Request for Additional Information No. 30, Revision 0

7/29/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 15.06.05 – Loss of Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary
Application Section: FSAR Ch 15
SRSB Branch

Question 15.06.05-1:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Please provide the following information for the EPR Design:

a. Loop friction and geometry pressure losses from the core exit to the steam generators through the cold legs to the inlet nozzle of the reactor vessel. Also, provide the locked rotor RCP k-factor. Please provide the mass flow rates, flow areas, k-factors, hydraulic diameters and coolant temperatures for the pressure losses provided (upper plenum, hot legs, SGs, suction legs, RCPs, discharge legs, and all exit/inlet nozzles). Please also provide the loss from each of the intact cold legs through the annulus to a single broken cold leg.

b. mixing volume void fraction at two hrs in fig. 2-19 for the limiting large break LOCA.

c. LHSI head flow curve

d. elevation of the top of the core, bottom elevation of the suction leg piping, bottom elevation of the discharge legs, and bottom elevation of the downcomer

Response to Question 15.06.05-1:

A response to this question will be provided by September 24, 2008.

Question 15.06.05-2:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Do the large break LOCA precipitation times and, hence, timing to switch to the simultaneous injection includes consideration for breaks located on the top of the discharge leg piping? If not, please provide an analysis of breaks in this location.

Response to Question 15.06.05-2:

The location of pipe breaks in the large break loss-of-coolant accident (LBLOCA) analysis is based on a side pipe opening. The core region void fraction is determined by summing the volume of the void in each node of each region of the S-RELAP5 analysis in the core mixing/concentrating region at 200 seconds for the 2 ft^2 realistic large break loss-of-coolant accident (RLBLOCA) (2.05 ft^2 on each side of the break for a total of break area of 4.1 ft^2). This is used as a conservative bound for the evaluation of LBLOCA precipitation that sets the maximum time allowed before simultaneous injection is initiated. No credit is taken for the increase in water content as the decay heat decreases with time.

Once the switch to simultaneous injection is initiated, the core region will receive sufficient water flow from the hot legs receiving injection into the upper plenum to start dilution of any concentrated boron solution in the core concentrating region, independent of the break orientation. The excess water will flow down into the lower head and up the downcomer to the break. Any water accumulation in the crossover pipe will not have sufficient head to prevent the steam generated in the core from being transported through the steam generator to the break.

The conservatism of this analysis is sufficient to bound the postulation of a LBLOCA at any other location or opening orientation.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-3:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

What is the sump temperature vs. time following recirculation and how does this impact precipitation? Is the boric acid concentration in the vessel below the precipitation limit based on the minimum sump temperature at the time the switch to simultaneous injection is performed? Please explain.

Response to Question 15.06.05-3:

The sump temperature as a function of time is not considered in the analyses. The analyses assume that the solution enters the core region at the saturation temperature at atmospheric pressure (i.e., 212 °F) with all of the decay heat going into the latent heat of evaporation. No credit is taken for the subcooling of the water entering the core region during the analyses represented in Figure 2-19 of ANP-10288P.

The decay heat is based on the ANS 1971 draft 5.1 Standard with a multiplier of 1.2 on the fission product decay heat as approved for operating plants.

Accounting for the sump temperature and cooling by the low head safety injection (LHSI) heat exchangers would decrease the steam generation rate and steam exiting the core concentrating region. Likewise using the 212°F mixing limit eliminates precipitation at the core inlet if the water entered at the in-containment refueling water storage tank (IRWST) technical specification minimum temperature limit, at 59°F.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-4:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Can debris from the sump block portions of the core inlet and if so, what is the impact on precipitation timing in the regions where the core boric acid cannot diffuse downward into the lower plenum? Please identify the maximum core inlet blockage that can occur and show local concentrations in the core are below the precipitation limit. With the core inlet blocked, and boric acid and other precipitates in the core, show that the switch to simultaneous injection can flush the core and reduce the concentration to acceptable levels.

Response to Question 15.06.05-4:

AREVA performed tests in support of the Olkiluoto-3 (OL3) plant licensing to quantify and characterize debris penetration of the safety injection strainers. The OL3 plant tests utilized a debris source term that includes extensive use of mineral wool insulation. The safety injection system (SIS) strainers incorporate a filtering screen that is sized to retain and capture smaller debris than in the downstream locations including the core. Testing of the SIS strainer assembly with an OL3 source term over a 2 hour period indicated the solid content of the downstream water to be 10 ppm (30 minutes into the test) which decreases to non-measurable values at 2 hours. The test results are conservative for the U.S. EPR in that they reflect the design of the OL3 plant with extensive use of clad mineral wool. Because the U.S. EPR uses reflective metal insulation (RMI) on the reactor coolant system (RCS) the mineral wool source in the U.S. EPR source term will be reduced extensively. It is the fibrous material that penetrates the SIS strainer and forms the basis for downstream blockage of the core region. Due to the limited fibrous material available in the U.S. EPR, there is no downstream blockage that can impact core cooling.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-5:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Vapor exiting the two-phase surface in the core during the long term contains boric acid. What happens to the boric acid in the vapor as it passes through the steam generators to reach the break? Please discuss the plate-out effects on the RCS internals and the impact on long term cooling.

Response to Question 15.06.05-5:

A response to this question will be provided by September 24, 2008.

Question 15.06.05-6:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," data November 2007.

Please justify and explain how the void fractions were determined in Table 2-3.

Response to Question 15.06.05-6:

The void fractions in Table 2-3 of ANP-10288P are determined by dividing the sum of the node void volumes by the sum of the total node volumes from each component/region in the S-RELAP5 analysis in the core mixing/concentrating region at 200 seconds into the transient for the 2 ft^2 realistic large break loss-of-coolant accident (RLBLOCA). There are two typographical errors in Table 2-3 (in the void fraction column) which are corrected below in Table 15.06.05-6-1; however, the region total volume and the liquid volumes are correct. A detailed breakdown is given in Table 15.06.05-6-1 for the various regions in the S-RELAP5 model. The total core region mixing volumes are the correct values. A round-off of the numbers in Table 15.06.05-6-1 causes the heavy reflector void fraction value to appear to be 0.84.

Table 15.06.05-6-1—Core Mixing Volume for RLBLOCA

Region	Volume, ft^3	200 Second Void Fraction RLBLOCA	Liquid Volume, ft^3	Void Volume, ft^3
Core Region	976	0.62	371	605
Lower Support Plate to Heated Core	128	0.00	128	0
Upper Plenum to Bottom of Hot Leg	363	0.80	73	290
Heavy Reflector	38	0.83	6	32
Guide Tubes	93	0.58	39	54
Total for the Core Region Mixing Volume	1598	0.614	617	981

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-7:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Does the mixing volume consider the maximum content of sump debris that can accumulate in the core? What is the maximum amount (volume) of debris that can accumulate in the core and lower plenum regions during recirculation?

Response to Question 15.06.05-7:

The mixing volume does not consider the maximum content of sump debris that can accumulate in the core. The maximum amount (volume) of debris that can accumulate in the core and lower plenum regions during recirculation will be based on future testing. Testing of the safety injection system (SIS) strainer assembly over a two hour period indicates the solids content of the downstream water to be 10 ppm (30 minutes into the test) which, thereafter, decreases to non-measurable values at two hours. The test results are very conservative in that they reflect the design of the Olkiluoto-3 (OL3) plant which uses a debris source term that includes more extensive use of mineral wool than the U.S. EPR. The debris source term for the U.S. EPR utilizes more reflective metal insulation in lieu of mineral wool, thereby further reducing the maximum amount of debris that can accumulate in the core. The SIS strainer test results are described in ANP-10293, "U.S. EPR Design Features to Address GSI-191 Technical Report."

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-8:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Please describe the tests used to validate the two-phase level swell and boric acid precipitation models.

Response to Question 15.06.05-8:

A response to this question will be provided by October 22, 2008.

Question 15.06.05-9:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Justify the mixing of boric acid from the core into the lower plenum region throughout the entire event (given that colder water will stratify in the lower plenum during injection). Was the mixing volume in Table 2-3 used for all times in the boric acid buildup calculations presented in Fig 2-19? Explain the basis for using other mixing volumes, if that is the case.

Response to Question 15.06.05-9:

The lower plenum (see Table 2-3 of ANP-10288P) includes the volume from the bottom of the lower core support plate to the beginning of the fueled section in the fuel pin inside of the core barrel. It does not include any of the lower head volume. The difference in the heat generation distribution in the core region is expected to induce turbulence at least this far down into the region inside the core barrel. Once the hot side injection is started, the turbulence and recirculating flow at the lower support plate are expected to make the lower head volume part of the mixing volume However, no part of the lower head volume is included in the analysis model for the time to start simultaneous injection in Figure 2-19 of ANP-10288P.

The mixing volume in Table 2-3 of ANP-10288P is used for all times in the boric acid buildup calculations for the large break loss-of-coolant accident. The mixing volume is constant at the 200 second value for the generation of the core region boron concentration presented in Figure 2-19 of ANP-10288P. The S-RELAP-5 analyses indicate that the liquid volume could be increased with time. Thus the use of the concentrating volume at 200 seconds is conservative for the establishment of the time to switch to simultaneous injection. No other volumes are used.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-10:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," date November 2007.

Page 2-7 describes four sources of boric acid in the EPR design. Since following a large break LOCA very little liquid will remain in the vessel, combining the low concentration core boric acid with the other sources does not appear appropriate. Please discuss the effect of excluding the initial RCS concentration from the boric acid calculations. Also computing a mixed mean boric acid concentration to determine precipitation time does not take into account that some of the higher concentration sources could inject at much higher flow rates. As such, please show the concentration vs. time in Fig. 2-19 assuming that the EBS injects alone followed by only the IRWST as sources.

Response to Question 15.06.05-10:

A response to this question will be provided by October 22, 2008.

Question 15.06.05-11:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

Discuss the means by which the boric acid from the high concentration EBS tanks can be injected into the RCS? Could this be the sole source of injection once the accumulators empty? Please explain

Response to Question 15.06.05-11:

A response to this question will be provided by October 22, 2008.

Question 15.06.05-12:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

What is the basis for choosing the 200 second time for void fraction to compute the boric acid concentration vs. time? Also, what is the basis for choosing 2.5 sq. ft. break? Please explain.

Response to Question 15.06.05-12:

The 200 second time for void fraction is chosen because it is the end of the run for the specific realistic large break loss-of-coolant accident (RLBLOCA) peak cladding temperature (PCT) case. The boron precipitation analyses are related to long term cooling, thus using the 200 second value and holding it constant is conservative for establishing the time to switch to simultaneous injection.

The small break loss-of-coolant accident (SBLOCA) is evaluated for breaks up to 6 inches. All SBLOCA cases return to natural circulation. The four square foot break is considered to be a reasonable extension for the large break loss-of-coolant accident (LBLOCA) analyses to establish a time to simultaneous injection, because the 200 second water volume is held constant with time through the evaluation. The “2.5 ft^2” for the break opening is a typographical error; the break used in this analysis is 2.05 ft^2 at each side (4.1 ft^2 total).

This specific RLBLOCA PCT case chosen is extended to about 6000 seconds, and confirms that the 200 second value is conservative. In addition, the case extended to 6000 seconds confirms that the simultaneous injection dilutes the solution in the core concentrating region. The 200 seconds inventory is less than the inventory that is increasing at the end of the analysis (near 6000 seconds).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-13:

The staff submits the following Request for Information (RAI) based on the review of ANP-10288P entitled "U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report," dated November 2007.

The switch to simultaneous injection is identified to be 2 hrs post-LOCA. Is this switch time to be identified in the EOPs? Since the precipitation limit is reached about 10 minutes later, please demonstrate that the switch can be performed in less than 10 minutes.

Also, at 2 hrs post-LOCA, what is the entrainment rate in the hot legs due to steaming from the core at the lowest achievable RCS pressure following the limiting LBLOCA? Please justify and demonstrate that the hot leg injection is not entrained into the hot legs and steam generators at 7200 seconds. Please also justify the maximum elevation of the two-phase level in the hot leg at this time so that the appropriate vapor velocity (used in the entrainment calculation) in the upper portion of the hot leg can be determined.

Response to Question 15.06.05-13:

A response to this question will be provided by September 24, 2008.

Question 15.06.05-14:

Please provide the values of the sampled parameters and the range of each parameter used for the 59 cases for the equilibrium cycle and the 59 cases for the initial cycle analyses. Include the PCT result for each case. Provide the information in an Excel spreadsheet format if possible.

Response to Question 15.06.05-14:

Table 18-4 in AREVA NP's June 13, 2008, response to RAI-18 on ANP-10278 (NRC:08:039) provides the range of each plant, model, and calculation parameter from the equilibrium fuel cycle uncertainty analysis. The initial fuel cycle uncertainty analysis uses the same plant and model parameter ranges. Table 15.06.05-14-1 provides the calculation parameters for the initial fuel cycle.

Special probability functions have been created for the modified Bromley and Forslund-Rohsenow film boiling correlations. The probability density functions are defined by Equation 1 and Equation 2 below. The coefficients for the equations vary depending on whether they are to be applied to the S-RELAP5 parameters: FILMBL (low void fraction) or FRHTC (high void fraction).

[ ]

For q > switch, where q is a random number between 0 and 1.

The attached files, *15.06.05-14-1_eqcy.xls* and *15.06.05-14-2_cy01.xls*, contain the sampled parameter values for each case from the equilibrium cycle and initial cycle analyses.

