April 23, 2009

To: File

From: Ahsan Sallman

Subject: Containment Analysis- A Sensitivity Study to Determine the Effect of Changes in Drywell and Wetwell Airspace Volumes on the Peak Suppression Pool Temperature and Wetwell Pressure for a Long Term Analysis for NPSH

Description of Study

For a typical boiling water reactor (BWR) Mark I containment rated at 100% thermal power of 2004 MWt, a sensitivity study, using GOTHIC version 7.2a computer code, is performed (at 102-percent of rated thermal power) to determine how sensitive the peak suppression pool temperature is to a 10-percent (plus and minus) change in the drywell airspace and wetwell airspace volumes during a loss-of coolant accident (LOCA), Seven cases were studied as listed in Table 1 of Attachmant 1. Case 1 is the base case and the remaining 6 cases have either 10-percent change (increase or decrease) in drwyell airspace volume and/or a 10-percent change (increase or decrease) in the wetwell airspace volume from the corresponding volumes in the base case. The suppression pool water volume is kept the same in all cases. The remaining input parameters are also kept same in all cases and are biased for a conservative net positive suction head (NPSH) long term containment cooling analysis. Attachment 1 also shows the output graphs for suppression temperature drywell and wetwell pressures versus time for the seven cases. The analysis is performed up to 172,800-seconds (2-days) within which the suppression pool temperature is peaked. In all cases, assuming a single failure,

- **the residual heat removal (RHR) system automatically initiates in the low pressure coolant injection (LPCI) mode and is terminated at 600-seconds from LOCA.**
- **the core spray (CS) system automatically initiates and continuously operates during the transient.**
- **at 600-seconds from LOCA, the operator initiates the RHR system in the drywell and wetwell spray mode which continues during the transient**

Attachment 2 provides the GOTHIC input tables for the base case only. Attachment 3 provides the GOTHIC sketch of the model.

Results

The results are tabulated in Table 1 of Attachment 1.

Conclusion

Review of the results indicate that the peak suppression pool temperature and the time at which it occurs during the transient is insensitive to a (plus or minus) 10-percent change in drywell airspace volume or a (plus or minus) 10-percent change in wetwell airspace volume or both. Table 1 of attachment 1 also tabulates the drywell and wetwell pressures at the time when the peak suppression pool temperatures occurs which are also found to be practically the same in all cases. Also tabulated in Table 1 of Attachment 1 is the peak values of the drywell and wetwell pressures and their corresponding time of occurrence during the transient.

