February 15, 2008

Task
Conduct an evaluation of plant response using the scenario conditions set for JPM EP009-CR-001. This evaluation used the PVNGS Control Room Simulator (B) to dynamically evaluate plant behavior with and without operator action during a Steam Generator Tube Rupture and with various SGTR leak severities. The observed plant behavior was then used to check the validity of the JPM scenario. This activity was conducted with the following personnel:

- Operations Department Leader (licensed SRO)
- Operations Shift Manager (licensed SRO)
- Operations Reactor Operator (licensed RO)
- Operations Shift Technical Advisor
- Operations Training Instructor (SRO Certification)

The purpose of this JPM was to test the emergency coordinator's ability to classify an event given a specific set of plant conditions. The competency of interest was related to the application of EAL 1-2 for a potential loss of the fuel clad after RCS plenum level has been <21% and has recovered to >21%. The JPM used a SGTR as the event which causes loss of RCS coolant mass. The loss of both trains of High Pressure Safety Injection (HPSI) pumps complicates the event and reduces the makeup capability available to mitigate the RCS leakage. One train of HPSI is eventually restored.

Printouts from the Emergency Response Facility Data Acquisition and Display System (ERFDADS) are provided for specific parameters from each Scenario.

JPM EP009-CR-001 – Conditions provided in JPM

- Unit 1
- A SGTR >200 GPM has occurred.
- The crew tripped the reactor.
- On the reactor trip a Loss of Power to the grid occurred.
- A loss of both HPSI pumps occurred due to electrical problems.
- The CRS entered the Functional Recovery Procedure.
- The crew has restored power to PBA-S03 using the "A" DG and has started the "A" HPSI pump.
- RVLMS indicated <21% in the outlet plenum 10 minutes ago, but is currently above 21%.
- The secondary operator has stabilized the secondary plant using AF "A" and the ADV's
- Perform the duties of the Emergency Coordinator until relieved.
- This is a Time Critical JPM.

Simulator Setup- In all cases, the simulator was reset to 100% with a Middle of Core Life Snap.

Scenario 1 (375 GPM Leak)- This scenario was run with minimal operator action such that the major mitigating actions of the Emergency Operating Procedures were not implemented and no RCS inventory makeup was allowed during the 75 minute simulator run. This represents more severe conditions than the JPM scenario.

Initial Conditions

- SGTR with initial leakrate of 375 gpm. (this malfunction is equivalent to 50% severity of the guillotine shear of one S/G tube rupture)
- Reactor tripped by operator
- Loss of Offsite power occurs at the time of the reactor trip.
- No RCS makeup is used from either of the HPSI pumps or the Charging pumps
- Adequate feed is maintained using AFA-P01
- RCS Temp is maintained in the 560 to 570 degrees band using ADV's
- No other operator action is taken.

0745-Malfunction inserted
0805- RCS is at saturated conditions (0 degrees Subcooling)
0900- Simulator in Freeze

Final conditions/results-
RCS reached saturated conditions early in the scenario and did not recover. Reactor Vessel Outlet Plenum Level remained full (100% indicated) throughout the scenario and Reactor Vessel Head Level remained at or above 67% throughout the scenario. Steam Generator pressures were maintained at nominal hot standby values due to RCS temperature being maintained with Atmospheric Dump Valve operation. RCS pressure decreased to approximately 1180 psia such that the differential pressure between the RCS and affected S/G was <50 psid. The reduced D/P between the RCS and affected S/G caused substantial reduction of RCS leakrate during the scenario.

Emergency classification throughout this event would be Site Area Emergency due to EAL 1-7 potential loss of RCS, EAL 1-6 loss of RCS and EAL 1-14 loss of containment. The fuel barrier was not impacted.

Scenario 2 (750 GPM Leak)- This scenario was run with dynamic crew response with a more severe rupture of a double ended guillotine leak of 1 tube. This severity is equivalent to the UFSAR chapter 15 SGTR analysis rupture. The equipment malfunctions and operator actions in this scenario align well with the conditions given in the JPM scenario. The time delay of >1 hour for the operators to restore power to the Train "A" bus and then initiate HPSI flow is longer than the expected time for an operations crew to restore power from a Diesel Generator.

Initial Conditions

- SGTR with initial leakrate of 750gpm. (this malfunction is equivalent to 100% severity of the single tube guillotine shear rupture)
- Reactor tripped by operator
- Loss of Offsite power occurs at the time of the reactor trip.

- Train "B" HPSI is unavailable.
- The "A" Diesel Generator fails resulting in loss of PBA-S03.
- No HPSI makeup is available until the "A" DG is restored.
- Adequate feed is maintained using AFA-P01
- RCS Temp is maintained using ADV's

0942- Crew trips the reactor on low RCS pressure. The "A" class 4.16KV bus is de-energized due to loss of DG "A". The "B" HPSI pump fails and is unavailable. A Loss of Offsite Power occurred. The "B" AF pump failed and feed is established with AFA-P01. The RO starts the "B" Charging Pump during Standard Post Trip Actions. The crew implements the Emergency Operating Procedures to mitigate the event.
0952- Shift Manager classifies event as Site Area Emergency due to 1-6 (potential loss of RCS), 1-7 (potential loss of RCS), 1-14 (Loss of Containment). Team maintains feedwater flow to Steam Generators and steams to atmosphere with Atmospheric Dump Valves from both steam generators.
0953- Crew enters Functional Recovery Procedure due to SGTR with No HPSI flow.
0954- RCS at saturated conditions. EAL 1-6 now met for loss of RCS barrier but there is no change to the emergency classification.
1006- Crew uses ADV's to begin cooldown of RCS <540 degrees to support isolation of the affected S/G.
1006- Crew inserts manual MSIS and first Reactor Vessel Upper Head (RVUH) detector is uncovered. RVUH level indicates 67%.
1010- RVUH void expands (41%). RCS subcooling increases to 15 degrees due to cooldown of RCS.
1015- RCS Subcooling continues to increase to 28 degrees as RCS temperature decreases.
1018- S/G #1 is isolated by the operating crew. Atmospheric Dump Valve is closed from #1 S/G.
1024- RVUH level indicates 16%, "B" charging pump is secured for 5 minutes to transfer suction to alternate suction path via CHA-UV-536.
1044- Power is restored to PBA-S03 using the "A" Diesel Generator.
1045- HPSI "A" is started and inventory makeup flow to RCS is substantially increased.
1046- RCS subcooling increases to 24 degrees.
1047- Crew starts all Charging Pumps.
1104- Auxiliary Spray is initiated to lower RCS pressure to <1135 psia.
1105- Auxiliary Spray is stopped with RCS pressure at 1095 psia. HPSI Throttle Criteria are verified to be met, Crew starts to throttle HPSI flow to the RCS to maintain pressurizer level.
1107- simulator in freeze.

Final conditions/results-
Note- the scaling of the ERFDADS plot provided for RCS subcooling on this scenario is not optimal. The values for subcooling provided were recorded during the scenario.

RCS subcooling is restored to 24 degrees by operator action to cooldown RCS and establish High Pressure Safety Injection flow. Reactor Vessel Head Level dropped to

16% during rapid cooldown of RCS and then Reactor Vessel Head begins to refill with HPSI injection flow. Following isolation of S/G#1, the ADV on S/G #1 was not required to be opened again to maintain S/G #1 pressure. Plant response and operator action caused the differential pressure between the affected steam generator and RCS pressure to decrease to <50 psid such that RCS leakrate was substantially reduced. Following HPSI restoration, RCS inventory and subcooling recovered and were controlled. With expected operator action and a significant delay of 62 minutes to restore power to initiate HPSI flow, RCS level did not approach 21% in the outlet plenum. This SGTR event would not have resulted in RCS level dropping to <21% in the outlet plenum.

Emergency classification throughout this event would be Site Area Emergency due to EAL 1-7 potential loss of RCS, EAL 1-6 loss of RCS and EAL 1-14 loss of containment. The fuel barrier was not impacted.

Scenario 3 (1500 GPM leak)- This scenario included a much more severe SGTR equivalent to a double ended guillotine shear of 2 tubes. This severity is equivalent to twice the UFSAR Chapter 15 SGTR event severity. Initial RCS leakrate was 1500 GPM. The scenario was run with minimal operator action for the first 35 minutes to add conservatism and allow additional mass loss from the RCS. Following this delay period, the crew initiated steps to mitigate the event which included rapid cooldown of the RCS to <540 degrees and isolation of the affected S/G.

Initial Conditions

- SGTR with initial leakrate of 1500gpm. (this malfunction is equivalent to 100% severity of two tubes with a guillotine shear rupture)
- Reactor tripped by operator
- Loss of Offsite power occurs at the time of the reactor trip.
- The "B" HPSI pump is unavailable.
- The "A" Diesel Generator fails resulting in loss of PBA-S03.
- No HPSI makeup is available until the "A" DG is restored.
- Adequate feed is maintained using AFA-P01
- RCS Temp is maintained using ADV's

1435 Crew trips the reactor on low RCS pressure. The "A" class 4.16KV bus is de-energized due to loss of DG "A" and the "B" HPSI failed. A Loss of Offsite Power occurred. The "B" AF pump failed and feed is established with AFA-P01. No Charging Pumps are in service. The ADV's are operated to maintain RCS temperature.
1440- RCS subcooling decreases to 0 degrees (saturated conditions). Reactor Vessel Upper Head level is 100%
1447- RVUH indicated level is 67%. RCS is at saturated conditions. RCS pressure is 1378 psia and Steam Generator pressures are 1150psia.
1453- RVUH indicated level is 41%
1502- RVUH indicated level is 16%
1510- Crew now begins major mitigating actions of the emergency procedures and starts RCS cooldown to <540 degrees to allow isolation of affected S/G..

1512- RCS T-Hot is <540degrees.
1513- RVUH indicated level is 0%. Reactor Outlet Plenum level remains at 100%.
1516- With S/G #1 isolated and RCS pressure decreased due to the RCS cooldown, the RCS to affected S/G differential pressure is essentially 0 psid, RCS leakrate is substantially reduced.
1528- Simulator in Freeze.

Final conditions/results-
Note- the scaling of the ERFDADS plot provided for RCS subcooling on this scenario is not optimal. The values for subcooling provided were recorded during the scenario.

RCS subcooling was at 5 degrees and recovering. Reactor Vessel Head Level was at 16%. Following isolation of S/G #1, it was not necessary to open the ADV on S/G #1 again. Steam Generator and RCS pressures were essentially equal (S/G#1 at 907psia and RCS at 912 psia) such that RCS leakrate was minimal. With a large RCS leakrate and a significant delay of 35 minutes for operators to take major mitigating actions of the emergency procedures, RCS level did not approach 21% in the outlet plenum and RCS mass loss essentially stopped following start of RCS cooldown. The crew was in the process of initiating RCS makeup when the scenario was stopped. The scenario was stopped because RCS mass transfer to the affected S/G was essentially stopped and the actions to restore makeup would result in RCS refill. Based upon the demonstrated plant response, this SGTR event would not have resulted in RCS level dropping to <21% in the outlet plenum.

Emergency classification throughout this event would be Site Area Emergency due to EAL 1-7 potential loss of RCS, EAL 1-6 loss of RCS and EAL 1-14 loss of containment. The fuel barrier was not impacted.

Analysis

Observations from scenario:

- RCS mass loss is reduced due to RCS pressure decrease and resultant decrease in RCS-S/G differential pressure. This occurs even without operator actions to implement the major mitigating steps of the emergency procedures.
- RCS mass loss is substantially reduced or stopped when the operations crew takes actions in accordance with the Emergency Operations Procedures.
- Reactor Vessel Level did not approach <21% in the outlet plenum even with very large leakrates and significant and unrealistic delay of operator actions.
- RCS reaches saturated conditions for SGTR with loss of offsite power and no HPSI flow.
- RCS subcooling is restored with cooldown of the RCS and/or RCS makeup.
- Following isolation of the affected steam generator, the affected steam generator ADV's are not required to be opened again.

Conclusions:

1. During a large steam generator tube rupture of >200 GPM, it is not expected that Reactor Vessel Plenum Level will decrease to <21%. This is primarily due to the equalization of pressure between the affected Steam Generator and the RCS which substantially reduces the RCS leak-rate and minimizes or stops mass loss from the RCS. This remains true even with very conservative assumptions applied for large tube rupture size and significant delay of operator actions.
2. RCS Subcooling is lost following a tube rupture with a loss of offsite power and can be restored with Makeup to the RCS and cooldown of the RCS. At the time of classification, the RCS may be subcooled or not depending upon a number of variables including leak size, RCS makeup capability, RCS cooldown status and the timing of operator actions. This can result in the EAL for loss or potential loss of the RCS being used for the classification but does not change the classification if plenum level remains above 21%. When it is considered that plenum level will not drop to <21%, the emergency classification of this scenario will result in a Site Area Emergency in all cases regardless of any misunderstanding related to the extended steam release aspect of EAL 1-7.
3. Based upon the results, it is not realistic for the SGTR scenario to result in a Potential Loss of the Fuel Barrier. A loss of the fuel barrier for reasons other than the SGTR event would result in a General Emergency during a SGTR event with a Loss of Offsite Power. (Loss of Fuel 1-3 or 1-4, Loss of Containment 1-14 and loss or potential loss of RCS 1-6, 1-7)
4. The JPM scenario was focused on creating a set of conditions to test the EC knowledge related to application of EAL 1-2 when plenum level has dropped below 21% and then recovered. Due to the reduction in the RCS leakrate that occurs in a SGTR event when RCS pressure decreases, it is not realistic to expect that RCS level will lower to <21% in the plenum. Therefore, the use of a SGTR event was not a reasonable choice to test this competency. A LOCA event with significantly larger RCS mass loss would be the proper choice to test this competency. With a LOCA event, EAL 1-7 would not apply and the problem with EC understanding of the definition of prolonged steam releases would not bear on the classification.

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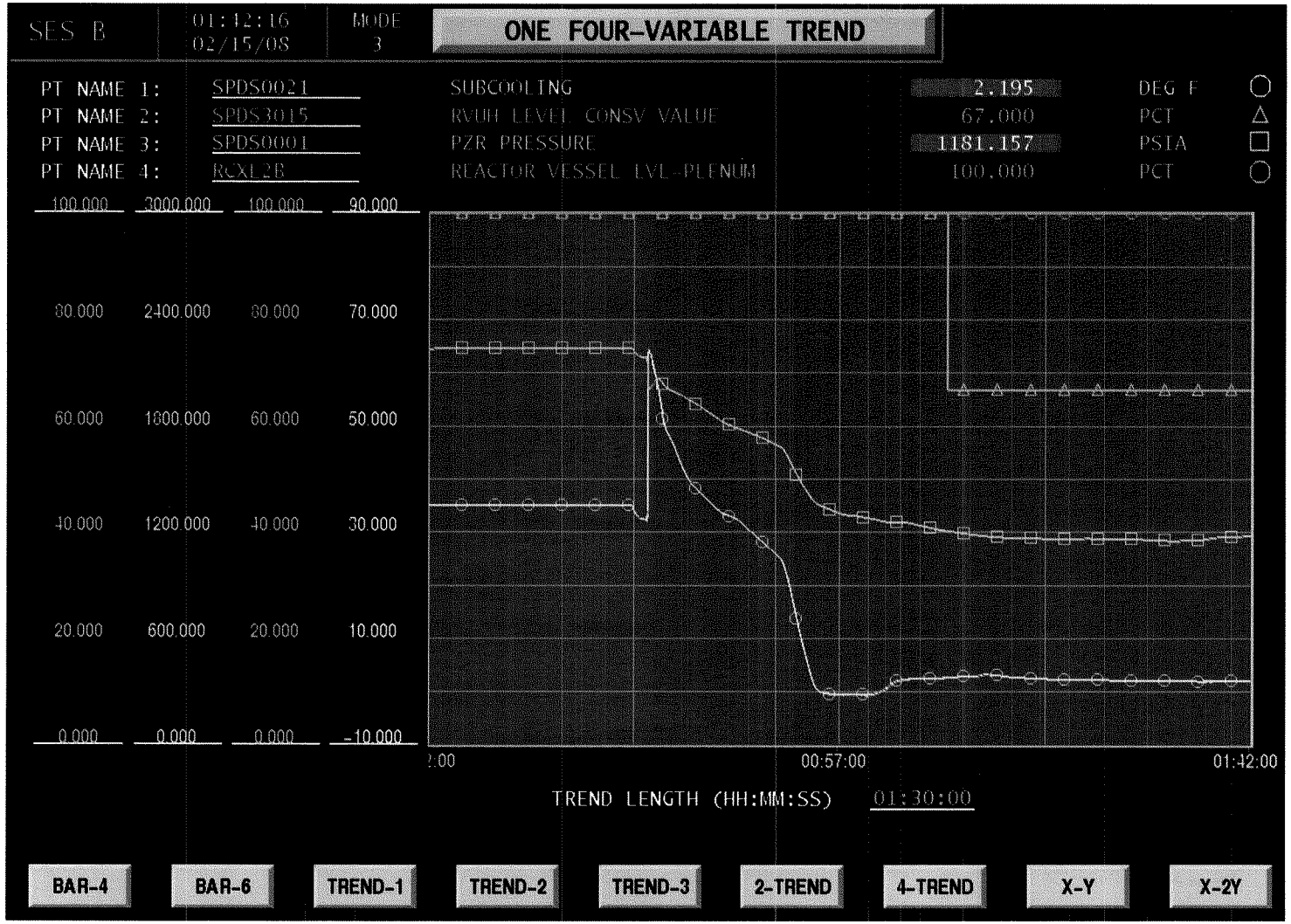
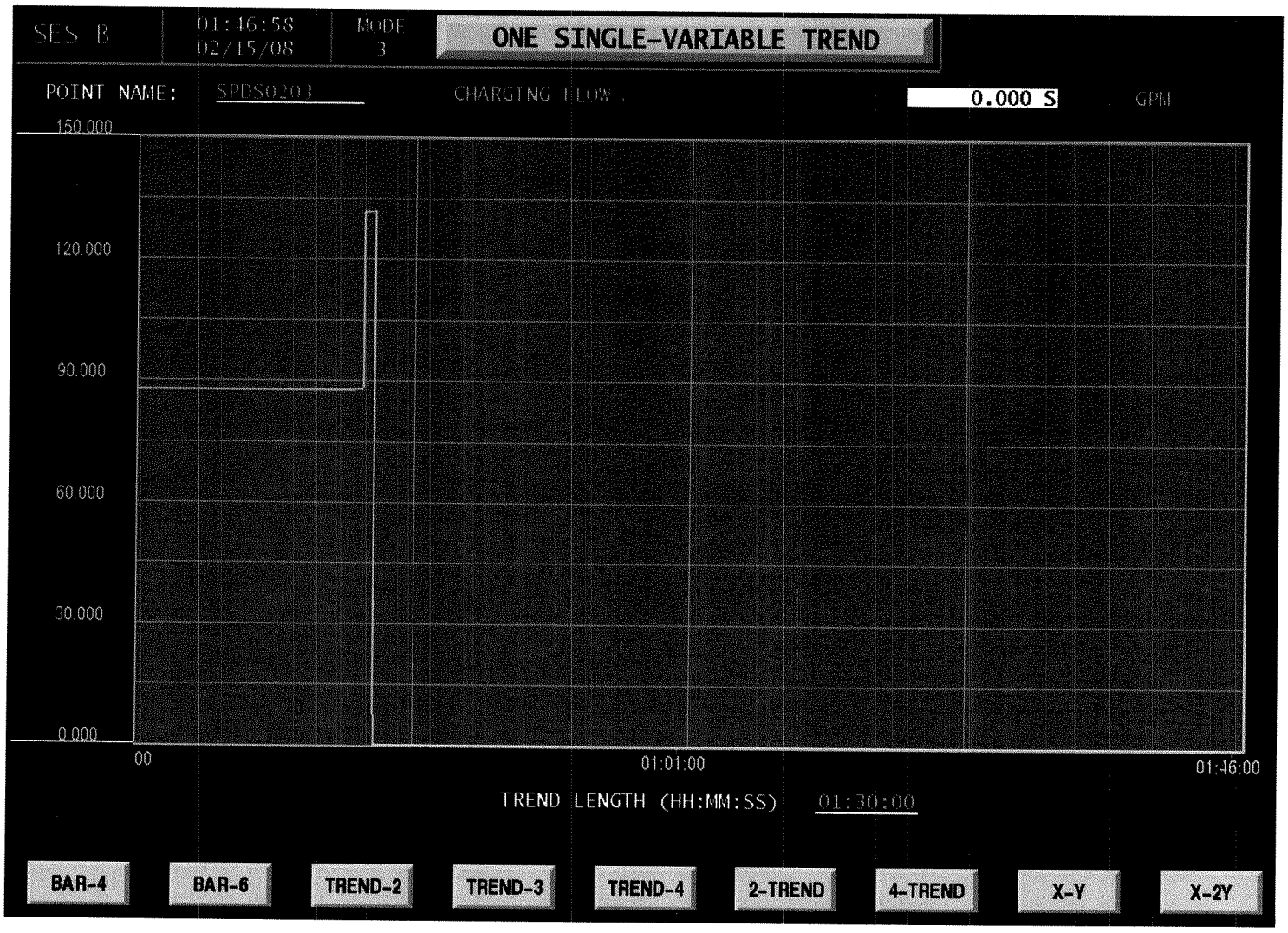
2/15/08



