EGS Generation 3 QDC Qualification Status

October 2010

QualTech NP
A Curtiss Wright Flow Control Company

Who is QualTech?

INTRODUCING

Combining the
Traditions and Excellence
of Trentec, EGS and NETCO

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Flow Control Company

QualTech NP

Commercial Grade Dedication (CGD)

Equipment Qualification

Seismic Testing

Airlocks, Hatches, Specialty Doors

Cables and Connectors

Electrical Penetrations

Motor Control Centers

Spent Fuel Pool Management

Custom Fabrication

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Enhanced Environmental Parameters

New qualification test provided enhanced parameters beyond previous testing. To accomplish this, EGS QDC design was modified. New test parameters include:

- Thermal aging 1,226 hours
- LOCA Pressure to 109 psig
- MSIV Steam Break Test to > 500°F
- Post-LOCA Submergence at 285°F/62 psig for 32 days
- Radiation 2.3E8 rads

Original vs. Gen 3 QDC

½” size is shown. ¾” and 1 ½” NPT sizes are also available.

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Enhanced Design

- All materials upgraded for improved radiation and thermal resistance
- Mechanical seals have been added at cable seal area for submergence
- Wave spring force has been reduced for ergonomic advantage (1/2-inch size only)
- Improved wire/cable strain relief
- Two piece backshell for interface versatility

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Wire/Cable Insulation Options

- XLPE
- PEEK
- Silicone Rubber with stainless steel armor

Test Sequence

- Baseline
- Vibration Aging (IEEE382, 5-200 Hz, Resonance > 100 Hz)
- Thermal Cycling (10 cycles, 30°C to 121°C)
- Cycle Aging (160 disconnects)
- Thermal Aging (1226 hr at 126°C, QL = 60 yrs at 50°C + 35 days at 121°C Abnormal Condition)
- Functional Tests
- Radiation Aging (3E7 rads-air, 5E5 rad/hr)

Test Sequence (cont'd)

- Thermal Cycling (10 cycles, 30°C to 121°C)
- Functional Tests
- Seismic (10 g RIM OBE sine sweeps to 100 Hz. 10 g RIM SSE sine beats to 64 Hz. Plus RMF SSE at table limit)
- Functional Tests
- Accident Radiation (2.8 rads-air, TID=2.3E8)
- Functional Tests
- LOCA/Submergence Simulation (Show Profiles)
- MSIV/MSLB Simulation (Show Profiles)
- Post – test Inspections

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Baseline

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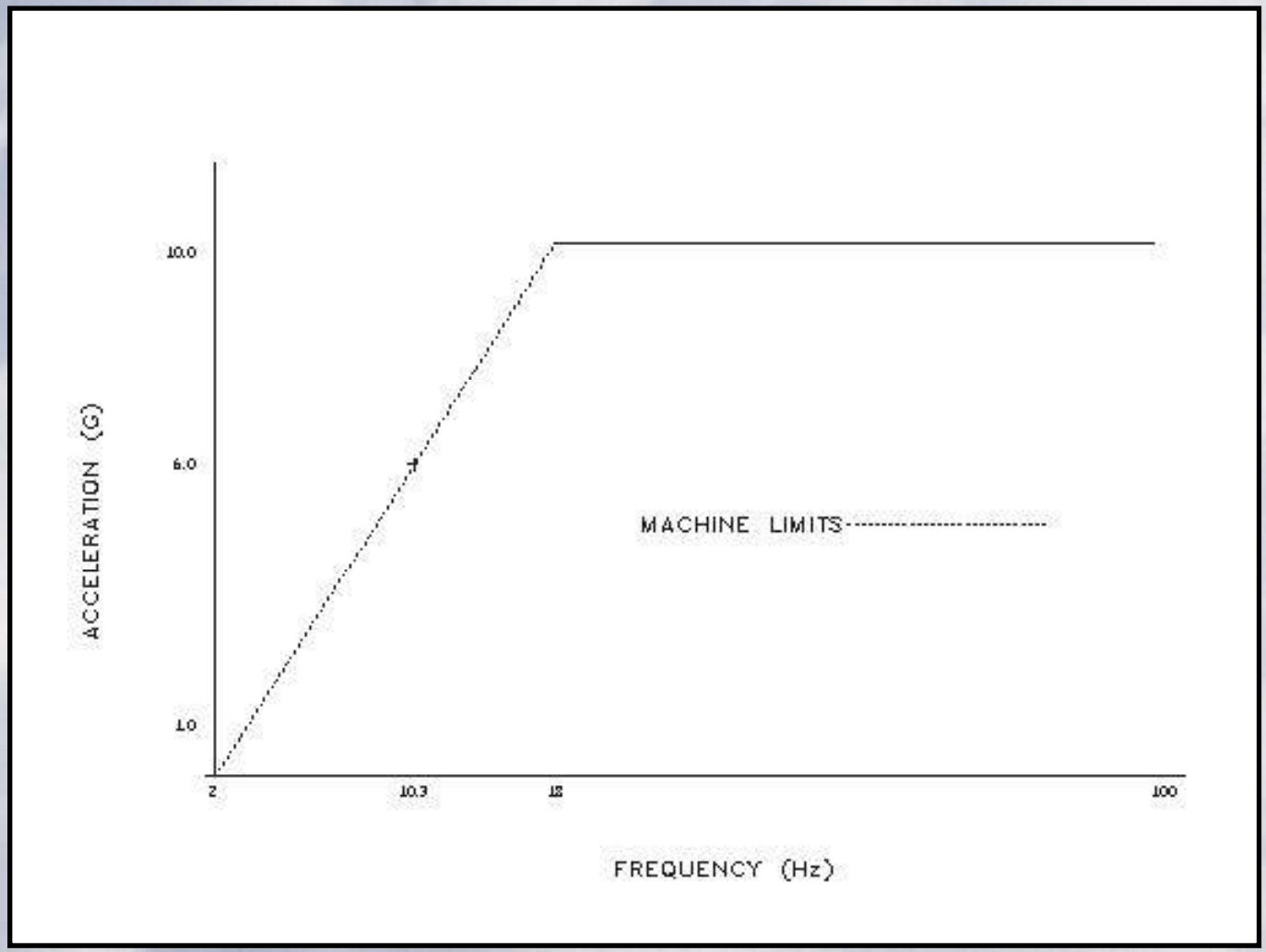
SEISMIC RIM OBE



