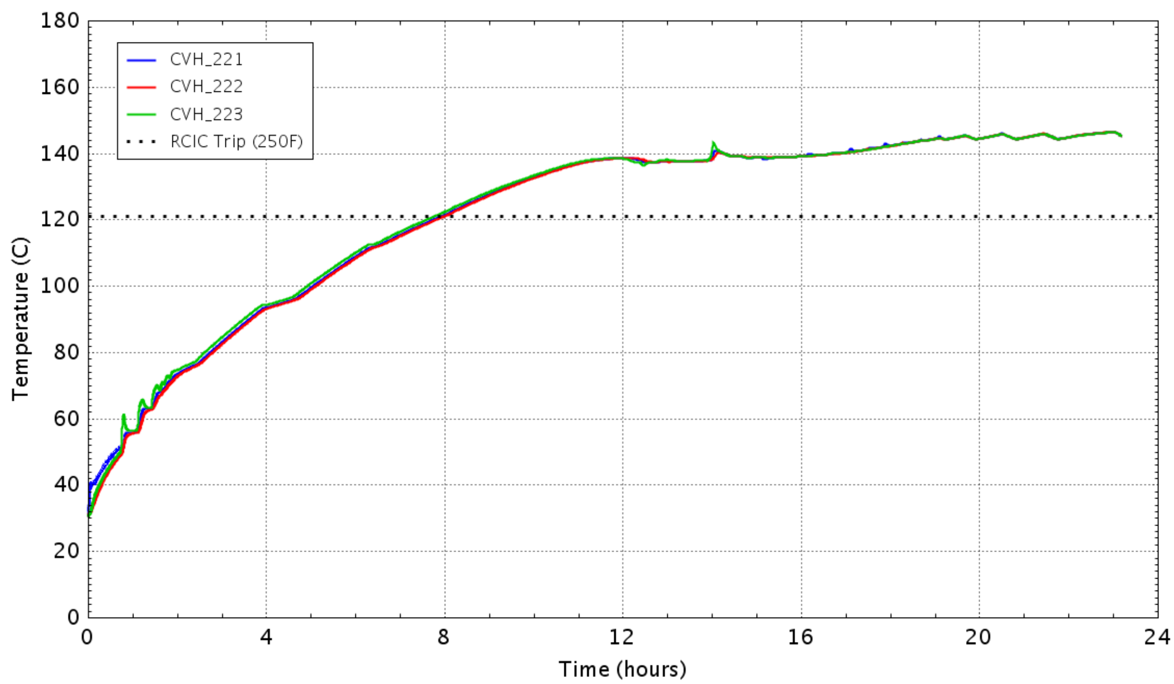

Figure D - 131 **Water temperature in the wetwell**

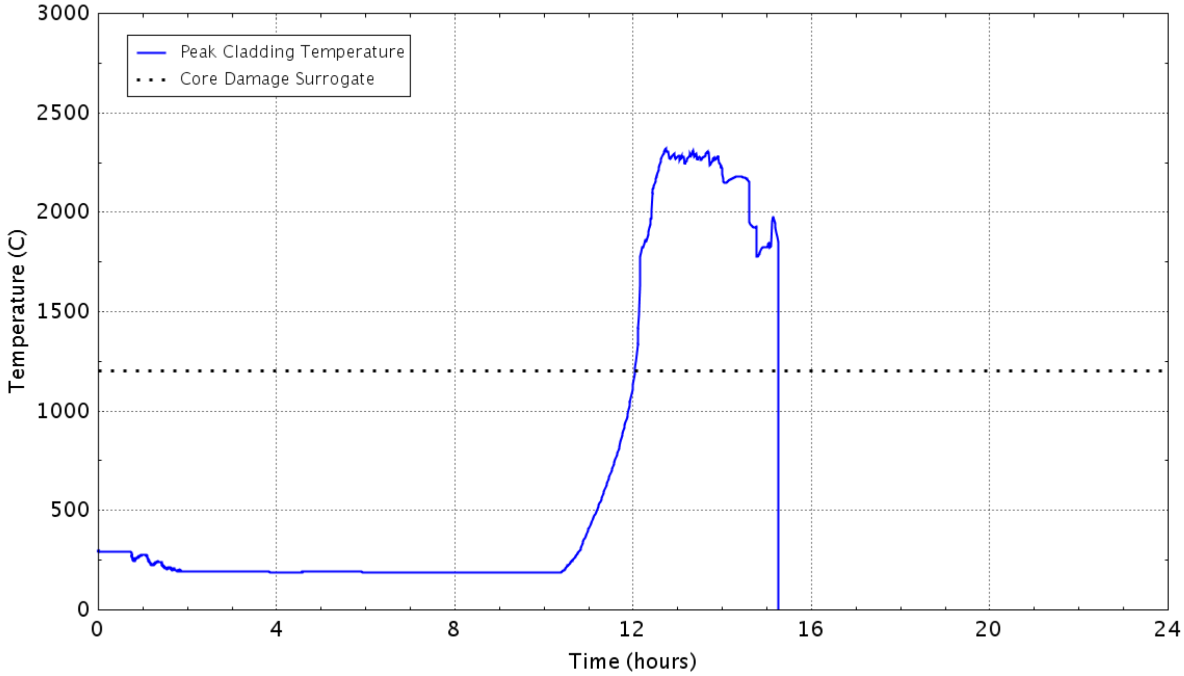

Figure D – 132 Peak temperature of the fuel cladding as a function oftime

D.1.12 Case 12: LOOPGR-38-9, AC Loss at t=0, RCIC Available Indefinitely, CST Unavailable, Perform Anticipatory Venting

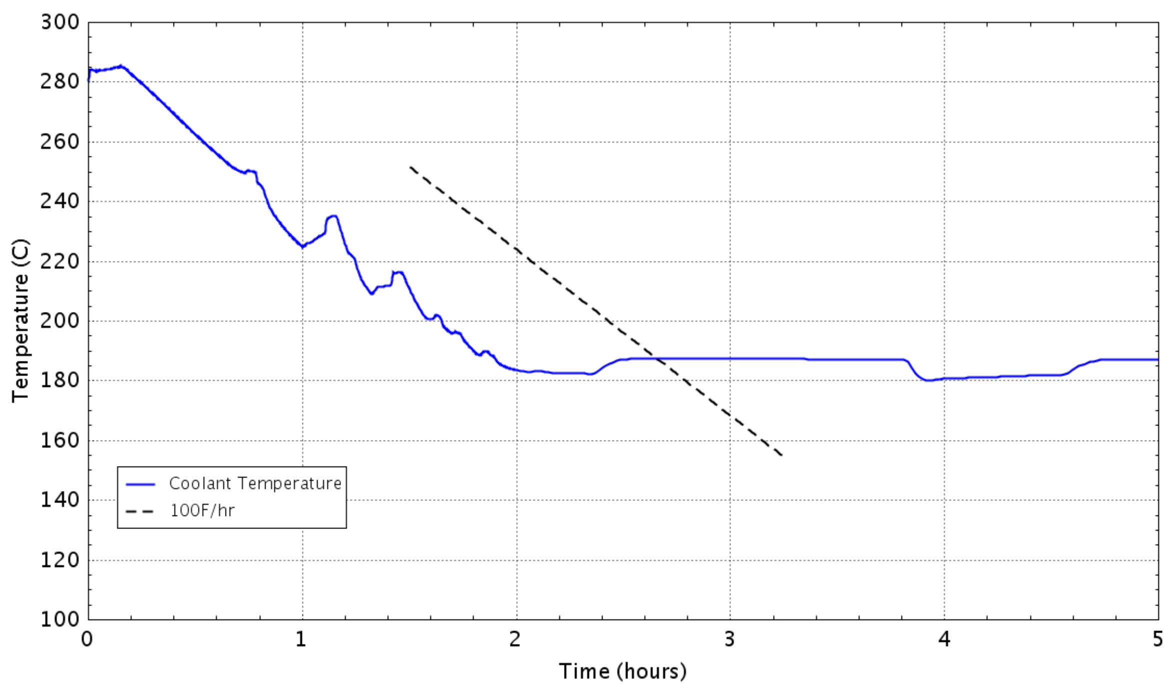

Figure D - 133 RPV cooldown rate

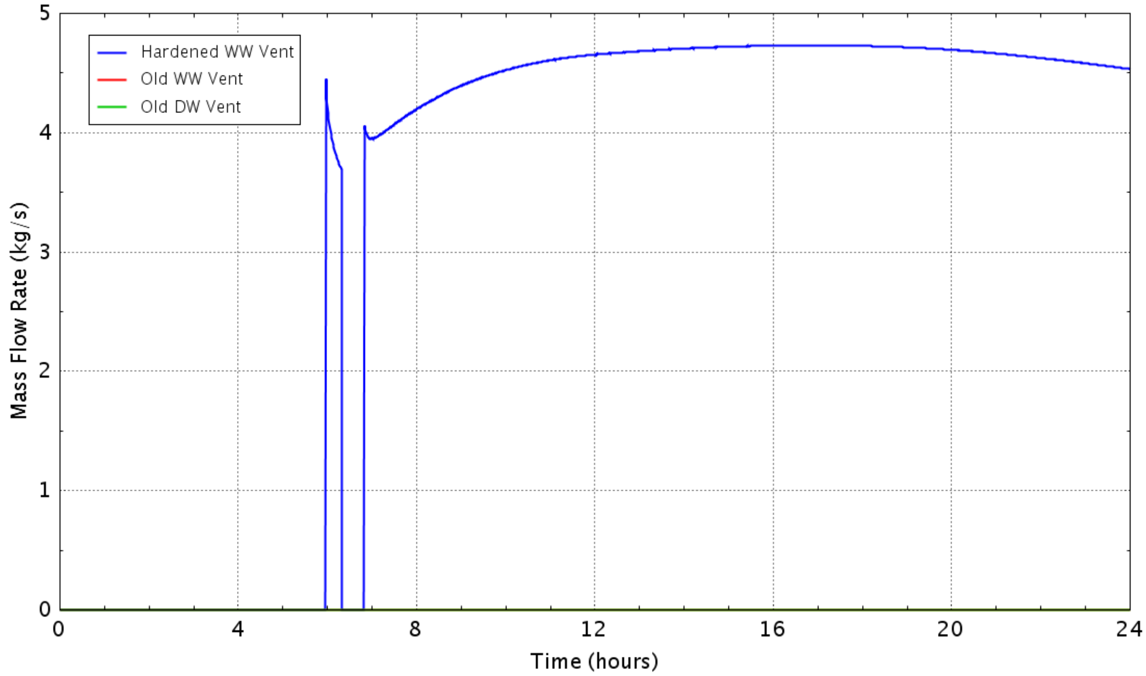

Figure D - 134 Flow rate of the containment vents

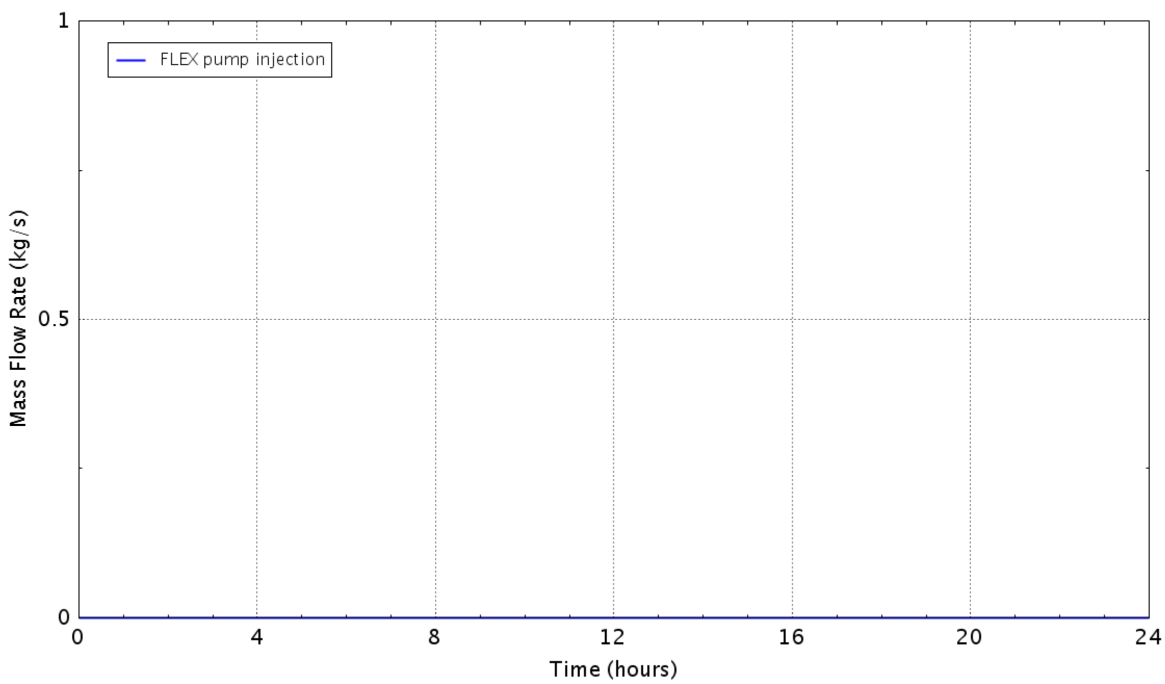

Figure D - 135 Flow rate of the FLEX pump

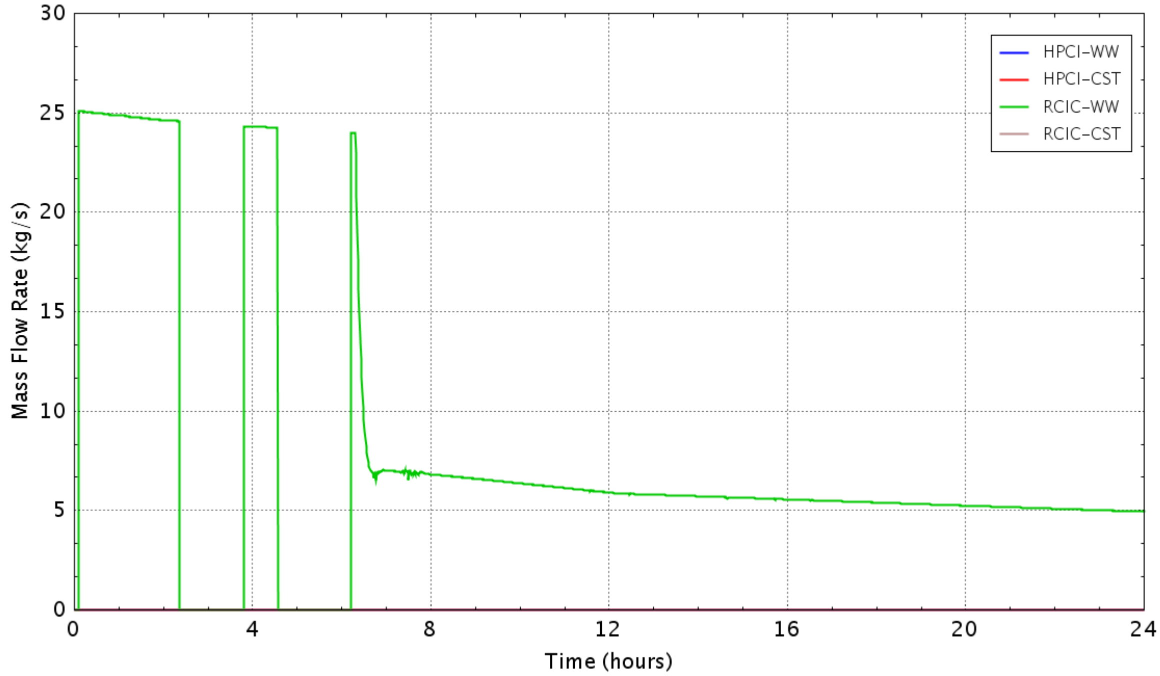

Figure D - 136 **Flow rate of the HPCI/RCIC pumps**

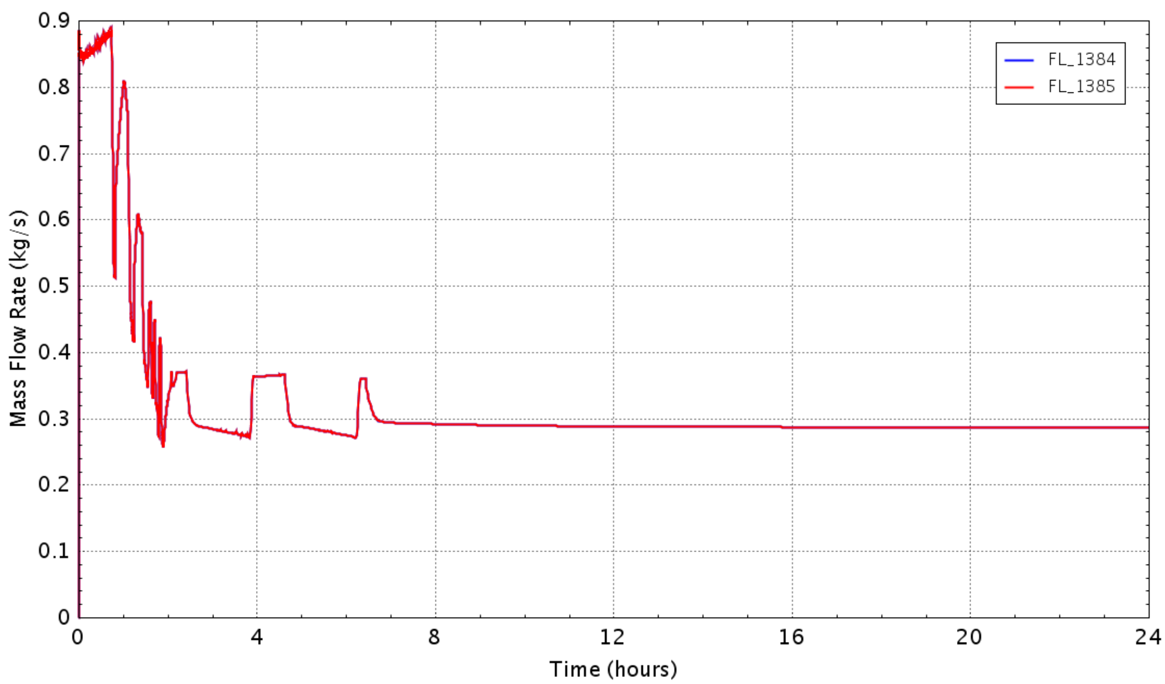

Figure D - 137 **Flow rate of the recirculating pump seal leakage**

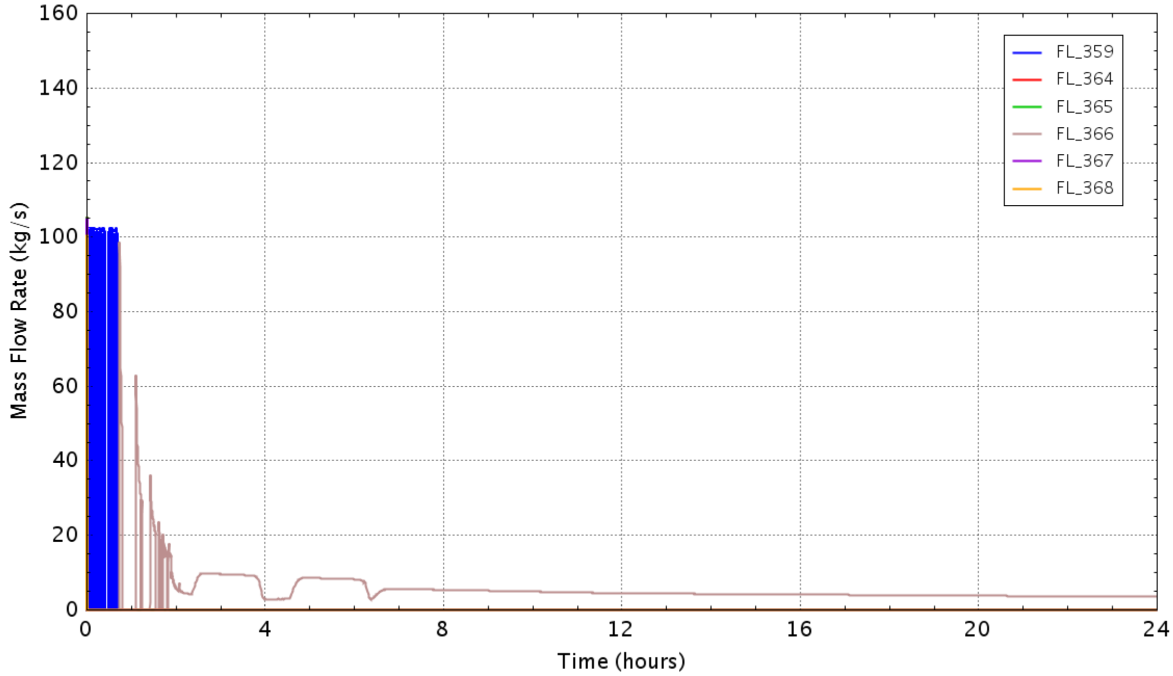

Figure D - 138 **Flow rate of the SRVs**

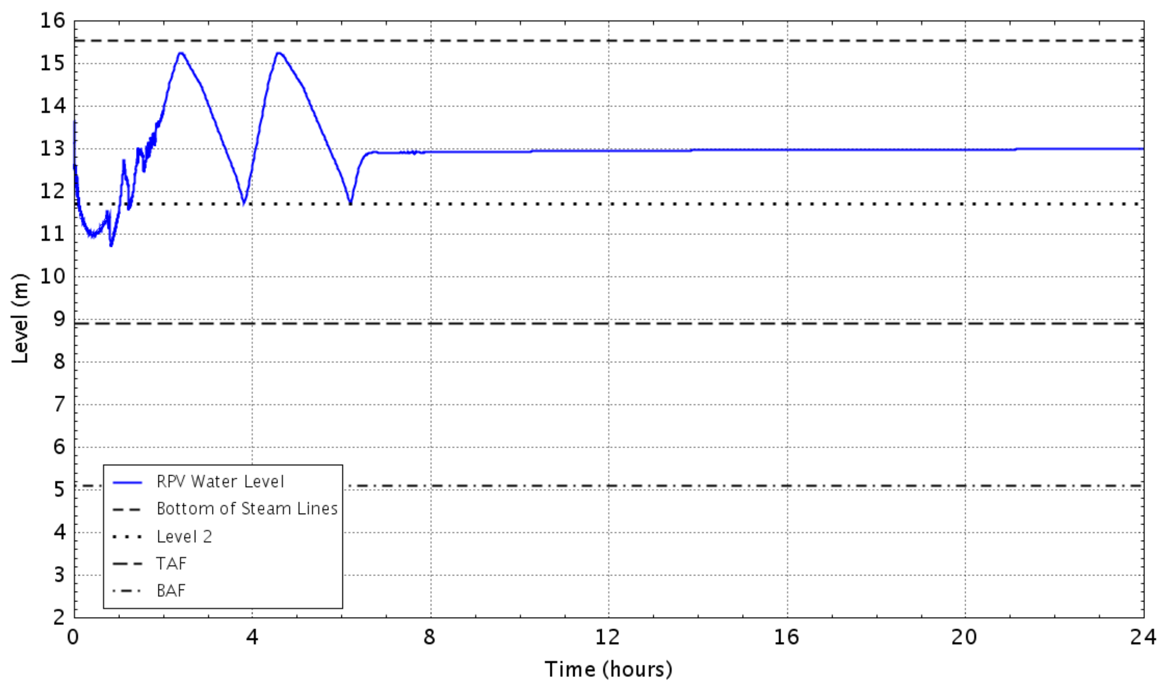

Figure D - 139 **RPV down comer water level**

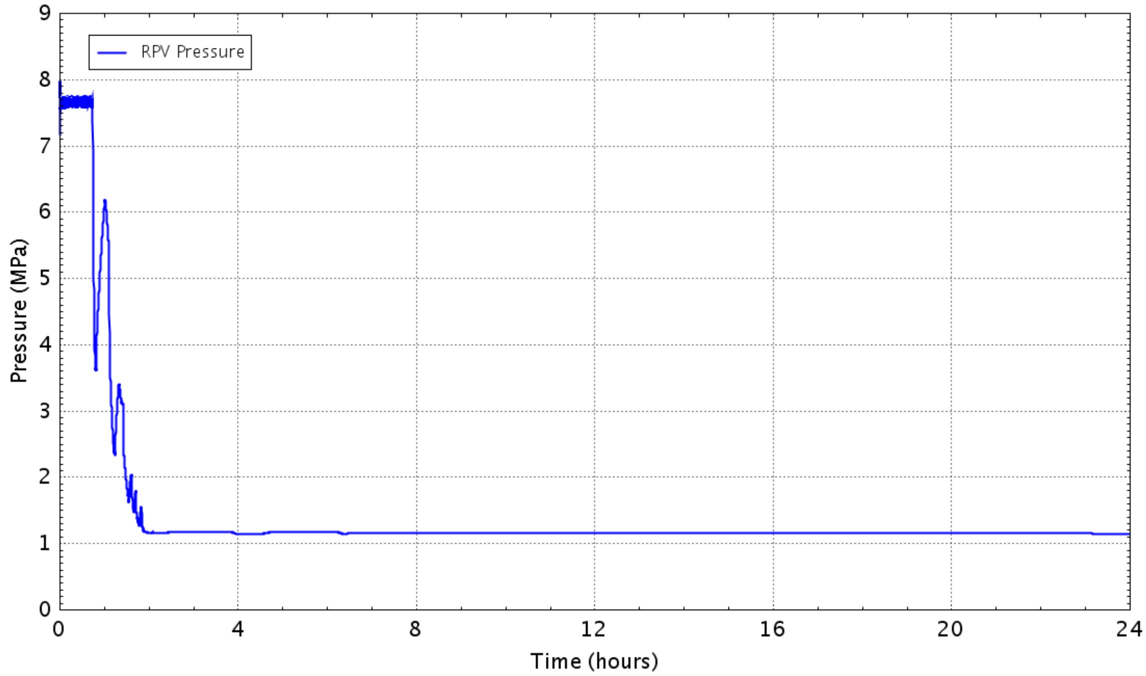

Figure D - 140 Pressure in theRPV

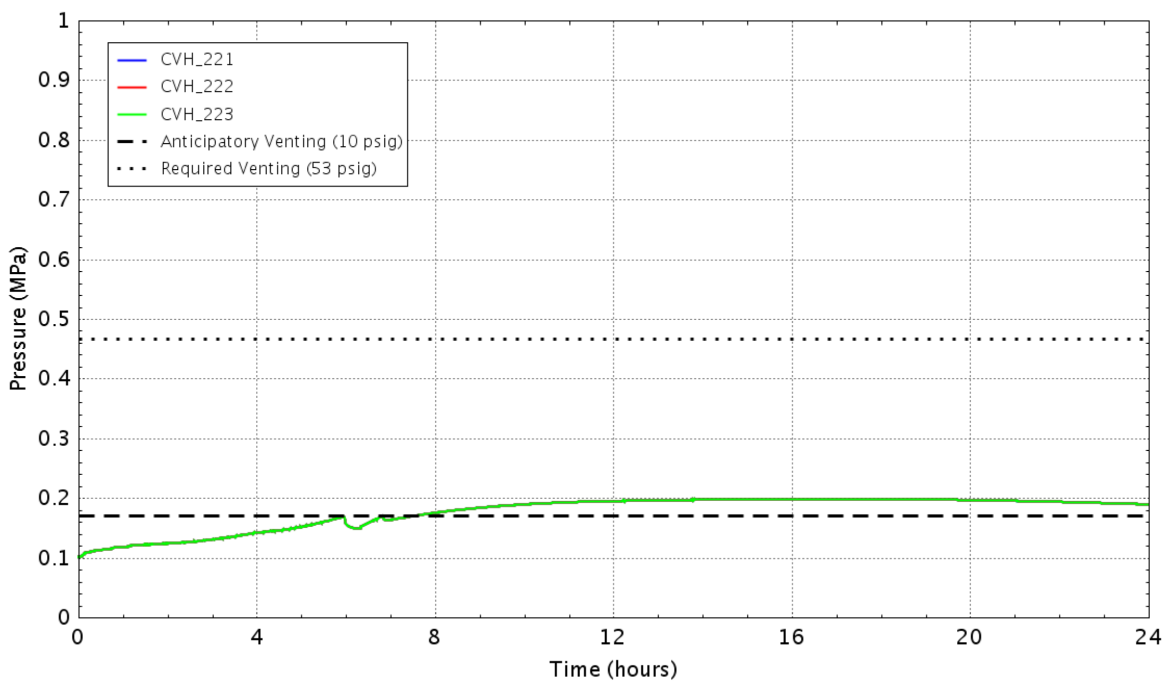

Figure D - 141 Pressure in the wetwell

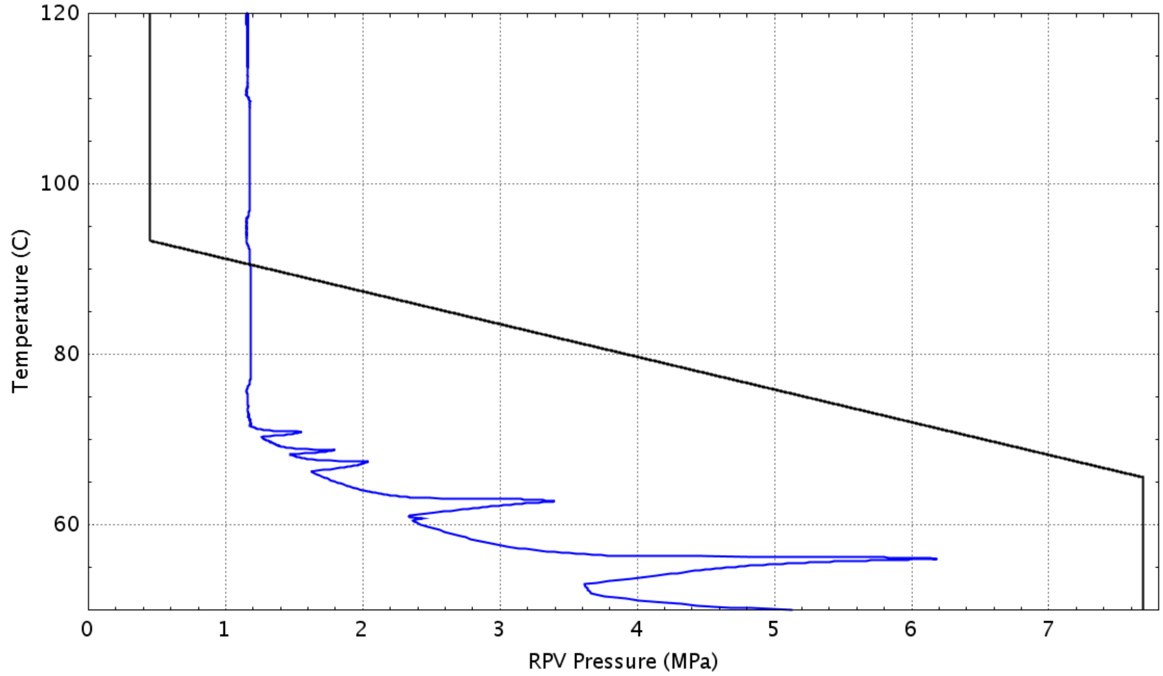

Figure D - 142 Plant status relative to the HCL curve (Graph 4 of the EOPs)

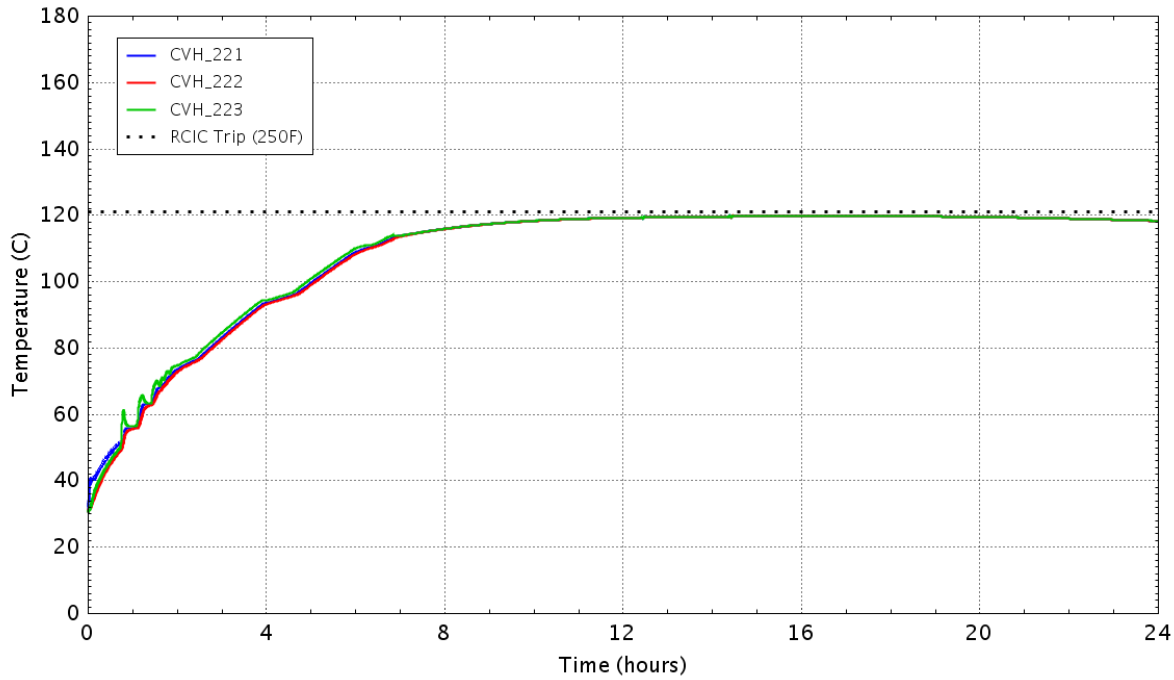

Figure D - 143 Water temperature in the wetwell

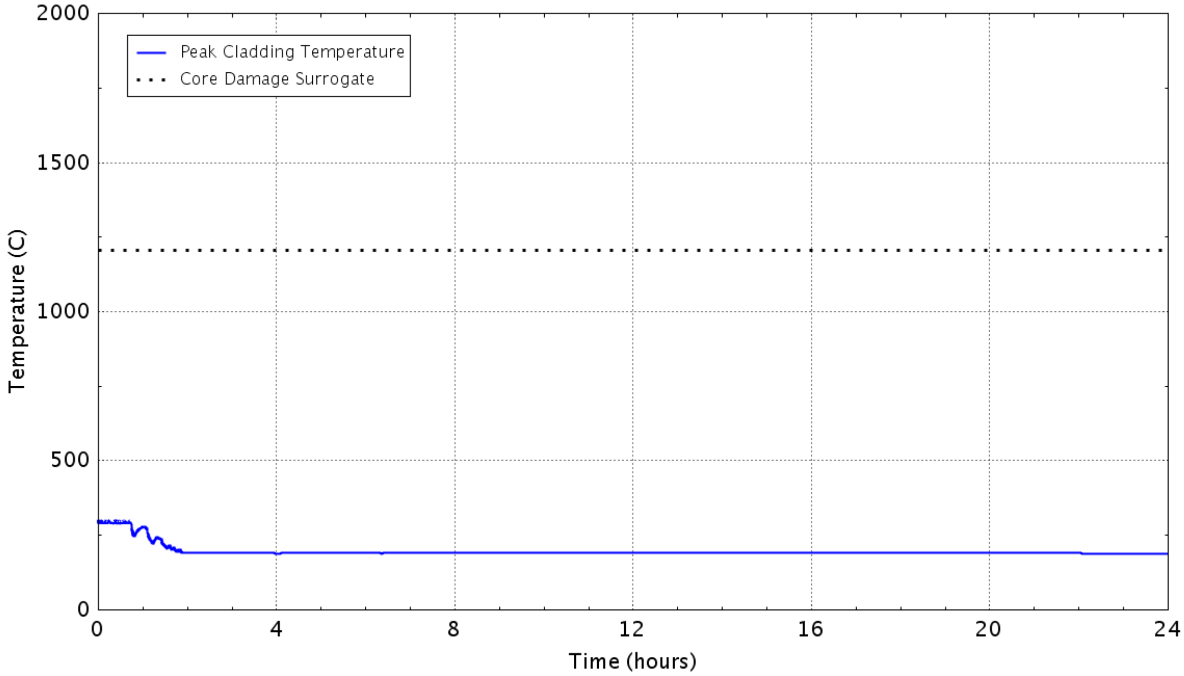

Figure D – 144 Peak temperature of the fuel cladding as a function oftime

D.1.13 Case 13: LOOPGR-38-9, AC Loss at 2 hrs., RCIC Loss at 4hrs., CST Available, Perform Required Venting Only

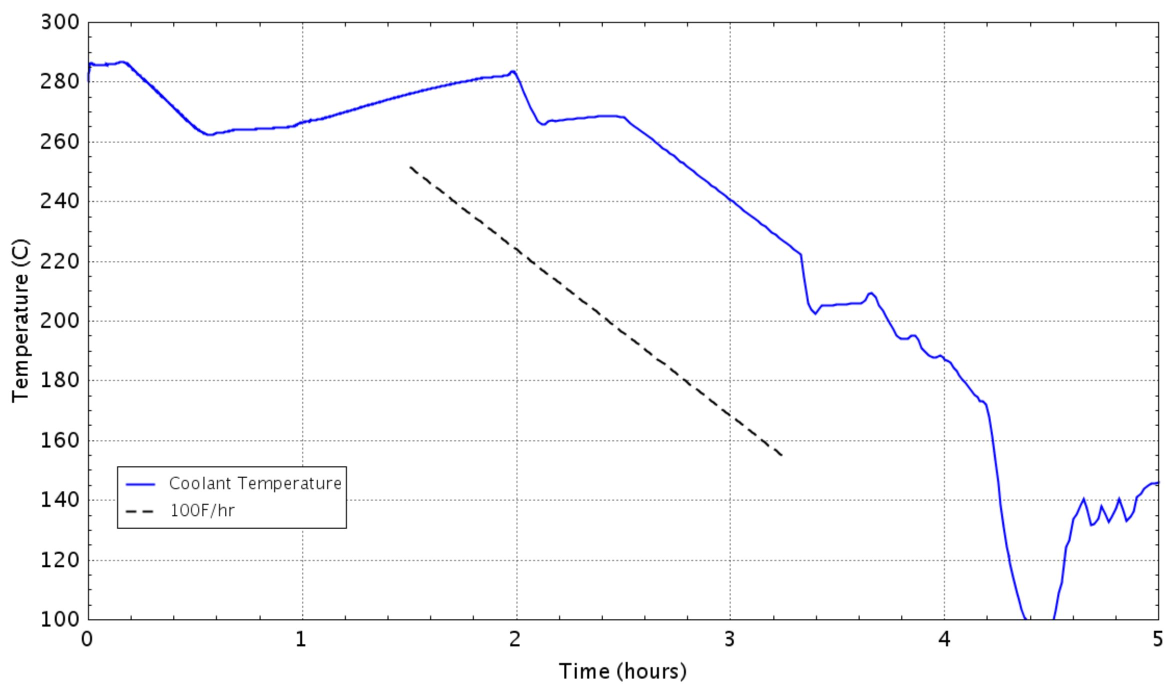

Figure D - 145 RPV cooldown rate

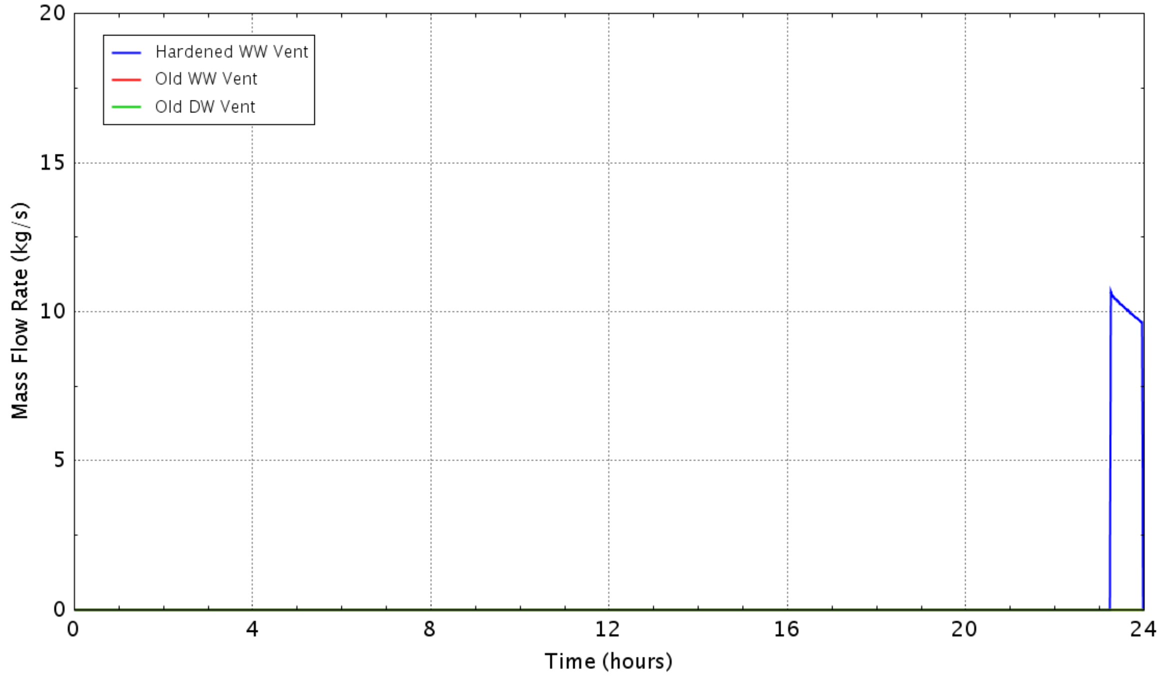

Figure D - 146 Flow rate of the containment vents

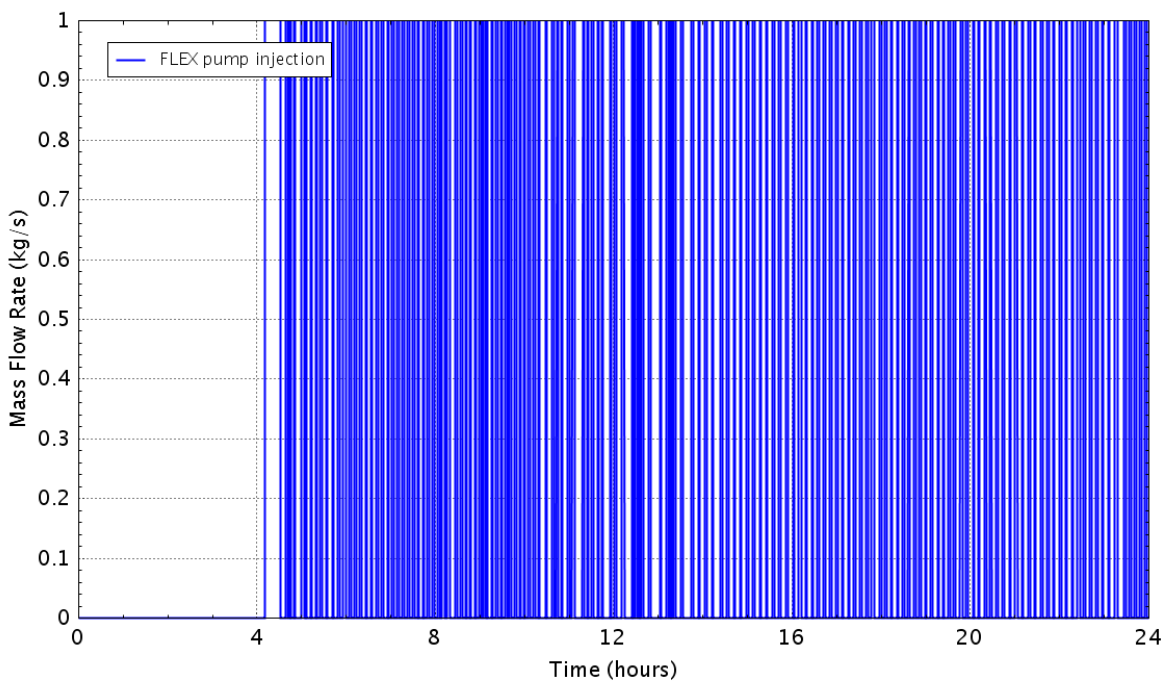

Figure D - 147 Flow rate of theFLEXpump

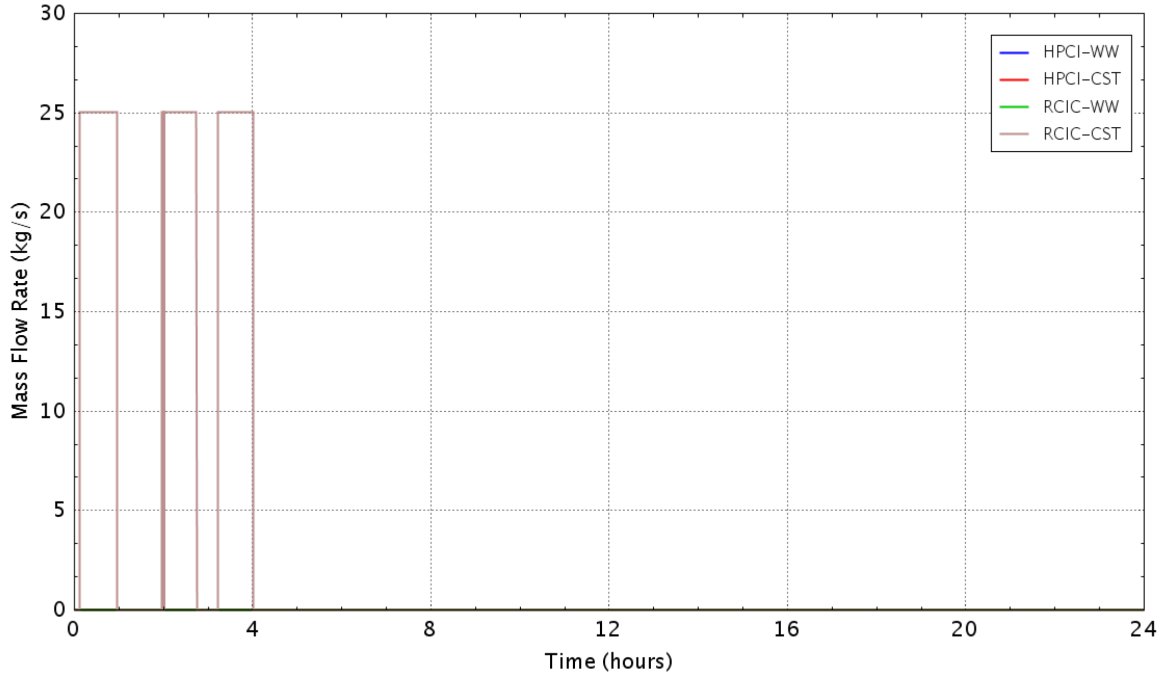

Figure D - 148 **Flow rate of the HPCI/RCIC pumps**

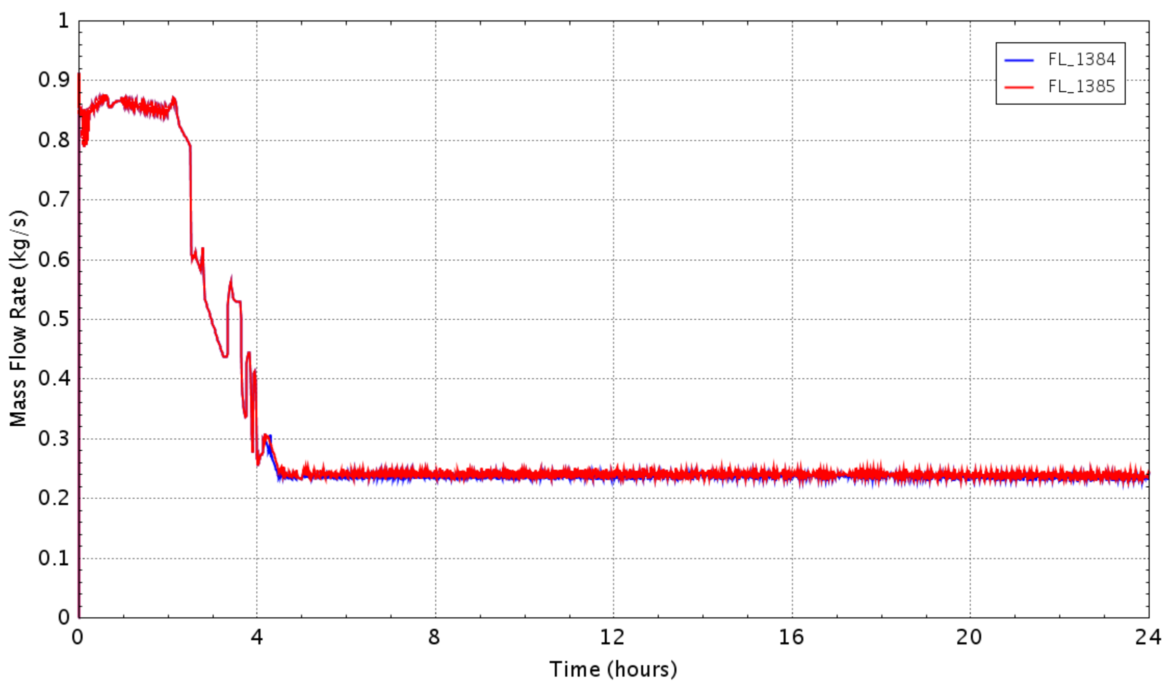

Figure D - 149 **Flow rate of the recirculating pump seal leakage**

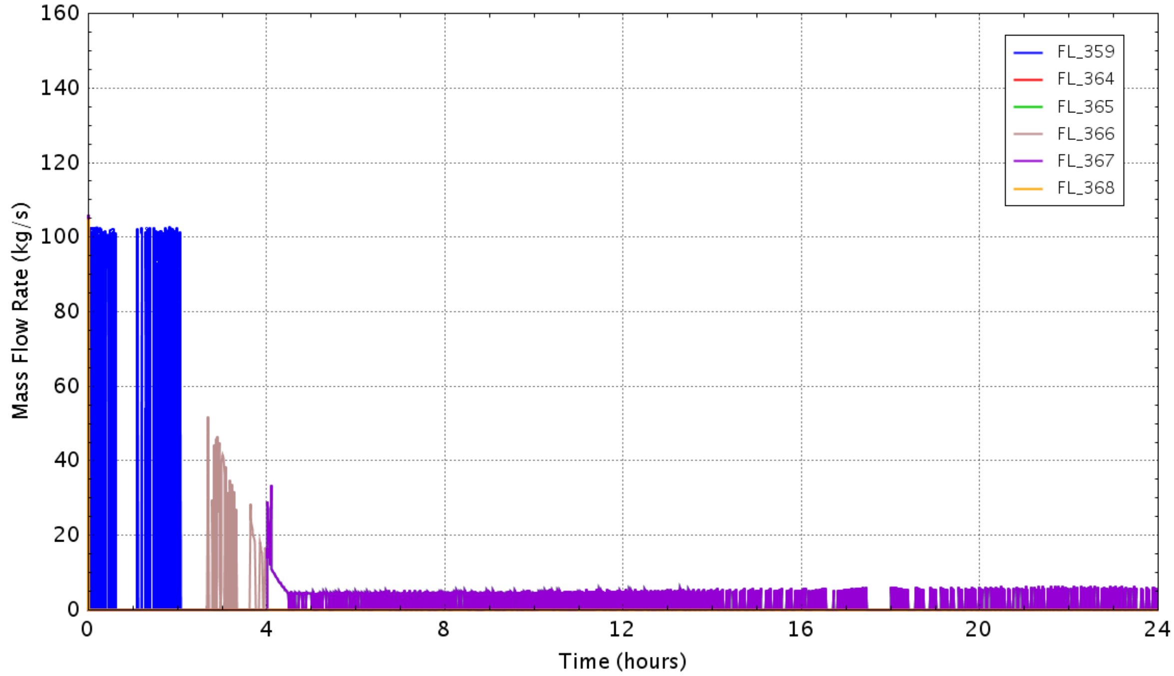

Figure D - 150 **Flow rate of the SRVs**

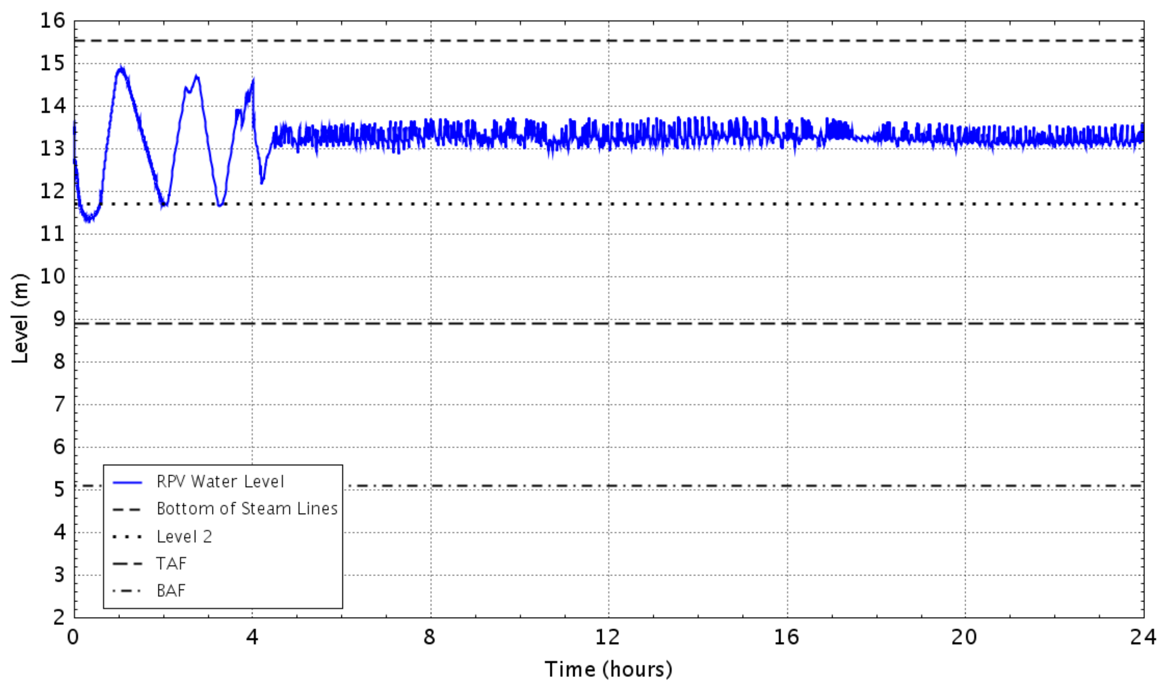

Figure D - 151 **RPV down comer water level**

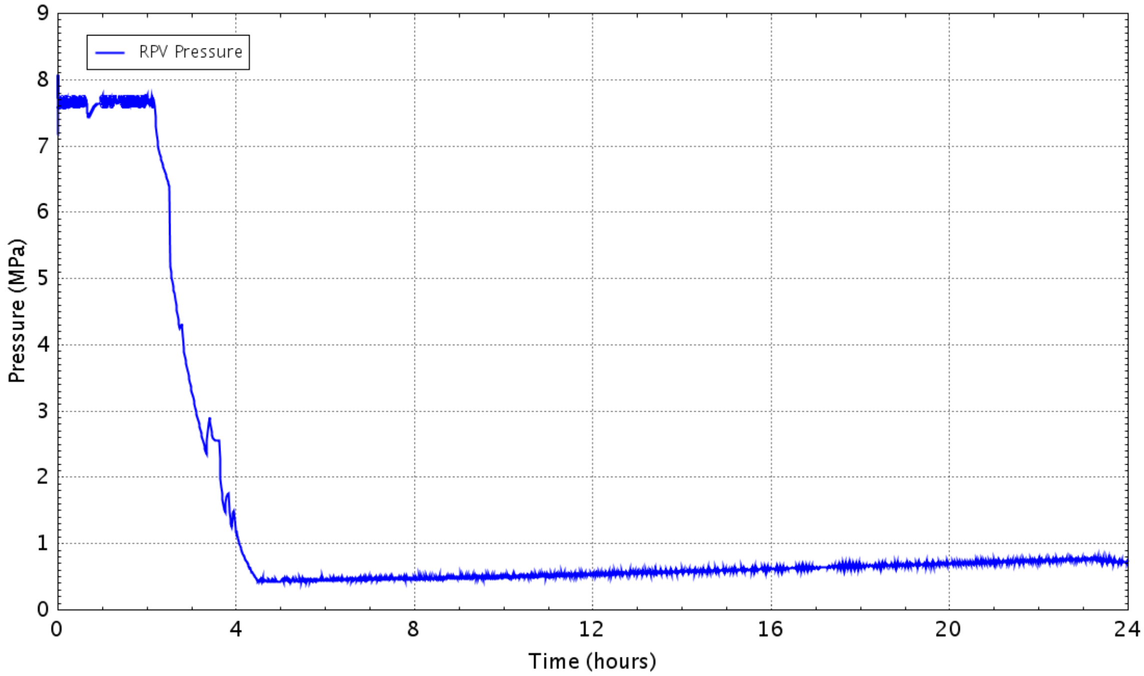

Figure D - 152 **Pressure in theRPV**

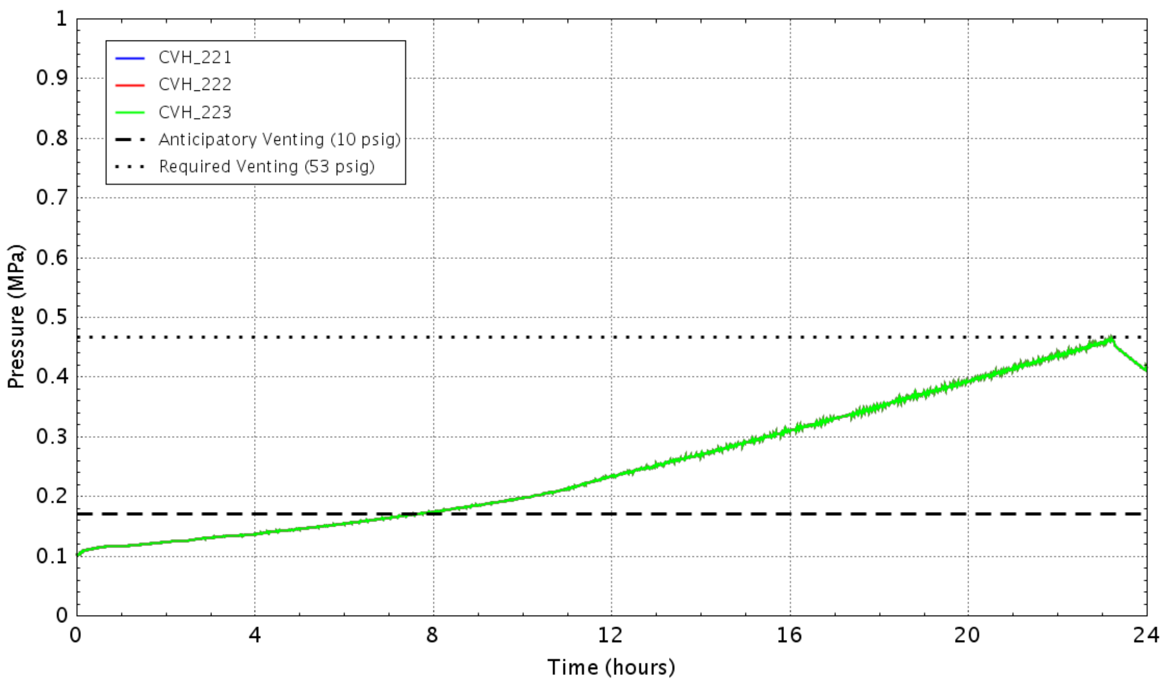

Figure D - 153 **Pressure in the wetwell**

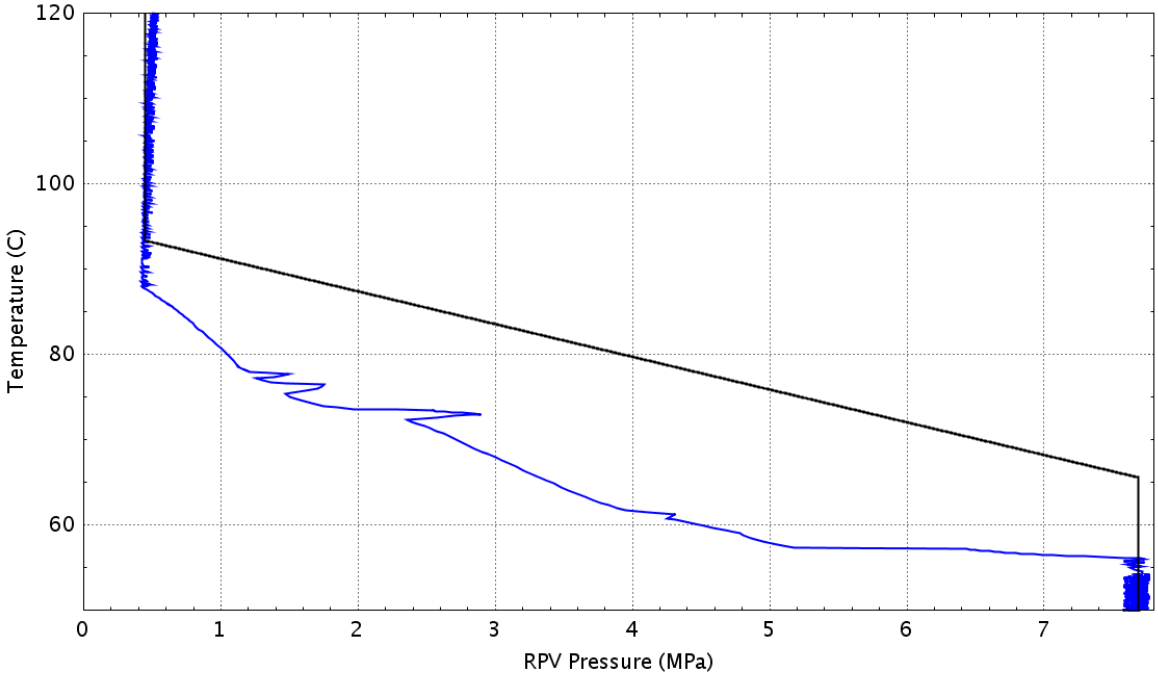

Figure D - 154 Plant status relative to the HCL curve (Graph 4 of the EOPs)

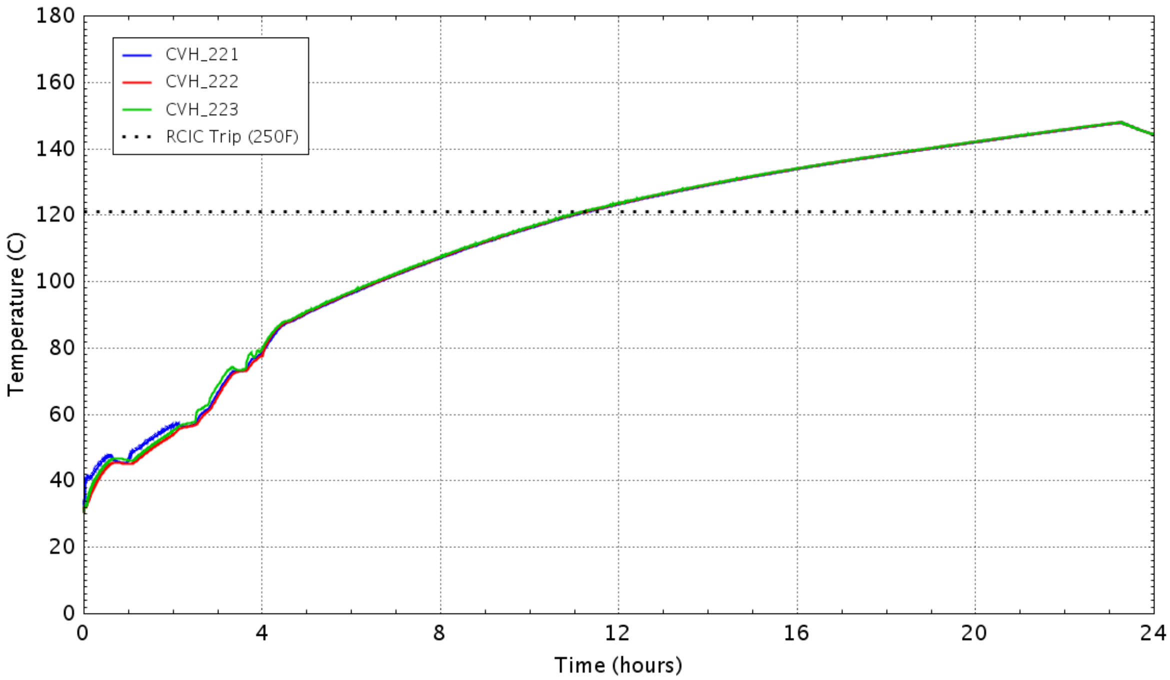

Figure D - 155 Water temperature in the wetwell

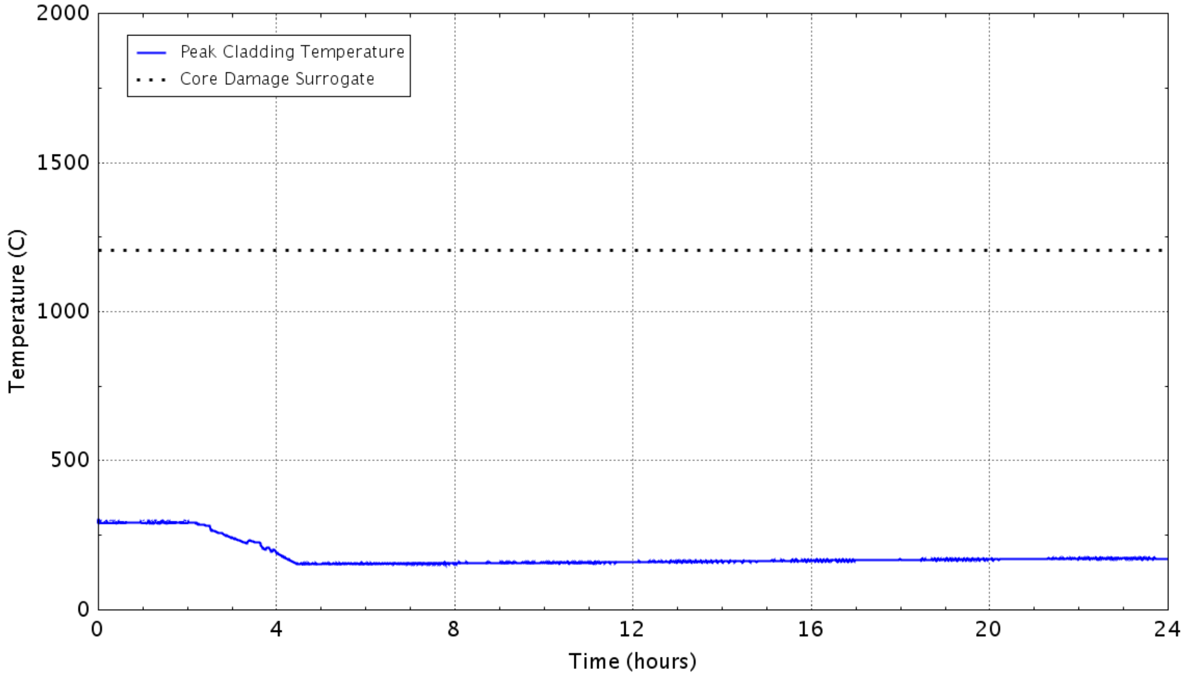

Figure D – 156 Peak temperature of the fuel cladding as a function oftime

D.1.14 Case 14: LOOPGR-38-9, AC Loss at 2 hrs., RCIC Loss at 8 hrs., CST Available, Perform Required Venting Only

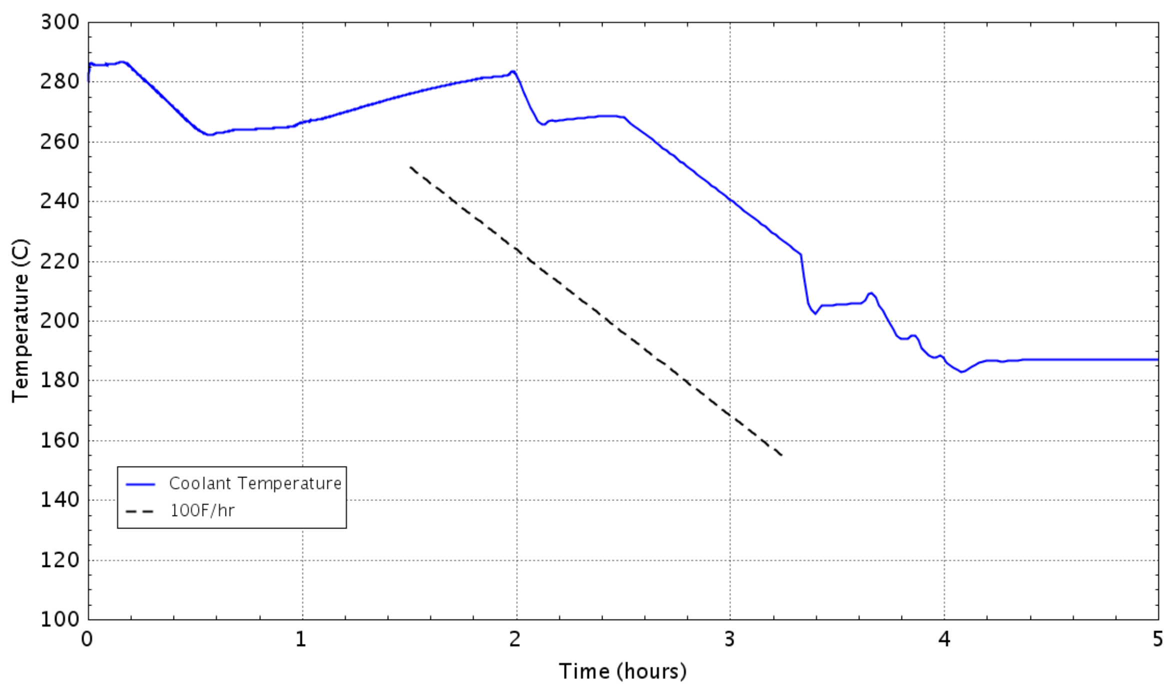

Figure D - 157 RPV cooldown rate

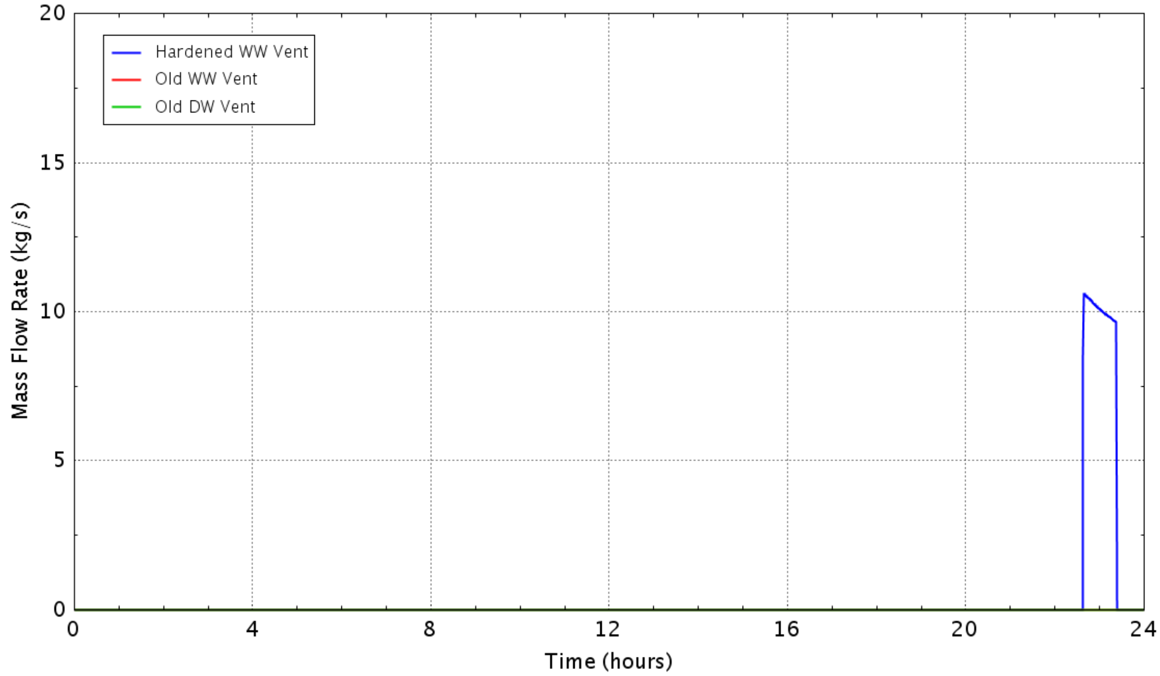

Figure D - 158 **Flow rate of the containment vents**

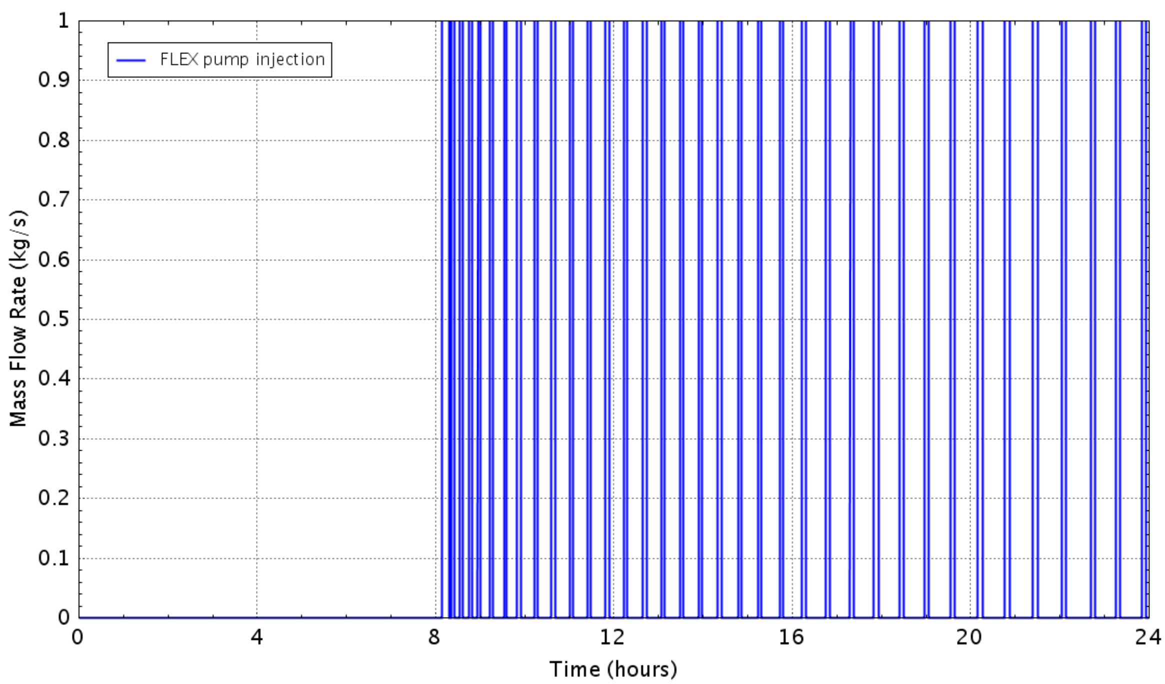

Figure D - 159 **Flow rate of theFLEXpump**

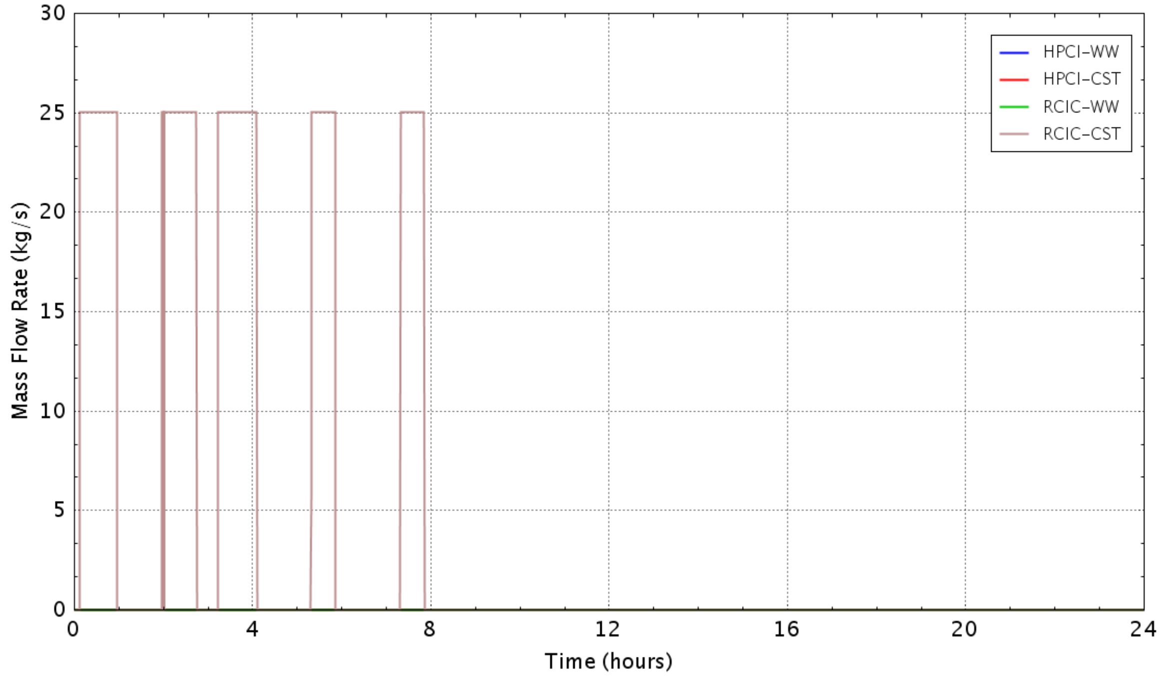

Figure D - 160 Flow rate of the HPCI/RCIC pumps

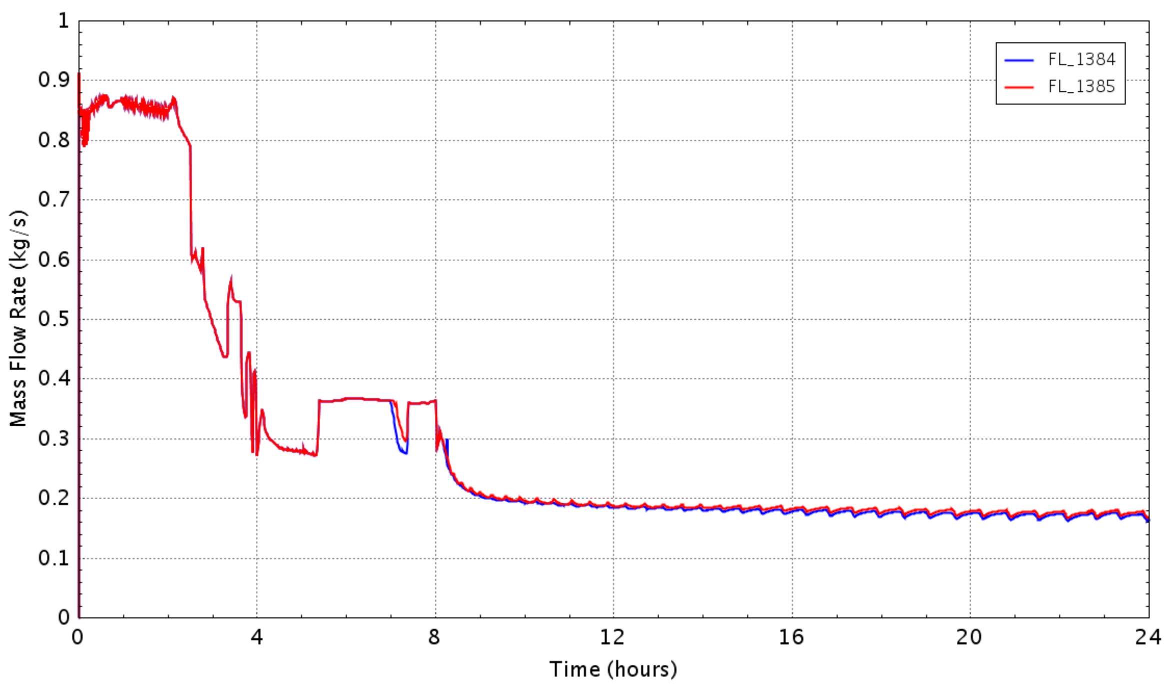

Figure D - 161 Flow rate of the recirculating pump seal leakage

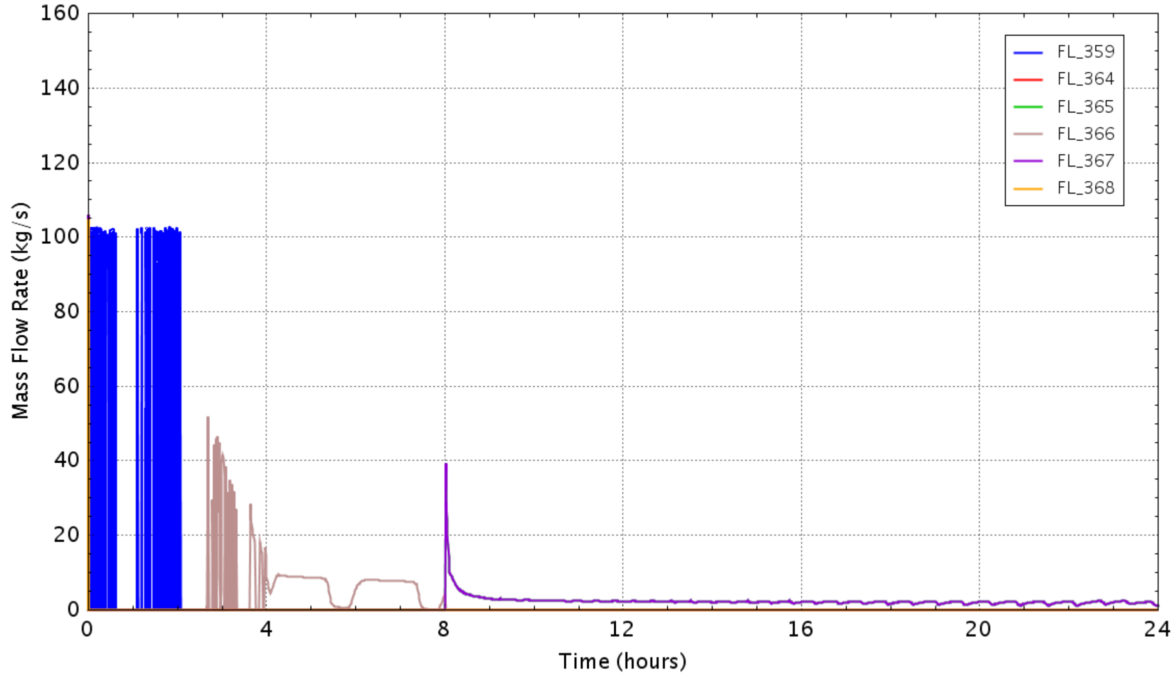

Figure D - 162 **Flow rate of the SRVs**

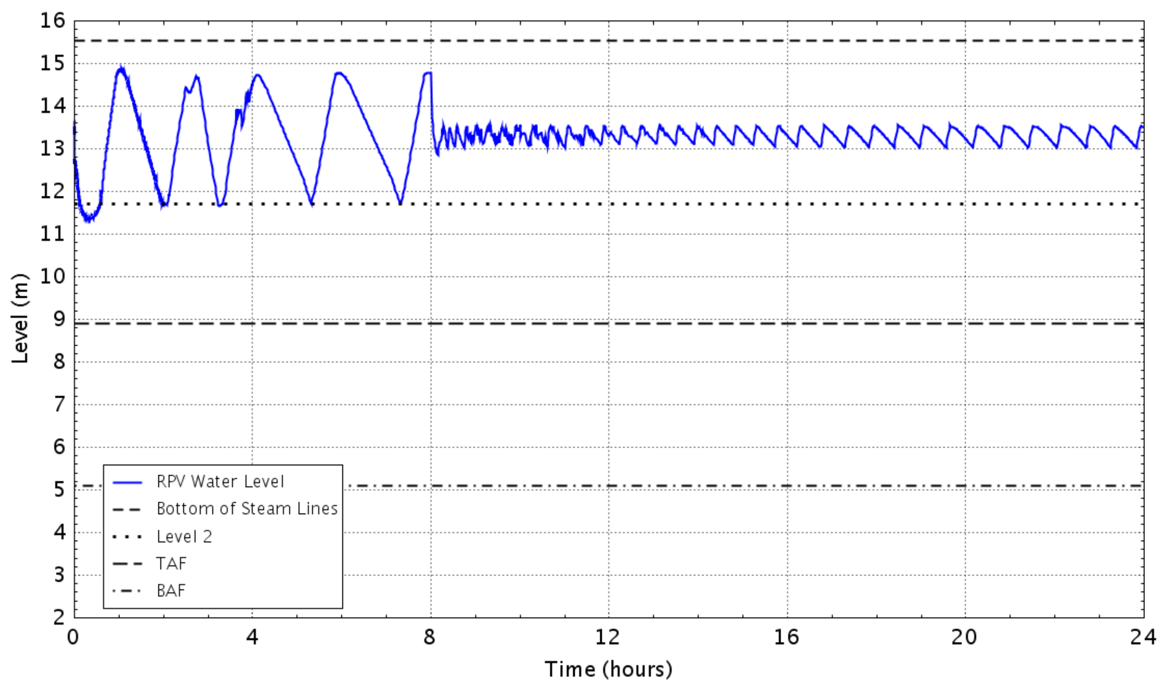

Figure D - 163 **RPV down comer water level**

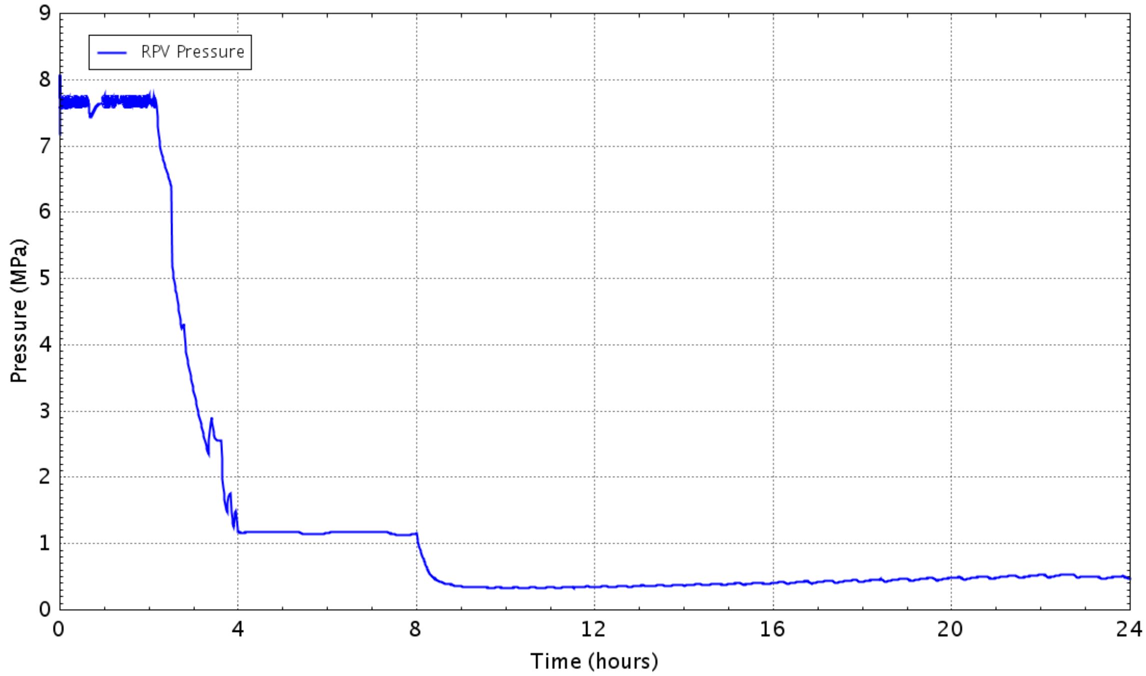

Figure D - 164 Pressure in theRPV

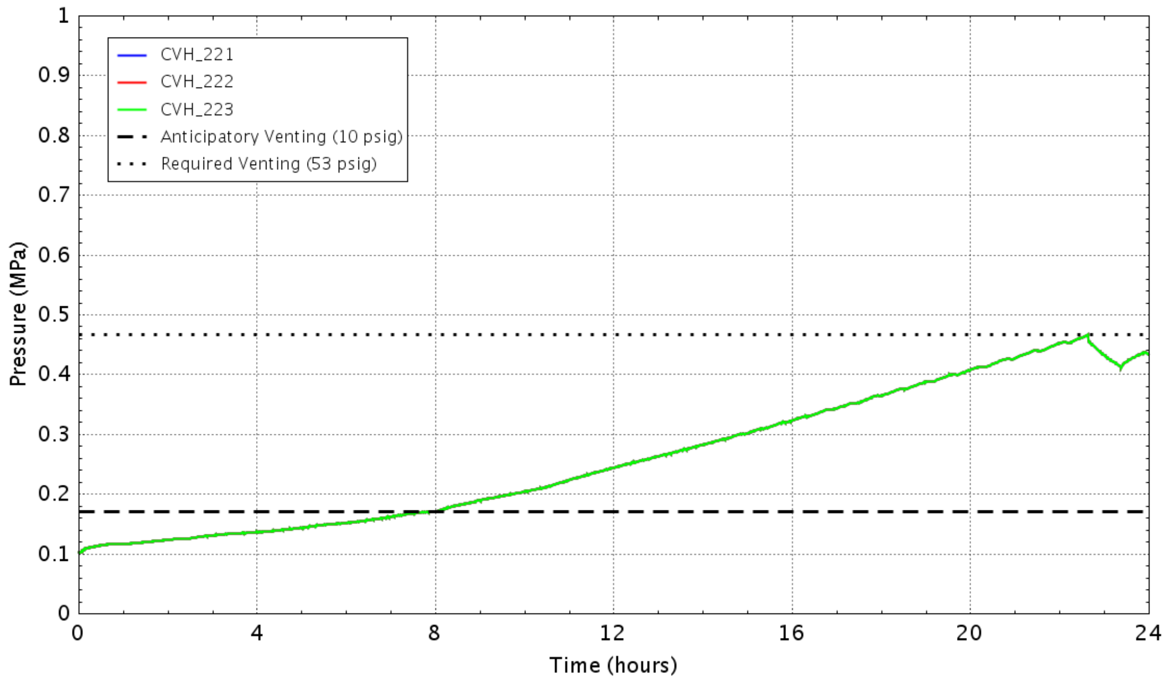

Figure D - 165 Pressure in the wetwell

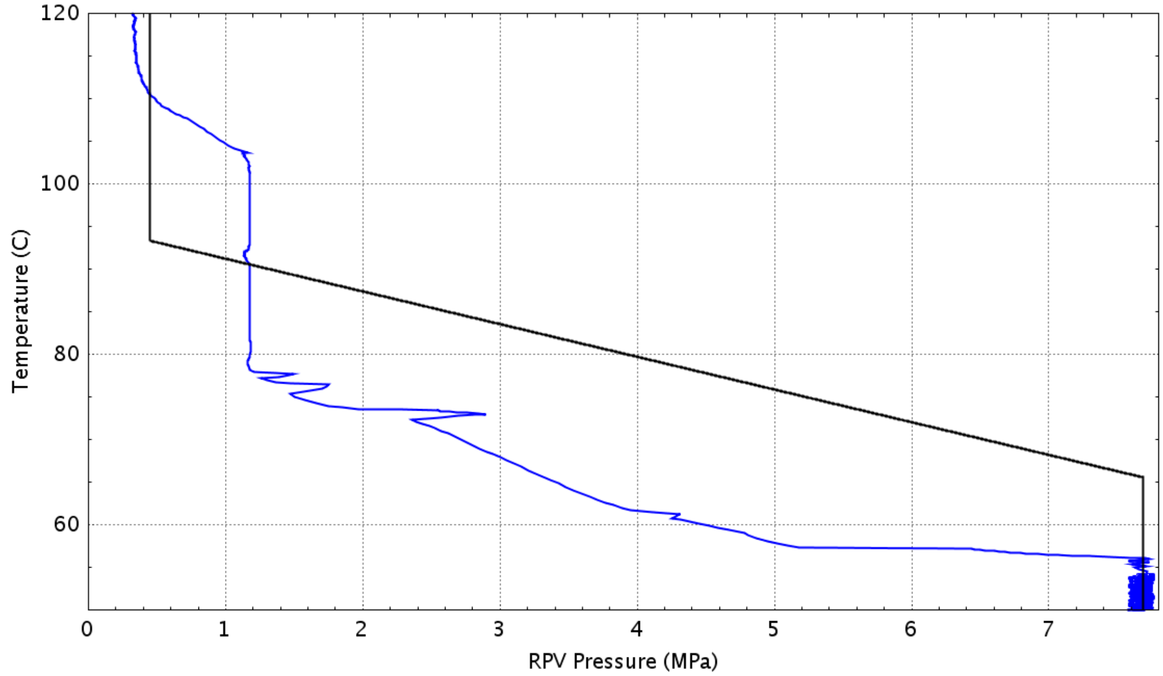

Figure D - 166 Plant status relative to the HCL curve (Graph 4 of the EOPs)

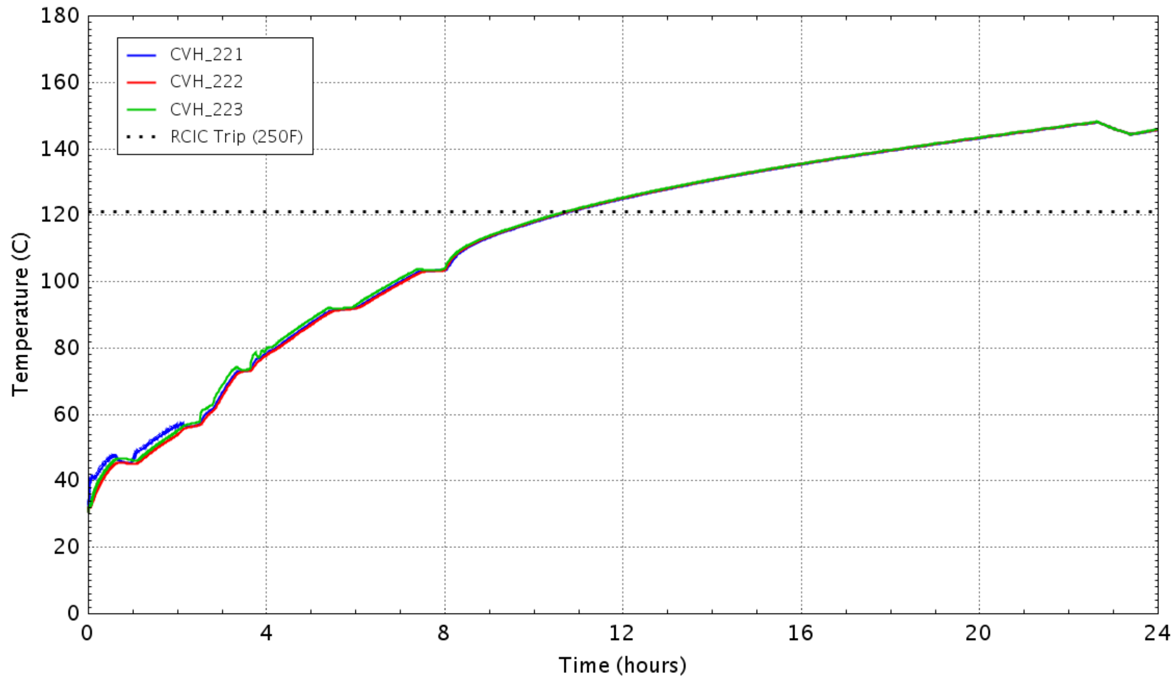

Figure D - 167 Water temperature in the wetwell

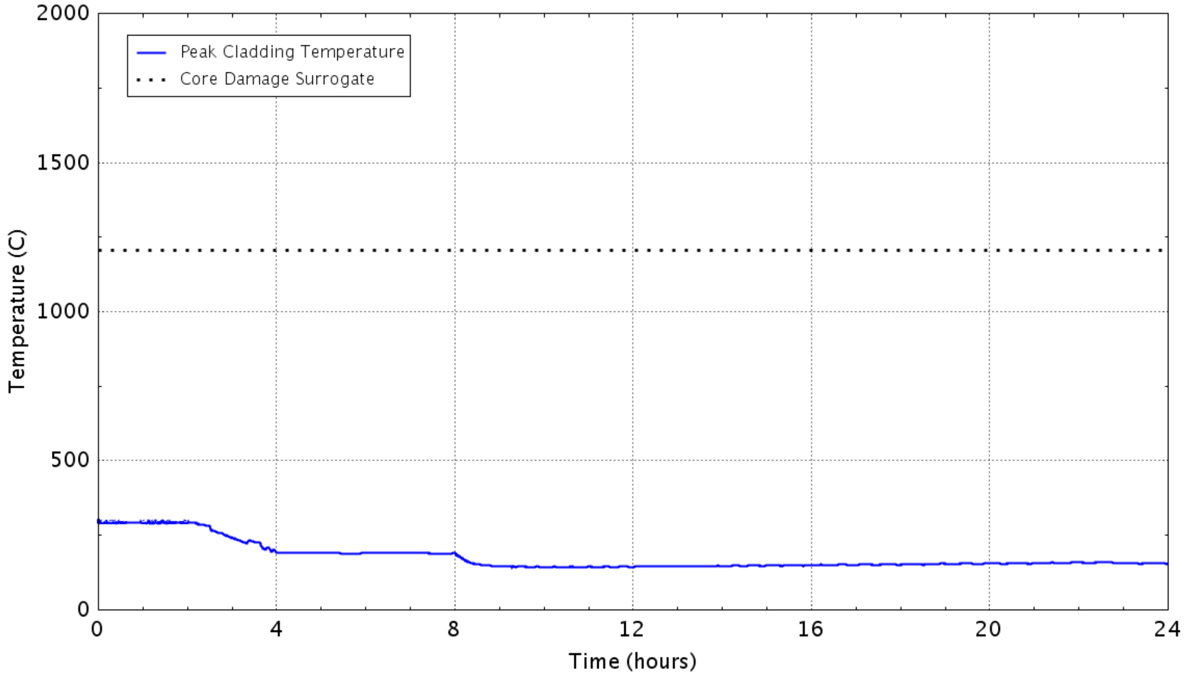

Figure D – 168 **Peak temperature of the fuel cladding as a function oftime**

D.1.15 Case 15: LOOPGR-38-9, AC Loss at 2 hrs., RCIC Available Indefinitely, CST Available, Anticipatory Venting

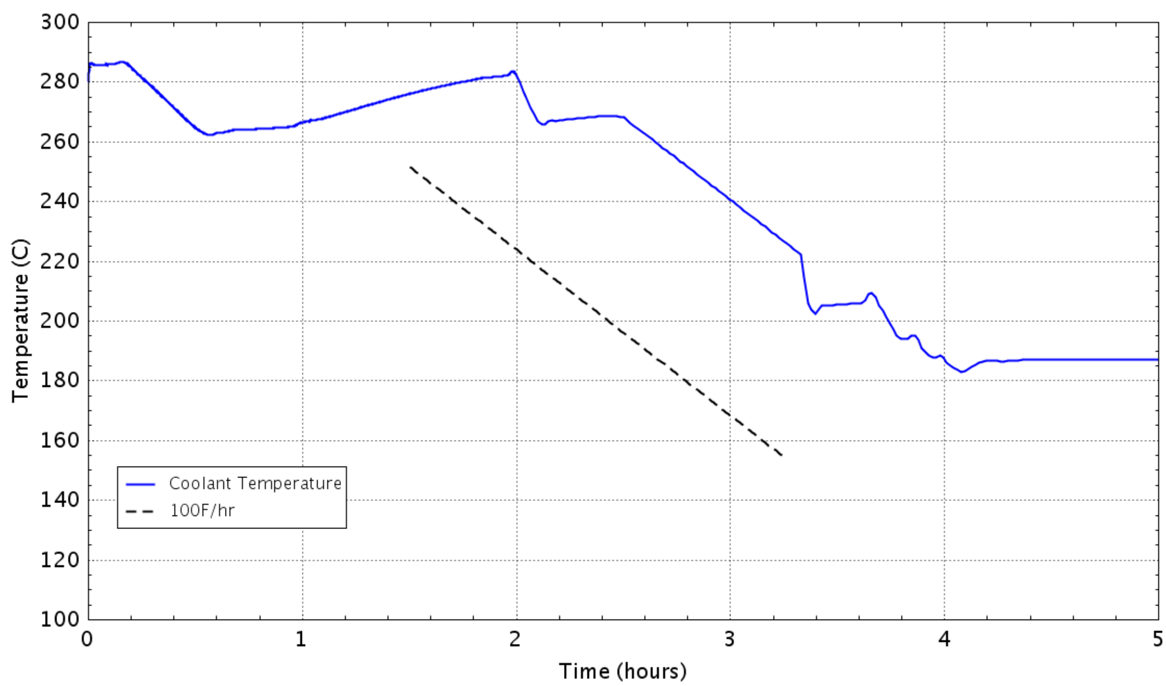

Figure D - 169 **RPV cooldown rate**

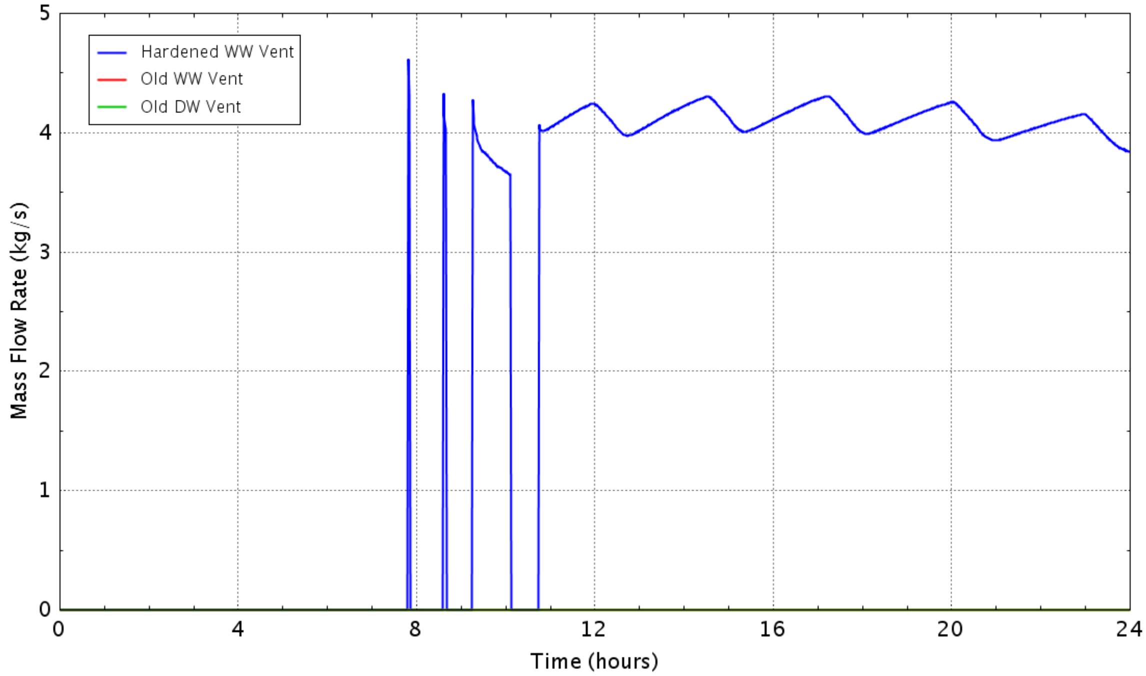

Figure D - 170　　Flow rate of the containment vents

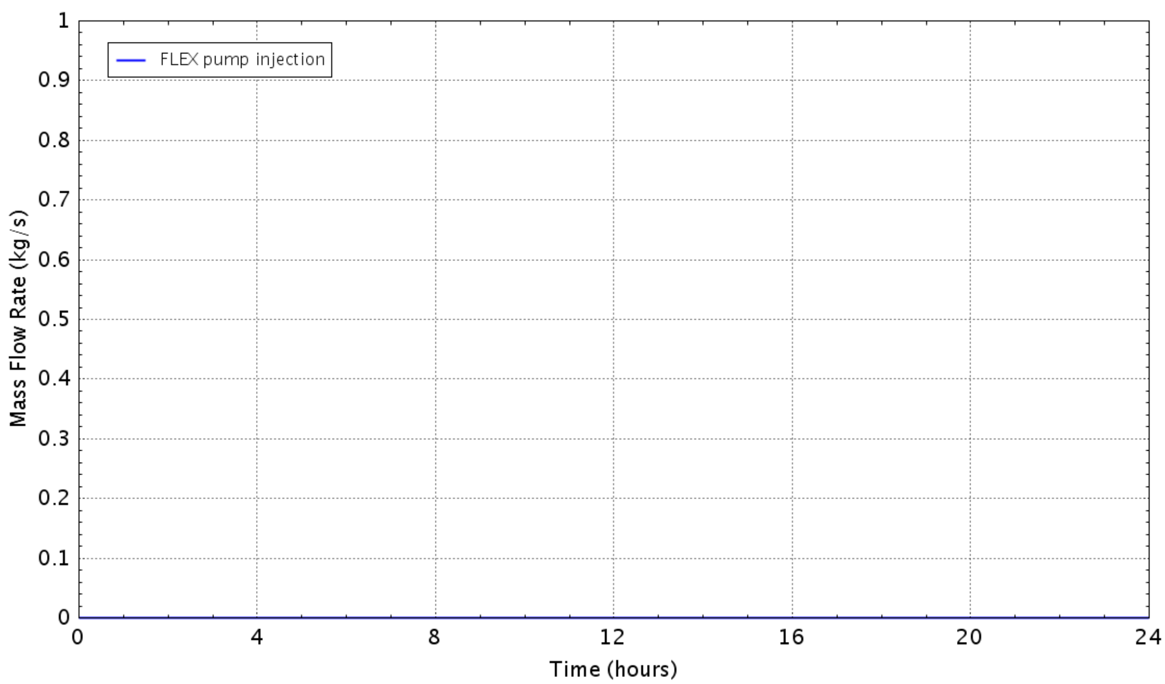

Figure D - 171　　Flow rate of the FLEX pump

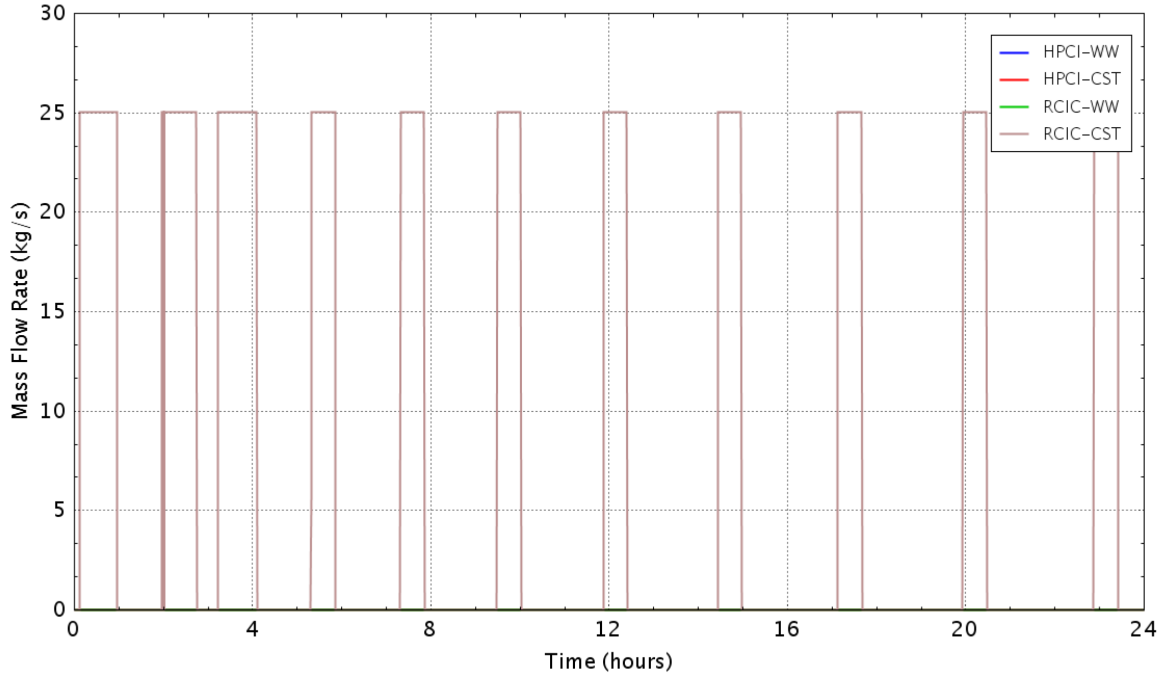

Figure D - 172 **Flow rate of the HPCI/RCIC pumps**

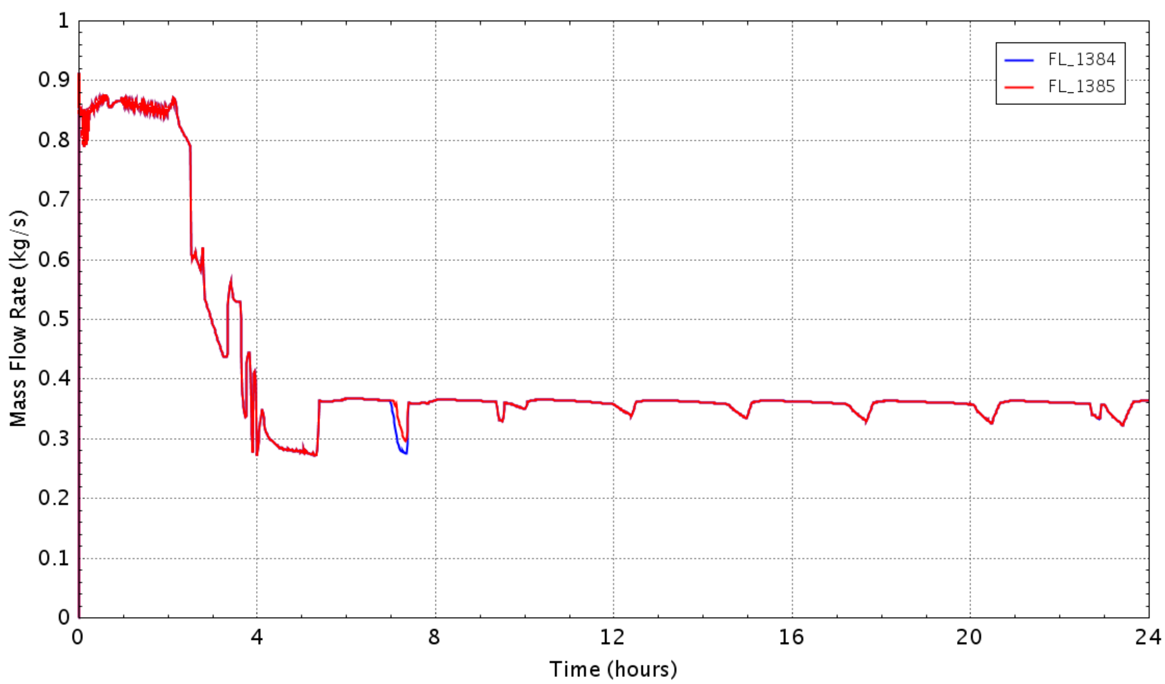

Figure D - 173 **Flow rate of the recirculating pump seal leakage**

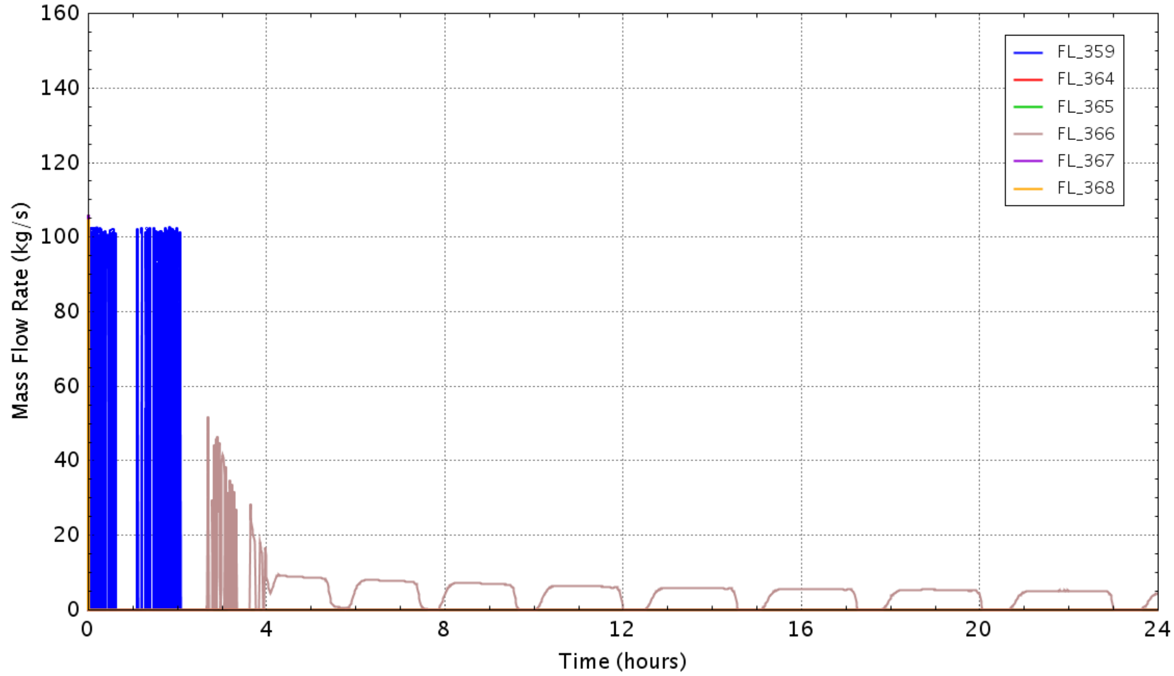

Figure D - 174 **Flow rate of the SRVs**

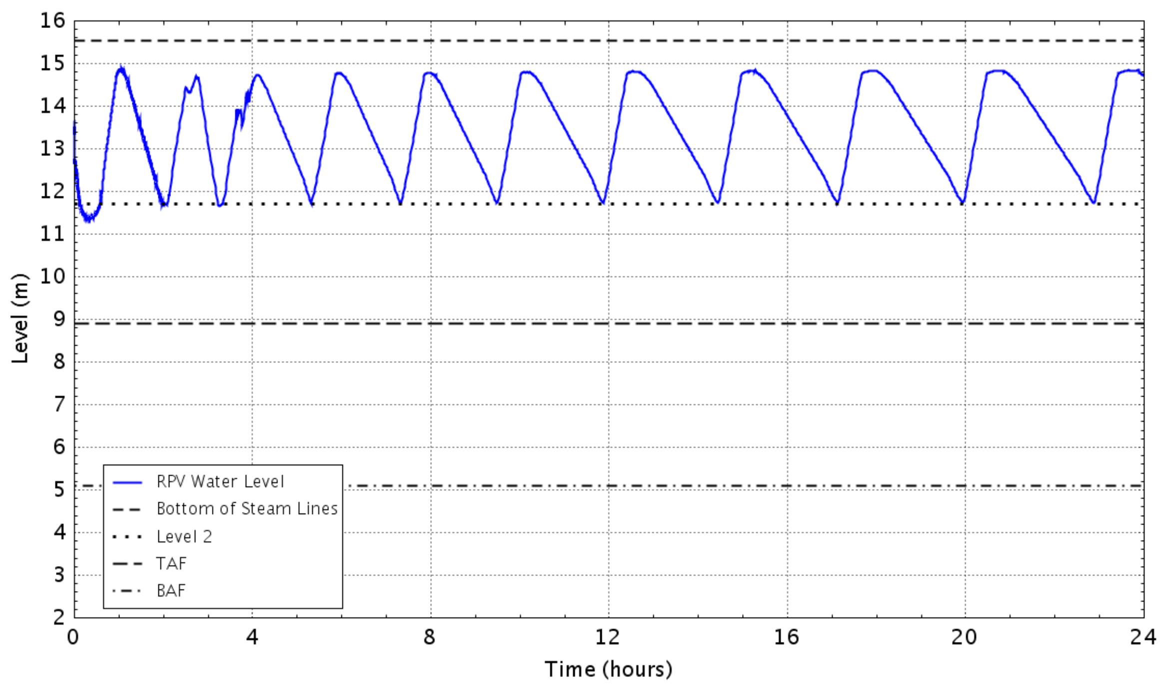

Figure D - 175 **RPV down comer water level**

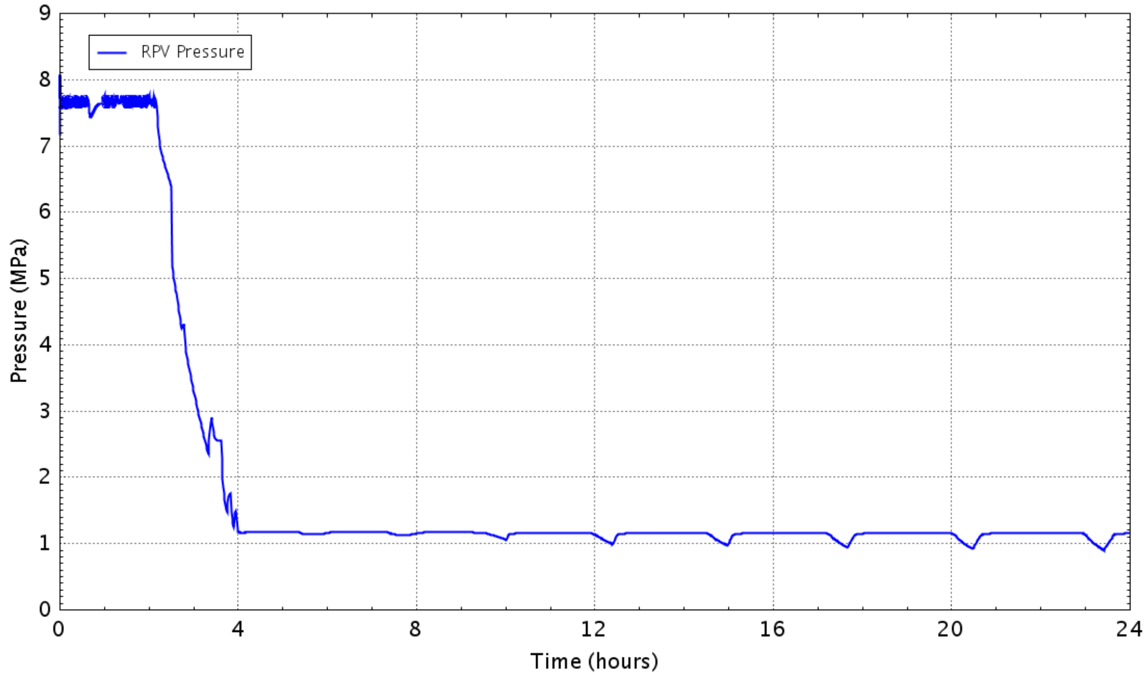

Figure D - 176 **Pressure in theRPV**

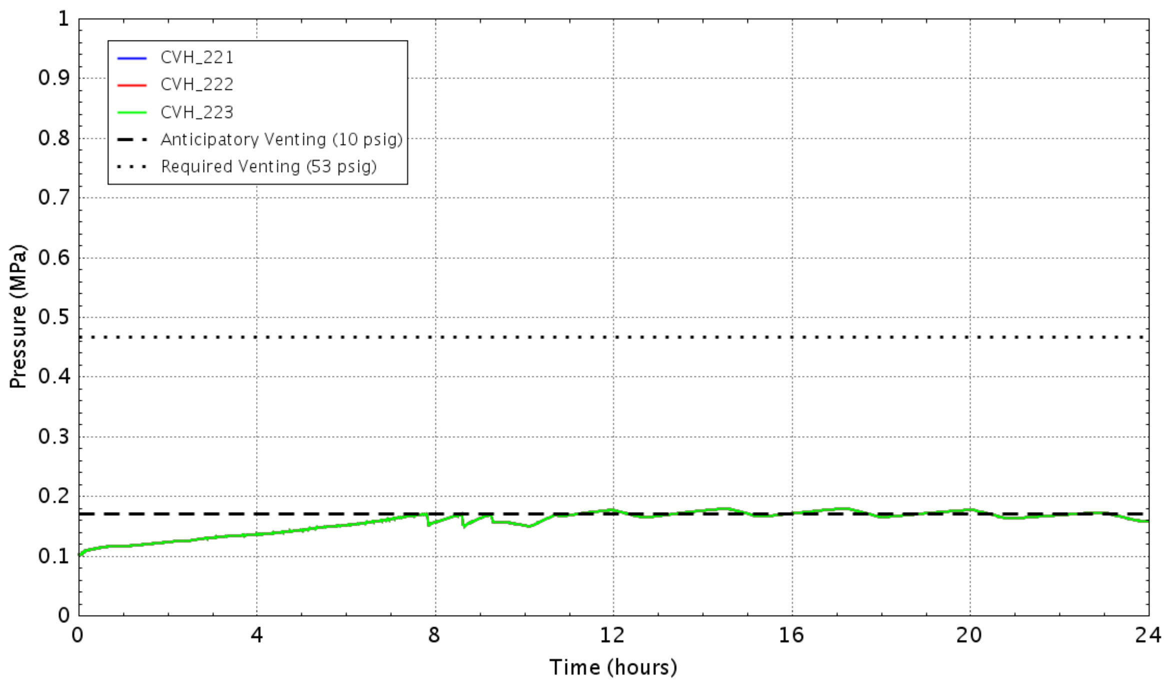

Figure D - 177 **Pressure in the wetwell**

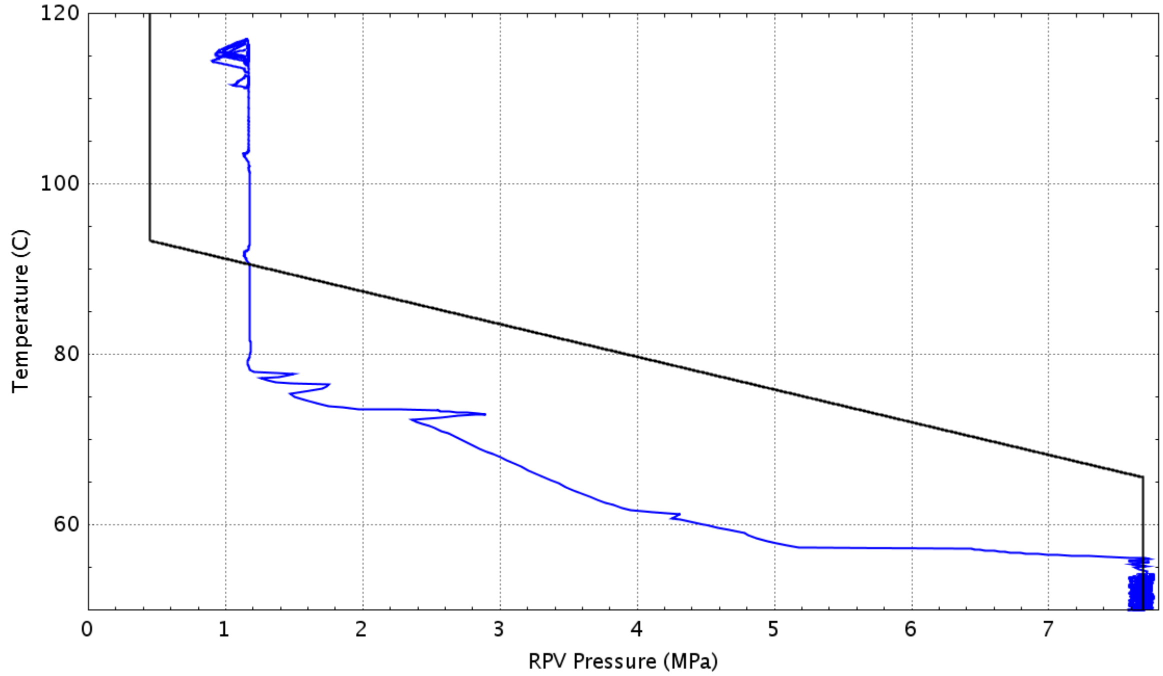

Figure D - 178 Plant status relative to the HCL curve (Graph 4 of the EOPs)

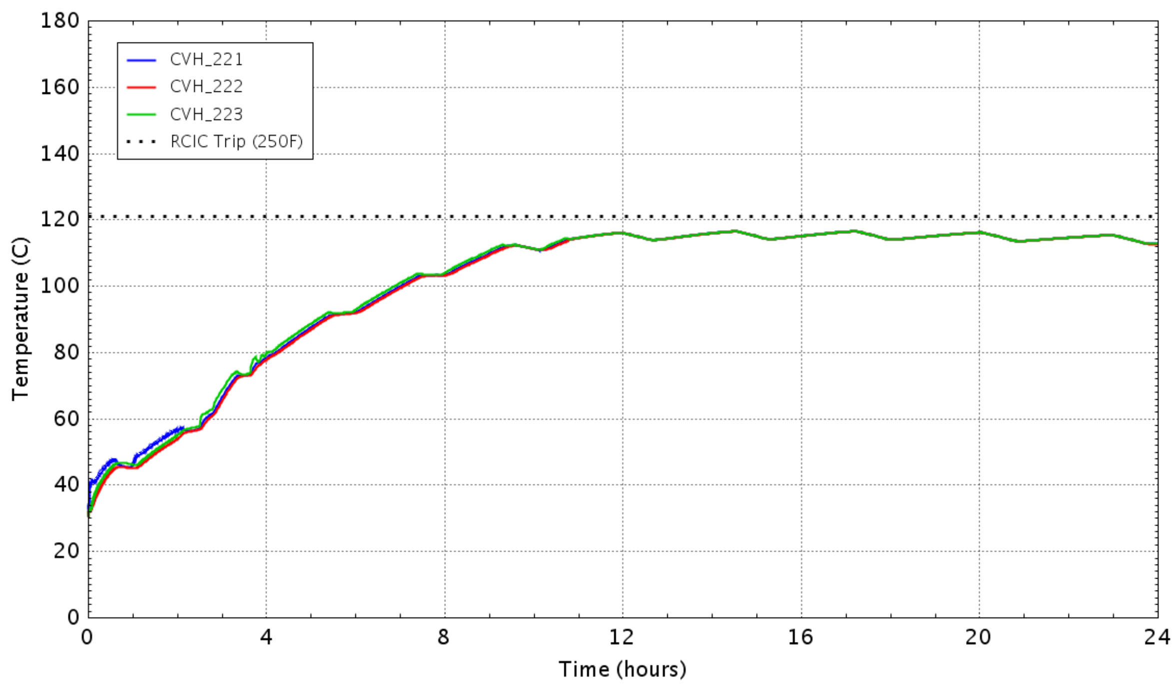

Figure D - 179 Water temperature in the wetwell

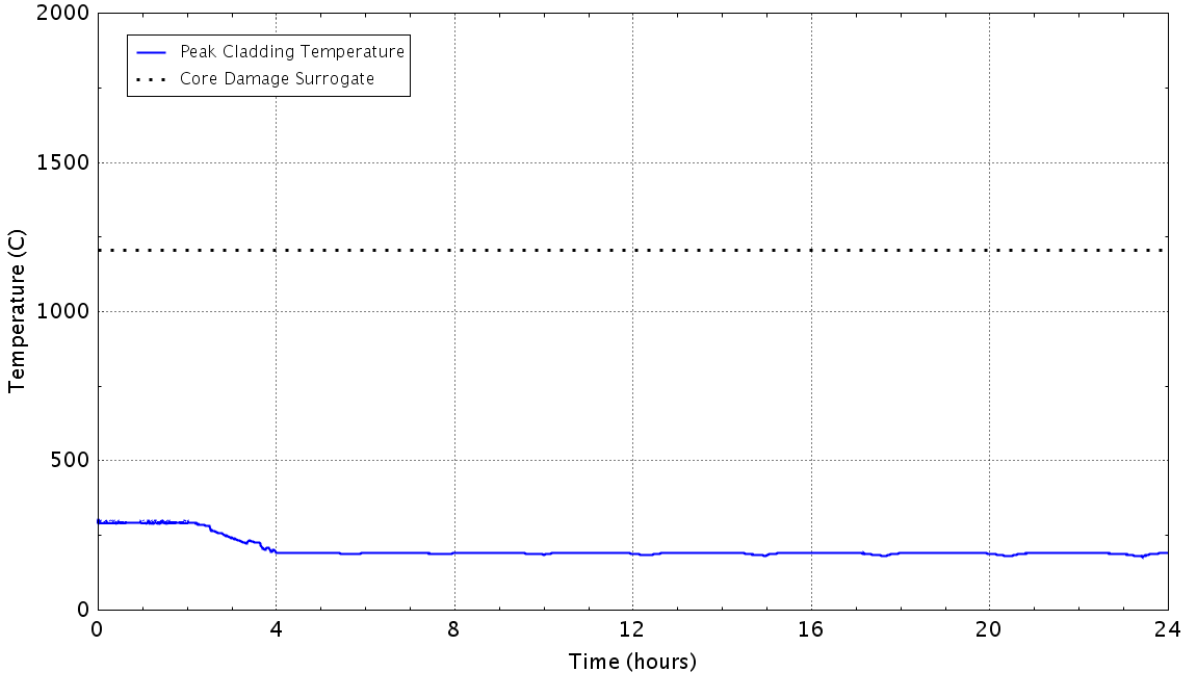

Figure D – 180 Peak temperature of the fuel cladding as a function oftime

D.1.16 Case 16: LOOPGR-38-9, AC Loss at 2 hrs., RCIC Available Indefinitely, CST Unavailable, Anticipatory Venting

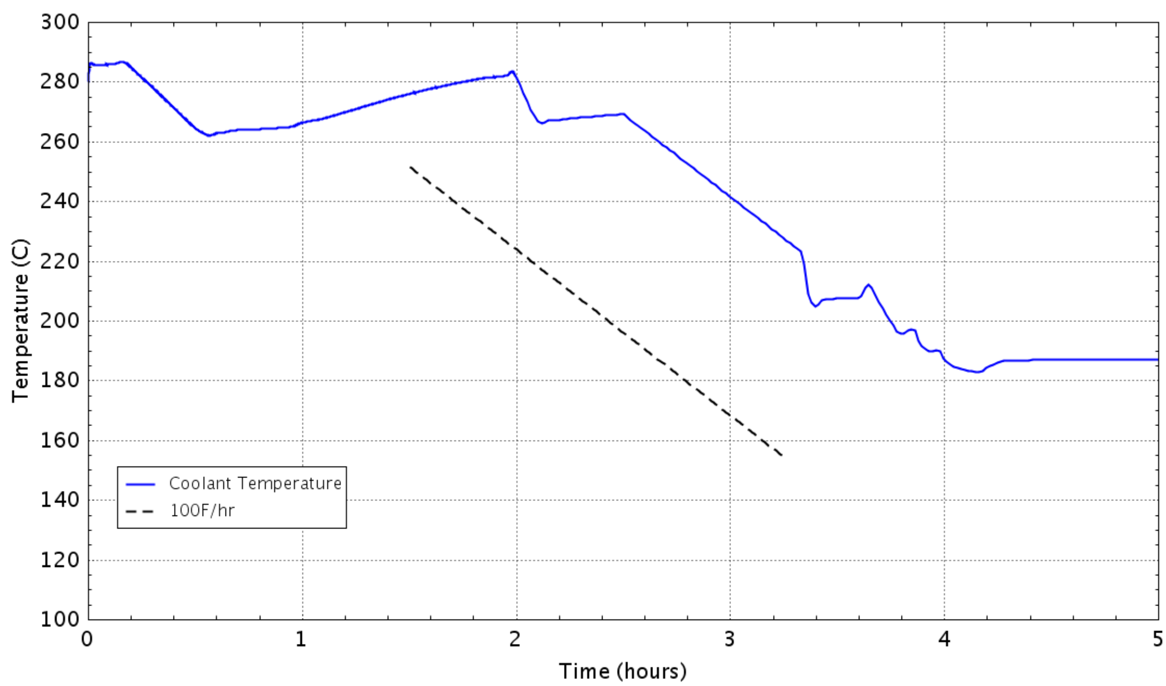

Figure D - 181 RPV cooldown rate

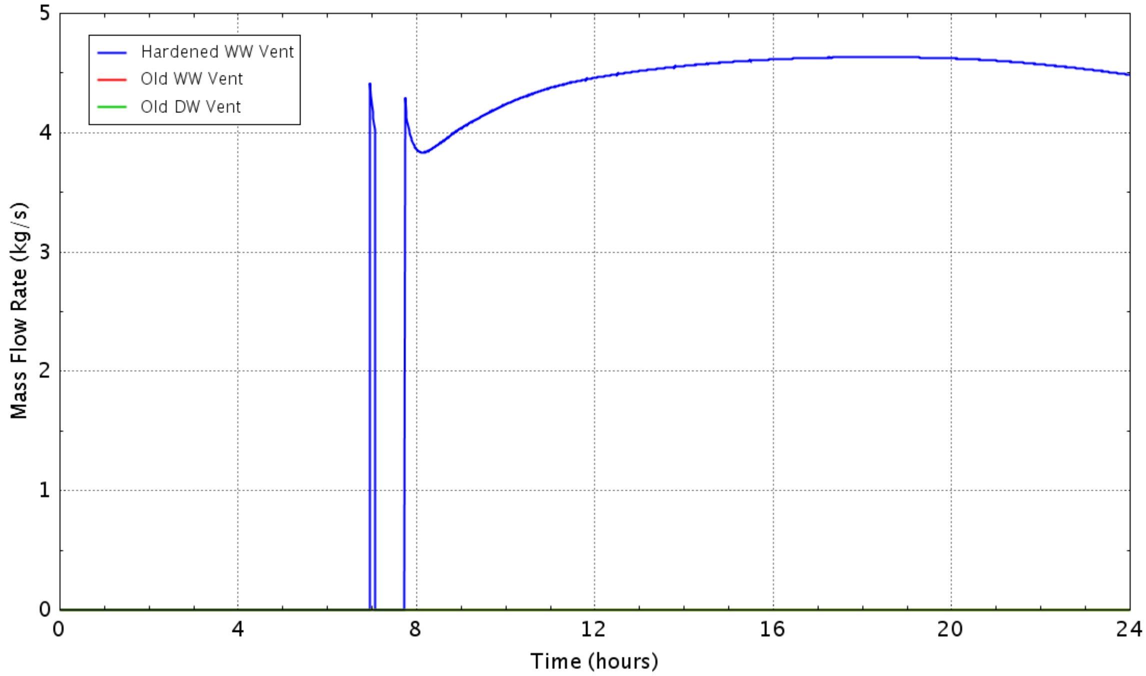

Figure D - 182 **Flow rate of the containment vents**

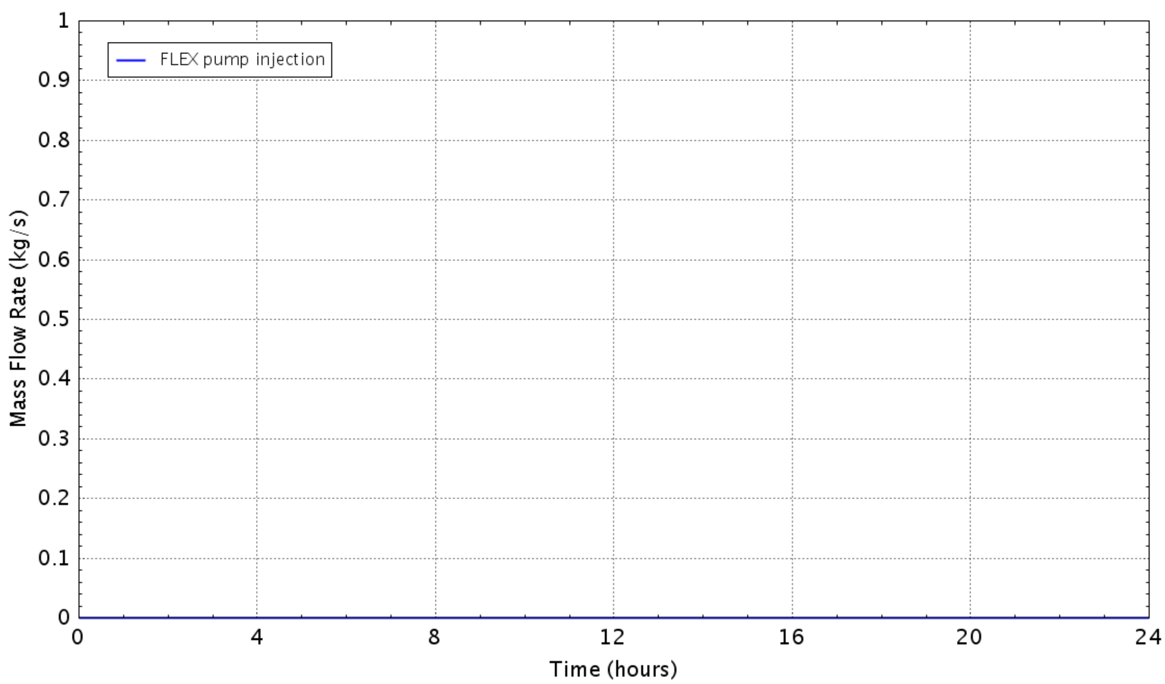

Figure D - 183 **Flow rate of the FLEX pump**

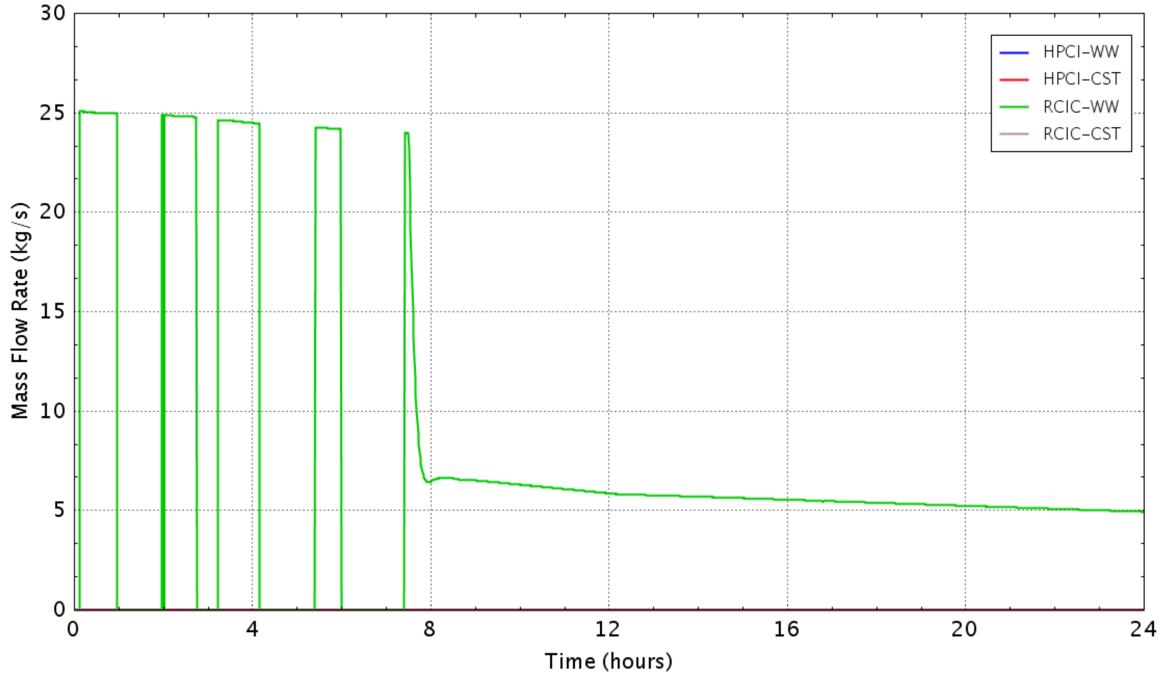

Figure D - 184 **Flow rate of the HPCI/RCIC pumps**

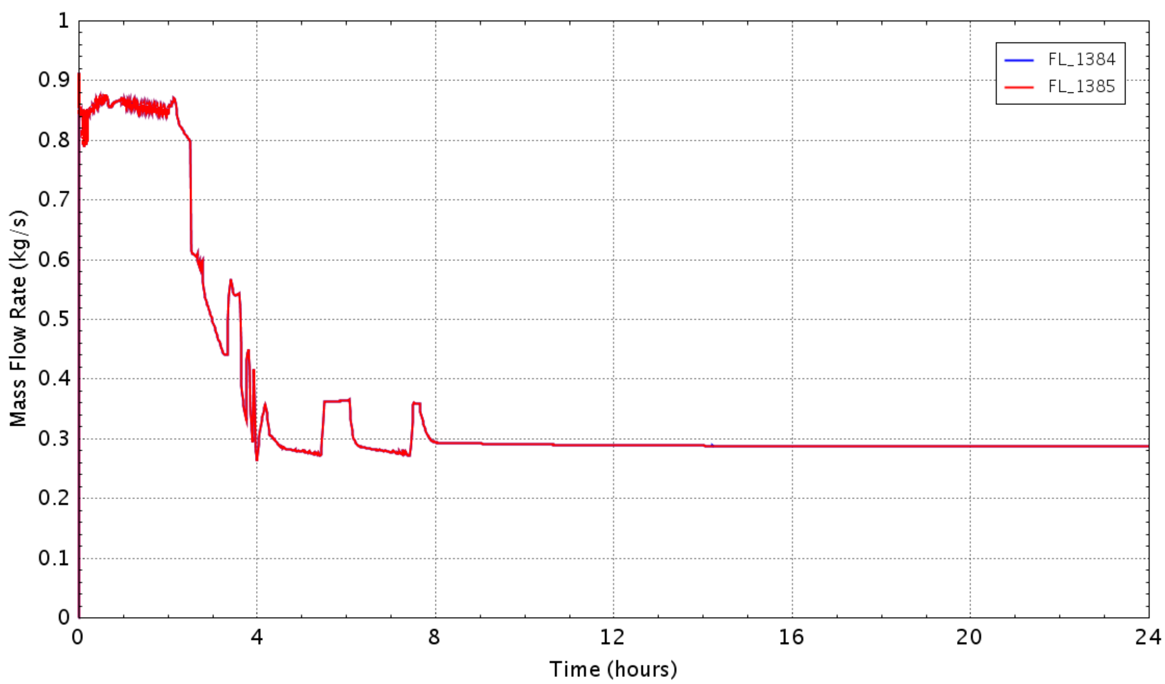

Figure D - 185 **Flow rate of the recirculating pump seal leakage**

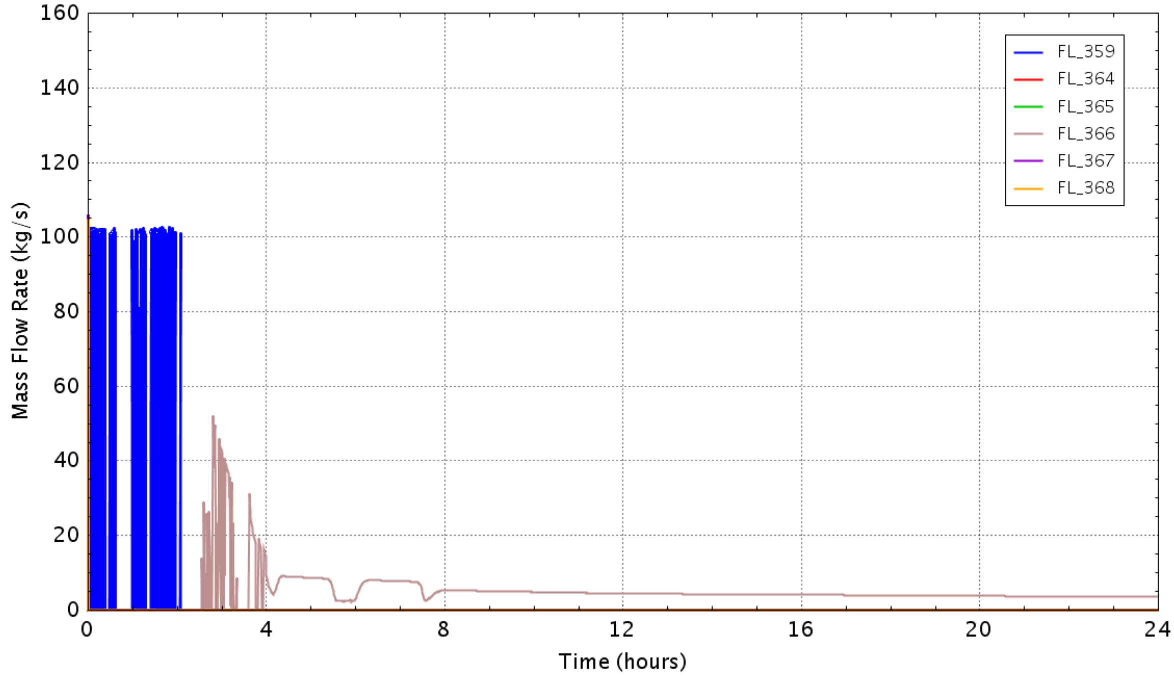

Figure D - 186 **Flow rate of the SRVs**

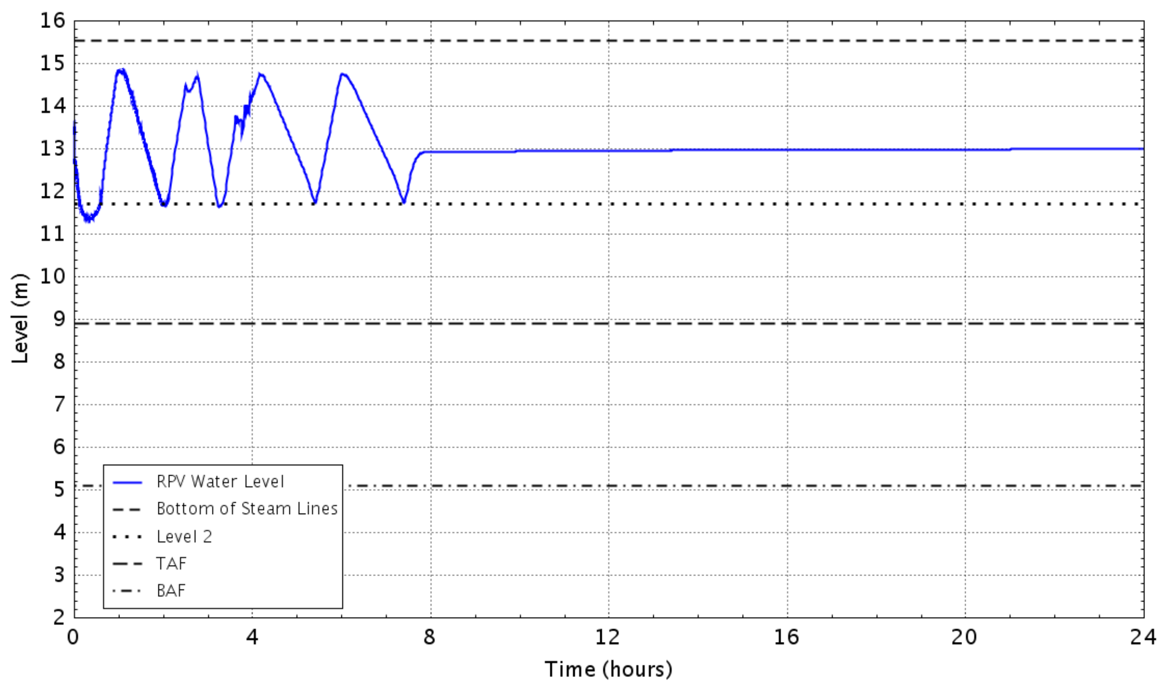

Figure D - 187 **RPV down comer water level**

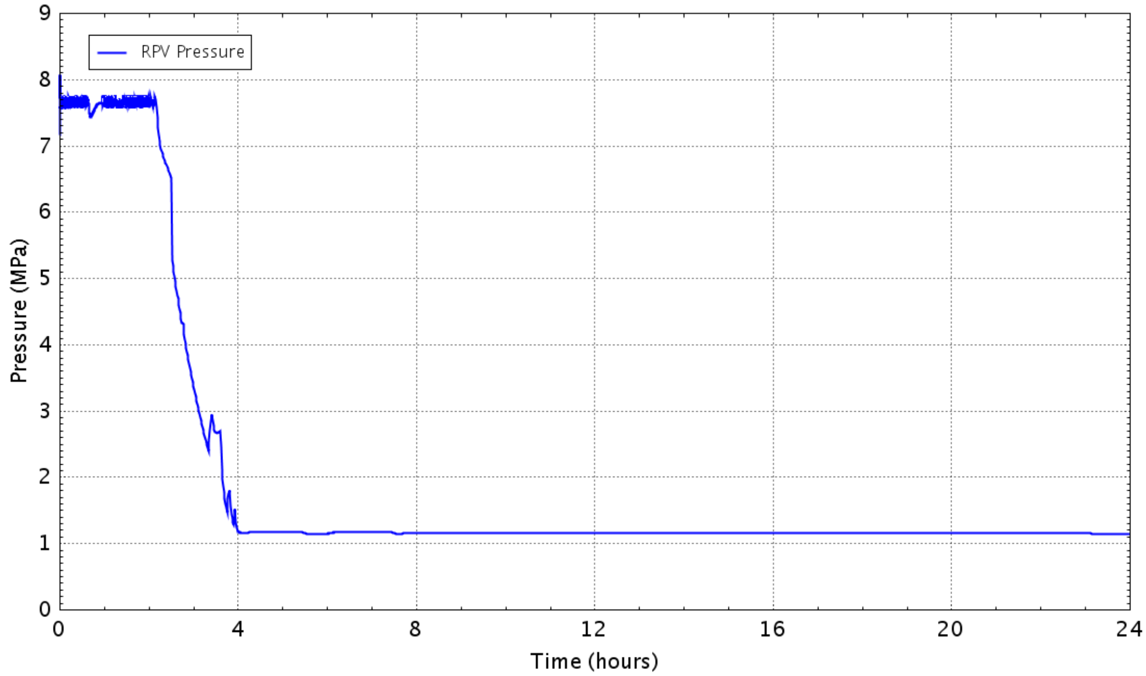

Figure D - 188 Pressure in theRPV

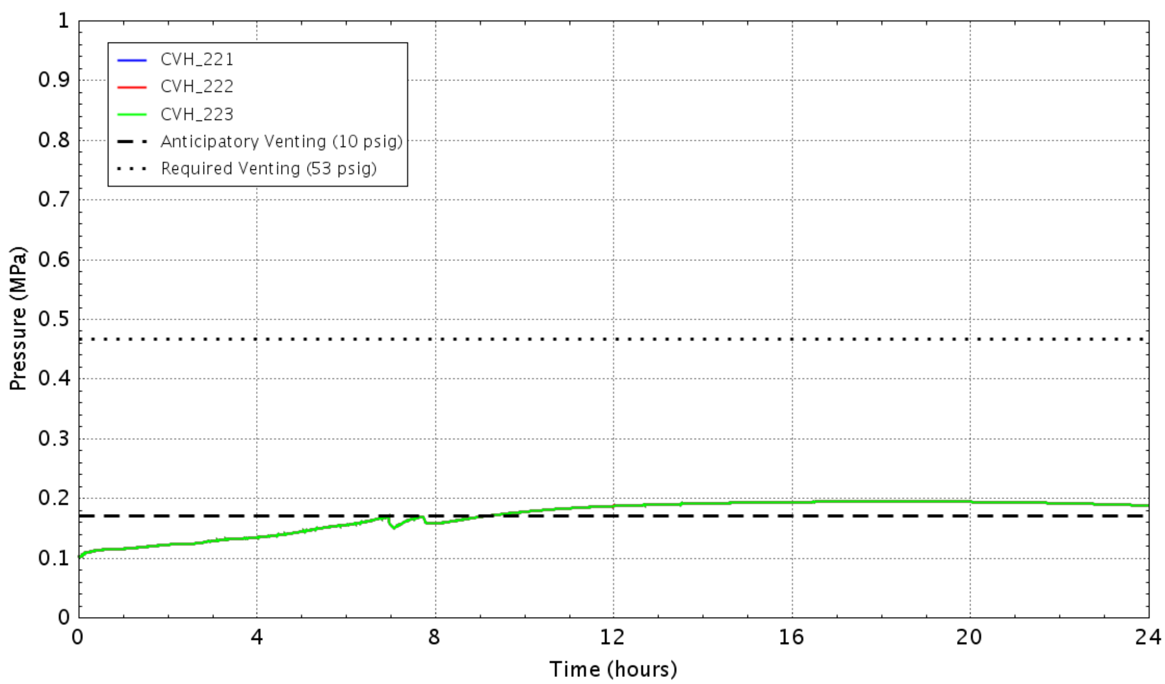

Figure D - 189 Pressure in the wetwell

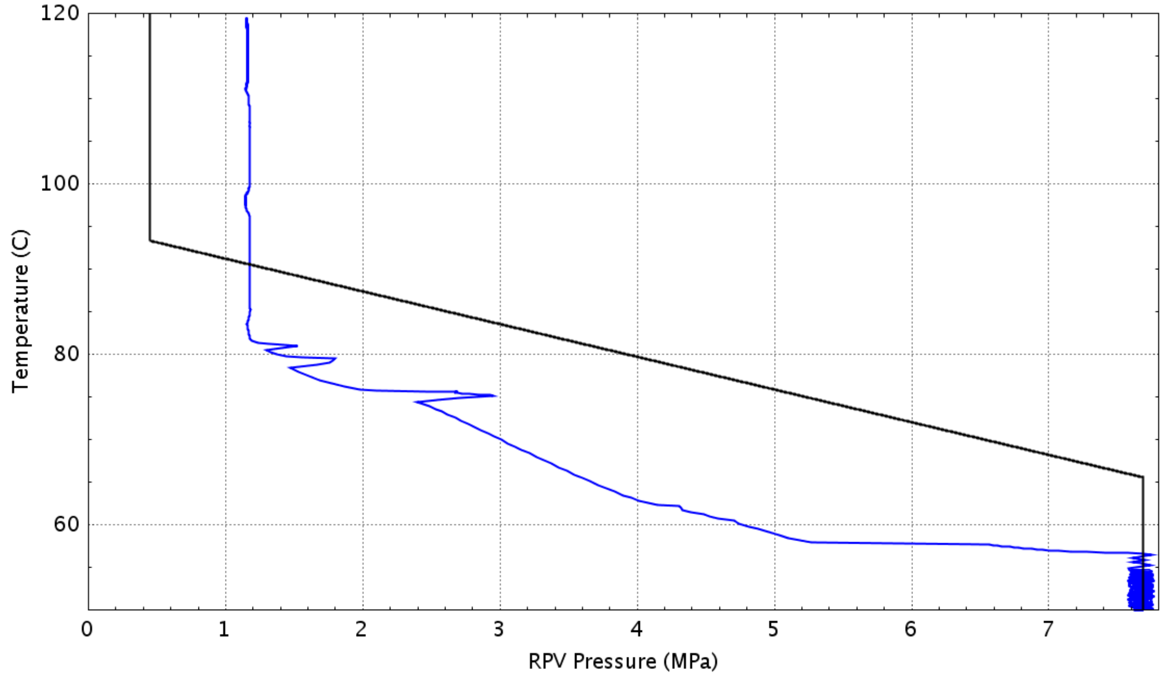

Figure D - 190 Plant status relative to the HCL curve (Graph 4 of the EOPs)

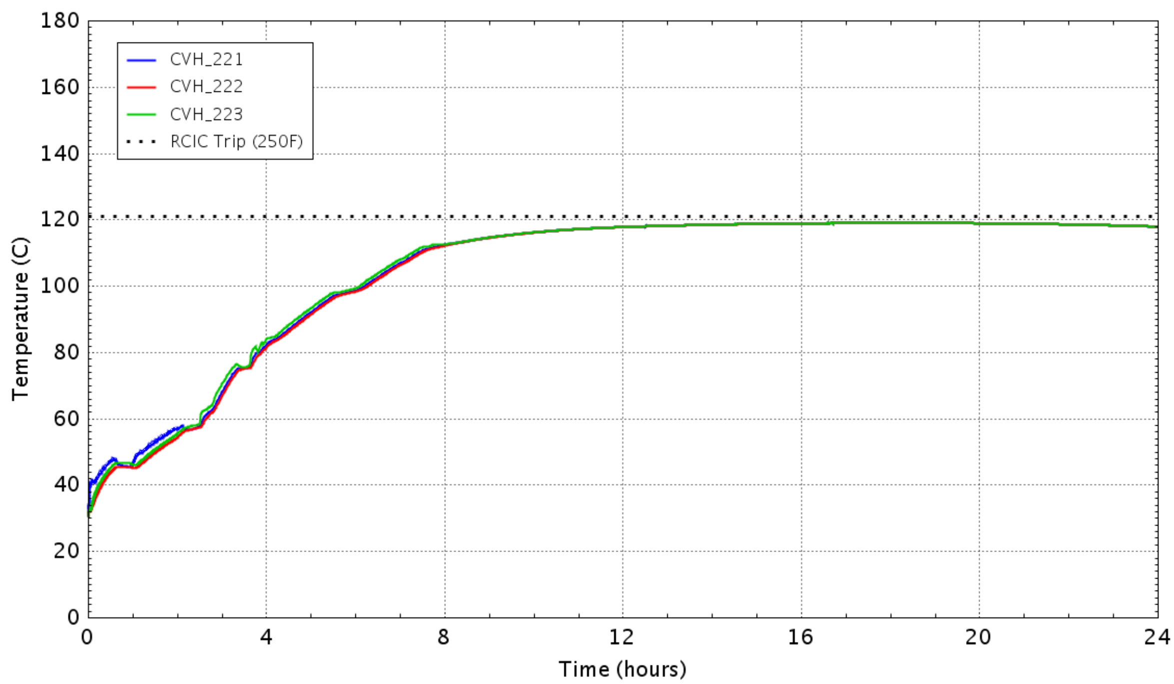

Figure D - 191 Water temperature in the wetwell

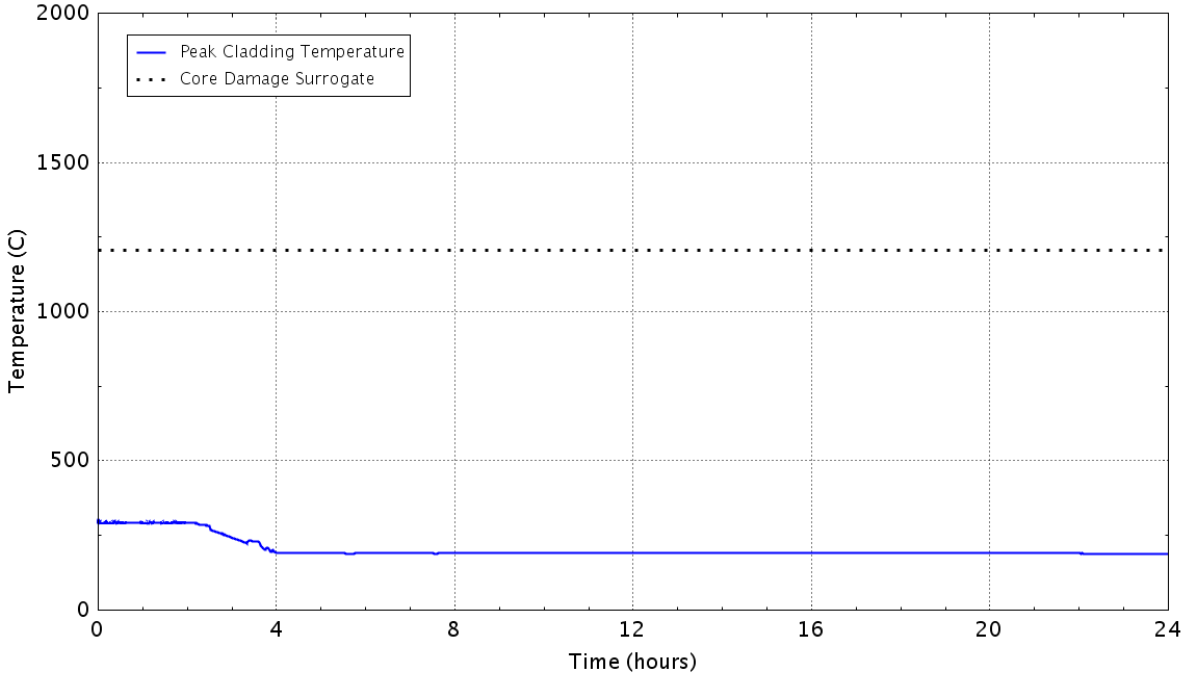

Figure D – 192 Peak temperature of the fuel cladding as a function oftime

D.2 LOMFW Scenarios

D.2.1 Case 17: LOMFW-25, RCIC Loss at 4 hrs., RPV Pressure Follows HCL Curve, FLEX injection at 5 hrs.

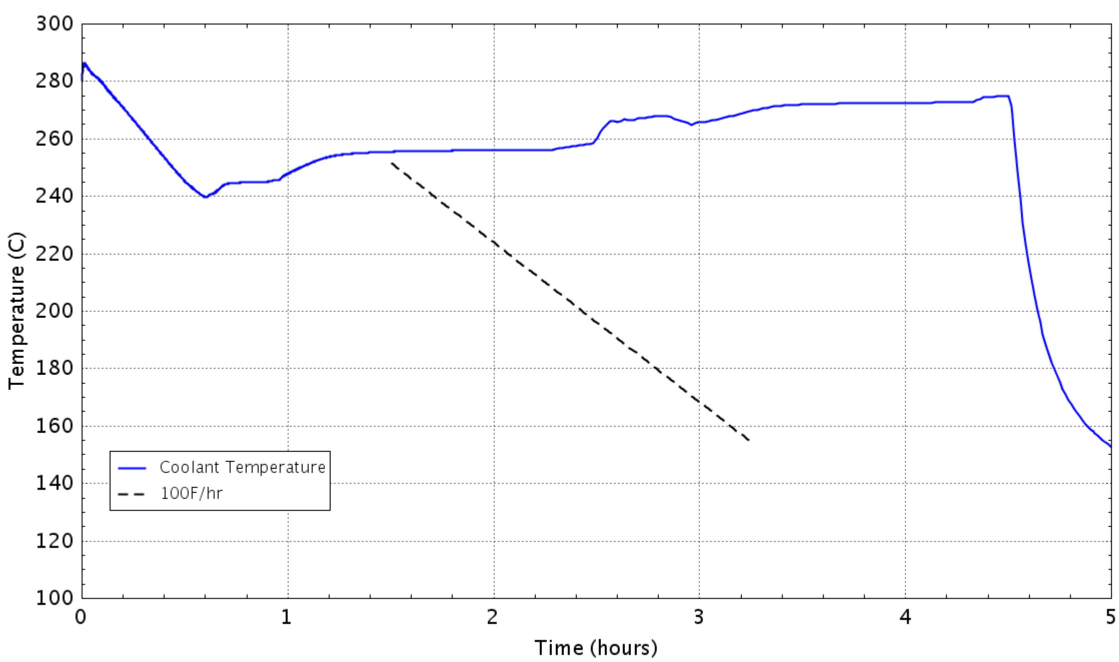

Figure D - 193 RPV cooldown rate

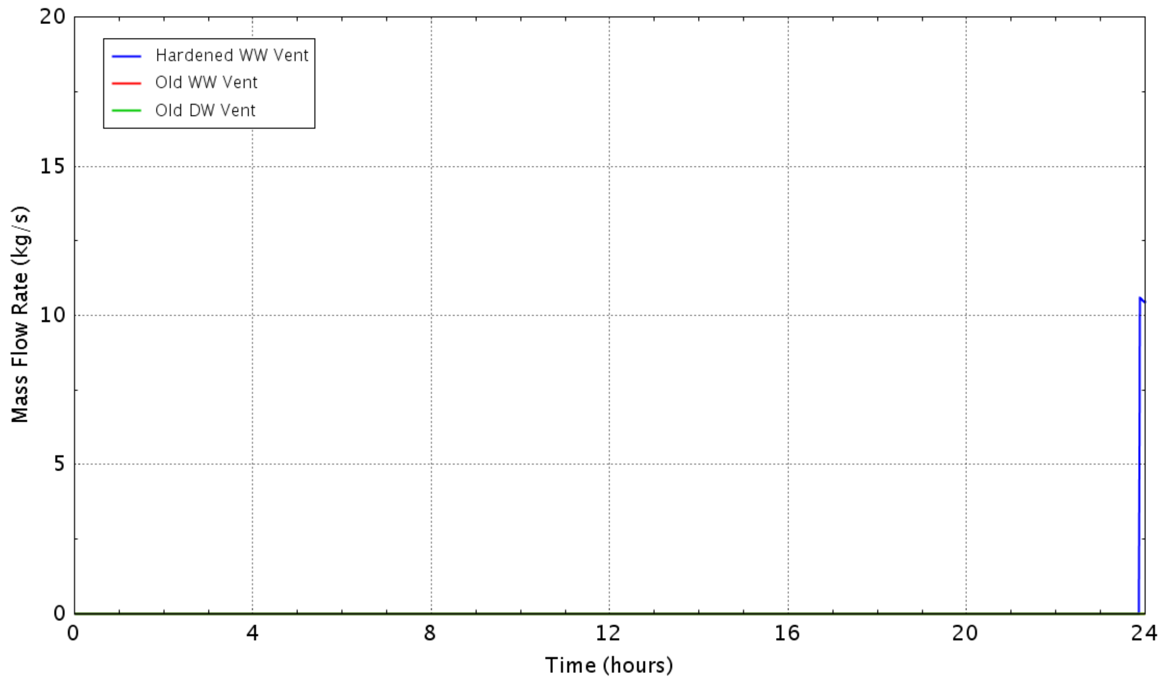

Figure D - 194 Flow rate of the containment vents

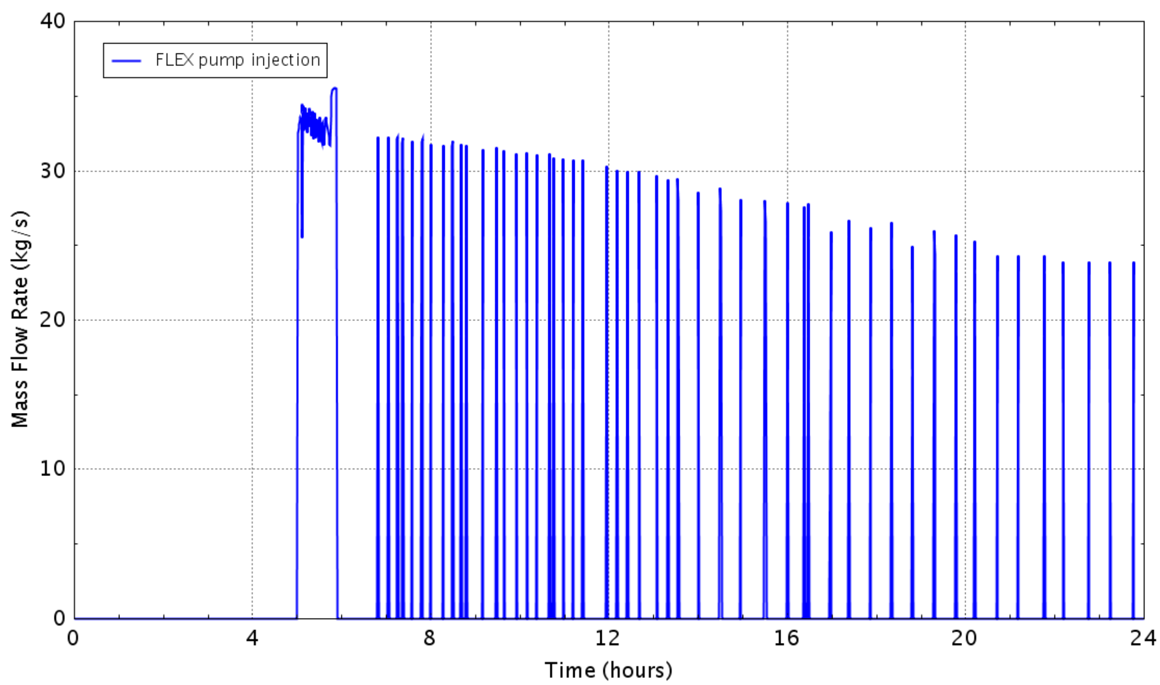

Figure D - 195 Flow rate of the FLEX pump

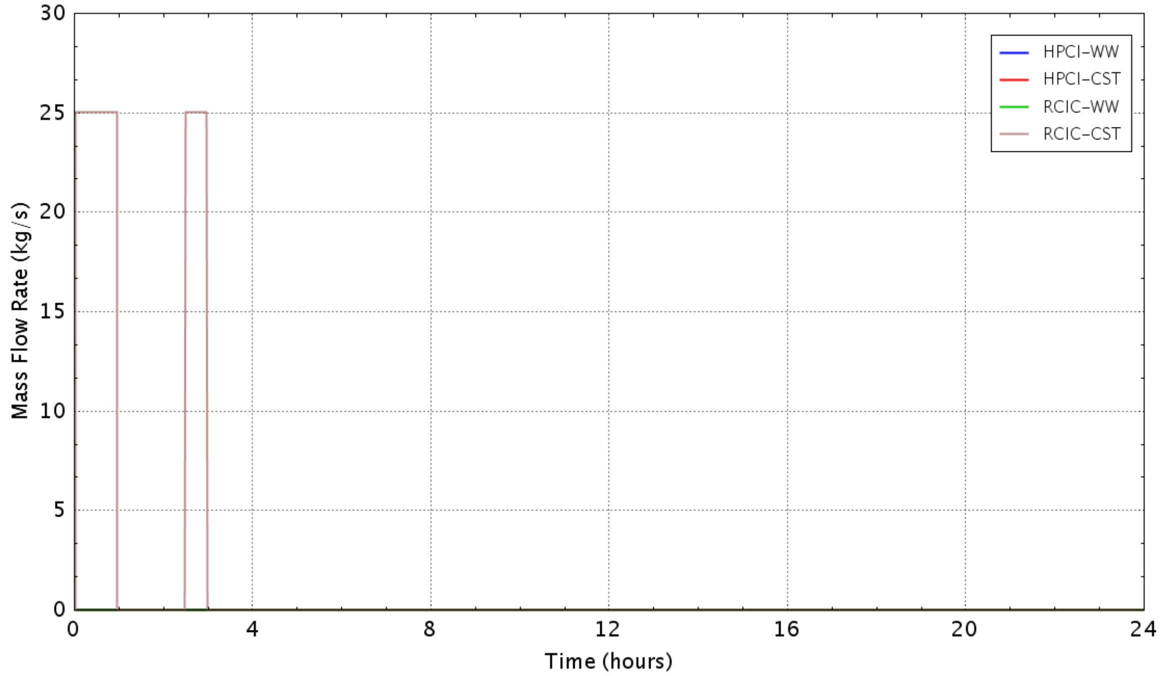

Figure D - 196 **Flow rate of the HPCI/RCIC pumps**

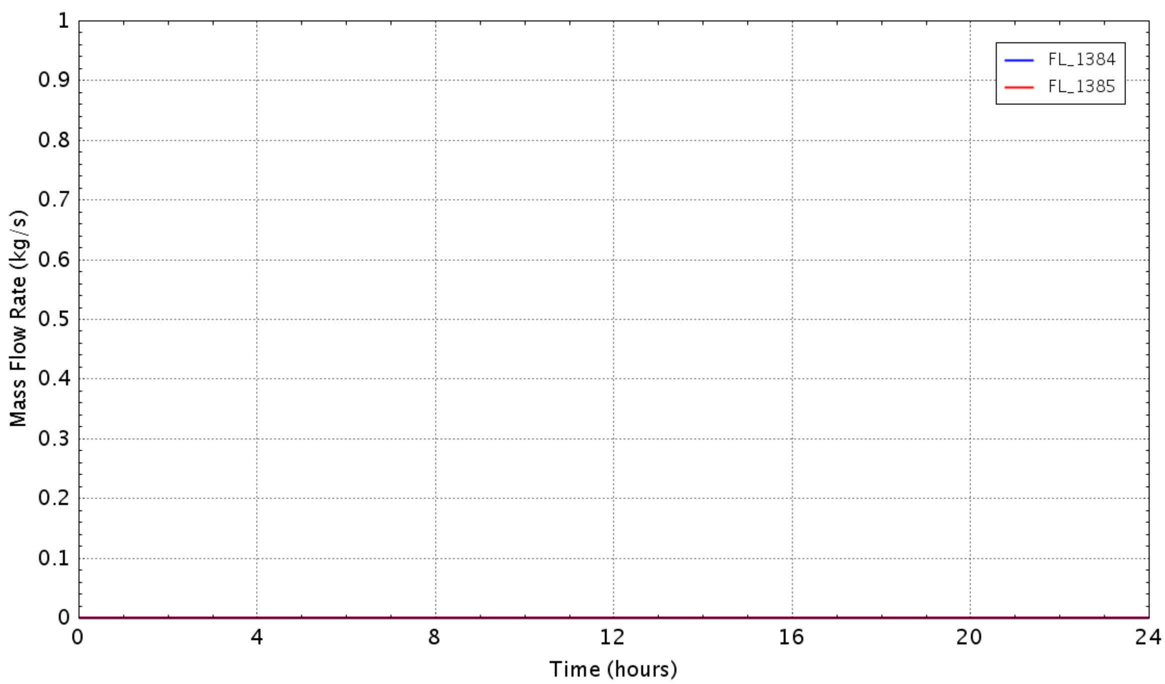

Figure D - 197 **Flow rate of the recirculating pump seal leakage**

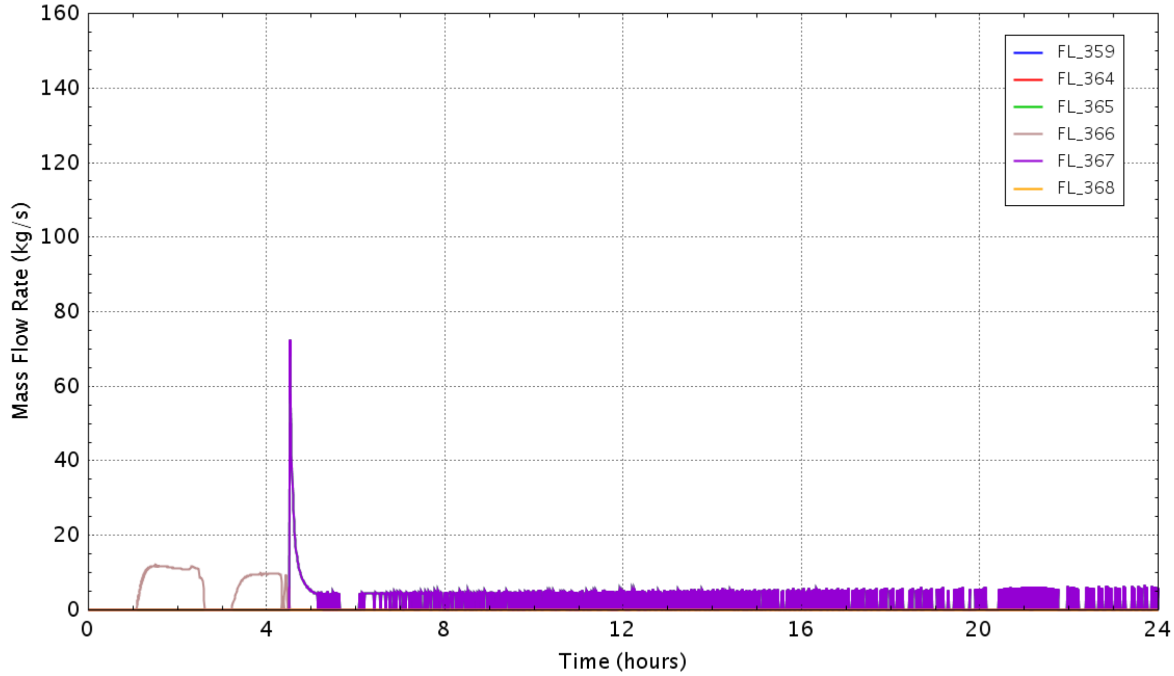

Figure D - 198 **Flow rate of the SRVs**

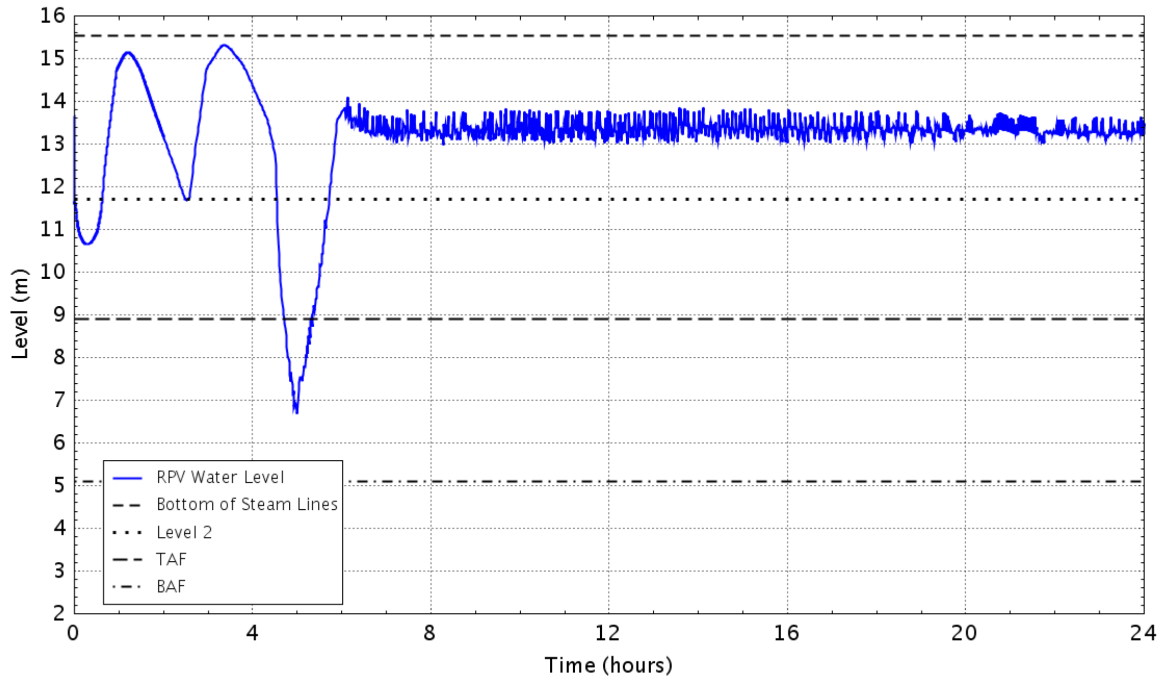

Figure D - 199 **RPV down comer water level**

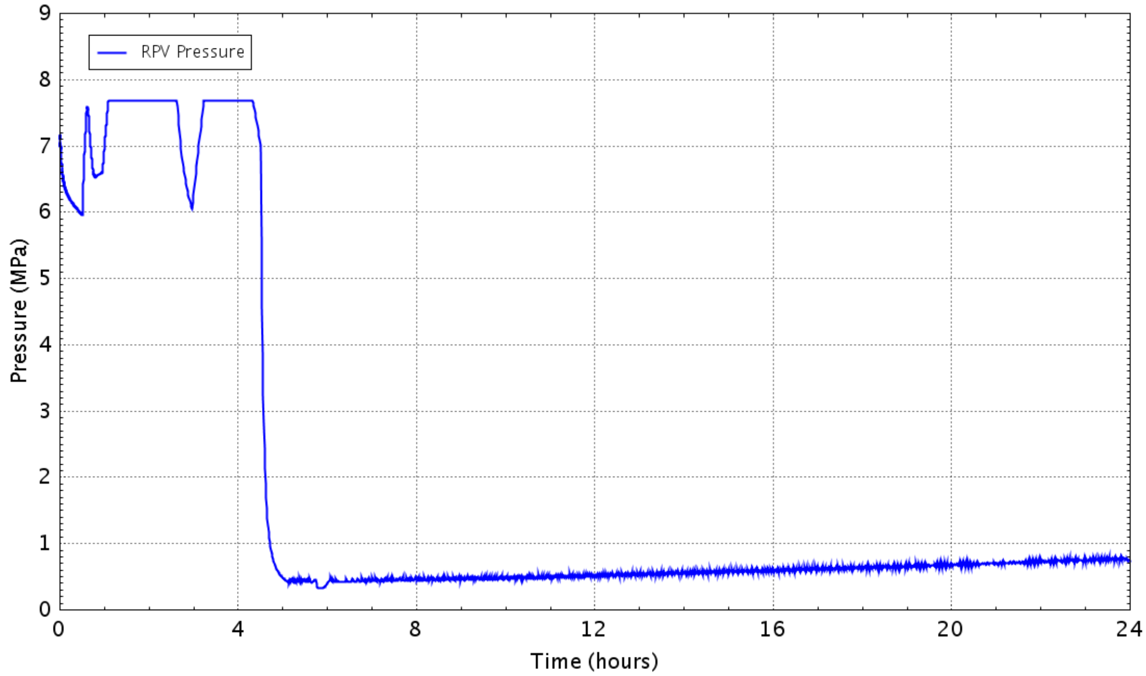

Figure D - 200 **Pressure in theRPV**

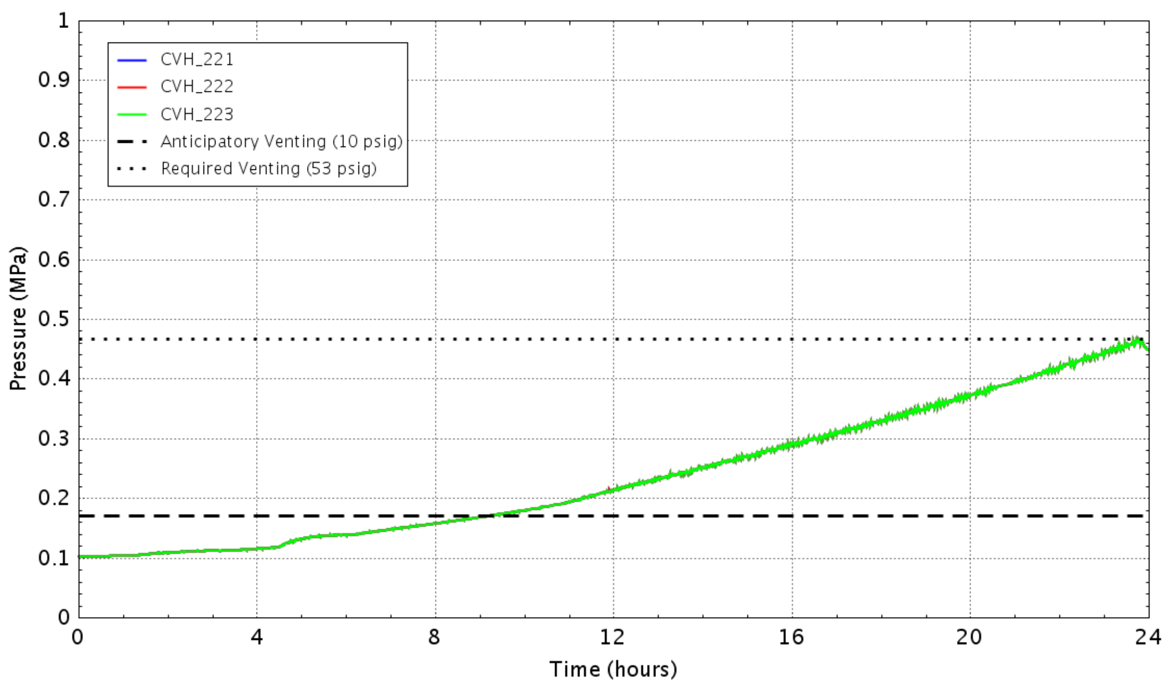

Figure D - 201 **Pressure in the wetwell**

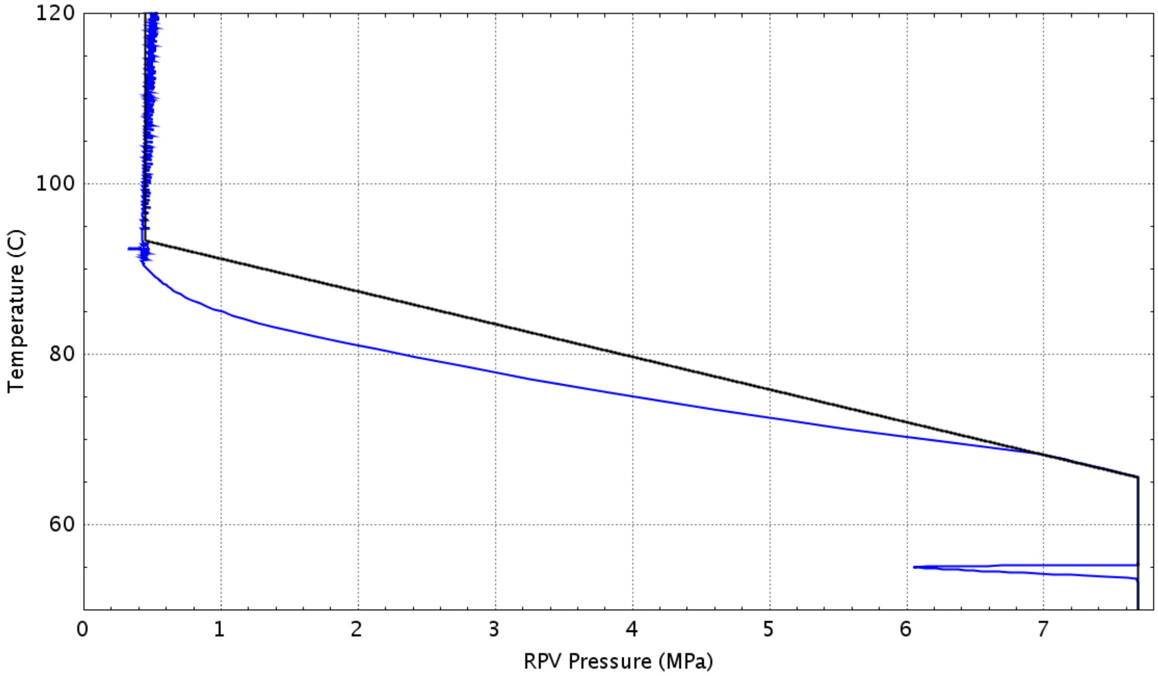

Figure D – 202 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

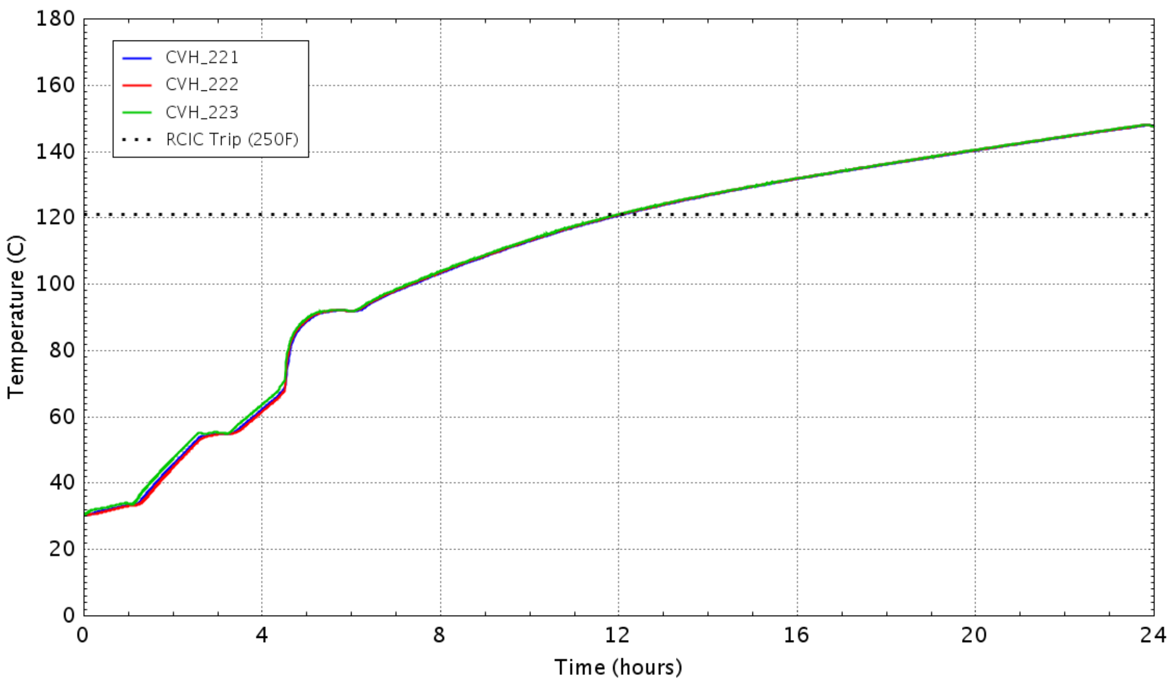

Figure D - 203 **Water temperature in the wetwell**

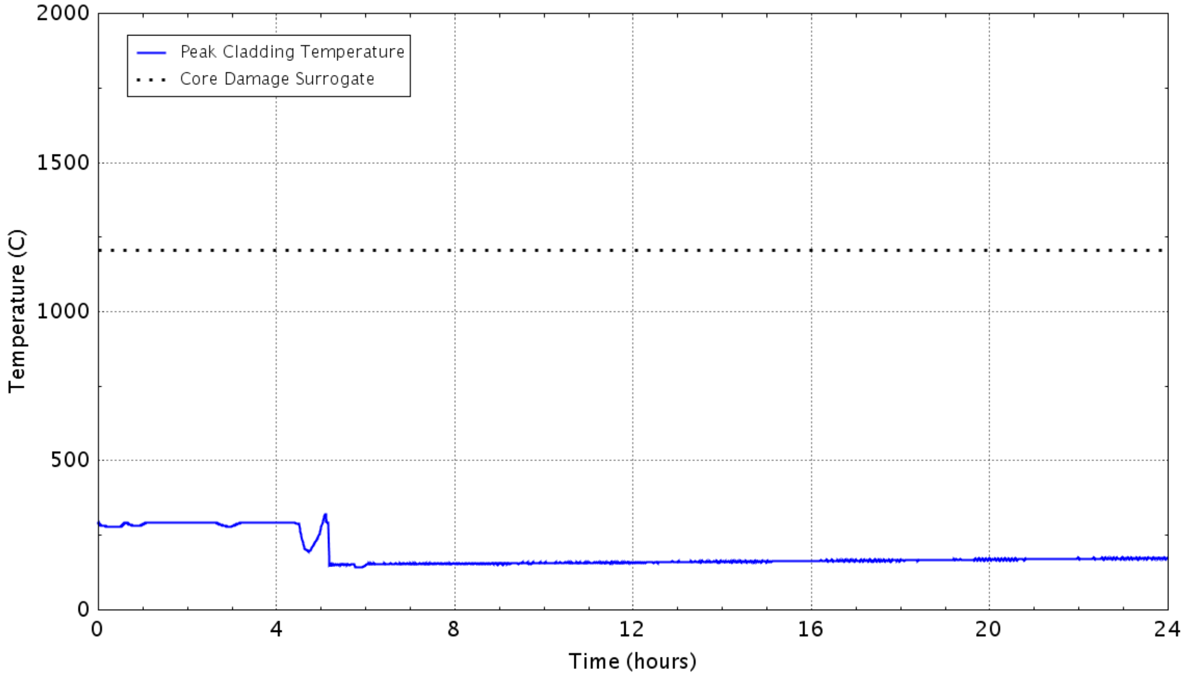

Figure D – 204 Peak temperature of the fuel cladding as a function oftime

D.2.2 Case 18: LOMFW-25, RCIC Loss at 4 hrs., RPV Pressure Follows HCL Curve, FLEX injection at 6 hrs.

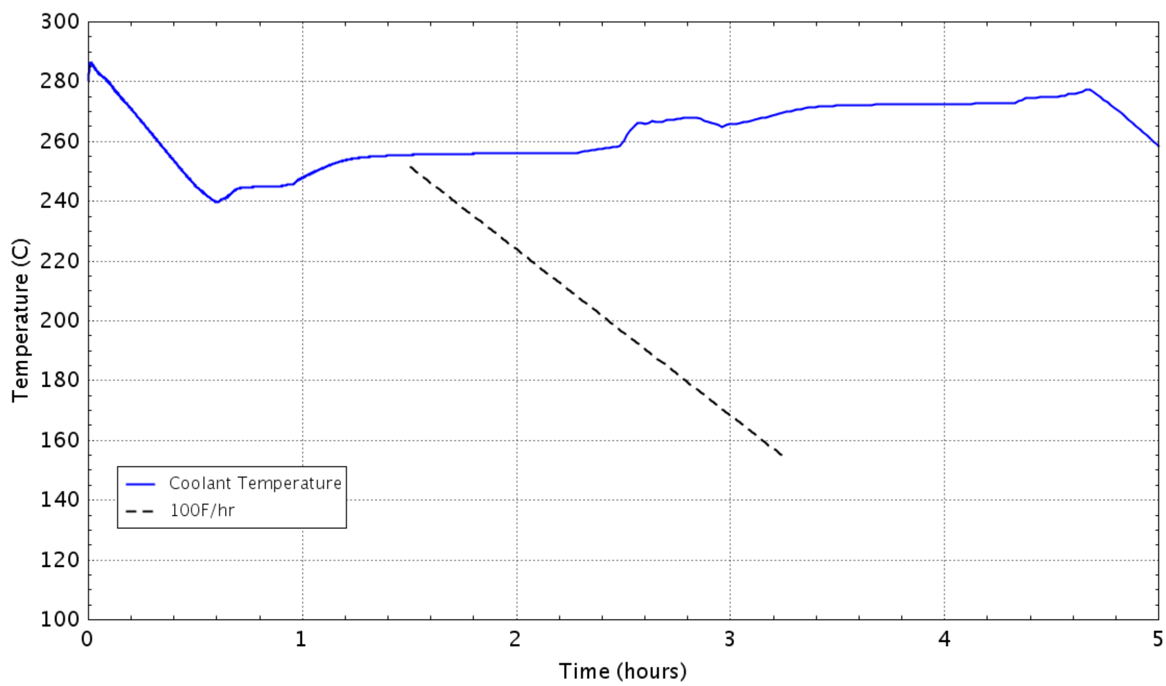

Figure D - 205 RPV cooldown rate

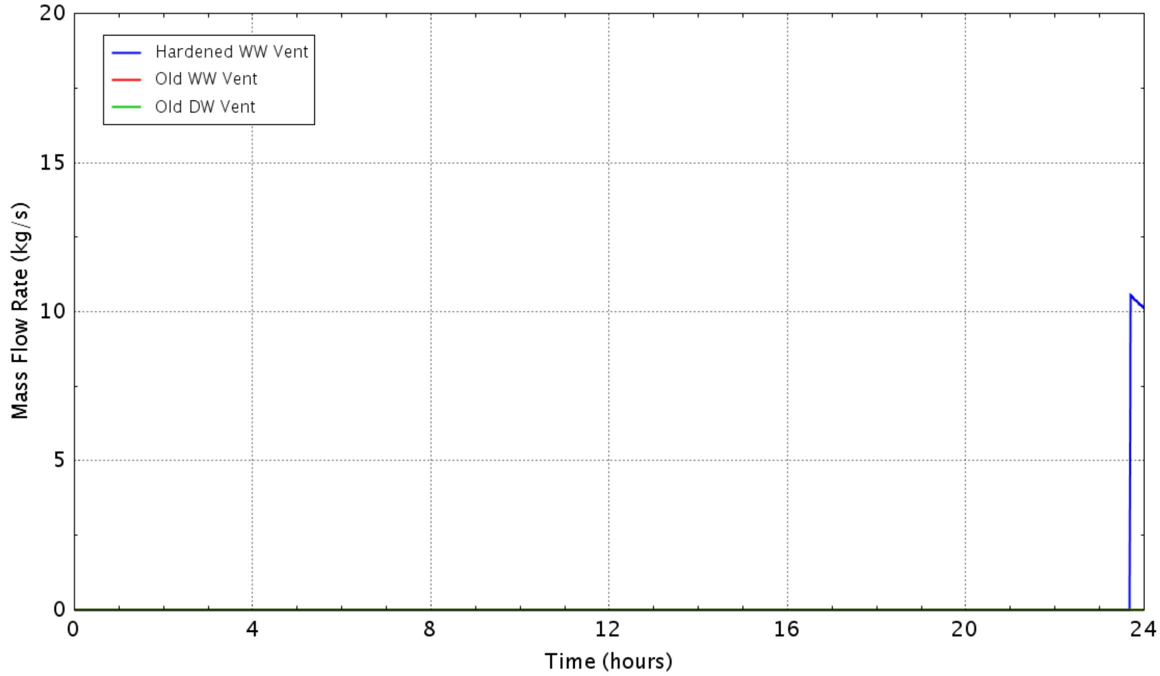

Figure D - 206 **Flow rate of the containment vents**

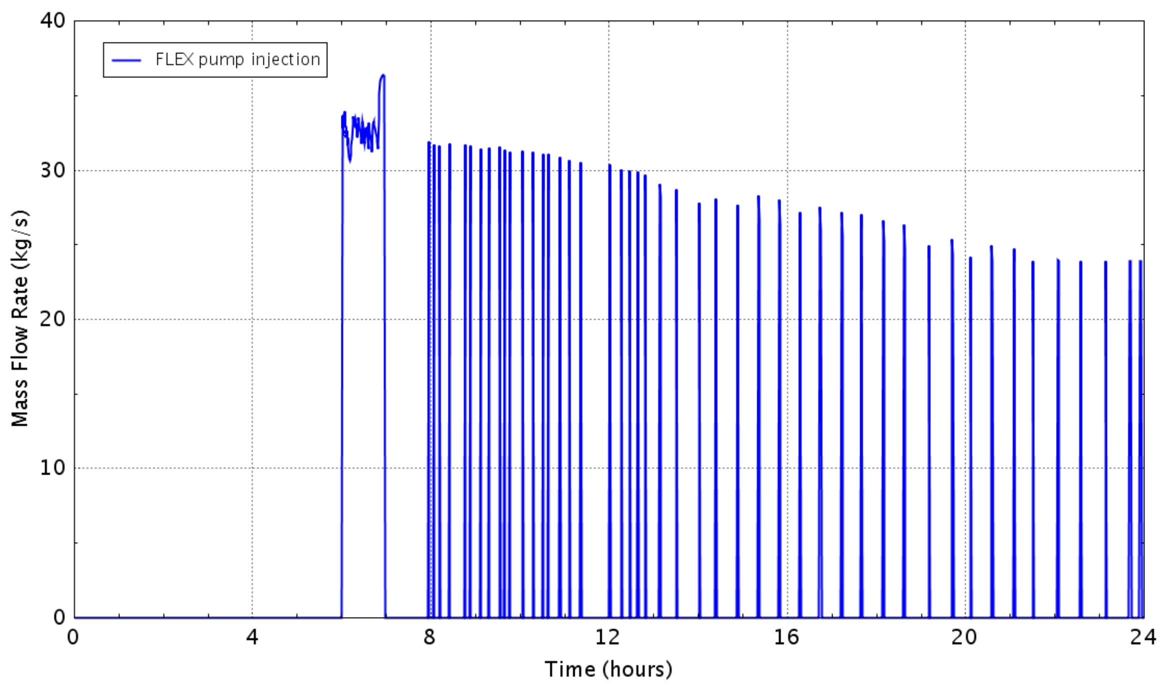

Figure D - 207 **Flow rate of theFLEXpump**

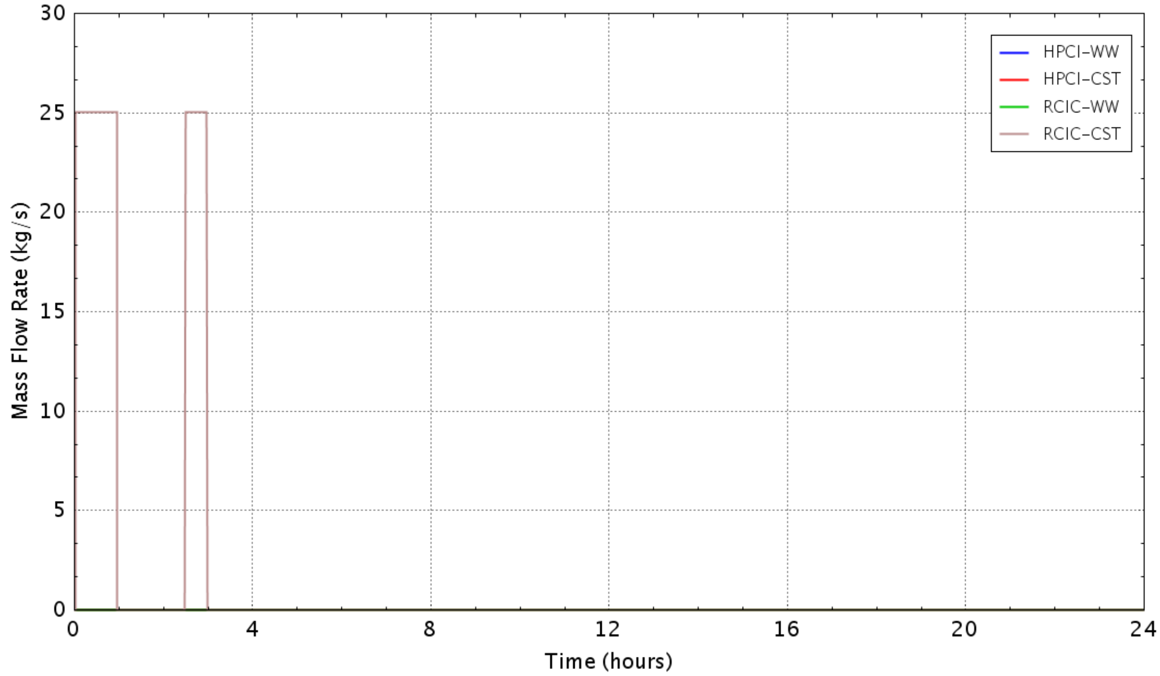

Figure D - 208 **Flow rate of the HPCI/RCIC pumps**

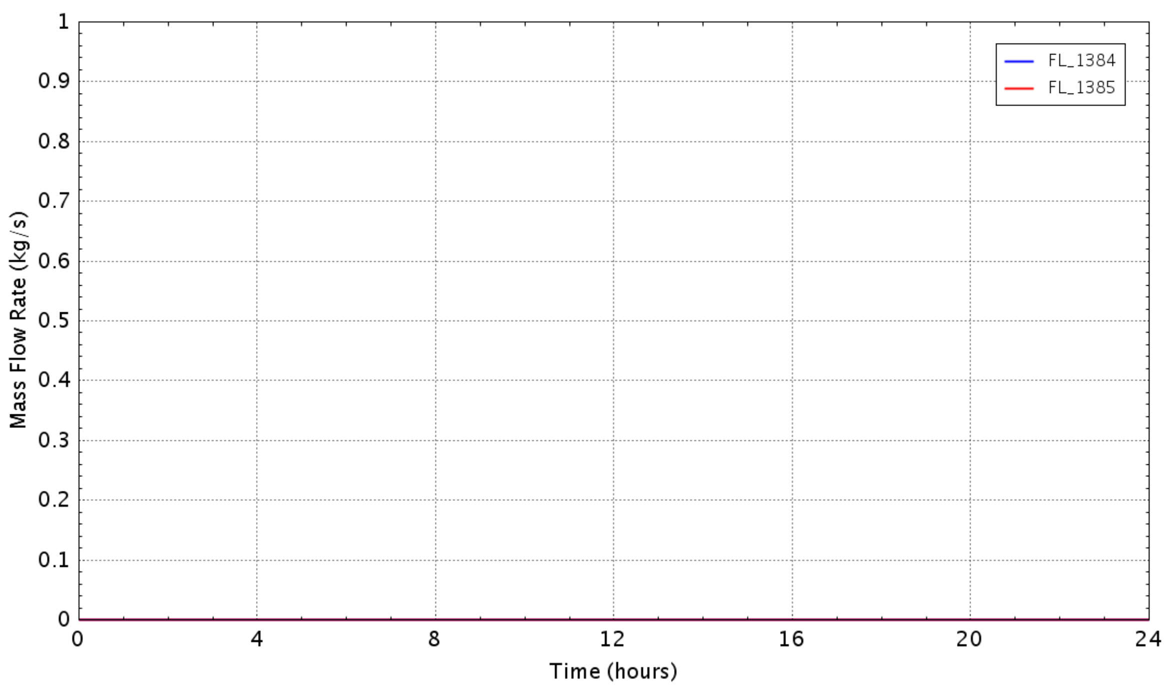

Figure D - 209 **Flow rate of the recirculating pump seal leakage**

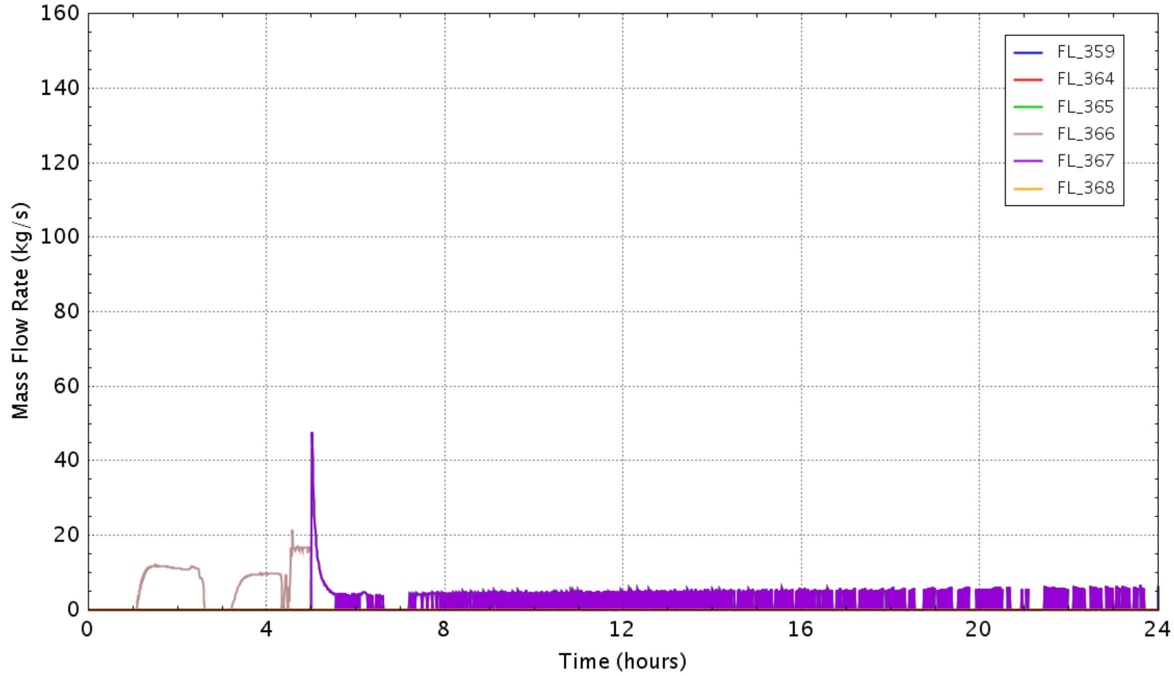

Figure D - 210 **Flow rate of the SRVs**

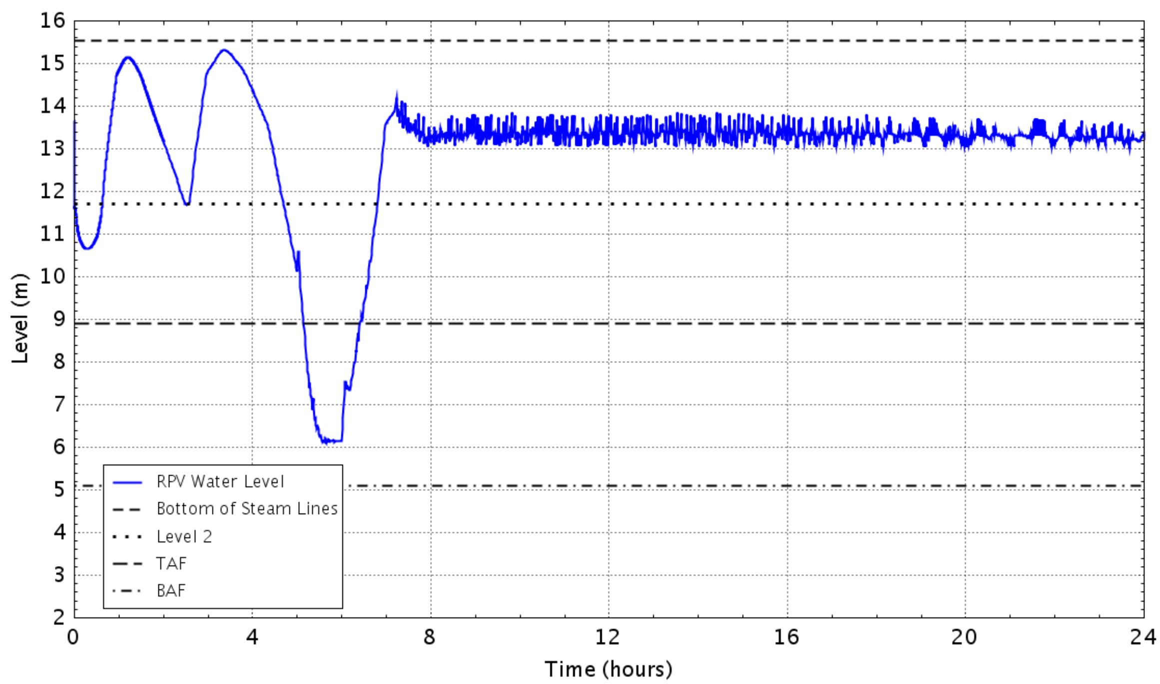

Figure D - 211 **RPV down comer water level**

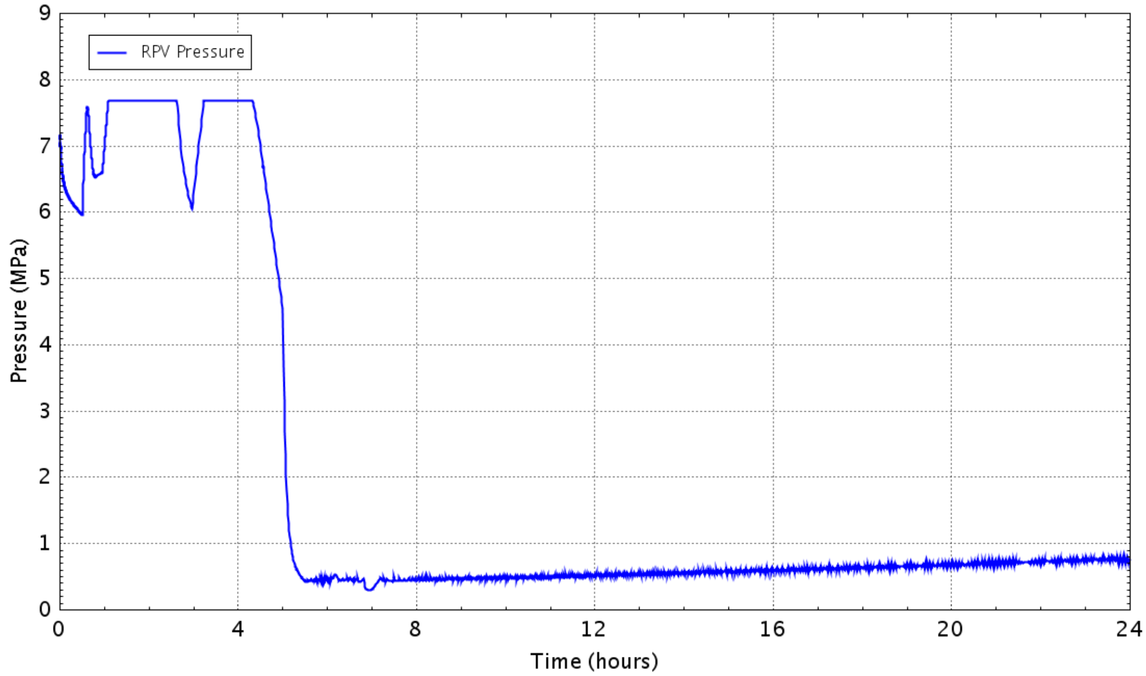

Figure D - 212 Pressure in theRPV

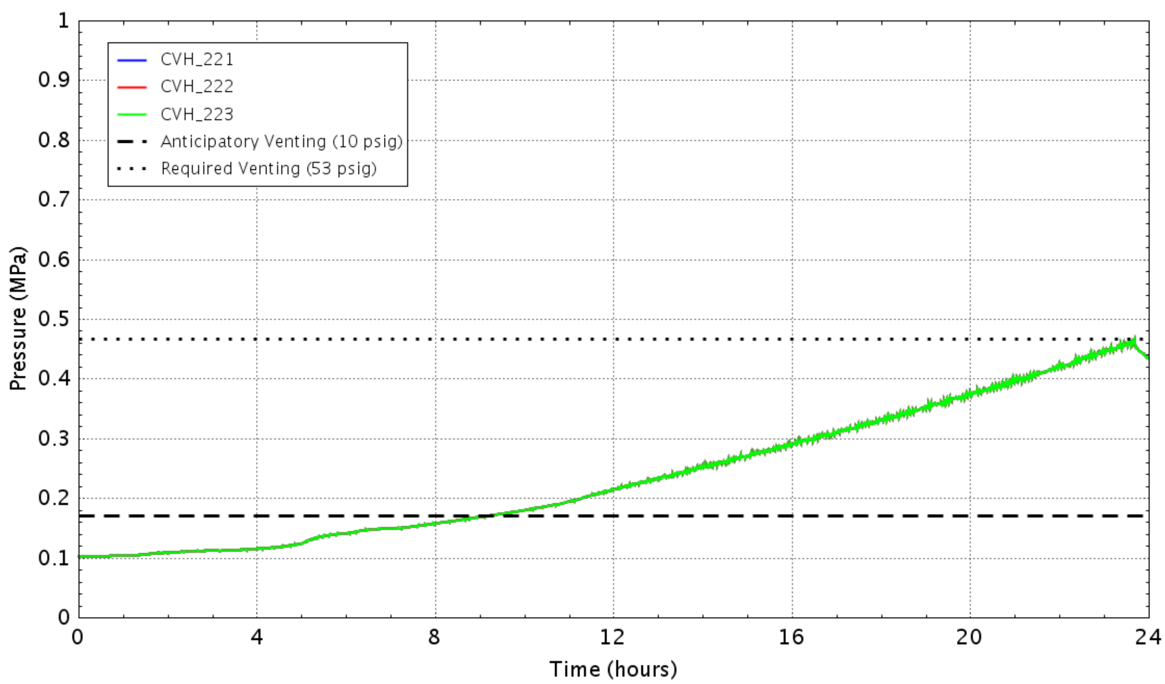

Figure D - 213 Pressure in the wetwell

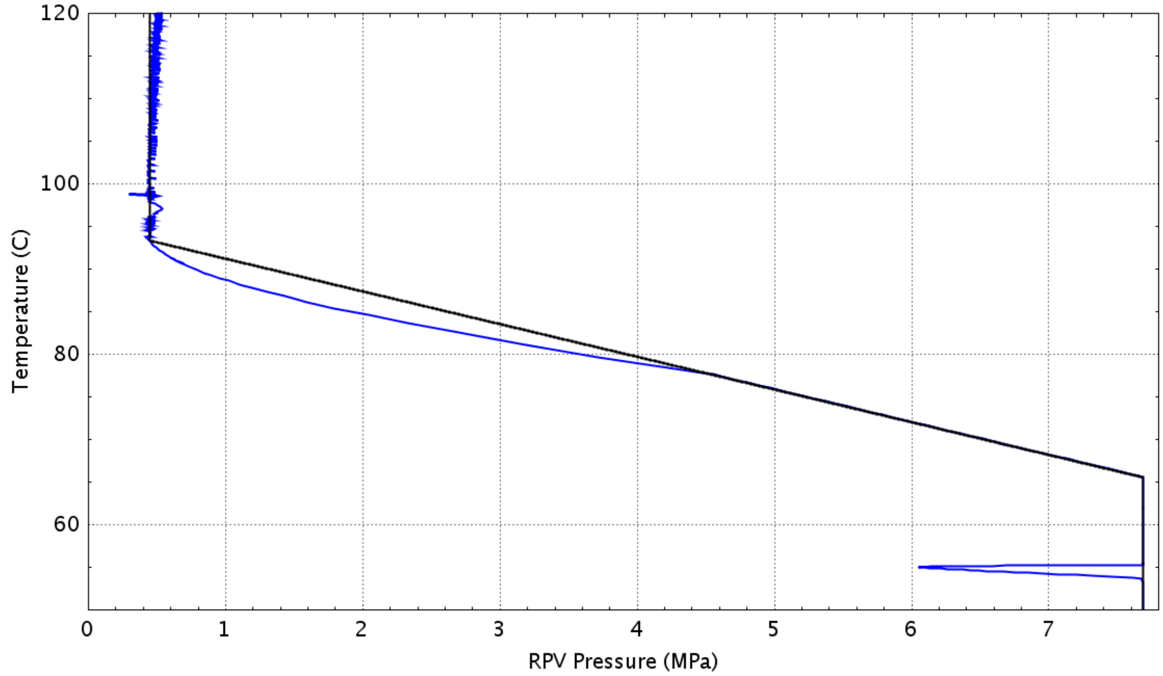

Figure D - 214 Plant status relative to the HCL curve (Graph 4 of the EOPs)

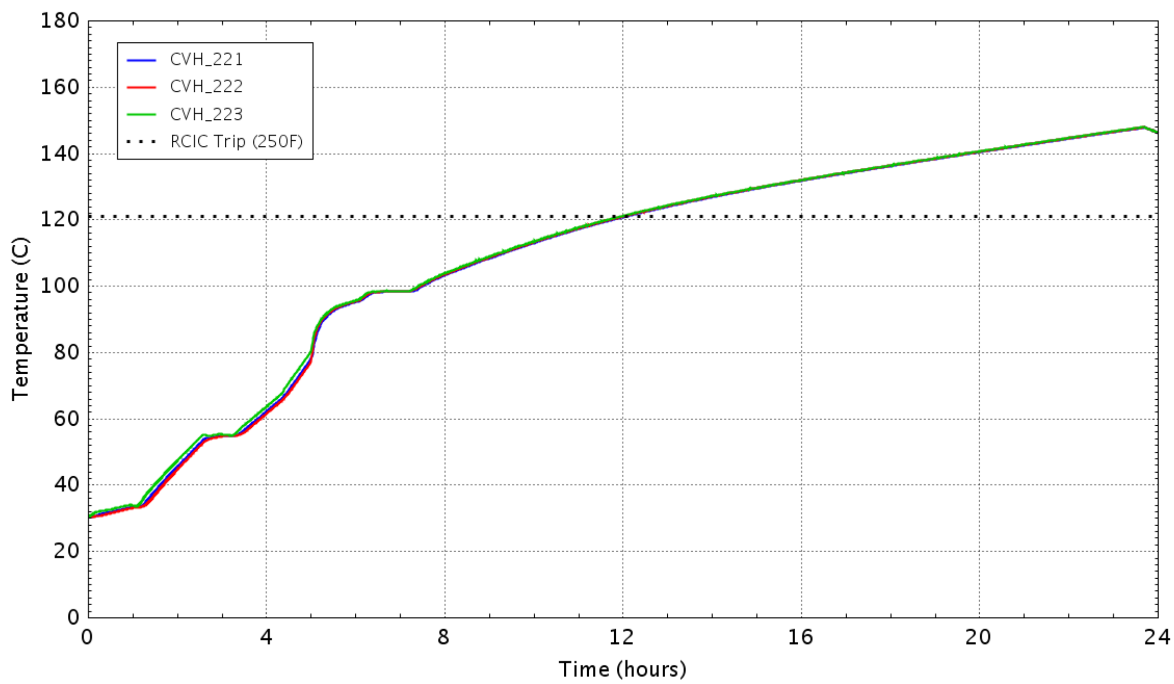

Figure D - 215 Water temperature in the wetwell

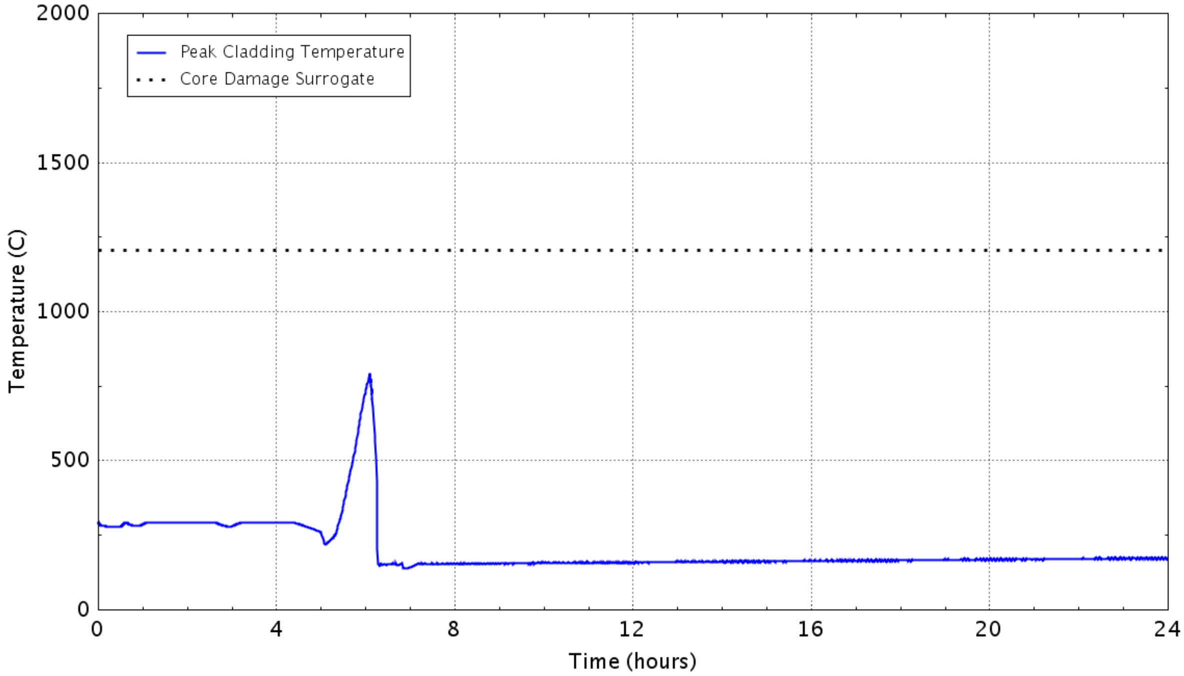

Figure D – 216 Peak temperature of the fuel cladding as a function oftime

D.2.3 Case 19: LOMFW-25, RCIC Loss at 4 hrs., Emergency Depressurization at HCL Curve, FLEX injection at 5hrs.

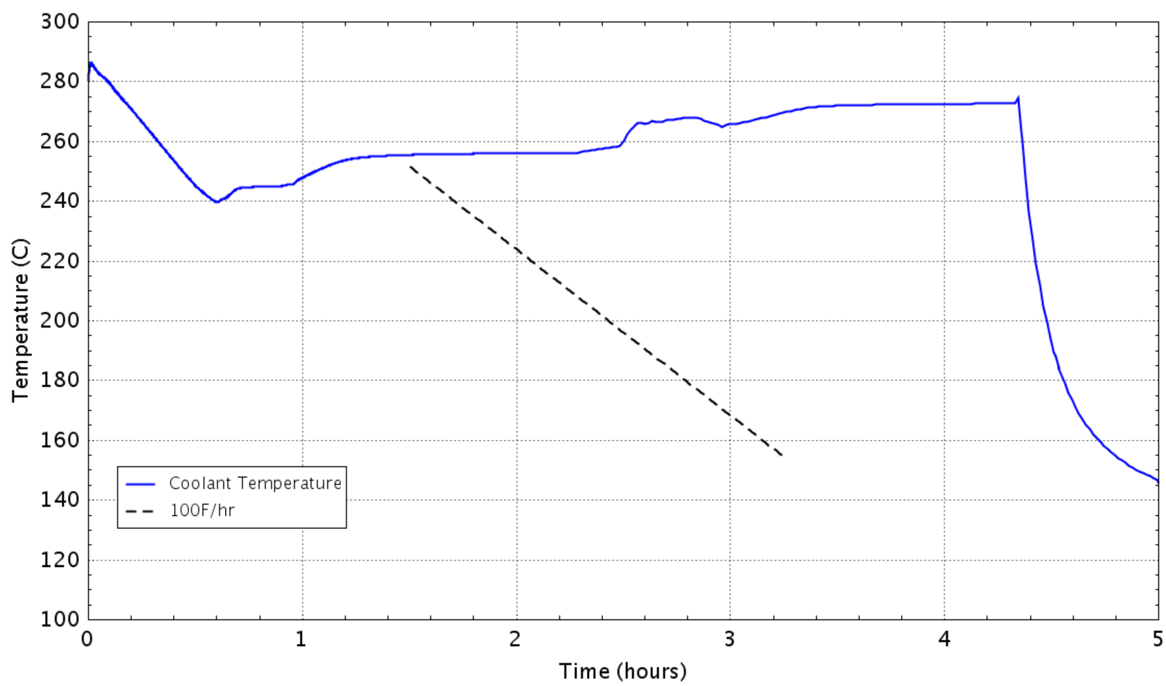

Figure D - 217 RPV cooldown rate

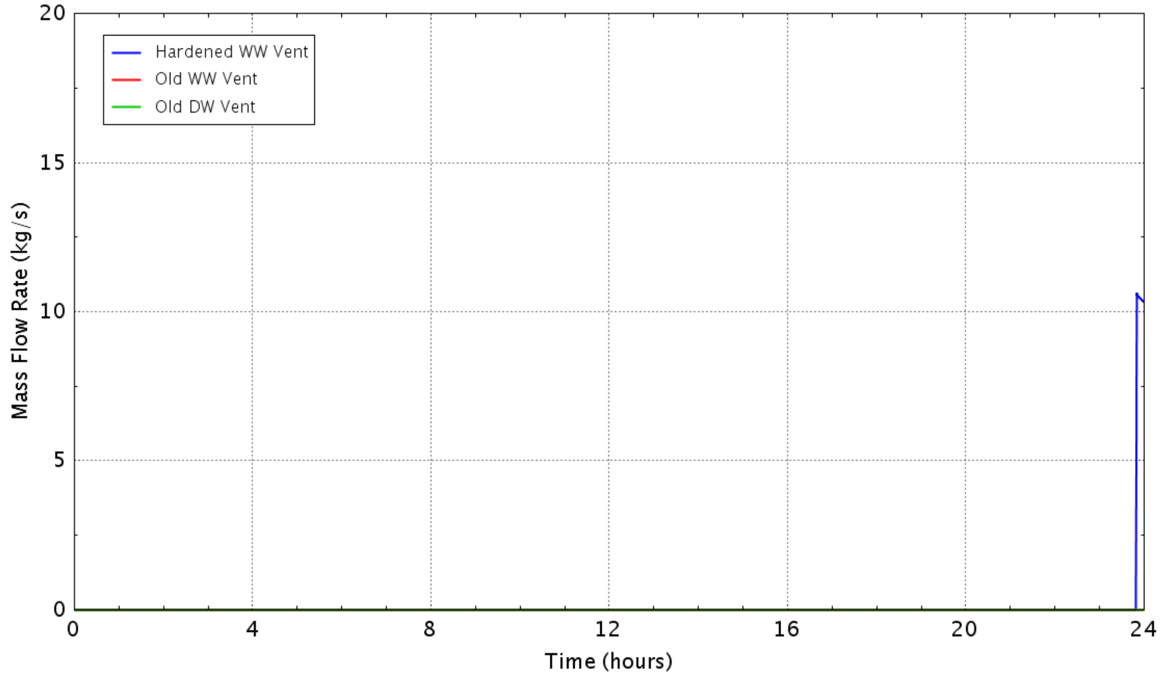

Figure D - 218 Flow rate of the containment vents

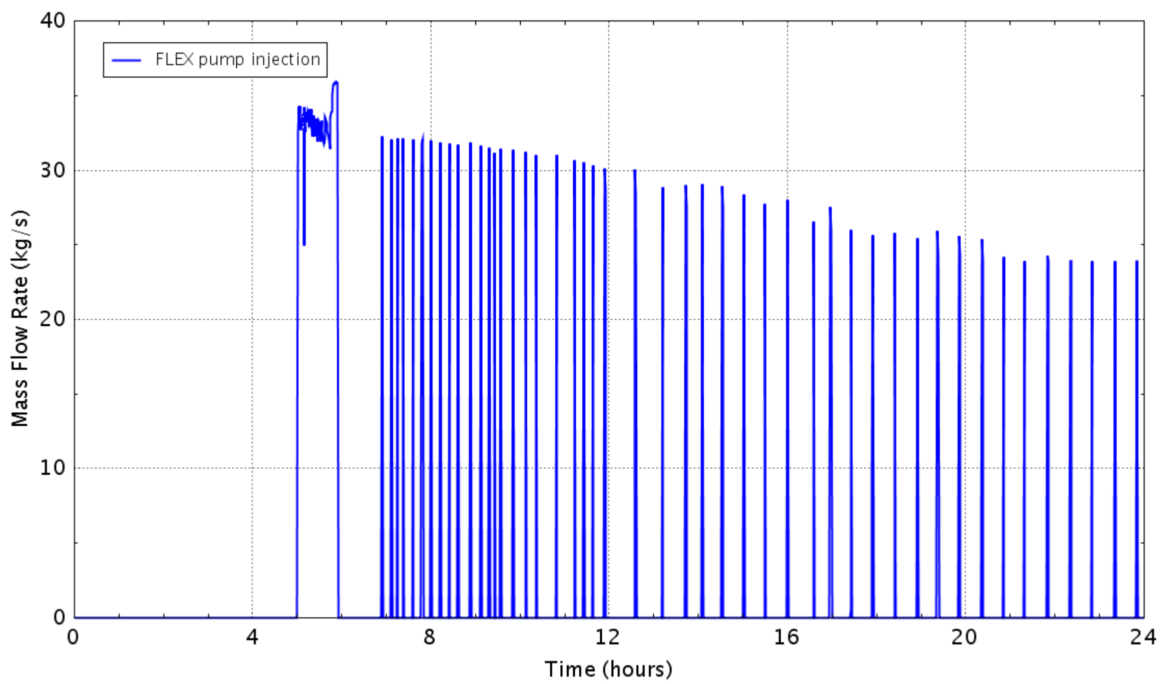

Figure D - 219 Flow rate of the FLEX pump

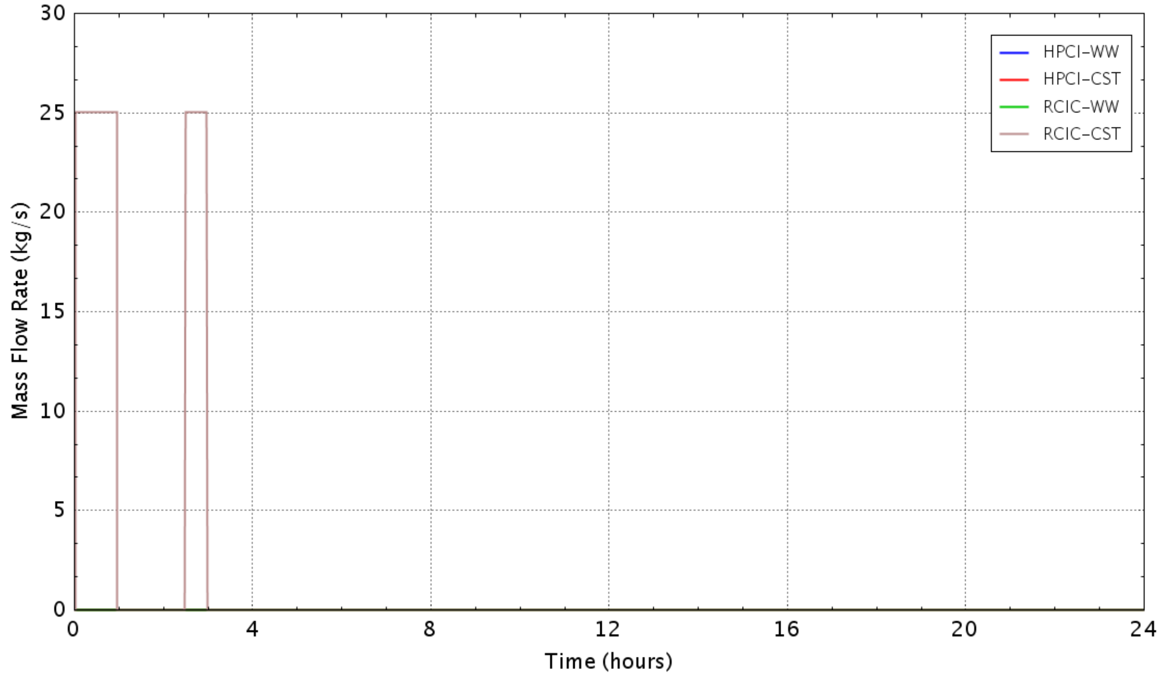

Figure D - 220 **Flow rate of the HPCI/RCIC pumps**

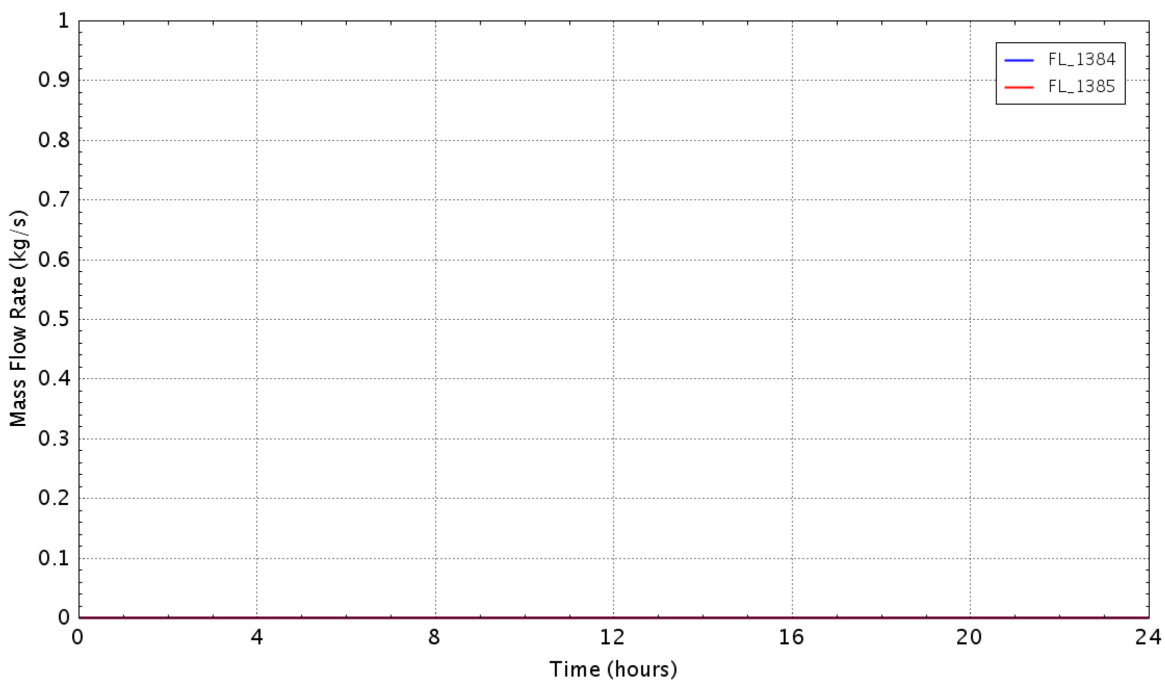

Figure D - 221 **Flow rate of the recirculating pump seal leakage**

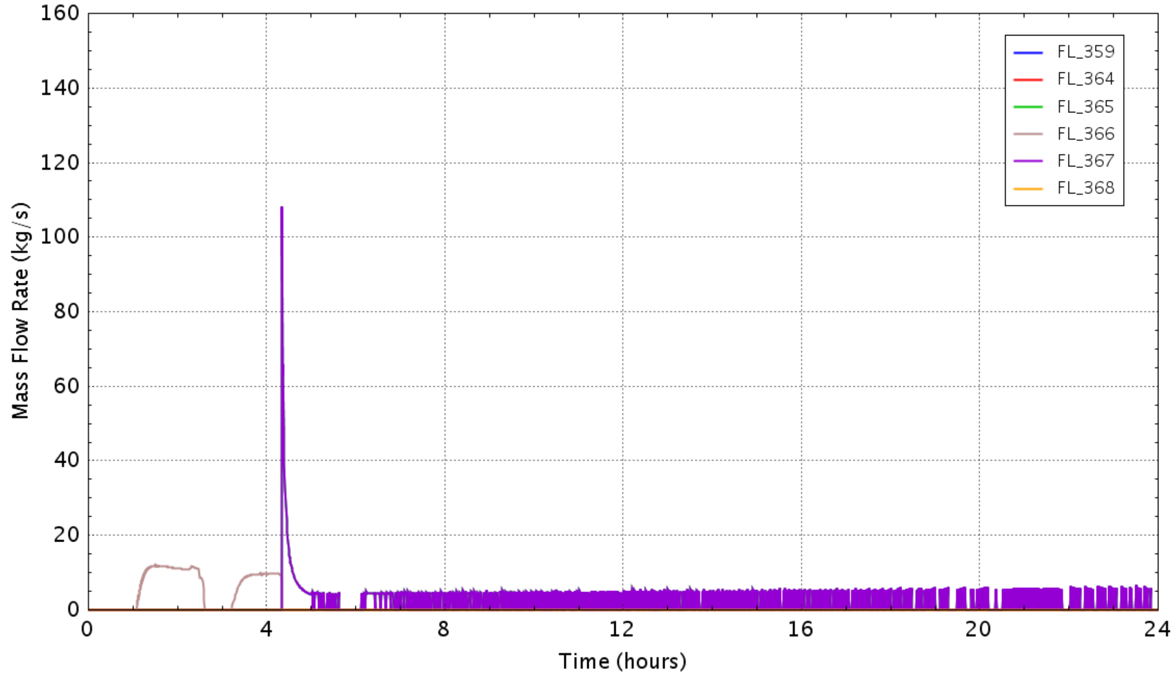

Figure D - 222 **Flow rate of the SRVs**

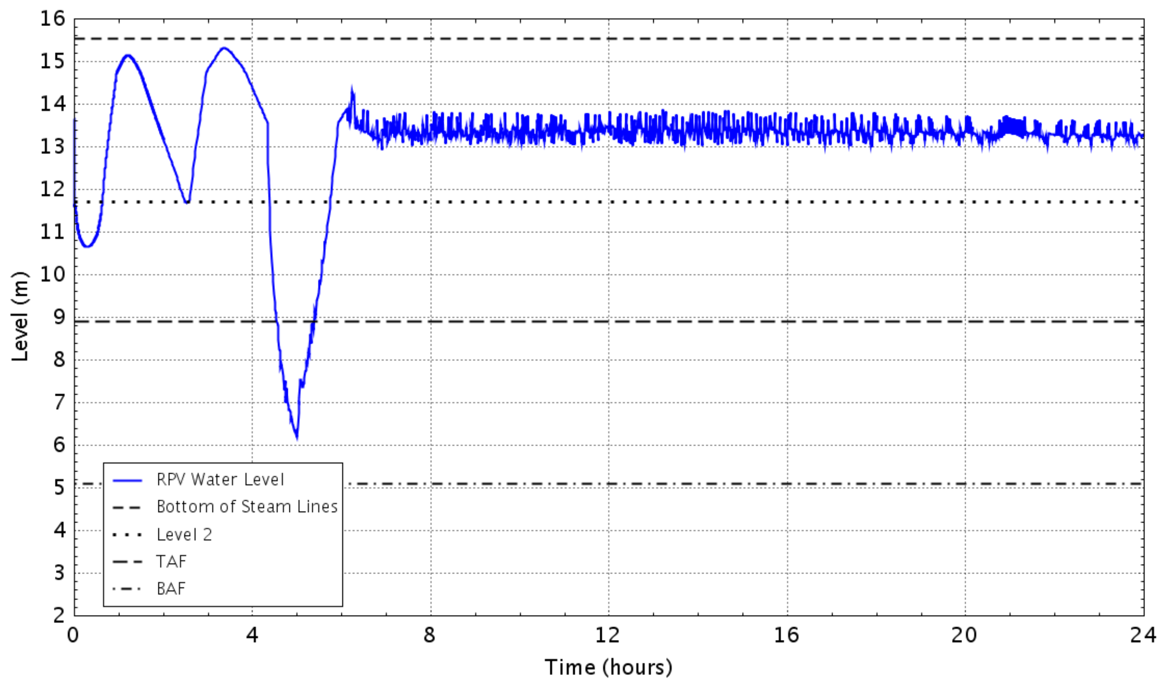

Figure D - 223 **RPV down comer water level**

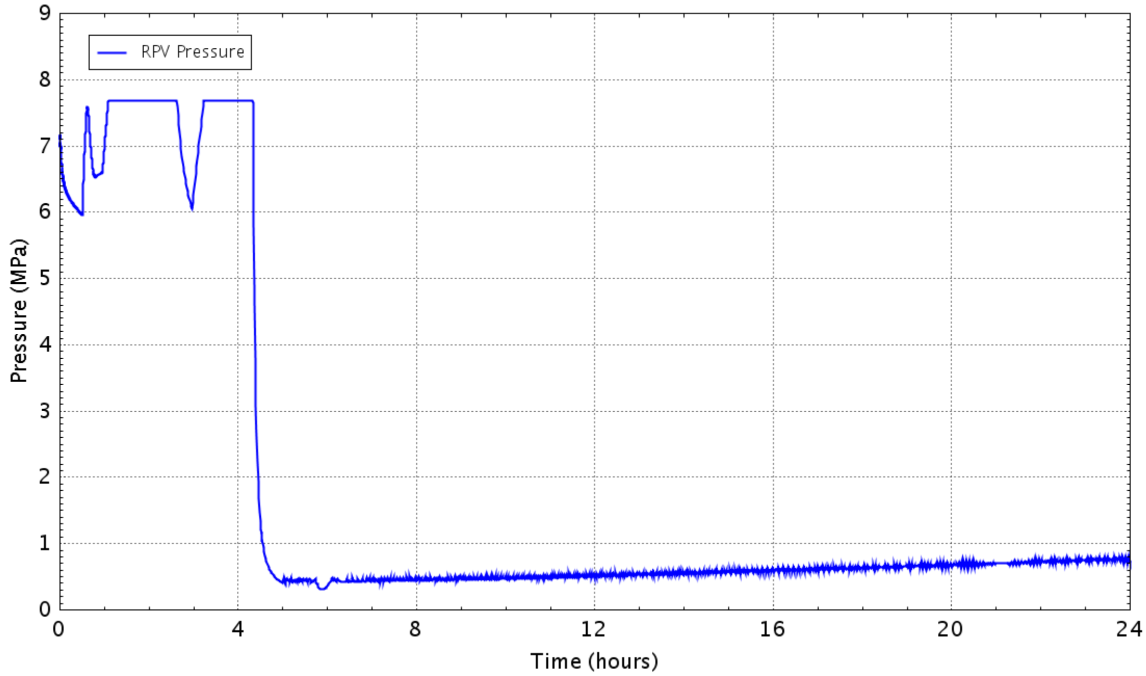

Figure D - 224 Pressure in theRPV

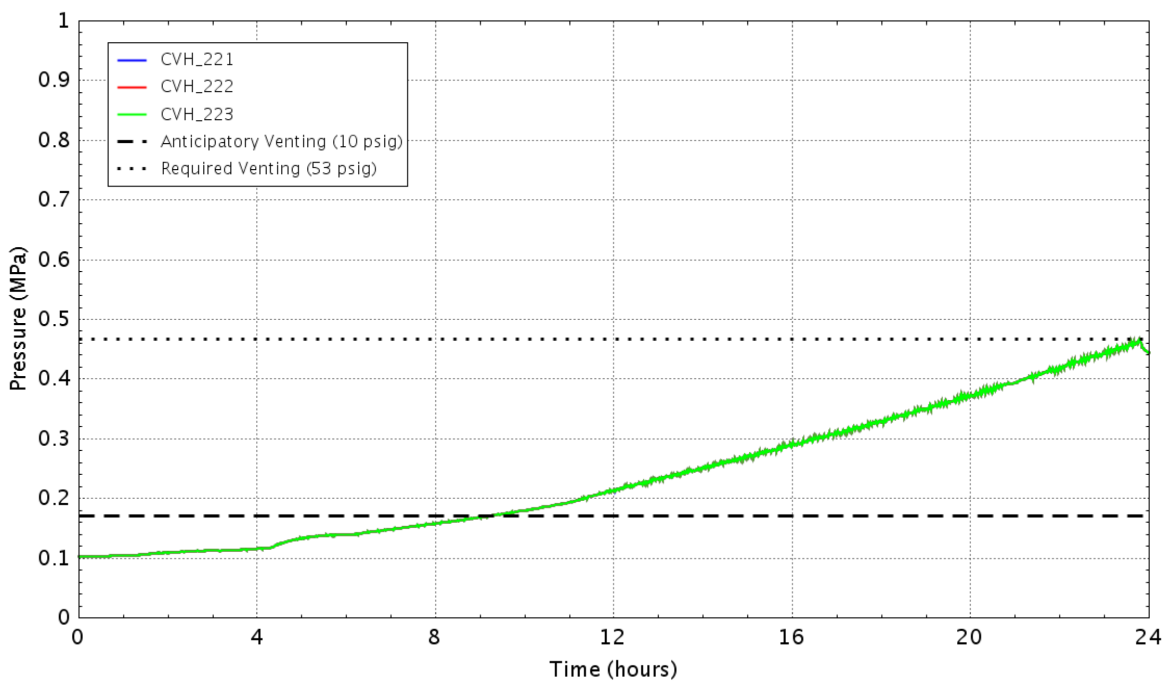

Figure D - 225 Pressure in the wetwell

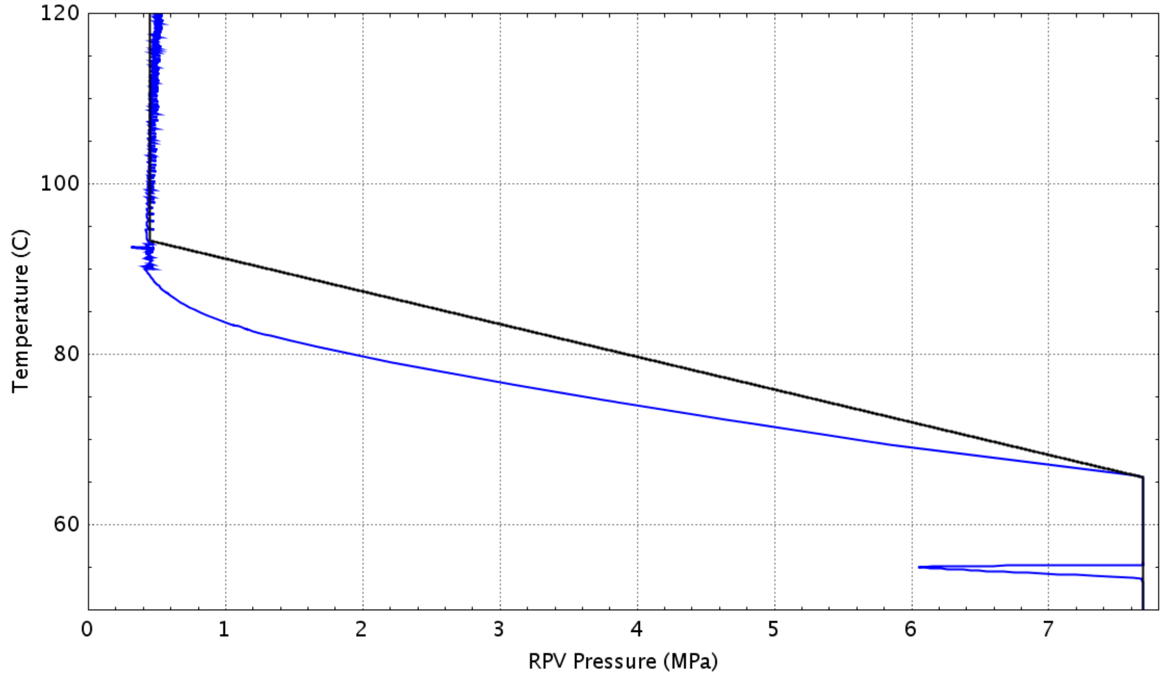

Figure D – 226 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

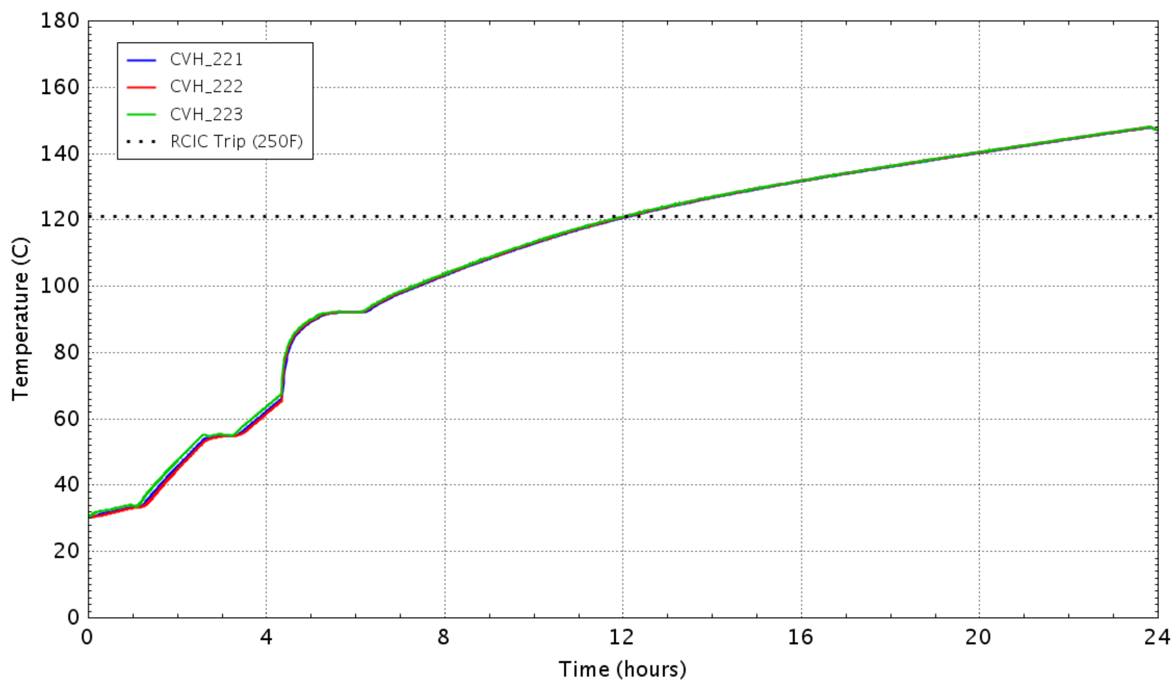

Figure D - 227 **Water temperature in the wetwell**

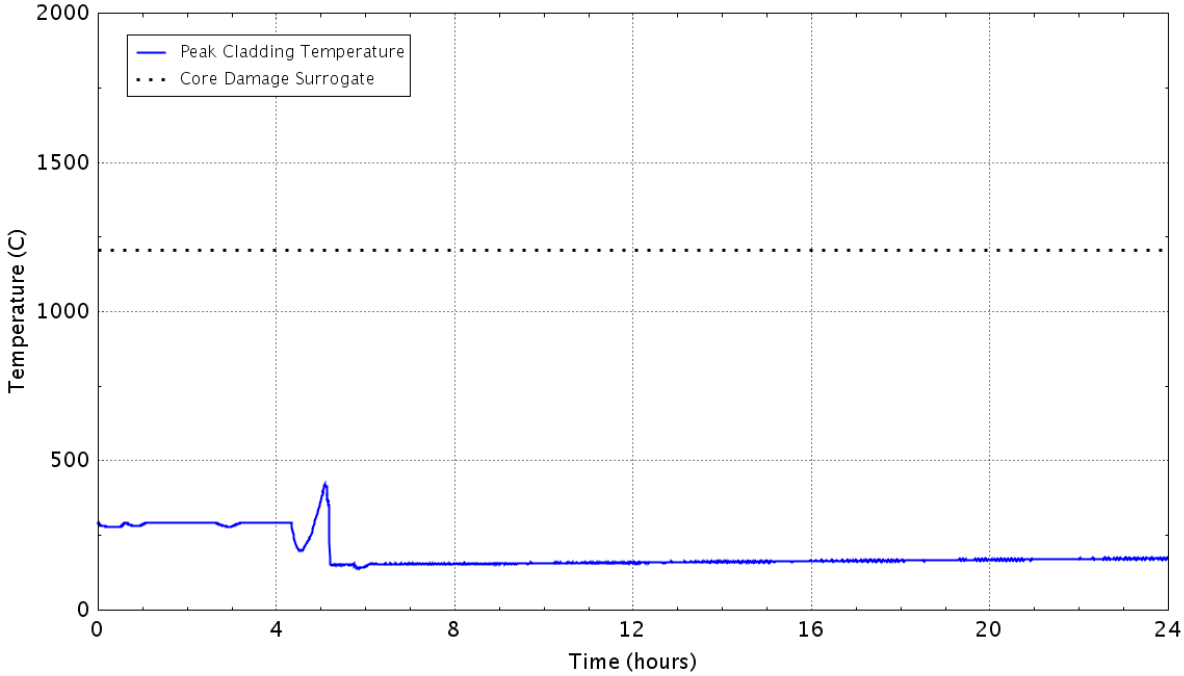

Figure D – 228 Peak temperature of the fuel cladding as a function oftime

D.2.4 Case 20: LOMFW-25, RCIC Loss at 4 hrs., Emergency Depressurization at HCL Curve, FLEX injection at 5 hrs. at -25% flow rate

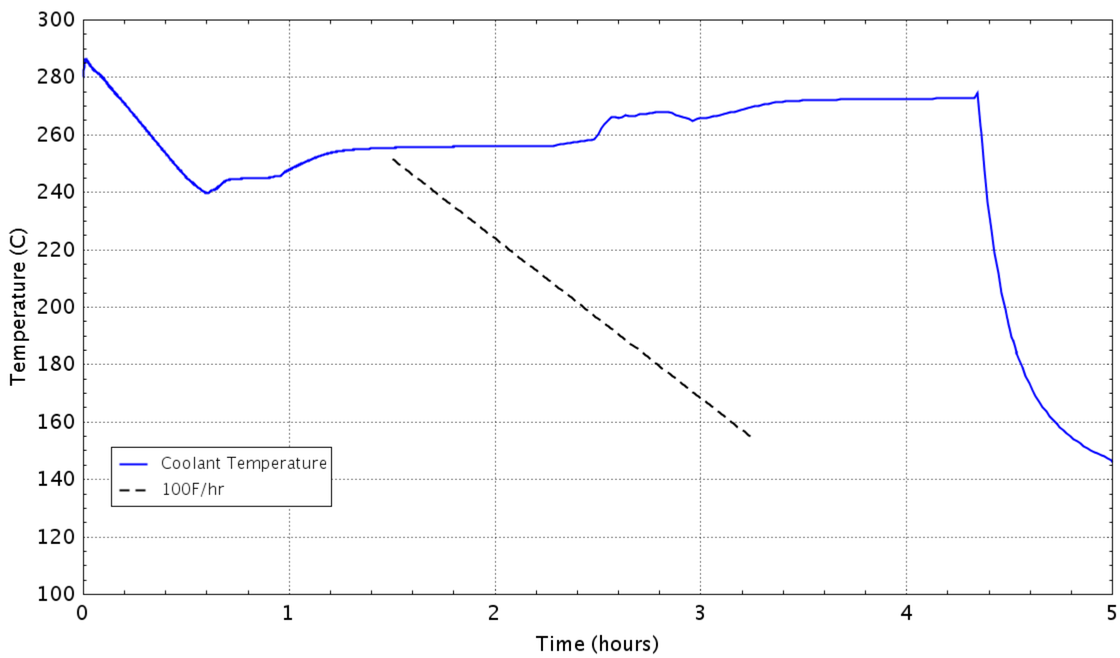

Figure D – 229 RPV cooldown rate

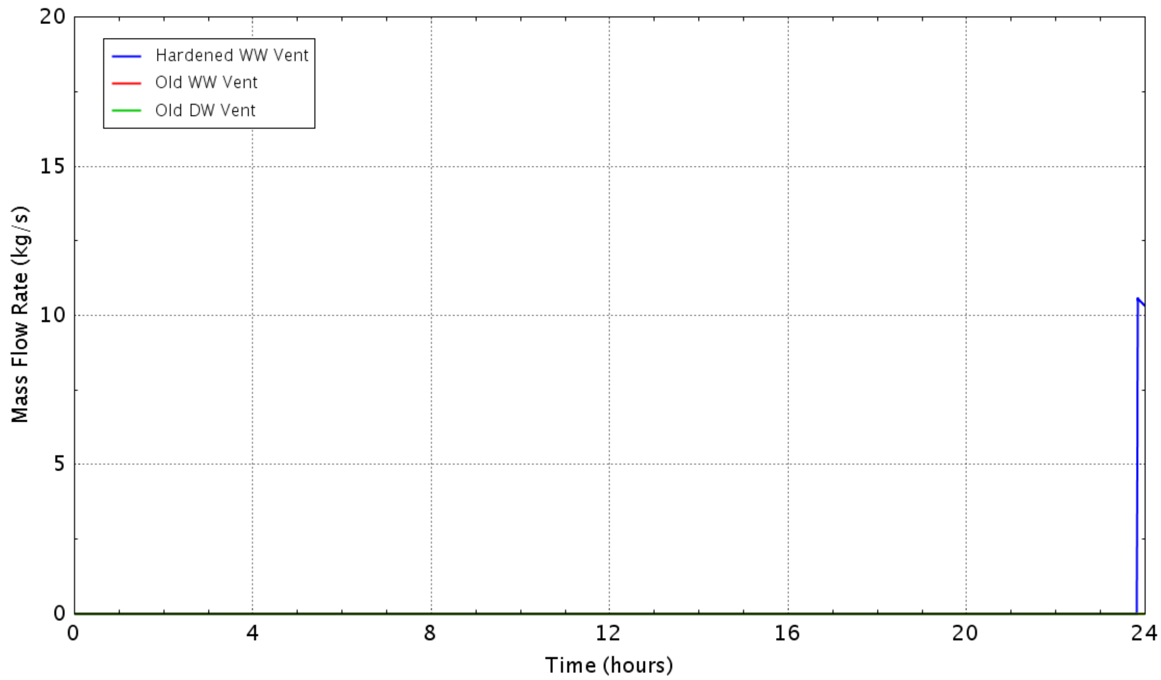

Figure D - 230 **Flow rate of the containment vents**

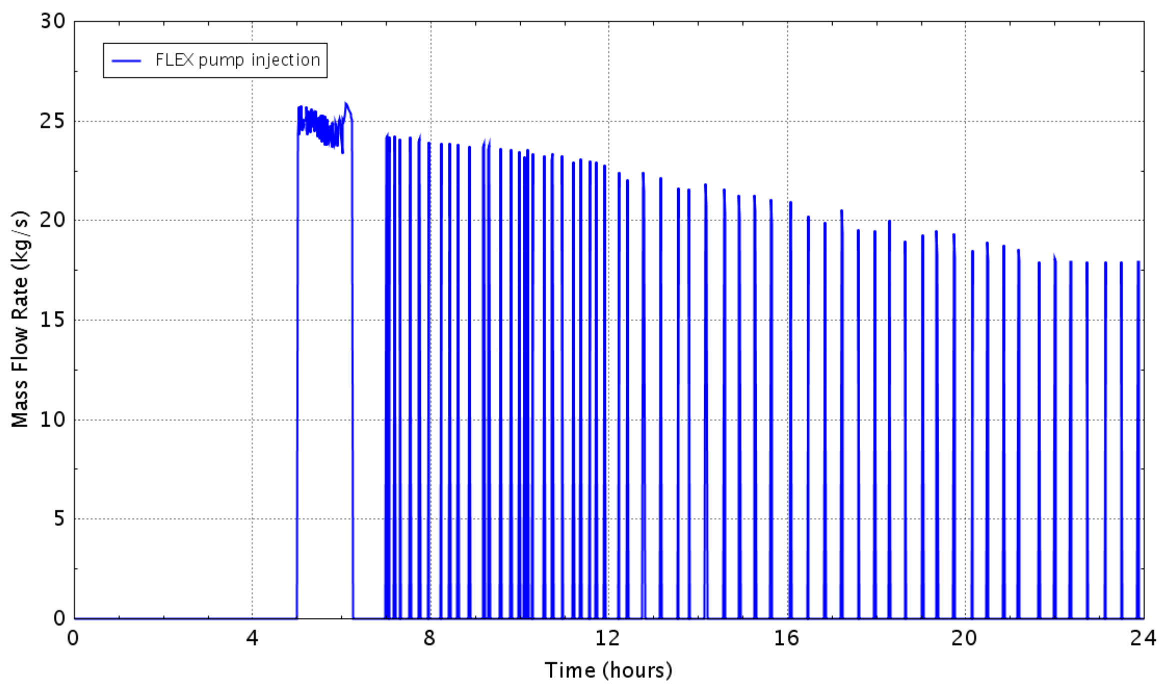

Figure D - 231 **Flow rate of the FLEX pump**

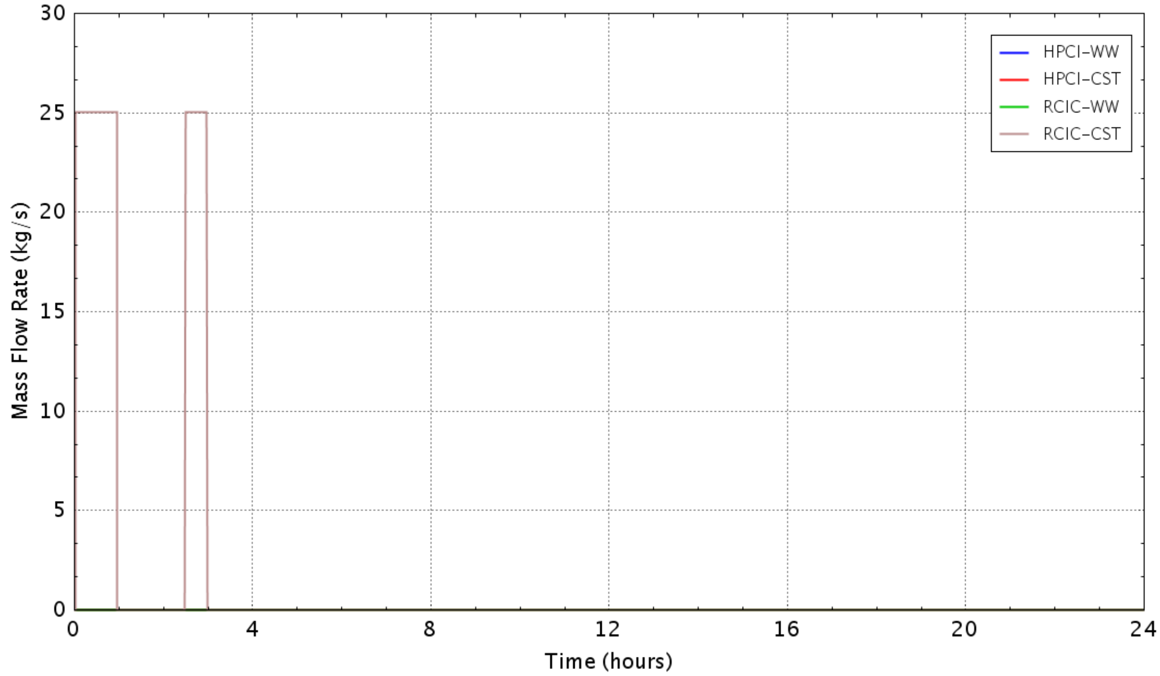

Figure D - 232 **Flow rate of the HPCI/RCIC pumps**

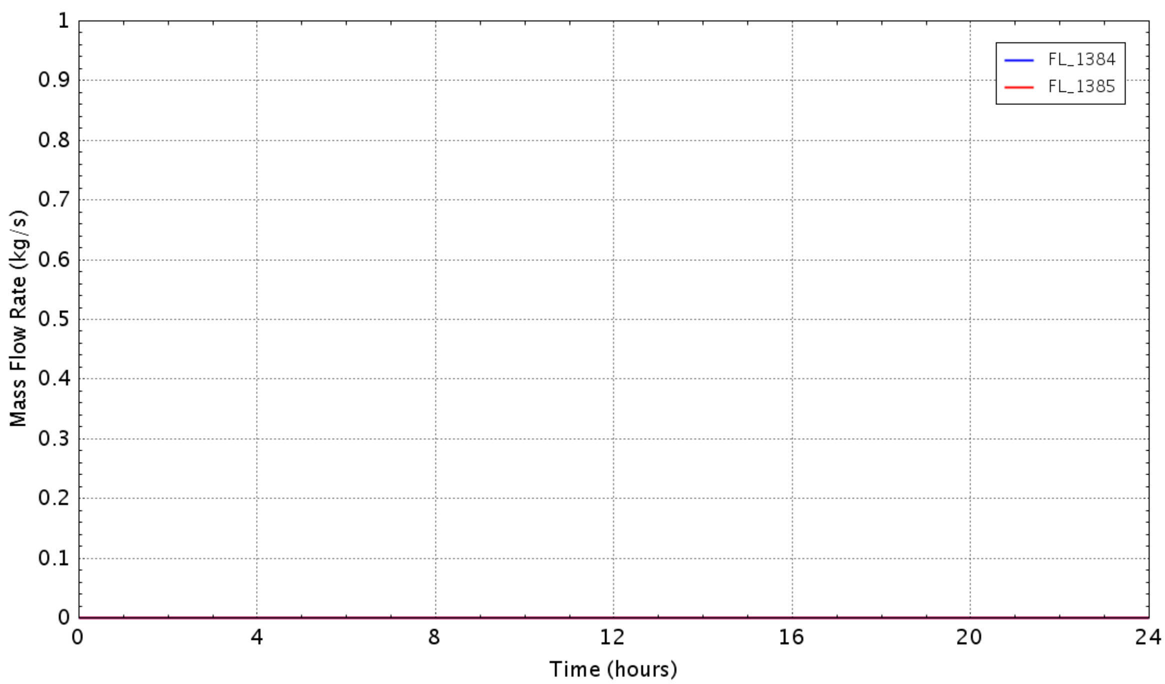

Figure D - 233 **Flow rate of the recirculating pump seal leakage**

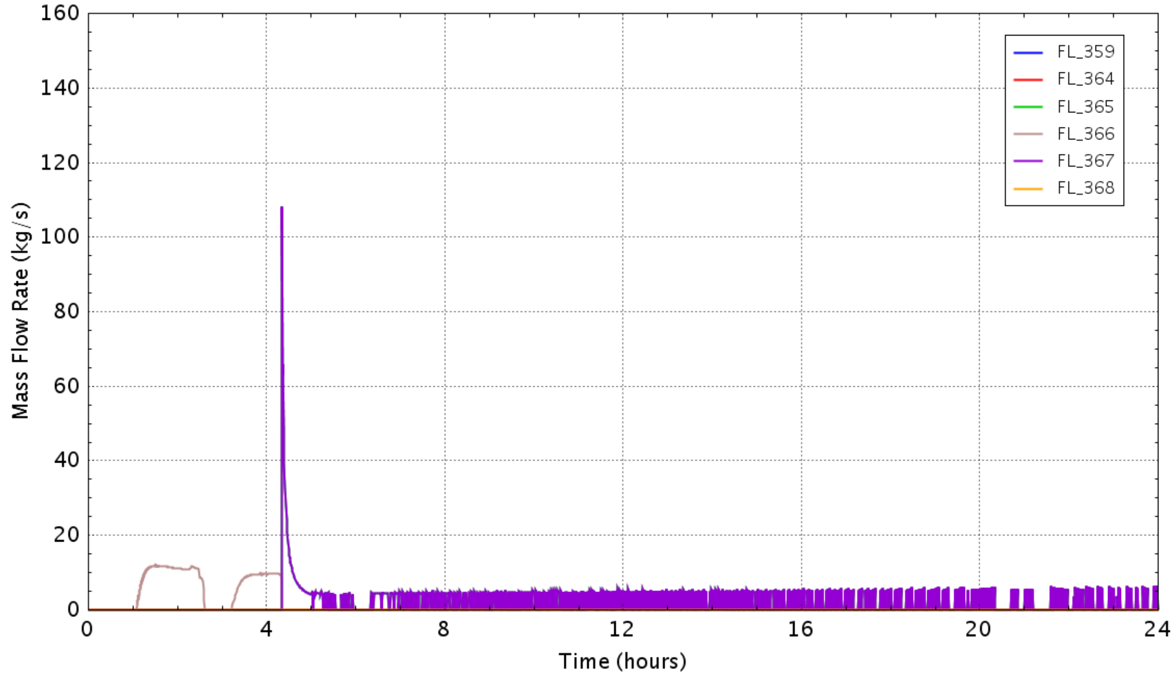

Figure D - 234 Flow rate of the SRVs

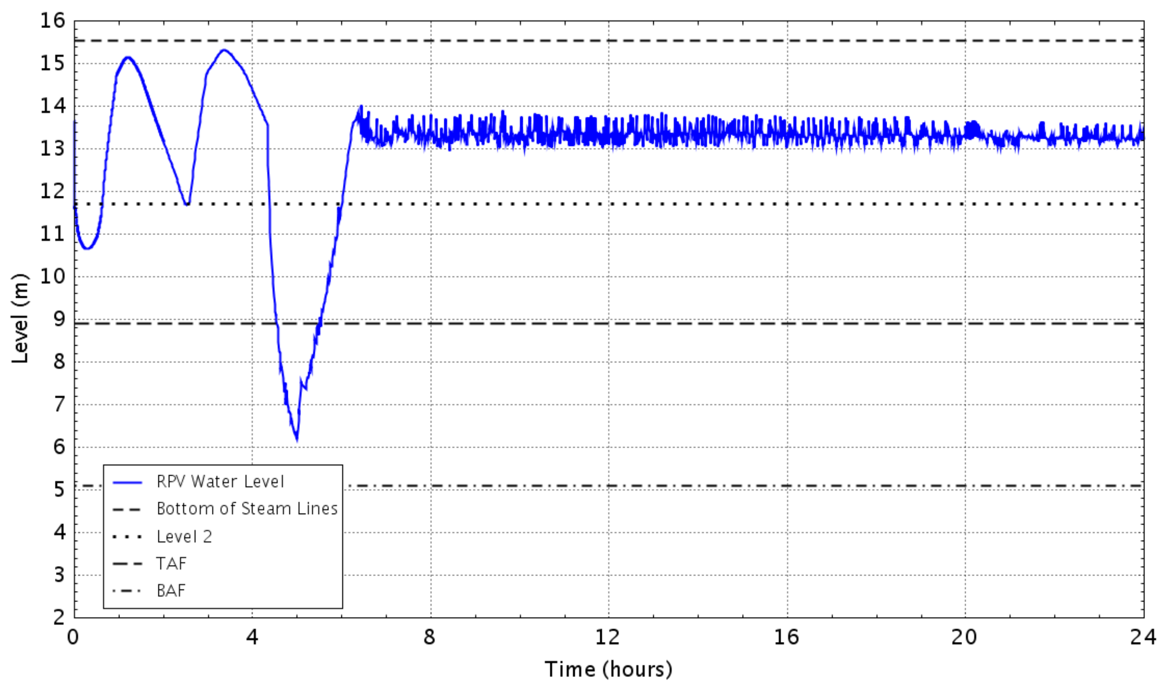

Figure D - 235 RPV down comer water level

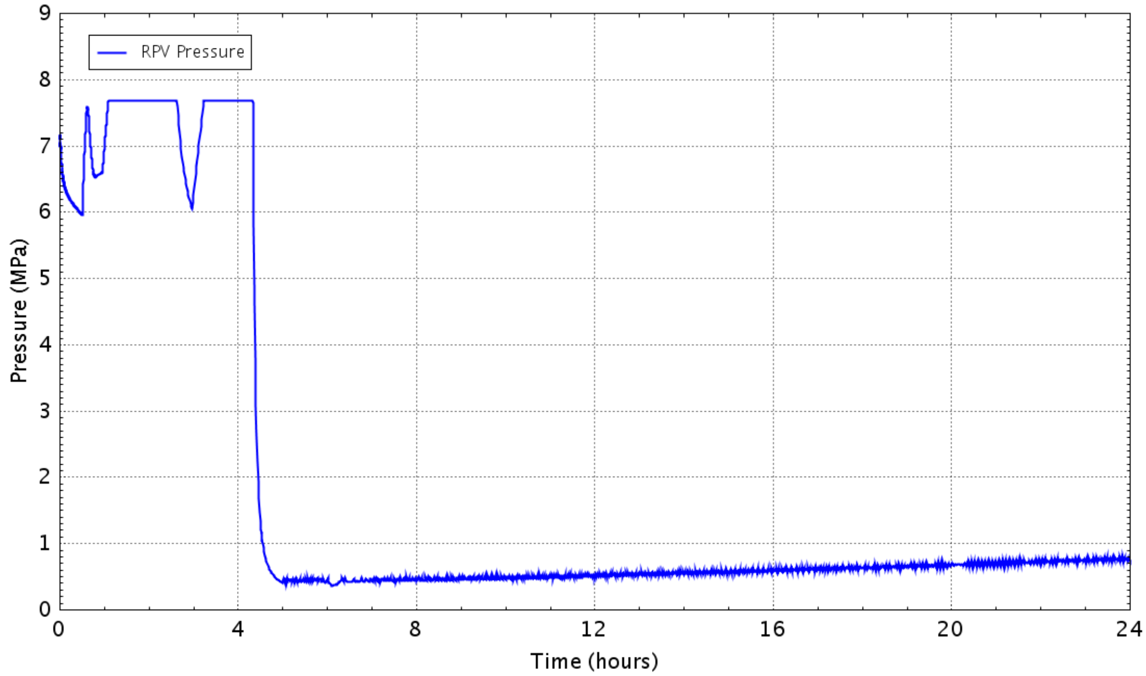

Figure D - 236 Pressure in theRPV

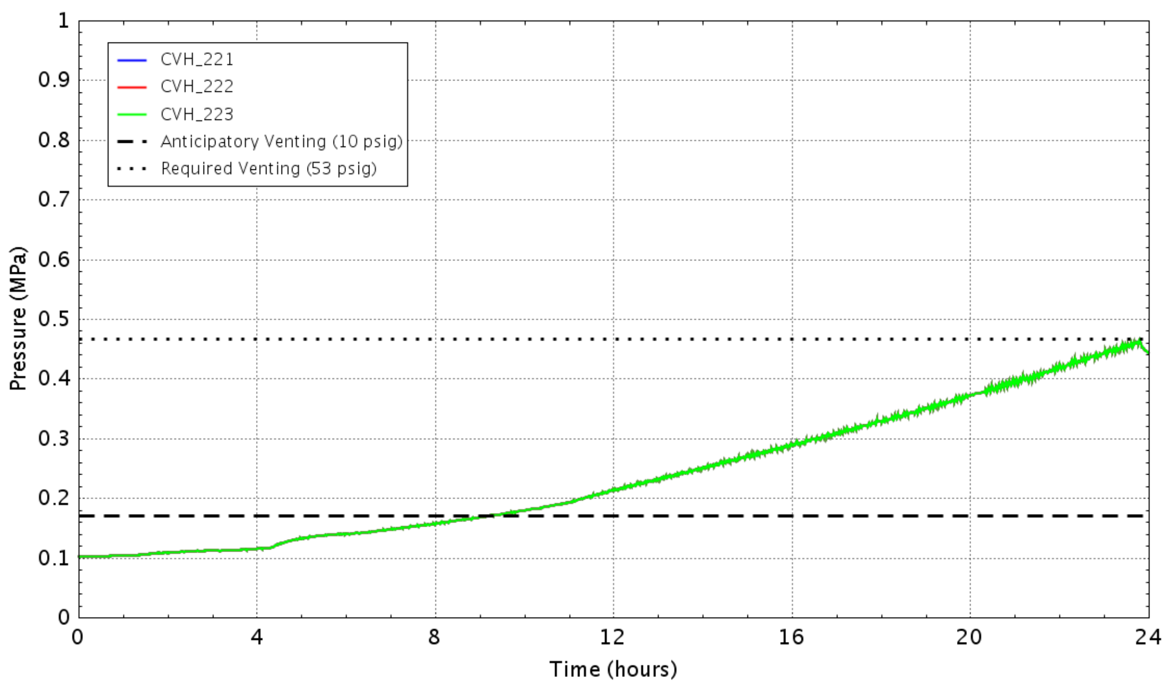

Figure D - 237 Pressure in the wetwell

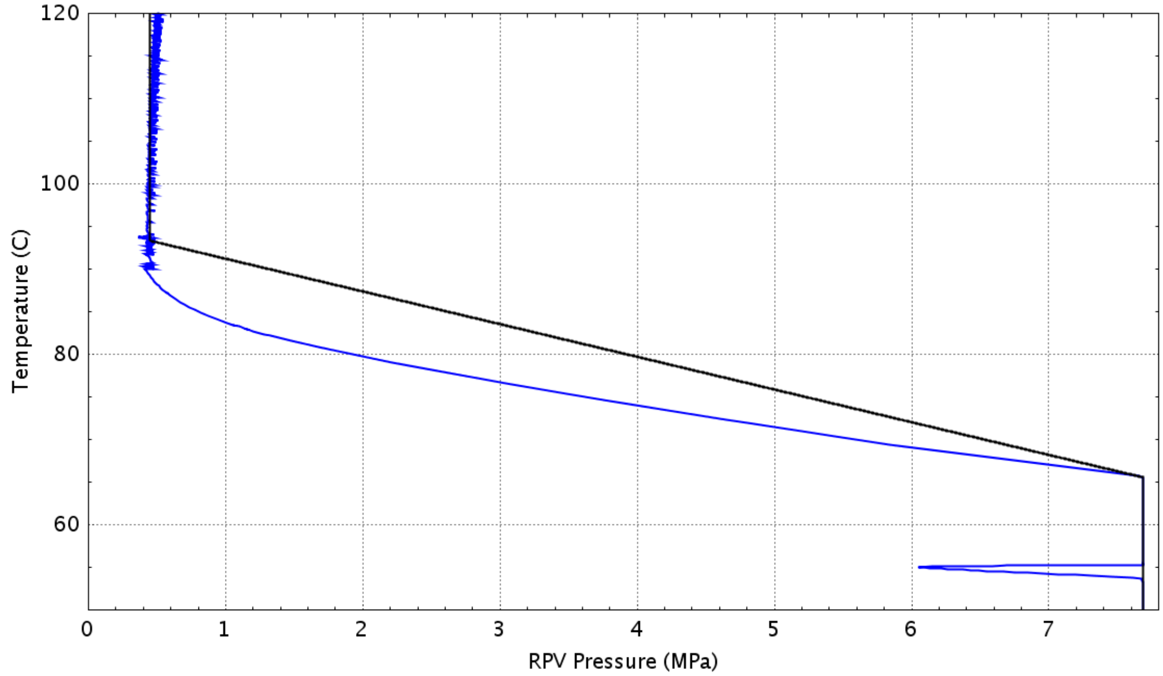

Figure D – 238 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

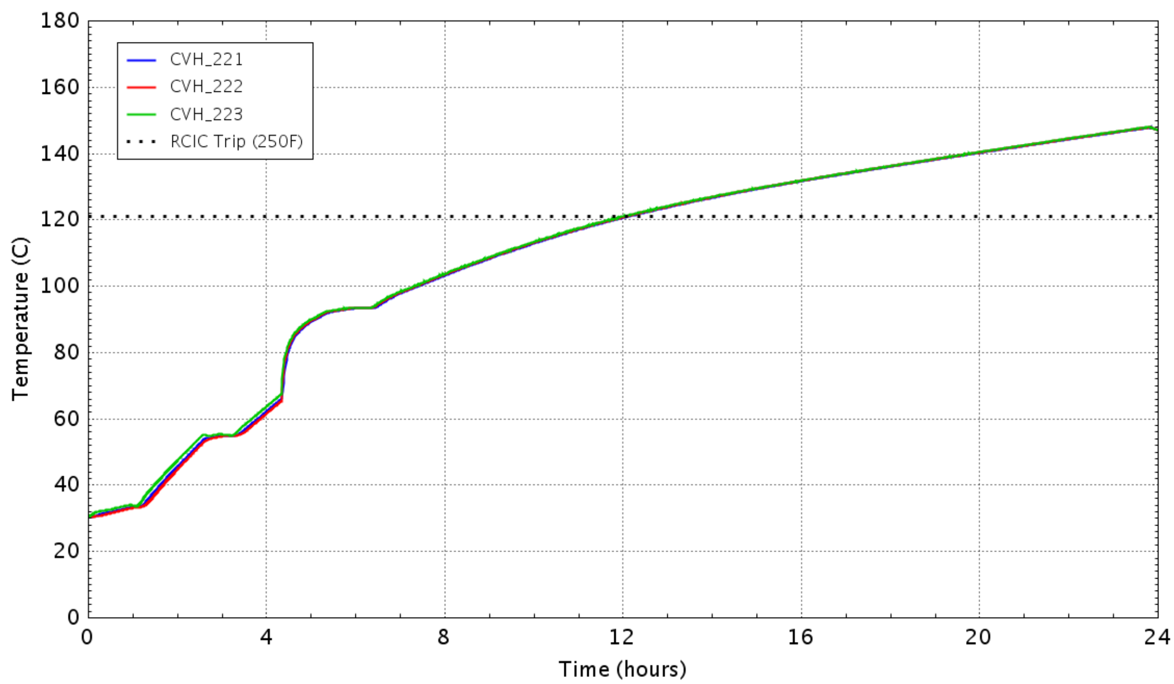

Figure D – 239 **Water temperature in the wetwell**

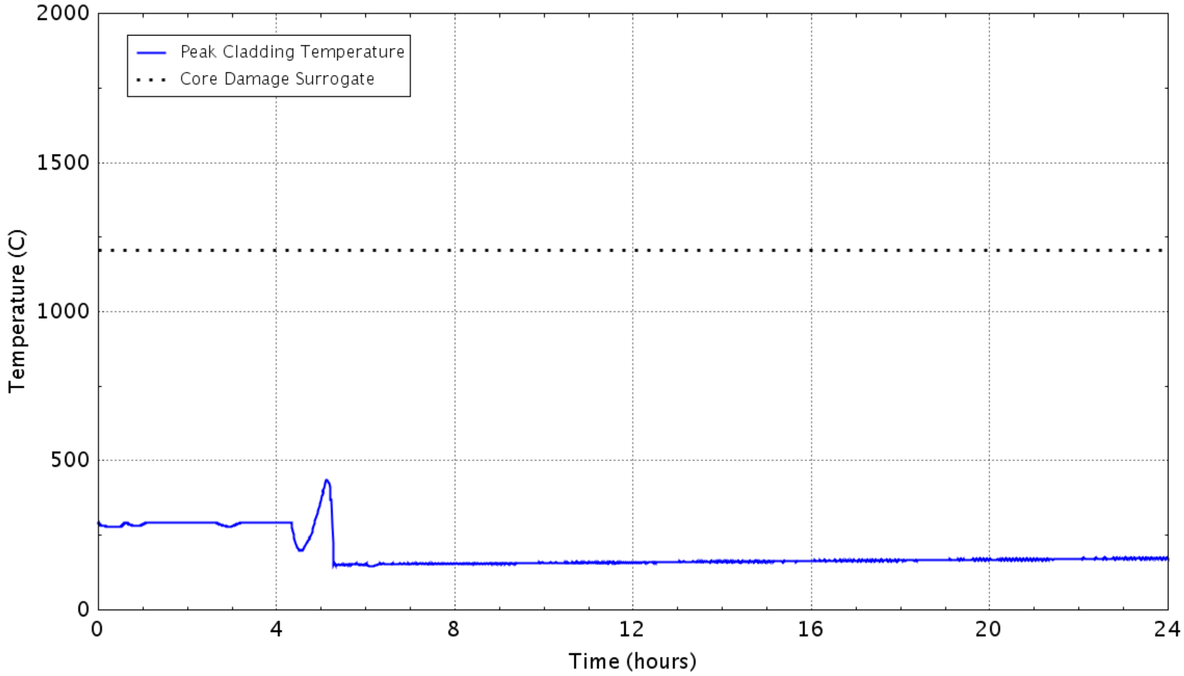

Figure D – 240 Peak temperature of the fuel cladding as a function oftime

D.2.5 Case 21: LOMFW-25, RCIC Loss at 4 hrs., Emergency Depressurization at HCL Curve, FLEX injection at 6hrs.

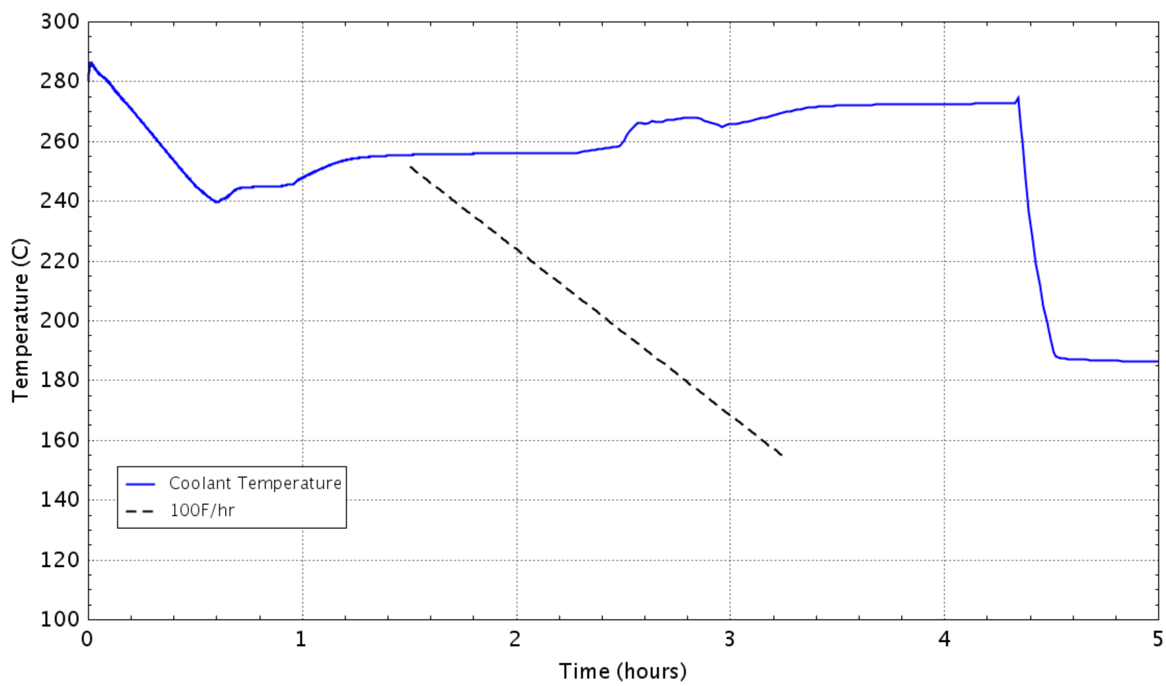

Figure D - 241 RPV cooldown rate

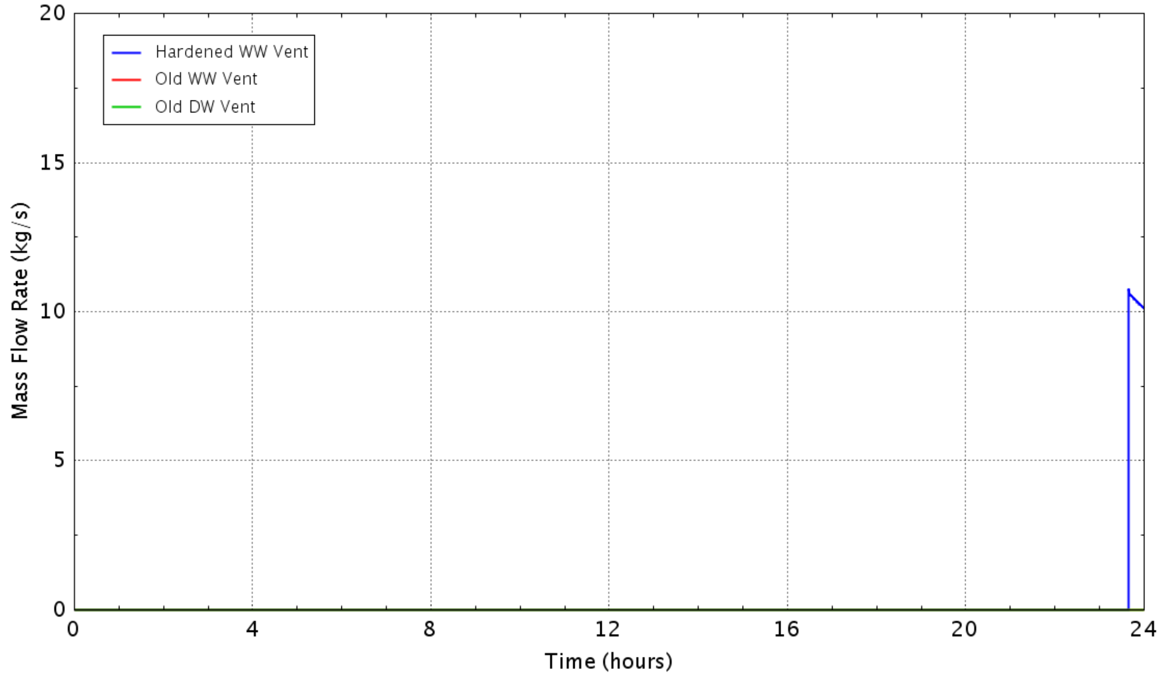

Figure D - 242 **Flow rate of the containment vents**

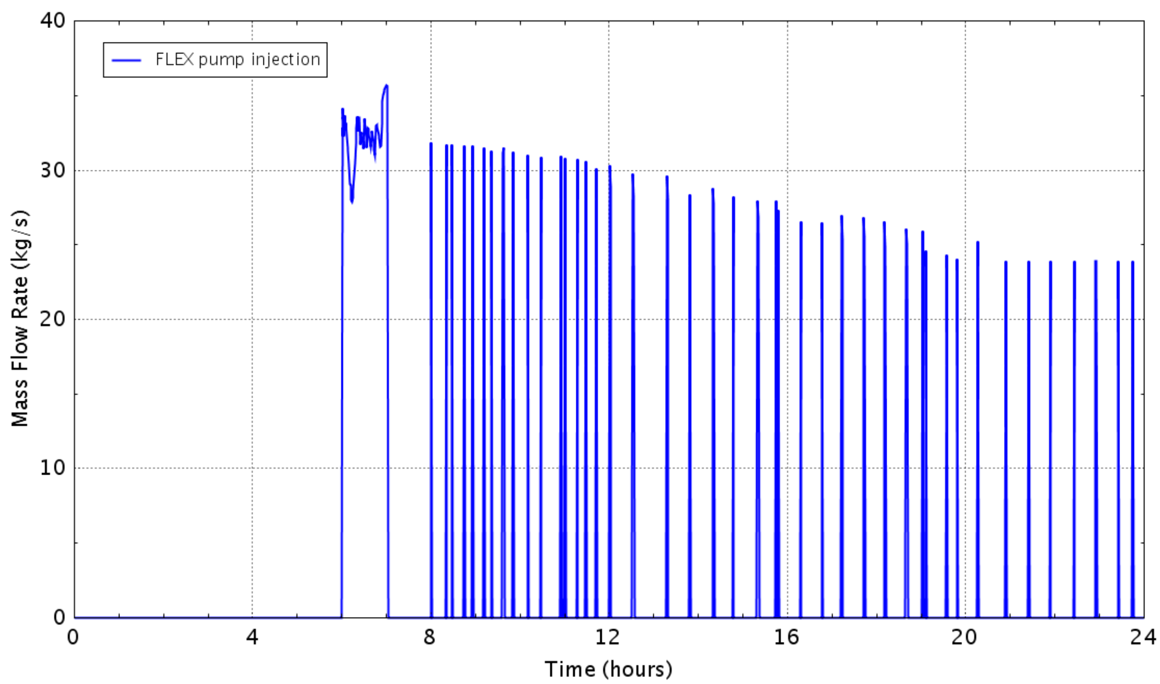

Figure D - 243 **Flow rate of the FLEX pump**

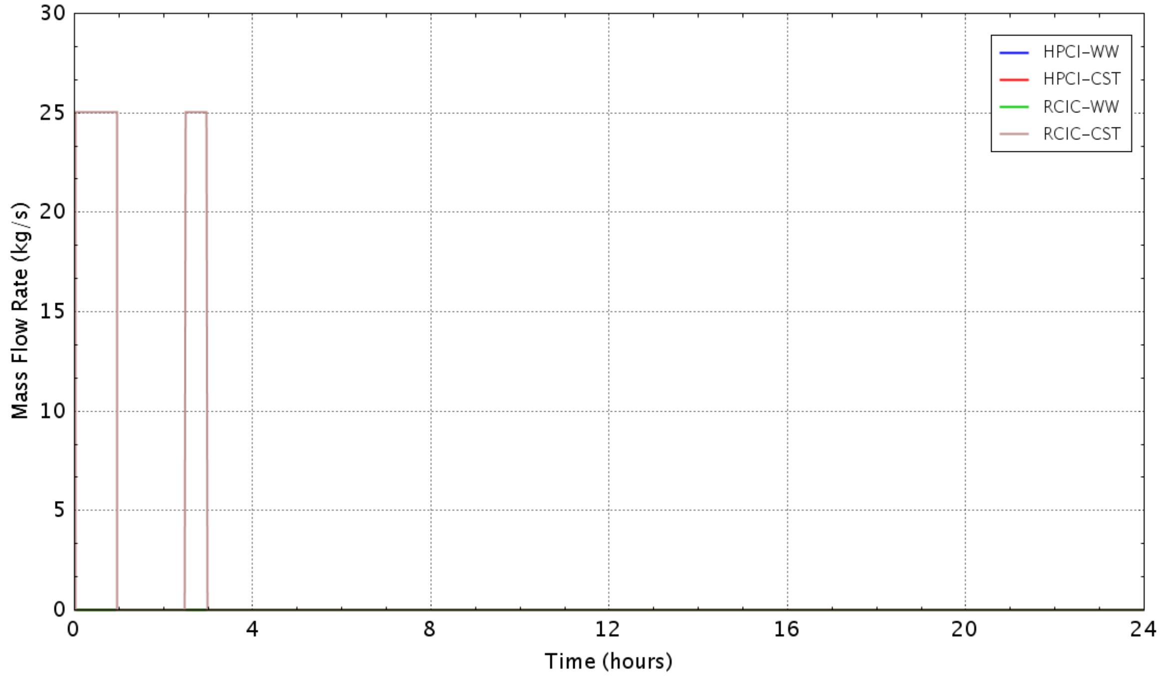

Figure D - 244 **Flow rate of the HPCI/RCIC pumps**

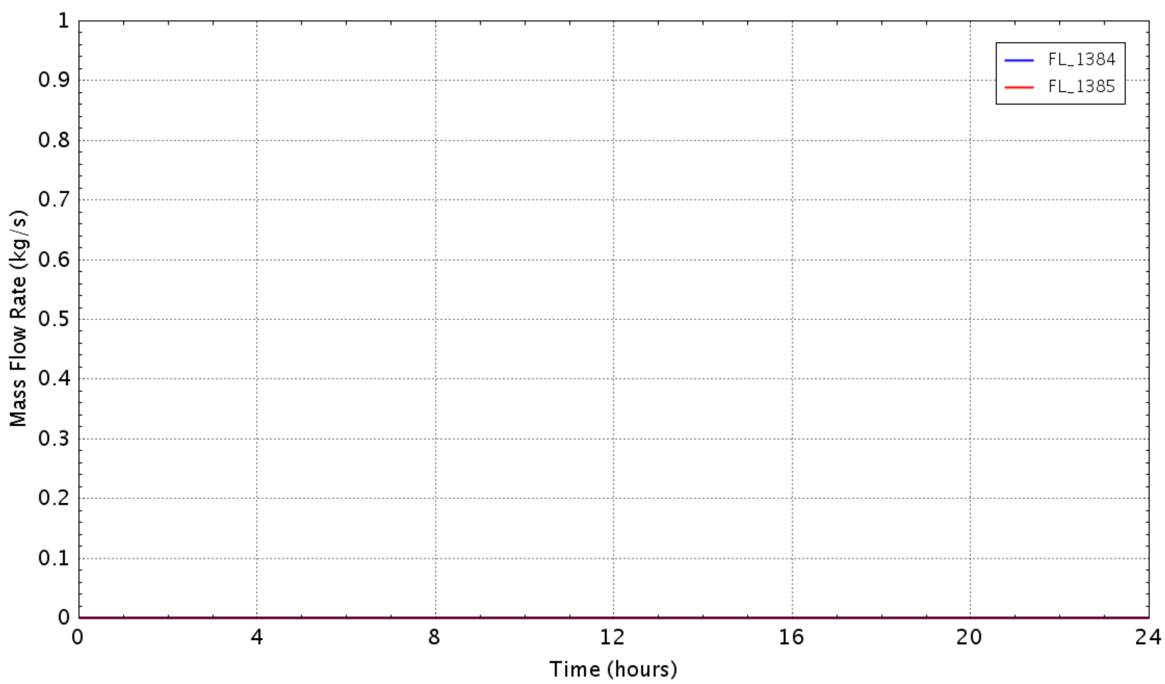

Figure D - 245 **Flow rate of the recirculating pump seal leakage**

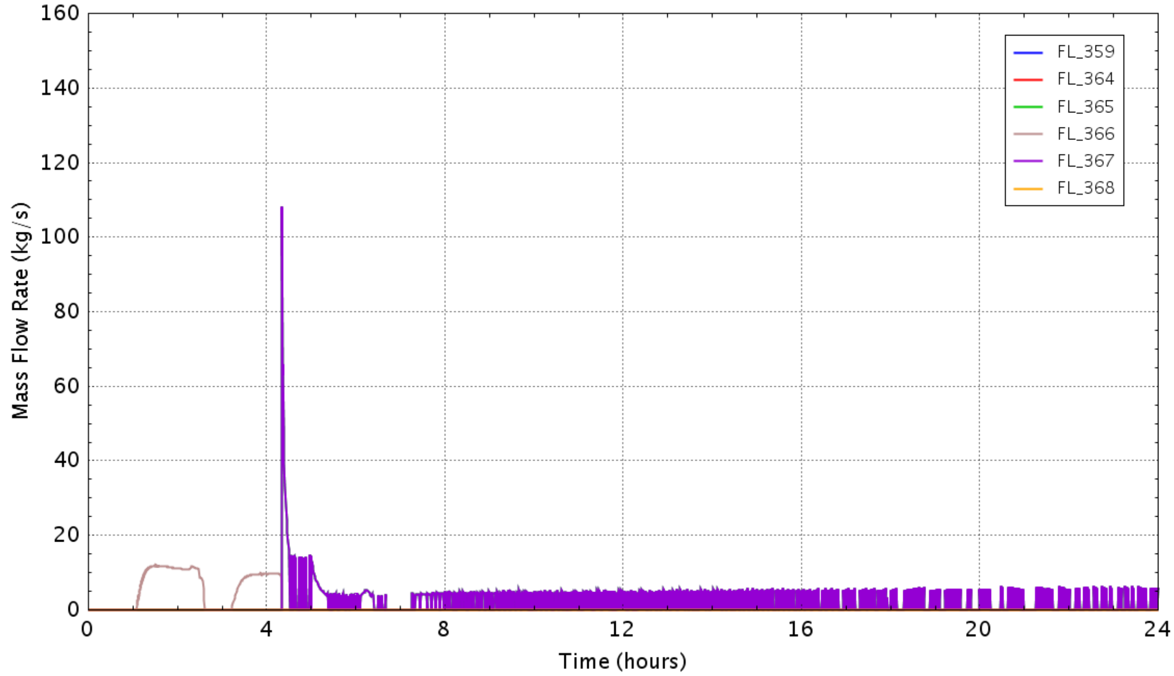

Figure D - 246 Flow rate of the SRVs

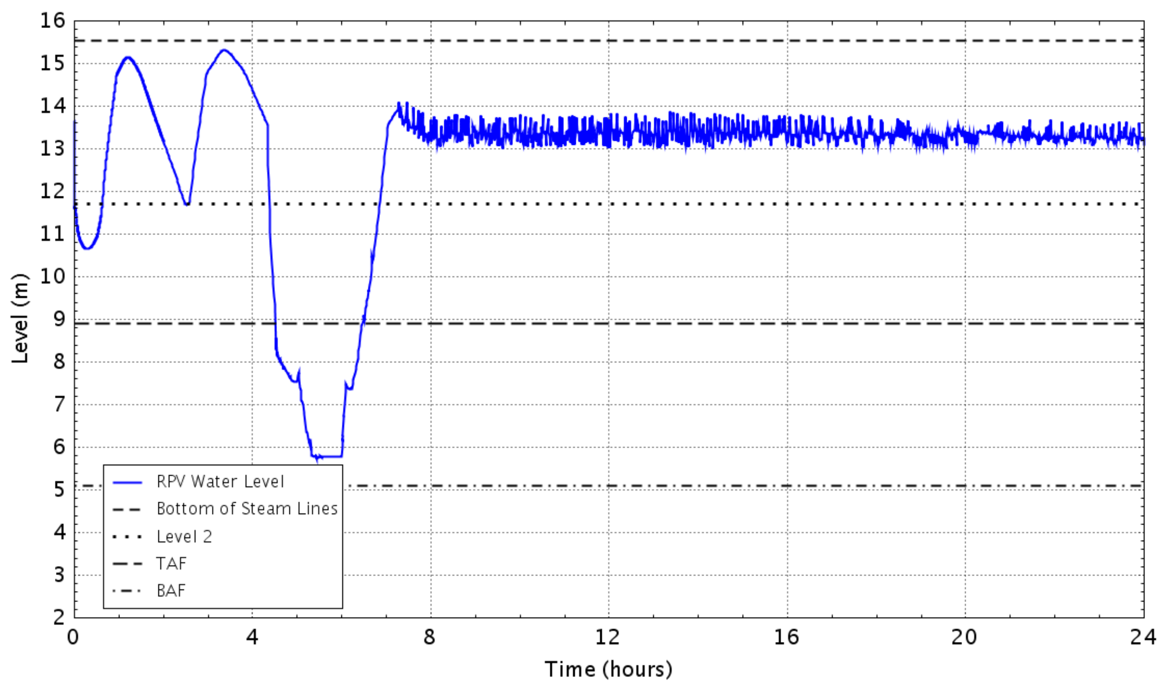

Figure D - 247 RPV down comer water level

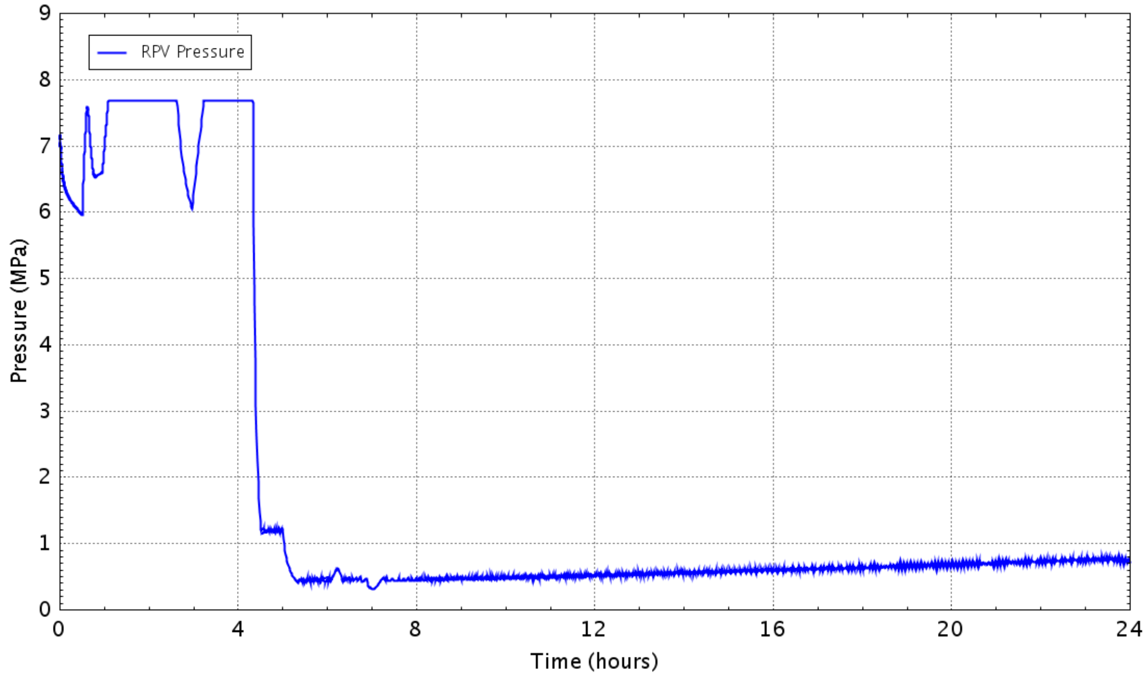

Figure D - 248 **Pressure in theRPV**

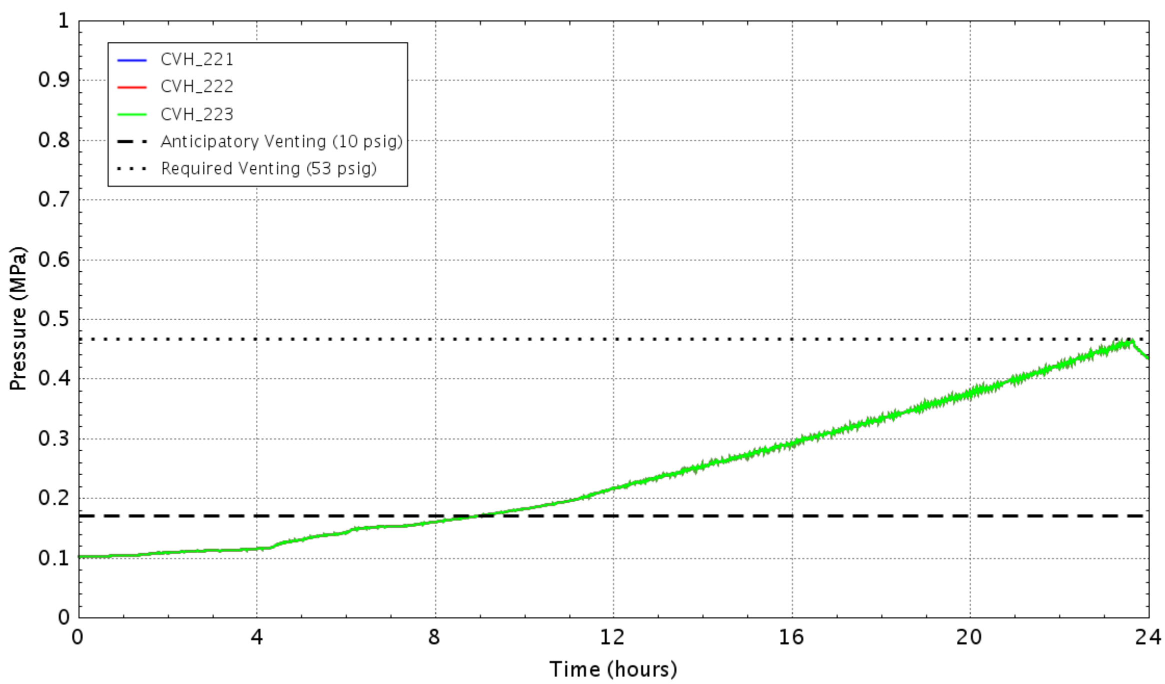

Figure D - 249 **Pressure in the wetwell**

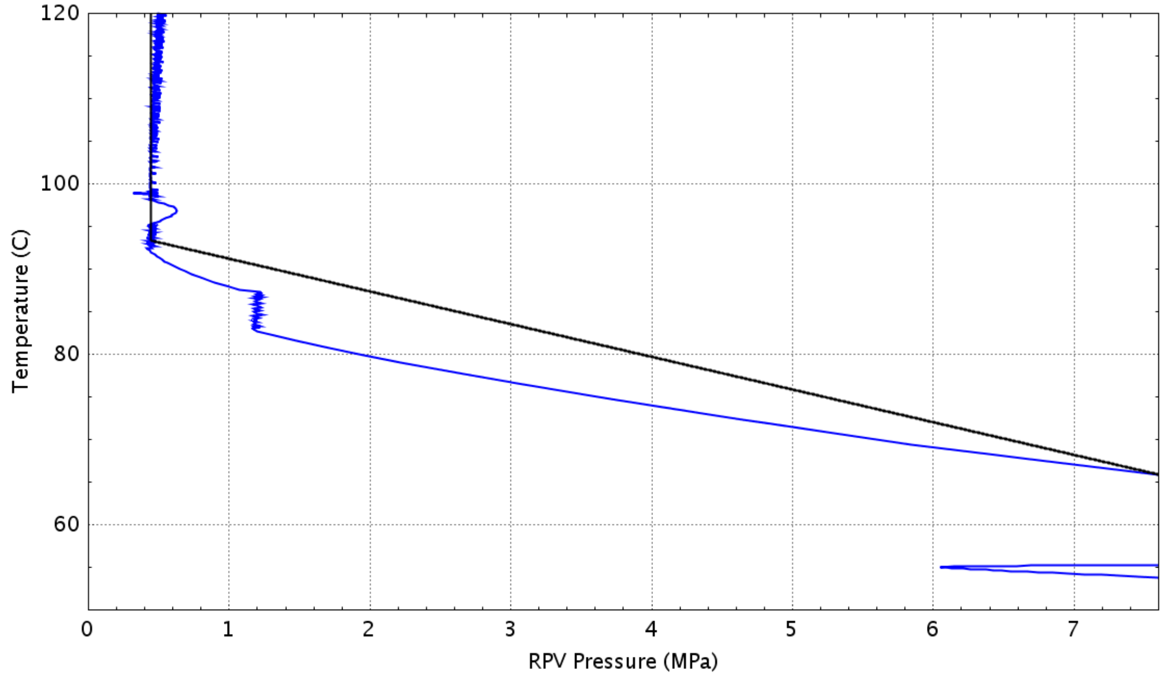

Figure D - 250 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

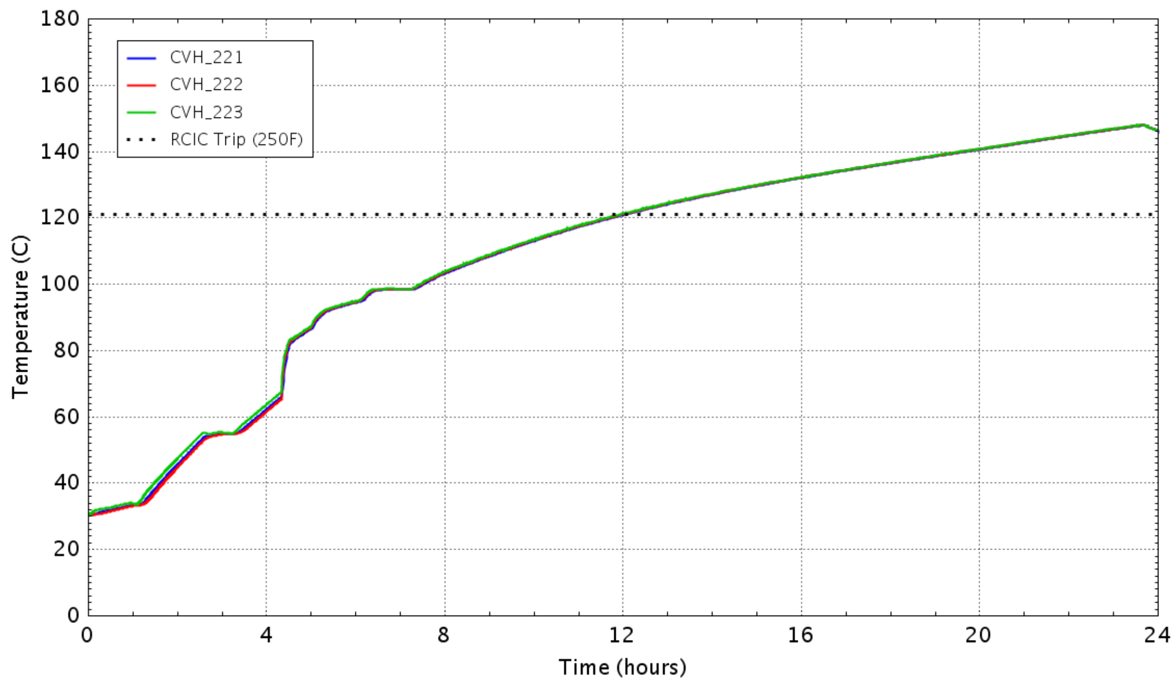

Figure D - 251 **Water temperature in the wetwell**

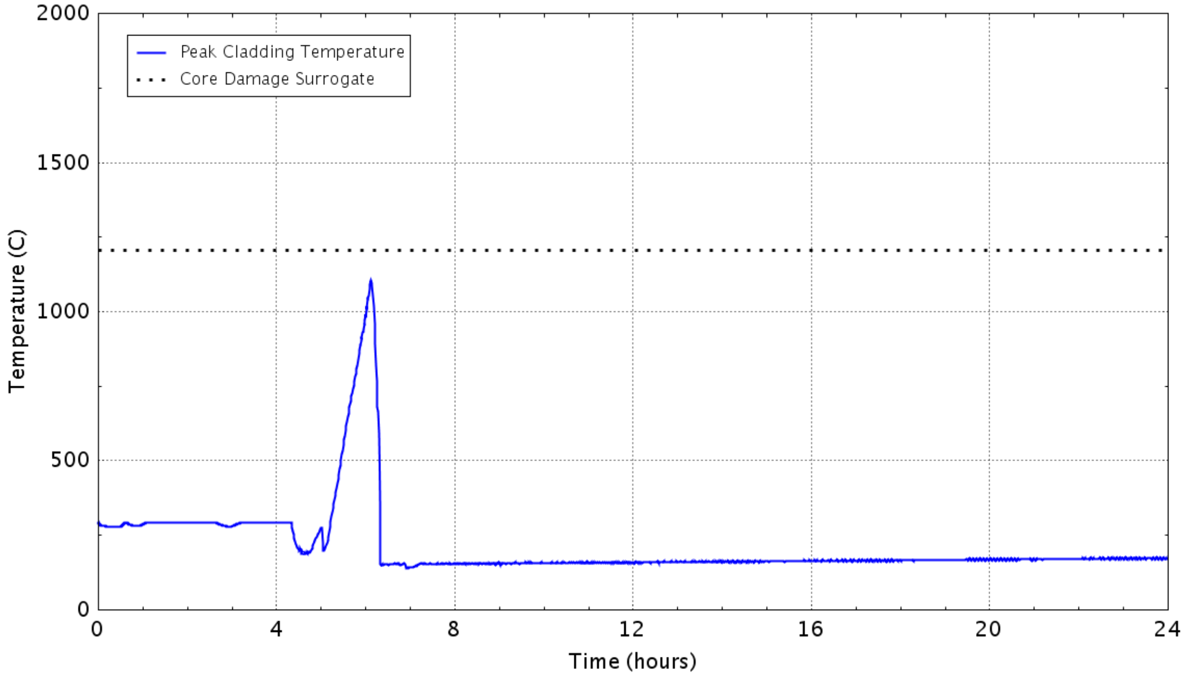

Figure D – 252 Peak temperature of the fuel cladding as a function oftime

D.2.6 Case 22: LOMFW-25, RCIC Loss at 8 hrs., RPV Pressure Follows HCL Curve, FLEX injection at 9 hrs.

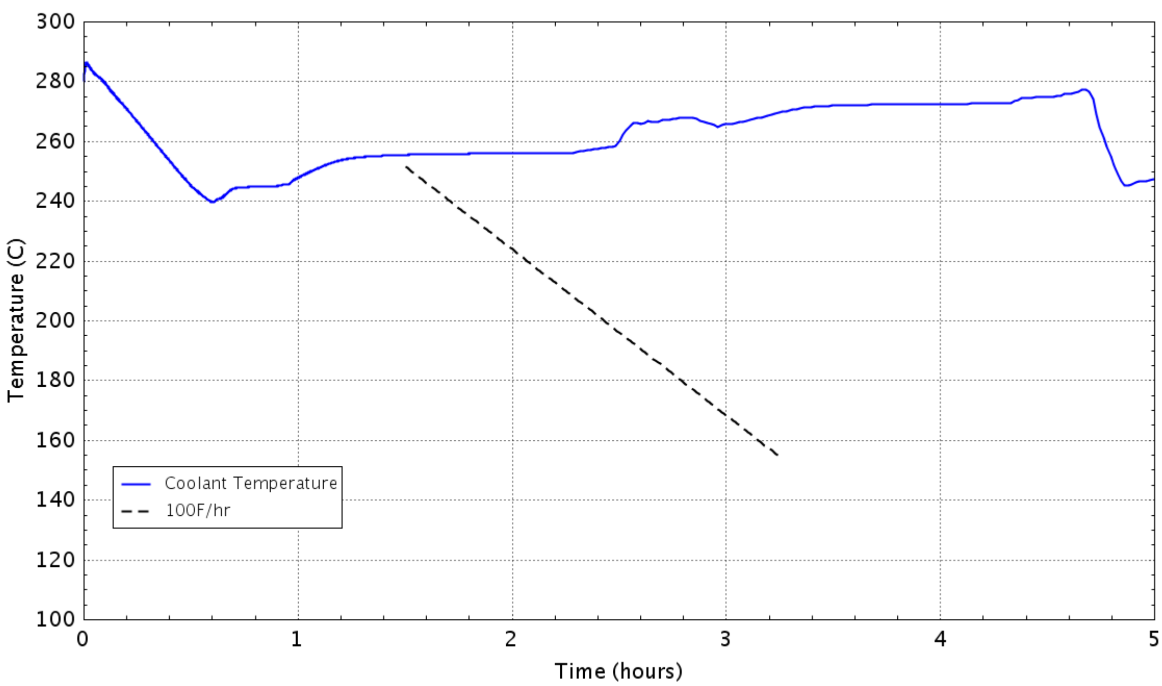

Figure D - 253 RPV cooldown rate

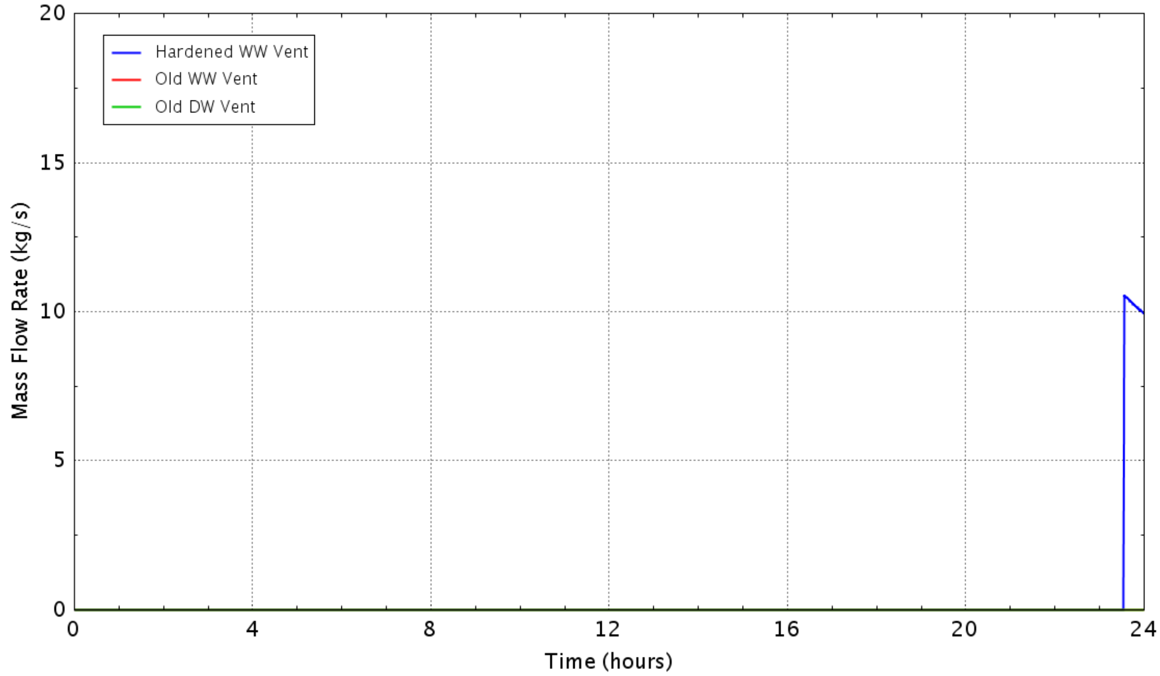

Figure D - 254 Flow rate of the containment vents

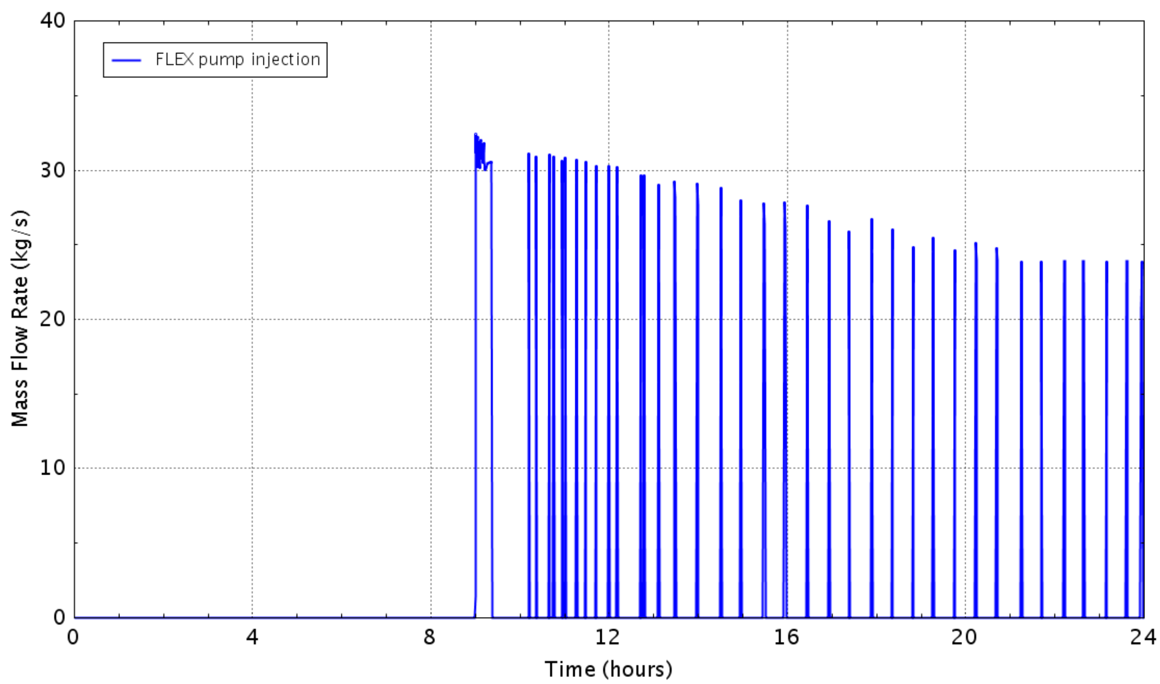

Figure D - 255 Flow rate of the FLEX pump

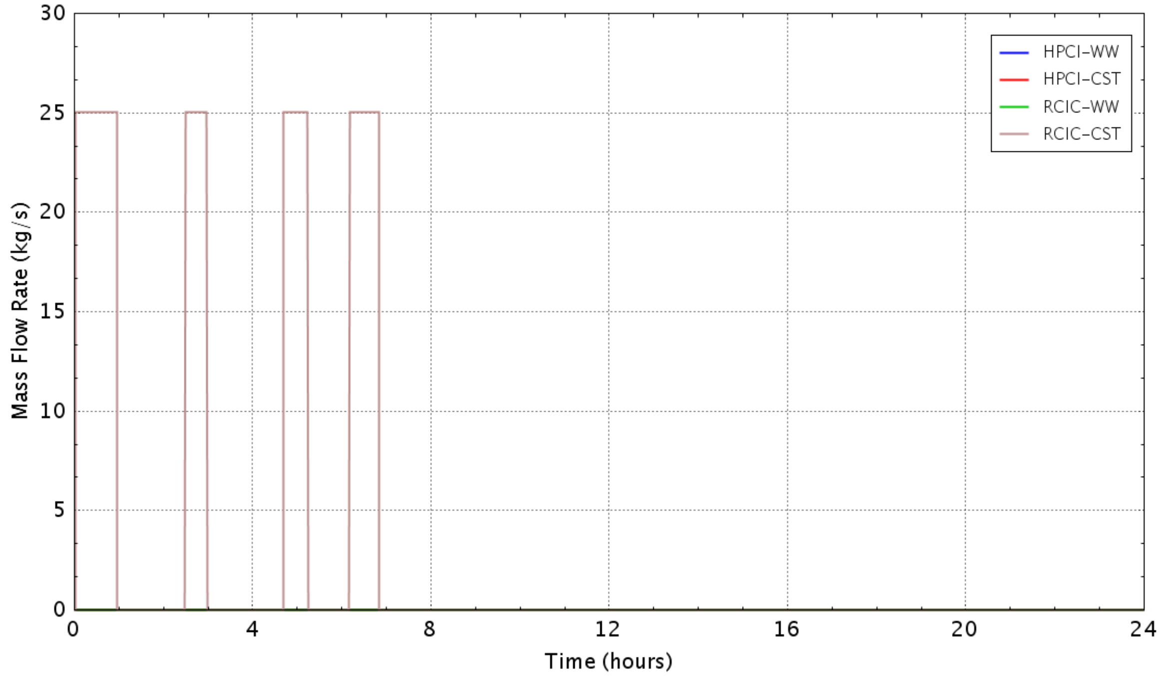

Figure D - 256 **Flow rate of the HPCI/RCIC pumps**

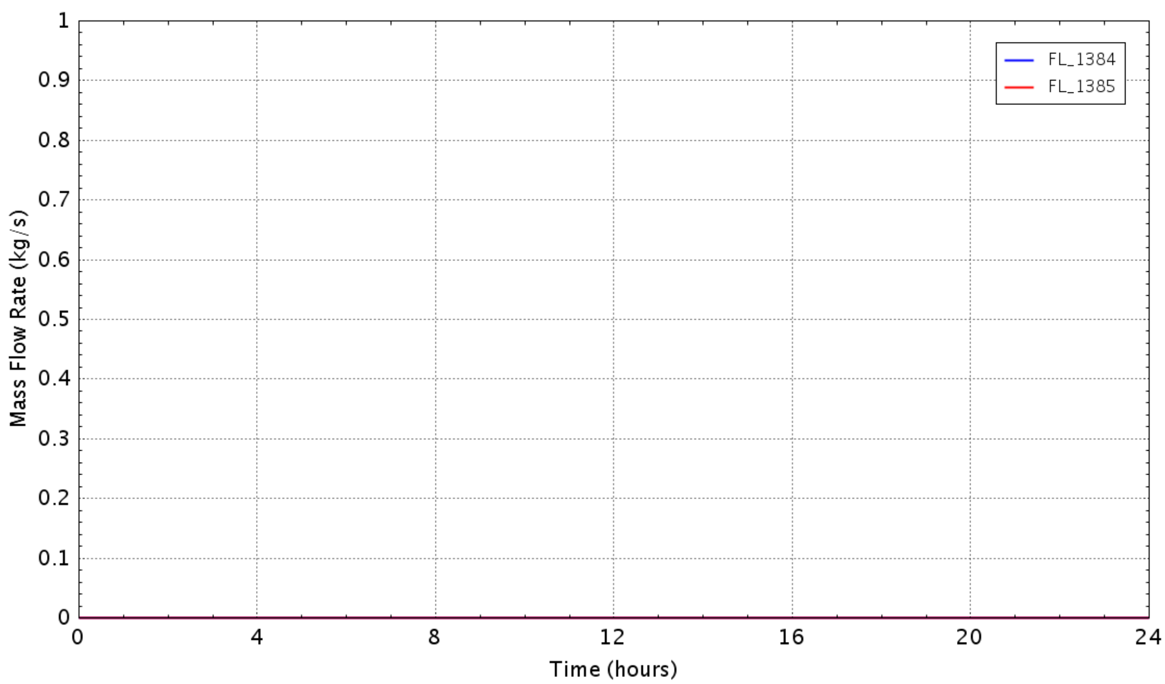

Figure D - 257 **Flow rate of the recirculating pump seal leakage**

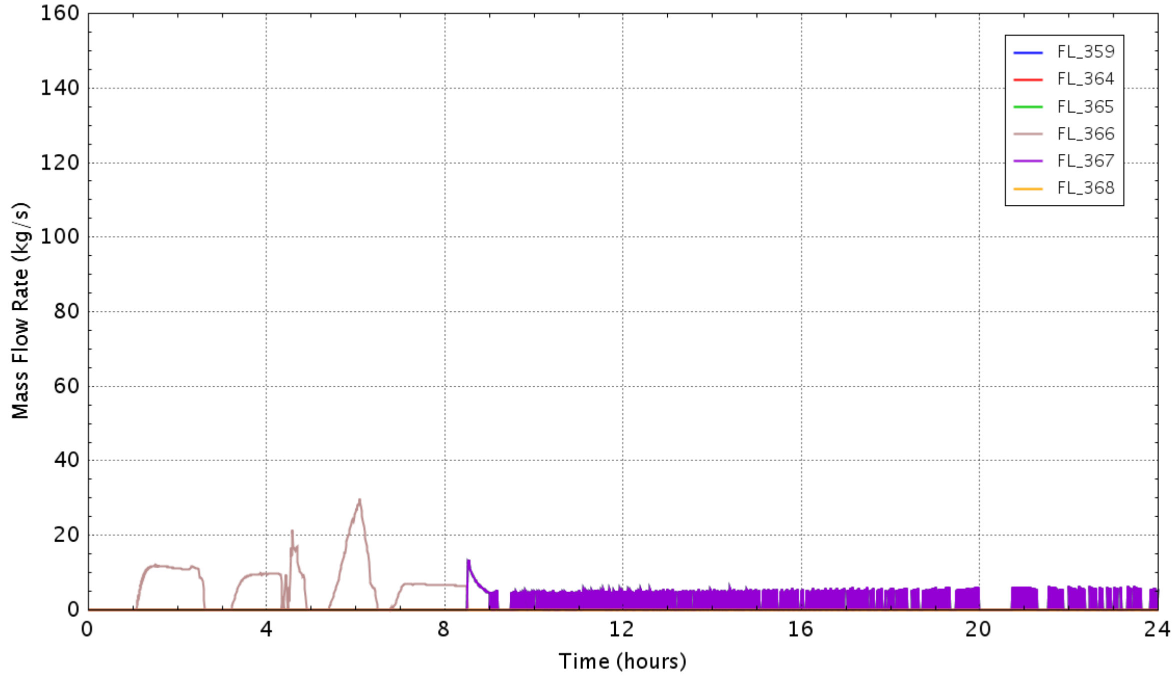

Figure D - 258 Flow rate of the SRVs

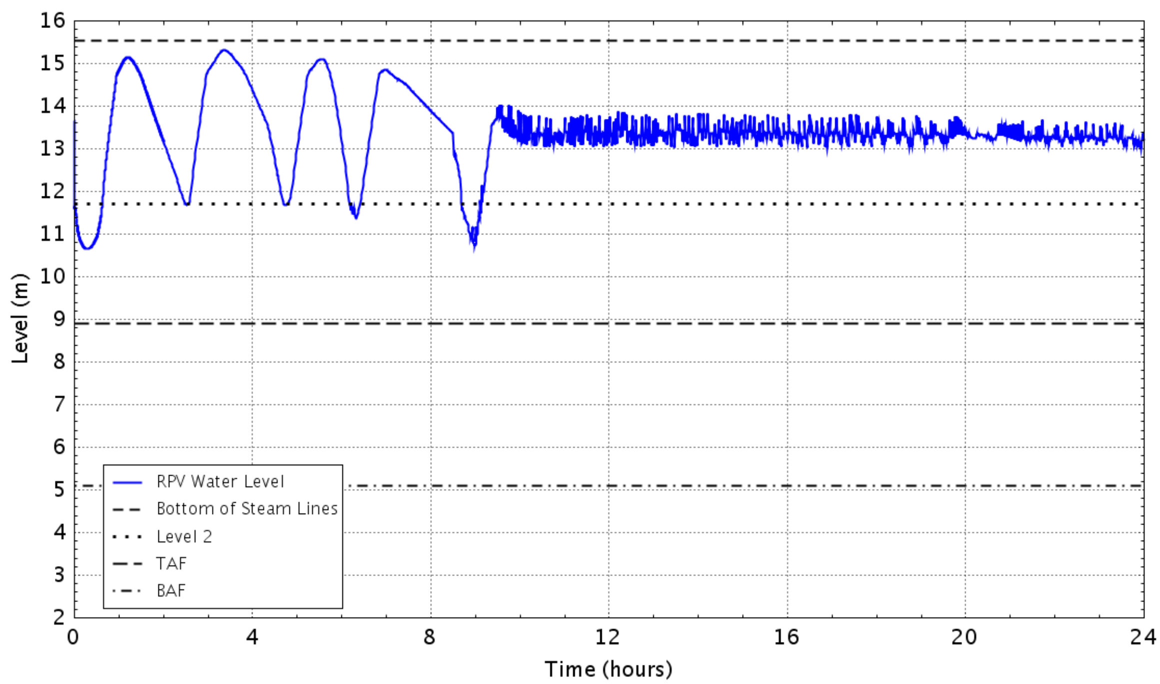

Figure D - 259 RPV down comer water level

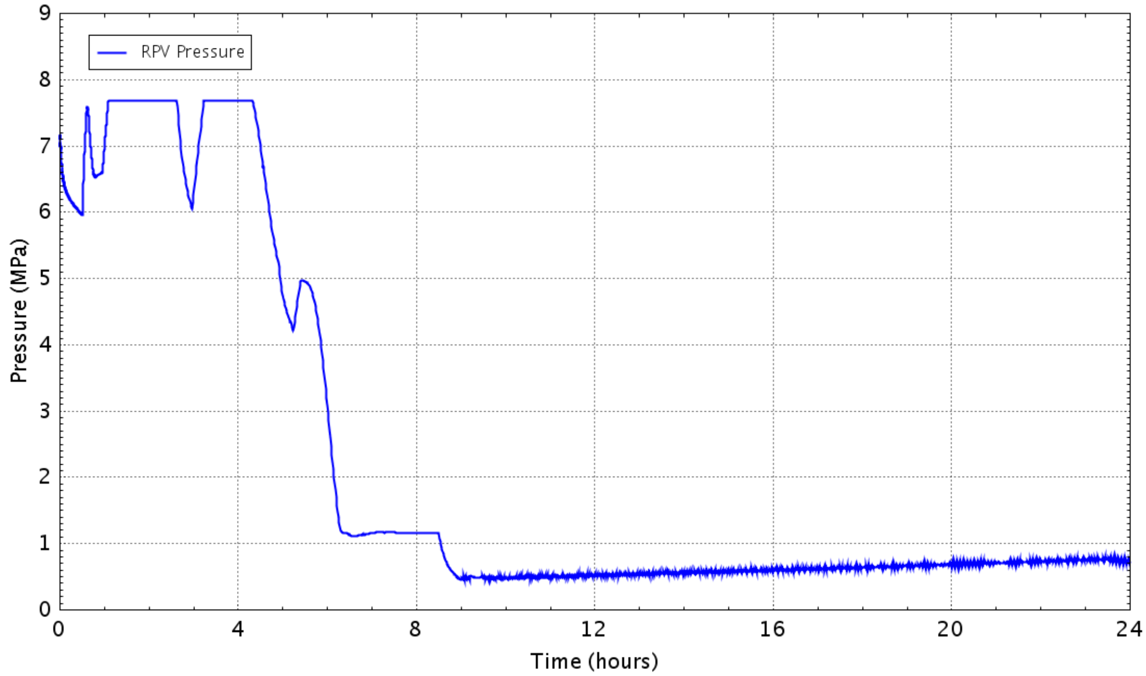

Figure D - 260 Pressure in theRPV

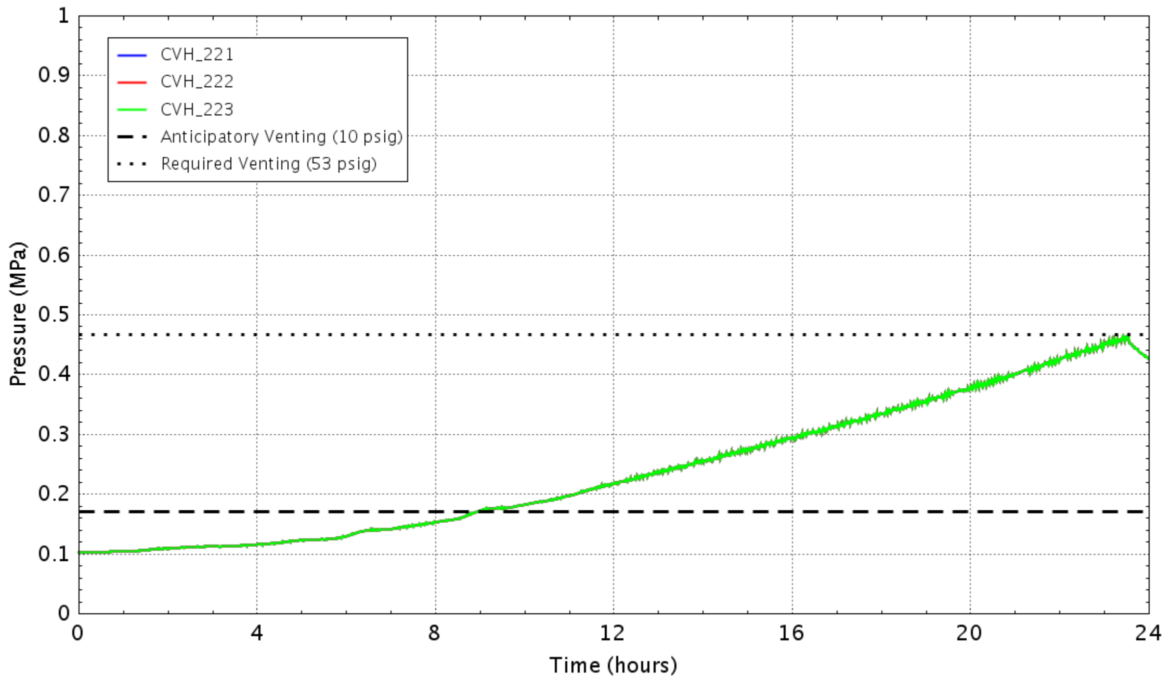

Figure D - 261 Pressure in the wetwell

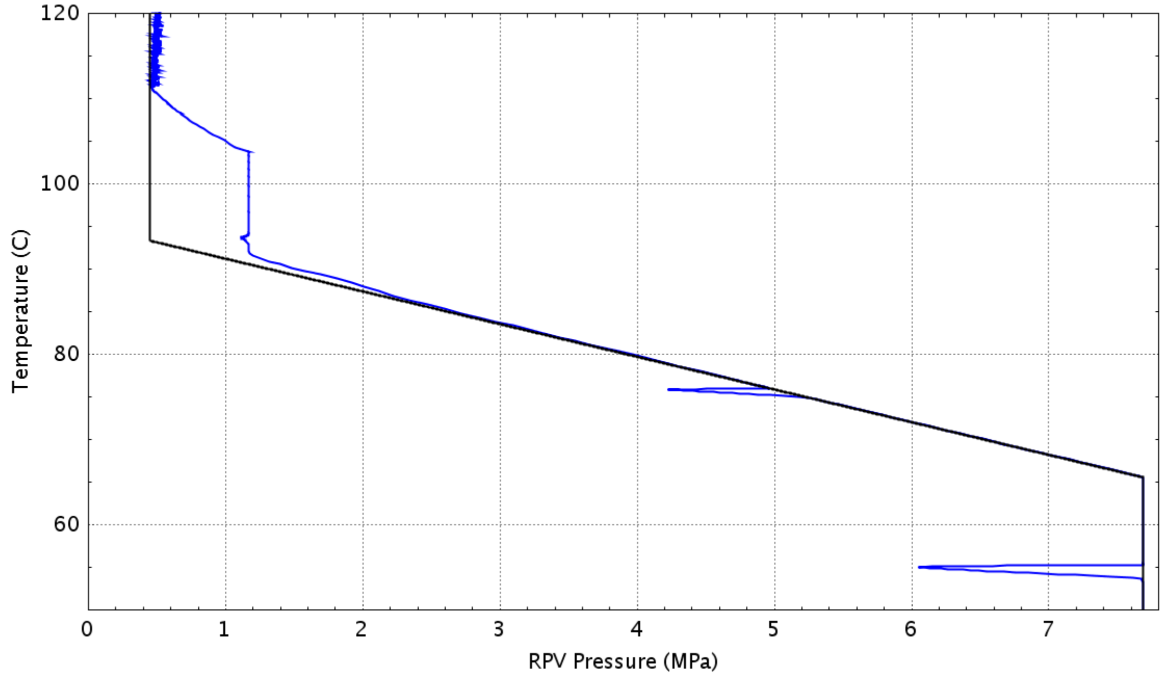

Figure D – 262 Plant status relative to the HCL curve (Graph 4 of the EOPs)

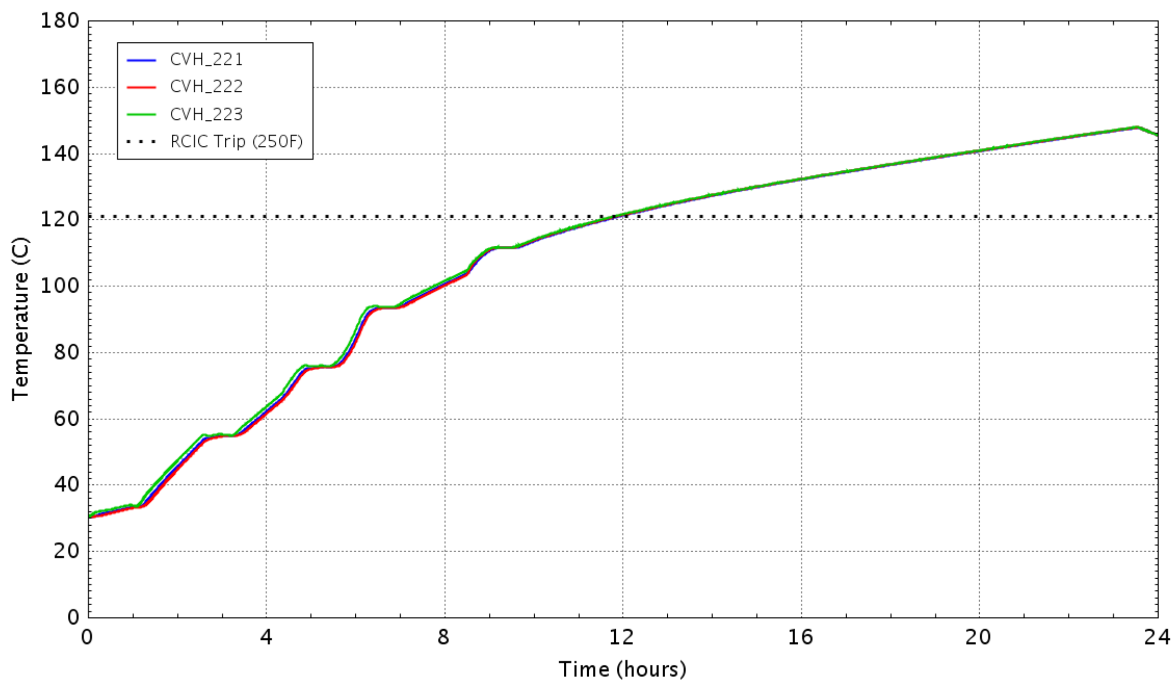

Figure D - 263 Water temperature in the wetwell

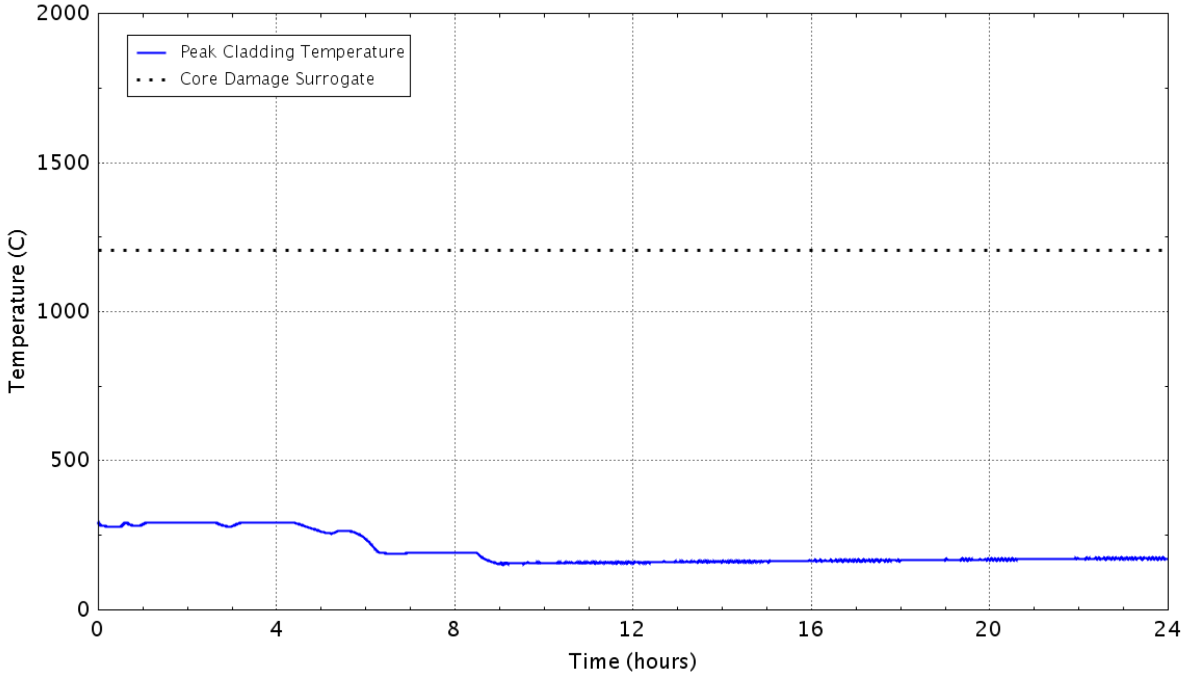

Figure D – 264 Peak temperature of the fuel cladding as a function oftime

D.2.7 Case 23: LOMFW-25, RCIC Loss at 8 hrs., Emergency Depressurization at HCL Curve, FLEX injection at 9hrs.

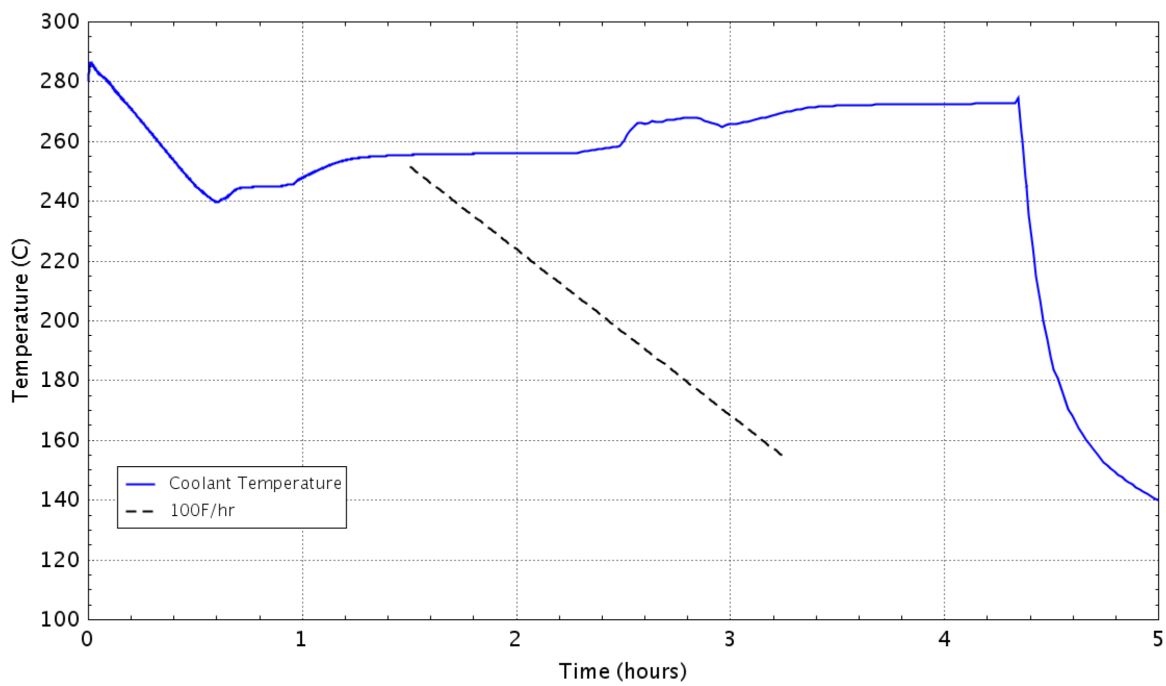

Figure D - 265 RPV cooldown rate

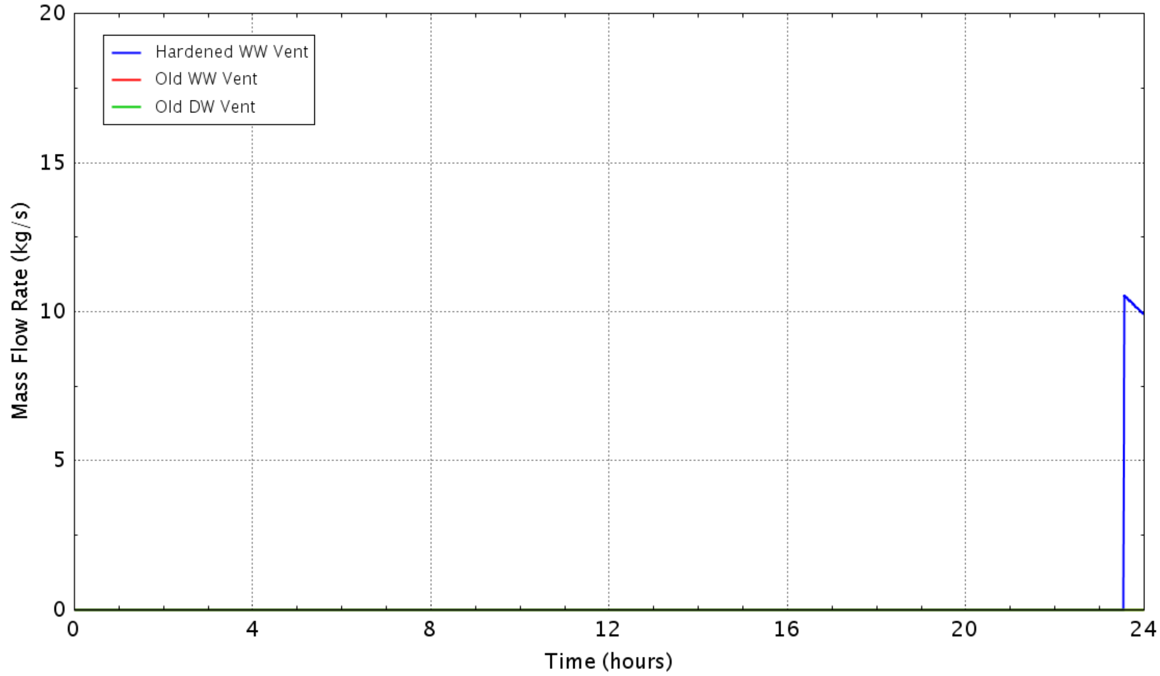

Figure D - 266 Flow rate of the containment vents

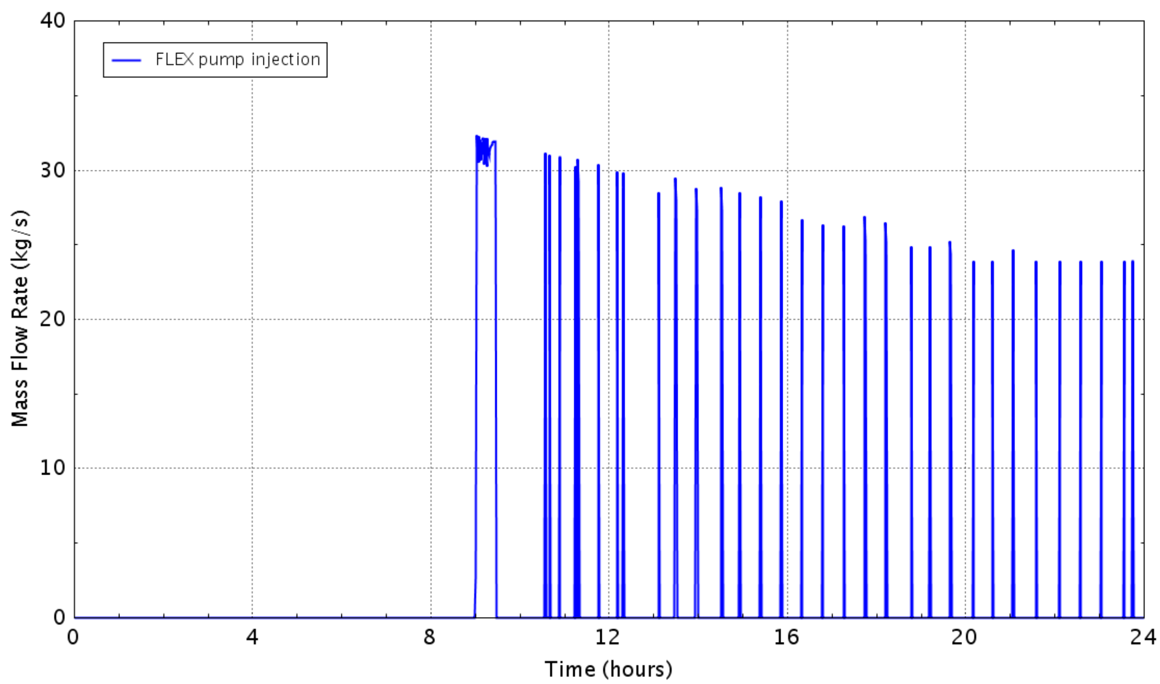

Figure D - 267 Flow rate of the FLEX pump

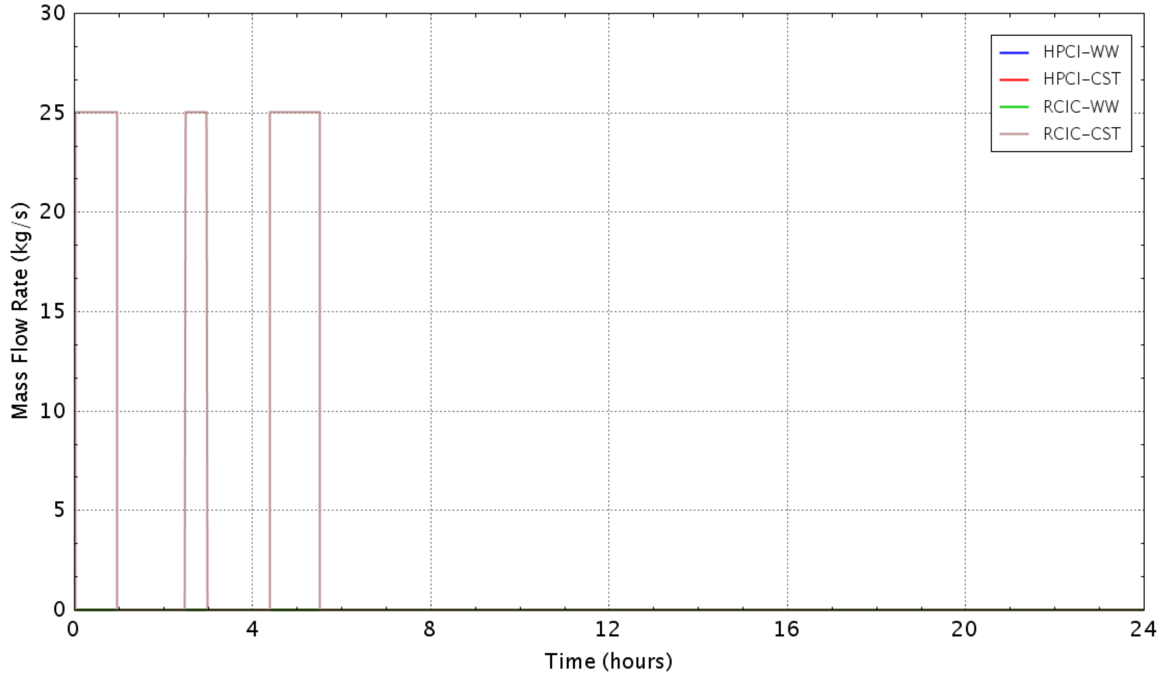

Figure D - 268 **Flow rate of the HPCI/RCIC pumps**

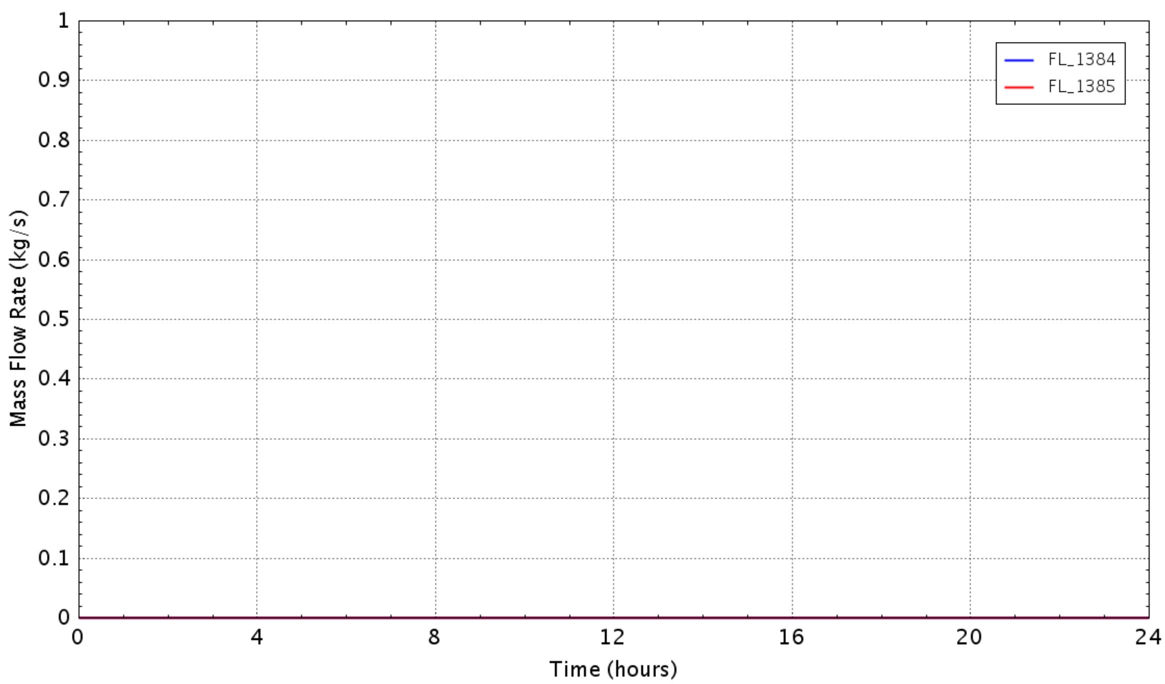

Figure D - 269 **Flow rate of the recirculating pump seal leakage**

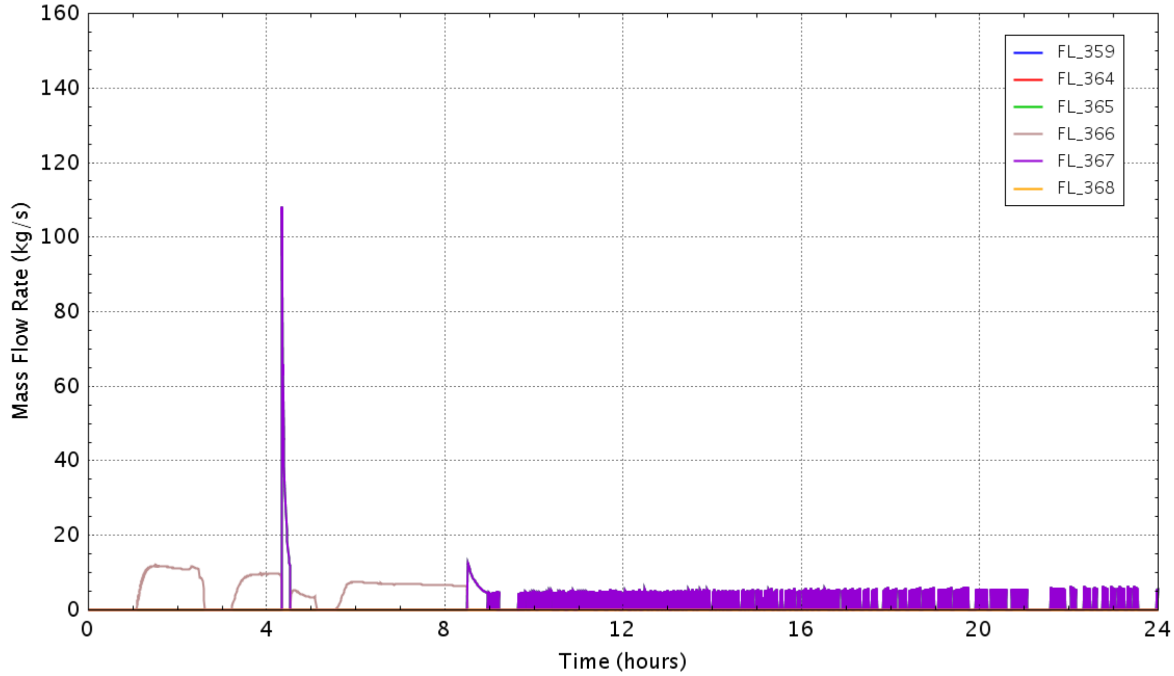

Figure D - 270 Flow rate of the SRVs

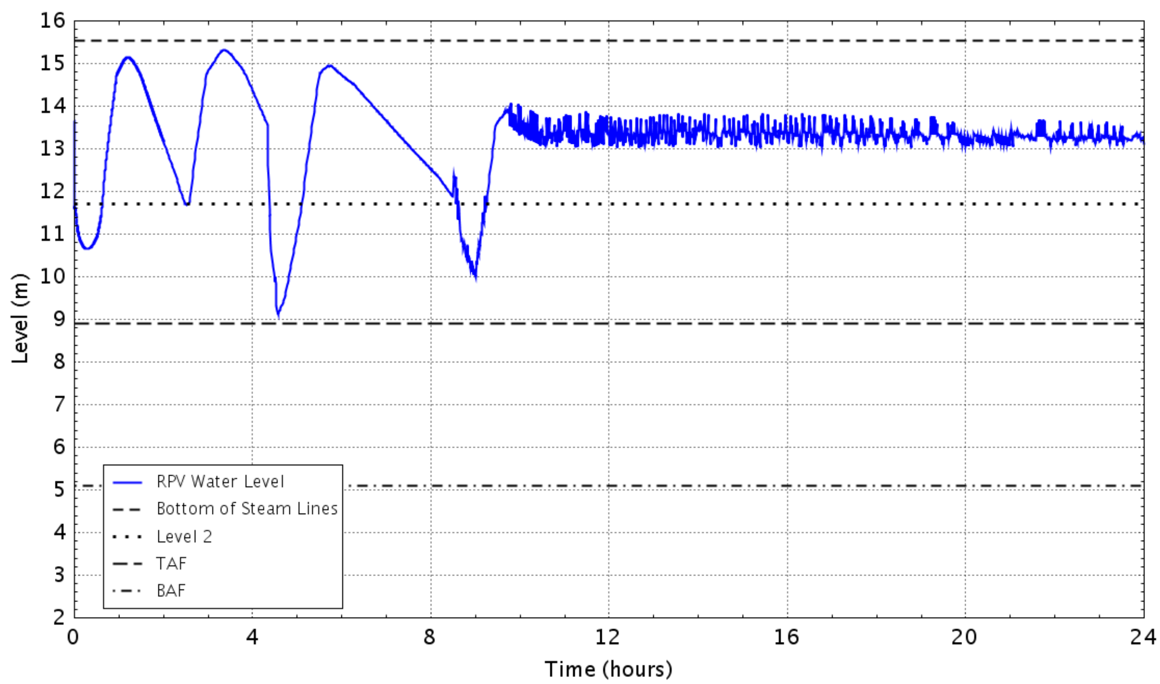

Figure D - 271 RPV down comer water level

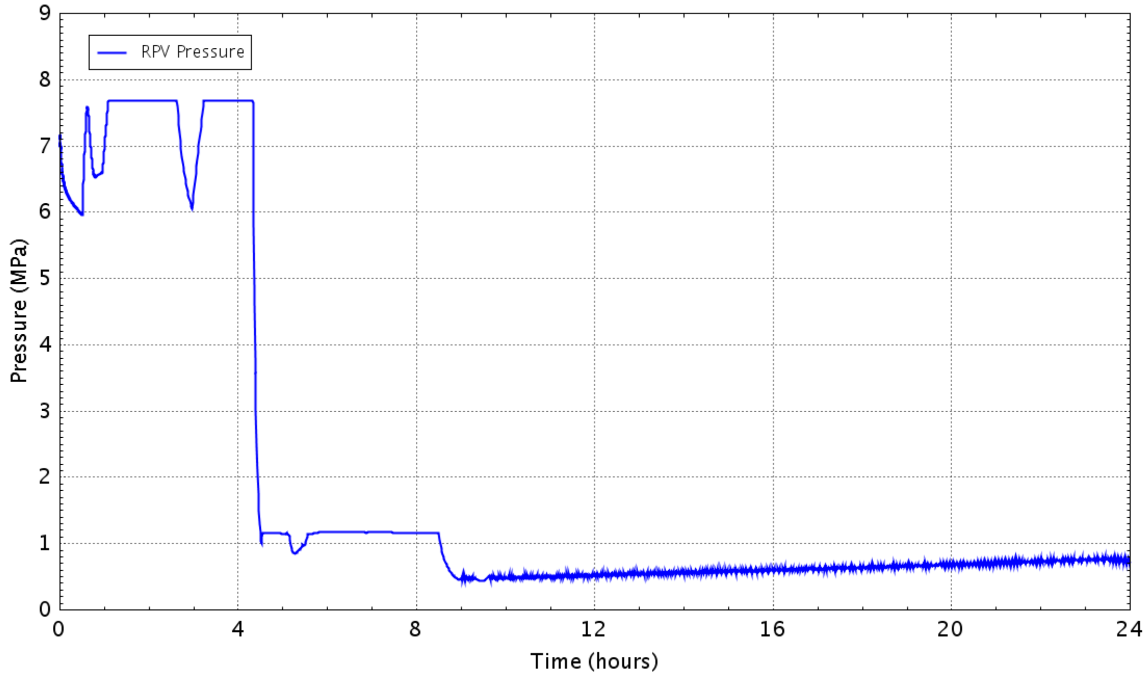

Figure D - 272 **Pressure in theRPV**

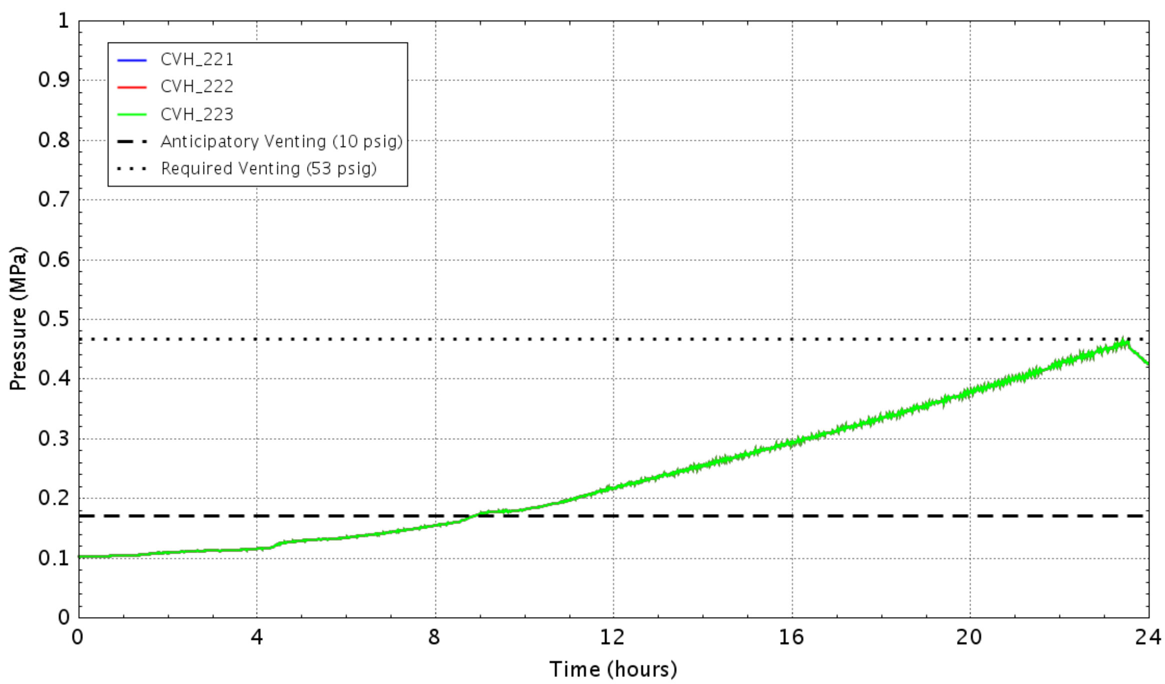

Figure D - 273 **Pressure in the wetwell**

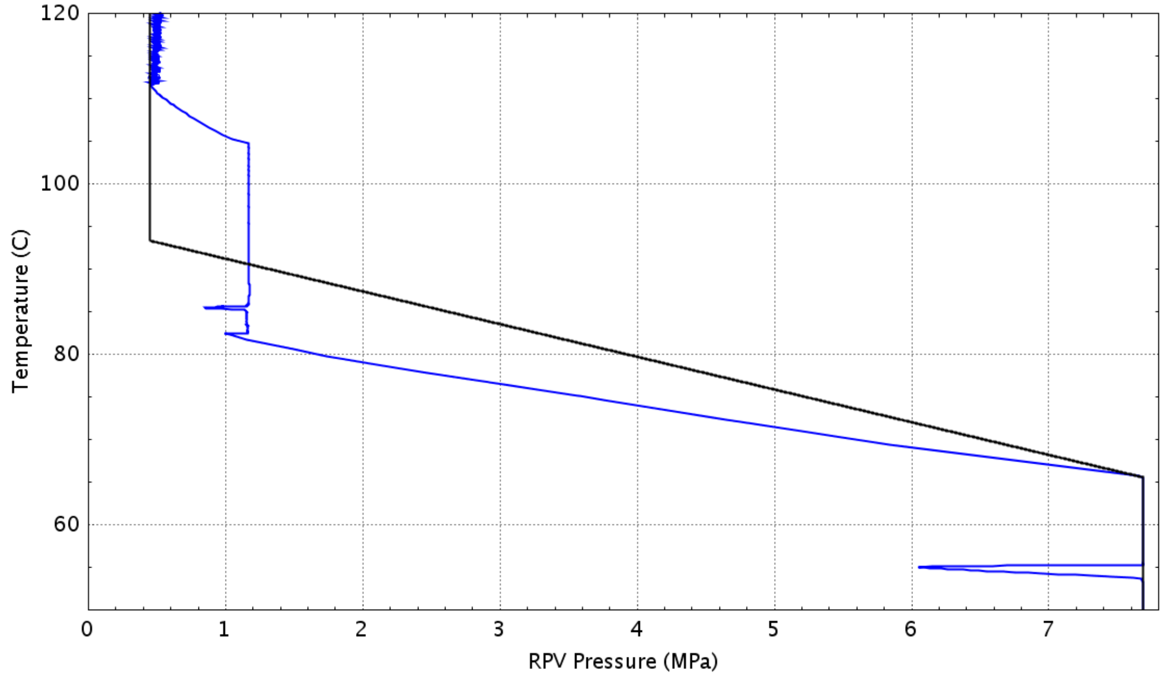

Figure D – 274 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

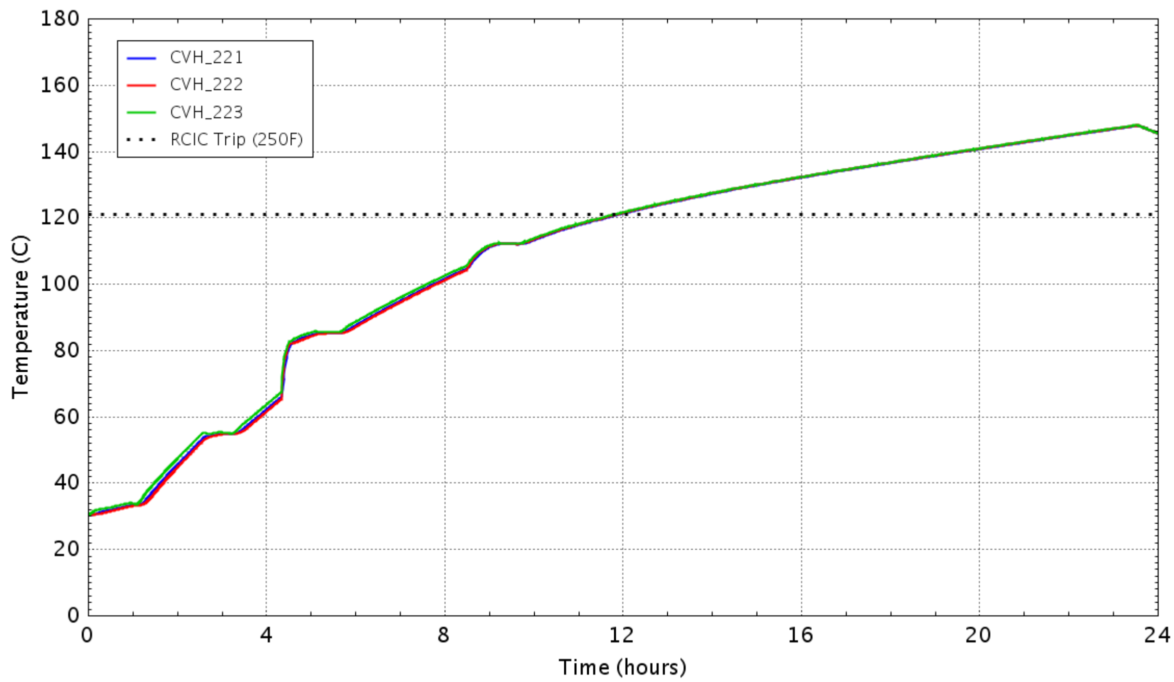

Figure D - 275 **Water temperature in the wetwell**

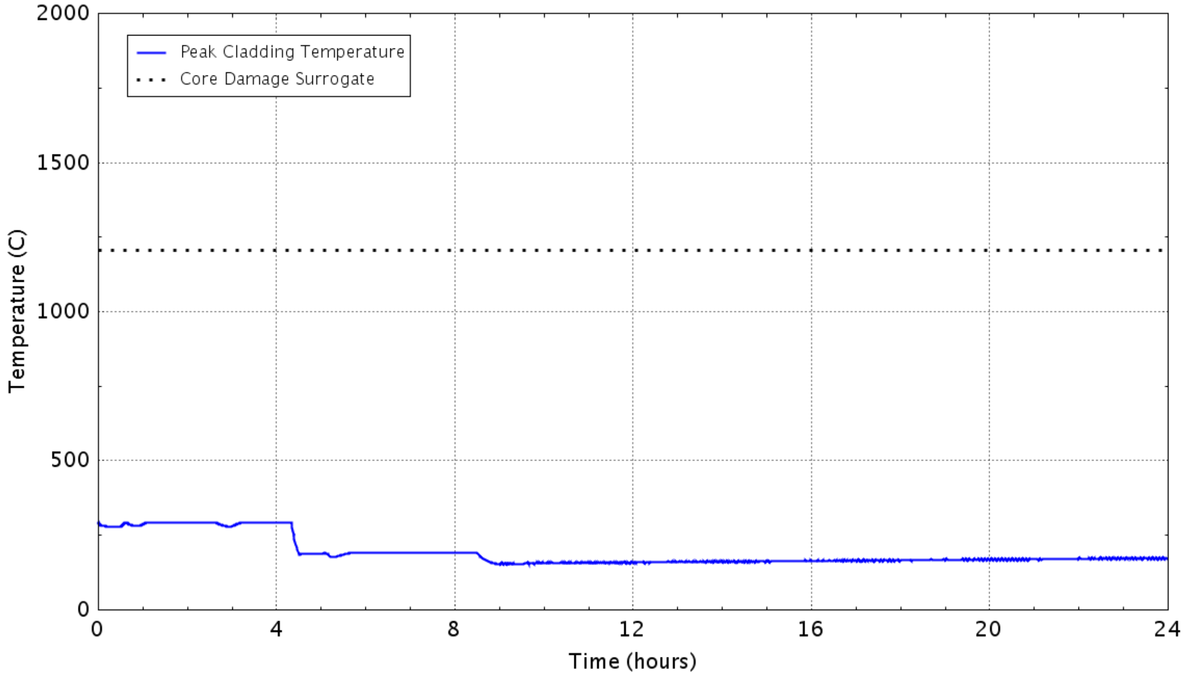

Figure D – 276 Peak temperature of the fuel cladding as a function oftime

D.2.8 Case 24: LOMFW-25, RCIC Loss at 8 hrs., Emergency Depressurization at HCL Curve, FLEX injection at 10 hrs.