SCENARIO 1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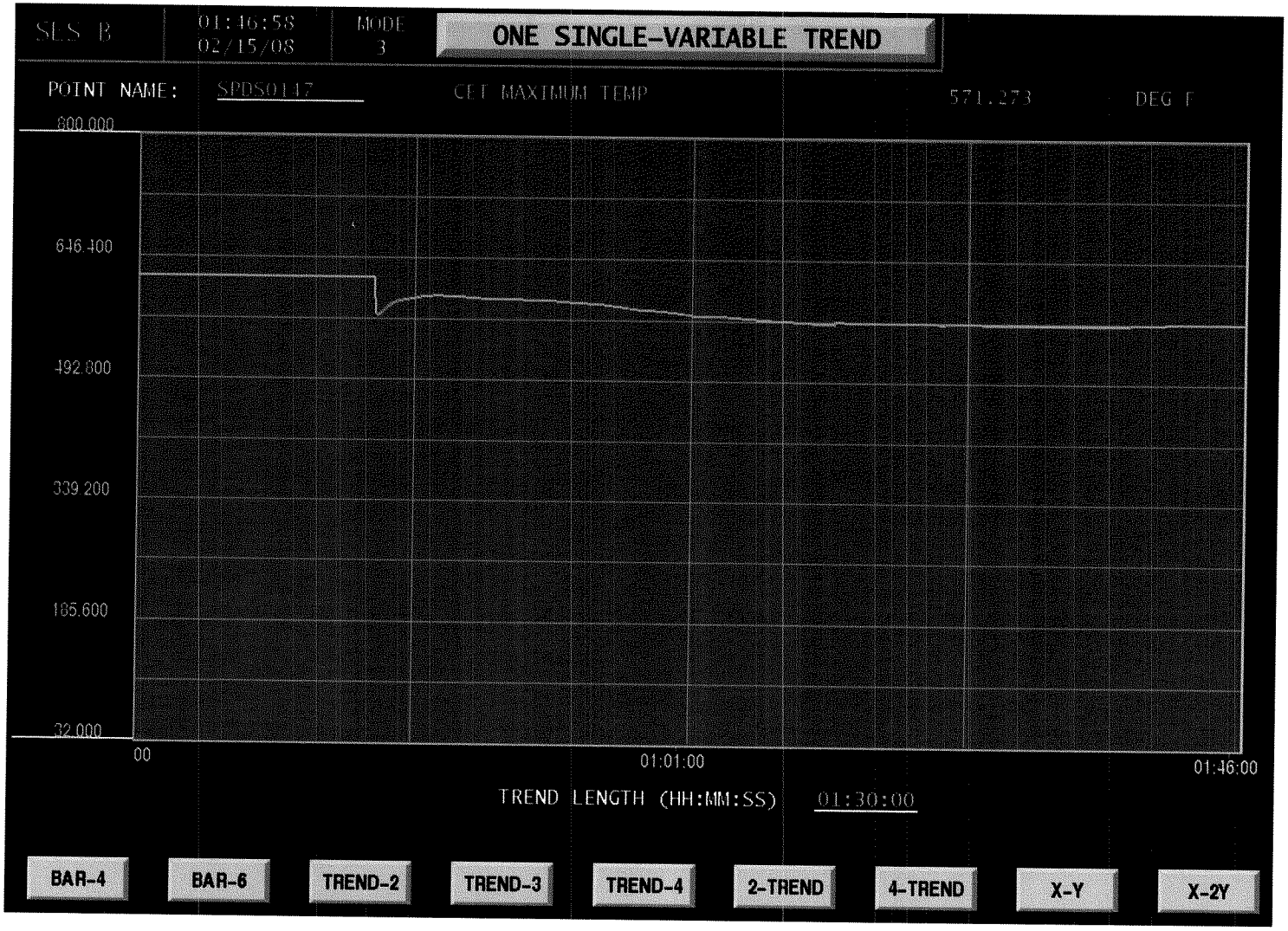
Scenario 1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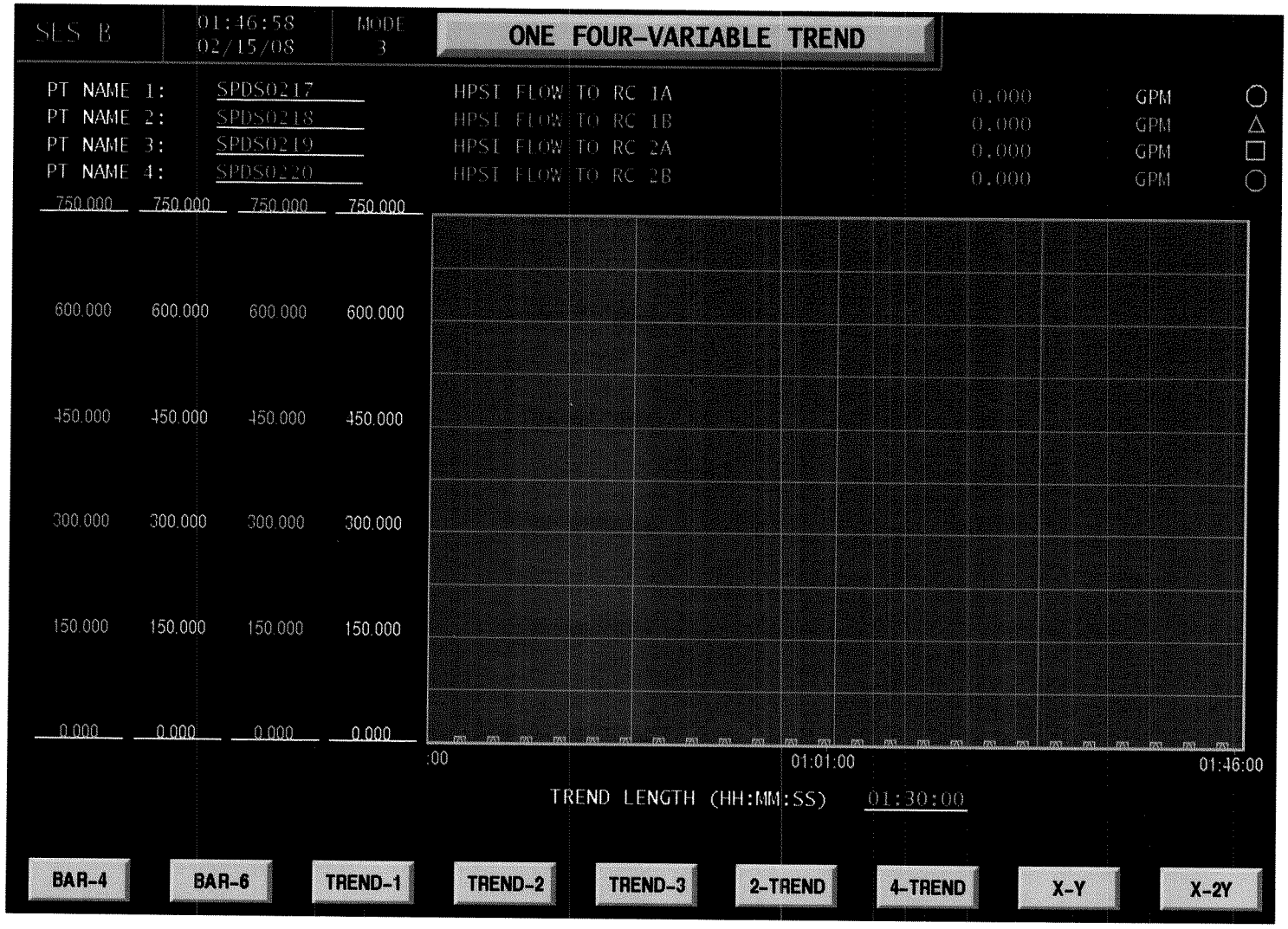
SCENARIO 1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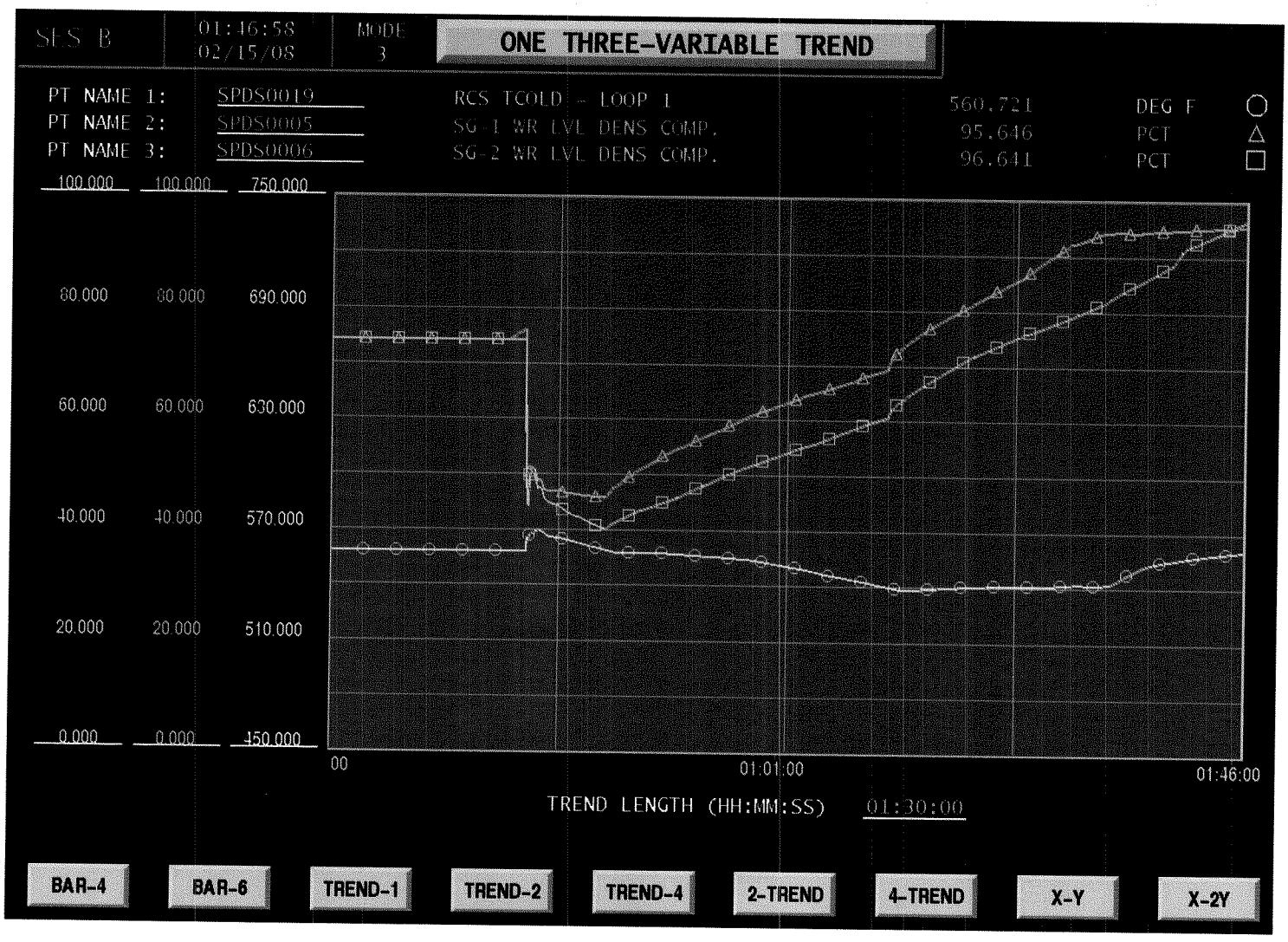
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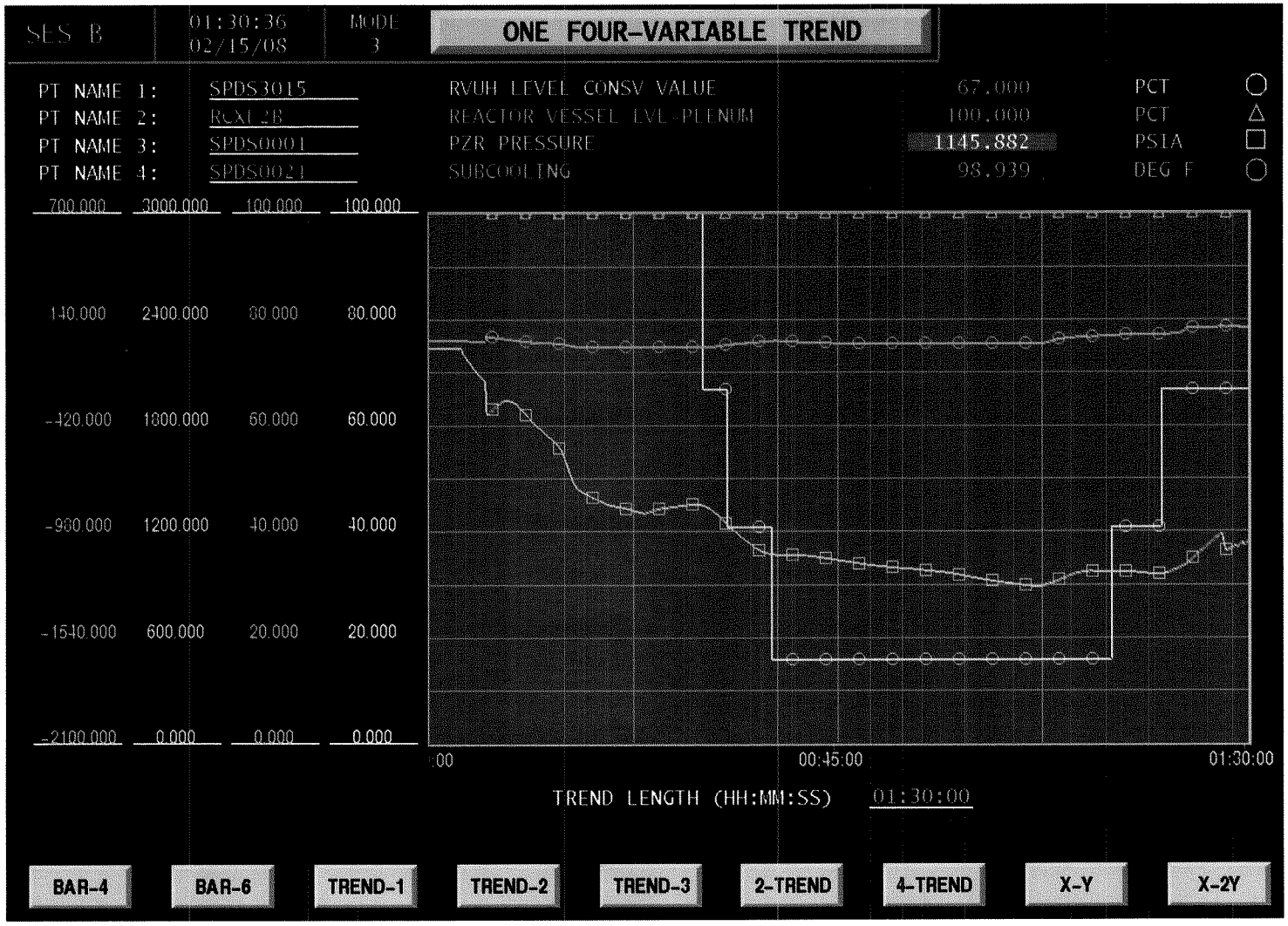

