ASTM INTERNATIONAL
Helping our world work better

100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA
19428-2959 USA

tel +1.610.832.9500
fax +1.610.832.9666
www.astm.org

COMMITTEE D02 on PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

CHAIRMAN: Scott Fenwick, National Biodiesel Board, PO Box 104848, Jefferson City, MO 65110-4898, United States (800) 841-5849, Fax: (537) 635-7913, e-mail: sfenwick@biodiesel.org

FIRST VICE CHAIRMAN: Gregory C Miiller, Tannas Co, 4800 James Savage Rd, Midland, MI 48642, United States (989) 496-2309, Fax: (989) 496-3438, e-mail: gmiiller@savantgroup.com

SECOND VICE CHAIRMAN: James J Simnick, Bp Global Fuels Technology, 150 Warrenville Rd, BP Technology Center Mail Stop 603-2W, Naperville, IL 60563, United States (331) 702-4071, Fax: (630) 420-4831, e-mail: simnicjj@bp.com

MEMBERSHIP SECRETARY: Ian P Mylrea, Stanhope-Seta, 70 Bramley Drive, Hampshire, RG27 8ZF, United Kingdom (193) 2 5-4589, e-mail: im@stanhope-seta.co.uk

STAFF MANAGER: Alyson Fick, (610) 832-9710, e-mail: afick@astm.org

SEQUENCE IX SURVELLANCE PANEL

Date: 6 Jun 24

ATTENDANCE

SWRI	Christine Eickstead, Khaled Rais
INTERTEK	Jason Soto, Al Lopez
LUBRIZOL	George Szappanos, Joe Gleason
AFTON	Jason Lekavich
INFINEUM	Todd Dvorak, Chris Tonstad, Andrew Ritchie
TMC	Rich Grundza
ORONITE	Robert Stockwell
SHELL	Jeff Hsu
GM	Brad Cosgrove
FORD	Mike Deegan
OHT	Jason Bowden
IMTS	Dave Passmore, Sid Clark
CQA	Mike Kunselman

ATTACHMENTS:

- ➔ **A: Meeting Agenda**
- ➔ **B: Presentation by Rich on oils**
- ➔ **C: Presentation by Christine on procedure update and pistons**

MEETING:

1. **Attendance. See table above.**

Motion to approve minutes from last SP meeting (9 Feb 24), Khaled. Robert seconds. Approval unanimous.

Action items from last set of minutes:

-Task force call for calculations to be held - Khaled

-New spark plug number has been added to the procedure - Rich

Fuel Supplier Report:

Halterman Solutions not on the call

Rich – TMC update (slides attached)

Rich - 224 reblend, 224-2 has been run on one IMTS test, 224-1 was a mixed blend that was perhaps slightly milder and 224-1 had a higher standard deviation.

Al - We need to be cautious bringing in new oil. Maybe we can run 224-2 following the existing blend as additional test?

Rich - We for 224-1 ran following 224 at least a few times in calibration as a sanity check. Or at least, 224 in one period and 224-1 in the next.

ACTION: Labs to check 224-1 reblend retains for number of possible tests. Cobble together 5 gallons cans and then send sample to Rich

Khaled – For 221-1, hopefully we can bring it in before we get into a crunch and need to combine retains. What is the plan for 224-1 once the labs gather the retains?

Rich - Check 224-1 retain inventory, assign cans testkeys once IR checked, 224-2 donates test after existing 224-1 and extend the period by an additional test. Historically, we use about 6 tests to evaluate.

Rich – For the aged oil re-blends, we don't have original blends so we will have to bring them in on actual cals.

Procedure Cleanup (slides attached):

Christine – Lubrizol, Intertek, and SwRI run 4 iterations on the same charge but the procedure in 8.10 could be interpreted to require a new charge for the 4 iterations.

Motion: Modify para. 8.10 as follows:

8.10 New-Engine Break In—Once a new engine has been installed on the test stand, perform the eight-hour break-in procedure shown in Table 2 using oil TMC 220. Once the break-in is complete, run four standard LSPI iterations using RO 220. Refer to 11.3 and 11.3.1. Motion – Christine, 2nd – Rich. Approved unanimous.

IMTS Pistons (attached presentation):

Rich – Recall that 220 oil target was very close to 0 that is where the +0.5 in the transformed result came from during development.

Rich and Mike – Maybe another lab can generate data?

George – We just calibrated so it will be some time for us.

George – Perhaps we should consider honing to accommodate the new pistons since they are a different material and require a different clearance?

Christine – honing is a new variable.

Jason L. – We would have BB pistons not honed and IMTS honed running at the same time? Seems like a nightmare.

Jason S. – Engine differences will further complicate the process since we AA, AC, AC1, AC2 etc.

Mike – I just checked at the clearance spec for metal-to-metal on forged pistons is 0.06-0.094 mm so we are not far off.

Rich – The matrix was on AC engines.

Christine – So can we run?

Geroge – I have concerns about 220. 0 might no longer be 0.

Rich – So should we consider bringing in 220 as a reference oil or some type of gauge?

Andrew R – We could mine data since 220 was originally meant to be a REO? See how far we are exactly.

Mike – I would like to see another engine run these pistons and discuss before approval.

ACTION: Rich to check 220 REO target history

AGENDA

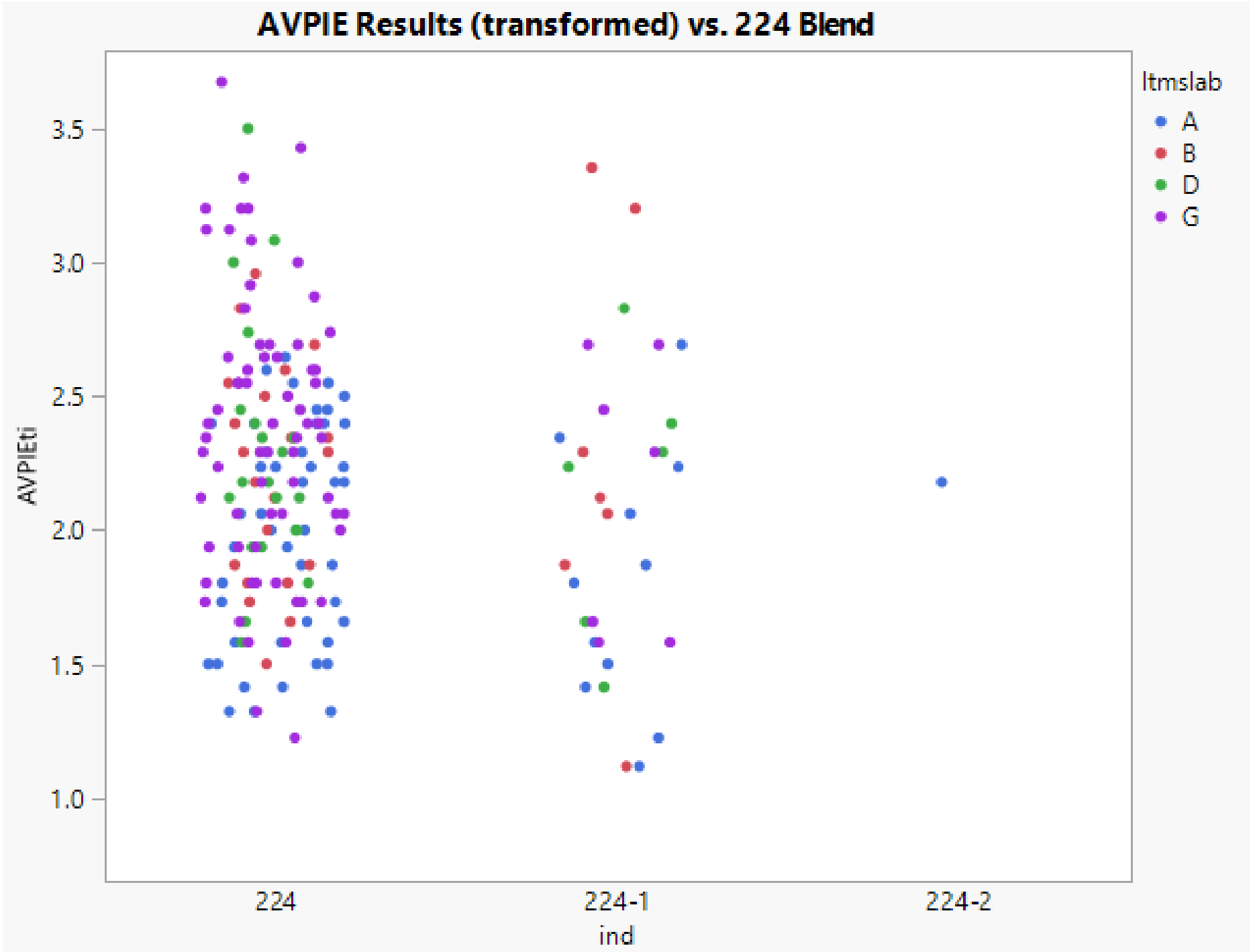
ASTM D8291Sequence IX Surveillance Panel (SwRI / Teams)