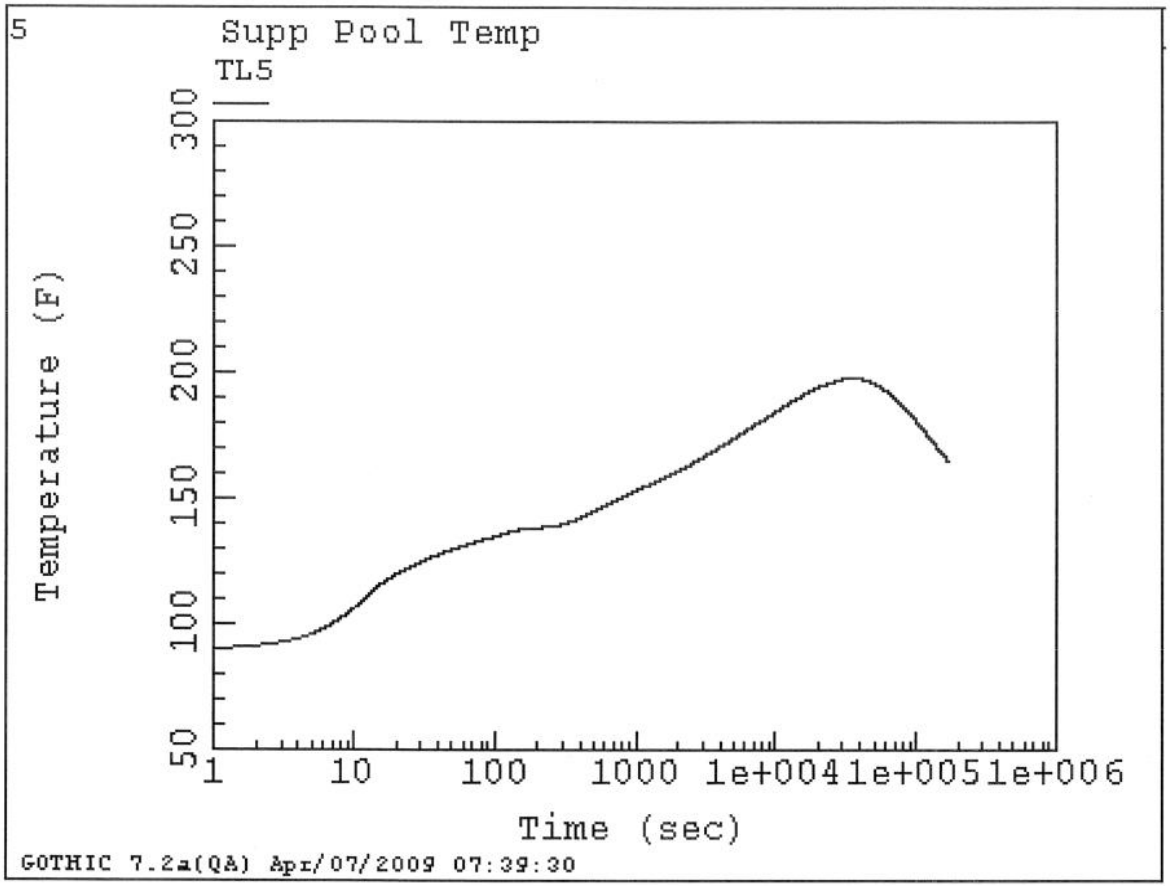
ATTACHMENT 1

Table 1: Sensitivity Study Results for LONG Term Containment Analysis for NPSH

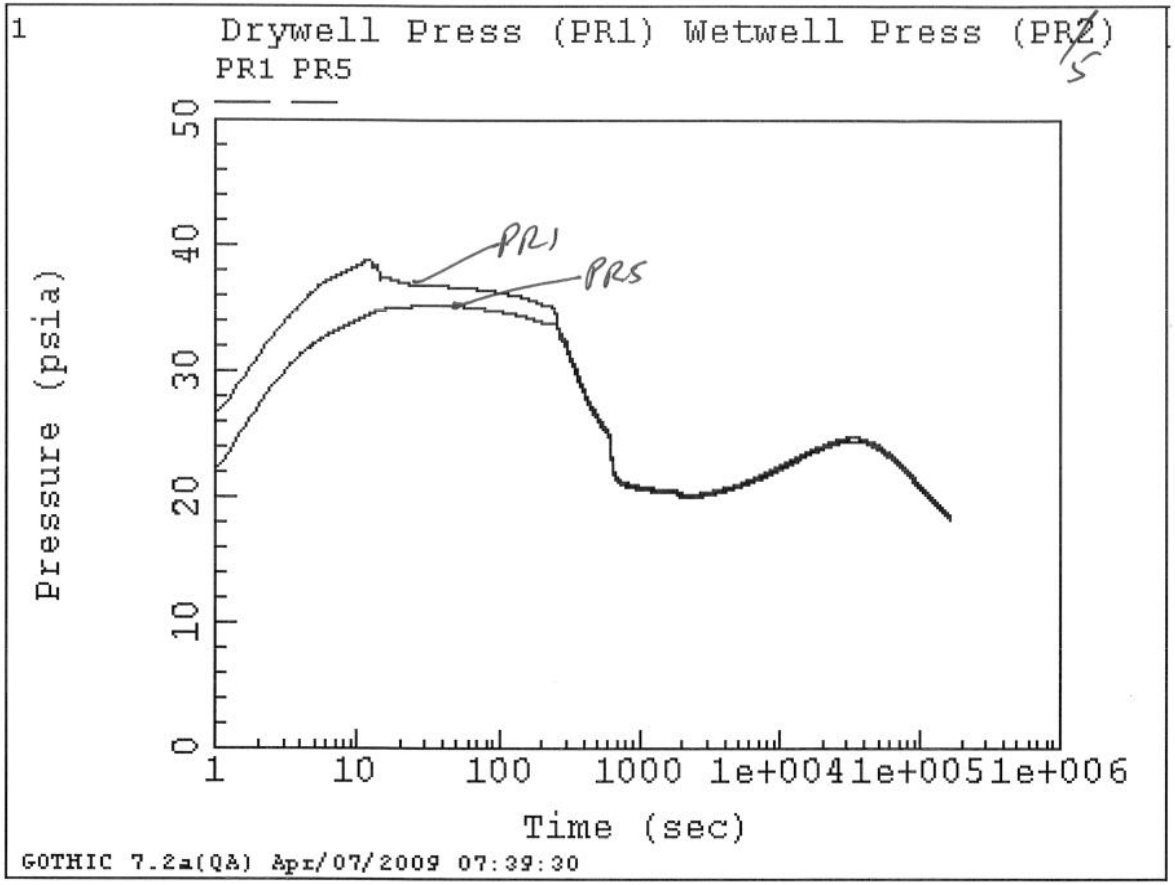
Case #	Drywell Airspace Volume (ft^3)	Wetwell Airspace Volume (ft^3)	Supp Pool Volume (ft^3)	Torus Volume (ft^3)	Torus Liquid Volume Fraction	At the time of maximum Suppression Pool Temperature				Maximum Drywell Pressure	Maximum Wetwell Pressure
						Time (seconds)	SP Temp (^oF)	DW Press (psia)	WW Press (psia)		
1.(Note a)	119325.3	108250	68000	176250	0.3858	35065.6	198.13	24.53	24.77	38.9 psia at 12.2 secs	35.2 psia at 36.2 secs
2.(Note b)	131257.8	108250	68000	176250	0.3858	35080.0	198.11	24.51	24.74	40.32 psia at 12.3 secs	36.83 psia at 35.2 secs
3.(Note c)	119325.3	119075	68000	187075	0.3635	34977.1	198.1	24.56	24.79	36.95 psia at 12.2 secs	33.25 psia at 40.5 secs
4.(Note d)	107392.5	108250	68000	176250	0.3858	35040.6	198.15	24.55	24.79	37.48 psia at 12.2 secs	33.59 psia at 35.1 secs
5.(Note e)	119325.3	97425	68000	165425	0.4111	34975.7	198.15	24.51	24.73	41.3 psia at 12.2 sec	37.62 psia at 34.4 secs
6. (Note f)	131257.8	119075	68000	187075	0.3635	34827.5	198.1	24.54	24.77	38.2 psia at 12.2 secs	34.7 psia at 37.5 secs
7. (Note g)	107392.5	97425	68000	165425	0.4111	34850.4	198.2	24.53	24.76	39.71 psia at 12.2 secs	35.81 psia at 35.4 secs

Notes:

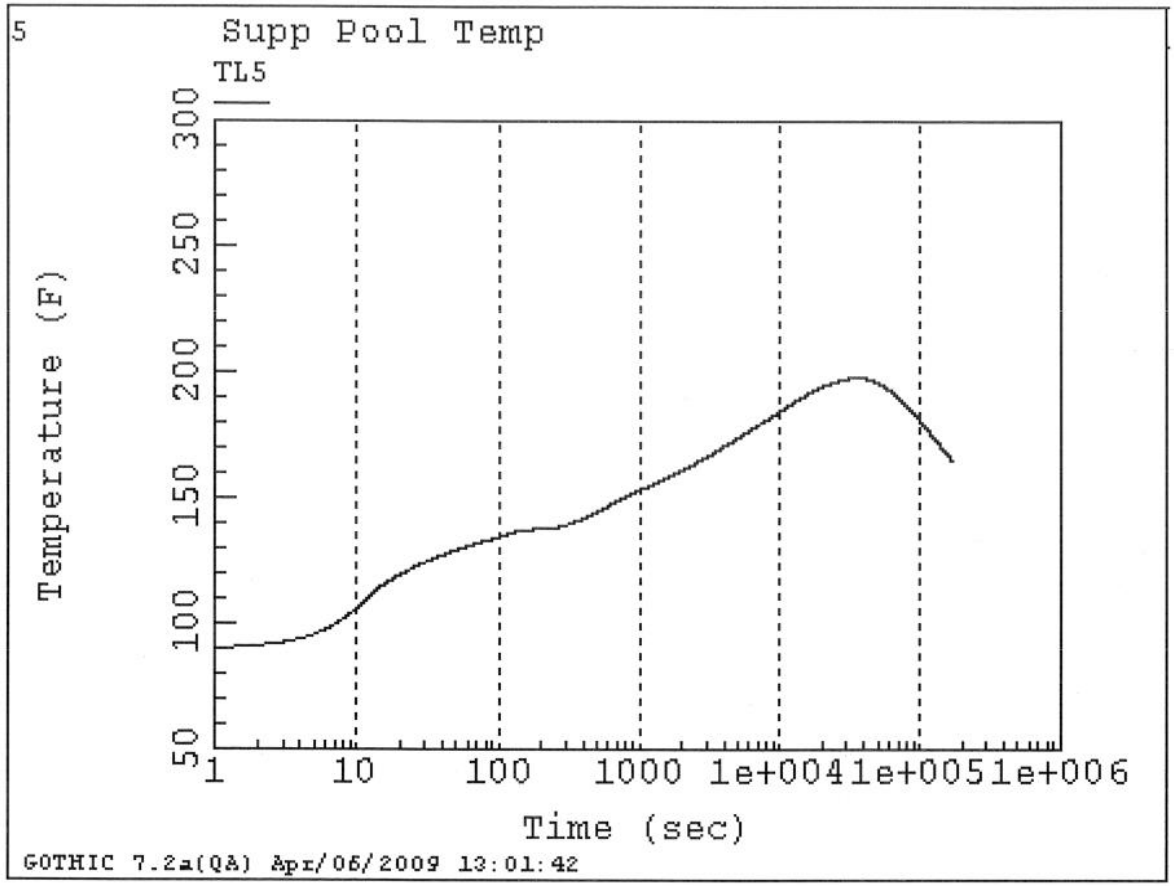
a) Base case
b) DW airspace volume increased by 10% from base case, WW airspace volume same as in base case.
c) DW airspace volume same as in base case, WW airspace volume increased by 10% from base case.
d) DW airspace volume decreased by 10% from base case, WW airspace volume same as in base case
e) DW airspace volume same as in base case, WW airspace volume decreased by 10% from base case.
f) DW & WW airspace volumes both increased by 10% from base case
g) DW & WW volume both decreased by 10% from base case



