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**COMMITTEE D02 ON PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS**

**CHAIRMAN:** RANDY F JENNINGS, TENNESSEE DEPT OF AGRIC, P O Box 40627, NASHVILLE, TN 37204, UNITED STATES (615) 837-5327, FAX: (615) 837-5335, E-MAIL: RANDY.JENNINGS@TN.GOV  
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Originally Issued: December , 2022

Reply to: Richard Grundza  
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Unapproved Minutes of the November 16, 2022  
Sequence IV Surveillance Panel Meeting.

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The meeting was called to order by Chairman Buscher at 8:00 AM Central Time.

A copy of the agenda is included as attachment 1.

A list of attendees is included as attachment 2.

Membership changes noted were Izabela Gabriel replaces Tracey King for Haltermann Carliss, Bill Hairston replaces Prasad Tumati for Haltermann Solutions, George Szappanos replaces Andrew Stevens for Lubrizol and Andrew Rohlfing replaces Ben Maddock for Afton.

Minutes from the 7/29/21 meeting were approved by voice vote.

The status of action items from the previous meeting(s) were reviewed as documented in attachment 3. All items were completed as documented in the attachment.

The panel discussed hardware for the Sequence IVA and IVB tests. The panel also reviewed the CPD report. All the hardware updates are included as attachment 4.

The panel reviewed the current industry charts and discussed the mild trend for both Average Volume loss and Iron (See attachment 5). During the meeting, the panel was informed that the KA24E fuel is stored in rail cars under 5 psi nitrogen blanket. The panel agreed to evaluate distillation and fuel dilution effects on severity as well as any fuel batch influence and planned a conference call for the week of 11/27/22.

The panel reviewed the documents and actions surrounding lobe failures and agreed that lobe failure was primarily a chemistry phenomenon and plans no further action on this item.

The panel reviewed the Chair's planned report to Subcommittee D02.B01, see attachment 6.

The remainder of the meeting was spent discussing continuing viability of the Sequence IVA test. Sources of IVA hardware were investigated and hardware is no longer available from Nissan or Nissan suppliers. Aftermarket hardware was evaluated, and while a source for cams was found, the manufacturing process is considerably different. Cams, especially, would be flame hardened where the Nissan hardware was quench hardened. Given these differences, the panel agreed that this situation was not ideal and agreed not to pursue it. Intertek currently has a limited amount of hardware and will no longer offer the test once this hardware is depleted. SwRI has 80-90 tests worth of kits left and could continue to have the test available for several years. The panel agreed to have the chair report the inform CLOG of the IVA hardware situation and follow up on any response from CLOG. Given the limited hardware, the panel agreed to allow calibration periods to be increased to 1 year or 15 test. Effective for tests completing on or after 11/16/22.

The panel reviewed and updated the scope and objectives of the Sequence IV panel. The updated scope and objectives are included as attachment 7.

Attachment 8 includes the motion and action items recorded during this meeting.

## **Sequence IV Surveillance Panel**

San Antonio, TX

Intertek – Port San Antonio

November 15, 2022








8:00 a.m. - 12:00 p.m.

### A G E N D A

1. Chairman comments.
2. Attendance sign-in sheet distribution.
3. Membership changes.
4. Approval of minutes for July 29, 2021
5. July 29, 2021 action item review.
6. Fuel supplier report – KA24E Green fuel.
7. CPD inventory status report.
8. TMC report.
9. Sequence IVB Zi action alarms for AVLI and FE.
10. Sequence IVB lobe failure investigation and SP response to ACC PAPTG.
11. Sequence IVA end of life / availability.
12. Review scope & objectives
13. Old business.
14. New business.
15. Motion and action item review.
16. Next meeting.
17. Adjourn.


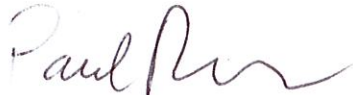






**MEMBERSHIP  
SEQUENCE IV SURVEILLANCE PANEL**

November 15, 2022

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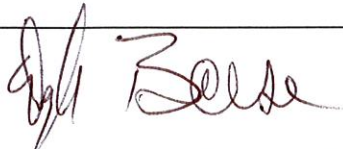



**MEMBERSHIP  
SEQUENCE IV SURVEILLANCE PANEL**

November 15, 2022

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Catanese Tony	Company: Lubrizol Phone No.: 216-225-5733 Cell No.: Email: <a href="mailto:tony.catanese@lubrizol.com">tony.catanese@lubrizol.com</a>	
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SEQUENCE IV SURVEILLANCE PANEL**

November 15, 2022

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Campbell, Bob	Company: Phone No.: Cell No.: Email:	
Castanien, Chris	Company: Phone No.: Cell No.: Email:	
Clark, Sid	Company: Phone No.: Cell No.: Email:	
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Dvorak, Todd	Company: Phone No.: Cell No.: Email:	
Hirano, Satoshi	Company: Phone No.: Cell No.: Email:	
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Kostan, Travis	Company: Phone No.: Cell No.: Email:	
Lang, Patrick	Company: Phone No.: Cell No.: Email:	

**NON-MEMBER MAILING LIST  
SEQUENCE IV SURVEILLANCE PANEL**

November 15, 2022

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Matthews, Tim	Company: Phone No.: Cell No.: Email:	
Meier, Adam	Company: Phone No.: Cell No.: Email:	
Okuda, Sachiko	Company: Phone No.: Cell No.: Email:	
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Affinito, Ricardo	Company: Oranite Phone No.: 713-954-6170 Cell No.: 510-230-7919 Email: affinito@chevron.com	
	Company: Phone No.: Cell No.: Email:	
	Company: Phone No.: Cell No.: Email:	

Sequence IV Surveillance Panel  
July 29, 2021  
7:00AM – 9:00AM  
Conference Call

Motions and Action Items

As Recorded at the Meeting by Bill Buscher

1. Action Item – The Sequence IV Surveillance Panel chair to contact the CLOG chair to obtain an update on the CLOG response and potential request to the Sequence IV Surveillance Panel for addressing Sequence IVA end of life / availability.  
**Completed. Email sent 8/3/2021.**
2. Action Item – The Sequence IV Surveillance Panel chair to distribute the Sequence IVA SAE paper number to surveillance panel members.  
**Completed.**
3. Motion – The Sequence IV Surveillance Panel approves revision to the Sequence IVB test procedure (D8350) to replace ASTM REO 1006-2 with ASTM REO SL-107 for the initial break-in / aging oil. Effective 7/29/2021.  
William Buscher / Andrew Stevens / Passed Unanimously 16 – 0 – 0  
**Completed. Sequence IVB Information Letter 21-2 issued 8/3/2021.**
4. Motion – The Sequence IV Surveillance Panel approves revision to the Sequence IVB test procedure (D8350) to align full stand instrument calibration period to reference calibration period (procedure to read the same as the Sequence VH test procedure). Effective 7/29/2021.  
William Buscher / Khaled Rais / Passed Unanimously 16 – 0 – 0  
**Completed. Sequence IVB Information Letter 21-2 issued 8/3/2021.**



**Seq. IVB Inventory Status Report  
As of October 31, 2022**

**Seq. IV Surveillance Panel November 15, 2022  
&  
PCEOCP December 06, 2022**

**1. Seq. IVB Engine Inventory Life Estimates (Based on Industry Wide Consumption Rates)**

<b>Remaining Engine Inventory Life (Based on 2 Year Average Industry Consumption Rate)</b>	
Current OHTIVB-16000-2 Engine Assembly	12.21 Years
Including Engine Component Build-Out	17.47 Years

<b>Remaining Engine Inventory Life (Based on 1 Year Industry Consumption Rate)</b>	
OHTIVB-16000-2 Engine Assembly	15.93 Years
Including Engine Component Build-Out	22.60 Years

**Comments:**

- Industry Engine Consumption Rates have decreased 67.39% since 2018.
- From 2020 to October 31, 2022, Industry Engine Consumption Rates have decreased 48.28%.
- At the time of this estimate, the supplier anticipates engine consumption rates to remain the same or decrease.
- The supplier has also acquired enough ancillary engine kit materials (OHTIVB-103-1) to match our engine inventory.

**2. Seq. IVB Intake and Exhaust Camshaft Inventory Life Estimates (Based on Industry Wide Consumption Rates)**

<b>Remaining Camshaft Inventory Life (Based on 2 Year Average Consumption Rate)</b>	
Seq. IVB Intake Camshaft	20.57 Years
Seq. IVB Exhaust Camshaft	23.66 Years

<b>Remaining Camshaft Inventory Life (Based on 1 Year Consumption Rate)</b>	
Seq. IVB Intake Camshaft	30.05 Years
Seq. IVB Exhaust Camshaft	23.66 Years

**Comments:**

- From 2020 to October 31, 2022, Industry Camshaft Consumption Rates have decreased 47.26%.
- At the time of this estimate, the supplier anticipates camshaft consumption rates to remain the same or decrease.
- The supplier has also acquired enough camshaft test kit (OHTIVB-102-1) materials to match our camshaft inventory.

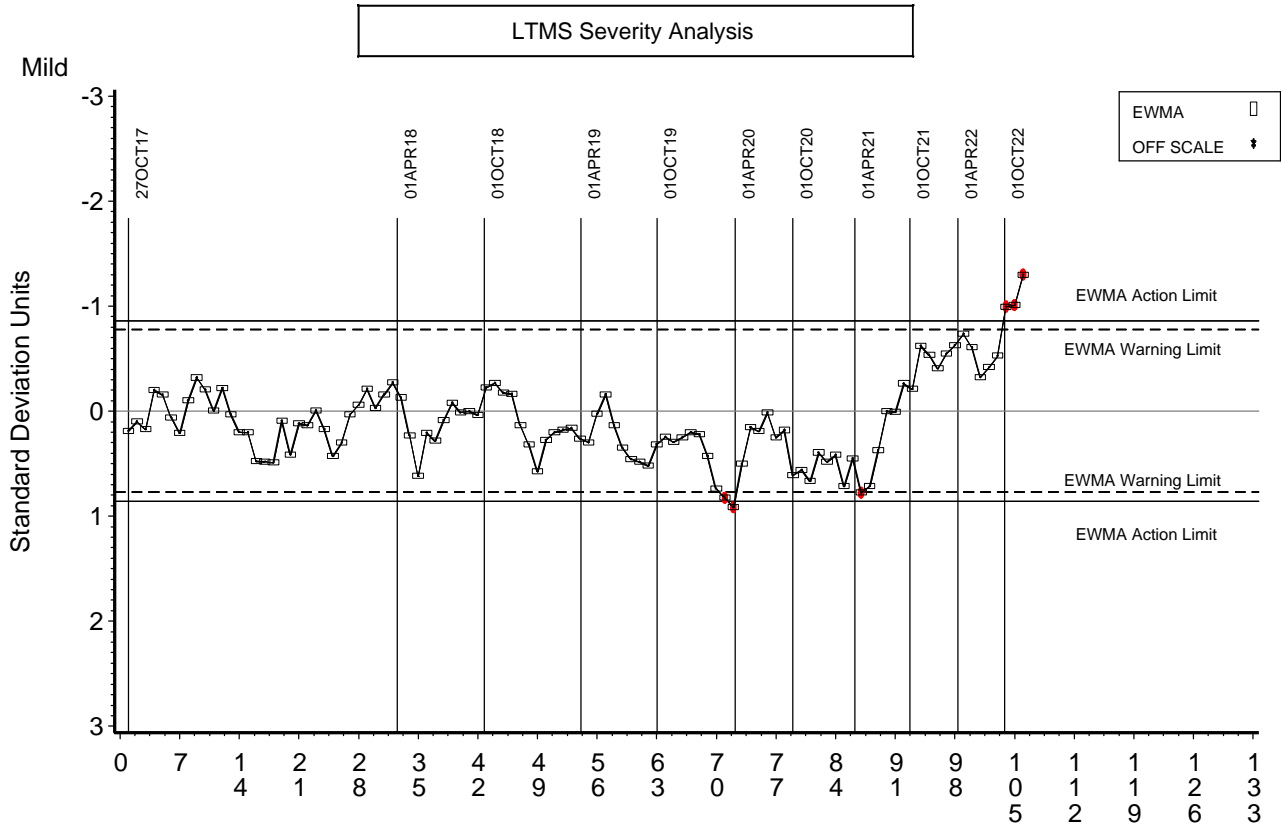
**3. Seq. IVB Test Lifters Inventory Life Estimates (Based on Industry Wide Consumption Rates)**

<b>Remaining Lifter Inventory Life (Based on 1 &amp; 2 Year Average Consumption Rate)</b>	
Minimum Inventory Life of any Given Lifter Size (1 Year Consumption Rate)	8 Years
Minimum Inventory Life of any Given Lifter Size (2 Year Consumption Rate)	10 Years

- There are 25 individual lifter grades (sizes). The remaining lifter inventory life estimate indicates the earliest depletion of any given lifter grade.
- At the time of this estimate, there is one lifter Grade that has less than 14 years remaining of inventory.
- The lifters are still in production. The supplier is in the process of acquiring additional lifters to ensure a minimum of 15 years of lifter availability for any given grade.
- At the time of this estimate, the supplier anticipates lifter consumption rates to remain the same or decrease.