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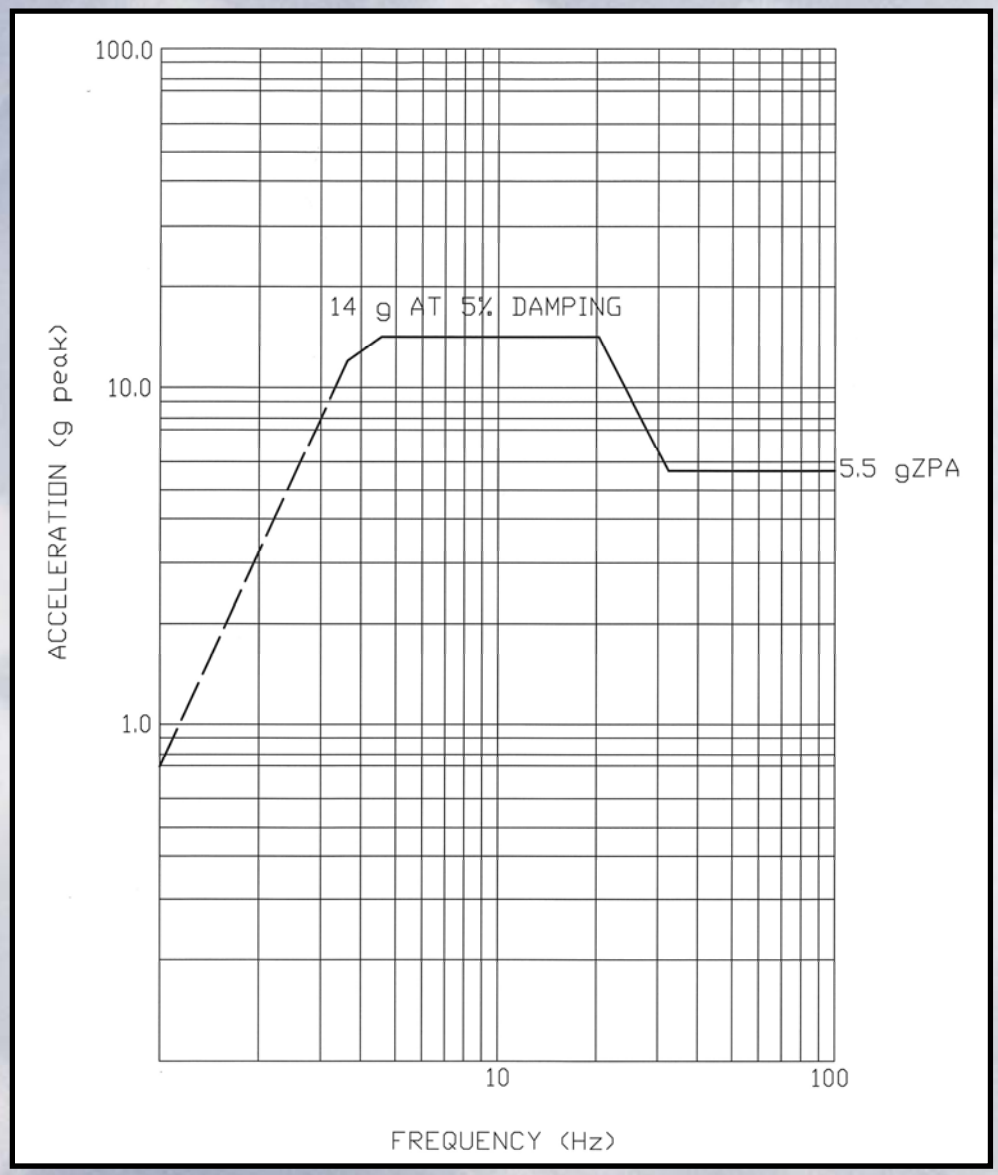
SEISMIC RMF RRS



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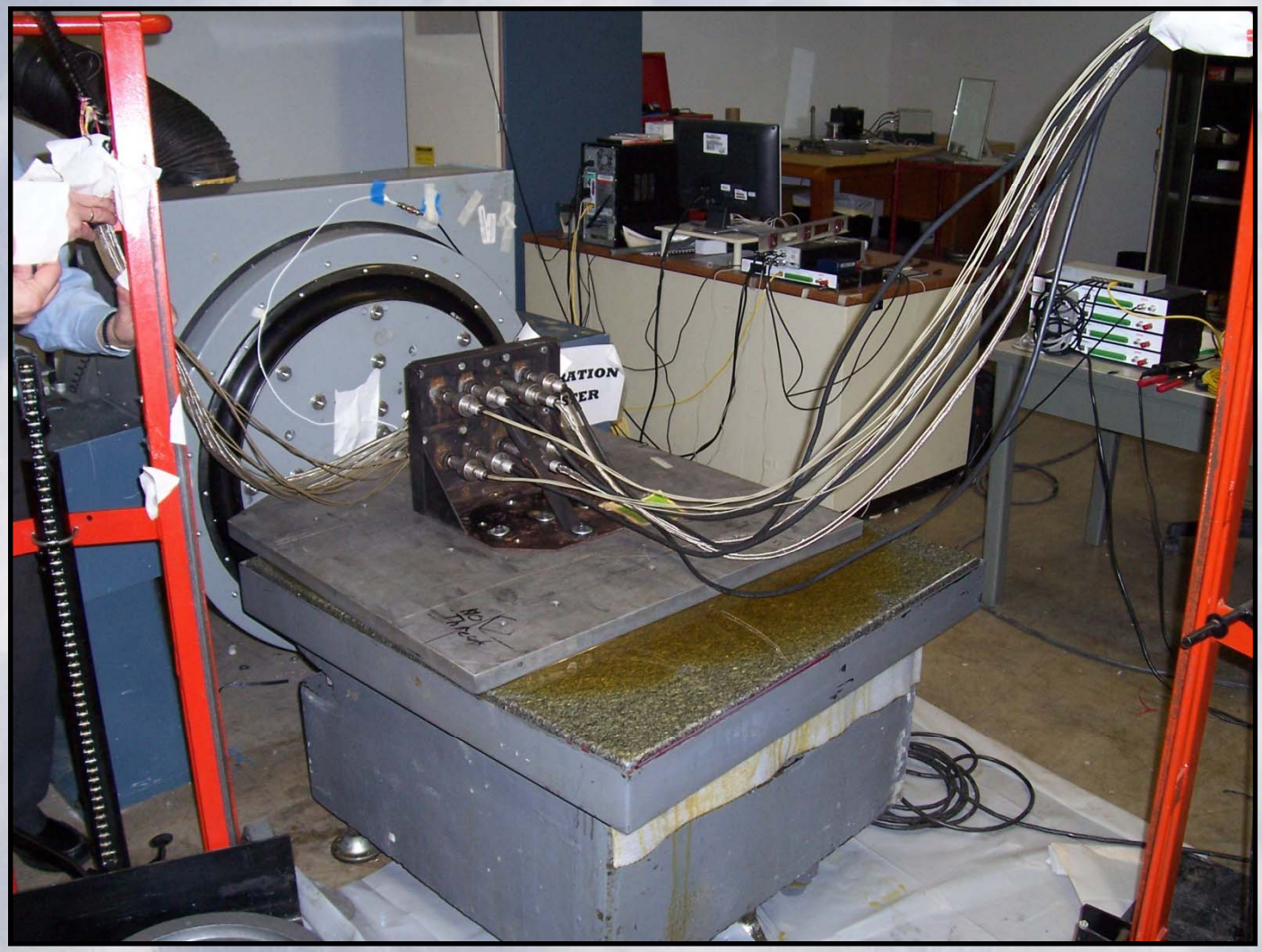
Seismic Testing