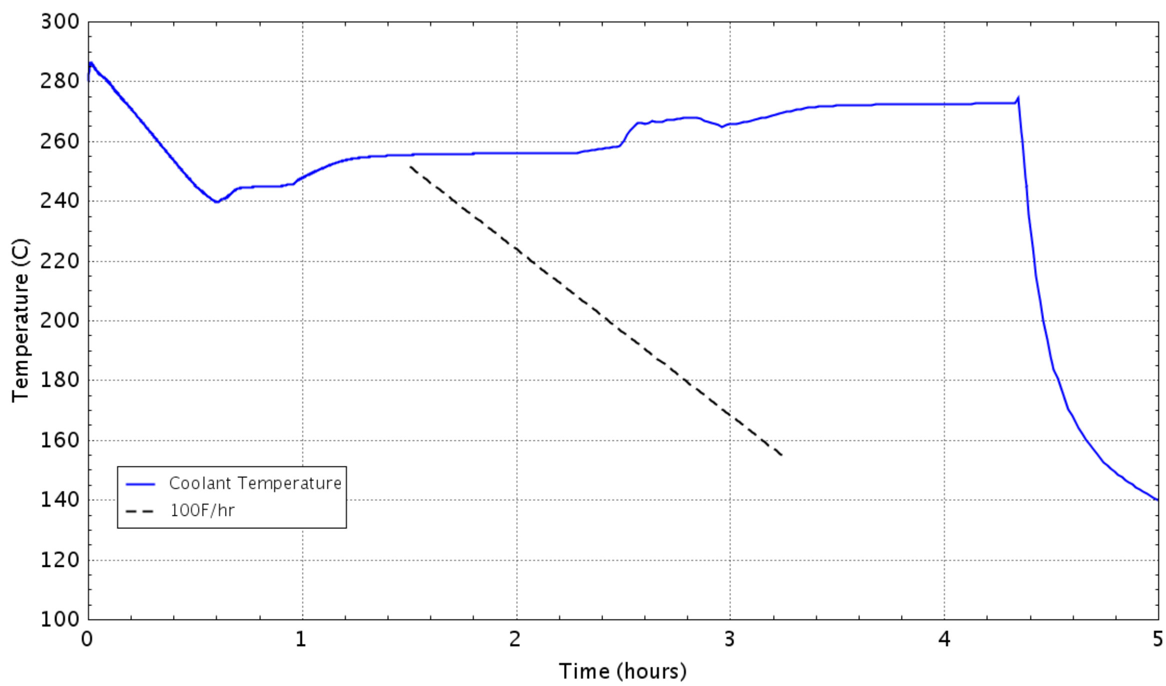

Figure D – 277 RPV cooldown rate

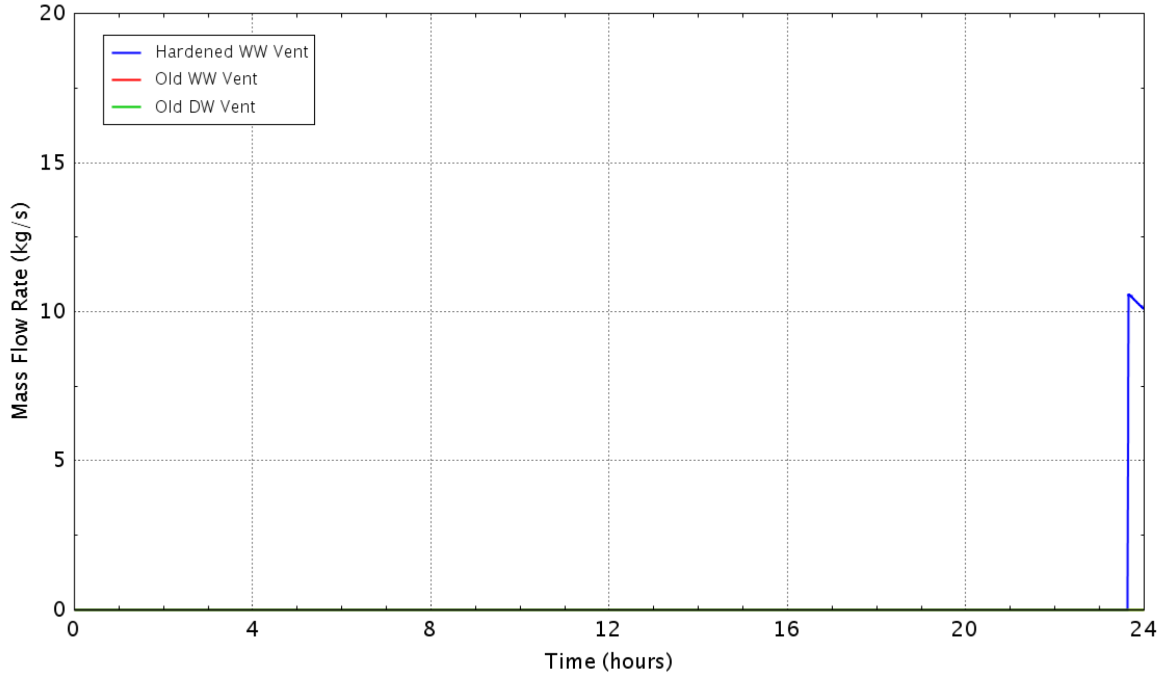

Figure D - 278 **Flow rate of the containment vents**

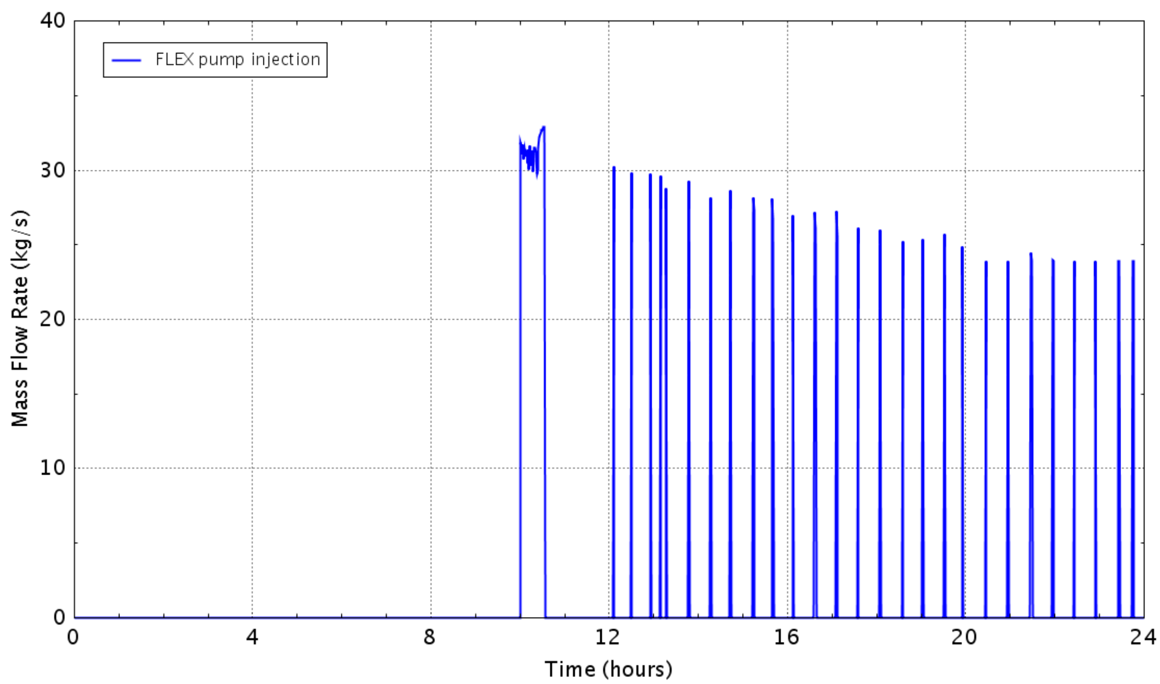

Figure D - 279 **Flow rate of the FLEX pump**

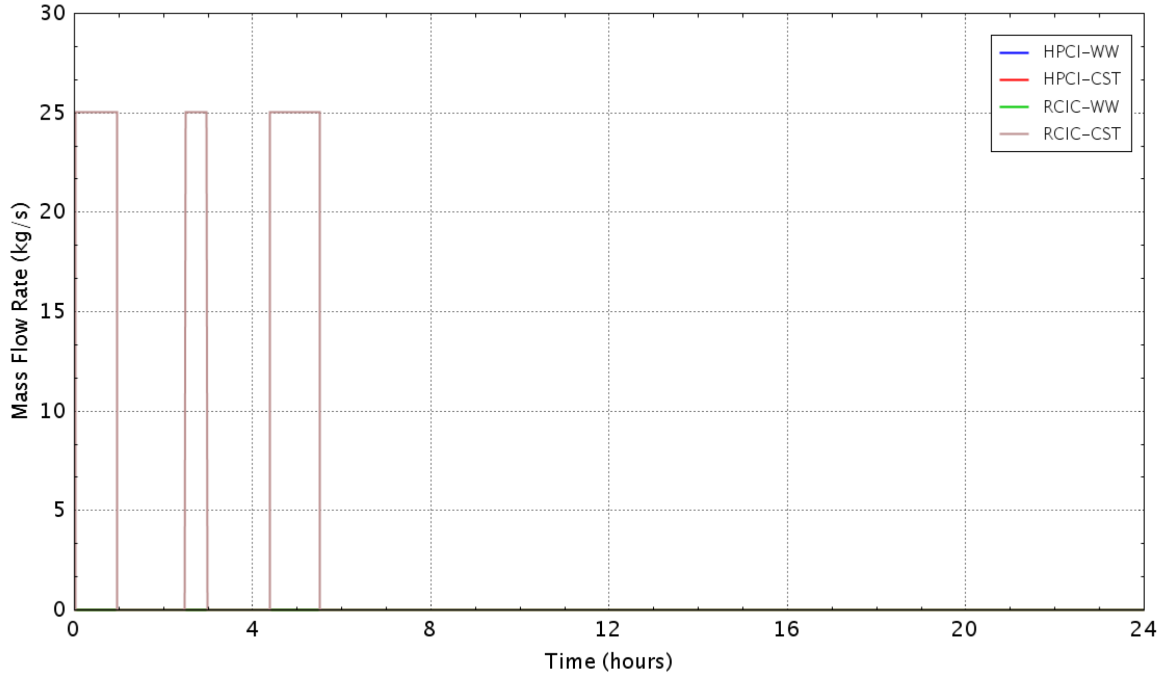

Figure D - 280 Flow rate of the HPCI/RCIC pumps

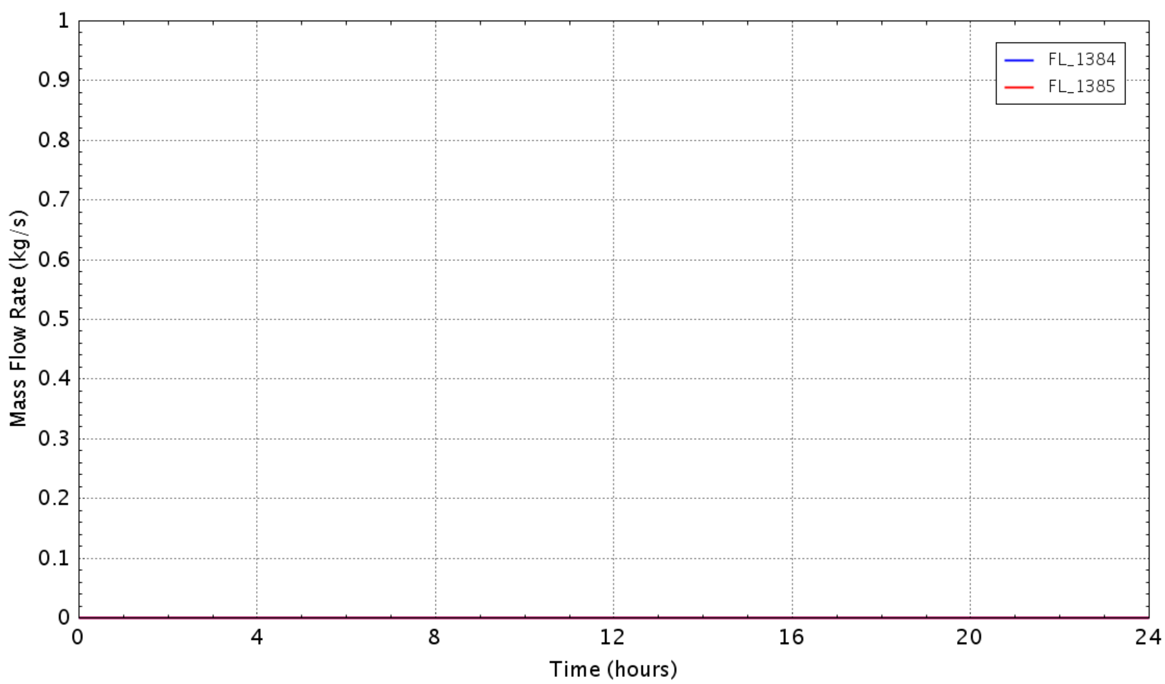

Figure D - 281 Flow rate of the recirculating pump seal leakage

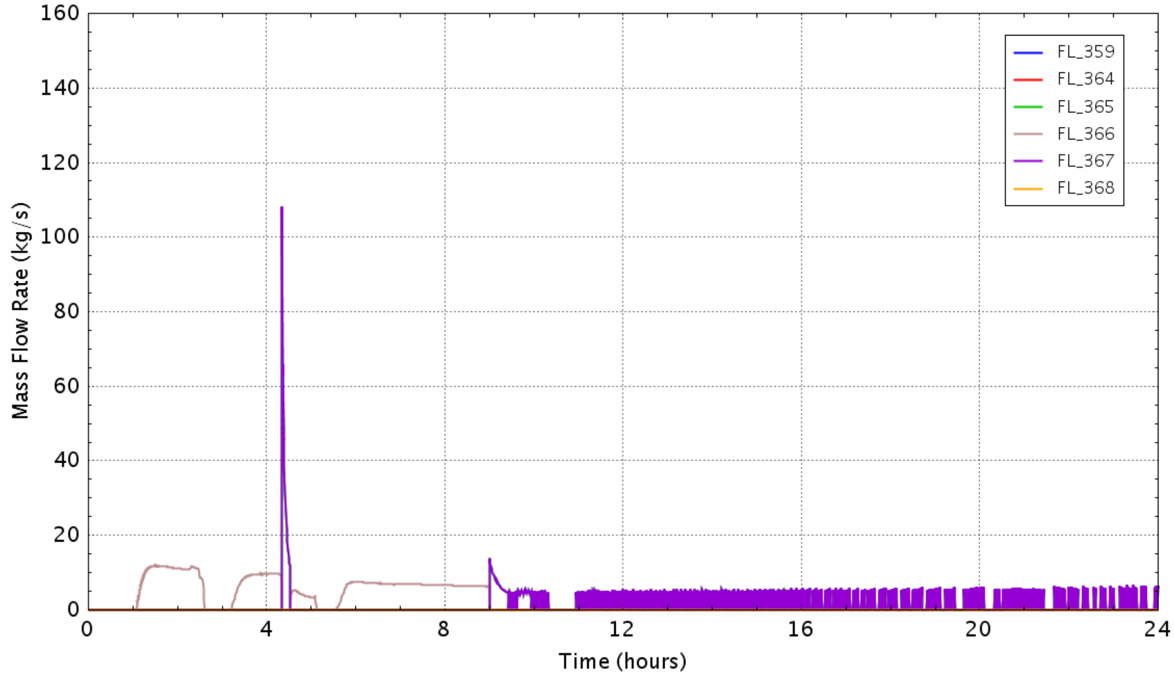

Figure D - 282 **Flow rate of the SRVs**

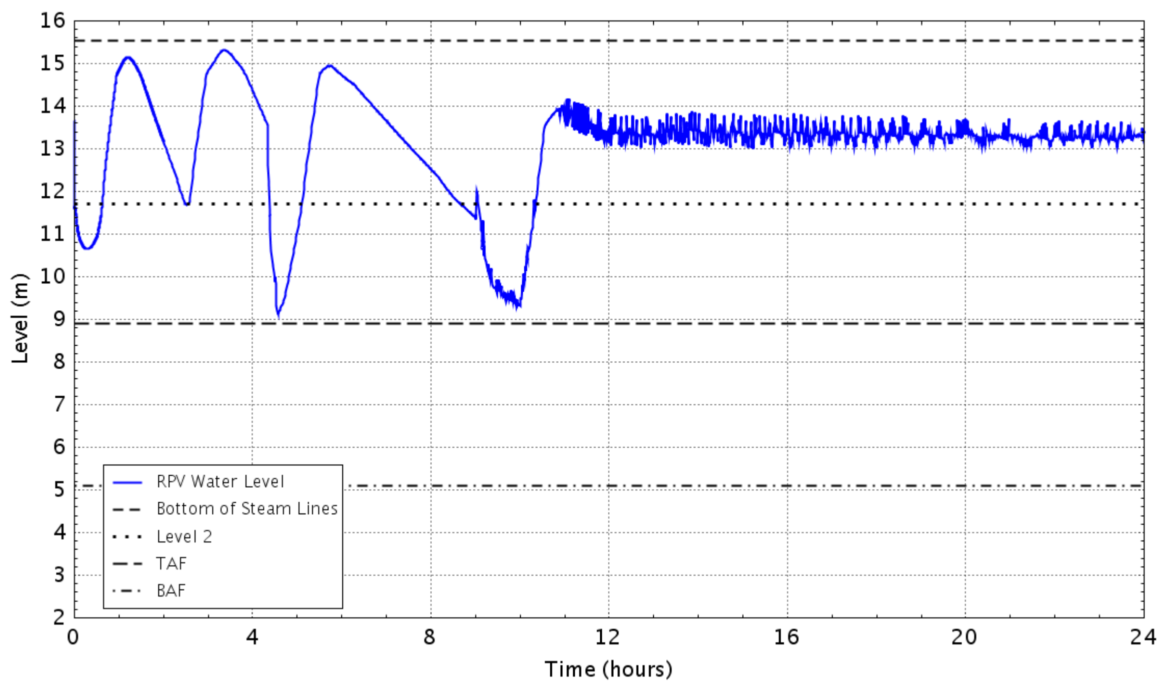

Figure D - 283 **RPV down comer water level**

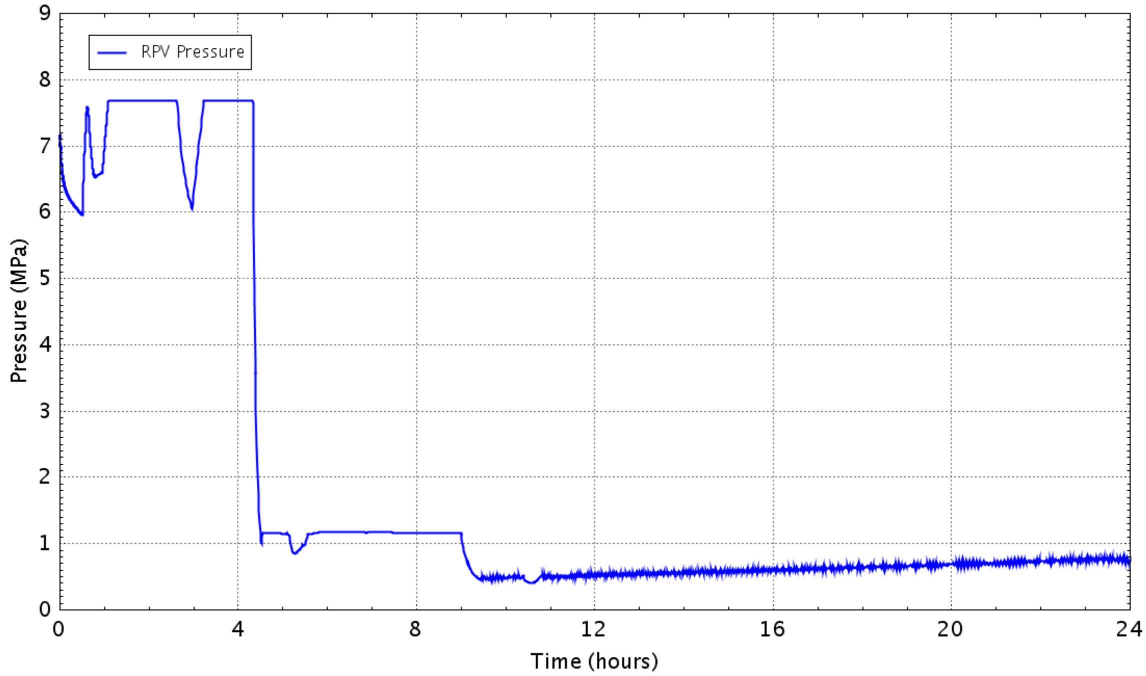

Figure D - 284 **Pressure in theRPV**

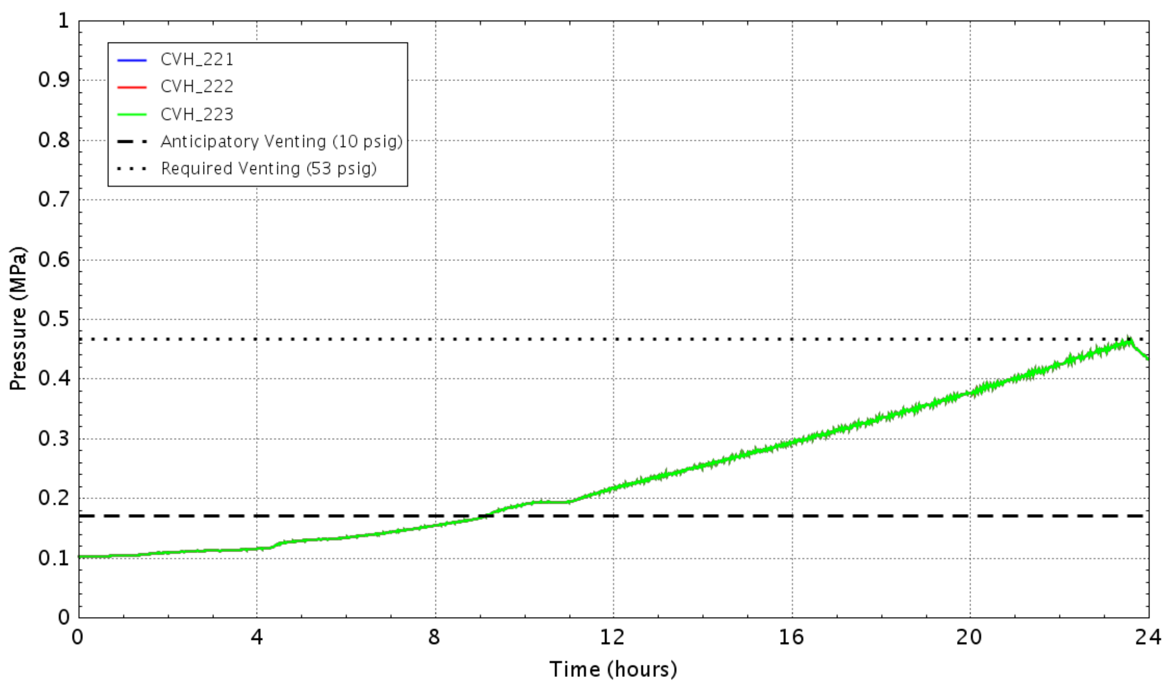

Figure D - 285 **Pressure in the wetwell**

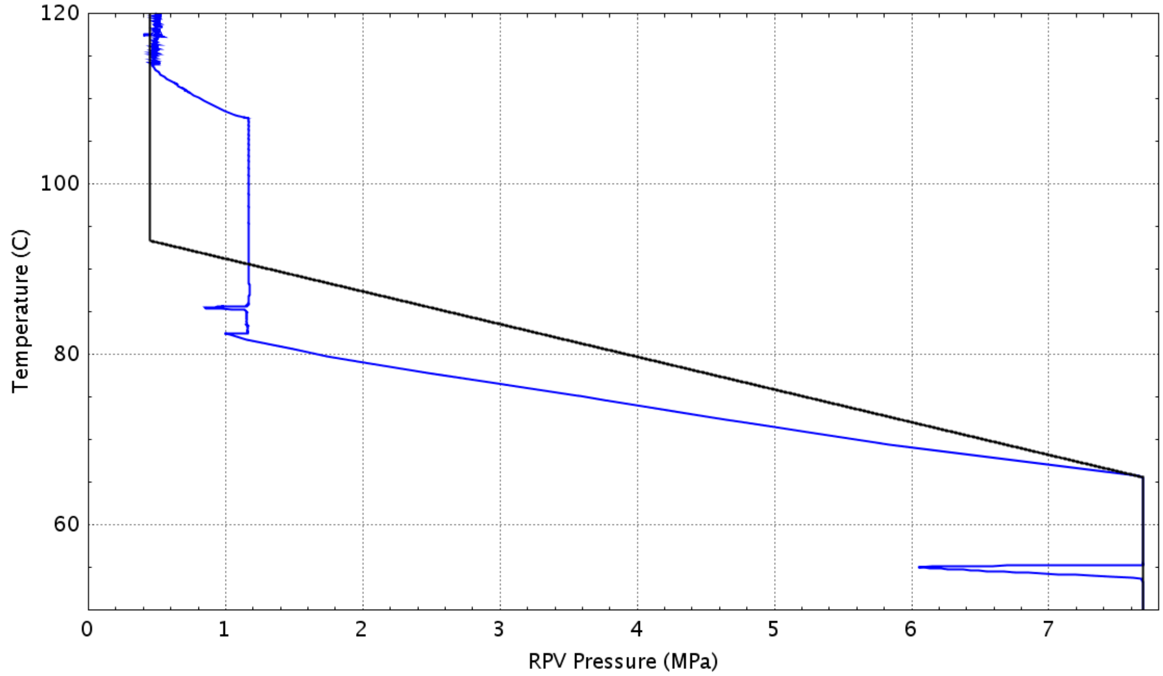

Figure D – 286 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

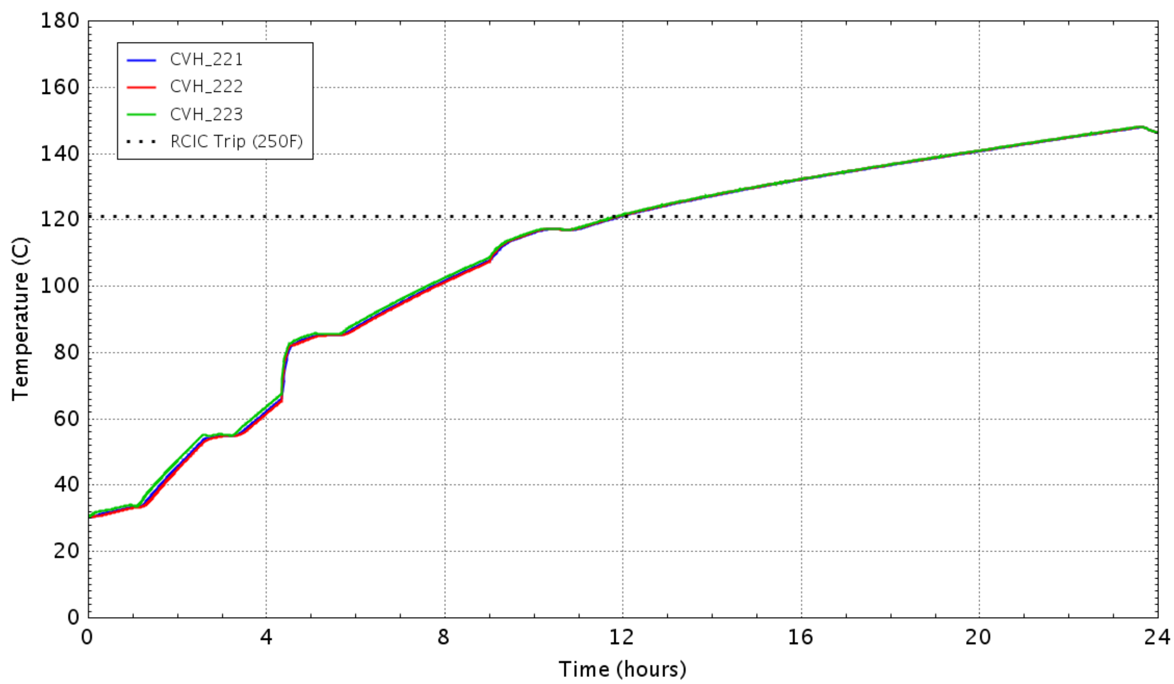

Figure D - 287 **Water temperature in the wetwell**

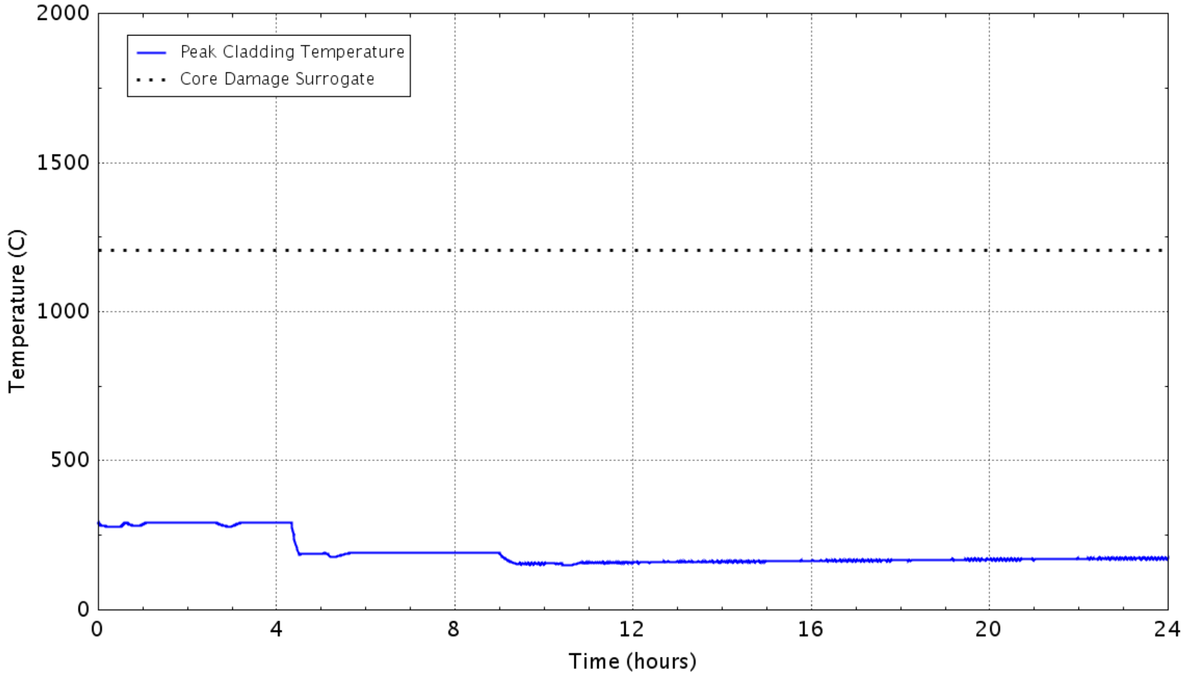

Figure D – 288 **Peak temperature of the fuel cladding as a function oftime**

D.2.9 Case 25: LOMFW-25, RCIC Loss at 8 hrs., Emergency Depressurization atHCL Curve, FLEX injection at 10 hrs. at -25% flow rate

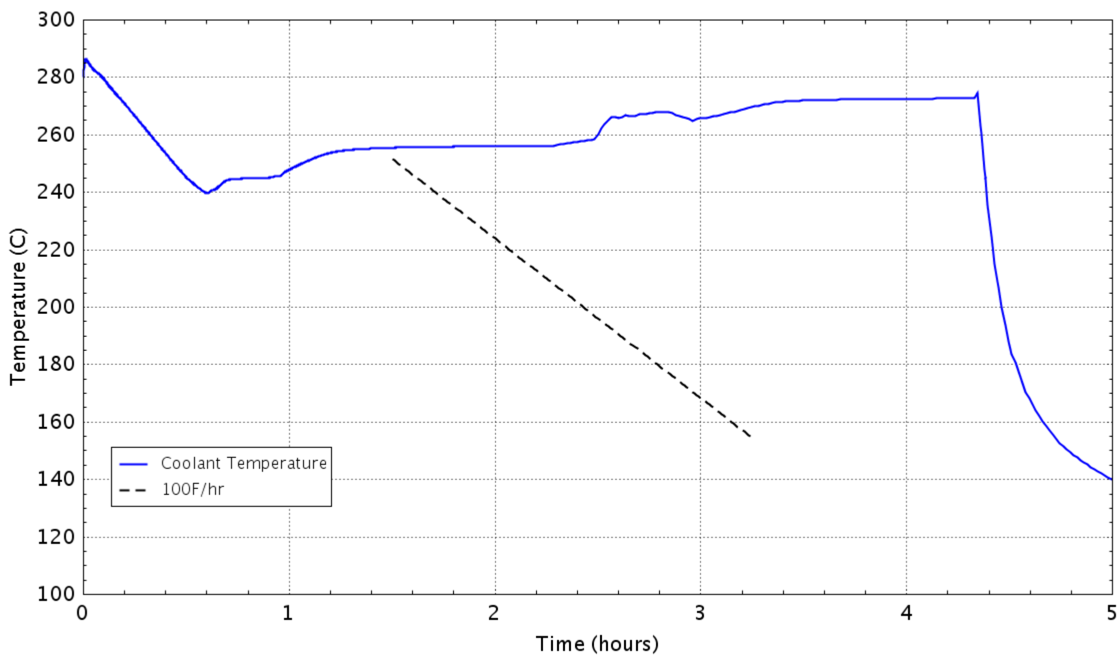

Figure D - 289 **RPV cooldown rate**

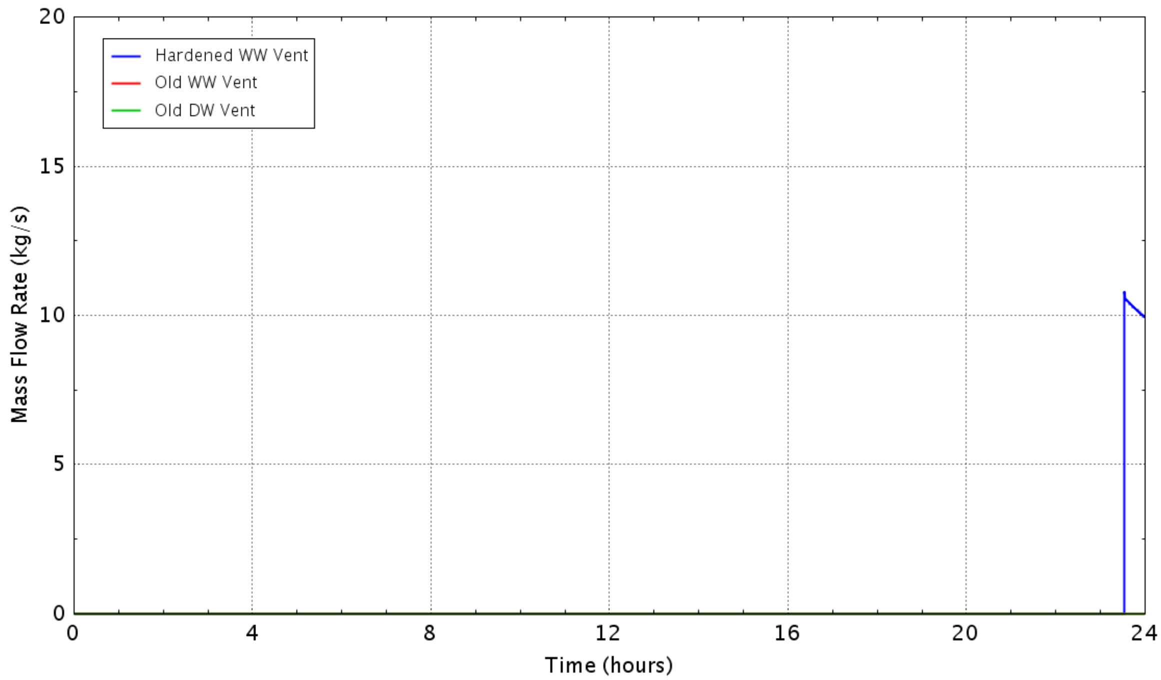

Figure D - 290 **Flow rate of the containment vents**

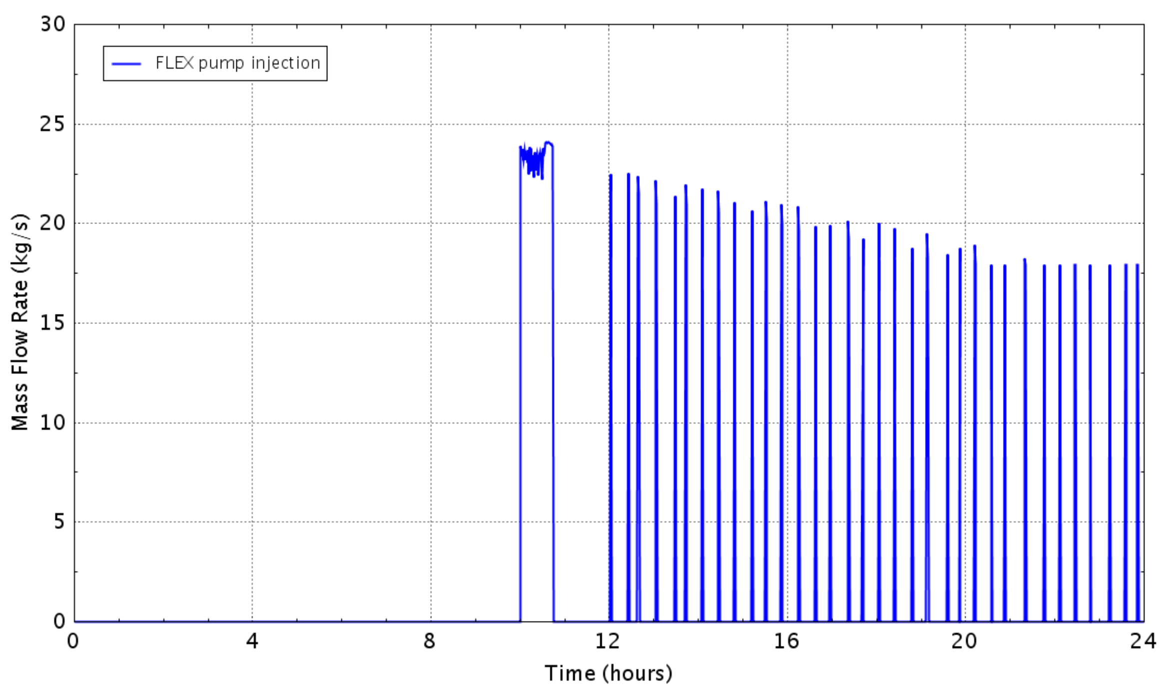

Figure D - 291 **Flow rate of the FLEX pump**

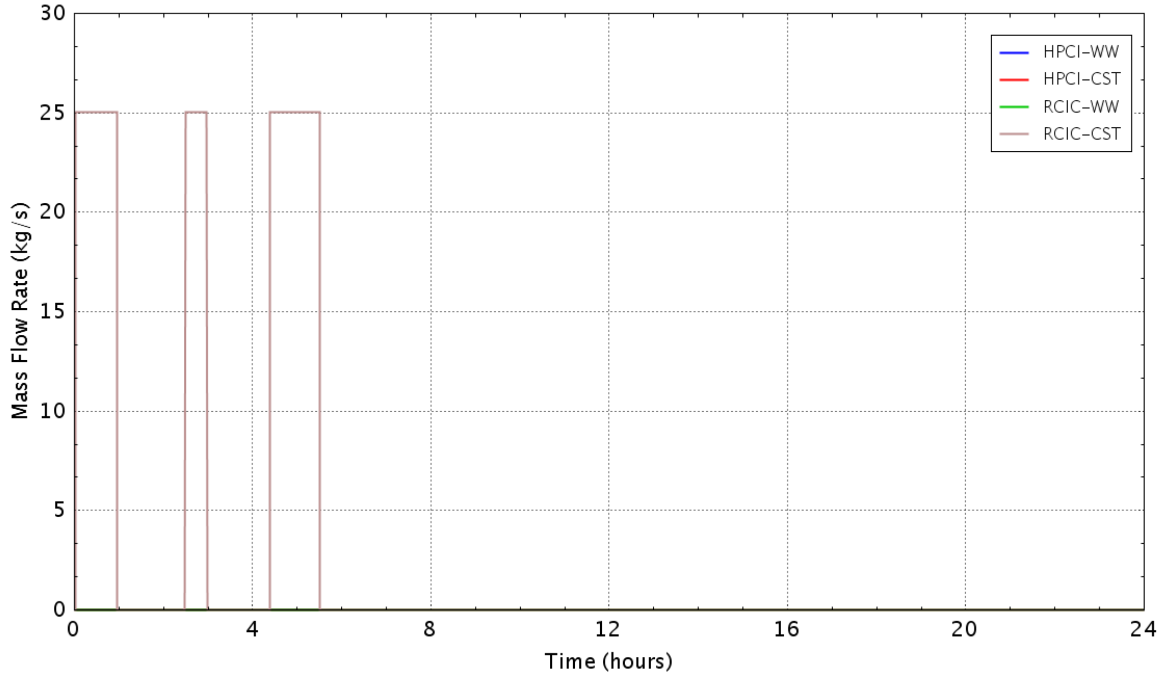

Figure D - 292 Flow rate of the HPCI/RCIC pumps

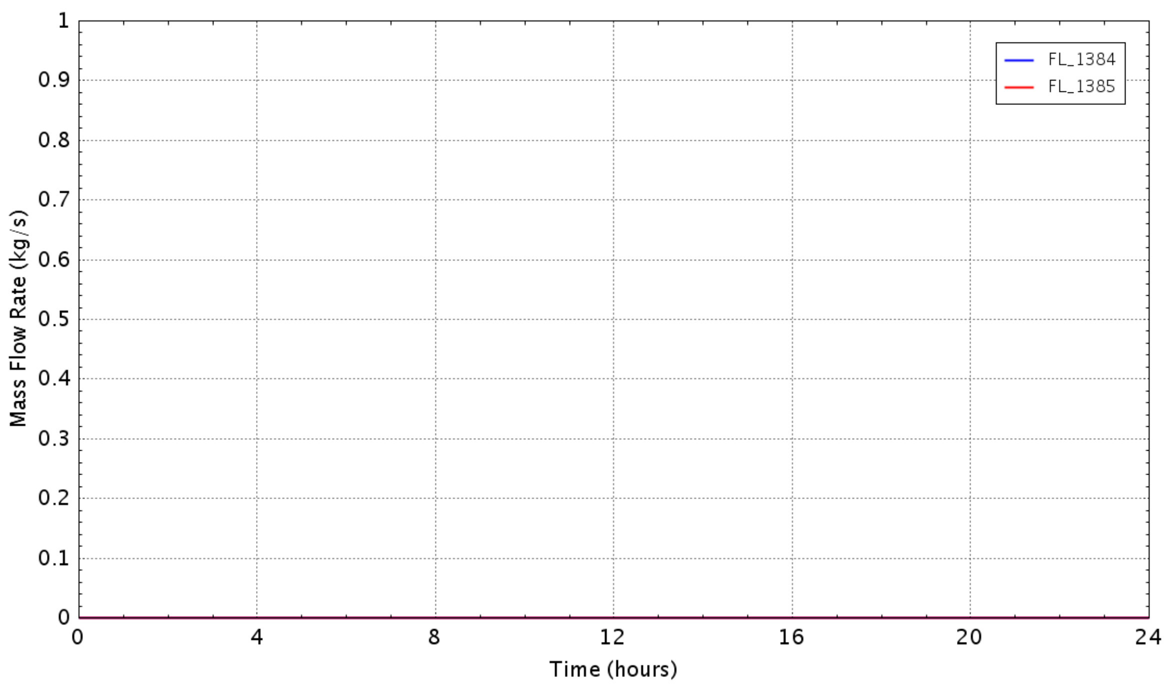

Figure D - 293 Flow rate of the recirculating pump seal leakage

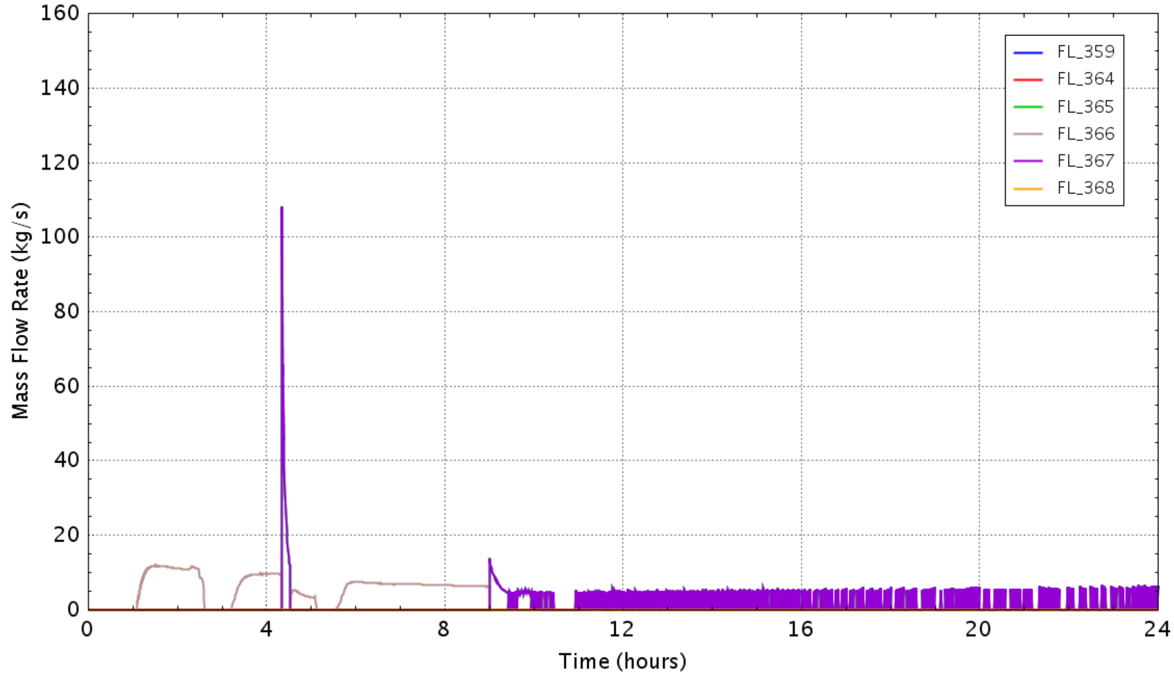

Figure D - 294 **Flow rate of the SRVs**

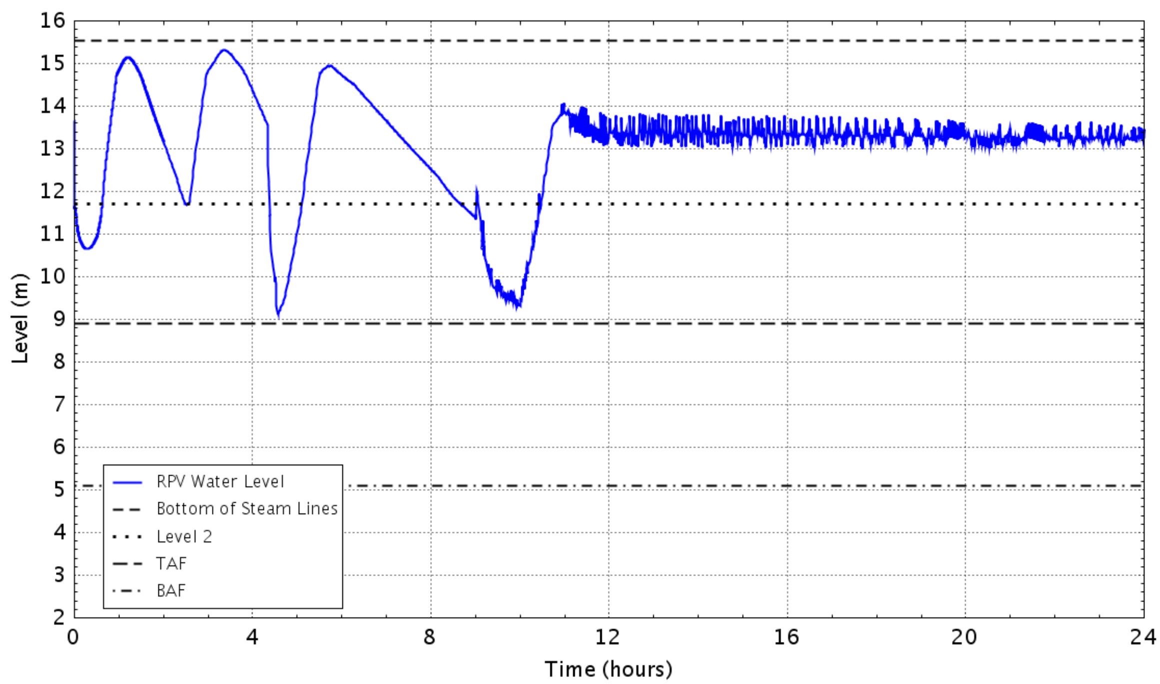

Figure D - 295 **RPV down comer water level**

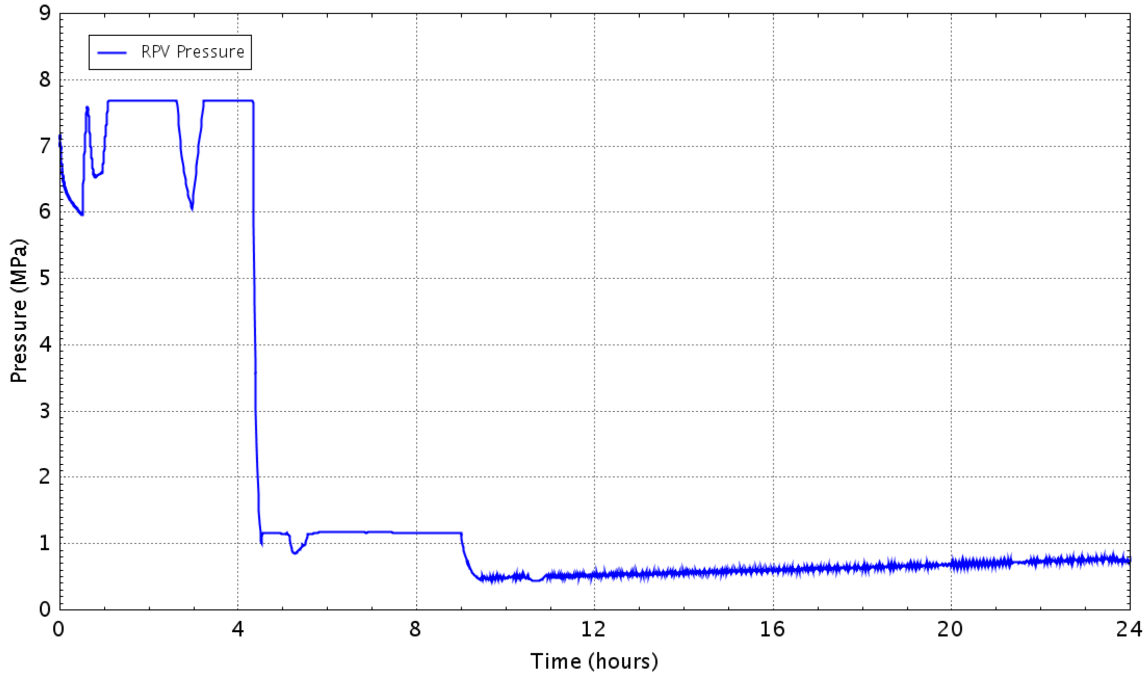

Figure D - 296 **Pressure in theRPV**

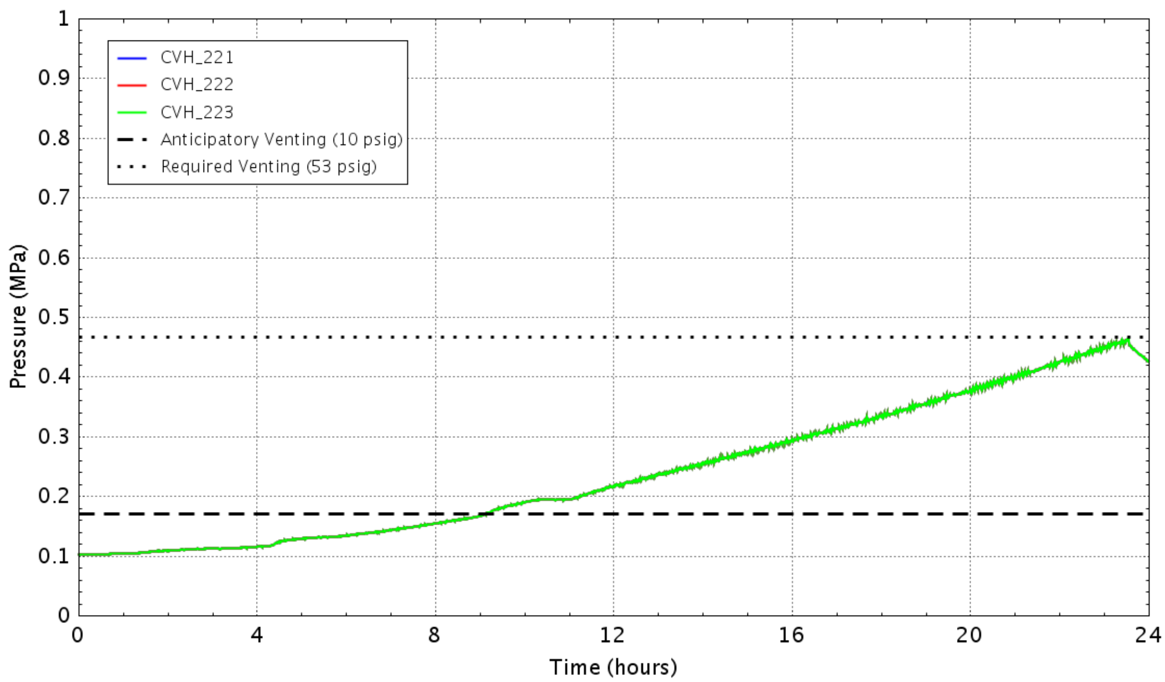

Figure D - 297 **Pressure in the wetwell**

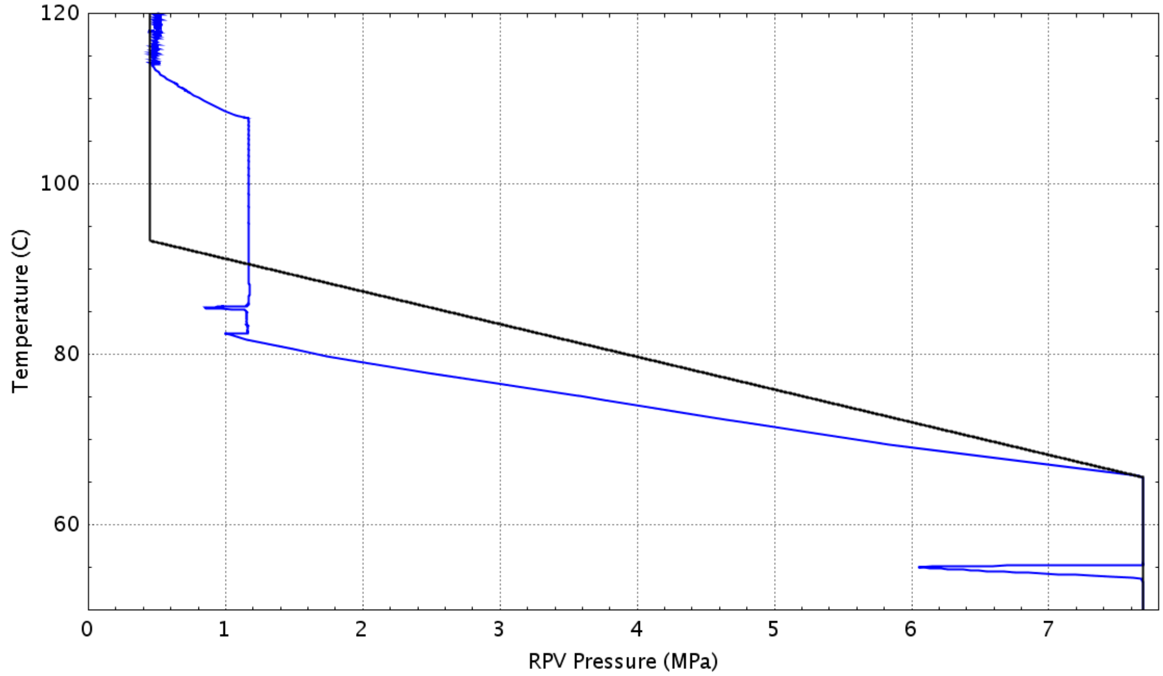

Figure D – 298 Plant status relative to the HCL curve (Graph 4 of the EOPs)

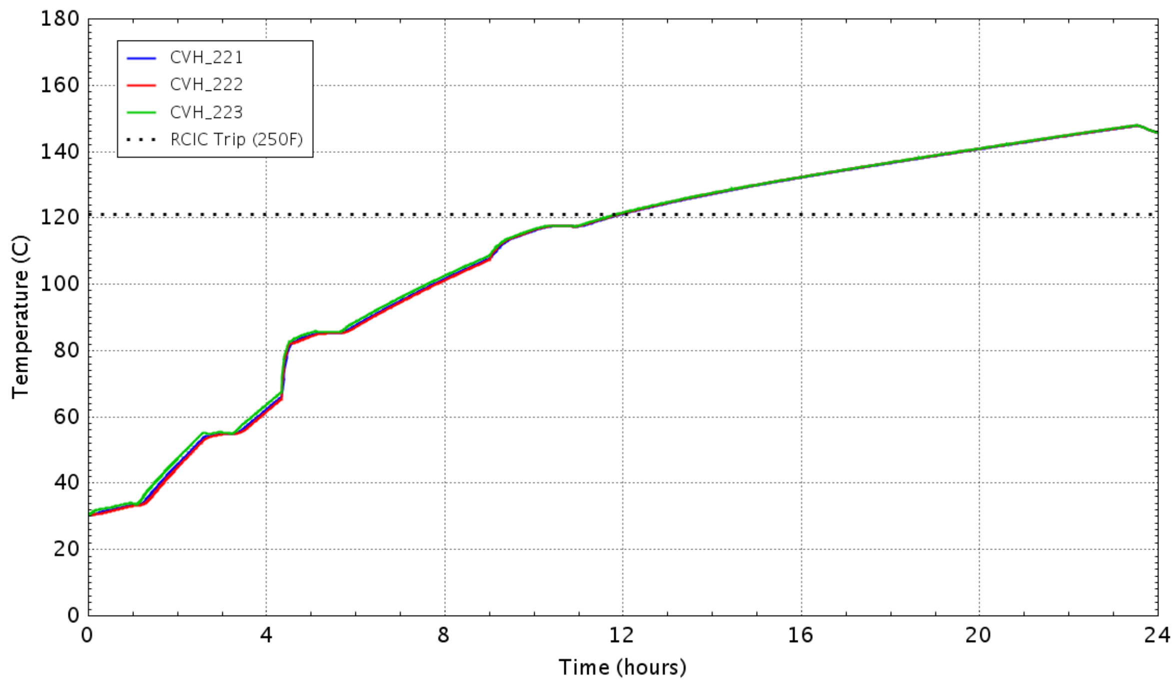

Figure D - 299 Water temperature in the wetwell

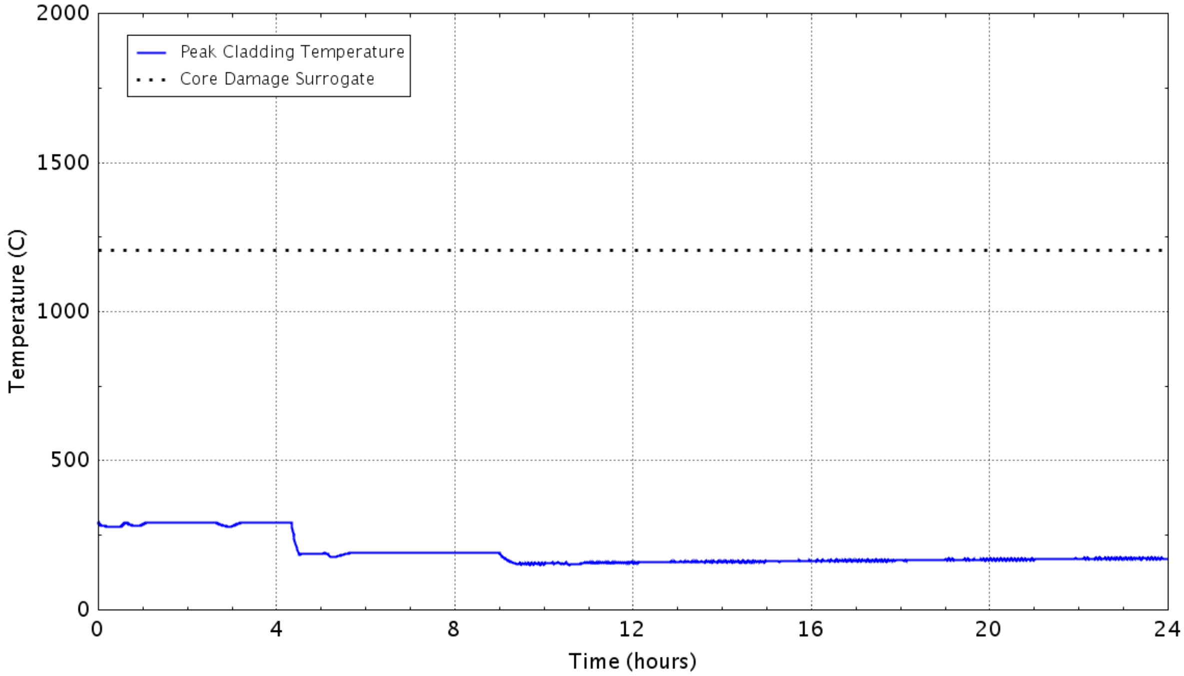

Figure D – 300 Peak temperature of the fuel cladding as a function oftime

D.3 Sensitivity Analyses

D.3.1 Case 7a: Sensitivity to LOOPGR-38-9 Case 7 with HPCI Available Instead of RCIC

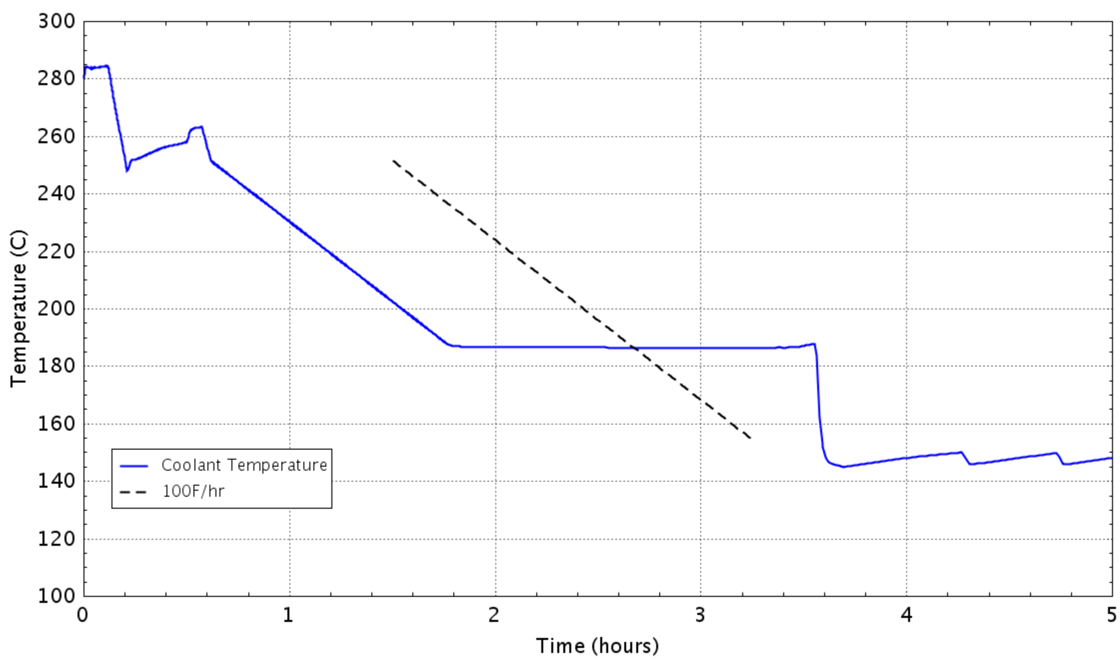

Figure D - 301 RPV cooldown rate

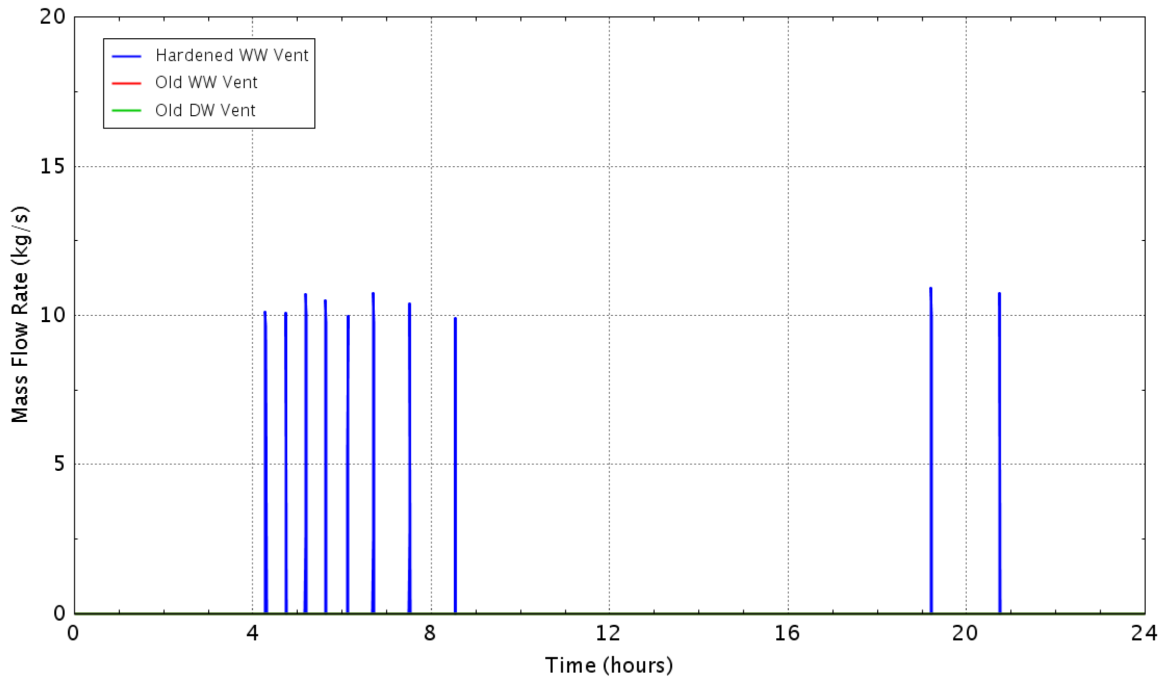

Figure D - 302 **Flow rate of the containment vents**

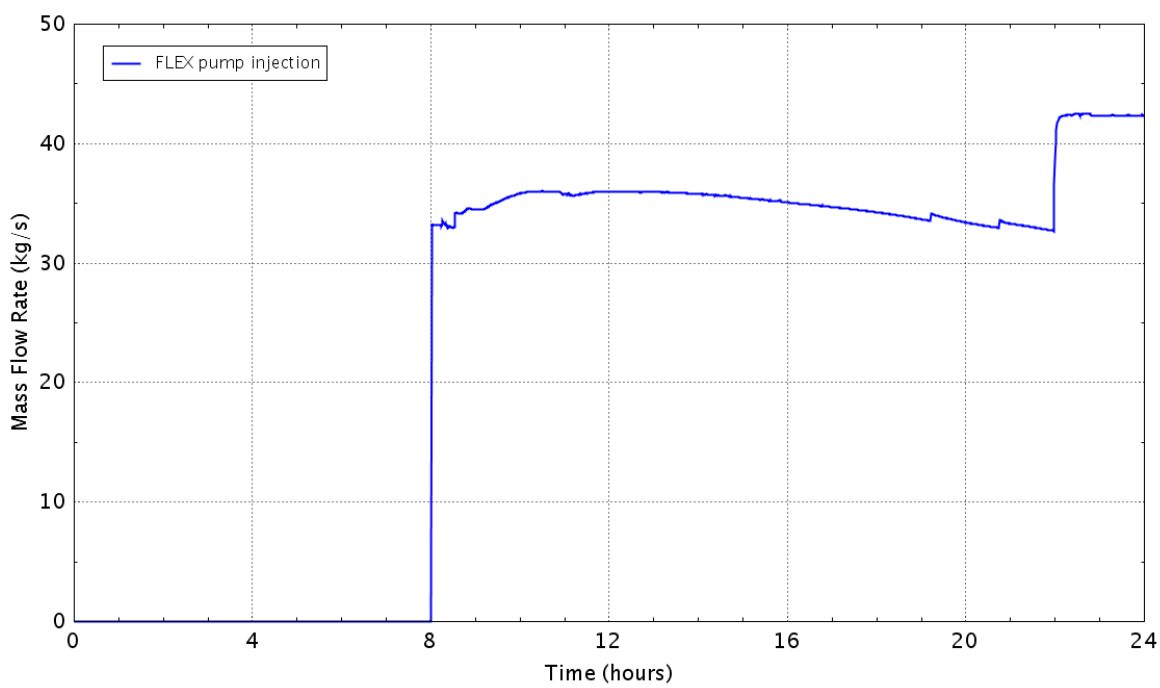

Figure D - 303 **Flow rate of the FLEX pump**

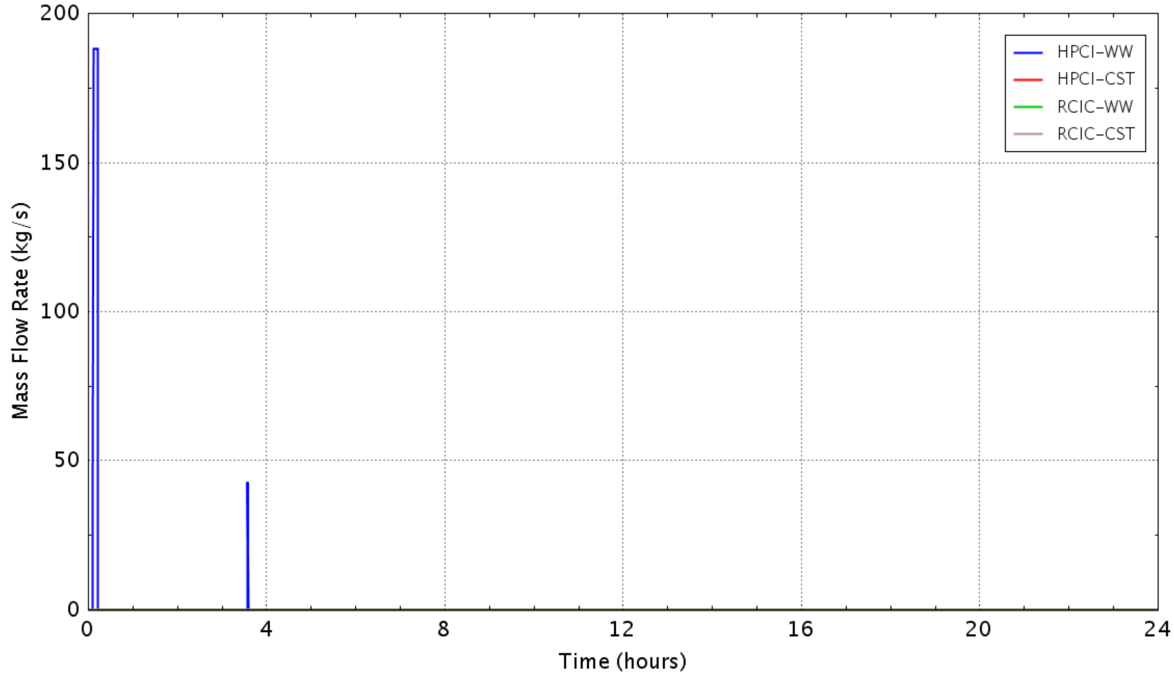

Figure D - 304 Flow rate of the HPCI/RCIC pumps

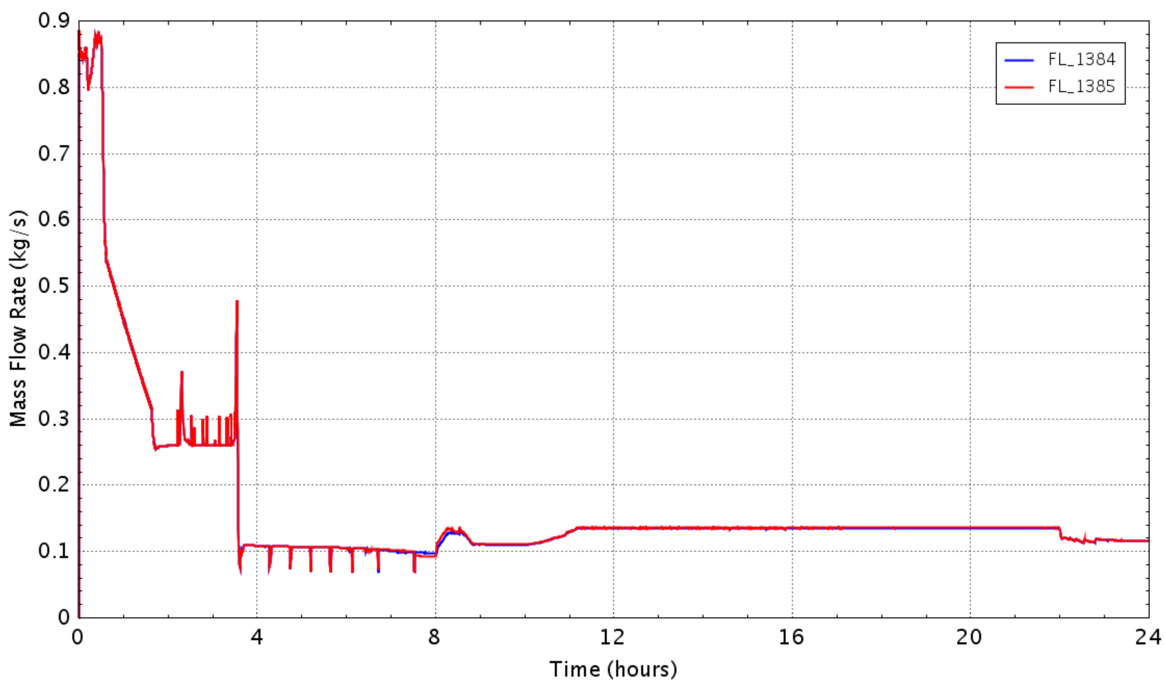

Figure D - 305 Flow rate of the recirculating pump seal leakage

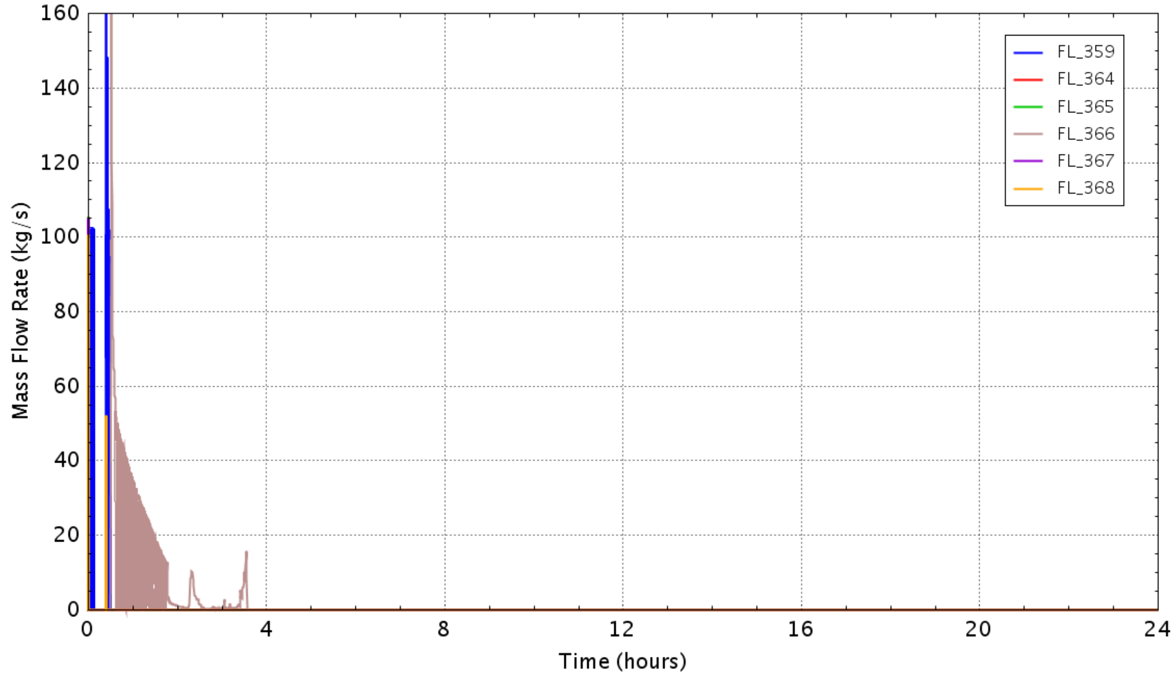

Figure D - 306 **Flow rate of the SRVs**

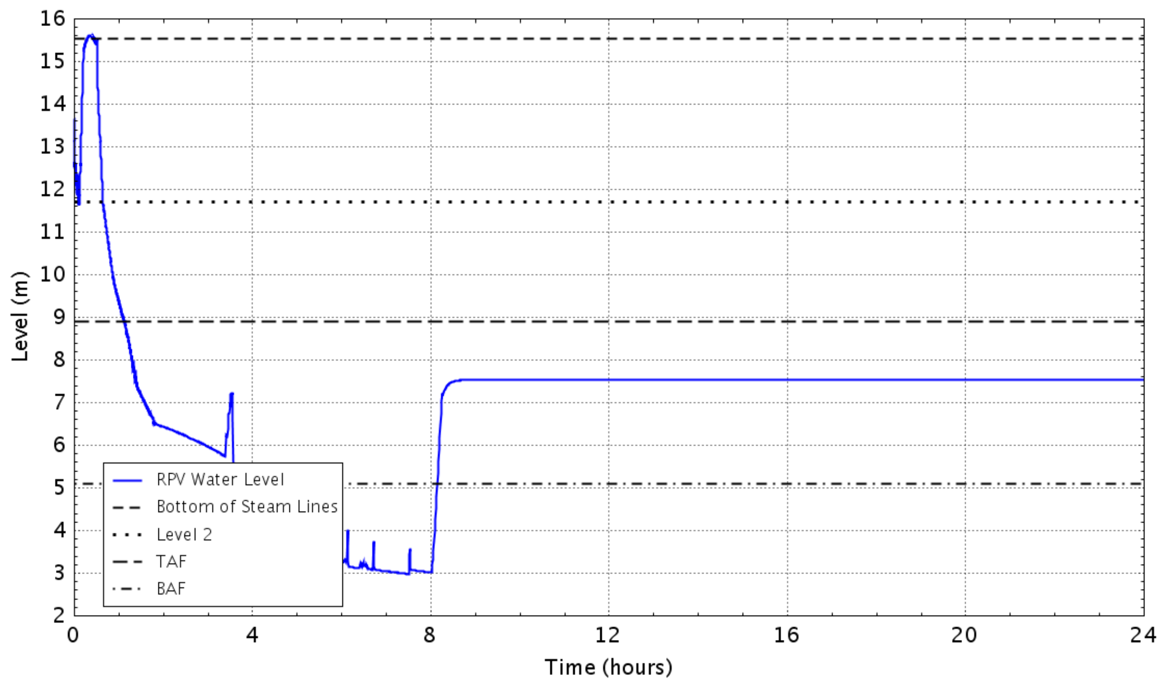

Figure D - 307 **RPV down comer water level**

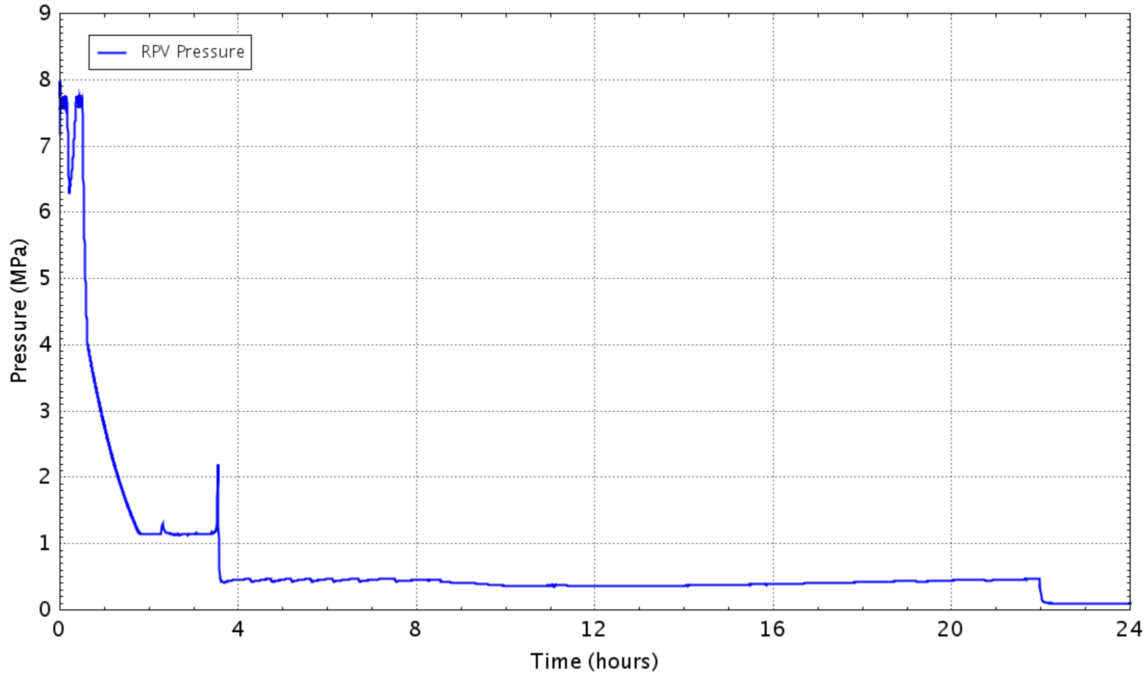

Figure D - 308 **Pressure in theRPV**

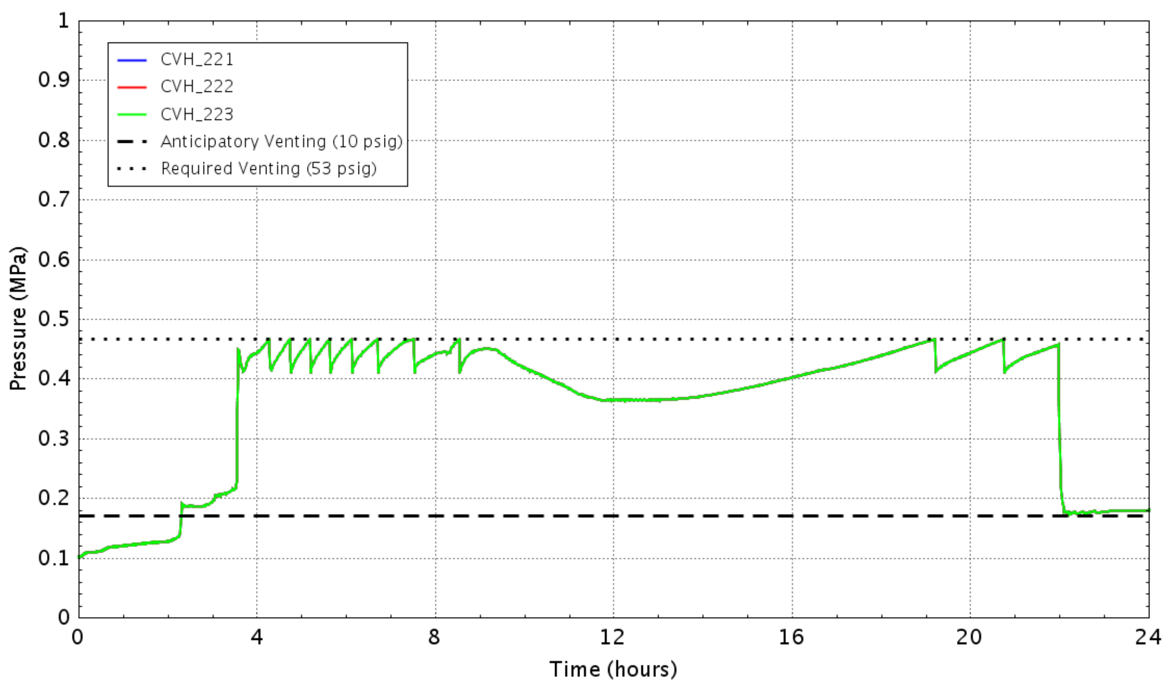

Figure D - 309 **Pressure in the wetwell**

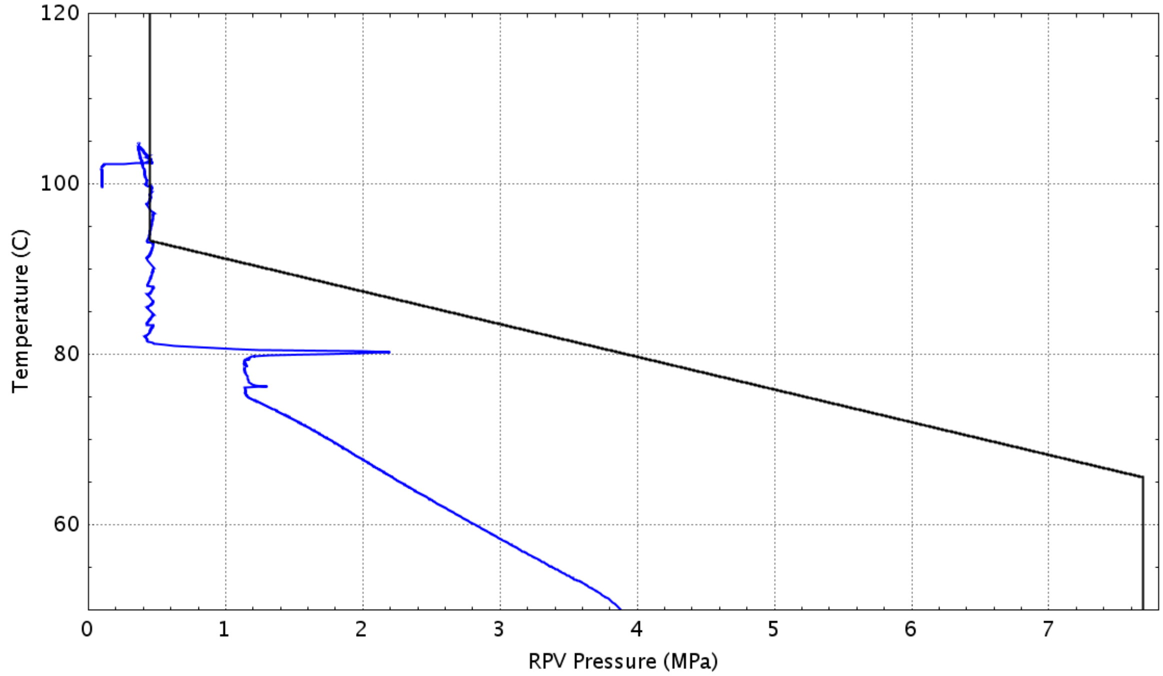

Figure D – 310 Plant status relative to the HCL curve (Graph 4 of the EOPs)

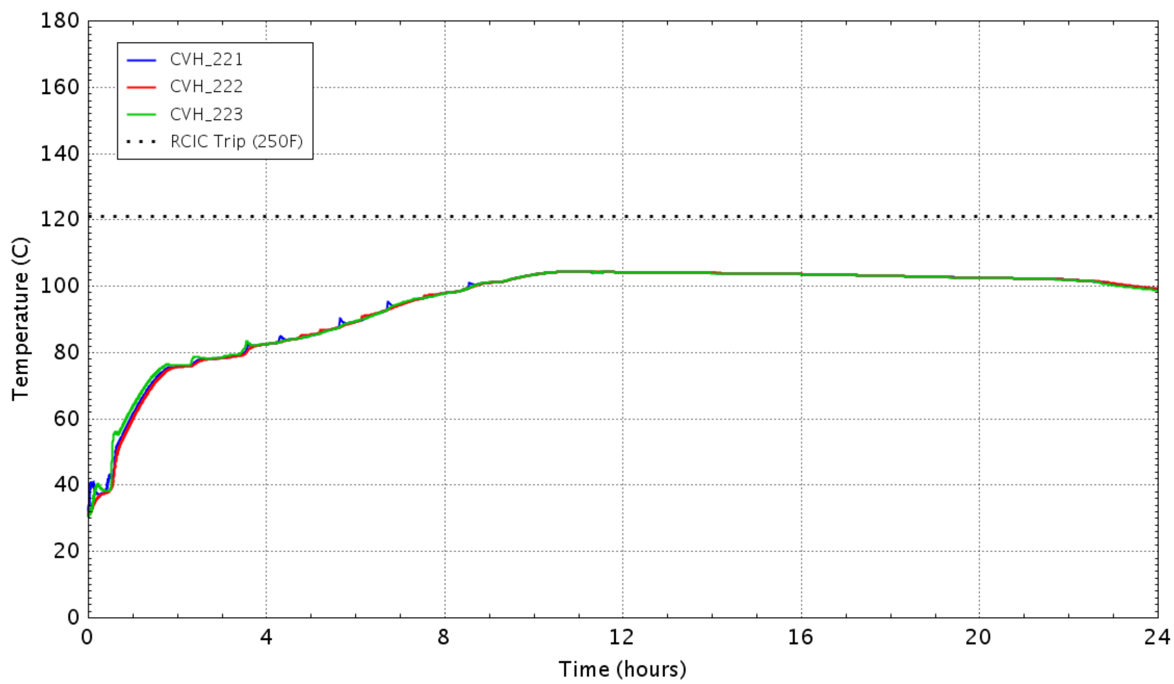

Figure D - 311 Water temperature in the wetwell

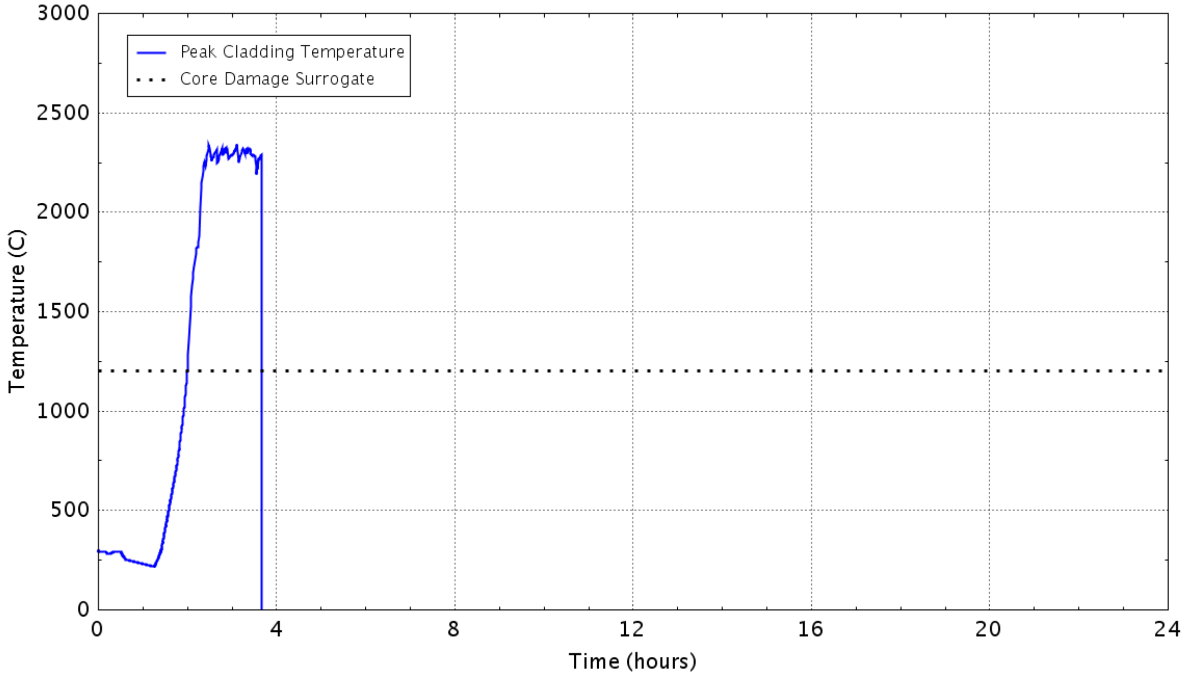

Figure D – 312 Peak temperature of the fuel cladding as a function oftime

D.3.2 Case 8a: Sensitivity to LOOPGR-38-9 Case 8 with HPCI Available Instead of RCIC

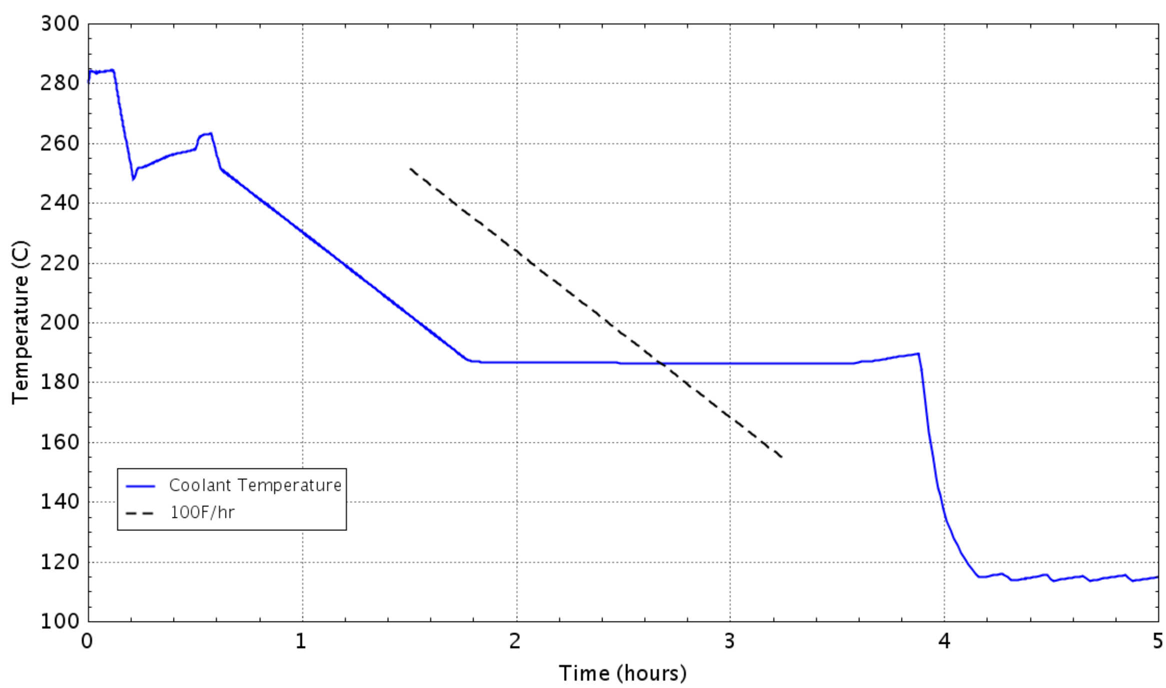

Figure D - 313 RPV cooldown rate

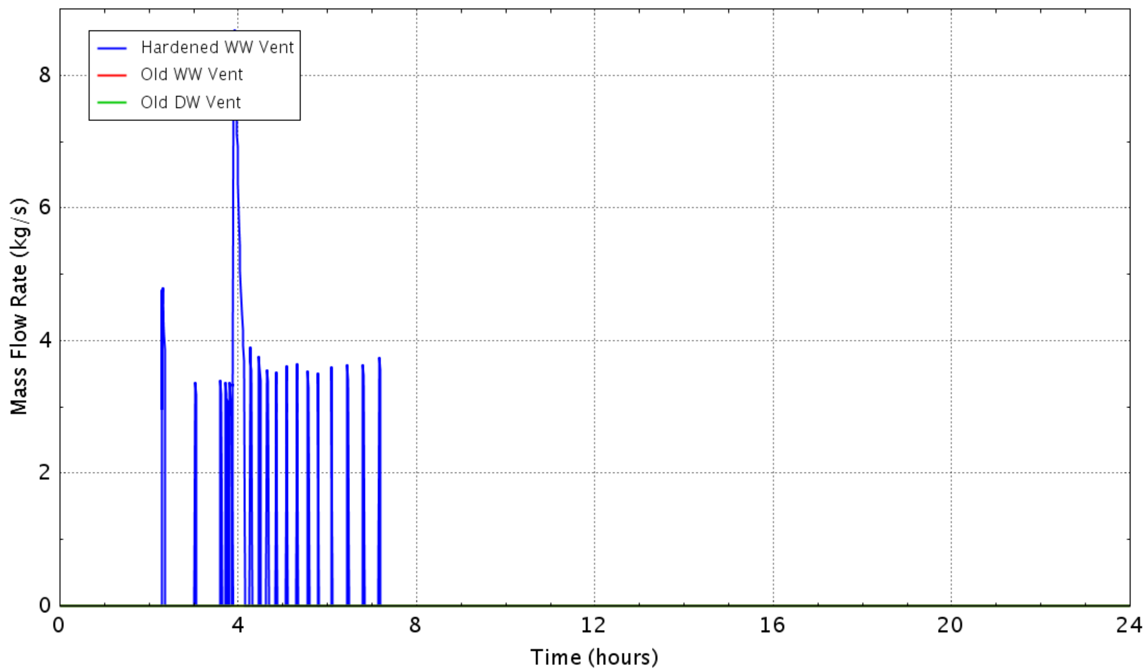

Figure D - 314 Flow rate of the containment vents

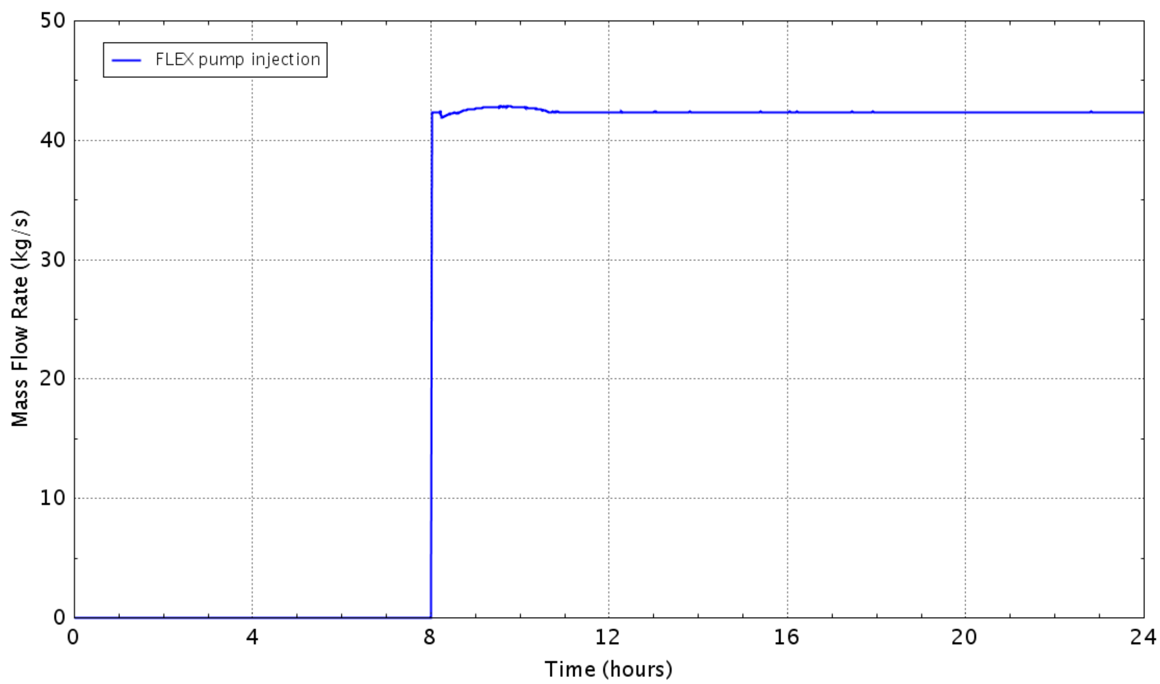

Figure D - 315 Flow rate of the FLEX pump

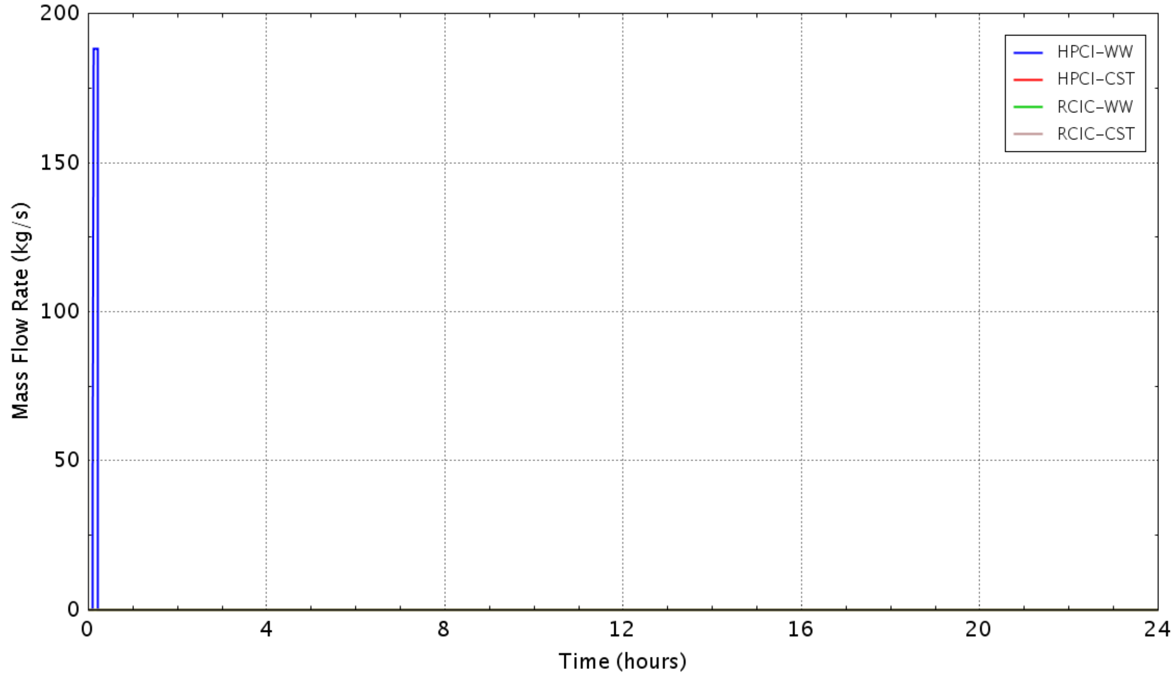

Figure D - 316 **Flow rate of the HPCI/RCIC pumps**

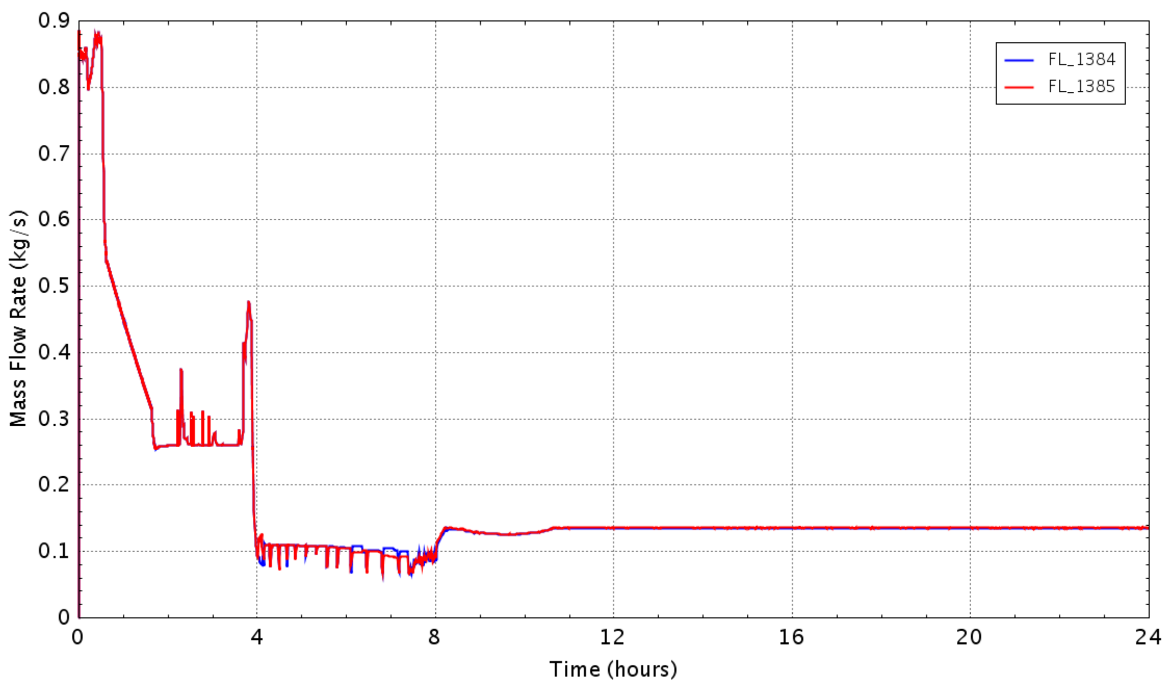

Figure D - 317 **Flow rate of the recirculating pump seal leakage**

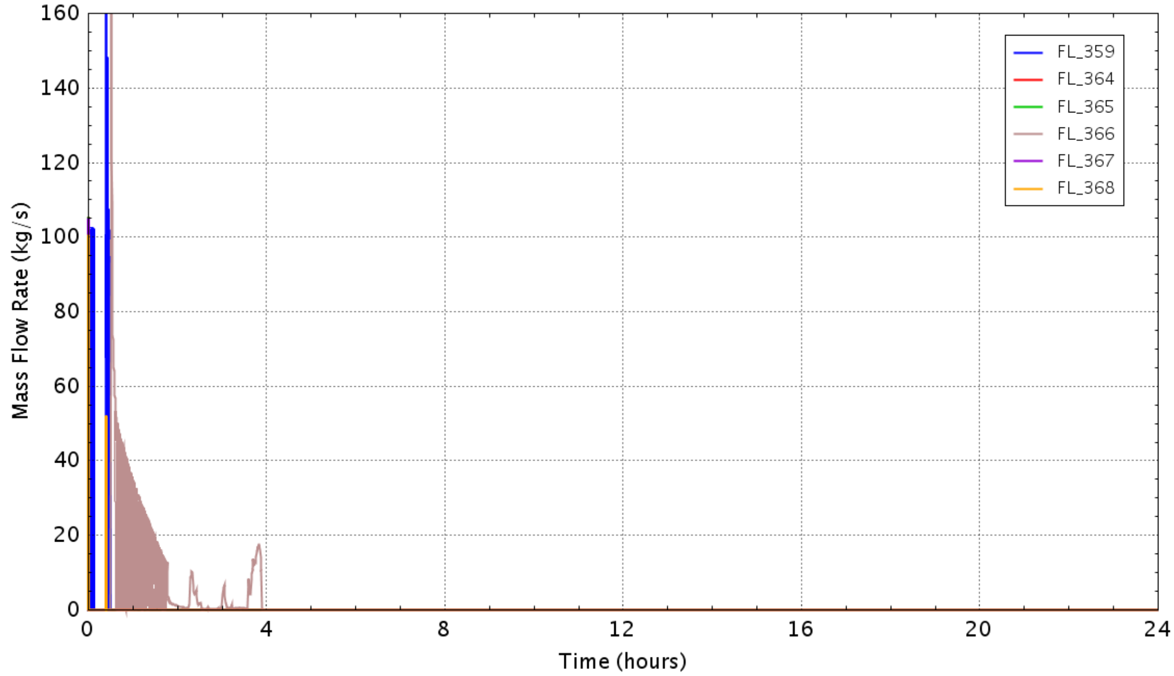

Figure D - 318 Flow rate of the SRVs

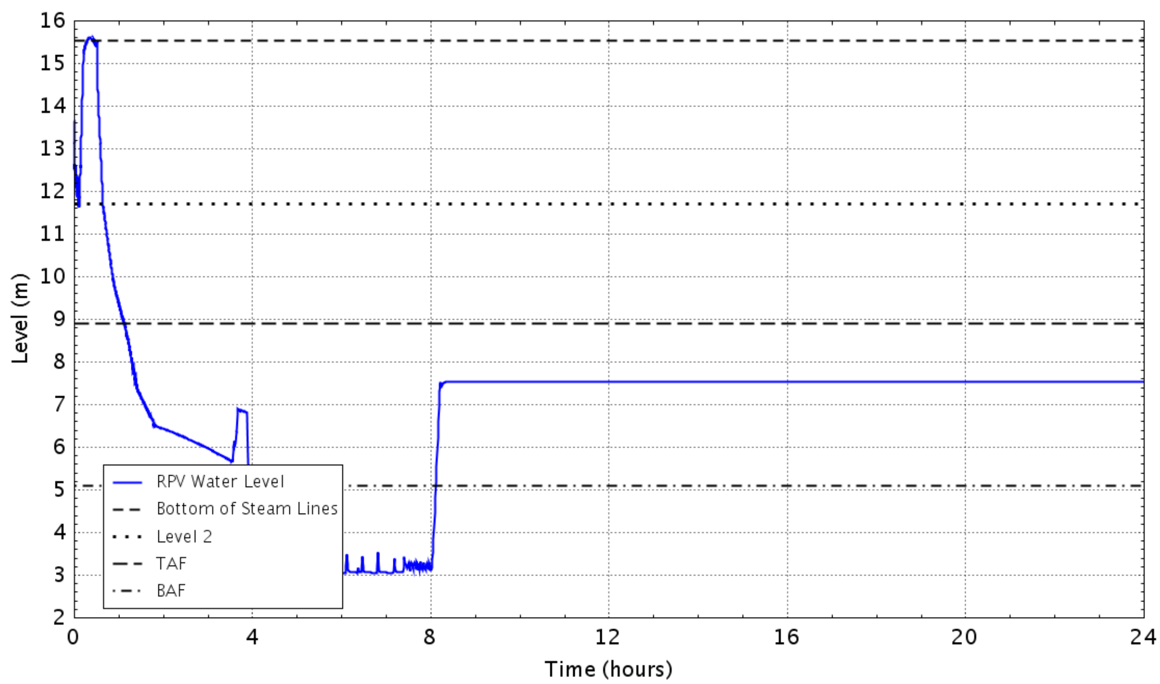

Figure D - 319 RPV down comer water level

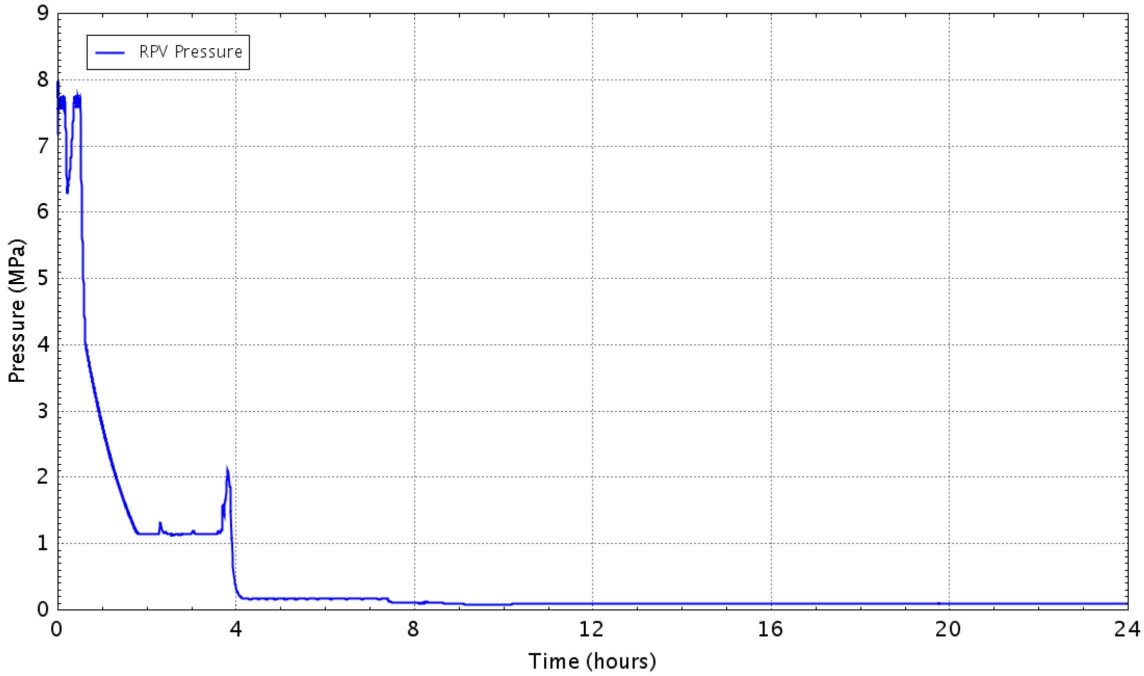

Figure D - 320 Pressure in theRPV

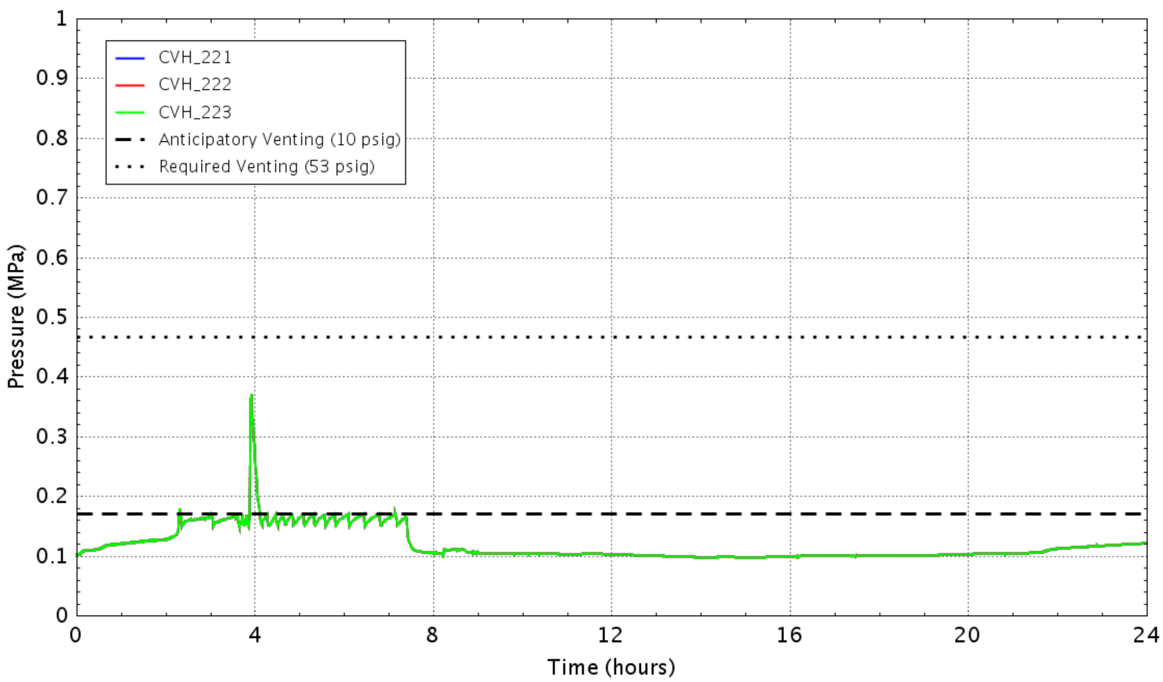

Figure D - 321 Pressure in the wetwell

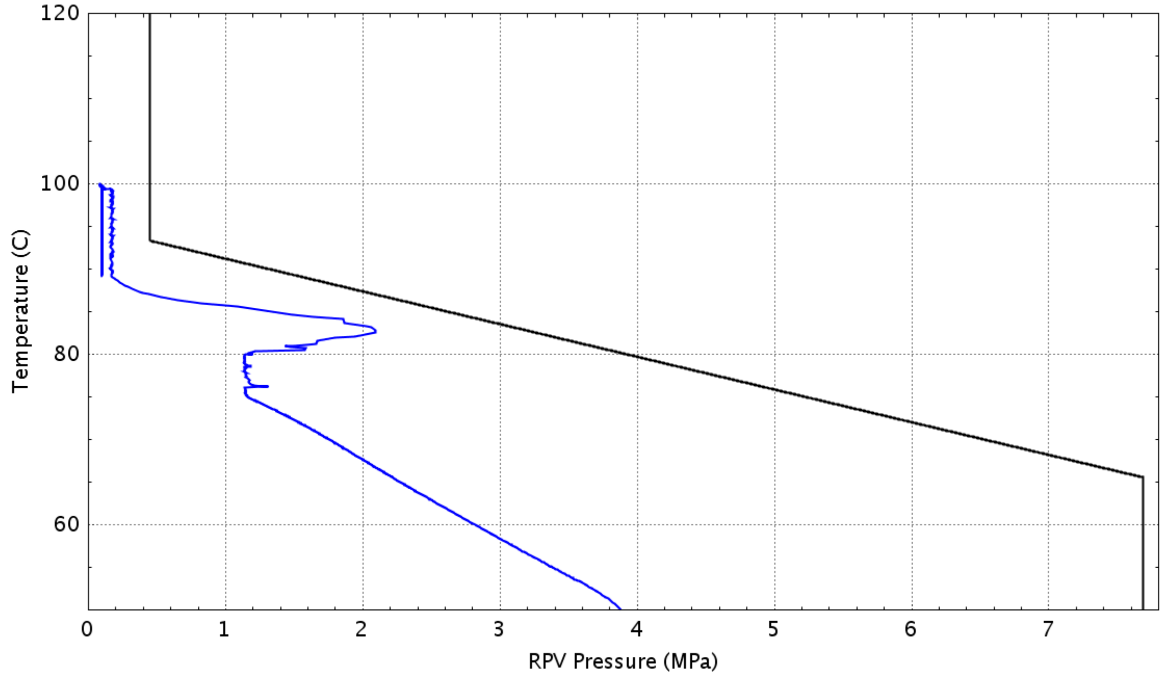

Figure D – 322 Plant status relative to the HCL curve (Graph 4 of the EOPs)

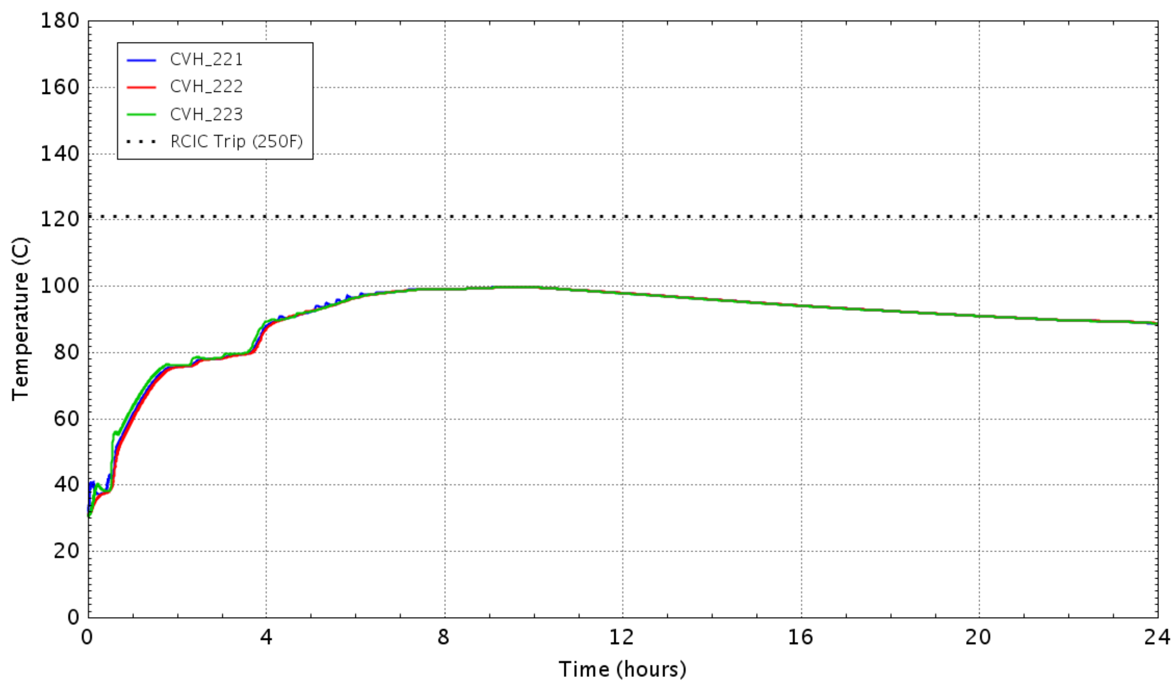

Figure D - 323 Water temperature in the wetwell

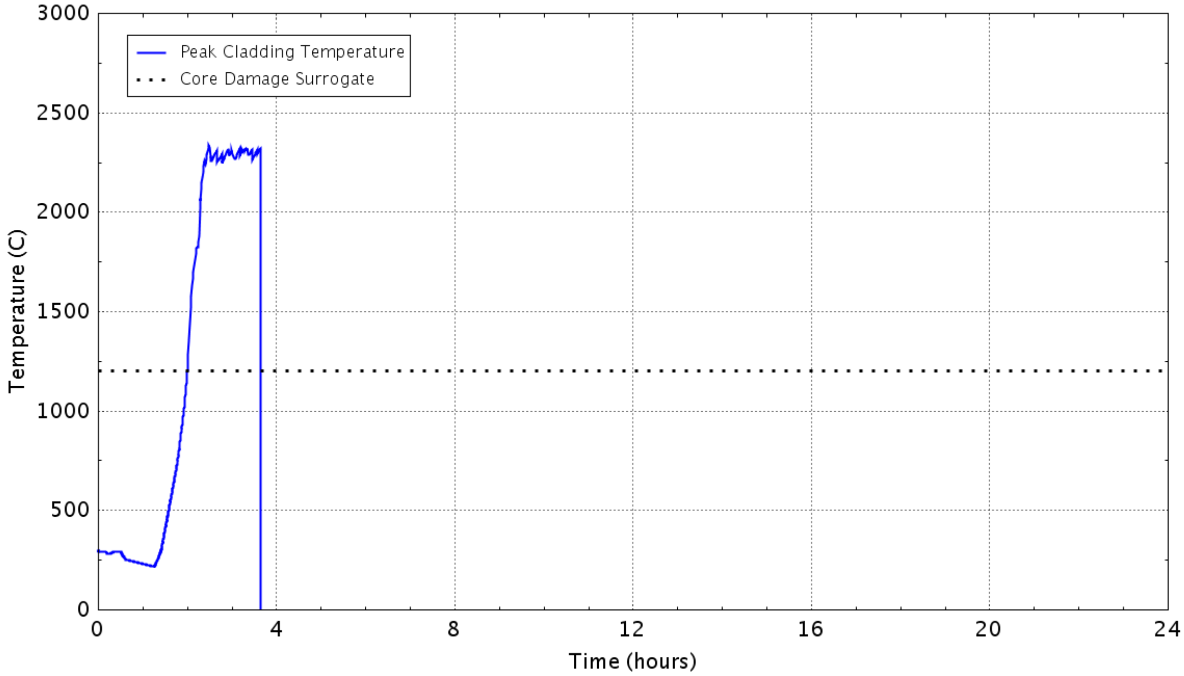

Figure D – 324 Peak temperature of the fuel cladding as a function oftime

D.3.3 Case 8b: Sensitivity to LOOPGR-38-9 Case 8 with FLEXDelivered Flow Reduced by 50%

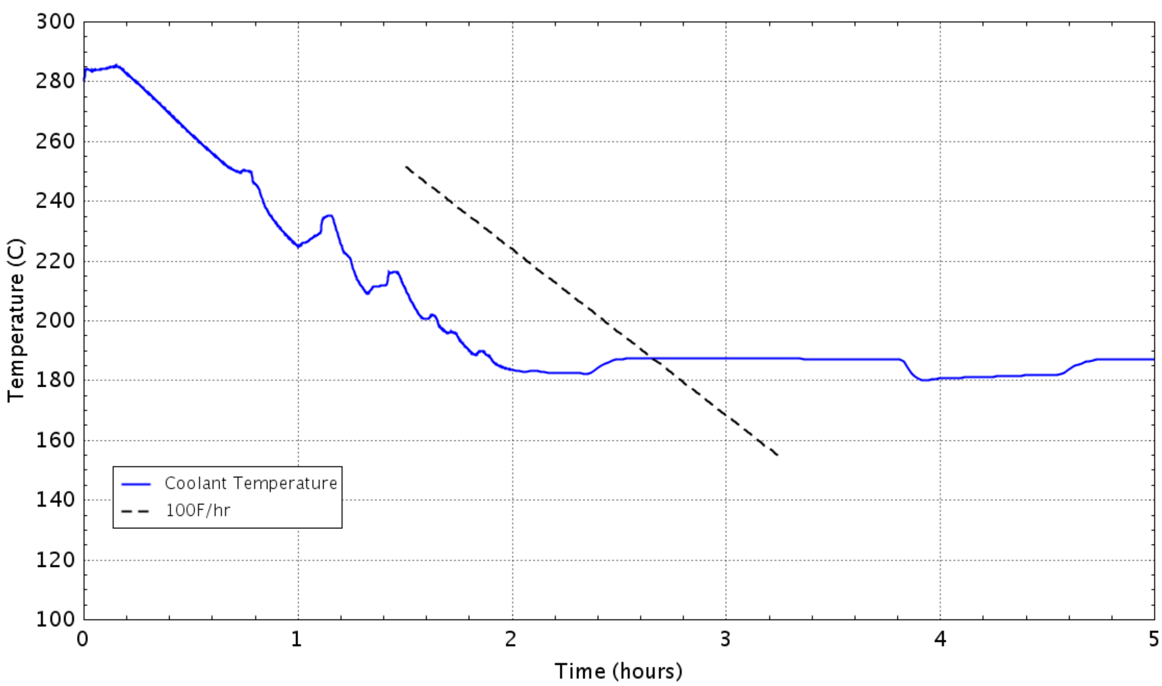

Figure D - 325 RPV cooldown rate

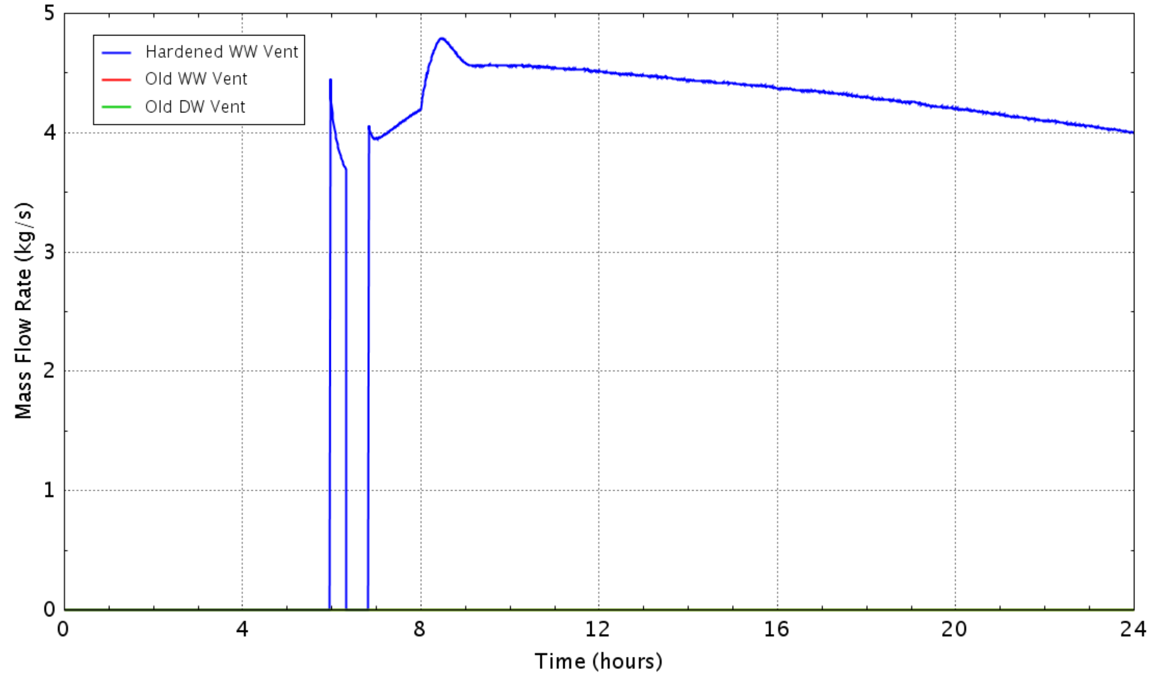

Figure D - 326 **Flow rate of the containment vents**

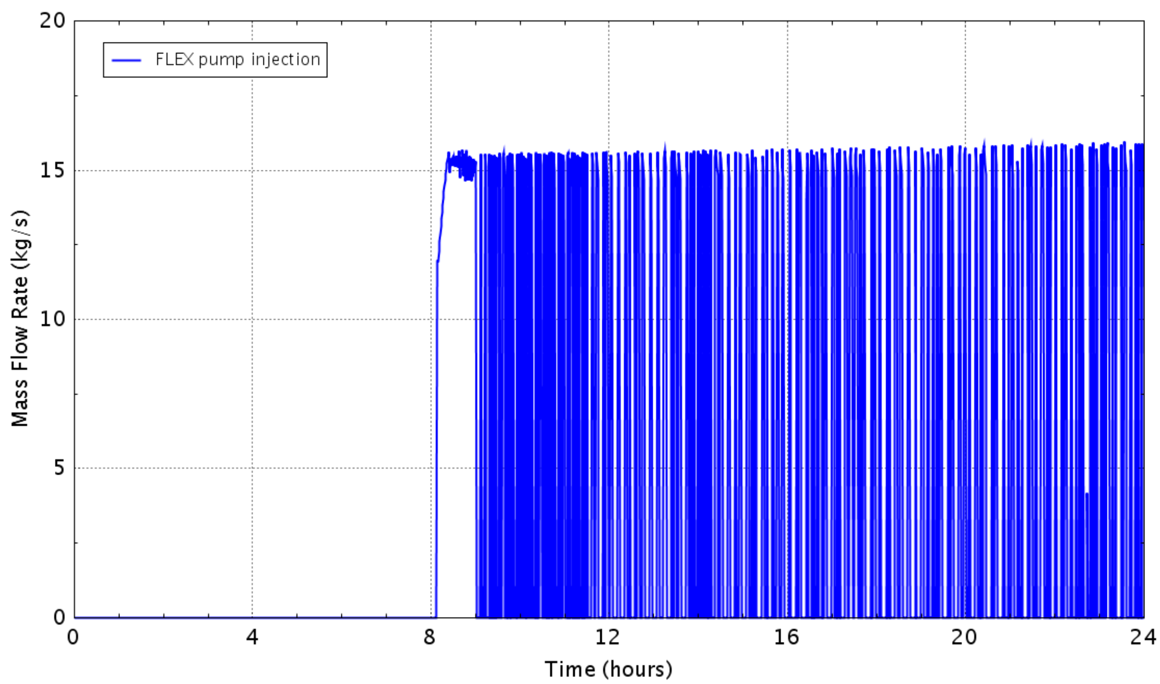

Figure D - 327 **Flow rate of the FLEX pump**

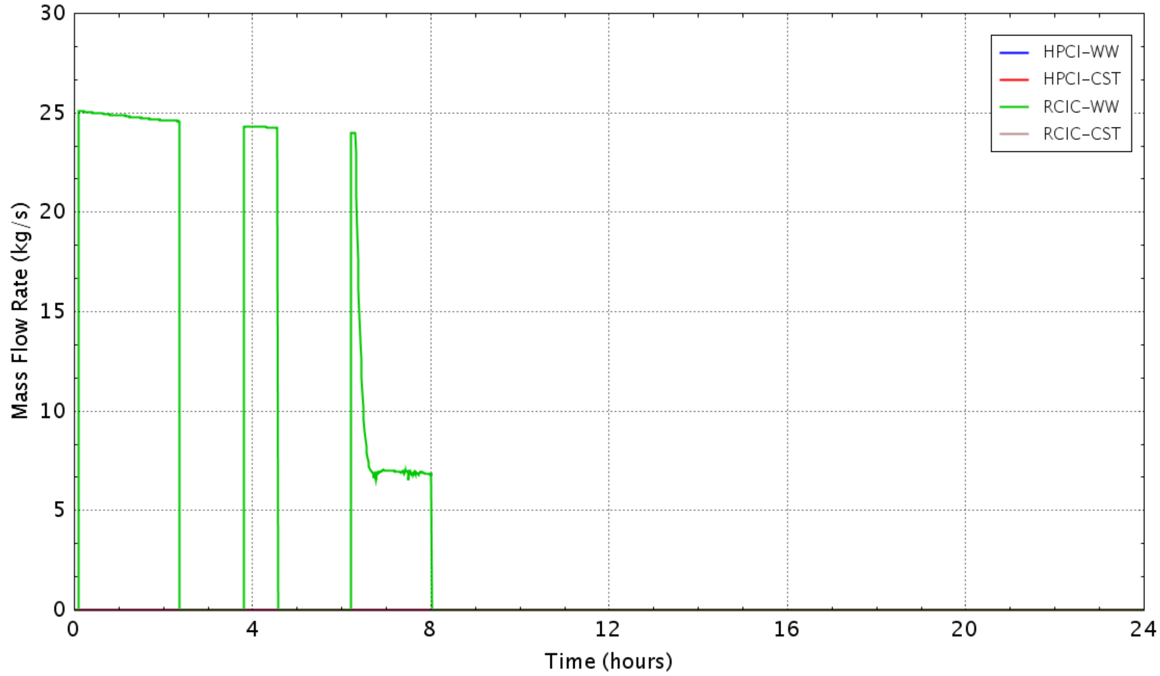

Figure D - 328 **Flow rate of the HPCI/RCIC pumps**

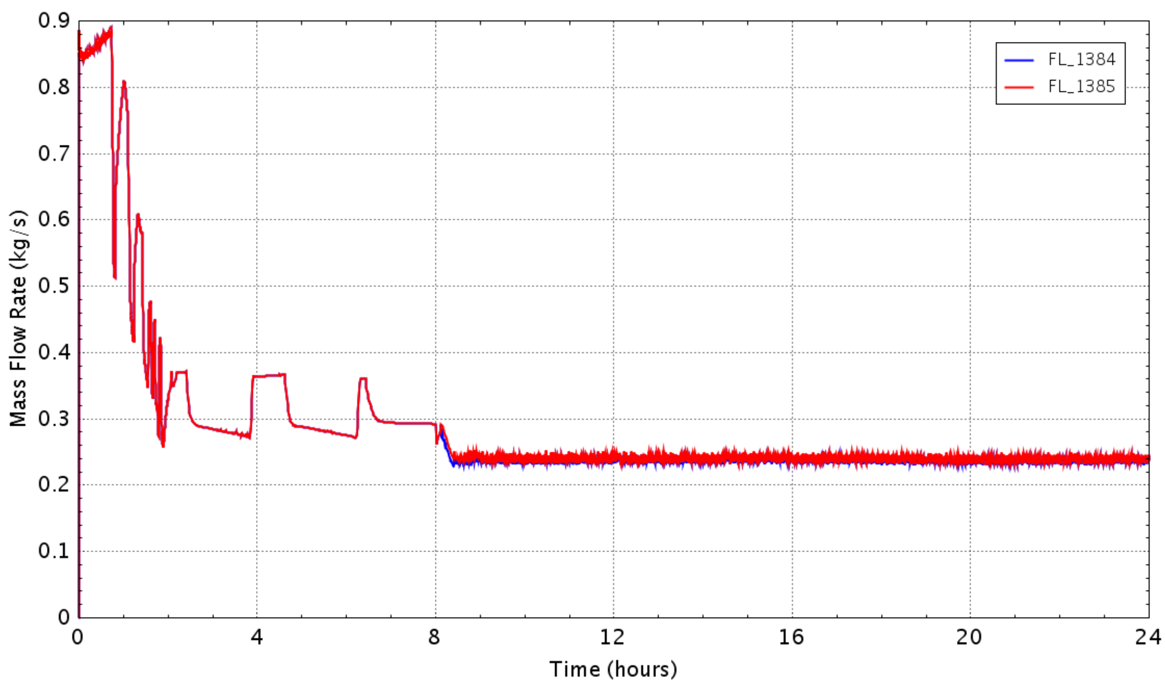

Figure D - 329 **Flow rate of the recirculating pump seal leakage**

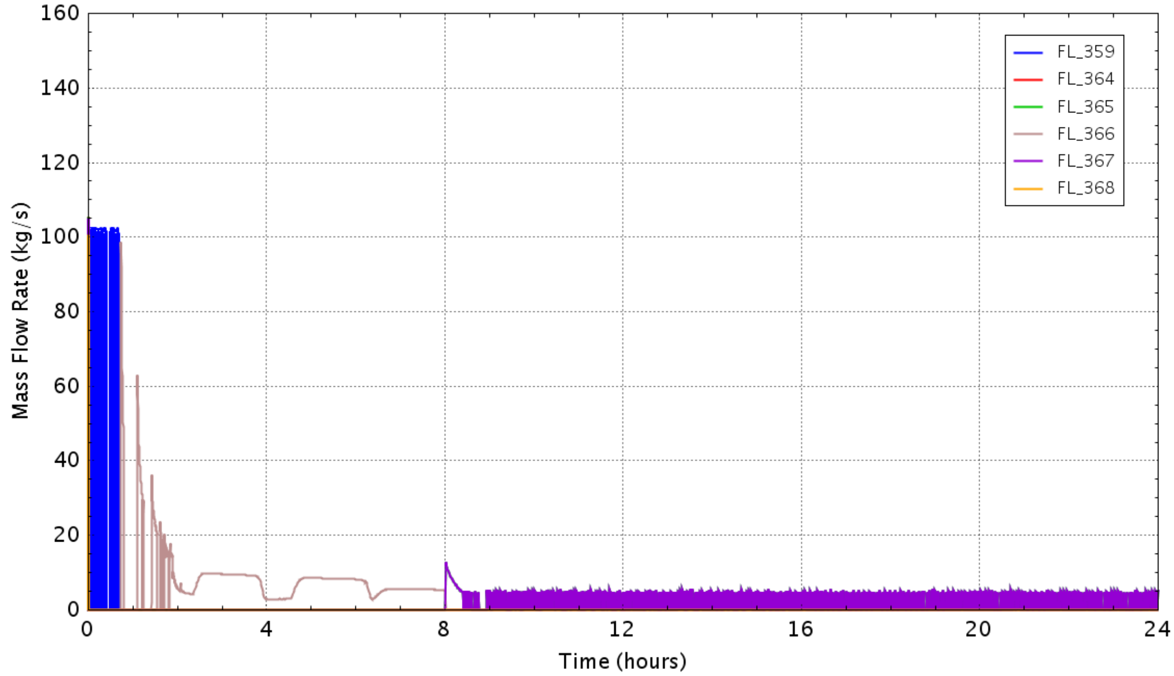

Figure D - 330 Flow rate of the SRVs

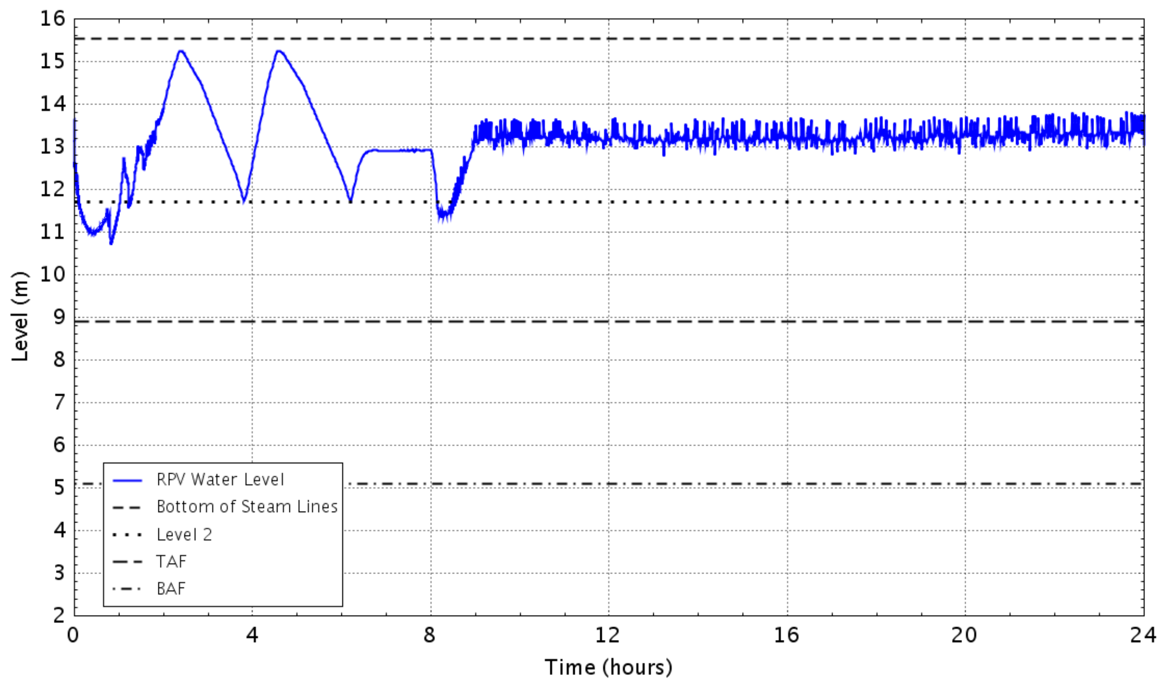

Figure D - 331 RPV down comer water level

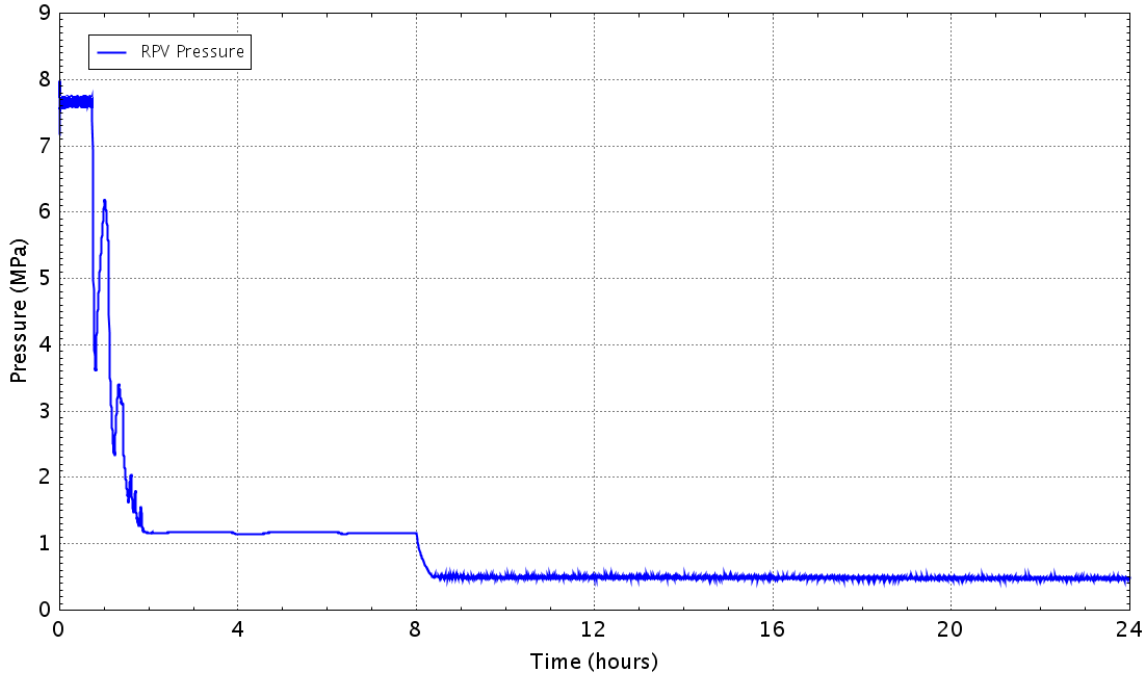

Figure D - 332 **Pressure in theRPV**

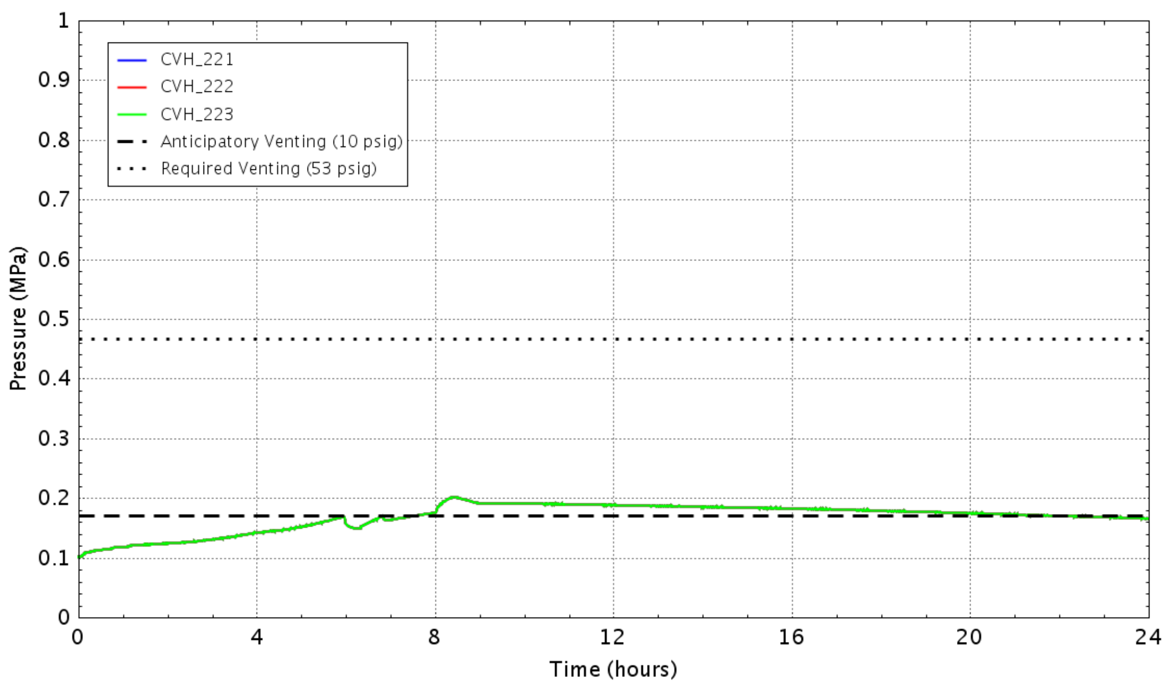

Figure D - 333 **Pressure in the wetwell**

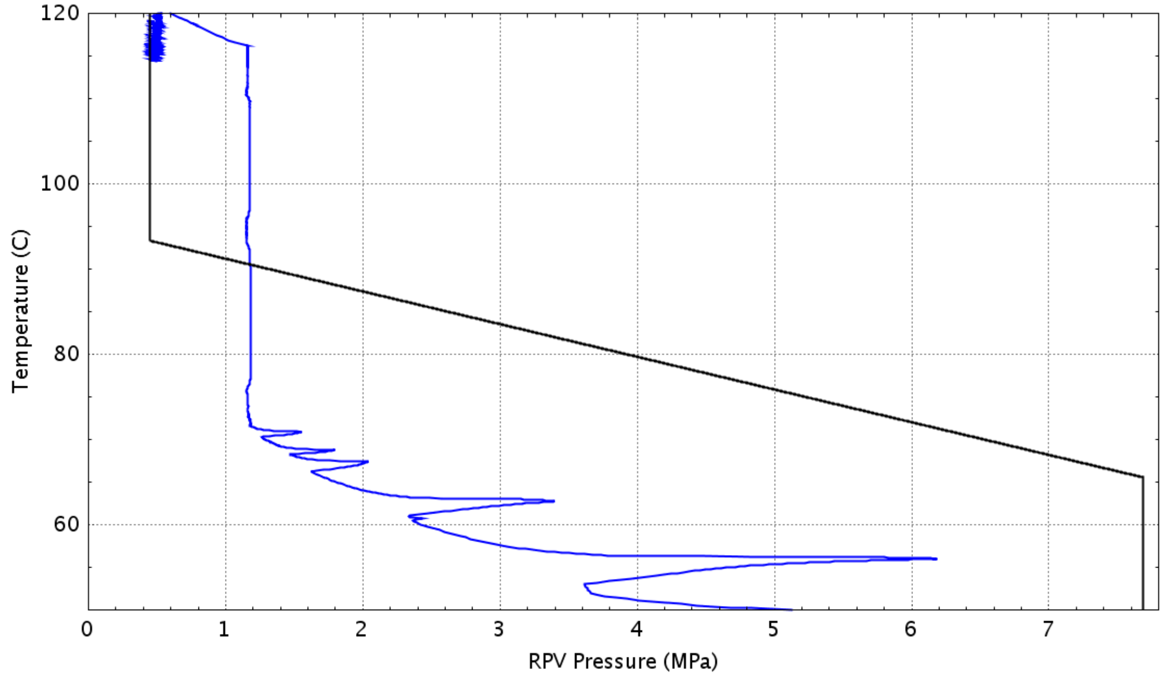

Figure D – 334 Plant status relative to the HCL curve (Graph 4 of the EOPs)

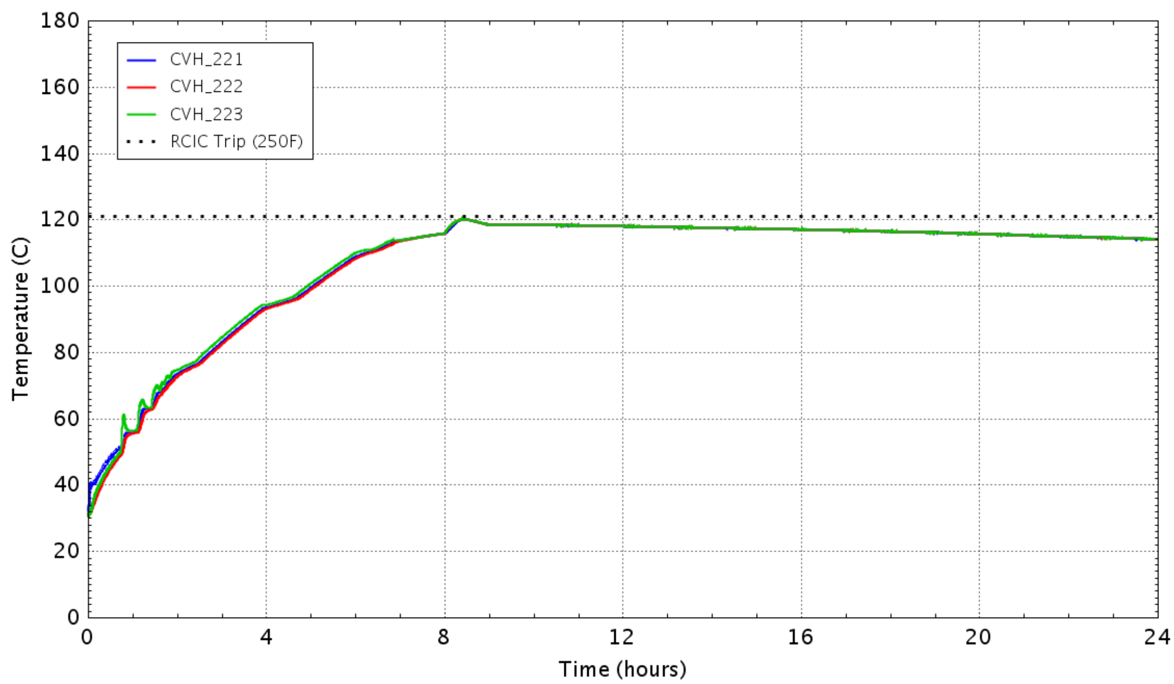

Figure D - 335 Water temperature in the wetwell

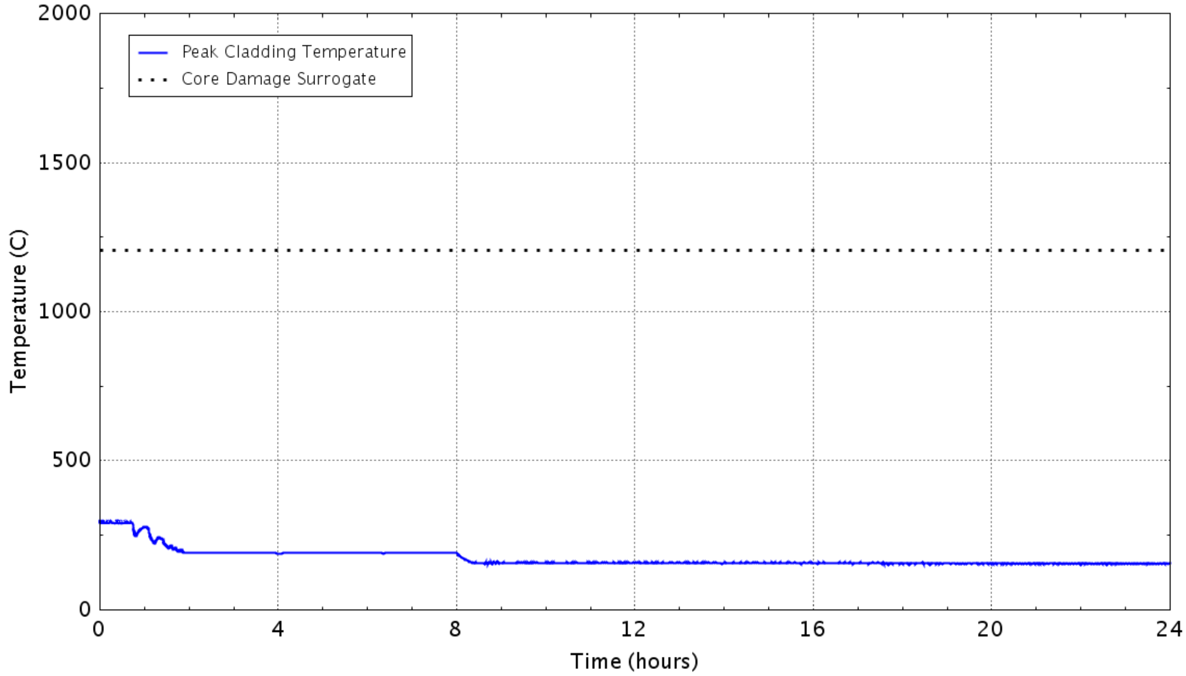

Figure D – 336 Peak temperature of the fuel cladding as a function oftime

D.3.4 Case 8c: Sensitivity to LOOPGR-38-9 Case 8 with Increased RCP Seal Leakage $(13 m^3/hr)$

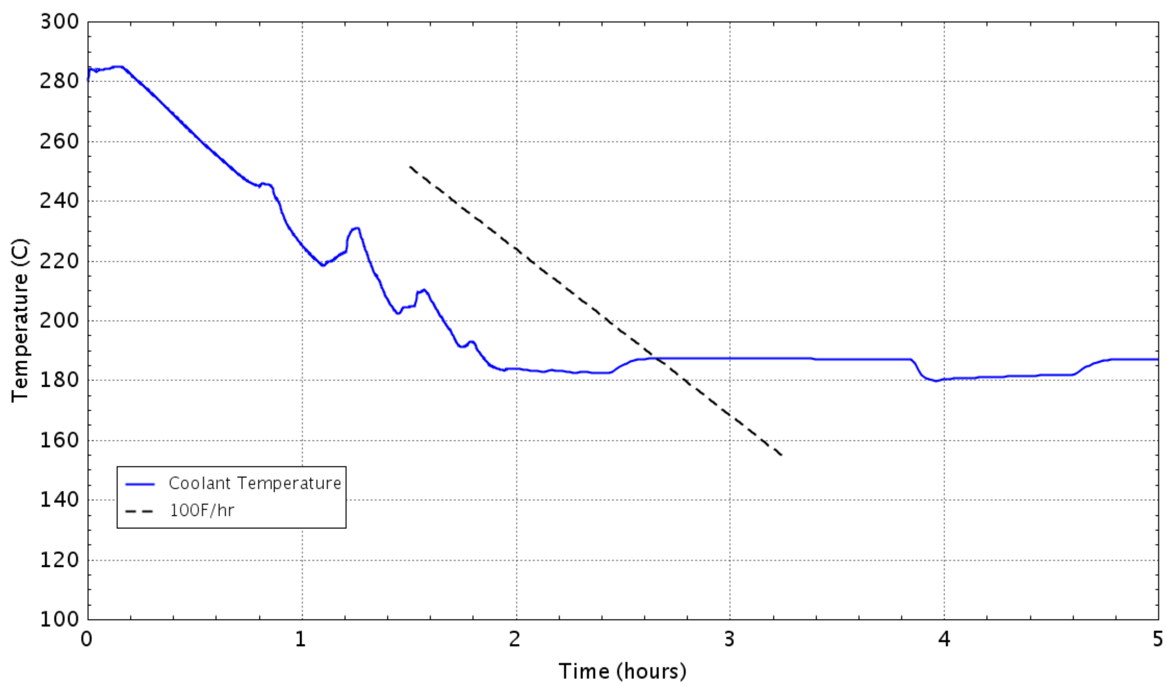

Figure D - 337 RPV cooldown rate

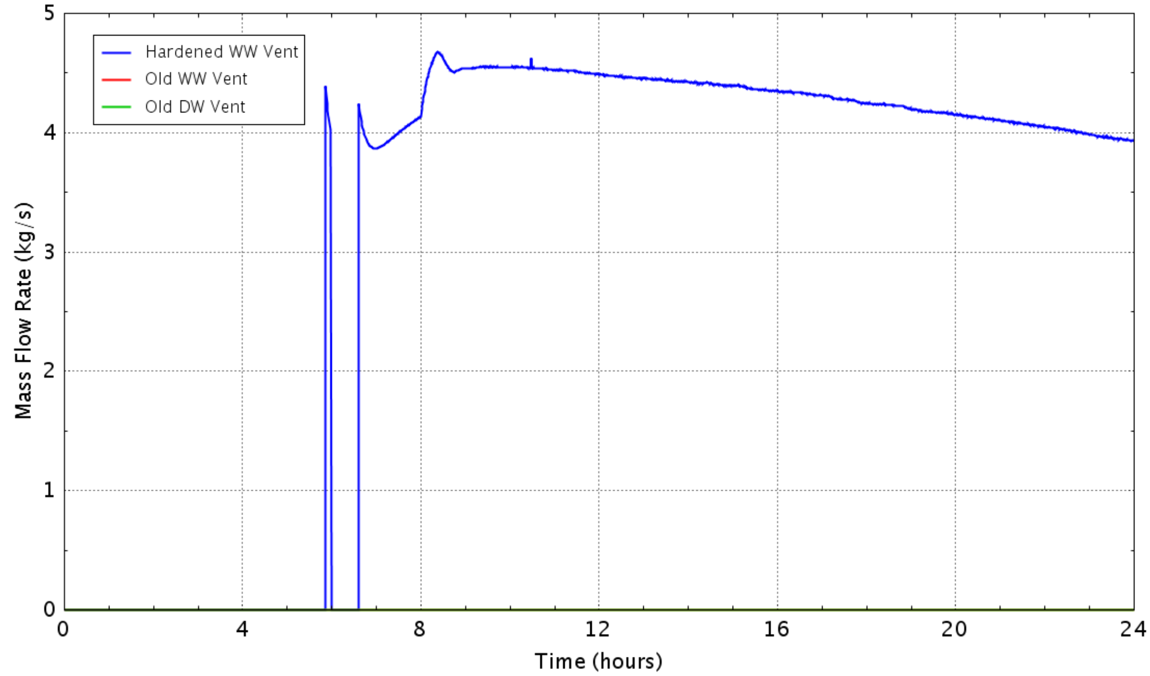

Figure D - 338 Flow rate of the containment vents

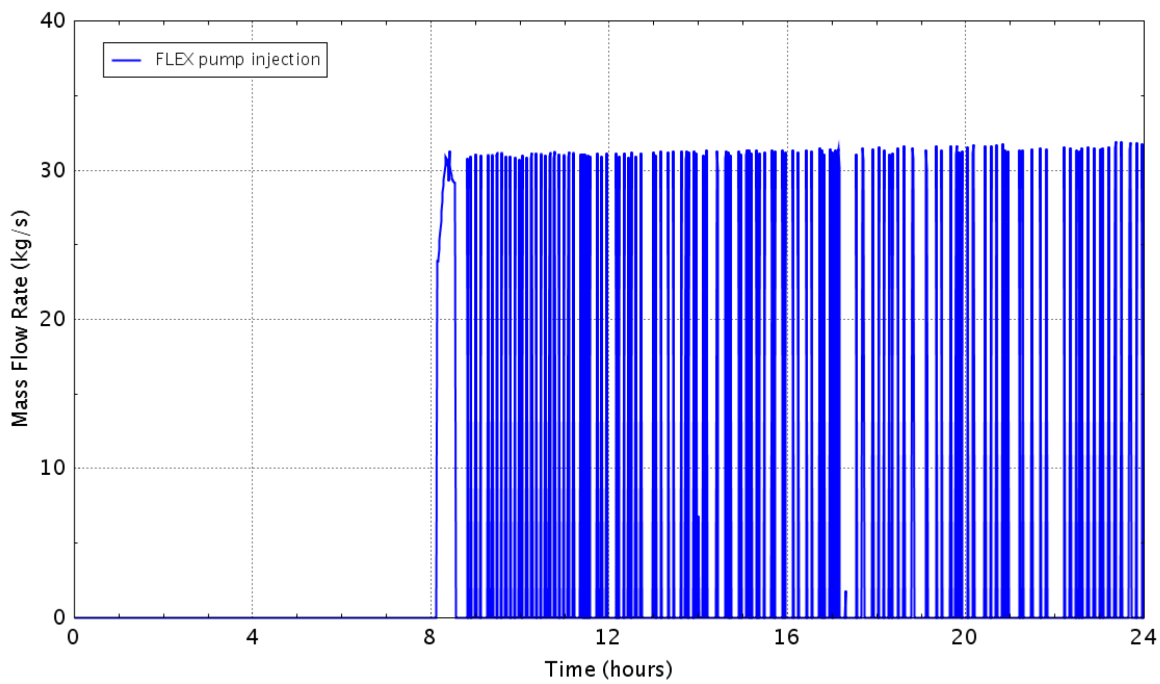

Figure D - 339 Flow rate of the FLEX pump

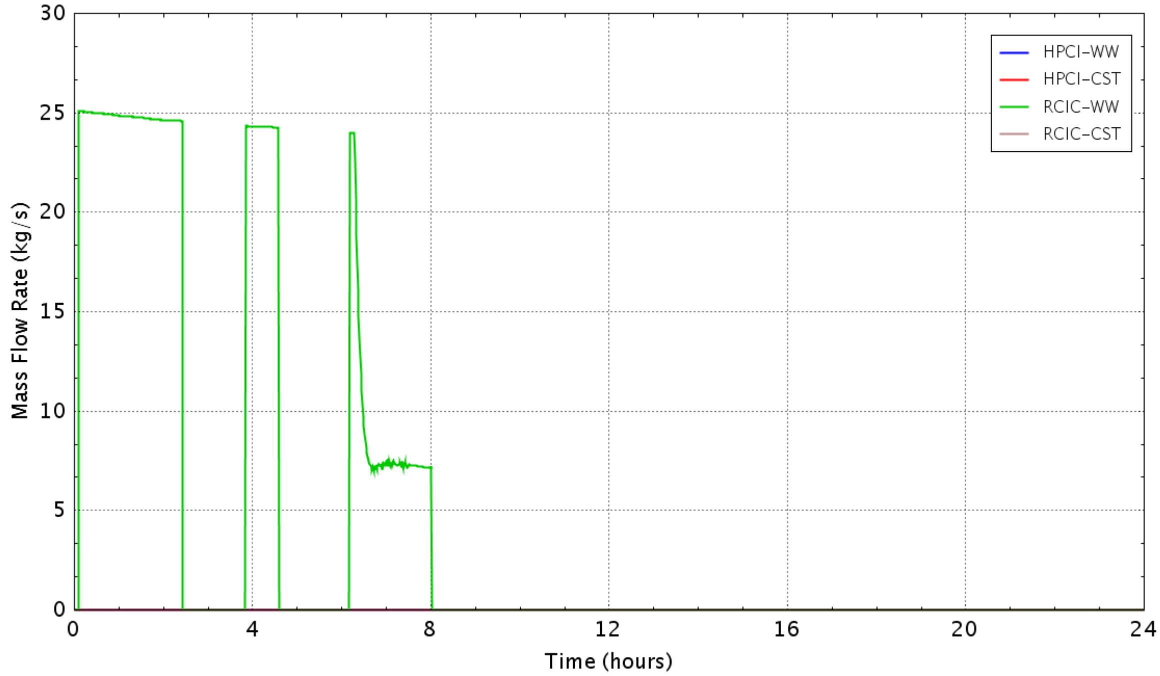

Figure D - 340 **Flow rate of the HPCI/RCIC pumps**

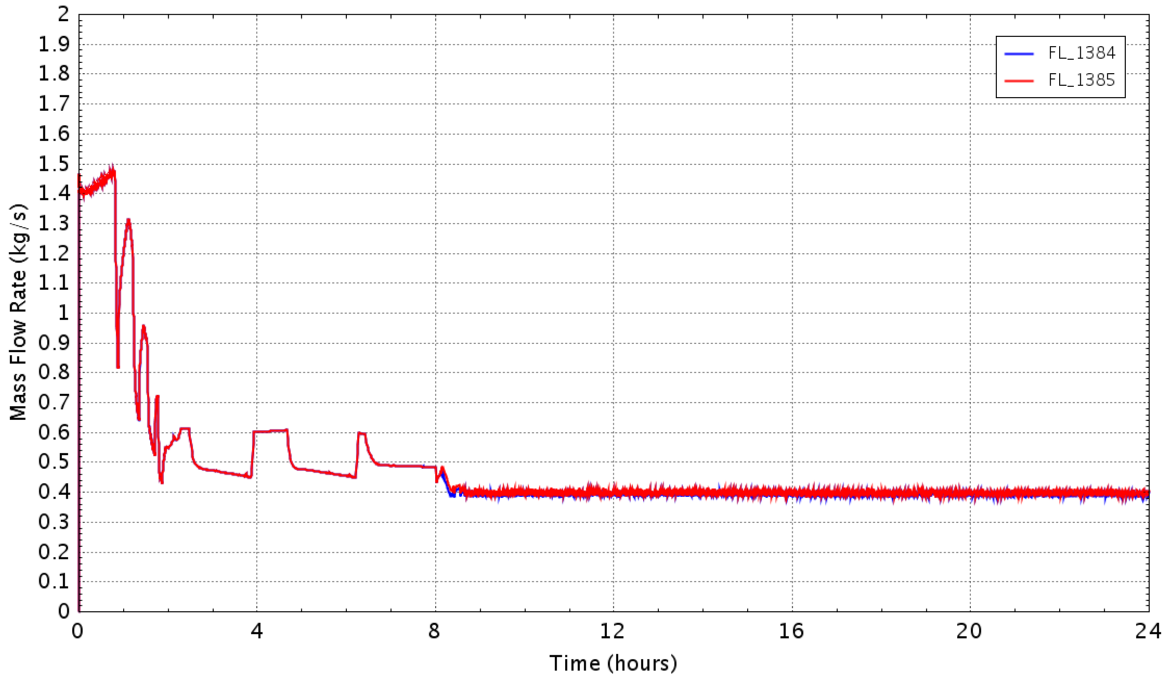

Figure D - 341 **Flow rate of the recirculating pump seal leakage**

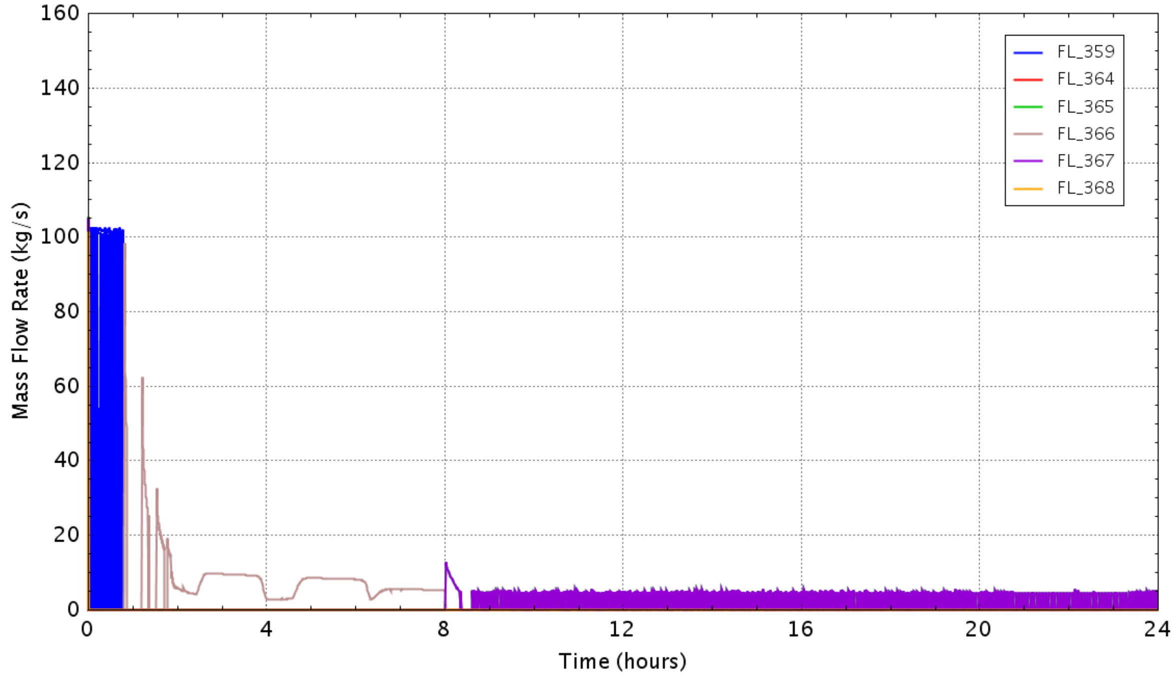

Figure D - 342 Flow rate of the SRVs

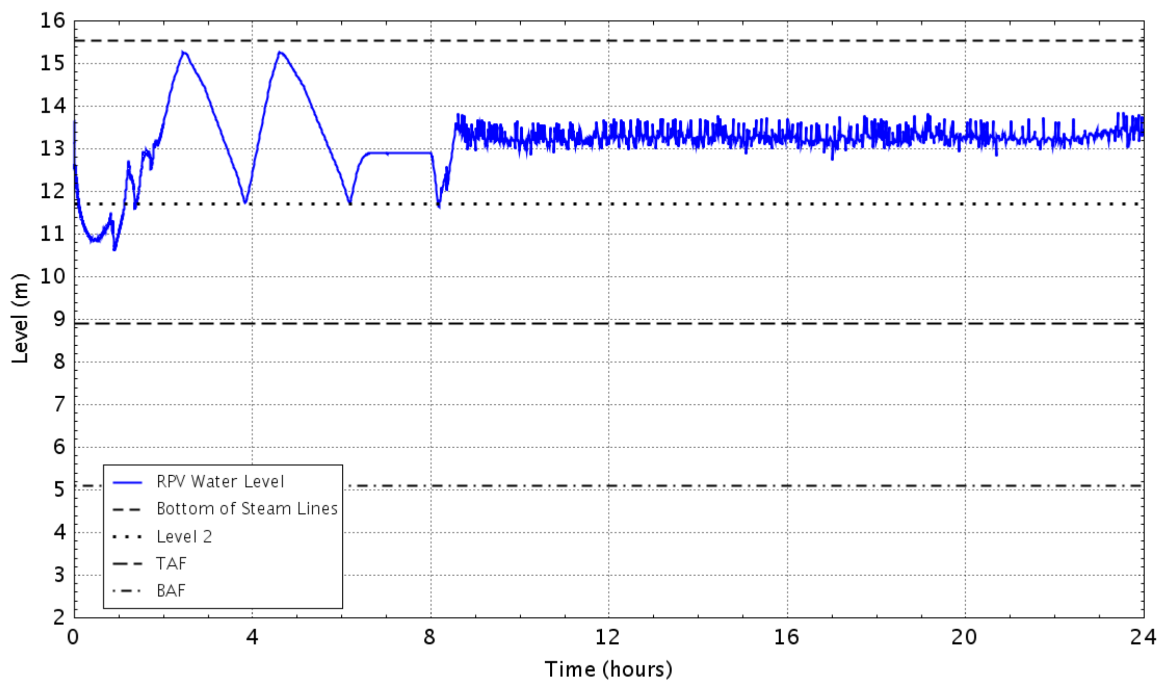

Figure D - 343 RPV down comer water level

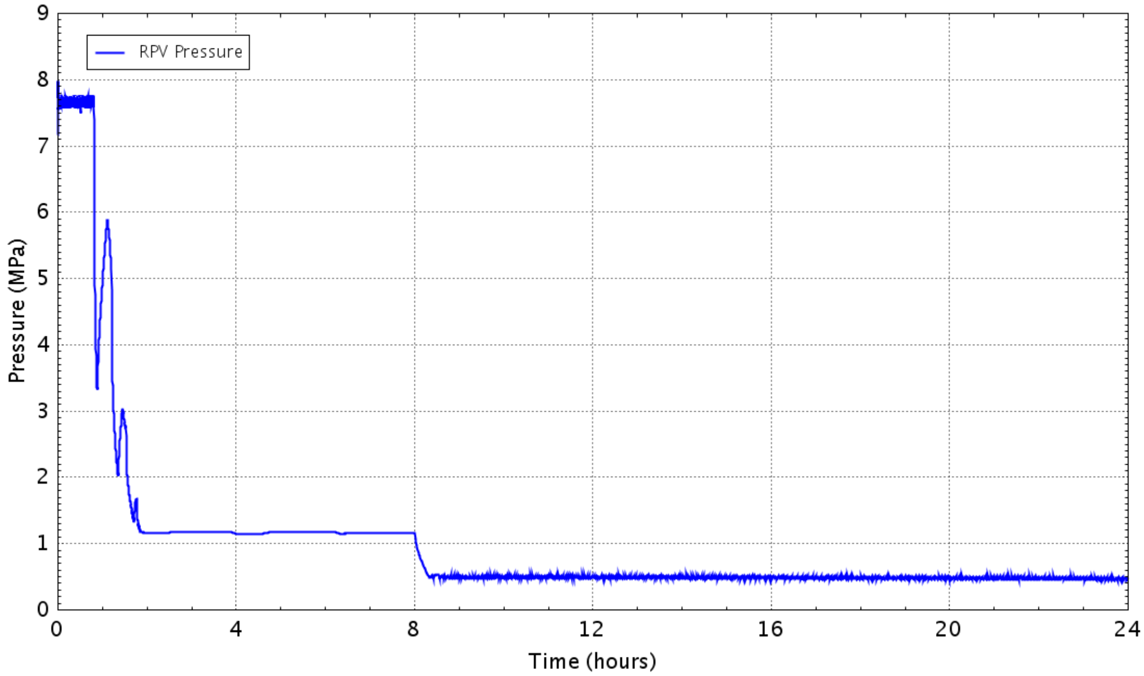

Figure D - 344 **Pressure in theRPV**

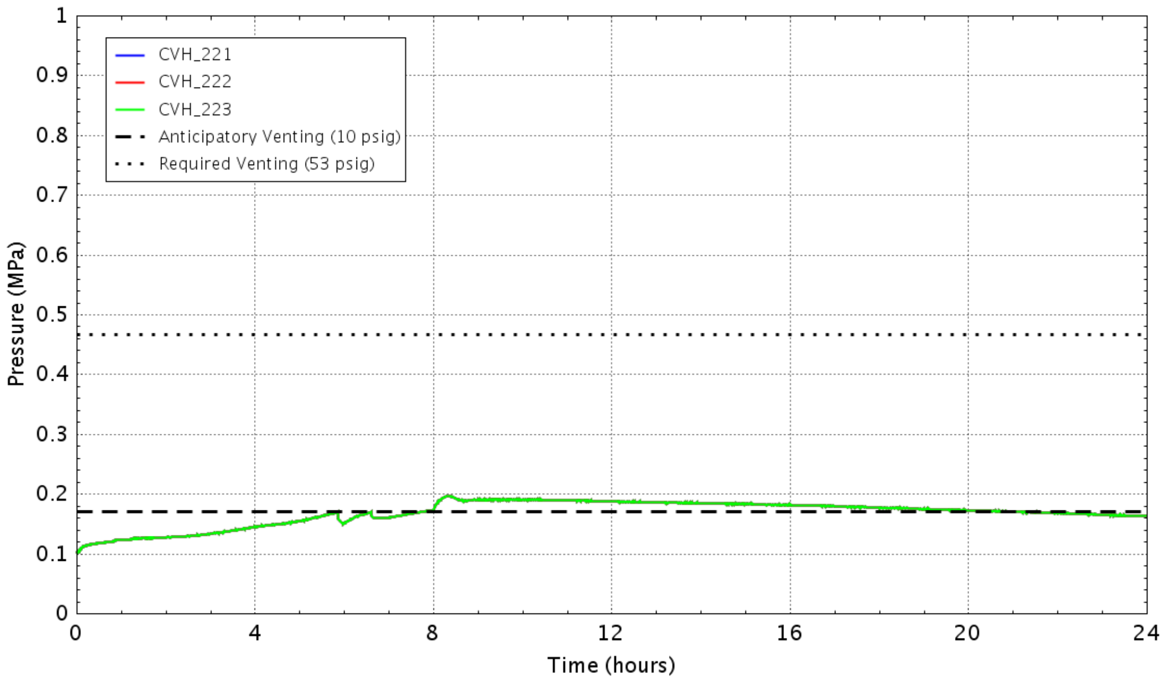

Figure D - 345 **Pressure in the wetwell**

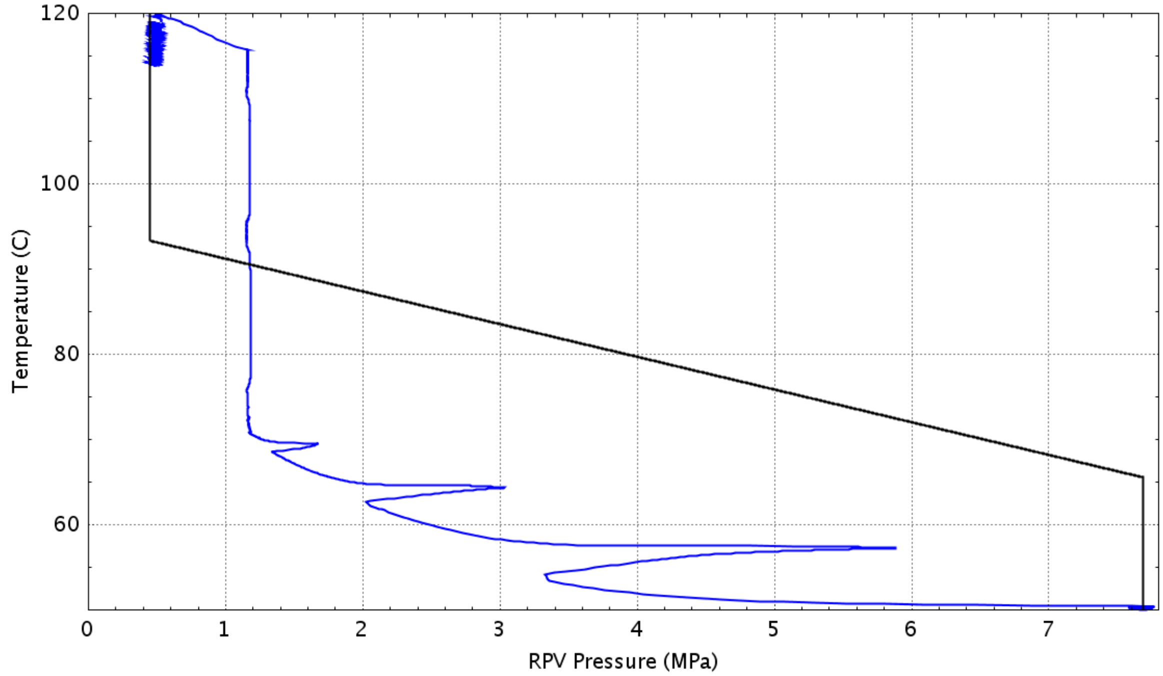

Figure D – 346 Plant status relative to the HCL curve (Graph 4 of the EOPs)

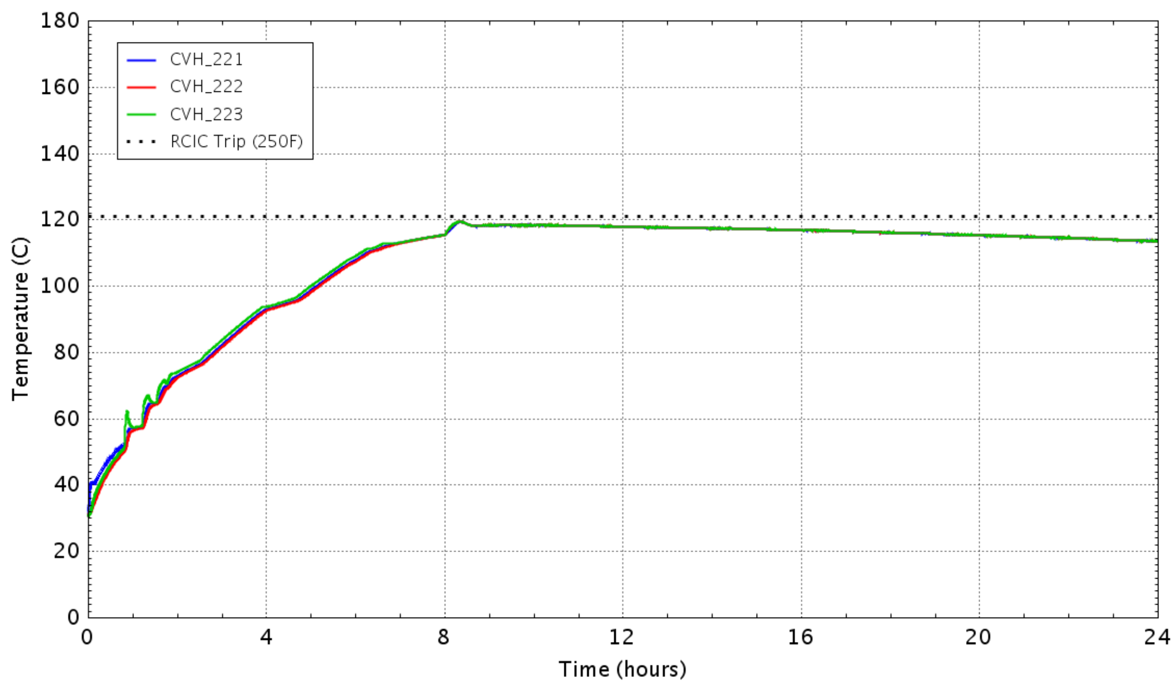

Figure D - 347 Water temperature in the wetwell

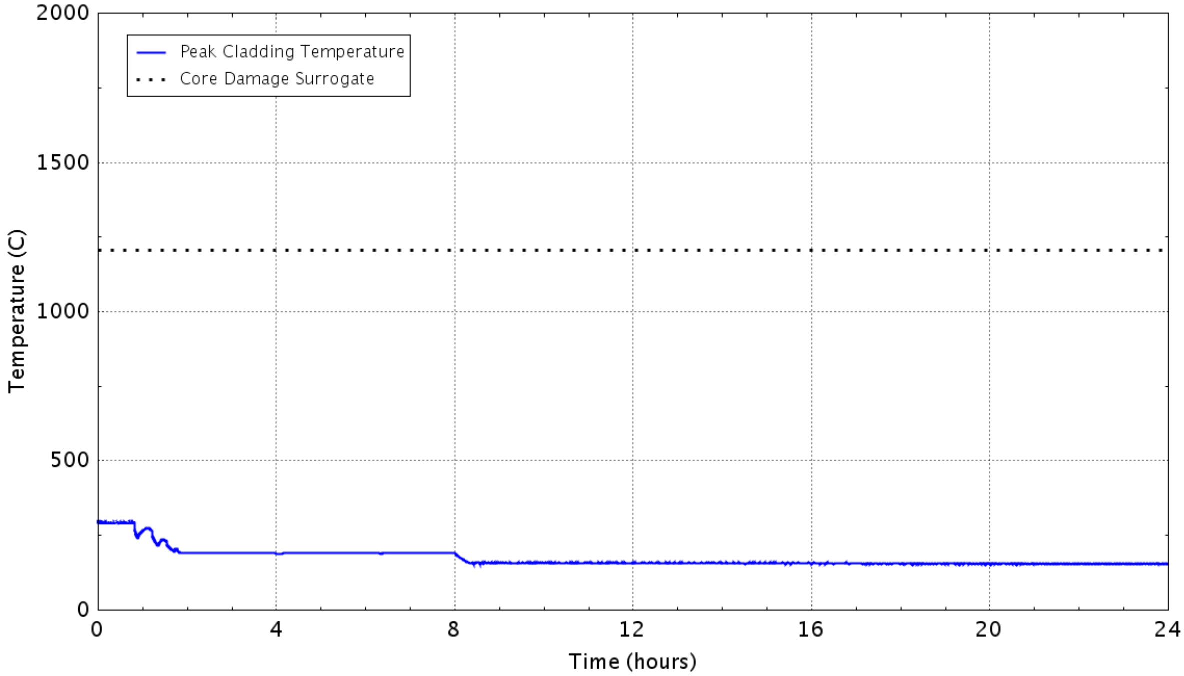

Figure D – 348 Peak temperature of the fuel cladding as a function oftime

D.3.5 Case 8d: Sensitivity to LOOPGR-38-9 Case 8 with No RCPSeal Leakage

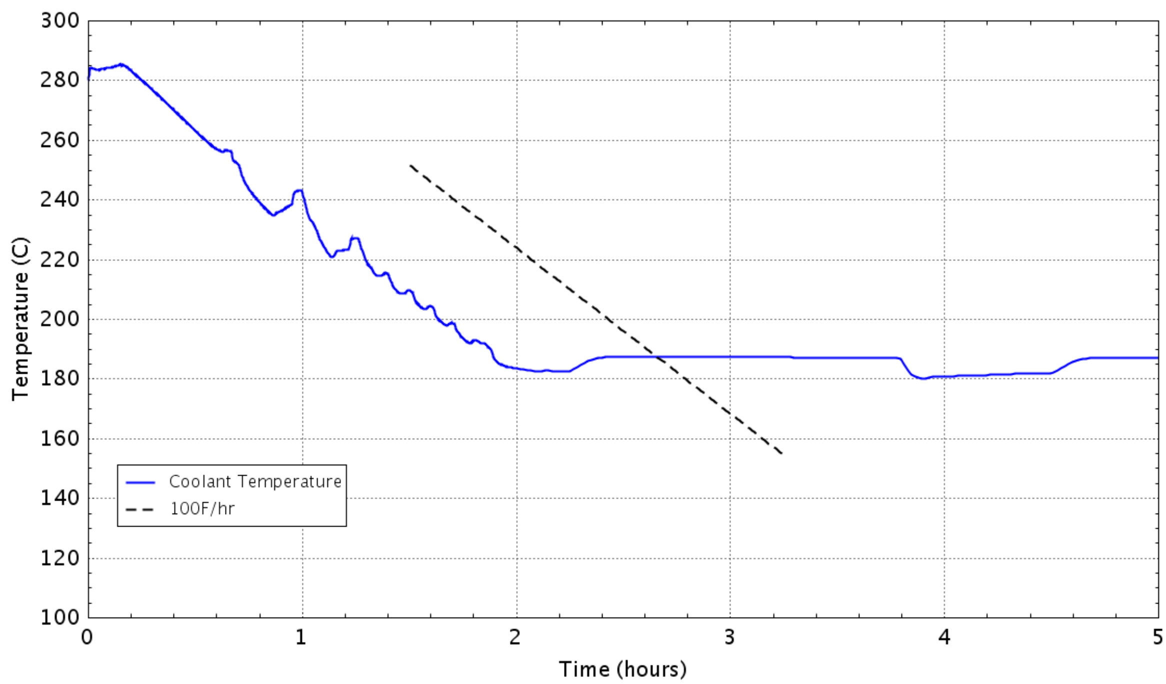

Figure D - 349 RPV cooldown rate

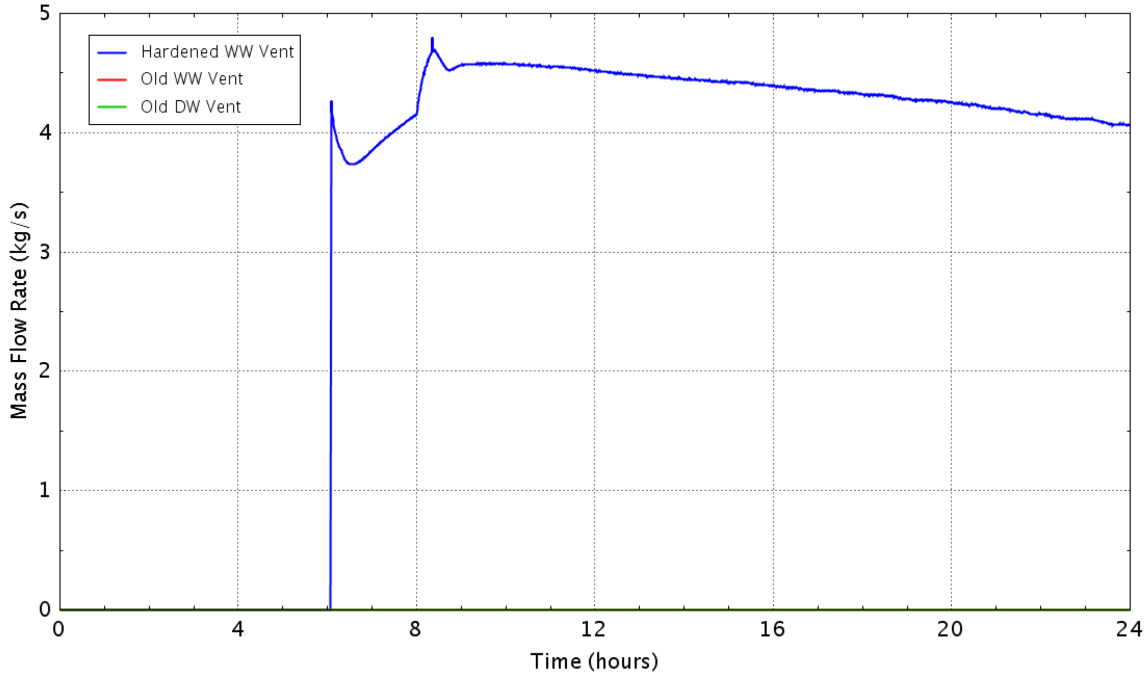

Figure D - 350 **Flow rate of the containment vents**

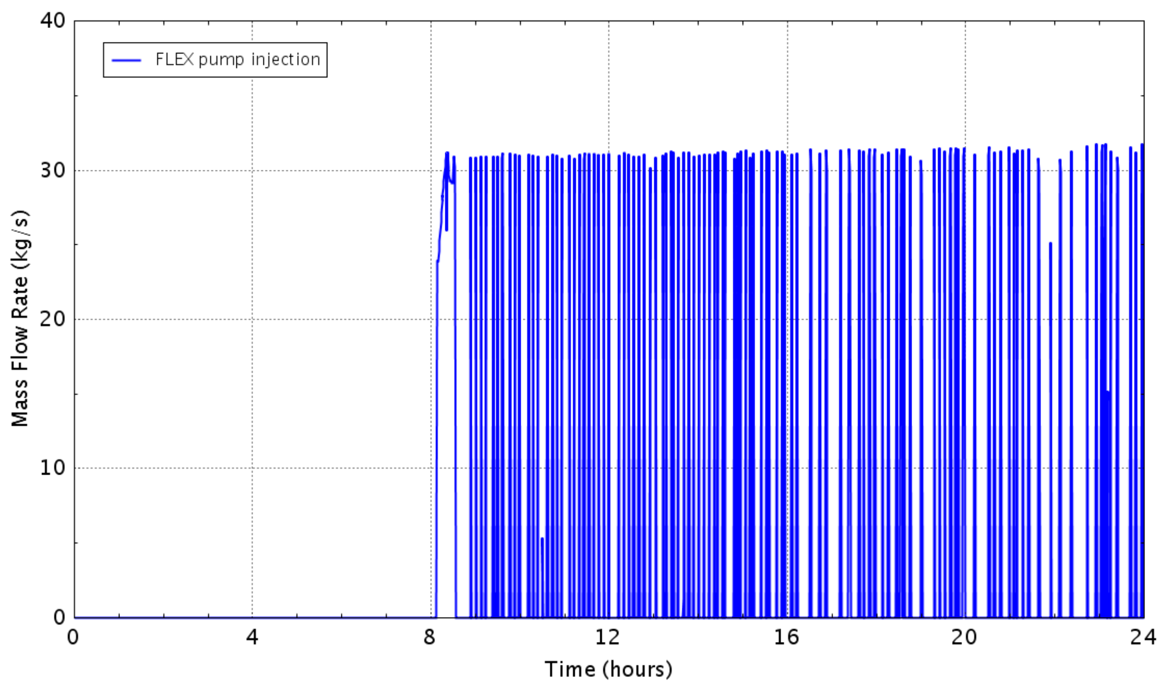

Figure D - 351 **Flow rate of the FLEX pump**

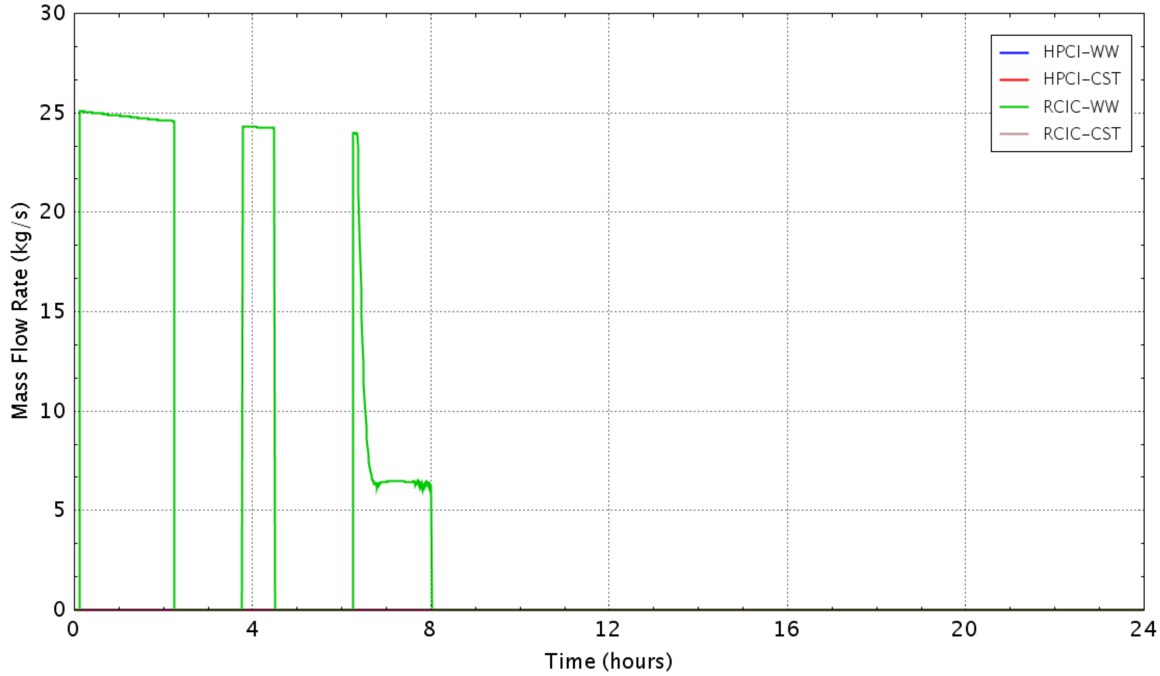

Figure D - 352 **Flow rate of the HPCI/RCIC pumps**

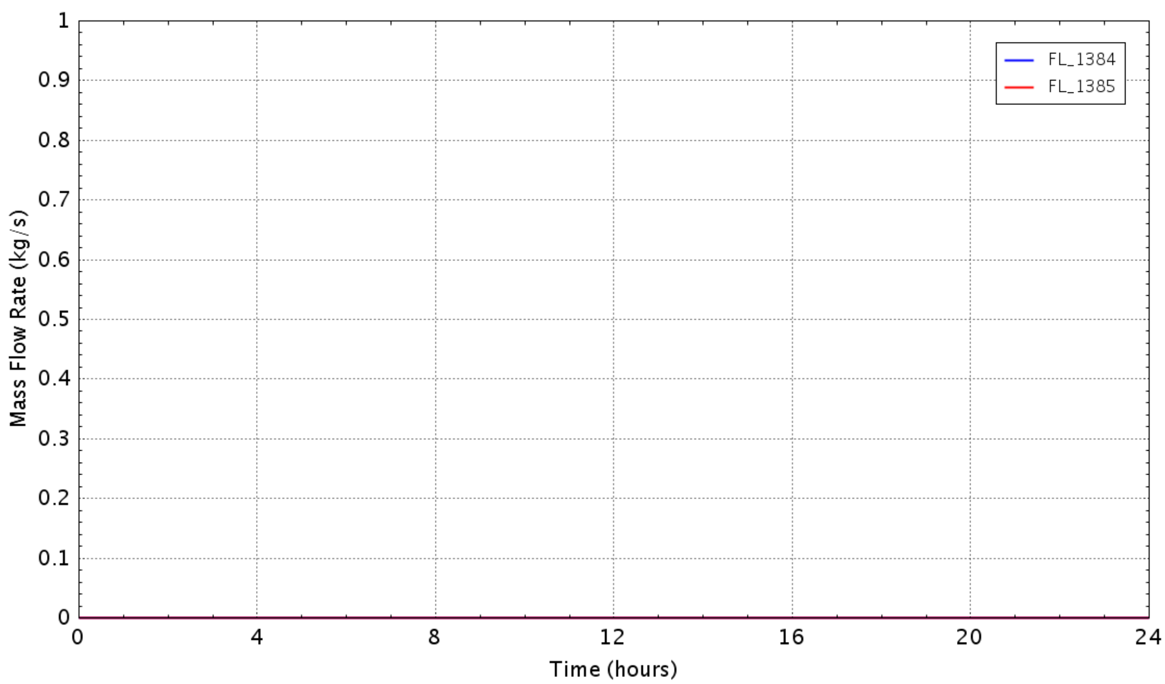

Figure D - 353 **Flow rate of the recirculating pump seal leakage**

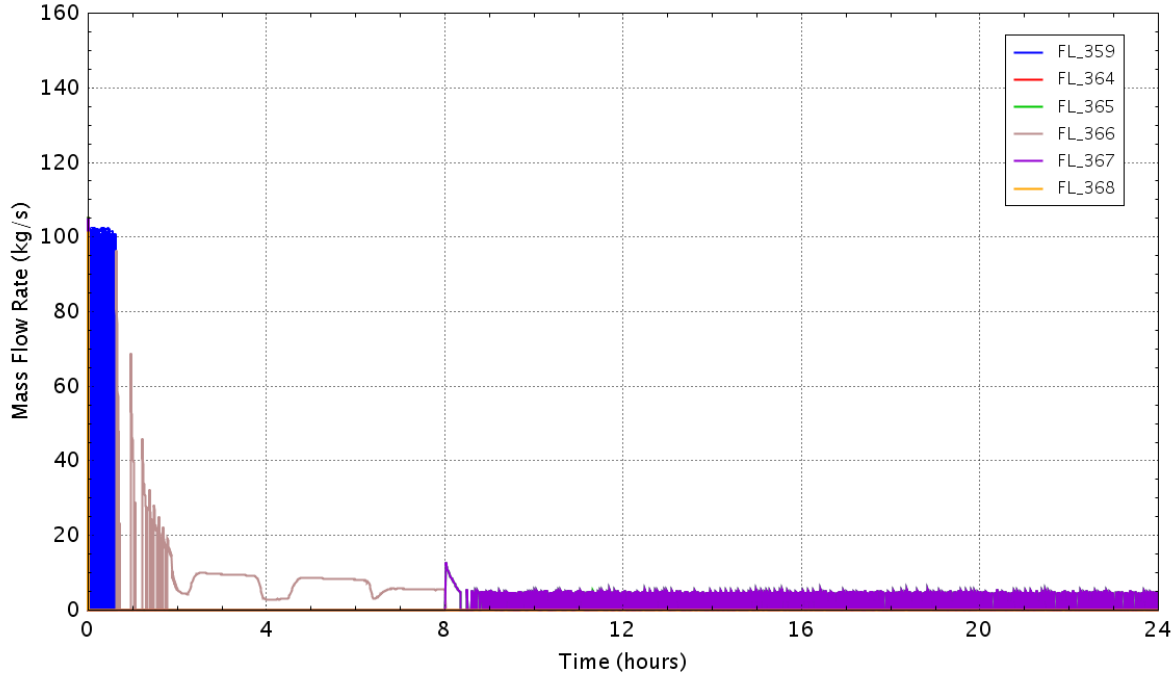

Figure D - 354 **Flow rate of the SRVs**

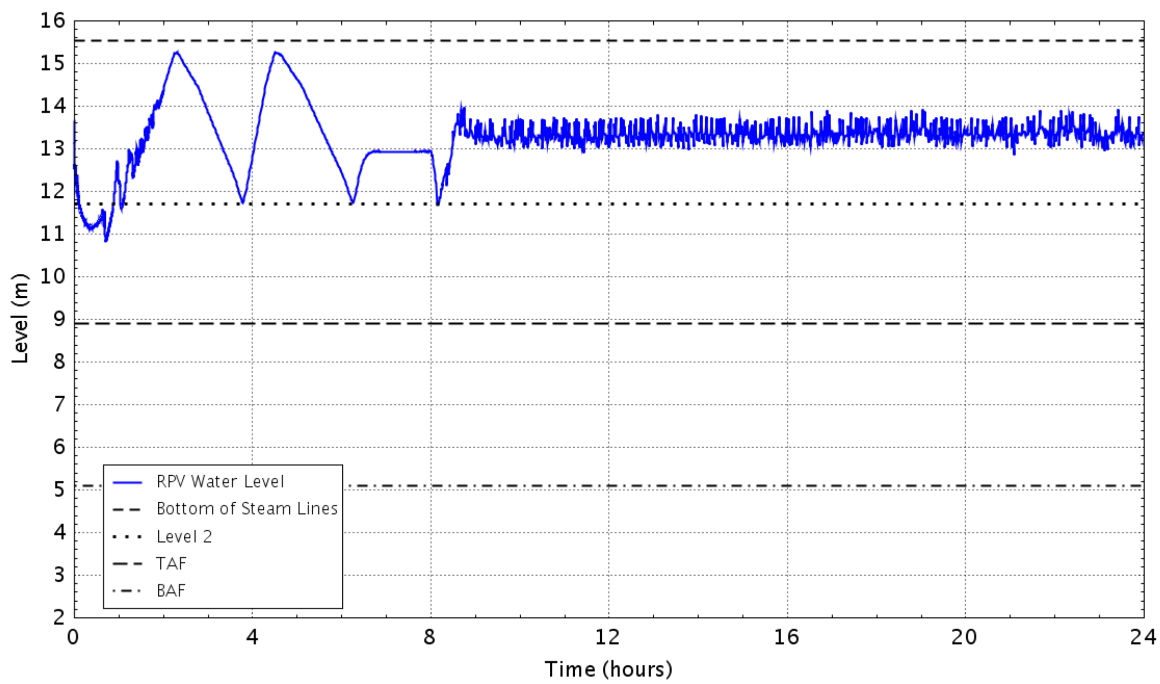

Figure D - 355 **RPV down comer water level**

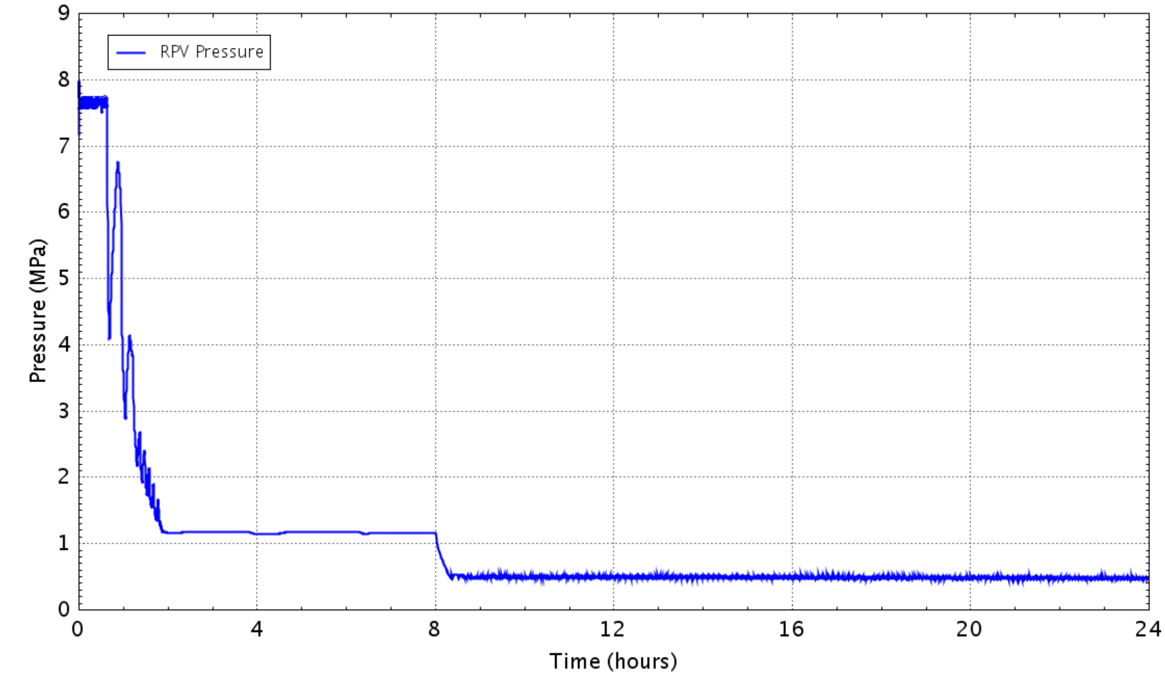

Figure D - 356 **Pressure in theRPV**

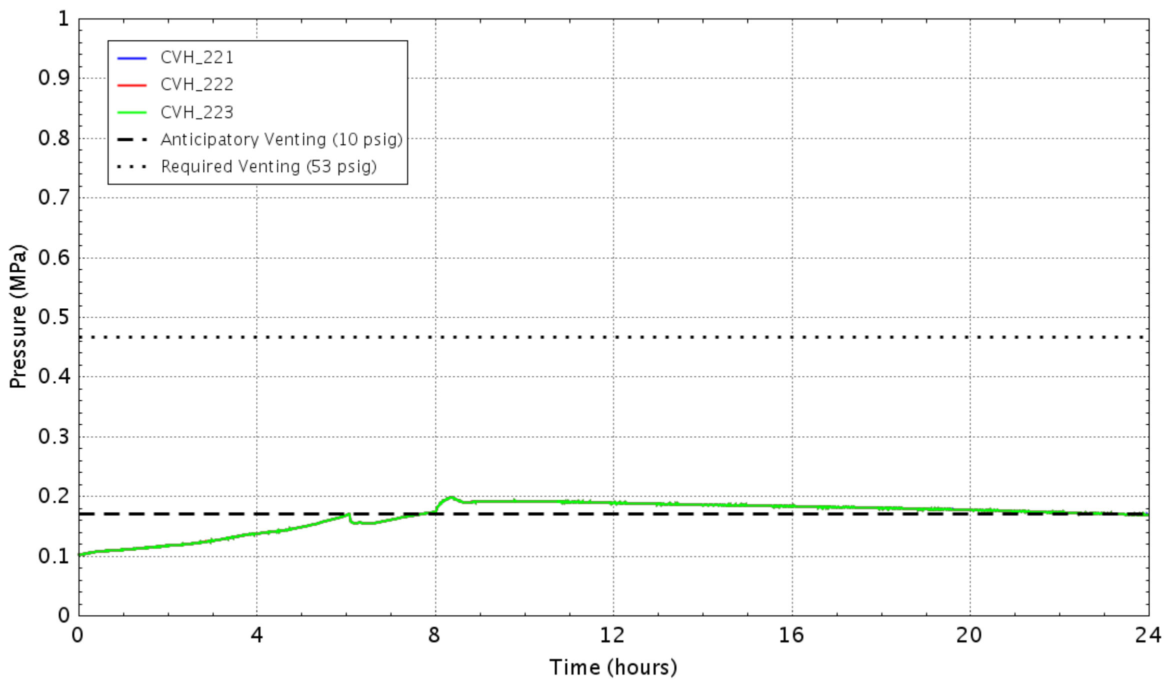

Figure D - 357 **Pressure in the wetwell**

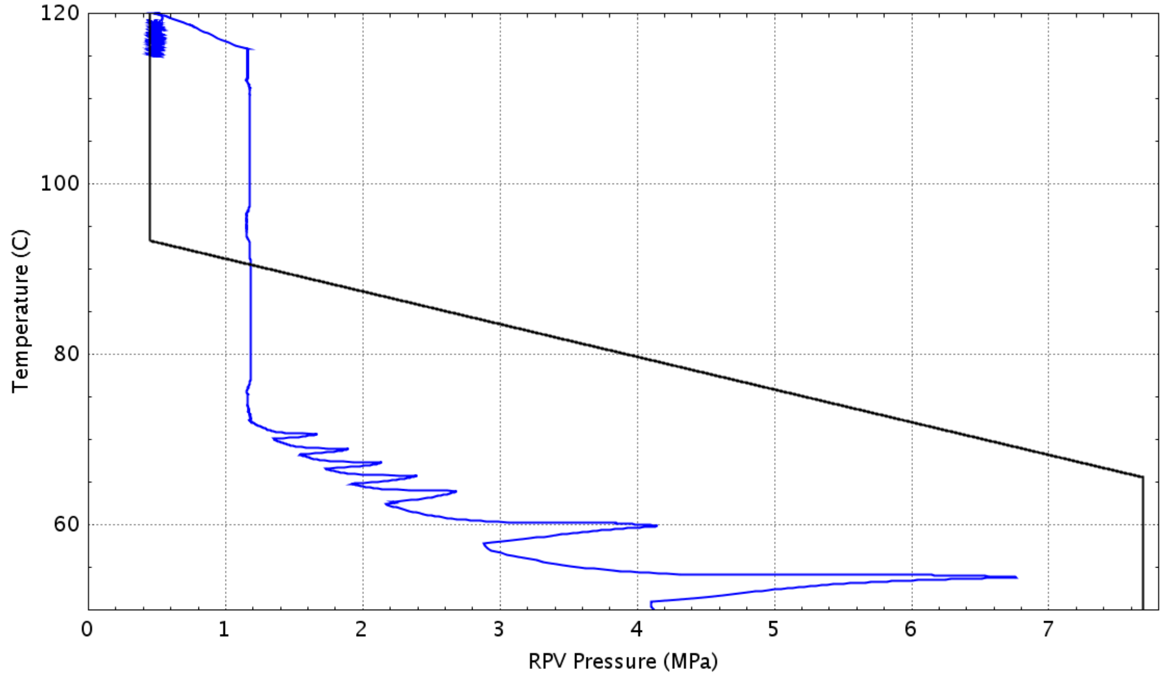

Figure D – 358 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

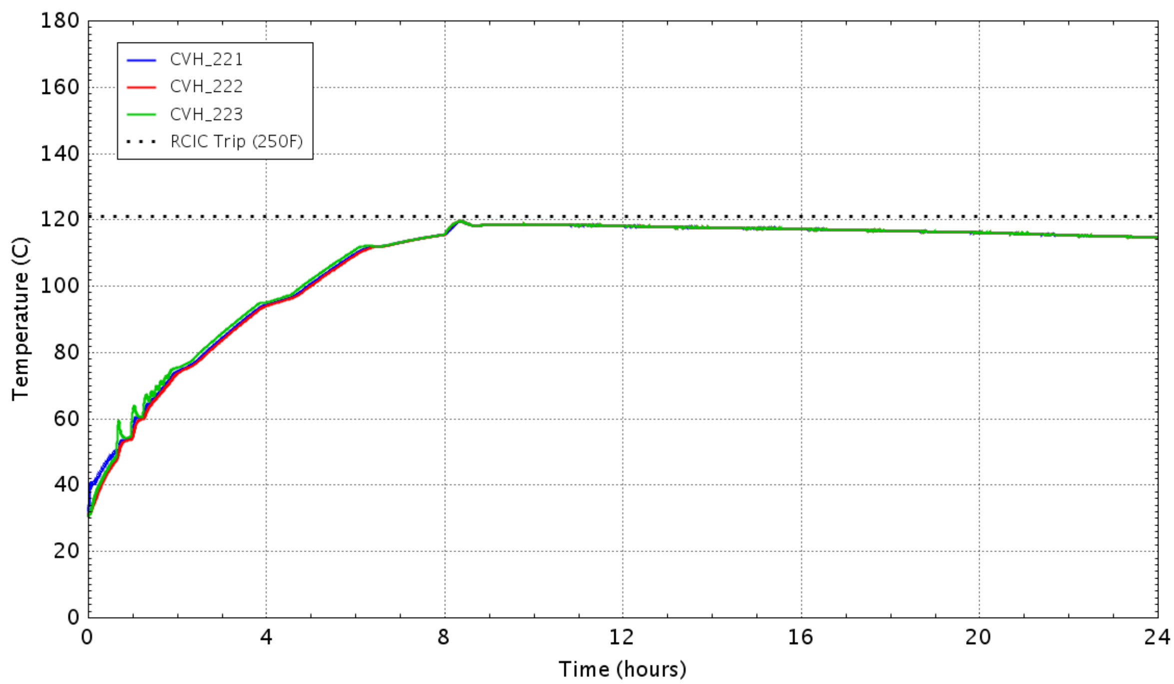

Figure D - 359 **Water temperature in the wetwell**

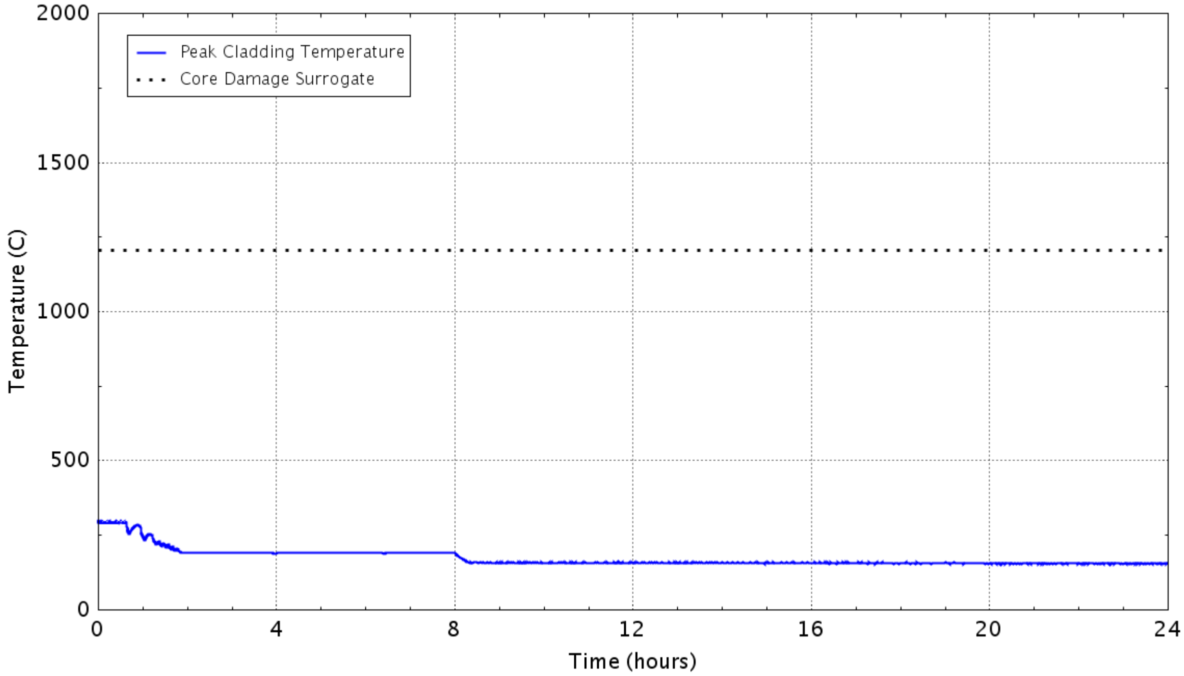

Figure D – 360 Peak temperature of the fuel cladding as a function oftime

D.3.6 Case 8e: Sensitivity to LOOPGR-38-9 Case 8 with Water LevelRun Up to the Steamlines Prior to FLEX Swap-Over

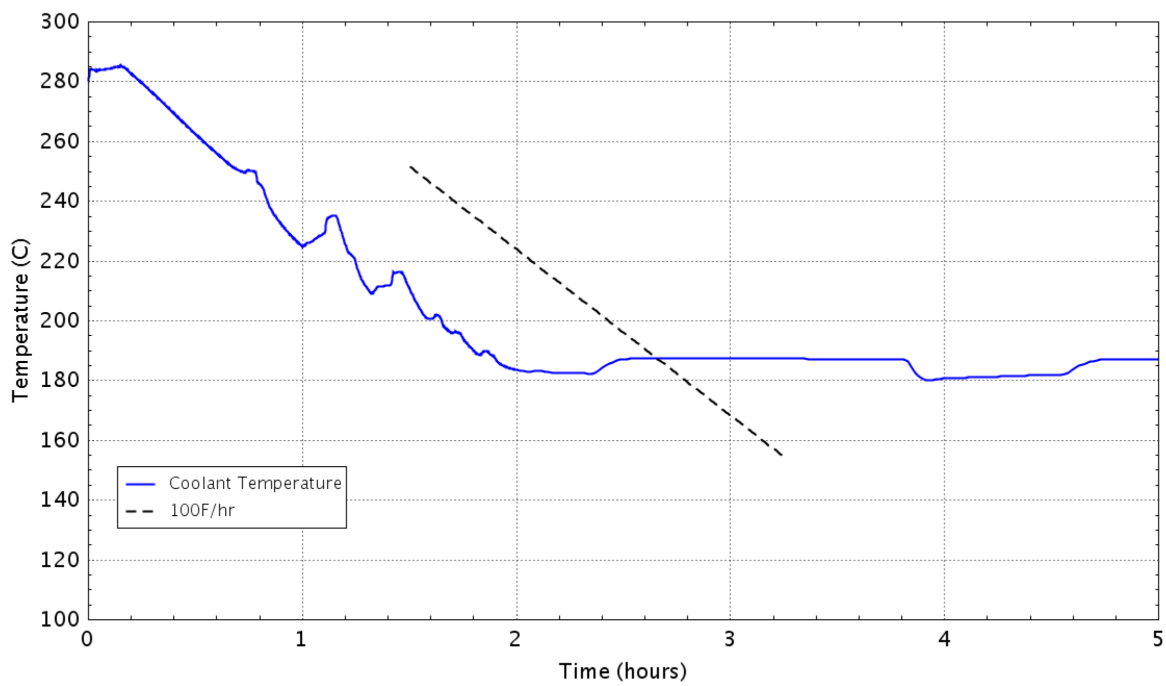

Figure D - 361 RPV cooldown rate

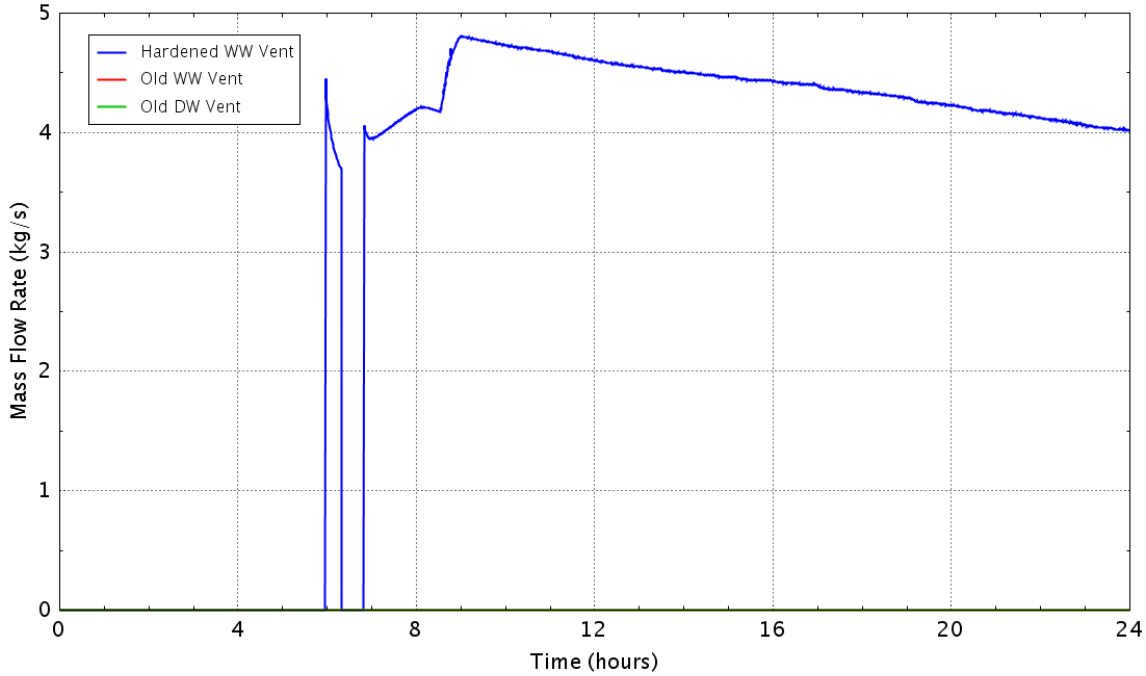

Figure D - 362 **Flow rate of the containment vents**

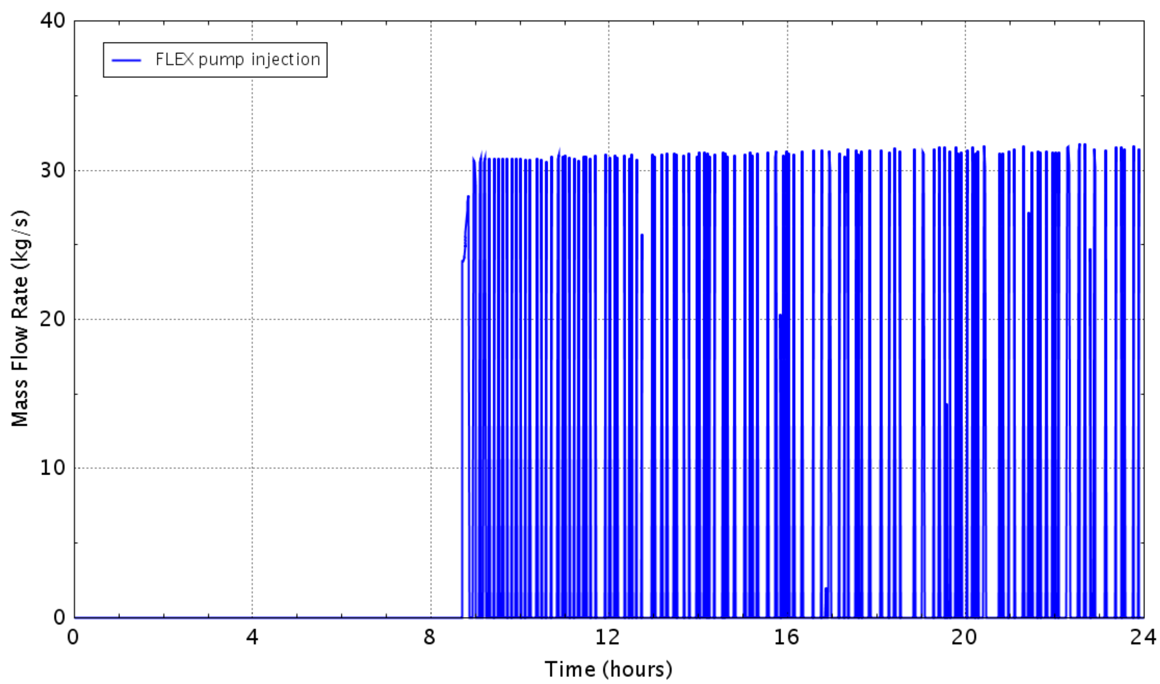

Figure D - 363 **Flow rate of the FLEX pump**

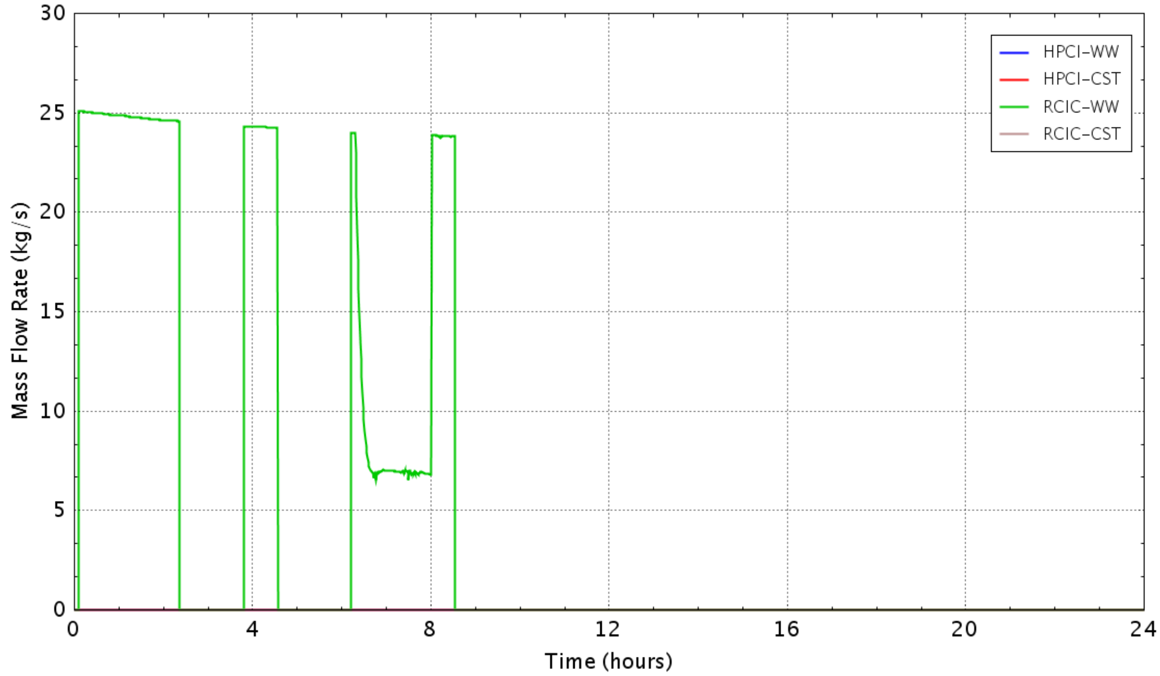

Figure D - 364 **Flow rate of the HPCI/RCIC pumps**

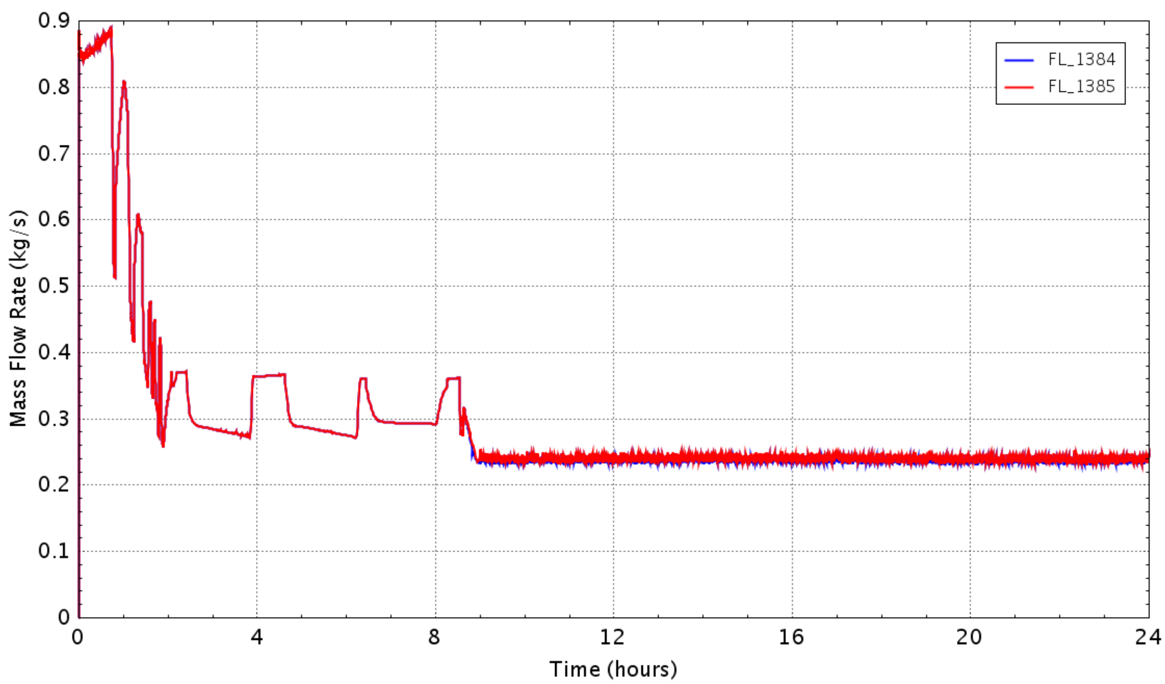

Figure D - 365 **Flow rate of the recirculating pump seal leakage**

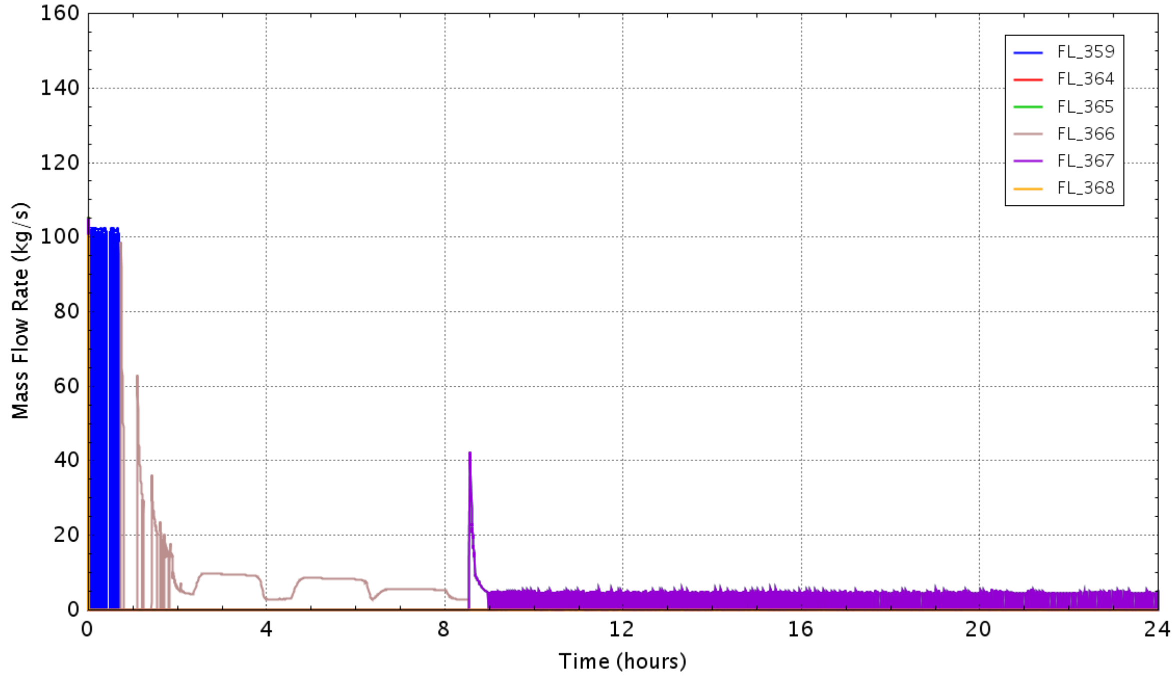

Figure D - 366 Flow rate of the SRVs

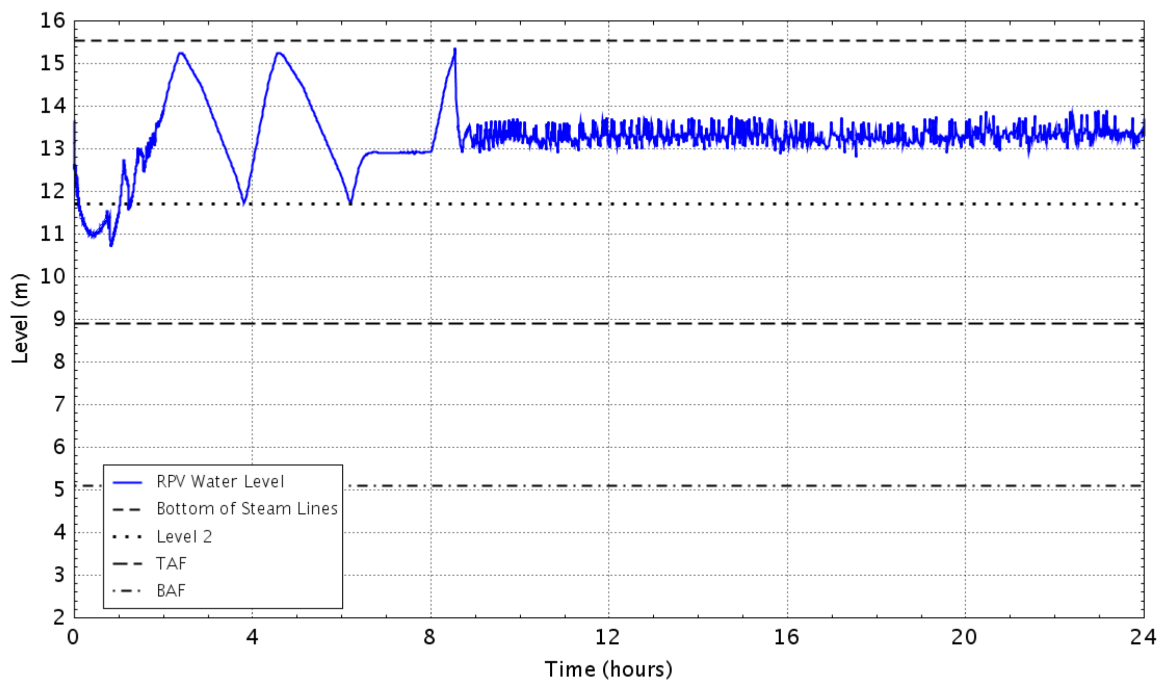

Figure D - 367 RPV down comer water level

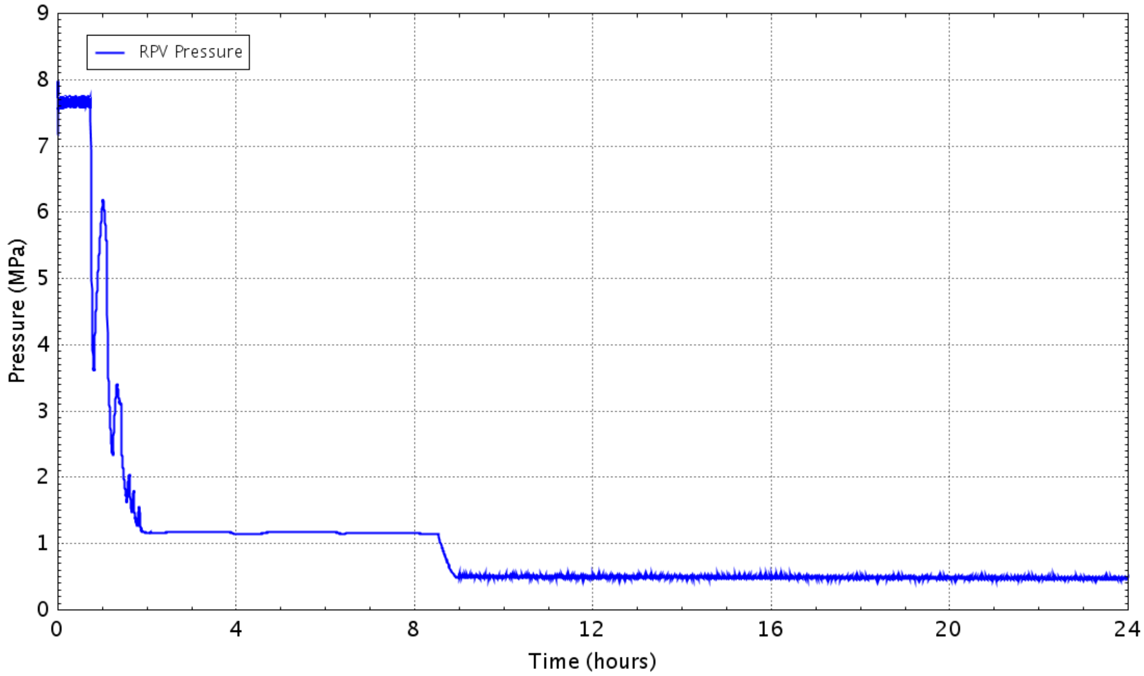

Figure D - 368 Pressure in theRPV

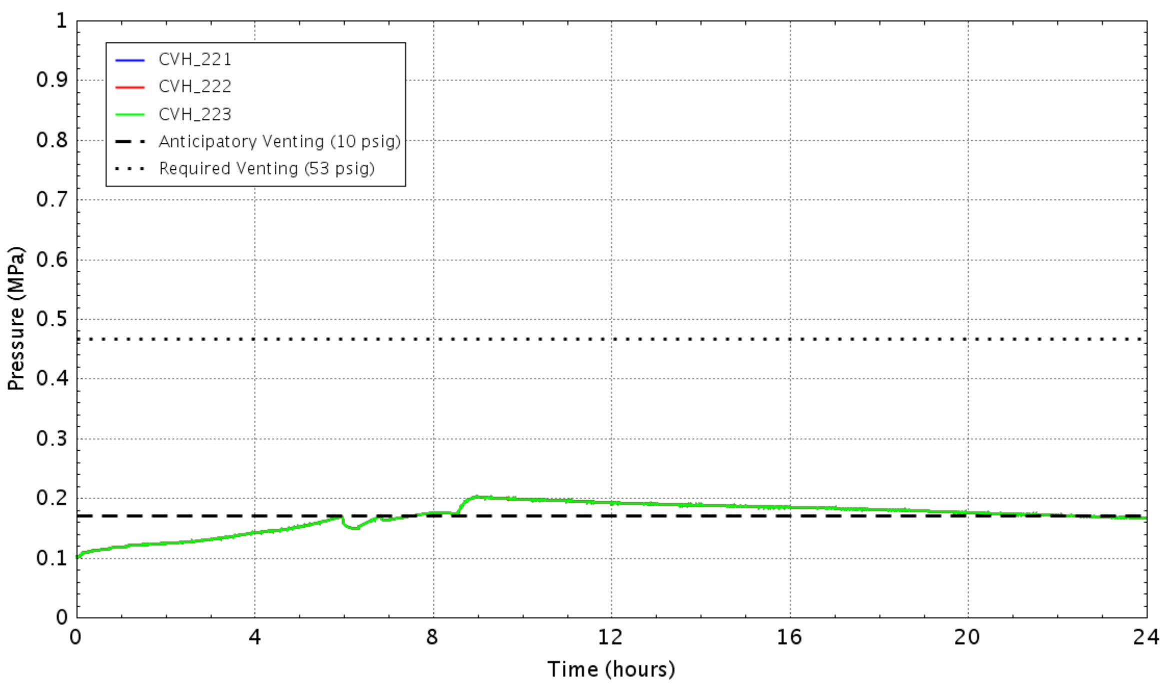

Figure D - 369 Pressure in the wetwell

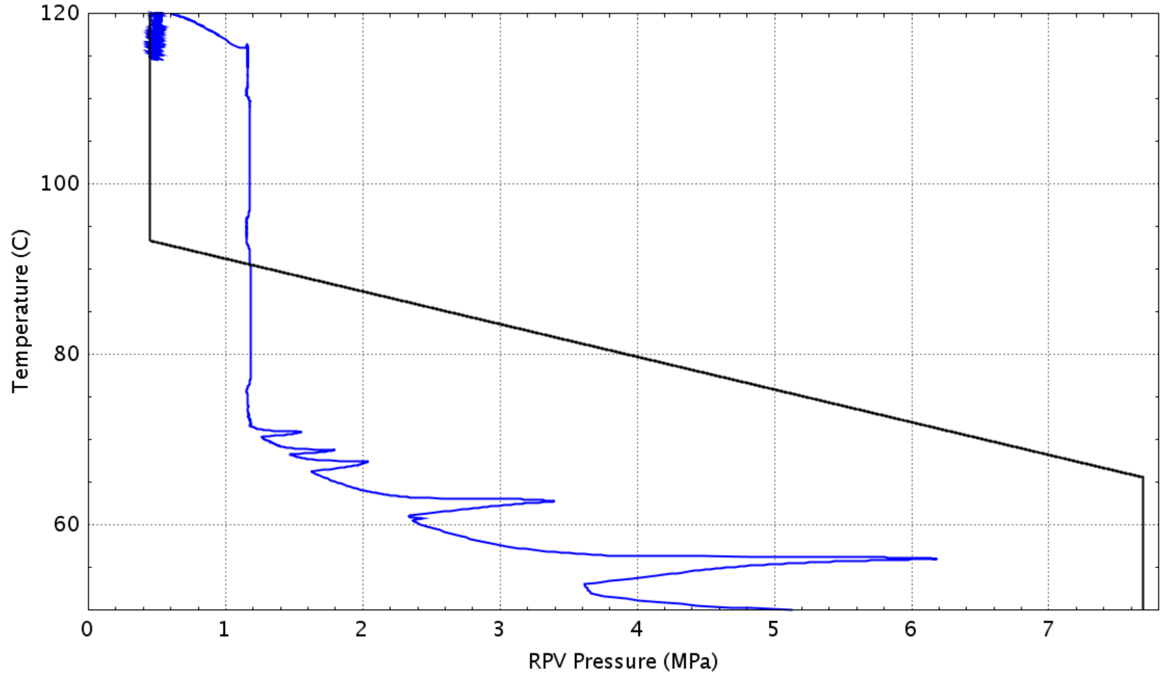

Figure D – 370 Plant status relative to the HCL curve (Graph 4 of the EOPs)

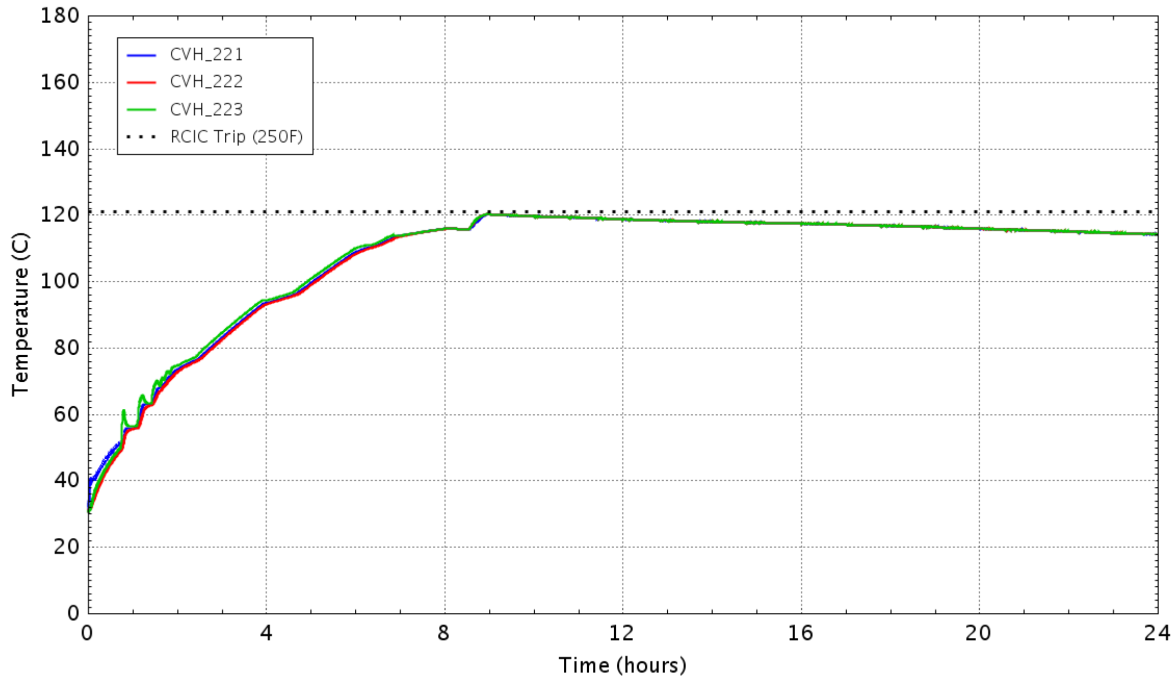

Figure D - 371 Water temperature in the wetwell

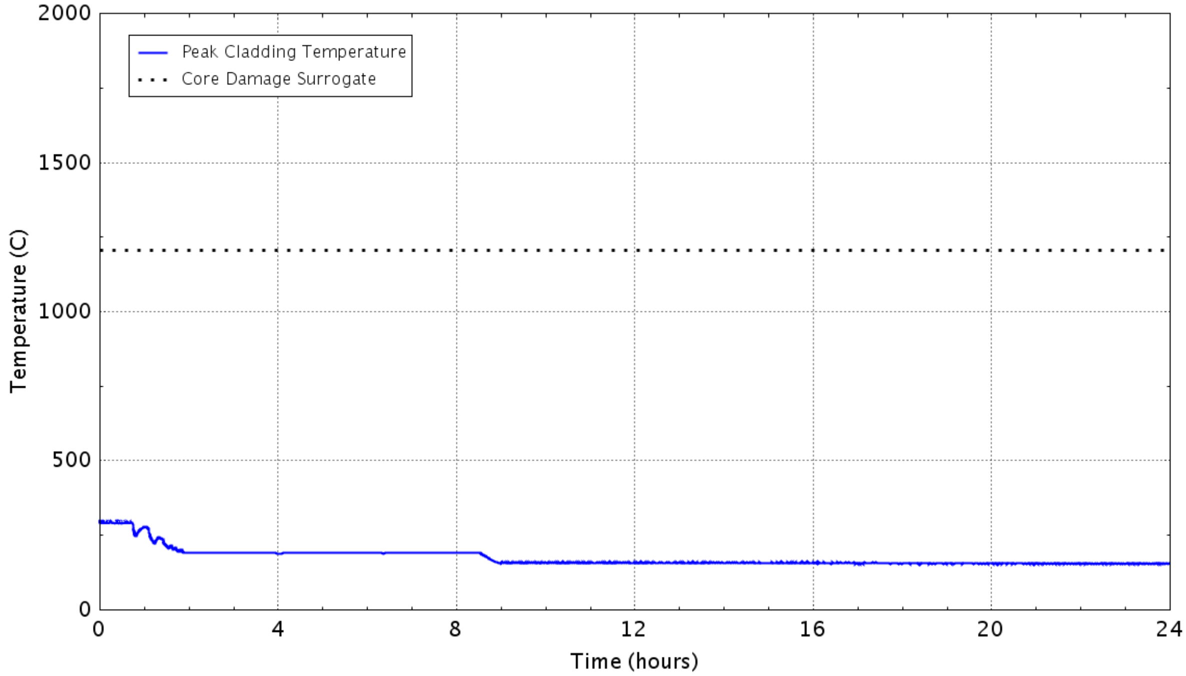

Figure D – 372 Peak temperature of the fuel cladding as a function oftime

D.3.7 Case 8f: Sensitivity to LOOPGR-38-9 Case 8 with Decay Heat Following Built-in ANS Standard

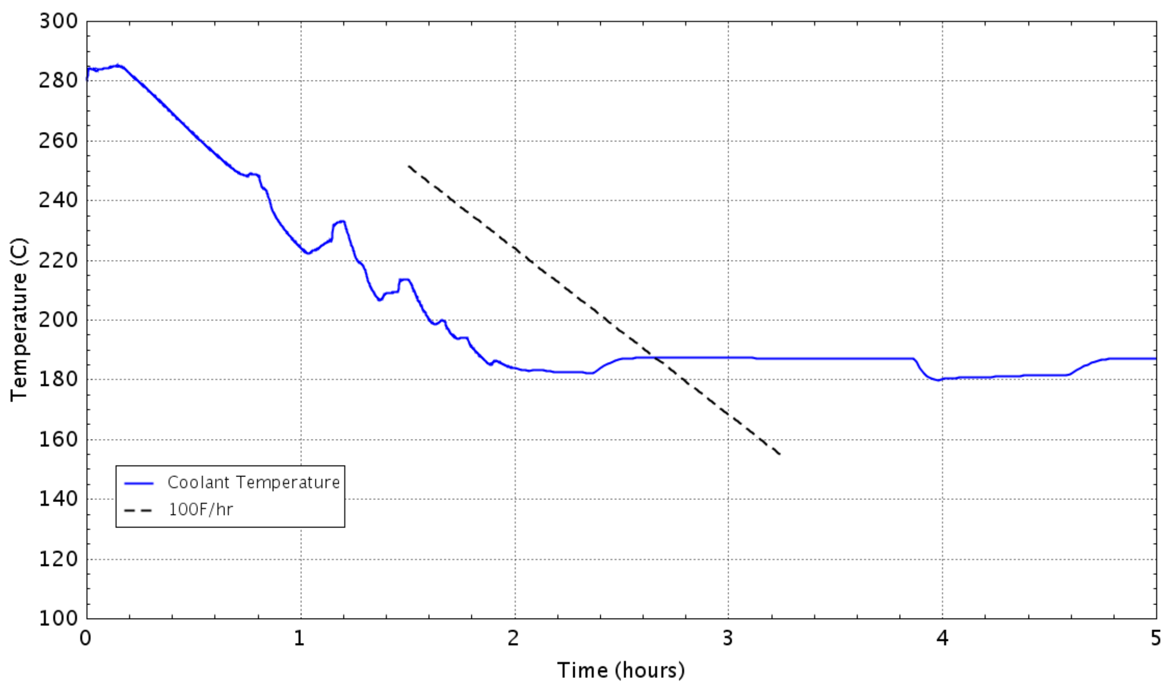

Figure D - 373 RPV cooldown rate

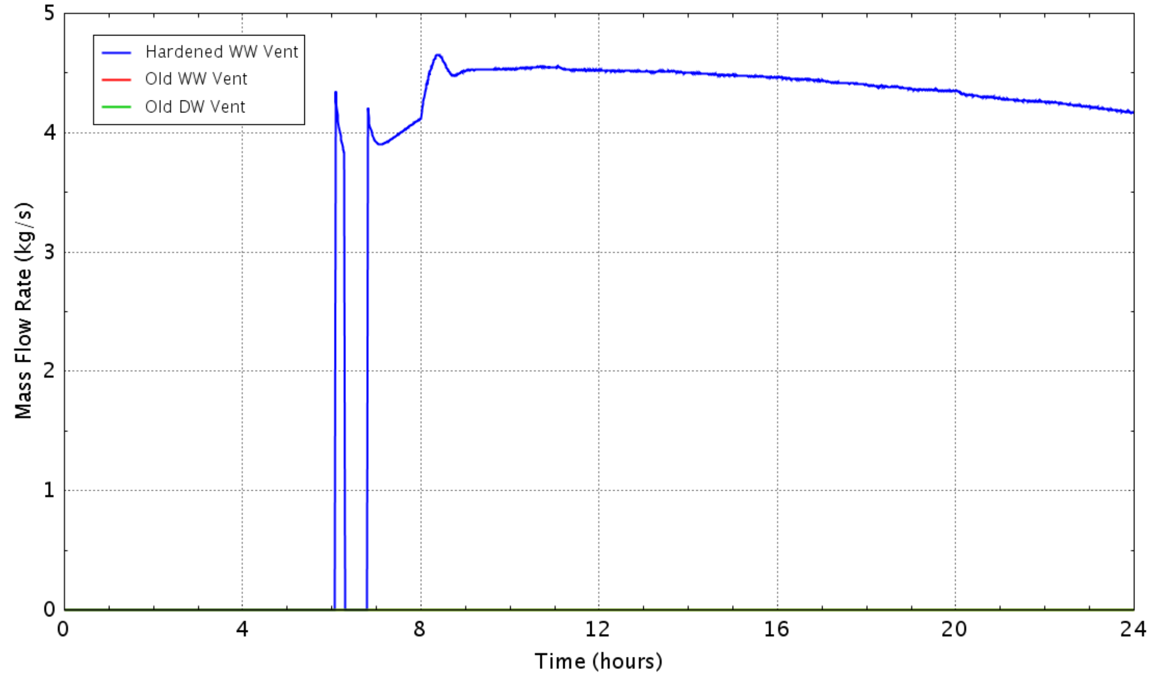

Figure D - 374 **Flow rate of the containment vents**

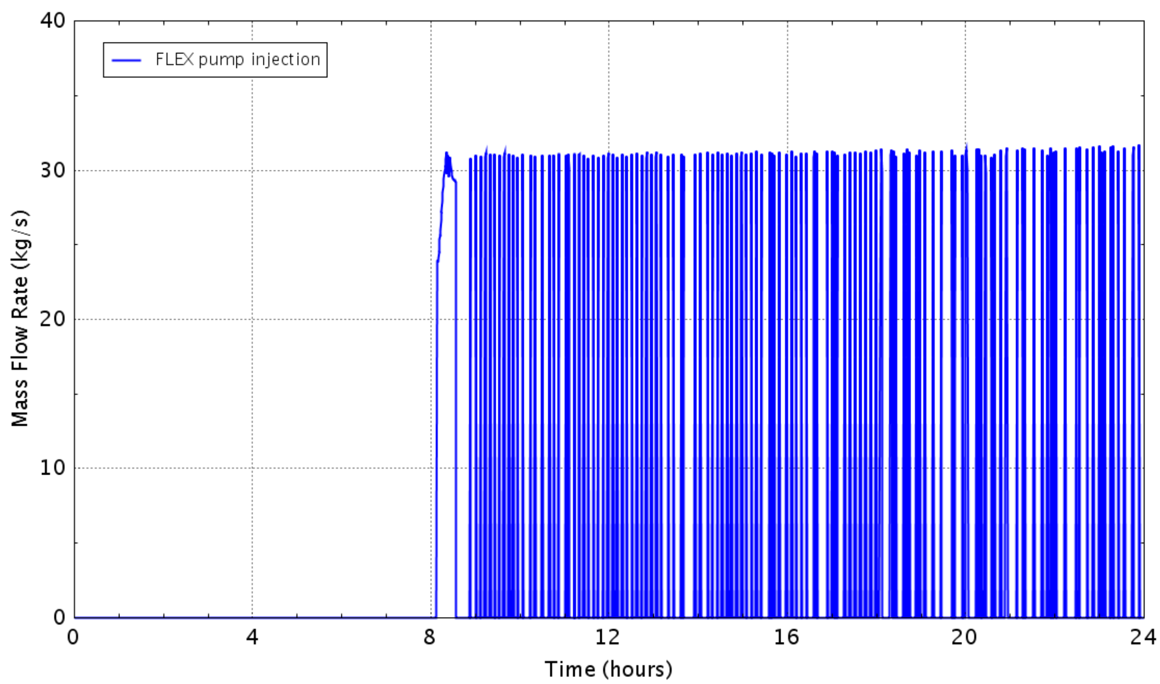

Figure D - 375 **Flow rate of the FLEX pump**

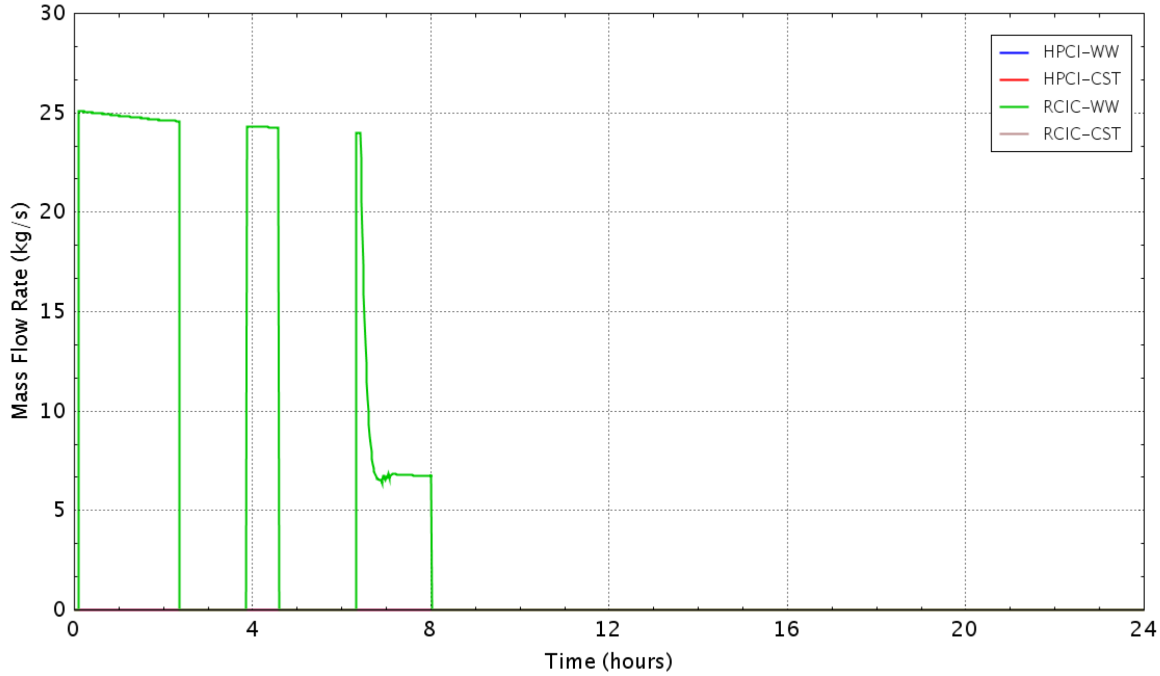

Figure D - 376 **Flow rate of the HPCI/RCIC pumps**

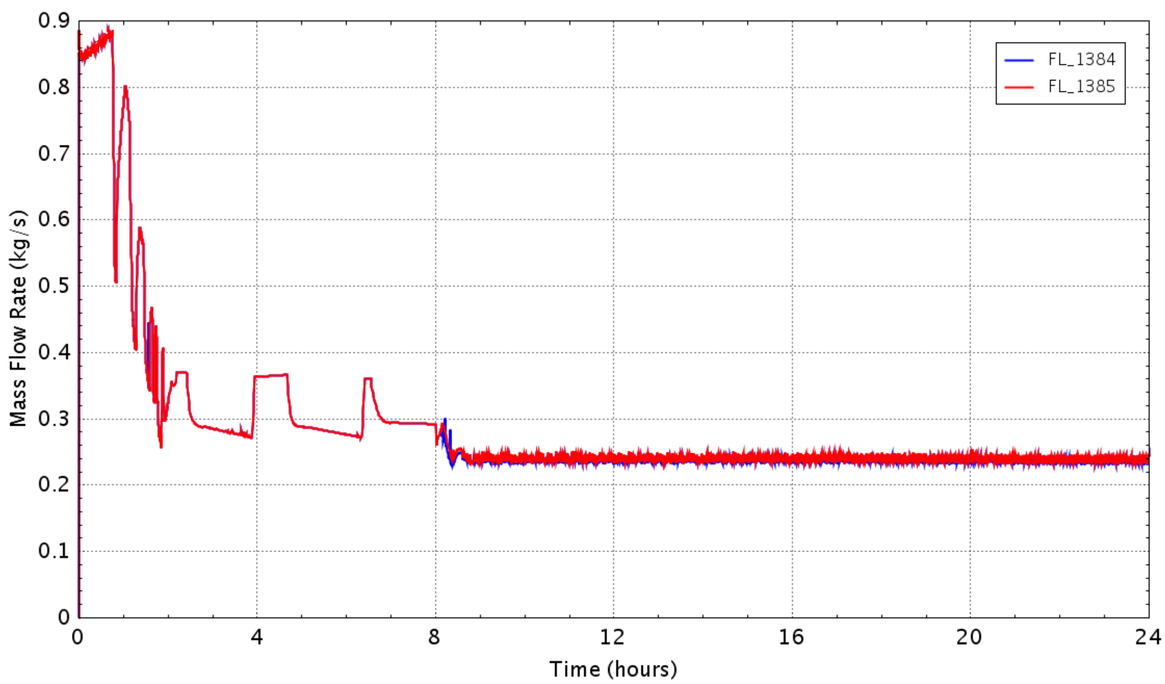

Figure D - 377 **Flow rate of the recirculating pump seal leakage**

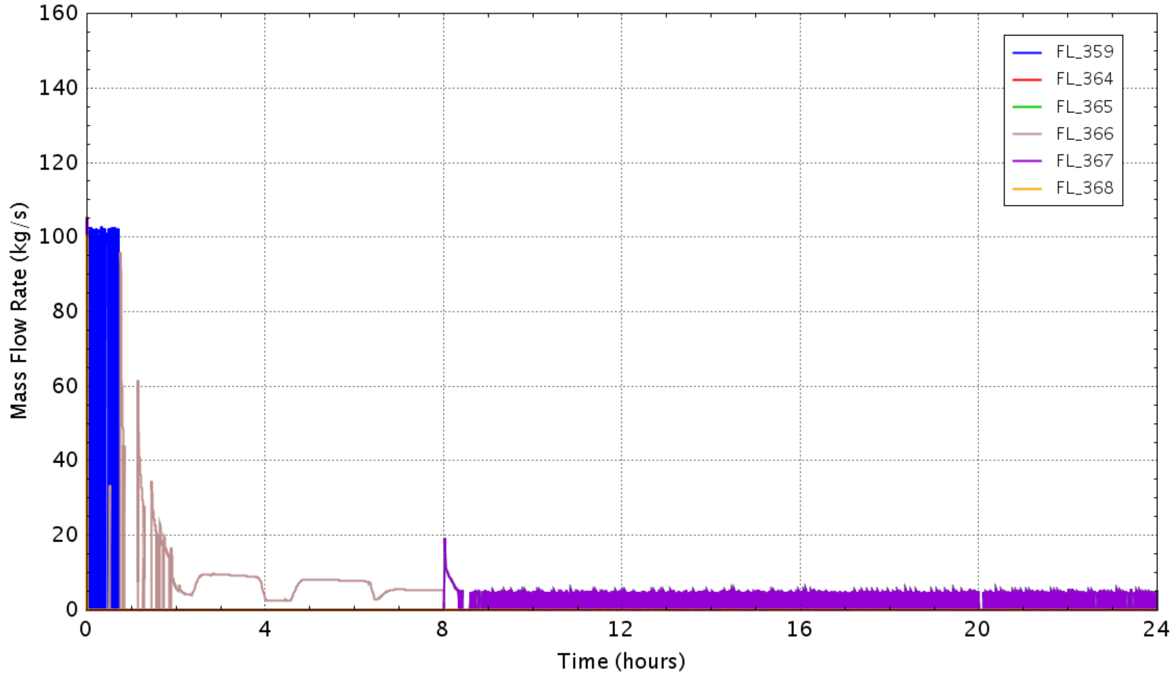

Figure D - 378 Flow rate of the SRVs

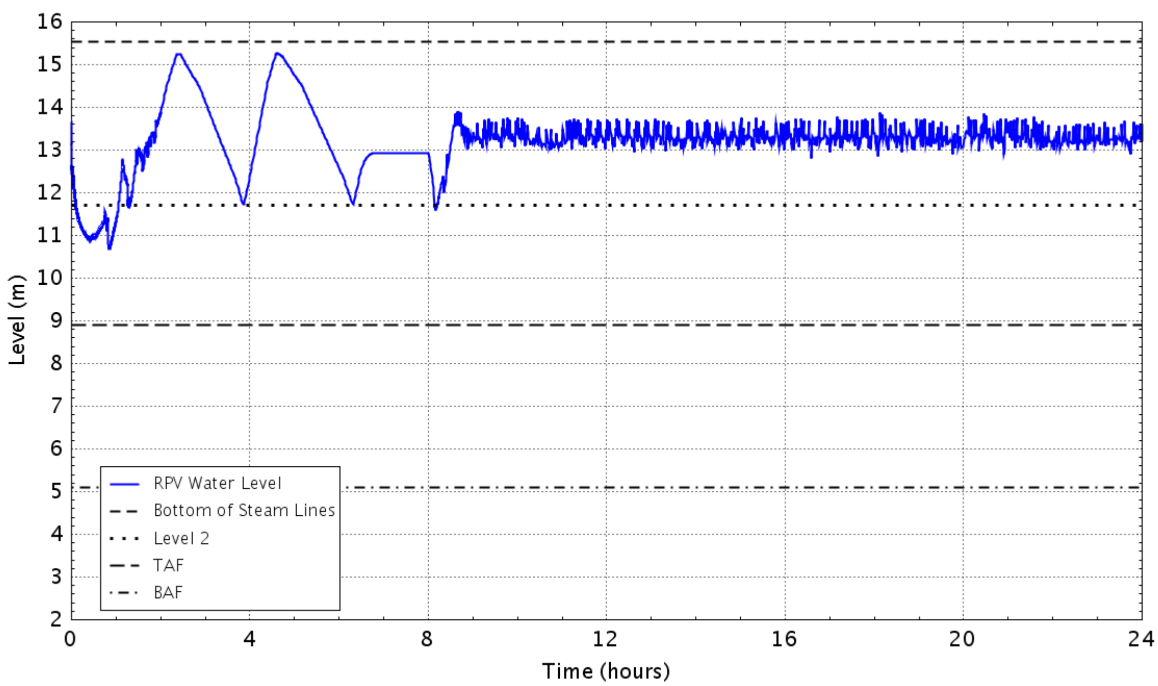

Figure D - 379 RPV down comer water level

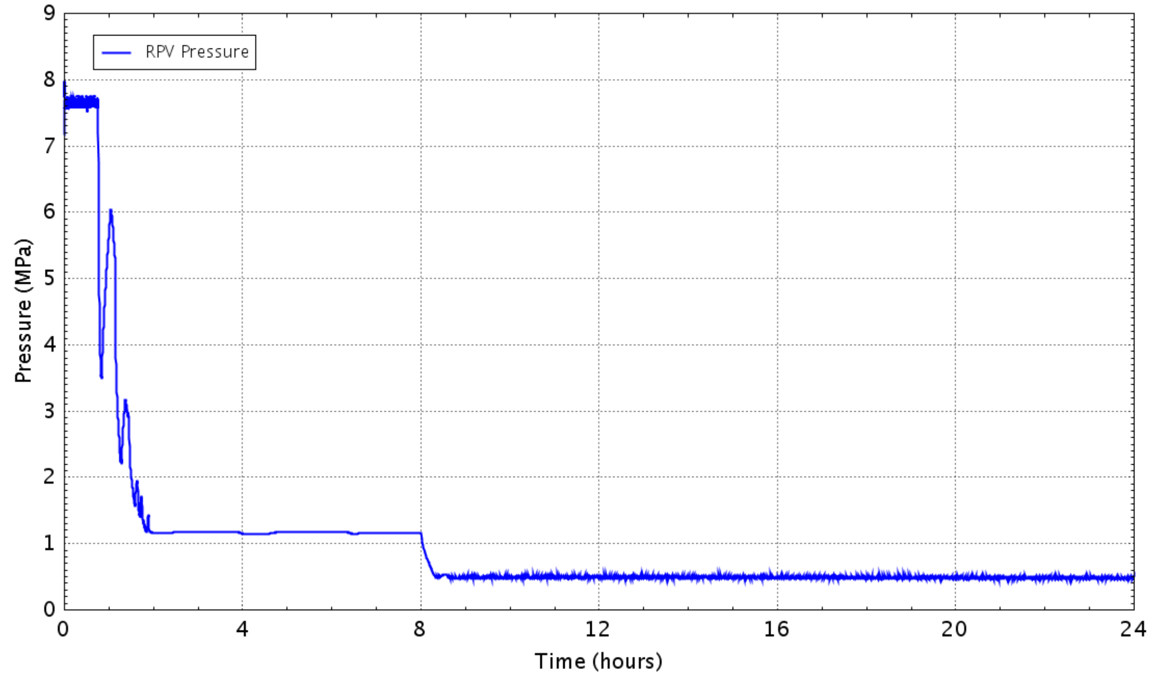

Figure D - 380 Pressure in theRPV

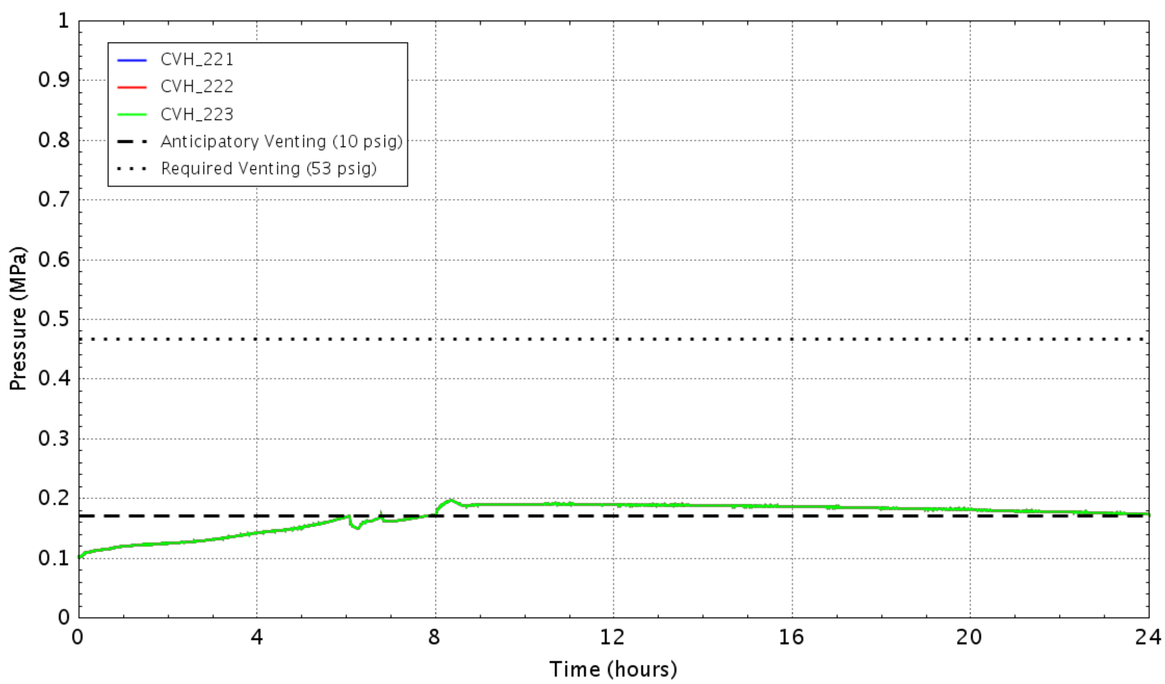

Figure D - 381 Pressure in the wetwell

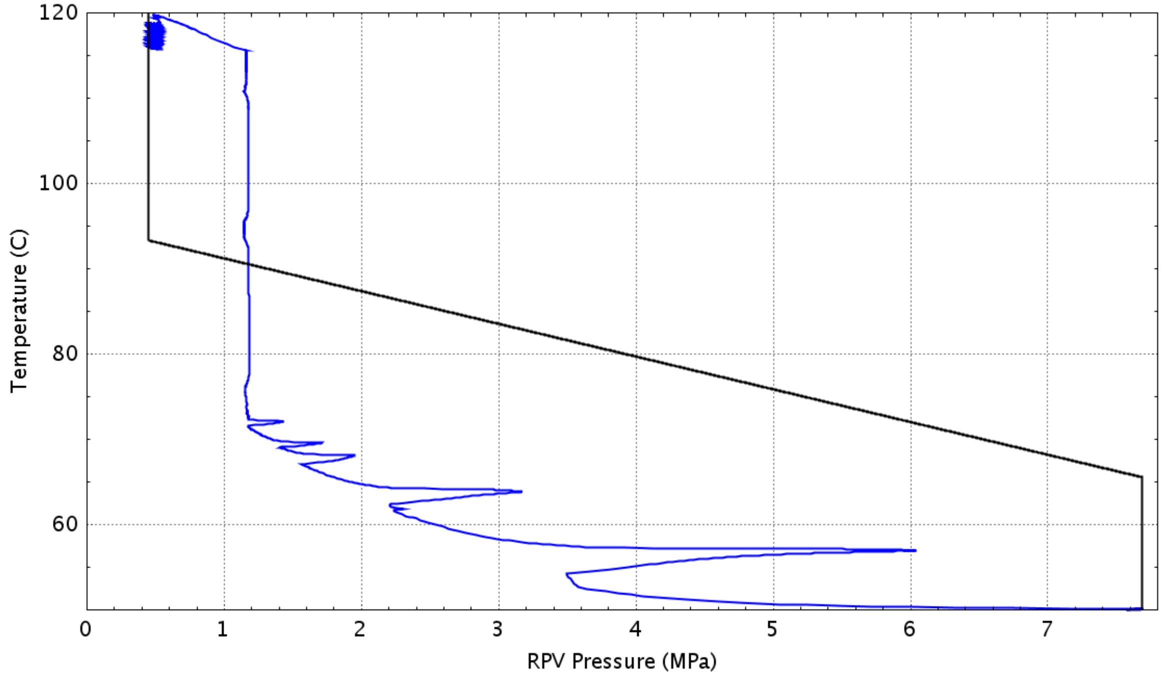

Figure D – 382 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

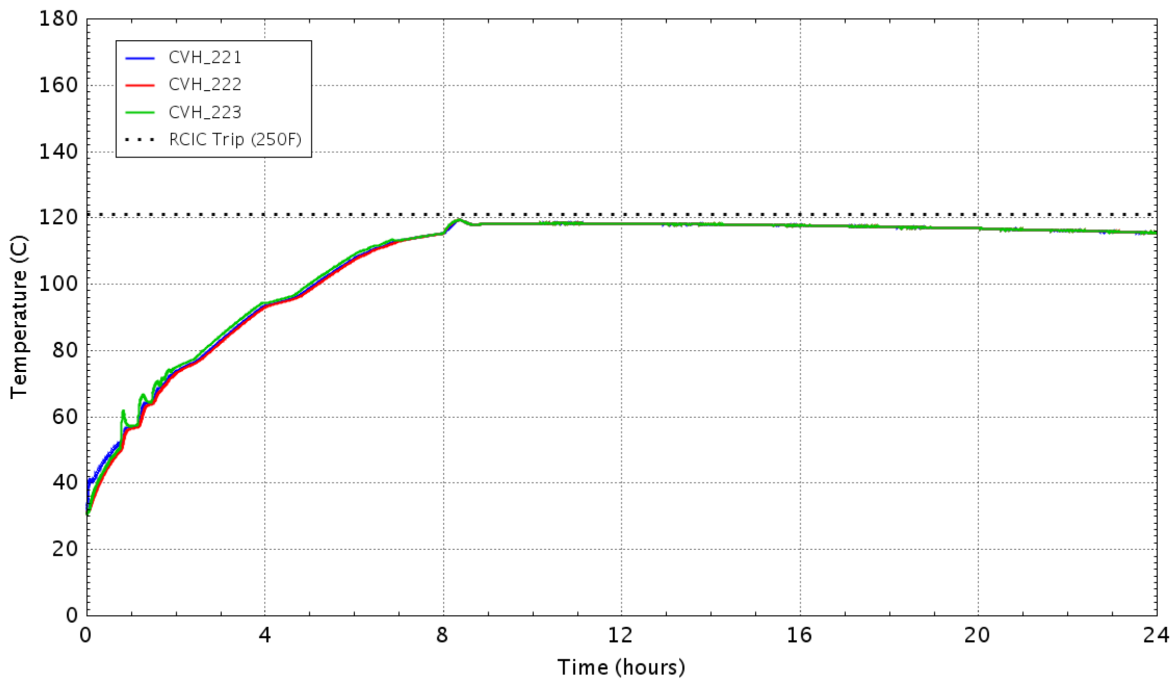

Figure D - 383 **Water temperature in the wetwell**

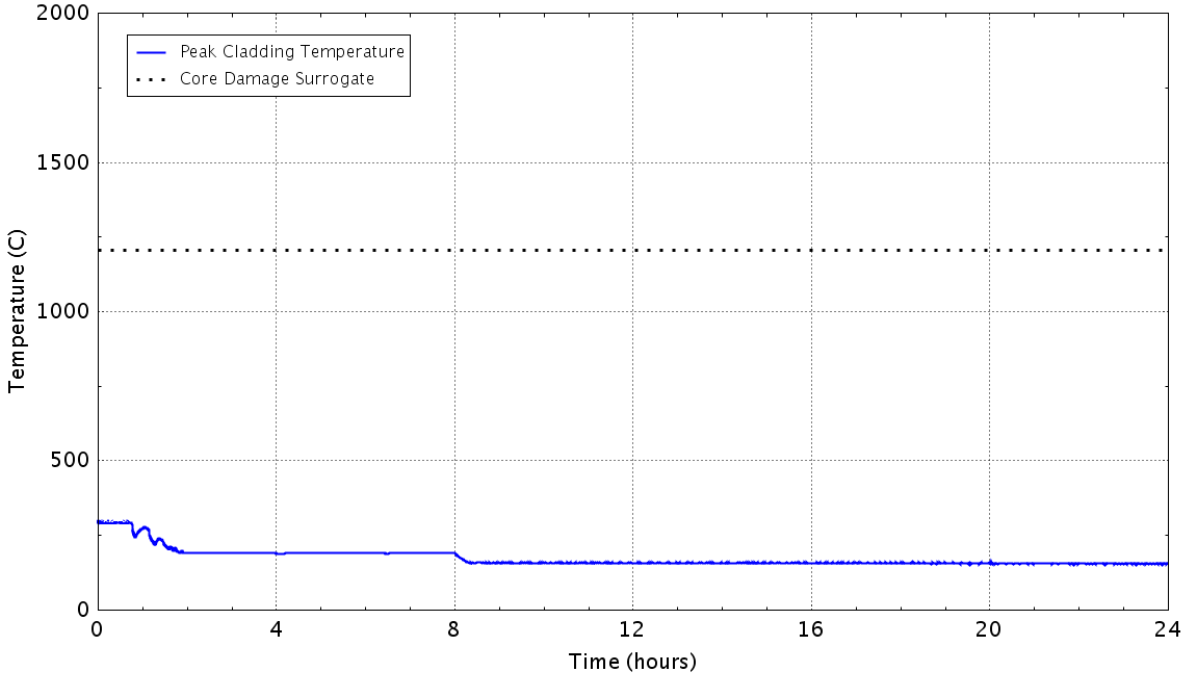

Figure D – 384 Peak temperature of the fuel cladding as a function oftime

D.3.8 Case 9a: Sensitivity to LOOPGR-38-9 Case 9 with HPCI Available Instead of RCIC

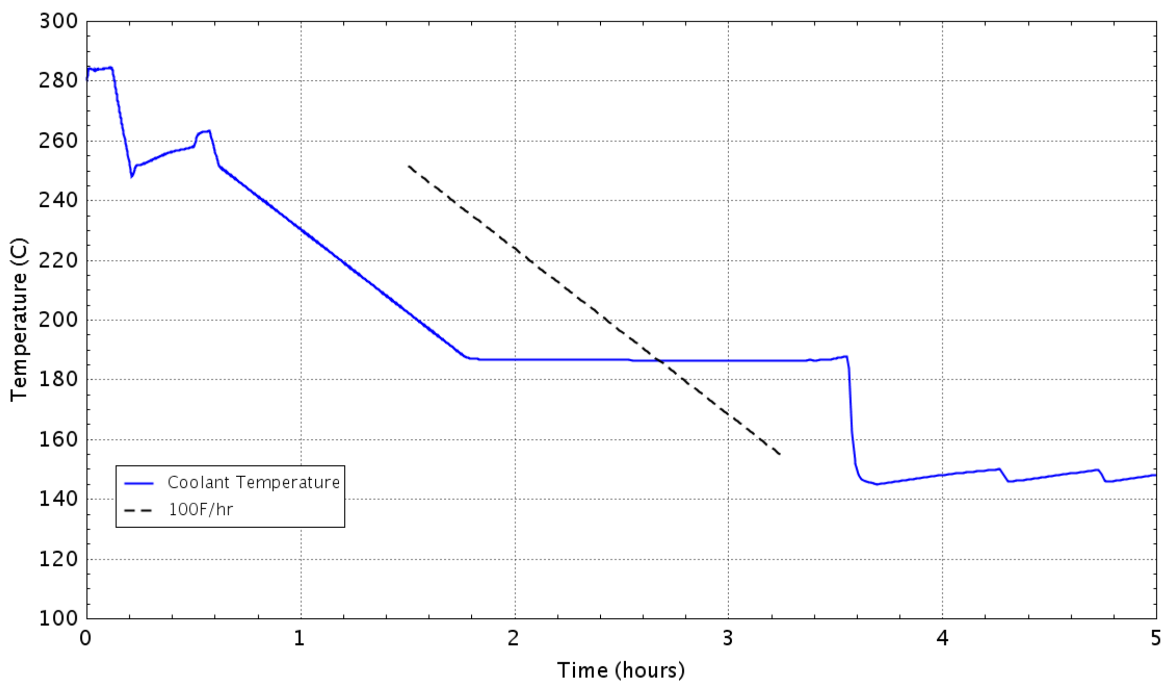

Figure D - 385 RPV cooldown rate

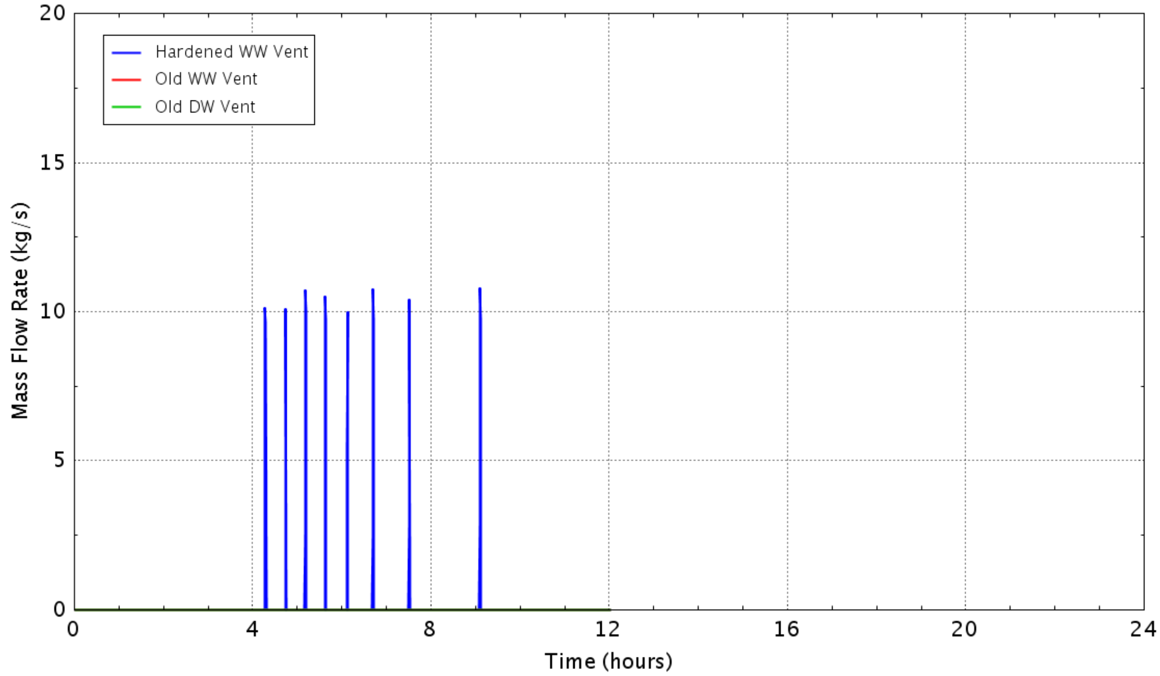

Figure D - 386 Flow rate of the containment vents

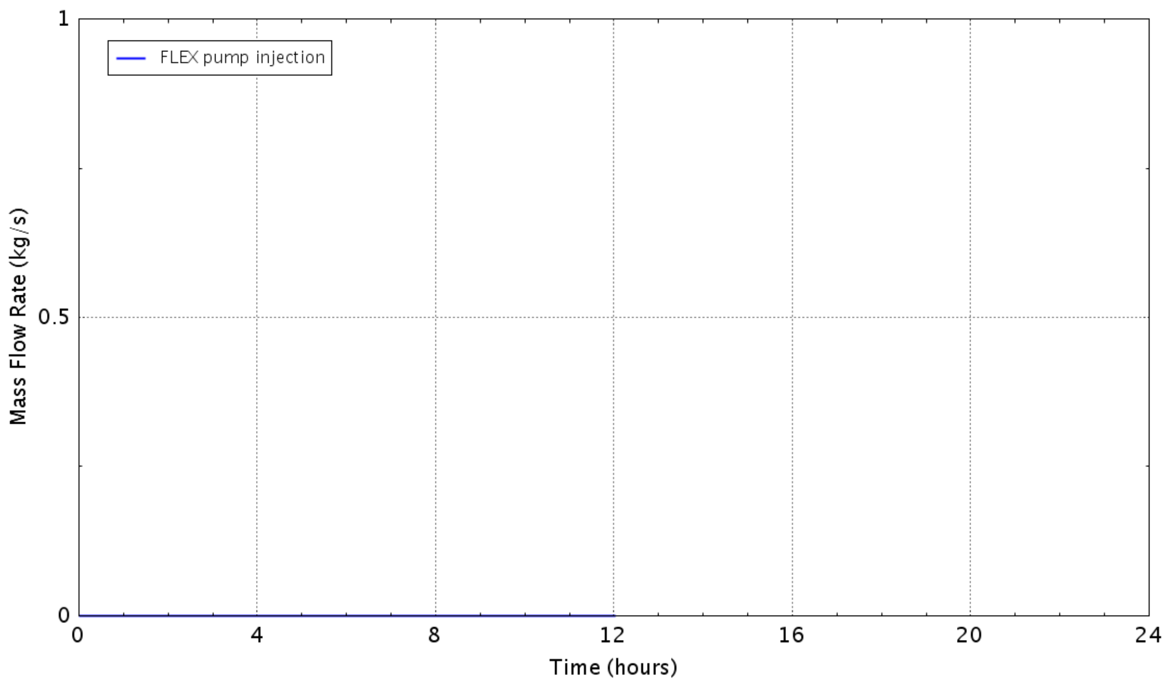

Figure D - 387 Flow rate of the FLEX pump

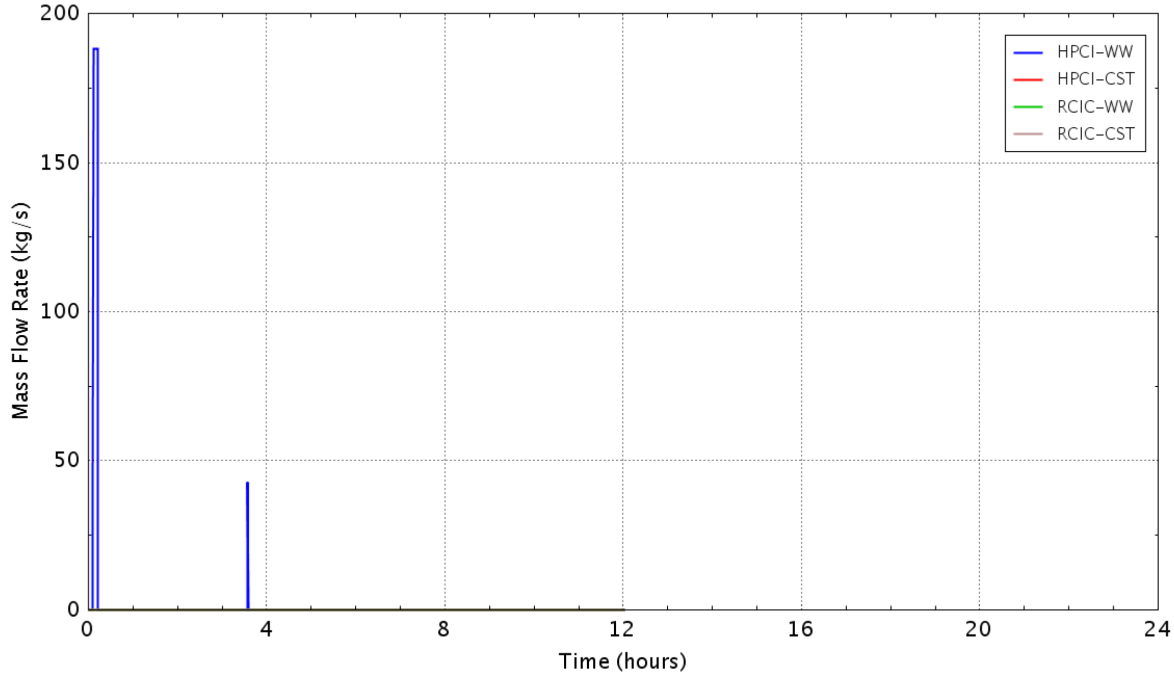

Figure D - 388 **Flow rate of the HPCI/RCIC pumps**

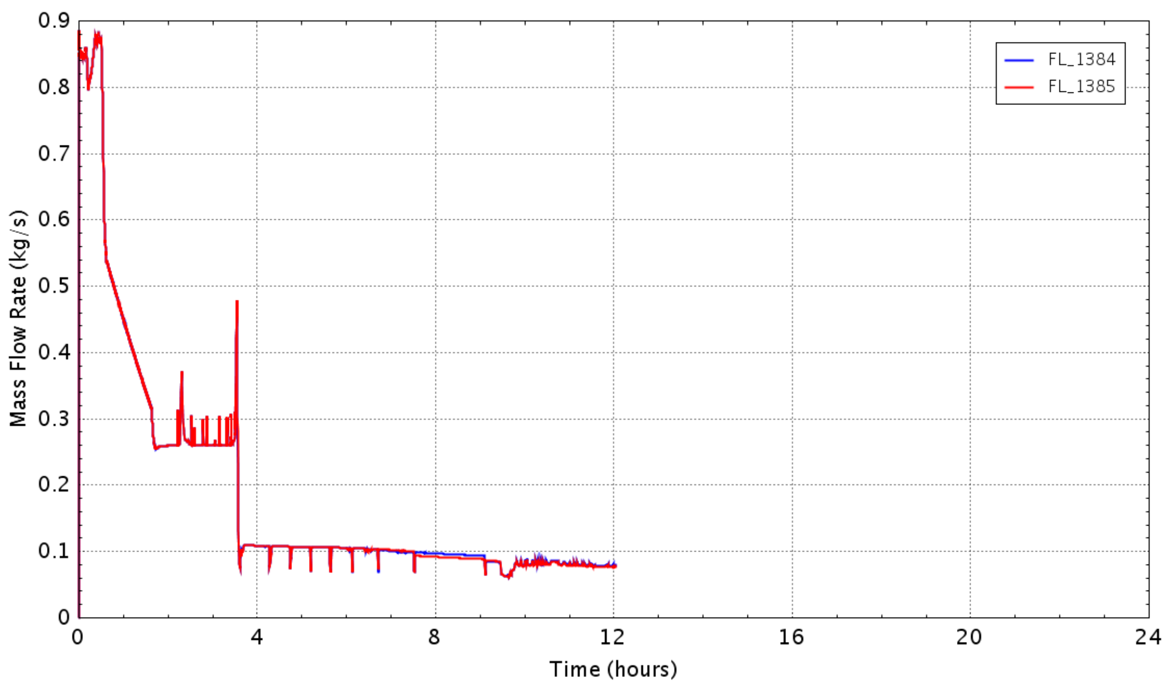

Figure D - 389 **Flow rate of the recirculating pump seal leakage**

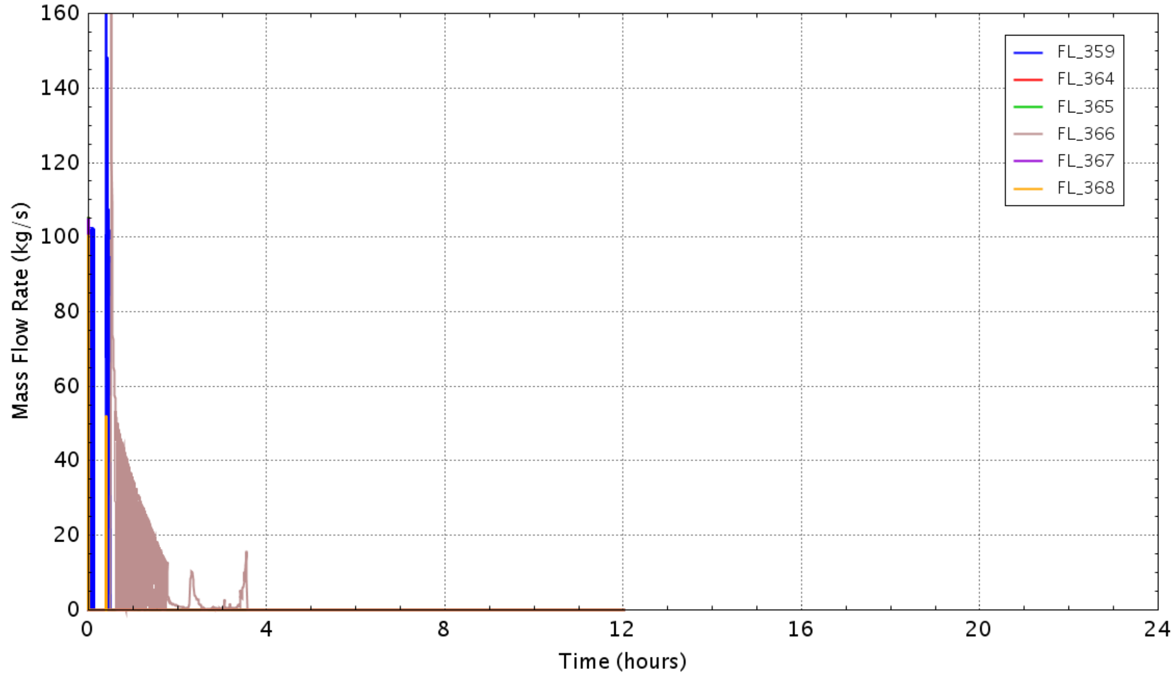

Figure D - 390 Flow rate of the SRVs

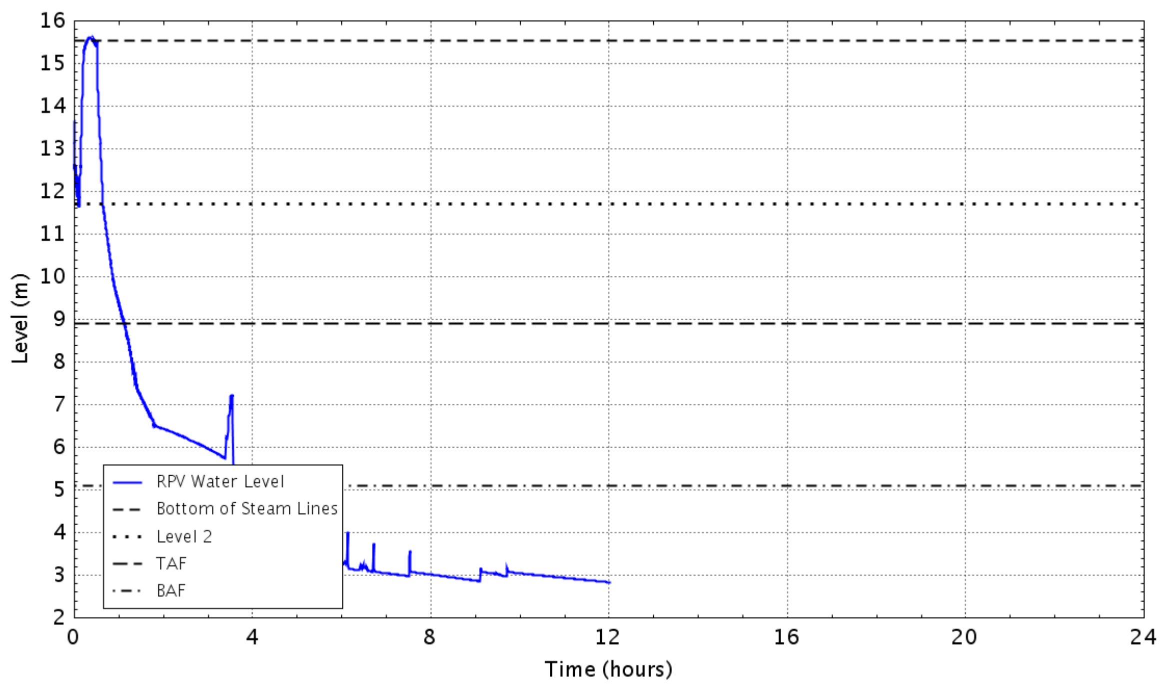

Figure D - 391 RPV down comer water level

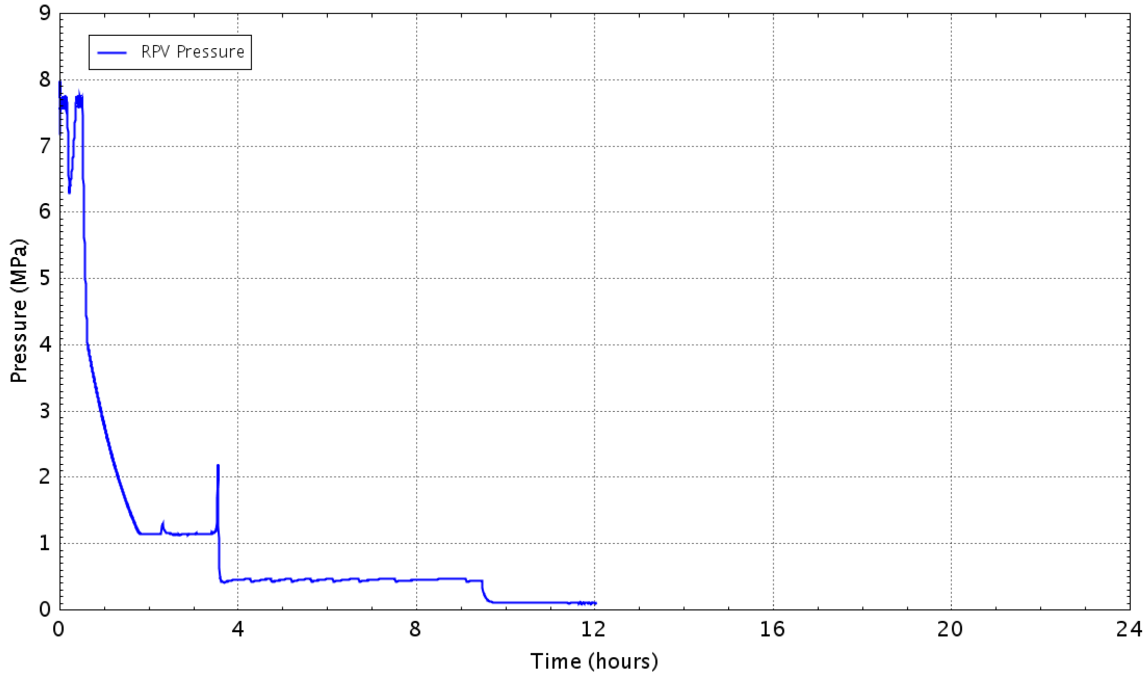

Figure D - 392 **Pressure in theRPV**

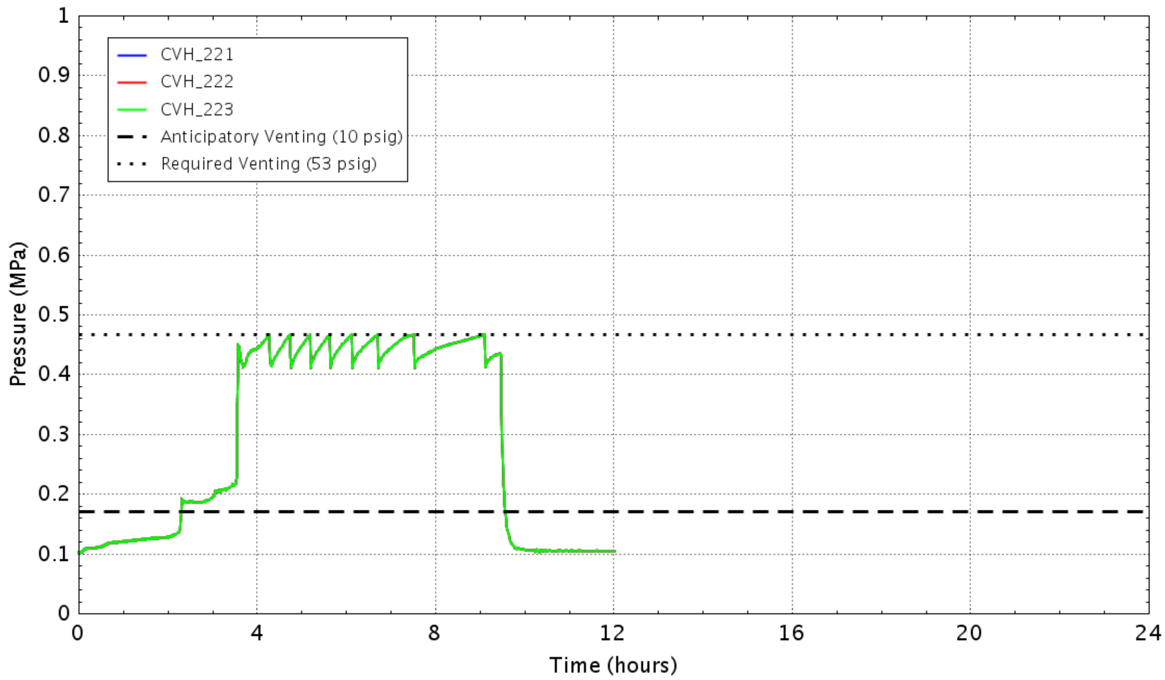

Figure D - 393 **Pressure in the wetwell**

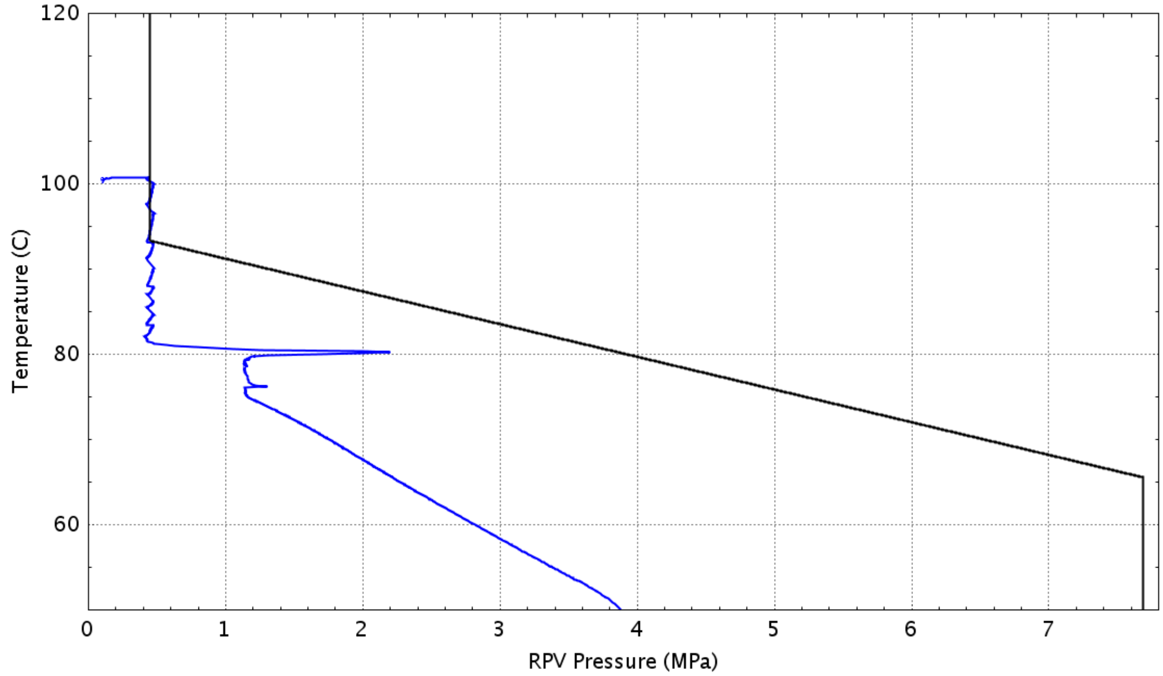

Figure D – 394 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

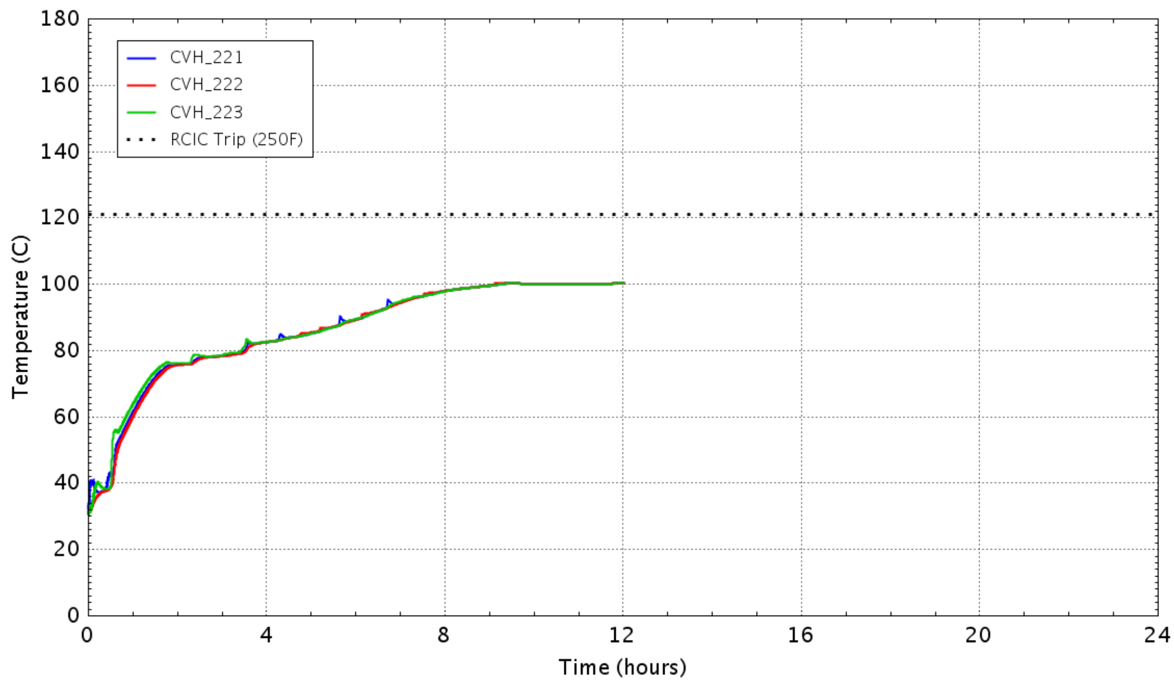

Figure D - 395 **Water temperature in the wetwell**

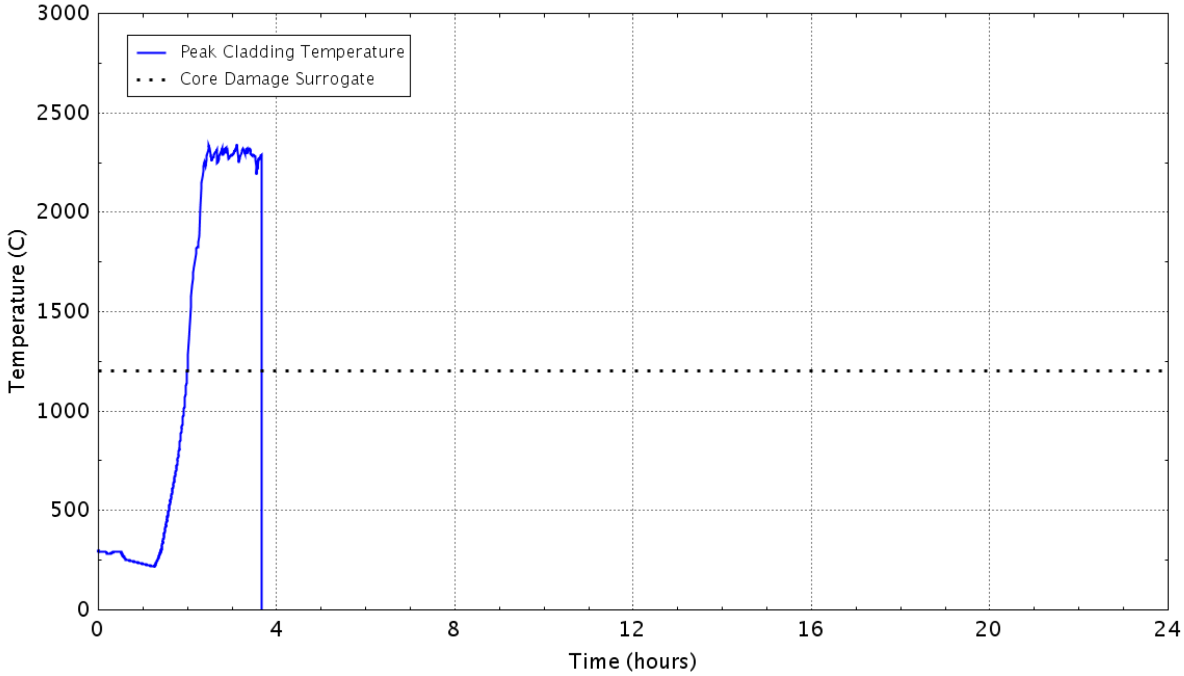

Figure D – 396 Peak temperature of the fuel cladding as a function oftime

D.3.9 Case 17a: Sensitivity to LOMFW-25 Case 17 with RPV Cooldown Beginning at 30 min. at Maximum Allowable Rate

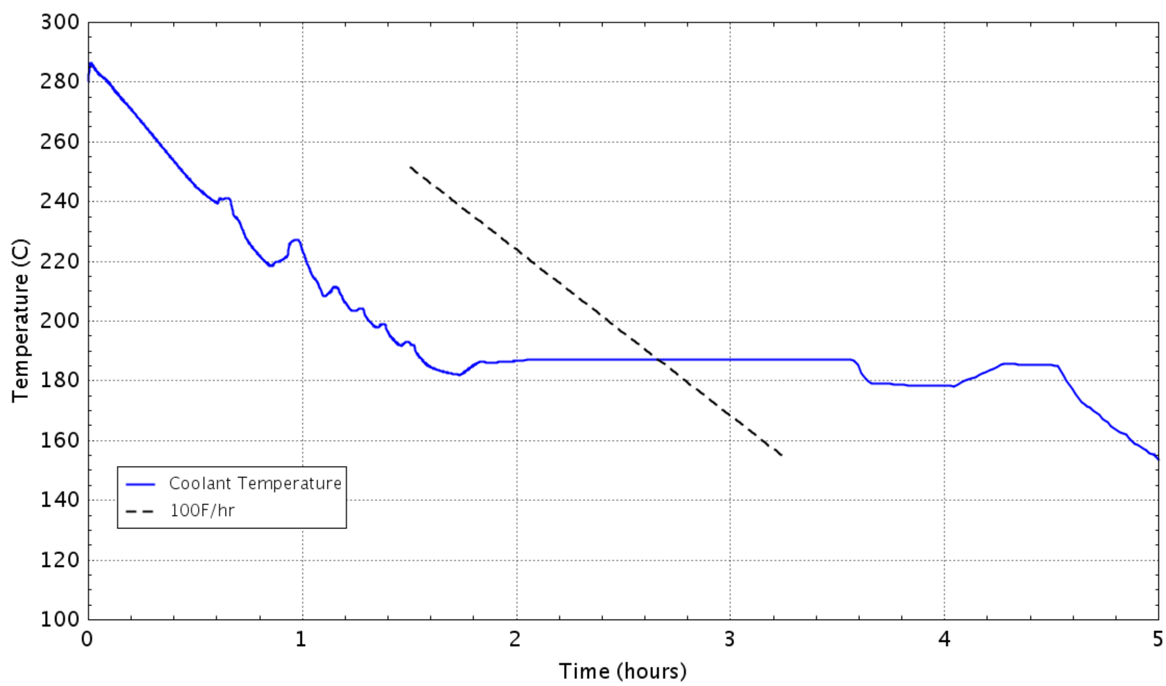

Figure D - 397 RPV cooldown rate

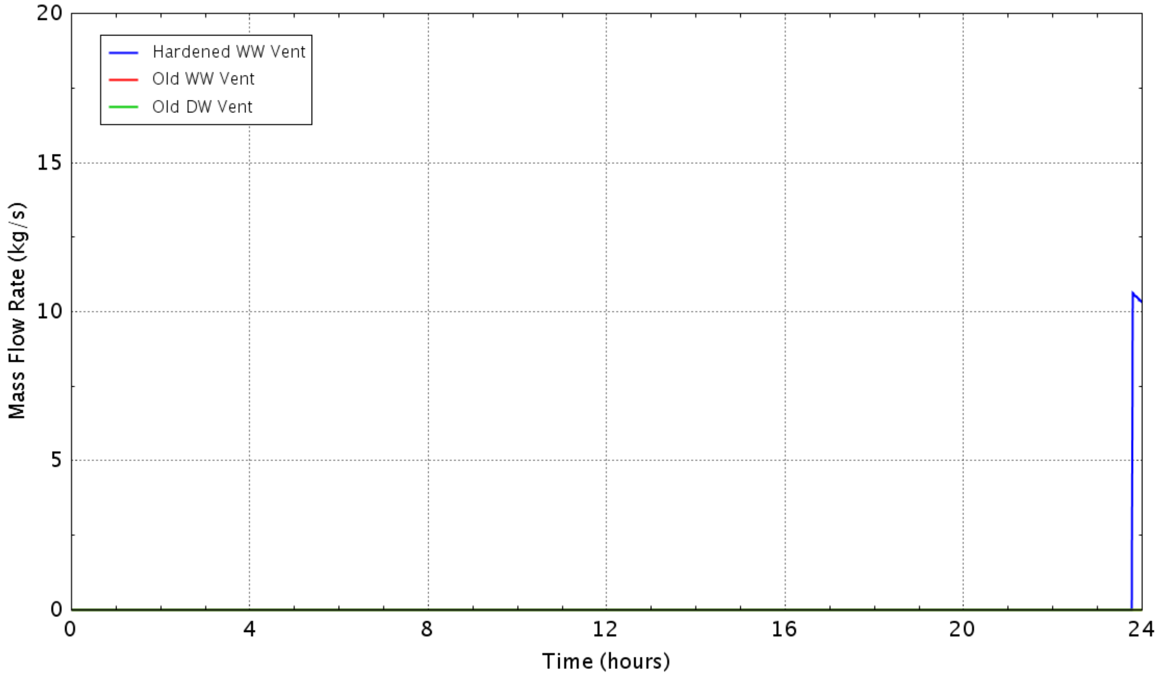

Figure D - 398 **Flow rate of the containment vents**

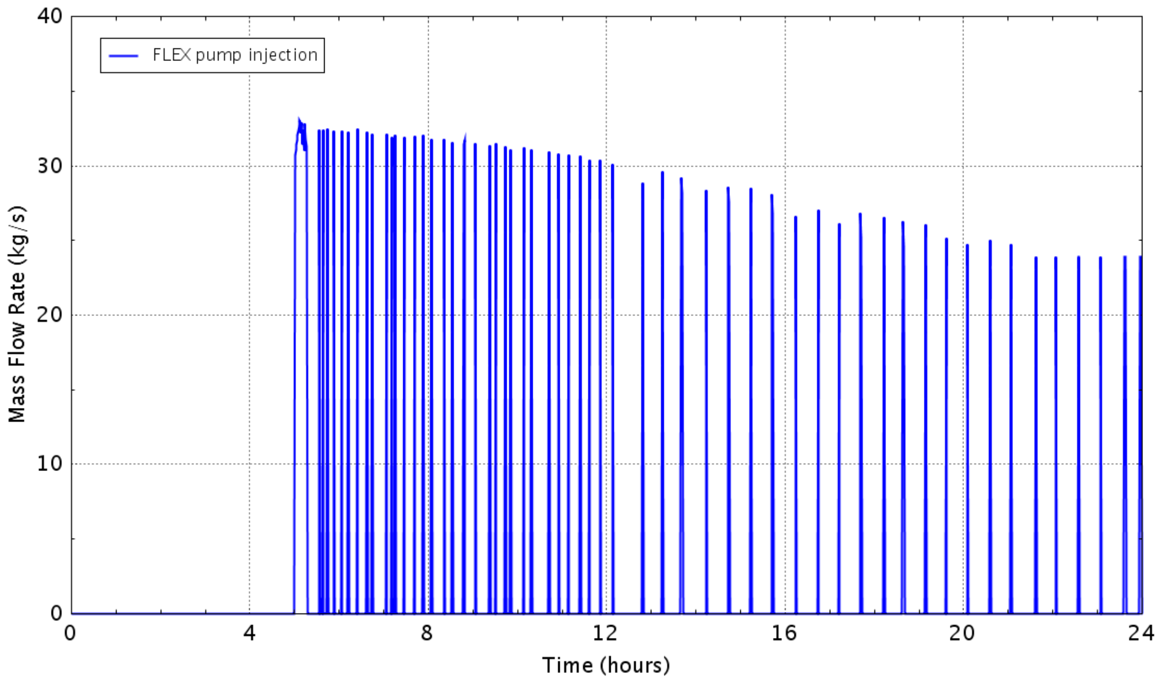

Figure D - 399 **Flow rate of the FLEX pump**

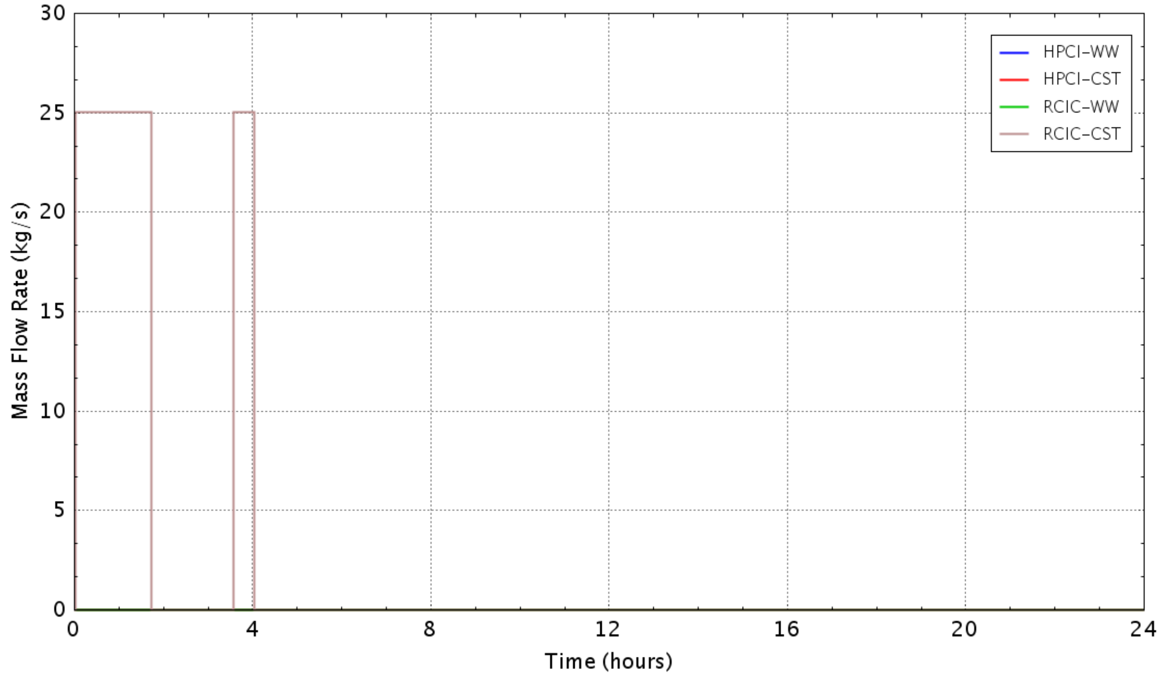

Figure D - 400 **Flow rate of the HPCI/RCIC pumps**

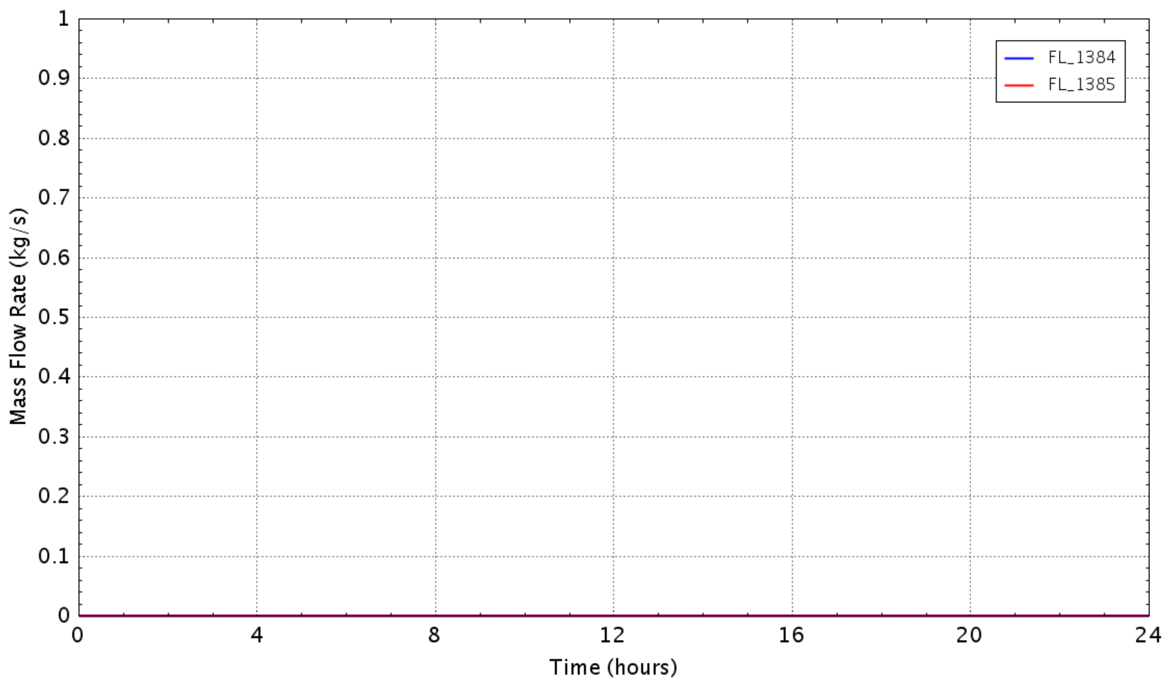

Figure D - 401 **Flow rate of the recirculating pump seal leakage**

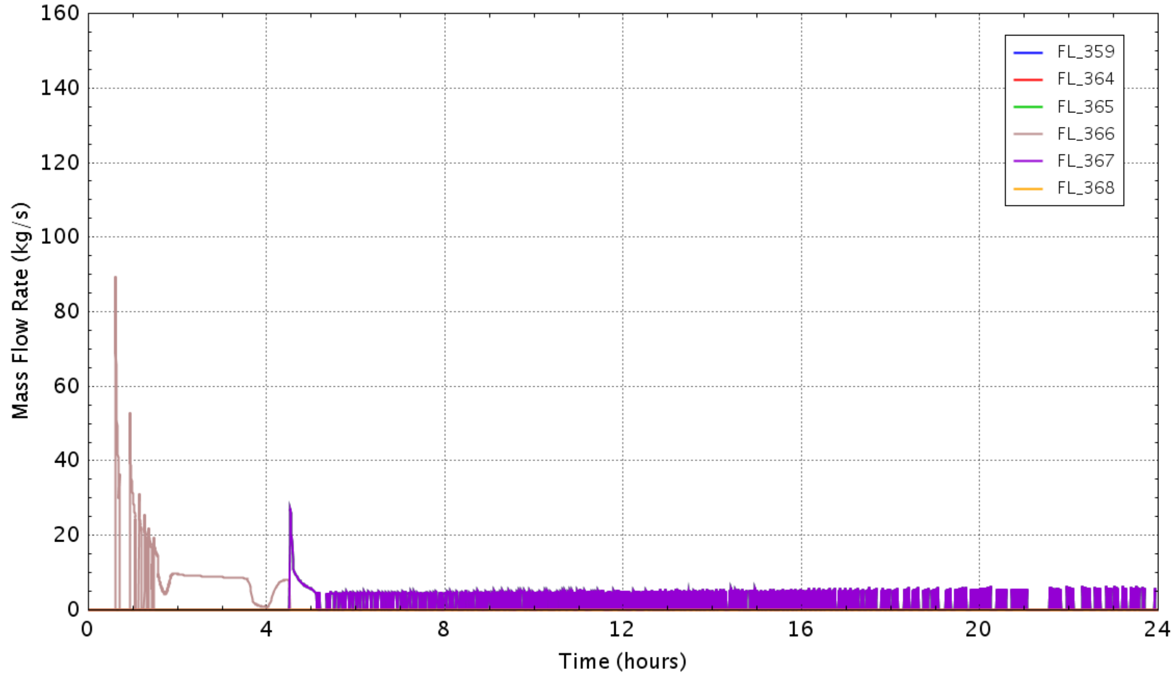

Figure D - 402 Flow rate of the SRVs

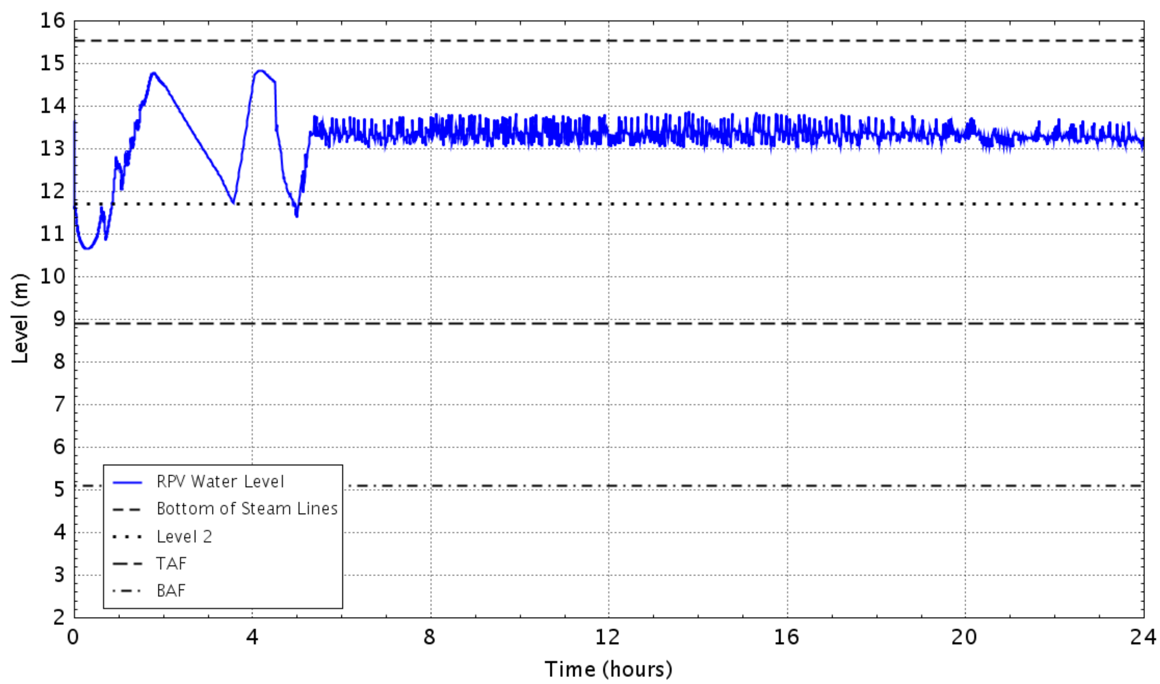

Figure D - 403 RPV down comer water level

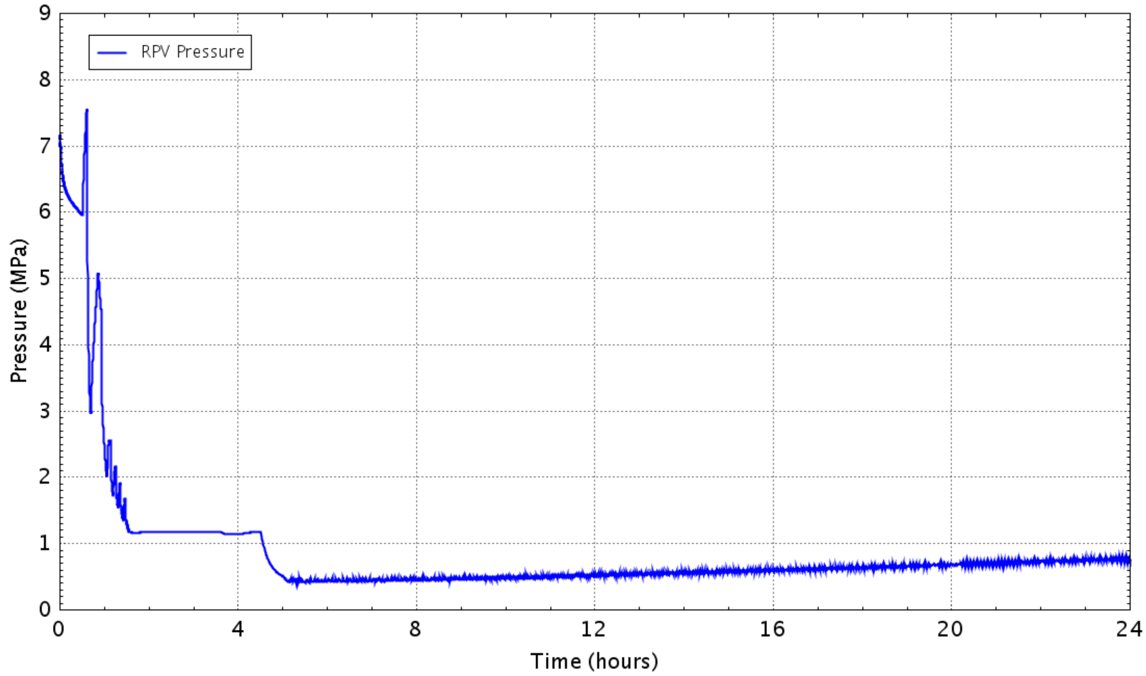

Figure D - 404 **Pressure in theRPV**

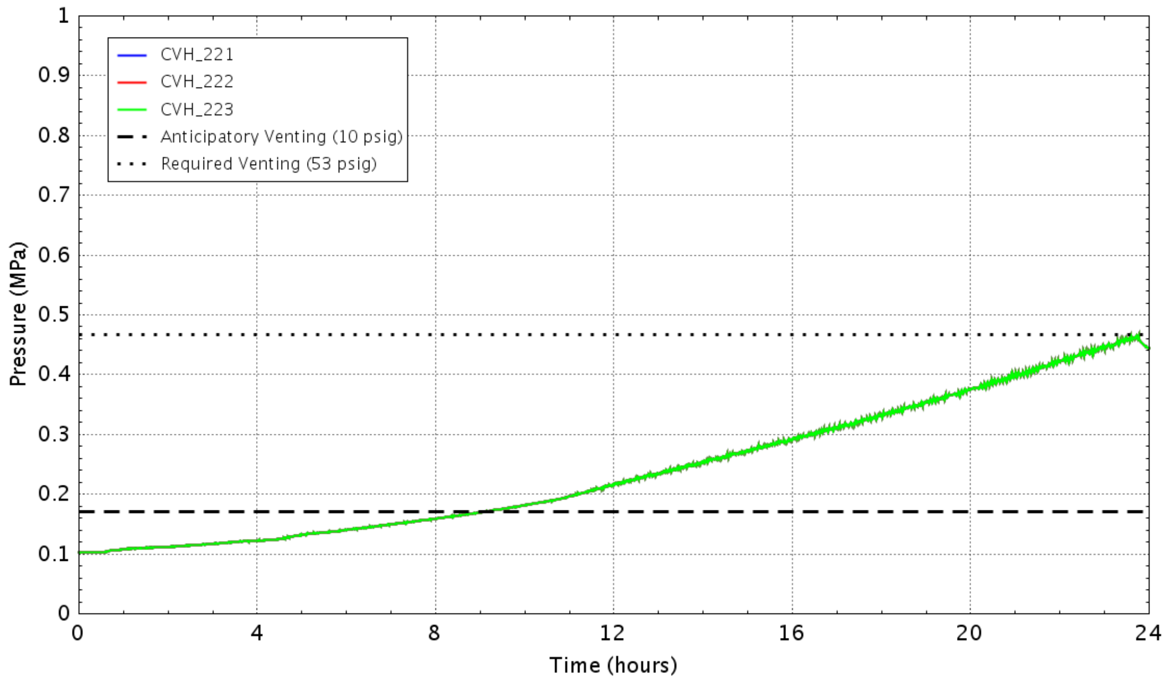

Figure D - 405 **Pressure in the wetwell**

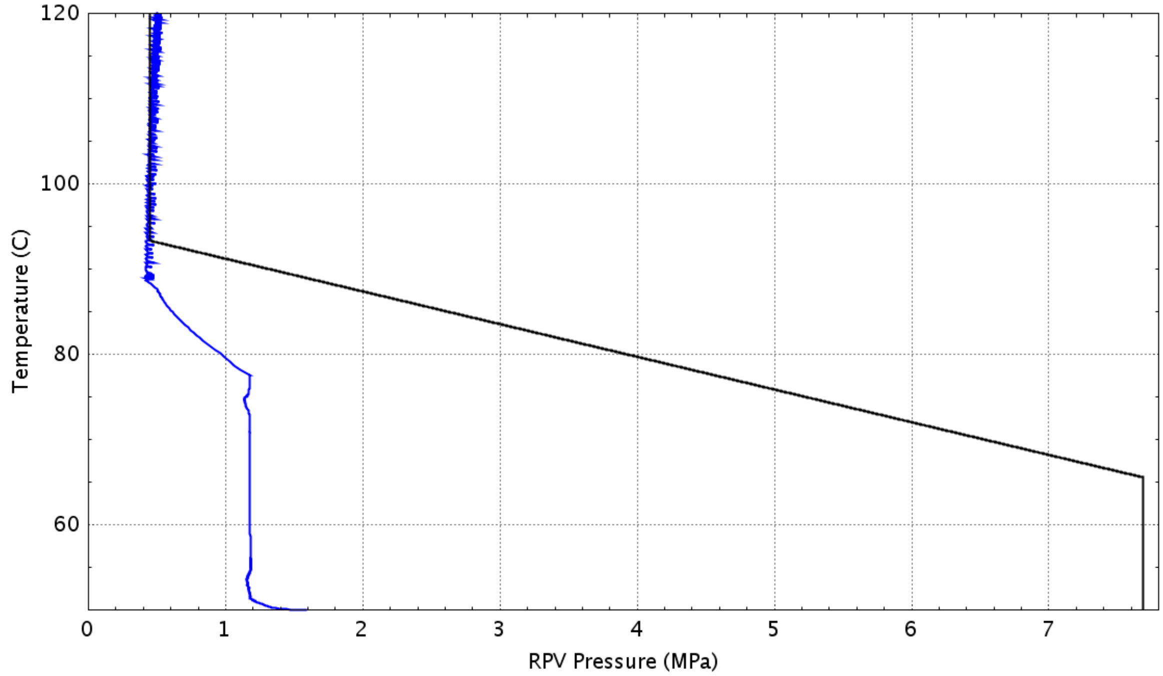

Figure D – 406 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

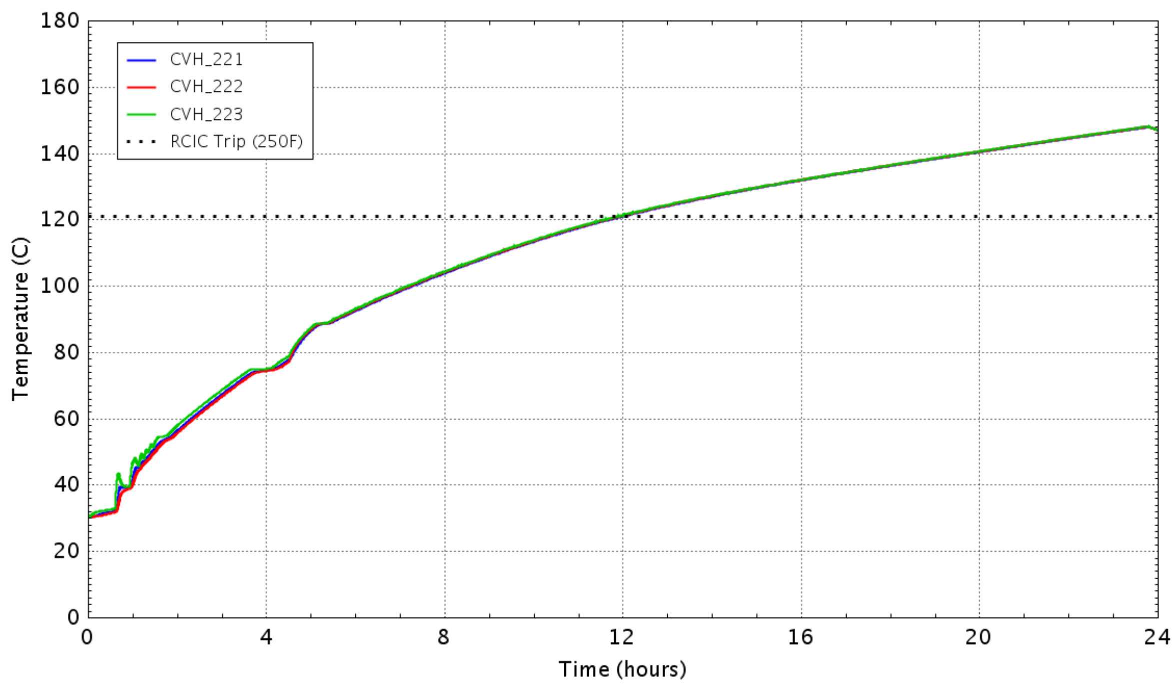

Figure D - 407 **Water temperature in the wetwell**

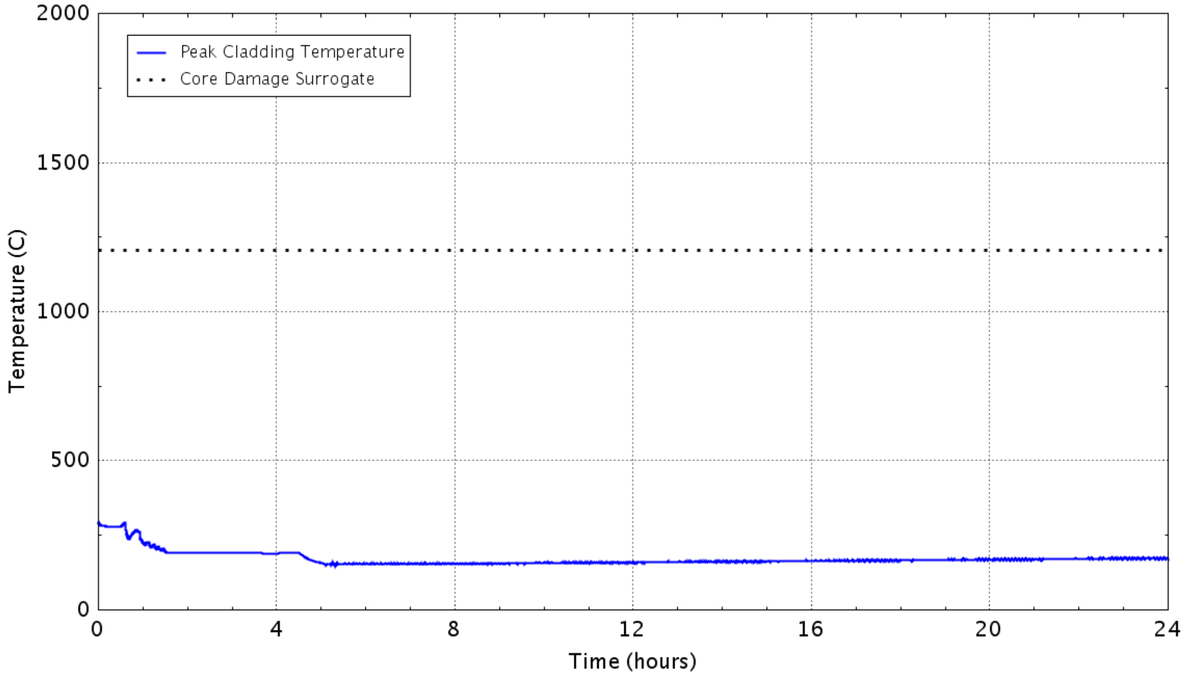

Figure D – 408 Peak temperature of the fuel cladding as a function oftime

D.3.10 Case 19a: Sensitivity to LOMFW-25 Case 19 with HPCI Available Instead of RCIC

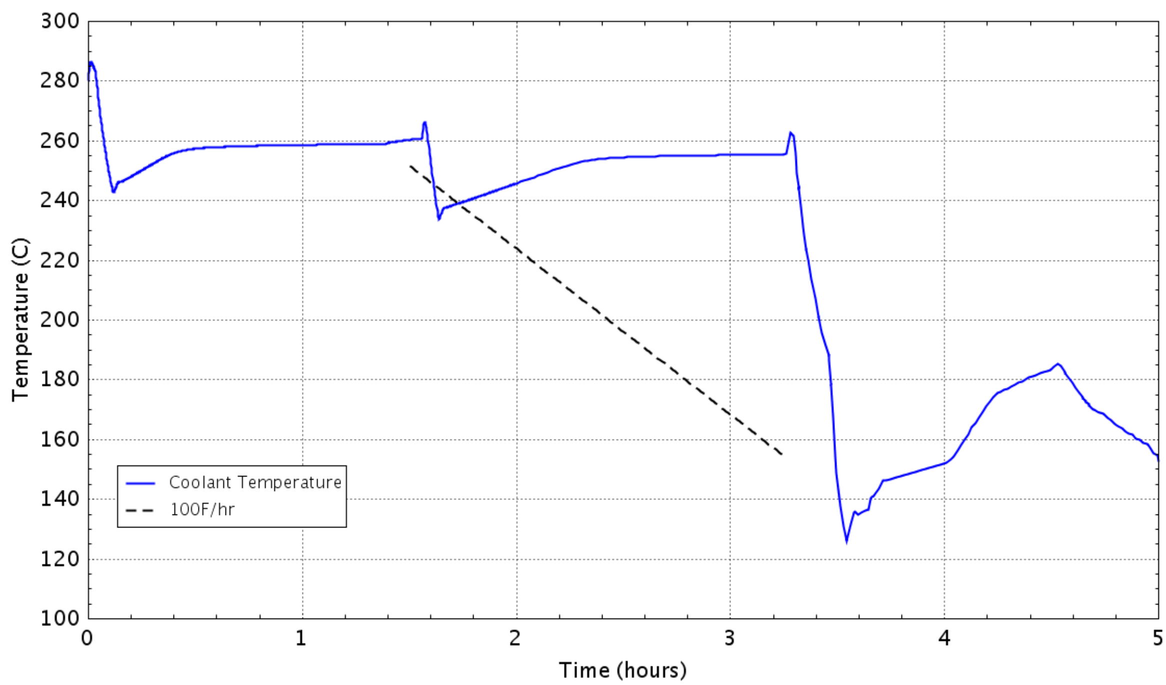

Figure D - 409 RPV cooldown rate

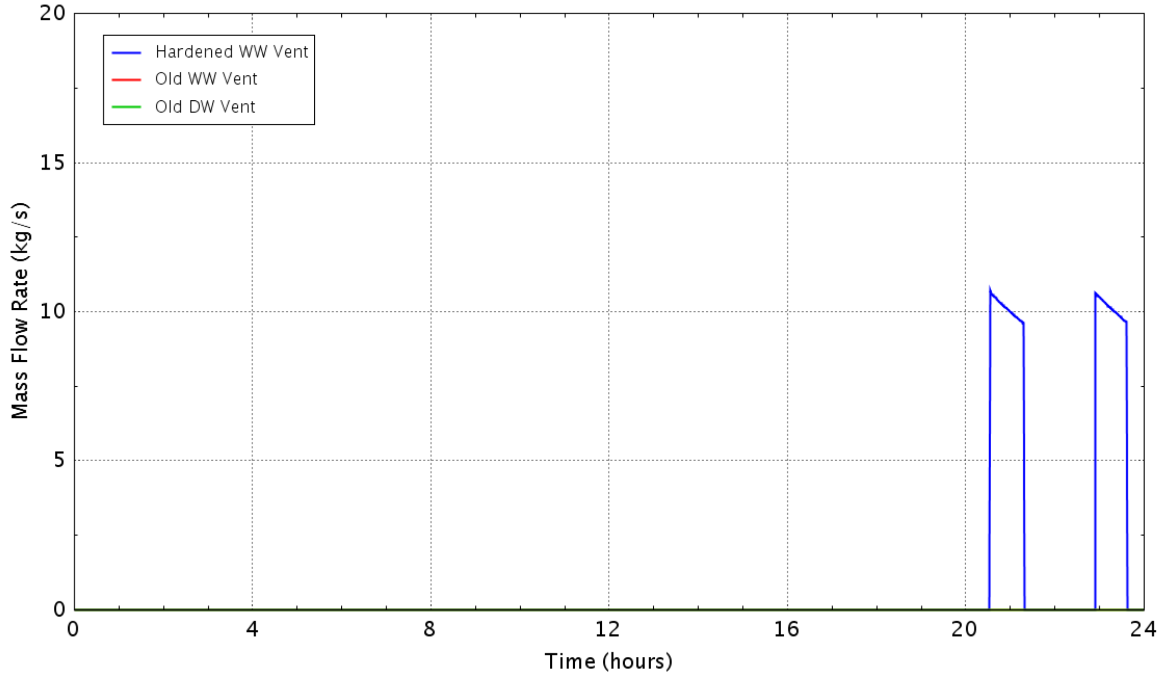

Figure D - 410 **Flow rate of the containment vents**

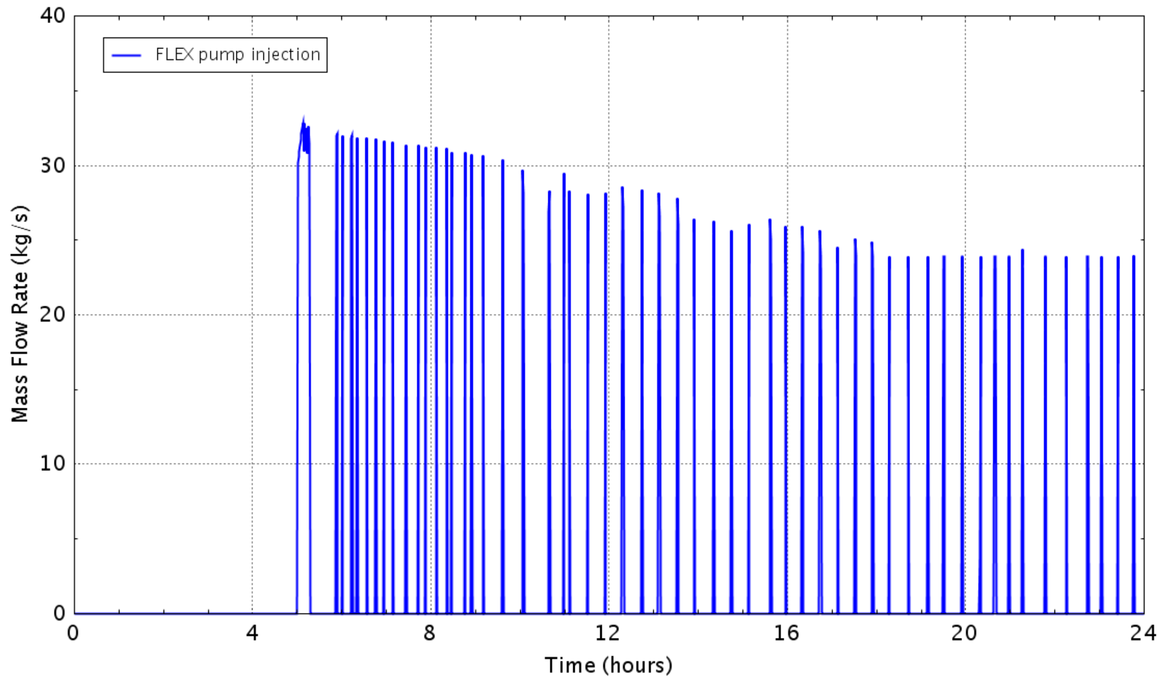

Figure D - 411 **Flow rate of the FLEX pump**

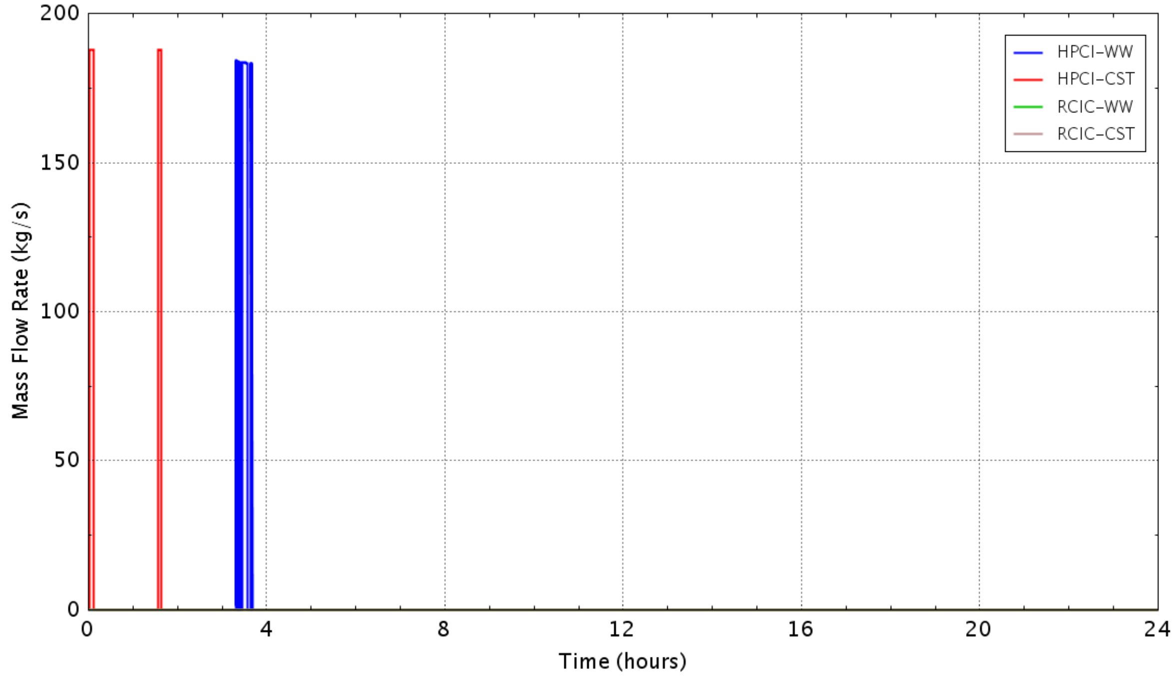

Figure D - 412 Flow rate of the HPCI/RCIC pumps

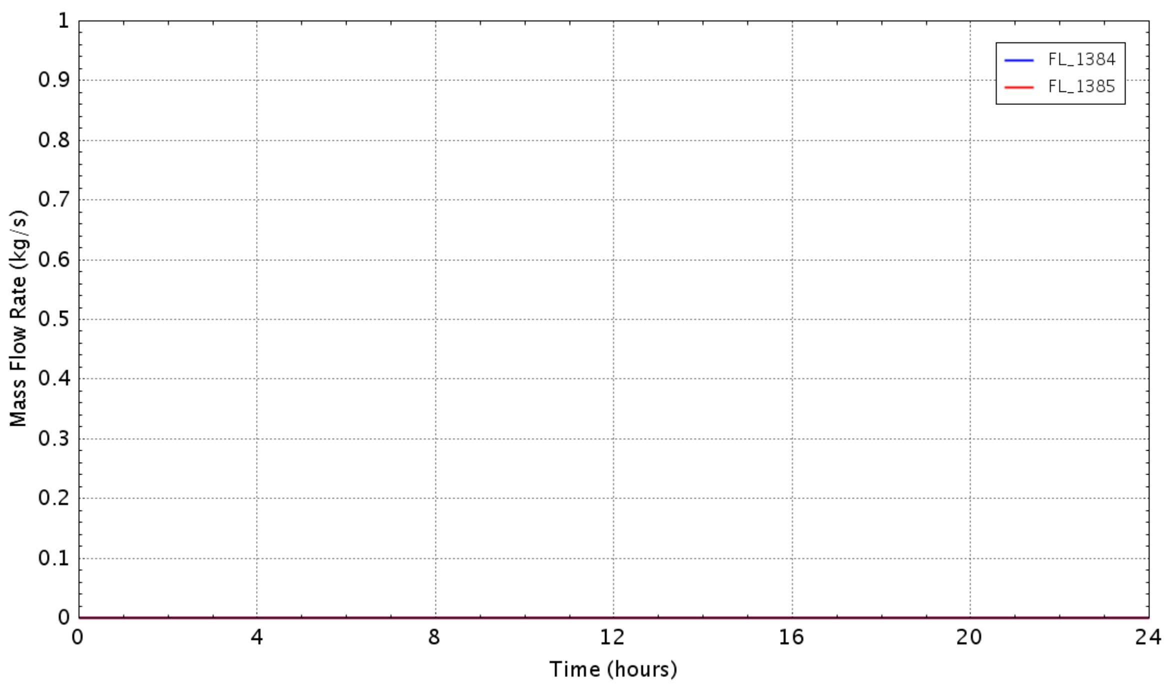

Figure D - 413 Flow rate of the recirculating pump seal leakage

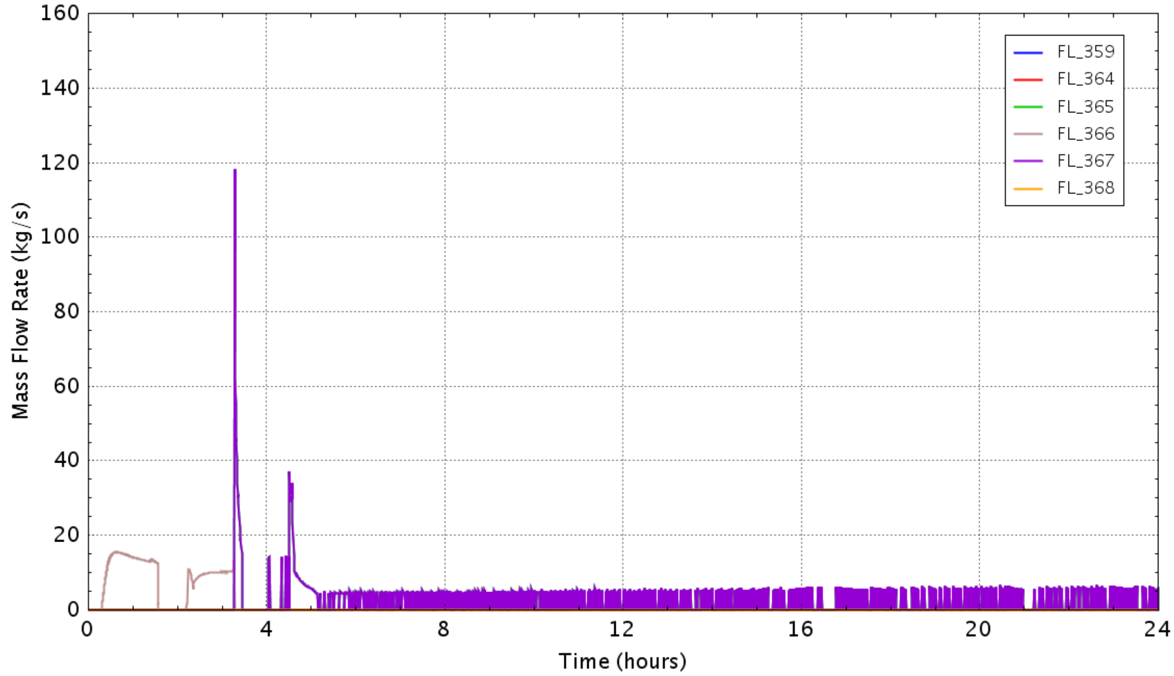

Figure D - 414 Flow rate of the SRVs

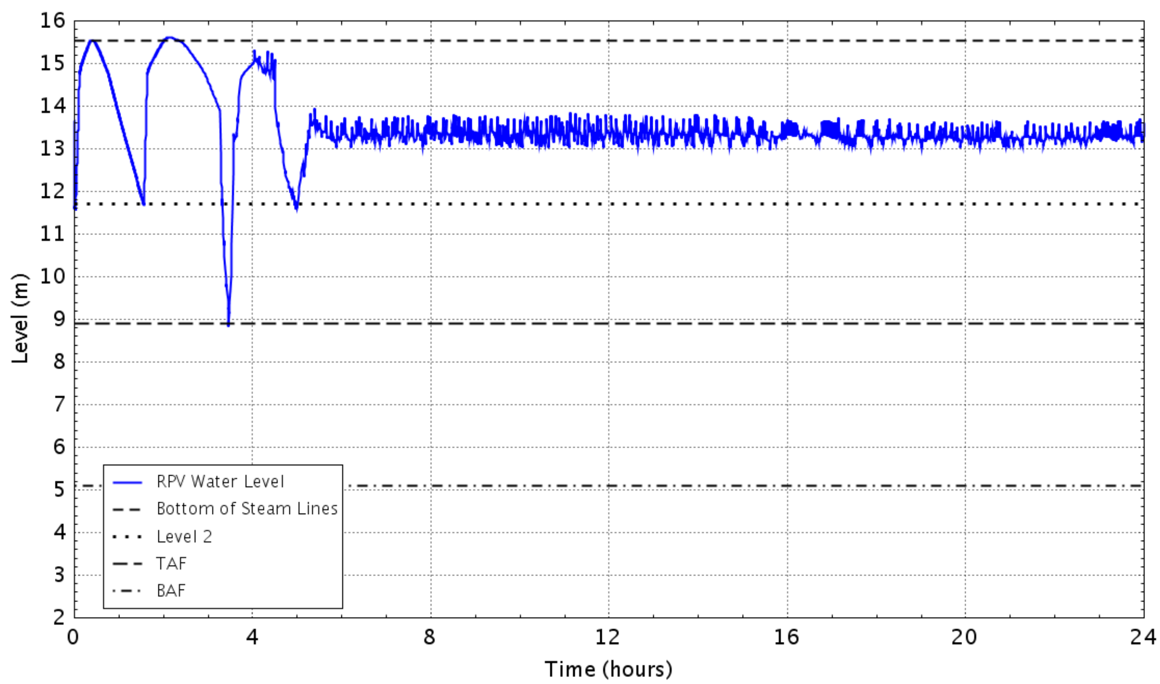

Figure D - 415 RPV down comer water level

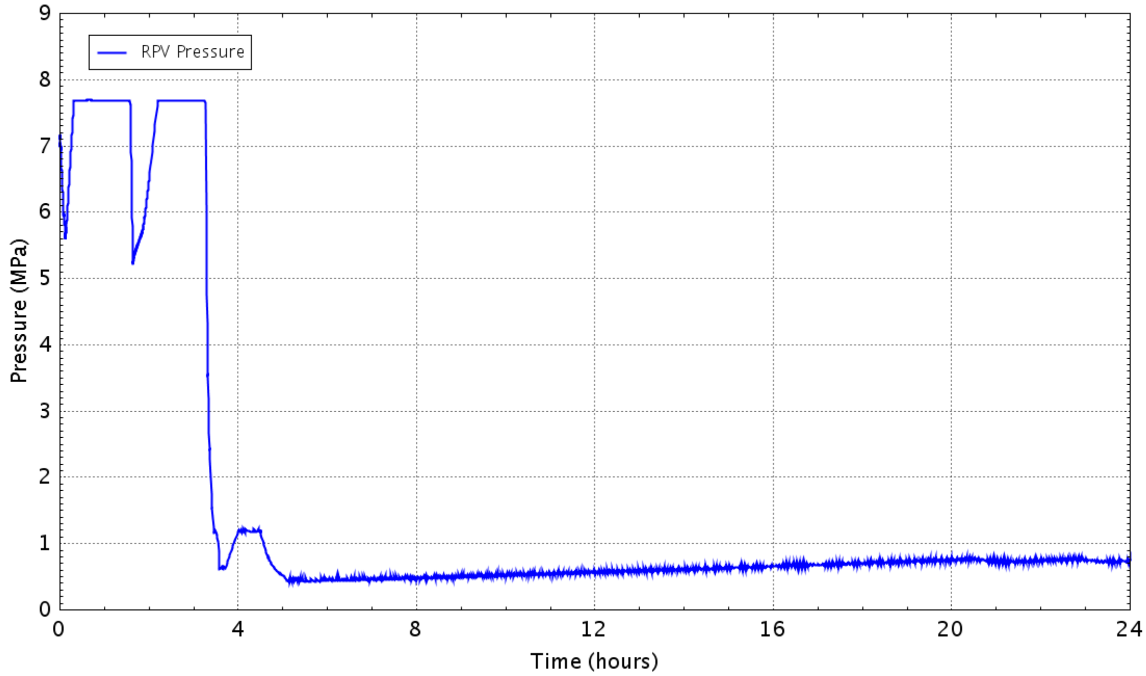

Figure D - 416 Pressure in theRPV

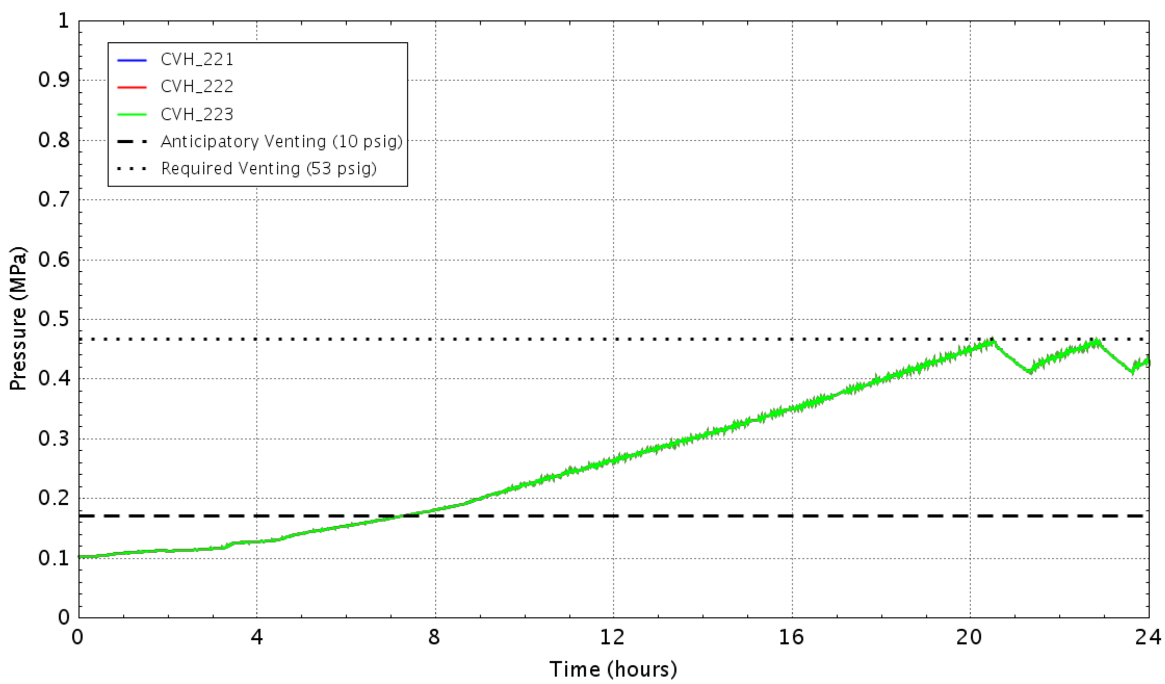

Figure D - 417 Pressure in the wetwell

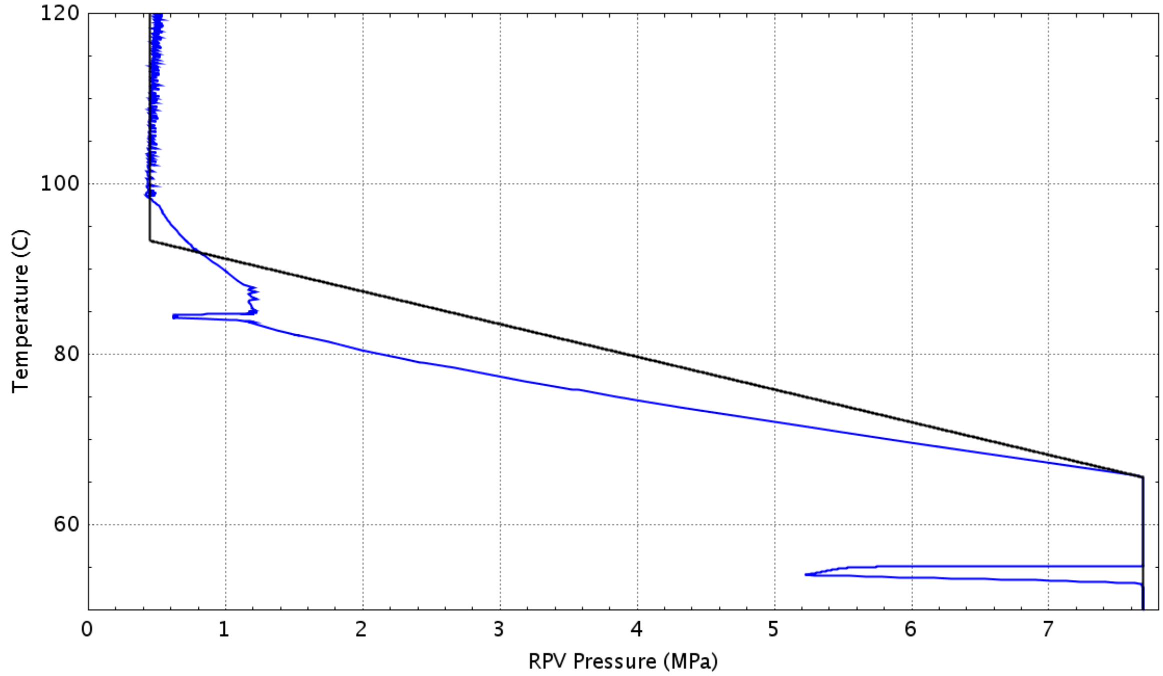

Figure D – 418 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

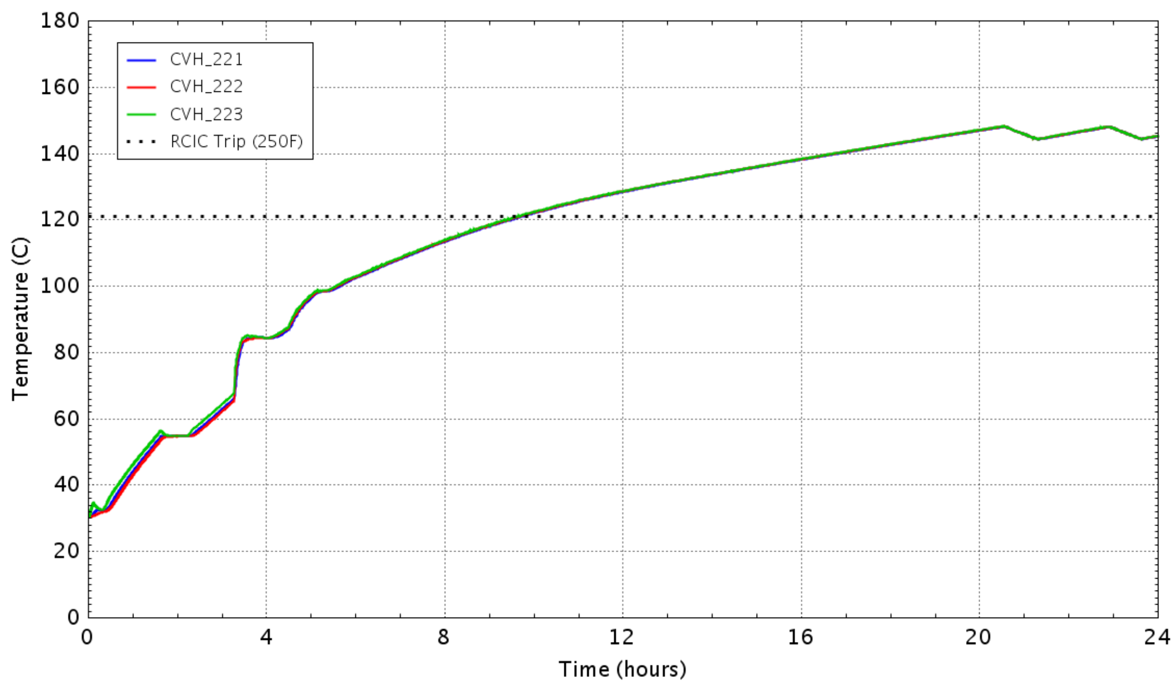

Figure D - 419 **Water temperature in the wetwell**

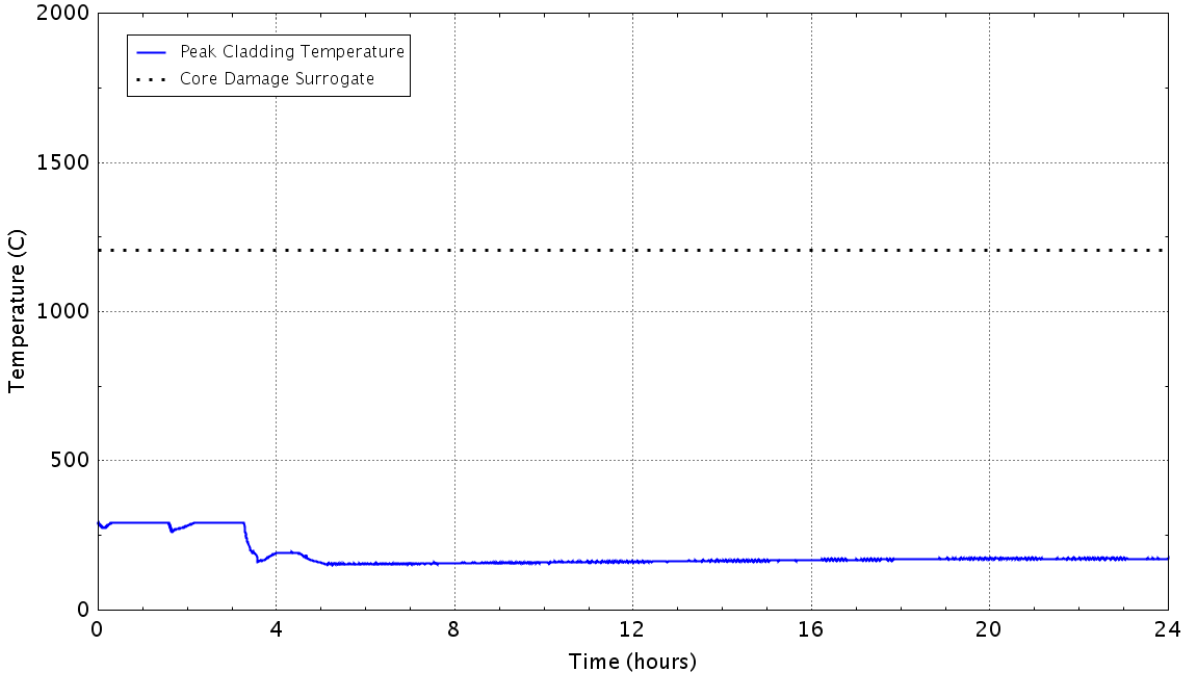

Figure D - 420 Peak temperature of the fuel cladding as a function of time

D.3.11 Case 19b: Sensitivity to LOMFW-25 Case 19 with RCIC Lost at5 hrs.