Khaled Rais – Chairman

Thursday, June 6, 2024 – 9:30 AM to 11:00 AM (EST)

1. Attendance
2. Chairman's Comments
3. Approval of Minutes from Last Meeting
4. Review of action items from last meeting (Khaled Rais)
    - 4.1. Task Force call for calculations
    - 4.2. New spark plug number added to the report?
5. Fuel Supplier Report (Haltermann)
6. TMC Report
    - 6.1. LTMS Update (Rich Grundza)
    - 6.2. 224-1 Results Update (Rich Grundza)
        - Final review of 224-1 results.
    - 6.3. 224-2 Introduction
7. Hardware
    - 7.1. IMTS Piston Update (Prove-out results)
8. New Business and Discussion
    - 8.1. Break-in procedure cleanup
    - 8.2. Afton to comment on variability of ECM parameters that are intended to be fixed.
    - 8.3. Open to any other topics from the panel
9. Next Meeting: Will be at the call of the chairman.

Sequence IX Reference Oils


AVPIE Results (transformed) vs. 224 Blend
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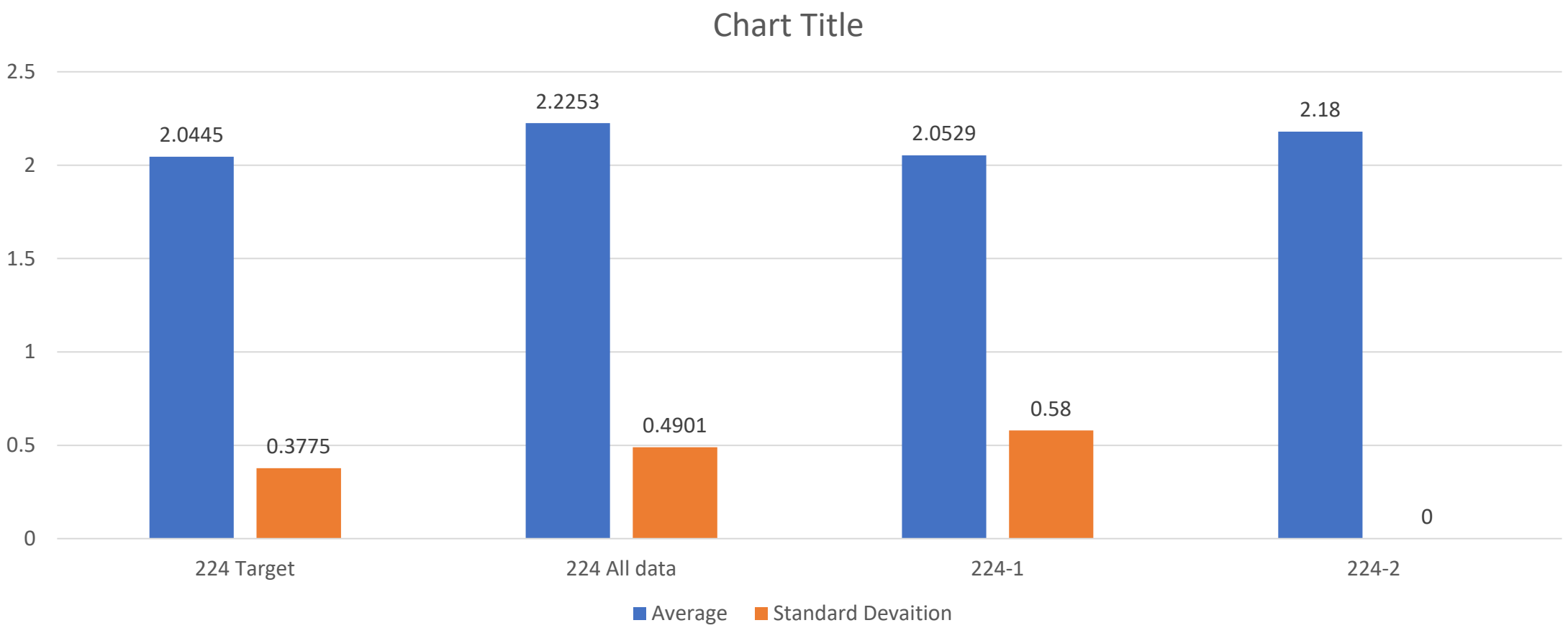
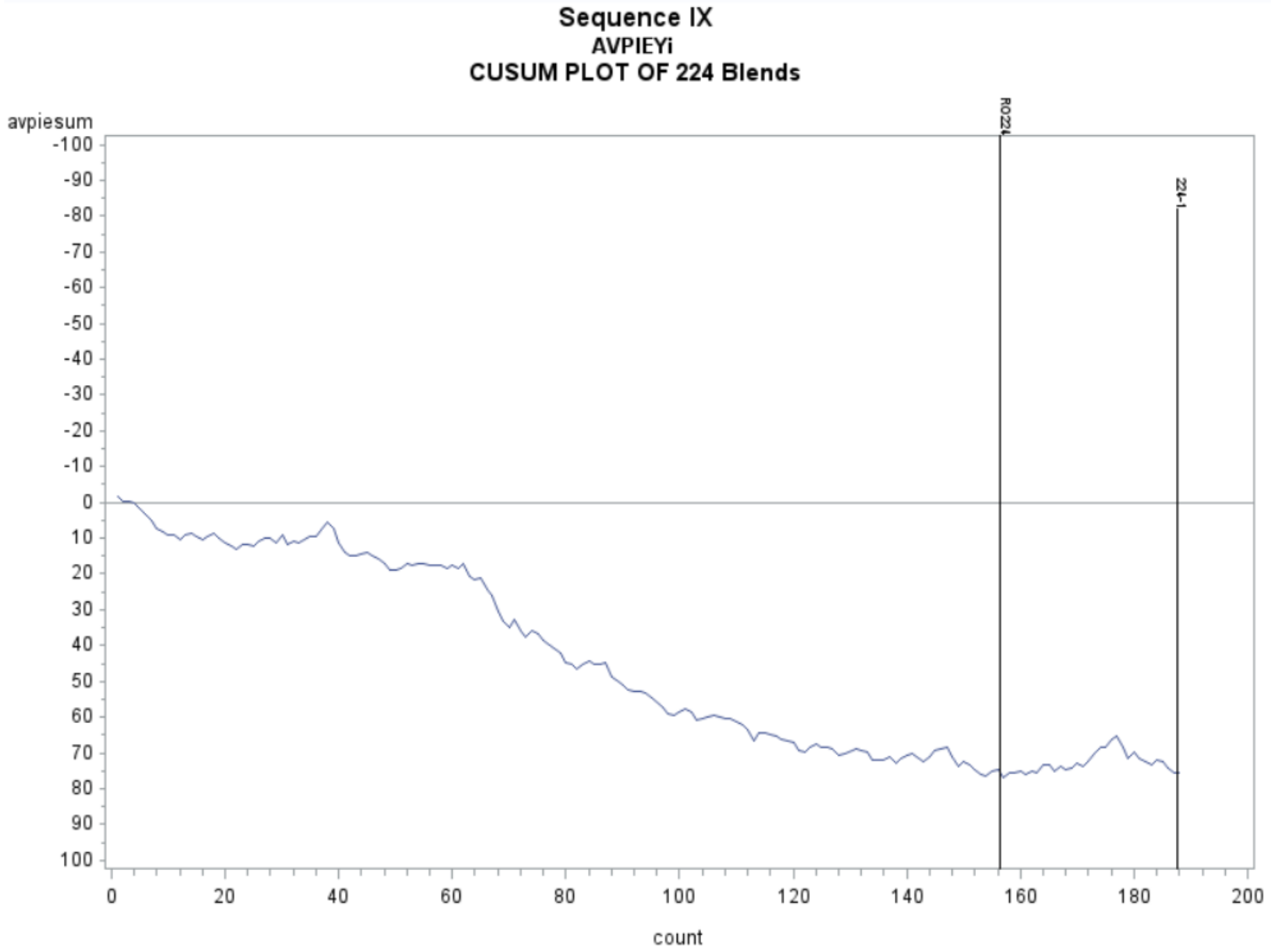