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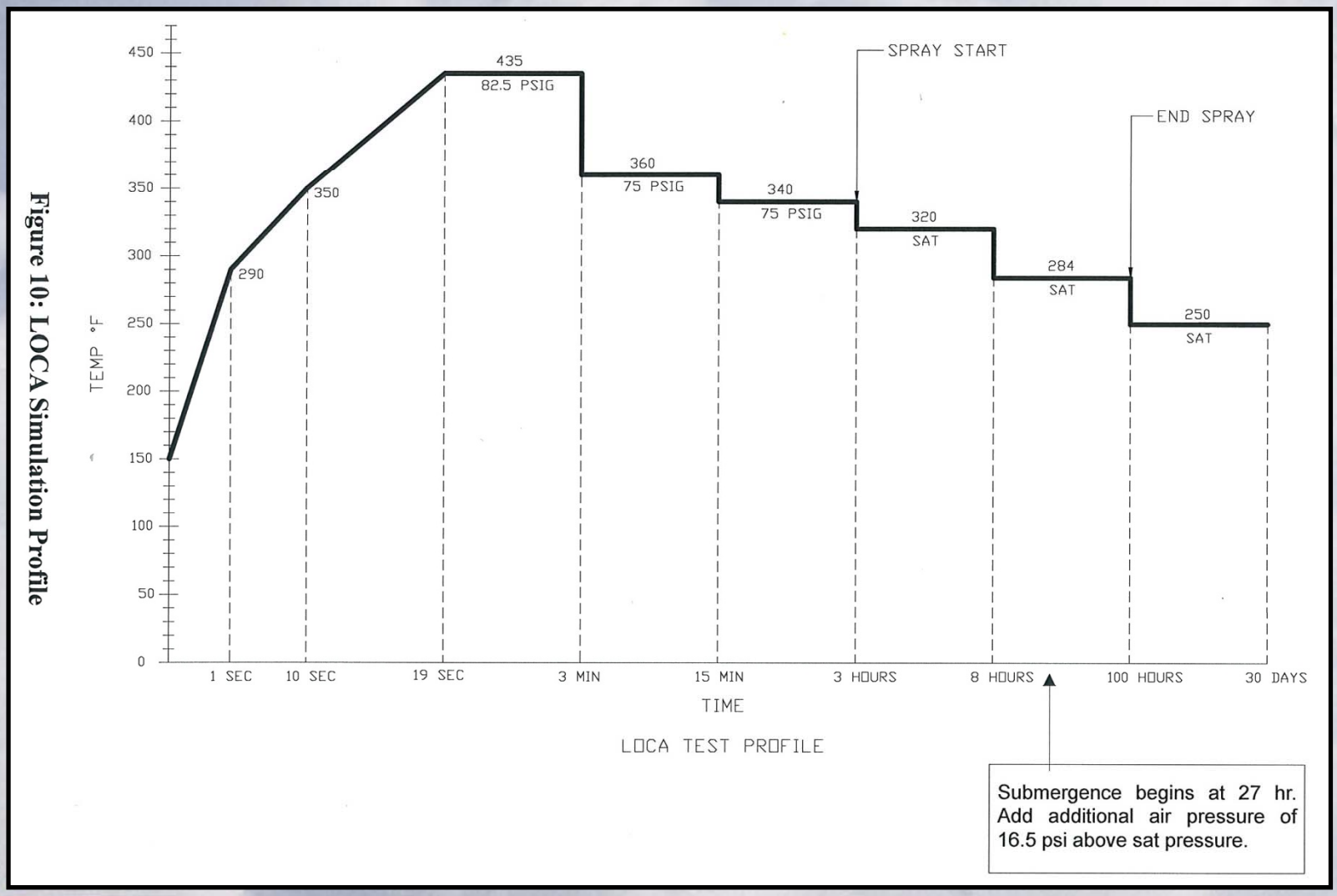
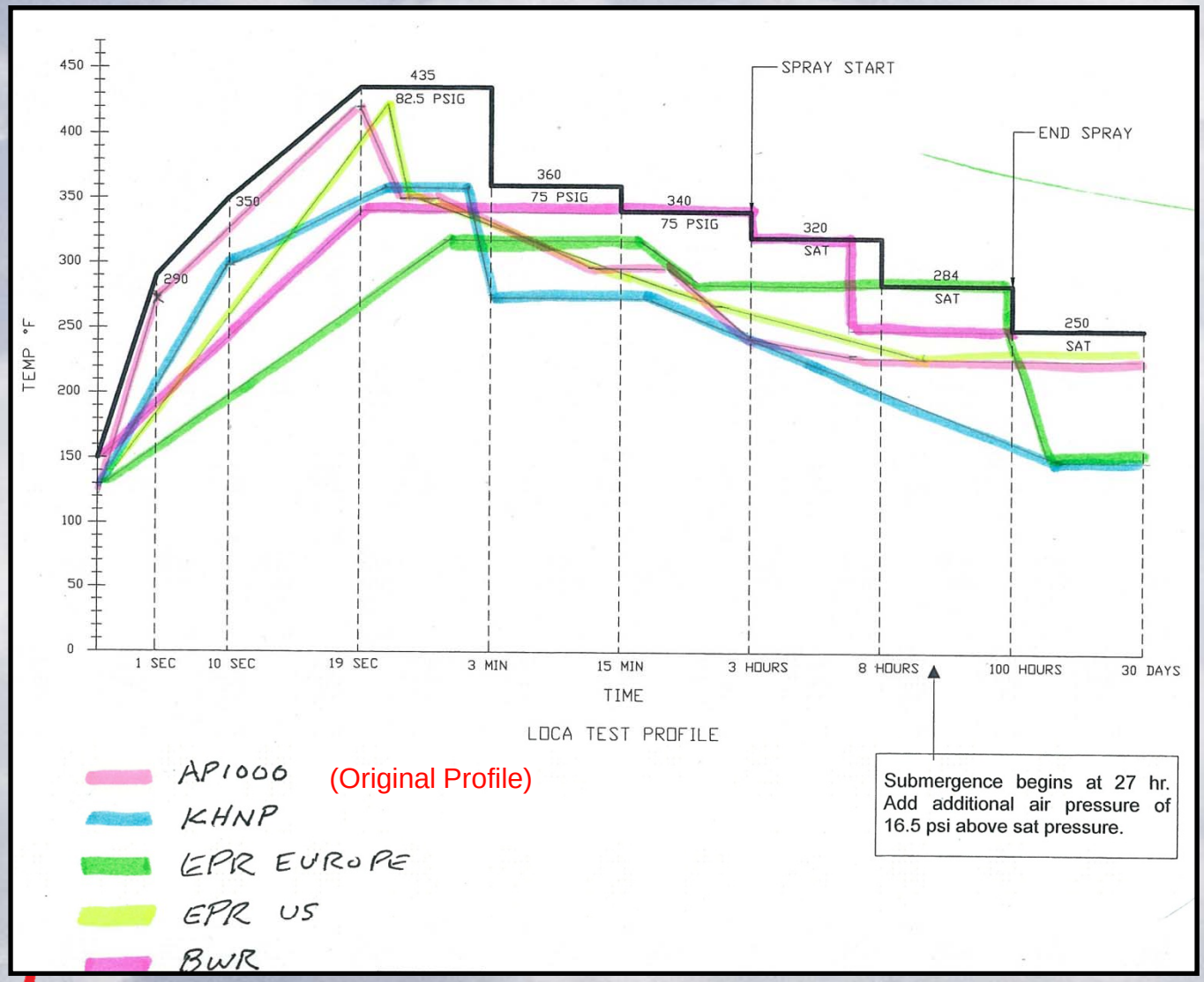
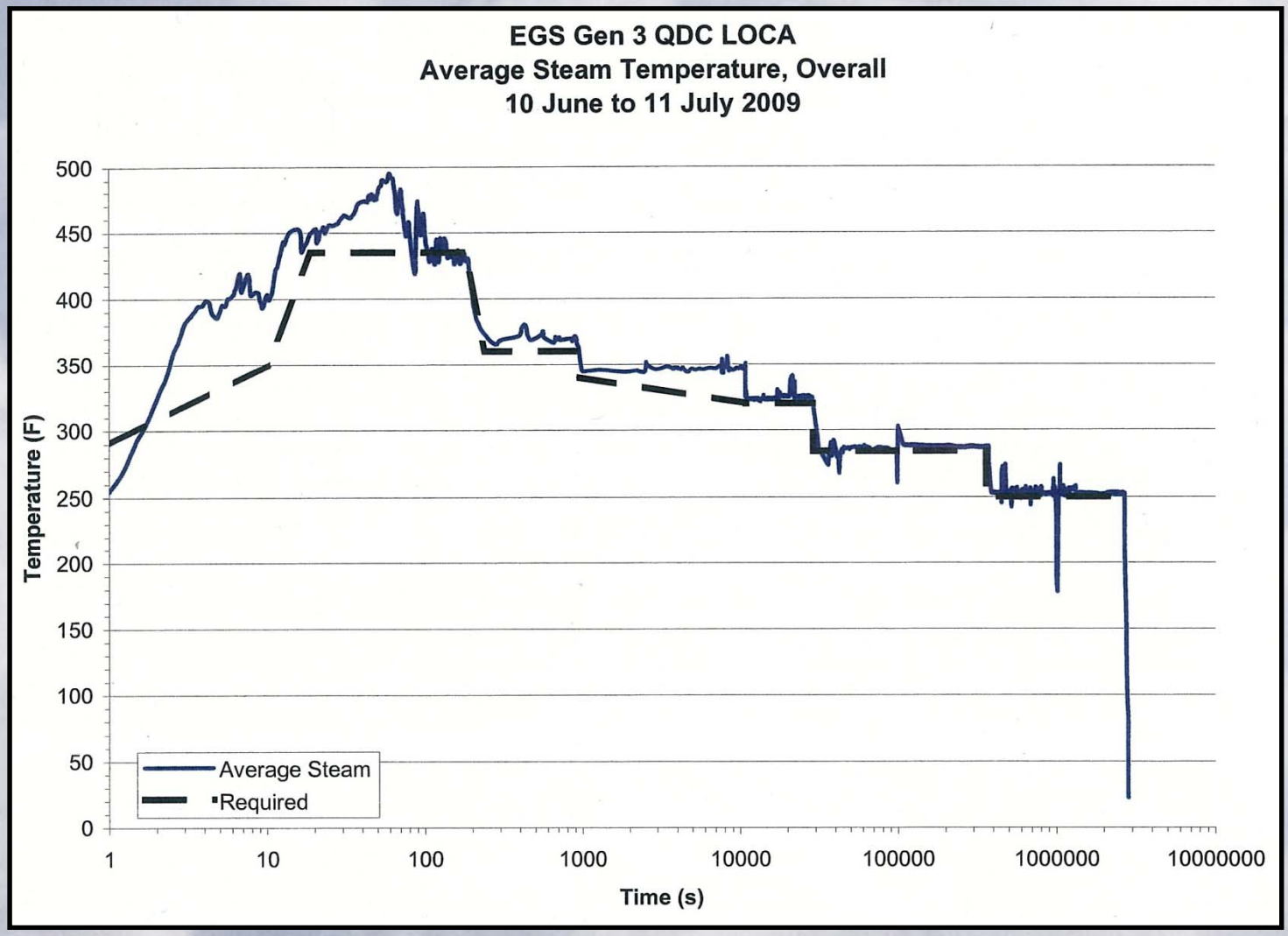
Generic LOCA Profile