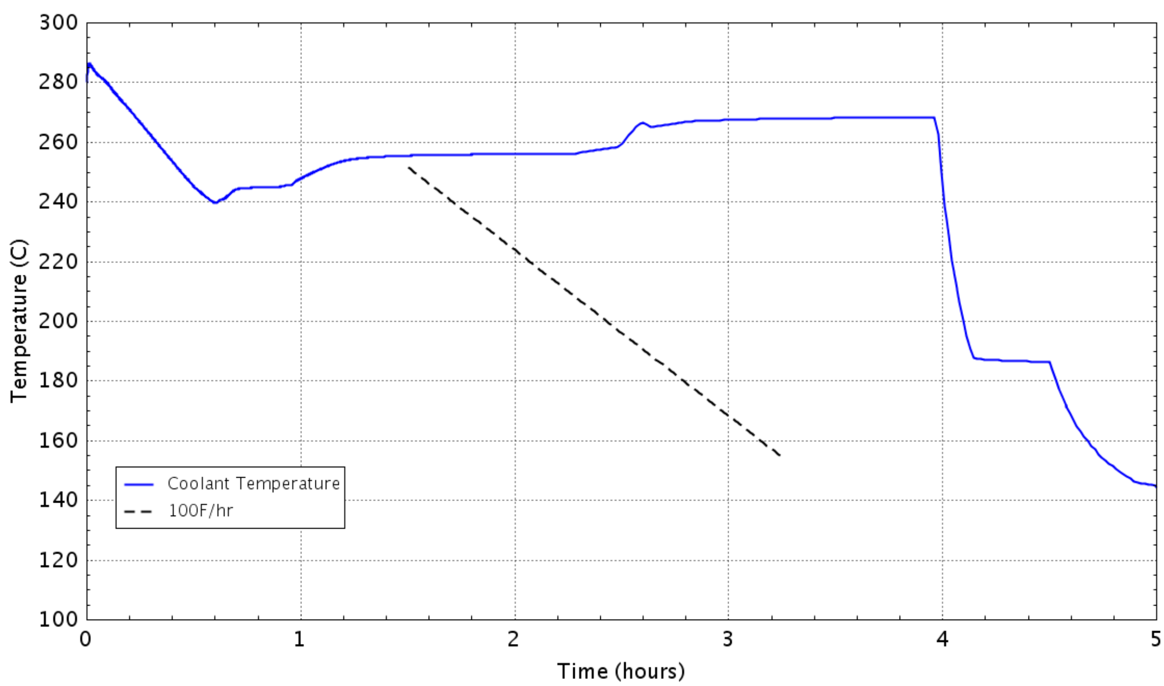

Figure D - 421 RPV cooldown rate

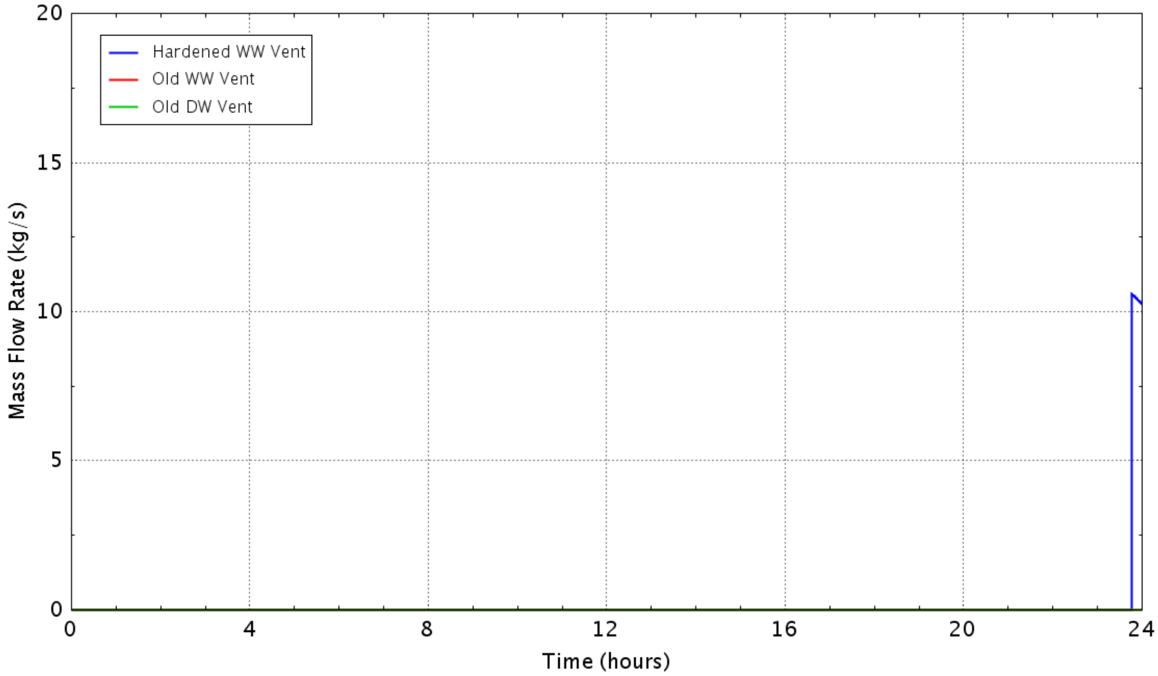

Figure D - 422 **Flow rate of the containment vents**

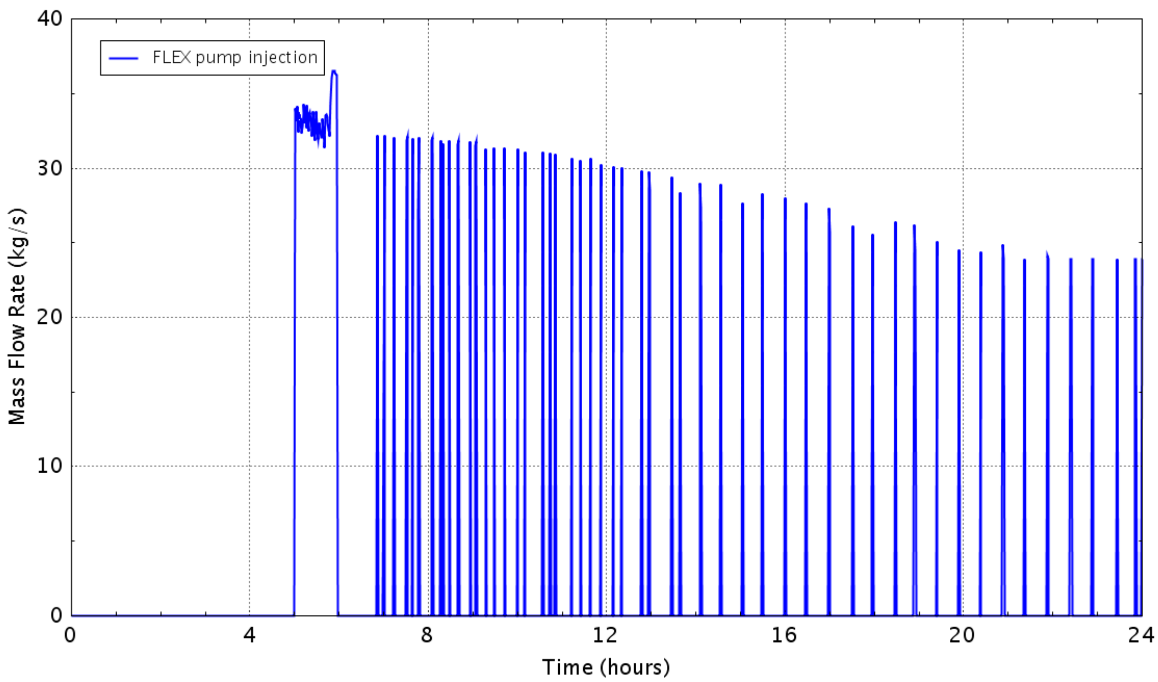

Figure D - 423 **Flow rate of the FLEX pump**

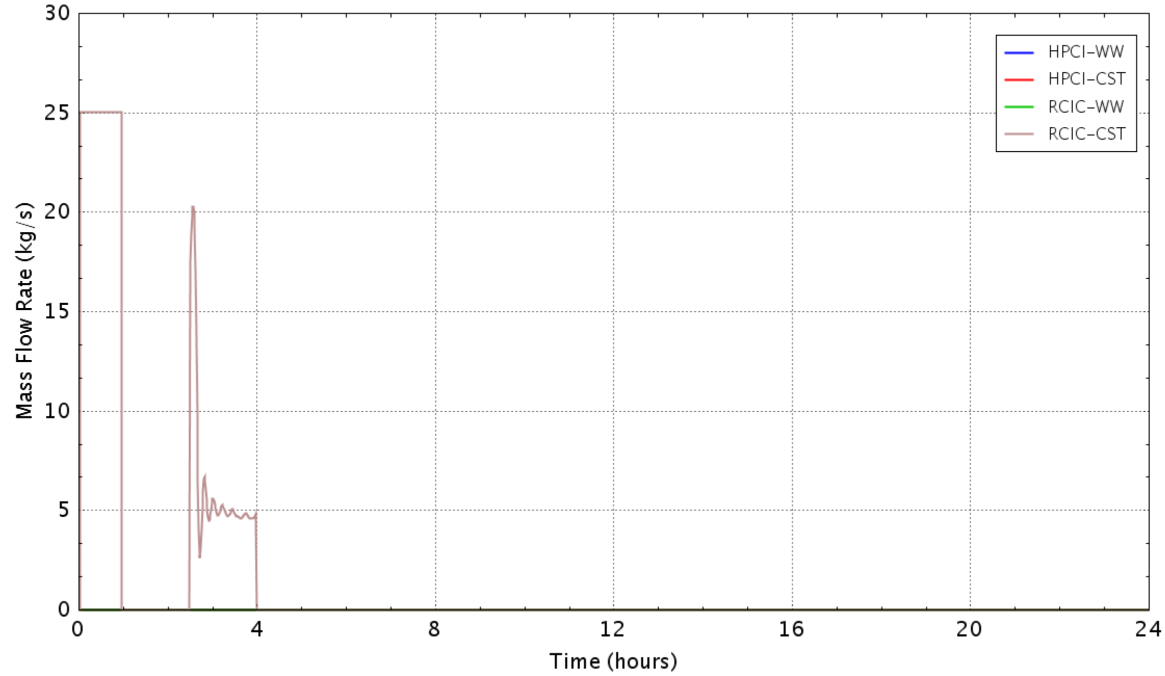

Figure D - 424 **Flow rate of the HPCI/RCIC pumps**

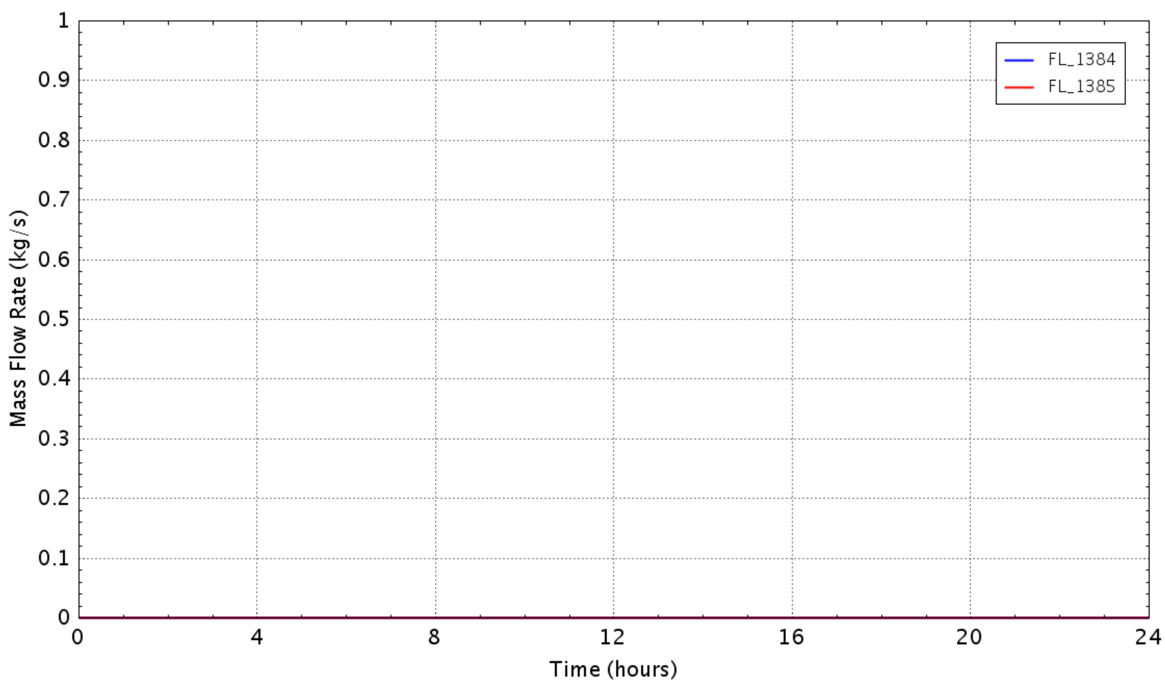

Figure D - 425 **Flow rate of the recirculating pump seal leakage**

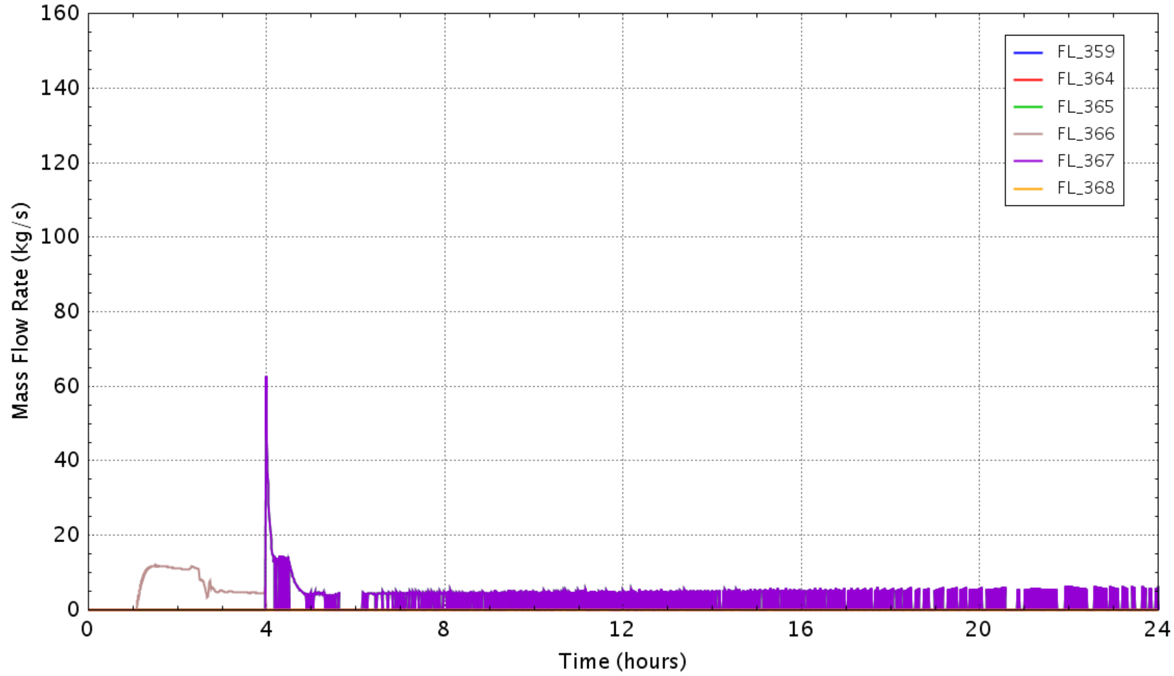

Figure D - 426 Flow rate of the SRVs

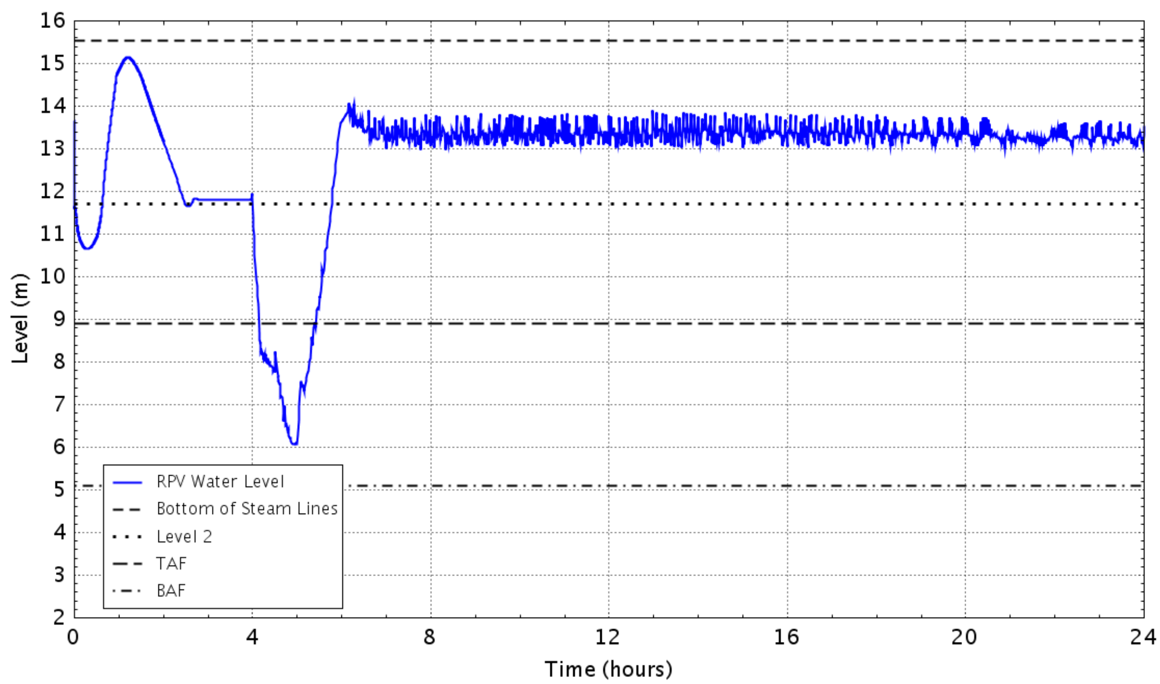

Figure D - 427 RPV down comer water level

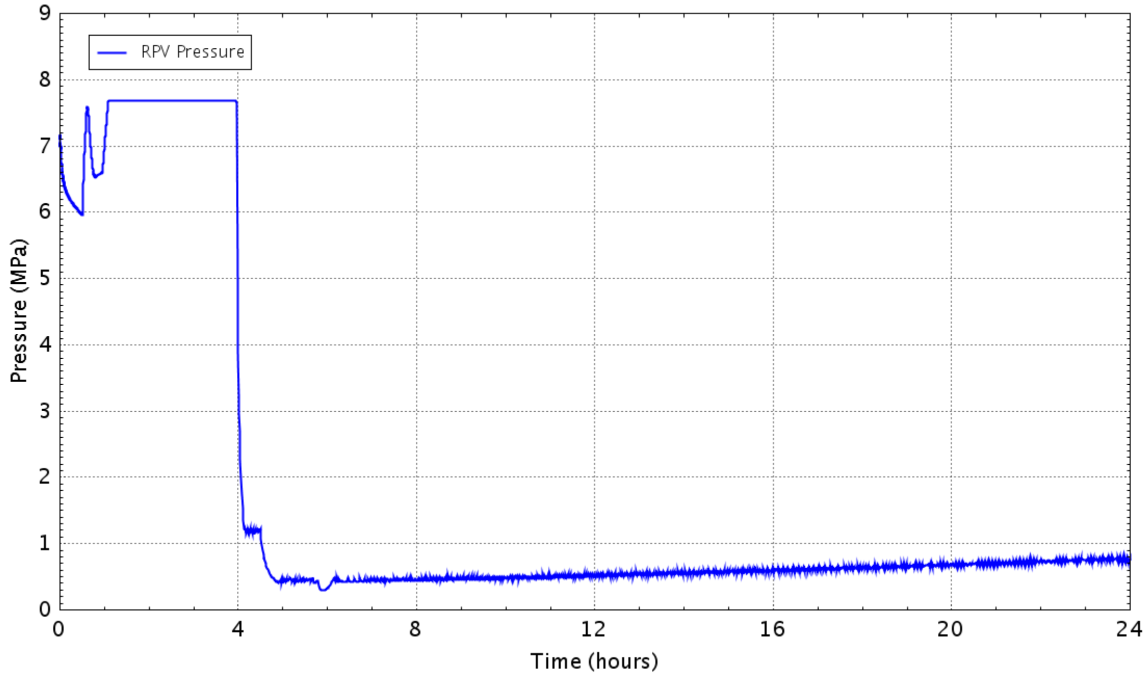

Figure D - 428 **Pressure in theRPV**

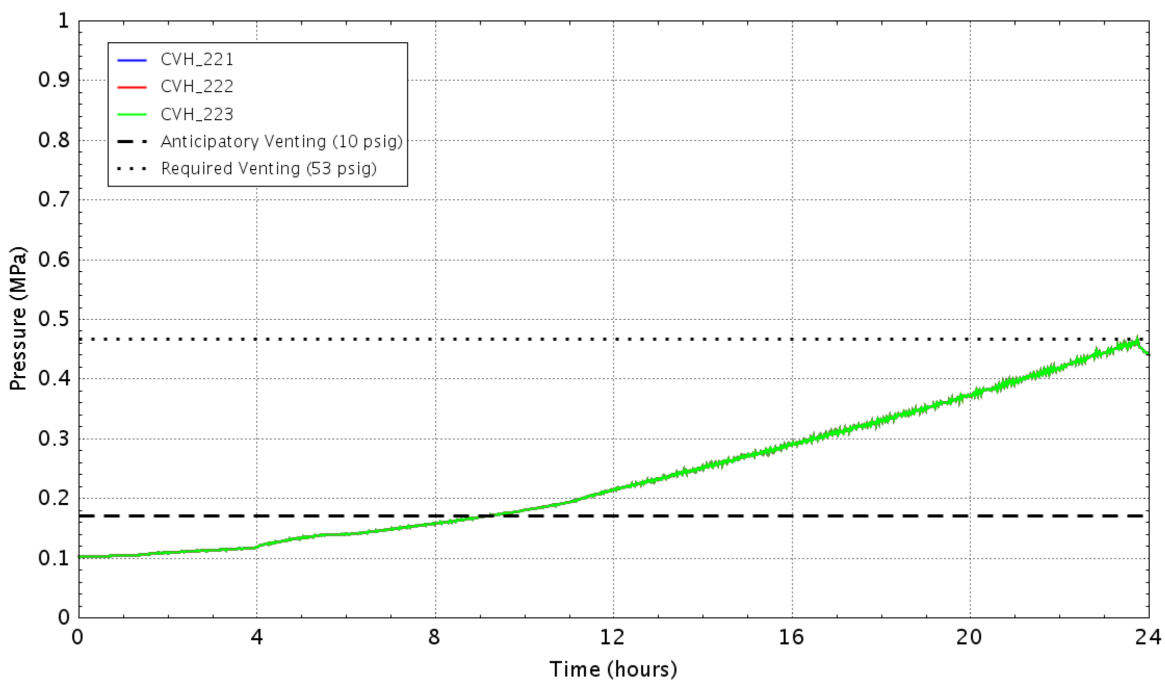

Figure D - 429 **Pressure in the wetwell**

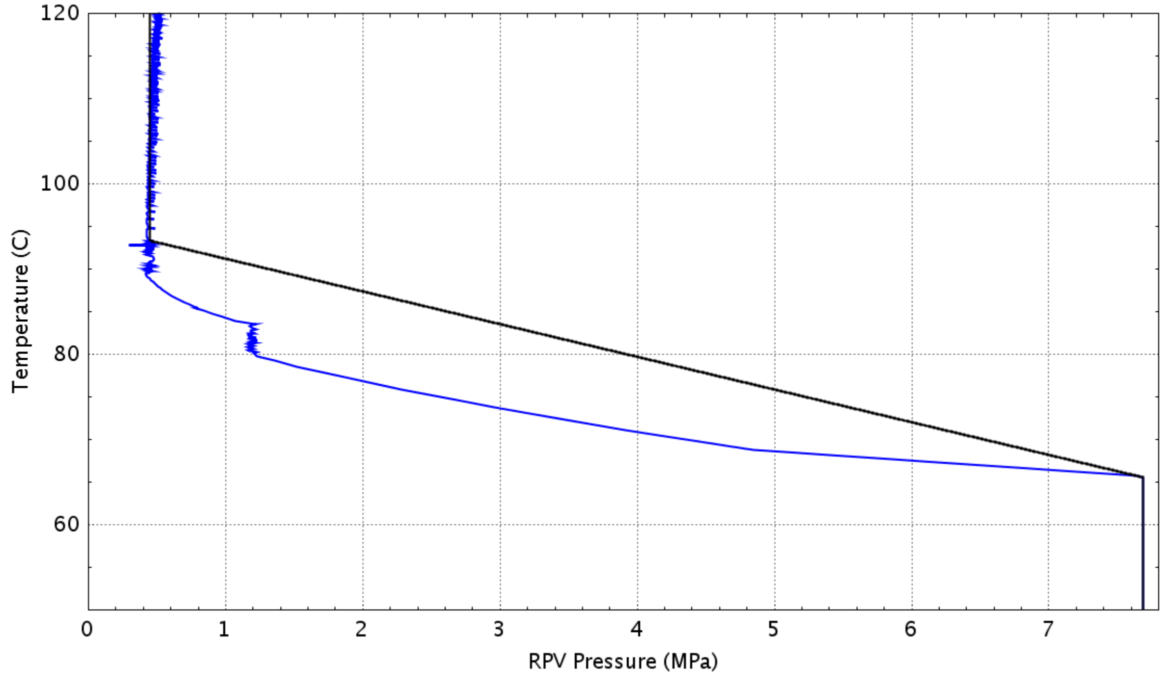

Figure D – 430 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

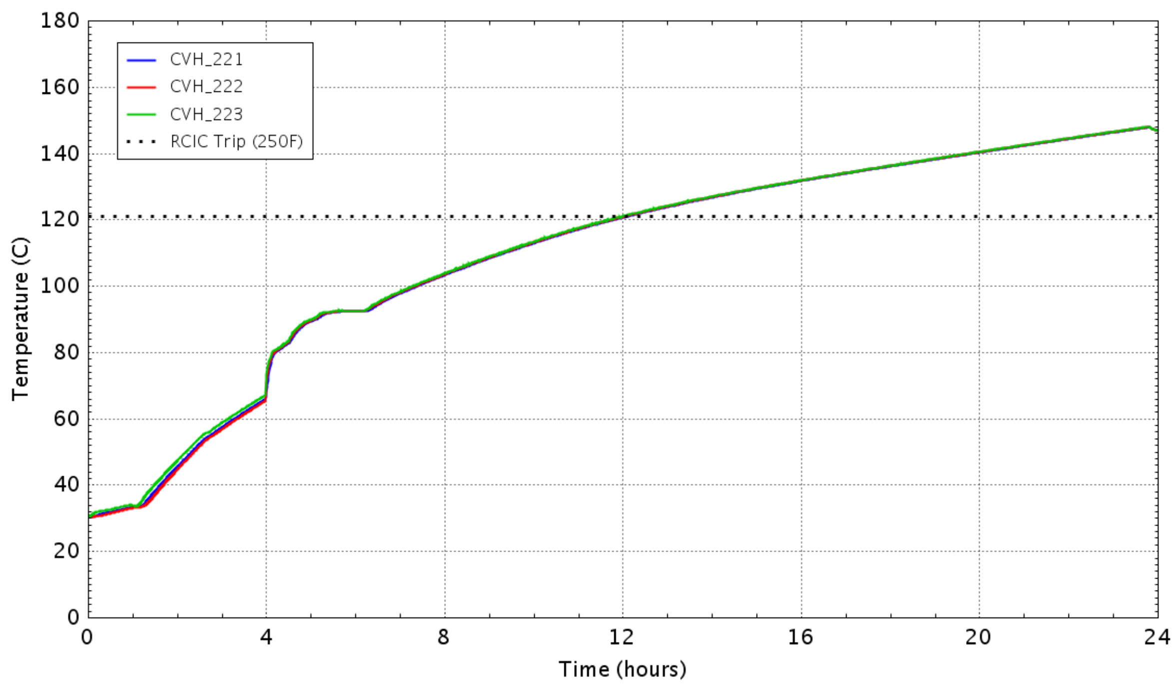

Figure D - 431 **Water temperature in the wetwell**

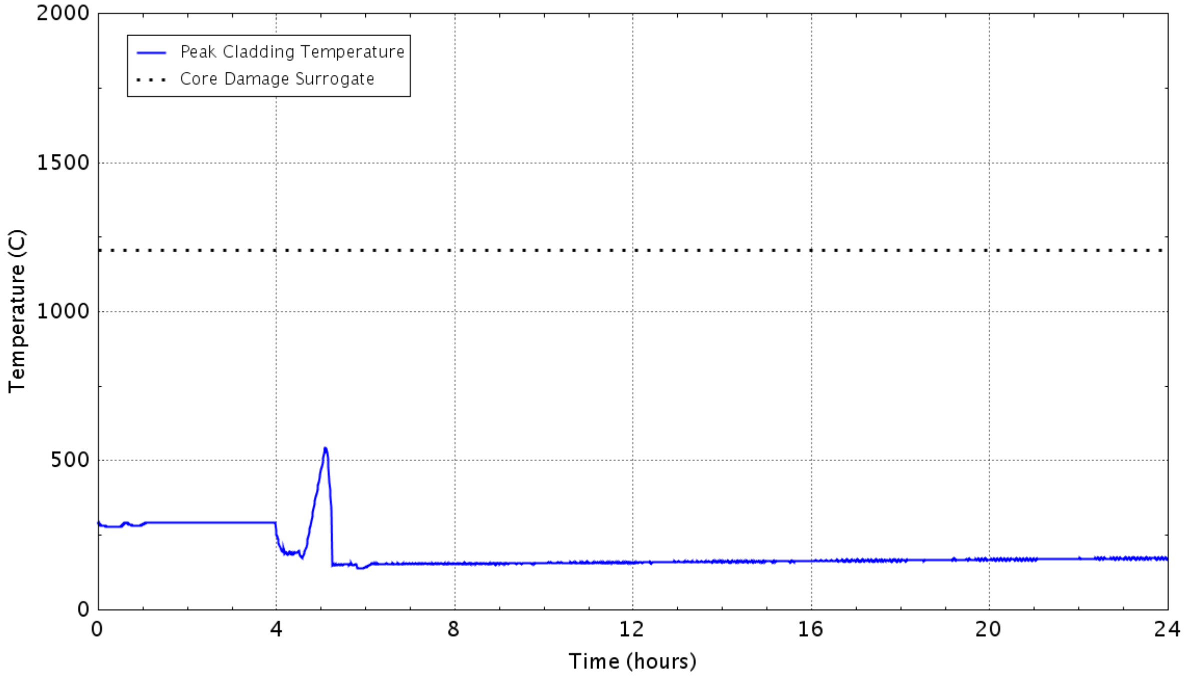

Figure D – 432 Peak temperature of the fuel cladding as a function oftime

D.3.12 Case 19c: Sensitivity to LOMFW-25 Case 19 with MSIVClosure at the start of the transient

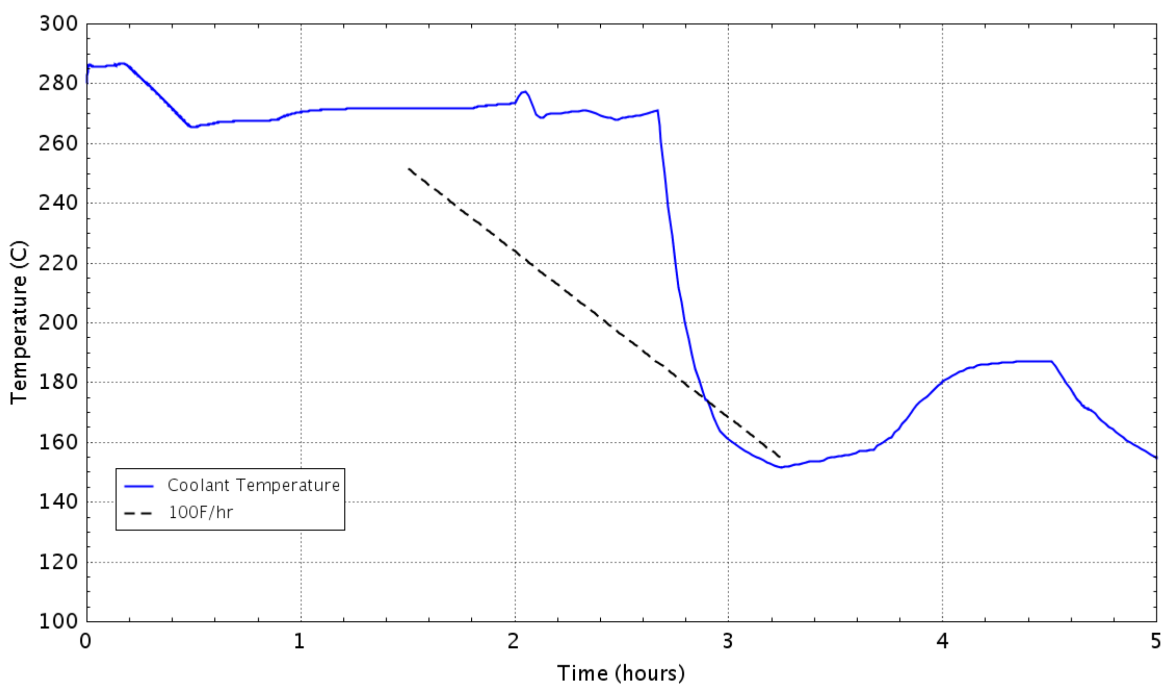

Figure D - 433 RPV cooldown rate

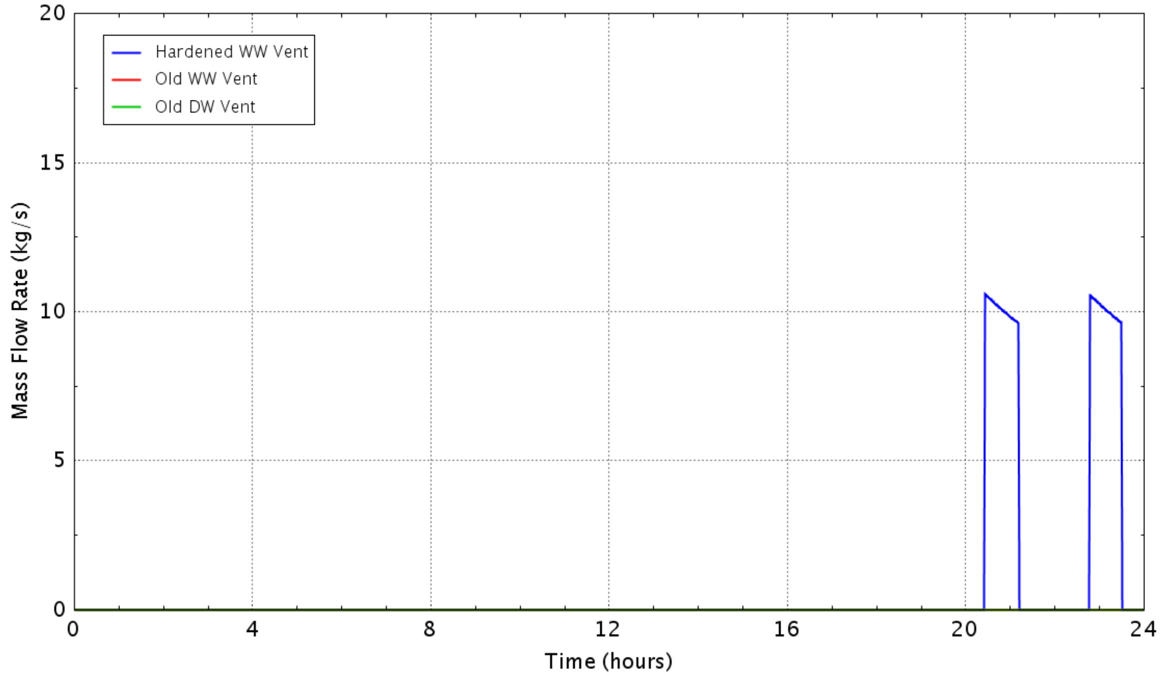

Figure D - 434 Flow rate of the containment vents

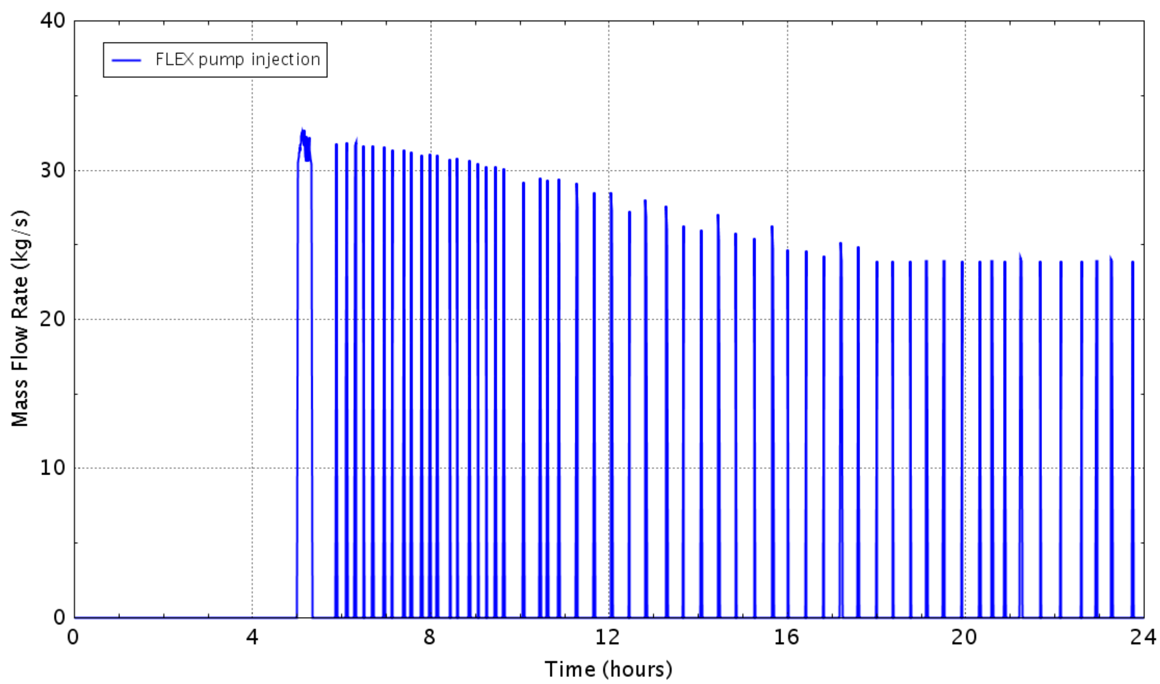

Figure D - 435 Flow rate of the FLEX pump

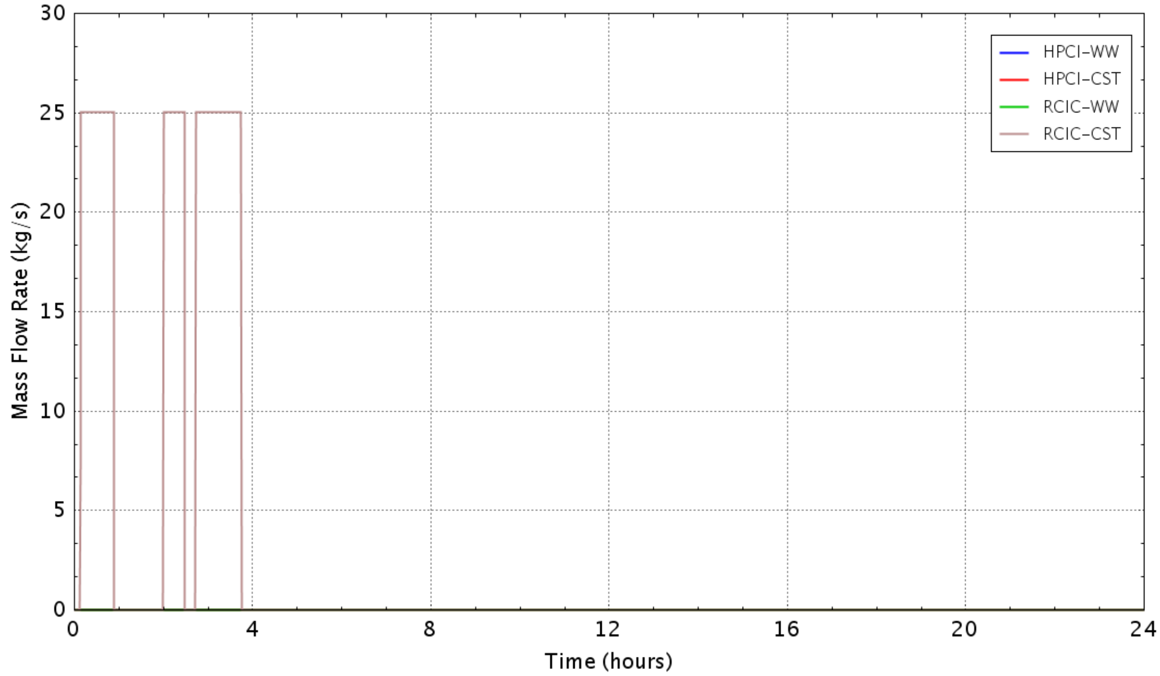

Figure D - 436 **Flow rate of the HPCI/RCIC pumps**

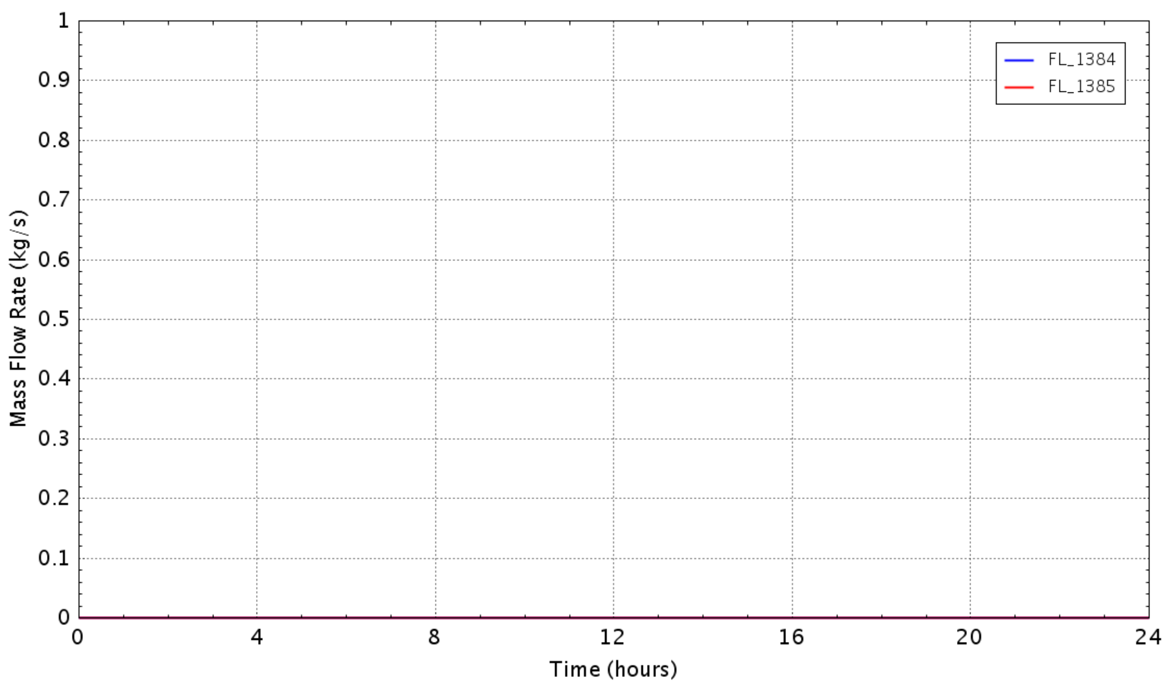

Figure D - 437 **Flow rate of the recirculating pump seal leakage**

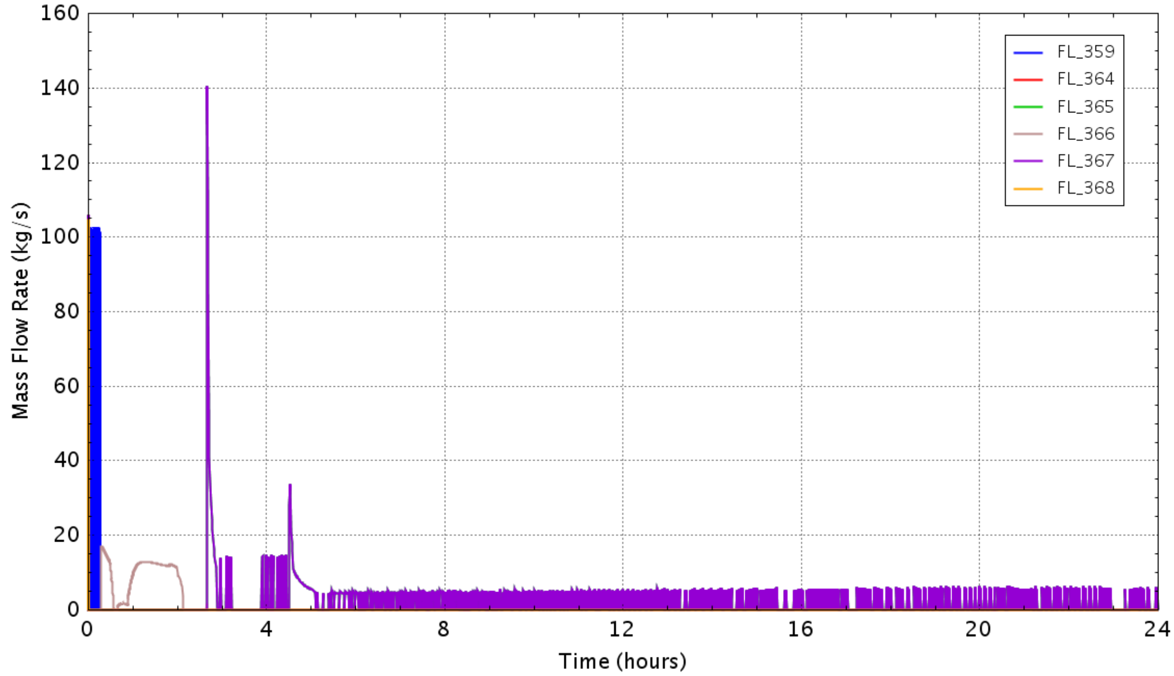

Figure D - 438 **Flow rate of the SRVs**

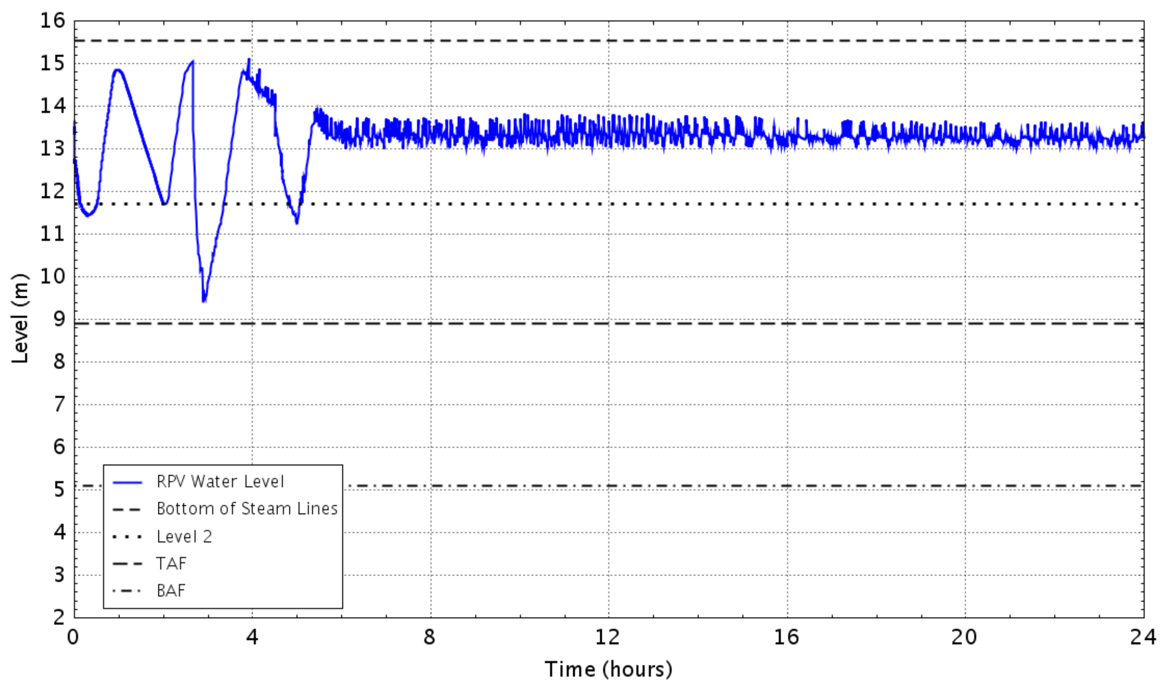

Figure D - 439 **RPV down comer water level**

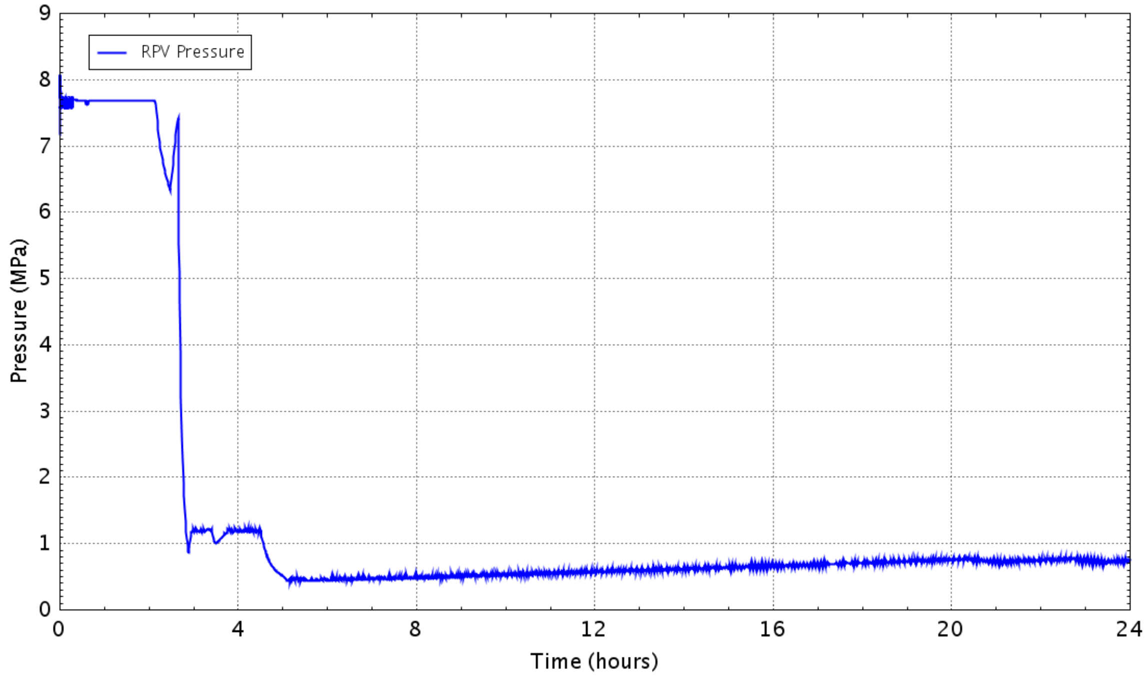

Figure D - 440 Pressure in theRPV

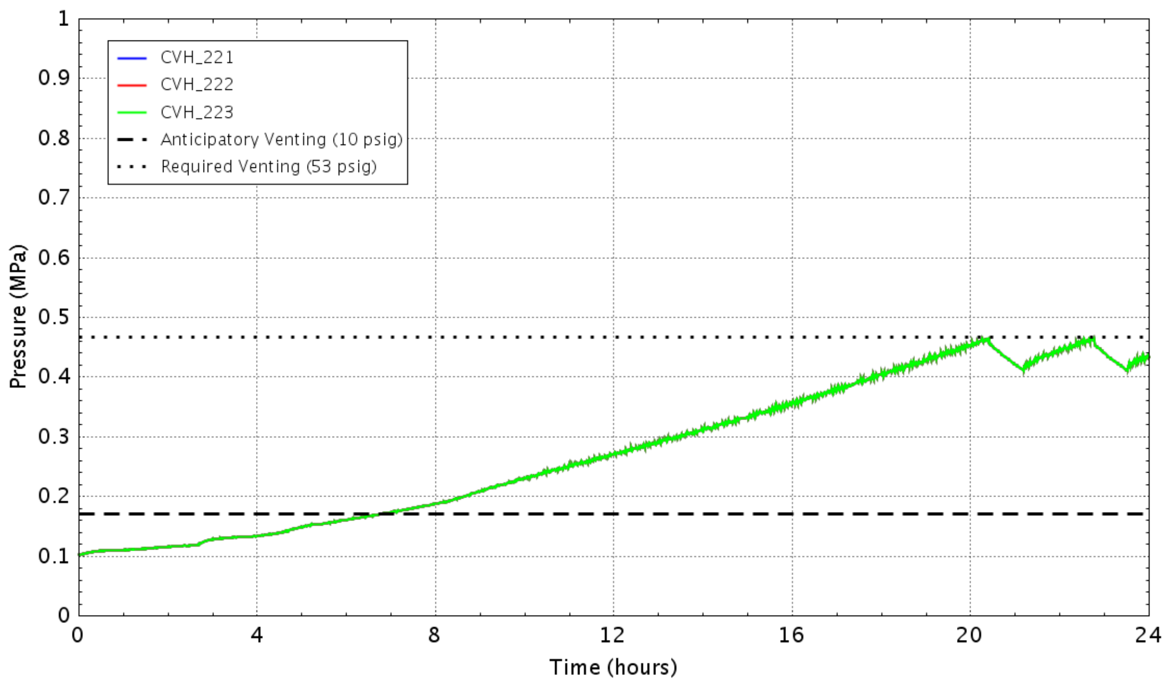

Figure D - 441 Pressure in the wetwell

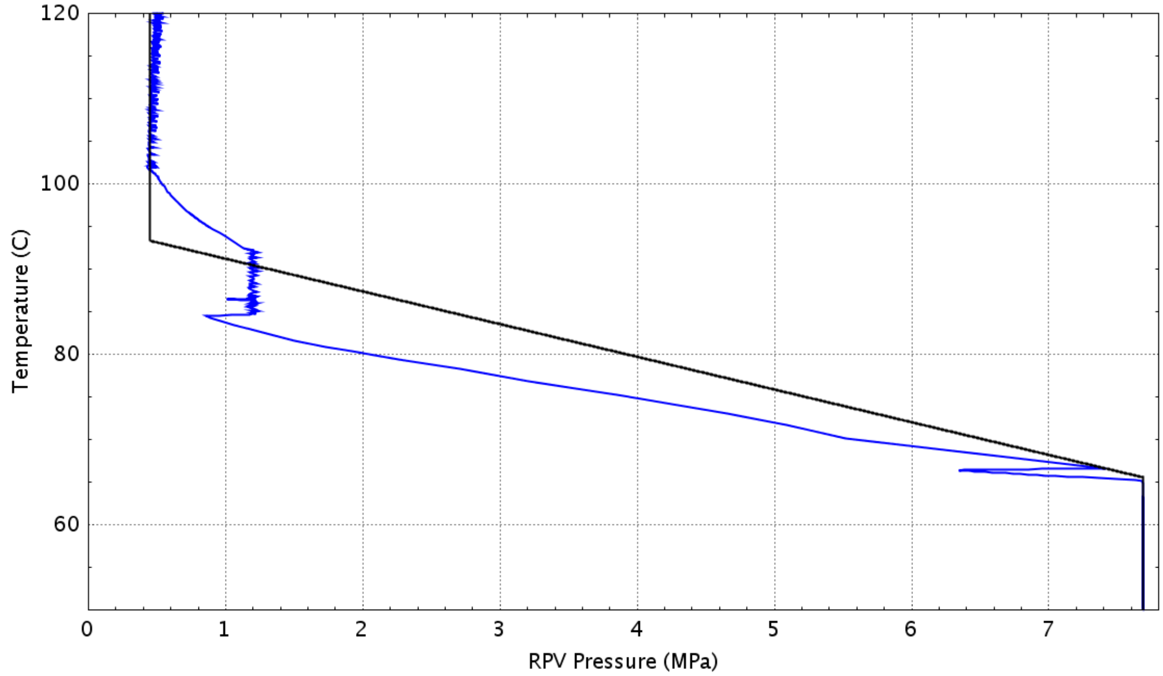

Figure D – 442 Plant status relative to the HCL curve (Graph 4 of the EOPs)

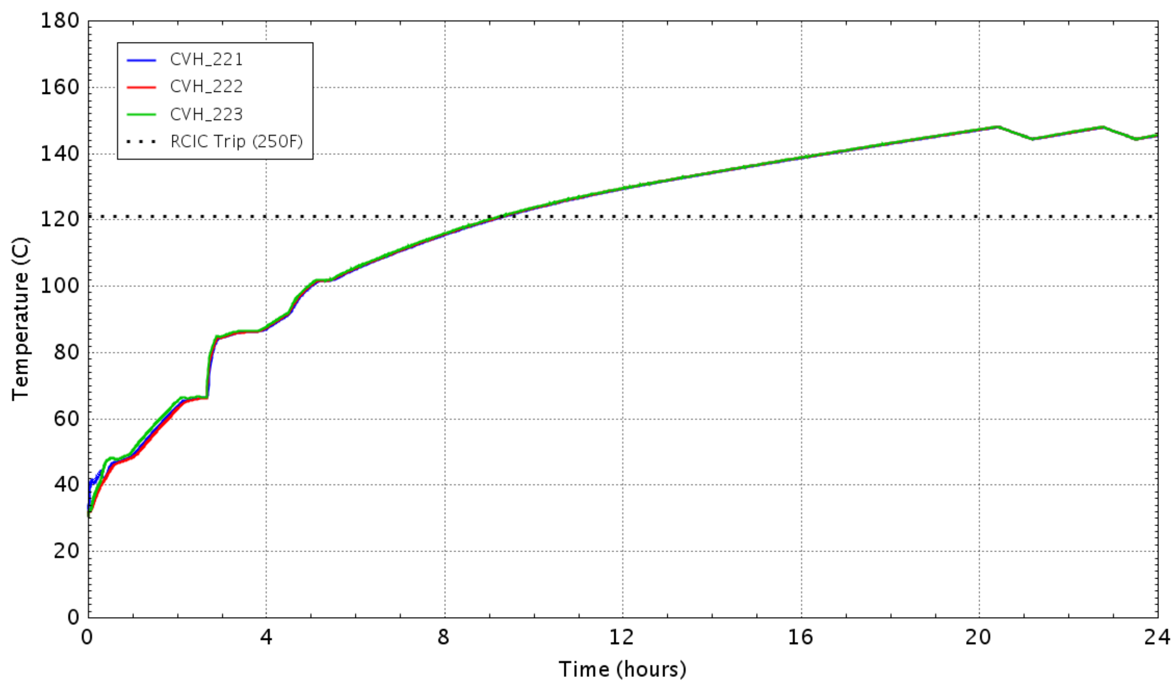

Figure D - 443 Water temperature in the wetwell

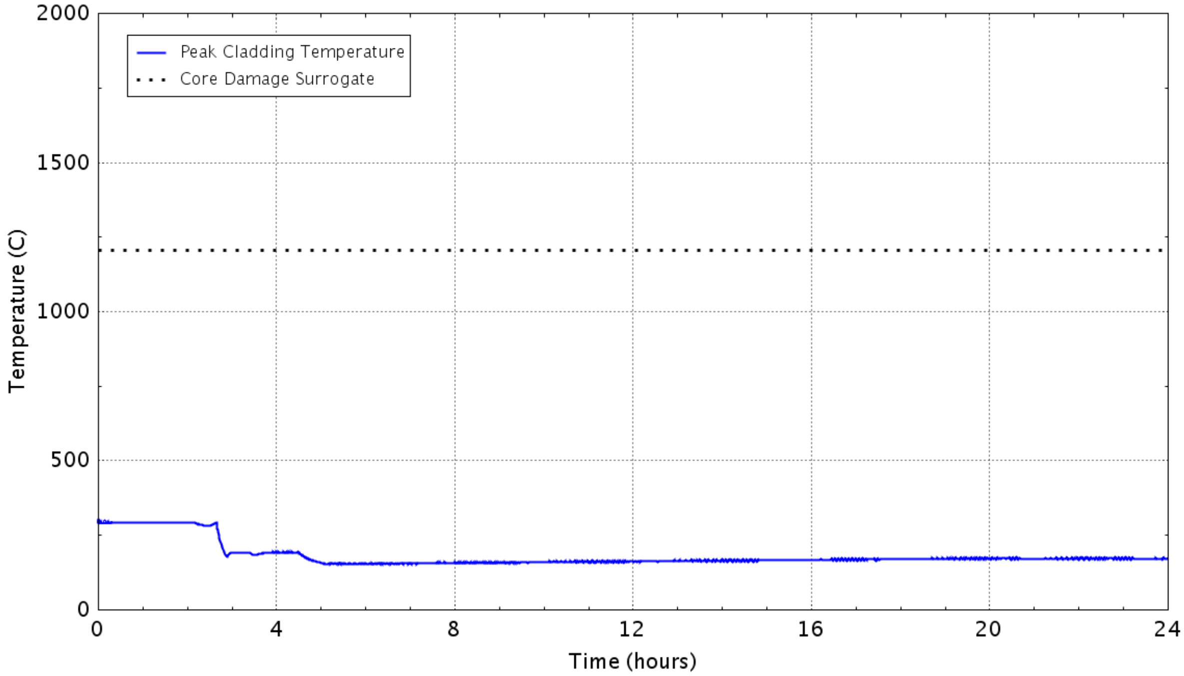

Figure D – 444 Peak temperature of the fuel cladding as a function oftime

D.3.13 Case 21a: Sensitivity to LOMFW-25 Case 21 with RCIC lost at6 hrs.

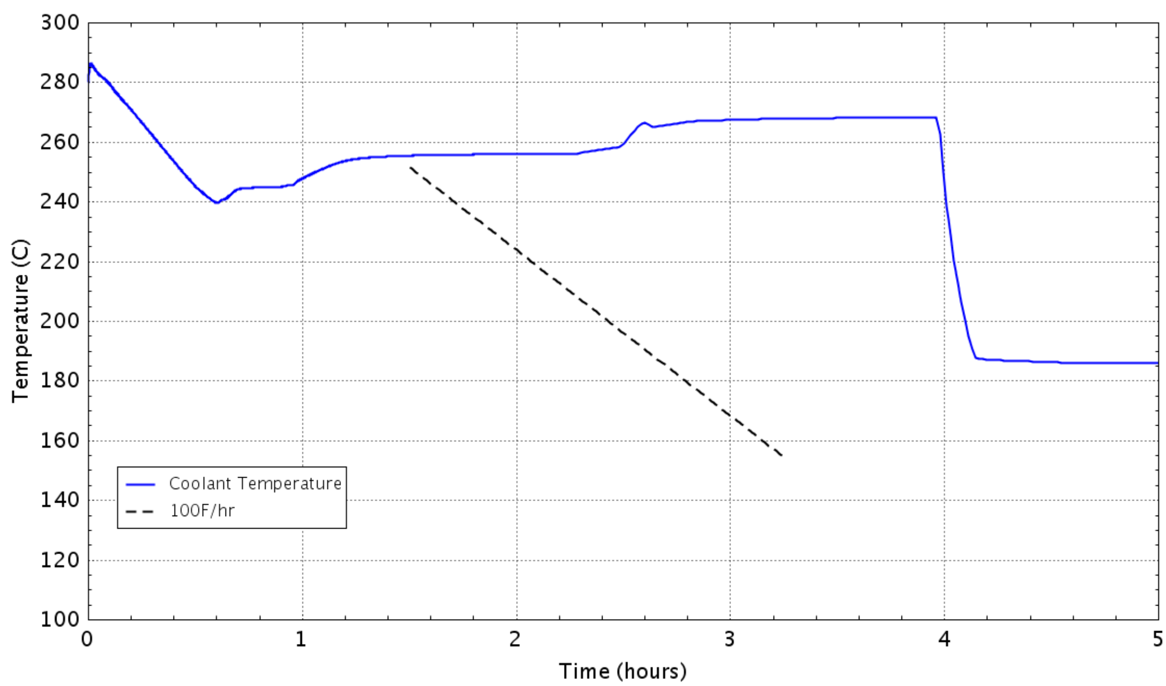

Figure D - 445 RPV cooldown rate

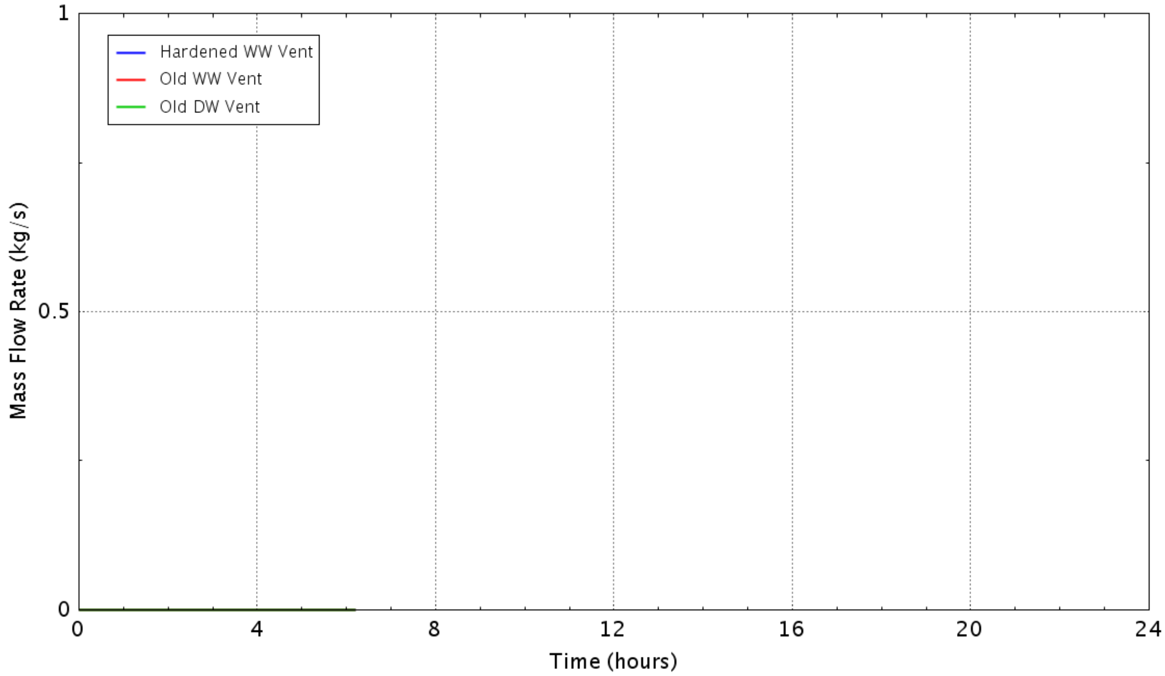

Figure D - 446 Flow rate of the containment vents

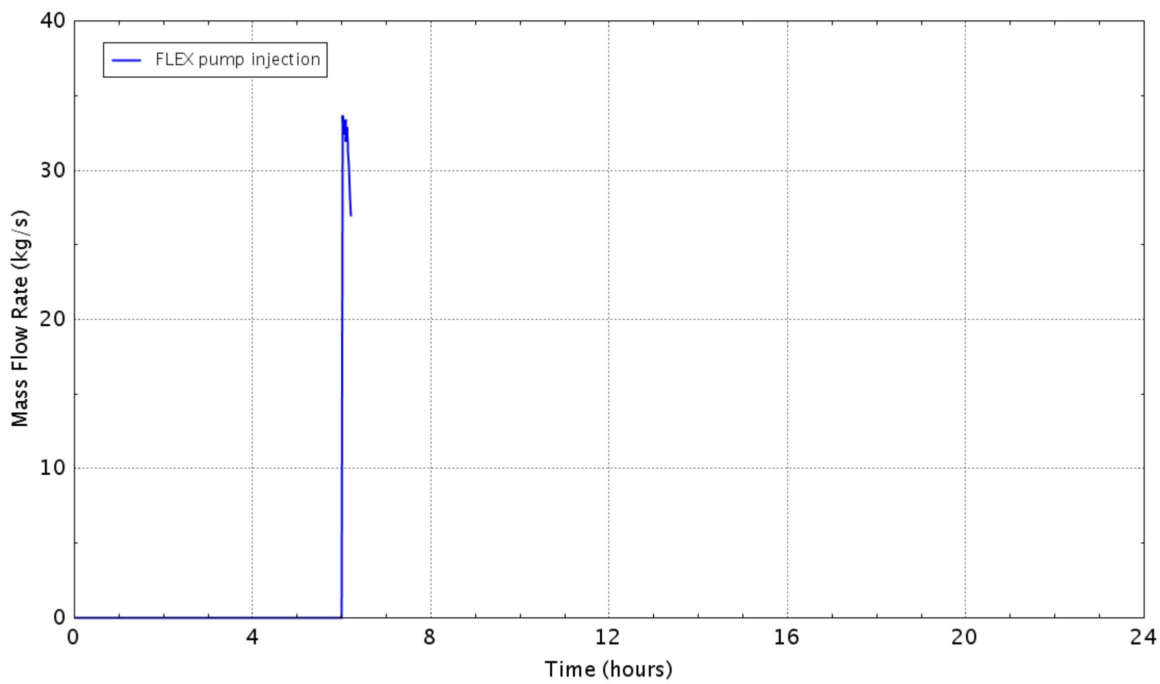

Figure D - 447 Flow rate of the FLEX pump

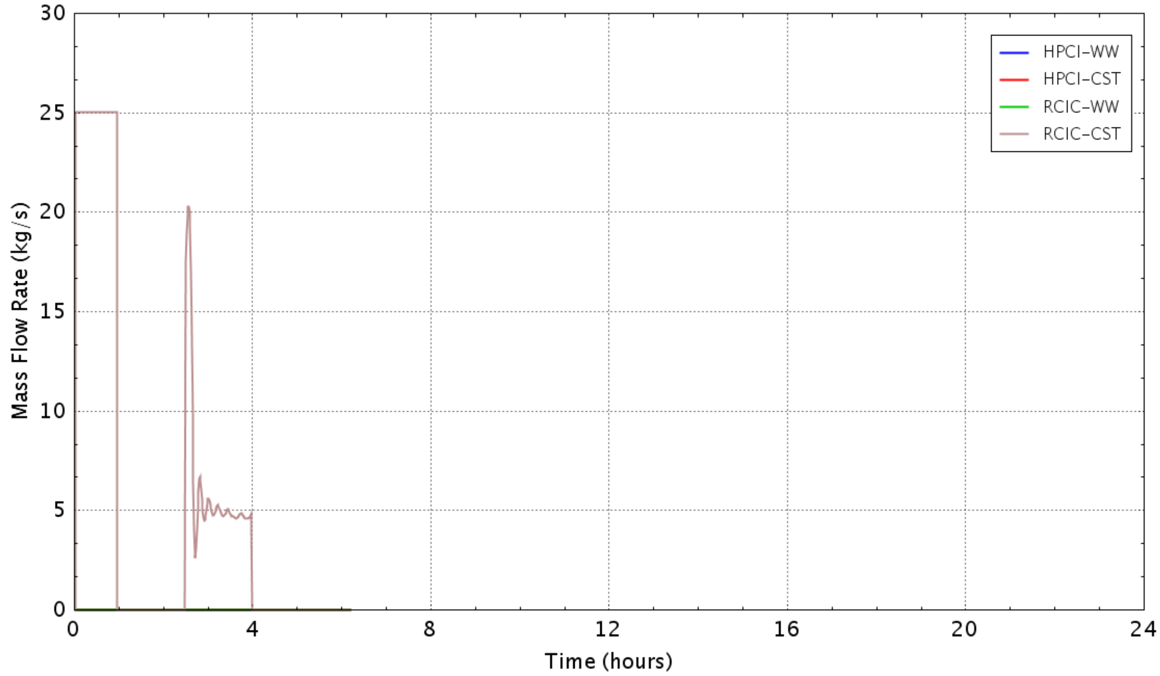

Figure D - 448 **Flow rate of the HPCI/RCIC pumps**

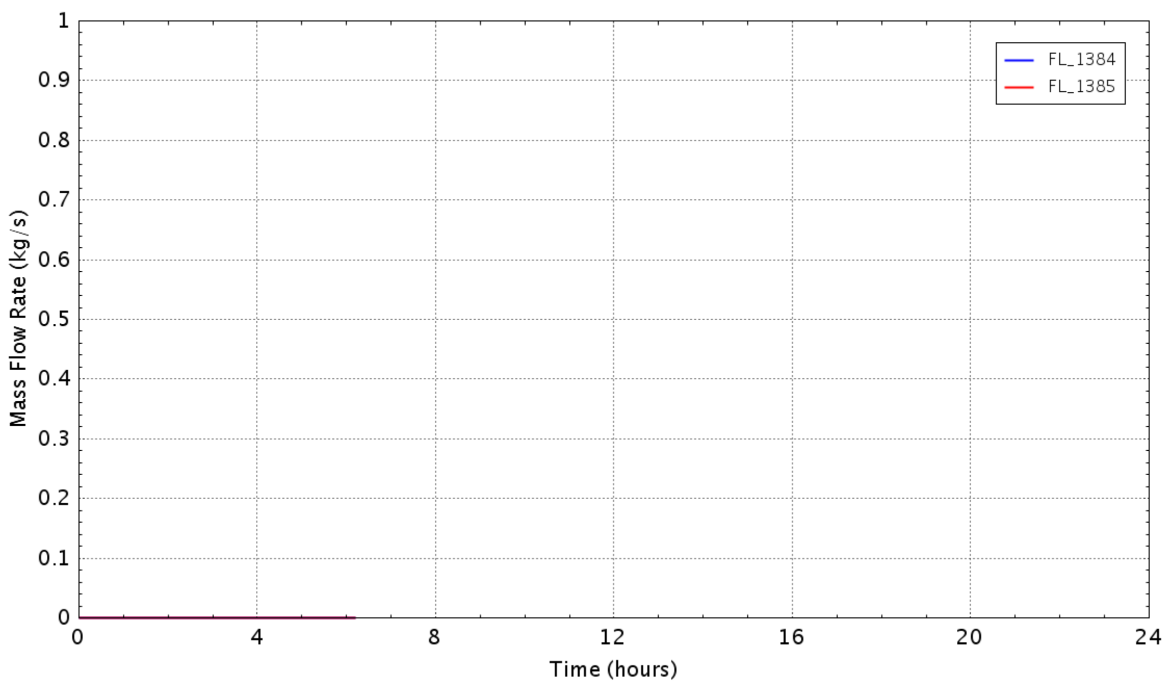

Figure D - 449 **Flow rate of the recirculating pump seal leakage**

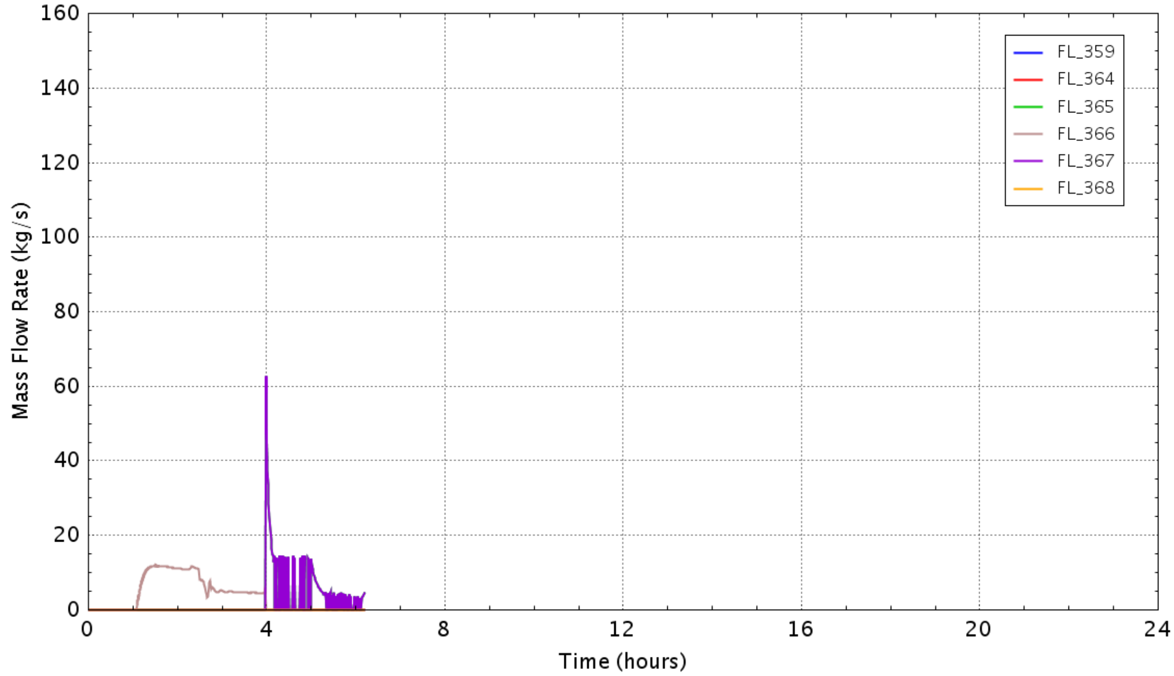

Figure D - 450 **Flow rate of the SRVs**

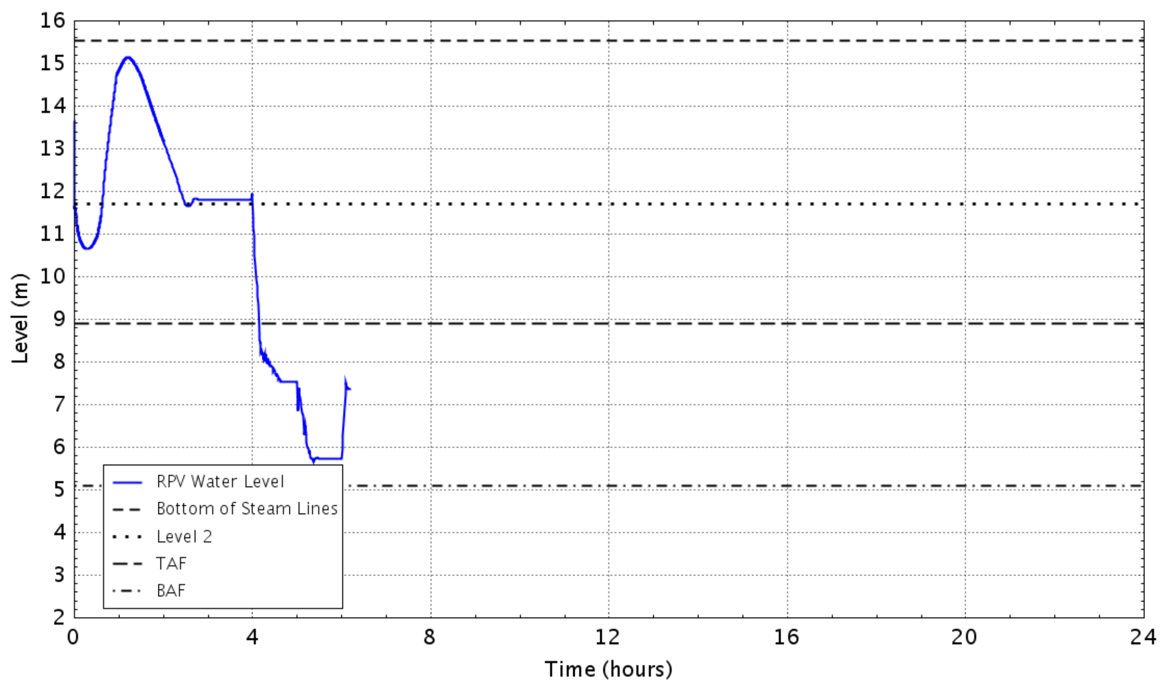

Figure D - 451 **RPV down comer water level**

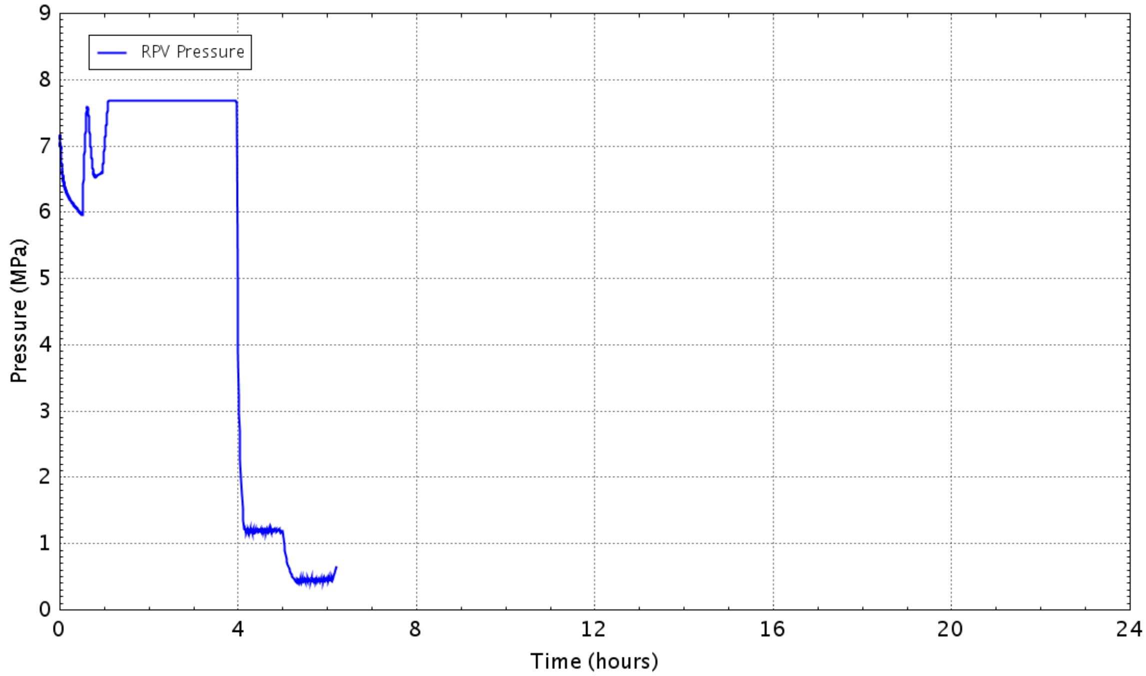

Figure D - 452 Pressure in theRPV

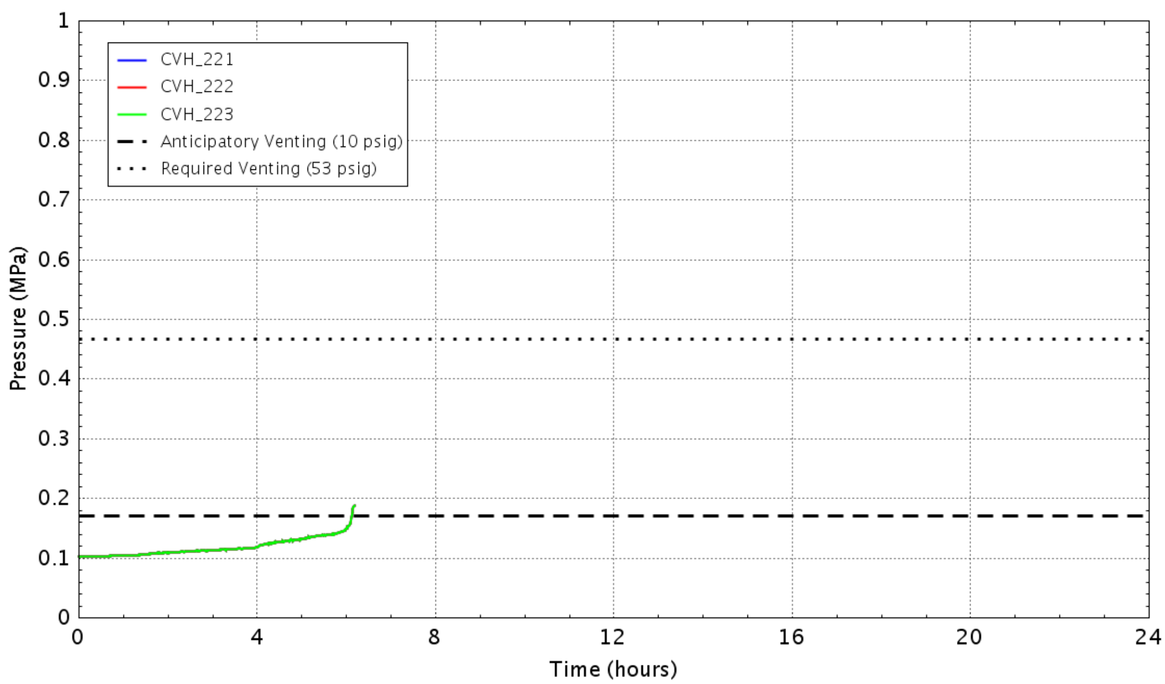

Figure D - 453 Pressure in the wetwell

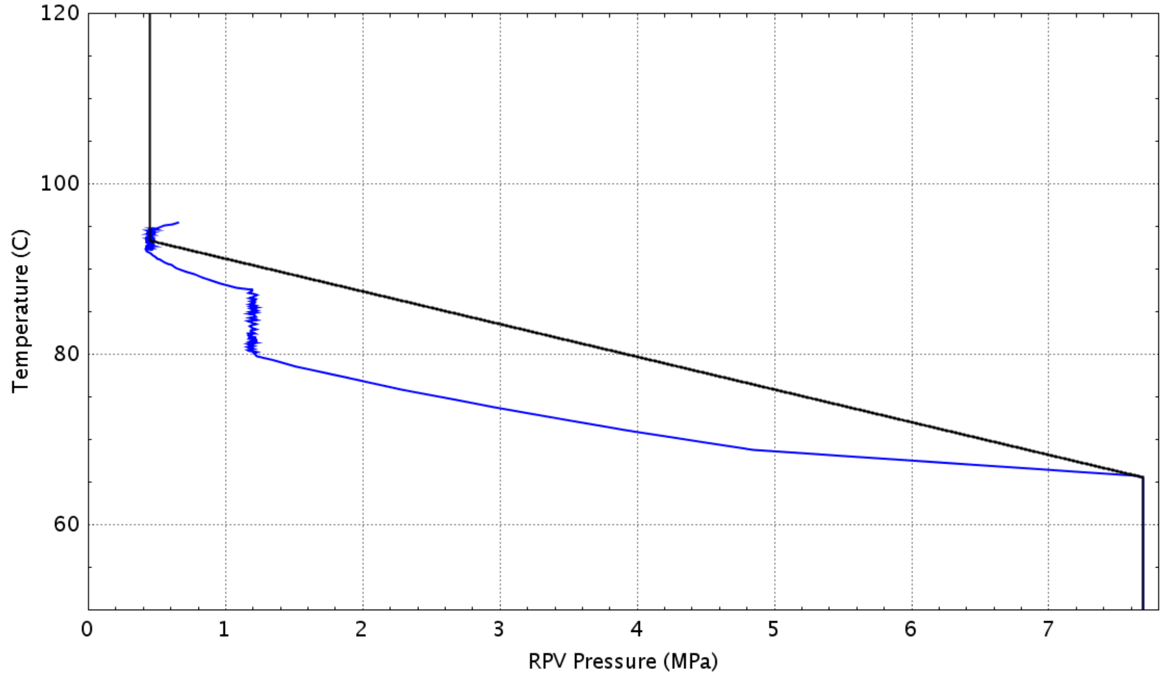

Figure D – 454 Plant status relative to the HCL curve (Graph 4 of the EOPs)

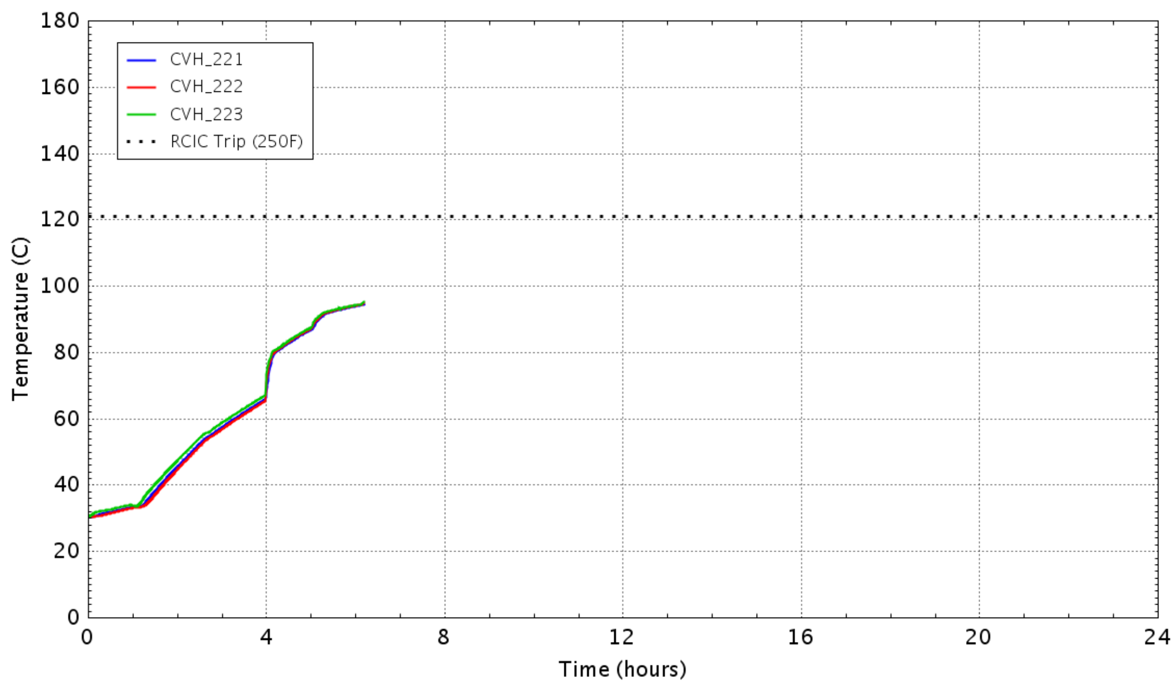

Figure D - 455 Water temperature in the wetwell

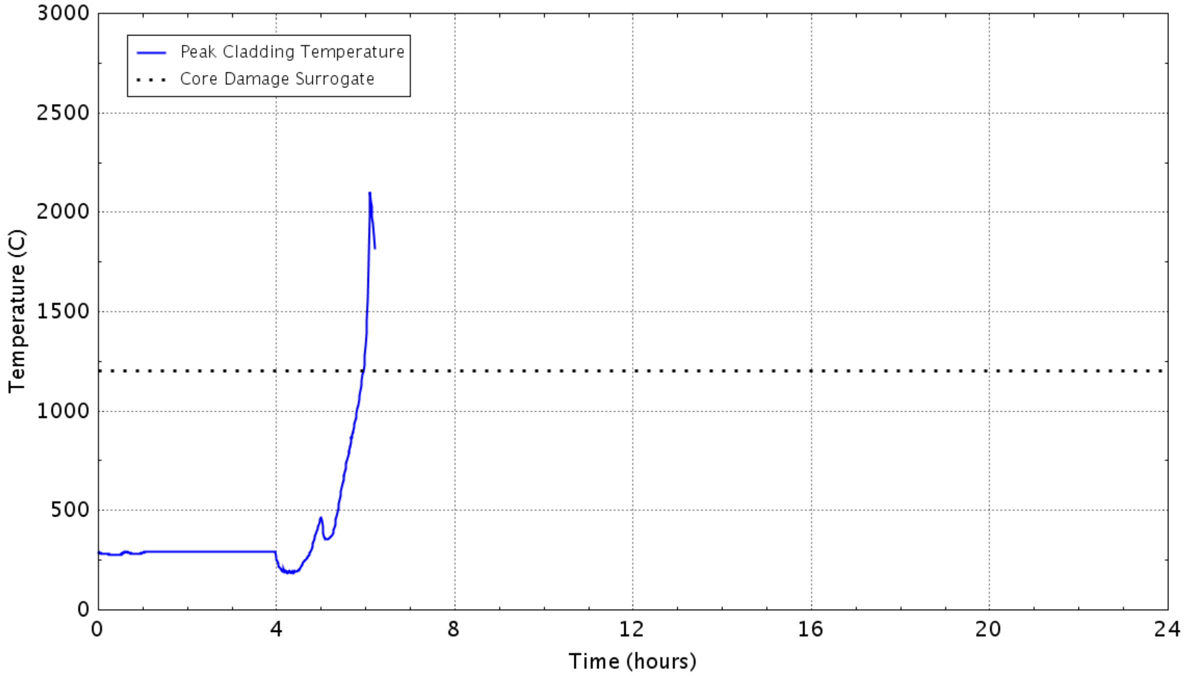

Figure D – 456 **Peak temperature of the fuel cladding as a function oftime**

D.3.14 Case 22a: Sensitivity to LOMFW-25 Case 22 with HPCI Available Instead of RCIC

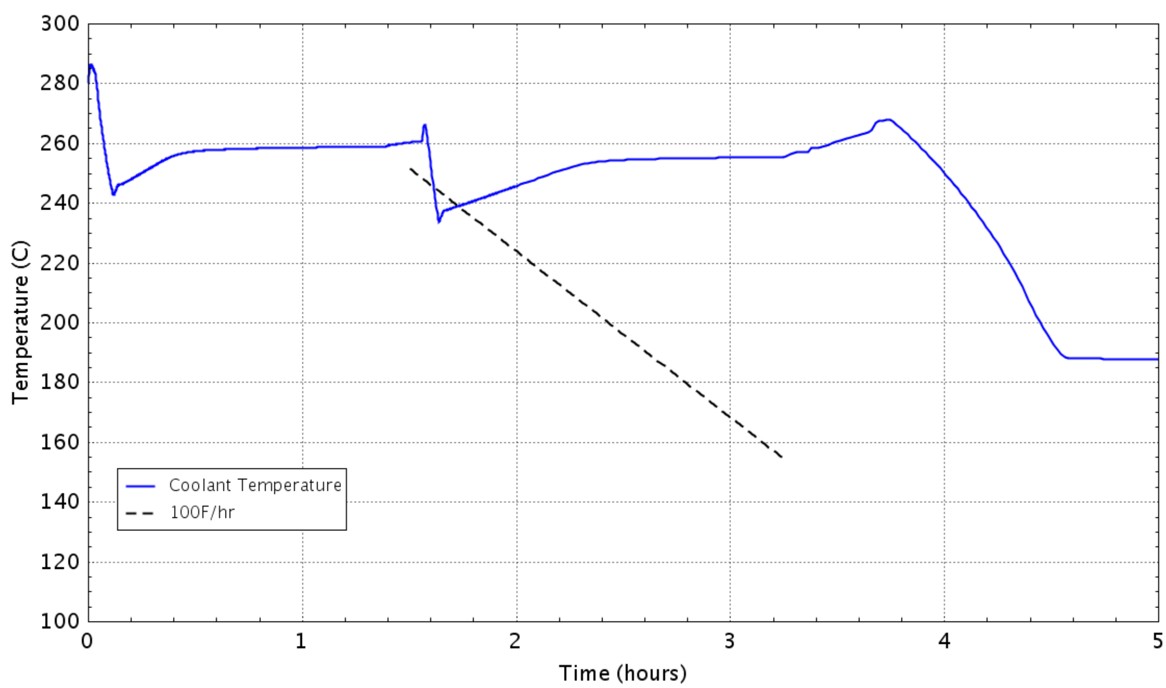

Figure D - 457 **RPV cooldown rate**

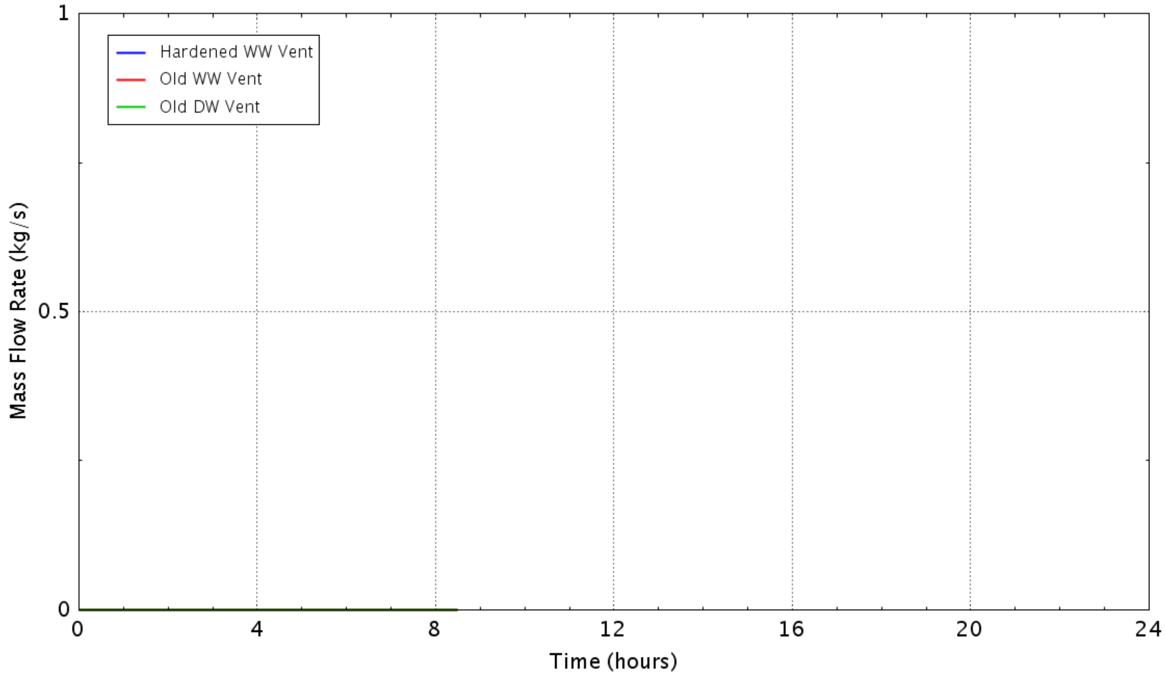

Figure D - 458 **Flow rate of the containment vents**

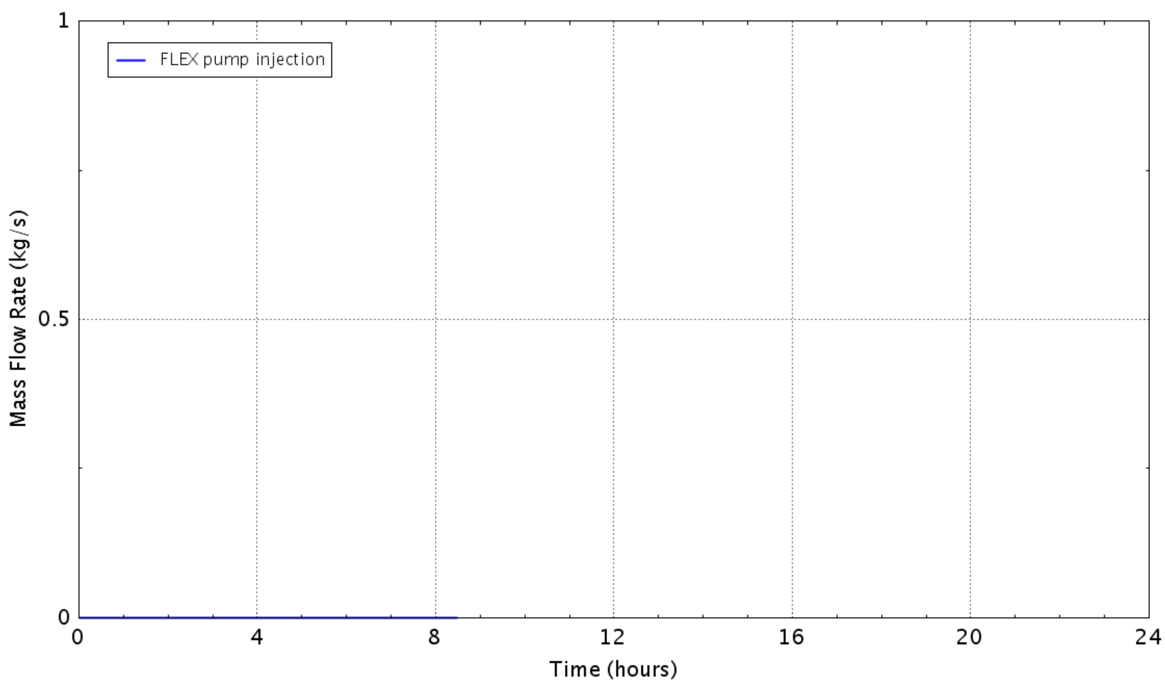

Figure D - 459 **Flow rate of the FLEX pump**

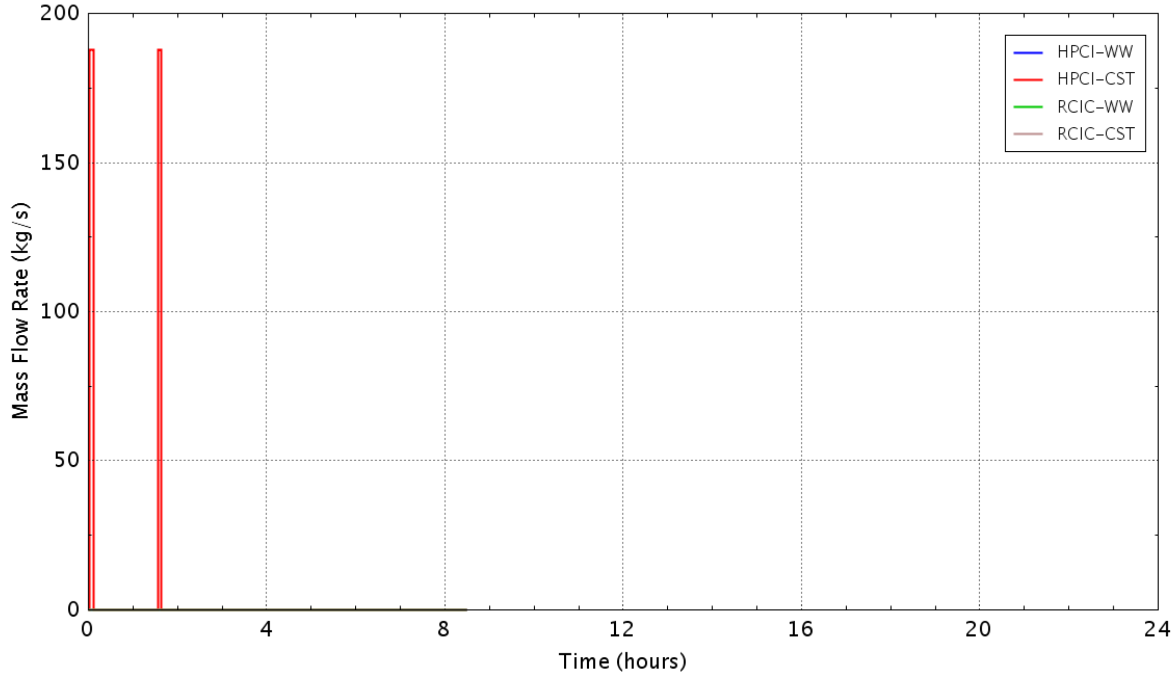

Figure D - 460 Flow rate of the HPCI/RCIC pumps

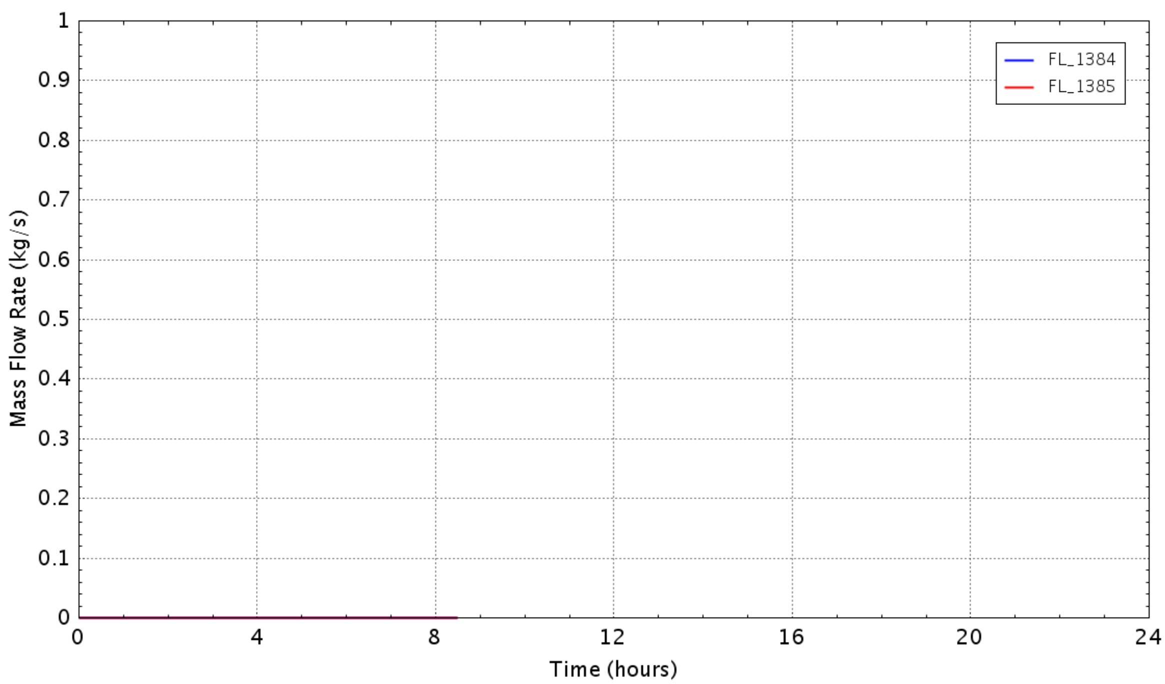

Figure D - 461 Flow rate of the recirculating pump seal leakage

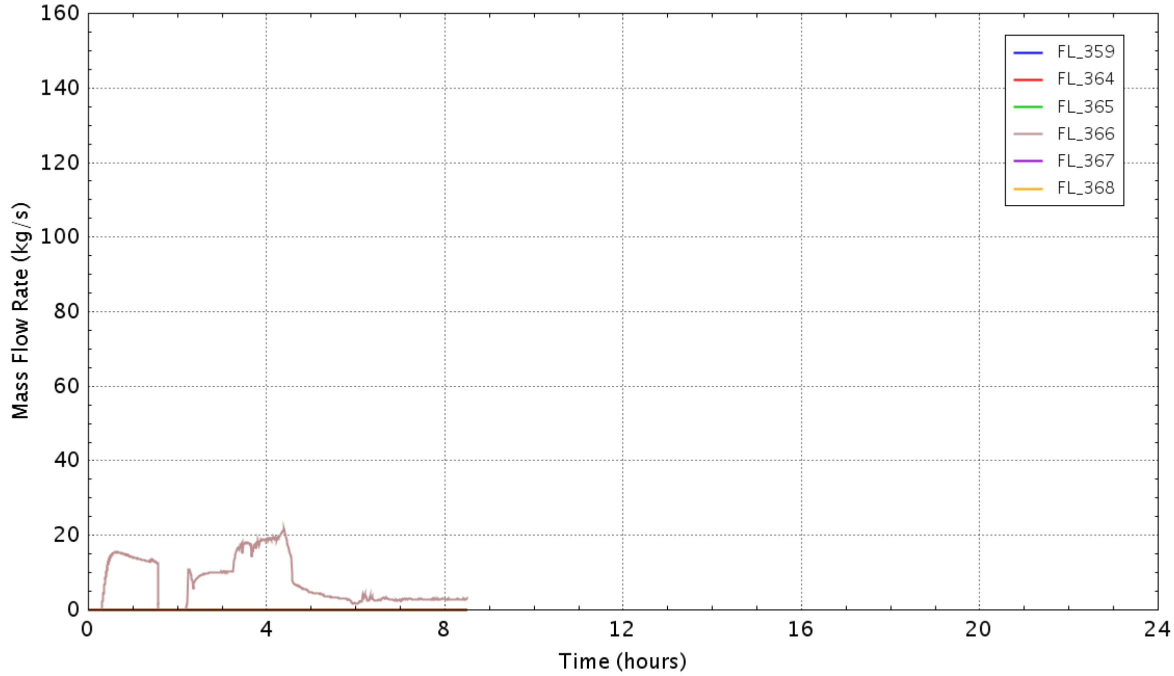

Figure D - 462 **Flow rate of the SRVs**

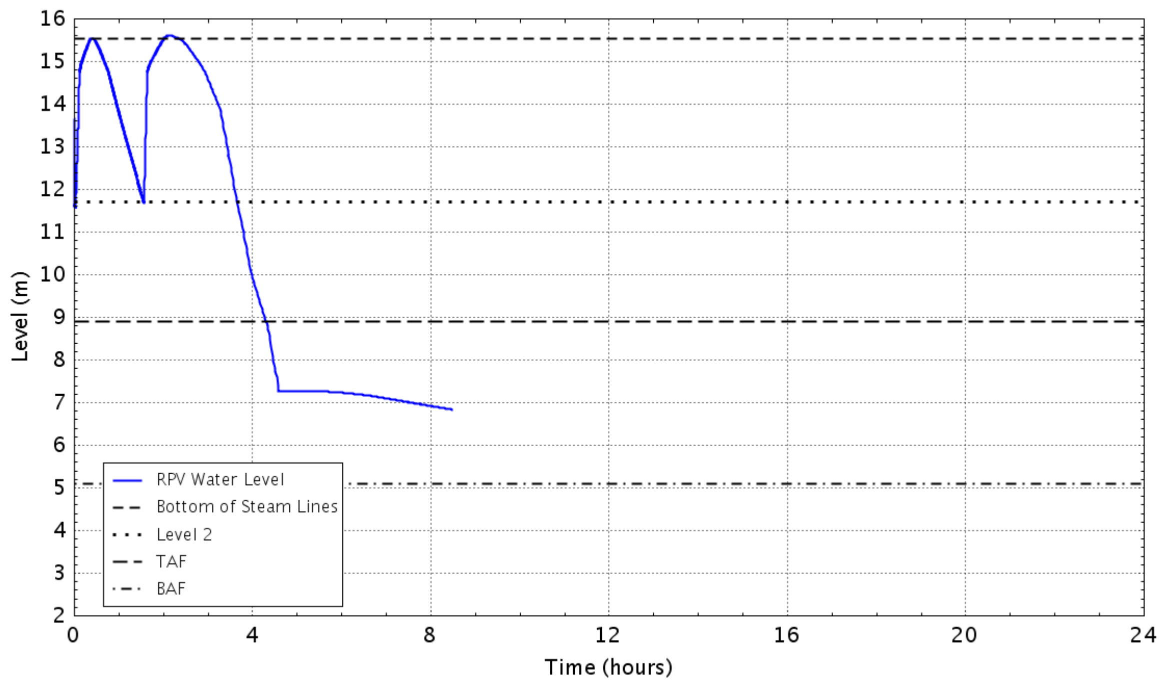

Figure D - 463 **RPV down comer water level**

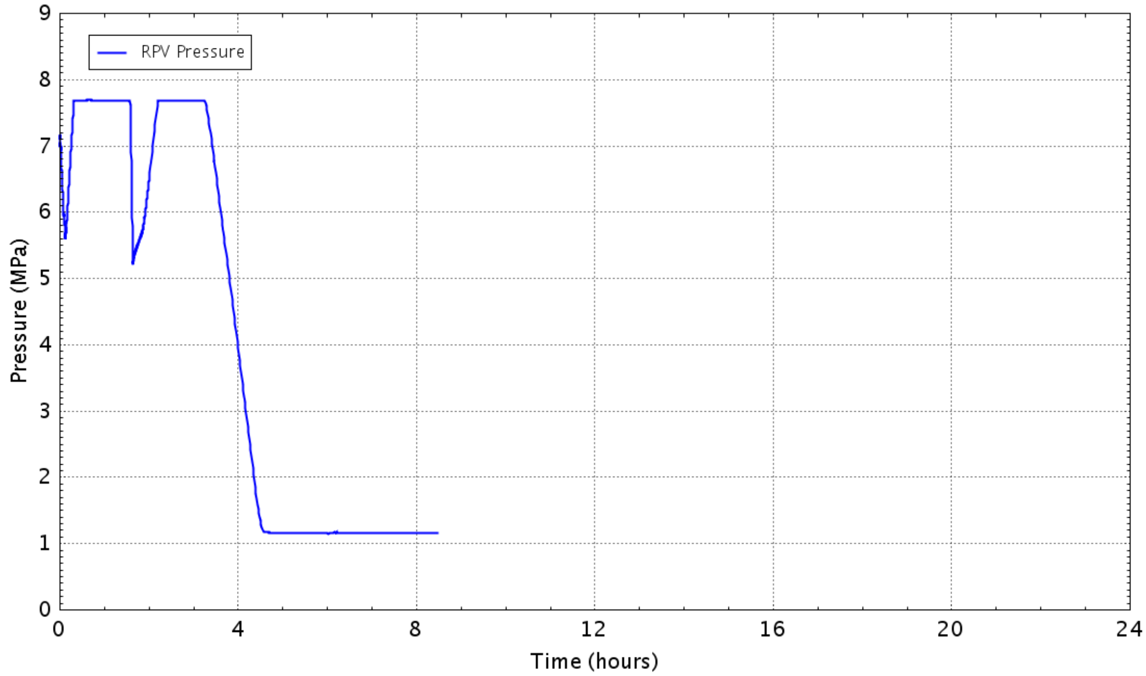

Figure D - 464 Pressure in theRPV

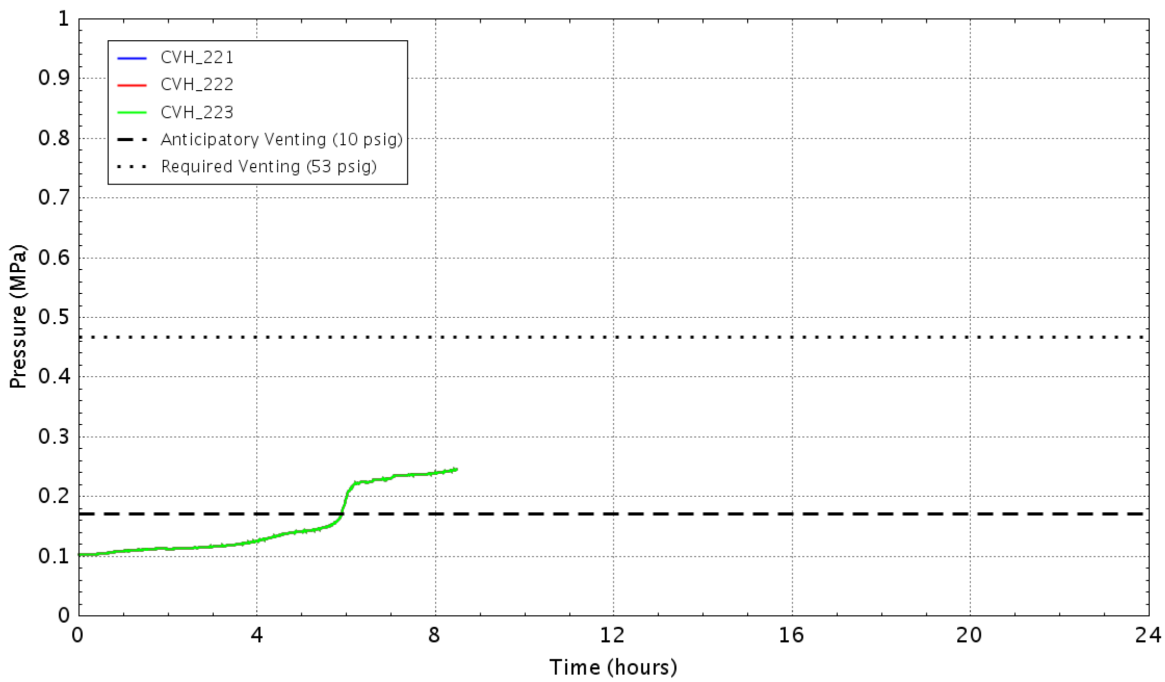

Figure D - 465 Pressure in the wetwell

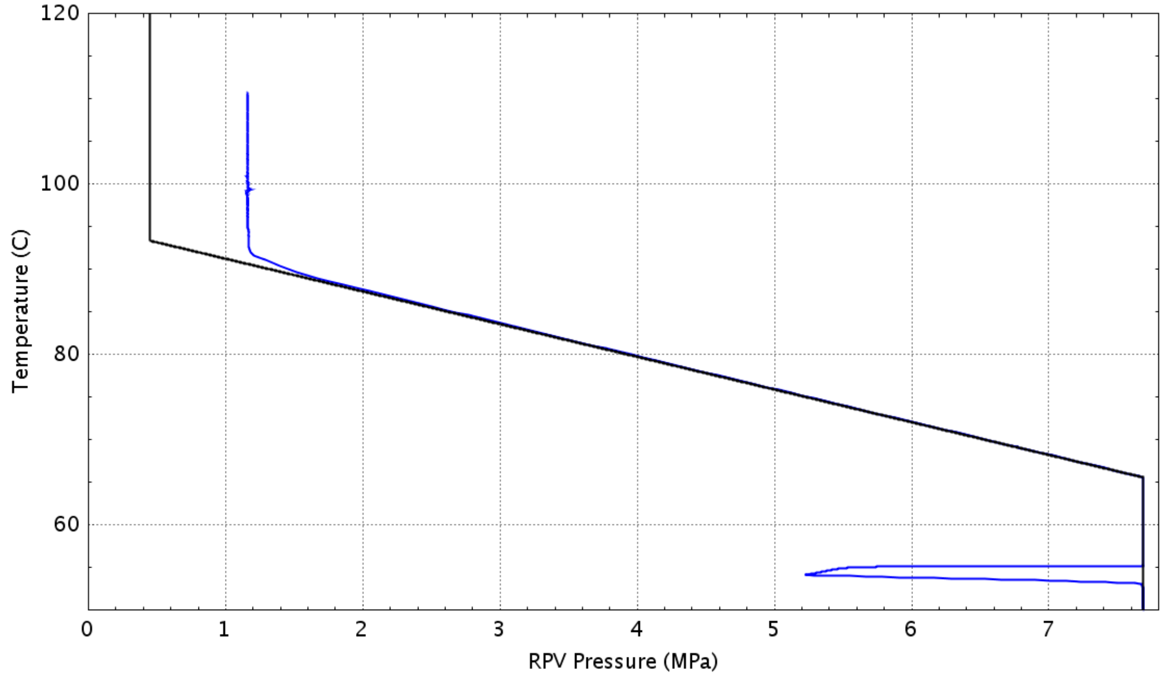

Figure D – 466 Plant status relative to the HCL curve (Graph 4 of the EOPs)

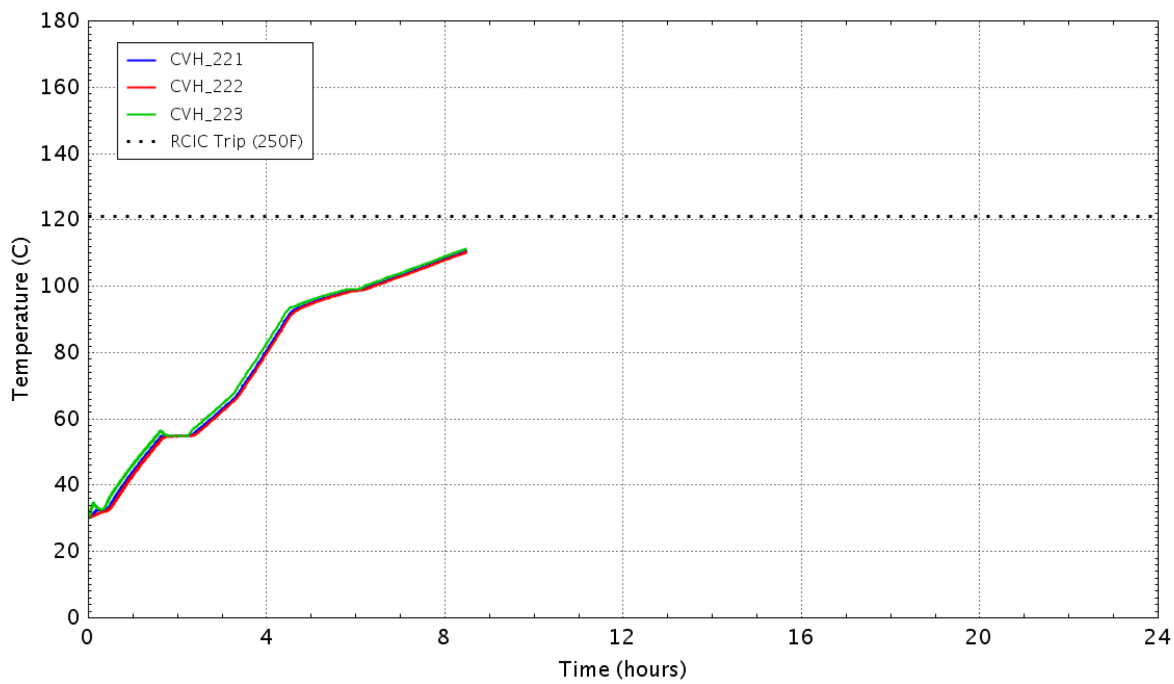

Figure D - 467 Water temperature in the wetwell

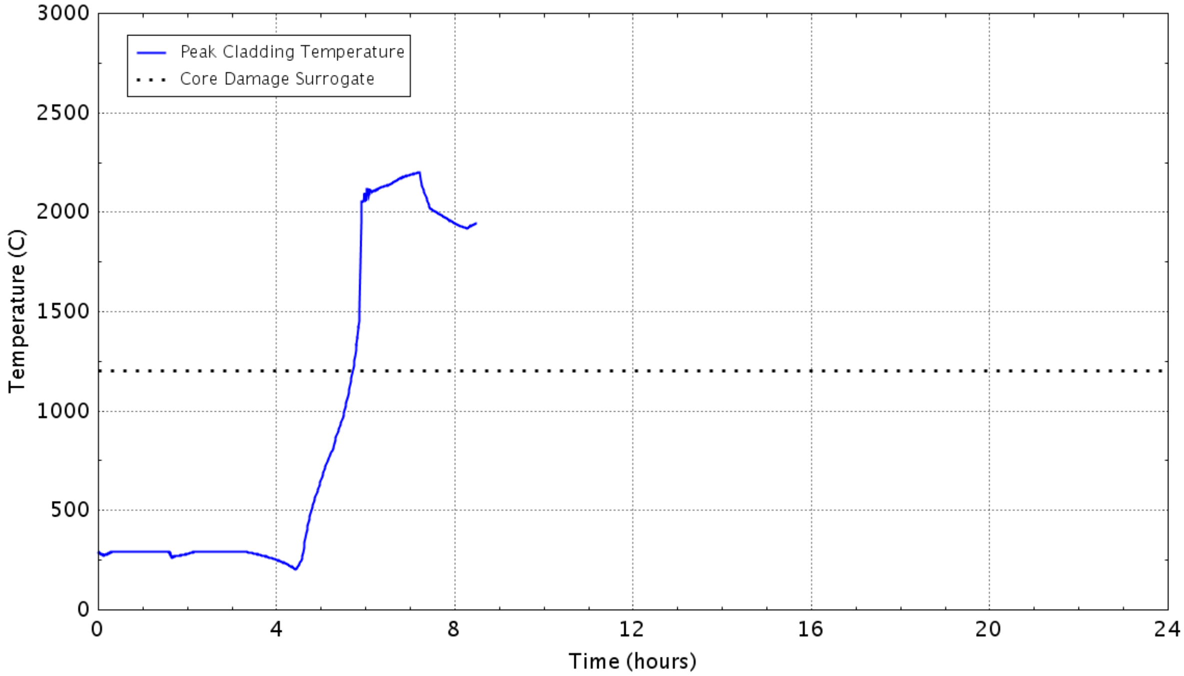

Figure D – 468 Peak temperature of the fuel cladding as a function oftime

D.3.15 Case 22b: Sensitivity to LOMFW-25 Case 22 with FLEXDelivered Flow Reduced by 50%

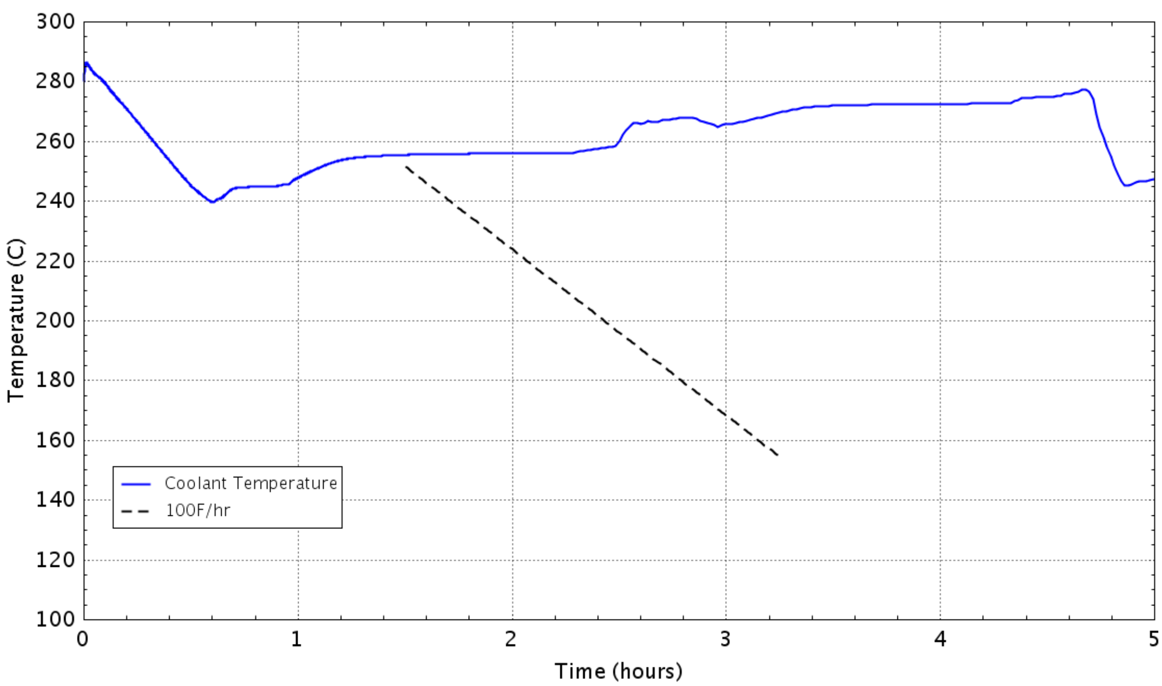

Figure D - 469 RPV cooldown rate

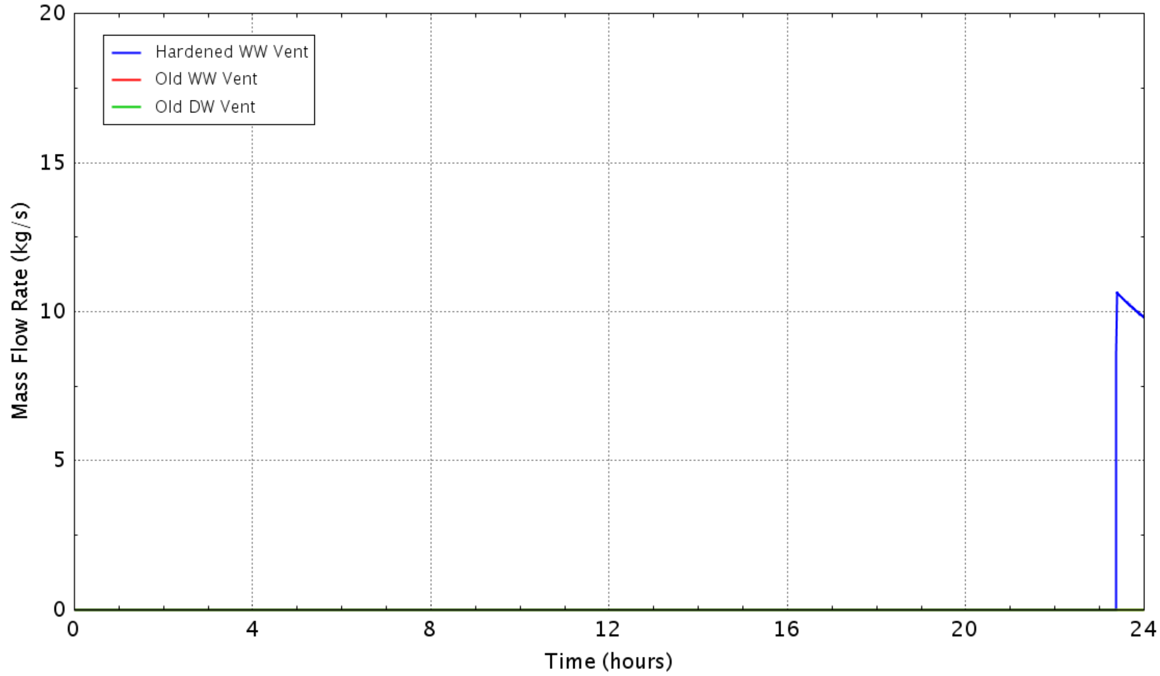

Figure D - 470 Flow rate of the containment vents

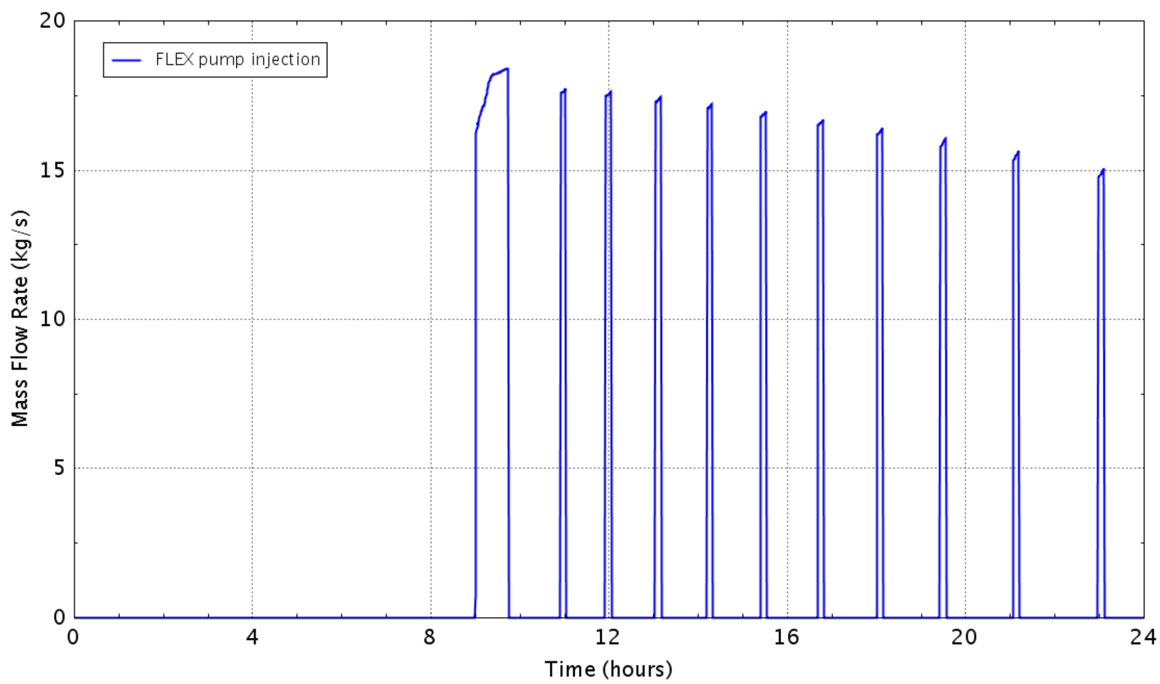

Figure D - 471 Flow rate of the FLEX pump

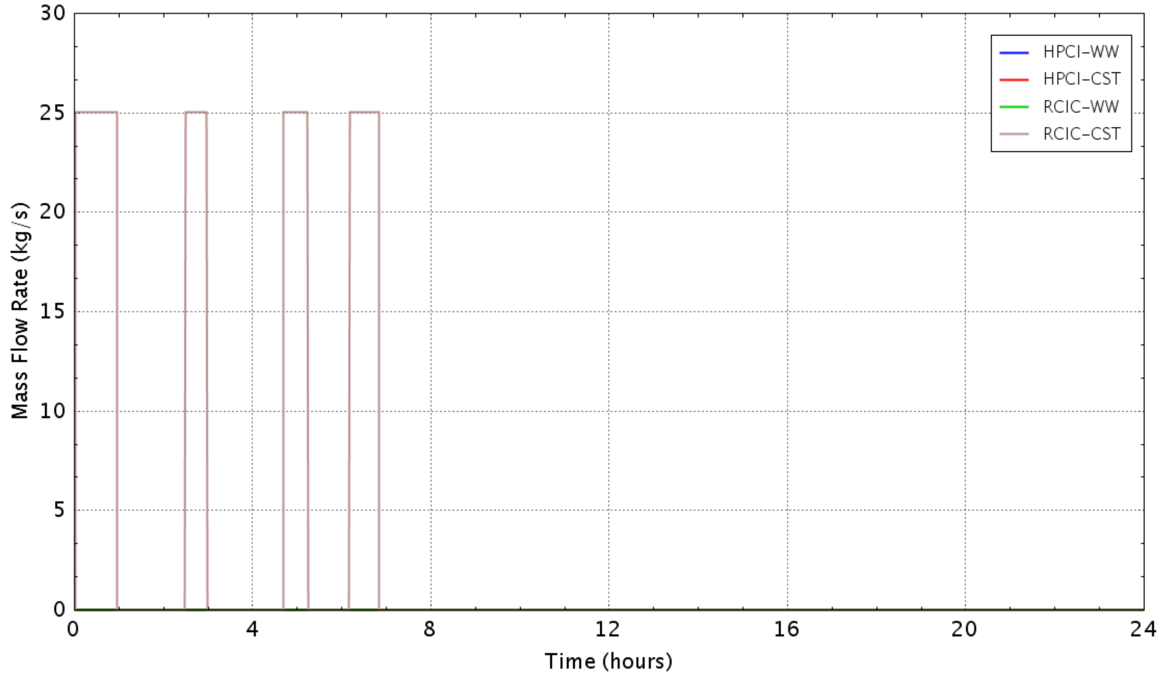

Figure D - 472 **Flow rate of the HPCI/RCIC pumps**

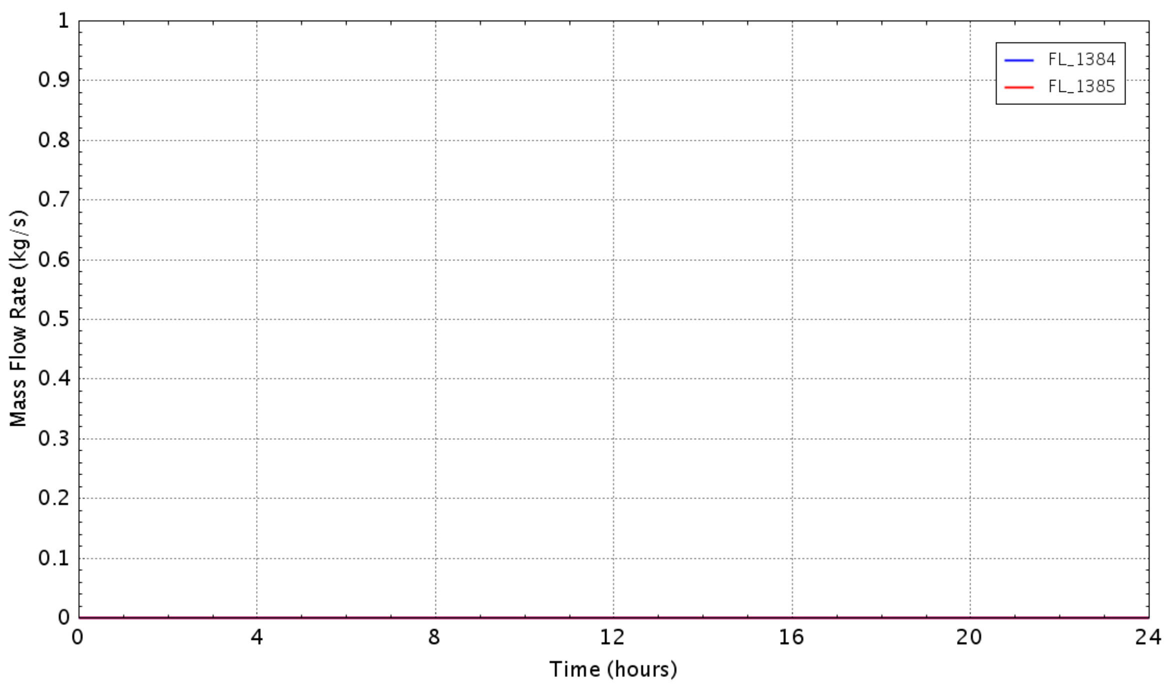

Figure D - 473 **Flow rate of the recirculating pump seal leakage**

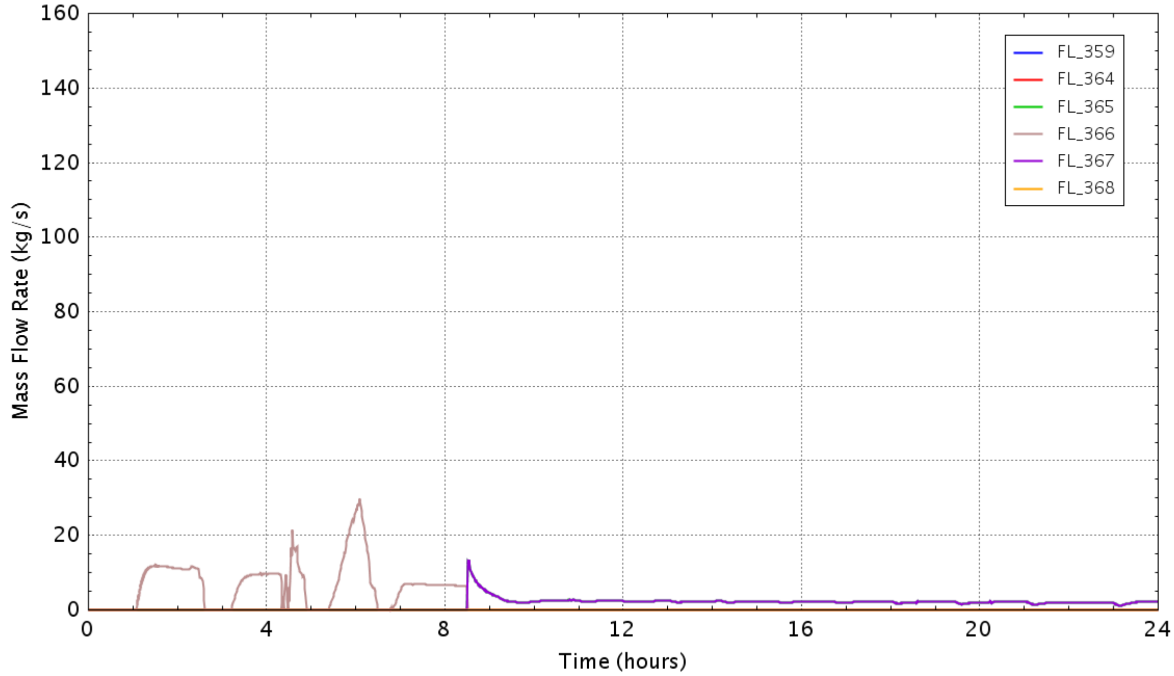

Figure D - 474 **Flow rate of the SRVs**

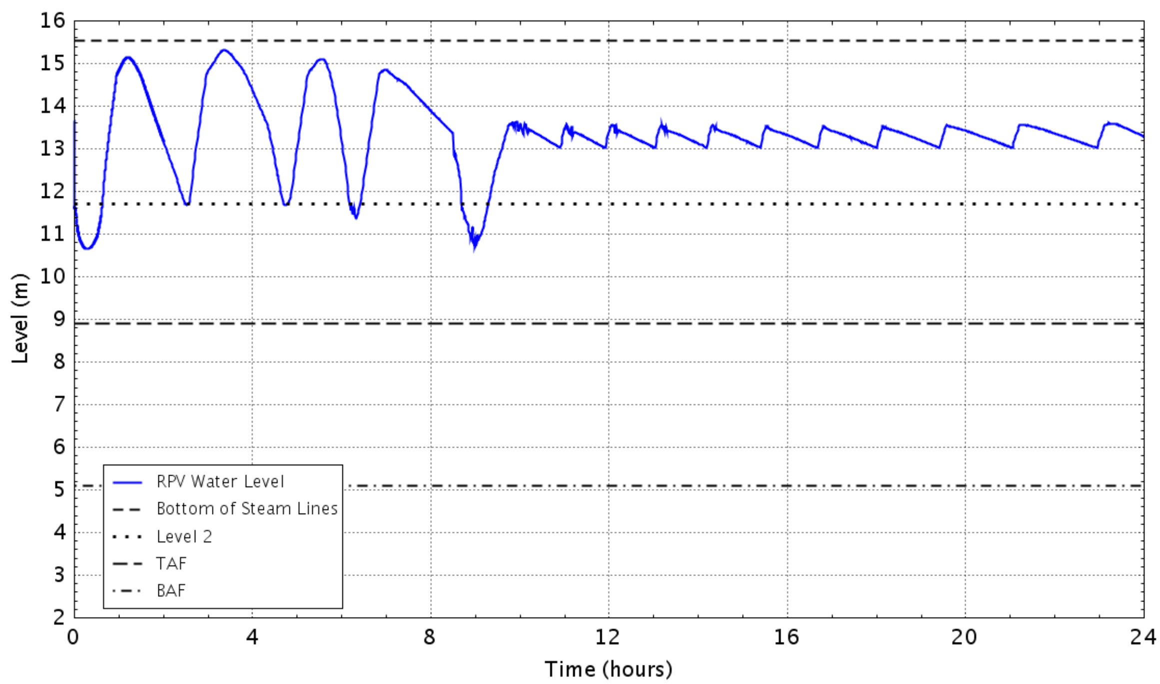

Figure D - 475 **RPV down comer water level**

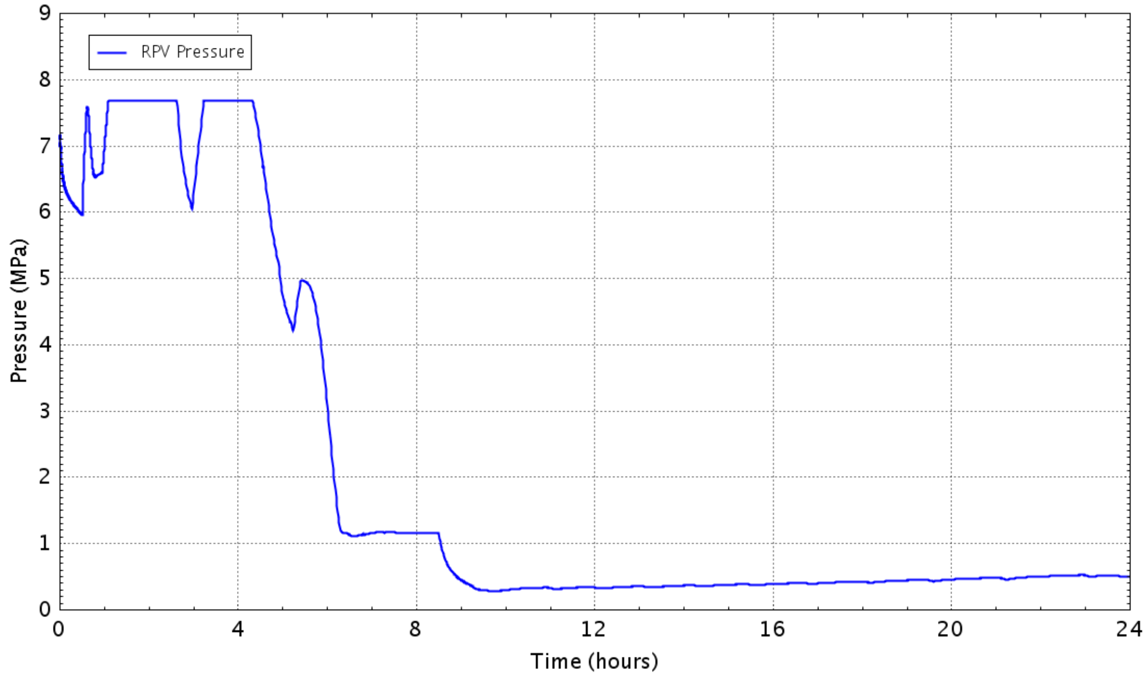

Figure D - 476 Pressure in theRPV

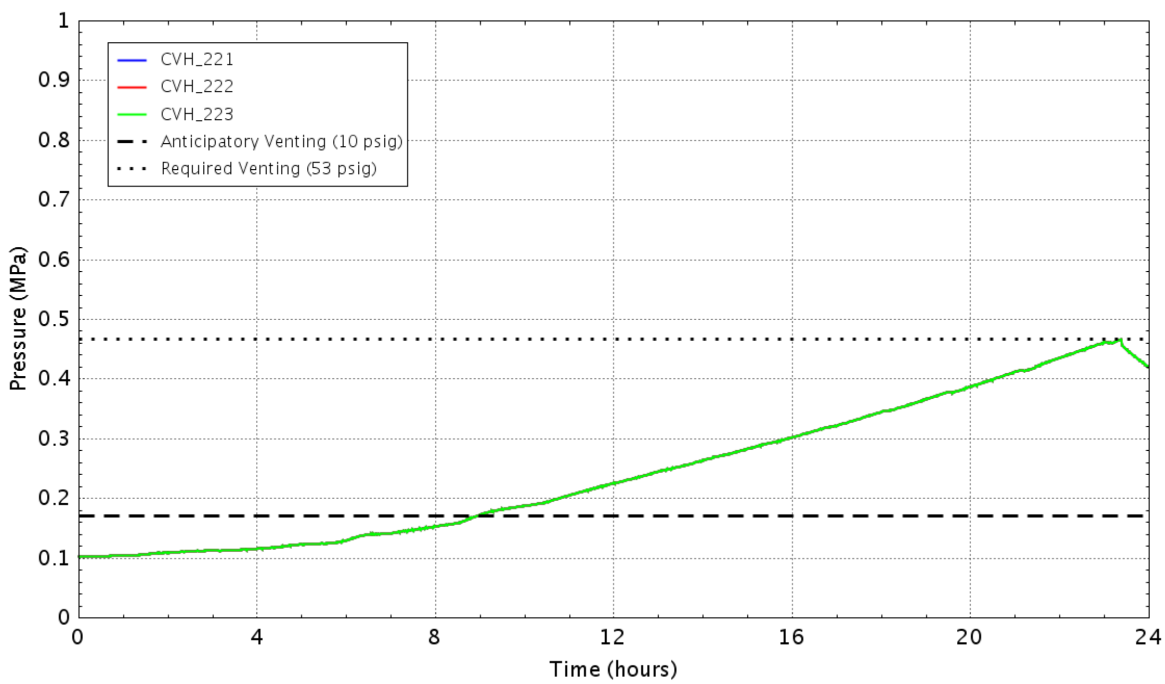

Figure D - 477 Pressure in the wetwell

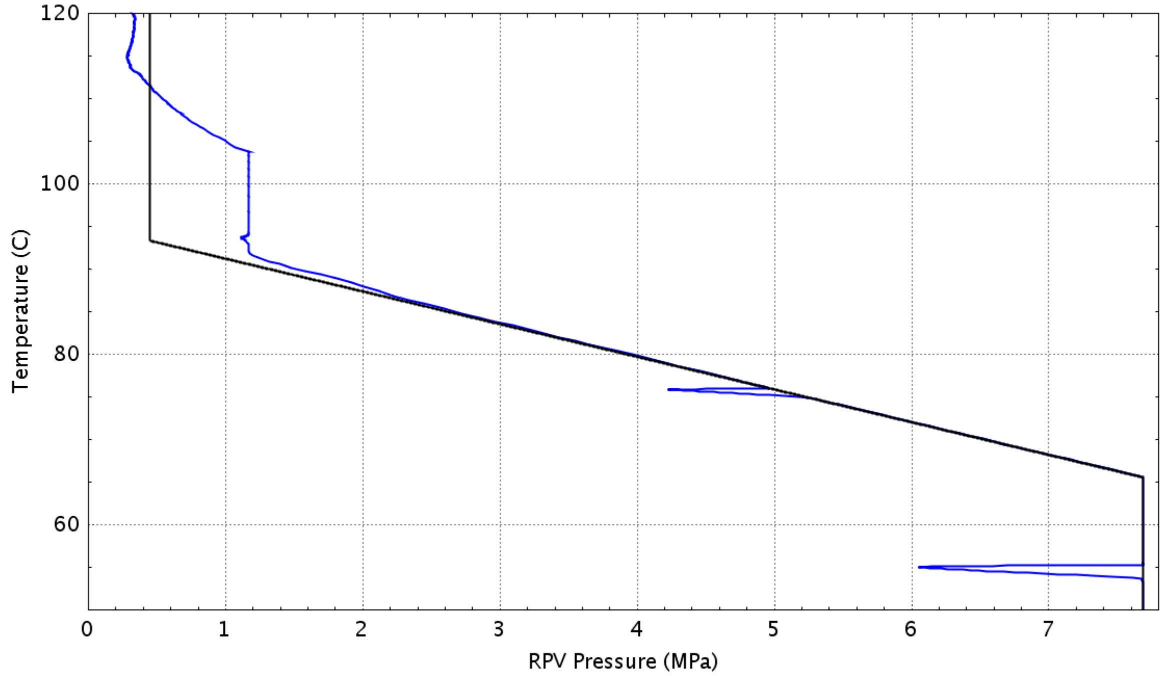

Figure D – 478 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

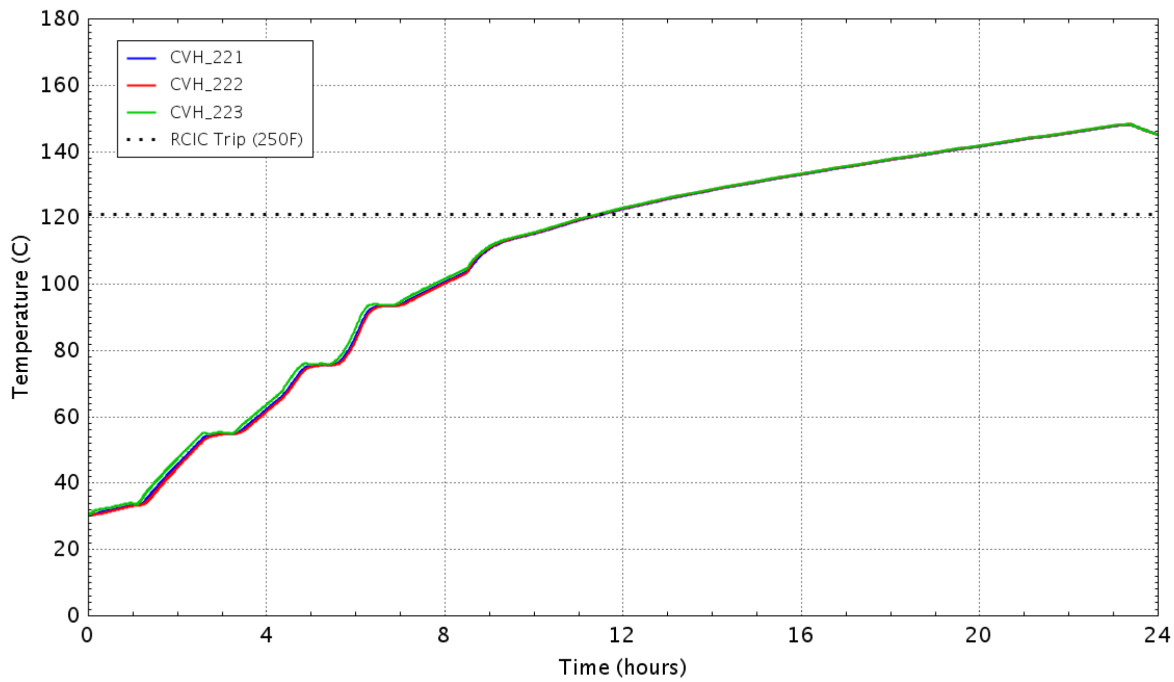

Figure D - 479 **Water temperature in the wetwell**

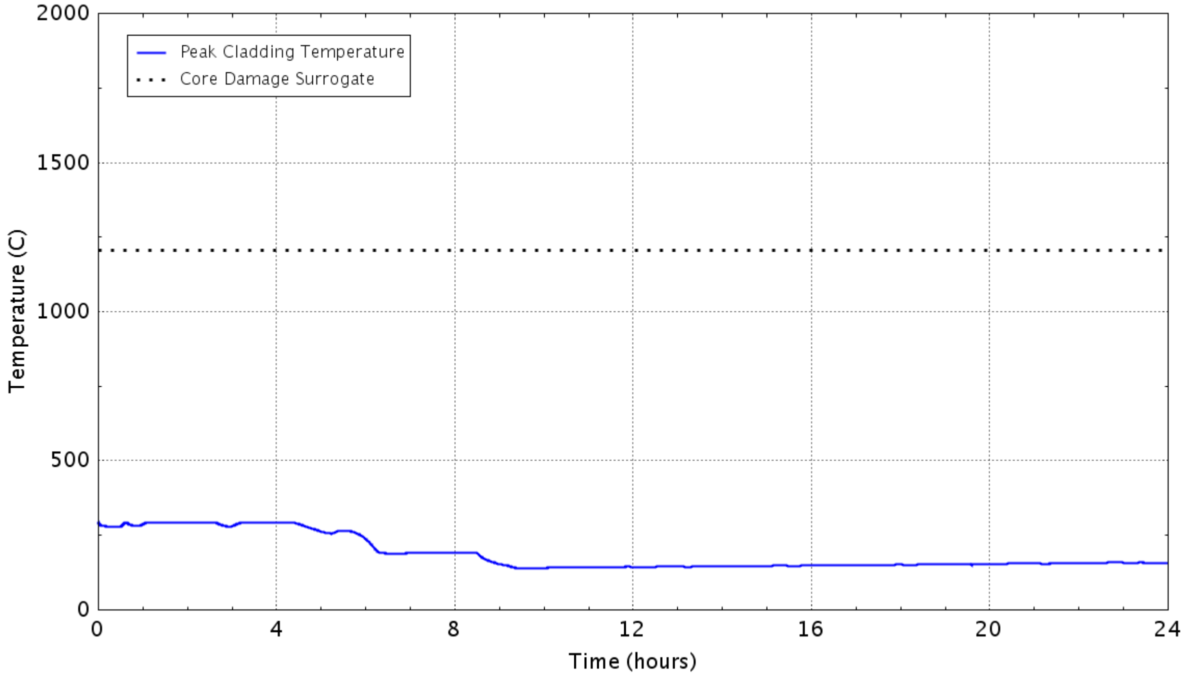

Figure D – 480 Peak temperature of the fuel cladding as a function oftime

D.3.16 Case 22c: Sensitivity to LOMFW-25 Case 22 with RCICDelivered Flow Reduced by 10%

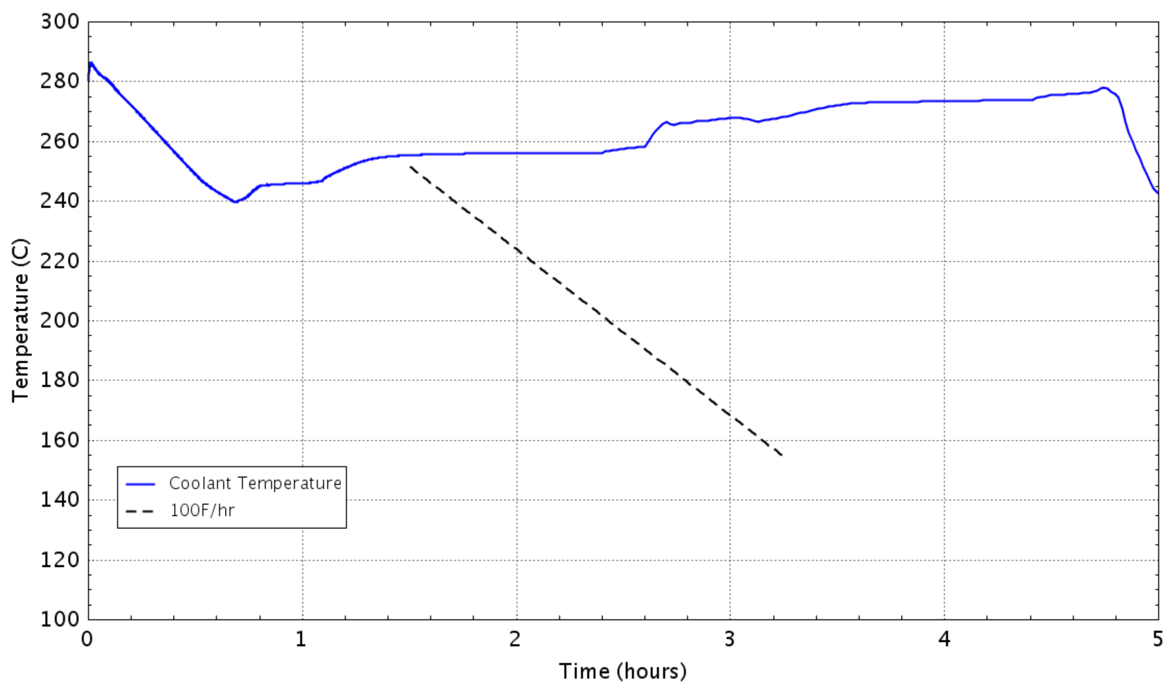

Figure D - 481 RPV cooldown rate

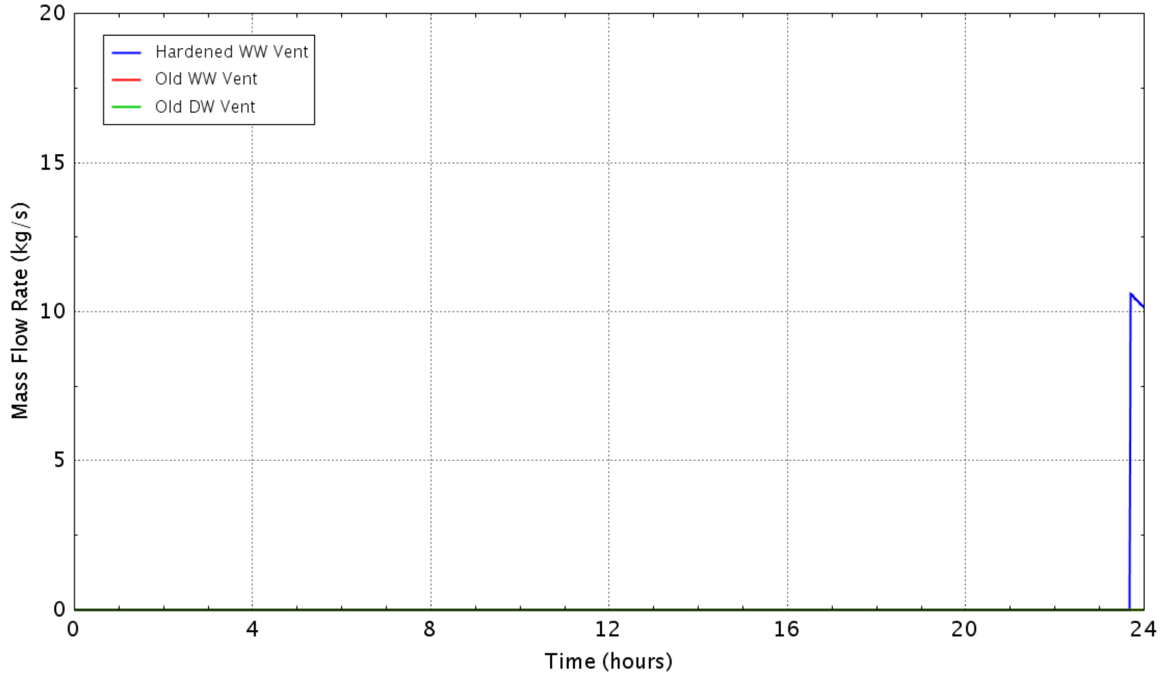

Figure D - 482 Flow rate of the containment vents

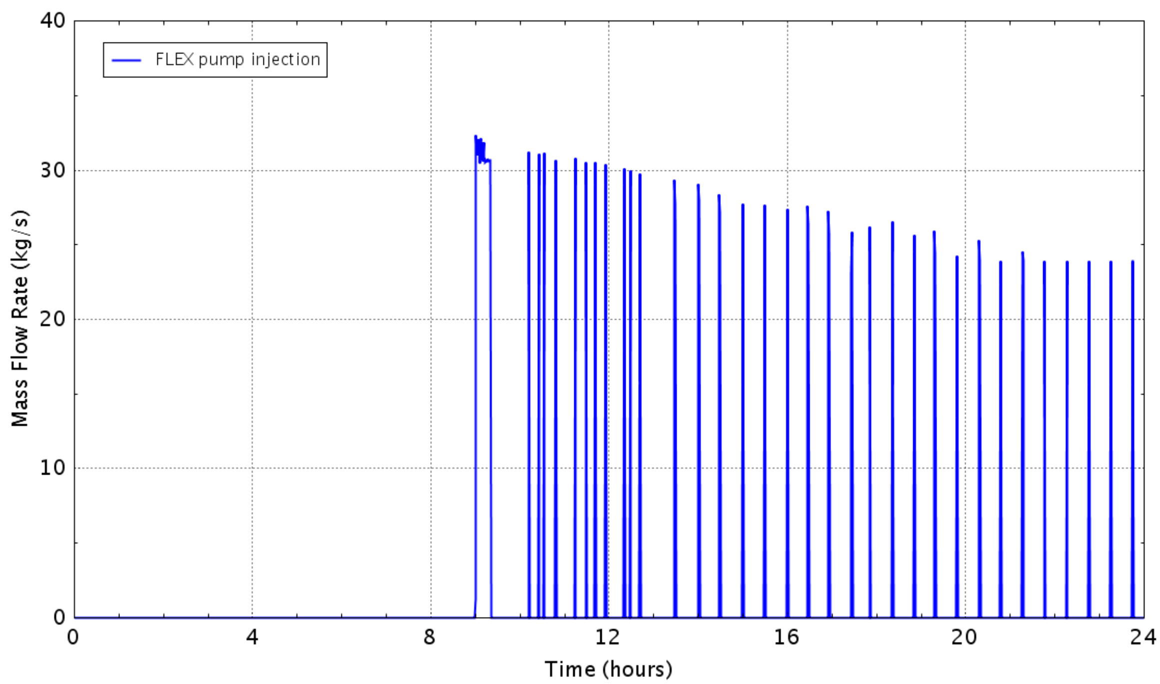

Figure D - 483 Flow rate of the FLEX pump

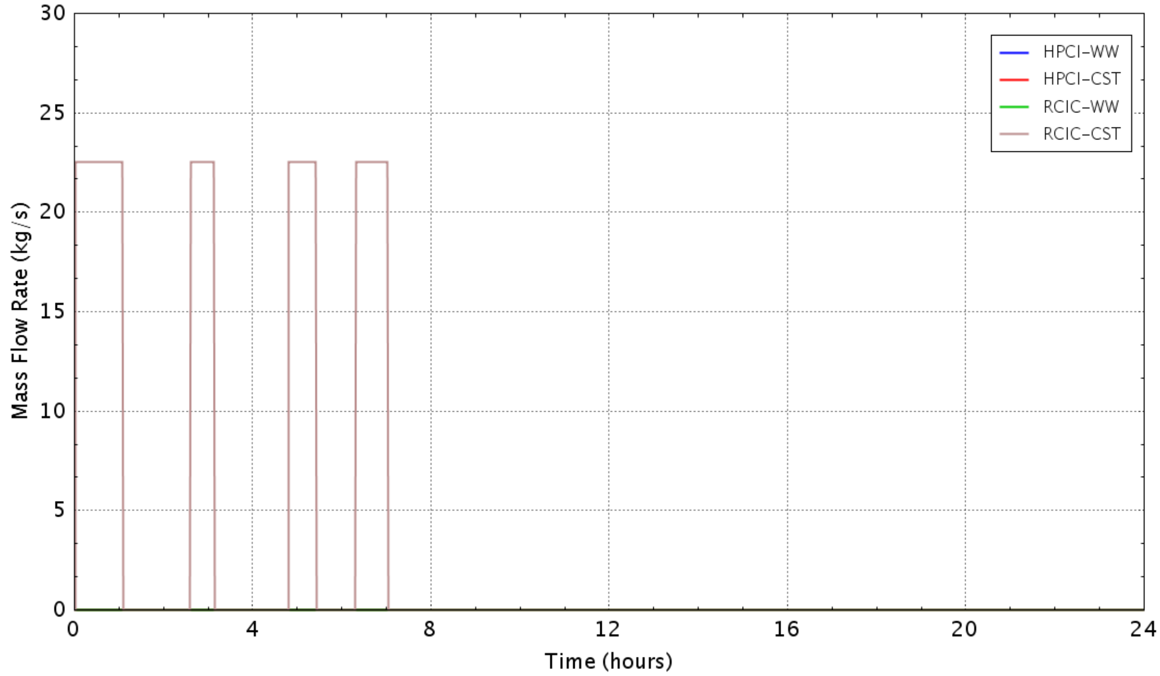

Figure D - 484 **Flow rate of the HPCI/RCIC pumps**

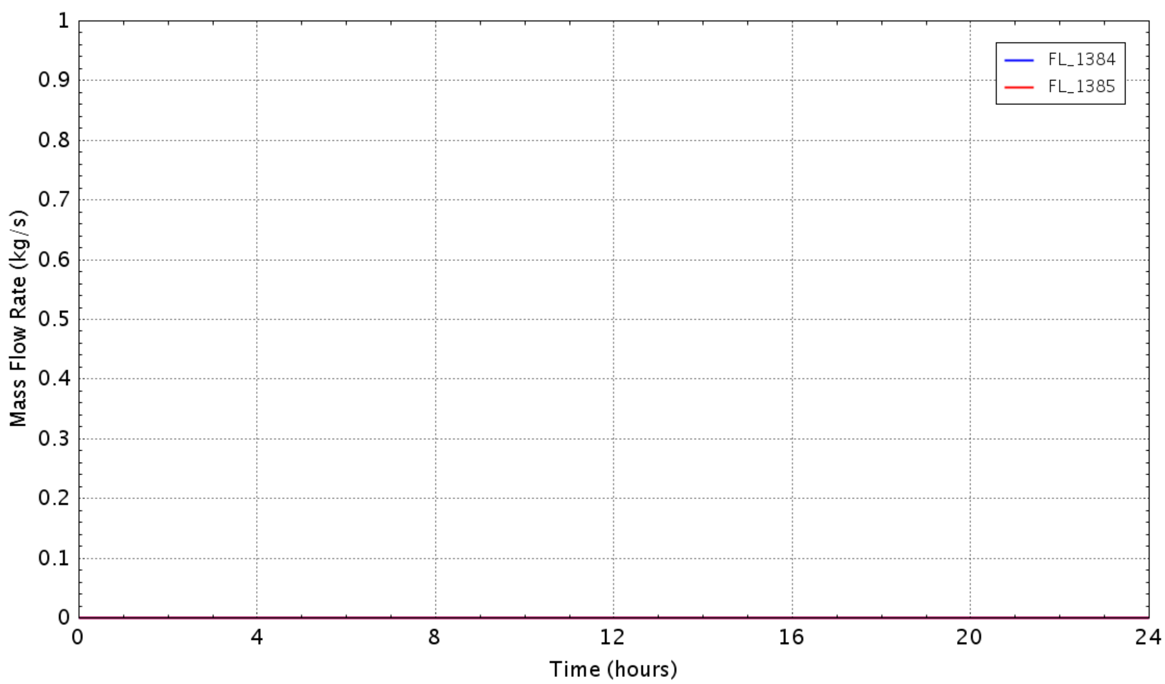

Figure D - 485 **Flow rate of the recirculating pump seal leakage**

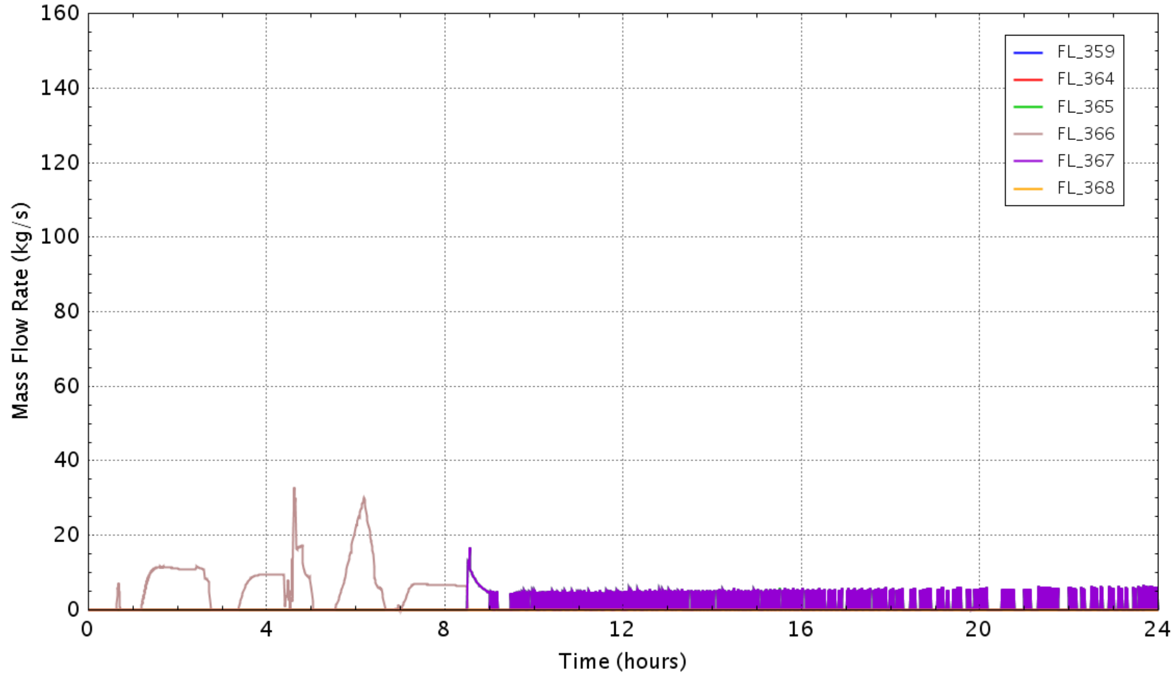

Figure D - 486 Flow rate of the SRVs

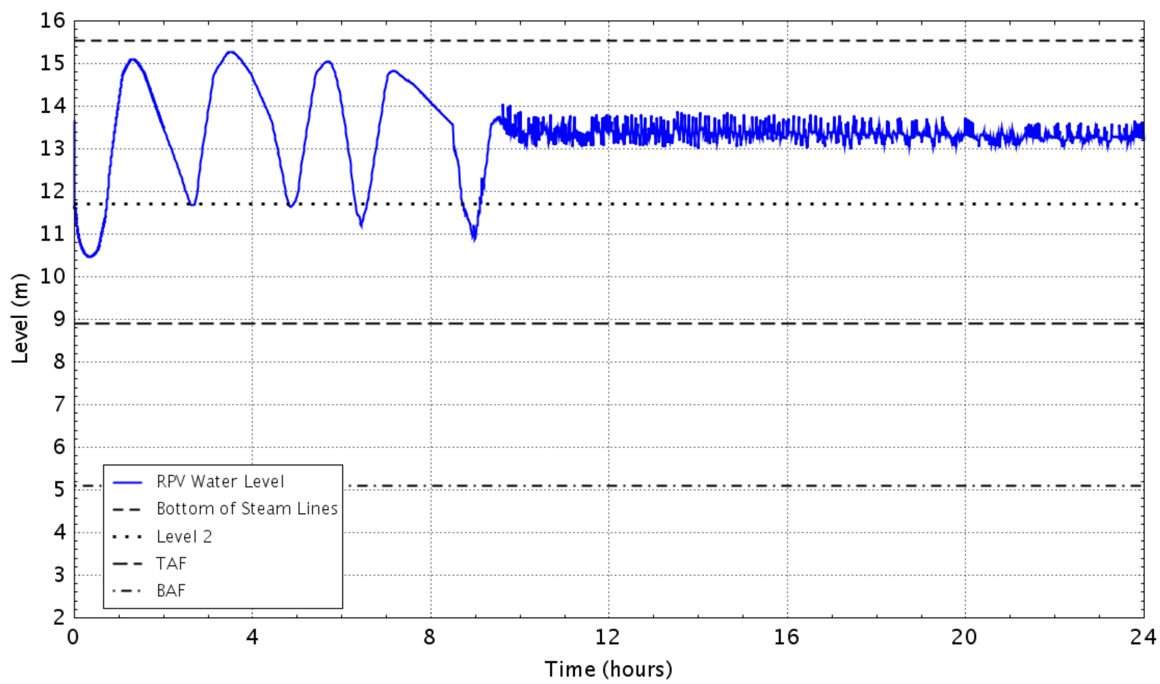

Figure D - 487 RPV down comer water level

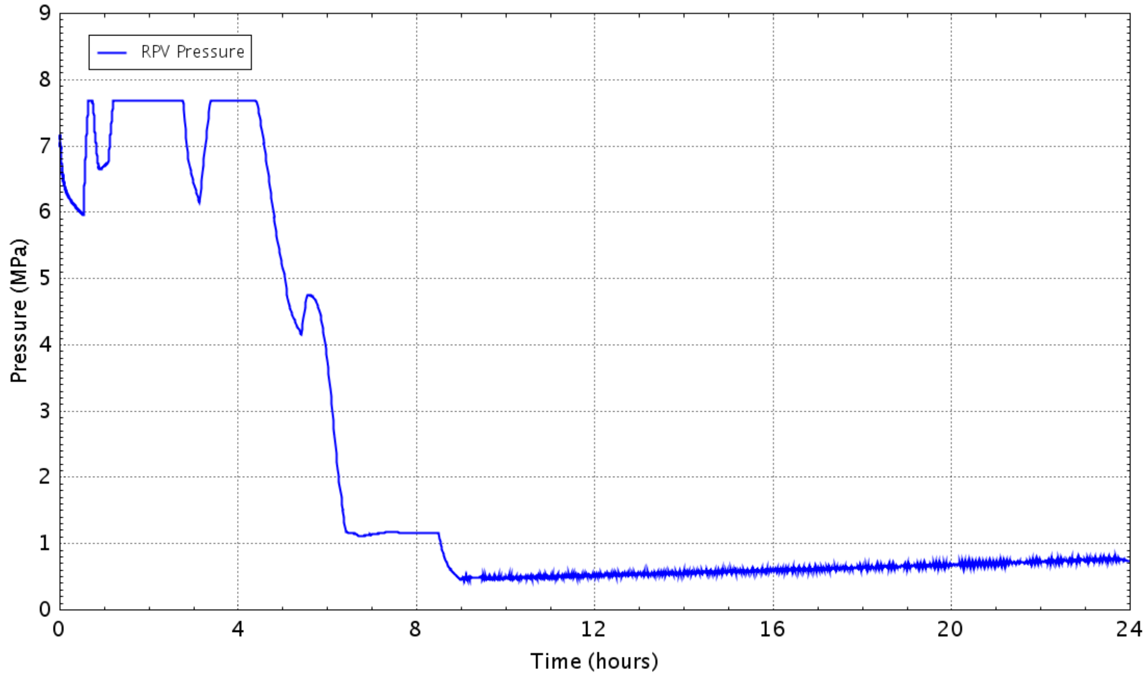

Figure D - 488 Pressure in theRPV

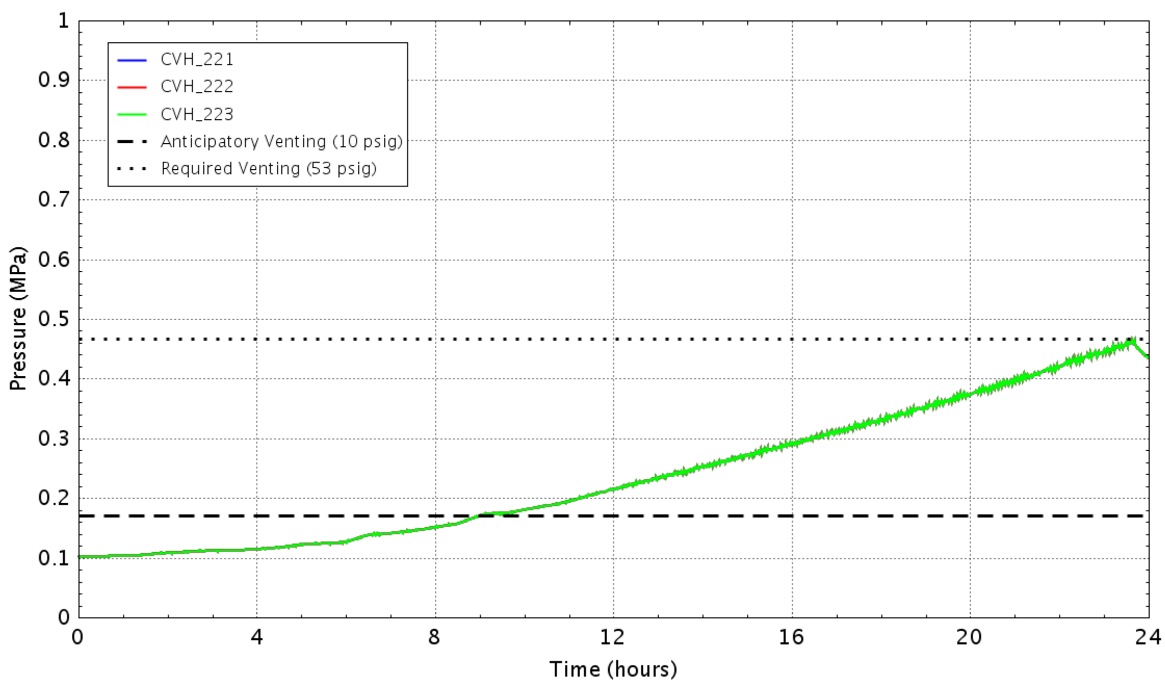

Figure D - 489 Pressure in the wetwell

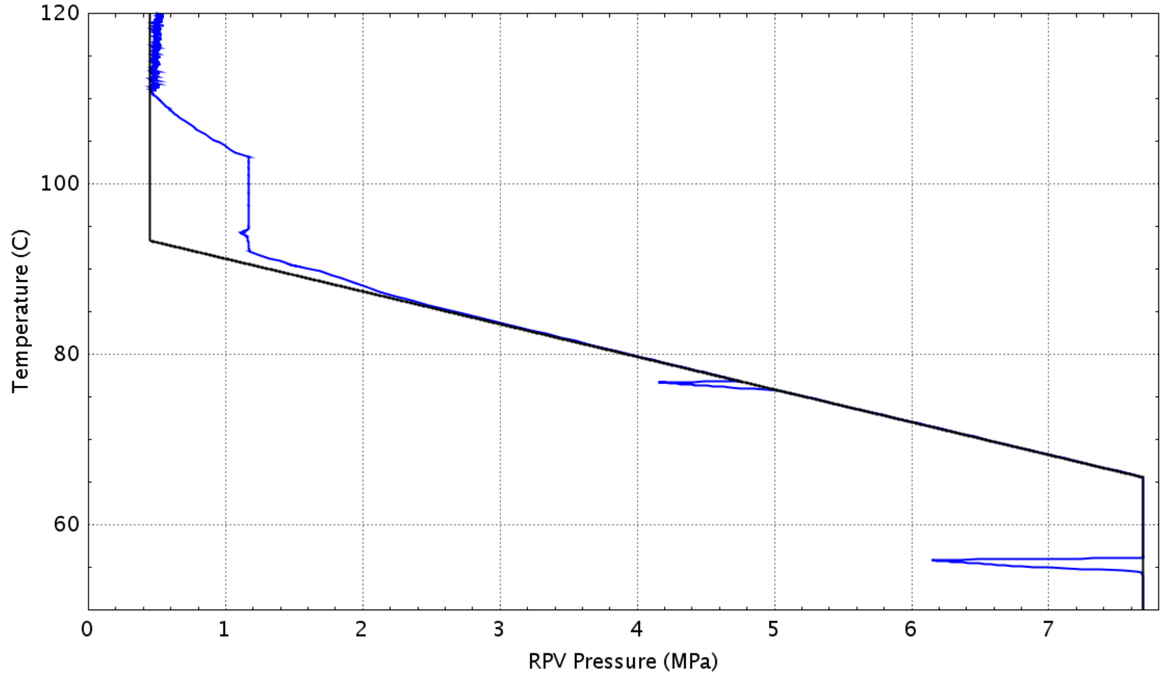

Figure D – 490 Plant status relative to the HCL curve (Graph 4 of the EOPs)

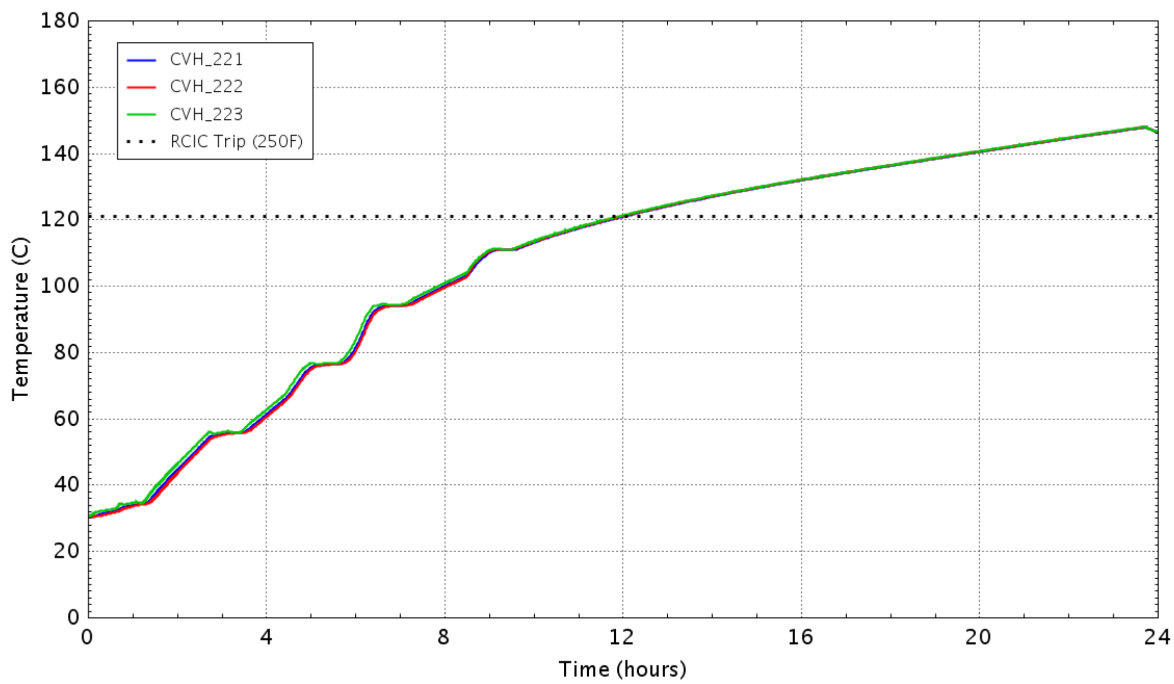

Figure D - 491 Water temperature in the wetwell

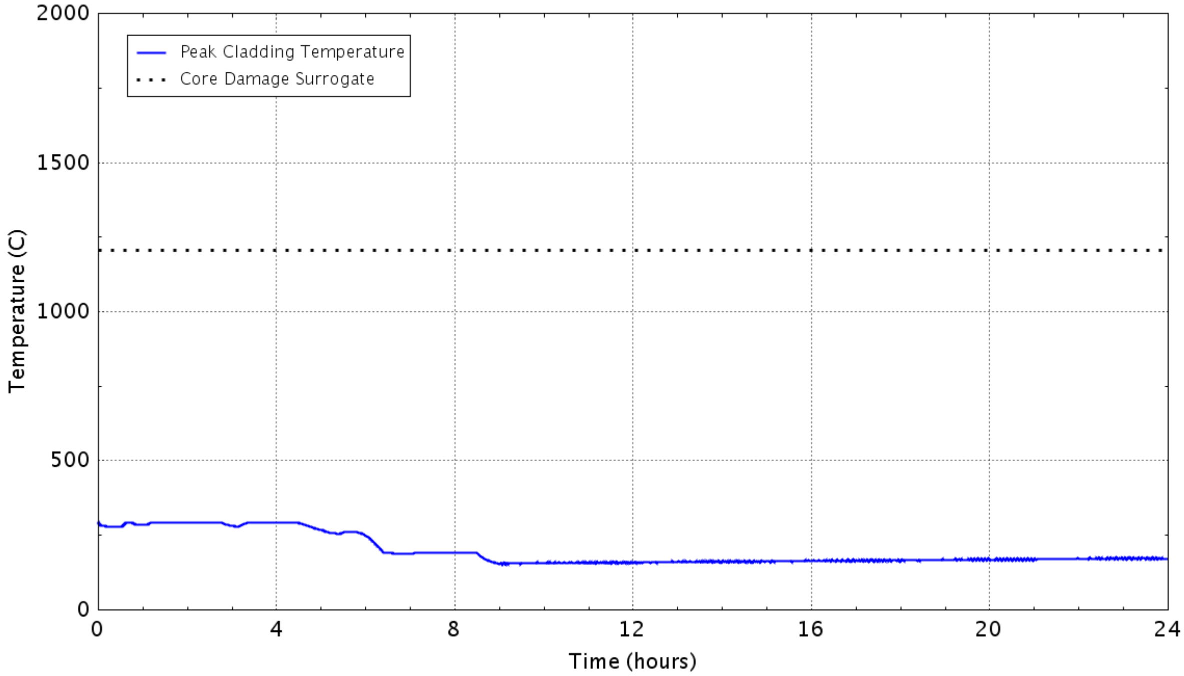

Figure D – 492 Peak temperature of the fuel cladding as a function oftime

D.3.17 Case 22d: Sensitivity to LOMFW-25 Case 22 with FLEXInjection Failure at 24 hrs.

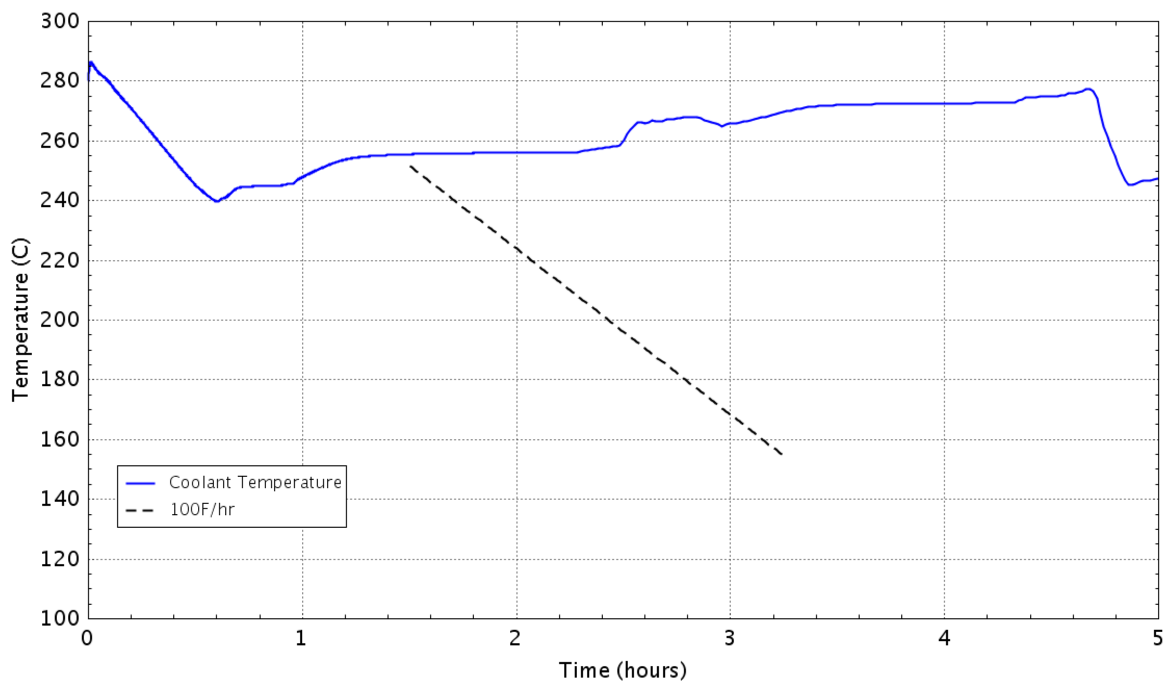

Figure D - 493 RPV cooldown rate

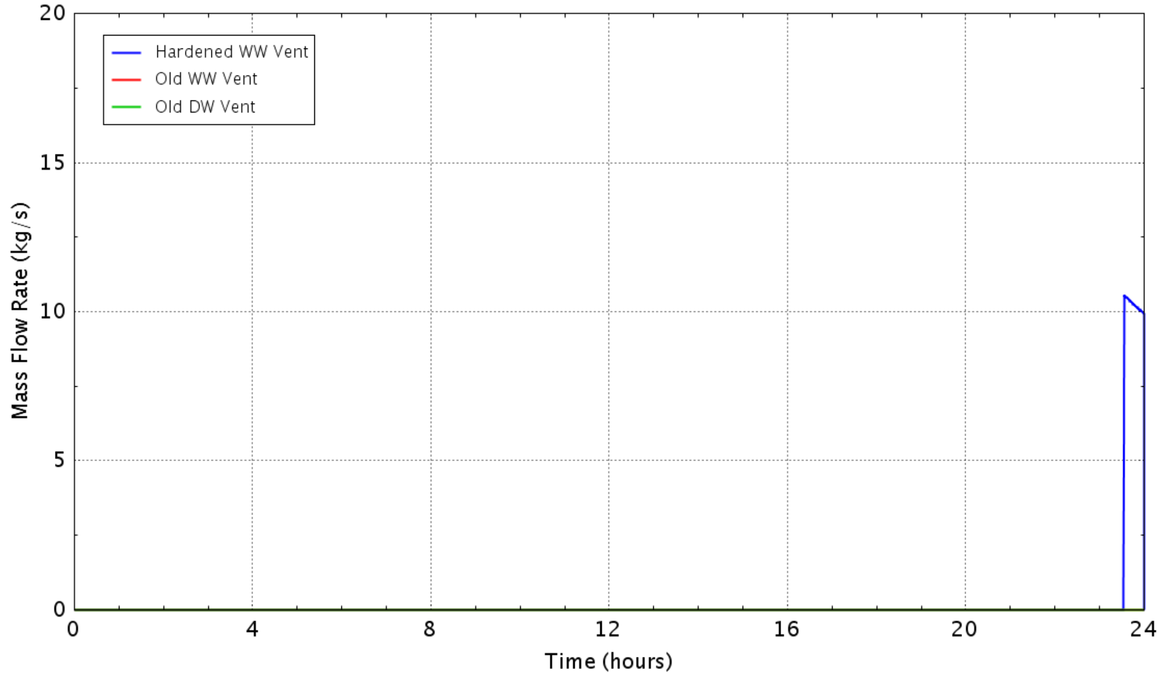

Figure D - 494 Flow rate of the containment vents

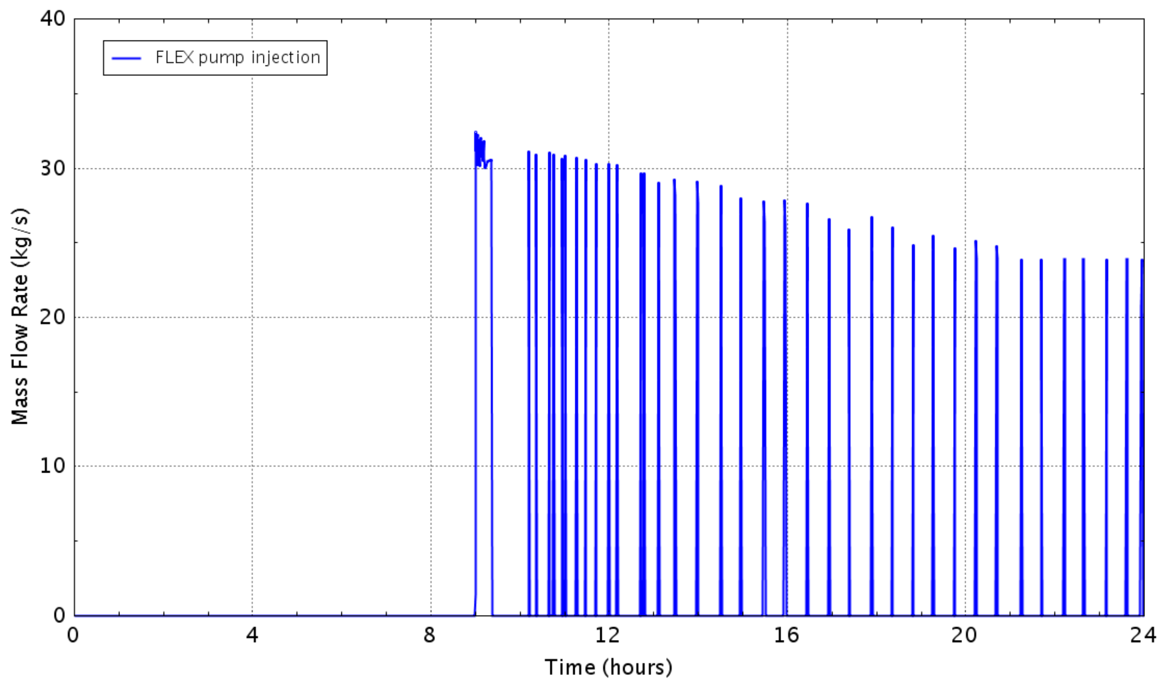

Figure D - 495 Flow rate of the FLEX pump

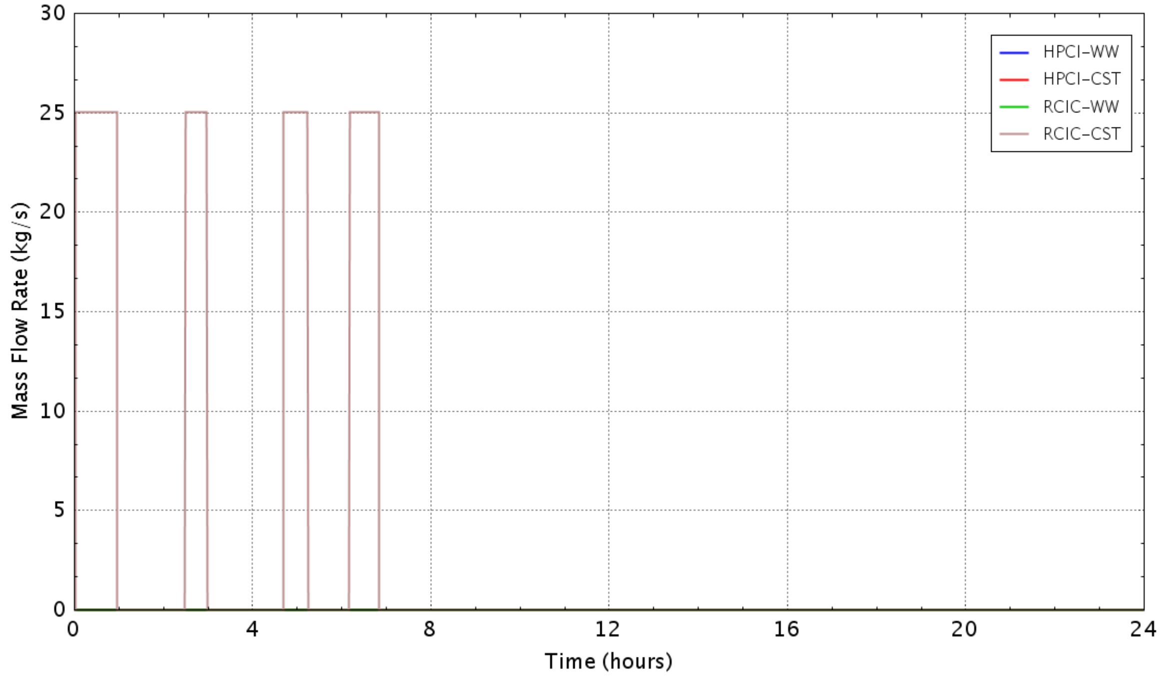

Figure D - 496 Flow rate of the HPCI/RCIC pumps

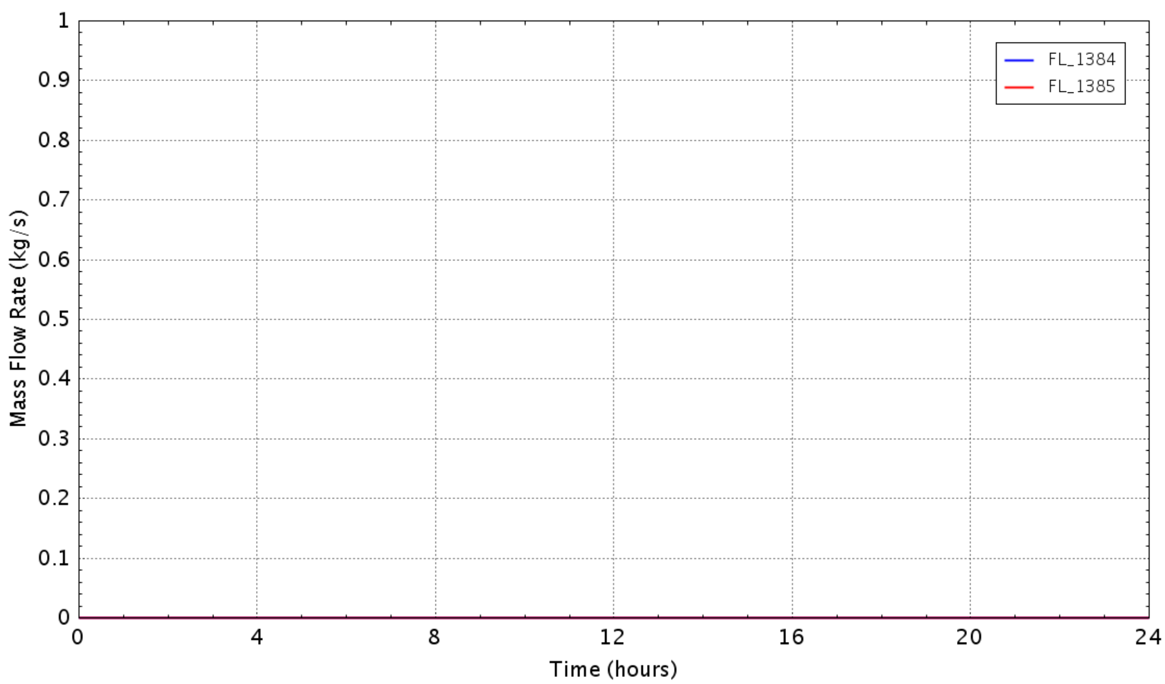

Figure D – 497 Flow rate of the recirculating pump sealleakage

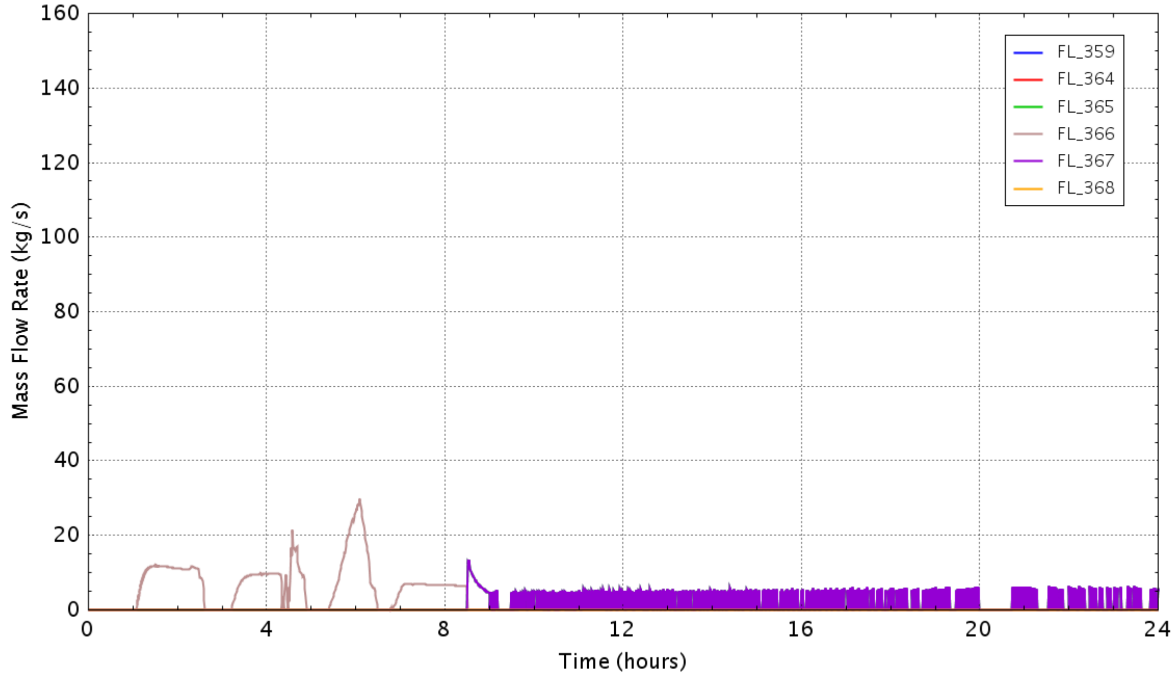

Figure D - 498 **Flow rate of the SRVs**

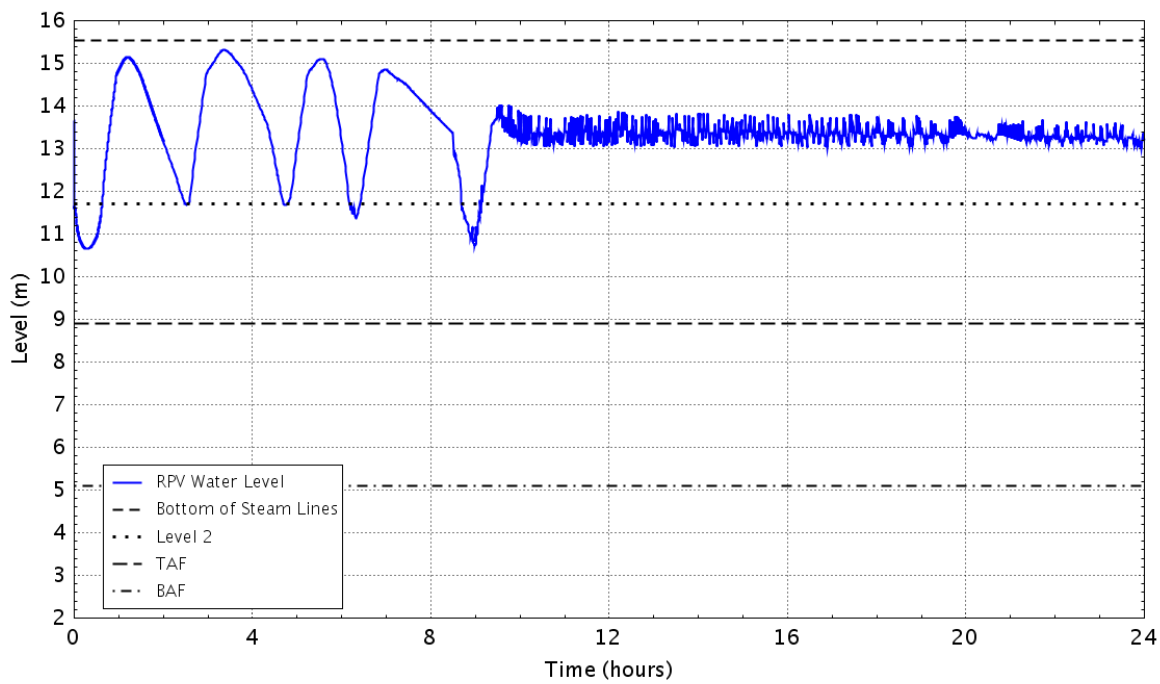

Figure D - 499 **RPV down comer water level**

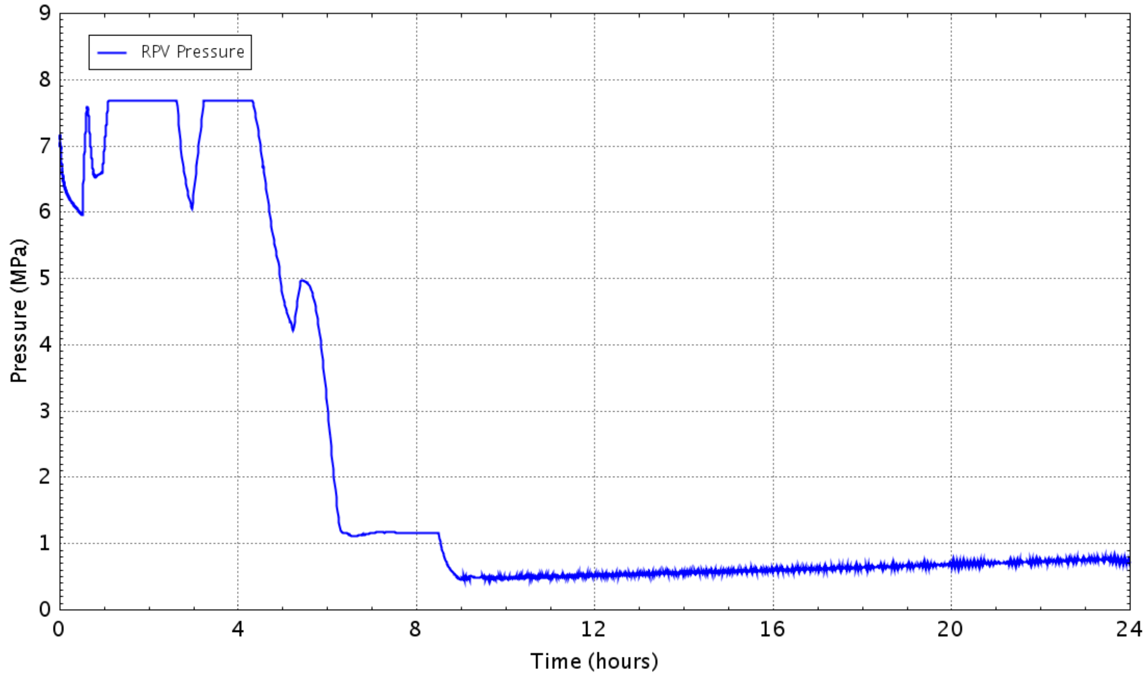

Figure D - 500 Pressure in theRPV

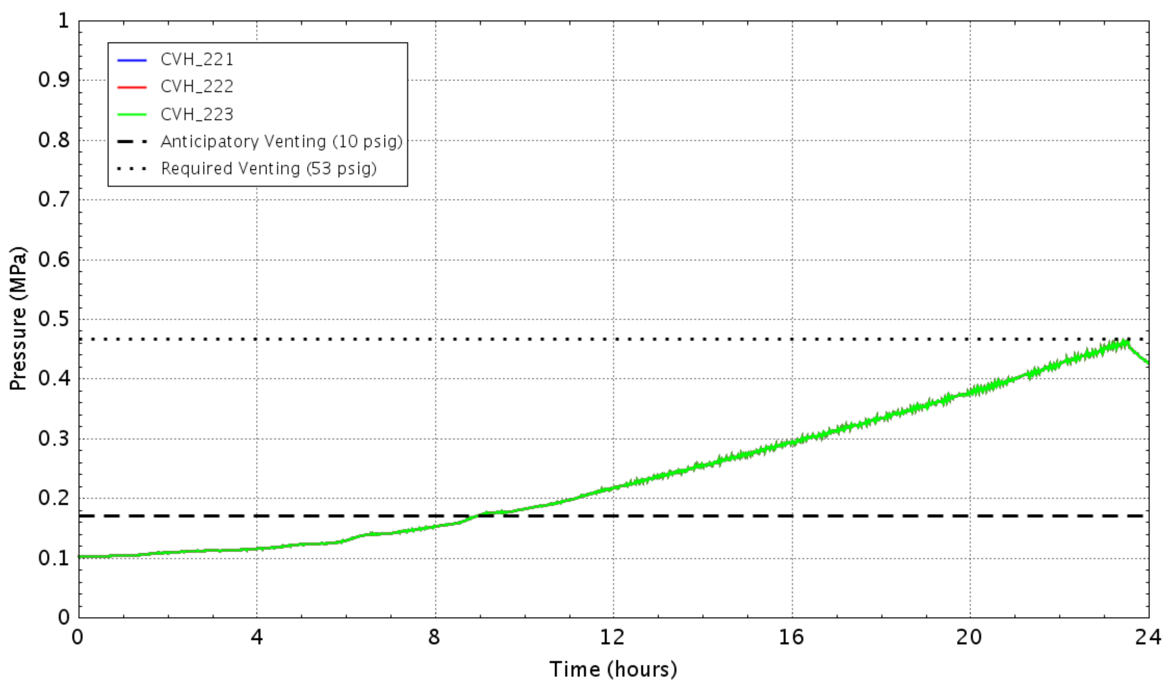

Figure D - 501 Pressure in the wetwell

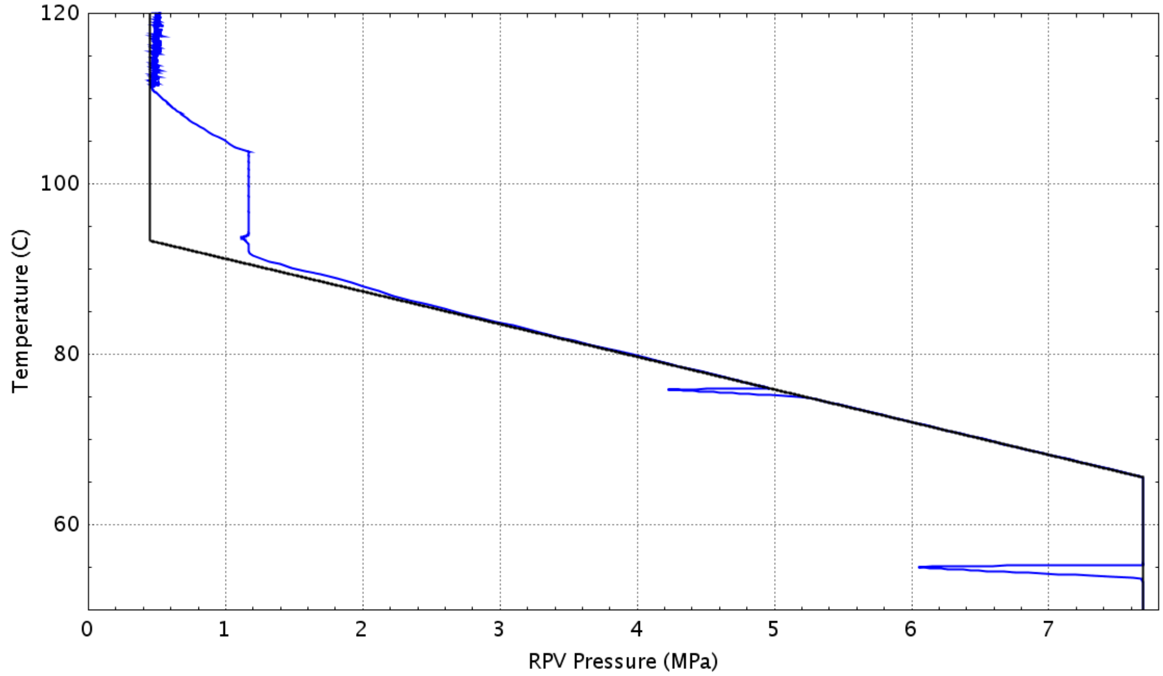

Figure D – 502 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

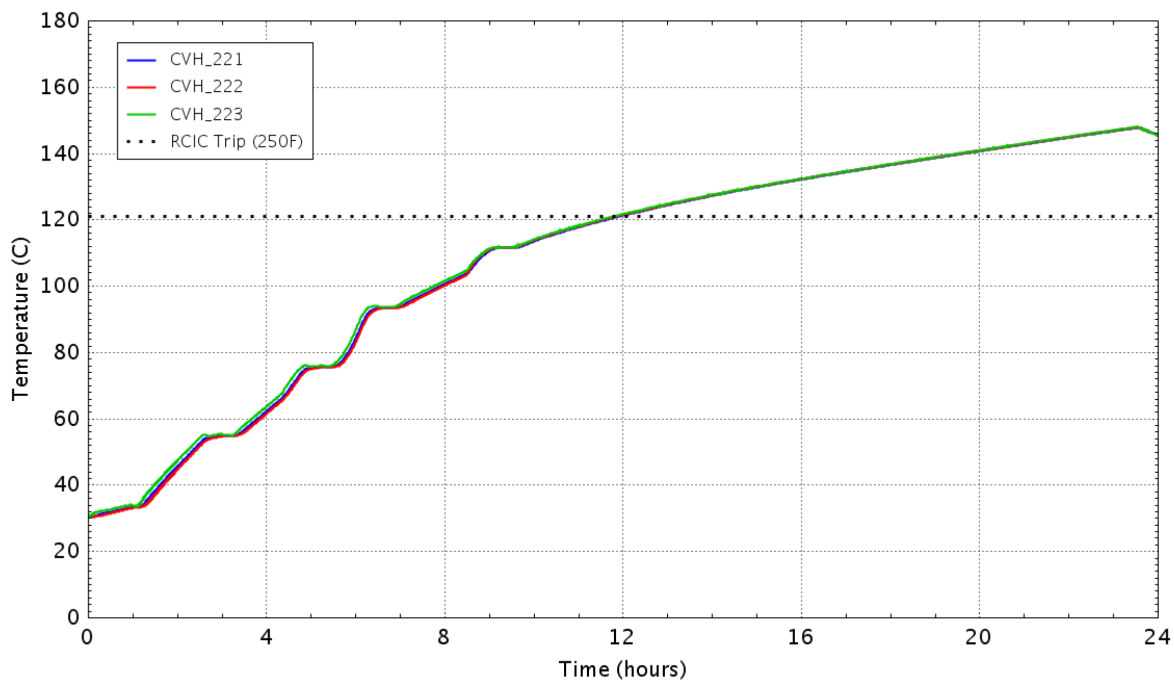

Figure D - 503 **Water temperature in the wetwell**

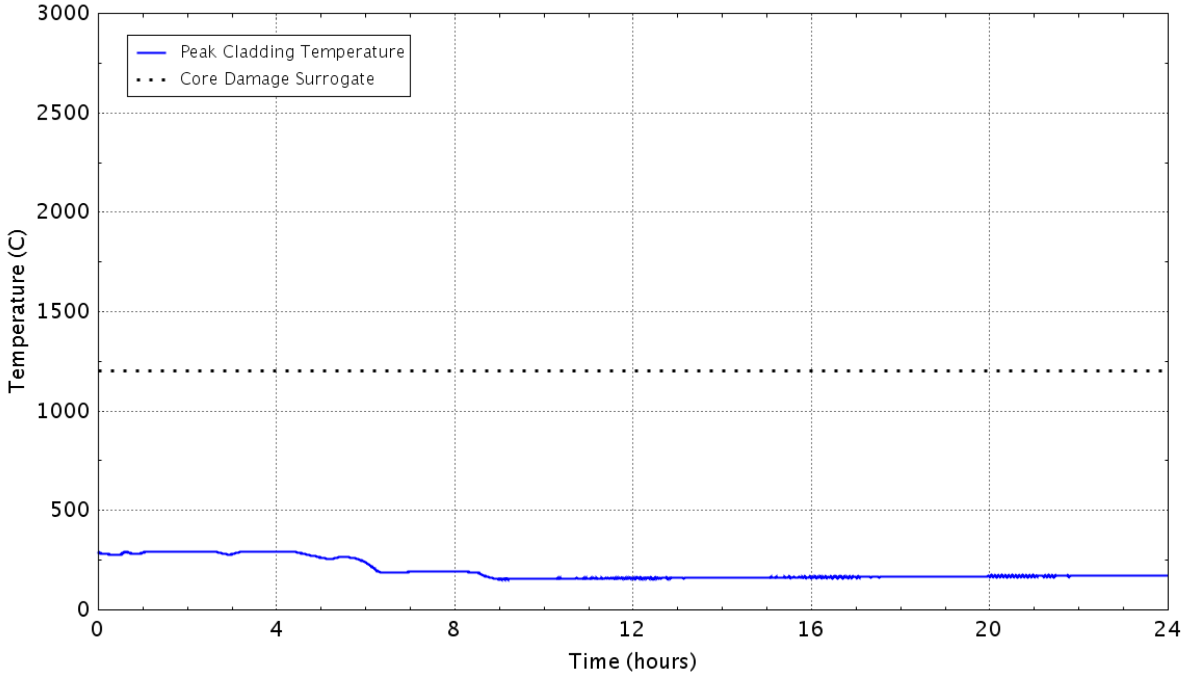

Figure D – 504 Peak temperature of the fuel cladding as a function oftime

D.3.18 Case 22e: Sensitivity to LOMFW-25 Case 22 with DecayHeat Following Built-in ANS Standard

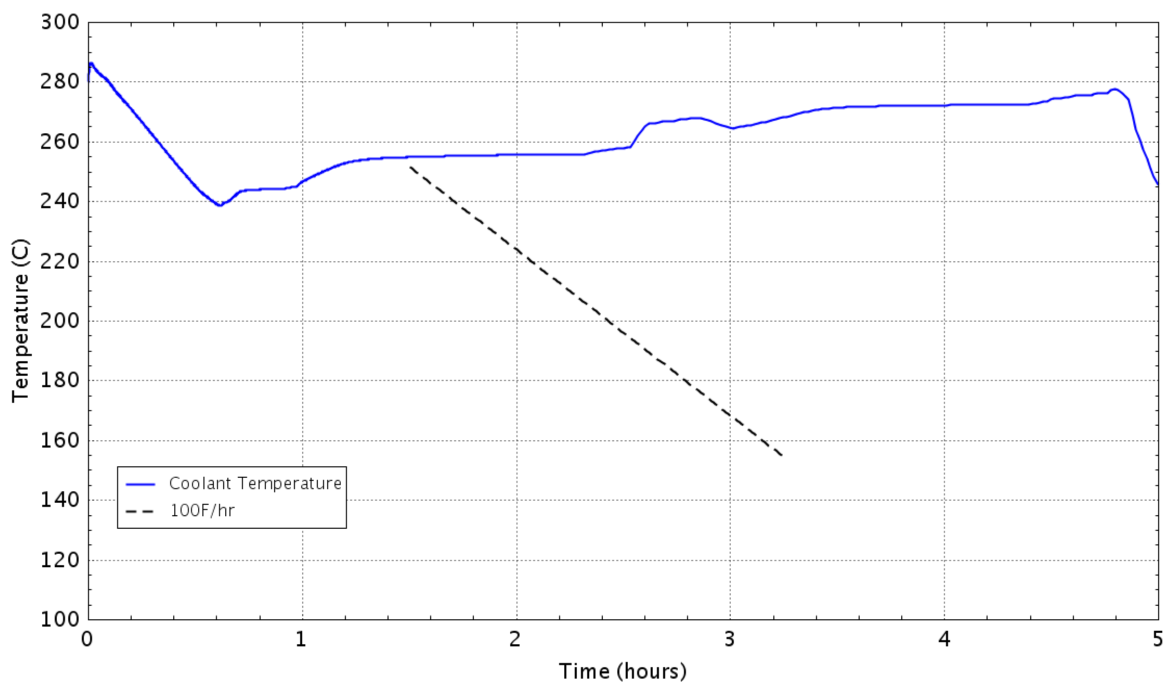

Figure D – 505 RPV cooldown rate

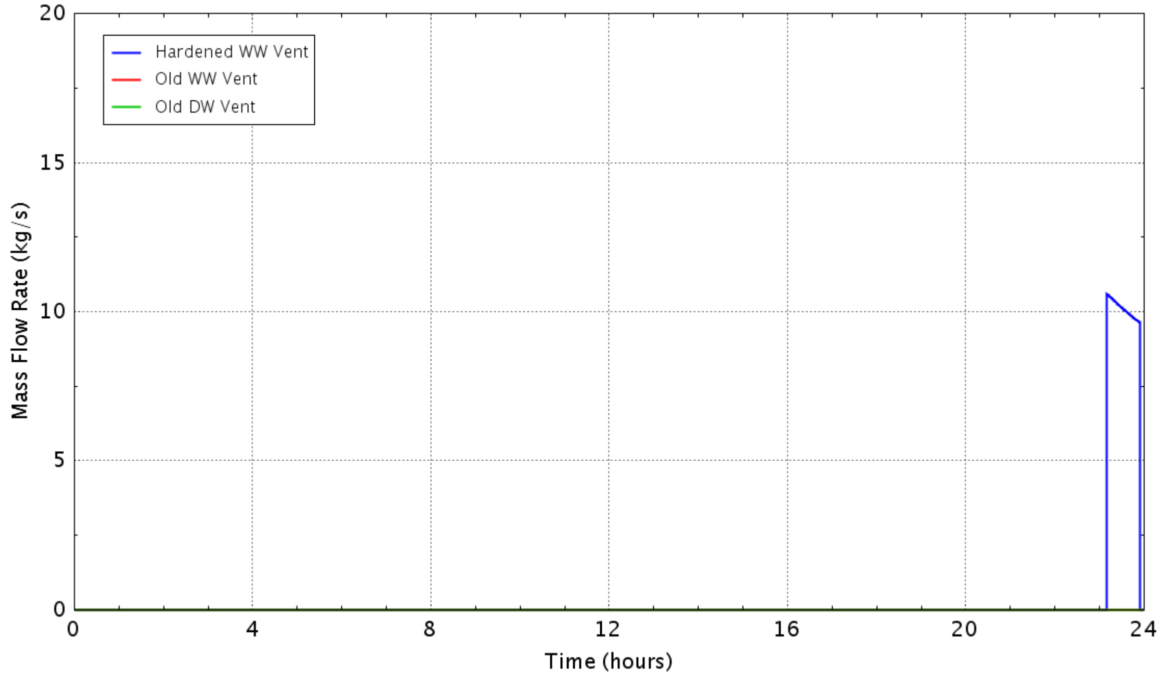

Figure D - 506 Flow rate of the containment vents

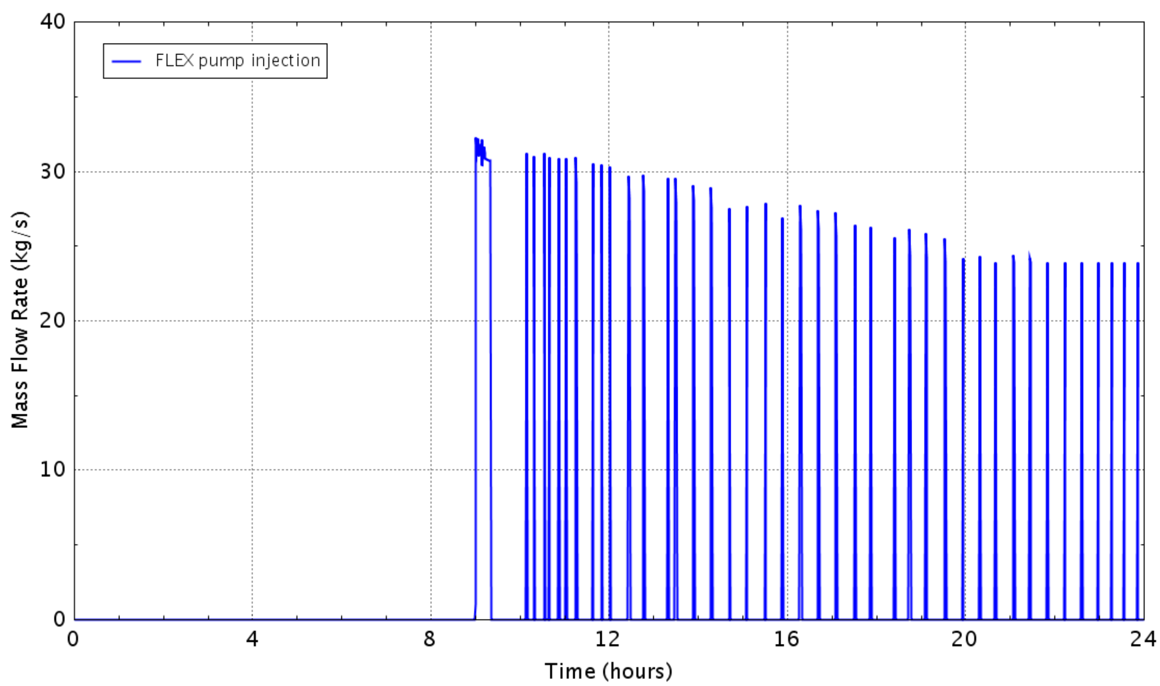

Figure D - 507 Flow rate of the FLEX pump

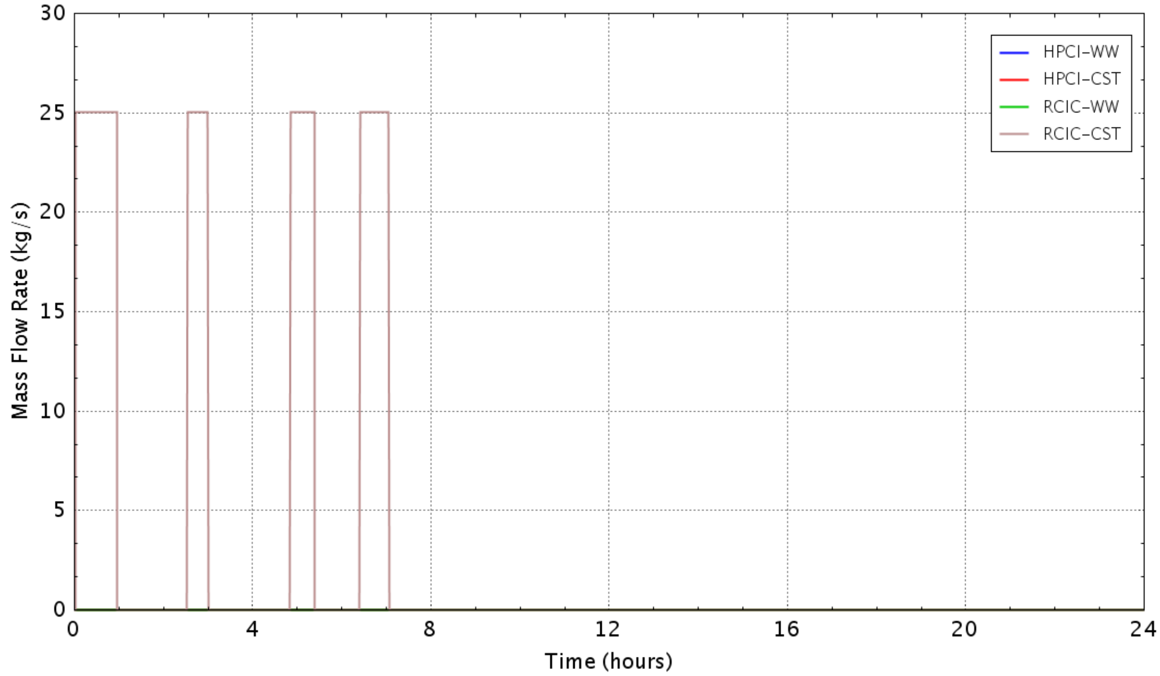

Figure D - 508 Flow rate of the HPCI/RCIC pumps

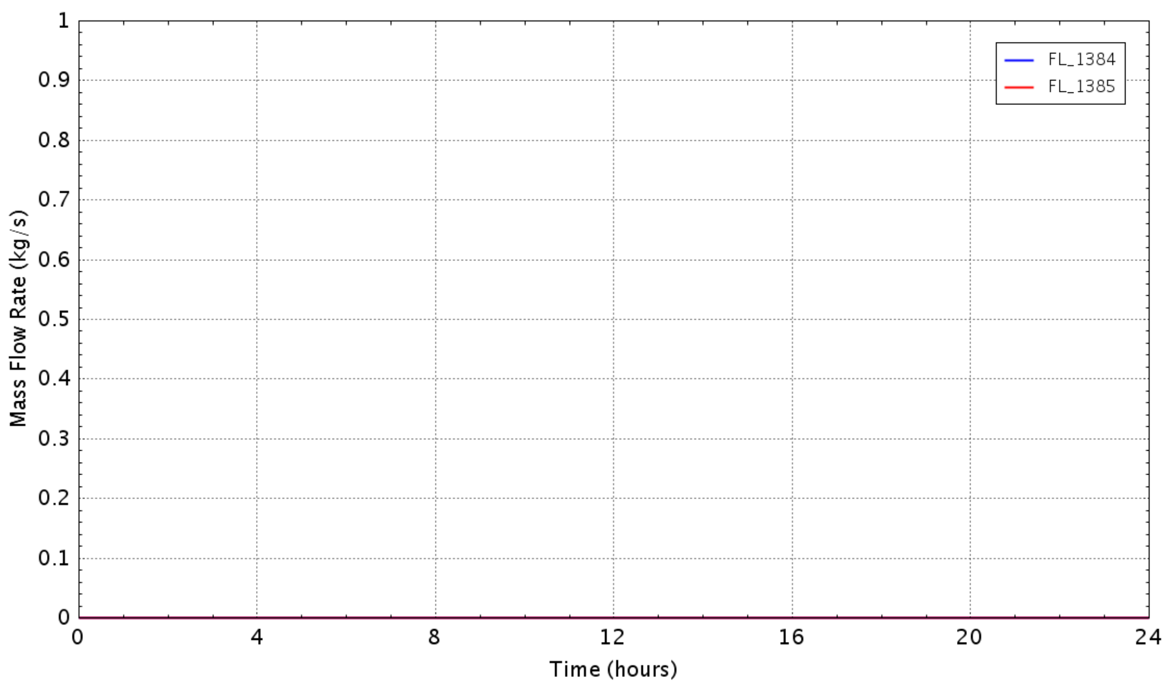

Figure D - 509 Flow rate of the recirculating pump seal leakage

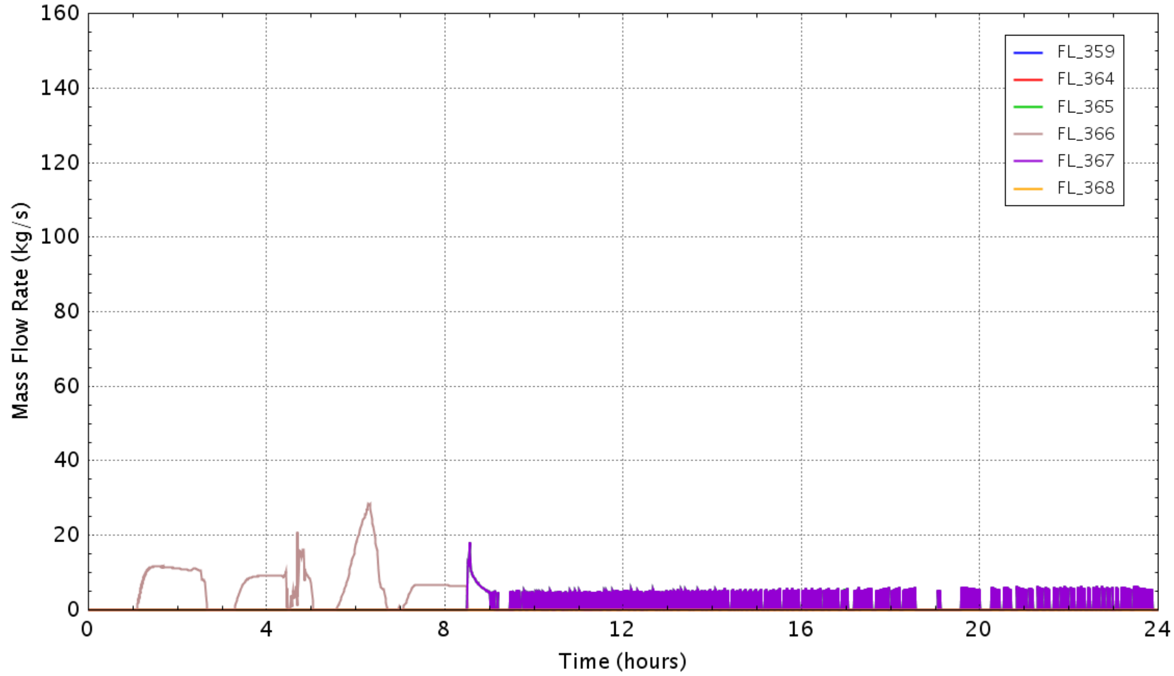

Figure D - 510 **Flow rate of the SRVs**

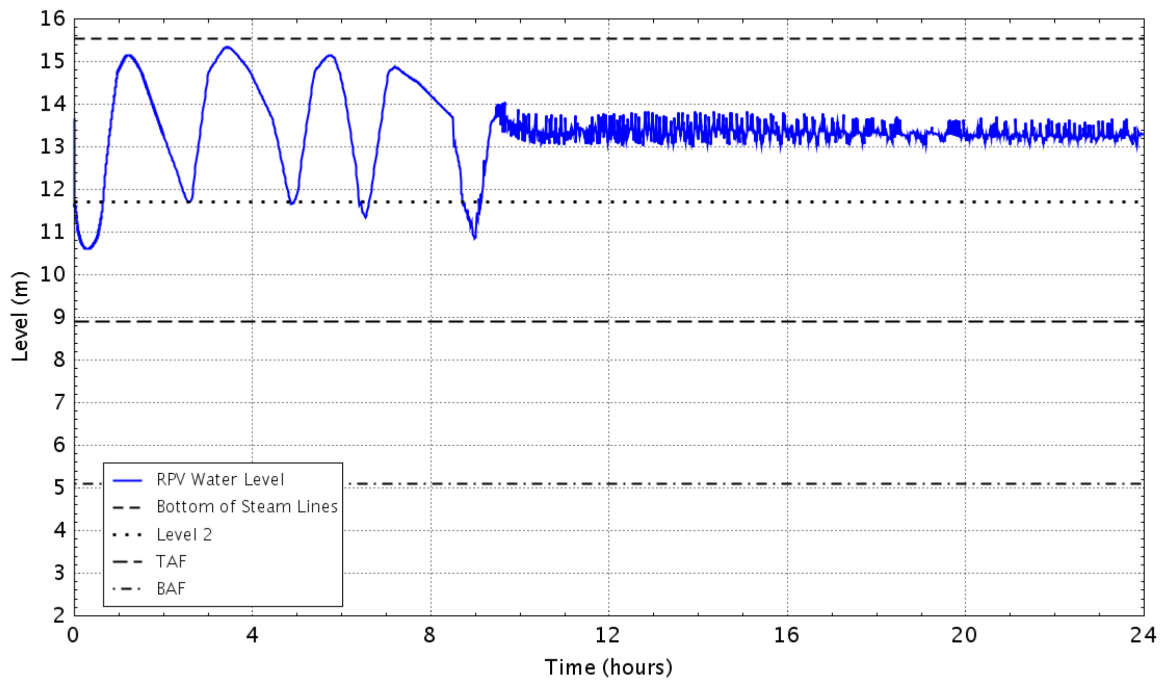

Figure D - 511 **RPV down comer water level**

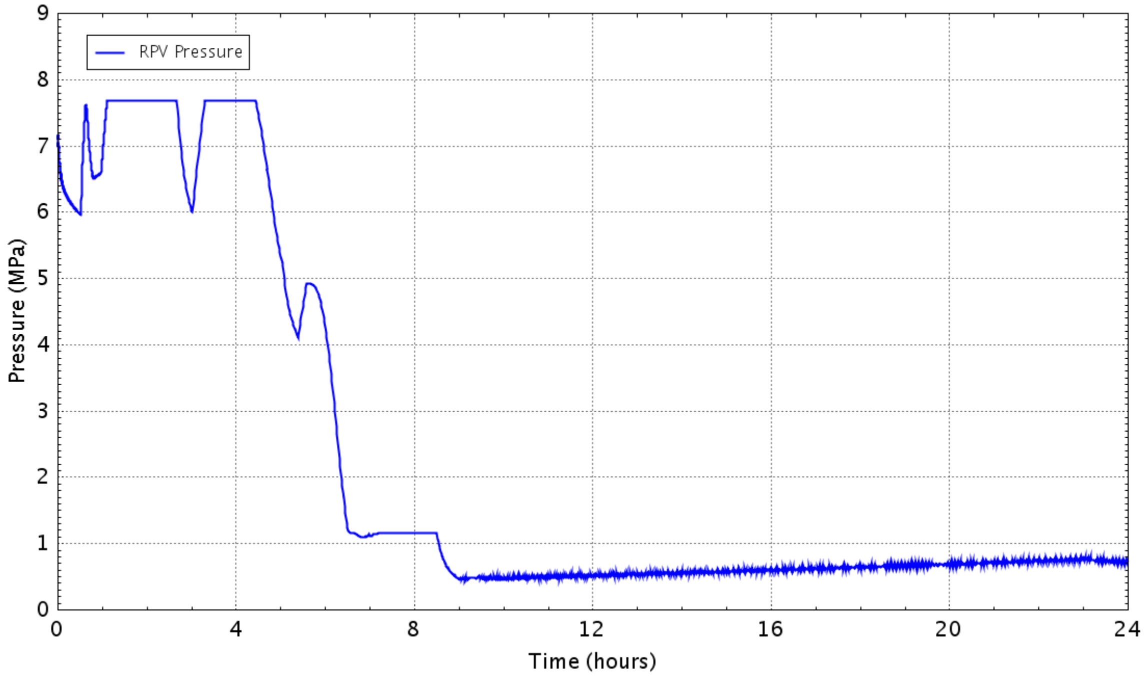

Figure D - 512 Pressure in theRPV

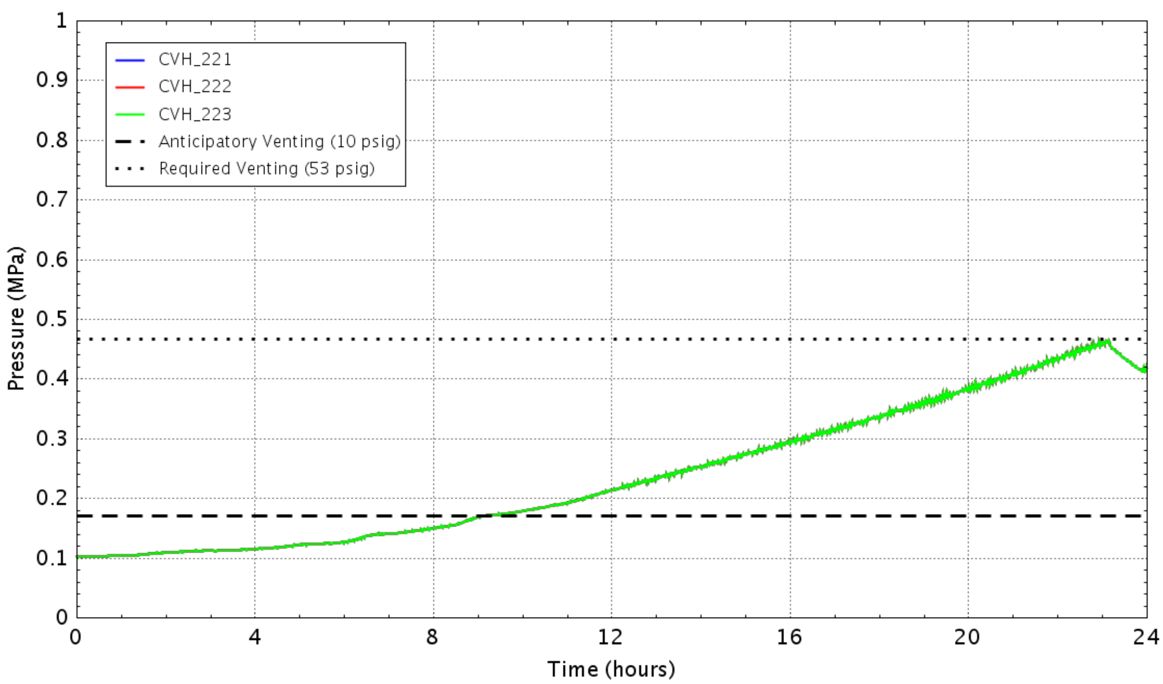

Figure D - 513 Pressure in the wetwell

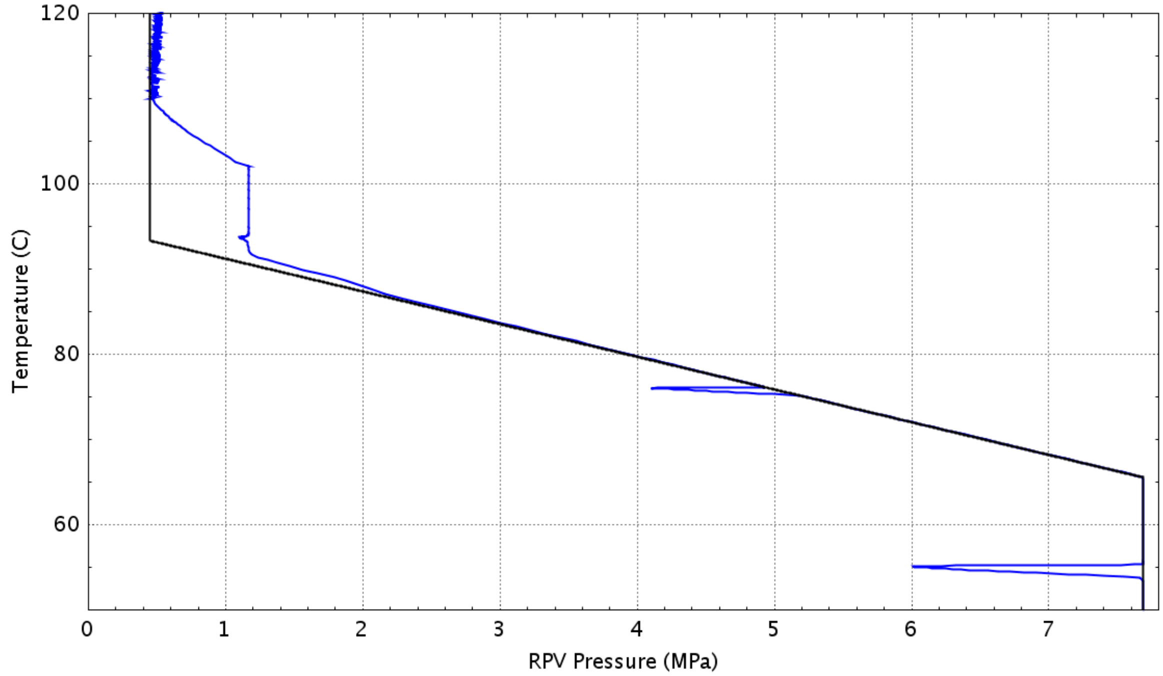

Figure D – 514 Plant status relative to the HCL curve (Graph 4 of the EOPs)

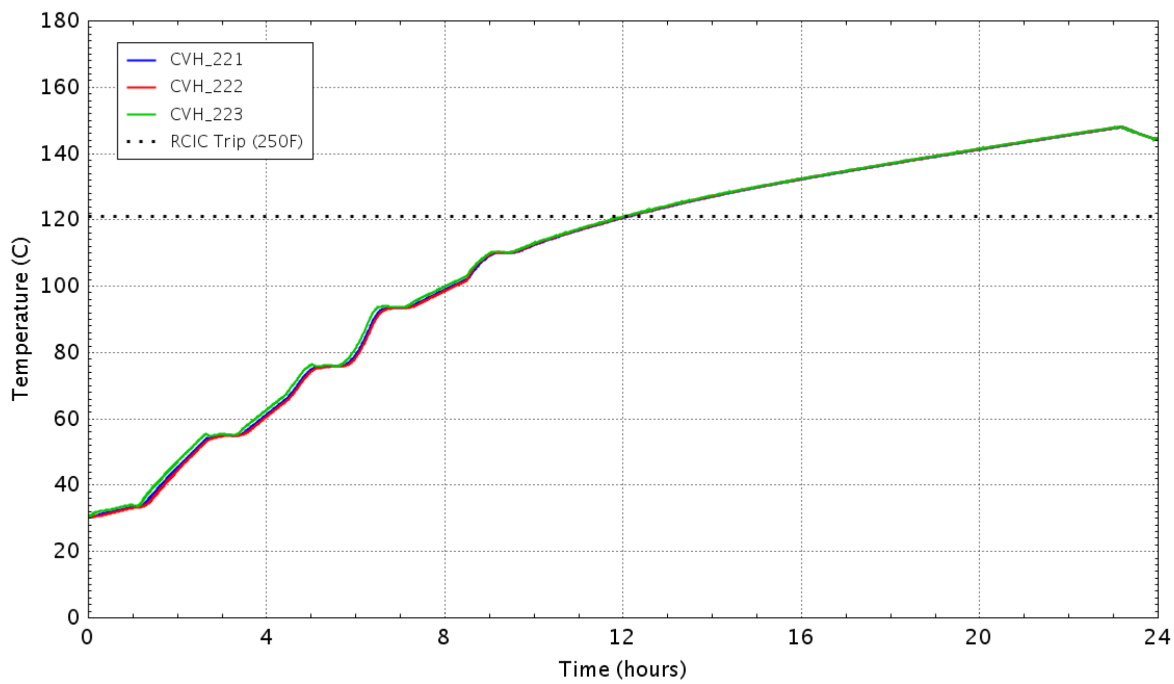

Figure D - 515 Water temperature in the wetwell

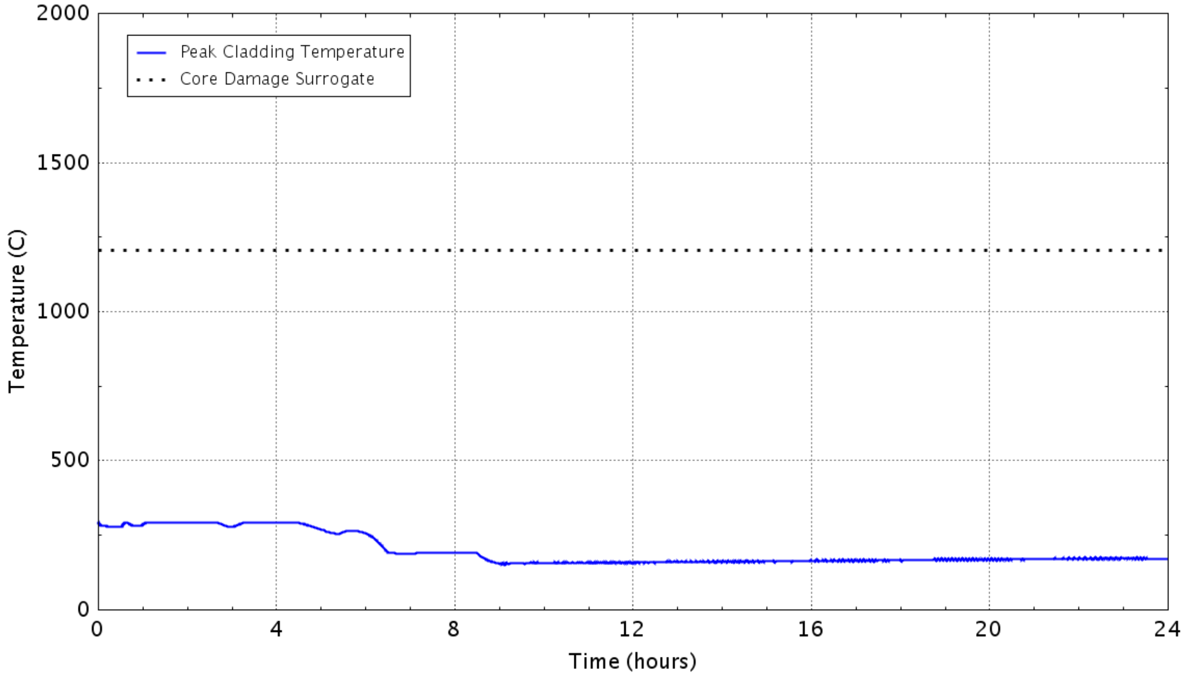

Figure D – 516 Peak temperature of the fuel cladding as a function oftime

D.3.19 Case 22f: Sensitivity to LOMFW-25 Case 22 with IncreasedRCIC Operating Level Band and Loss of RCIC on Steamline Flooding

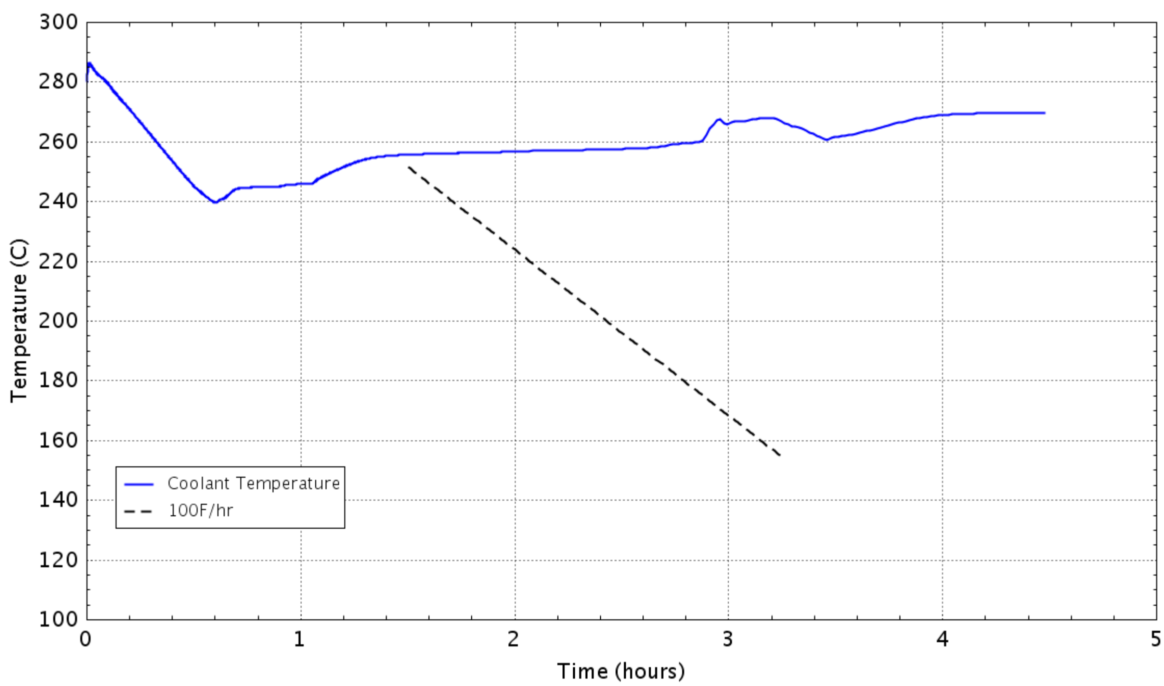

Figure D - 517 RPV cooldown rate

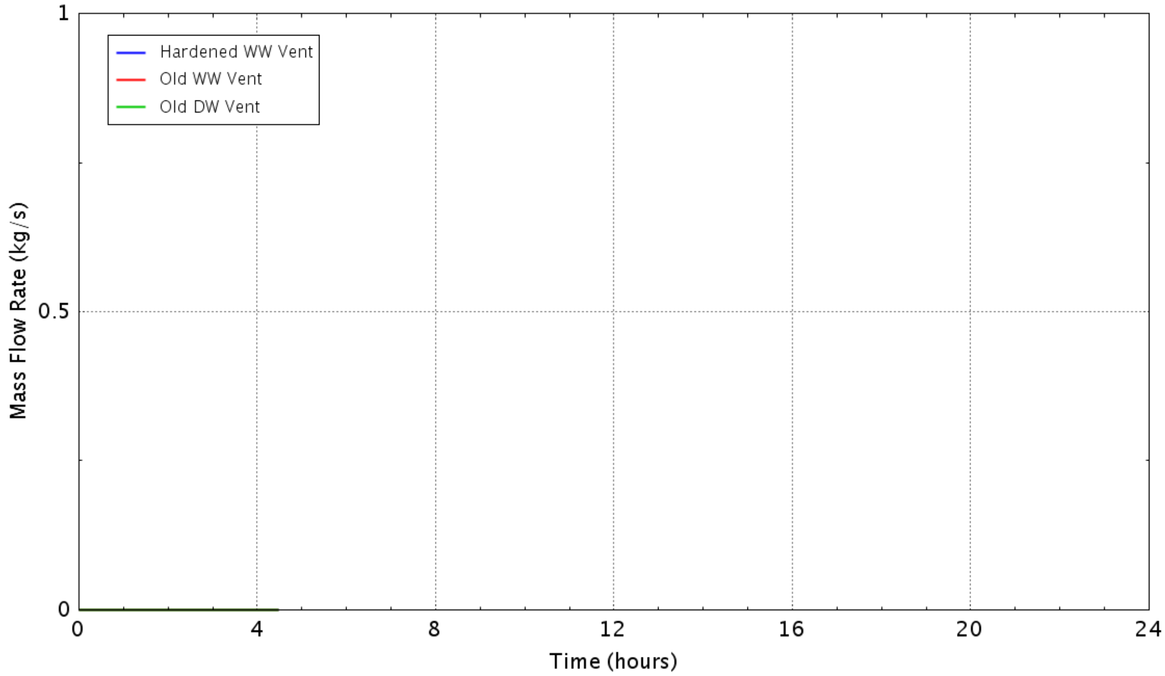

Figure D - 518 Flow rate of the containment vents

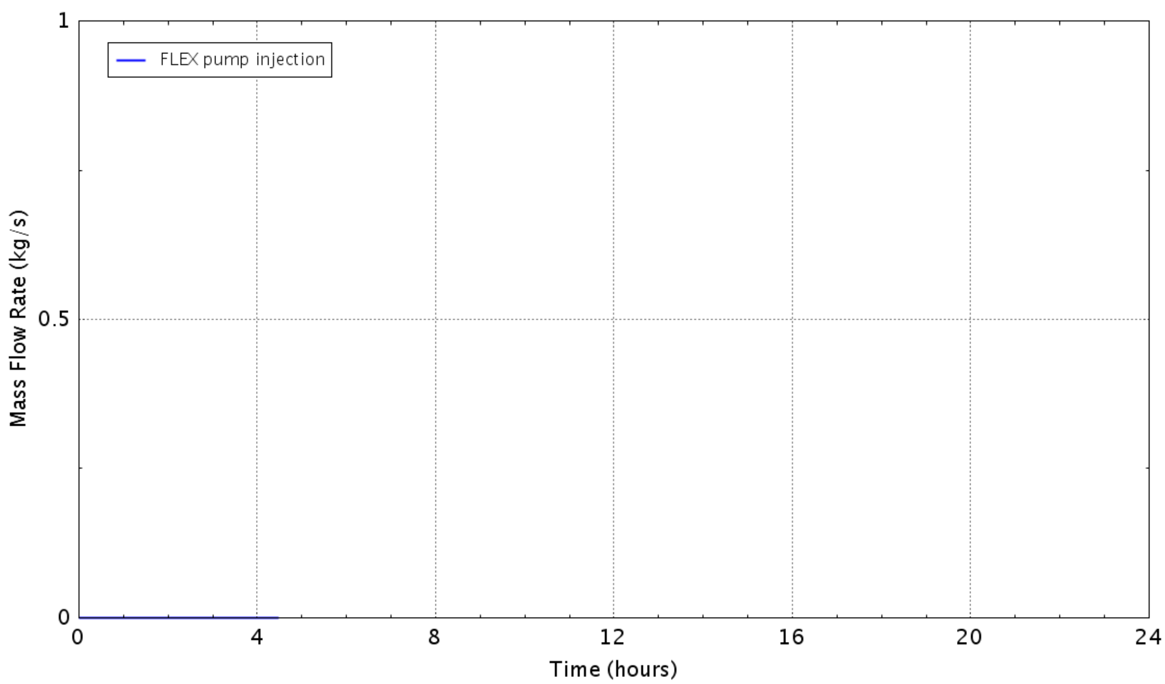

Figure D - 519 Flow rate of the FLEX pump

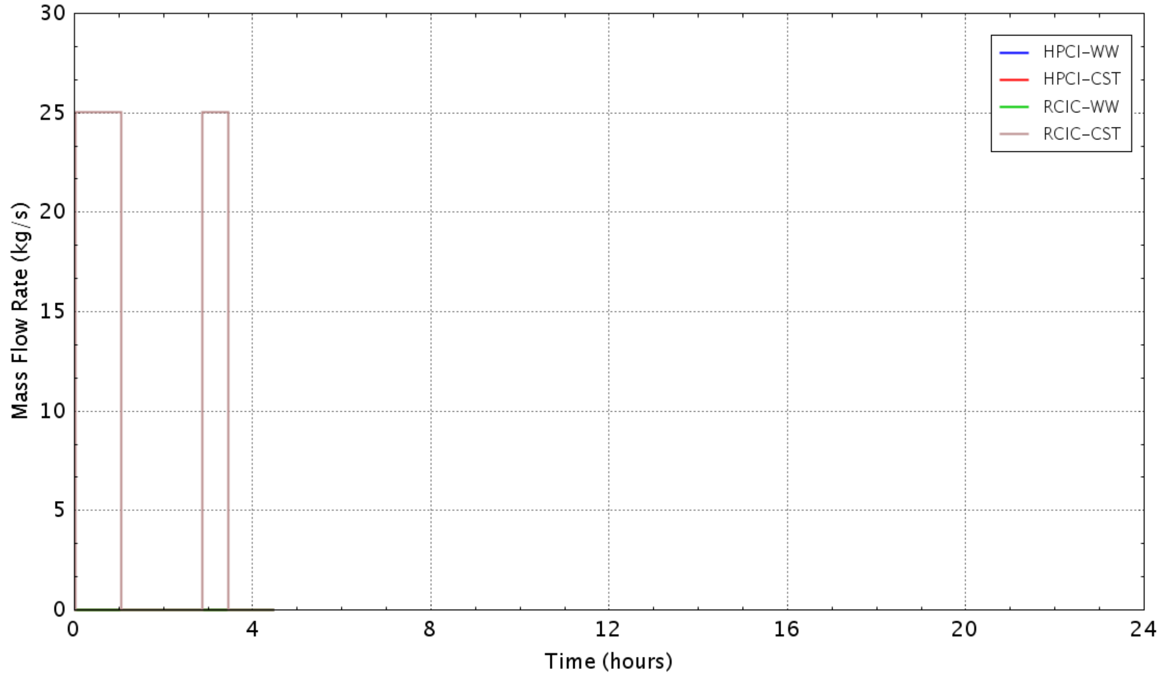

Figure D - 520 **Flow rate of the HPCI/RCIC pumps**

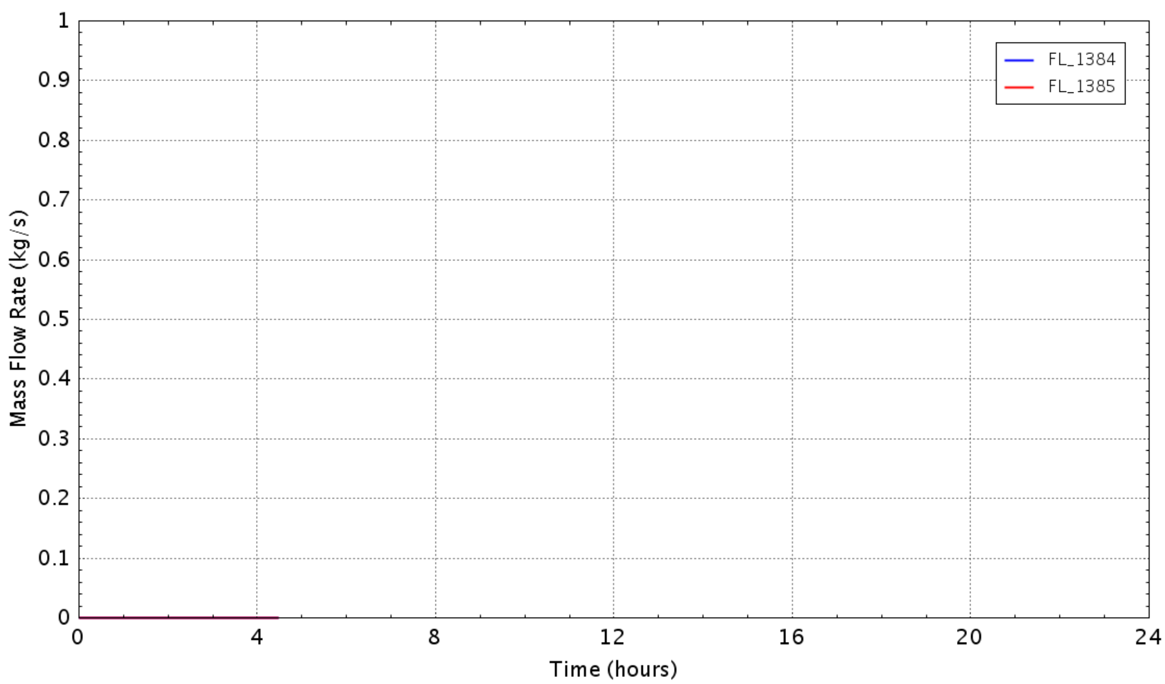

Figure D - 521 **Flow rate of the recirculating pump seal leakage**

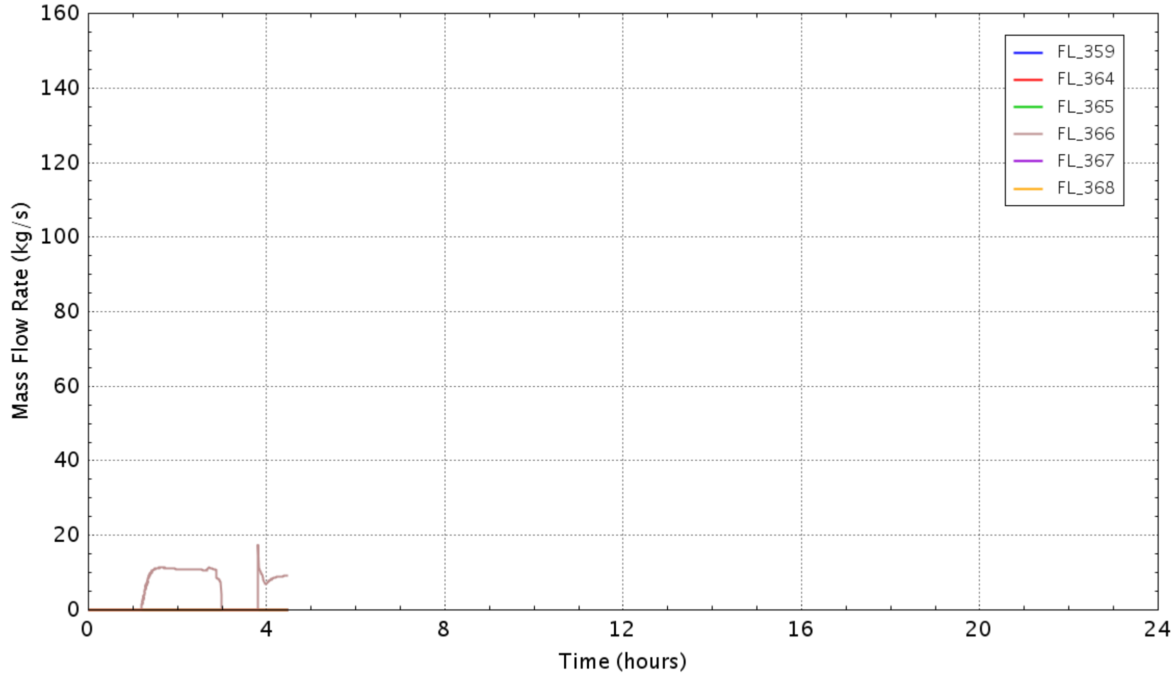

Figure D - 522 Flow rate of the SRVs

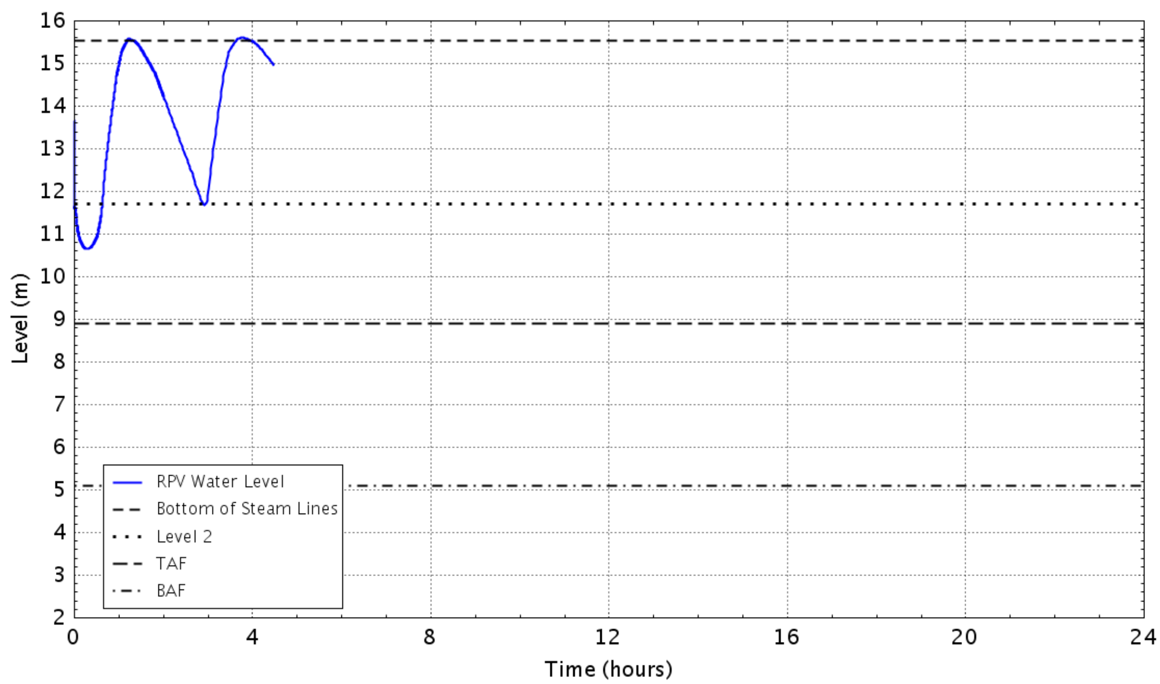

Figure D – 523 RPV down comer water level

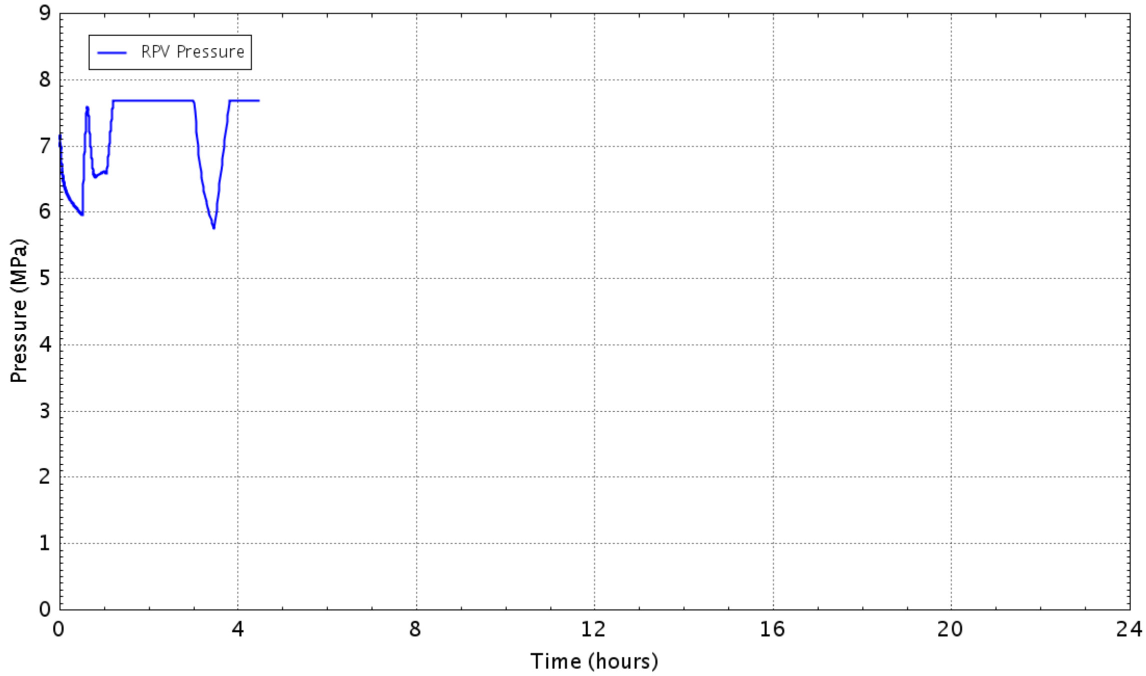

Figure D - 524 **Pressure in theRPV**

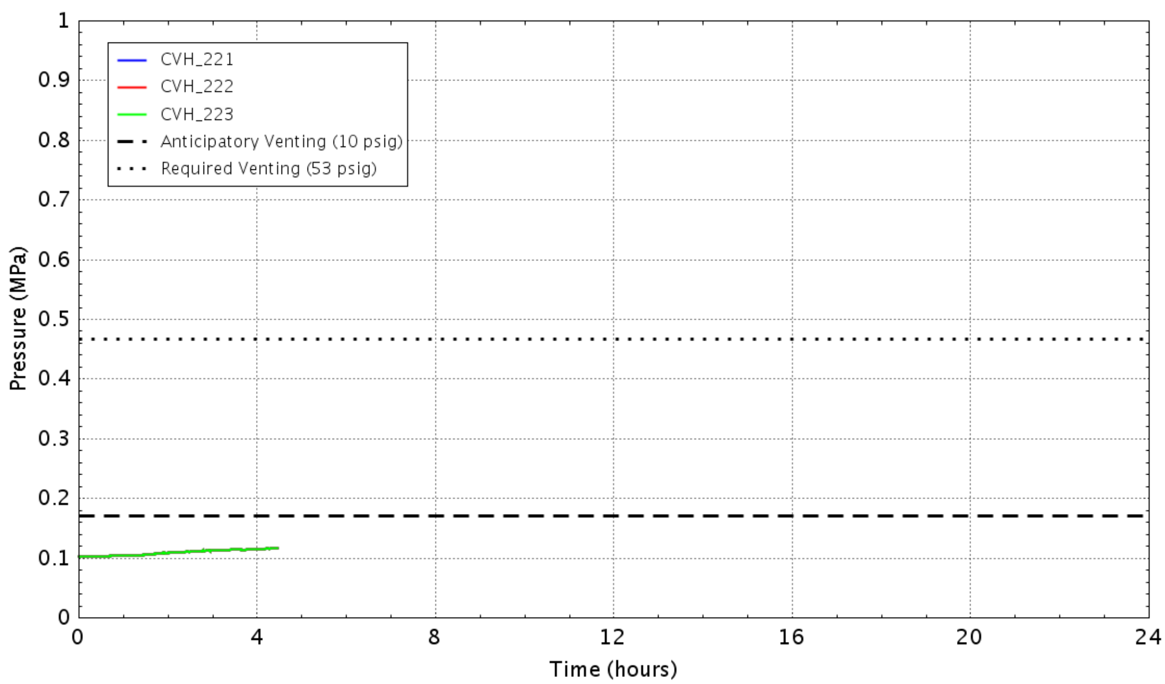

Figure D - 525 **Pressure in the wetwell**

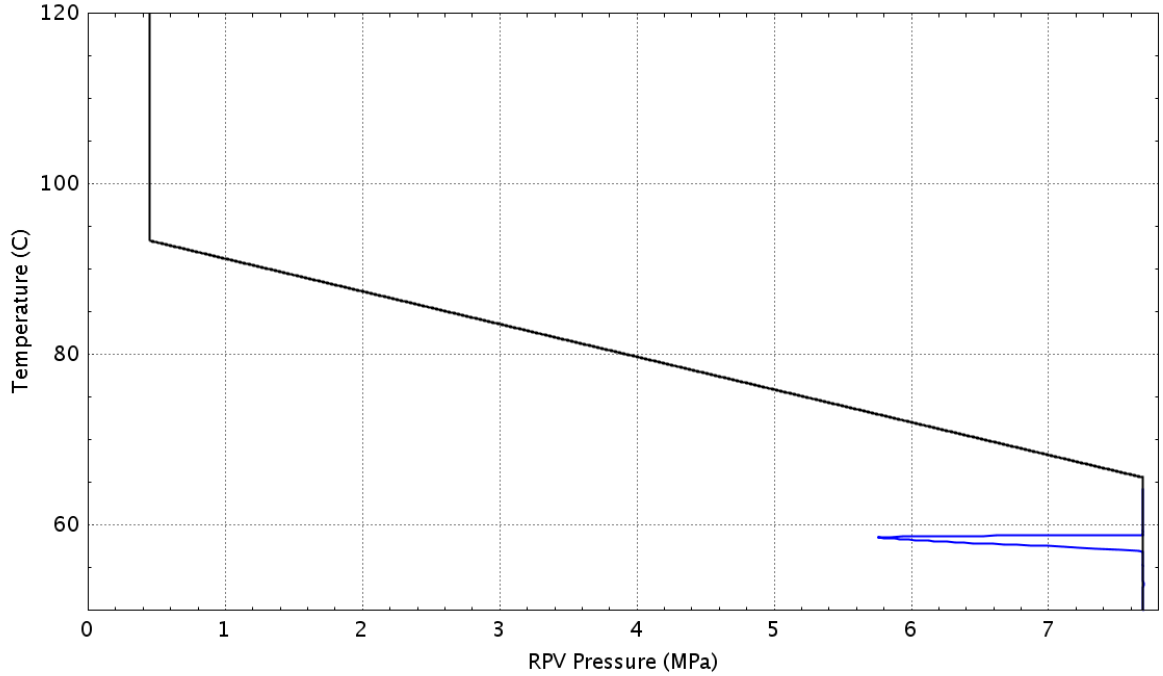

Figure D – 526 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

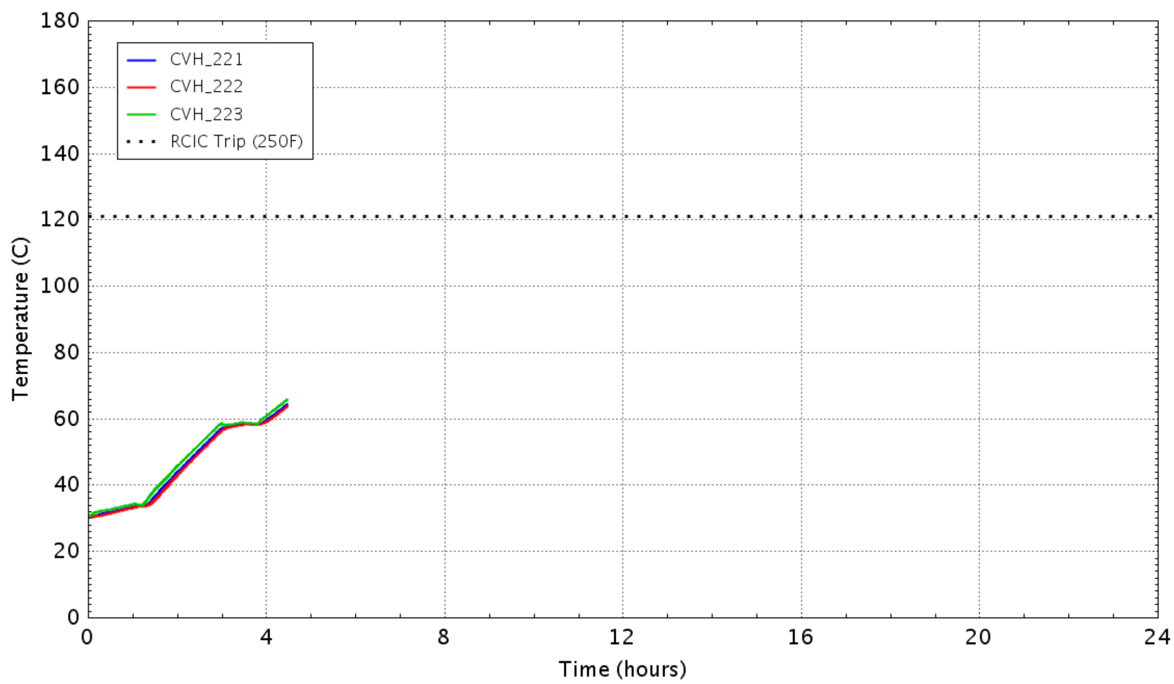

Figure D - 527 **Water temperature in the wetwell**

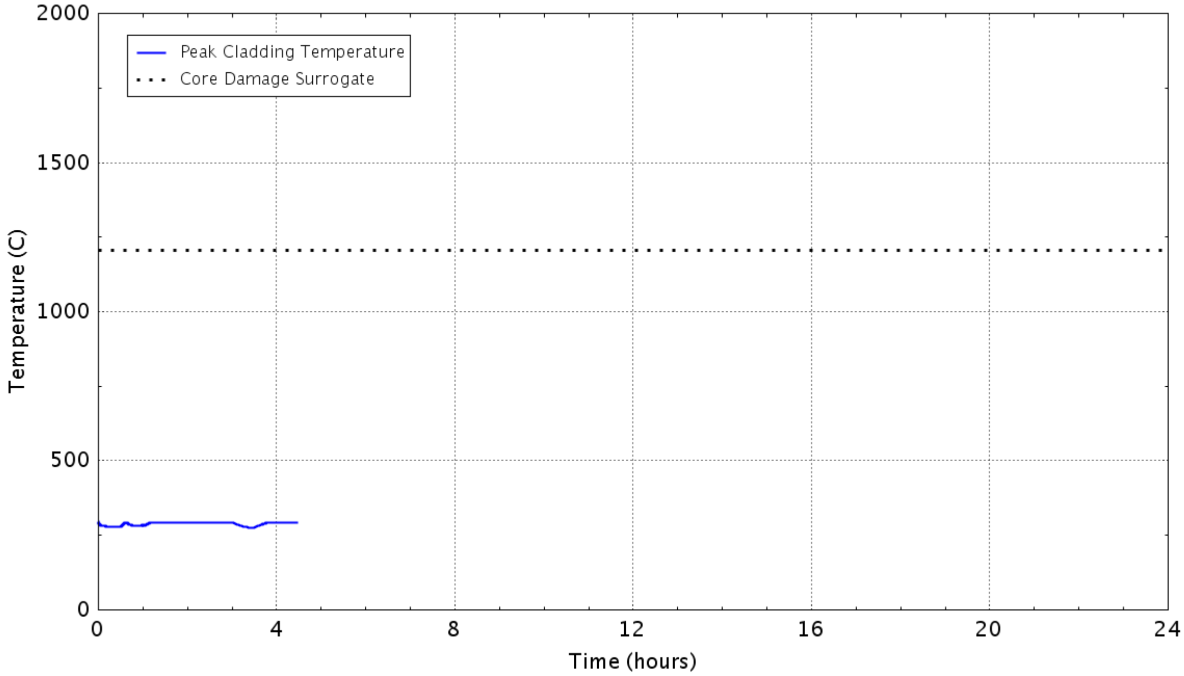

Figure D – 528 Peak temperature of the fuel cladding as a function oftime

D.3.20 Case 22g: Sensitivity to LOMFW-25 Case 22 with CST Unavailable

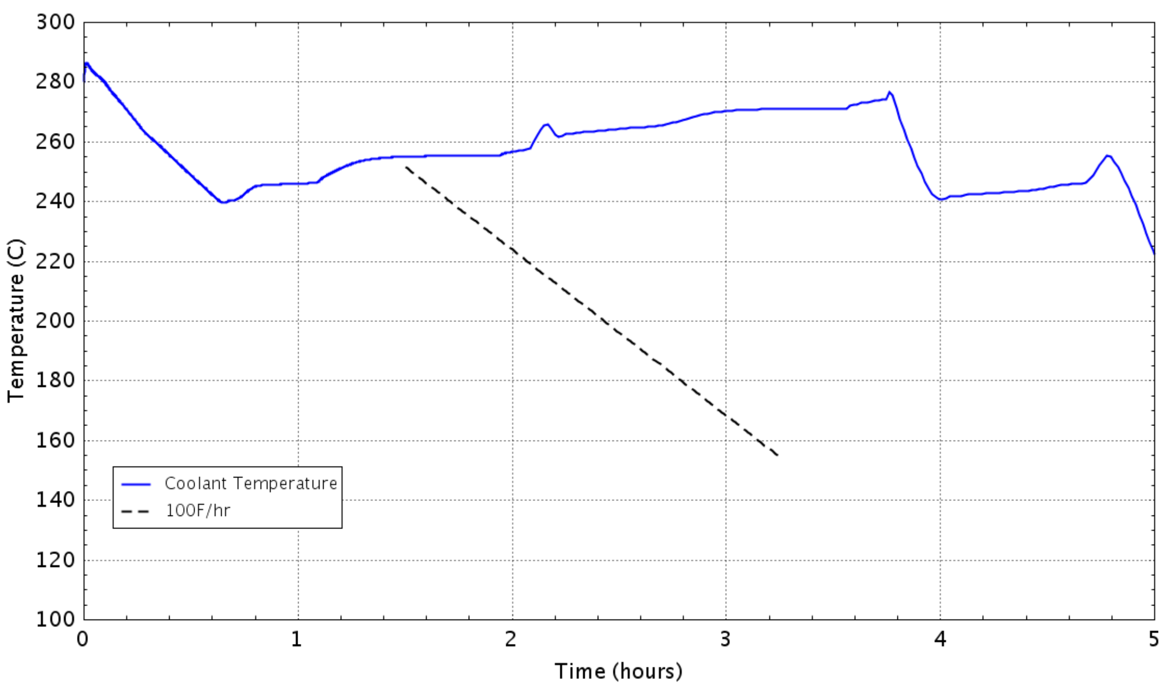

Figure D - 529 RPV cooldown rate

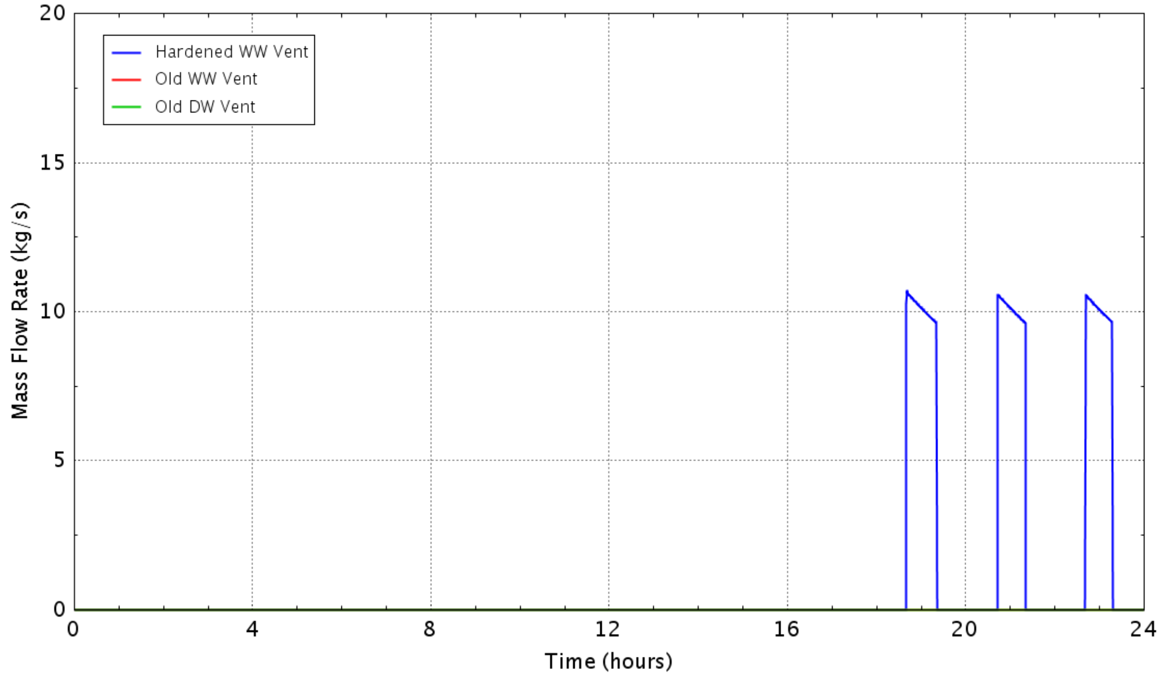

Figure D - 530 **Flow rate of the containment vents**

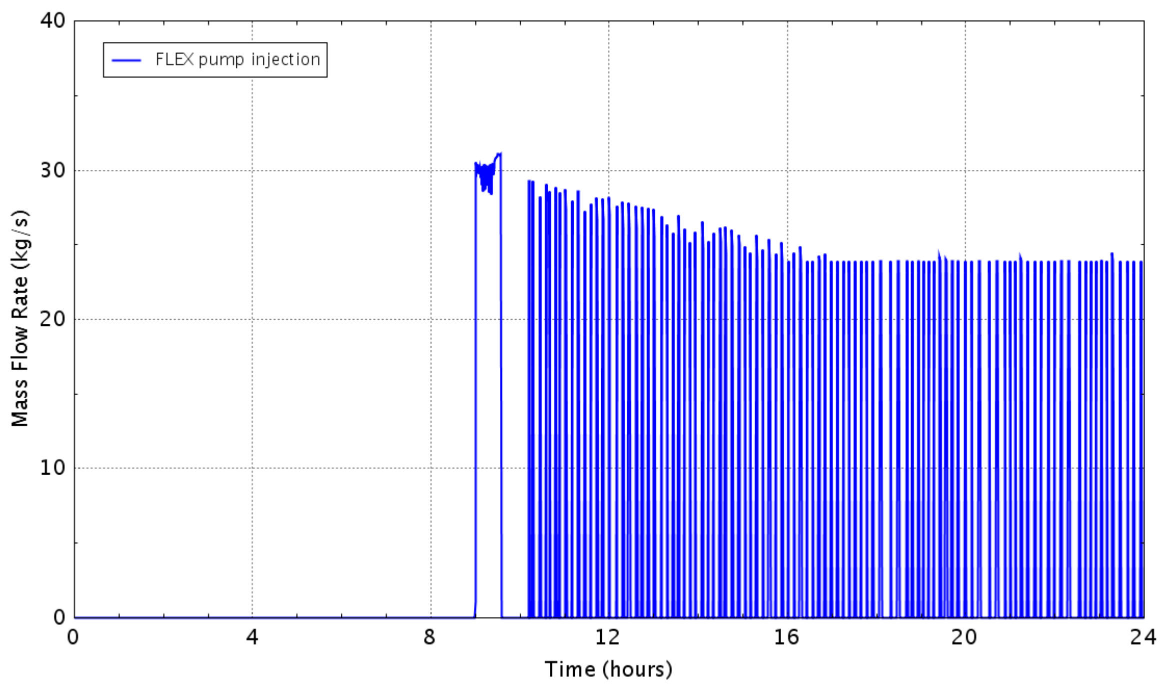

Figure D - 531 **Flow rate of the FLEX pump**

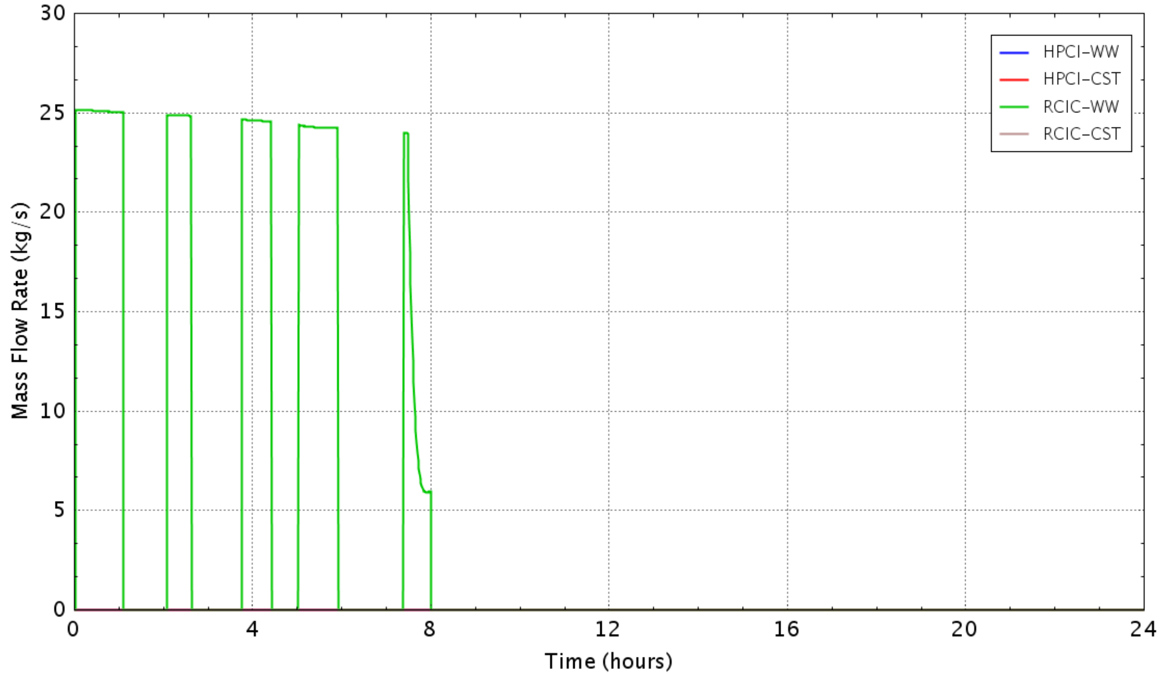

Figure D - 532 **Flow rate of the HPCI/RCIC pumps**

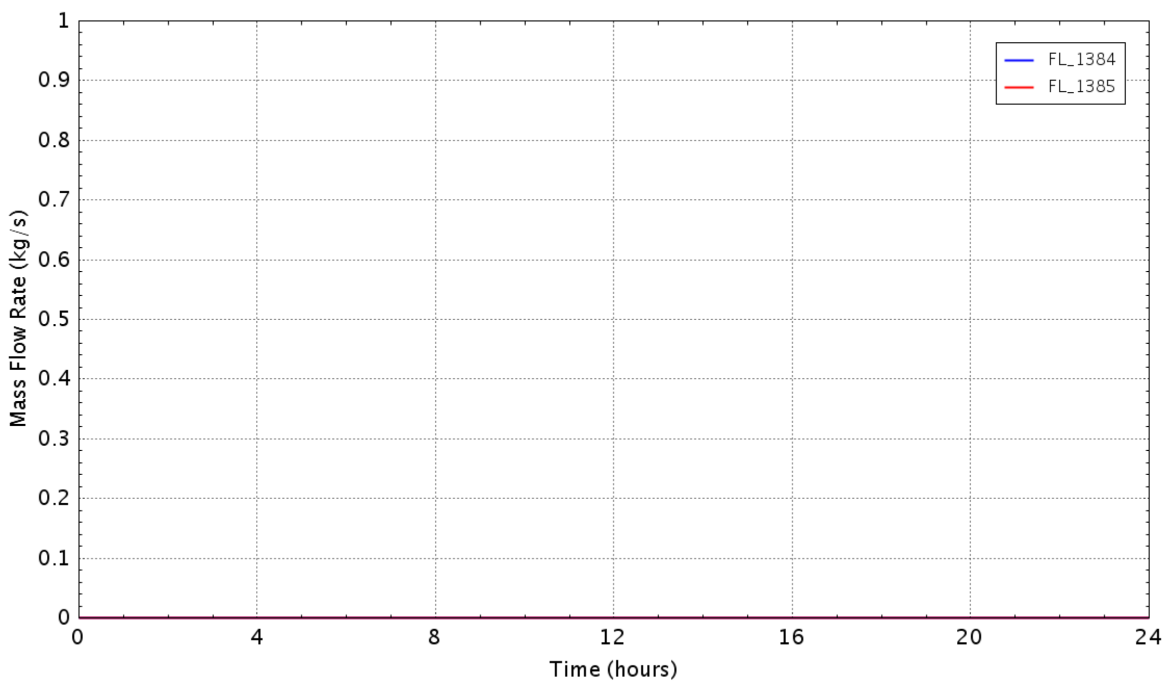

Figure D - 533 **Flow rate of the recirculating pump seal leakage**

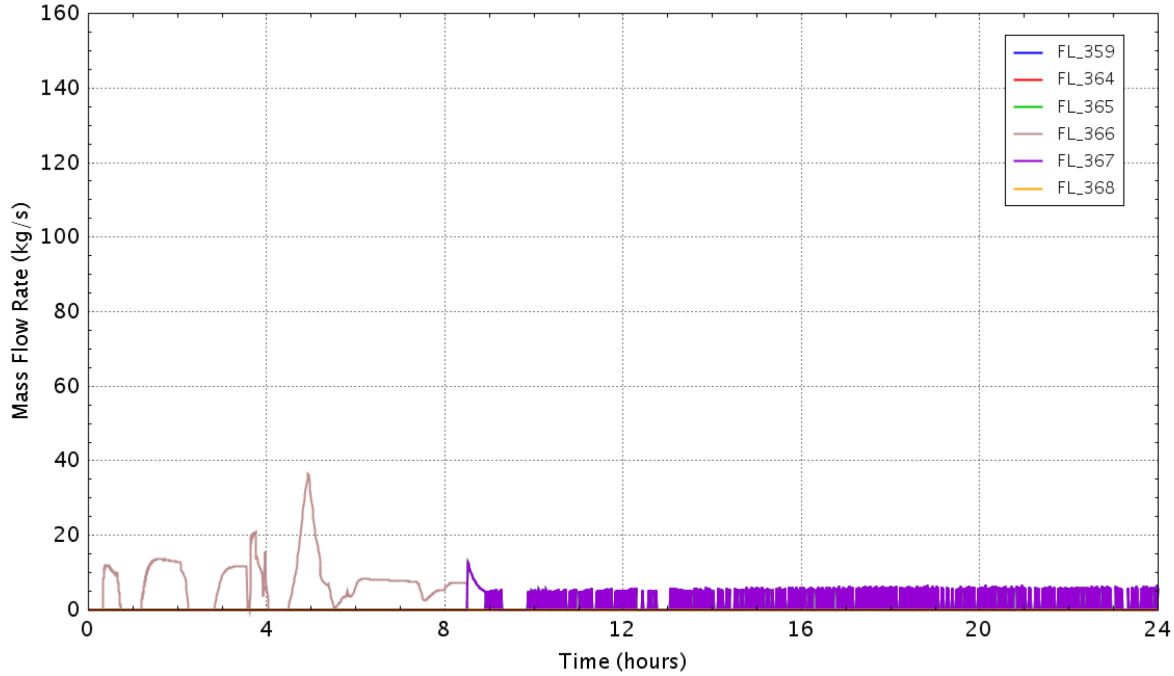

Figure D - 534 Flow rate of the SRVs

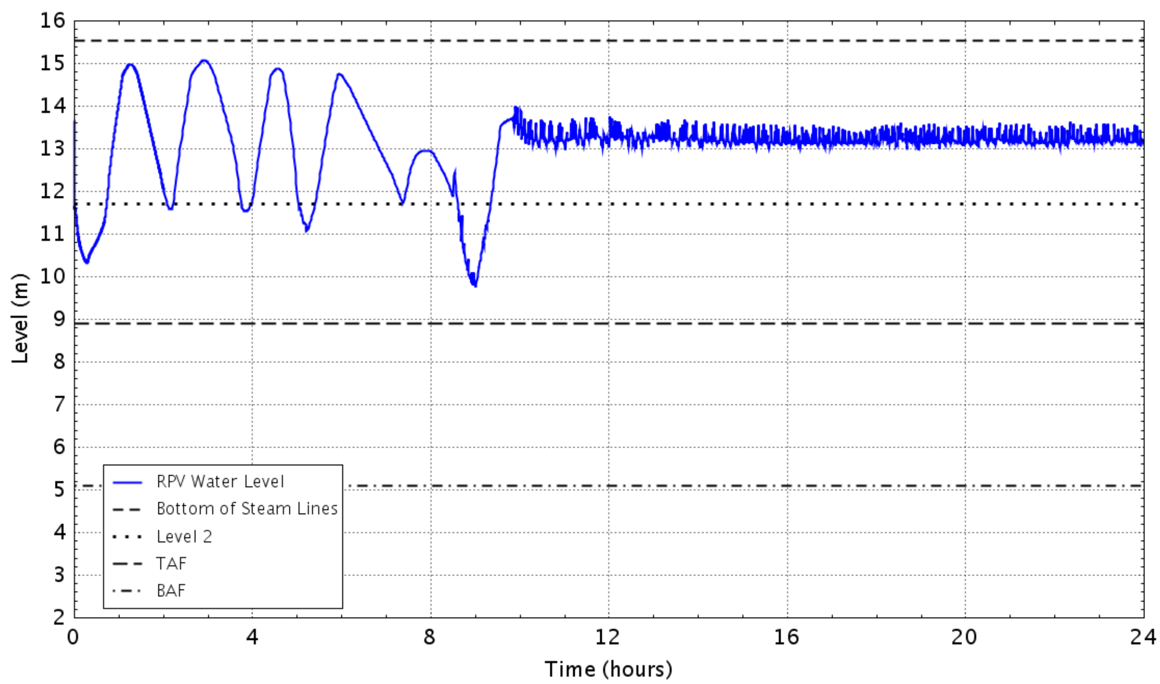

Figure D - 535 RPV down comer water level

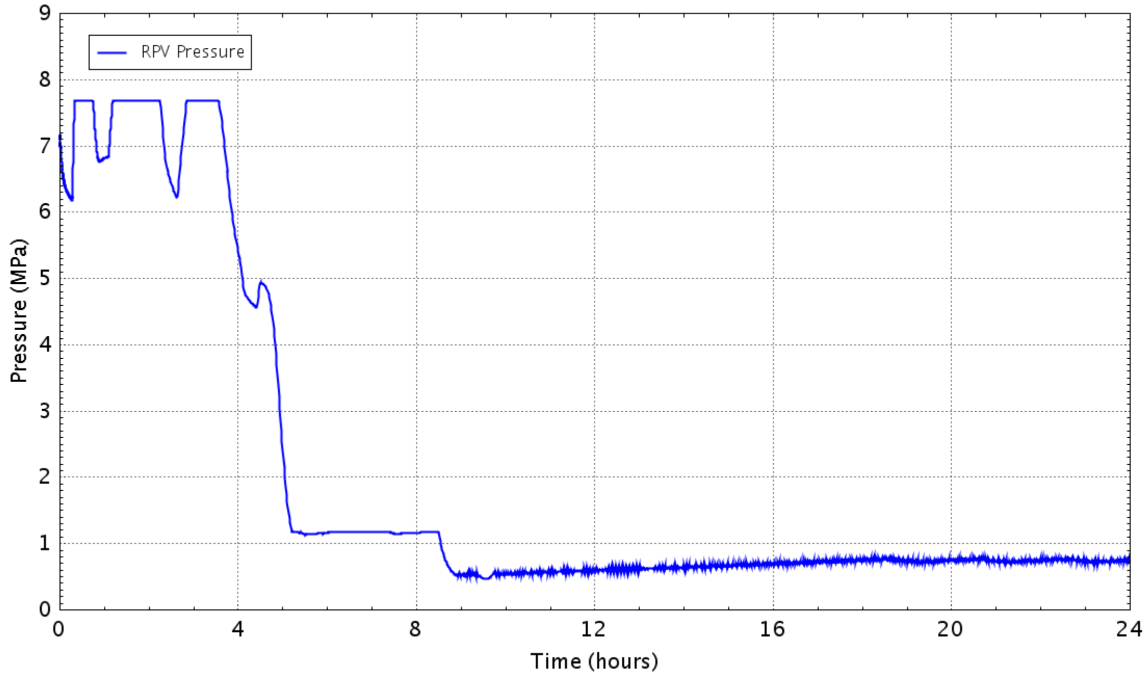

Figure D - 536 Pressure in theRPV

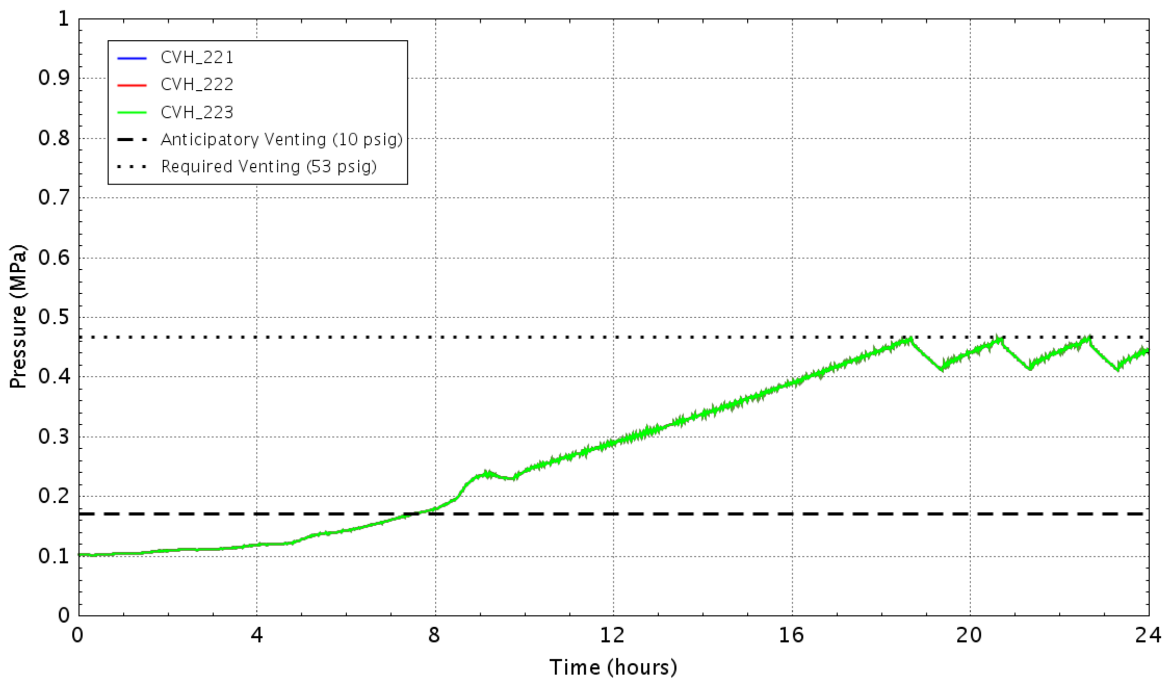

Figure D - 537 Pressure in the wetwell

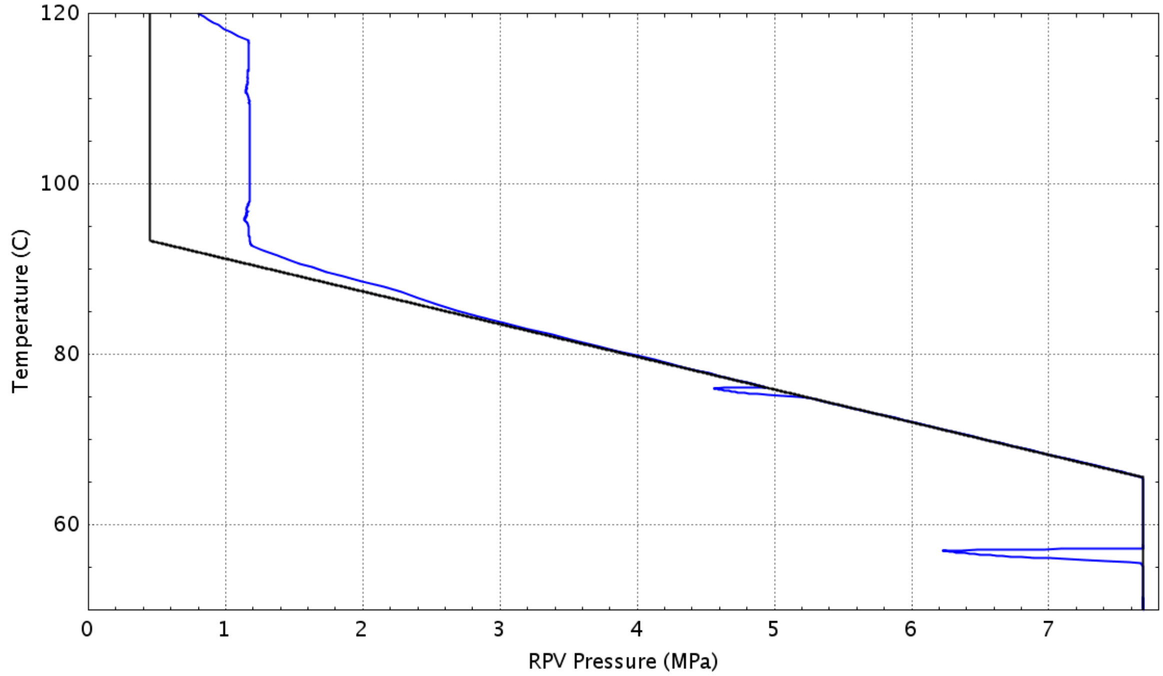

Figure D – 538 Plant status relative to the HCL curve (Graph 4 of the EOPs)

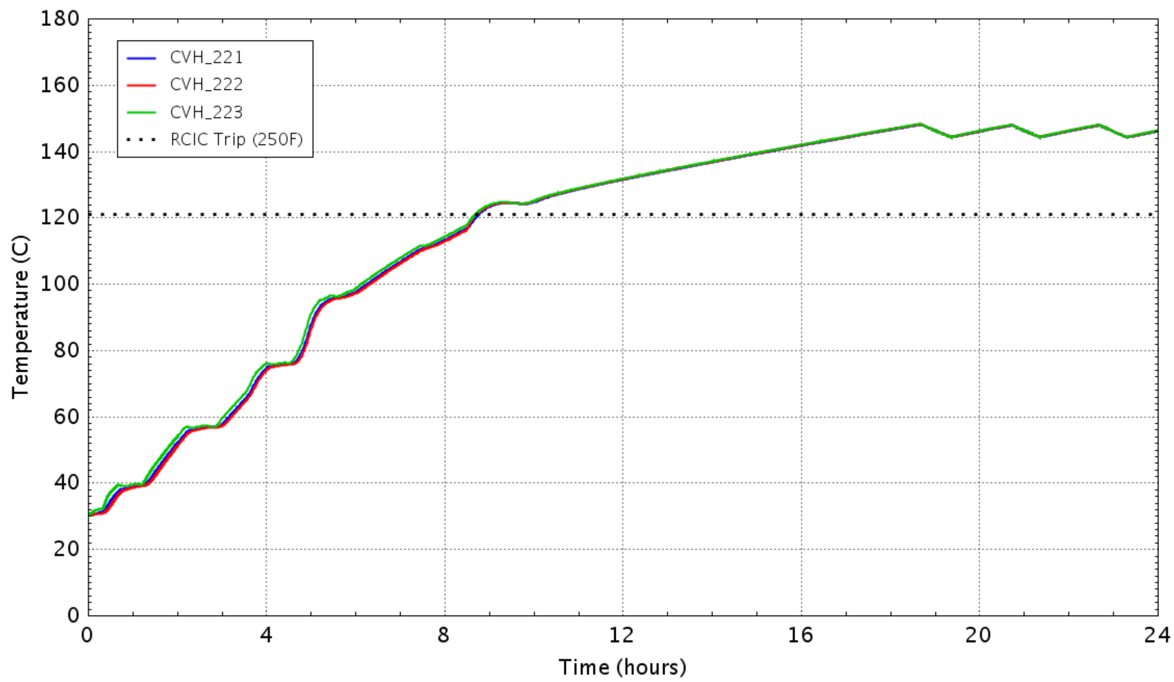

Figure D - 539 Water temperature in the wetwell

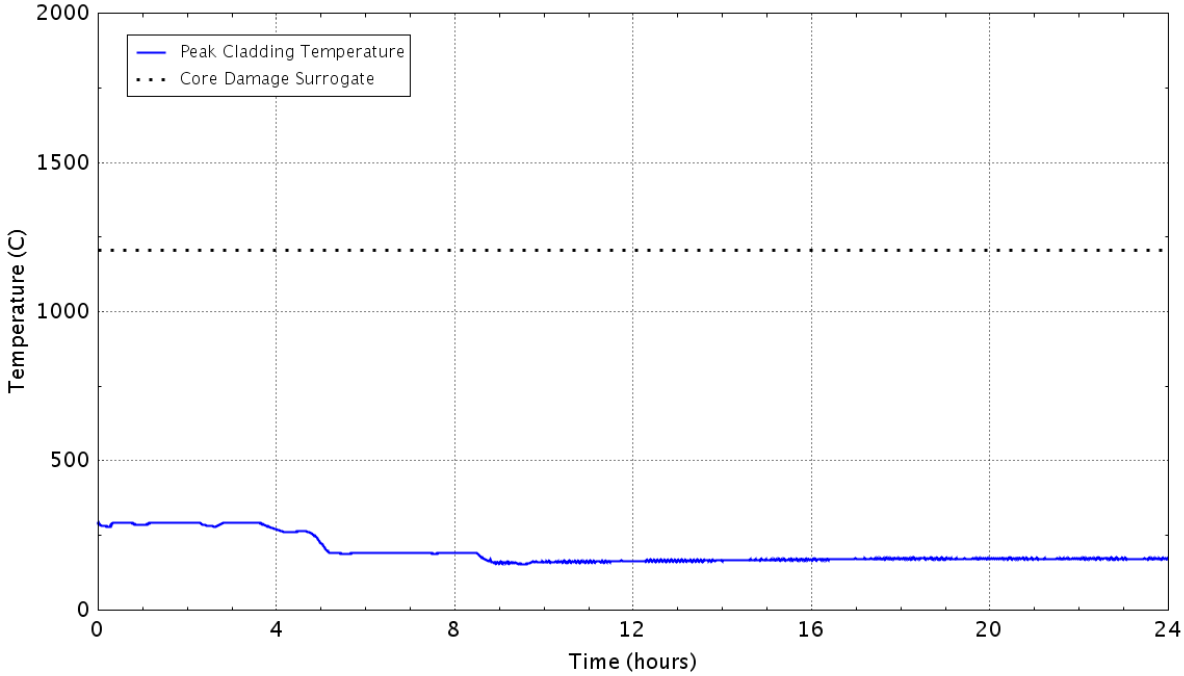

Figure D – 540 Peak temperature of the fuel cladding as a function oftime

D.3.21 Case 22h: Sensitivity to LOMFW-25 Case 22 with MSIVClosure at the Start of the Transient

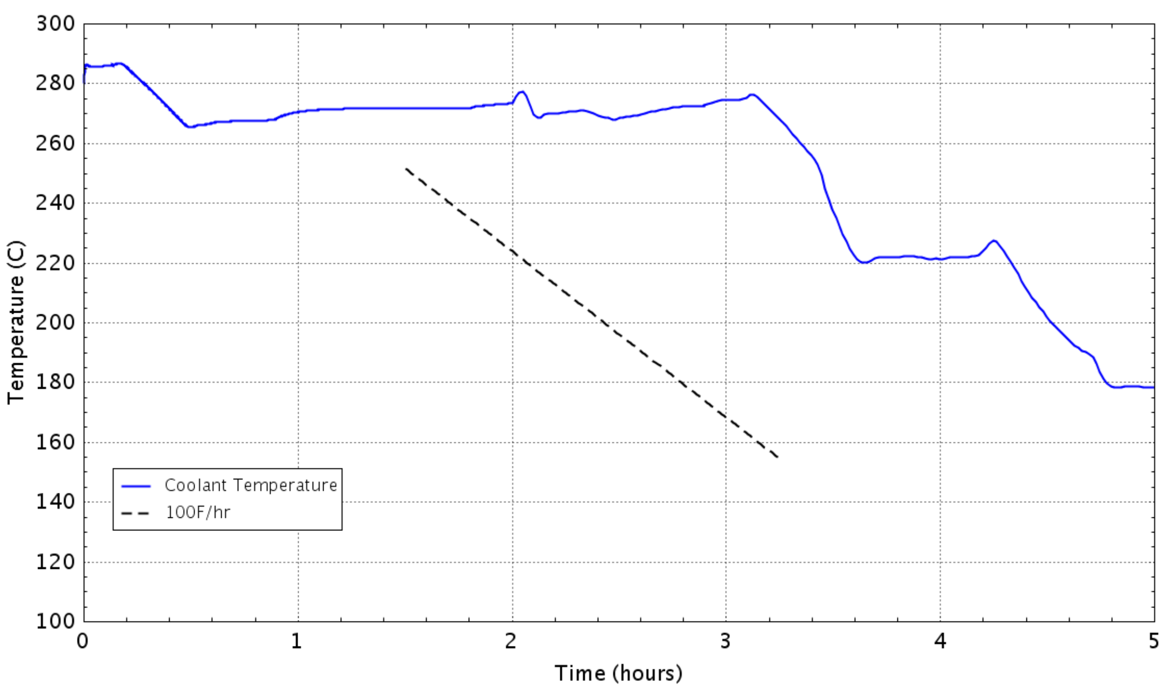

Figure D - 541 RPV cooldown rate

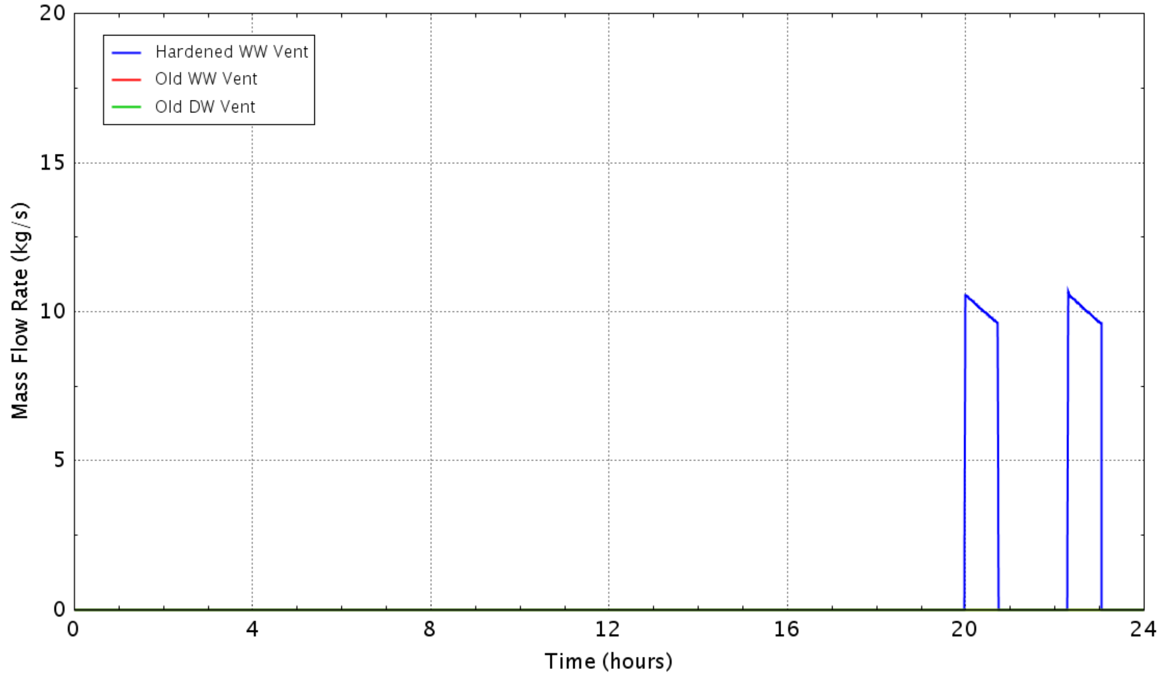

Figure D - 542 **Flow rate of the containment vents**

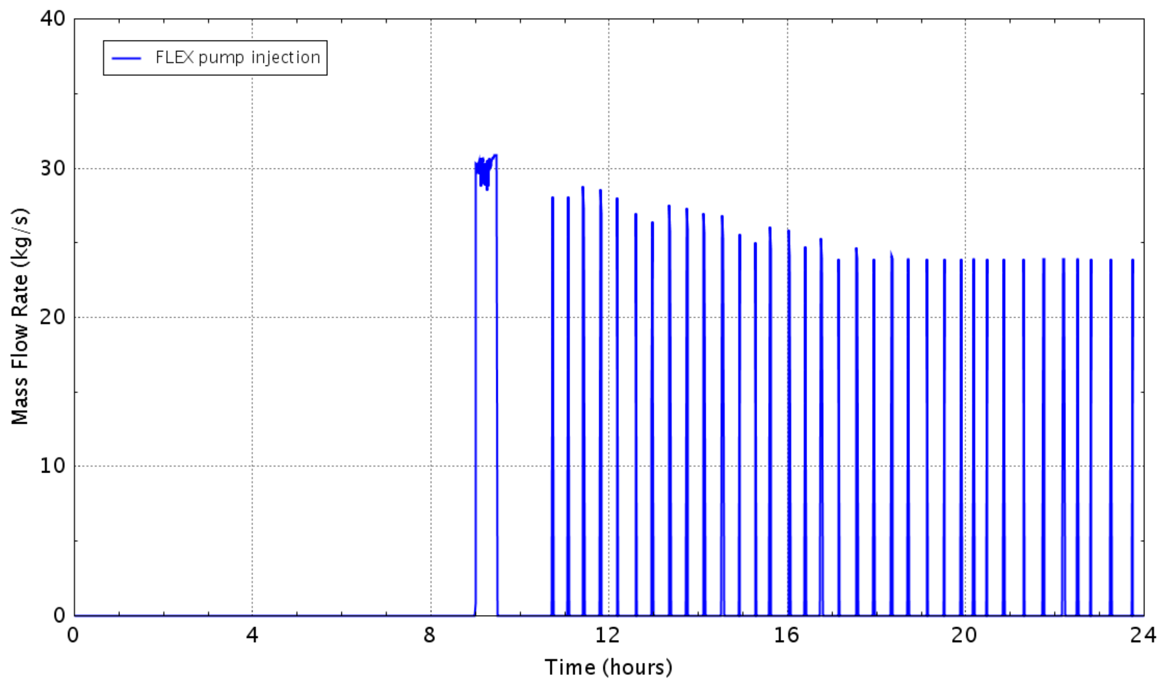

Figure D - 543 **Flow rate of the FLEX pump**

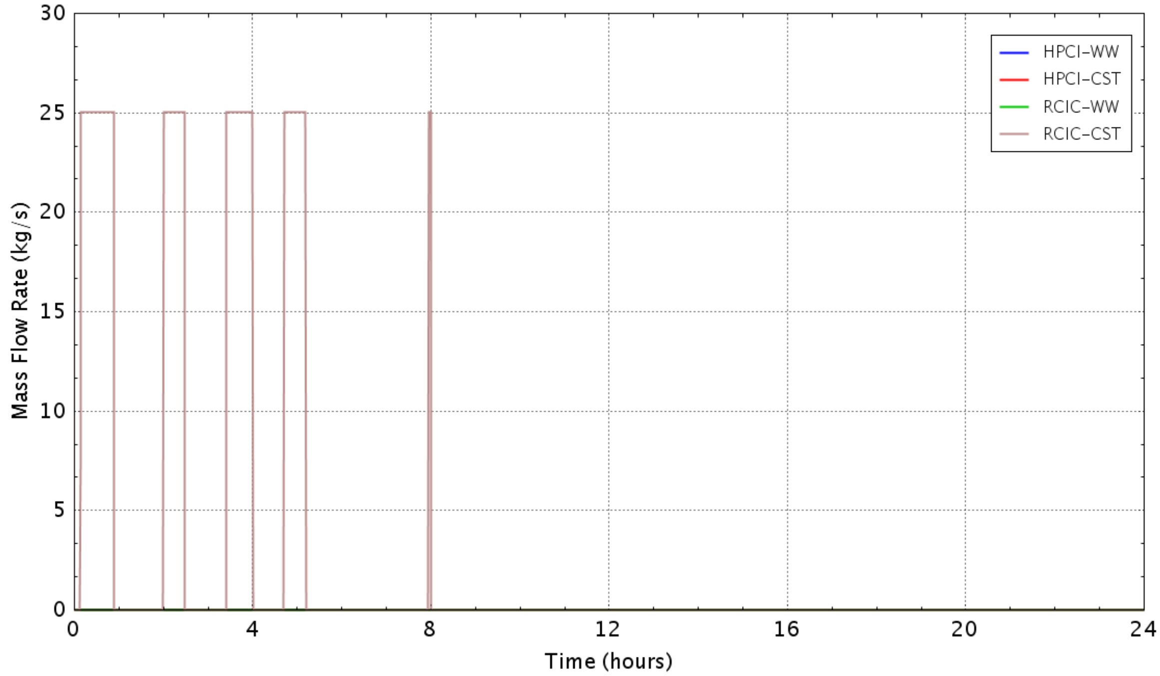

Figure D - 544 **Flow rate of the HPCI/RCIC pumps**

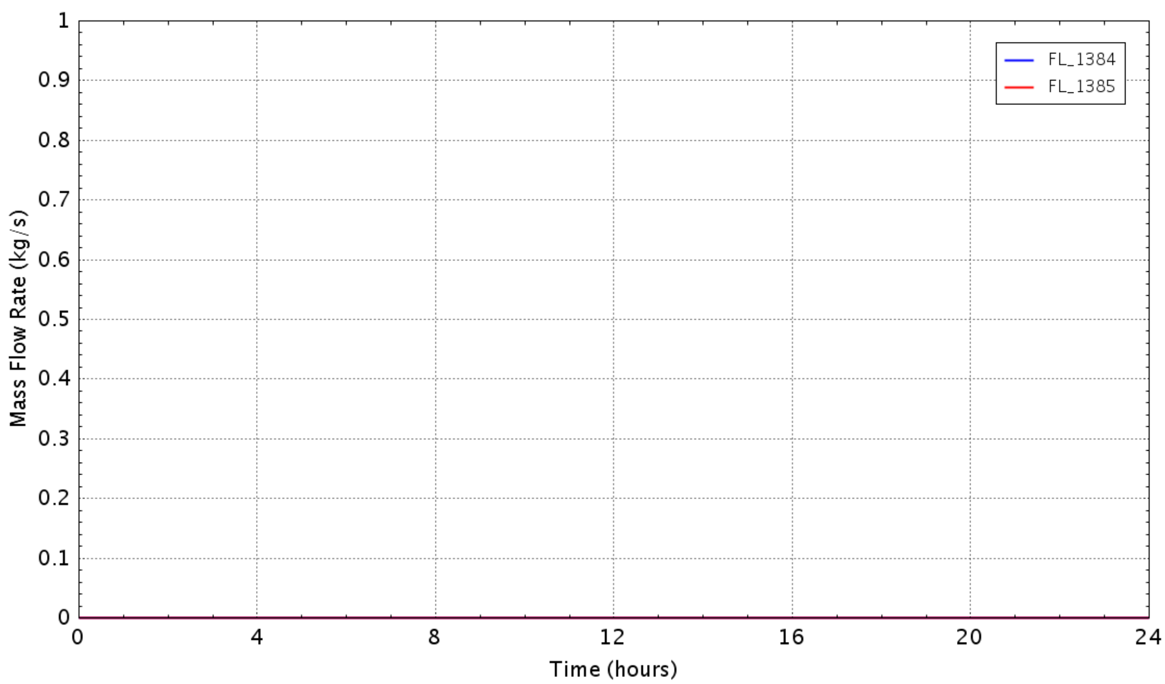

Figure D - 545 **Flow rate of the recirculating pump seal leakage**

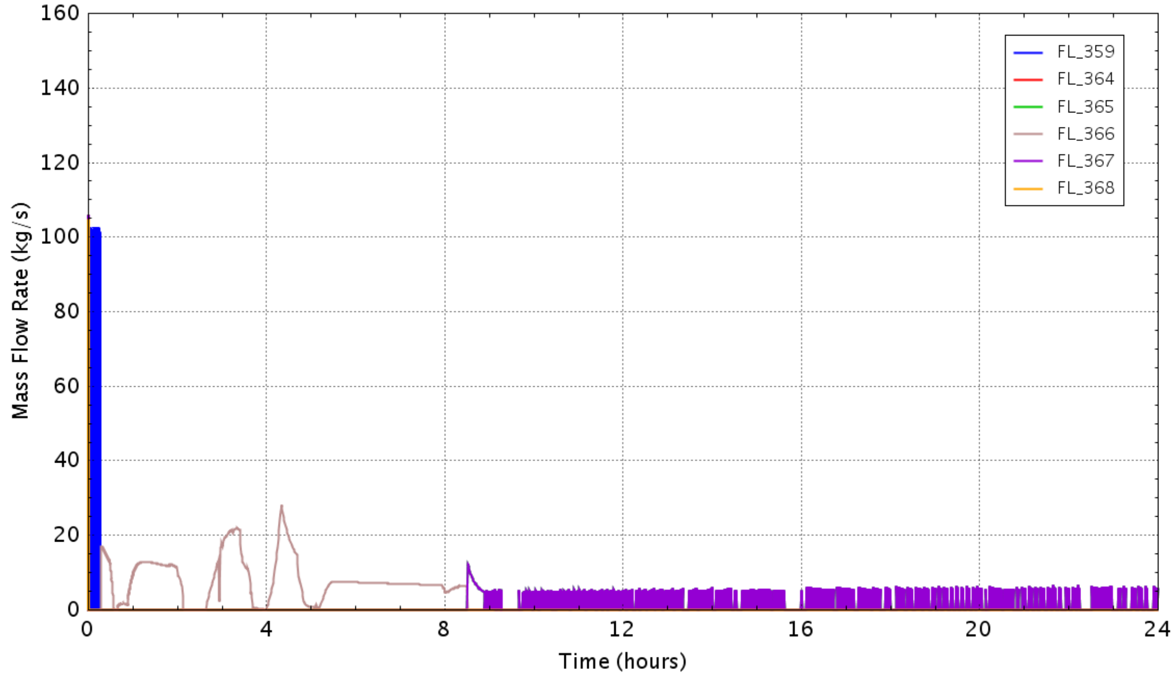

Figure D - 546 Flow rate of the SRVs

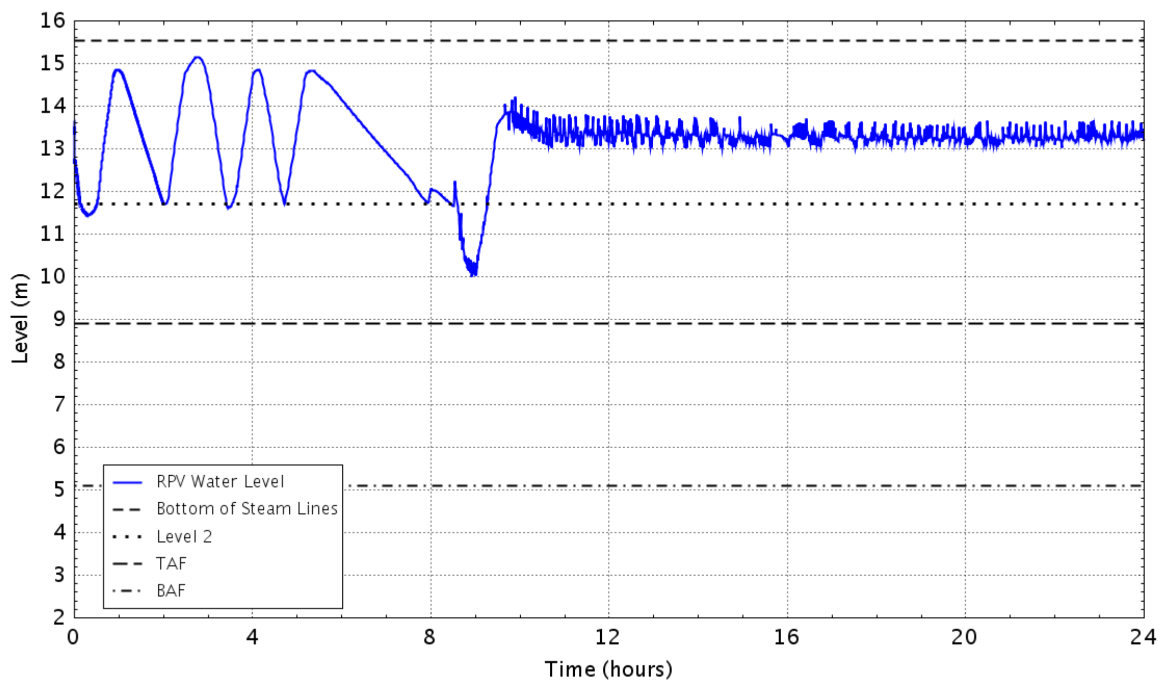

Figure D - 547 RPV down comer water level

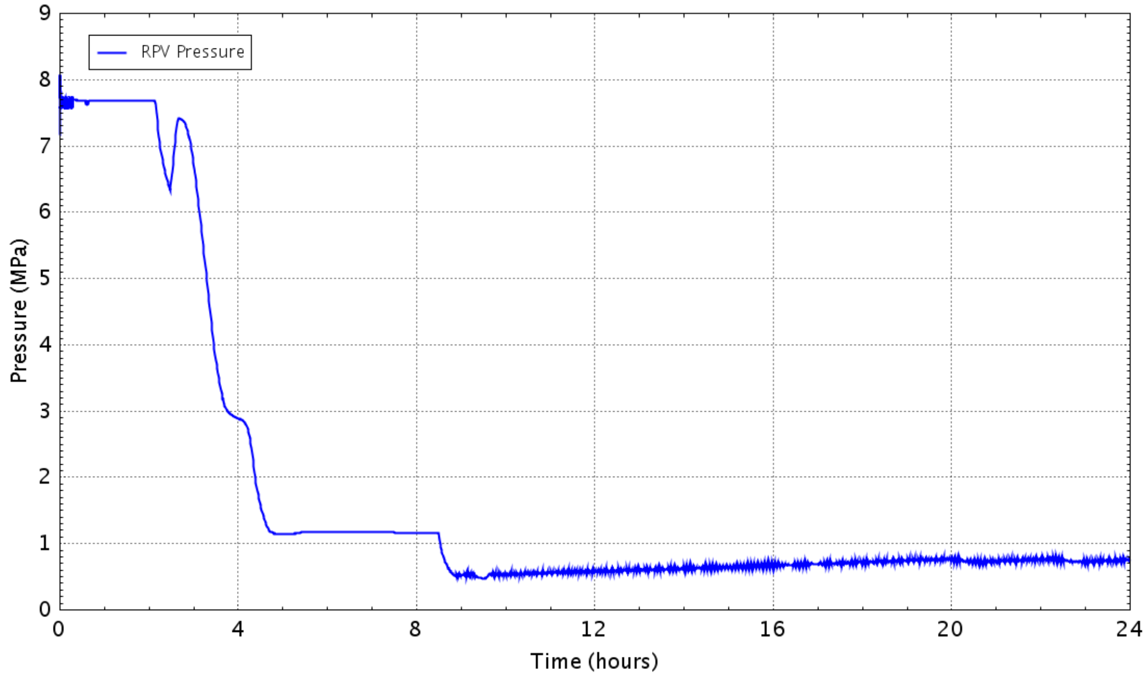

Figure D - 548 **Pressure in theRPV**

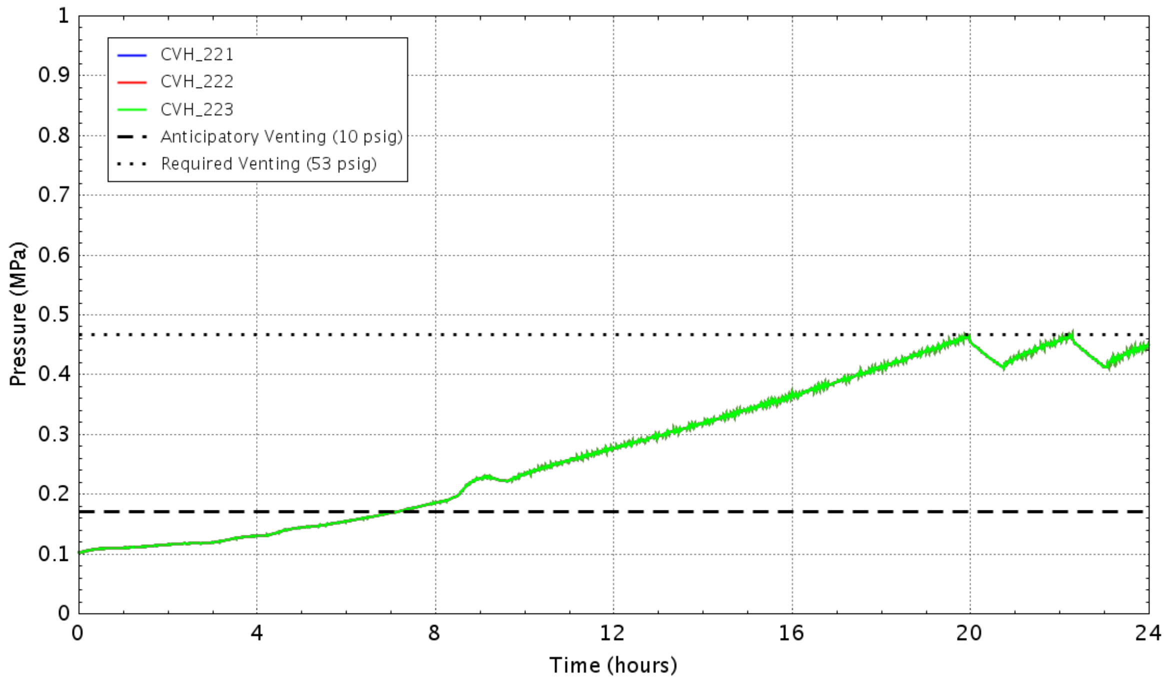

Figure D - 549 **Pressure in the wetwell**

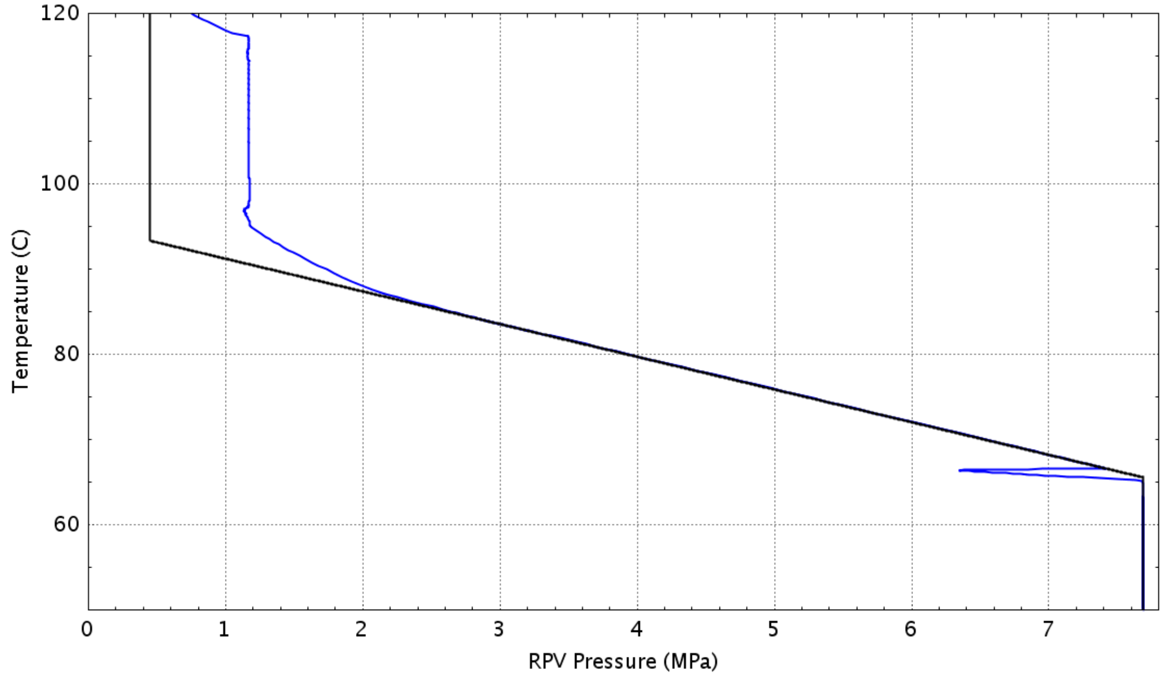

Figure D – 550 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

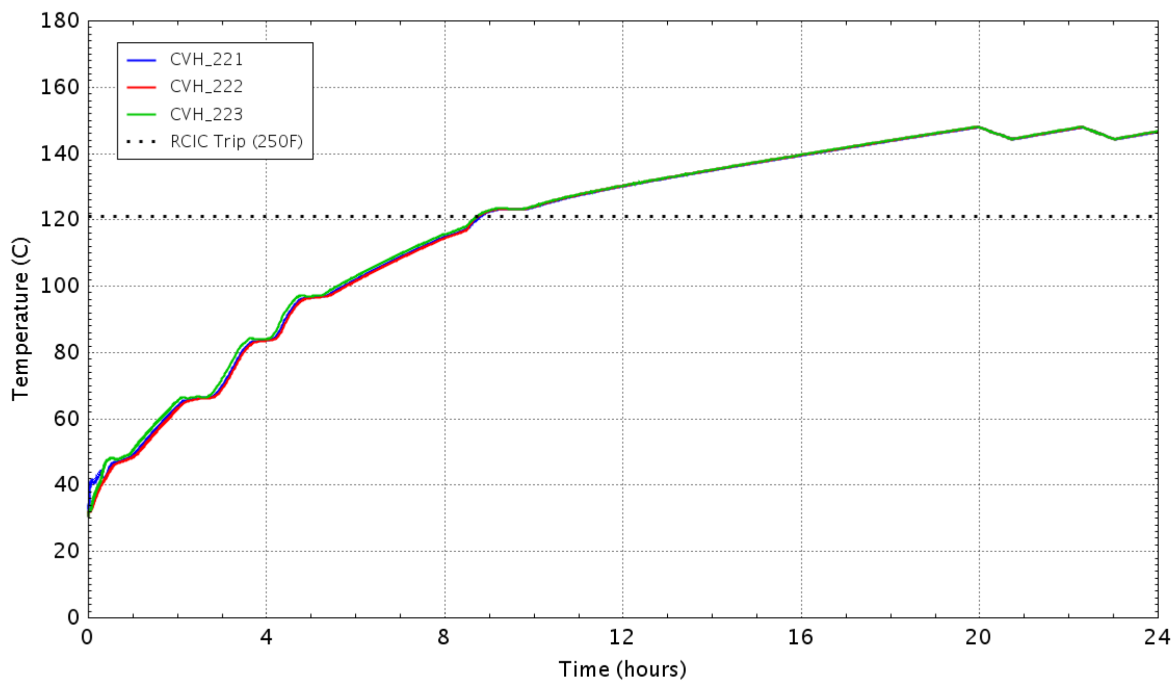

Figure D - 551 **Water temperature in the wetwell**

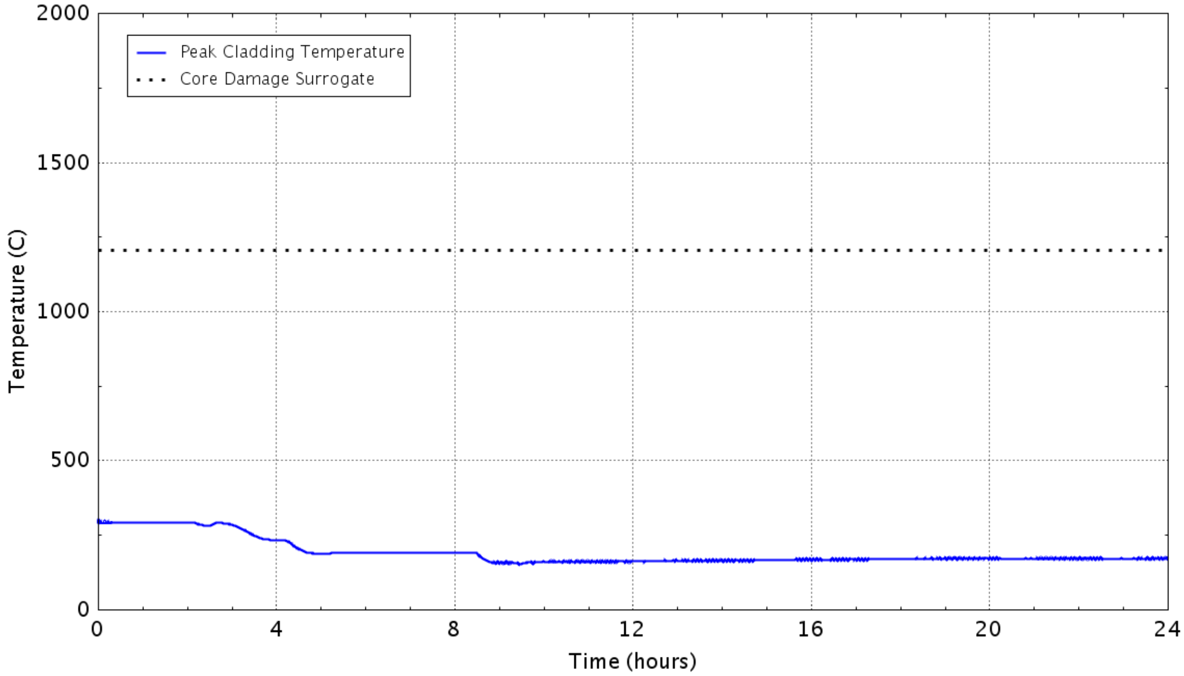

Figure D – 552 Peak temperature of the fuel cladding as a function oftime

D.3.22 Case 23a: Sensitivity to LOMFW-25 Case 23 with SRVFailing Open at 270 Cycles