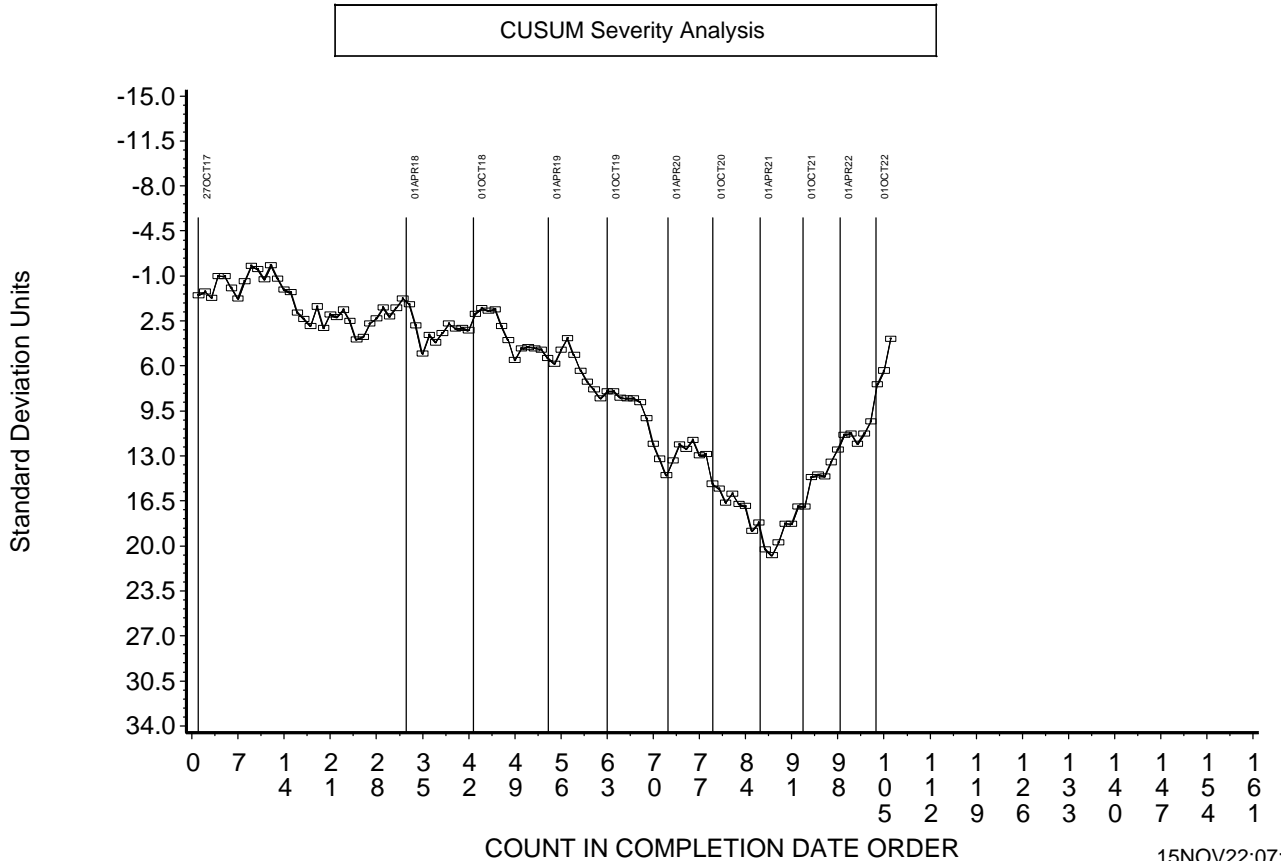
SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA

AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final



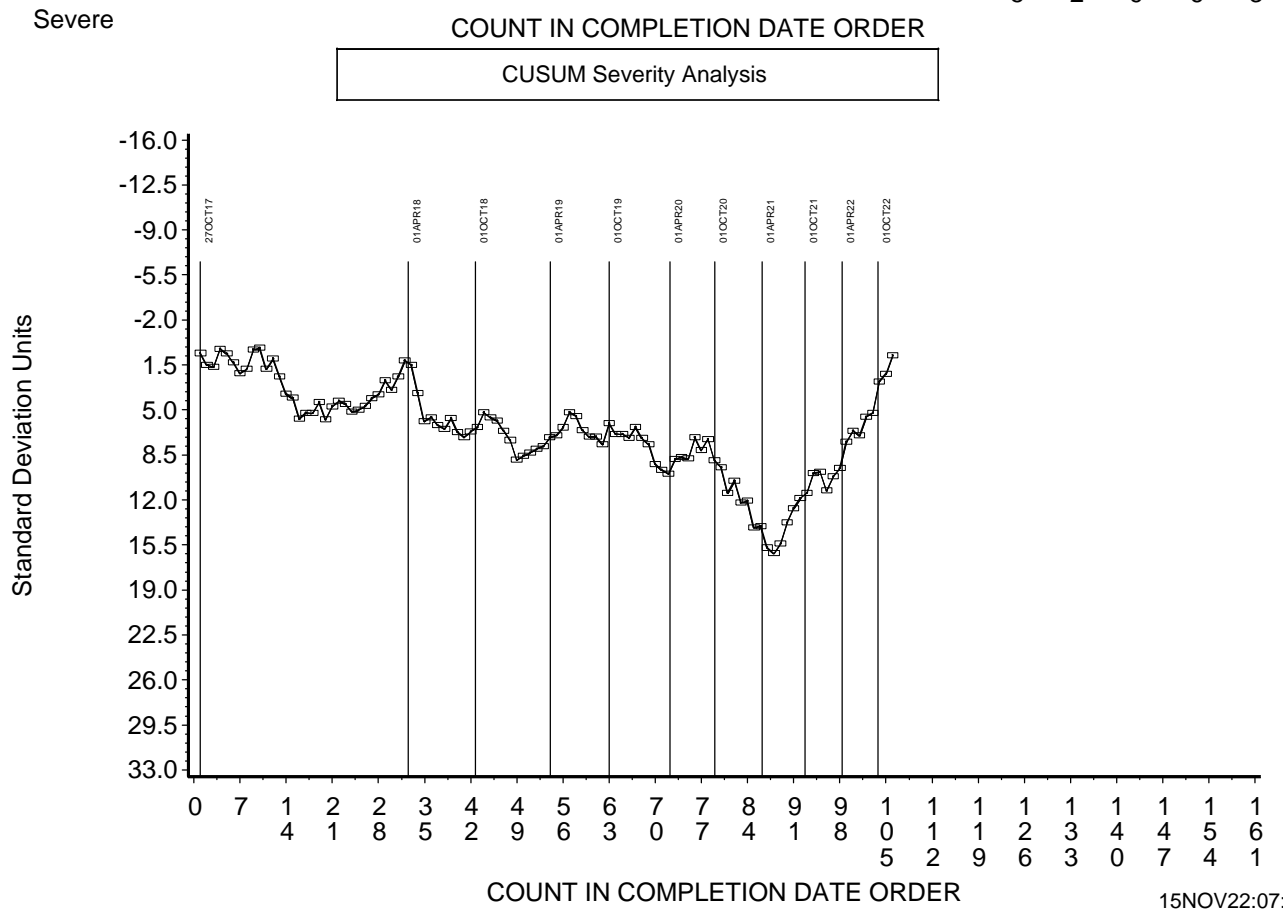
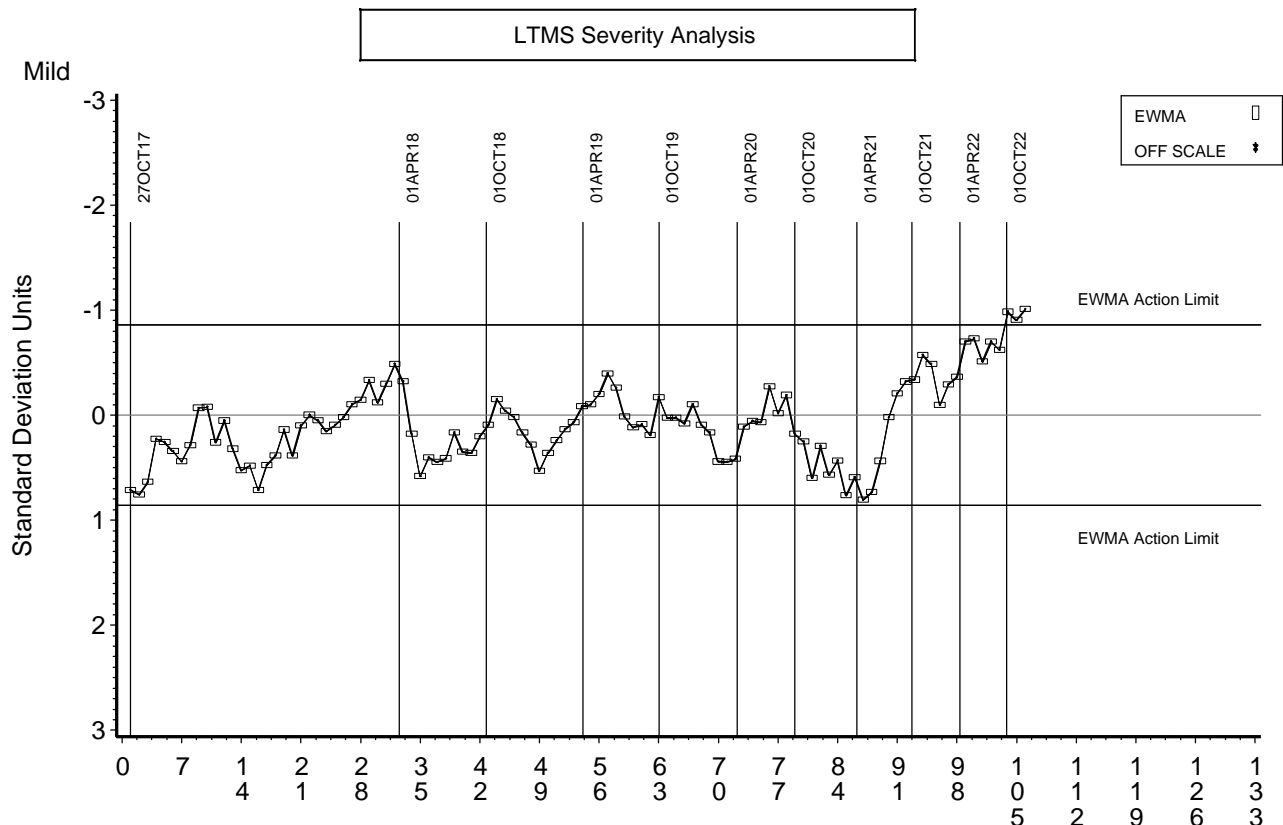
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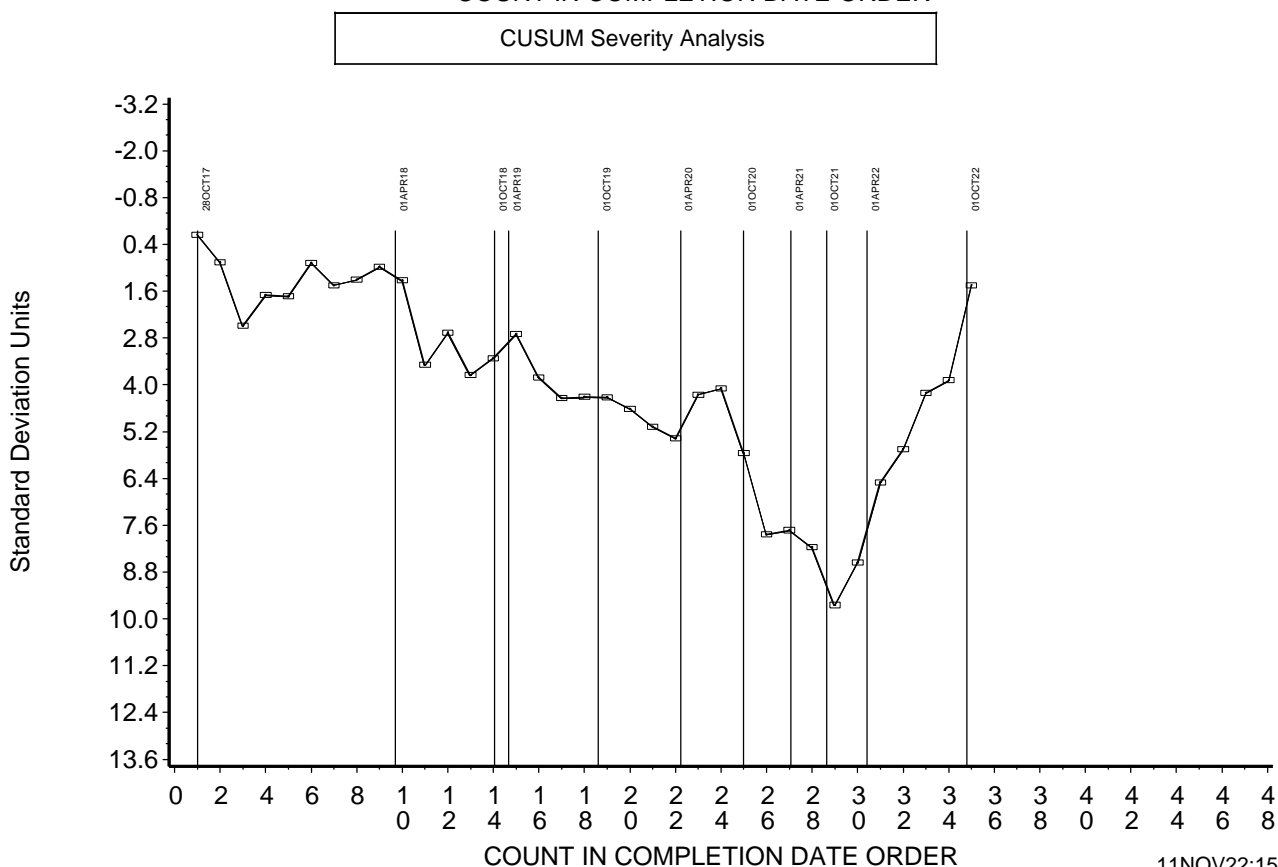
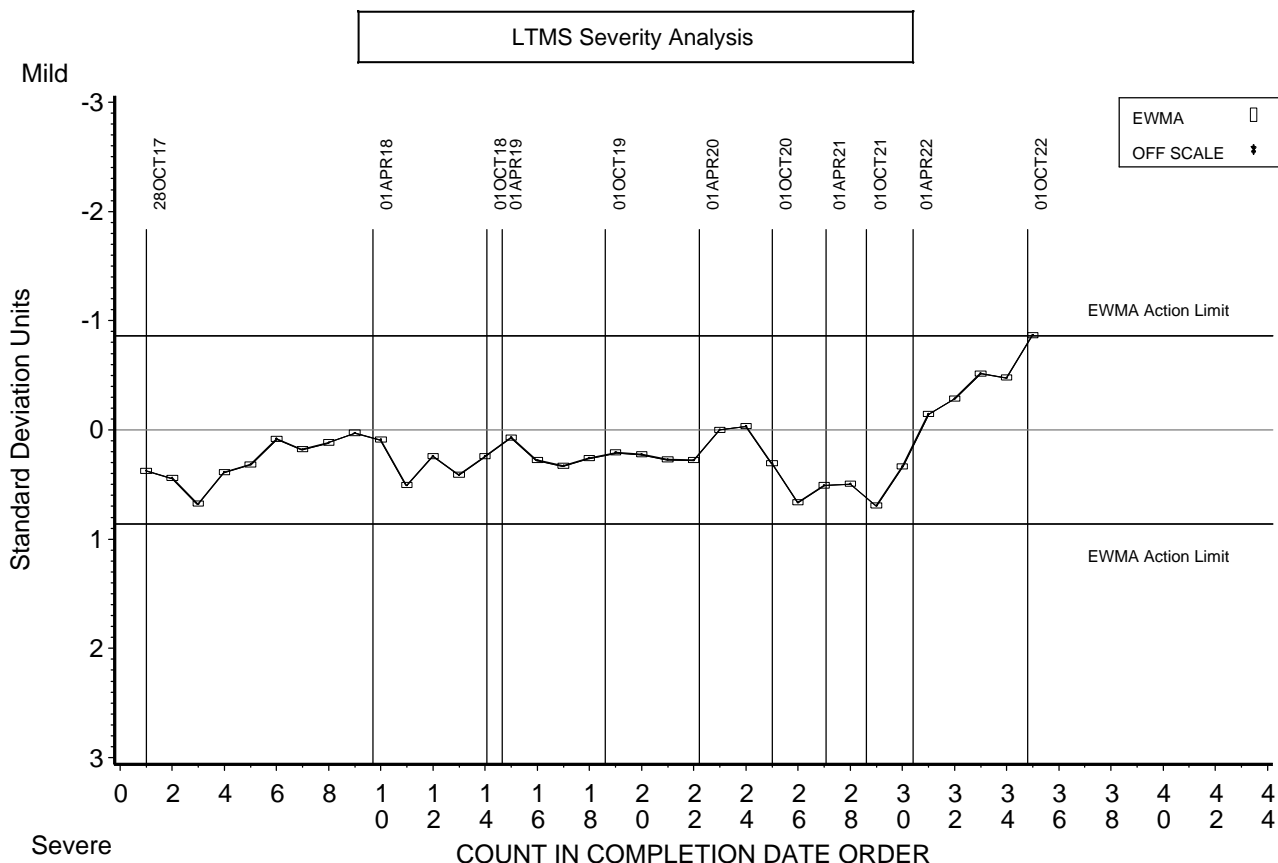