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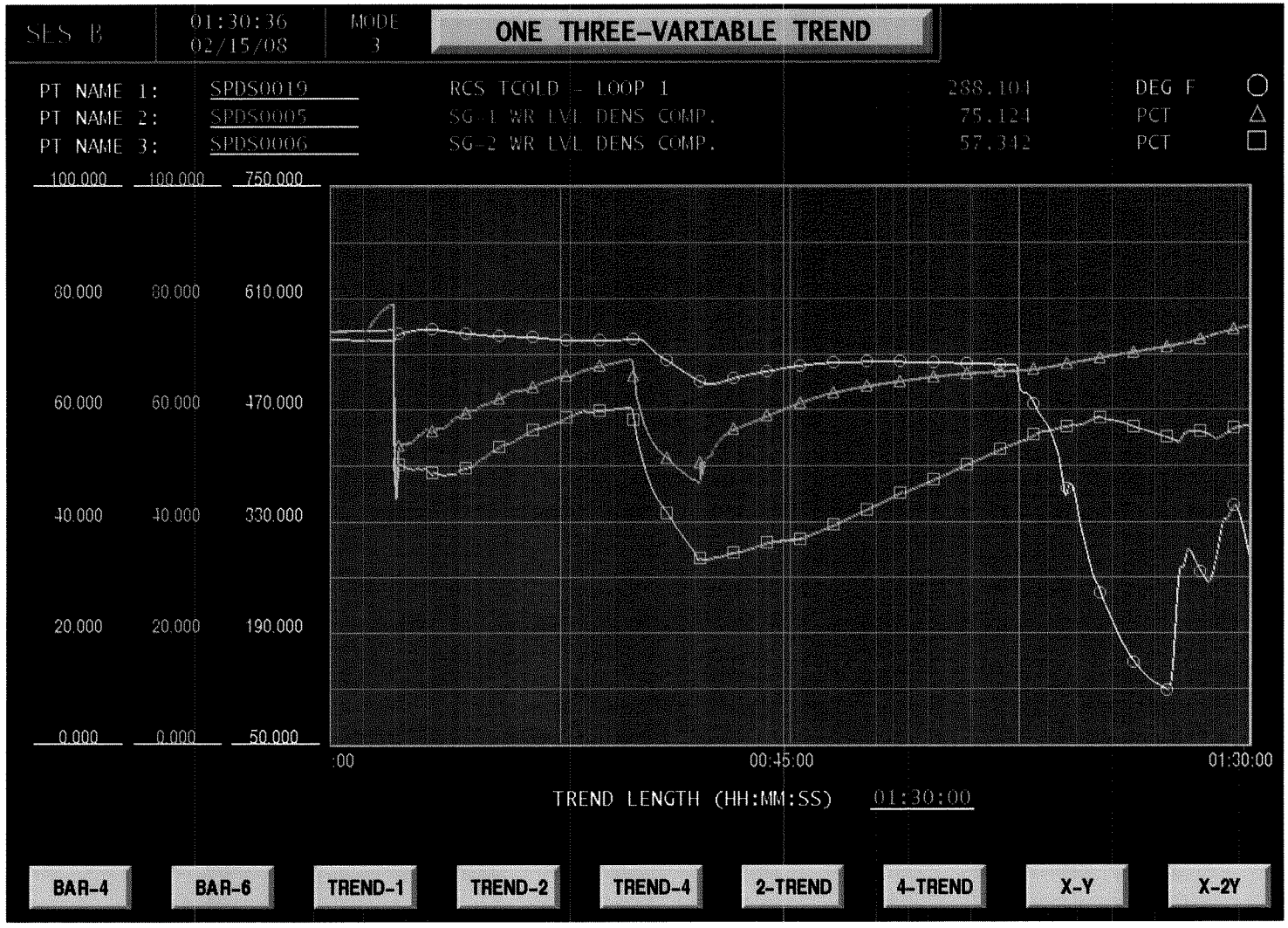
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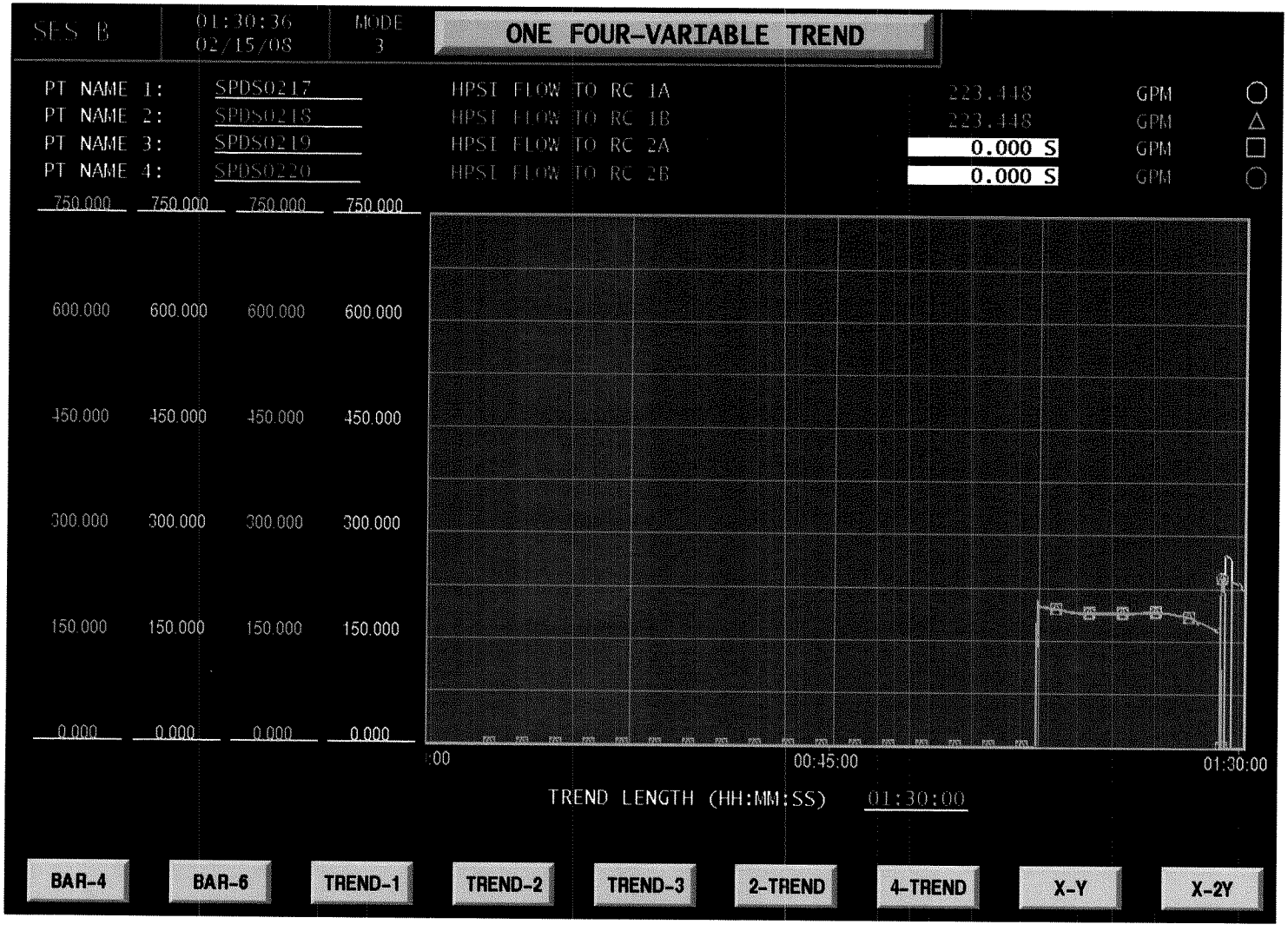
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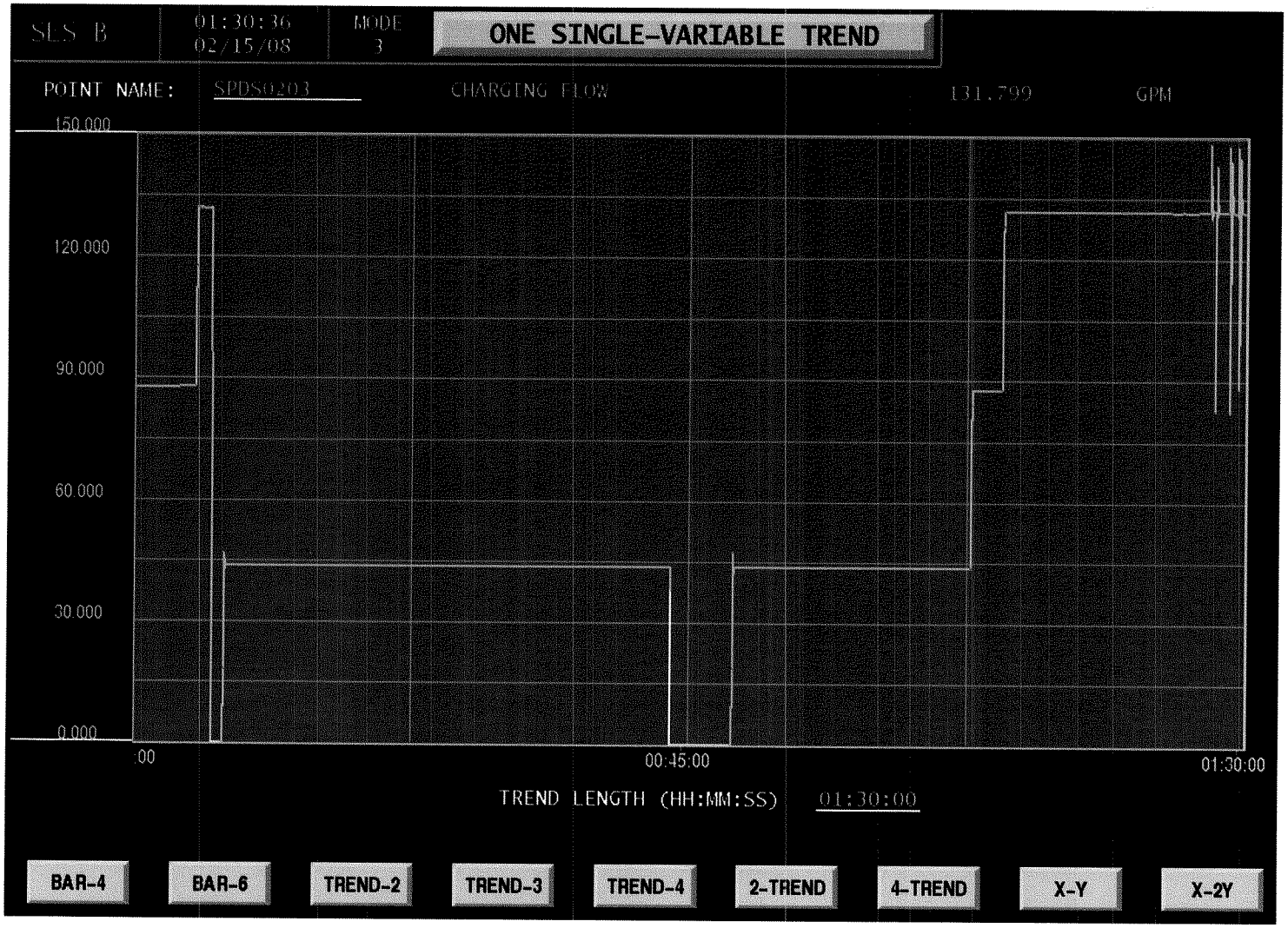
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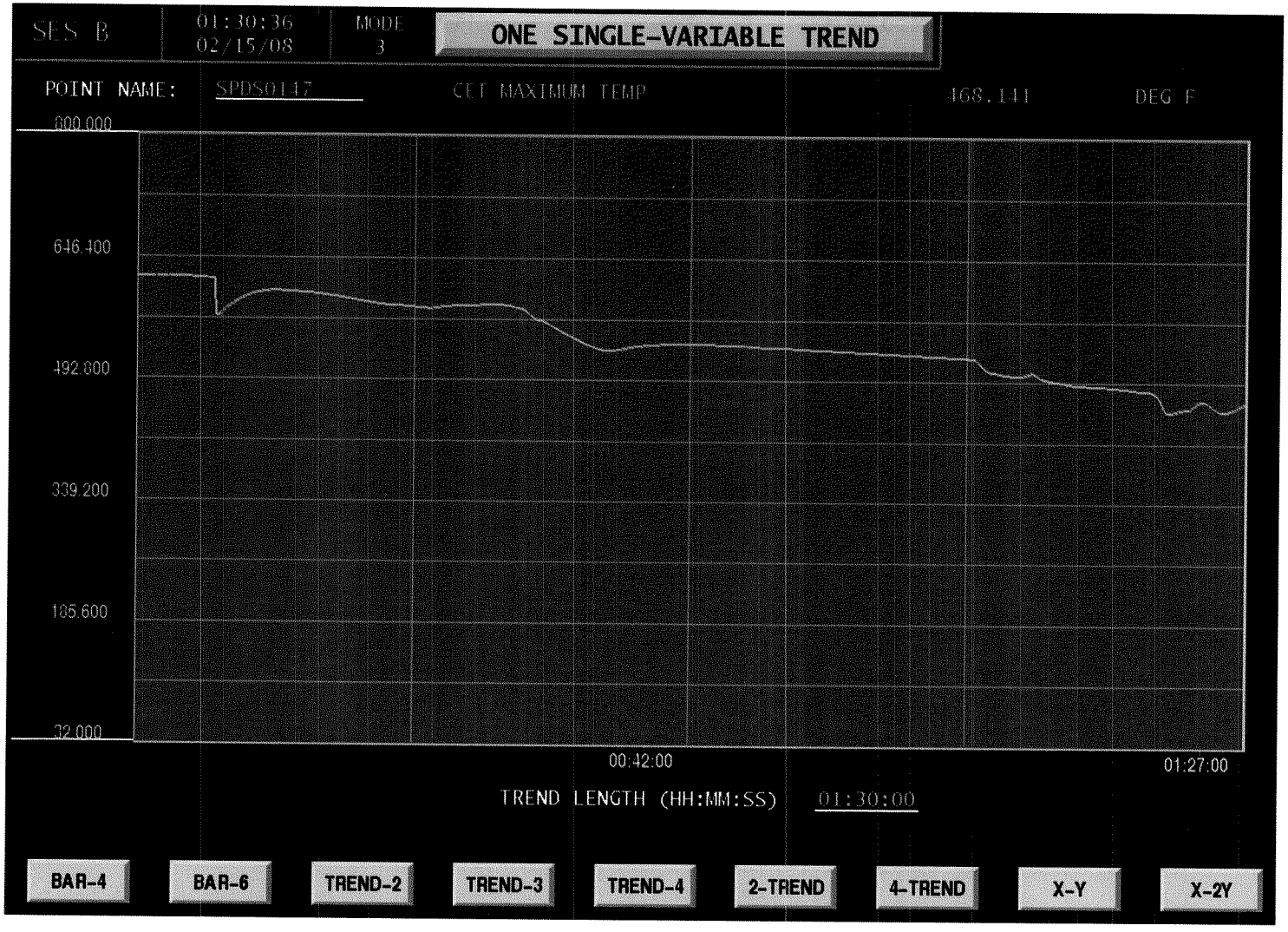
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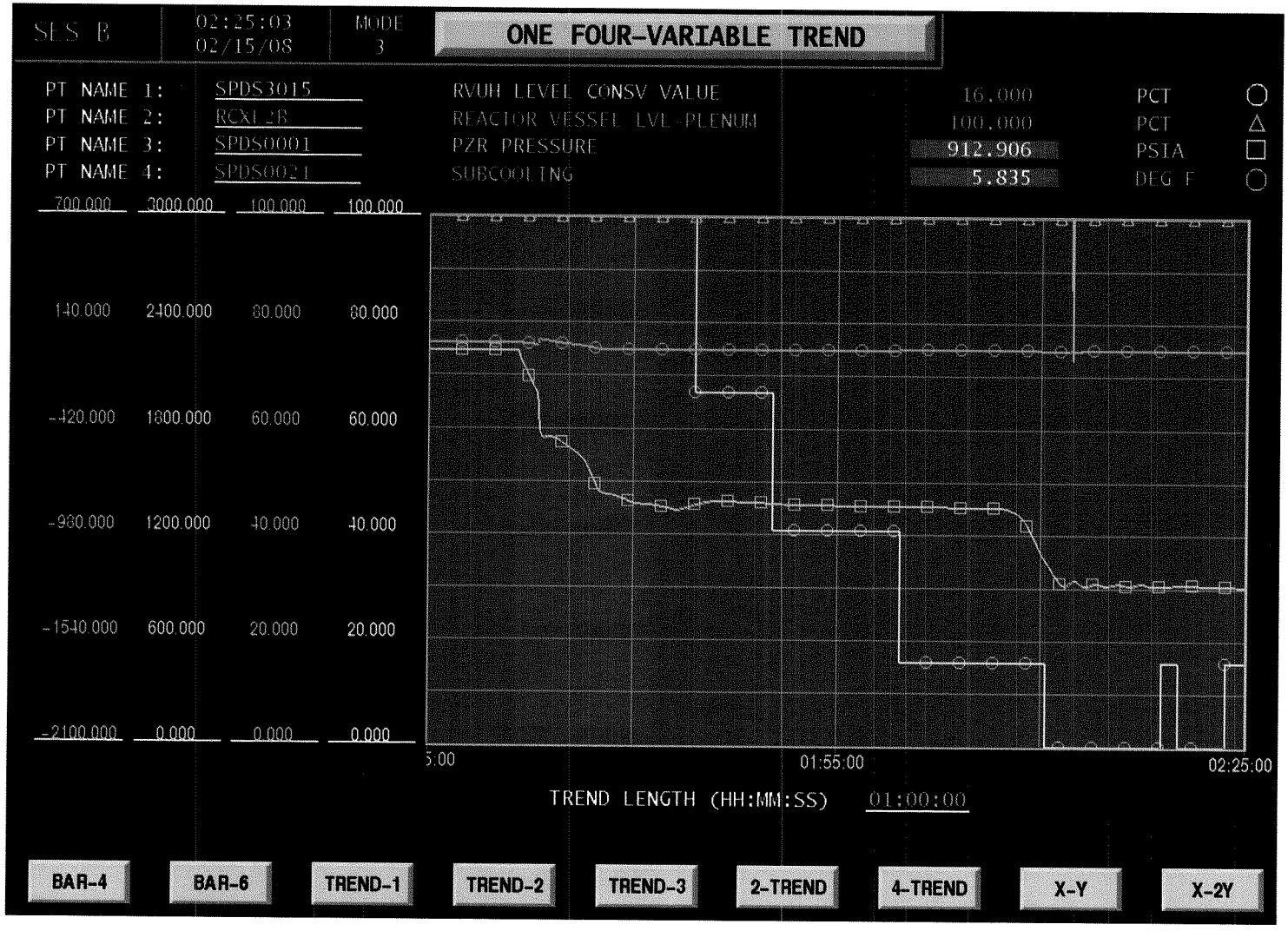