Note: 224-2 Result is on IMTS Pistons


Sequence IX
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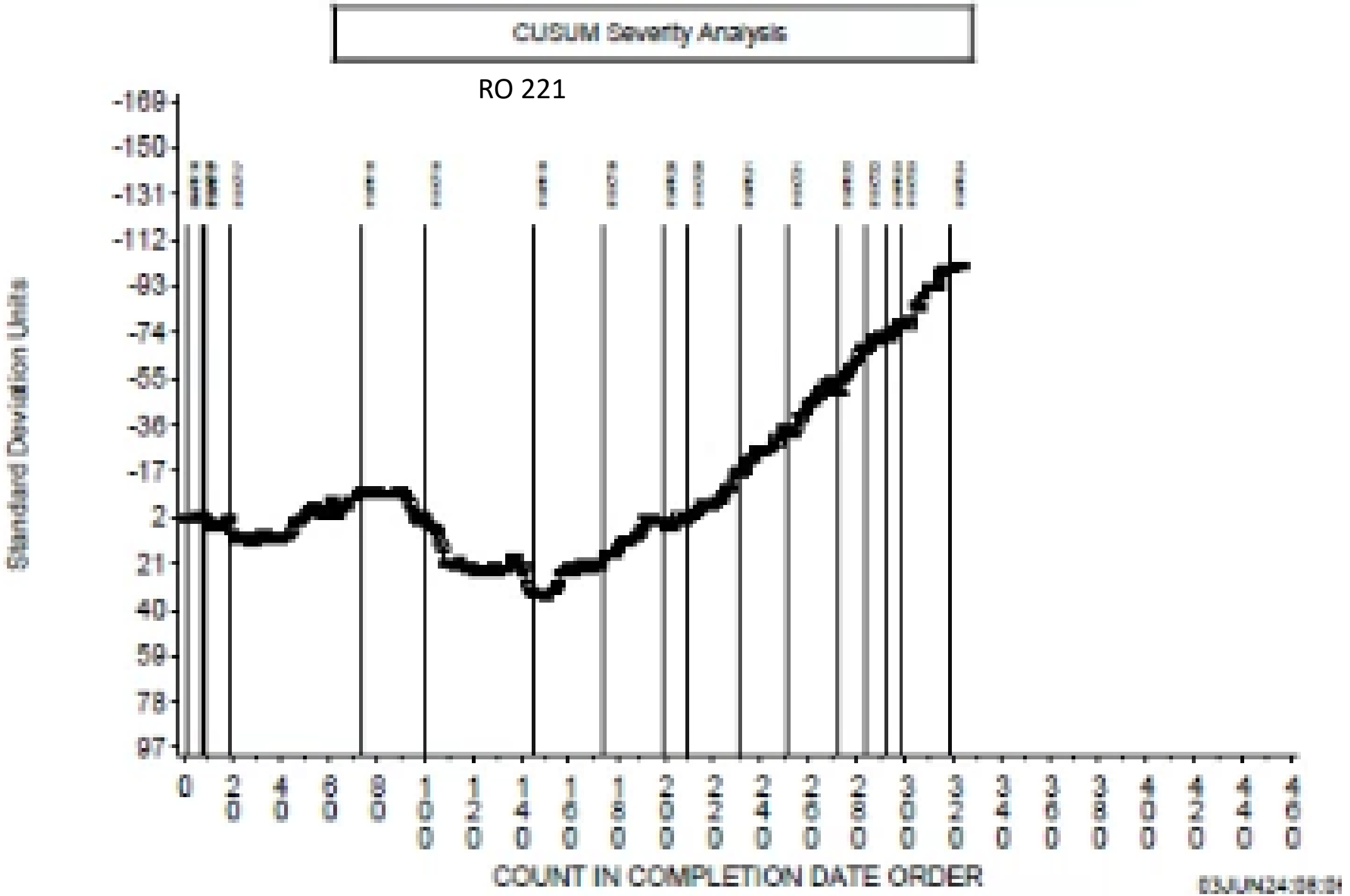
CUSUM Severity Analysis
RO 221
Standard Deviation Units
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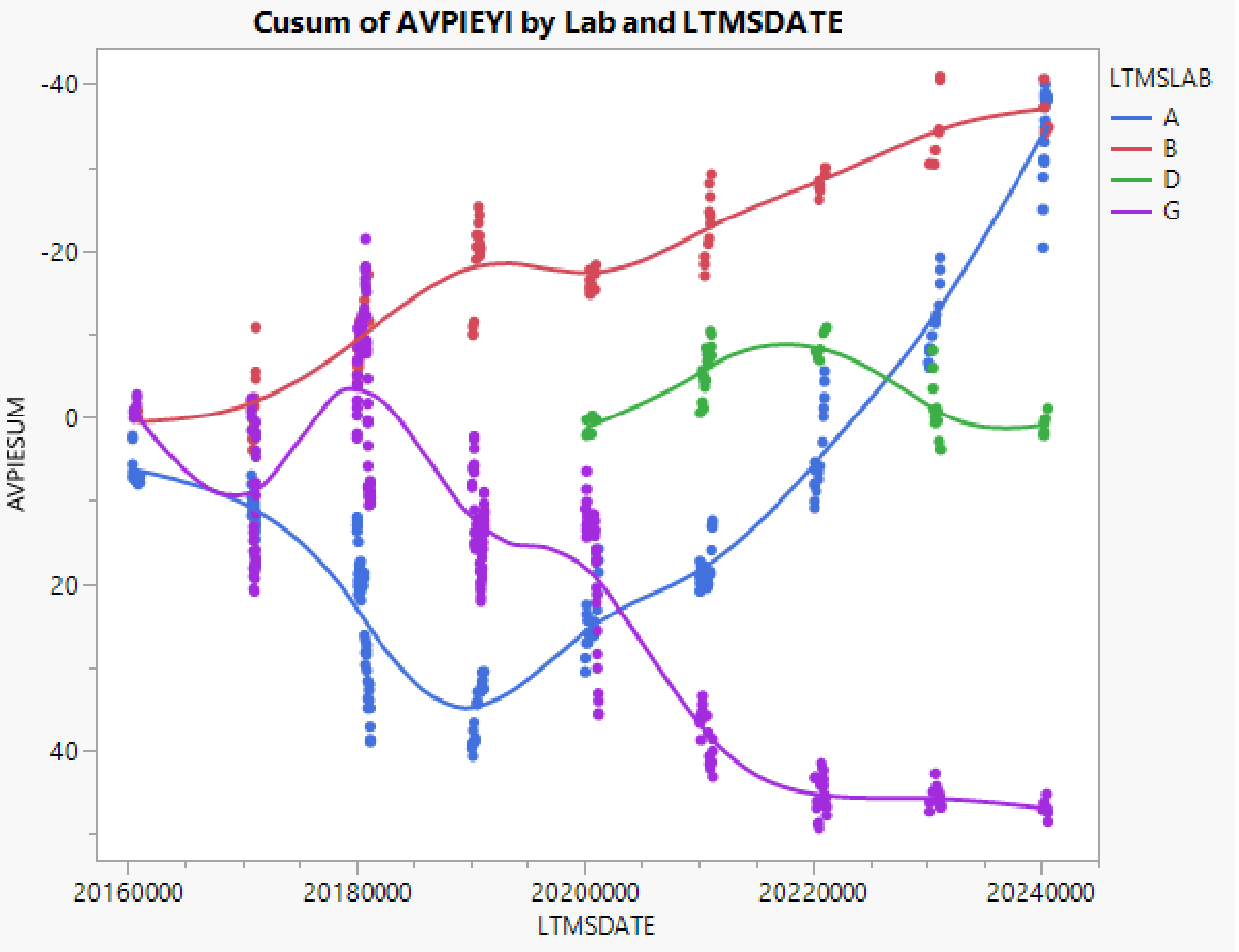
COUNT IN COMPLETION DATE ORDER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Oil Inventories

- Sequence IX Oils

  Reference oil 221, 46.5 gallons at TMC, actively pursuing reblend, should be available later this year.