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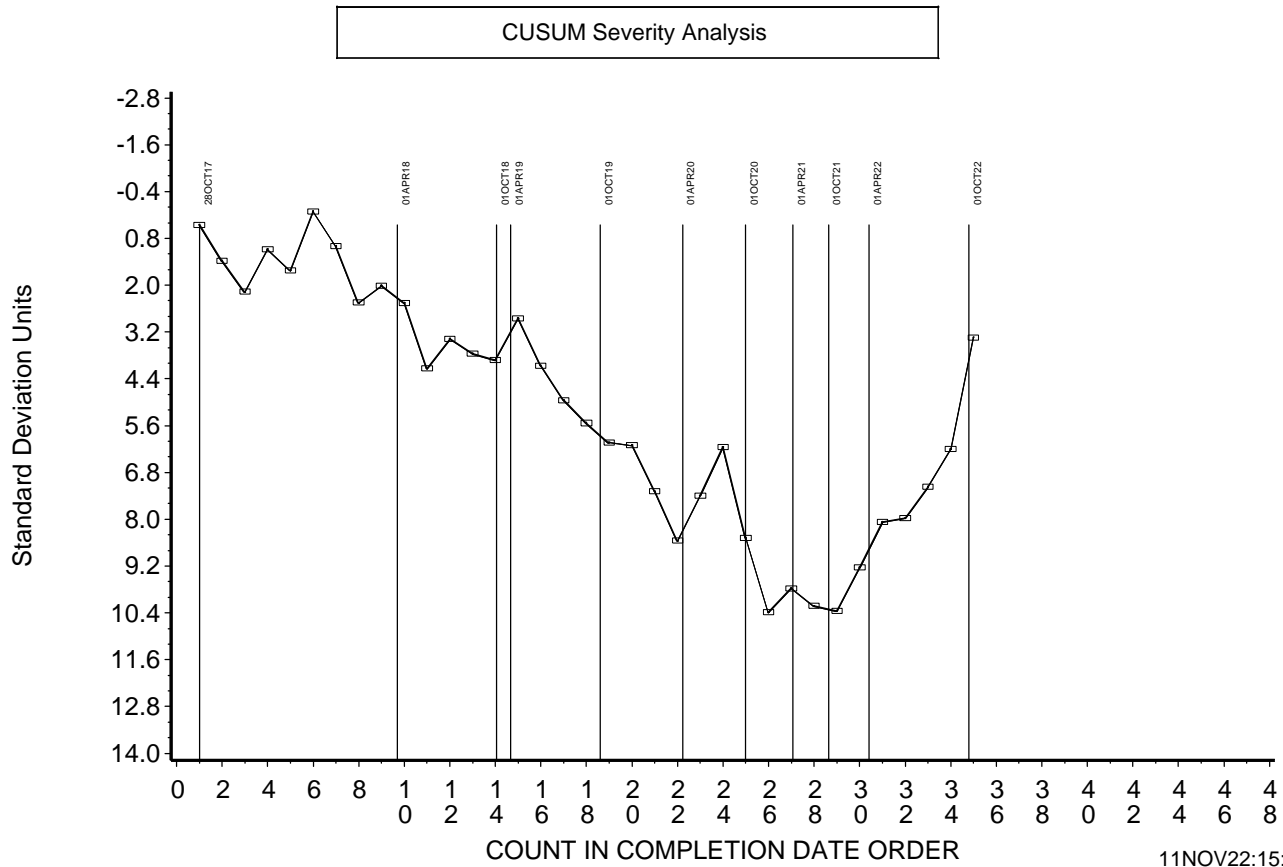
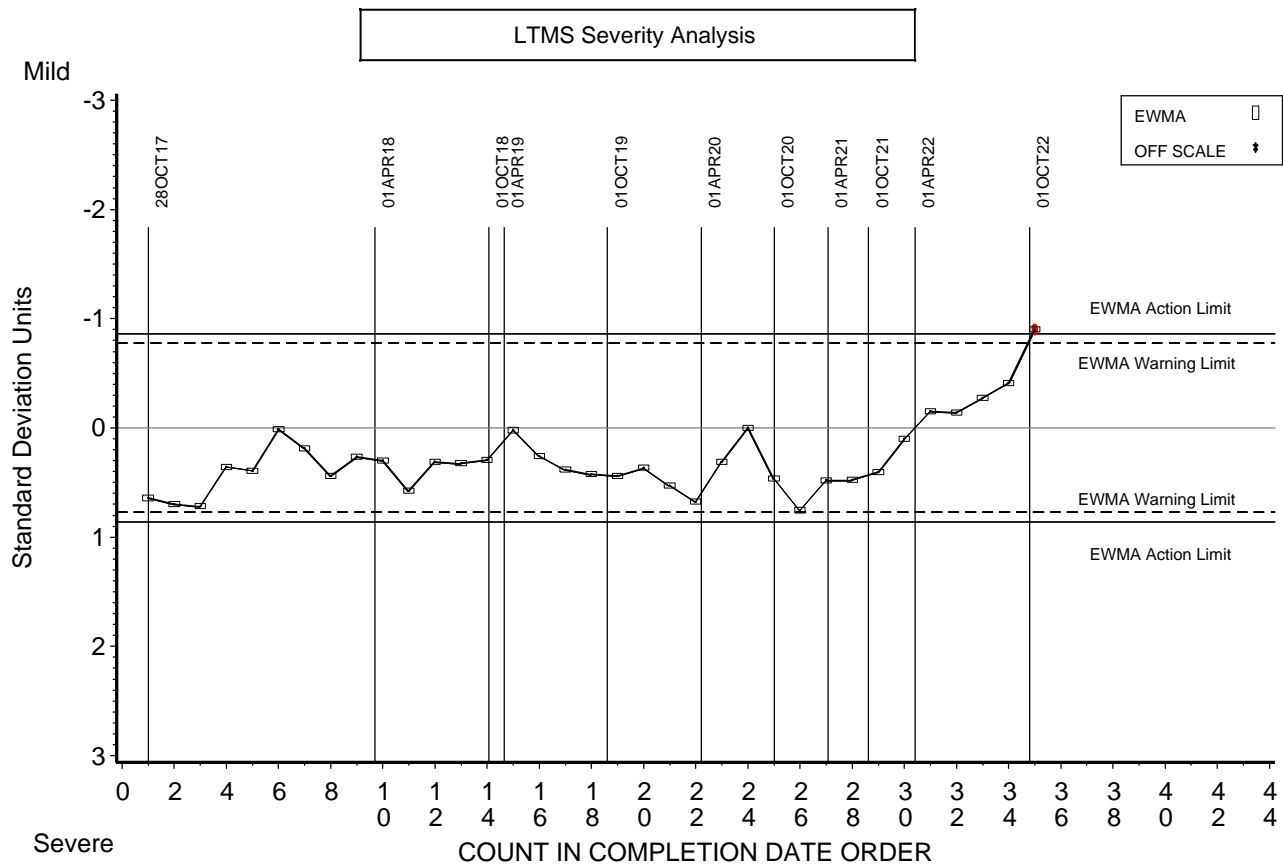
END OF TEST FE FINAL Severity Adjusted RESULT



SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA  
 Reference oil 1011  
 END OF TEST FE FINAL Severity Adjusted RESULT



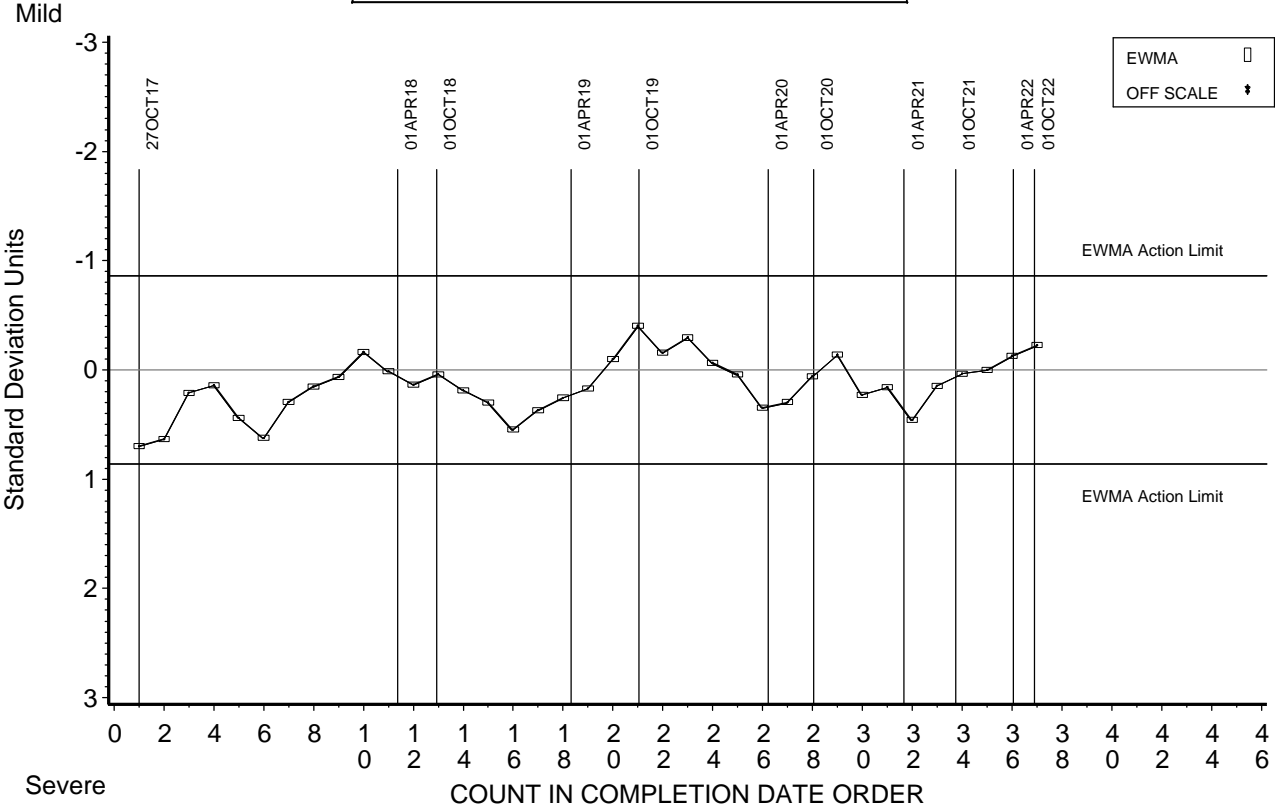
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Reference oil 1011  
AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final