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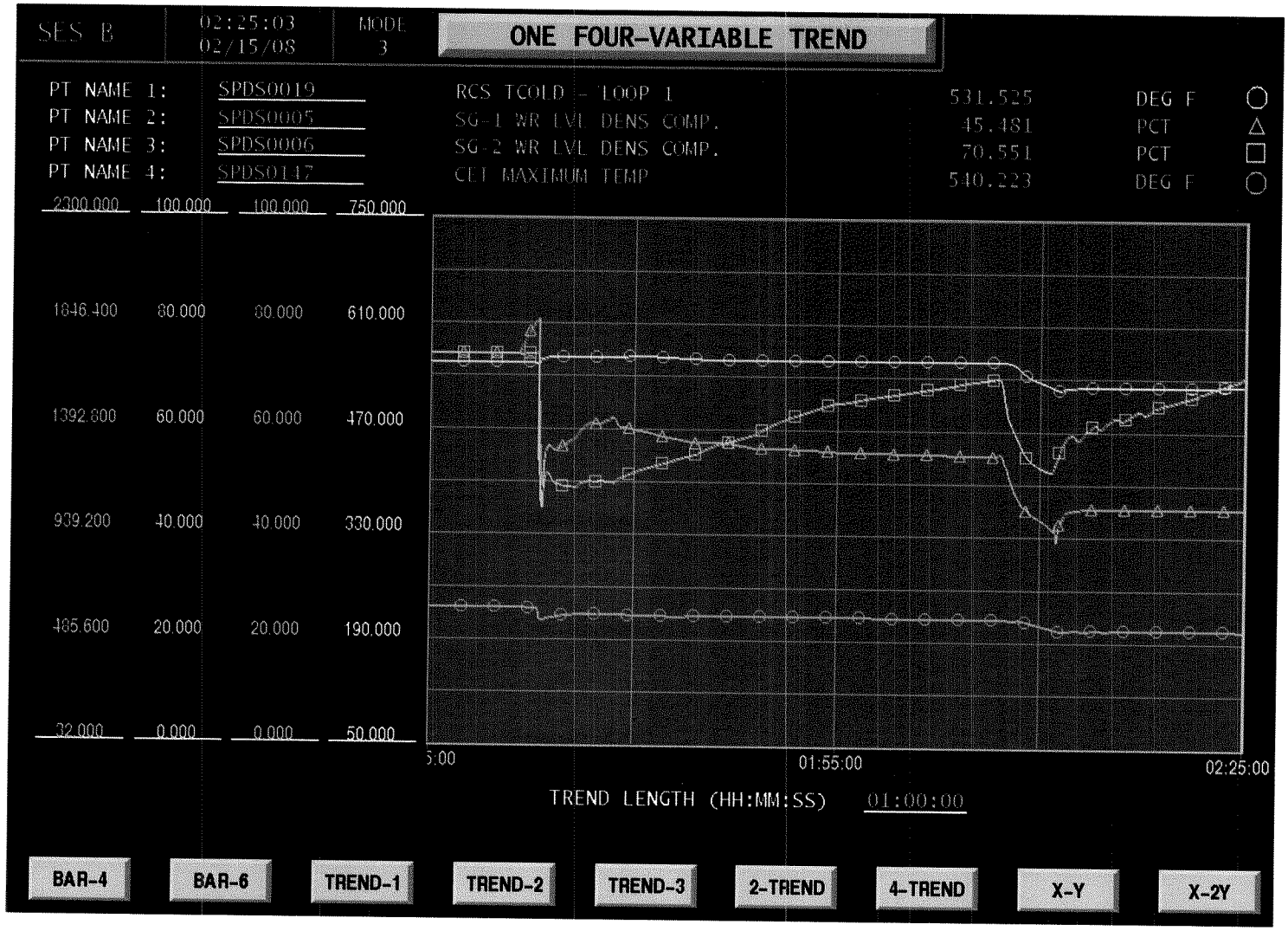
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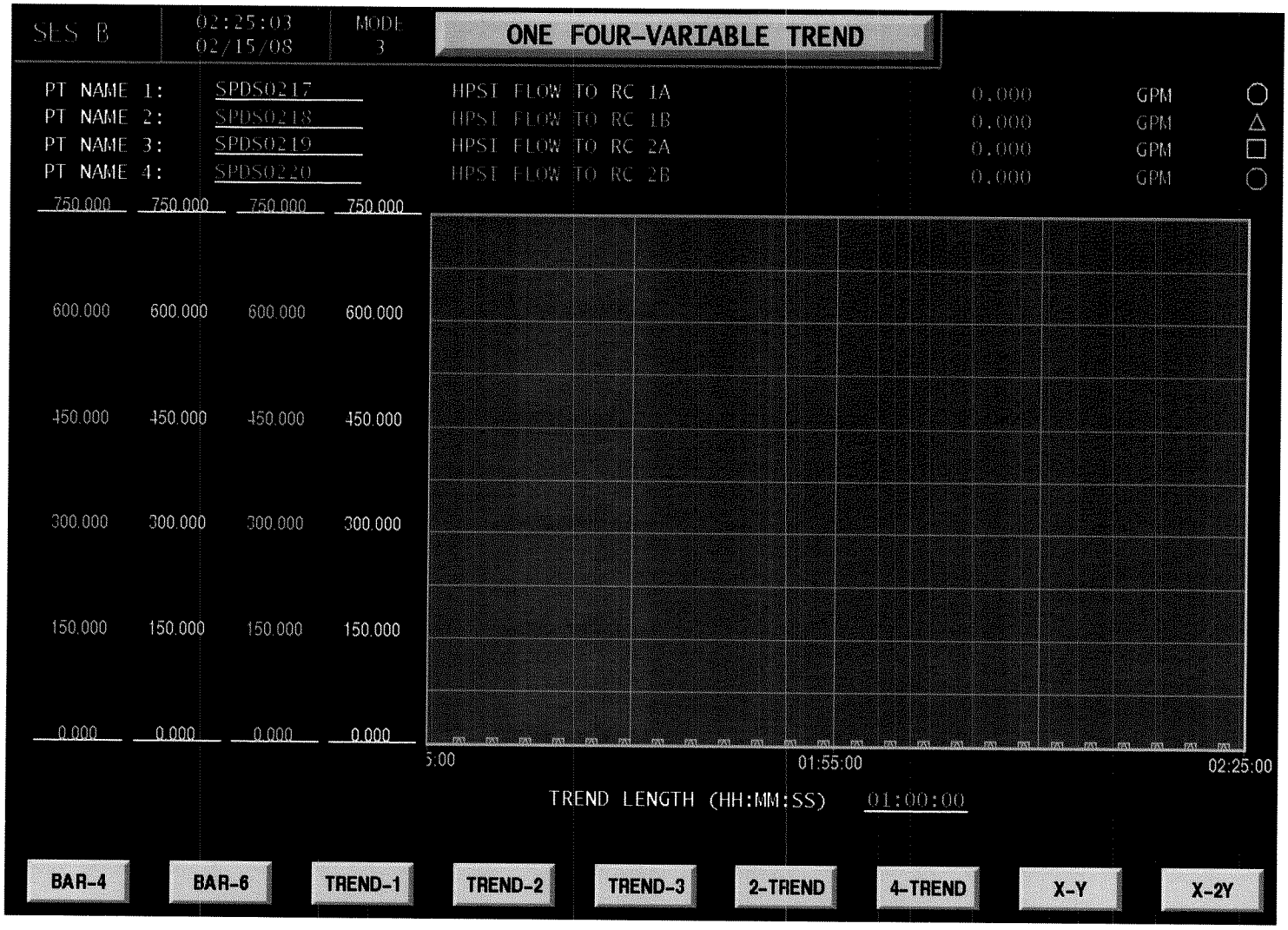
SCENARIO 3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HPSI FLOW TO RC 2B
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0.000 GPM
0.000 GPM
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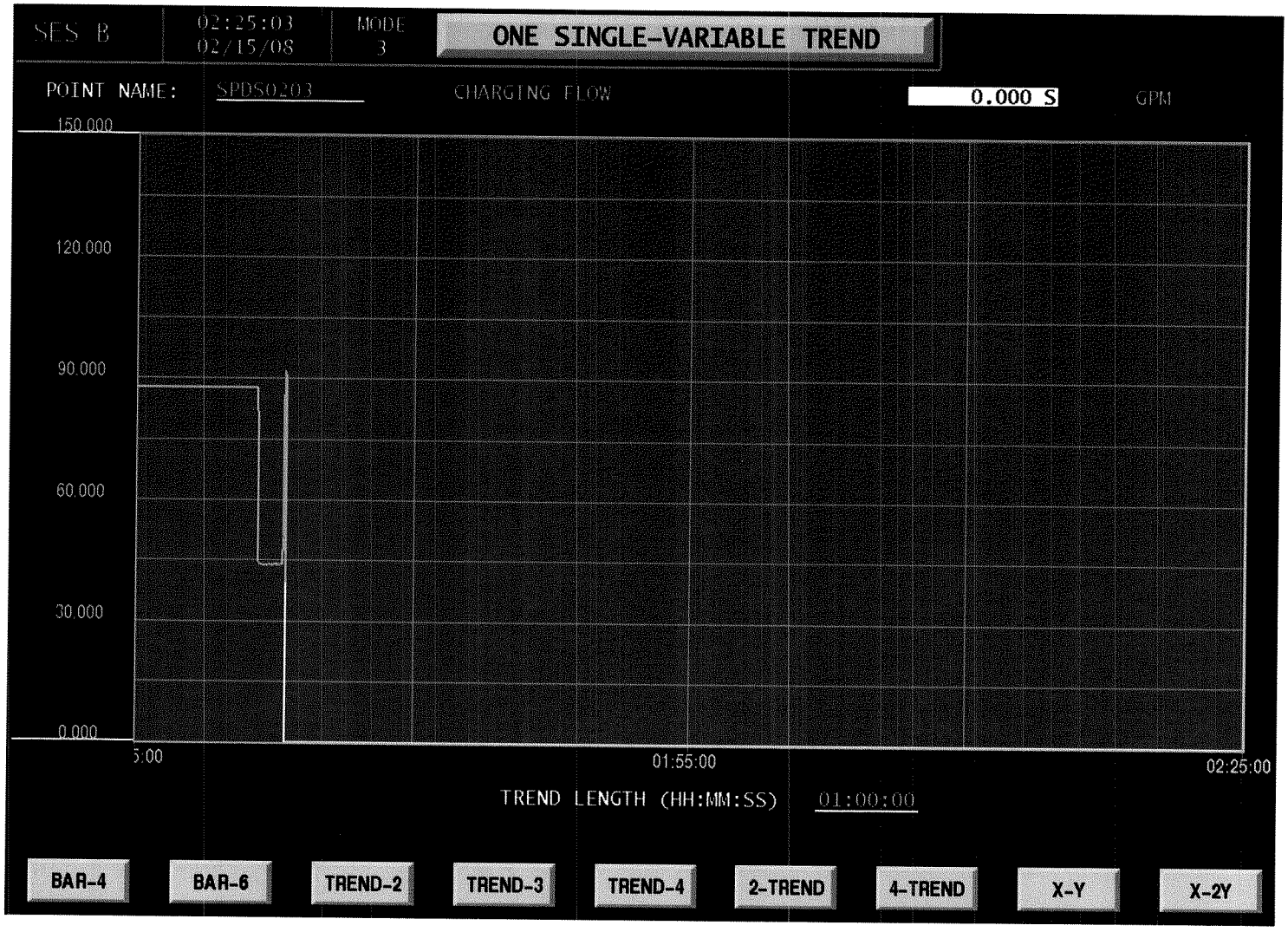
Scenario 3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POINT NAME:
SPDS0203
CHARGING FLOW
0.000 S
GPM
150.000
120.000
90.000
60.000
30.000
0.000
5:00
01:55:00
02:25:00
TREND LENGTH (HH:MM:SS)
01:00:00
BAR-4
BAR-6
TREND-2
TREND-3
TREND-4
2-TREND
4-TREND
X-Y
X-2Y

March 7, 2008

Task
Conduct an additional evaluation of the scenario used for JPM EP009-CR-001. This is in addition to the evaluations performed on Feb 15, 2008. This evaluation was performed to demonstrate conditions and operator actions that more closely follow the expected sequence of events for this scenario using the PVNGS emergency operations procedures. On the previous evaluations, additional conservatisms were used to add to the severity of the event (no operator actions or unrealistic delays in action). The PVNGS Control Room Simulator (B) was used to dynamically evaluate plant behavior with the expected operator actions during a large Steam Generator Tube Rupture with an initial leakrate of approximately 750gpm.

Printouts from the Emergency Response Facility Data Acquisition and Display System (ERFDADS) are provided for specific parameters from the scenario.

JPM EP009-CR-001 Conditions
- Unit 1
- A SGTR >200 GPM has occurred.
- The crew tripped the reactor.
- On the reactor trip a Loss of Power to the grid occurred.
- A loss of both HPSI pumps occurred due to electrical problems.
- The CRS entered the Functional Recovery Procedure.
- The crew has restored power to PBA-S03 using the "A" DG and has started the "A" HPSI pump.
- RVLMS indicated <21% in the outlet plenum 10 minutes ago, but is currently above 21%.
- The secondary operator has stabilized the secondary plant using AF "A" and the ADV's
- Perform the duties of the Emergency Coordinator until relieved.
- This is a Time Critical JPM.

Simulator Setup- The simulator was reset to 100% with a Middle of Core Life Snap.

Initial Conditions
- SGTR with initial leakrate of 750 gpm.
- Reactor tripped by operator
- Loss of Offsite power occurs at the time of the reactor trip.
- The "B" HPSI is unavailable.
- Adequate feed is maintained using AFA-P01

Scenario (750 GPM Leak)- Scenario was run with dynamic crew response with a double ended guillotine break of 1 tube. This severity is equivalent to the UFSAR chapter 15 SGTR analysis rupture. The equipment malfunctions and operator actions in this scenario align with the conditions given in the JPM scenario.

Initial Conditions

- SGTR with initial leakrate of 750gpm. (this malfunction is equivalent to 100% severity of the single tube guillotine shear rupture)
- Reactor tripped by operator
- Loss of Offsite power occurs at the time of the reactor trip.
- The "A" Diesel Generator fails resulting in loss of PBA-S03.
- No HPSI makeup is available until the "A" DG is restored.
- Adequate feed is maintained using AFA-P01
- RCS Temp is maintained using ADV's

1325-Start of Leak, Crew starts all available Charging Pumps (3) and enters Abnormal Operating Procedure (AOP) for excessive RCS leakrate.
1326- Crew isolates CVCS letdown flow IAW guidance of the AOP.
1327- Secondary Operator identifies S/G #1 level increasing, crew considers diagnosis of Steam Generator Tube leak.
1328- Crew trips Reactor due to Pzr level decreasing with letdown isolated and all charging running. Loss of Offsite Power occurs and "A" DG failure.
1329- Manual Safety Injection and Containment Isolation actuations are performed.
1330- RCS pressure is decreasing and is now 1935 psia, Pzr level is decreasing and is at 17.3%, ADV's are open to control RCS temperature. "B" Charging is running providing 44 GPM makeup flow to the RCS. RCS subcooling at 32 degrees and dropping.
1332- Reactor Coolant Pump Controlled Bleedoff flow to the Volume Control Tank is isolated
1333- RCS subcooling is <24degrees, Pzr level is decreasing and is now at 4%
1335- RCS pressure is now at 1675 psia, RCS subcooling is now at 16 degrees, Pzr level is 0%
1336- RCS subcooling is at approximately 2 degrees. RCS is saturated
1338- Crew enters the Functional Recovery Procedure. Steaming affected S/G to atmosphere periodically to maintain pressure <1200 psia.
1339- RCS pressure is now at 1365 psia, S/G #1 pressure is now at 1151psia
1348- Crew begins actions to restore power to "A" Class 4.16 KV bus
1349- RCS pressure now at 1358 psia, S/G #1 pressure now at 1141 psia
1351- crew initiates Main Steam Isolation Actuation IAW procedure guidance.
1352- Crew starts SGTR mitigation with Heat Removal 2 appendix of FRP
1353- Crew is now rapidly cooling down the RCS. Reactor Vessel Upper Head level indication decreases to 67% in upper head (first head voiding)
1358- RVUH level is now at 41% , RCS subcooling increases to 12 degrees, RCS pressure is now at 1180psia, S/G #1 pressure is now at 710psia
1401- RCS hot leg temperature is <540degrees, crew isolates S/G #1. RCS pressure is now at 1060 psia, S/G #1 pressure is now at 612 psia, RVUH indication is now at 16% in upper head, RCS subcooling is 29.5 degrees.
1405- S/G #1 is now isolated, crew continues cooldown of RCS at reduced rate
1415- power restored to "A" PB bus, HPSI "A" is started and crew begins injecting to RCS at 200GPM per loop. RCS pressure is now at 918psia, S/G #1 pressure is now at 810psia.

