Detroit DD13 Taskforce Agenda
Meeting Minutes
Thursday January 10, 2013

Attendance

The meeting attendance is shown in Attachment 1.

Agenda, Test Scope & Objectives and Timeline
Jim Matasic reviewed the agenda for the meeting and also reviewed the Test Scope & Objectives on page 3 of attachment 2. He presented a current test timeline on page 4 of the same attachment.

Daimler Status Update
Daimler gave update on internal test development. This information can be found on page 5 of attachment 2. It was asked if the 2.9 HTHS oils on page 6 of attachment 2 were the same or different oils. Daimler stated that they are all the same oil.

Lubrizol Status Update
Internal testing update was presented by Jim Matasic, shown on page 8 & 9 of Attachment 2. A question was asked about oil temperature control and Jim stated that control is done by the ECM. Questions about coolant aeration and liner cavitation were asked and Jim stated that there was no evidence of either. Jim also stated they have experienced no derate issues. The coolant being used is 50/50 glycol.

Analytical Update/Results
Jim Matasic gave and update on analytical methods and results shown in Attachment 2, pages 10-19. There was discussion about the method used to determine TBN and it was agreed that it needed to be clarified/updated by the sub B07 bench testing committee. There was a question about how it is determined that scuffing has occurred during a test. A rise in crankcase pressure is used to identify scuffing.

Hardware
Jim Matasic discussed efforts to obtain non-coated rings in order to increase the propensity to scuff from page 20 of attachment 2. Current rings are stock. There was some discussion about the future status of all the hardware specifically whether there would be significant technology changes in the near future that would jeopardize this test. Daimler/Lubrizol indicated that there are no known major hardware changes in the next few years.

General Discussion
After the presentation there was some general discussion and questions.

-Q: Any special dyno considerations for this test? A: No
-Q: Typical crankcase pressures? A: ~0+/- 0.1 on a new build and an increase of 0.5-1 for scuffing.

-No scuffing seen in field but concerned about scuffing seen in durability testing.
-Tests have not been overfueled. Tried post injection but no fuel dilution.
-Piston cooling nozzles modified with no effect.
-Methods to measure boiling/cavitation discussed. No viable option found.
-C02 measurements are being taken during steady state operation.

General Discussion (cont.)

-Discussion about whether it was the total cycle that leads to scuffing or if there is a certain part of the cycle at which scuffing occurs (i.e. CCP rise).
-Discussion on the need for oil temp and EGR control for test consistency.
-Question was asked about overhead damage in addition to power cyclinder and the answer was no.
-DDC is considering expanding to another lab to accelerate development.

From:	Matasic, James
To:	Ahlborn, Jonathan; Alessi, Michael L; andy.broff@swri.org; Bob Salgueiro (Bob.Salgueiro@Infineum.com); Bob Shureb (robert.shureb@daimler.com); Bradley Carter Intertek; Buchanan, Jessica; "Campbell, Bob"; Castanien, Chris; Conti, Riccardo; Cooper, Mark (MAWC); Darryl Purificati (dpurificati@suncor.com); Duncan, David; Elisa.Santos@infineum.com; Evans, Gail; Fitzpatrick, Adrian; Galic, Mary; Goshorn, Ken; gregory.braziunas@daimler.com; Gutzwiller, James; NON-LZ MCCORD JIM; jason.krietsch@daimler.com; Jeff Clark; Jeremy Dean (jeremy.dean@daimler.com); Jim Linden (lindenjim@hotmail.com); NON-LZ MORITZ JIM; Joan Evans (joan.evans@infineum.com); John Pettingill; john.cruz@daimler.com; Larch, William; Loop, John; Mesfin Belay, Ph.D. (mesfin.belay@daimler.com); Pat Fetterman; Rajakumar, Allison; Ron Buck; Rutherford, Jim (JARU); Schweitzer, Addison J. (addison.schweitzer@swri.org); Scinto, Phil; NON-LZ RICHARDS SCOTT; Sean A. Moyer; Shank, Greg; shawn.whitacre@cummins.com; NON-LZ GEARHART STEVE; Tom Wingfield (WINGFTM@cpchem.com); Vujica, Joseph; Zack Bishop
Subject:	1-10-13 DD13 Task Force Meeting - Minutes ***CORRECTION***
Date:	Thursday, January 17, 2013 9:45:24 AM

Greg at Detroit pointed out a mistake in the minutes and clarified my comment from last week... Thanks Greg!

Oil Temperature is controlled by a mechanical thermostat in the oil module. The oil thermostat and also holding coolant temp constant will hold oil temp constant. There is also a coolant thermostat, but we have this blocked open and control coolant temperature with a control valve and heat exchanger. The oil thermostat starts to open (allow flow though the oil cooler) at 115 C, and is fully open at 125 C. There is a hysteresis in the wax motor of the thermostat which is about 2-3 C. Therefore, with normal coolant temps the gallery oil temp usually runs about 112-113C. With 110 C coolant like we are running it will run about 116 C (114-117C on our LZ stand during the cycle, with the exception of idle conditions where it drops a bit lower).

I would add that we will need to look at tighter control as we move forward with test development.