CASE 1 – BASE CASE



CASE 1 – BASE CASE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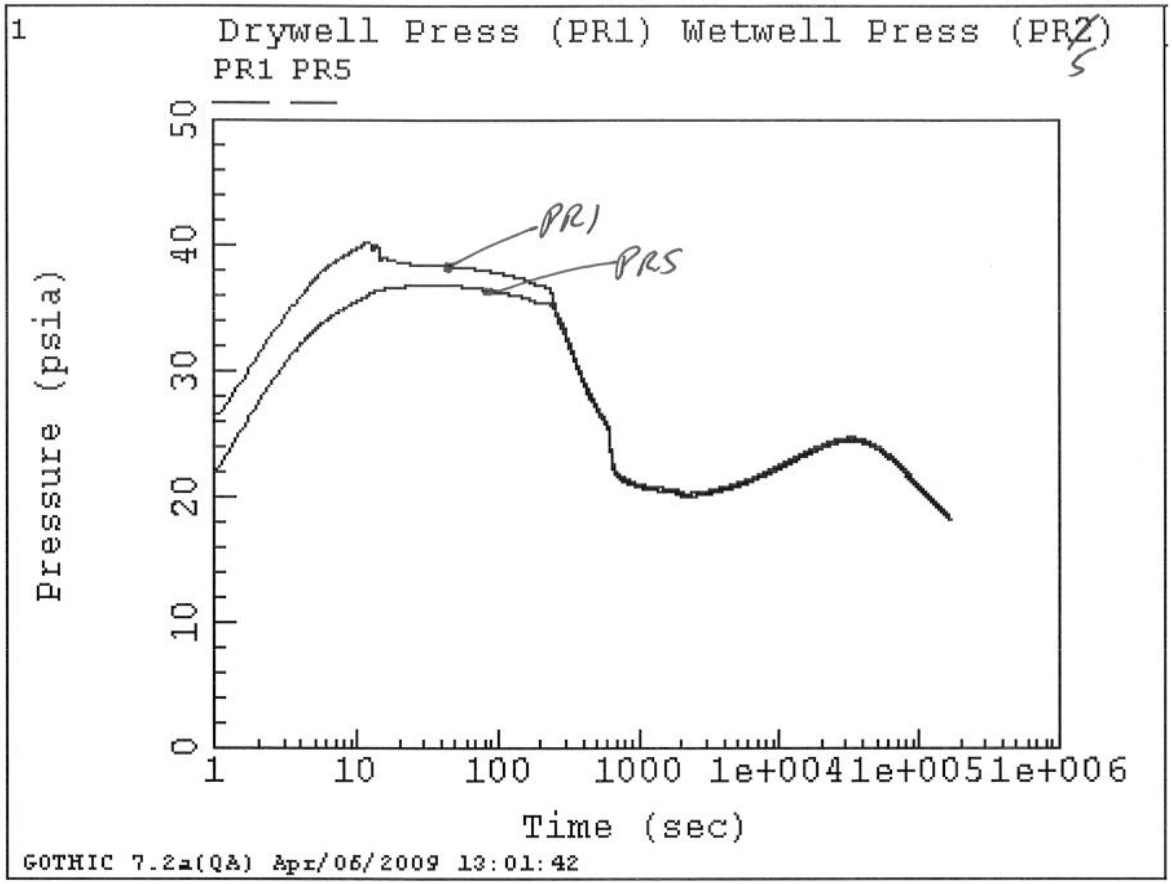
Supp Pool Temp
TL5
Temperature (F)
300
250
200
150
100
50
1
10
100
1000
1e+004
1e+005
1e+006
Time (sec)
GOTHIC 7.2a(QA) Apr/06/2009 13:01:42

CASE 2


1
Drywell Press (PR1) Wetwell Press (PR~~2~~5)
PR1 PR5
PR1
PR5
Pressure (psia)
0
10
20
30
40
50
1
10
100
1000
1e+004
1e+005
1e+006
Time (sec)
GOTHIC 7.2a(QA) Apr/06/2009 13:01:42