1416- crew now takes action to lower RCS pressure to equalize pressure between RCS and affected S/G, RCS subcooling at 38 degrees and increasing
1423- RVUH head level is increasing and is now 41%.
1423- Crew implements appendix 15 to reduce voiding in head.
1430- RVUH level is now at 67%
1433- Crew Vents Head to Reactor Drain Tank to minimize RCS voids. RCS to S/G #1 differential pressure <50 psid.
1440- Pzr is refilling with indicated level, RVUH level is now at 100%
1446- Crew throttles HPSI to maintain Pressurizer Level.
1447- Crew energizes Pzr Heaters

Final conditions/results-
Reactor Vessel Head is refilled and is full at end of scenario, Pressurizer level is recovering. Following isolation of the affected S/G, the ADV on that S/G was not opened again. Steam Generator to RCS differential pressure was reduced to <50 psid such that RCS leakrate was substantially reduced and RCS mass transfer to the affected S/G was essentially stopped. RCS makeup from charging and HPSI was restoring RCS inventory and subcooling. With expected operator action, RCS level did not approach 21% in the outlet plenum.

Emergency classification throughout this event would be Site Area Emergency due to EAL 1-7 potential loss of RCS, EAL 1-6 loss of RCS and EAL 1-14 loss of containment. The fuel barrier was not impacted.

Analysis

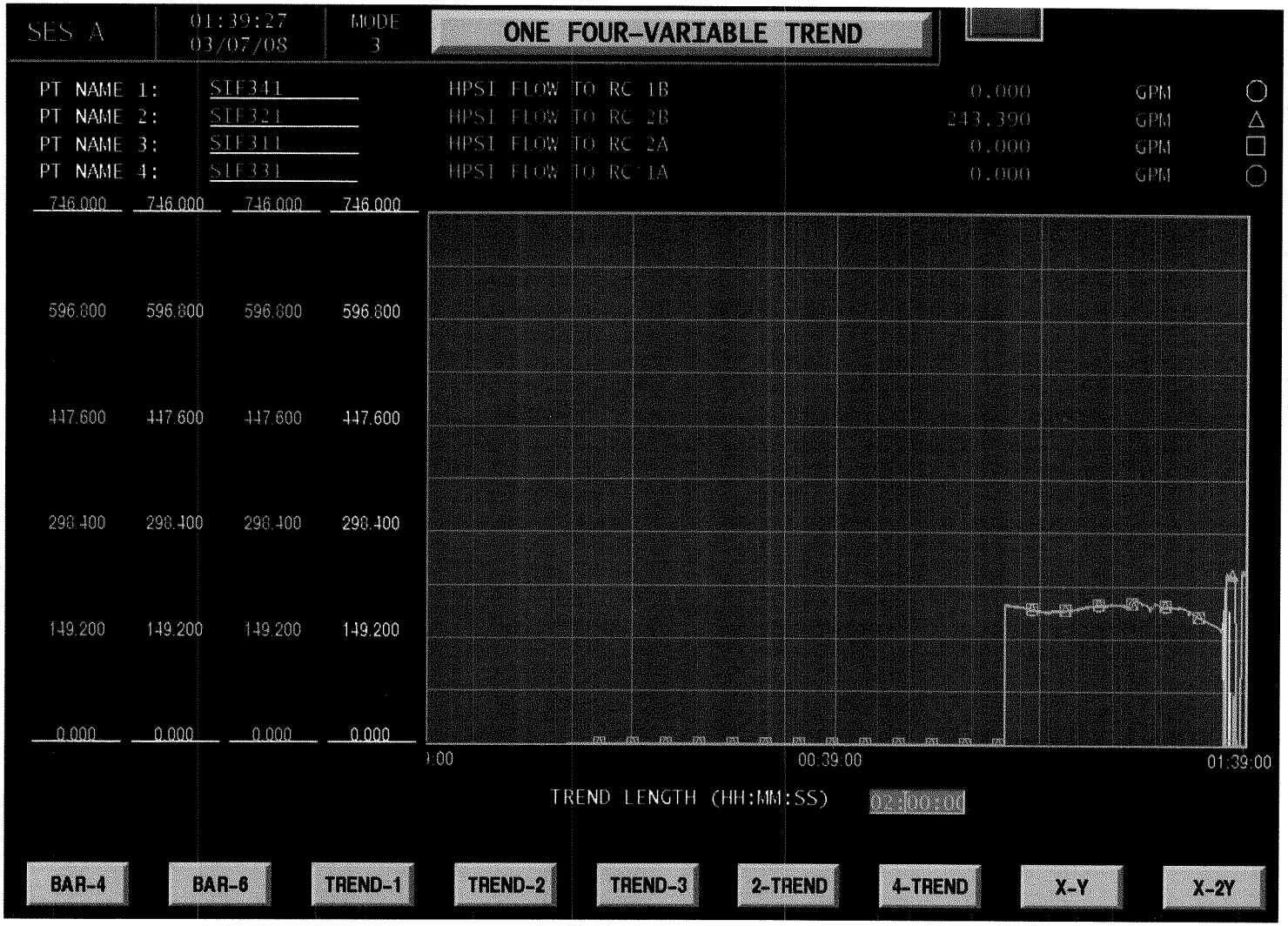
Observations from scenario:

- RCS mass loss is reduced due to RCS pressure decrease and resultant decrease in RCS-S/G differential pressure even with no operator action.
- RCS mass loss is substantially reduced or stopped when the operations crew takes actions in accordance with the Emergency Operations Procedures.
- Reactor Vessel Level did not approach <21% in the outlet plenum
- RCS reaches saturated conditions for SGTR with loss of offsite power and no HPSI flow.
- RCS subcooling is restored with cooldown of the RCS and/or RCS makeup.
- Following isolation of the affected steam generator, the affected steam generator ADV's are not required to be opened again.

Conclusions

1. Operator actions with a large SGTR effectively mitigate the event and reduce RCS mass loss such that it is not expected that Reactor Vessel Plenum Level will decrease to <21%. This is primarily due to the equalization of pressure between the affected Steam Generator and the RCS which substantially reduces or stops the RCS leak-rate

2. RCS subcooling is lost following a tube rupture with a loss of offsite power and can be restored with Makeup to the RCS and cooldown of the RCS. At the time of classification, the RCS may be subcooled or not. This can result in the EAL for loss or potential loss of the RCS being used for the classification but does not change the classification if plenum level remains above 21%.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03/07/08
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PT NAME 2:
SIF321
PT NAME 3:
SIF311
PT NAME 4:
SIF331
HPSI FLOW TO RC 1B
0.000
GPM
HPSI FLOW TO RC 2B
243.390
GPM
HPSI FLOW TO RC 2A
0.000
GPM
HPSI FLOW TO RC 1A
0.000
GPM
746.000
746.000
746.000
746.000
596.800
596.800
596.800
596.800
447.600
447.600
447.600
447.600
298.400
298.400
298.400
298.400
149.200
149.200
149.200
149.200
0.000
0.000
0.000
0.000
00:39:00
01:39:00
TREND LENGTH (HH:MM:SS)
02:00:00
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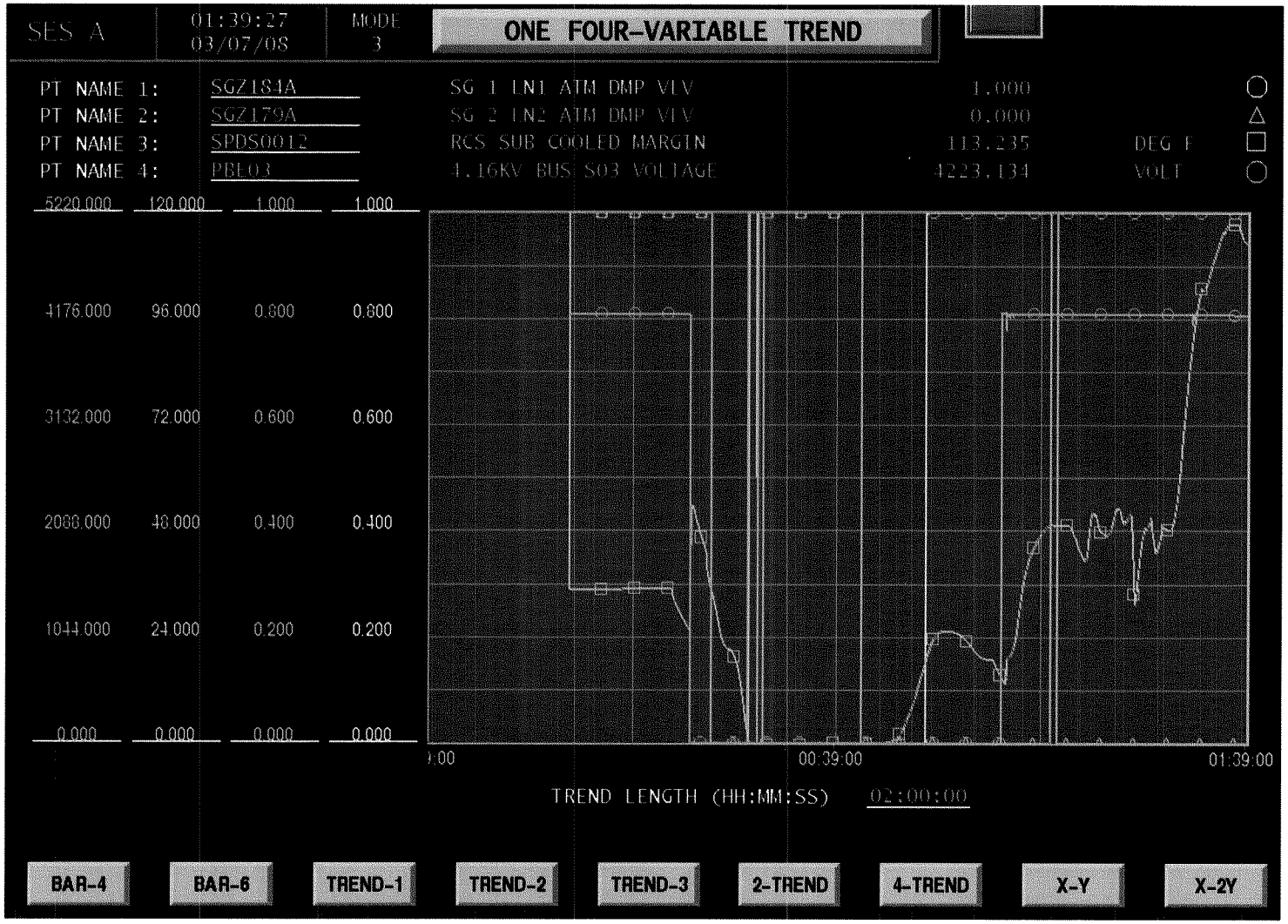
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y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03/07/08
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PT NAME 1:
SGZ184A
PT NAME 2:
SGZ179A
PT NAME 3:
SPDS0012
PT NAME 4:
PBE03
SG 1 LN1 ATM DMP VLV
1.000
SG 2 LN2 ATM DMP VLV
0.000
RCS SUB COOLED MARGIN
113.235
DEG F
4.16KV BUS S03 VOLTAGE
4223.134
VOLT
5220.000
120.000
1.000
1.000
4176.000
96.000
0.800
0.800
3132.000
72.000
0.600
0.600
2088.000
48.000
0.400
0.400
1044.000
24.000
0.200
0.200
0.000
0.000
0.000
0.000
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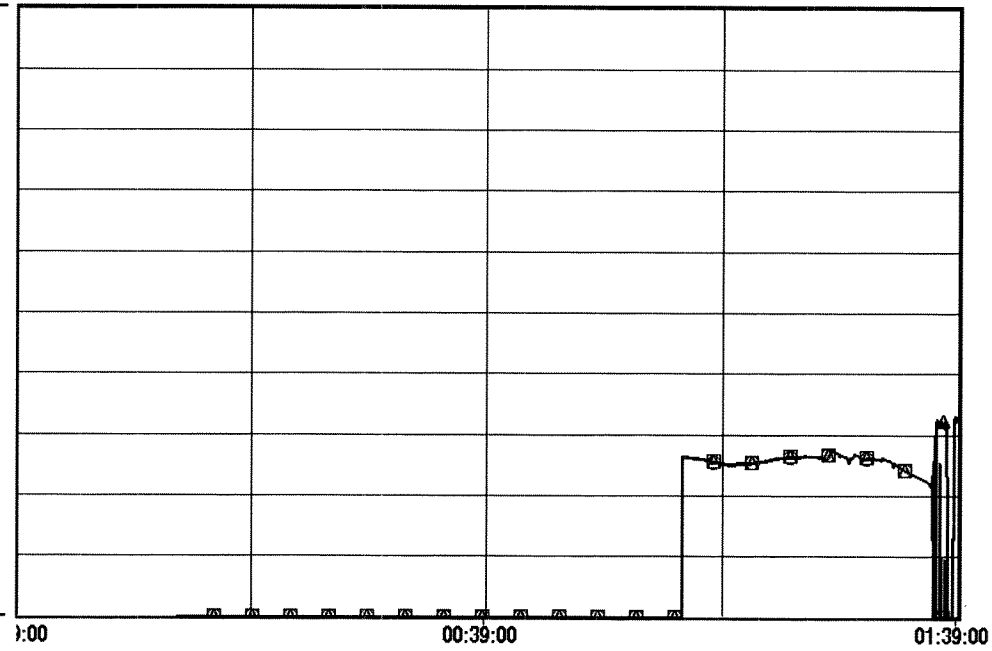
01:39:00
TREND LENGTH (HH:MM:SS)
02:00:00
BAR-4
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y

SES A 01:39:27 03/07/08 MODE 3 ONE FOUR-VARIABLE TREND

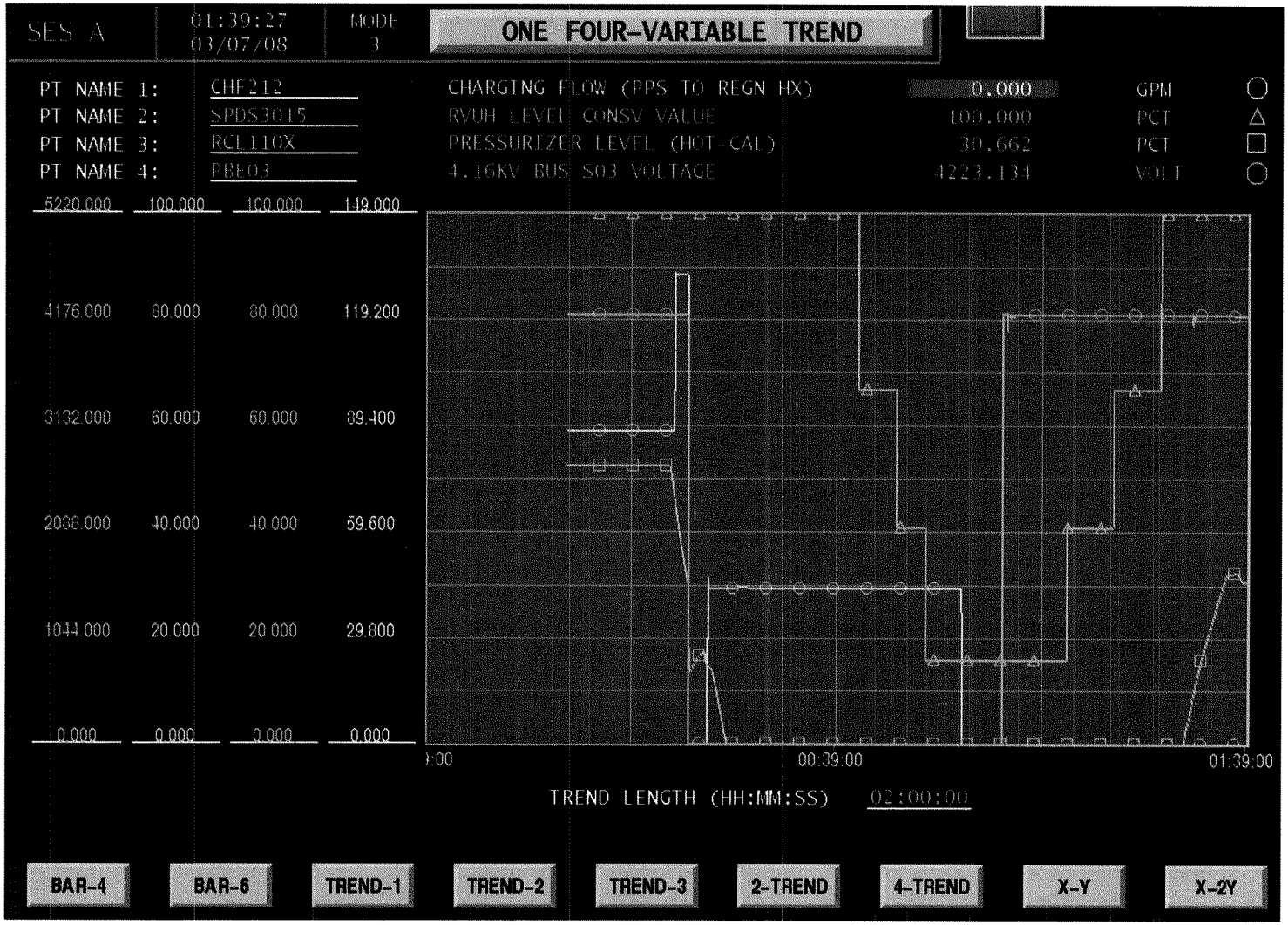
PT NAME 1:	SIF341	HPSI FLOW TO RC 1B	0.000	GPM	○
PT NAME 2:	SIF321	HPSI FLOW TO RC 2B	243.390	GPM	△
PT NAME 3:	SIF311	HPSI FLOW TO RC 2A	0.000	GPM	□
PT NAME 4:	SIF331	HPSI FLOW TO RC 1A	0.000	GPM	○