Composite Generic LOCA



Actual LOCA Profile



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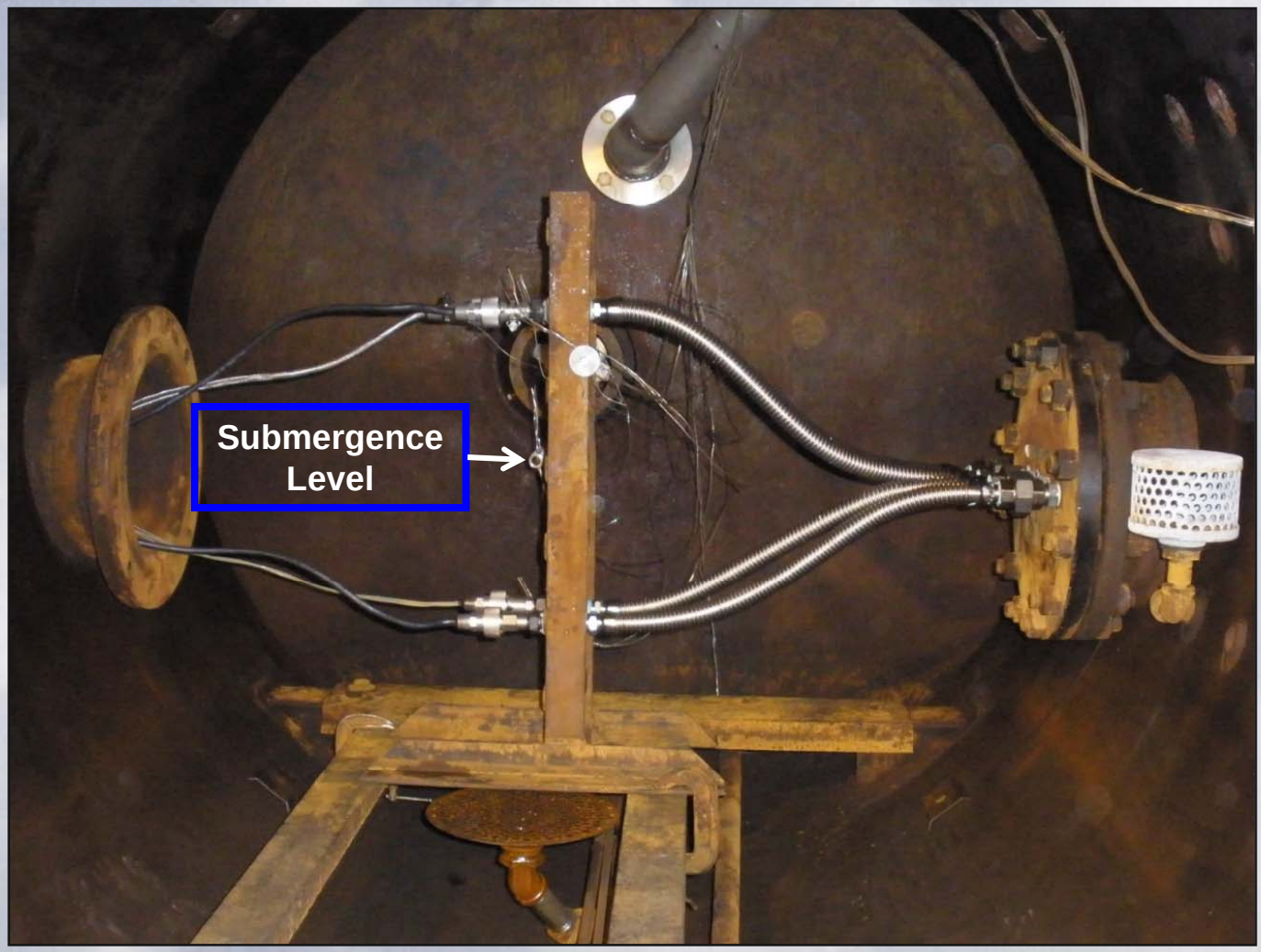
QDC Prior to LOCA