CASE 2

ATTACHMENT 1

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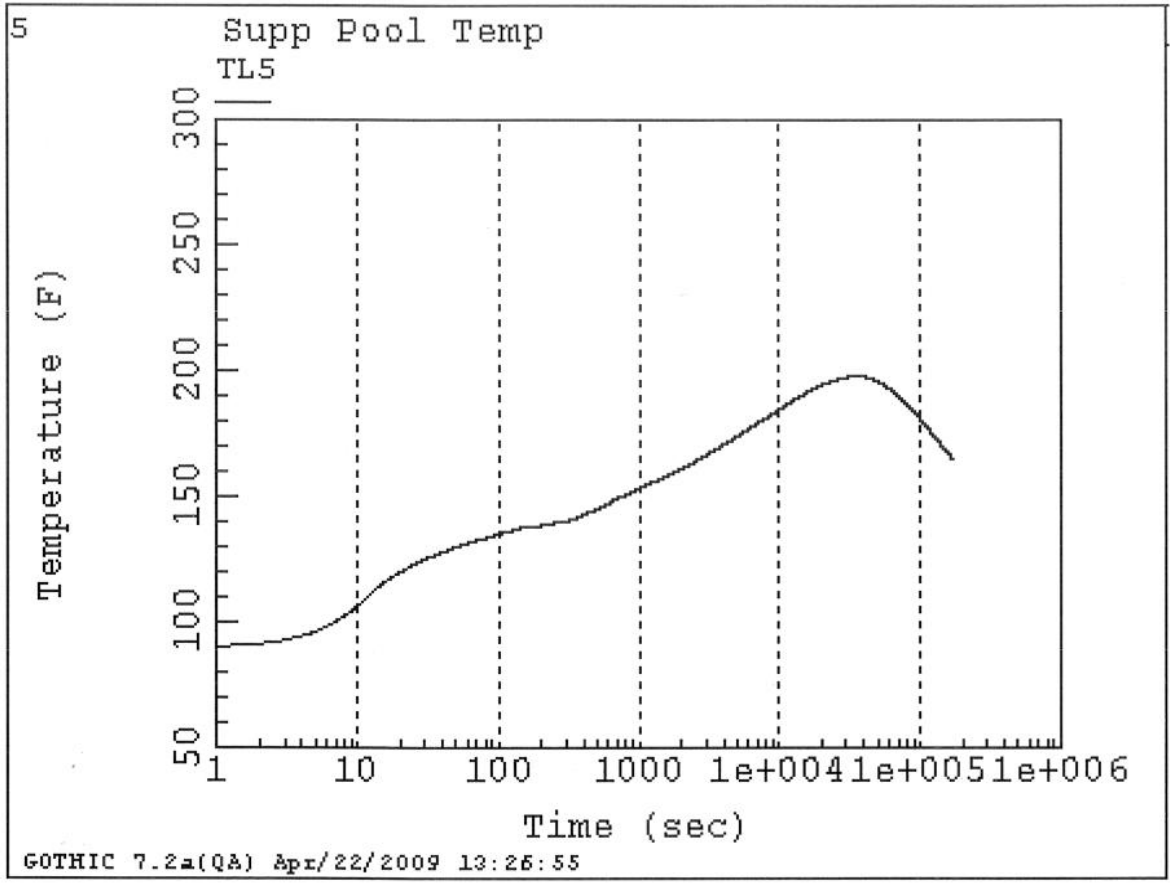

CASE 3

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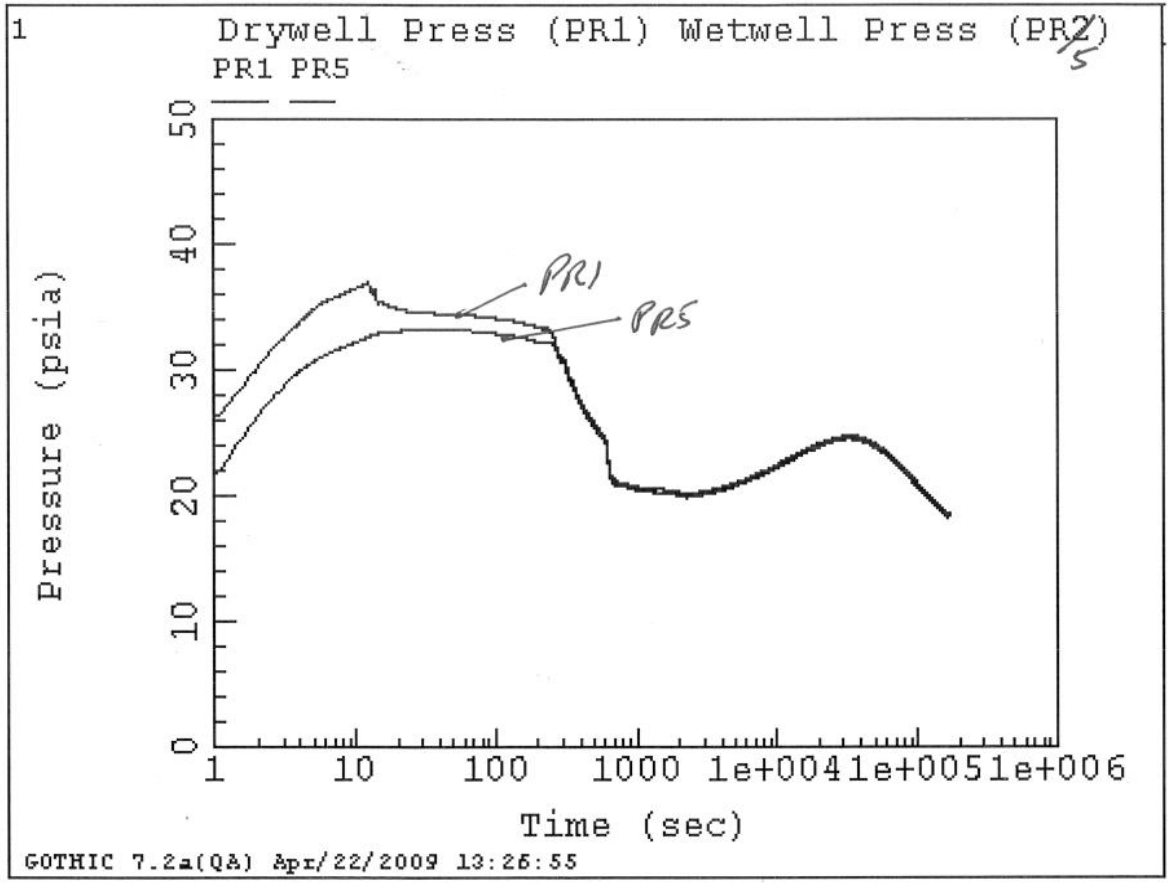