Table 15.06.05-14-1—Calculation Parameters for Initial Fuel Cycle Uncertainty Analysis

Parameter Name	Lower Value or Mean	Upper Value or Std. Dev	Probability Density Function
Calculation Parameters			
Time in cycle	0	41	uniform
Fq	[ ]	2.6	uniform
[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-15:

Please confirm that FSAR Figures 5.6-27 through 15.6-36 are from the same simulation as FSAR Figures 15.6-37 through 15.6-50.

Response to Question 15.06.05-15:

U.S. EPR FSAR Tier 2, Figures 5.6-27 through 15.6-36 are from the same simulation as U.S. EPR FSAR Tier 2, Figures 15.6-37 through 15.6-50.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-16:

Plotted information has only been provided for the equilibrium cycle case. Please provide a set of plots similar to FSAR Figures15.6-27 through 15.6-50 for the limiting PCT initial cycle case.

Response to Question 15.06.05-16:

The requested figures are provided.

- Figure 15.06.05-16-1—PCT Independent of Elevation
- Figure 15.06.05-16-2—Hot Rod Cladding Temperature
- Figure 15.06.05-16-3—Primary System Pressure
- Figure 15.06.05-16-4—Flows Supplied to ECCS
- Figure 15.06.05-16-5—Flows Delivered by ECCS
- Figure 15.06.05-16-6—Core Inlet Flow
- Figure 15.06.05-16-7—Core Outlet Flow
- Figure 15.06.05-16-8—Break Flow
- Figure 15.06.05-16-9—Collapsed Liquid Level in the Downcomer
- Figure 15.06.05-16-10—Core Liquid level
- Figure 15.06.05-16-11—Reactor Power
- Figure 15.06.05-16-12—Secondary System Pressure
- Figure 15.06.05-16-13—Downcomer Mass Flowrate
- Figure 15.06.05-16-14—Core Inlet Temperature
- Figure 15.06.05-16-15—Core Inlet Quality
- Figure 15.06.05-16-15—Core Inlet Quality
- Figure 15.06.05-16-16—Core Outlet Temperature
- Figure 15.06.05-16-17—Core Outlet Quality
- Figure 15.06.05-16-18—In-core Temperature
- Figure 15.06.05-16-19—In-core Quality
- Figure 15.06.05-16-20—Cladding Temperature
- Figure 15.06.05-16-21—Heat Transfer Coefficient
- Figure 15.06.05-16-22—Primary to Secondary Heat Transfer
- Figure 15.06.05-16-23—Pump Speed
- Figure 15.06.05-16-24—Containment Pressure