Thanks,

Jim

James C. Matasic

Test engineer

The Lubrizol Corporation

29400 Lakeland Blvd.

Wickliffe, Ohio 44092-2298

Desk/Cell Phone: (440) 347-2487 **Fax:** (440) 347-4096

E-mail: james.matasic@lubrizol.com **Mail Drop:** 123A

From: Matasic, James
Sent: Thursday, January 17, 2013 7:39 AM

DD13 Task Force Attendance

San Antonio, TX

1/10/2013

Attachment 1

NAME	ORG
Jeff Clark	TMC
JIM MORITZ	INTERTEK
GREG SHANK	VOLVO
KEN GOSHORN	VOLVO
Jim McCord	SwRI
Bob Campbell	AFTON
ZACK BISHOP	TEI
MARK SUTHERLAND	TEI
Jeremy Dean	Detroit Diesel
RON BUCK	TEI
Jim Linden	TOTAL LUBRICANTS
BRADLEY CARTER	INTERTEK
Mark Cooper	Oronite
Jim Rutherford	Oronite
Mike Hlessi	EMRE
Riccardo Coufi	EMRE
JIM GUTZWILLER	INFINEUM
ANDY BROFF	SwRI
Bob Salgueiro	Infineum
PAT FETTERMAN	INFINEUM
Elisa Santos	Infineum
CHRIS CASTANIEN	LZ
JON AHLBORN	LZ
Jim Matasic	LZ
John Cruz	Detroit Diesel
SEAN MOYER	TMC

ATTACHMENT 2

Detroit DD13 Task Force

San Antonio, Texas 01-10-2013

Agenda

• **Test Scope and Objectives**	**Jim Matasic**
• **Timeline**	**Jim Matasic**
• **Daimler Scuffing Experience**	**Detroit**
• **Current Test Status**	**Jim Matasic**
• **New Rings**	**Jim Matasic**
• **Topics for next meeting**	**Jim Matasic**
• **Schedule for Next Meeting**	**Jim Matasic**

Test Scope and Objectives

Scope

This Task Force is responsible for development of the Detroit DD13 engine test. It is accountable to the ASTM Heavy Duty Engine Oil Classification Panel and subsequently to ASTM Sub-Committee B0.02.

The Task Force will strive to achieve its objectives via close cooperation and interaction with the test sponsor, participating test laboratories, and other ASTM functions (including Task Force Sub-Groups, the Test Monitoring Center, and the designated Central Parts Distributor).

Objectives

- Evaluate preliminary test configuration and operational conditions and develop accordingly.
- Expedite test procedure consistent with PC-11 timeline.
- Identify and evaluate key performance criteria.
- Demonstrate discrimination with respect to key performance criteria.
- Optimize test procedure for maximum test precision and reliability.
- Monitor PC-11 matrix execution.
- Monitor/assist statistical evaluation of matrix data.
- Recommend HDEOCP endorsement of DD13 test, key performance criteria and associated limits.
- Complete ASTM ballots for test standard approval.
- Complete ASTM ballots of Detroit DD13 research report

Specific Activities

- Develop Primary Test Parameters
  - Power Cylinder Scuffing
    - Determine best method of scuffing evaluation, pass/fail/etc
- Evaluate and Compare Range of Secondary Test Parameters
  - Con Rod Bearings
  - Top Ring Weightloss
  - Cylinder Liner Wear

Timeline

- Test demonstration
  - 1Q 2013
- Installation at other labs to begin
  - 1Q 2013
- Test standard finalized and discrimination testing
  - 2Q 2013 thru 4Q 2013
- Precision matrix to begin
  - 1Q 2014

Status updates

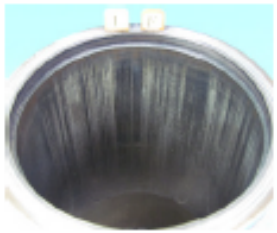
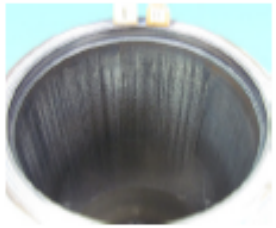
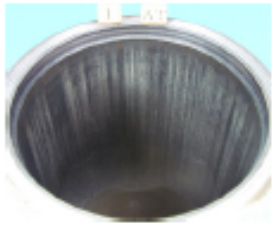
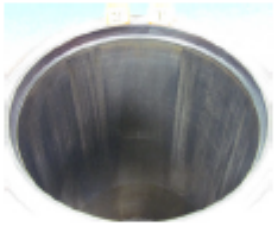
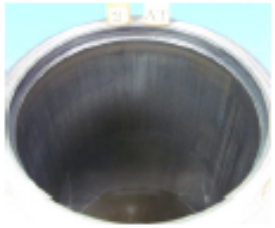
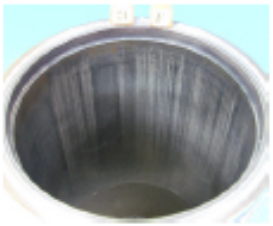
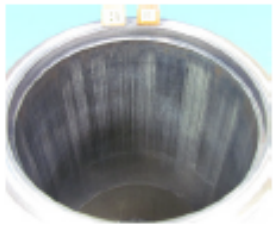
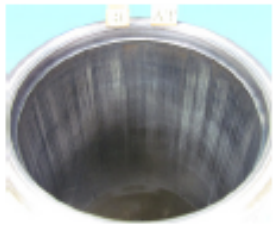
- Detroit developed cal based on test cycle that has indicated repeatable scuffing on multiple engines during standard durability testing of field capable hardware using field capable oils.
- Detroit refining cycle, adjusting cal to accelerate scuffing
- ECM sent to Lubrizol, on test
- Detroit working with Stuttgart on PC-11 supply of critical hardware parts
  - Special parts on order for Lubrizol's use

Source:
Department

Proposed Scuffing Cal

Engine	Engine Config.	Oil HTHS (cSt)	Hours	Comments
A	MY2013	2.9	457h	Scuffing on all cylinders except #2
A	MY2013	2.9	355h	Scuffing on all 6 cylinders.
B	MY2013	3.3	824h	Scuffing on #2, #3, #4, #6
C	MY2013	2.9	847h	Scuffing on all 6 cylinders. Different Calibration.