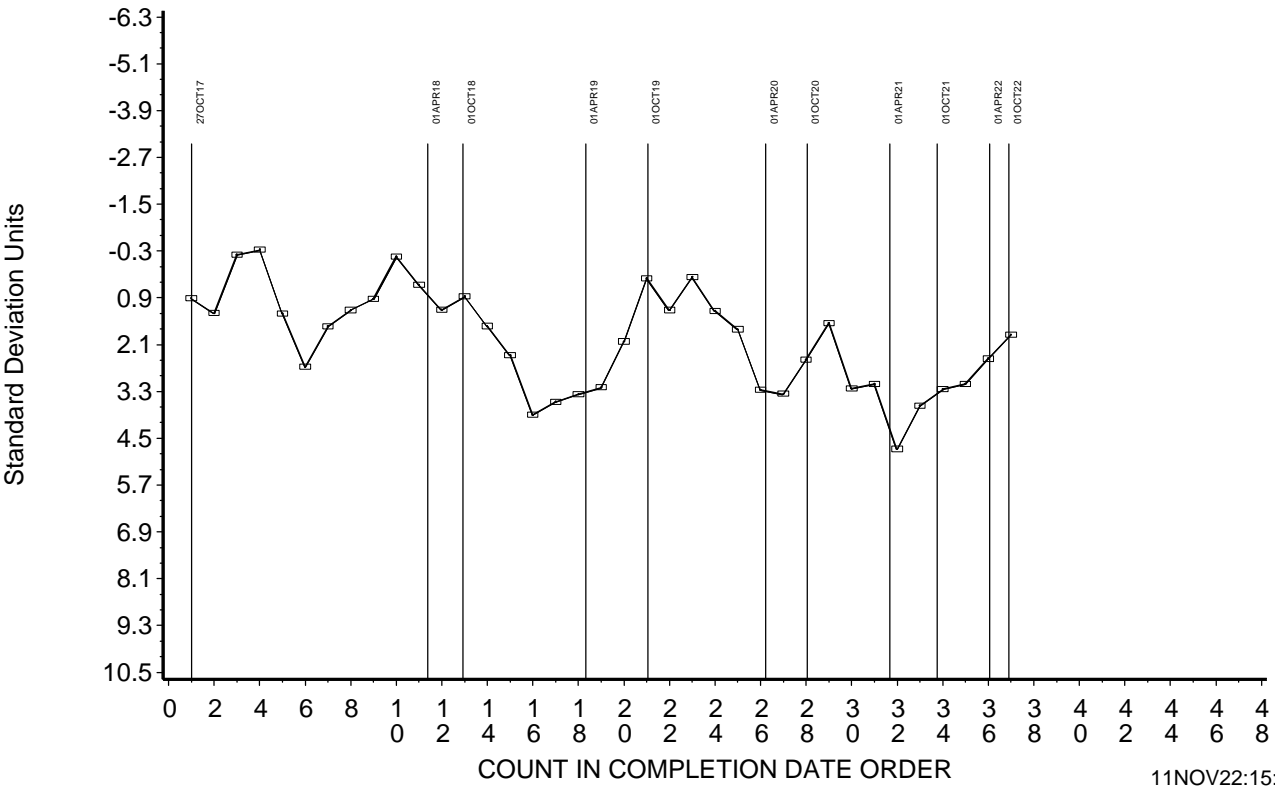
SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA  
Reference oil 1012  
END OF TEST FE FINAL Severity Adjusted RESULT



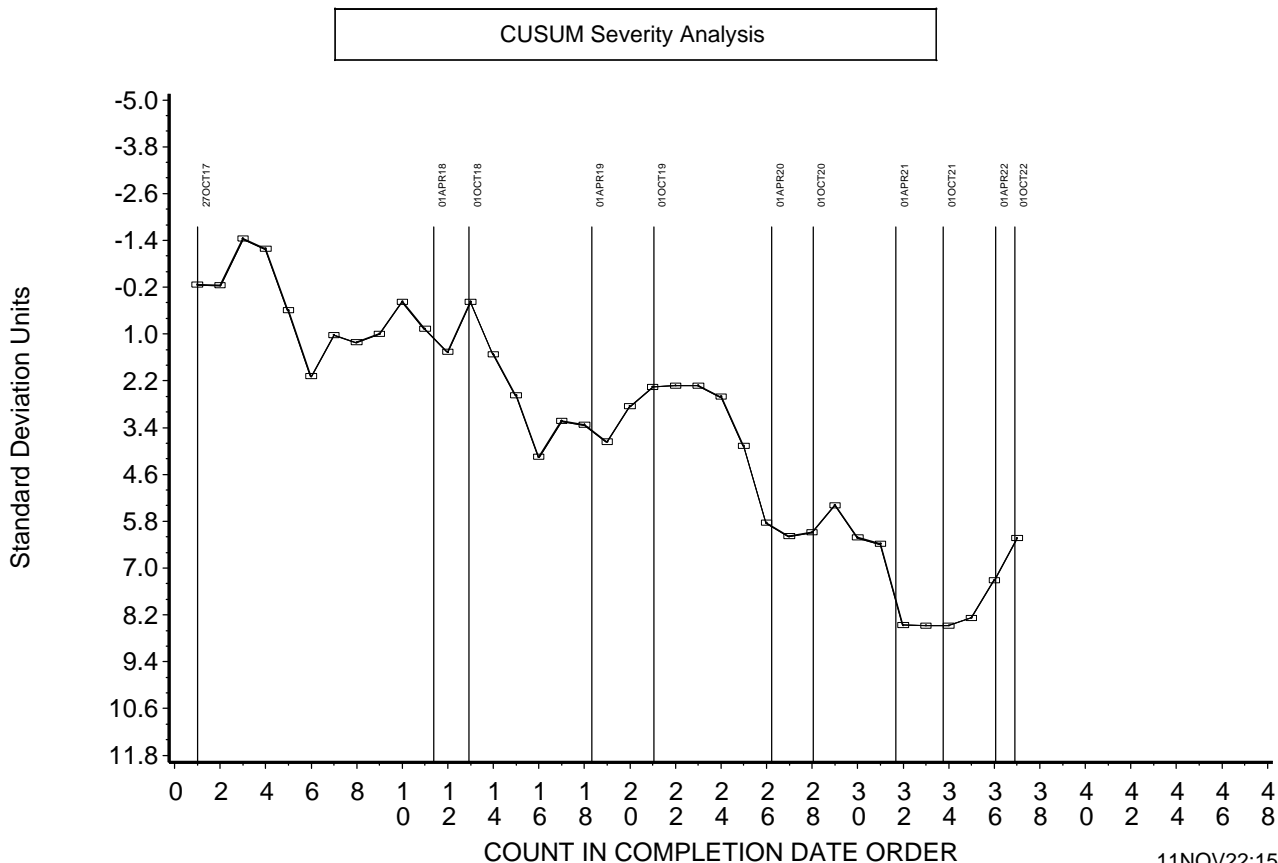
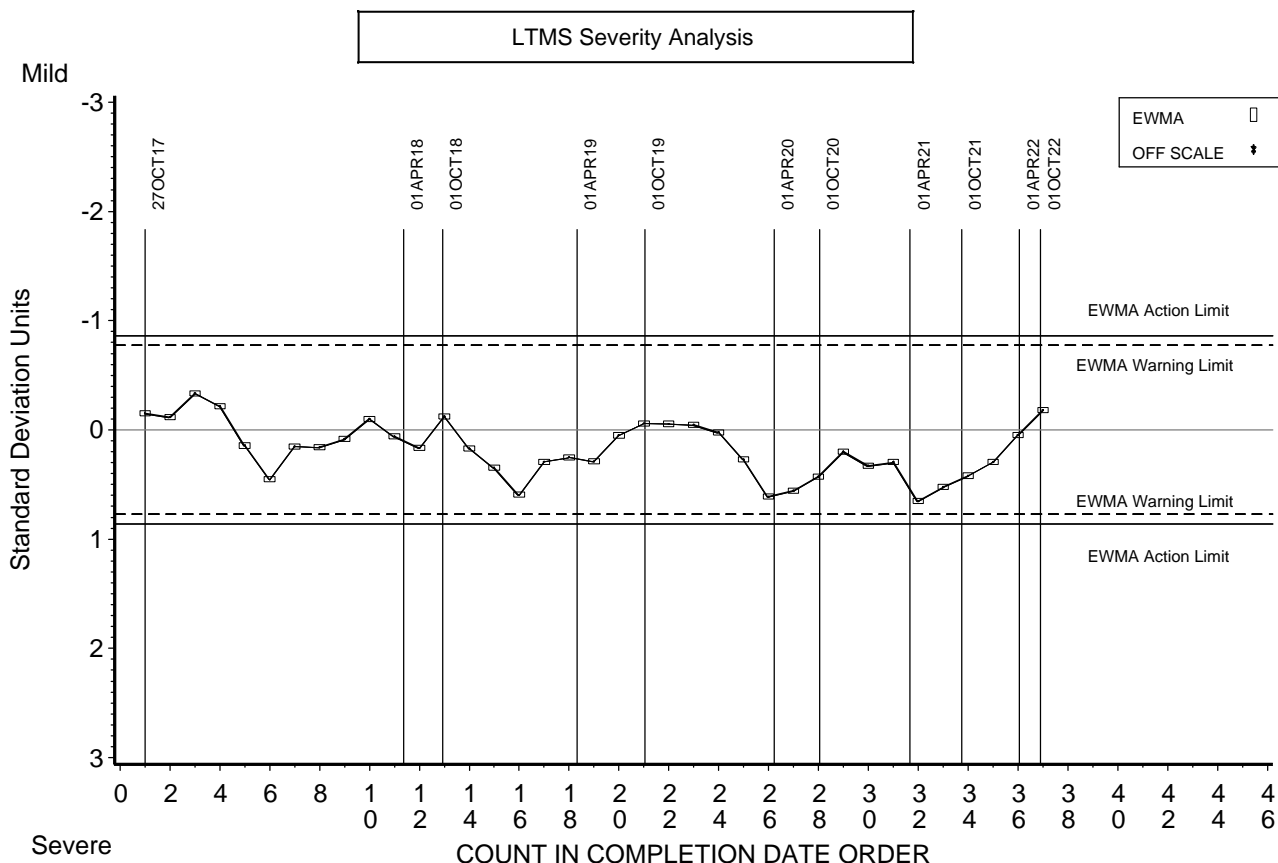
LTMS Severity Analysis