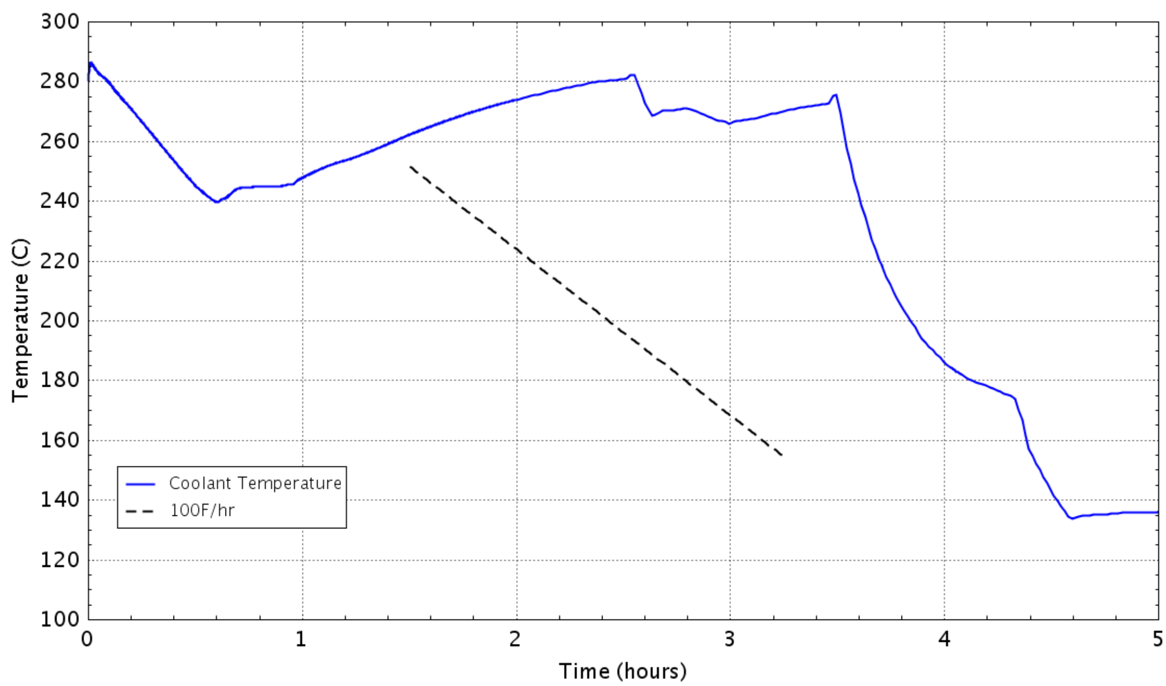

Figure D - 553 RPV cooldown rate

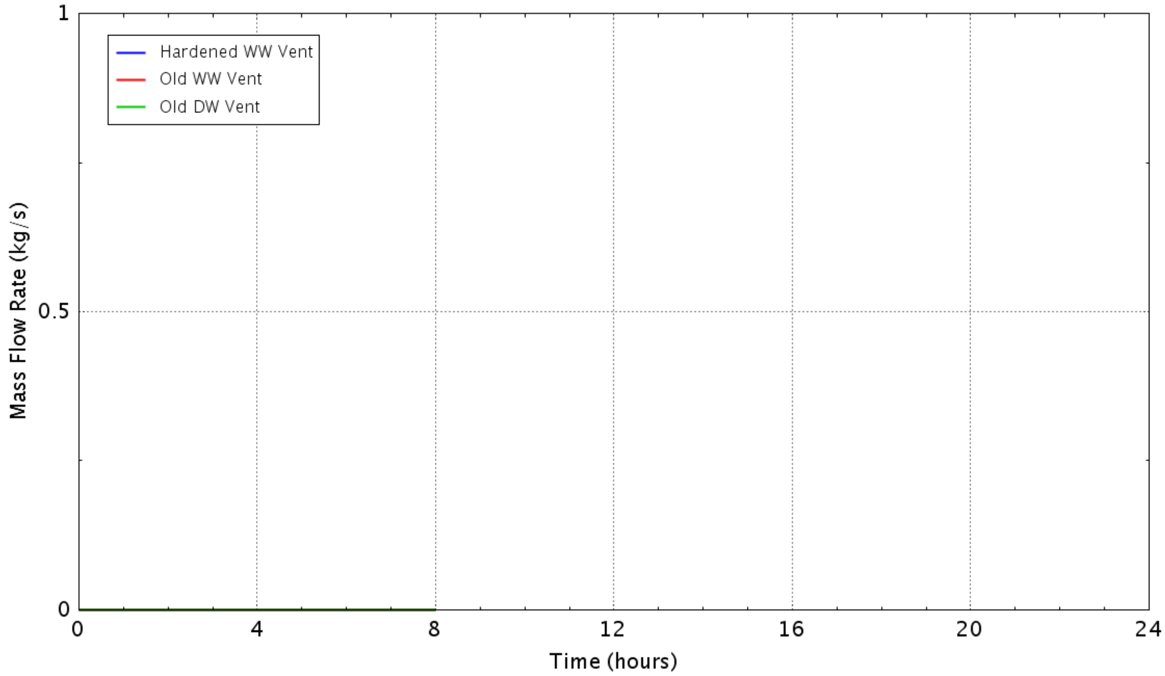

Figure D - 554 **Flow rate of the containment vents**

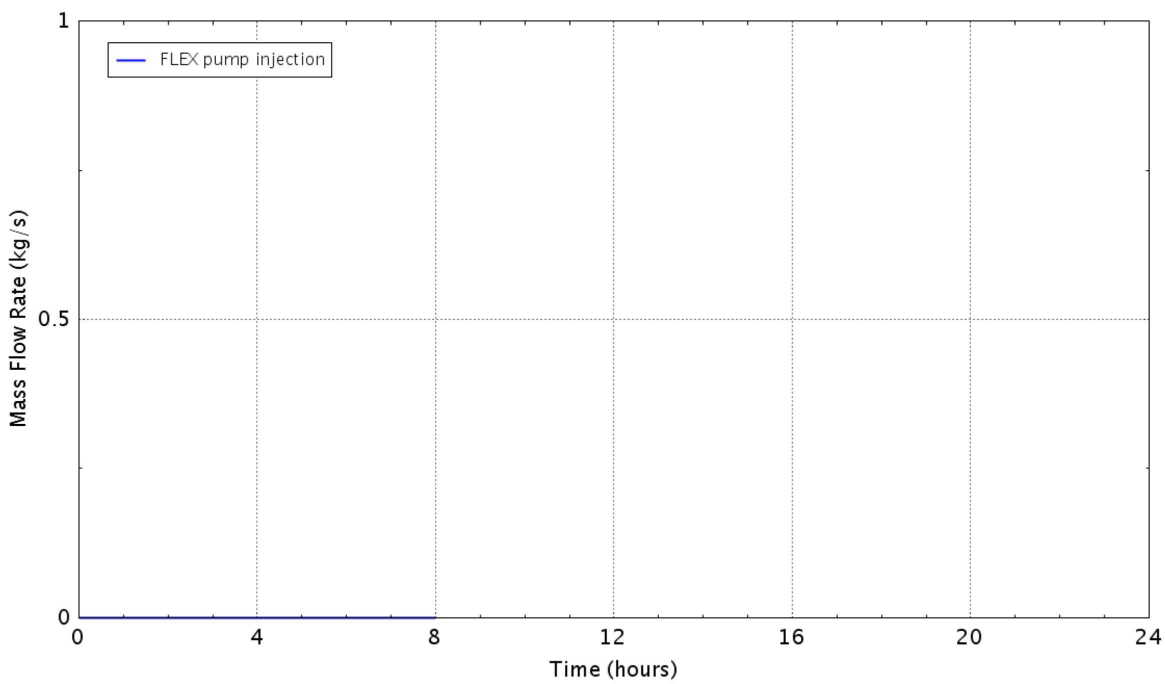

Figure D - 555 **Flow rate of the FLEX pump**

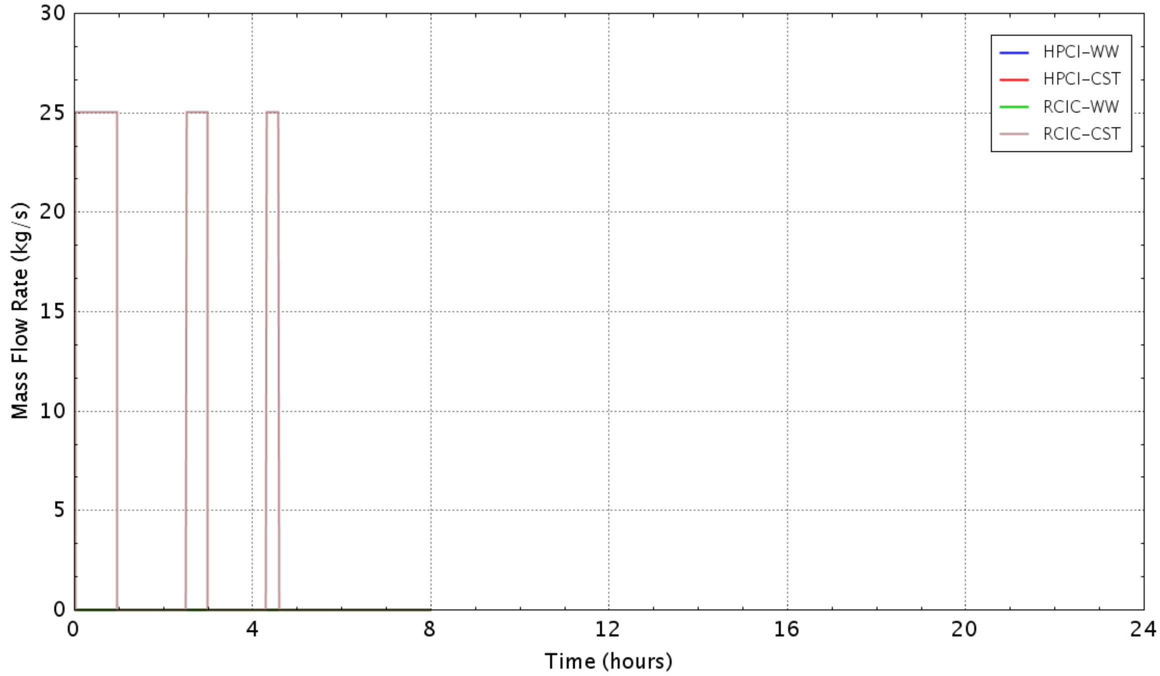

Figure D - 556 Flow rate of the HPCI/RCIC pumps

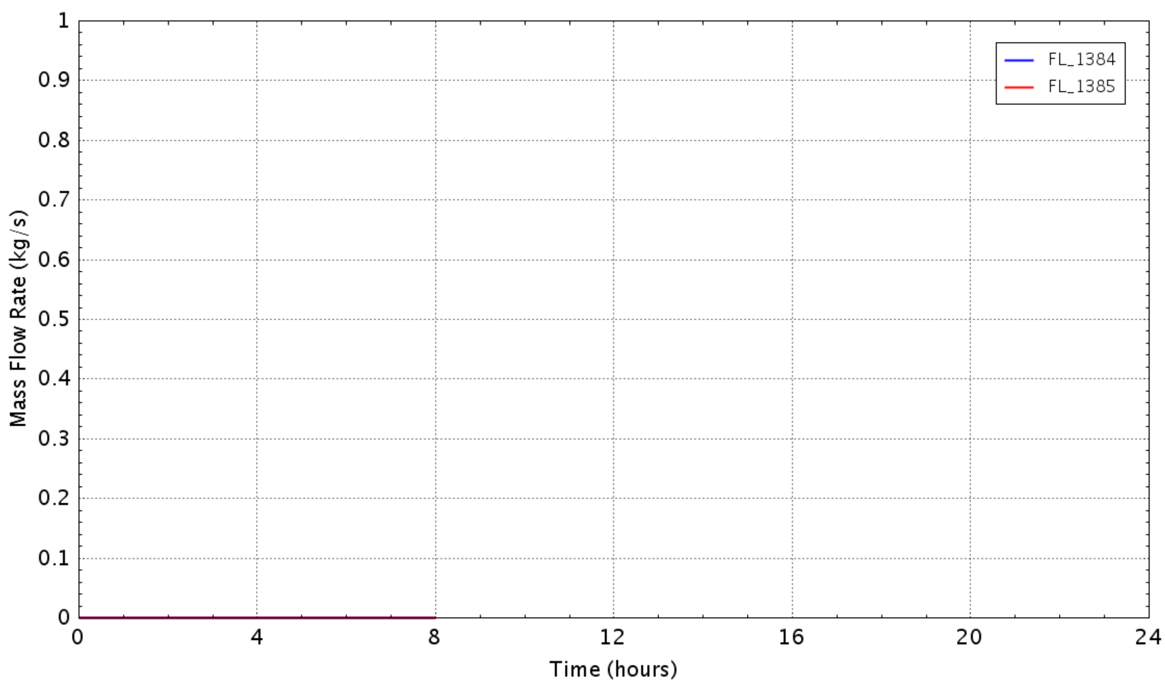

Figure D - 557 Flow rate of the recirculating pump seal leakage

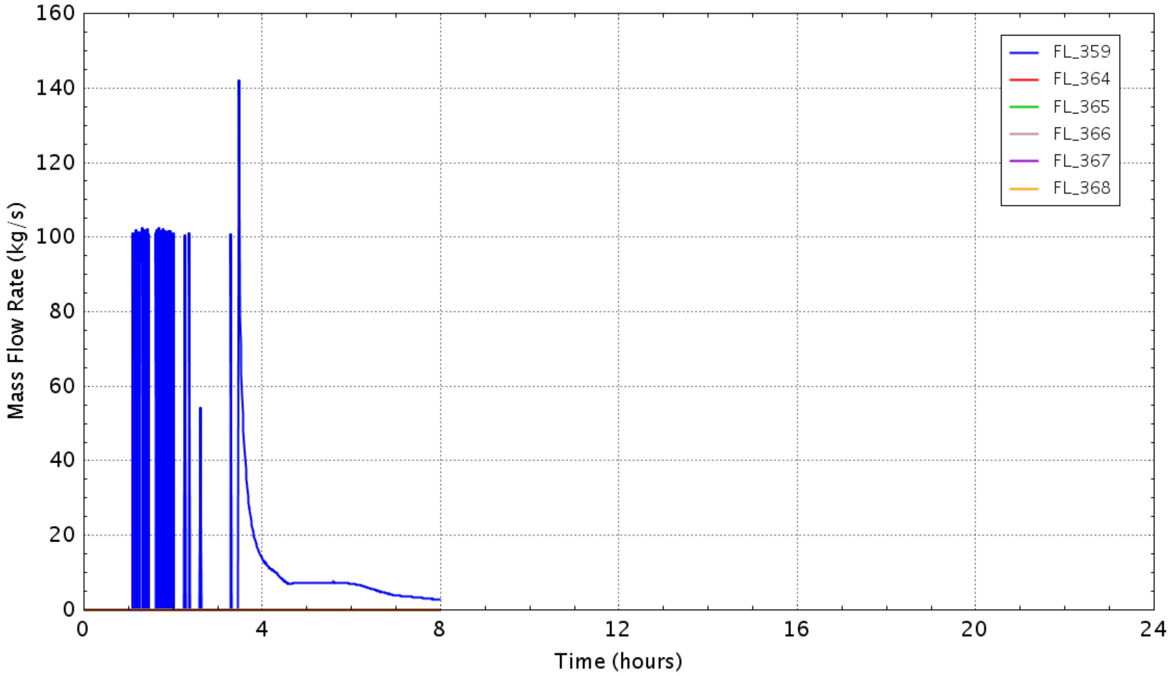

Figure D - 558 **Flow rate of the SRVs**

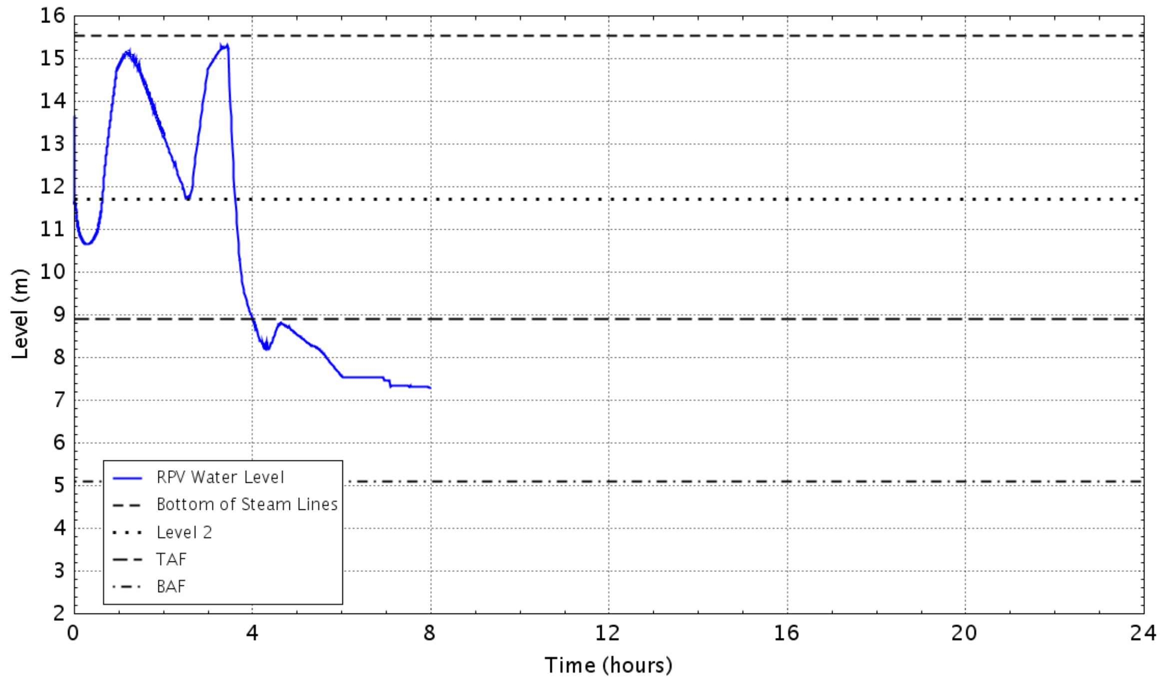

Figure D - 559 **RPV down comer water level**

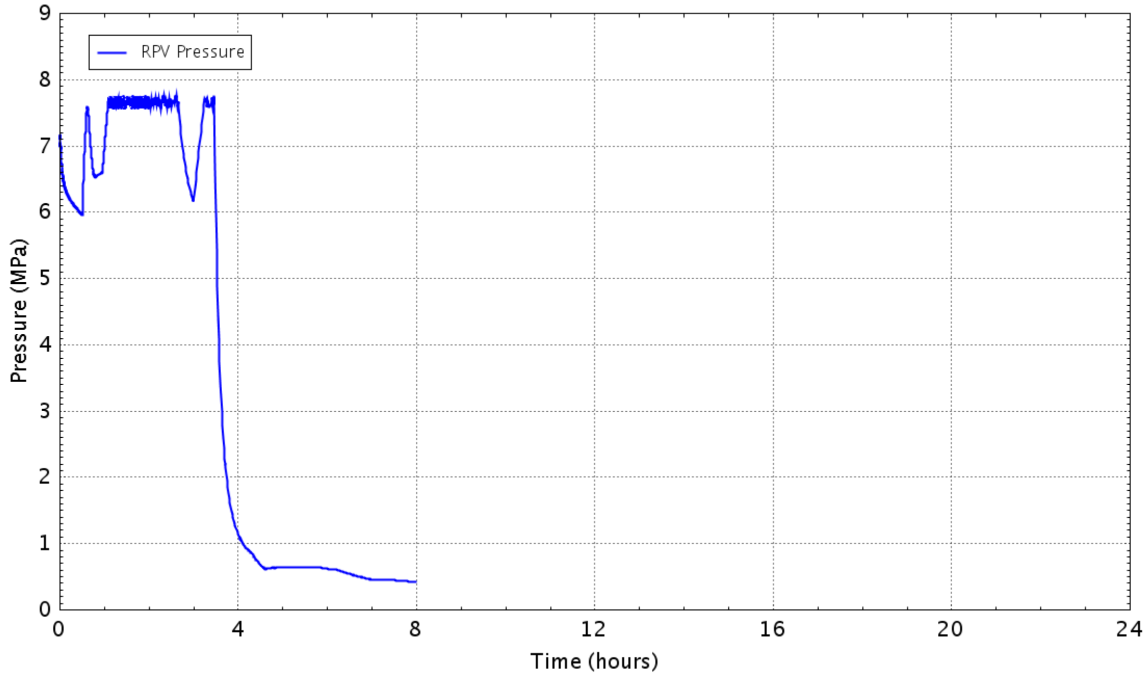

Figure D - 560 Pressure in theRPV

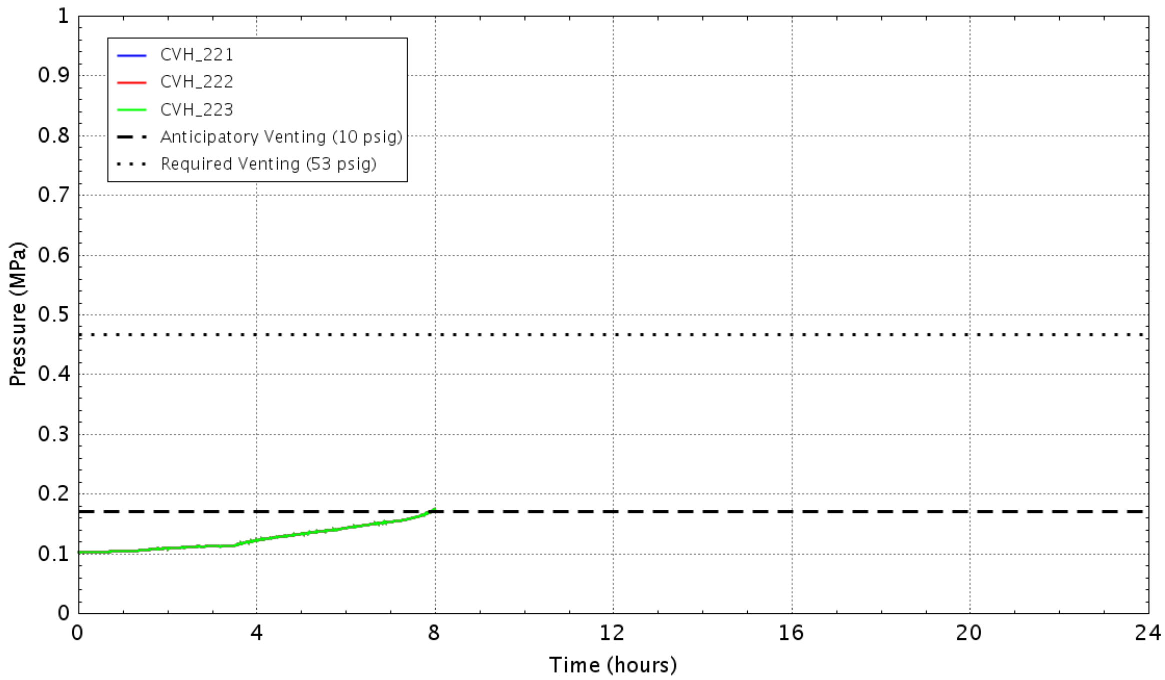

Figure D - 561 Pressure in the wetwell

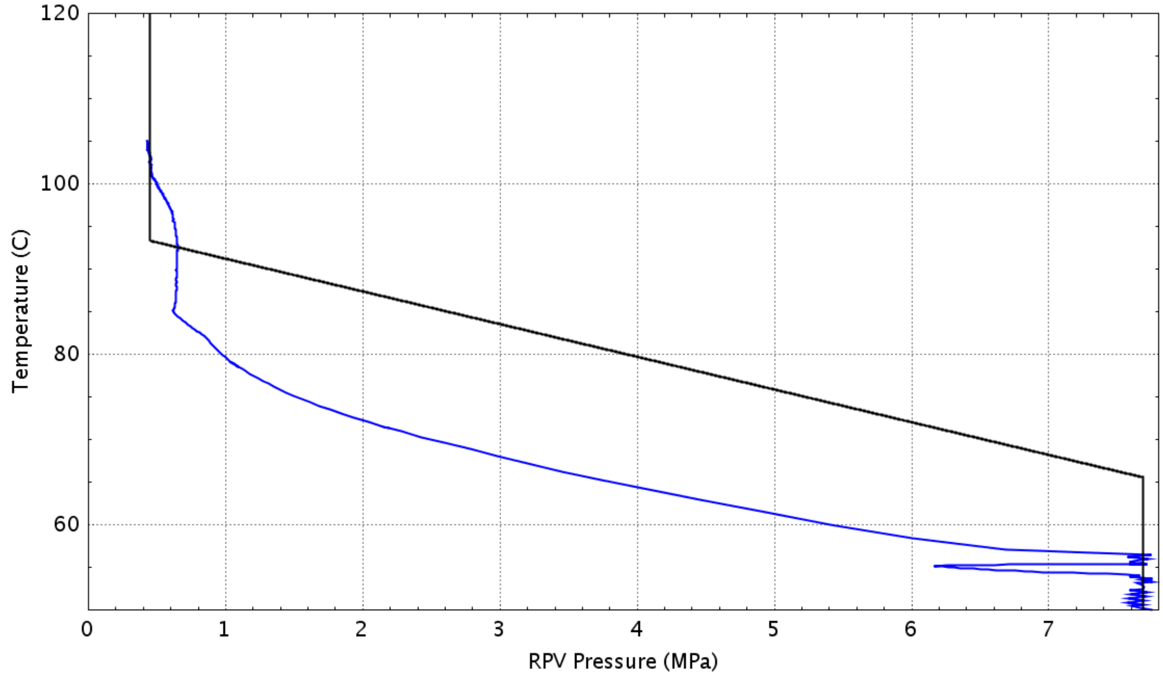

Figure D – 562 Plant status relative to the HCL curve (Graph 4 of the EOPs)

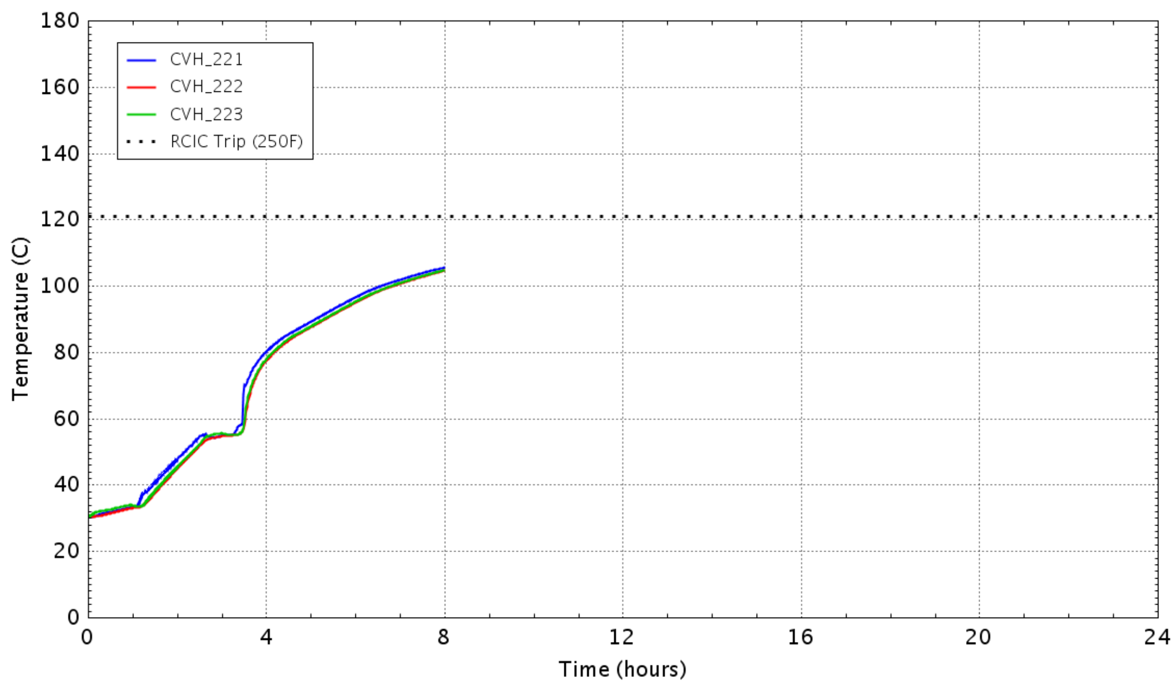

Figure D - 563 Water temperature in the wetwell

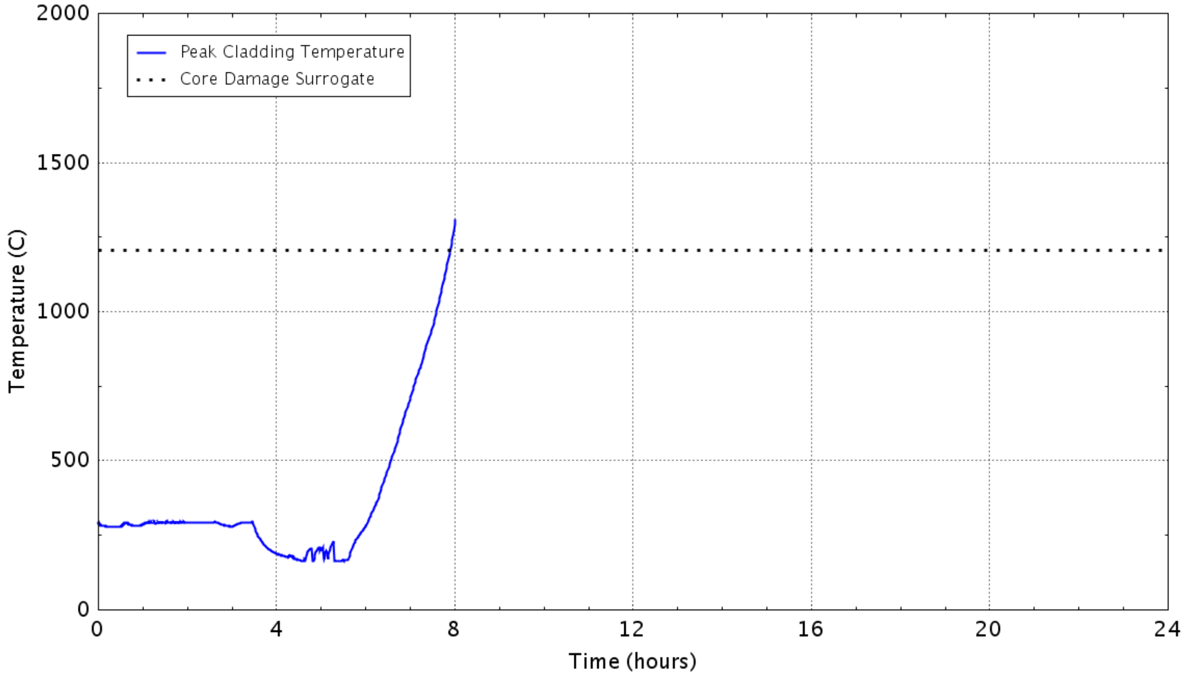

Figure D – 564 **Peak temperature of the fuel cladding as a function of time**

APPENDIX E
DETAILED CHAPTER 5 ANALYSIS RESULTS

DETAILED CHAPTER 5 ANALYSIS RESULTS

E.1 LOOP Scenarios

E.1.1 Case 1: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the 2-in. Drywell Bypass, RCIC Fully Functional

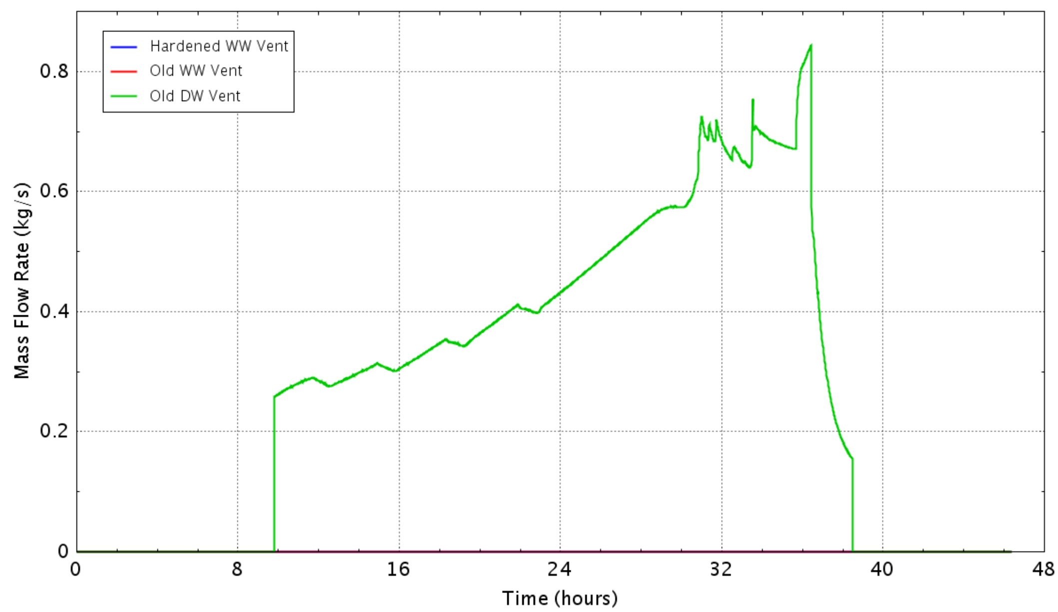

Figure E – 1 Flow rate of the containment vents

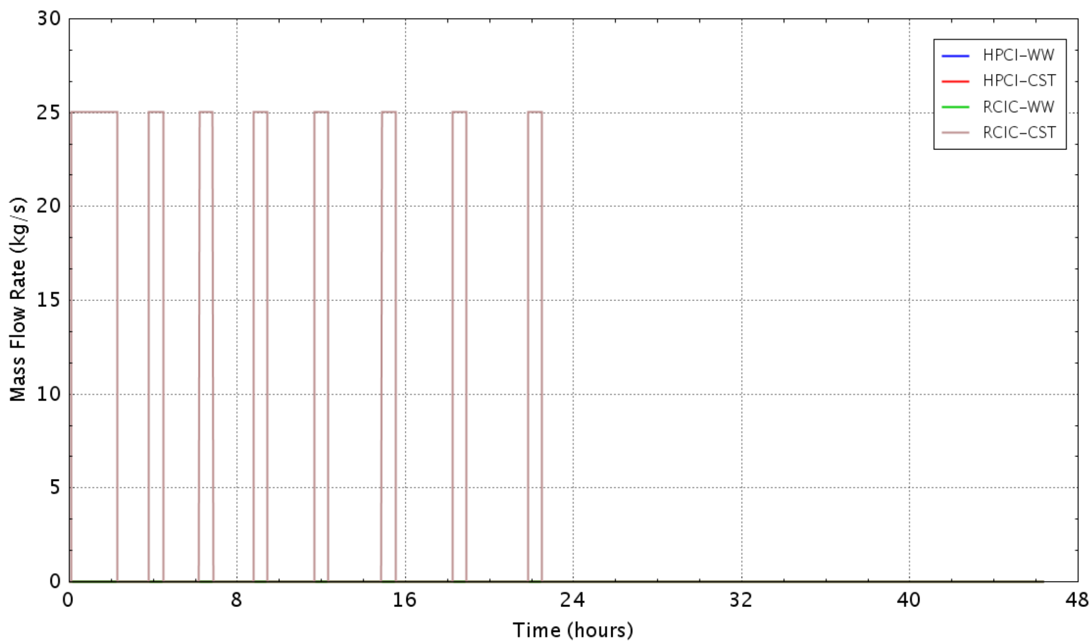

Figure E - 2 Flow rate of the HPCI/RCIC pumps

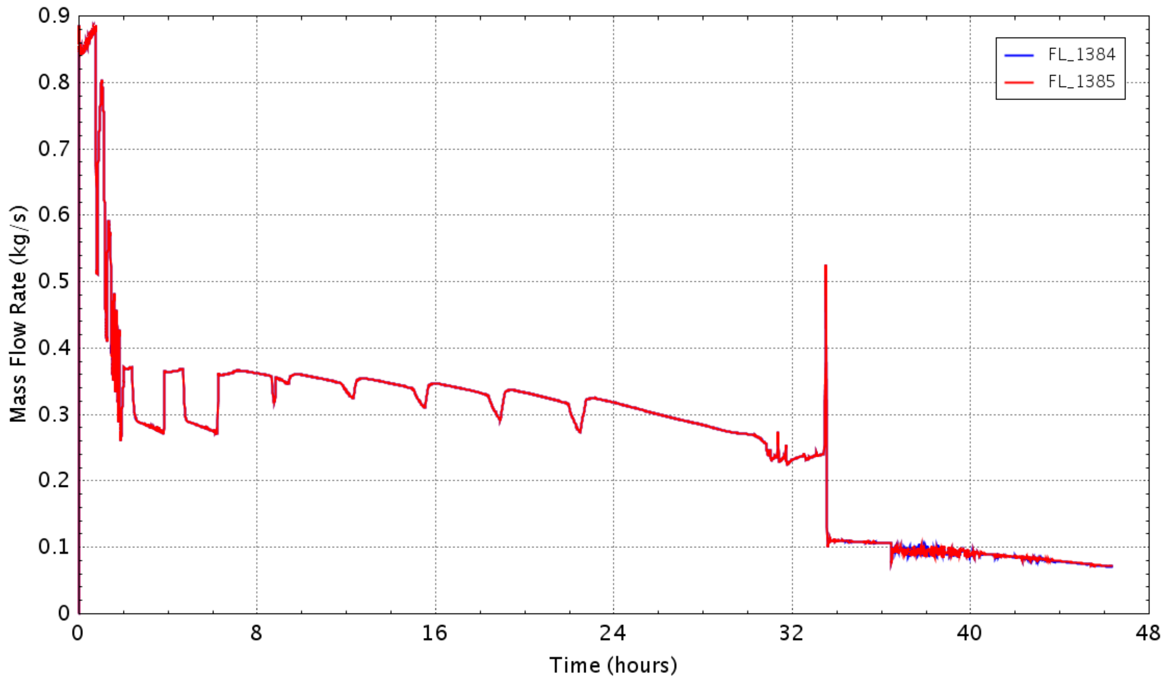

Figure E - 3 **Flow rate of the recirculating pump seal leakage**

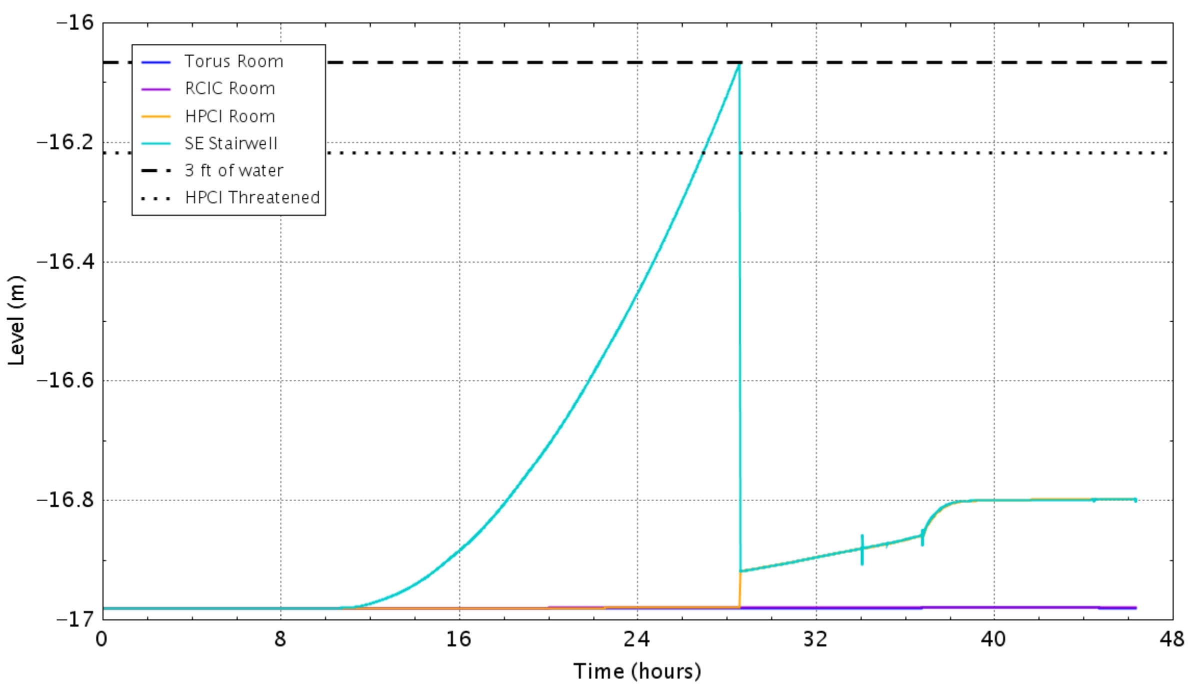

Figure E - 4 **Water level in the reactor building basement**

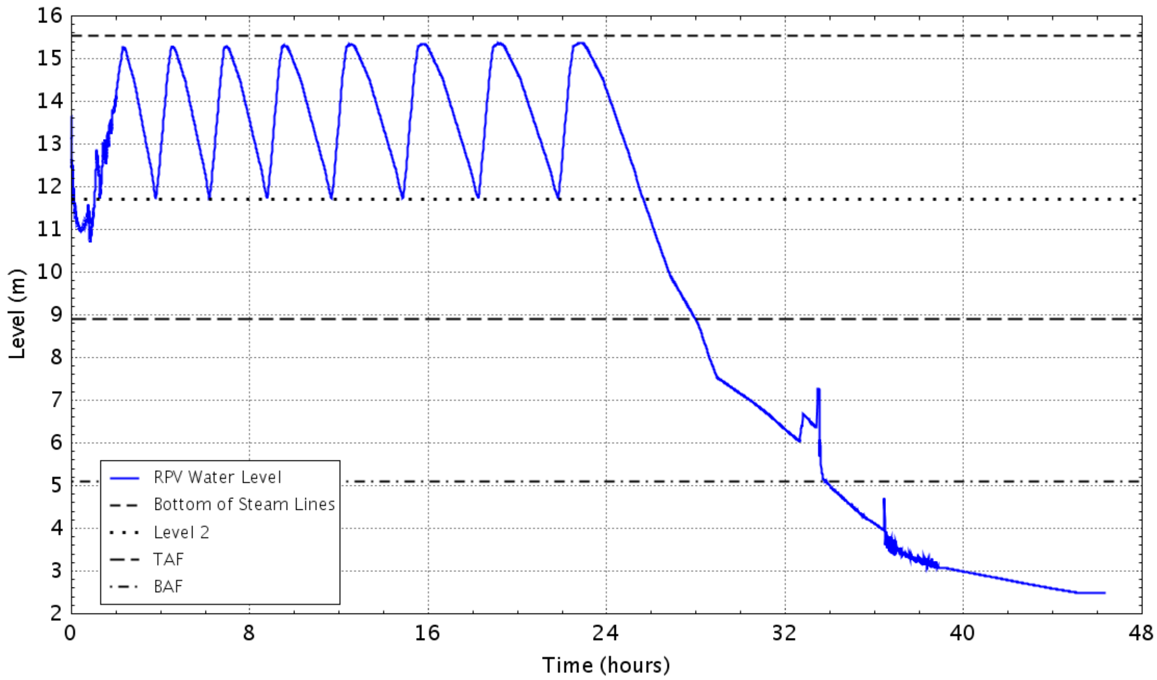

Figure E - 5 **RPV down comer water level**

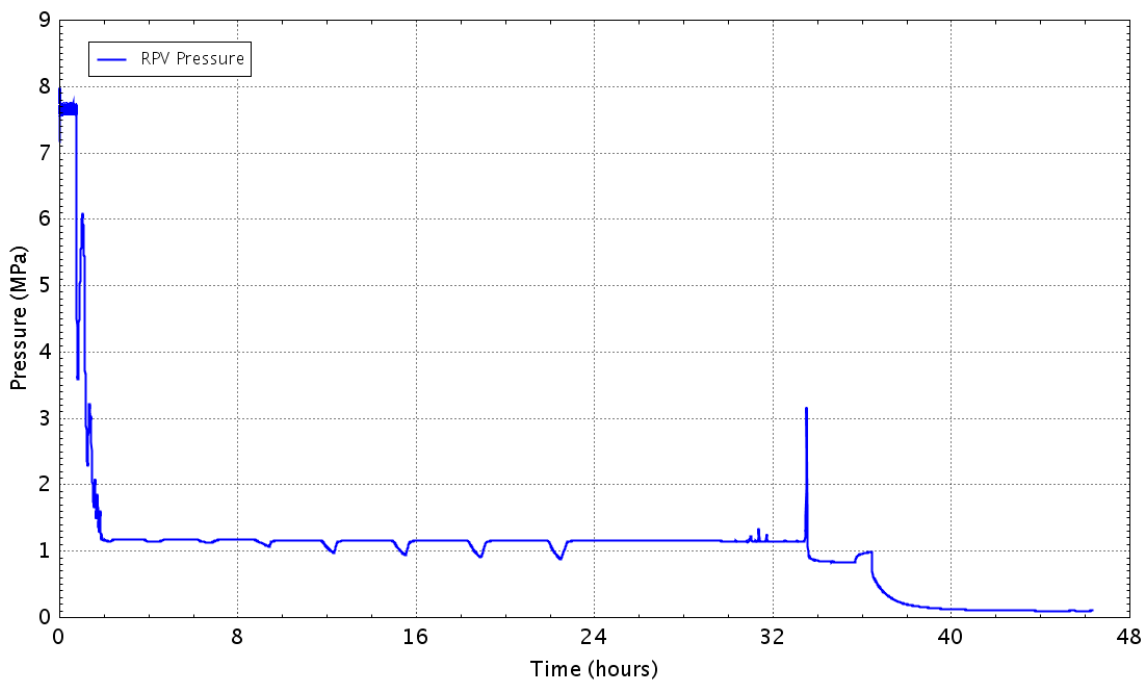

Figure E - 6 **Pressure in theRPV**

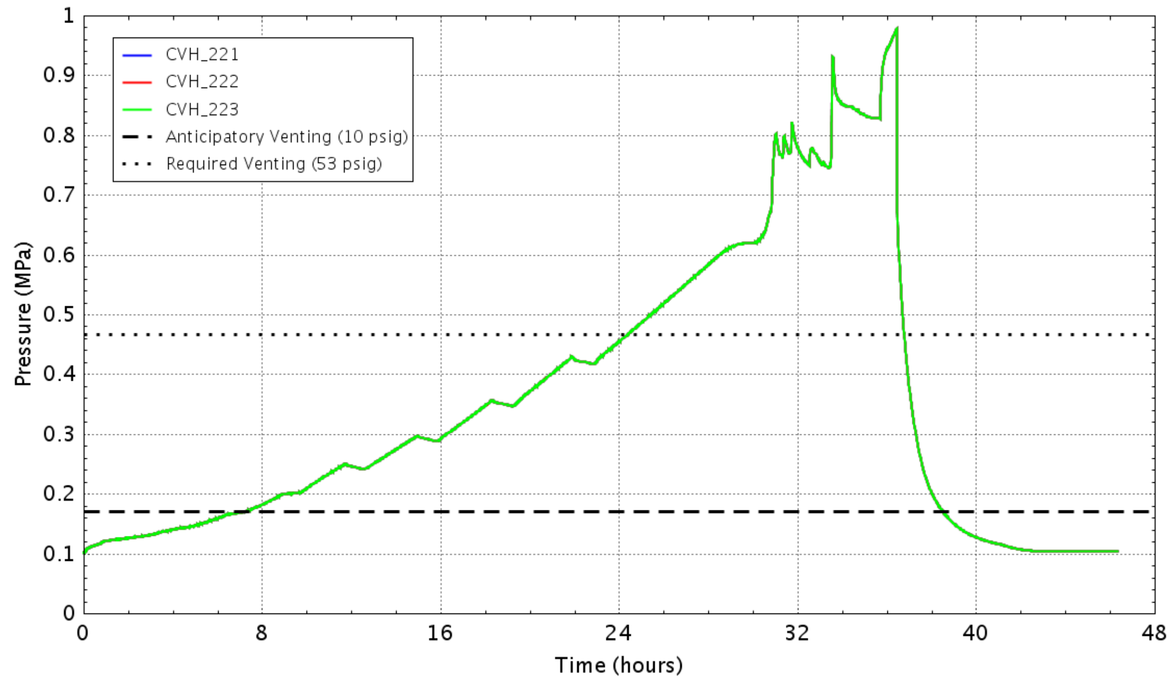

Figure E - 7 **Pressure in the wetwell**

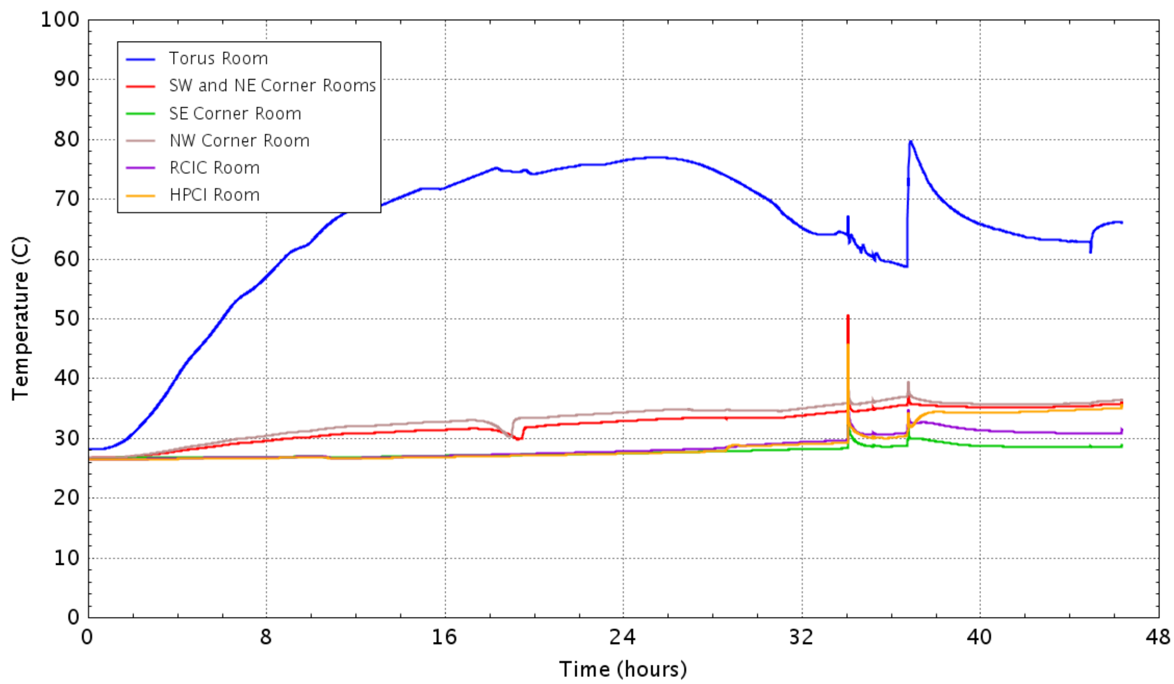

Figure E - 8 **Vapor temperature in the reactor building basement**

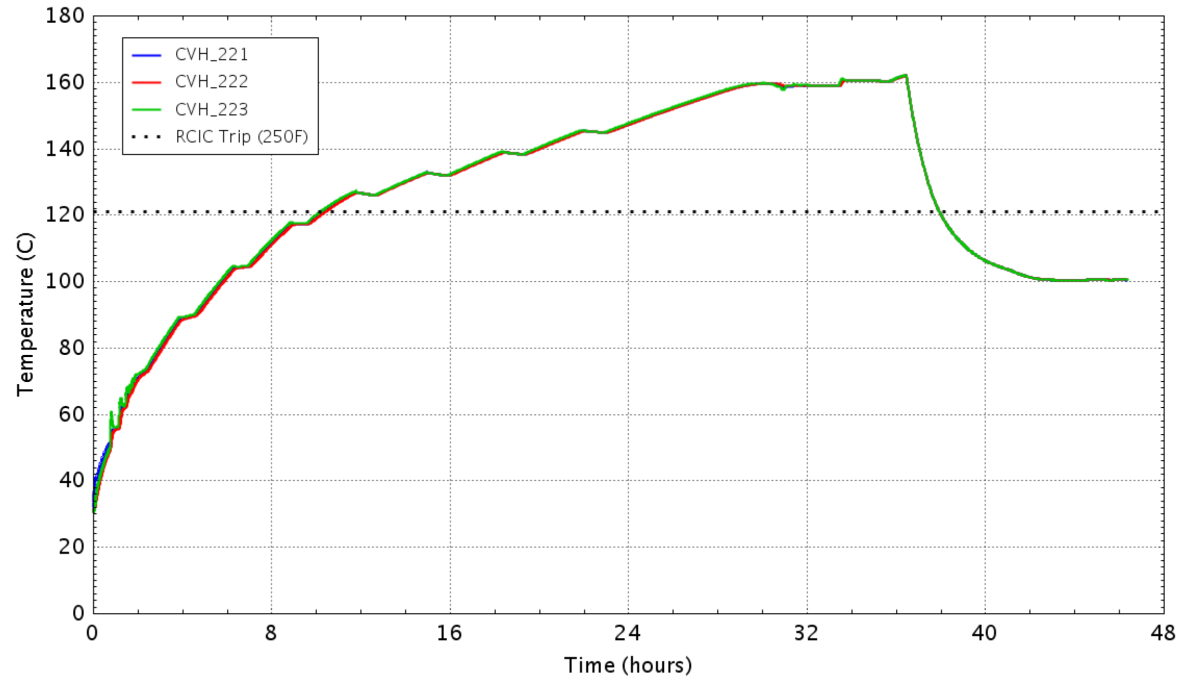

Figure E - 9 **Water temperature in the wetwell**

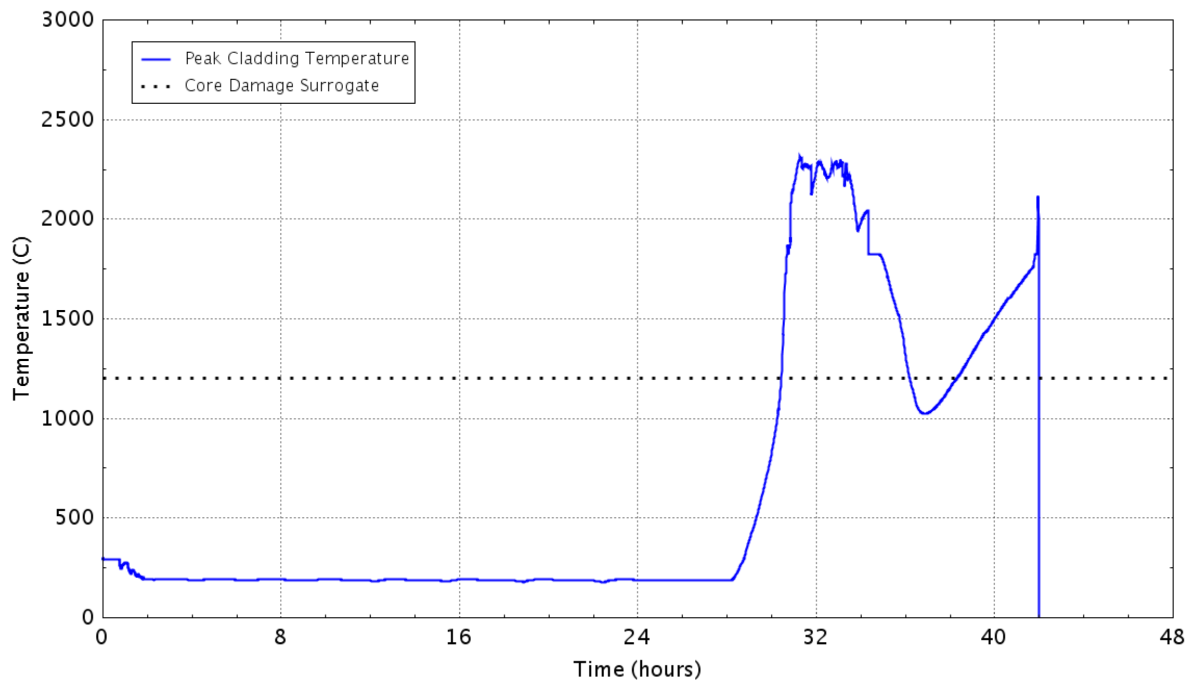

Figure E - 10 **Peak temperature of the fuel cladding as a function of time**

E.1.2 Case 2: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the 2-in. Drywell Bypass, RCIC 50%Degraded

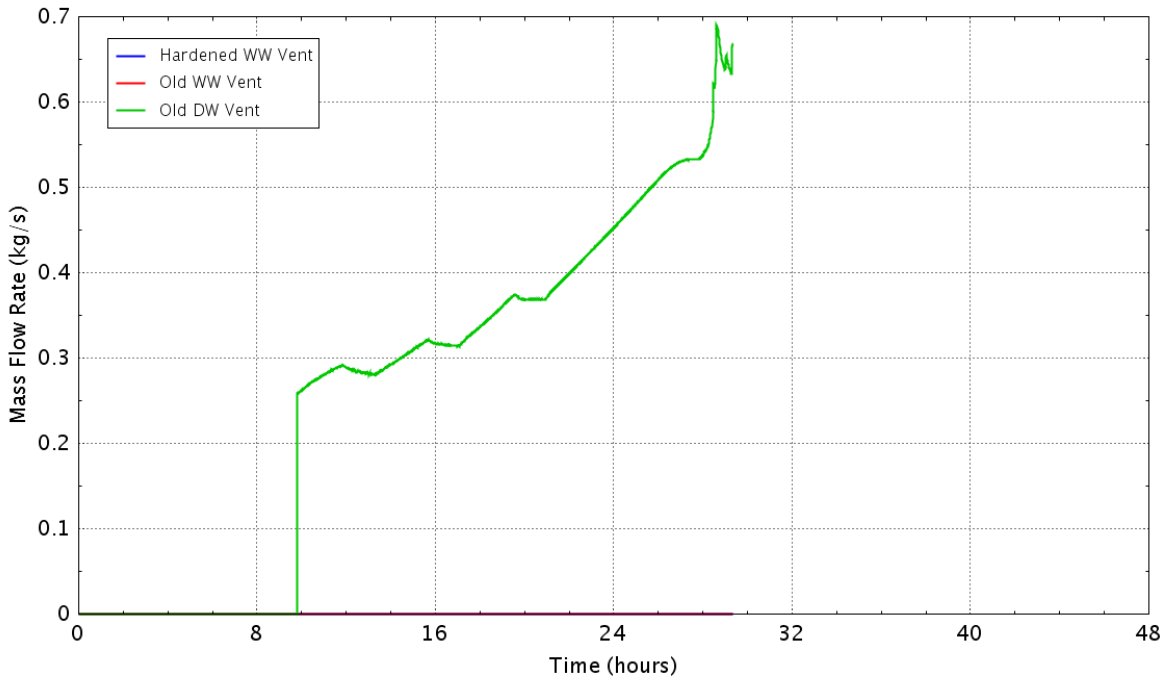

Figure E - 11 Flow rate of the containment vents

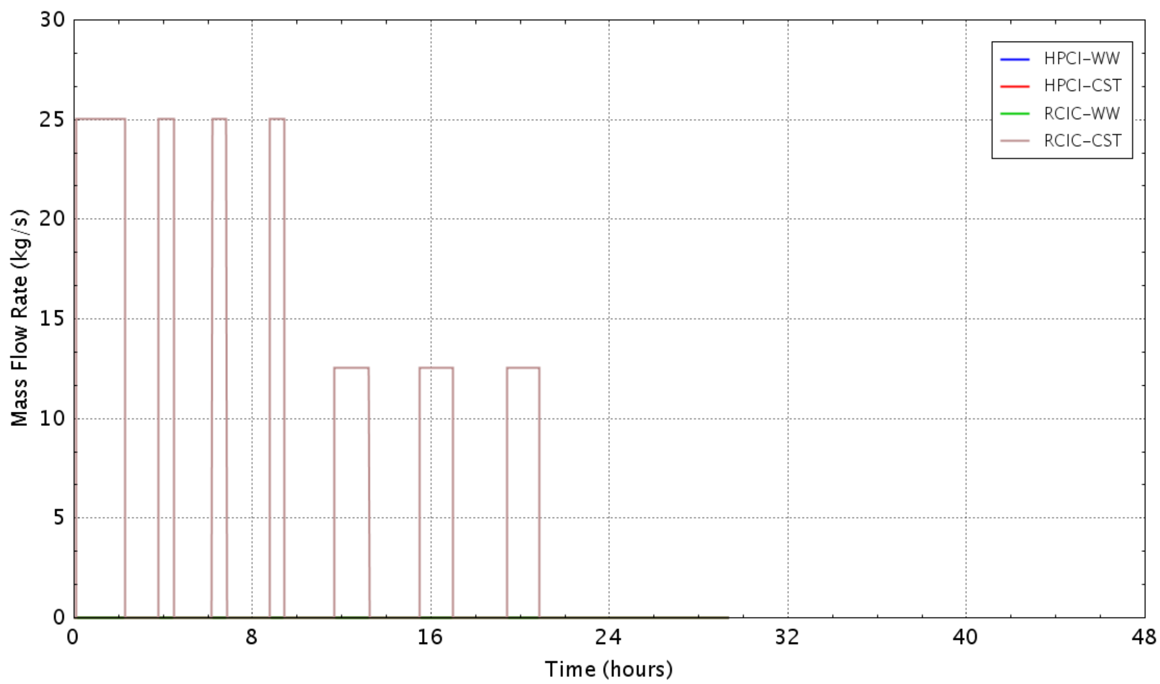

Figure E - 12 Flow rate of the HPCI/RCIC pumps

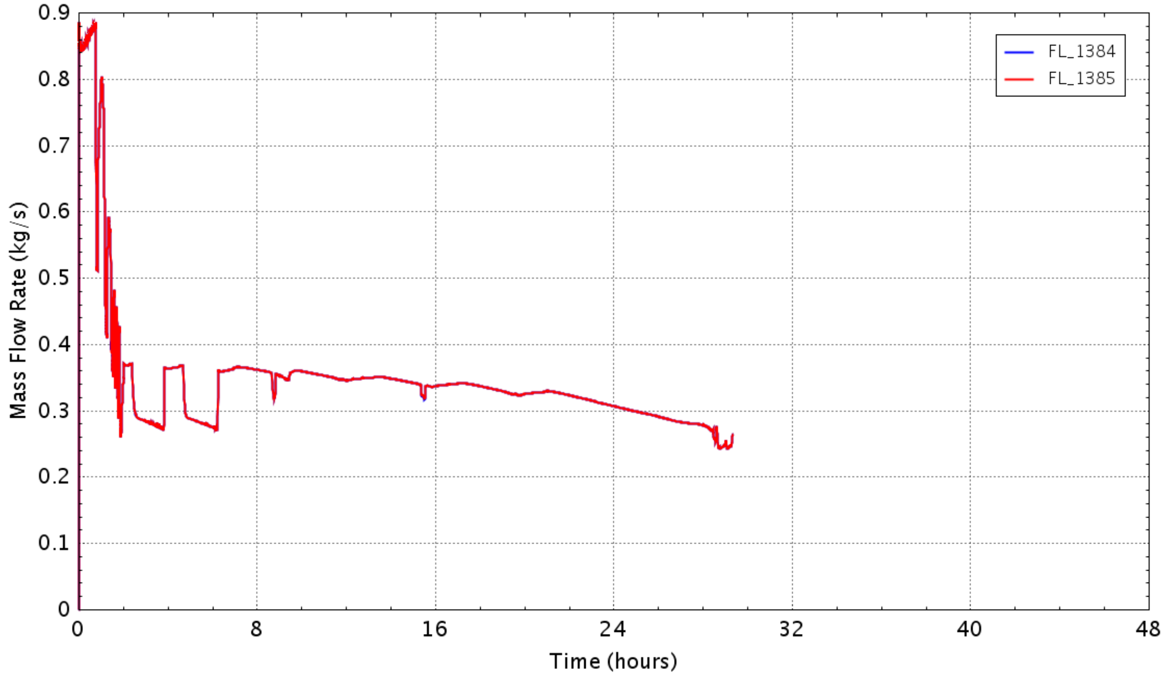

Figure E - 13 **Flow rate of the recirculating pump seal leakage**

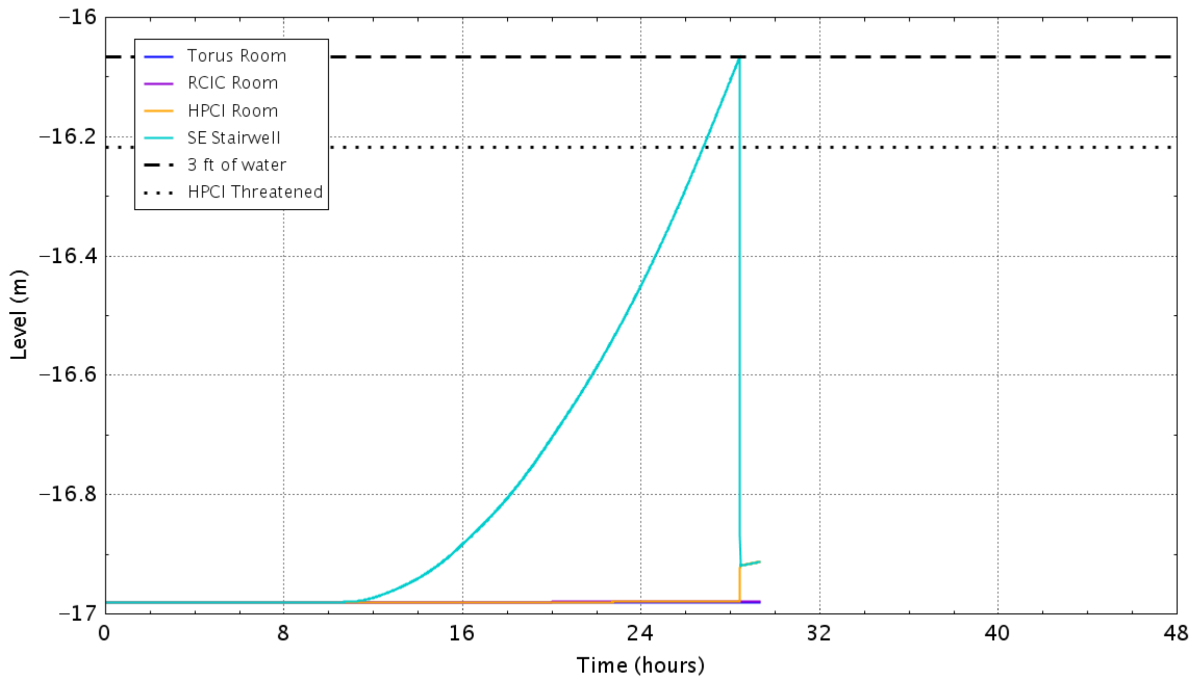

Figure E - 14 **Water level in the reactor building basement**

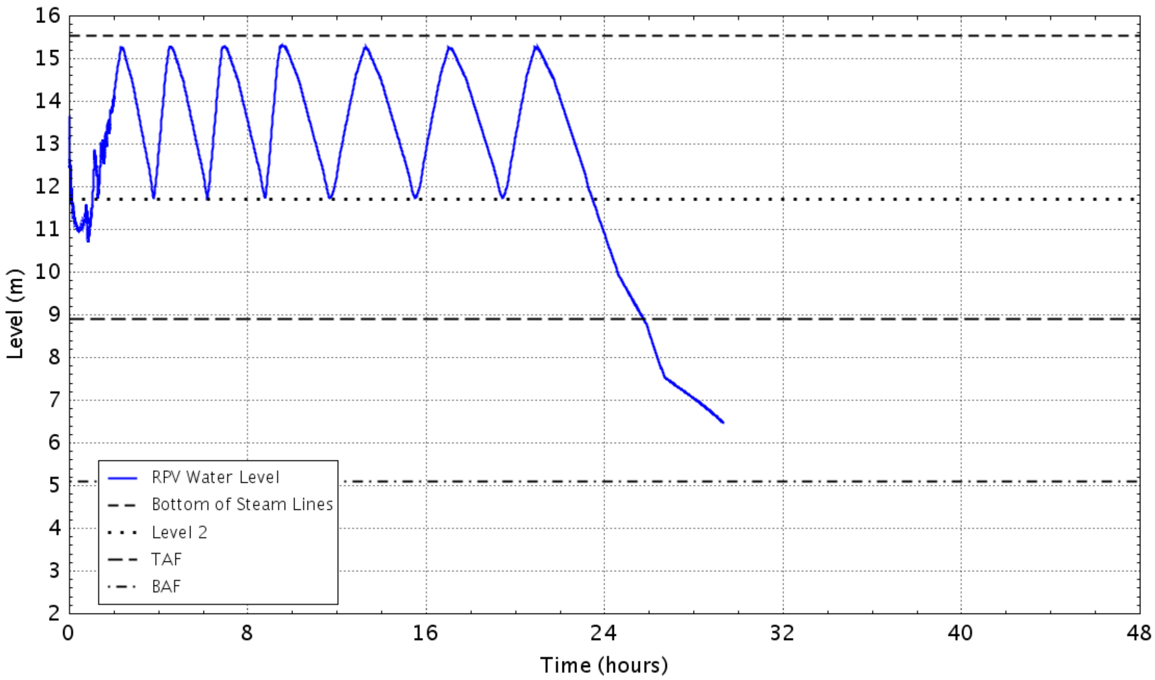

Figure E - 15 RPV down comer water level

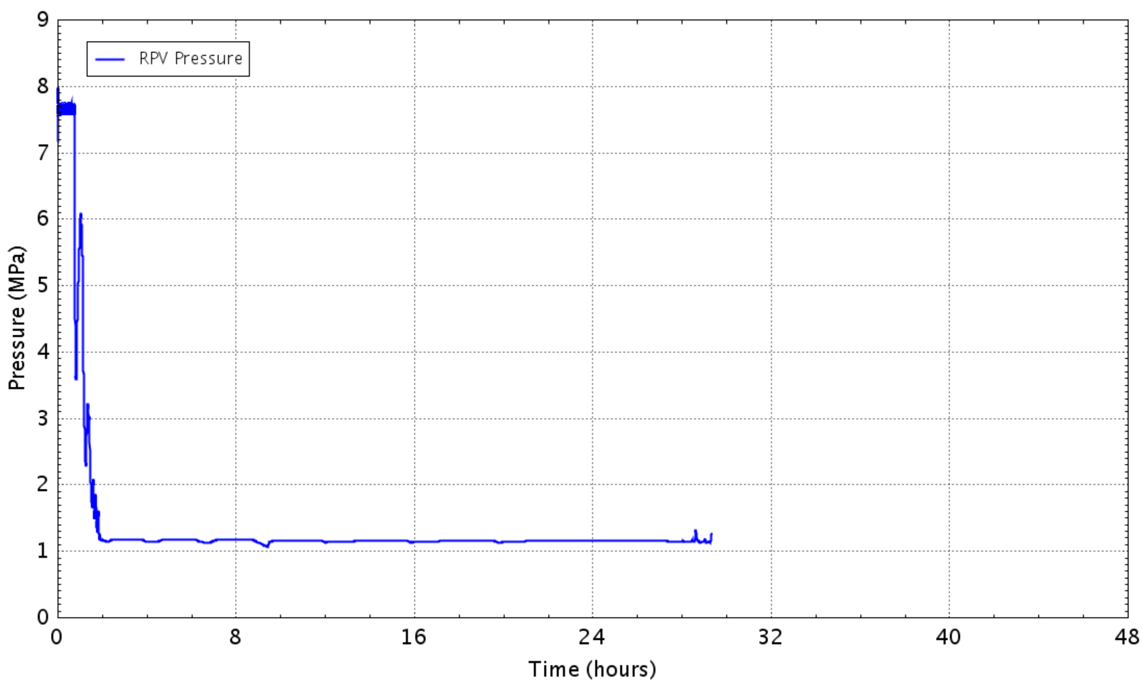

Figure E - 16 Pressure in theRPV

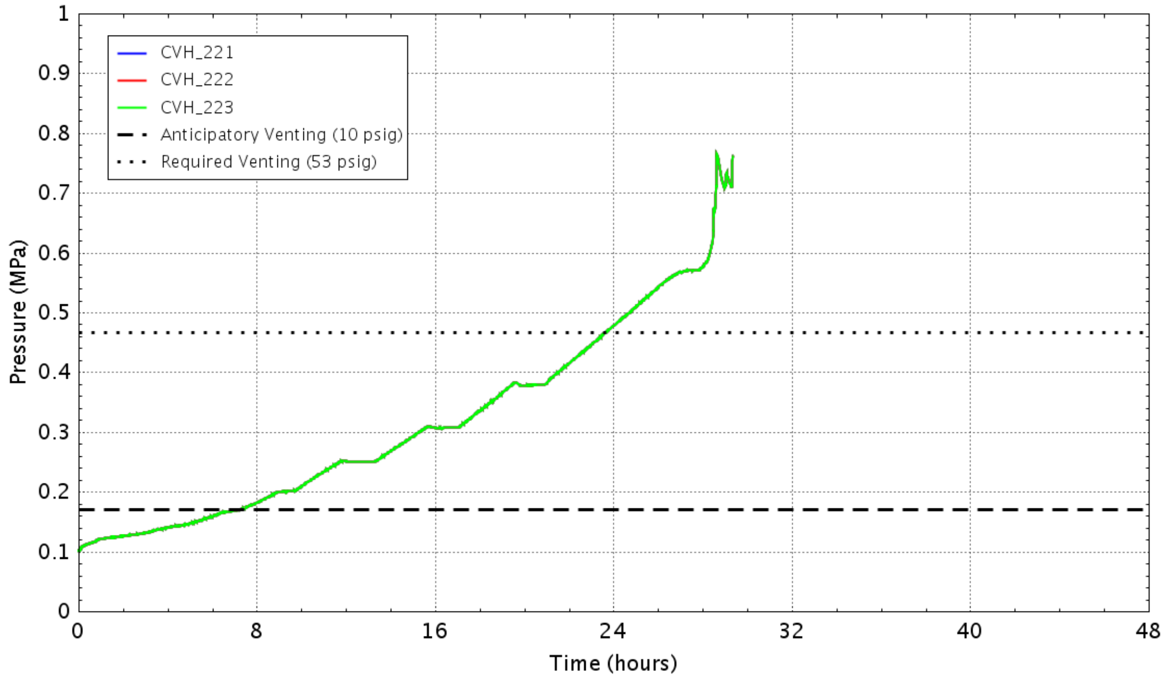

Figure E - 17 Pressure in the wetwell

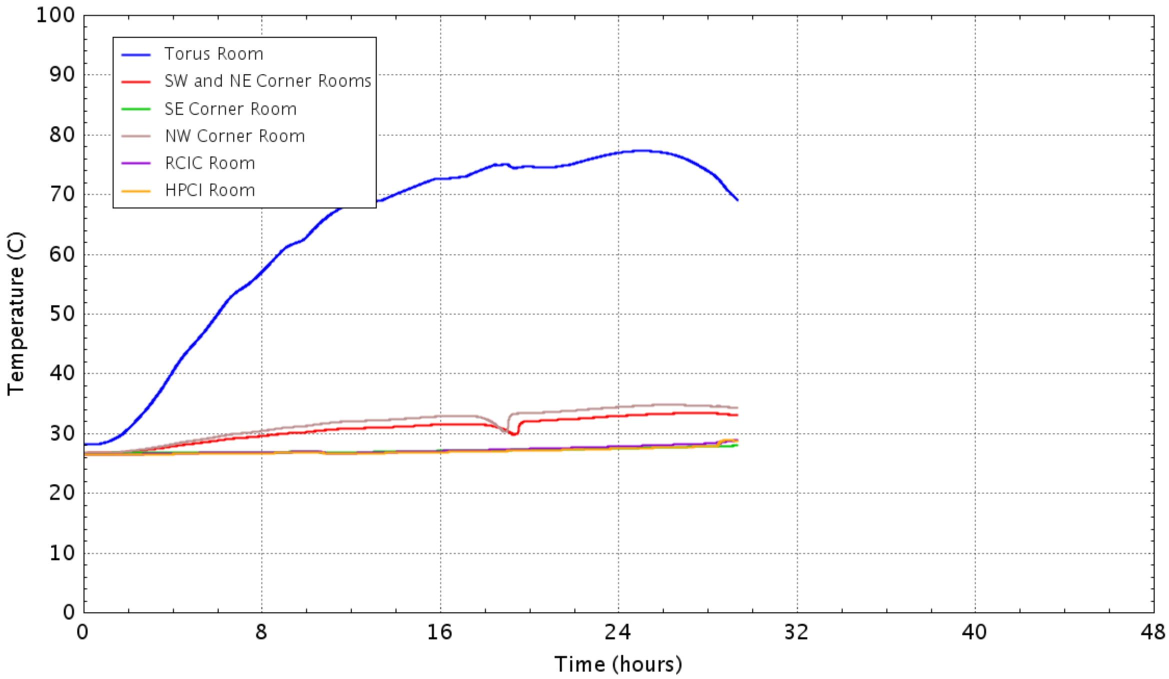

Figure E - 18 Vapor temperature in the reactor building basement

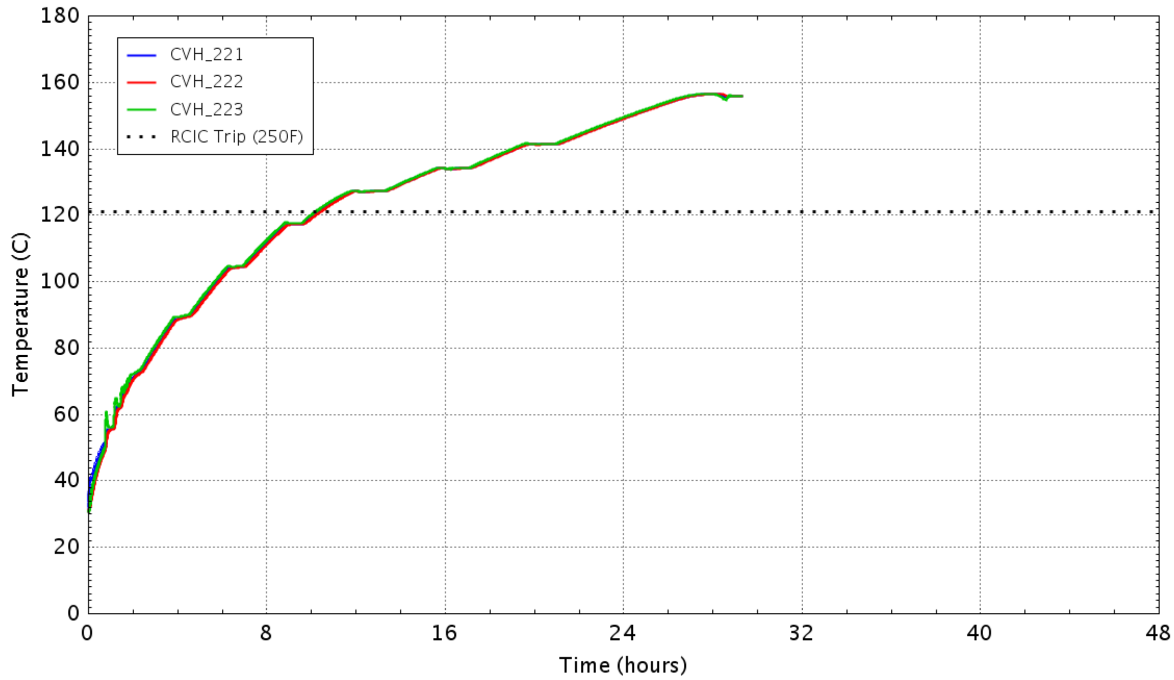

Figure E - 19 **Water temperature in the wetwell**

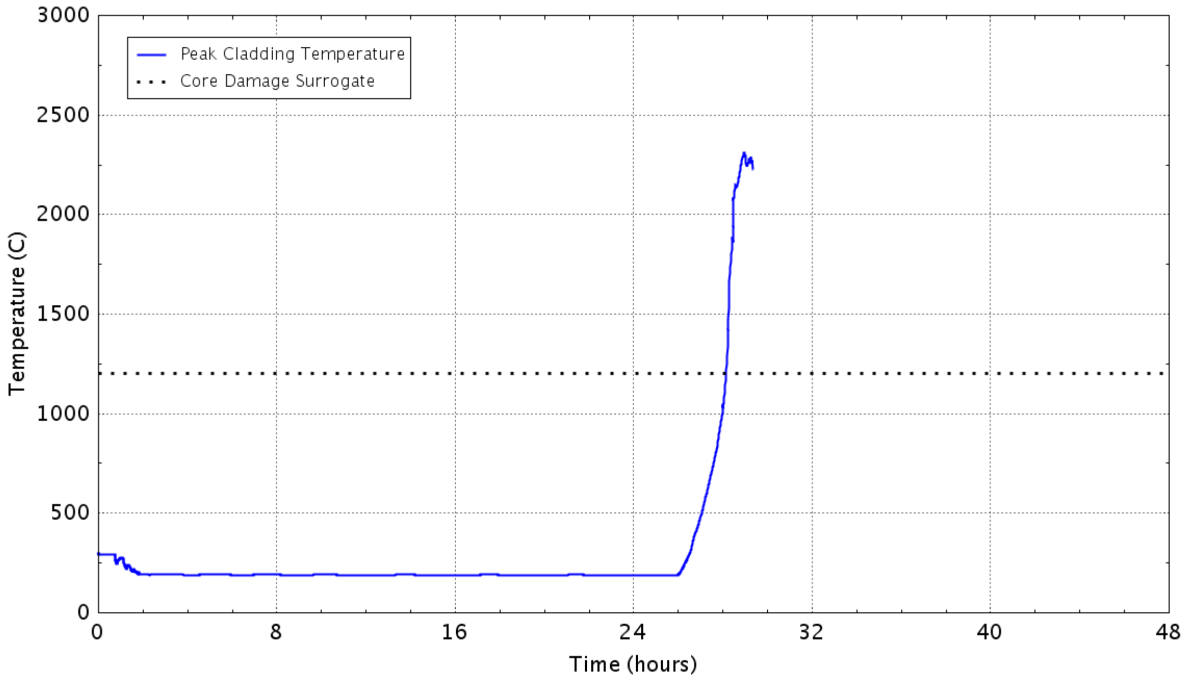

Figure E - 20 **Peak temperature of the fuel cladding as a function of time**

E.1.3 Case 3: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the 18-in. Drywell Main Vent, RCIC FullyFunctional

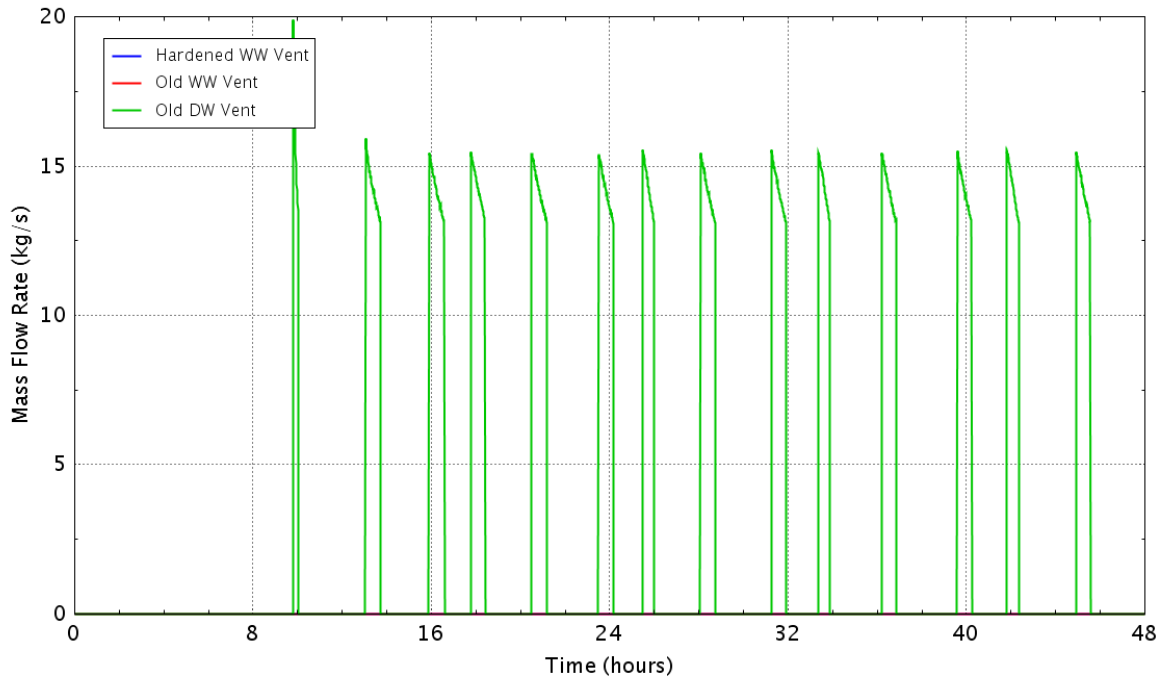

Figure E - 21 Flow rate of the containment vents

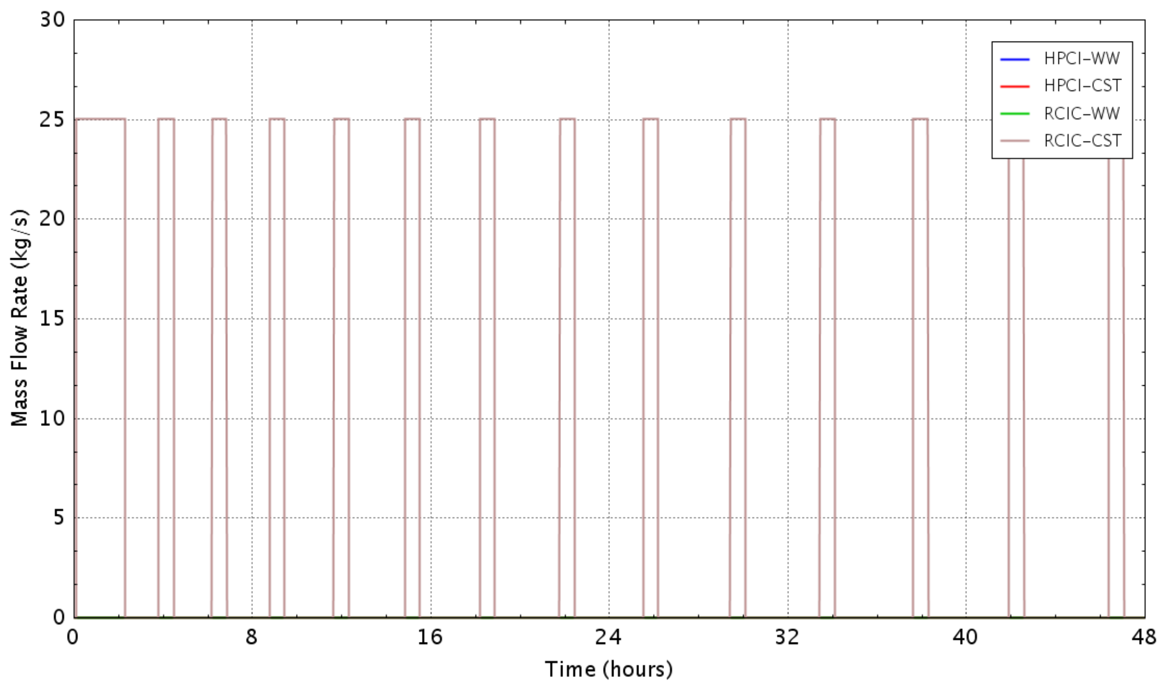

Figure E - 22 Flow rate of the HPCI/RCIC pumps

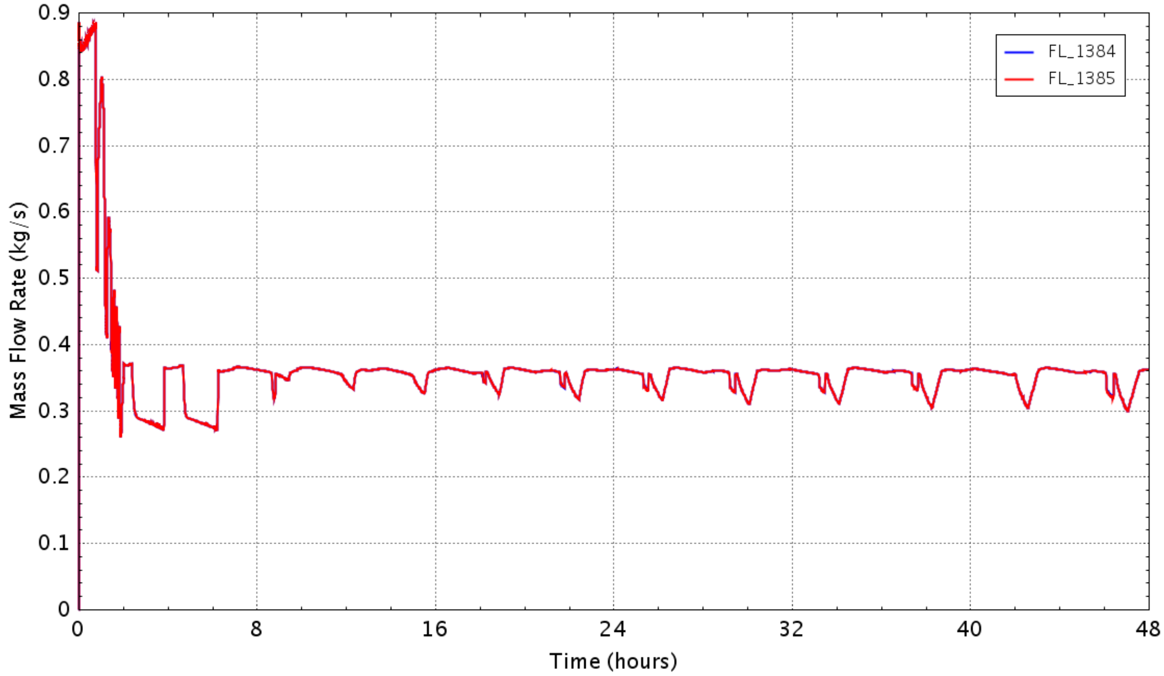

Figure E - 23 **Flow rate of the recirculating pump seal leakage**

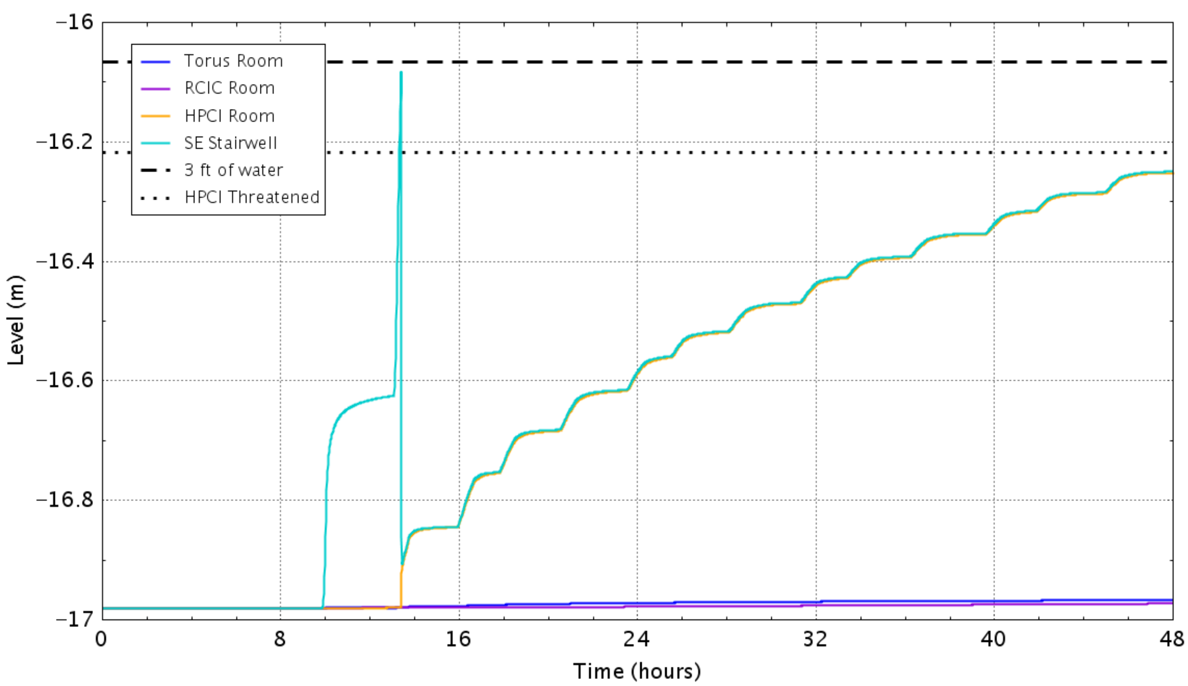

Figure E - 24 **Water level in the reactor building basement**

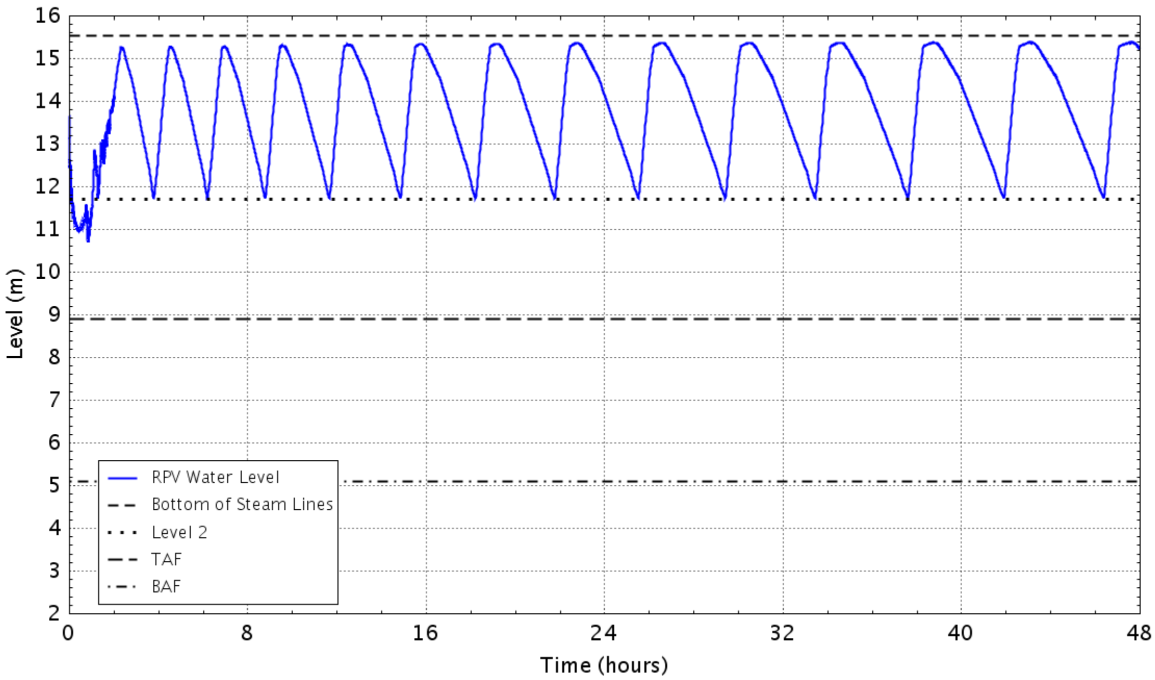

Figure E - 25 **RPV down comer water level**

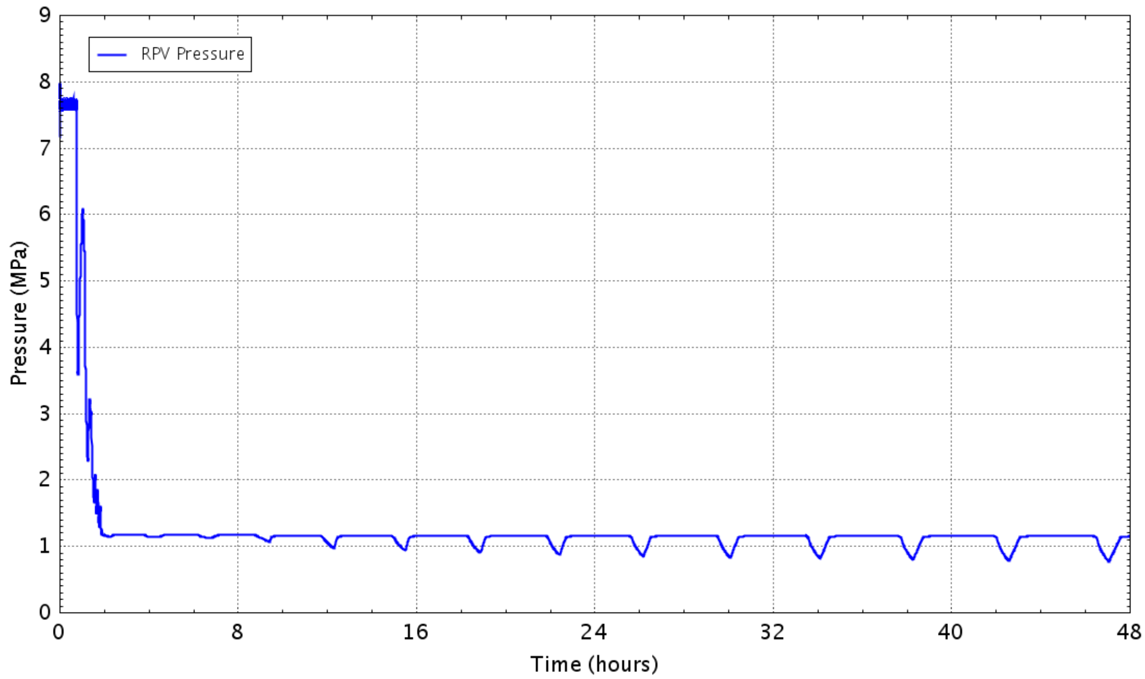

Figure E - 26 **Pressure in theRPV**

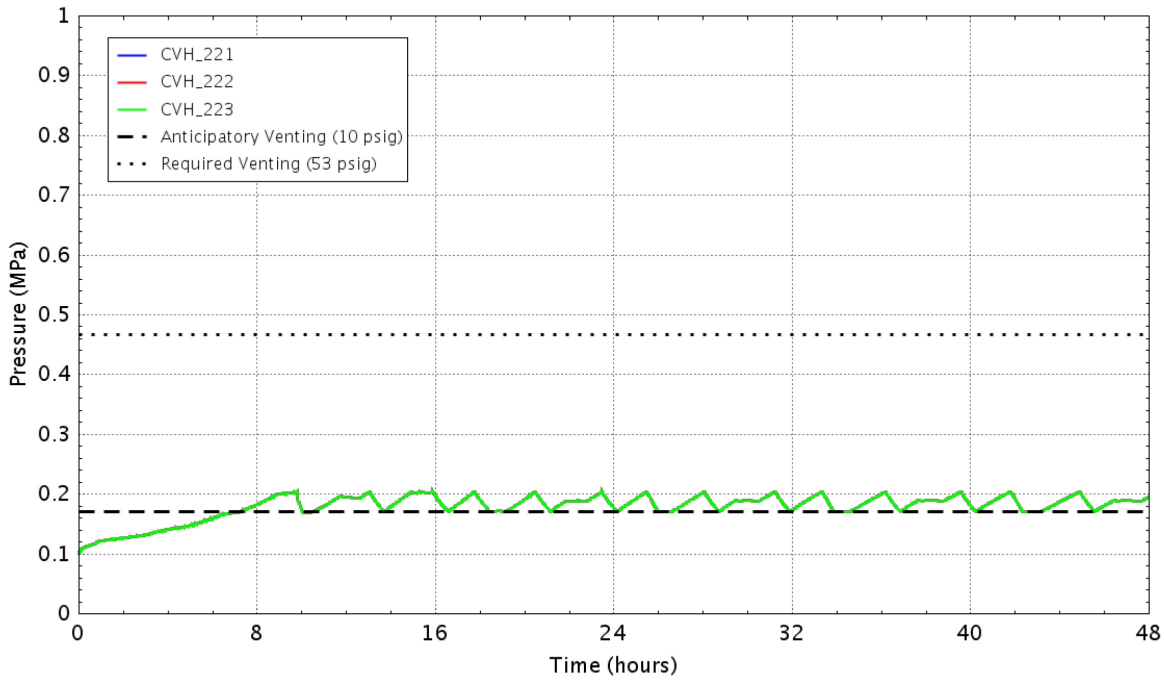

Figure E - 27 **Pressure in the wetwell**

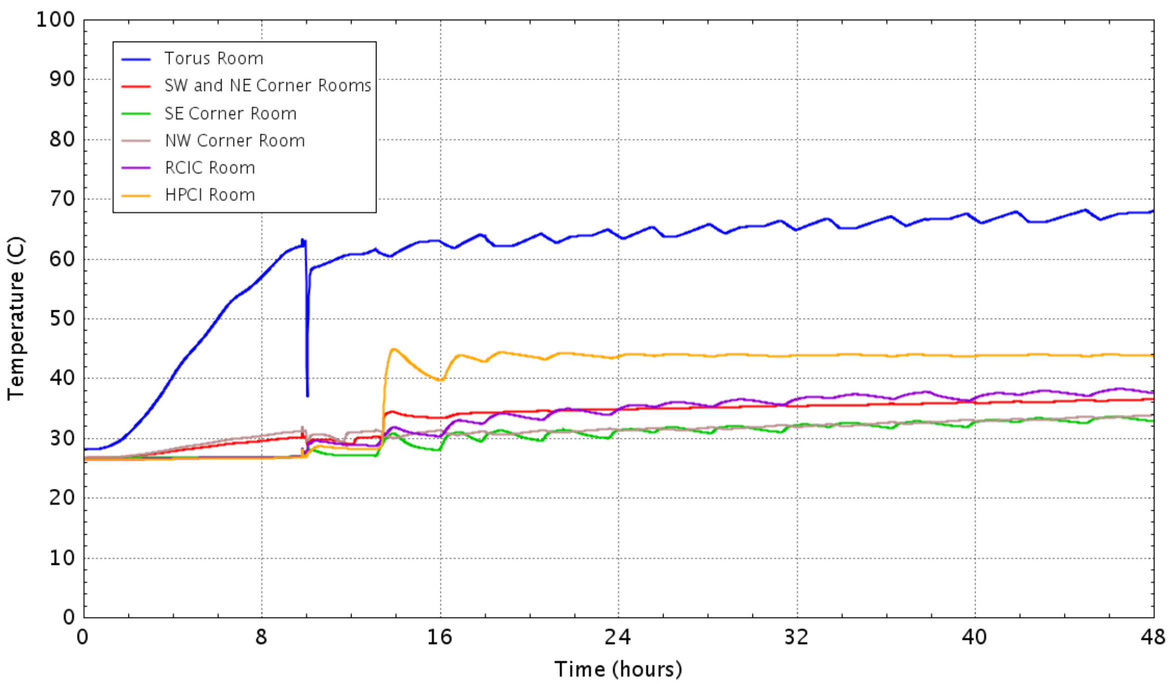

Figure E - 28 **Vapor temperature in the reactor building basement**

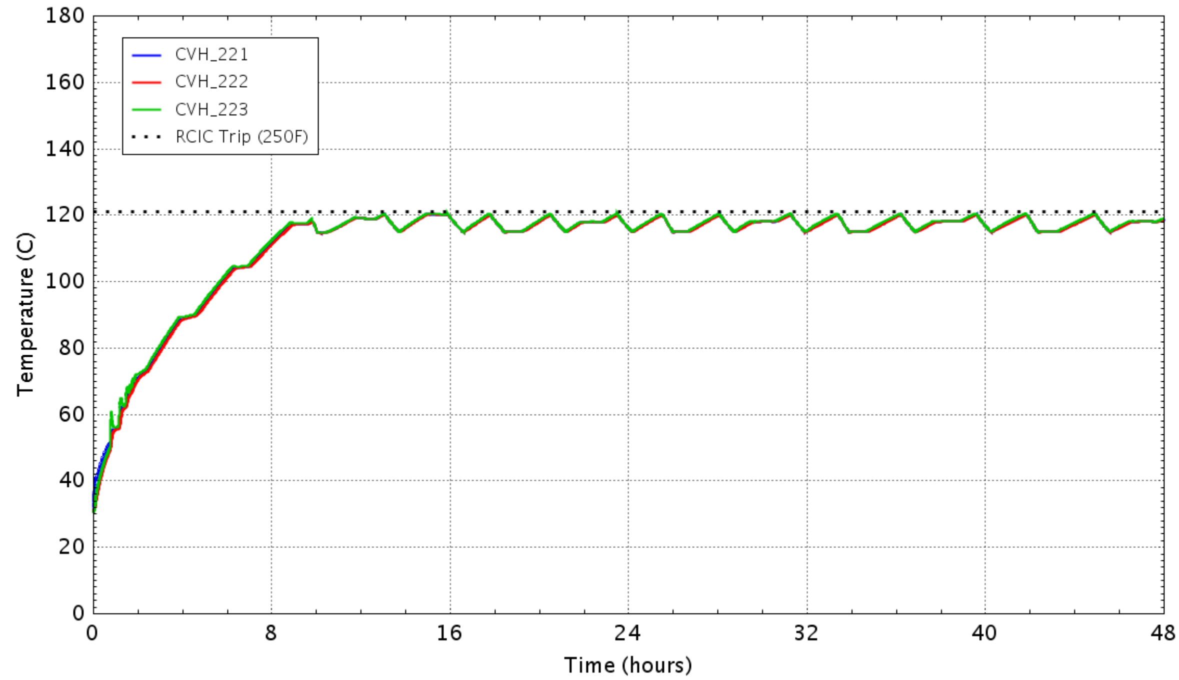

Figure E - 29 **Water temperature in the wetwell**

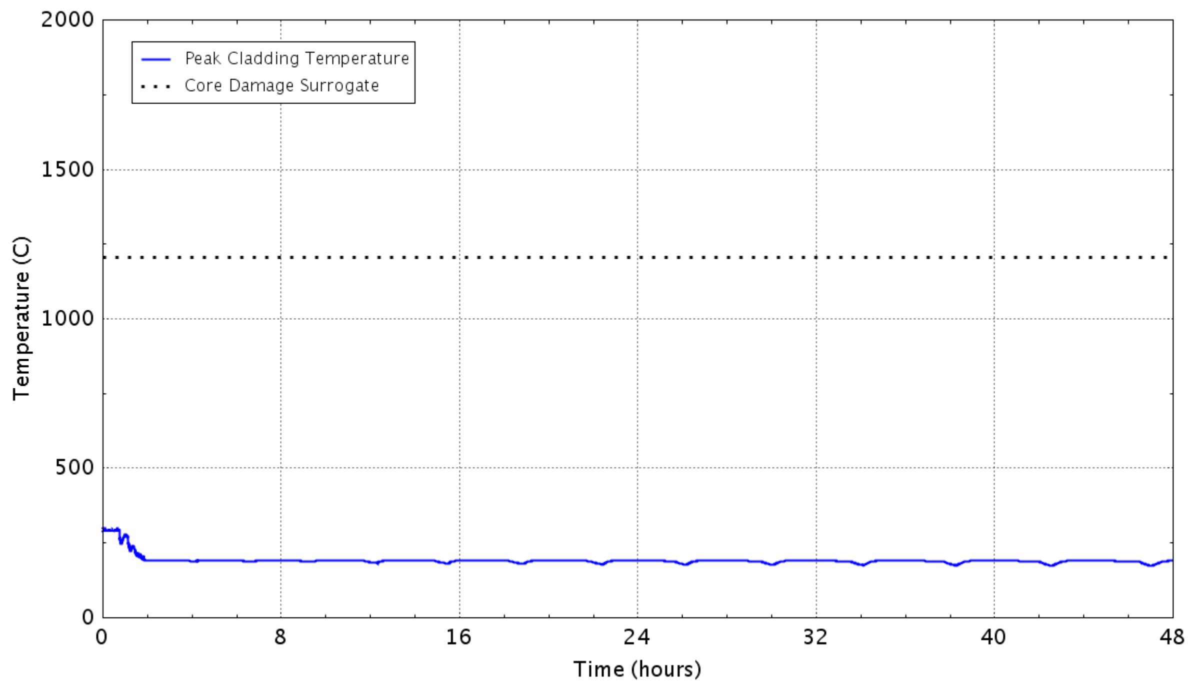

Figure E - 30 **Peak temperature of the fuel cladding as a function of time**

E.1.4 Case 4: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the 18-in. Drywell Main Vent, RCIC 50%Degraded

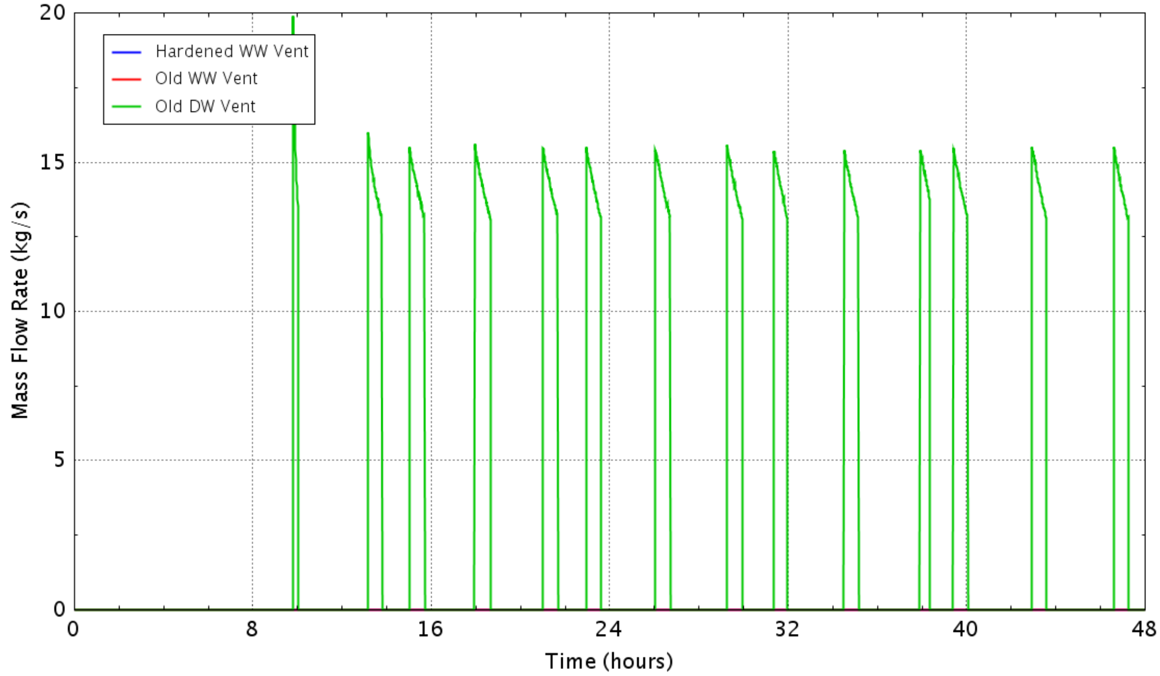

Figure E - 31 Flow rate of the containment vents

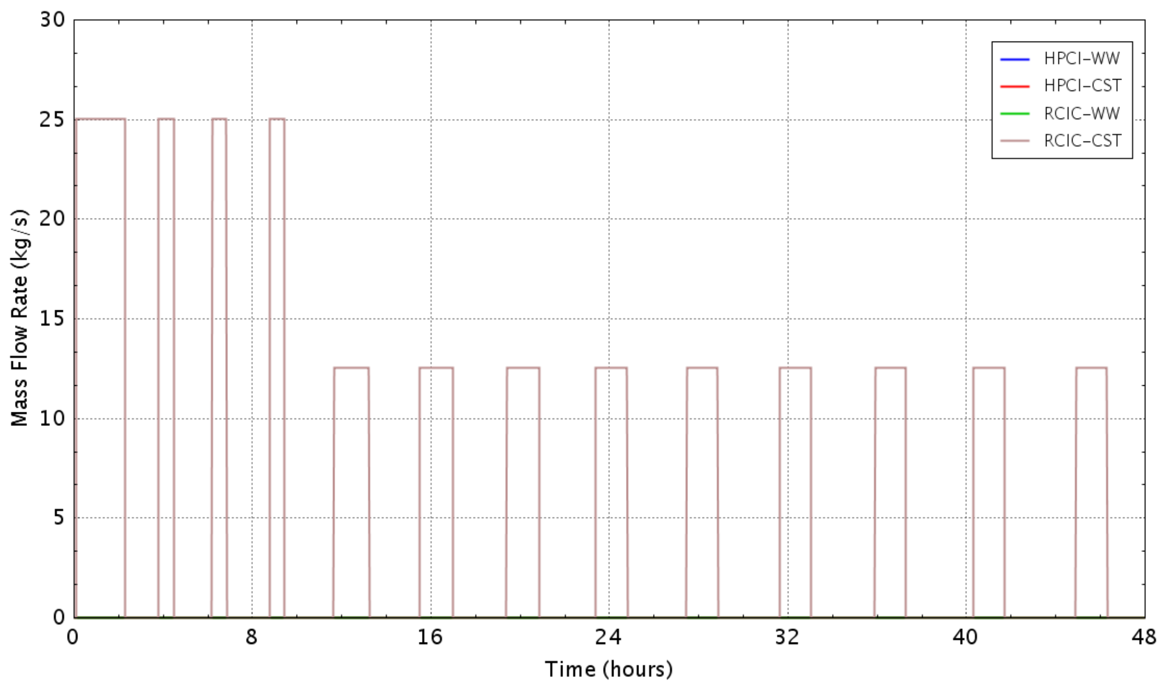

Figure E - 32 Flow rate of the HPCI/RCIC pumps

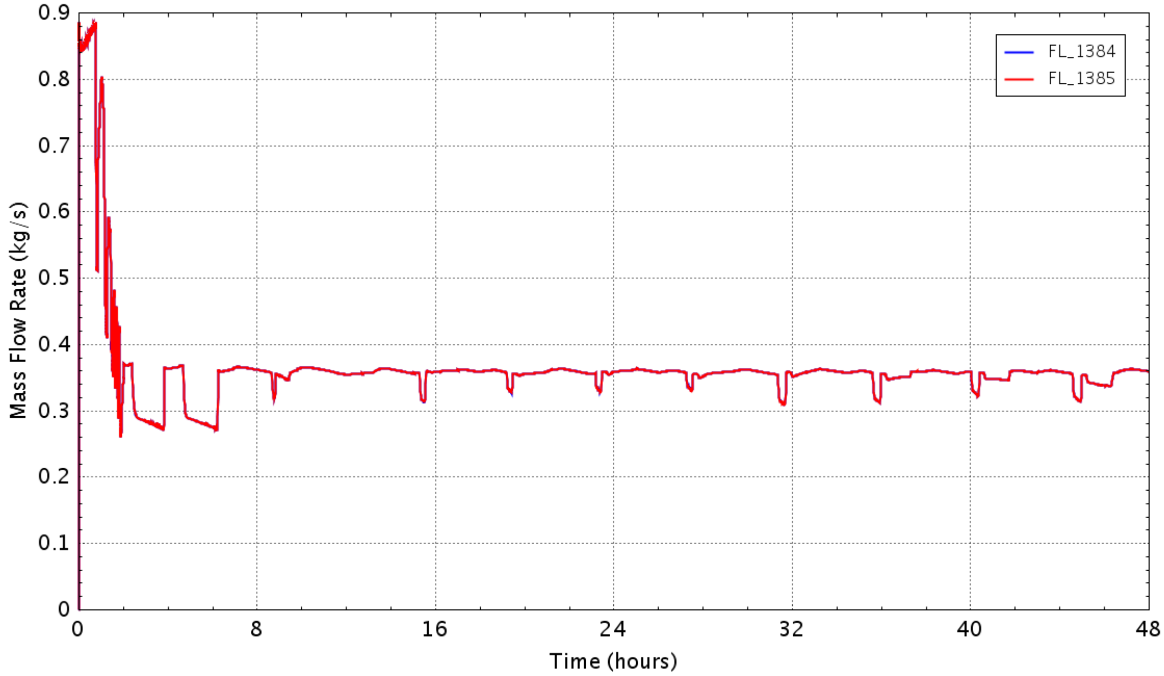

Figure E - 33 **Flow rate of the recirculating pump seal leakage**

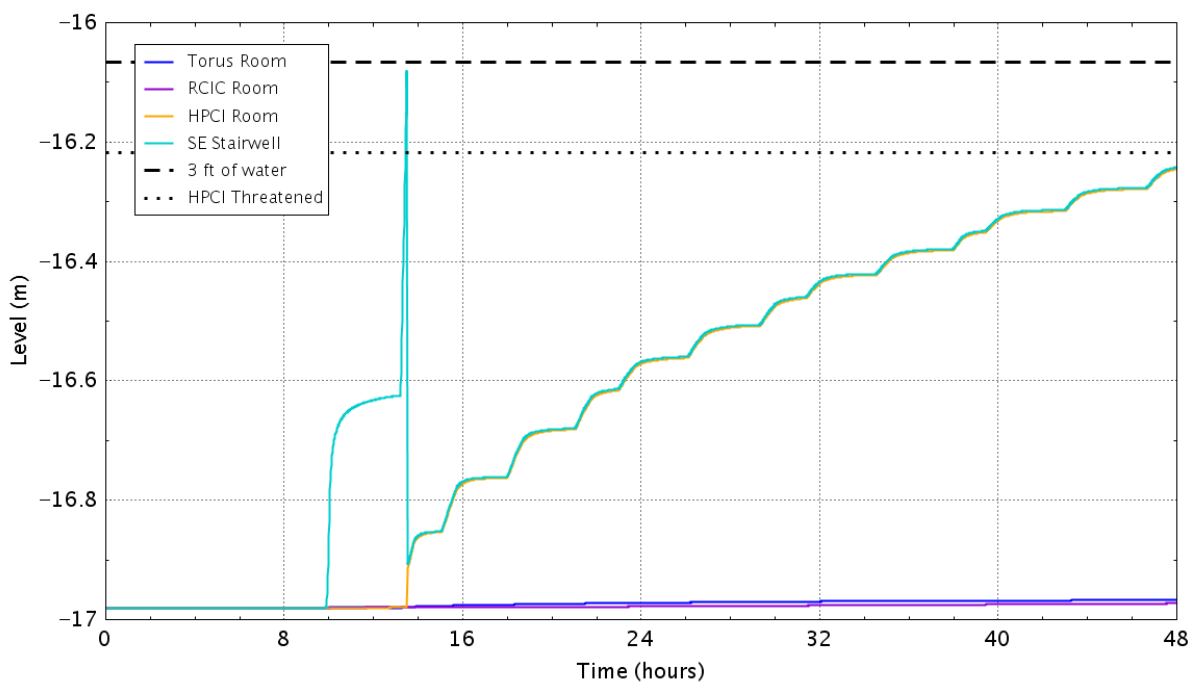

Figure E - 34 **Water level in the reactor building basement**

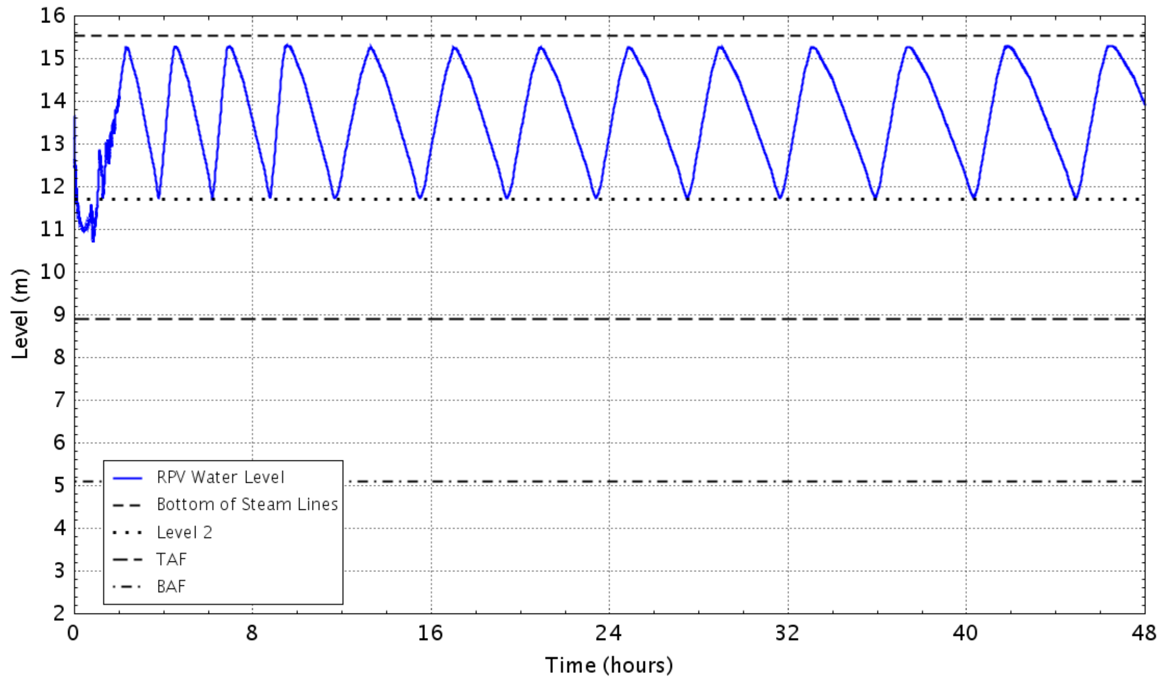

Figure E - 35 RPV down comer water level

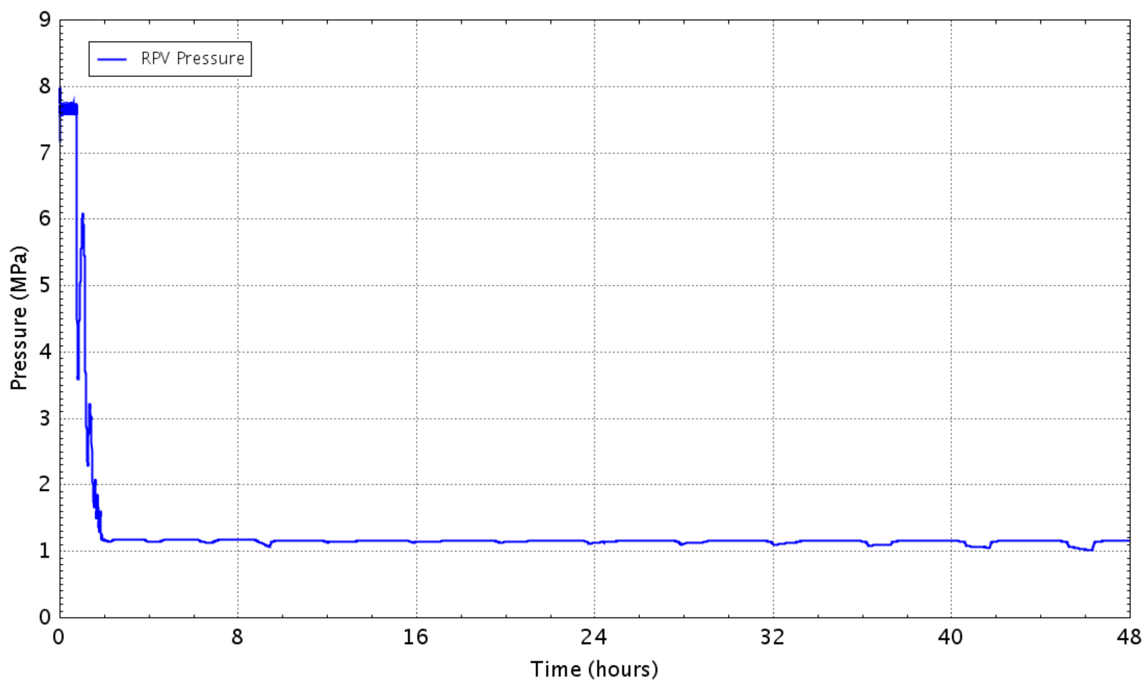

Figure E - 36 Pressure in theRPV

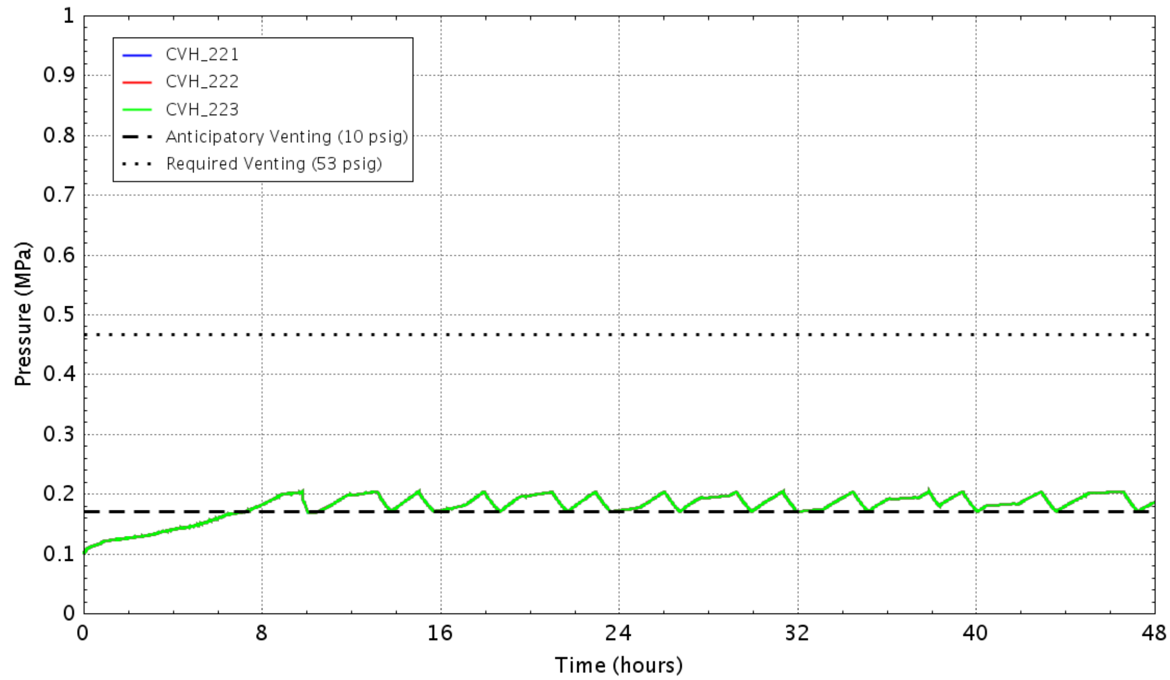

Figure E - 37 Pressure in the wetwell

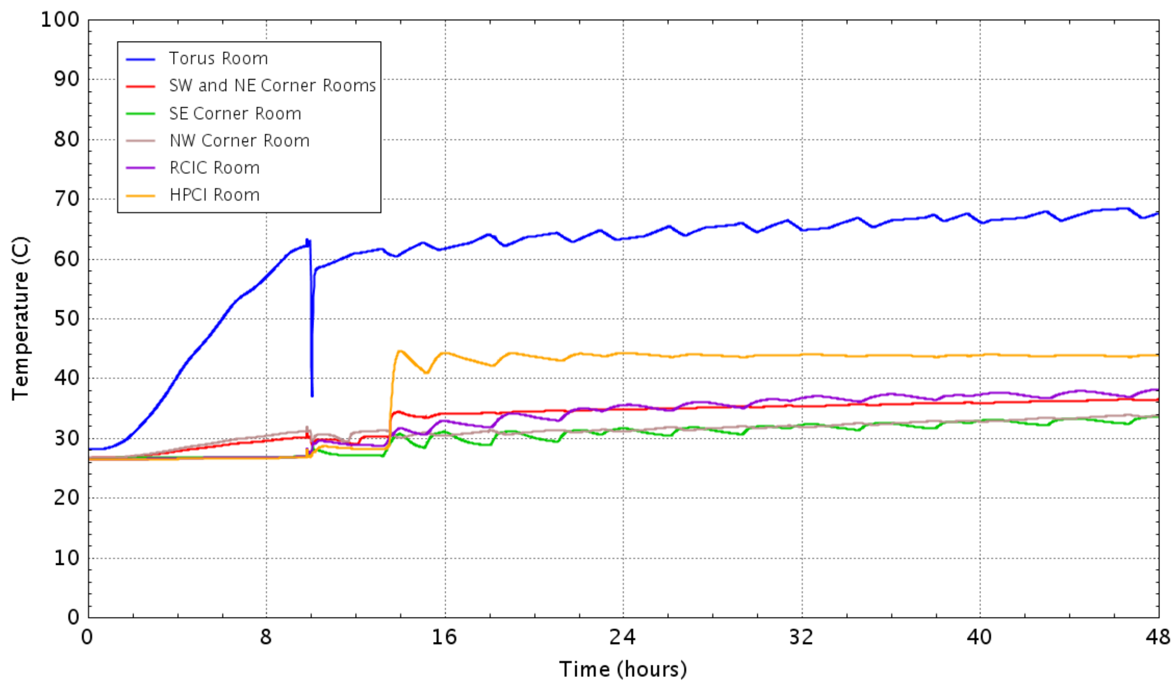

Figure E - 38 Vapor temperature in the reactor building basement

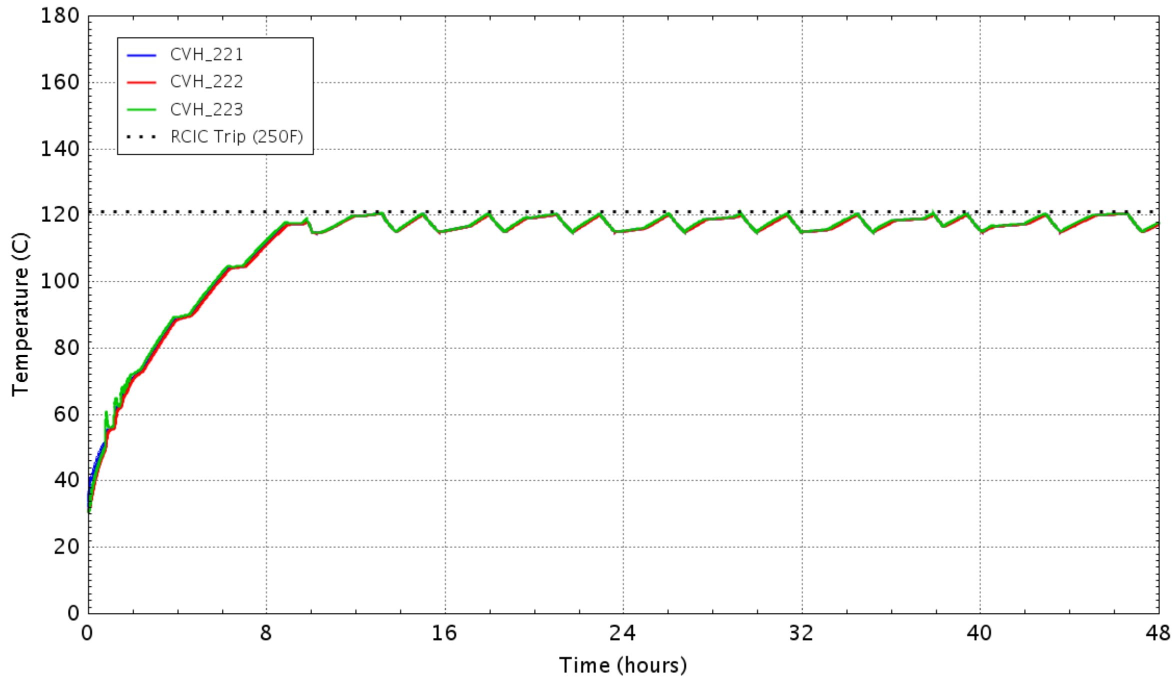

Figure E - 39 **Water temperature in the wetwell**

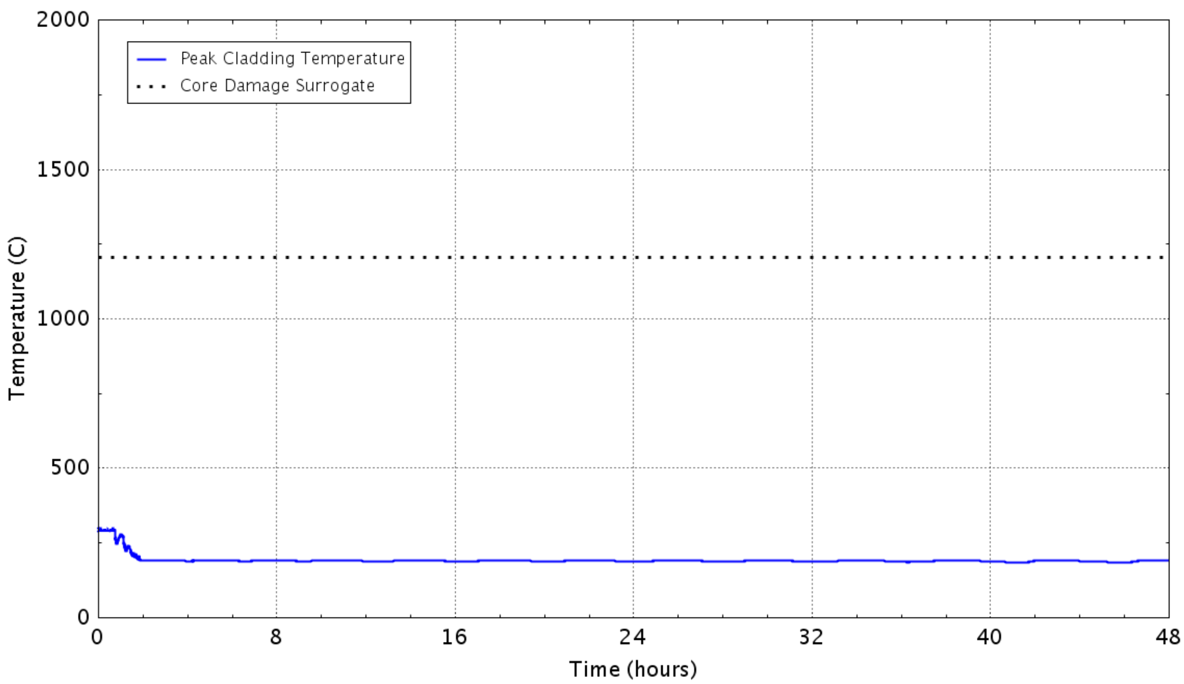

Figure E - 40 **Peak temperature of the fuel cladding as a function of time**

E.1.5 Case 5: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the HCV, ECCS Fully Functional

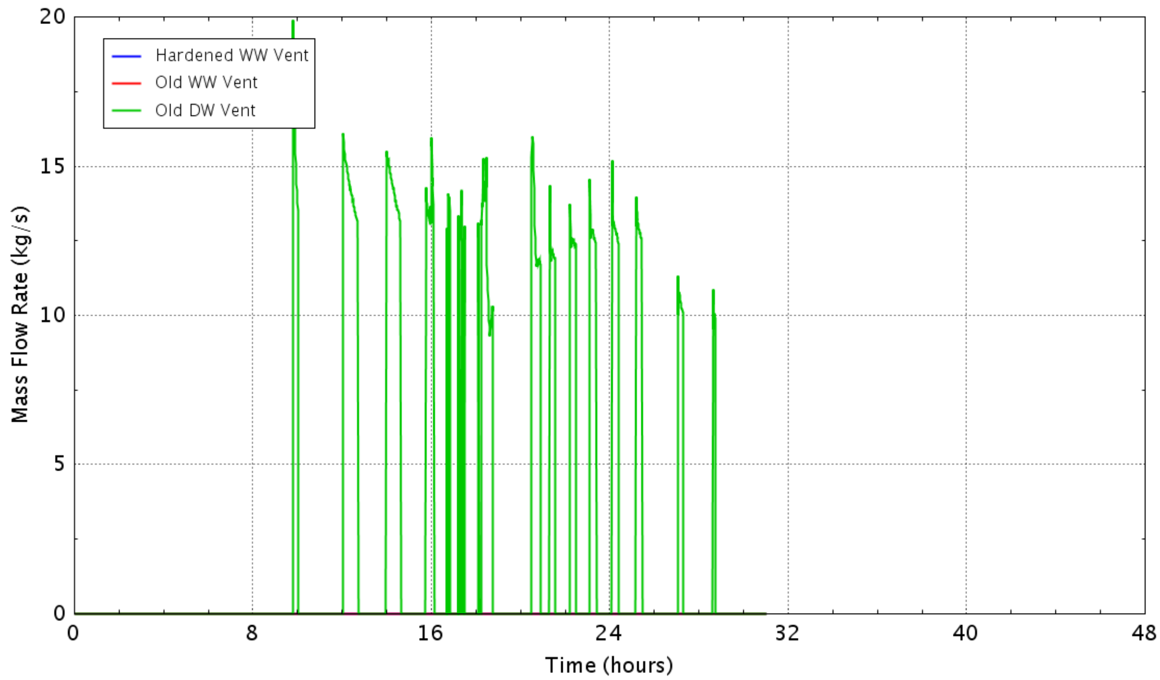

Figure E - 41 Flow rate of the containment vents

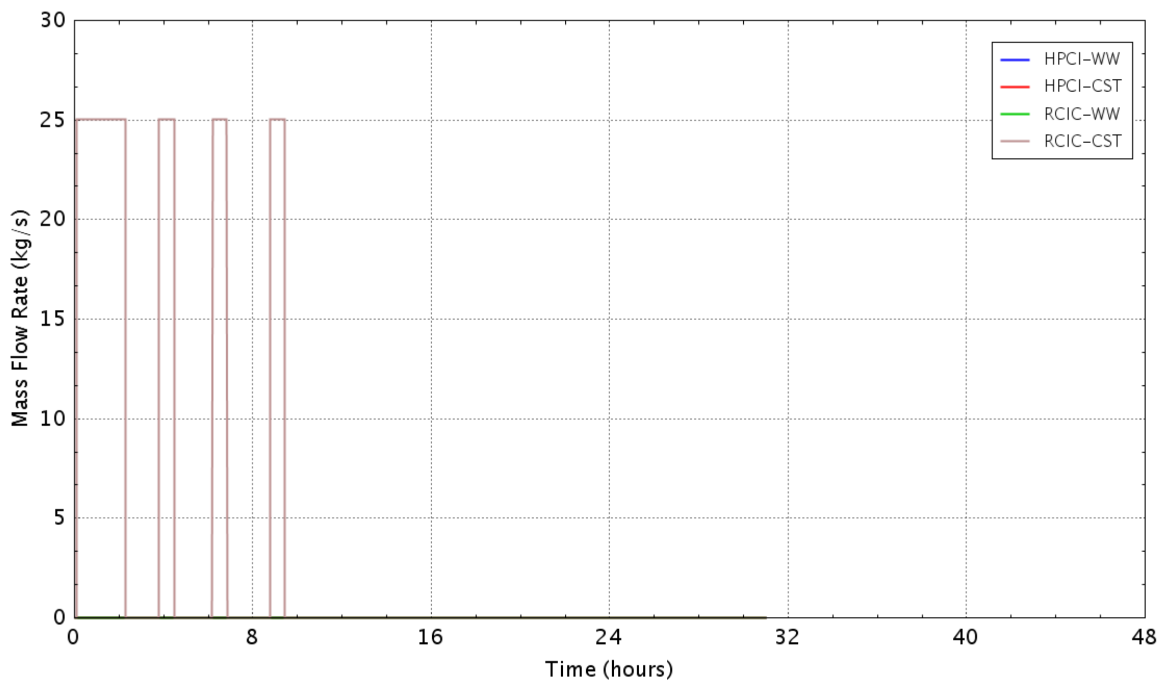

Figure E - 42 Flow rate of the HPCI/RCIC pumps

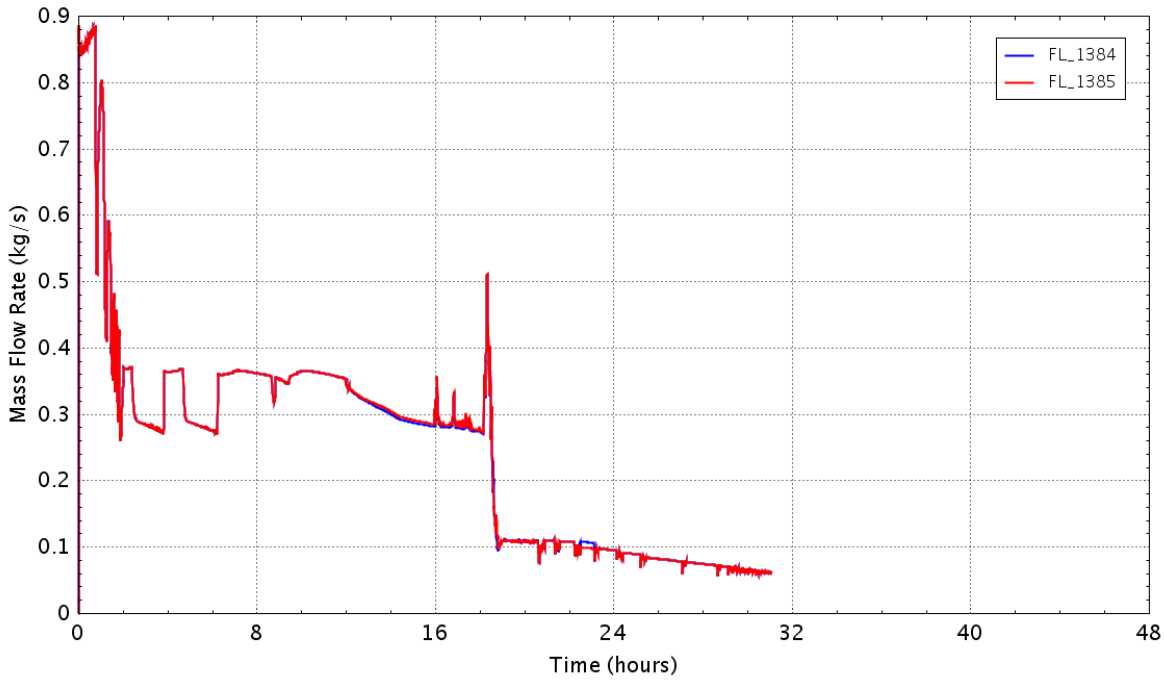

Figure E - 43 **Flow rate of the recirculating pump seal leakage**

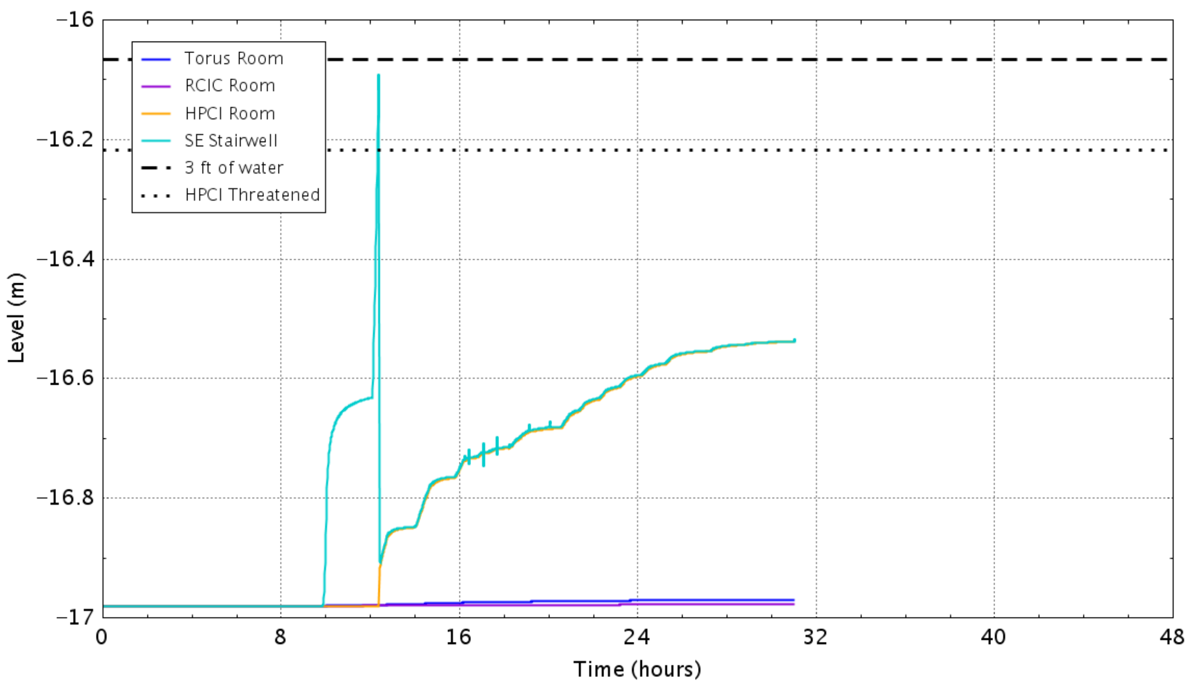

Figure E - 44 **Water level in the reactor building basement**

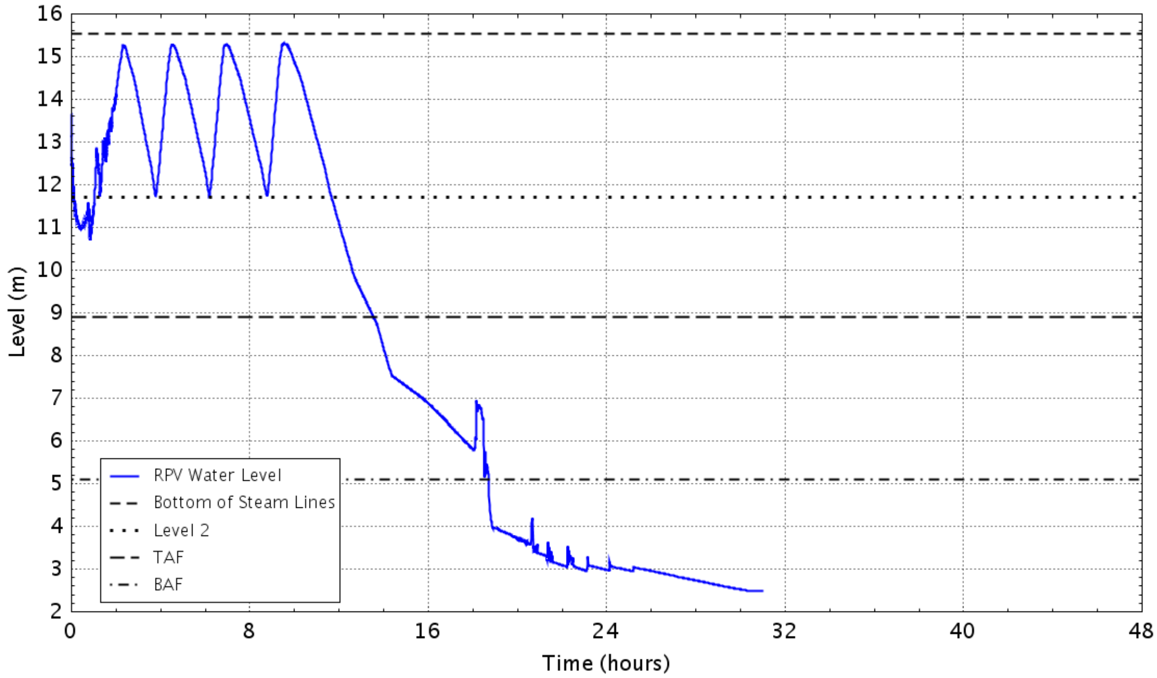

Figure E - 45 RPV down comer water level

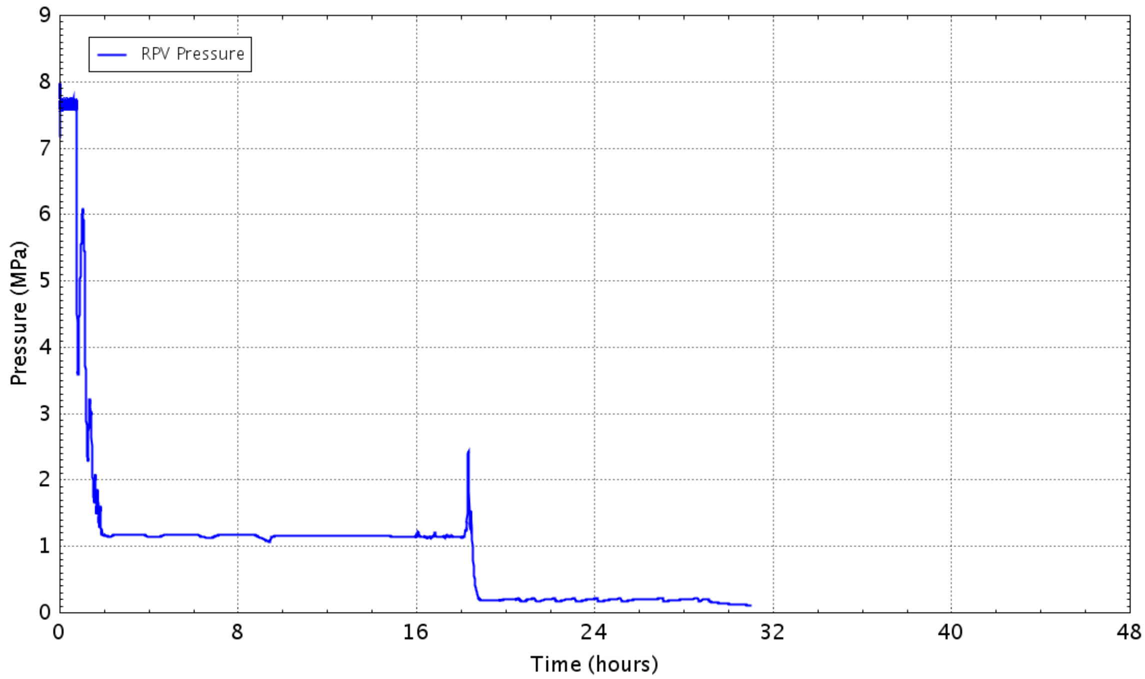

Figure E - 46 Pressure in theRPV

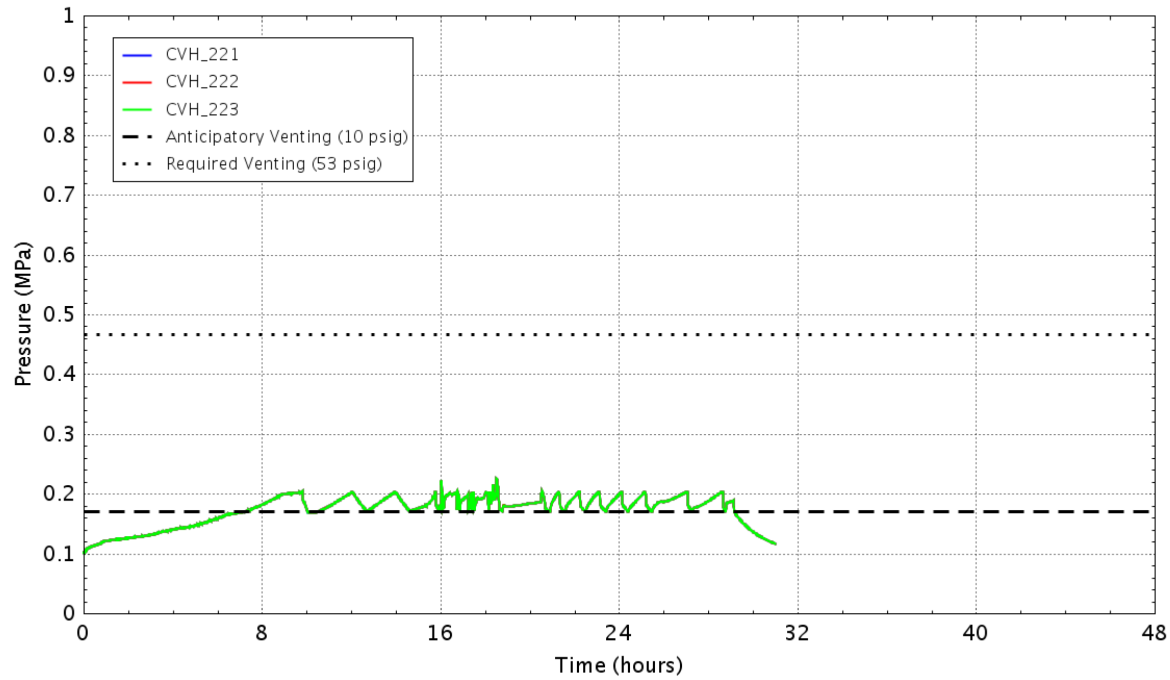

Figure E - 47 **Pressure in the wetwell**

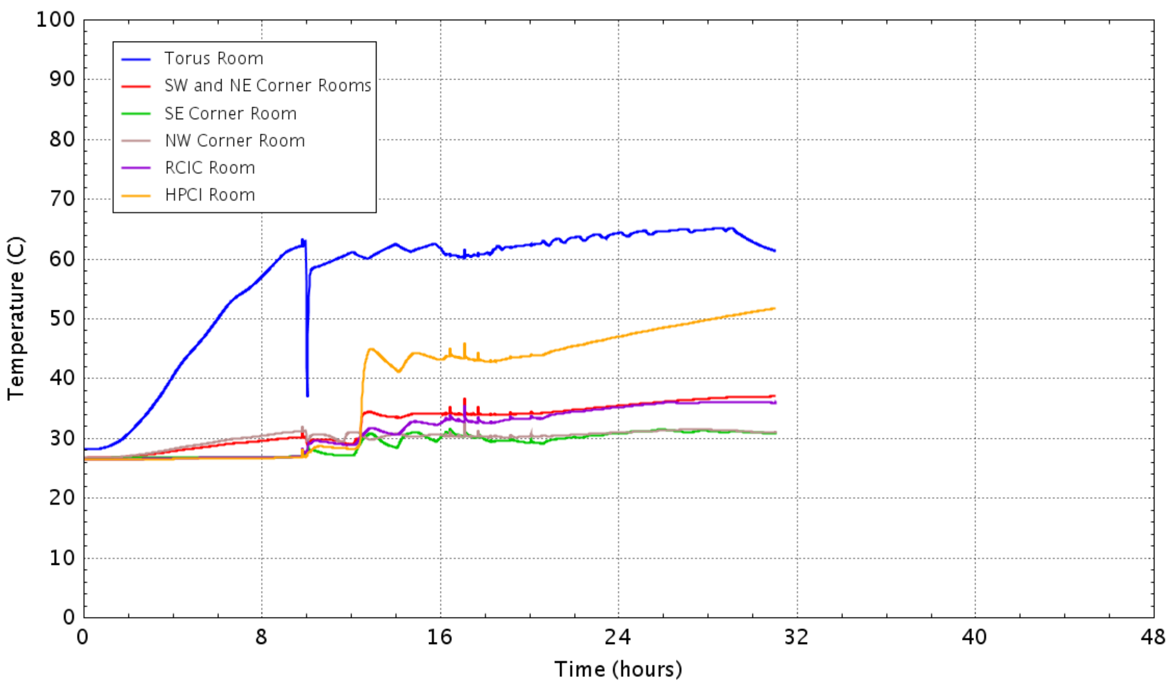

Figure E - 48 **Vapor temperature in the reactor building basement**

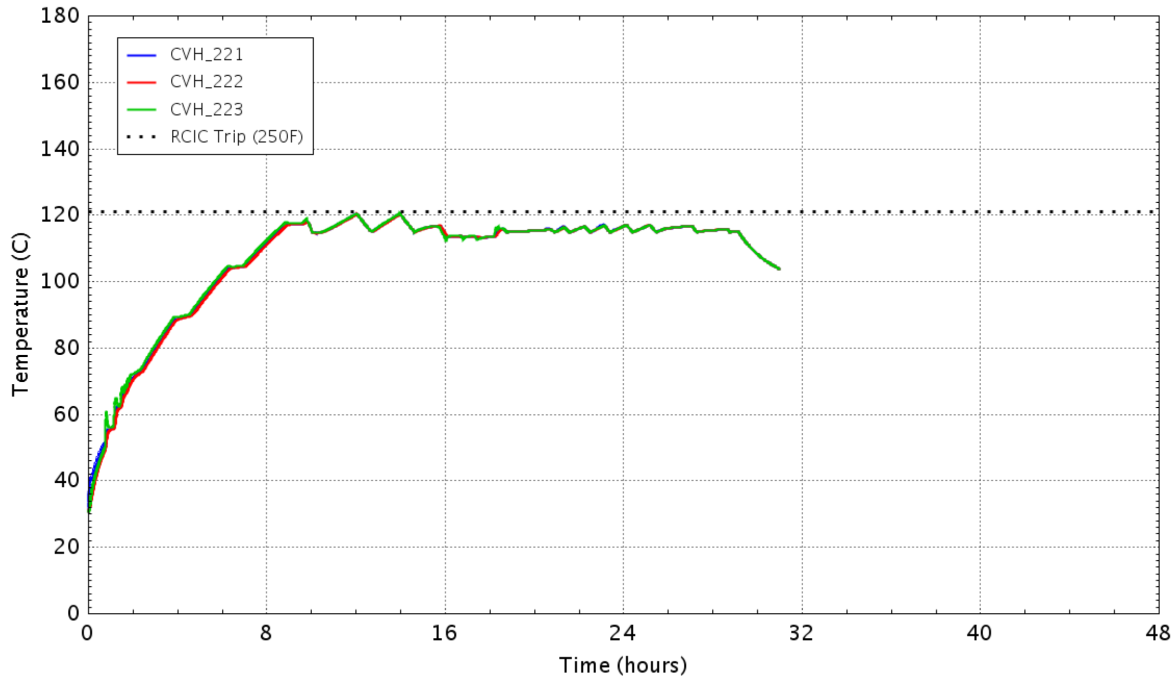

Figure E - 49 **Water temperature in the wetwell**

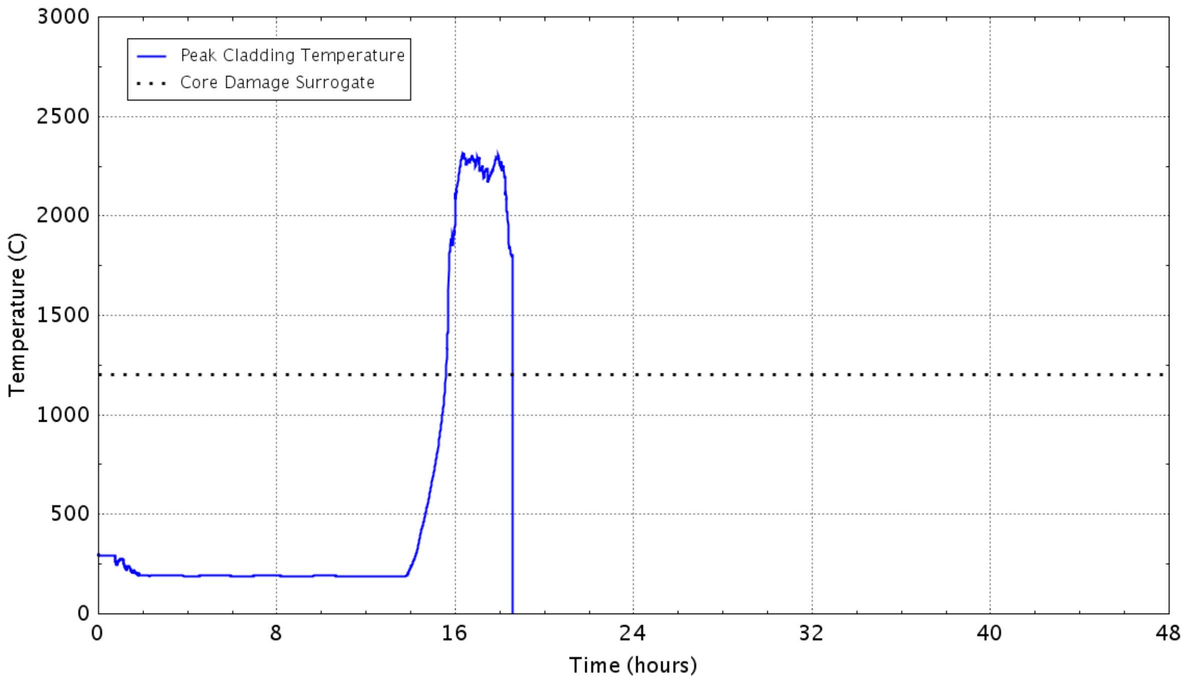

Figure E - 50 **Peak temperature of the fuel cladding as a function of time**

E.1.6 Case 6: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the HCV, ECCS 50% Degraded

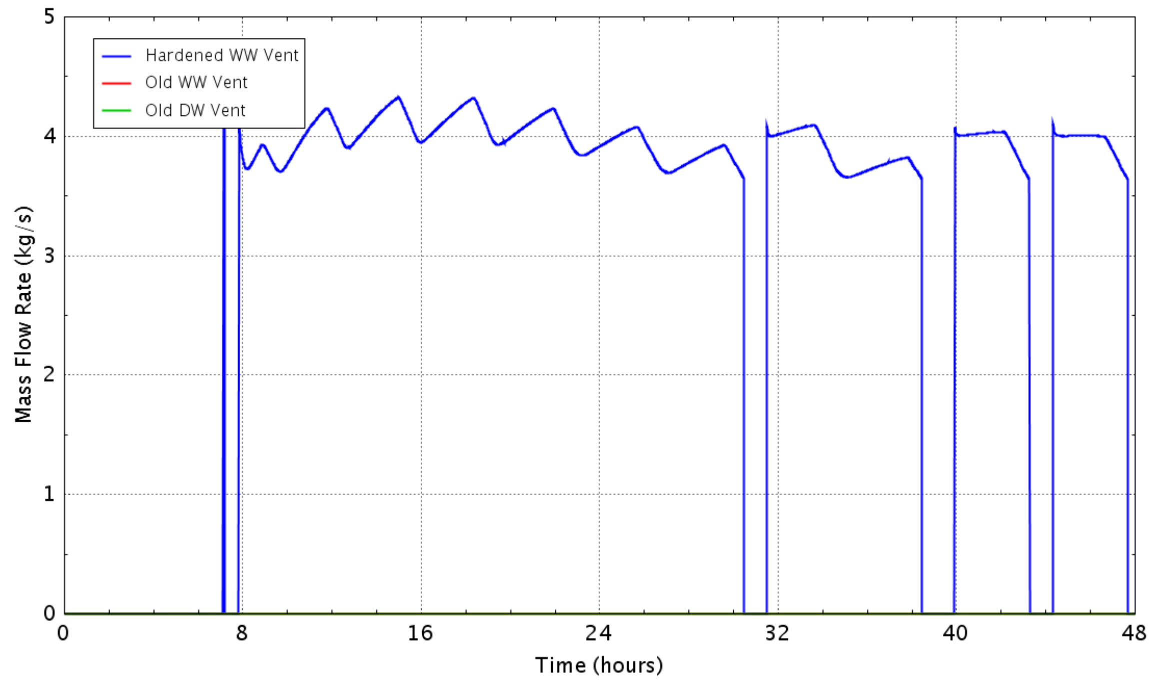

Figure E - 51 **Flow rate of the containment vents**

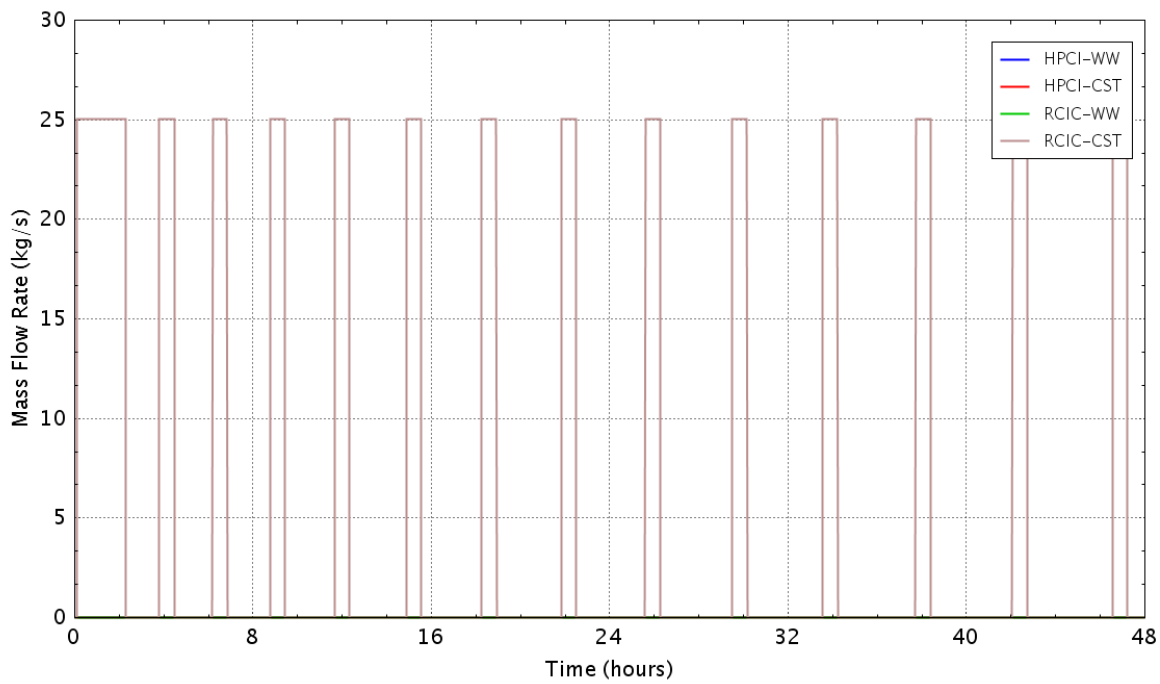

Figure E – 52 **Flow rate of the HPCI/RCIC pumps**

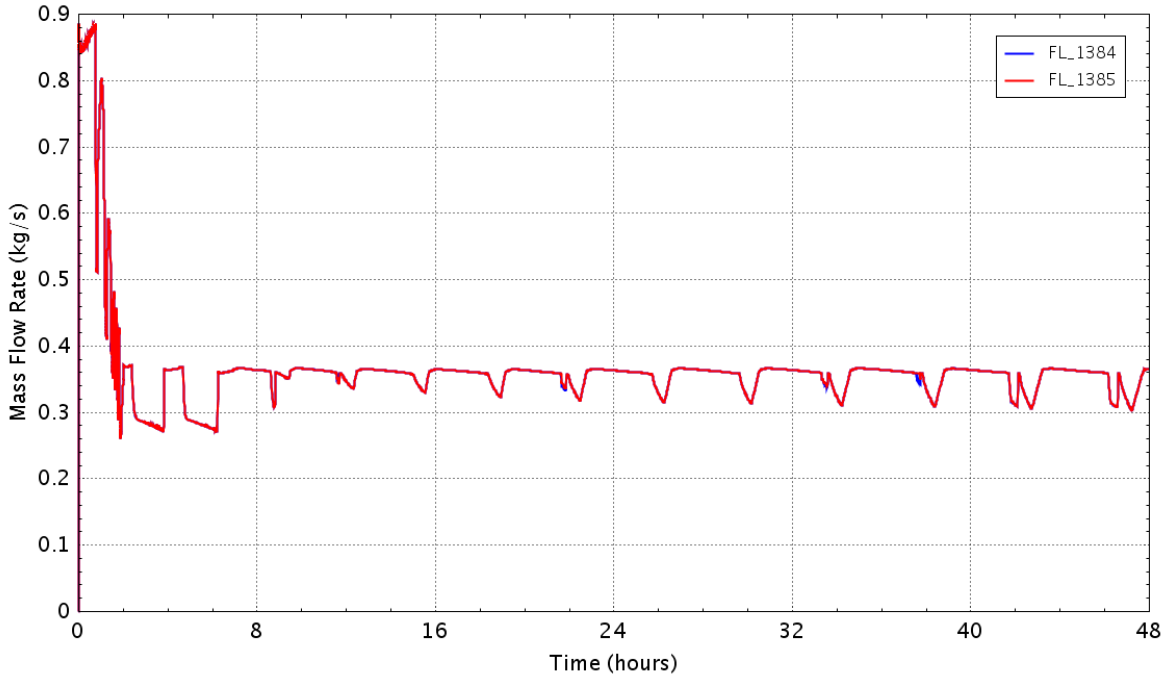

Figure E - 53 Flow rate of the recirculating pump seal leakage

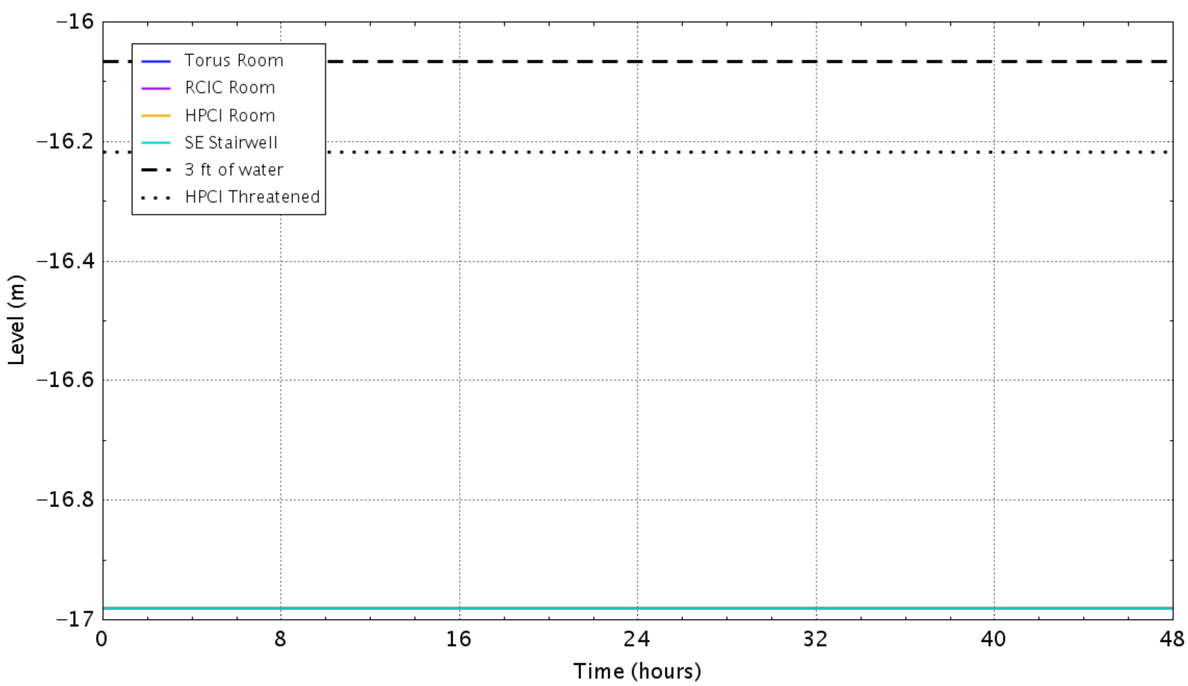

Figure E - 54 Water level in the reactor building basement

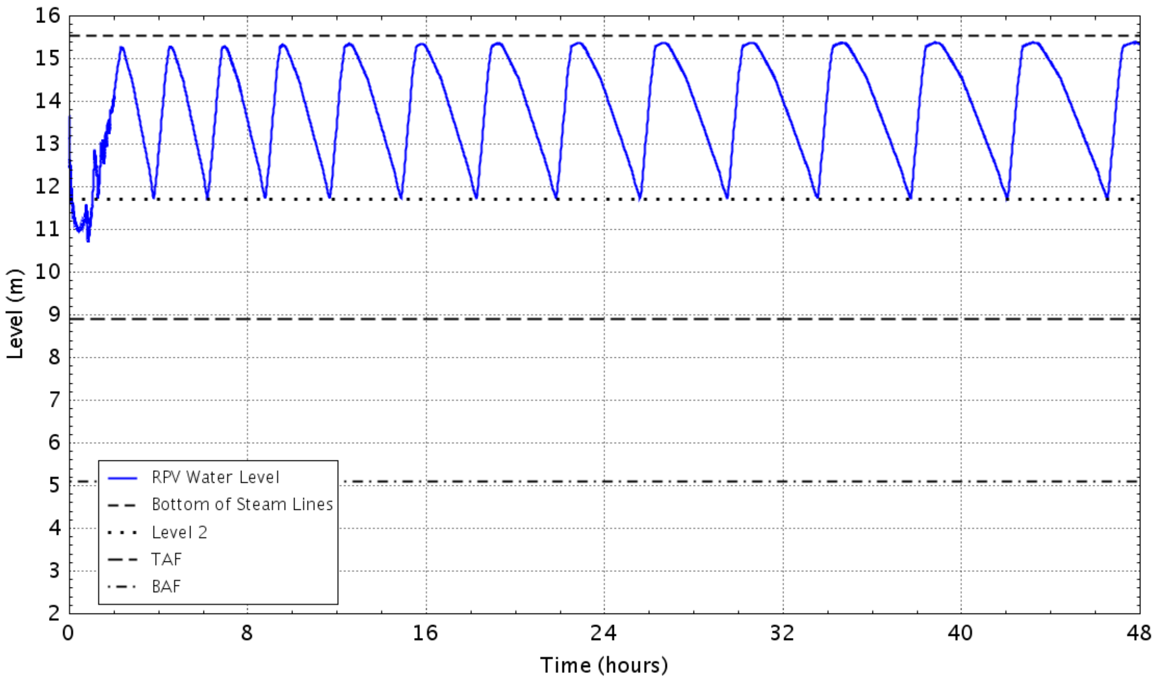

Figure E - 55 RPV down comer water level

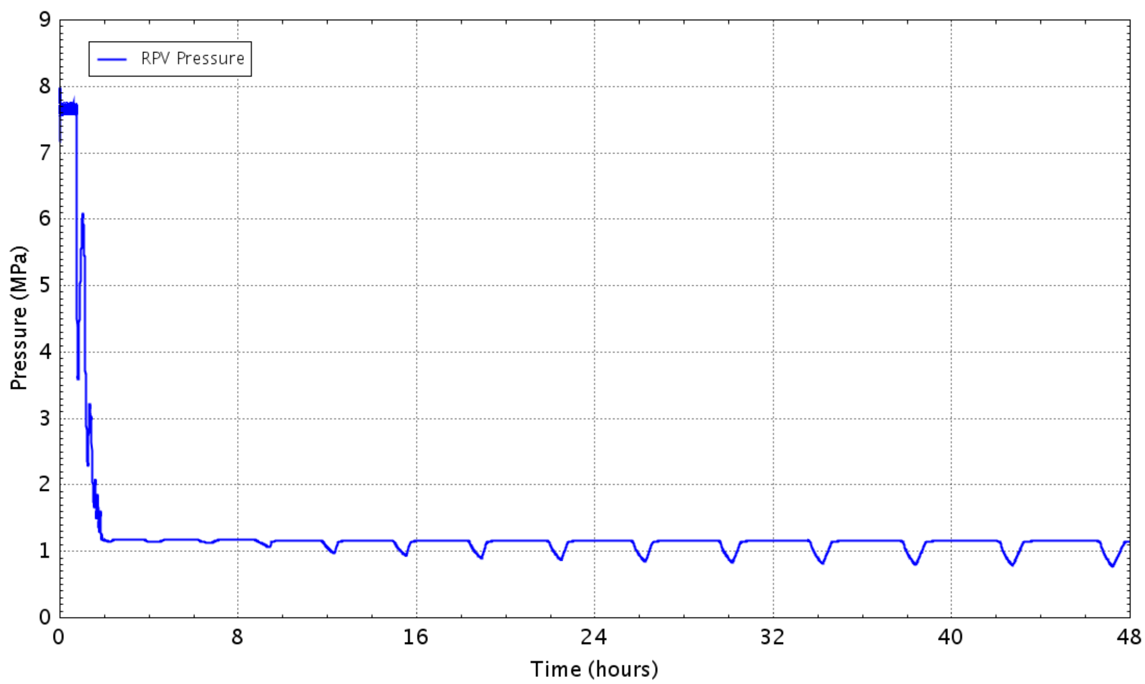

Figure E - 56 Pressure in theRPV

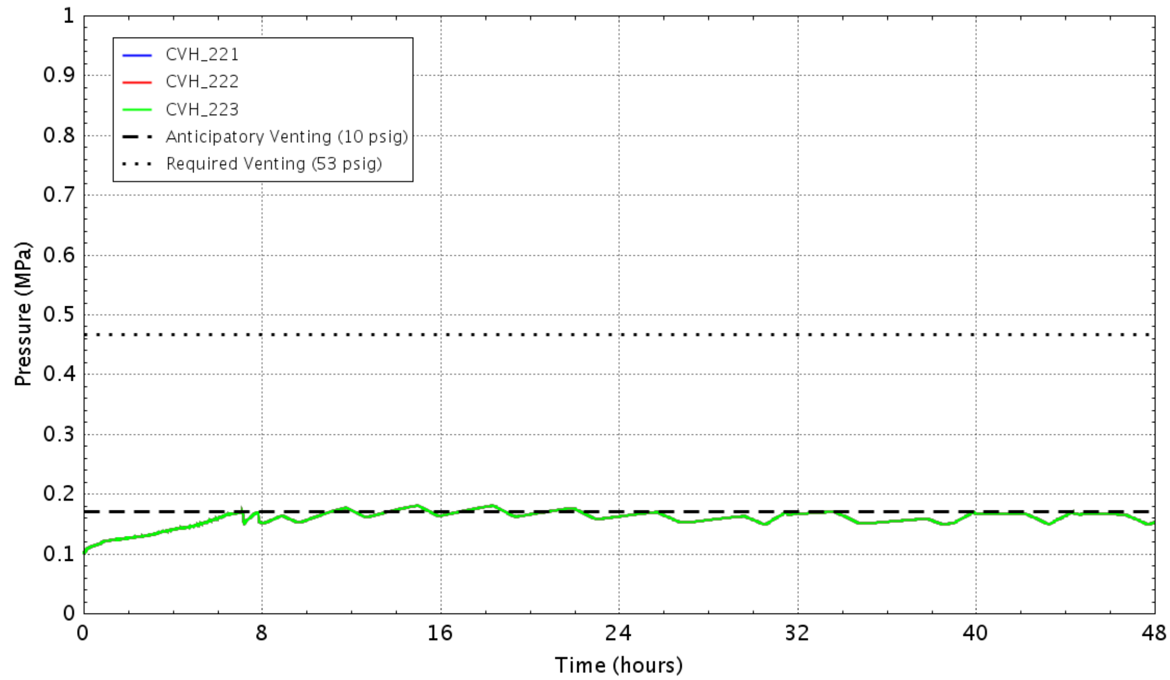

Figure E - 57 **Pressure in the wetwell**

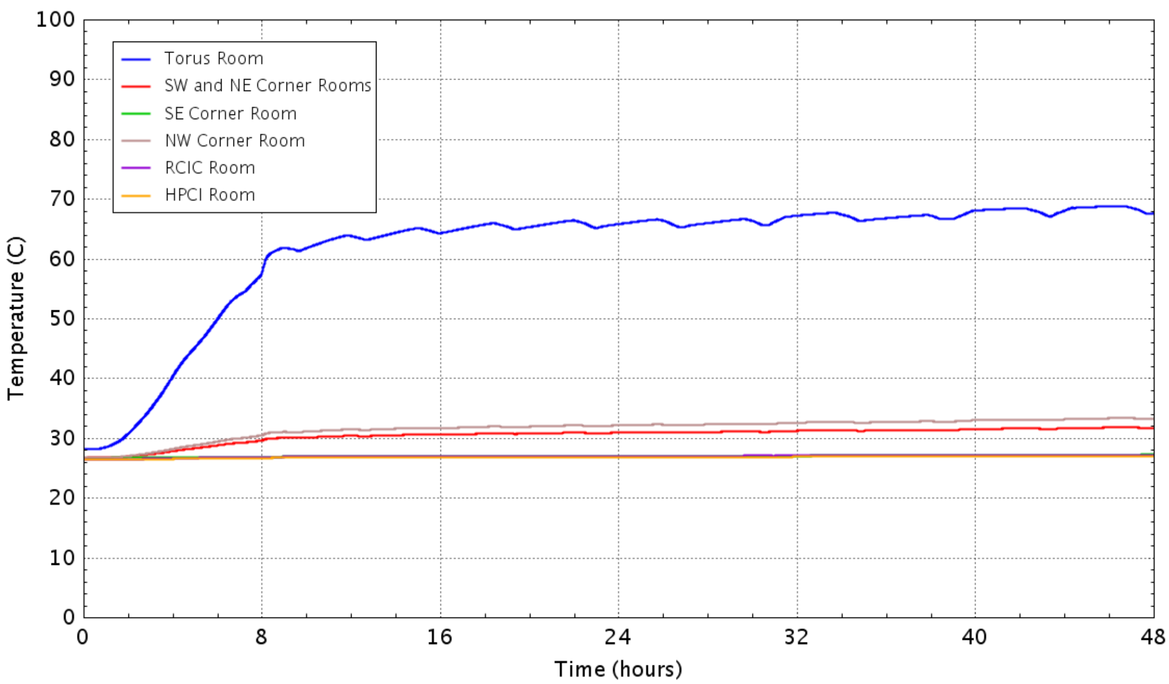

Figure E - 58 **Vapor temperature in the reactor building basement**

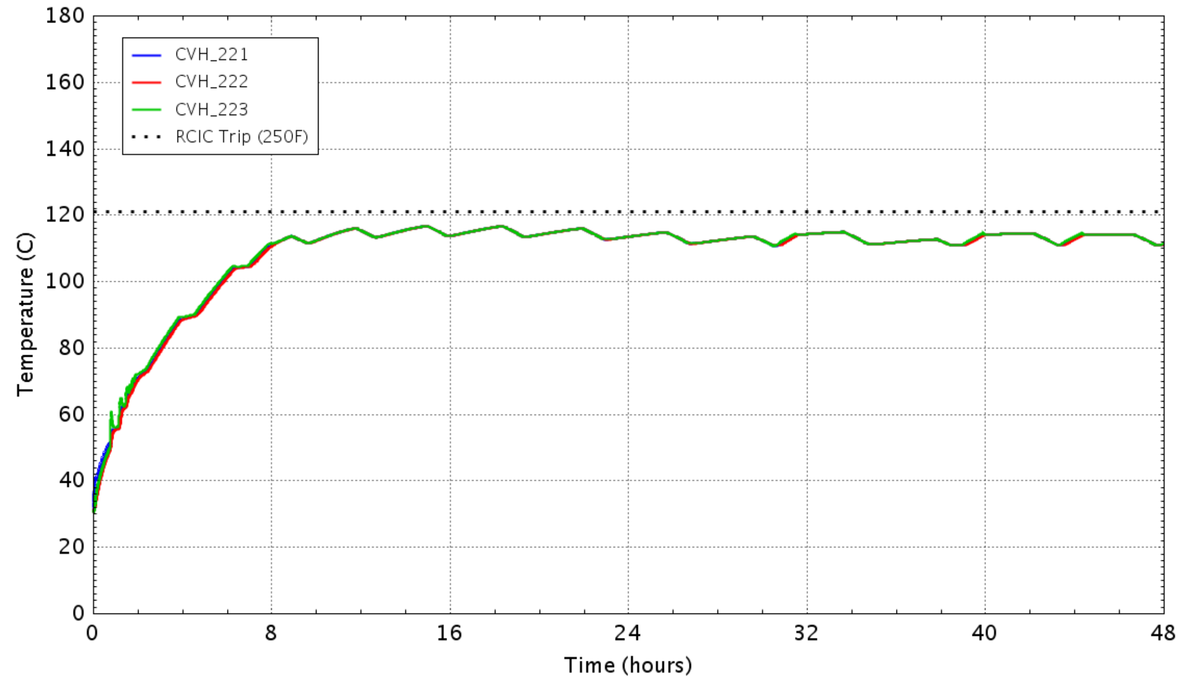

Figure E - 59 Water temperature in the wetwell

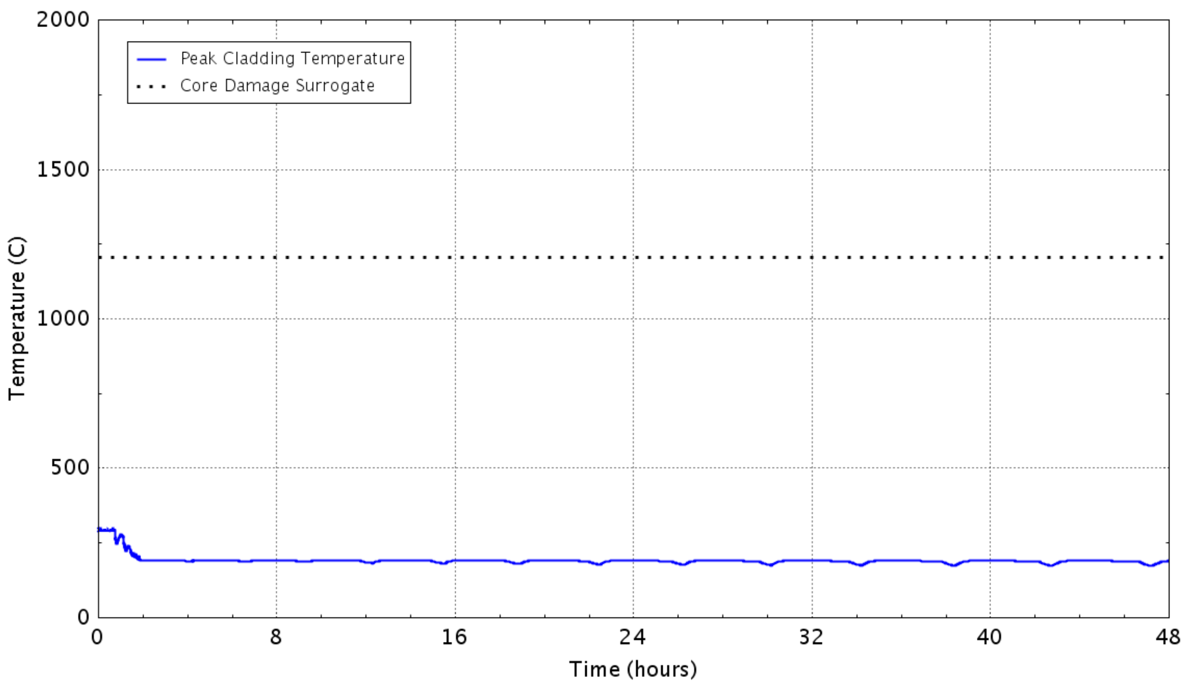

Figure E – 60 Peak temperature of the fuel cladding as a function oftime

E.1.7 Case 7: LOOPGR-38-9, Perform Anticipatory Venting, Containment Venting via the HCV, ECCS Non-functional

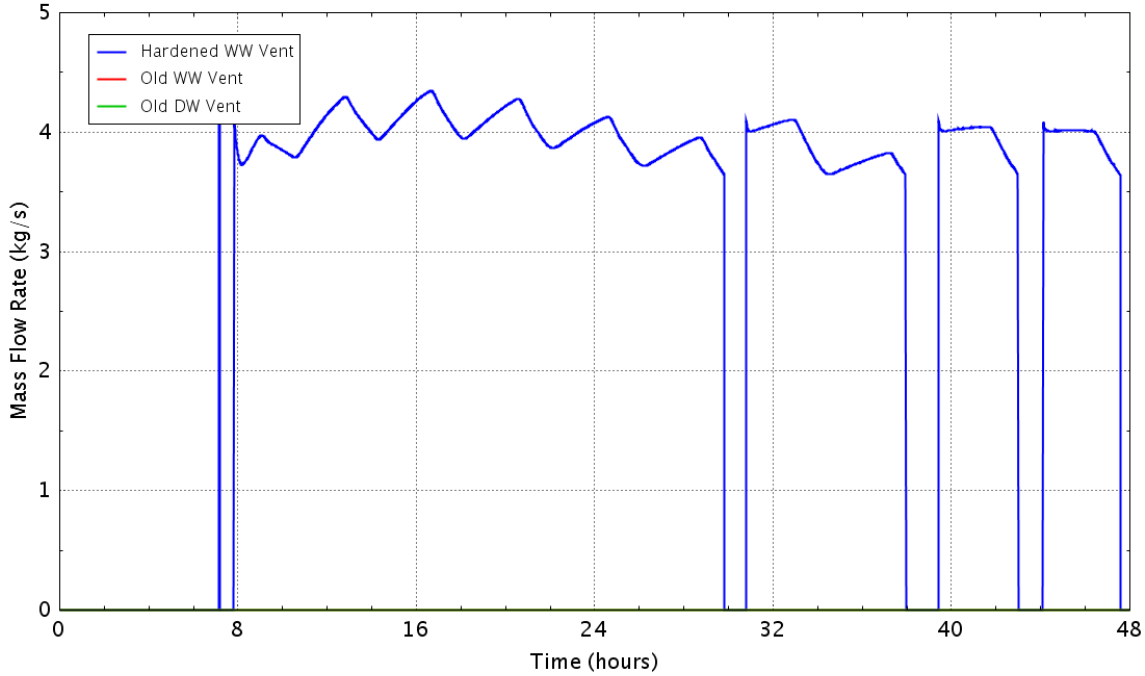

Figure E - 61 Flow rate of the containment vents

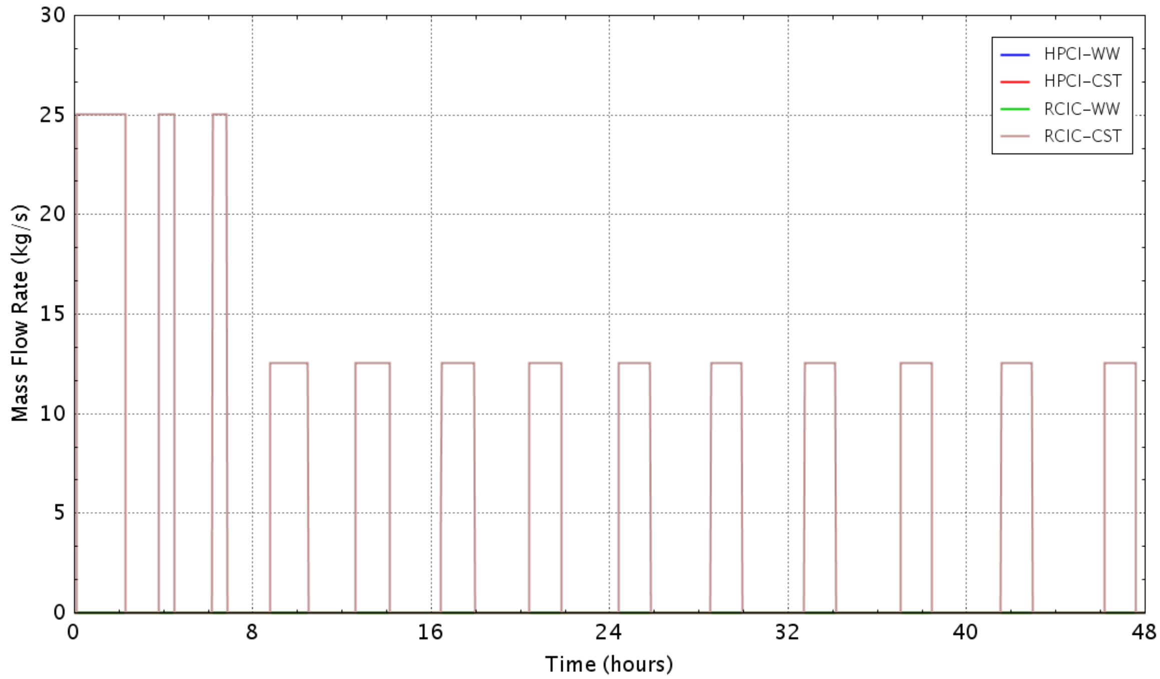

Figure E - 62 Flow rate of the HPCI/RCIC pumps

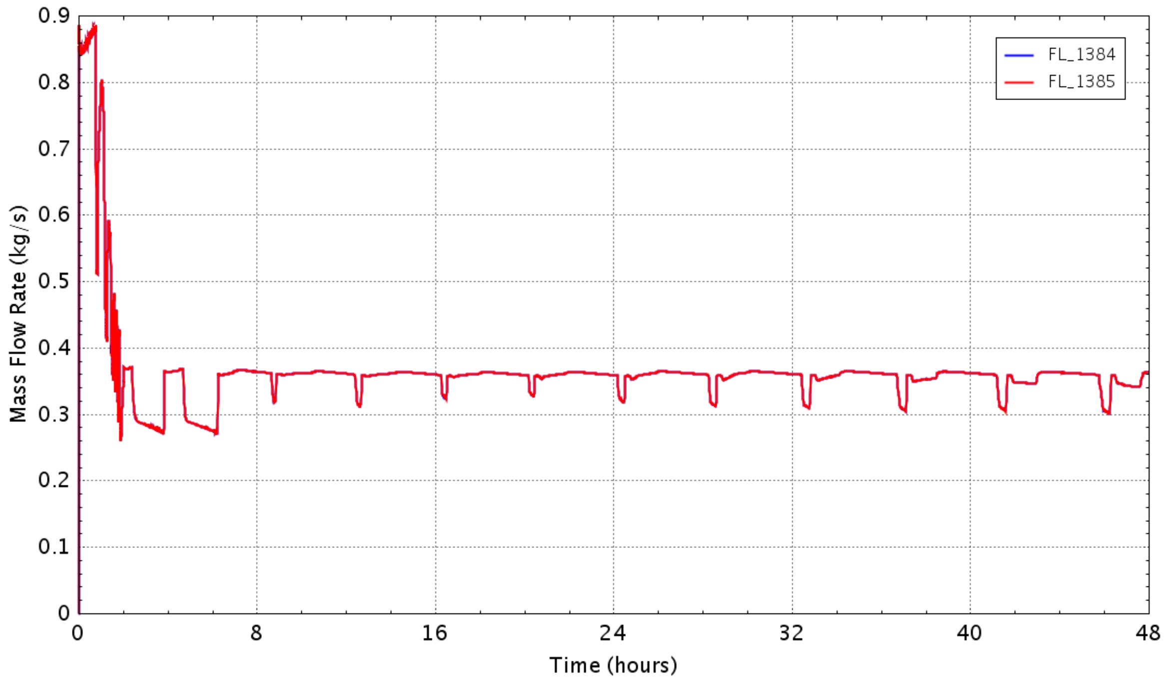

Figure E - 63 Flow rate of the recirculating pump seal leakage

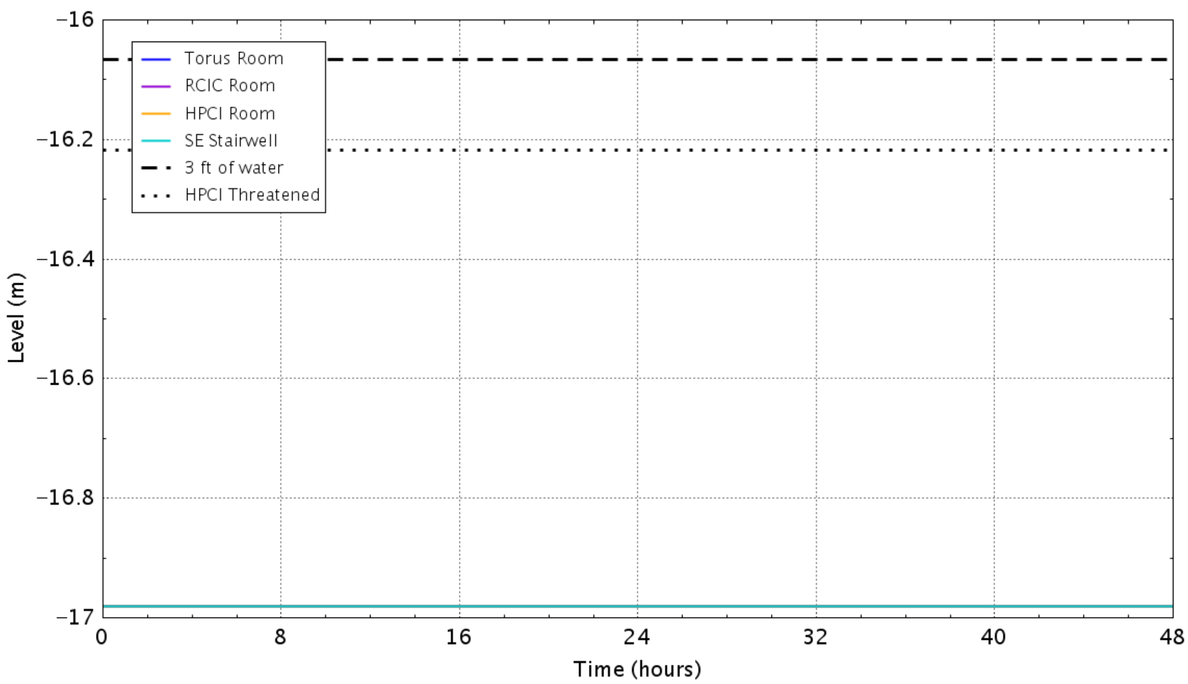

Figure E - 64 Water level in the reactor building basement

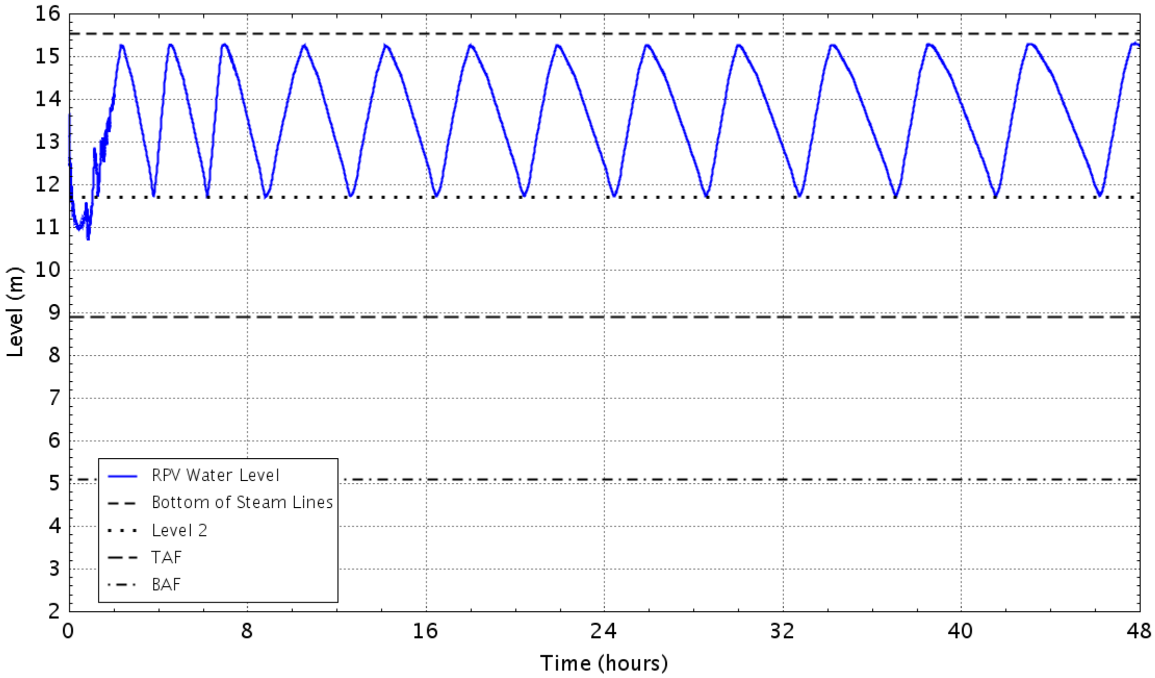

Figure E - 65 RPV down comer water level

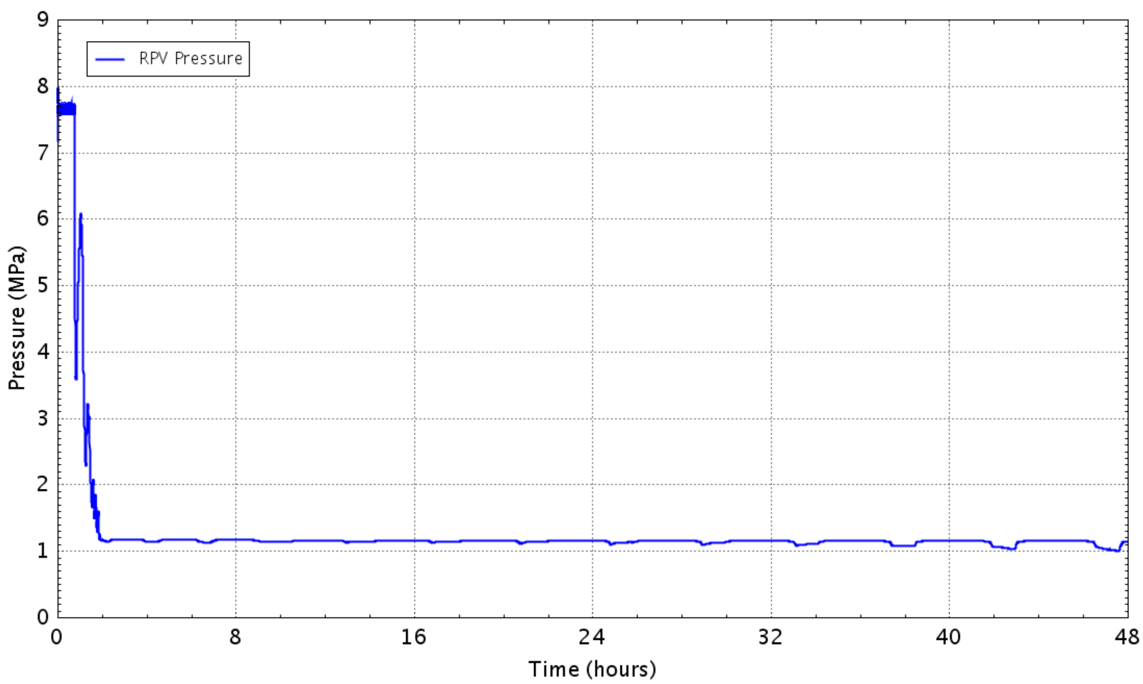

Figure E - 66 Pressure in theRPV

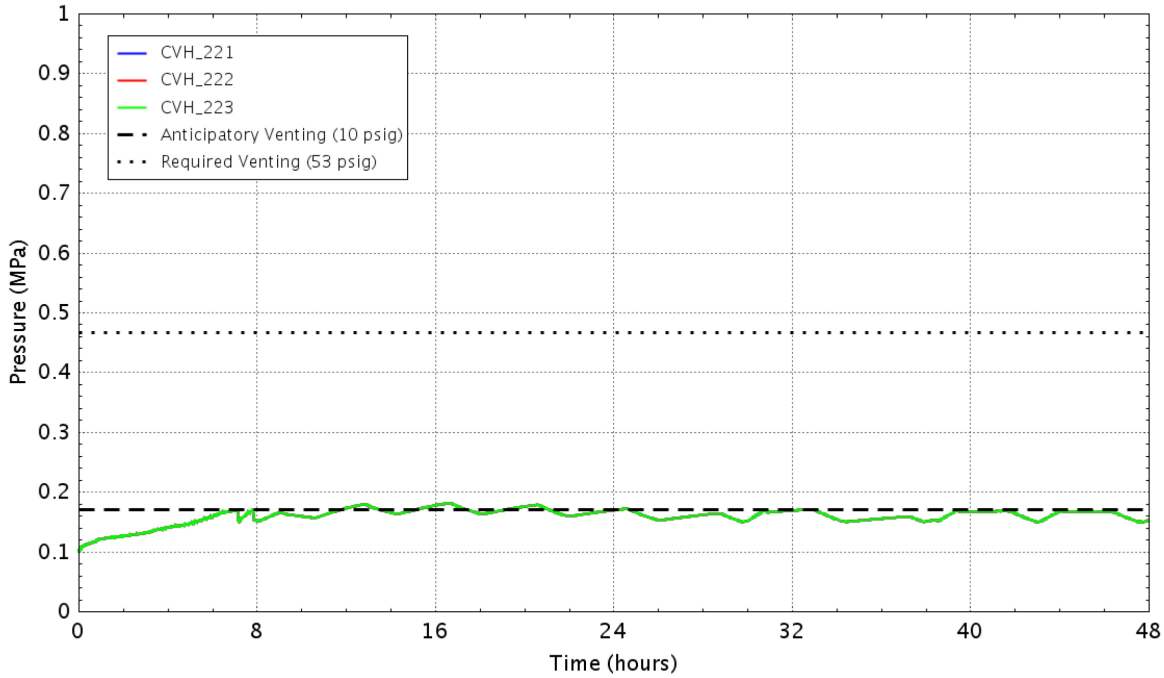

Figure E - 67 **Pressure in the wetwell**

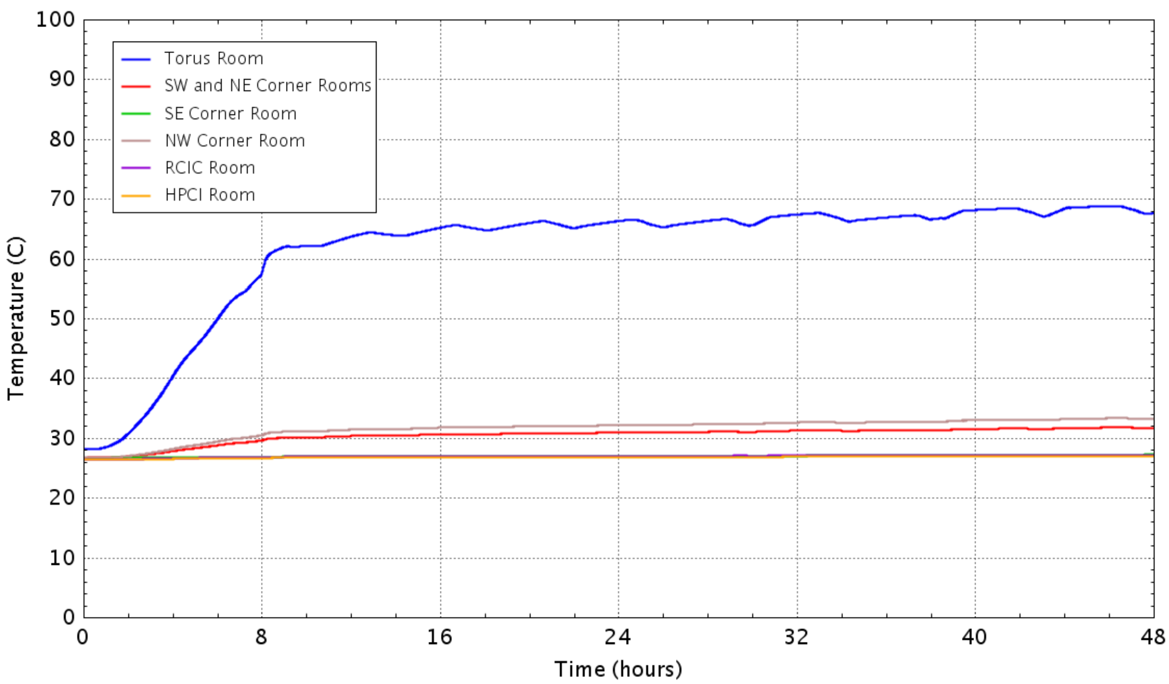

Figure E - 68 **Vapor temperature in the reactor building basement**

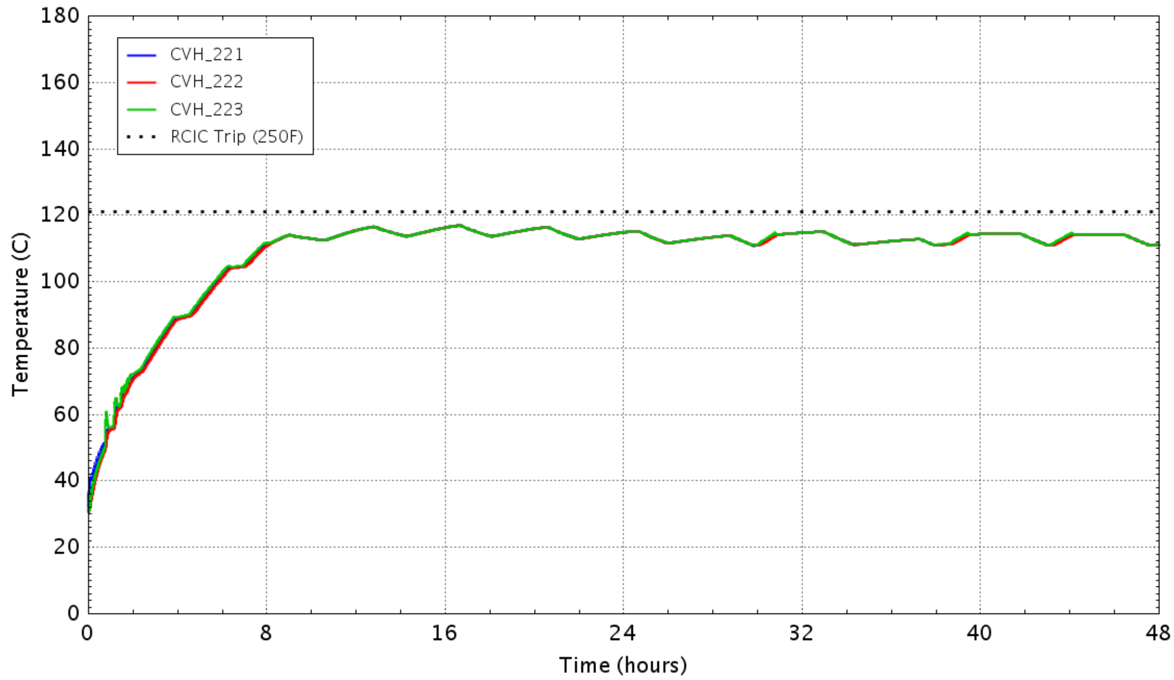

Figure E - 69 **Water temperature in the wetwell**

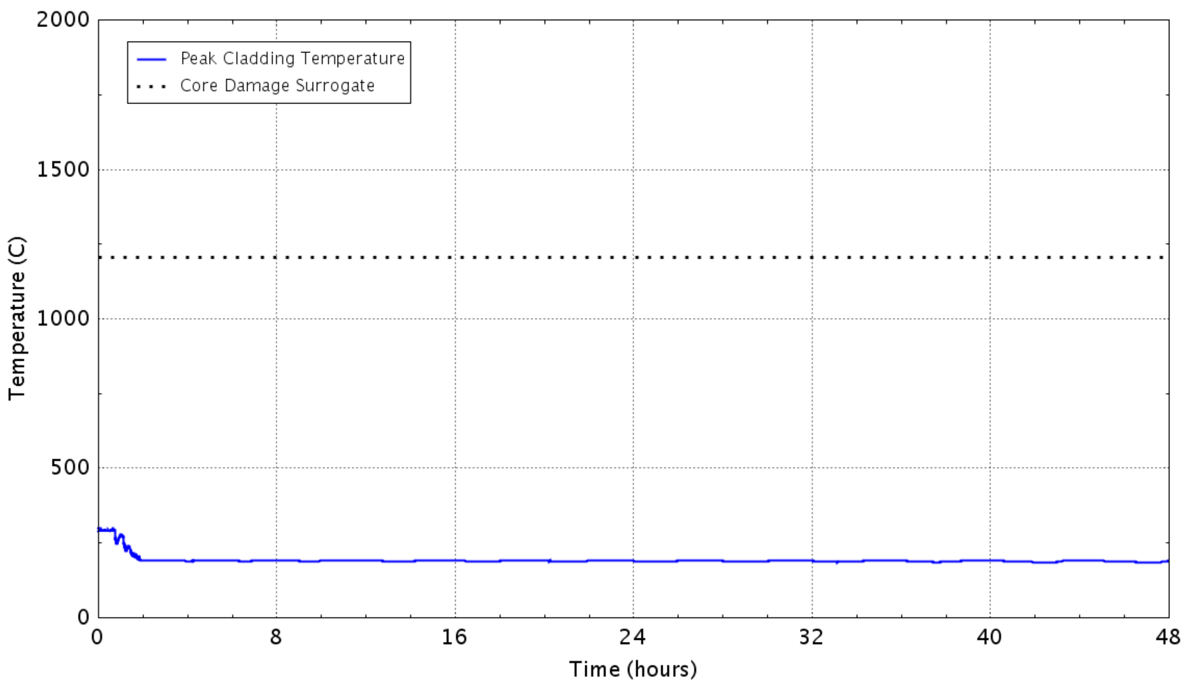

Figure E - 70 **Peak temperature of the fuel cladding as a function of time**

E.1.8 Case 8: LOOPGR-38-9, Containment Failure at 53 psig, Containment Venting via the 2-in. Drywell Bypass, RCIC Fully Functional

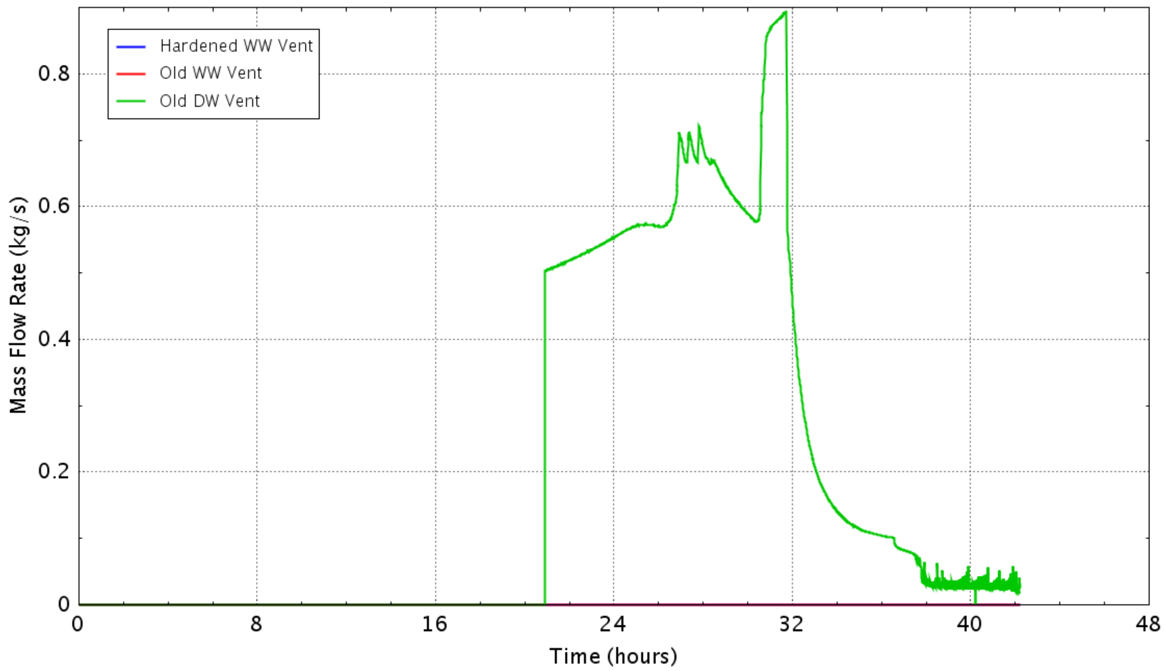

Figure E - 71 Flow rate of the containment vents

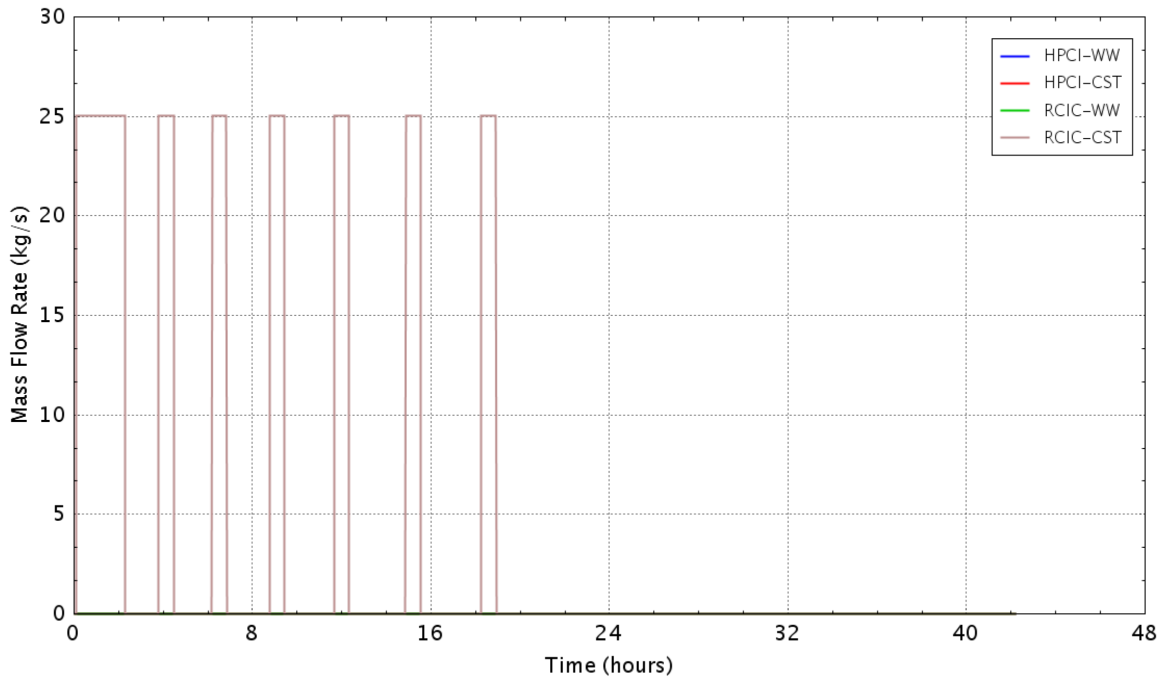

Figure E - 72 Flow rate of the HPCI/RCIC pumps

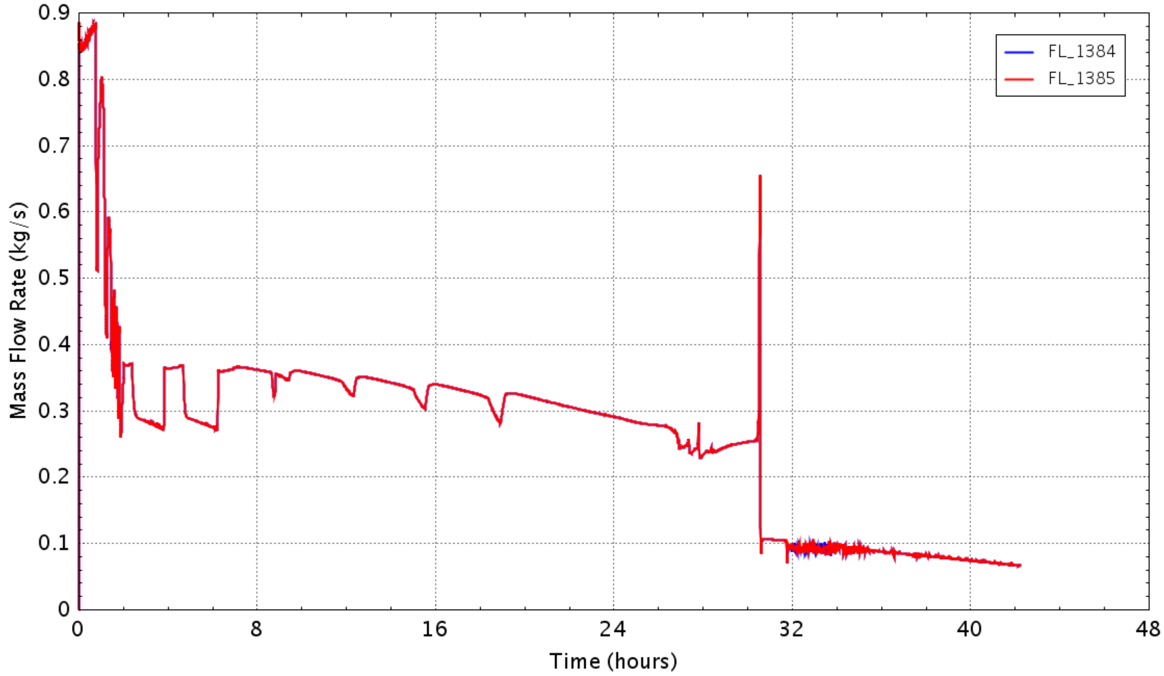

Figure E - 73 **Flow rate of the recirculating pump seal leakage**

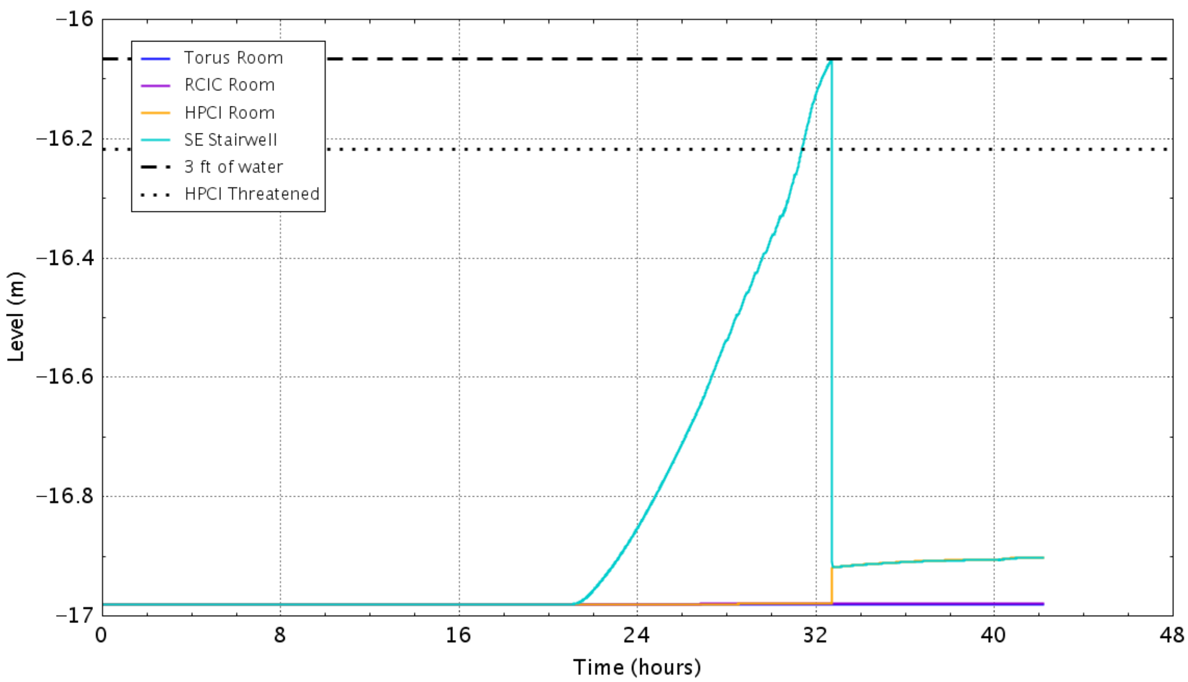

Figure E - 74 **Water level in the reactor building basement**

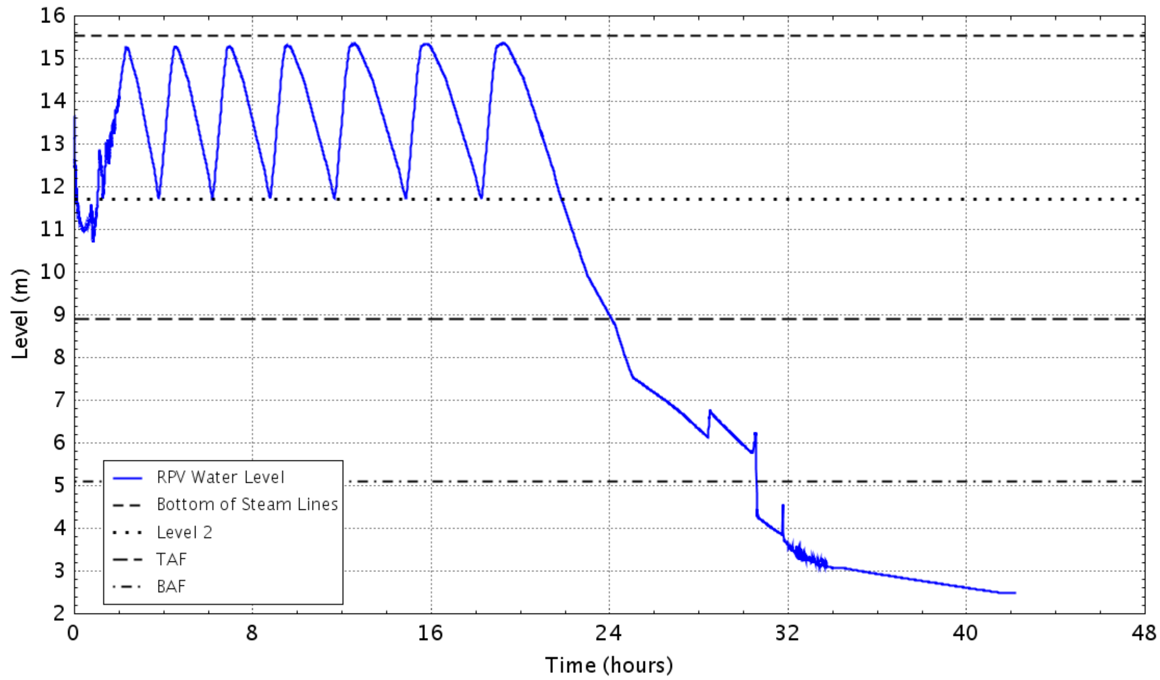

Figure E - 75 **RPV down comer water level**

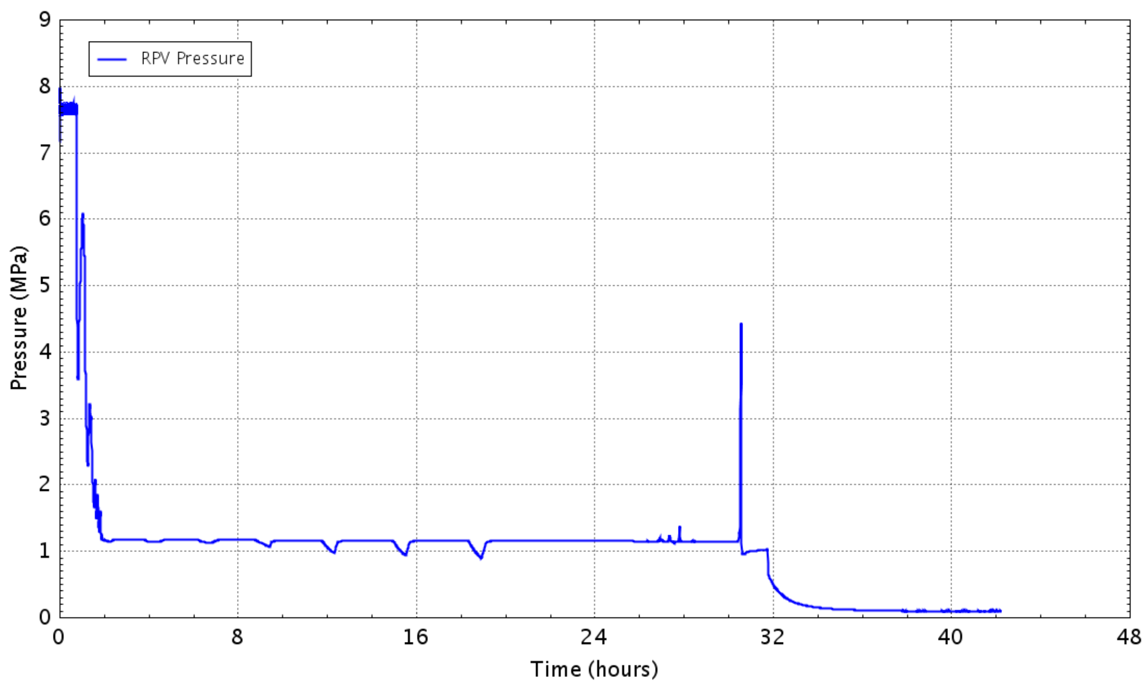

Figure E - 76 **Pressure in theRPV**

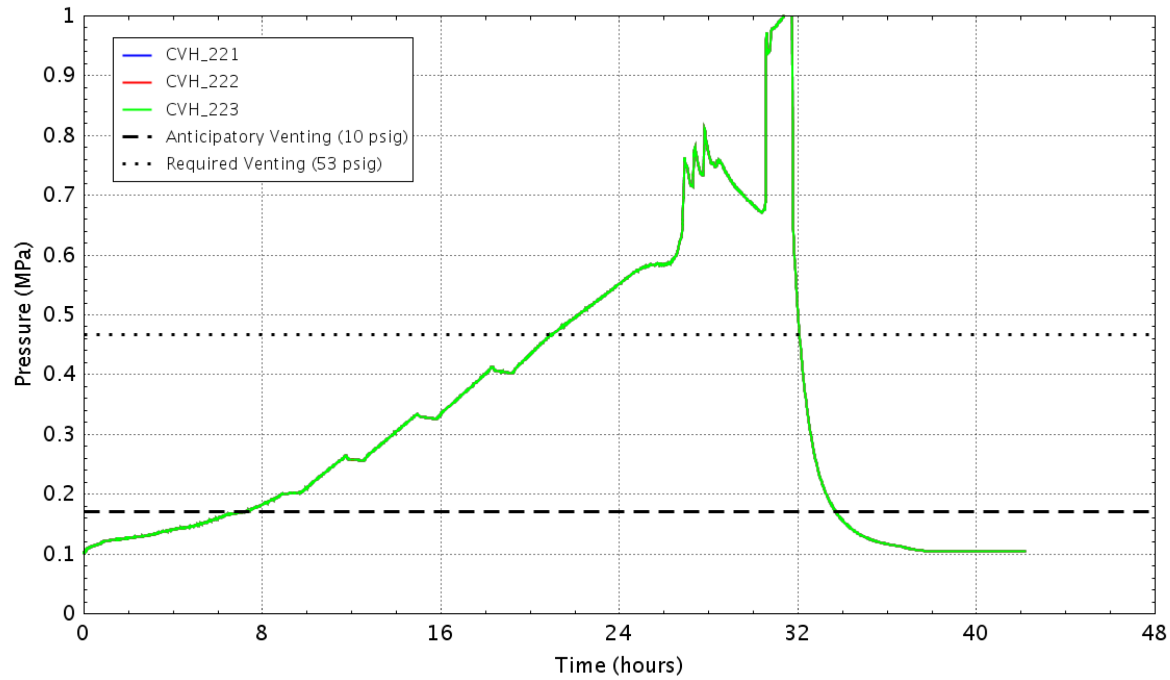

Figure E - 77 Pressure in the wetwell

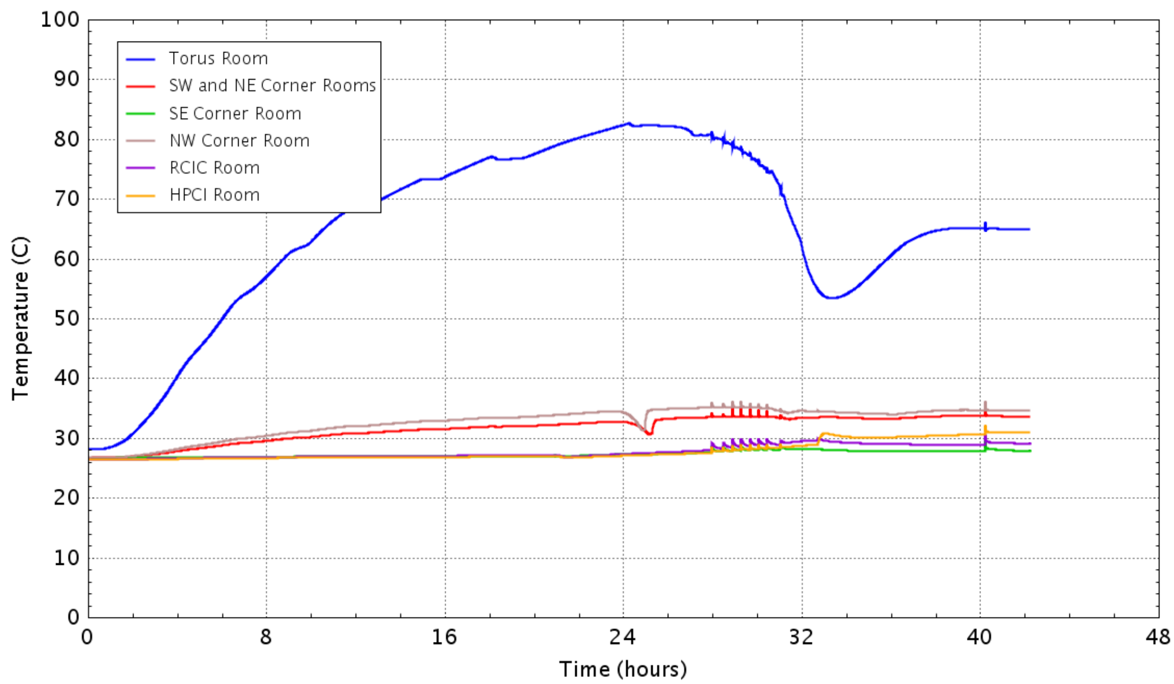

Figure E - 78 Vapor temperature in the reactor building basement

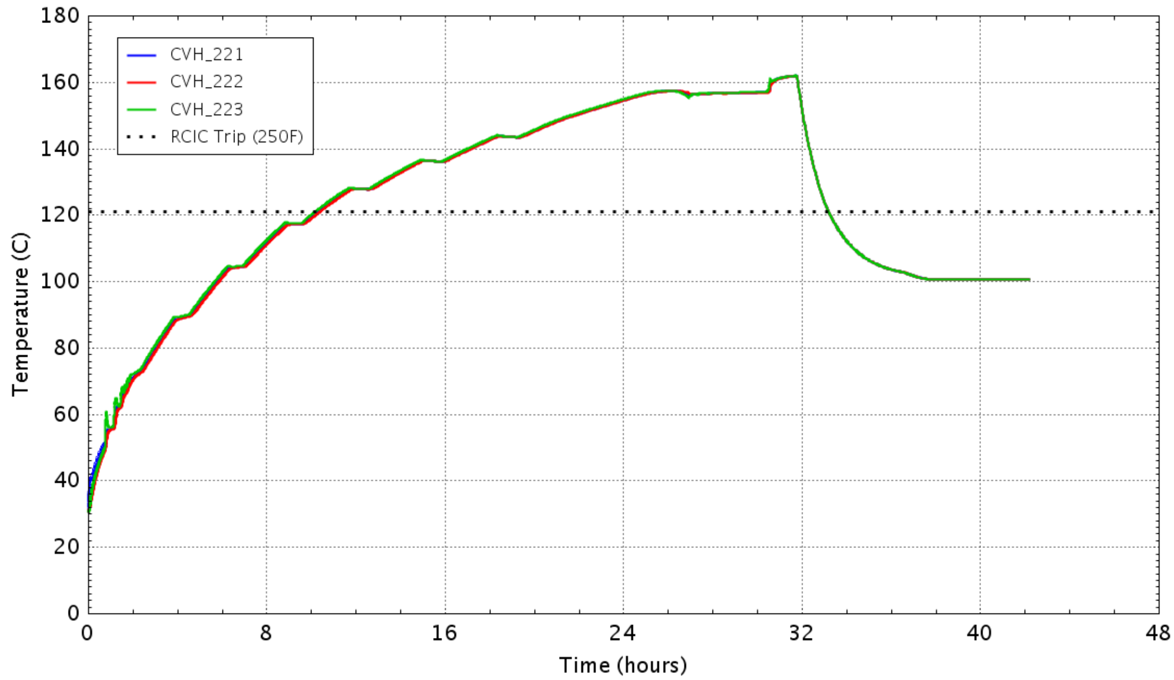

Figure E - 79 **Water temperature in the wetwell**

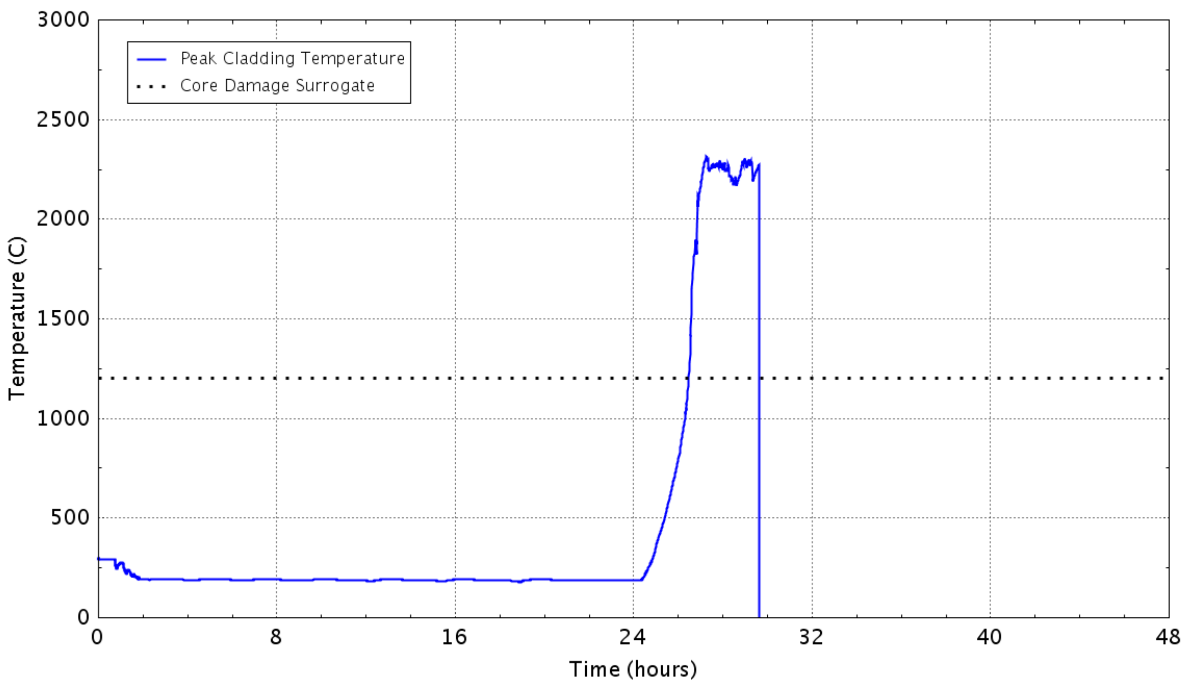

Figure E – 80 **Peak temperature of the fuel cladding as a function oftime**

E.1.9 Case 9: LOOPGR-38-9, Containment Failure at 53 psig, Containment Venting via the 2-in. Drywell Bypass, RCIC 50%Degraded

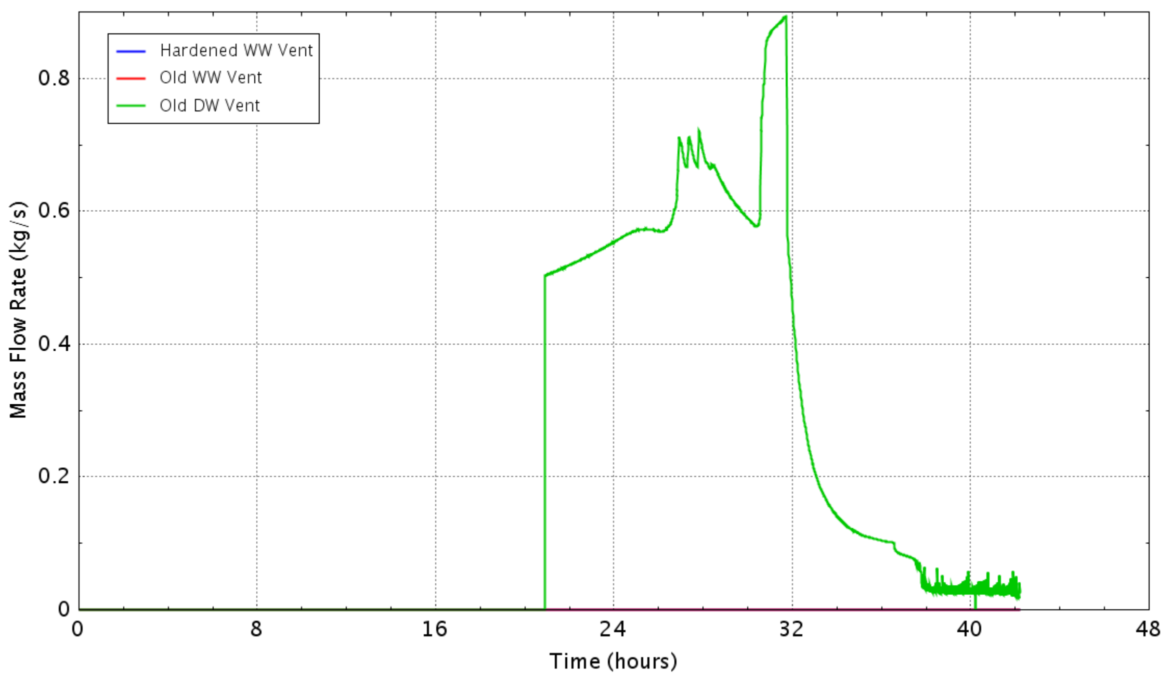

Figure E - 81 Flow rate of the containment vents

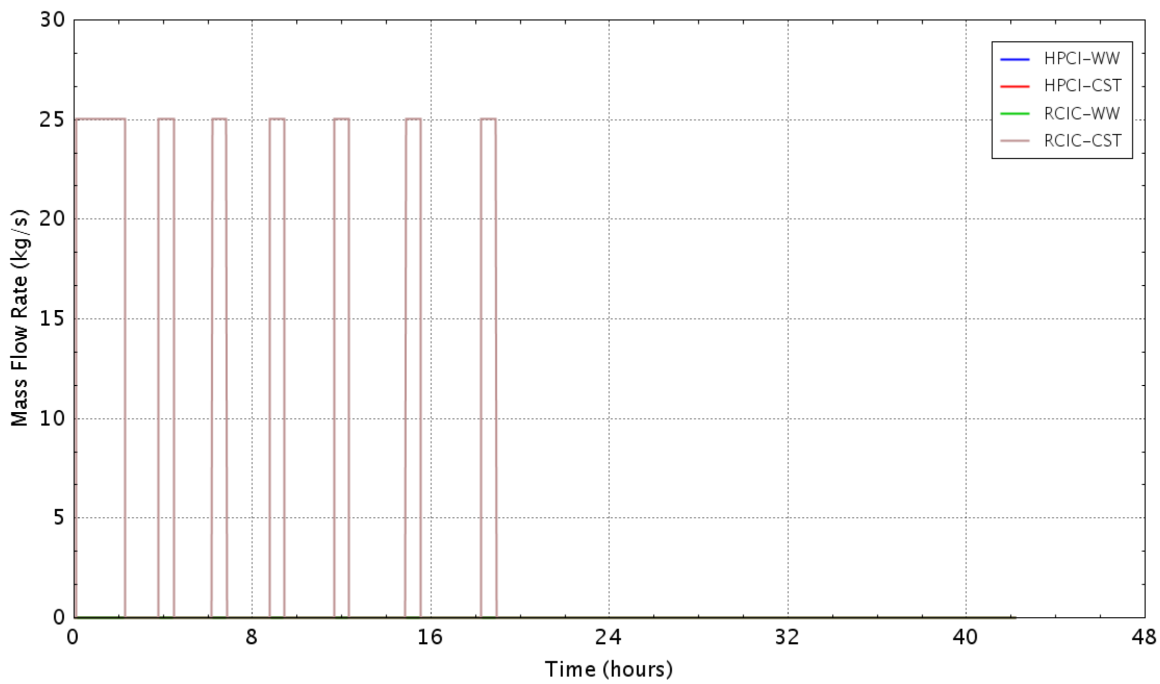

Figure E - 82 Flow rate of the HPCI/RCIC pumps

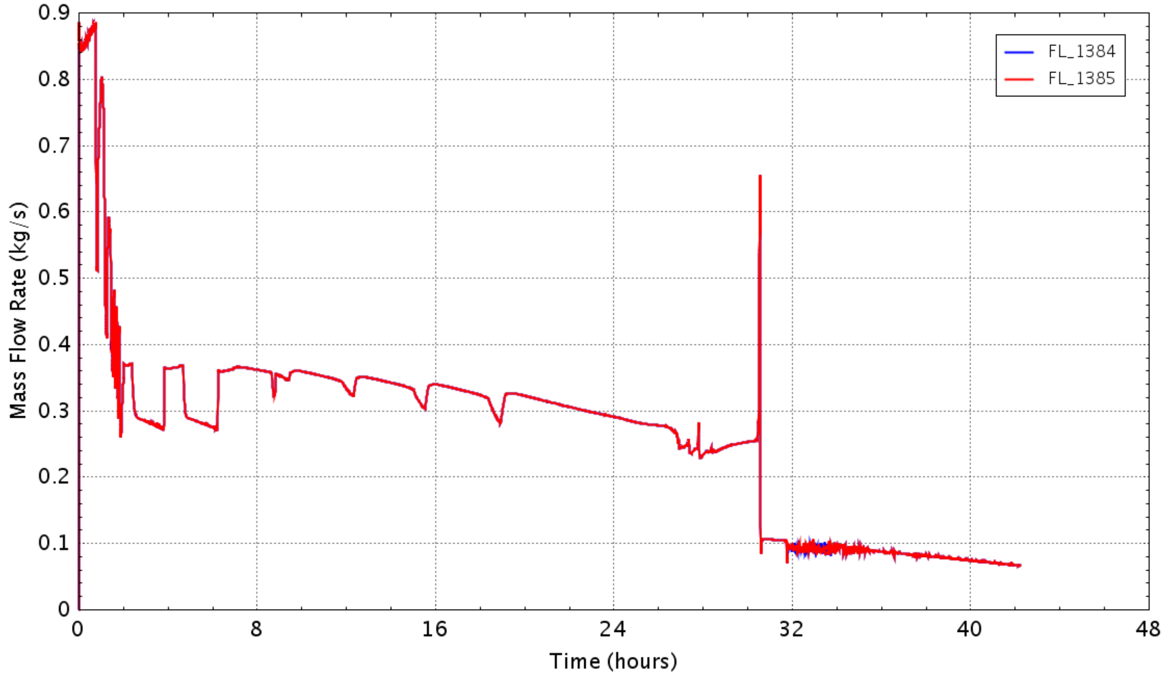

Figure E - 83 Flow rate of the recirculating pump seal leakage

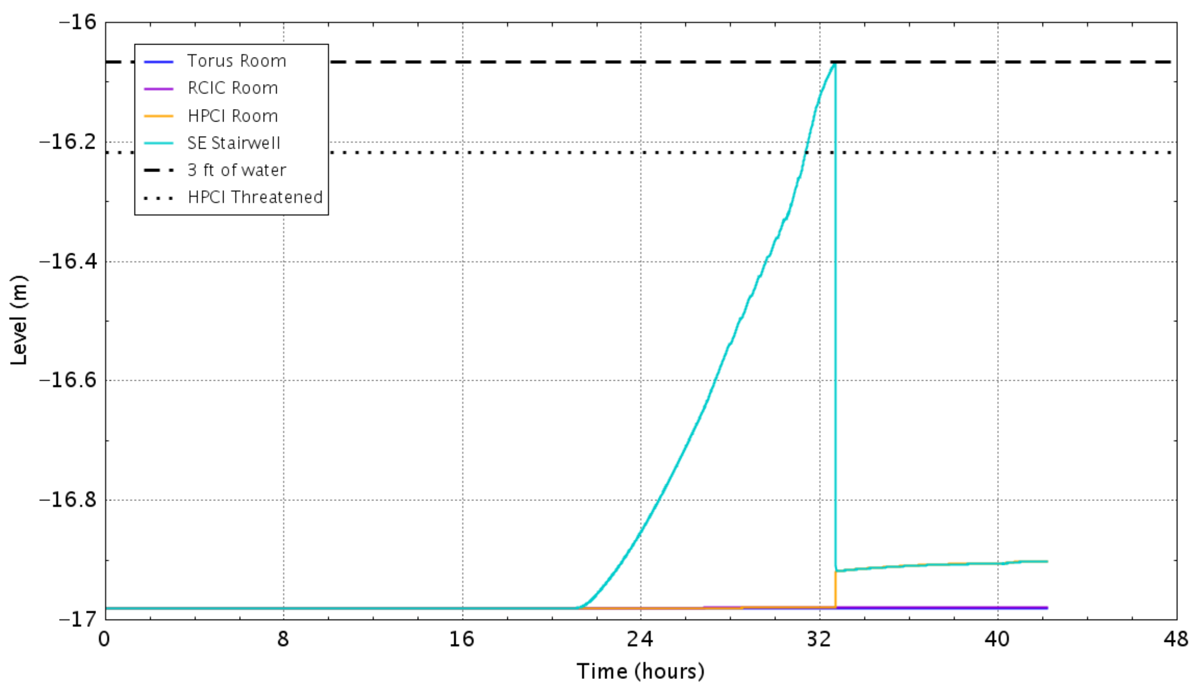

Figure E - 84 Water level in the reactor building basement

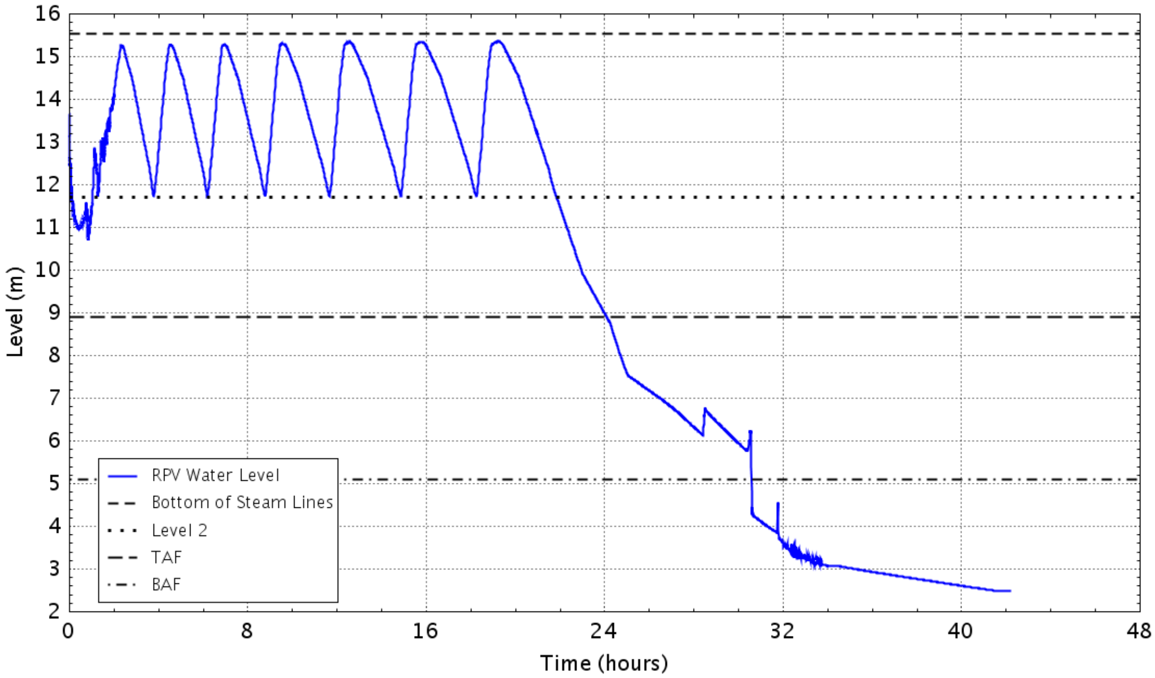

Figure E - 85 RPV down comer water level

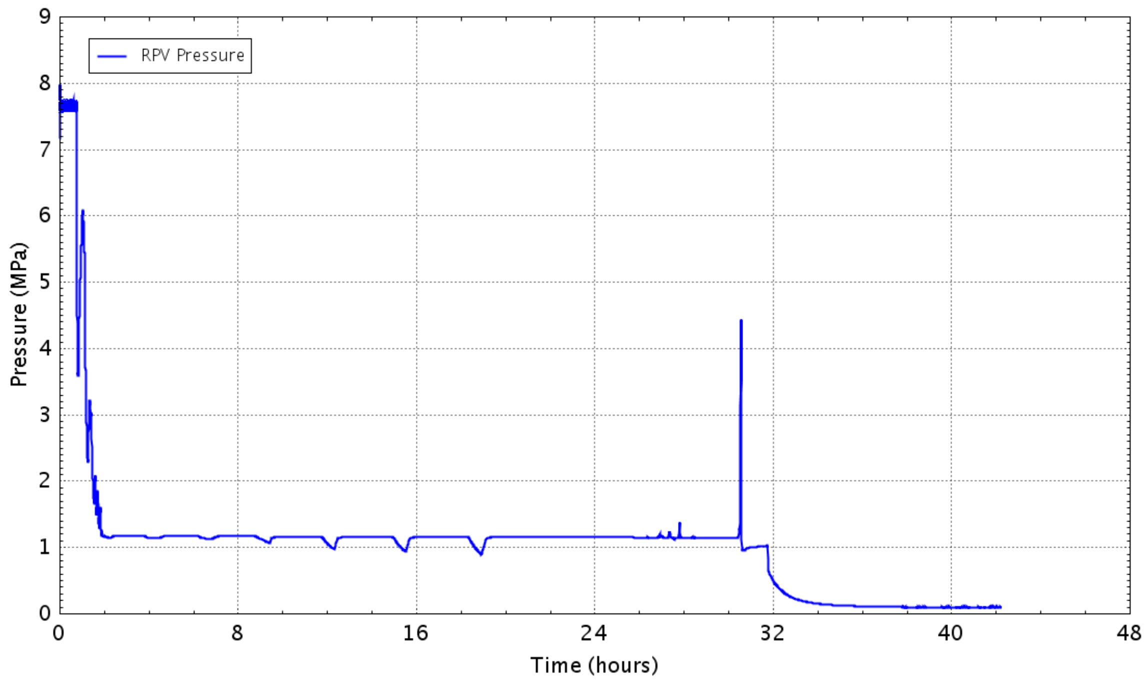

Figure E - 86 Pressure in theRPV

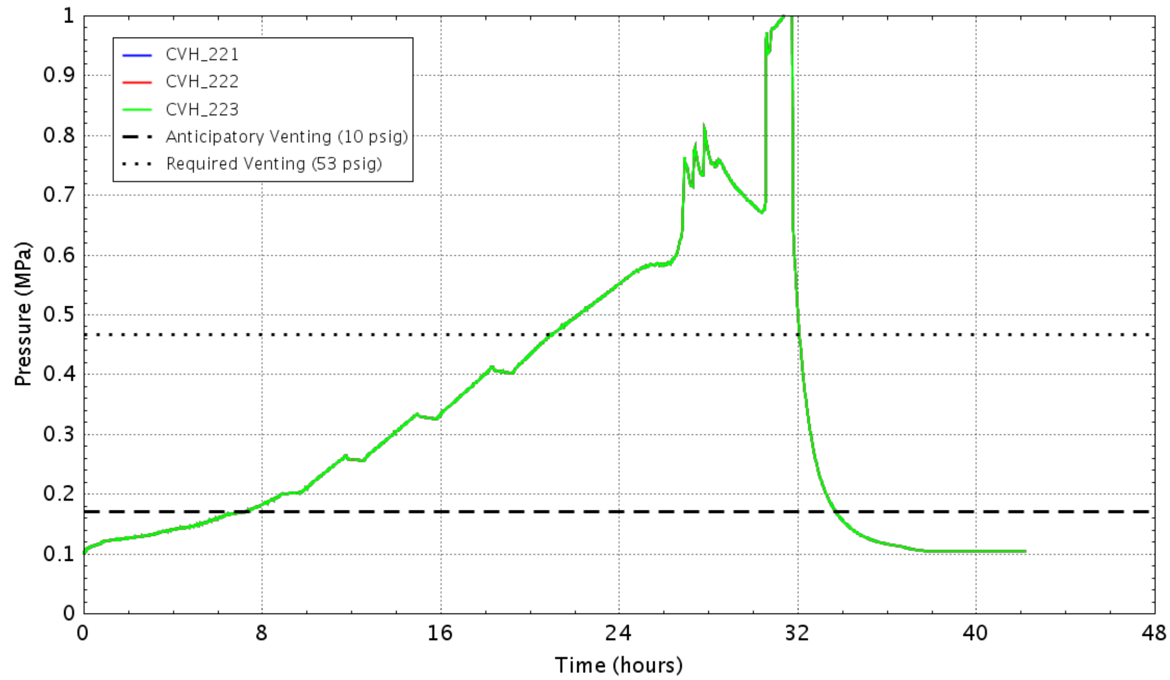

Figure E - 87 **Pressure in the wetwell**

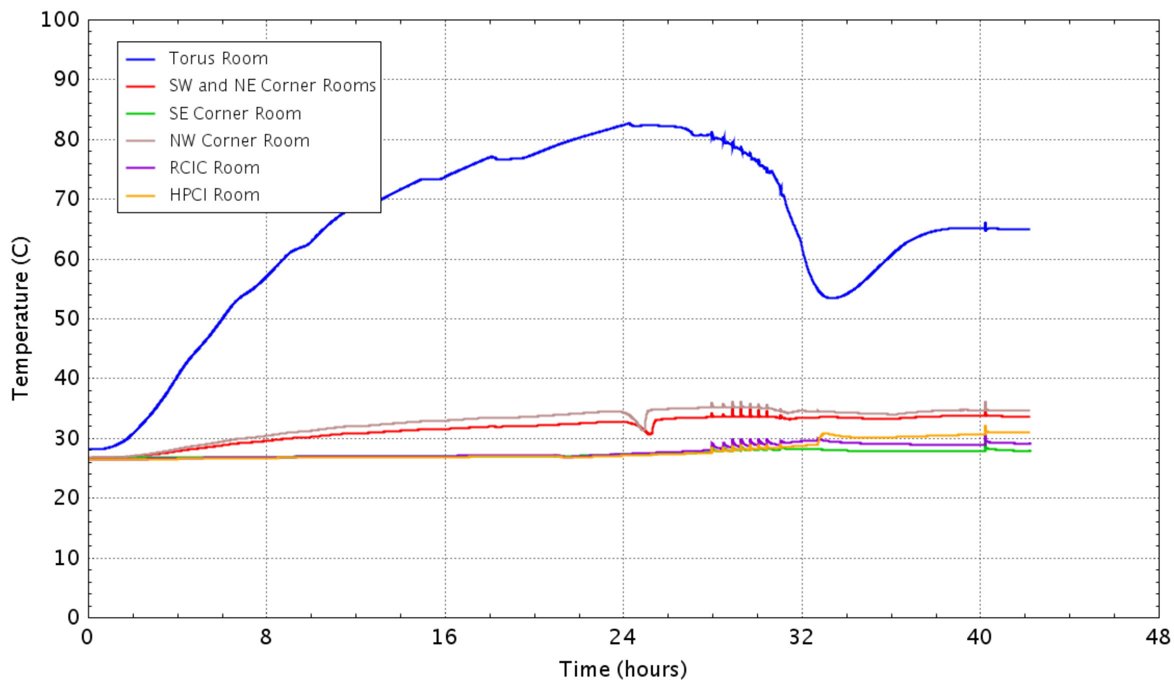

Figure E – 88 **Vapor temperature in the reactor building basement**

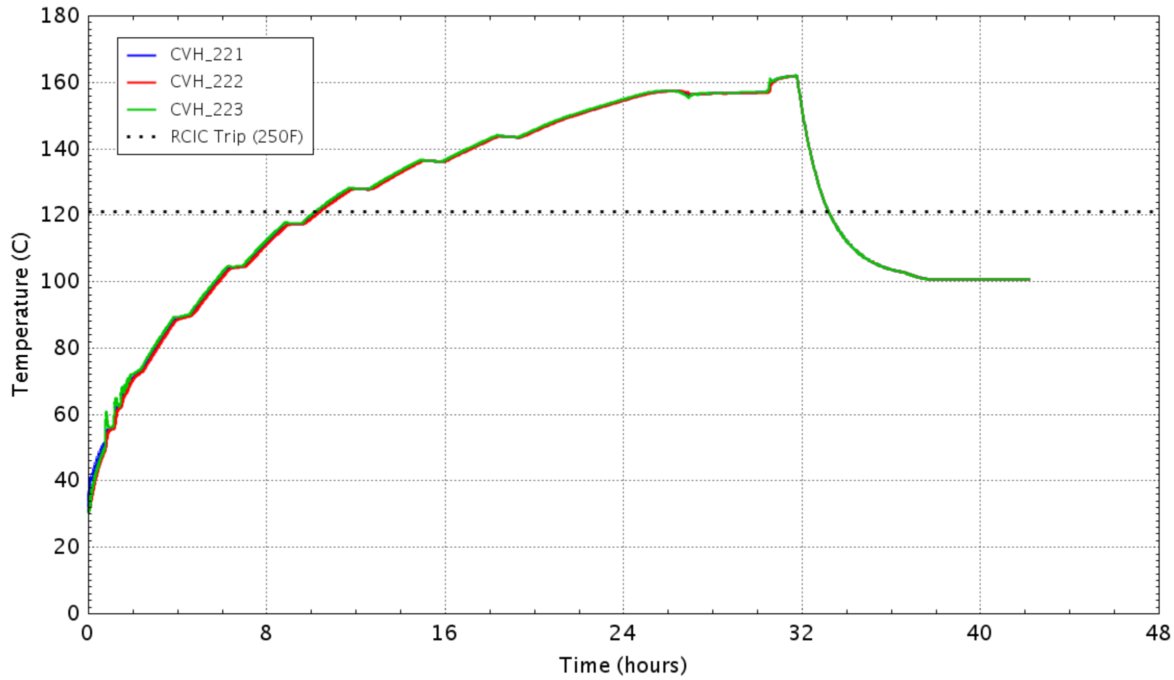

Figure E - 89 **Water temperature in the wetwell**

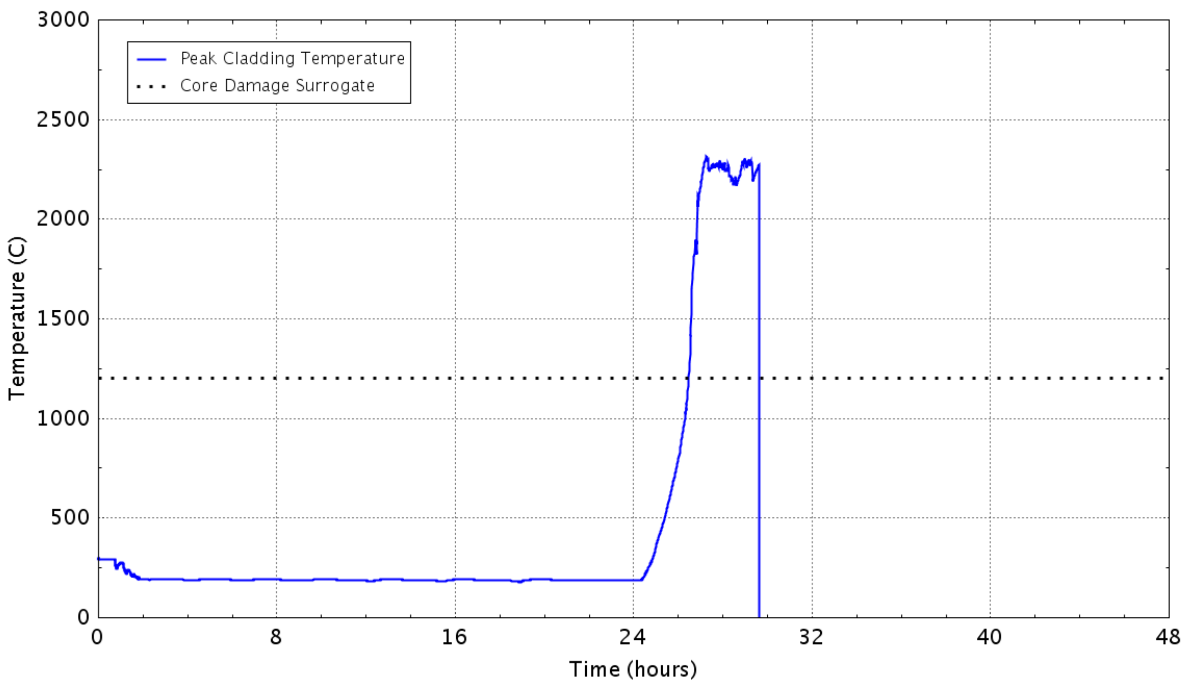

Figure E - 90 **Peak temperature of the fuel cladding as a function of time**

E.1.10 Case 10: LOOPGR-38-9, Containment Failure at 53 psig, Containment Venting via the 18-in. Drywell Main Vent, RCIC Fully Functional

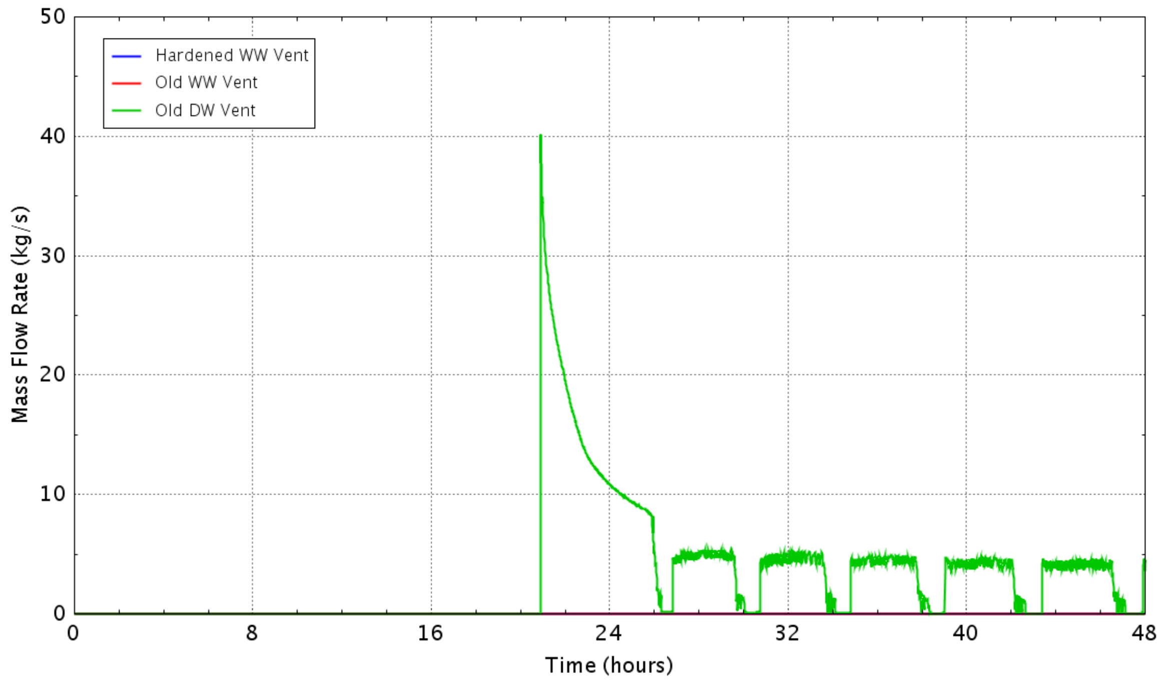

Figure E - 91 Flow rate of the containment vents

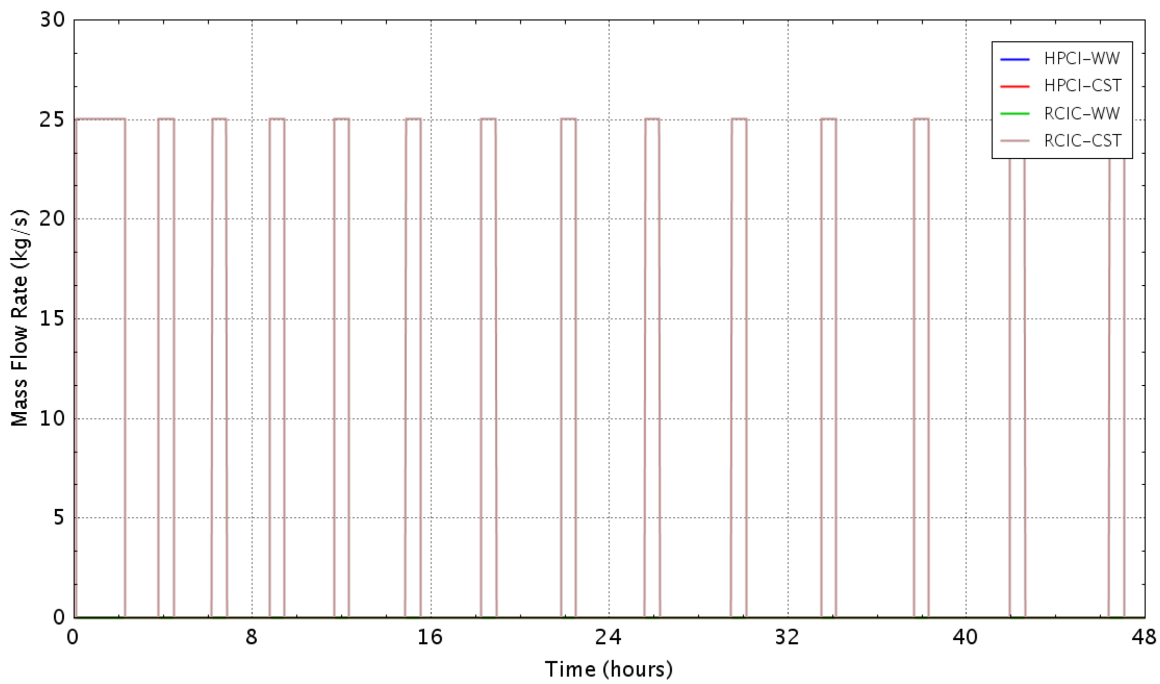

Figure E - 92 Flow rate of the HPCI/RCIC pumps

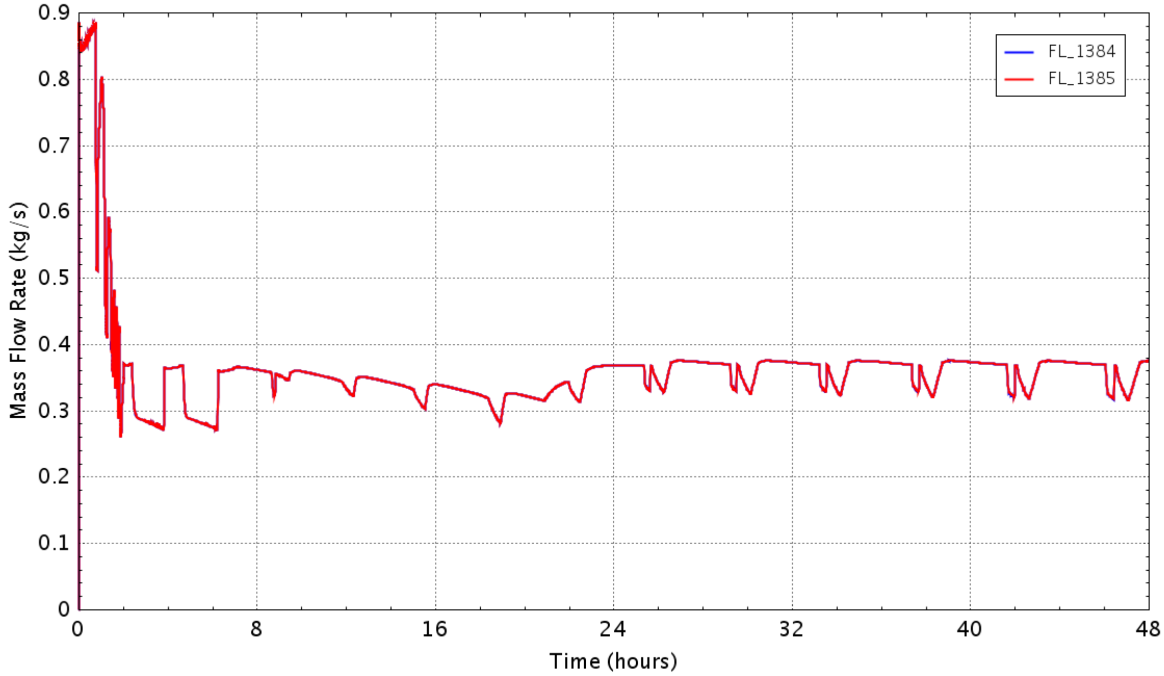

Figure E - 93 **Flow rate of the recirculating pump seal leakage**

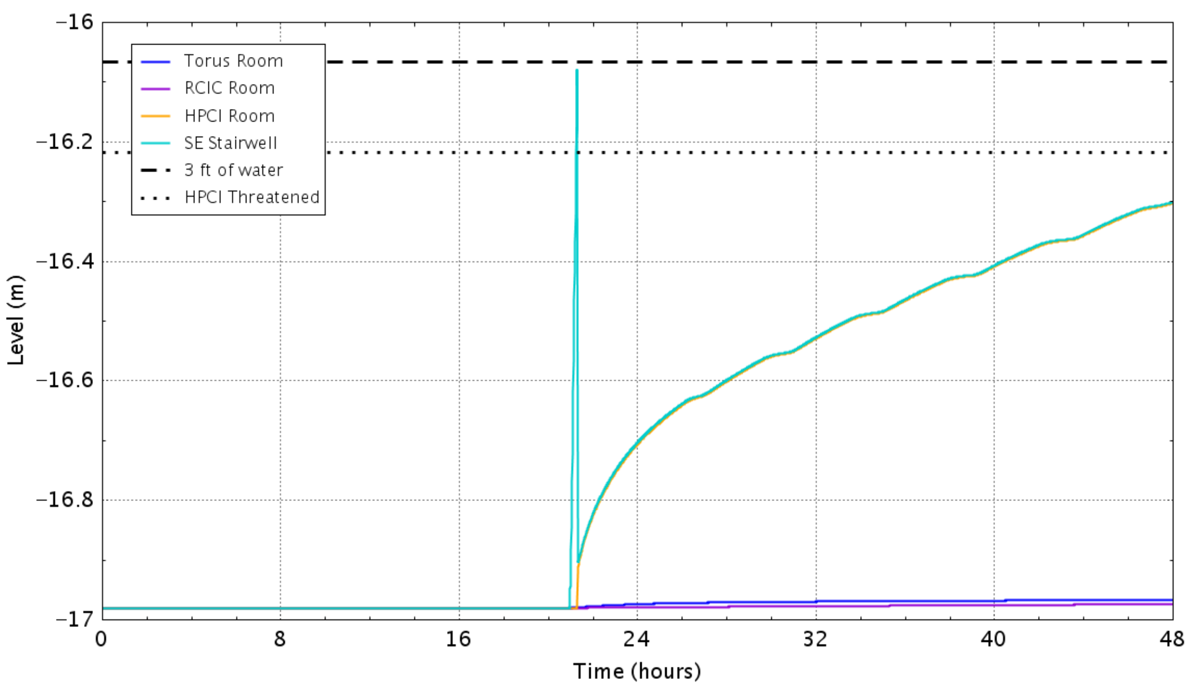

Figure E - 94 **Water level in the reactor building basement**

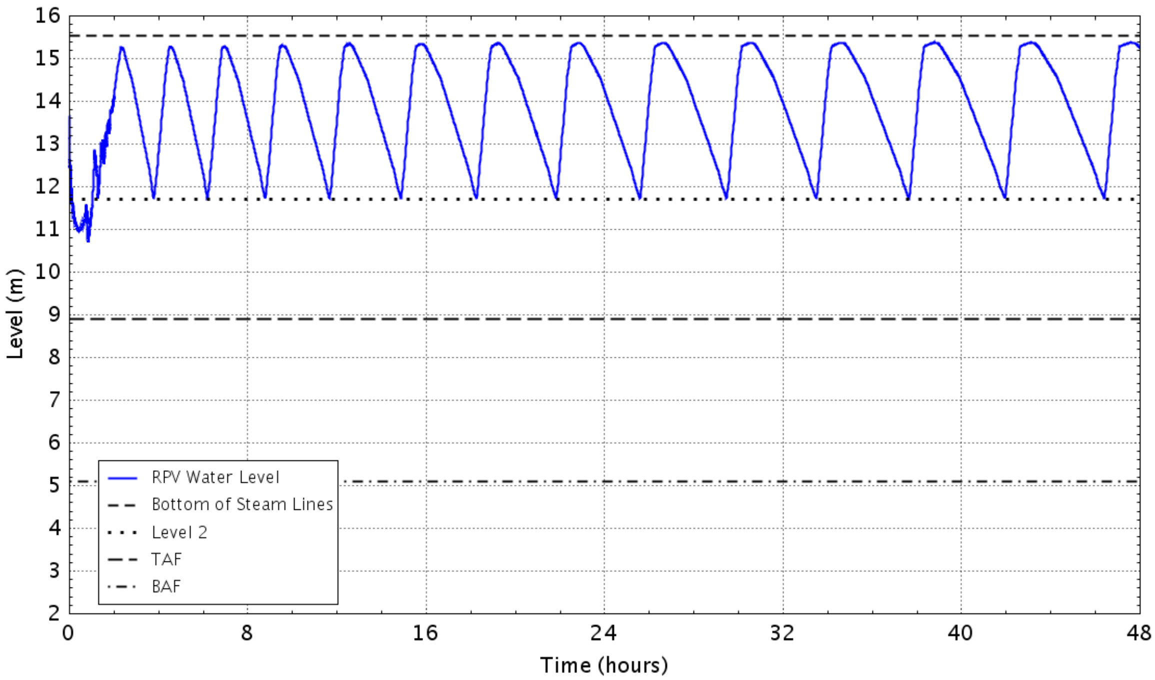

Figure E - 95 RPV down comer water level

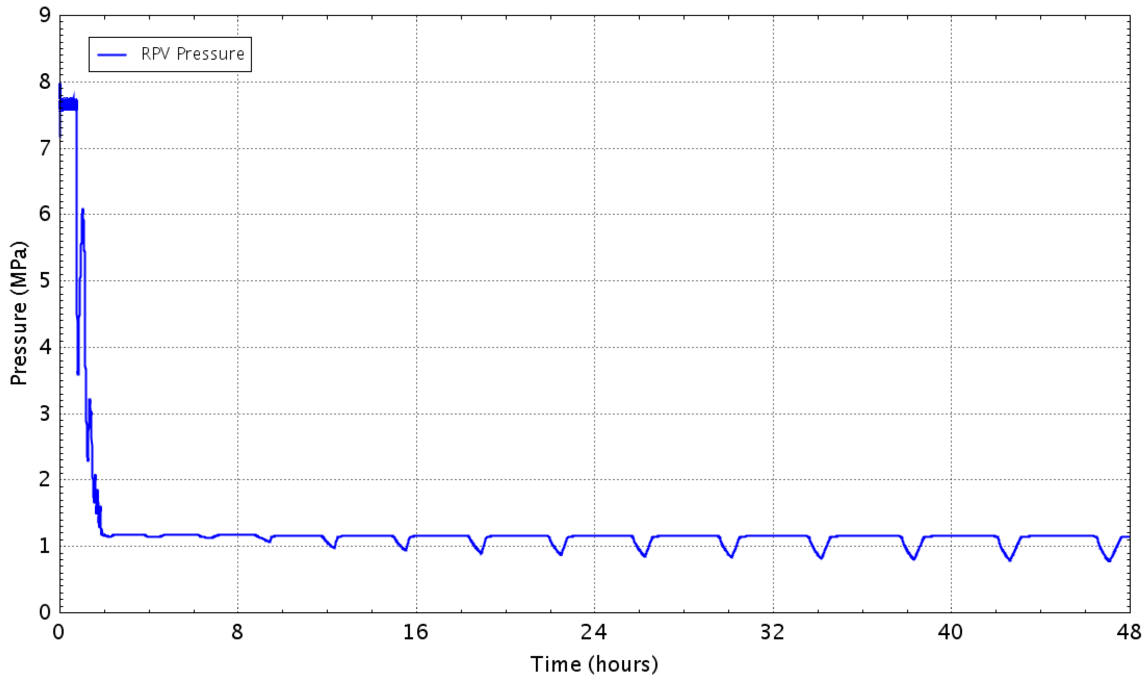

Figure E - 96 Pressure in theRPV

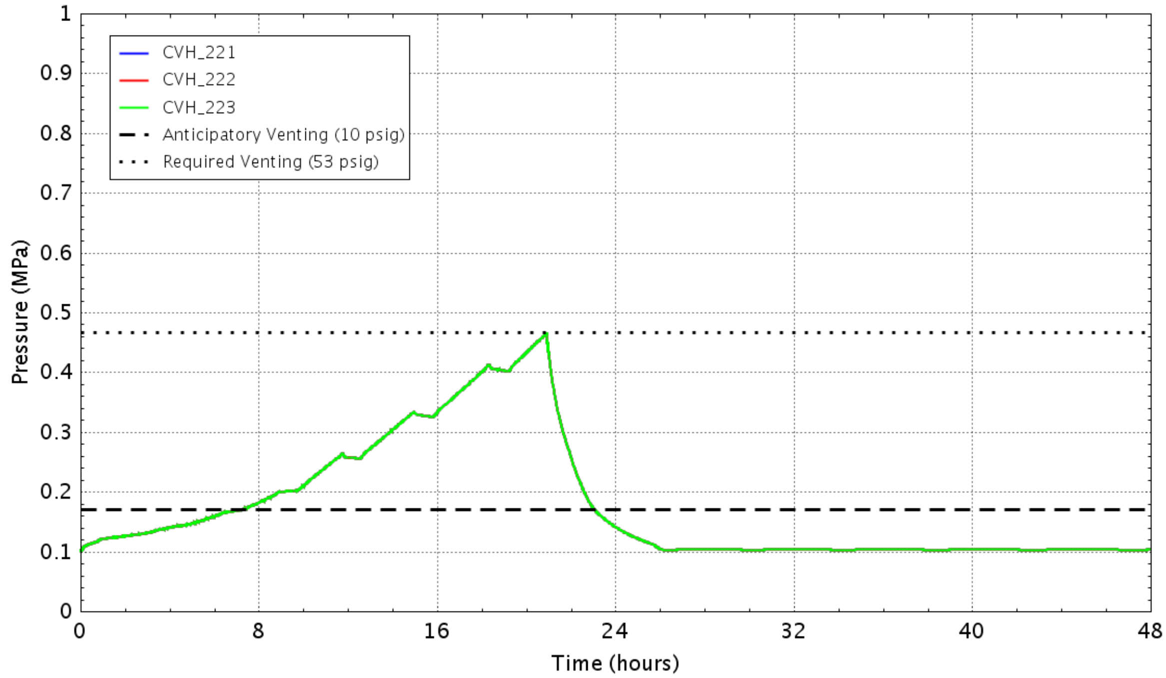

Figure E - 97 **Pressure in the wetwell**

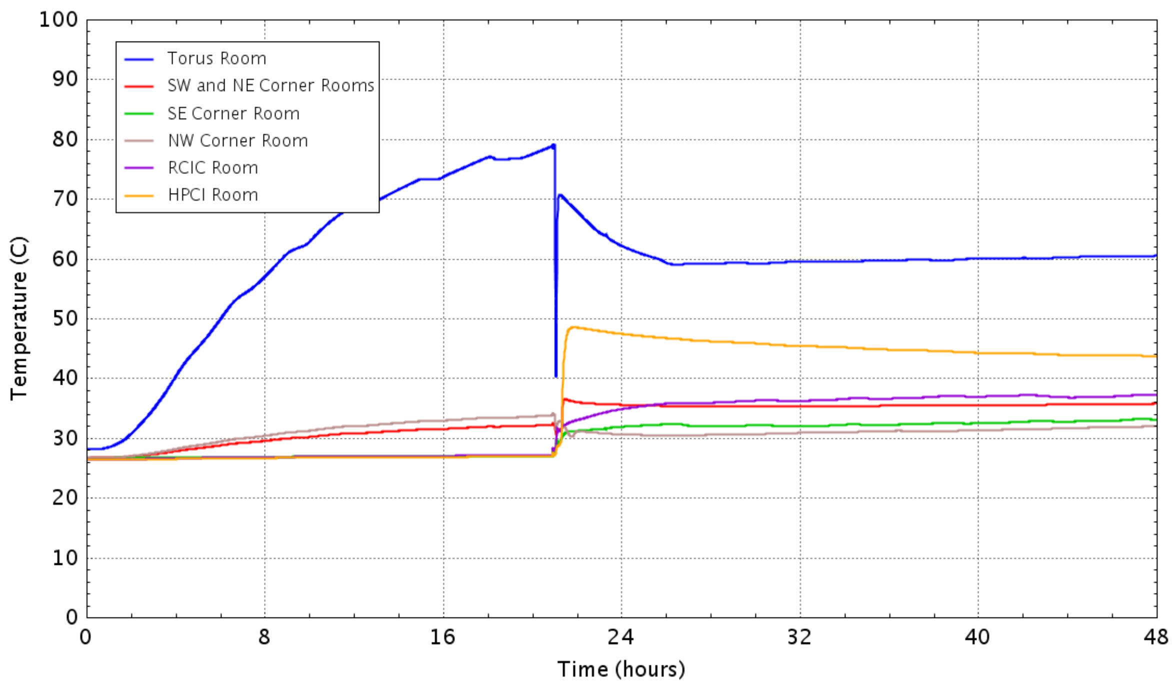

Figure E - 98 **Vapor temperature in the reactor building basement**

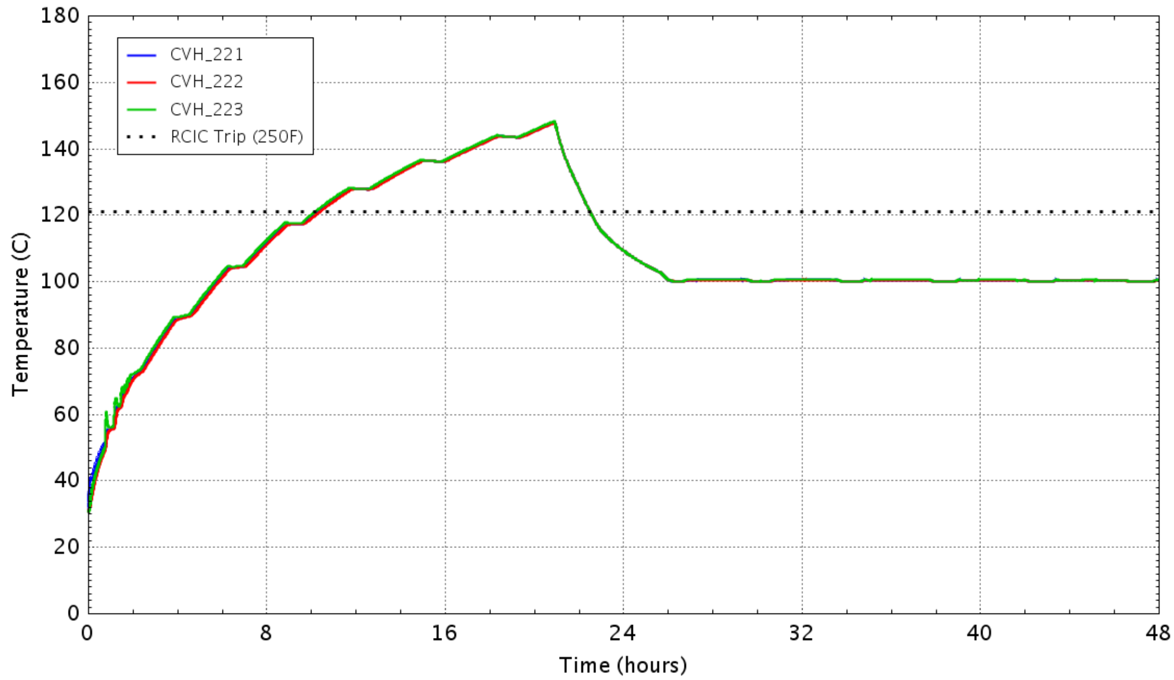

Figure E - 99 Water temperature in the wetwell

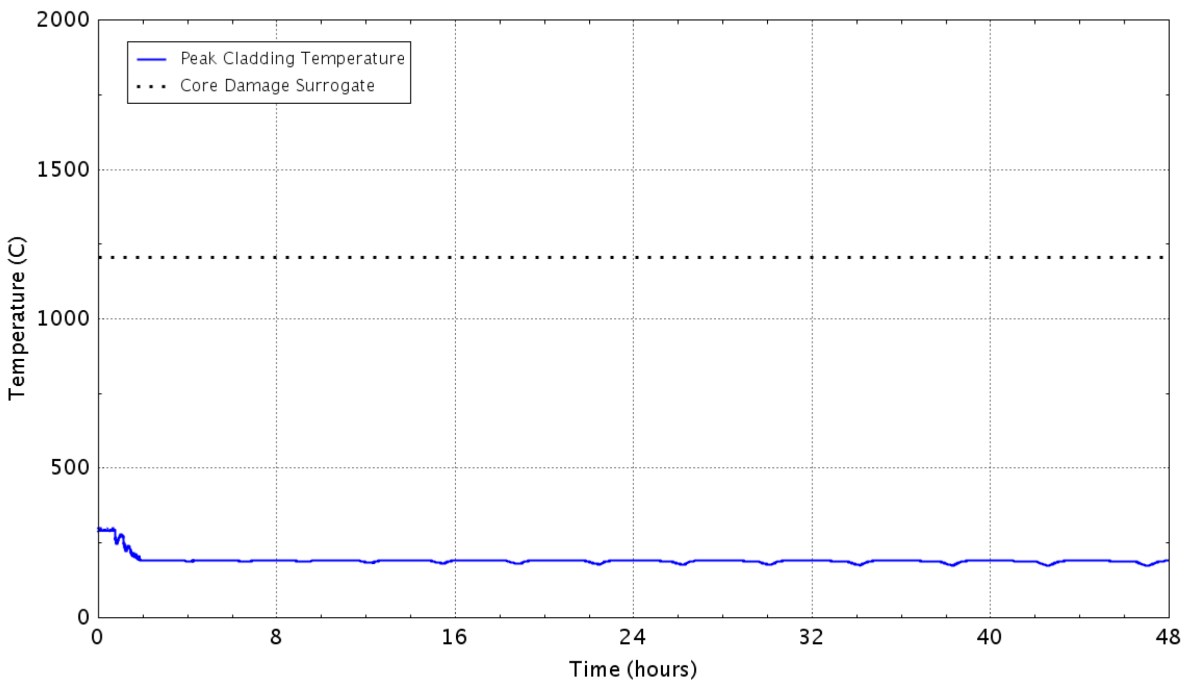

Figure E – 100 Peak temperature of the fuel cladding as a function oftime

E.1.11 Case 11: LOOPGR-38-9, Containment Failure at 53 psig, Containment Venting via the 18-in. Drywell Main Vent, RCIC 50%Degraded

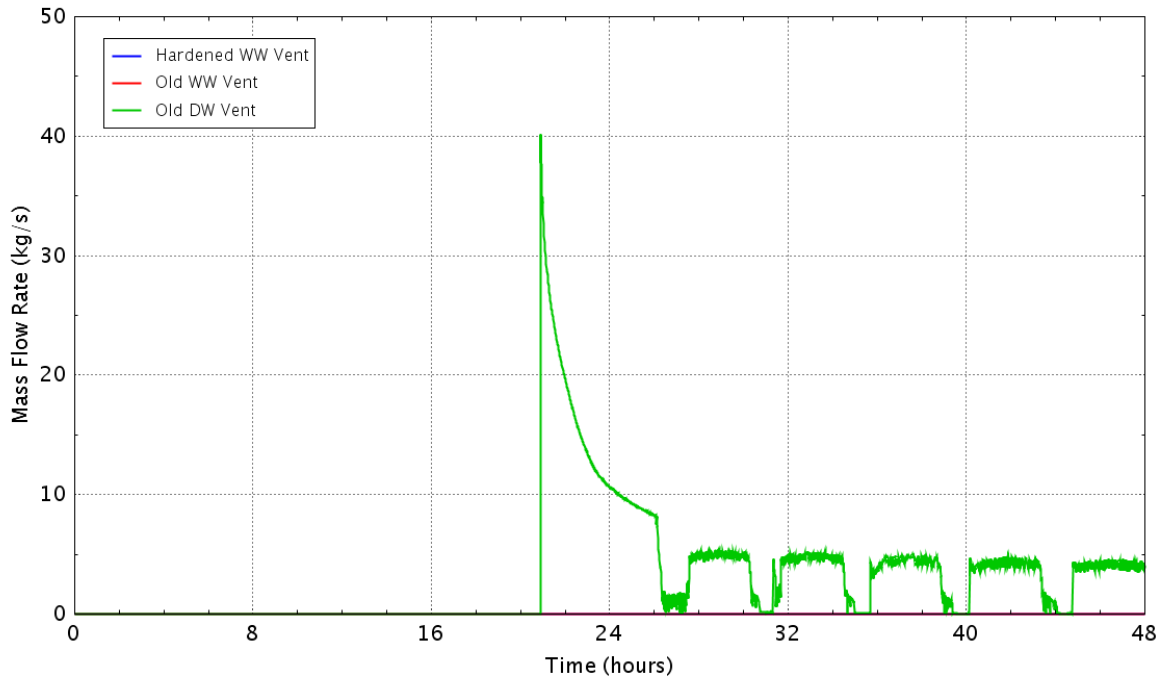

Figure E - 101 Flow rate of the containment vents

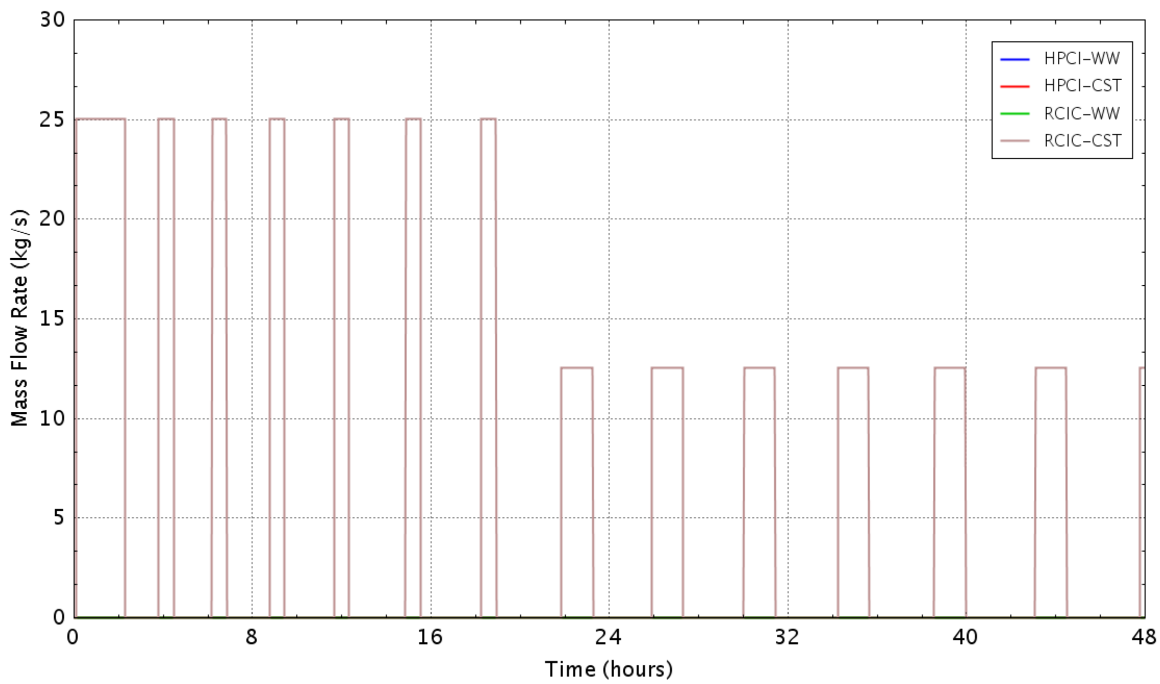

Figure E - 102 Flow rate of the HPCI/RCIC pumps

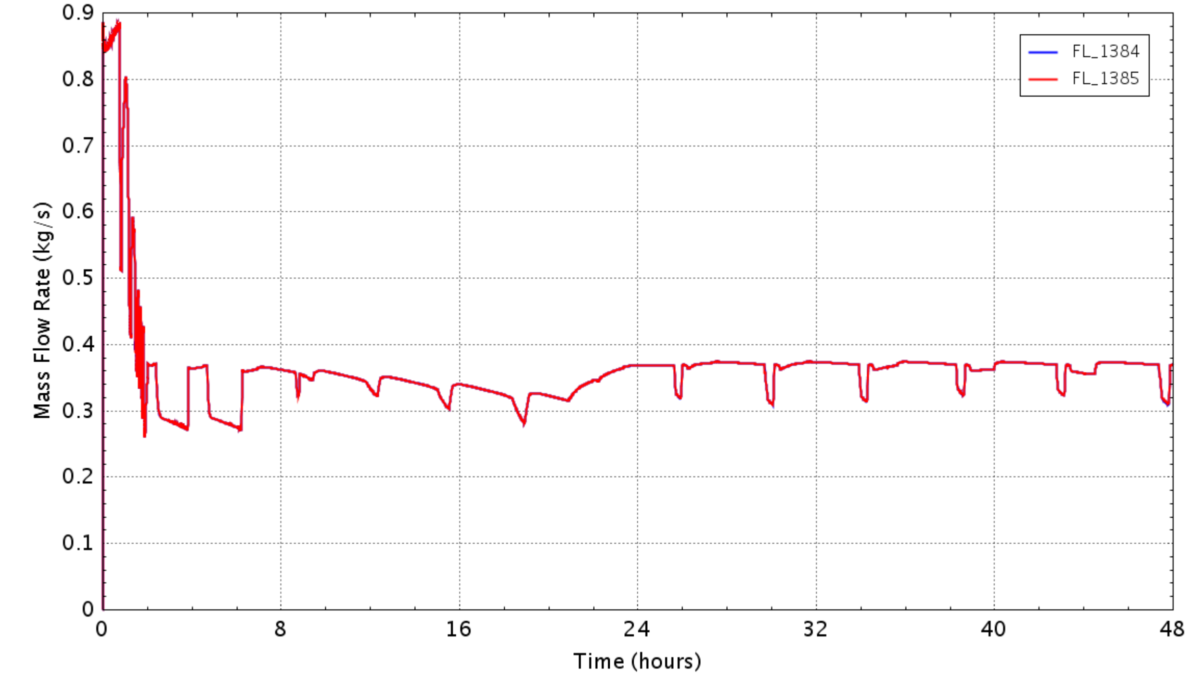

Figure E - 103 **Flow rate of the recirculating pump seal leakage**

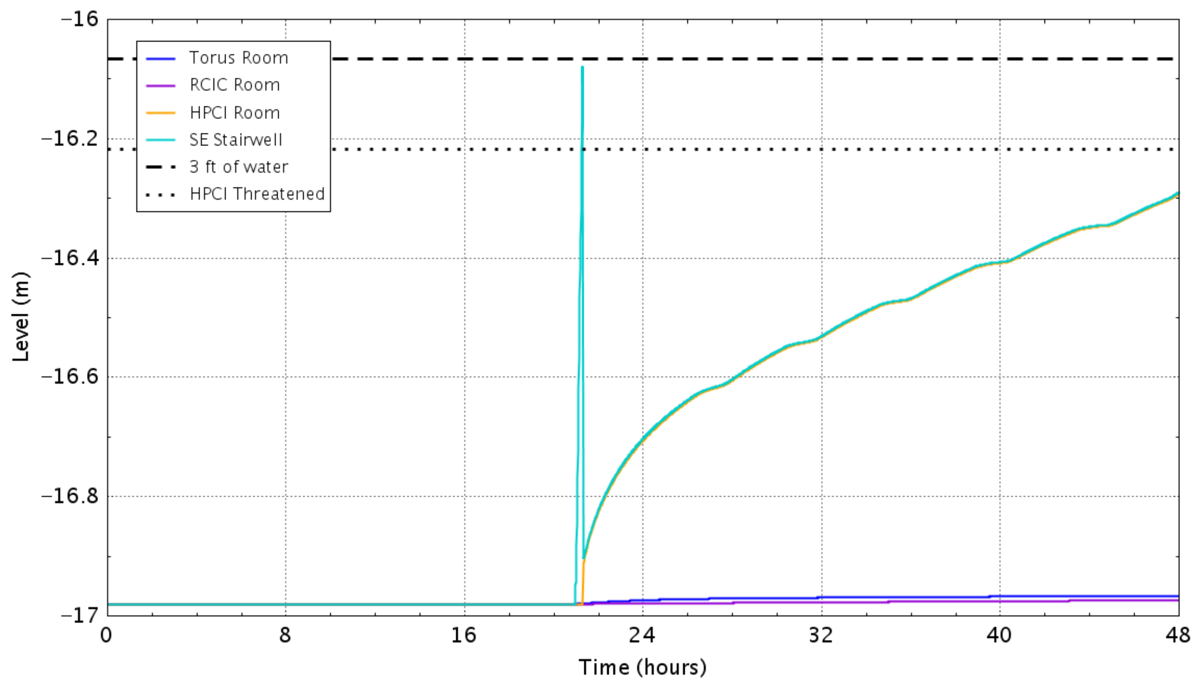

Figure E - 104 **Water level in the reactor building basement**

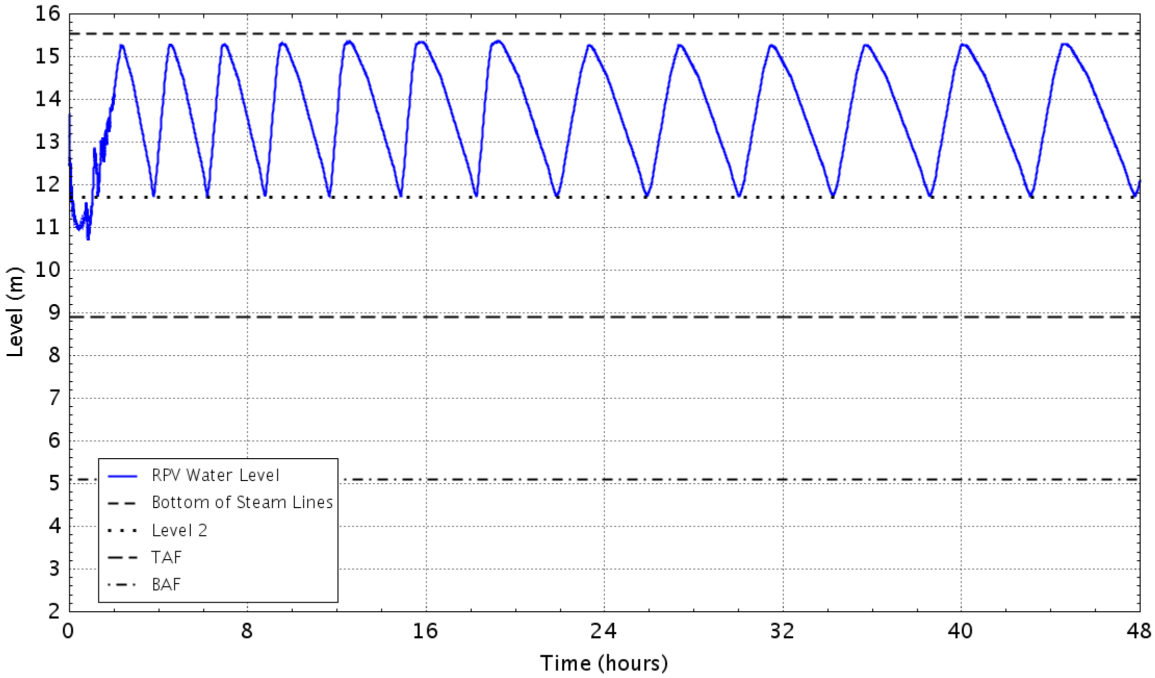

Figure E - 105 RPV down comer water level

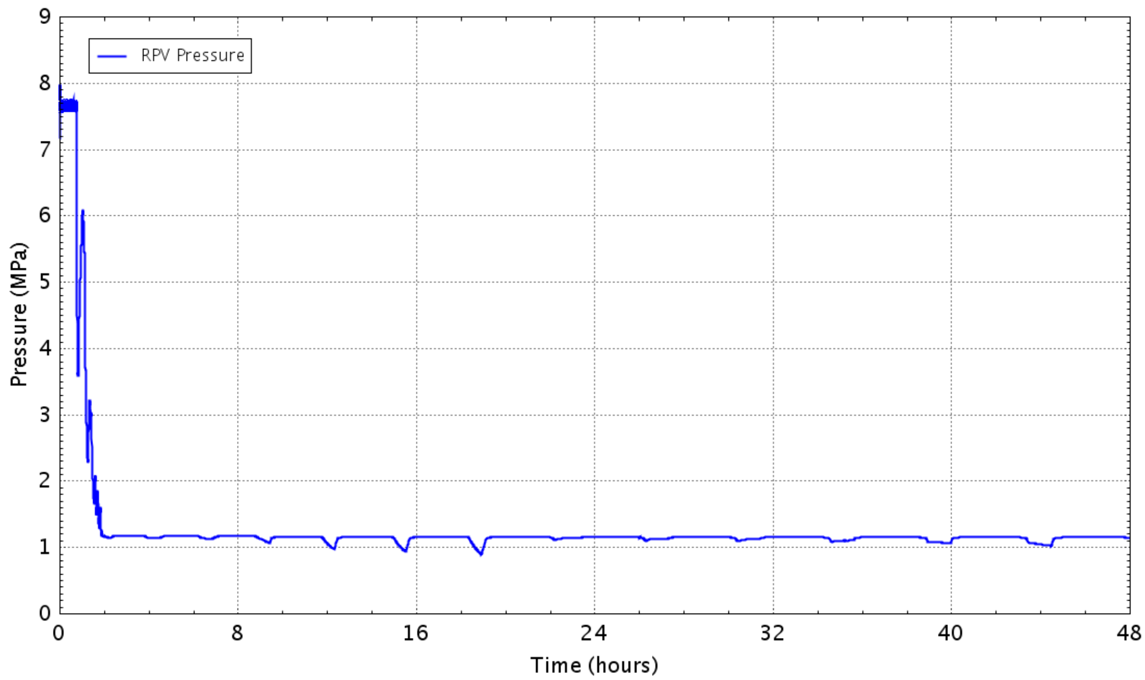

Figure E - 106 Pressure in theRPV

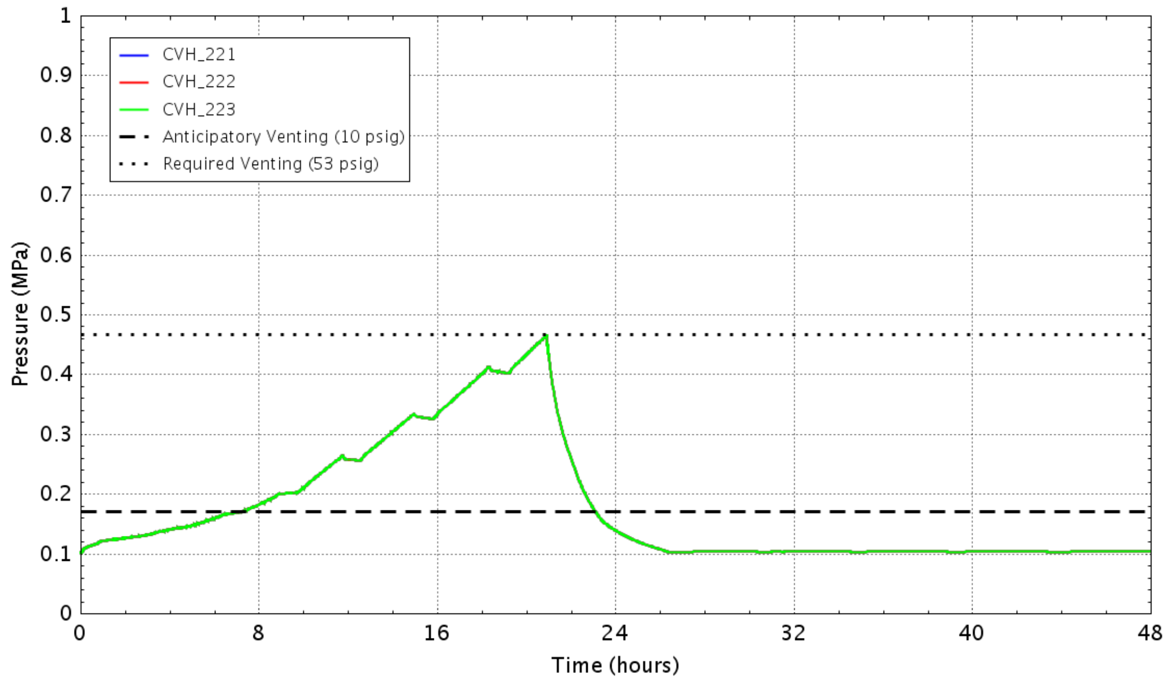

Figure E - 107 Pressure in the wetwell

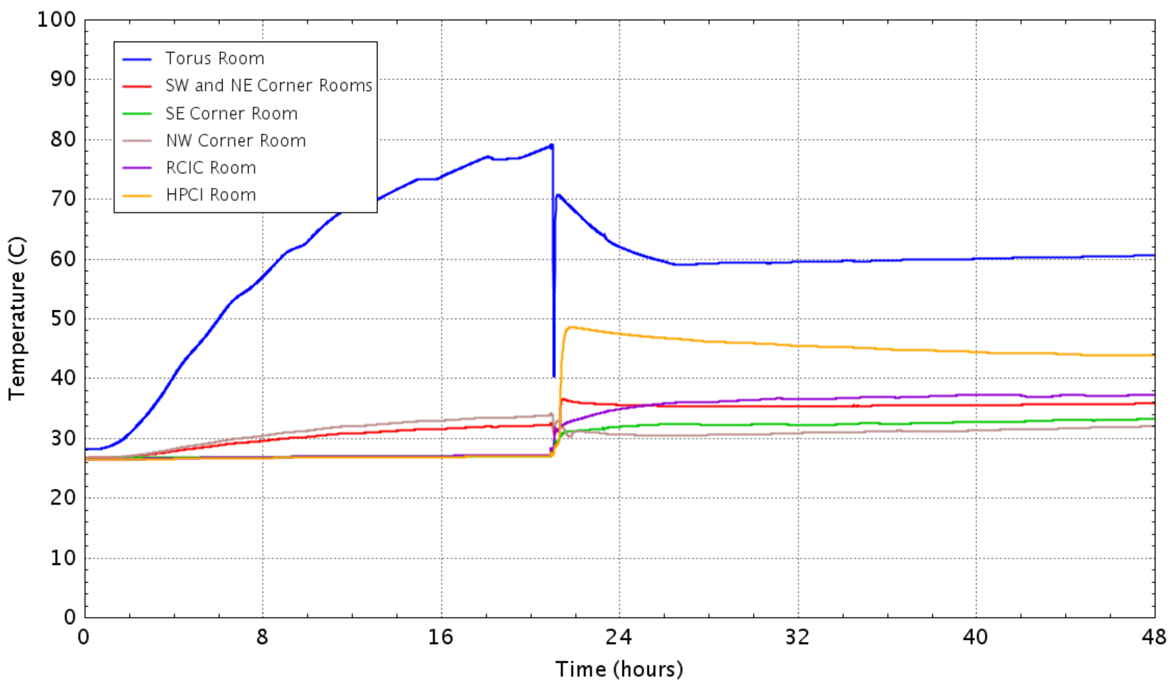

Figure E - 108 Vapor temperature in the reactor building basement

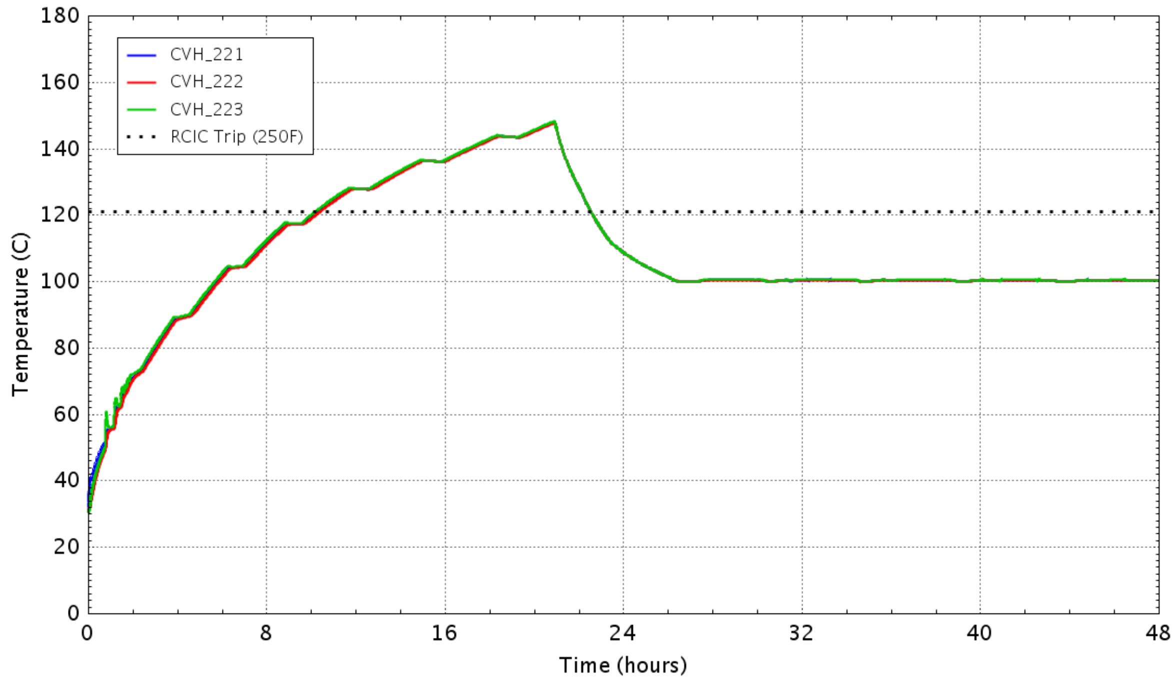

Figure E - 109 Water temperature in the wetwell

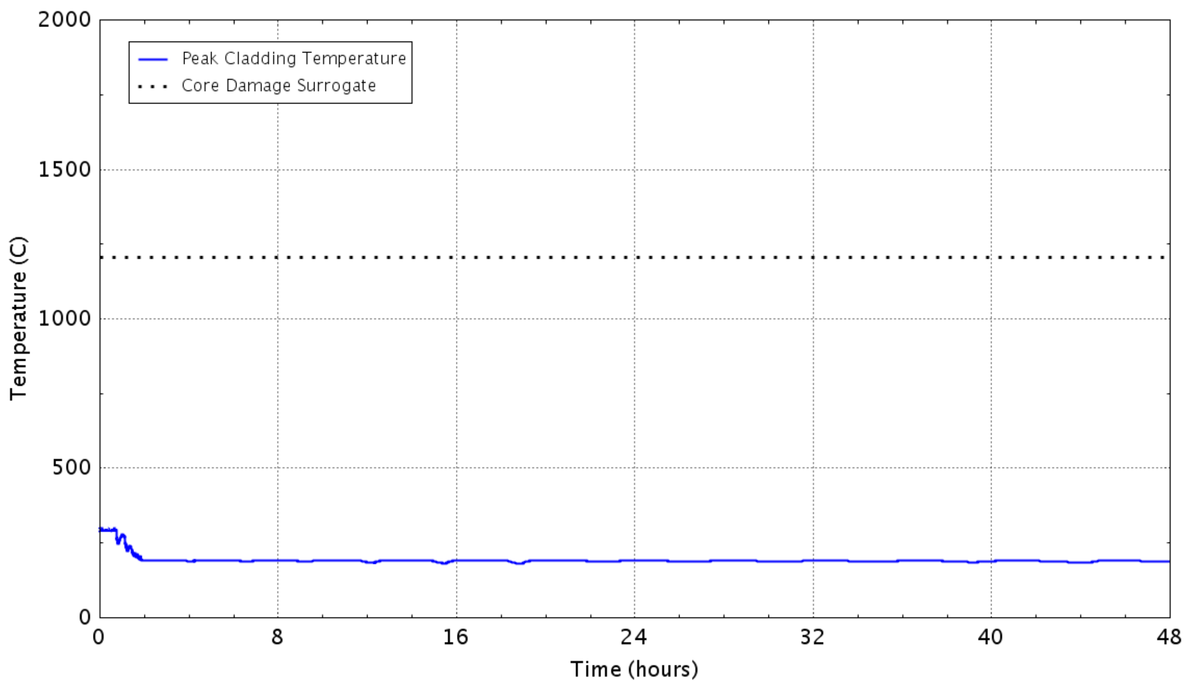

Figure E – 110 Peak temperature of the fuel cladding as a function oftime

E.1.12 Case 12: LOOPGR-38-9, Containment Failure at 53 psig, Containment Venting via the 18-in. Drywell Main Vent,RCIC Non-functional

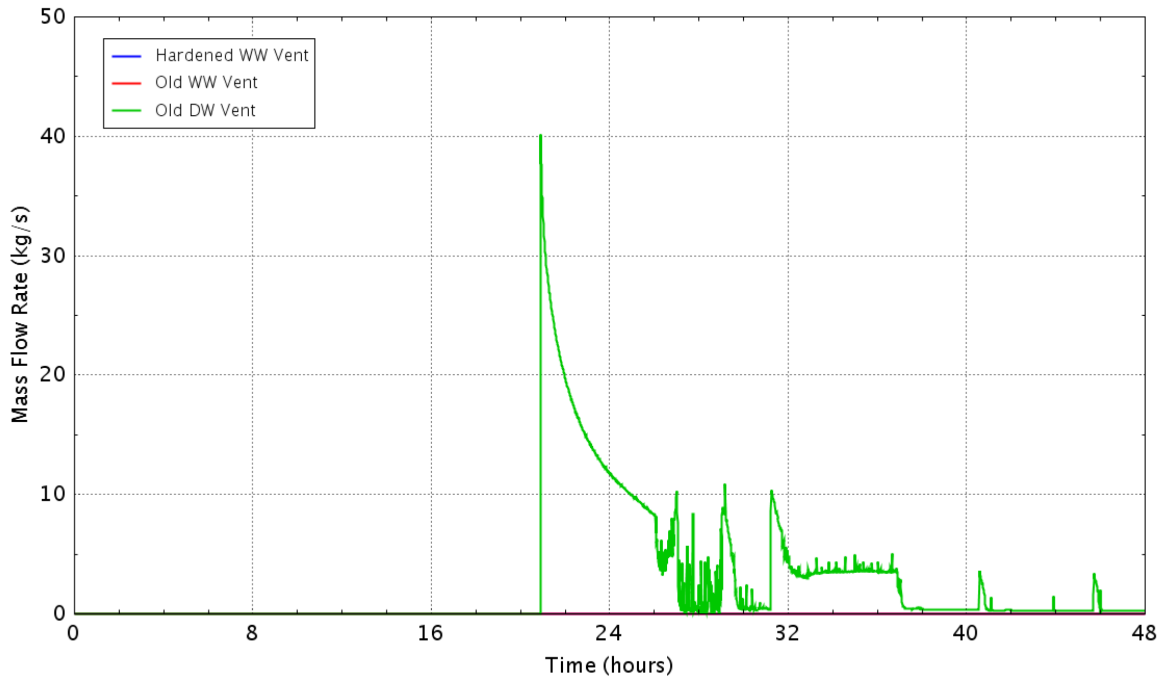

Figure E - 111 Flow rate of the containment vents

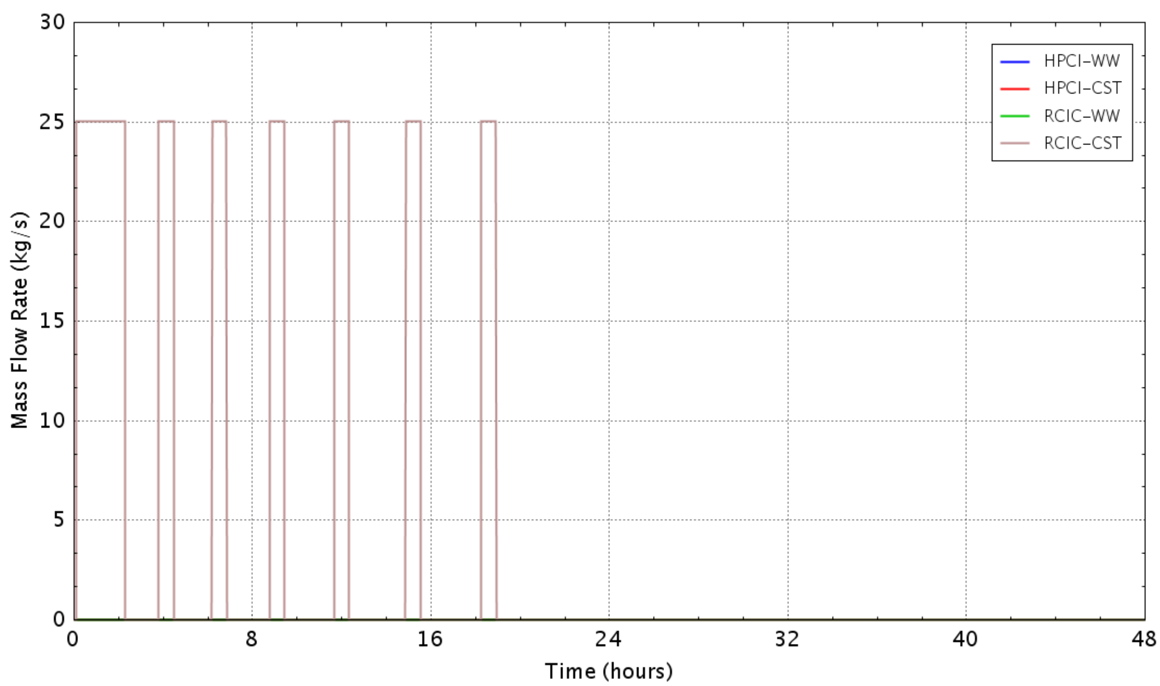

Figure E - 112 Flow rate of the HPCI/RCIC pumps

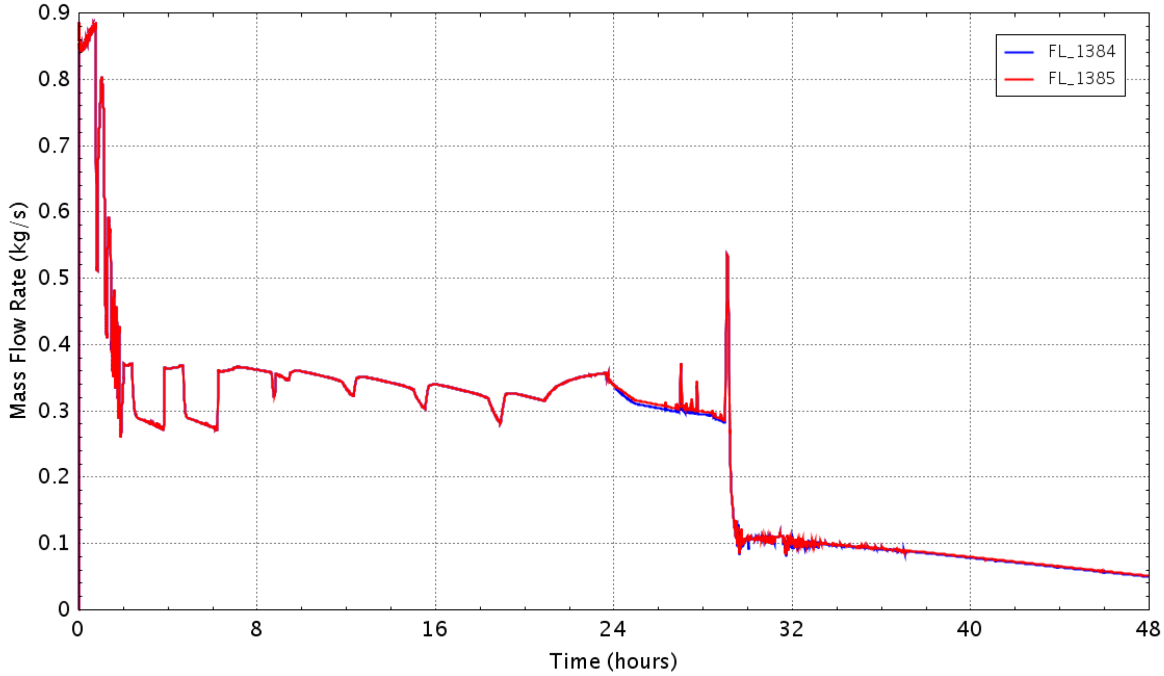

Figure E - 113 Flow rate of the recirculating pump seal leakage

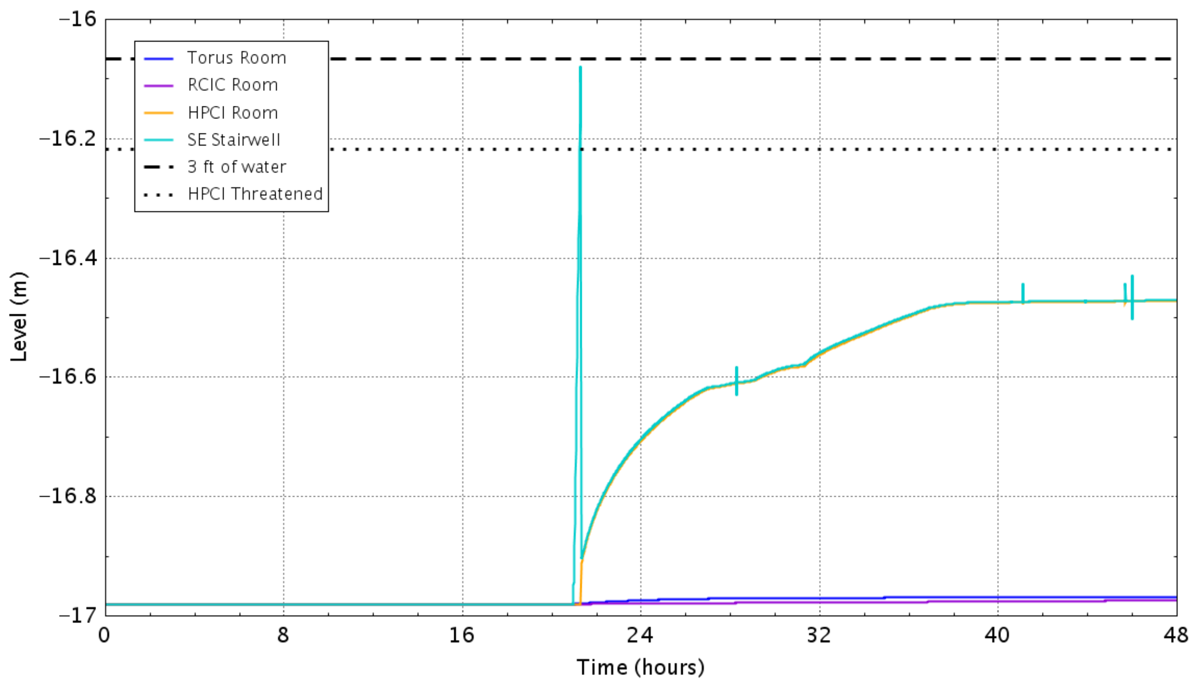

Figure E - 114 Water level in the reactor building basement

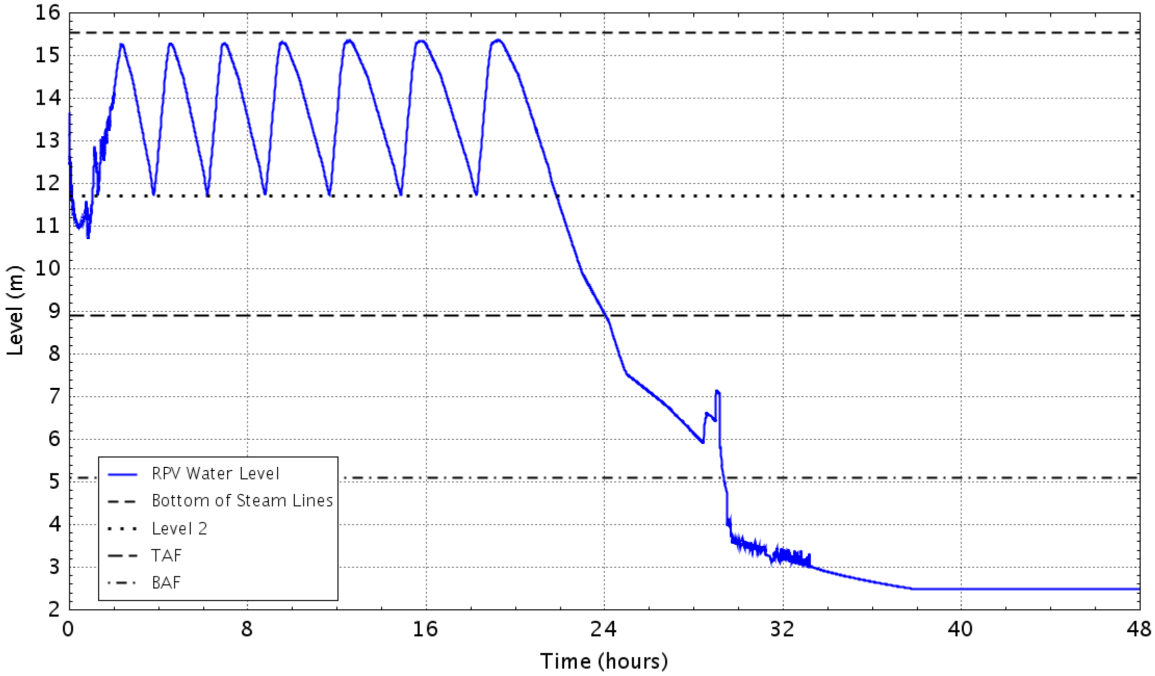

Figure E - 115 **RPV down comer water level**

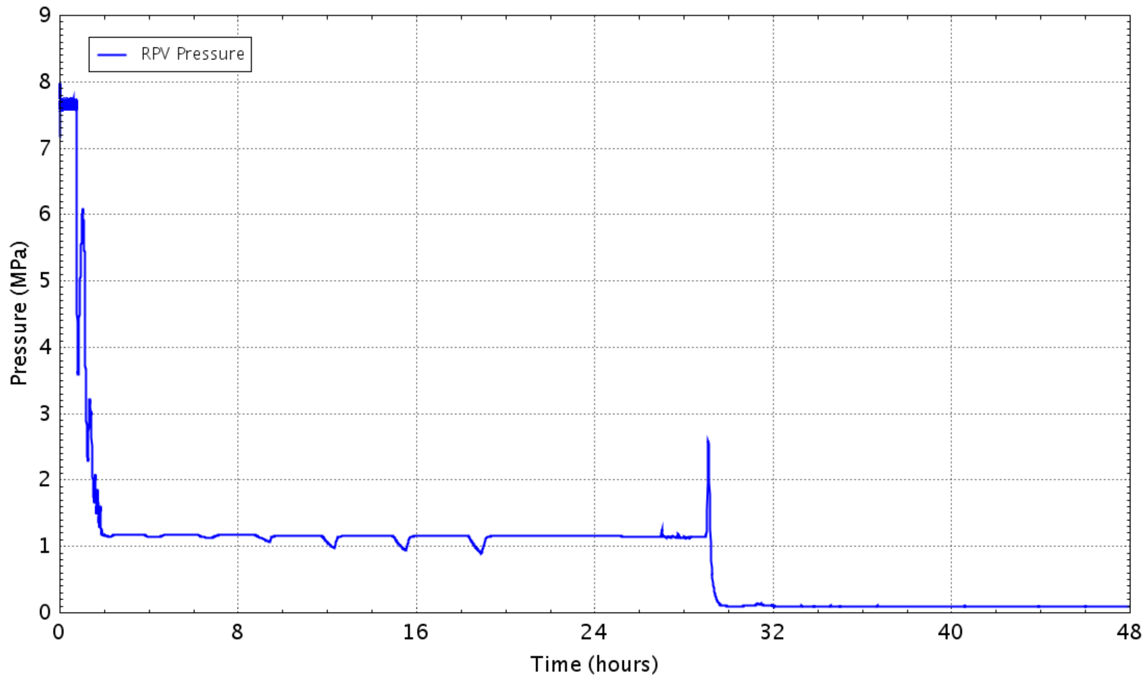

Figure E - 116 **Pressure in theRPV**

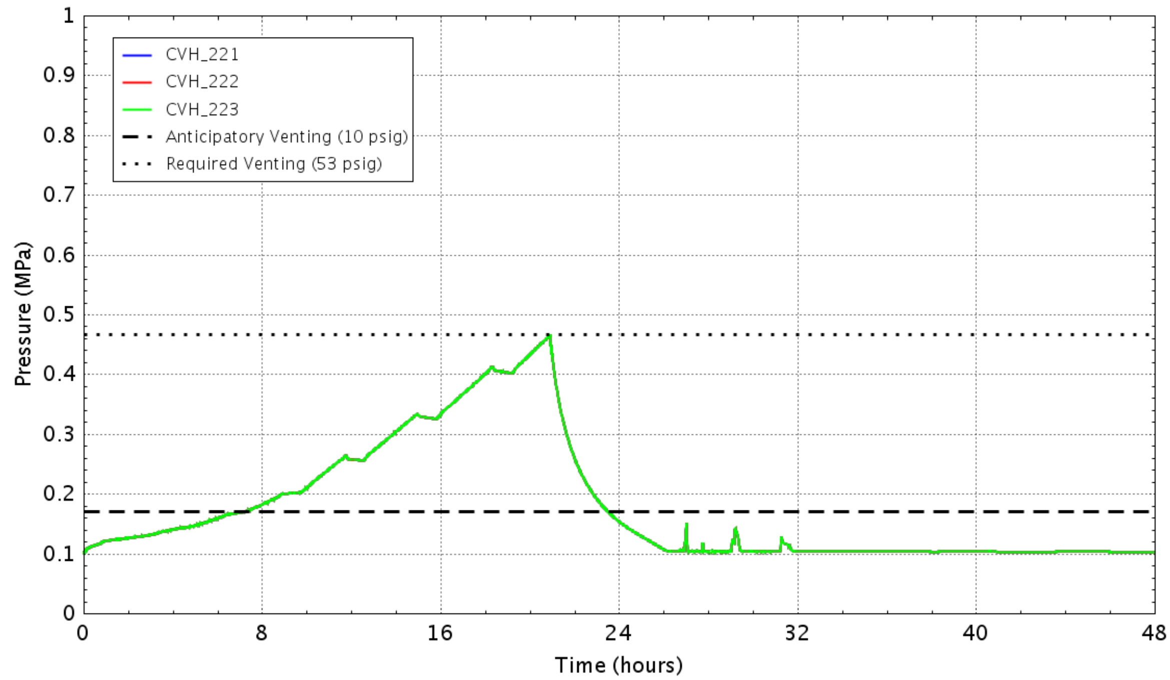

Figure E - 117 **Pressure in the wetwell**

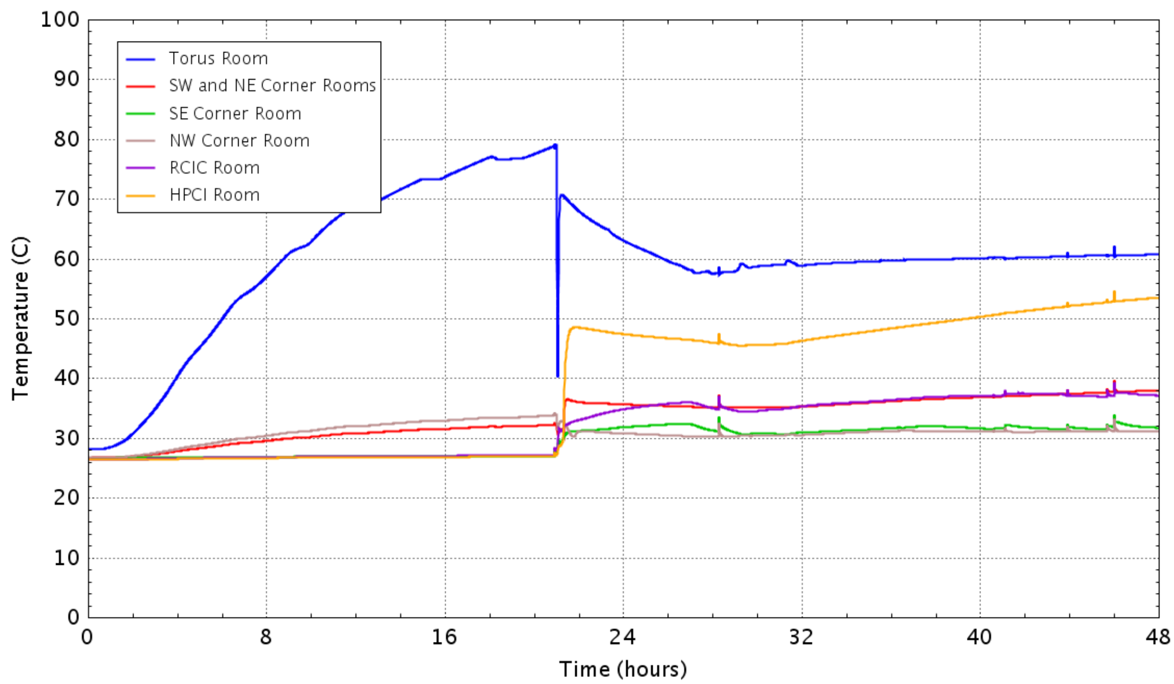

Figure E - 118 **Vapor temperature in the reactor building basement**

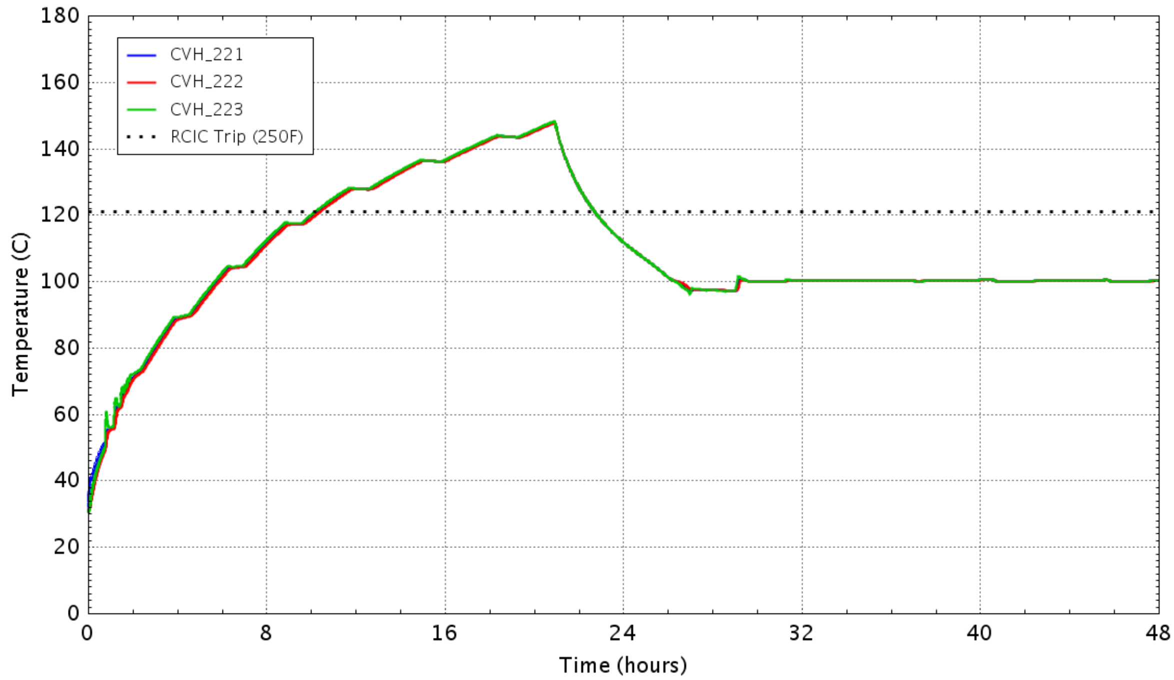

Figure E - 119 Water temperature in the wetwell

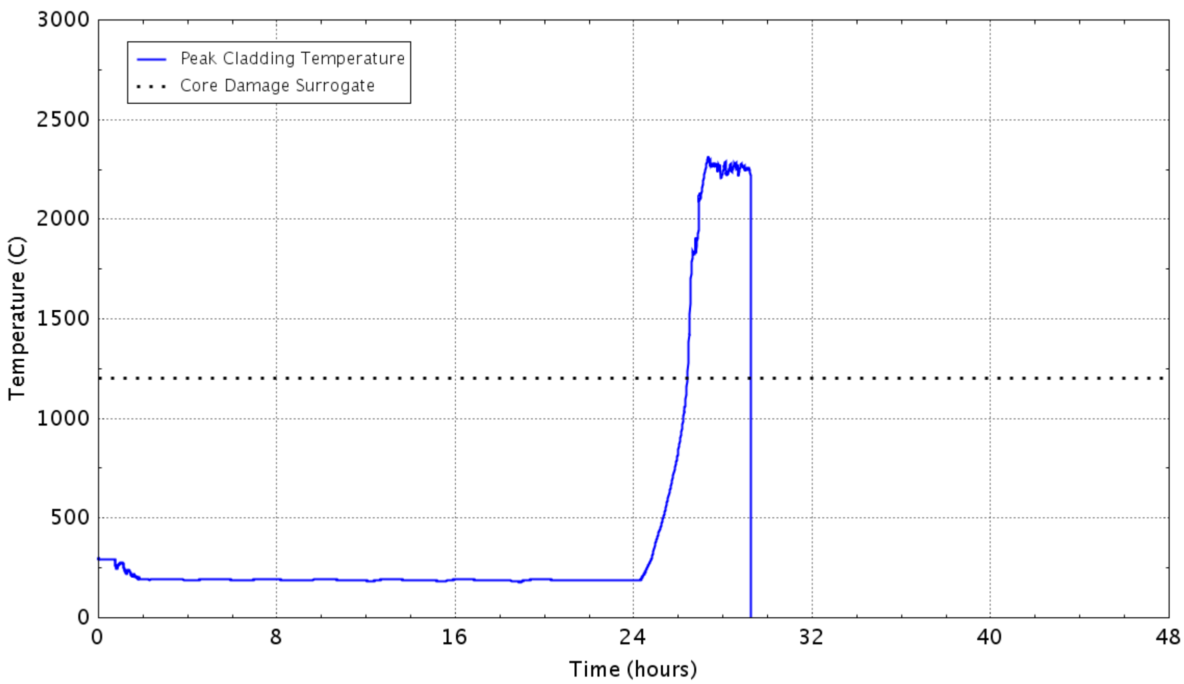

Figure E – 120 Peak temperature of the fuel cladding as a function oftime

E.1.13 Case 13: LOOPGR-38-9, Containment Failure at 53 psig, Containment Venting via the HCV, RCIC Fully Functional

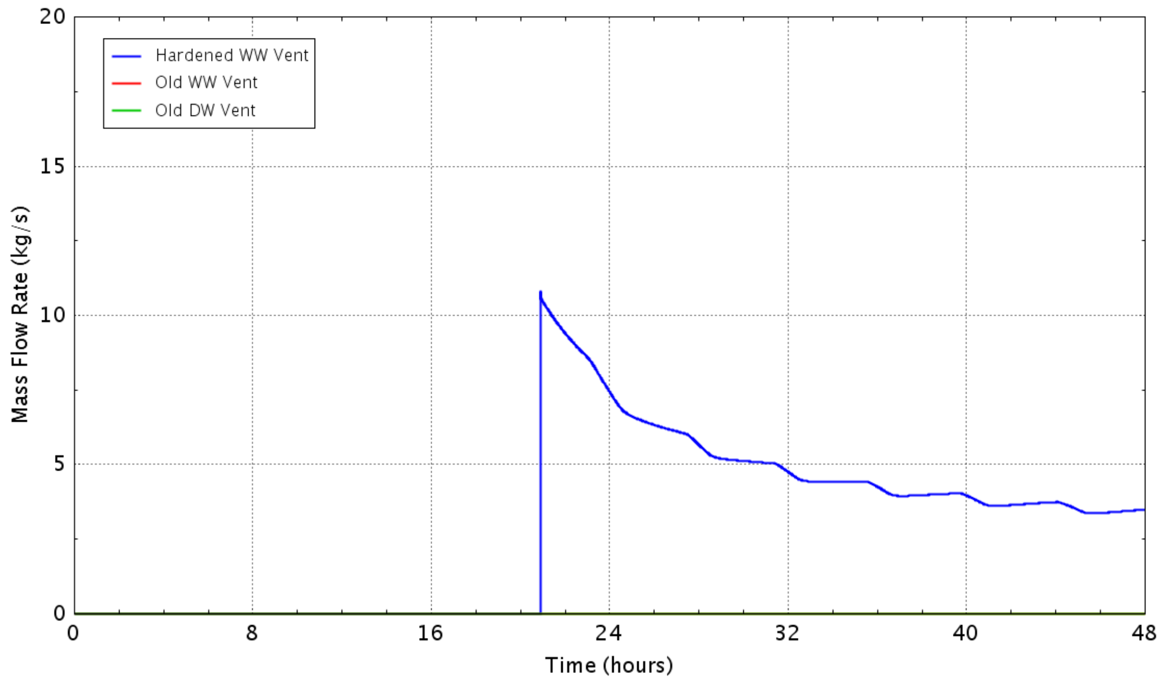

Figure E - 121 Flow rate of the containment vents

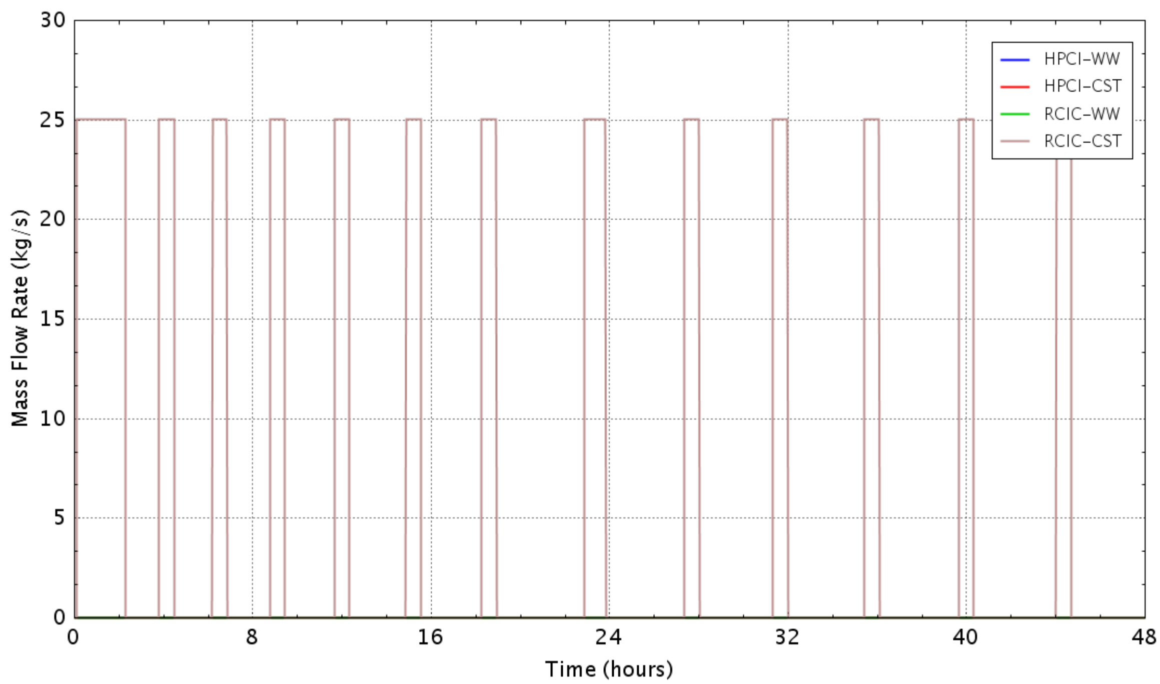

Figure E - 122 Flow rate of the HPCI/RCIC pumps

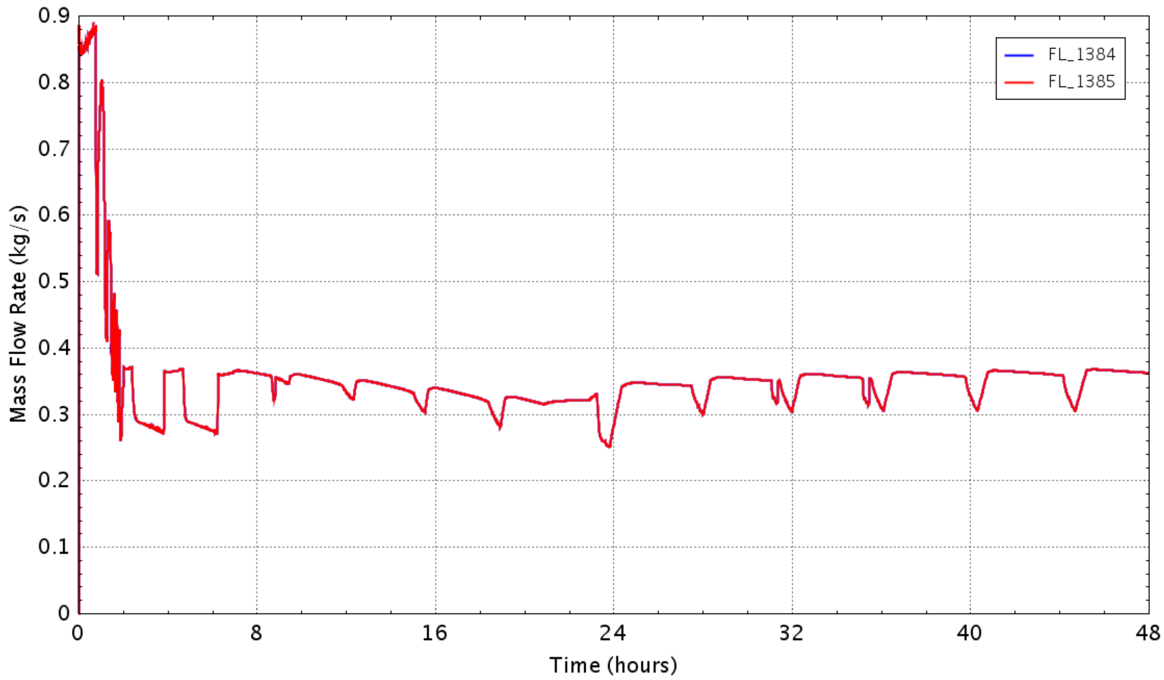

Figure E - 123 **Flow rate of the recirculating pump seal leakage**

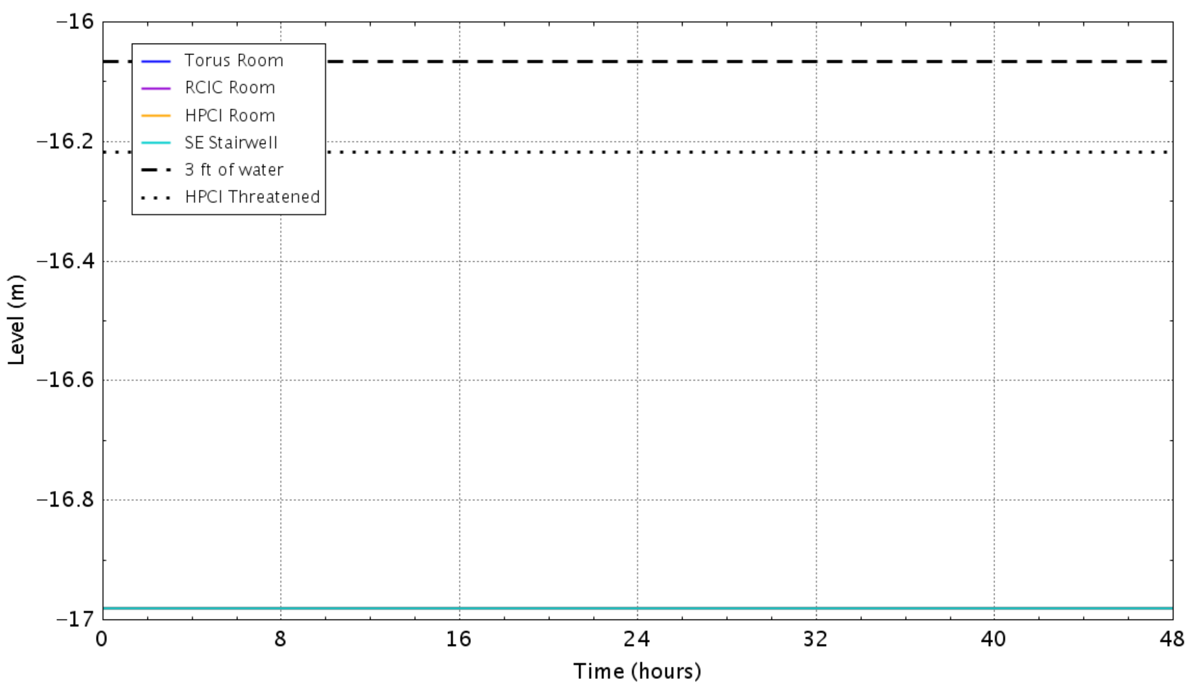

Figure E - 124 **Water level in the reactor building basement**

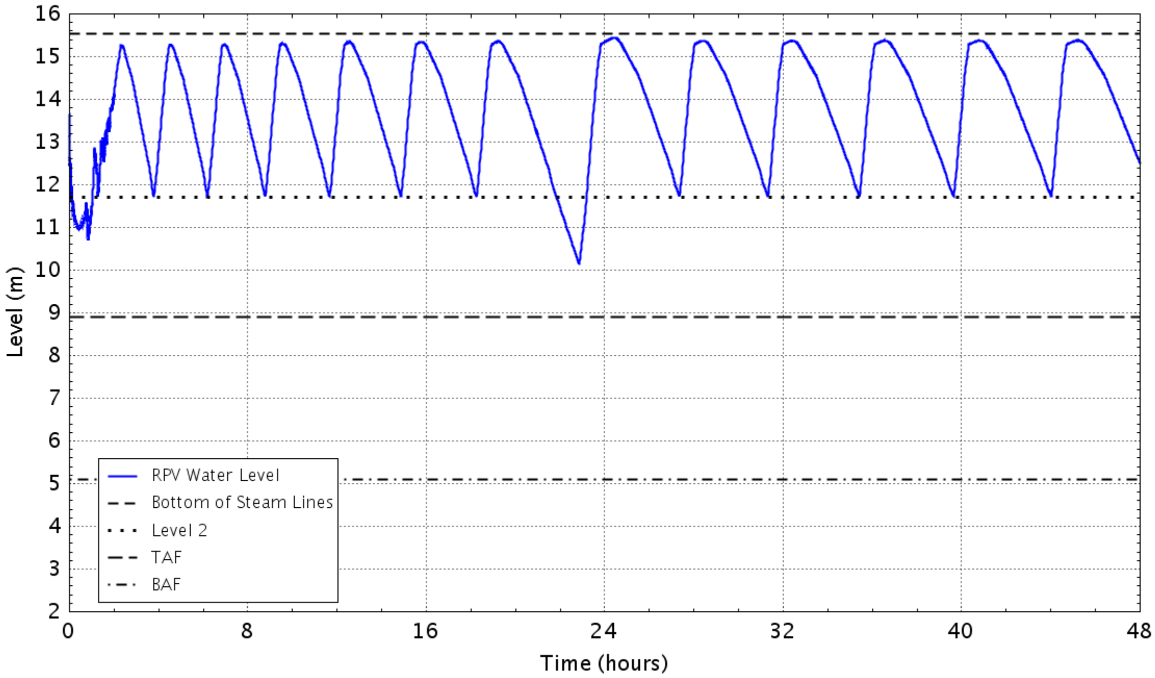

Figure E - 125 RPV down comer water level

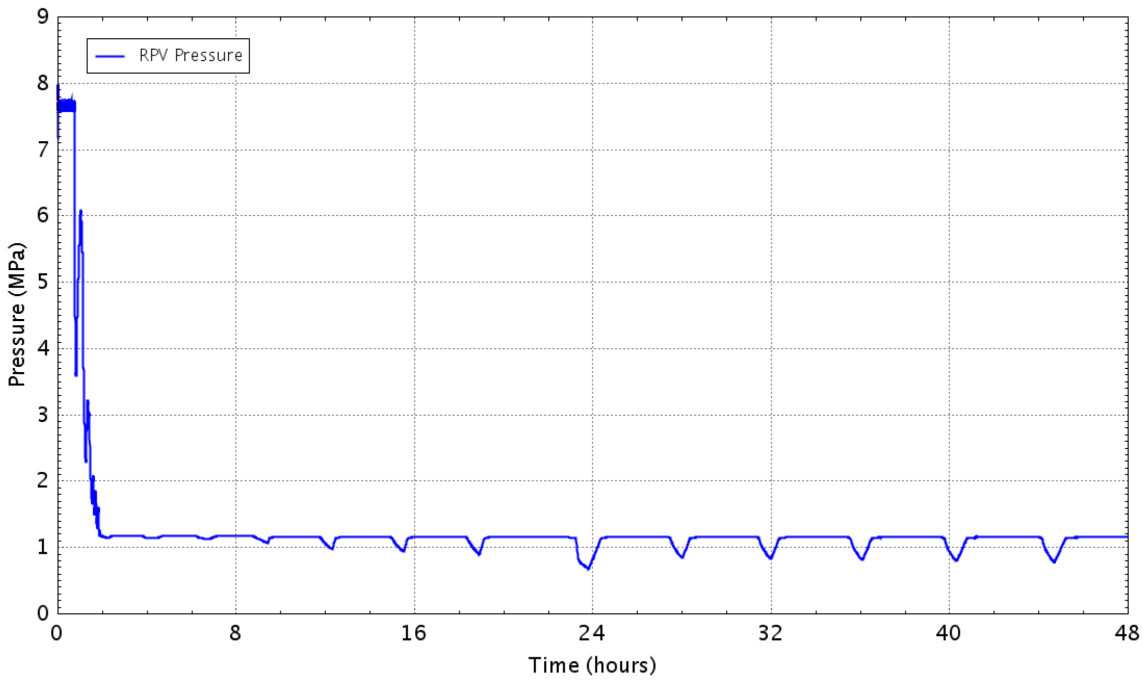

Figure E - 126 Pressure in theRPV

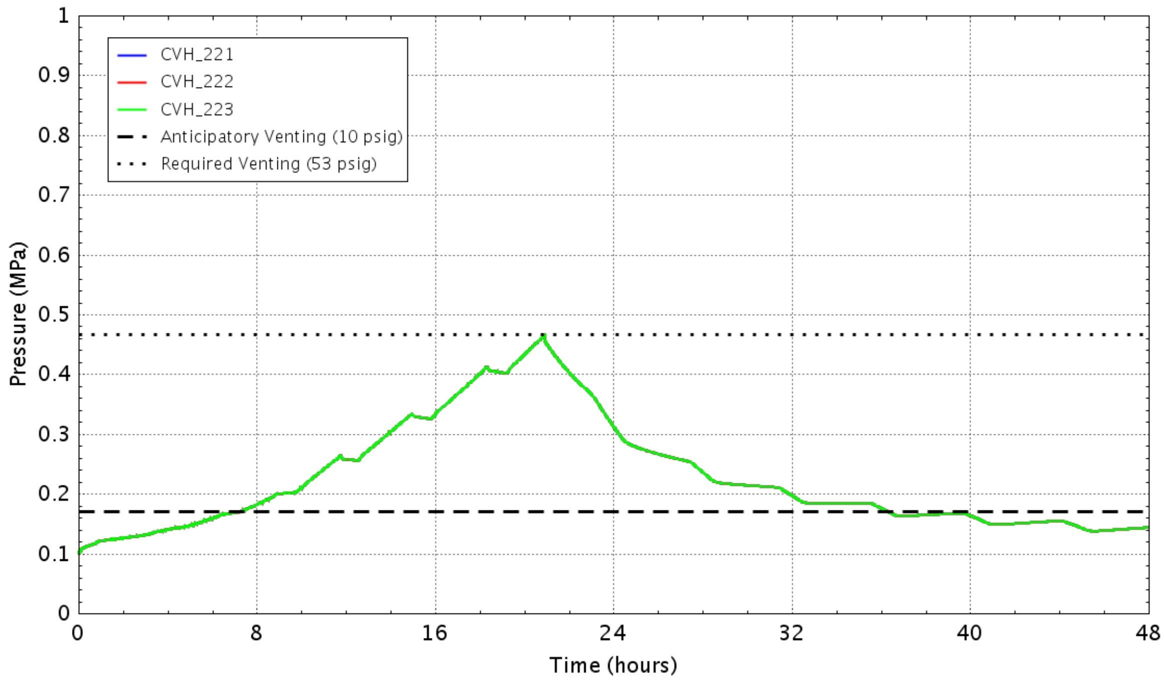

Figure E - 127 Pressure in the wetwell

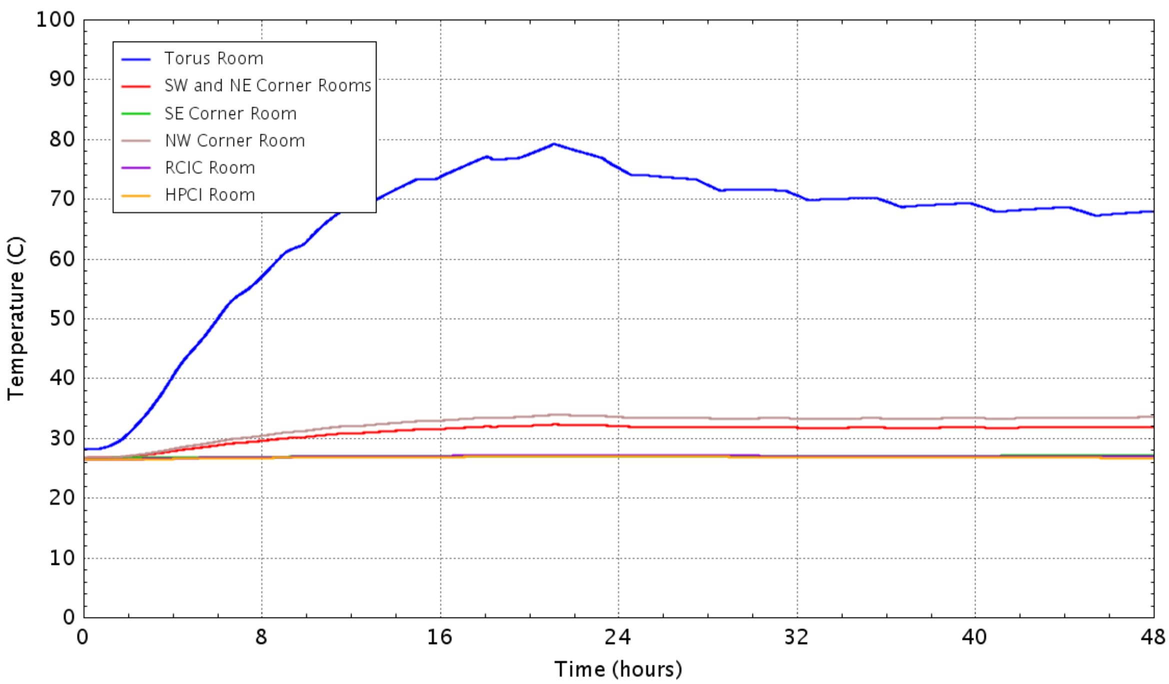

Figure E - 128 Vapor temperature in the reactor building basement

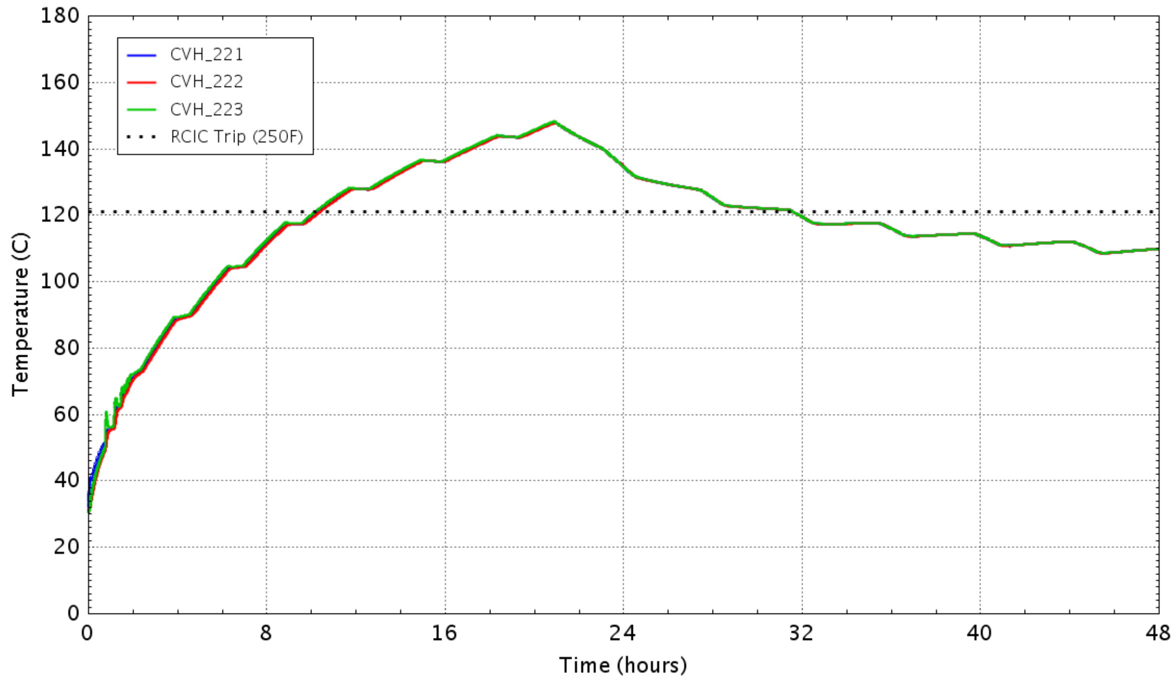

Figure E - 129 **Water temperature in the wetwell**

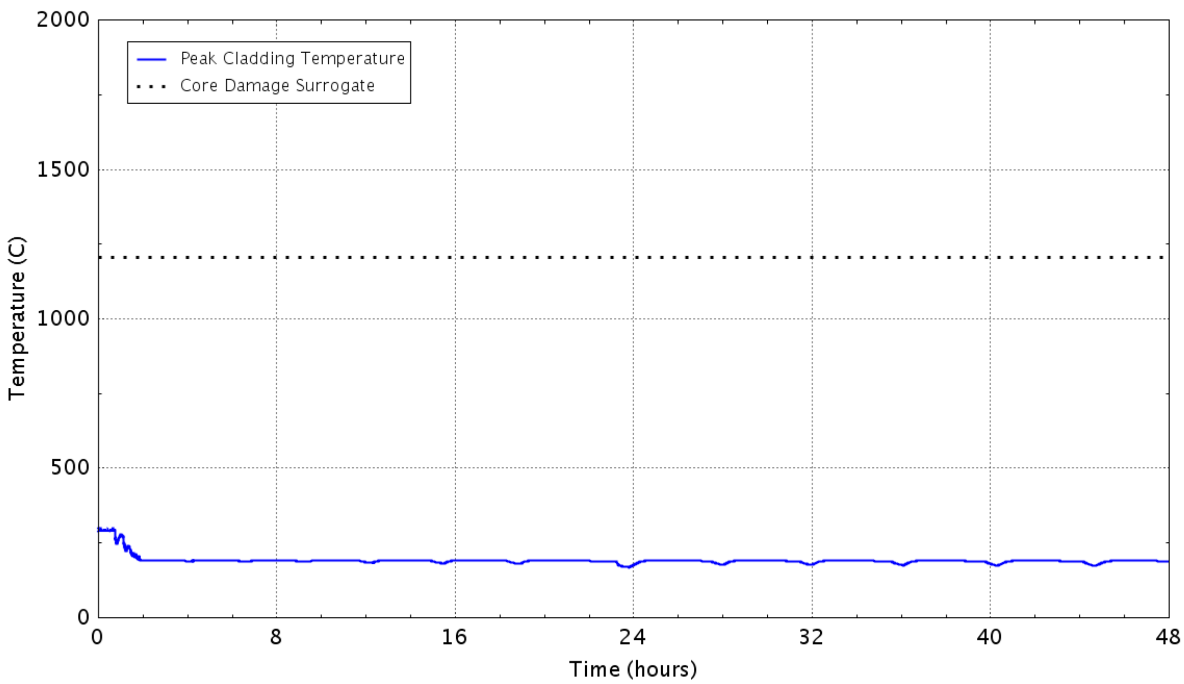

Figure E – 130 **Peak temperature of the fuel cladding as a function oftime**

E.1.14 Case 14: LOOPGR-38-9, Containment Failure at 53psig, Containment Venting via the HCV, RCIC 50% Degraded