746.000	746.000	746.000	746.000
596.800	596.800	596.800	596.800
447.600	447.600	447.600	447.600
298.400	298.400	298.400	298.400
149.200	149.200	149.200	149.200
0.000	0.000	0.000	0.000



TREND LENGTH (HH:MM:SS)

BAR-4 BAR-6 TREND-1 TREND-2 TREND-3 2-TREND 4-TREND X-Y X-2Y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03/07/08
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PT NAME 1:
CHF212
CHARGING FLOW (PPS TO REGN HX)
0.000
GPM
PT NAME 2:
SPDS3015
RVUH LEVEL CONSV VALUE
100.000
PCT
PT NAME 3:
RCL110X
PRESSURIZER LEVEL (HOT-CAL)
30.662
PCT
PT NAME 4:
PBE03
4.16KV BUS S03 VOLTAGE
4223.134
VOLT
5220.000
100.000
100.000
149.000
4176.000
80.000
80.000
119.200
3132.000
60.000
60.000
89.400
2088.000
40.000
40.000
59.600
1044.000
20.000
20.000
29.800
0.000
0.000
0.000
0.000
00:39:00
01:39:00
TREND LENGTH (HH:MM:SS)
02:00:00
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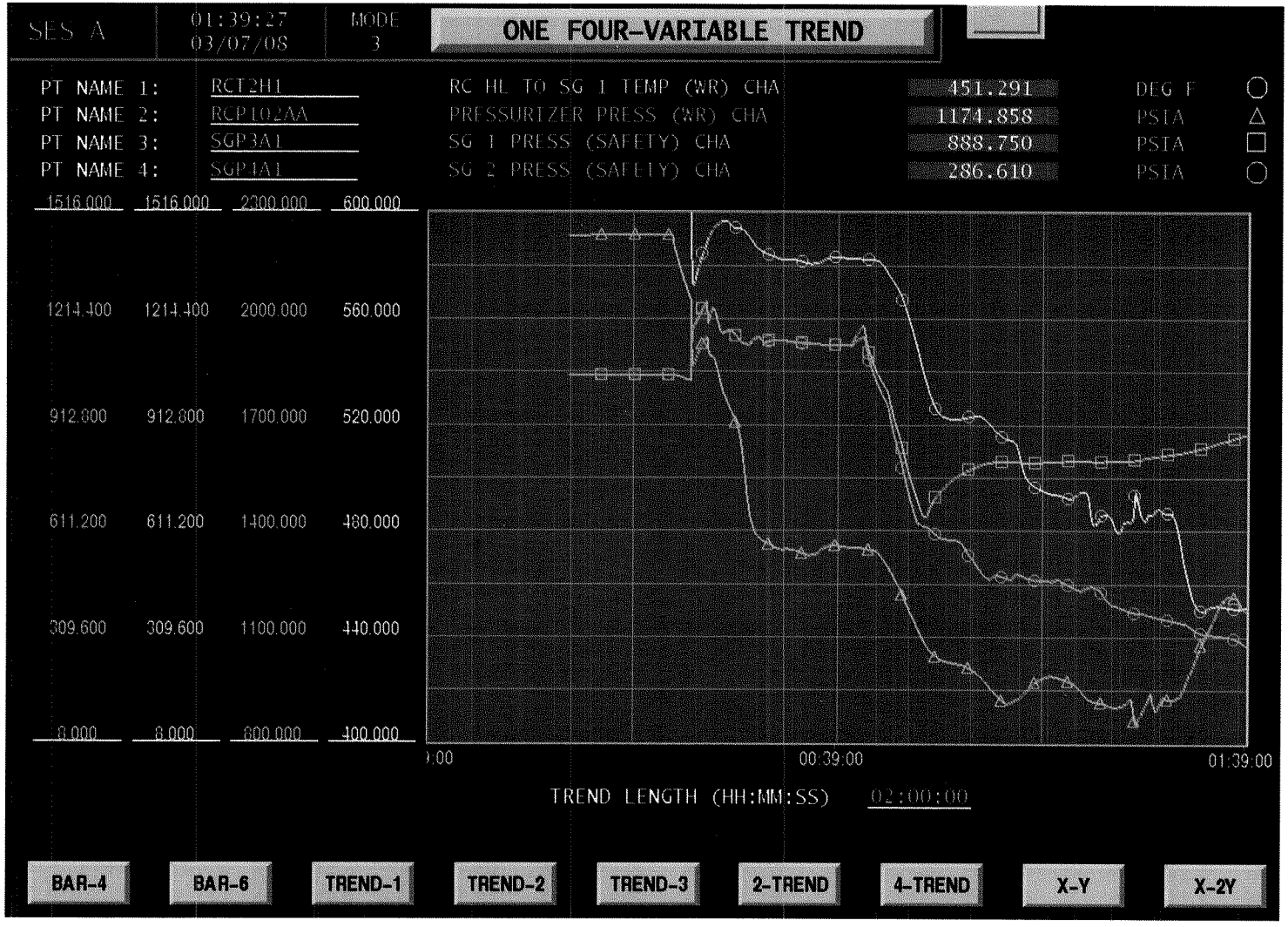
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y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03/07/08
MODE
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ONE FOUR-VARIABLE TREND
PT NAME 1:
RCT2H1
RC HL TO SG 1 TEMP (WR) CHA
451.291
DEG F
PT NAME 2:
RCP102AA
PRESSURIZER PRESS (WR) CHA
1174.858
PSIA
PT NAME 3:
SGP3A1
SG 1 PRESS (SAFETY) CHA
888.750
PSIA
PT NAME 4:
SGP1A1
SG 2 PRESS (SAFETY) CHA
286.610
PSIA
1516.000
1516.000
2300.000
600.000
1214.400
1214.400
2000.000
560.000
912.800
912.800
1700.000
520.000
611.200
611.200
1400.000
480.000
309.600
309.600
1100.000
440.000
8.000
8.000
800.000
400.000
00:39:00
01:39:00
TREND LENGTH (HH:MM:SS)
02:00:00
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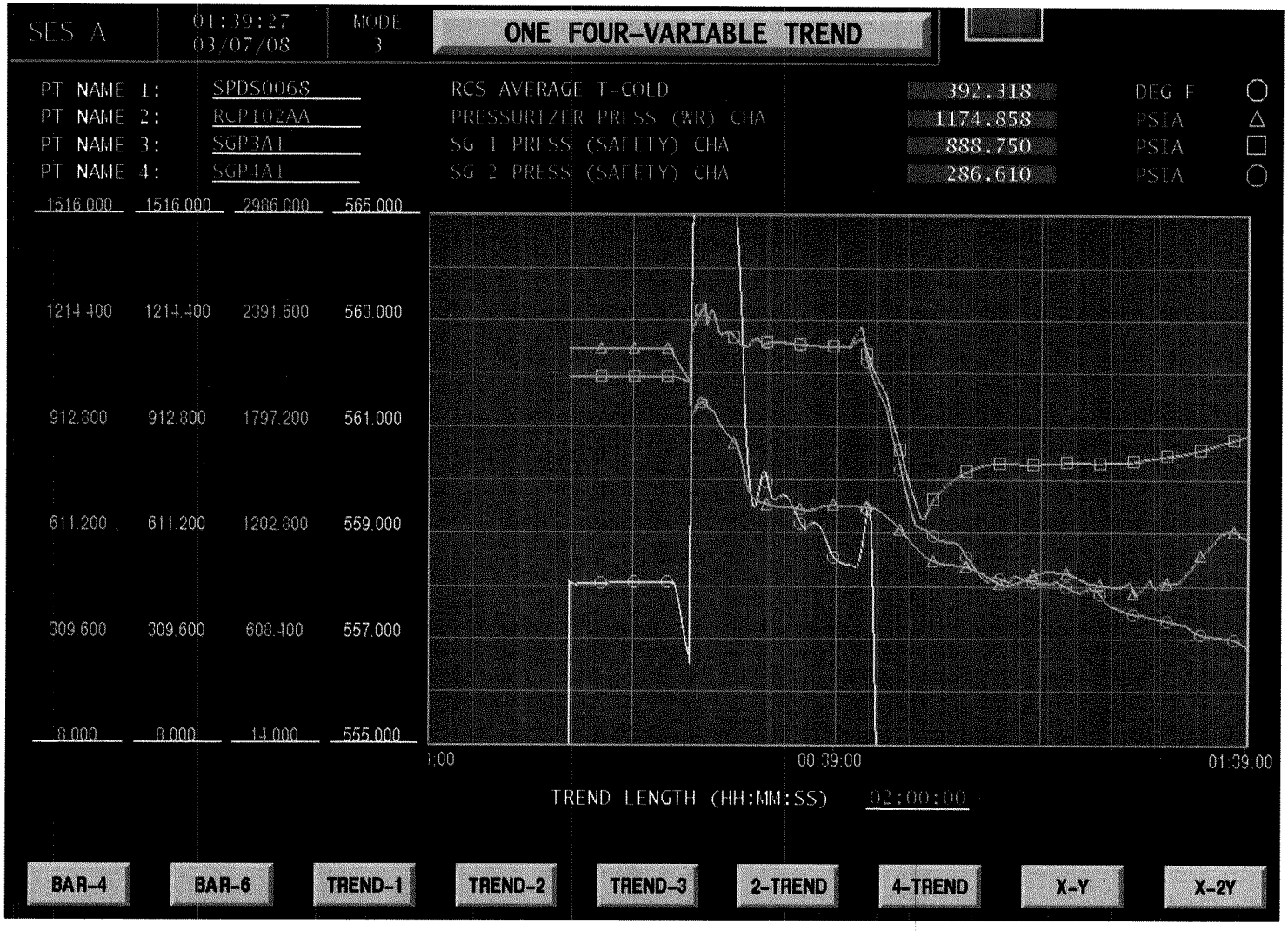
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y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03/07/08
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PT NAME 2: RCP102AA
PT NAME 3: SGP3A1
PT NAME 4: SGP1A1
RCS AVERAGE T-COLD
PRESSURIZER PRESS (WR) CHA
SG 1 PRESS (SAFETY) CHA
SG 2 PRESS (SAFETY) CHA
392.318
1174.858
888.750
286.610
DEG F
PSIA
PSIA
PSIA
1516.000 1516.000 2986.000 565.000
1214.400 1214.400 2391.600 563.000
912.800 912.800 1797.200 561.000
611.200 611.200 1202.800 559.000
309.600 309.600 608.400 557.000
8.000 8.000 14.000 555.000
:00
00:39:00
01:39:00
TREND LENGTH (HH:MM:SS) 02:00:00
BAR-4
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y

Continuation of Simulator Review for JPM EP009-CR-001

April 3, 2008

A dynamic simulator scenario was run, as requested by the NRC, to evaluate the possibility of having a loss or potential loss of the Fuel Barrier (of the Fission Product Barrier Table) during a Steam Generator Tube Rupture where the faulted SG was steamed to atmosphere. The particular conditions with this evaluation were (1) the availability of only one High Pressure Safety Injection pump and (2) a complete loss of Steam Generator feed.
The operating crew followed the guidance of station Emergency Operating Procedures but veered towards non-conservative actions that would tend to drive two key parameters towards the potential loss of the Fuel Barrier: RVLMS Outlet plenum (<21%) and Core Exit Thermocouple temperature (>700 degree F.). As this evaluation will show, even with less than prudent actions (still bounded by the Functional Recovery Procedure), Outlet Plenum level and CET temperature never approached EAL values.

Synopsis of Event.

1726 – The following events occur simultaneously:

- Loss of Offsite power causing a reactor trip
- PBA-S03 bus faults
- HPSI B pump fails electrically
- Steam driven Aux Feedpump fails
- B Aux Feedpump fails
- Double-ended guillotine break of one SG tube (750 gpm) in SG 1.

This results in a loss of all feed, loss of Reactor Coolant Pumps, and Operators stabilizing plant temperature on ADVs. AFAS 2 actuates within 6 minutes. SIAS/CIAS actuates within 8 minutes.

1735 – SM declares Alert based on EALs 2-3 (one Vital bus energized by DG) and 1-8 (Loss of all Feed).

1740 – Crew enters Functional Recovery Procedure (FRP).

1745 – SM declares SAE based on 1-6 (RCS leak >44gpm, **Potential loss**), 1-7 (SGTR >44 gpm, **Potential loss**), 1-8 (Loss of all Feed, **Potential loss**), 1-14 (Release of Contaminated Secondary water, **Loss**)

1747 – CRS has jeopardized HR-2 and CI-1 of the FRP and begins taking action in HR-2 (higher safety function)

1755 – HR-2 directs plant cooldown. EAL 1-7 (Loss) is now met due to prolonged release with SGTR. This is still a Site Area Emergency, but 1-7 (Loss) and 1-14 (Loss) are now driving the classification.

1805 – HR-2 directs depressurizing the RCS to minimize the leak into the SG. Auxiliary Spray is used. As pressure is lowered, HPSI flow increases, negating the pressure drop. It is important to note that HPSI throttle criteria can never be met since there is no feedwater. Spray continues for seven minutes and is stopped. Subcooling drops to 20 degrees then recovers. No voiding occurs even in the Reactor Vessel Upper Head.

1807 – HR-2 comes to a decision point: isolating the most affected SG. Obviously, there are two choices.

1. Isolate SG 1 with the tube leak. If this path is taken, the ADVs on SG 1 (as well as all other isolation valves) are closed. When SG 2 goes dry, heat removal is lost. RCS temperature and pressure rise, as well as SG pressure. RCS pressure could rise to a maximum of 2500 psia, where the Primary Safeties would lift (corresponds to 668 degrees F on CETs). HR-2 will direct keeping SG1 pressure <1135 psig by opening the ADV. With RCS pressure high, leak rate into the SG will increase, and a new equilibrium in heat removal will be established.

2. Isolate SG 2 (most affected since it has no heat removal capabilities). The crew chooses this path.

1836 – The crew has continued an aggressive cooldown, but still no voiding on RVLMS has occurred. Other key parameters: RCS pressure 1354 psia, 107 degrees subcooling, and CET temperature 477 degrees and continuing to drop.

Conclusion

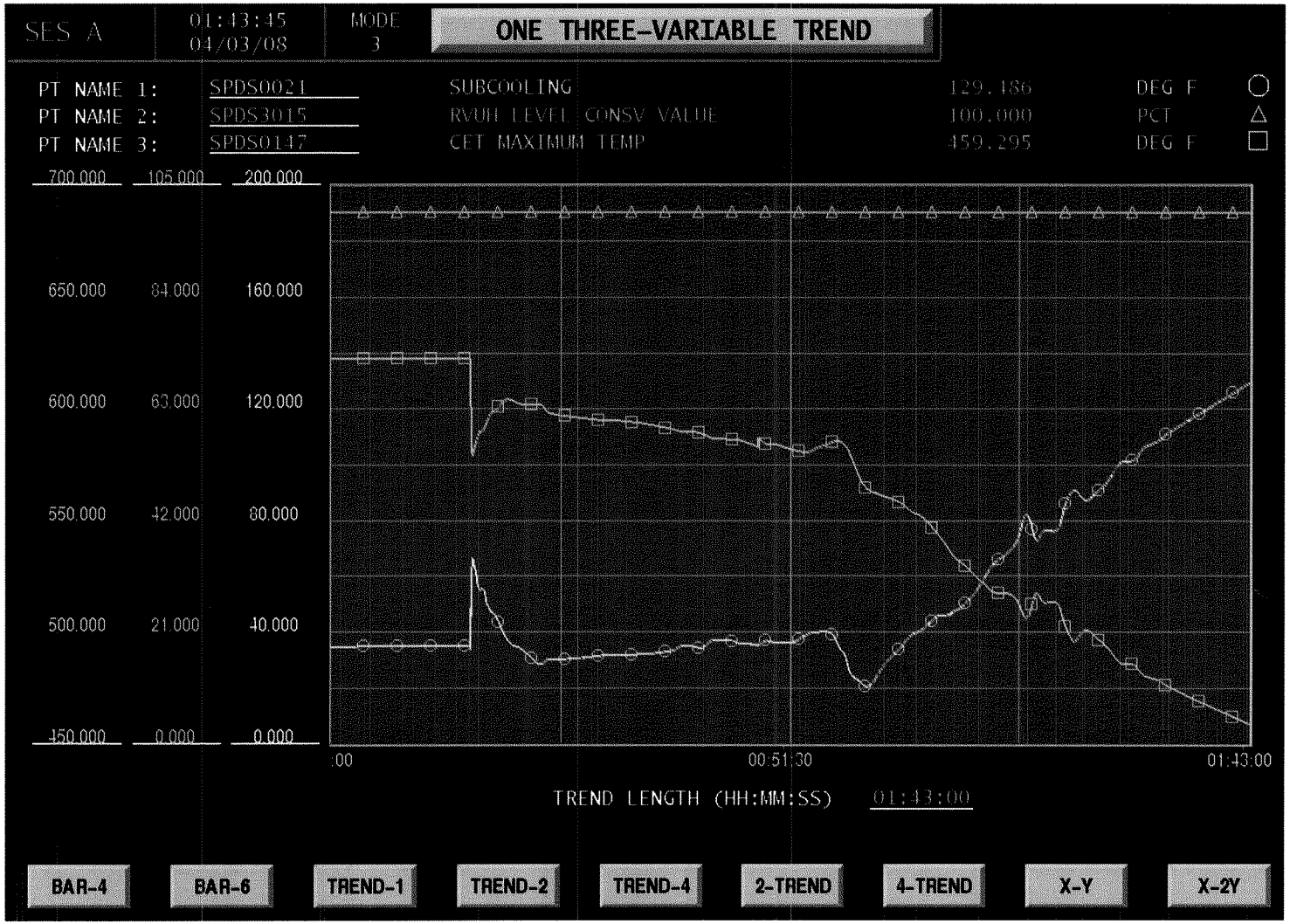
Graphs of key parameters are attached, including CETs and Reactor Vessel Outlet Plenum.

There are three key points that this evaluation highlights:

1. The FRP will direct the plant to be cooled down. This means that the classification will be SAE for 1-7 (loss) and 1-14 (loss).

2. If the crew did NOT cooldown the plant, the classification is still SAE, but the driving EALs are 1-6 and 1-7 (both potential losses) and 1-14.