CUSUM Severity Analysis

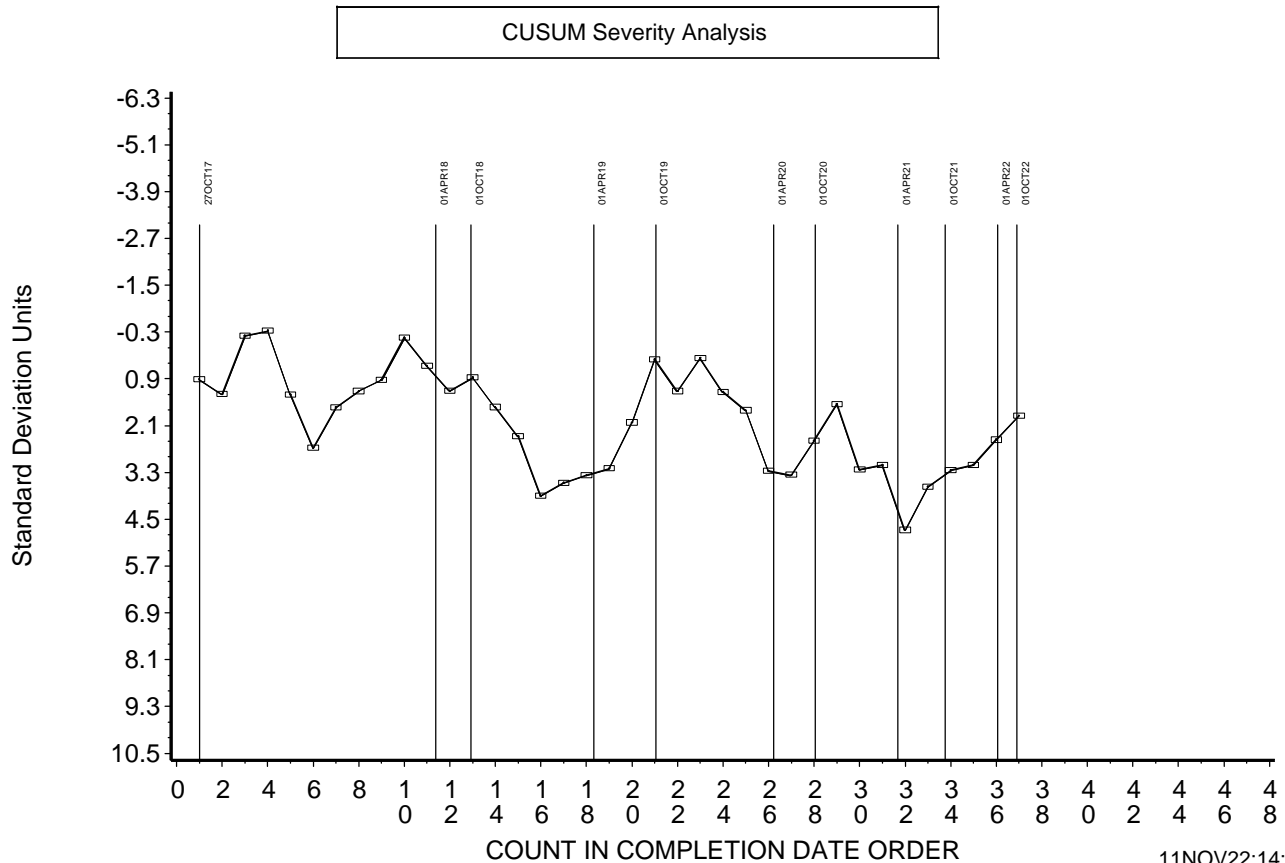
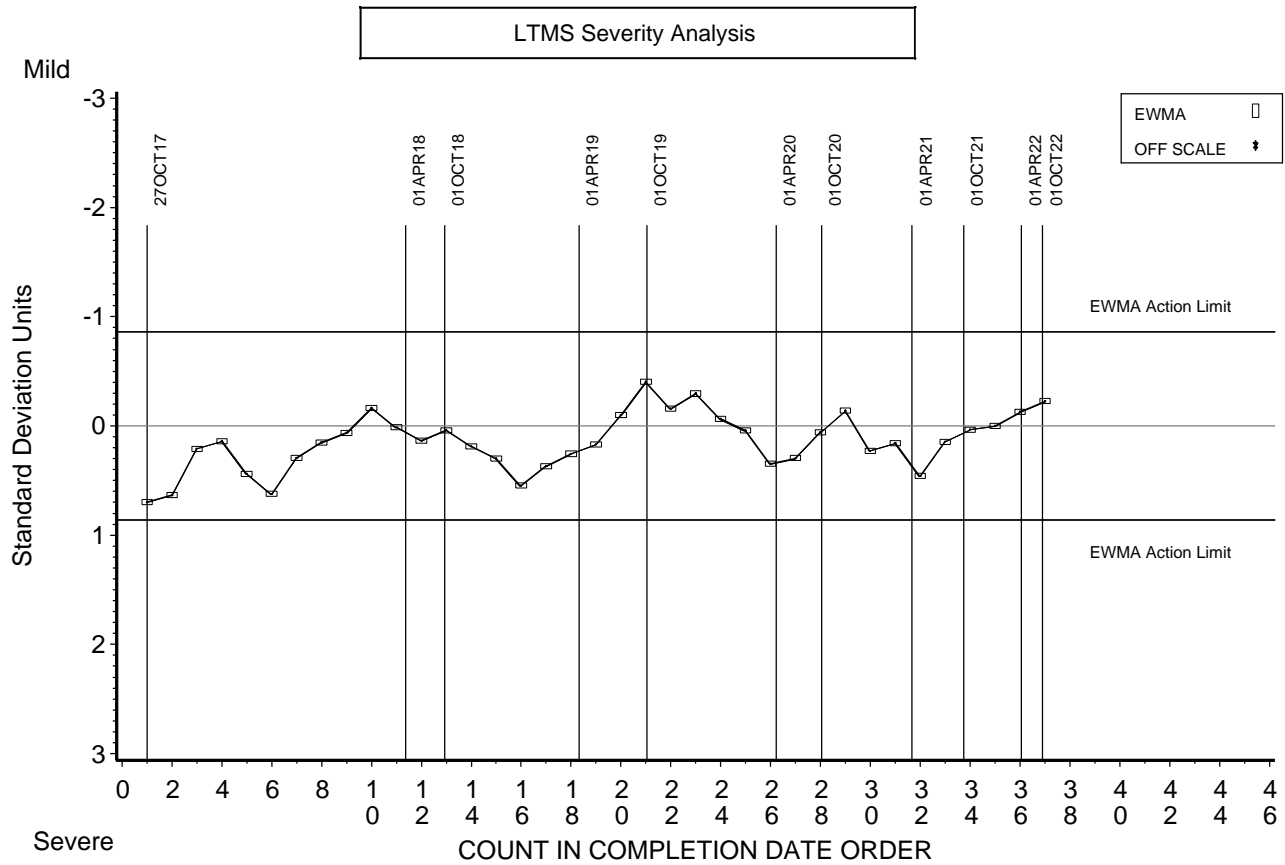


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 Reference oil 1012  
 AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final

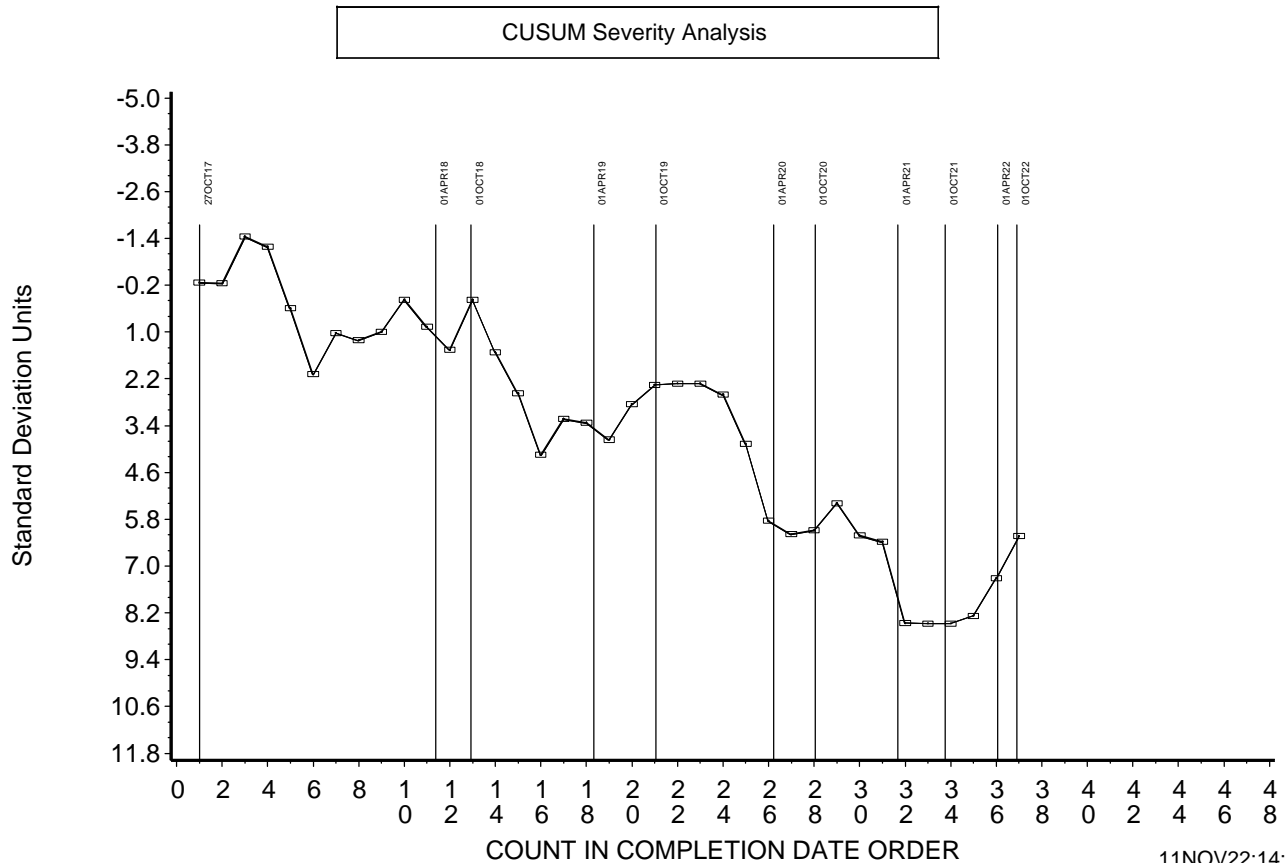
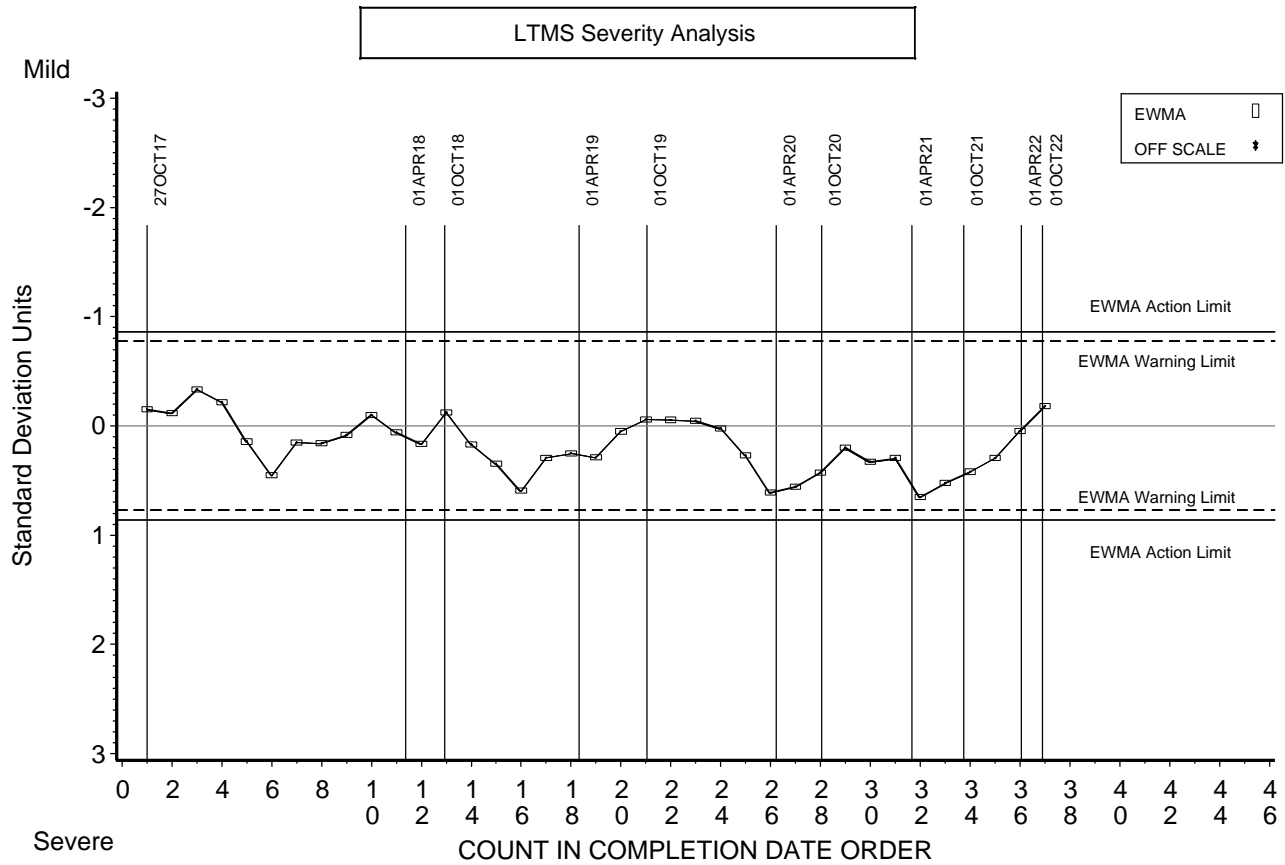




SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA  
 Reference oil 300  
 END OF TEST FE FINAL Severity Adjusted RESULT



SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA  
 Reference oil 300  
 AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final