  Reference oil 224-1, 3.5 gallons at TMC, depleted.

  Reference oil 224-2, 725 gallons at TMC, several cans at labs, need to introduce (1 test on IMTS pistons)

  Sequence IXAGED, Both original blends depleted, 500 gallon reblends of each available. Next reference sequence in at least two labs will need to be on reblends.

CHRISTINE EICKSTEAD

JUNE 2024

IX SP Items

PROCEDURE CLEAN-UP – Engine Break-In Iterations

- Problem:
  - The LSPI procedure specifies that new engines run an 8-hour break-in using RO 220.
  - The procedure does not call for the standard-practice four iterations run on RO 220.
    - It seems that all labs are running these (?), but the procedure doesn't actually give instructions for them.

PROCEDURE CLEAN-UP – Engine Break-In Iterations

- Background:

> 8.10 *New-Engine Break In*—Once a new engine has been installed on the test stand, perform the eight-hour break-in procedure shown in Table 6 using oil TMC 220.[26]

TABLE 6 Sequence IX Eight-Hour, Break-In Procedure

Step	Engine Speed, r/min	Engine Torque, N·m	Time per Stage, h:min	Total Time, h:min
Install new oil filter and charge engine with 4.2 kg of new oil				
1	1000[A]	0	0:30	0:30
Oil change 1: Shut engine down, drain used oil, and remove oil filter. Allow oil to drain for 20 min. Install new oil filter and add 4.2 kg of new oil. Start engine and idle for 5 min				
2	1500	38	0:30	1:00
3	2000	72	0:30	1:30
4	2500	111	0:30	2:00
5	3000	135	0:30	2:30
6	3000	150	3:15	5:45
7	2000	72	0:15	6:00
8	3250	155	0:15	6:15
9	3500	155	0:15	6:30
10	3750	155	0:15	6:45
11	4000	155	1:15	8:00
Bring engine to idle speed for 5 min, then shut down				
Oil change 2: Drain used oil and remove oil filter. Allow oil to drain for 20 min. Install new oil filter and add 4.2 kg new oil.				

[A] Idle speed.

Instructions for flush and oil charge after 8-hour break-in, but no instructions for what to actually *do* with this charge.

PROCEDURE CLEAN-UP – Engine Break-In Iterations

- Info from Minutes:
  - The most recent mention of RO 220 in the minutes was from a Task Force meeting on 7 April 2017 (note: this was before RO 224 was introduced):

Discussion 1	Since TMC 220 is closest to the pass/fail limits, how do we incorporate it into the reference procedure?

Motions

Motion 1 – Require oil TMC 220 to be run with every 3rd and 5th reference sequences. Calibration status will not be granted until the TMC 220 oil has been completed and accepted.

Made by Ron Romano, Seconded by Charlie Leverett

Yes - 8

No – 2

Waive – 2

The resolution of this motion is tabled for discussion for inclusion in the test procedure.

  - There is no further discussion or resolution of this topic.

PROCEDURE CLEAN-UP – Engine Break-In Iterations

- Conclusion:
  - All labs are (presumably) running the four iterations on RO 220 following the 8-hour break-in. These have been discussed in previous Industry meetings.
  - Exclusion from the procedure was probably an oversight that just needs to be cleaned up.

PROCEDURE CLEAN-UP – Engine Break-In Iterations

- Proposal:
  - Modify para. 8.10 as follows:

8.10 *New-Engine Break In*—Once a new engine has been installed on the test stand, perform the eight-hour break-in procedure shown in Table 2 using oil TMC 220. Once the break-in is complete, run four standard LSPI iterations using RO 220. Refer to 11.3 and 11.3.1.

- Modify Table 2 as follows:

TABLE 2 Sequence IX Eight-Hour, Break-In Procedure

Step	Engine speed, r/min	Engine torque, N•m	Time per stage, h:min	Total Time, h:min
Install new oil filter and charge engine with 4.2 kg of new oil				
1	1000[A]	0	0:30	0:30
Oil change 1: Shut engine down, drain used oil, and remove oil filter. Allow oil to drain for 20 min. Install new oil filter and add 4.2 kg of new oil.				
Start engine and idle for 5 min				
2	1500	38	0:30	1:00
3	2000	72	0:30	1:30
4	2500	111	0:30	2:00
5	3000	135	0:30	2:30
6	3000	150	3:15	5:45
7	2000	72	0:15	6:00
8	3250	155	0:15	6:15
9	3500	155	0:15	6:30
10	3750	155	0:15	6:45
11	4000	155	1:15	8:00
Bring engine to idle speed for 5 min, then shut down				
Oil change 2: Drain used oil and remove oil filter. Allow oil to drain for 20 min. Install new oil filter and add 4.2 kg new oil.				
Complete four standard LSPI iterations using this test charge. Refer to 11.3 and 11.3.1.				

[A] Idle speed.

IMTS PISTONS

- SwRI has run an AA engine with the latest set of IMTS pistons installed. This testing was conducted on a stand just out of reference.

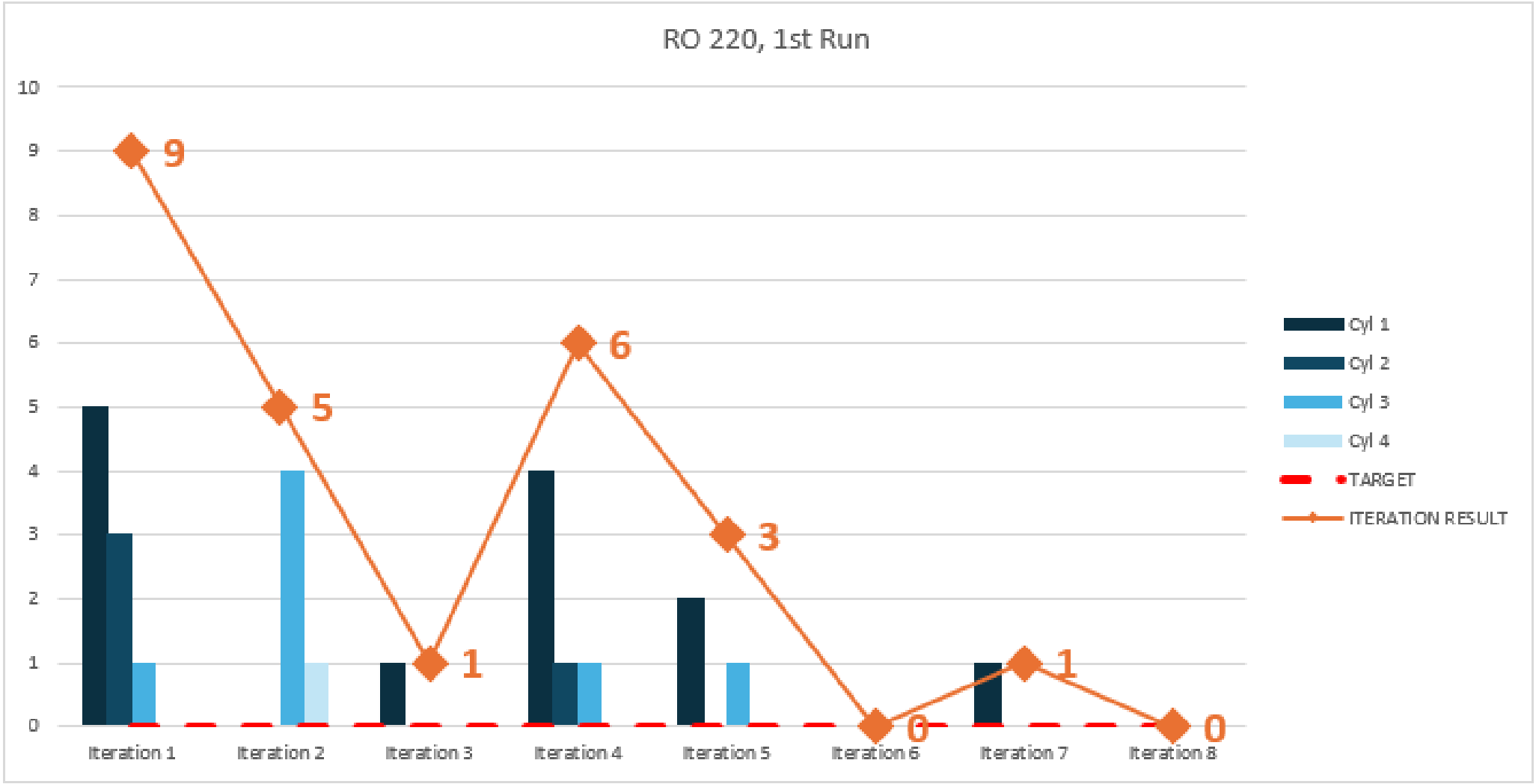
IMTS PISTONS

- Measurements:

Cylinder Number	Location	Piston Diameter		Piston Clearance	
		Longitudinal, mm	Transverse, mm	Longitudinal, mm	Transverse, mm
1	Top Land	86.769	86.897		
	2nd Land	86.338	86.447		
	3rd land	86.767	86.878		
	Skirt		87.455	0.053	
2	Top Land	86.765	86.894		
	2nd Land	86.328	86.453		
	3rd land	86.76	86.875		
	Skirt		87.457	0.051	
3	Top Land	86.74	86.895		
	2nd Land	86.335	86.454		
	3rd land	86.765	86.878		
	Skirt		87.457	0.050	
4	Top Land	86.768	86.895		
	2nd Land	86.335	86.454		
	3rd land	86.765	86.879		
	Skirt		87.455	0.054	

- Note: Piston skirt diameter includes coating of roughly 0.025mm. The OEM clearance spec is 0.0225-0.0475 mm.

IMTS PISTONS – RO 220



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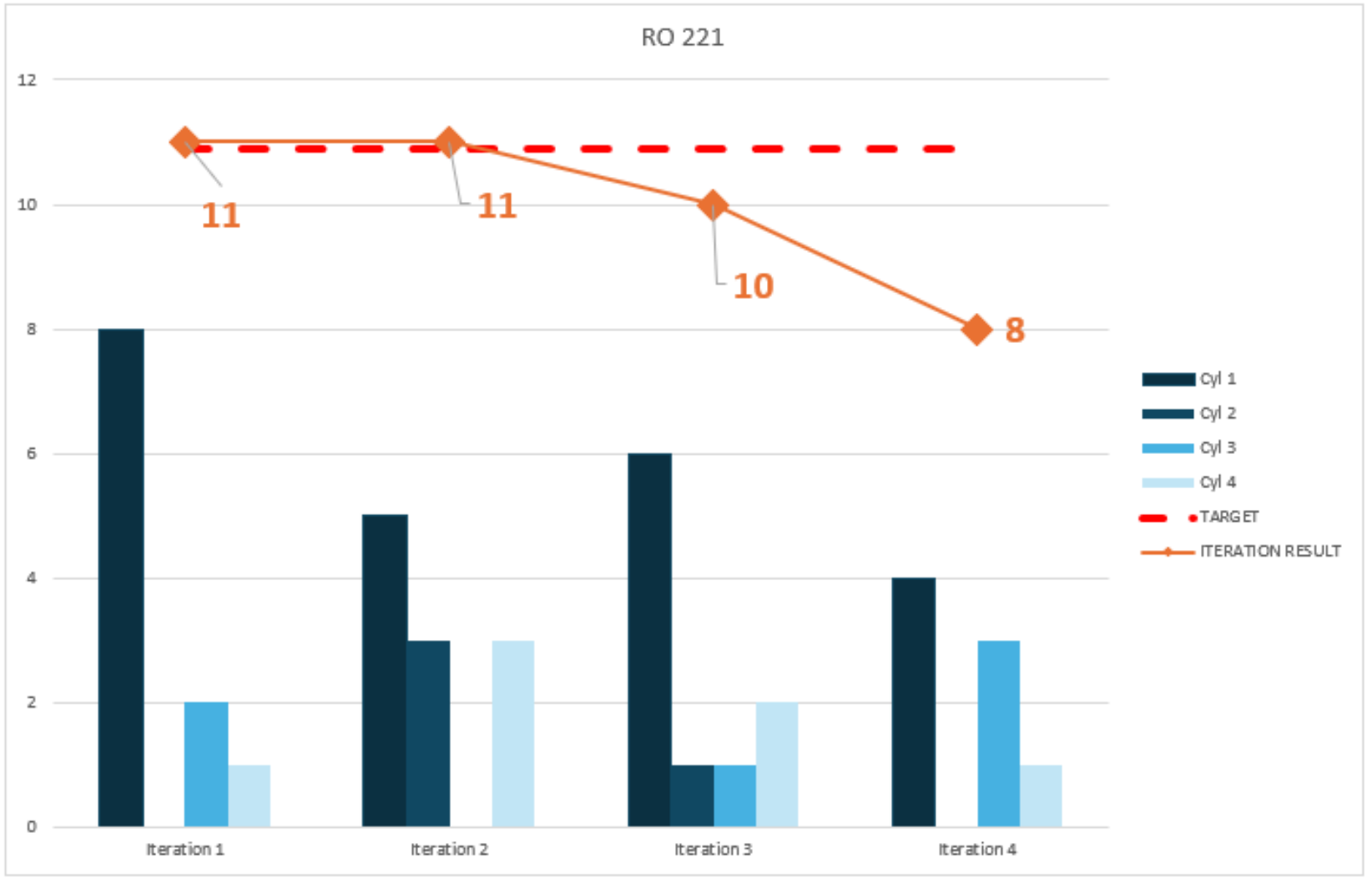
IMTS PISTONS – RO 221



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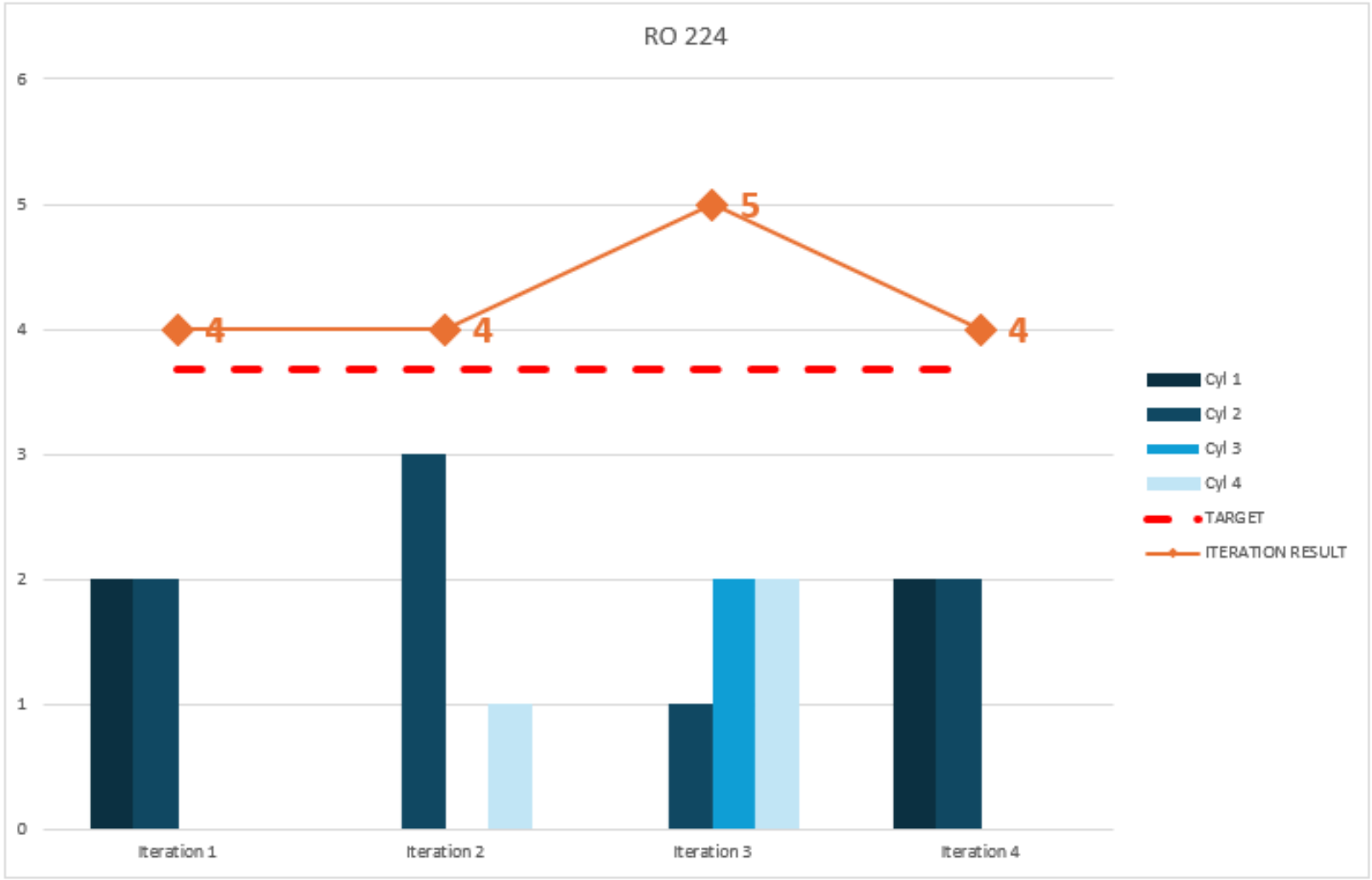
IMTS PISTONS – RO 224