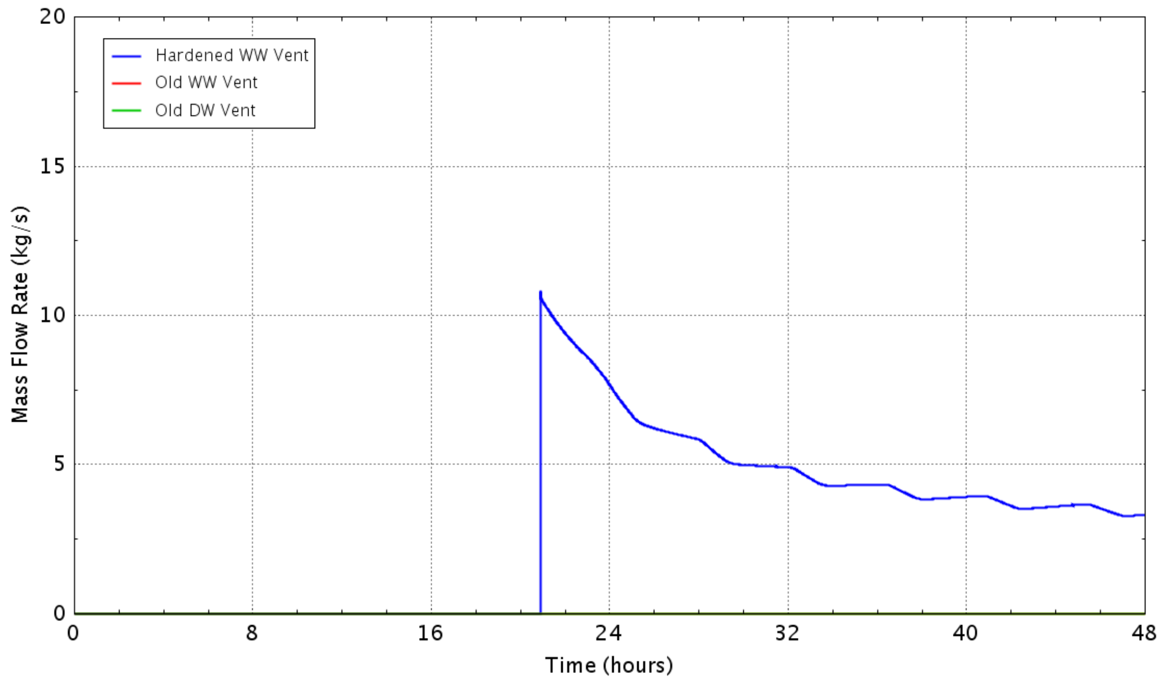

Figure E - 131 Flow rate of the containment vents

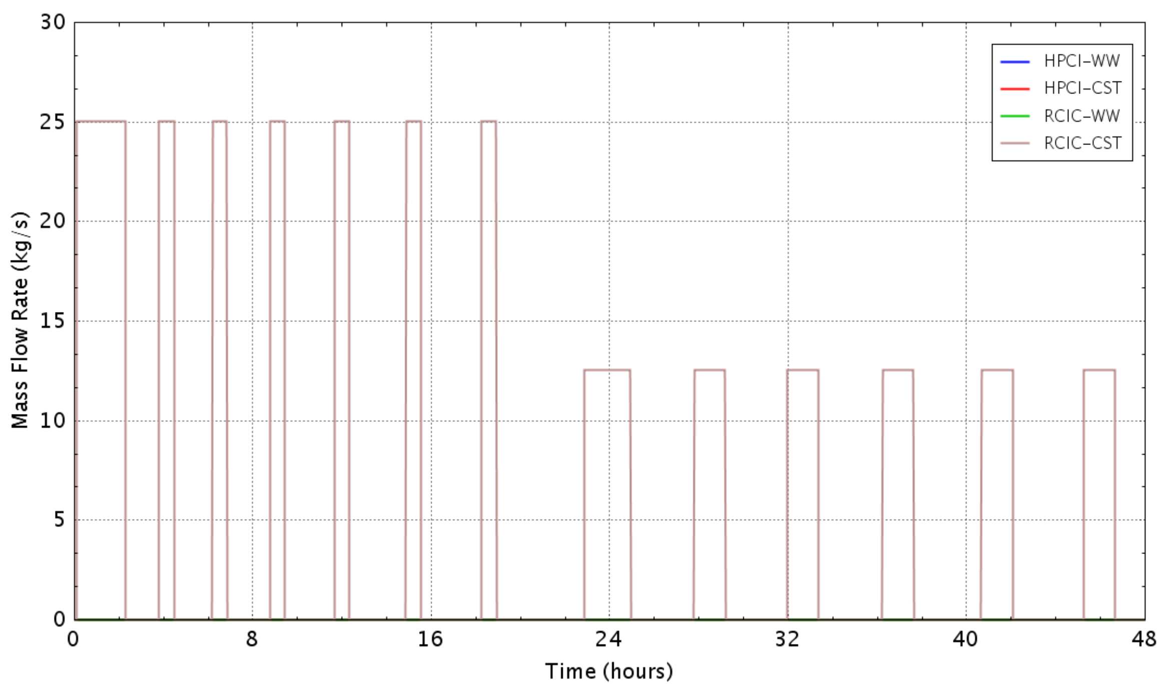

Figure E - 132 Flow rate of the HPCI/RCIC pumps

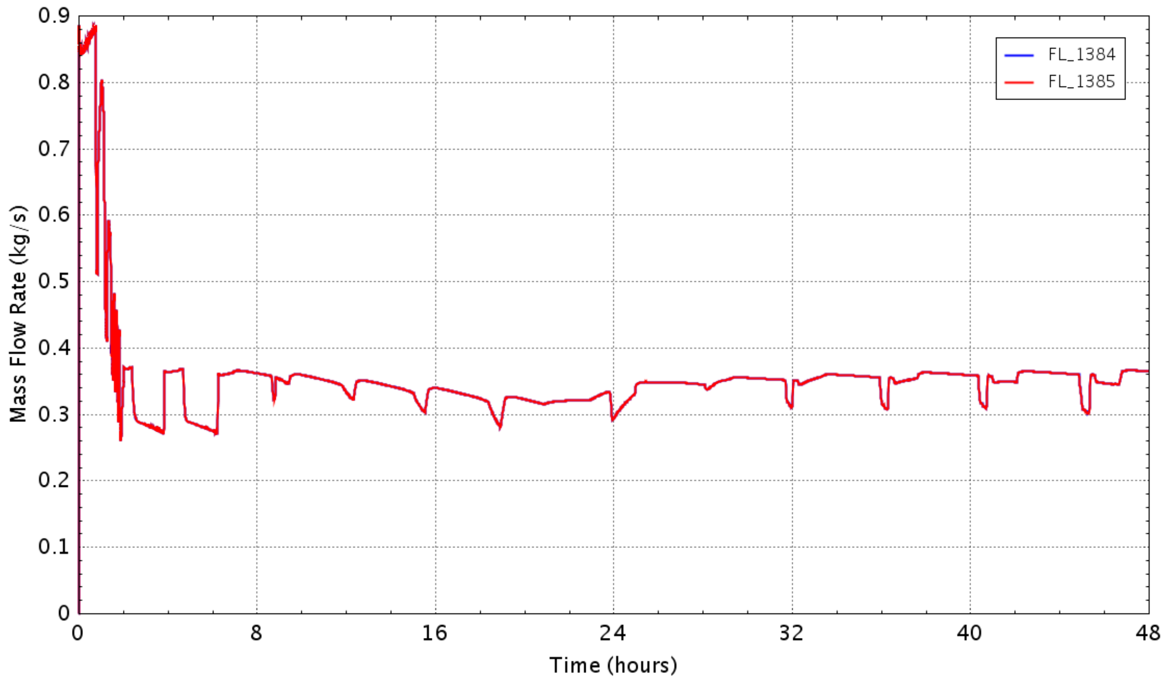

Figure E - 133 **Flow rate of the recirculating pump seal leakage**

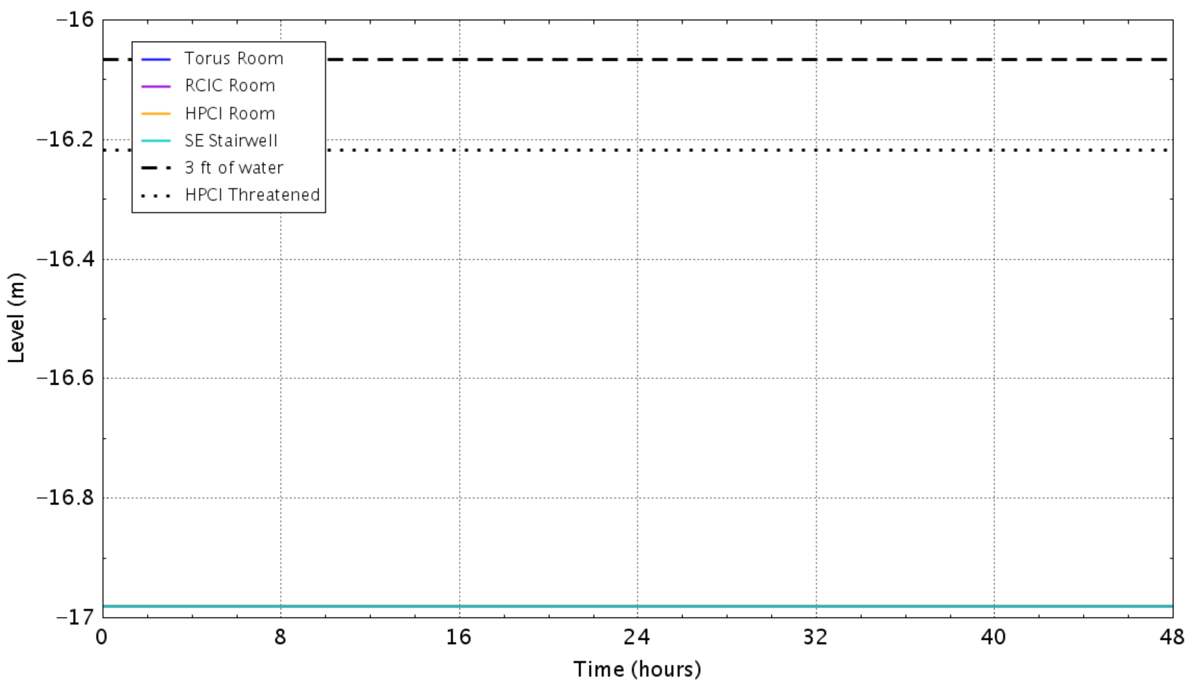

Figure E - 134 **Water level in the reactor building basement**

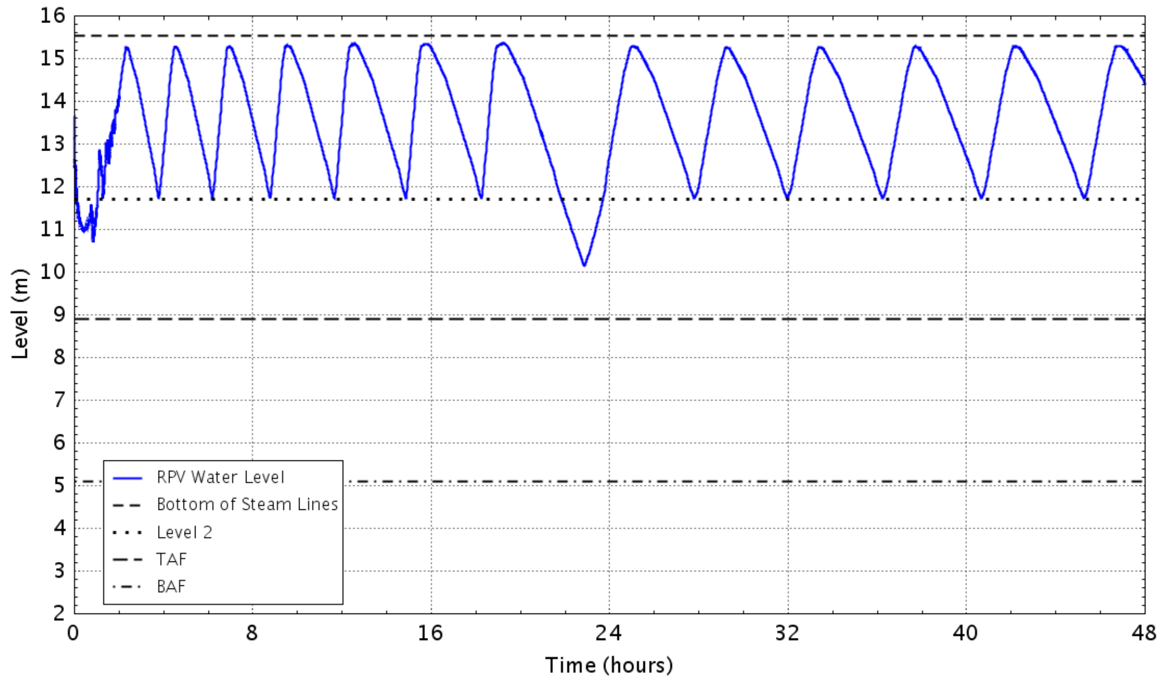

Figure E - 135 RPV down comer water level

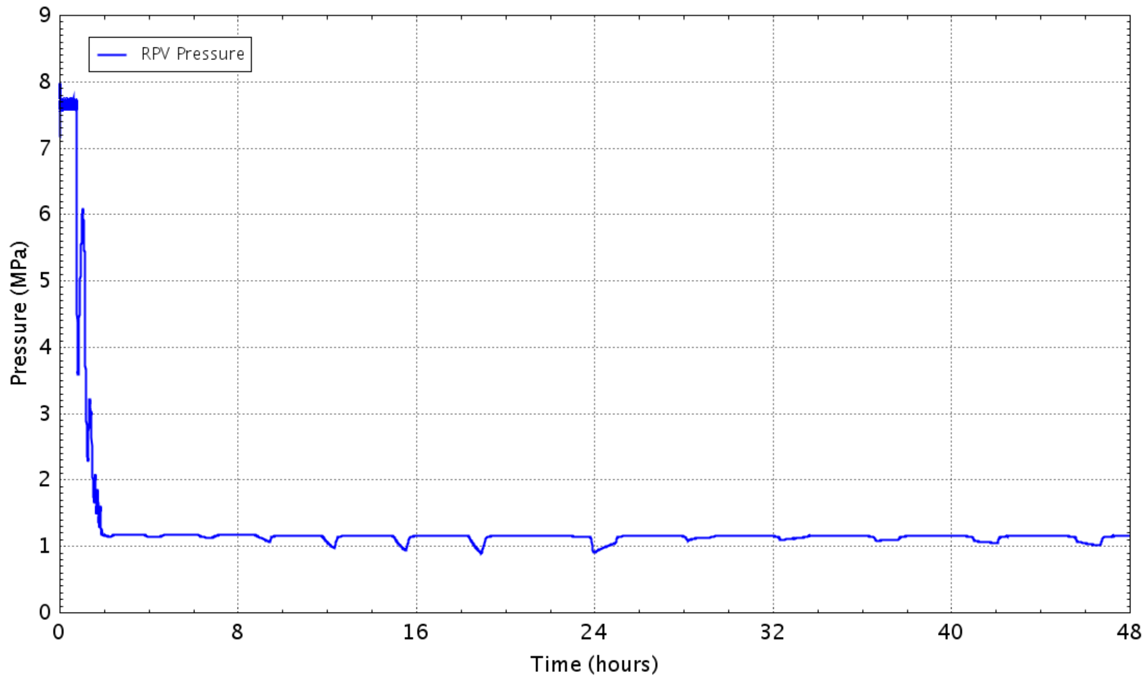

Figure E - 136 Pressure in theRPV

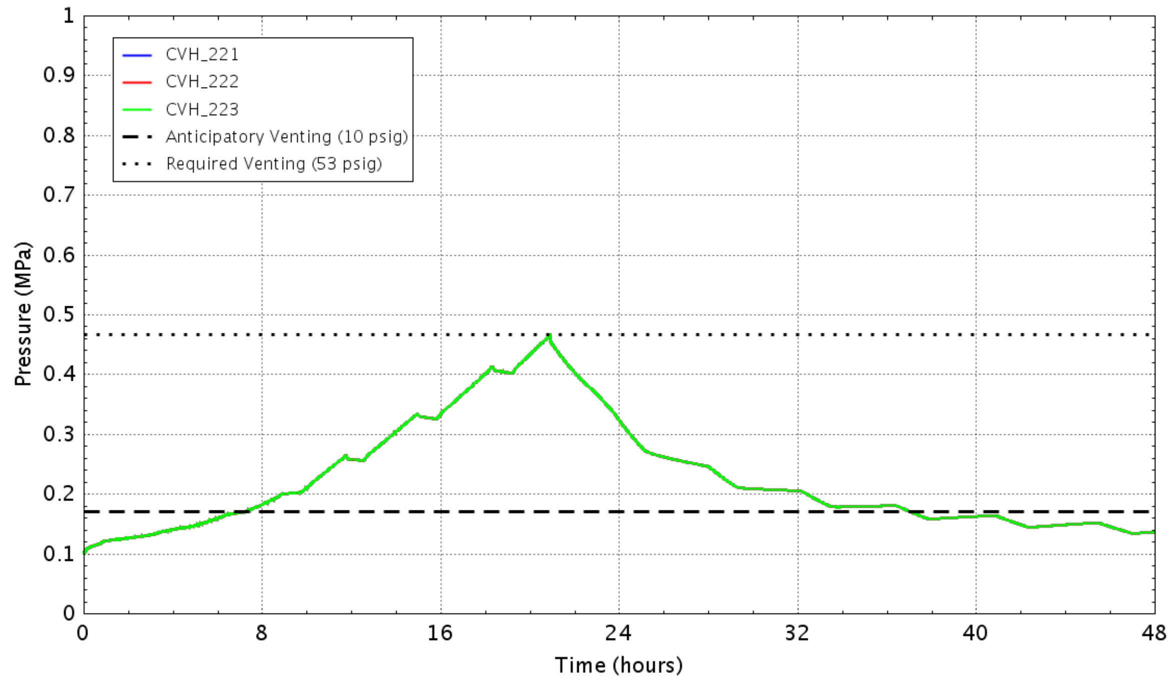

Figure E - 137 Pressure in the wetwell

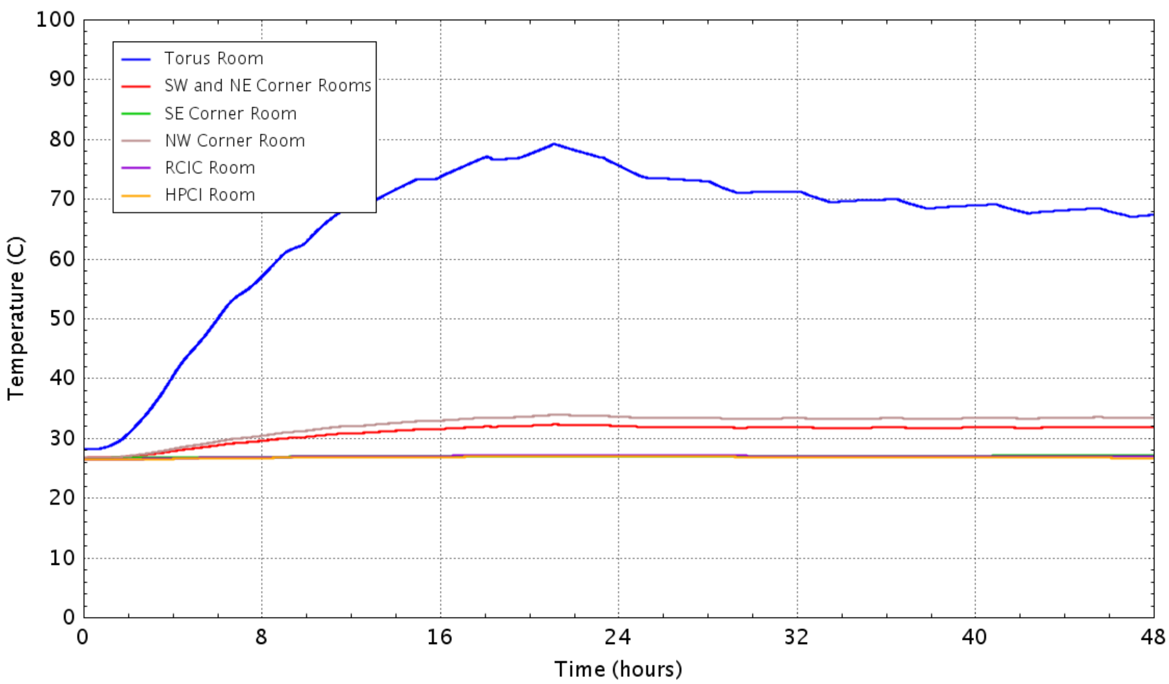

Figure E - 138 Vapor temperature in the reactor building basement

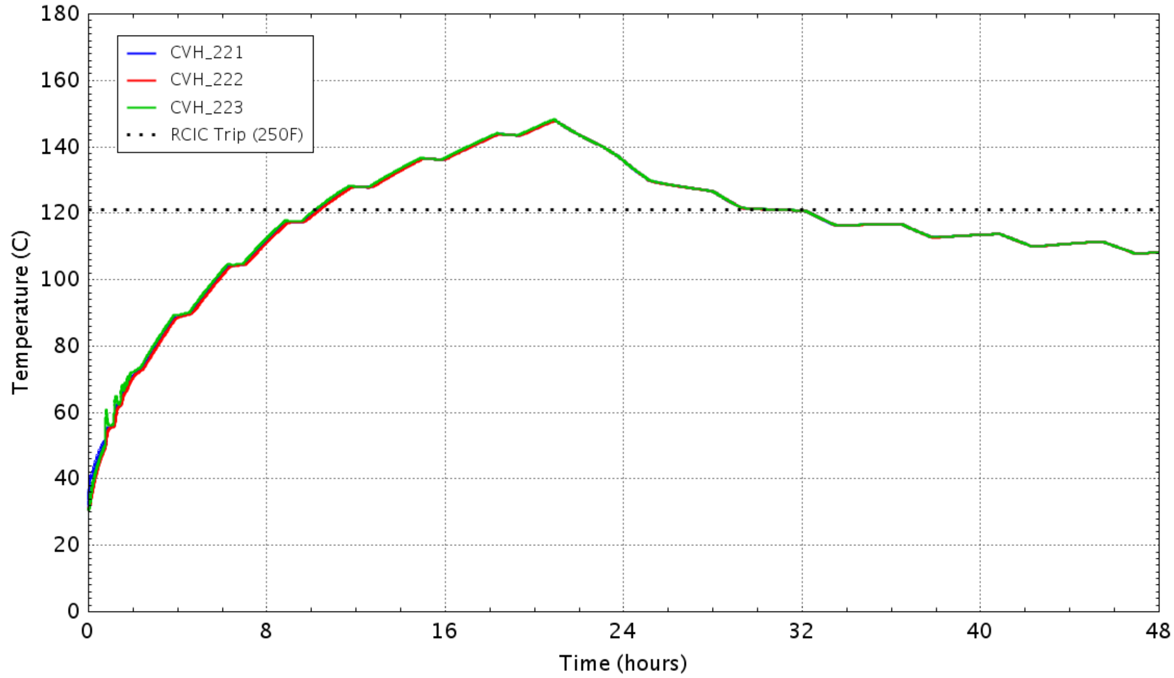

Figure E - 139 Water temperature in the wetwell

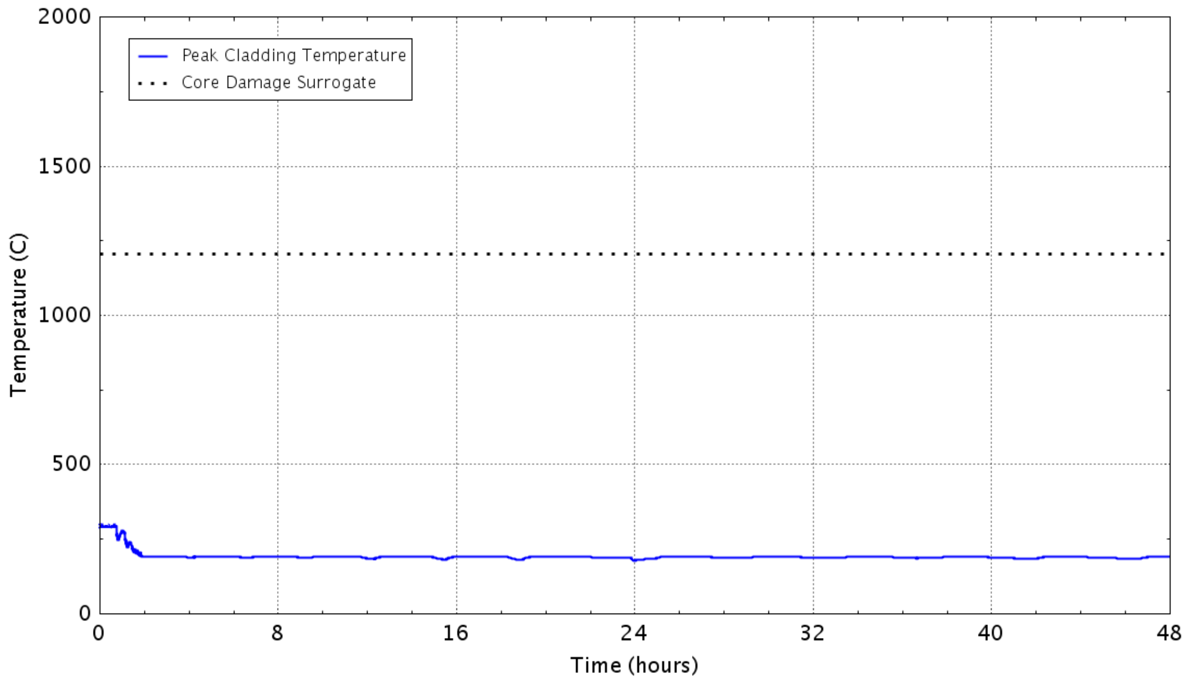

Figure E - 140 Peak temperature of the fuel cladding as a function of time

E.2 LOMFW Scenarios

E.2.1 Case 15: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 2-in. Torus Bypass, RCIC Fully Functional

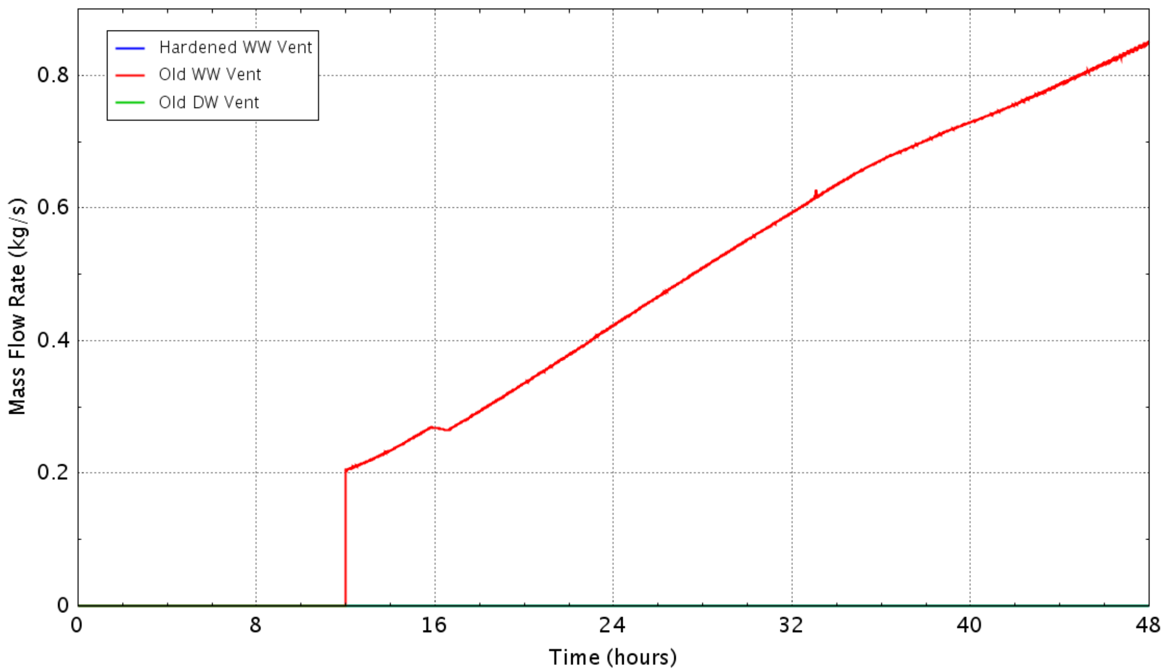

Figure E - 141 Flow rate of the containment vents

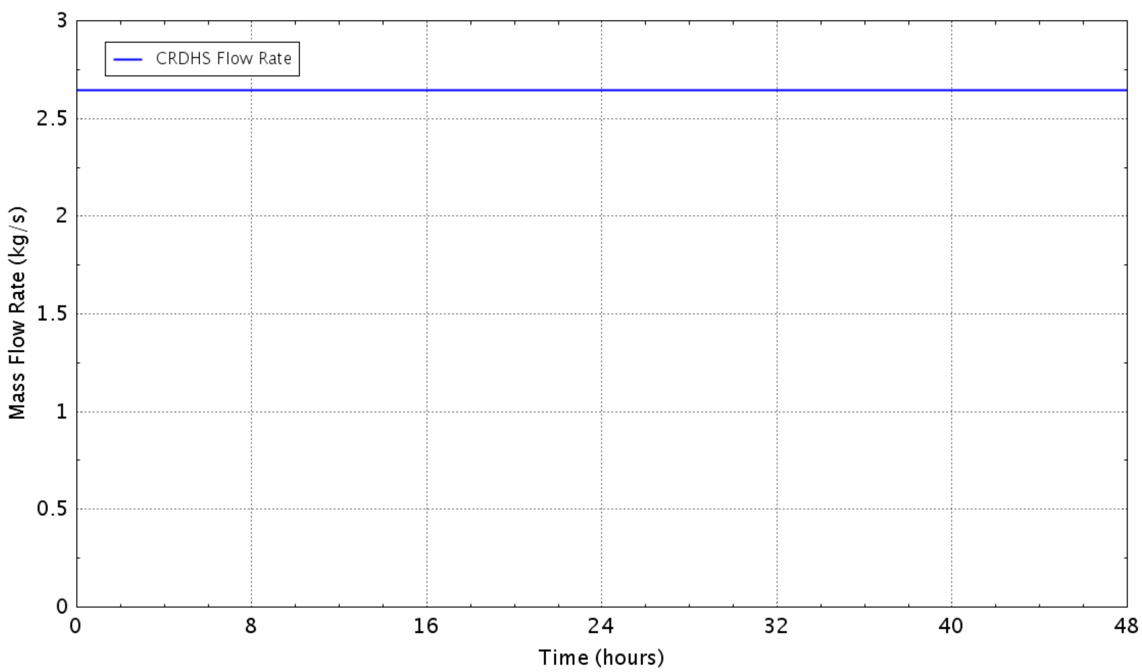

Figure E – 142 Flow rate of the control rod drive hydraulic system

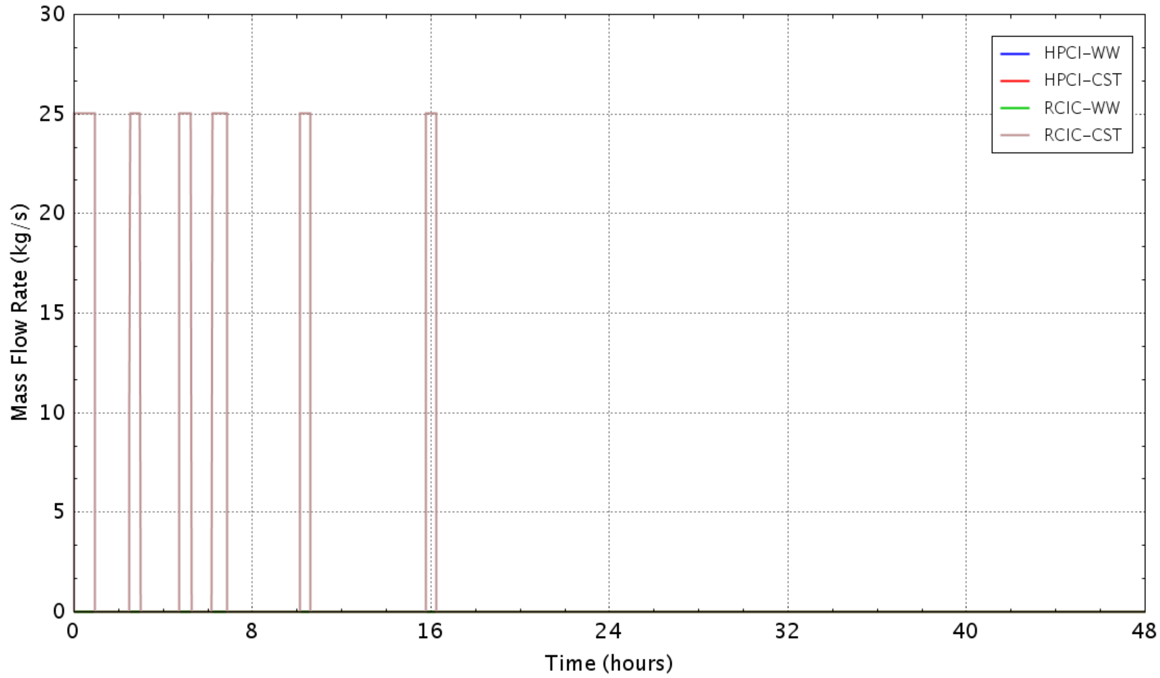

Figure E - 143 Flow rate of the HPCI/RCIC pumps

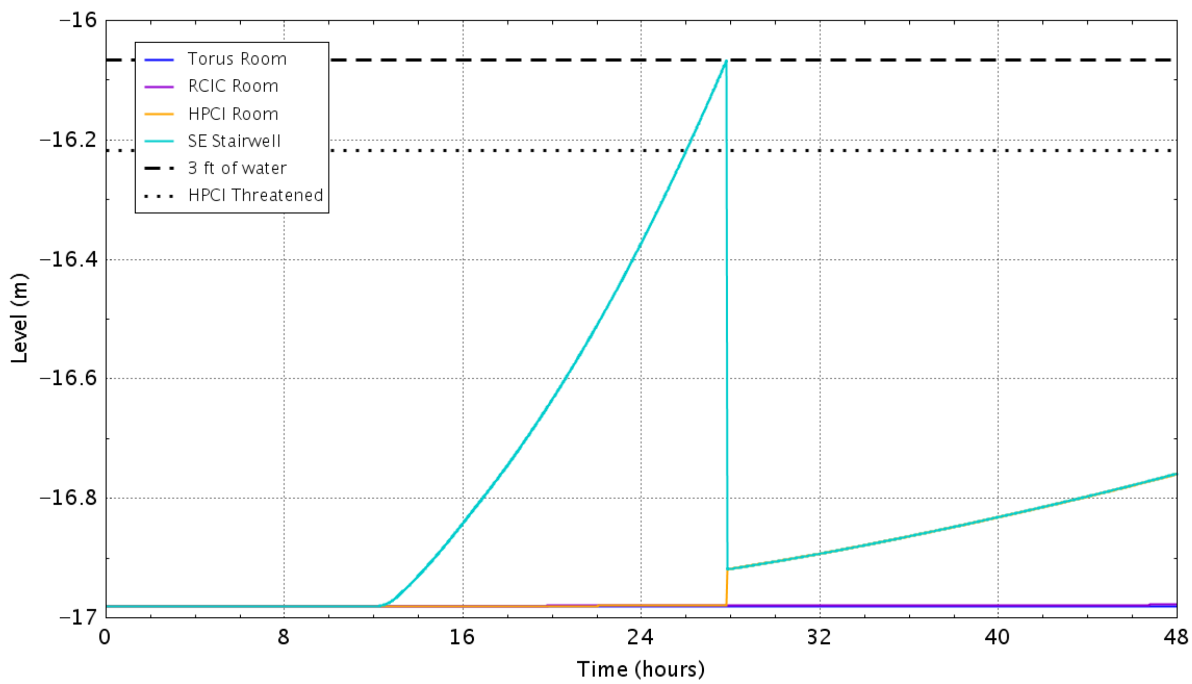

Figure E - 144 Water level in the reactor building basement

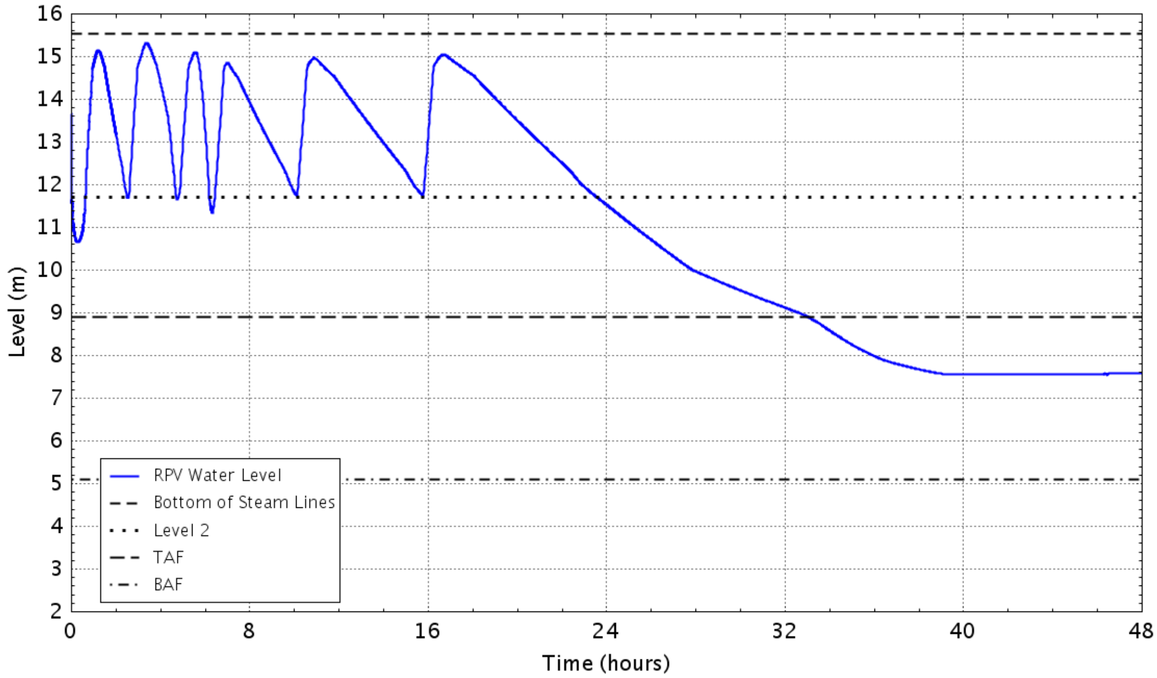

Figure E - 145 **RPV down comer water level**

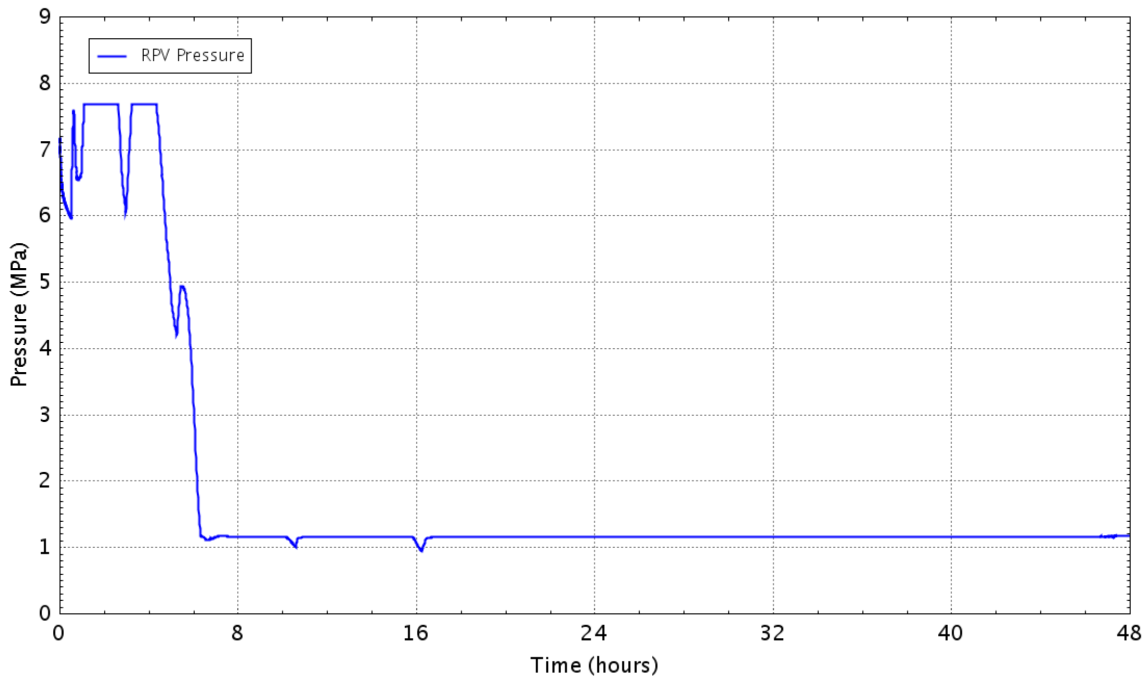

Figure E - 146 **Pressure in theRPV**

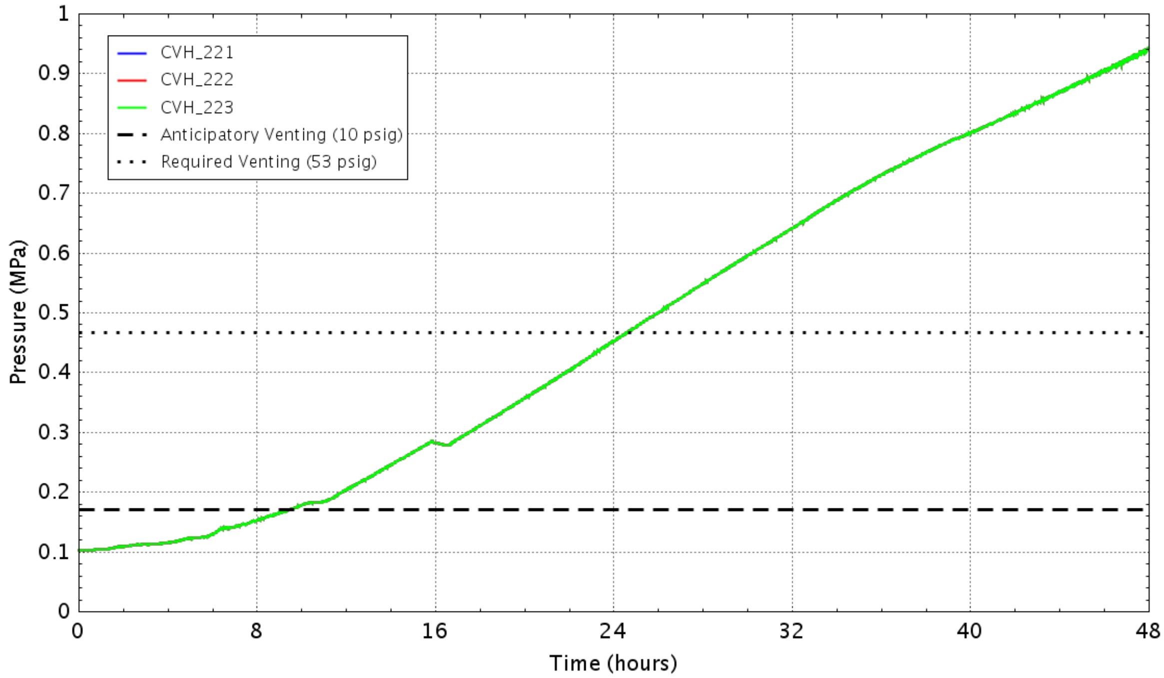

Figure E - 147 **Pressure in the wetwell**

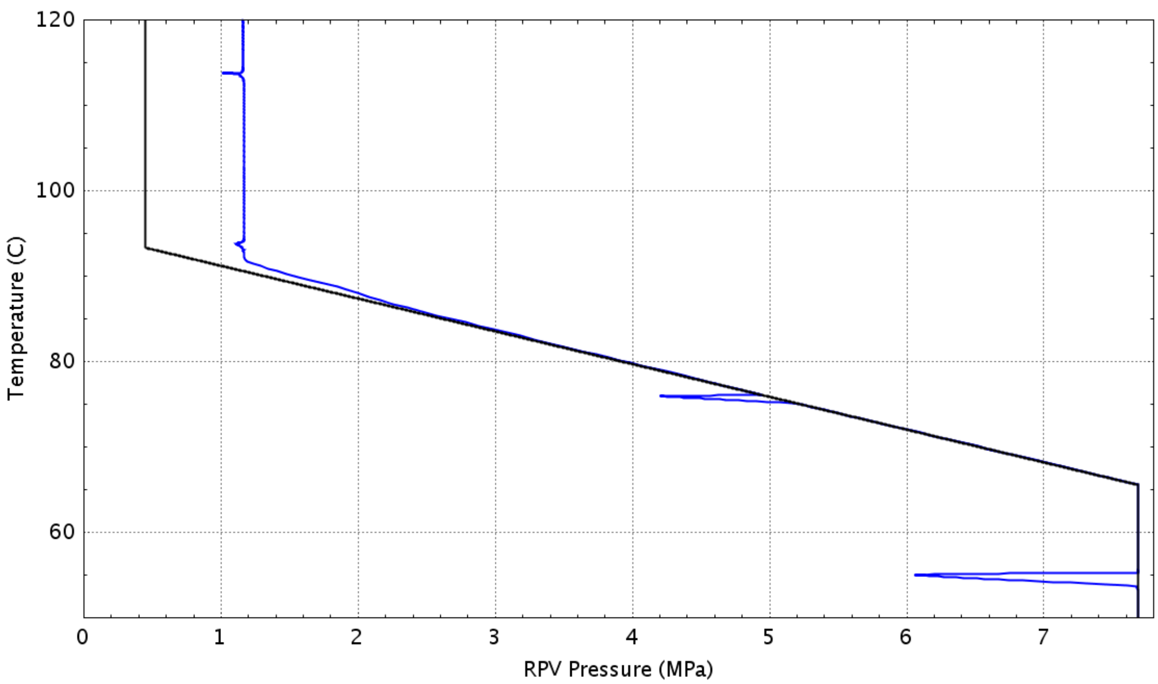

Figure E - 148 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

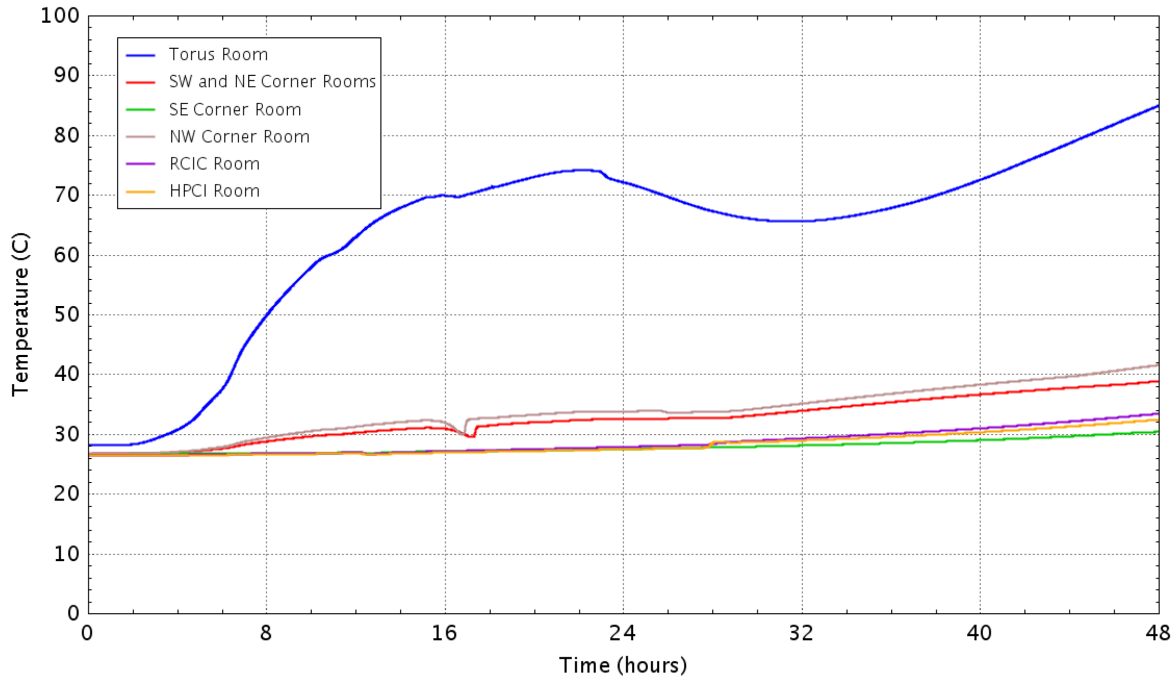

Figure E - 149 Vapor temperature in the reactor building basement

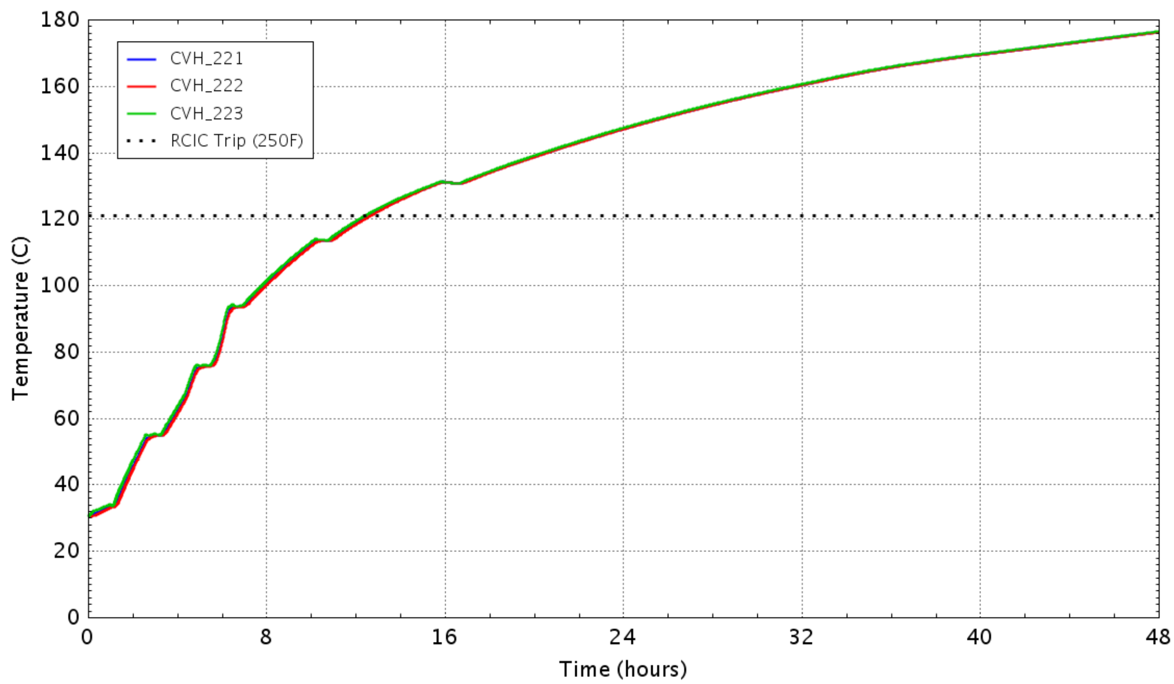

Figure E - 150 Water temperature in the wetwell

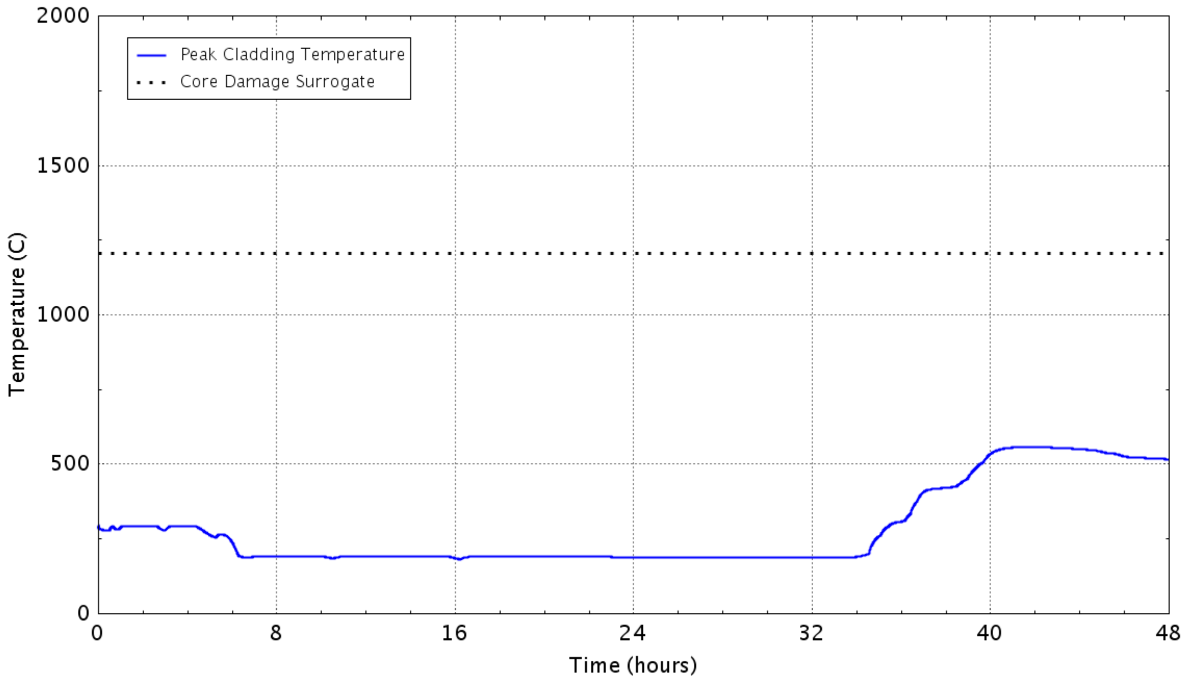

Figure E – 151 Peak temperature of the fuel cladding as a function oftime

E.2.2 Case 16: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 2-in. Torus Bypass, RCIC 50% Degraded

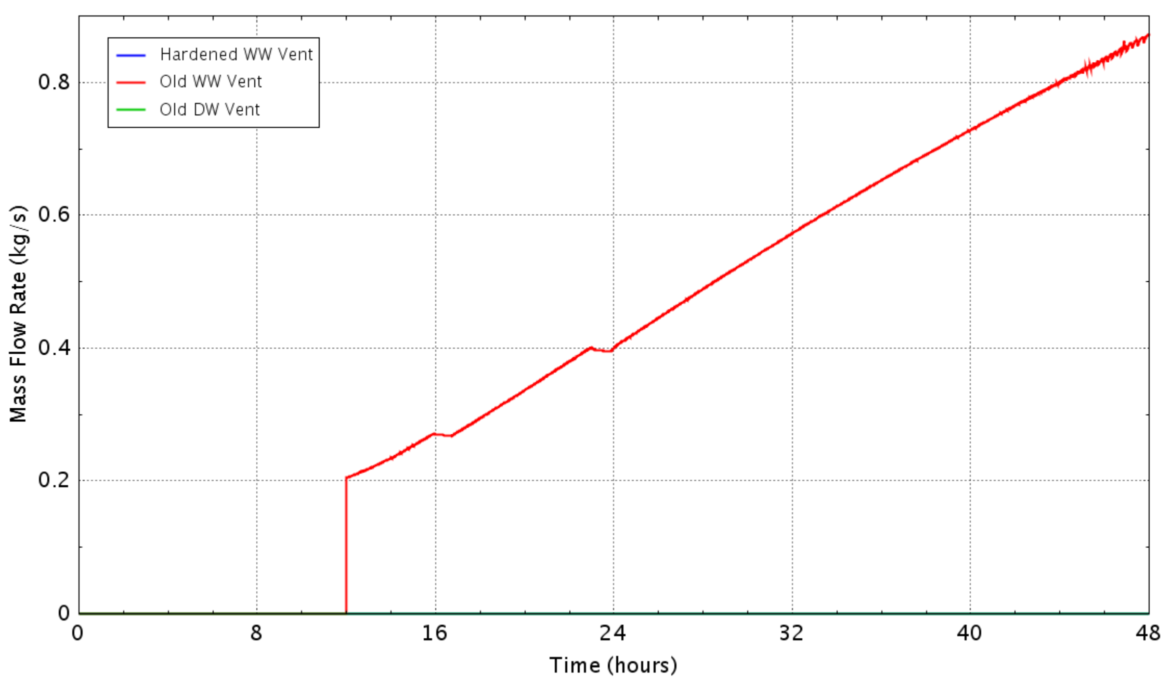

Figure E - 152 Flow rate of the containment vents

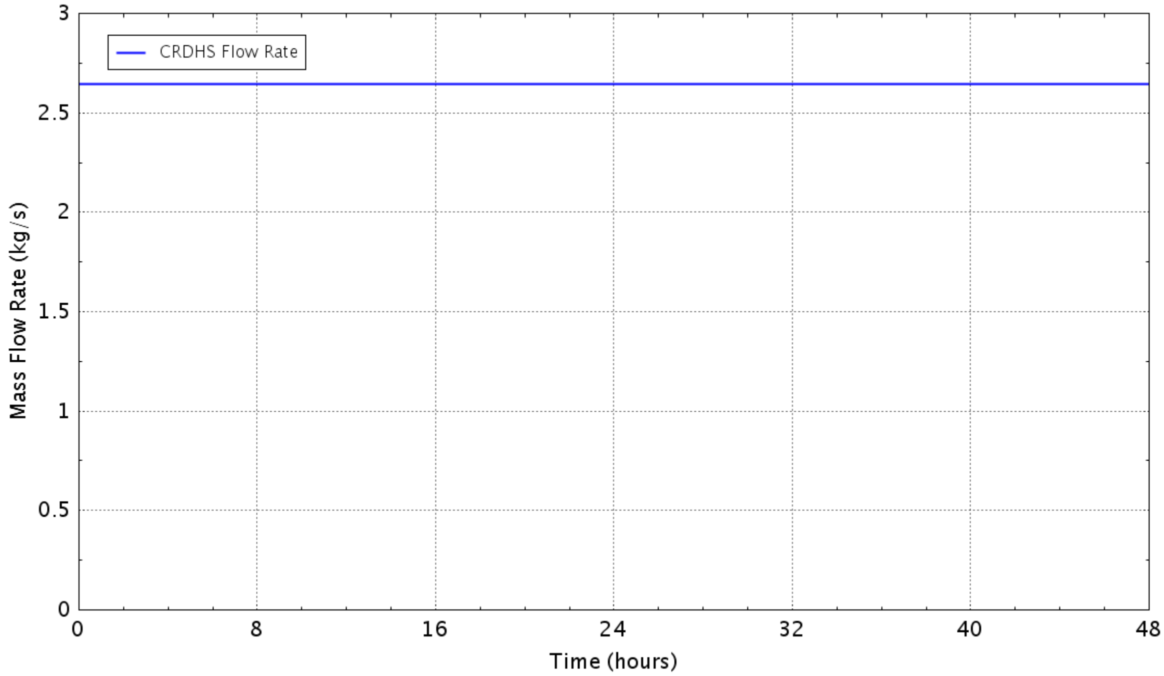

Figure E - 153 **Flow rate of the control rod drive hydraulic system**

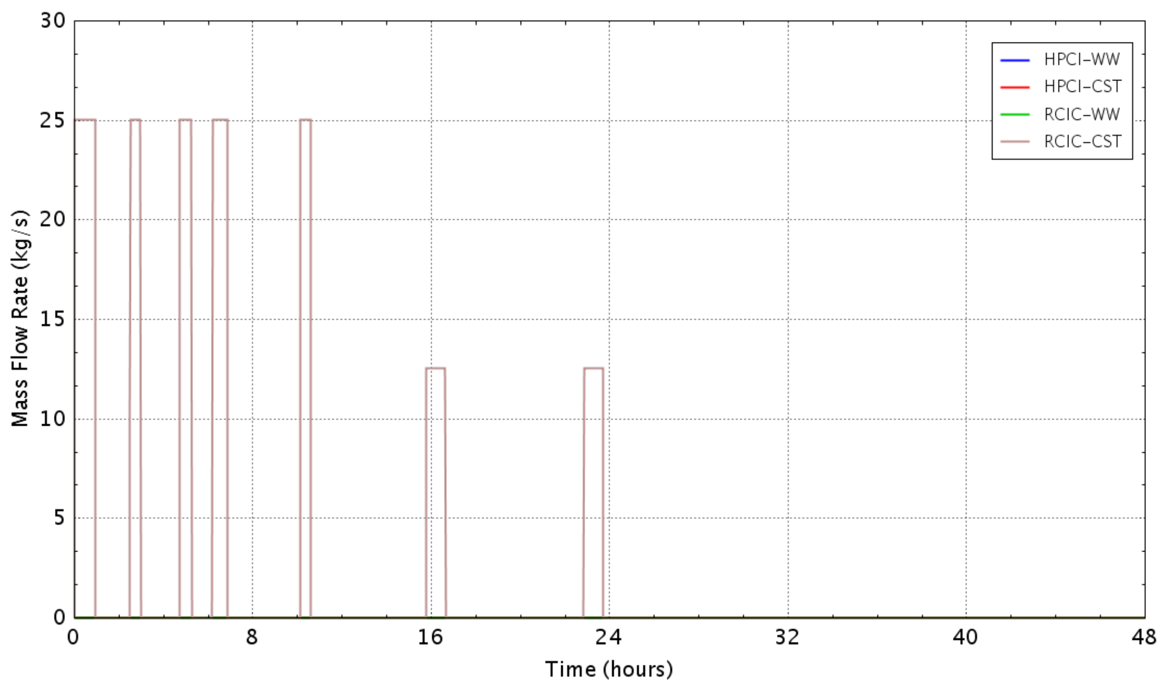

Figure E - 154 **Flow rate of the HPCI/RCIC pumps**

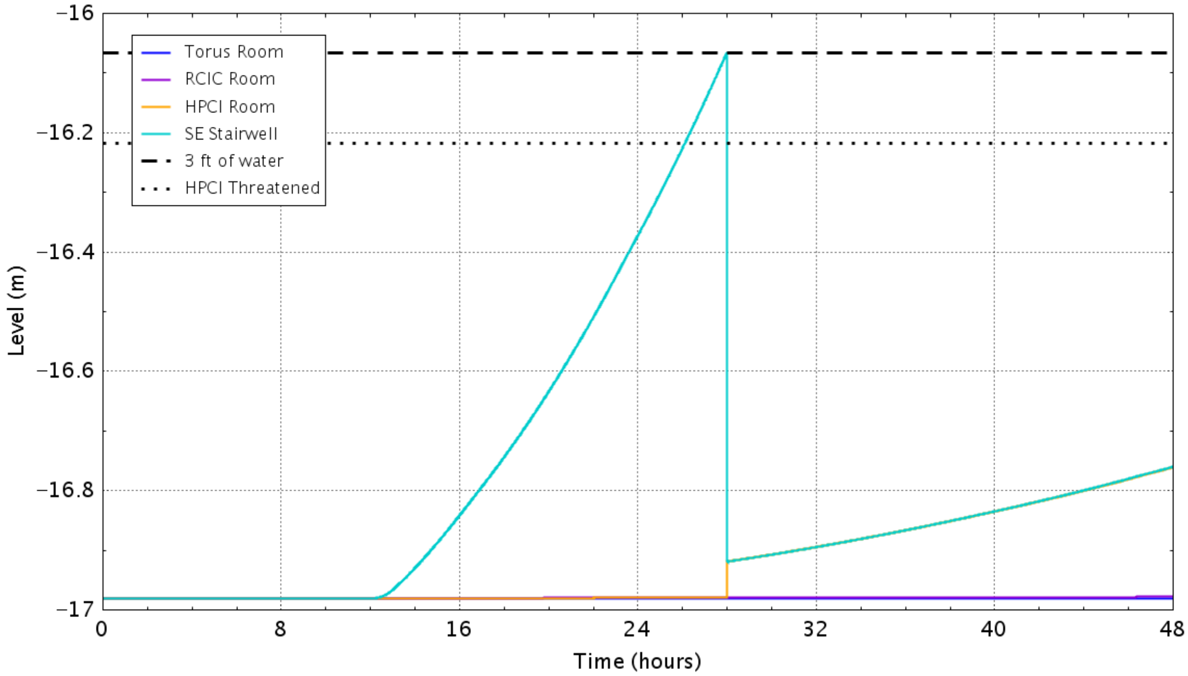

Figure E - 155 **Water level in the reactor building basement**

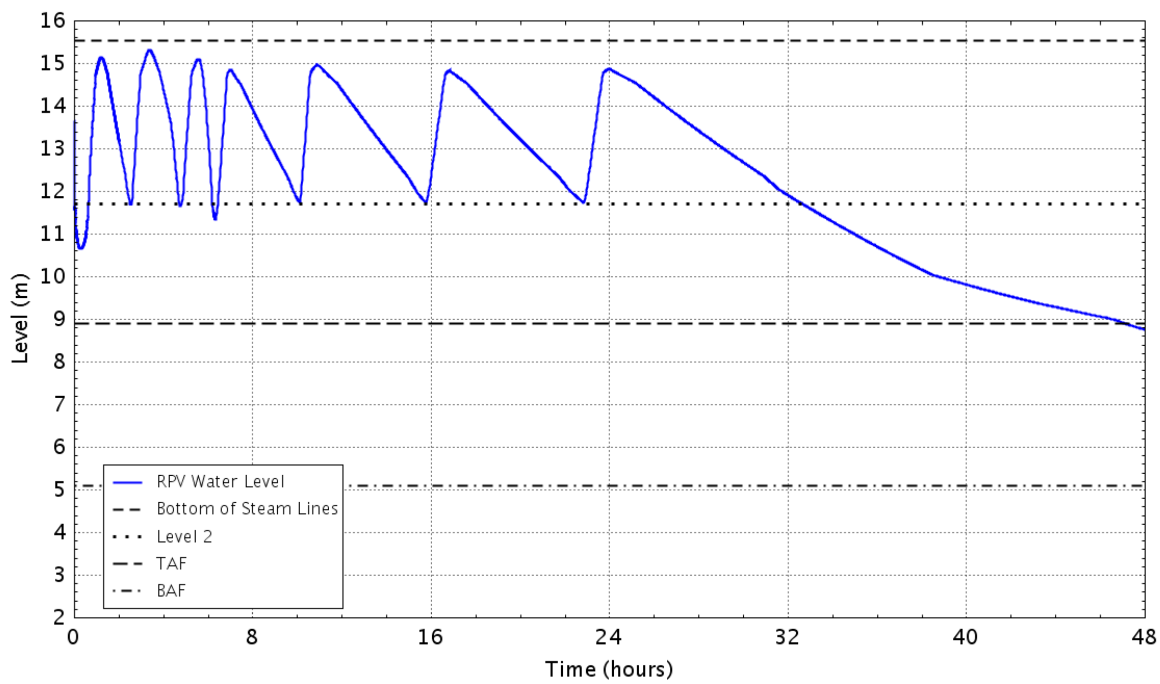

Figure E - 156 **RPV down comer water level**

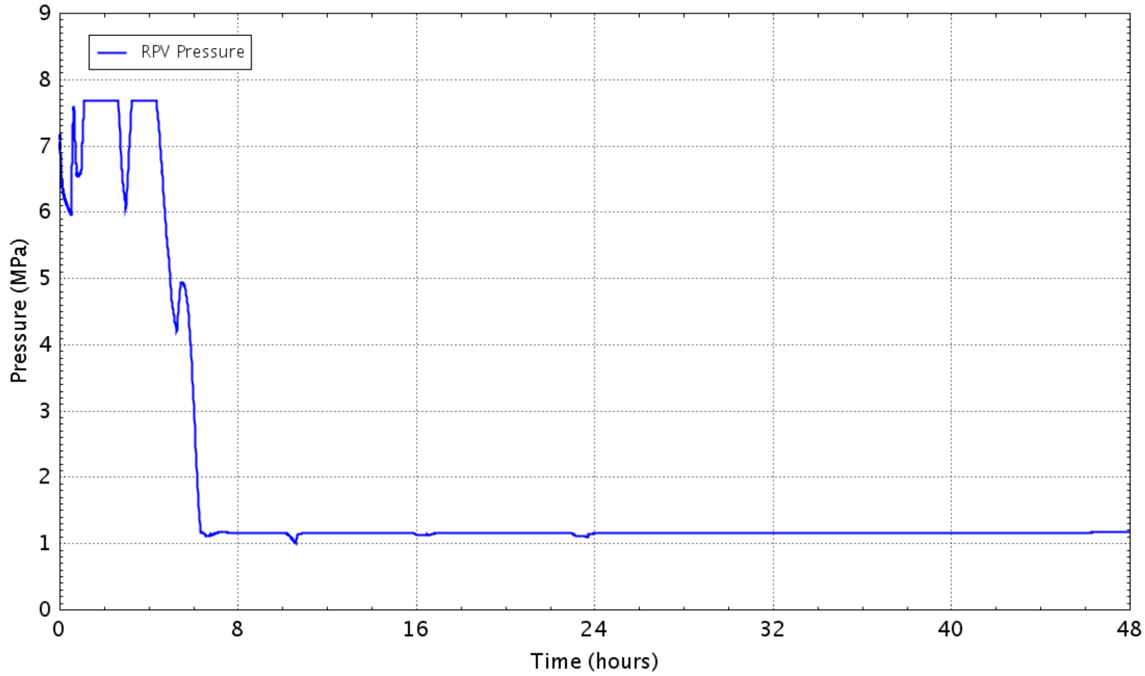

Figure E - 157 **Pressure in theRPV**

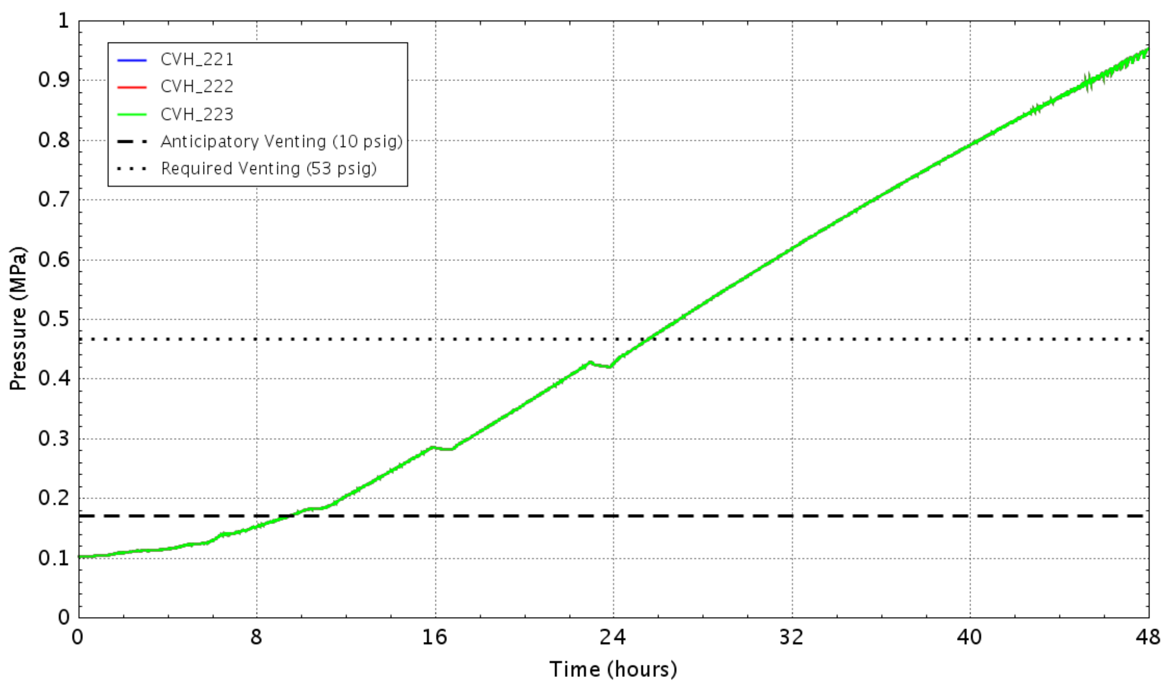

Figure E - 158 **Pressure in the wetwell**

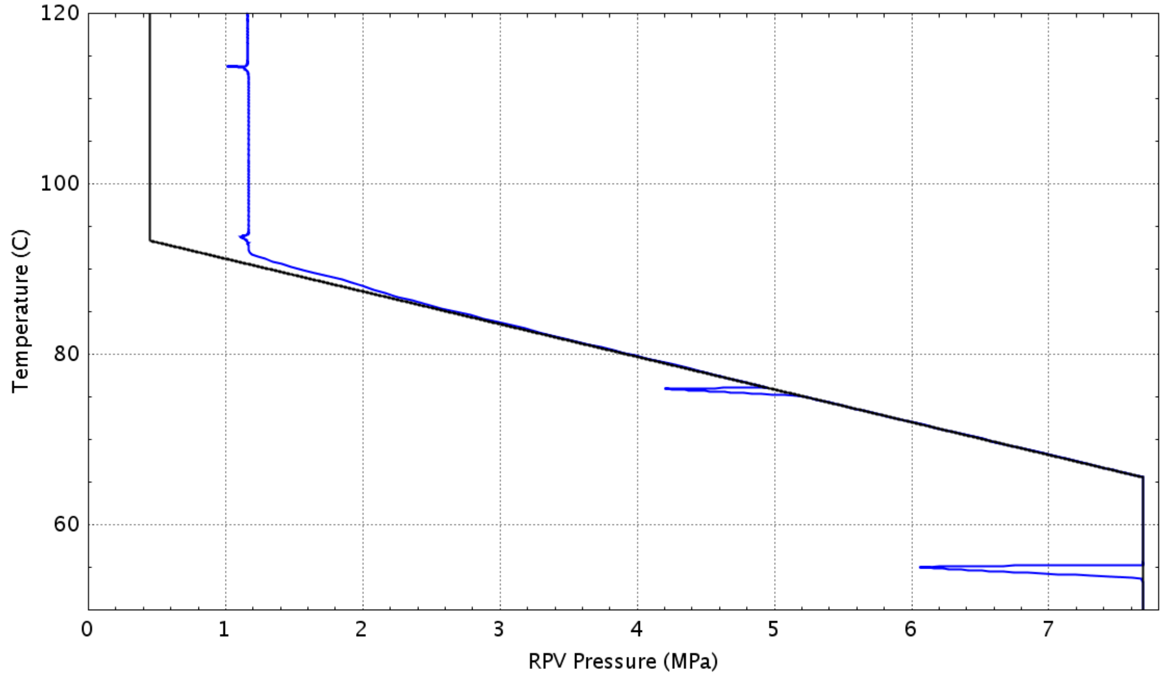

Figure E – 159 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

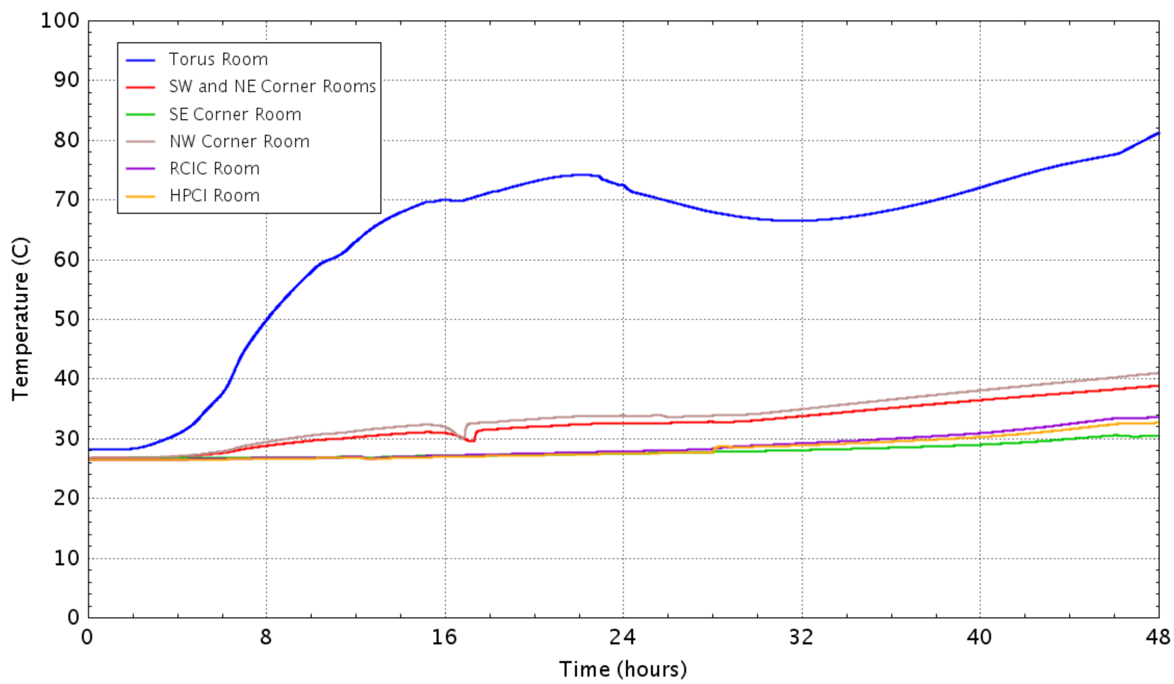

Figure E - 160 **Vapor temperature in the reactor building basement**

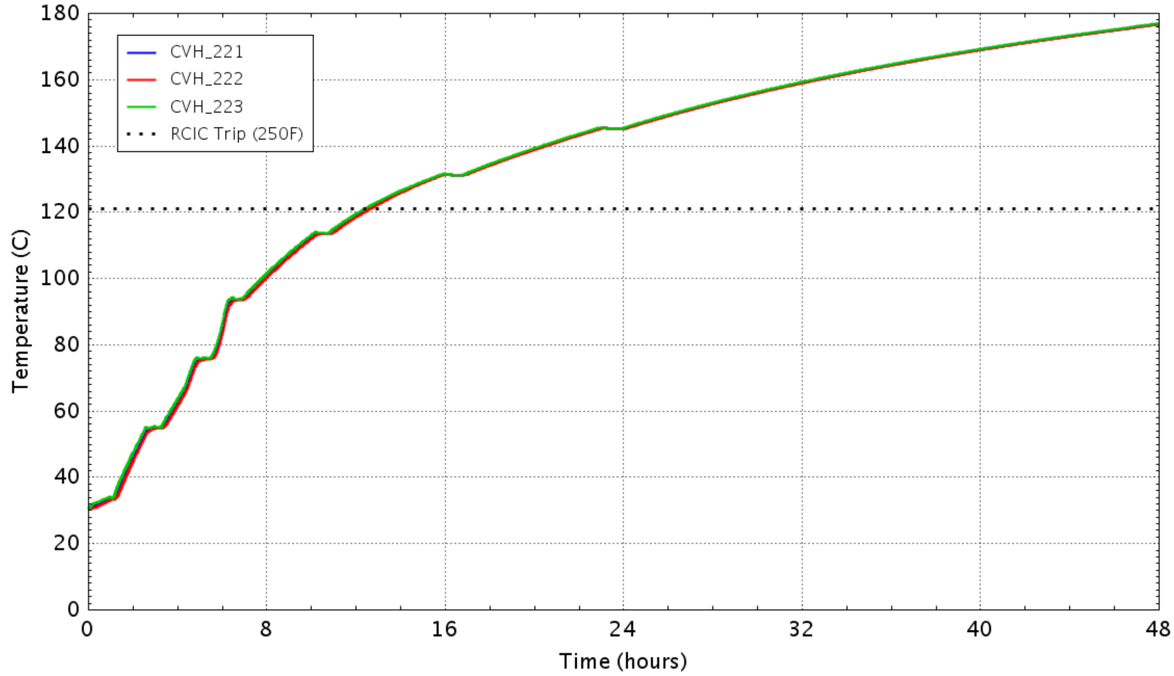

Figure E - 161 **Water temperature in the wetwell**

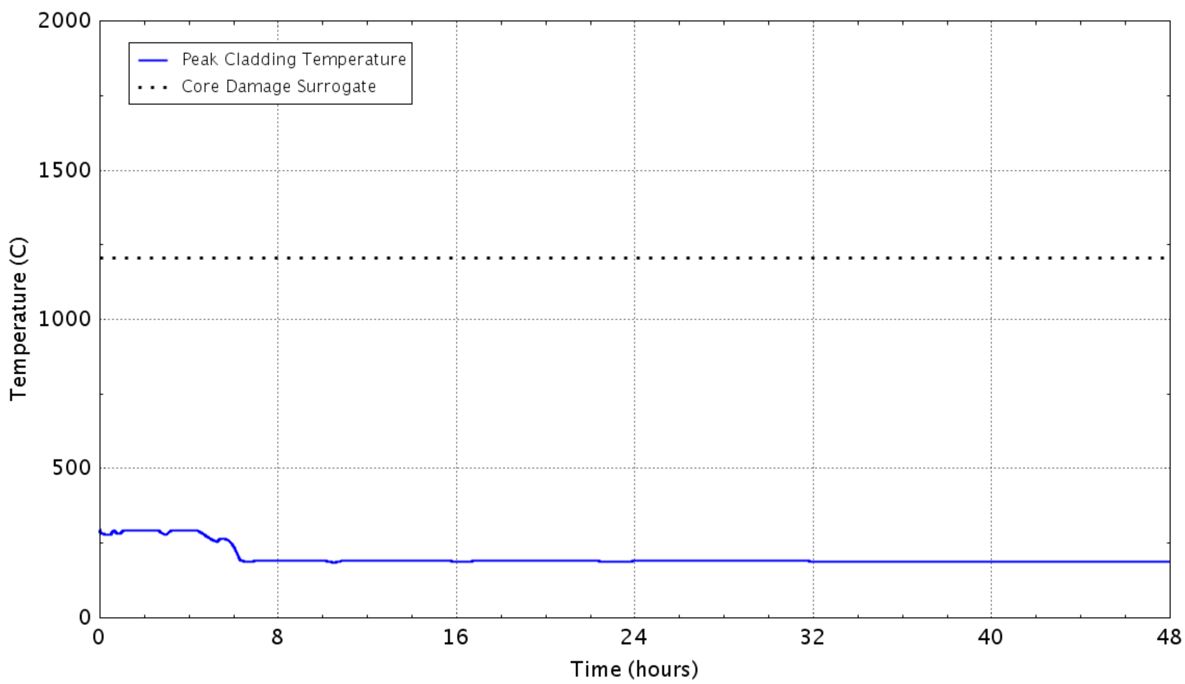

Figure E – 162 **Peak temperature of the fuel cladding as a function oftime**

E.2.3 Case 17: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 18-in. Torus Vent, RCIC Fully Functional

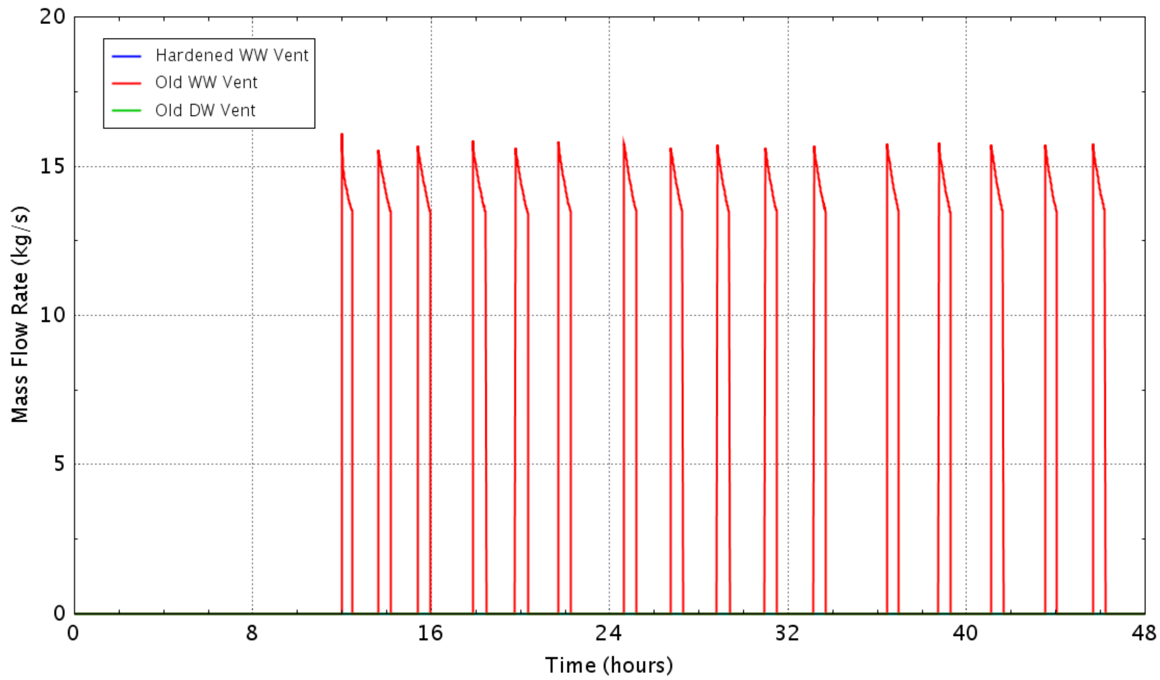

Figure E - 163 **Flow rate of the containment vents**

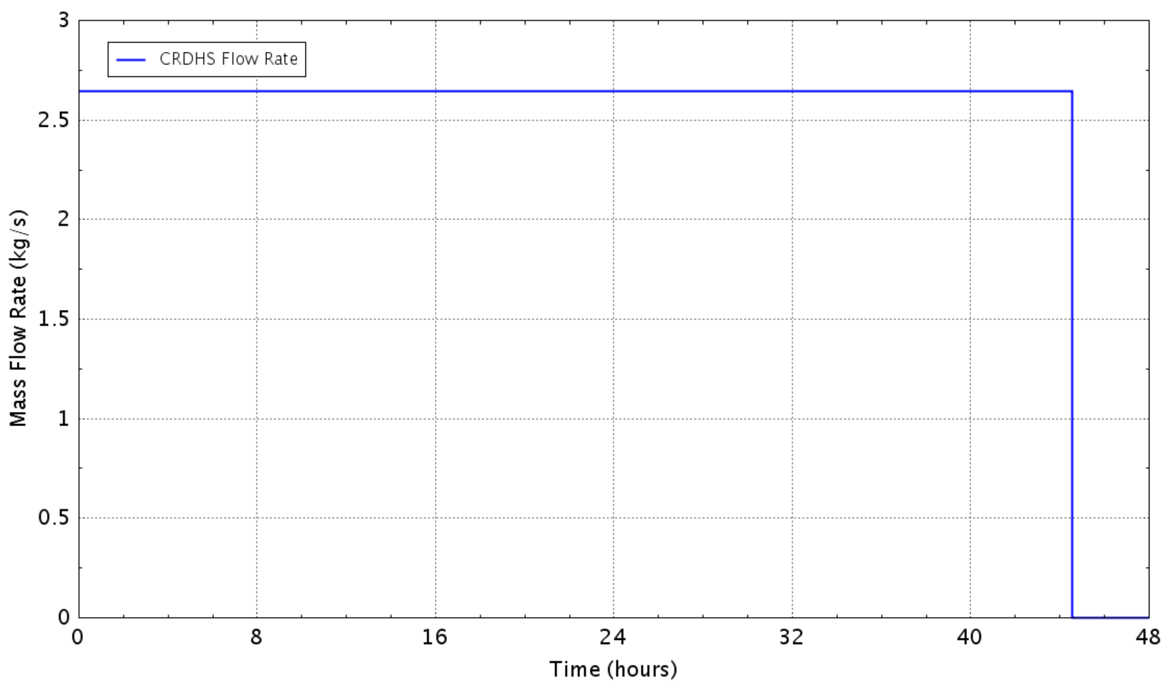

Figure E - 164 **Flow rate of the control rod drive hydraulic system**

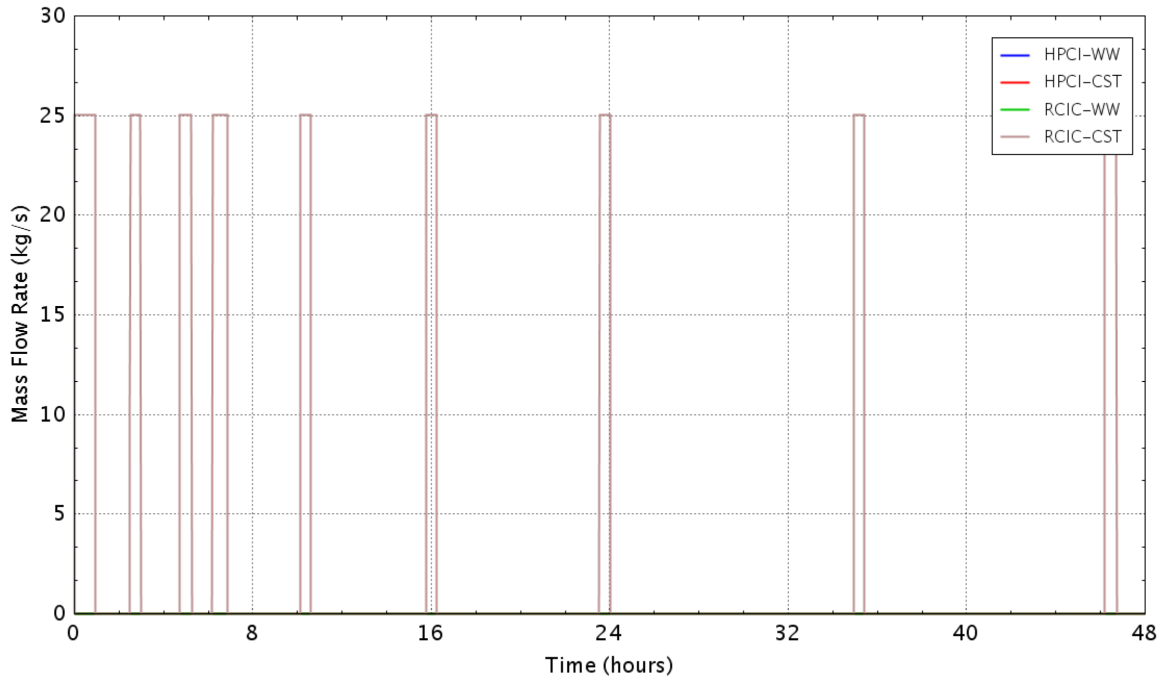

Figure E - 165 Flow rate of the HPCI/RCIC pumps

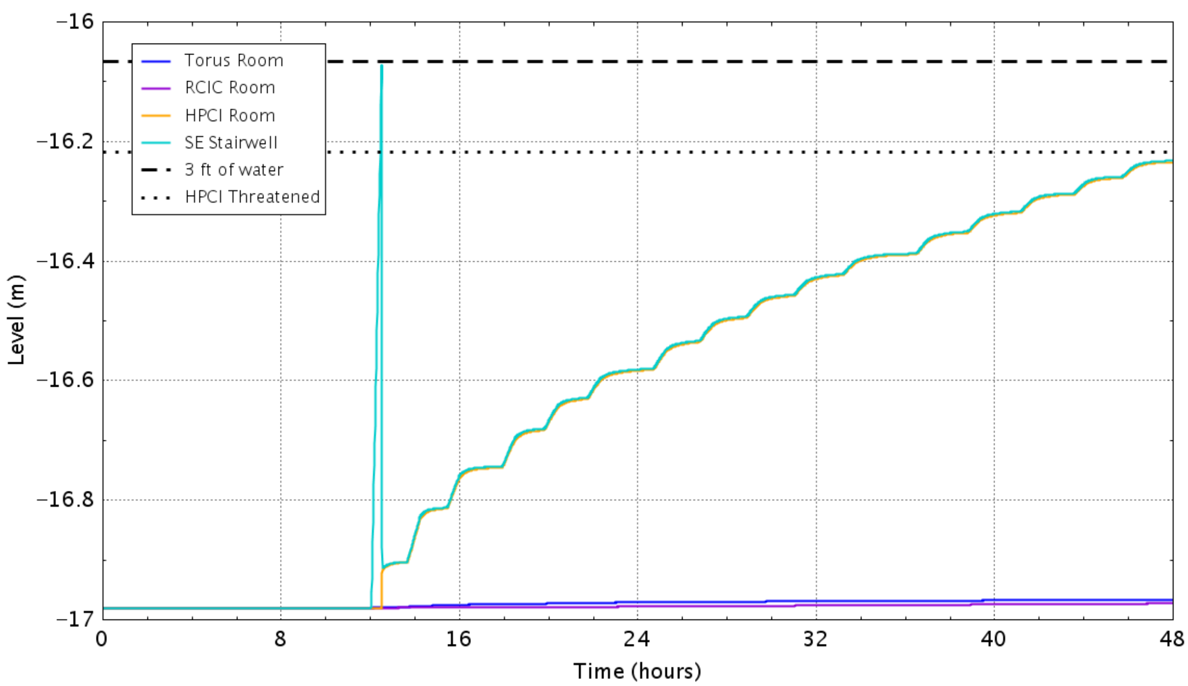

Figure E - 166 Water level in the reactor building basement

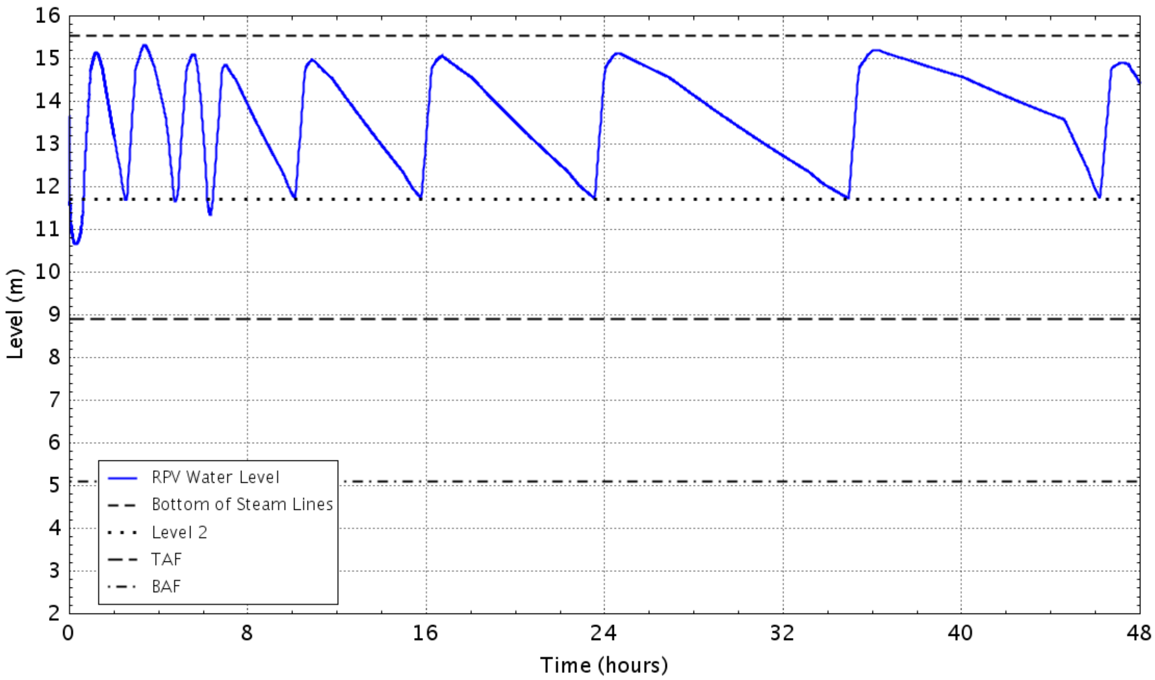

Figure E - 167 RPV down comer water level

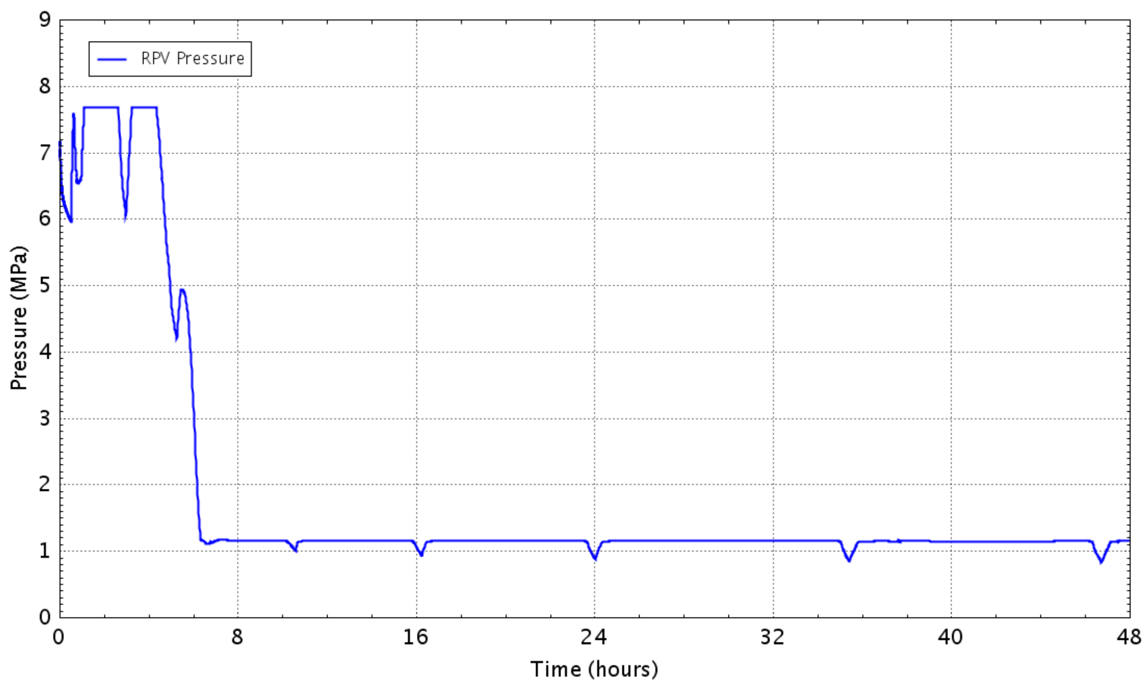

Figure E - 168 Pressure in theRPV

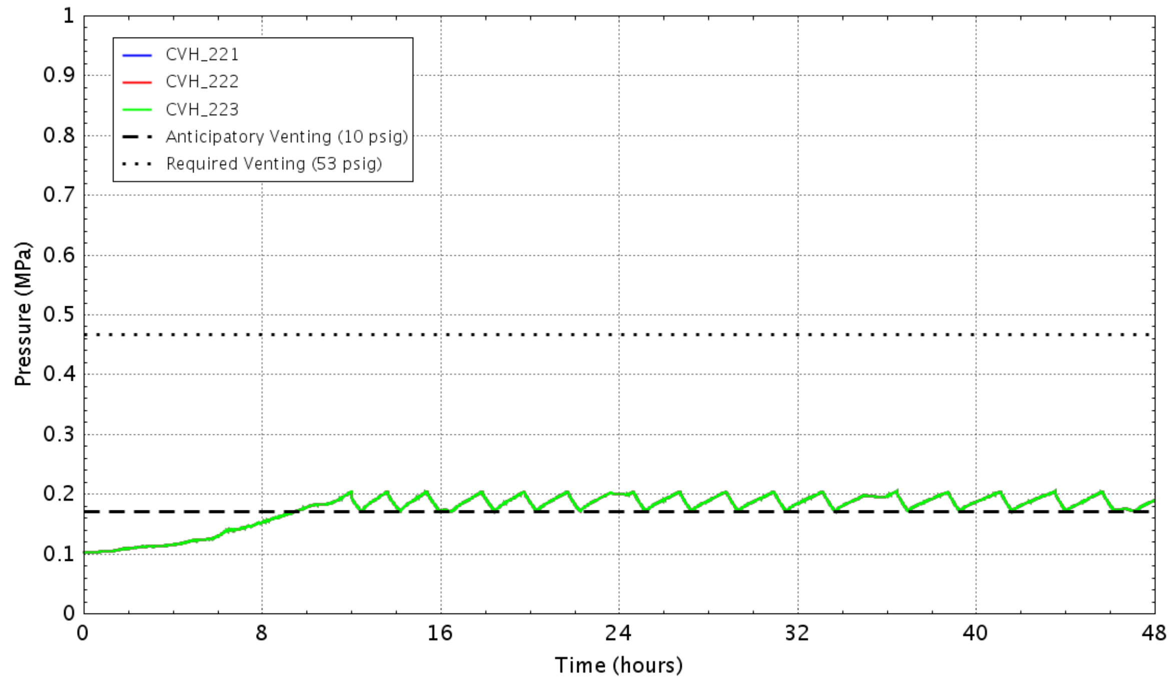

Figure E - 169 Pressure in the wetwell

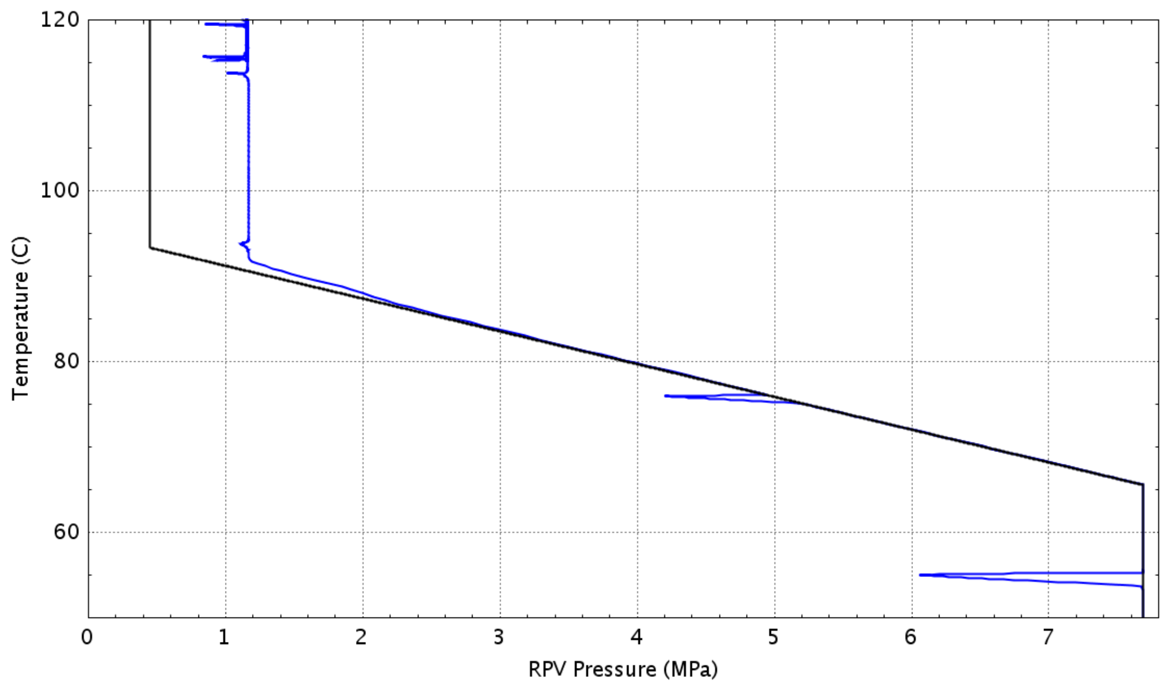

Figure E - 170 Plant status relative to the HCL curve (Graph 4 of the EOPs)

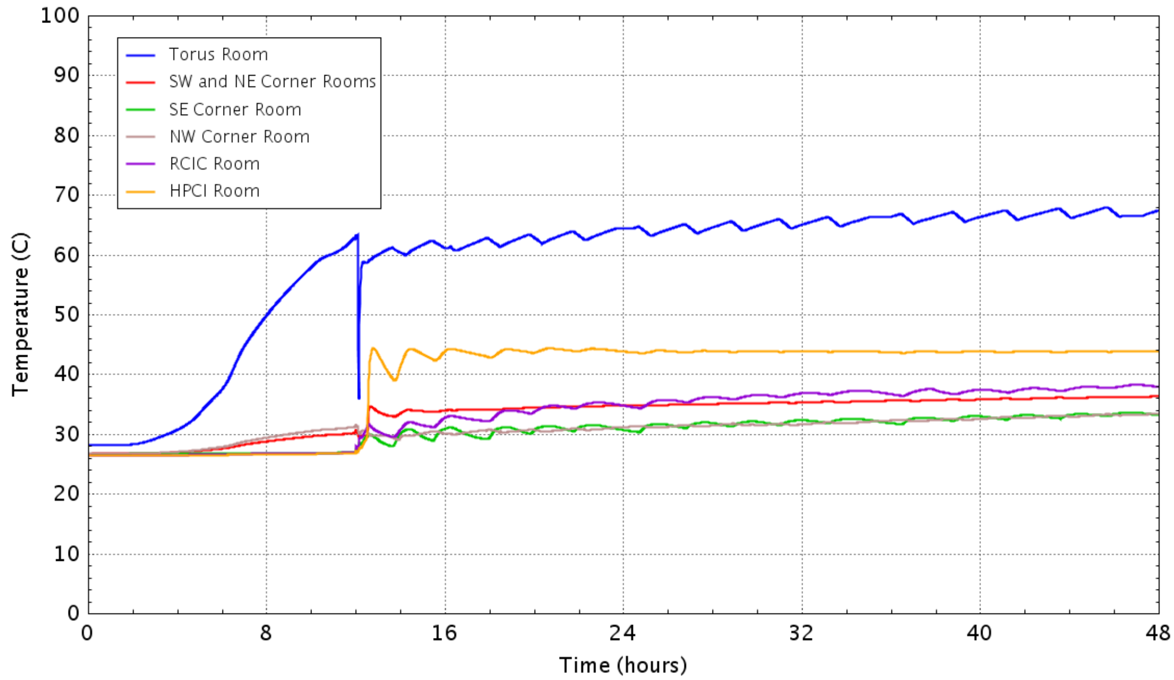

Figure E - 171 **Vapor temperature in the reactor building basement**

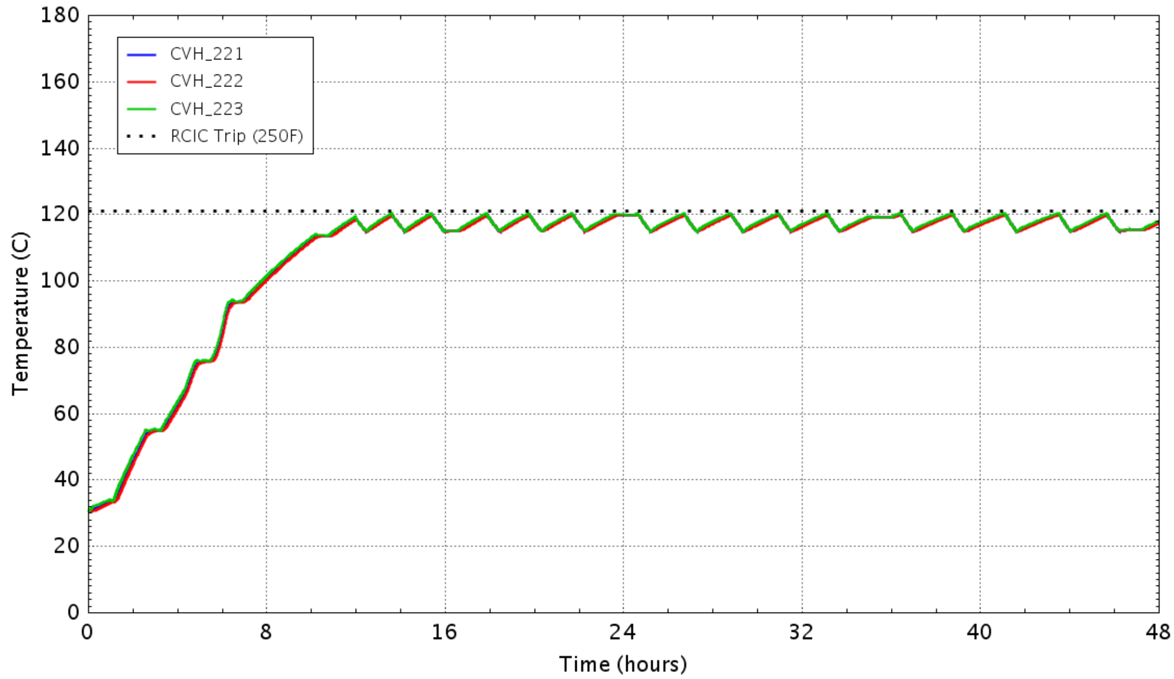

Figure E - 172 **Water temperature in the wetwell**

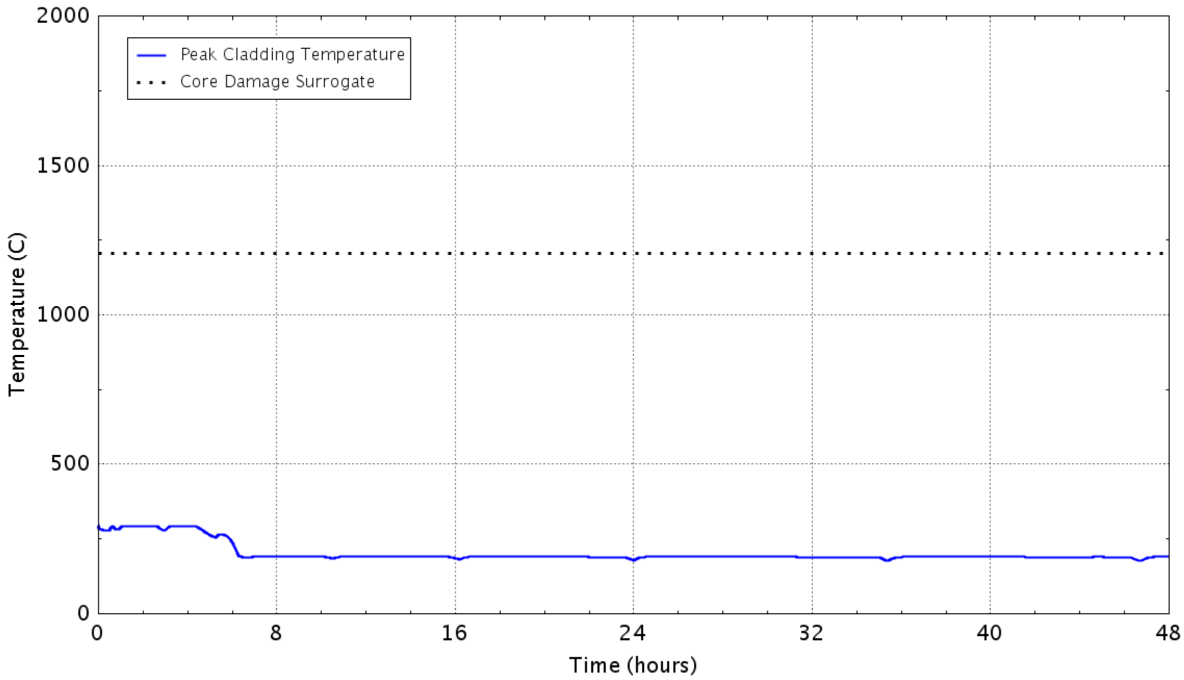

Figure E – 173 Peak temperature of the fuel cladding as a function oftime

E.2.4 Case 18: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 18-in. Torus Vent, RCIC 50% Degraded

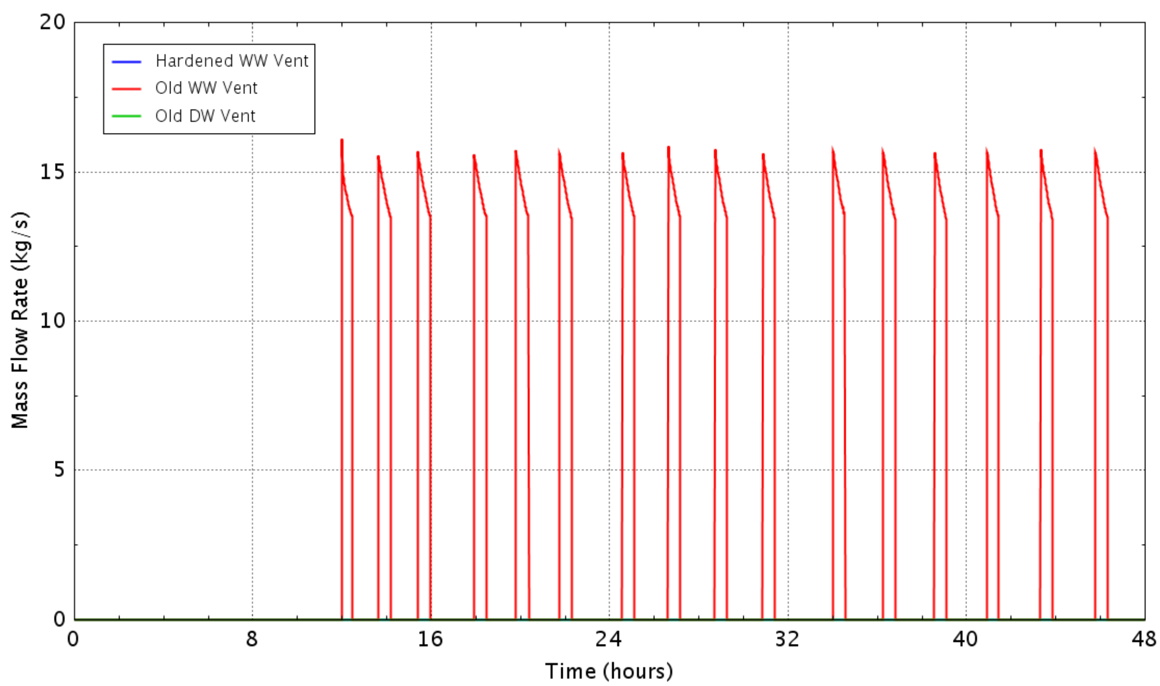

Figure E - 174 Flow rate of the containment vents

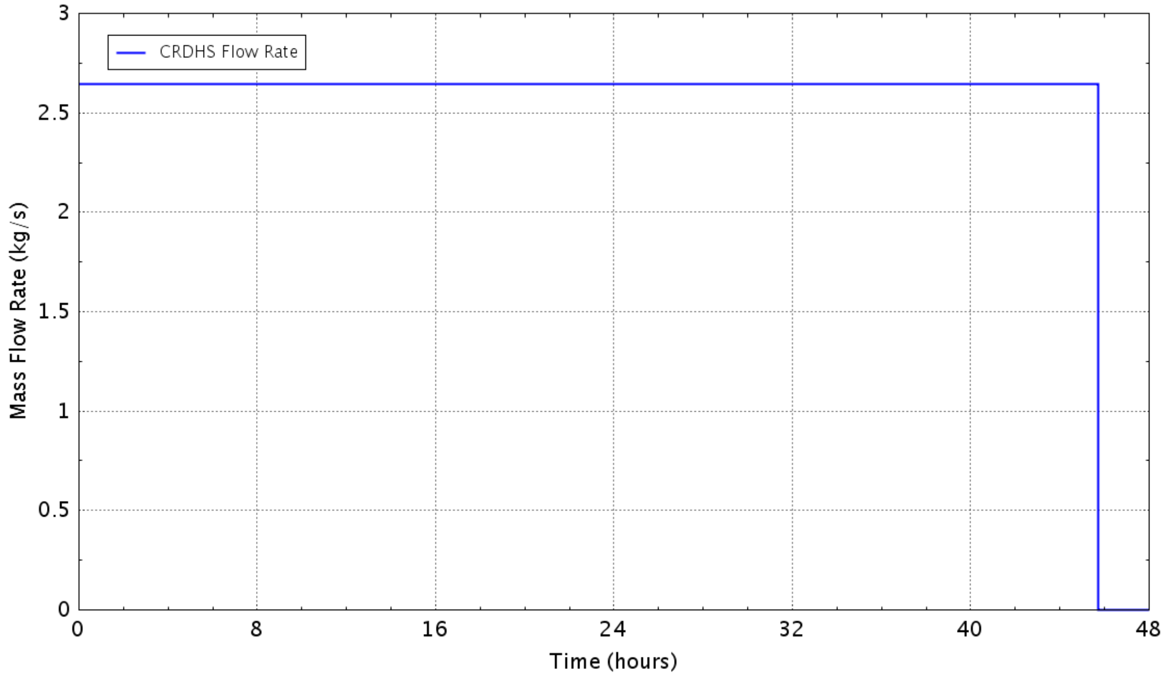

Figure E - 175 Flow rate of the control rod drive hydraulic system

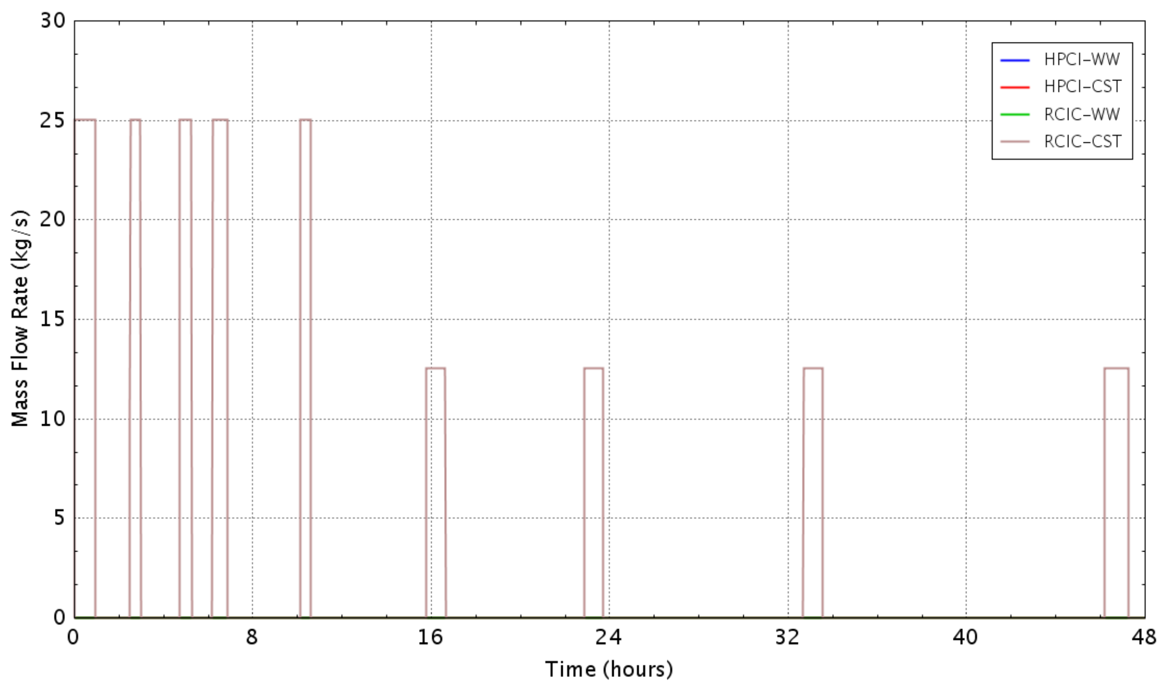

Figure E - 176 Flow rate of the HPCI/RCIC pumps

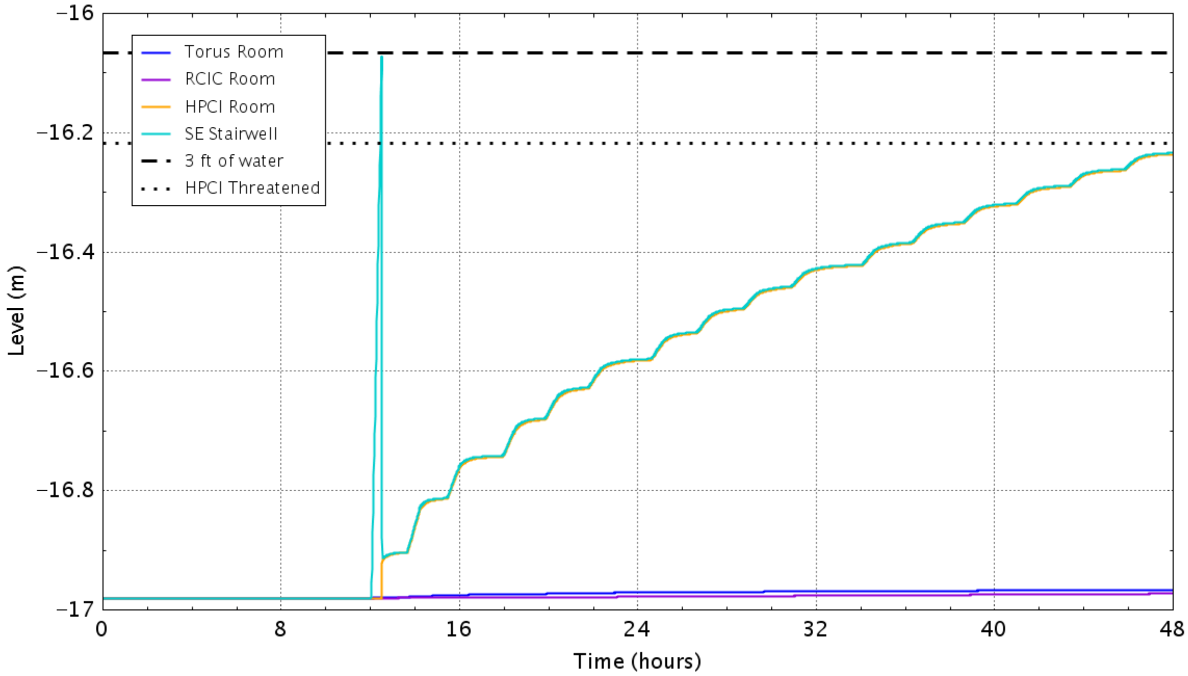

Figure E - 177 **Water level in the reactor building basement**

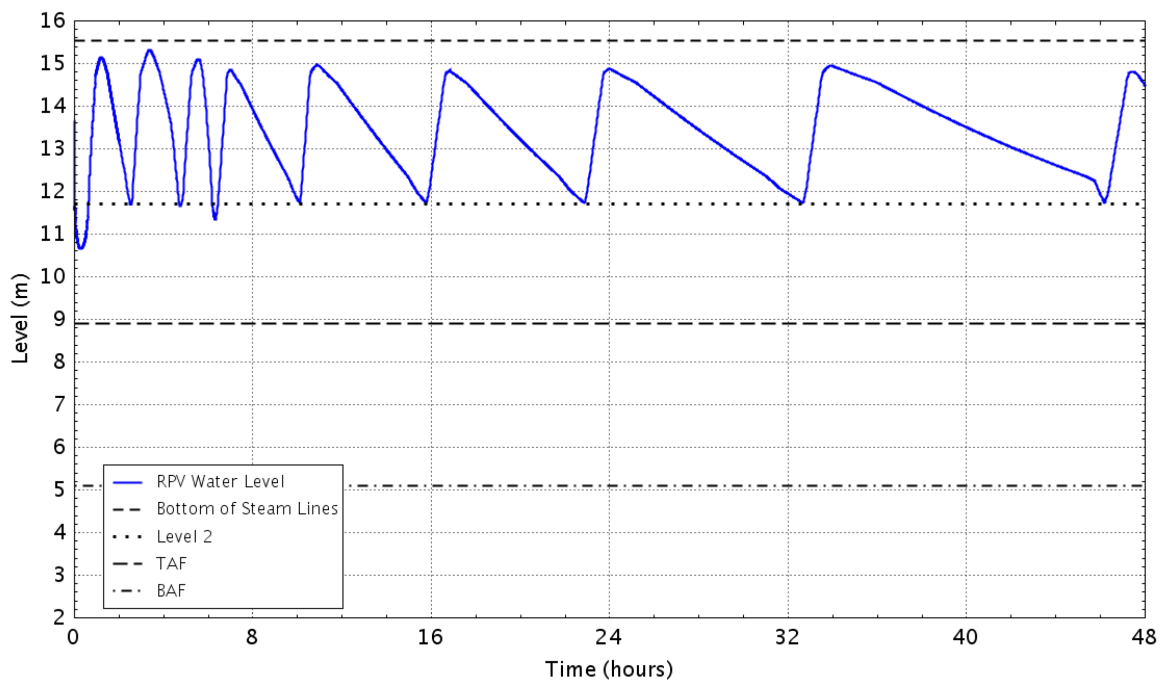

Figure E - 178 **RPV down comer water level**

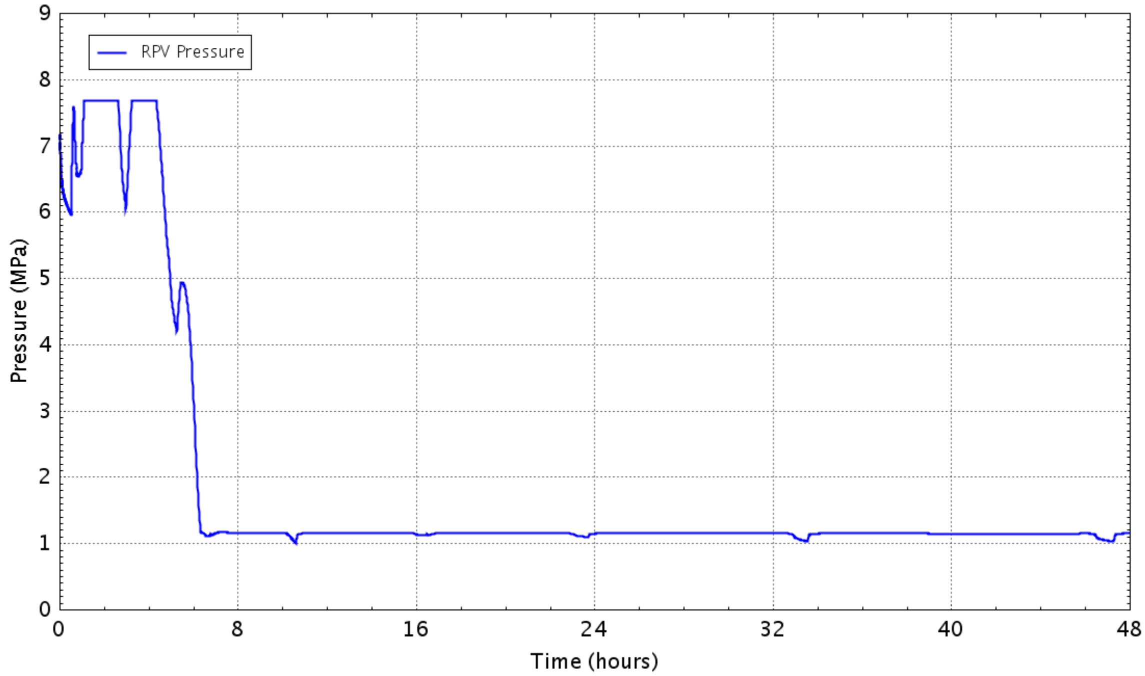

Figure E - 179 **Pressure in theRPV**

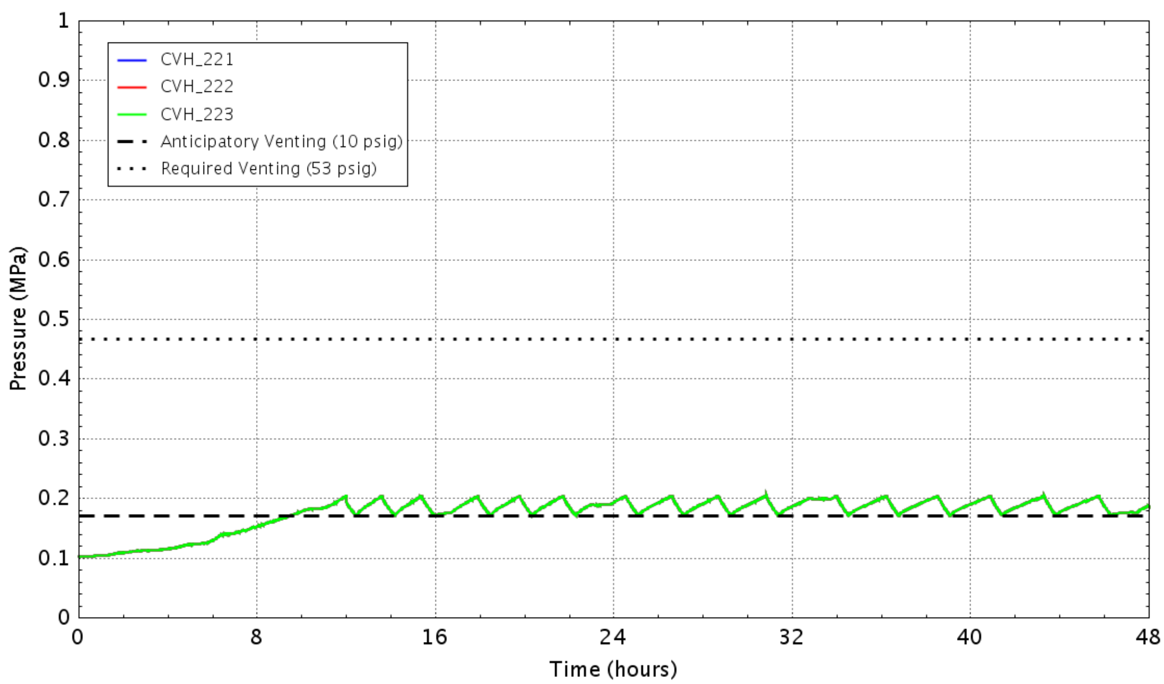

Figure E - 180 **Pressure in the wetwell**

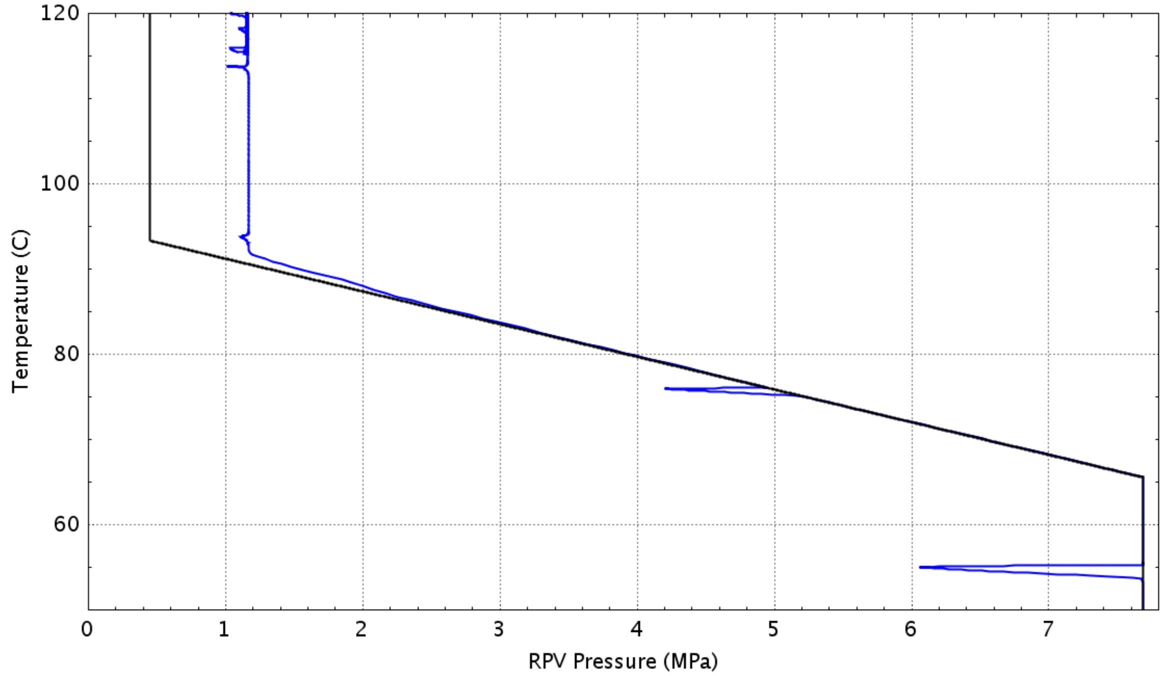

Figure E – 181 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

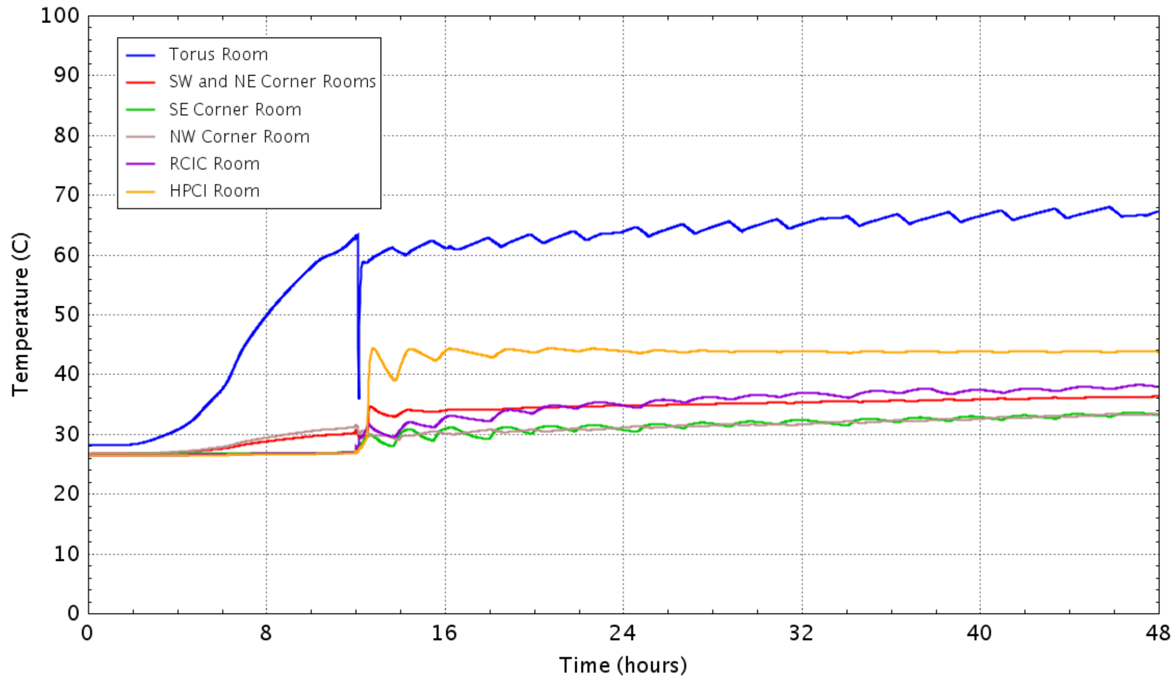

Figure E - 182 **Vapor temperature in the reactor building basement**

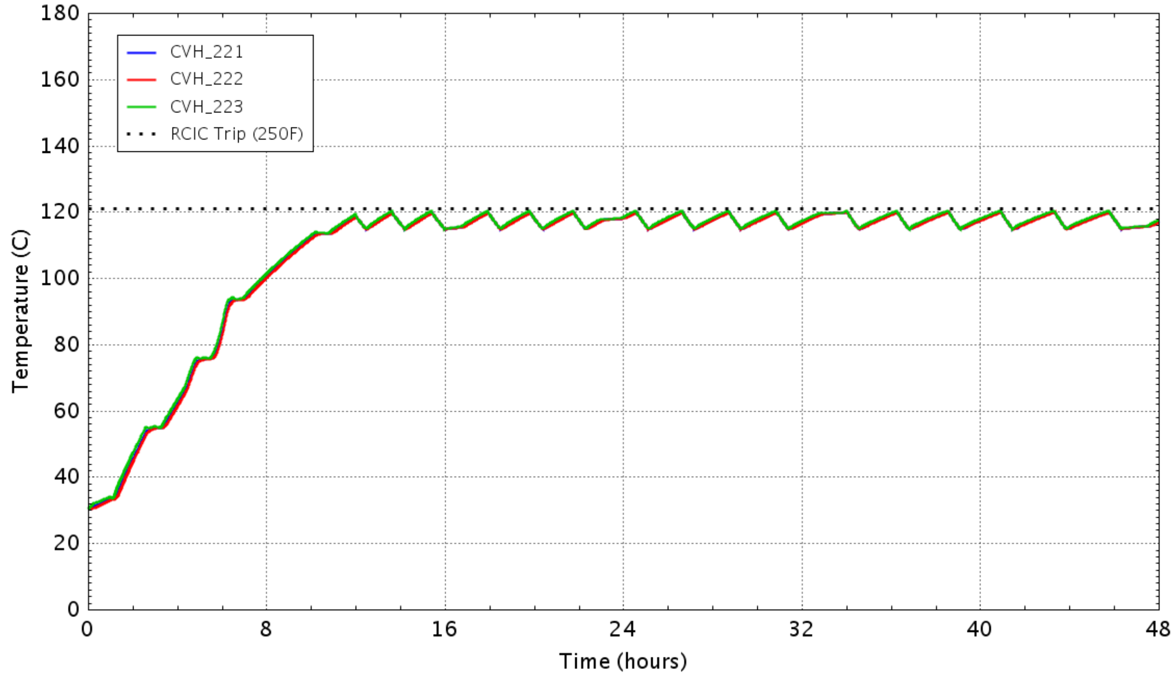

Figure E - 183 Water temperature in the wetwell

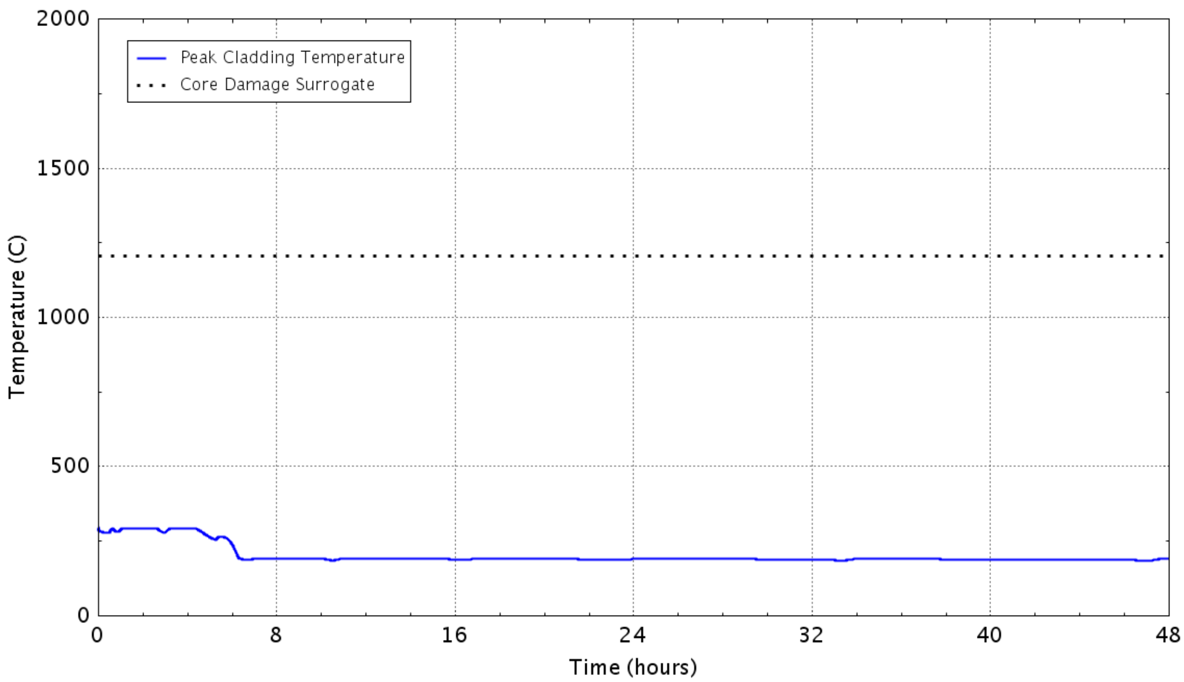

Figure E – 184 Peak temperature of the fuel cladding as a function oftime

E.2.5 Case 19: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 18-in. Torus Vent, RCIC Non-functional

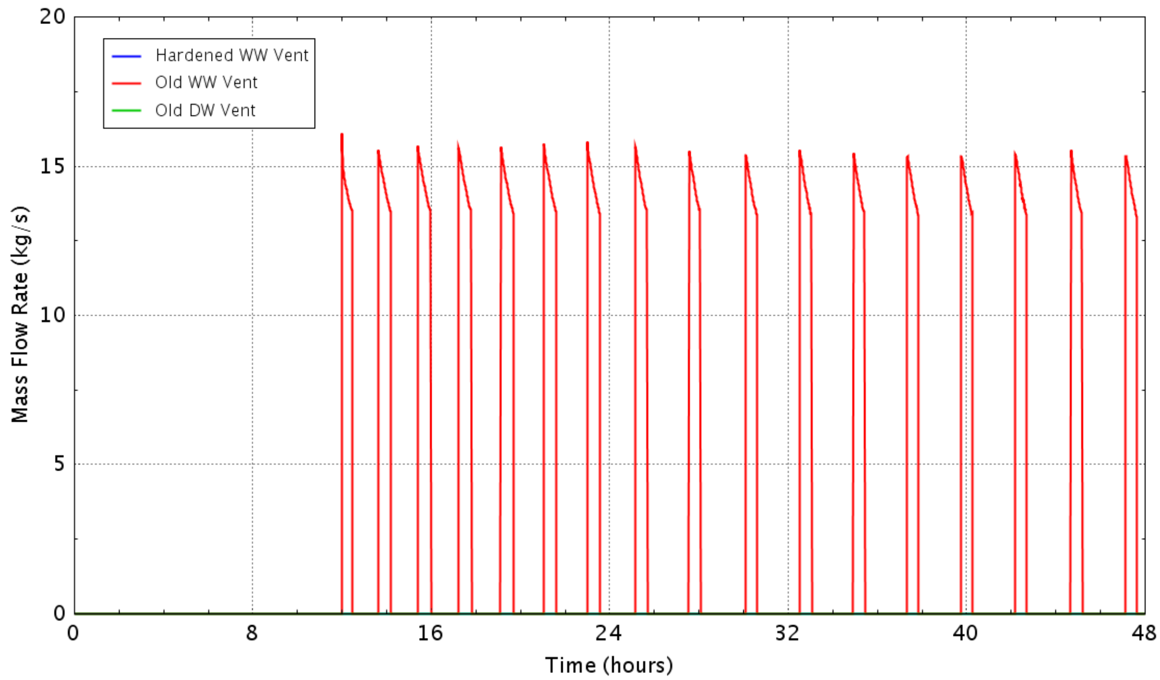

Figure E - 185 Flow rate of the containment vents

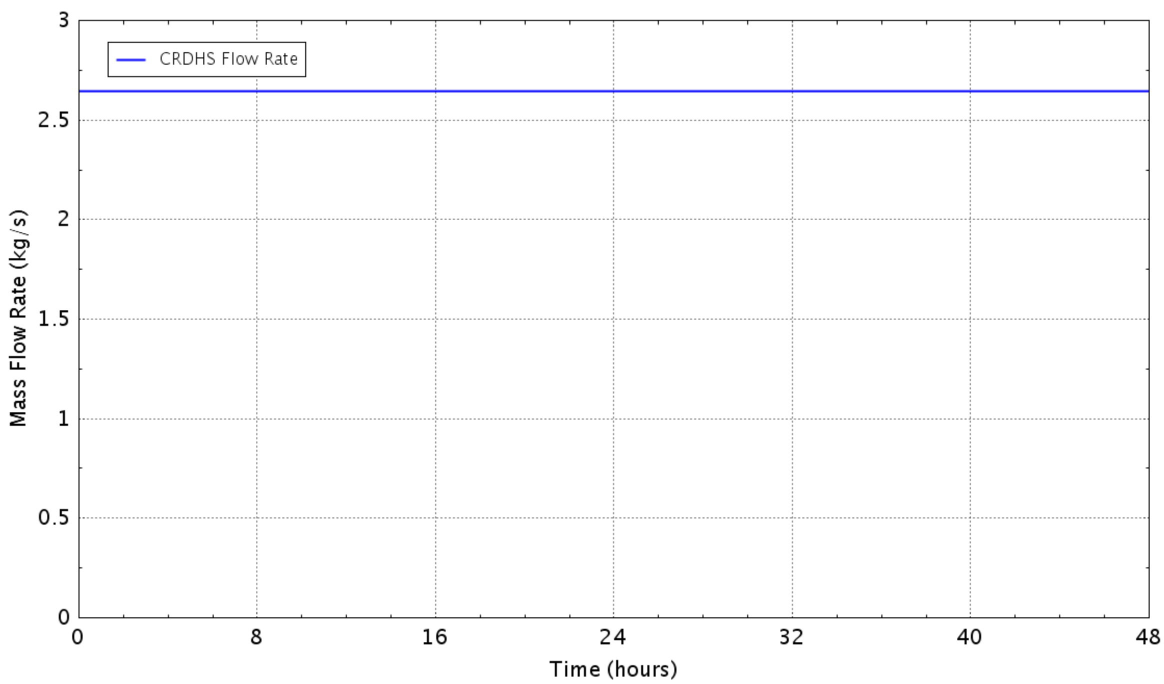

Figure E - 186 Flow rate of the control rod drive hydraulic system

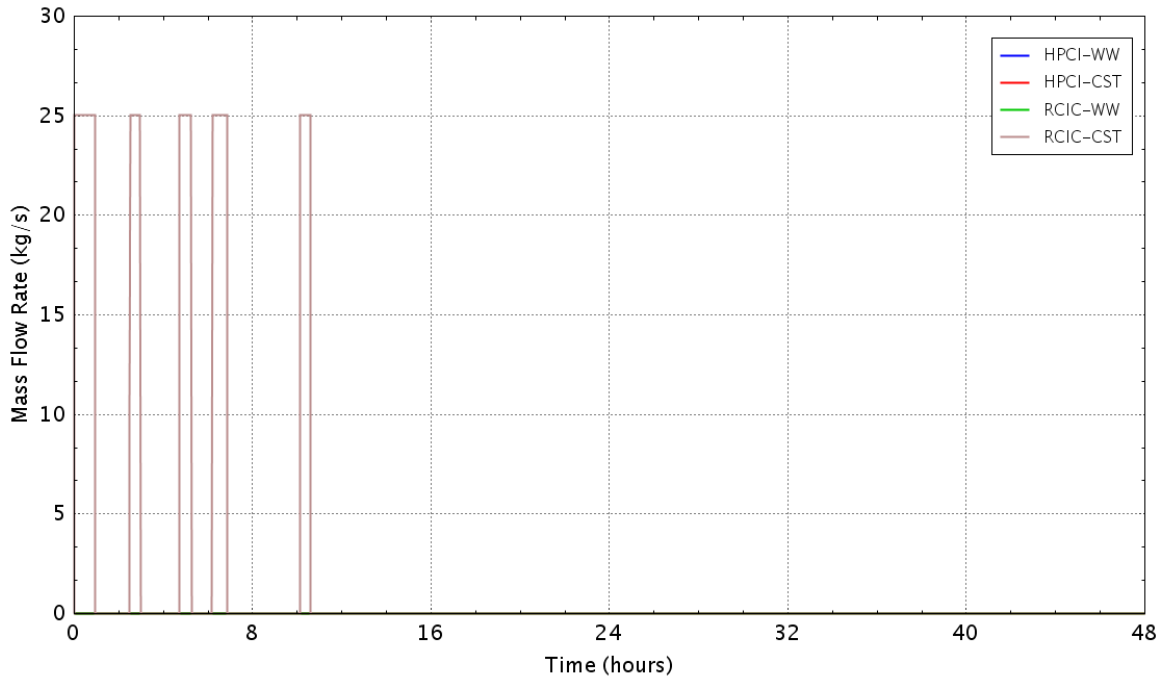

Figure E - 187 **Flow rate of the HPCI/RCIC pumps**

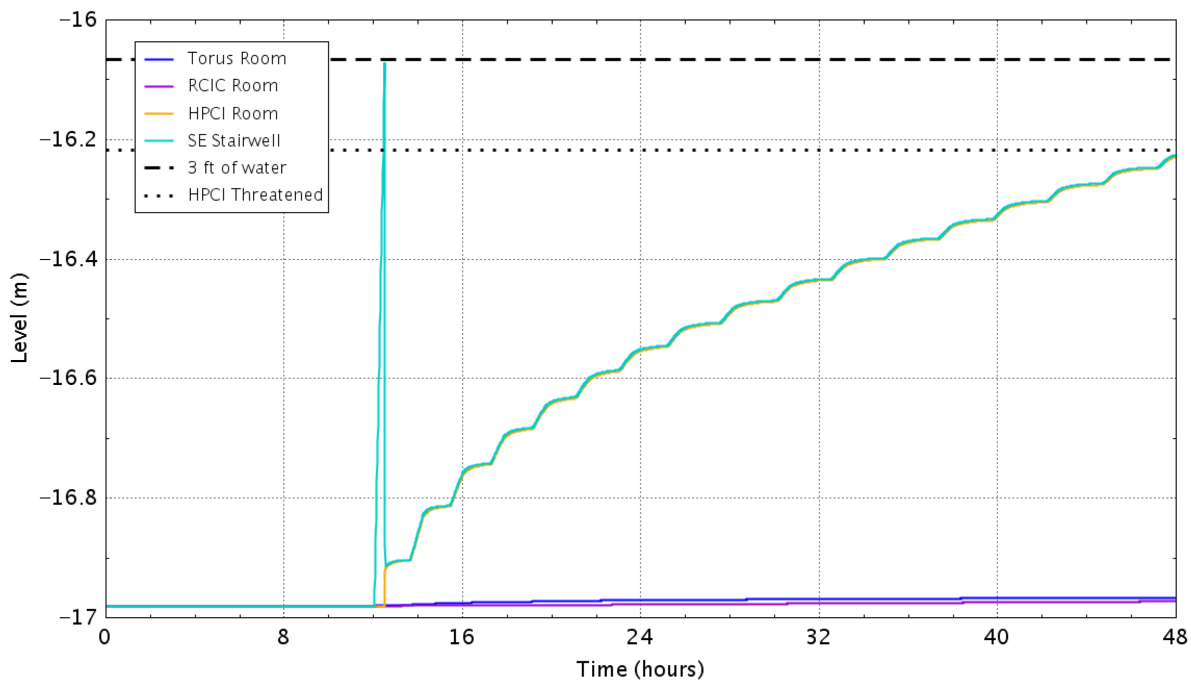

Figure E - 188 **Water level in the reactor building basement**

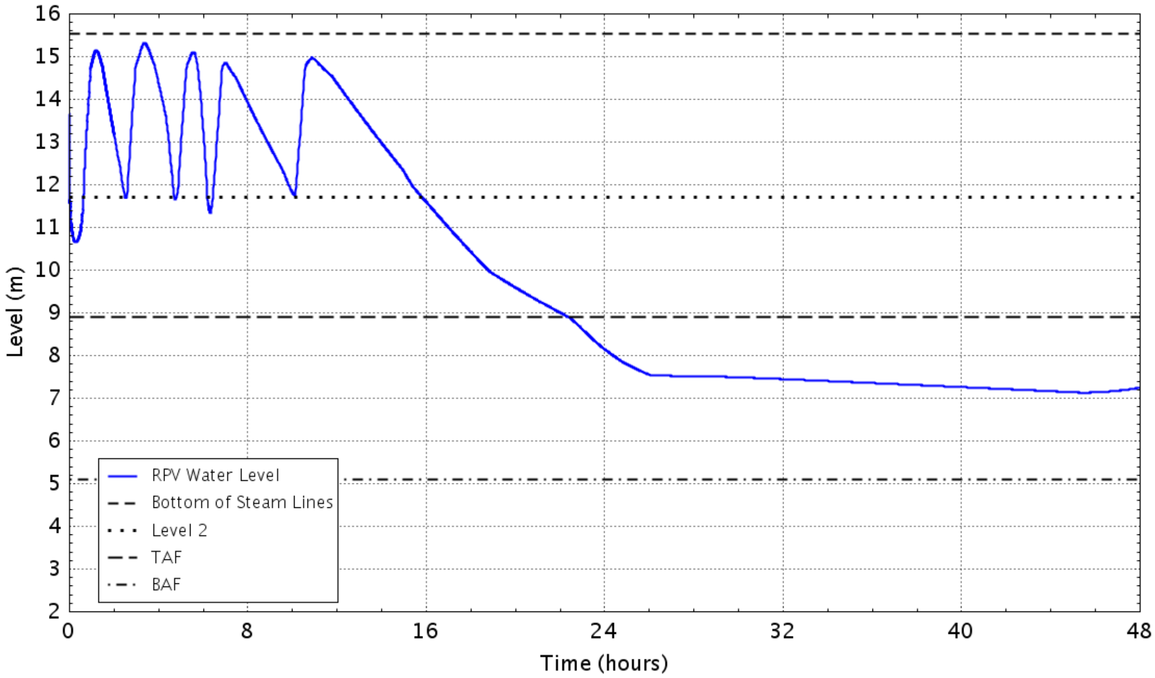

Figure E - 189 RPV down comer water level

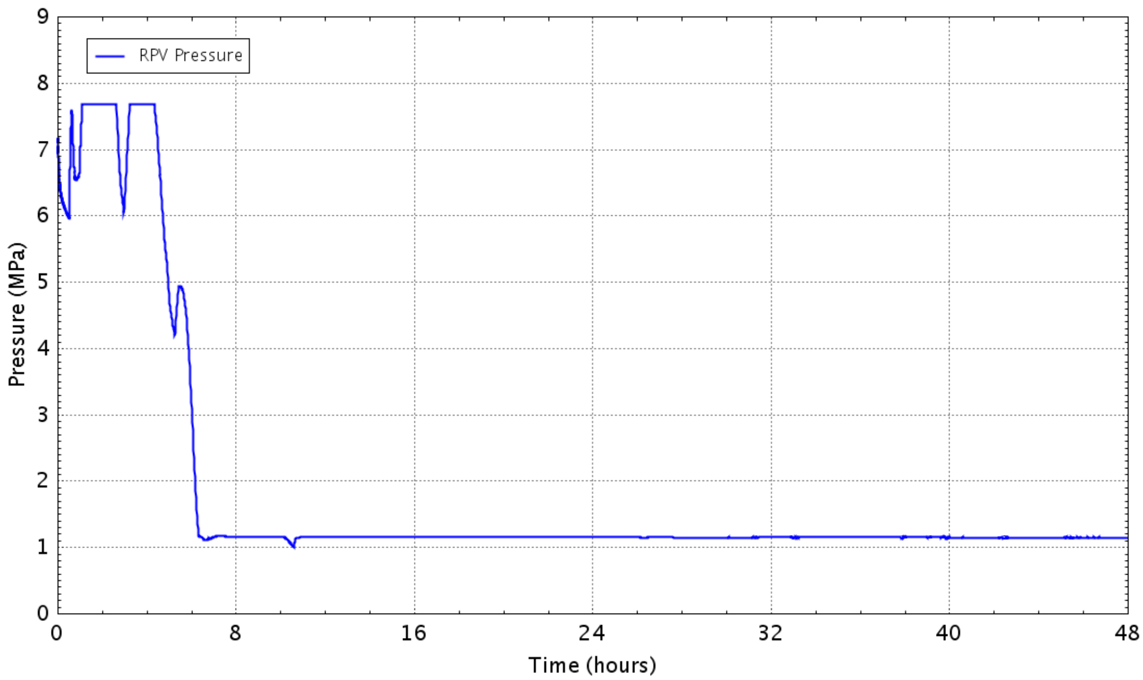

Figure E - 190 Pressure in theRPV

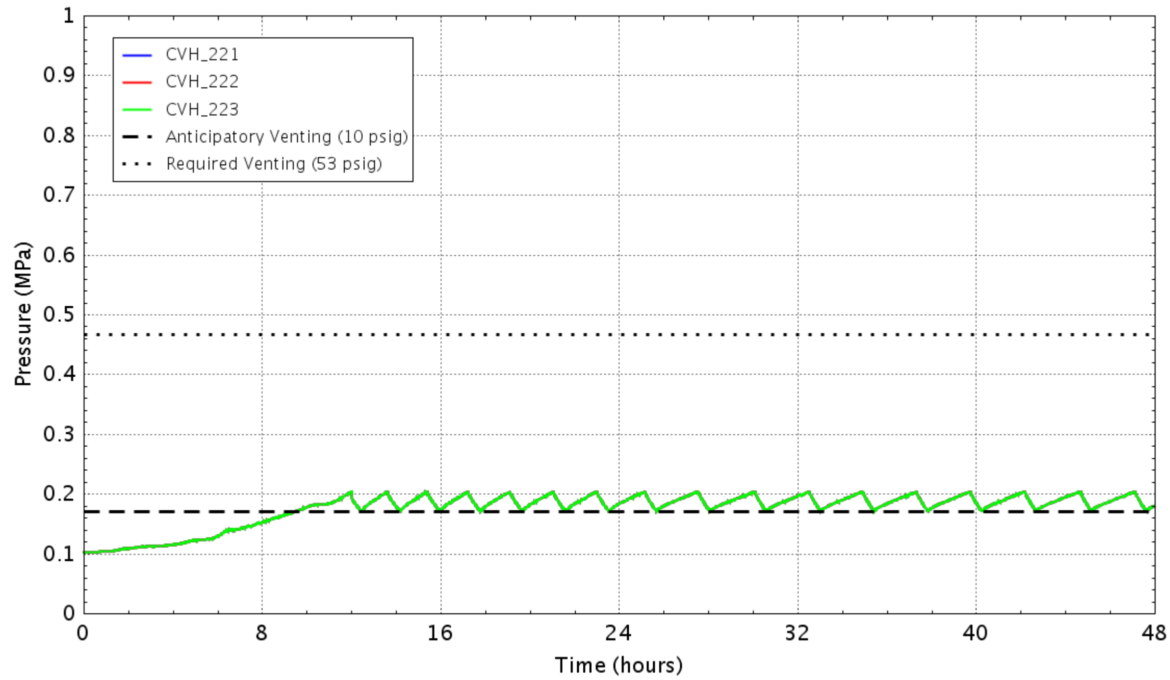

Figure E - 191 Pressure in the wetwell

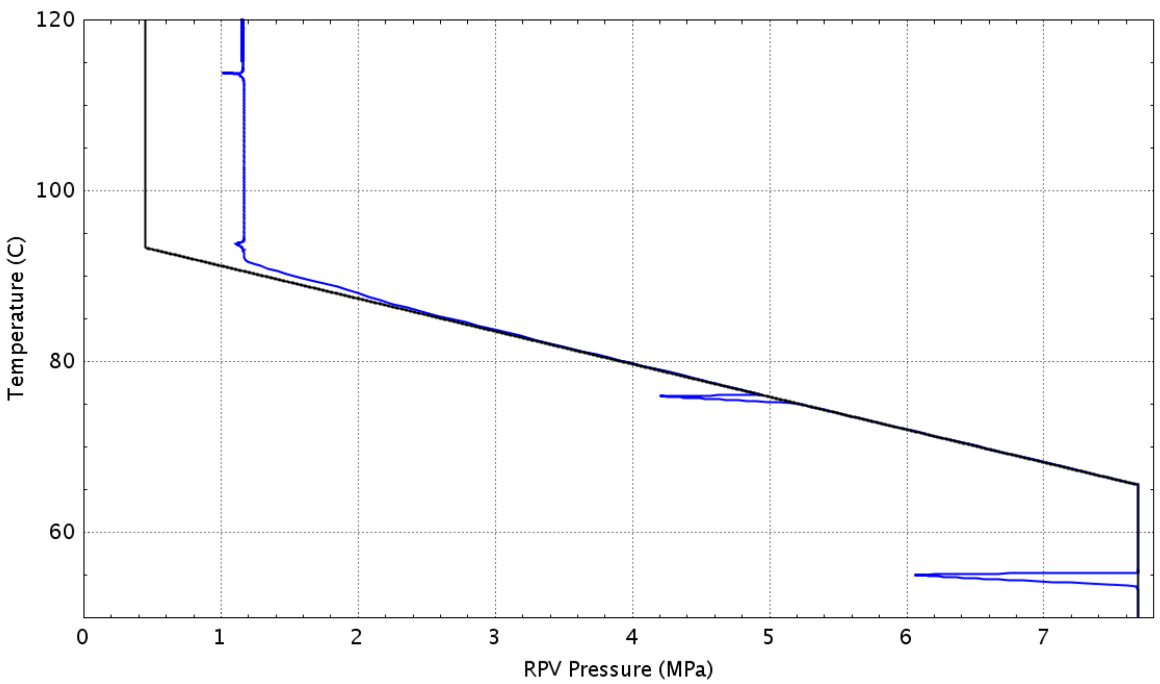

Figure E – 192 Plant status relative to the HCL curve (Graph 4 of the EOPs)

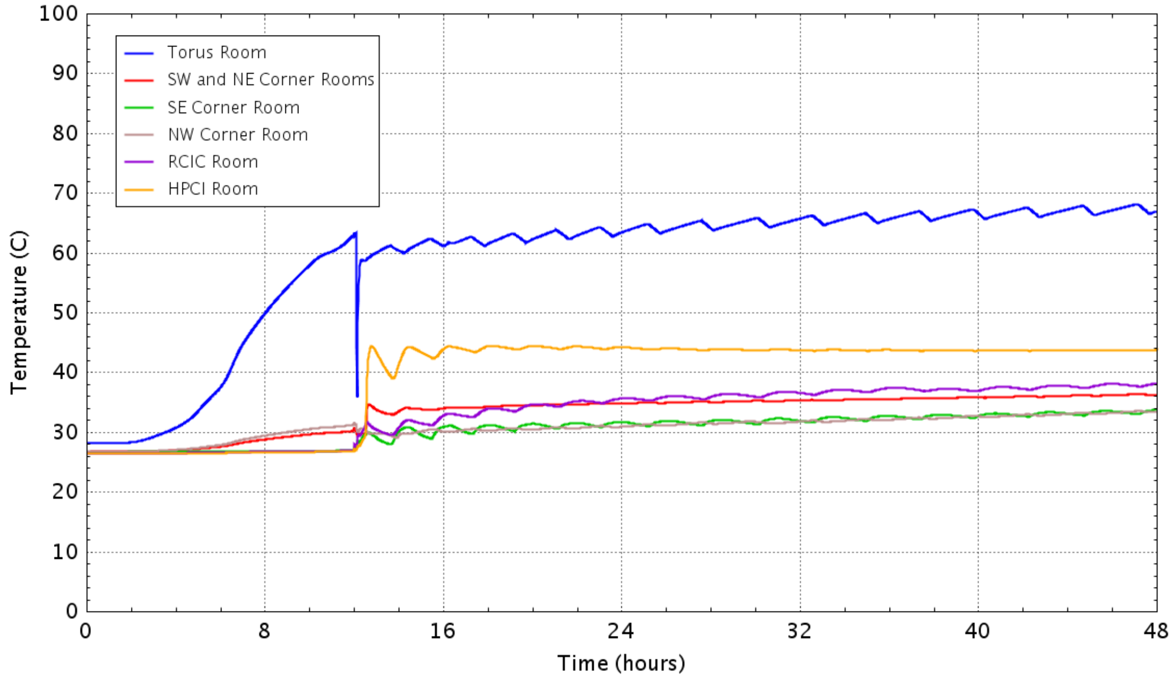

Figure E – 193 Vapor temperature in the reactor buildingbasement

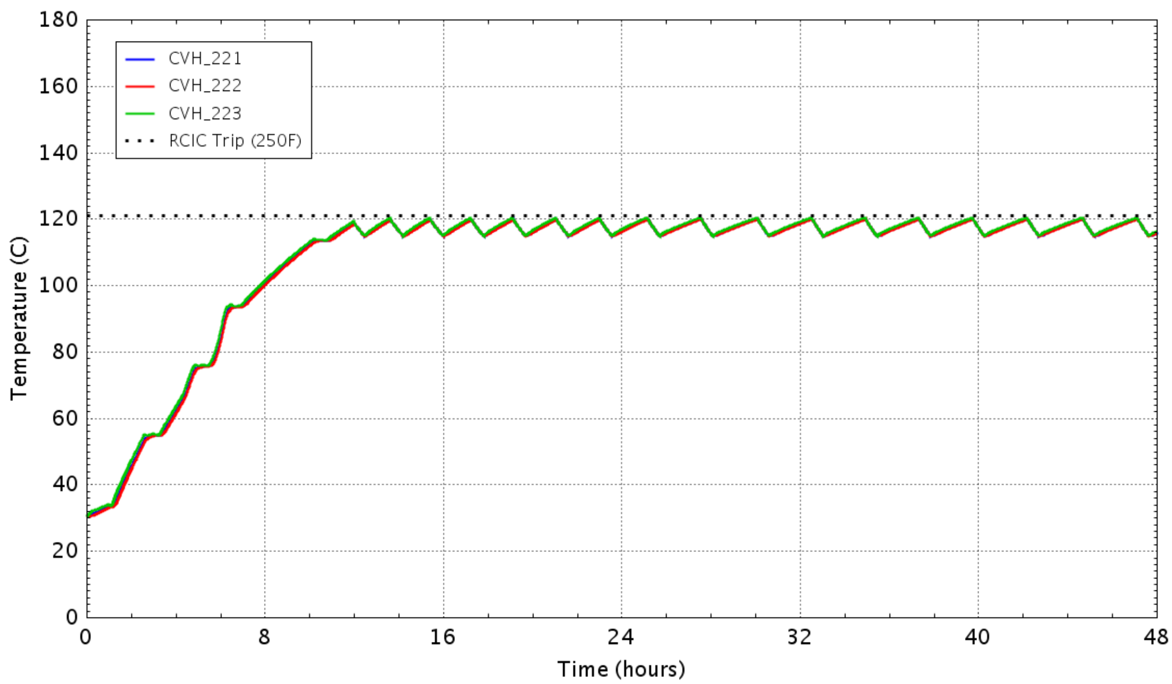

Figure E – 194 Water temperature in the wetwell

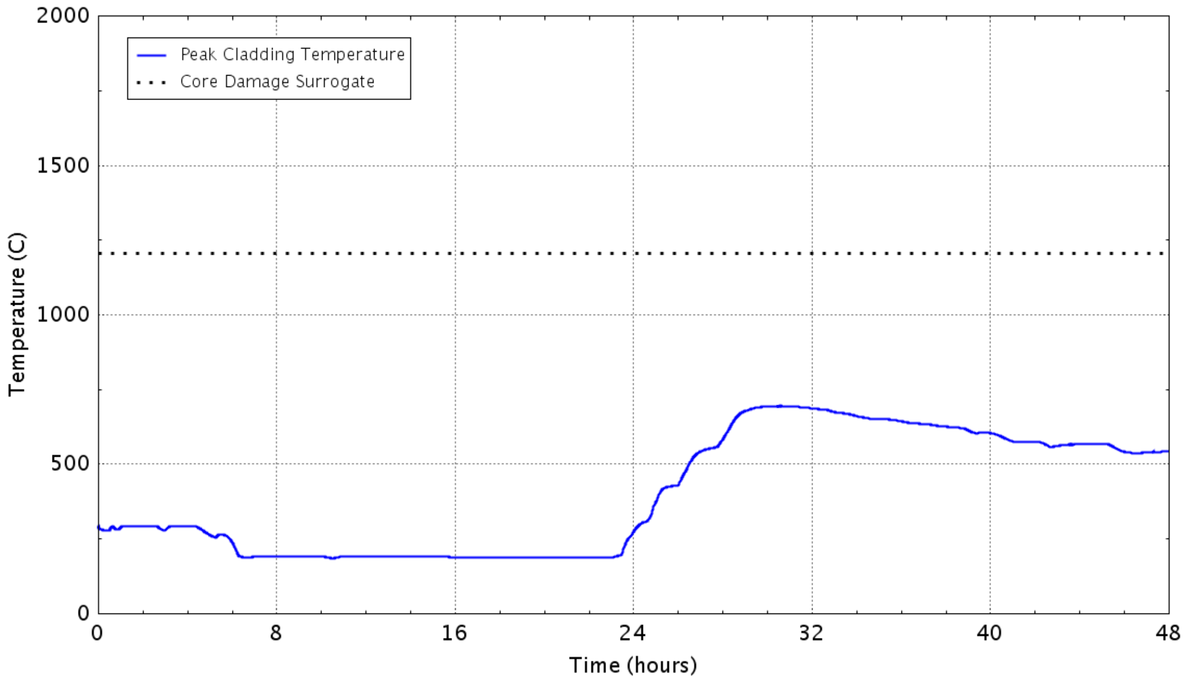

Figure E – 195 Peak temperature of the fuel cladding as a function oftime

E.2.6 Case 20: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 2-in. Drywell Bypass, RCIC Fully Functional

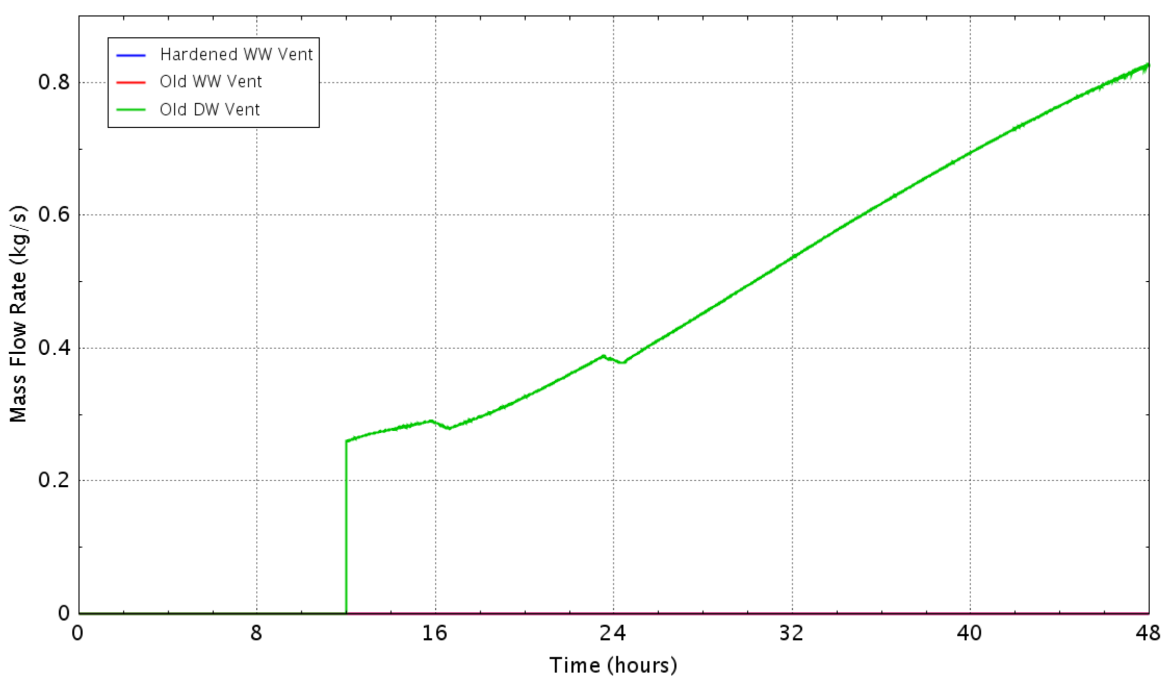

Figure E – 196 Flow rate of the containment vents

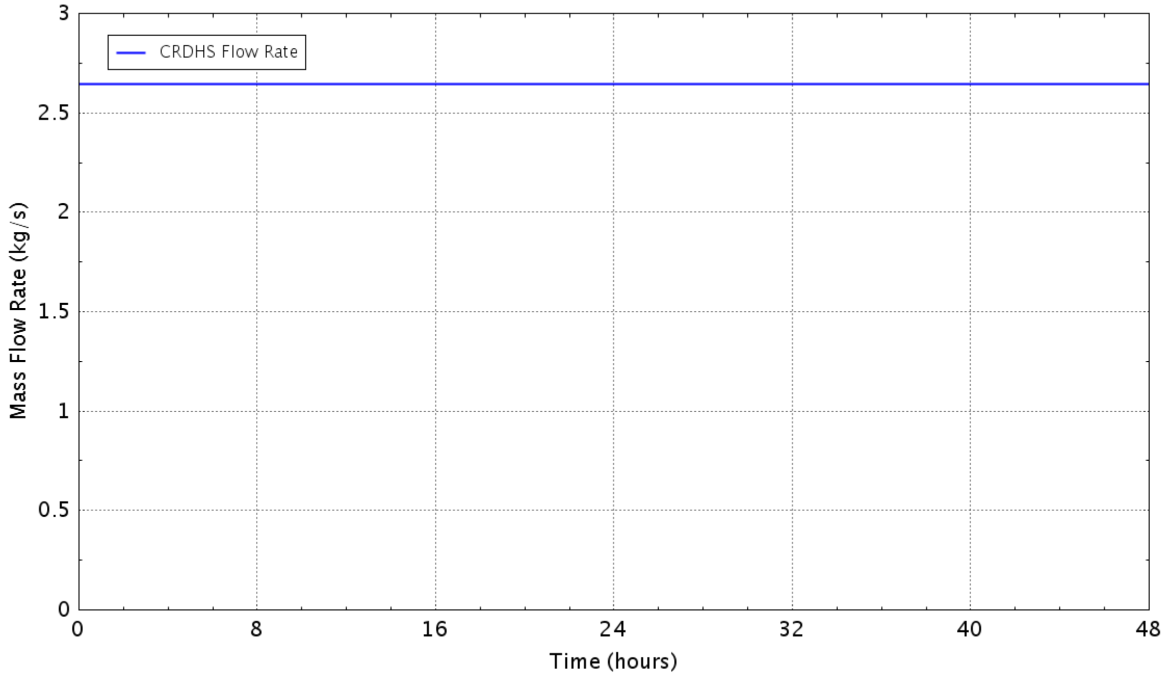

Figure E – 197 Flow rate of the control rod drive hydraulicsystem

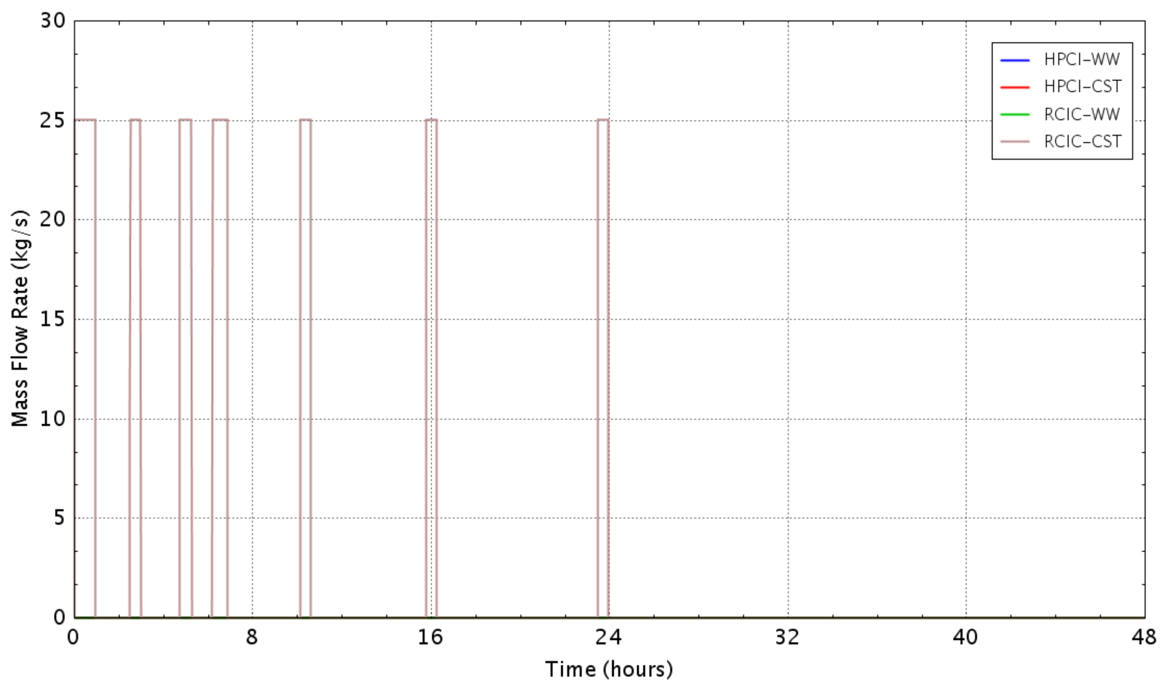

Figure E - 198 Flow rate of the HPCI/RCIC pumps

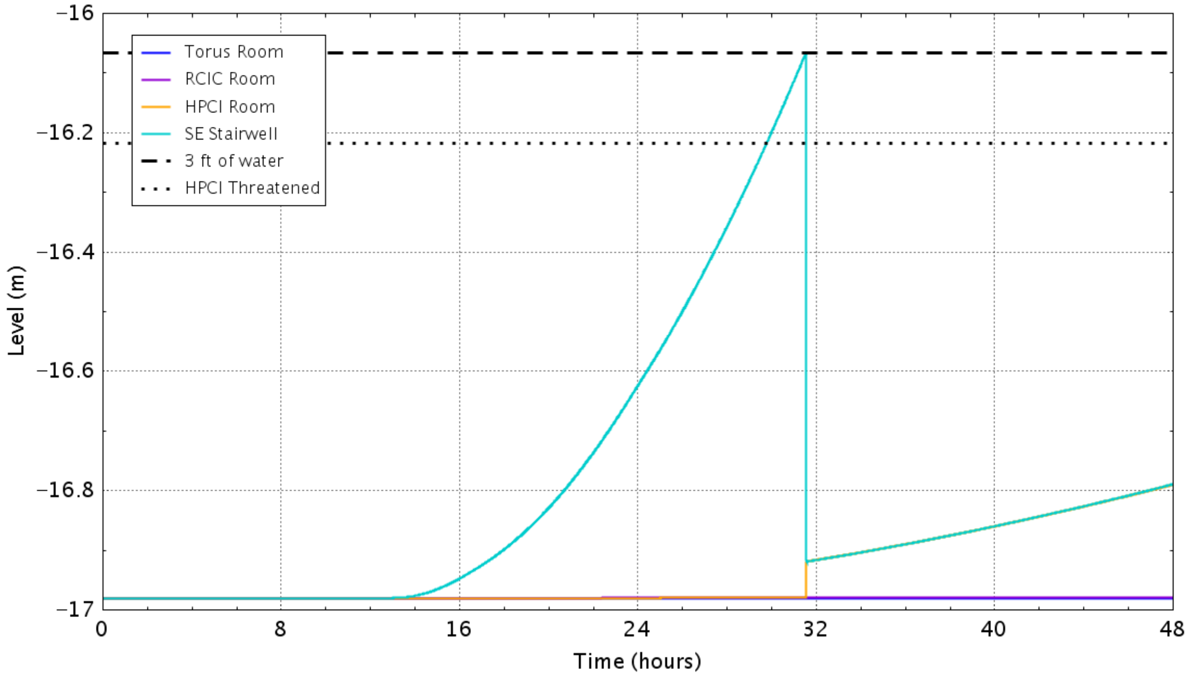

Figure E - 199 **Water level in the reactor building basement**

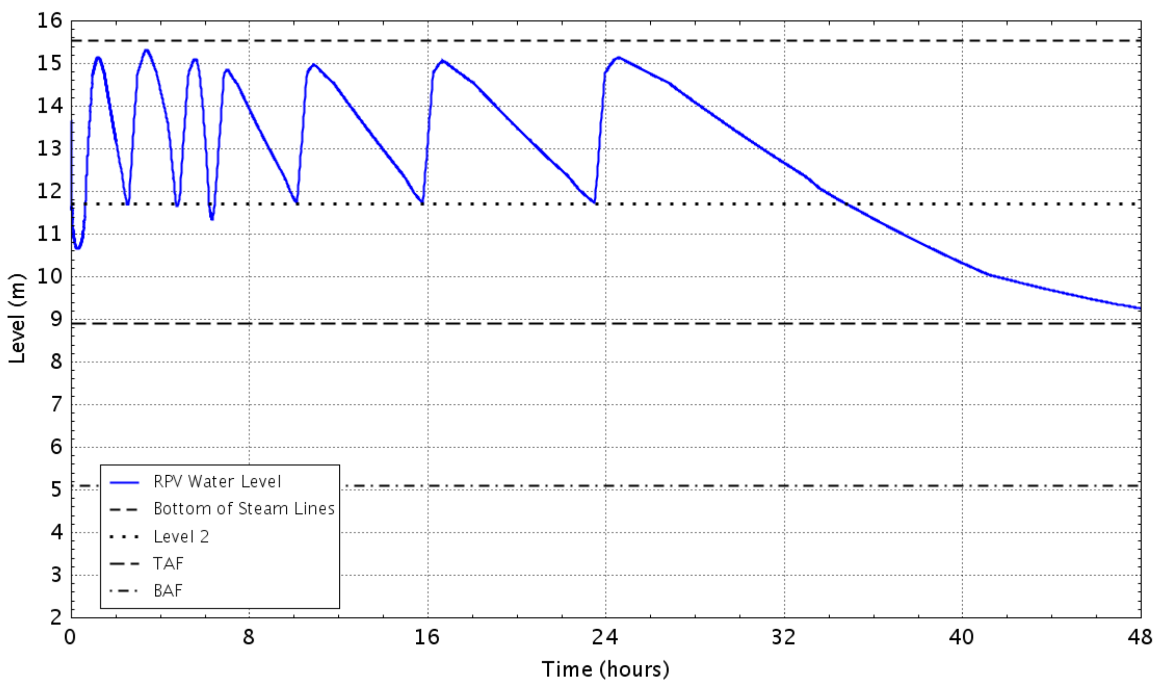

Figure E - 200 **RPV down comer water level**

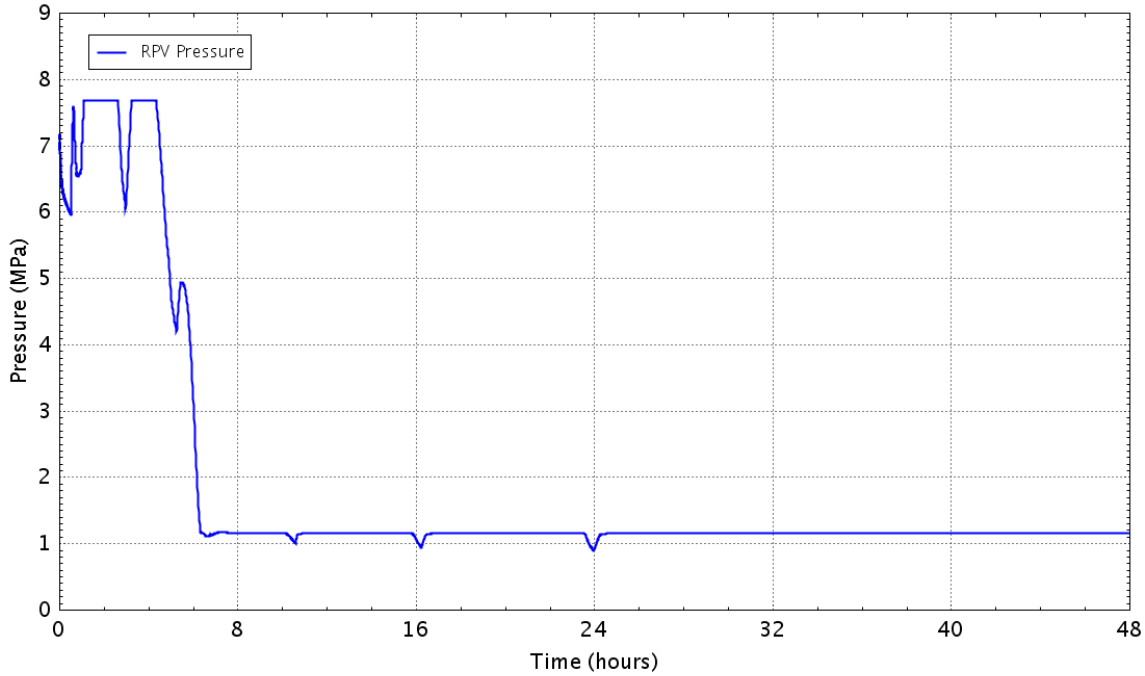

Figure E - 201 Pressure in theRPV

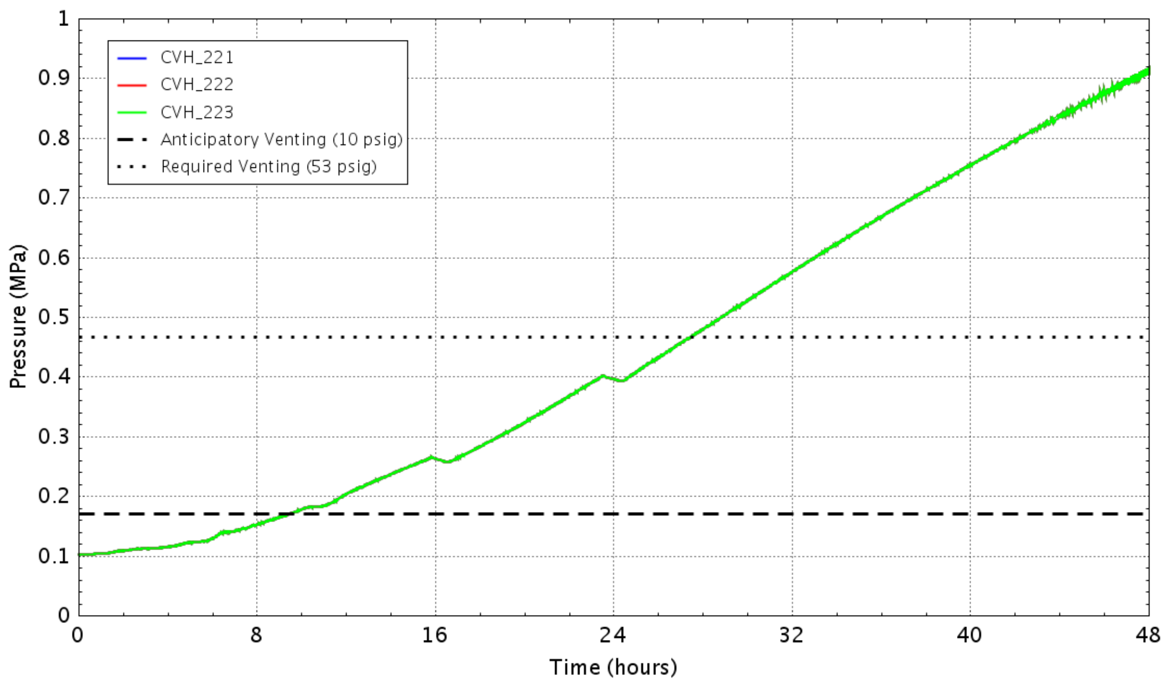

Figure E - 202 Pressure in the wetwell

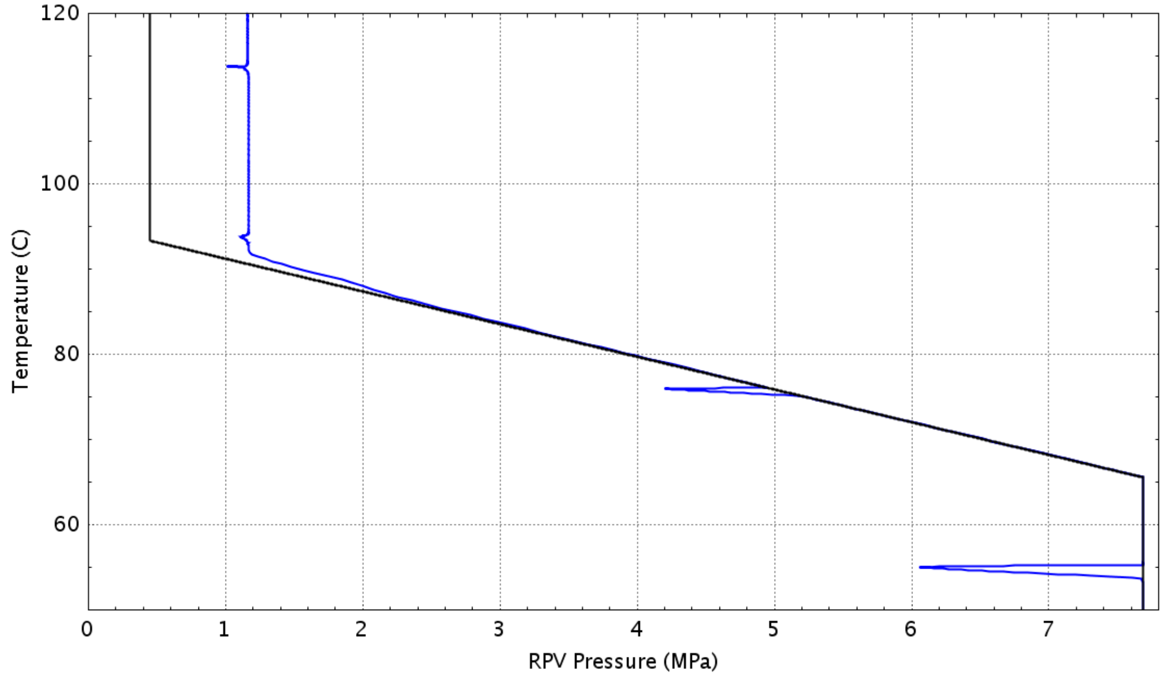

Figure E – 203 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

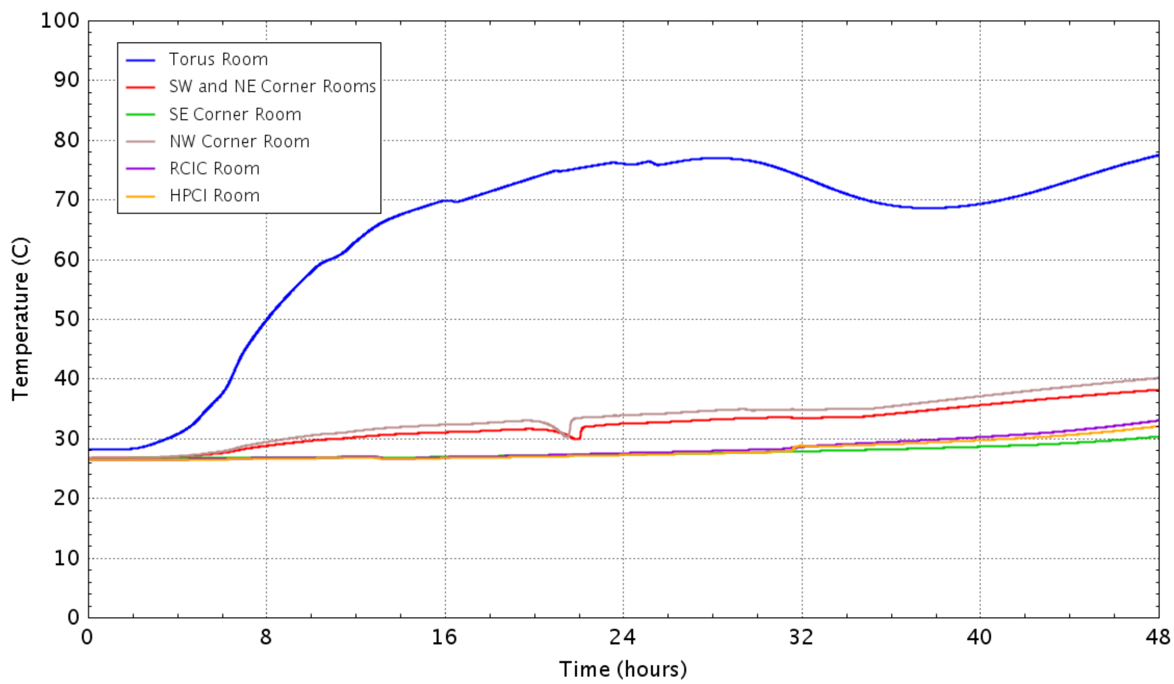

Figure E – 204 **Vapor temperature in the reactor buildingbasement**

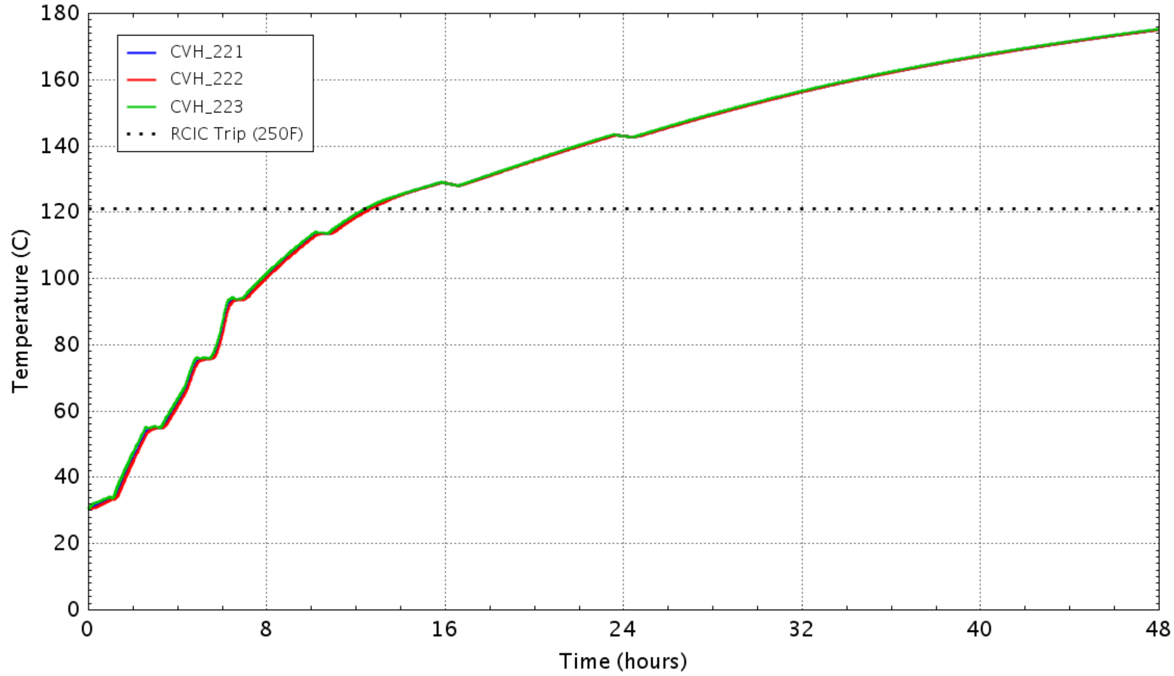

Figure E - 205 **Water temperature in the wetwell**

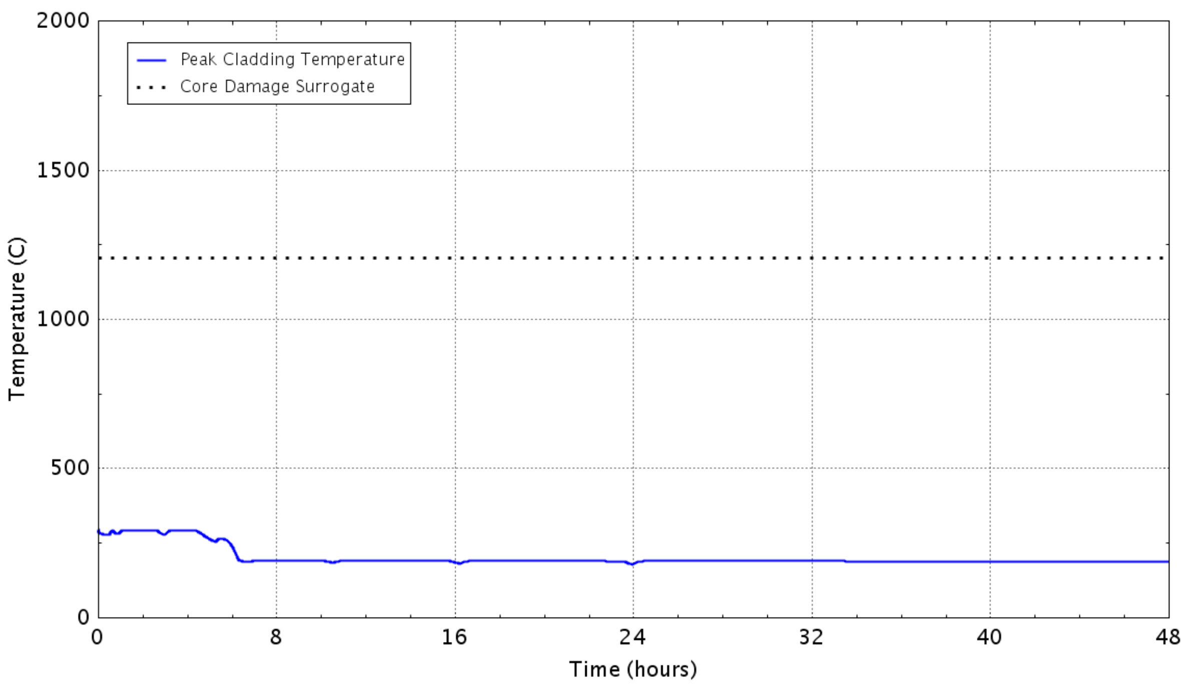

Figure E – 206 **Peak temperature of the fuel cladding as a function of time**

E.2.7 Case 21: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 2-in. Drywell Bypass, RCIC 50% Degraded

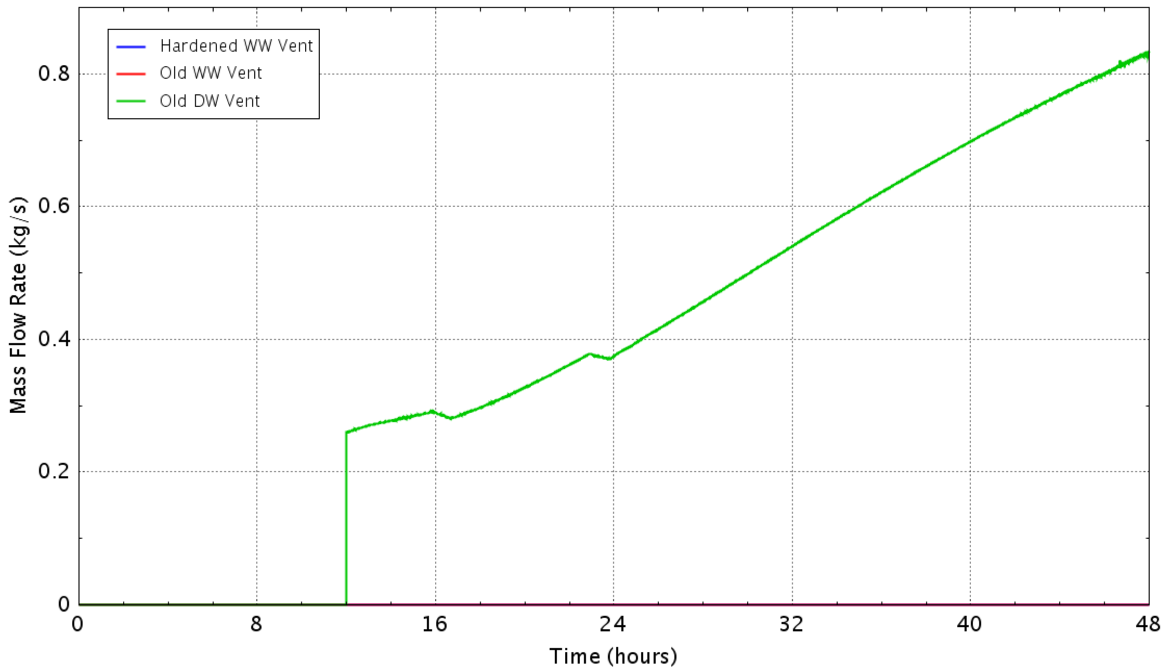

Figure E - 207 Flow rate of the containment vents

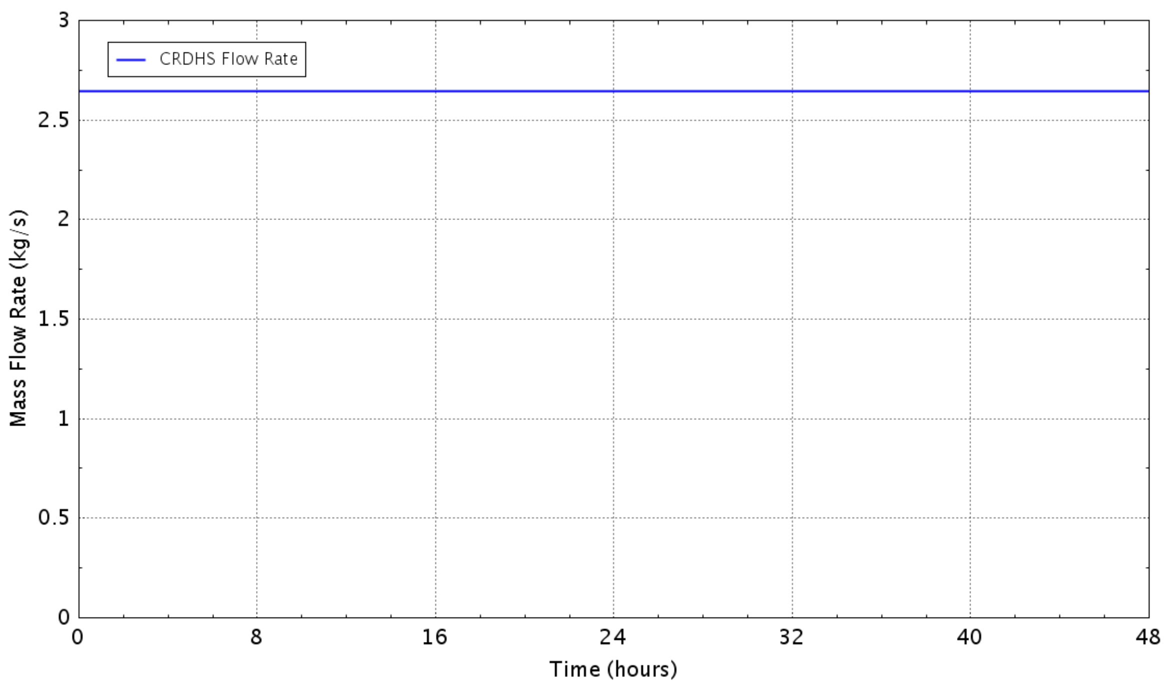

Figure E - 208 Flow rate of the control rod drive hydraulic system

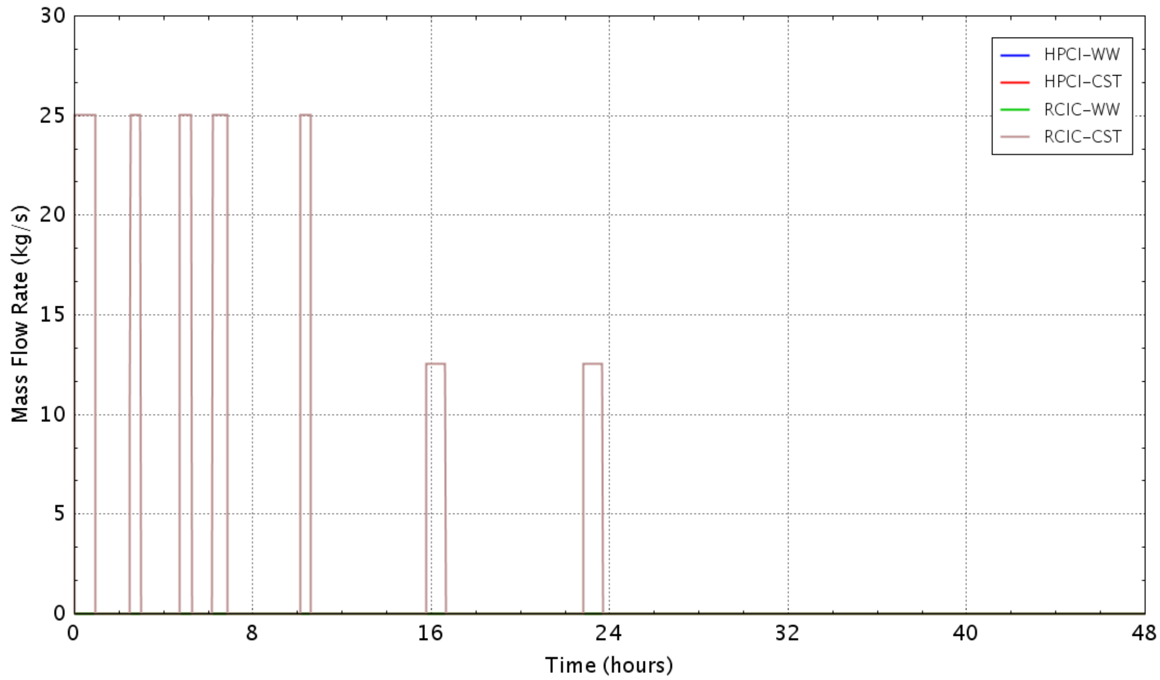

Figure E - 209 Flow rate of the HPCI/RCIC pumps

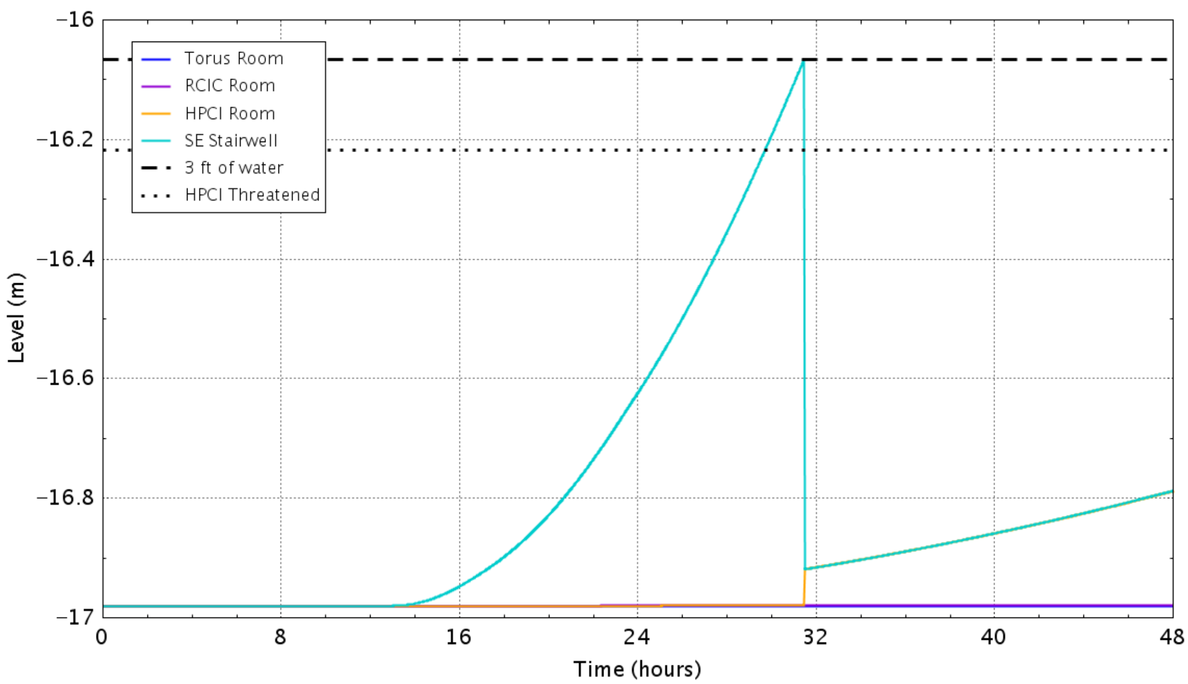

Figure E - 210 Water level in the reactor building basement

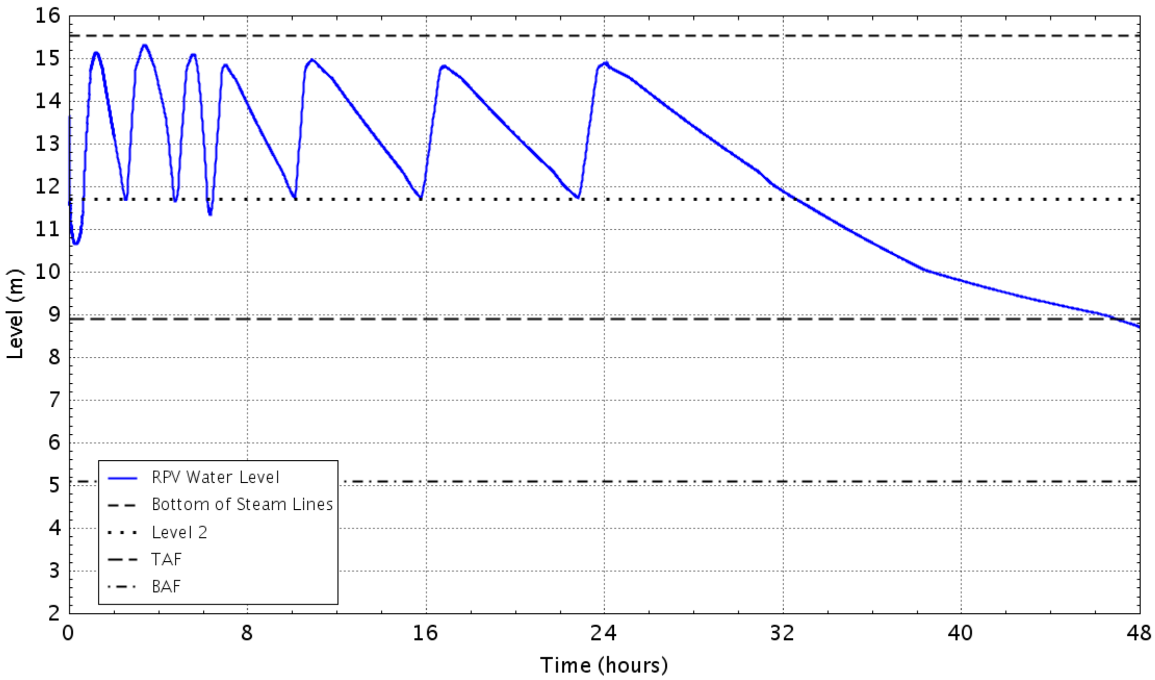

Figure E - 211 **RPV down comer water level**

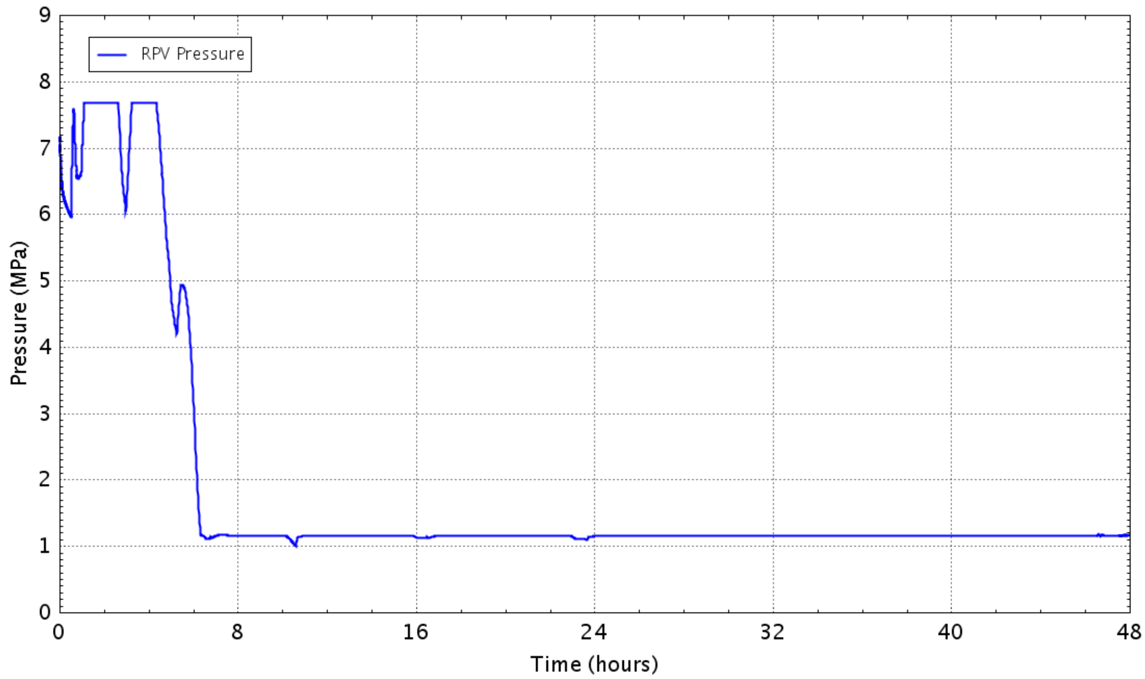

Figure E - 212 **Pressure in theRPV**

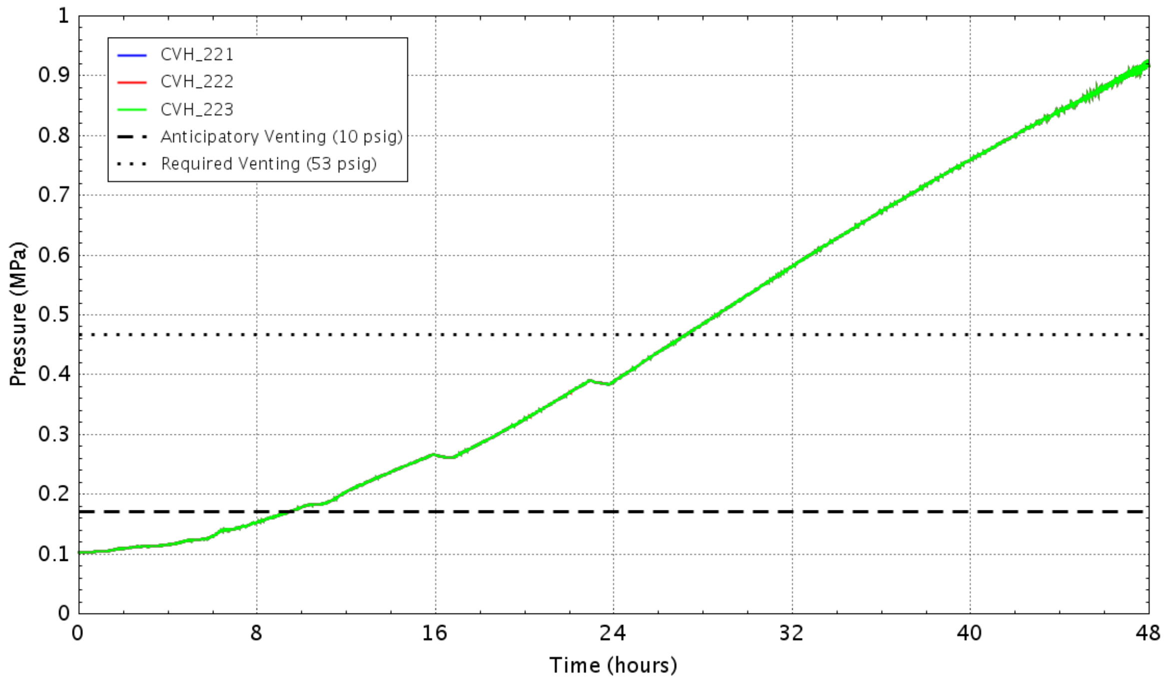

Figure E - 213 **Pressure in the wetwell**

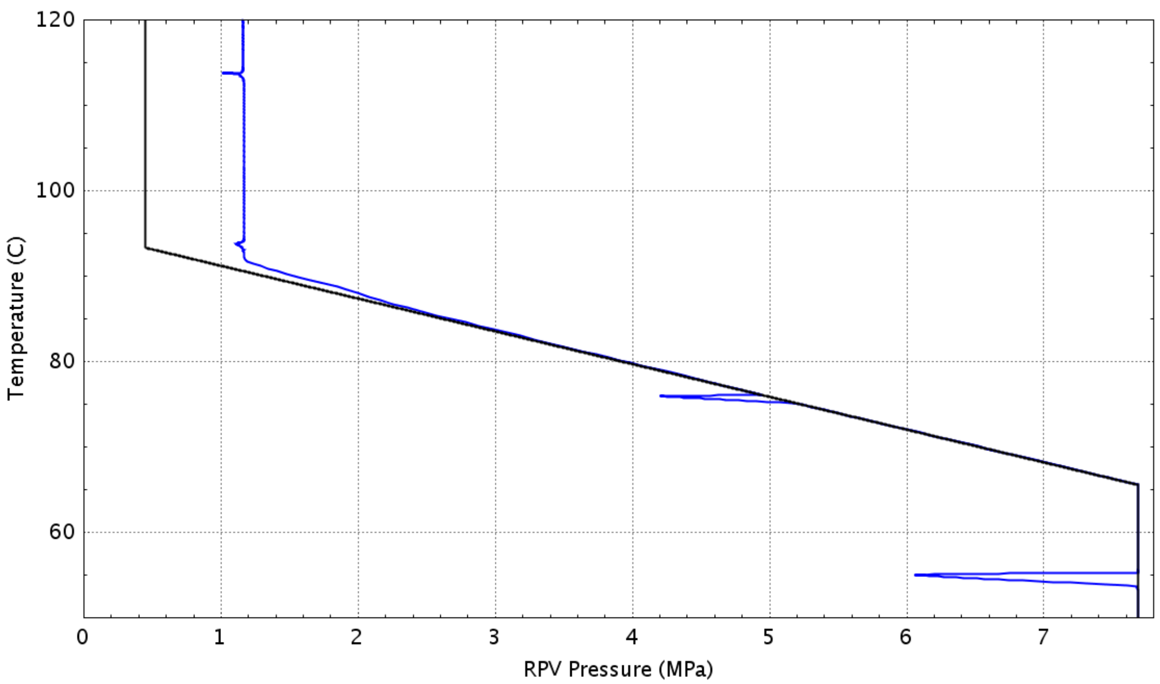

Figure E – 214 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

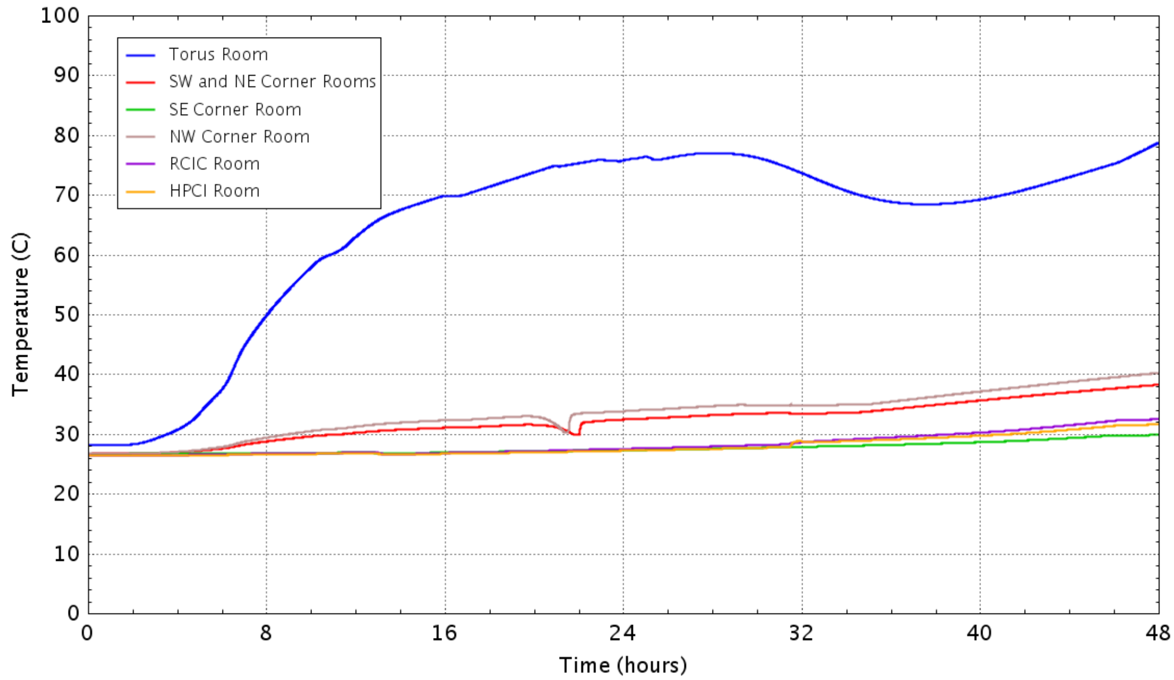

Figure E - 215 **Vapor temperature in the reactor building basement**

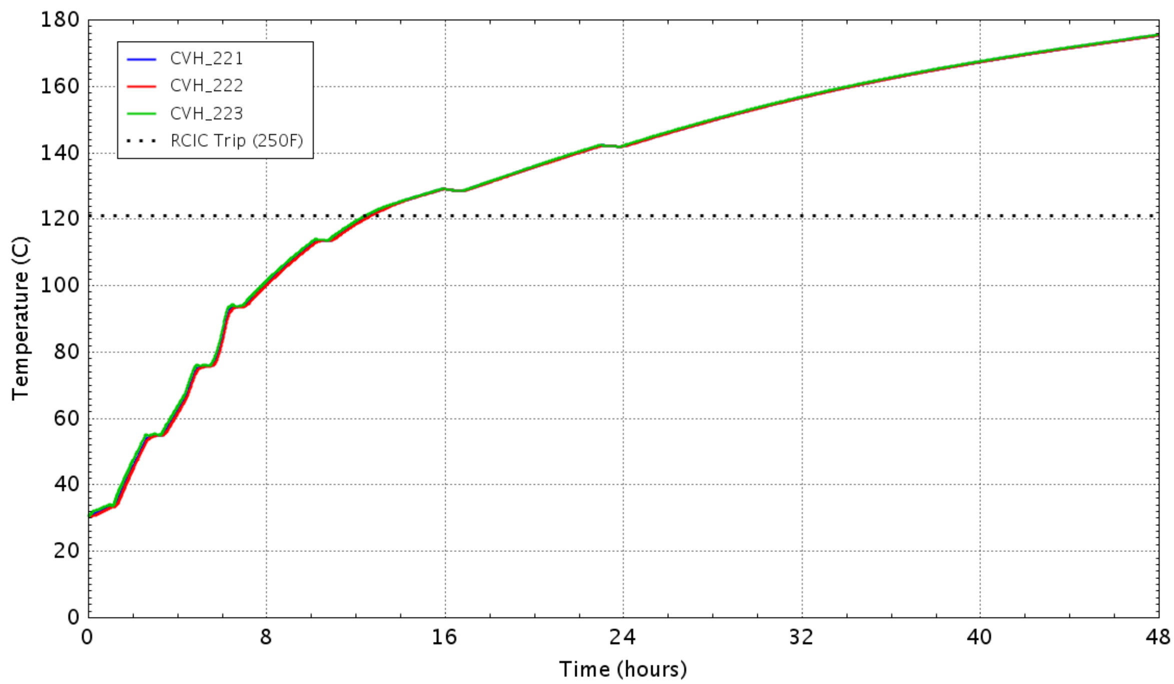

Figure E - 216 **Water temperature in the wetwell**

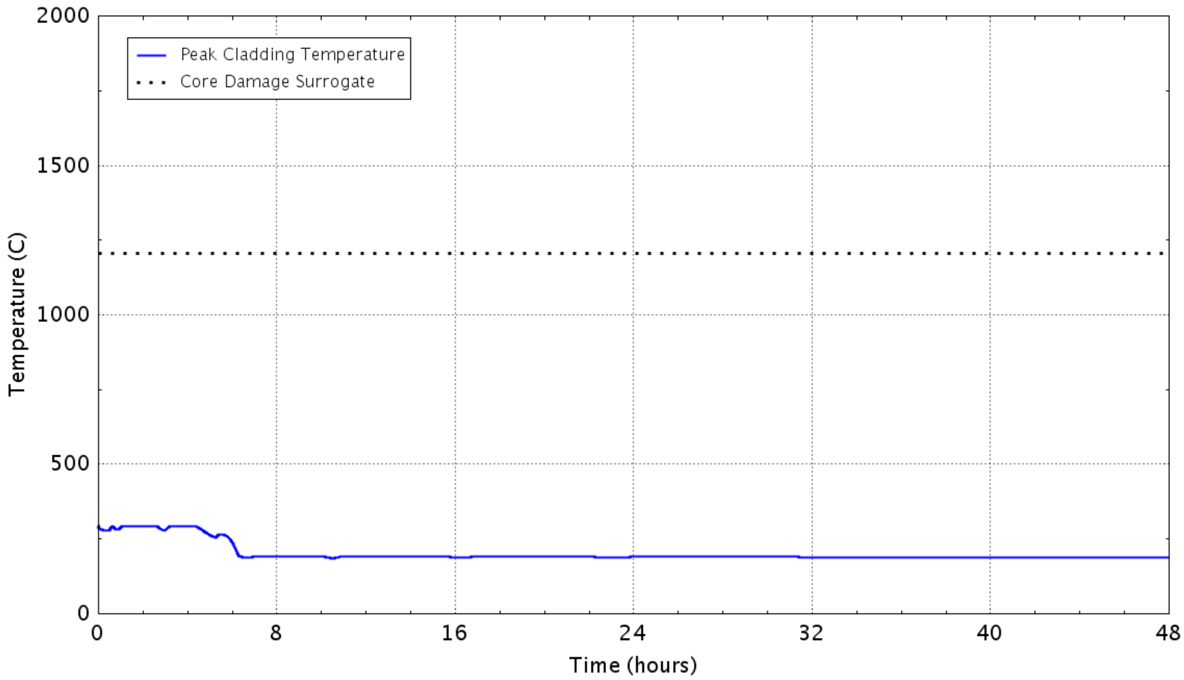

Figure E - 217 **Peak temperature of the fuel cladding as a function of time**

E.2.8 Case 22: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 18-in. Drywell Vent, RCIC Fully Functional

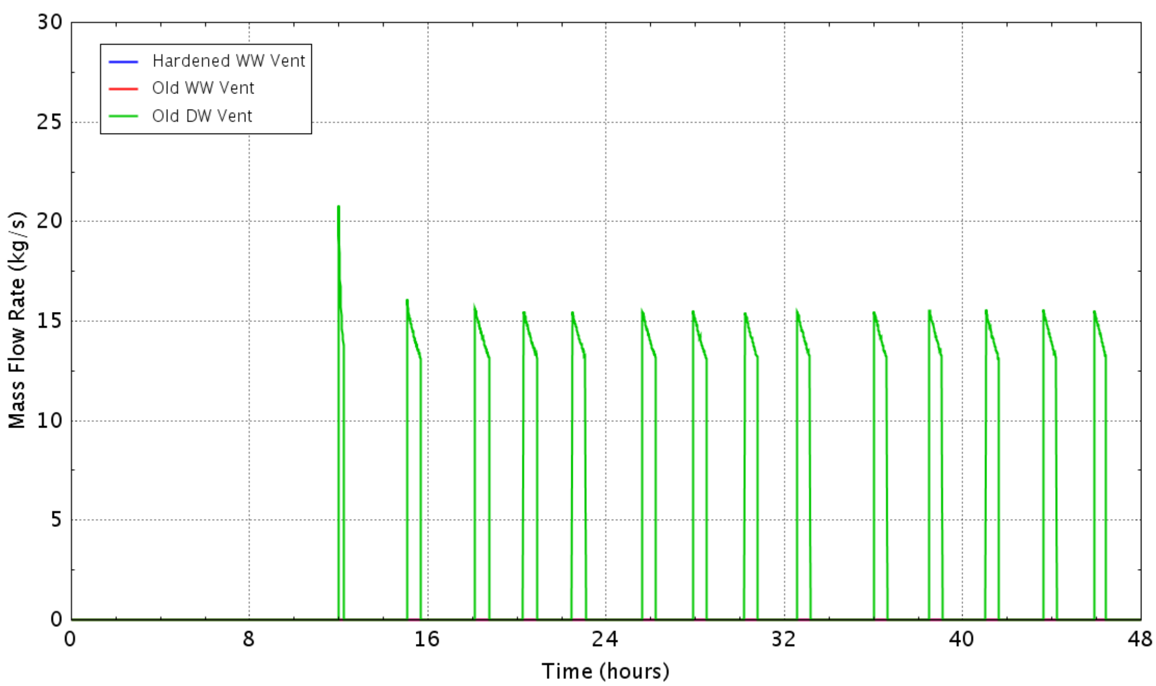

Figure E - 218 **Flow rate of the containment vents**

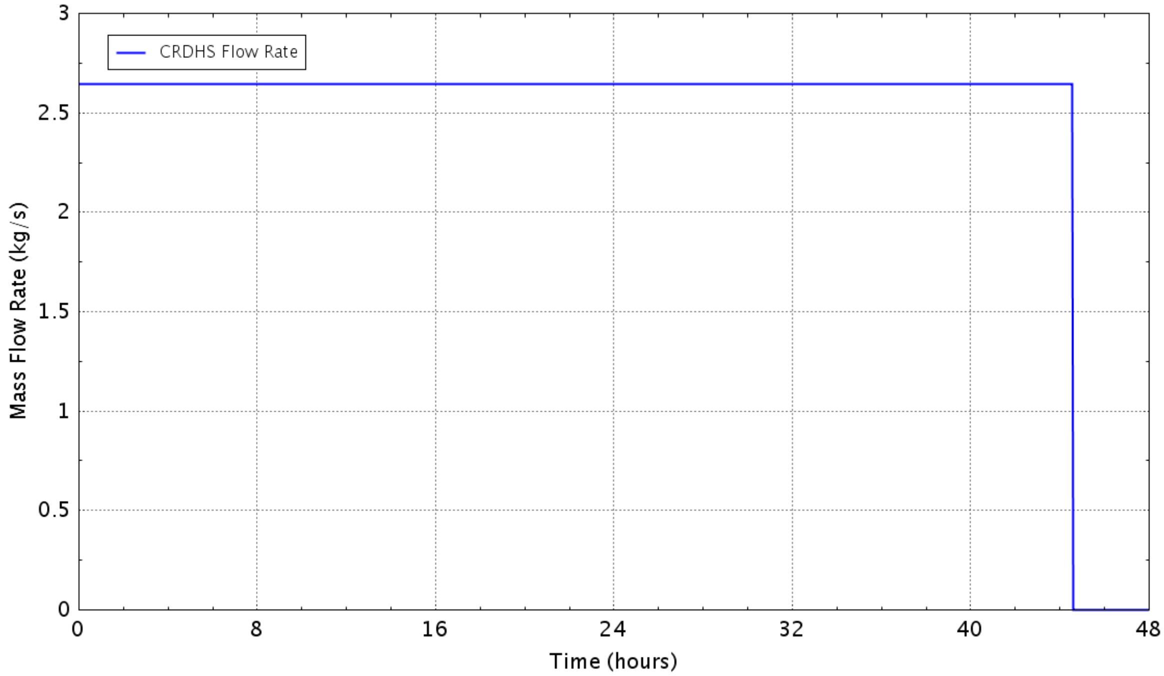

Figure E - 219 **Flow rate of the control rod drive hydraulic system**

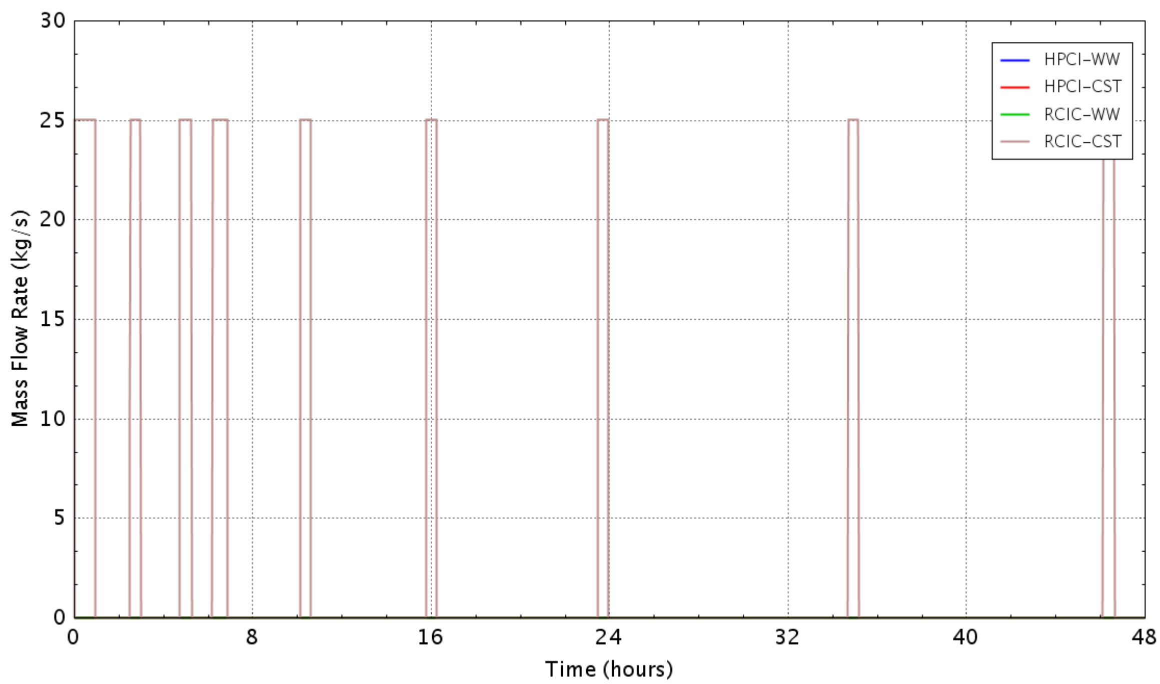

Figure E - 220 **Flow rate of the HPCI/RCIC pumps**

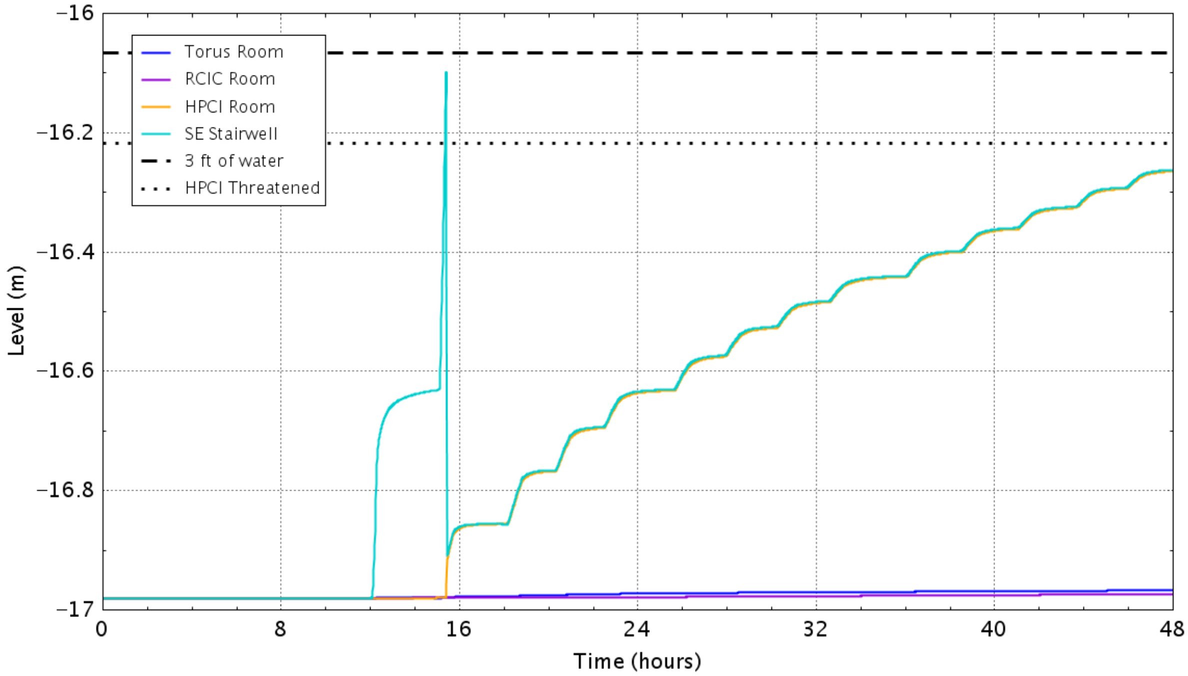

Figure E - 221 **Water level in the reactor building basement**

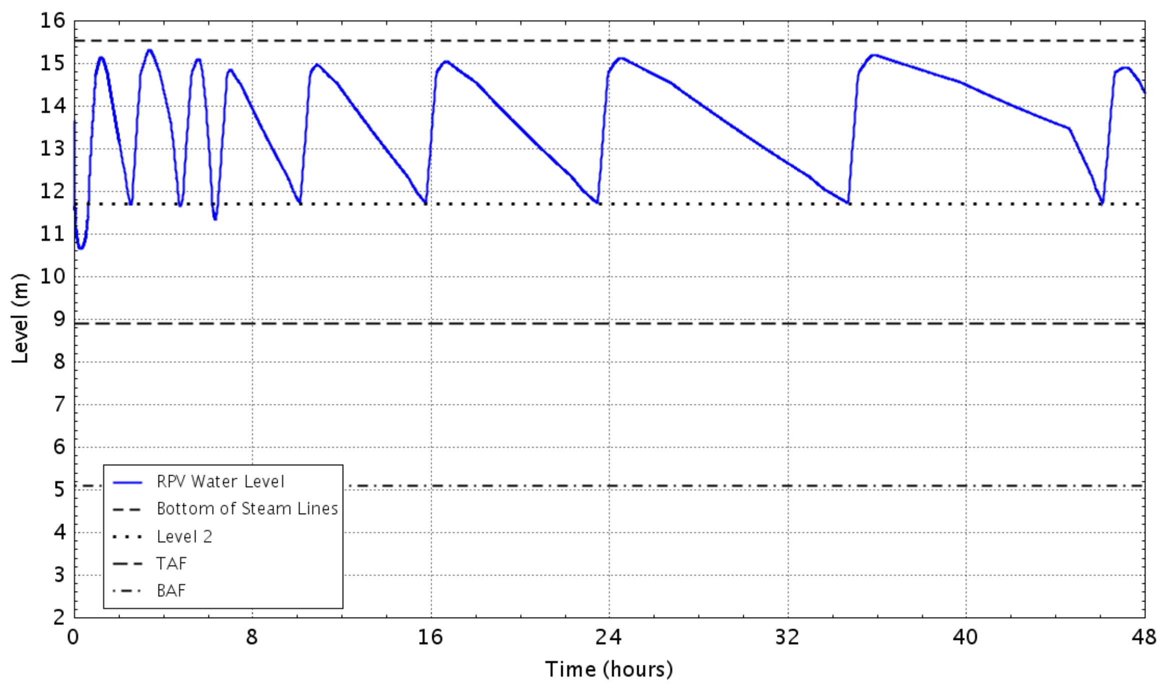

Figure E - 222 **RPV down comer water level**

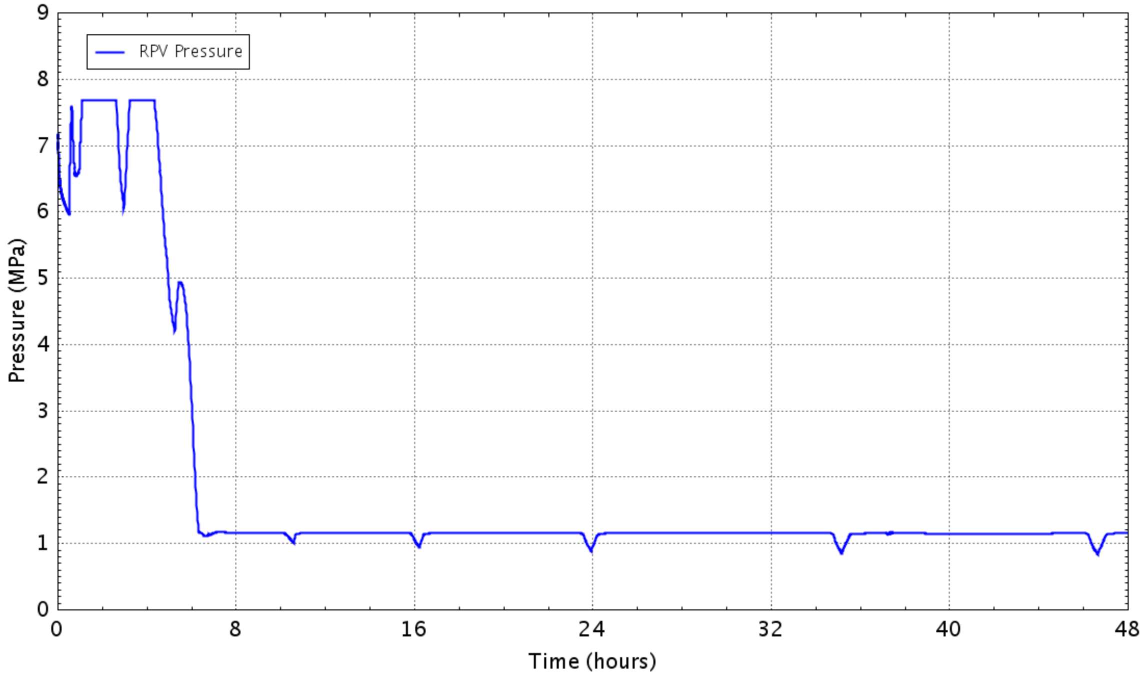

Figure E - 223 **Pressure in theRPV**

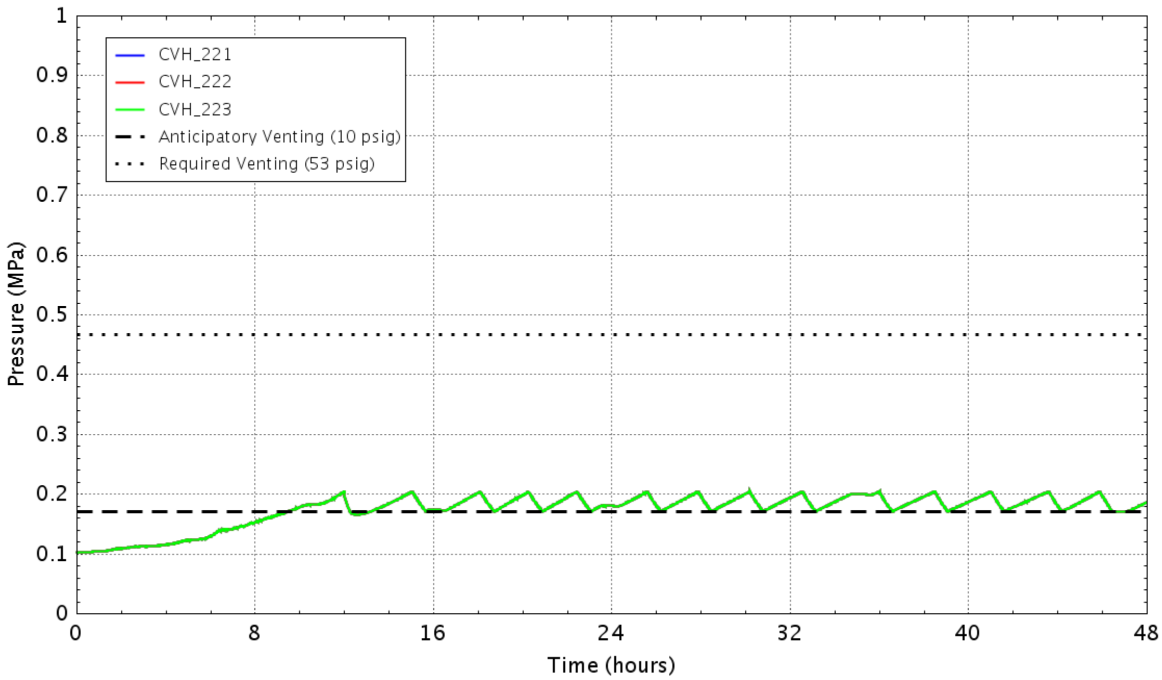

Figure E - 224 **Pressure in the wetwell**

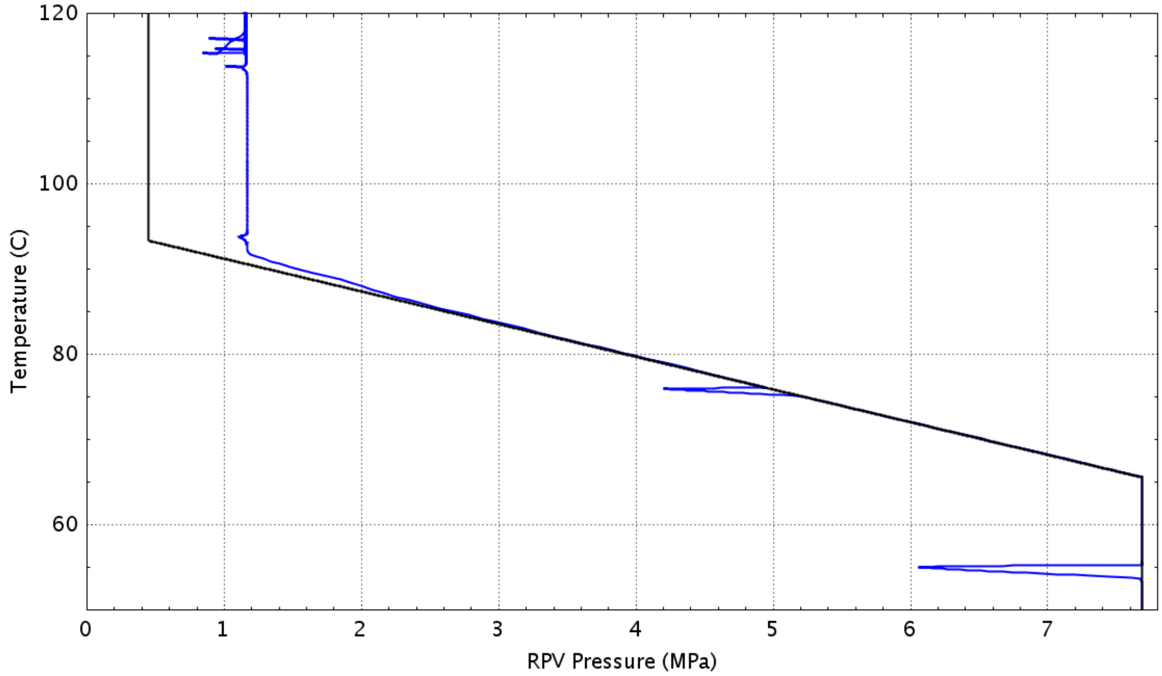

Figure E – 225 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

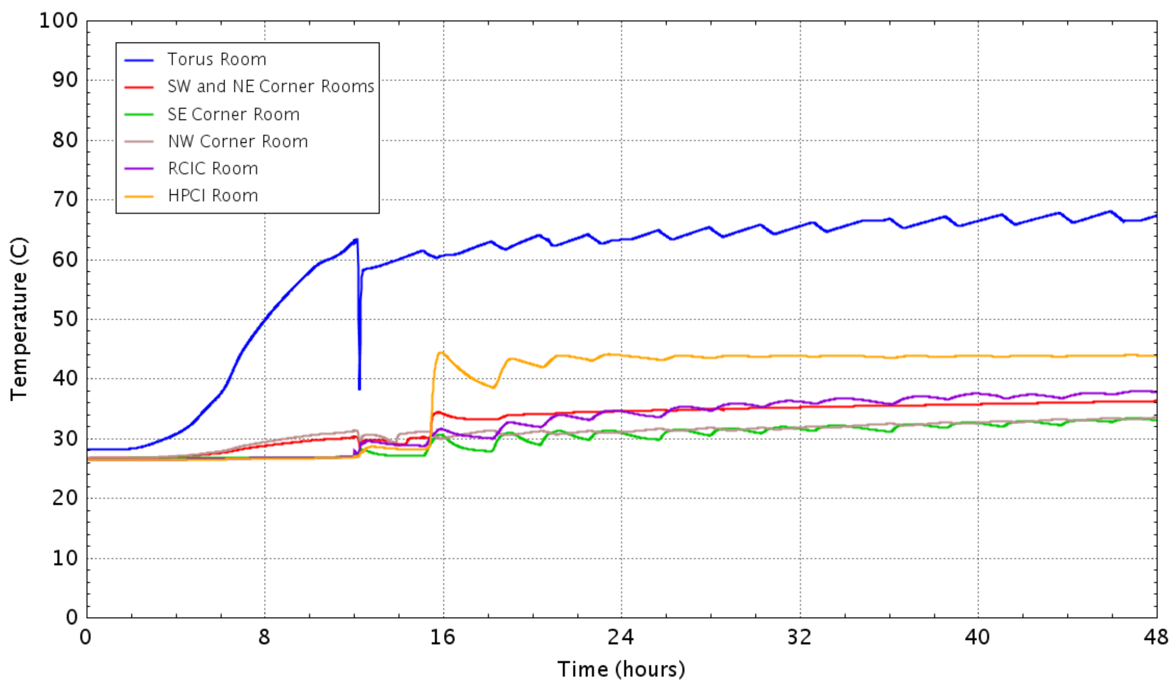

Figure E - 226 **Vapor temperature in the reactor building basement**

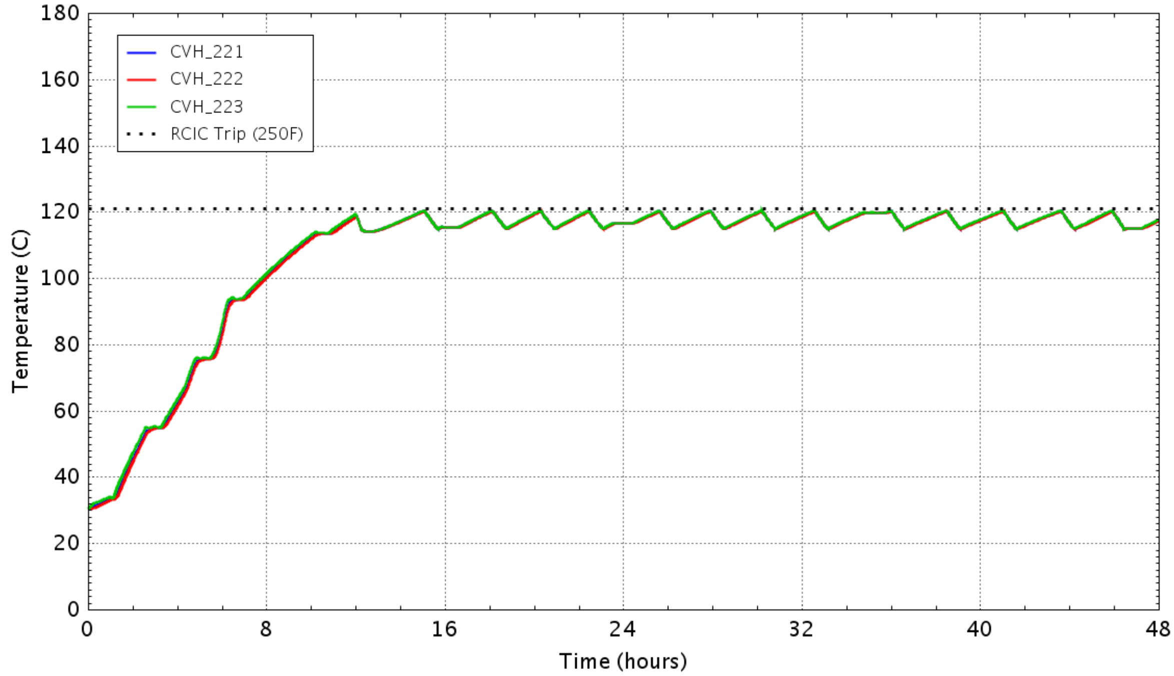

Figure E - 227 **Water temperature in the wetwell**

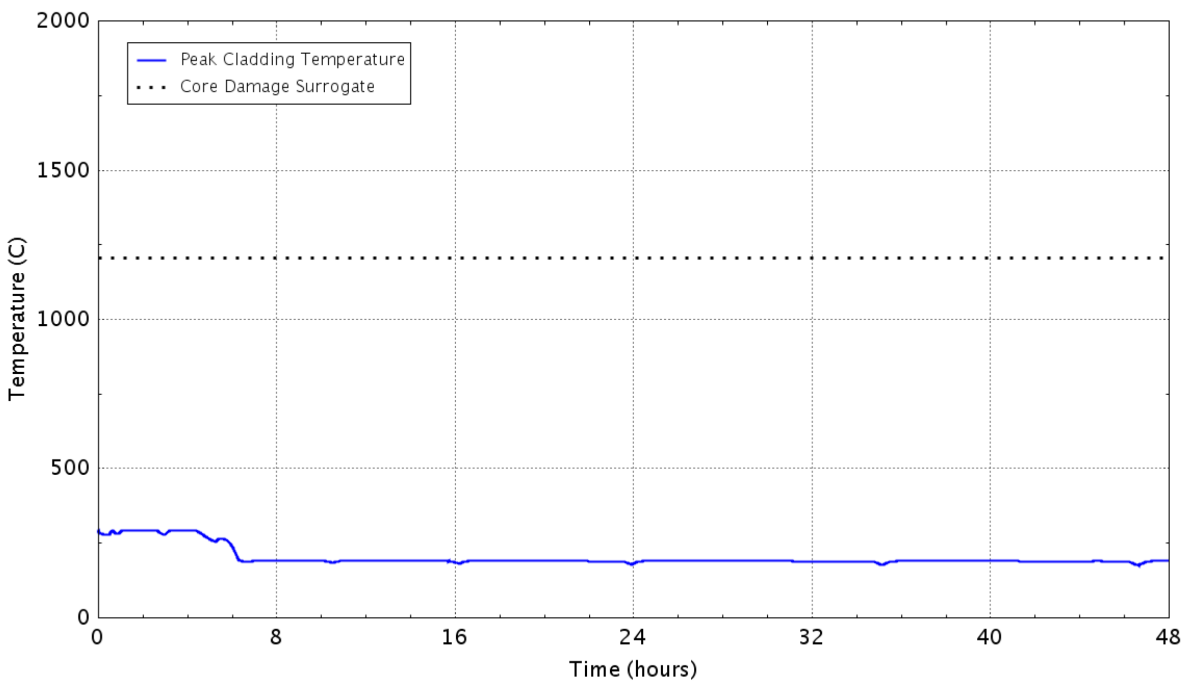

Figure E – 228 **Peak temperature of the fuel cladding as a function oftime**

E.2.9 Case 23: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 18-in. Drywell Vent, RCIC 50% Degraded

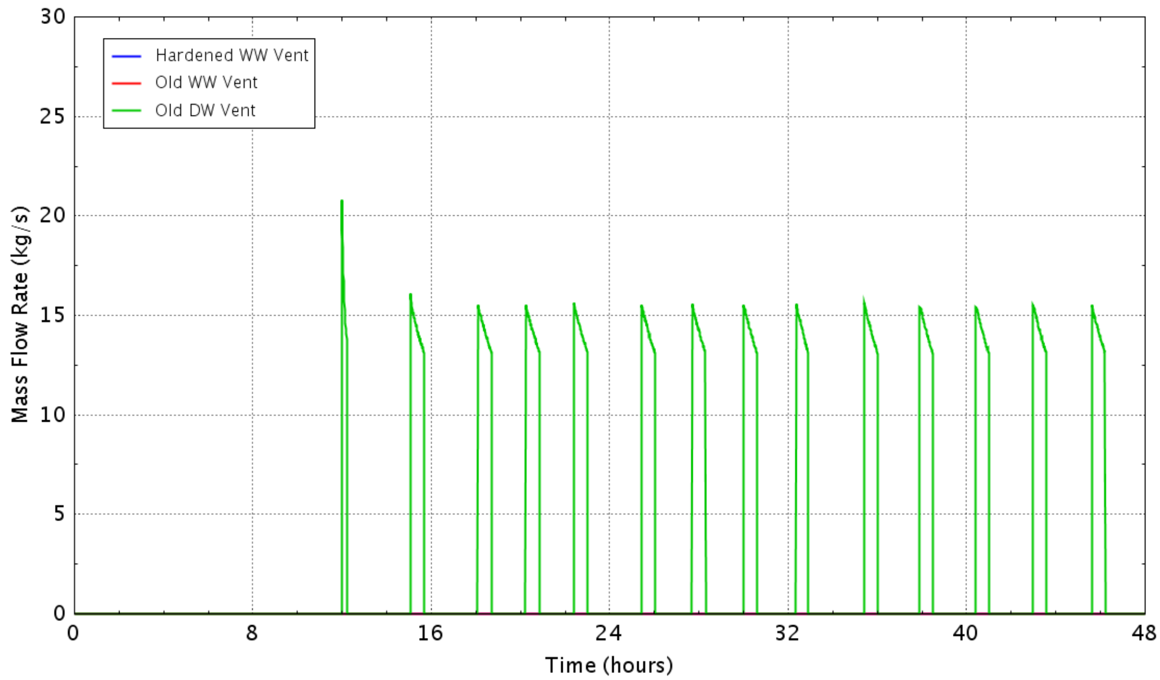

Figure E - 229 Flow rate of the containment vents

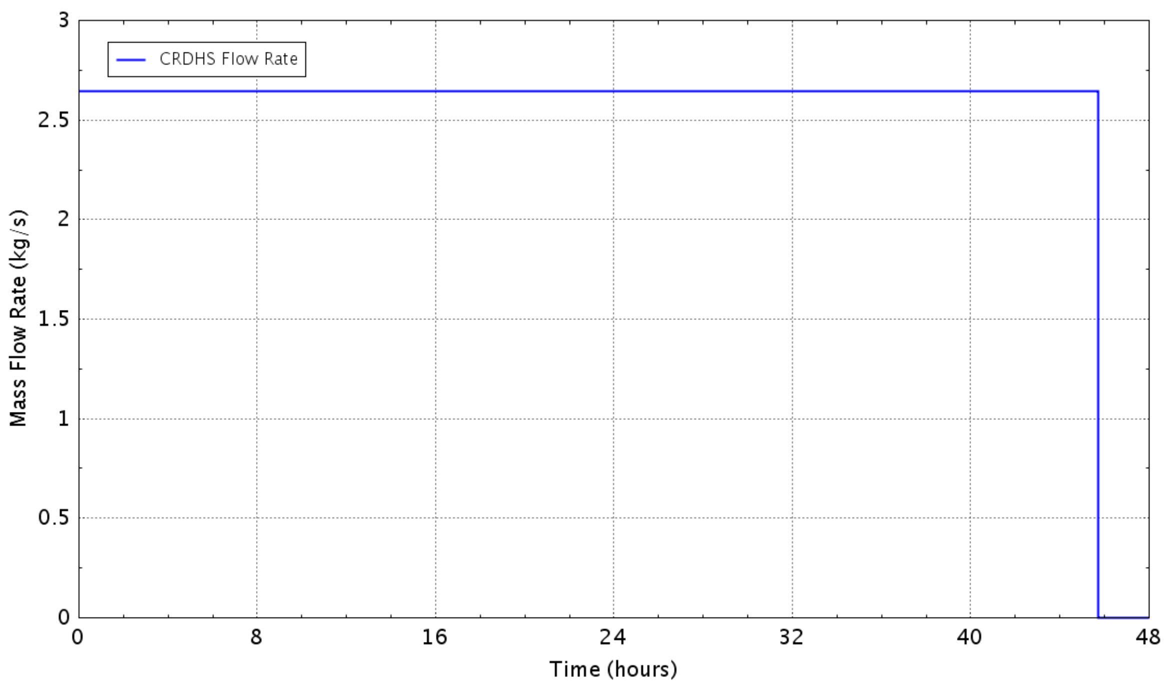

Figure E - 230 Flow rate of the control rod drive hydraulic system

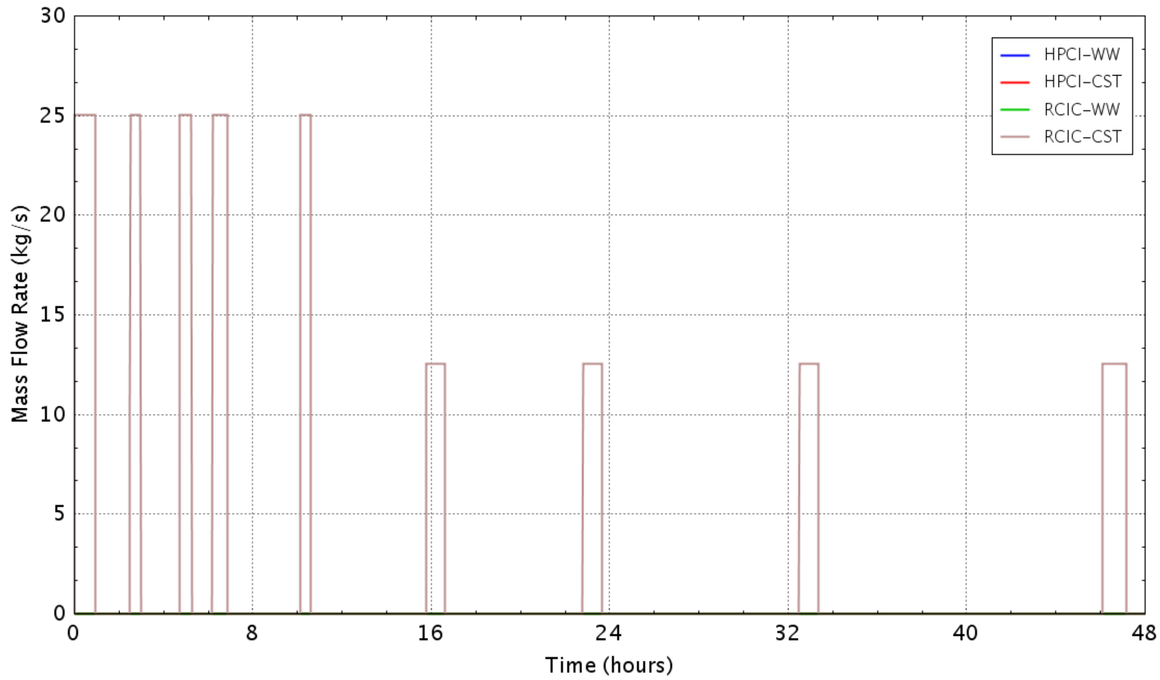

Figure E - 231 **Flow rate of the HPCI/RCIC pumps**

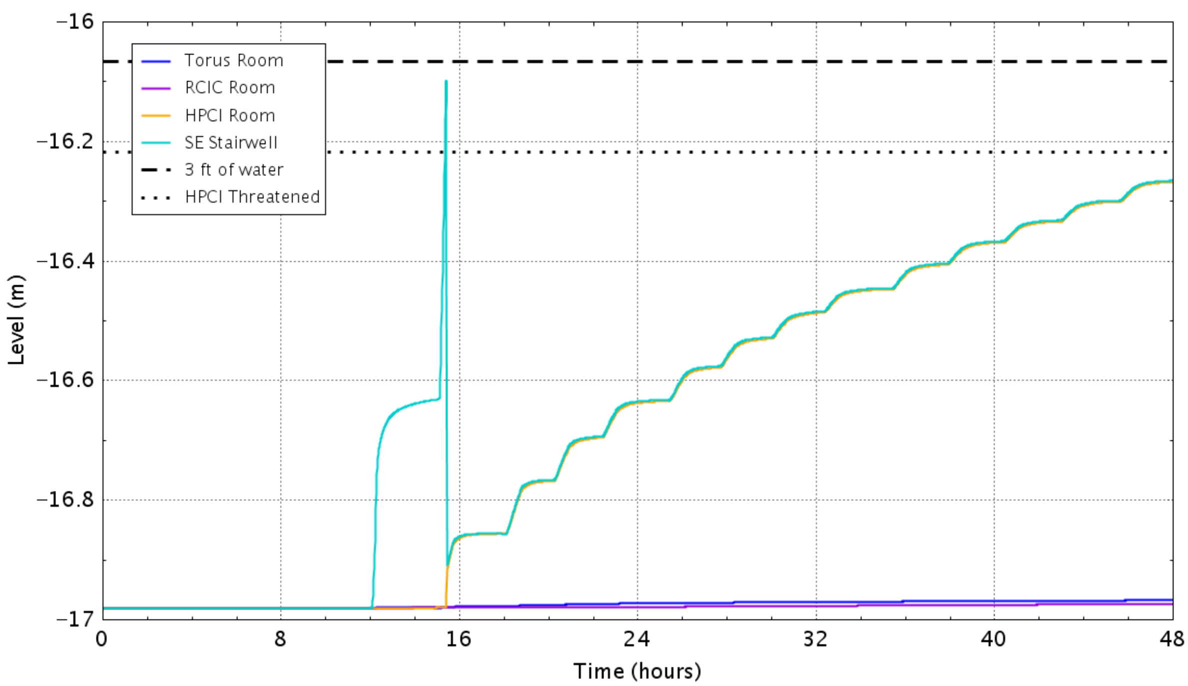

Figure E - 232 **Water level in the reactor building basement**

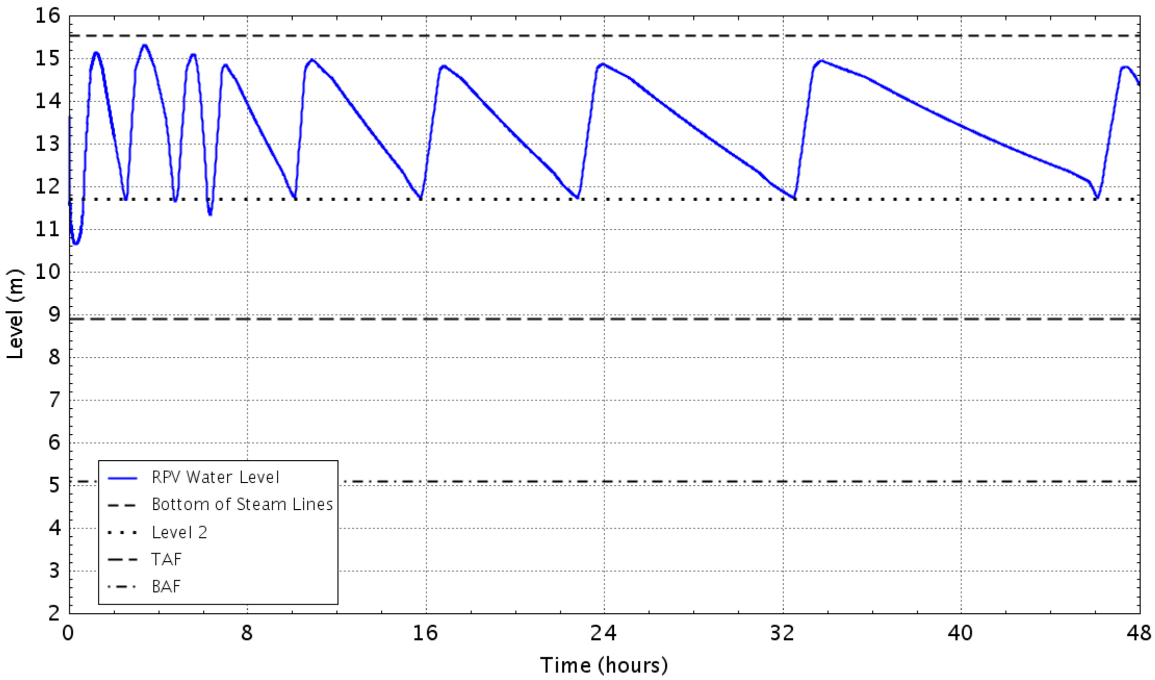

Figure E - 233 **RPV down comer water level**

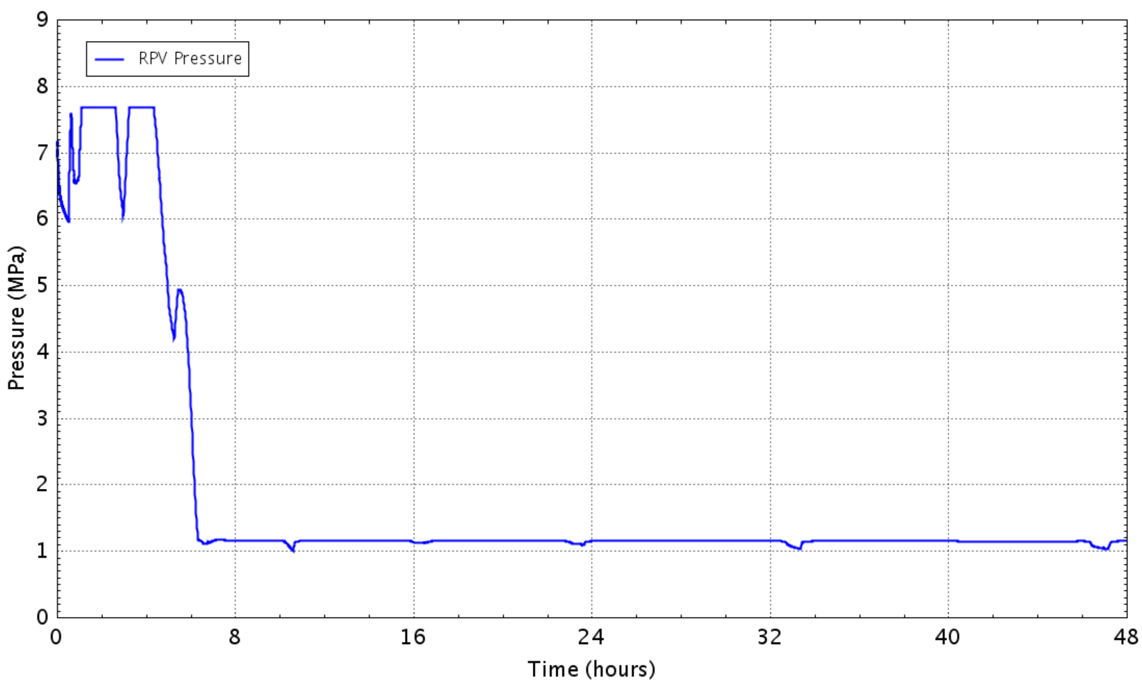

Figure E - 234 **Pressure in theRPV**

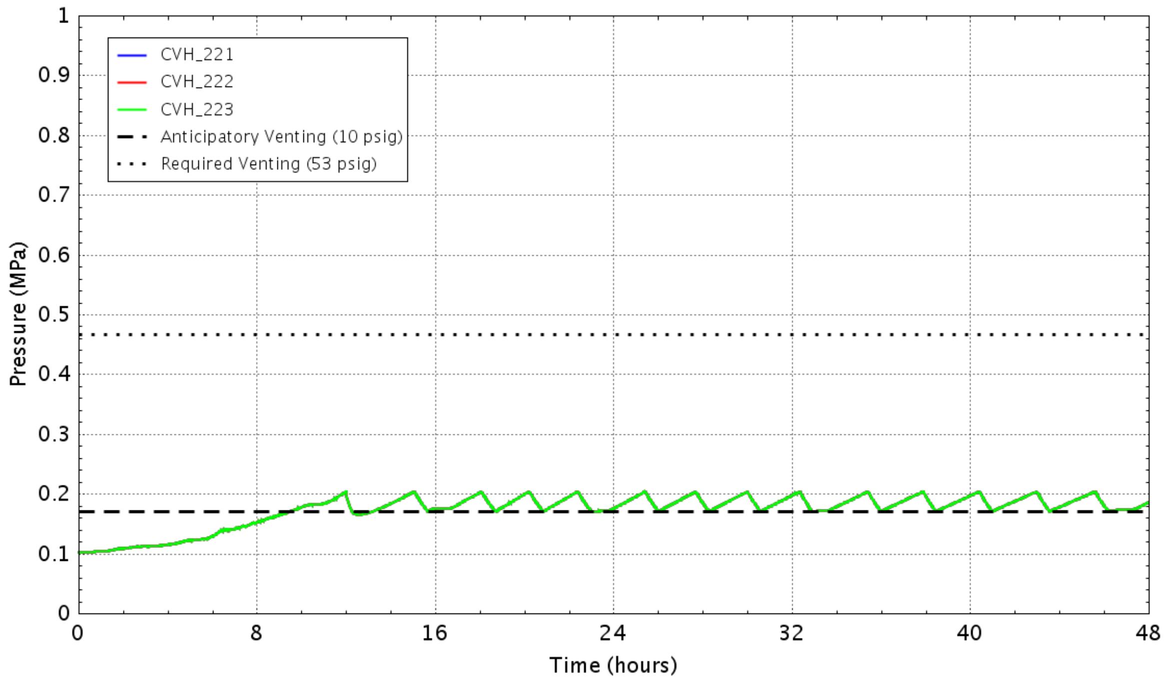

Figure E - 235 Pressure in the wetwell

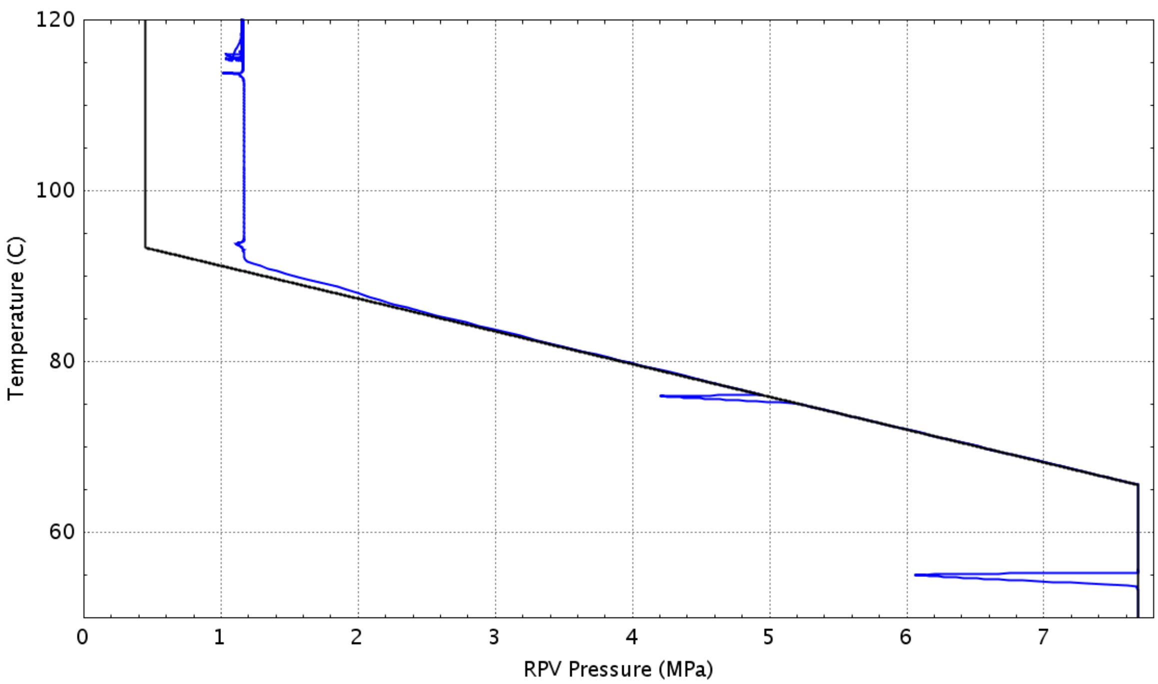

Figure E – 236 Plant status relative to the HCL curve (Graph 4 of the EOPs)

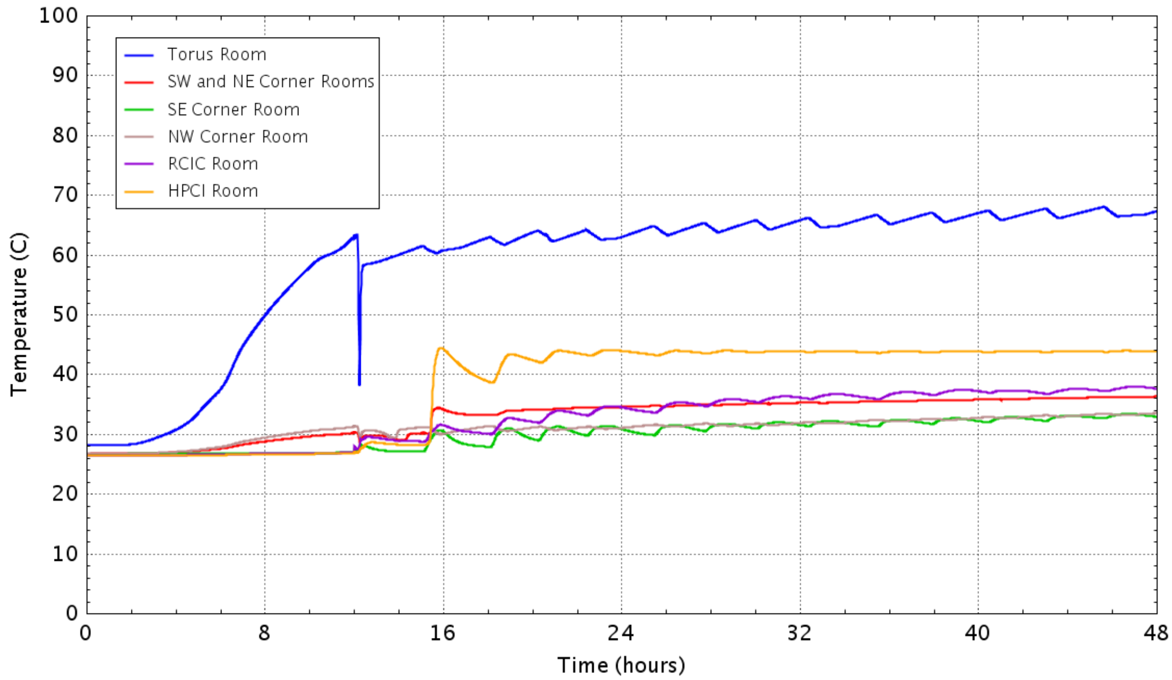

Figure E - 237 **Vapor temperature in the reactor building basement**

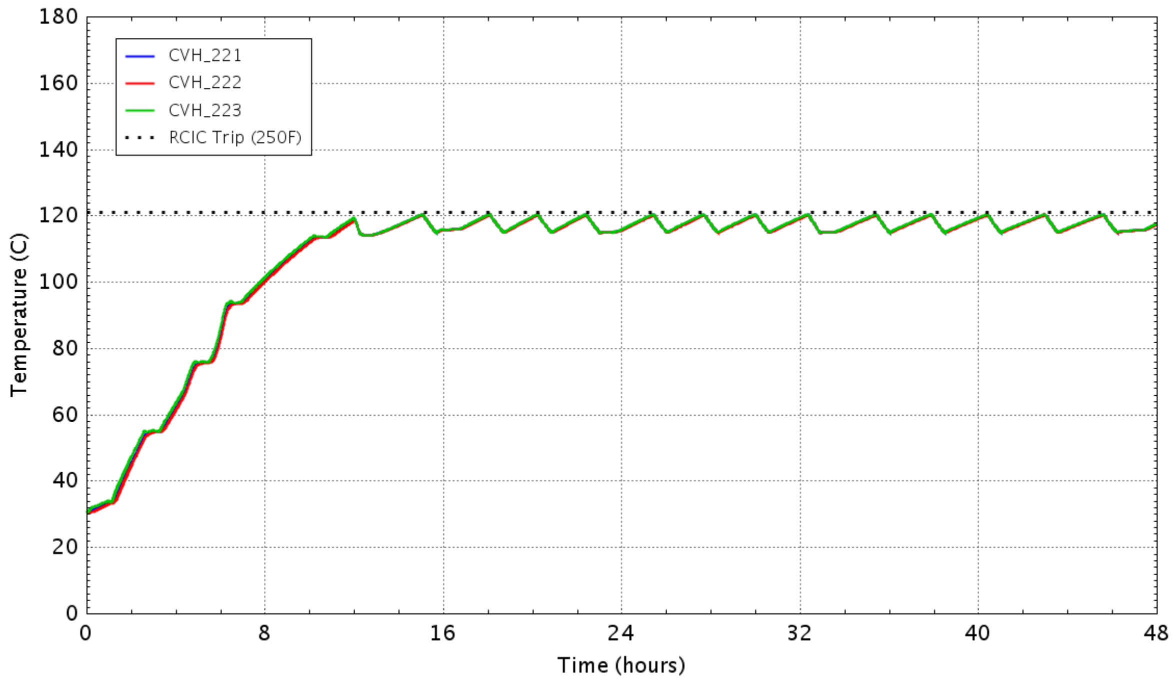

Figure E - 238 **Water temperature in the wetwell**

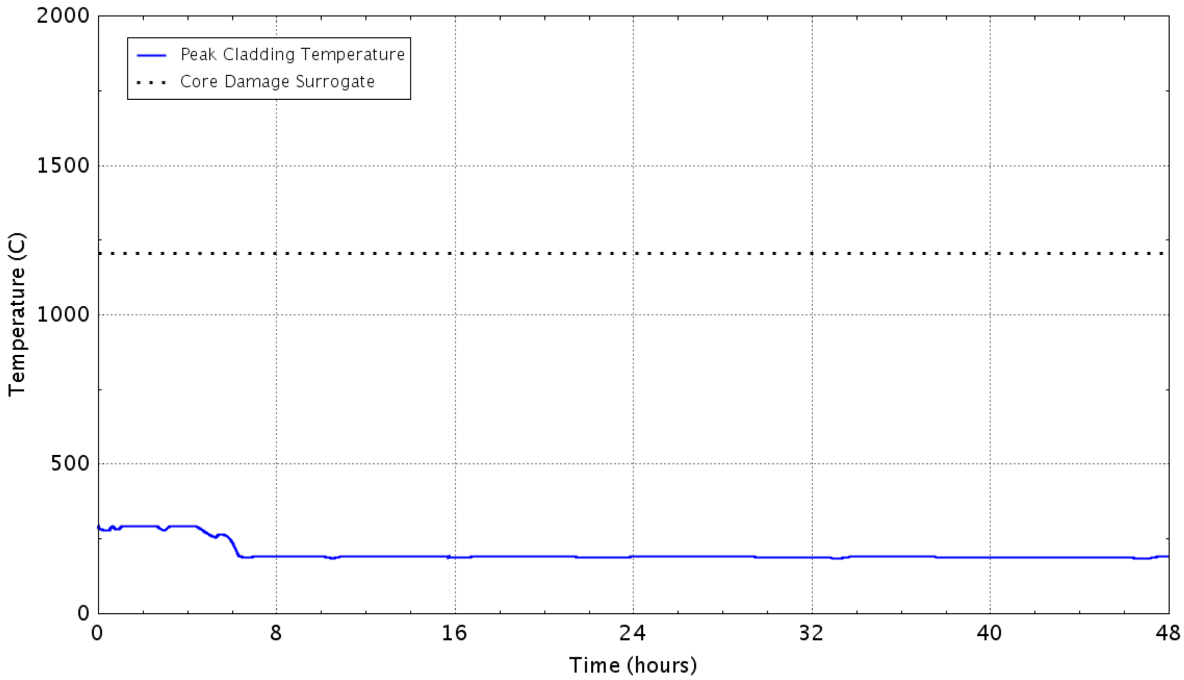

Figure E – 239 Peak temperature of the fuel cladding as a function oftime

E.2.10 Case 24: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the 18-in. Drywell Vent, RCIC Non-functional

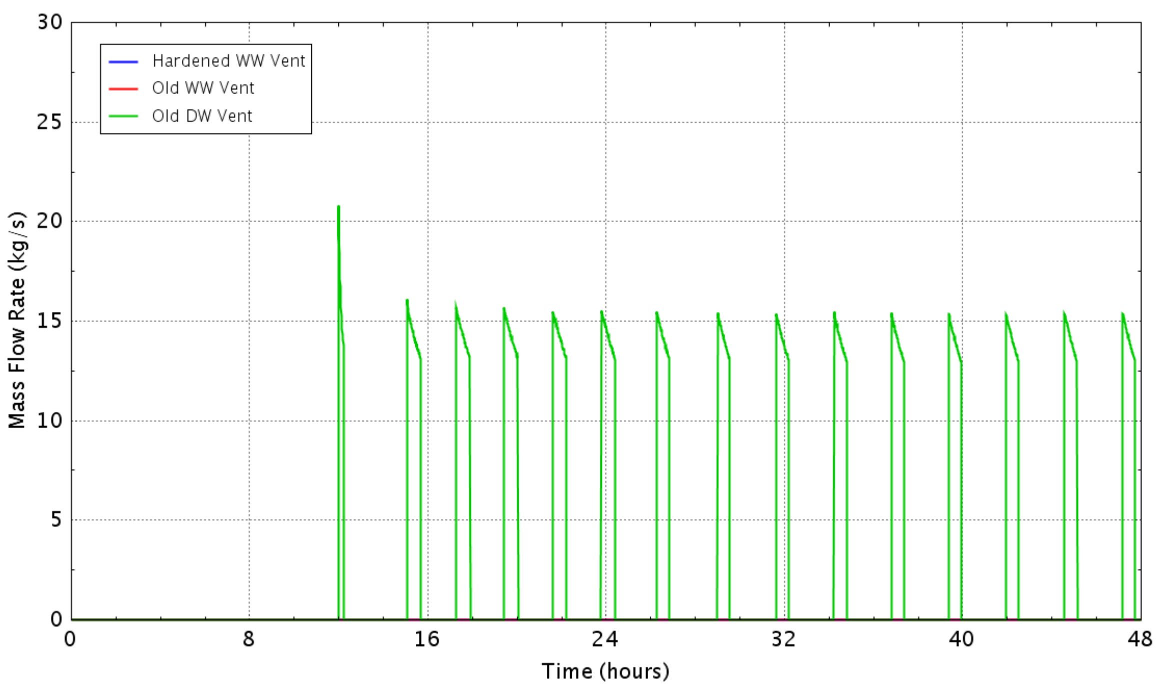

Figure E - 240 Flow rate of the containment vents

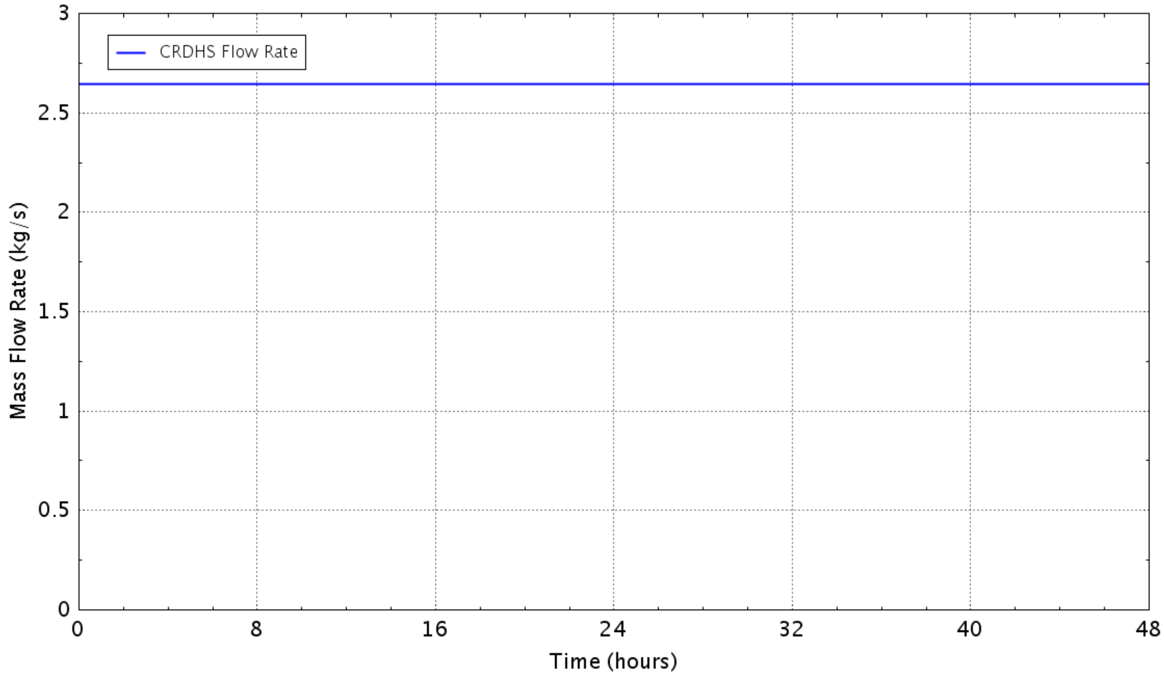

Figure E - 241 Flow rate of the control rod drive hydraulic system

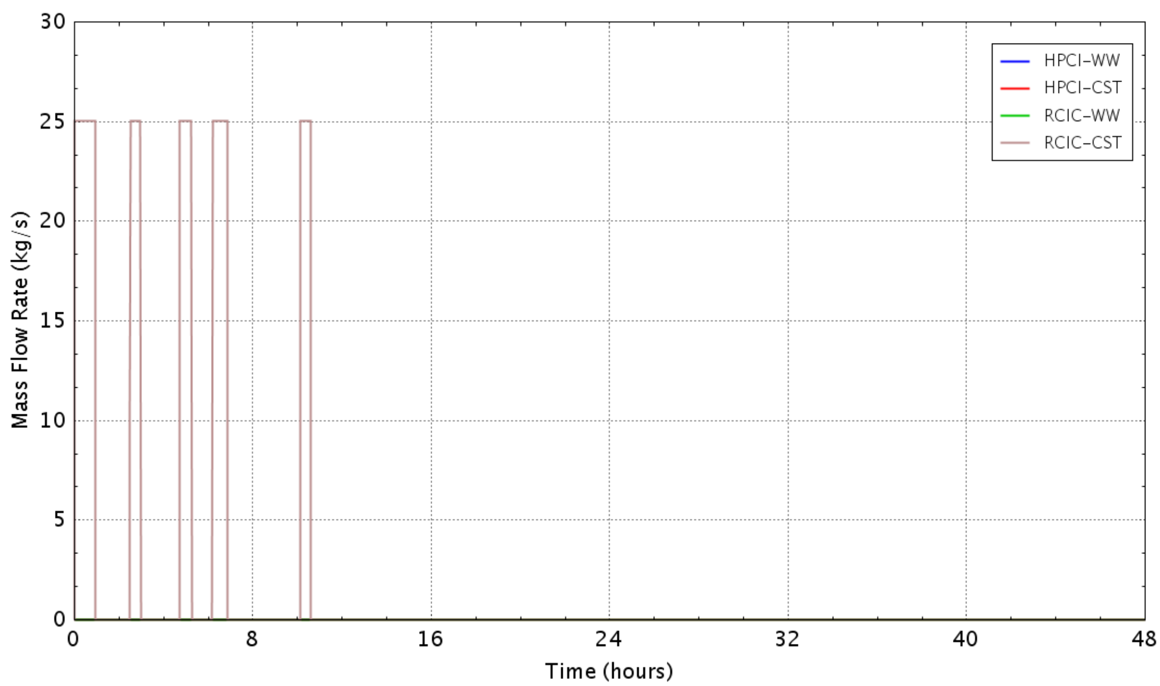

Figure E - 242 Flow rate of the HPCI/RCIC pumps

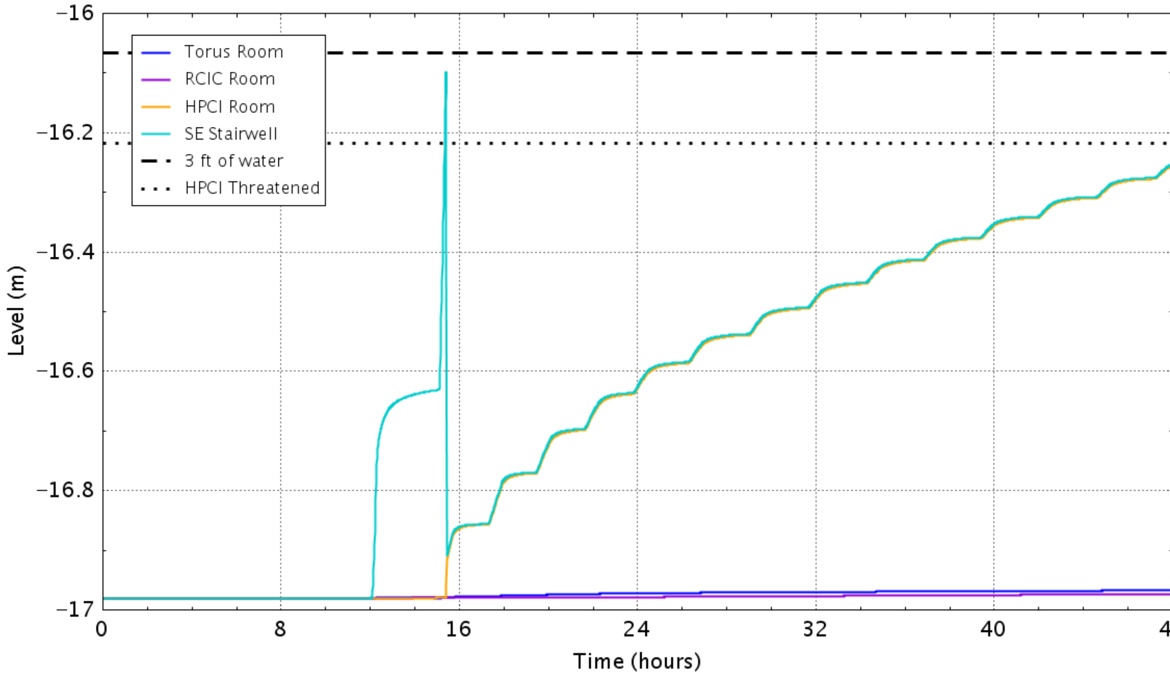

Figure E - 243 **Water level in the reactor building basement**

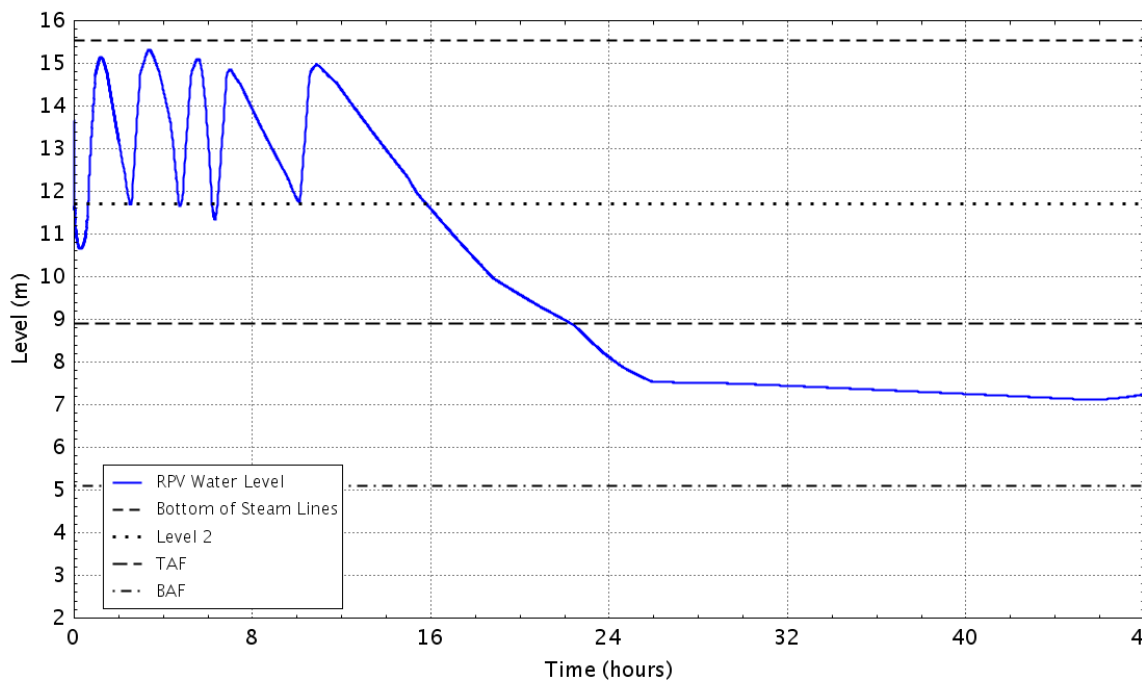

Figure E - 244 **RPV down comer water level**

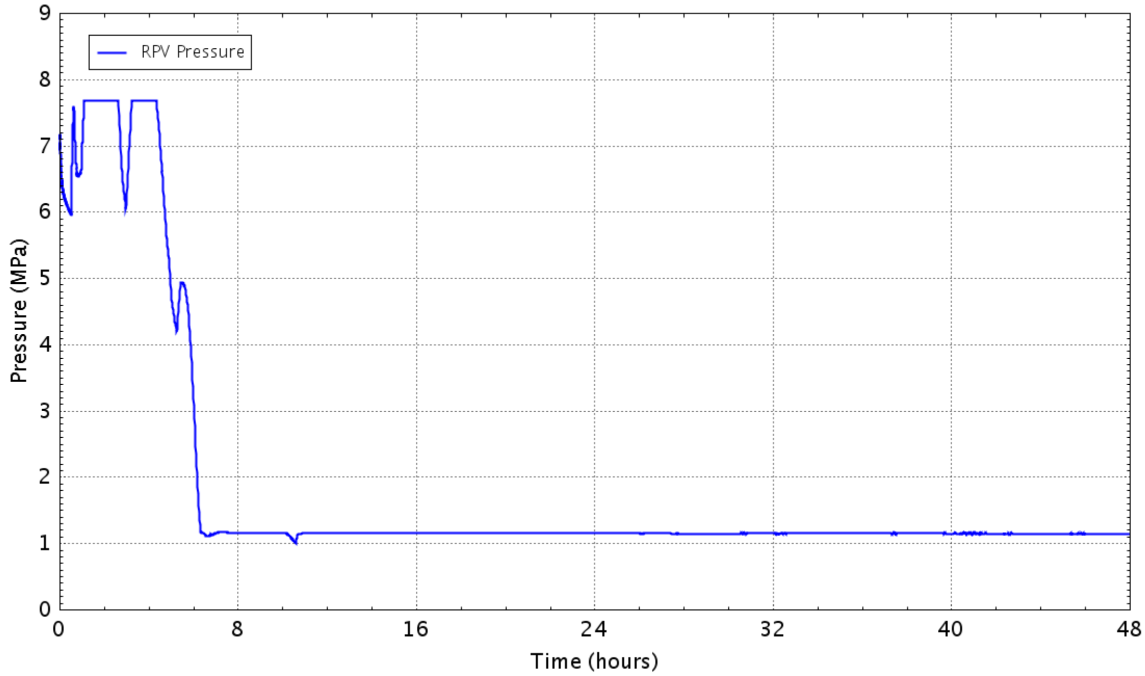

Figure E - 245 **Pressure in theRPV**

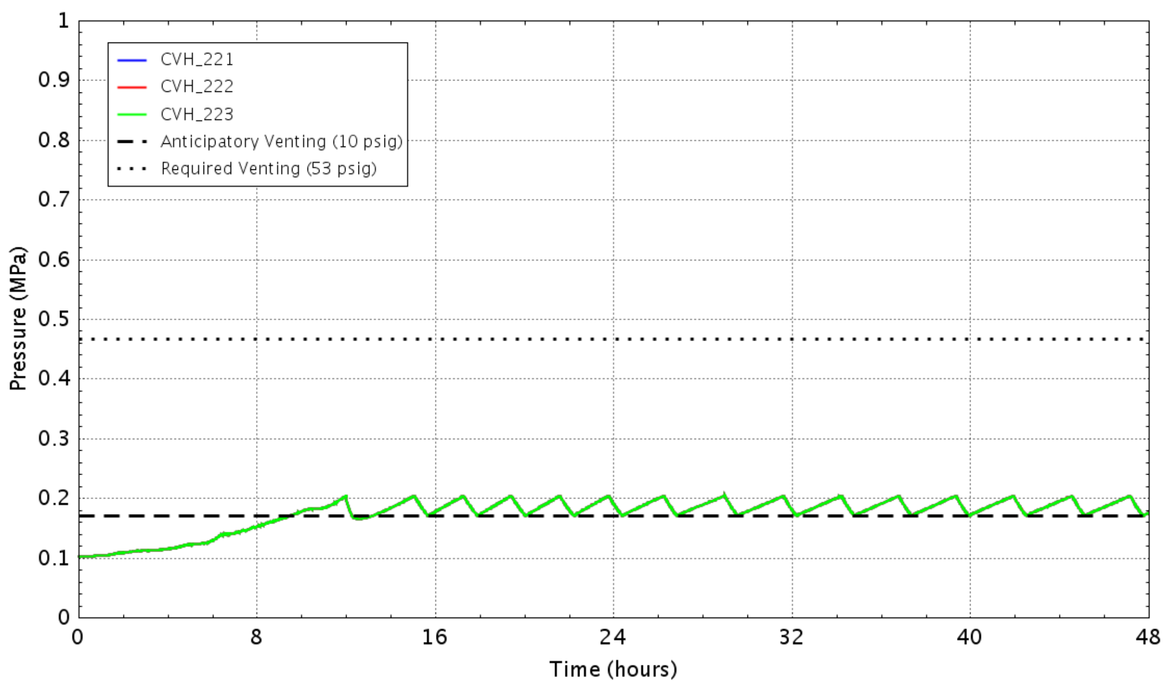

Figure E - 246 **Pressure in the wetwell**

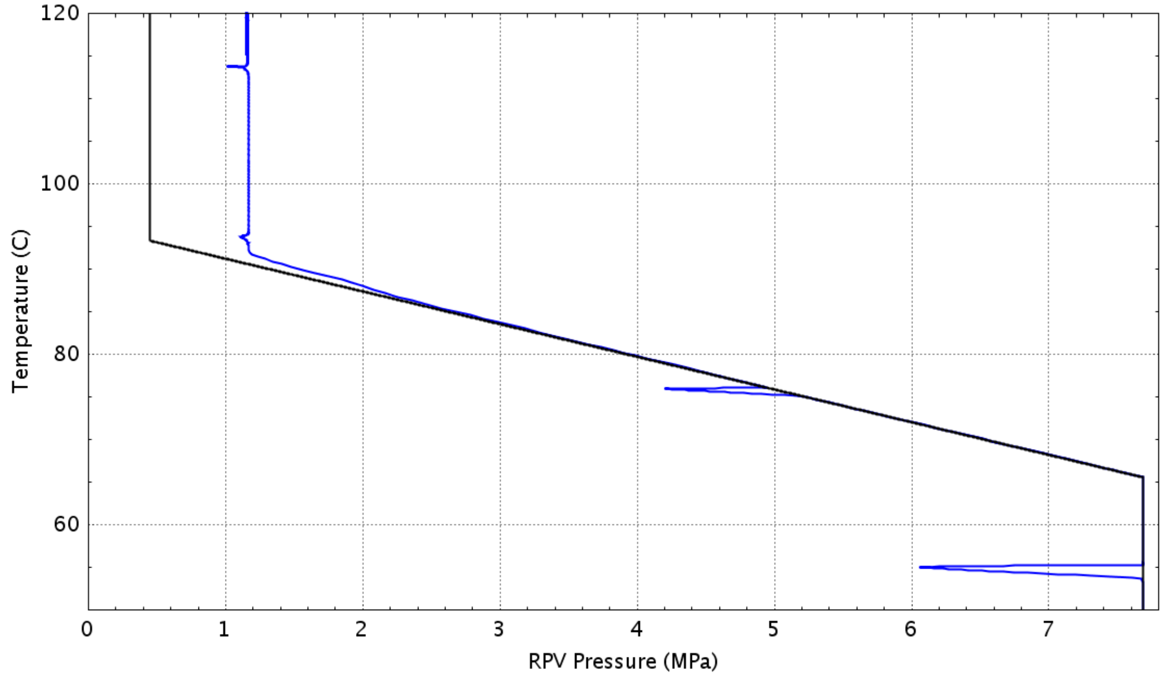

Figure E – 247 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

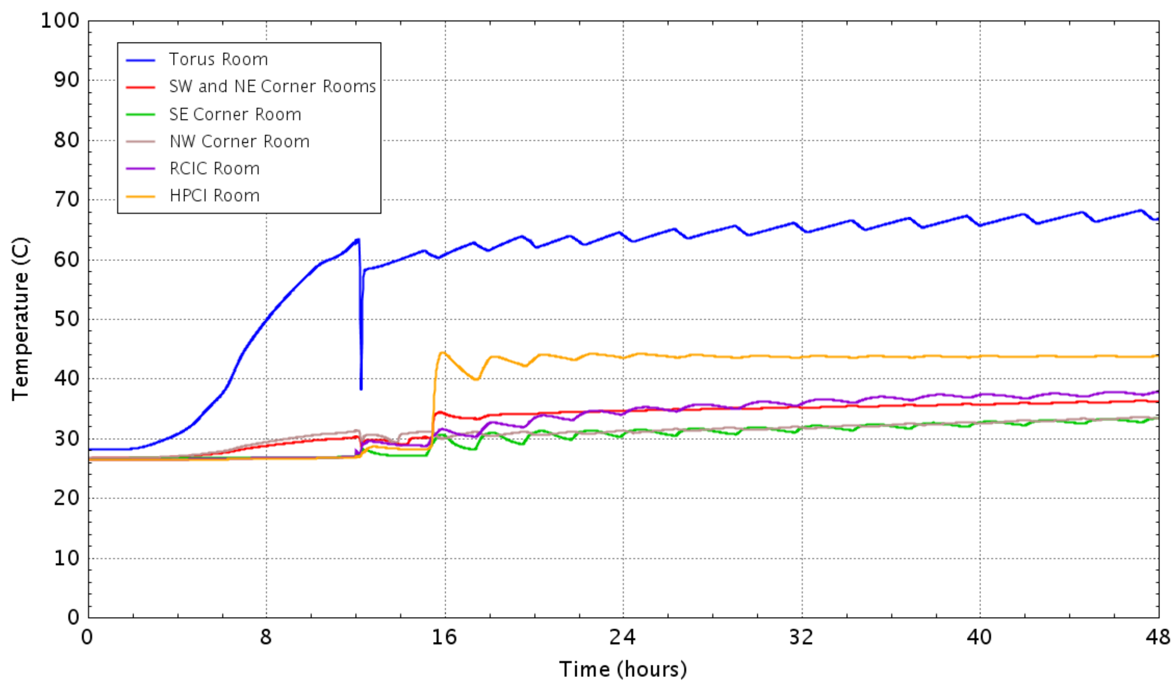

Figure E - 248 **Vapor temperature in the reactor building basement**

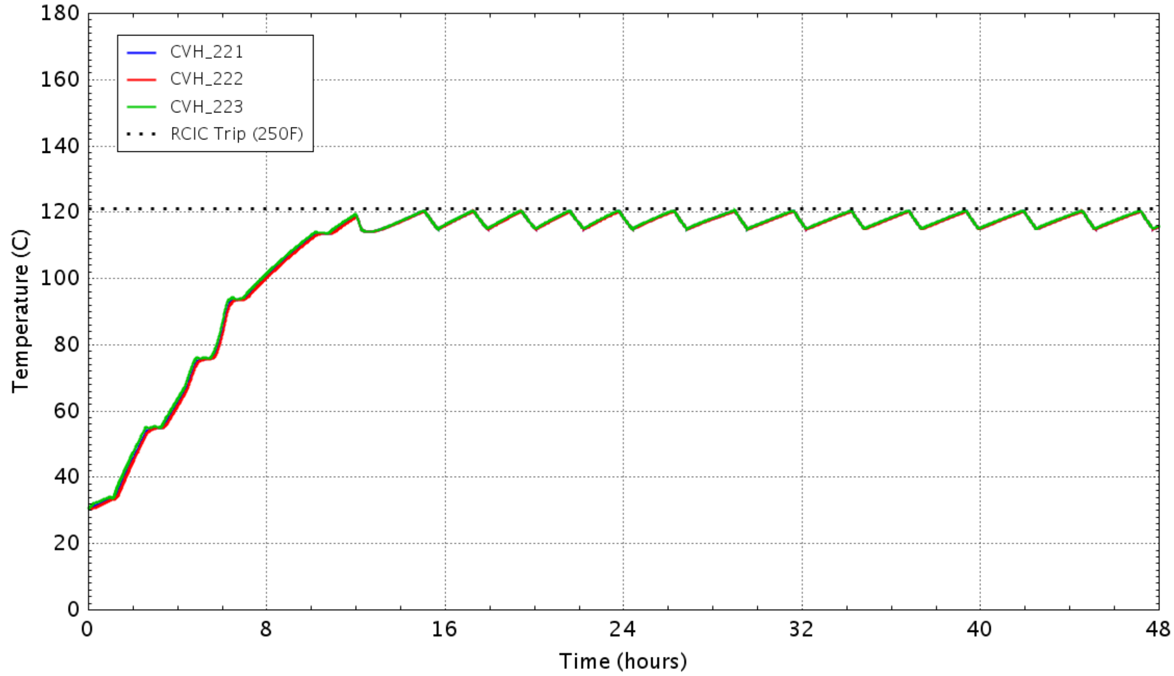

Figure E - 249 **Water temperature in the wetwell**

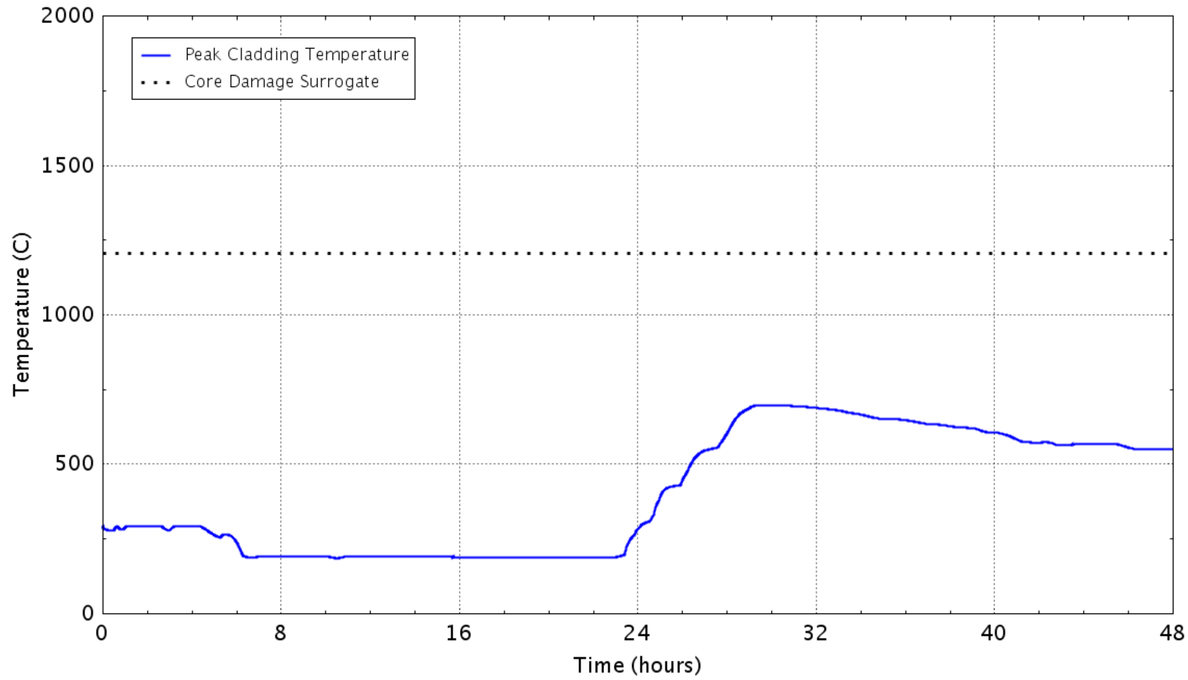

Figure E - 250 **Peak temperature of the fuel cladding as a function of time**

E.2.11 Case 25: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the HCV, RCIC Fully Functional

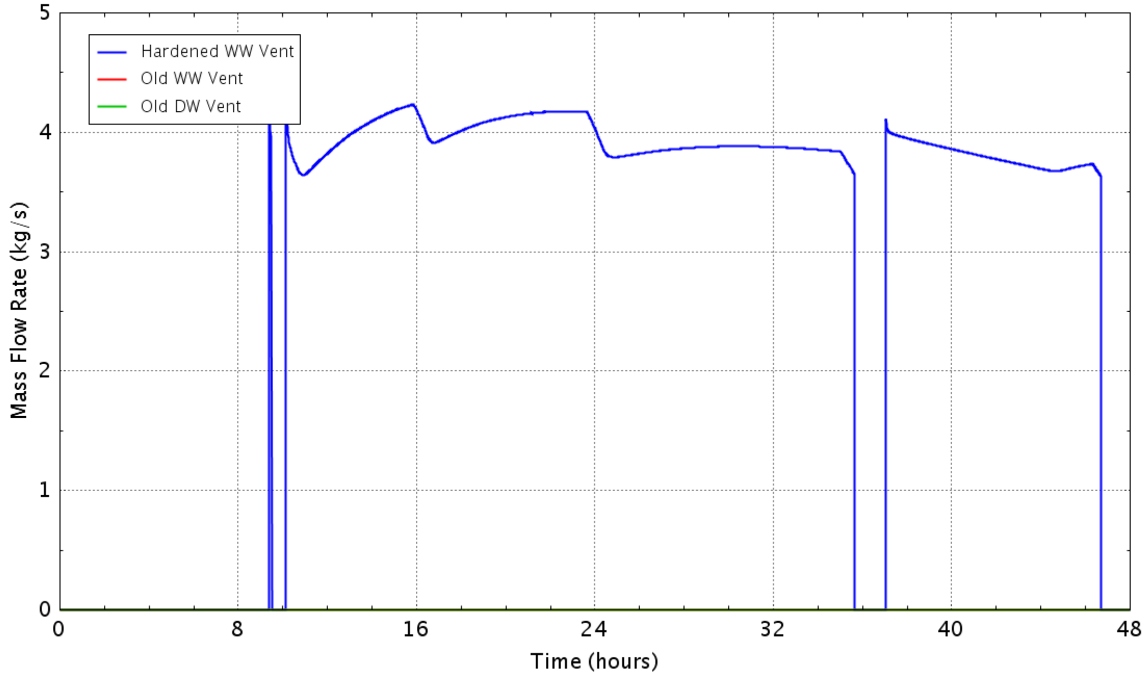

Figure E - 251 **Flow rate of the containment vents**

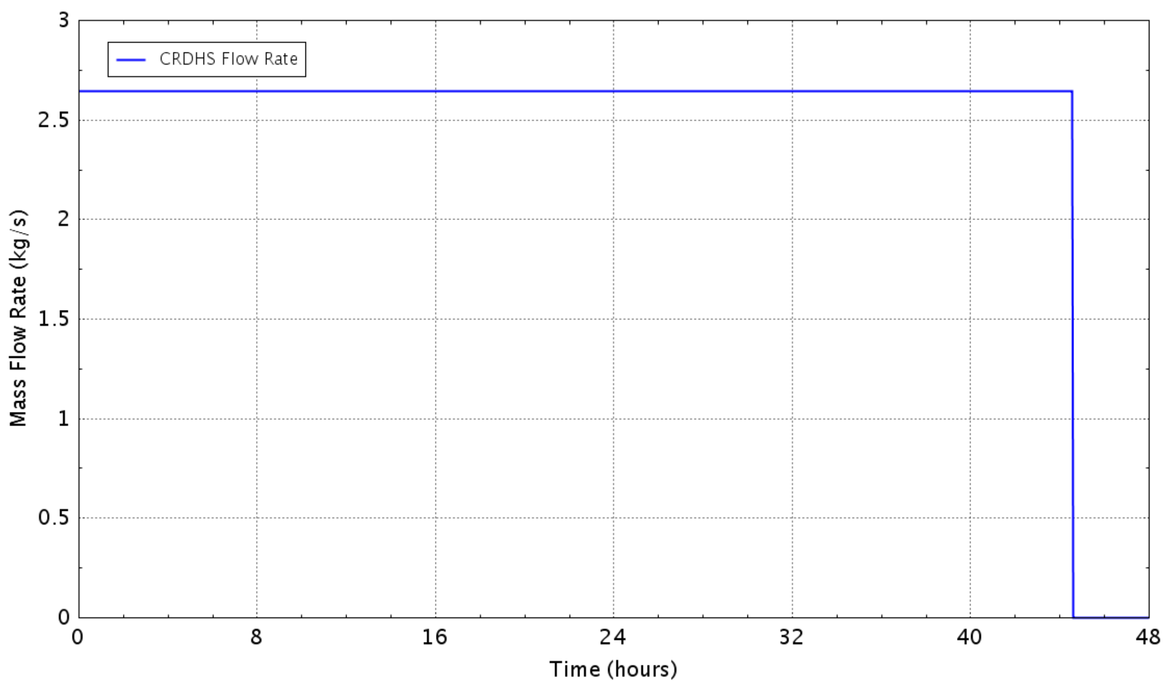

Figure E - 252 **Flow rate of the control rod drive hydraulic system**

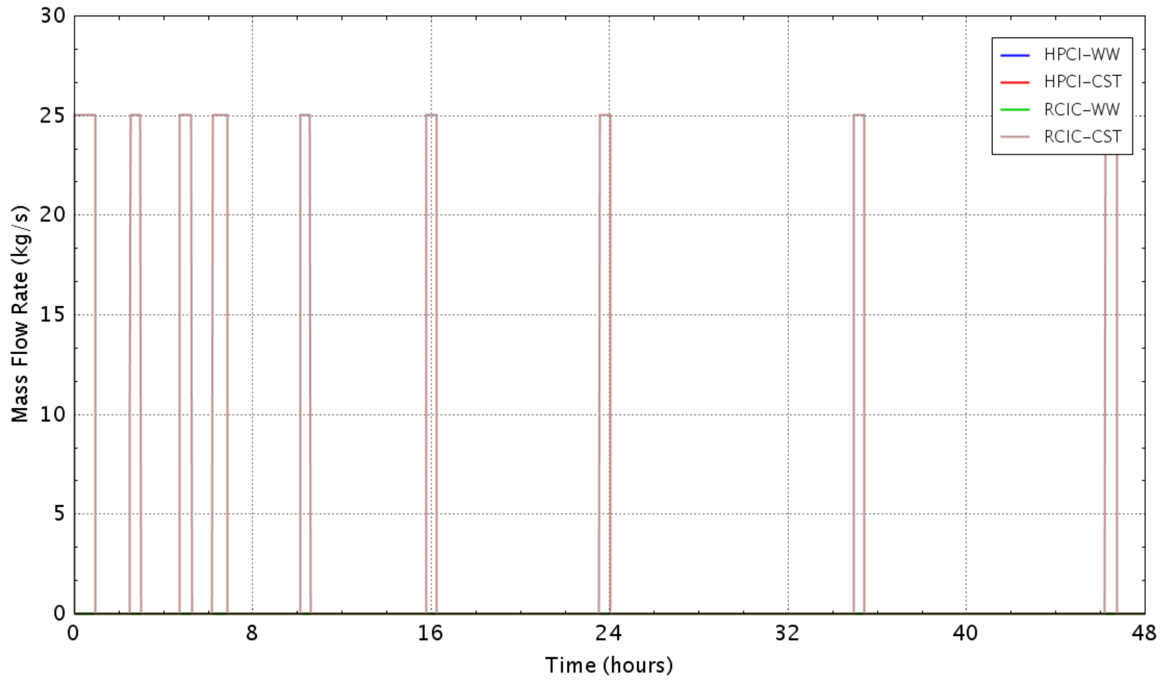

Figure E - 253 **Flow rate of the HPCI/RCIC pumps**

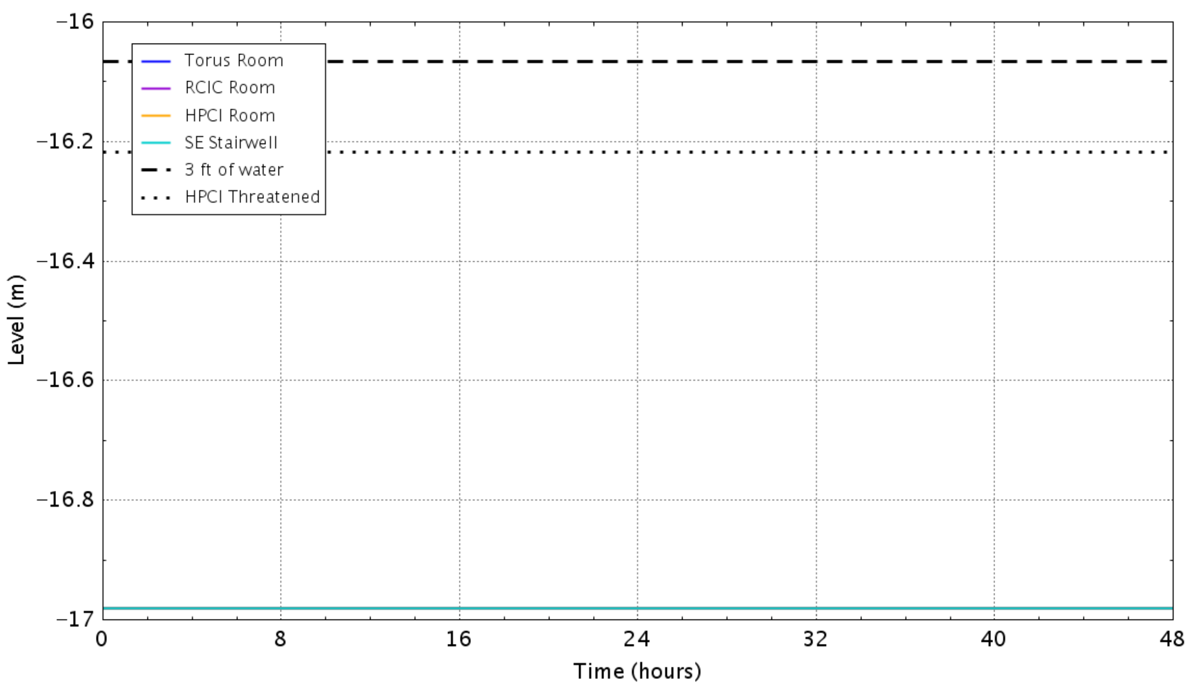

Figure E - 254 **Water level in the reactor building basement**

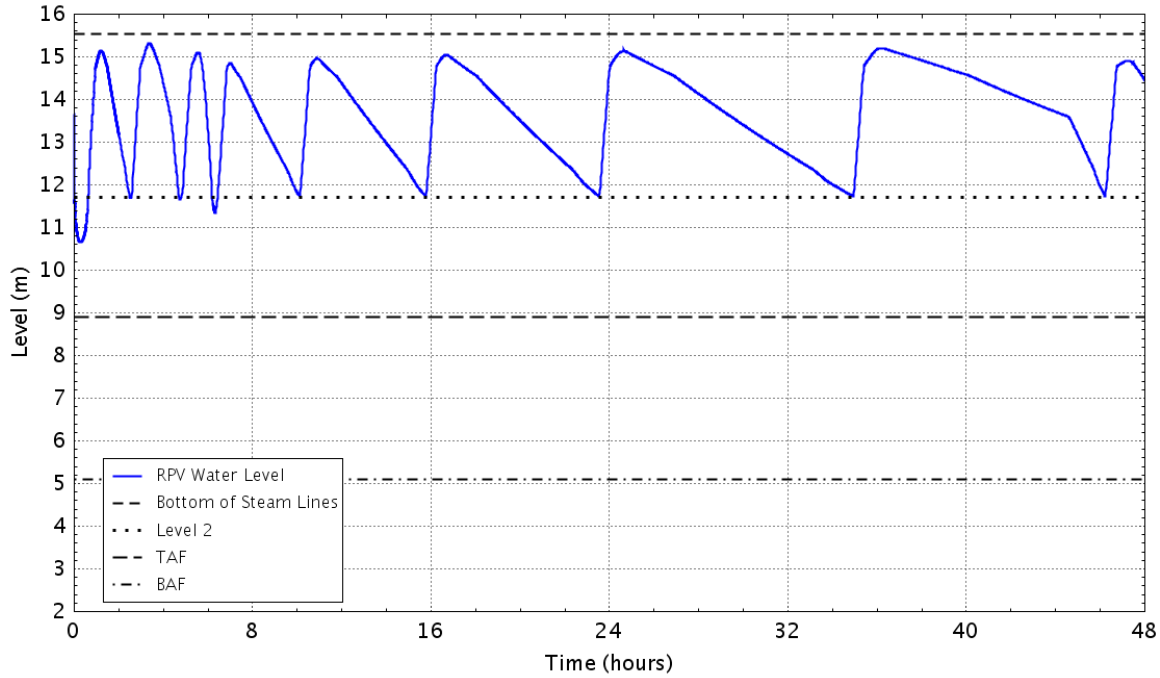

Figure E - 255 **RPV down comer water level**

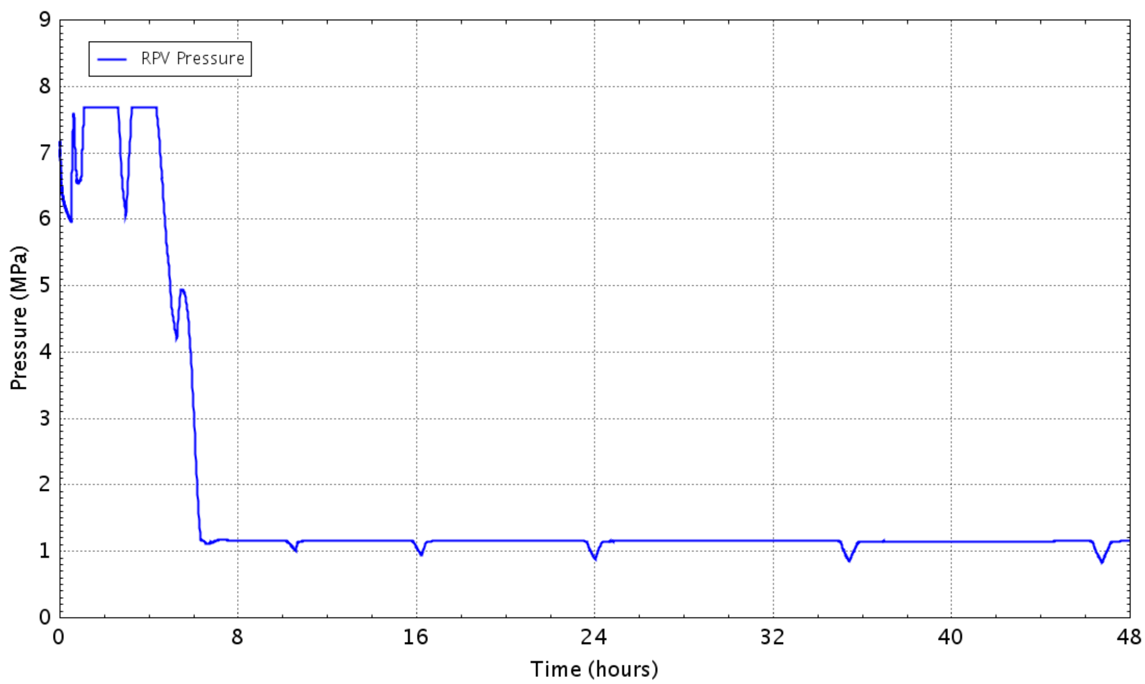

Figure E - 256 **Pressure in theRPV**

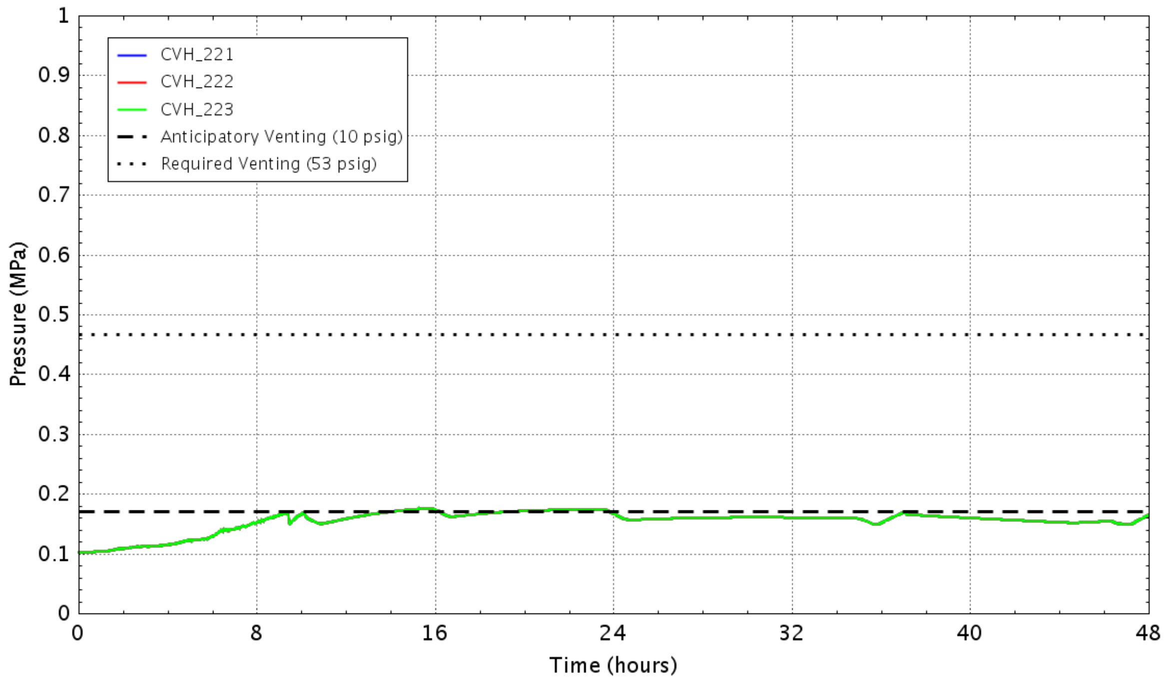

Figure E - 257 Pressure in the wetwell

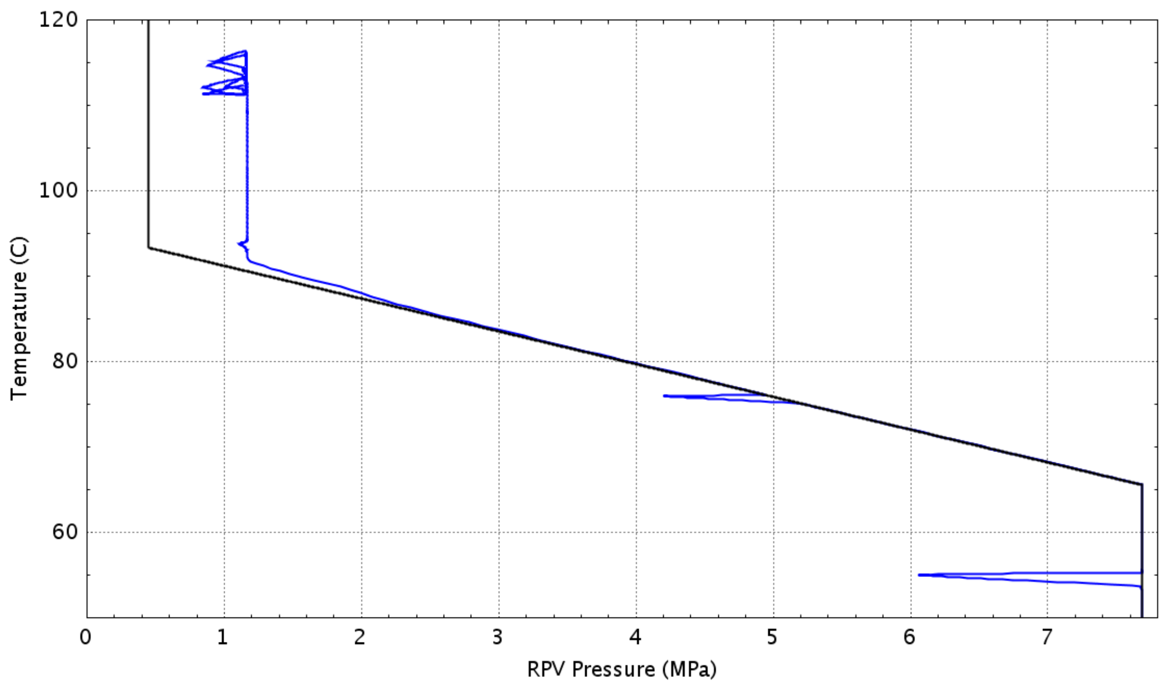

Figure E – 258 Plant status relative to the HCL curve (Graph 4 of the EOPs)

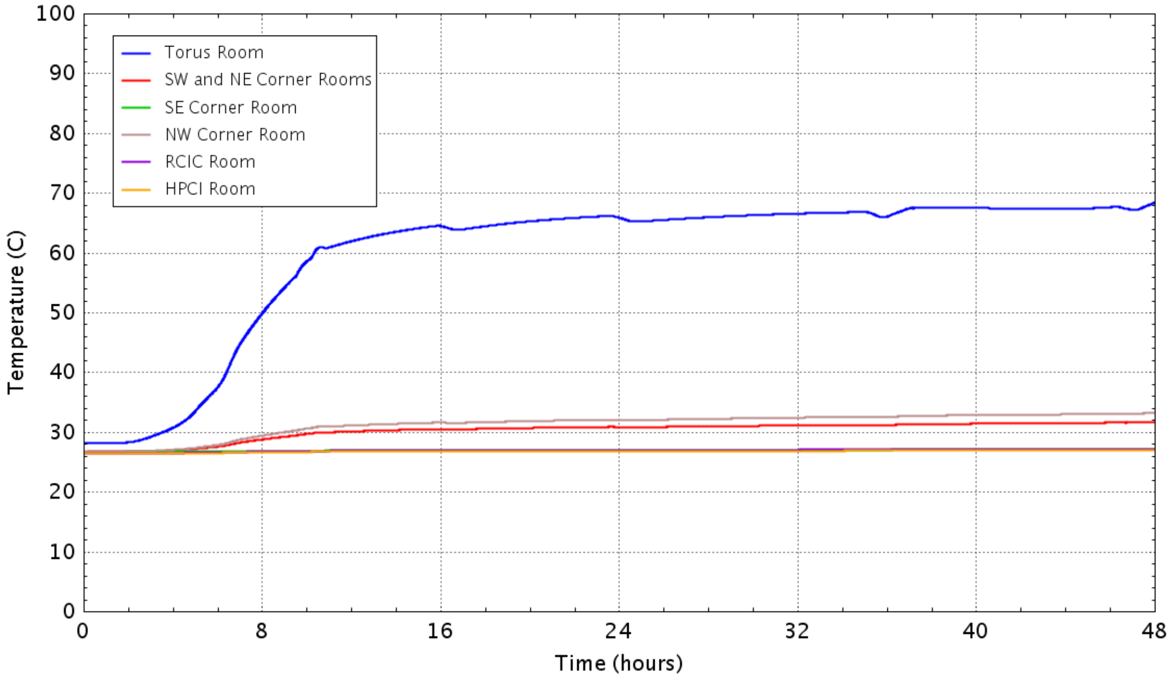

Figure E - 259 **Vapor temperature in the reactor building basement**

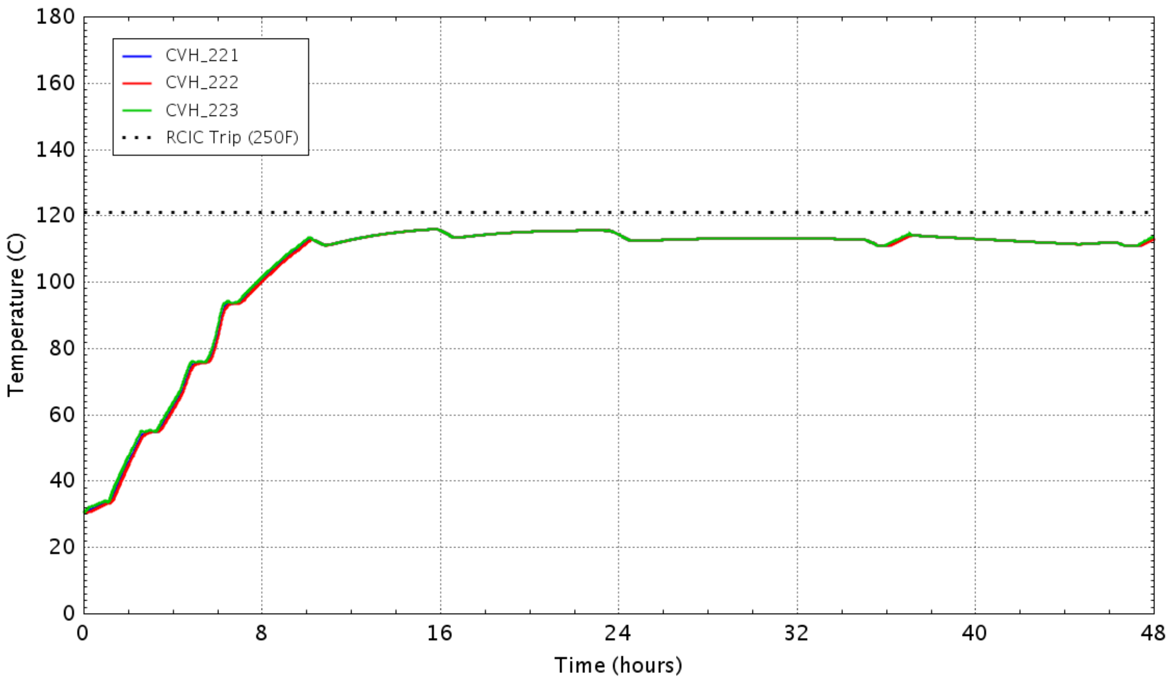

Figure E - 260 **Water temperature in the wetwell**

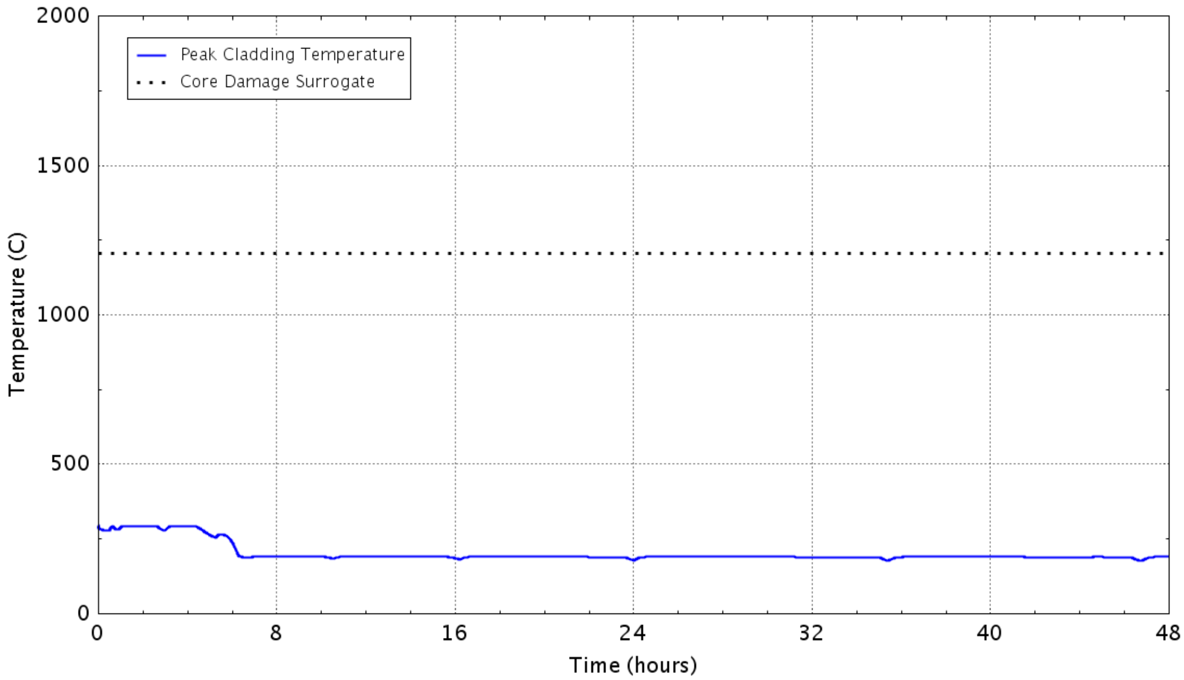

Figure E – 261 Peak temperature of the fuel cladding as a function oftime

E.2.12 Case 26: LOMFW-25, Perform Anticipatory Venting, Containment Venting via the HCV, RCIC Non-functional

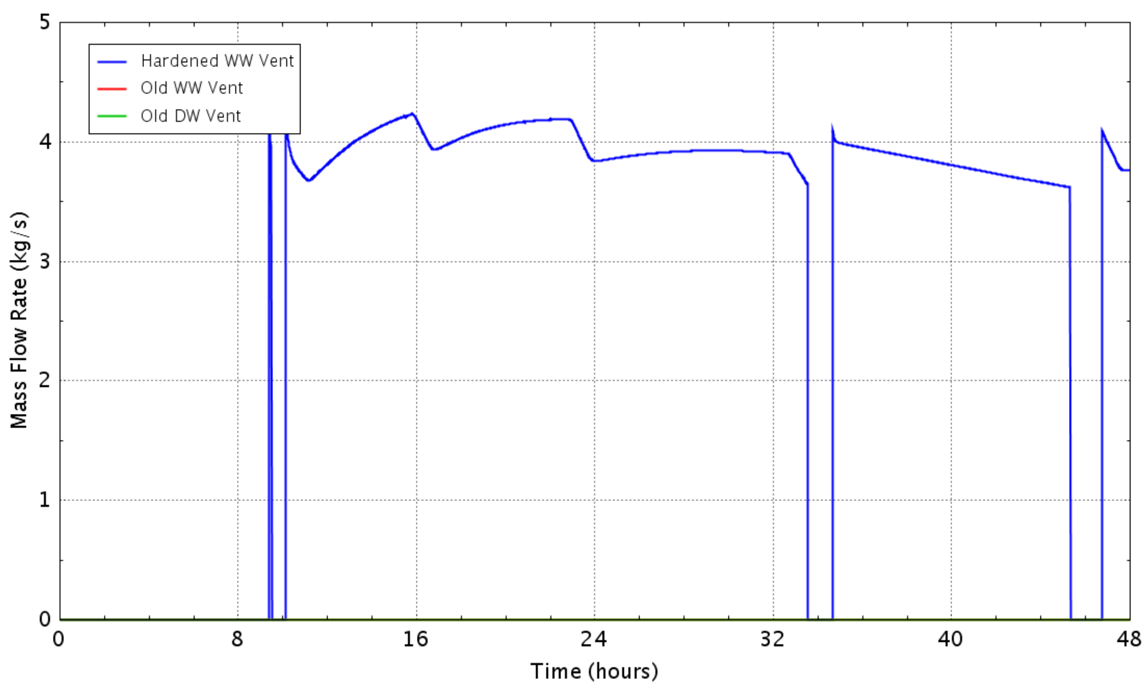

Figure E - 262 Flow rate of the containment vents

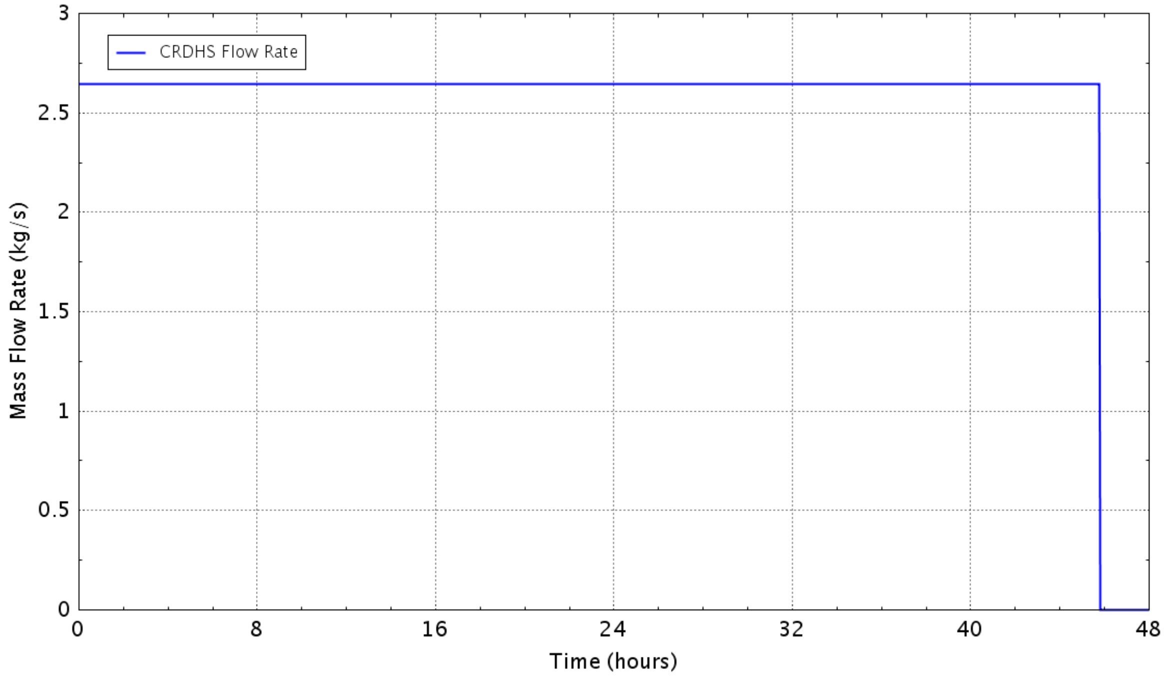

Figure E - 263 **Flow rate of the control rod drive hydraulic system**

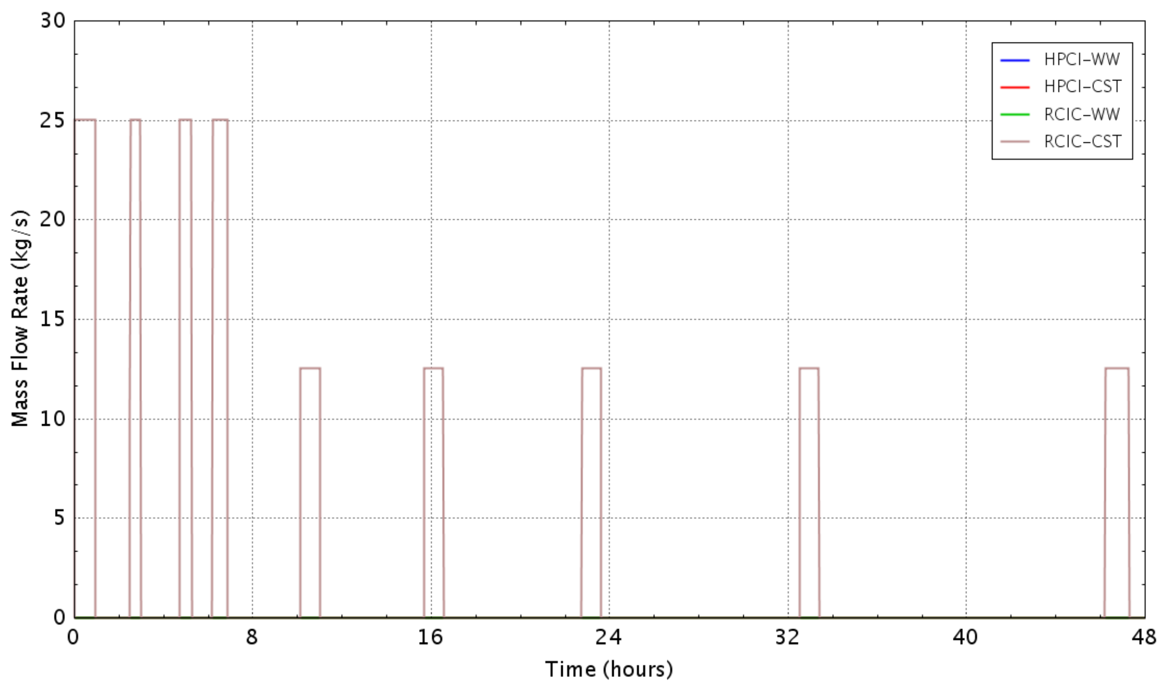

Figure E - 264 **Flow rate of the HPCI/RCIC pumps**

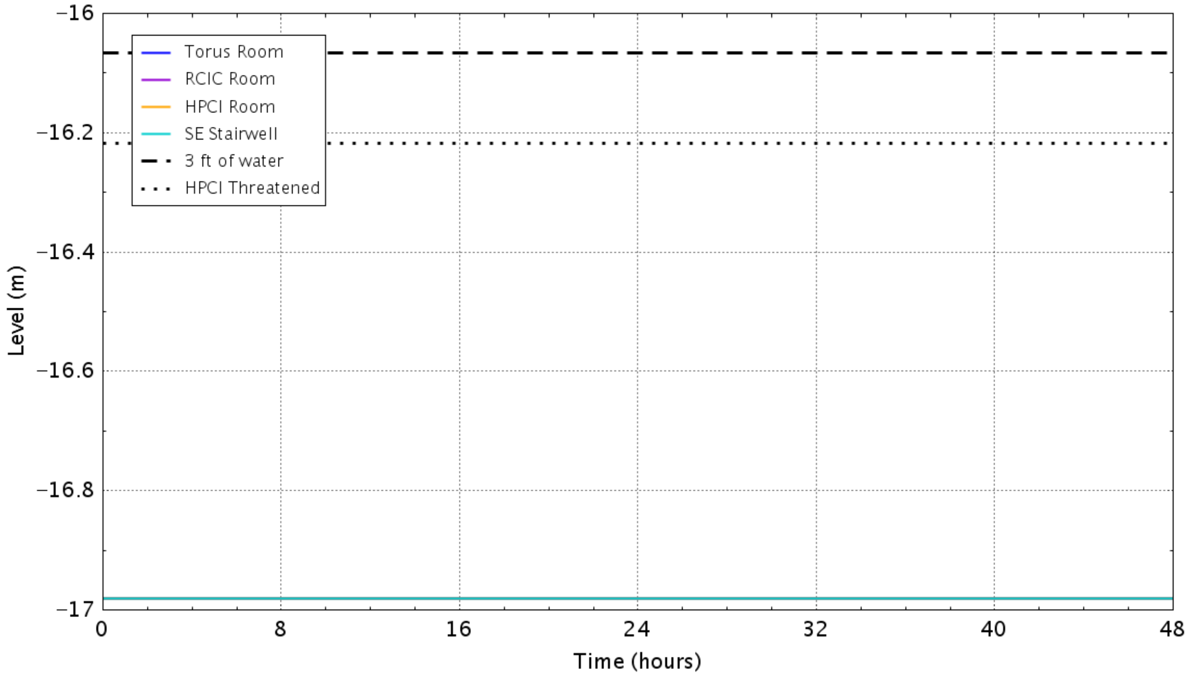

Figure E – 265 **Water level in the reactor building basement**

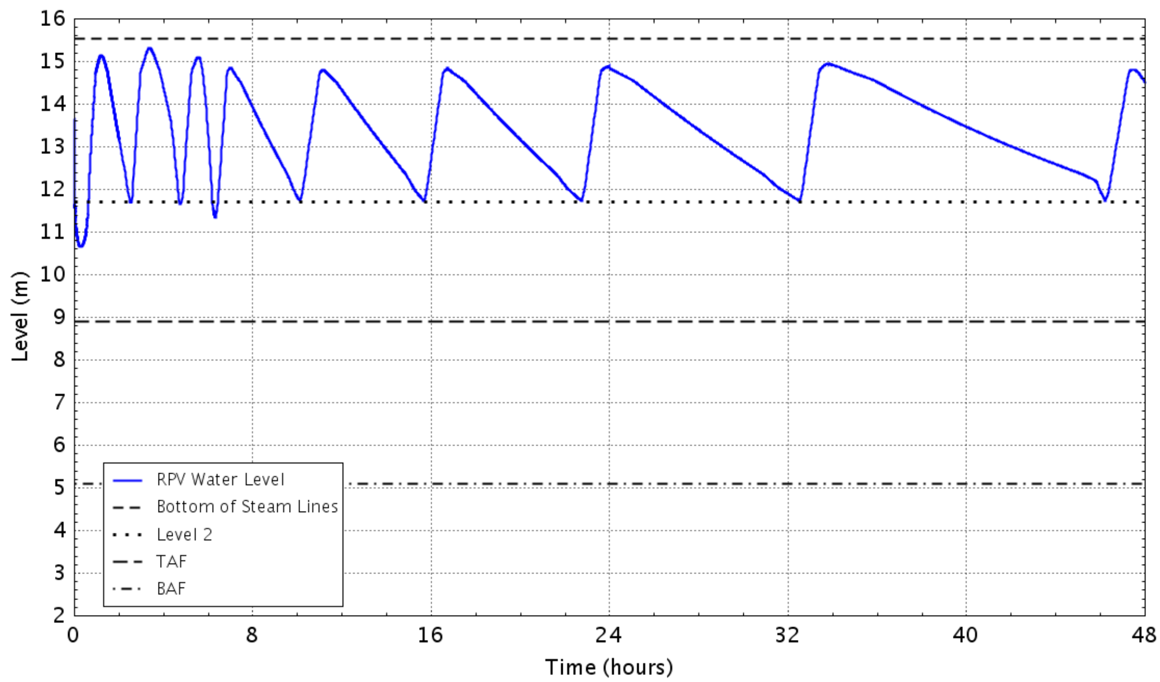

Figure E – 266 **RPV down comer water level**

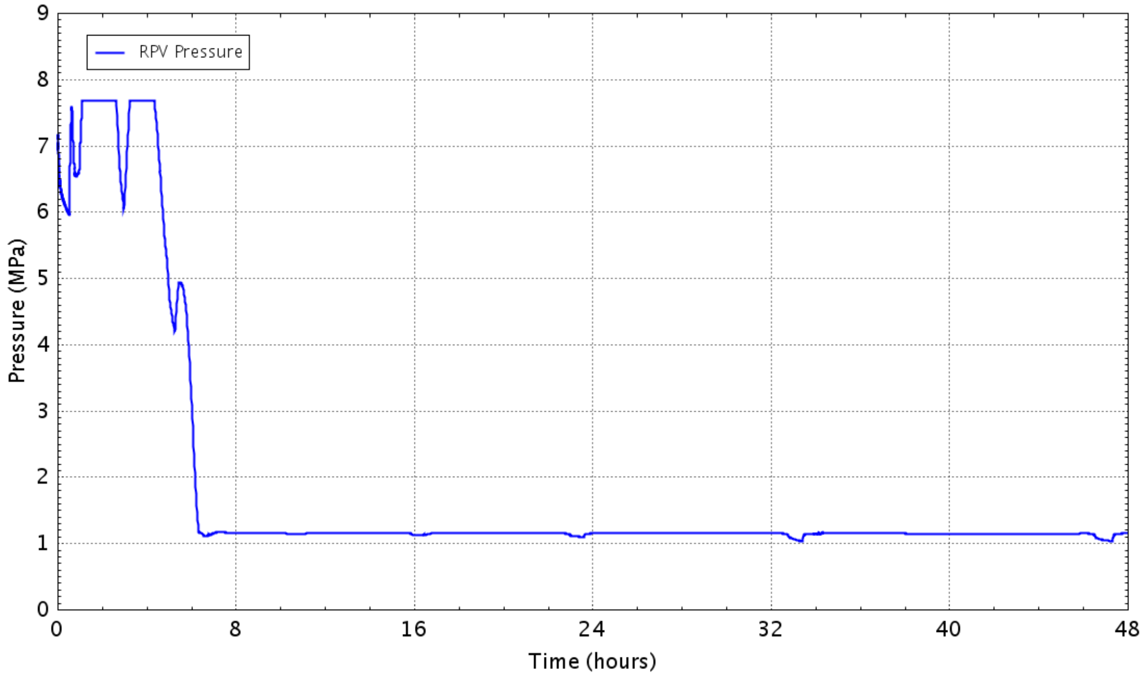

Figure E - 267 **Pressure in theRPV**

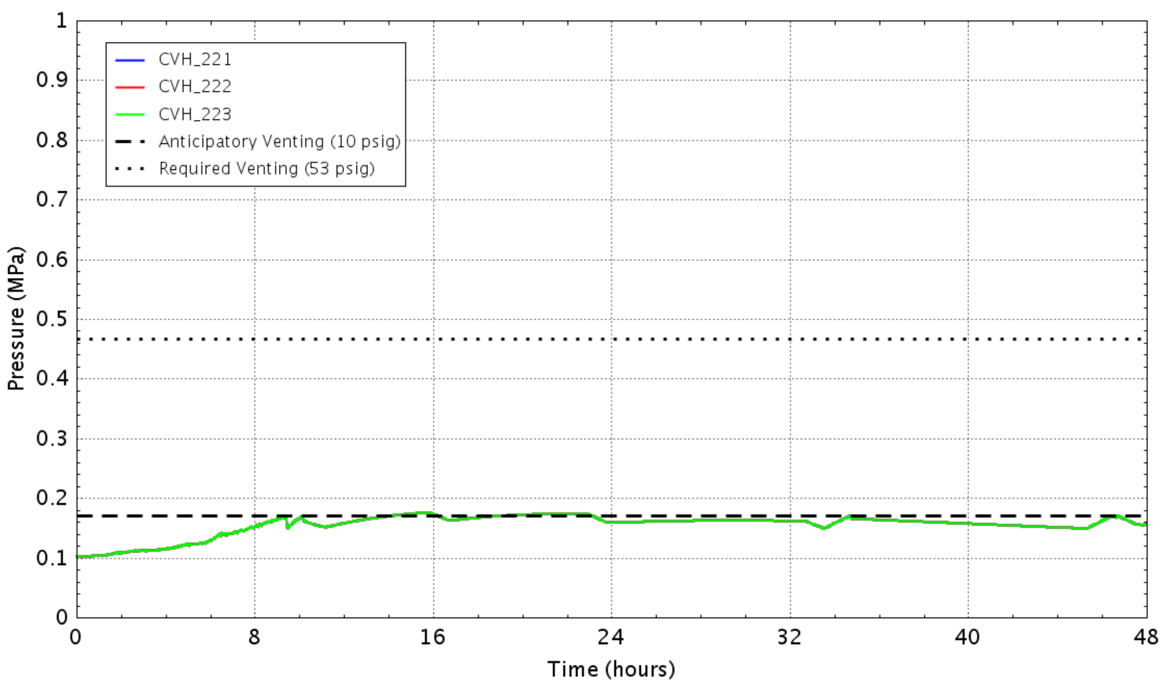

Figure E - 268 **Pressure in the wetwell**

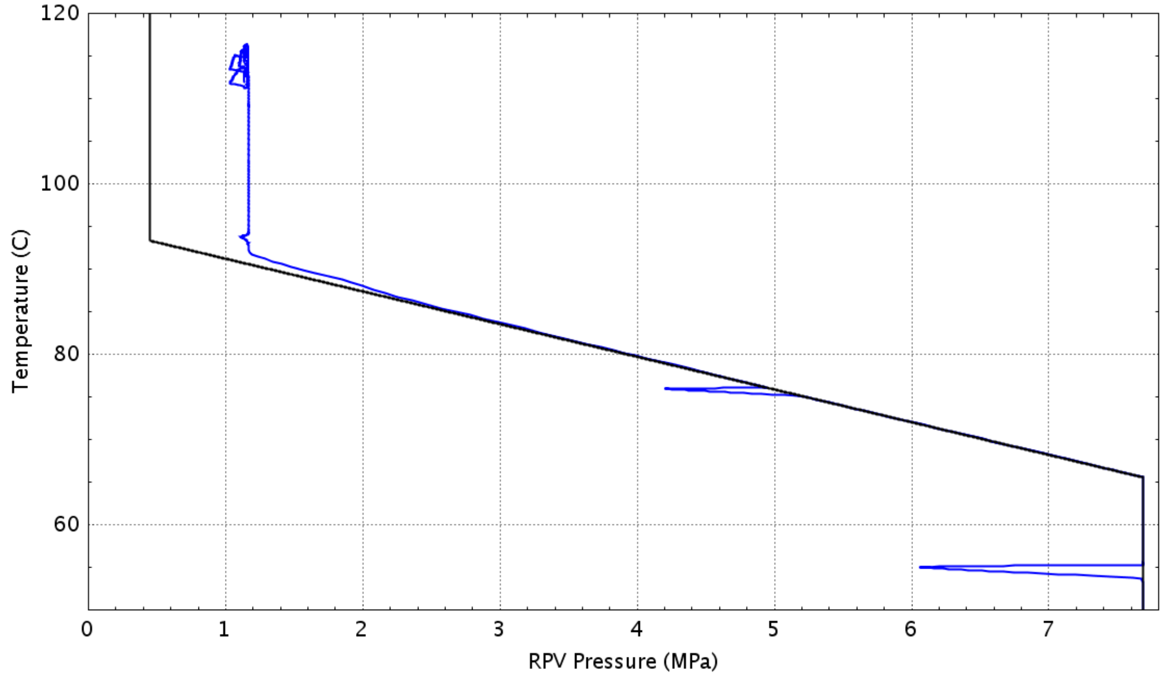

Figure E – 269 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

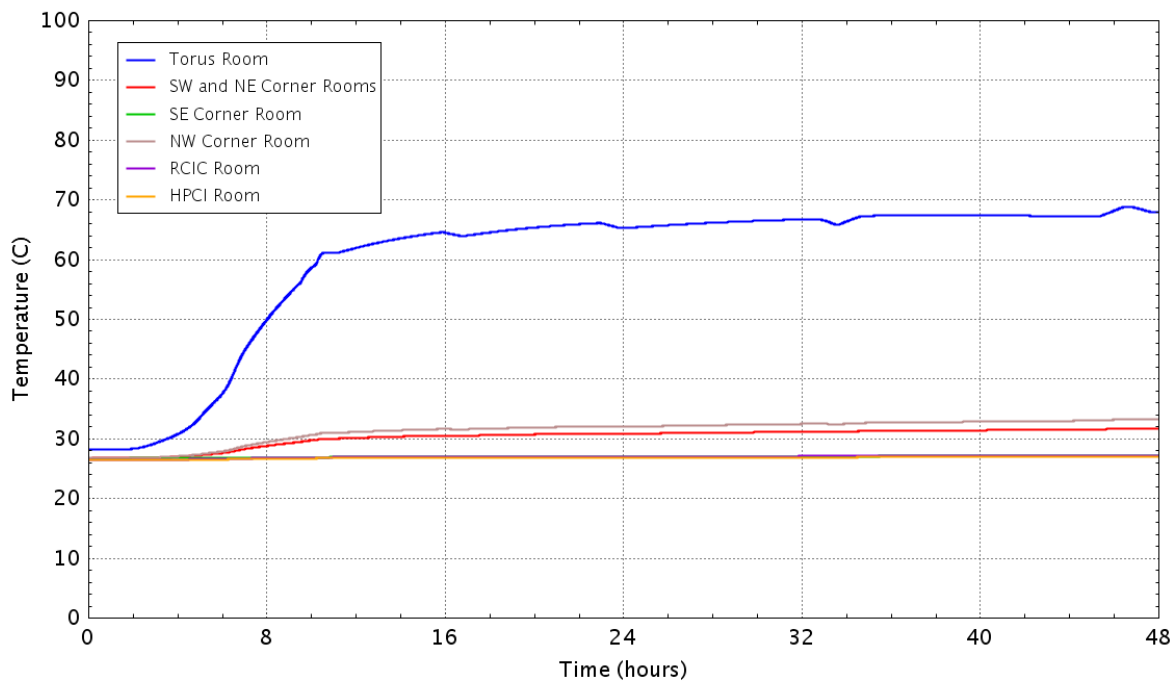

Figure E - 270 **Vapor temperature in the reactor building basement**

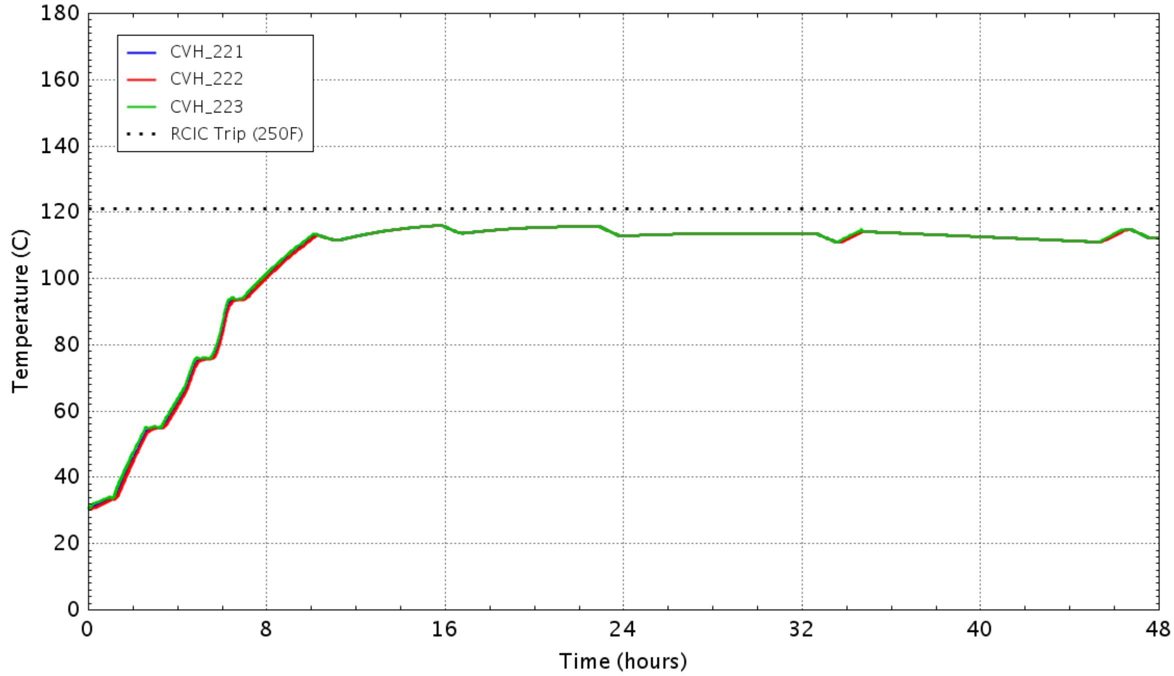

Figure E - 271 Water temperature in the wetwell

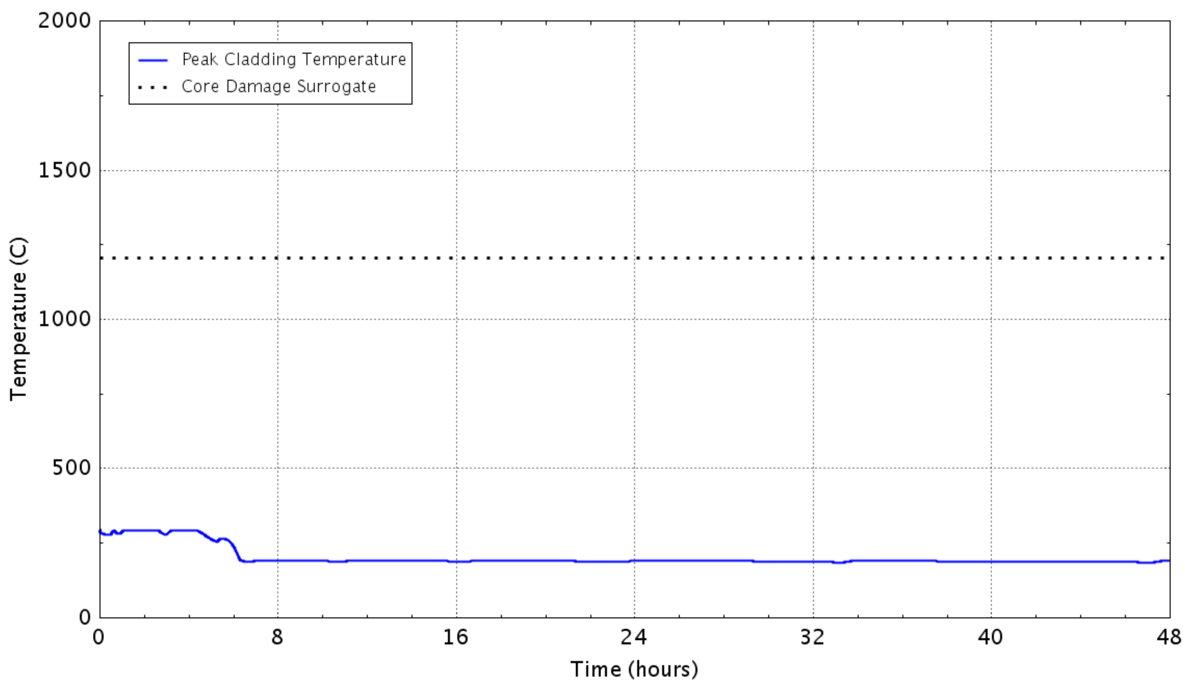

Figure E – 272 Peak temperature of the fuel cladding as a function oftime

E.2.13 Case 27: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 2-in. Torus Bypass, RCIC Fully Functional

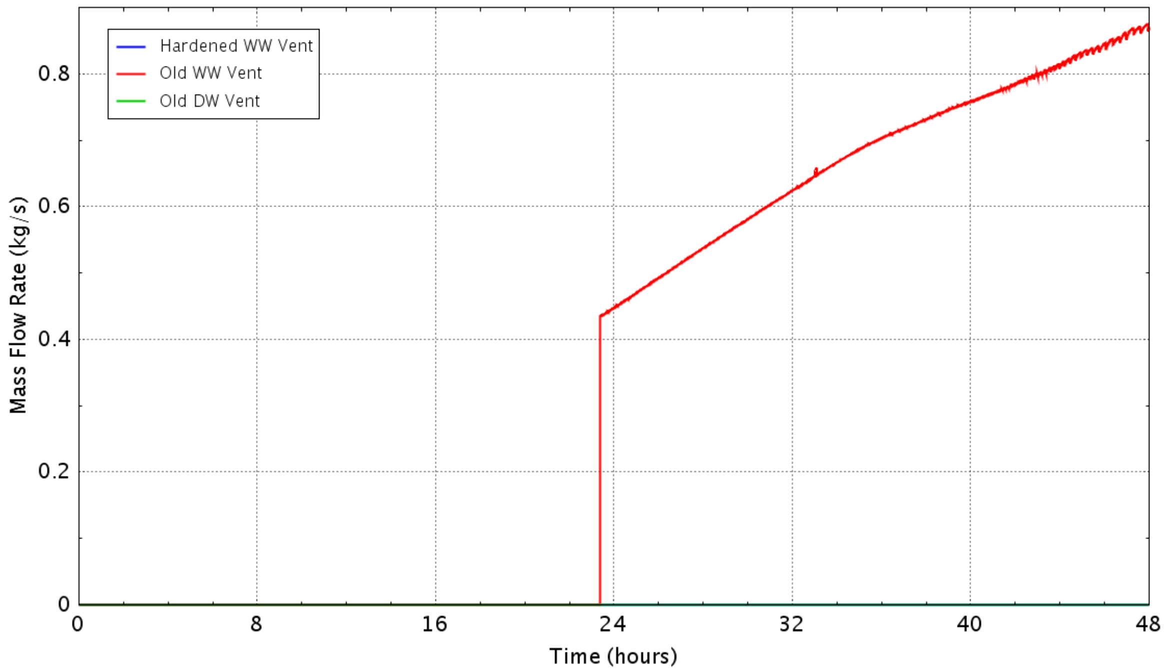

Figure E - 273 **Flow rate of the containment vents**

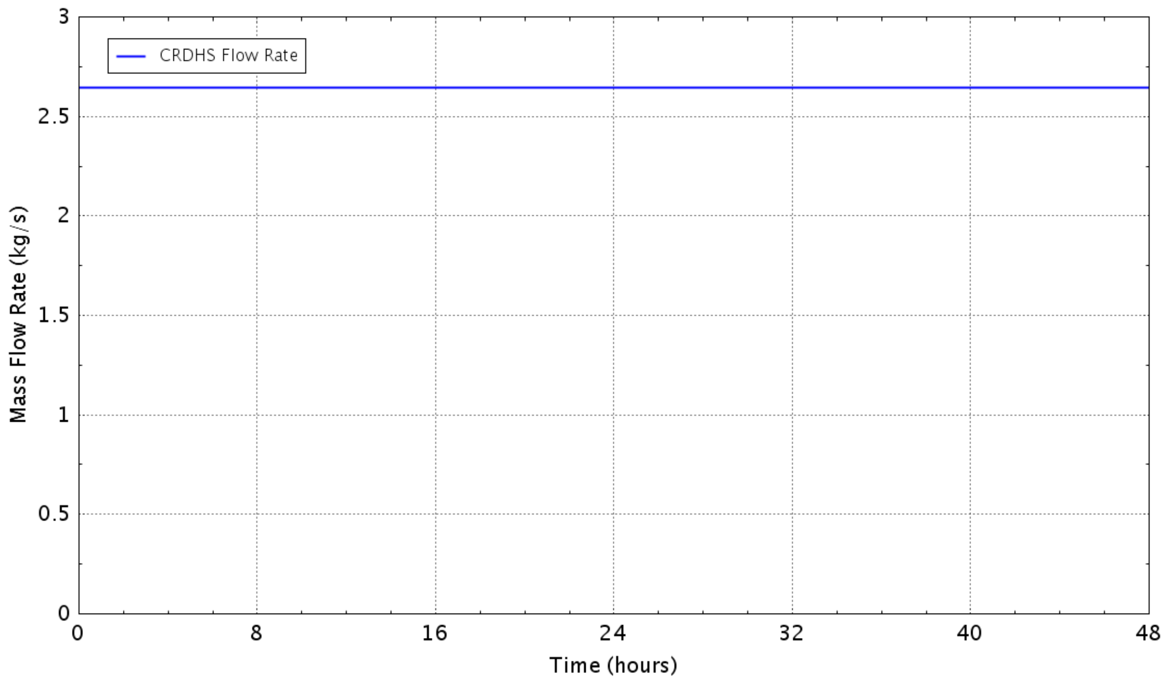

Figure E - 274 **Flow rate of the control rod drive hydraulic system**

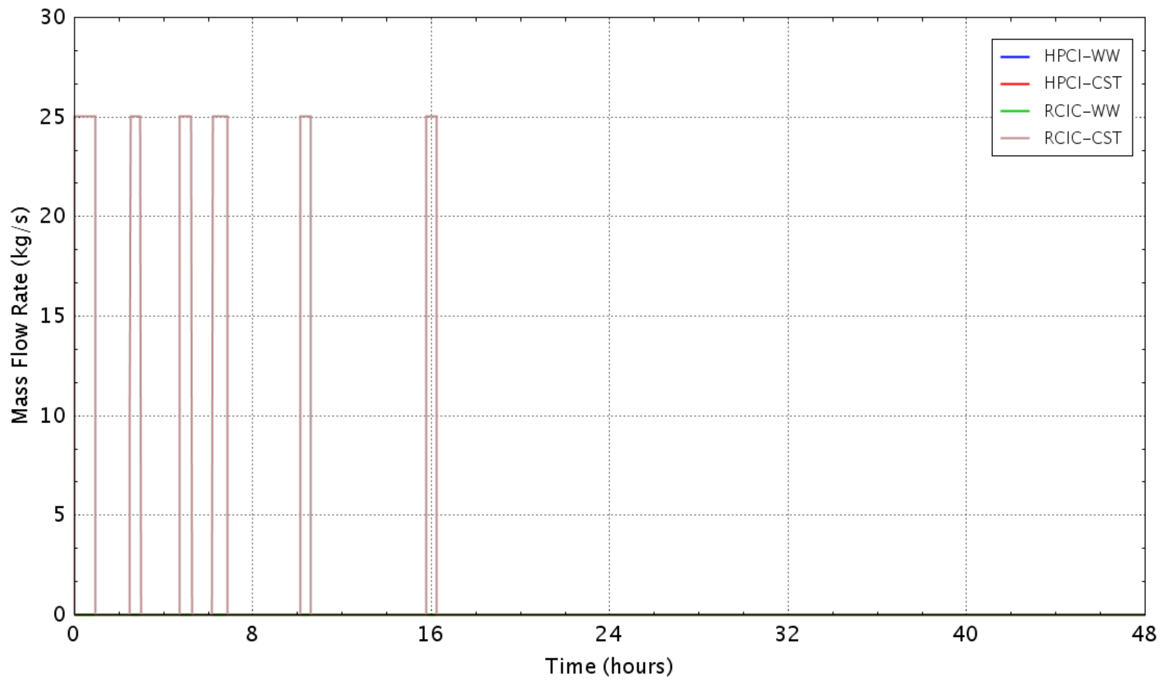

Figure E - 275 **Flow rate of the HPCI/RCIC pumps**

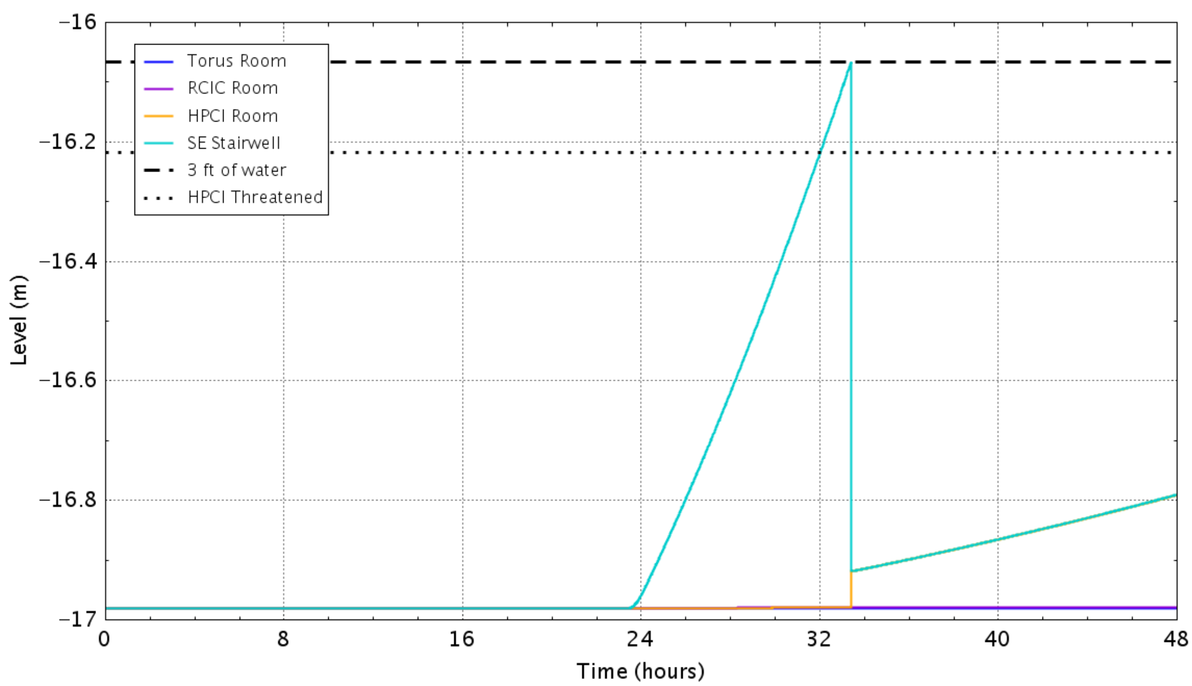

Figure E - 276 **Water level in the reactor building basement**

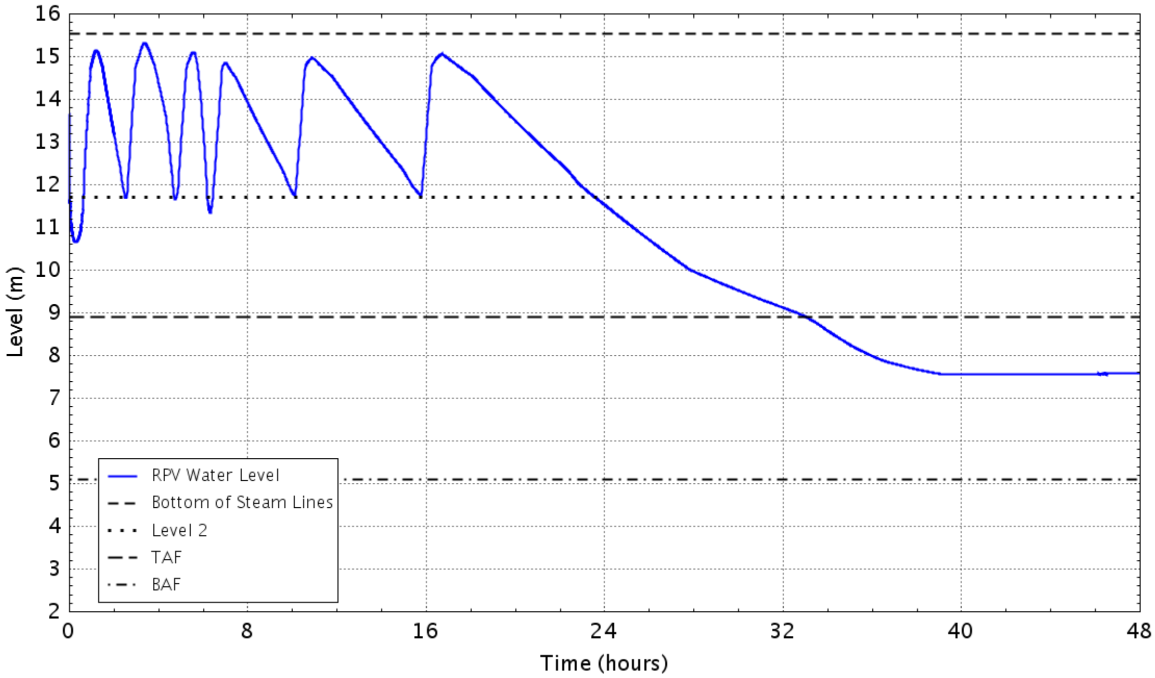

Figure E - 277 **RPV down comer water level**

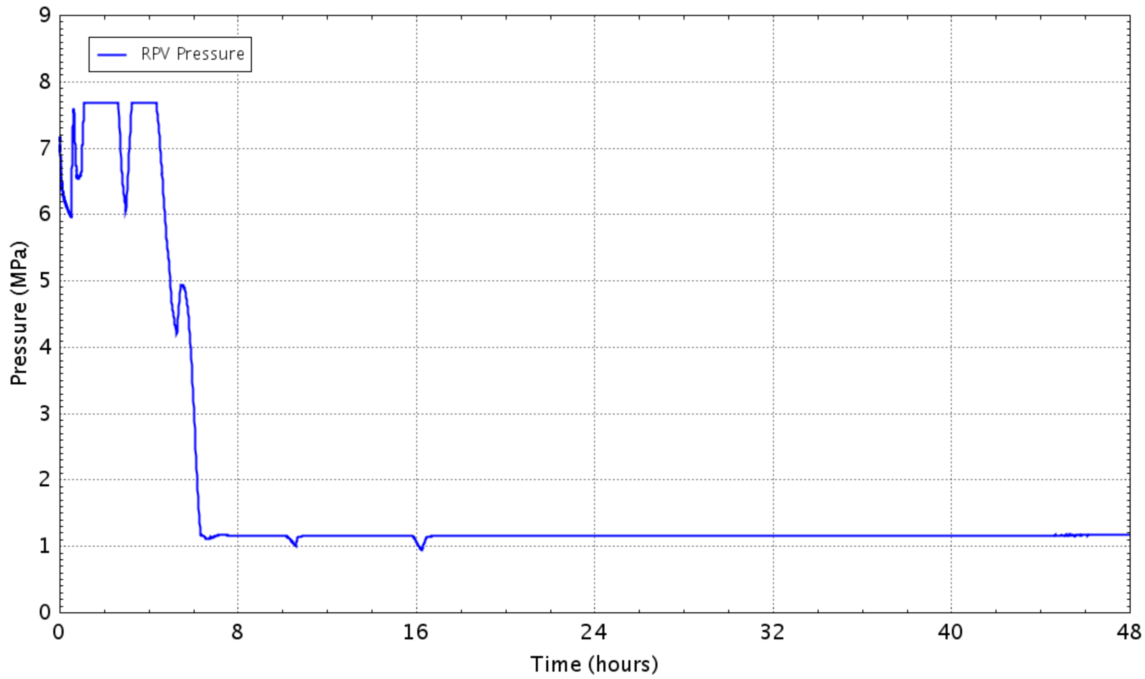

Figure E - 278 **Pressure in theRPV**

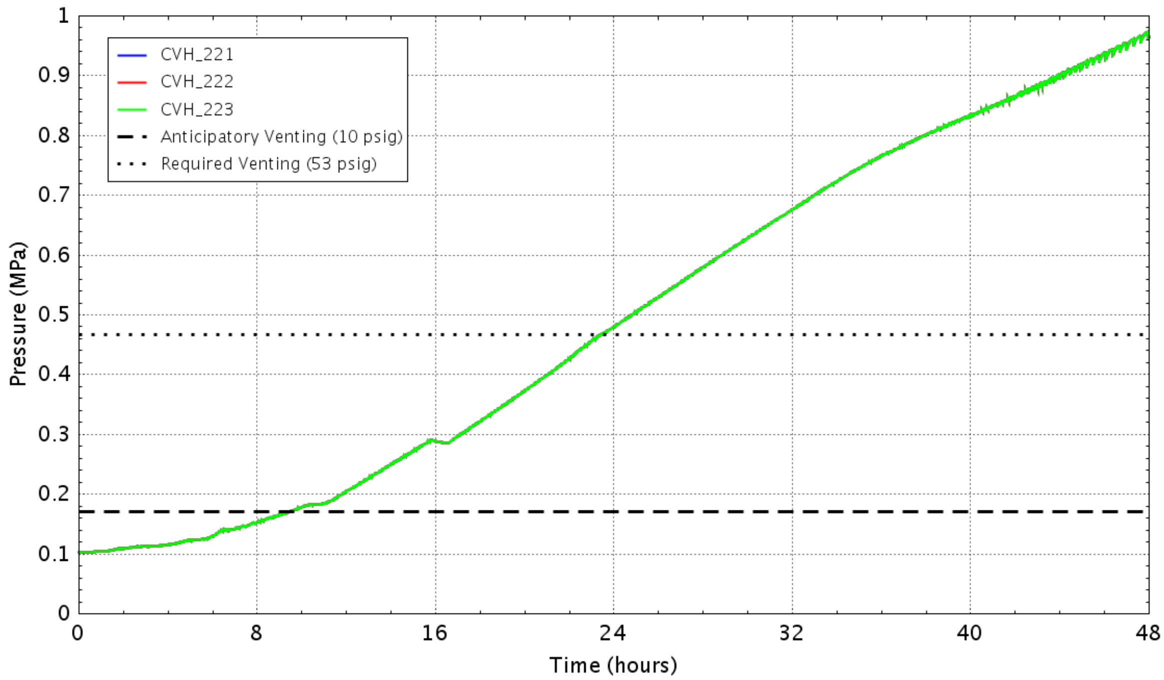

Figure E - 279 Pressure in the wetwell

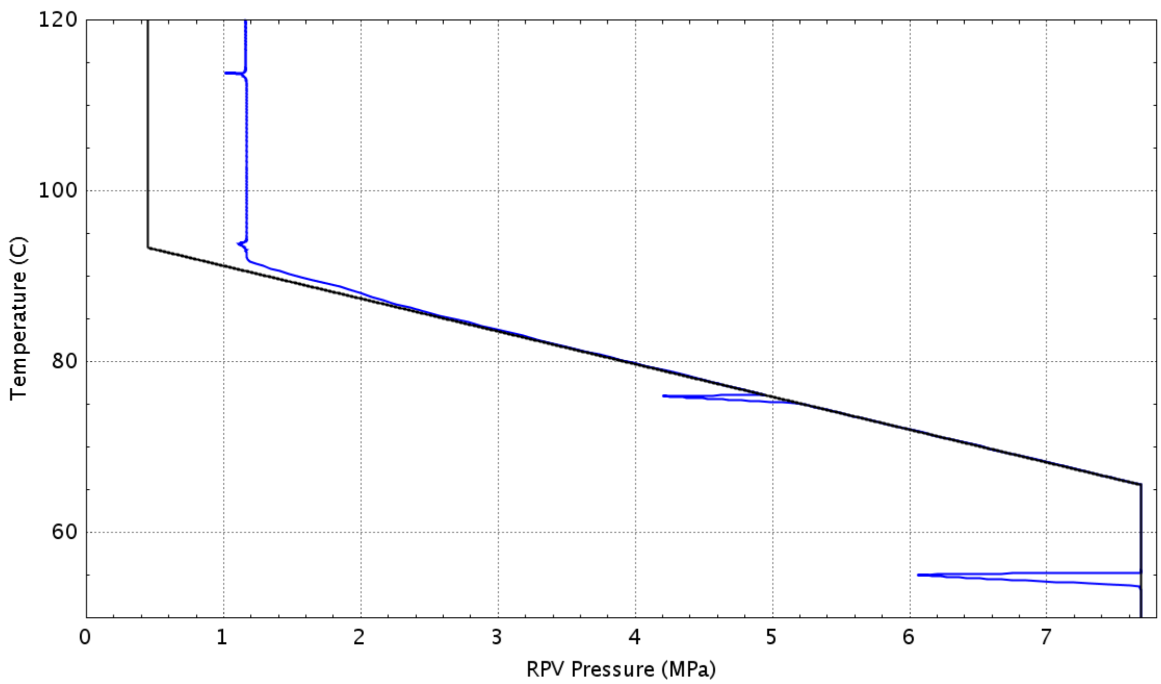

Figure E – 280 Plant status relative to the HCL curve (Graph 4 of the EOPs)