CASE 3

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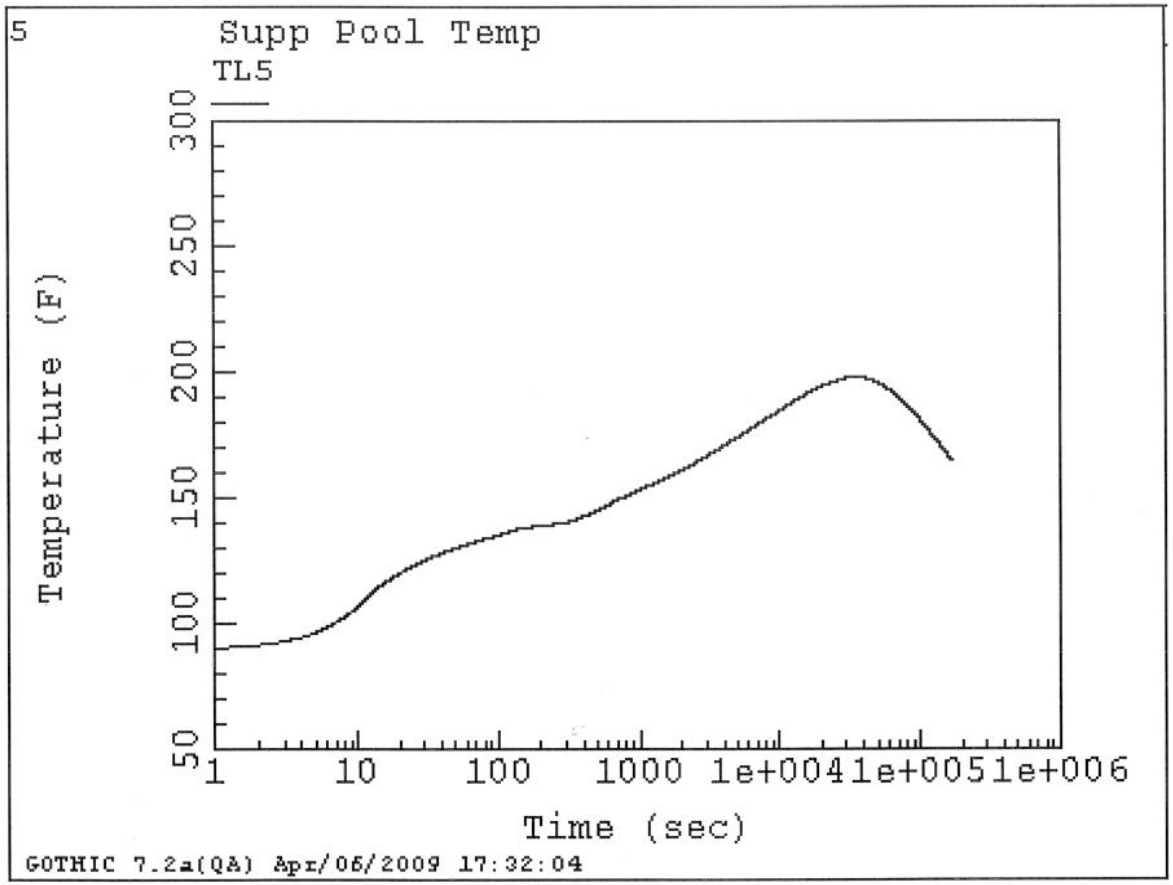

CASE 4

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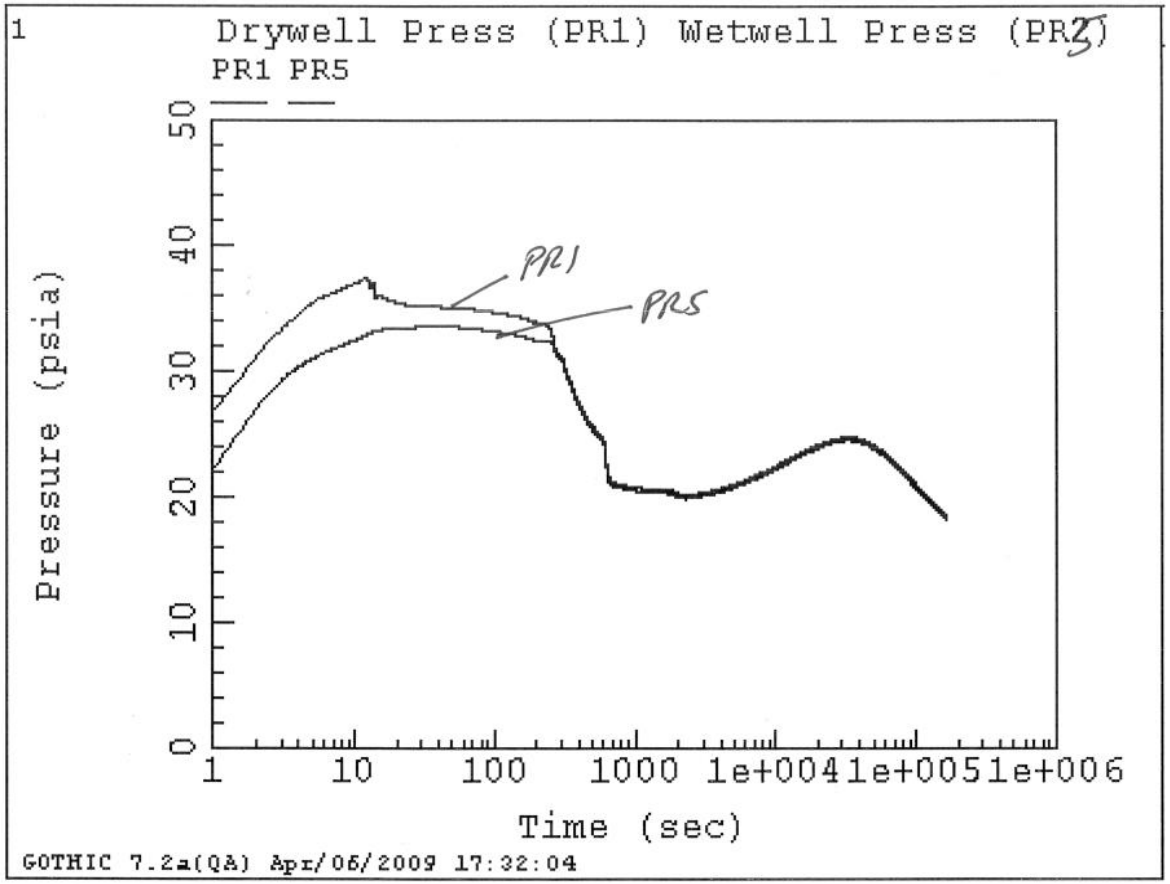