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QDC Prior to LOCA

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QDC After LOCA

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QDC After LOCA

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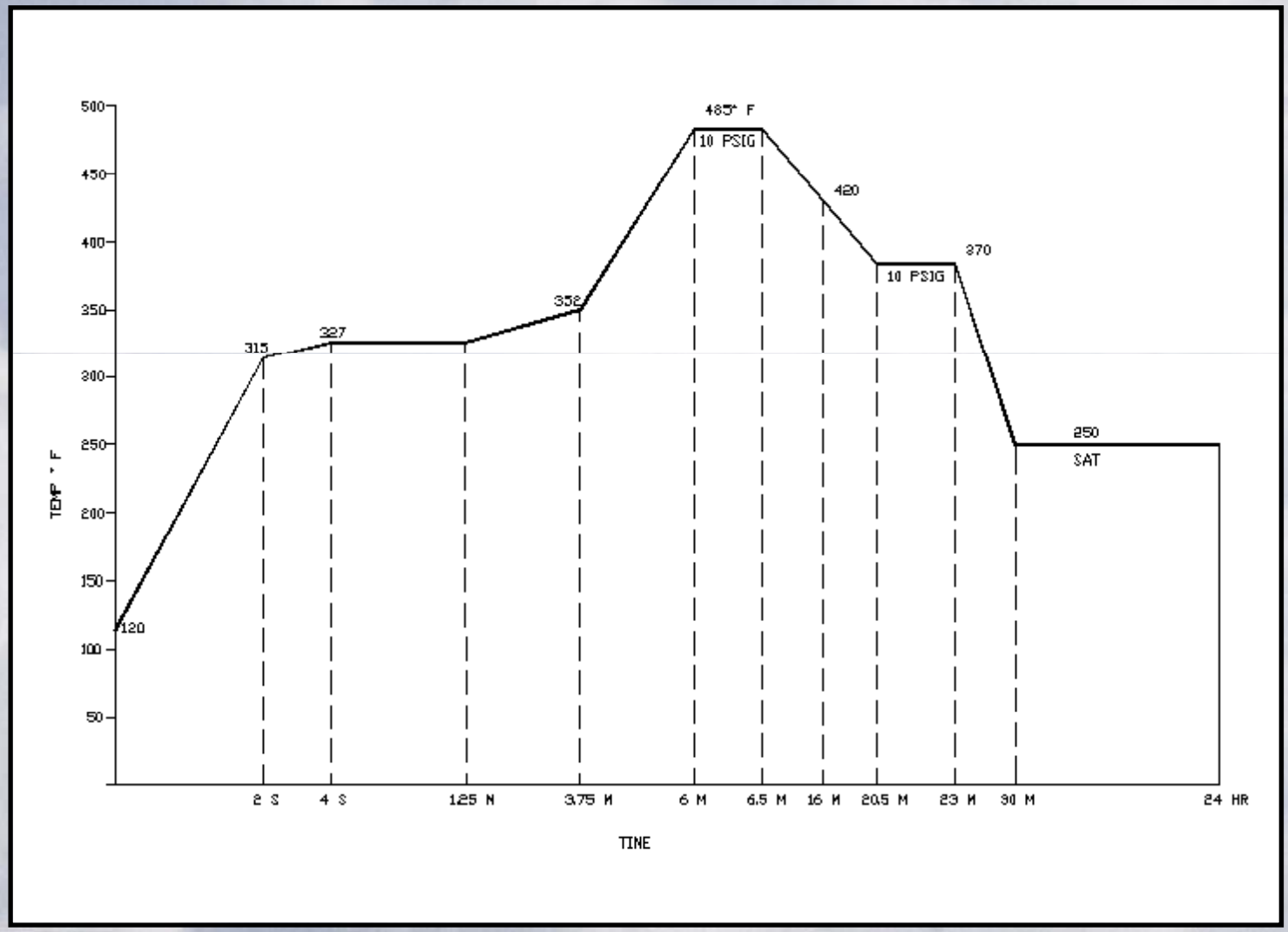
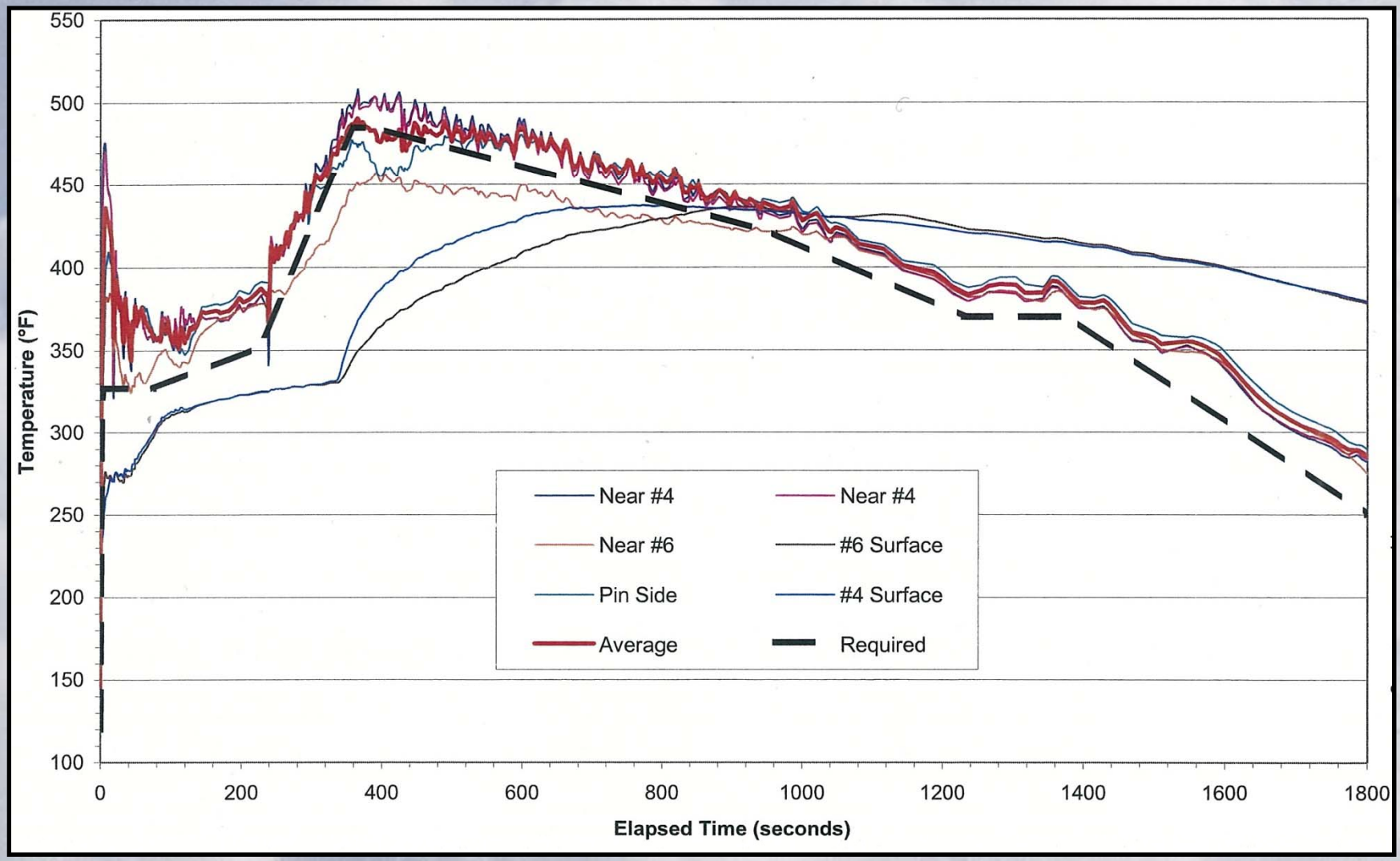
Required MSLB/MSIV



Actual MSLB



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Supplemental Testing

Report No. EGS-TR-23009-14 was published in September 2009. After the report was issued, the AP1000 LOCA and MSIV profiles were revised upward. Therefore, additional supplemental testing was performed on aged spare specimens 2 and 8. First, the 27.5 hour MSIV test was performed and then a 32+day LOCA Test was performed. After 28 hours, Specimen 8 was submerged for ~31days while Specimen 2 remained in the steam environment above the submergence level. The specimens survived both tests.

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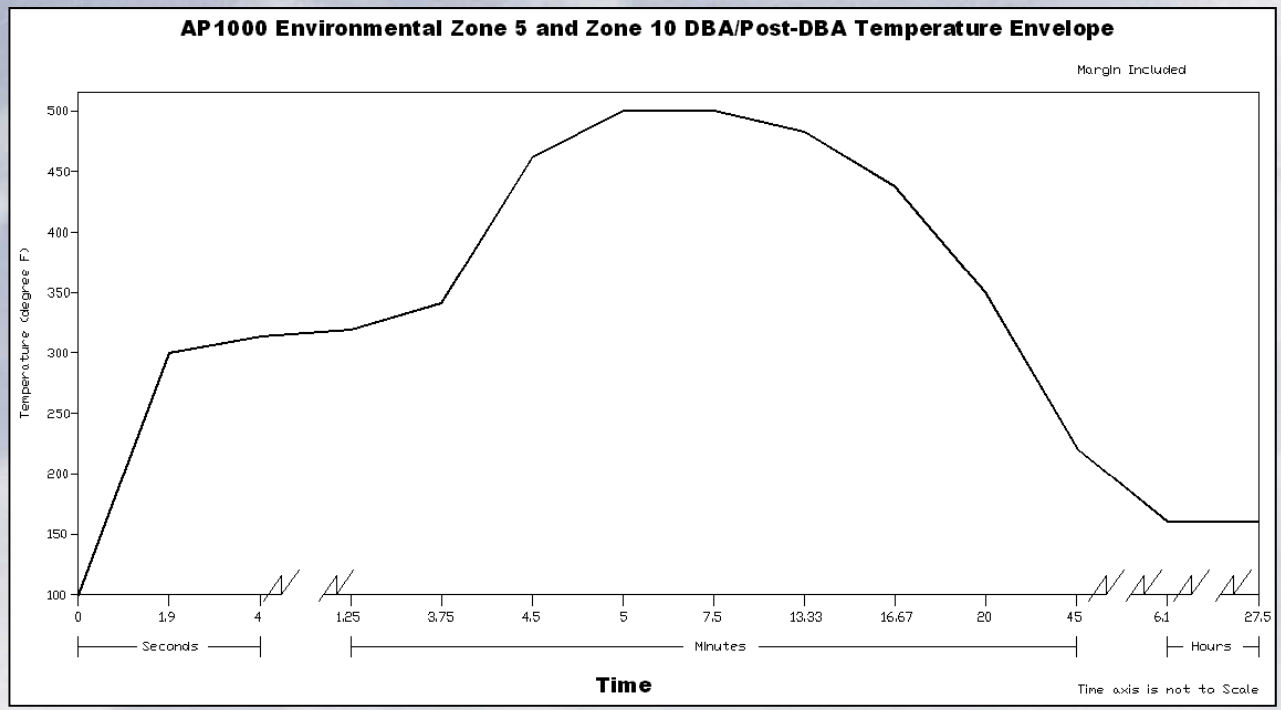
Required Profile