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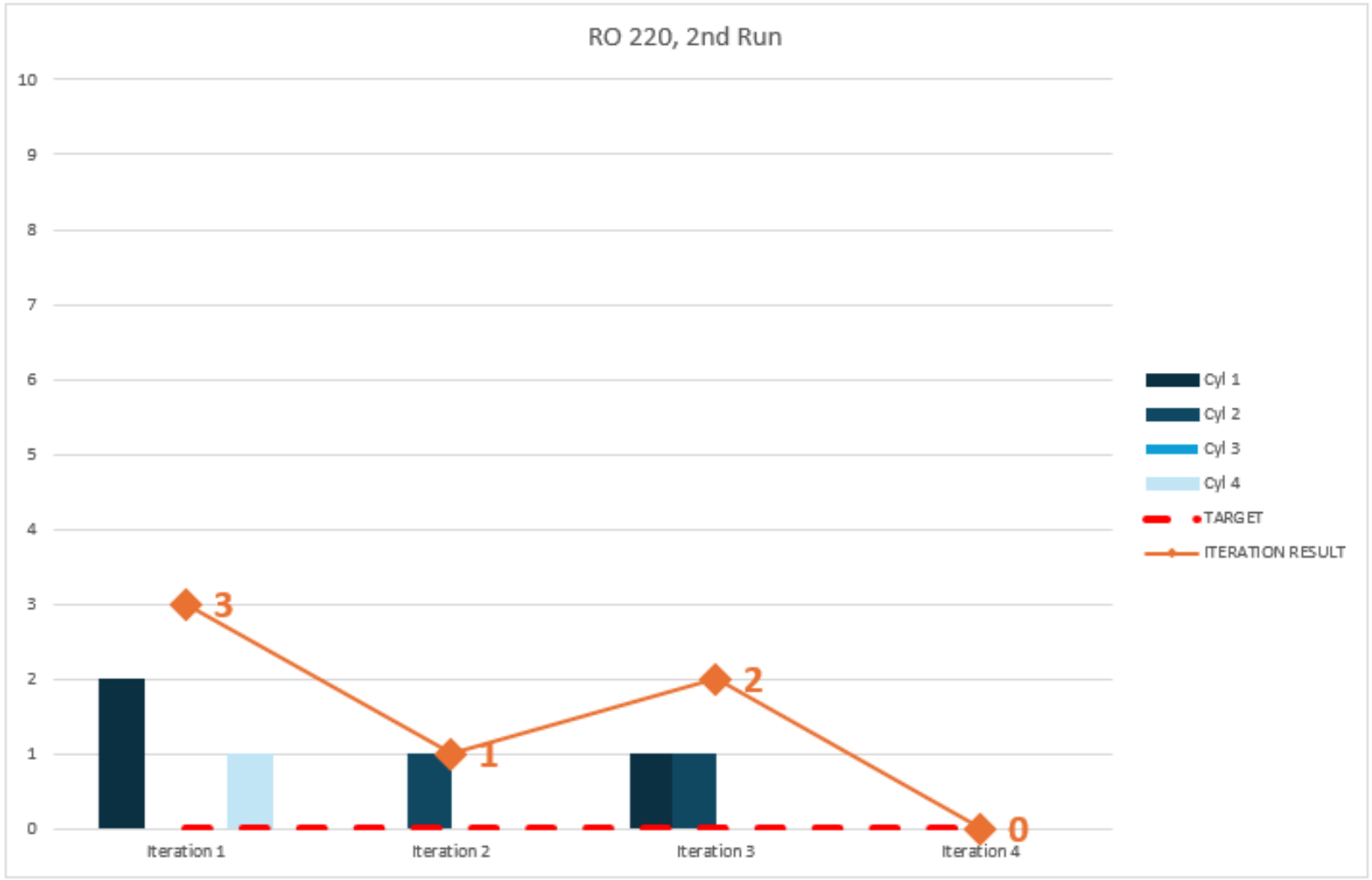
IMTS PISTONS – RO 220



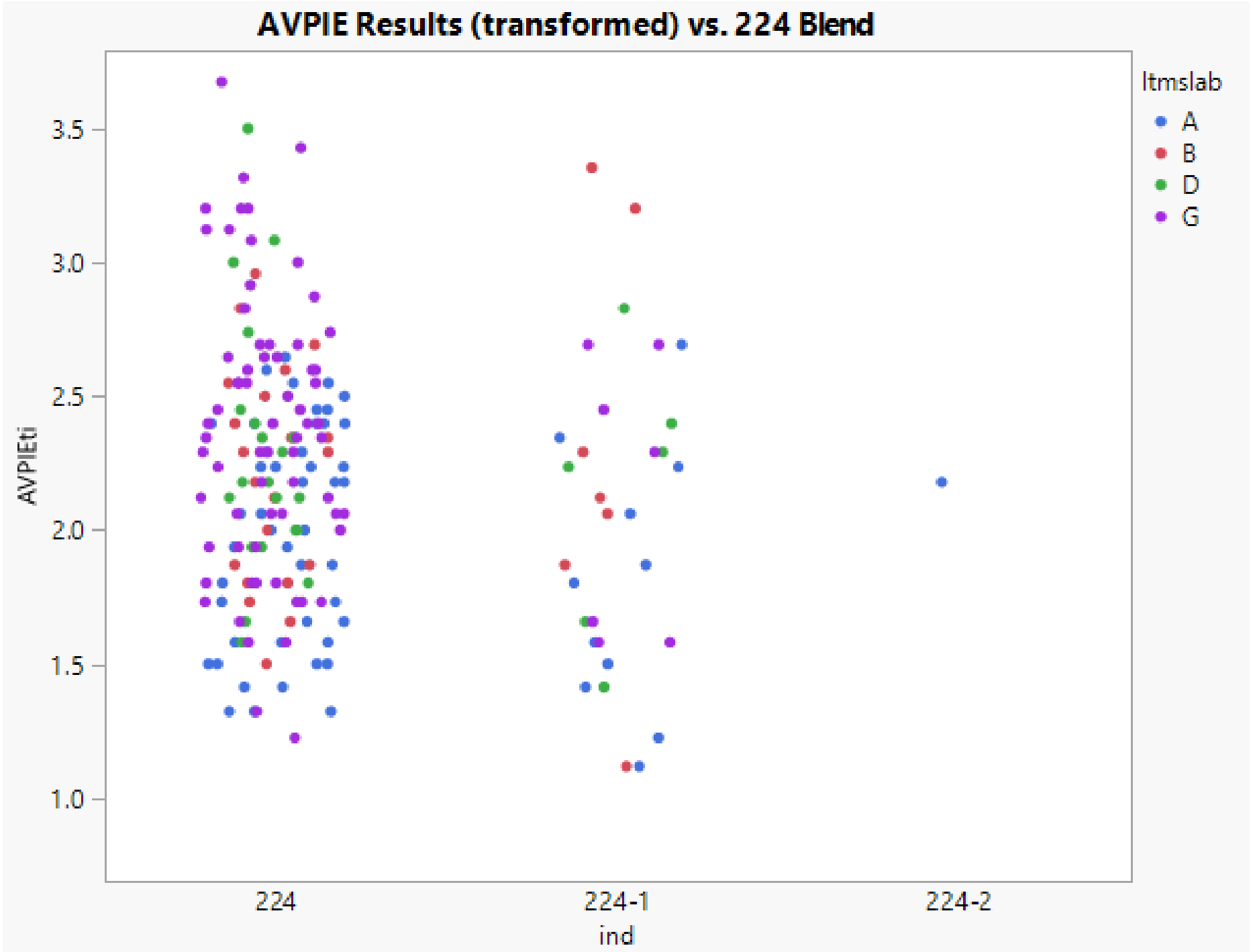
AvPIE = 1.5

IMTS PISTONS

- Summary:
  - The IMTS piston engine showed higher-than-normal activity on RO 220.
  - The IMTS piston engine was on target on both ROs 221 and 224.