CASE 4

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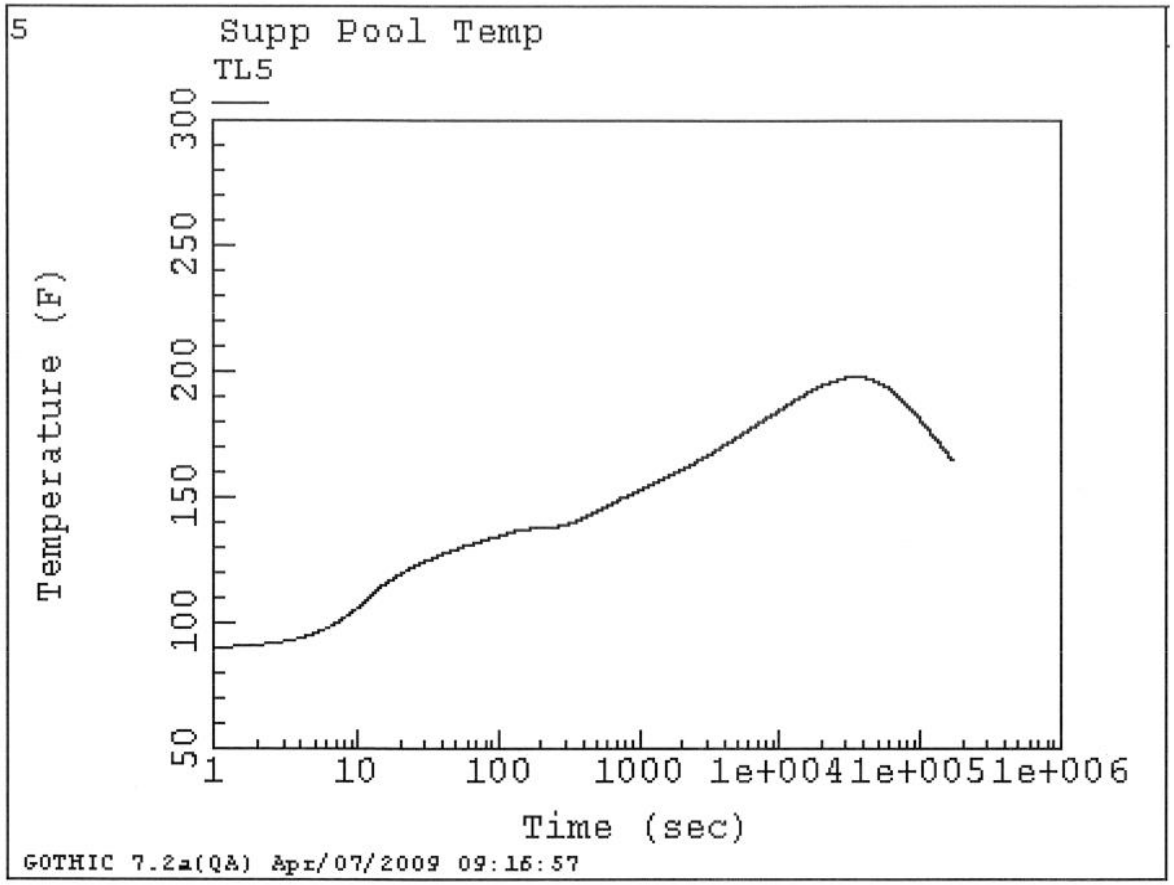

CASE 5

ATTACHMENT 1

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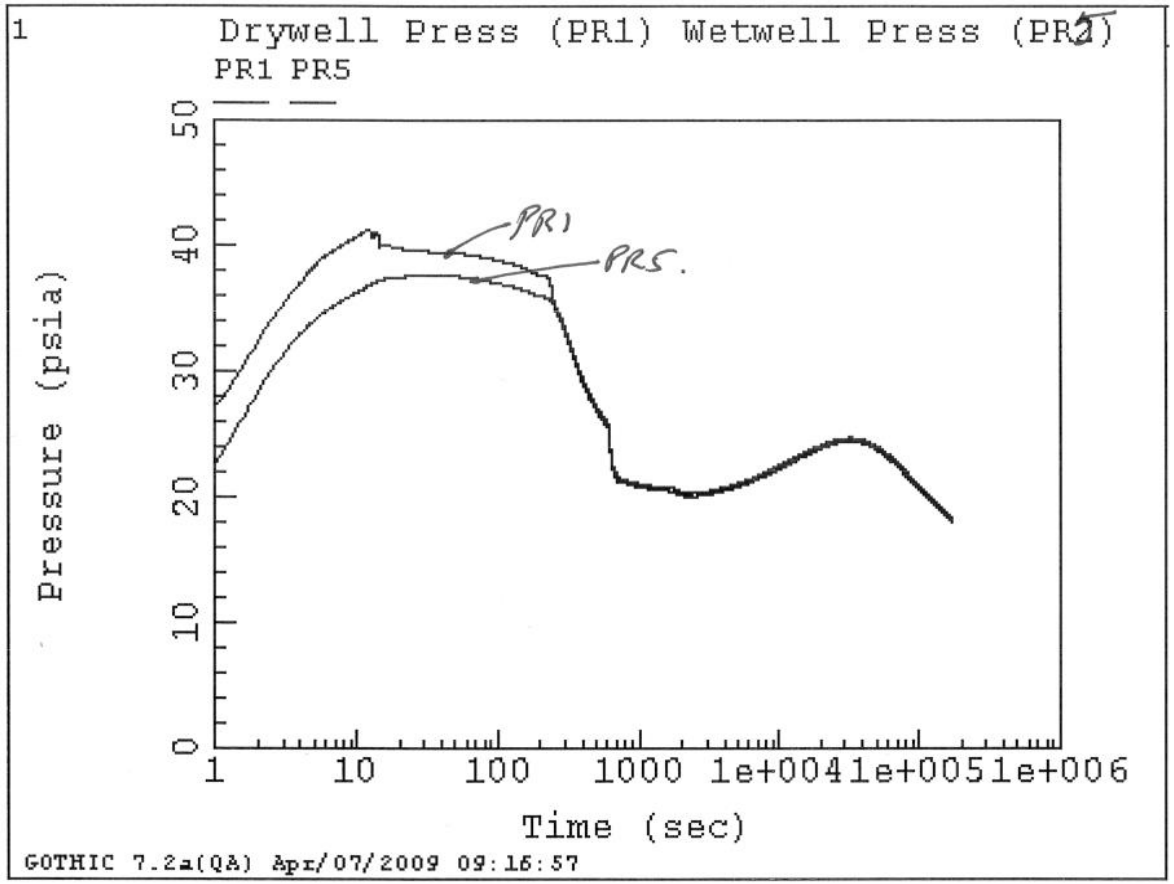