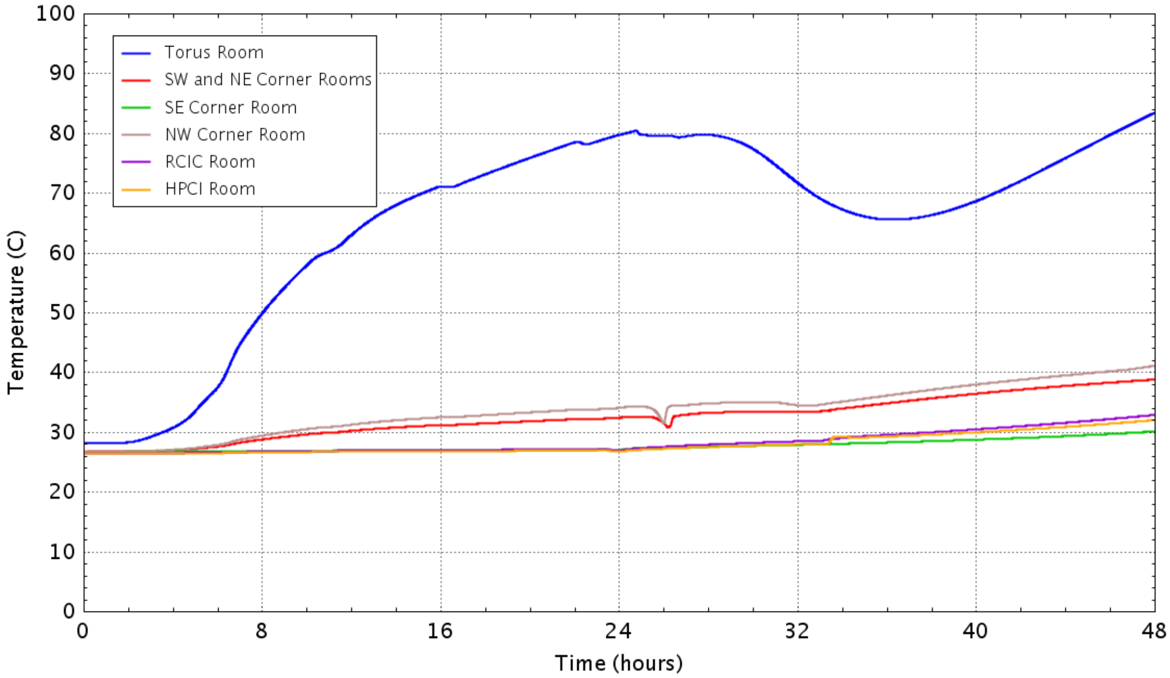

Figure E - 281 **Vapor temperature in the reactor building basement**

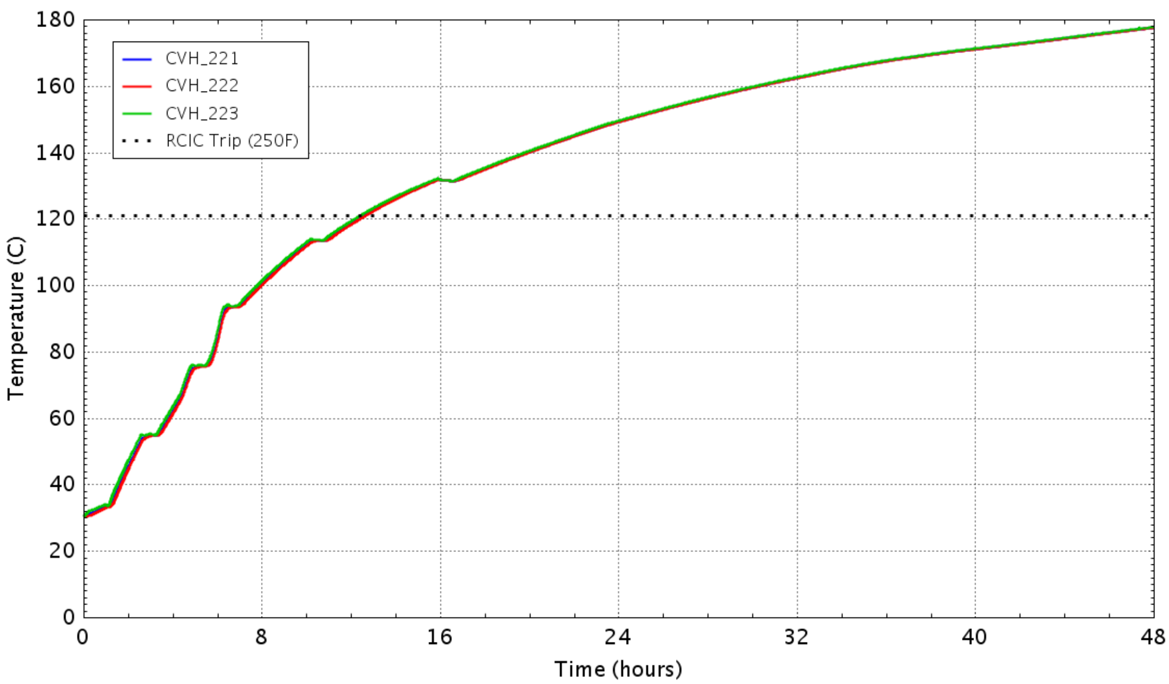

Figure E - 282 **Water temperature in the wetwell**

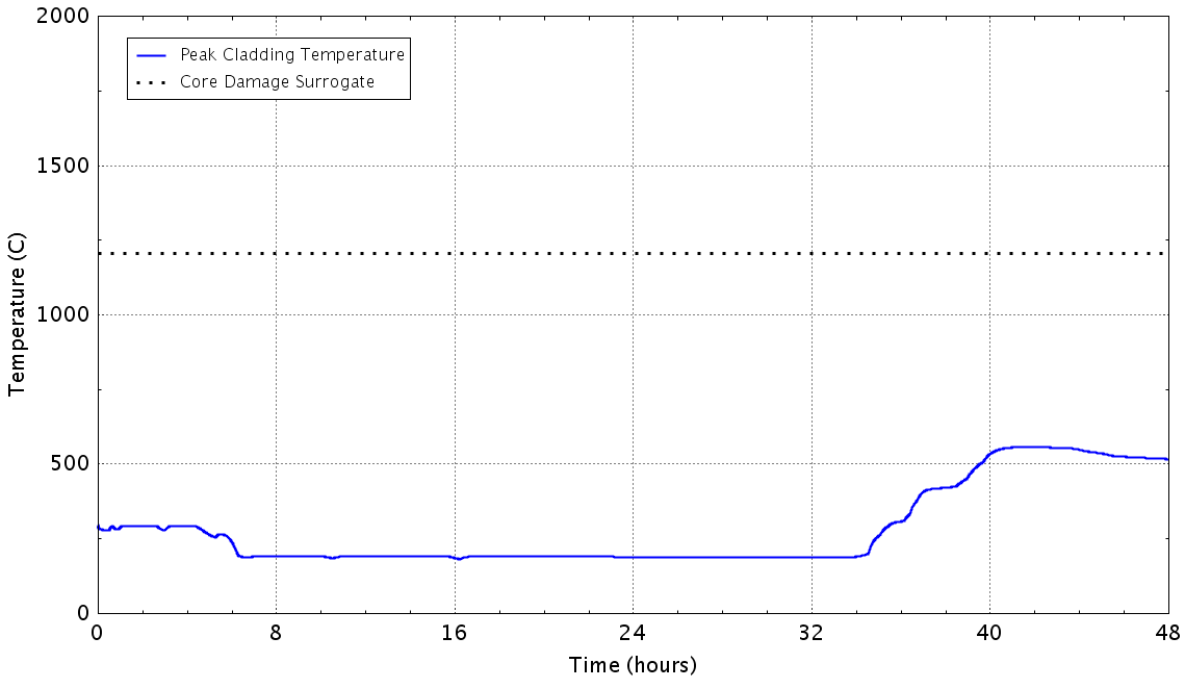

Figure E – 283 **Peak temperature of the fuel cladding as a function oftime**

E.2.14 Case 28: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 2-in. Torus Bypass, RCIC 50%Degraded

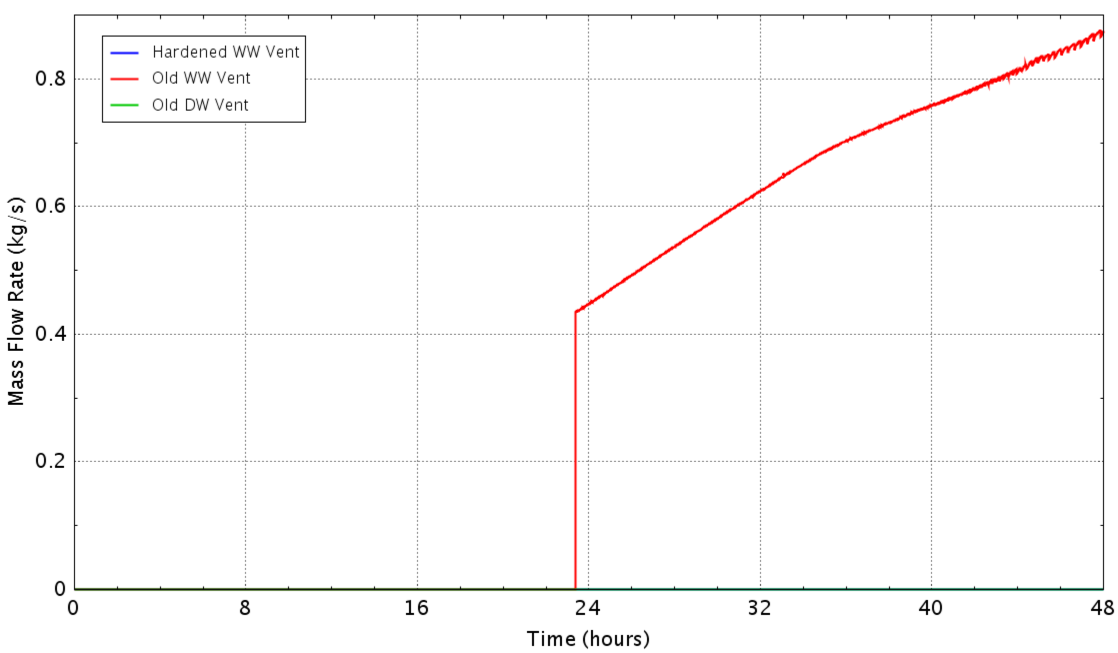

Figure E - 284 **Flow rate of the containment vents**

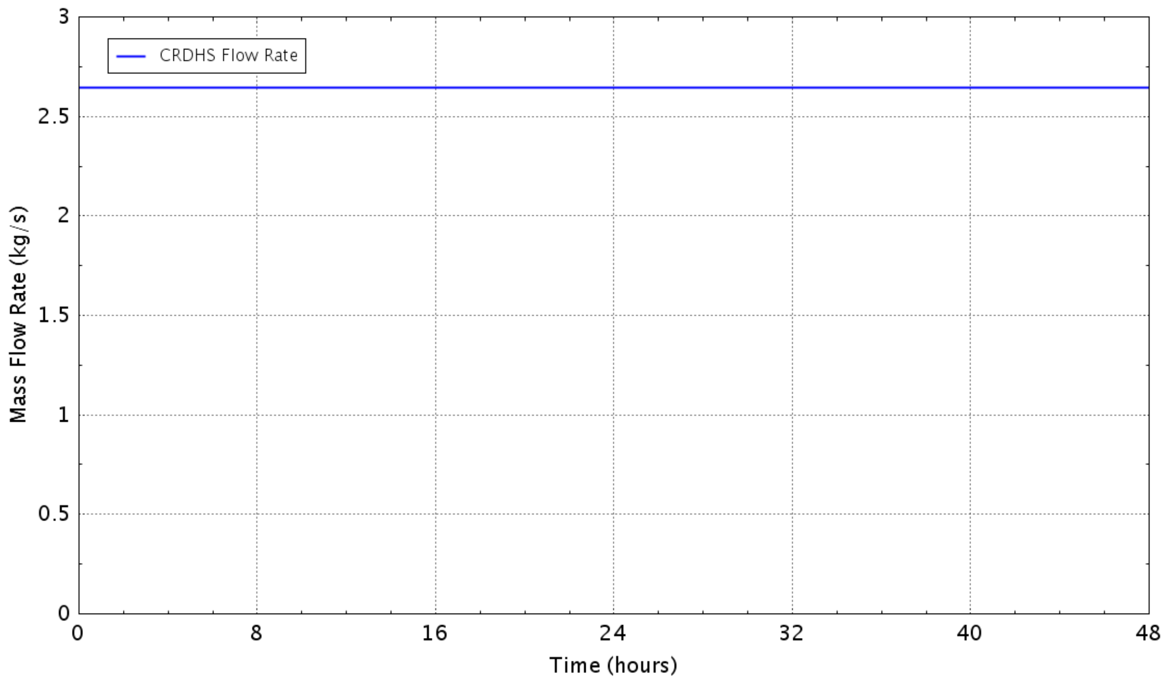

Figure E – 285 **Flow rate of the control rod drive hydraulicsystem**

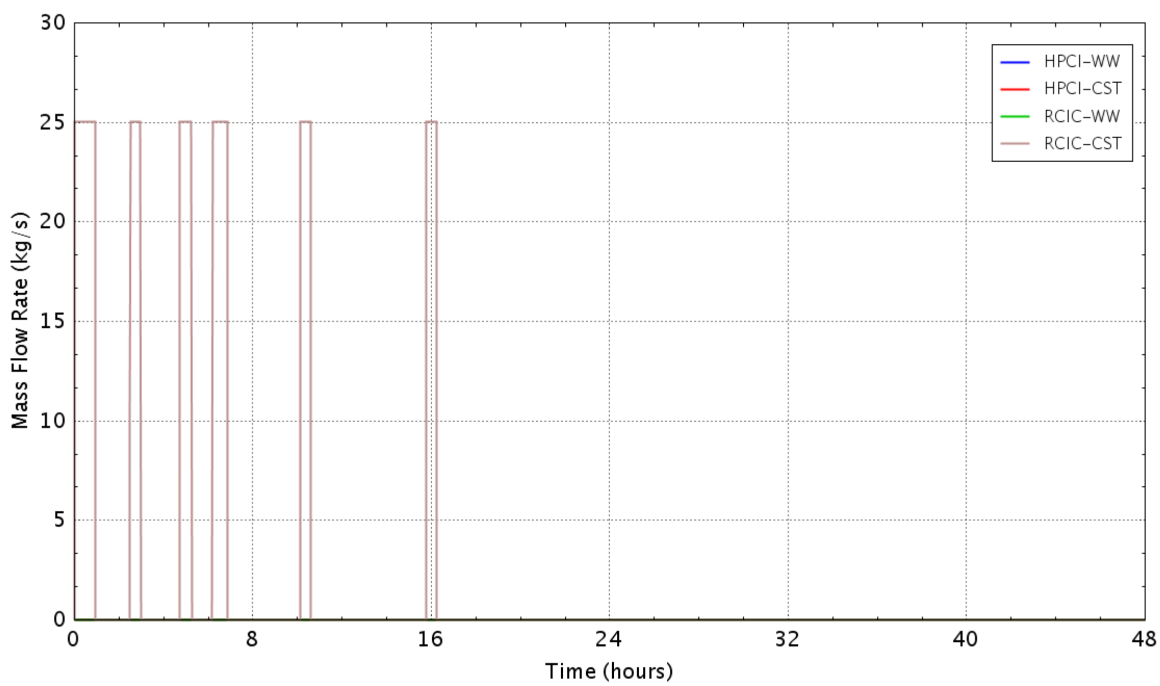

Figure E - 286 **Flow rate of the HPCI/RCIC pumps**

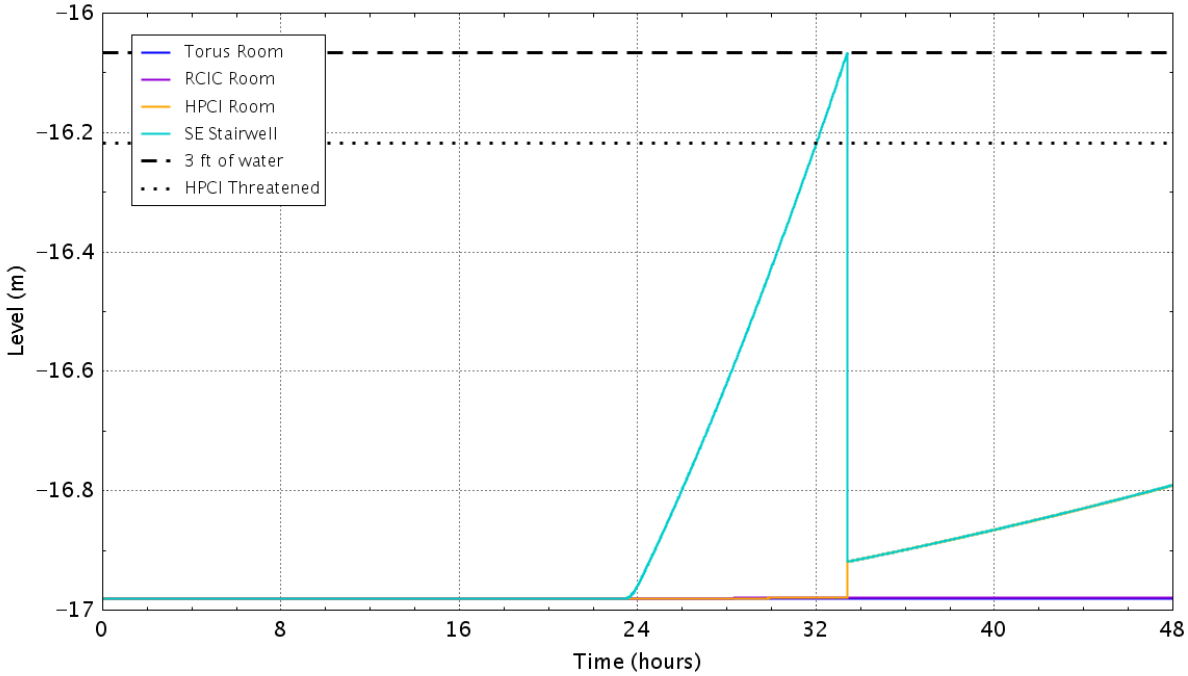

Figure E - 287 Water level in the reactor building basement

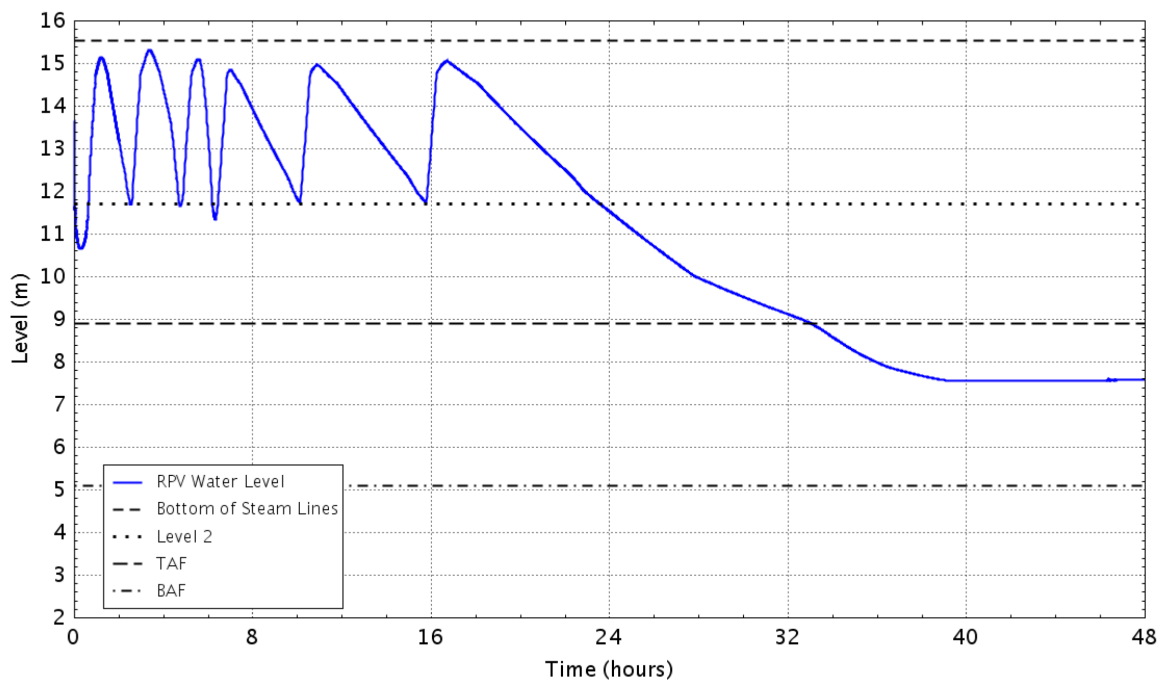

Figure E - 288 RPV down comer water level

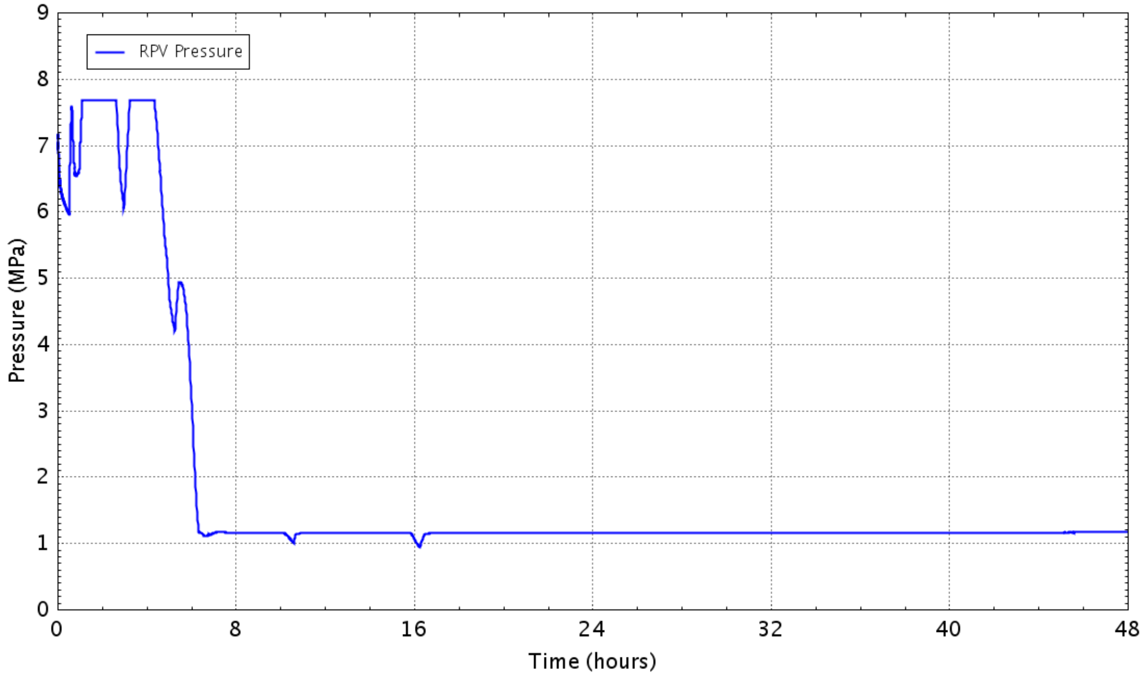

Figure E - 289 **Pressure in theRPV**

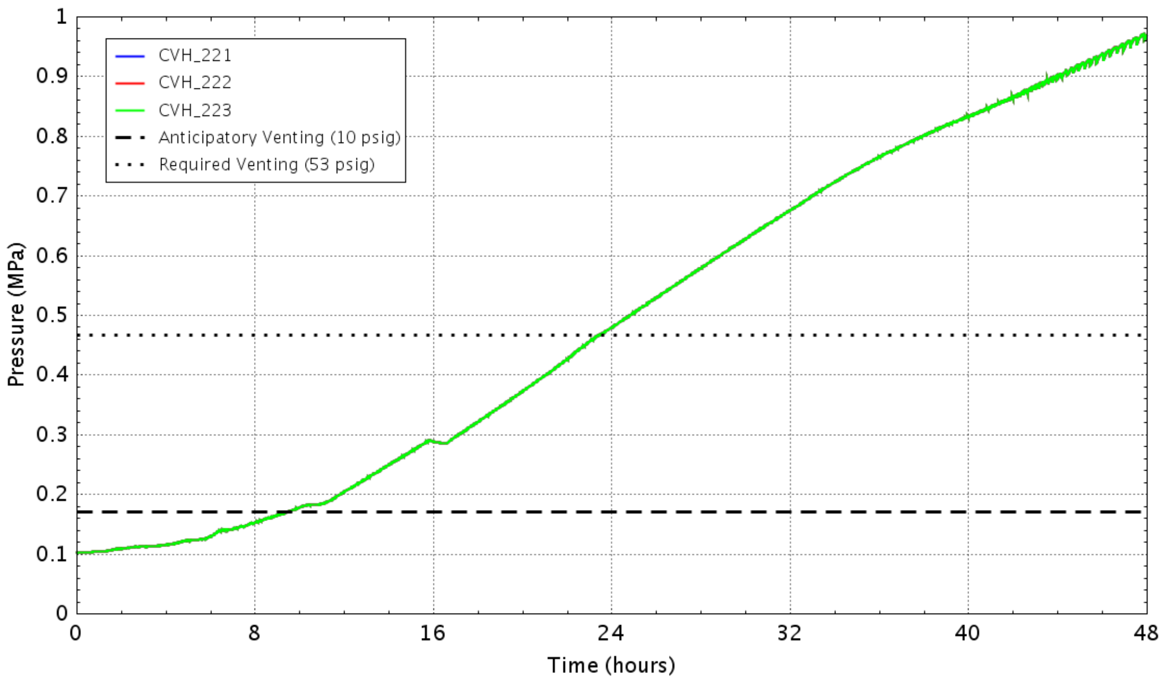

Figure E - 290 **Pressure in the wetwell**

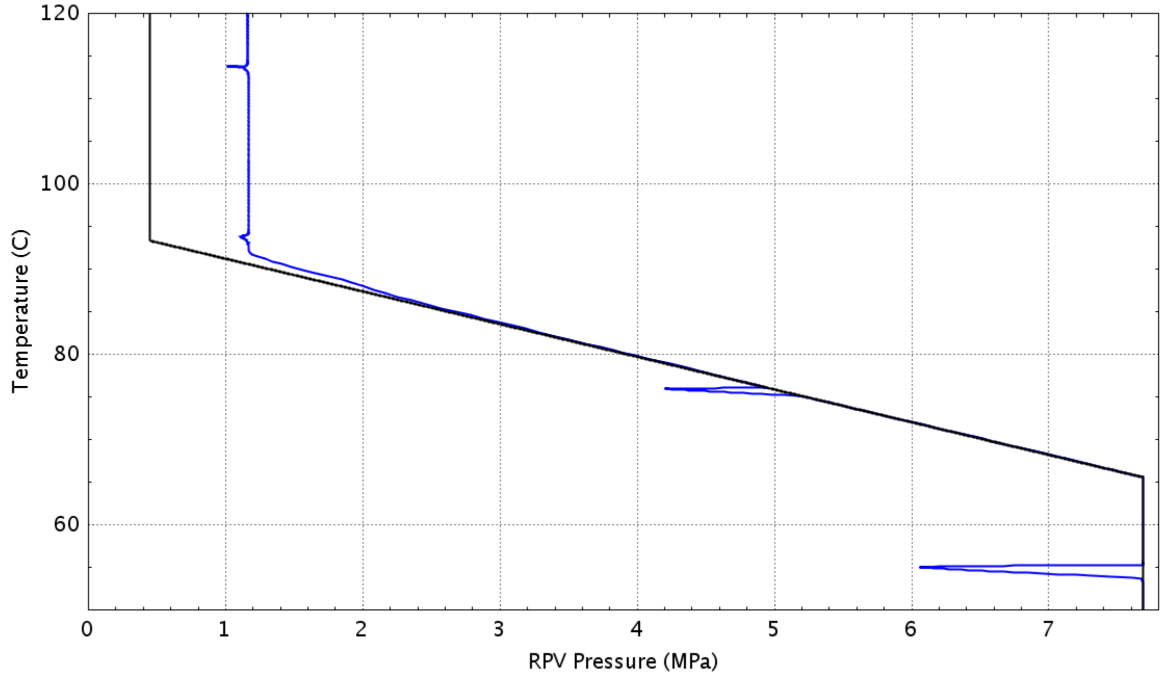

Figure E – 291 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

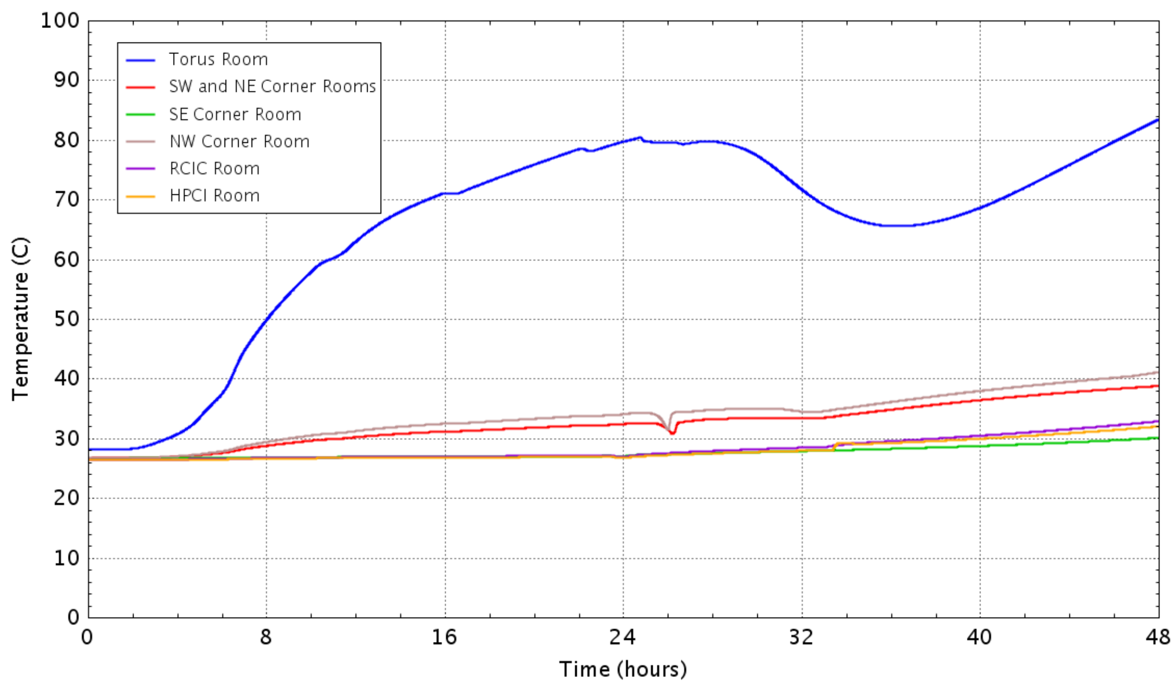

Figure E - 292 **Vapor temperature in the reactor building basement**

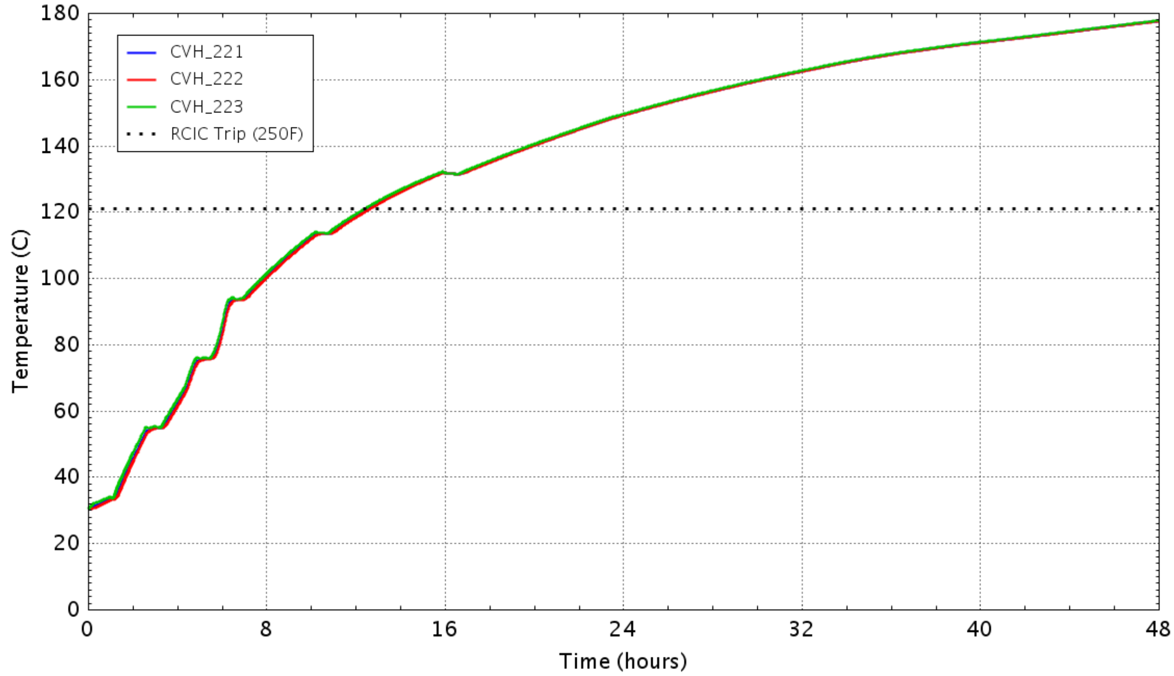

Figure E - 293 Water temperature in the wetwell

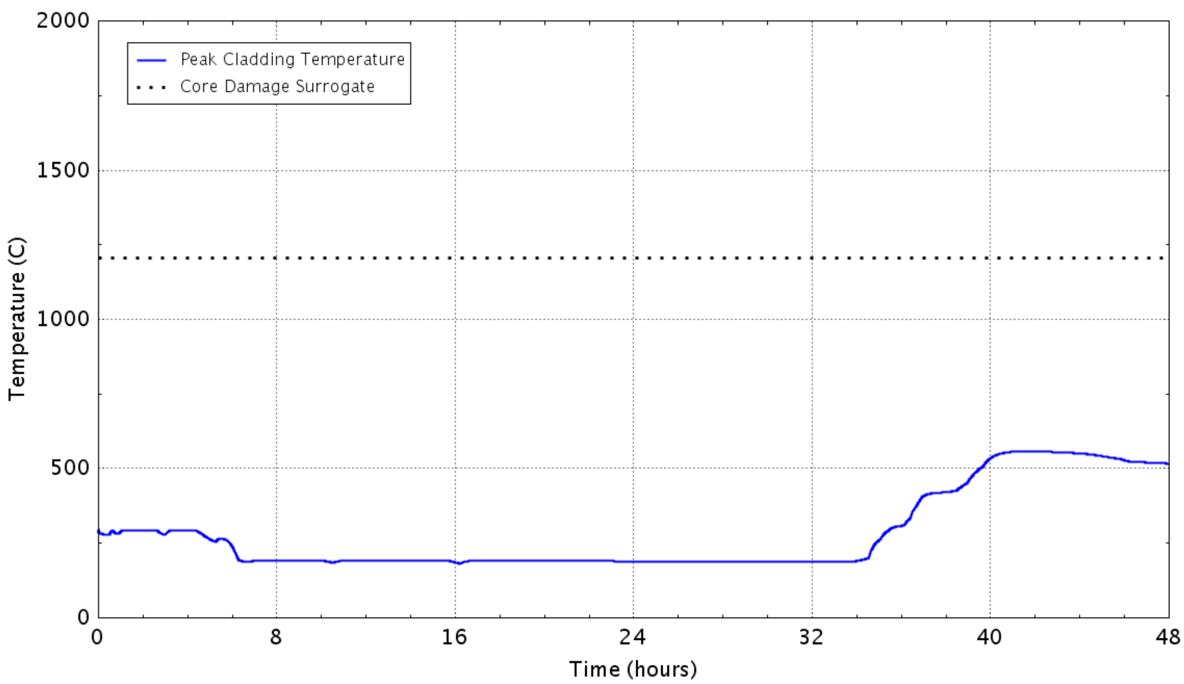

Figure E – 294 Peak temperature of the fuel cladding as a function oftime

E.2.15 Case 29: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 18-in. Torus Vent, RCIC Fully Functional

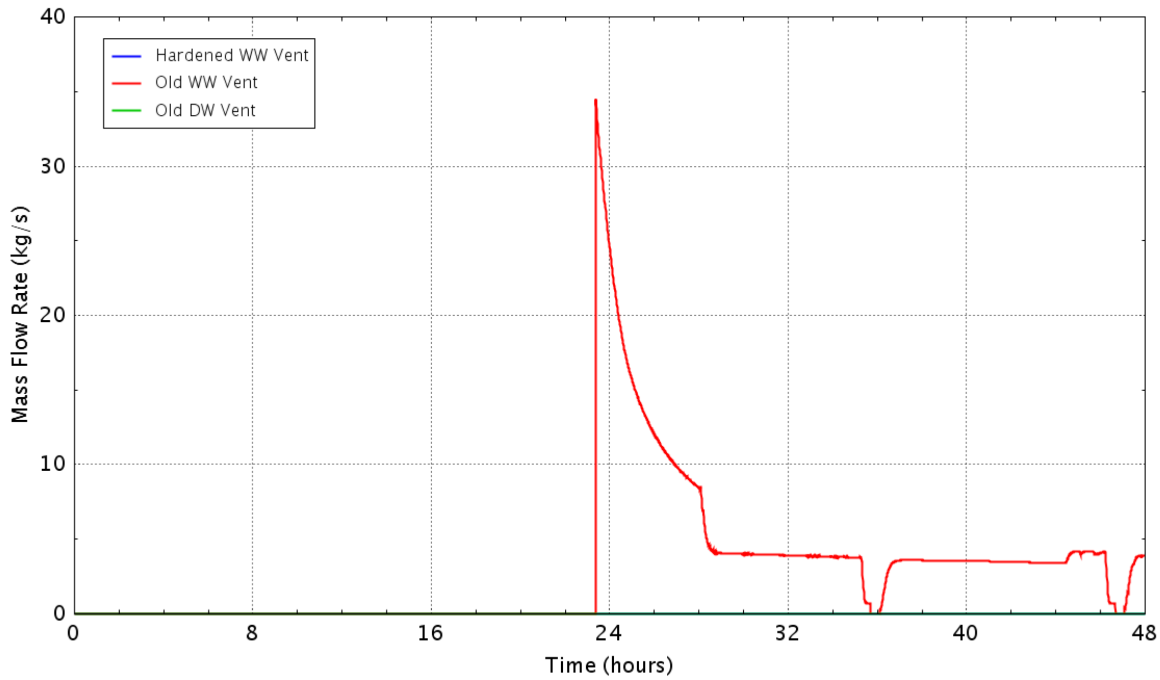

Figure E - 295 Flow rate of the containment vents

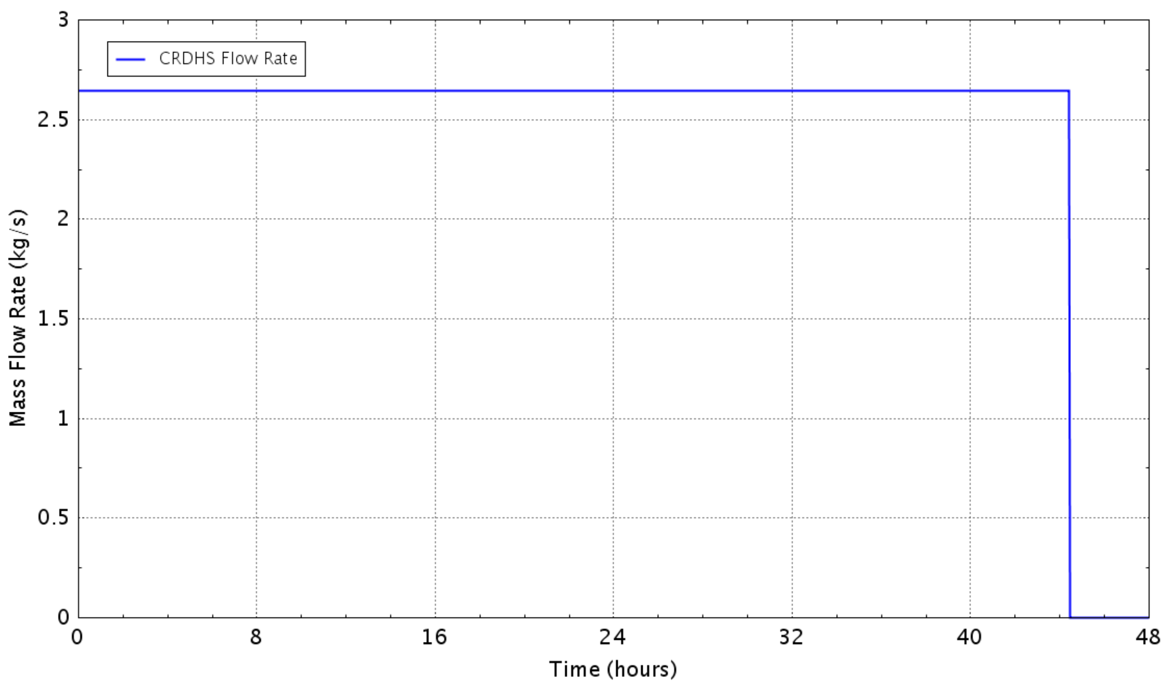

Figure E - 296 Flow rate of the control rod drive hydraulic system

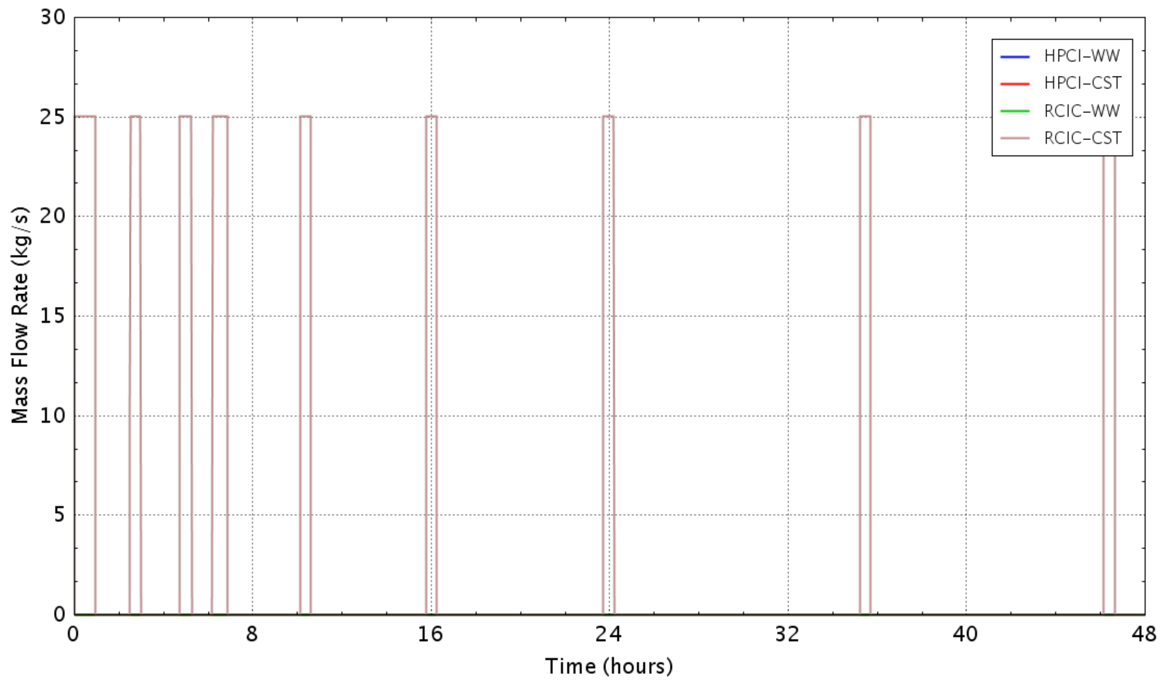

Figure E - 297 Flow rate of the HPCI/RCIC pumps

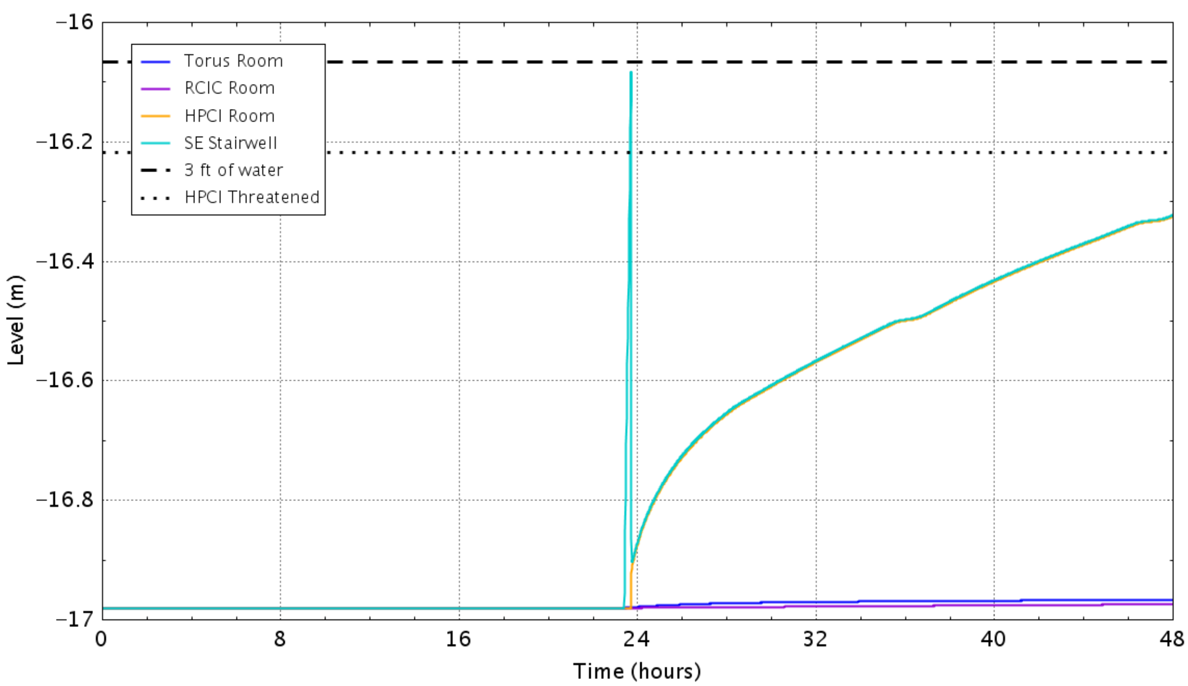

Figure E - 298 Water level in the reactor building basement

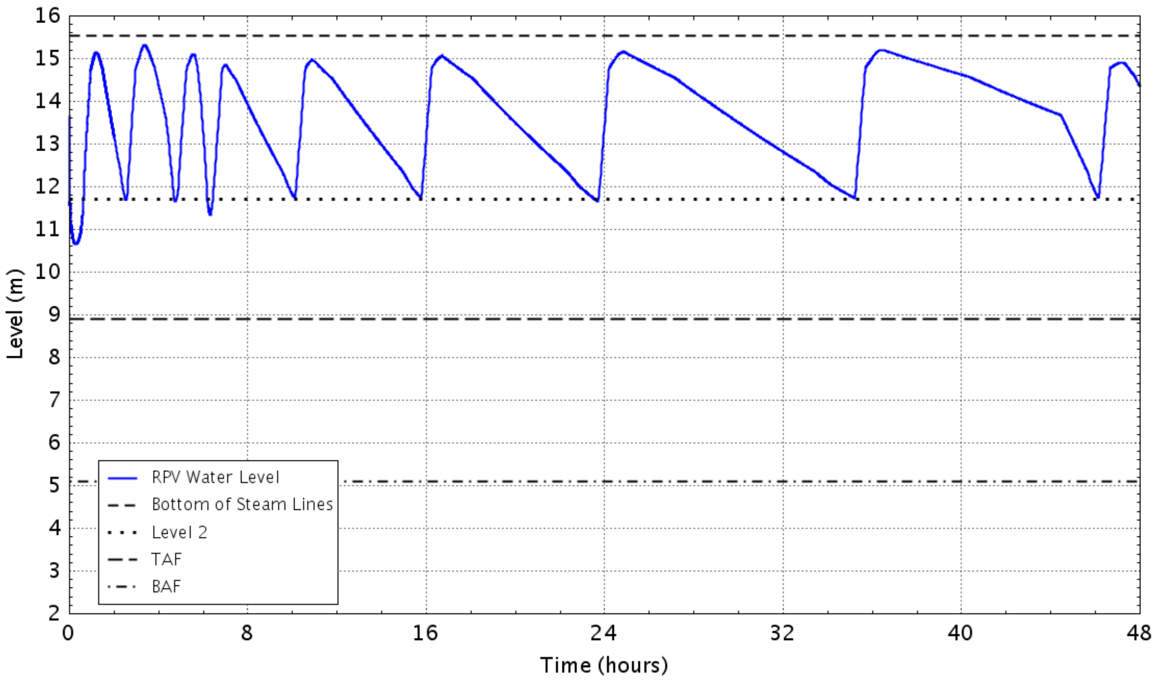

Figure E - 299 **RPV down comer water level**

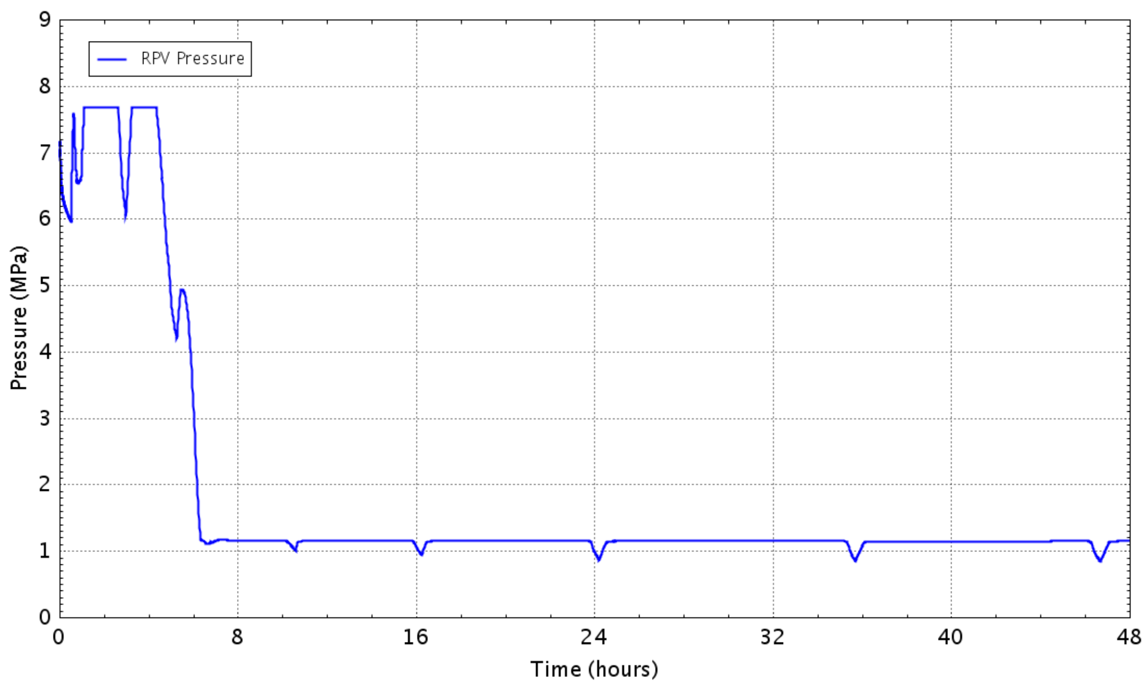

Figure E - 300 **Pressure in theRPV**

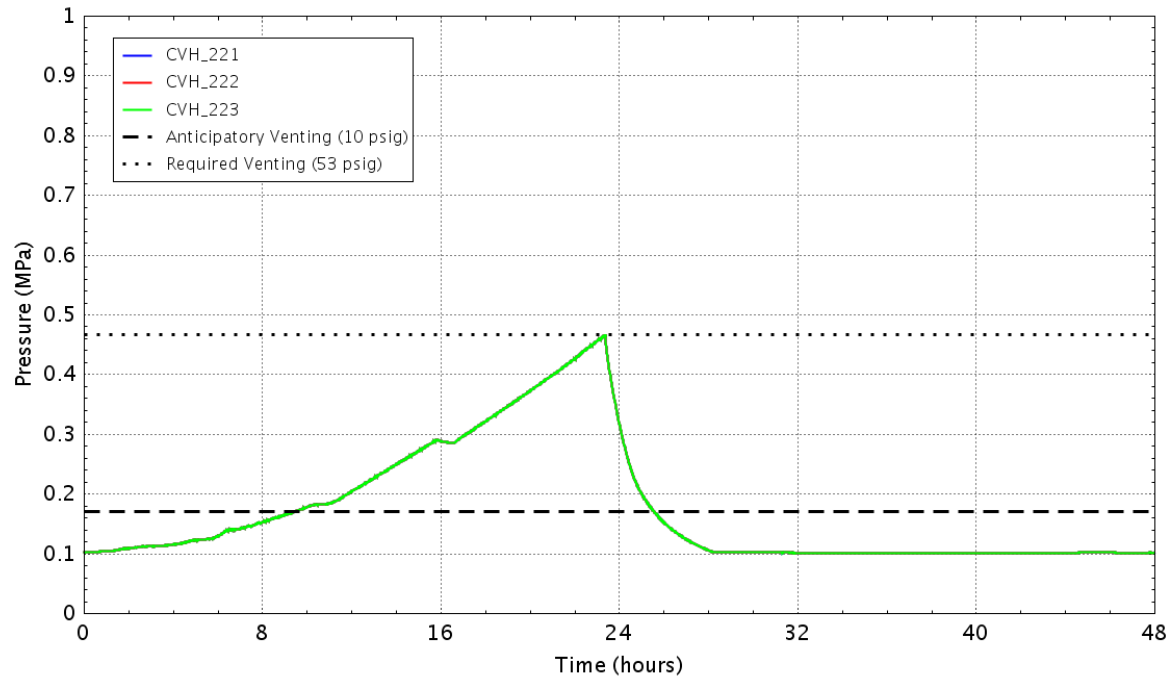

Figure E - 301 Pressure in the wetwell

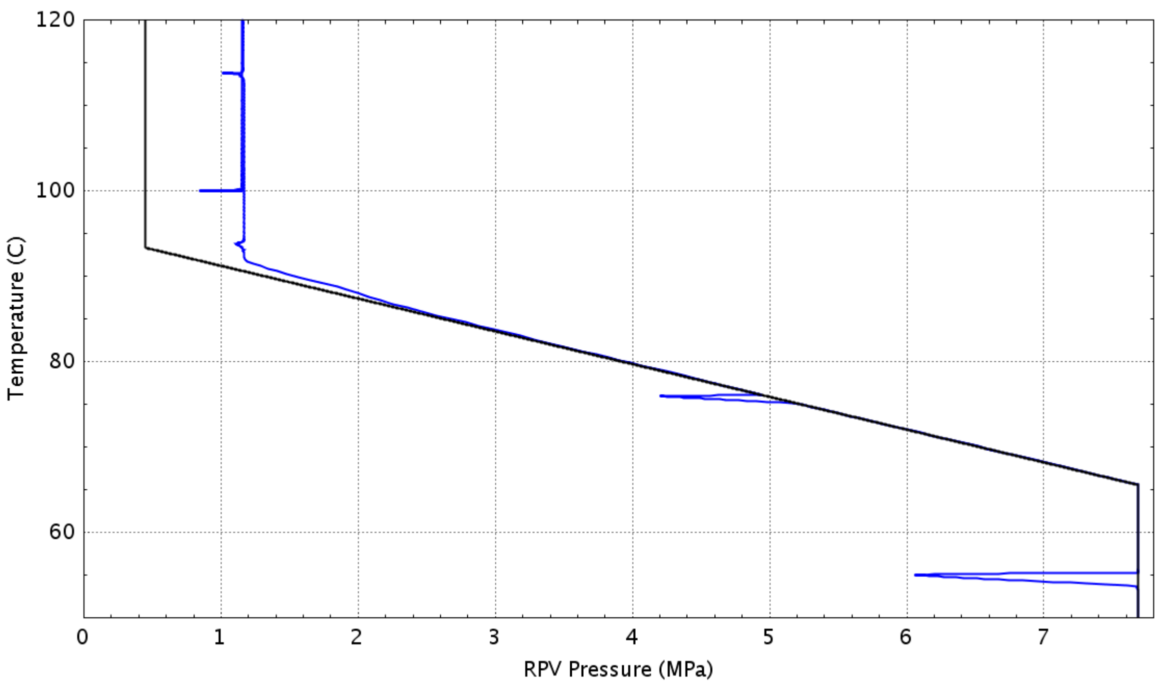

Figure E - 302 Plant status relative to the HCL curve (Graph 4 of the EOPs)

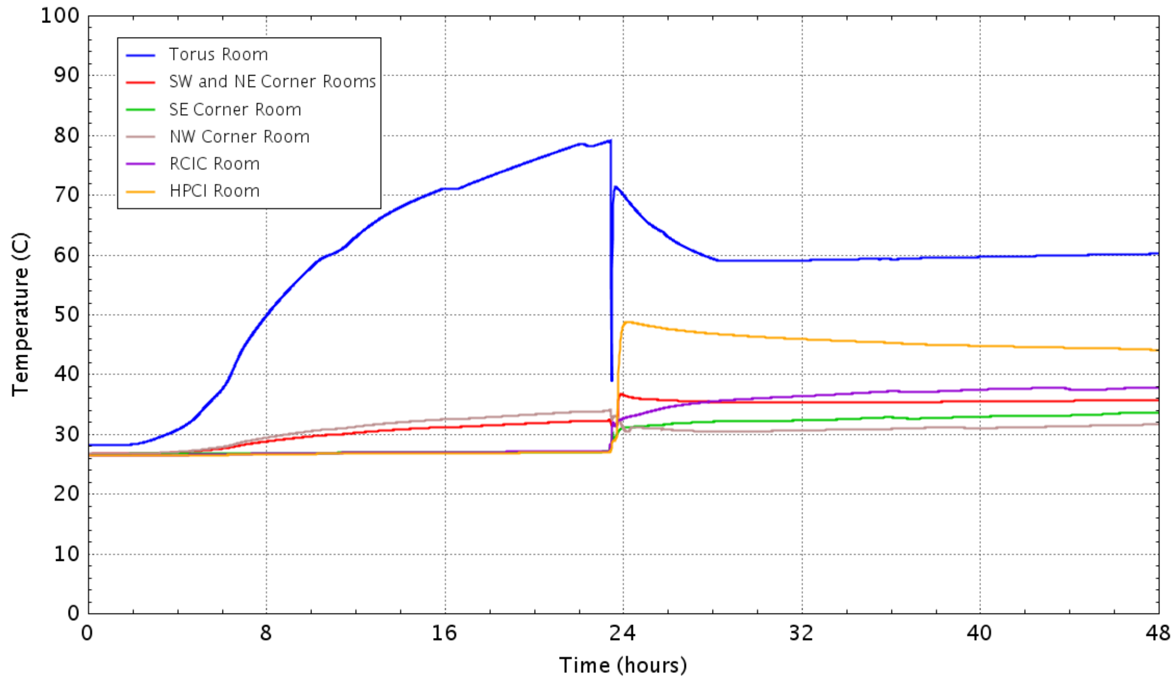

Figure E - 303 Vapor temperature in the reactor building basement

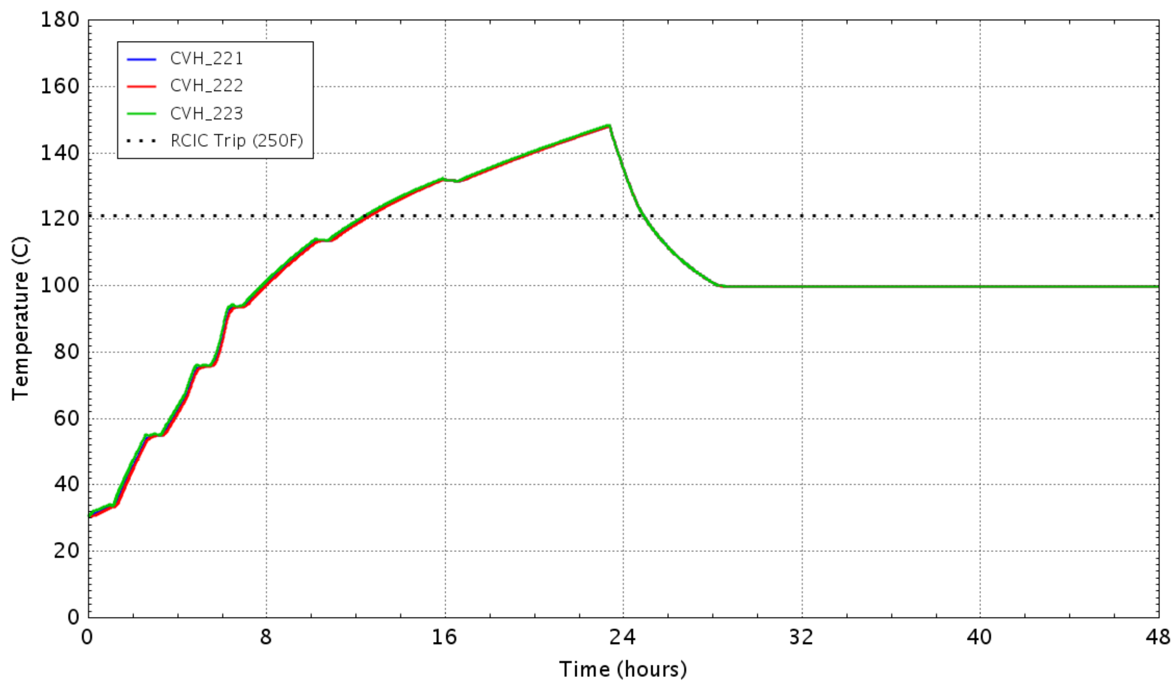

Figure E - 304 Water temperature in the wetwell

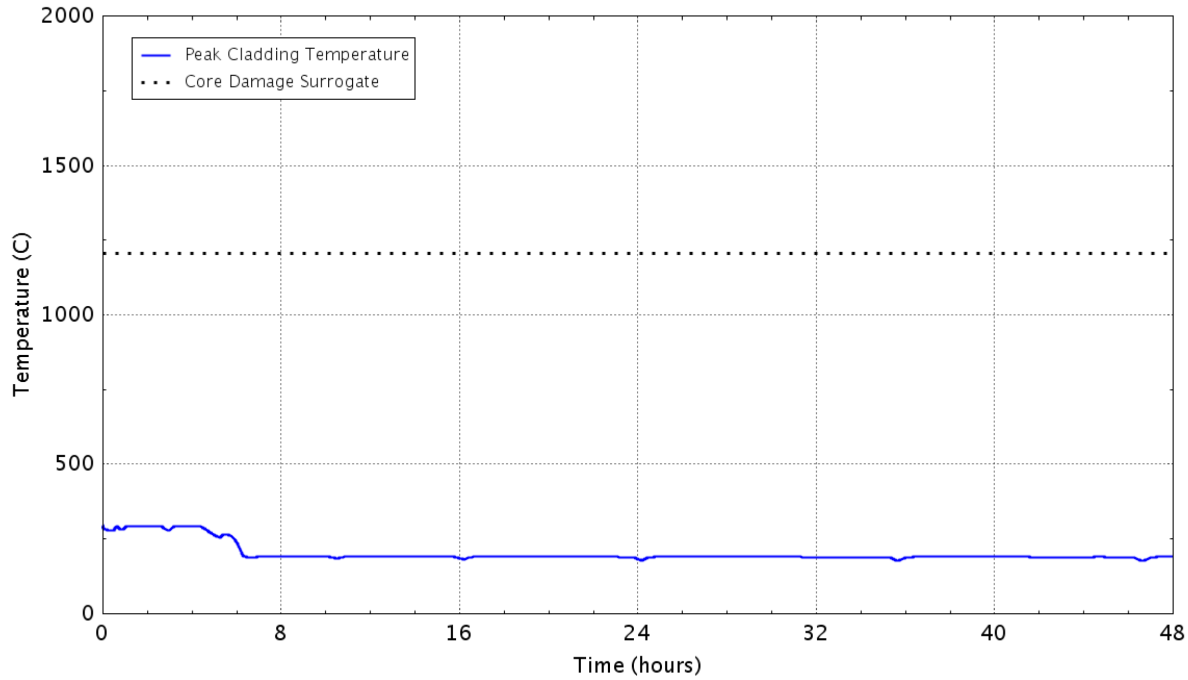

Figure E – 305 Peak temperature of the fuel cladding as a function oftime

E.2.16 Case 30: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 18-in. Torus Vent, RCIC 50%Degraded

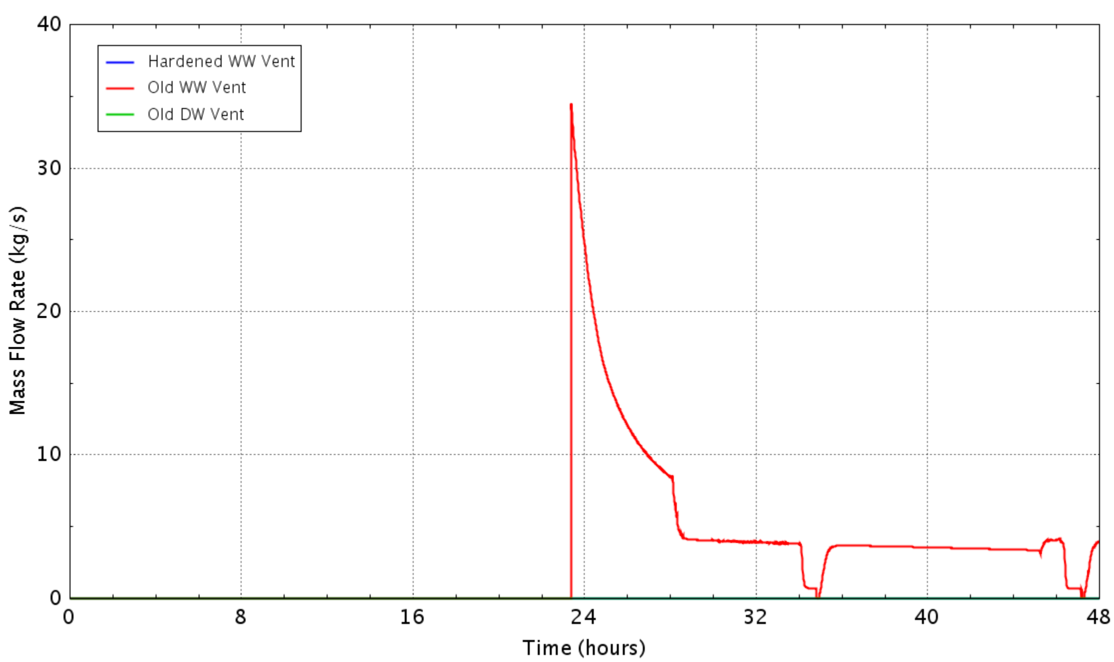

Figure E – 306 Flow rate of the containment vents

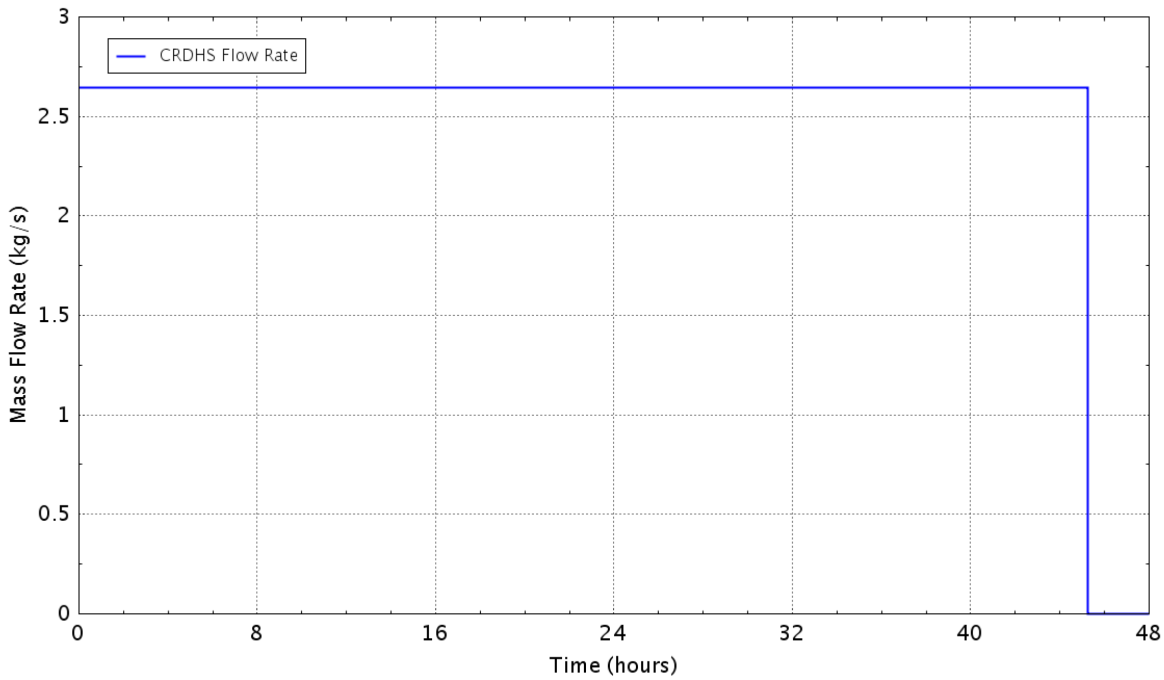

Figure E - 307 Flow rate of the control rod drive hydraulic system

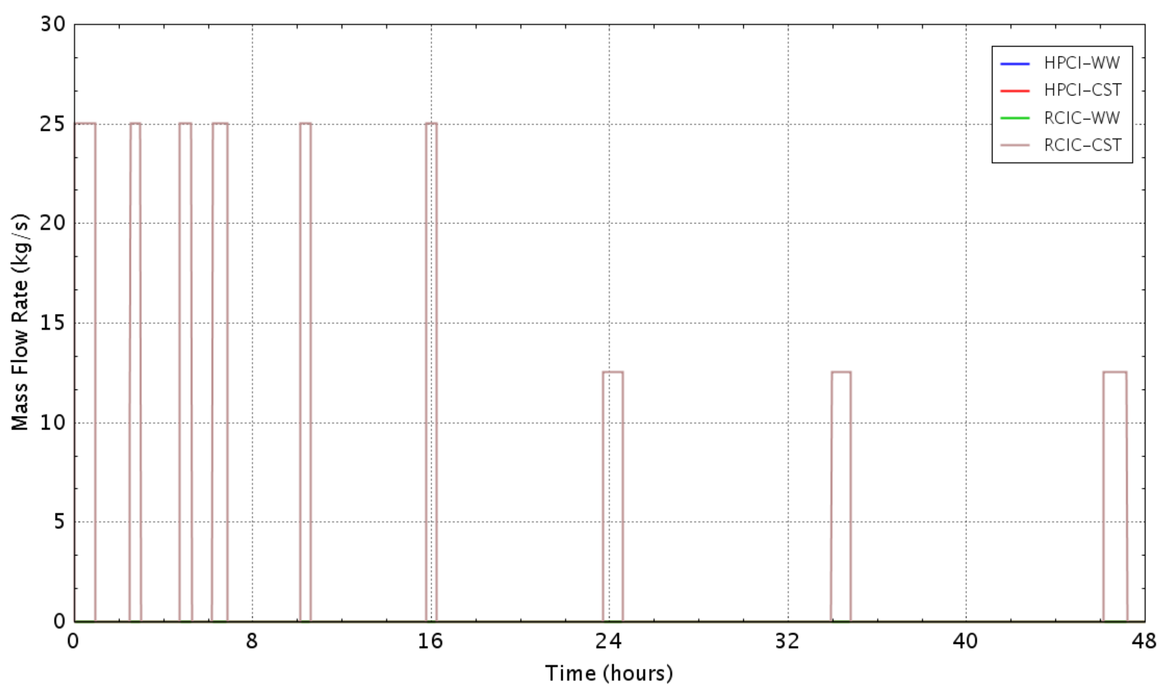

Figure E - 308 Flow rate of the HPCI/RCIC pumps

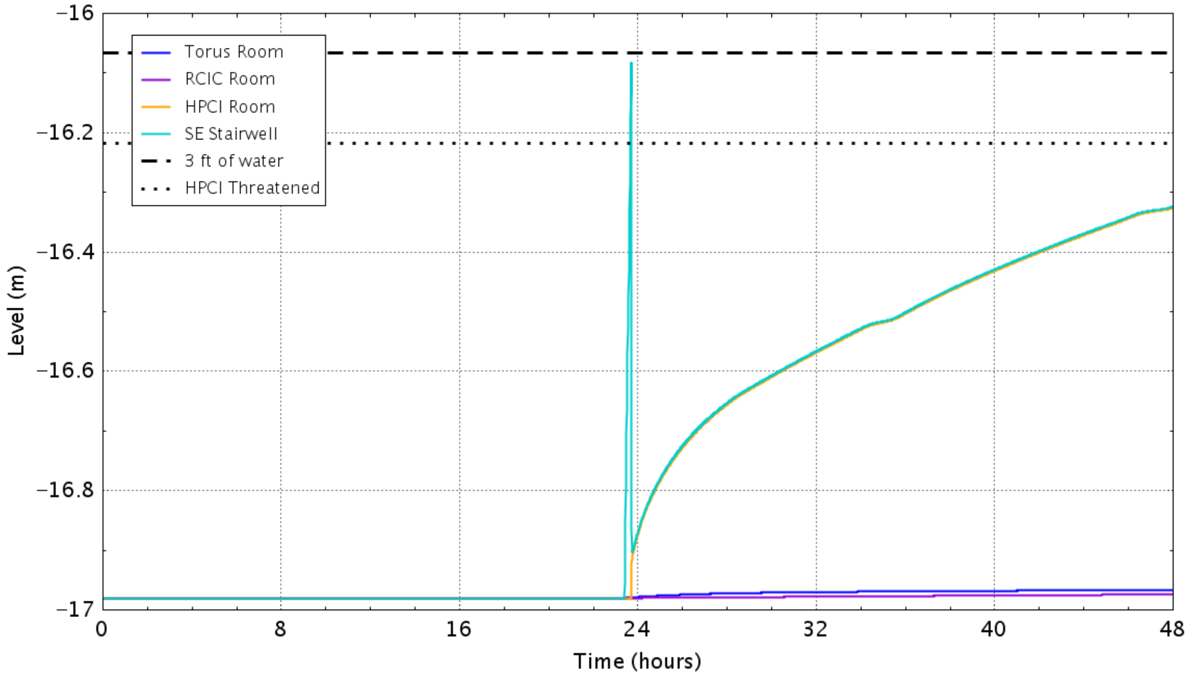

Figure E - 309 Water level in the reactor building basement

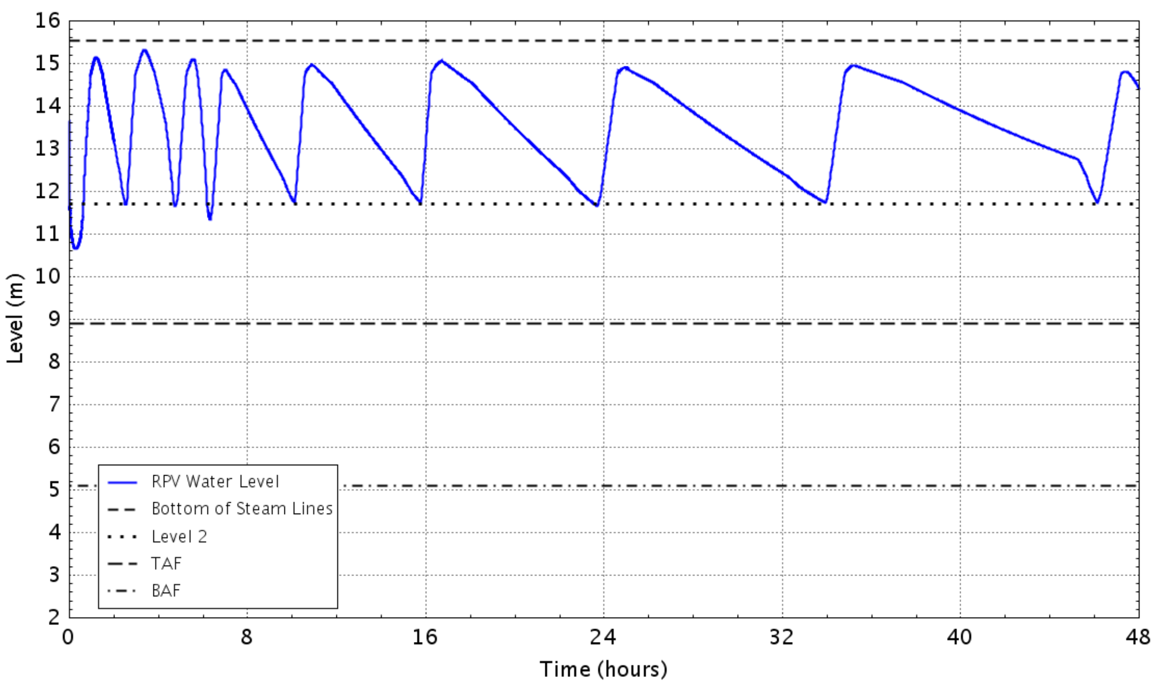

Figure E - 310 RPV down comer water level

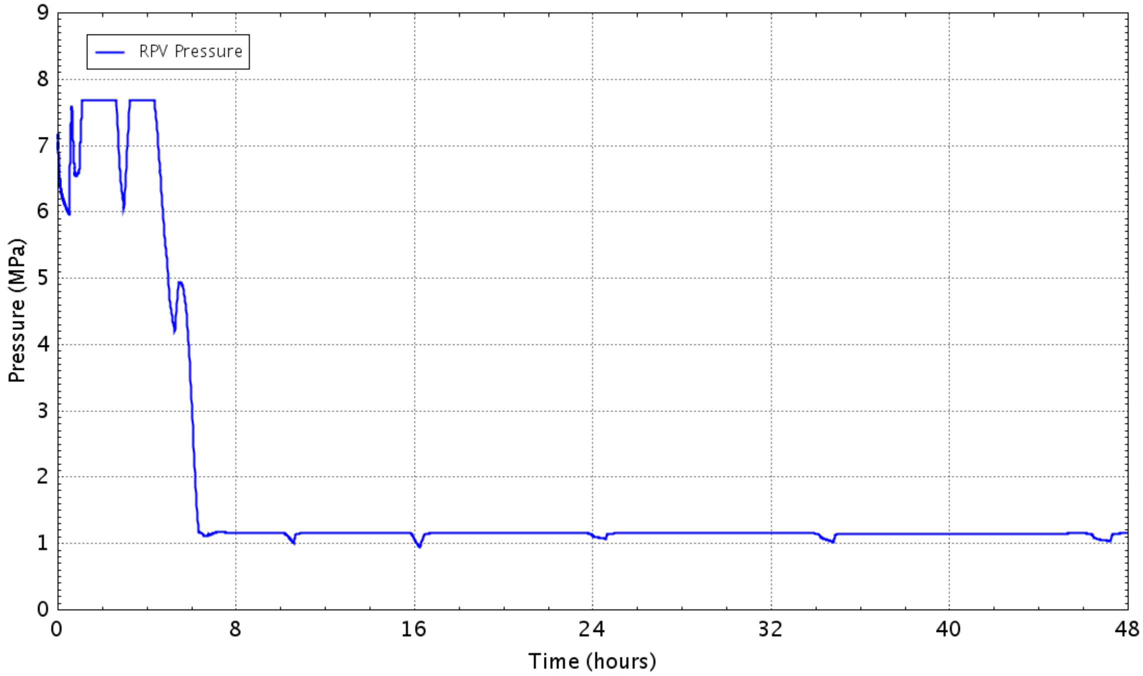

Figure E - 311 Pressure in theRPV

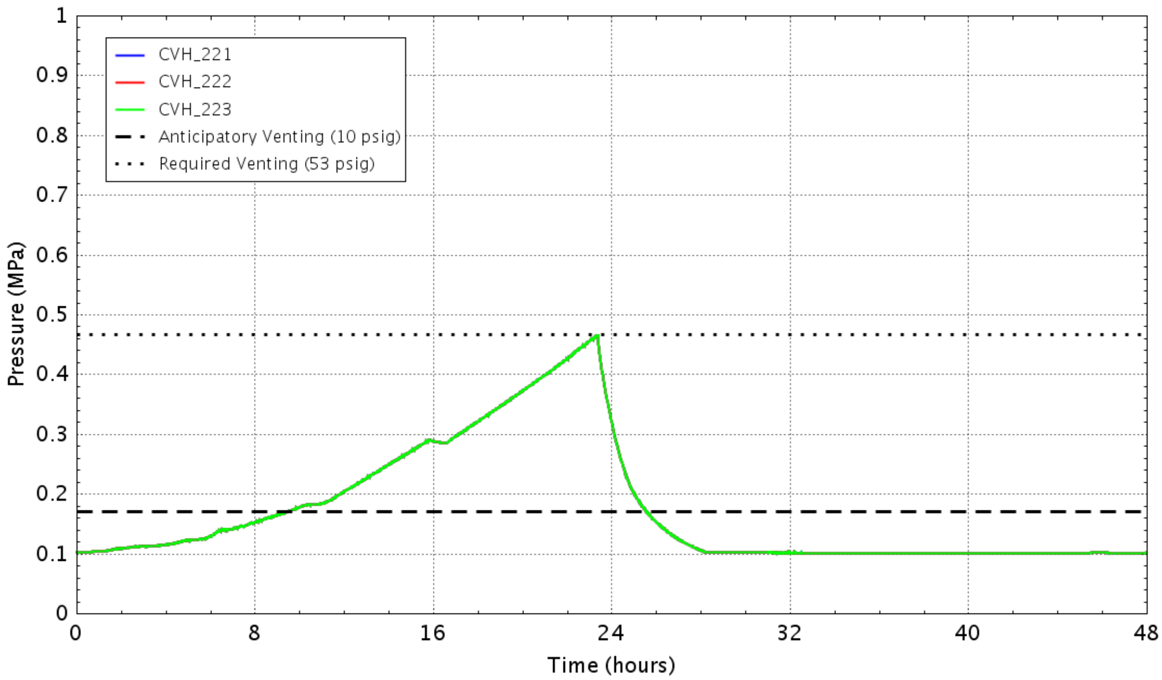

Figure E - 312 Pressure in the wetwell

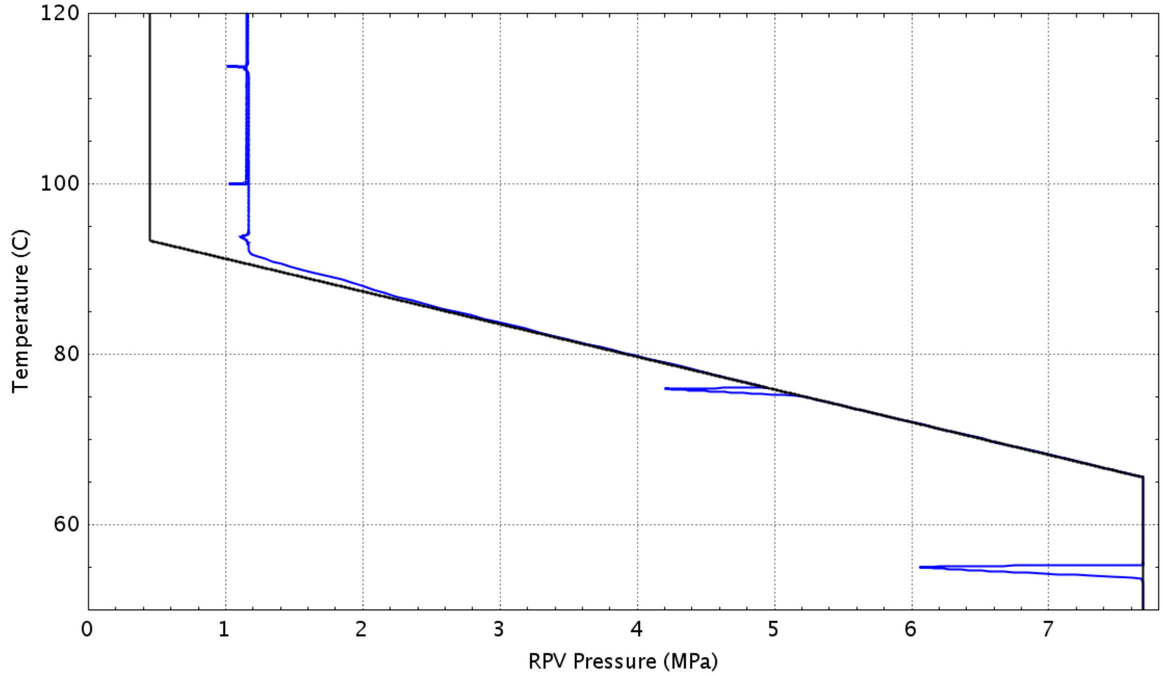

Figure E – 313 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

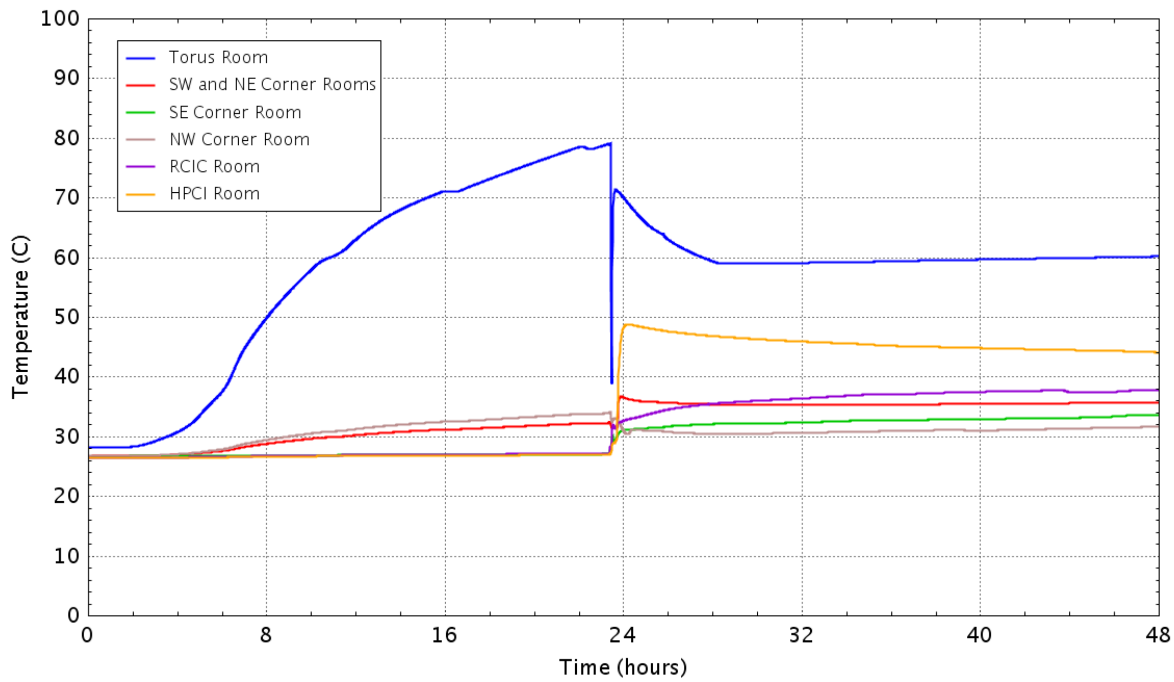

Figure E - 314 **Vapor temperature in the reactor building basement**

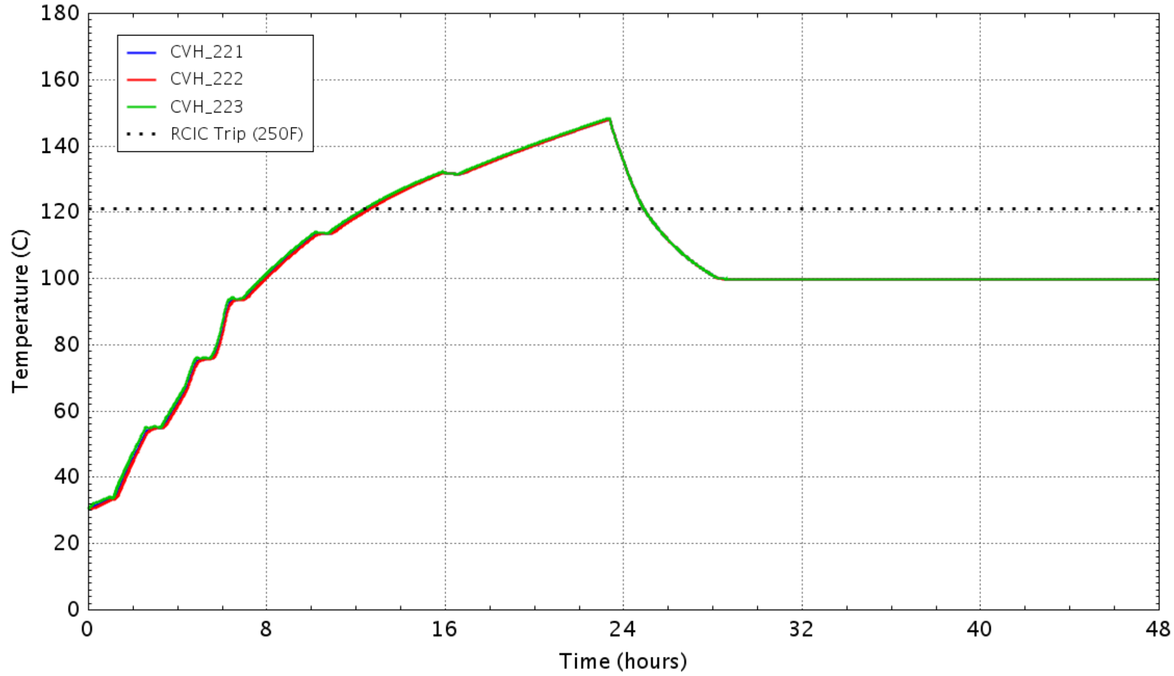

Figure E - 315 Water temperature in the wetwell

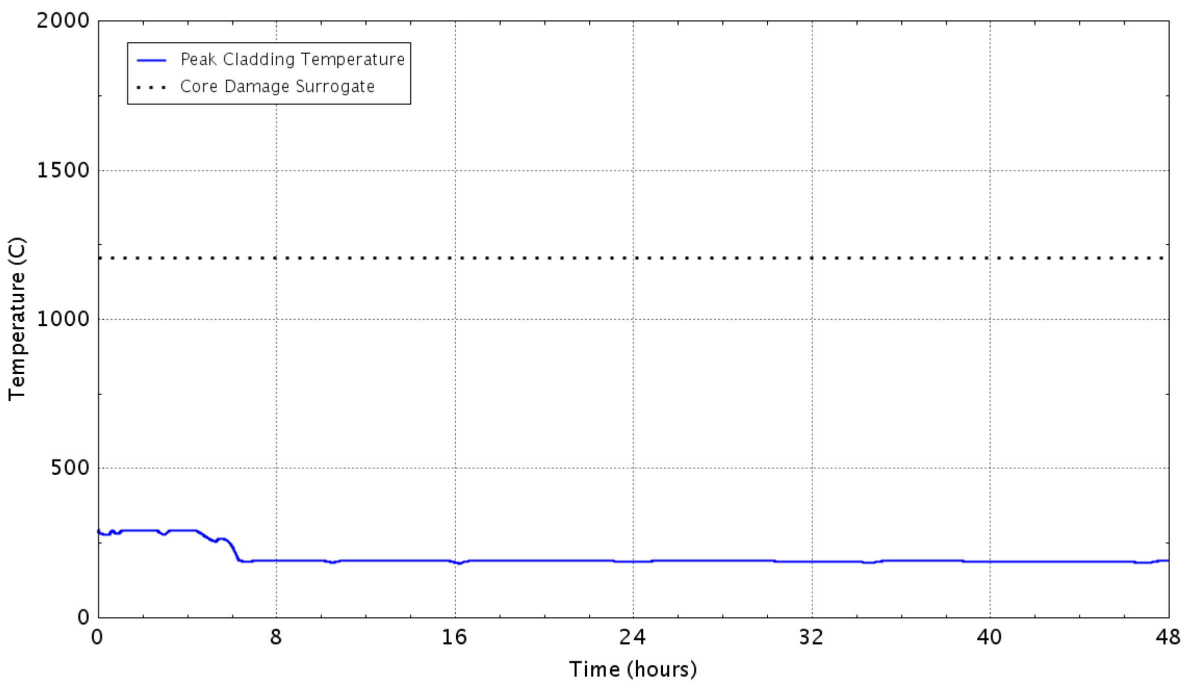

Figure E – 316 Peak temperature of the fuel cladding as a function oftime

E.2.17 Case 31: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 18-in. Torus Vent, RCIC Non-functional

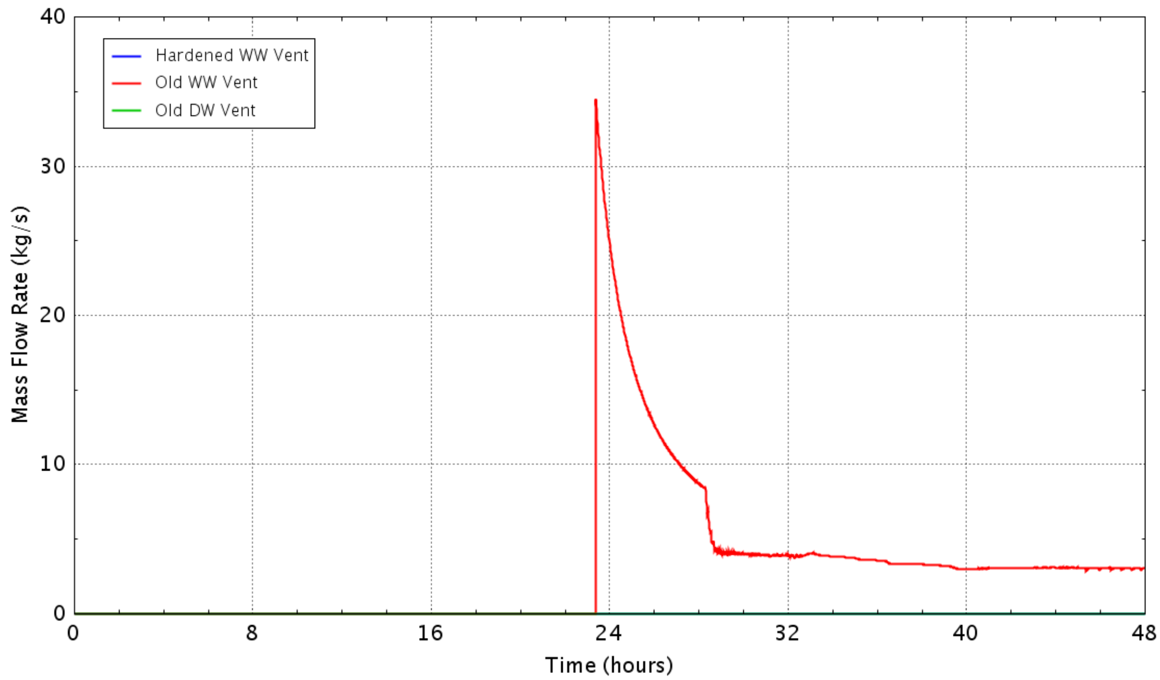

Figure E - 317 Flow rate of the containment vents

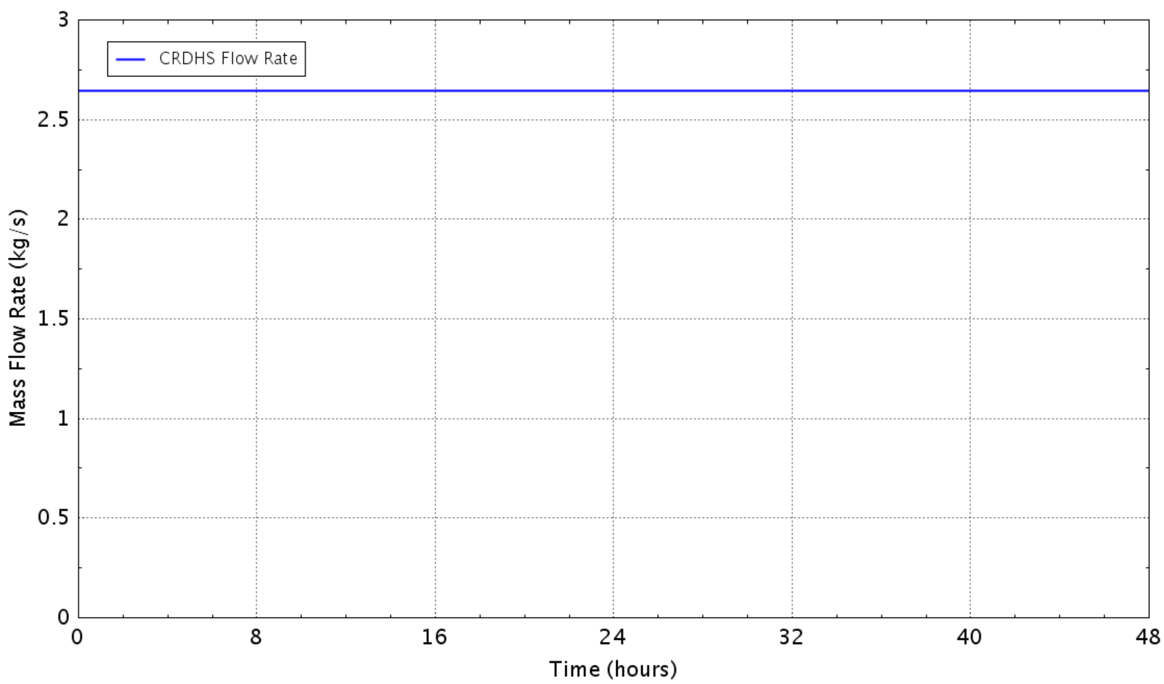

Figure E - 318 Flow rate of the control rod drive hydraulic system

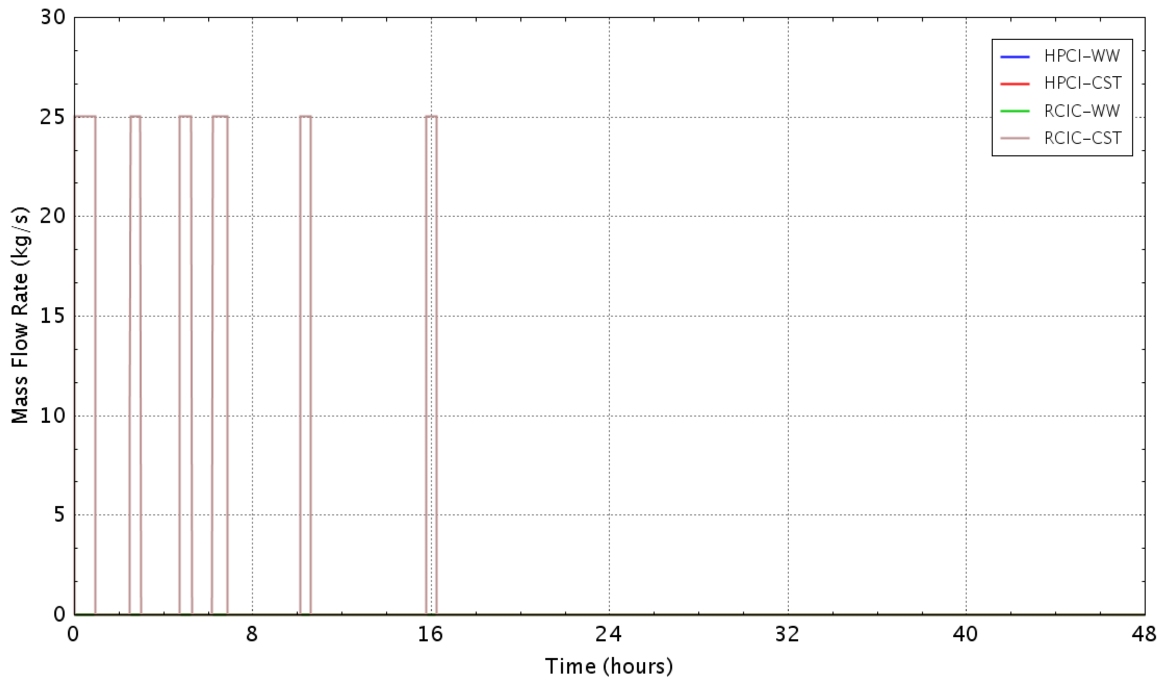

Figure E - 319 **Flow rate of the HPCI/RCIC pumps**

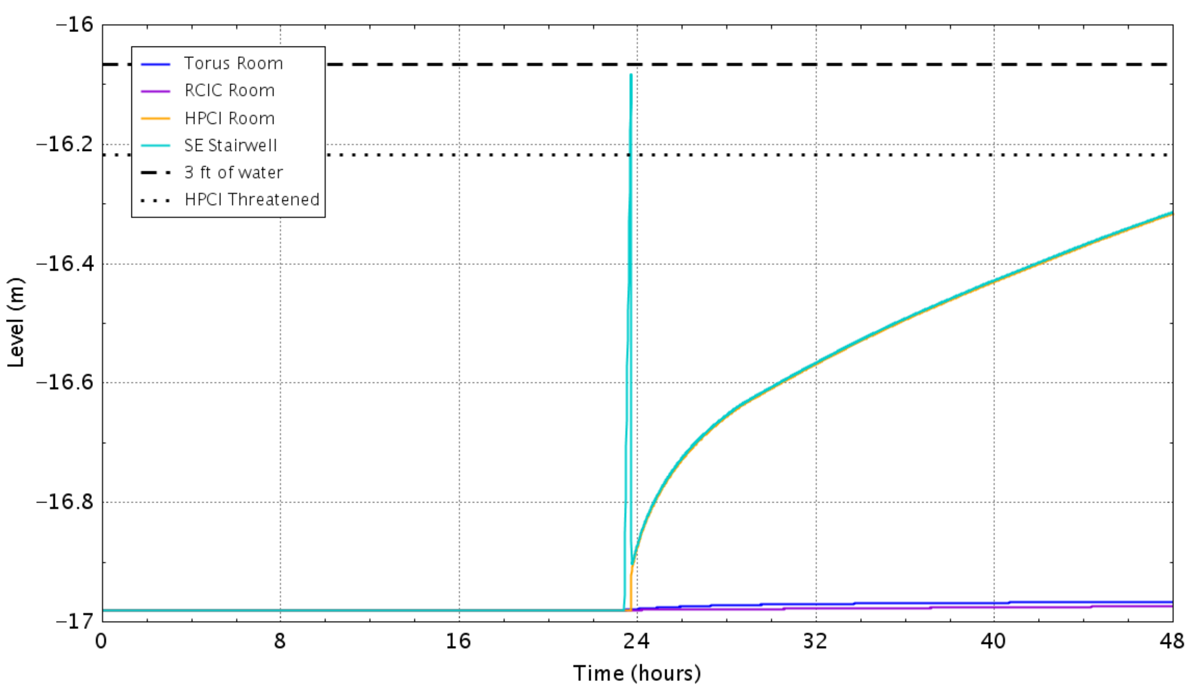

Figure E - 320 **Water level in the reactor building basement**

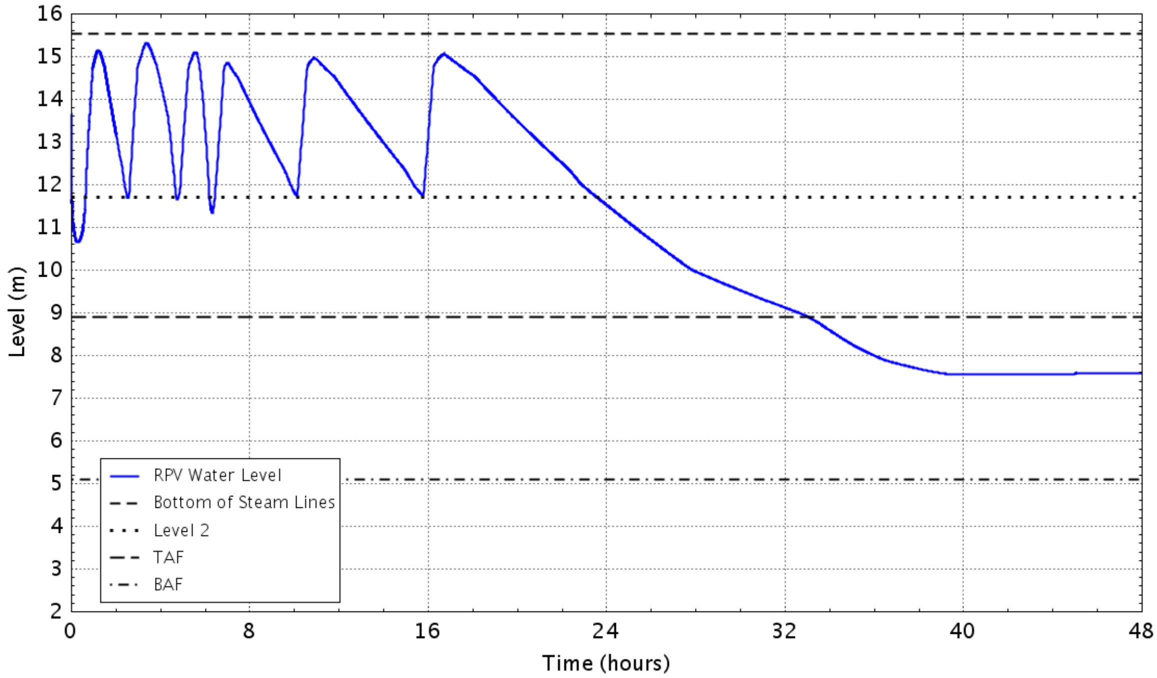

Figure E - 321 **RPV down comer water level**

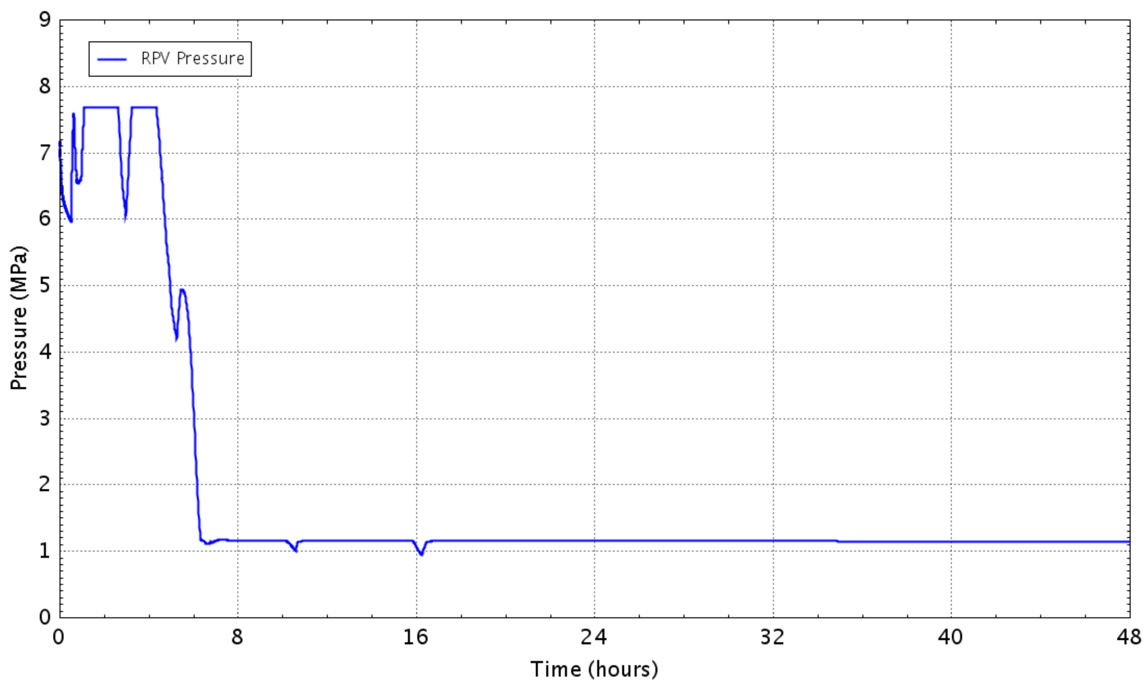

Figure E - 322 **Pressure in theRPV**

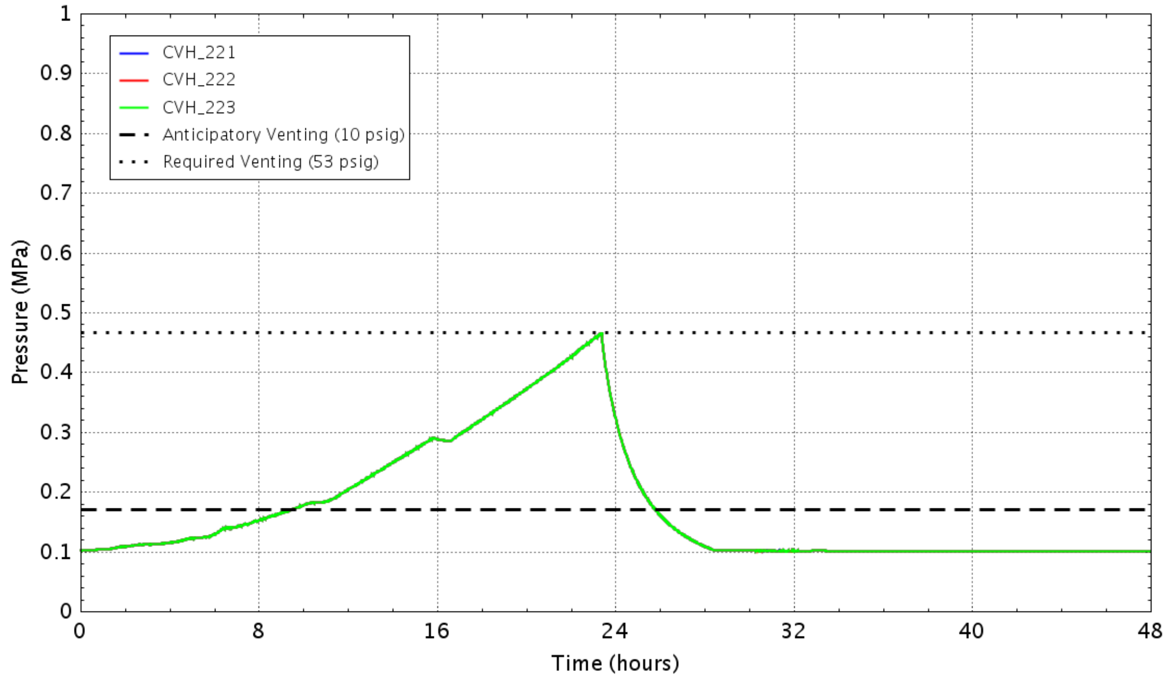

Figure E - 323 Pressure in the wetwell

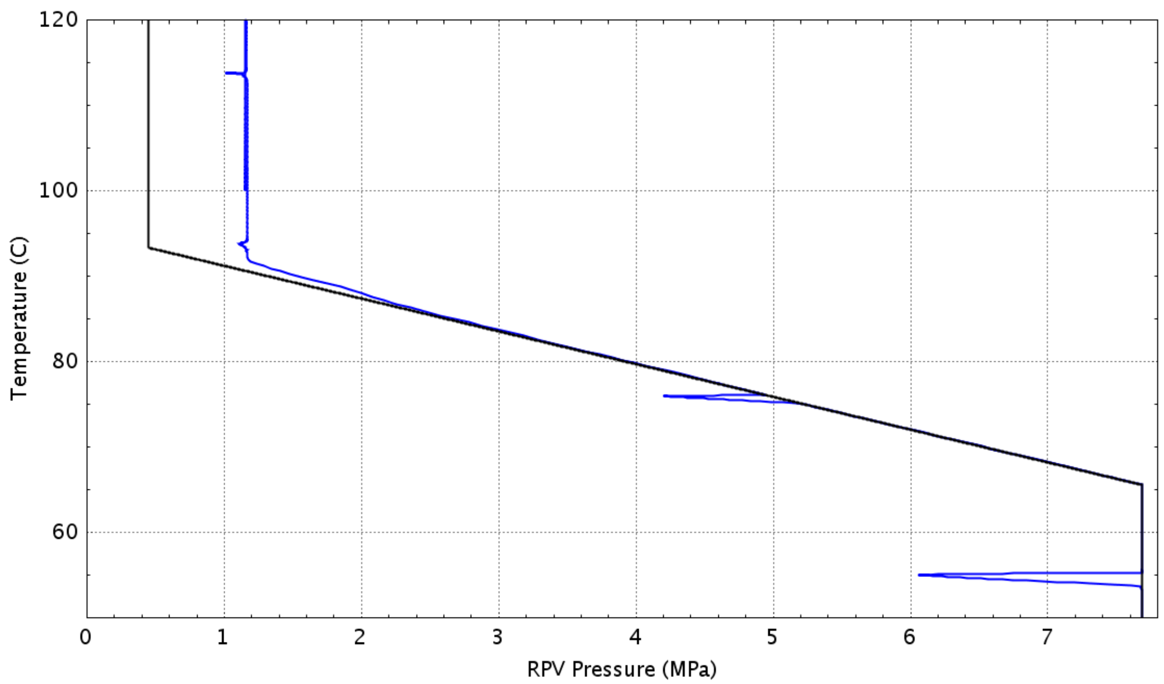

Figure E - 324 Plant status relative to the HCL curve (Graph 4 of the EOPs)

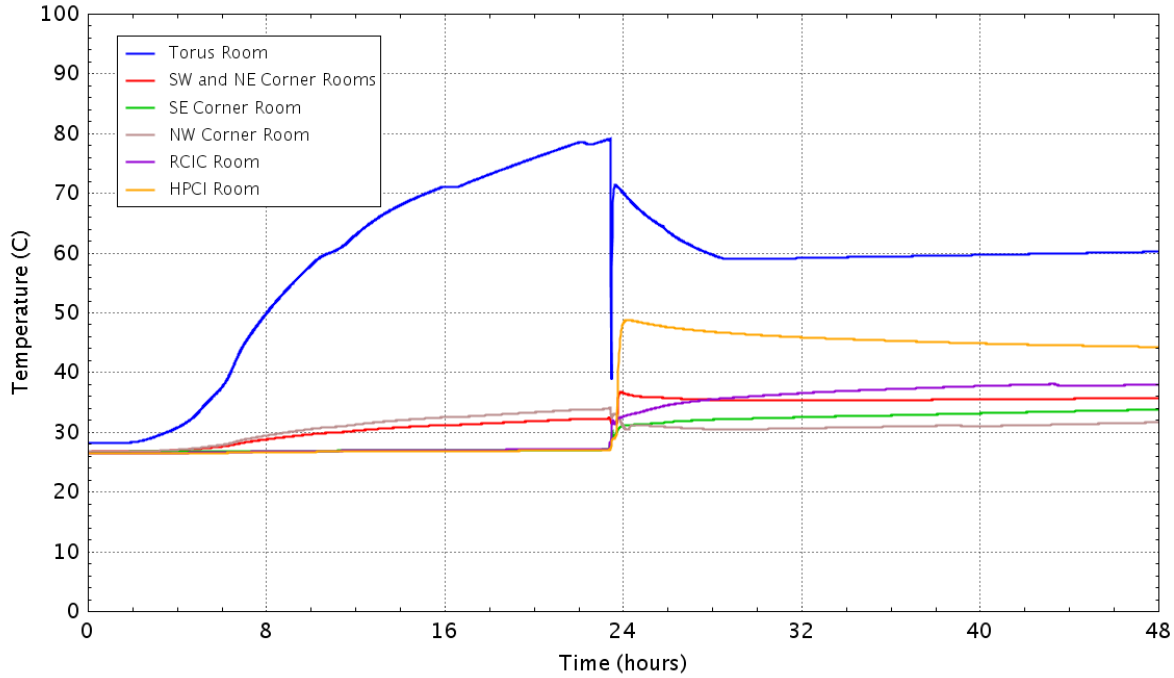

Figure E - 325 **Vapor temperature in the reactor building basement**

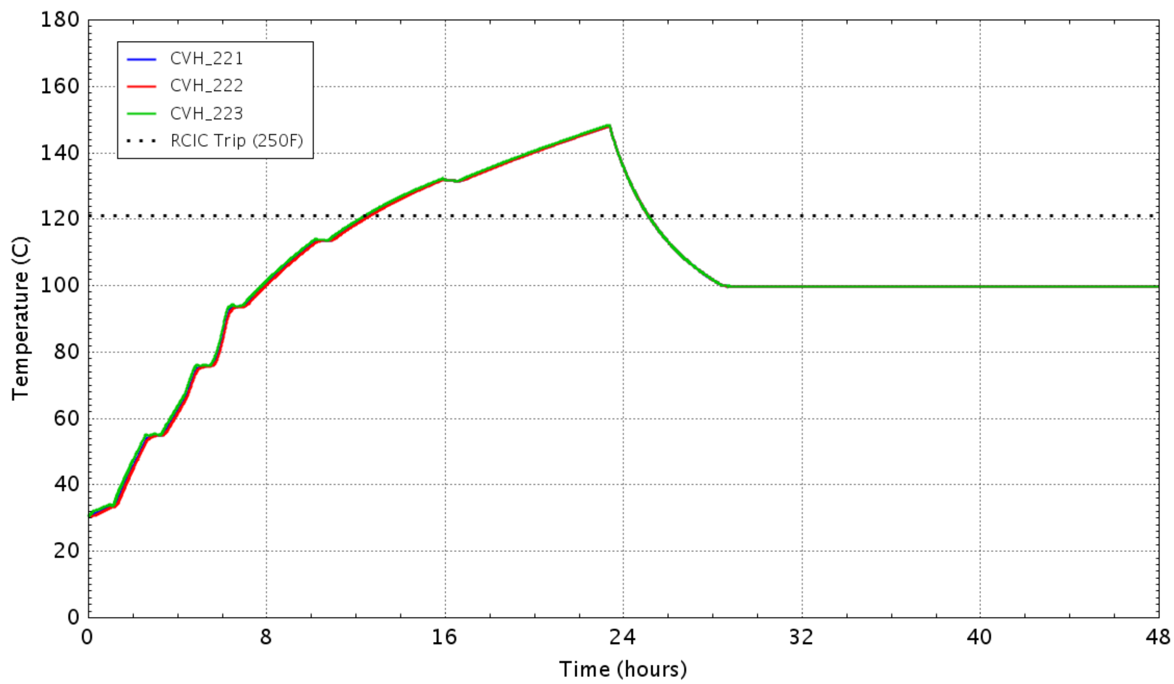

Figure E - 326 **Water temperature in the wetwell**

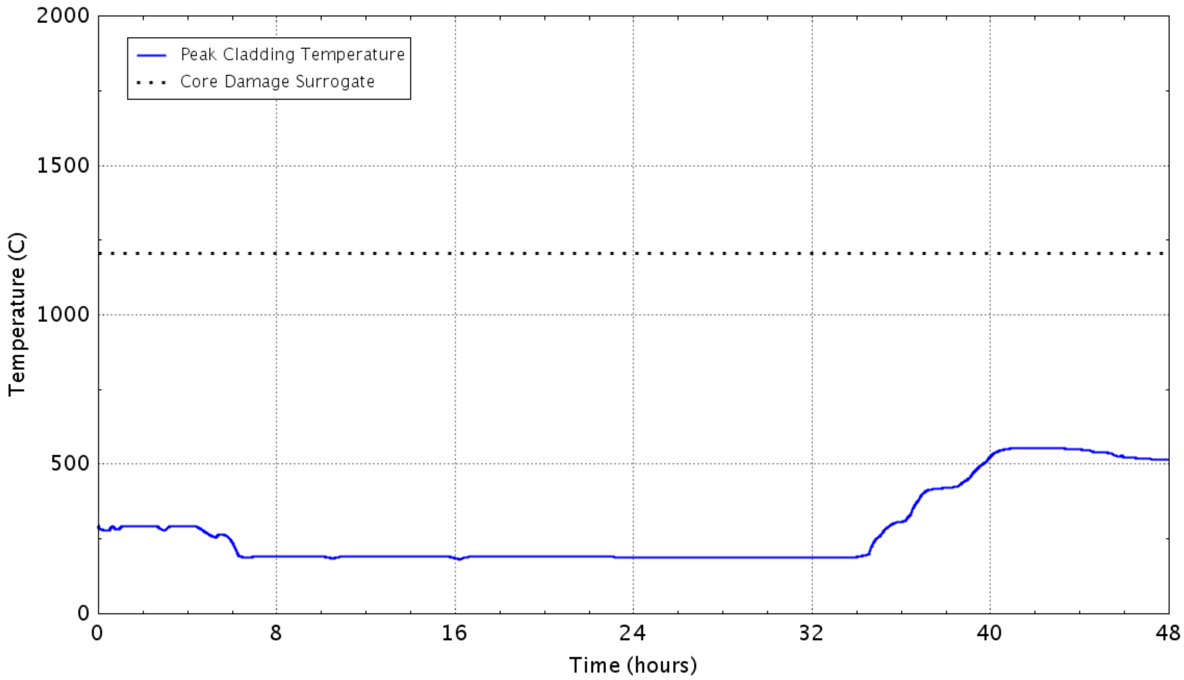

Figure E – 327 Peak temperature of the fuel cladding as a function oftime

E.2.18 Case 32: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 2-in. Drywell Bypass, RCIC FullyFunctional

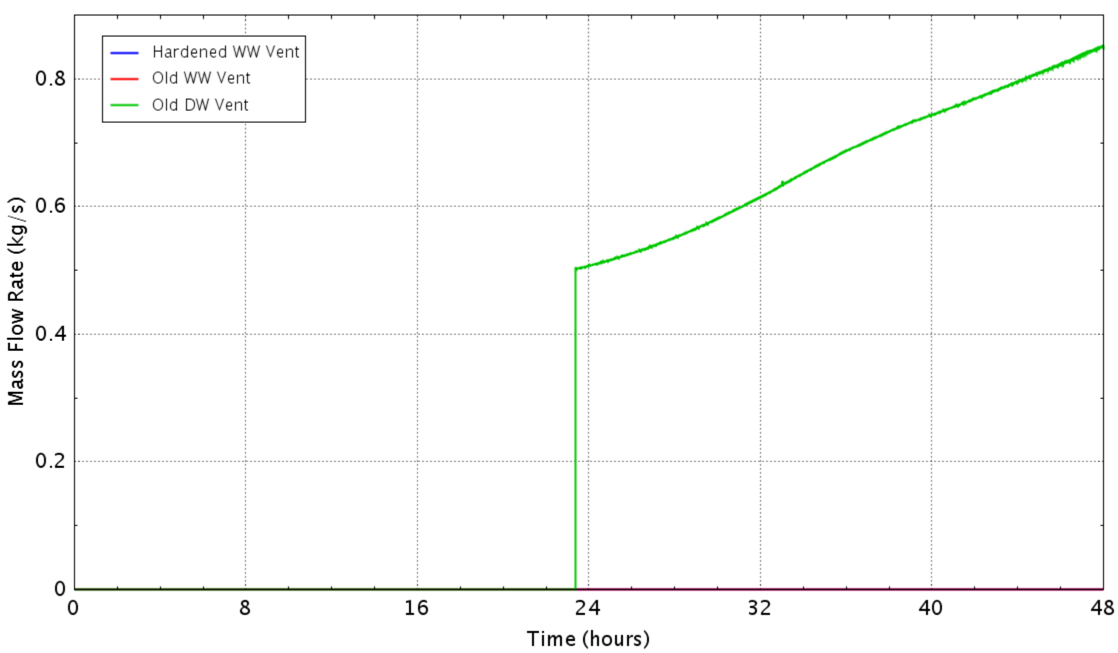

Figure E - 328 Flow rate of the containment vents

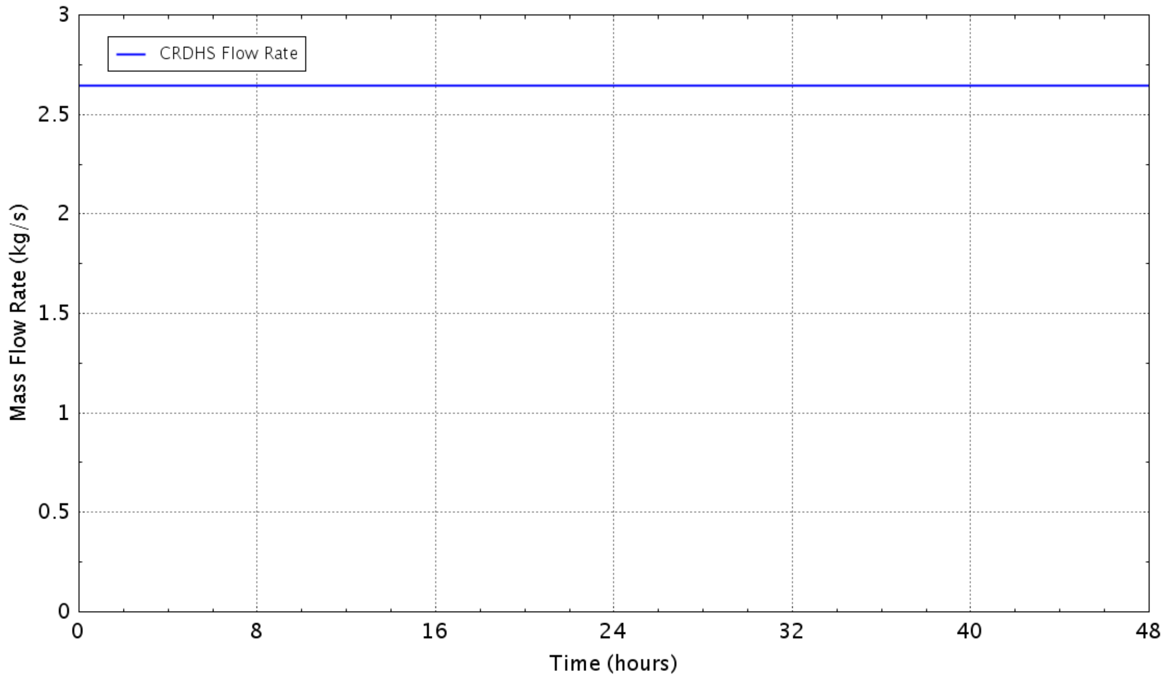

Figure E - 329 **Flow rate of the control rod drive hydraulic system**

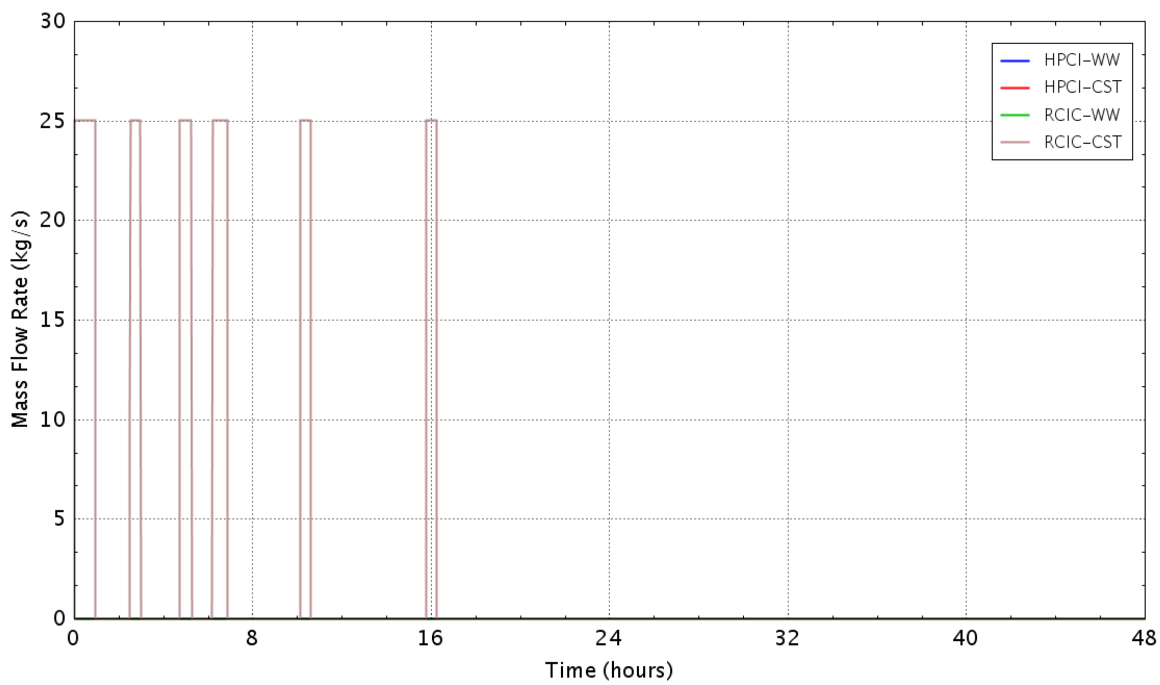

Figure E - 330 **Flow rate of the HPCI/RCIC pumps**

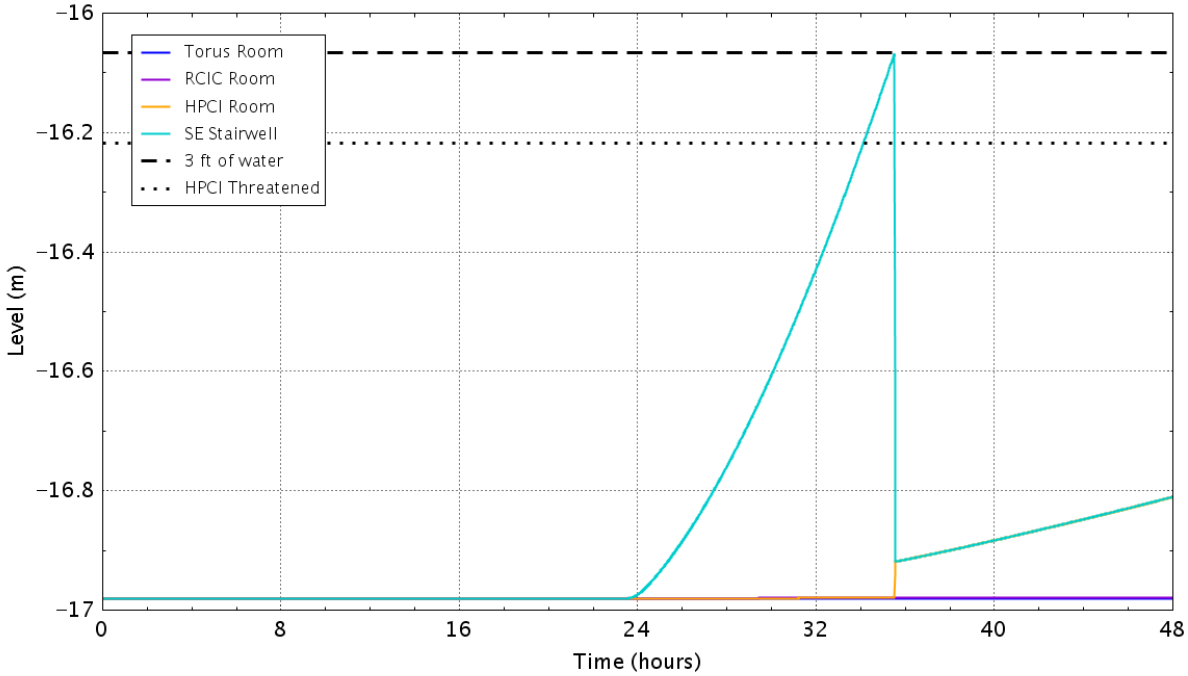

Figure E - 331 Water level in the reactor building basement

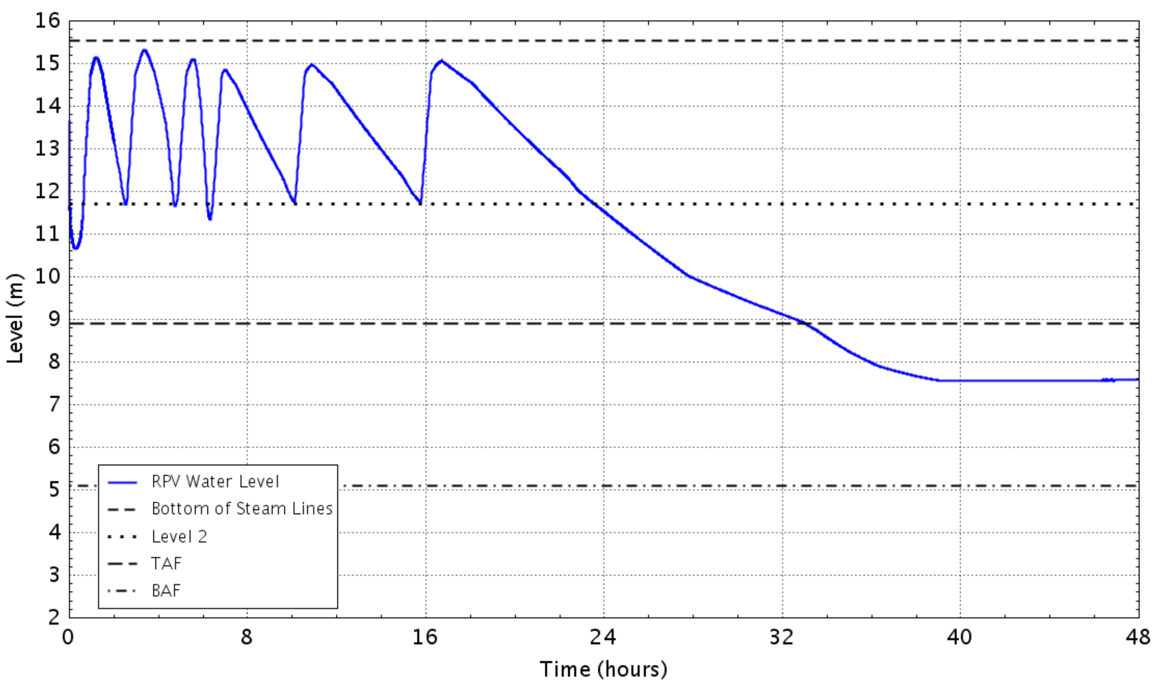

Figure E - 332 RPV down comer water level

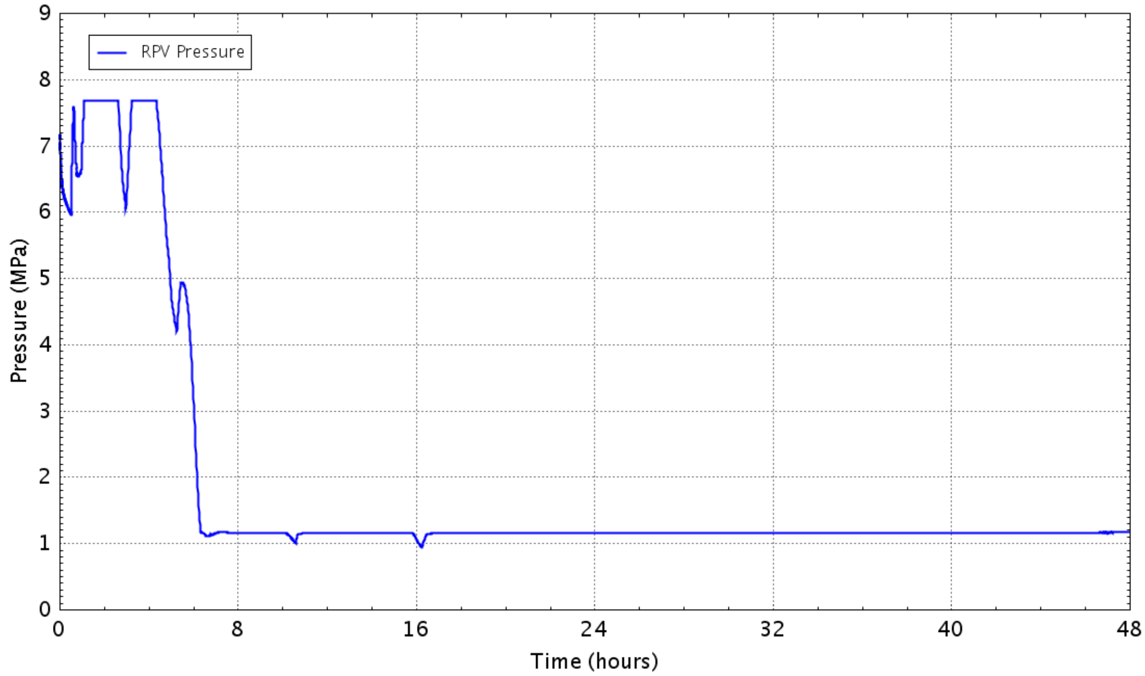

Figure E - 333 Pressure in theRPV

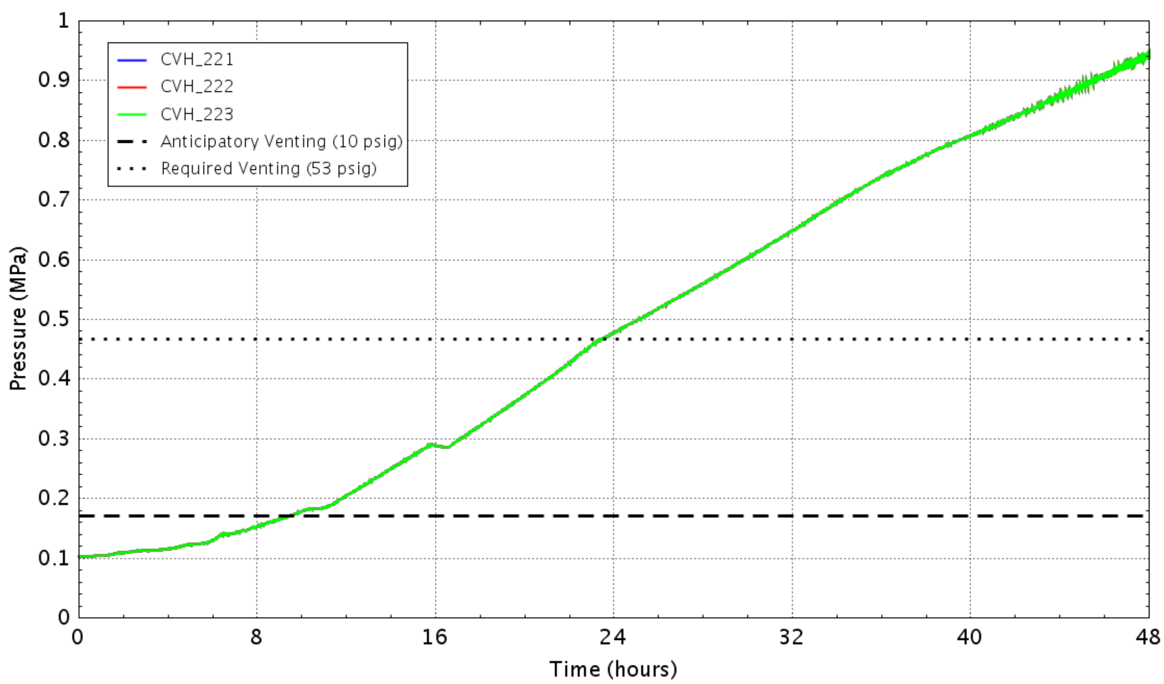

Figure E - 334 Pressure in the wetwell

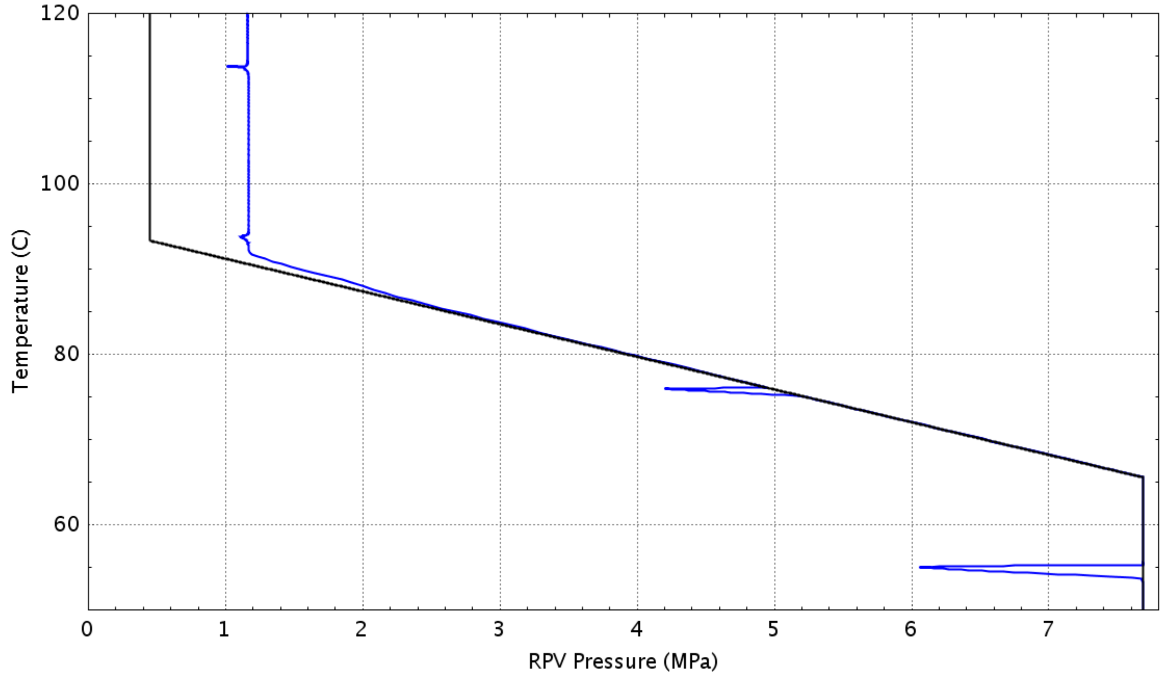

Figure E – 335 Plant status relative to the HCL curve (Graph 4 of the EOPs)

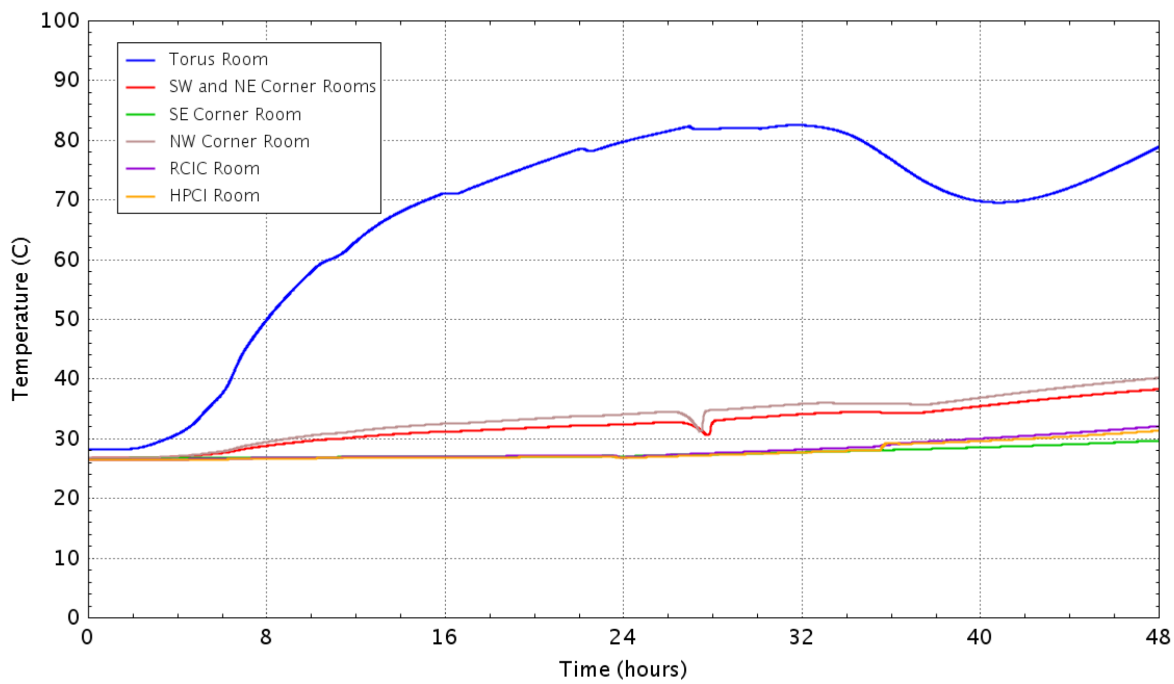

Figure E - 336 Vapor temperature in the reactor building basement

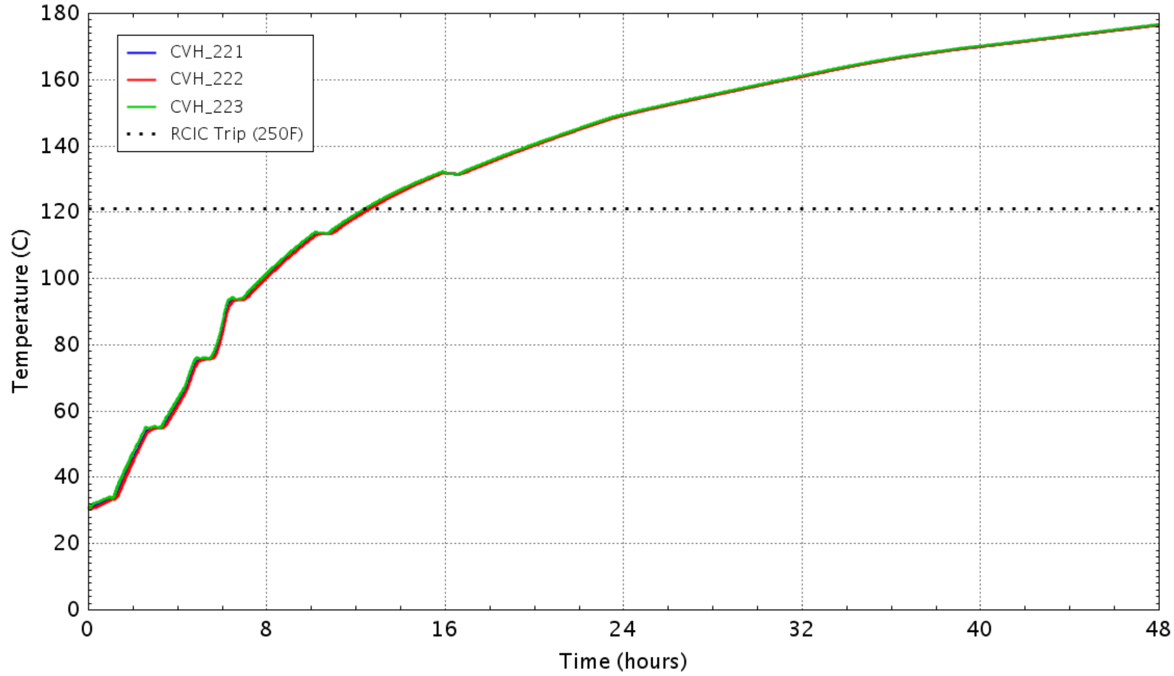

Figure E - 337 **Water temperature in the wetwell**

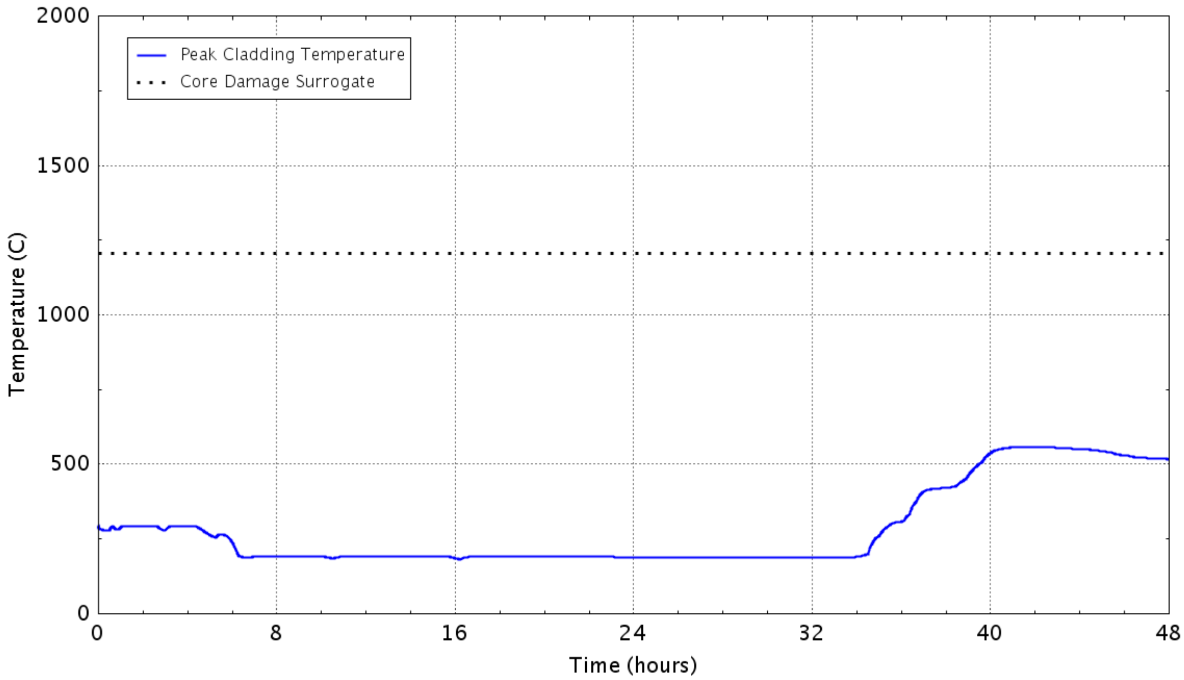

Figure E – 338 **Peak temperature of the fuel cladding as a function oftime**

E.2.19 Case 33: LOMFW-25, Containment Failure at 53 psig, ContainmentVenting via the 2-in. Drywell Bypass, RCIC 50%Degraded

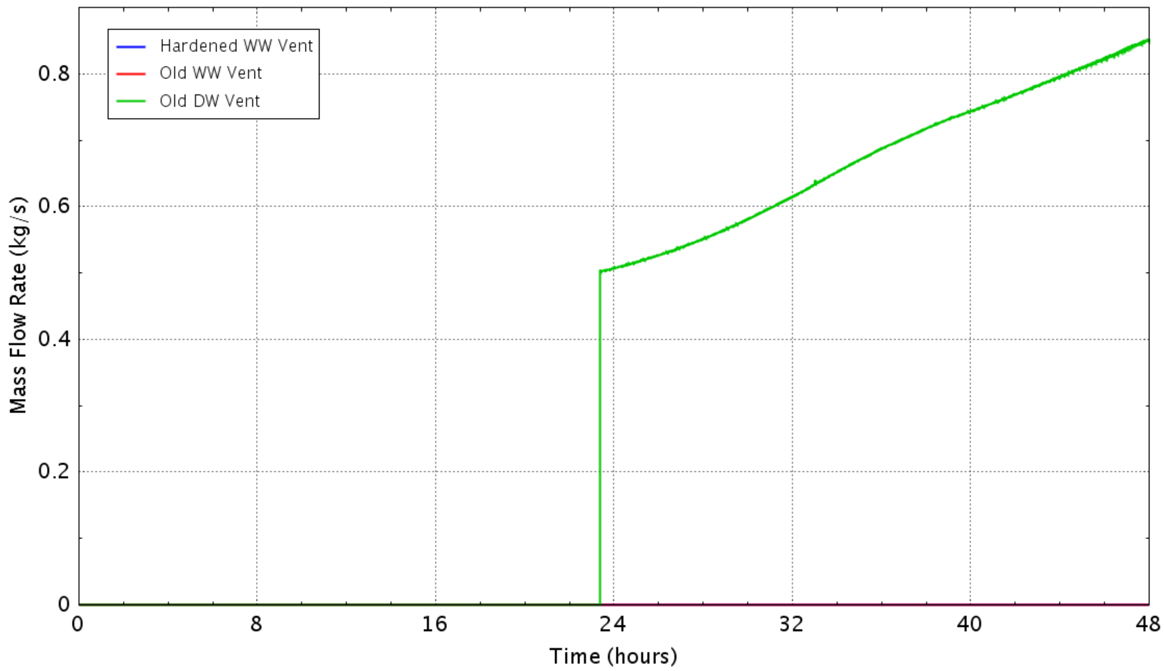

Figure E - 339 Flow rate of the containment vents

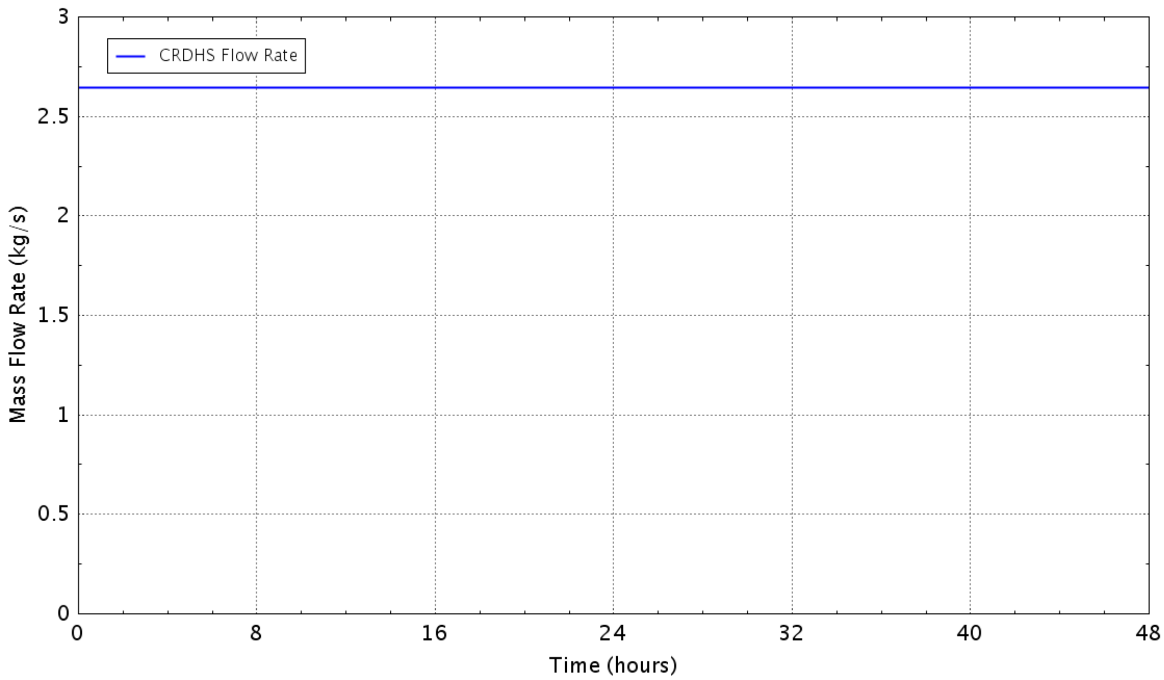

Figure E - 340 Flow rate of the control rod drive hydraulic system

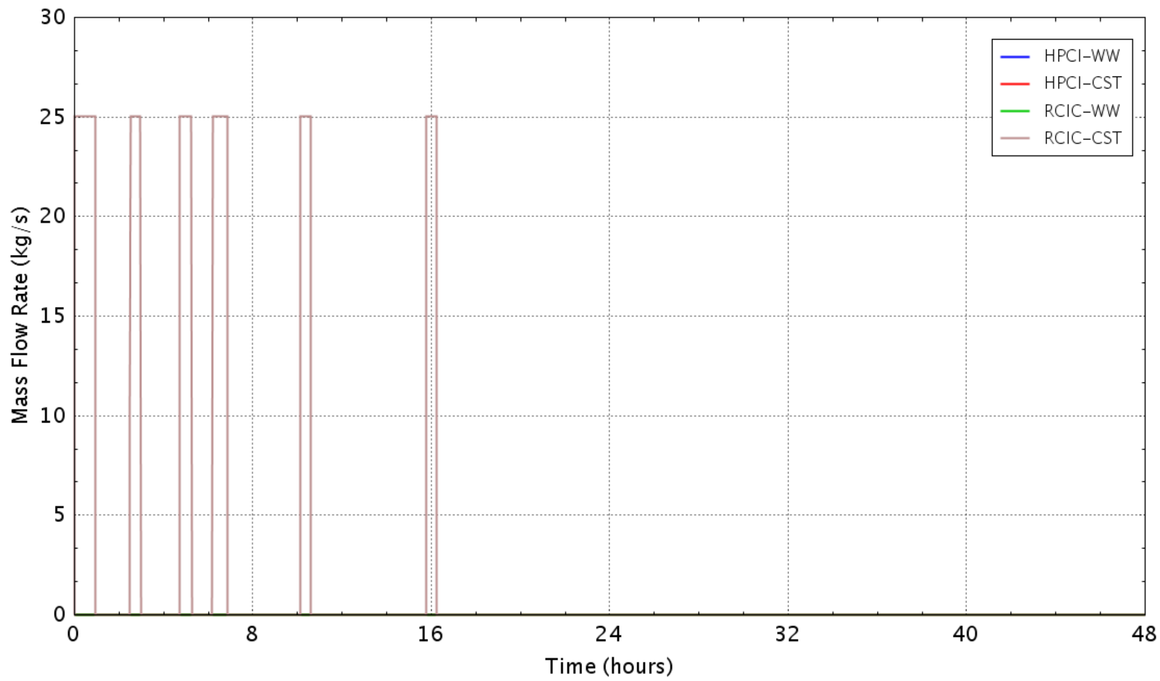

Figure E - 341 Flow rate of the HPCI/RCIC pumps

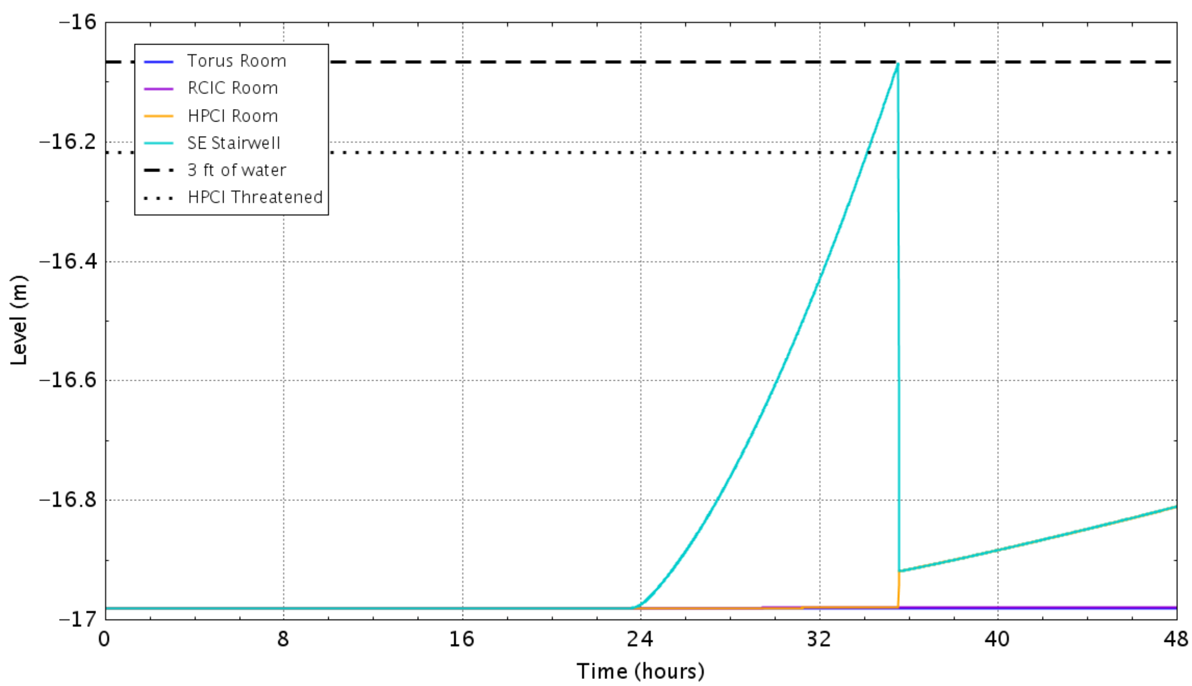

Figure E - 342 Water level in the reactor building basement

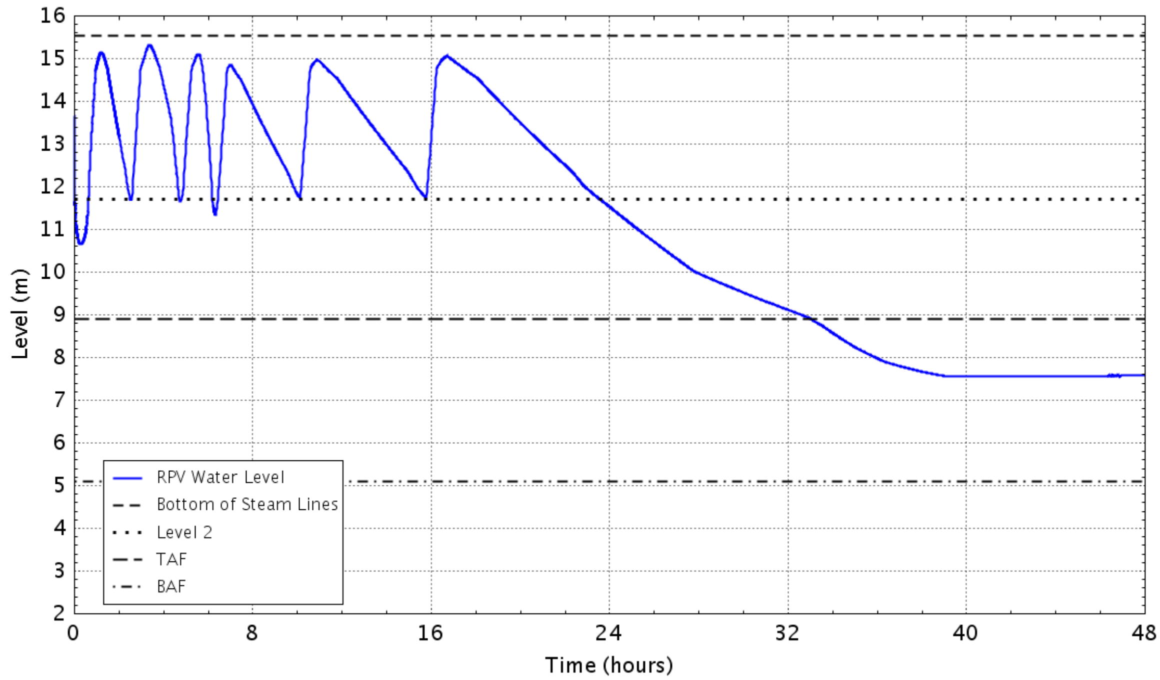

Figure E - 343 RPV down comer water level

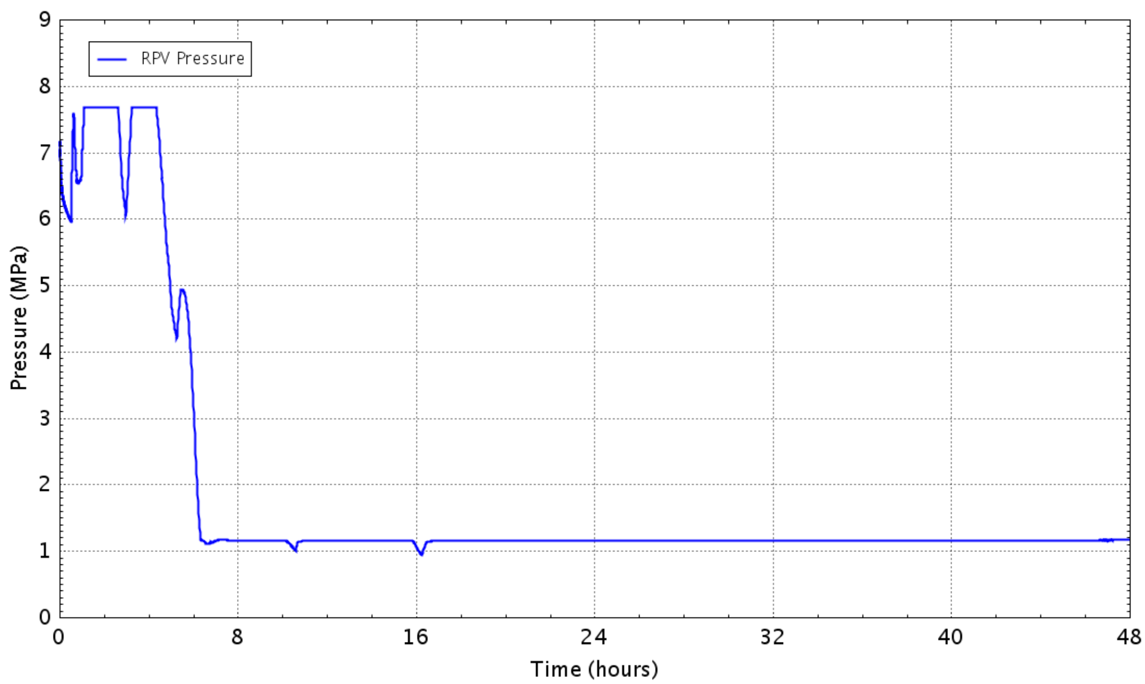

Figure E - 344 Pressure in theRPV

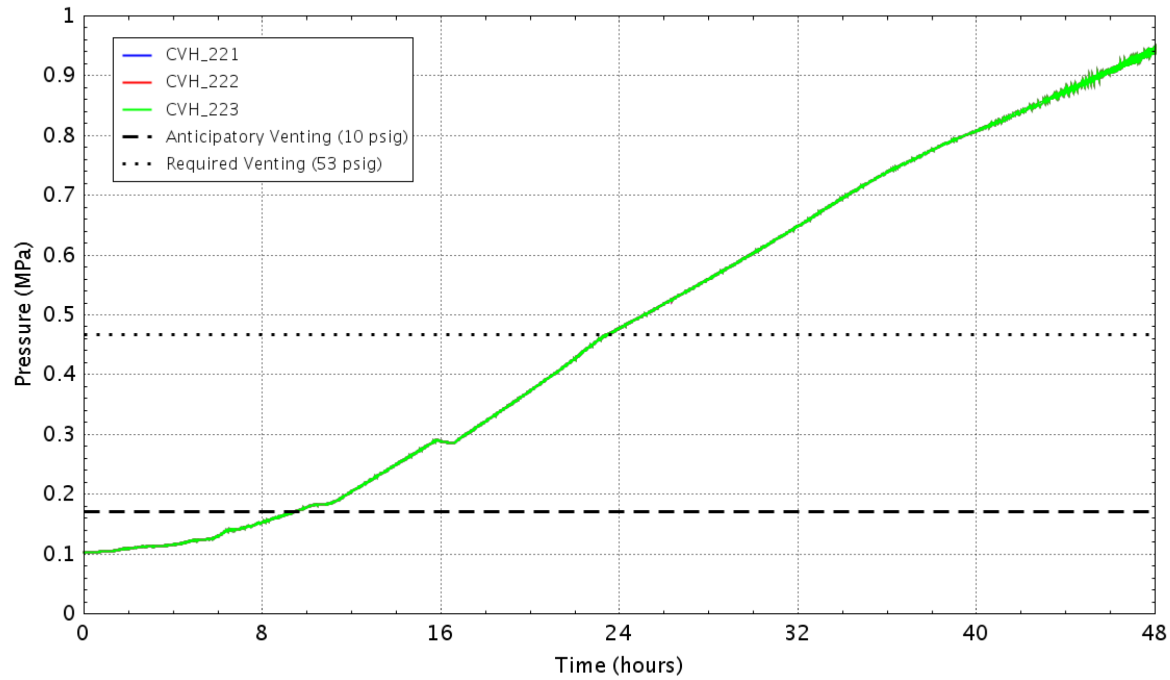

Figure E - 345 **Pressure in the wetwell**

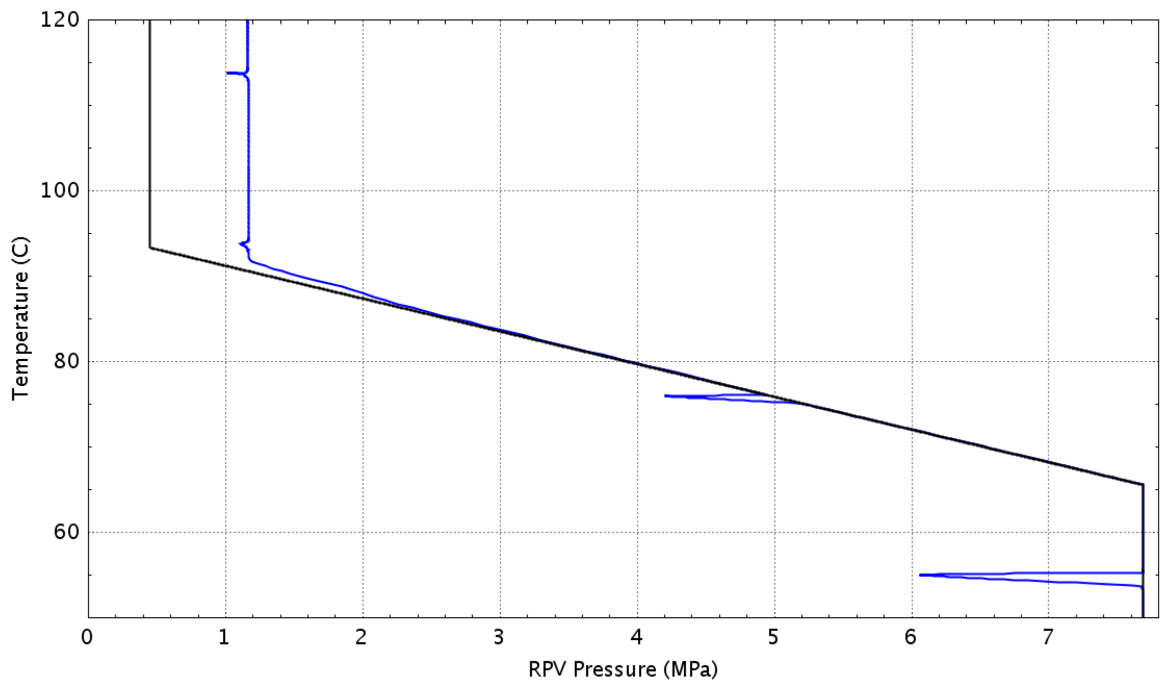

Figure E – 346 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

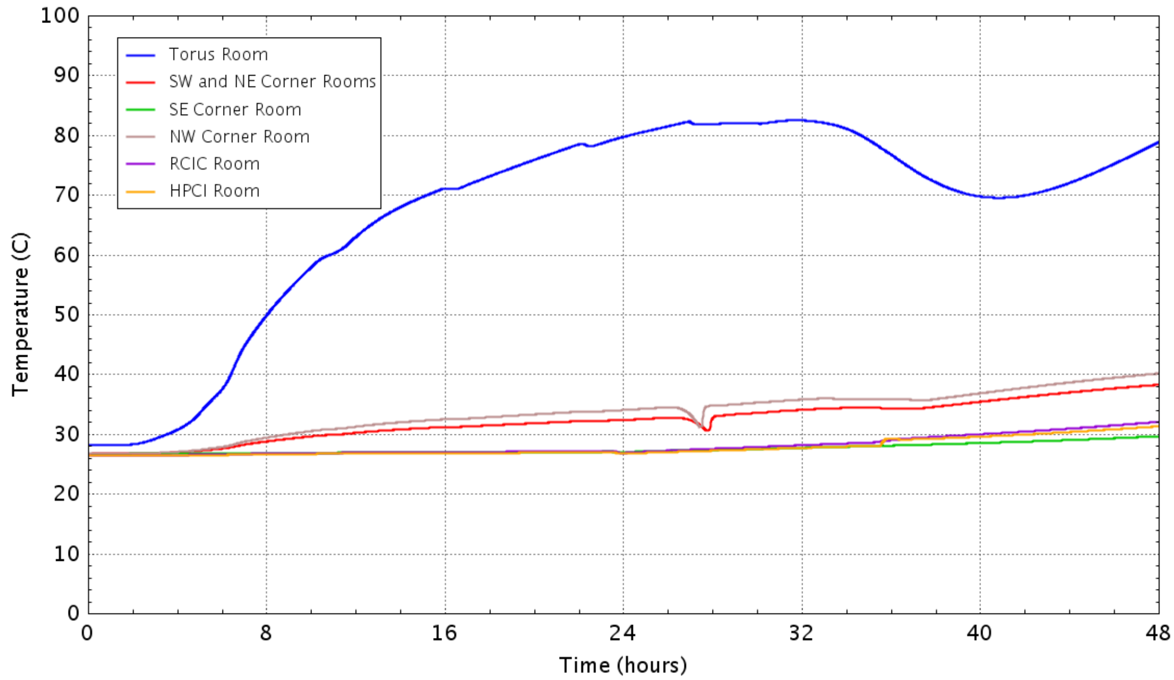

Figure E - 347 Vapor temperature in the reactor building basement

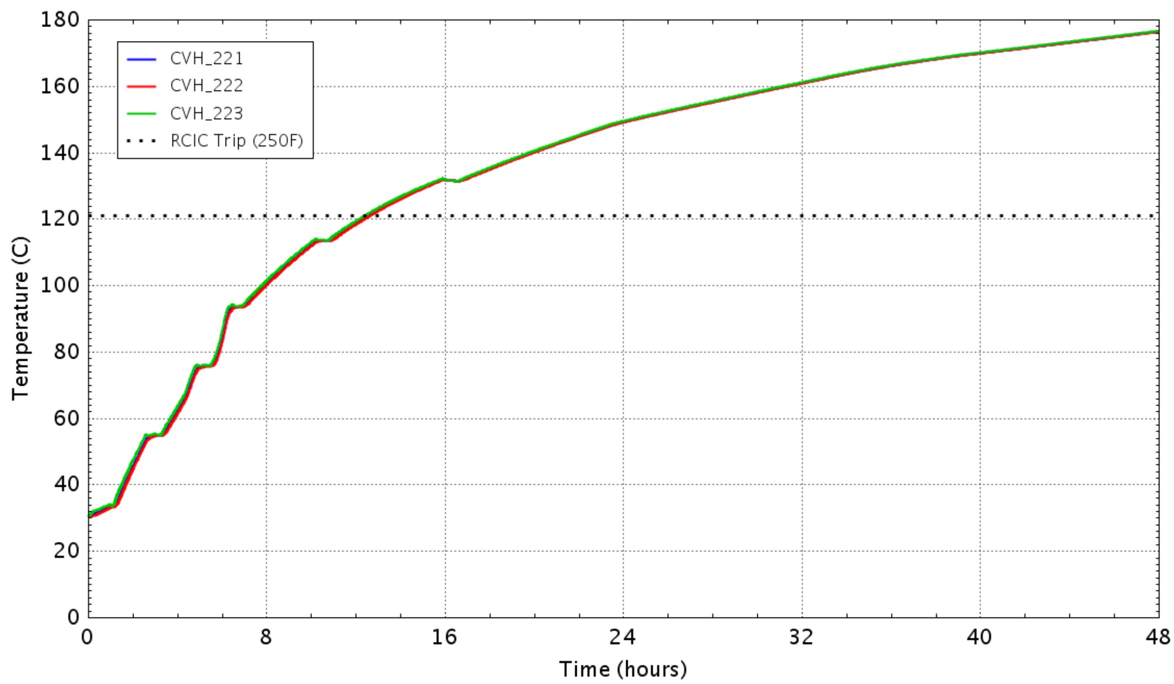

Figure E - 348 Water temperature in the wetwell

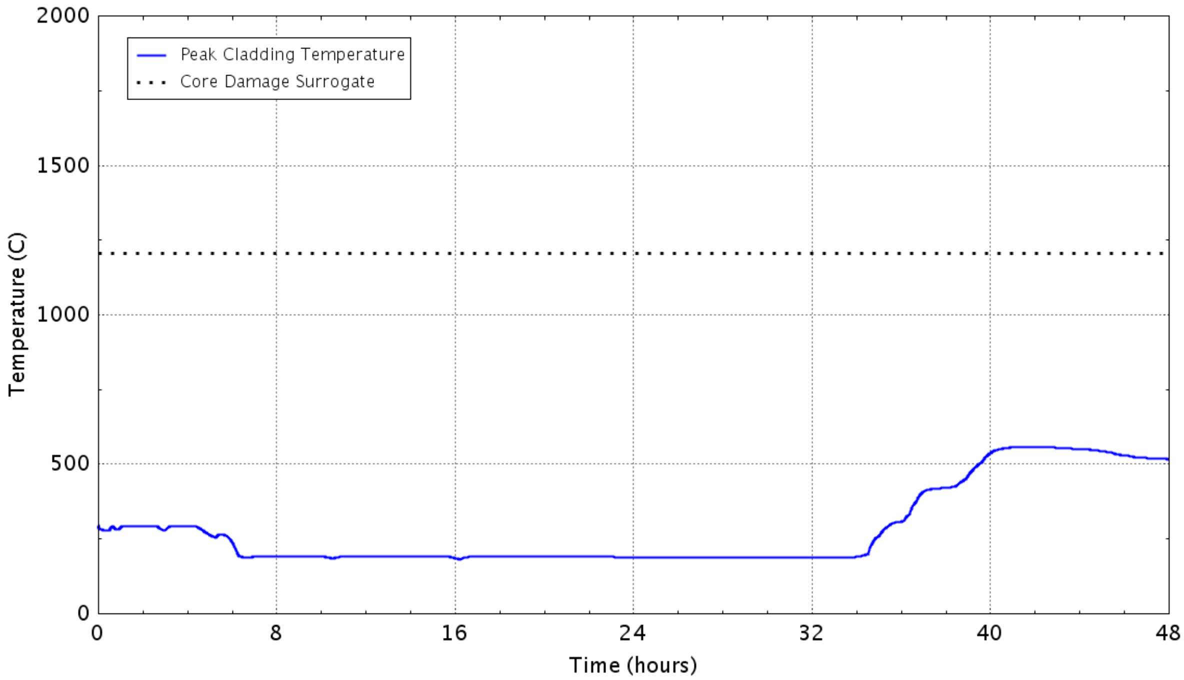

Figure E – 349 Peak temperature of the fuel cladding as a function oftime

E.2.20 Case 34: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 18-in. Drywell Vent, RCIC Fully Functional

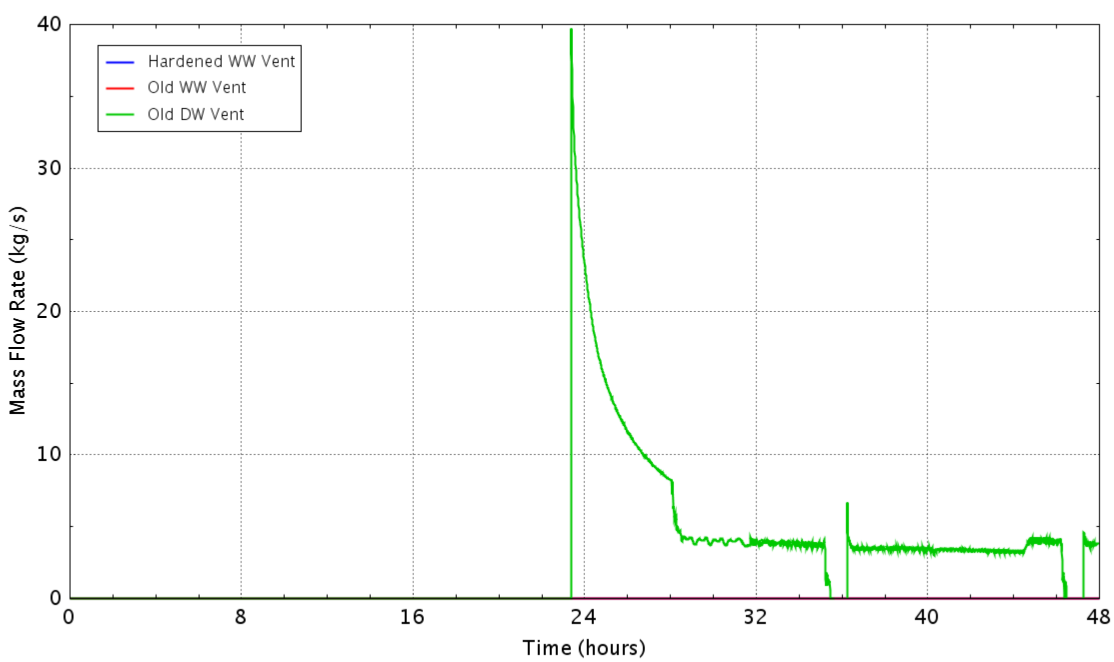

Figure E - 350 Flow rate of the containment vents

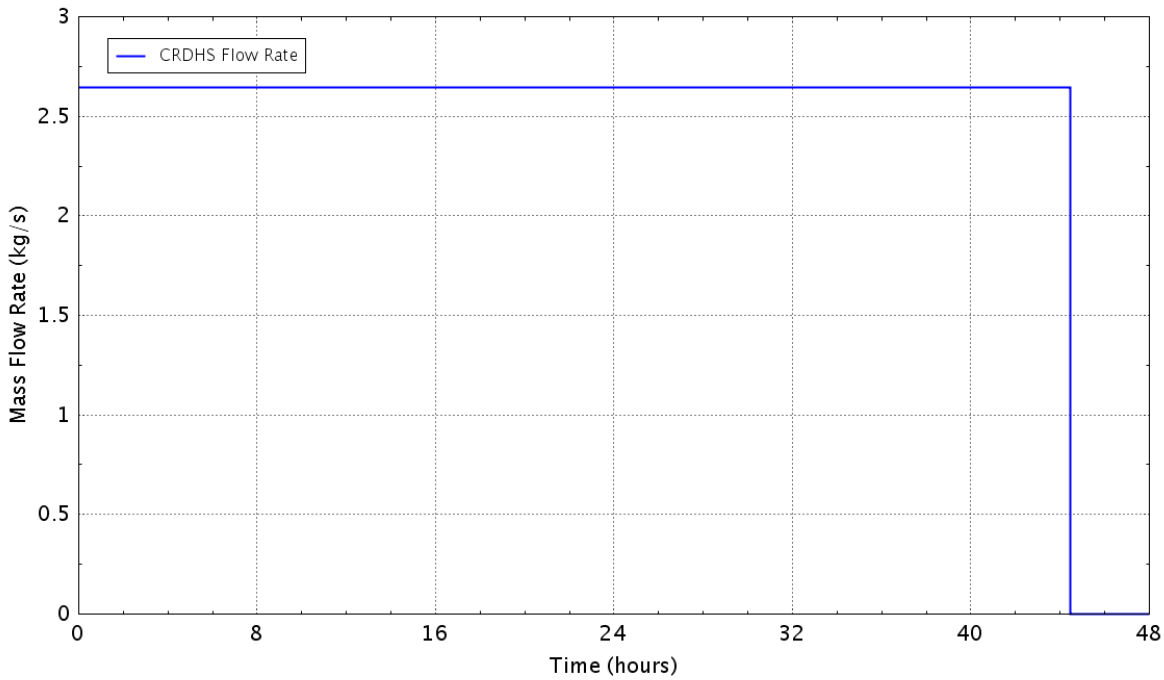

Figure E - 351 **Flow rate of the control rod drive hydraulic system**

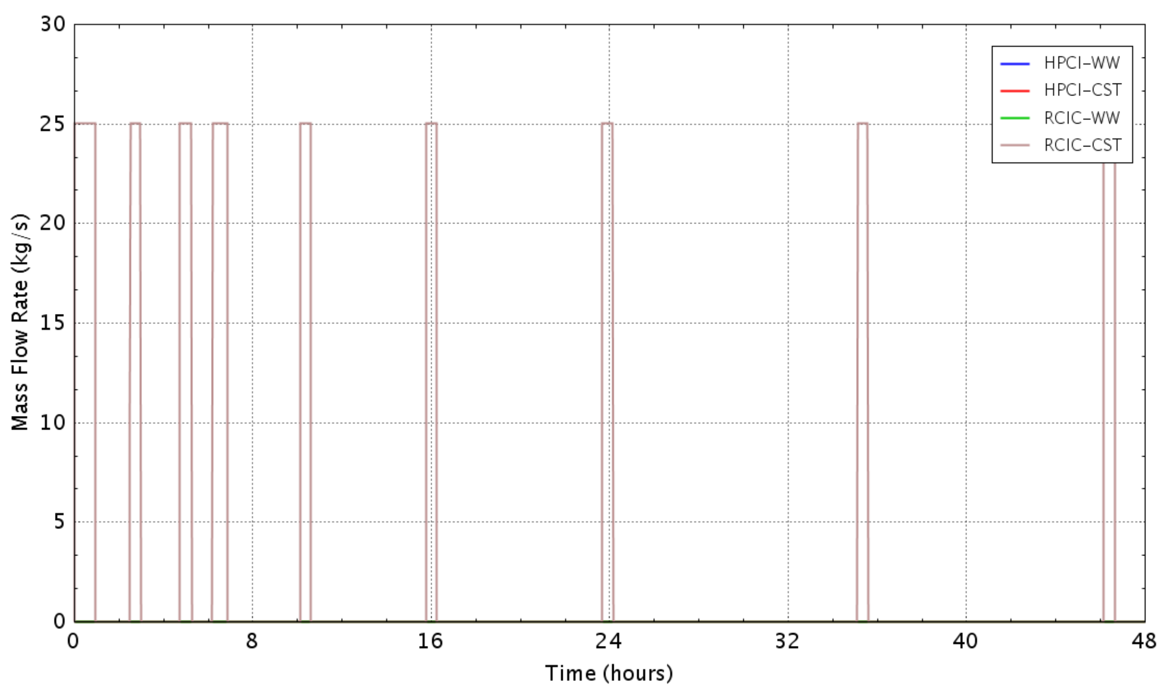

Figure E - 352 **Flow rate of the HPCI/RCIC pumps**

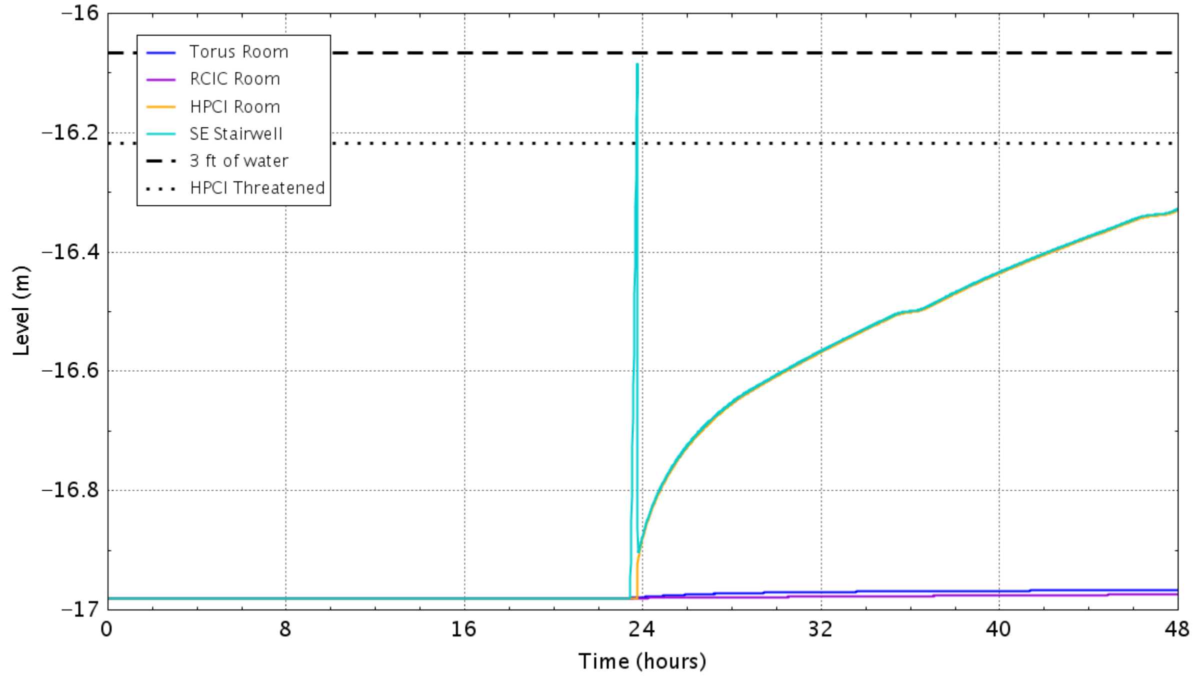

Figure E - 353 Water level in the reactor building basement

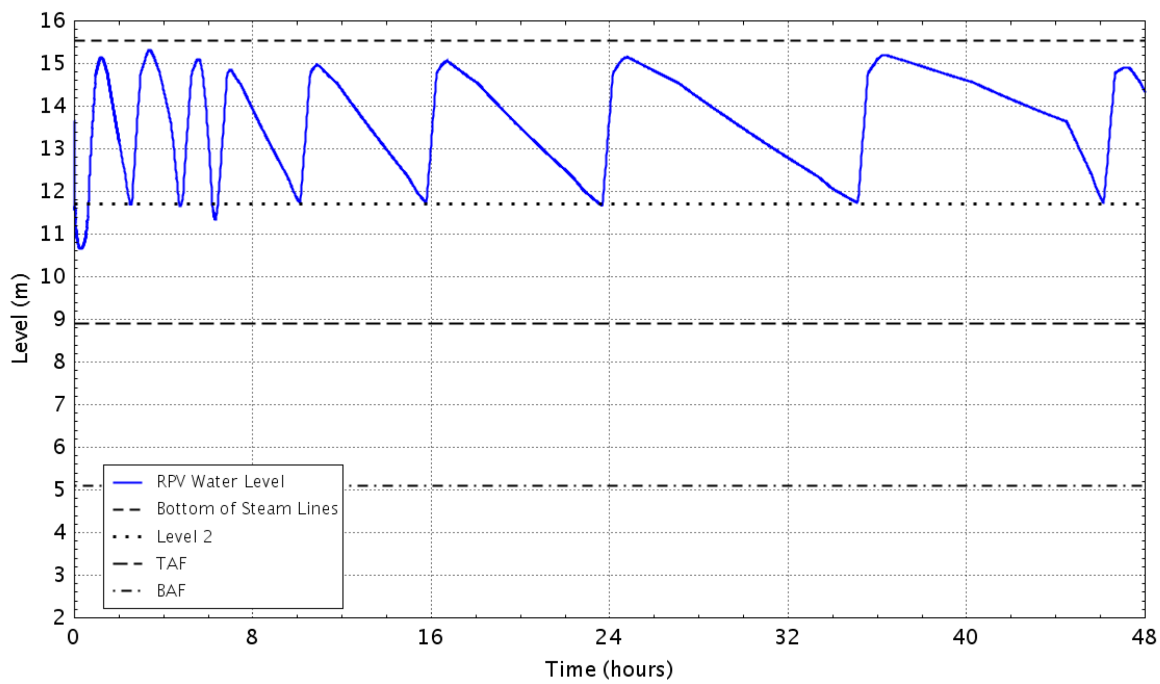

Figure E - 354 RPV down comer water level

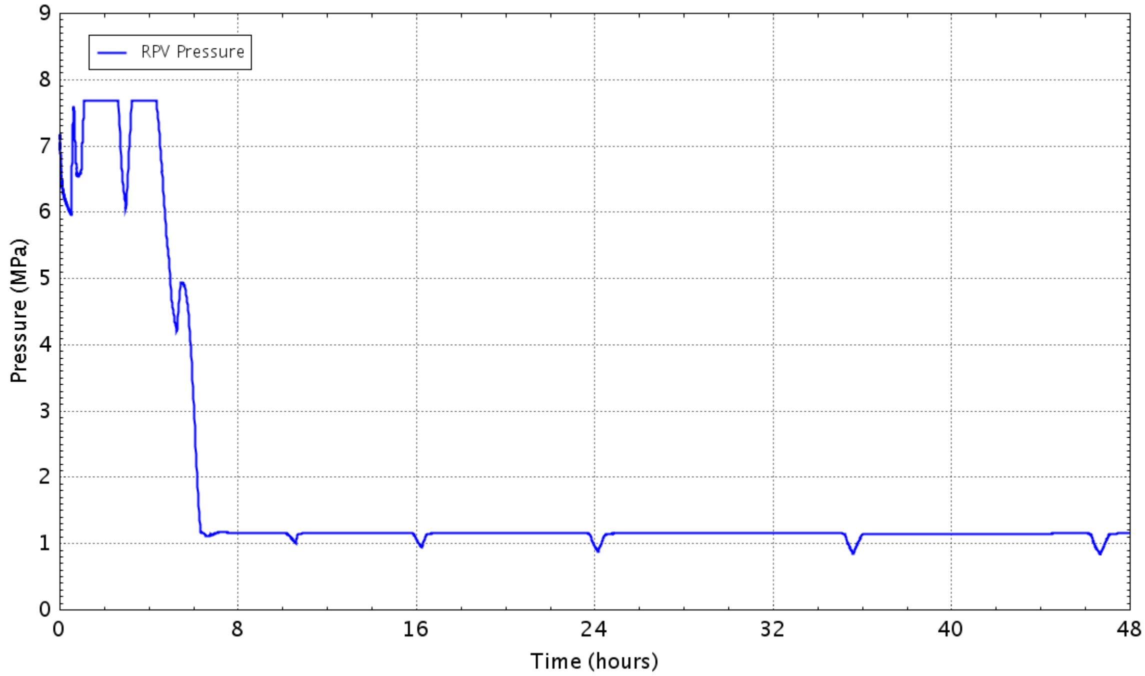

Figure E - 355 **Pressure in theRPV**

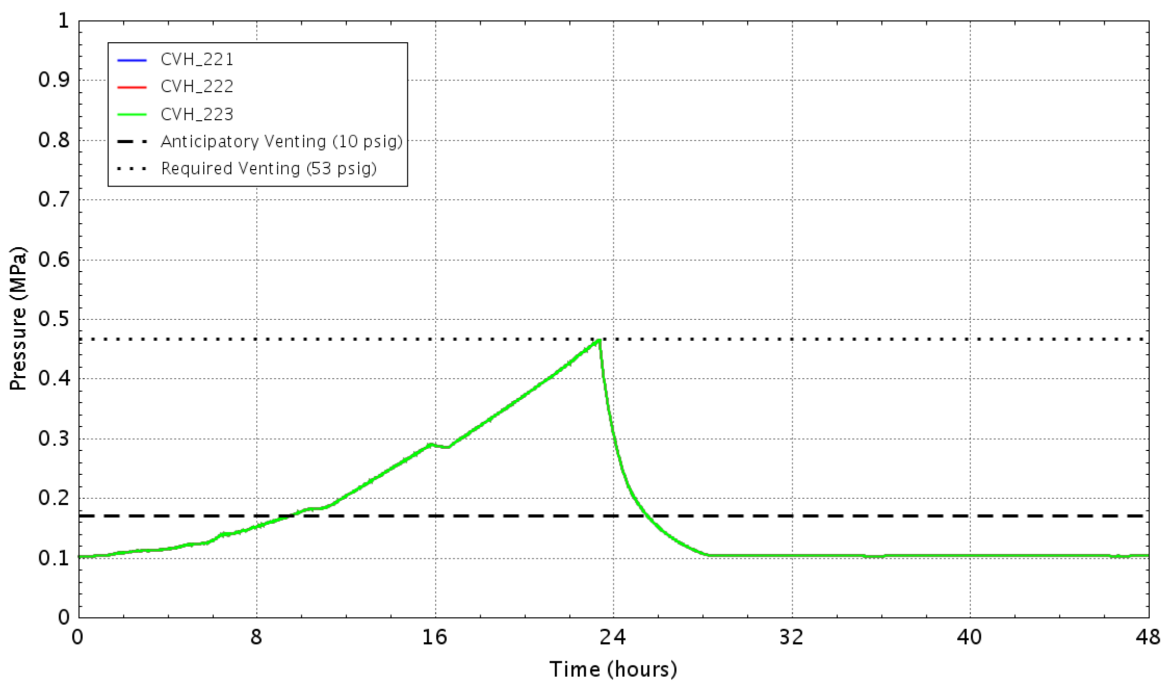

Figure E - 356 **Pressure in the wetwell**

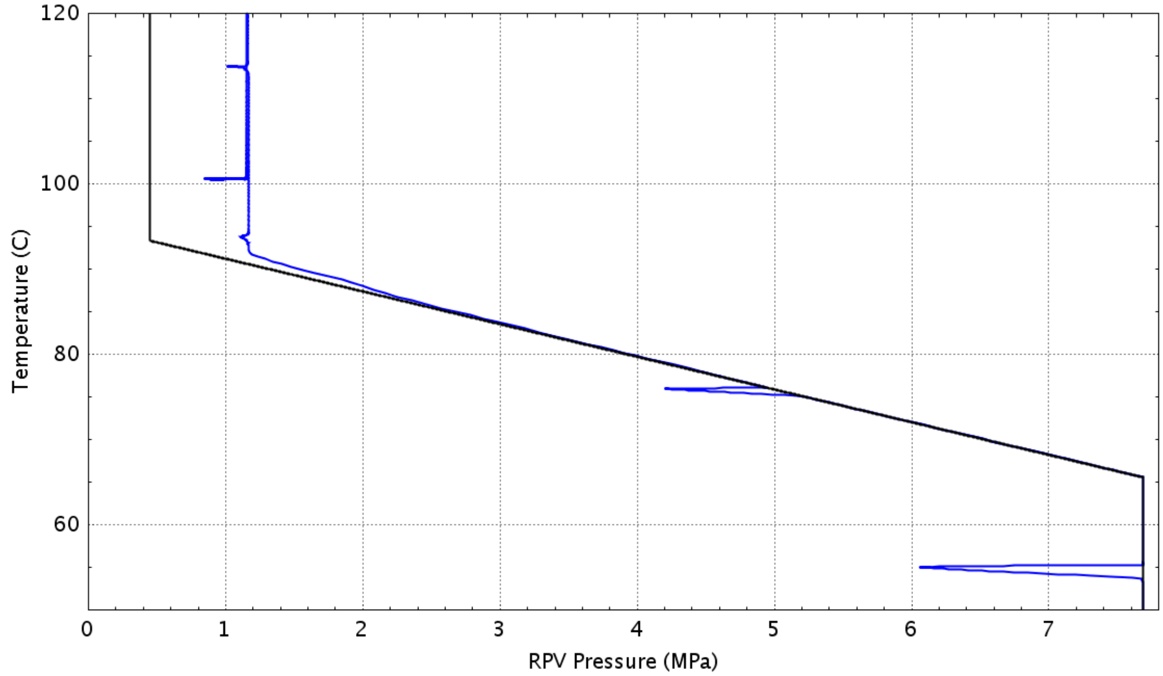

Figure E – 357 Plant status relative to the HCL curve (Graph 4 of the EOPs)

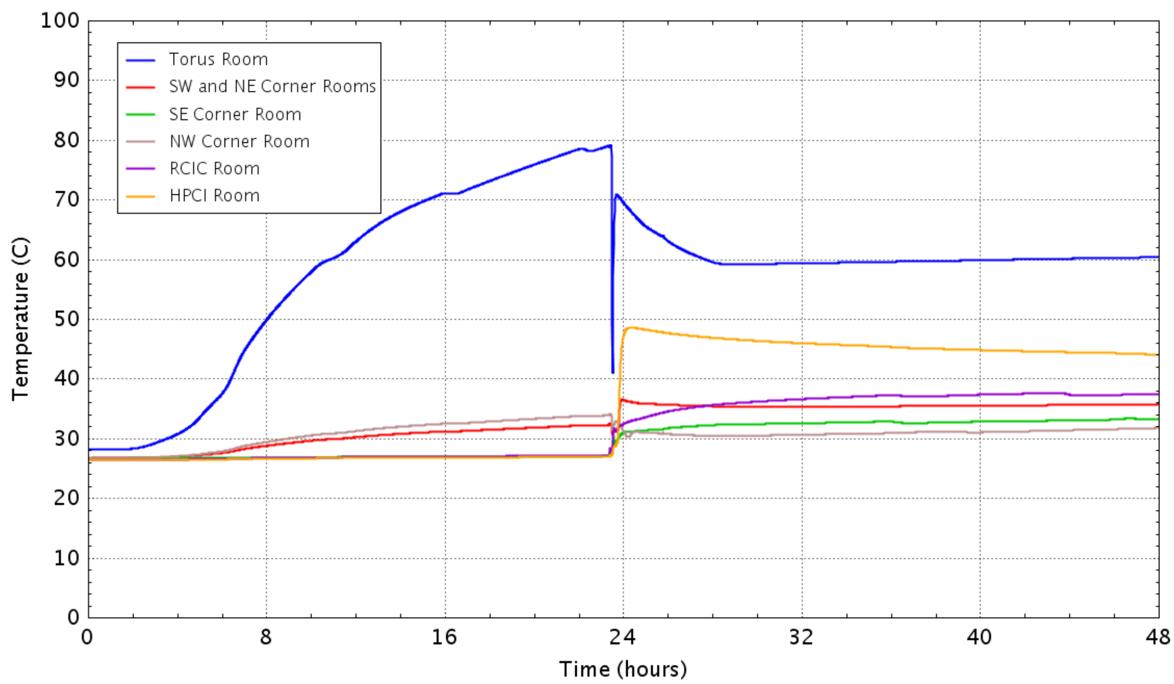

Figure E – 358 Vapor temperature in the reactor buildingbasement

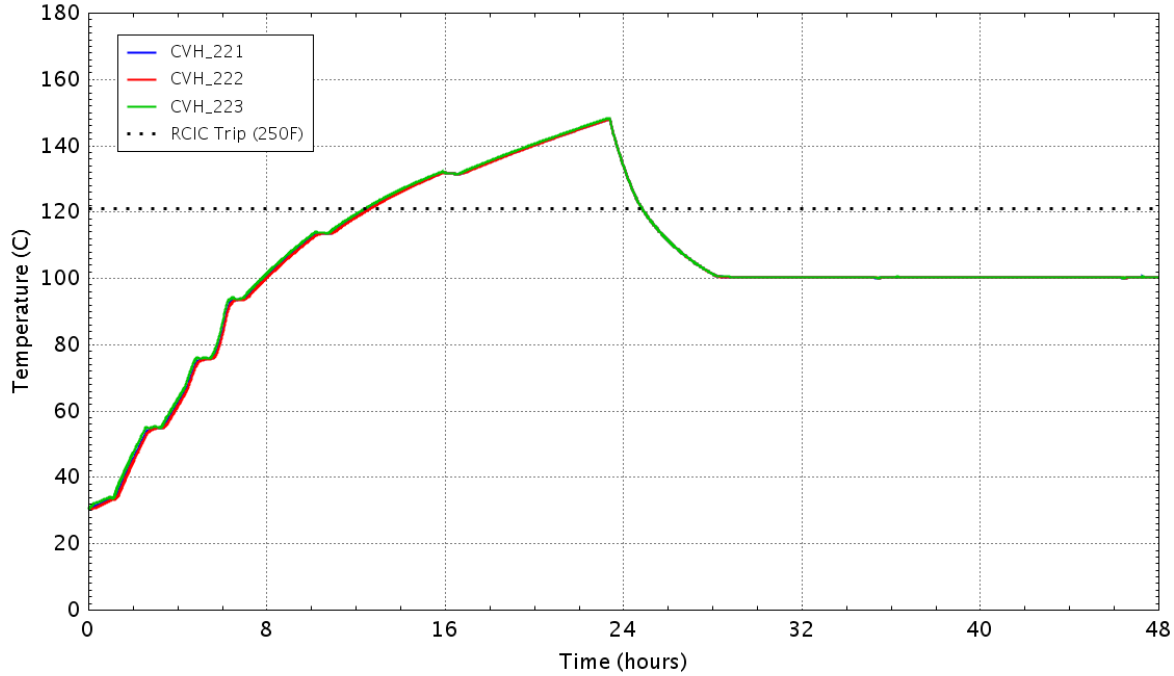

Figure E - 359 Water temperature in the wetwell

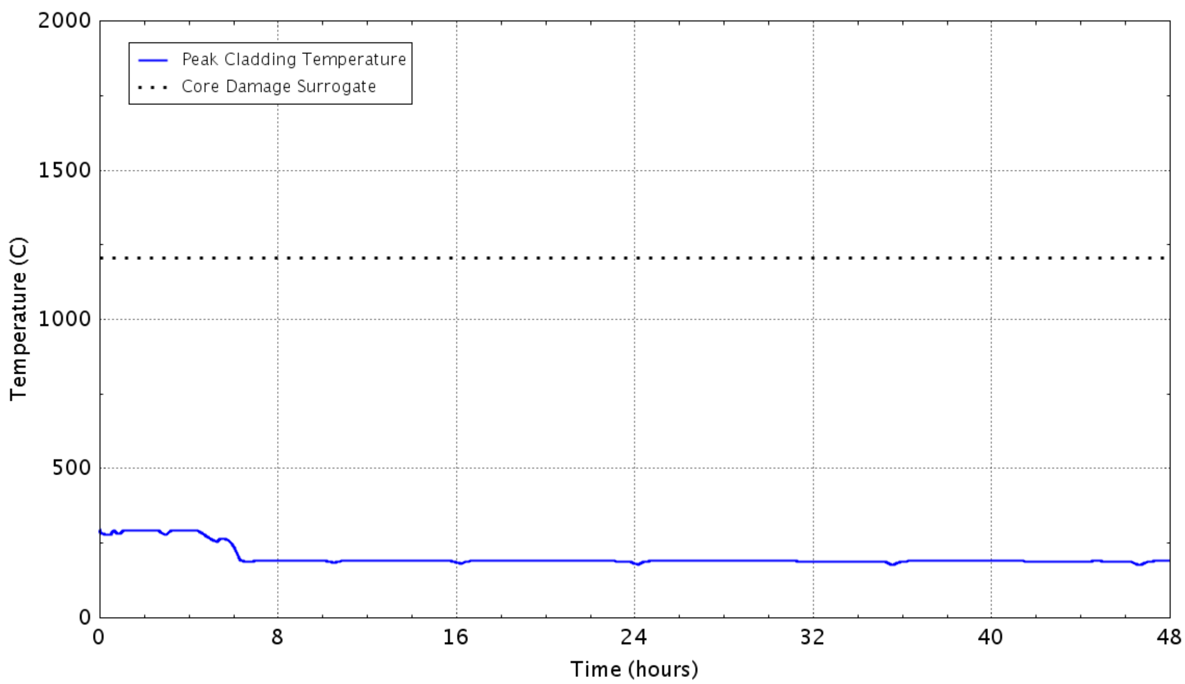

Figure E - 360 Peak temperature of the fuel cladding as a function of time

E.2.21 Case 35: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 18-in. Drywell Vent, RCIC 50% Degraded

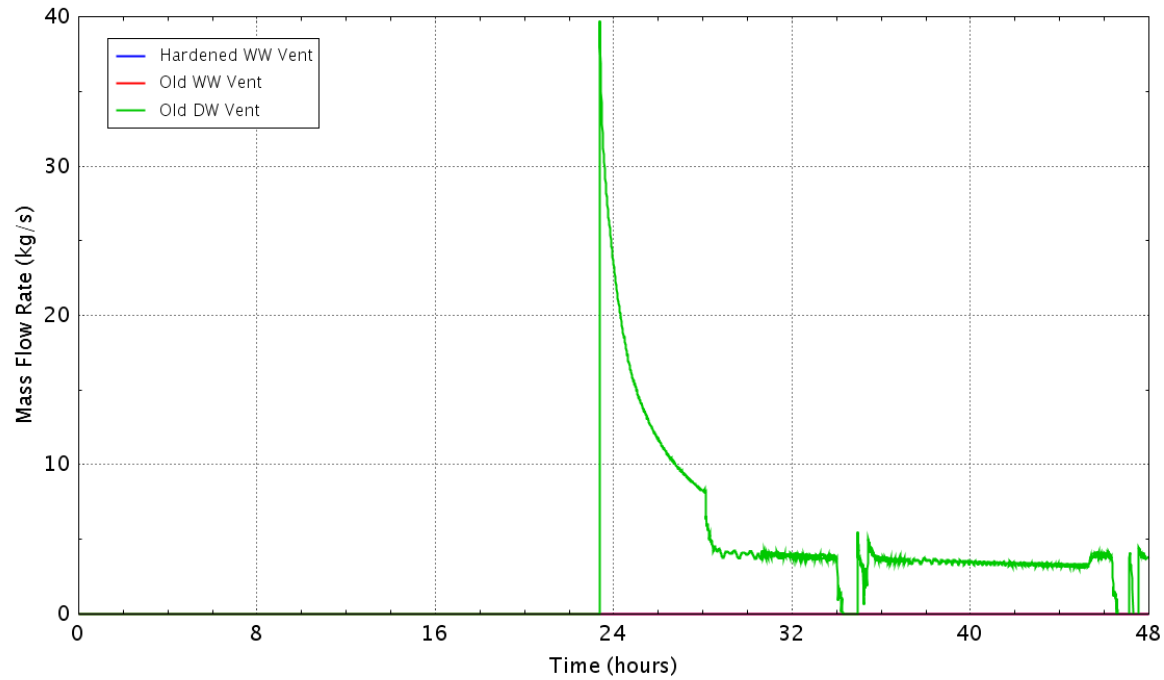

Figure E - 361 Flow rate of the containment vents

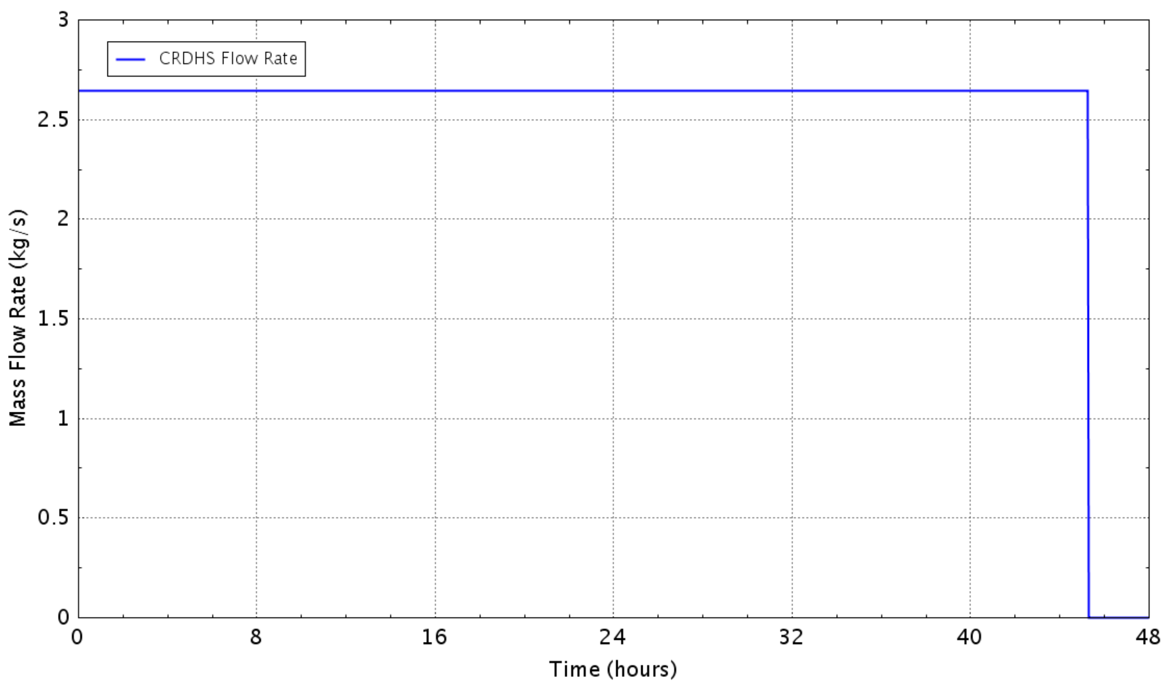

Figure E - 362 Flow rate of the control rod drive hydraulic system

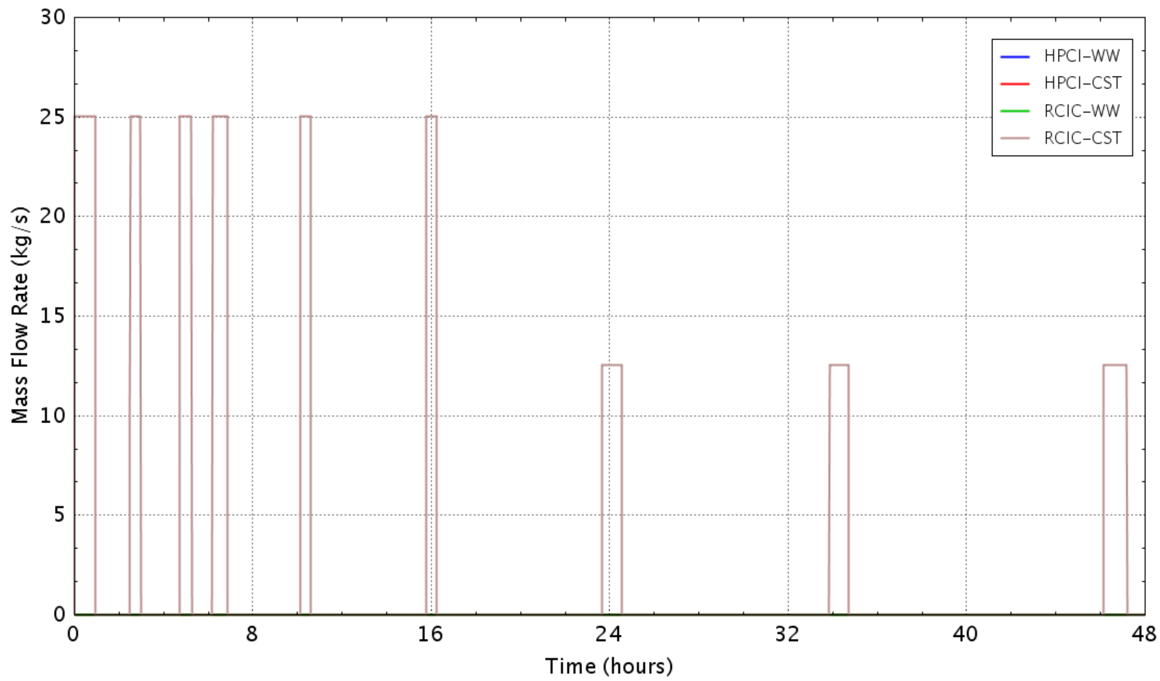

Figure E - 363 Flow rate of the HPCI/RCIC pumps

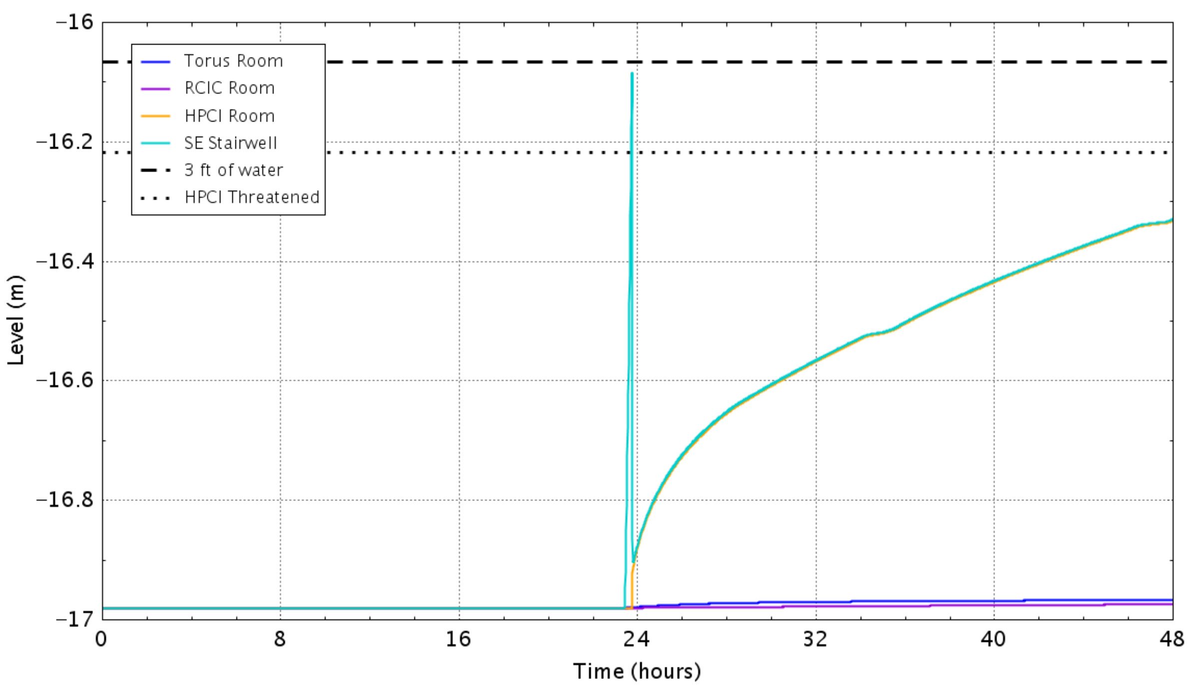

Figure E - 364 Water level in the reactor building basement

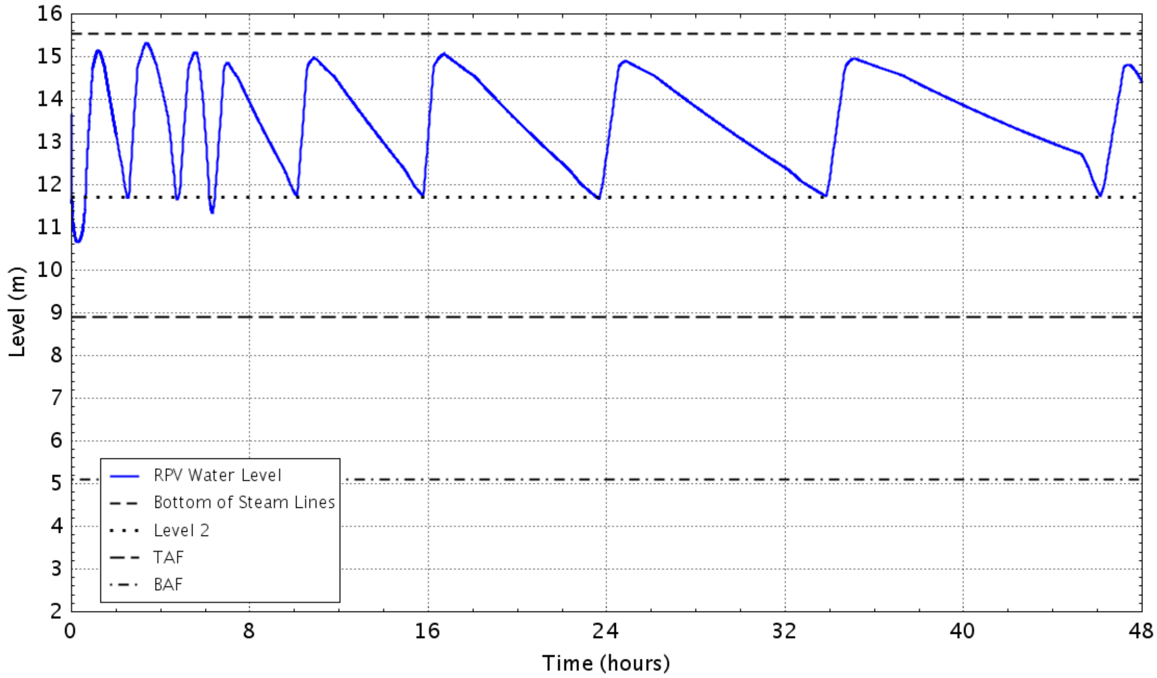

Figure E - 365 **RPV down comer water level**

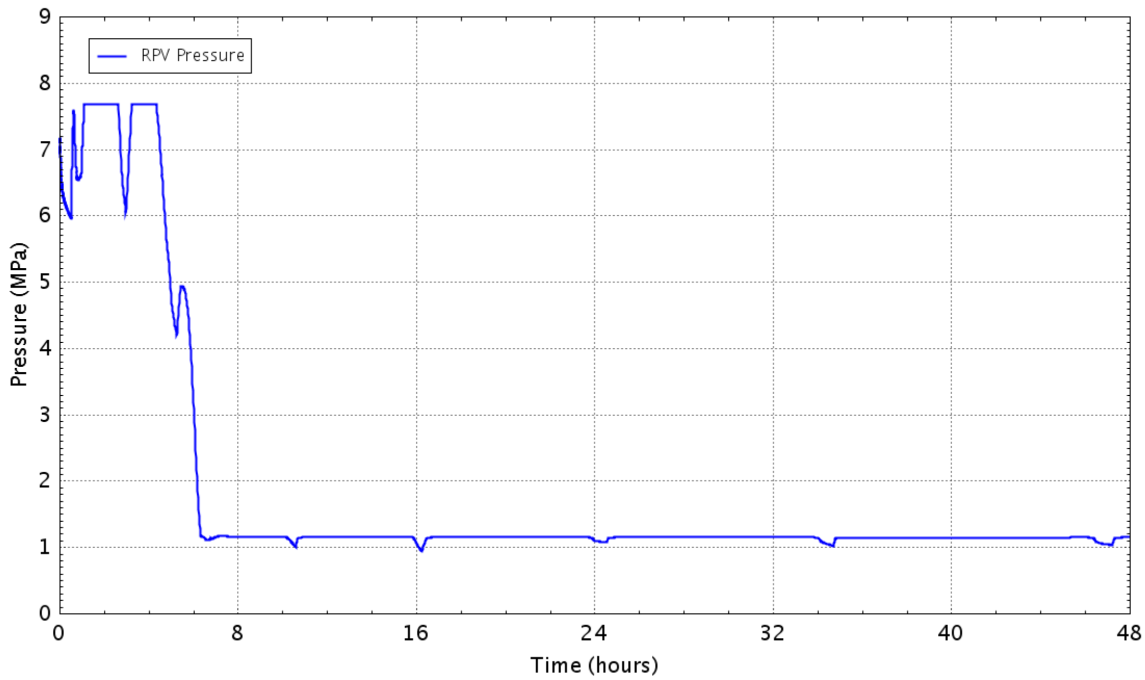

Figure E - 366 **Pressure in theRPV**

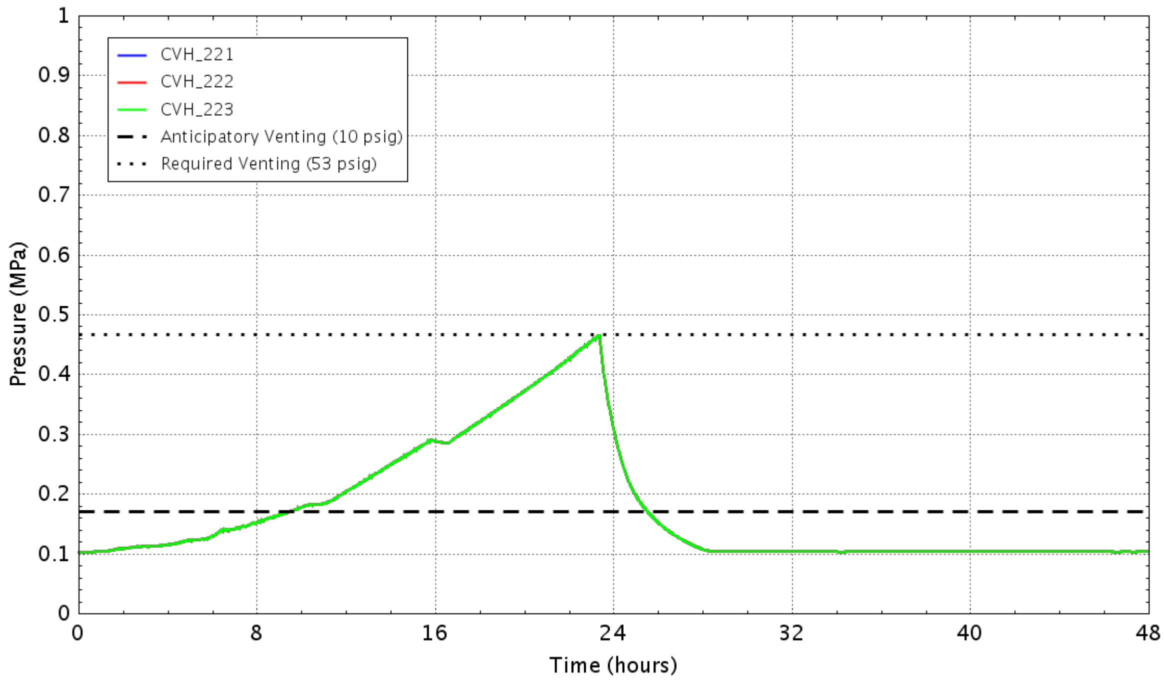

Figure E - 367 Pressure in the wetwell

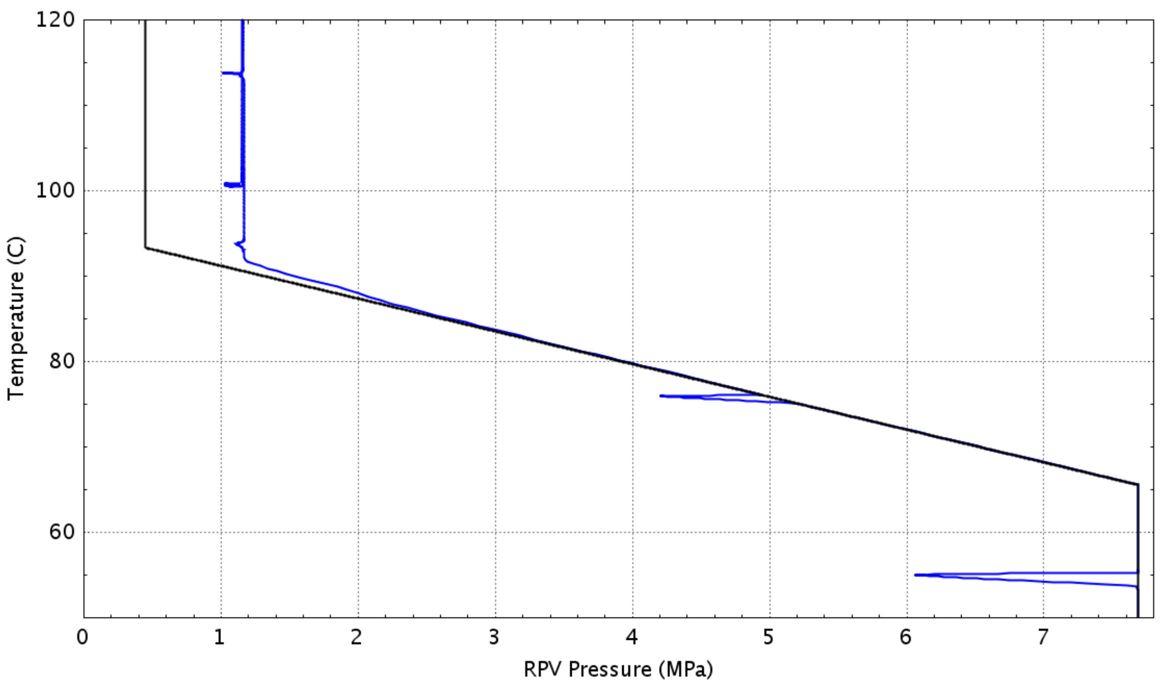

Figure E - 368 Plant status relative to the HCL curve (Graph 4 of the EOPs)

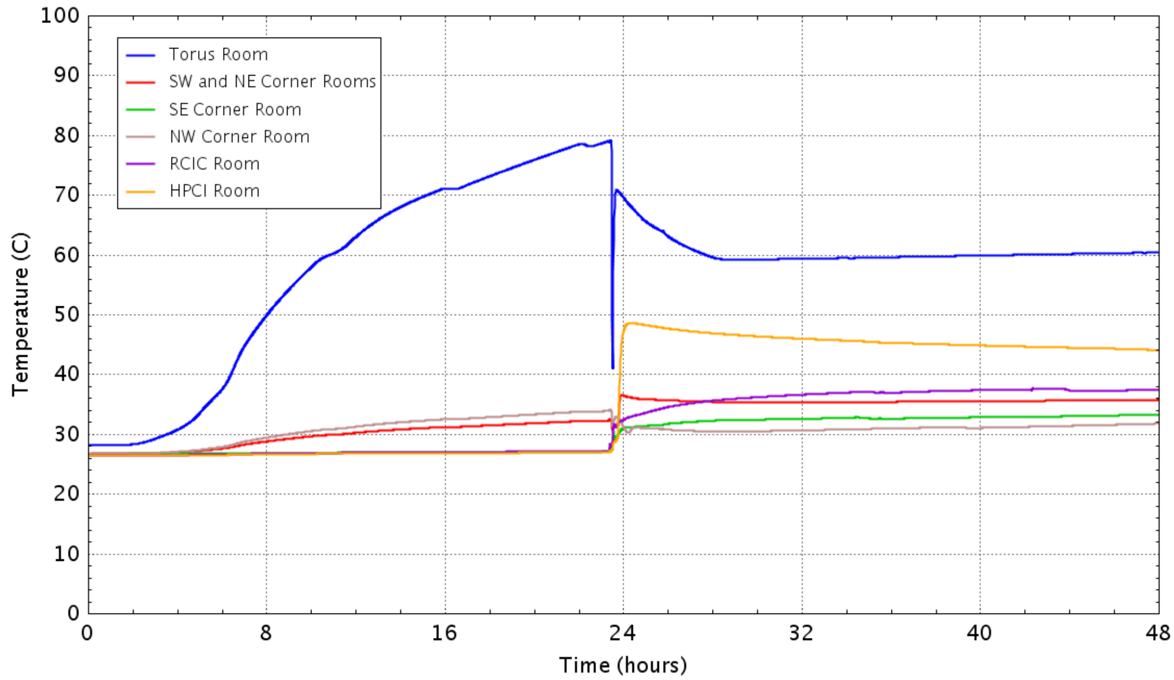

Figure E - 369 **Vapor temperature in the reactor building basement**

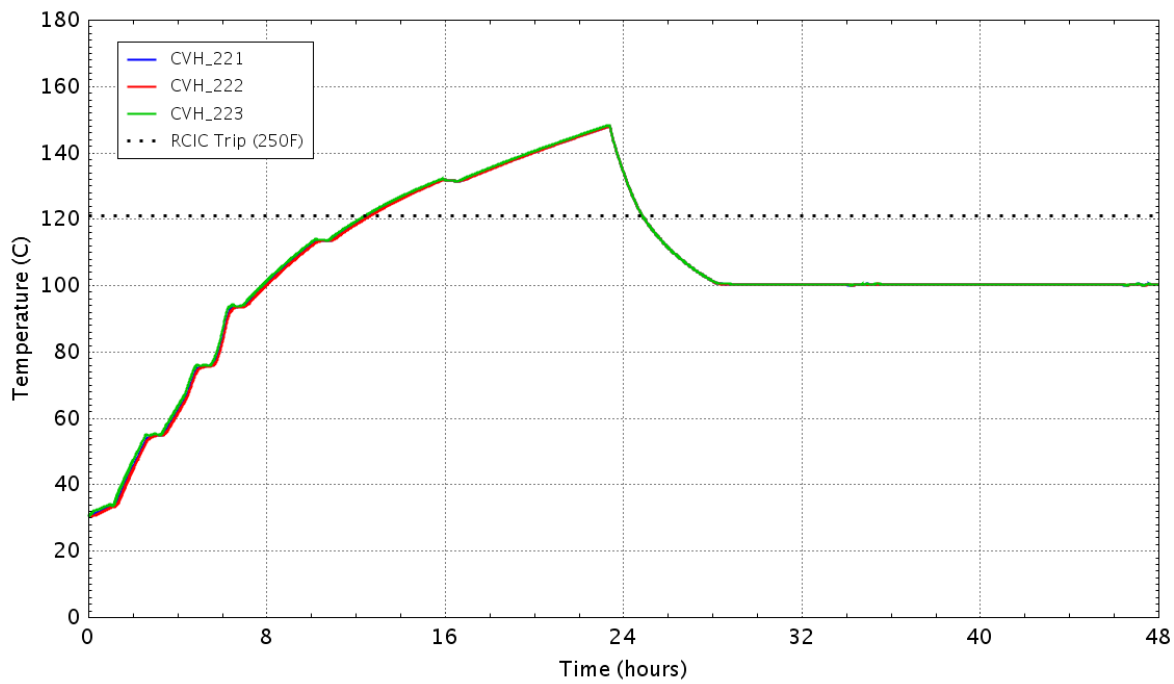

Figure E - 370 **Water temperature in the wetwell**

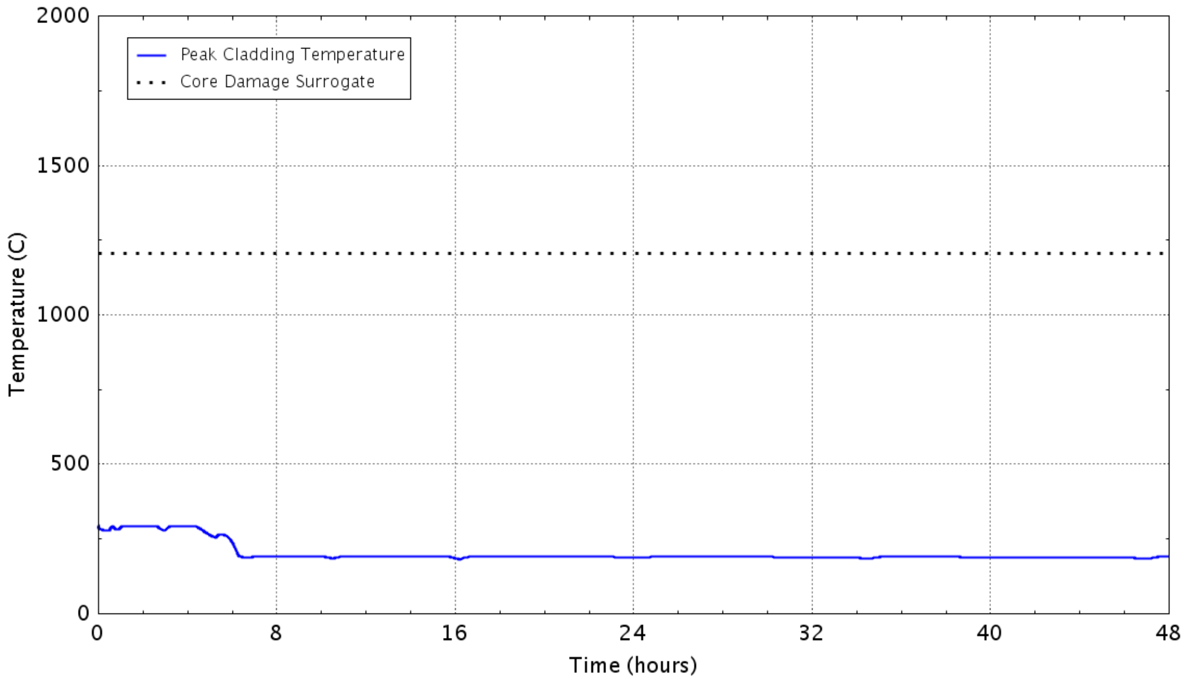

Figure E – 371 Peak temperature of the fuel cladding as a function oftime

E.2.22 Case 36: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the 18-in. Drywell Vent, RCIC Non-functional

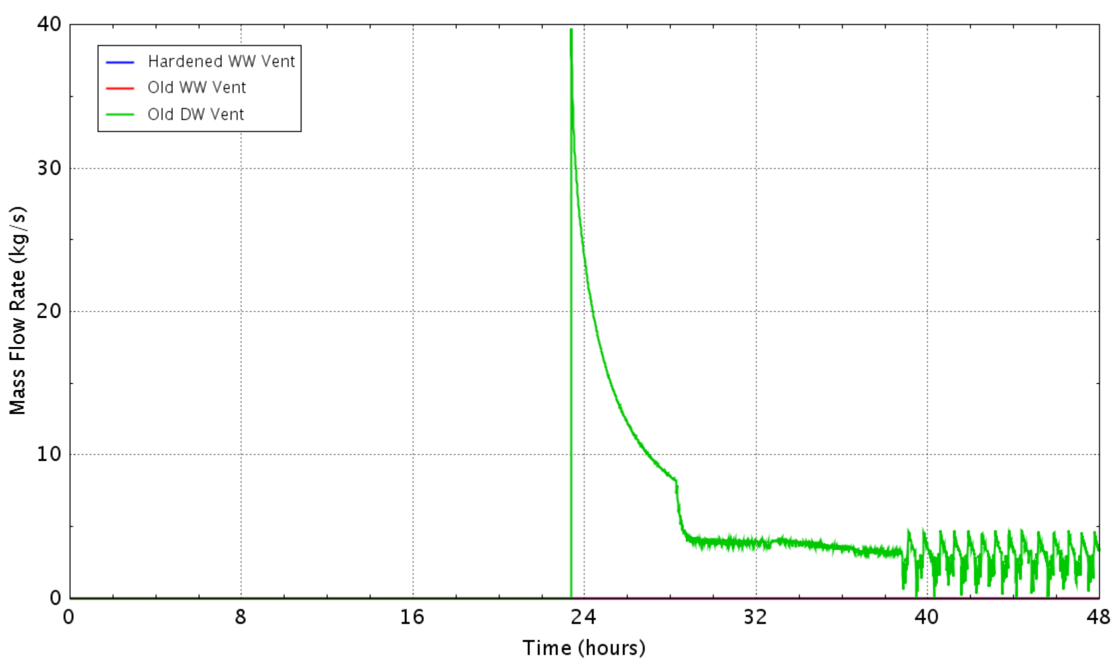

Figure E - 372 Flow rate of the containment vents

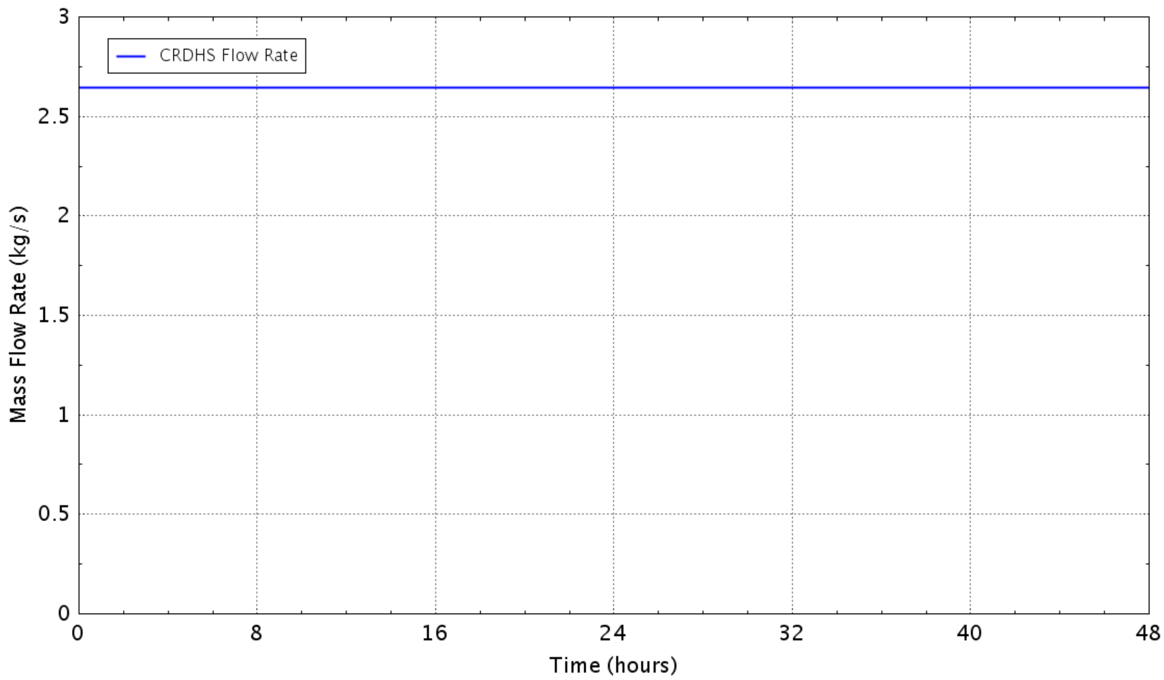

Figure E - 373 **Flow rate of the control rod drive hydraulic system**

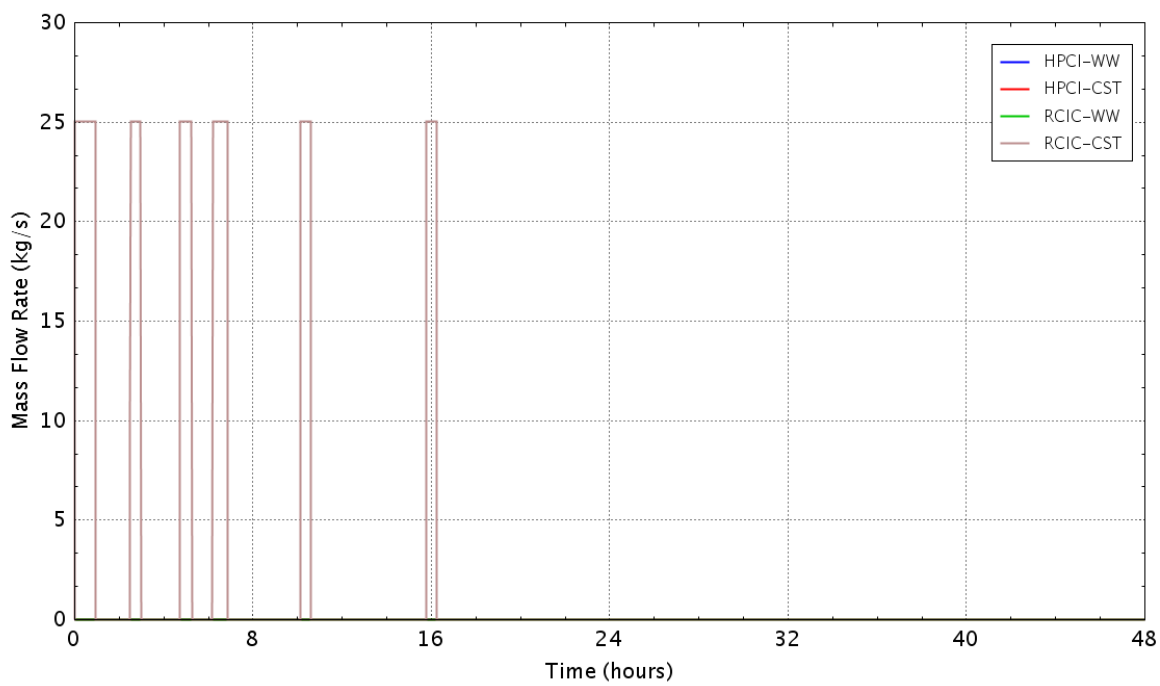

Figure E - 374 **Flow rate of the HPCI/RCIC pumps**

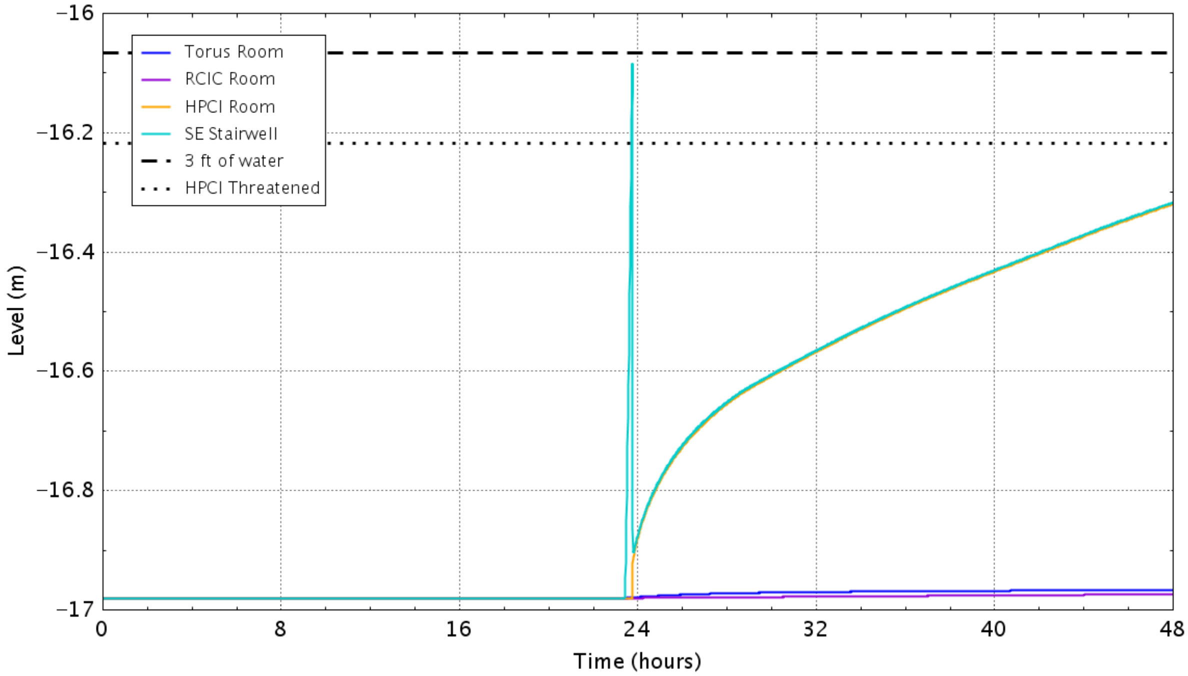

Figure E - 375 **Water level in the reactor building basement**

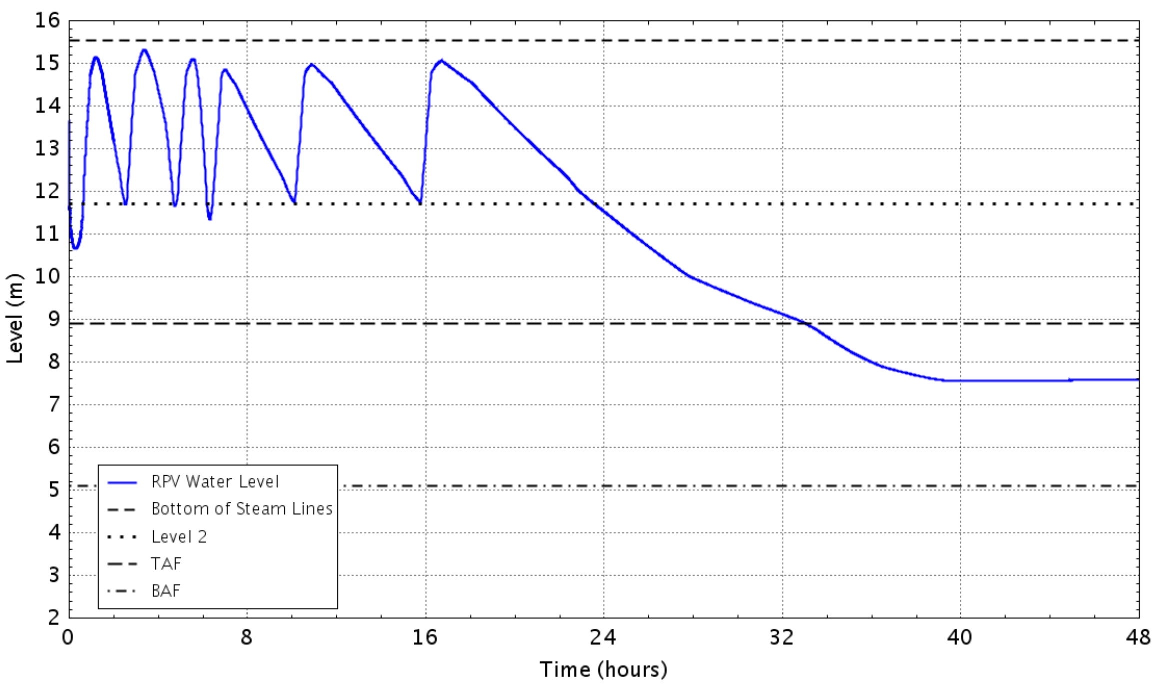

Figure E - 376 **RPV down comer water level**

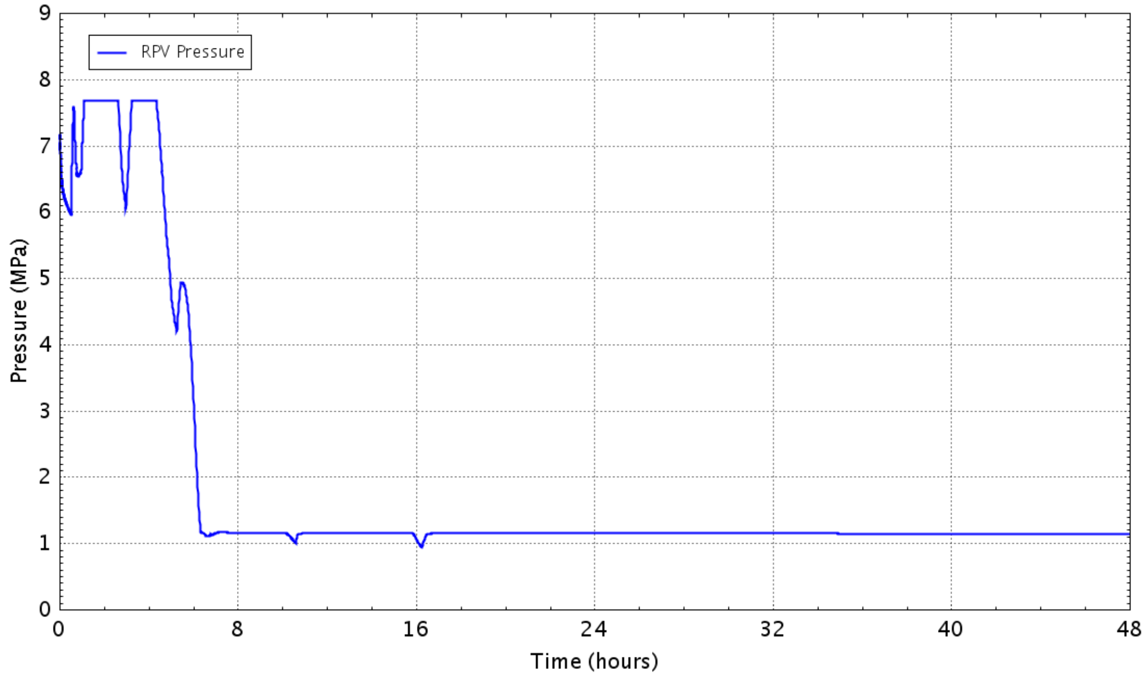

Figure E - 377 **Pressure in theRPV**

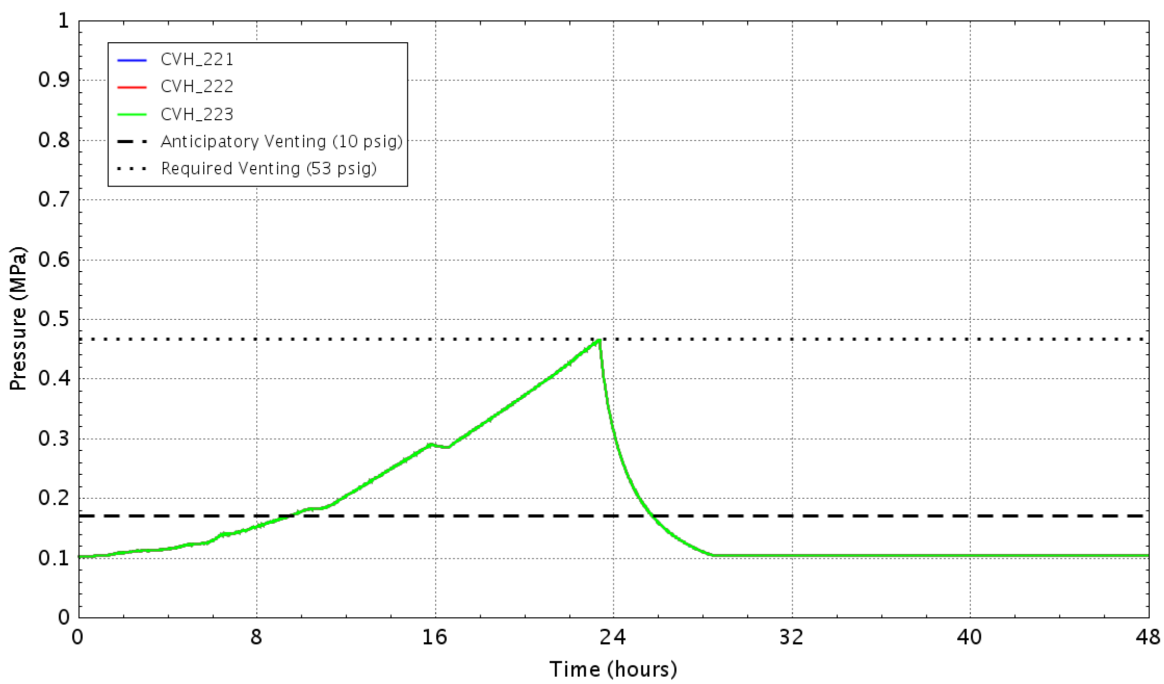

Figure E - 378 **Pressure in the wetwell**

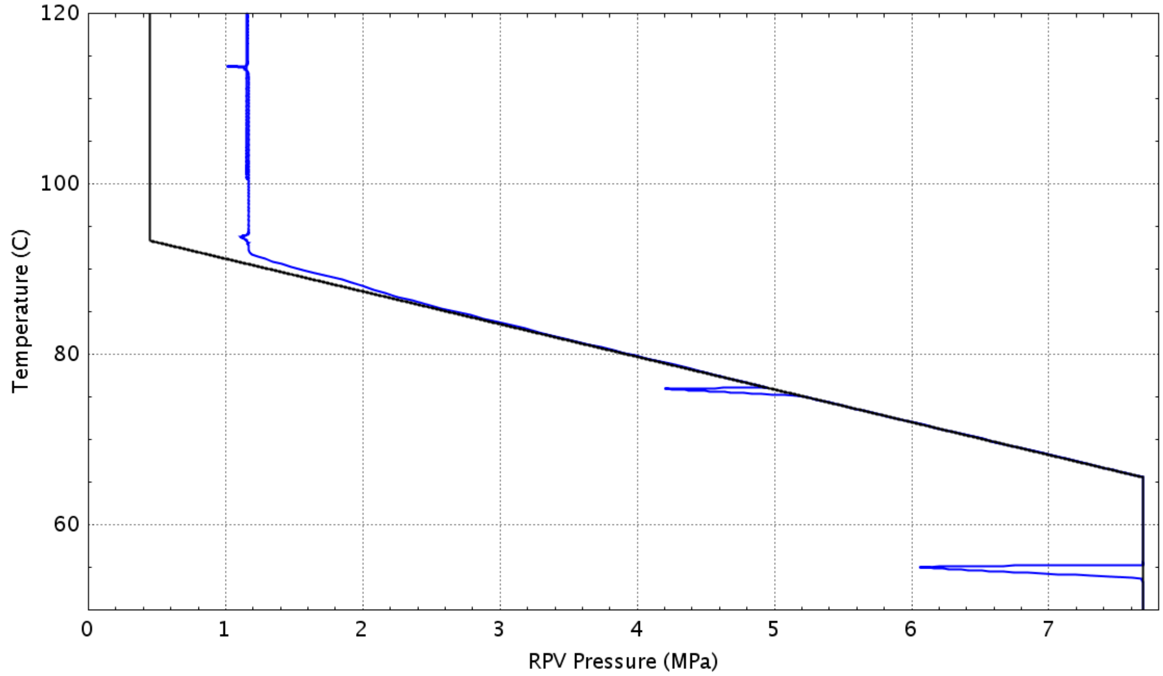

Figure E – 379 Plant status relative to the HCL curve (Graph 4 of the EOPs)

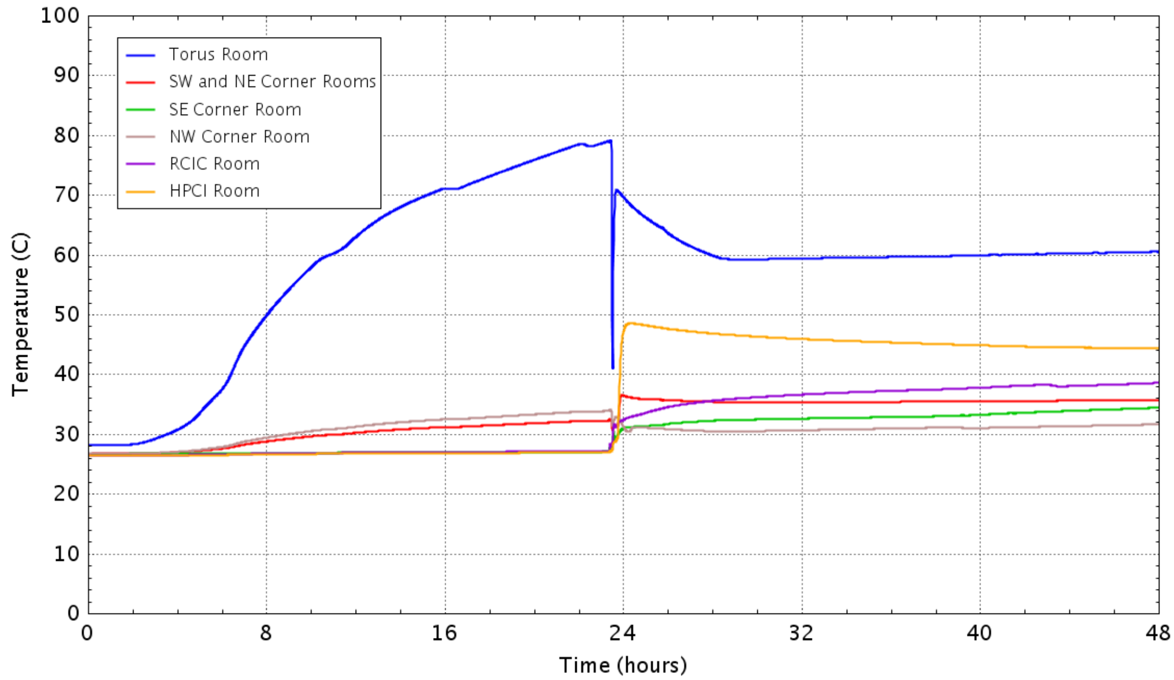

Figure E – 380 Vapor temperature in the reactor buildingbasement

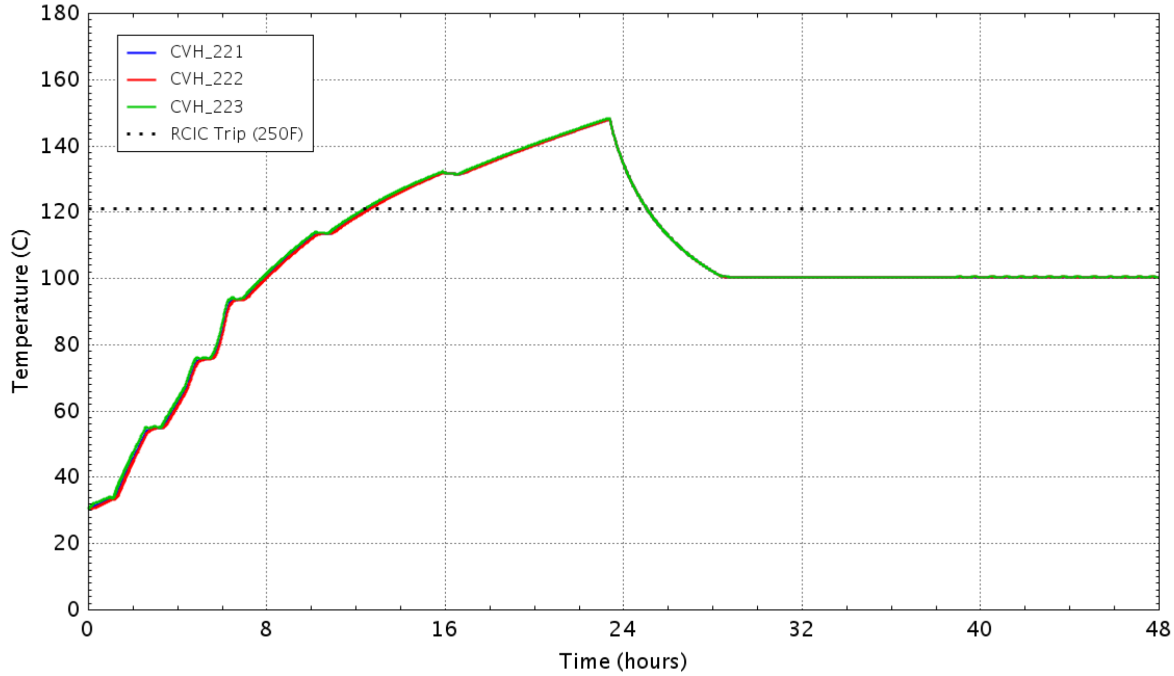

Figure E - 381 **Water temperature in the wetwell**

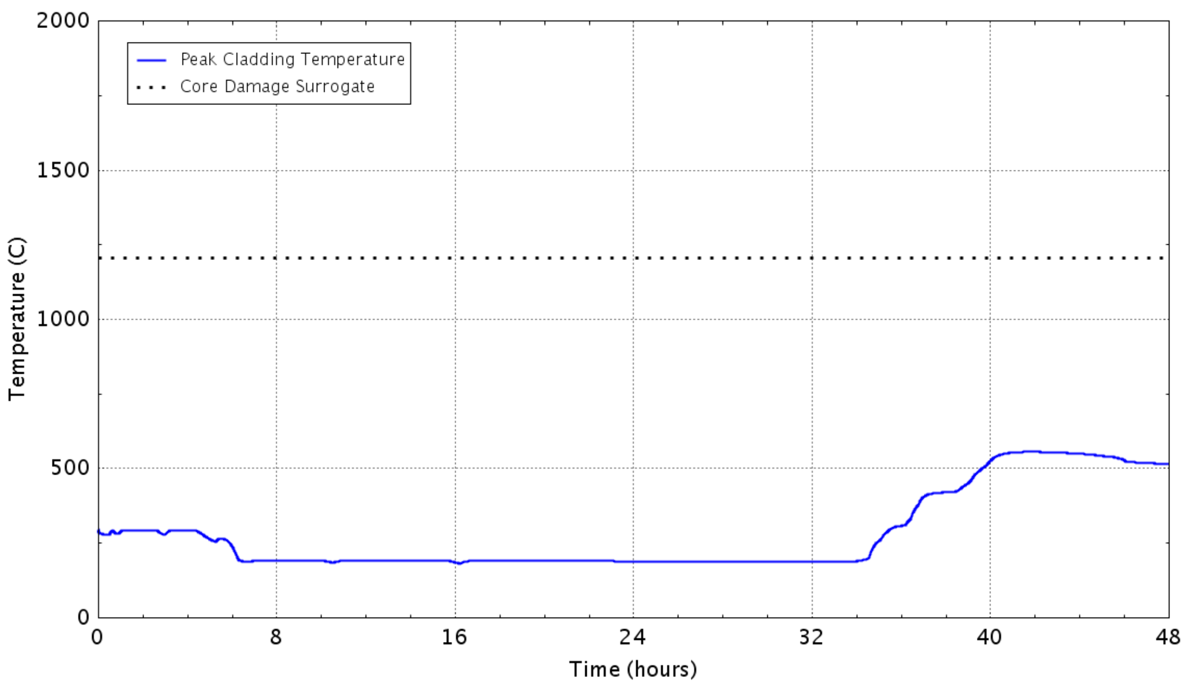

Figure E – 382 **Peak temperature of the fuel cladding as a function oftime**

E.2.23 Case 37: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the HCV, RCIC Fully Functional

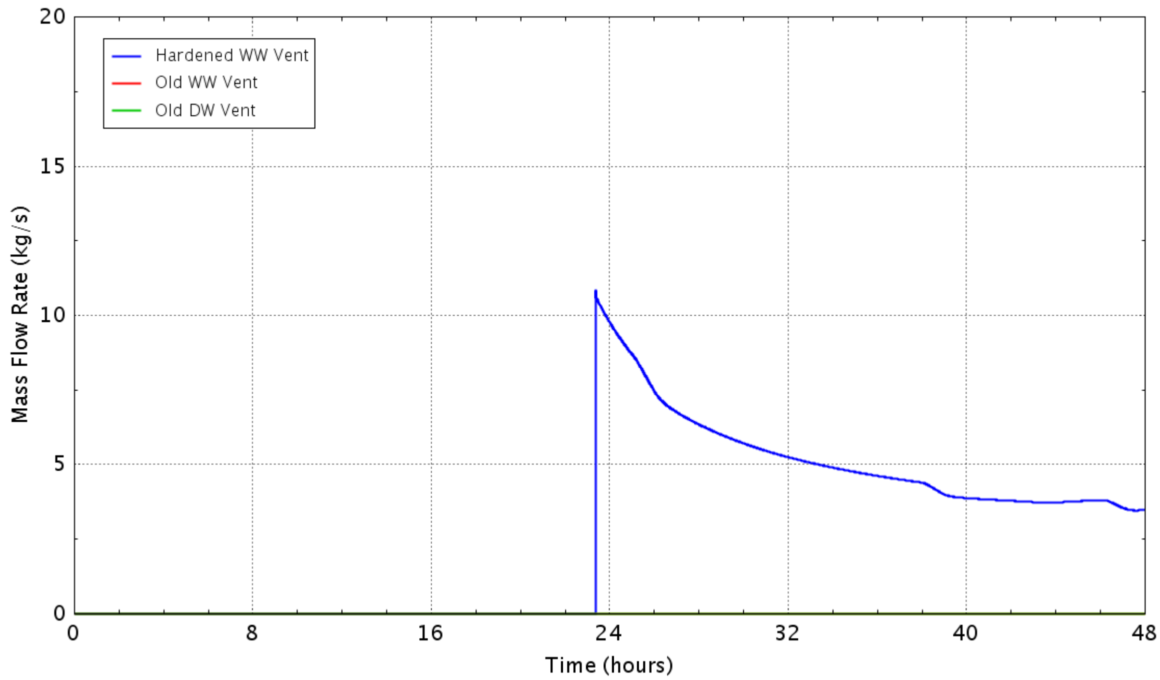

Figure E – 383 Flow rate of the containment vents

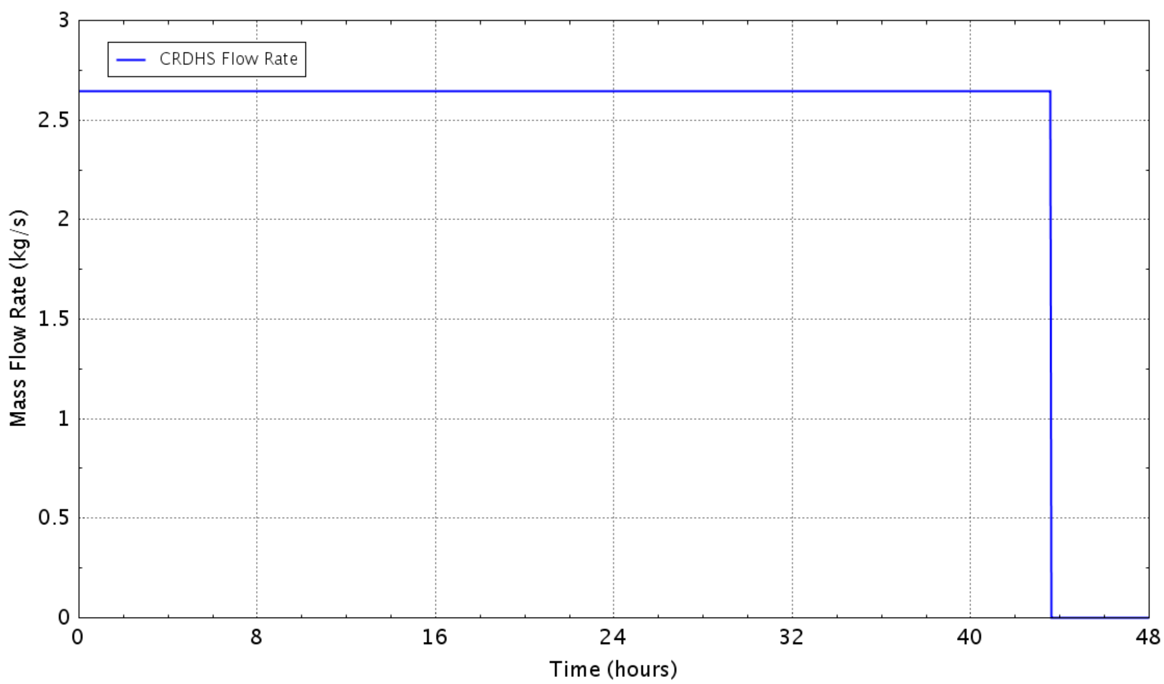

Figure E – 384 Flow rate of the control rod drive hydraulic system

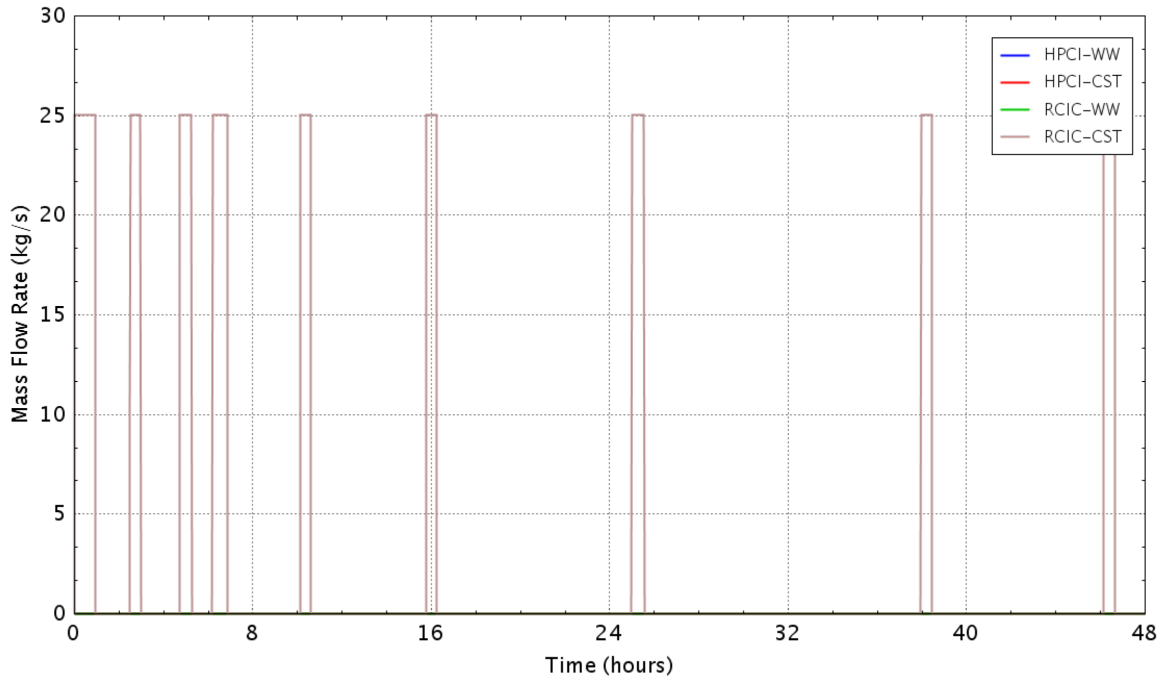

Figure E - 385 Flow rate of the HPCI/RCIC pumps

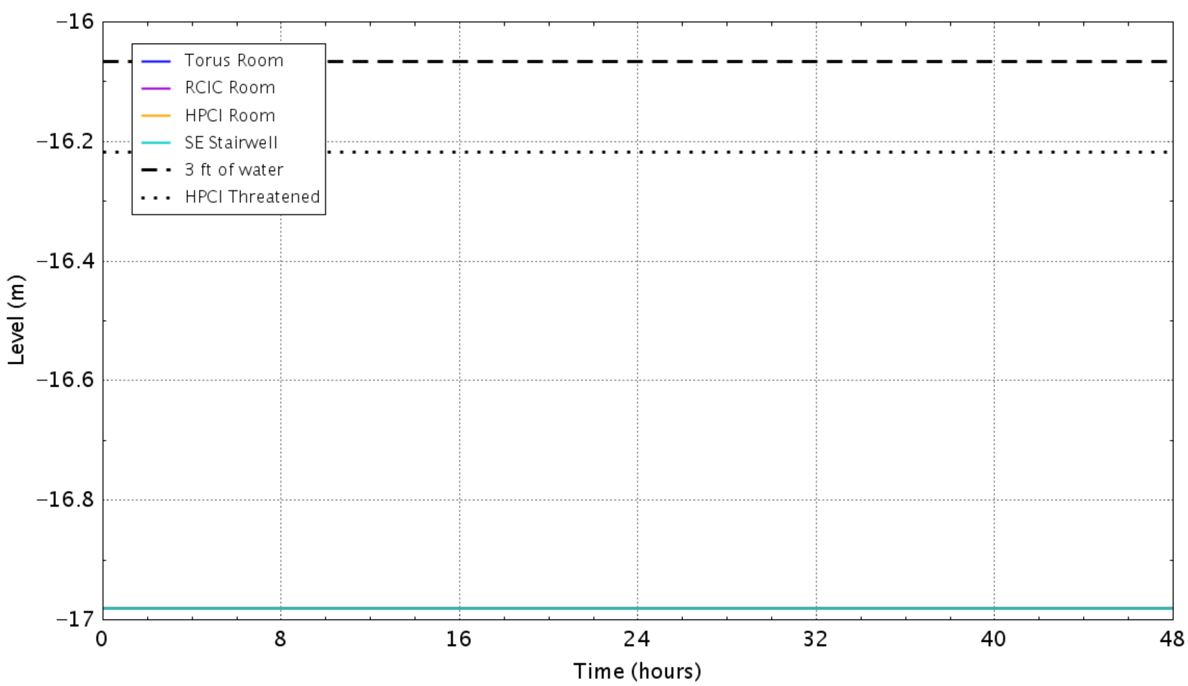

Figure E - 386 Water level in the reactor building basement

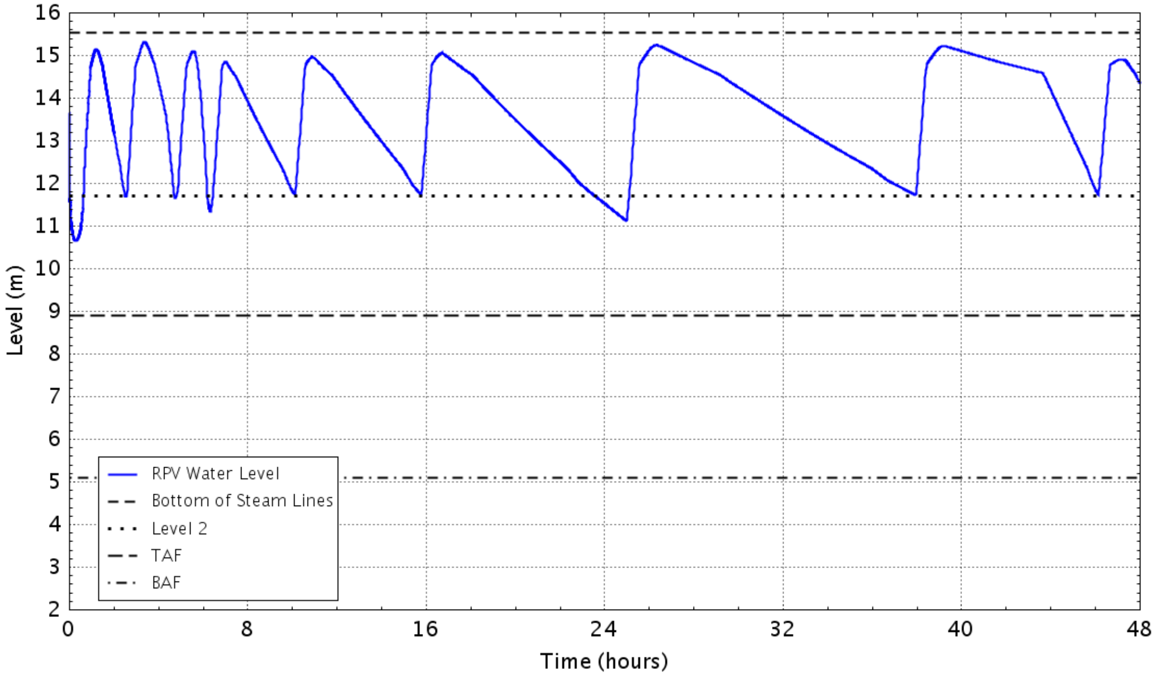

Figure E - 387 **RPV down comer water level**

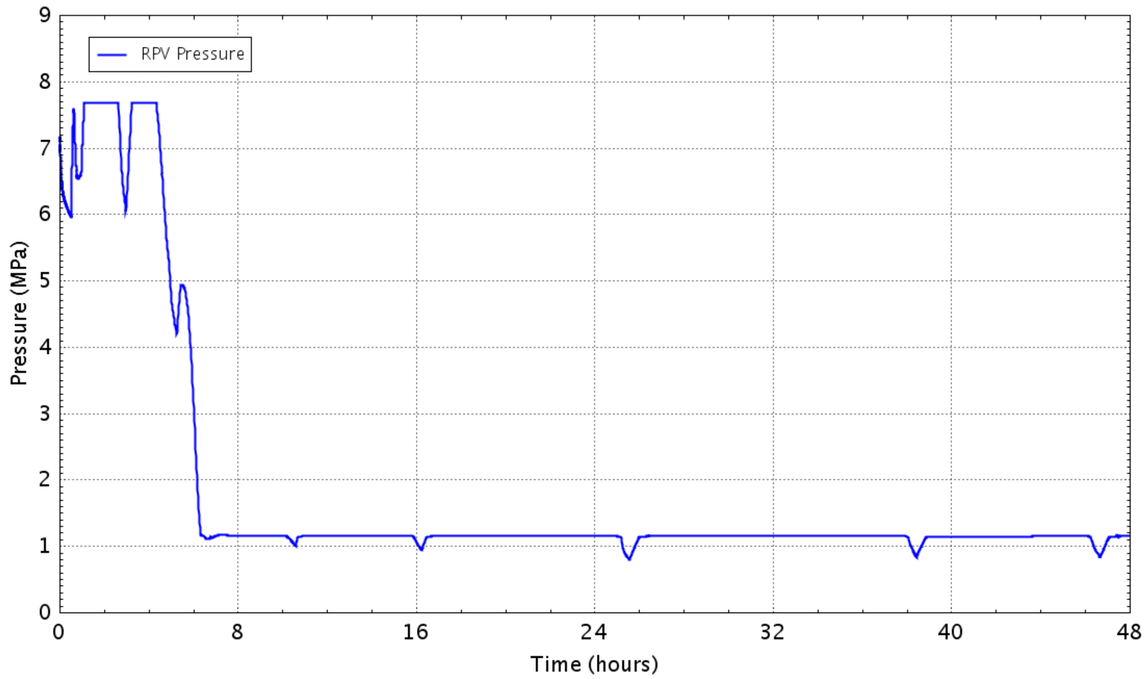

Figure E - 388 **Pressure in theRPV**

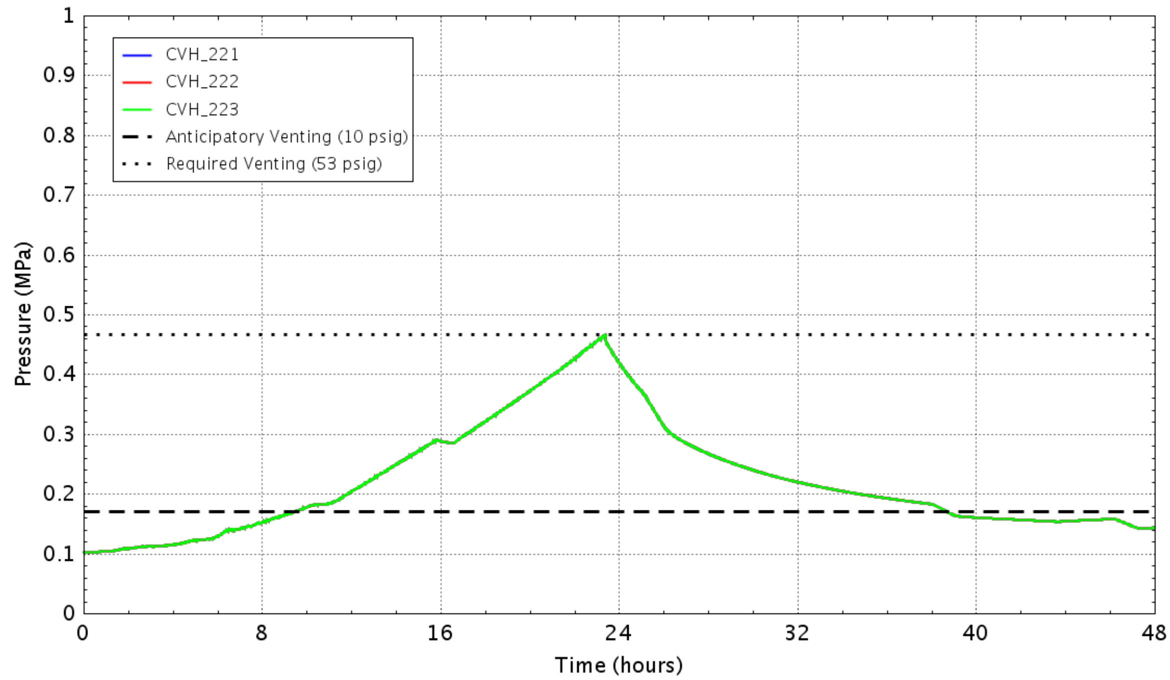

Figure E - 389 Pressure in the wetwell

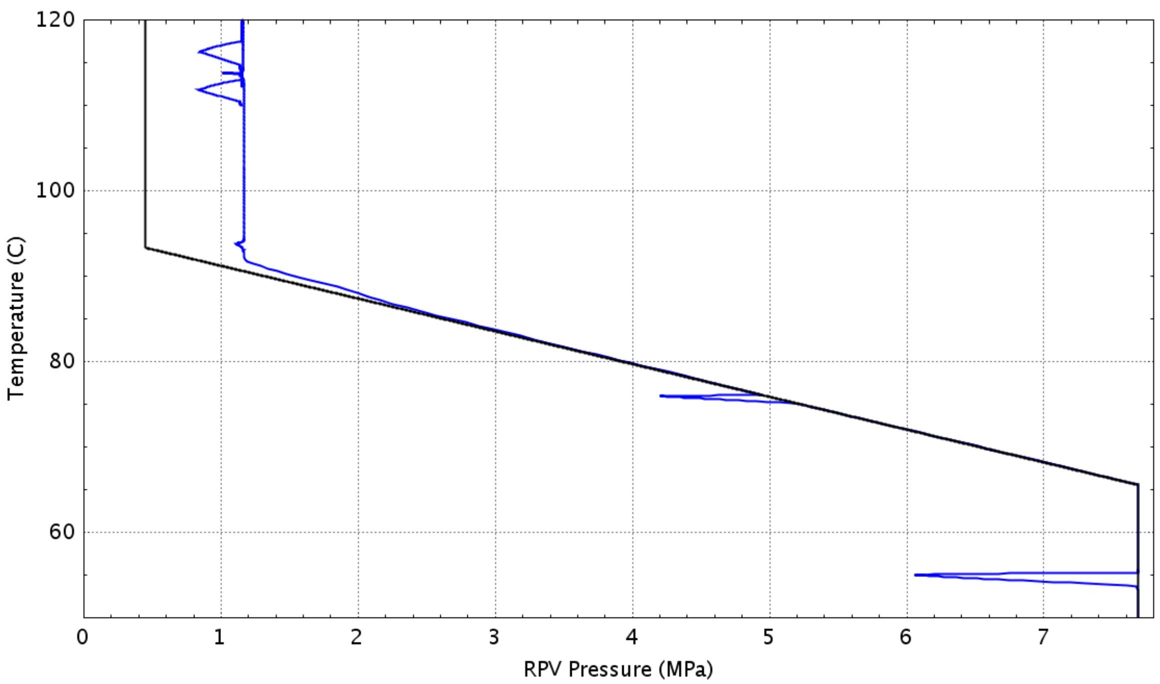

Figure E - 390P lant status relative to the HCL curve (Graph 4 of the EOPs)

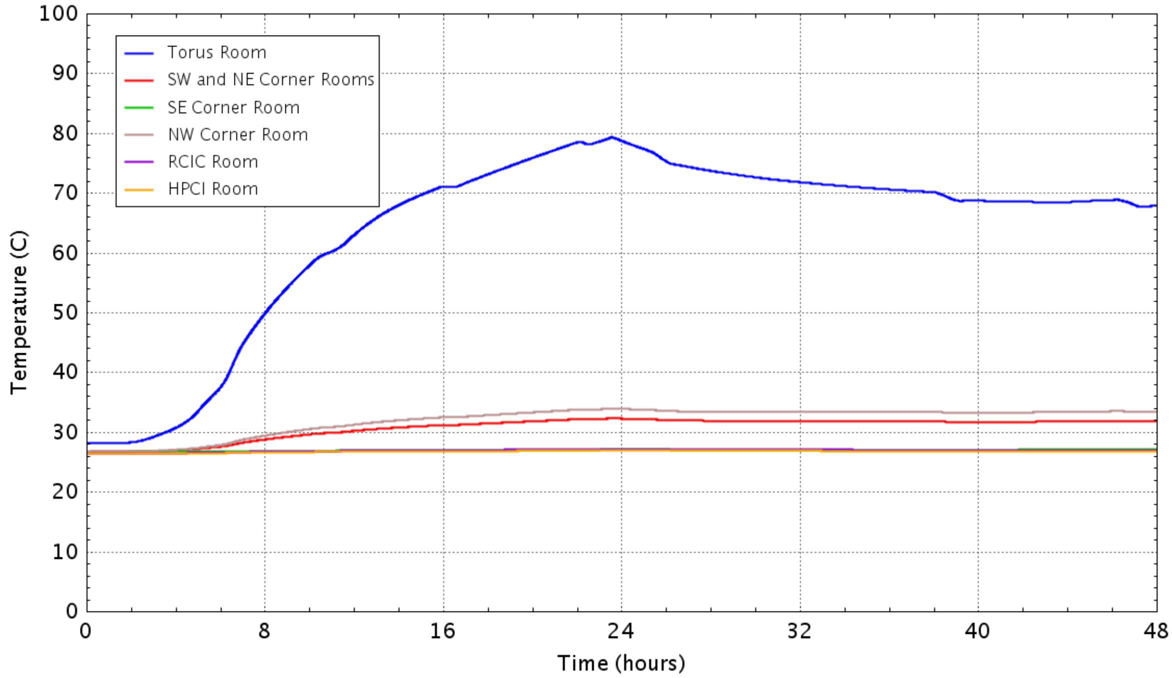

Figure E – 391 **Vapor temperature in the reactor buildingbasement**

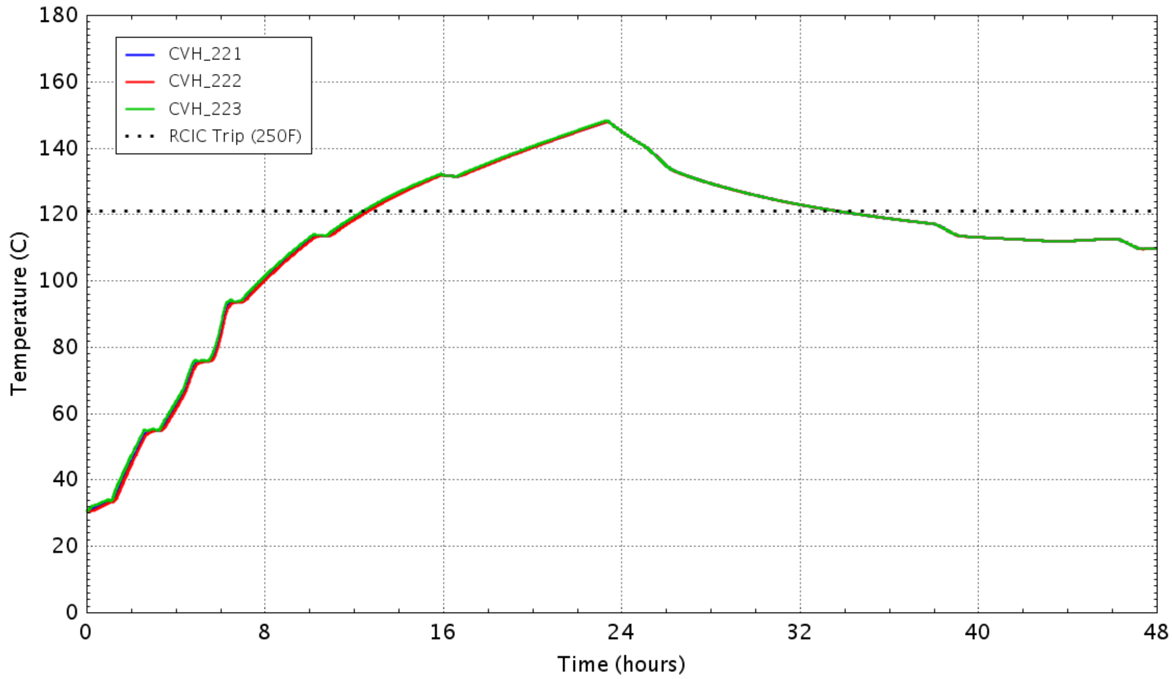

Figure E - 392 **Watertemperatureinthewetwell**

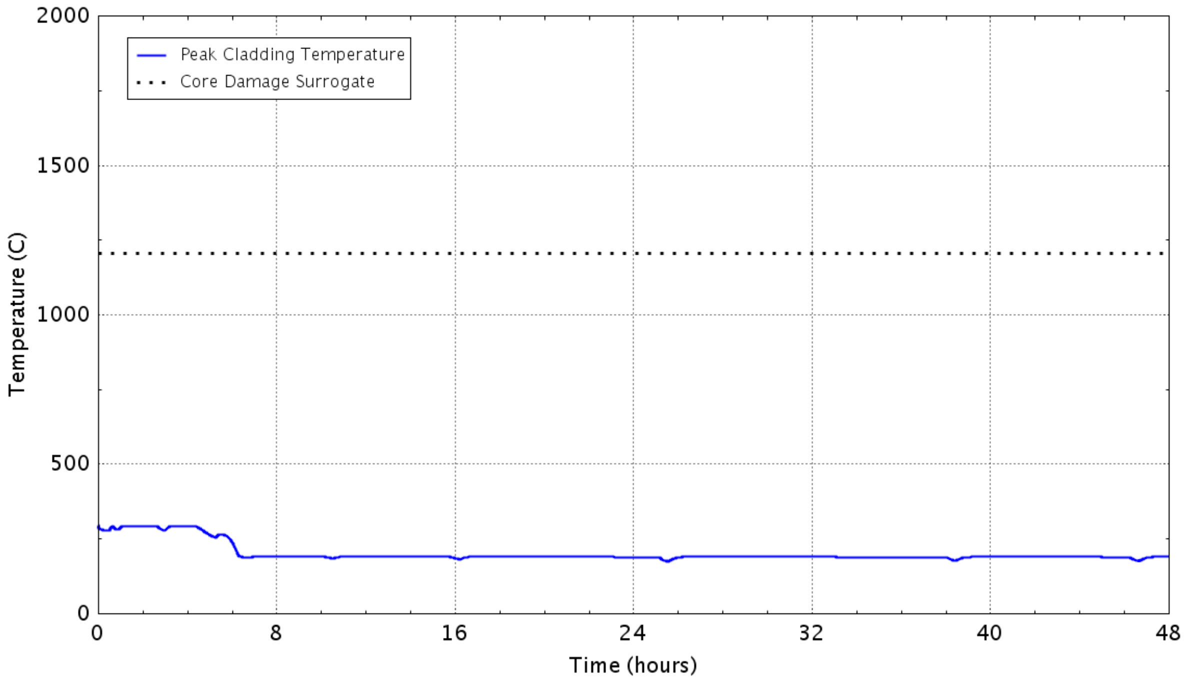

Figure E – 393 **Peak temperature of the fuel cladding as a function oftime**

E.2.24 Case 38: LOMFW-25, Containment Failure at 53 psig, Containment Venting via the HCV, RCIC Non-functional

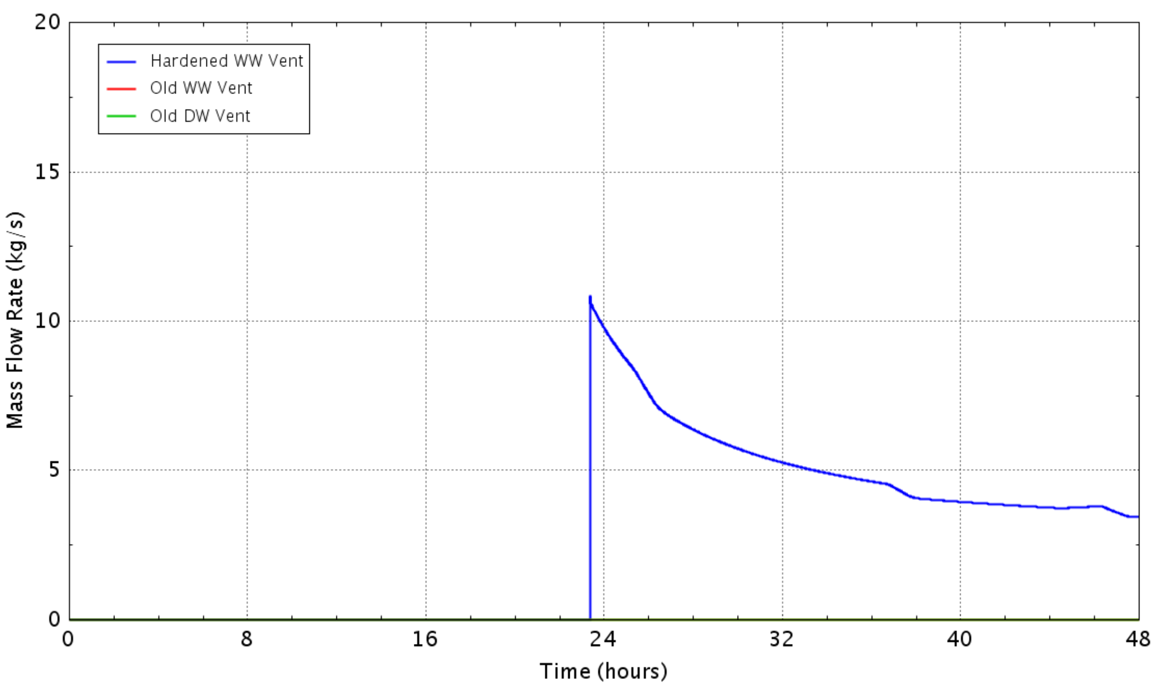

Figure E - 394 **Flow rate of the containment vents**

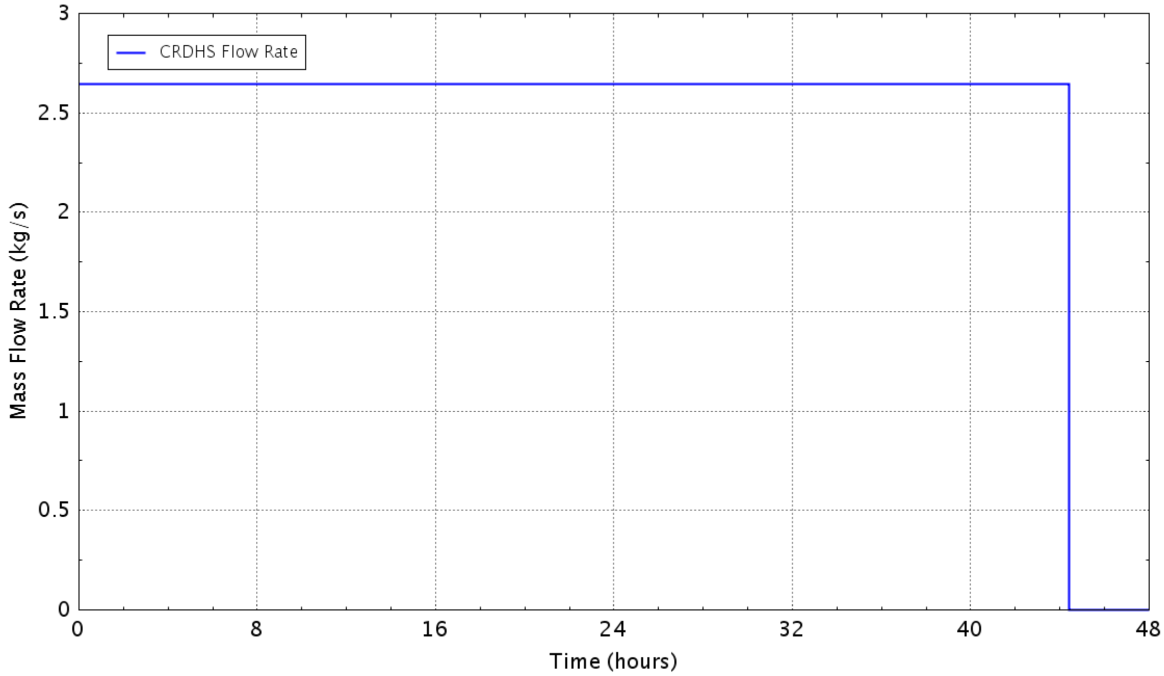

Figure E - 395 **Flow rate of the control rod drive hydraulic system**

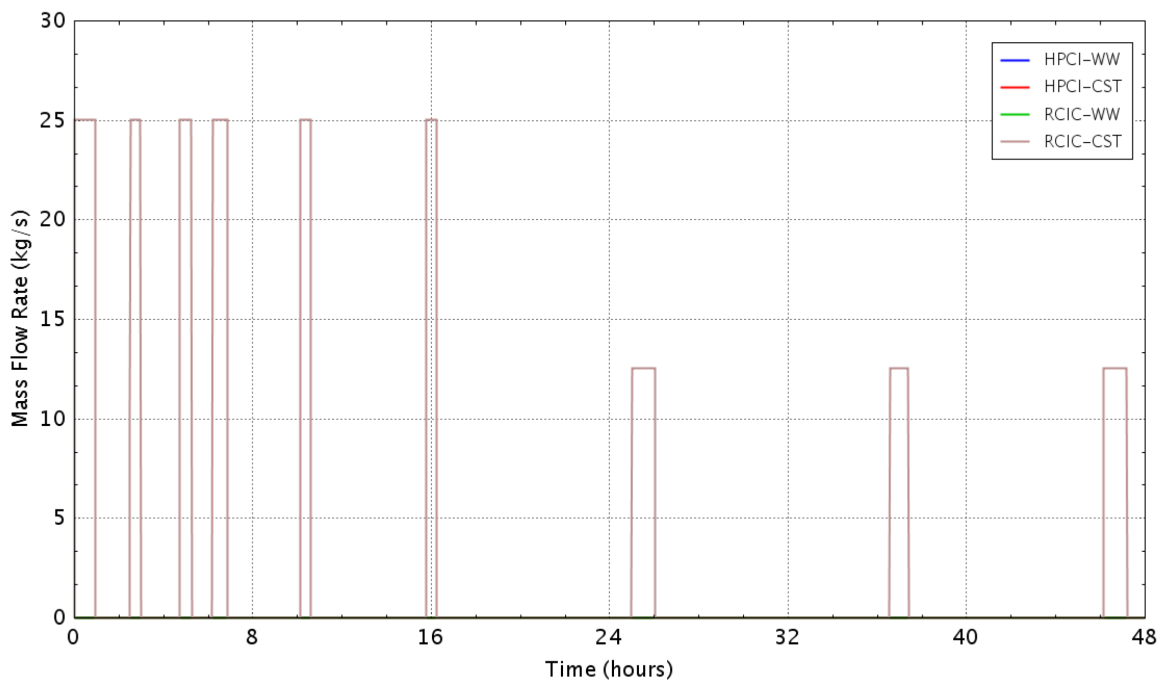

Figure E - 396 **Flow rate of the HPCI/RCIC pumps**

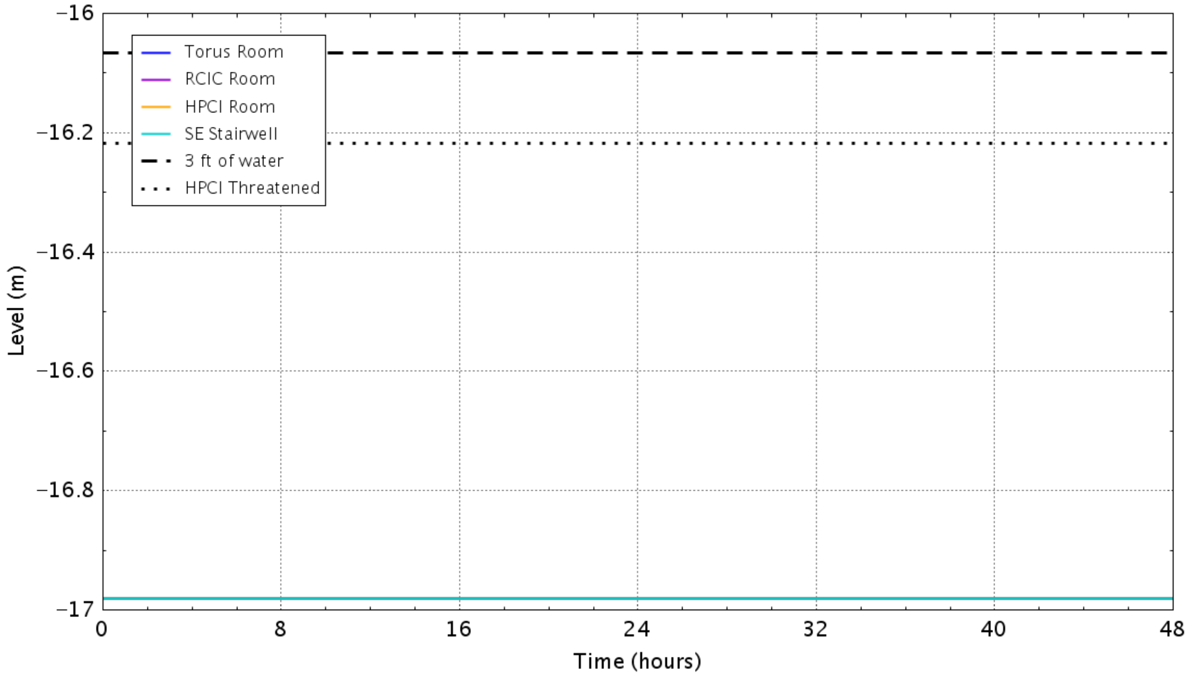

Figure E - 397 Water level in the reactor building basement

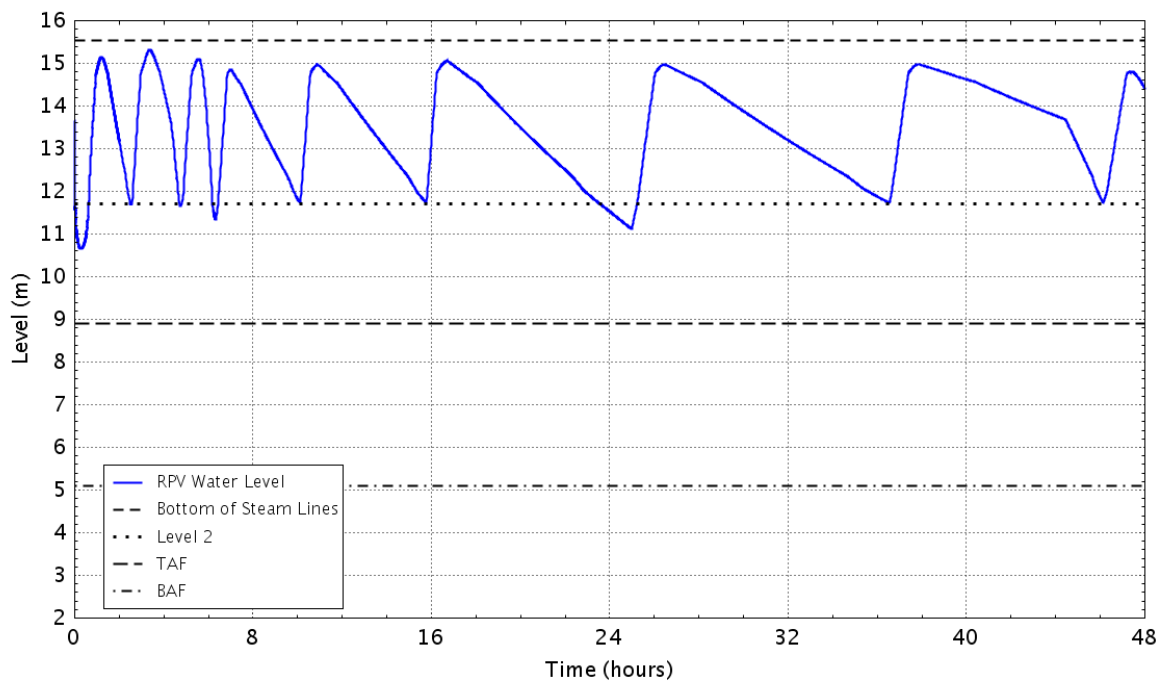

Figure E - 398 RPV down comer water level

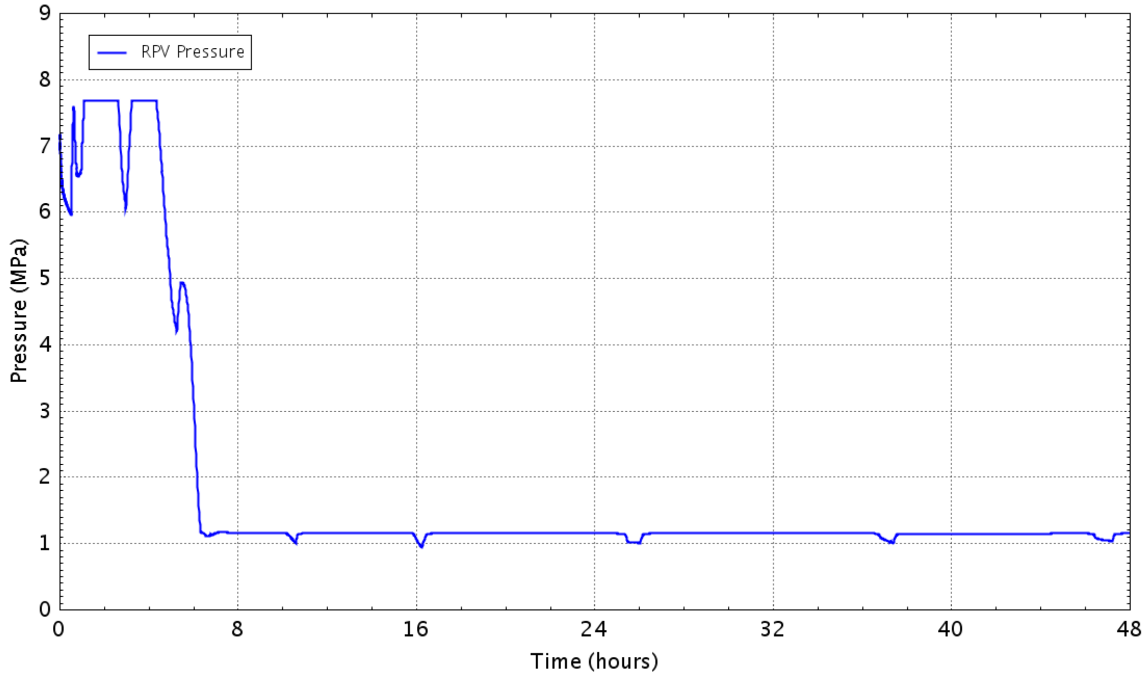

Figure E - 399 **Pressure in theRPV**

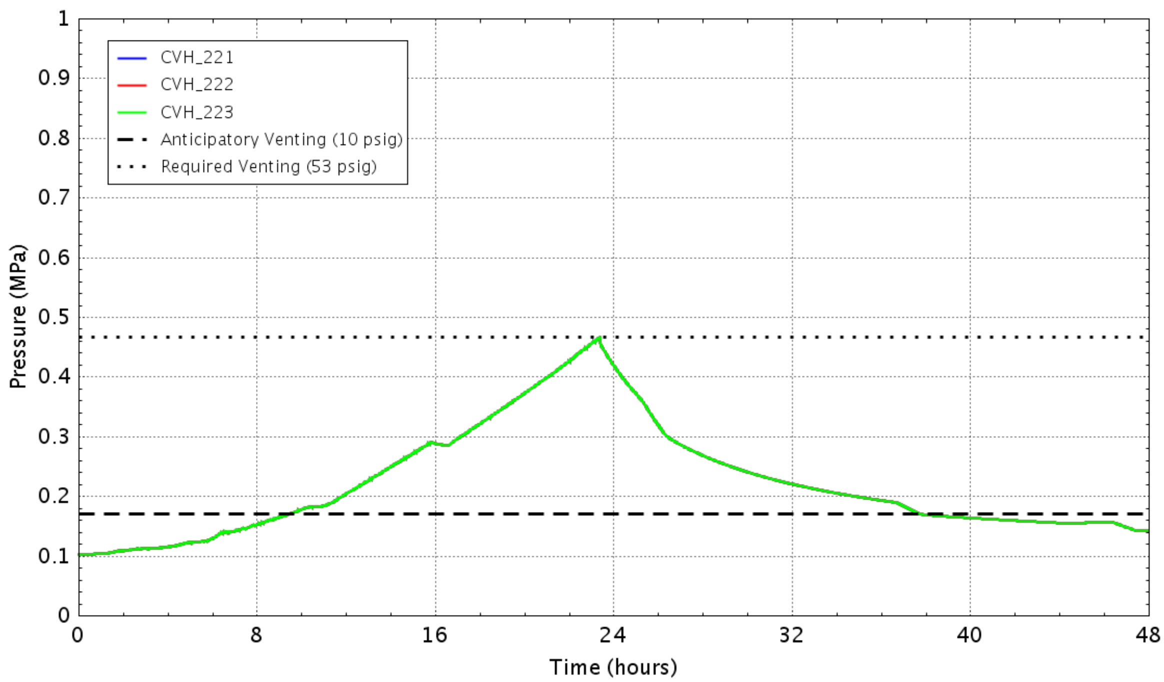

Figure E - 400 **Pressure in the wetwell**

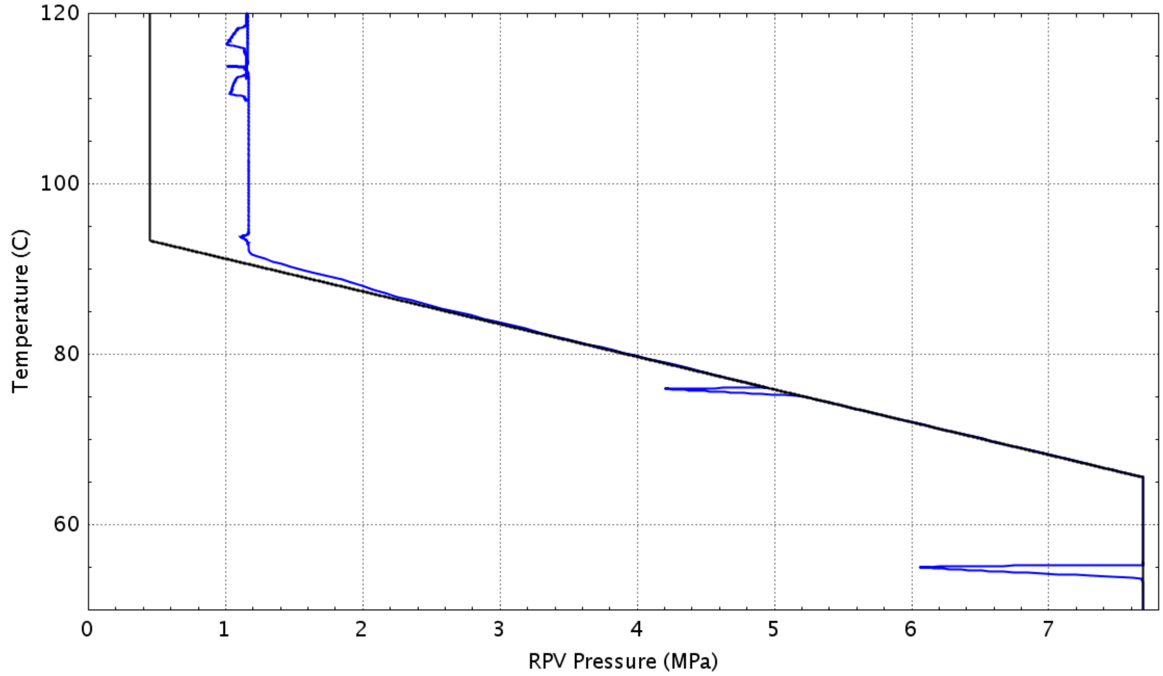

Figure E – 401 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

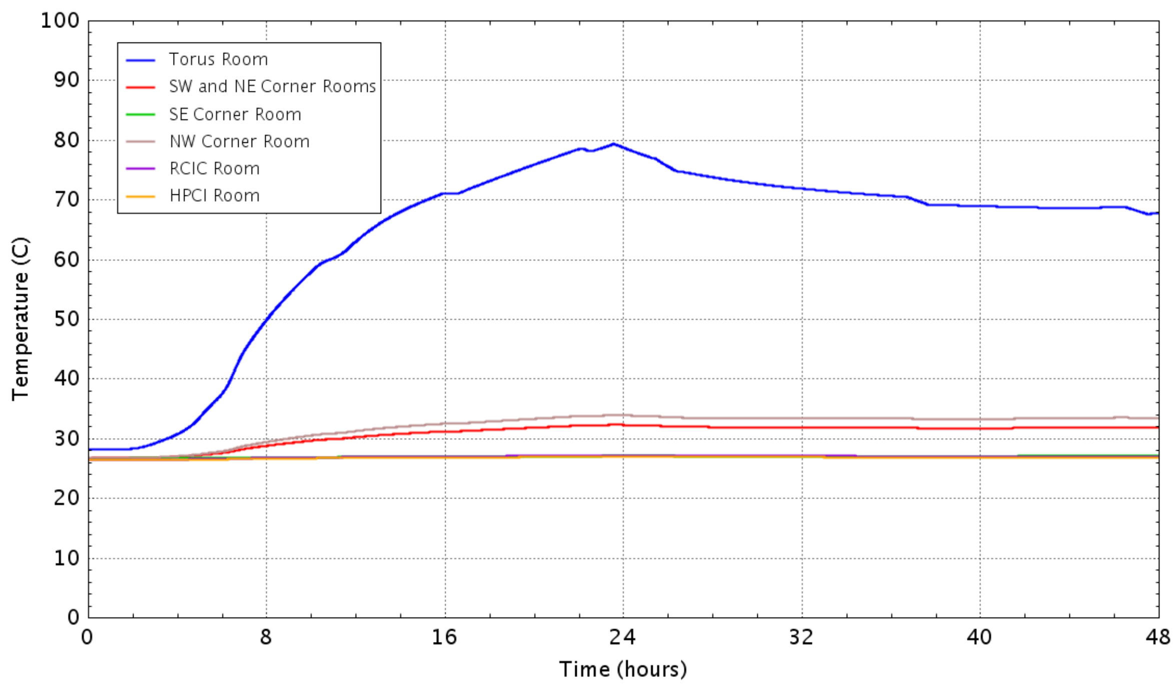

Figure E - 402 **Vapor temperature in the reactor building basement**

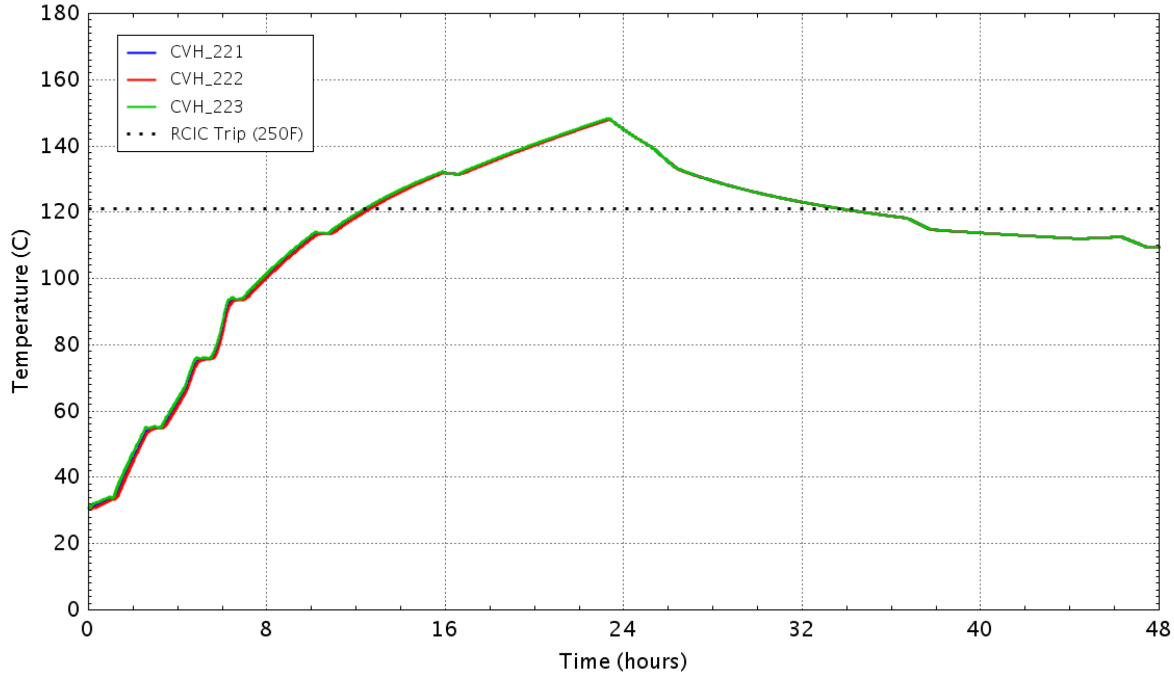

Figure E - 403 Water temperature in the wetwell

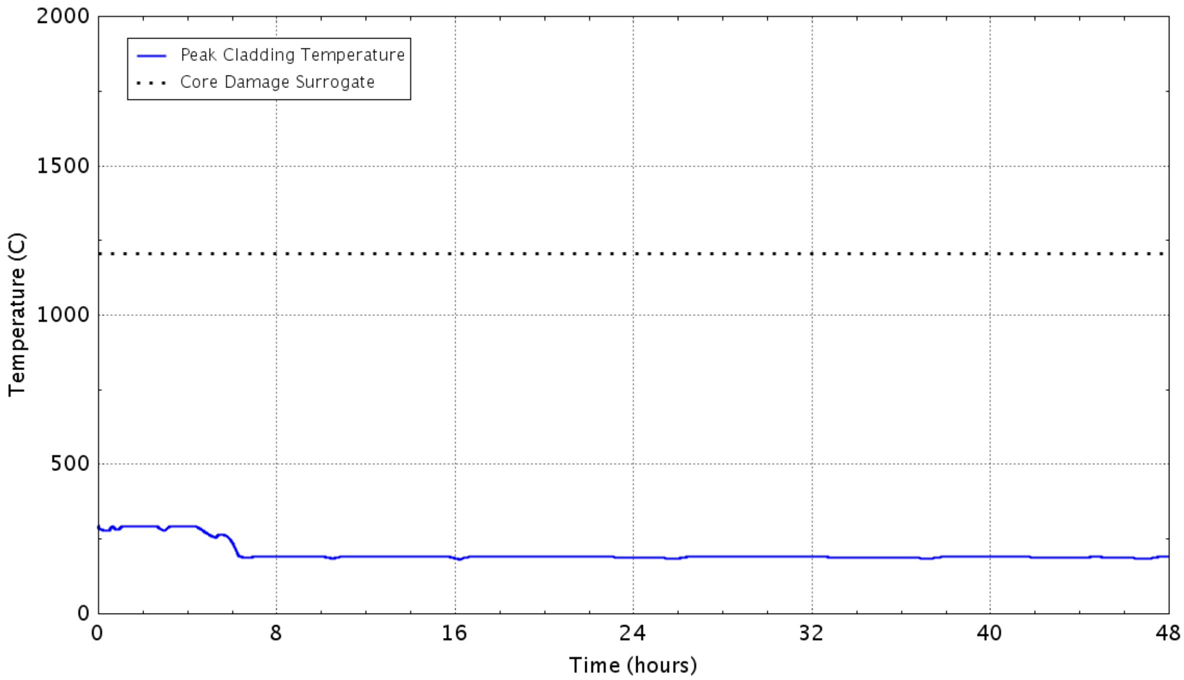

Figure E – 404 Peak temperature of the fuel cladding as a function oftime

E.3 Sensitivity Analyses

E.3.1 Case 1a: Sensitivity to LOOPGR-38-9 Case 1 withCSTUnavailable

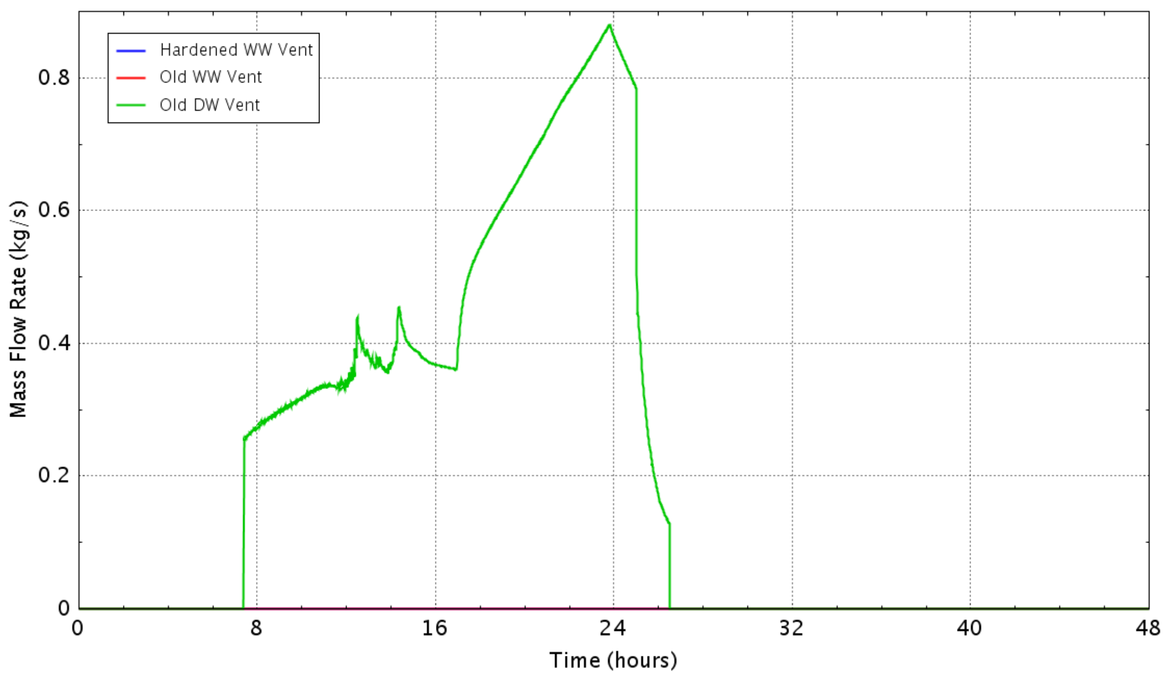

Figure E - 405 Flow rate of the containment vents

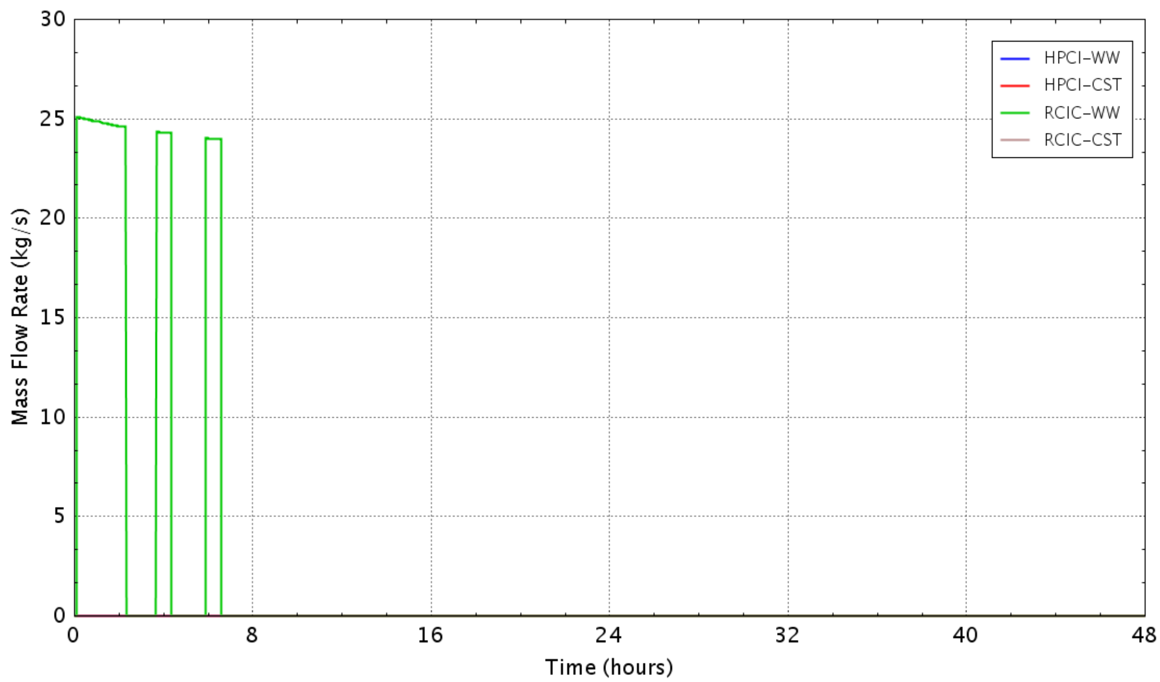

Figure E - 406 Flow rate of the HPCI/RCIC pumps

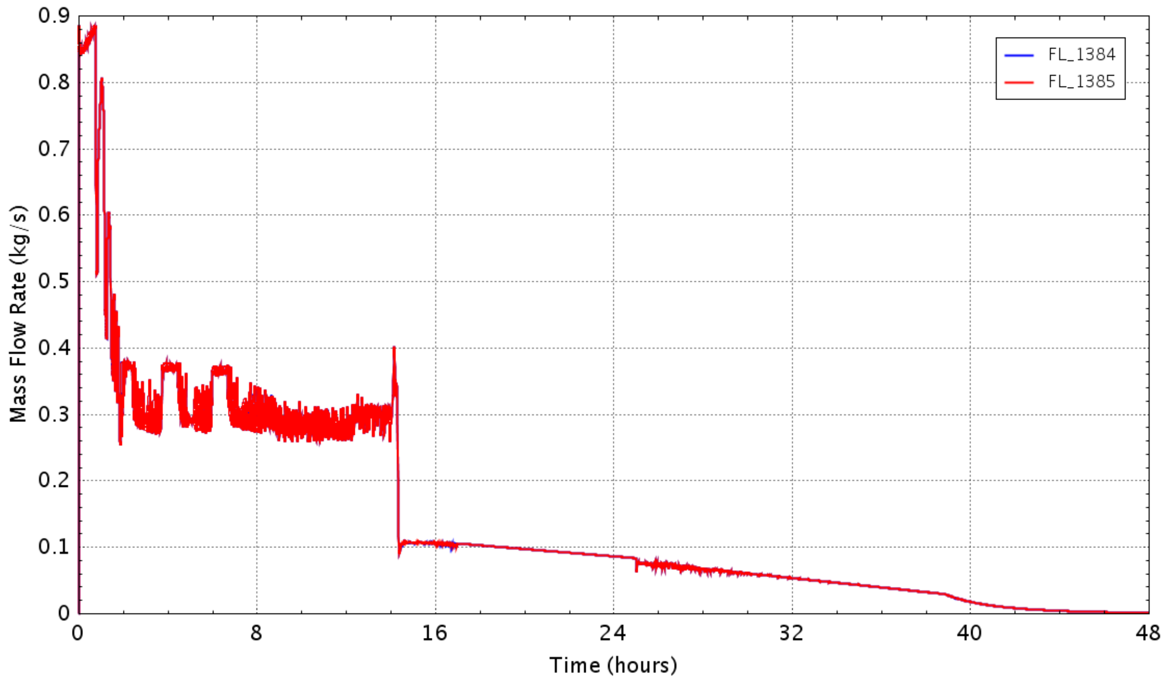

Figure E - 407 Flow rate of the recirculating pump seal leakage

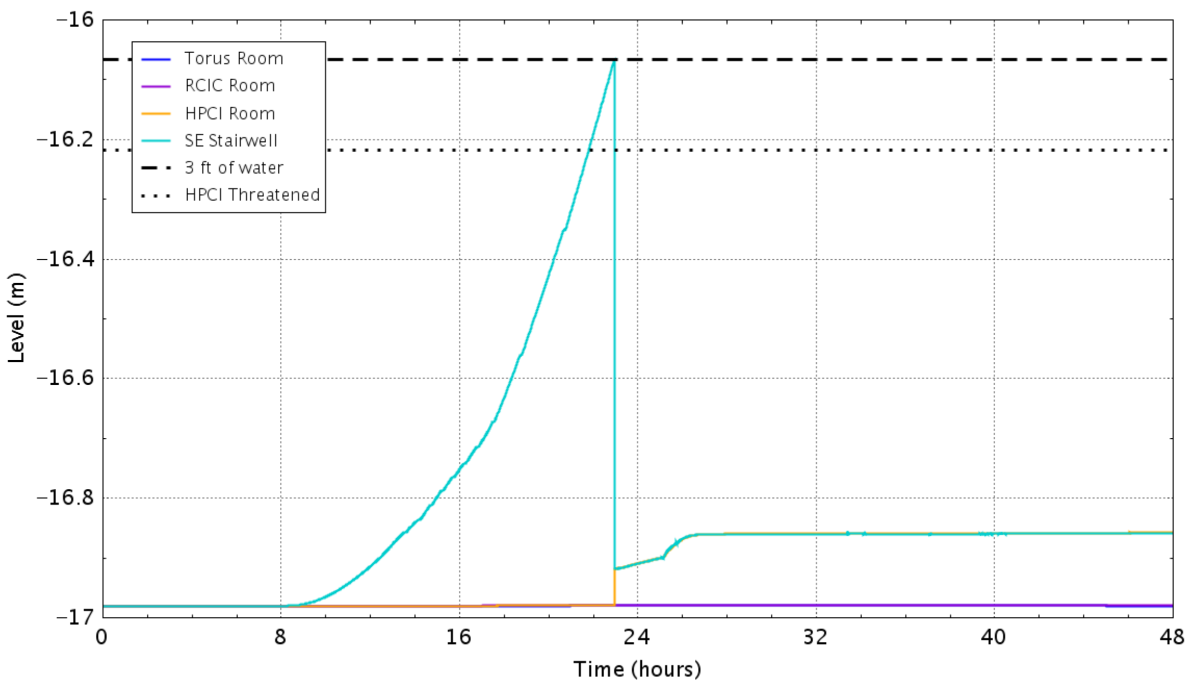

Figure E - 408 Water level in the reactor building basement

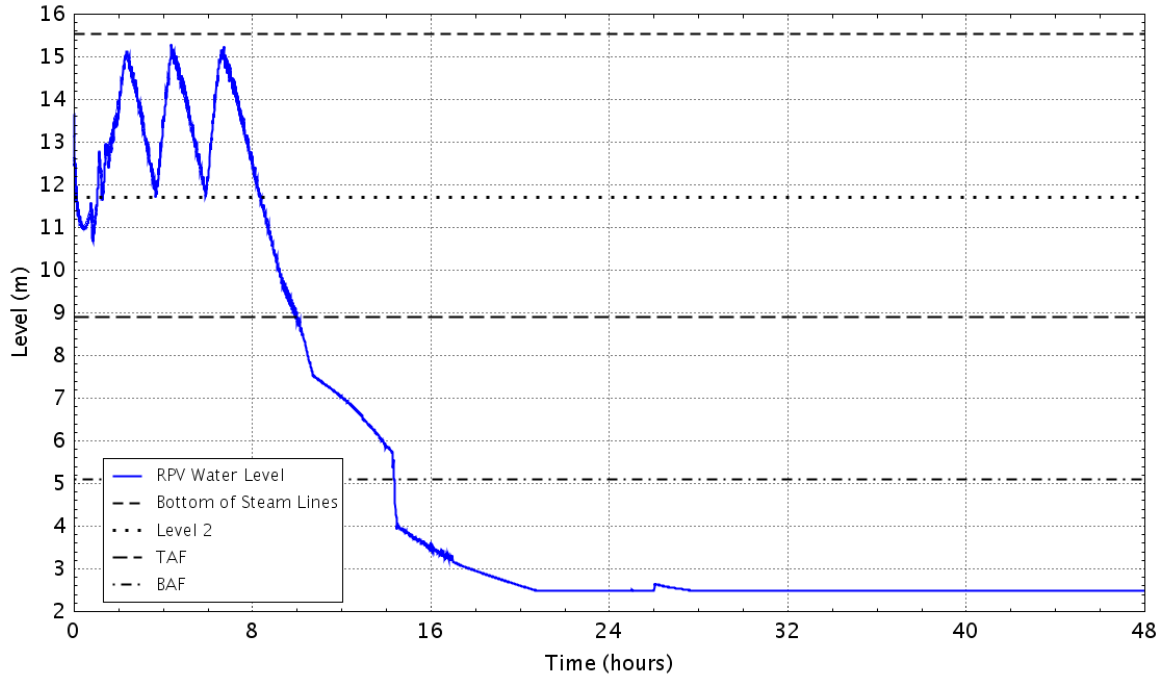

Figure E - 409 RPV down comer water level

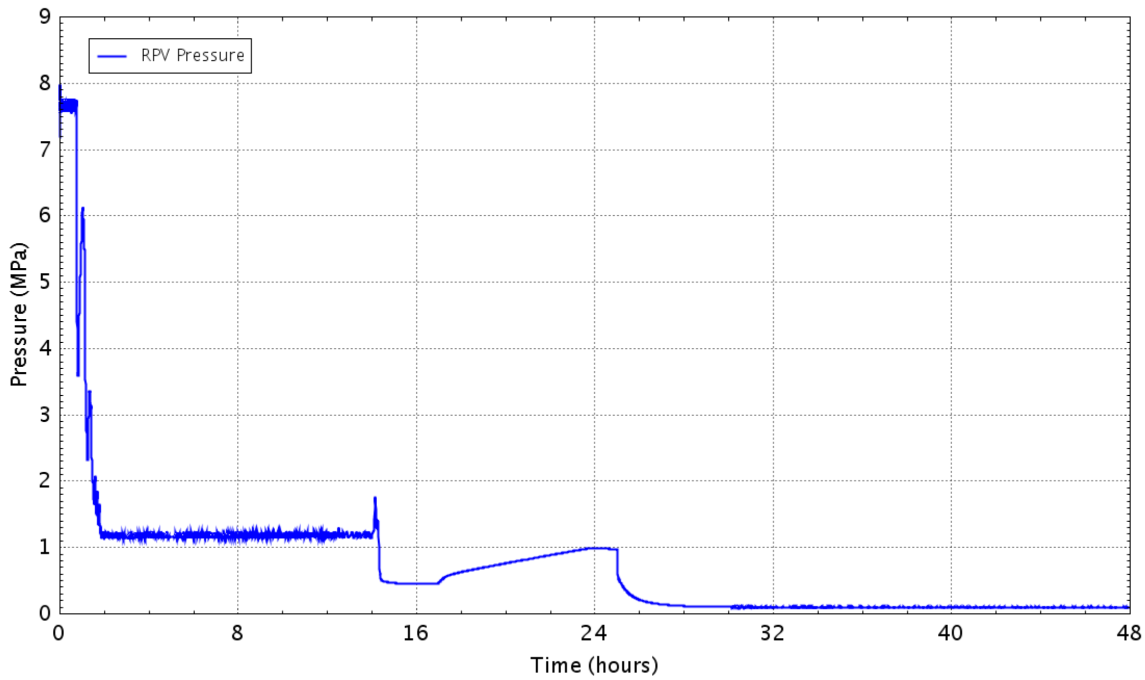

Figure E - 410 Pressure in theRPV

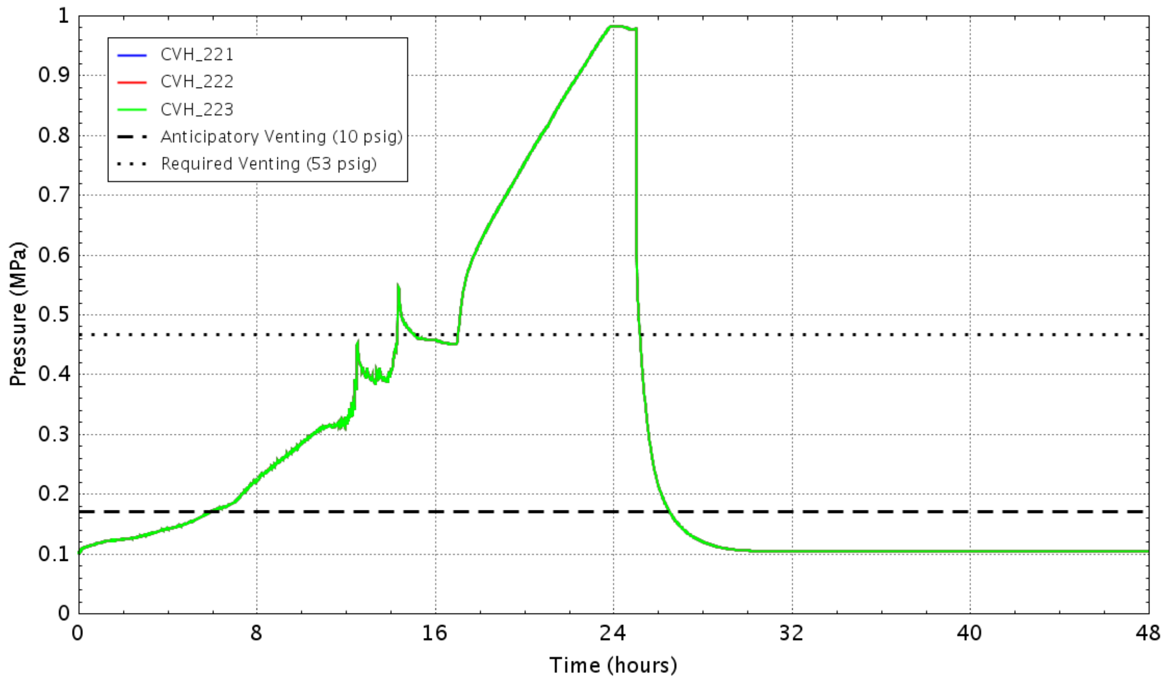

Figure E – 411 Pressure in the wetwell

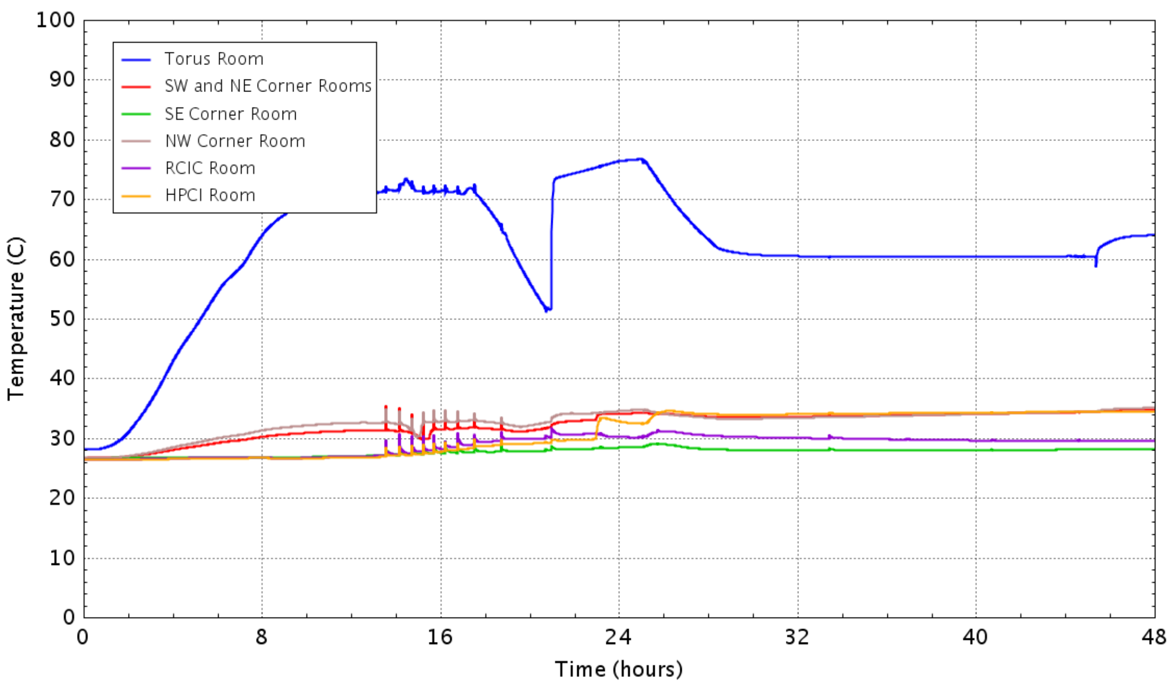

Figure E - 412 Vapor temperature in the reactor building basement

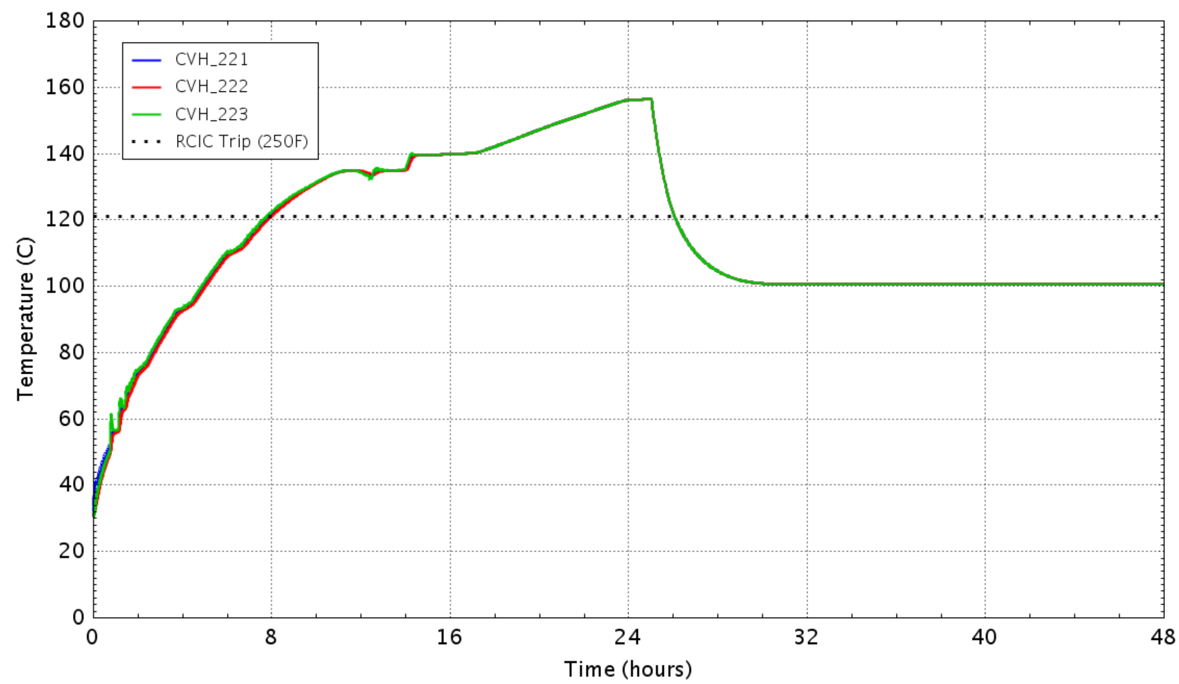

Figure E - 413 Water temperature in the wetwell

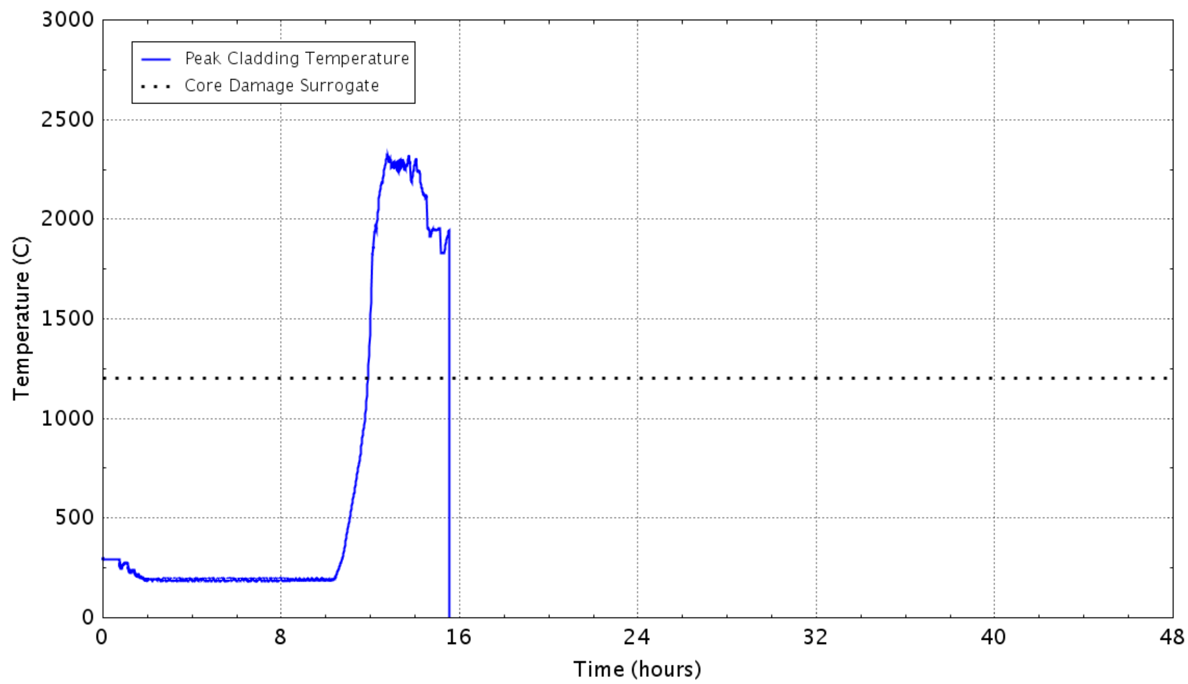

Figure E - 414 Peak temperature of the fuel cladding as a function of time

E.3.2 Case 3a: Sensitivity to LOOPGR-38-9 Case 3 with HPCI Available Insteadof RCIC