- Conclusion:
  - While the activity on RO 220 is unusual, RO 220 performance is not an acceptance criteria.
  - The engine was on target on the two required ROs, 221 and 224.
  - The IMTS piston engine meets the requirements the group has previously used to introduce new piston hardware to this test (dealer pistons, machined pistons).

- Proposal:
  - SwRI proposes that IMTS pistons be approved for use in the LSPI test.


AVPIE Results (transformed) vs. 224 Blend
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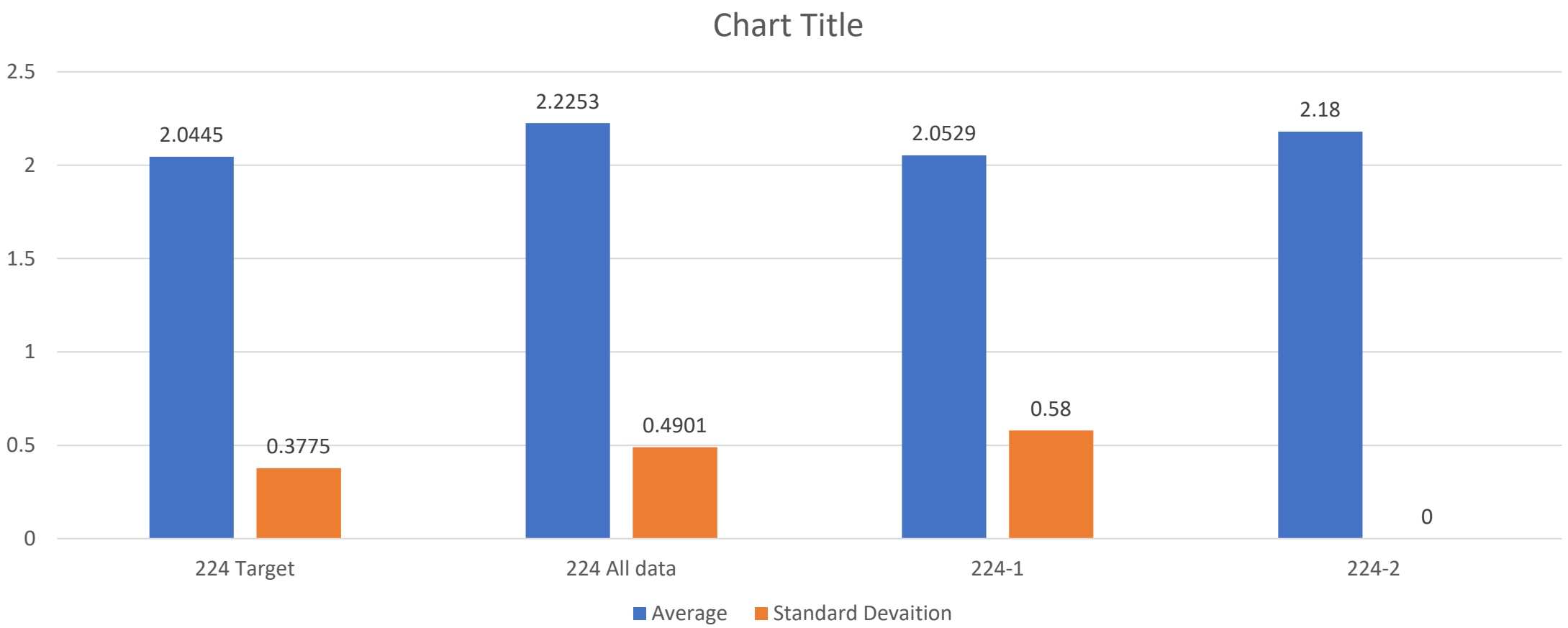
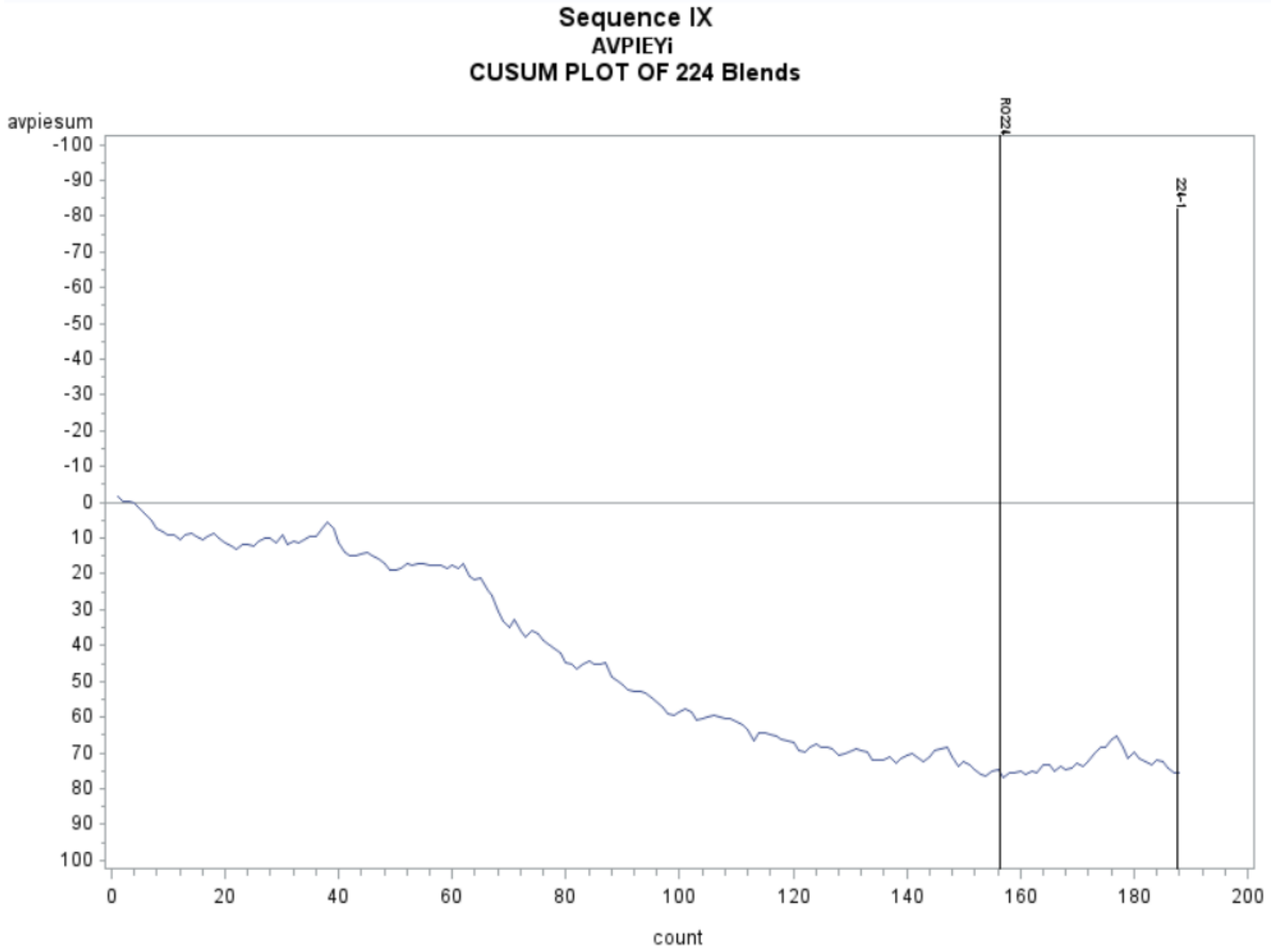