Figure 15.06.05-16-1—PCT Independent of Elevation

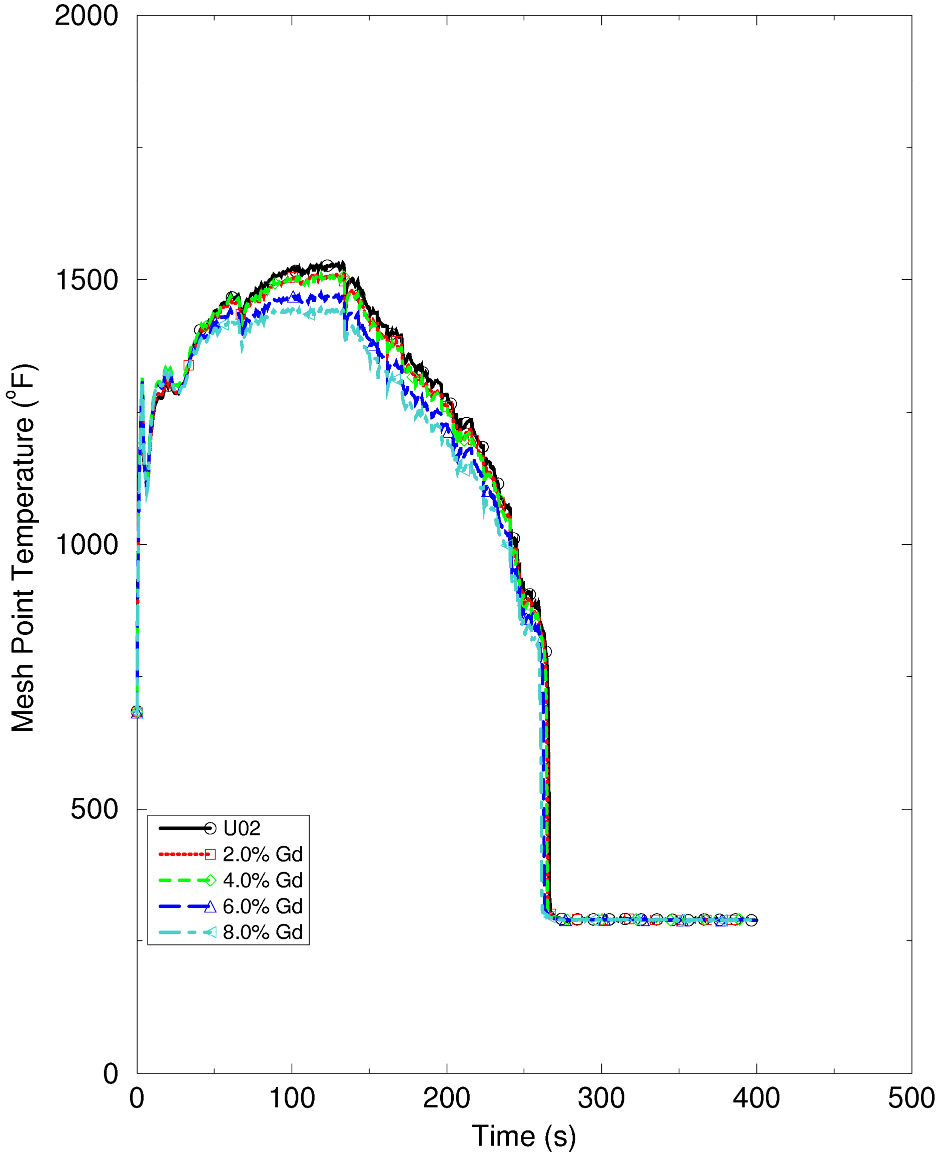


Figure 15.06.05-16-2—Hot Rod Cladding Temperature

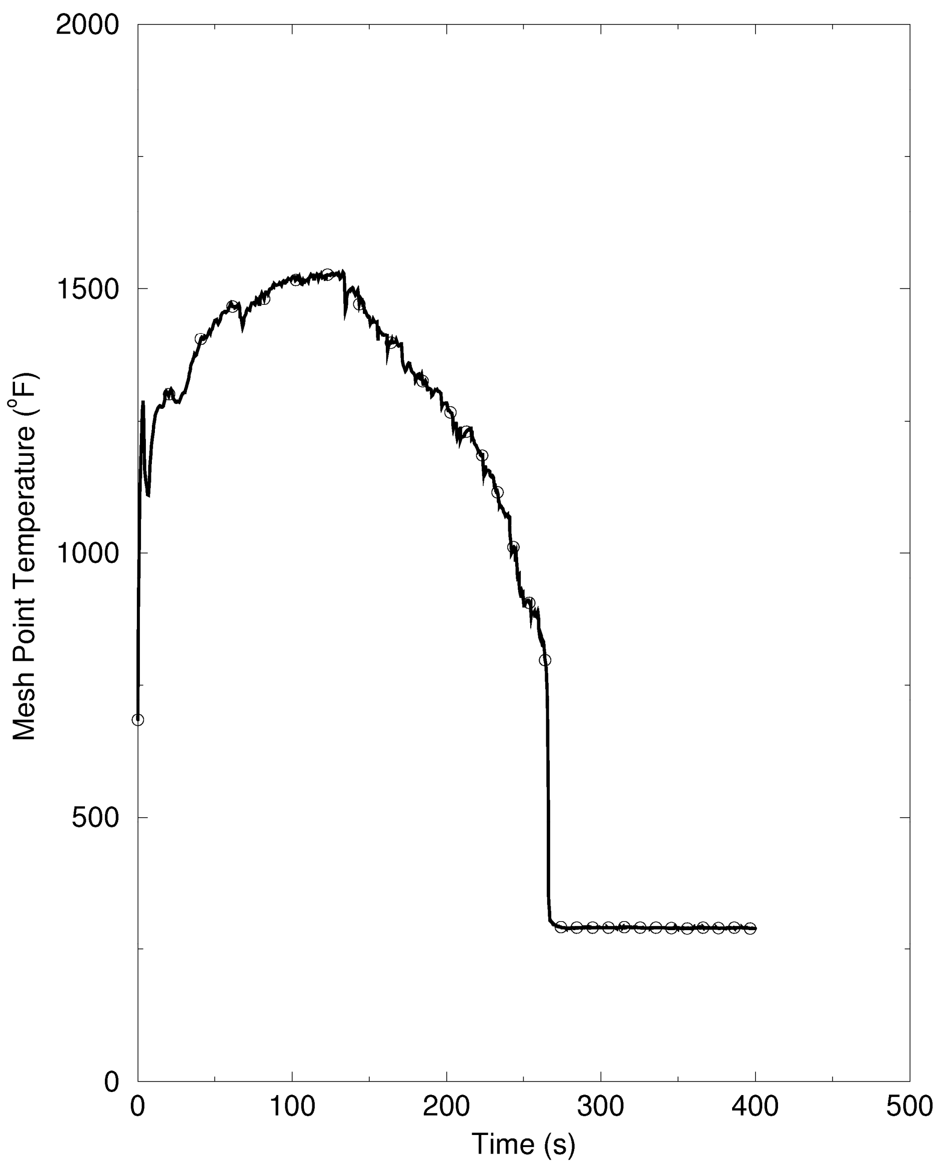


Figure 15.06.05-16-3—Primary System Pressure

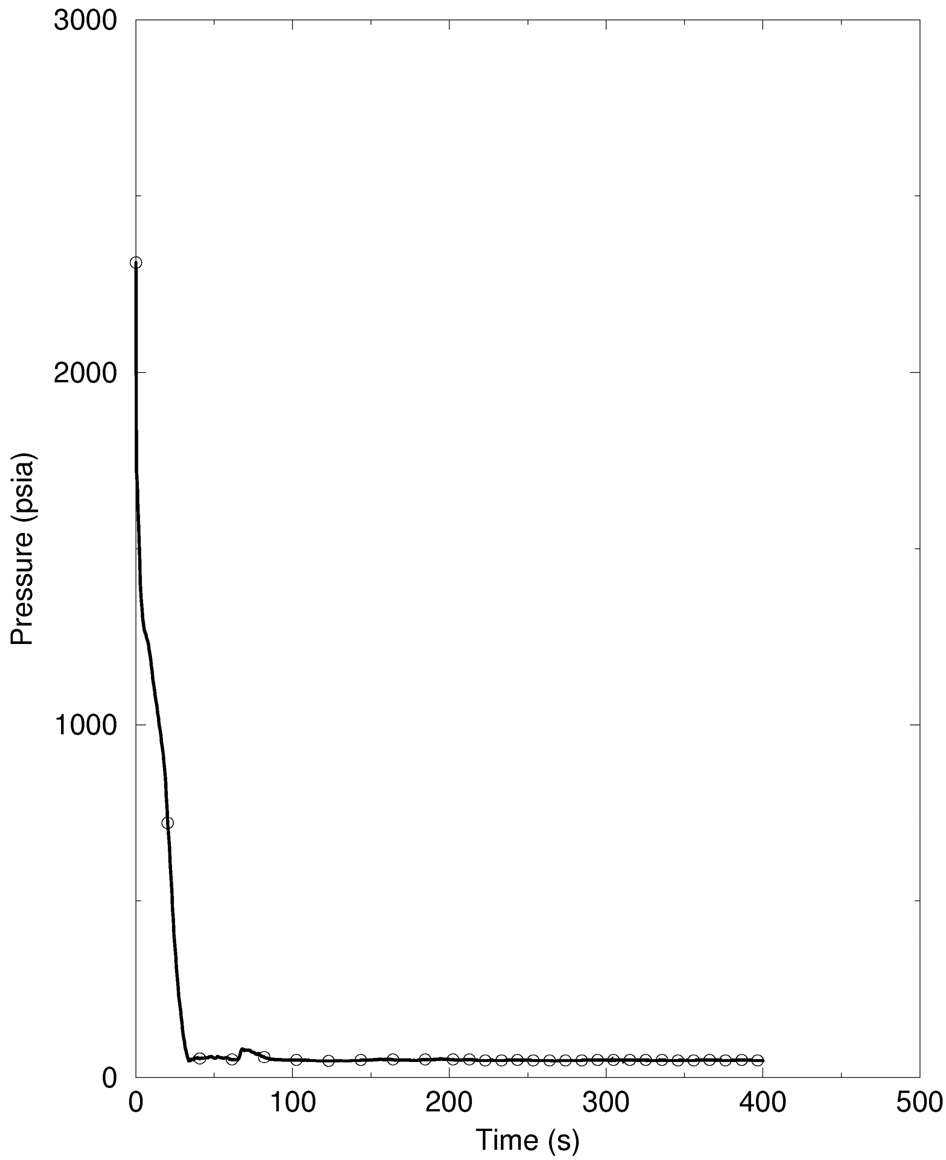


Figure 15.06.05-16-4—Flows Supplied to ECCS

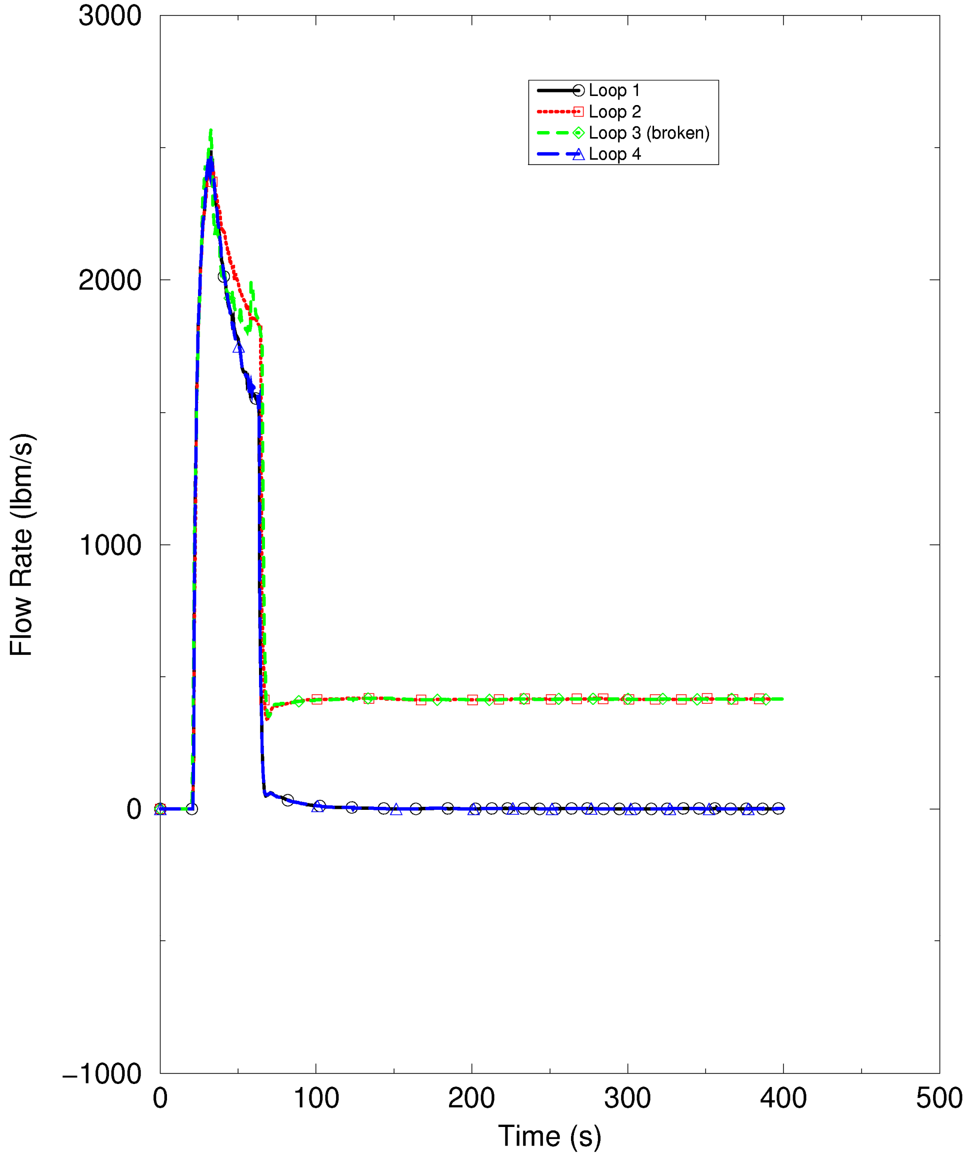


Figure 15.06.05-16-5—Flows Delivered by ECCS

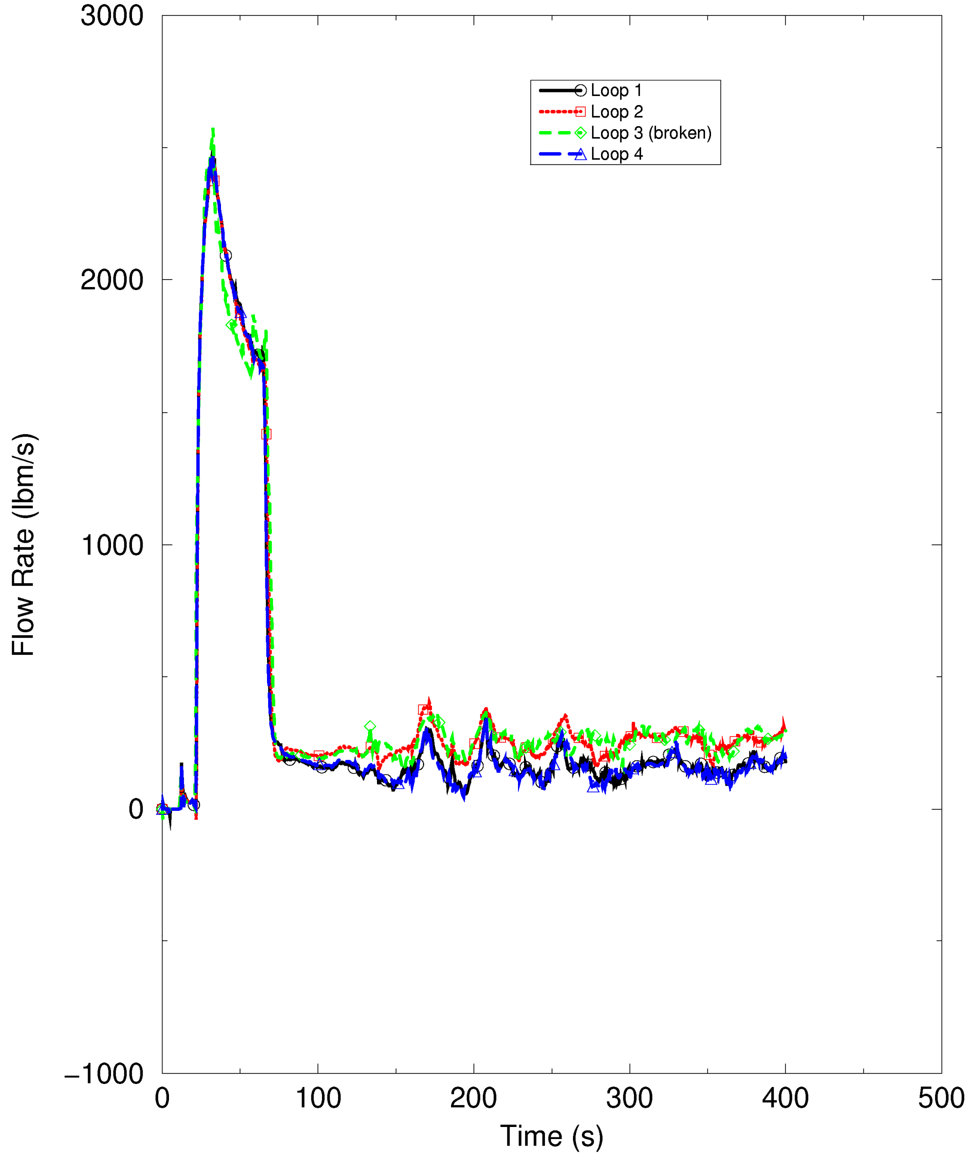


Figure 15.06.05-16-6—Core Inlet Flow

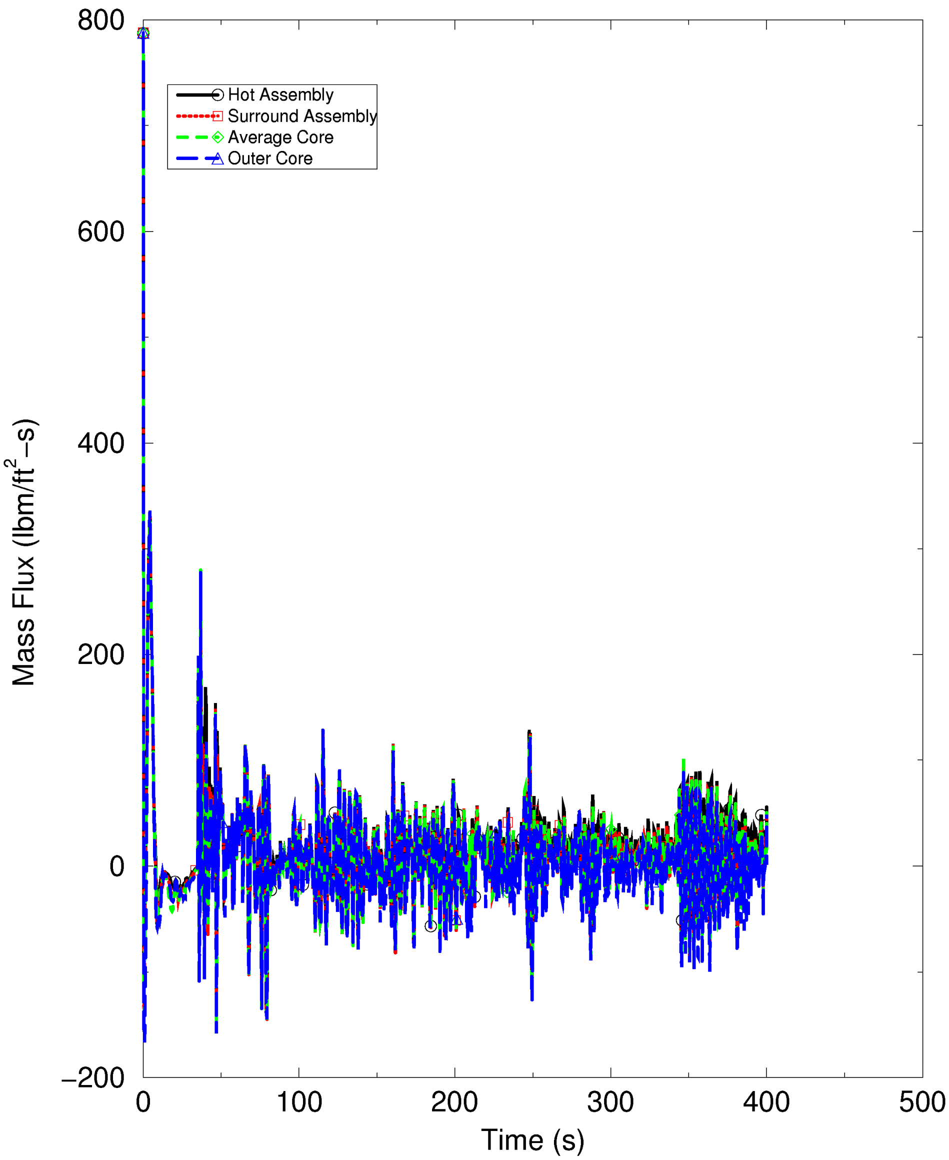


Figure 15.06.05-16-7—Core Outlet Flow

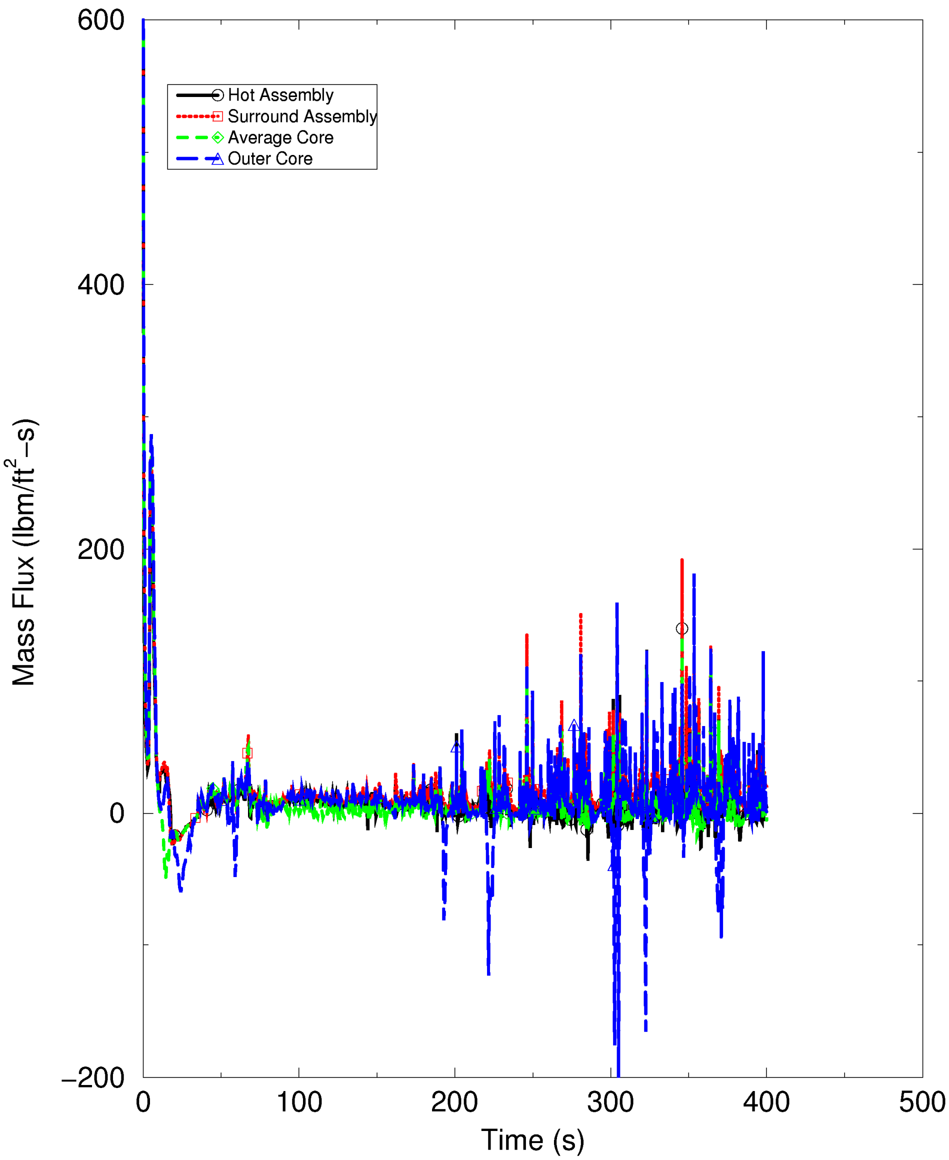


Figure 15.06.05-16-8—Break Flow

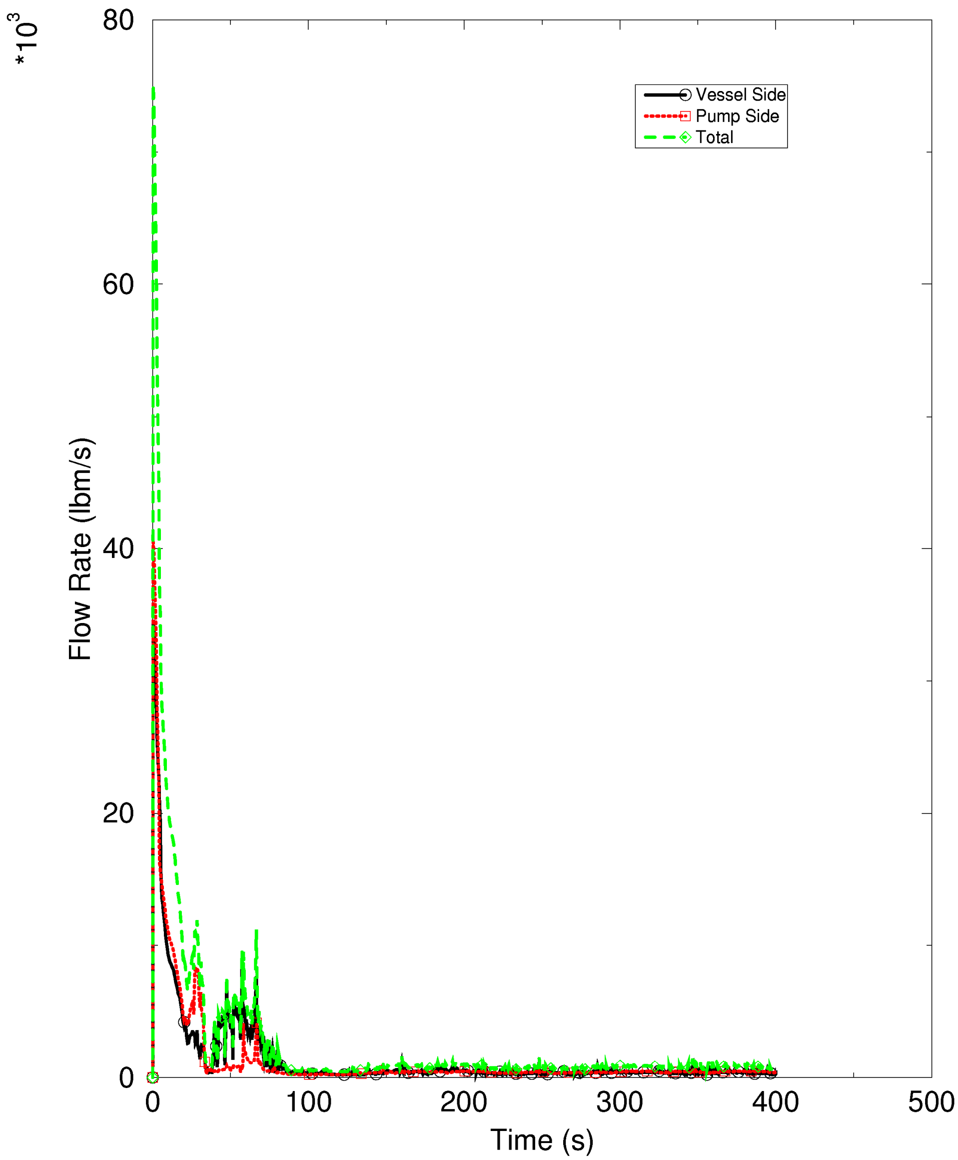


Figure 15.06.05-16-9—Collapsed Liquid Level in the Downcomer

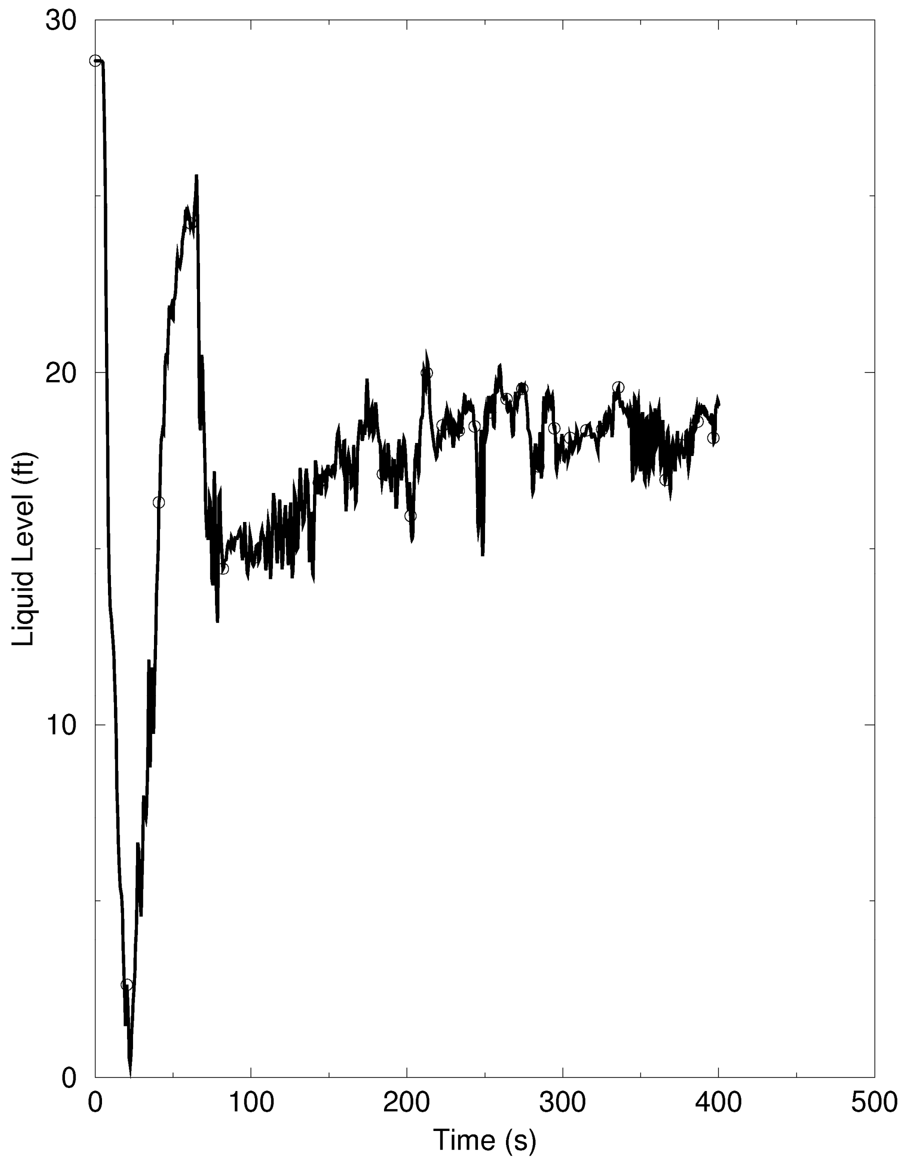


Figure 15.06.05-16-10—Core Liquid level

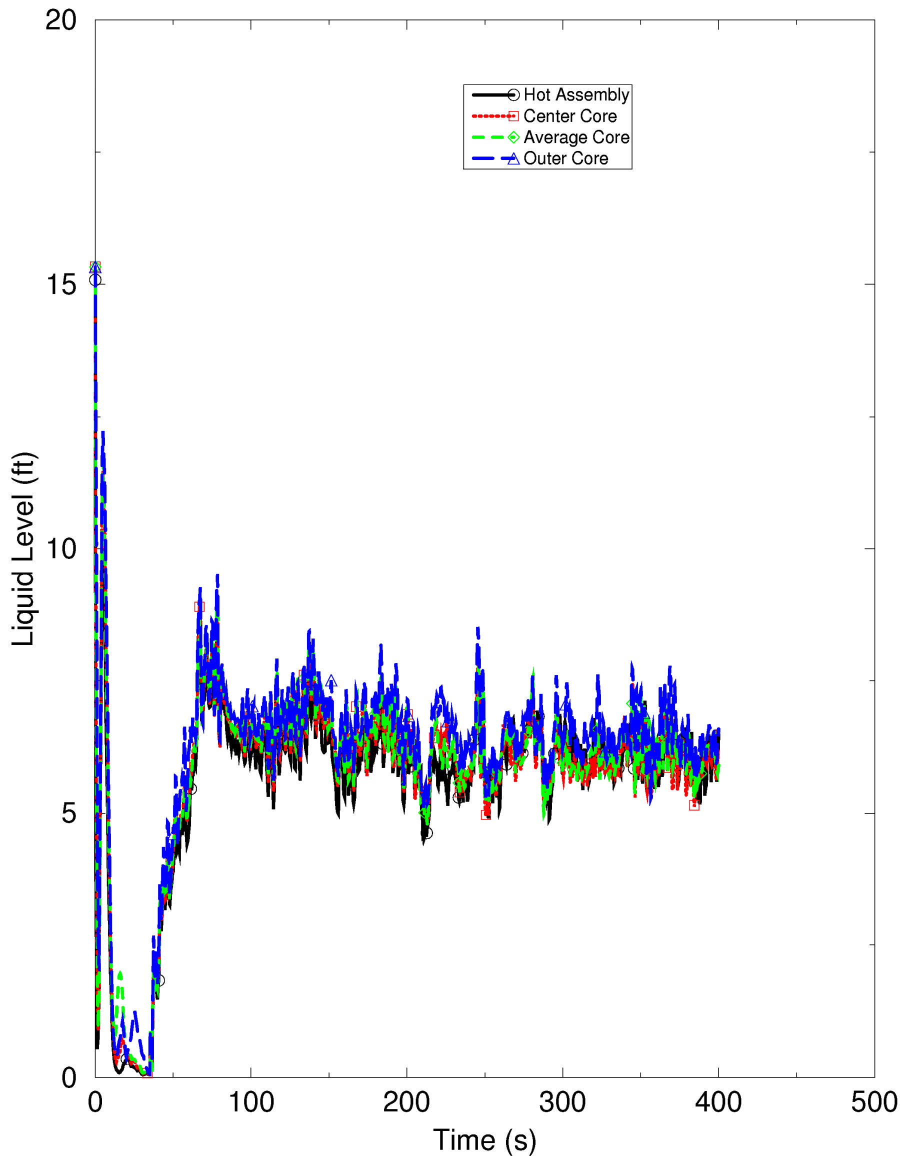


Figure 15.06.05-16-11—Reactor Power

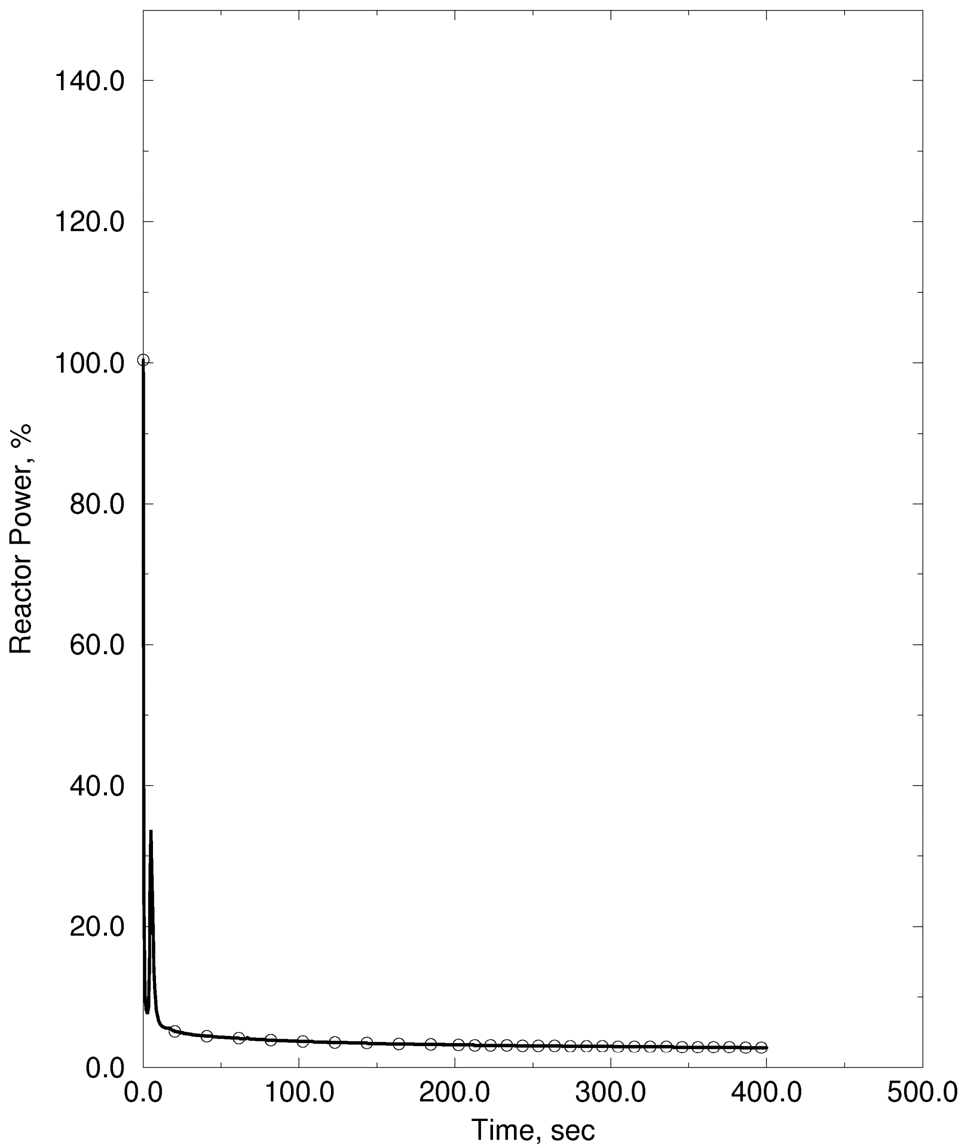


Figure 15.06.05-16-12—Secondary System Pressure

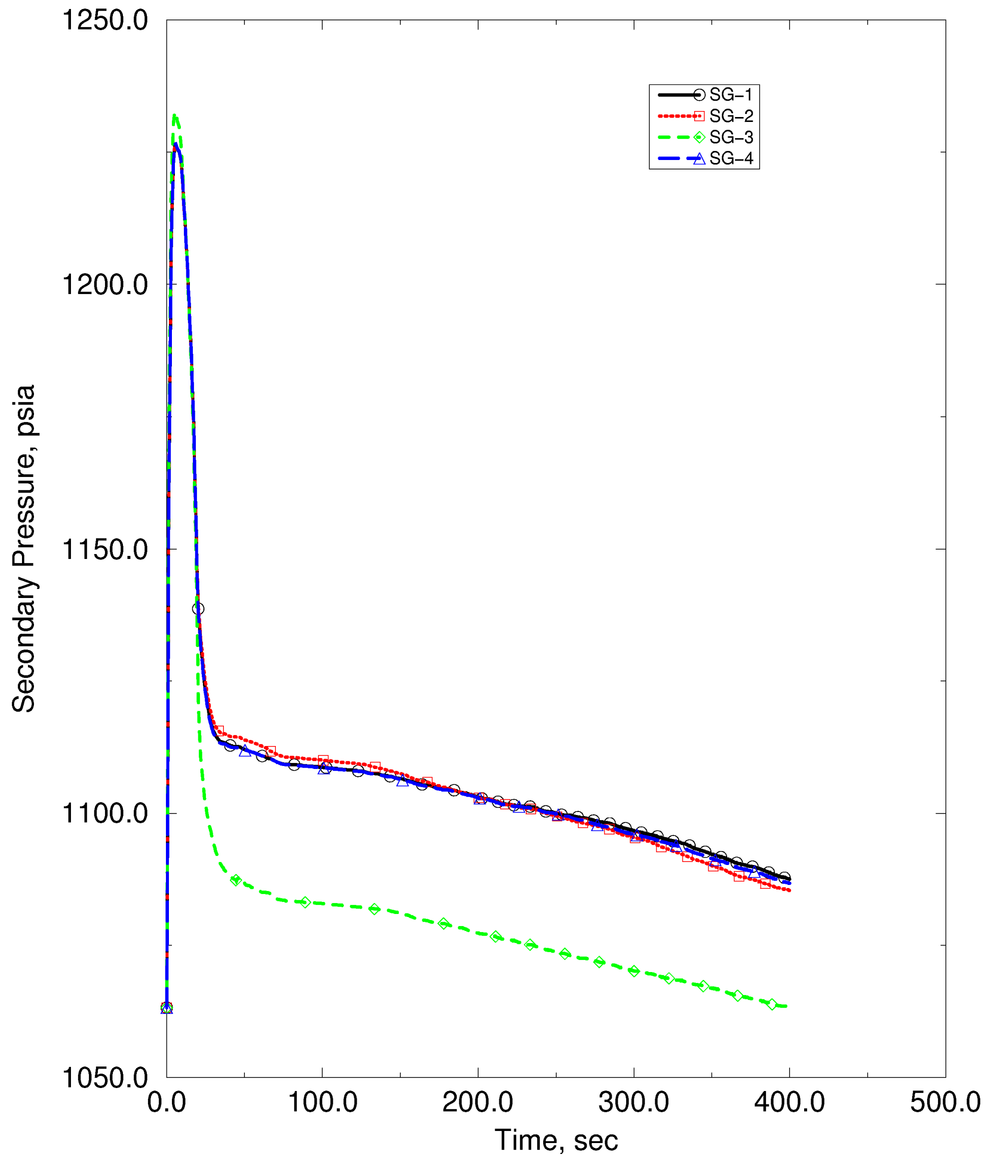


Figure 15.06.05-16-13—Downcomer Mass Flowrate

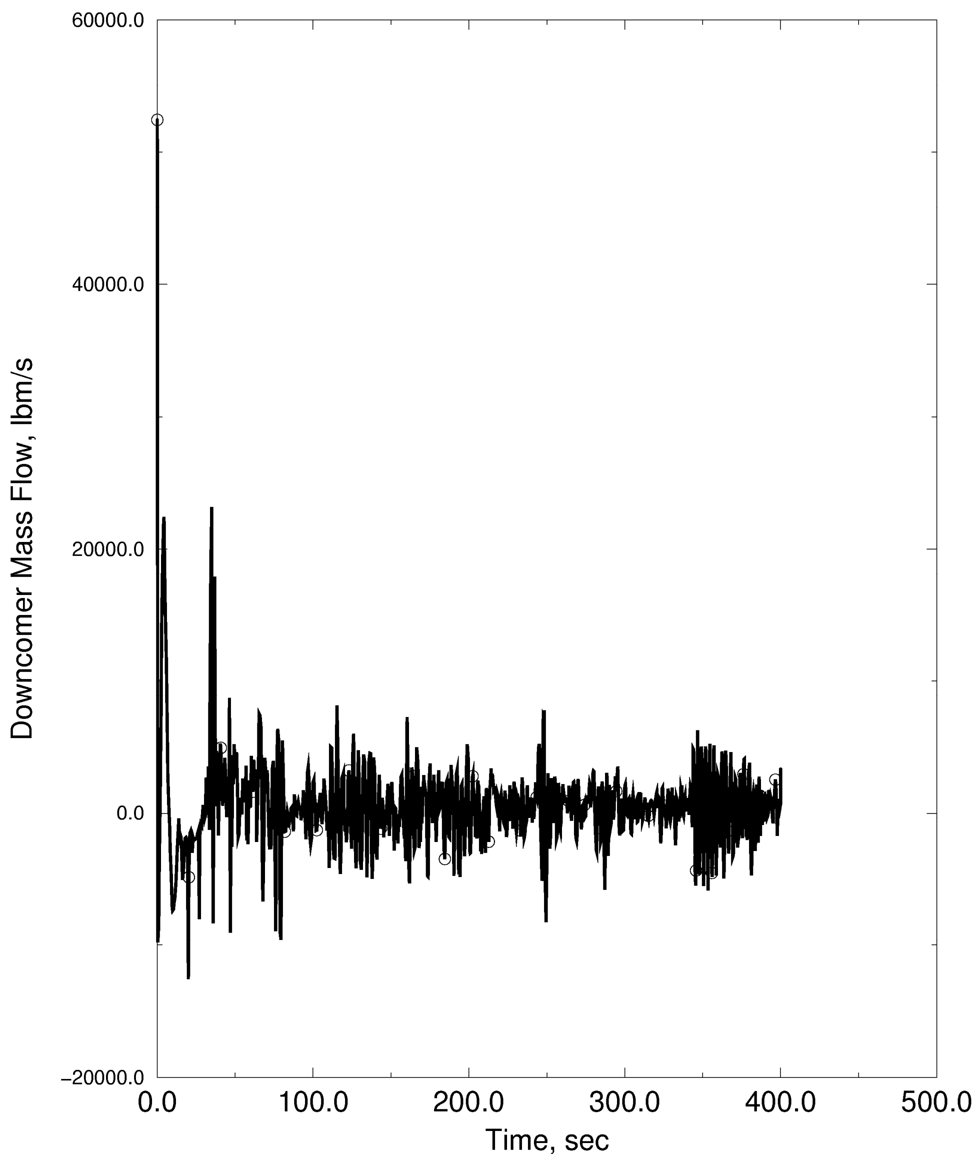


Figure 15.06.05-16-14—Core Inlet Temperature

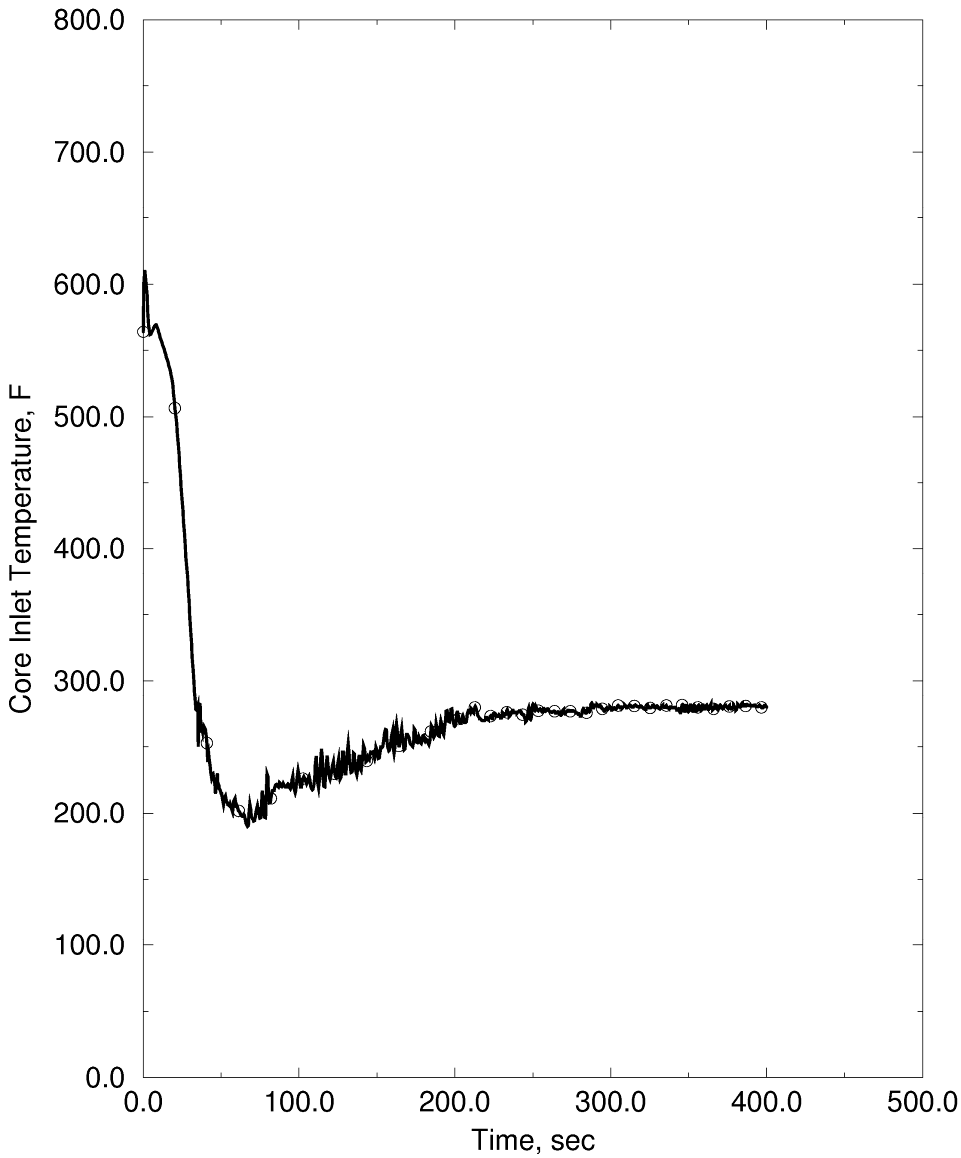


Figure 15.06.05-16-15—Core Inlet Quality

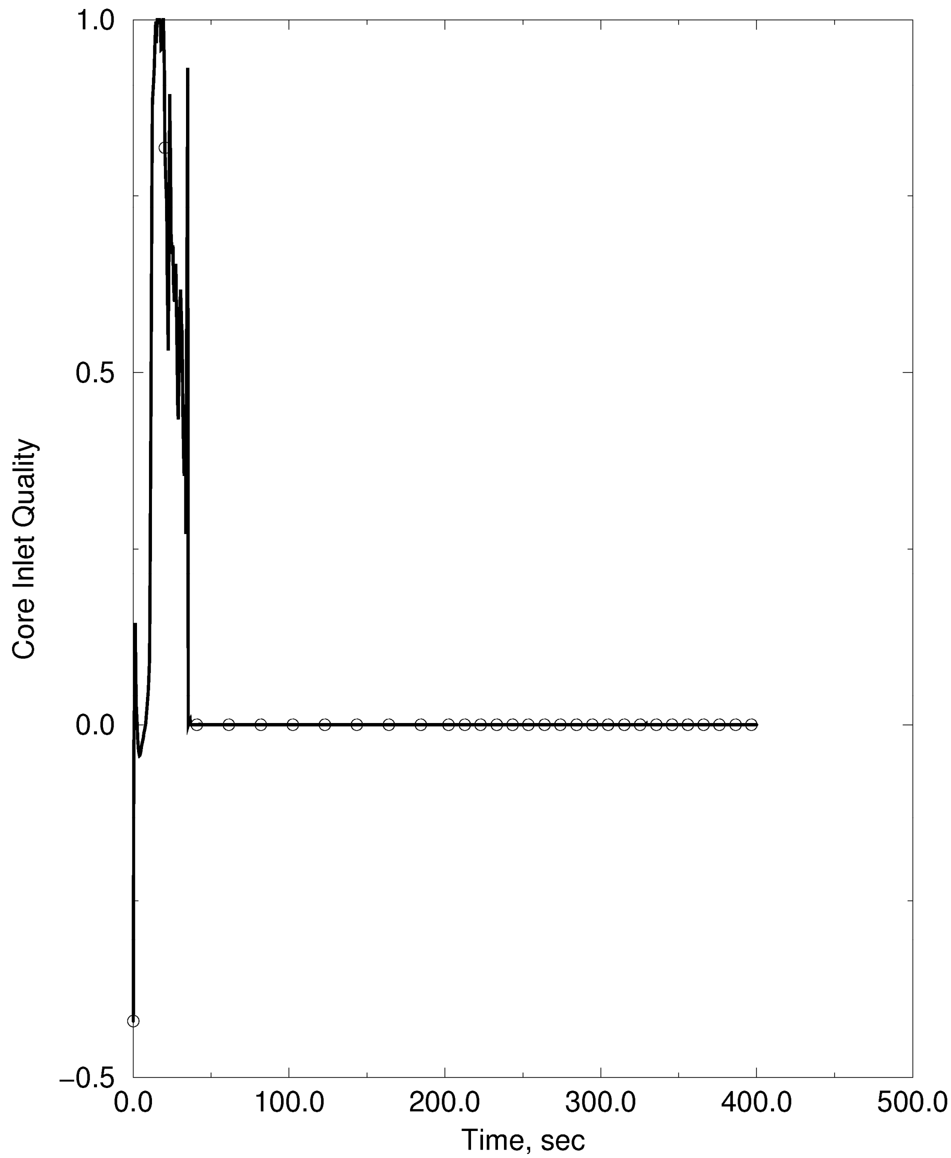


Figure 15.06.05-16-16—Core Outlet Temperature

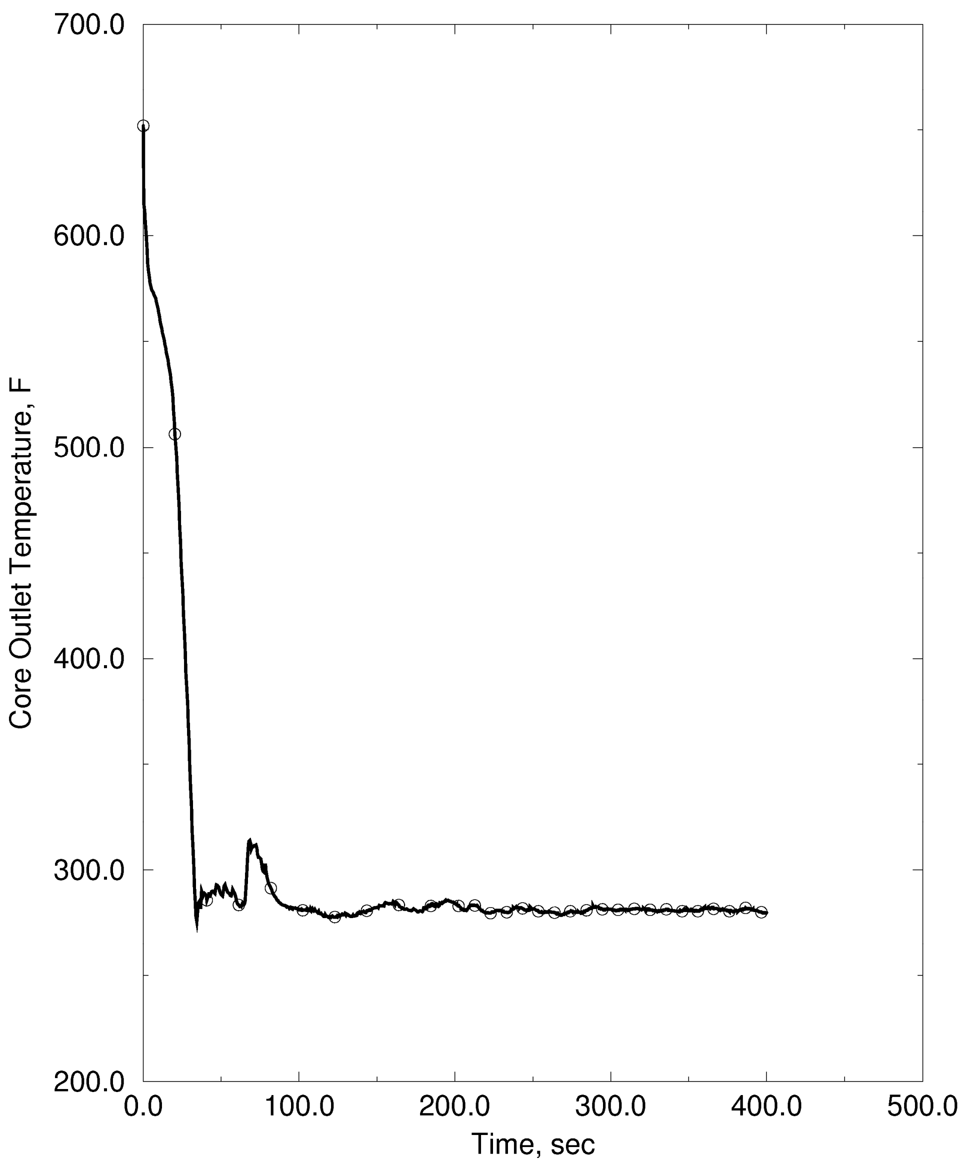


Figure 15.06.05-16-17—Core Outlet Quality

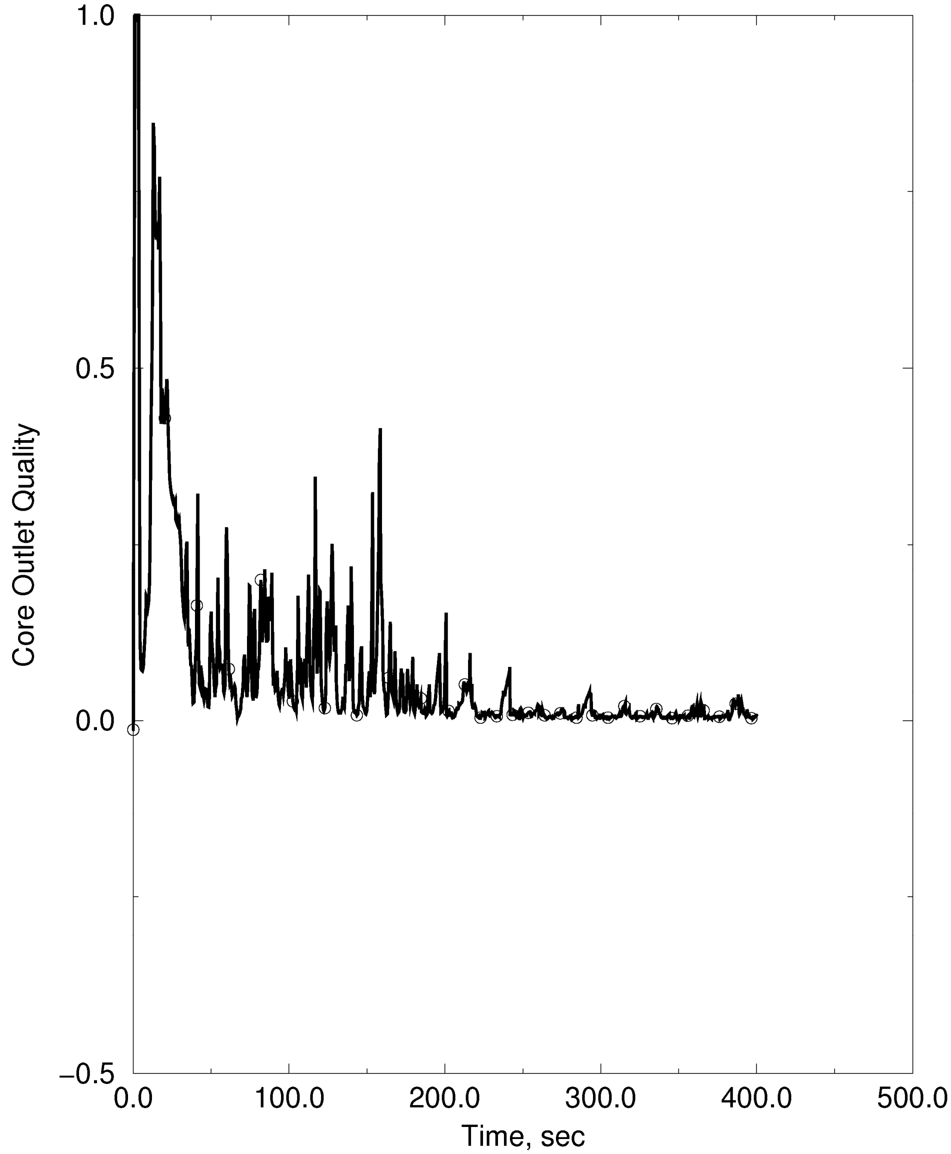


Figure 15.06.05-16-18—In-core Temperature

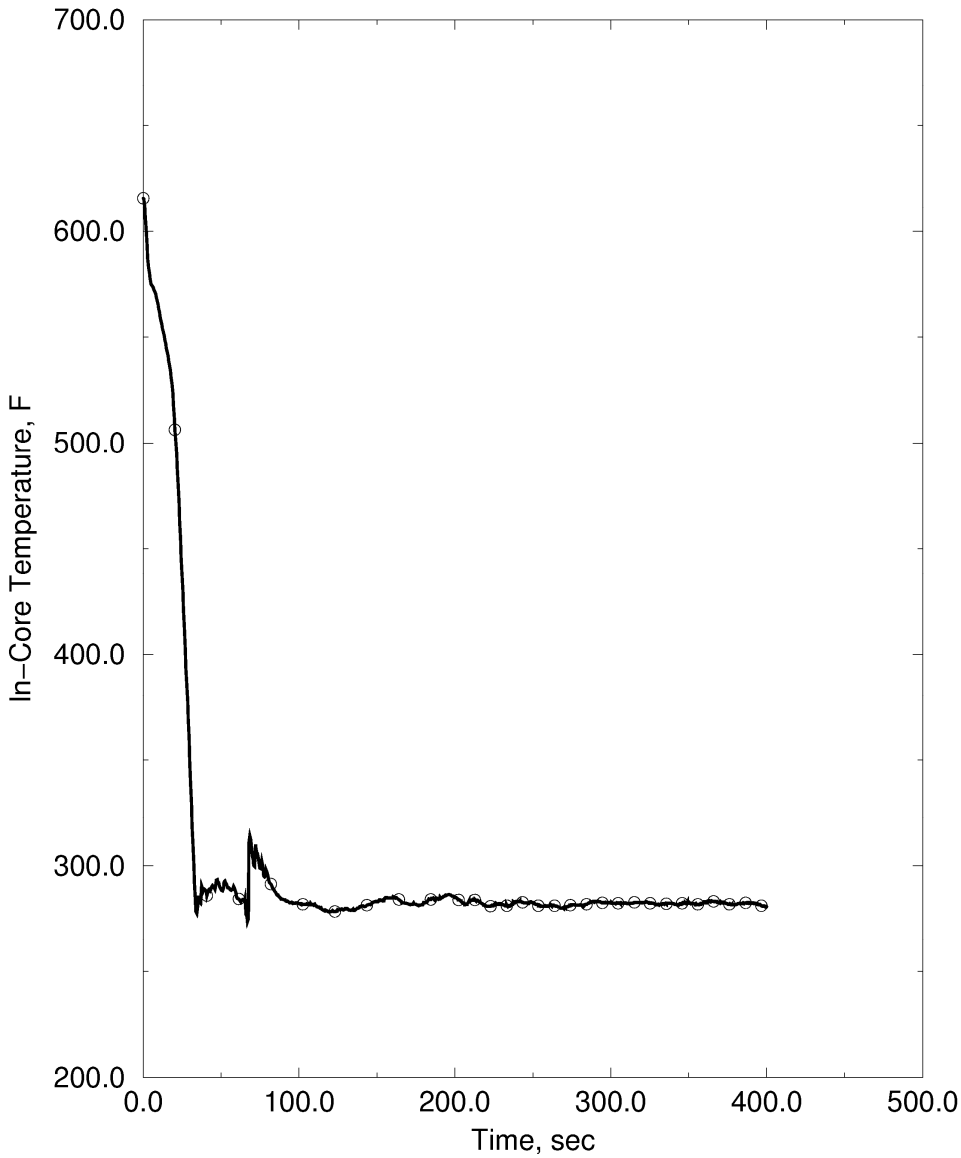