Scuffed Liners

#1cyl	F		T		R		AT	
#2cyl	F		T		R		AT	
#3yl	F		T		R		AT	

Source:

Testing Update

- LZ running new cycle/cal

- Test is at 500hrs on 1-9-13
  - 1st 200hrs at steady state based on older calibration that was thought most likely to cause scuffing (1300rpm/700Nm)
  - ECU changed at 200 hours to exactly match the calibration and cycle causing scuffing at Daimler

Test Cycle

Test Cycle

STEP	TIME (sec)	SPEED (rpm)	Throttle (%)	Step Type
1	120	600	0	constant
2	10	1800	100	ramp
3	960	1800	100	constant
4	10	900	35	ramp
5	130	900	35	constant
6	10	600	0	ramp
7	130	600	0	constant
8	10	1000	100	ramp
9	350	1100	100	ramp
10	960	1100	100	constant
11	1560	2000	100	ramp
12	180	2000	100	constant
13	120	1800	100	ramp
14	120	1800	100	constant
15	10	600	0	ramp

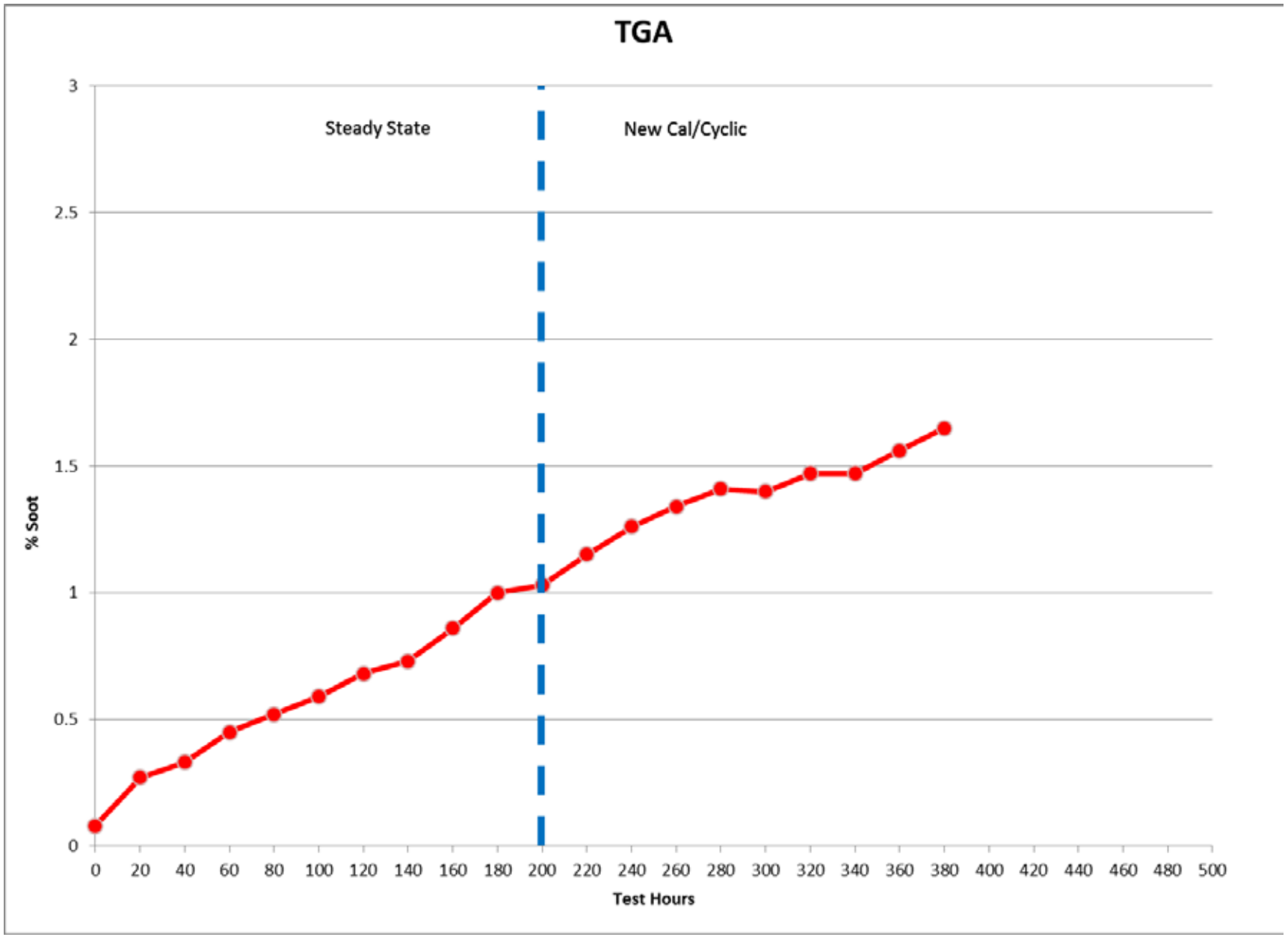
Controlled Parameters For All Stages

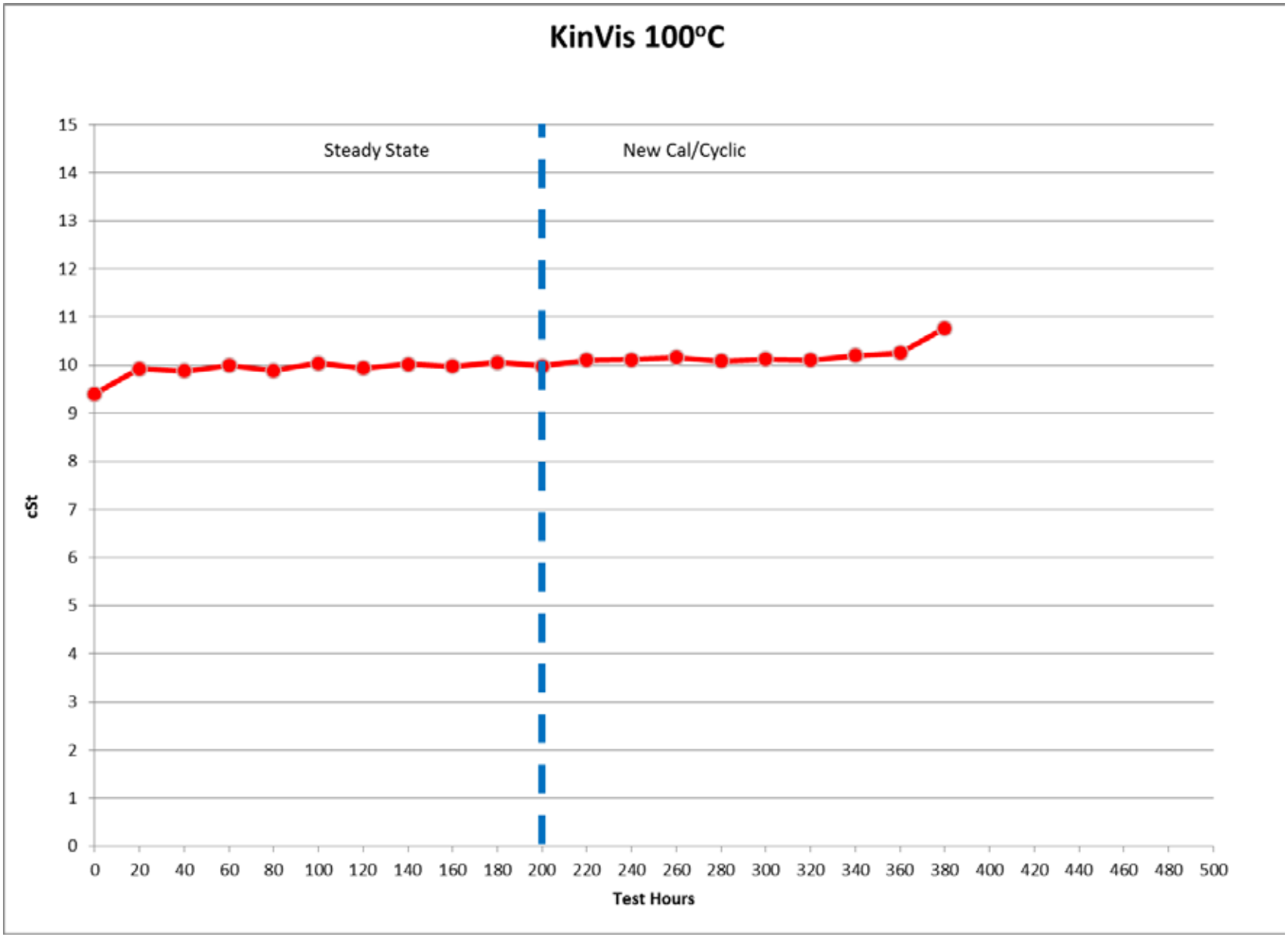
TCLEO	110C ± 2
TAIRIN	35C ± 2
TFUEL	38C ± 2
PCLEO	70kPa ± 3