3. As the cooldown continues, fuel barrier conditions only improve. CET temperature of course will drop and the Reactor Vessel will stay full as HPSI flow increases with dropping SG pressure (and increasing primary to secondary leak flow). Without a degradation of the fuel barrier, a General Emergency classification cannot be met.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04/03/08
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3
ONE THREE-VARIABLE TREND
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SPDS0021
SUBCOOLING
129.186
DEG F
PT NAME 2:
SPDS3015
RVUH LEVEL CONSV VALUE
100.000
PCT
PT NAME 3:
SPDS0147
CET MAXIMUM TEMP
459.295
DEG F
700.000
105.000
200.000
650.000
84.000
160.000
600.000
63.000
120.000
550.000
42.000
80.000
500.000
21.000
40.000
450.000
0.000
0.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
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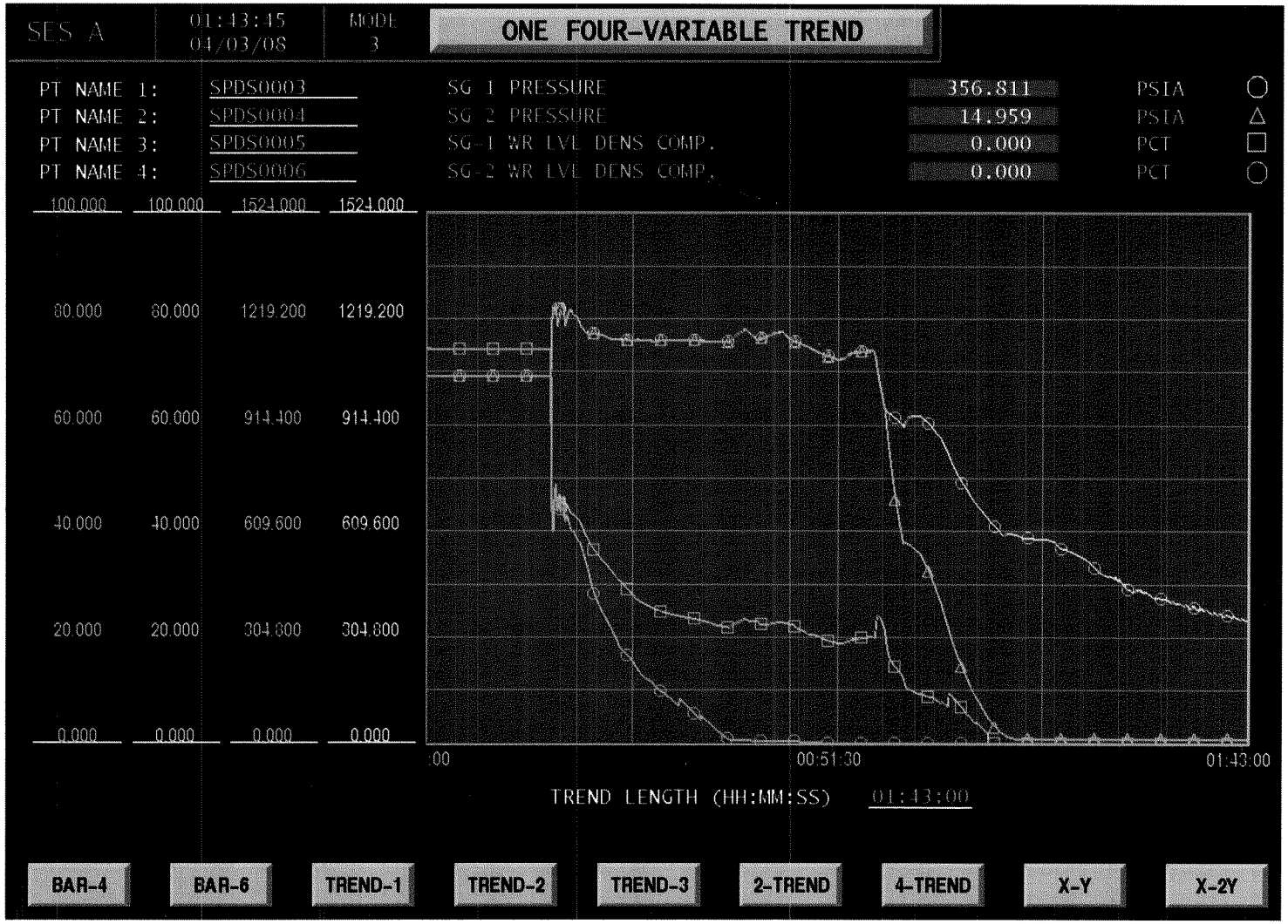
BAR-6
TREND-1
TREND-2
TREND-4
2-TREND
4-TREND
X-Y
X-2Y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04/03/08
MODE
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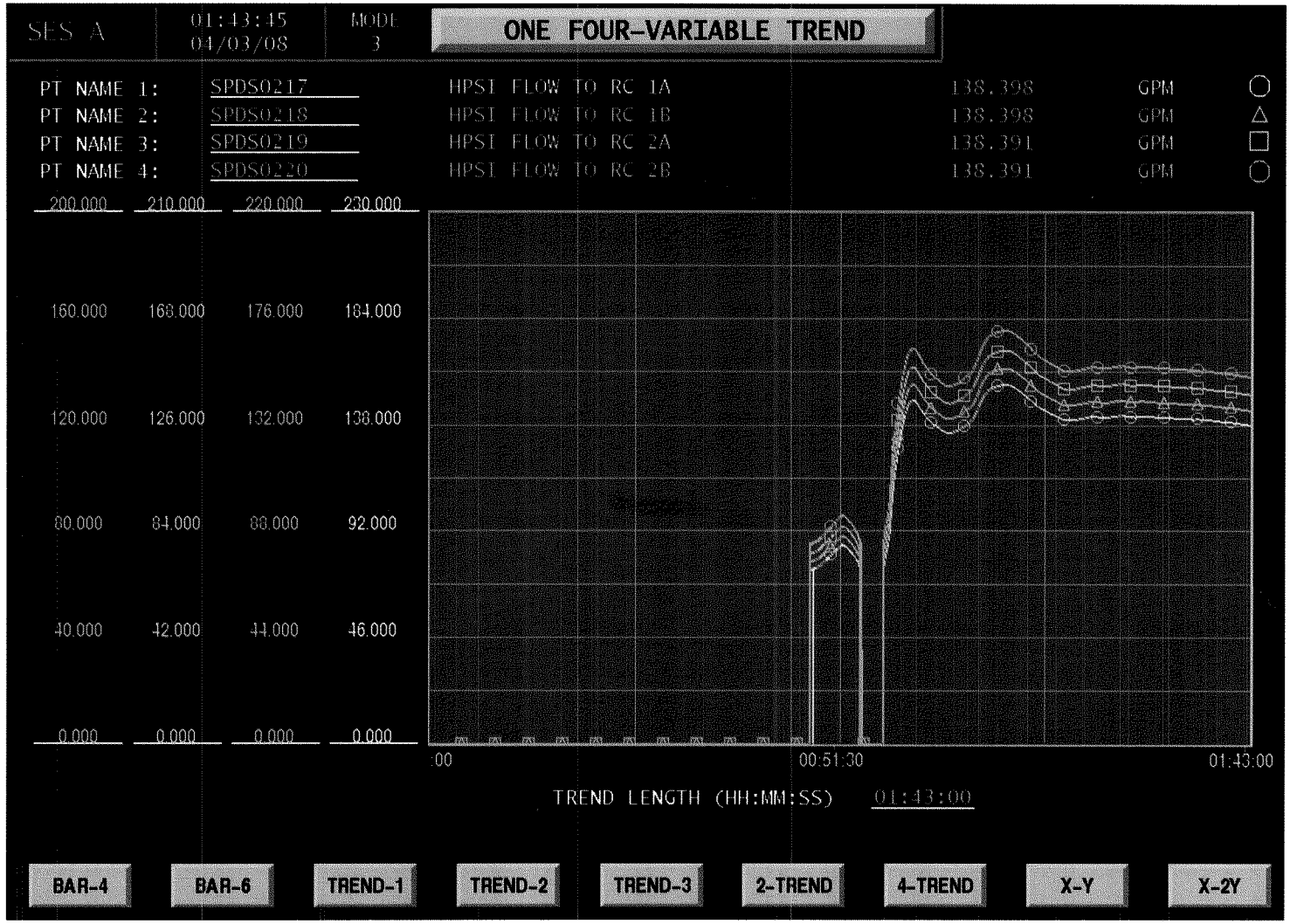
ONE FOUR-VARIABLE TREND
PT NAME 1: SPDS0003
PT NAME 2: SPDS0004
PT NAME 3: SPDS0005
PT NAME 4: SPDS0006
SG 1 PRESSURE
SG 2 PRESSURE
SG-1 WR LVL DENS COMP.
SG-2 WR LVL DENS COMP.
356.811
14.959
0.000
0.000
PSIA
PSIA
PCT
PCT
100.000 100.000 1524.000 1524.000
80.000 80.000 1219.200 1219.200
60.000 60.000 914.400 914.400
40.000 40.000 609.600 609.600
20.000 20.000 304.800 304.800
0.000 0.000 0.000 0.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS) 01:43:00
BAR-4
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y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04/03/08
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SPDS0217
HPSI FLOW TO RC 1A
138.398
GPM
PT NAME 2:
SPDS0218
HPSI FLOW TO RC 1B
138.398
GPM
PT NAME 3:
SPDS0219
HPSI FLOW TO RC 2A
138.391
GPM
PT NAME 4:
SPDS0220
HPSI FLOW TO RC 2B
138.391
GPM
200.000
210.000
220.000
230.000
160.000
168.000
176.000
184.000
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138.000
80.000
84.000
88.000
92.000
40.000
42.000
44.000
46.000
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0.000
0.000
0.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
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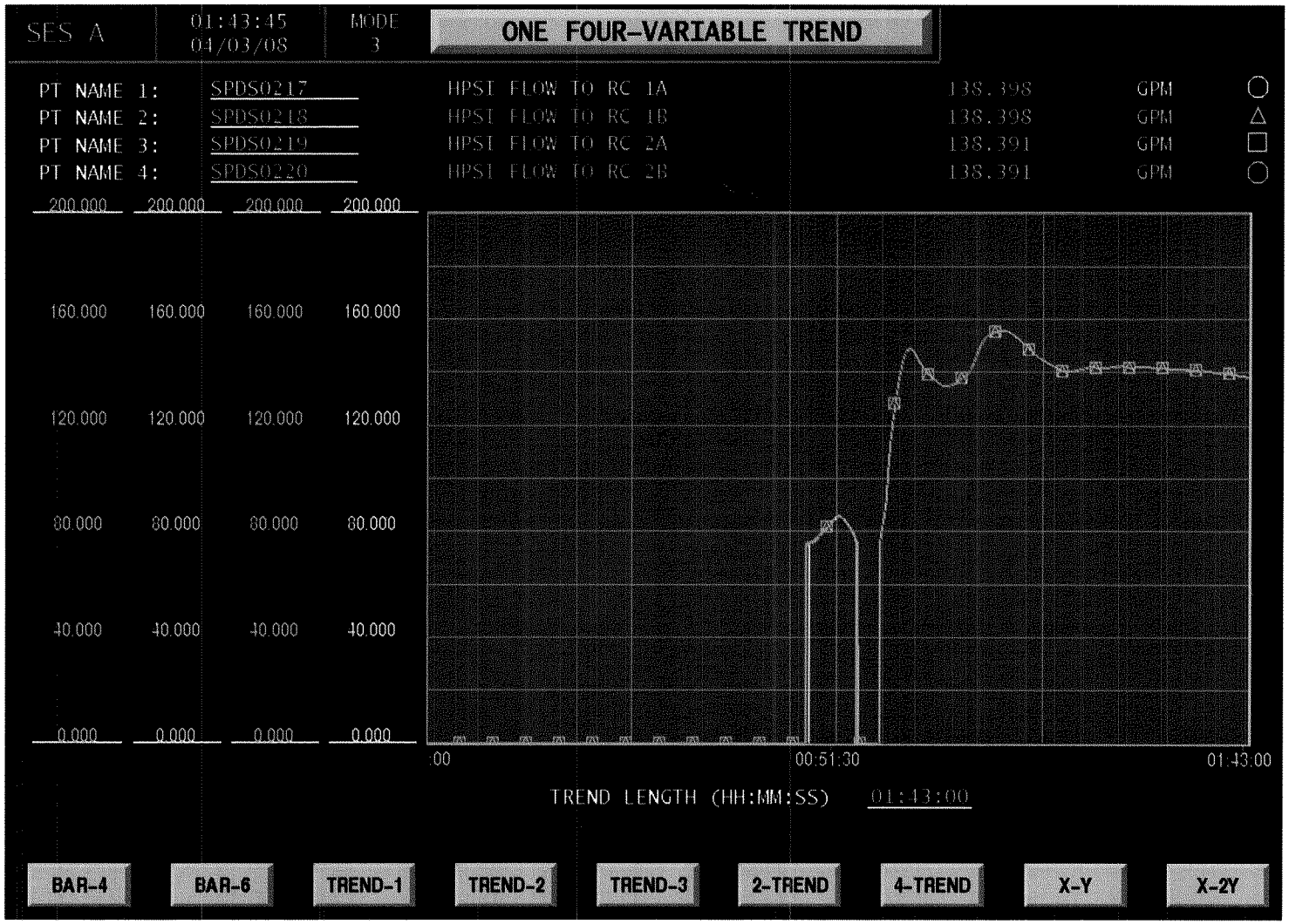
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y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04/03/08
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HPSI FLOW TO RC 1A
138.398
GPM
PT NAME 2:
SPDS0218
HPSI FLOW TO RC 1B
138.398
GPM
PT NAME 3:
SPDS0219
HPSI FLOW TO RC 2A
138.391
GPM
PT NAME 4:
SPDS0220
HPSI FLOW TO RC 2B
138.391
GPM
200.000
200.000
200.000
200.000
160.000
160.000
160.000
160.000
120.000
120.000
120.000
120.000
80.000
80.000
80.000
80.000
40.000
40.000
40.000
40.000
0.000
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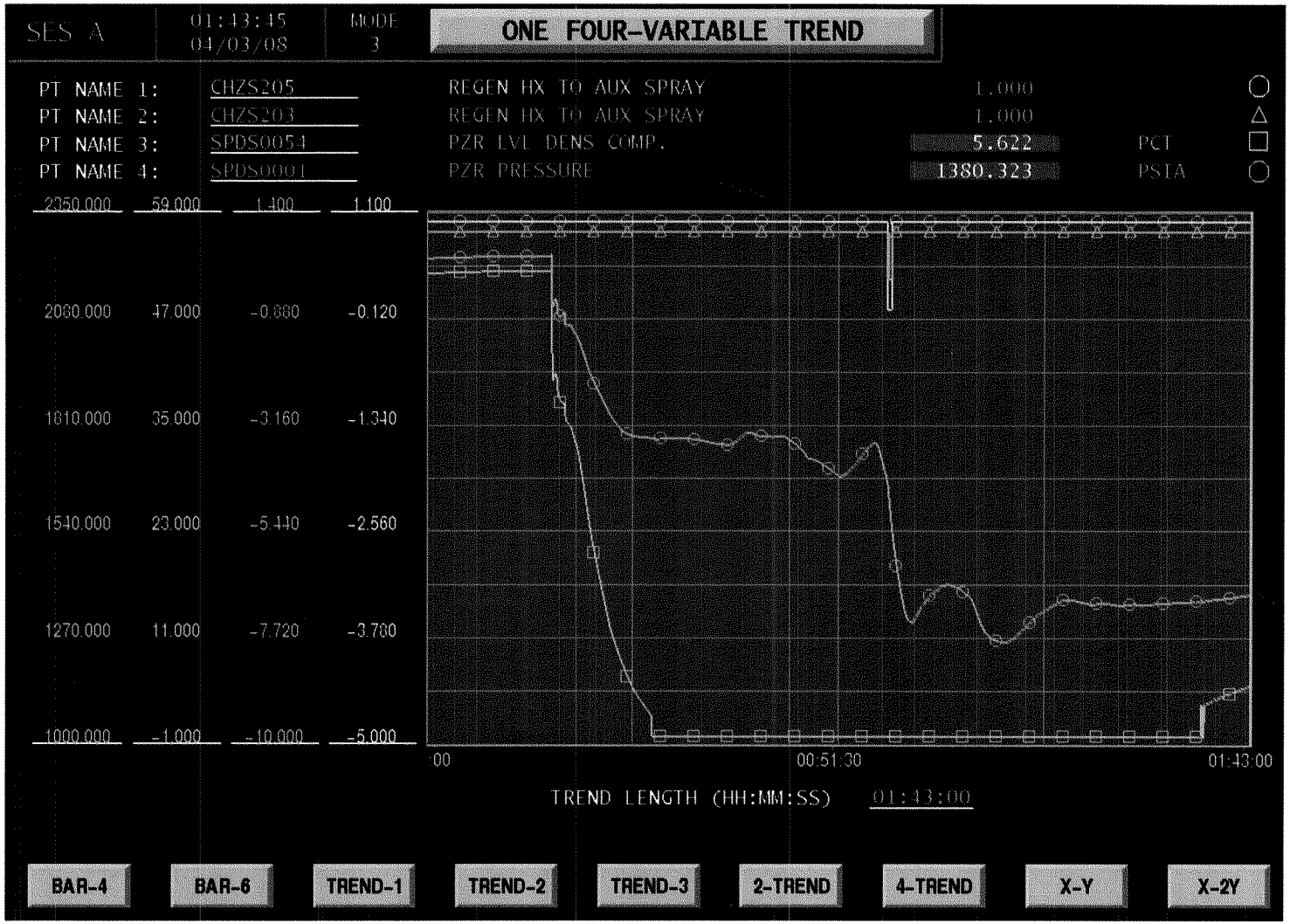
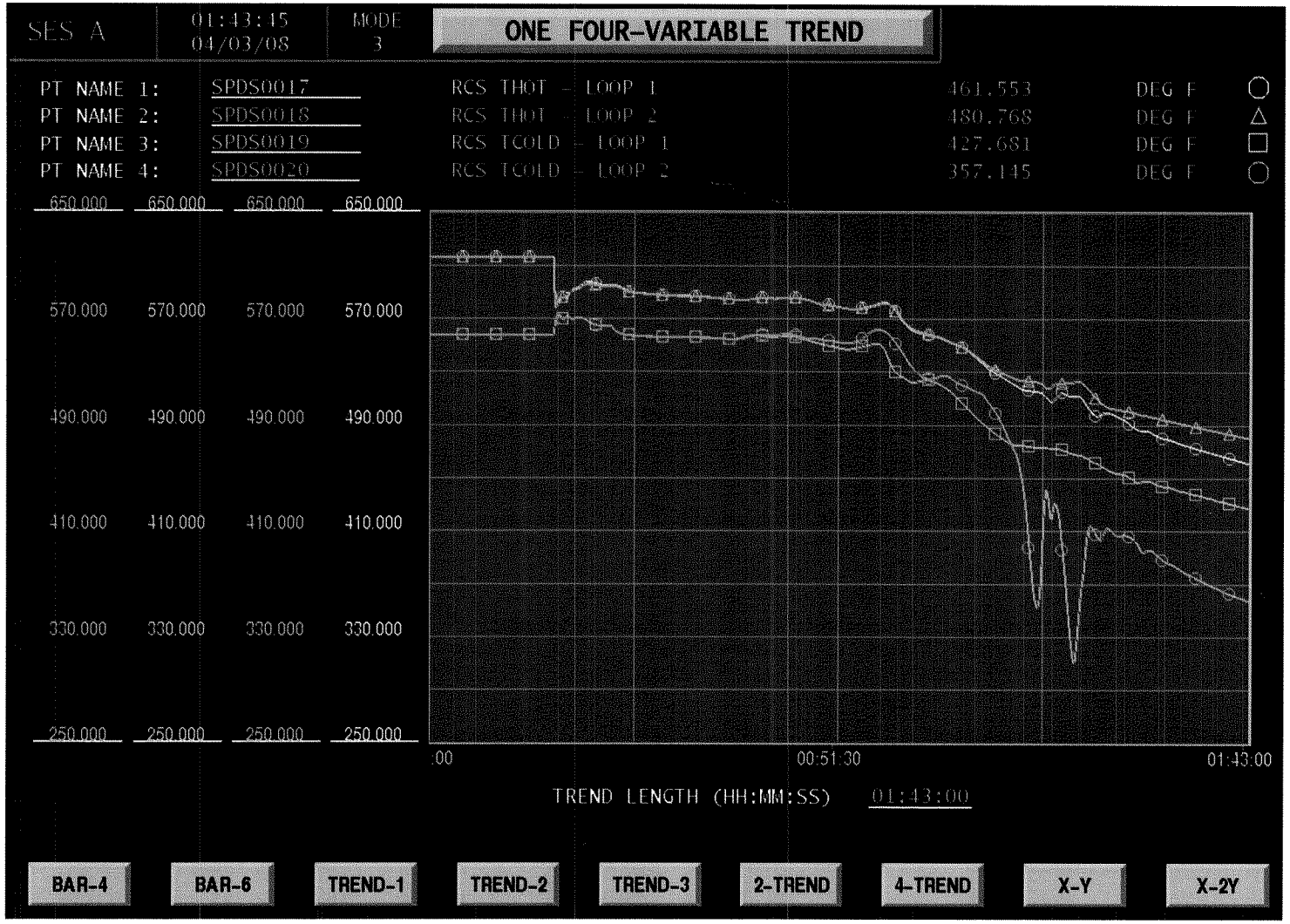
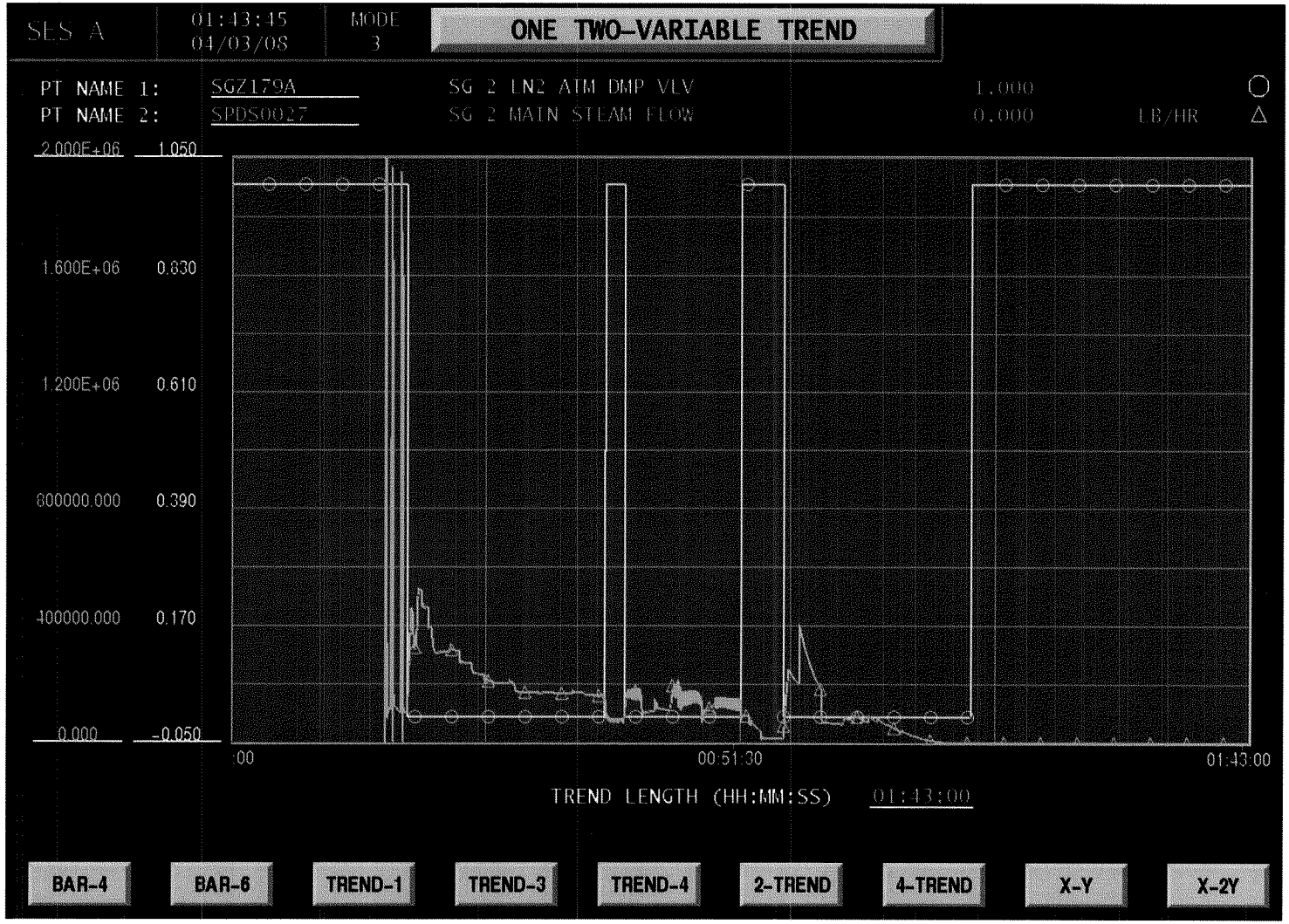
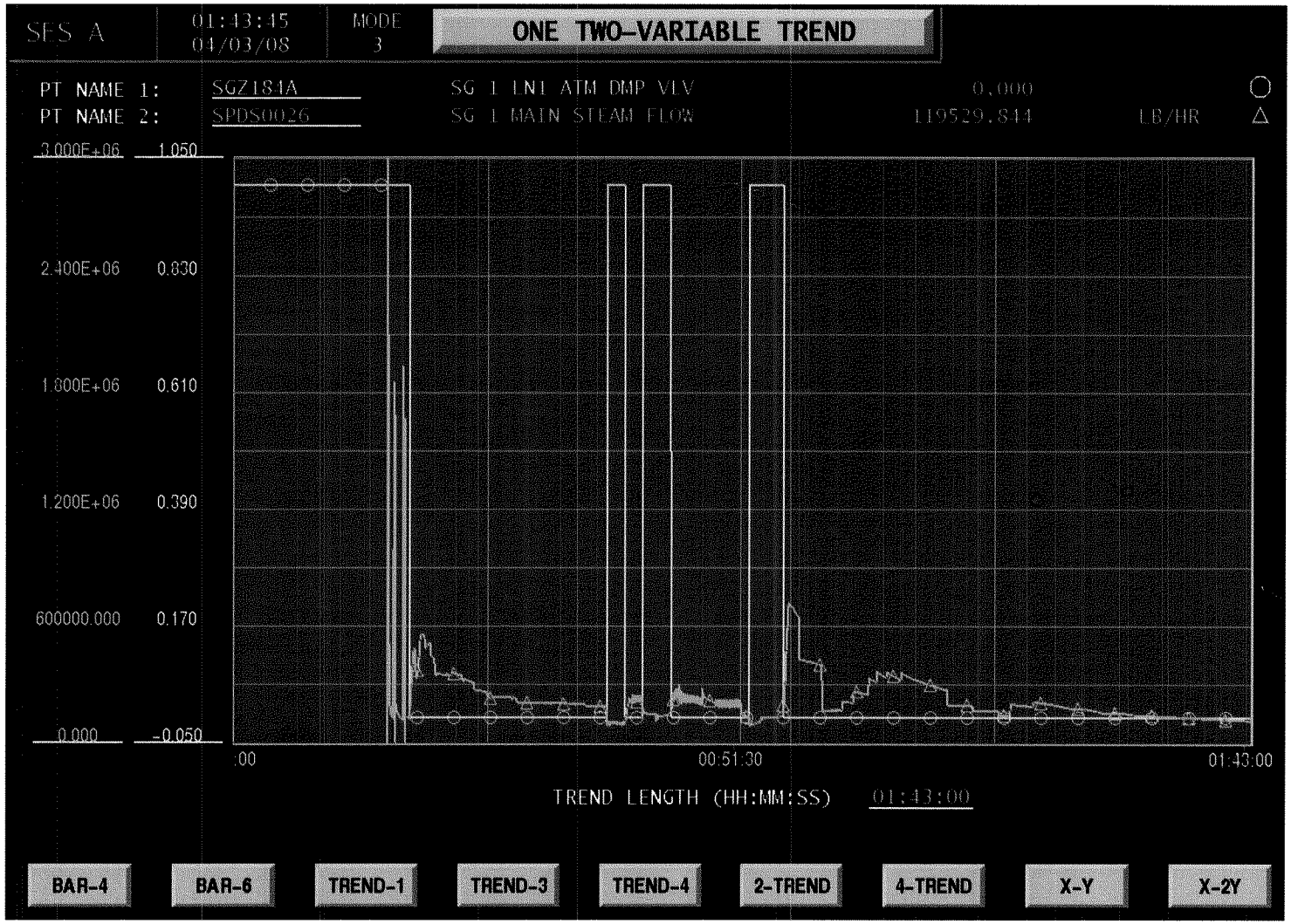
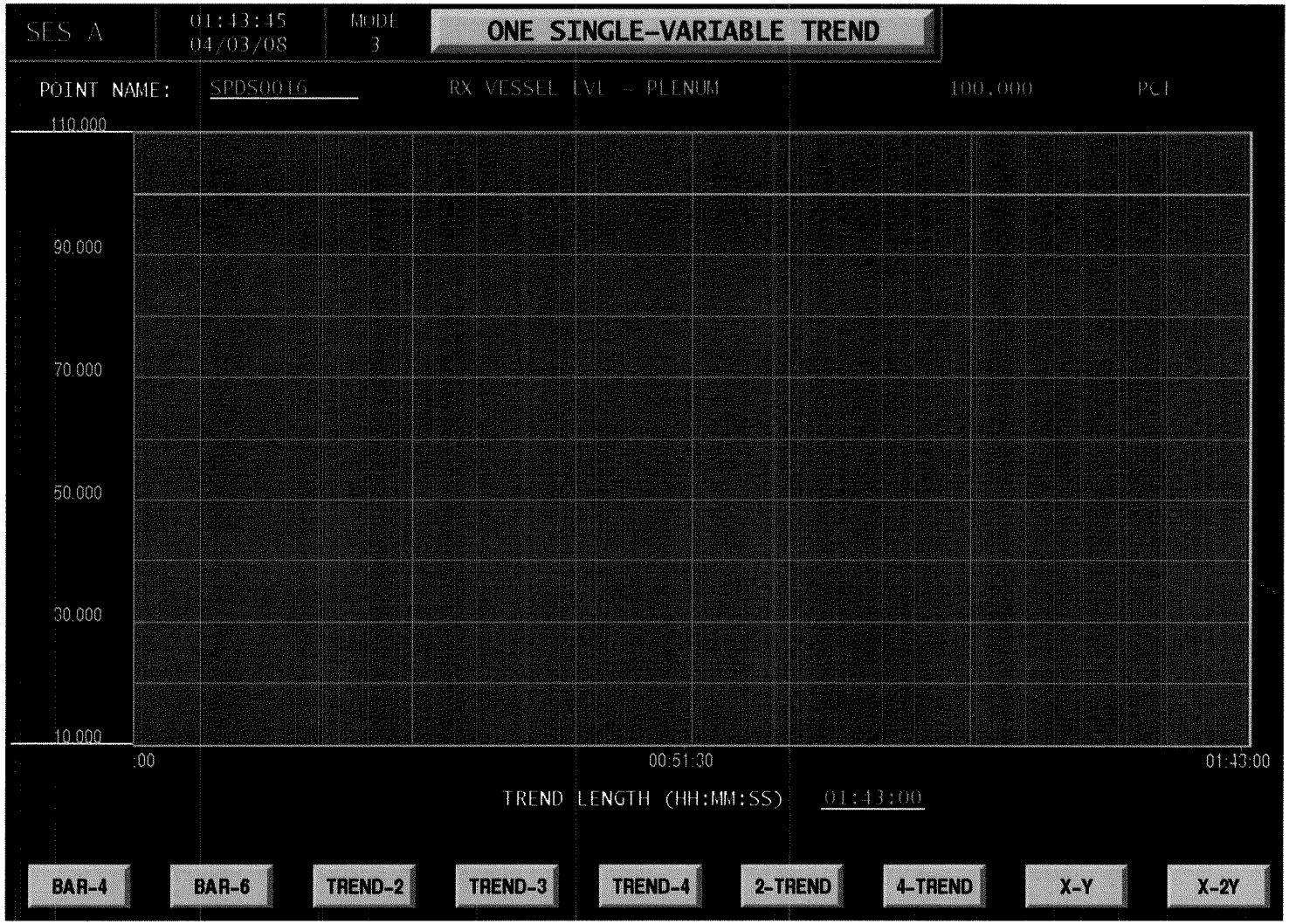
0.000
0.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
01:43:00
BAR-4
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y