Figure 15.06.05-16-19—In-core Quality

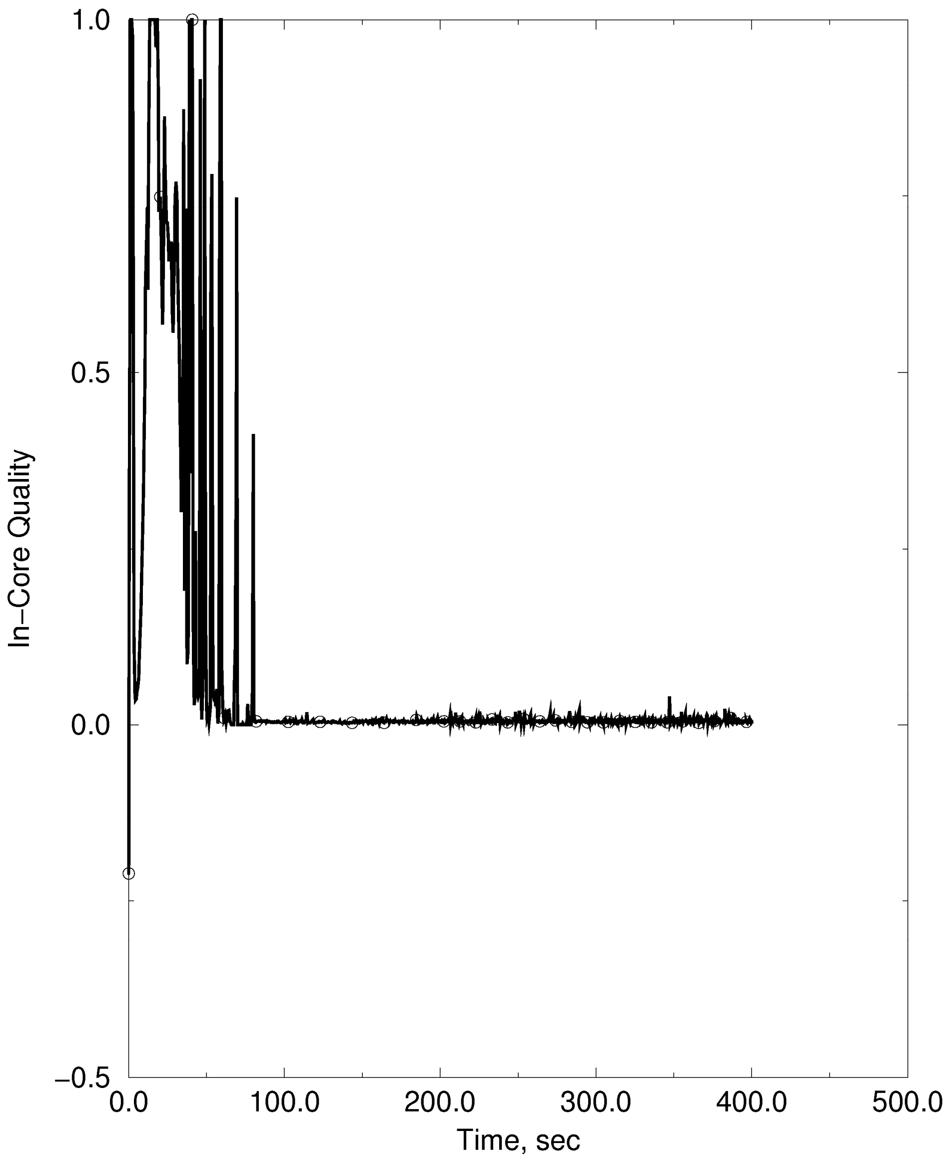


Figure 15.06.05-16-20—Cladding Temperature

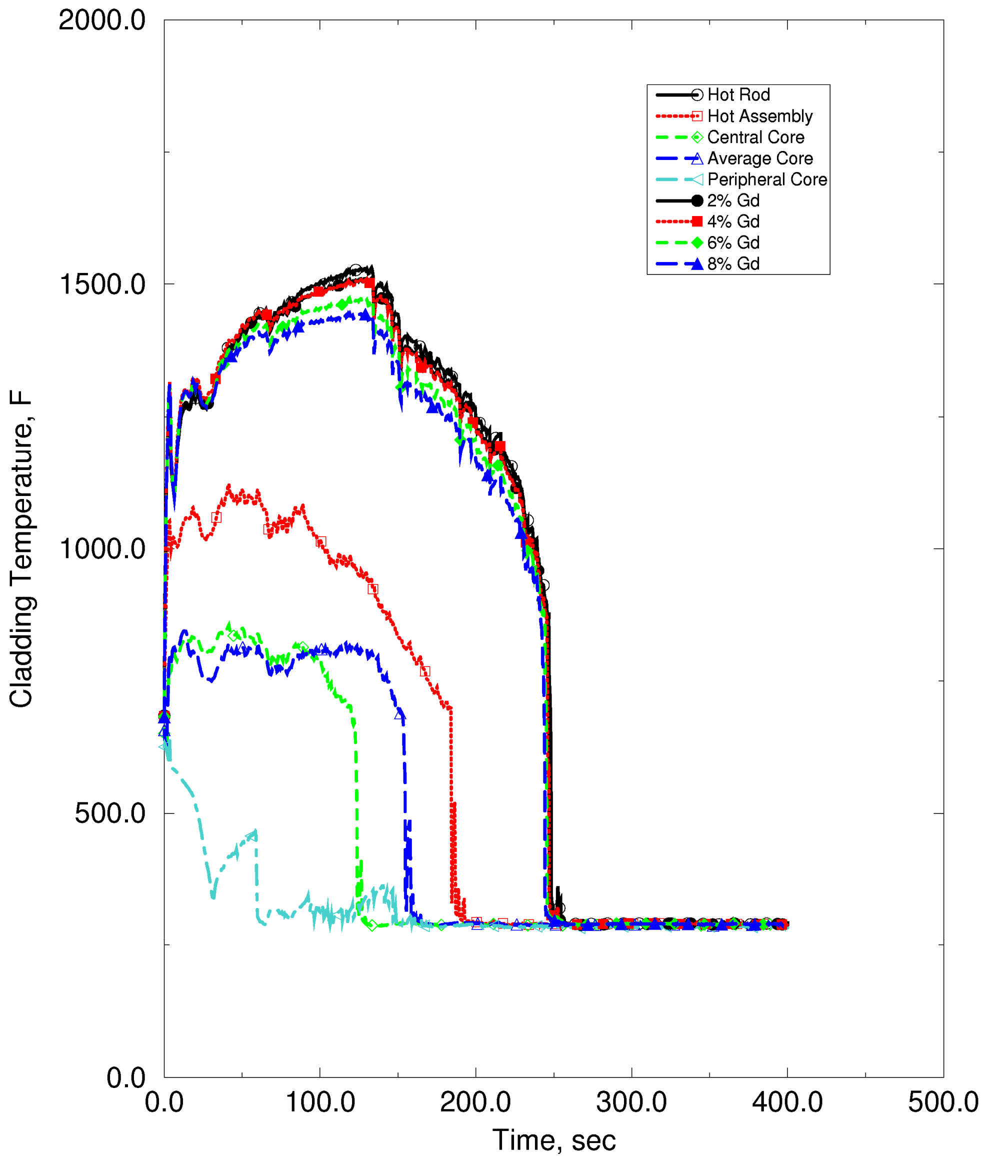


Figure 15.06.05-16-21—Heat Transfer Coefficient

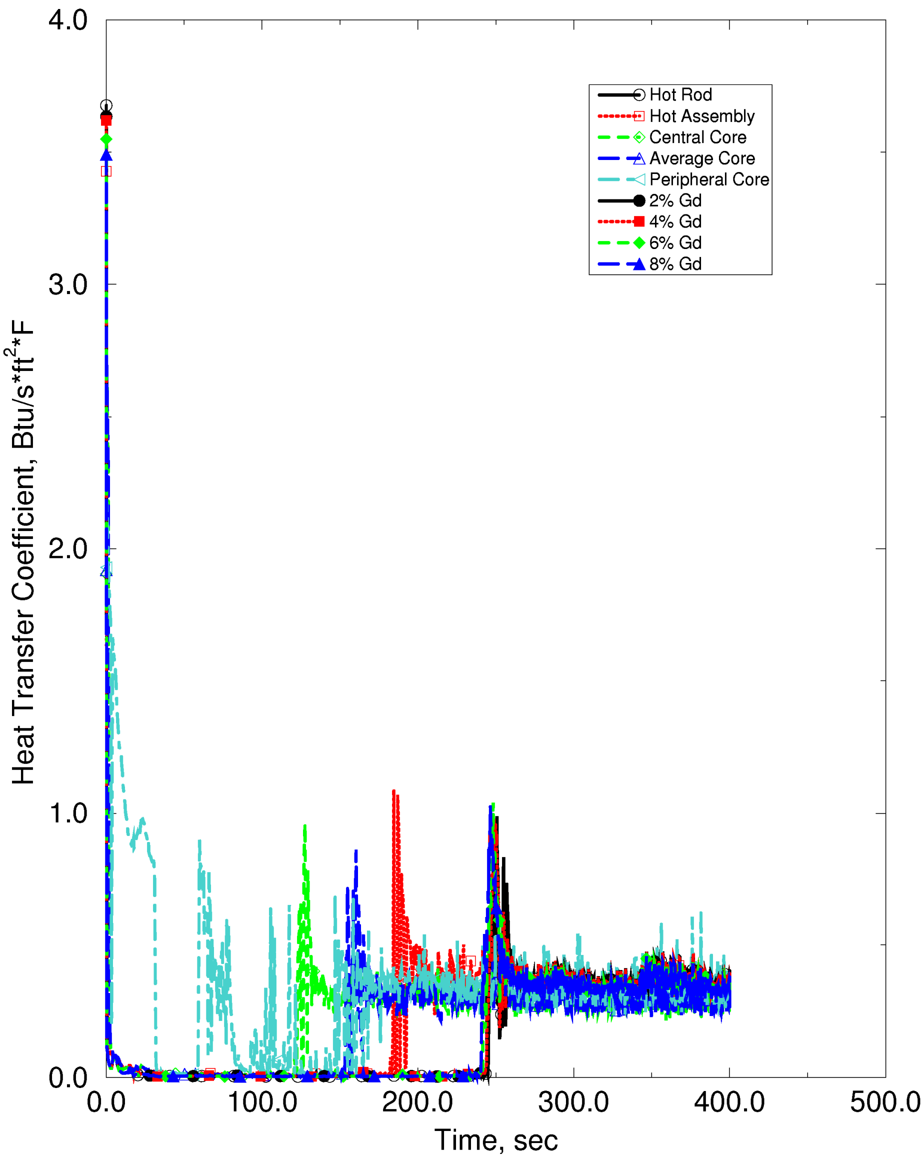


Figure 15.06.05-16-22—Primary to Secondary Heat Transfer

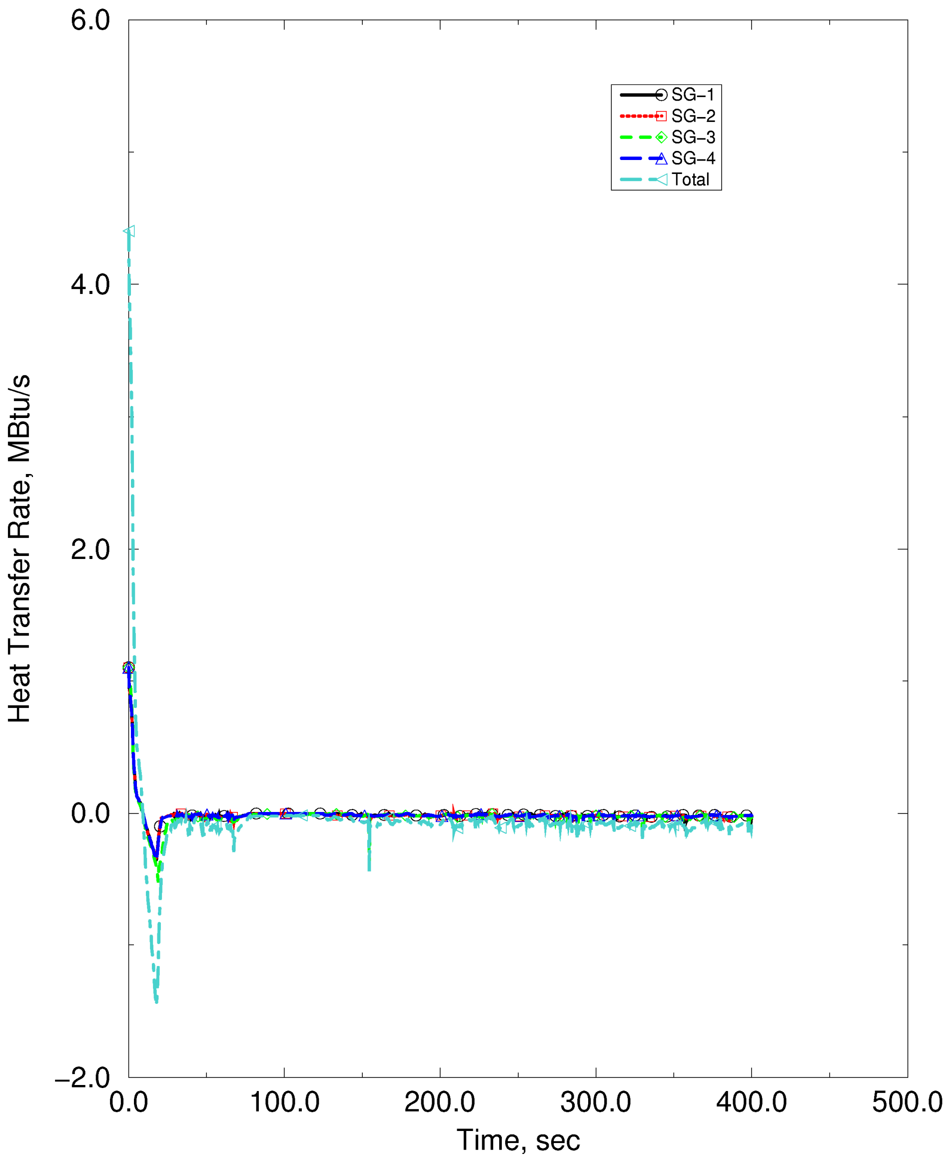


Figure 15.06.05-16-23—Pump Speed

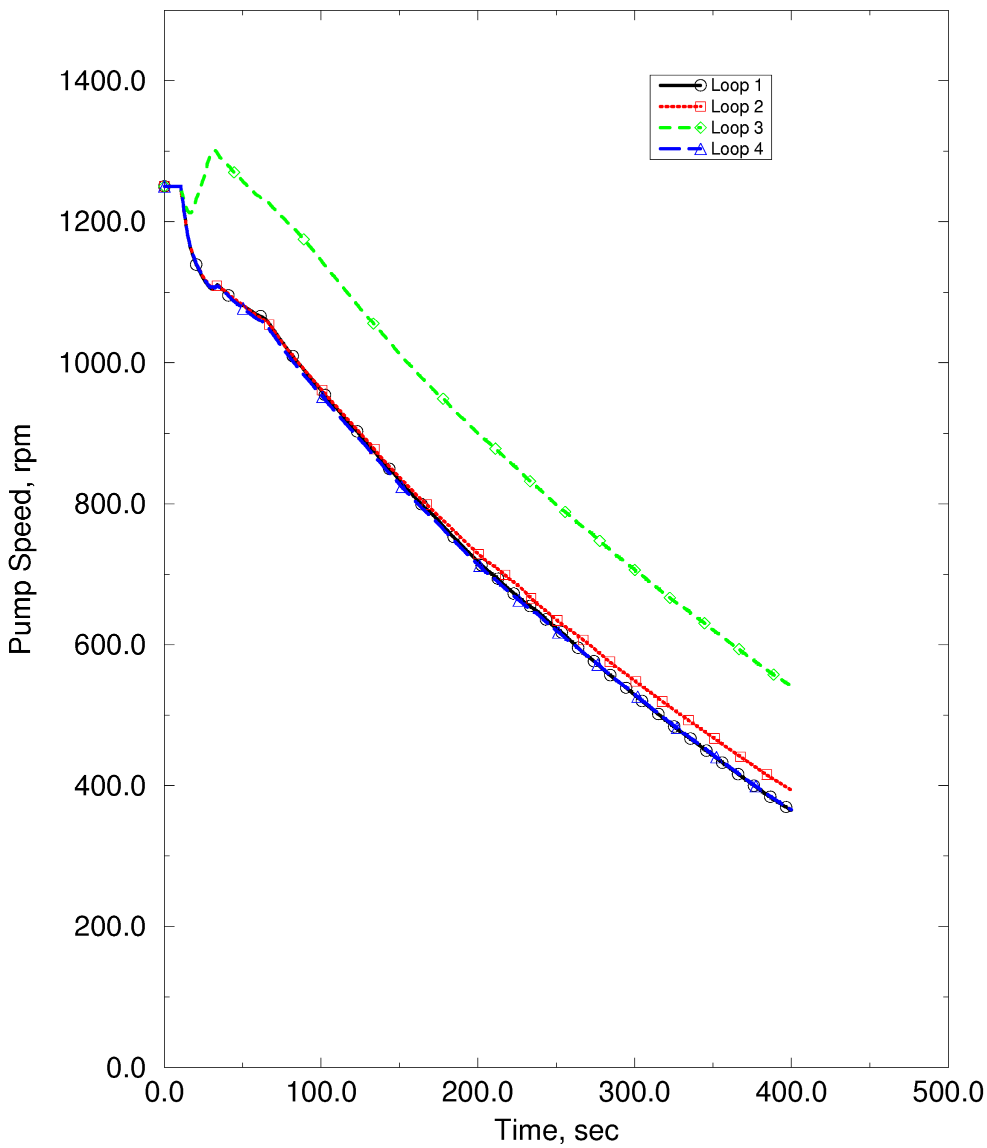
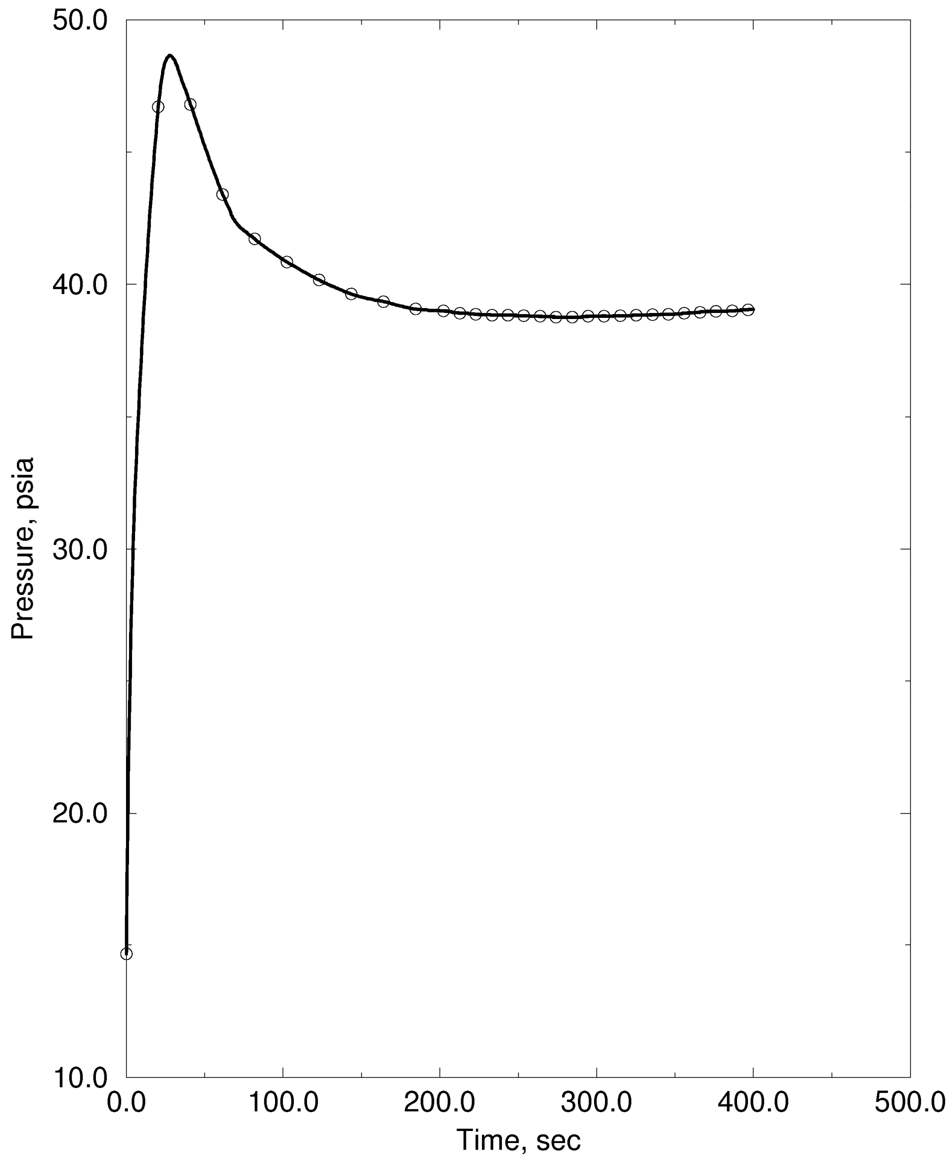


Figure 15.06.05-16-24—Containment Pressure



FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-17:

FSAR Figure 15.6-49 shows the broken loop pump is calculated to overspeed to twice its normal value. Please provide the methodology used to determine that such an overspeed can be physically accommodated.

Response to Question 15.06.05-17:

The maximum reactor coolant pump (RCP) overspeed due to a loss-of-coolant accident (LOCA) is based on the largest break size after the application of the leak-before-break (LBB) analysis. The LBB analysis is described in U.S. EPR FSAR Tier 2, Section 3.6.3. General Design Criterion 4 of 10 CFR 50, Appendix A requires structures, systems, and components important to safety are designed to accommodate the effects from LOCAs. However, the dynamic effects associated with postulated pipe ruptures may be excluded from the design basis when the analysis reviewed and approved by NRC demonstrates that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping. In accordance with U.S. EPR FSAR Tier 2, Section 3.6.3, LBB has been established for the reactor coolant system main coolant loop piping which includes the hot legs, crossover legs, cold legs and pressurizer surge line.