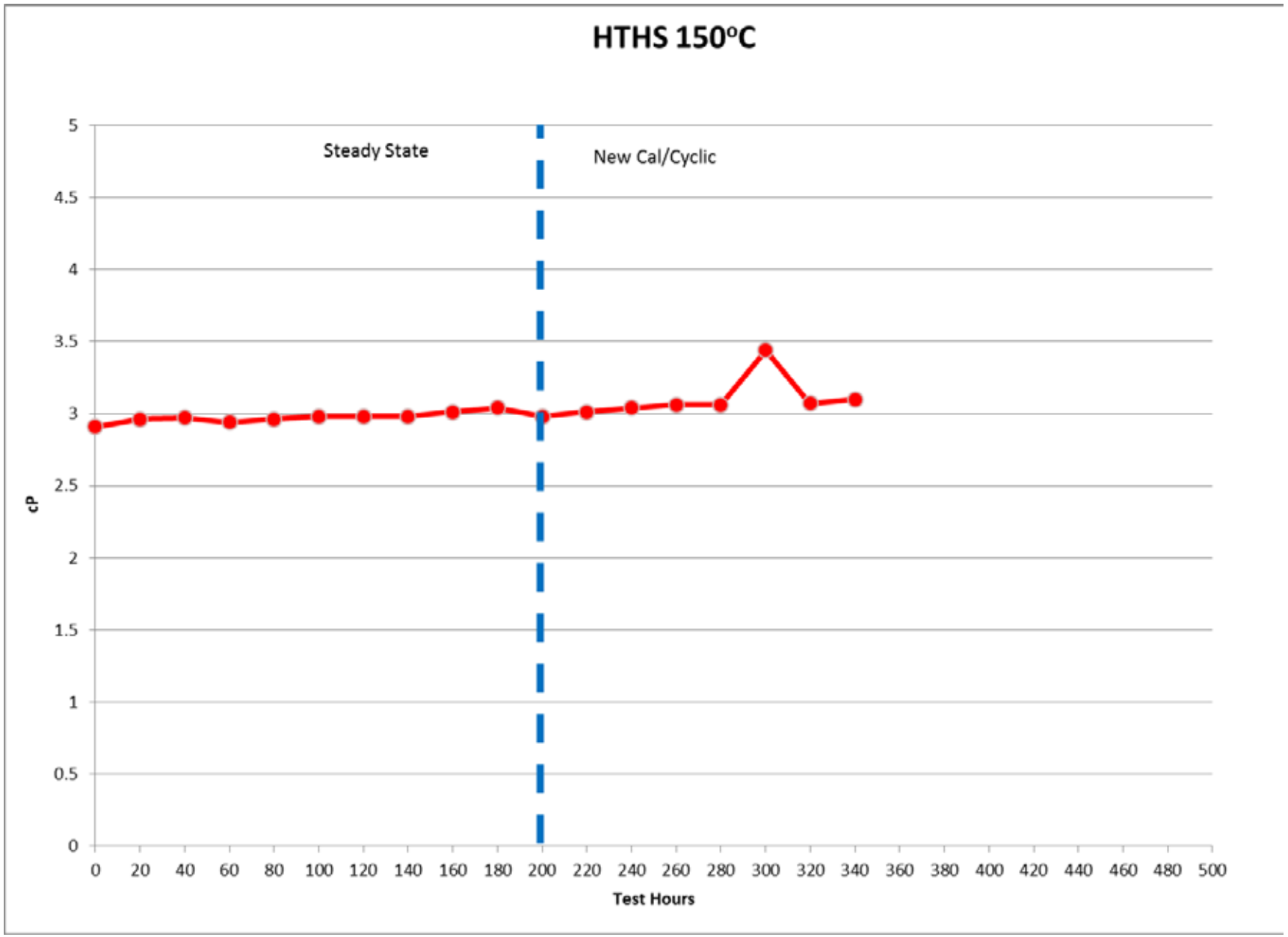
Analytical Update

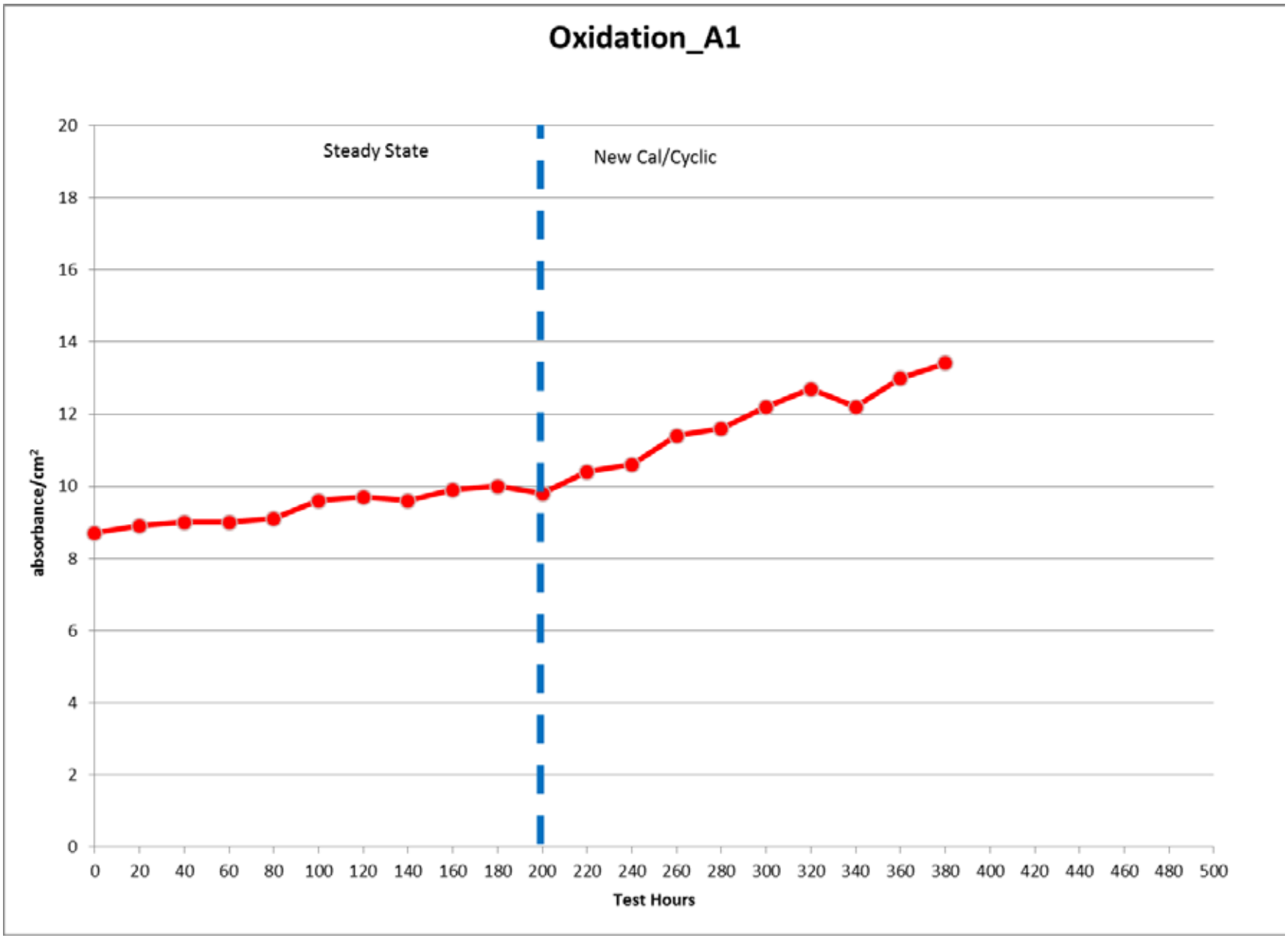
Sample Schedule

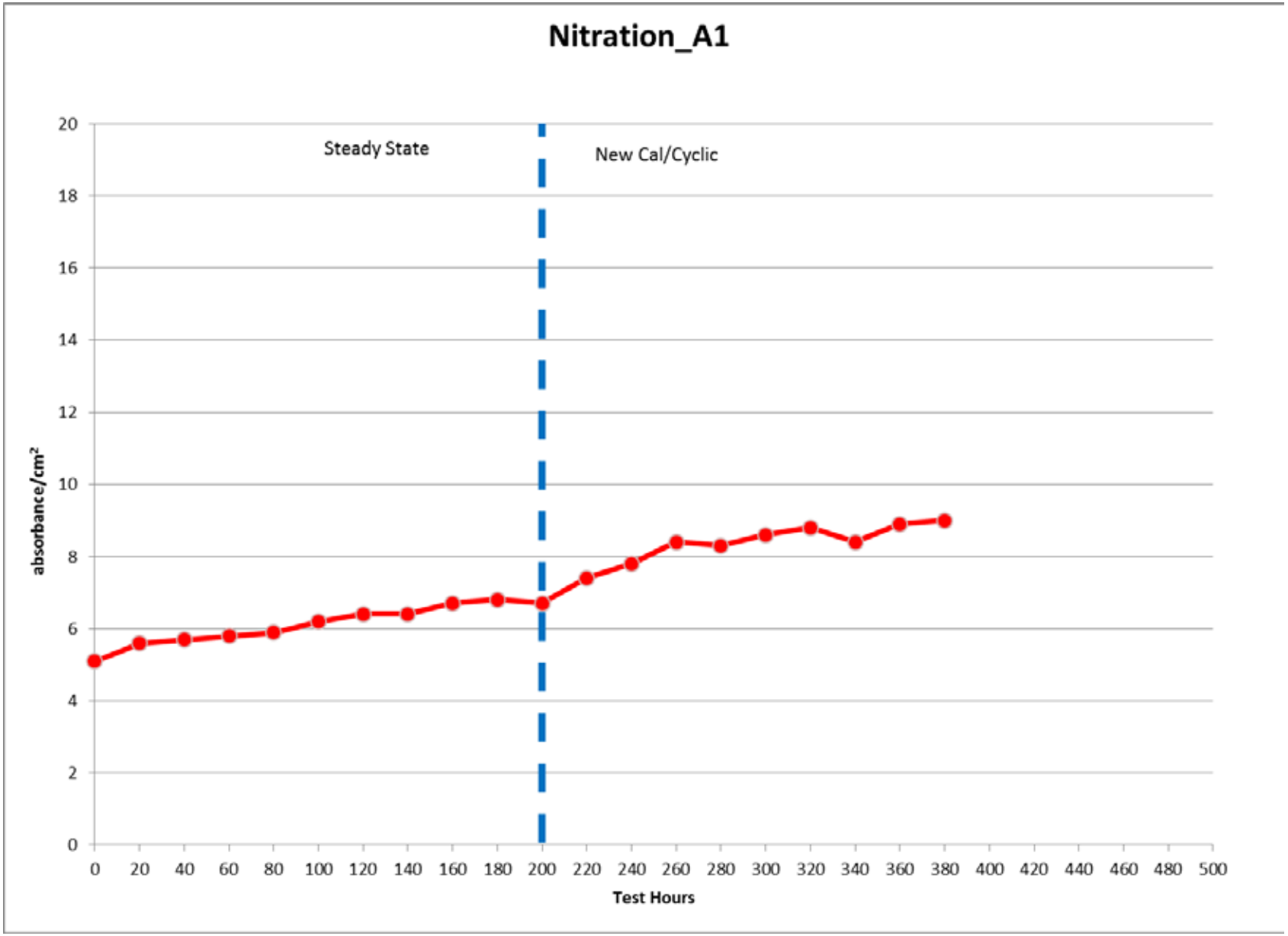
Procedure	Description	Frequency
T8 method	TGA	every 20hrs
T8 method	KIN_VISC	every 20hrs
D445_40	KIN_VISC	every 20hrs
D7109	90 pass shear	only new
D3524	Fuel Dil	every 20hrs
D4683	HTHS (150)	every 20hrs
D6616	HTHS (100)	every 20hrs
E2412_OX_NIT	OX A1	every 20hrs
	NIT A1	
	OX A2	
	NIT A2	
D5185 - ICP	Al	every 20hrs
	B	
	Ca	
	Cr	
	Cu	
	Fe	
	Mg	
	Na	
	Pb	
	P	
	Si	
	S	
	Sn	
	Zn	
D4739	TBN	every 20hrs
D664	TAN	every 20hrs