CASE 5

ATTACHMENT 1

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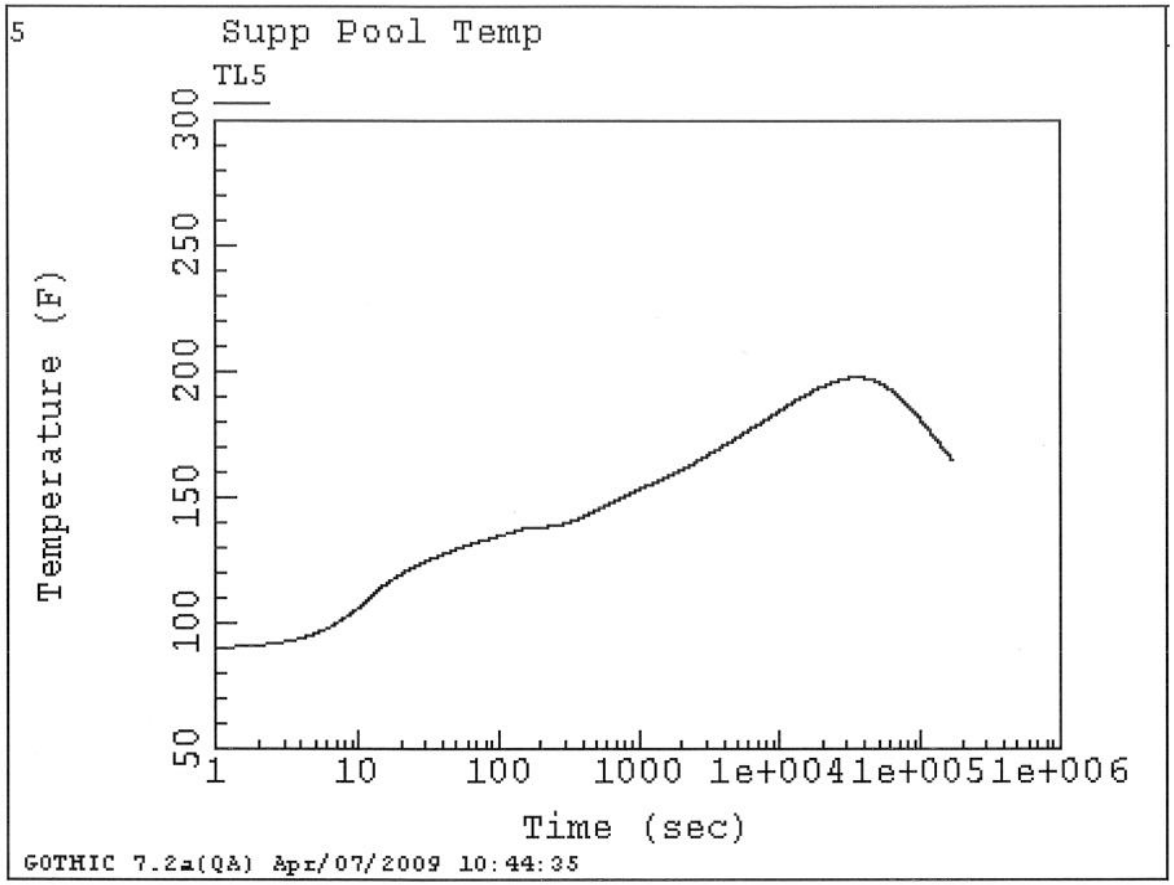

CASE 6

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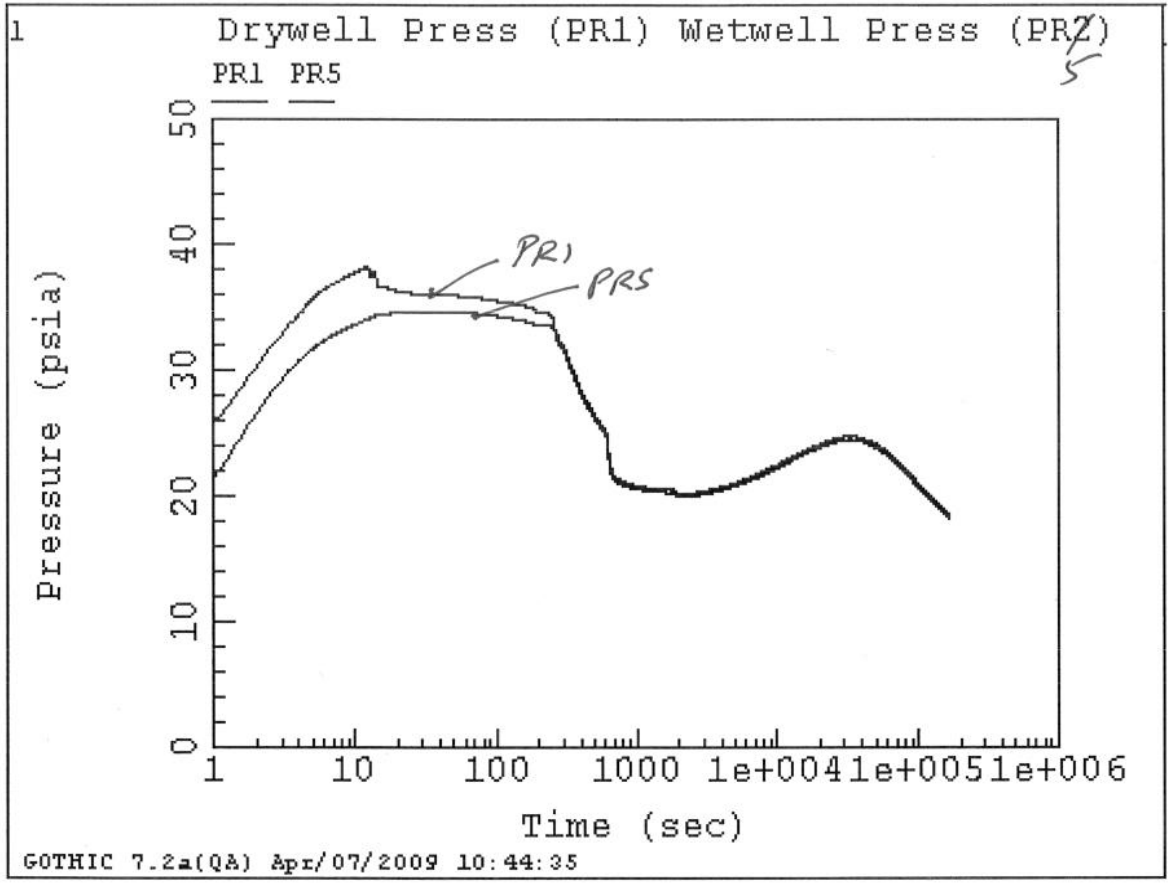