Duration	Temperature (oF) – includes a 15oF margin
0 Seconds	105
1.9 Seconds	315
4 Seconds	328
1.25 Minutes	335
3.75 Minutes	355
4.5 Minutes	454
5 Minutes	500
7.5 Minutes	499
13.33 Minutes	485
16.67 Minutes	435
20 Minutes	365
45 Minutes	250
27.5 Hours	250

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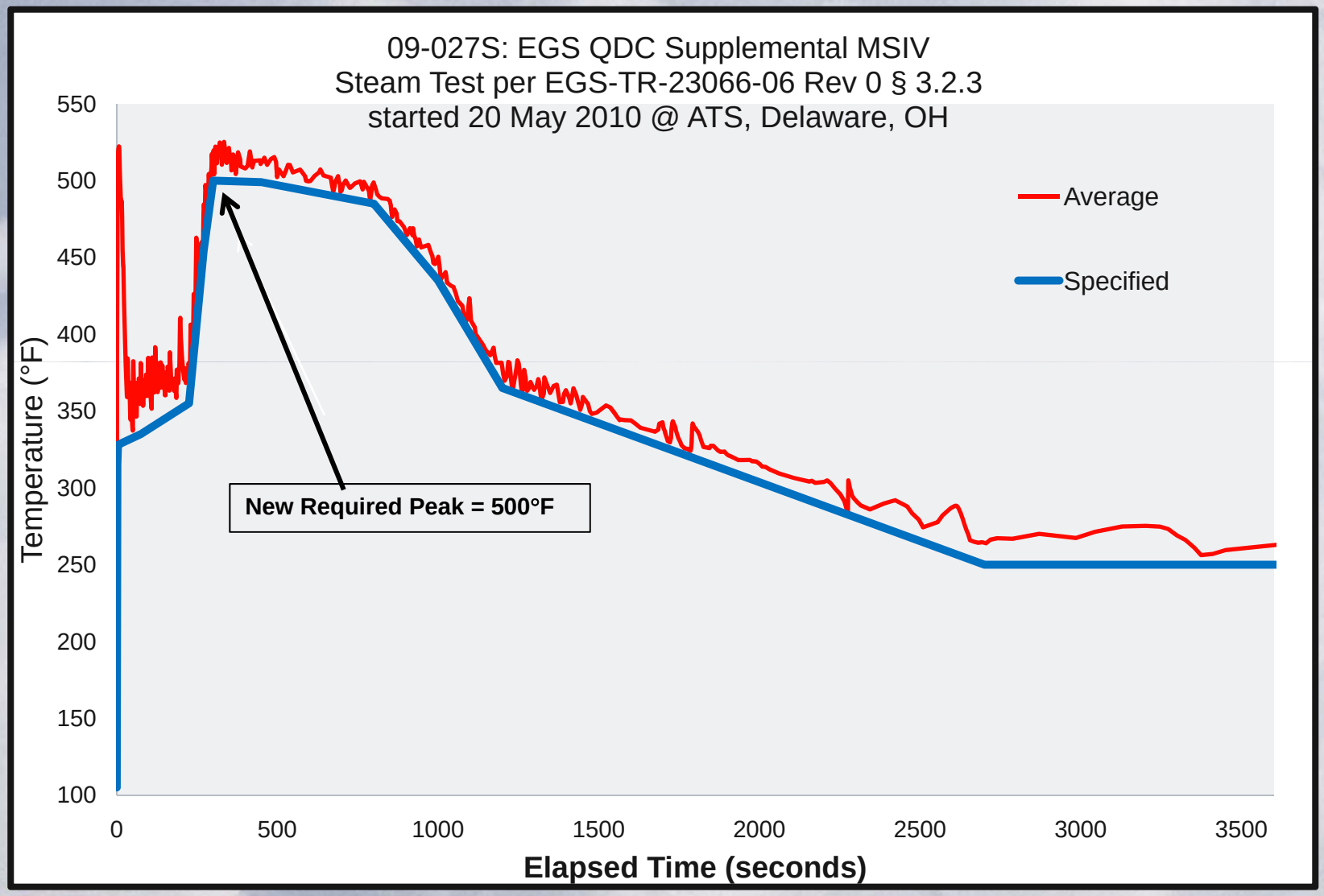
Supplemental MSIV Test Profile



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Supplemental MSIV Test

Specimens 2 & 8 Prior to MSIV

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Supplemental MSIV Test

Specimens 2 & 8 Prior to MSIV

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Supplemental MSIV Test

Specimens 2 & 8 Post MSIV

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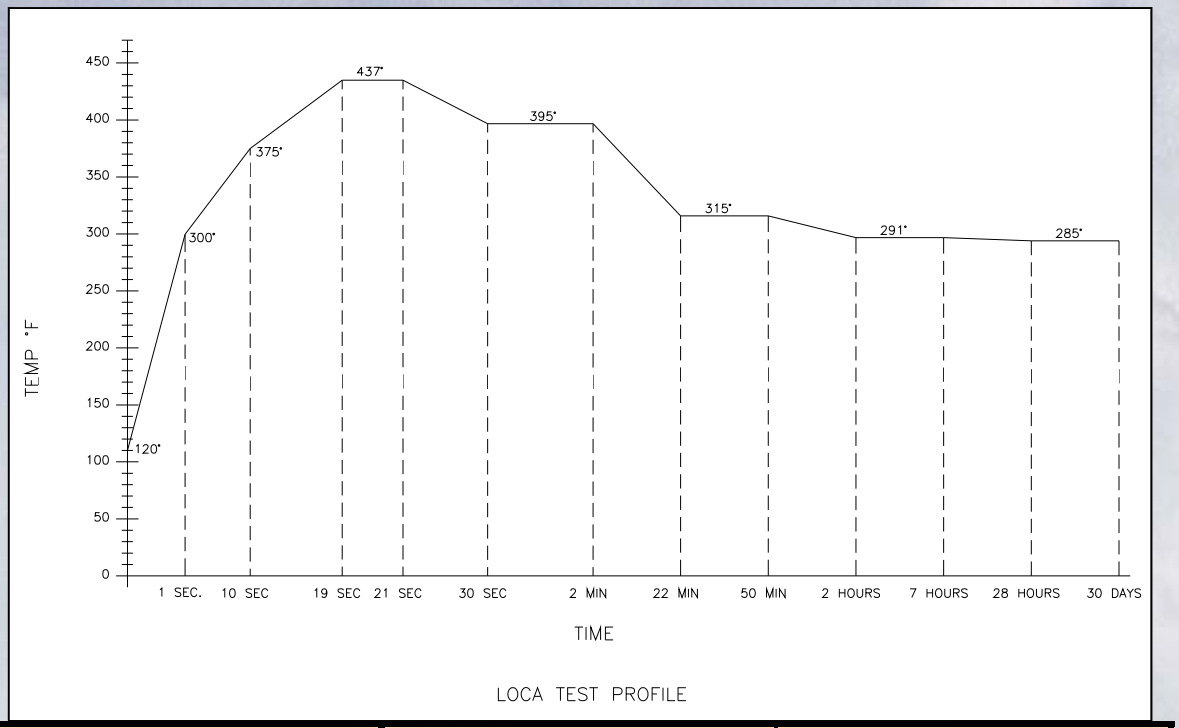
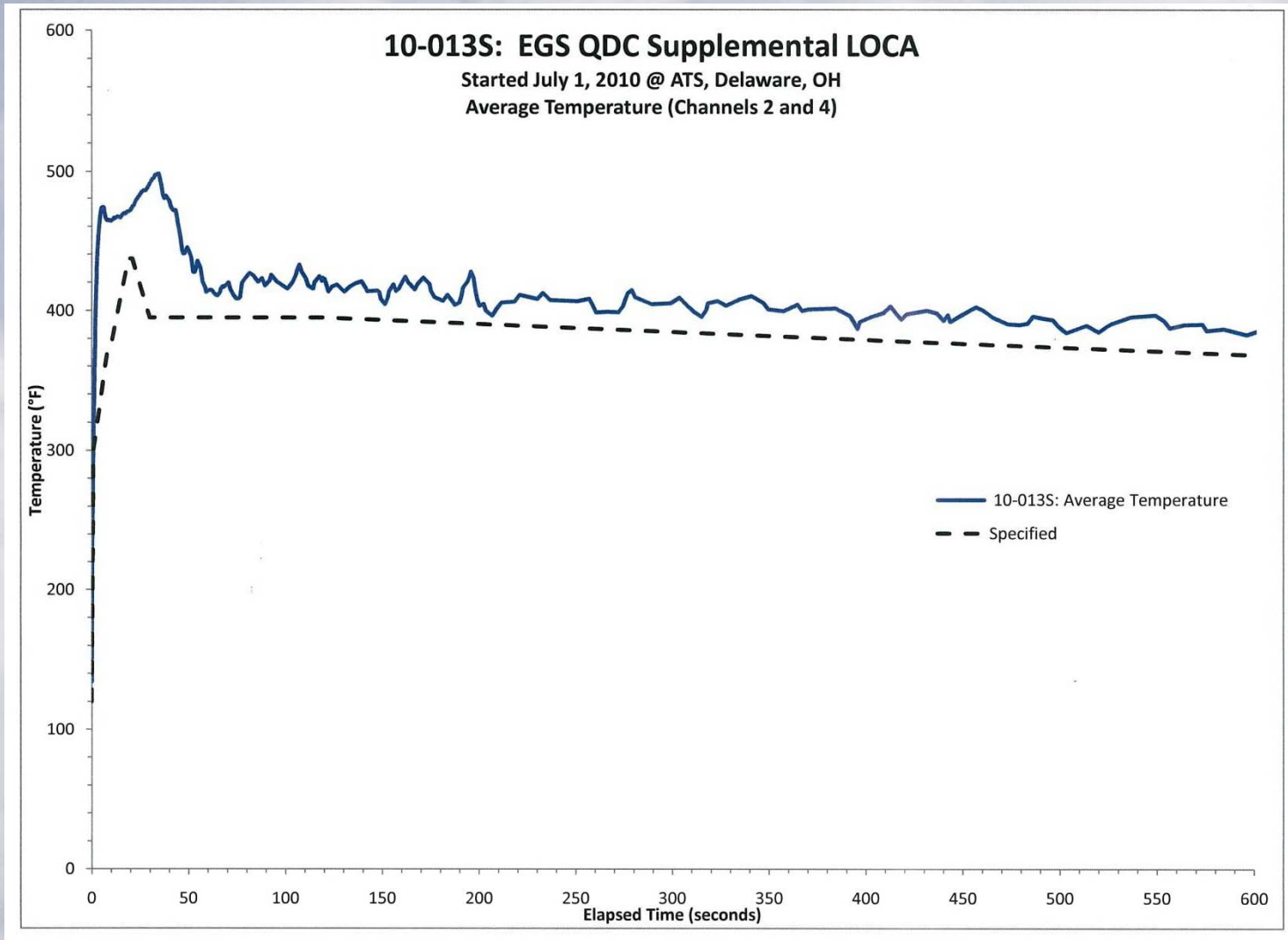
LOCA Profile