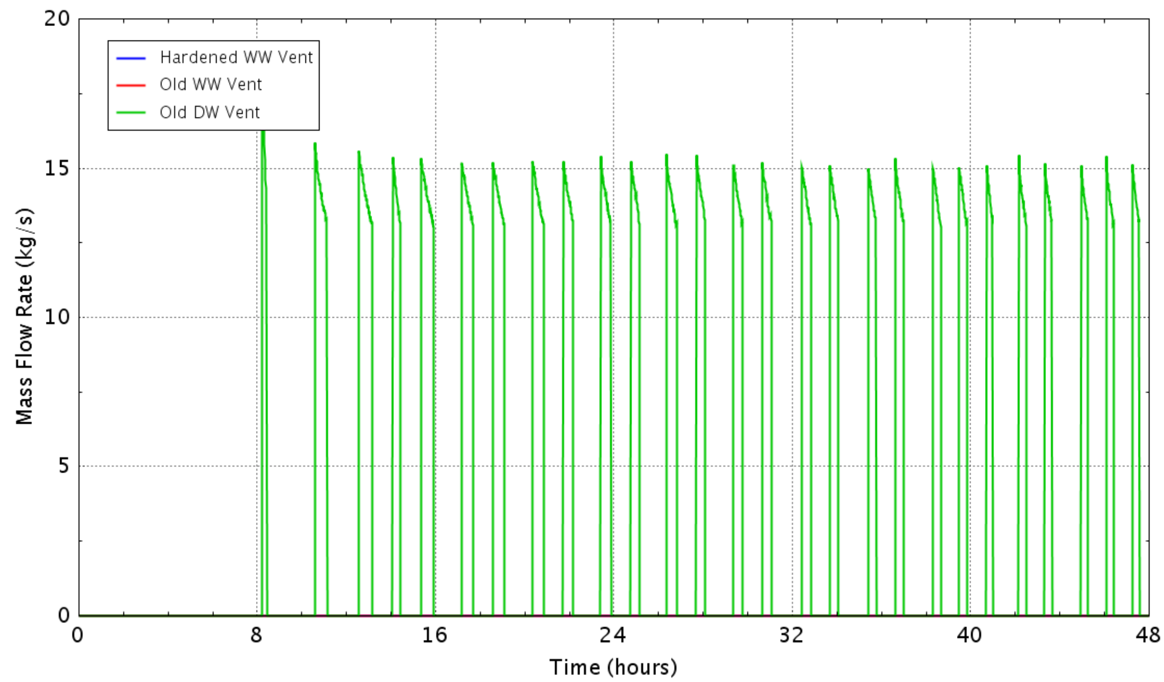

Figure E - 415 Flow rate of the containment vents

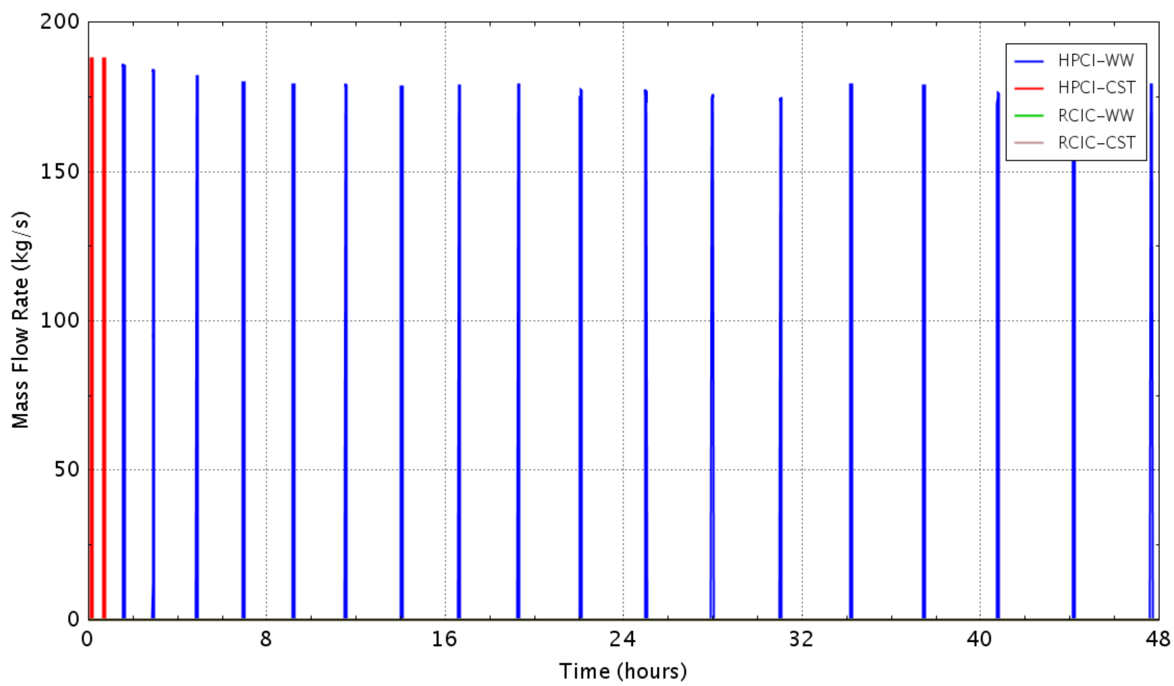

Figure E - 416 Flow rate of the HPCI/RCIC pumps

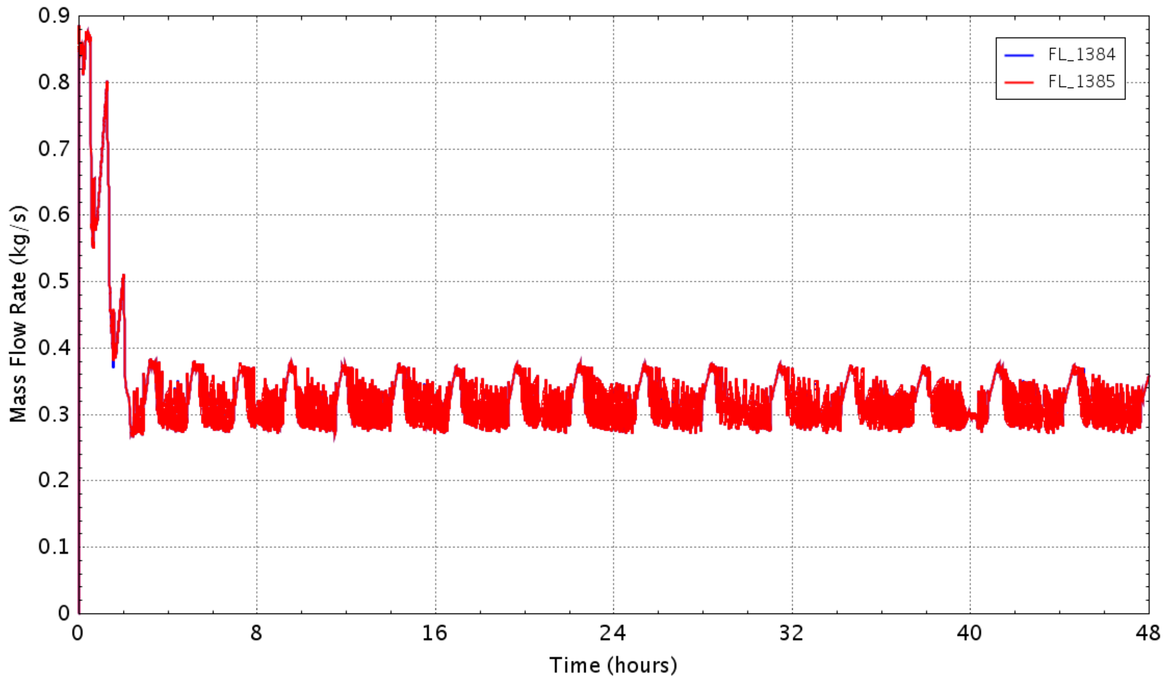

Figure E - 417 Flow rate of the recirculating pump seal leakage

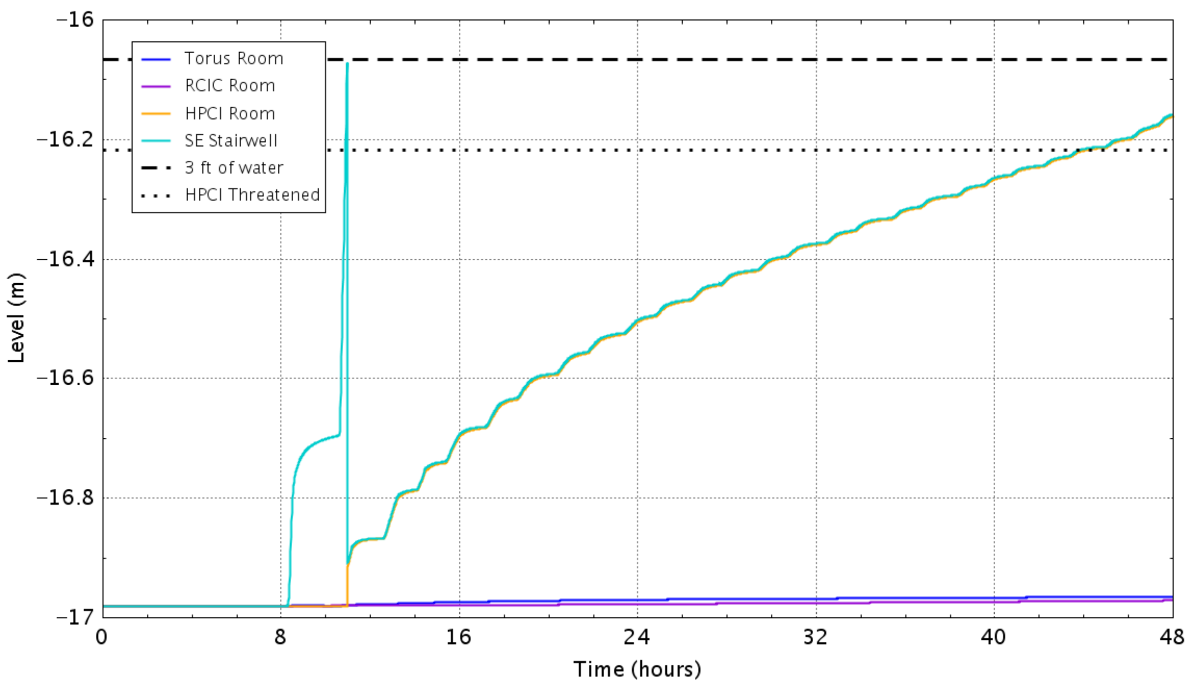

Figure E - 418 Water level in the reactor building basement

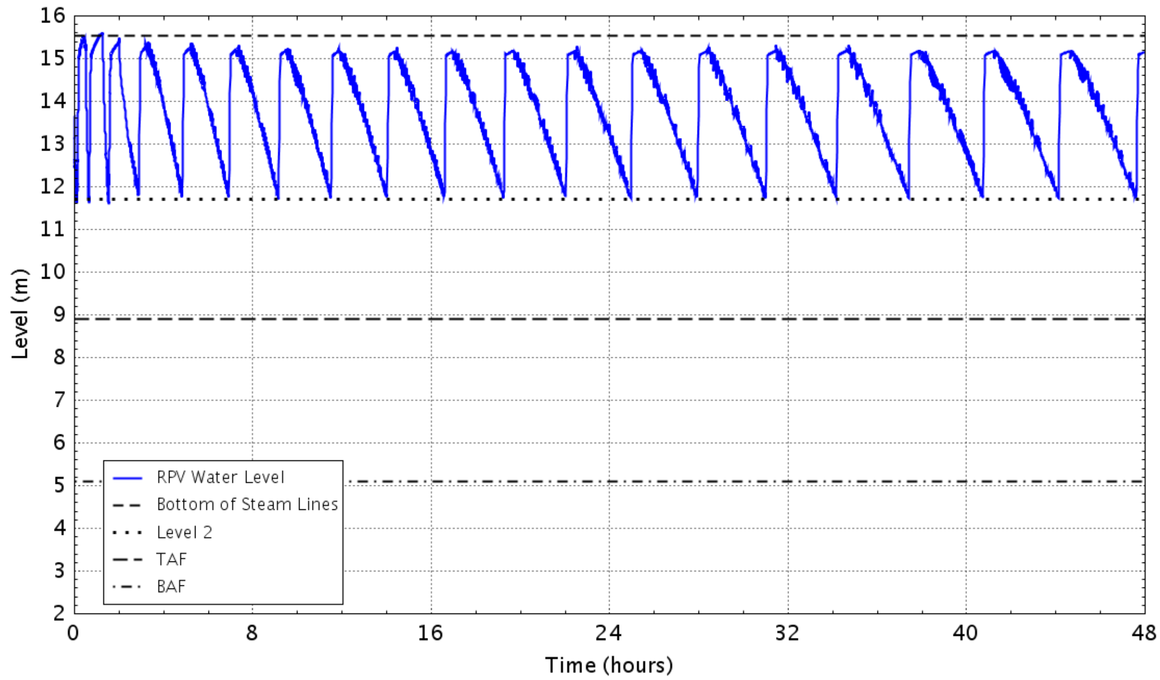

Figure E - 419 RPV down comer water level

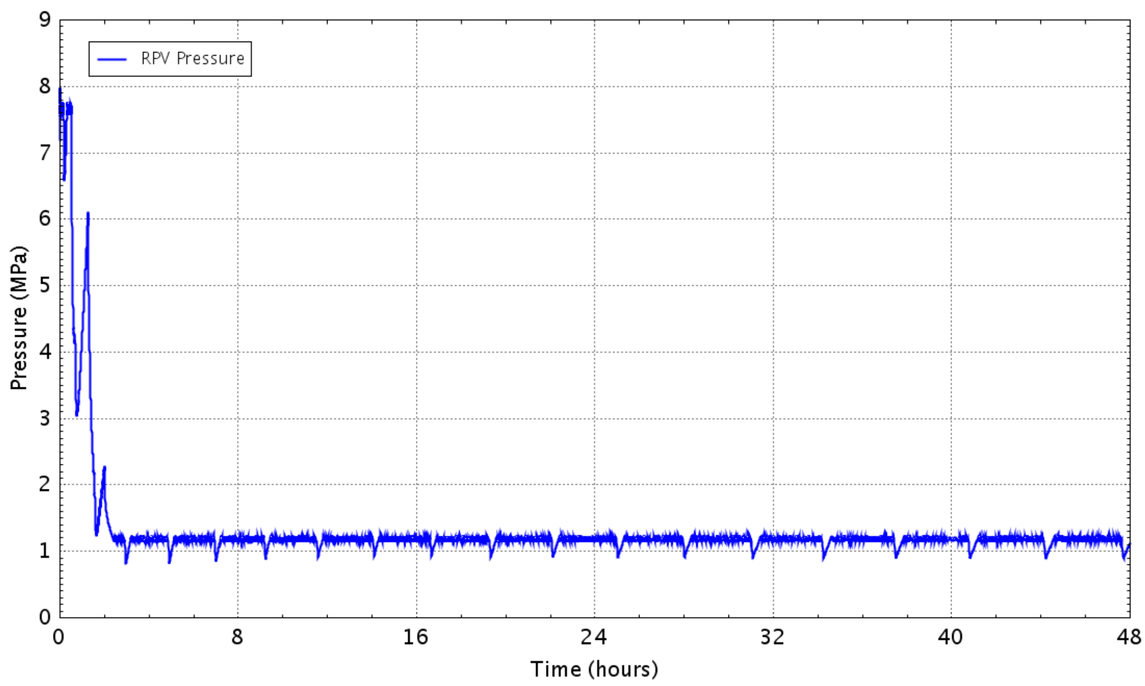

Figure E - 420 Pressure in theRPV

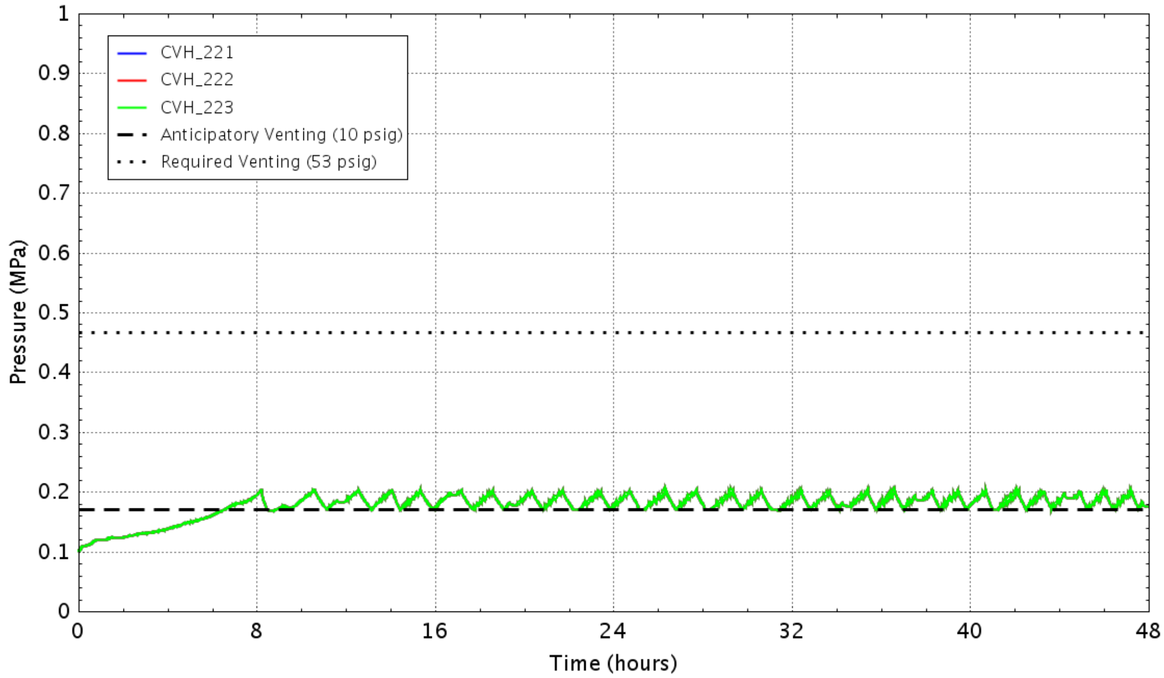

Figure E - 421 Pressure in the wetwell

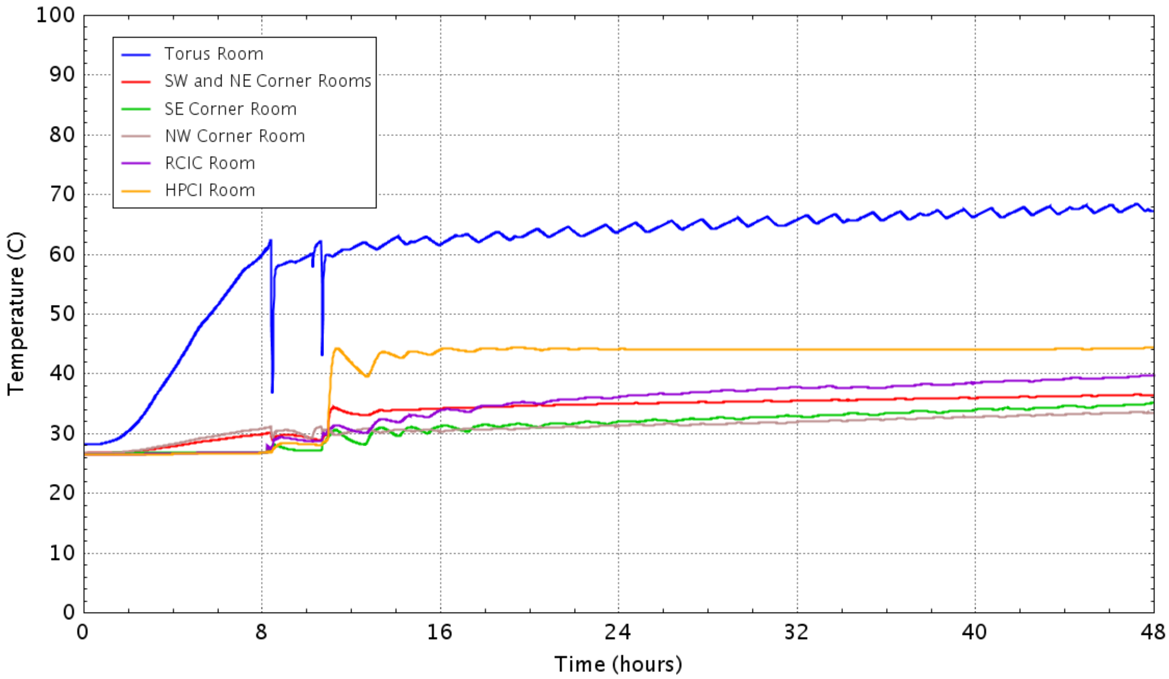

Figure E - 422 Vapor temperature in the reactor building basement

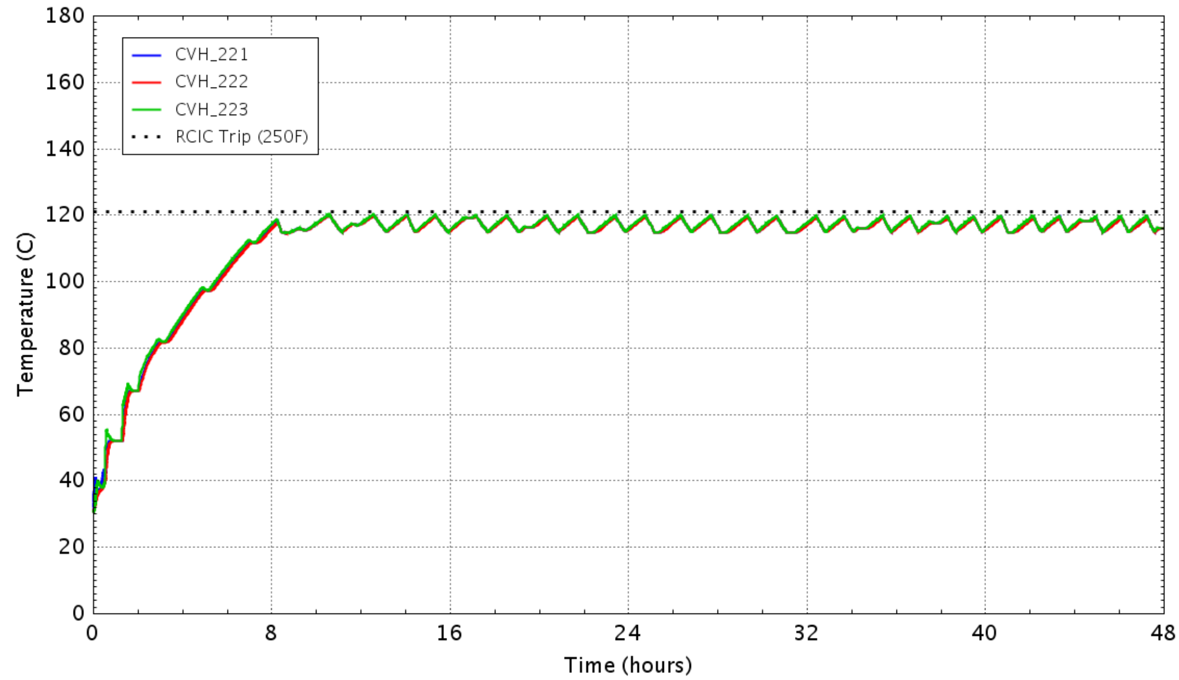

Figure E - 423 **Water temperature in the wetwell**

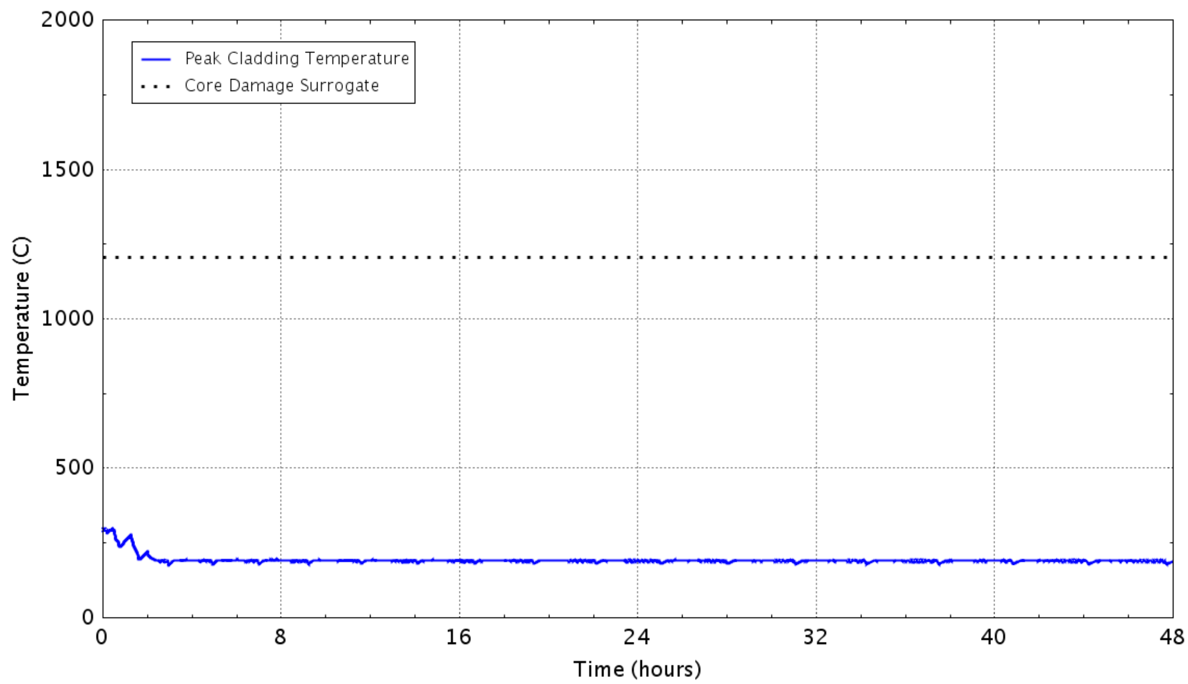

Figure E - 424 **Peak temperature of the fuel cladding as a function of time**

E.3.3 Case 3b: Sensitivity to LOOPGR-38-9 Case 3 with CST Unavailable

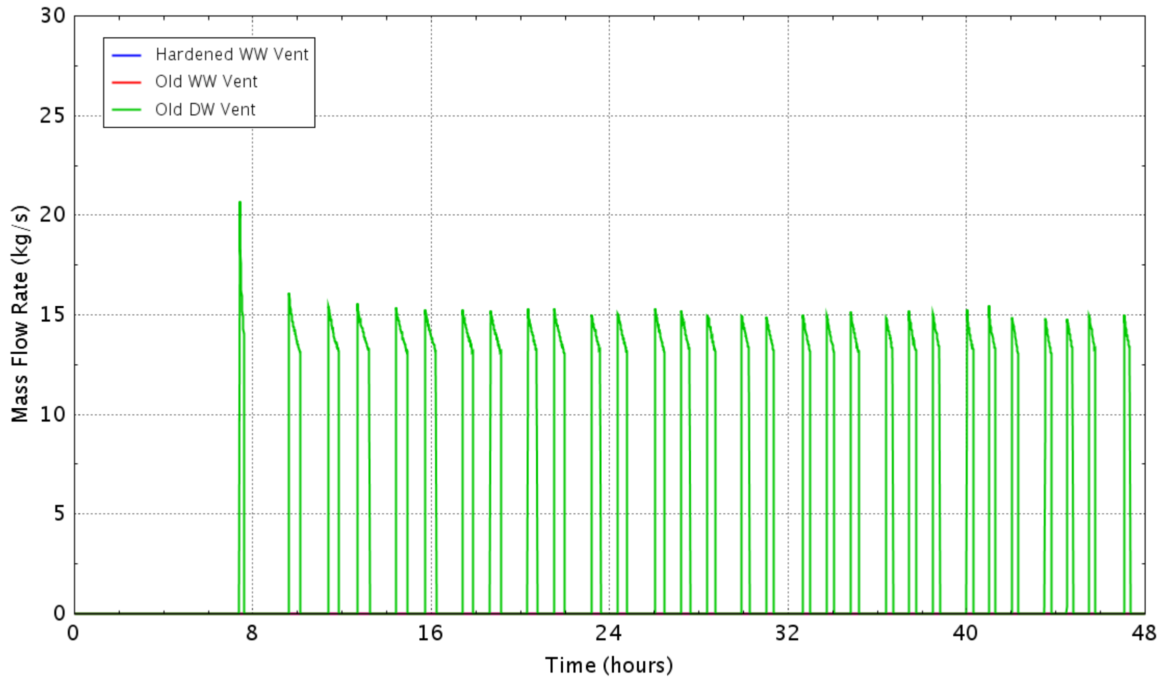

Figure E - 425 Flow rate of the containment vents

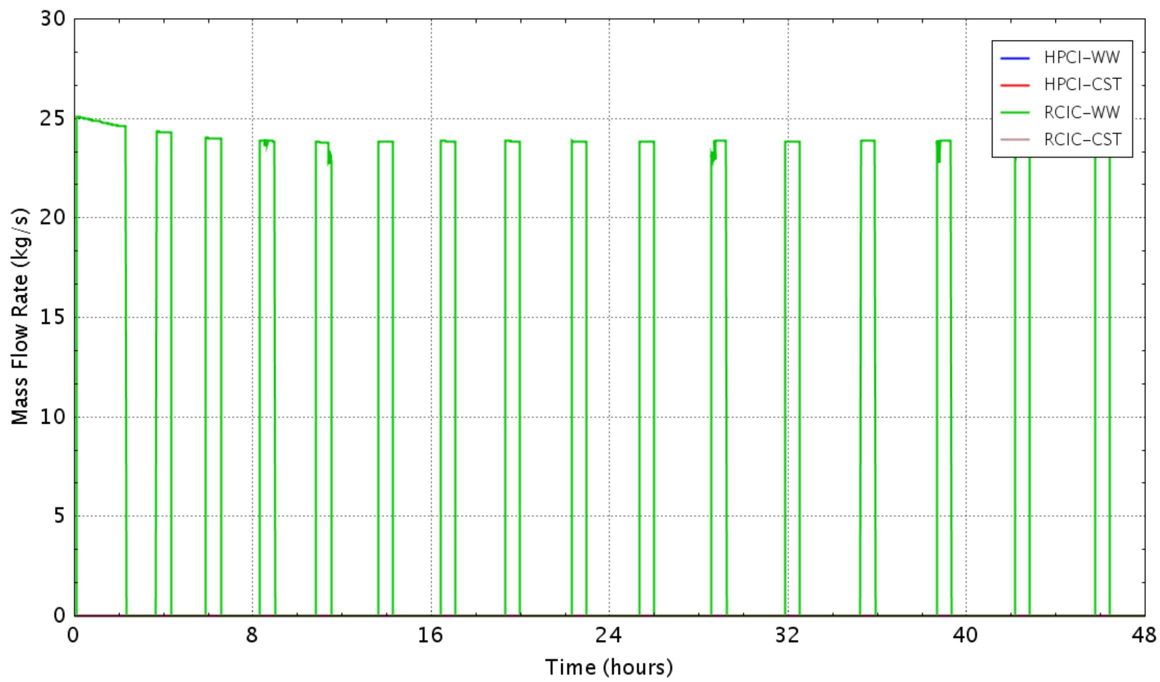

Figure E - 426 Flow rate of the HPCI/RCIC pumps

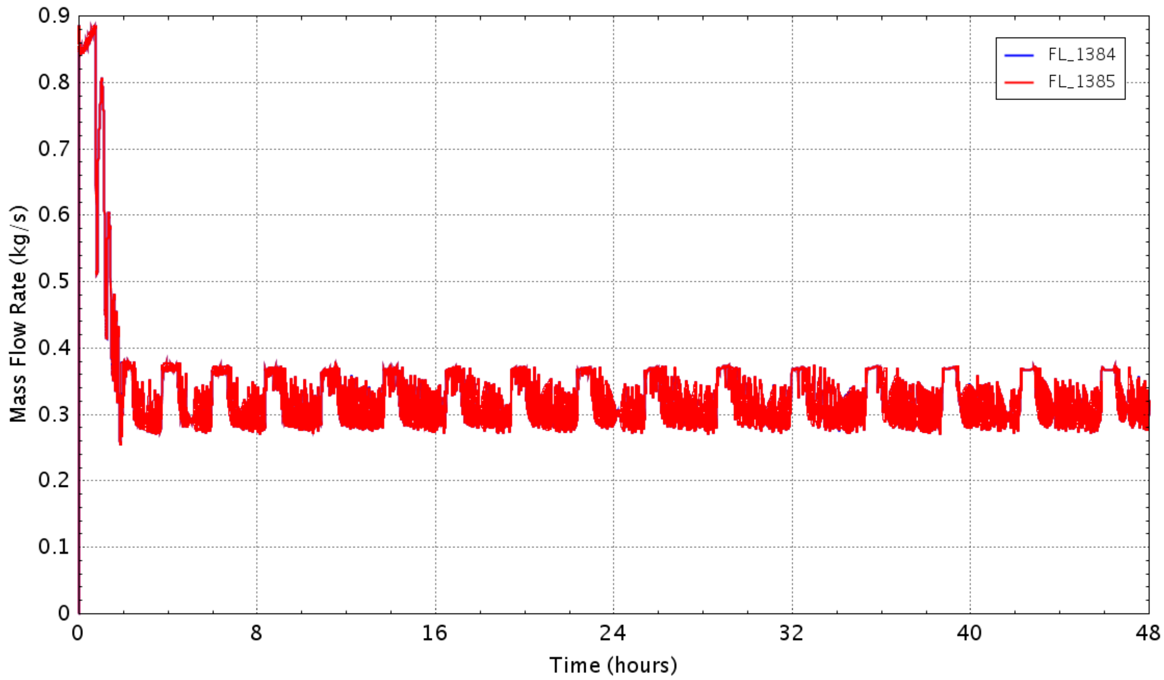

Figure E - 427 **Flow rate of the recirculating pump seal leakage**

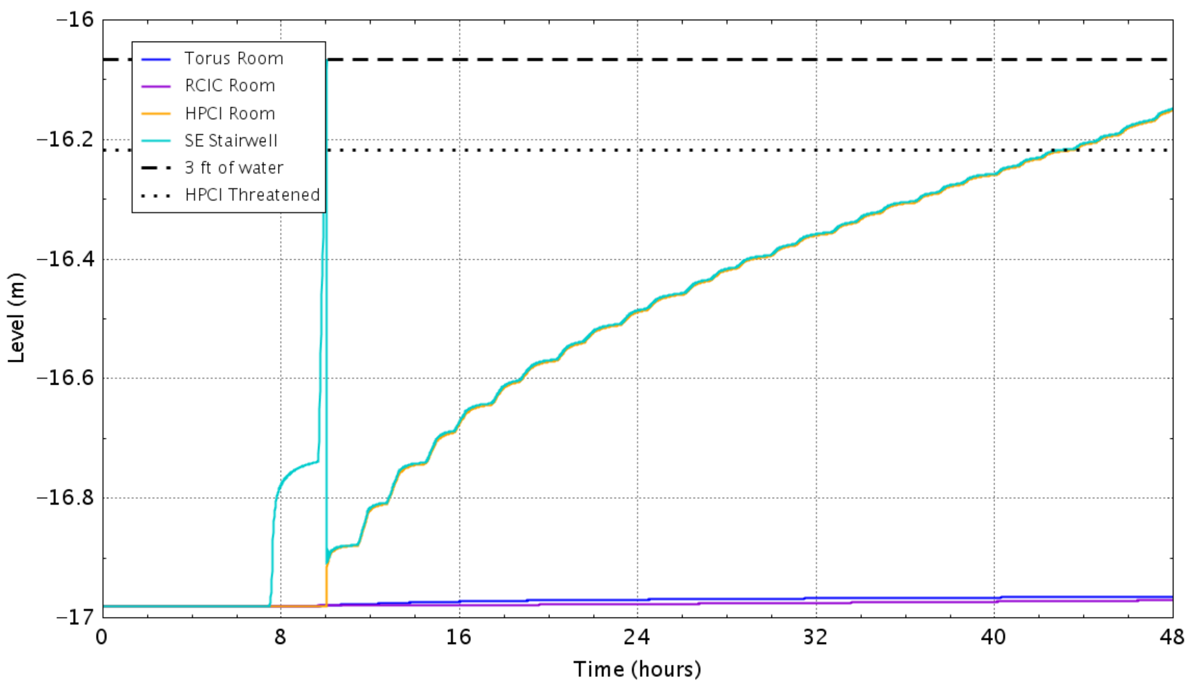

Figure E - 428 **Water level in the reactor building basement**

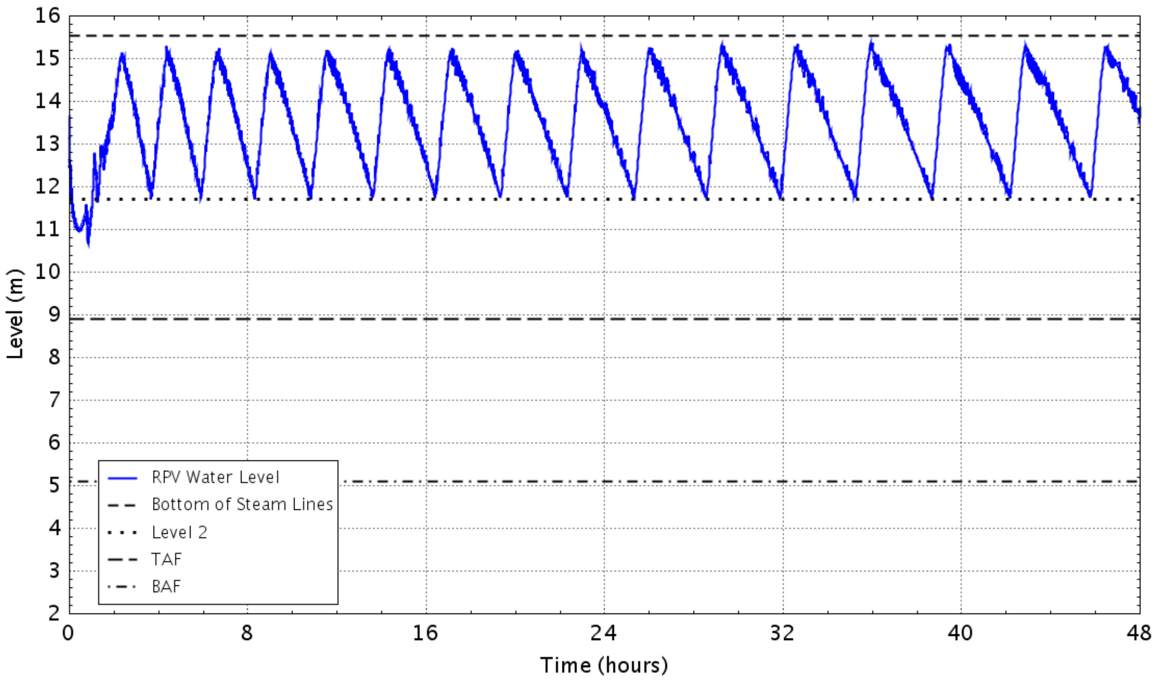

Figure E - 429 RPV down comer water level

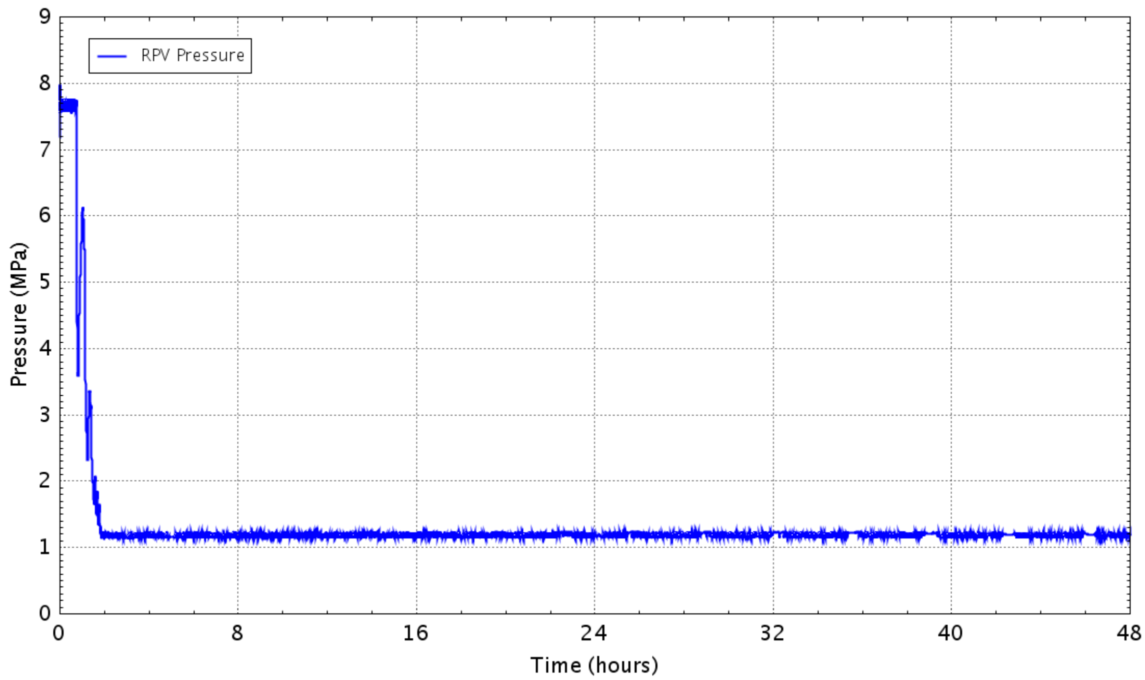

Figure E - 430 Pressure in theRPV

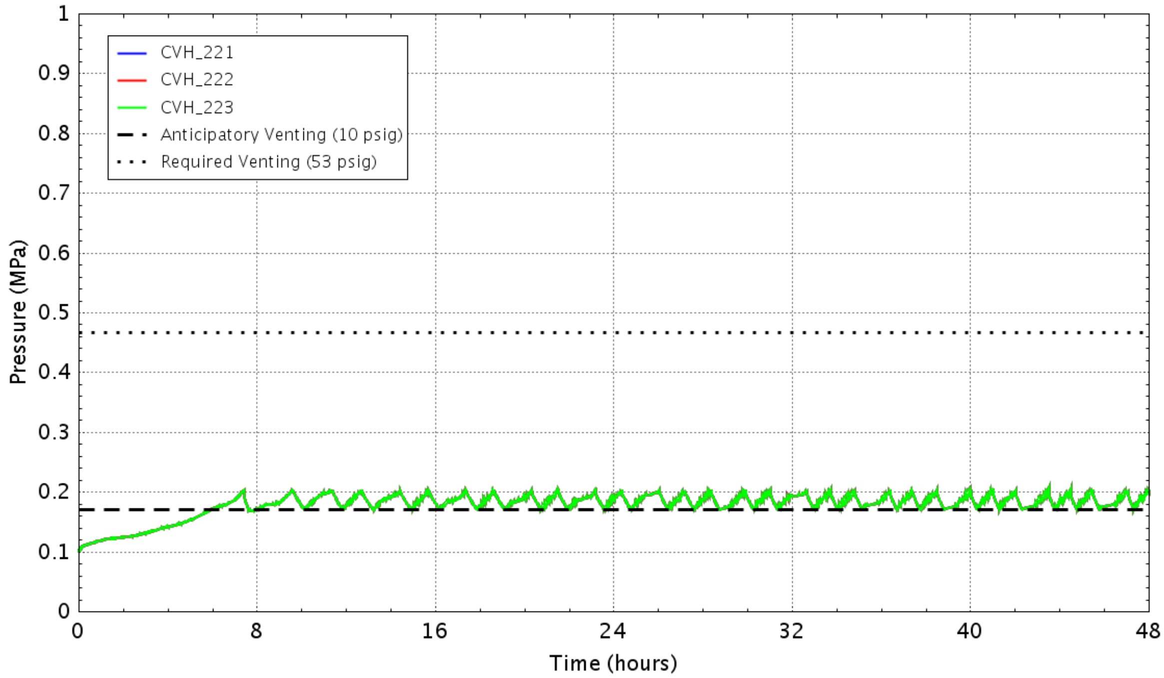

Figure E - 431 Pressure in the wetwell

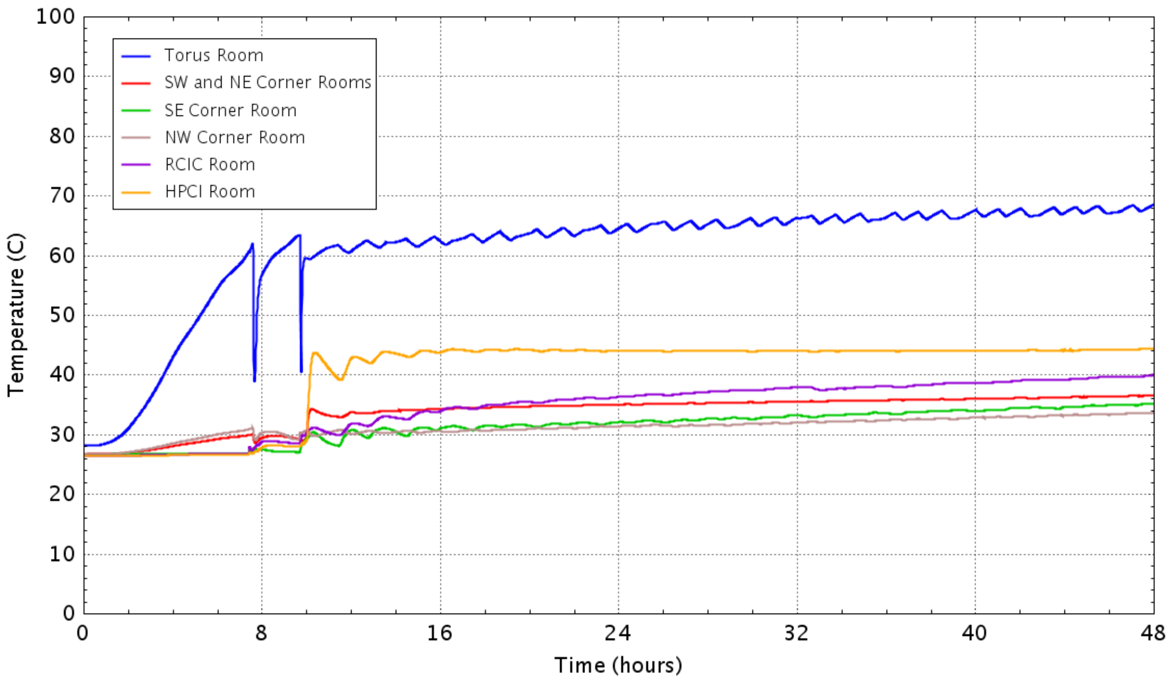

Figure E - 432 Vapor temperature in the reactor building basement

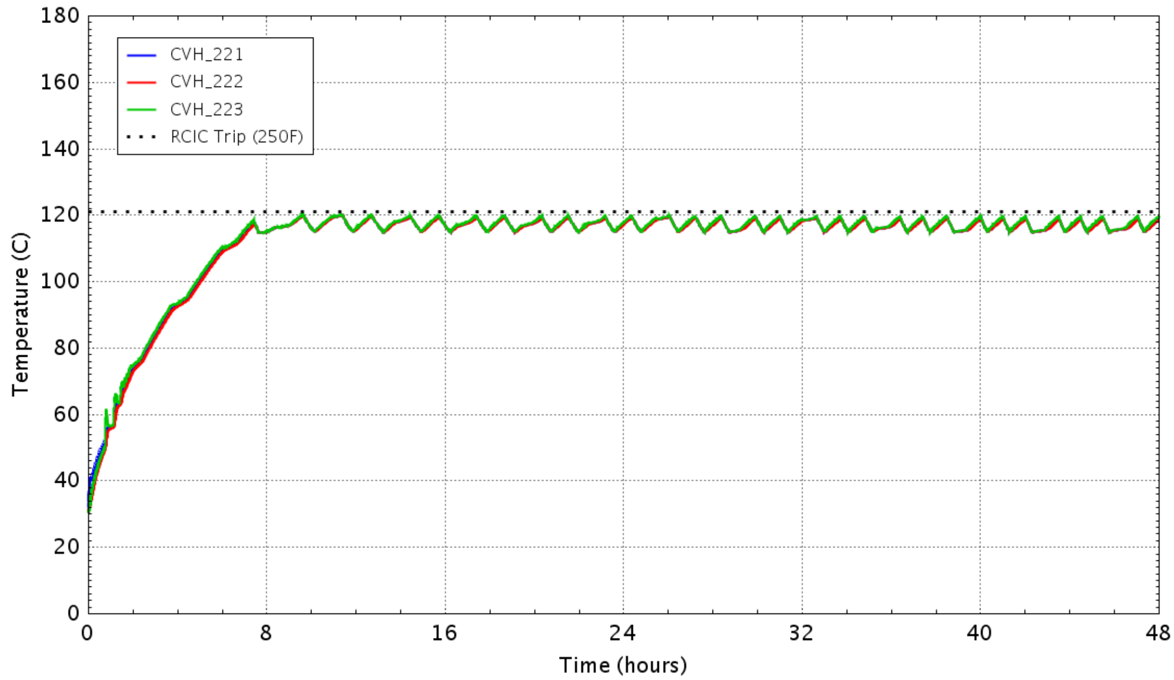

Figure E - 433 **Water temperature in the wetwell**

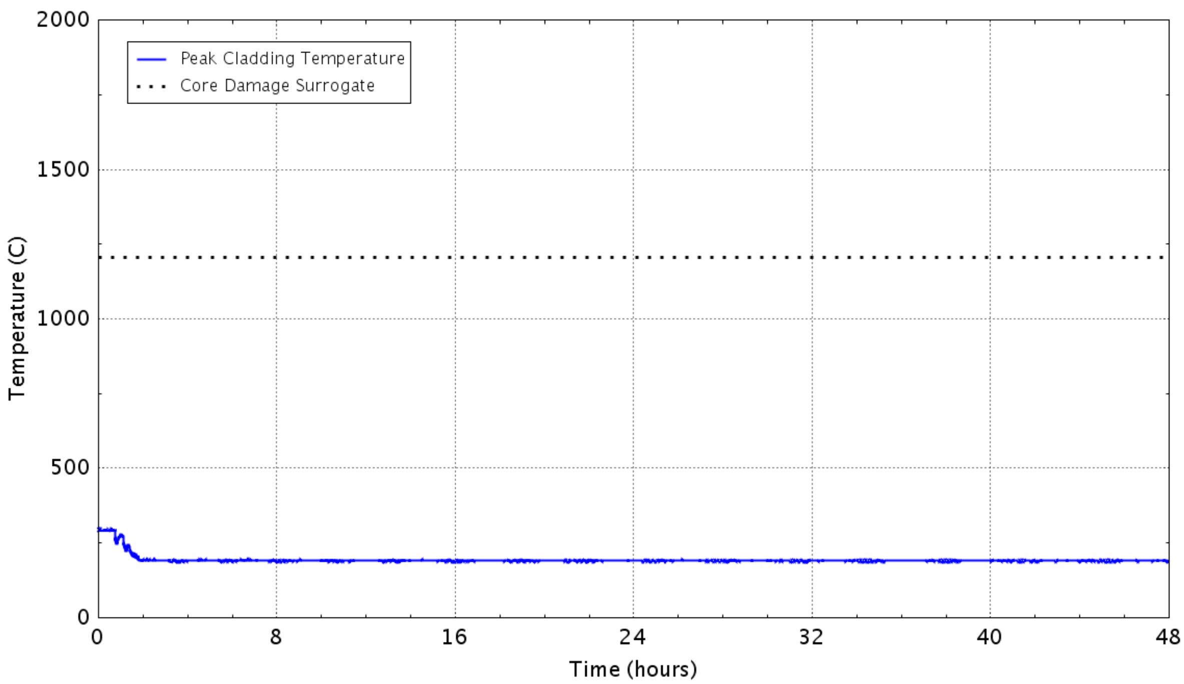

Figure E - 434 **Peak temperature of the fuel cladding as a function of time**

E.3.4 Case 3c: Sensitivity to LOOPGR-38-9 Case 3 with NoContainmentventing

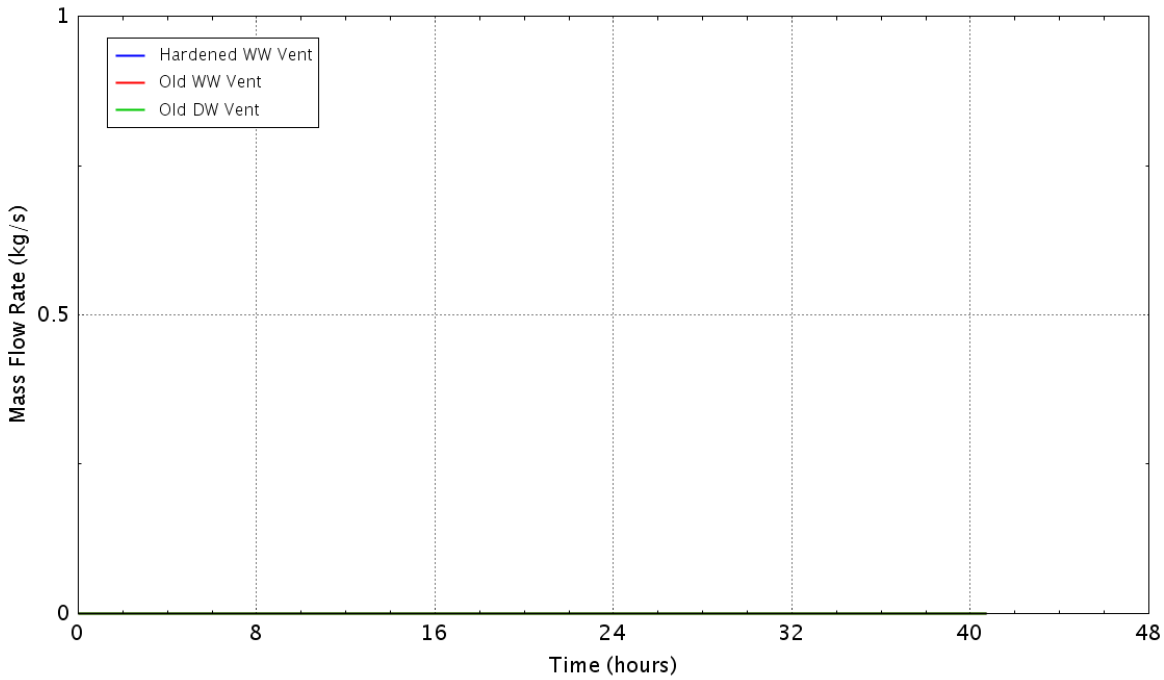

Figure E - 435 Flow rate of the containment vents

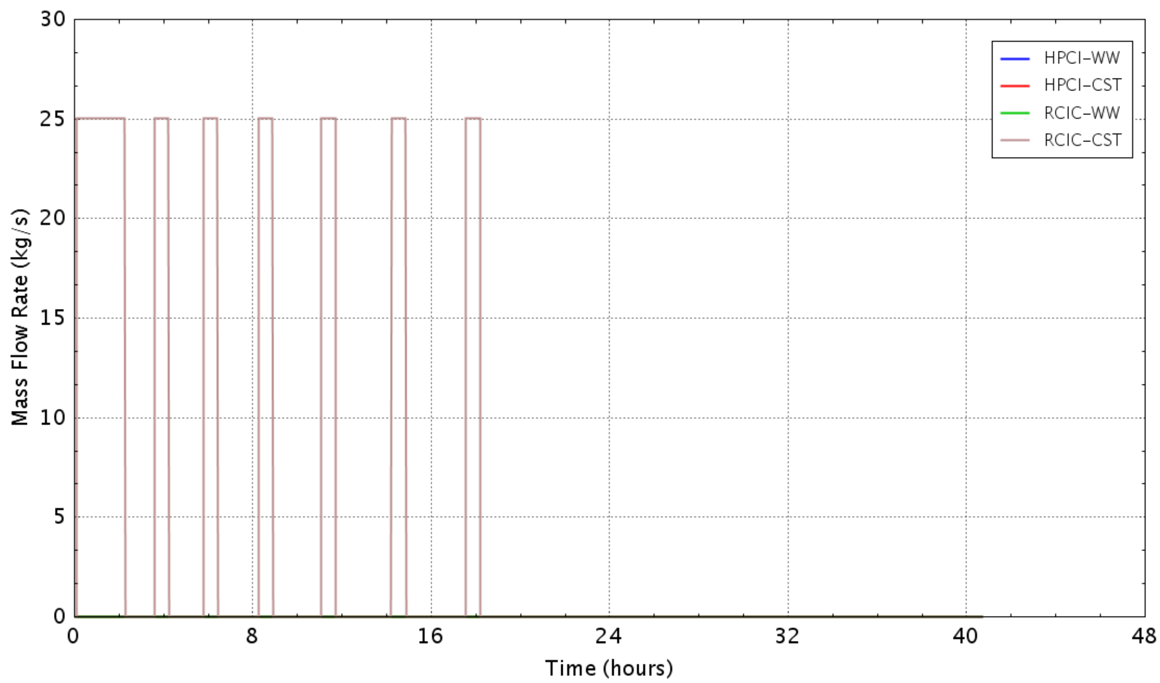

Figure E - 436 Flow rate of the HPCI/RCIC pumps

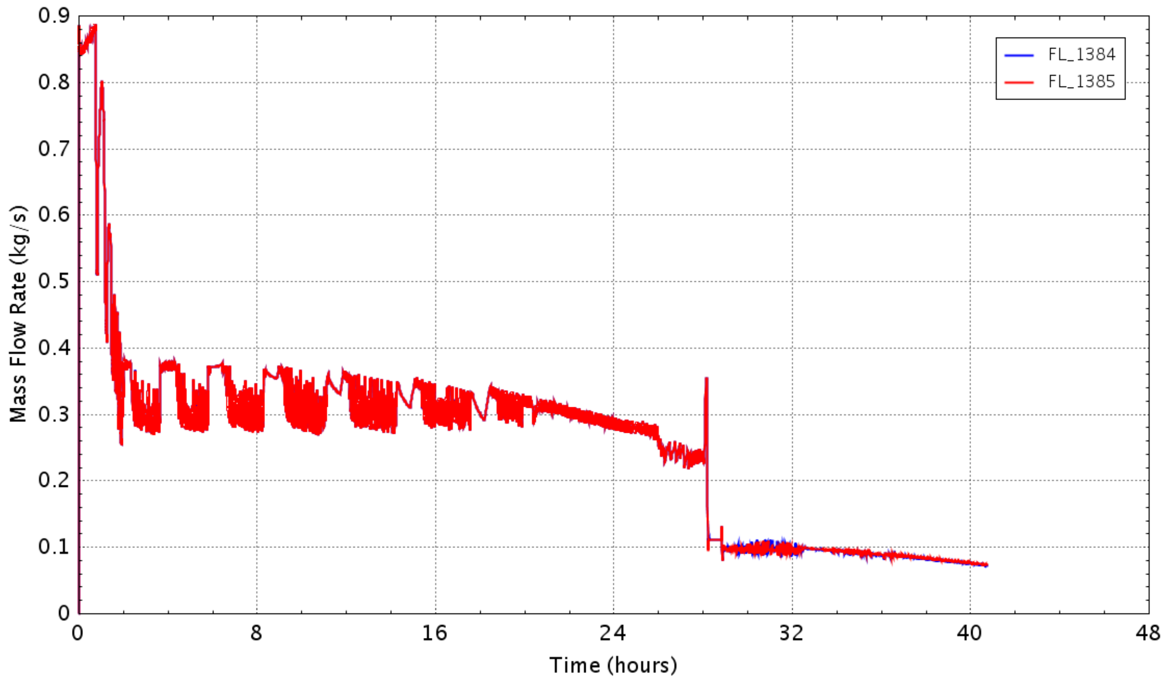

Figure E - 437 Flow rate of the recirculating pump seal leakage

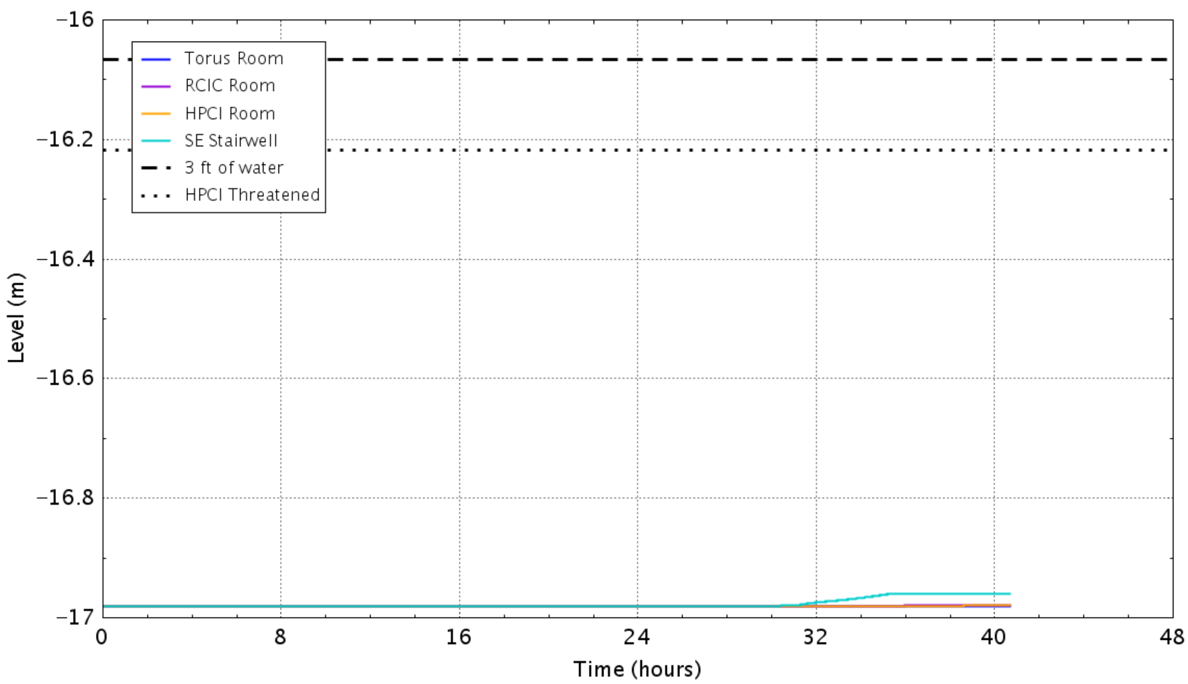

Figure E - 438 Water level in the reactor building basement

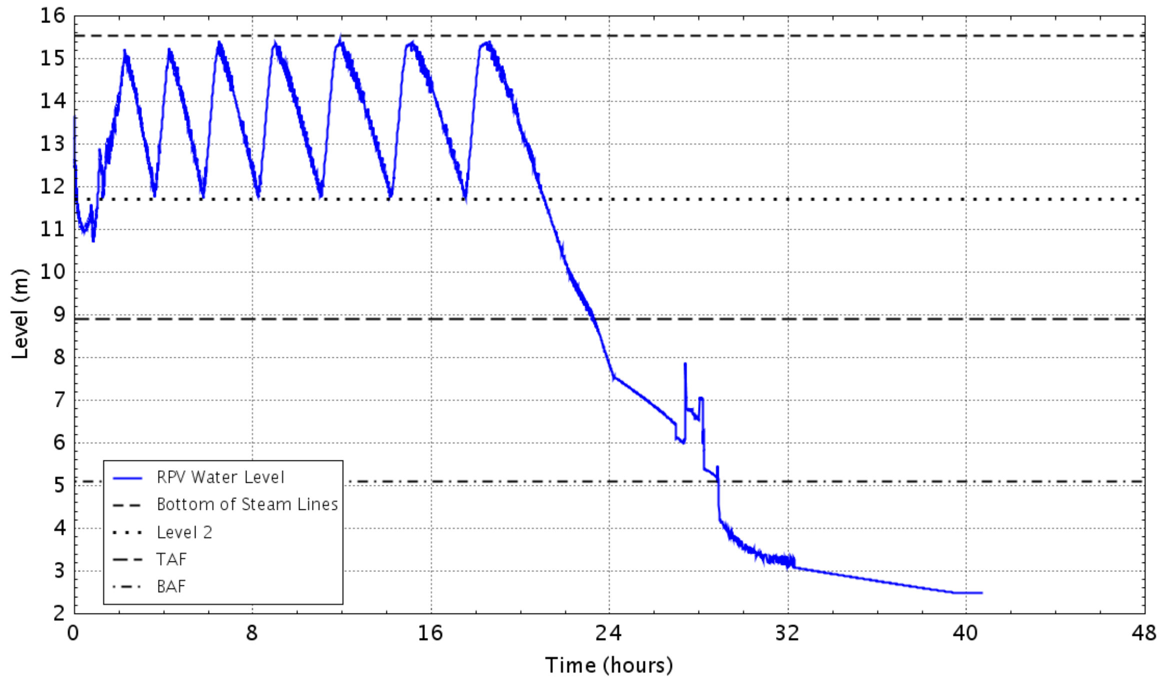

Figure E - 439 RPV down comer water level

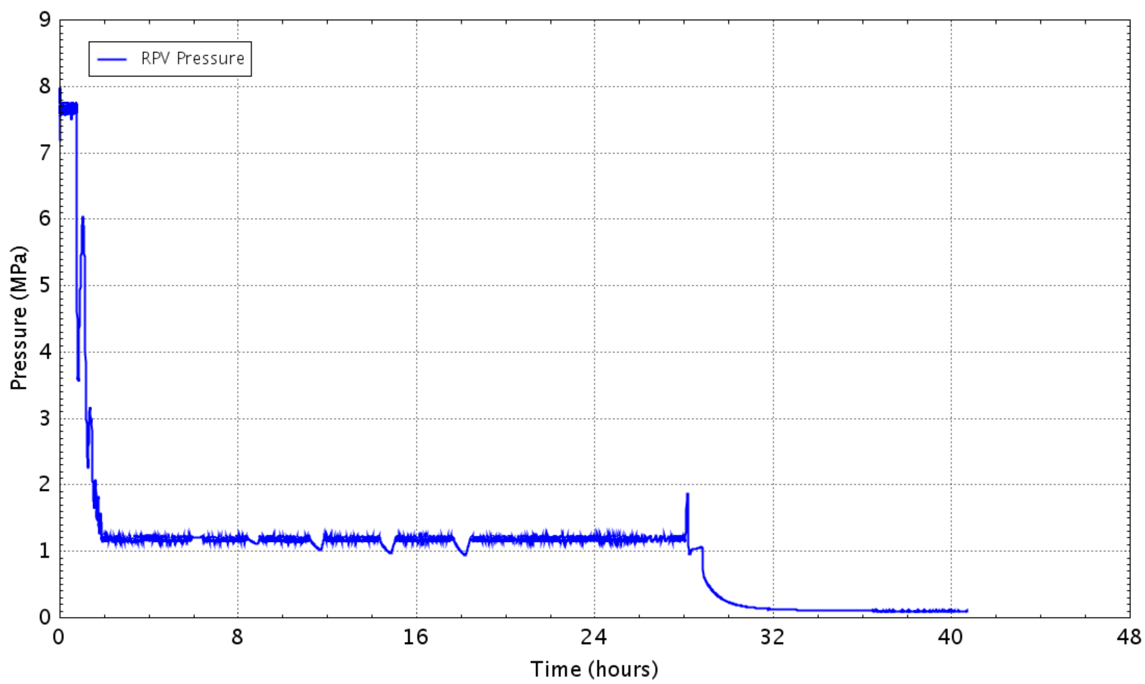

Figure E - 440 Pressure in theRPV

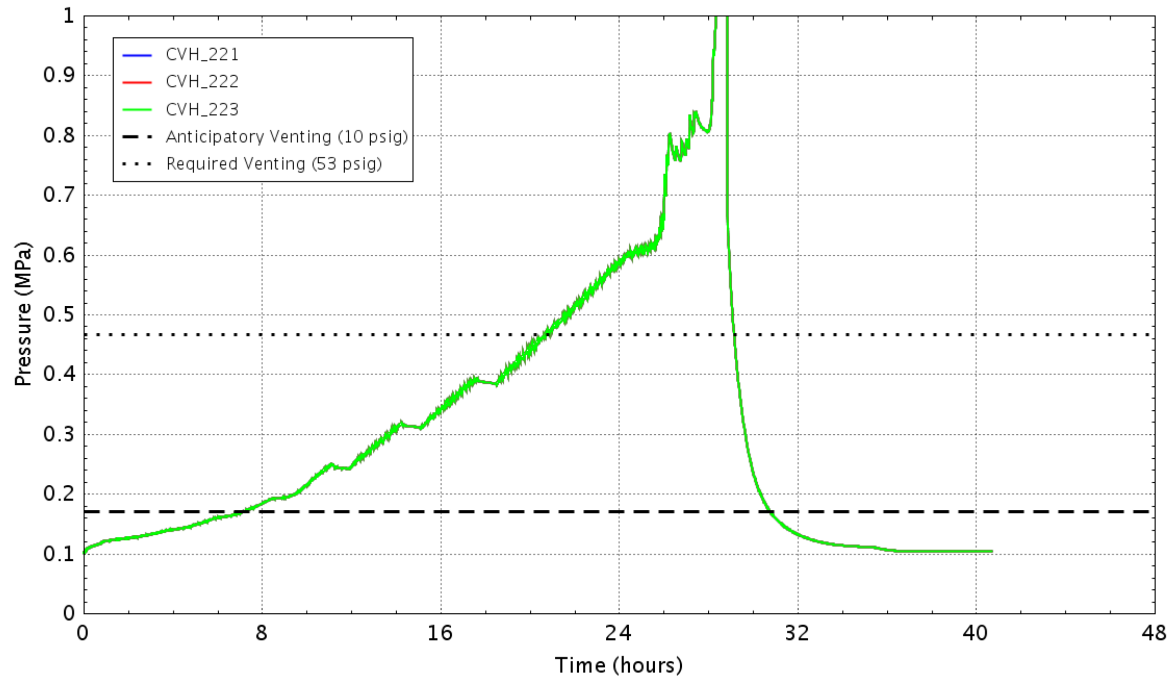

Figure E - 441 Pressure in the wetwell

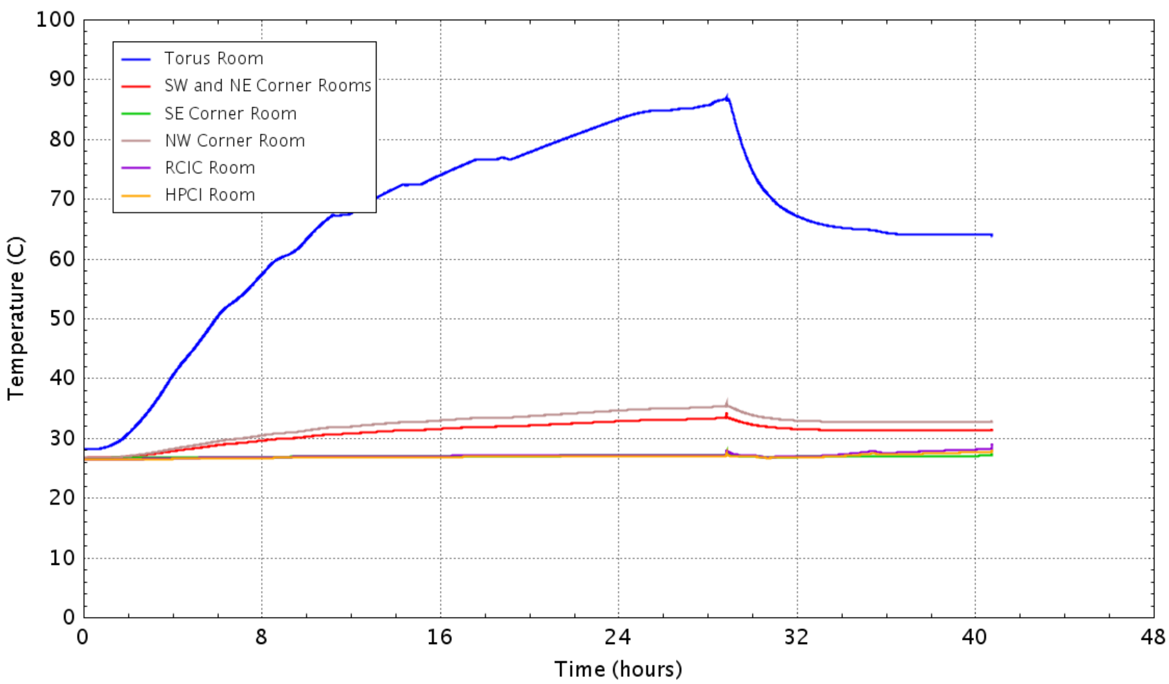

Figure E - 442 Vapor temperature in the reactor building basement

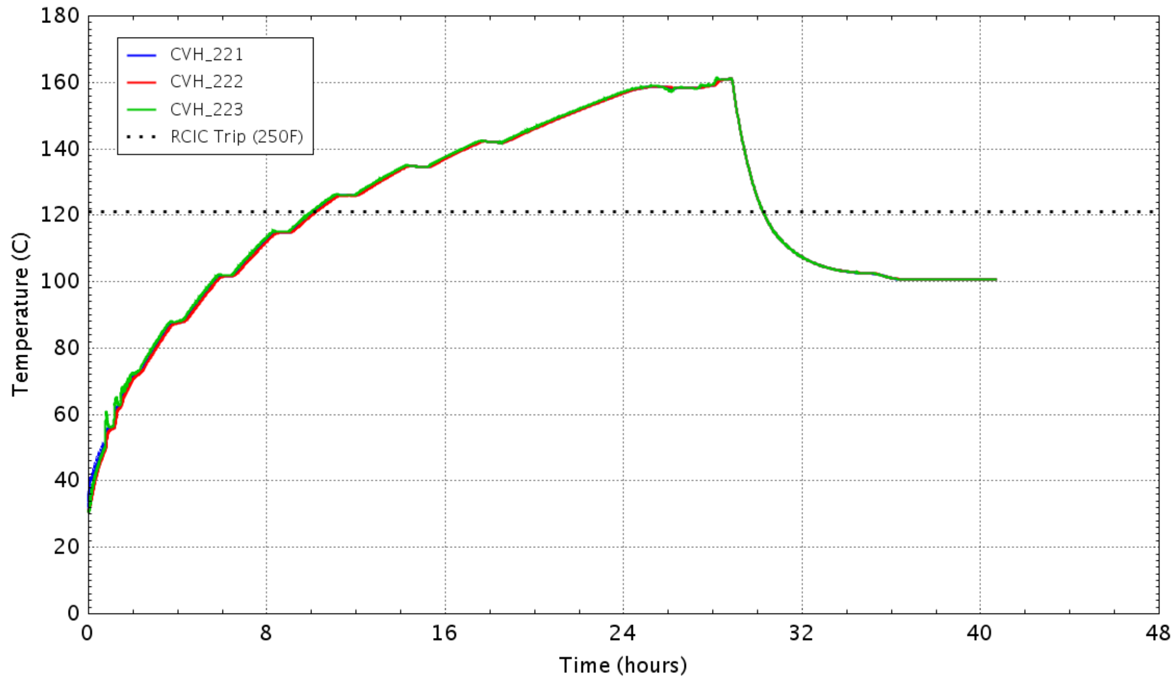

Figure E - 443 Water temperature in the wetwell

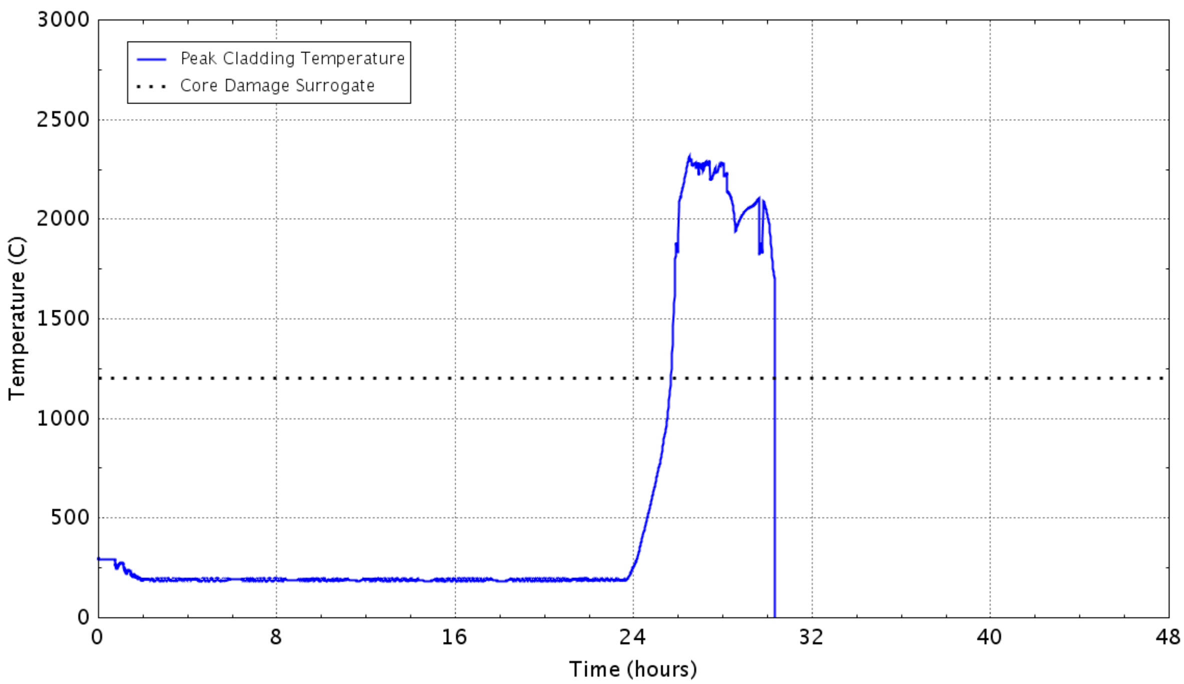

Figure E – 444 Peak temperature of the fuel cladding as a function of time

E.3.5 Case 3d: Sensitivity to LOOPGR-38-9 Case 3 with IncreasedSeal Leakage (150 gpm Total)

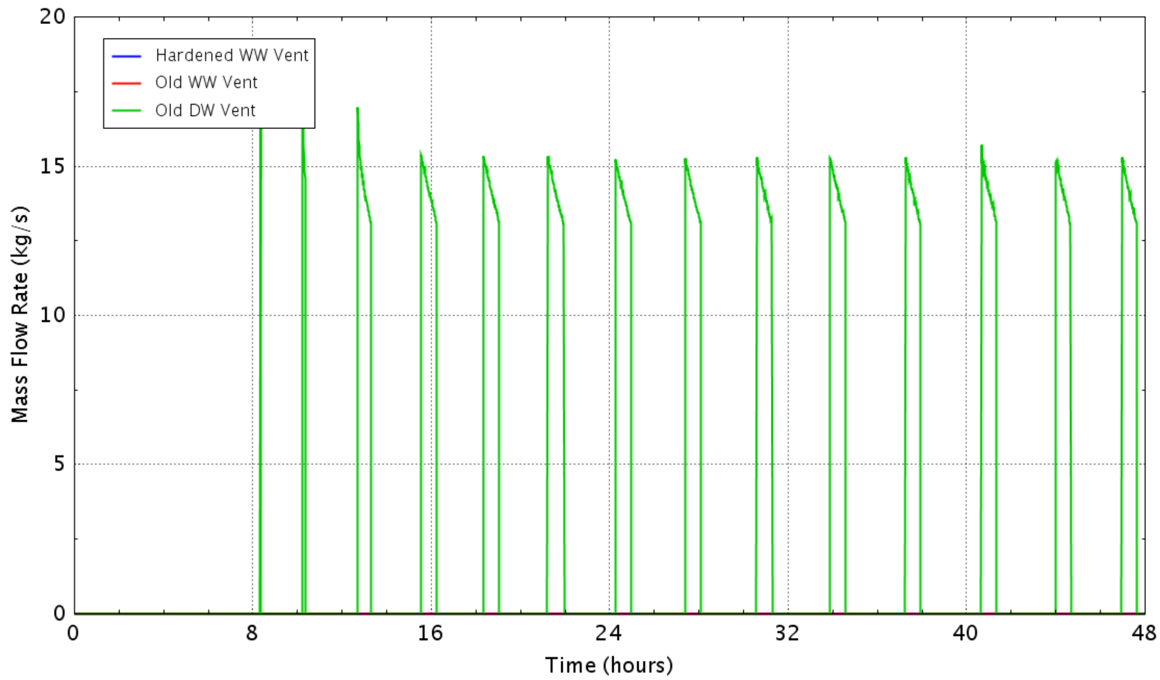

Figure E - 445 **Flow rate of the containment vents**

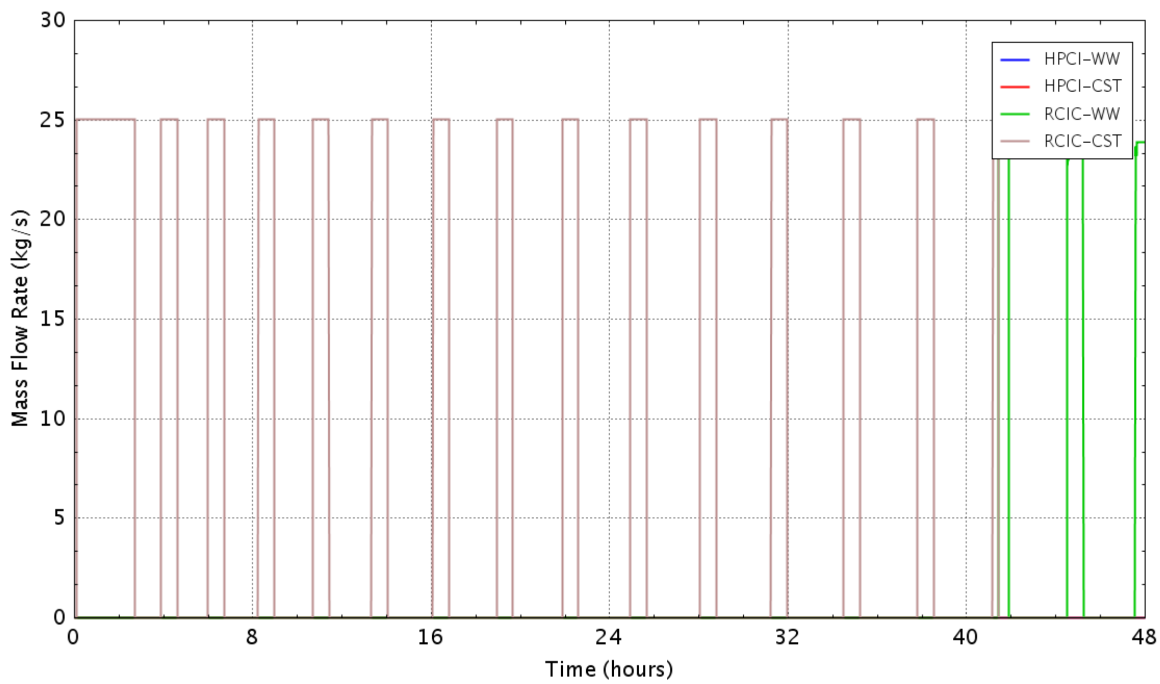

Figure E - 446 **Flow rate of the HPCI/RCIC pumps**

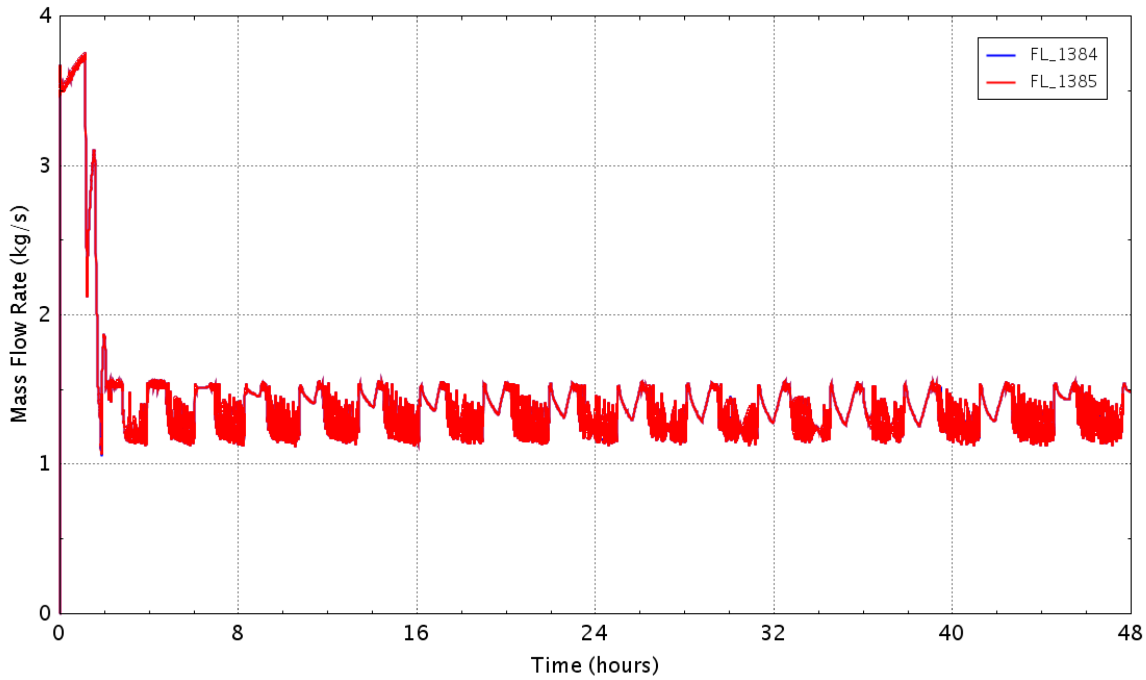

Figure E - 447 **Flow rate of the recirculating pump seal leakage**

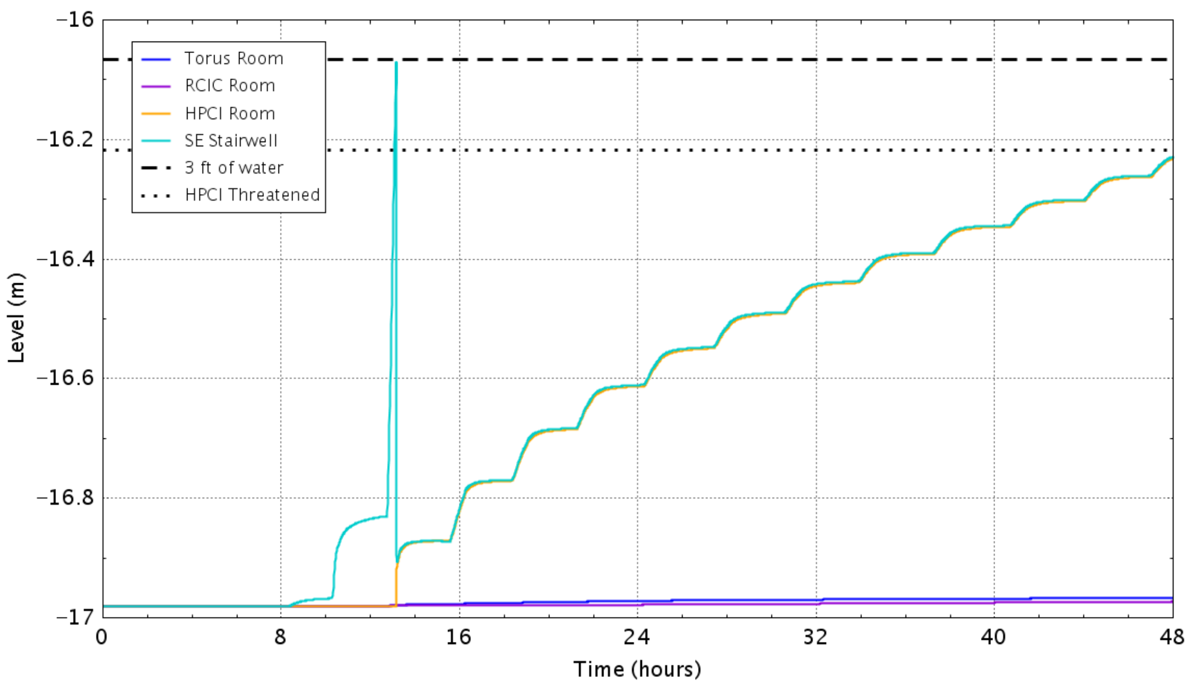

Figure E - 448 **Water level in the reactor building basement**

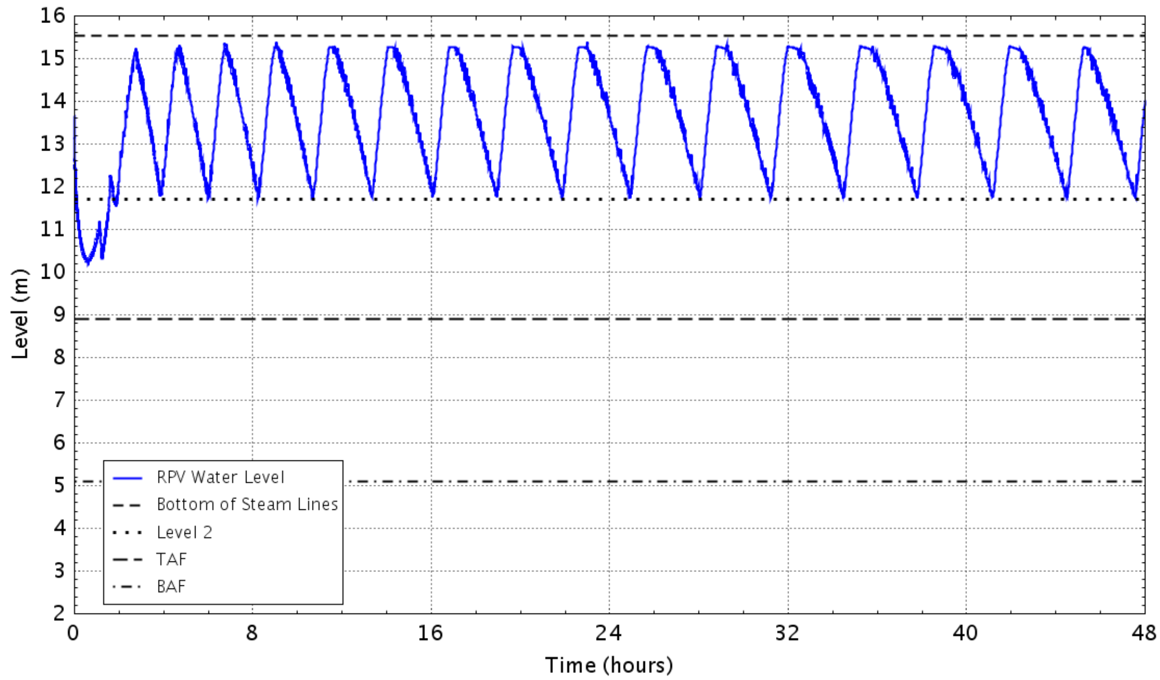

Figure E - 449 RPV down comer water level

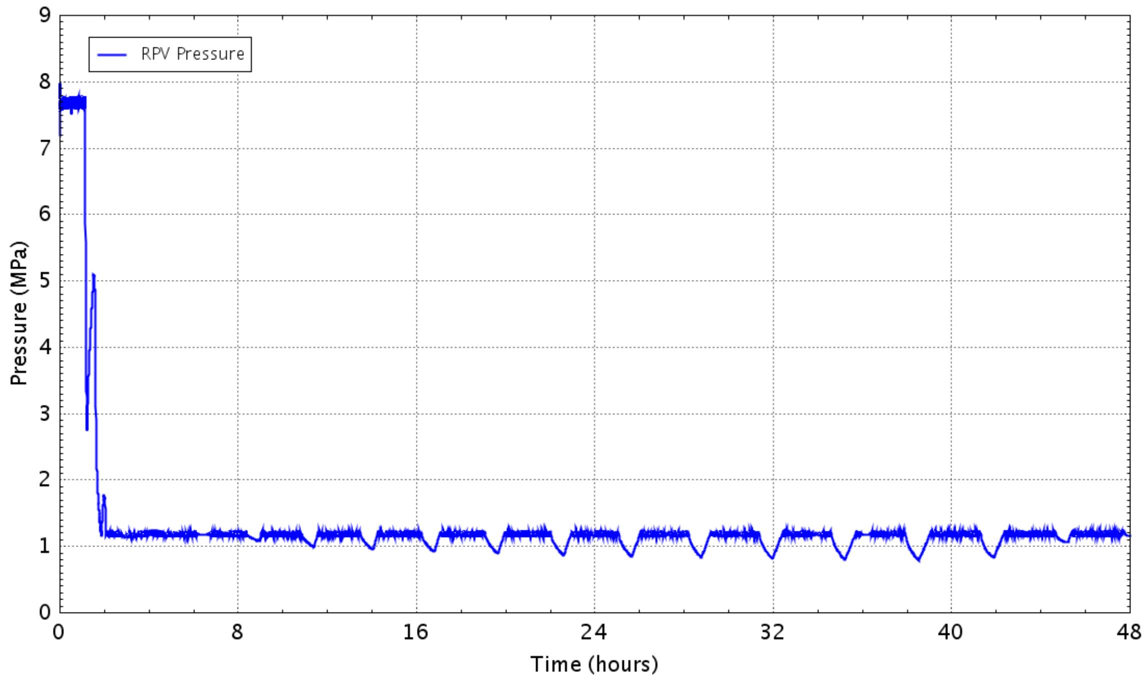

Figure E - 450 Pressure in theRPV

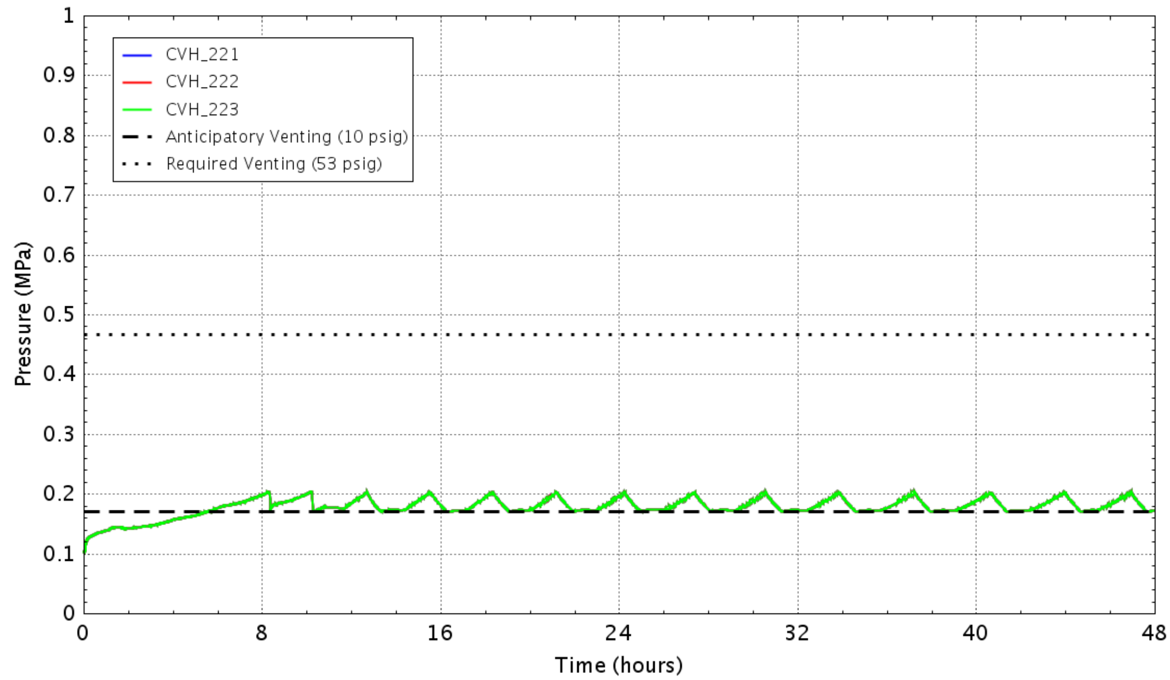

Figure E - 451 Pressure in the wetwell

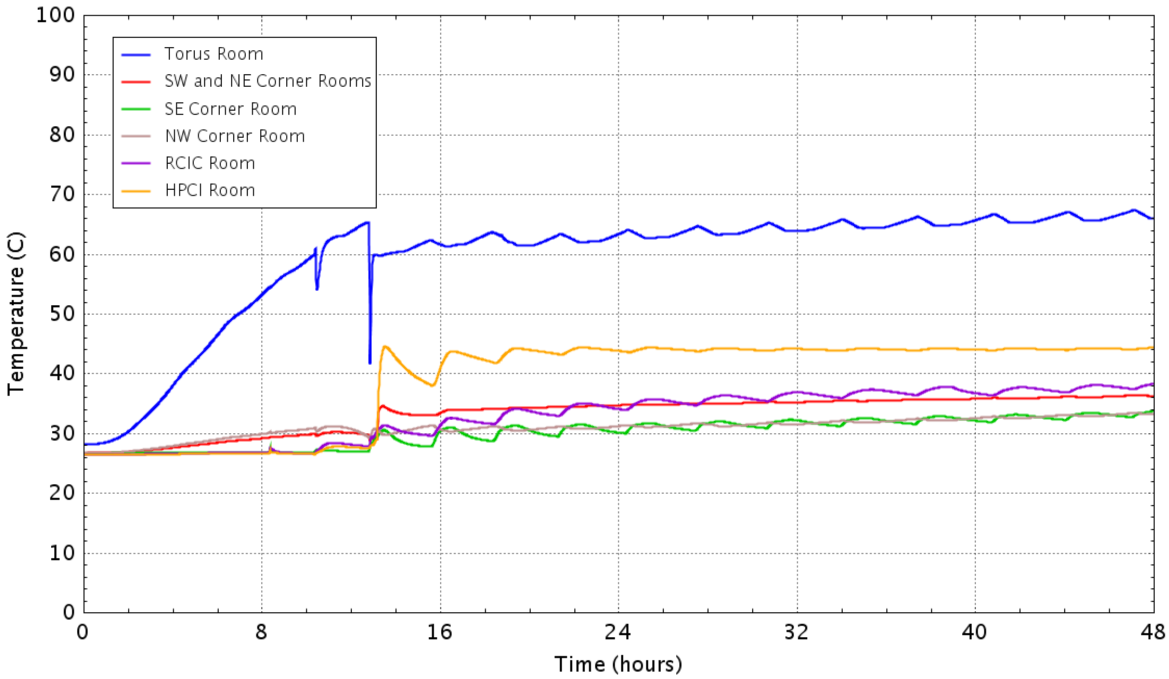

Figure E - 452 Vapor temperature in the reactor building basement

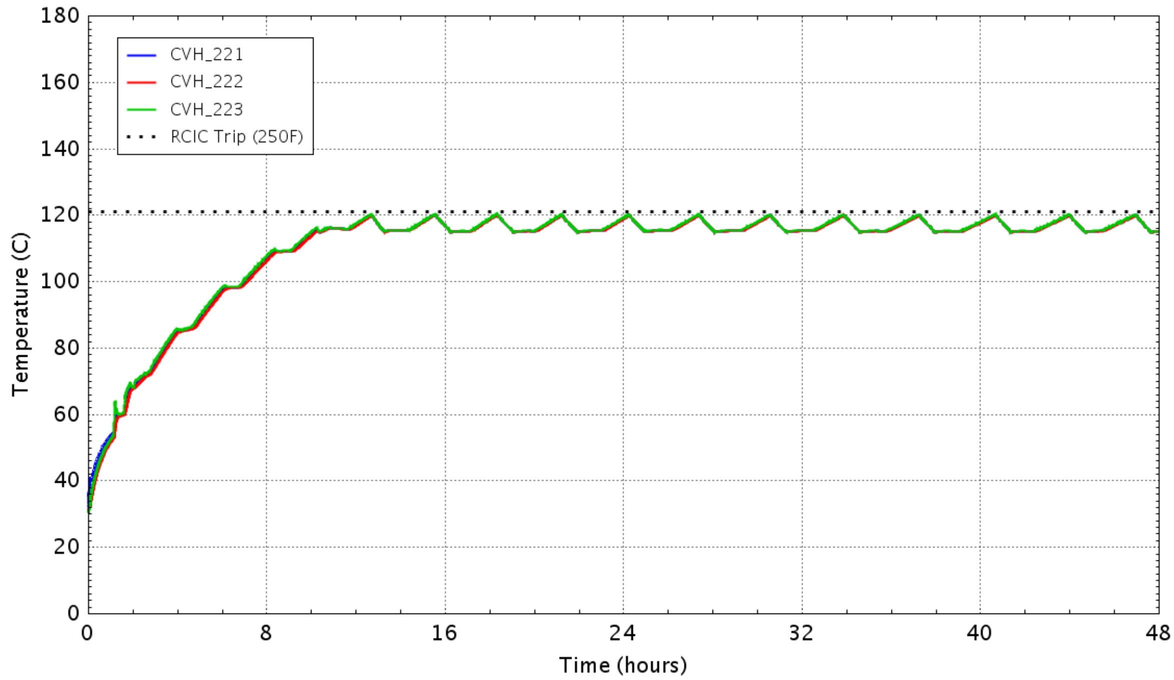

Figure E - 453 **Water temperature in the wetwell**

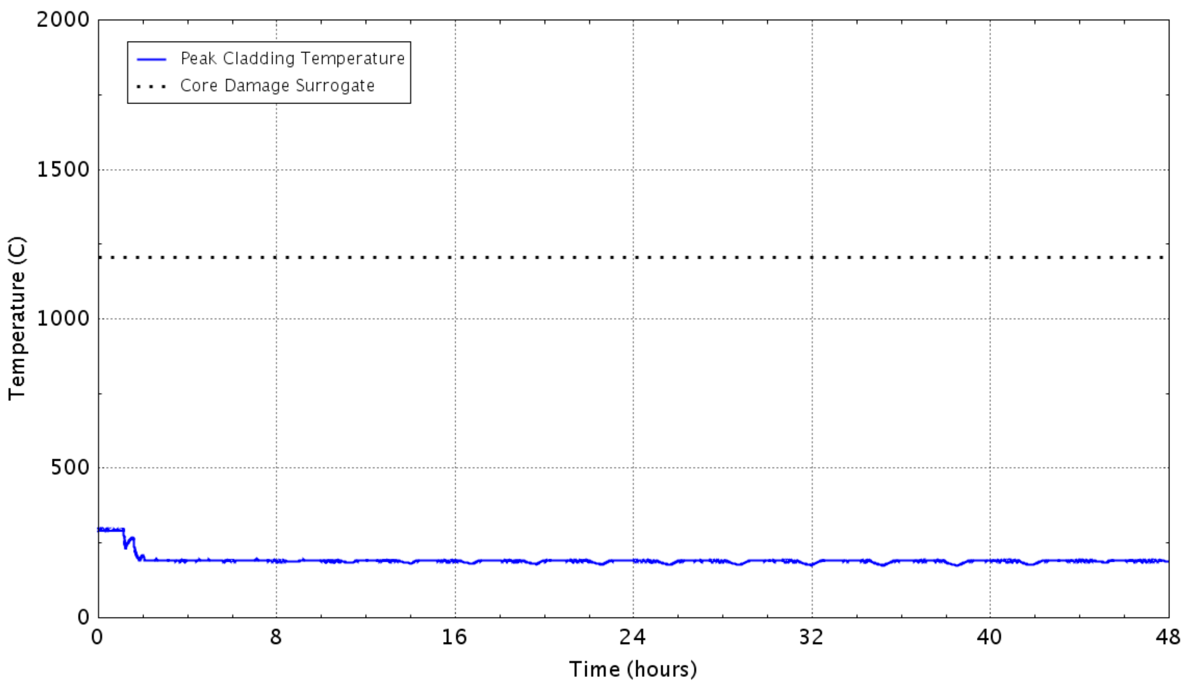

Figure E - 454 **Peak temperature of the fuel cladding as a function of time**

E.3.6 Case 3e: Sensitivity to LOOPGR-38-9 Case 3 with Increased Seal Leakage(300 gpm Total)

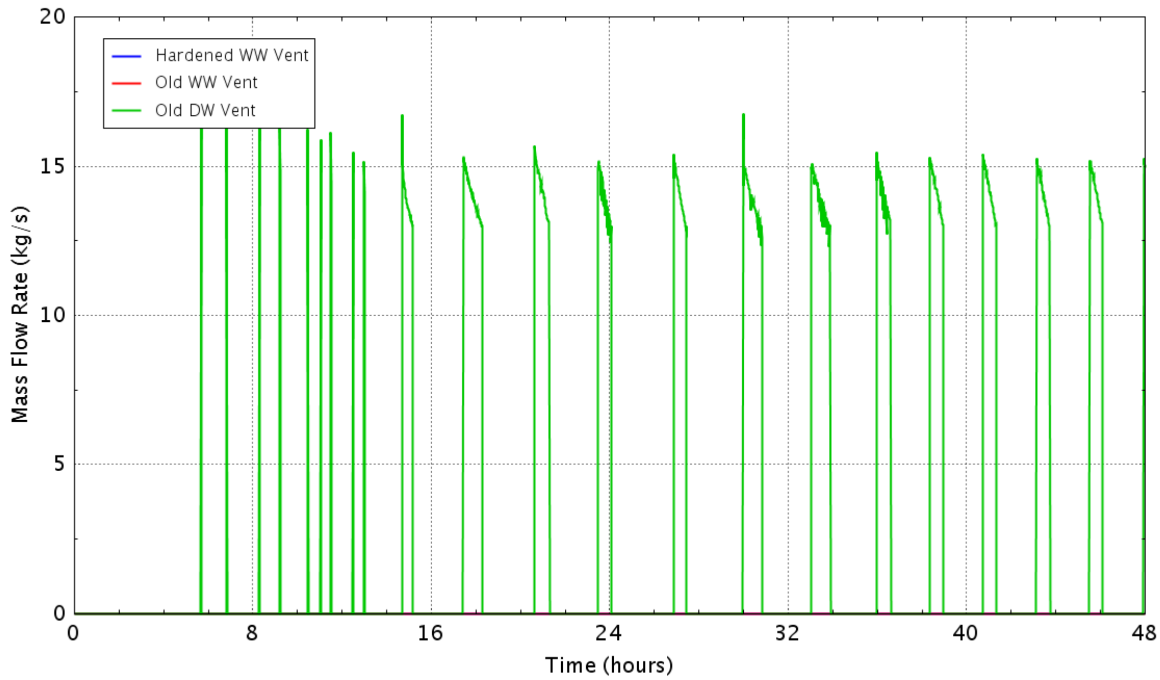

Figure E - 455 Flow rate of the containment vents

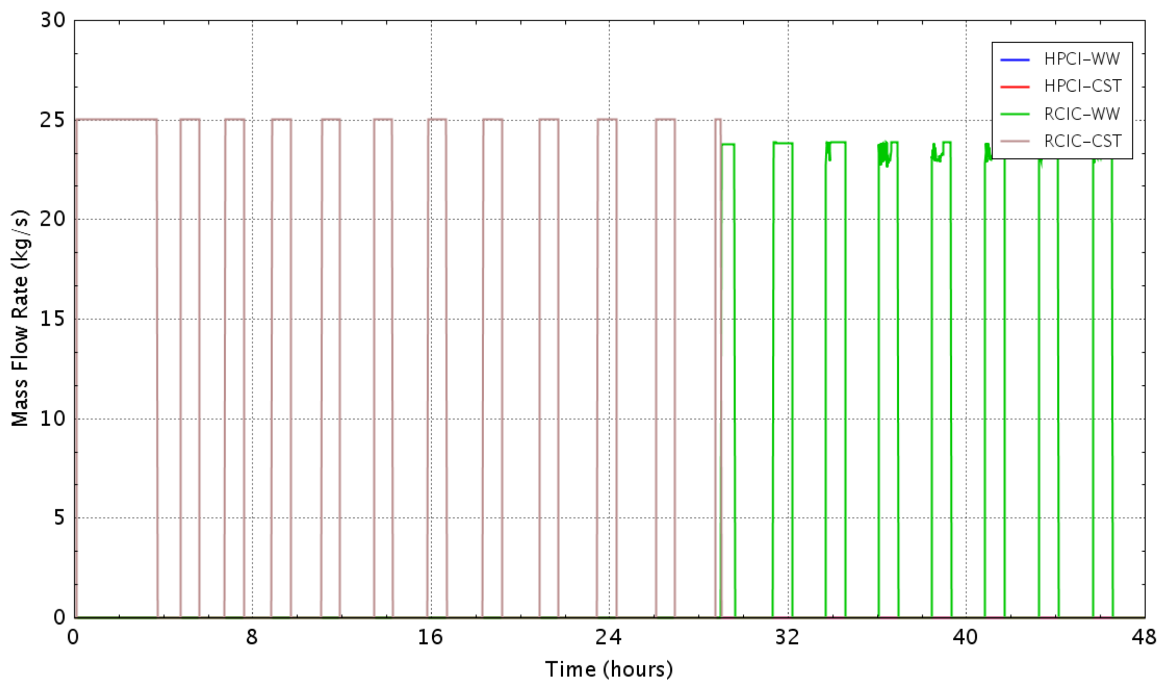

Figure E - 456 Flow rate of the HPCI/RCIC pumps

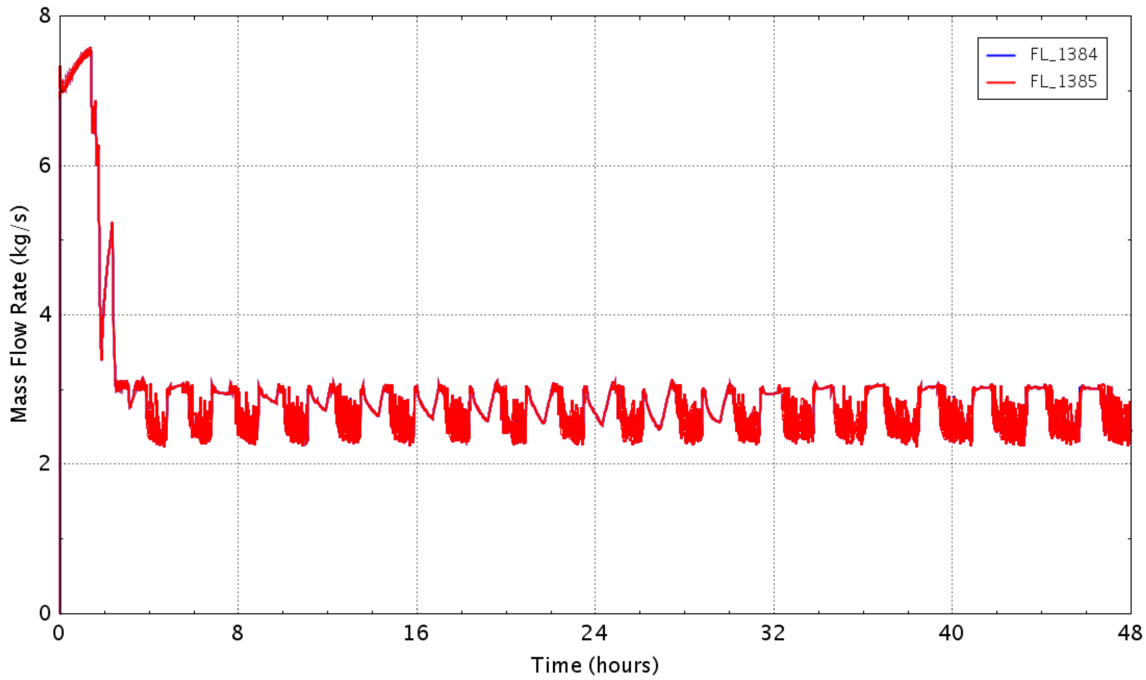

Figure E - 457 **Flow rate of the recirculating pump seal leakage**

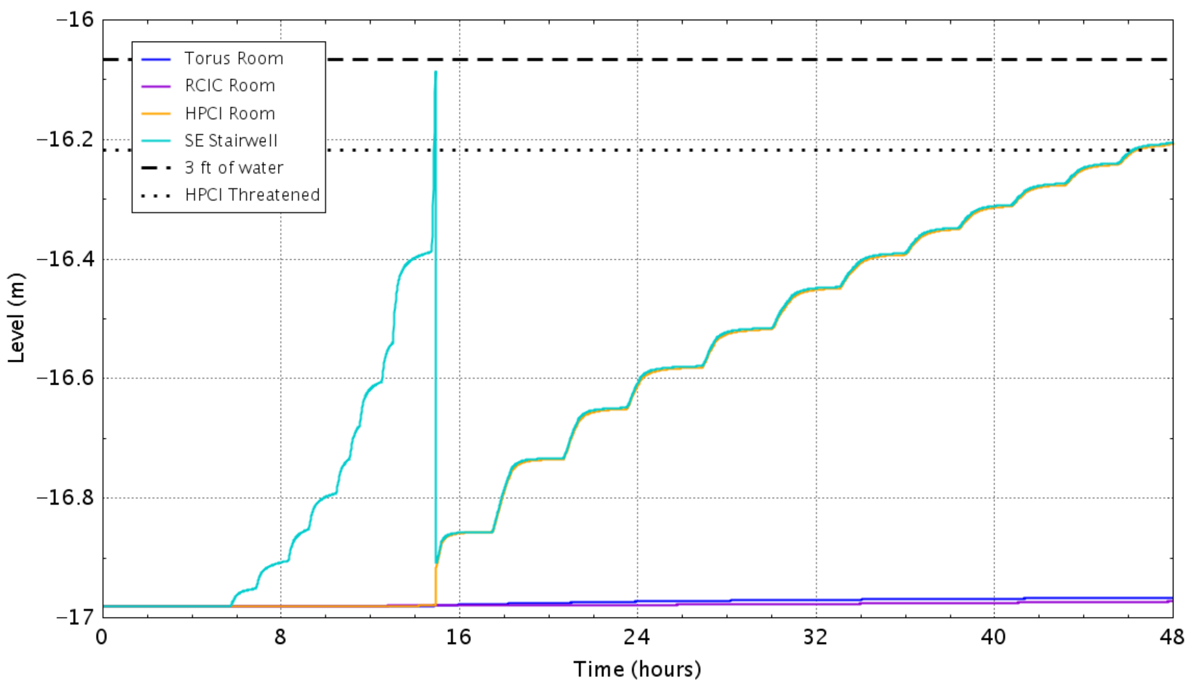

Figure E - 458 **Water level in the reactor building basement**

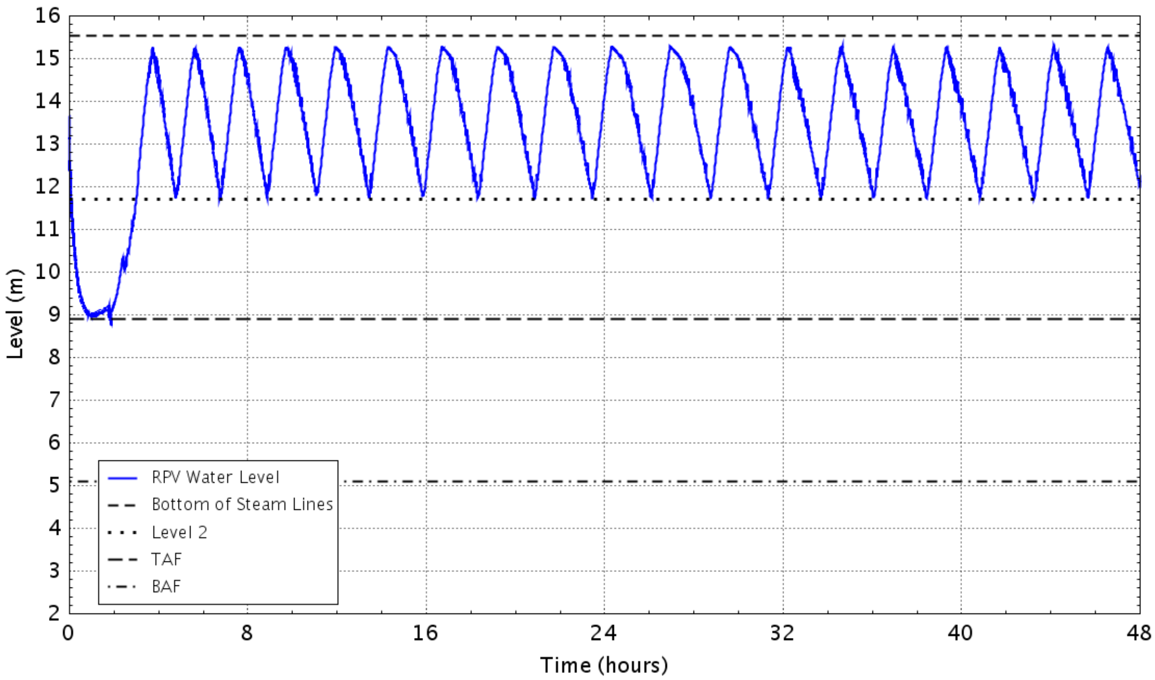

Figure E - 459 **RPV down comer water level**

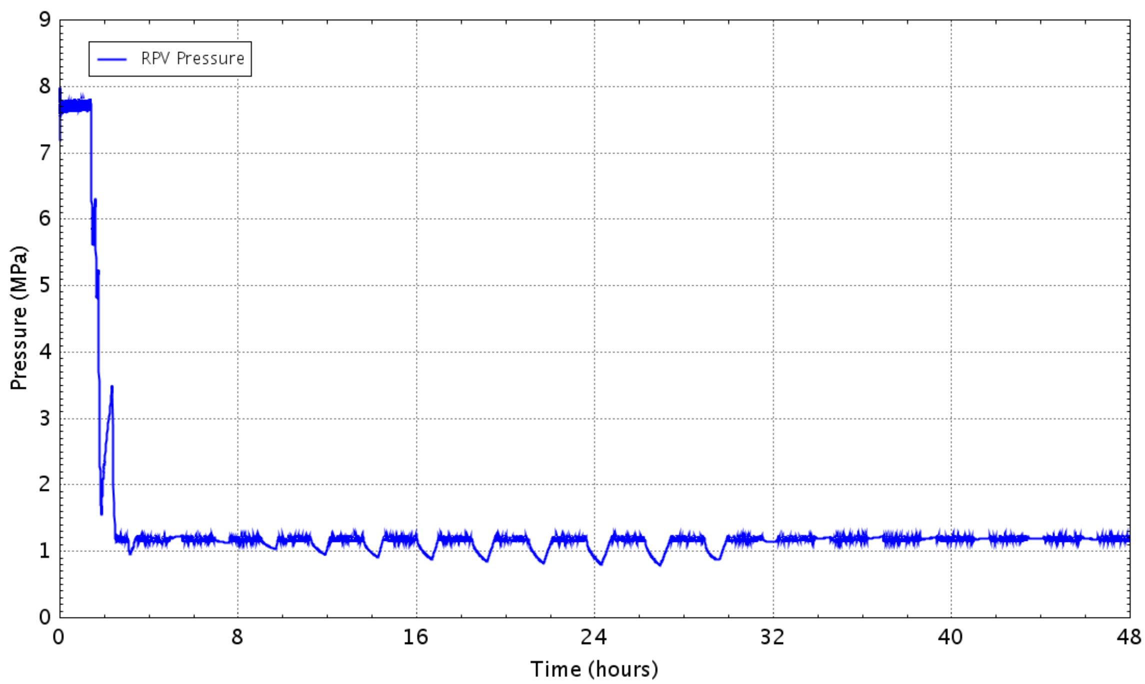

Figure E - 460 **Pressure in theRPV**

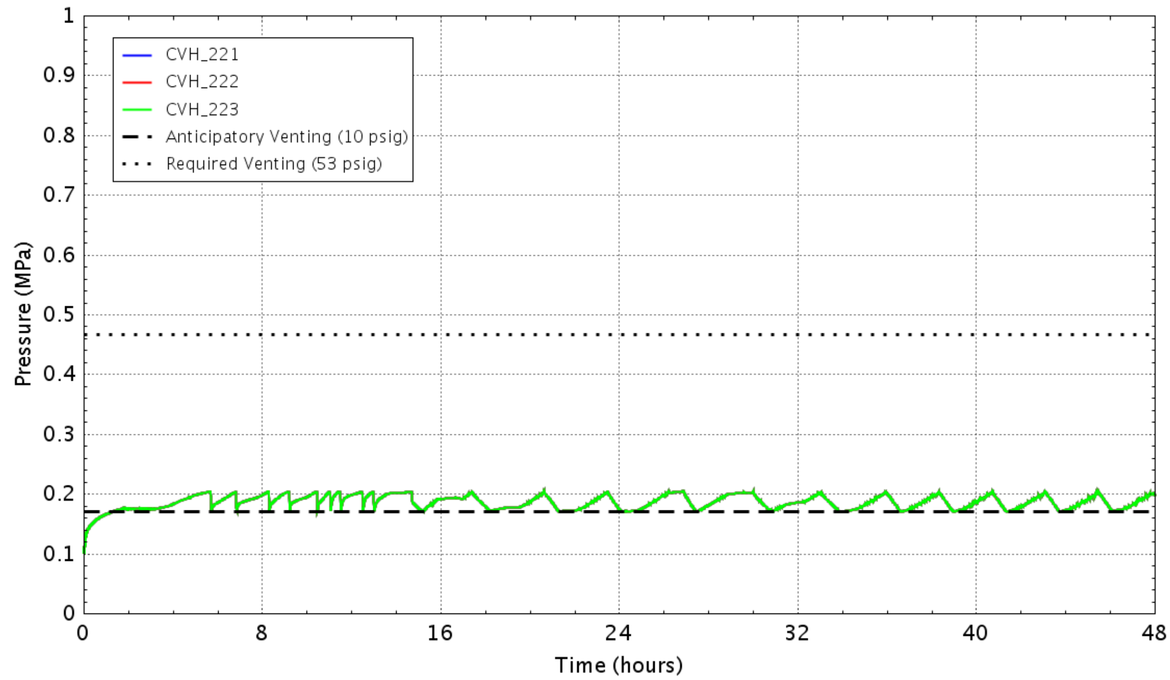

Figure E - 461 Pressure in the wetwell

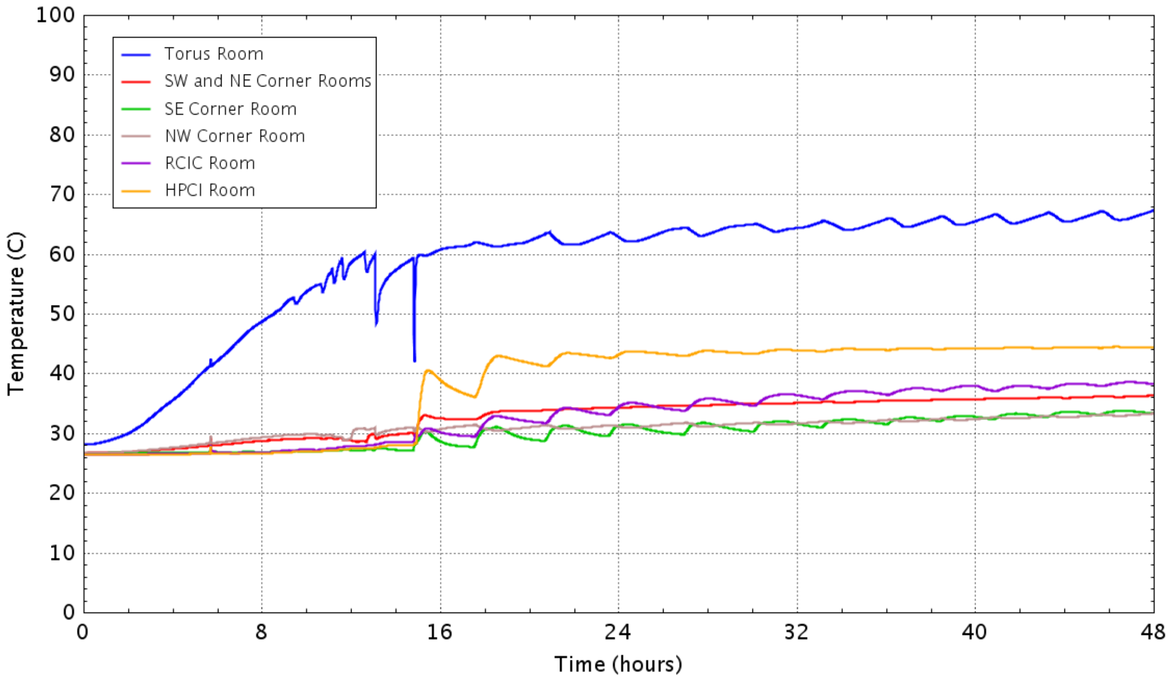

Figure E - 462 Vapor temperature in the reactor building basement

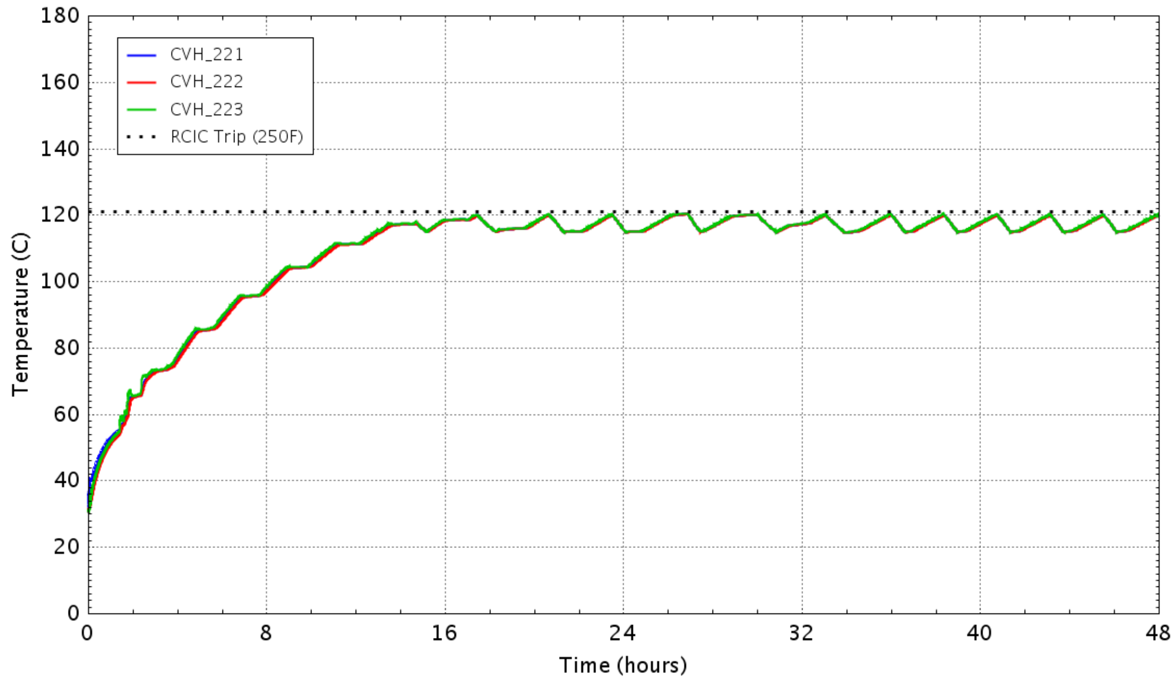

Figure E - 463 Water temperature in the wetwell

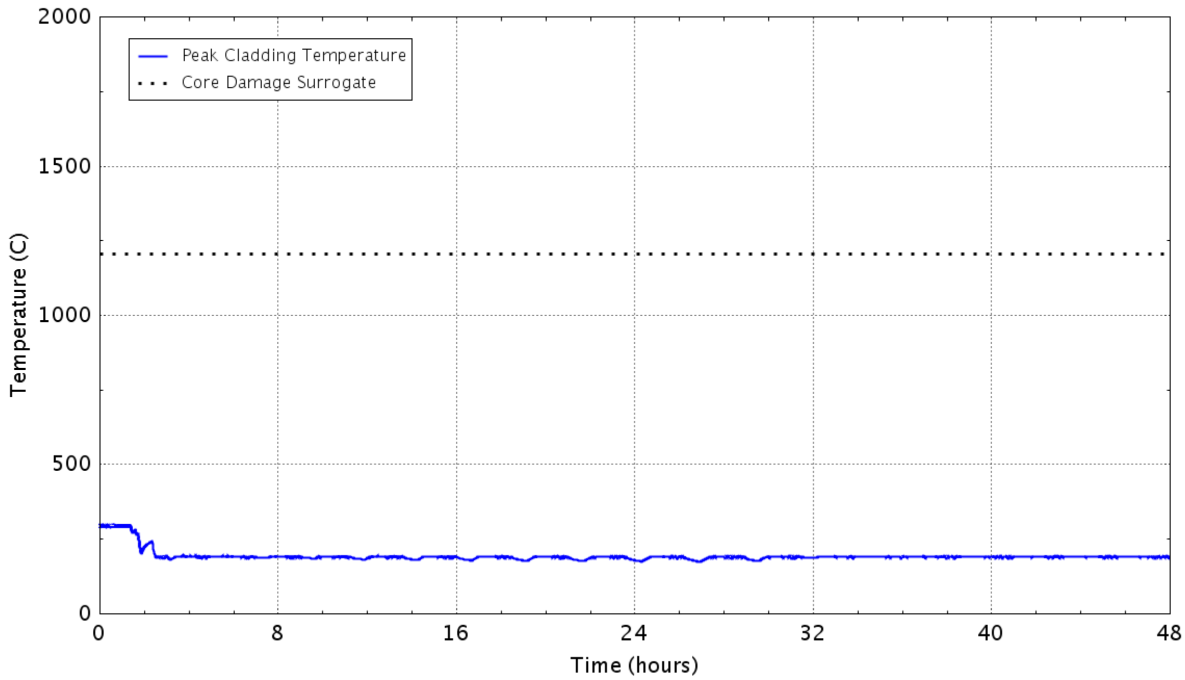

Figure E – 464 Peak temperature of the fuel cladding as a function oftime

E.3.7 Case 3f: Sensitivity to LOOPGR-38-9 Case 3 with Increased Seal Leakage (150 gpm Total) Starting at 17 min.

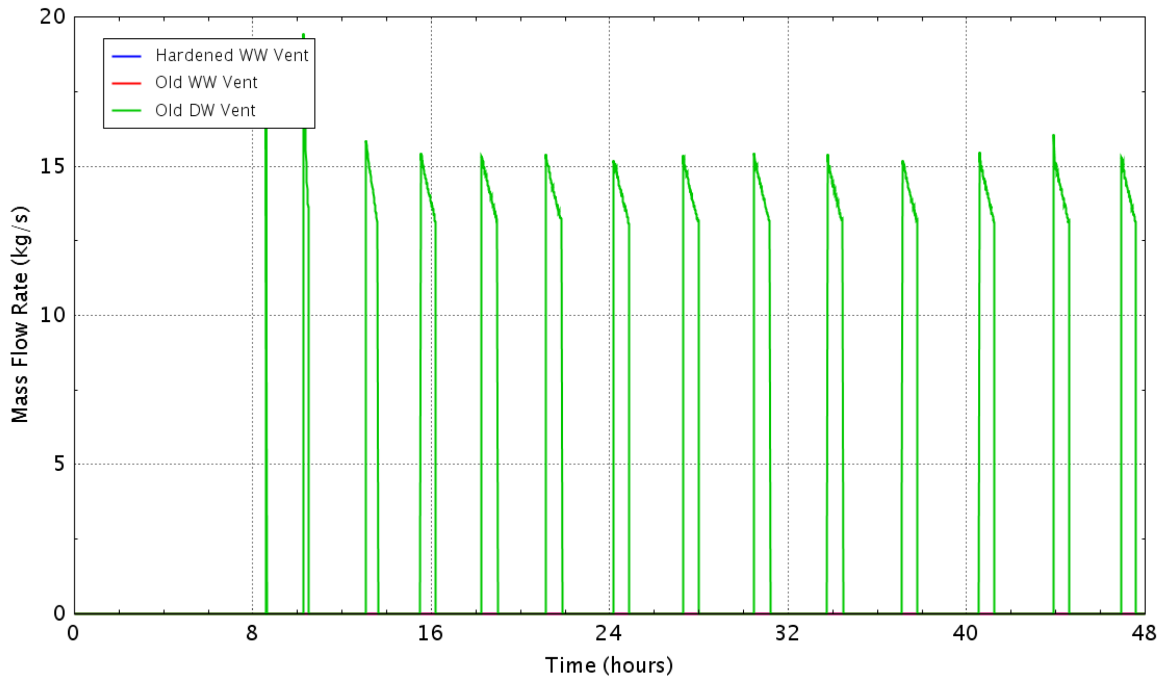

Figure E - 465 Flow rate of the containment vents

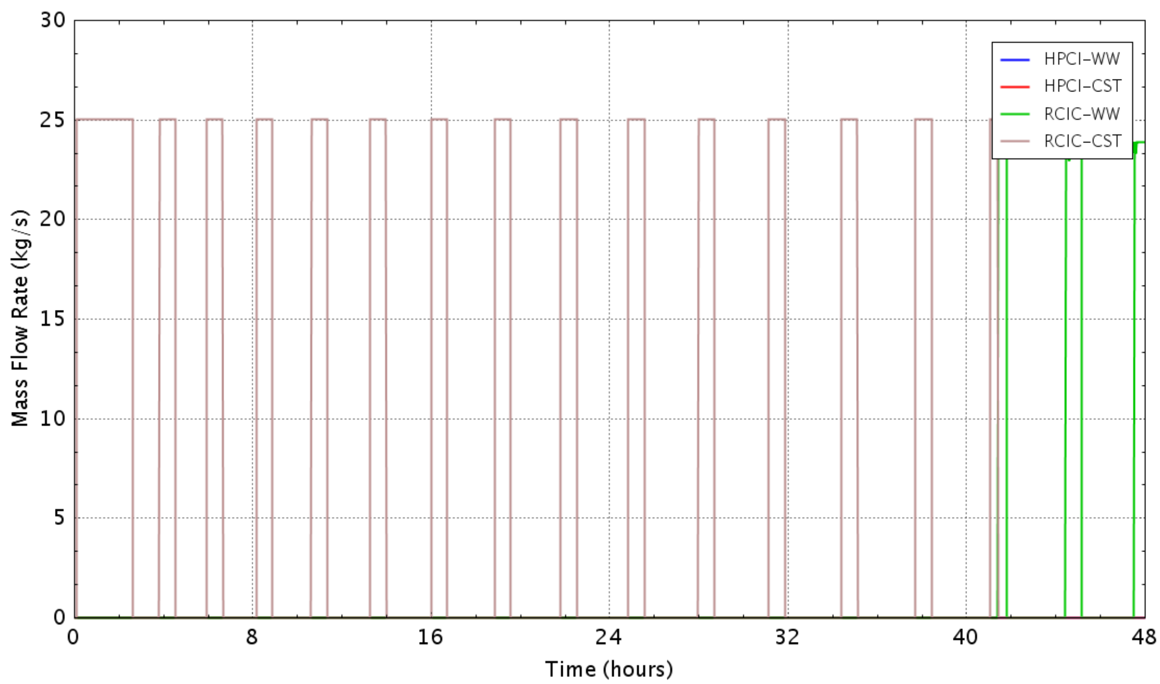

Figure E - 466 Flow rate of the HPCI/RCIC pumps

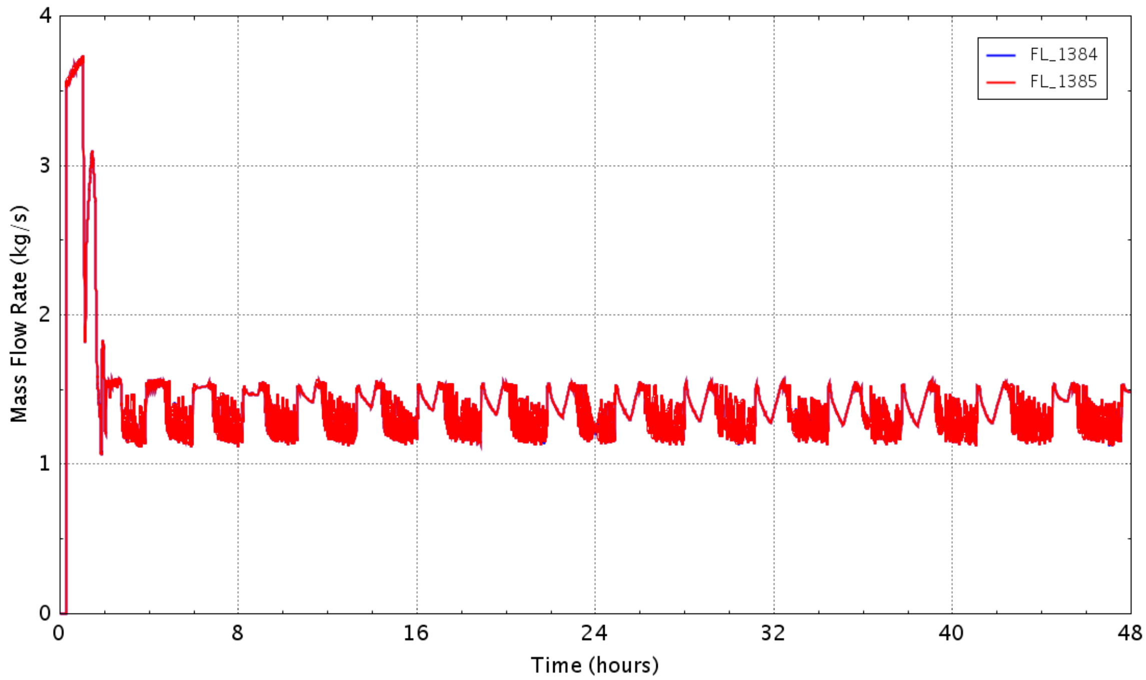

Figure E - 467 **Flow rate of the recirculating pump seal leakage**

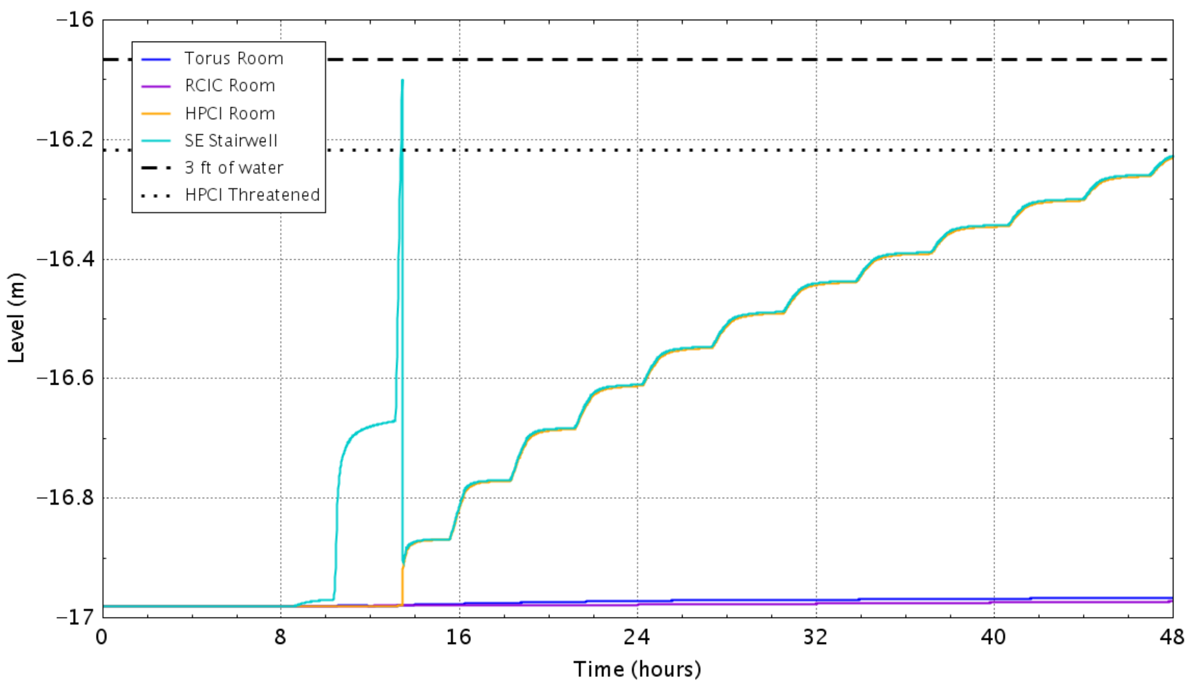

Figure E - 468 **Water level in the reactor building basement**

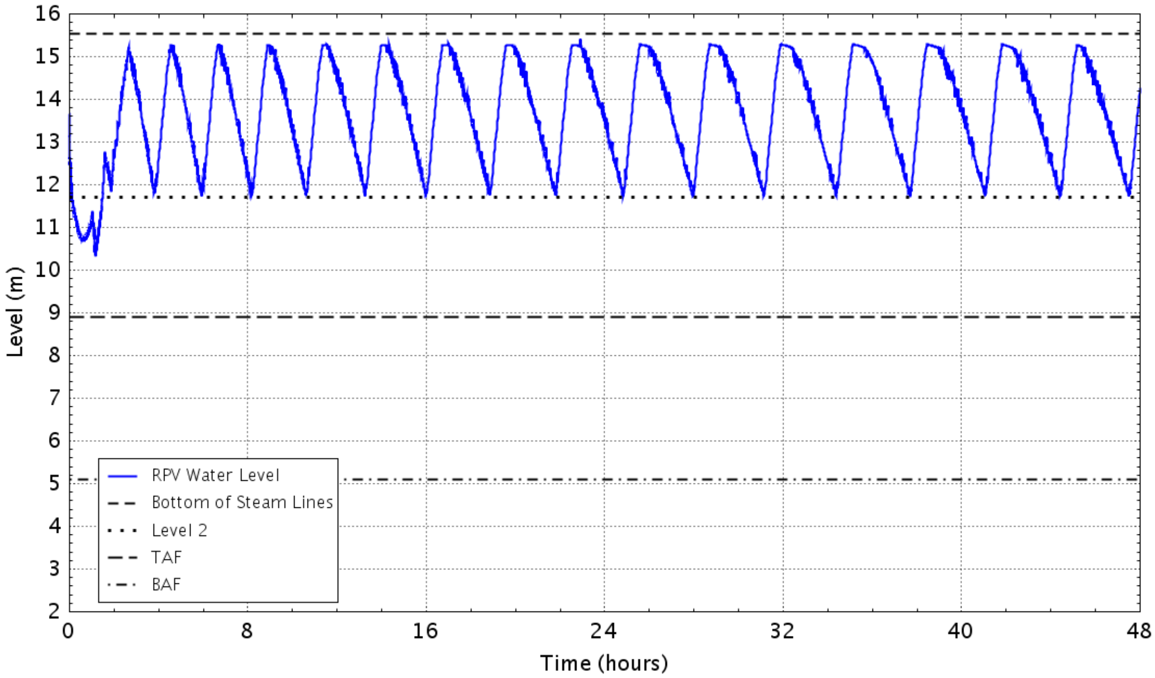

Figure E - 469 **RPV down comer water level**

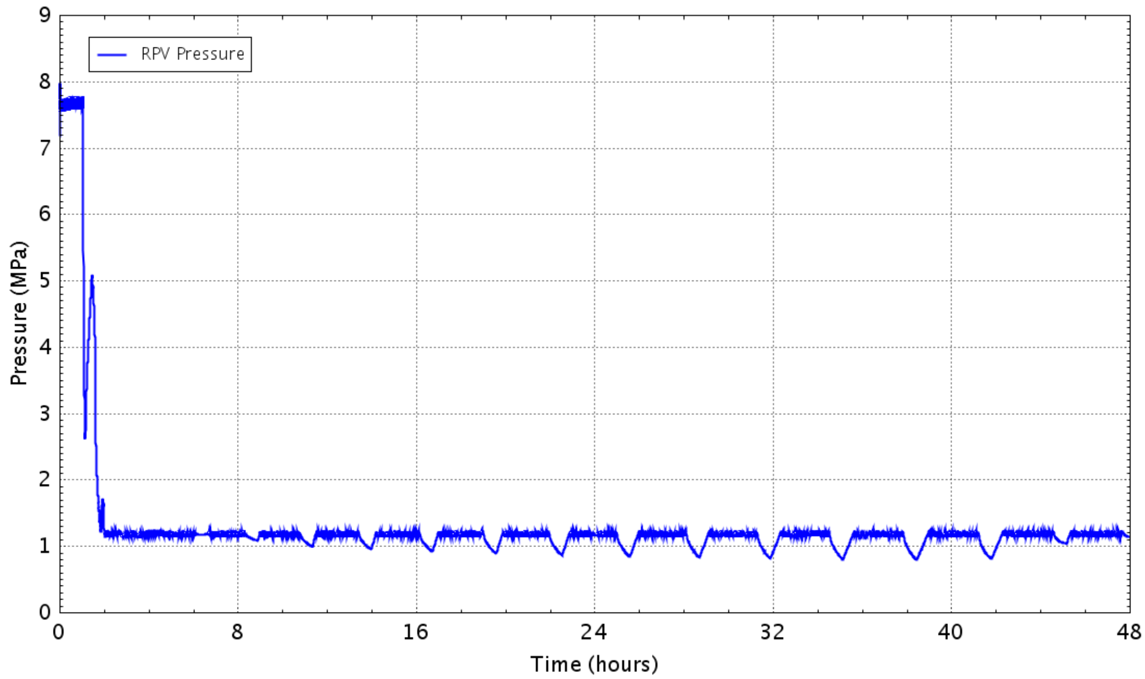

Figure E - 470 **Pressure in theRPV**

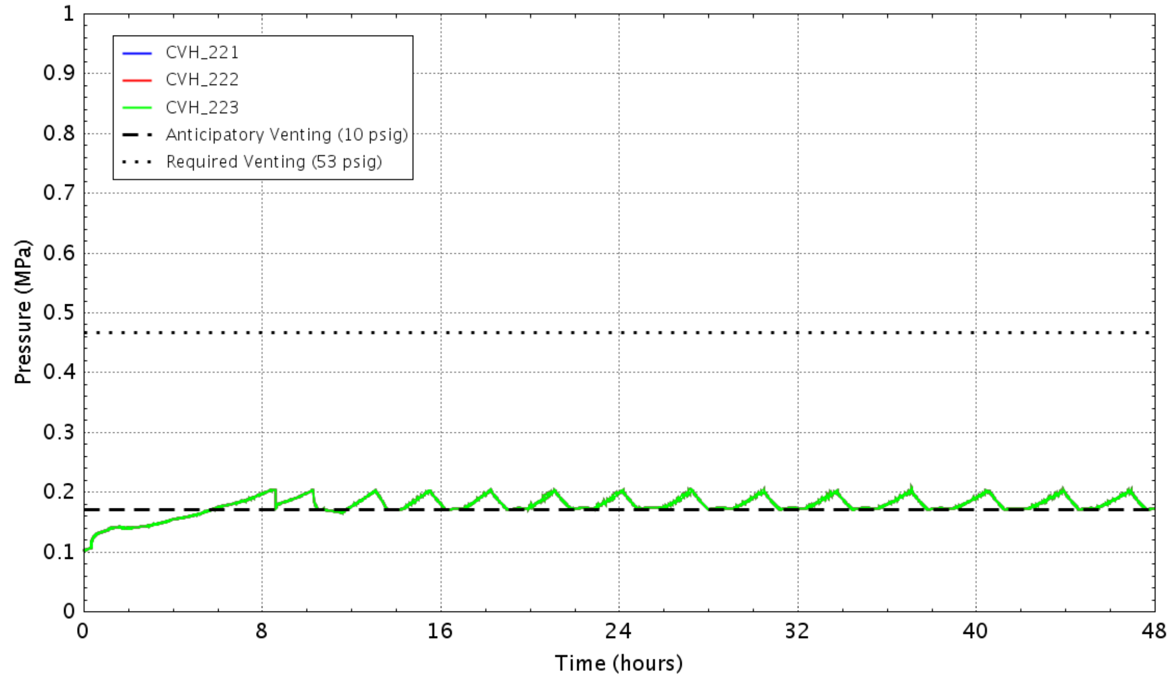

Figure E - 471 Pressure in the wetwell

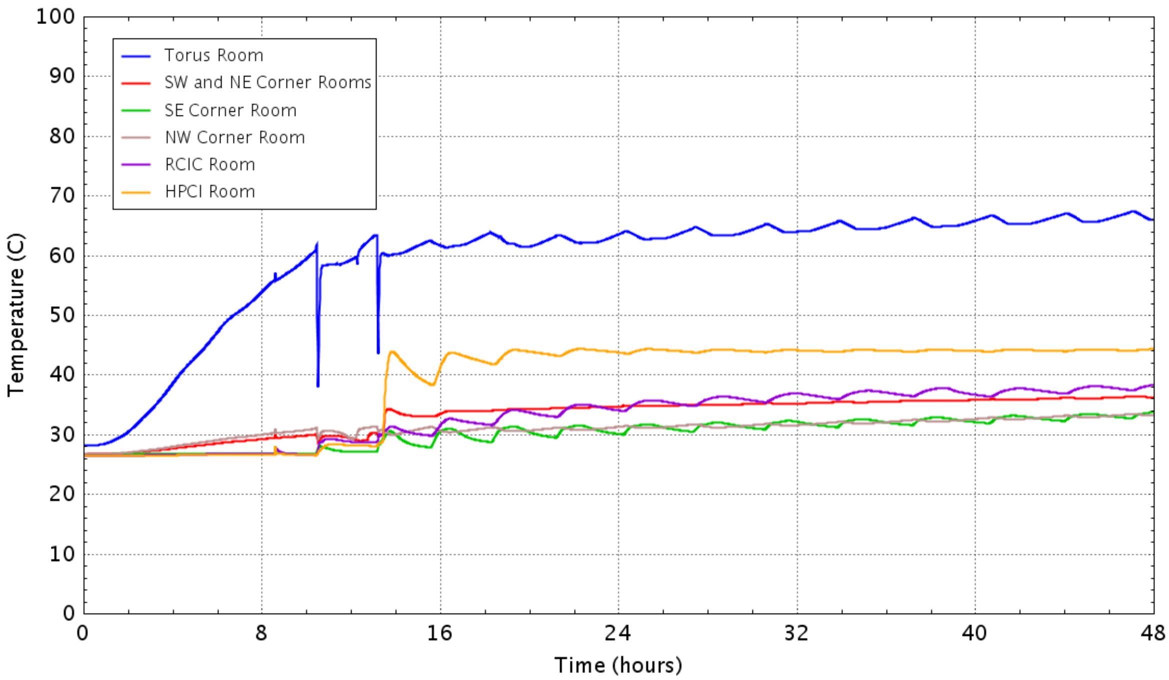

Figure E - 472 Vapor temperature in the reactor building basement

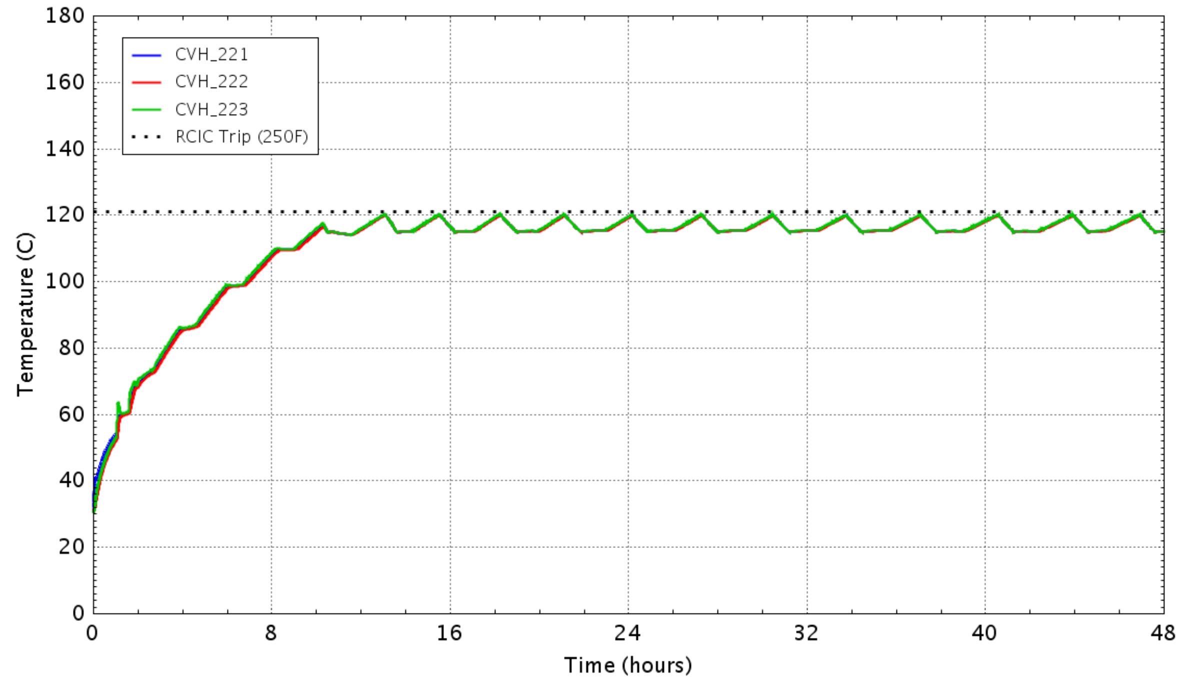

Figure E - 473 Water temperature in the wetwell

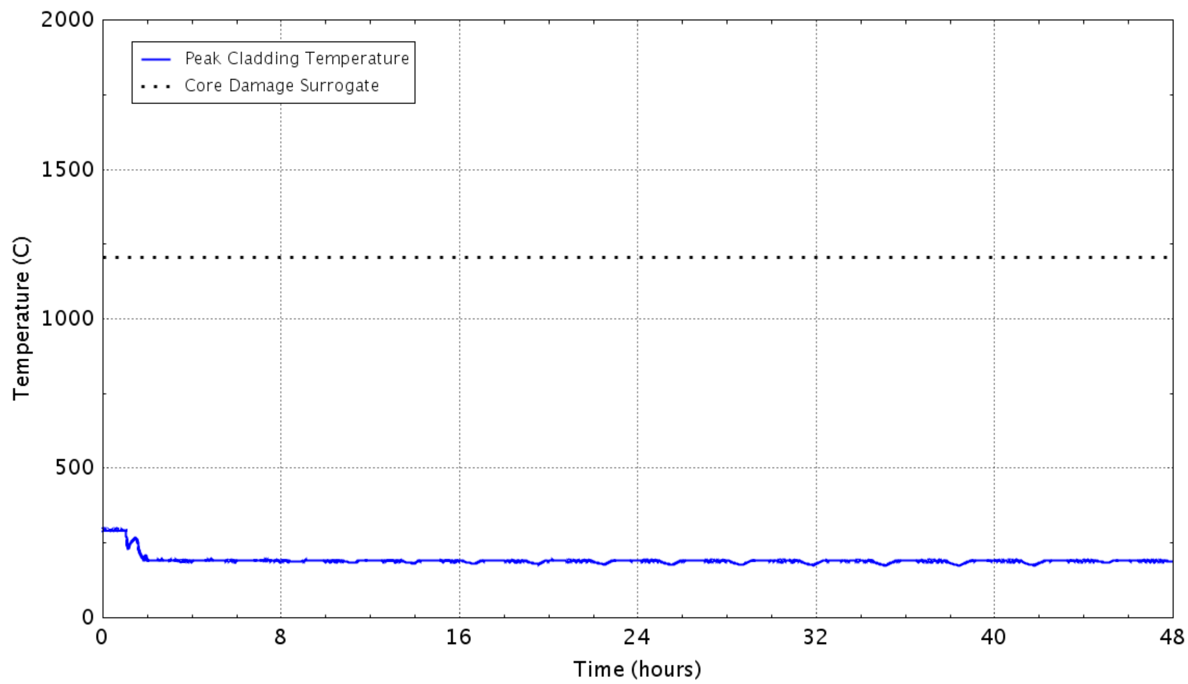

Figure E – 474 Peak temperature of the fuel cladding as a function oftime

E.3.8 Case 3g: Sensitivity to LOOPGR-38-9 Case 3 with IncreasedSeal Leakage (300 gpm Total) Starting at 17 min.

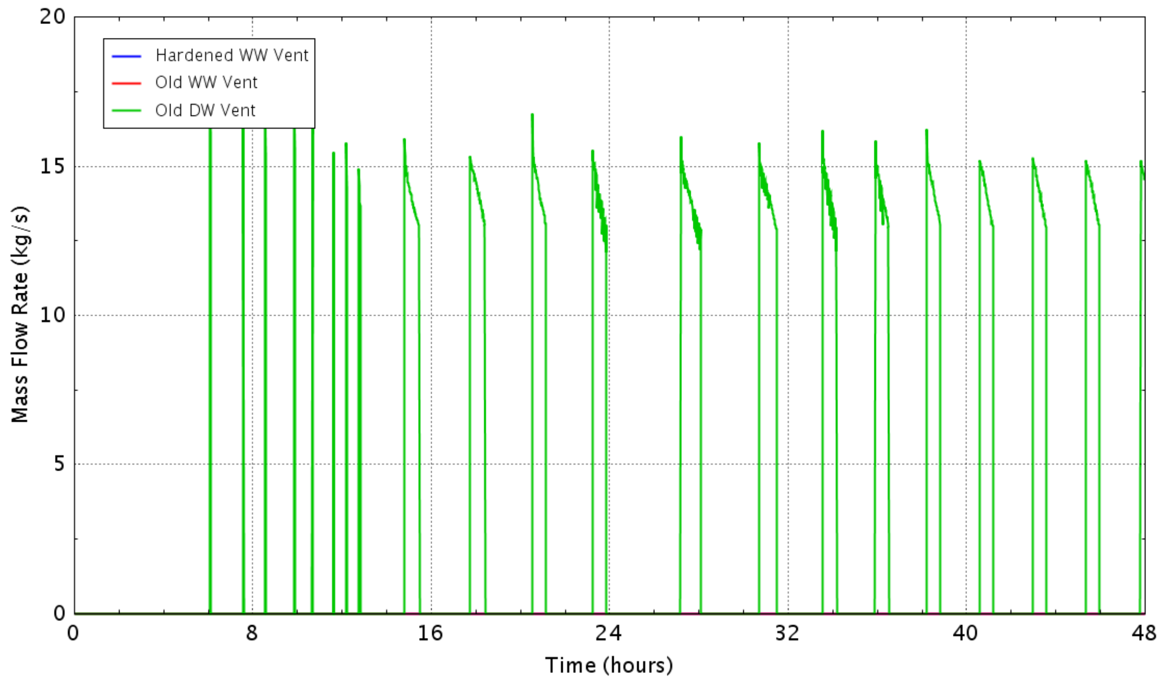

Figure E - 475 Flow rate of the containment vents

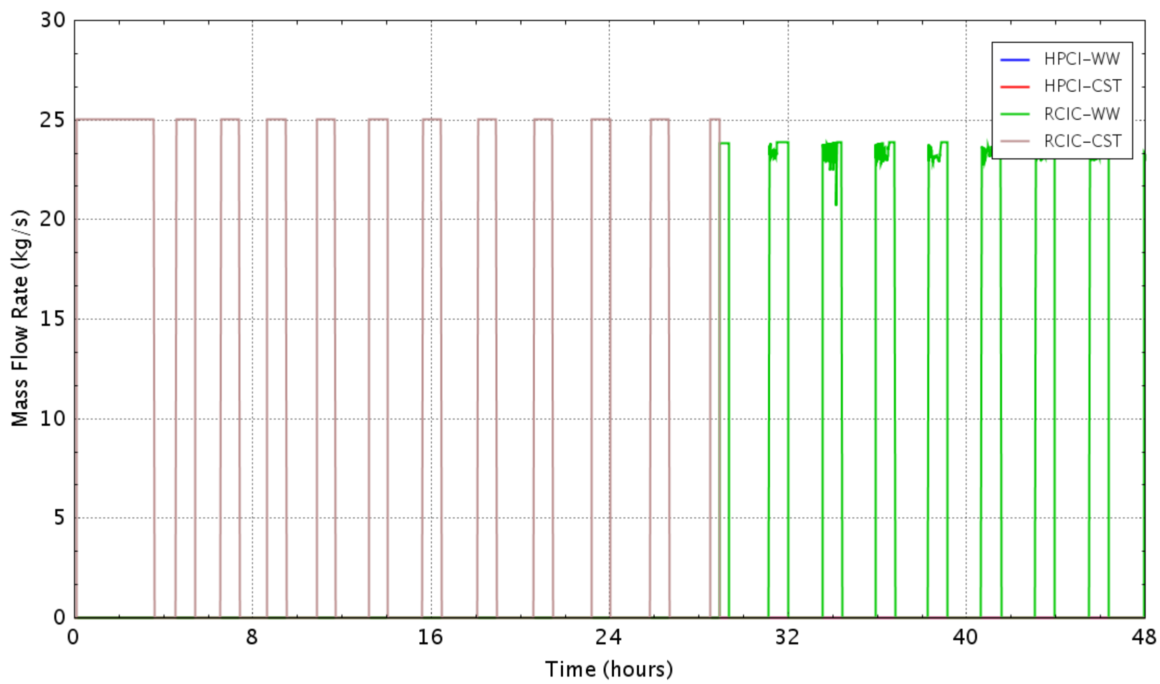

Figure E - 476 Flow rate of the HPCI/RCIC pumps

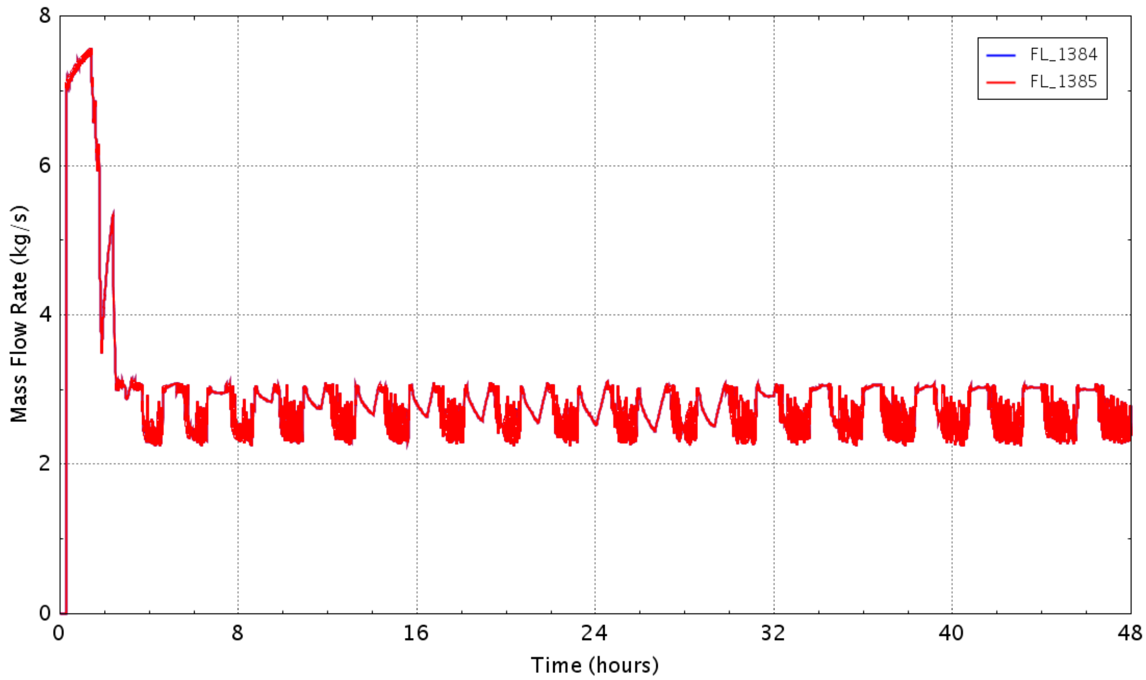

Figure E - 477 **Flow rate of the recirculating pump seal leakage**

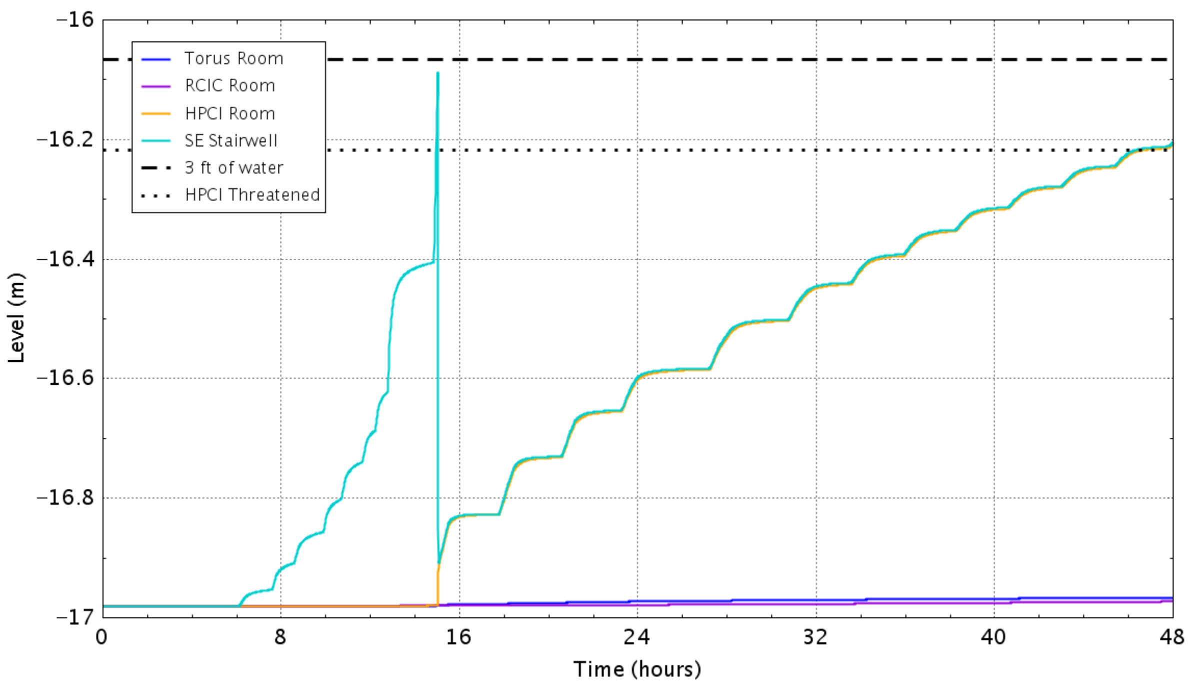

Figure E - 478 **Water level in the reactor building basement**

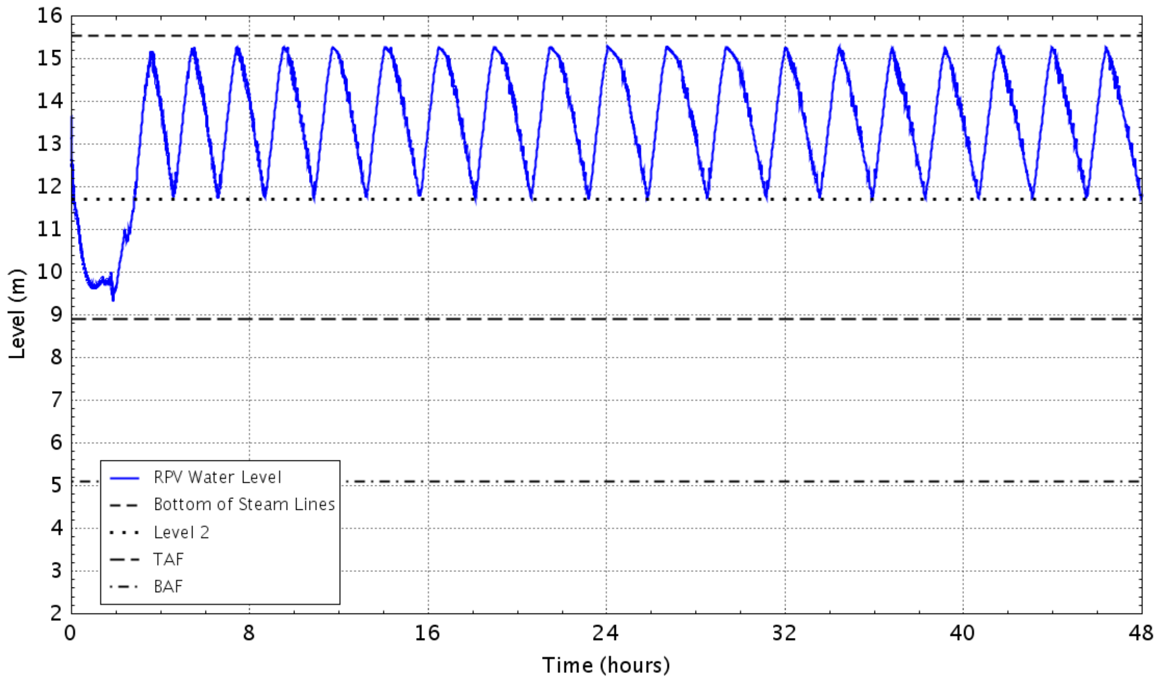

Figure E - 479 **RPV down comer water level**

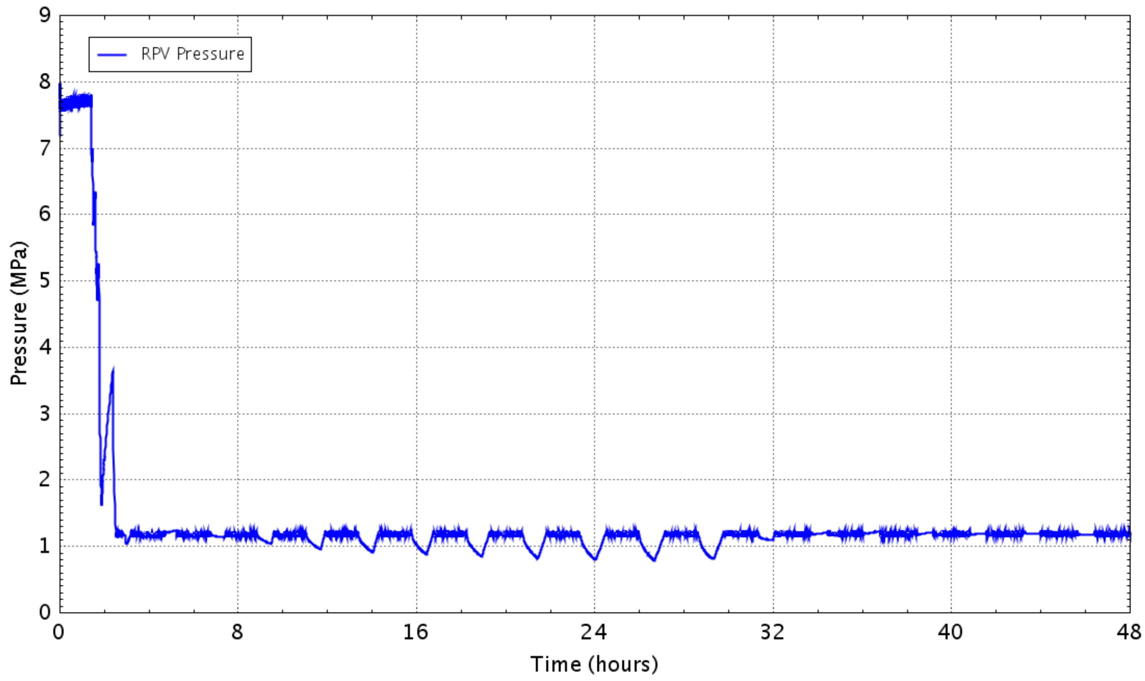

Figure E - 480 **Pressure in theRPV**

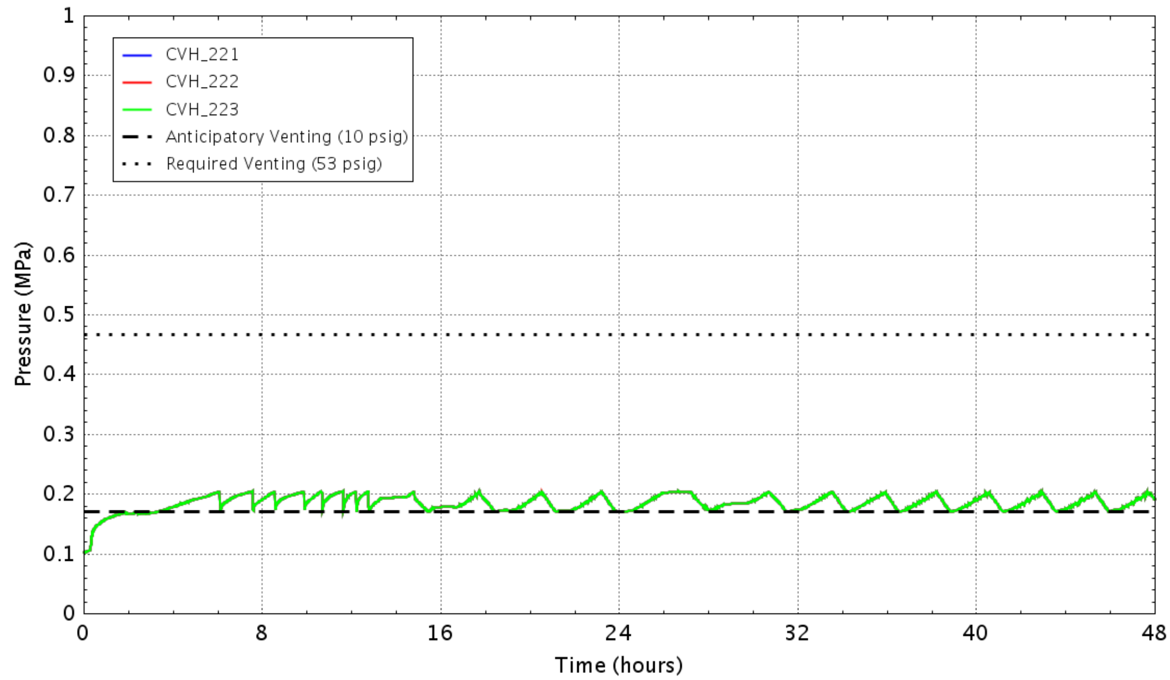

Figure E - 481 **Pressure in the wetwell**

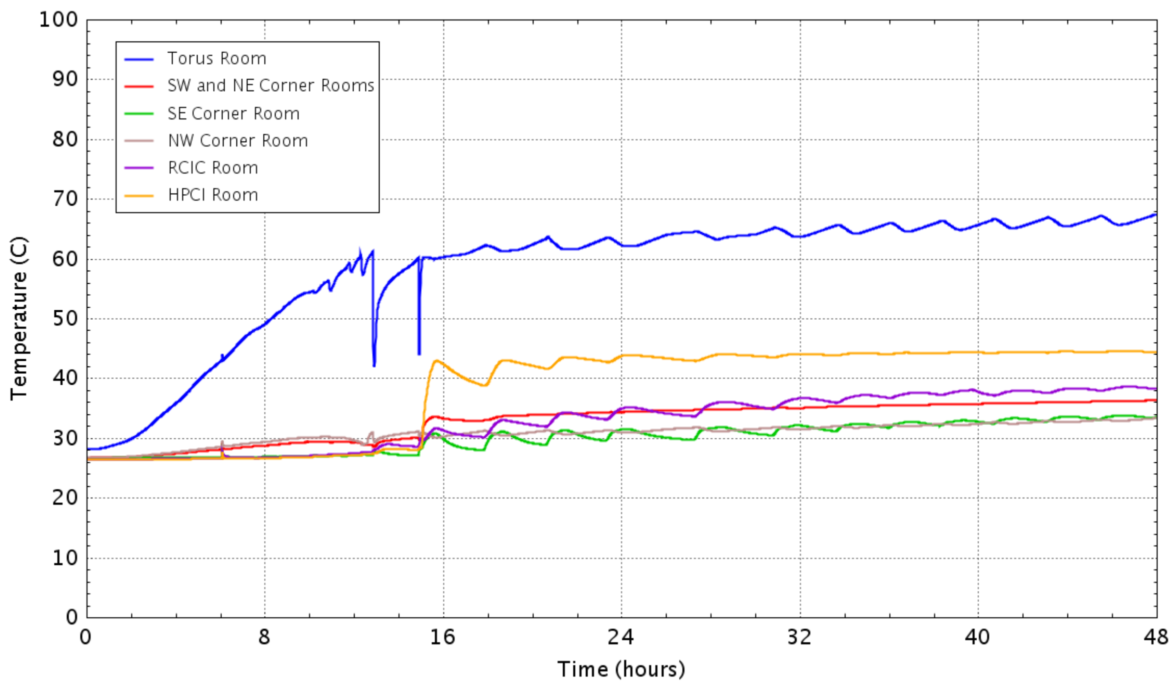

Figure E - 482 **Vapor temperature in the reactor building basement**

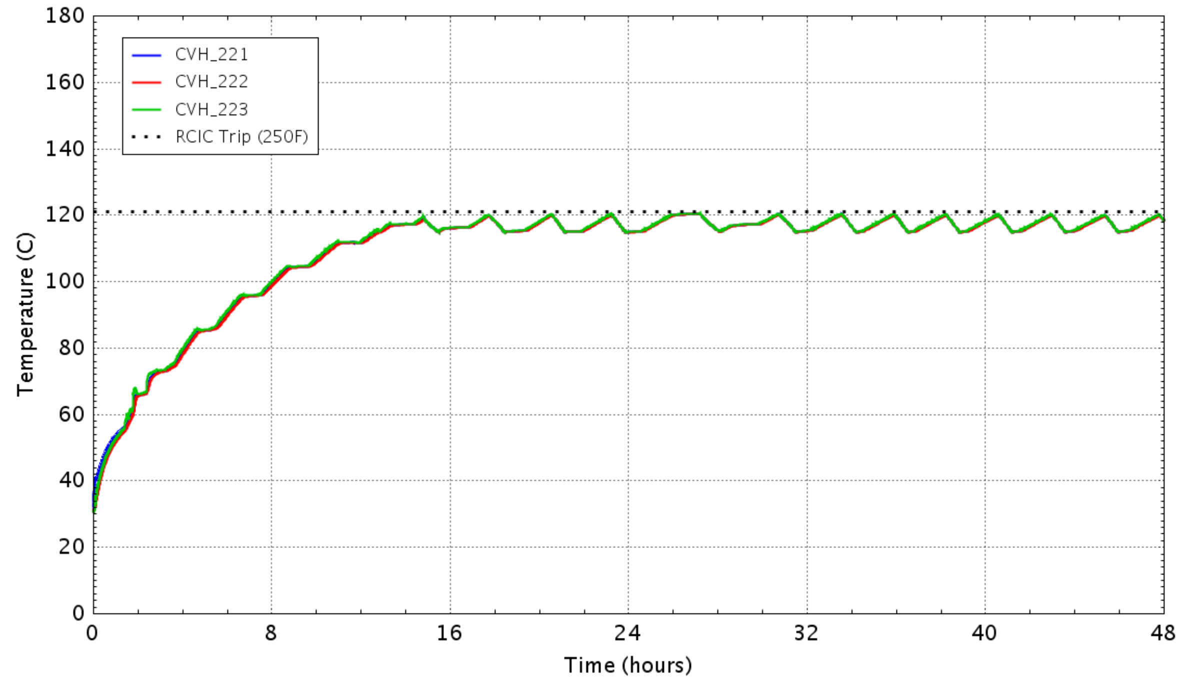

Figure E - 483 Water temperature in the wetwell

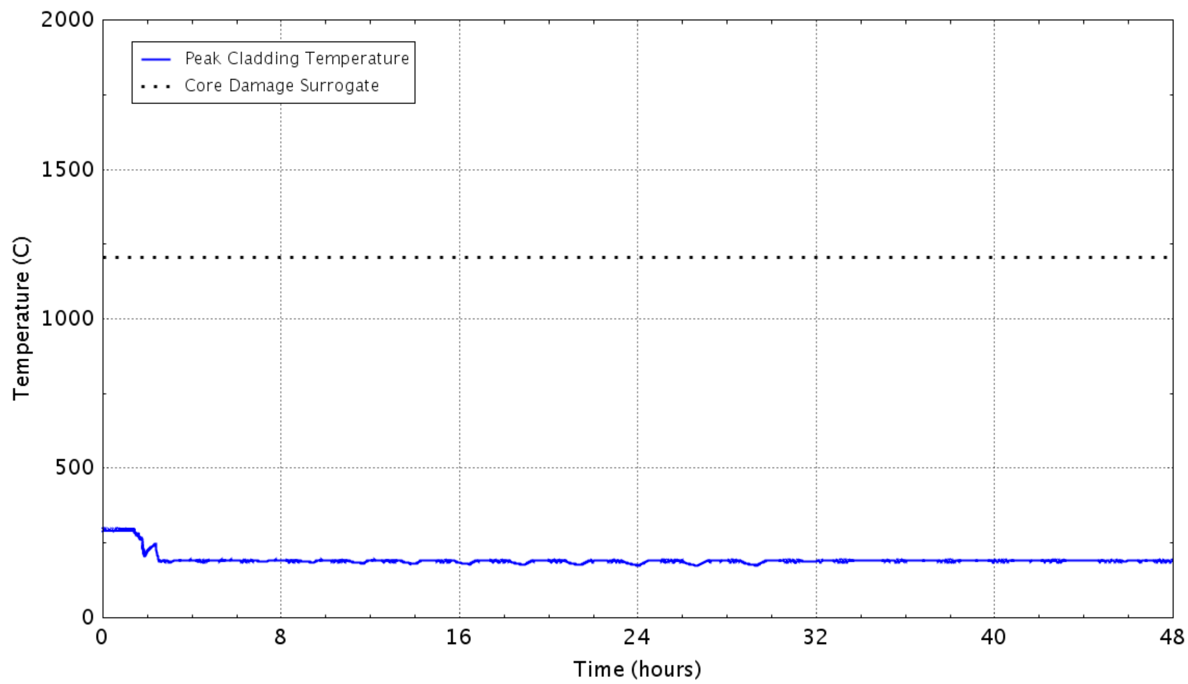

Figure E – 484 Peak temperature of the fuel cladding as a function of time

E.3.9 Case 8a: Sensitivity to LOOPGR-38-9 Case 8 withCSTUnavailable

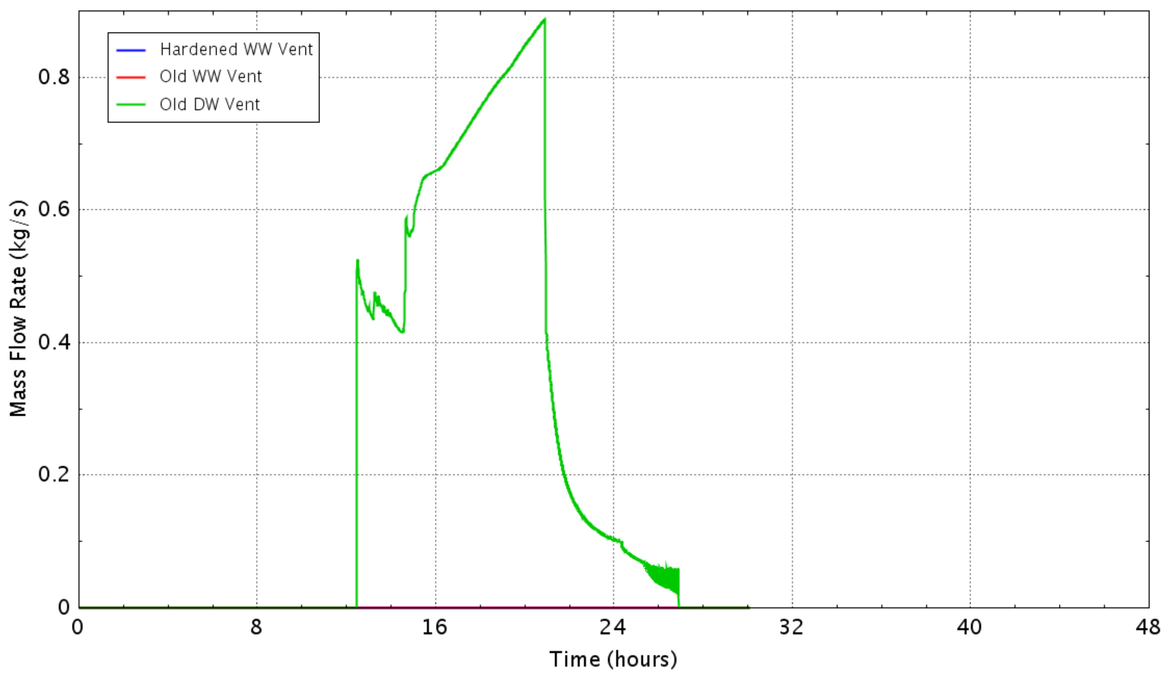

Figure E - 485 Flow rate of the containment vents

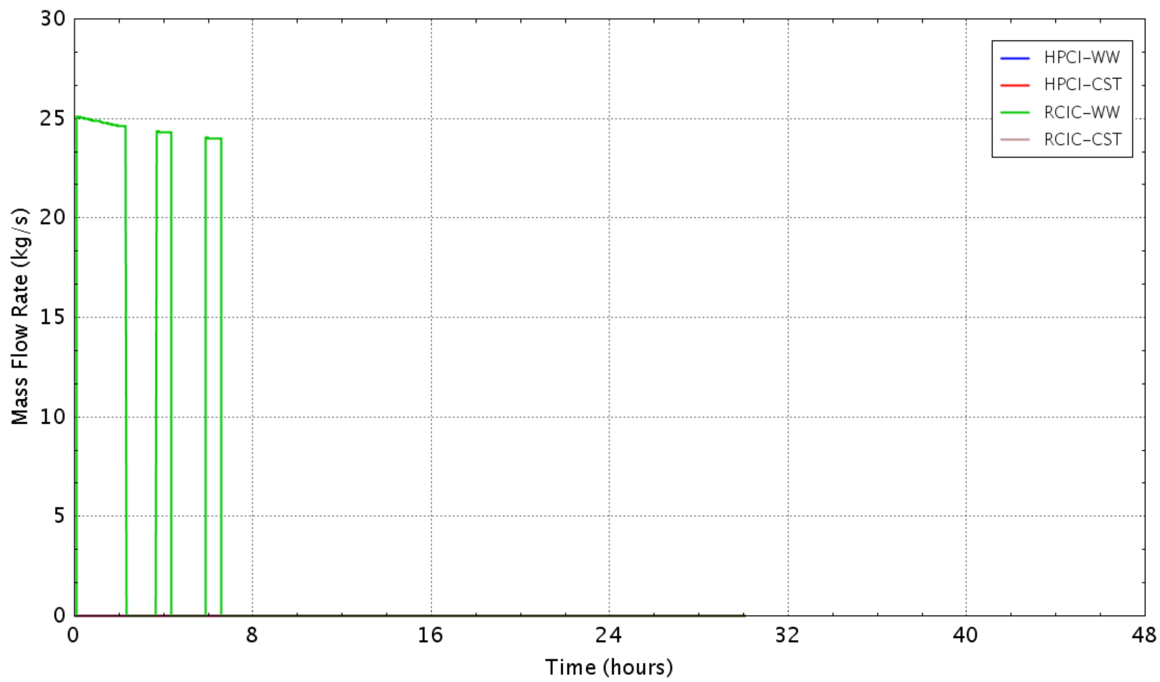

Figure E - 486 Flow rate of the HPCI/RCIC pumps

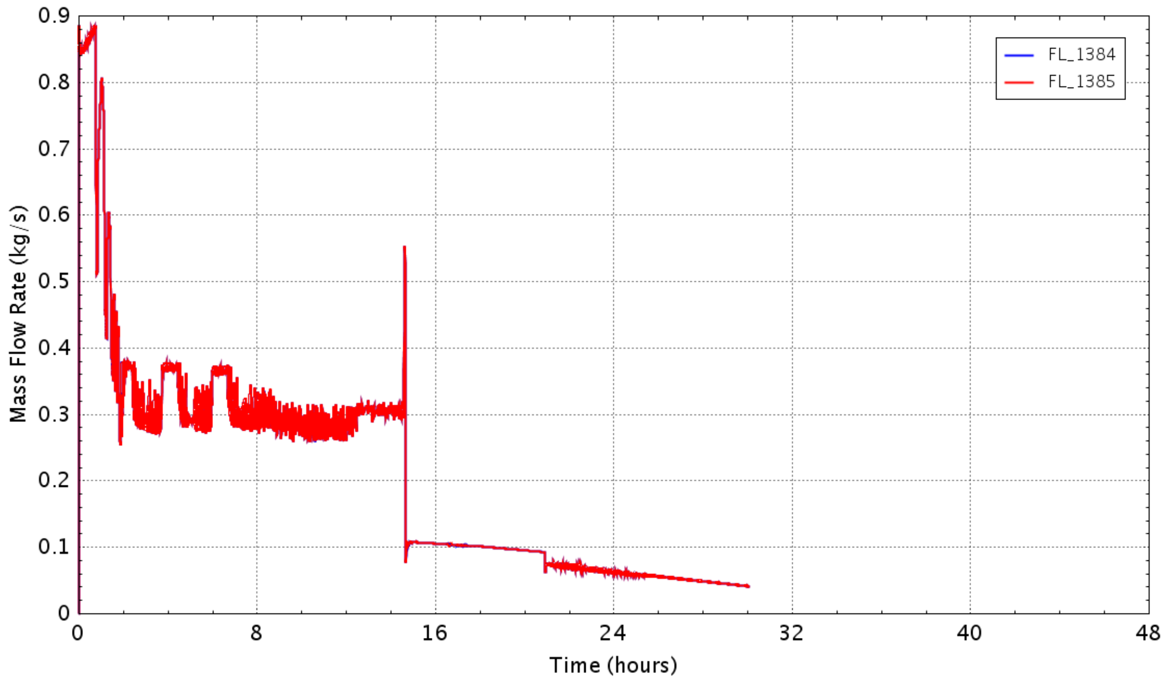

Figure E - 487 Flow rate of the recirculating pump seal leakage

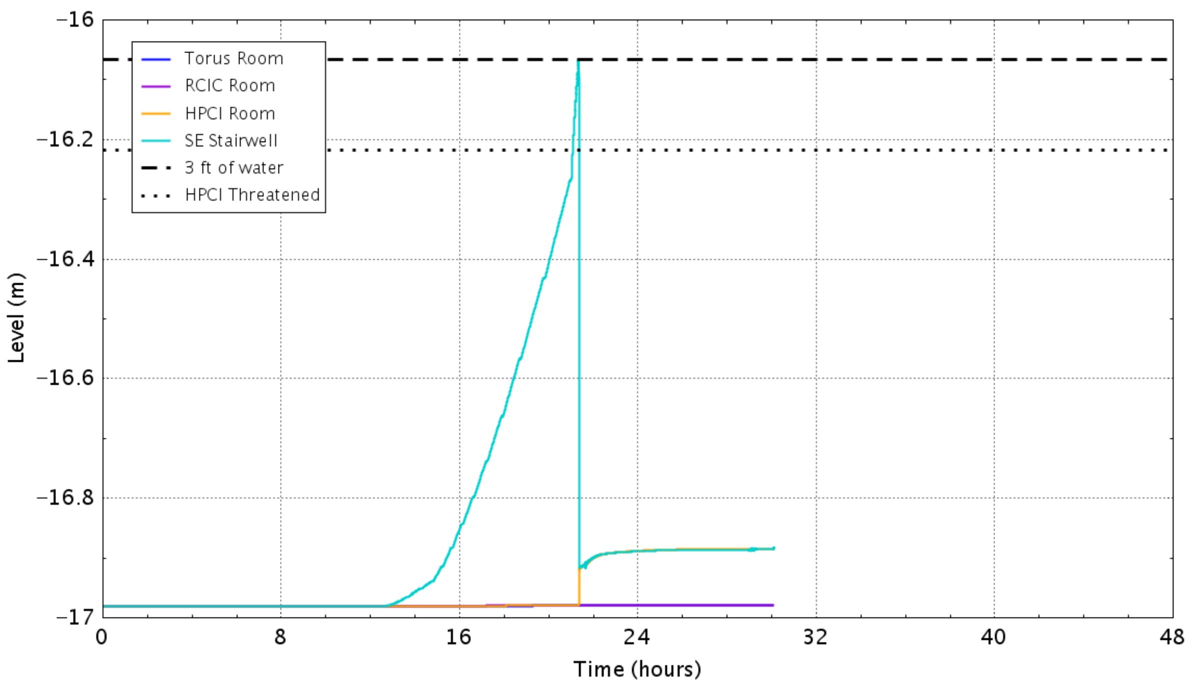

Figure E - 488 Water level in the reactor building basement

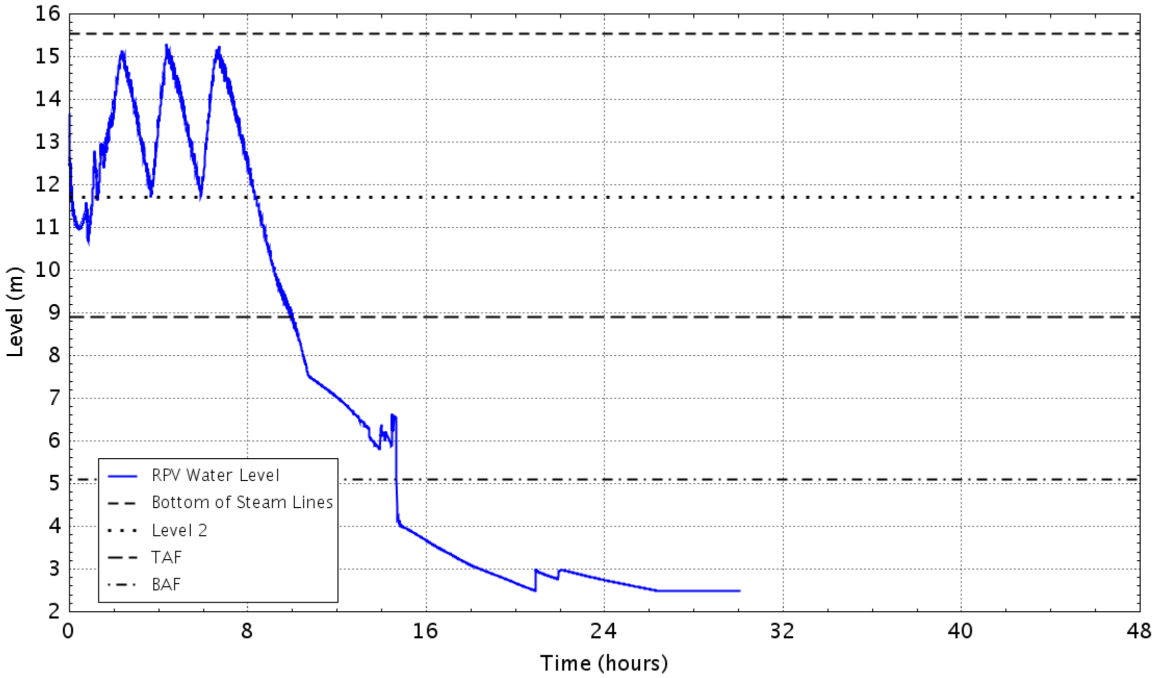

Figure E - 489 RPV down comer water level

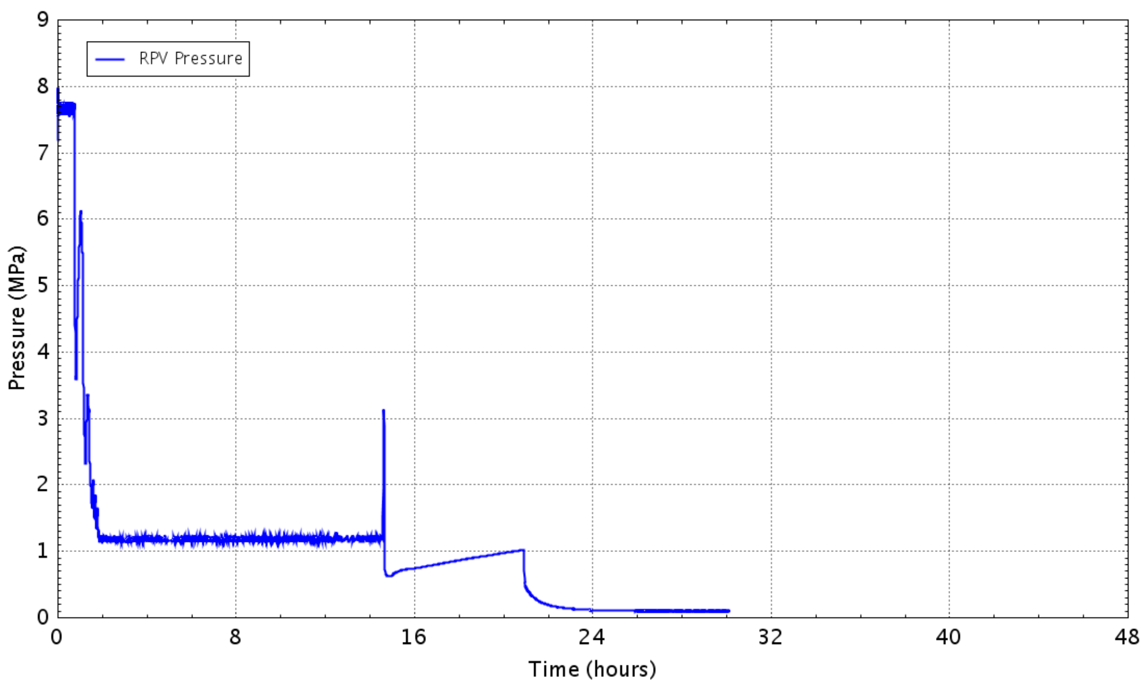

Figure E - 490 Pressure in theRPV

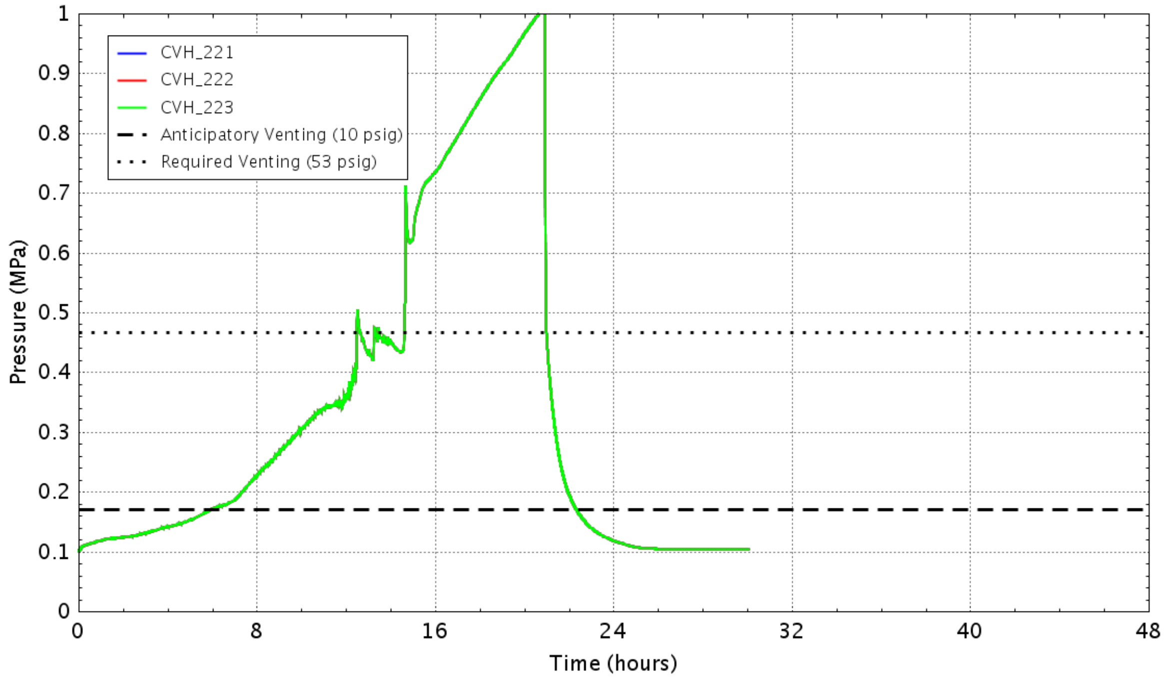

Figure E - 491 Pressure in the wetwell

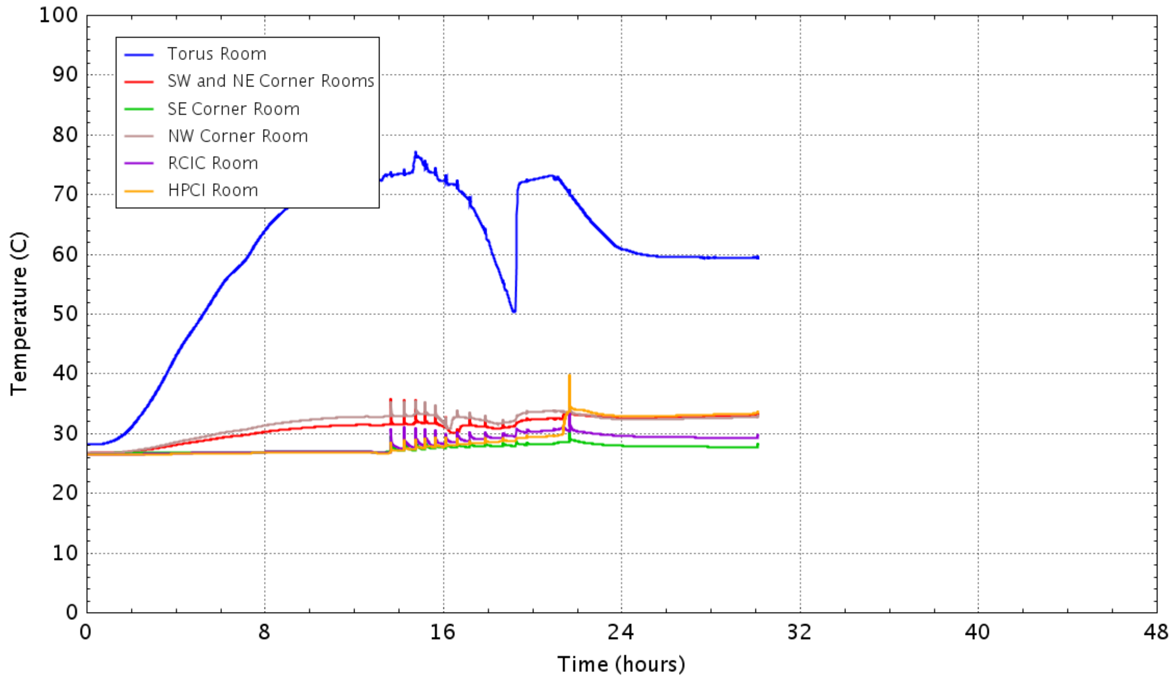

Figure E - 492 Vapor temperature in the reactor building basement

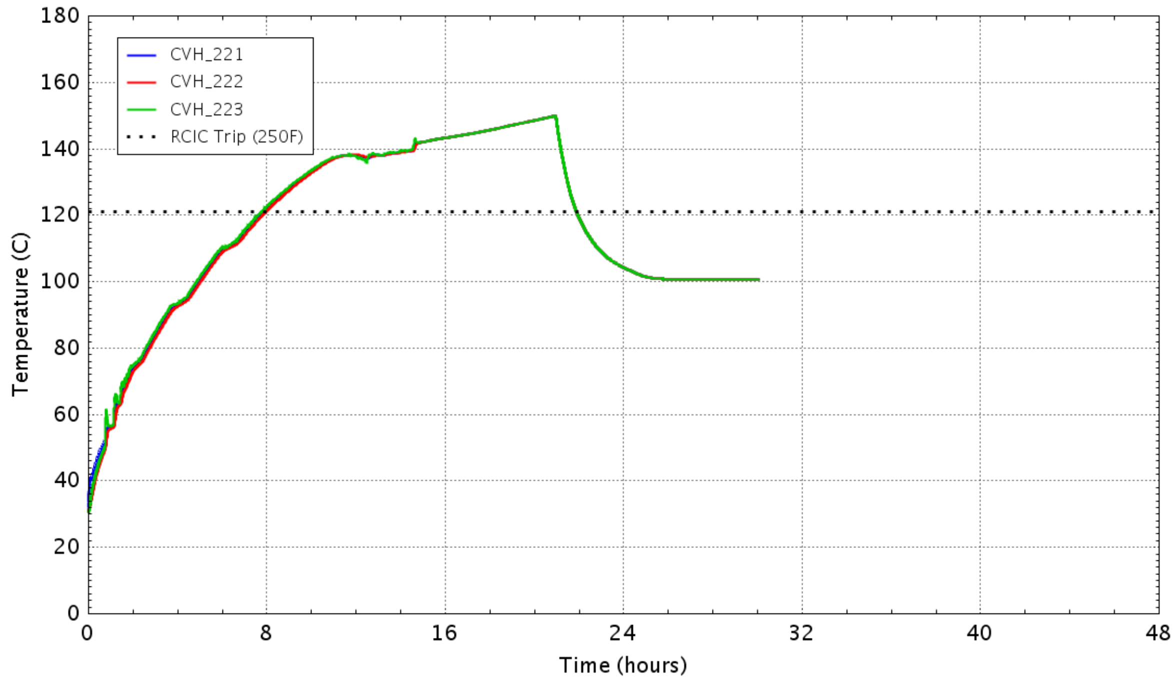

Figure E - 493 Water temperature in the wetwell

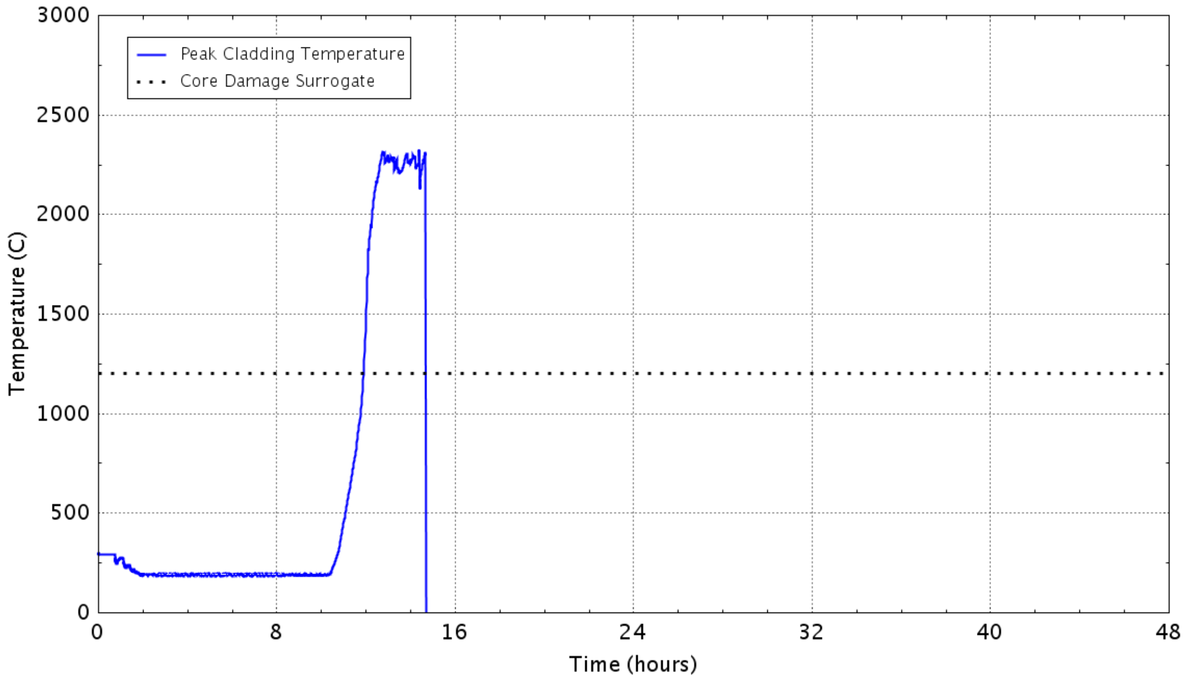

Figure E - 494 Peak temperature of the fuel cladding as a function of time

E.3.10 Case 10a: Sensitivity to LOOPGR-38-9 Case 10 with HPCI Available Instead of RCIC

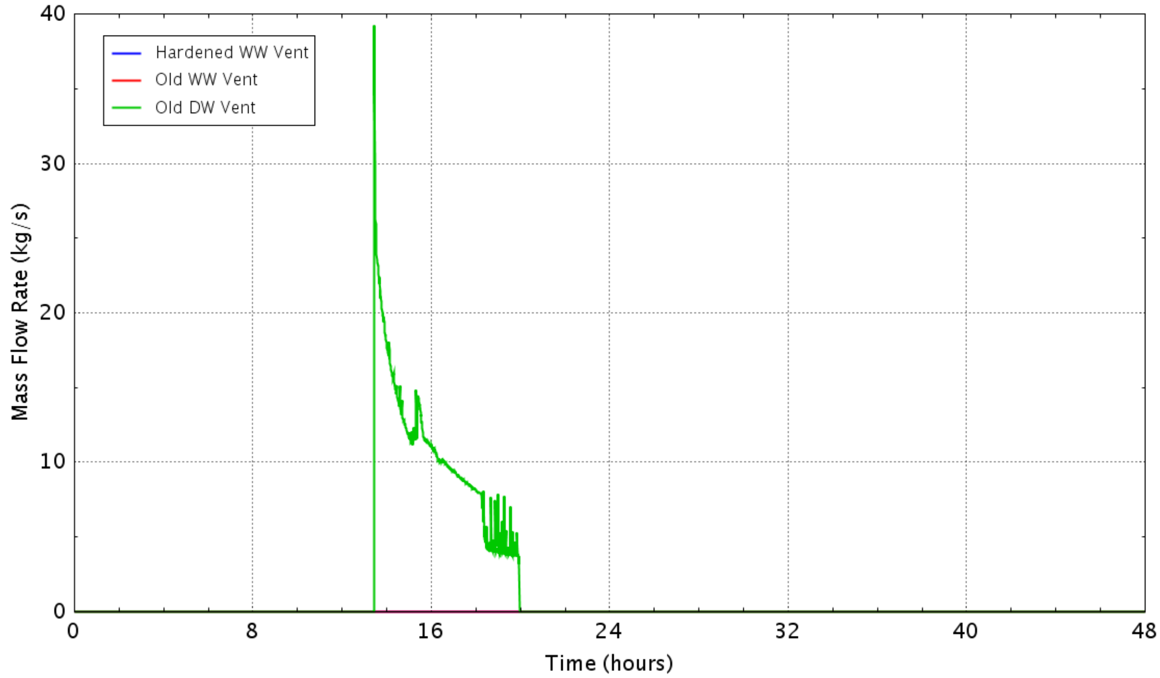

Figure E - 495 Flow rate of the containment vents

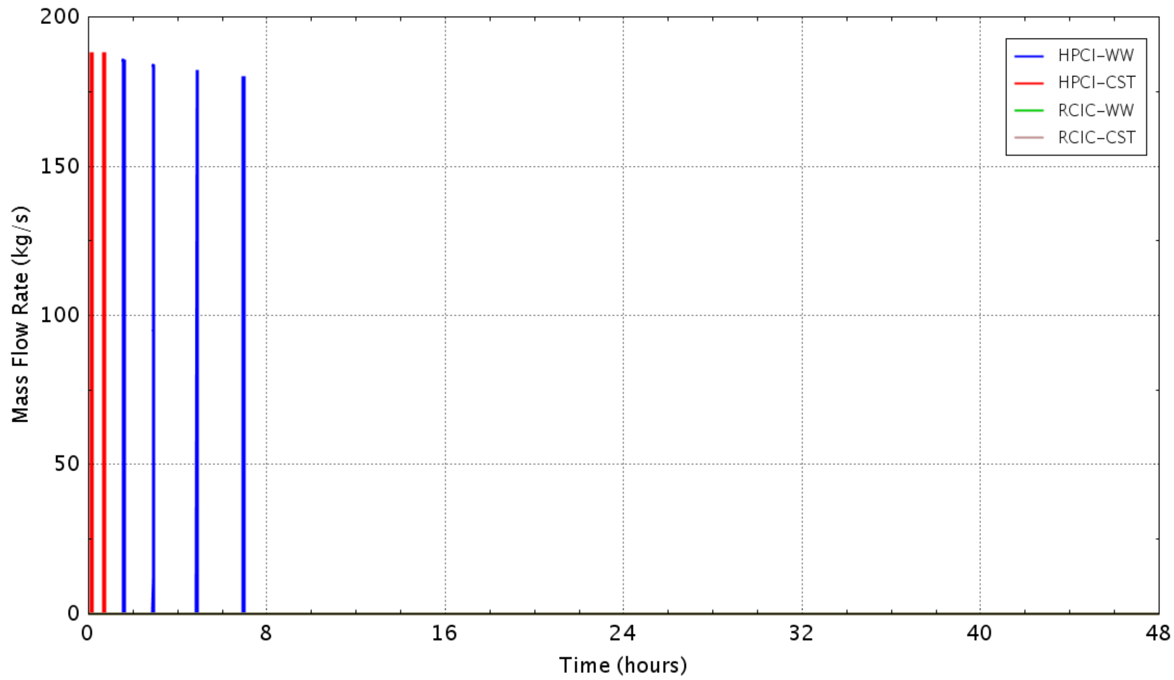

Figure E – 496 Flow rate of the HPCI/RCIC pumps

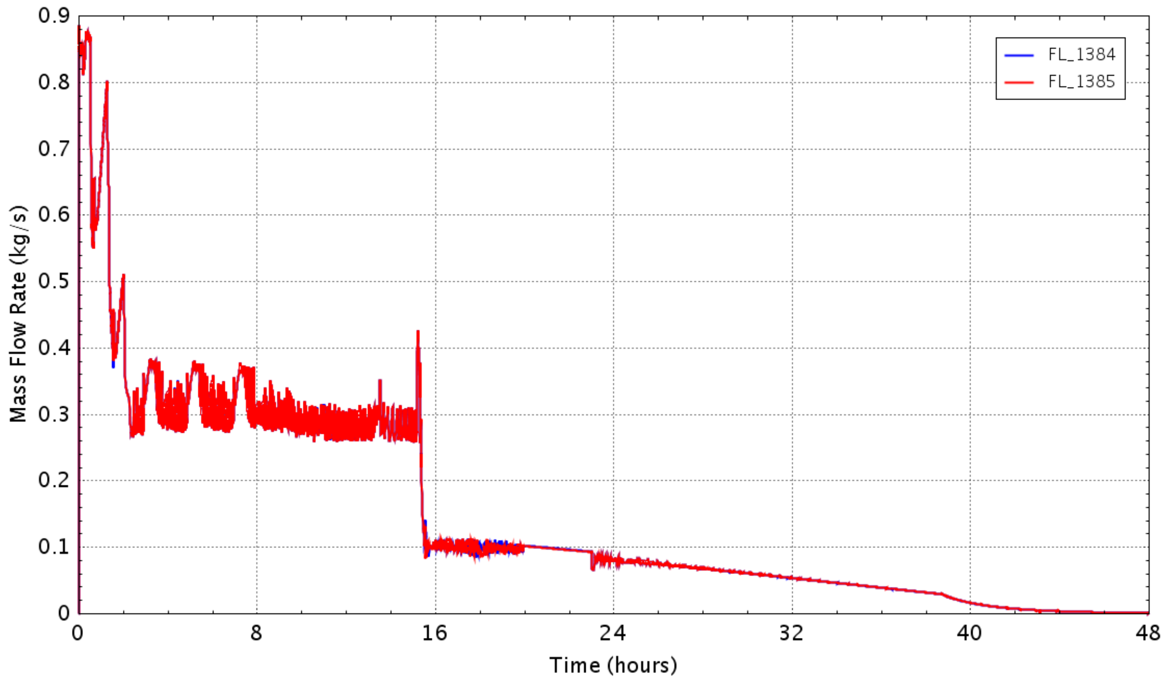

Figure E - 497 Flow rate of the recirculating pump seal leakage

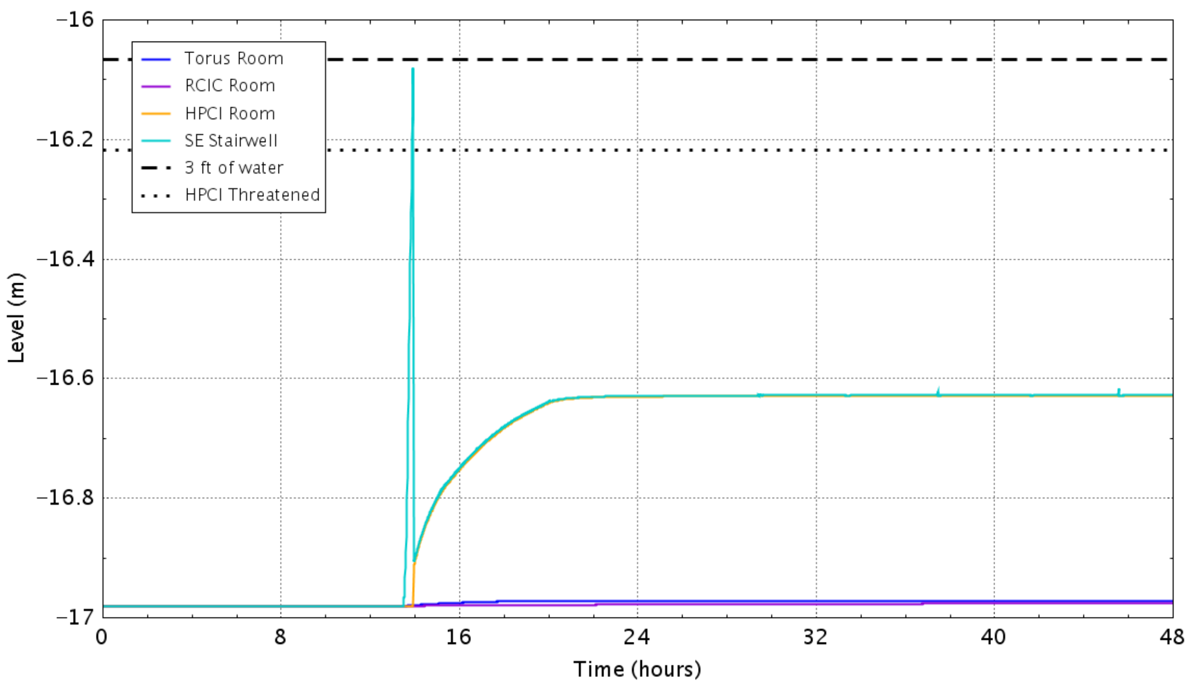

Figure E - 498 Water level in the reactor building basement

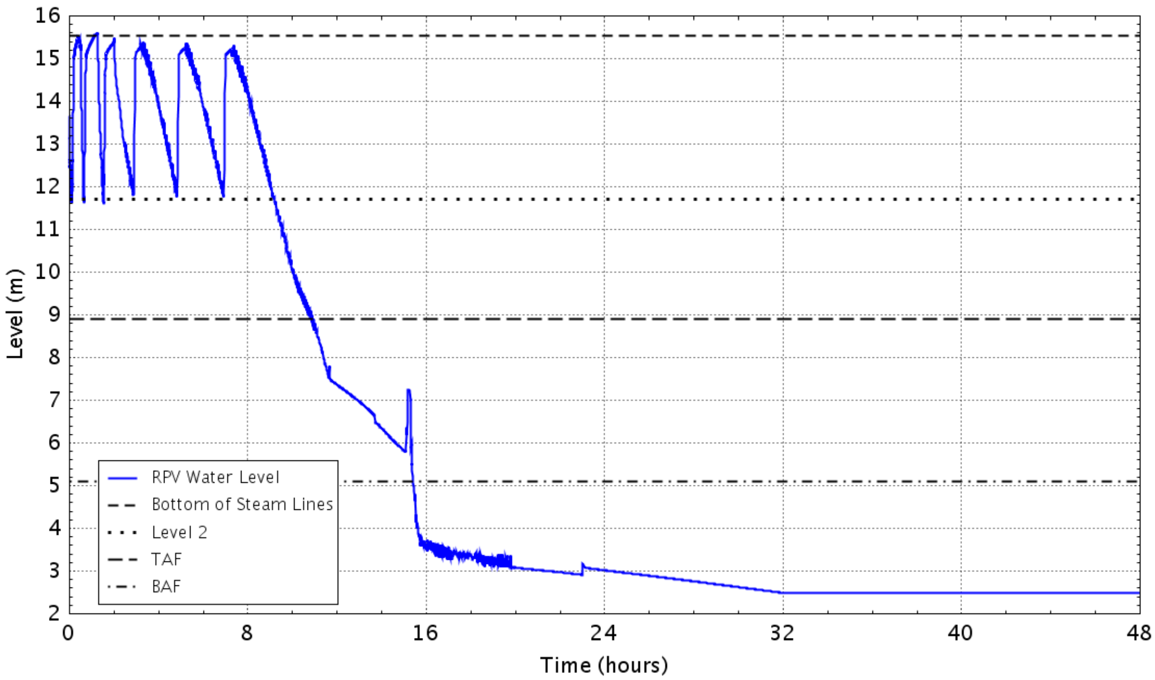

Figure E - 499 RPV down comer water level

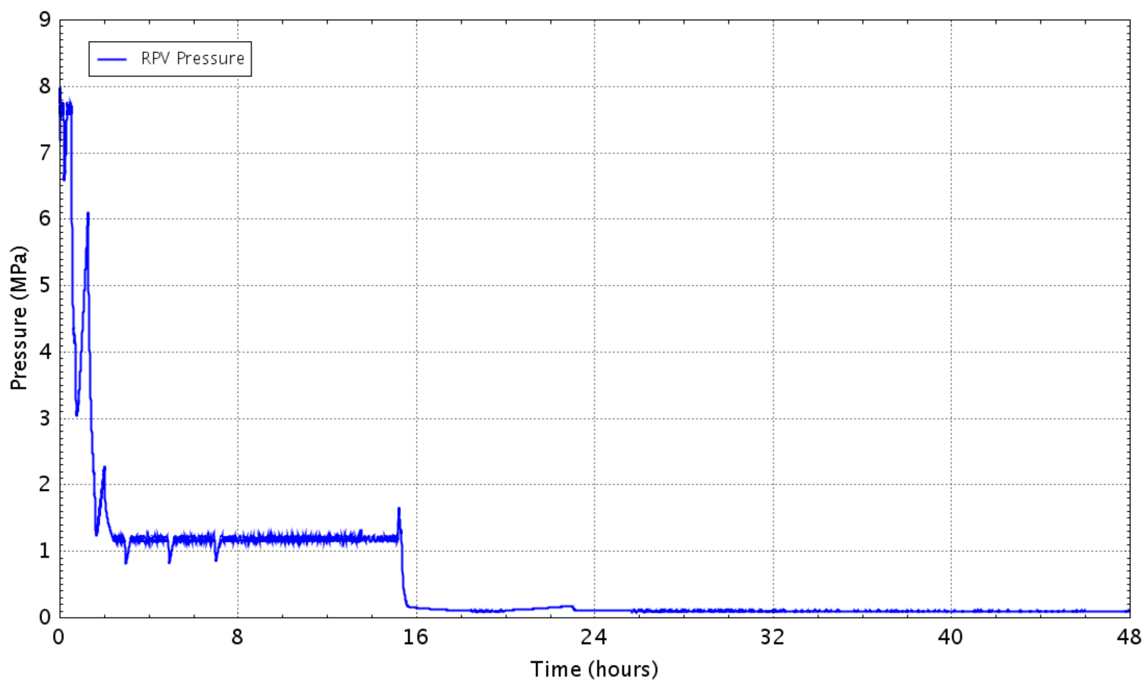

Figure E - 500 Pressure in theRPV

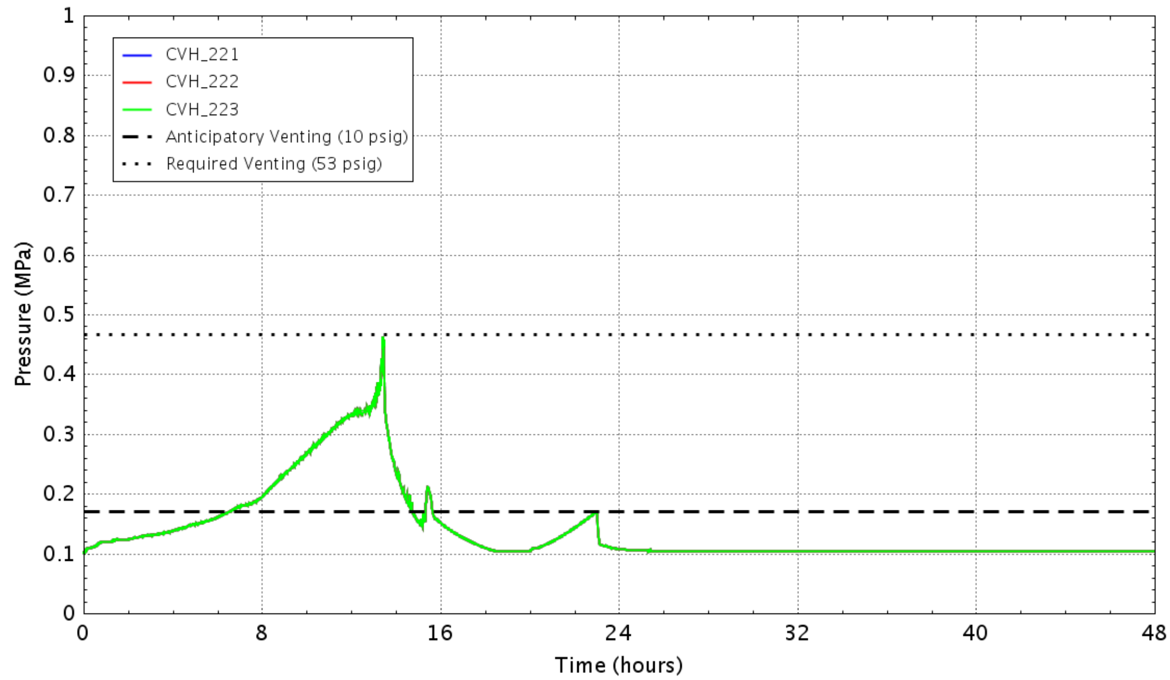

Figure E - 501 Pressure in the wetwell

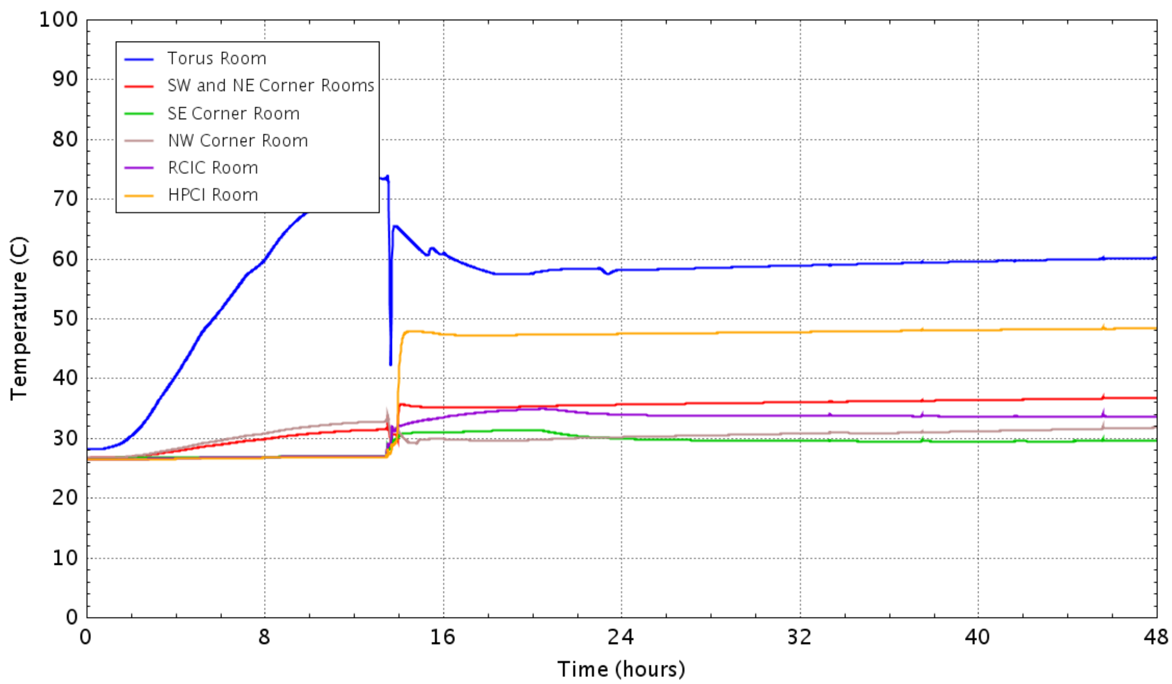

Figure E - 502 Vapor temperature in the reactor building basement

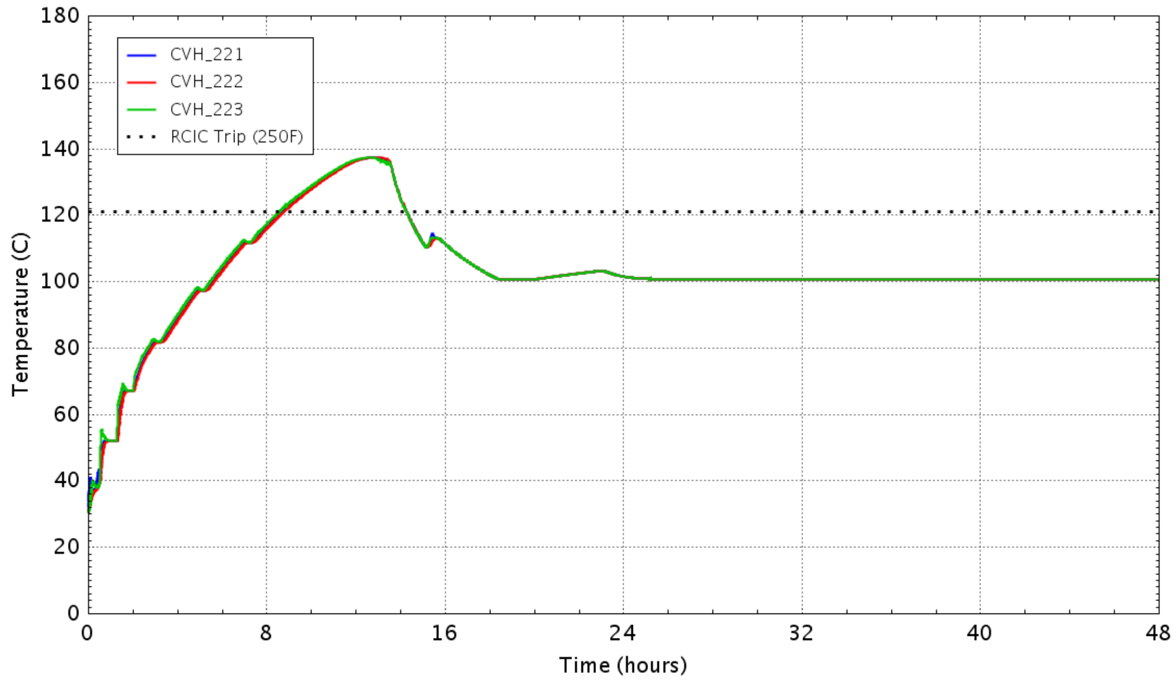

Figure E - 503 Water temperature in the wetwell

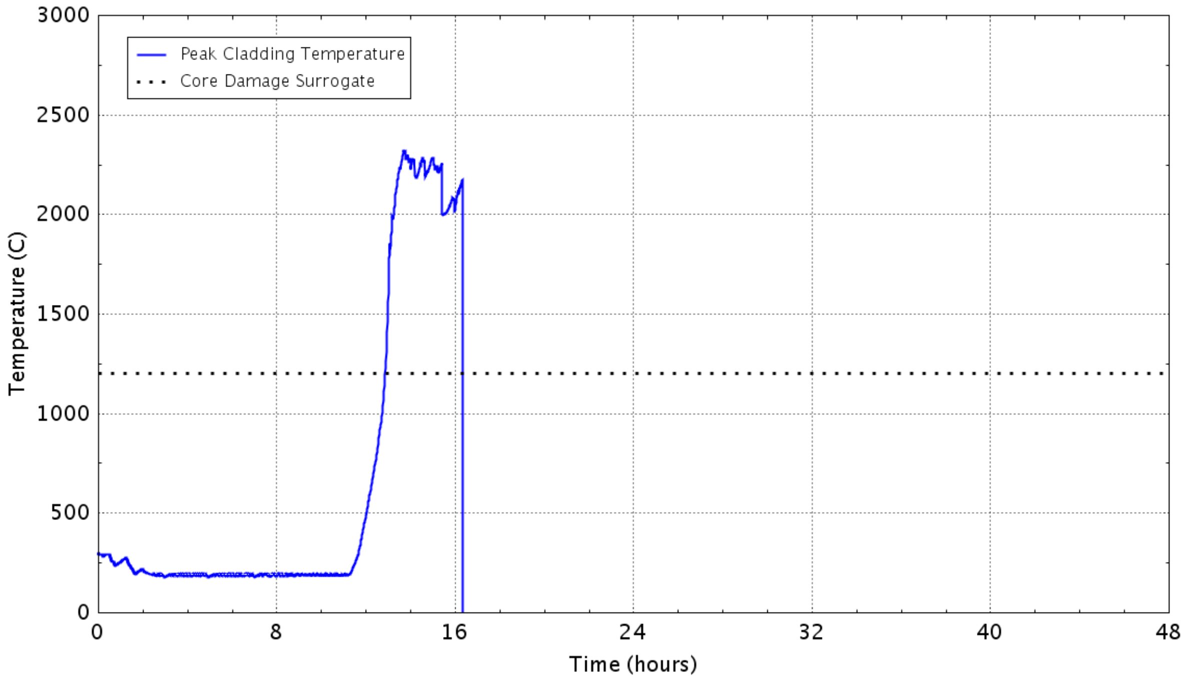

Figure E – 504 Peak temperature of the fuel cladding as a function of time

E.3.11 Case 10b: Sensitivity to LOOPGR-38-9 Case 10 with CST Unavailable

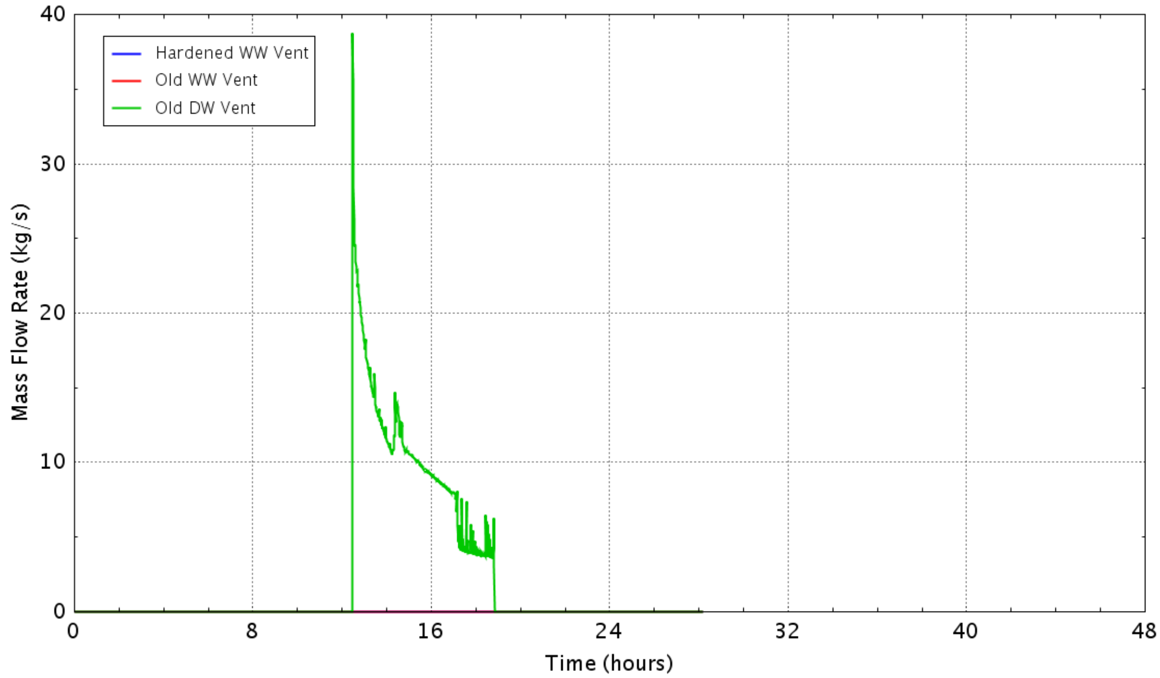

Figure E - 505 Flow rate of the containment vents

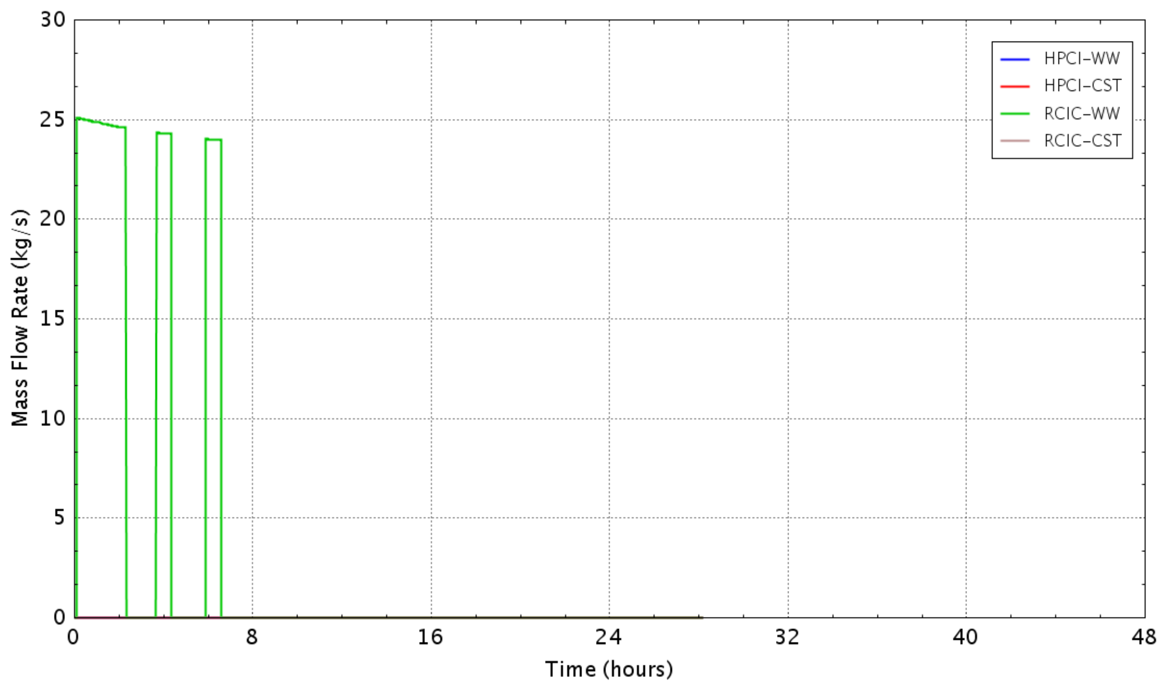

Figure E - 506 Flow rate of the HPCI/RCIC pumps

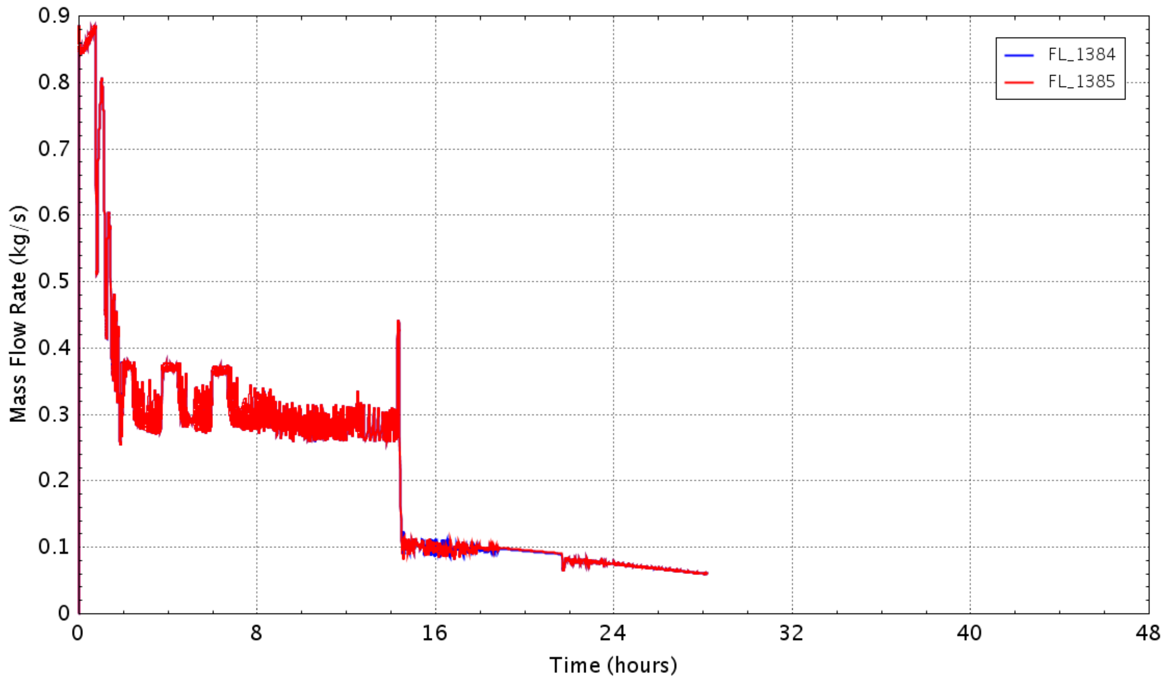

Figure E - 507 **Flow rate of the recirculating pump seal leakage**

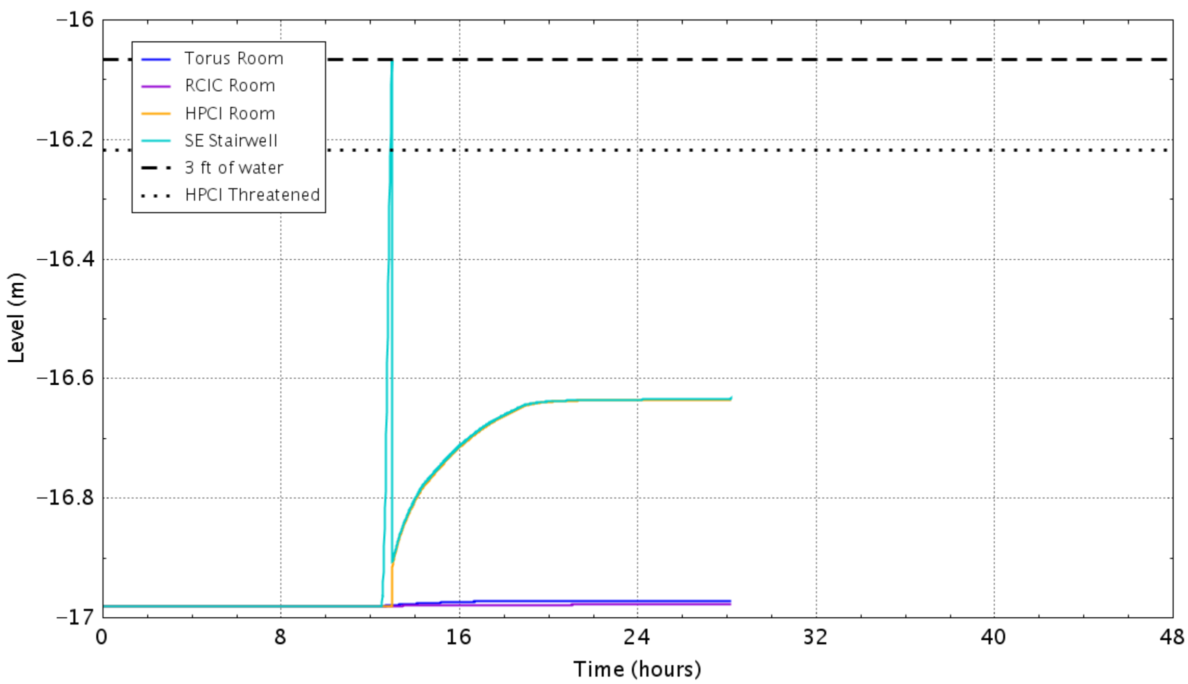

Figure E - 508 **Water level in the reactor building basement**

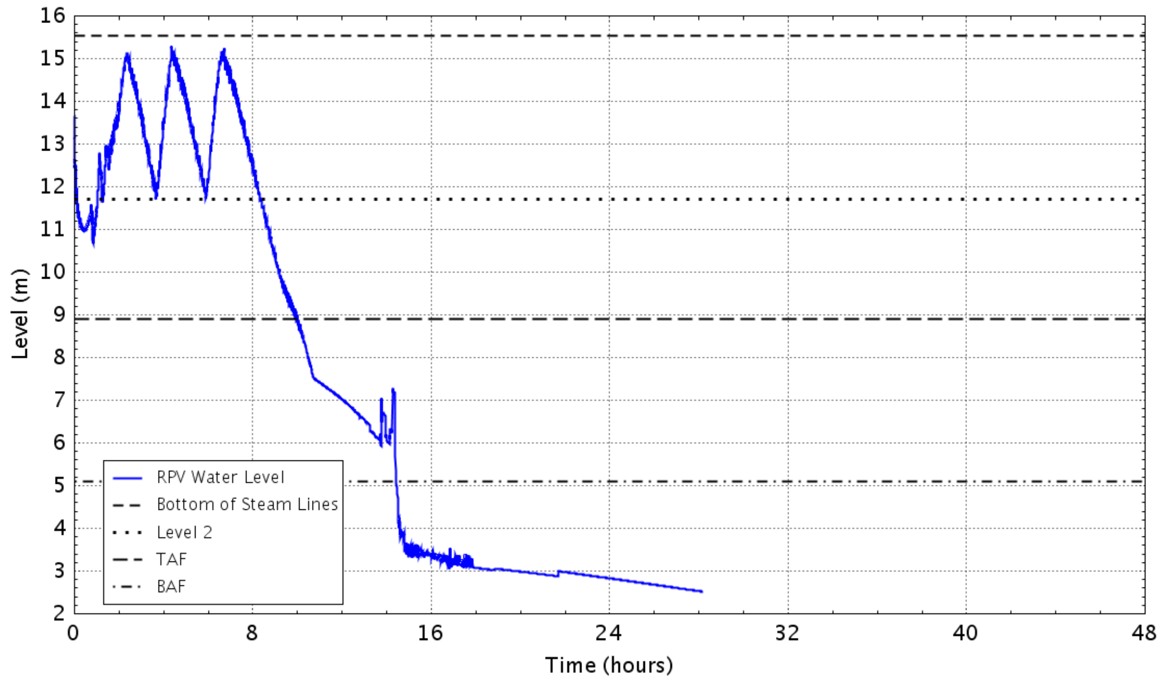

Figure E - 509 RPV down comer water level

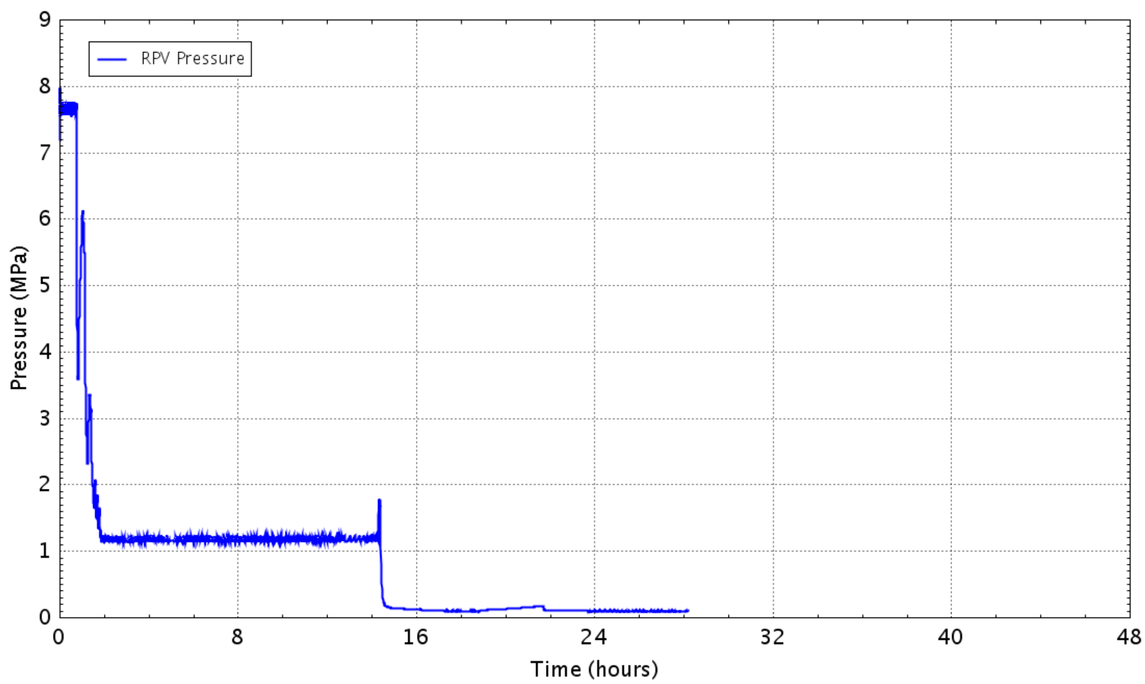

Figure E - 510 Pressure in theRPV

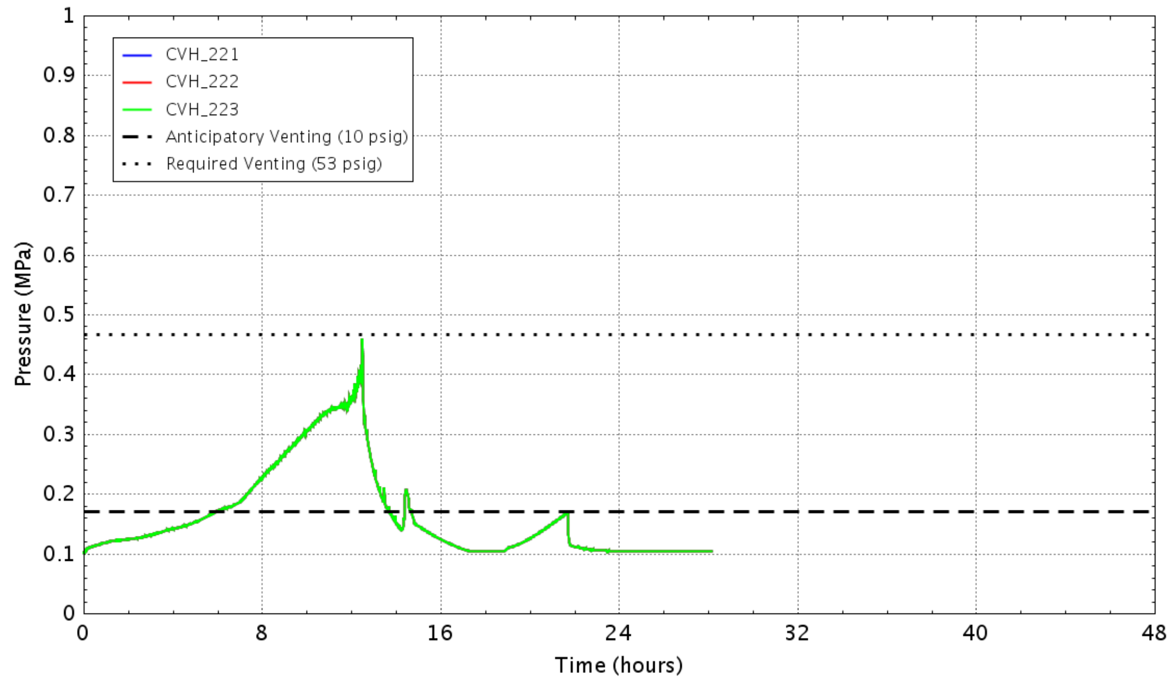

Figure E - 511 Pressure in the wetwell

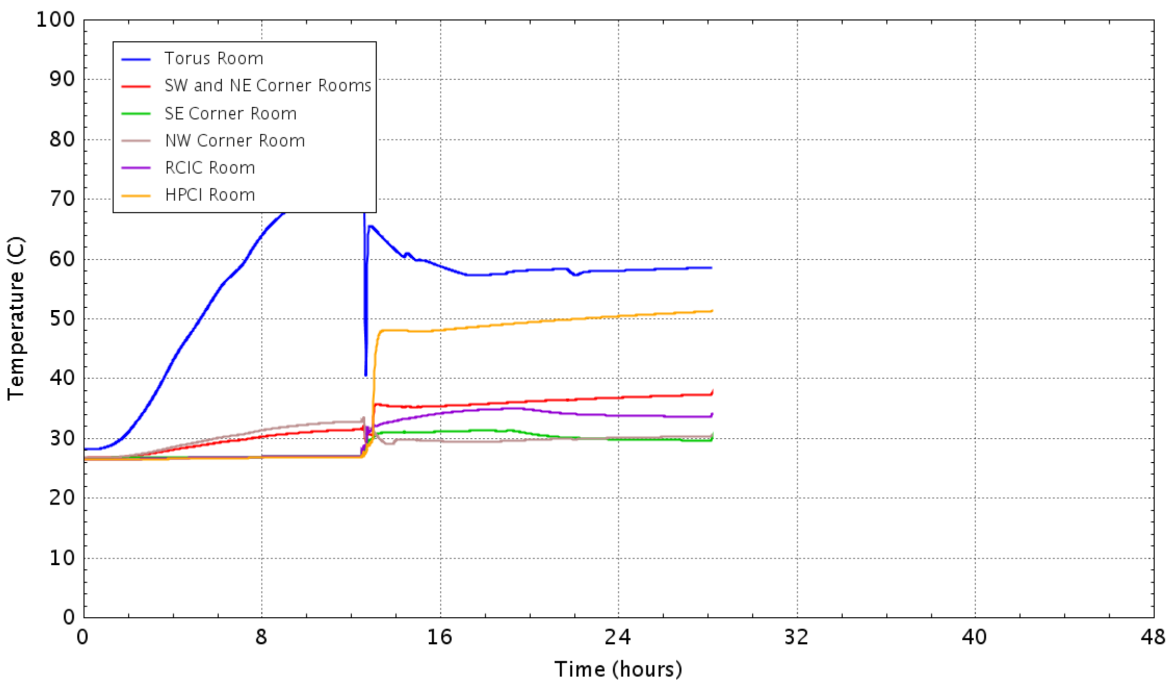

Figure E - 512 Vapor temperature in the reactor building basement

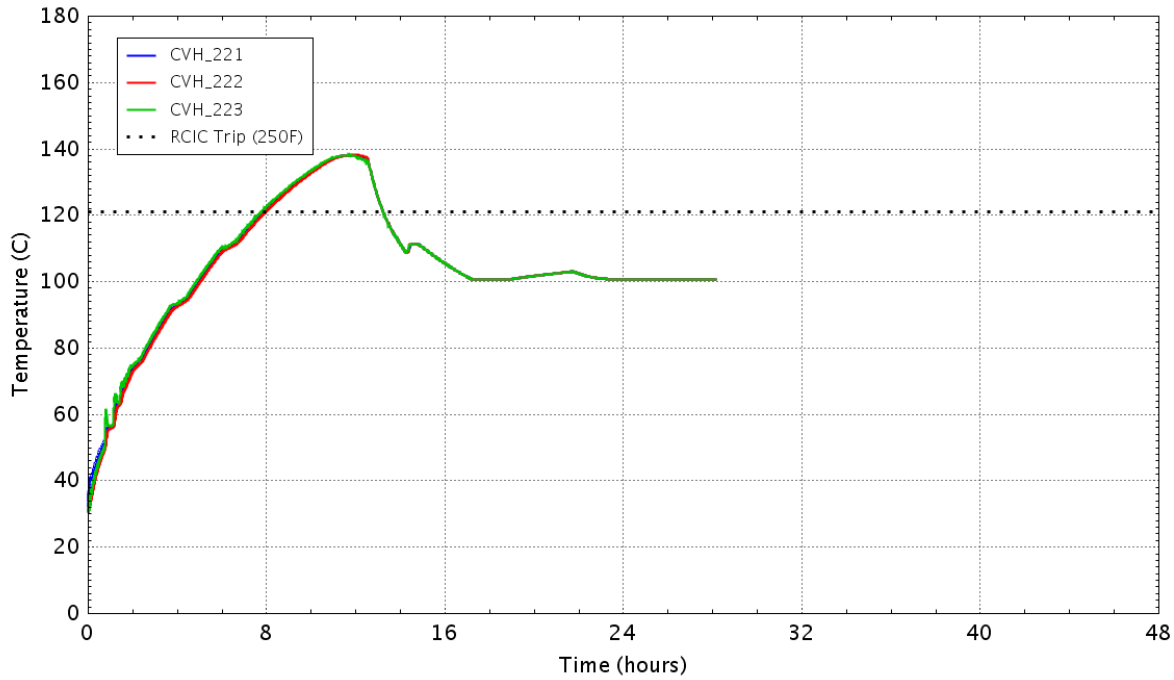

Figure E - 513 **Water temperature in the wetwell**

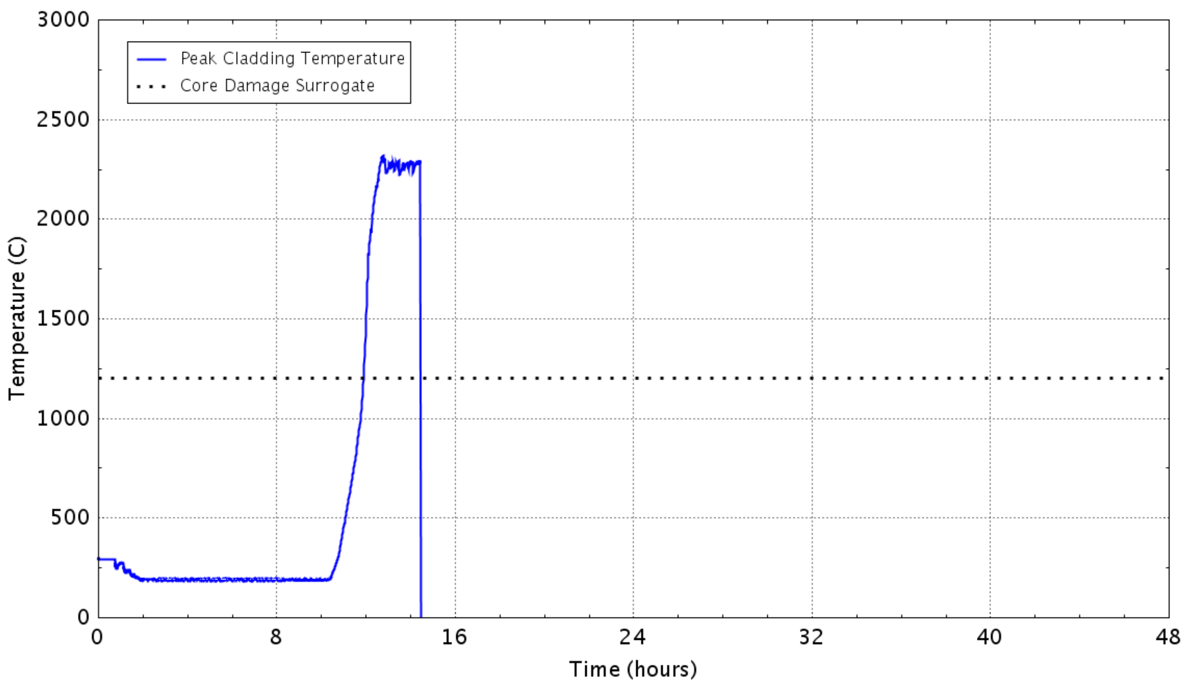

Figure E - 514 **Peak temperature of the fuel cladding as a function of time**

E.3.12 Case 15a: Sensitivity to LOMFW-25 Case 15 with CRDHS Unavailable

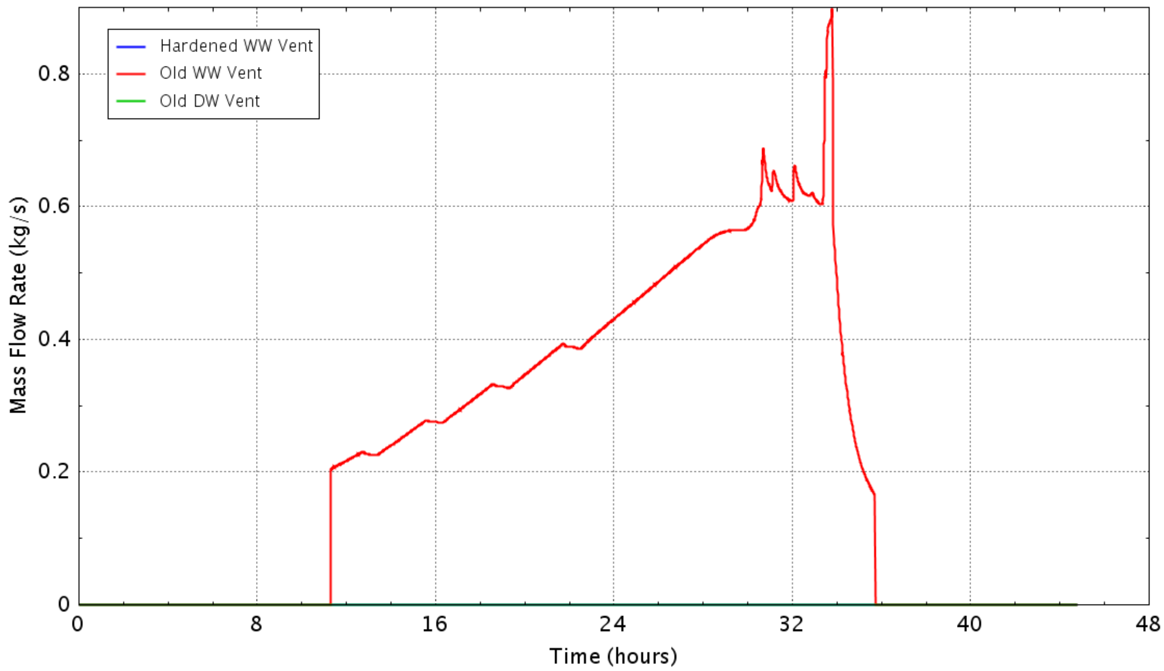

Figure E - 515 Flow rate of the containment vents

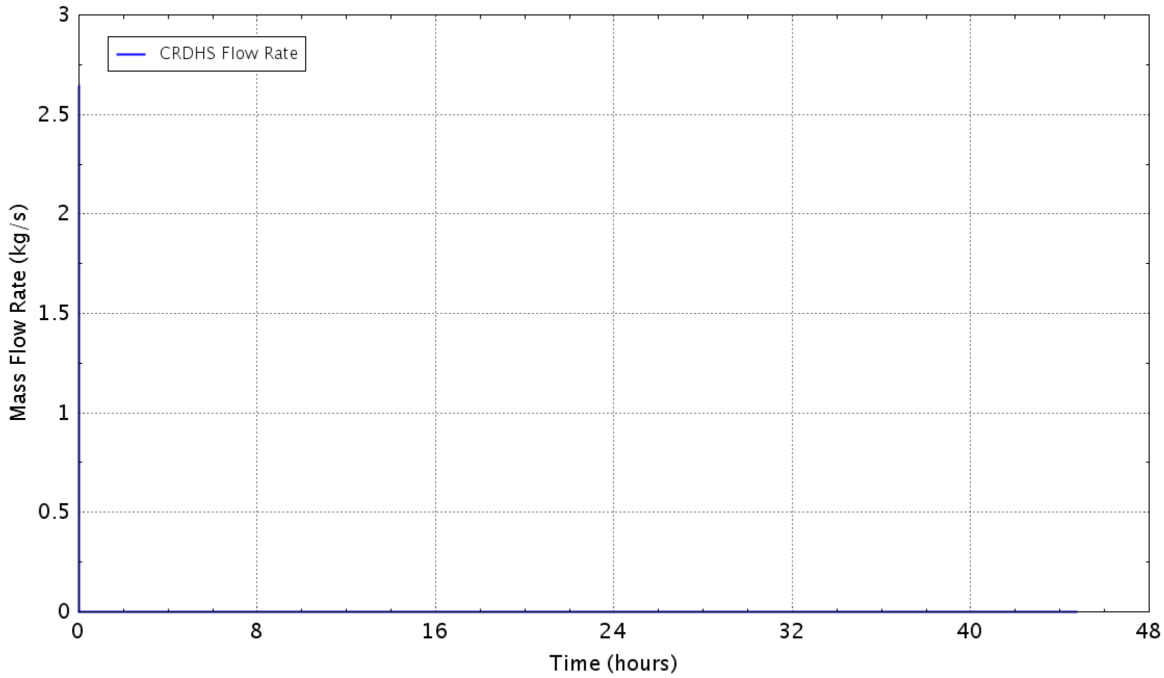

Figure E - 516 Flow rate of the control rod drive hydraulic system

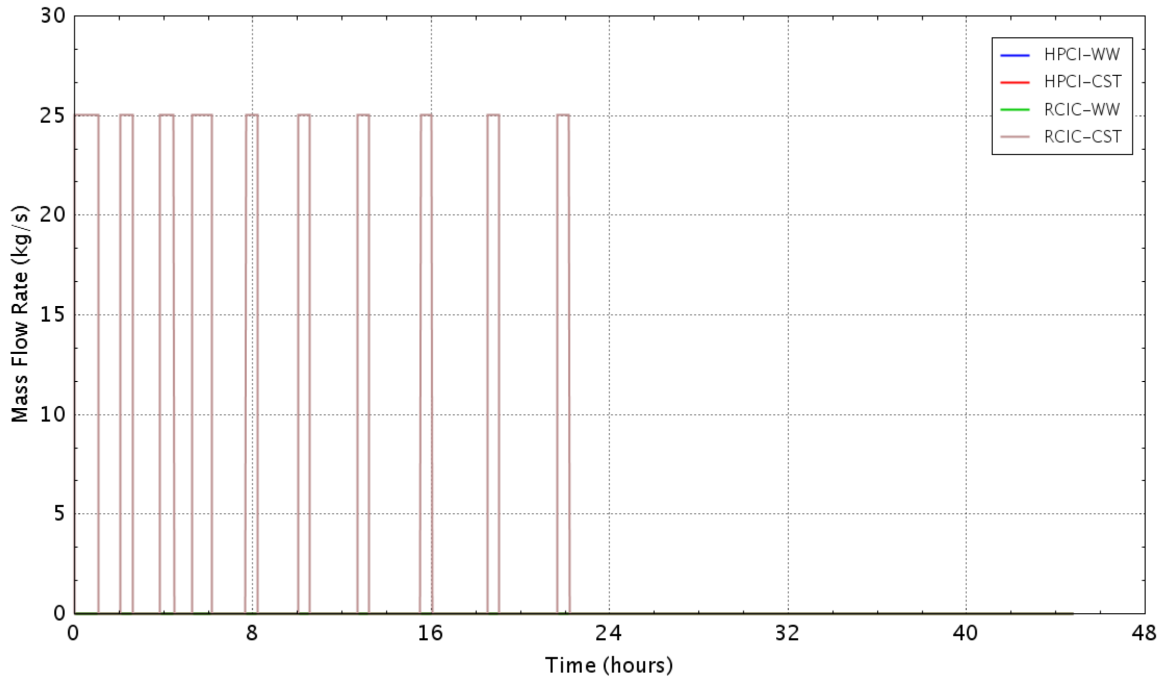

Figure E - 517 Flow rate of the HPCI/RCIC pumps

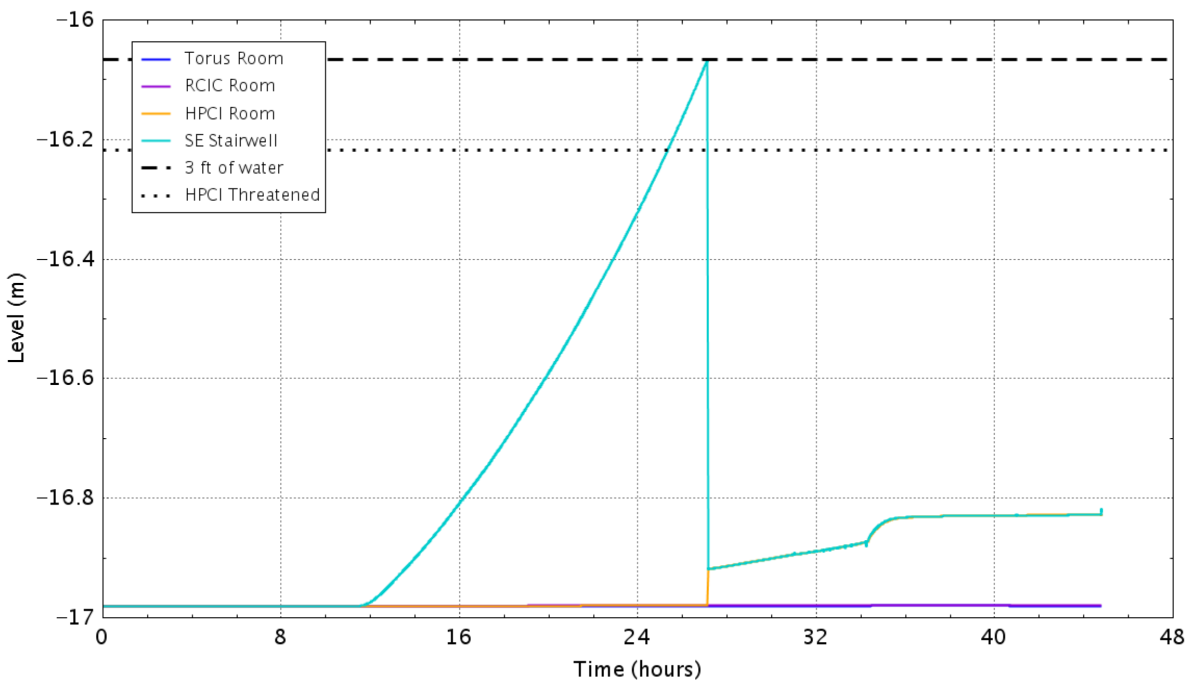

Figure E - 518 Water level in the reactor building basement

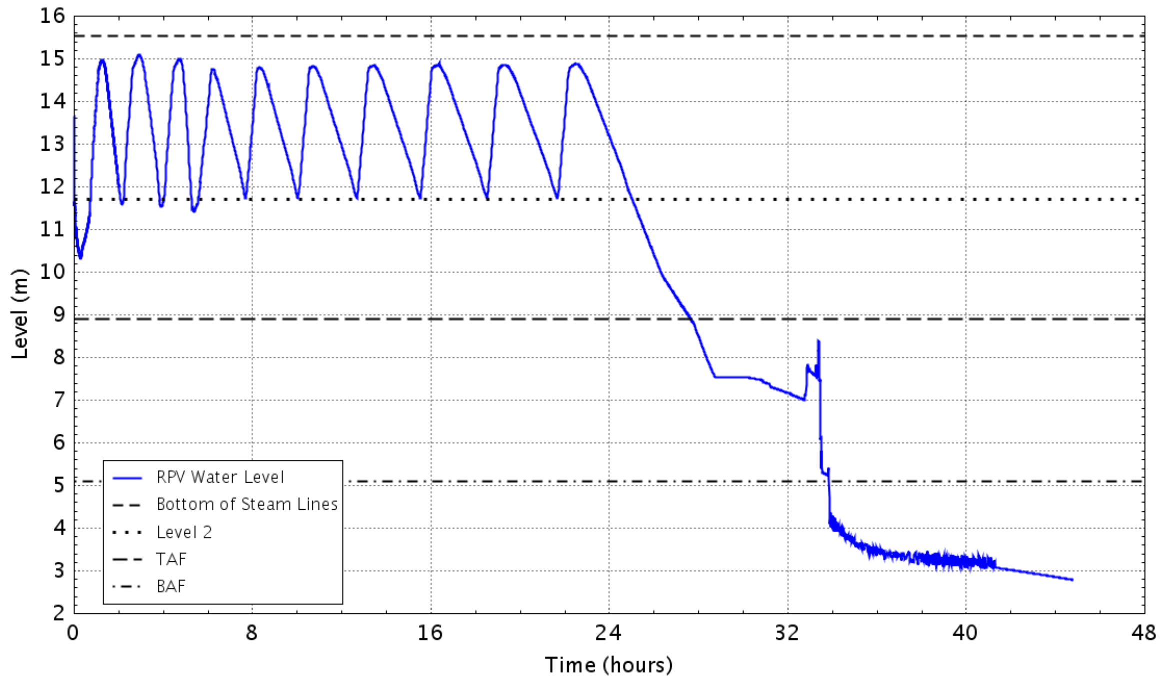

Figure E - 519 RPV down comer water level

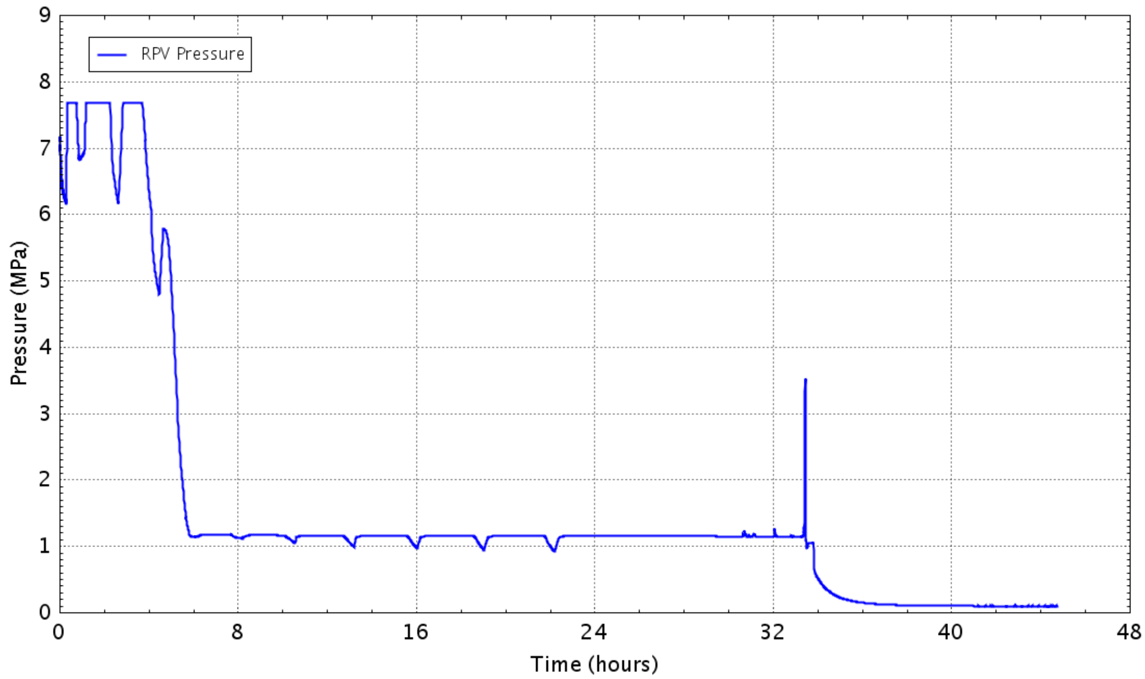

Figure E - 520 Pressure in theRPV

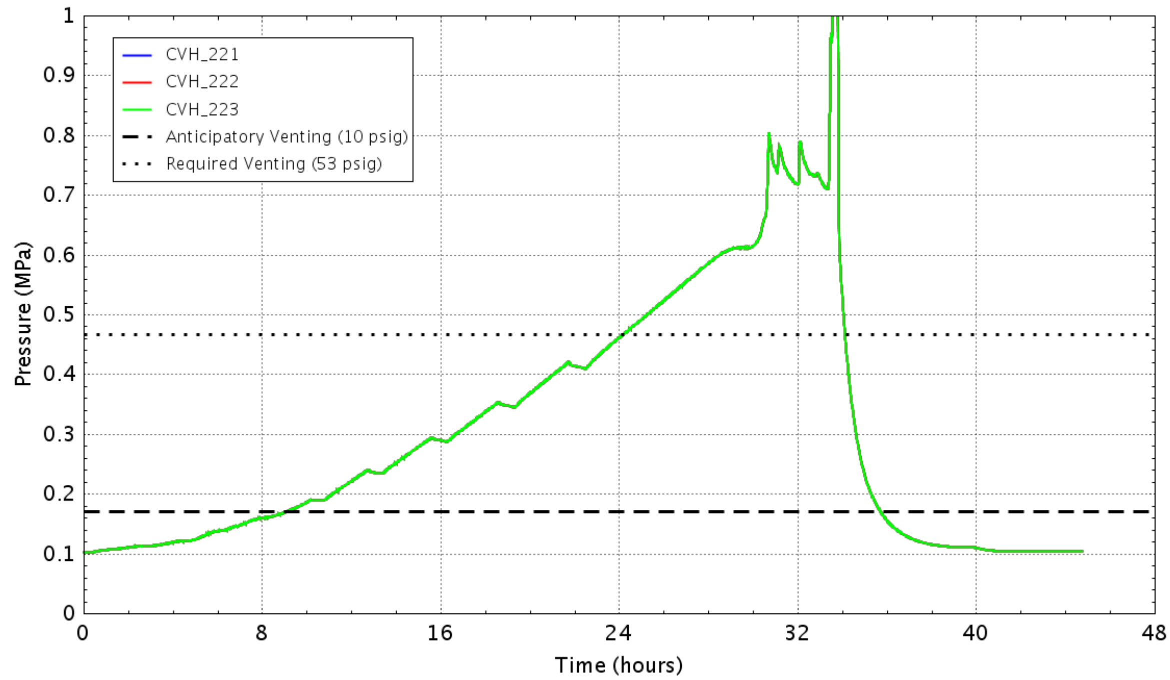

Figure E - 521 **Pressure in the wetwell**

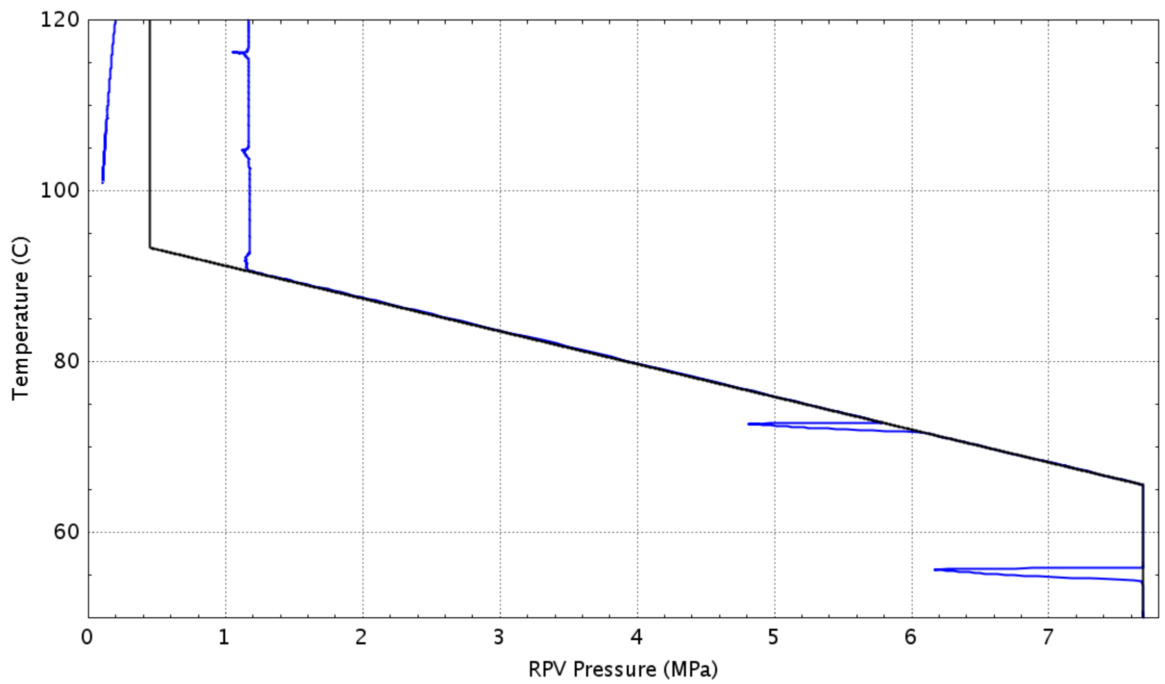

Figure E – 522 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

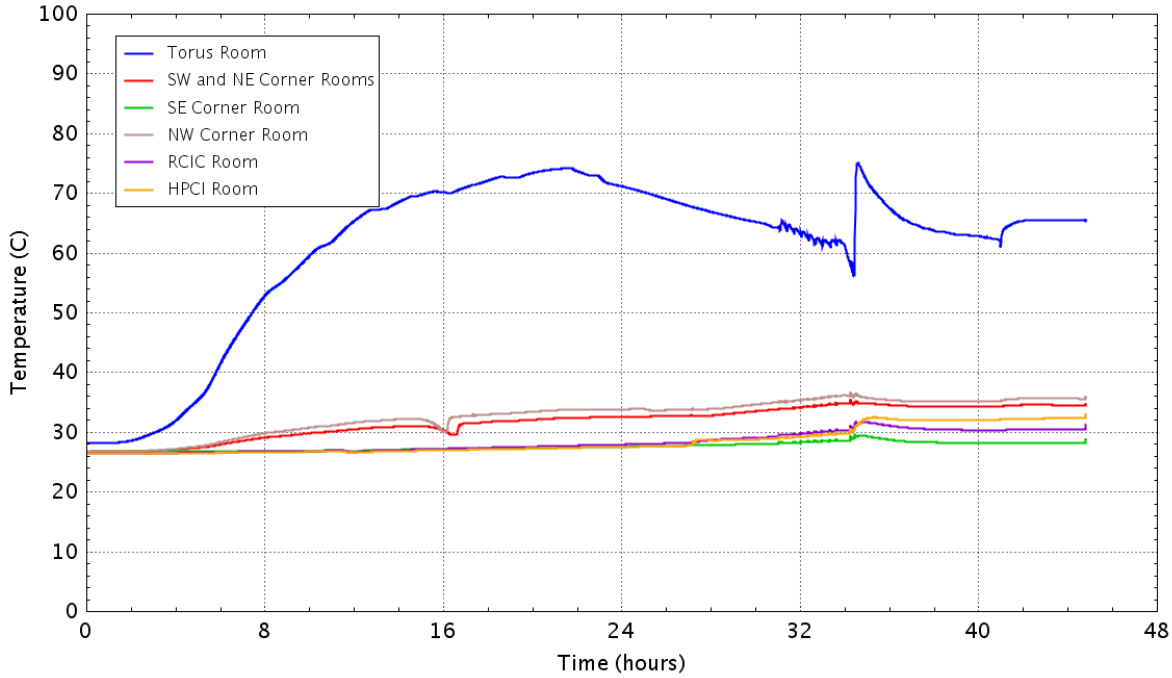

Figure E - 523 **Vapor temperature in the reactor building basement**

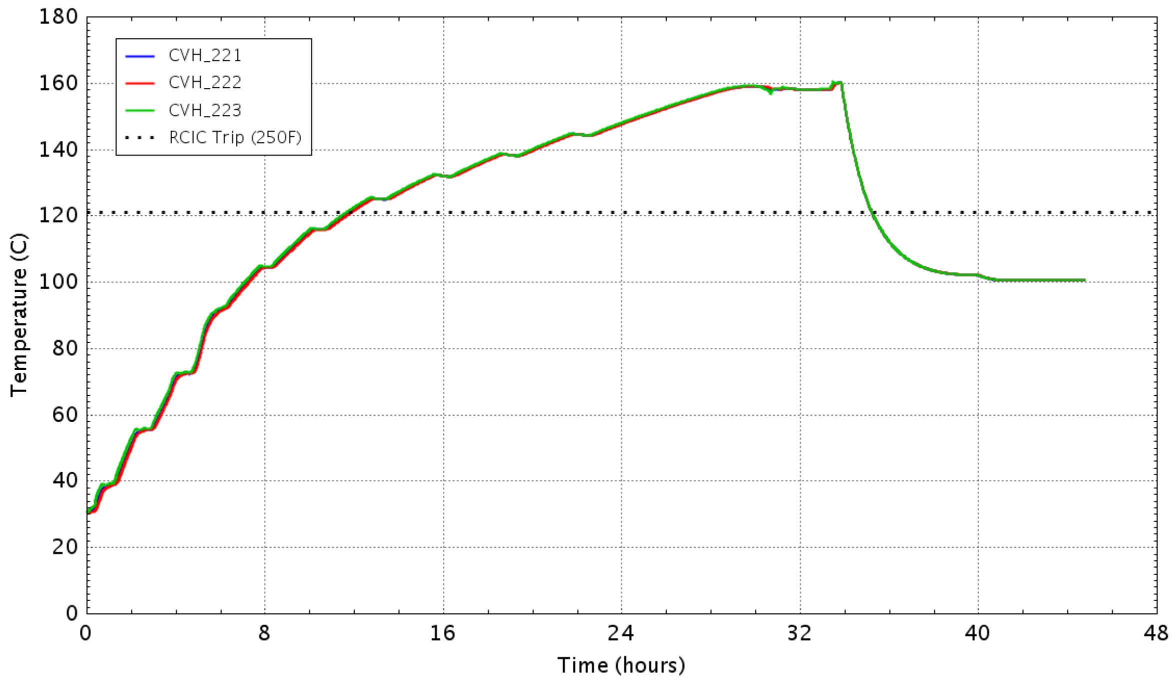

Figure E - 524 **Water temperature in the wetwell**

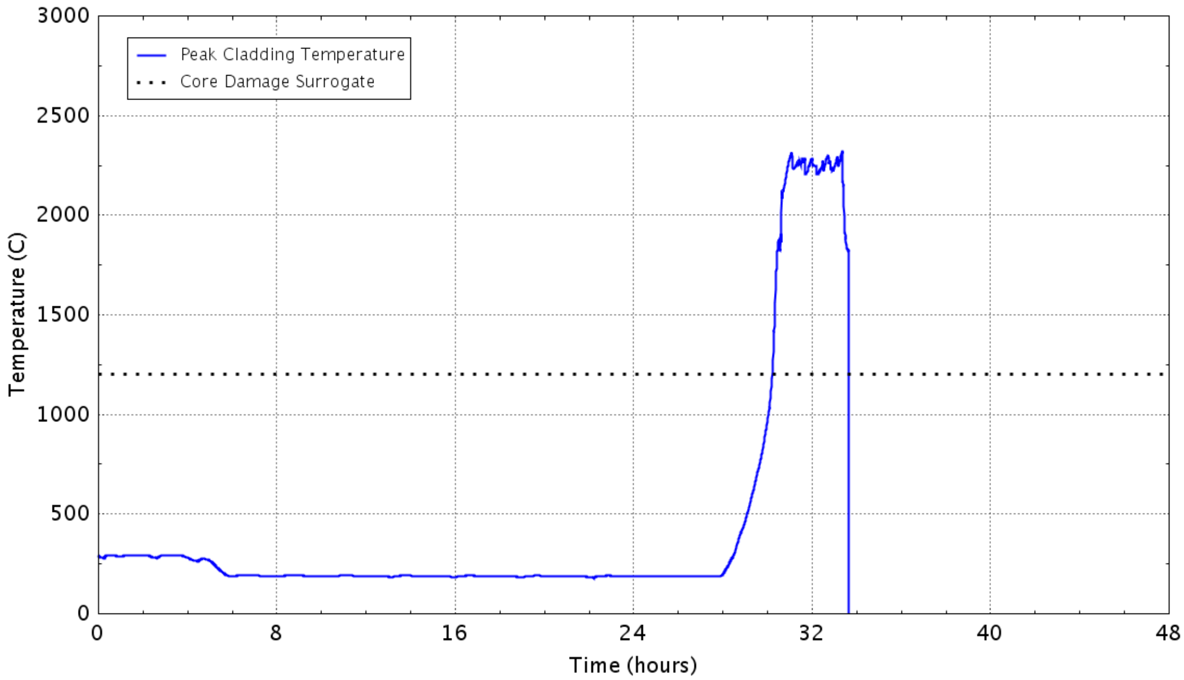

Figure E - 525 **Peak temperature of the fuel cladding as a function of time**

E.3.13 Case 15b: Sensitivity to LOMFW-25 Case 15 with MSIVClosure at the Start of the Transient

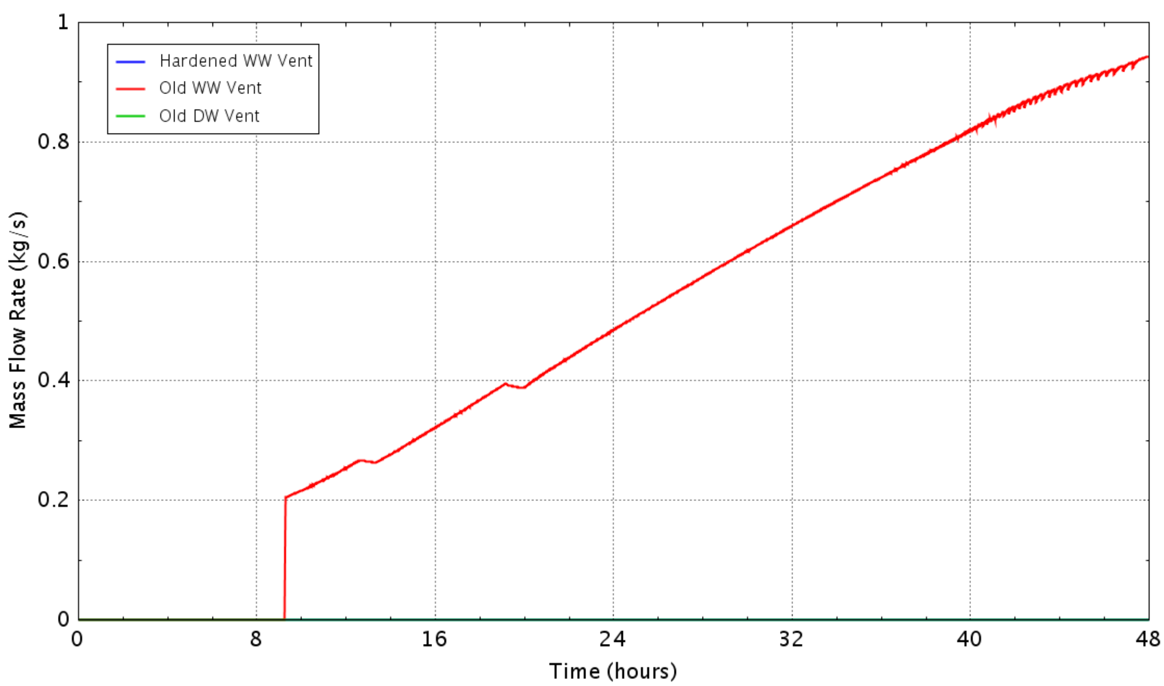

Figure E - 526 **Flow rate of the containment vents**

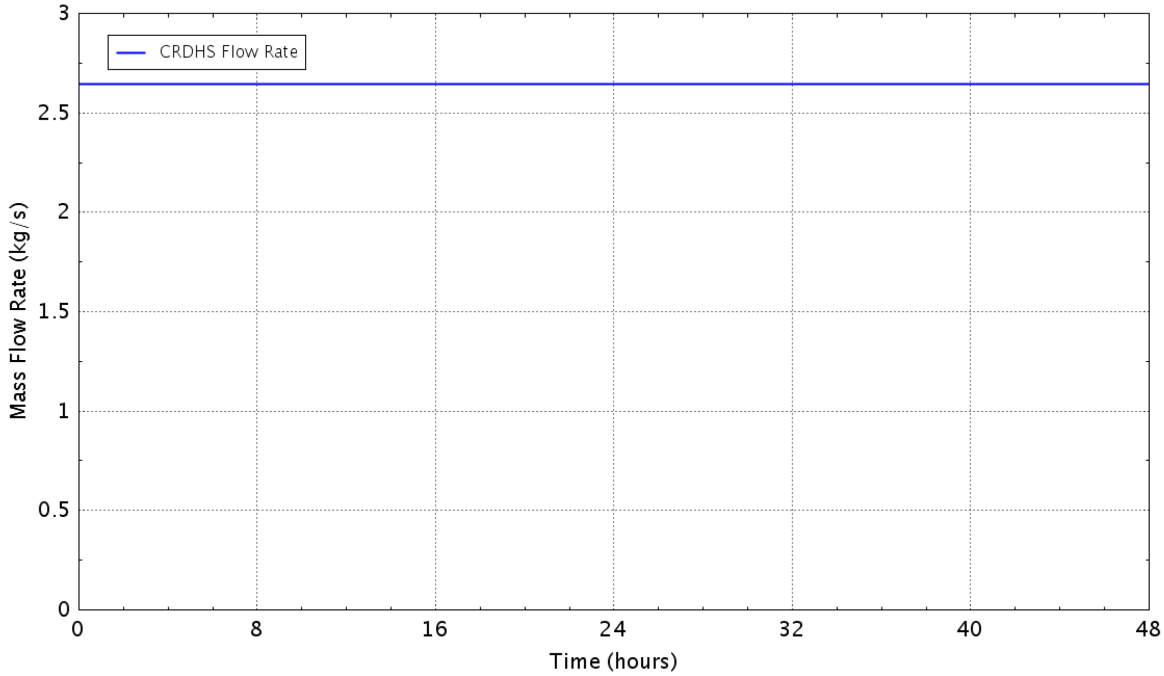

Figure E - 527 **Flow rate of the control rod drive hydraulic system**

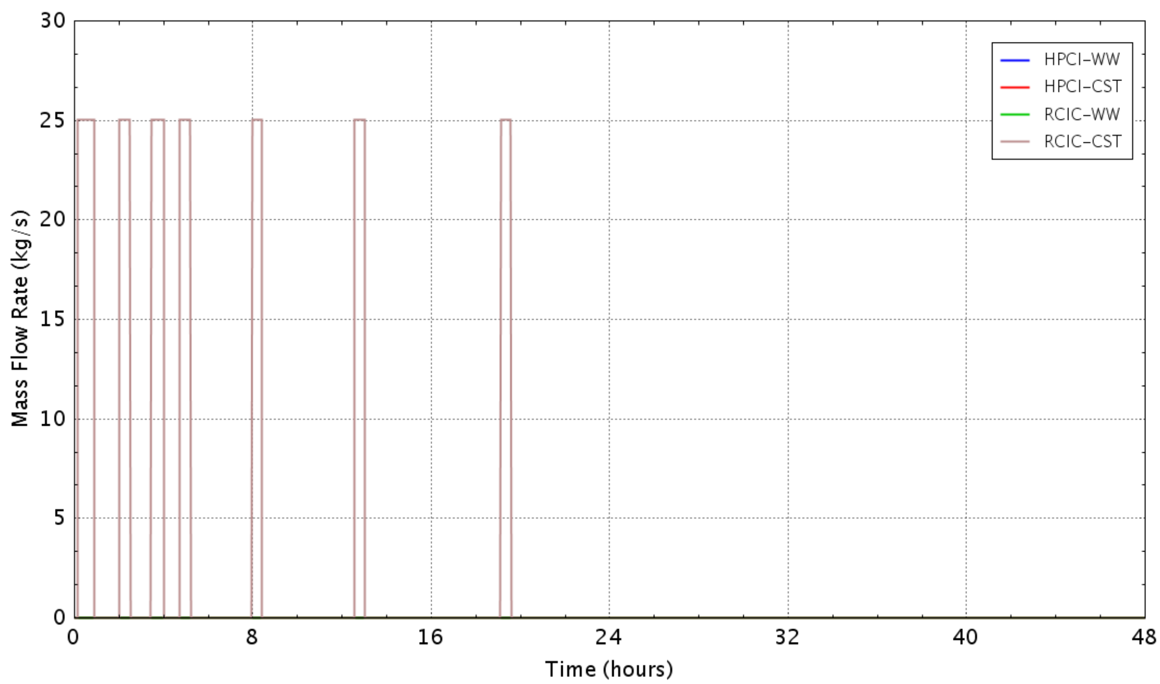

Figure E - 528 **Flow rate of the HPCI/RCIC pumps**

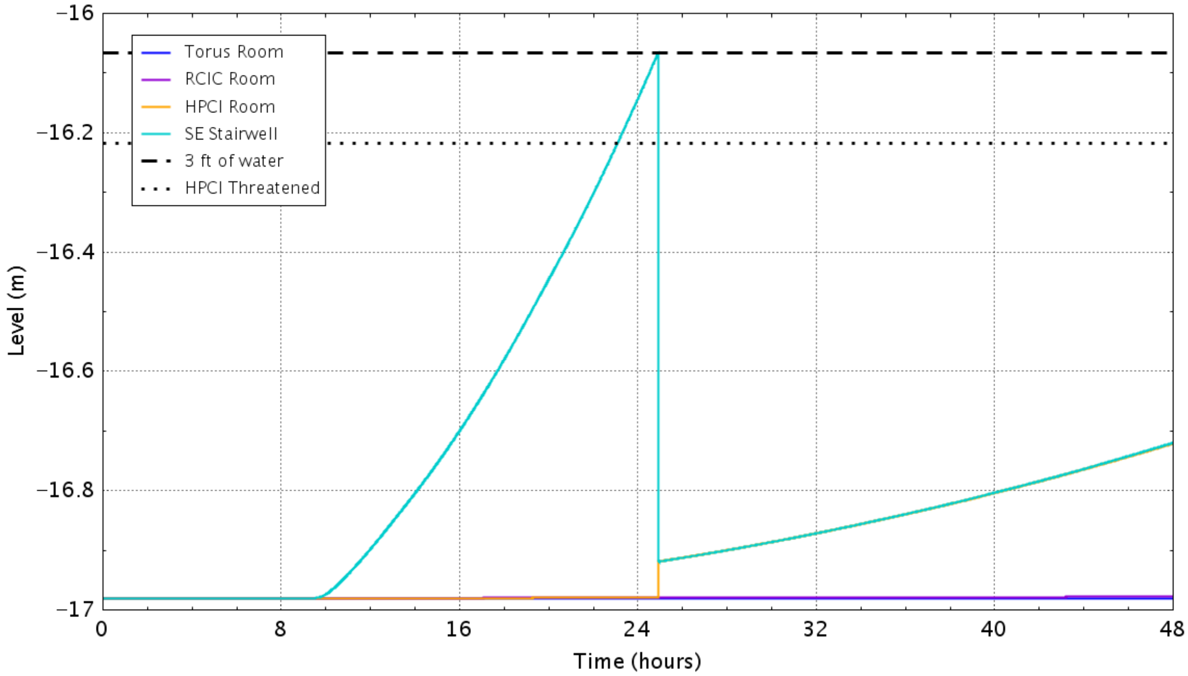

Figure E - 529 **Water level in the reactor building basement**

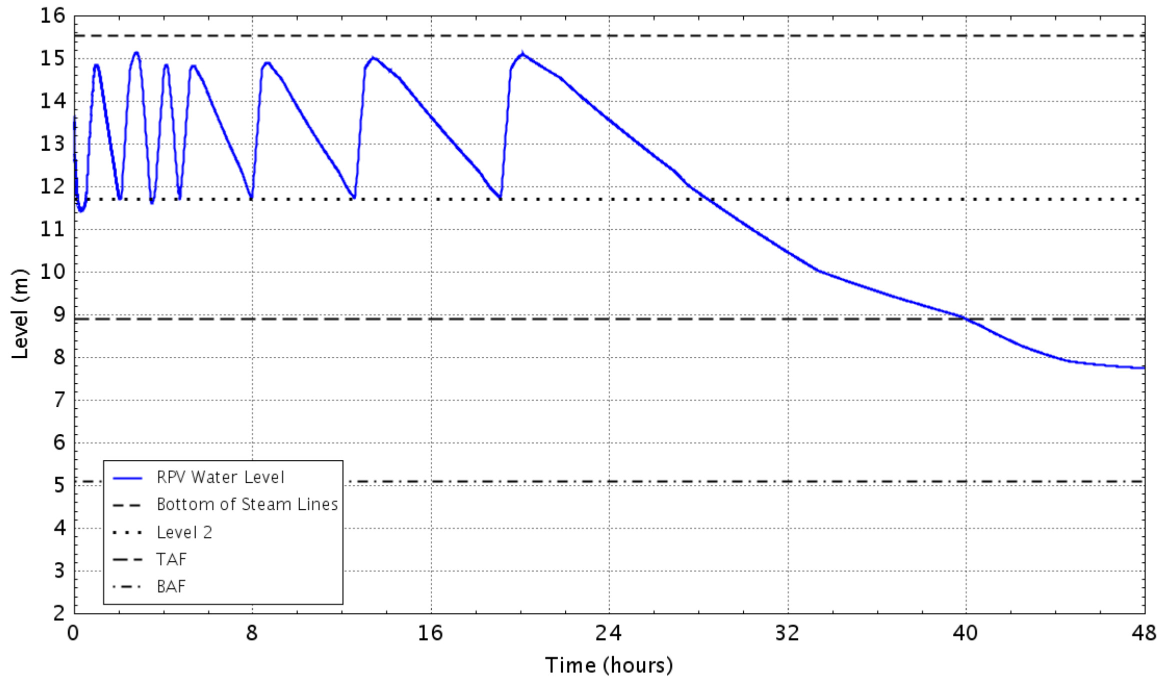

Figure E - 530 **RPV down comer water level**

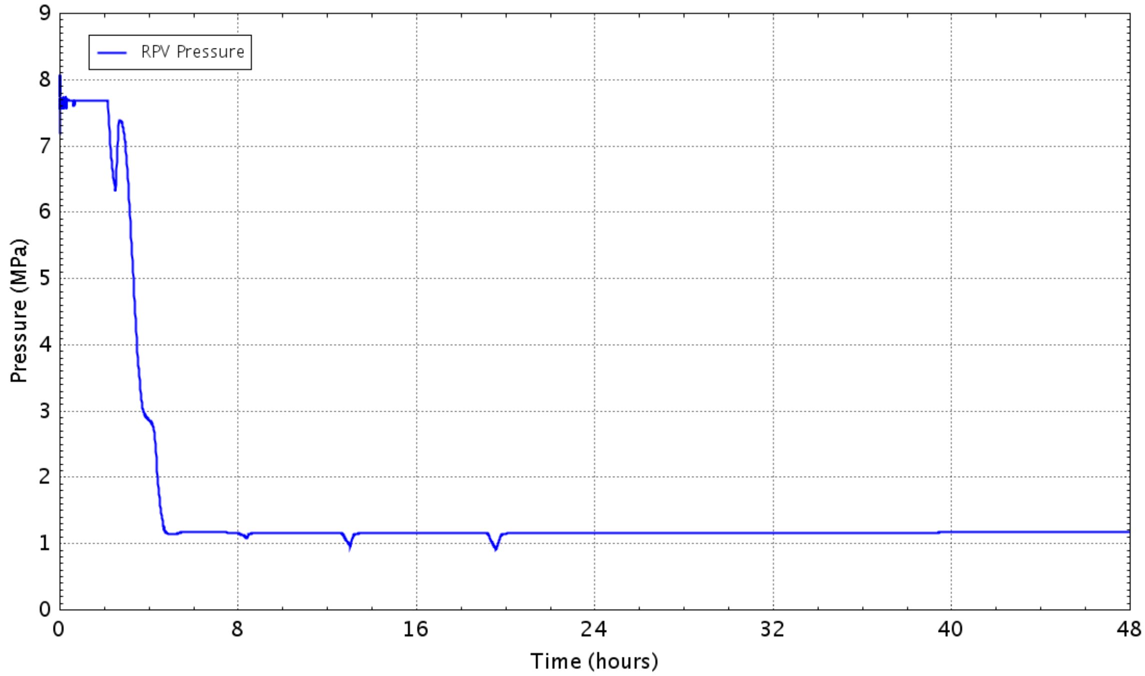

Figure E - 531 Pressure in theRPV

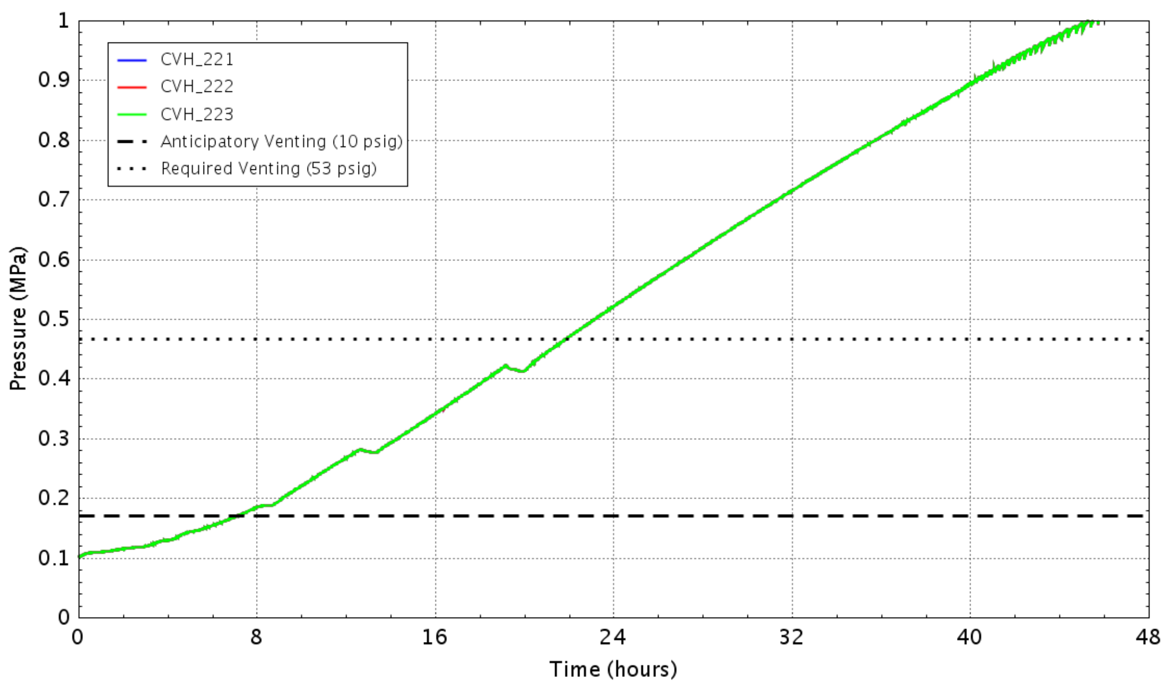

Figure E - 532 Pressure in the wetwell

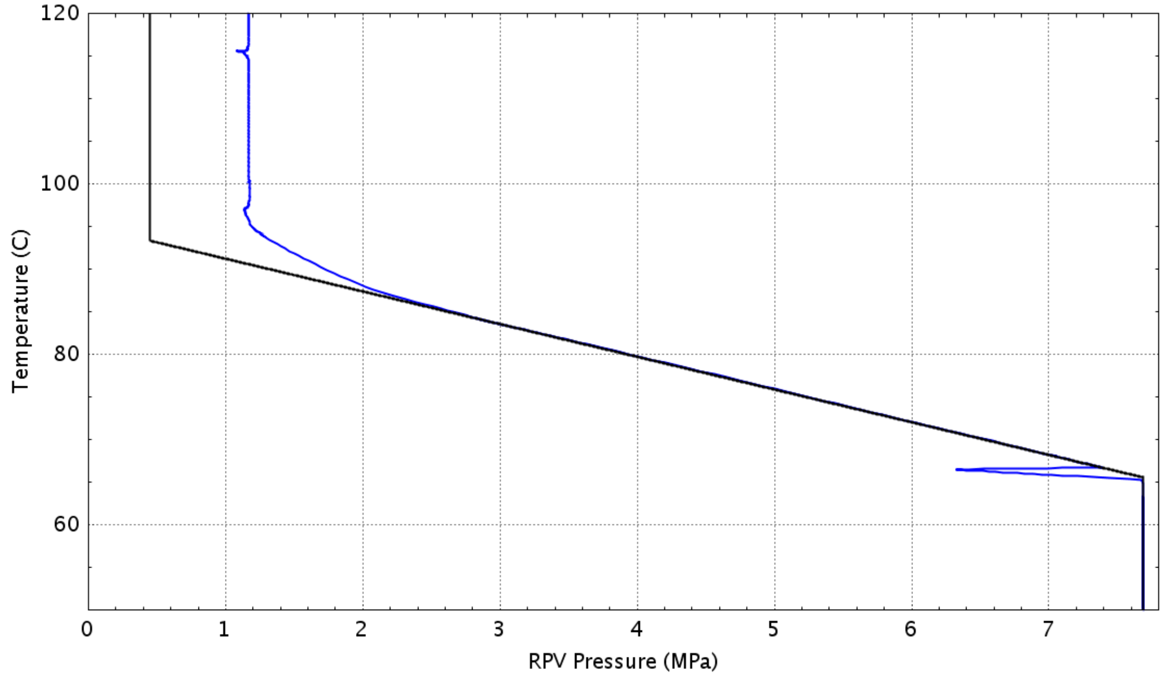

Figure E – 533 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

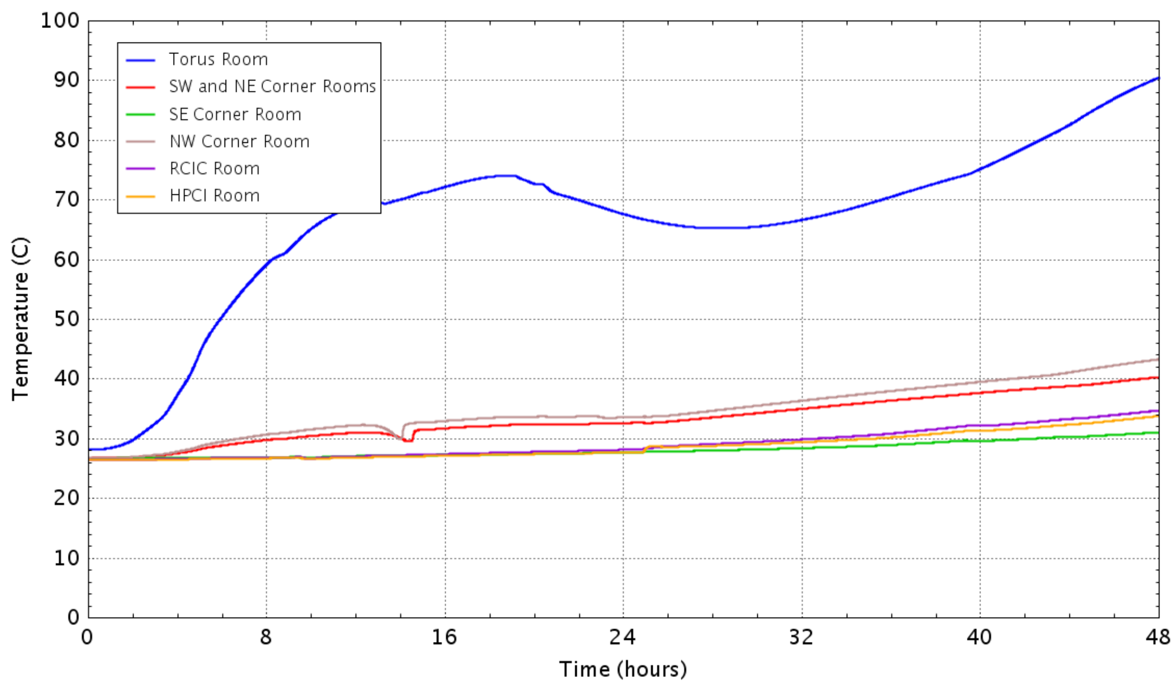

Figure E - 534 **Vapor temperature in the reactor building basement**

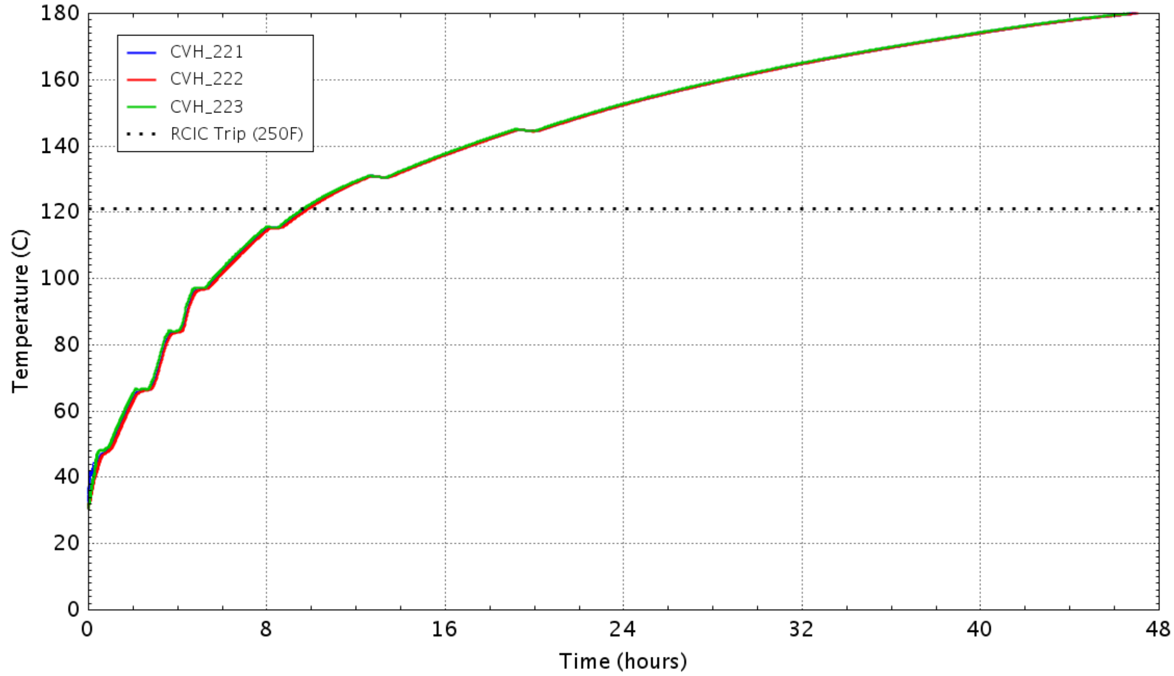

Figure E - 535 Water temperature in the wetwell

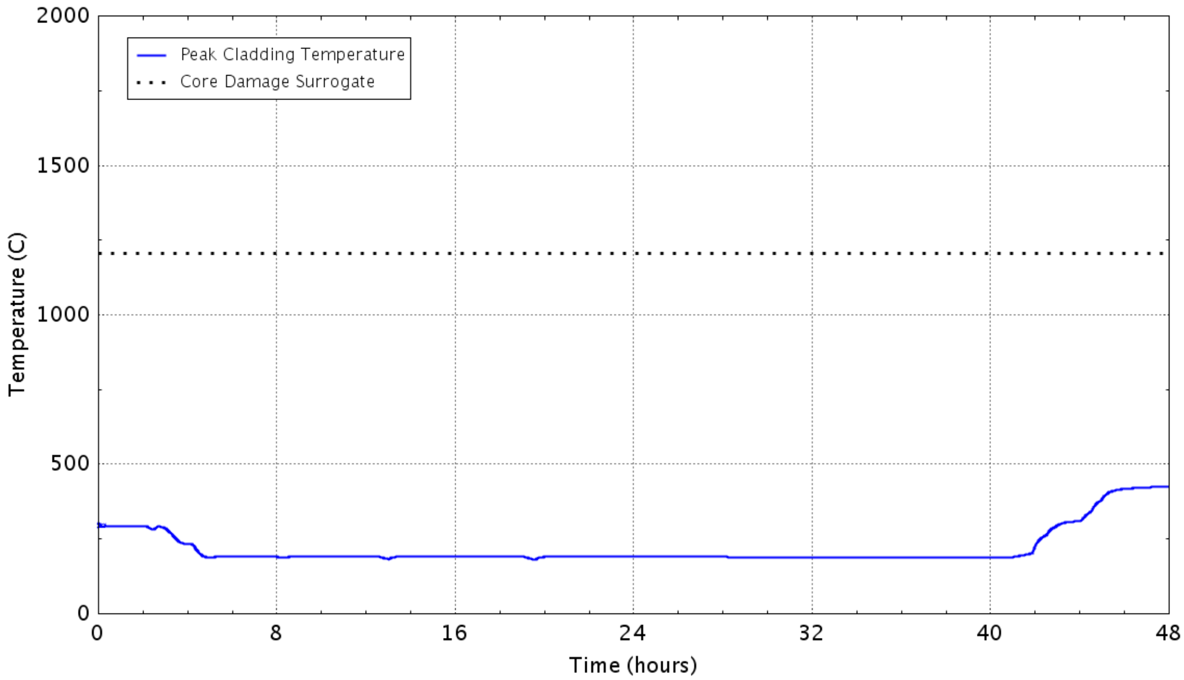

Figure E - 536 Peak temperature of the fuel cladding as a function of time

E.3.14 Case 17a: Sensitivity to LOMFW-25 Case 17 with HPCI Available Instead of RCIC

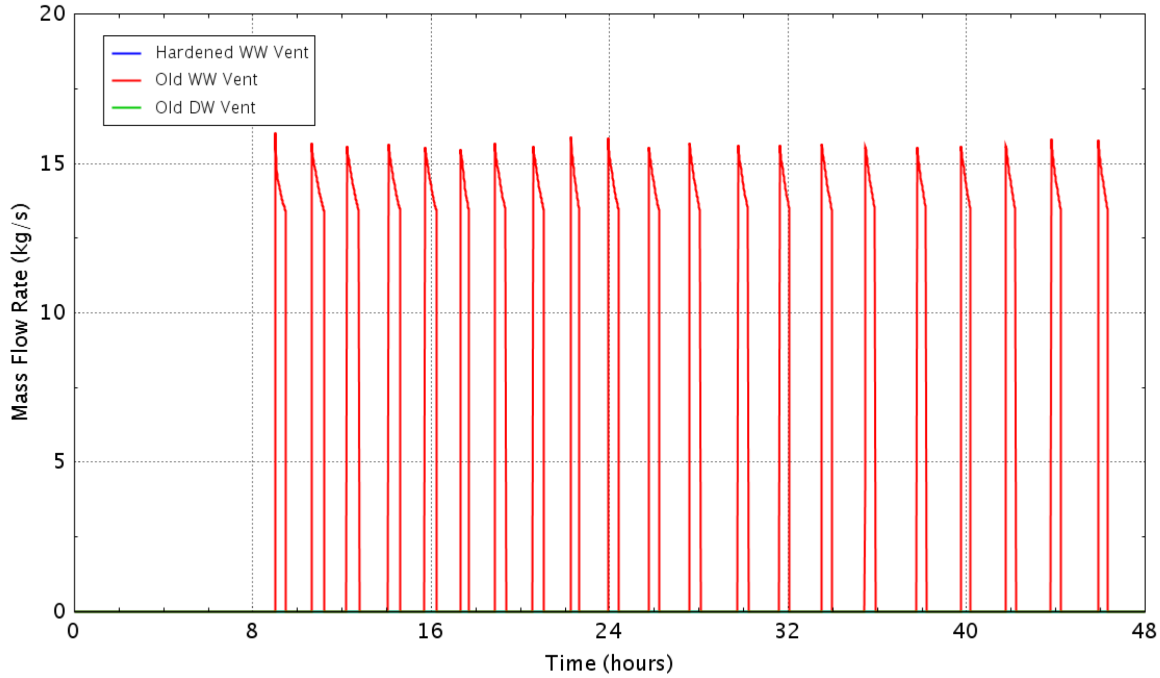

Figure E - 537 Flow rate of the containment vents

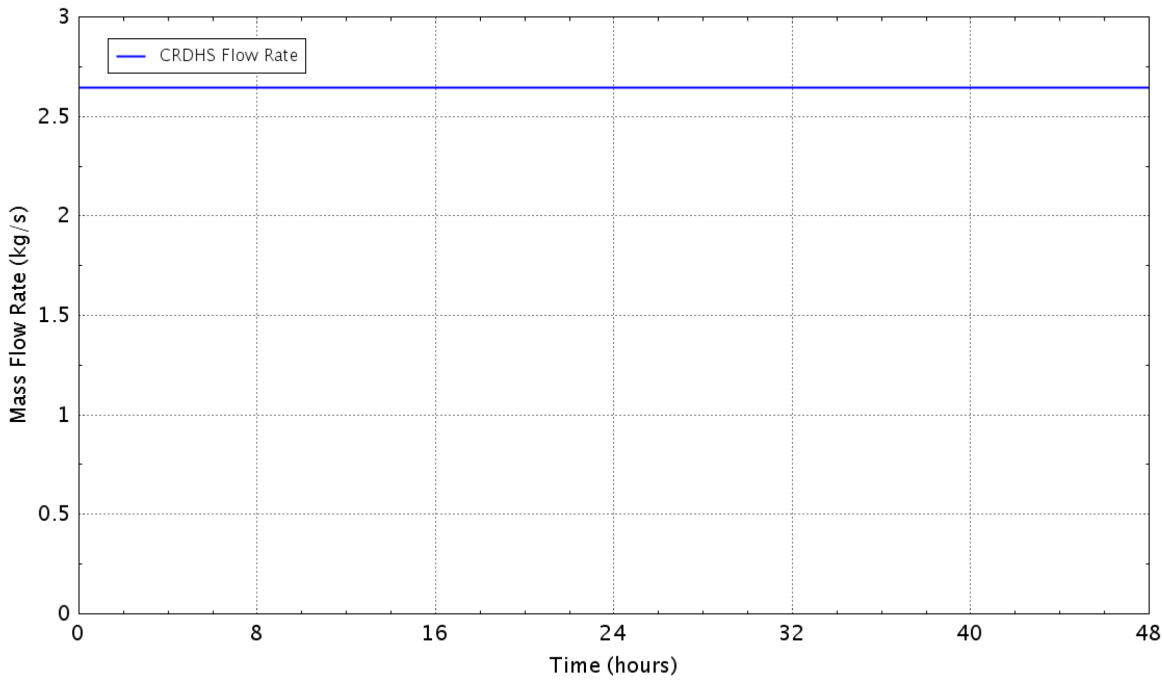

Figure E - 538 Flow rate of the control rod drive hydraulic system

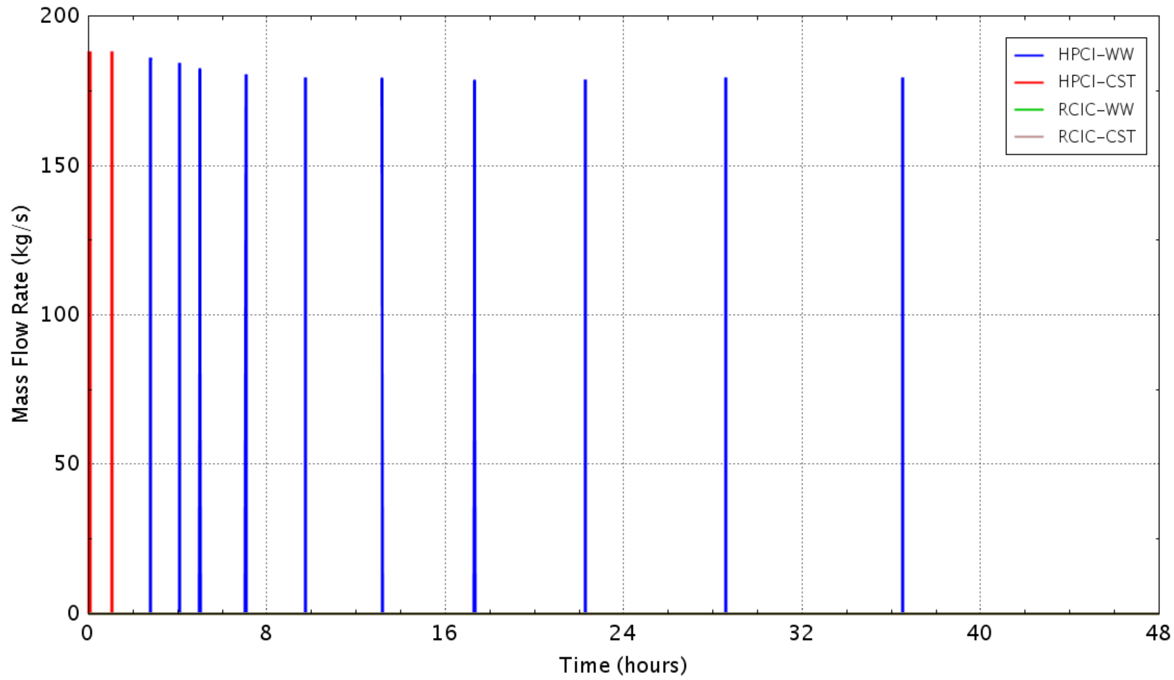

Figure E - 539 Flow rate of the HPCI/RCIC pumps

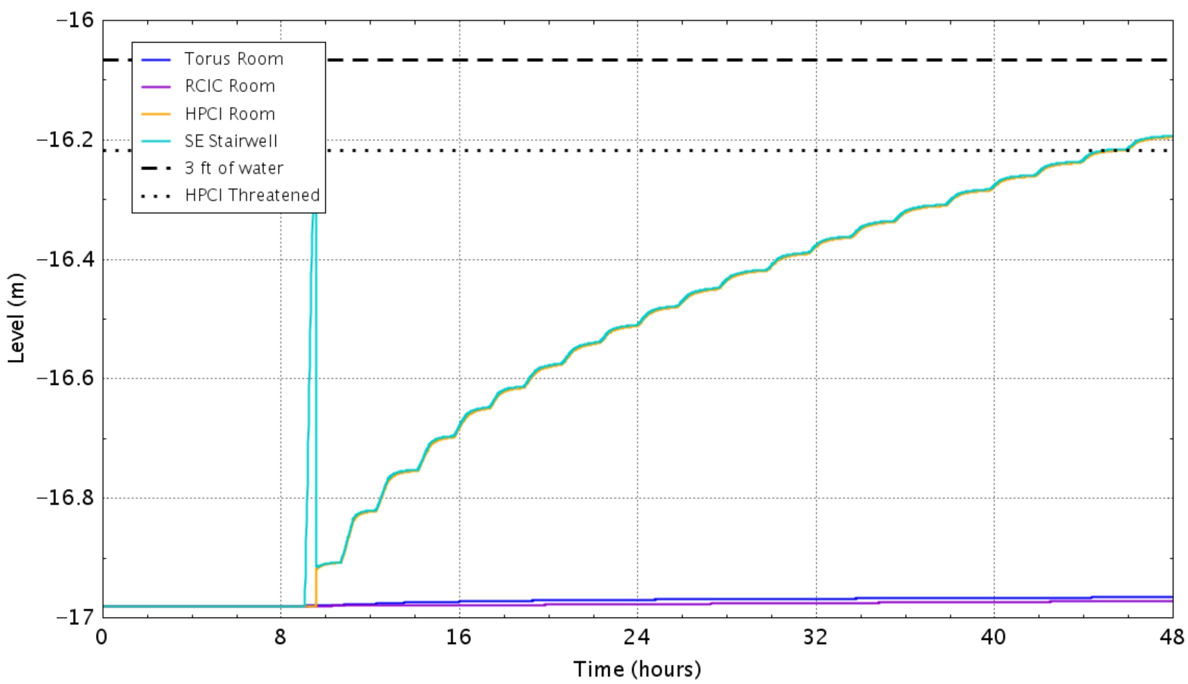

Figure E - 540 Water level in the reactor building basement

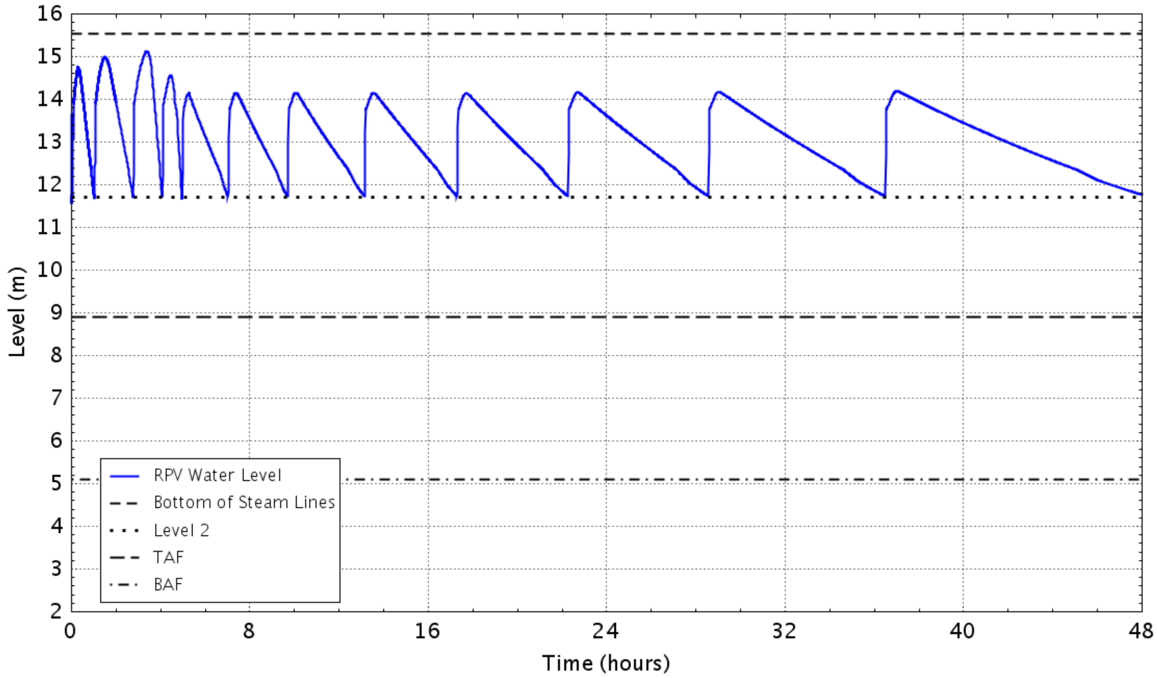

Figure E – 541 RPV down comer water level

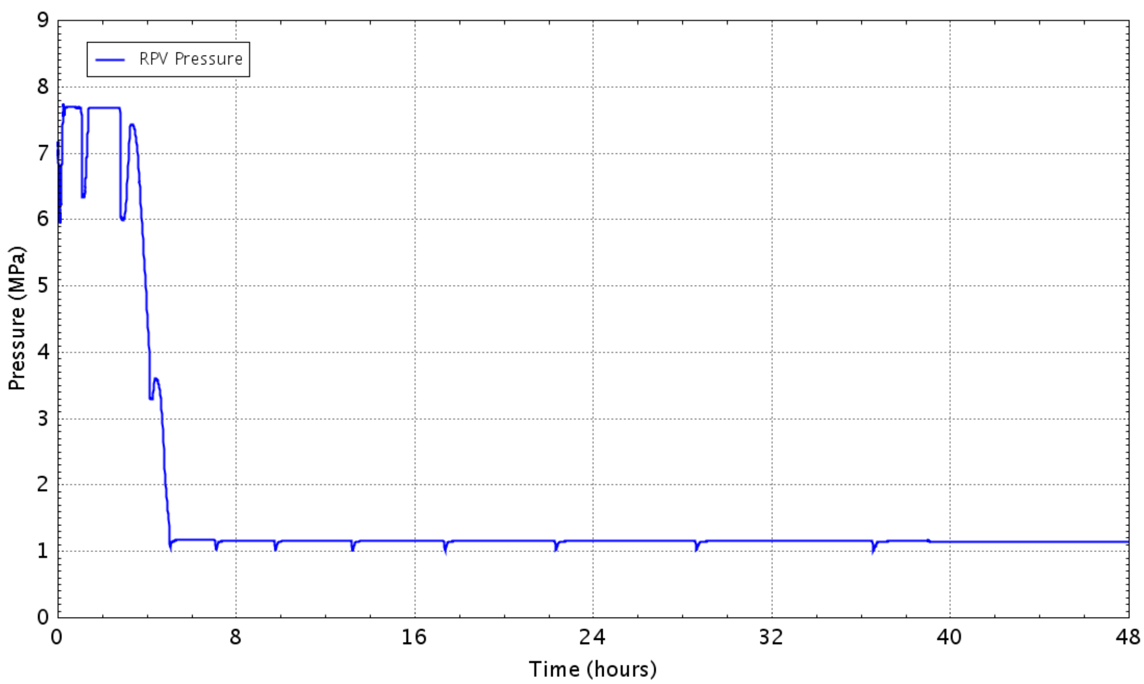

Figure E – 542 Pressure in theRPV

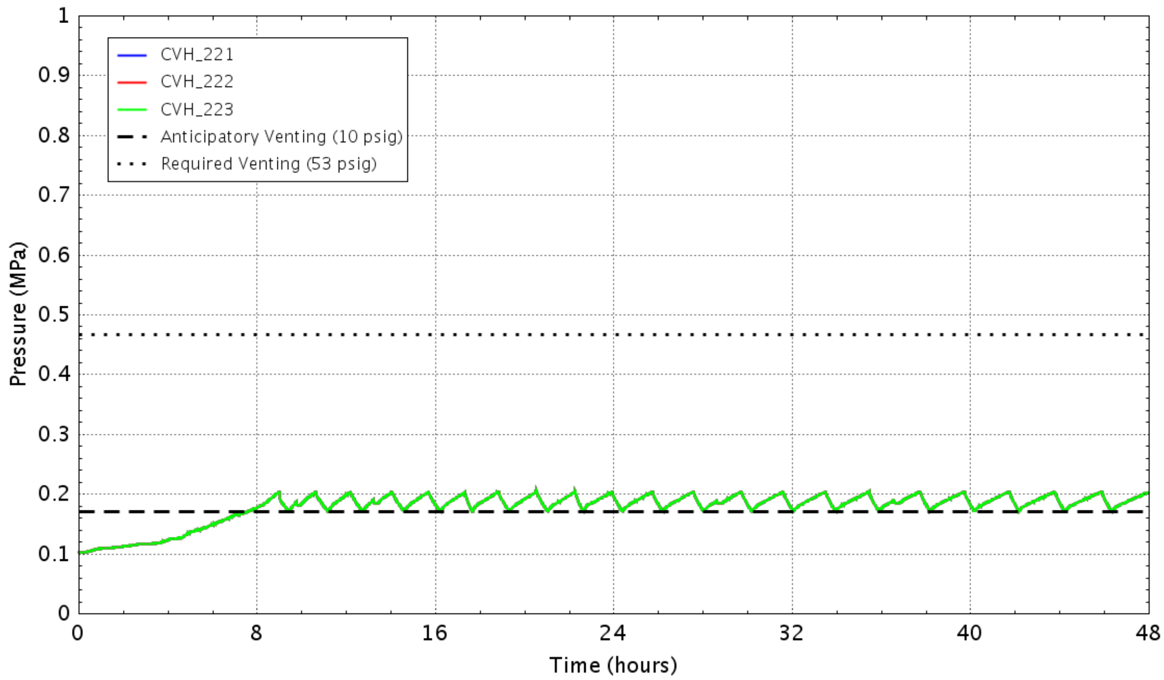

Figure E – 543 Pressure in the wetwell

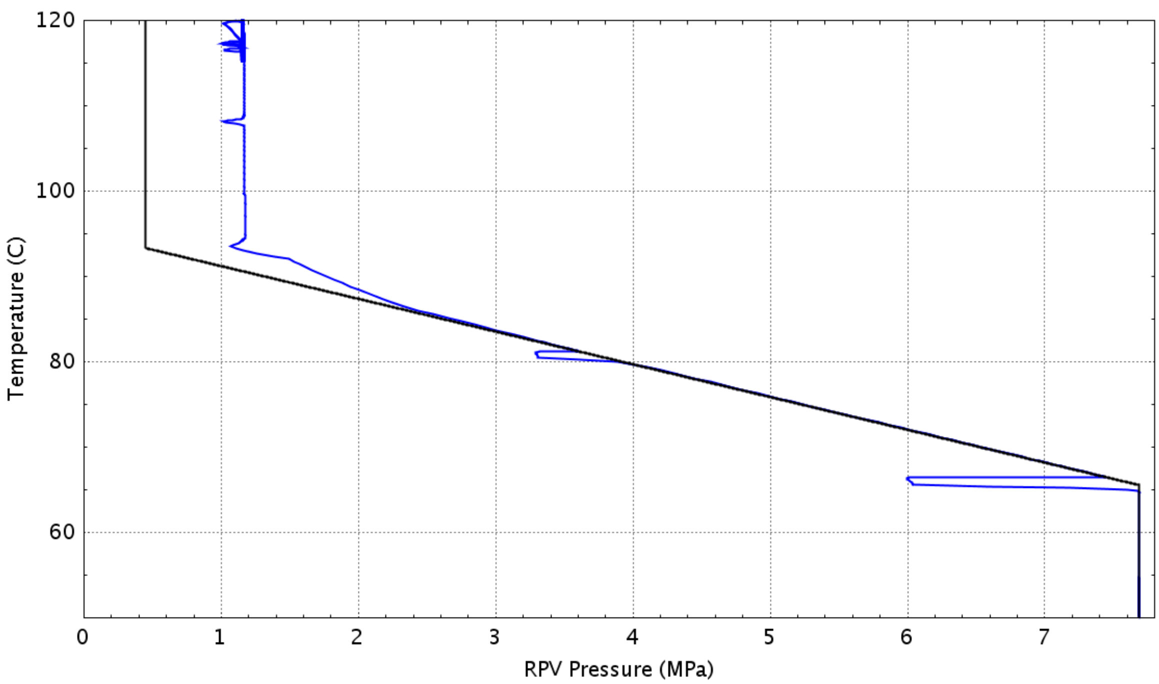

Figure E – 544 Plant status relative to the HCL curve (Graph 4 of the EOPs)

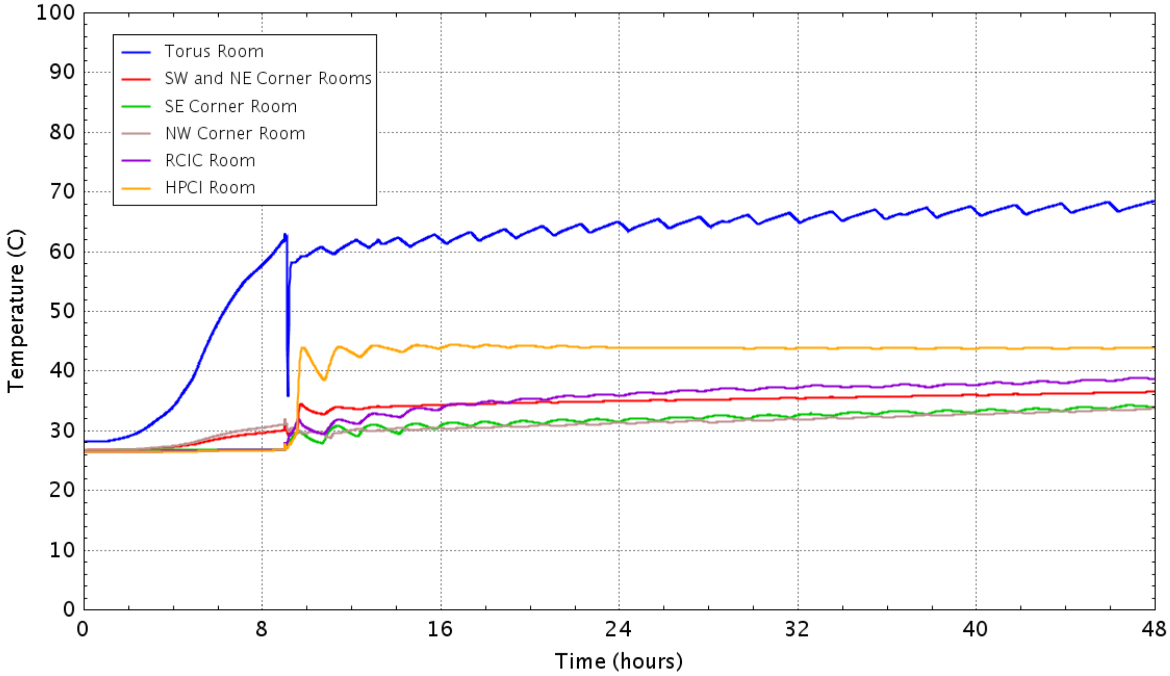

Figure E – 545 Vapor temperature in the reactor building basement

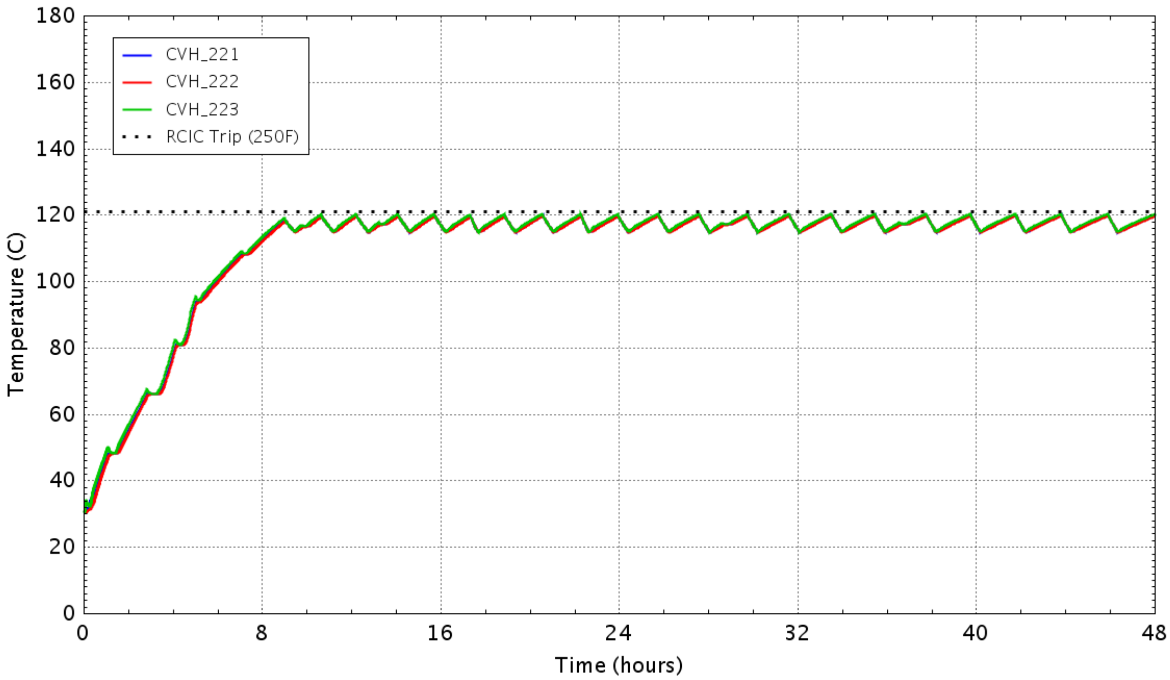

Figure E – 546 Water temperature in the wetwell

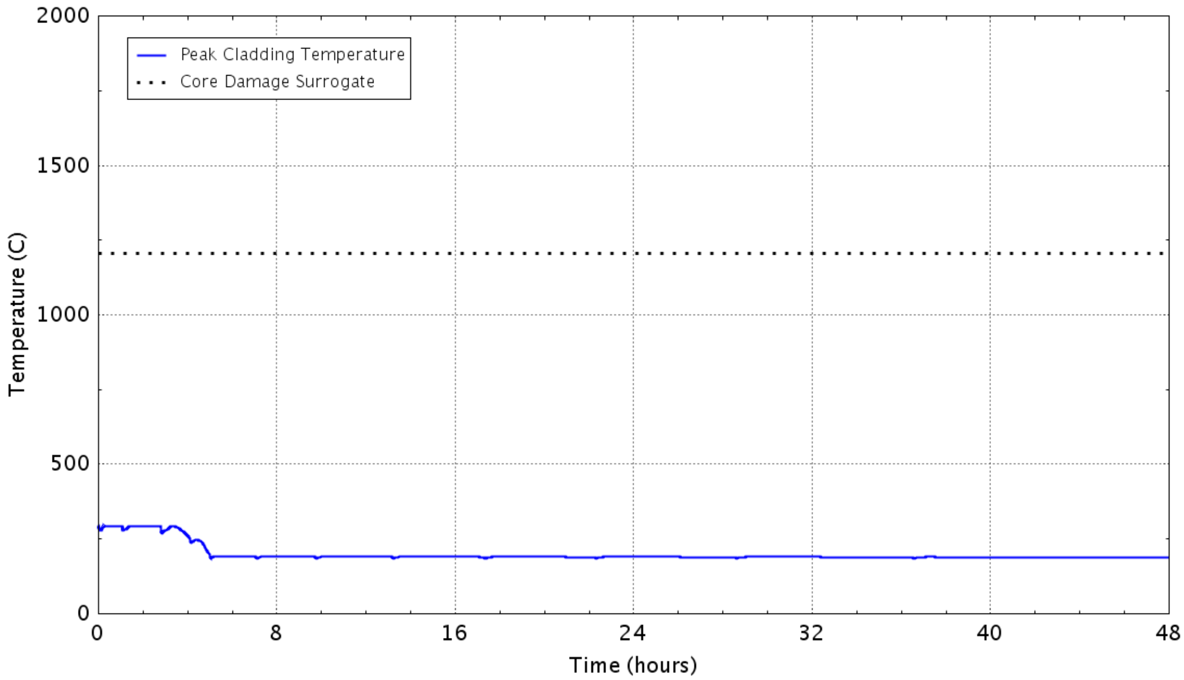

Figure E - 547 Peak temperature of the fuel cladding as a function of time

E.3.15 Case 17b: Sensitivity to LOMFW-25 Case 17 with SRVFailing Open at 270 Cycles

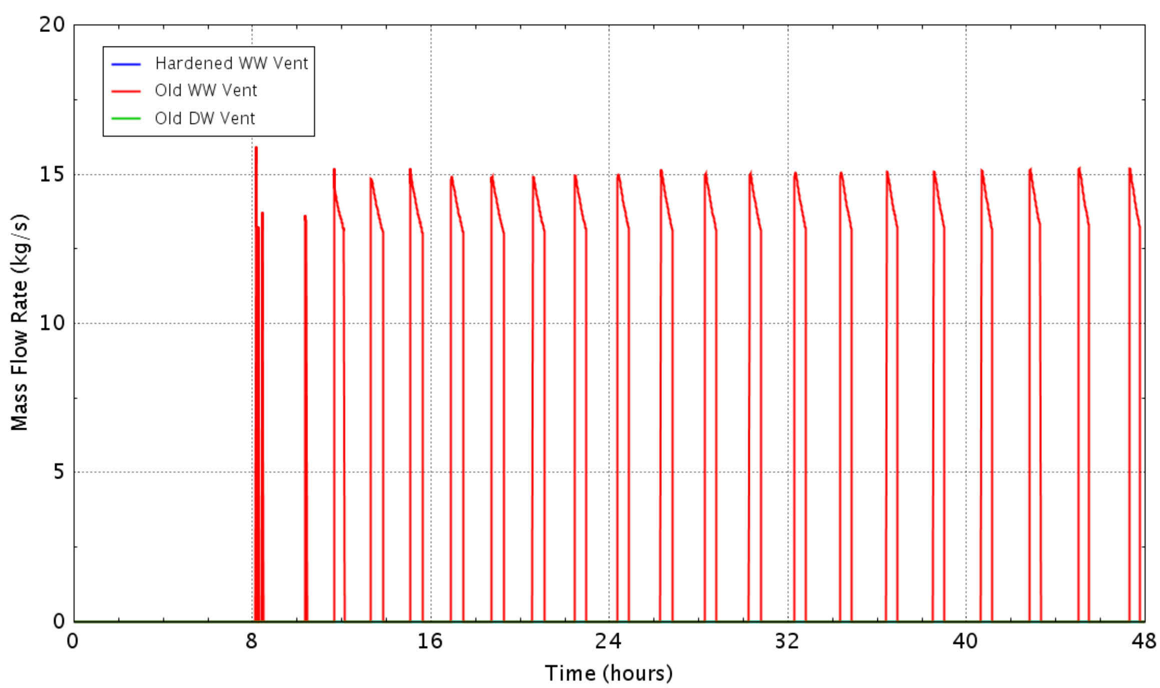

Figure E - 548 Flow rate of the containment vents

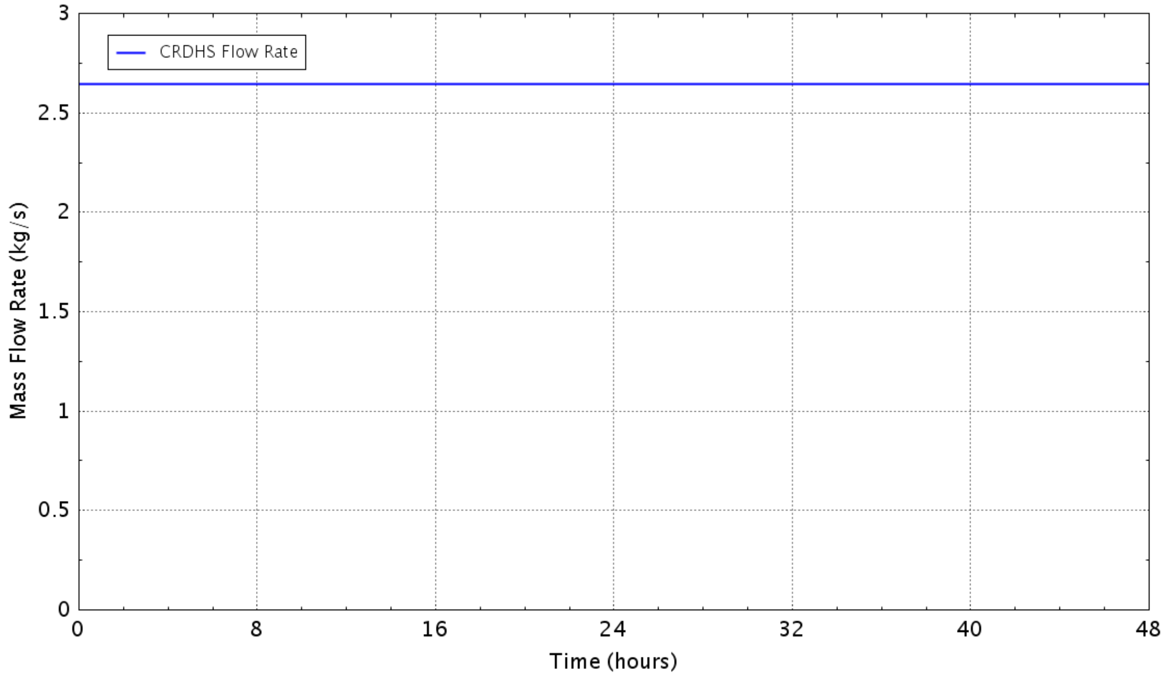

Figure E - 549 Flow rate of the control rod drive hydraulic system

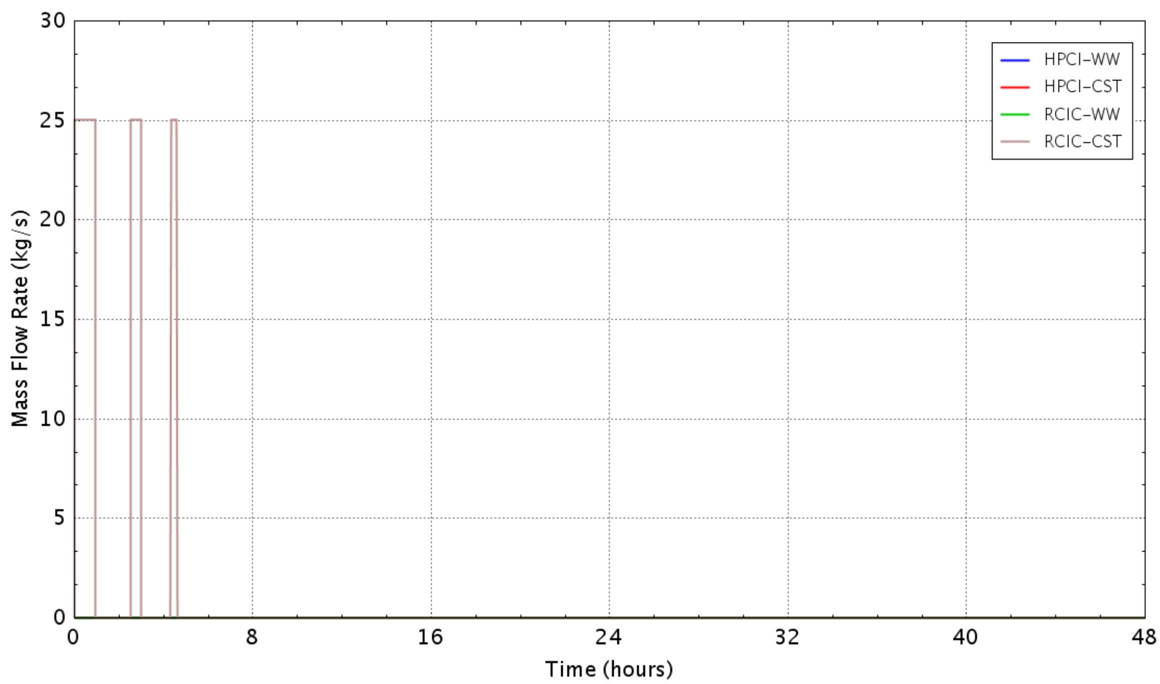

Figure E - 550 Flow rate of the HPCI/RCIC pumps

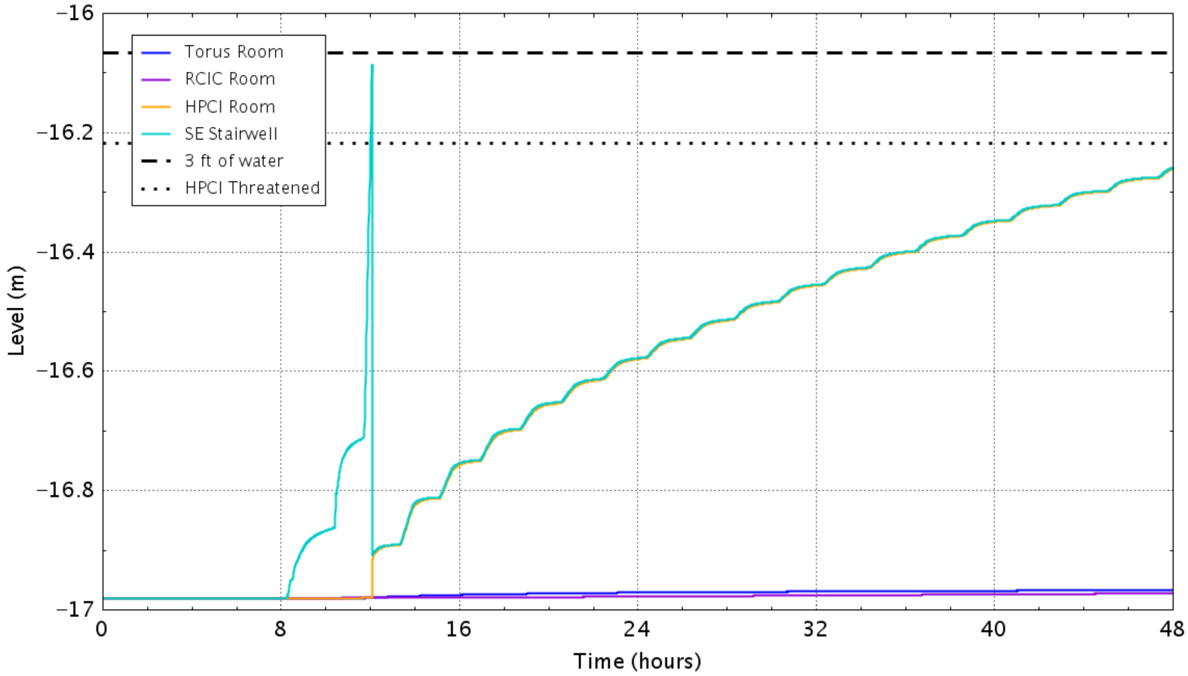

Figure E - 551 **Water level in the reactor building basement**

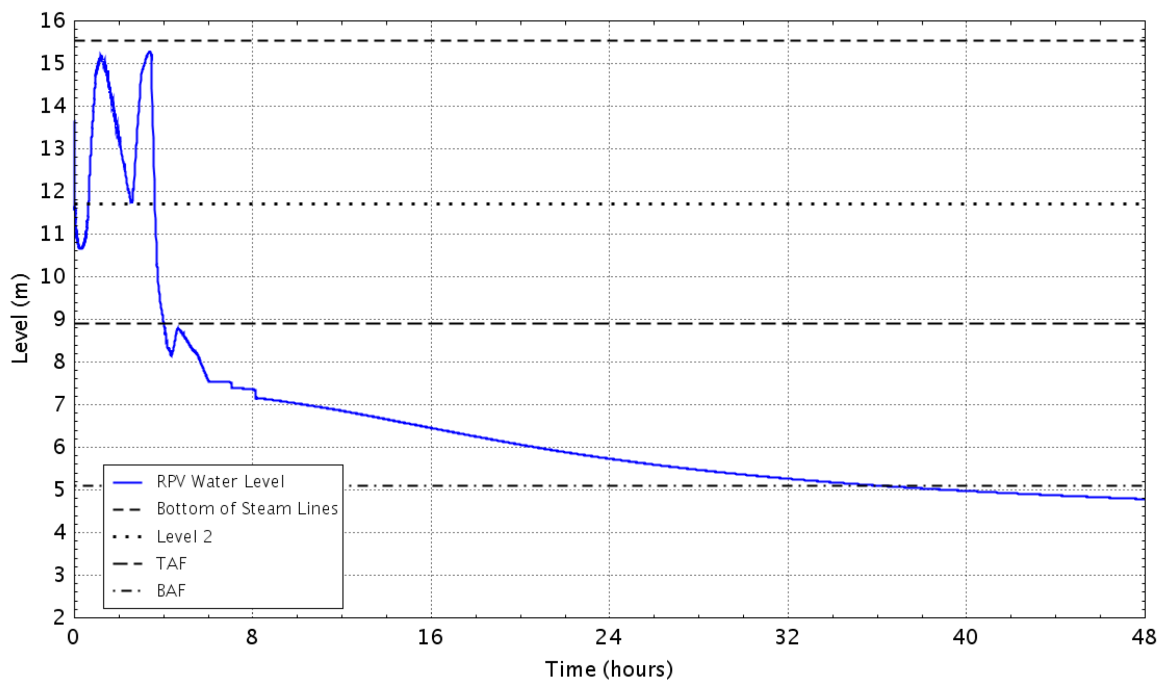

Figure E - 552 **RPV down comer water level**

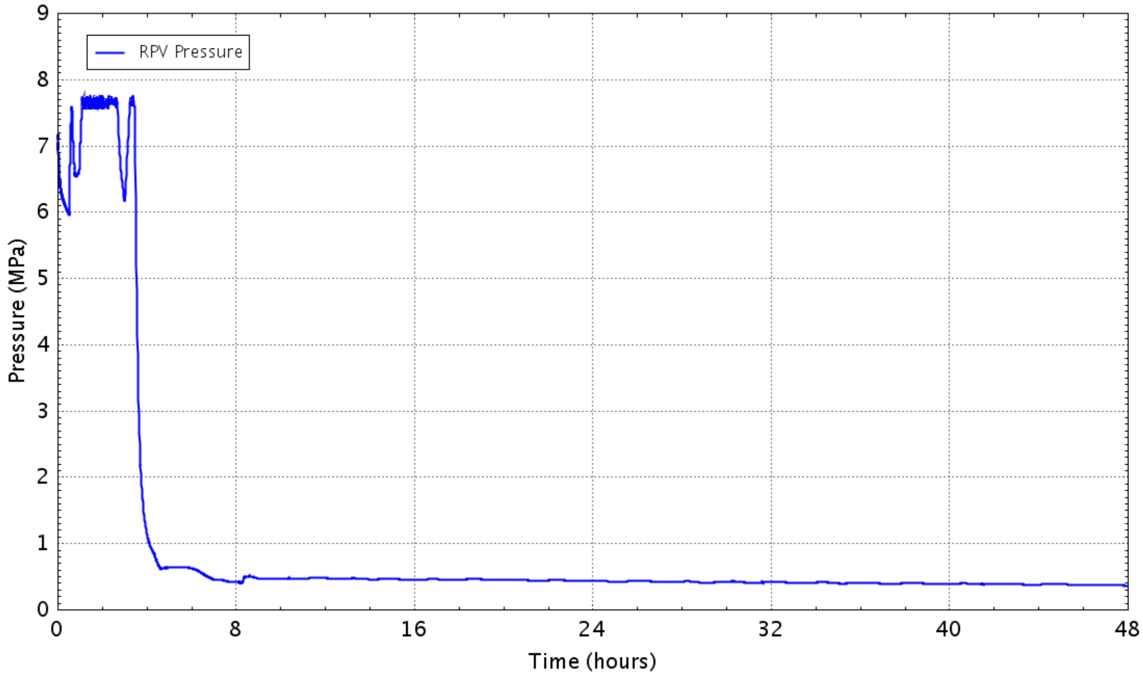

Figure E - 553 **Pressure in theRPV**

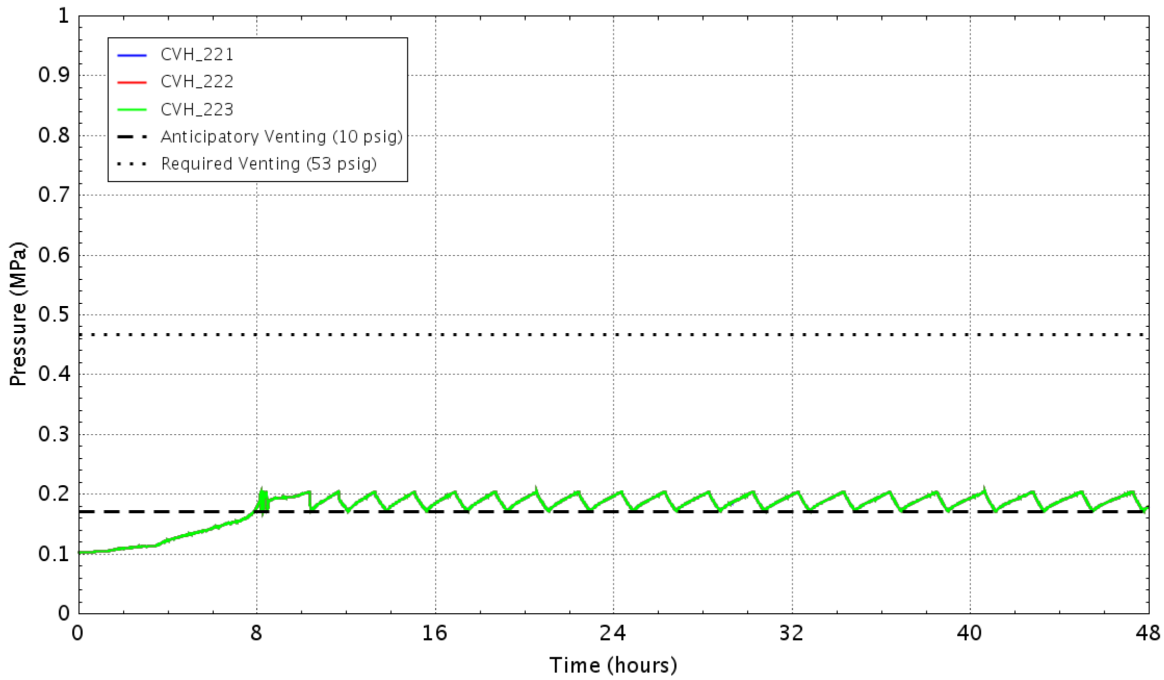

Figure E - 554 **Pressure in the wetwell**

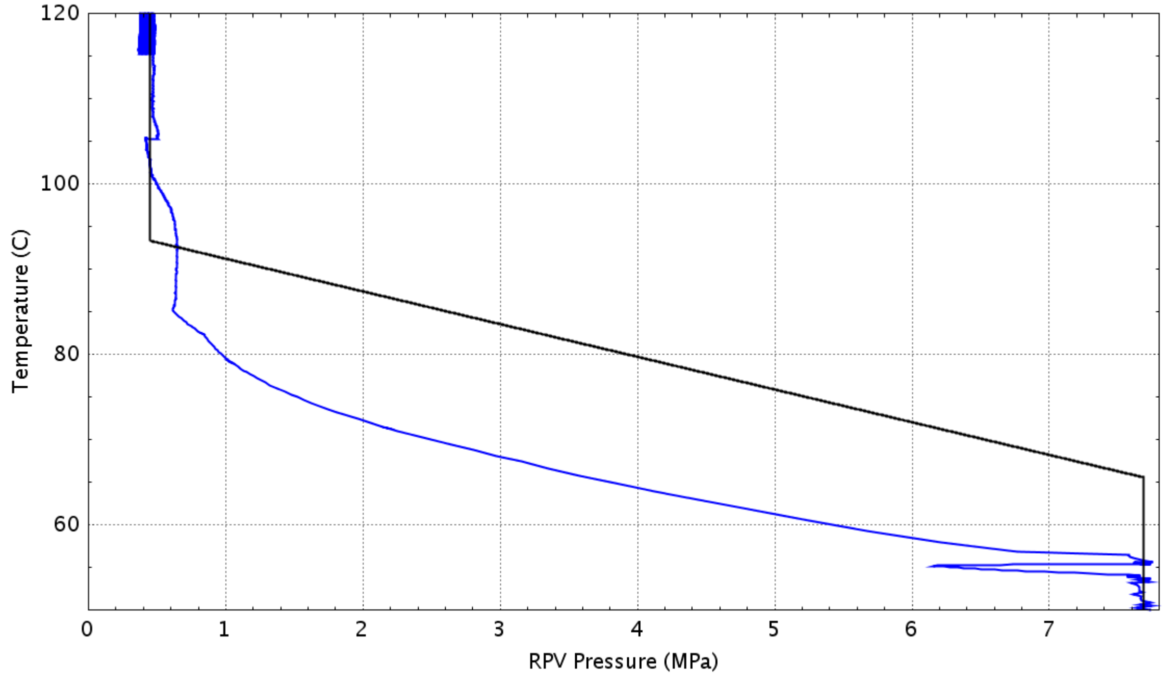

Figure E – 555 Plant status relative to the HCL curve (Graph 4 of the EOPs)

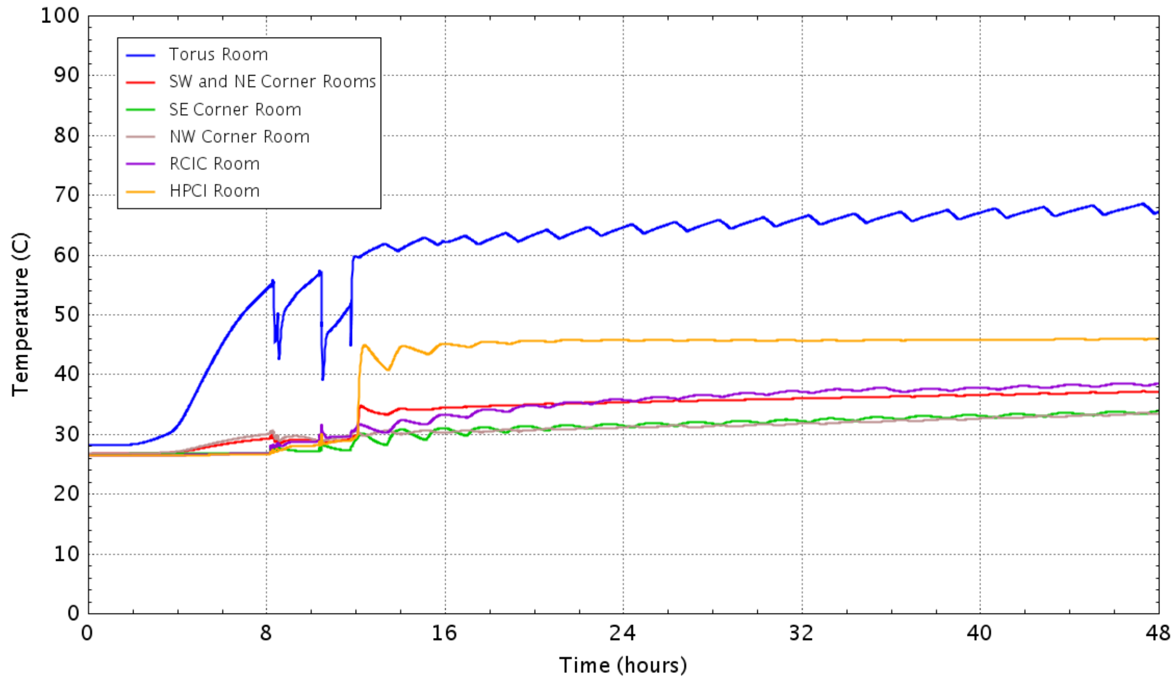

Figure E – 556 Vapor temperature in the reactor building basement

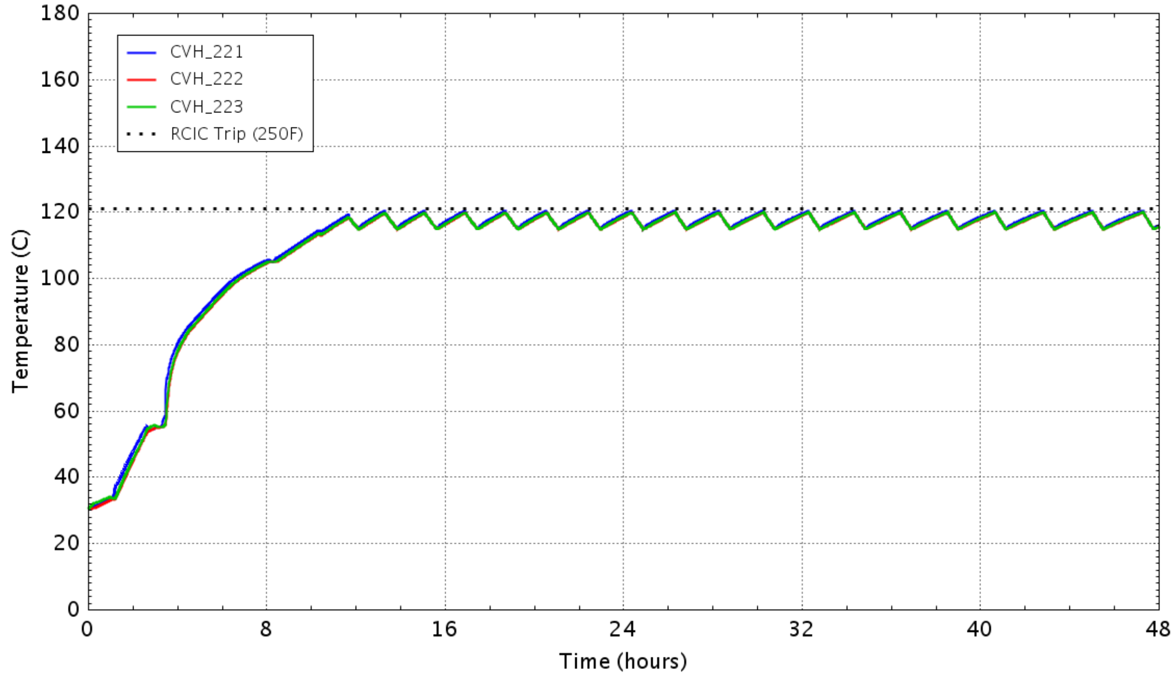

Figure E - 557 **Water temperature in the wetwell**

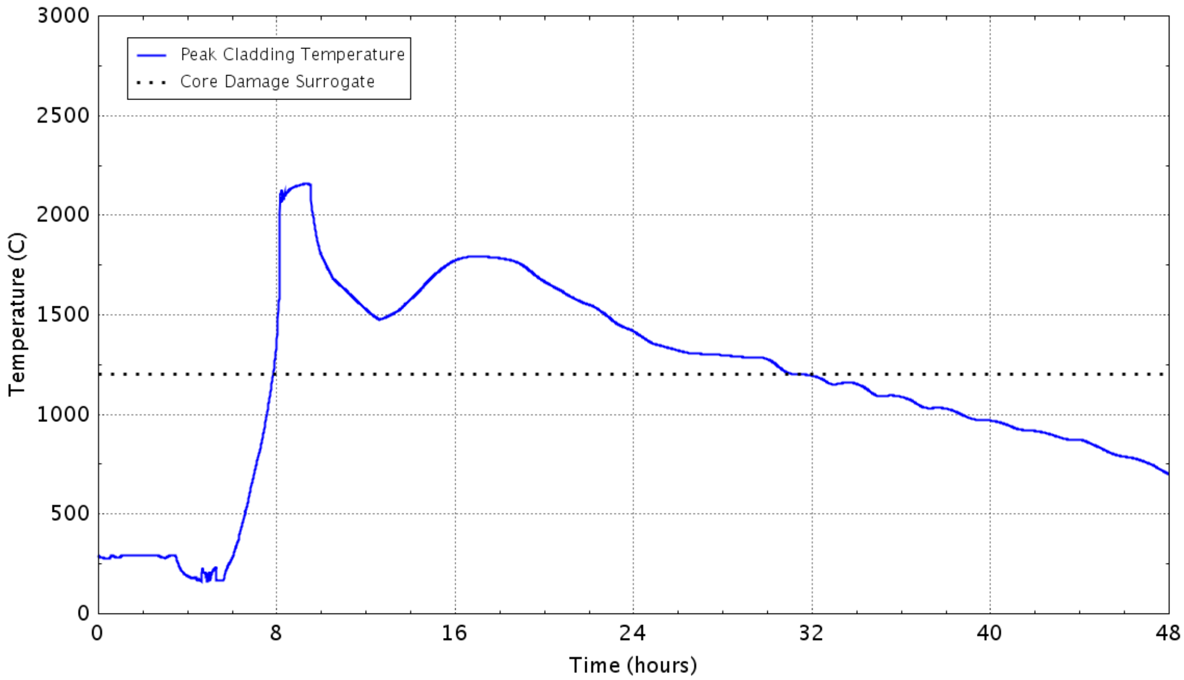

Figure E - 558 **Peak temperature of the fuel cladding as a function of time**

E.3.16 Case 17c: Sensitivity to LOMFW-25 Case 17 with RCIC Lostafter Three Complete Cycles