CASE 6

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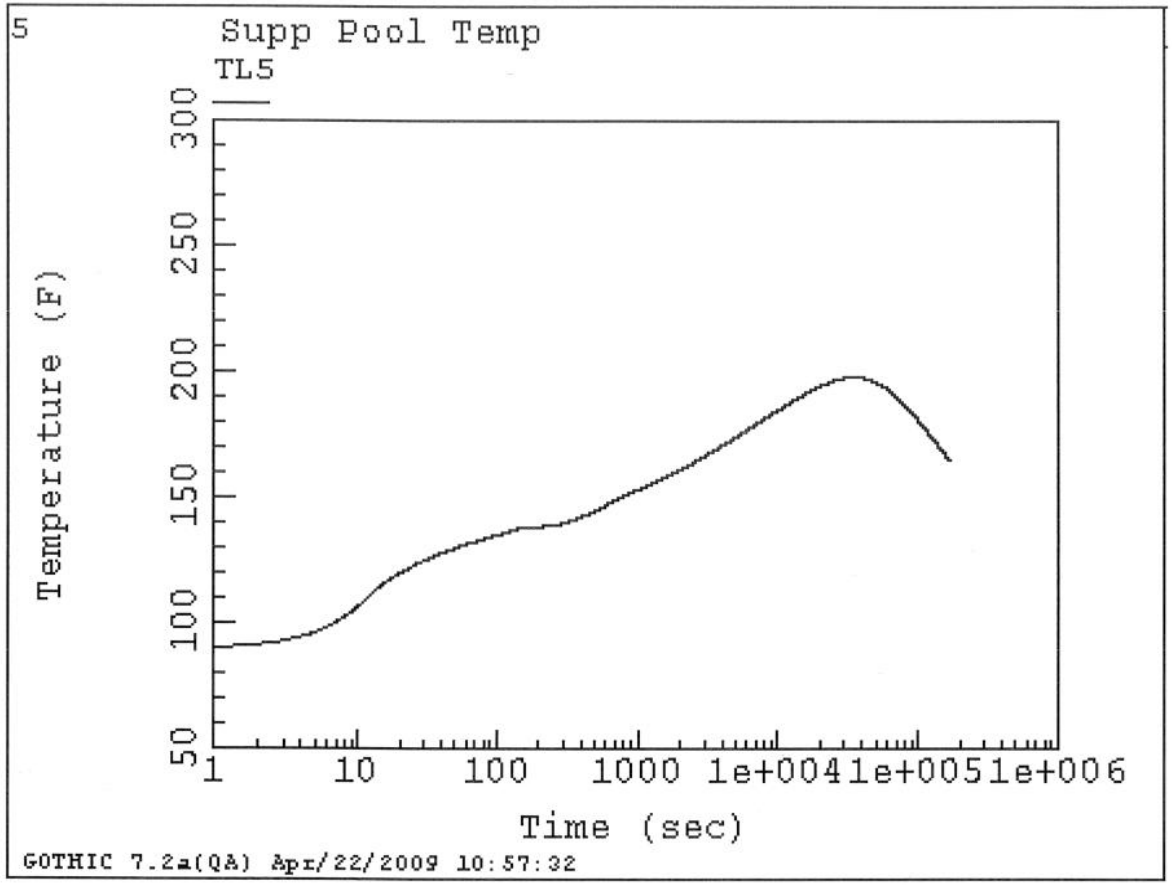

CASE 7

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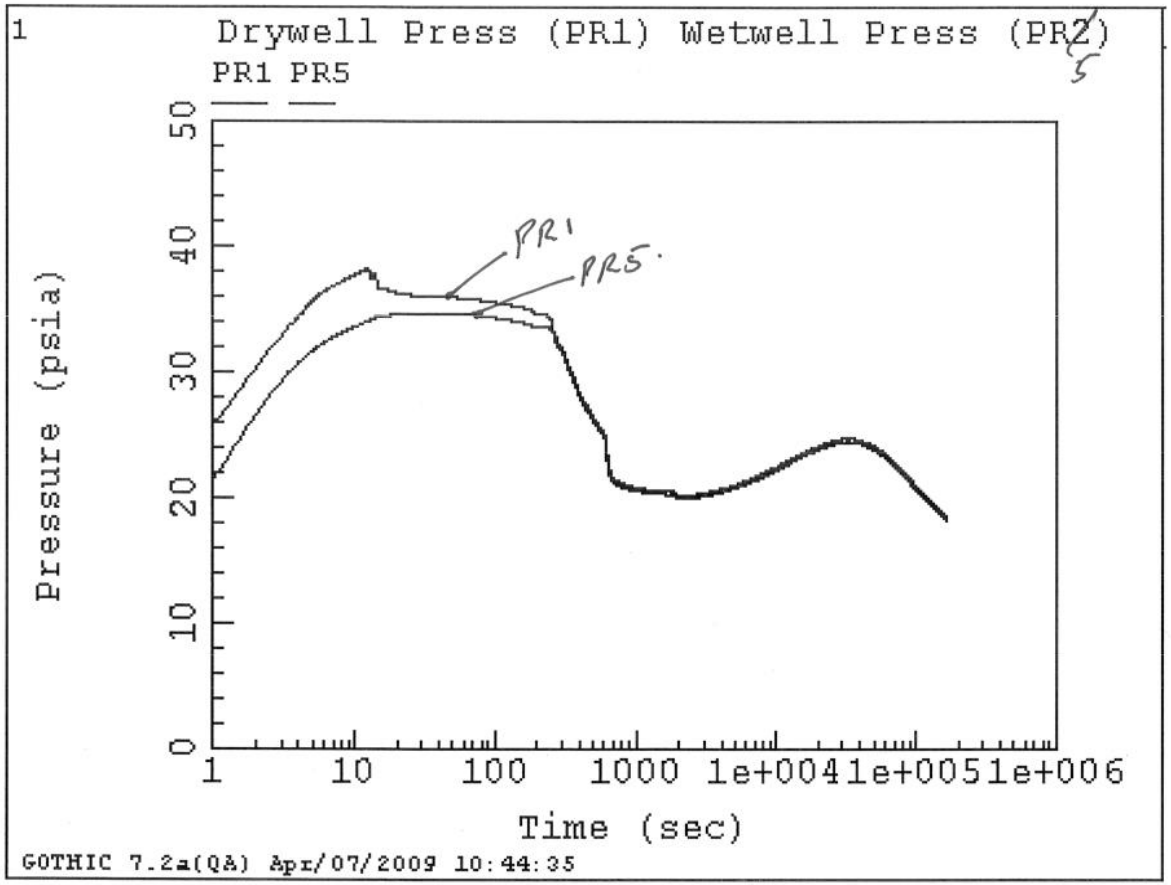

CASE 7