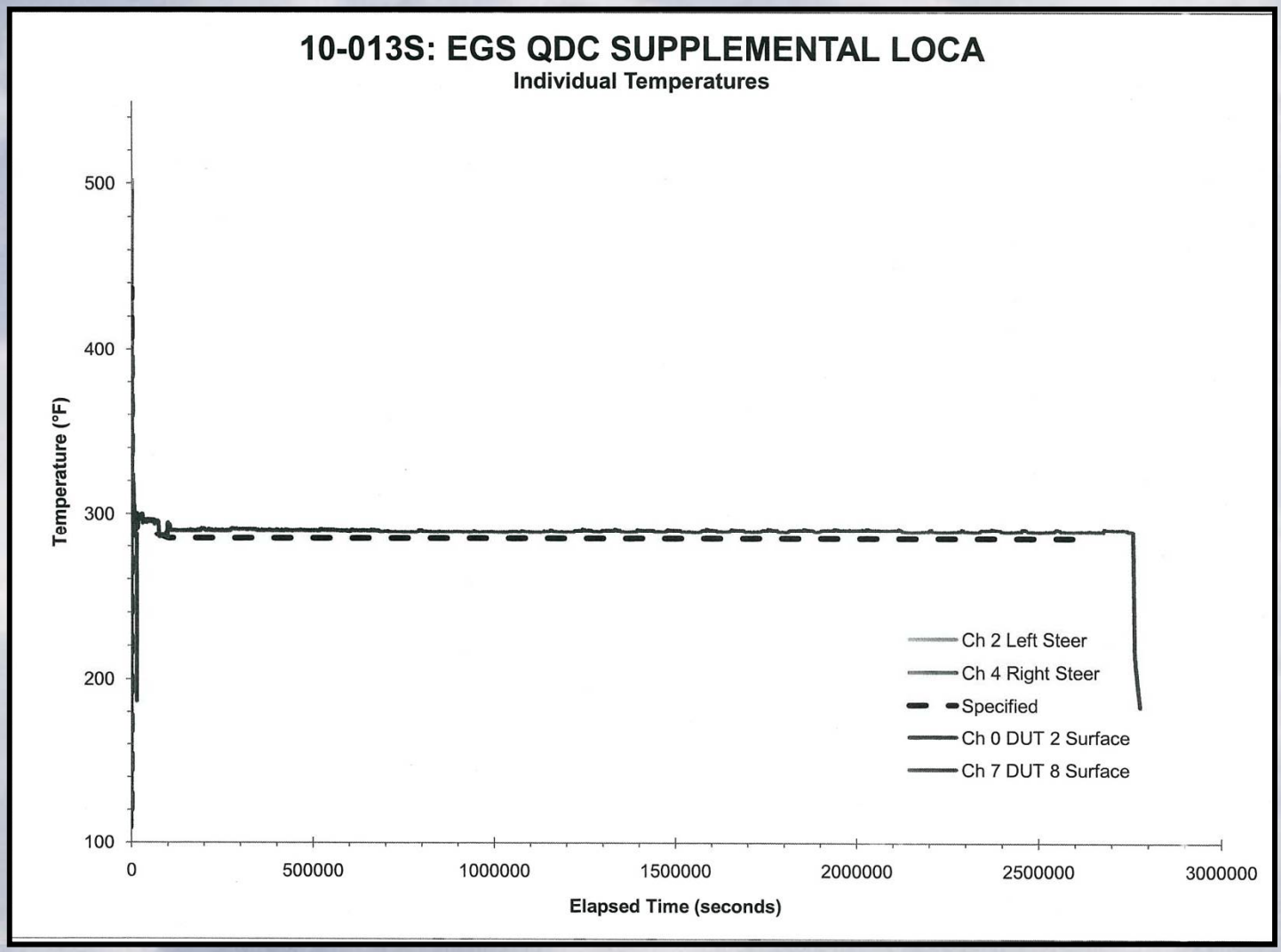
Duration	Temperature (°F)	Press (psia)
1 Second	300	26.6
10 Seconds	375	63.3
19 Seconds	437	72.8
21 Seconds	437	72.8
30 Seconds	395	72.8
2 Minutes	395	72.8
22 Minutes	315	82.7
50 Minutes	315	79.8
2 Hours	291	62.0
7 Hours	291	60.0
28 Hours	285	60.0
30 Days	285	60.0