Standard Review Plan Section 5.4.1.1 states that the “anticipated overspeed should include consideration of the maximum rotational speed of the flywheel if a break occurs in the reactor coolant piping in either the suction or discharge side of the pump.” It also states that an “acceptable basis for the assumed design overspeed, addressing pipe breaks consistent with the design basis for reactor coolant piping, should be submitted to the staff for review.” As described in U.S. EPR FSAR Tier 2, Section 3.6.3, the design basis for the reactor coolant piping is LBB.

Furthermore, as discussed in U.S. EPR FSAR Tier 2, Section 5.4.1.4, the largest break size remaining after the application of the LBB analysis does not result in a significant RCP overspeed. This overspeed would be less than the design RCP design overspeed of 125% of normal operating speed.

Therefore, the evaluation of RCP overspeed for the U.S. EPR does not need to assume a double-ended guillotine break in the main coolant piping.

AREVA’s June 13, 2008, response to RAI-15 on ANP-10278 provides an evaluation of the broken-loop RCP failing and locking during the realistic large break loss-of-coolant accident (RLBLOCA) transient.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-18:

Please provide a description of the approach taken to assess the particulates bypass fraction through the sump screens as well as possible accumulation of debris in the core region taking into account the specific types, amounts and characteristics of insulation materials, and other latent debris initially present in the U.S. EPR containment. Discuss the results obtained along with any supporting evidence used.