# Sequence IVA & IVB

ASTM D6891 & D8350

## Presentation to PCEOCP

June 28, 2022

Prepared By: William A. Buscher III, S.P. Chairman

# Sequence IV SP Report

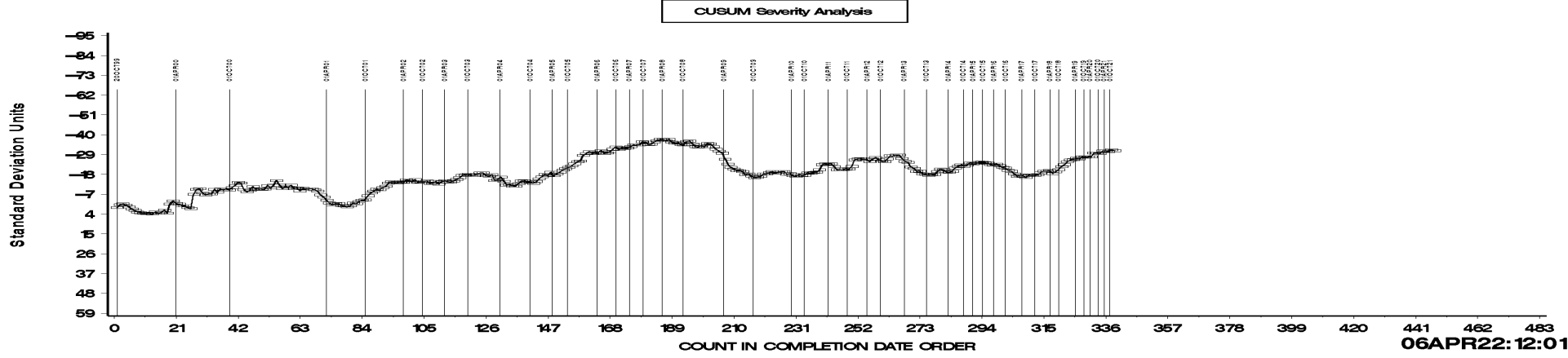
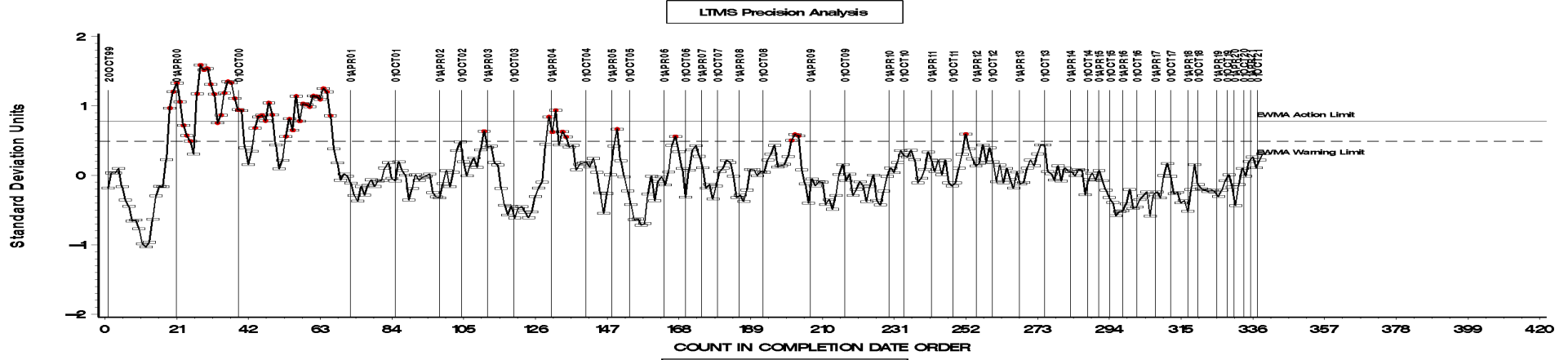
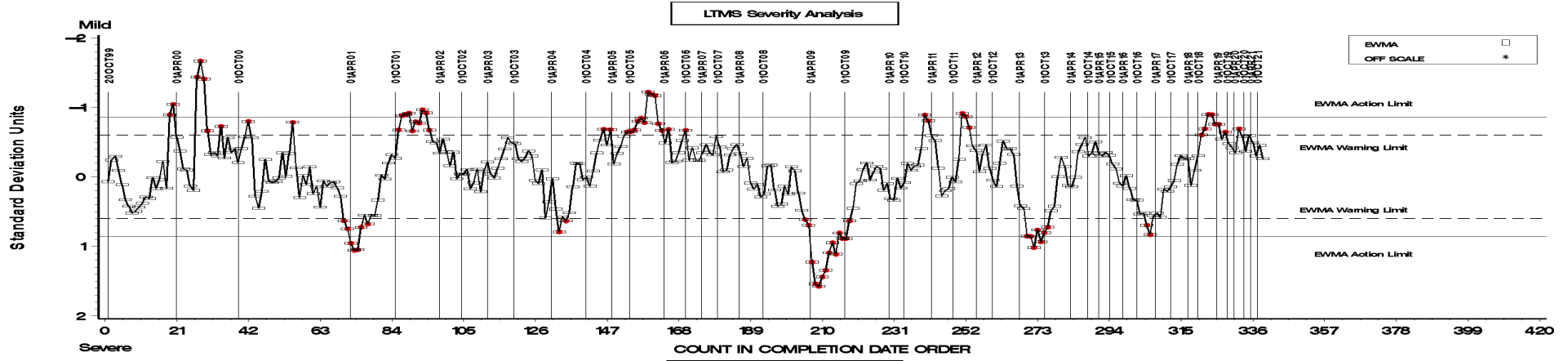
## Sequence IVA Test Status

- 2 Stands Calibrated at 2 labs
  - Current calibration periods end in July and October 2022
  - 1 lab has 2 additional stands, currently out of calibration
- Remaining test hardware as of 6/24/2022:
  - Lab A (3 stands) has 30 + runs remaining
    - Just discovered additional hardware, currently inspecting and counting
  - Lab B (1 stand) has 2 runs remaining
- Test precision and severity are both in control for ACW
- 10 Registered candidate tests so far this year (Average of 1.7/month)
  - Compared to 48 in 2022 (Average of 4.0/month)
  - Compared to 42 in 2020 (Average of 3.5/month)
- Currently no short-term issues with this test

# SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA

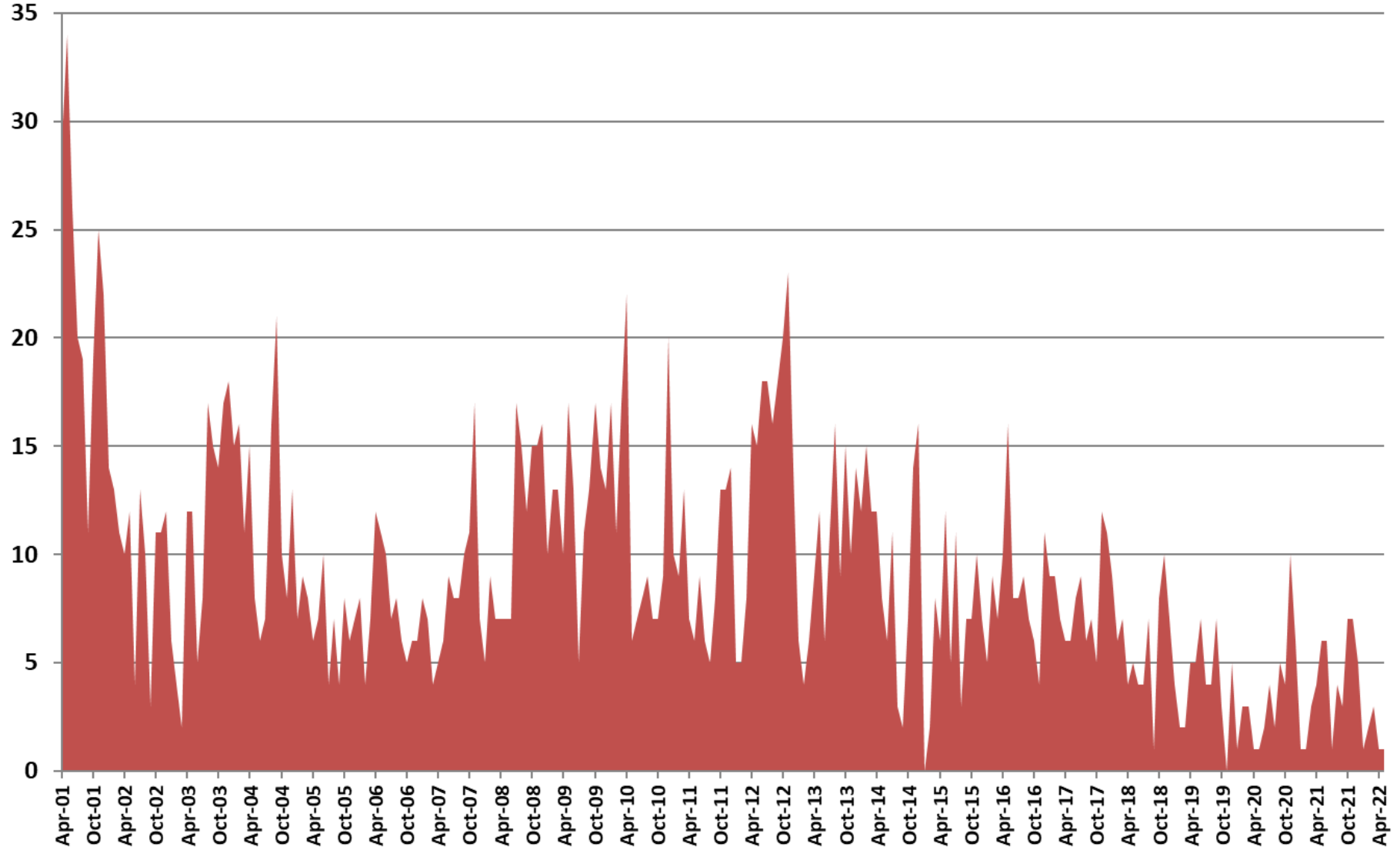


## AVERAGE CAM WEAR



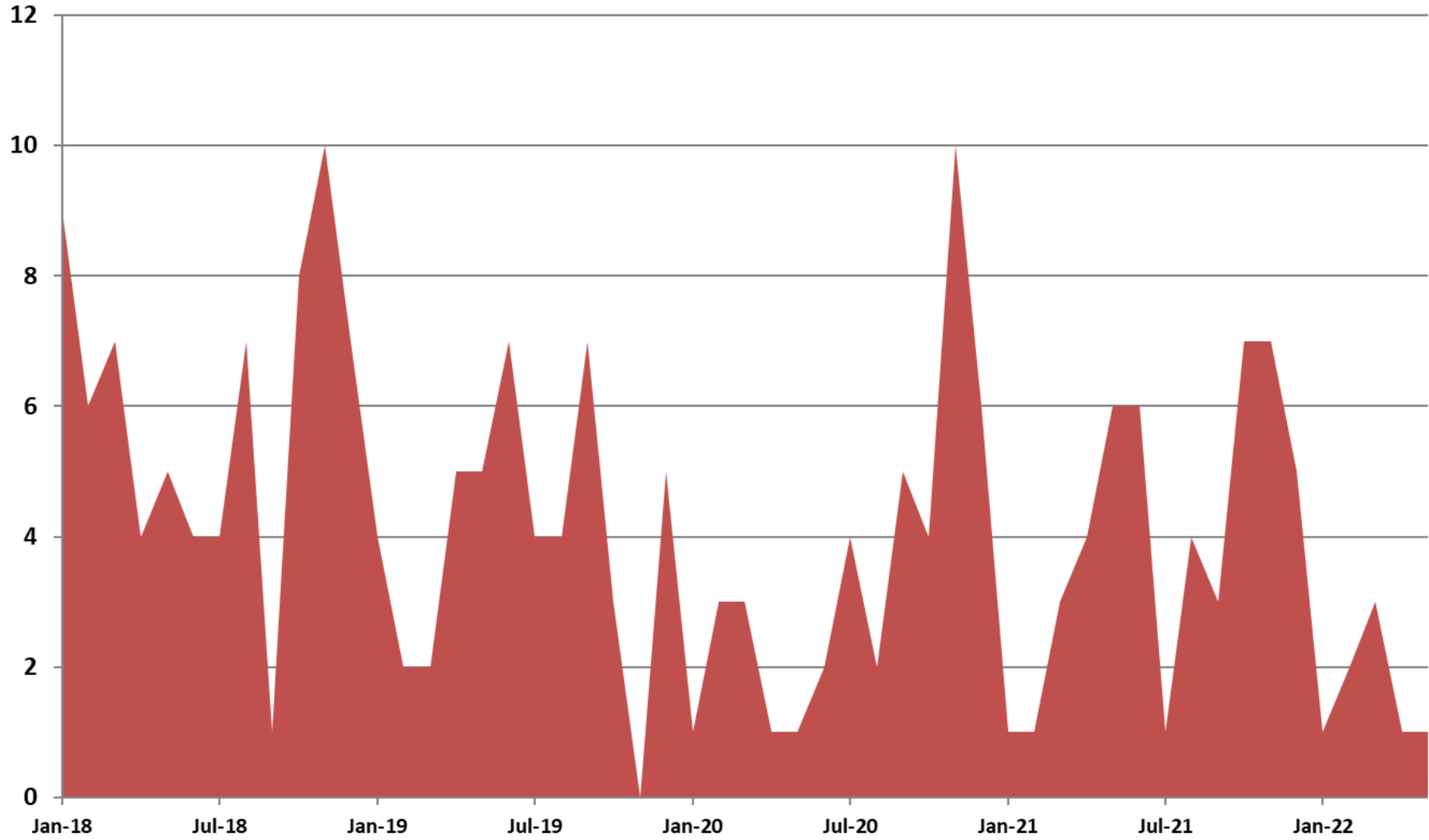
# IVA Candidate Activity Levels

■ IVA



# IVA Candidate Activity Levels

■ IVA



# Sequence IV SP Report

## Sequence IVA Test Status

- Long-term hardware availability issue exists with this test
  - As of 6/24/2022 there is remaining test hardware available for 32 tests
    - All remaining test hardware is located at independent labs, but at a 15:1 ratio
  - Current hardware will be depleted around the end of 2022
    - One lab will deplete hardware around August 2022 and the other lab will deplete hardware around the end of 2022
- But, this just in from one of the independent labs:
  - We just discovered some IVA camshafts in our climate-controlled warehouse that were not accounted for
  - We are in the process of coordinating a 100% inspection on them which may take another week or so
    - It is possible that not all of the cams are useable but we will find out
  - We won't have the definitive test count for this meeting, but feel free to advise that the lab's test count will increase, and the quantity is currently being determining