Note: 224-2 Result is on IMTS Pistons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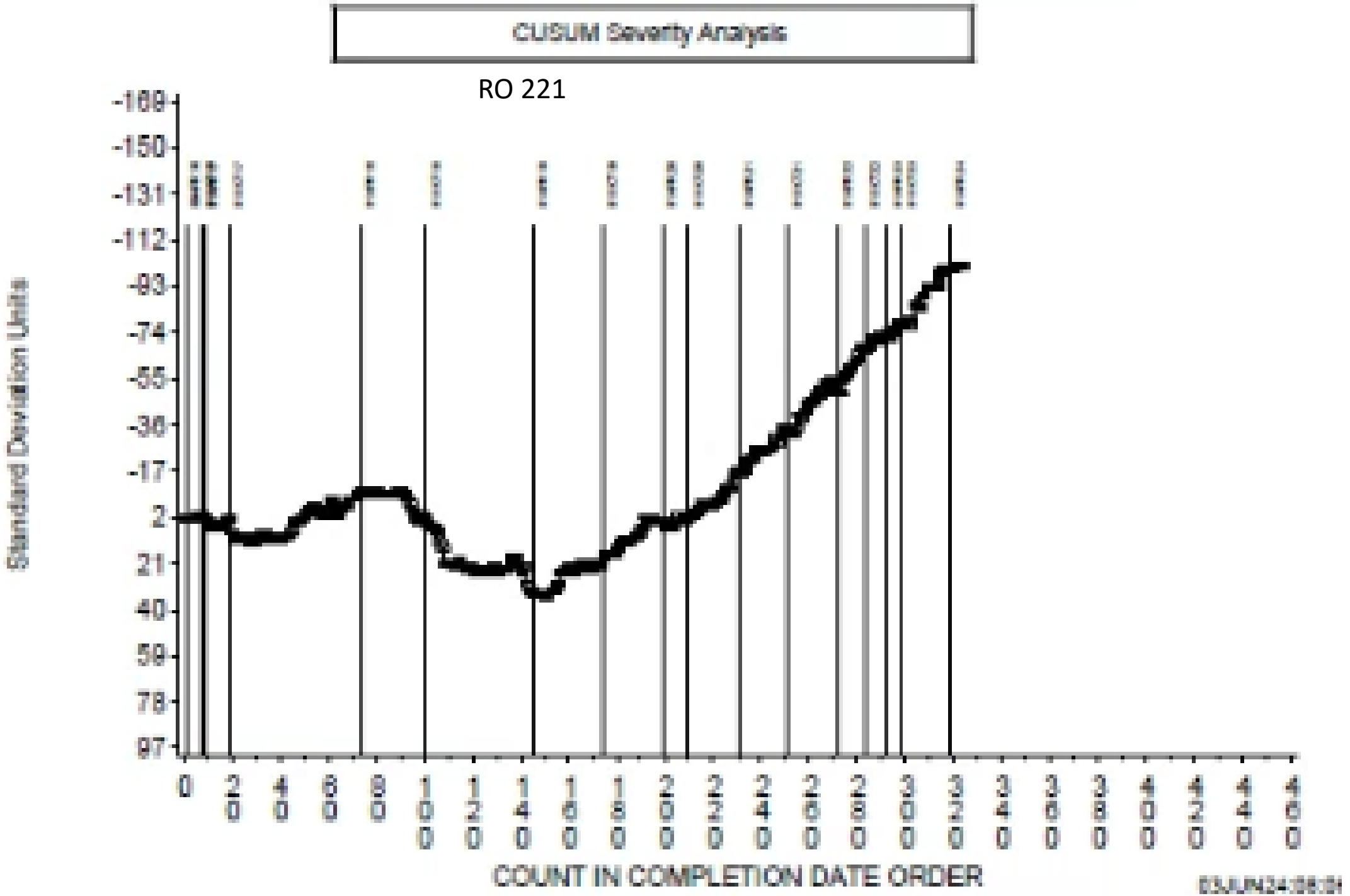
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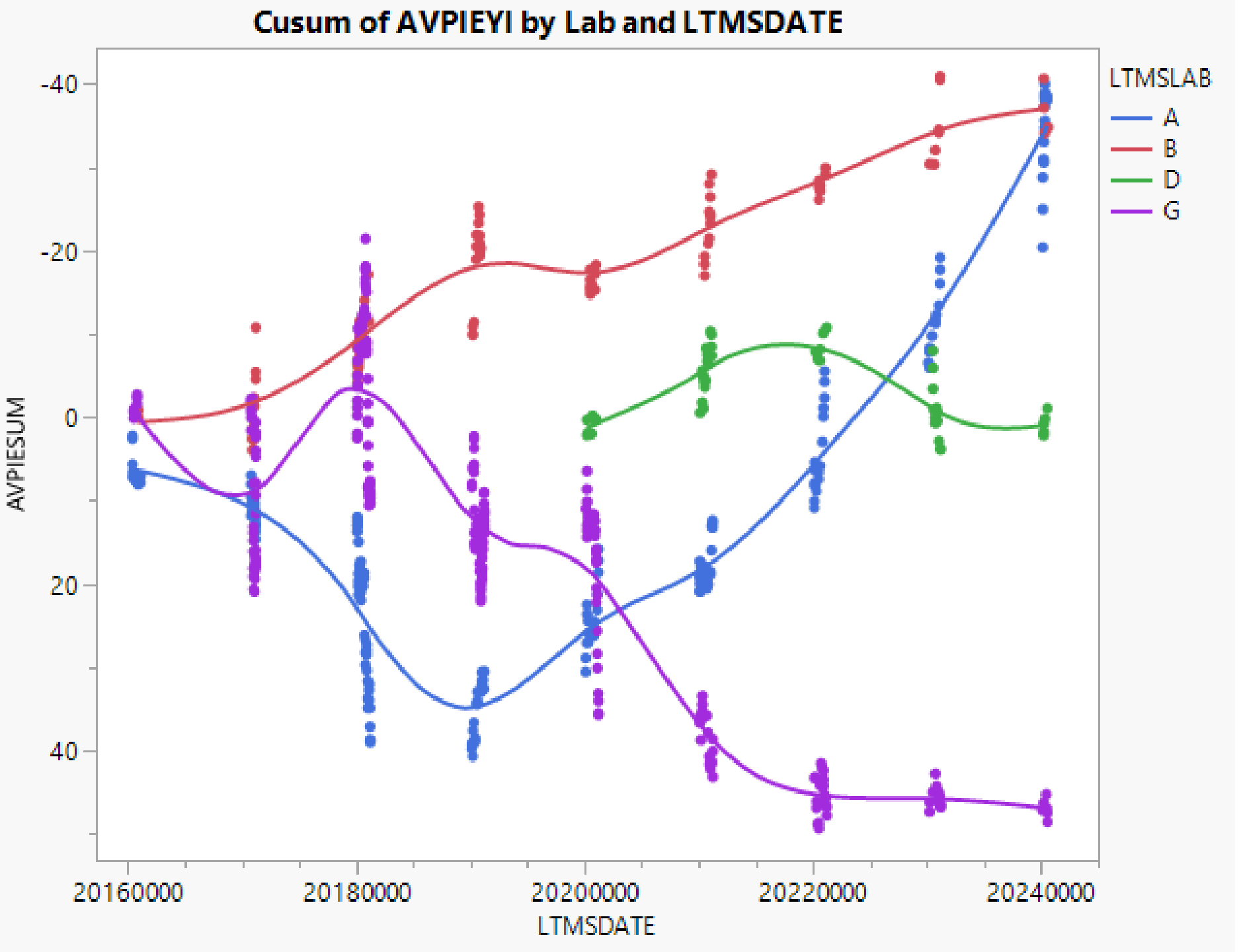
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LTMSLAB
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B
D
G

Oil Inventories

- Sequence IX Oils

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