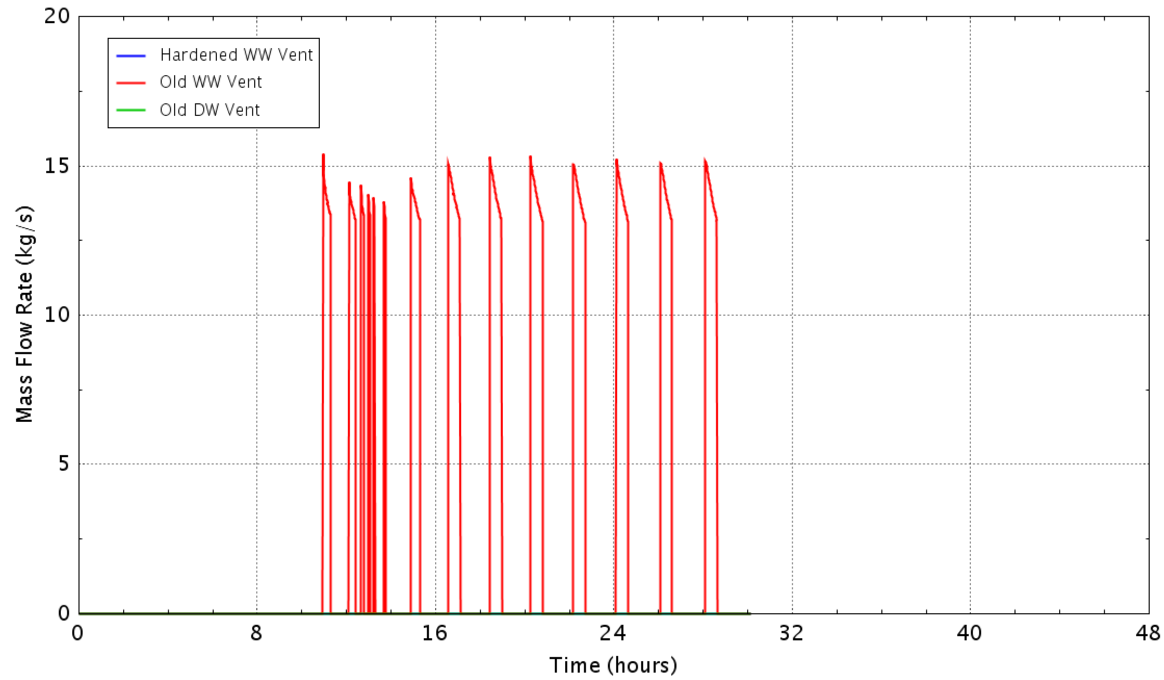

Figure E - 559 Flow rate of the containment vents

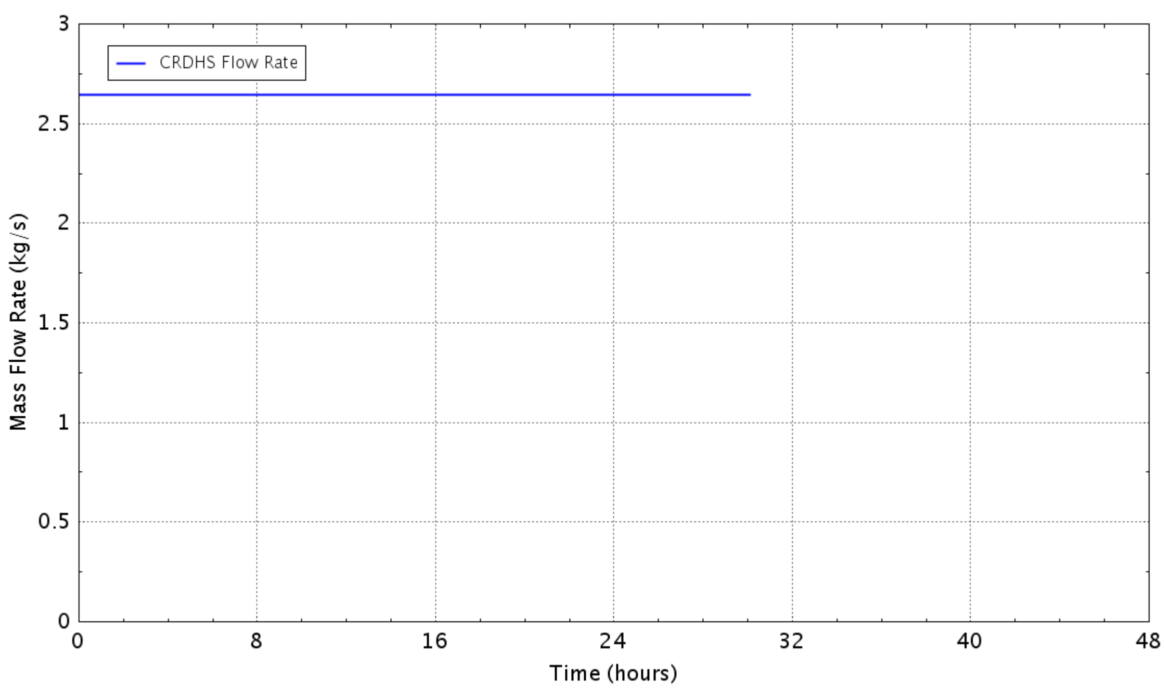

Figure E - 560 Flow rate of the control rod drive hydraulic system

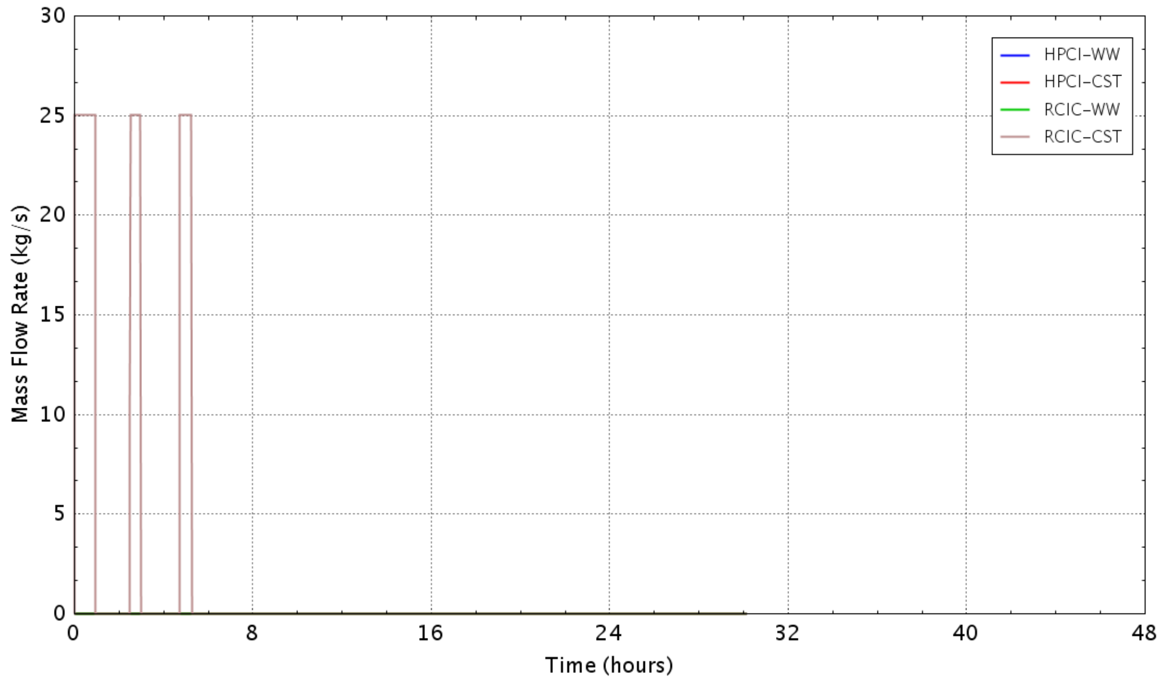

Figure E - 561 Flow rate of the HPCI/RCIC pumps

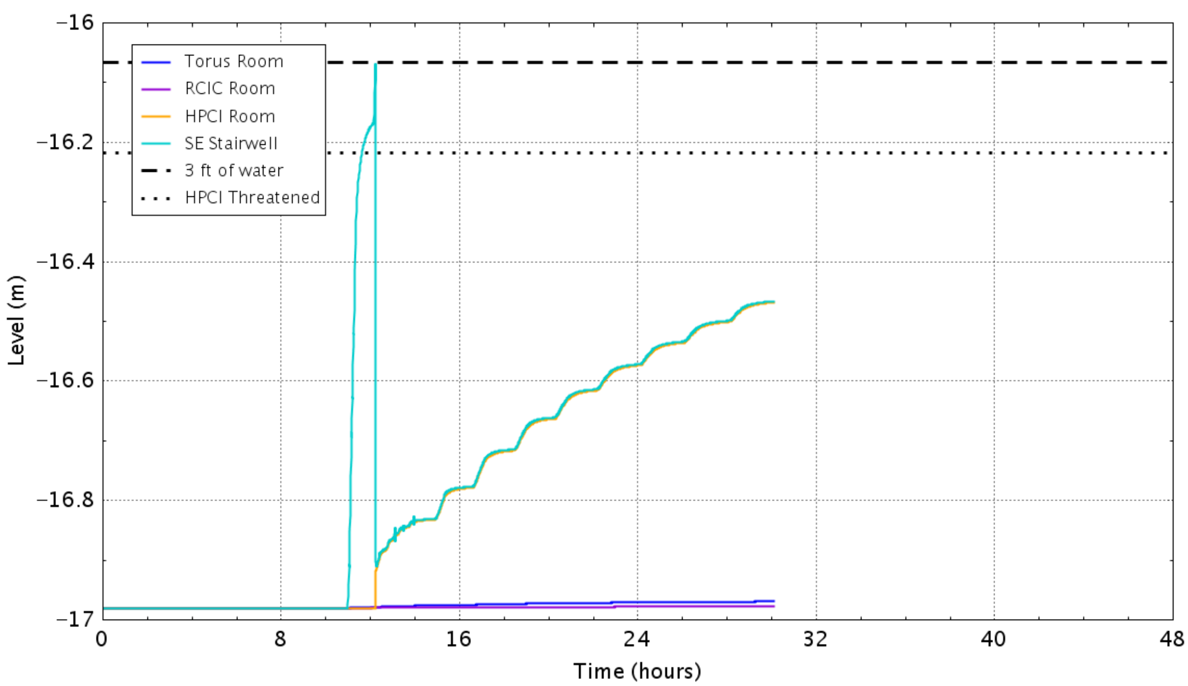

Figure E - 562 Water level in the reactor building basement

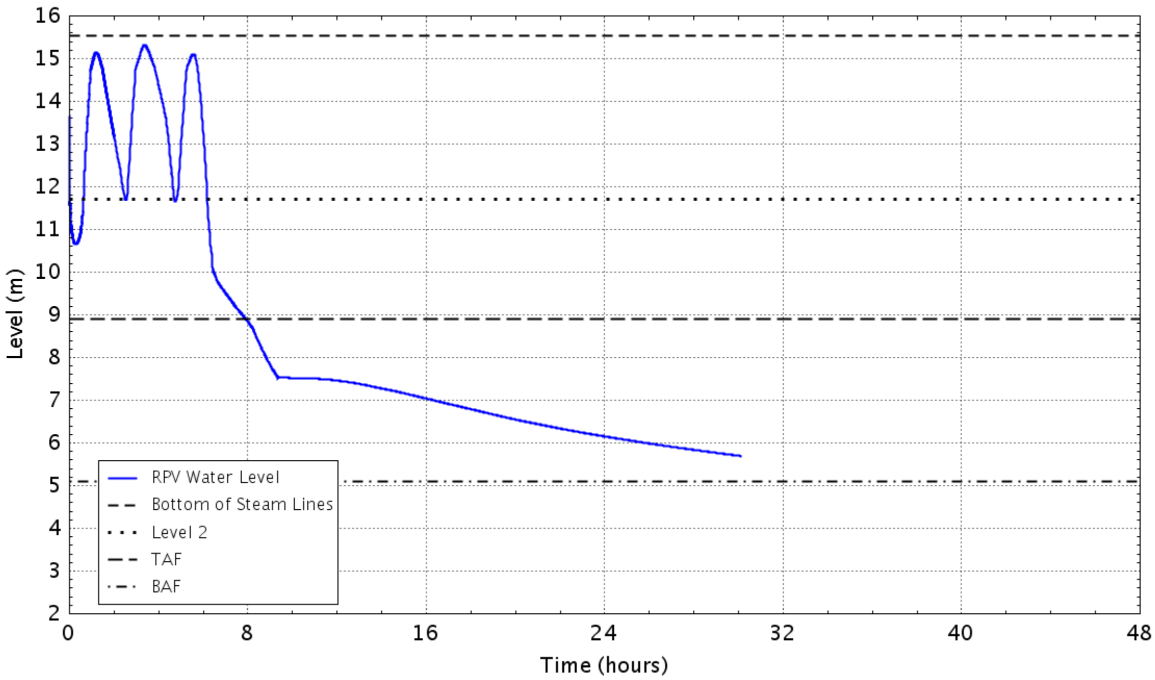

Figure E - 563 **RPV down comer water level**

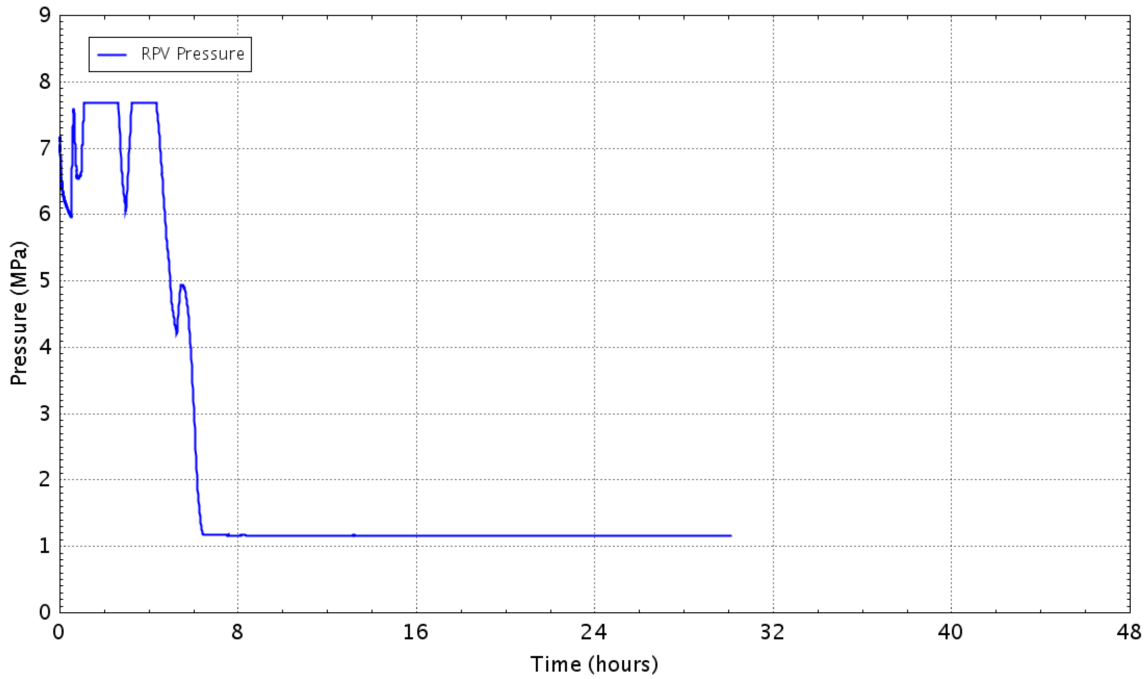

Figure E - 564 **Pressure in theRPV**

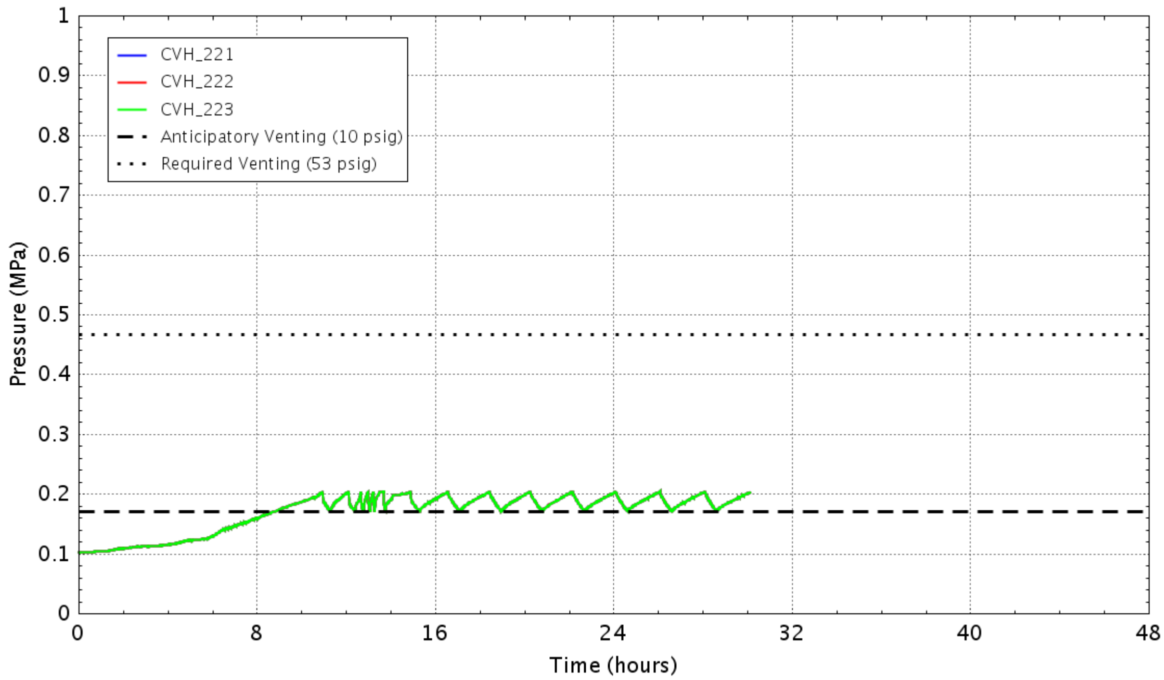

Figure E - 565 Pressure in the wetwell

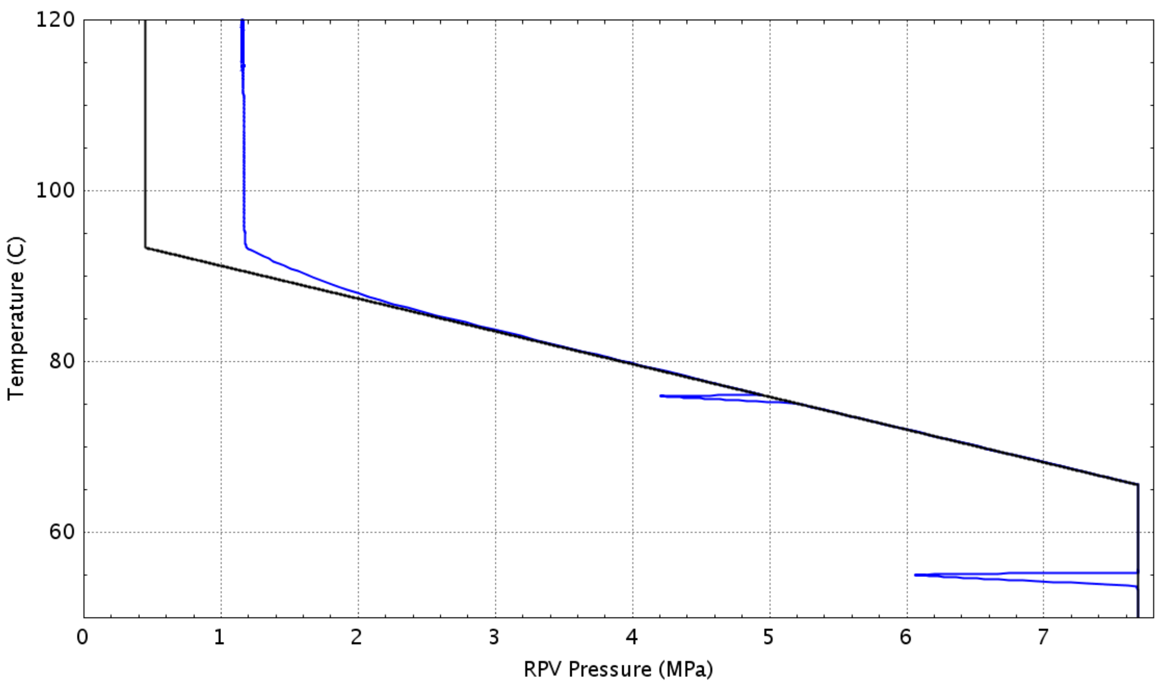

Figure E – 566 Plant status relative to the HCL curve (Graph 4 of the EOPs)

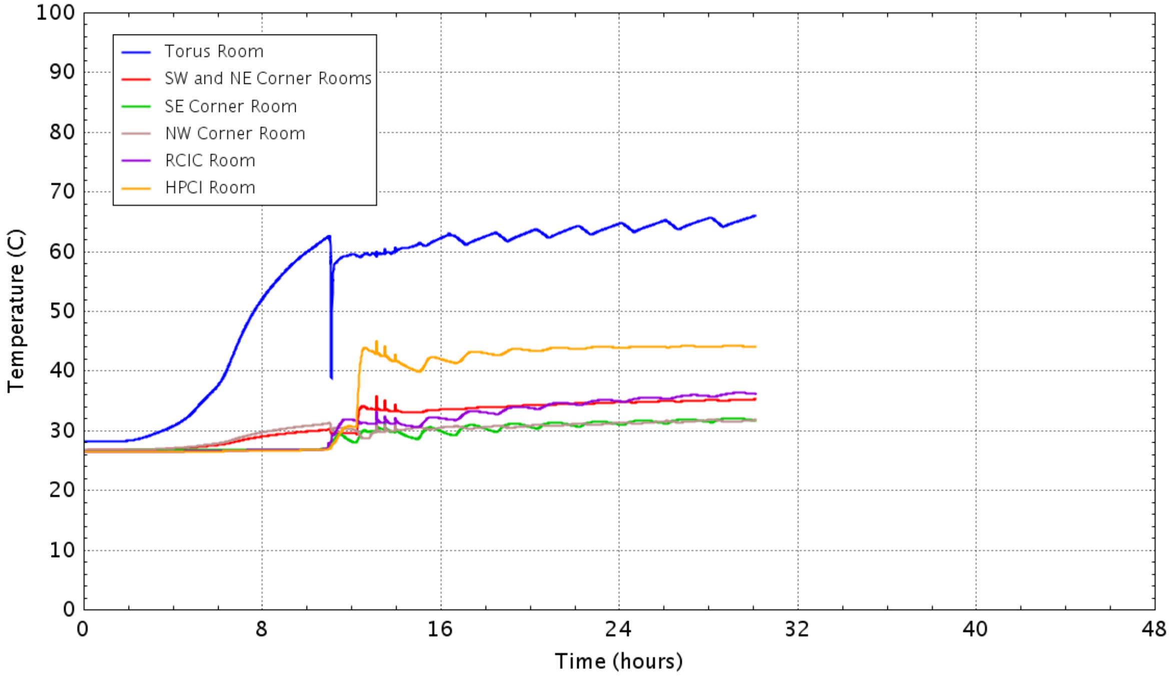

Figure E - 567 Vapor temperature in the reactor building basement

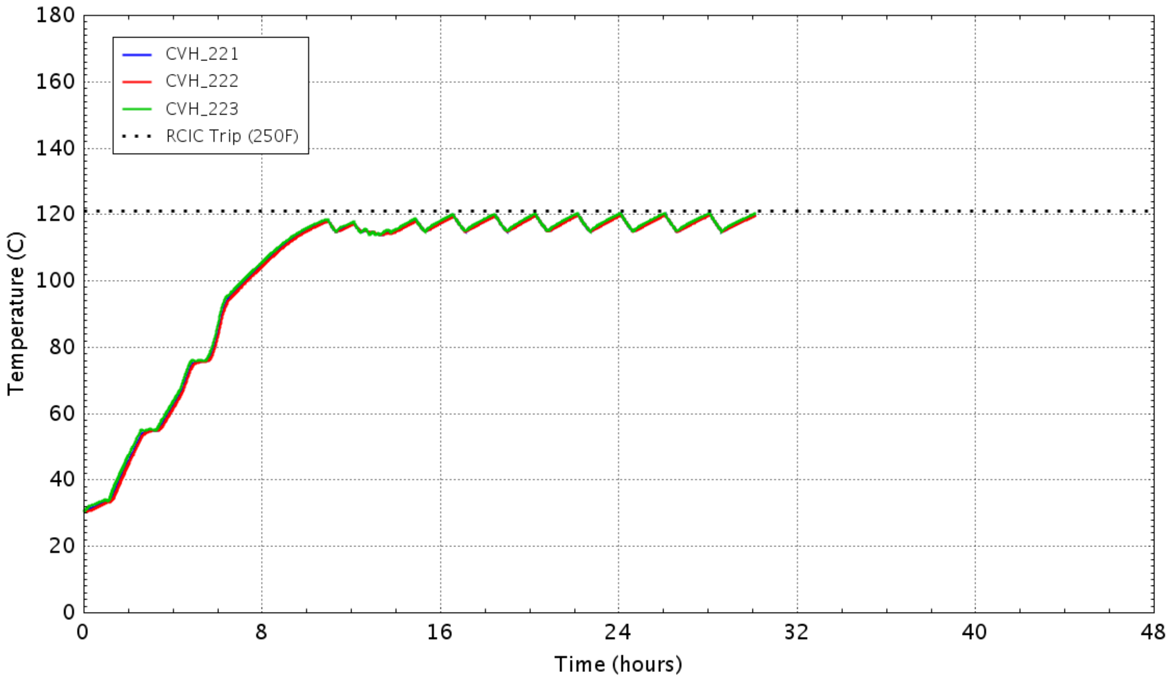

Figure E - 568 Water temperature in the wetwell

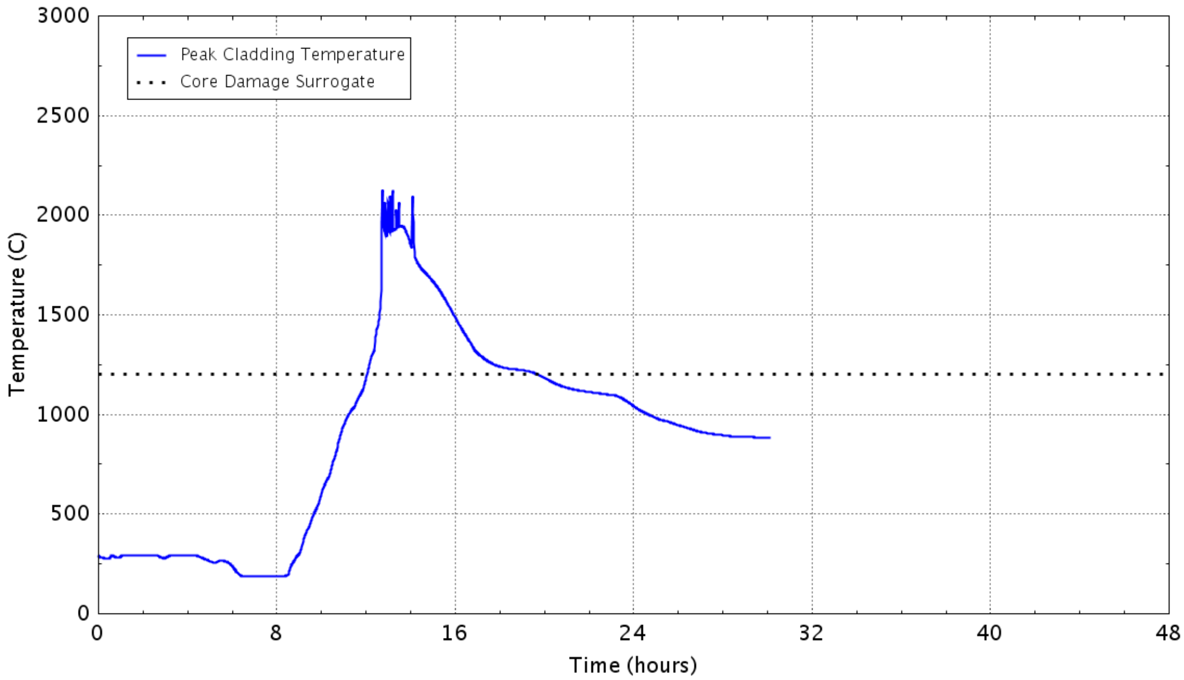

Figure E - 569 Peak temperature of the fuel cladding as a function of time

E.3.17 Case 17d: Sensitivity to LOMFW-25 Case 17 with RCIC Lostafter Four Complete Cycles

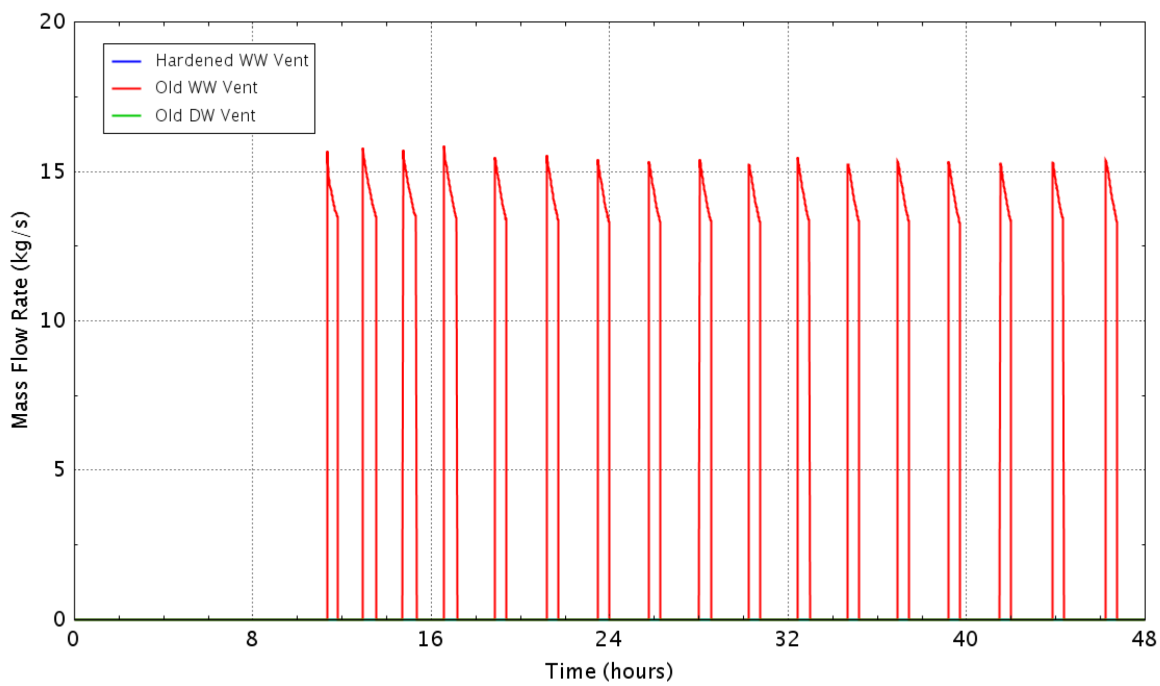

Figure E - 570 Flow rate of the containment vents

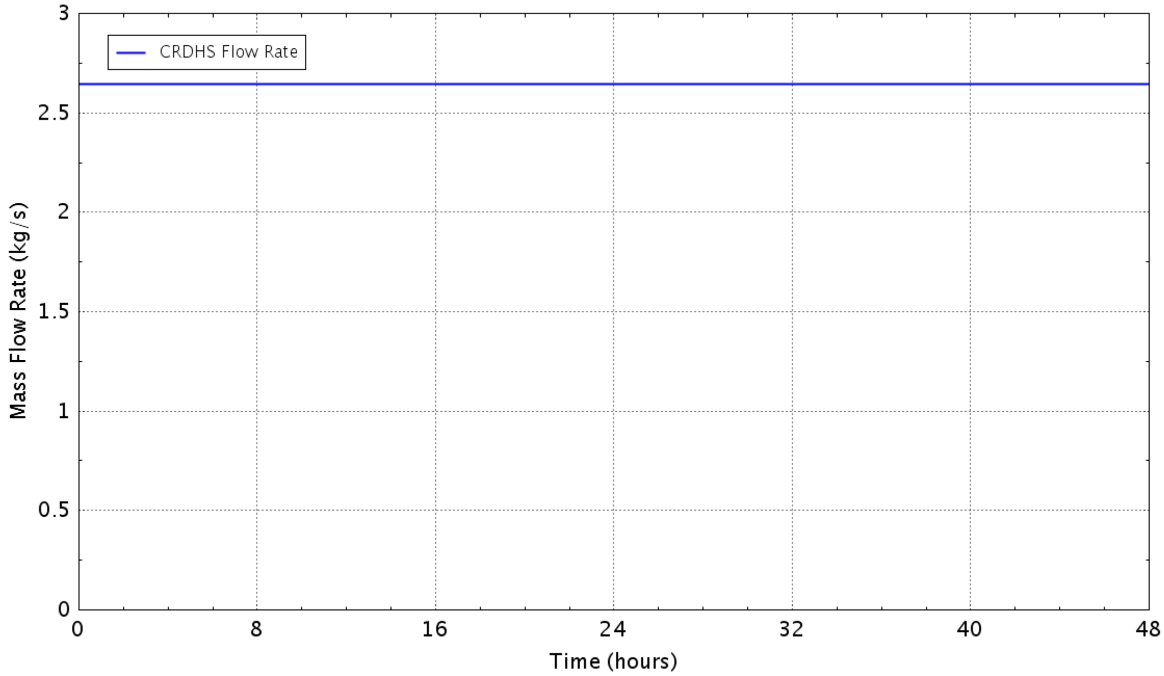

Figure E - 571 Flow rate of the control rod drive hydraulic system

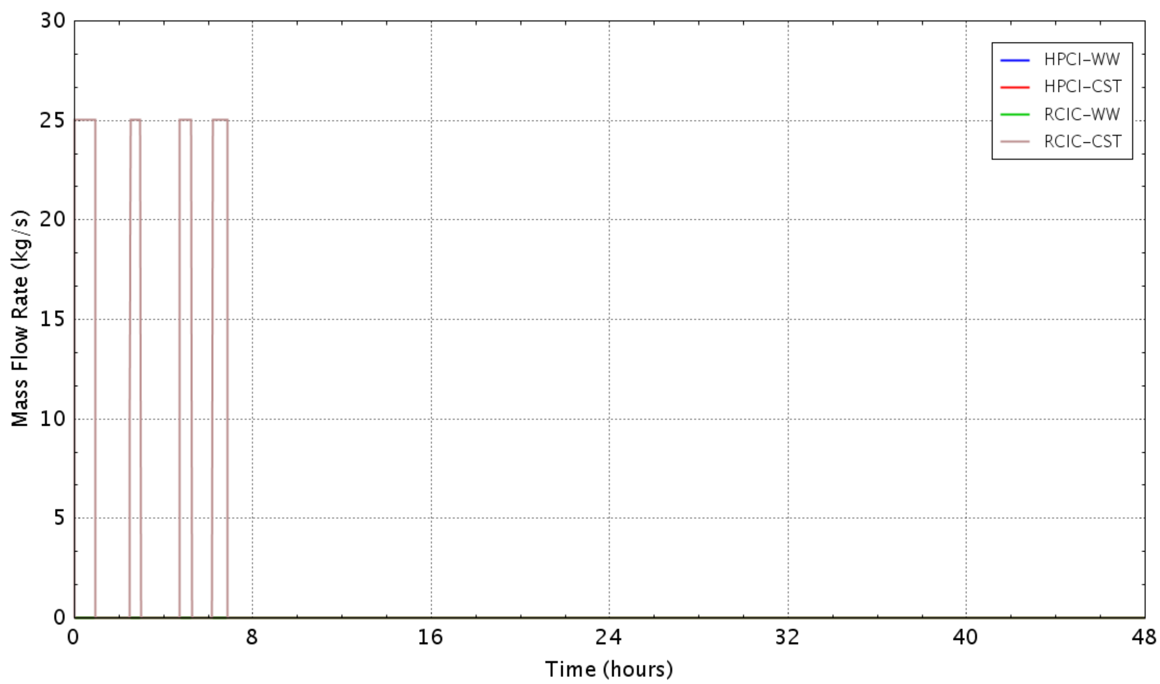

Figure E - 572 Flow rate of the HPCI/RCIC pumps

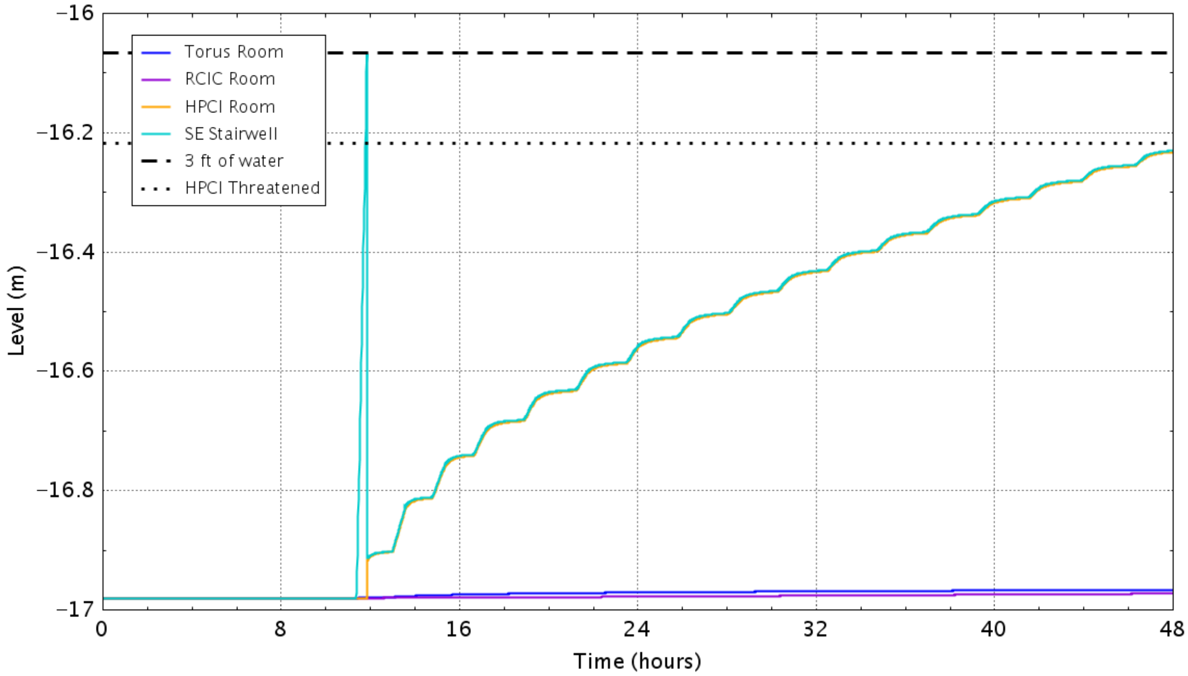

Figure E - 573 **Water level in the reactor building basement**

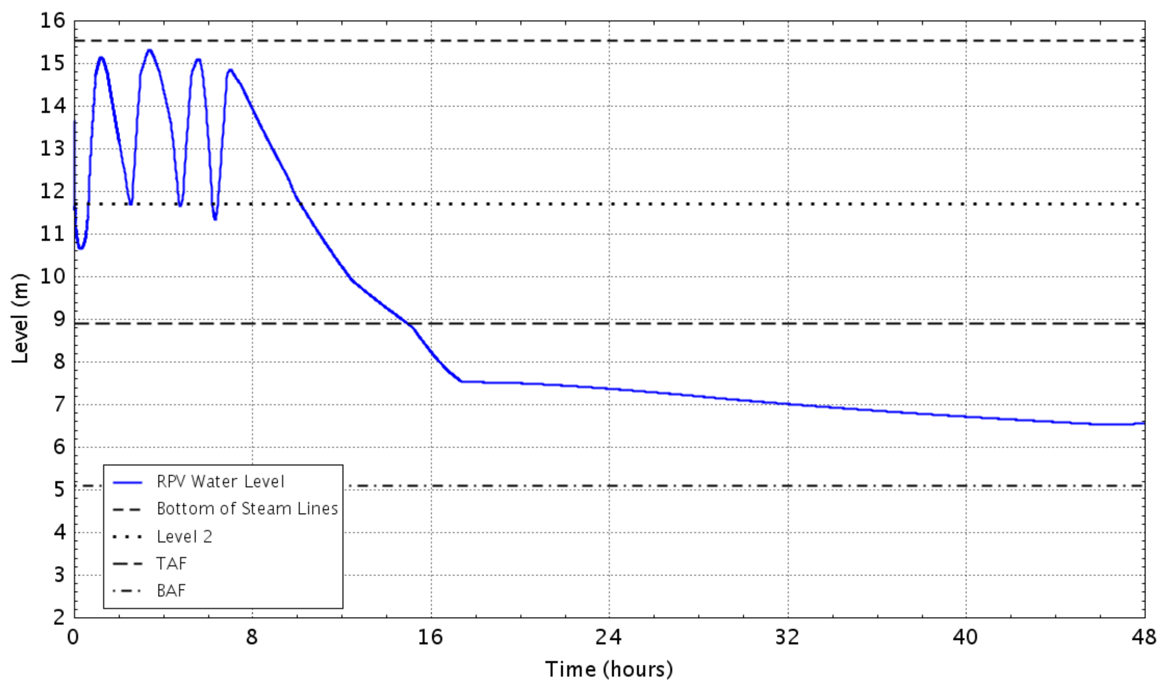

Figure E - 574 **RPV down comer water level**

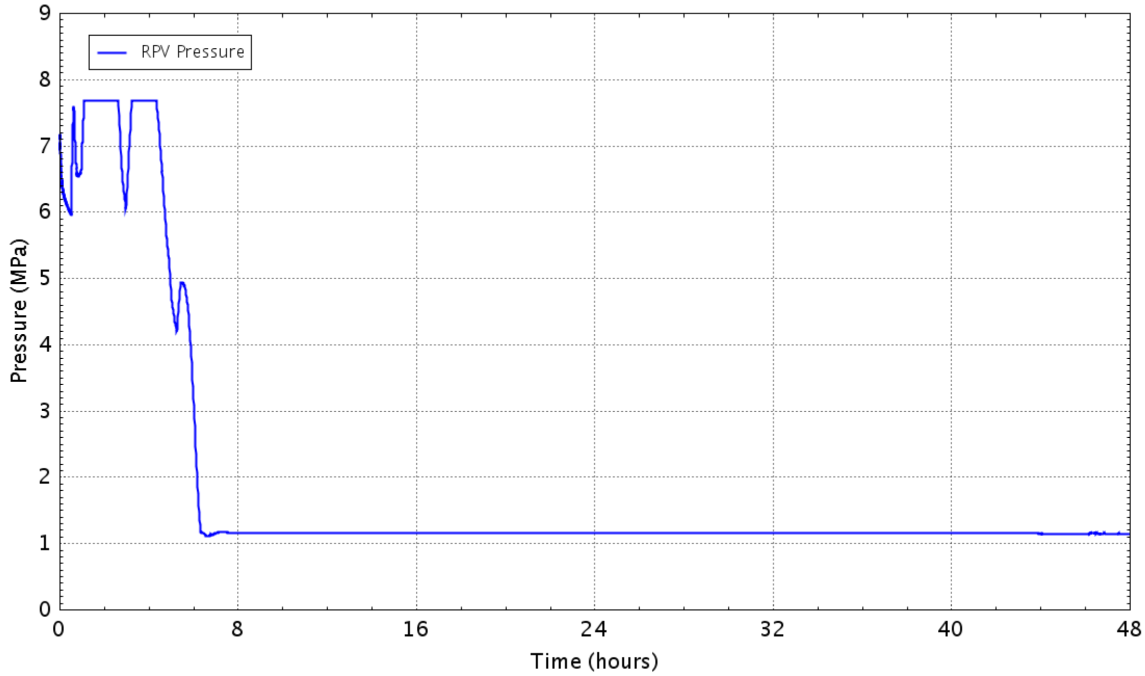

Figure E - 575 Pressure in theRPV

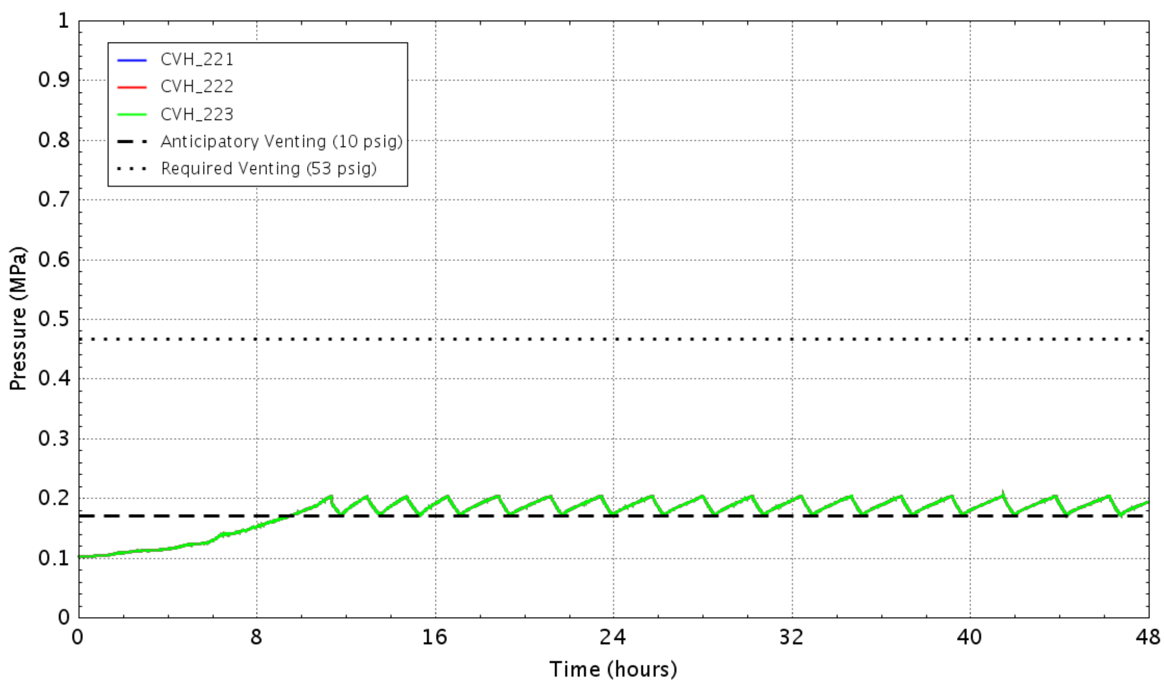

Figure E - 576 Pressure in the wet well

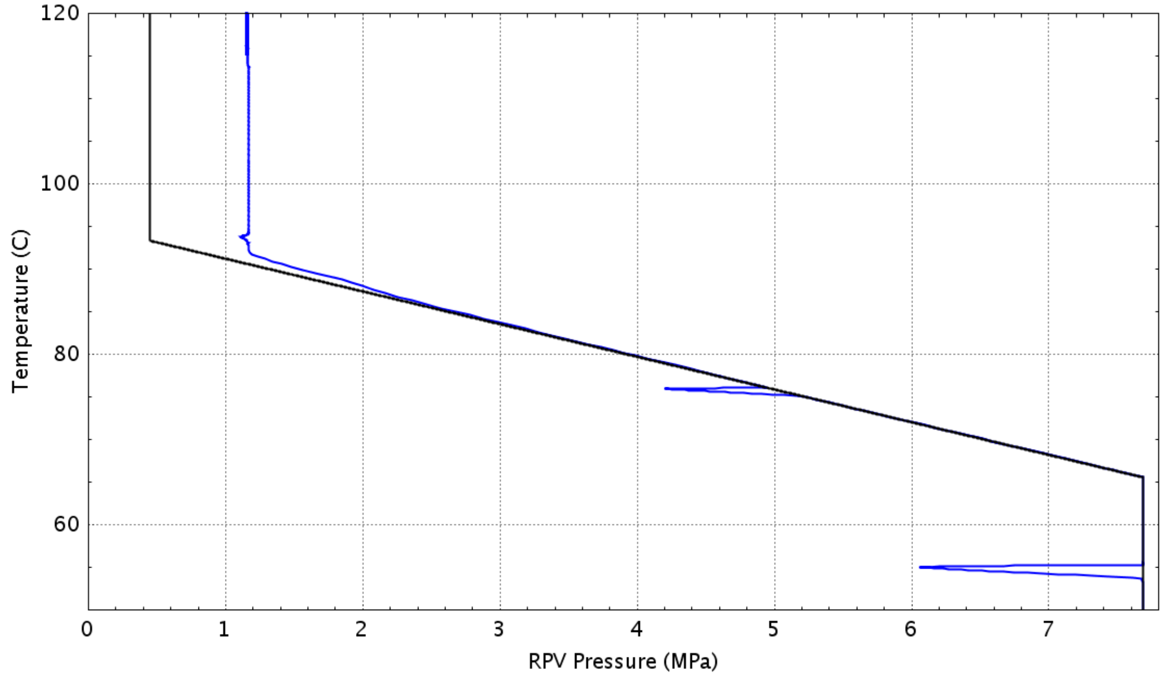

Figure E – 577 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

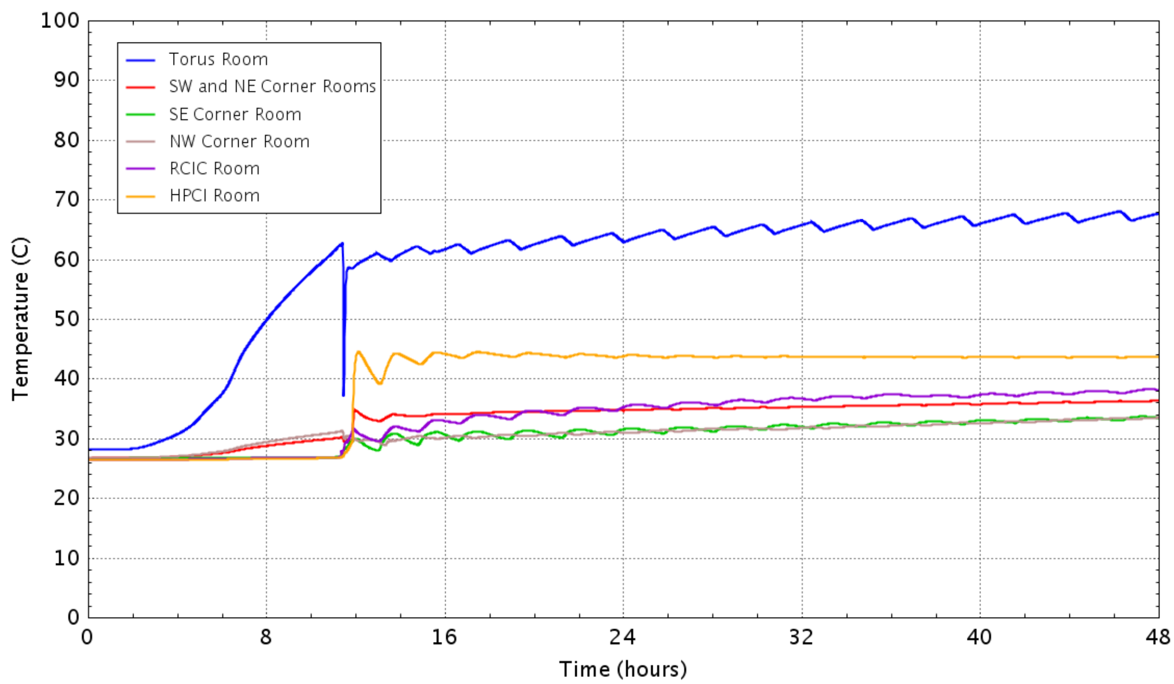

Figure E - 578 **Vapor temperature in the reactor building basement**

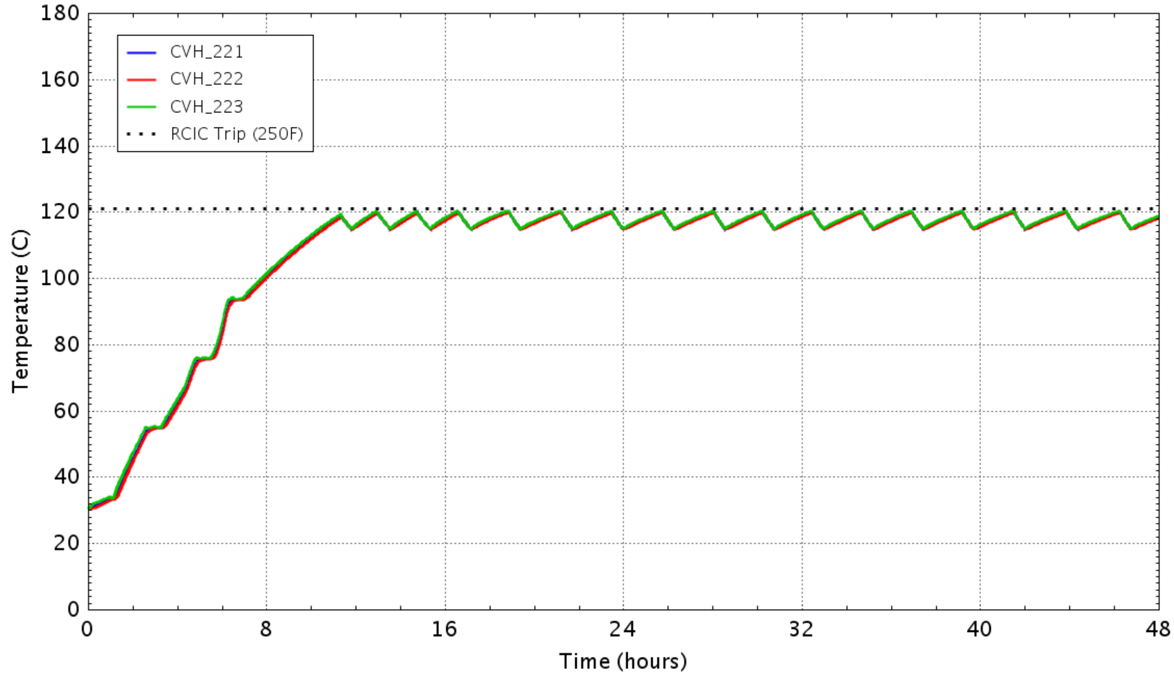

Figure E - 579 Water temperature in the wetwell

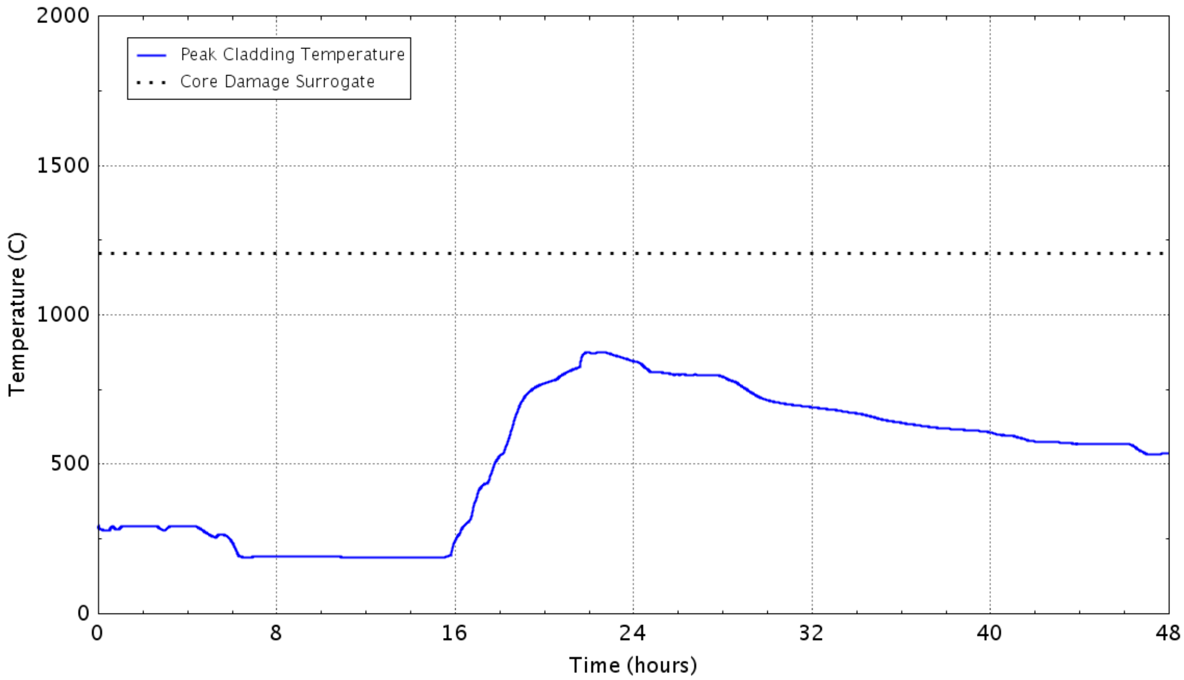

Figure E – 580 Peak temperature of the fuel cladding as a function oftime

E.3.18 Case 17e: Sensitivity to LOMFW-25 Case 17 with CST Unavailable

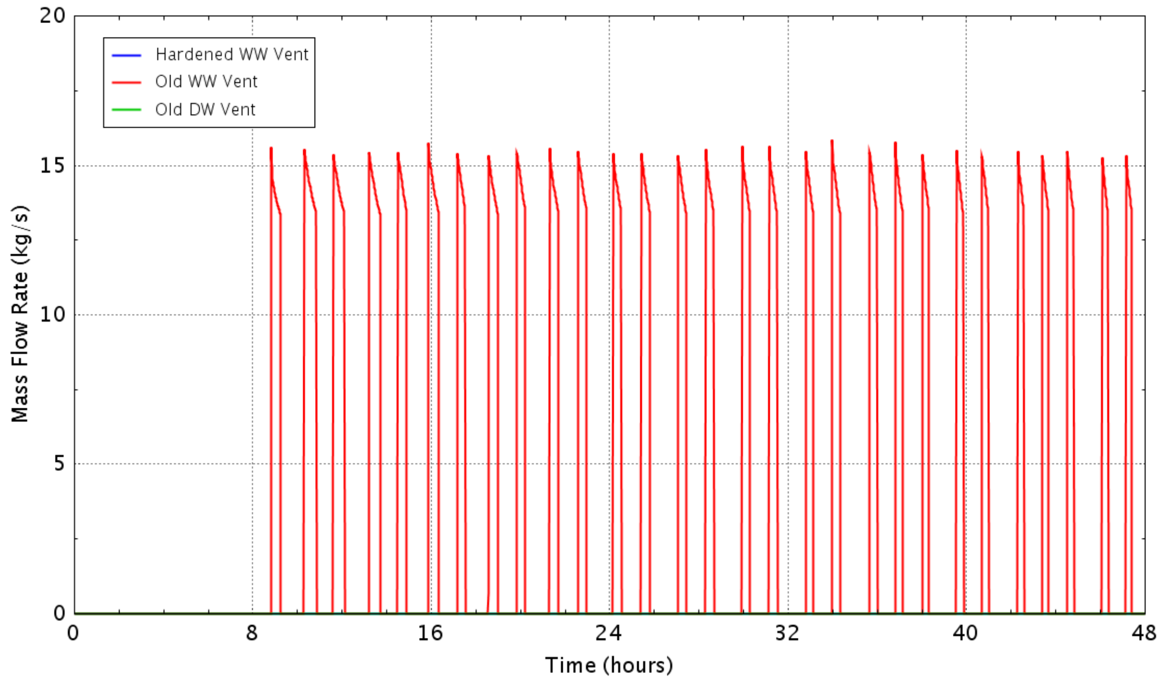

Figure E - 581 Flow rate of the containment vents

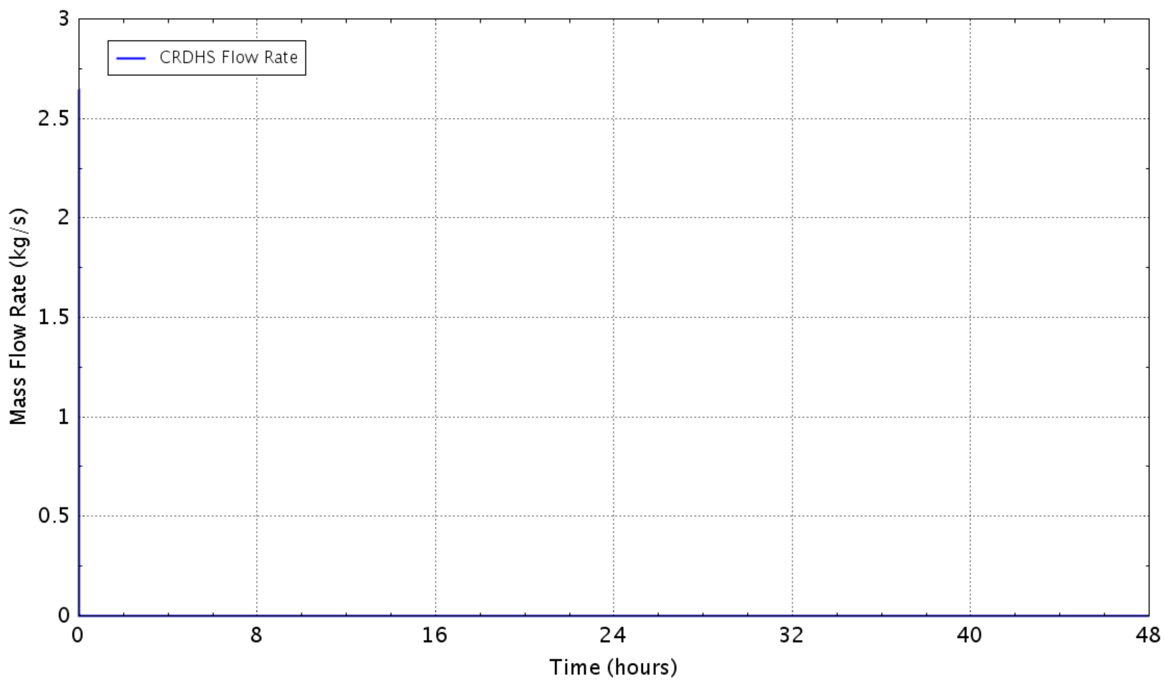

Figure E - 582 Flow rate of the control rod drive hydraulic system

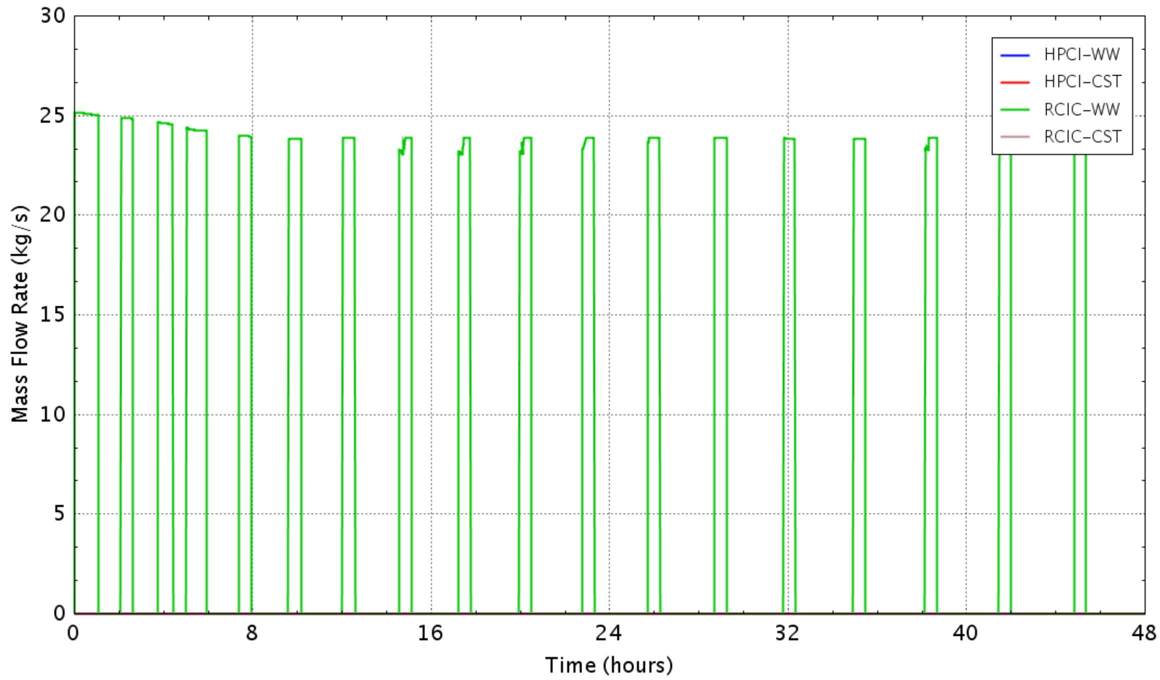

Figure E - 583 Flow rate of the HPCI/RCIC pumps

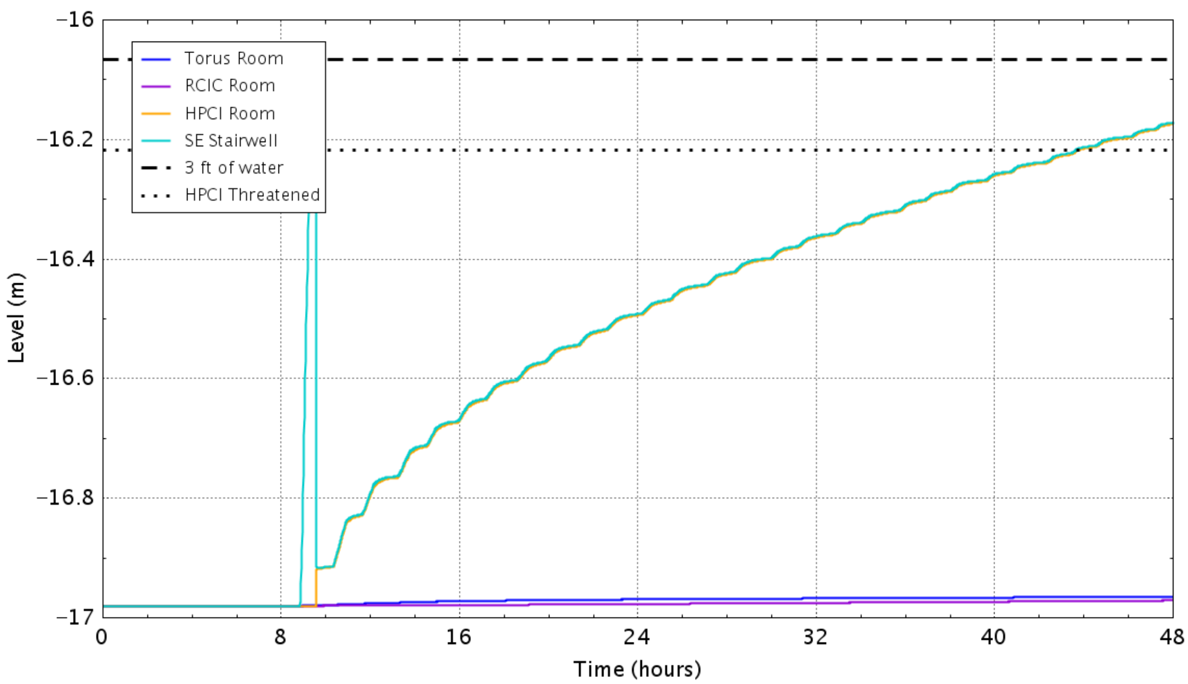

Figure E - 584 Water level in the reactor building basement

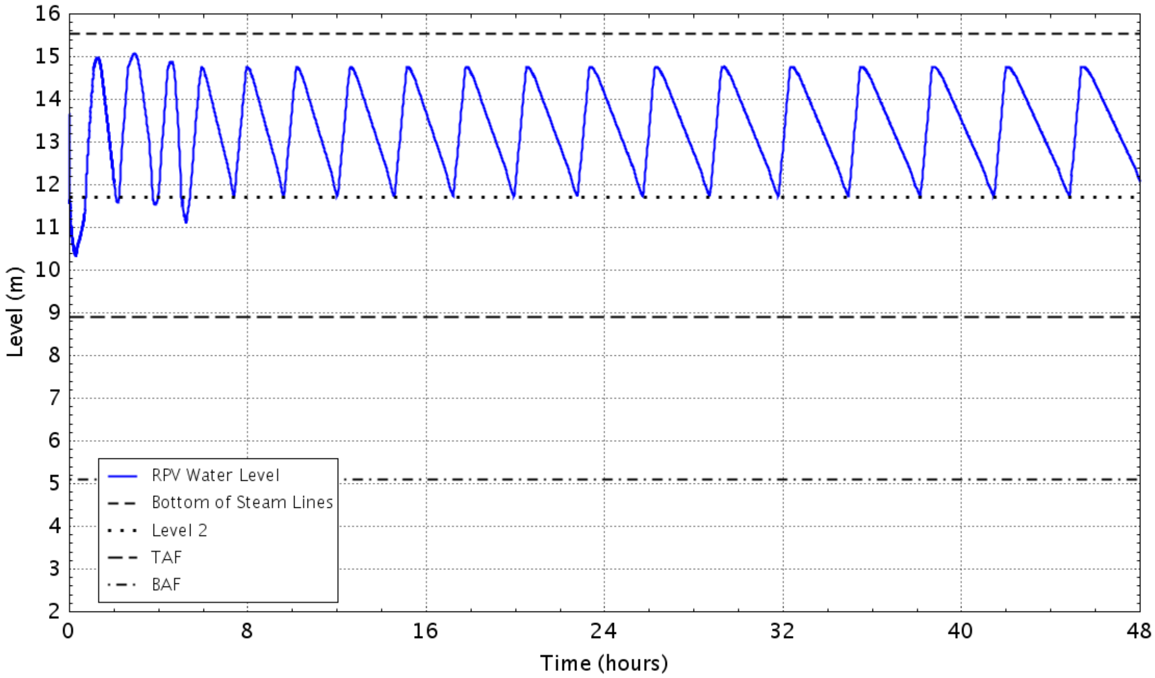

Figure E – 585 RPV down comer water level

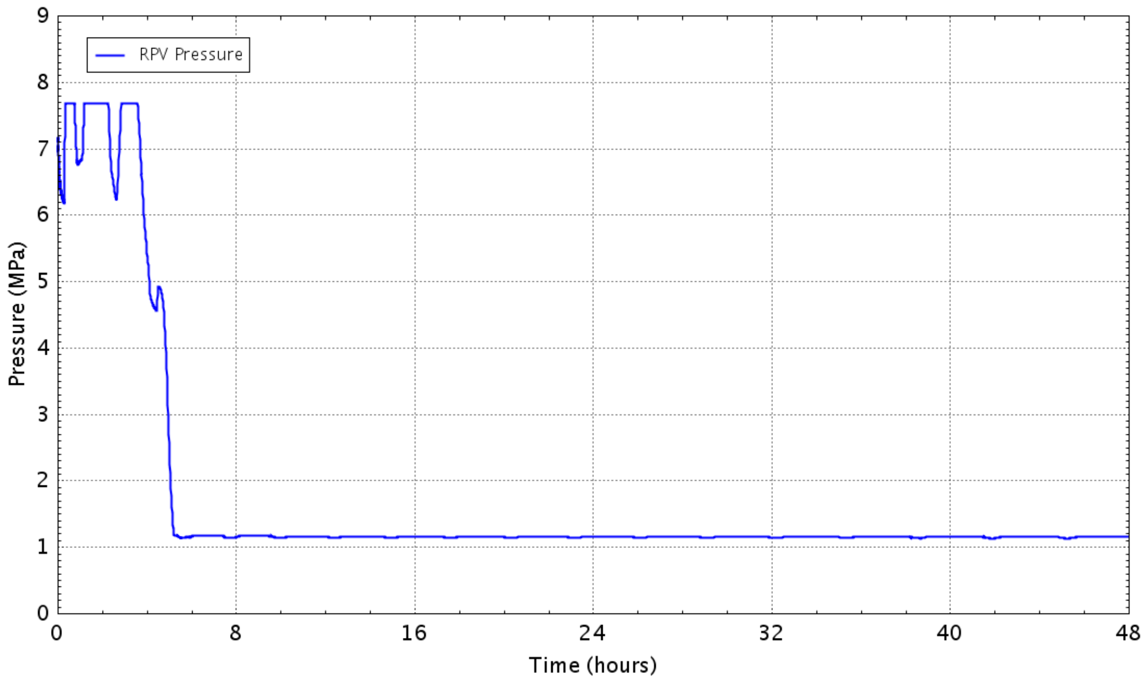

Figure E - 586 Pressure in theRPV

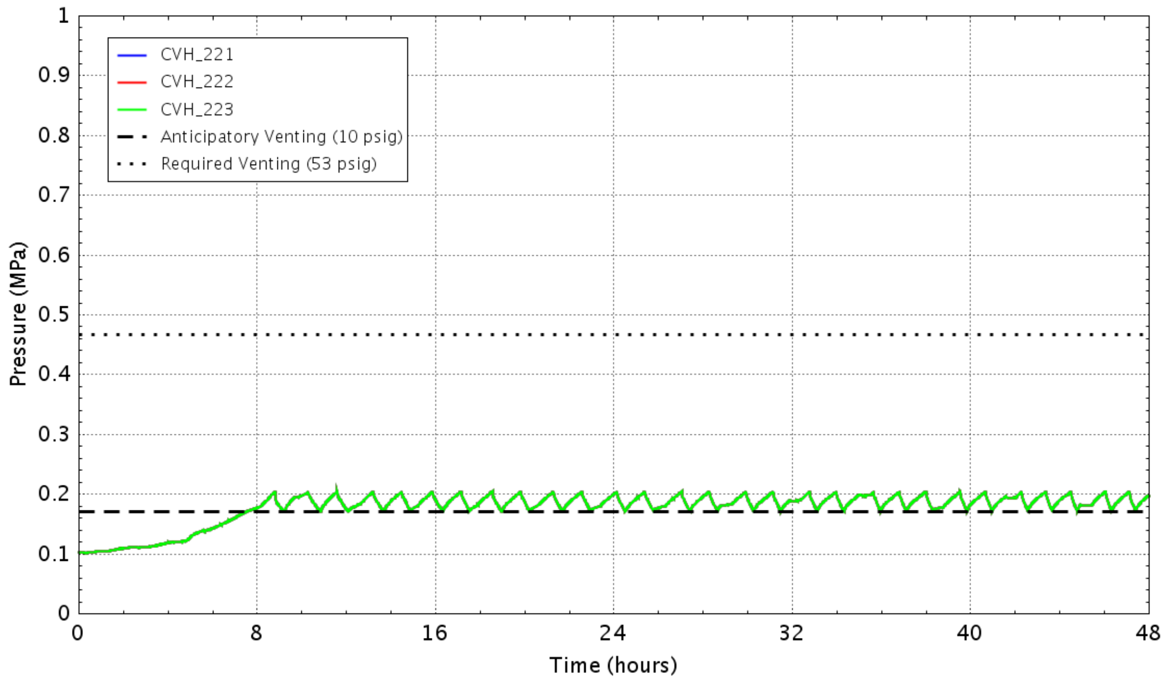

Figure E - 587 **Pressure in the wetwell**

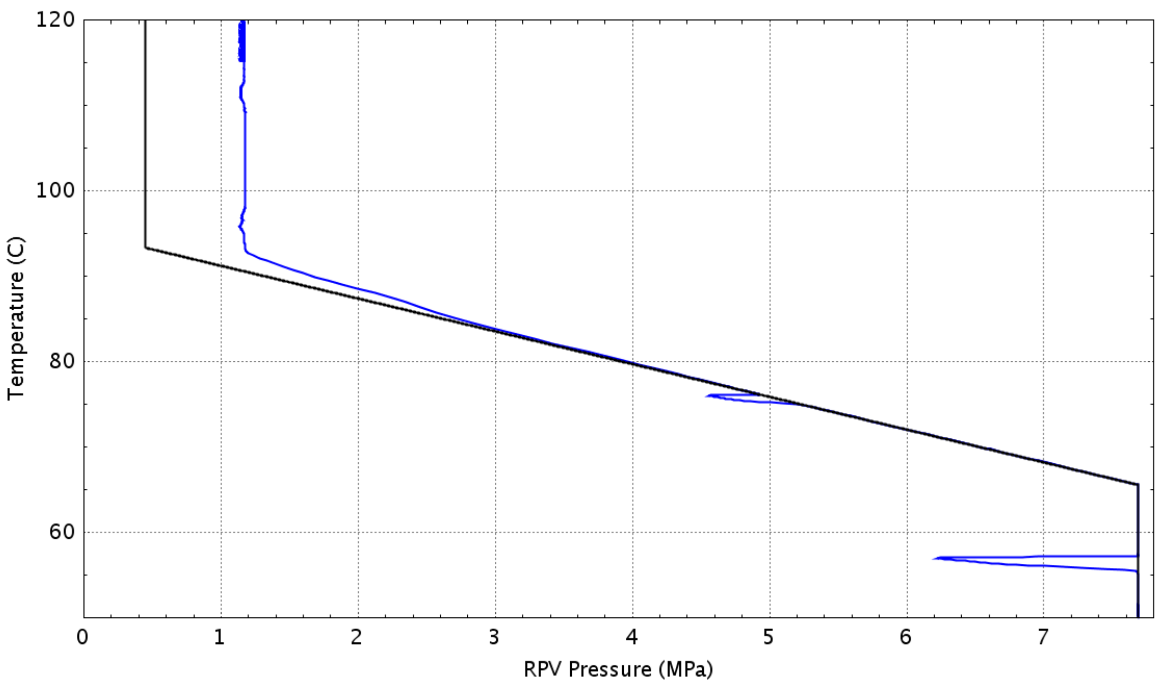

Figure E – 588 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

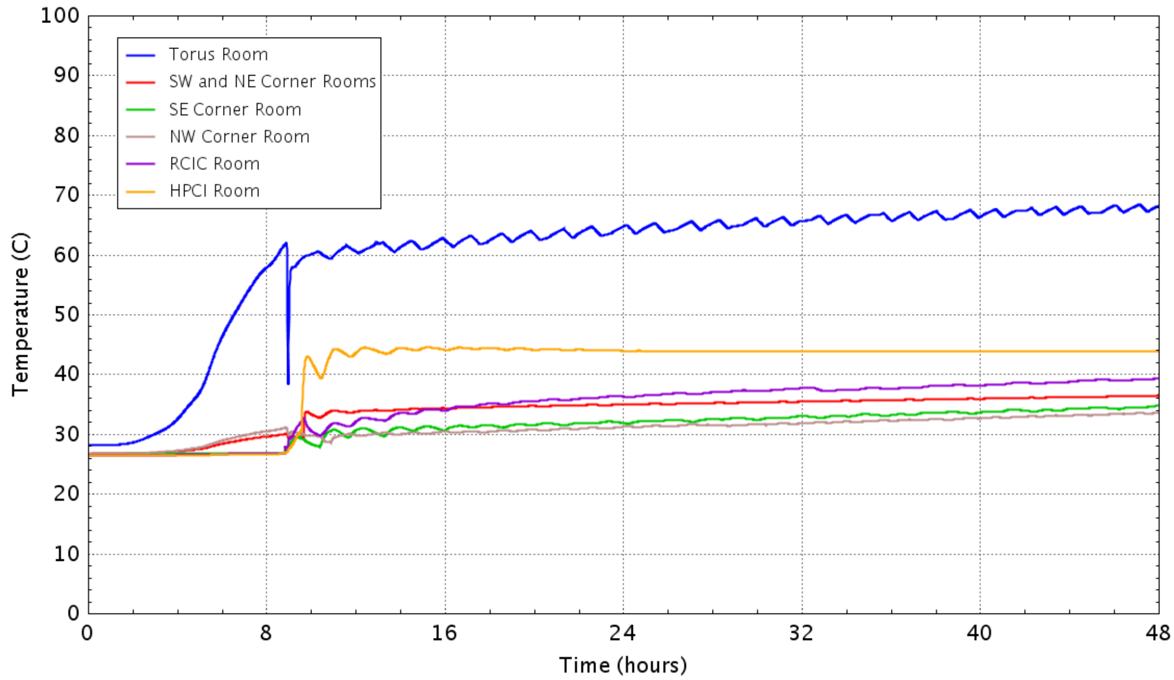

Figure E - 589 **Vapor temperature in the reactor building basement**

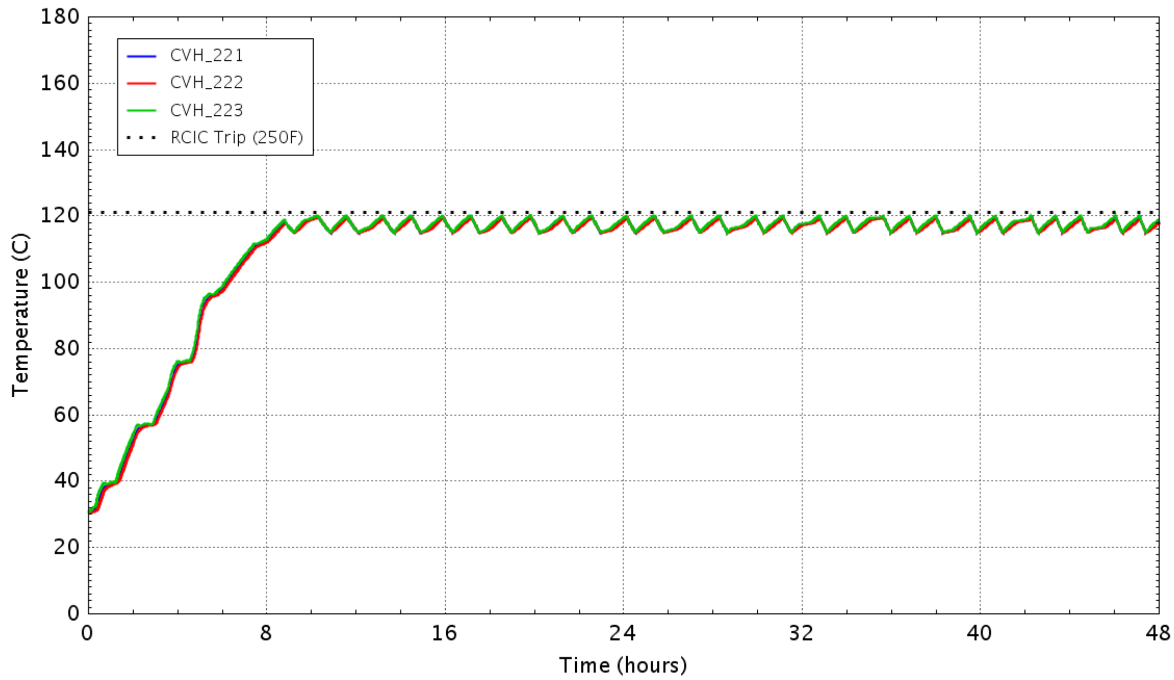

Figure E - 590 **Water temperature in the wetwell**

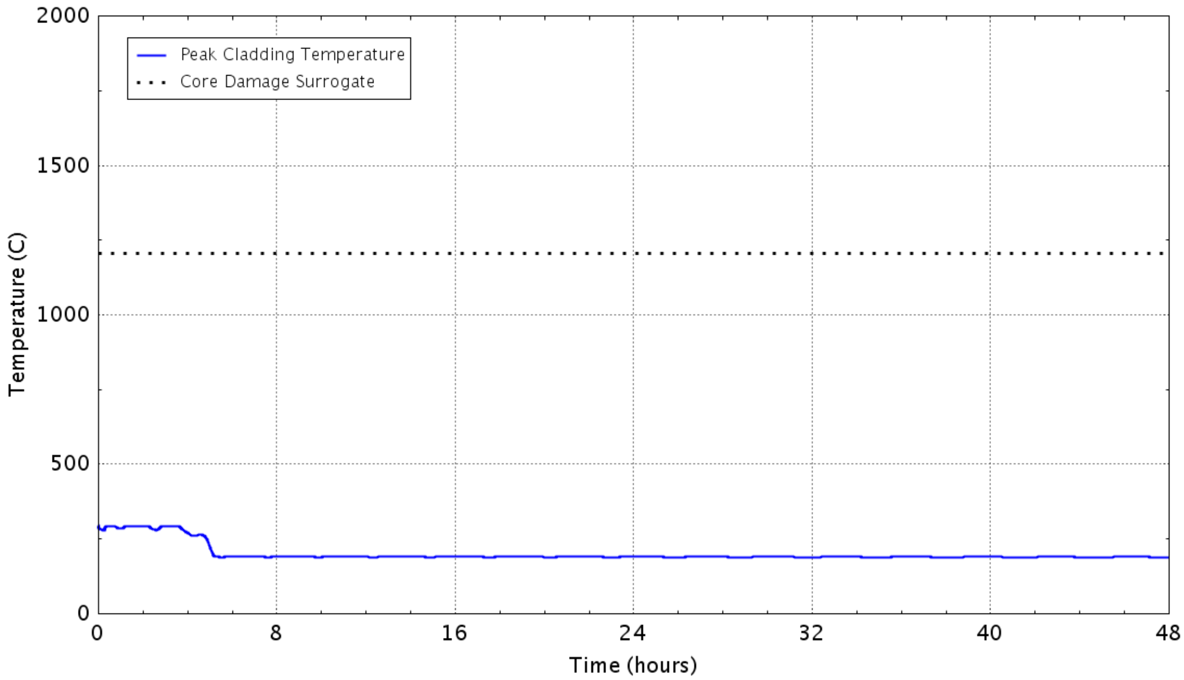

Figure E – 591 Peak temperature of the fuel cladding as a function oftime

E.3.19 Case 17f: Sensitivity to LOMFW-25 Case 17 with NominalSeal Leakage

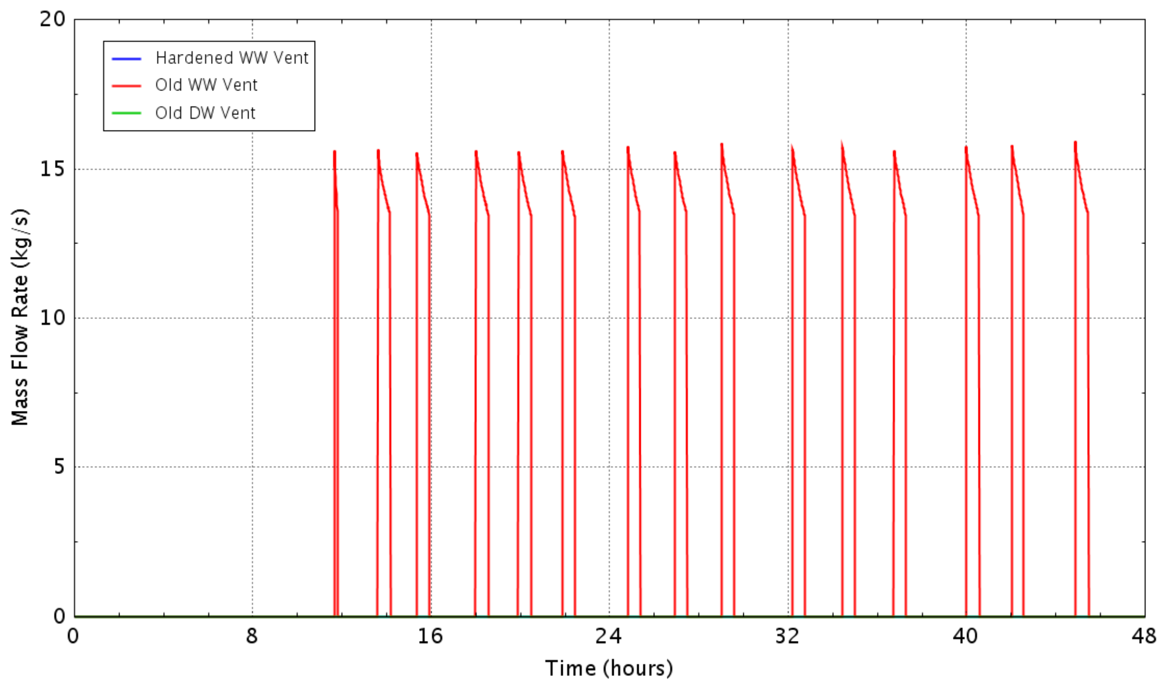

Figure E - 592 Flow rate of the containment vents

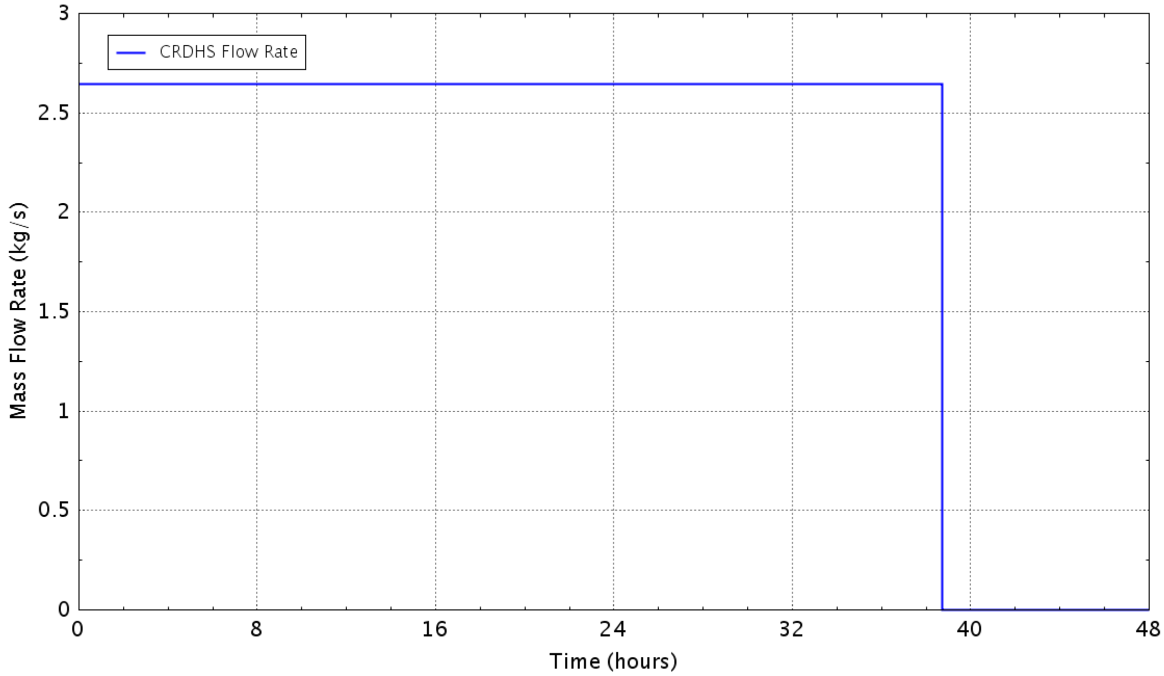

Figure E - 593 Flow rate of the control rod drive hydraulic system

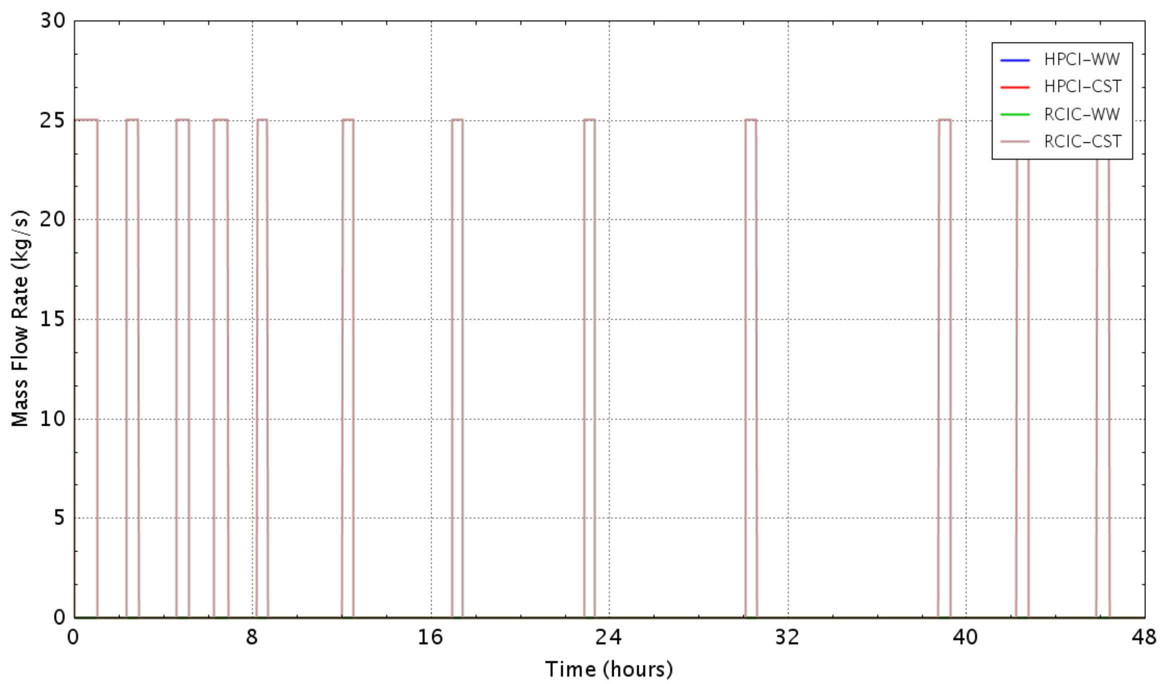

Figure E - 594 Flow rate of the HPCI/RCIC pumps

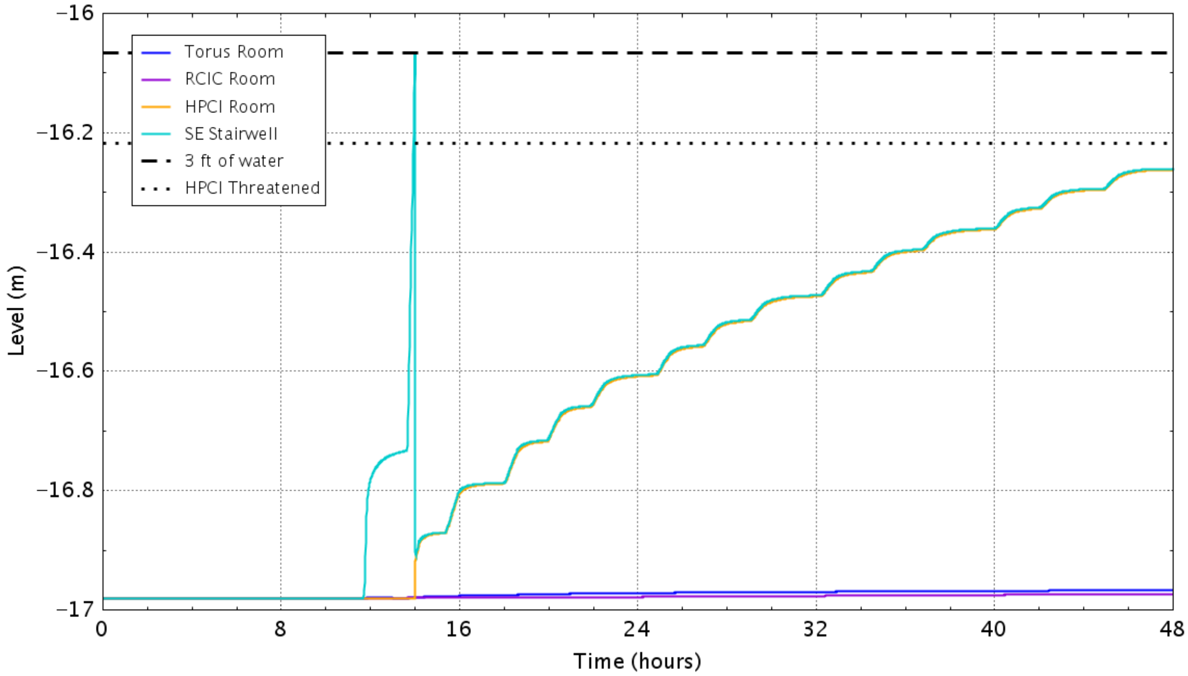

Figure E - 595 Water level in the reactor building basement

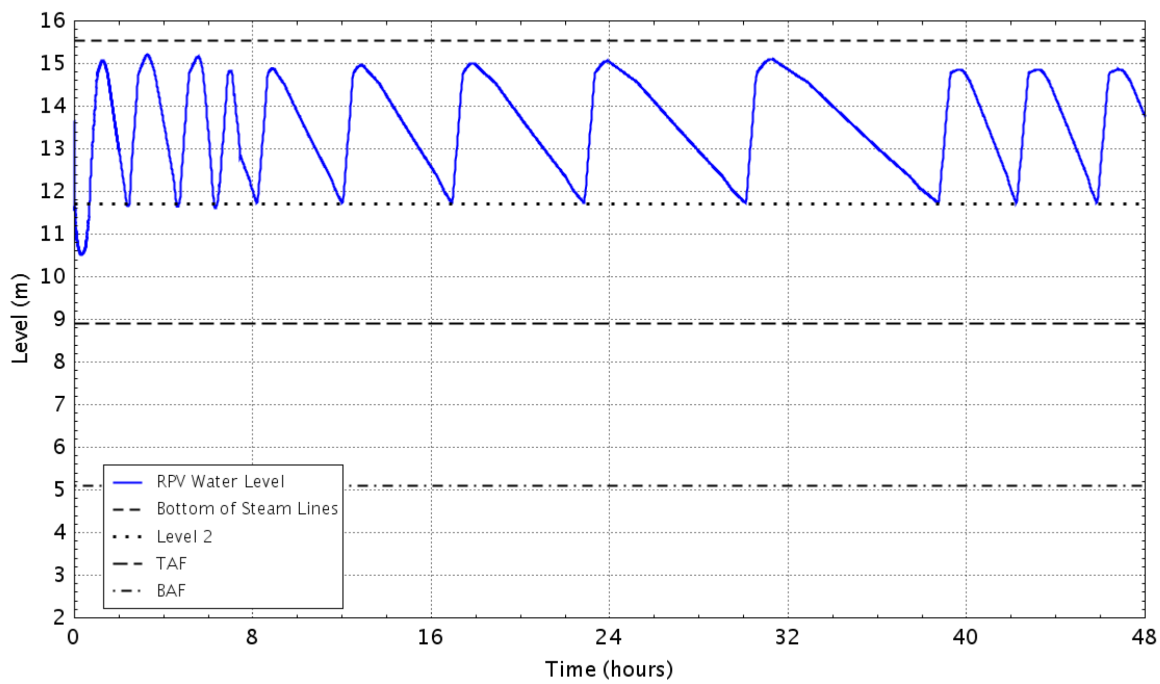

Figure E - 596 RPV down comer water level

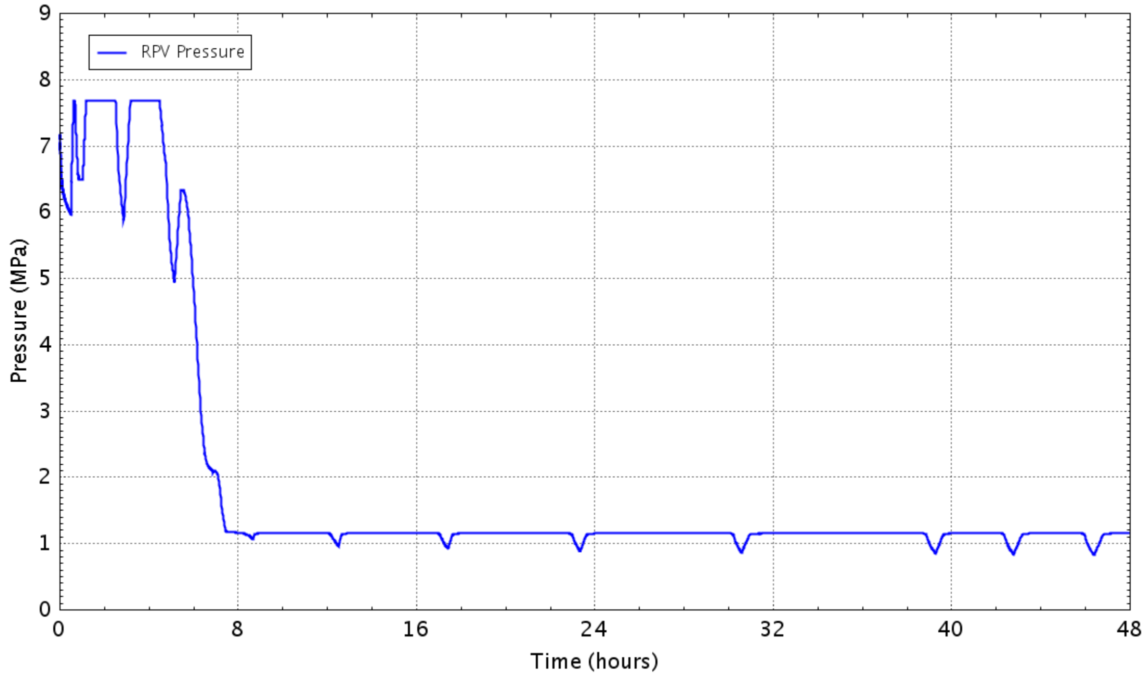

Figure E - 597 **Pressure in theRPV**

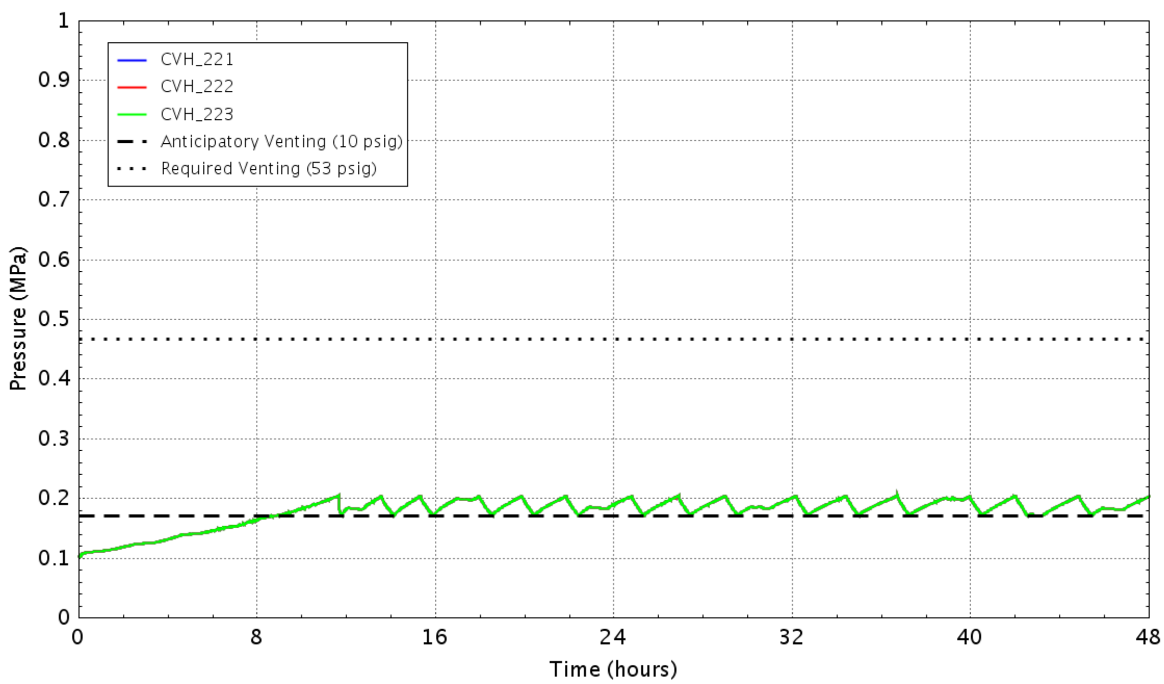

Figure E - 598 **Pressure in the wetwell**

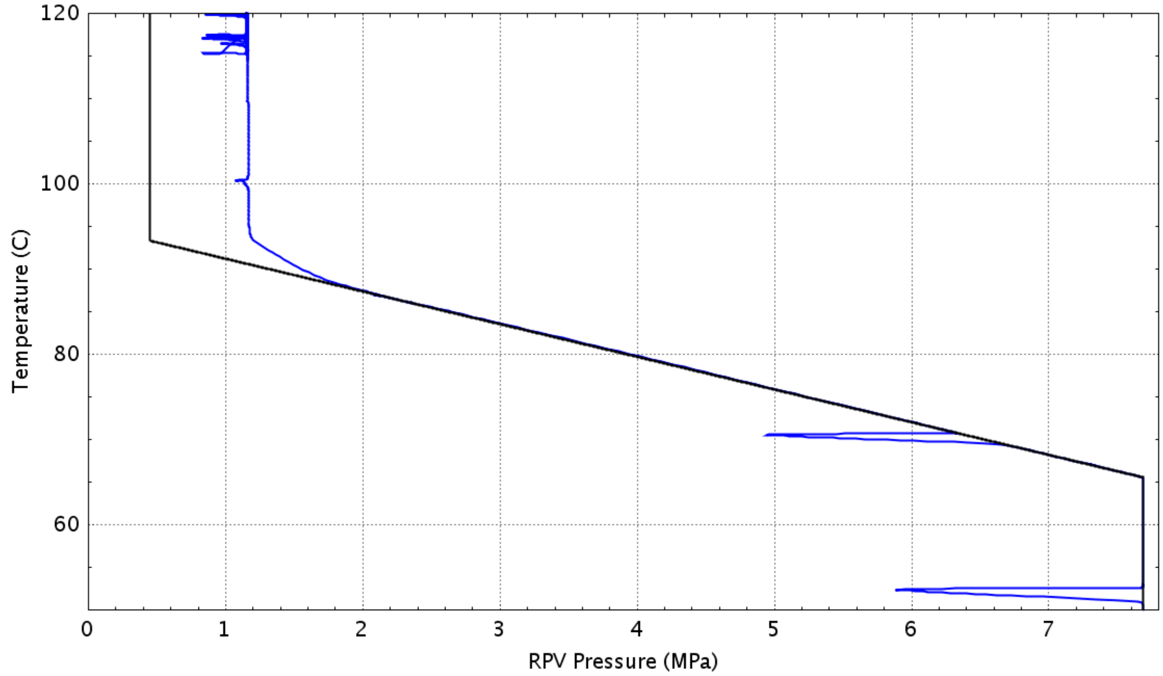

Figure E – 599 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

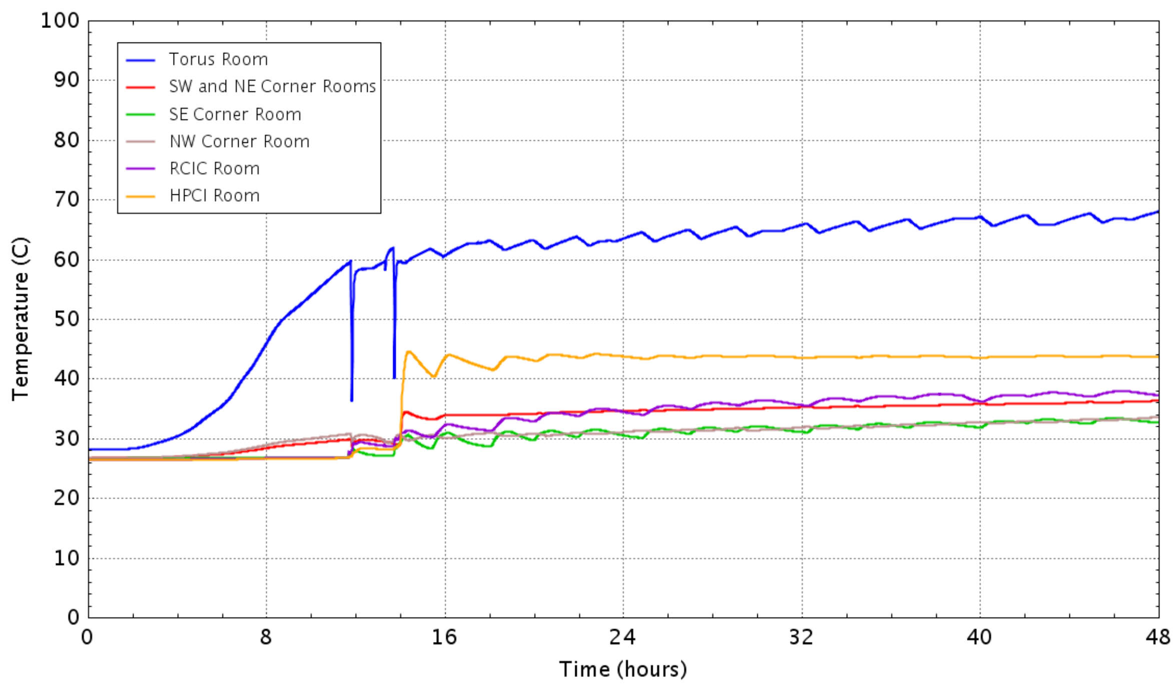

Figure E - 600 **Vapor temperature in the reactor building basement**

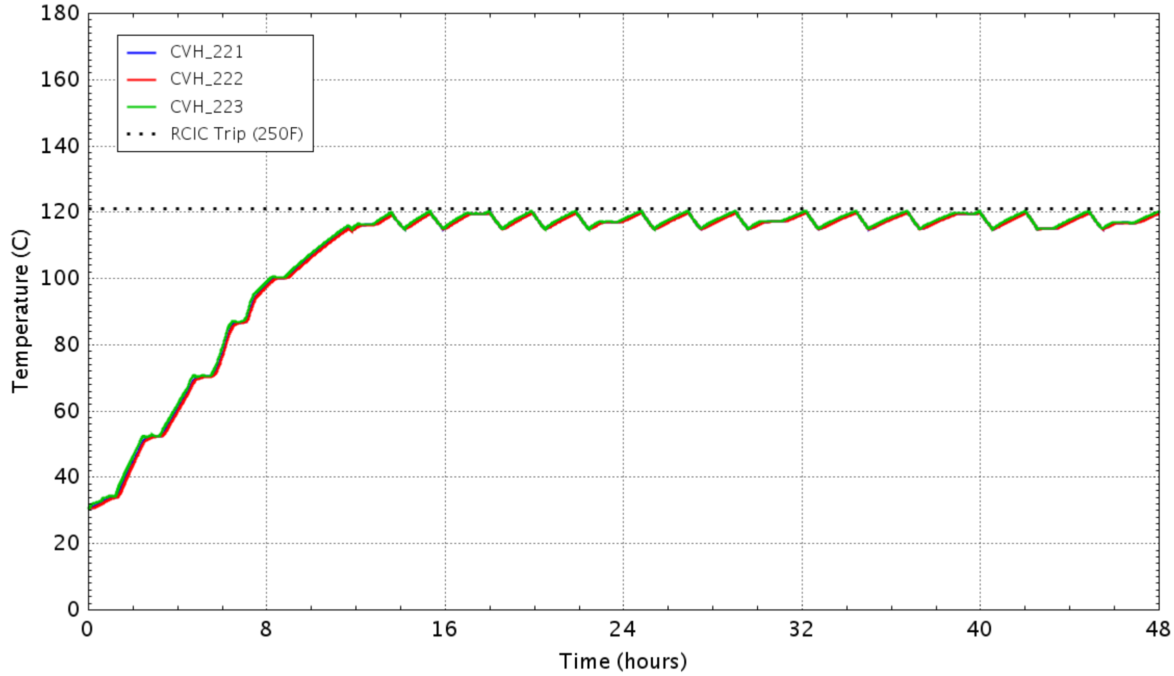

Figure E - 601 Water temperature in the wetwell

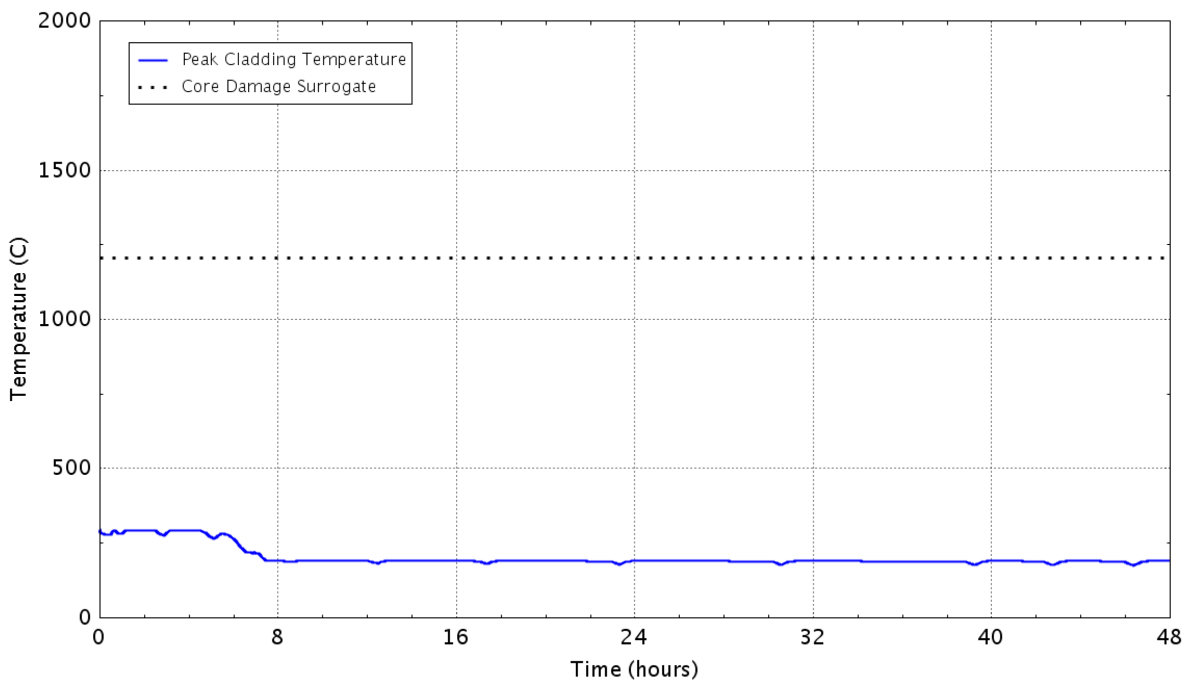

Figure E – 602 Peak temperature of the fuel cladding as a function oftime

E.3.20 Case 17g: Sensitivity to LOMFW-25 Case 17 with IncreasedSeal Leakage (150 gpm Total)

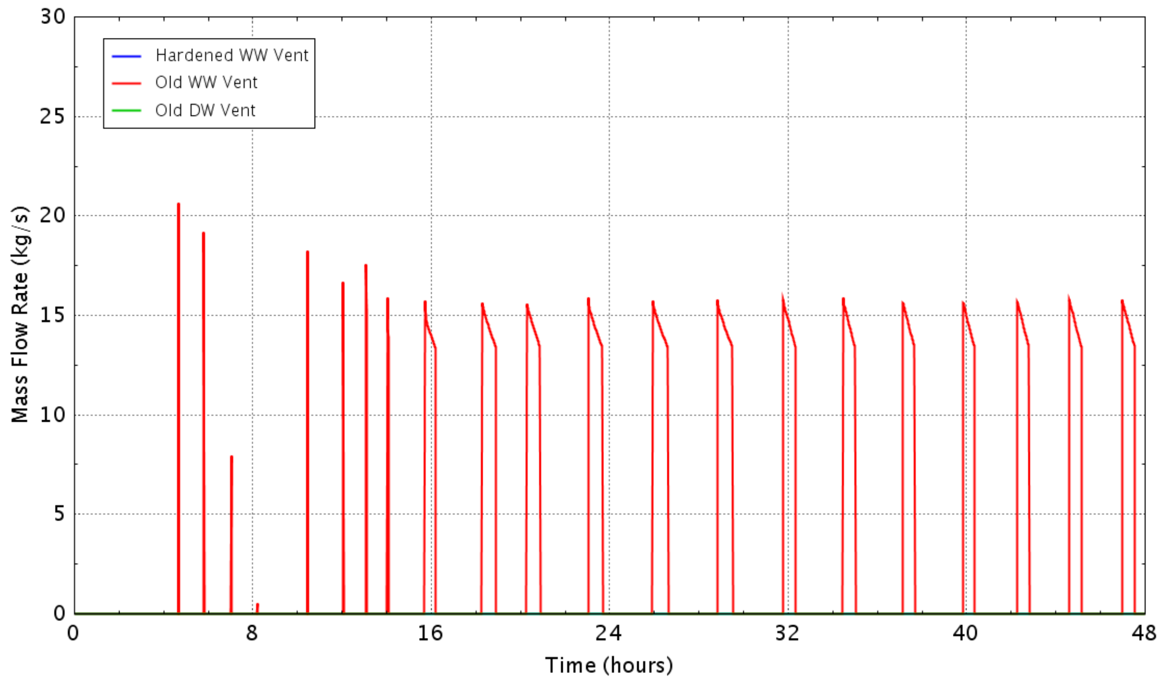

Figure E - 603 Flow rate of the containment vents

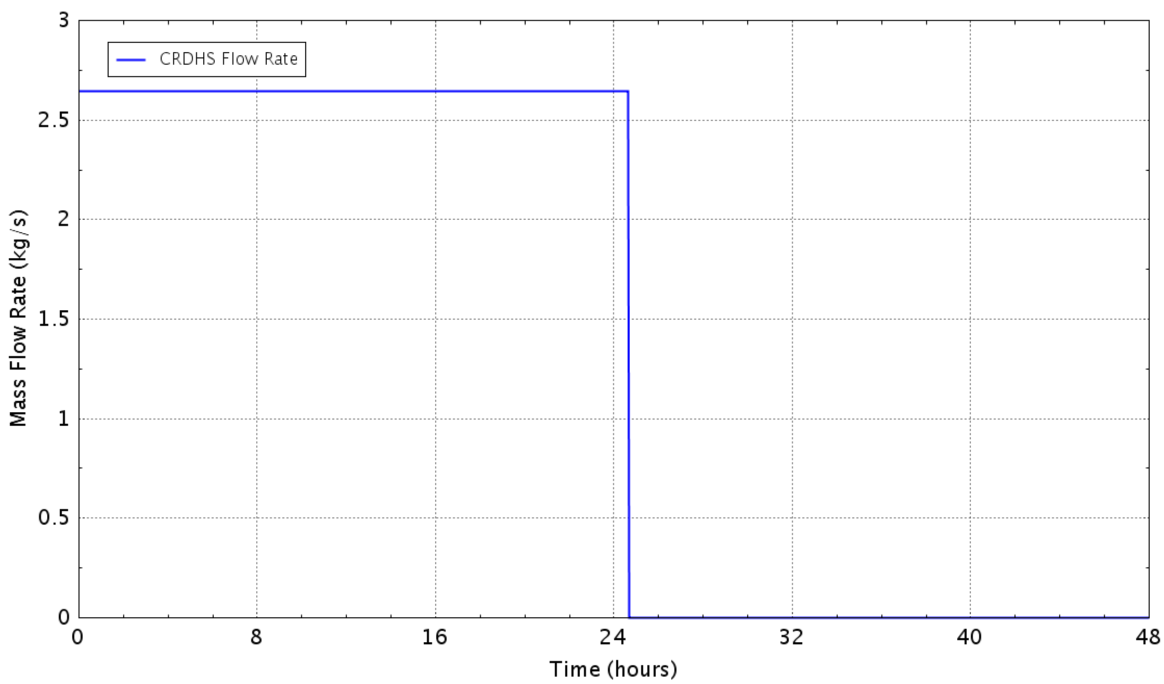

Figure E - 604 Flow rate of the control rod drive hydraulic system

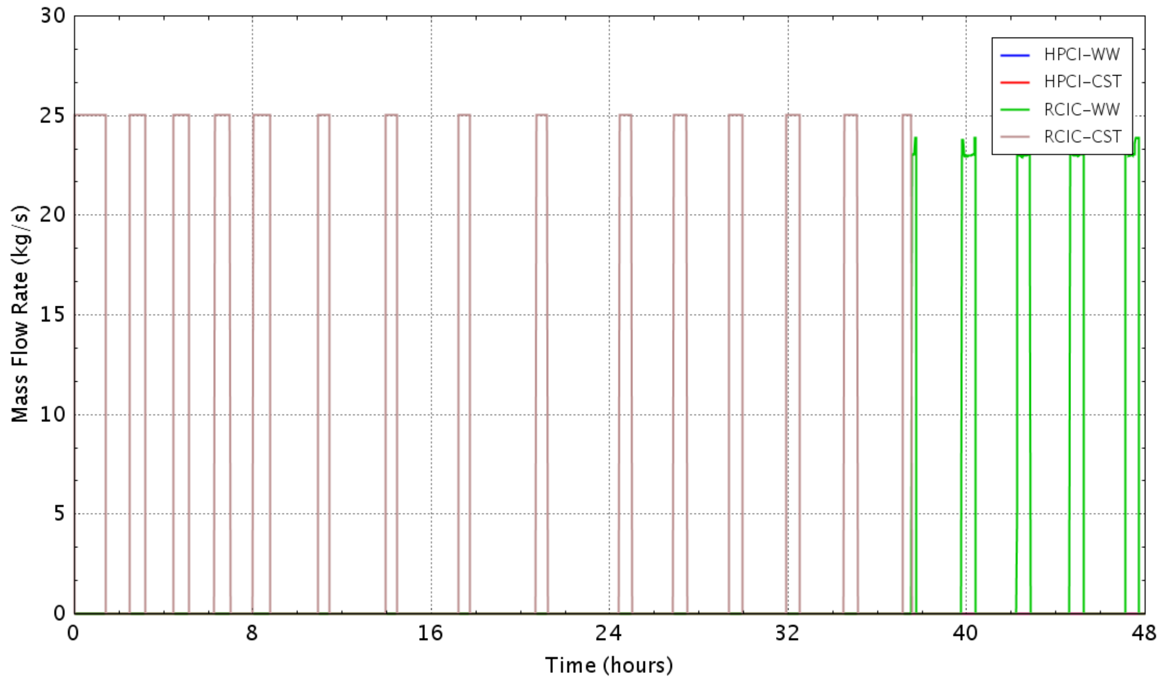

Figure E - 605 Flow rate of the HPCI/RCIC pumps

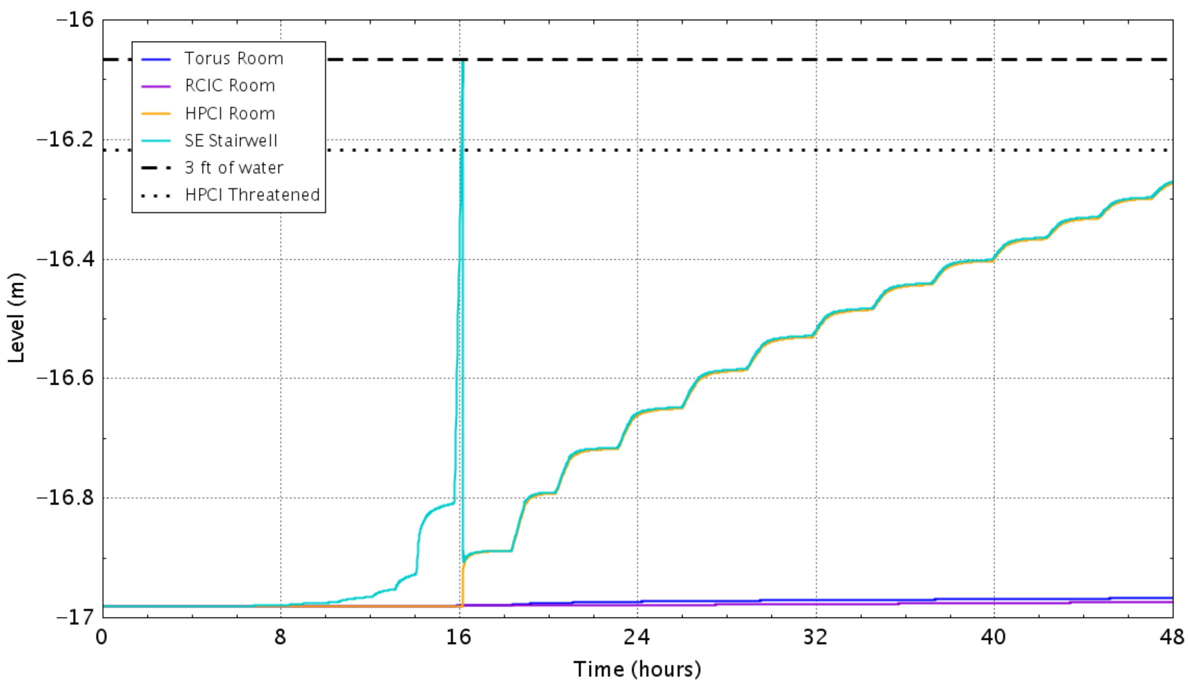

Figure E - 606 Water level in the reactor building basement

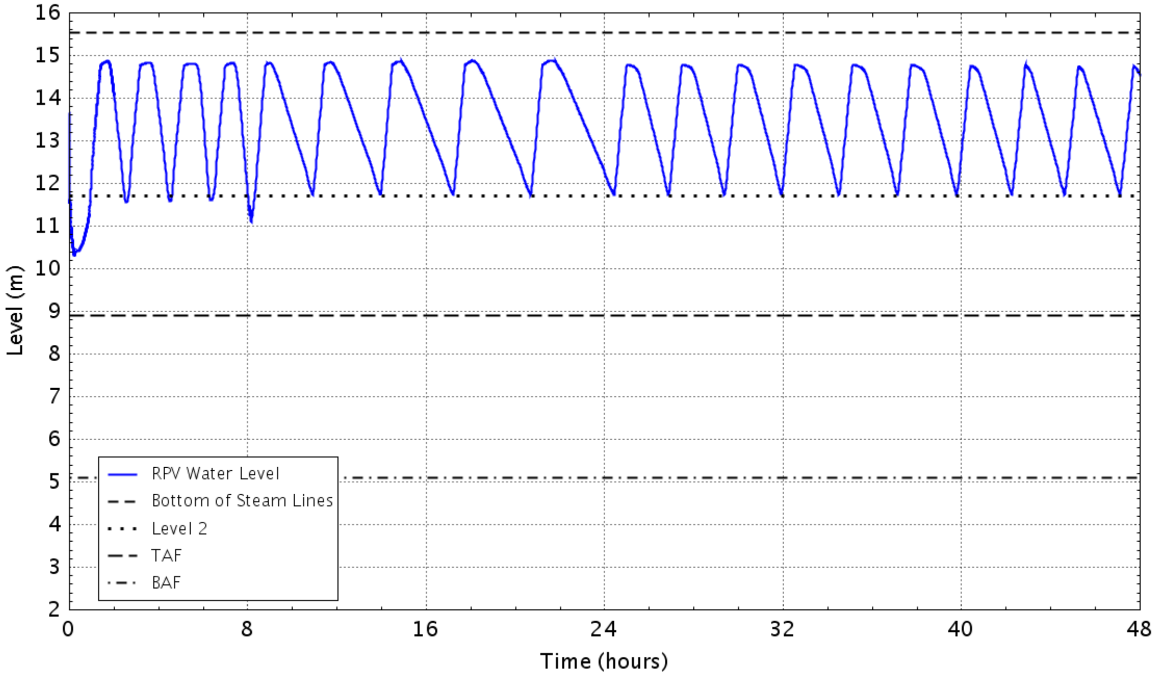

Figure E - 607 **RPV down comer water level**

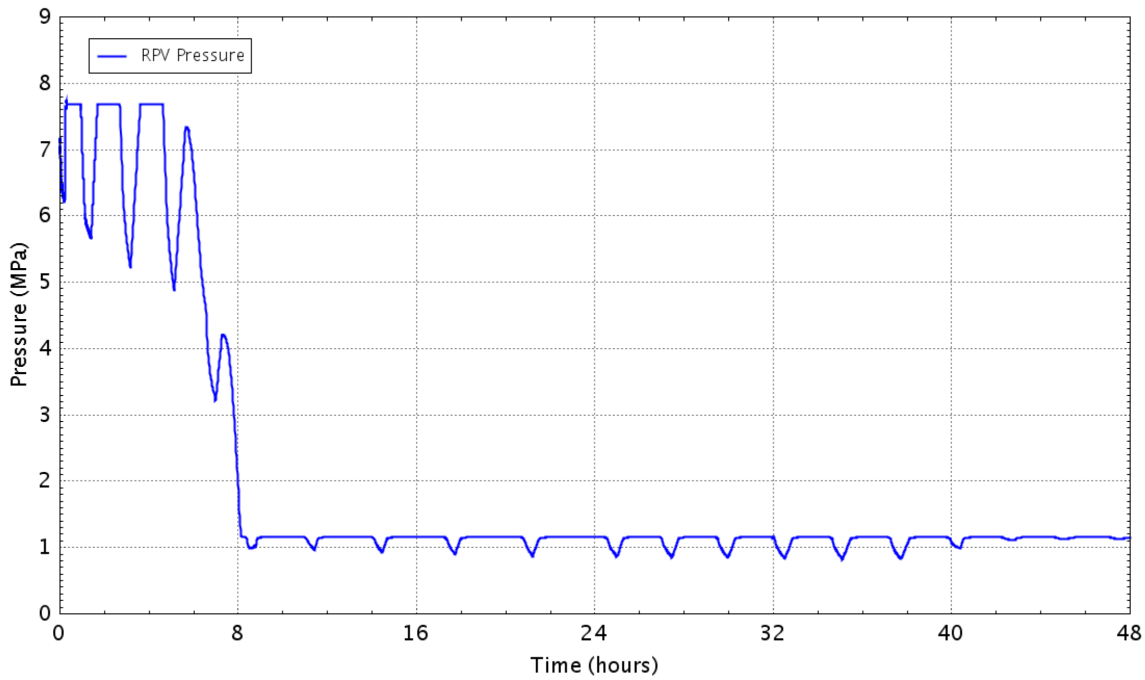

Figure E - 608 **Pressure in theRPV**

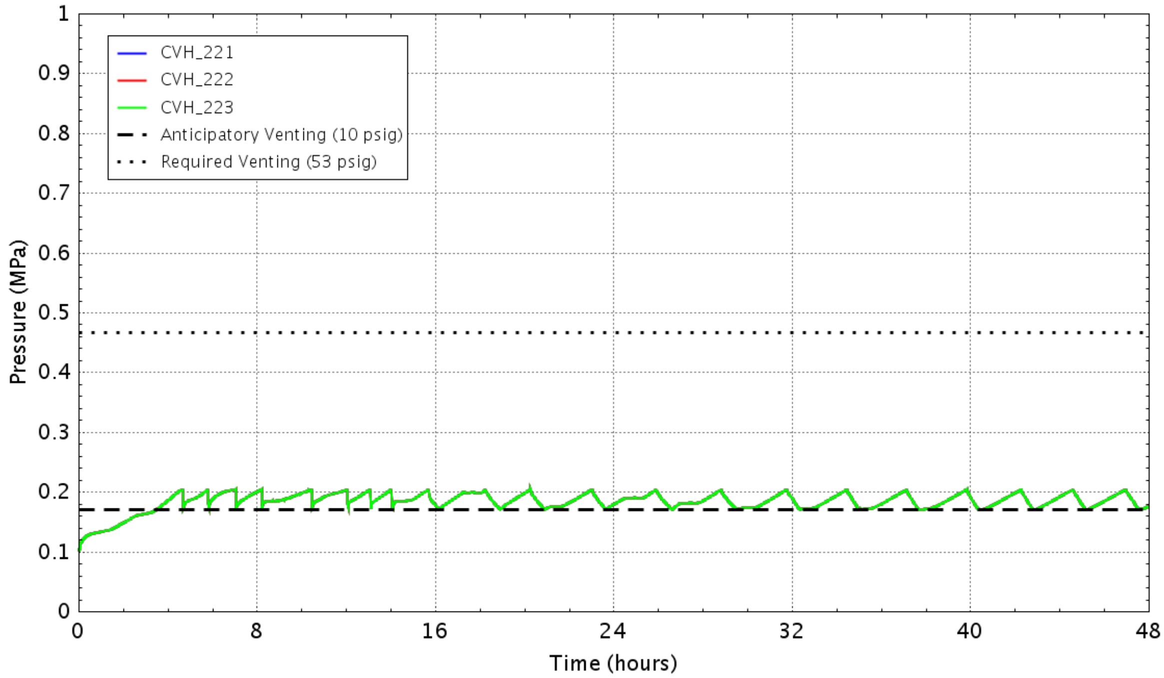

Figure E - 609 Pressure in the wetwell

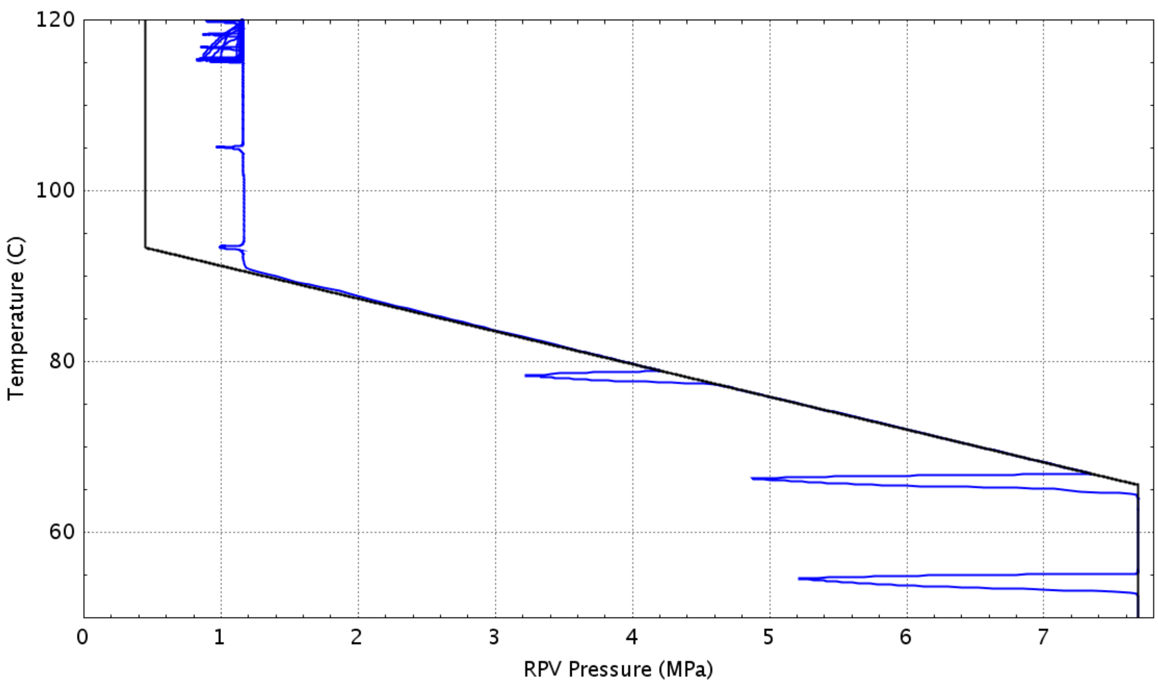

Figure E – 610 Plant status relative to the HCL curve (Graph 4 of the EOPs)

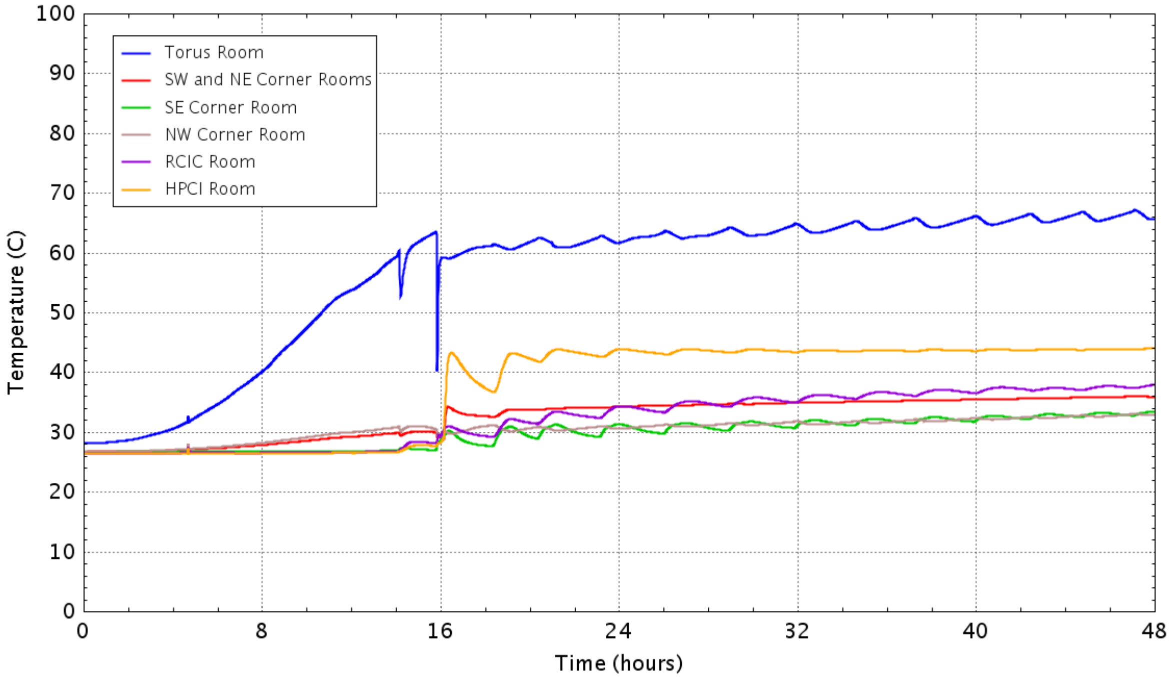

Figure E - 611 **Vapor temperature in the reactor building basement**

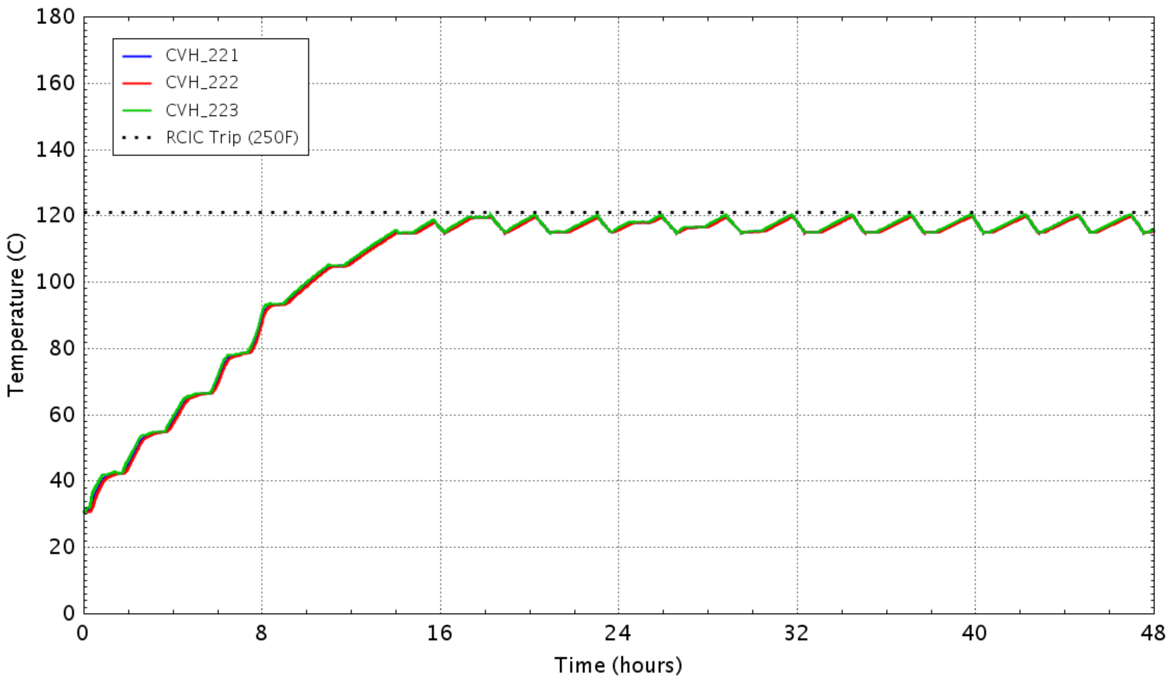

Figure E - 612 **Water temperature in the wetwell**

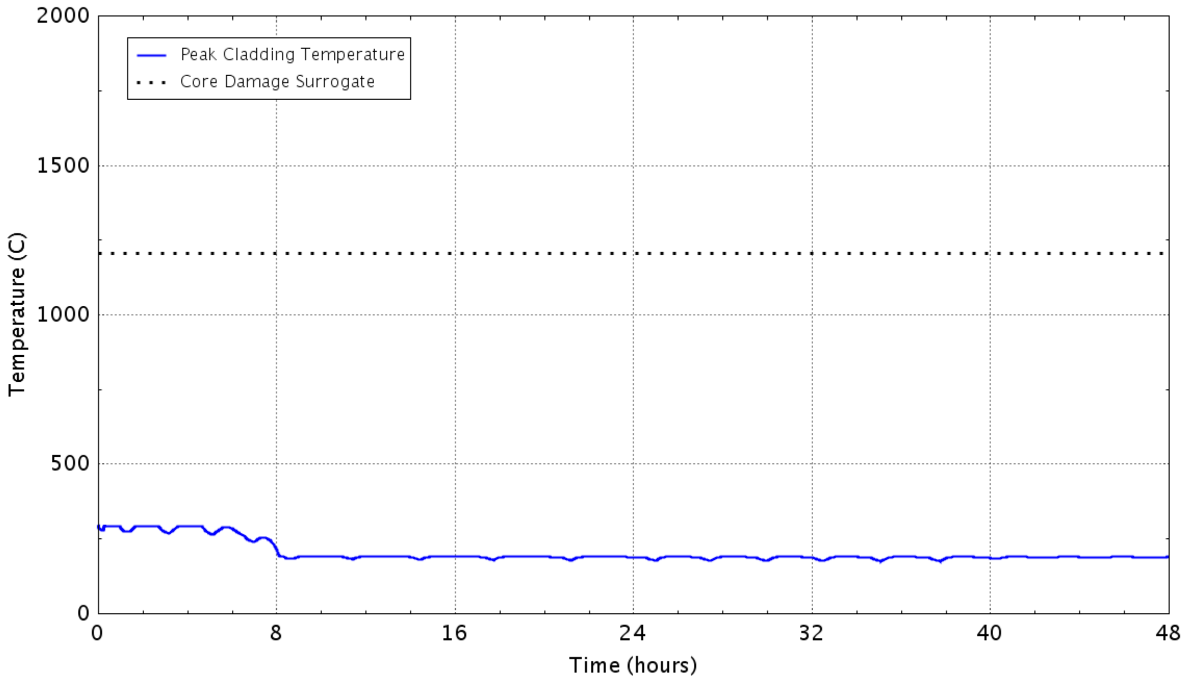

Figure E – 613 Peak temperature of the fuel cladding as a function oftime

E.3.21 Case 17h: Sensitivity to LOMFW-25 Case 17 withRapid RPV Depressurization at HCL

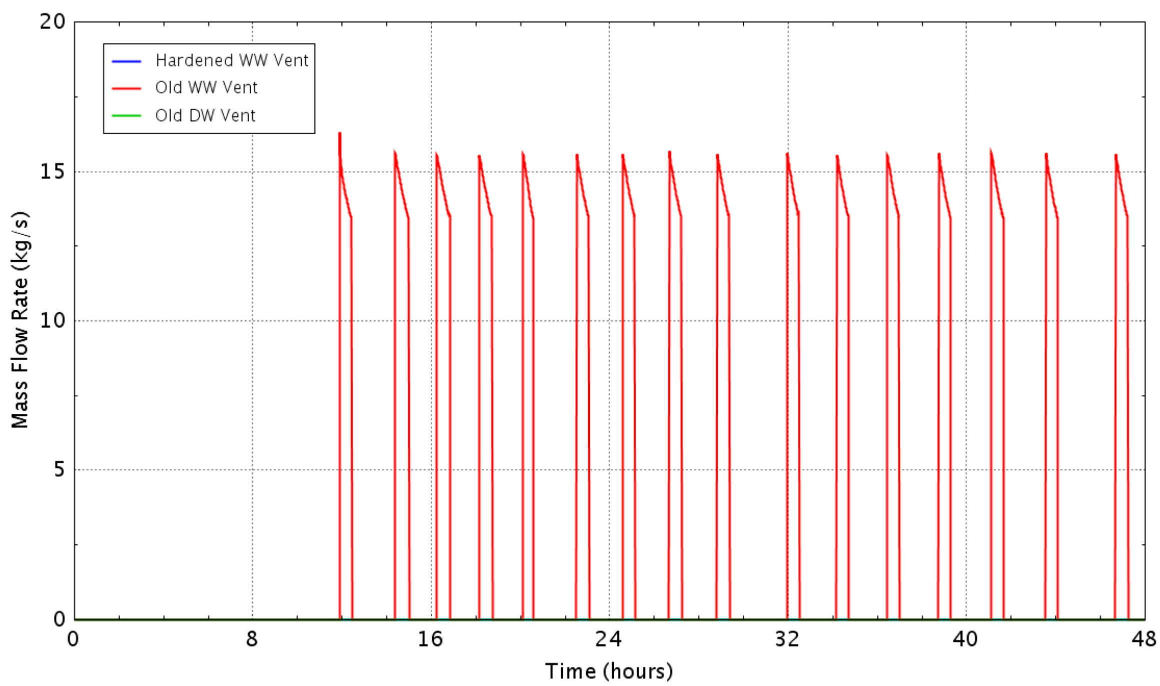

Figure E - 614 Flow rate of the containment vents

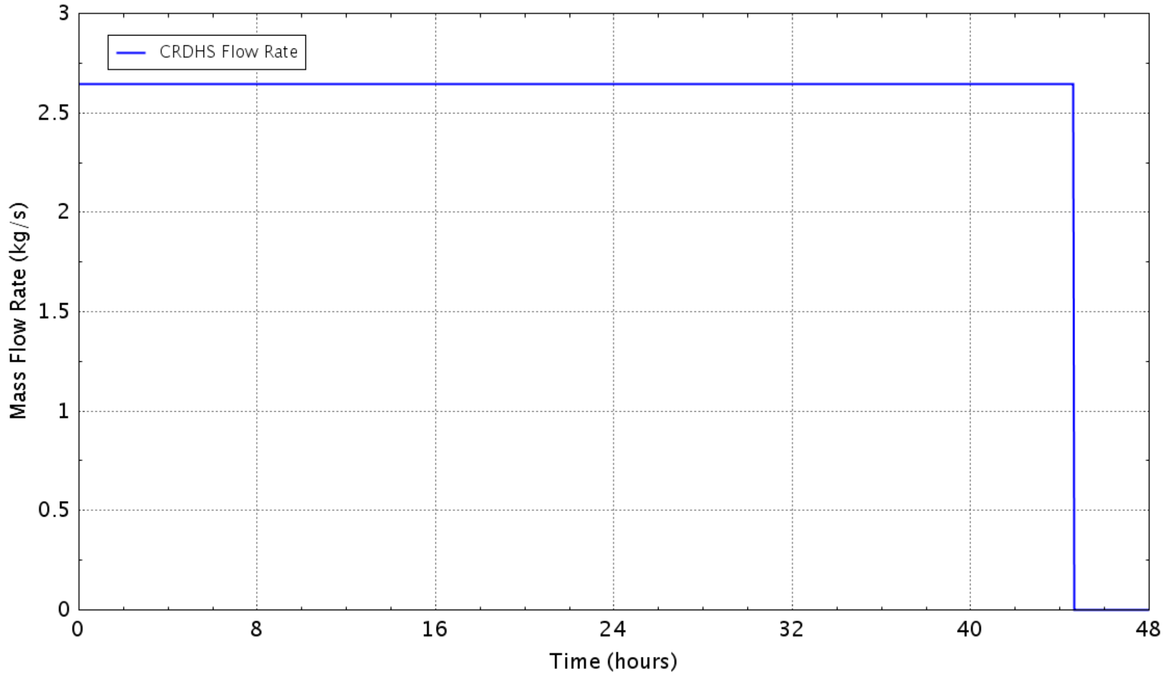

Figure E - 615 Flow rate of the control rod drive hydraulic system

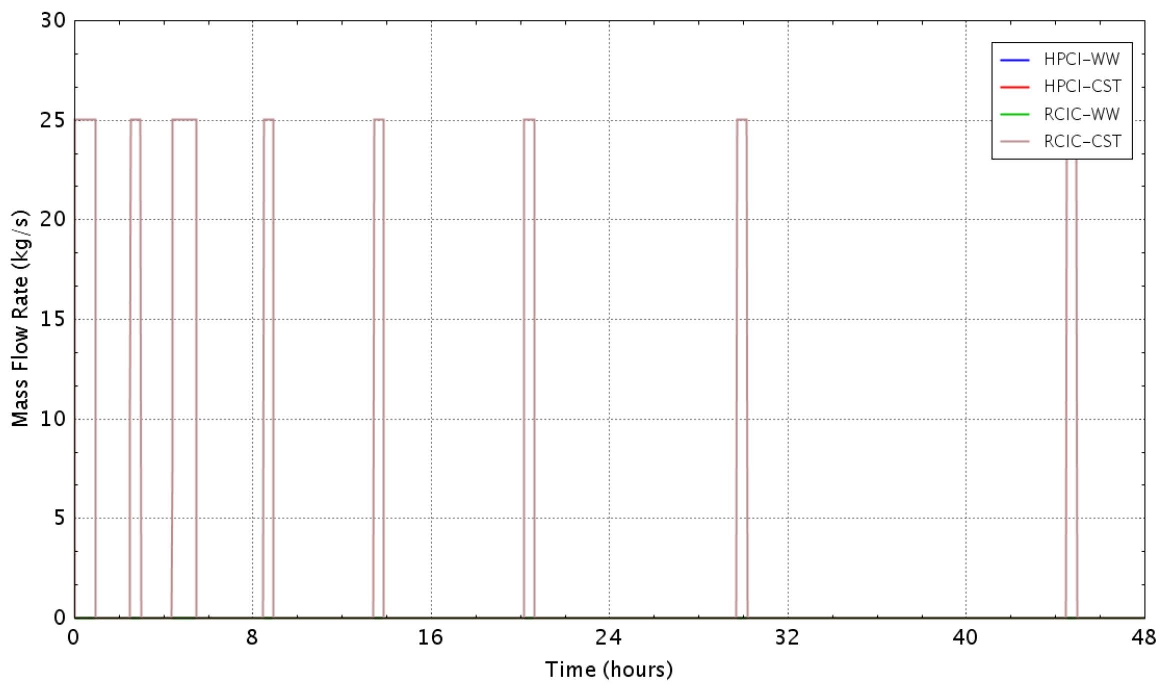

Figure E - 616 Flow rate of the HPCI/RCIC pumps

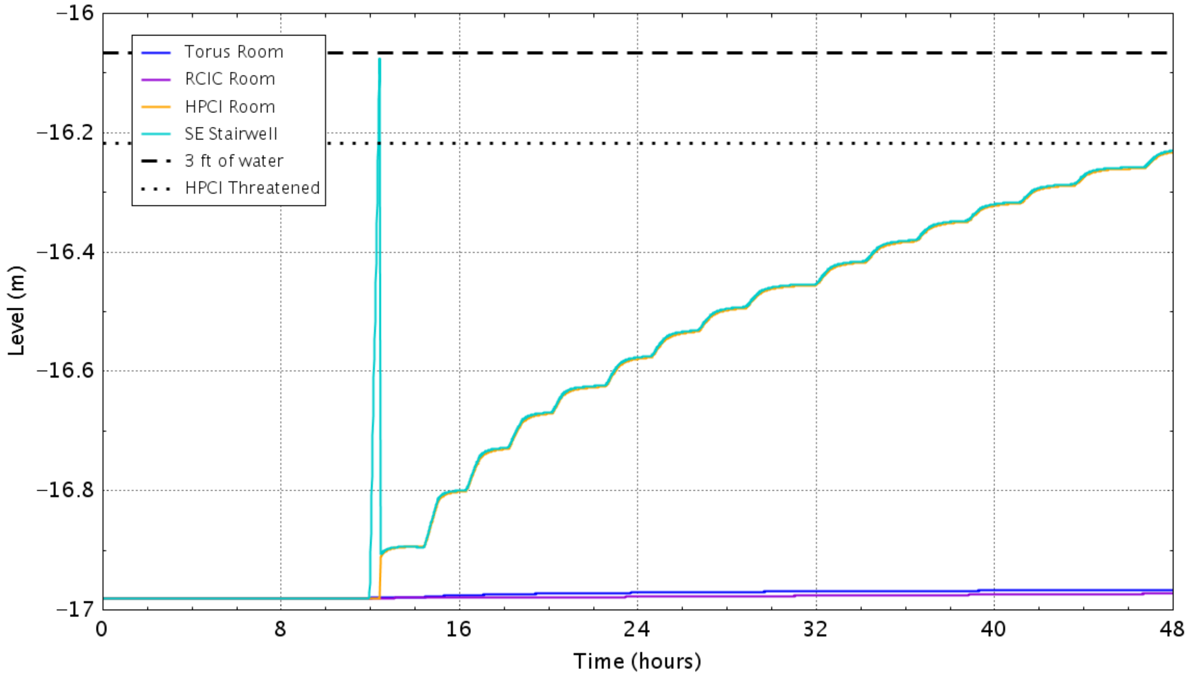

Figure E - 617 Water level in the reactor building basement

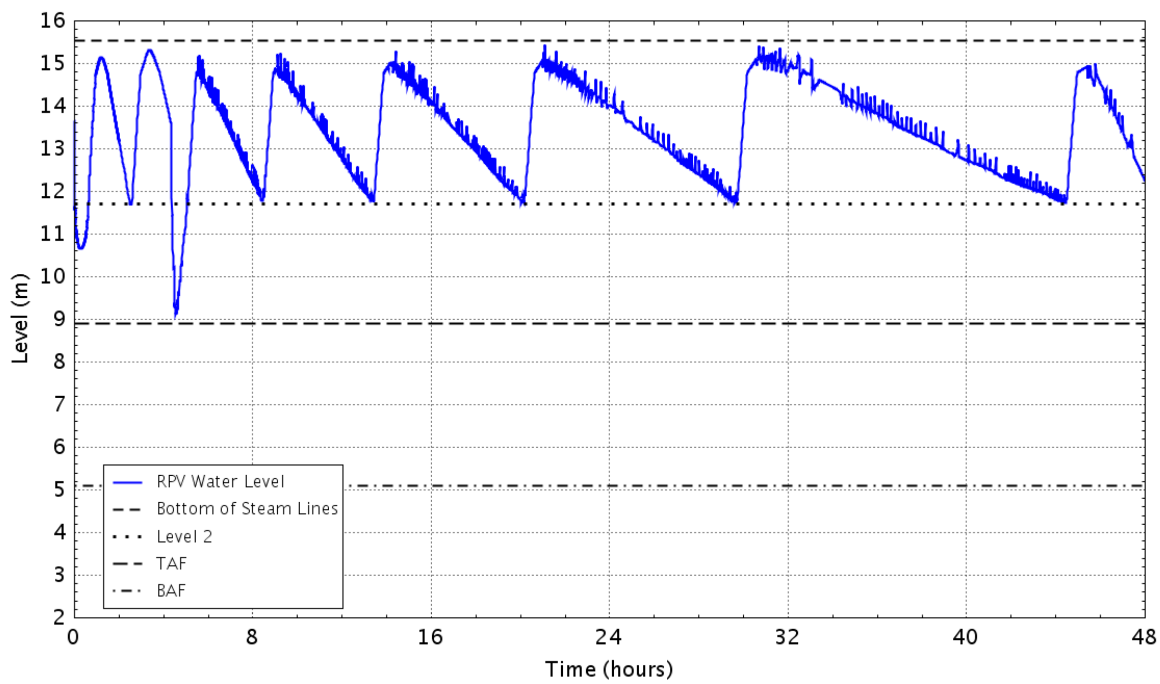

Figure E - 618 RPV down comer water level

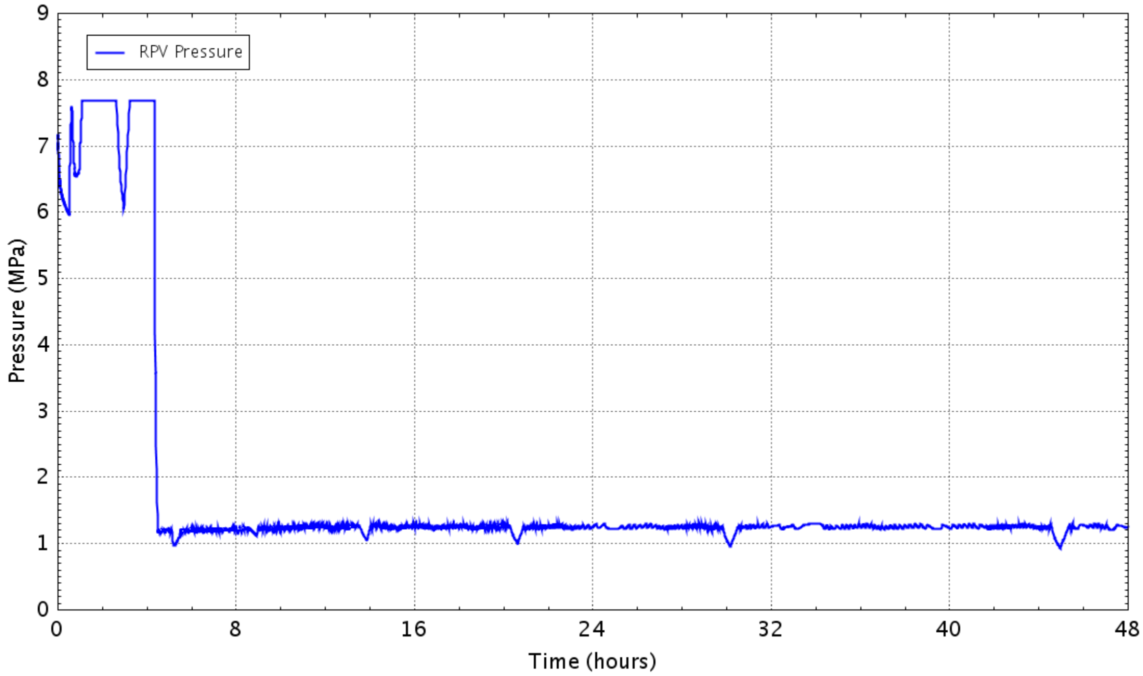

Figure E - 619 Pressure in theRPV

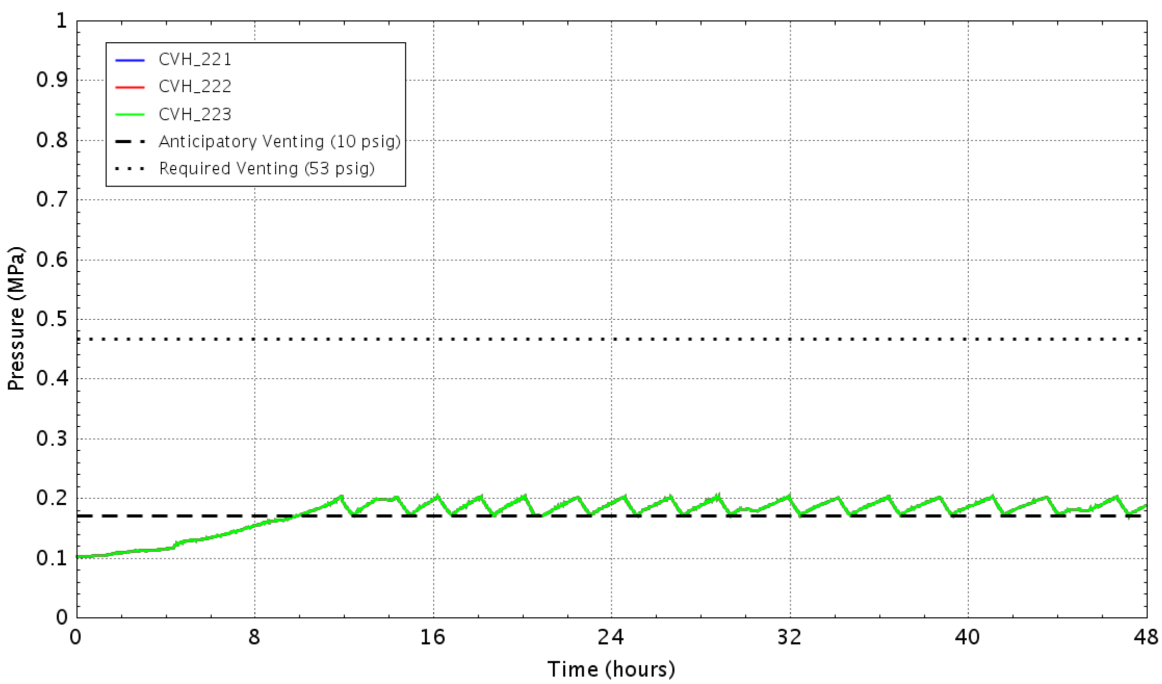

Figure E - 620 Pressure in the wetwell

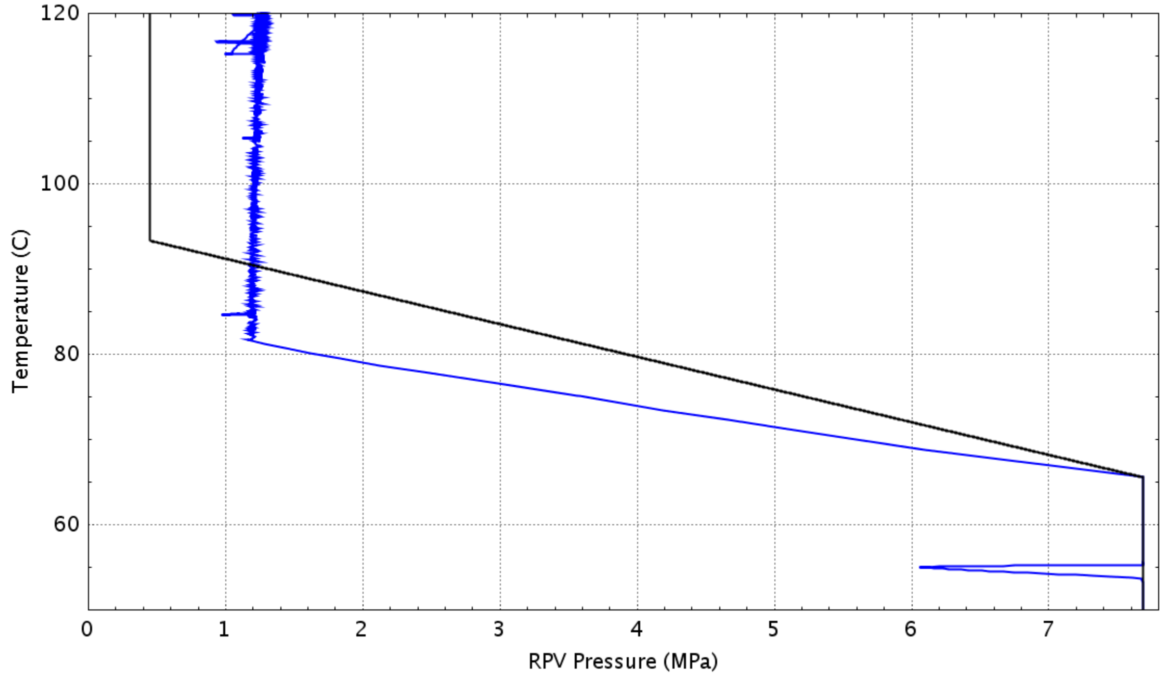

Figure E – 621 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

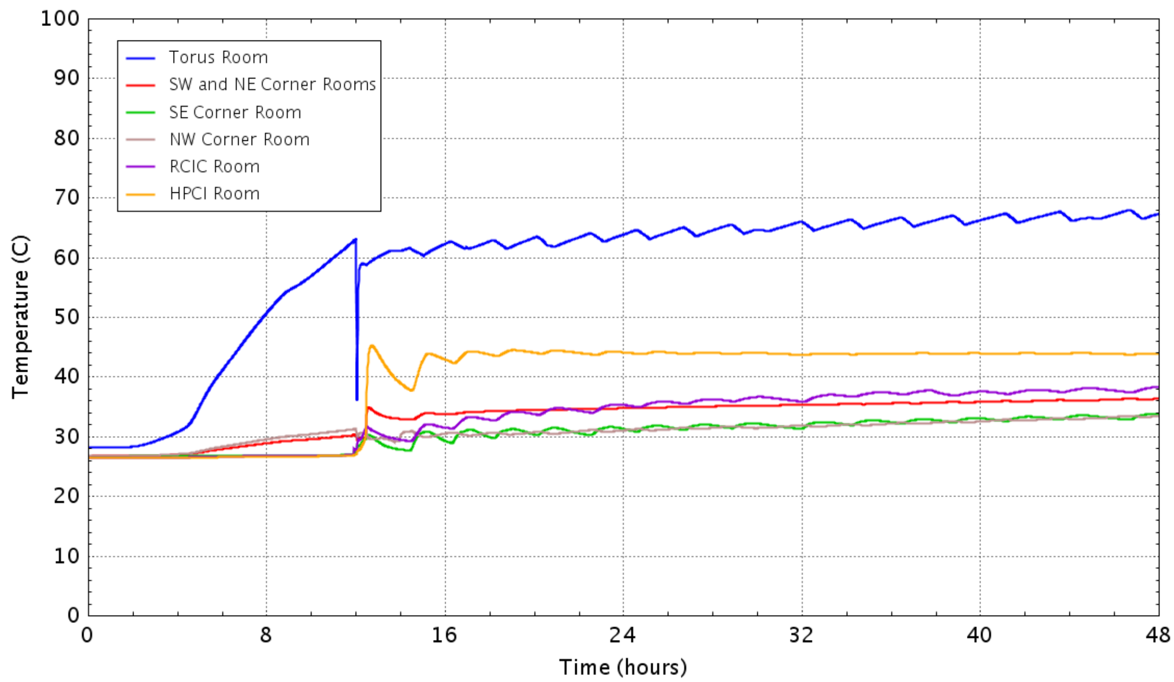

Figure E - 622 **Vapor temperature in the reactor building basement**

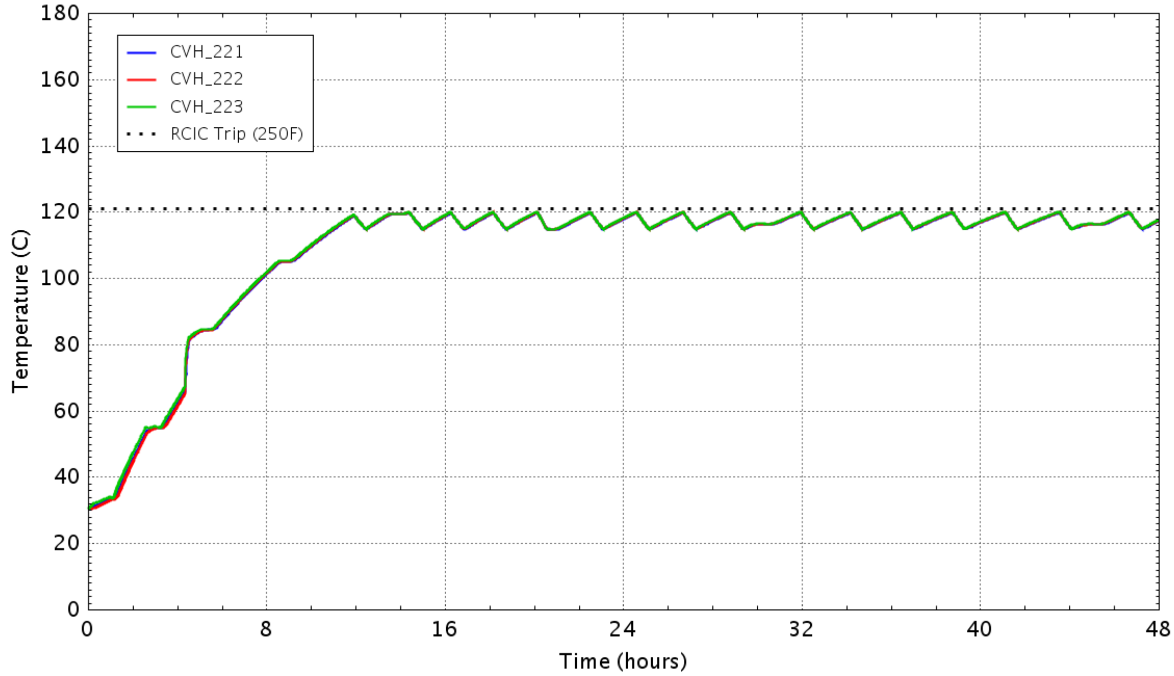

Figure E - 623 **Water temperature in the wetwell**

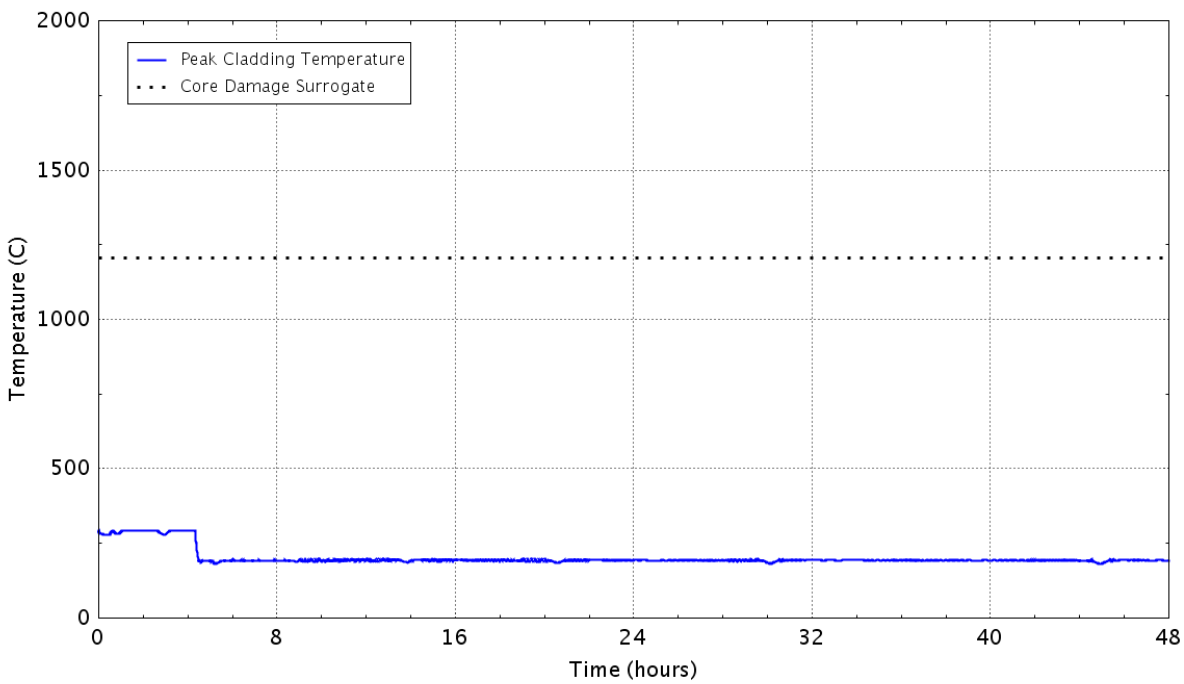

Figure E - 624 **Peak temperature of the fuel cladding as a function of time**

E.3.22 Case 17i: Sensitivity to LOMFW-25 Case 17 with MSIV Closure at the Start of the Transient

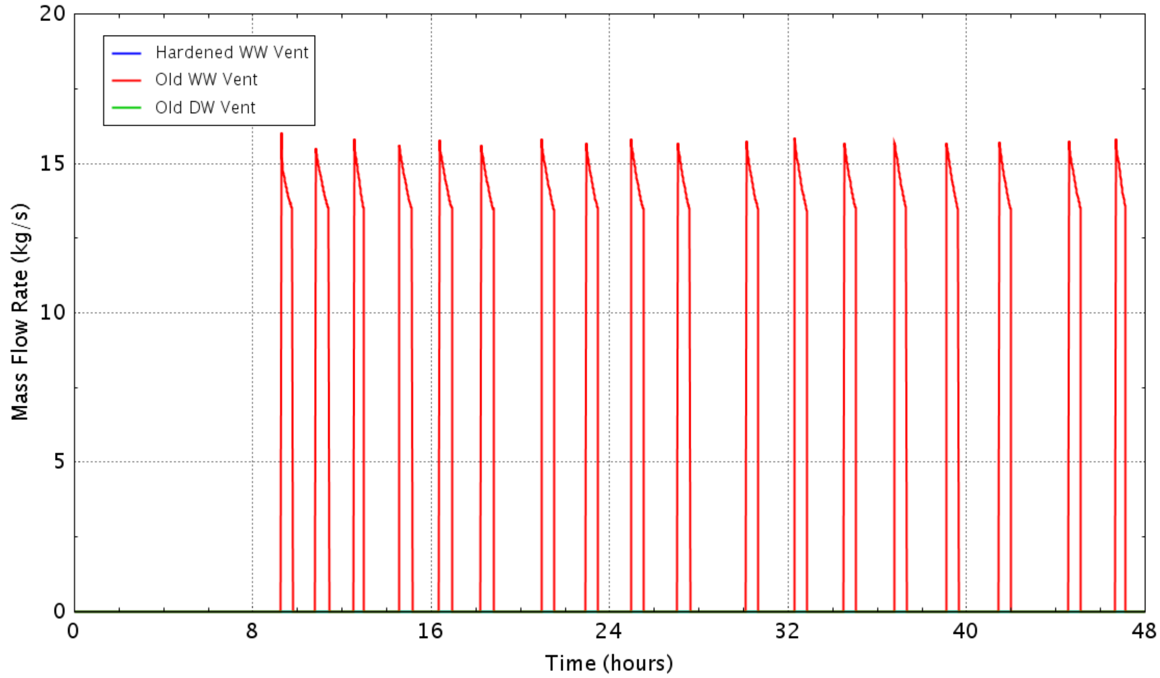

Figure E - 625 Flow rate of the containment vents

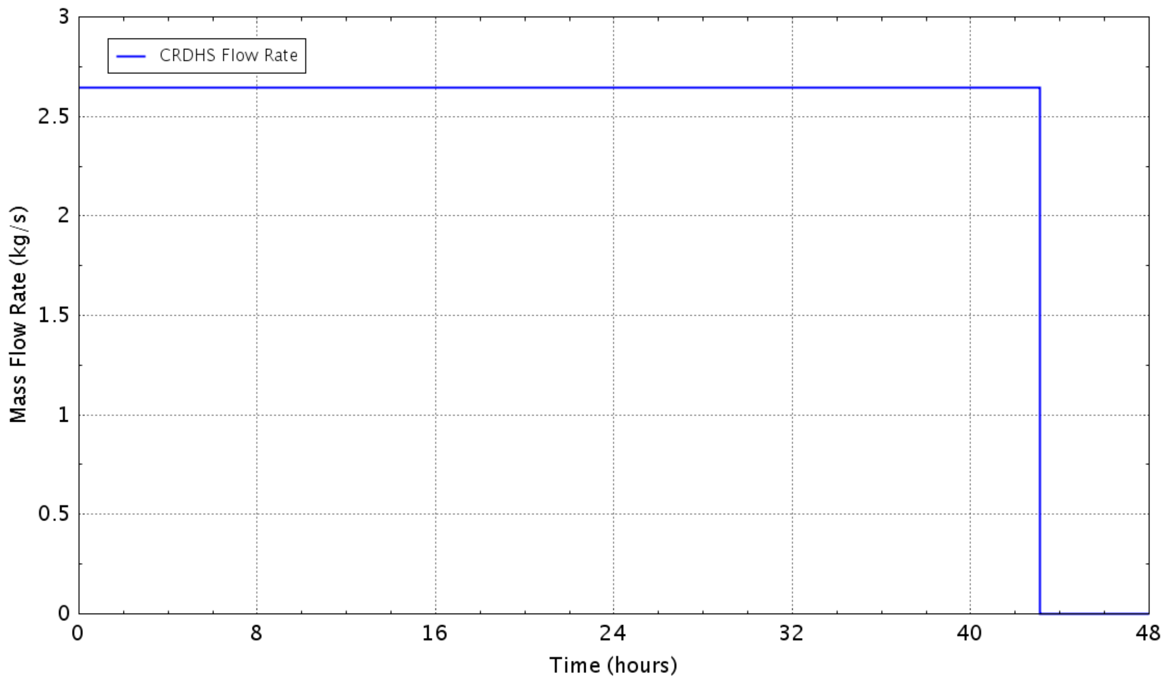

Figure E - 626 Flow rate of the control rod drive hydraulic system

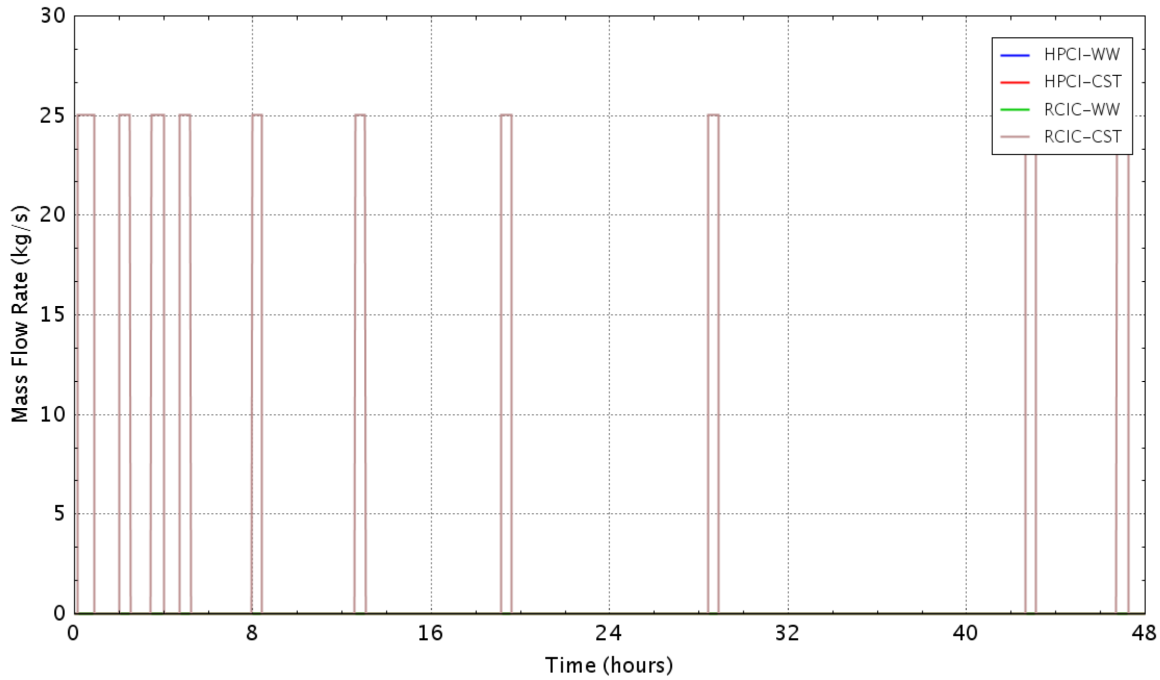

Figure E - 627 Flow rate of the HPCI/RCIC pumps

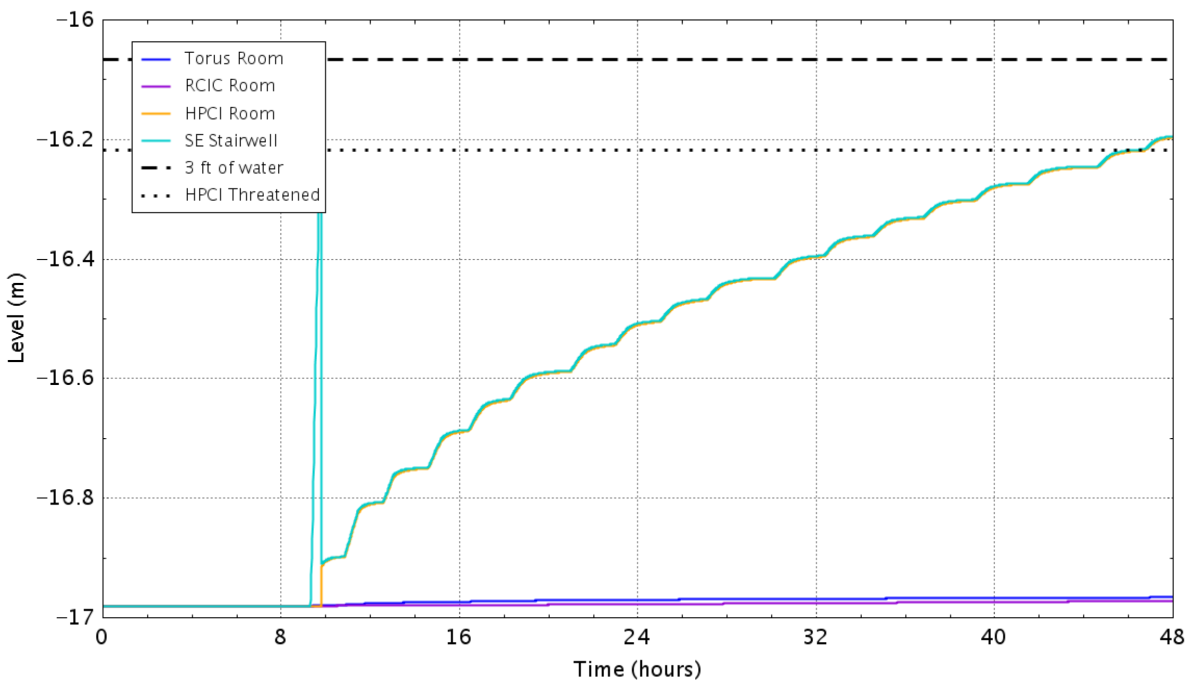

Figure E - 628 Water level in the reactor building basement

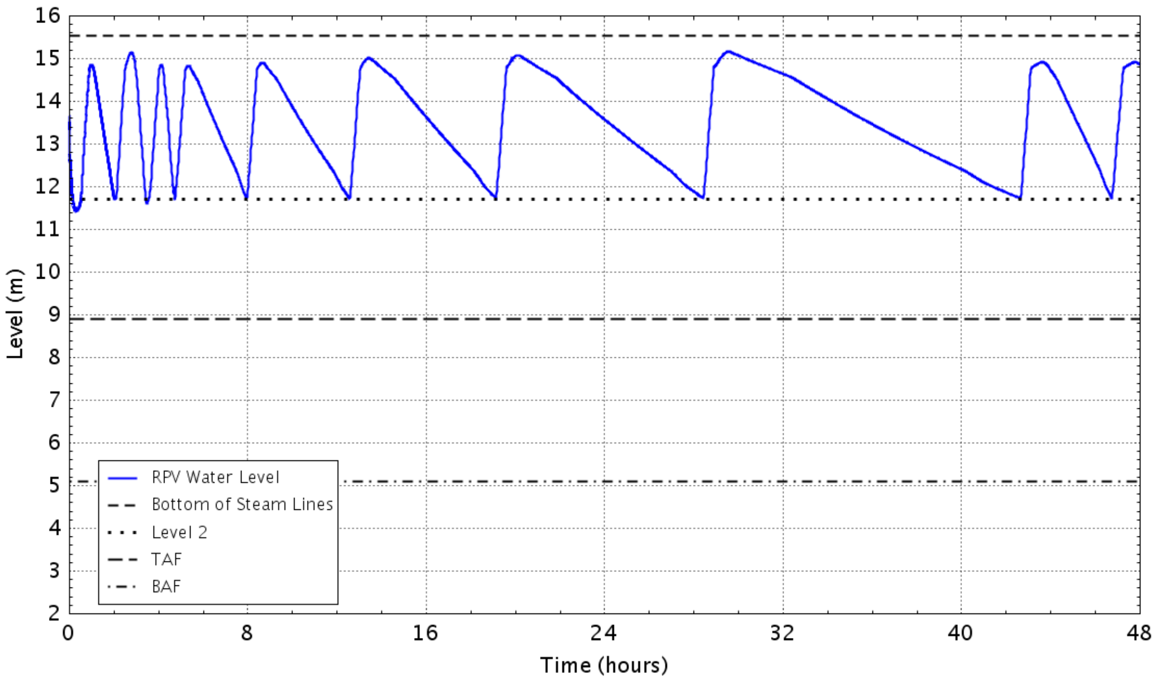

Figure E - 629 RPV down comer water level

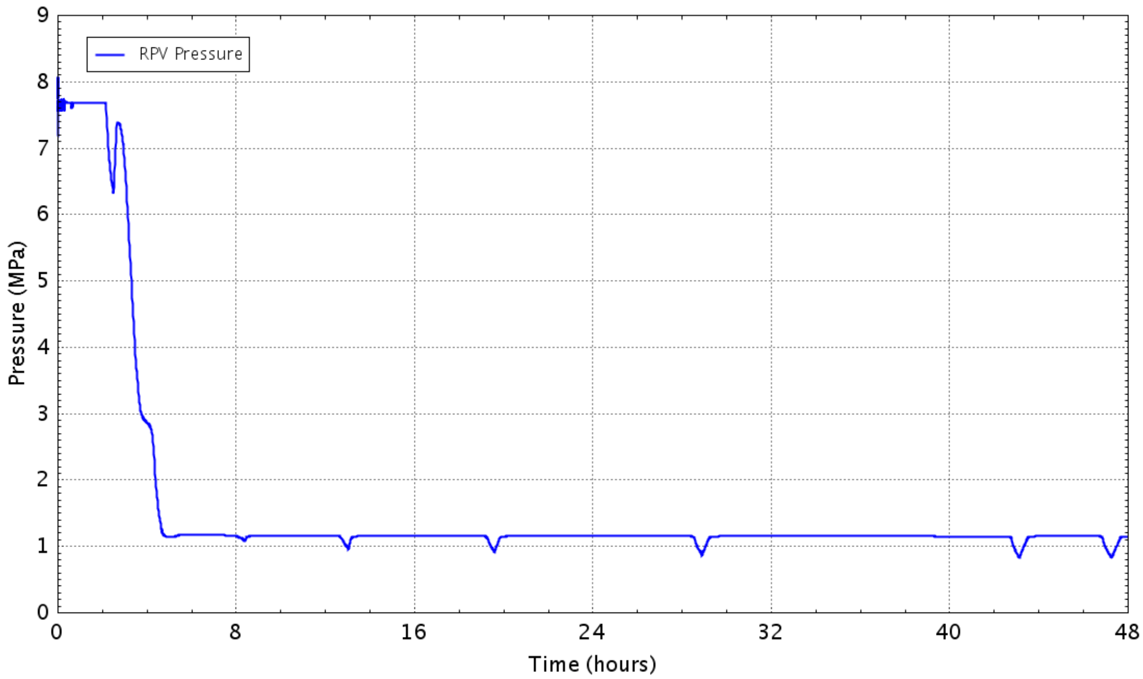

Figure E - 630 Pressure in theRPV

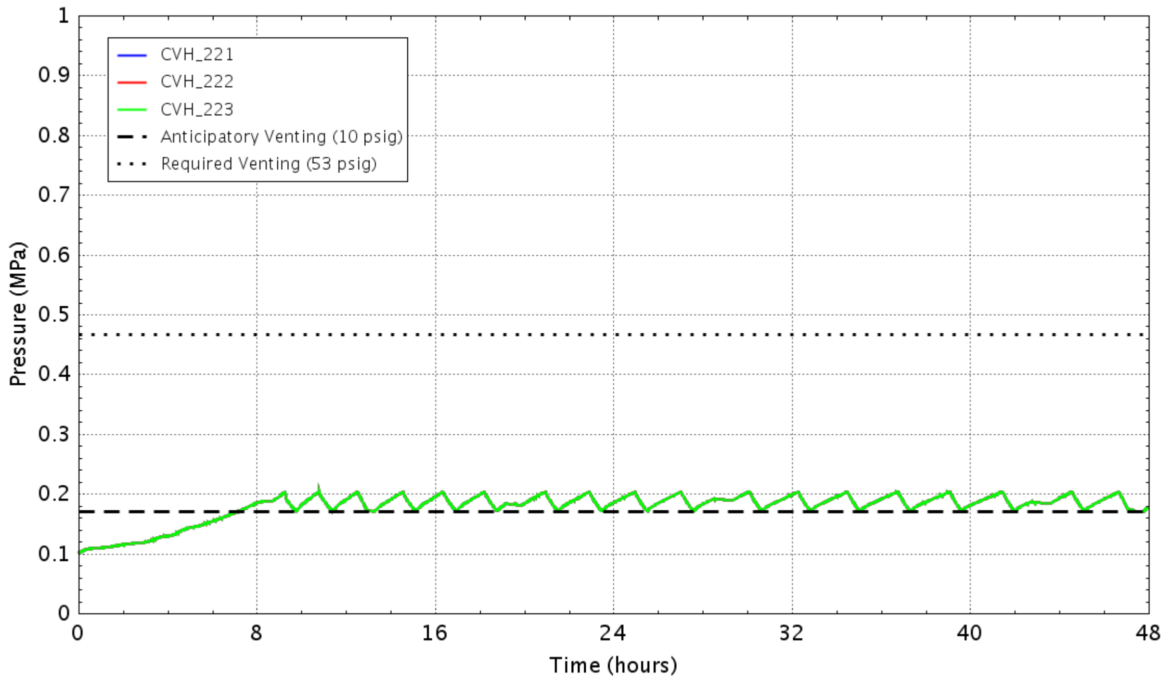

Figure E - 631 Pressure in the wetwell

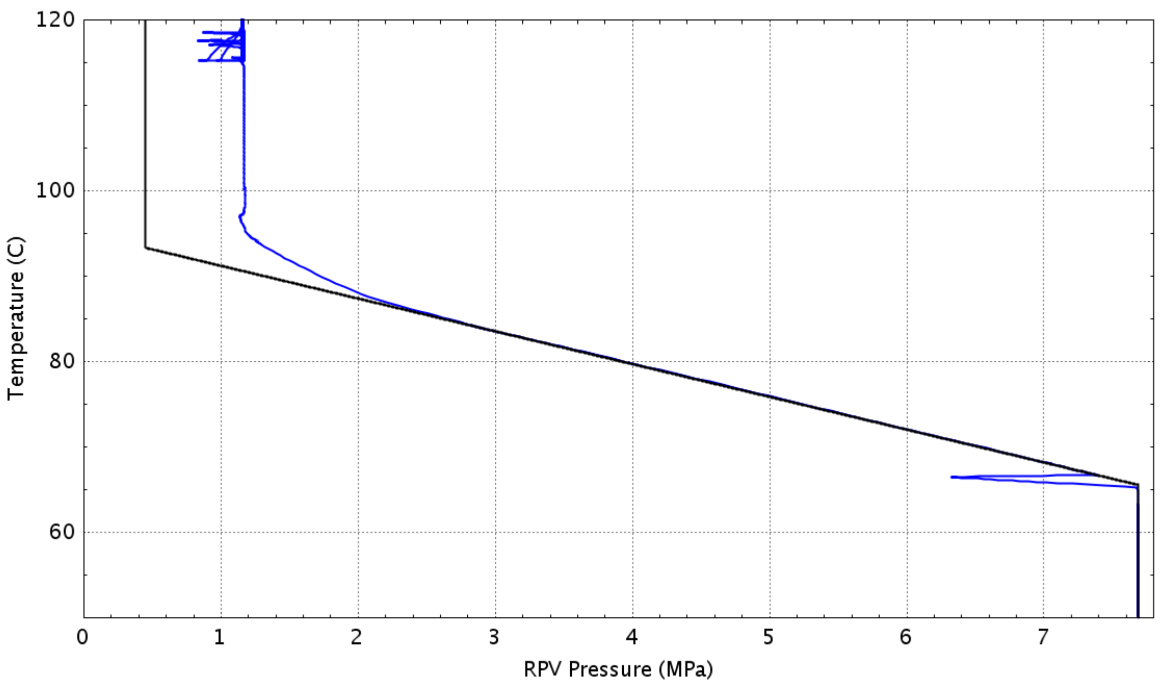

Figure E – 632 Plant status relative to the HCL curve (Graph 4 of the EOPs)

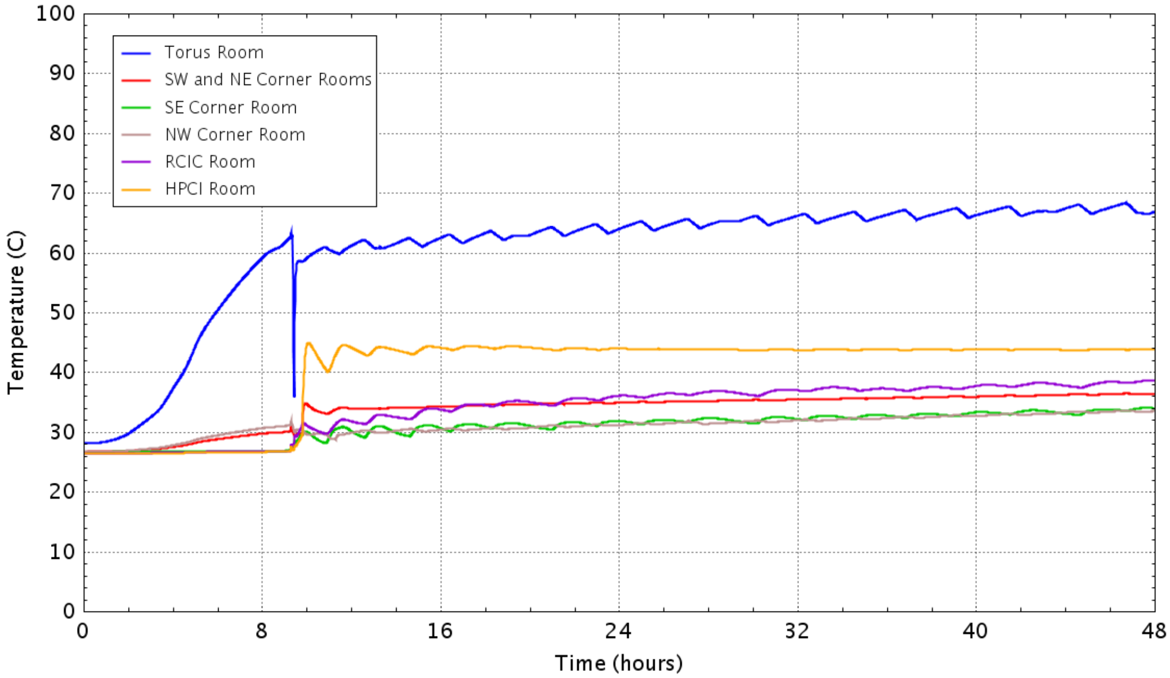

Figure E - 633 **Vapor temperature in the reactor building basement**

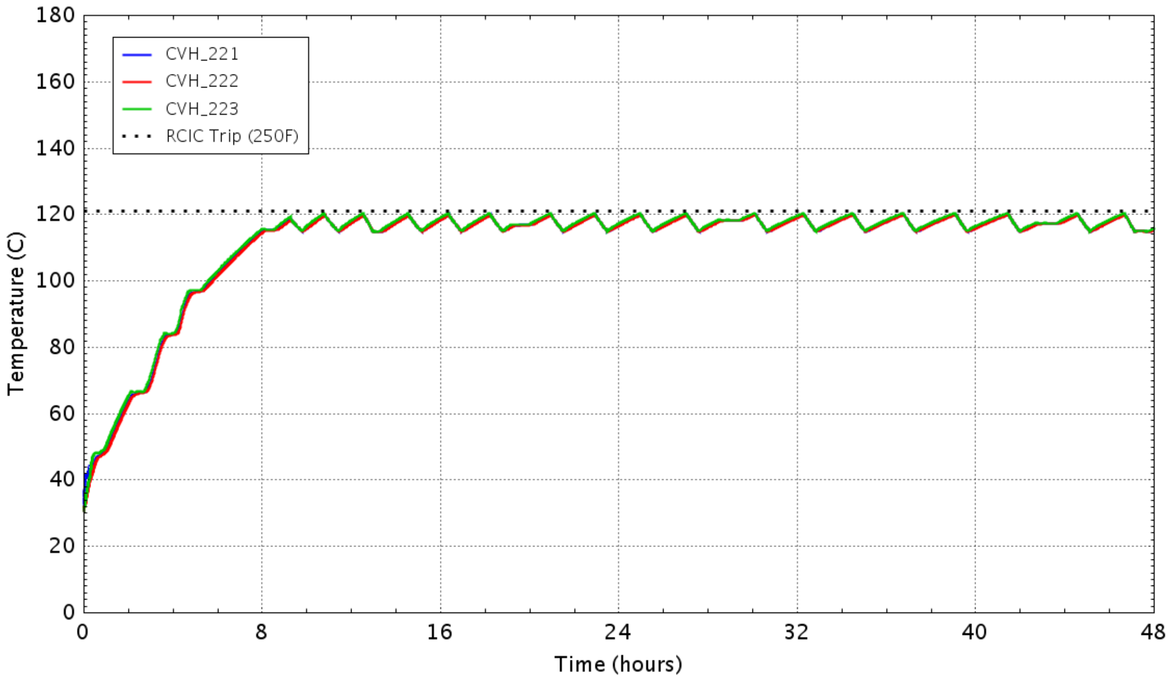

Figure E - 634 **Water temperature in the wetwell**

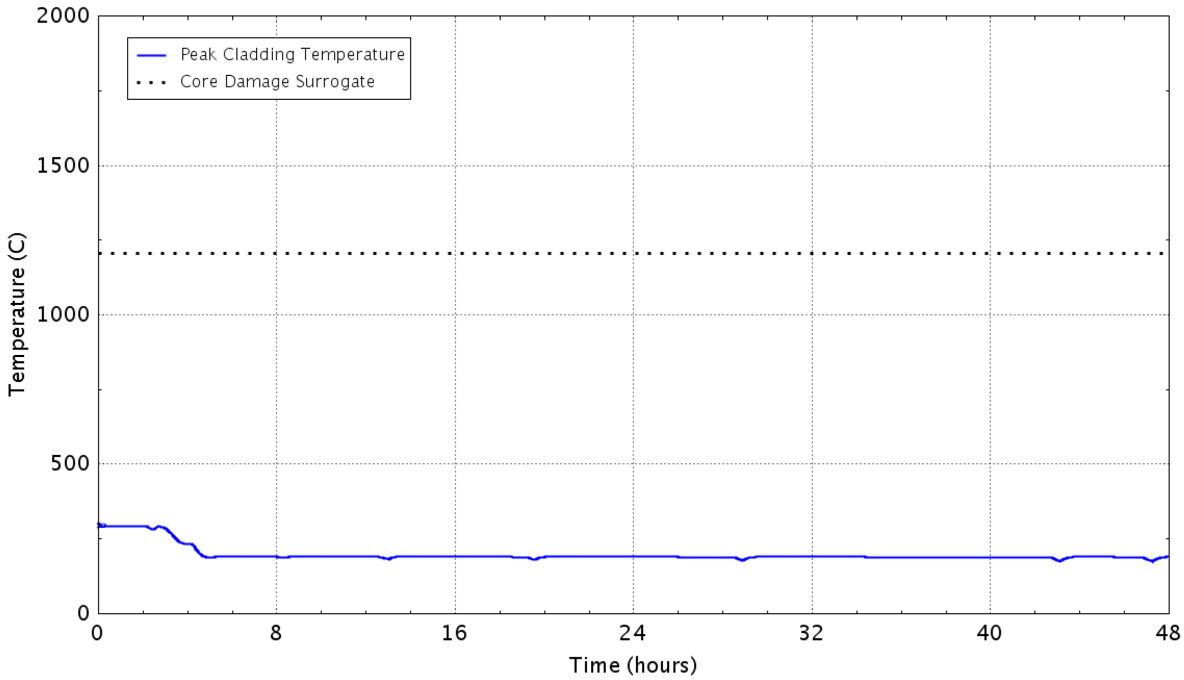

Figure E - 635 Peak temperature of the fuel cladding as a function of time

E.3.23 Case 19a: Sensitivity to LOMFW-25 Case 19 with NominalSeal Leakage

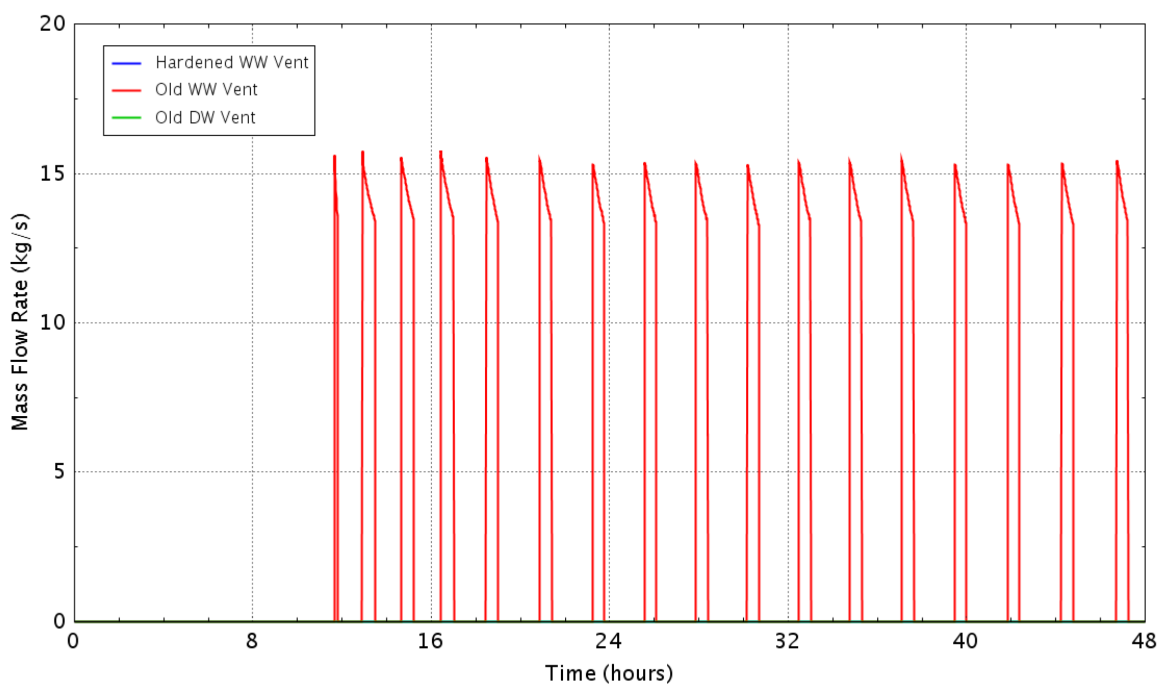

Figure E - 636 Flow rate of the containment vents

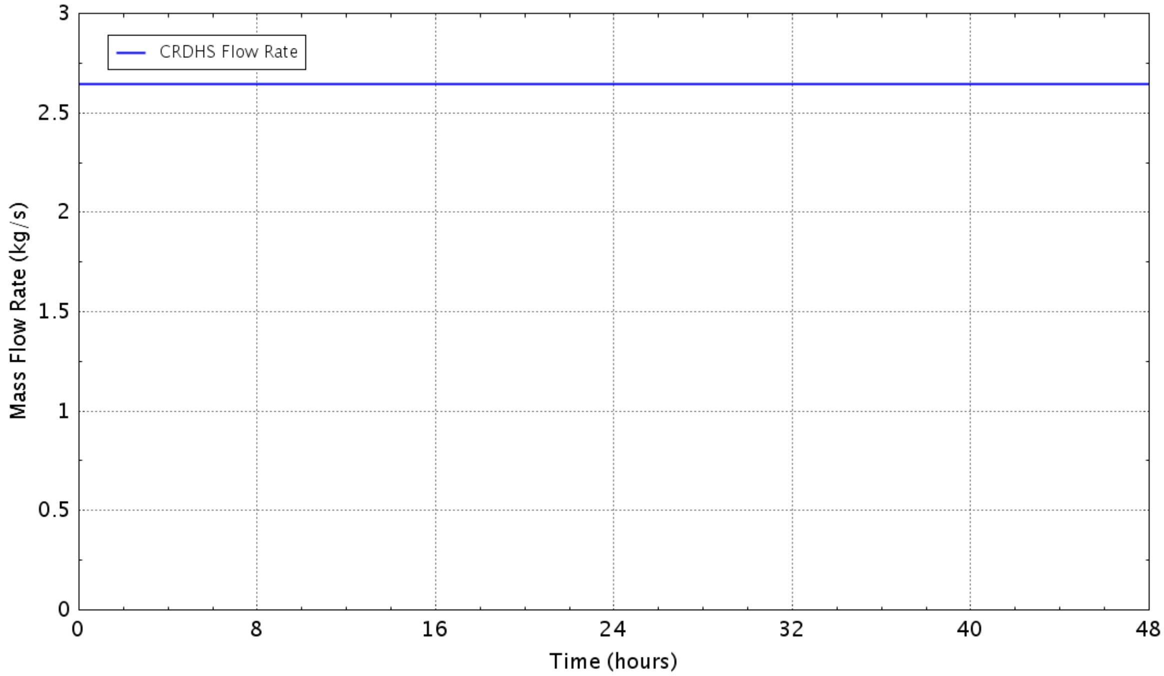

Figure E - 637 **Flow rate of the control rod drive hydraulic system**

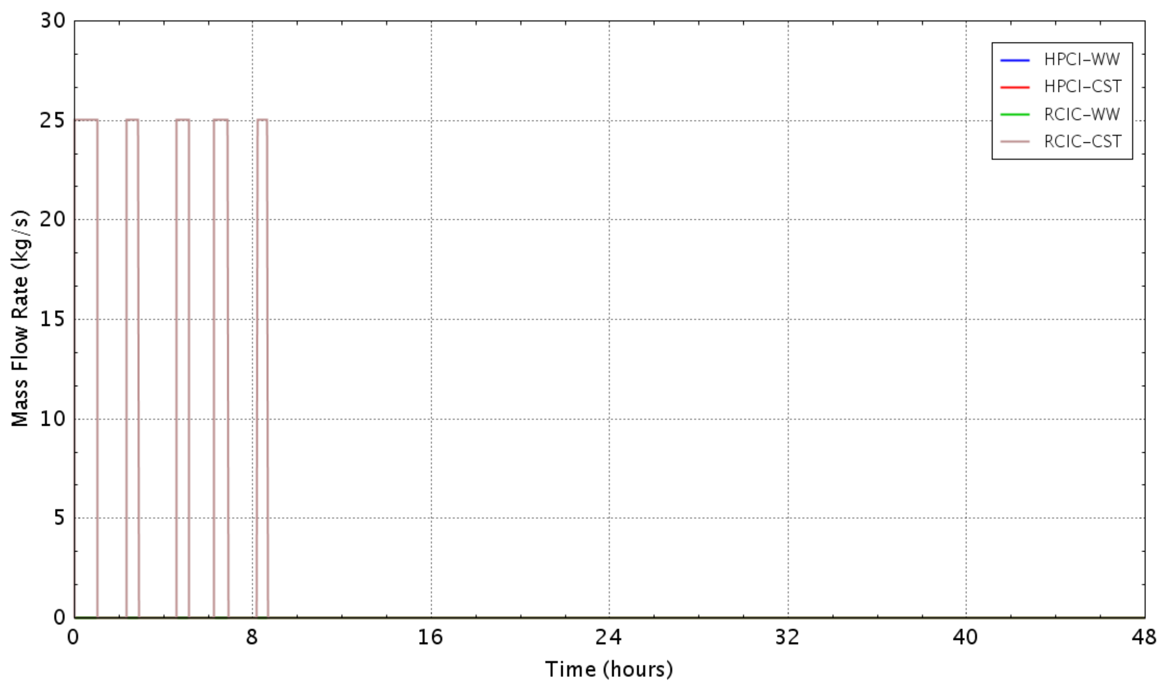

Figure E - 638 **Flow rate of the HPCI/RCIC pumps**

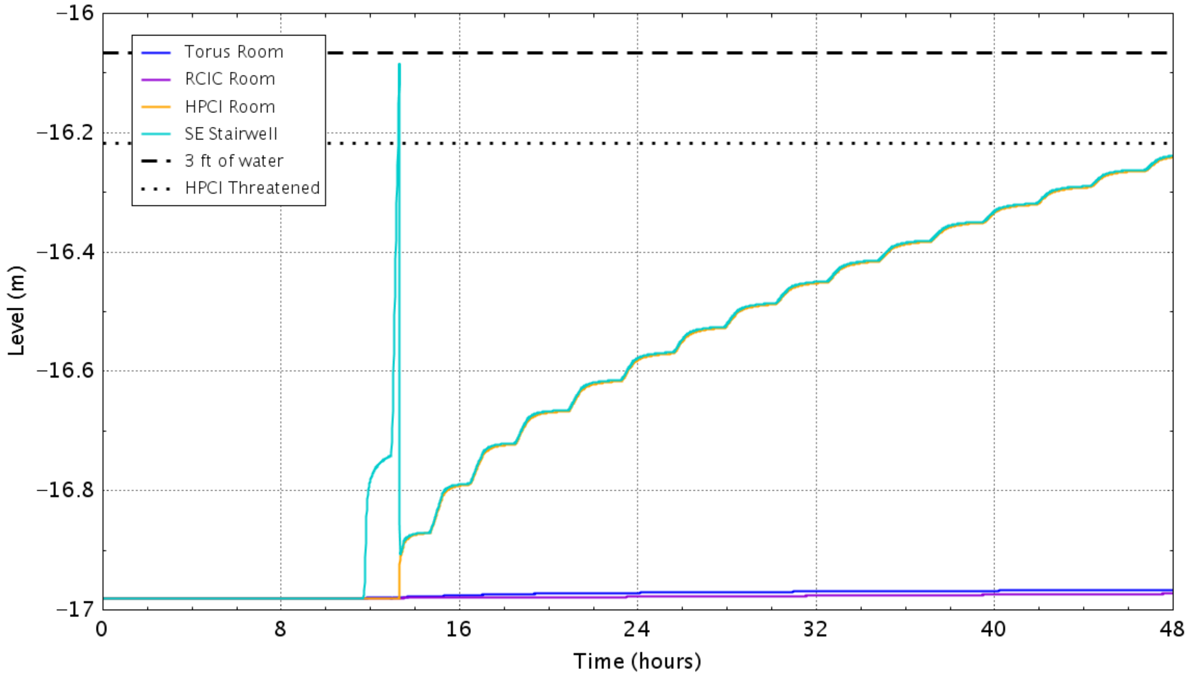

Figure E - 639 **Water level in the reactor building basement**

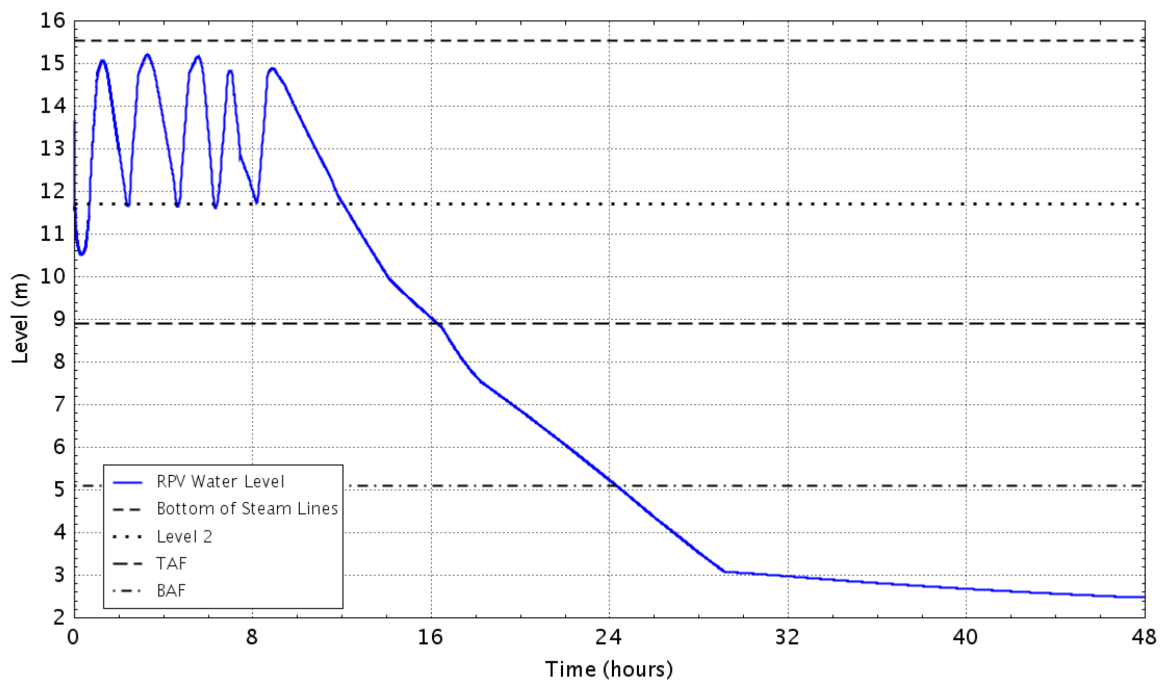

Figure E - 640 **RPV down comer water level**

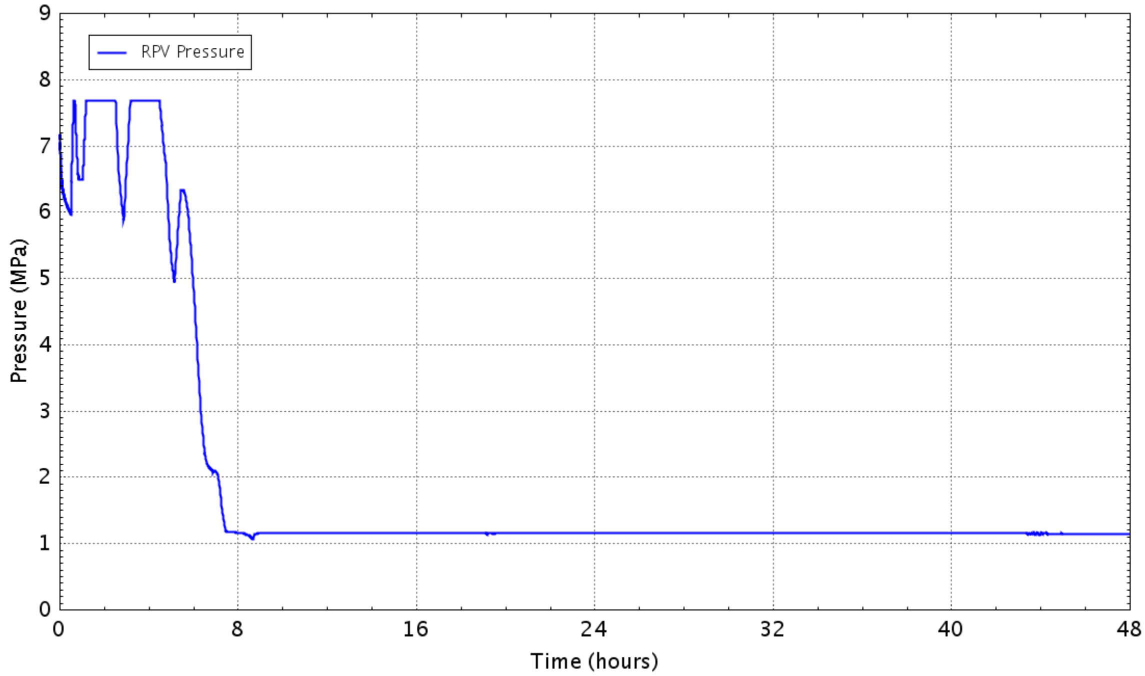

Figure E - 641 **Pressure in theRPV**

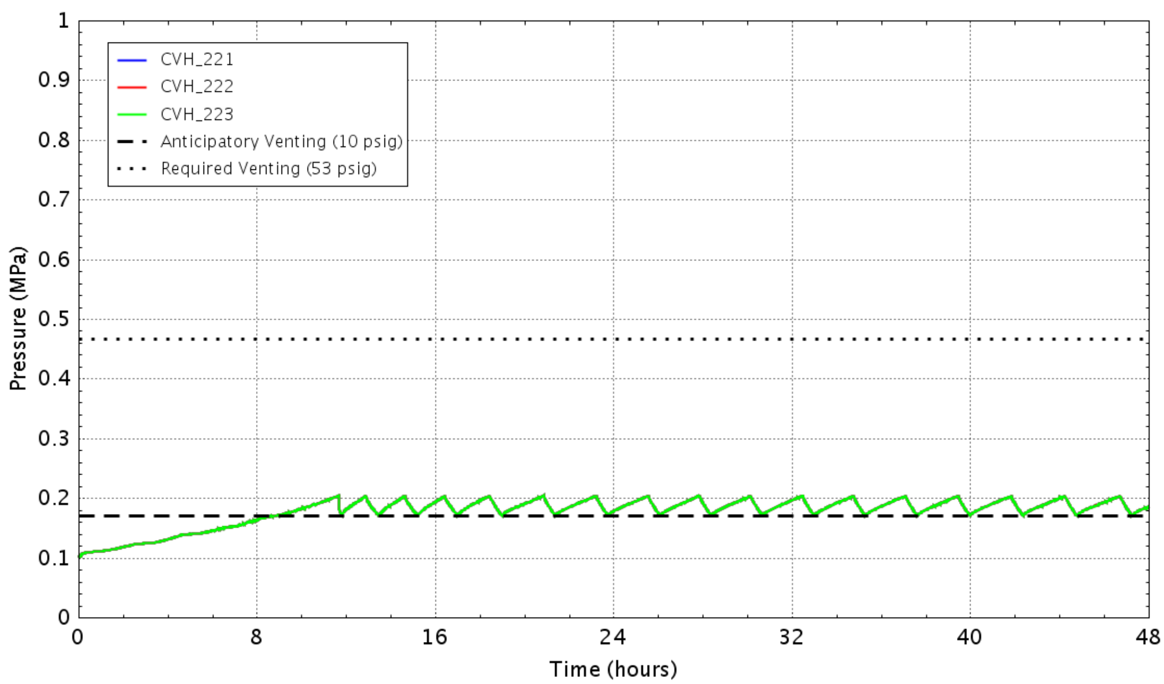

Figure E - 642 **Pressure in the wetwell**

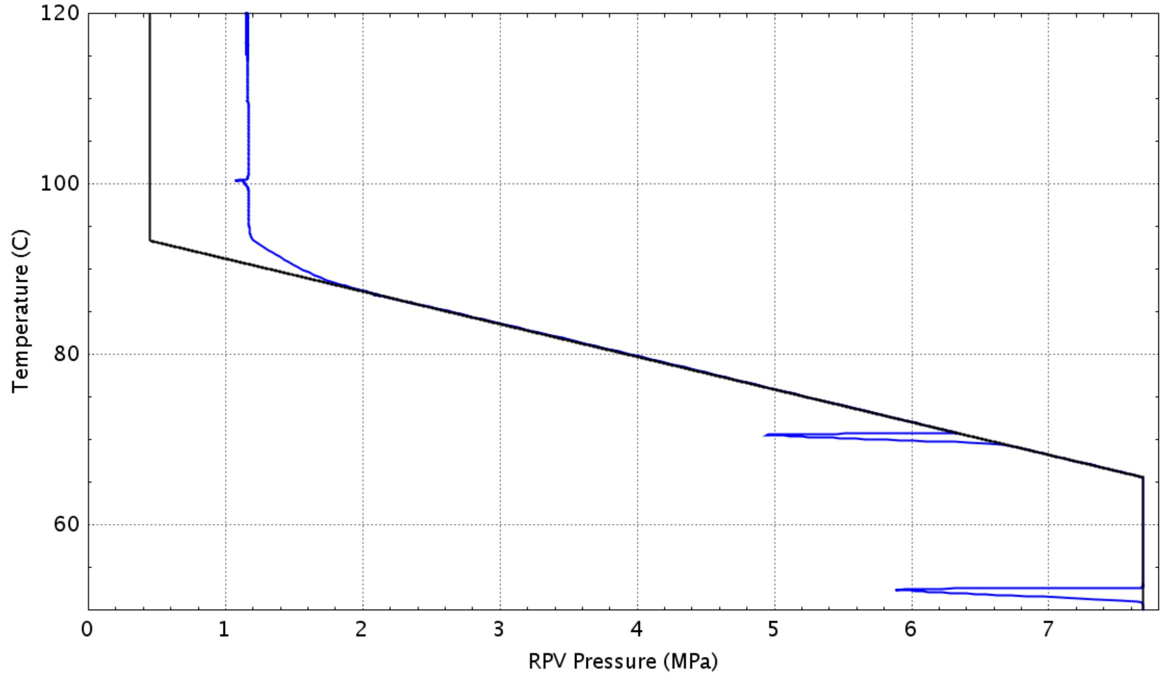

Figure E – 643 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

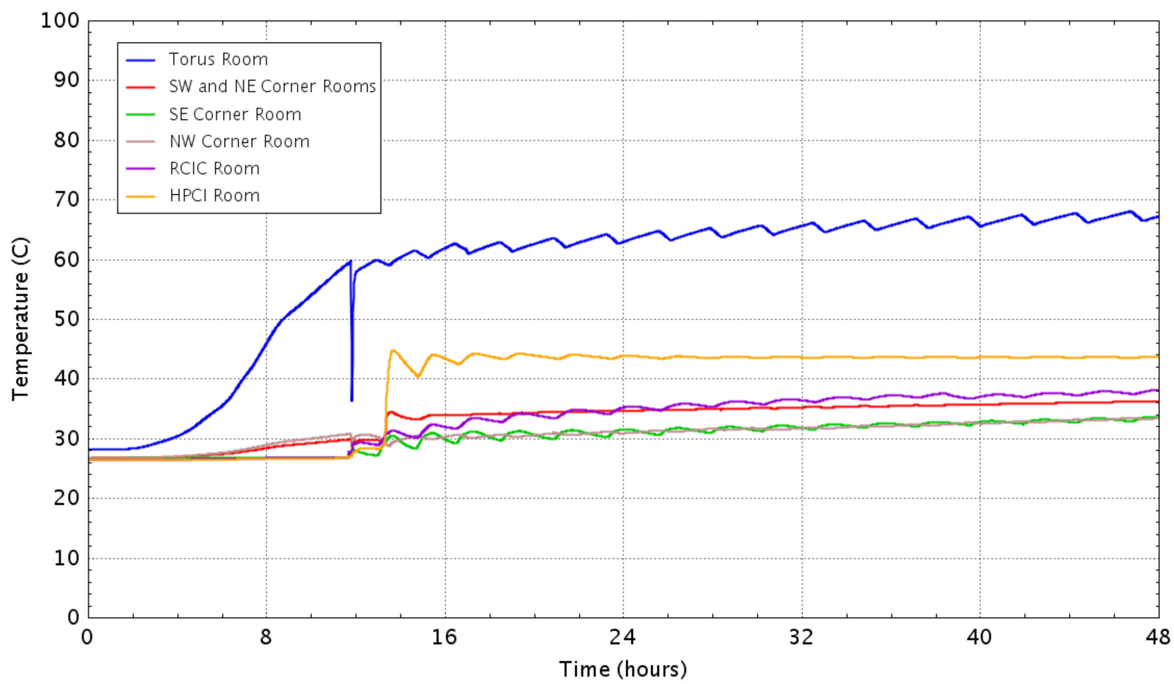

Figure E - 644 **Vapor temperature in the reactor building basement**

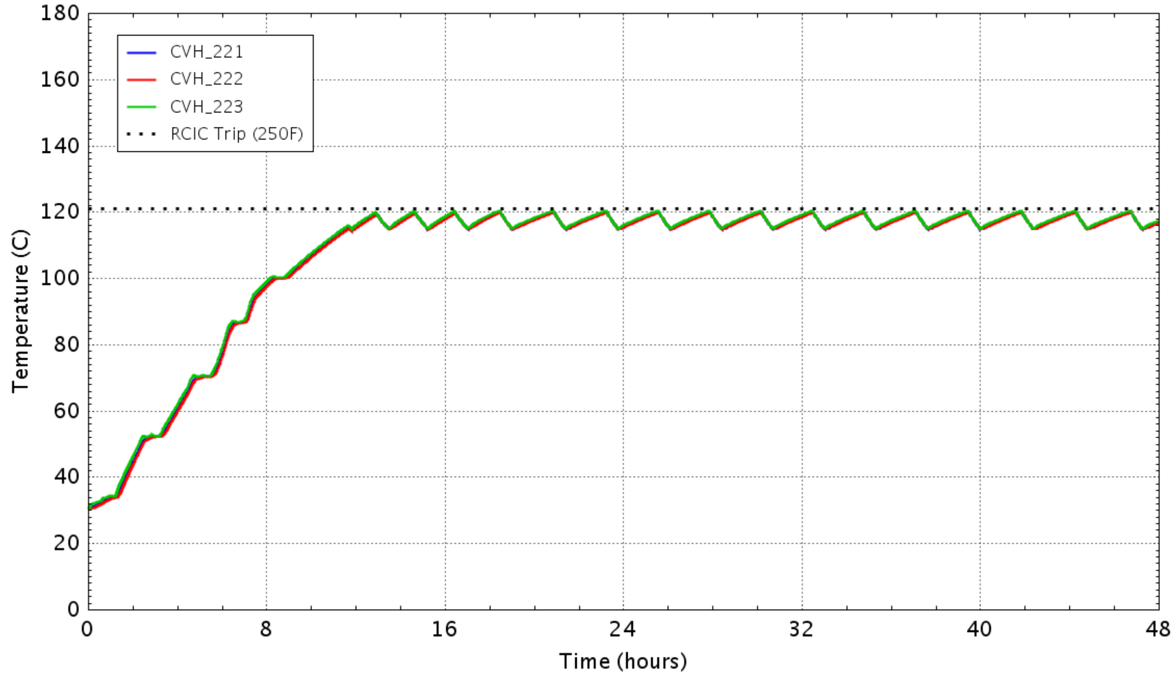

Figure E - 645 **Water temperature in the wetwell**

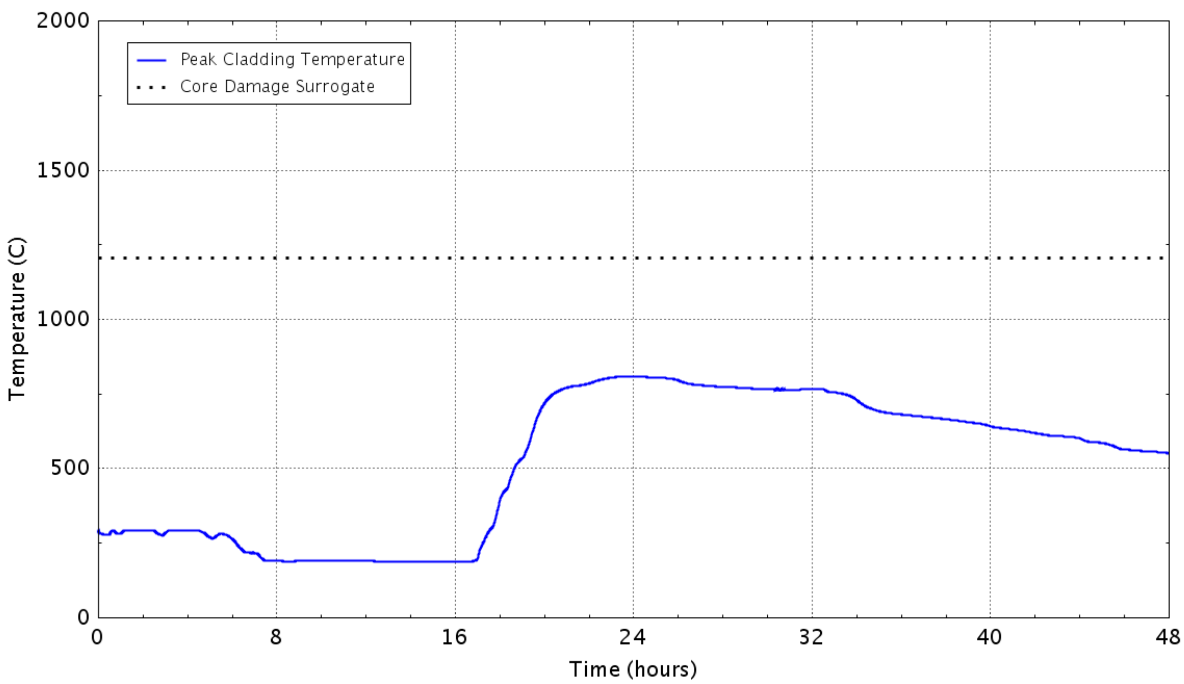

Figure E - 646 **Peak temperature of the fuel cladding as a function of time**

E.3.24 Case 19b: Sensitivity to LOMFW-25 Case 19 with CRDHS Unavailable

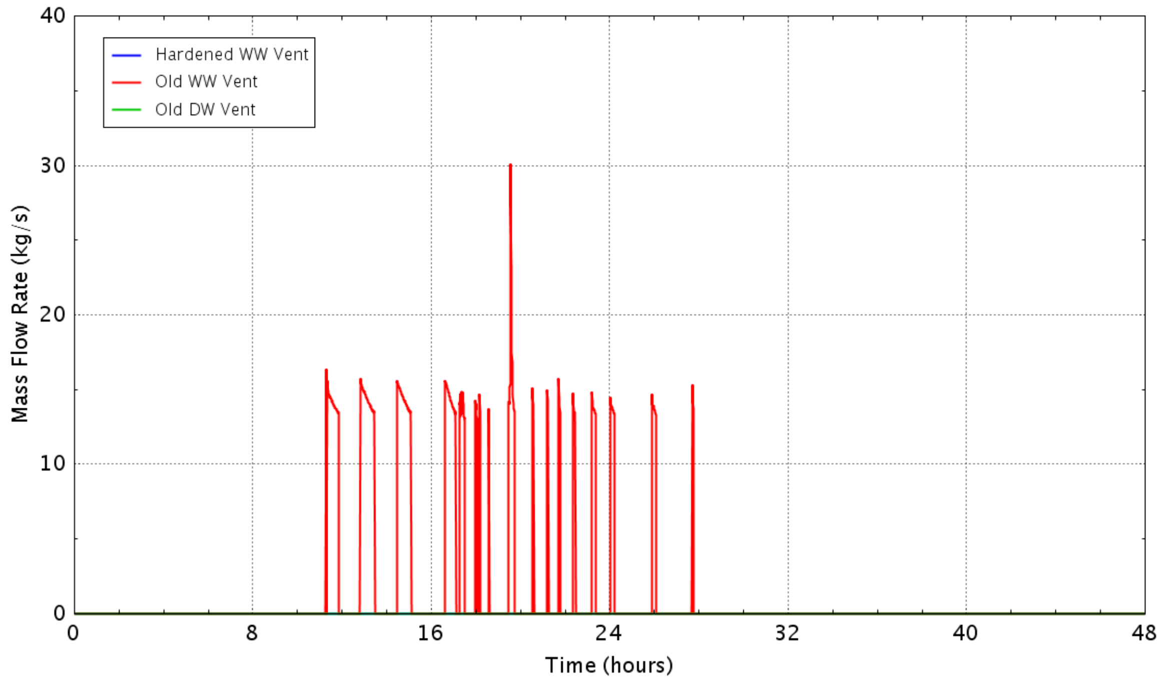

Figure E - 647 Flow rate of the containment vents

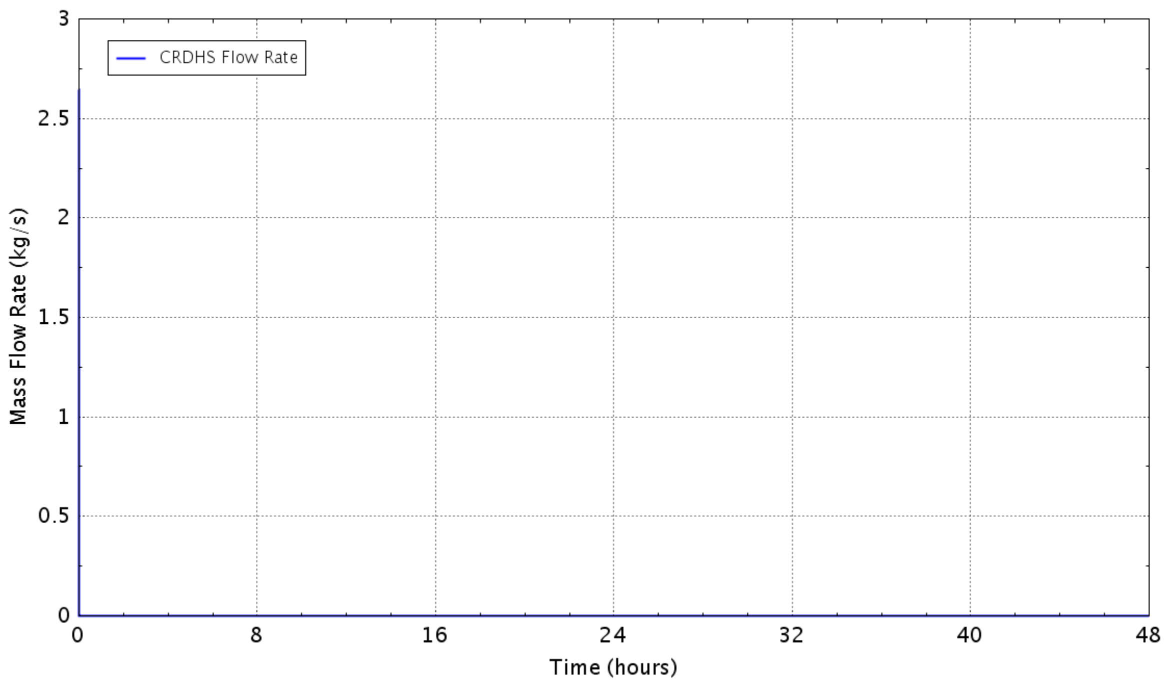

Figure E - 648 Flow rate of the control rod drive hydraulic system

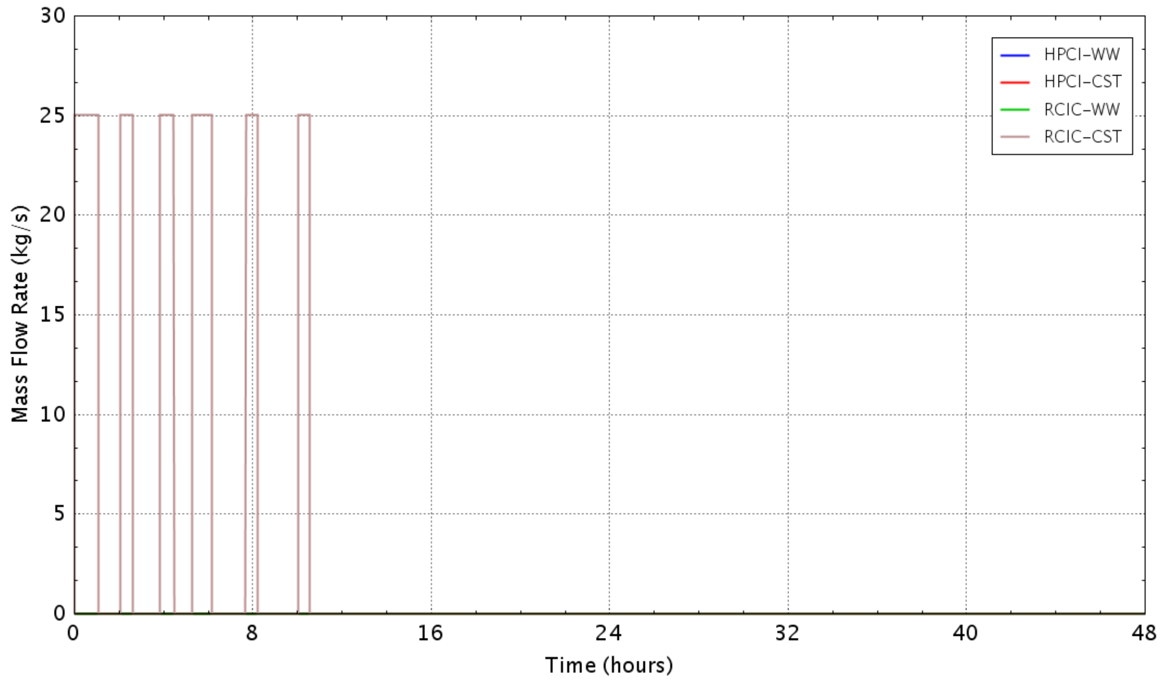

Figure E - 649 **Flow rate of the HPCI/RCIC pumps**

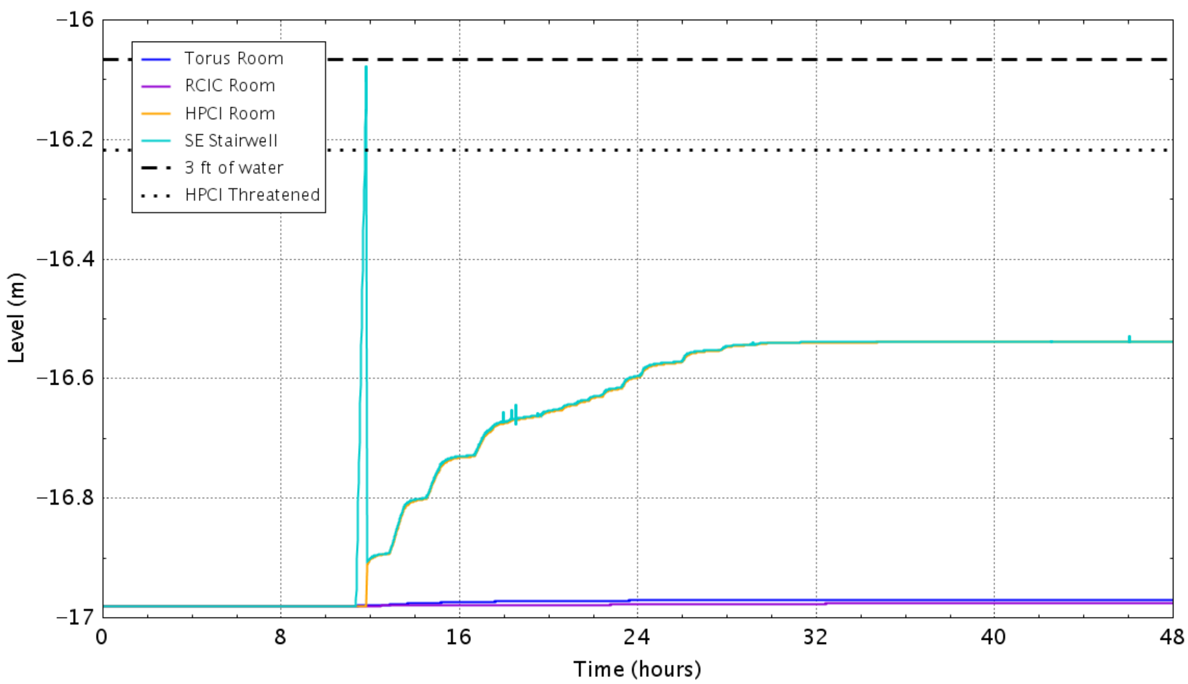

Figure E - 650 **Water level in the reactor building basement**

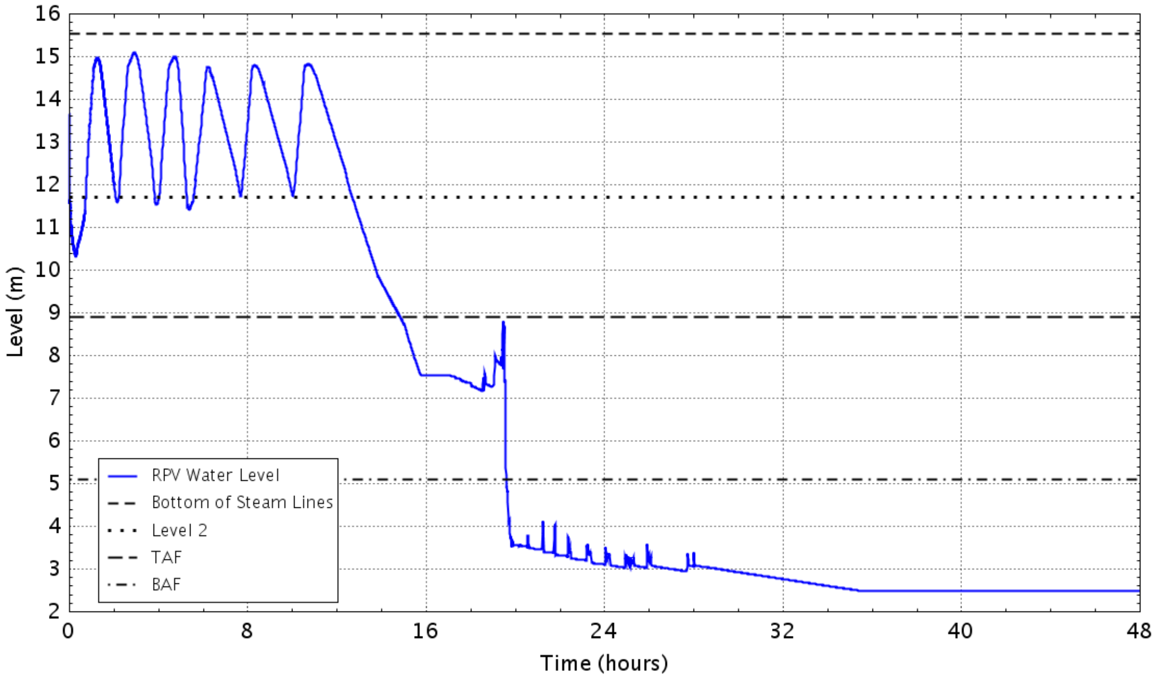

Figure E - 651 **RPV down comer water level**

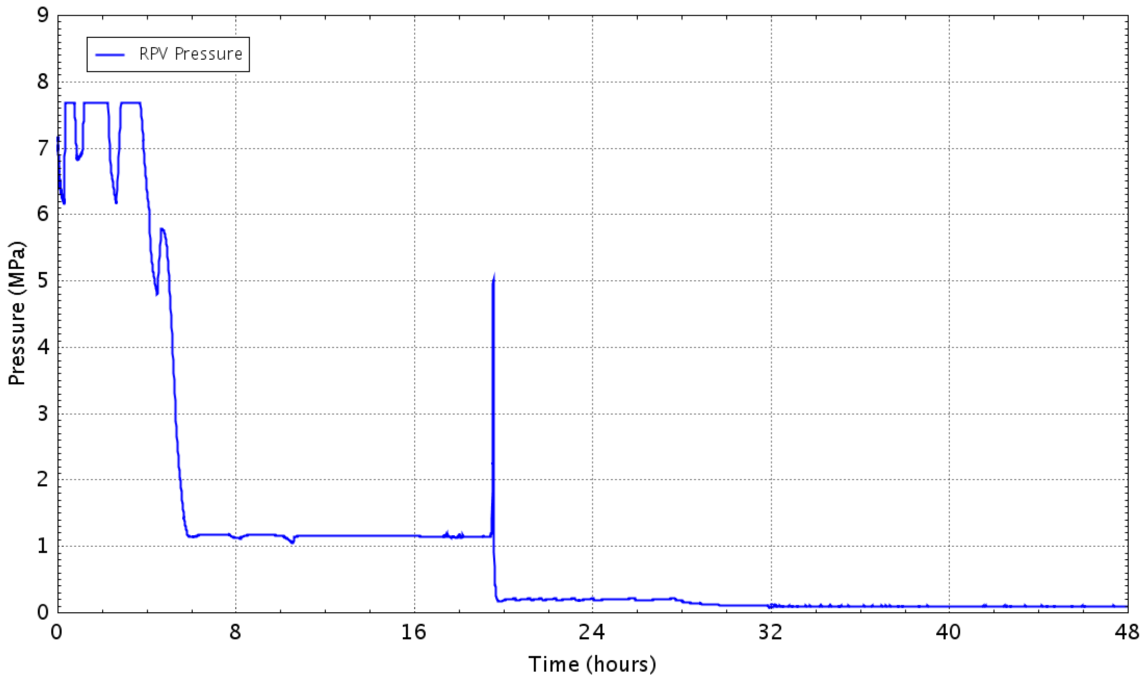

Figure E - 652 **Pressure in theRPV**

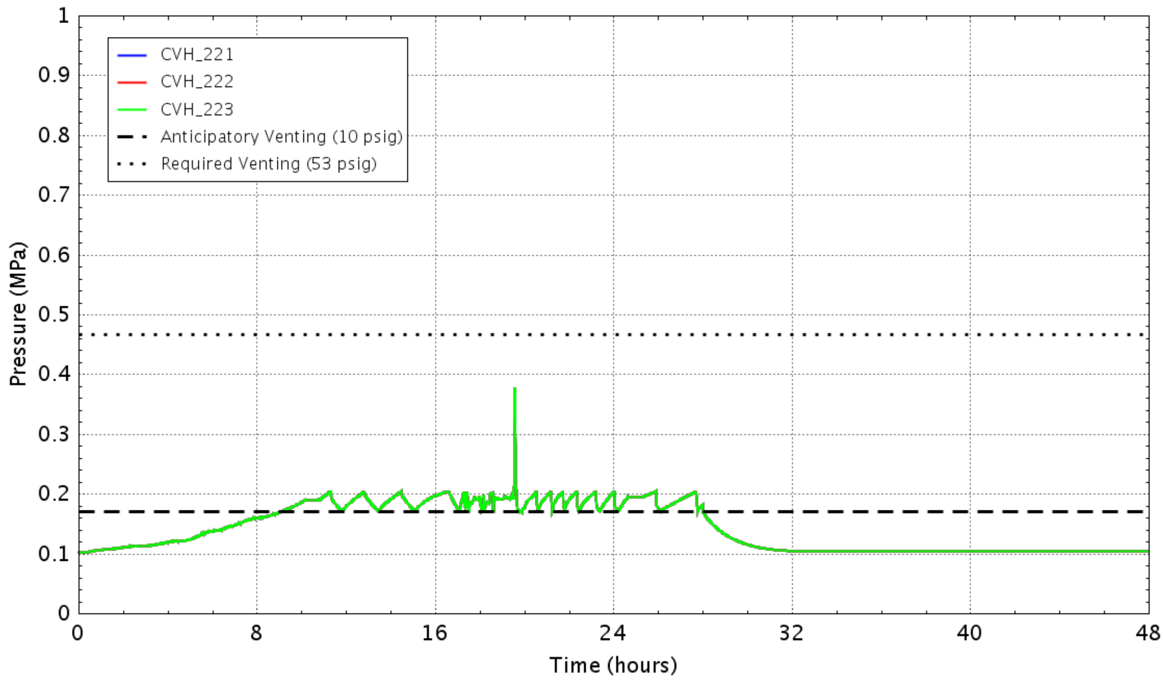

Figure E - 653 Pressure in the wetwell

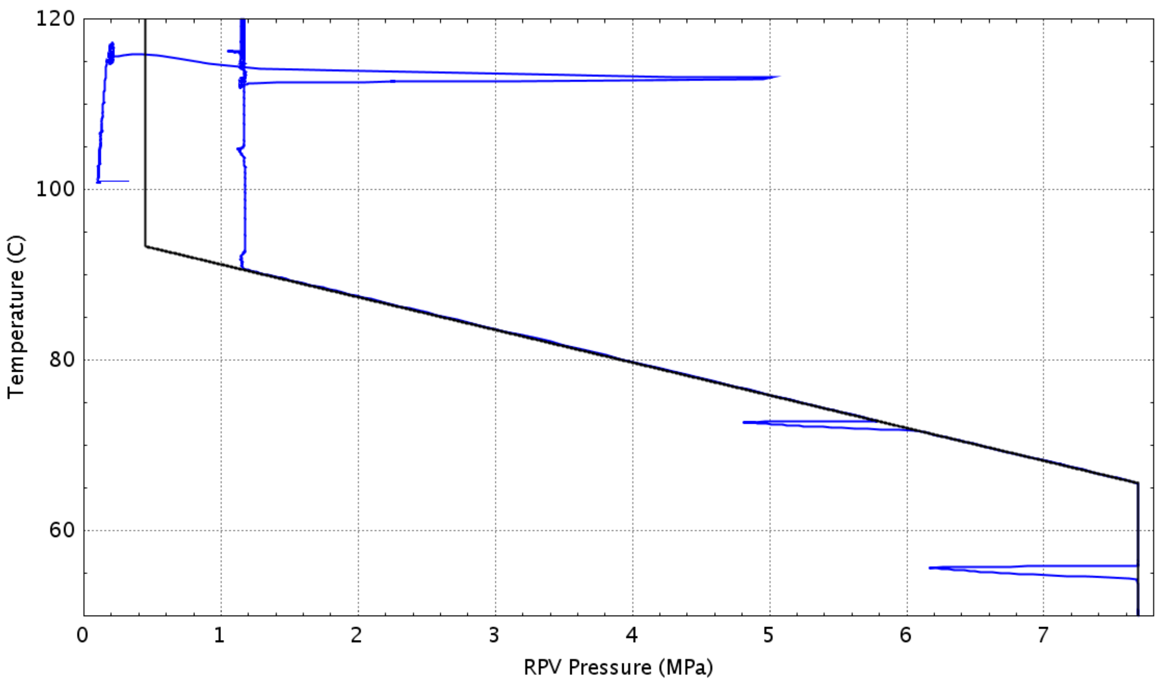

Figure E – 654 Plant status relative to the HCL curve (Graph 4 of the EOPs)

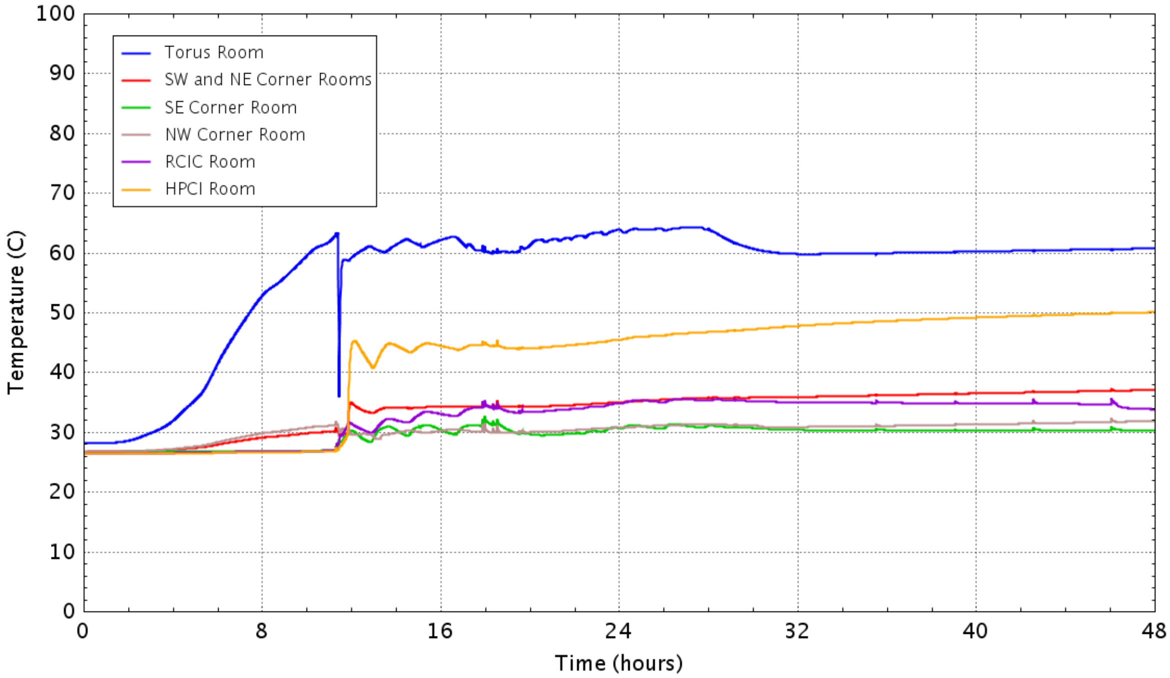

Figure E - 655 **Vapor temperature in the reactor building basement**

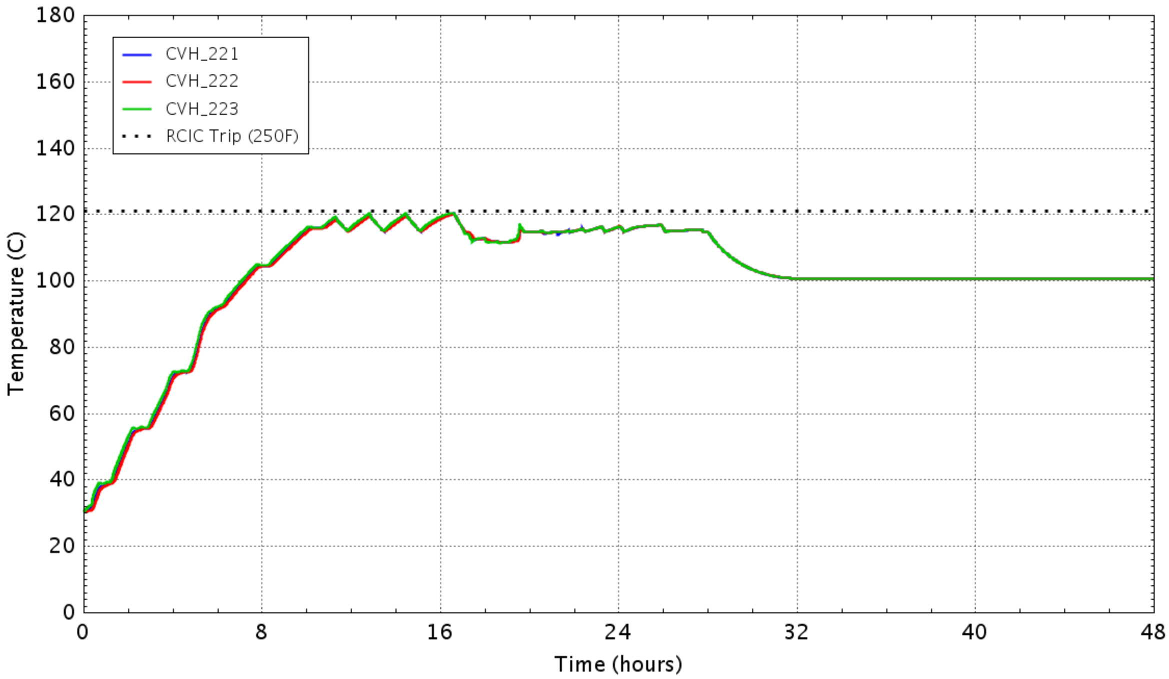

Figure E - 656 **Water temperature in the wetwell**

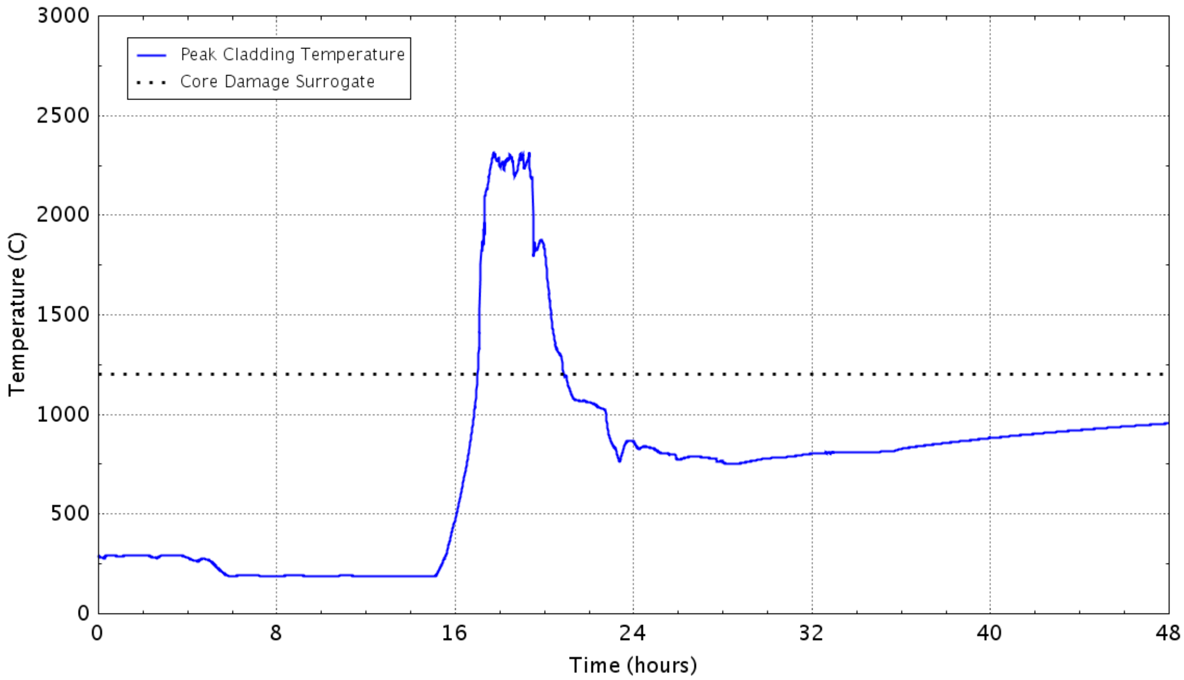

Figure E - 657 **Peak temperature of the fuel cladding as a function of time**

E.3.25 Case 19c: Sensitivity to LOMFW-25 Case 19 with MSIVClosure at the Start of the Transient

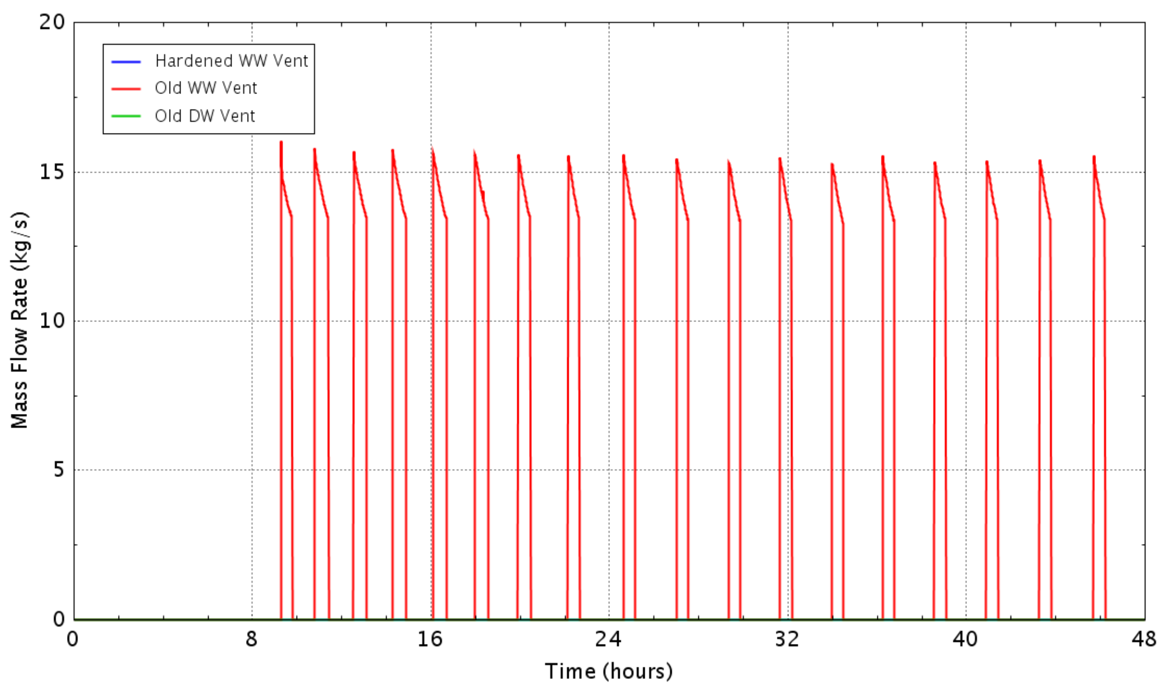

Figure E - 658 **Flow rate of the containment vents**

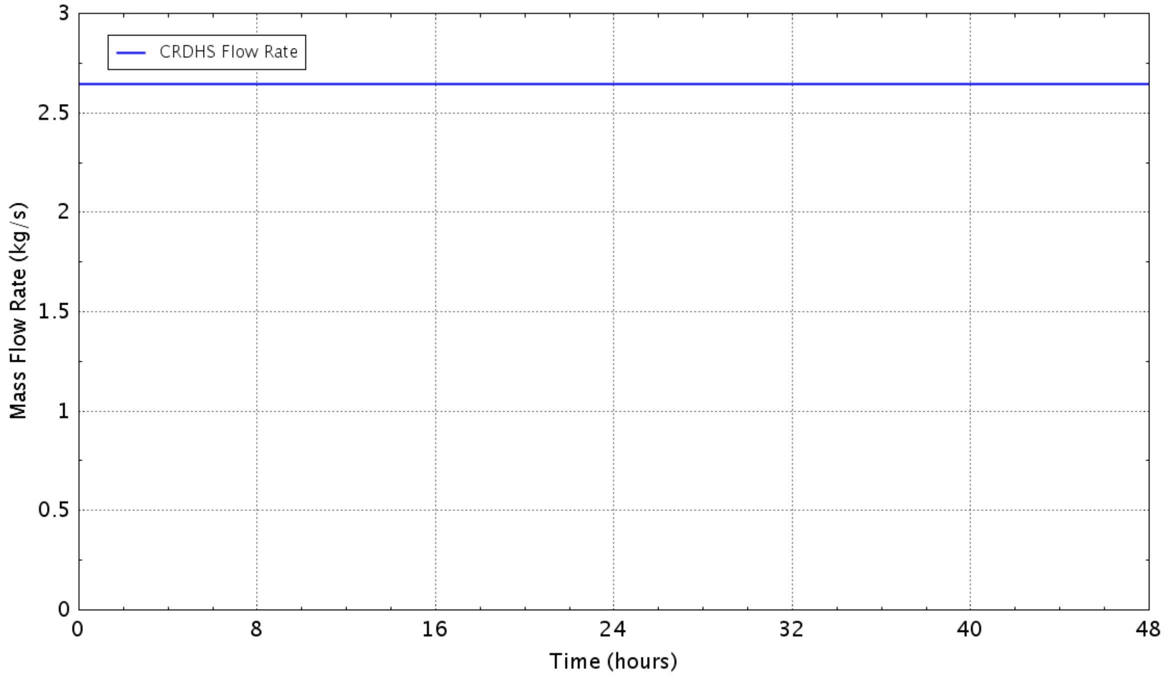

Figure E - 659 Flow rate of the control rod drive hydraulic system

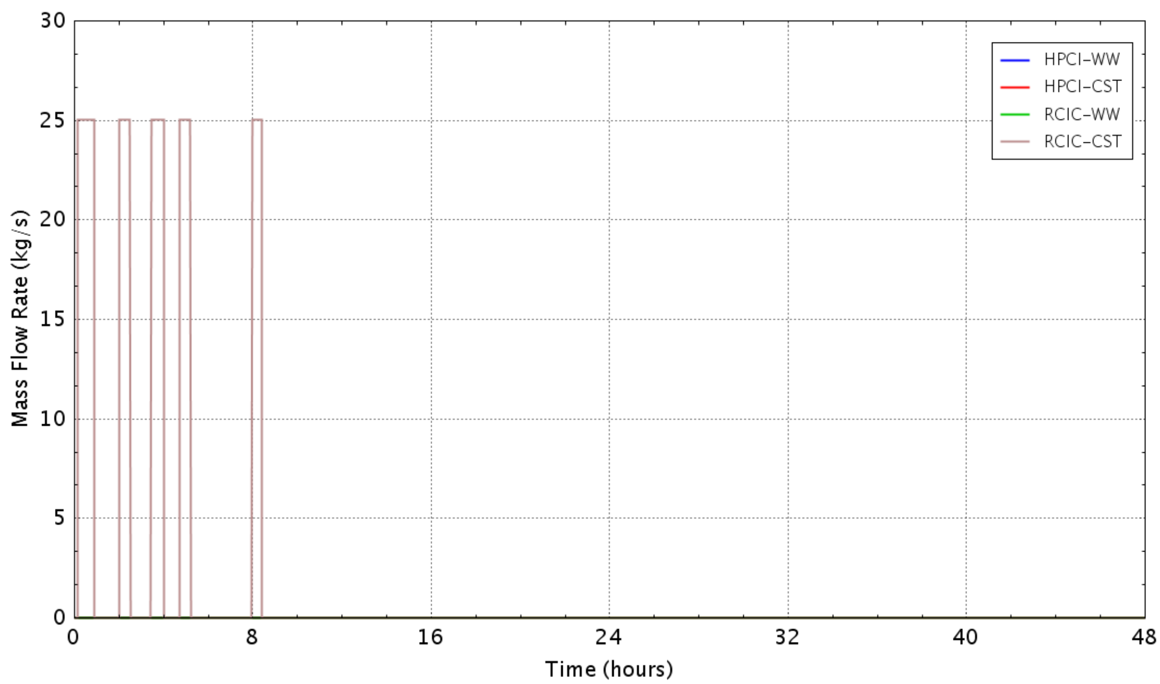

Figure E - 660 Flow rate of the HPCI/RCIC pumps

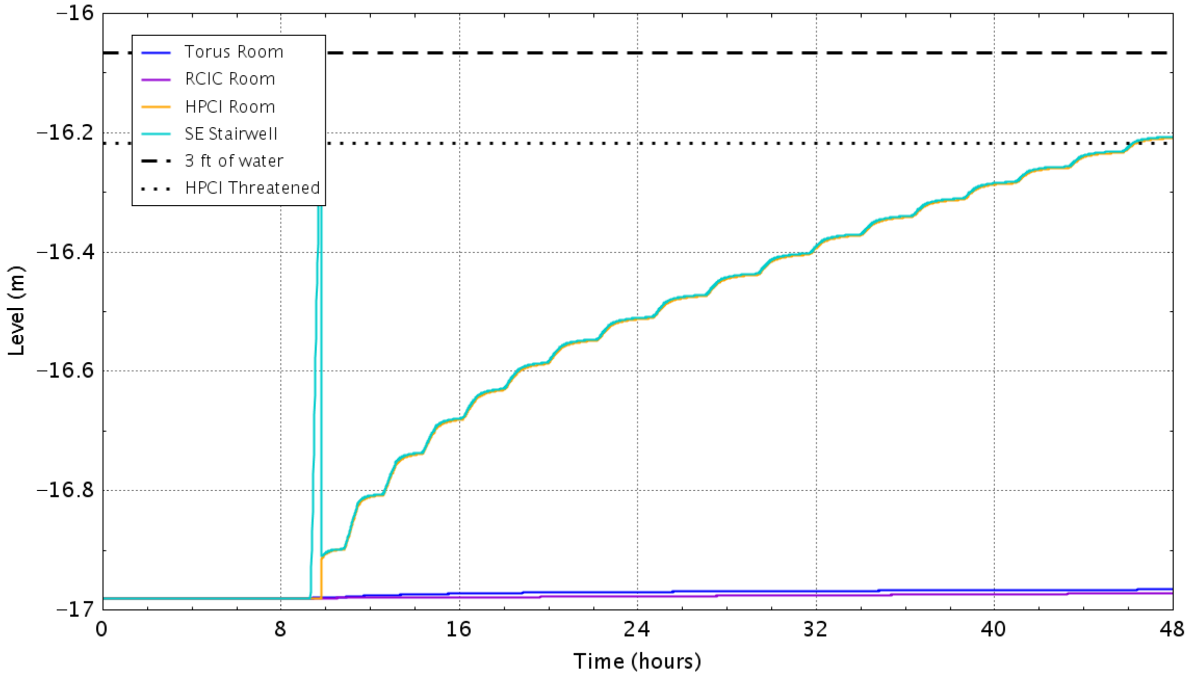

Figure E - 661 Water level in the reactor building basement

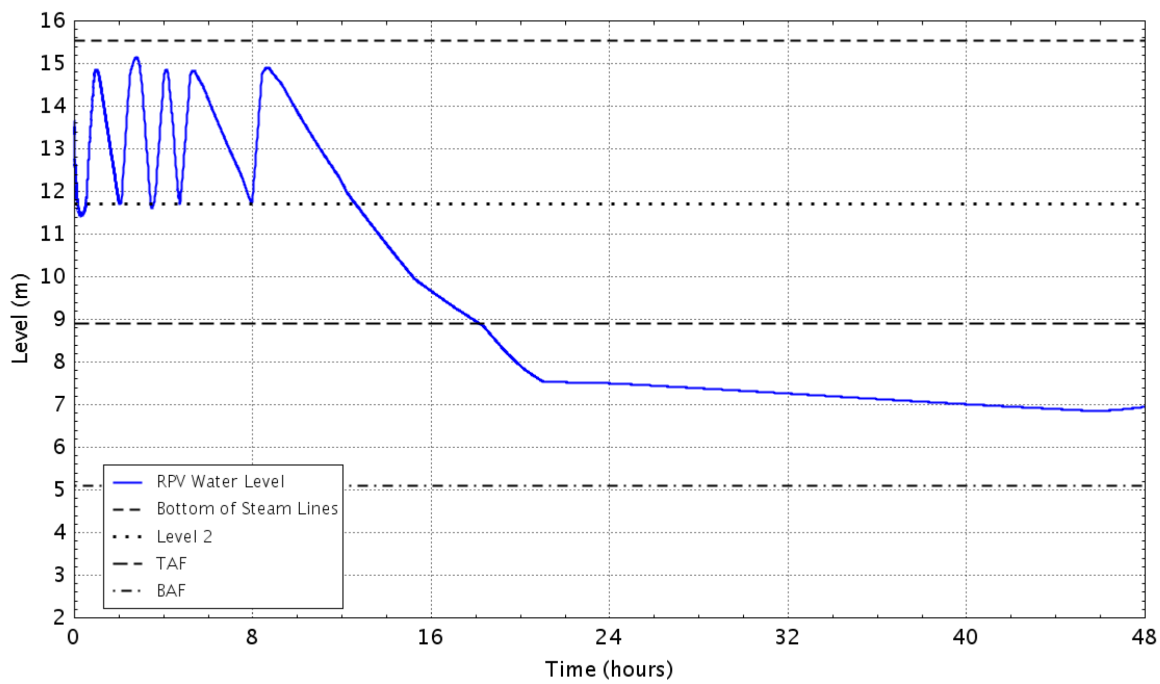

Figure E - 662 RPV down comer water level

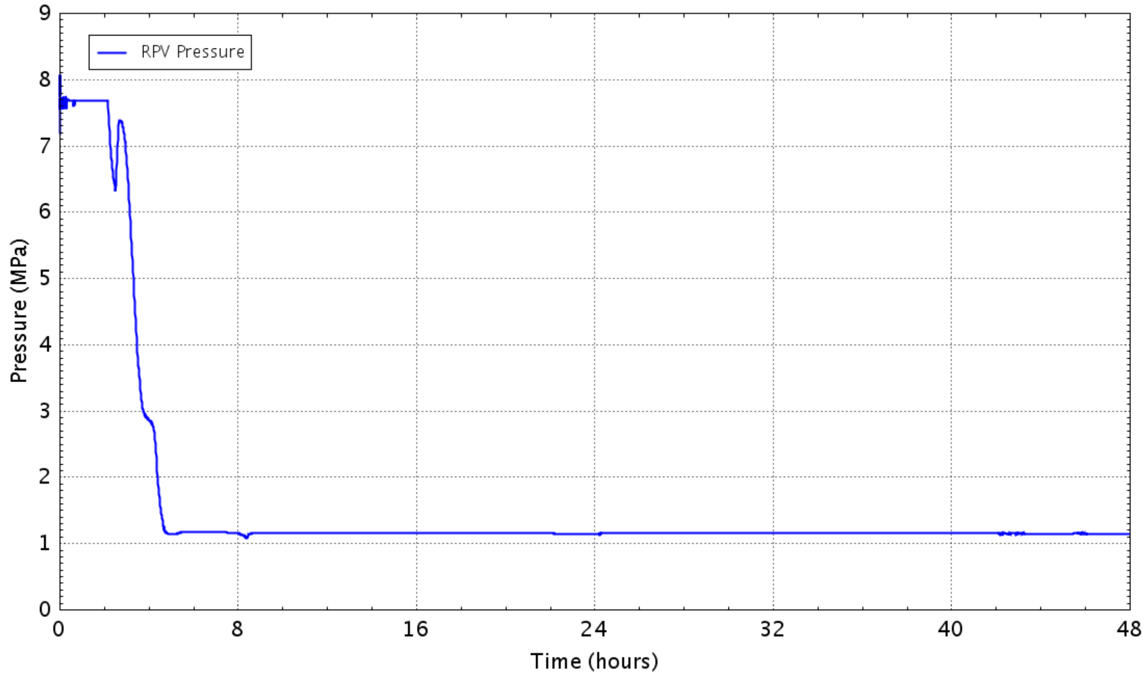

Figure E - 663 **Pressure in theRPV**

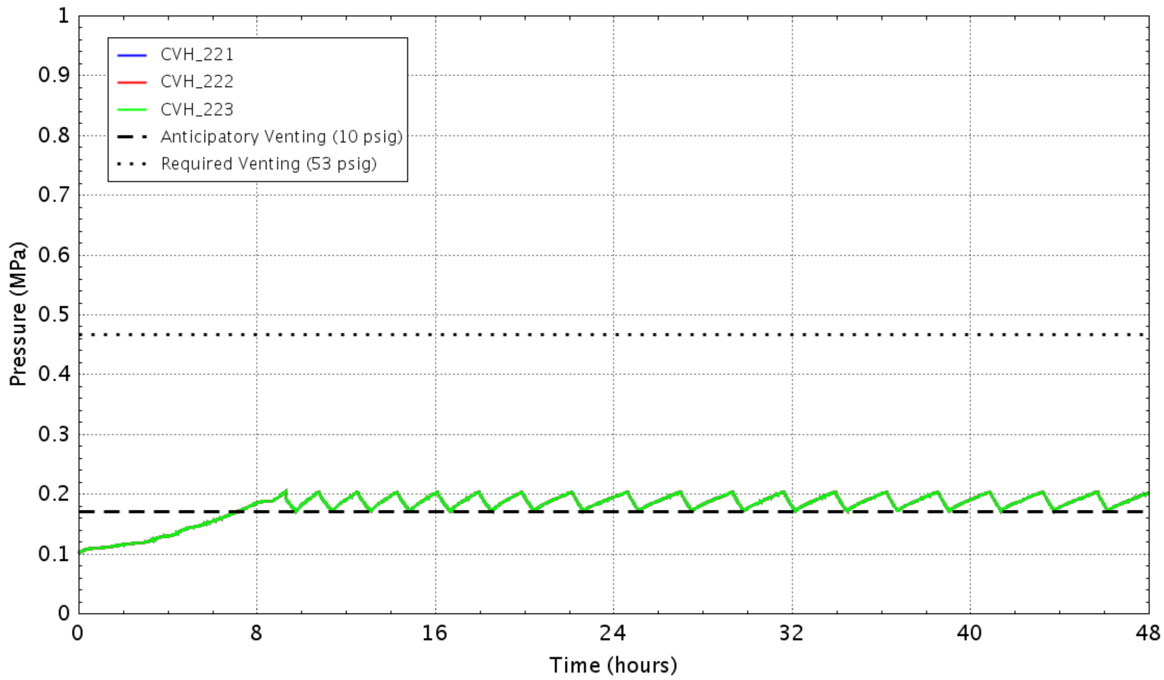

Figure E - 664 **Pressure in the wetwell**

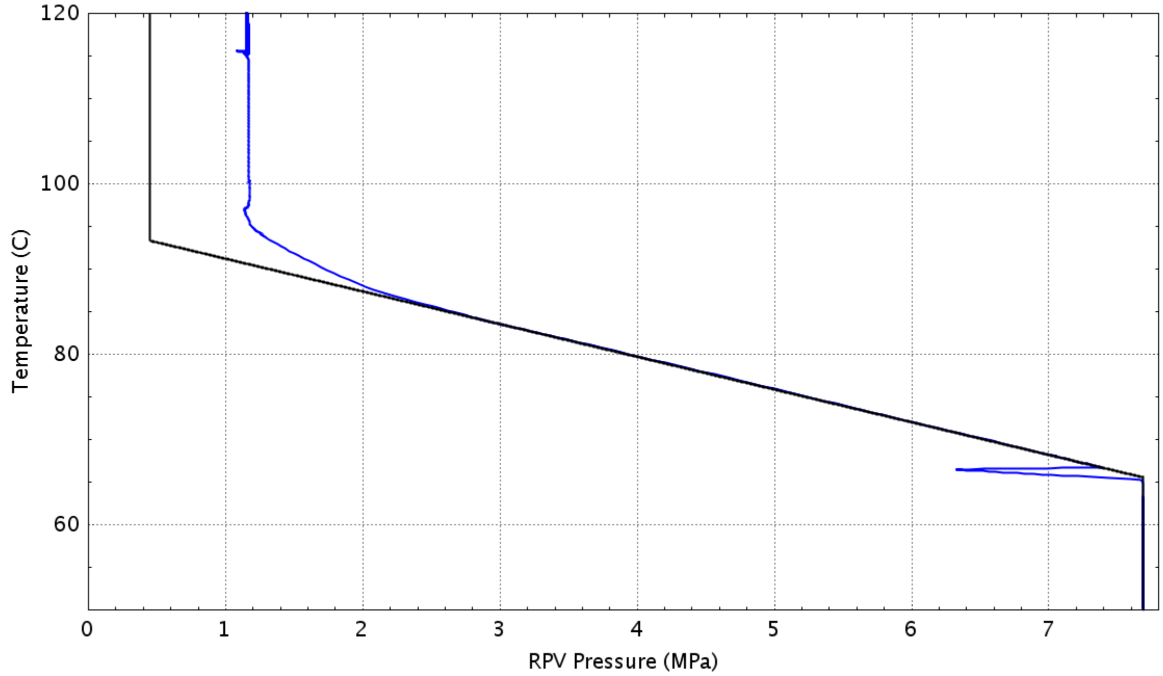

Figure E – 665 Plant status relative to the HCL curve (Graph 4 of the EOPs)

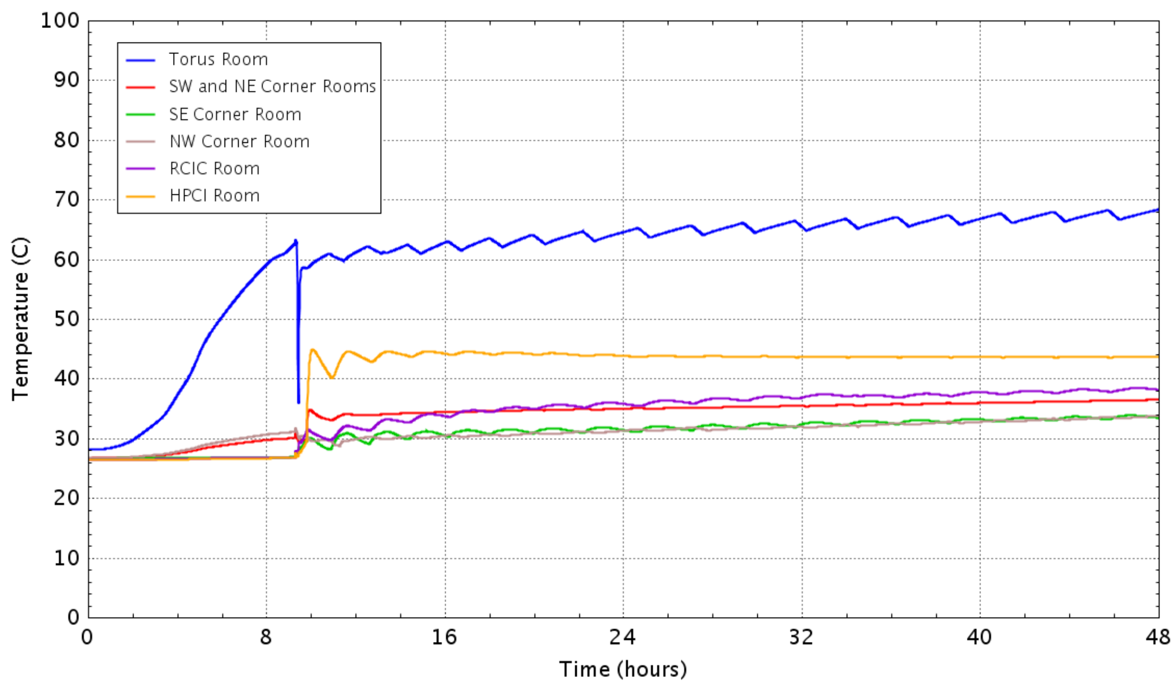

Figure E - 666 Vapor temperature in the reactor building basement

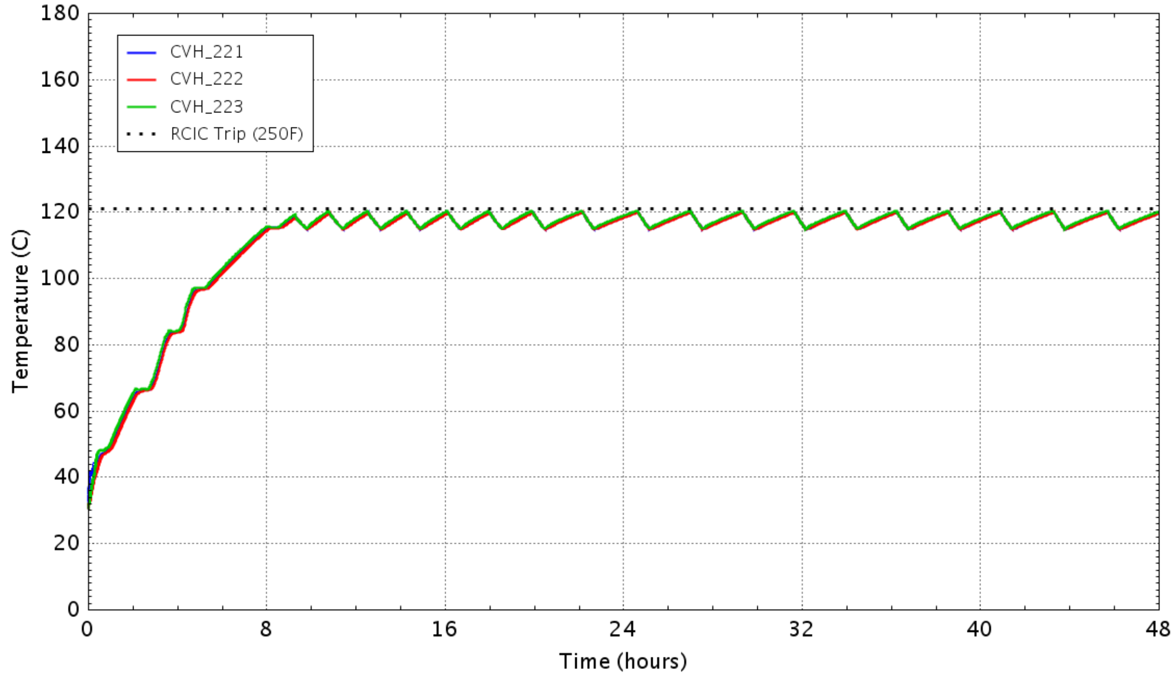

Figure E - 667 **Water temperature in the wetwell**

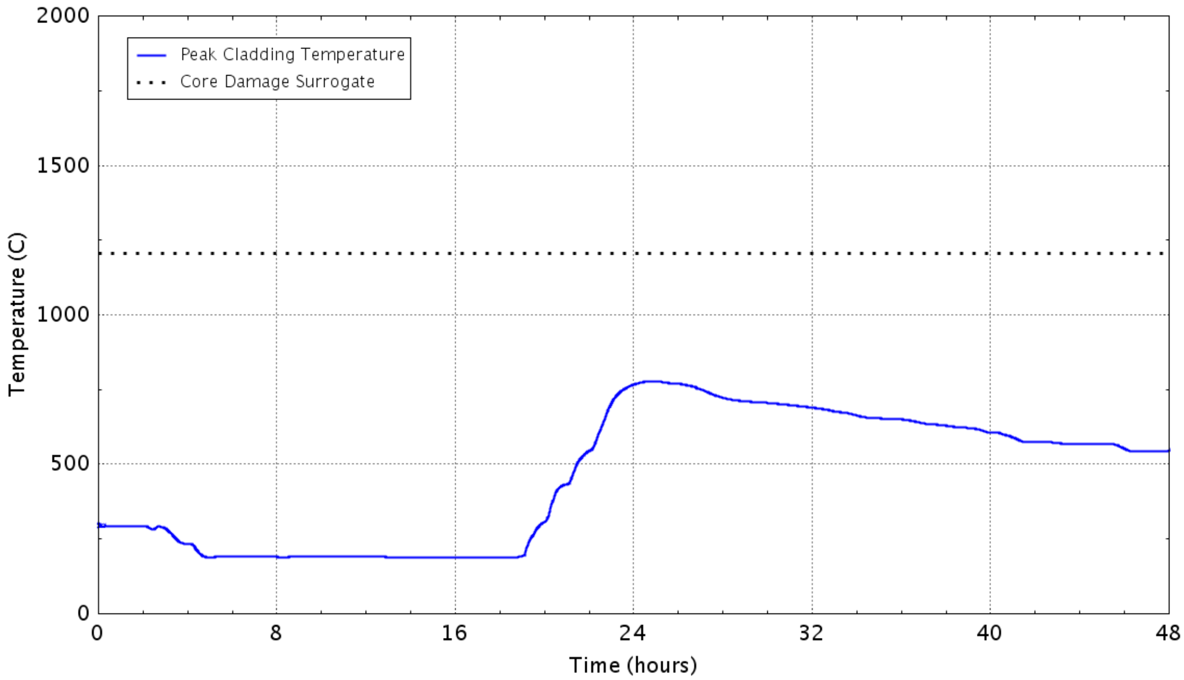

Figure E - 668 **Peak temperature of the fuel cladding as a function of time**

E.3.26 Case 29a: Sensitivity to LOMFW-25 Case 29 with HPCI Available Instead of RCIC

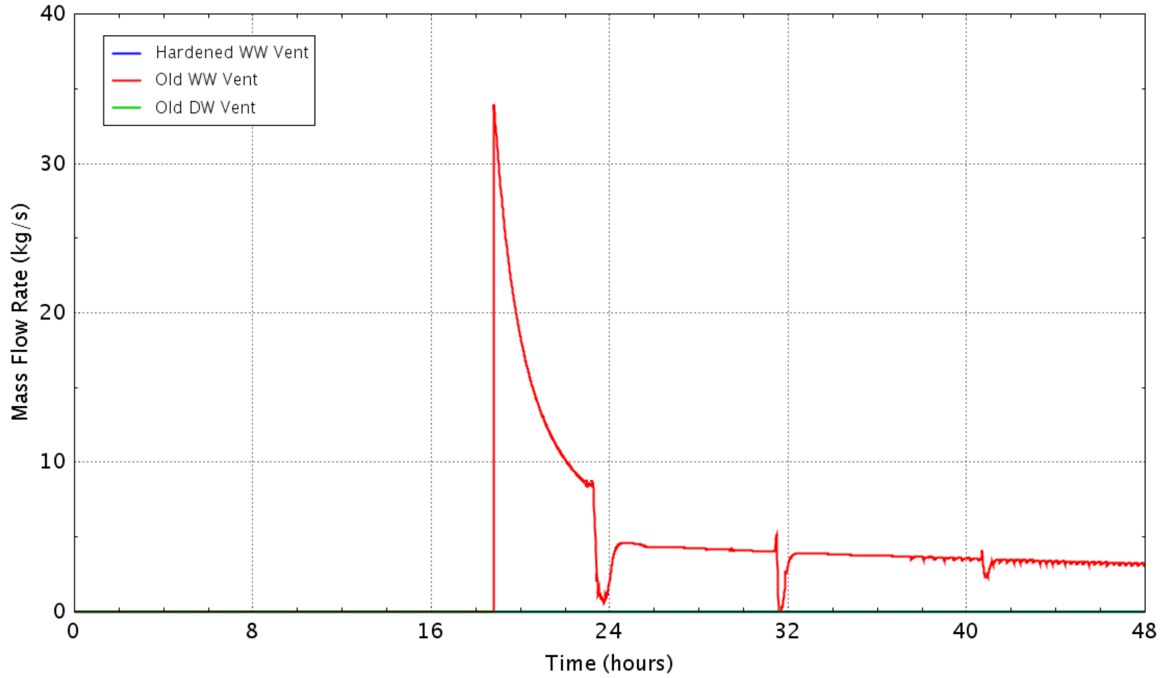

Figure E – 669 Flow rate of the containment vents

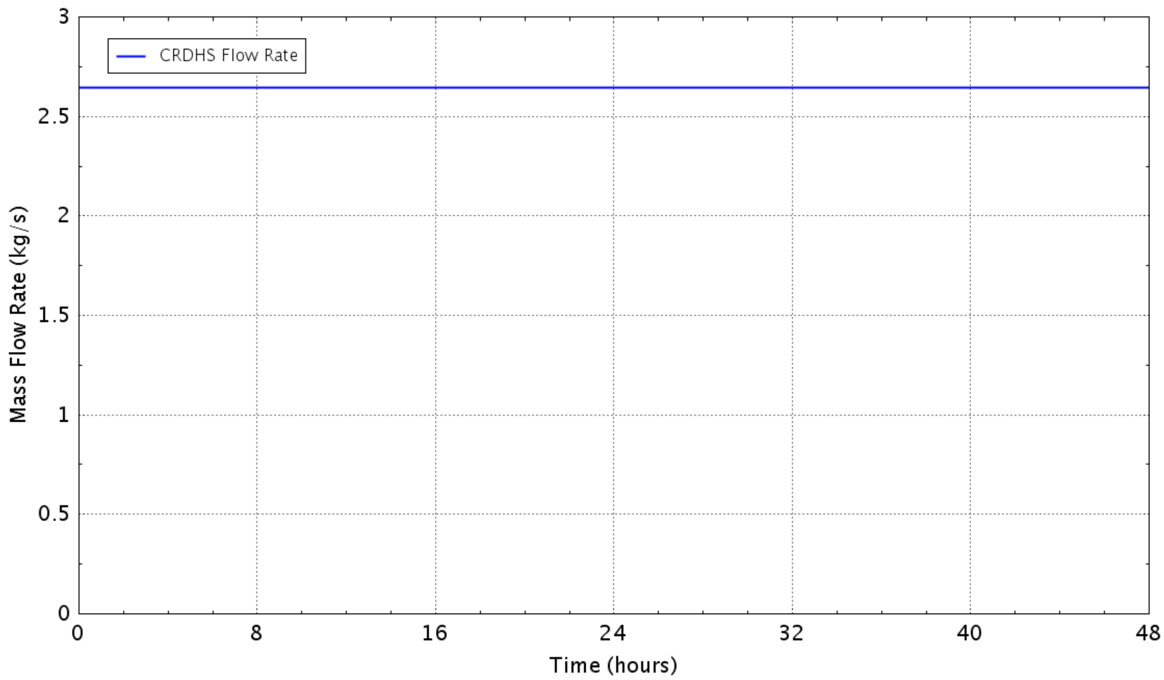

Figure E – 670 Flow rate of the control rod drive hydraulicsystem

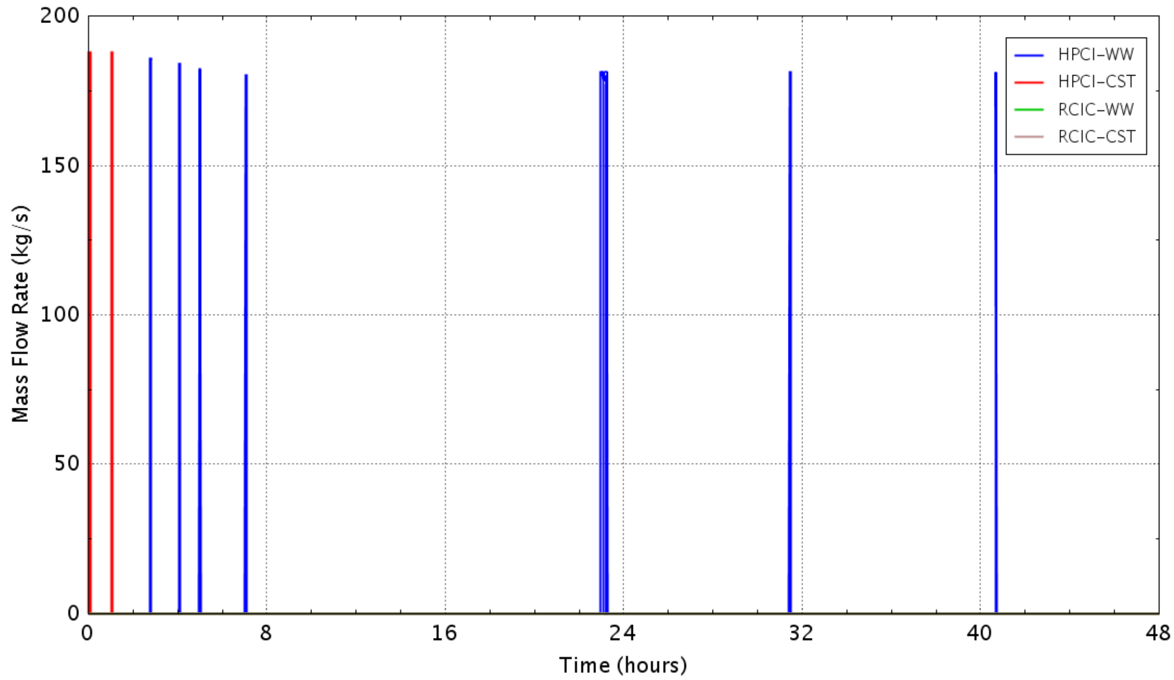

Figure E – 671 Flow rate of the HPCI/RCIC pumps

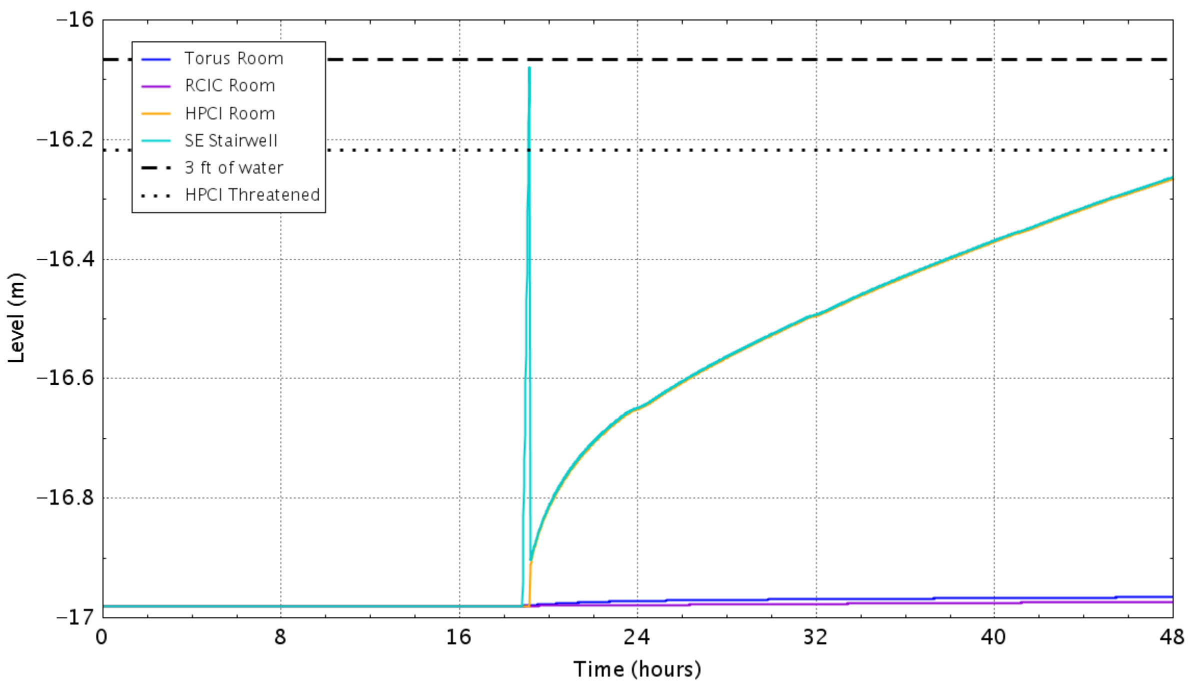

Figure E – 672 Water level in the reactor building basement

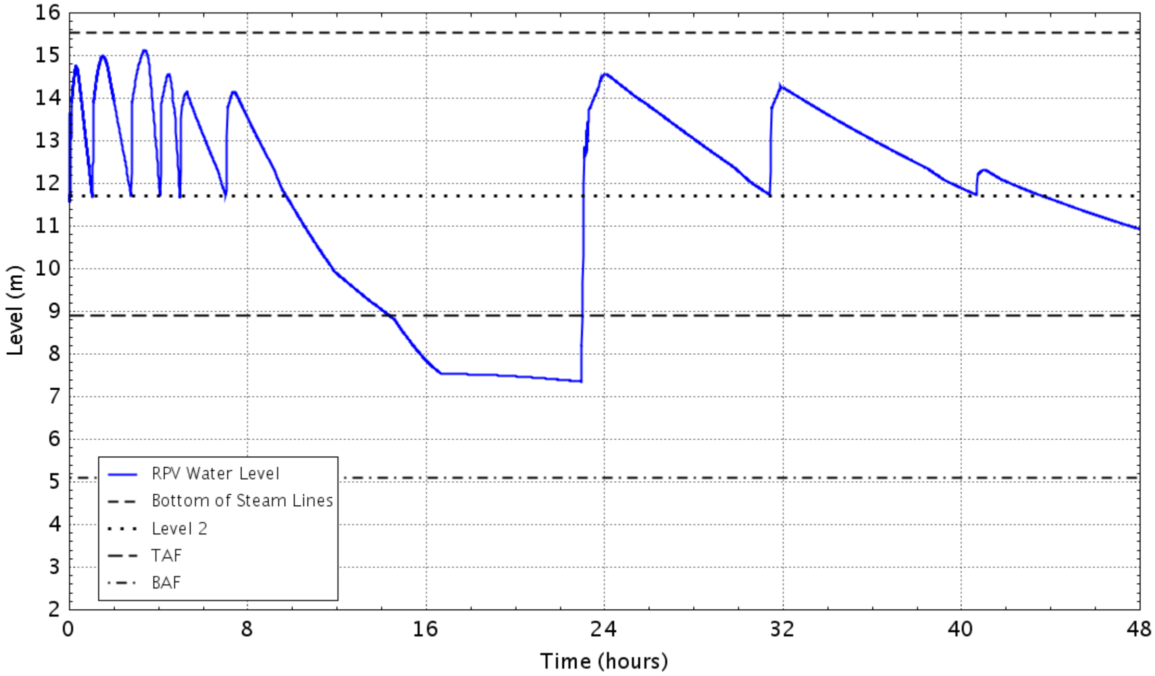

Figure E – 673 RPV down comer water level

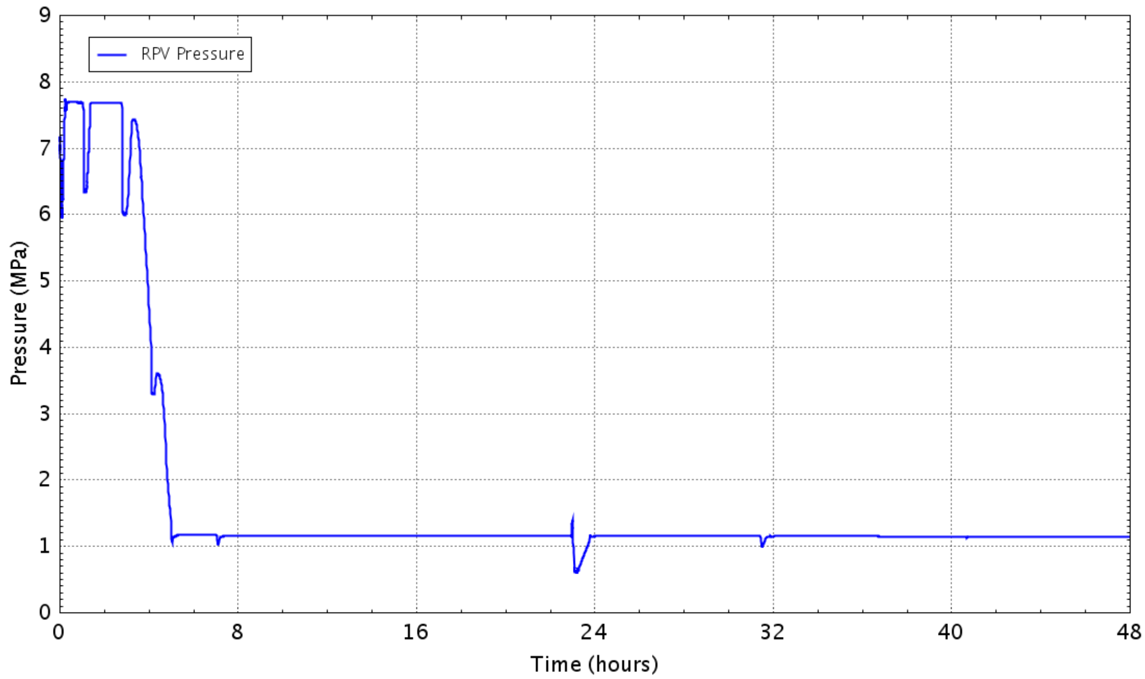

Figure E – 674 Pressure in the RPV

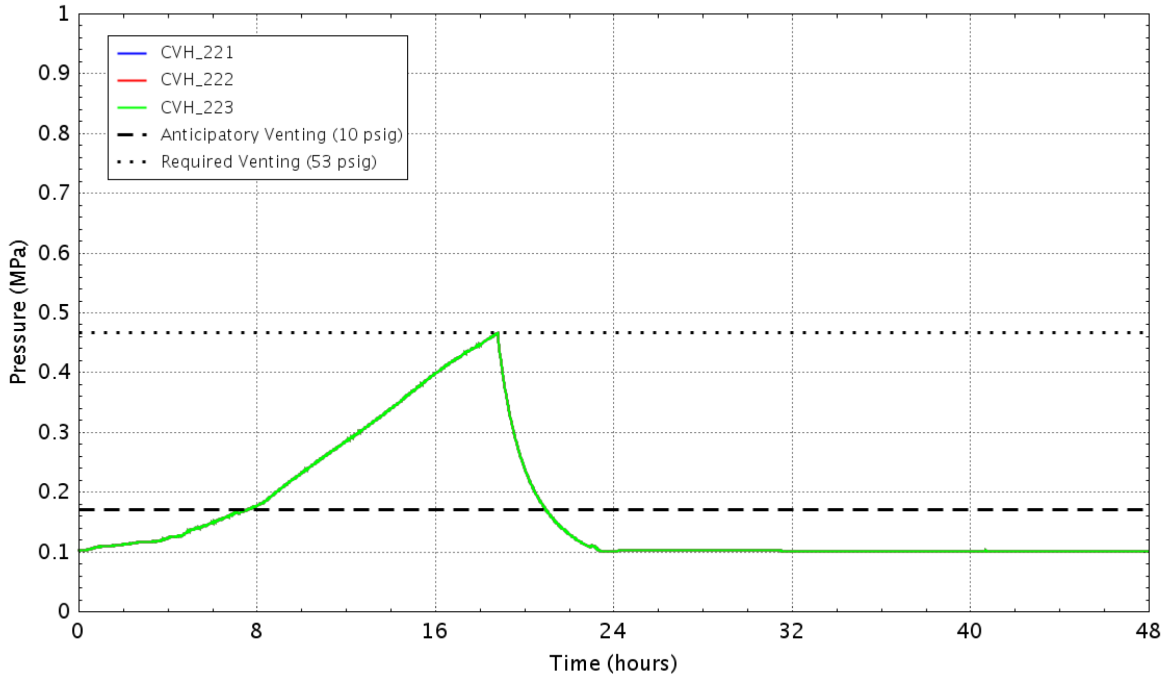

Figure E – 675 Pressure in the wetwell

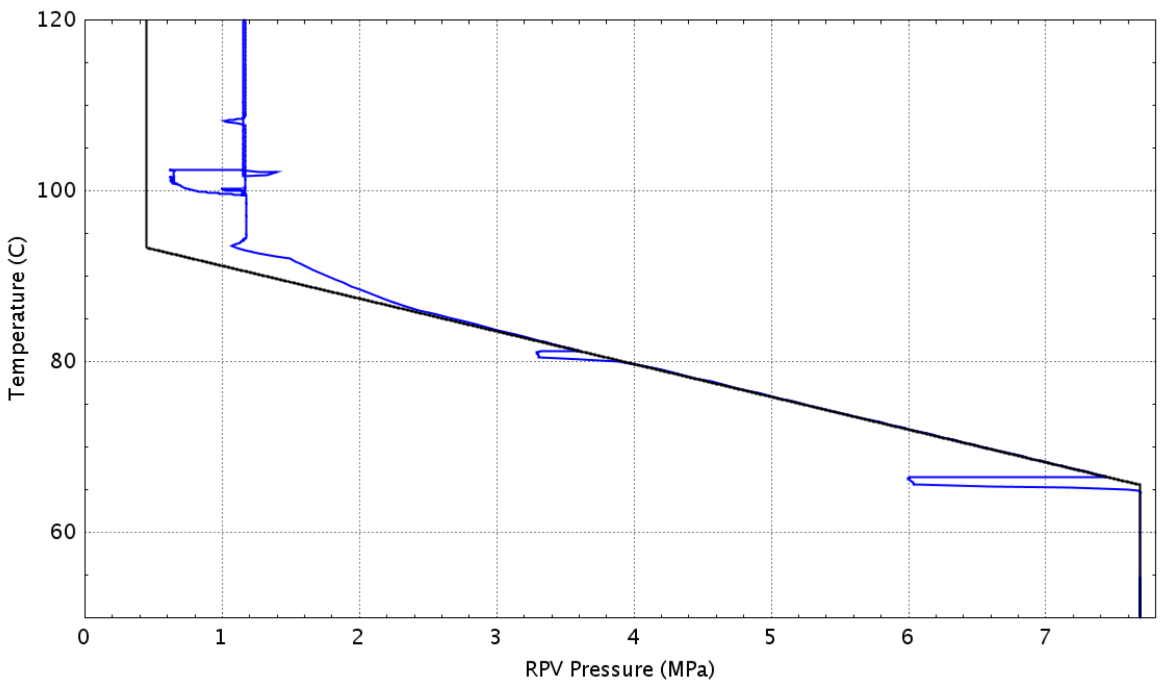

Figure E – 676 Plant status relative to the HCL curve (Graph 4 of the EOPs)

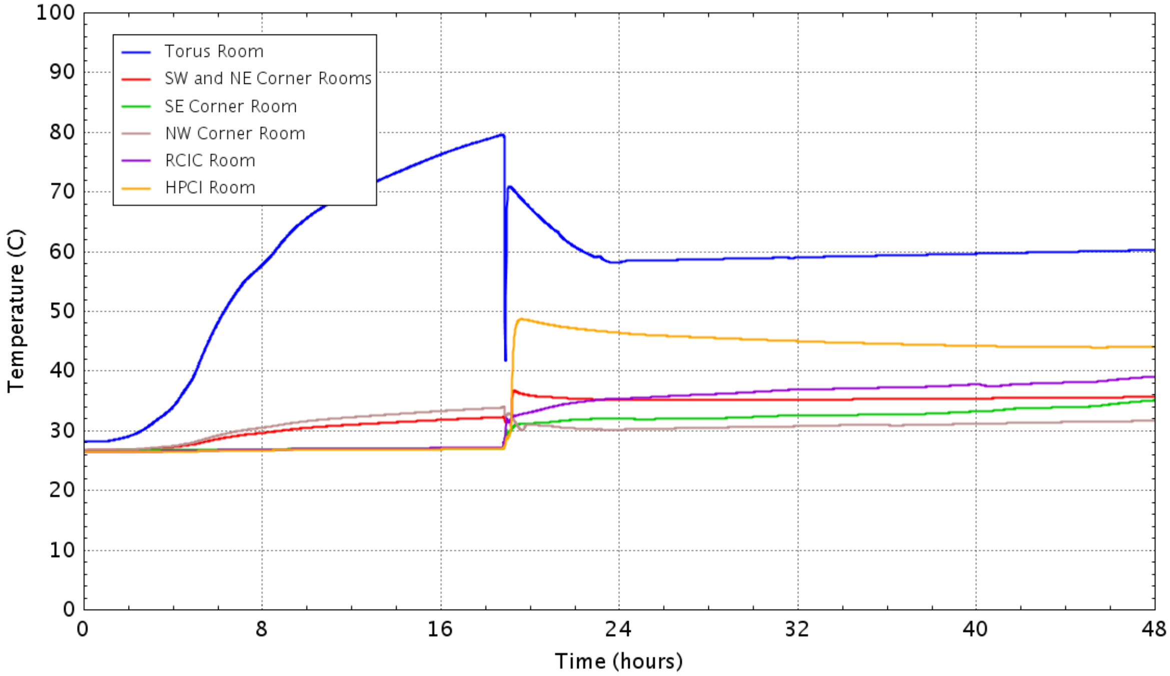

Figure E – 677 Vapor temperature in the reactor buildingbasement

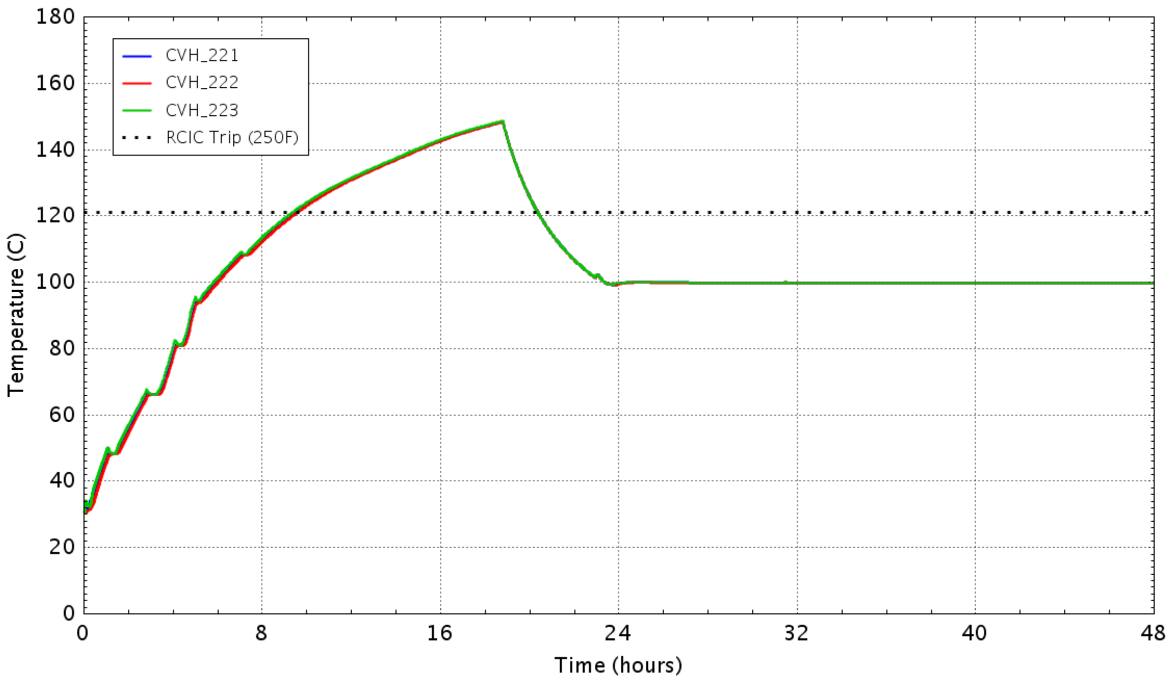

Figure E – 678 Water temperature in the wetwell

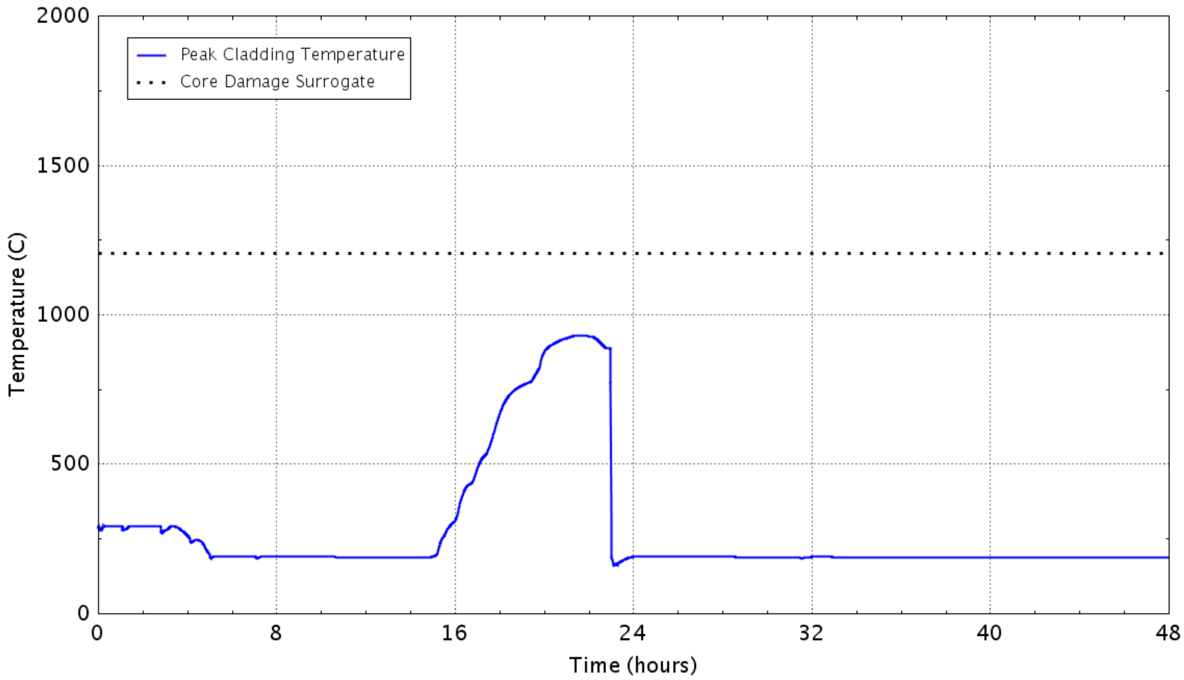

Figure E – 679 Peak temperature of the fuel cladding as a function oftime

E.3.27 Case 29b: Sensitivity to LOMFW-25 Case 29 with CST Unavailable

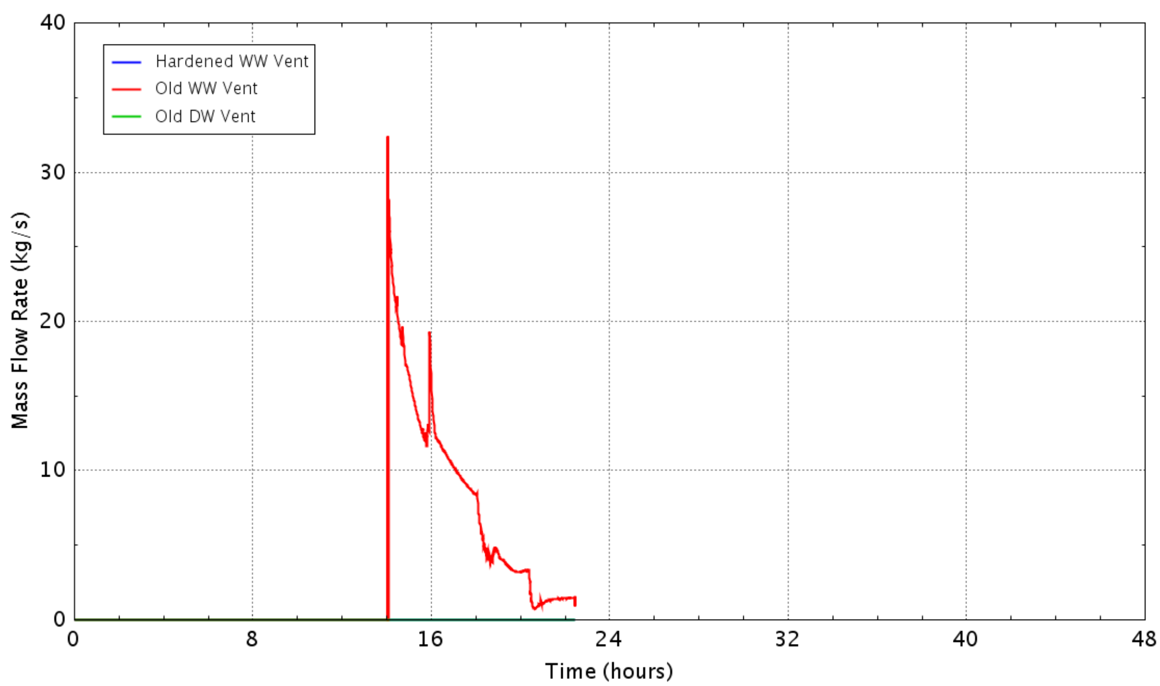

Figure E – 680 Flow rate of the containment vents

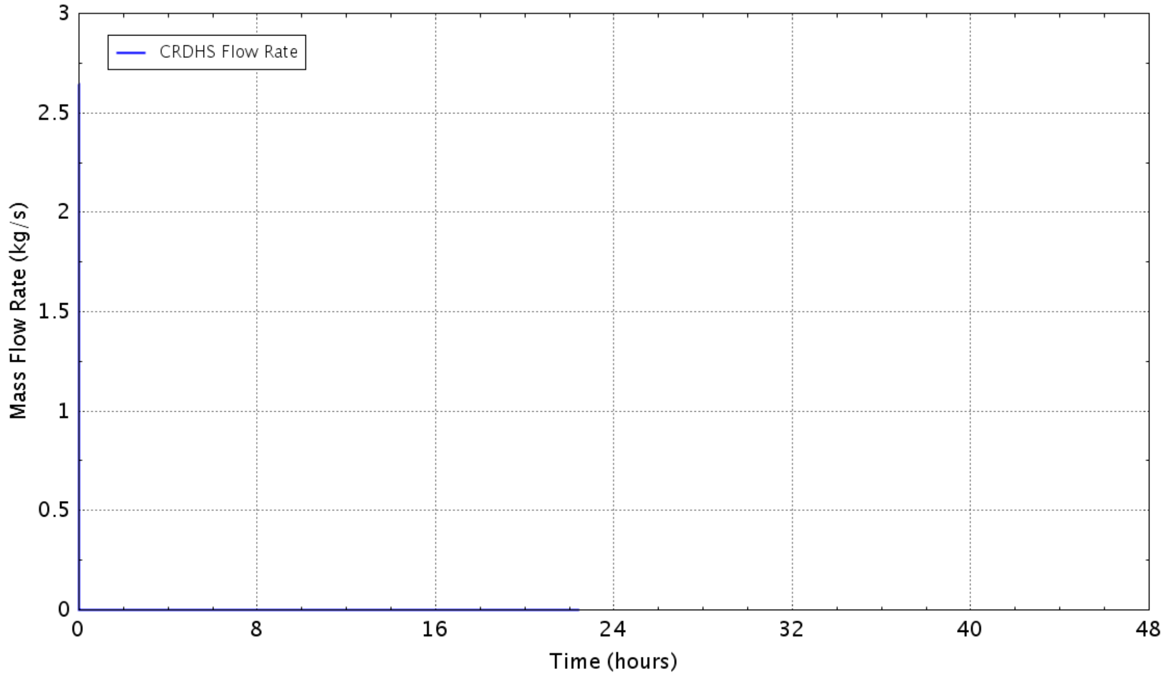

Figure E – 681 **Flow rate of the control rod drive hydraulicsystem**

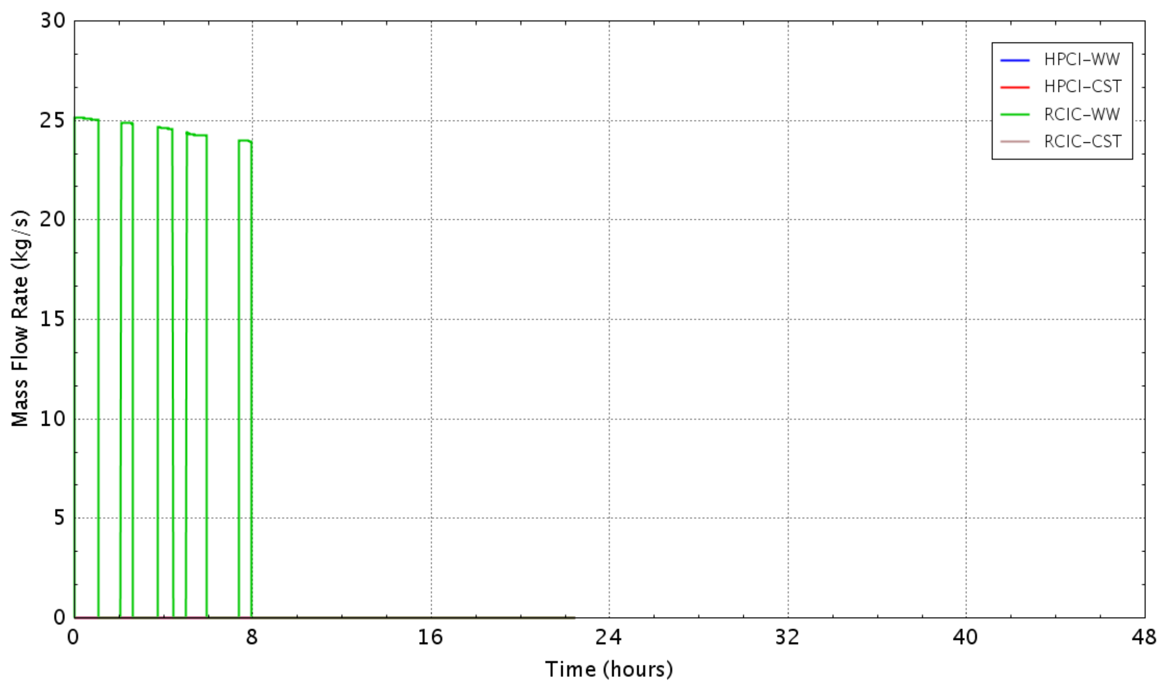

Figure E – 682 **Flow rate of the HPCI/RCIC pumps**

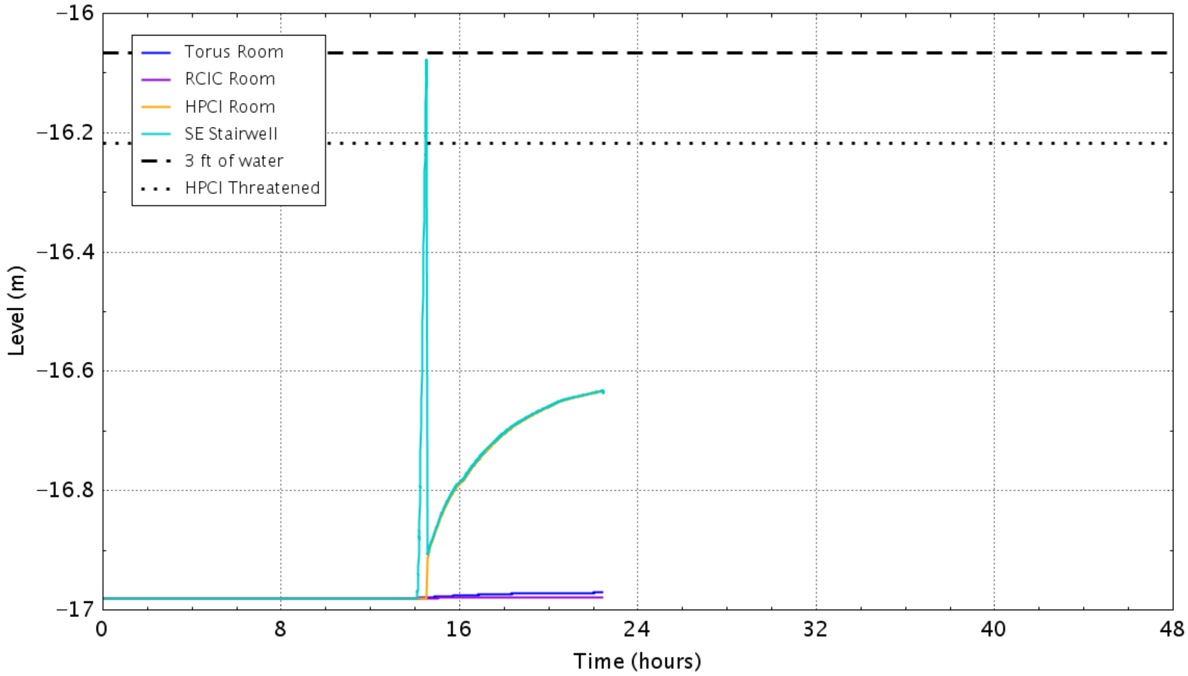

Figure E – 683 Water level in the reactor building basement

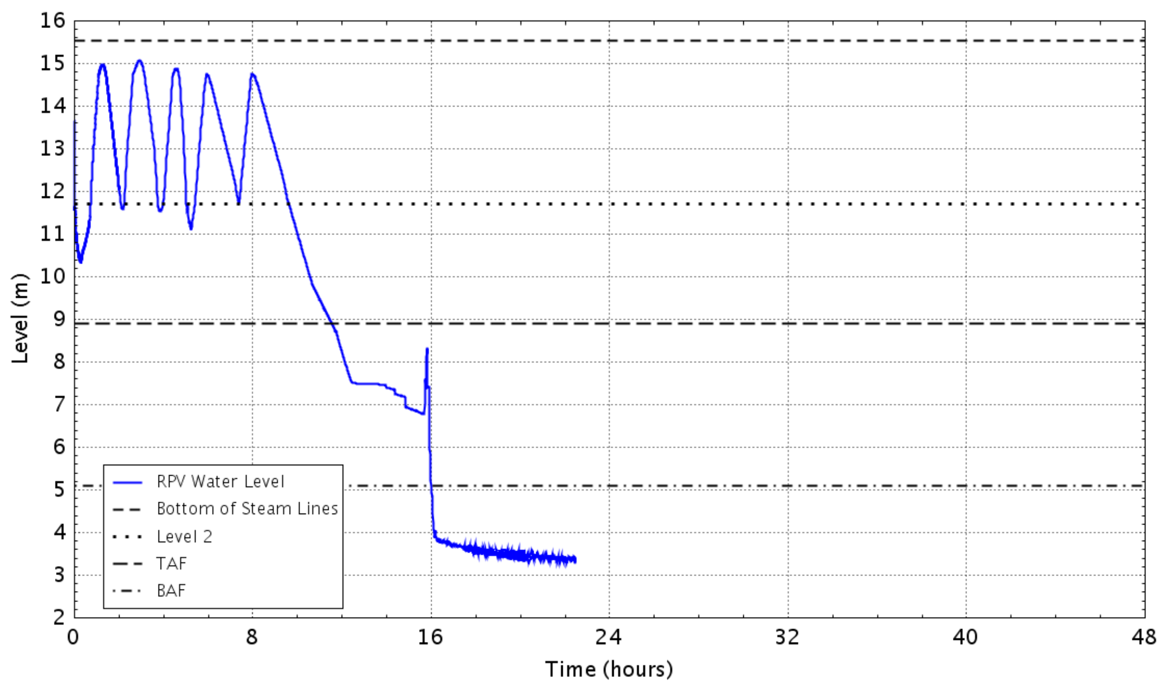

Figure E – 684 RPV down comer water level

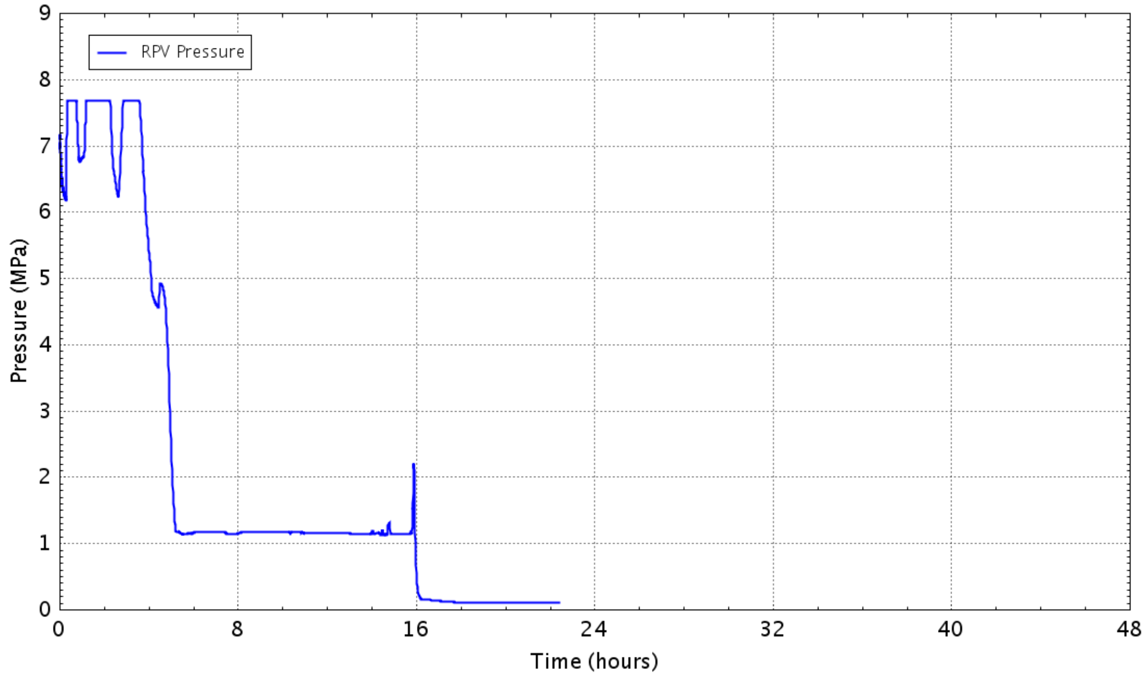

Figure E – 685 Pressure in the RPV

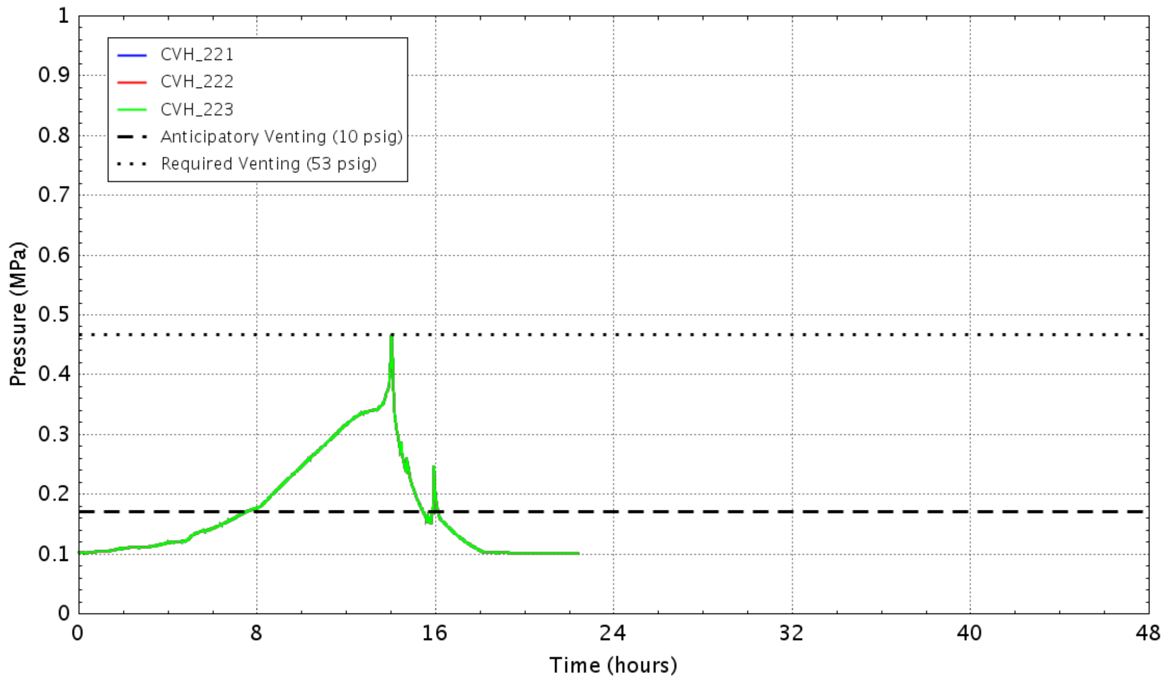

Figure E – 686 Pressure in the wetwell

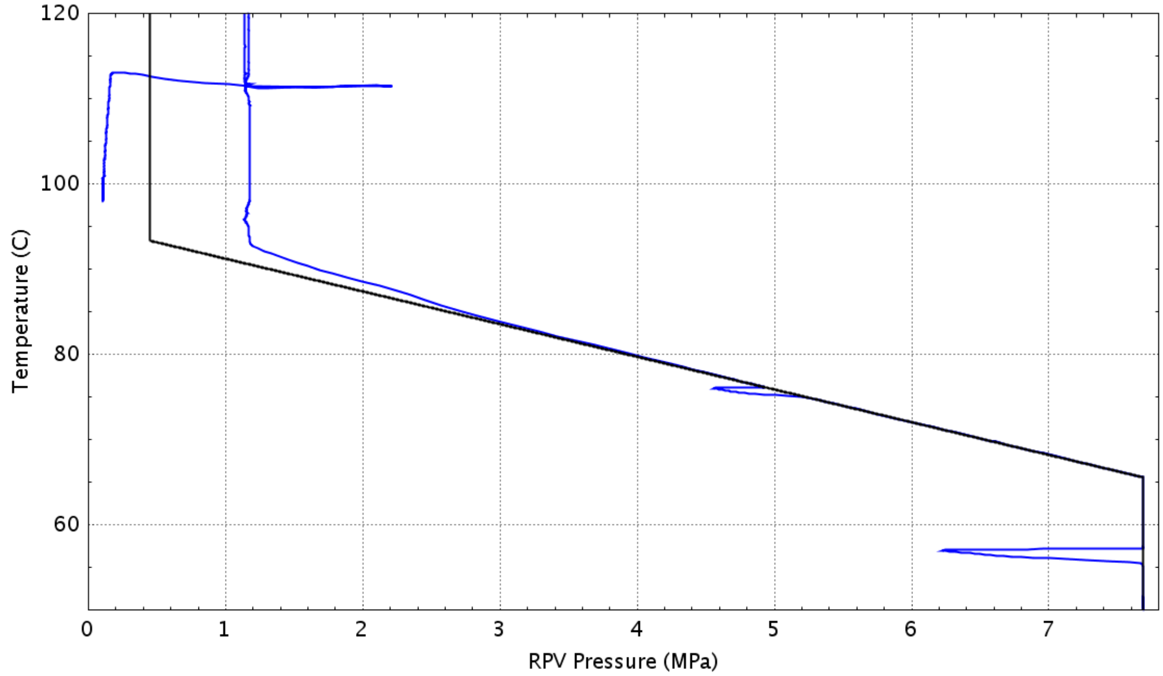

Figure E – 687 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

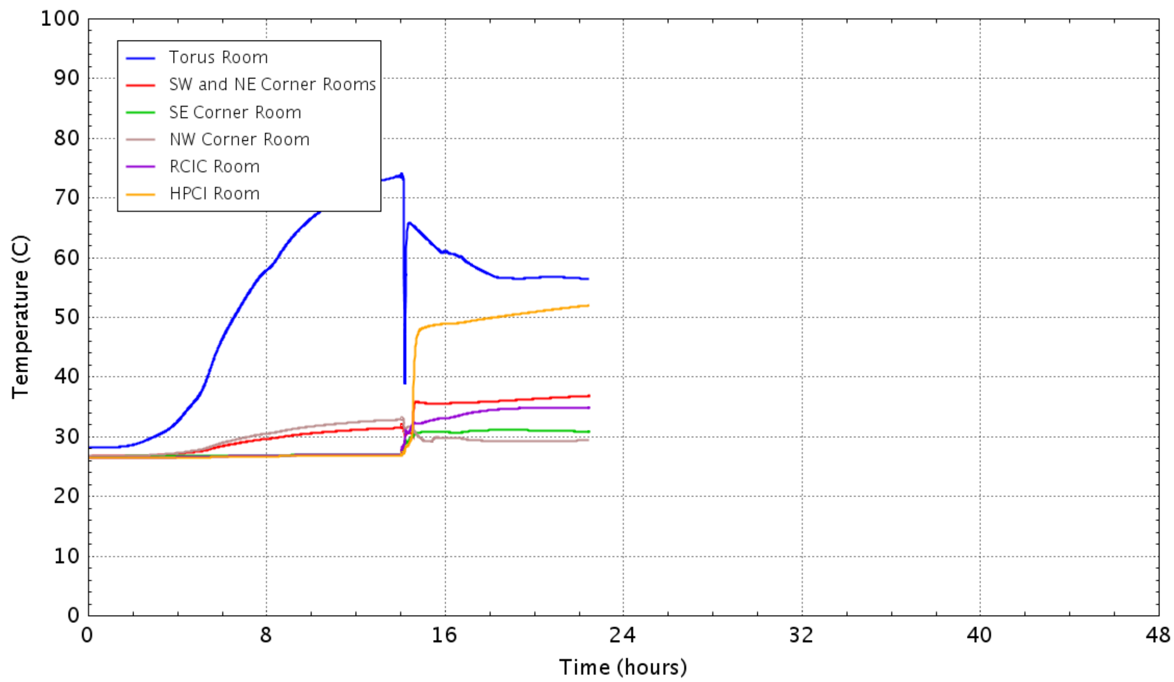

Figure E – 688 **Vapor temperature in the reactor buildingbasement**

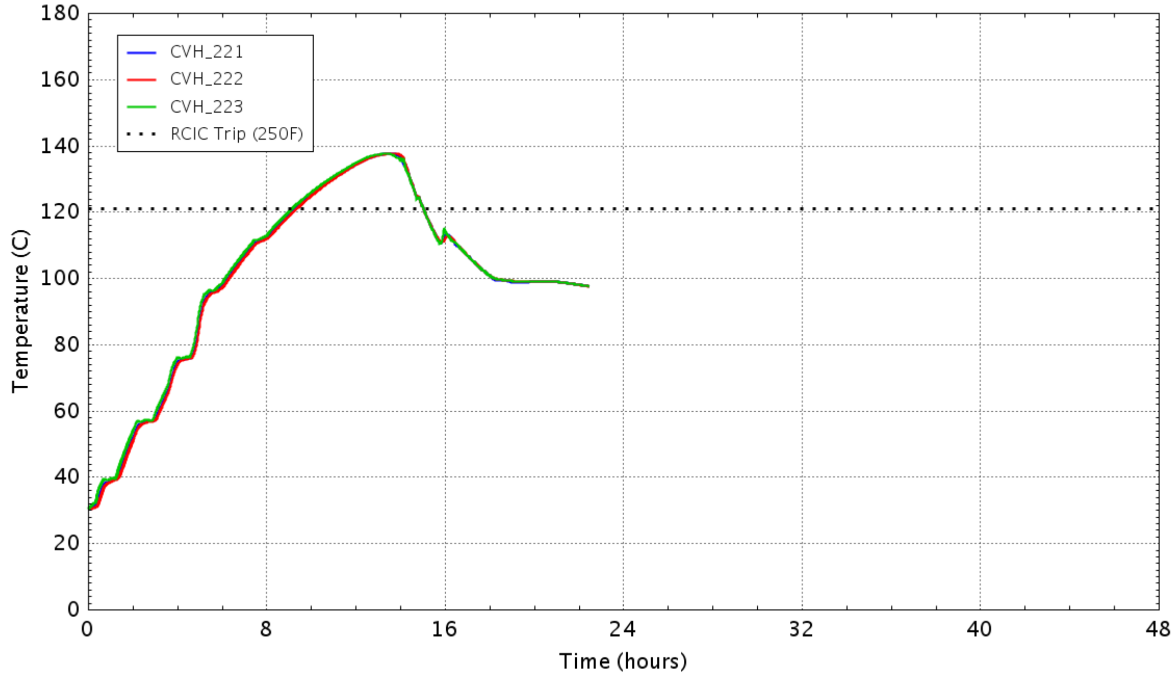

Figure E – 689 Water temperature in the wetwell

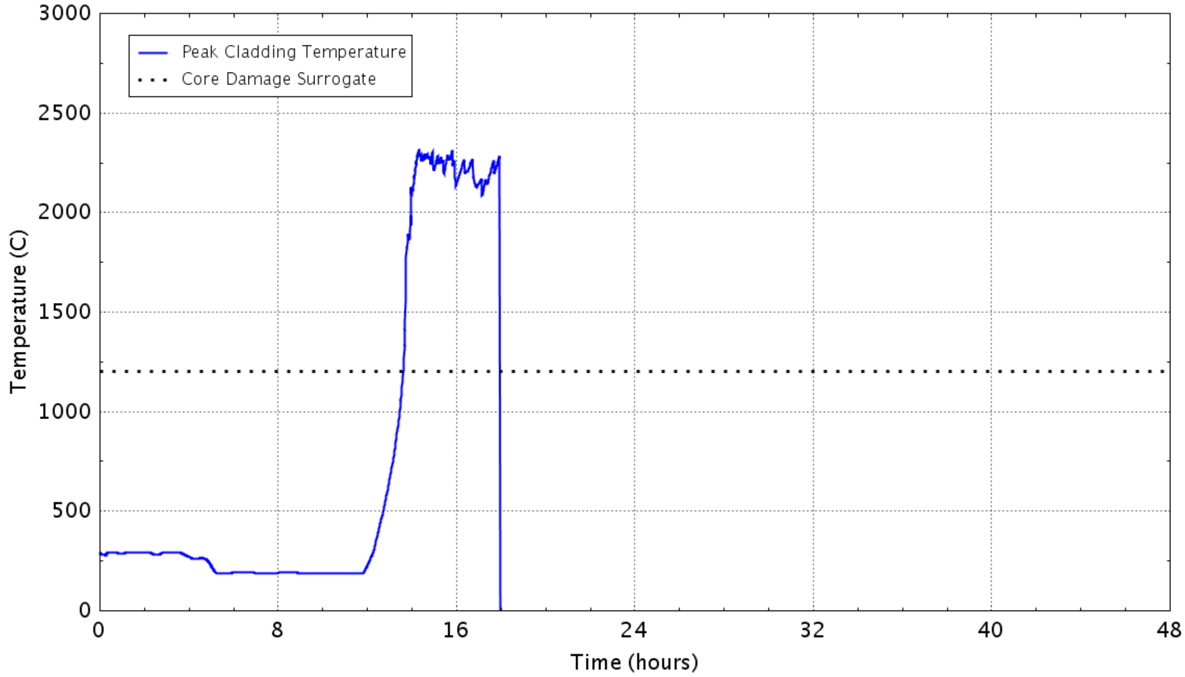

Figure E – 690 Peak temperature of the fuel cladding as a function oftime

E.3.28 Case 31a: Sensitivity to LOMFW-25 Case 29 with CRDHS Unavailable

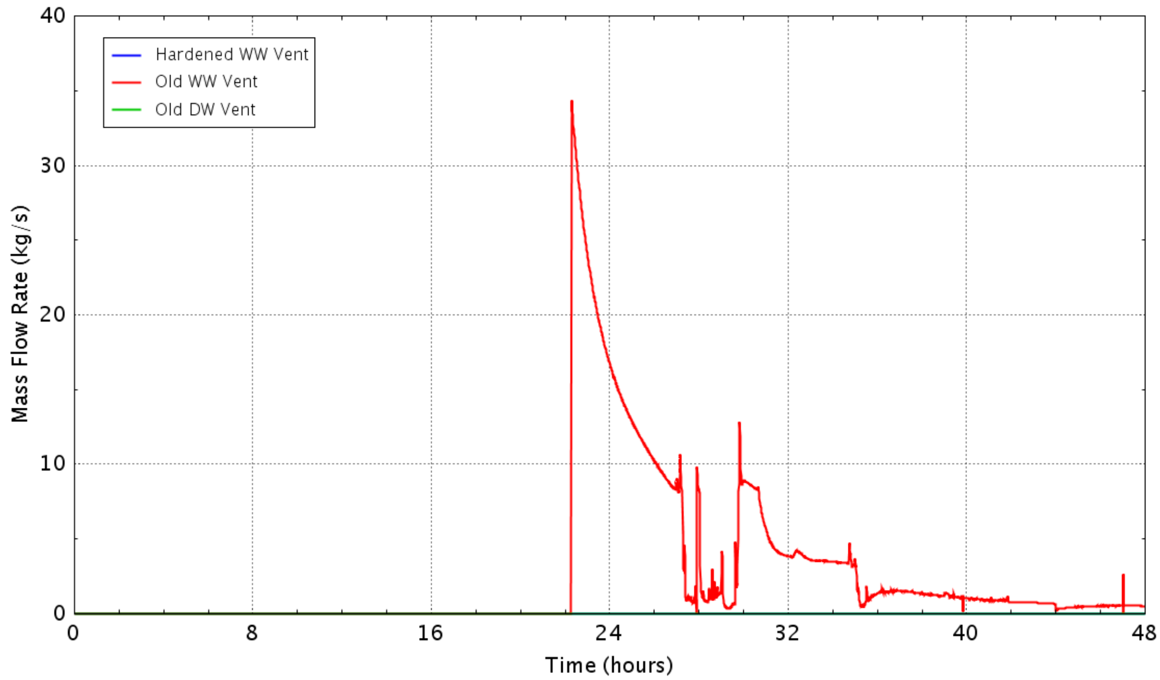

Figure E - 691 Flow rate of the containment vents

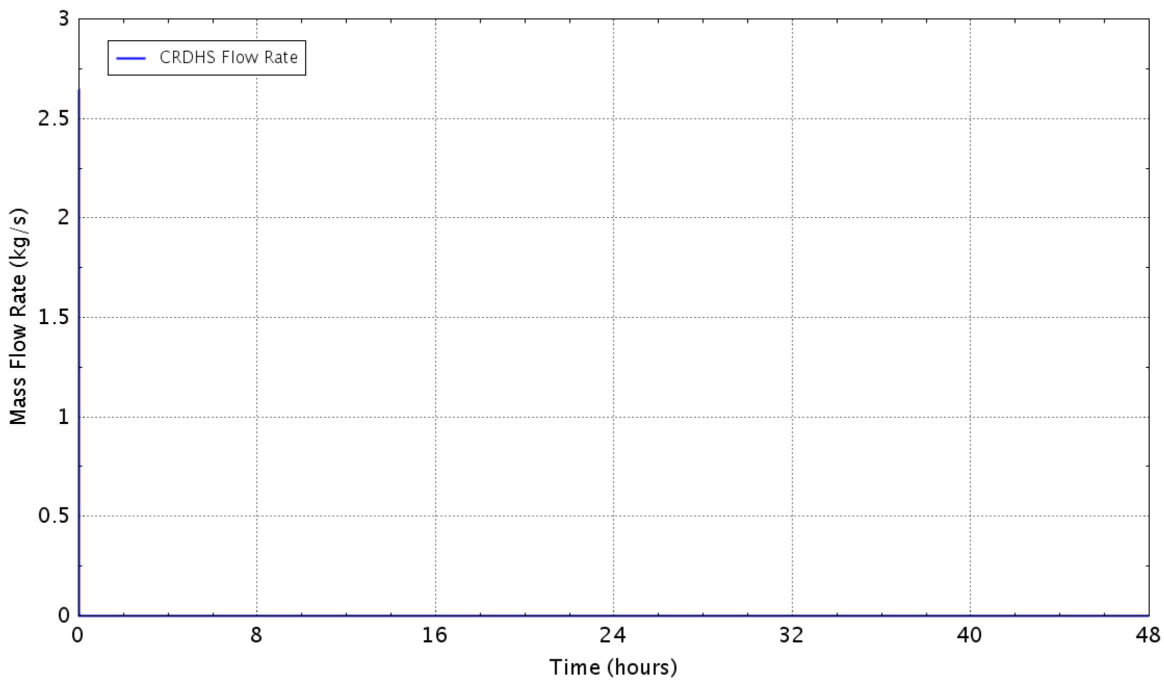

Figure E - 692 Flow rate of the control rod drive hydraulic system

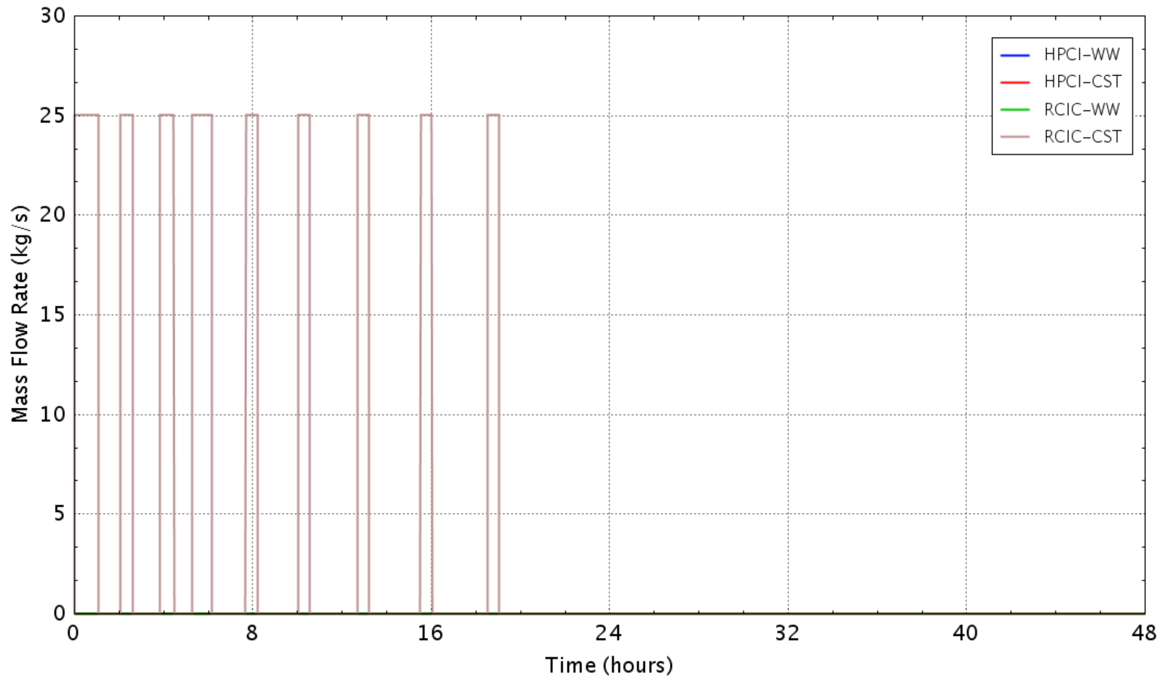

Figure E – 693 Flow rate of the HPCI/RCIC pumps

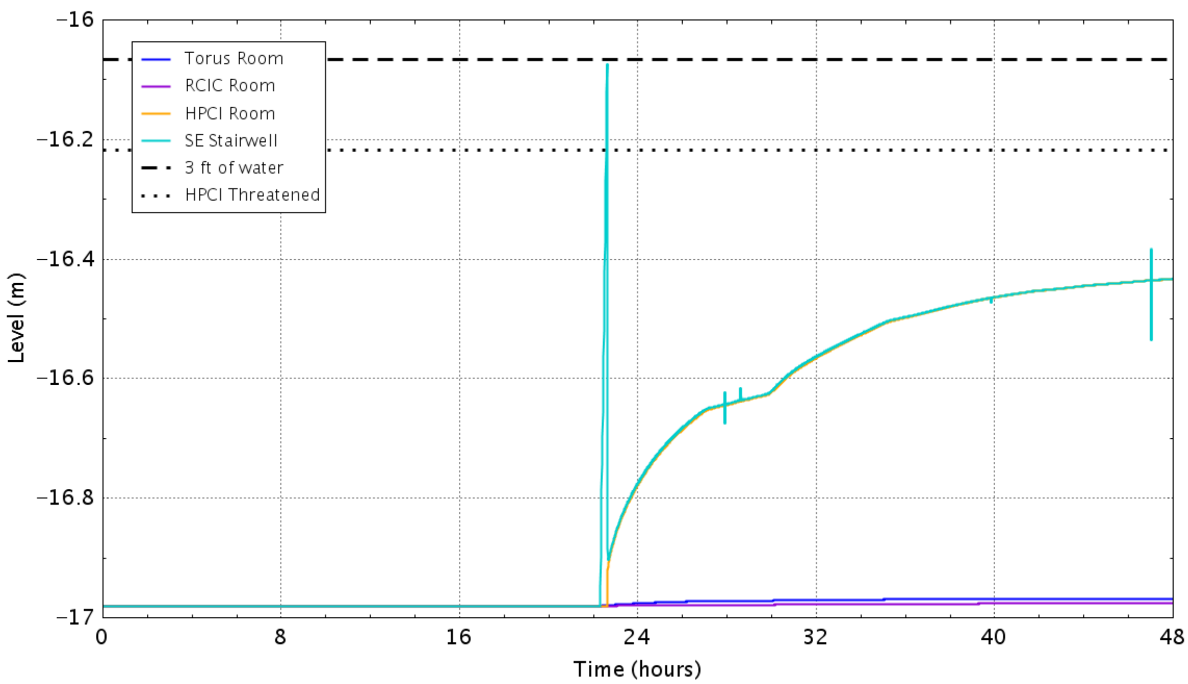

Figure E – 694 Water level in the reactor building basement

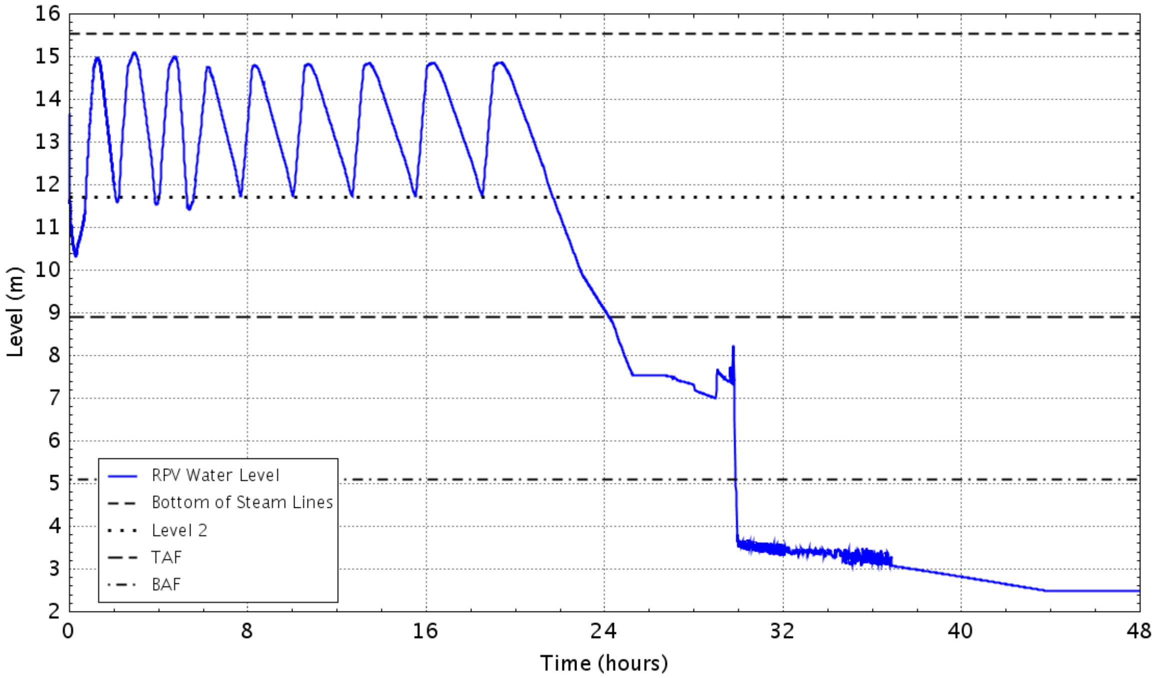

Figure E - 695 RPV down comer water level

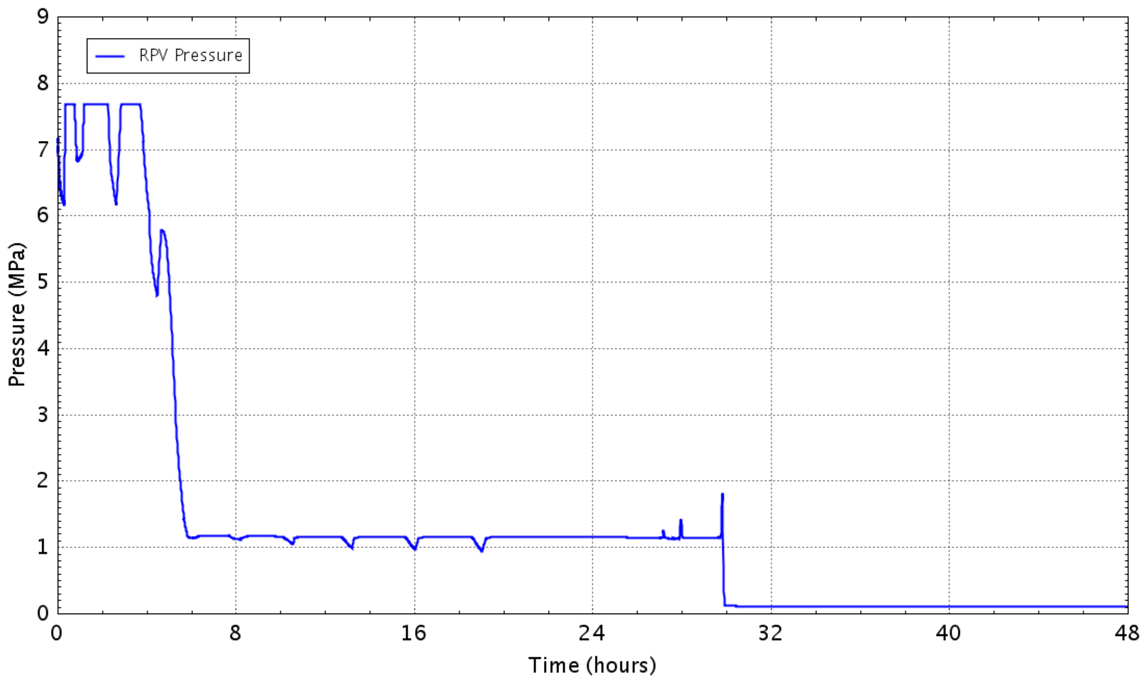

Figure E – 696 Pressure in the RPV

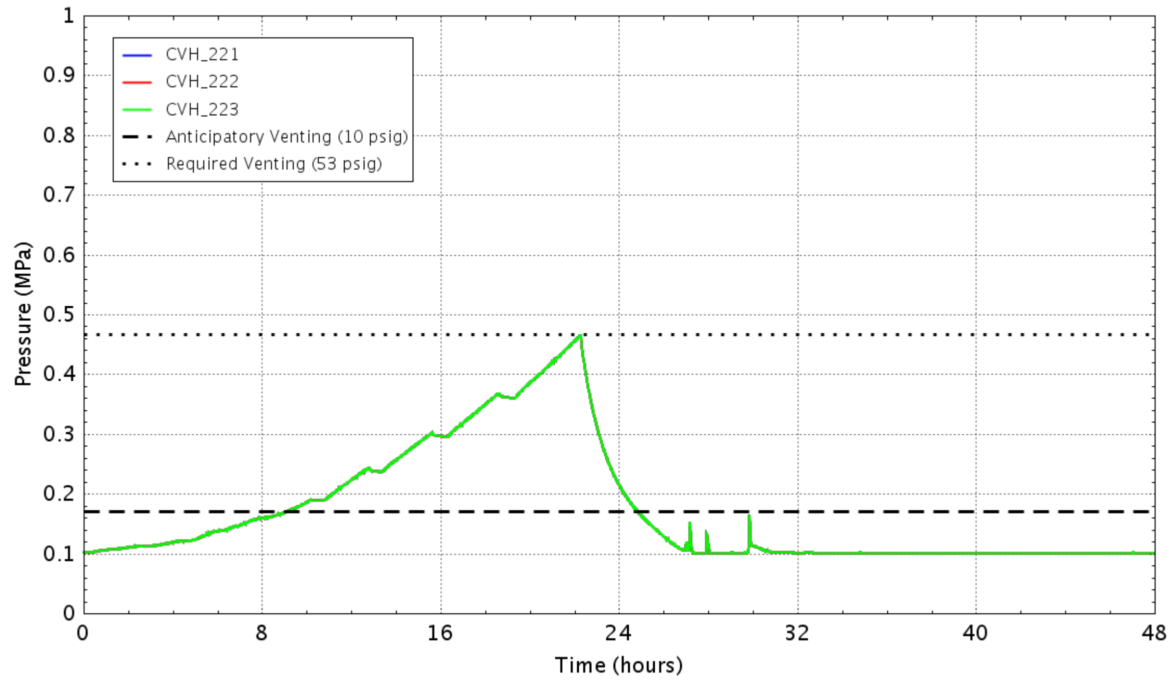

Figure E – 697 **Pressure in the wetwell**

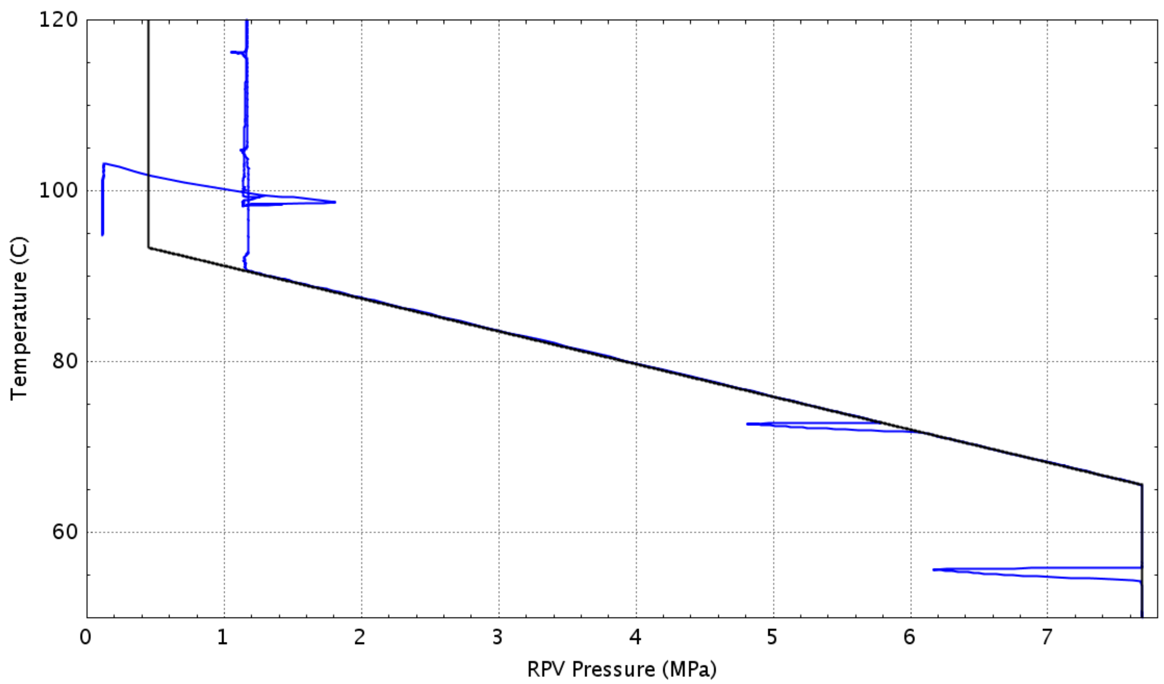

Figure E – 698 **Plant status relative to the HCL curve (Graph 4 of the EOPs)**

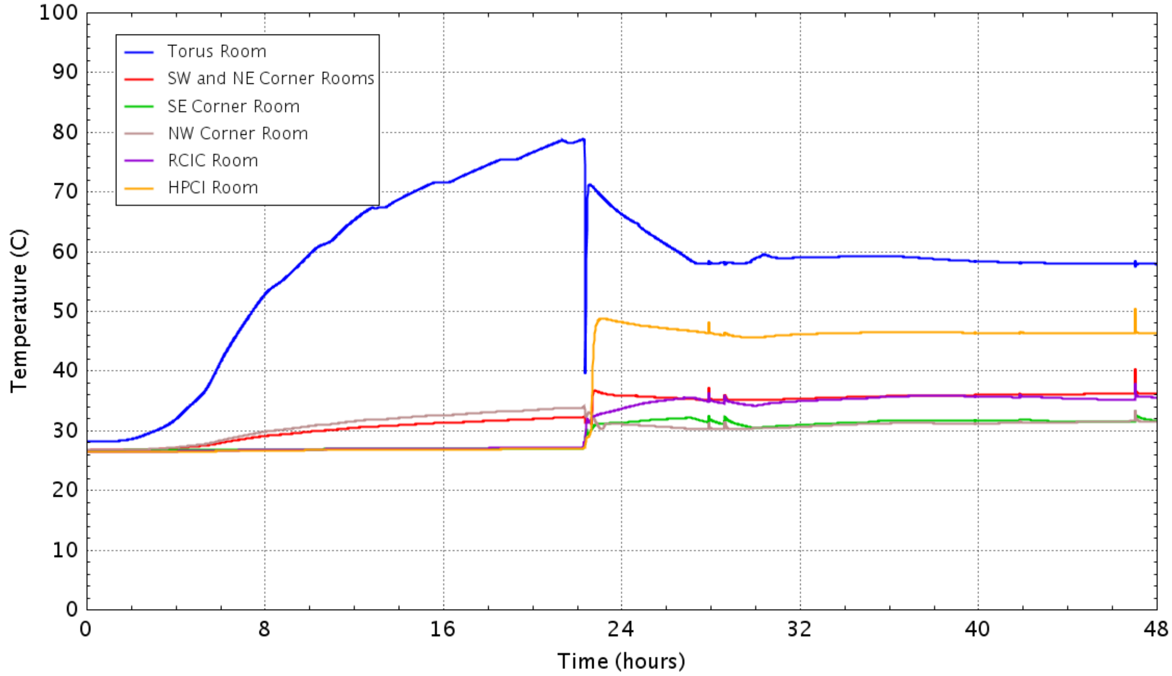

Figure E – 699 **Vapor temperature in the reactor buildingbasement**

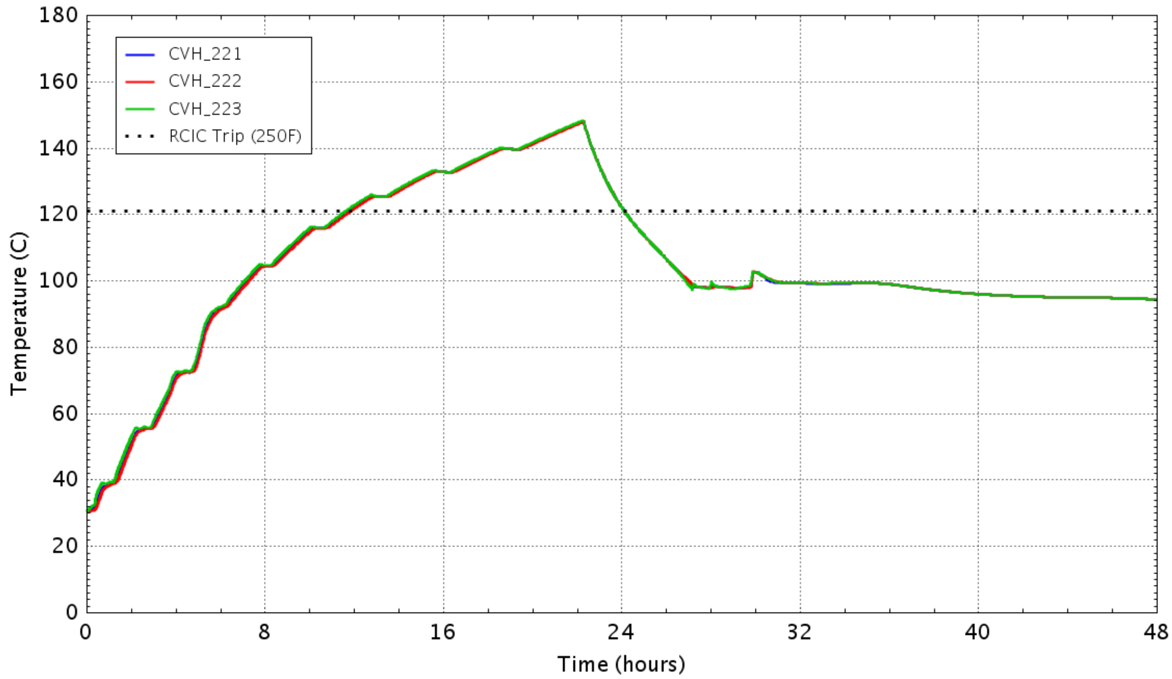

Figure E – 700 **Water temperature in the wetwell**

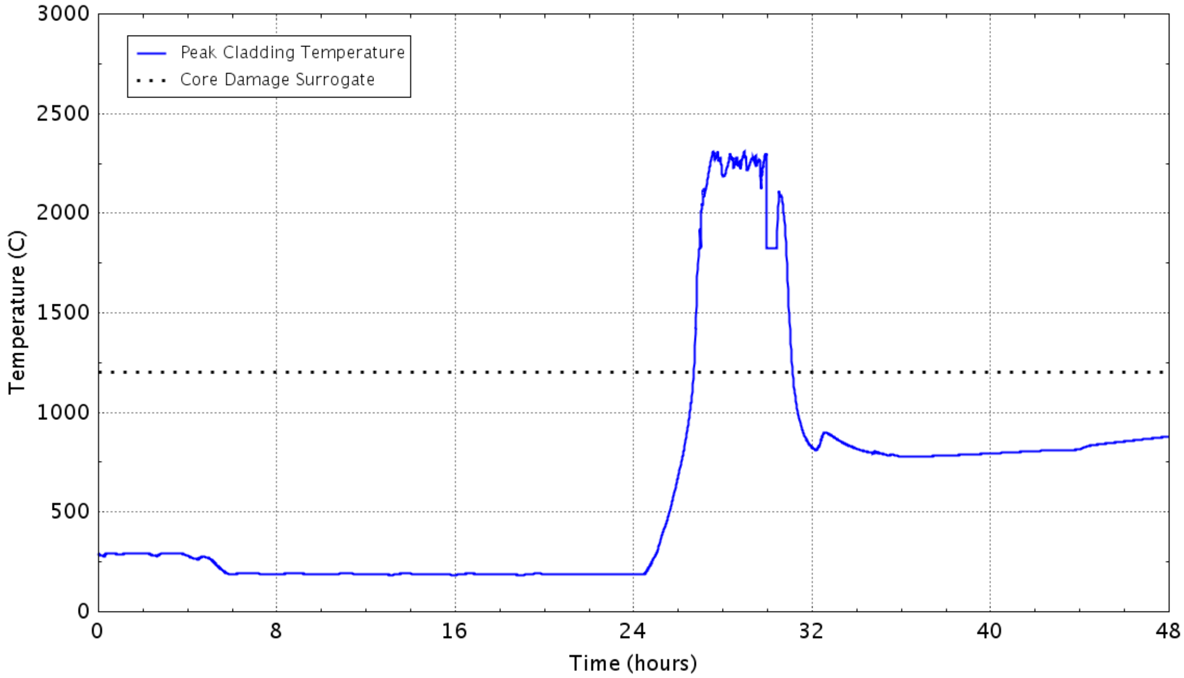

Figure E – 701 **Peak temperature of the fuel cladding as a function of time**

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2. TITLE AND SUBTITLE Confirmatory Thermal-Hydraulic Analysis To Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Duane Arnold Appendices D - E	3. DATE REPORT PUBLISHED MONTH: October — YEAR: 2020 4. FIN OR GRANT NUMBER
5. AUTHOR(S) S. Campbell, S. Dennis, D. Helton, M. Khatib-Rahbar, A. Krall, L. Kozak, R. Buell, F. Sock, J. Pires	6. TYPE OF REPORT Technical 7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Office of Nuclear Regulatory Research
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10. SUPPLEMENTARY NOTES
S. Dennis

11. ABSTRACT (200 words or less)

This report extends the work documented in NUREG-2187, “Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Byron Unit 1,” issued January 2016, to the Duane Arnold Energy Center. Its purpose is to produce an additional set of best estimate thermal-hydraulic calculations that can be used to confirm or enhance specific success criteria for system performance and operator timing found in the agency’s probabilistic risk assessment tools. Along with enhancing the technical basis for the agency’s independent standardized plant analysis risk (SPAR) models, these calculations are expected to be a useful reference to model end users for specific regulatoryapplications.

This report first describes major assumptions used in this study. It then describes the major plant characteristics for the Duane Arnold Energy Center, in addition to the MELCOR model used to represent the plant. Finally, the report presents the results of MELCOR calculations for selected initiators and compares these results to SPAR success criteria, the licensee’s success criteria, or other generic studies.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)	13. AVAILABILITY STATEMENT
PRA, Success Criteria, MELCOR, thermal-hydraulic	unlimited
	14. SECURITY CLASSIFICATION
	(This Page) unclassified
	(This Report) unclassified
	15. NUMBER OF PAGES
	16. PRICE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

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Appendices D - E

Confirmatory Thermal-Hydraulic Analysis To Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Duane Arnold

October 2020