MEETING MINUTES: ROBO SURVEILLANCE PANEL

Meeting: ROBO SP Meeting

Date: April 15, 2021

Location: MS Teams (virtual)

Minutes by: Justin Mills – SP Chair

Actions:

1. Tom Schofield to add reference oil 436 (and corresponding limits) in LTMS. Upon its adoption, use of 438-2 will be suspended.
1. ROBO SP members to review draft ASTM D7528 with dilute NO2 procedure. Any comments or recommendations should be provided to the dilute NO2 workgroup (Alan Flamberg, Matt Schlaff, Justin Mills, Tom Schofield) prior to the next SP meeting.
2. Justin Mills to tentatively schedule the next ROBO SP meeting for May 13, 2021.

Membership and Attendance:

Ace Glass	Dave Lawrence, *Tom Petrocella
Afton	Shelia Thompson, Jeff Yang, Todd Dvorak
ASTM TMC	*Tom Schofield
Chevron Oronite	Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	*Joe Franklin, *Matt Schlaff, *Rachel Stone
Lubrizol	Aimee Shinhearl
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	*Justin Mills, *Justin Kontra, *Gabriel Walkup
Vanderbilt Chemicals	Al Filho, Ron Hiza
SwRI	*Becky Grinfield, Joe De La Cruz, *Mike Birke, *Young-Li McFarland
Valvoline	Amol Savant, Kevin Figgatt, *Steve Lazzara
Koehler Instruments	Raj Shah, *Vincent Colantuini
Tannas/Savant	*Greg Miller, Ted Selby
General Interest	*Alan Flamberg
Guests	

* Denotes attendance

MEETING MINUTES: ROBO SURVEILLANCE PANEL

Summary:

- Meeting convened at 10:03EDT on April 15, 2021
- No modifications to agenda
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update
  - None were provided by during meeting, but afterward it was requested to add Amy Ross (Valvoline) to SP list.
- Meeting minutes from January 7, 2021 SP meeting were accepted (motion made by Tom Schofield and seconded by Alan Flamberg)
- Actions from the August 13th meeting were reviewed. Outstanding actions include:
  - Justin Mills, Matt Schlaff, Tom Schofield to update ASTM D7528 to include dilute NO2.
- ROBO industry statistics
  - The last semester, 2021APR (10/01/20 – 3/31/21) concluded with 112 runs reported. Yi= -0.10, indicating a slight mild bias. Pooled s = 0.3190 indicating the test is running less precise than target. Neither the severity or precision are cause for alarm.
- TMC reference oils
  - At the January 7th meeting, SP voted to finalize limits for 434-3 which became effective in February:

TMC 434-3	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
Option #2	**22**	**10.8172**	**49,871**	**0.1389**	**37,987**	**65,473**	**10.5450**	**11.0894**

  - At the January 7th meeting, SP agreed 436 could replace 438-2 assuming more data was generated to set limits. Consensus was that limits for 438-2 are overly broad and the test would benefit from having a clean, passing reference oil like 436.
    - Limit setting for 436 was discussed in detail. Of the 17 donated runs, 2 were identified as outliers through Tukey Box methodology (any data points <Q1 - 1.5*IQR or >Q3 + 1.5*IQR are considered outliers). Both outliers fell just outside the acceptance criteria, so there some discussion on whether they should be removed or included for interim limit setting. The SP reviewed the following three options:

TMC 436		n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
Option #1	No bias correction. Outliers removed.	15	10.3297	30,629	0.1087	24,750	37,904	10.1166	10.5428
Option #2	Average Yi from TMC statistics (Yi = -0.1000). Outliers removed.		10.3475	31,179		25,195	38,584	10.1344	10.5606
Option #3	Average Yi from TMC statistics (Yi = -0.1000). Outliers included	17	10.3437	31,061	0.1605	22,677	42,544	10.0291	10.6583

      - After some discussion it seemed Option #3 was most favorable, so a motion was made to Matt Schlaff to use Option #3 (as shown above) as the interim limits for 436 with the understanding that final limits would be set when a sufficient amount of data is available. The motion was seconded by Alan Flamberg.
        - A hand vote was taken and there was one negative – Gabriel Walkup (Evonik) preferred Option #2 because it was more consistent with our limit setting practices in the past.
        - Despite the negative, the majority ruled in favor, so the motion passed. Interim limits for 436 are as follows:

TMC 436		n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
Option #3	Average Yi from TMC statistics (Yi = -0.1000). Outliers included	17	10.3437	31,061	0.1605	22,677	42,544	10.0291	10.6583

      - Following the acceptance of the 436 interim limits, a motion was made by Alan Flamberg to add 436 to the LTMS and include it as approved reference oil assignment. Upon its adoption, suspend the use of 438-2 as a reference oil. The motion was seconded by Gabriel Walkup.
        - A vote was taken, and all were in favor. The motion passed.
- Dilute Nitrogen Dioxide

- A draft revision of ASTM D7528 was prepared and issued to the surveillance panel prior to this meeting. In this meeting Alan Flamberg provided an overview of changes made to the method.
  - Alan discussed the challenges with specifying limits/tolerances for dilute NO2. He shared the proposed limits/tolerances along with an example of how to calculate total NO2 introduced during the test.
  - The surveillance panel was encouraged to review the draft method and provide any comments or recommendations to the dilute NO2 workgroup (Alan Flamberg, Matt Schlaff, Justin Mills, Tom Schofield) prior to the next SP meeting. If all goes according to plan, we will seek a SP vote at the next meeting.
- It was also brought to our attention that the data dictionary and report forms will need to be updated before implementing dilute NO2. This process may take several weeks.