# Sequence IV SP Report

## Sequence IVA Test Status

- Long-term reference oil availability issue might also exist with this test
  - REO 1006-2 is the only reference oil used for this test and it is also used for the VIII

# Sequence IV SP Report

## Sequence IVA Test Status

- Task Force formed under the Seq. IV SP to attempt to extend the life of this test
  - LSG requesting to extend life of IVA for **10 years**
  - Based on recent usage rates for this test, LSG and task force agreed to target a usage rate of 50 tests per year
  - Goal is to procure additional test hardware for **500 tests**
  - To maintain 2 calibrated stands, 1 at each independent lab, will require a minimum of 4 reference tests per year
    - 4 reference tests per year will require 16 gallons of reference oil per year, or 3 drums of reference oil for 10 years
    - Factoring in the potential for unsuccessful reference tests, it is more likely that **4 to 5 drums** of reference oil will be needed for 10 years
    - If this quantity of REO 1006-2 is not available for this test, will need to procure and introduce another reference oil, possibly **REO SL-107**

# Sequence IV SP Report

## Sequence IVA Test Status

- Task Force formed under the Seq. IV SP to attempt to extend the life of this test
  - Task force members include SP chair, IMTS, Intertek and SwRI
  - IMTS Update (dual approach):
    - 1) Working with Melling (**IMTS has yet to receive any cost estimates**)
      - Rocker arms
      - Rocker shafts
      - Camshafts (**500 camshafts could be available end of September for processing, IMTS would only order 100pcs.**)
        - Offshore fully ground KA24E Camshafts
          - Need to confirm type of hardening process (Chilled Iron / Flame Hardened)
        - IMTS will re-grind small group for prove-out matrix

# Sequence IV SP Report

## Sequence IVA Test Status

- IMTS Update (dual approach):
  - 2) Working with Edelbroch Group/IMTS (IMTS has yet to receive any cost estimates)
    - Secure 500 1994 KA24E camshaft billets
      - Flame Hardened / Tempered / Centers and Journals
      - Will take six months/plus for billet supply 500pc min. order
      - IMTS will process small group for prove-out matrix
    - Option 1 could be less costly specially if the labs want to commit to the purchase of 100 kits with no prove-out
    - Option 2 will be more costly period!
    - FYI, IMTS is an approved supplier/associate member of the Edelbrock Group
- Requirements to proceed:
  - Industry funding to procure significant supply of un-proven camshafts and conduct prove-out testing/matrix

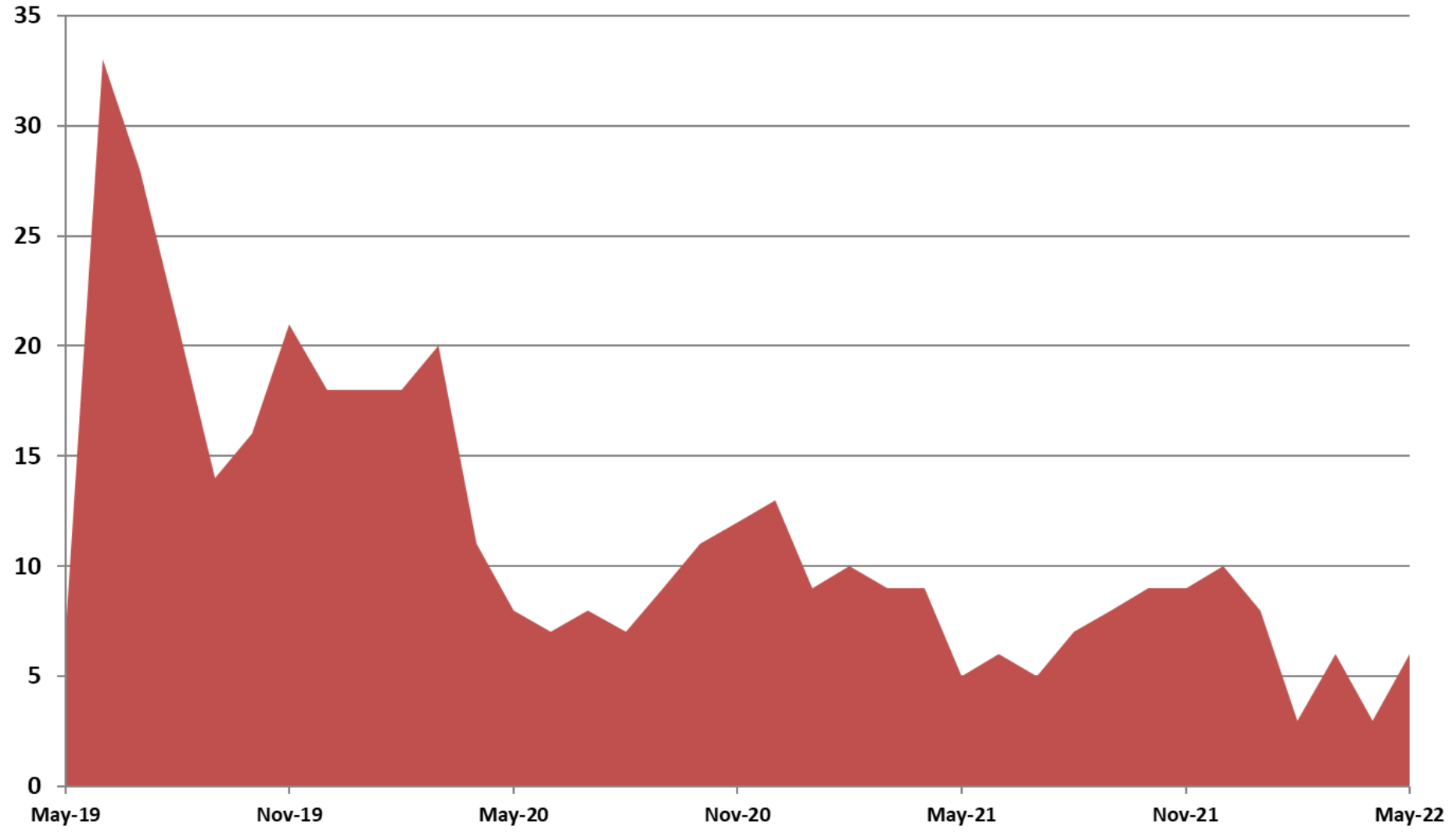
# Sequence IV SP Report

## Sequence IVB Test Status

- 5 stands calibrated at 4 labs
  - Current calibration periods end in September – November 2022
  - 1 lab has 2 additional stands, currently out of calibration
  - 1 lab has 3 additional stands, currently out of calibration
- Test severity is in control for both AVLI and FE
  - AVLI severity continued to trend mild during this period
  - FE severity shifted slightly back towards target this period
- 29 registered candidate tests this year (Average of 4.8/month)
  - Compared to 96 in 2021 (Average of 8.0/month)
  - Compared to 142 in 2020 (Average of 11.8/month)
  - Usage significantly decreasing from 2019 through 2022

# IVB Candidate Activity Levels

■ IVB



# Sequence IV SP Report

## Sequence IVB Test Status

- Currently no issues with this test, with the exception of the ACC PAPTG request to the SP to investigate increase in camshaft lobe failures during candidate tests
  - As previously reported, an increase in lifter rotation rate with modified valve spring keeper was observed
    - This might prove to reduce lobe failures
  - Manufacturing and delivery of additional modified keepers has been completed
  - SwRI provided some modified keepers to Intertek to examine and experiment with

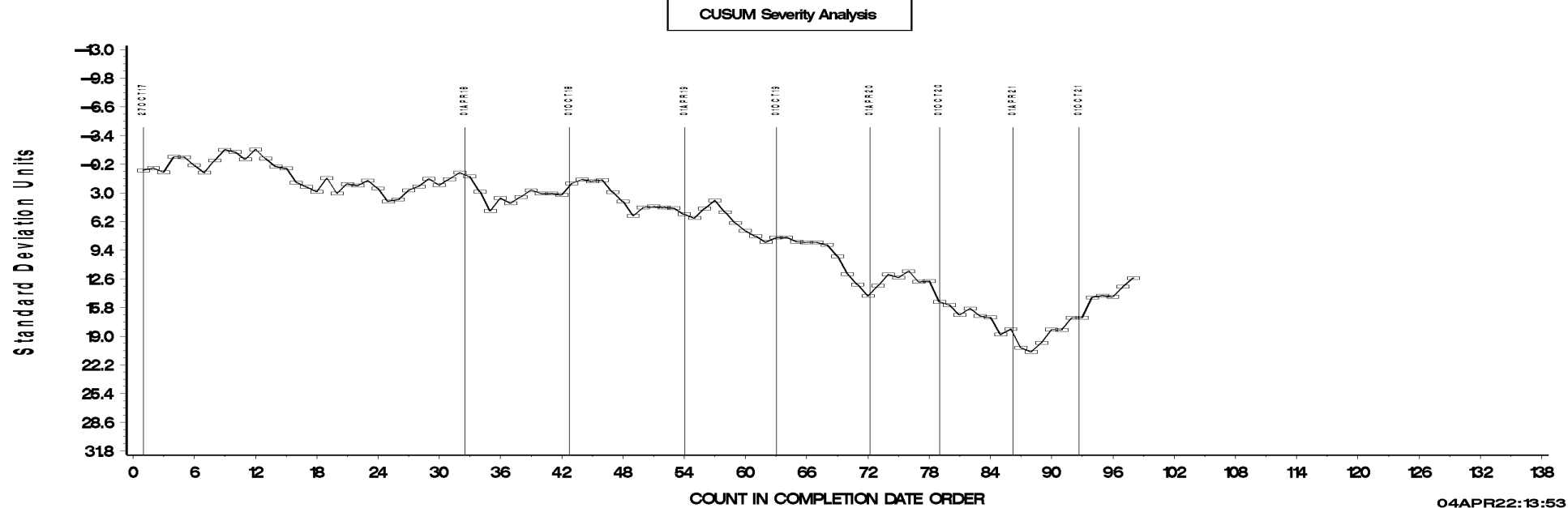
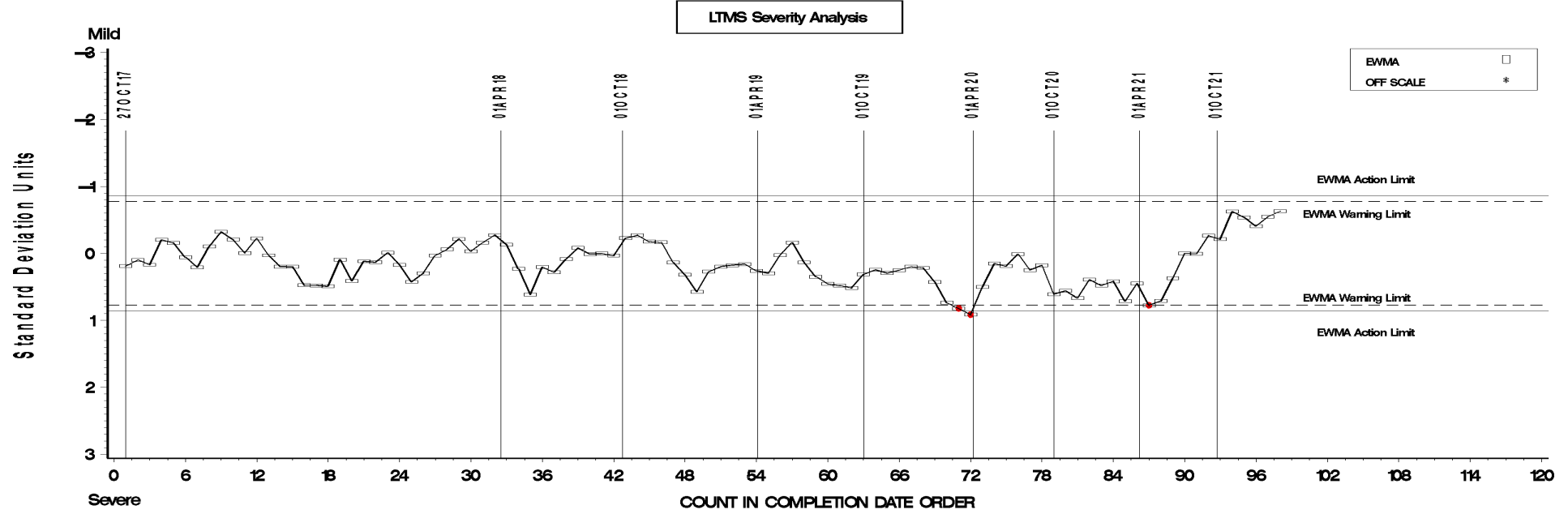
# Sequence IV SP Report