Response to Question 15.06.05-18:

The approach and assessment of the in-containment refueling water storage tank (IRWST) debris retention equipment design are delineated in ANP-10293, “U.S. EPR Design Features to Address GSI-191 Technical Report." Testing of the IRWST debris retention equipment concludes there will be no adverse downstream effects due to transport of LOCA debris. Testing of the safety injection system (SIS) strainer assembly over a 2 hour period indicates the solids content of the downstream water to be 10 ppm (30 minutes into the test) which, thereafter, decreases to non-measurable values at 2 hours. The test results are conservative in that they reflect the design of the Olkiluoto-3 (OL3) plant. The OL3 plant utilizes a debris source term that includes more extensive use of mineral wool. The debris source term for the US EPR utilizes more reflective metal insulation (RMI) in lieu of mineral wool, thereby further reducing the potential of introducing debris into the primary reactor coolant system. The SIS strainer test results are described in ANP-10293.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-19:

Please provide assessment of any possible degradation of long-term core cooling capabilities resulting from debris particulates penetration, transport, and accumulation in the primary reactor coolant system.

Response to Question 15.06.05-19:

There is no expected degradation of long-term cooling capabilities resulting from debris particulate penetration, transport, and accumulation in the primary reactor coolant system. The safety injection system (SIS) strainers incorporate a filtering screen that is sized to retain and capture the debris smaller than other locations in the emergency core cooling system suction flow path. The SIS strainer test results indicate a downstream solids content of 10 ppm that decays to non-measurable values at 2 hours into the test. The test results are conservative in that they reflect the design of the Olkiluoto-3 (OL3) plant. The OL3 plant utilizes a debris source term that includes more extensive use of mineral wool. The debris source term for the U.S. EPR utilizes more reflective metal insulation in lieu of mineral wool, thereby further reducing the potential of introducing debris into the primary reactor coolant system. The SIS strainer test results are described in ANP-10293, "U.S. EPR Design Features to Address GSI-191 Technical Report."

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 15.06.05-20:

The limiting size for the SBLOCA has changed from 4” in ANP-10263 to 6.5” in the FSAR. Please explain what model assumptions resulted in this change of the limiting break size.

Response to Question 15.06.05-20:

A response to this question will be provided by October 22, 2008.

Question 15.06.05-21:

According to FSAR Figure 15.6-83 the highest PCTs for non-LOOP cases are the 3½" break as well as the 5½" - 6½" breaks. The SG nodding study presented in ANP-10291P showed that PCT for 4" break increased 121 K when more axial nodes were used. If this same result applied to non-LOOP cases, a different size break might then be the limiting case. Please justify not using detailed SG axial nodalization as given in ANP-10291P for the nodalization used in the FSAR analyses.

Response to Question 15.06.05-21:

A response to this question will be provided by September 24, 2008.

Question 15.06.05-22:

Please provide the methodology to determine that the single failure of an EDG is worse than the failure of the MSRCV in the broken loop SG.

Response to Question 15.06.05-22:

A response to this question will be provided by September 24, 2008.

Question 15.06.05-23:

According to ANP-10291P the accumulators in the SBLOCA simulation are isolated when non-condensable gases are detected at their nozzles. Please justify the conservatism of this assumption, particularly with respect to long term cooling.

Response to Question 15.06.05-23:

A response to this question will be provided by September 24, 2008.

Question 15.06.05-24:

The SBLOCA calculations assume no leakage paths between the hot legs and the vessel downcomer. Please justify this assumption and discuss its impact on the analysis and related safety conclusions.

Response to Question 15.06.05-24:

A response to this question will be provided by October 22, 2008.

Question 15.06.05-25:

Please provide the methodology for determining the various break locations (e.g., bottom, side, and top) in the RCP discharge leg.

Response to Question 15.06.05-25:

A response to this question will be provided by September 24, 2008.