SES A
01:43:45
04/03/08
MODE
3
ONE FOUR-VARIABLE TREND
PT NAME 1: CHZS205
PT NAME 2: CHZS203
PT NAME 3: SPDS0054
PT NAME 4: SPDS0001
REGEN HX TO AUX SPRAY
1.000
REGEN HX TO AUX SPRAY
1.000
PZR LVL DENS COMP.
5.622
PCT
PZR PRESSURE
1380.323
PSIA
2350.000 59.000 1.400 1.100
2080.000 47.000 -0.860 -0.120
1810.000 35.000 -3.160 -1.340
1540.000 23.000 -5.440 -2.560
1270.000 11.000 -7.720 -3.780
1000.000 -1.000 -10.000 -5.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS) 01:43:00
BAR-4
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y


SES A
01:43:15
04/03/08
MODE
3
ONE FOUR-VARIABLE TREND
PT NAME 1:
SPDS0017
PT NAME 2:
SPDS0018
PT NAME 3:
SPDS0019
PT NAME 4:
SPDS0020
RCS THOT - LOOP 1
461.553
DEG F
RCS THOT - LOOP 2
480.768
DEG F
RCS TCOLD - LOOP 1
427.681
DEG F
RCS TCOLD - LOOP 2
357.145
DEG F
650.000
650.000
650.000
650.000
570.000
570.000
570.000
570.000
490.000
490.000
490.000
490.000
410.000
410.000
410.000
410.000
330.000
330.000
330.000
330.000
250.000
250.000
250.000
250.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
01:43:00
BAR-4
BAR-6
TREND-1
TREND-2
TREND-3
2-TREND
4-TREND
X-Y
X-2Y


SES A
01:43:15
04/03/08
MODE
3
ONE TWO-VARIABLE TREND
PT NAME 1:
SGZ179A
SG 2 LN2 ATM DMP VLV
1.000
PT NAME 2:
SPDS0027
SG 2 MAIN STEAM FLOW
0.000
LB/HR
2.000E+06
1.050
1.600E+06
0.830
1.200E+06
0.610
800000.000
0.390
400000.000
0.170
0.000
-0.050
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
01:43:00
BAR-4
BAR-6
TREND-1
TREND-3
TREND-4
2-TREND
4-TREND
X-Y
X-2Y


SES A
01:43:45
04/03/08
MODE
3
ONE TWO-VARIABLE TREND
PT NAME 1:
SGZ184A
SG 1 LN1 ATM DMP VLV
0.000
PT NAME 2:
SPDS0026
SG 1 MAIN STEAM FLOW
1199529.844
LB/HR
3.000E+06
1.050
2.400E+06
0.830
1.800E+06
0.610
1.200E+06
0.390
600000.000
0.170
0.000
-0.050
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
01:43:00
BAR-4
BAR-6
TREND-1
TREND-3
TREND-4
2-TREND
4-TREND
X-Y
X-2Y


SES A
01:43:45
04/03/08
MODE
3
ONE SINGLE-VARIABLE TREND
POINT NAME:
SPDS0016
RX VESSEL LVL - PLENUM
100.000
PCT
110.000
90.000
70.000
50.000
30.000
10.000
:00
00:51:30
01:43:00
TREND LENGTH (HH:MM:SS)
01:43:00
BAR-4
BAR-6
TREND-2
TREND-3
TREND-4
2-TREND
4-TREND
X-Y
X-2Y