## Sequence IVB Test Status

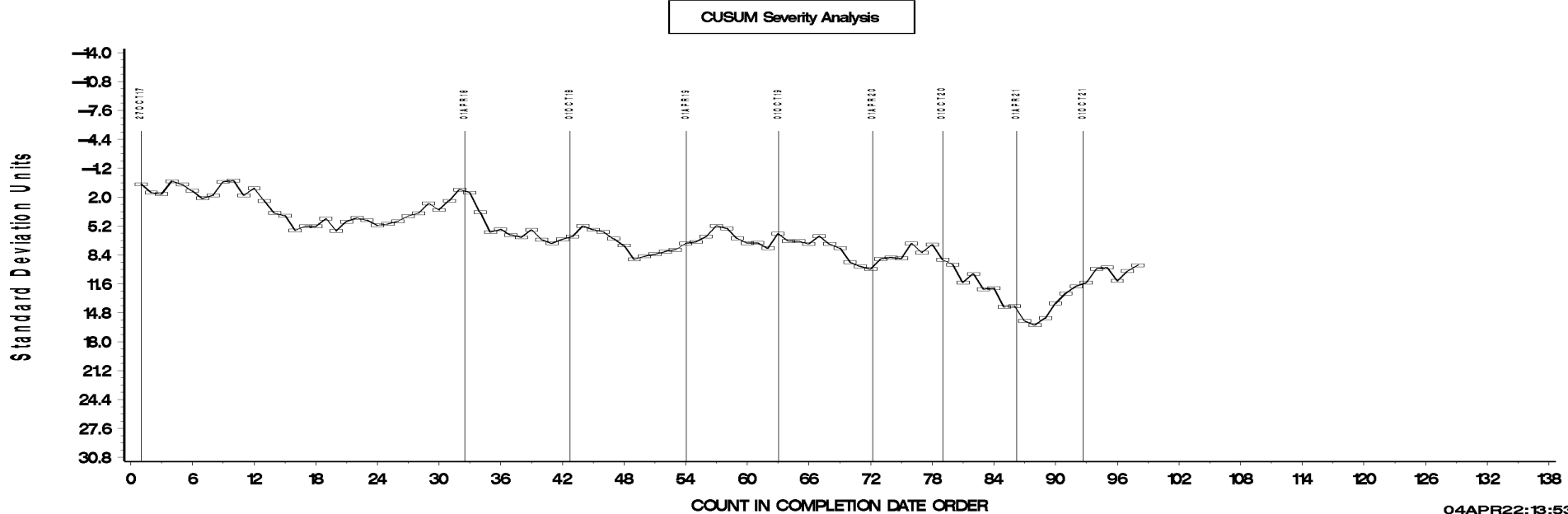
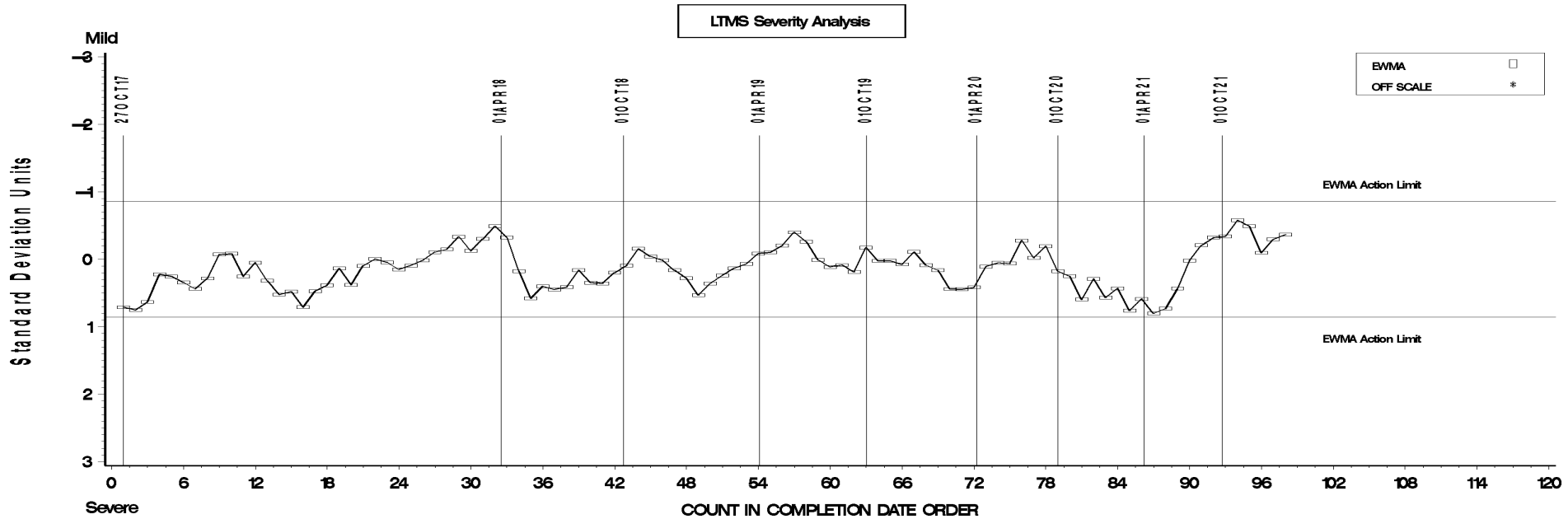
- SwRI activities:
  - SwRI ran the new modified keepers in a test engine multiple times for several hours each time
  - There was not a significant increase in the average rotation speed with the new modified keepers
  - This result was surprising given that a pronounced increase in rotation speed was observed earlier when keepers from a different engine were used in the IVB
- Intertek activities:
  - Intertek built a rig, using a section of a used test cylinder head to compare the differences in torque required to rotate an intake valve with stock keepers installed versus modified keepers installed
  - Intertek has not yet installed modified keepers into a running test engine
- Both labs continue to investigate



AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final



END OF TEST FE FINAL Severity Adjusted RESULT



# Sequence IV SP Report

## Sequence IVB CPD Inventory Status Report as of May 16, 2022

### 1. Seq. IVB Engine Inventory Life Estimates (Based on Industry Wide Consumption Rates)

Remaining Engine Inventory Life (Based on 2 Year Average Industry Consumption Rate)	
Current OHTIVB-16000-2 Engine Assembly	10.04 Years
Including Engine Component Build-Out	14.12 Years

Remaining Engine Inventory Life (Based on 1 Year Industry Consumption Rate)	
OHTIVB-16000-2 Engine Assembly	12.30 Years
Including Engine Component Build-Out	17.30 Years

#### Comments:

- Industry Engine Consumption Rates have decreased 63.04% since 2018.
- From 2020 to May 16, 2022, Industry Engine Consumption Rates have decreased 41.38%.
- At the time of this estimate, the supplier anticipates engine consumption rates to remain the same or decrease.
- The supplier has also acquired enough ancillary engine kit materials (OHTIVB-103-1) to match their engine inventory.

# Sequence IV SP Report

## Sequence IVB CPD Inventory Status Report as of May 16, 2022

### 2. Seq. IVB Intake and Exhaust Camshaft Inventory Life Estimates (Based on Industry Wide Consumption Rates)

Remaining Camshaft Inventory Life (Based on 2 Year Average Consumption Rate)	
Seq. IVB Intake Camshaft	18.07 Years
Seq. IVB Exhaust Camshaft	20.71 Years

Remaining Camshaft Inventory Life (Based on 1 Year Consumption Rate)	
Seq. IVB Intake Camshaft	20.21 Years
Seq. IVB Exhaust Camshaft	23.17 Years

#### Comments:

- From 2020 to May 16, 2022, Industry Camshaft Consumption Rates have decreased 32.19%.
- At the time of this estimate, the supplier anticipates camshaft consumption rates to remain the same or decrease.
- The supplier has also acquired enough camshaft test kit (OHTIVB-102-1) materials to match their camshaft inventory.

# Sequence IV SP Report

## Sequence IVB CPD Inventory Status Report as of May 16, 2022

### 3. Seq. IVB Test Lifters Inventory Life Estimates (Based on Industry Wide Consumption Rates)

Remaining Lifter Inventory Life (Based on 1 & 2 Year Average Consumption Rate)	
Minimum Inventory Life (1 Year Consumption Rate)	10 Years
Minimum Inventory Life (2 Year Average Consumption Rate)	11 Years

- There are 25 individual lifter grades (sizes). The remaining lifter inventory life estimate indicates the earliest depletion of any given lifter grade.
- At the time of this estimate, the supplier anticipates lifter consumption rates to remain the same or decrease.

# Sequence IV SP Report

## Fuel – Oil - Hardware

- **Fuel:**
  - **IVA & IVB**
    - **KA24E Green Fuel – 34,000 gallons in Haltermann inventory, stored in rail cars in TX**
- **Reference Oils:**
  - **IVA**
    - **1006-2 SAE 5W-30 failing reference oil (4yr)**
      - **3.3 drums remaining for IVA & VIII**
  - **IVB**
    - **1012 SAE 5W-20 passing reference oil (5+yr)**
    - **1011-1 SAE 0W-16 currently introducing (5+yr)**
    - **300-1 SAE 5W-30 failing reference oil (3yr)**
- **Hardware:**
  - **IVA – availability pending new information**
    - **32 + runs remaining (0.5yr)**
    - **Currently using Batch BC-2 & BC-3 camshafts**
  - **IVB – currently no issues**
    - **Sufficient hardware quantities for current ILSAC, API, JASO, ACEA and Dexos® specifications and next generation of specifications (10+yr)**
    - **Currently using Batch G intake camshafts, Batch K exhaust camshafts and Batch A, B, C & D lifters**

**ASTM Sequence IV Surveillance Panel**

**Scope and Objectives**

**Scope**

The Sequence IV Surveillance Panel is responsible for the surveillance and continued improvement of the Sequence IVA test documented in Test Method D 6891 and the Sequence IVB test documented in Test Method D 8350, both as updated by the Information Letter system. Data on test precision and laboratory versus field correlation will be solicited and evaluated at least every six months. Improvements in wear measurement technique, test operation, test monitoring and test validation will be accomplished through continual communication with the Test Sponsors and Parts Distributors, ASTM Test Monitoring Center, ASTM Committee D02.B0.01 and the ASTM Passenger Car Engine Oil Classification Panel. Actions to improve the process will be recommended when deemed appropriate based on input from the proceeding. The Panel will review development and correlation of updated test procedures with previous test procedures. This process will provide a suitable test procedure for evaluating an automotive lubricant's effect on controlling valve train wear and overall engine wear for overhead valve train equipped engines with sliding followers or lifters.

<b><u>Objectives</u></b>	<b><u>Target Date</u></b>
1. Preserve Sequence IVA test hardware to maintain test availability for legacy specifications.	<i>On-going</i>
2. Maintain acceptable test hardware for the life of the Sequence IVB test.	<i>On-going</i>
3. Maintain acceptable test fuel for the life of both the Sequence IVA and Sequence IVB tests.	<i>On-going</i>
4. Maintain reference oil supply for the life of both the Sequence IVA and Sequence IVB tests.	<i>On-going</i>
5. Continue active monitoring of test severity and precision for both the Sequence IVA and Sequence IVB tests.	<i>On-going</i>
6. Maintain an on-going timeline / events list for the Sequence IVB test.	<i>On-going</i>

William A. Buscher III, Chairman  
Sequence IV Surveillance Panel

Updated: Nov. 2022



Sequence IV Surveillance Panel  
November 15, 2022  
8:00AM – 12:00PM  
Intertek – Port San Antonio  
San Antonio, TX

Motions and Action Items

As Recorded at the Meeting by Bill Buscher

1. Action Item – Evaluate fuel batch effect, lab and stand effect, reference oil effect and chart scale effect on Sequence IVB LTMS charts.
2. Action Item – Request fuel batch CofA data from fuel supplier from the last 3 KA24E Green fuel batches and from any time any of the fuel batches were adjusted. Request details on the current storage situation for the most recent KA24E Green fuel batch. Request information on the frequency of sampling and analysis checks of the current fuel batch in the fuel supplier's inventory.
3. Action Item - The Sequence IV Surveillance Panel chair to report back to the ACC PAPTG on the surveillance panel's discussions, action and conclusion for the ACC PAPTG request to the surveillance panel to investigate increase in camshaft lobe failures during candidate tests.
4. Motion – Extend the calibration interval for the Sequence IVA test from 15 tests or 6 months to 15 tests or 12 months. Effective 11/15/2022.  
Robert Stockwell / Andy Ritchie / Passed 9 – 0 – 4
5. Action Item – The Sequence IV Surveillance Panel chair to report back to CLOG on the surveillance panel's discussions, action and conclusion for the CLOG request to the surveillance panel to address Sequence IVA end of life / availability.