QDC Supplemental LOCA



10-013S: EGS QDC Supplemental LOCA

Individual Temperatures



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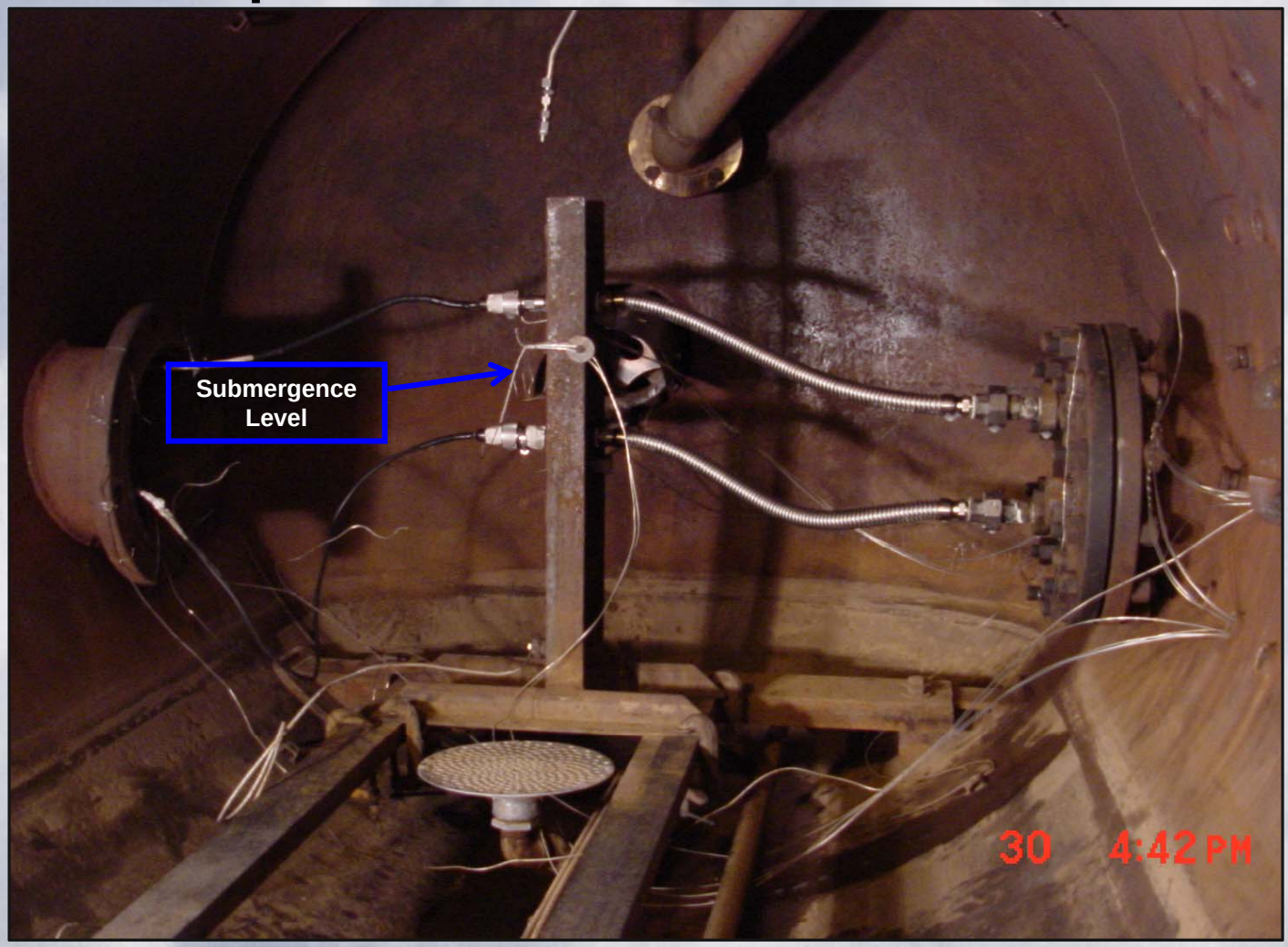
Supplemental LOCA

Specimens 2 & 8 Prior to LOCA



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Supplemental LOCA

Specimen 2 After LOCA

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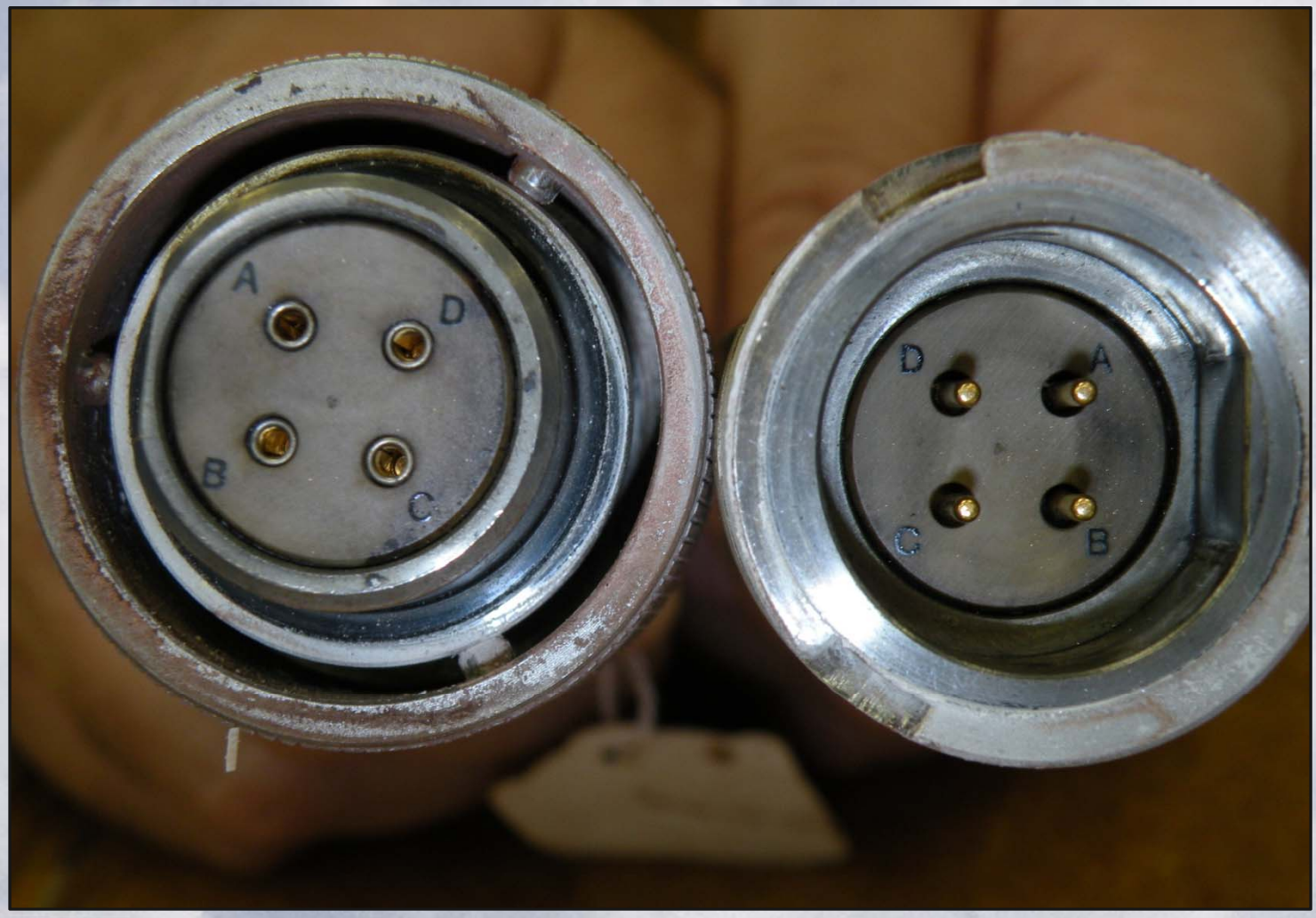
Supplemental LOCA

Specimen 8 After LOCA



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Test Reports

EGS-TR-23009-14 Rev. Original Published September 30, 2009	**Original Test of Specimens 1-8, including LOCA for Specimens 1, 3, 5 & 7 and MSIV for Specimens 4 & 6. This report will be revised by December 2011 to reference Supplemental Testing in 2010.**
EGS-TR-23066-08, Rev. A Published July 26, 2010	**Supplemental MSIV Test of Pre-Aged Specimens 2 & 8 to envelope revised AP1000 MSIV Profile.**
EGS-TR-23066-11, DRAFT Expected October 15, 2010	**Supplemental LOCA Test of Specimens 2 & 8 to envelope revised AP1000 LOCA Profile, including submergence.**

Results

- Program was successful and Gen 3 QDCs have already been supplied For the First AP1000 Units in China.

Questions and Contact Information

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