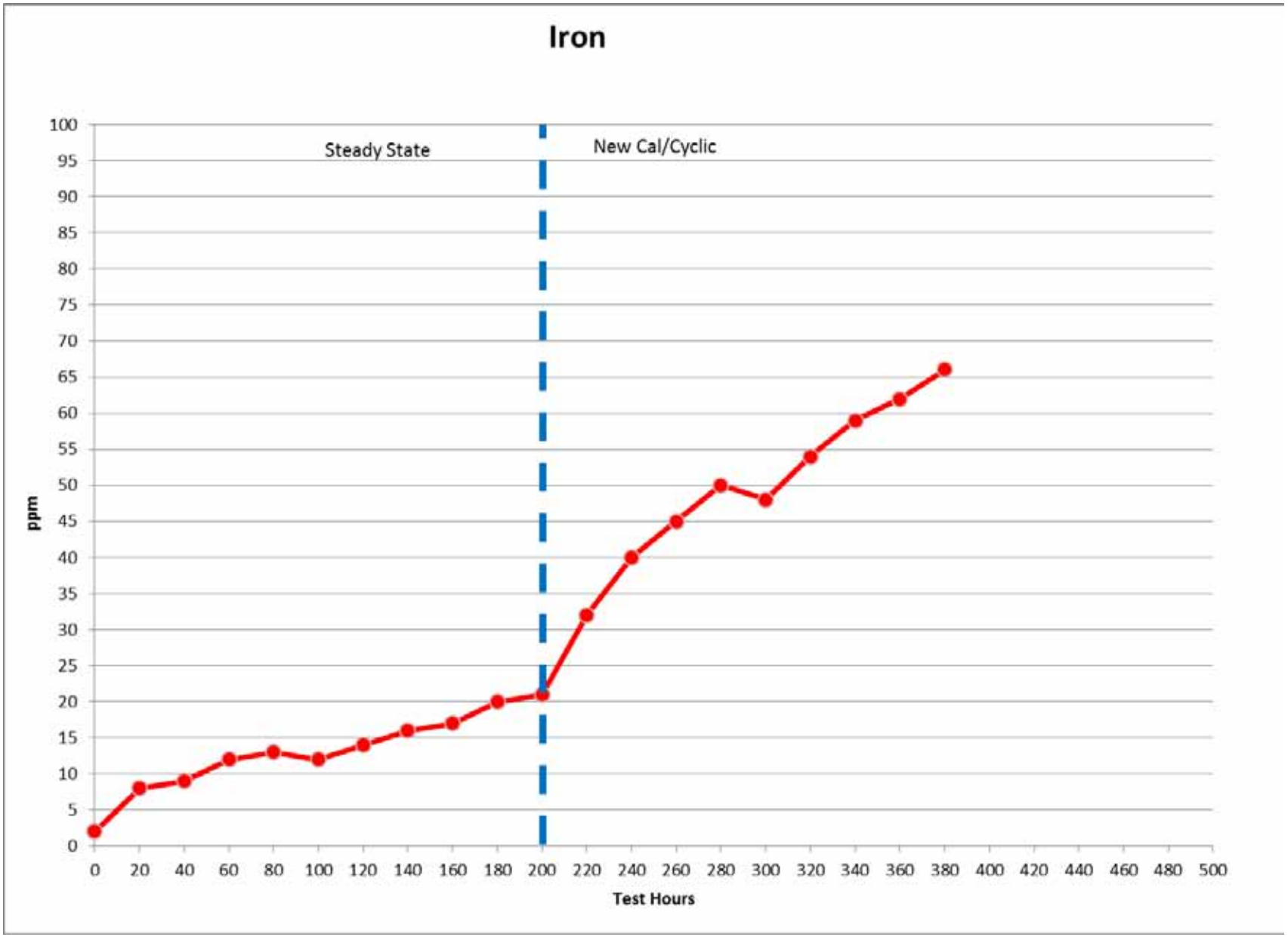


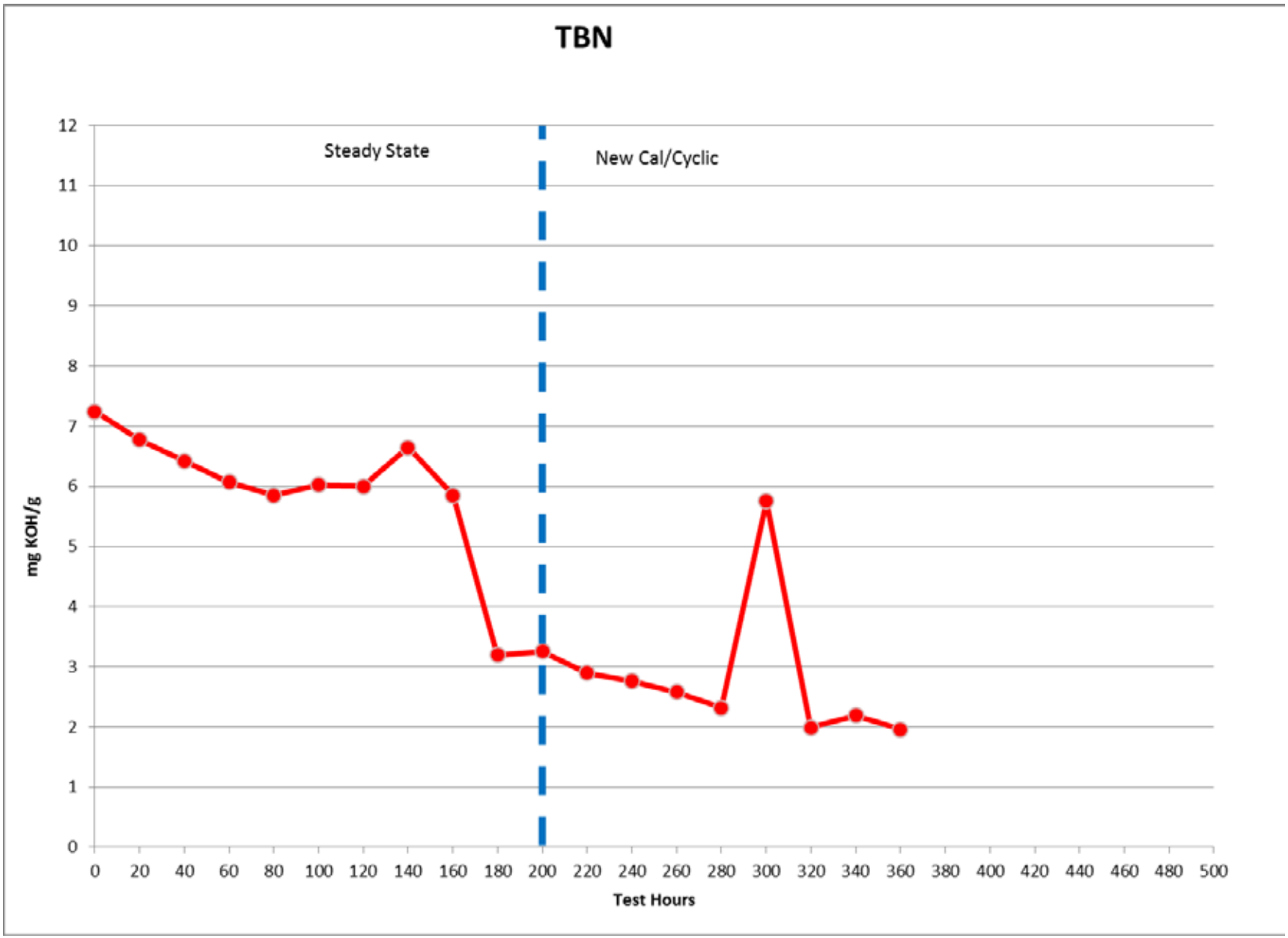


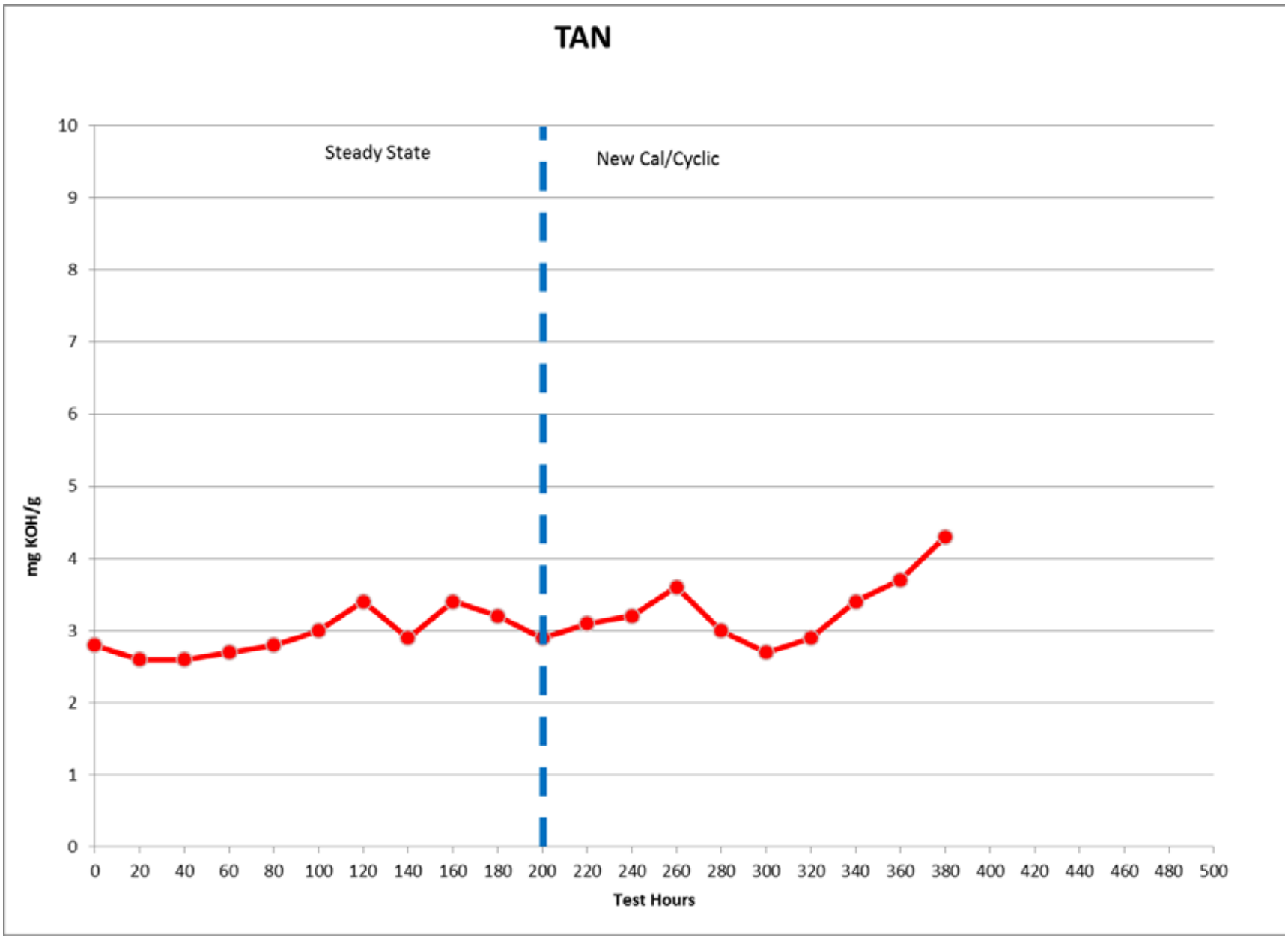












New Rings

- If necessary to accelerate the test, we are working on purchasing a batch of non-coated rings in an attempt to increase the propensity to scuffing

- Current rings are CKS style
  - Chrome Ceramic Matrix

Next Meeting

- Topics
  - ???
- Date
  - ???