- No additional topics
- Next meeting tentatively scheduled on May 13, 2021. Date may be postponed if necessary.
- Meeting adjourned 11:28EDT

Meeting Outcome:

1. The following limits for reference oil 436 were accepted as interim limits:

TMC 436		n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
Option #3	Average Yi from TMC statistics (Yi = -0.1000). Outliers included	17	10.3437	31,061	0.1605	22,677	42,544	10.0291	10.6583

2. Reference oil 436 will be added to LTMS and is approved for reference oil assignment. Upon its adoption, use of 438-2 will be suspended.
3. The draft revision to ASTM D7528 was reviewed. The SP was encouraged to provide any comments or recommendations to the dilute NO2 workgroup (Alan Flamberg, Matt Schlaff, Justin Mills, Tom Schofield) prior to the next SP meeting. If all goes according to plan, we will seek a SP vote at the next meeting.

-End report-

ASTM D7528: Bench Oxidation of Engine Oils by ROBO Apparatus

ROBO Surveillance Panel Meeting

April 15, 2021

Justin Mills

Agenda

- Welcome, ASTM statement
- Review membership of surveillance panel
- Review and approve minutes from previous meetings (see attachment)
- Review and follow-up on actions from January 7th meeting
- Current status of ROBO including statistics
- Reference oil update including
  - TMC 436 status
- Dilute nitrogen dioxide update
- Additional topics, if any
- Set next meeting

ASTM Antitrust and Recording Policy

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Electronic recording of ASTM meetings is prohibited.

Membership

Ace Glass	Dave Lawrence, **Tom Petrocella**
Afton	Shelia Thompson, Jeff Yang, Todd Dvorak
ASTM TMC	**Tom Schofield**
Chevron Oronite	Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	**Joe Franklin, Matt Schlaff**, **Rachel Stone**
Lubrizol	Aimee Shinhearl
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	**Justin Mills, Gabe Walkup**, **Justin Kontra**
Vanderbilt Chemicals	Al Filho, Ron Hiza
SwRI	**Becky Grinfield**, Joe De La Cruz, **Mike Birke**, **Yong-Li McFarland**
Valvoline	Amol Savant, Kevin Figgatt, **Steve Lazzara**
Koehler Instruments	Raj Shah, **Vincent Colantuini**
Tannas/Savant	**Greg Miller**, Ted Selby
General Interest	**Alan Flamberg**
Guests	William Monsees (Koehler)

Summary of changes:

1. No new changes to report.

Motion to accept January 7, 2021 meeting minutes – Approved 4/15/2021

MEETING MINUTES: ROBO SURVEILLANCE PANEL

Meeting: ROBO SP Meeting

Date: January 7, 2021

Location: MS Teams (virtual)

Minutes by: Justin Mills – SP Chair

Actions:

1. Tom Schofield to follow up with labs that have pending TMC 436 runs to donate. (Ideally labs can complete their donate TMC 436 runs prior to next meeting, so we can set limits)
2. Tom Schofield to update limits in LTMS for TMC 434-3 with an effective date of February 1 ,2021.
3. Justin Mills, Matt Schlaff, Tom Schofield, Alan Flamberg to continue to work on dilute NO2 procedure/method.
4. Justin Mills to tentatively schedule the next ROBO SP meeting for April 15, 2021.

Membership and Attendance:

Ace Glass	Dave Lawrence, *Tom Petrocella
Afton	Shelia Thompson, *Jeff Yang, Todd Dvorak
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Koehler Instruments	Raj Shah, *Vincent Colantuini
Tannas/Savant	Greg Miller, Ted Selby
General Interest	*Alan Flamberg
Guests	*Wiliam Monsees (Koehler)

* Denotes attendance

MEETING MINUTES: ROBO SURVEILLANCE PANEL

Summary:

- Meeting convened at 10:04EST on January 7, 2021
- No modifications to agenda
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update
  - Man Hon Tsang of Oronite, Mike Faile of Lubrizol, Bruce Zweitzig of Evonik requested to be removed due to a changes in their roles.
- Meeting minutes from August 13, 2020 SP meeting were accepted (motion made by Tom Schofield and seconded by Alan Flamberg)
- Actions from the August 13th meeting were reviewed. Outstanding actions include:
  - Justin Mills, Matt Schlaff, Tom Schofield to update ASTM D7528 to include dilute NO2.
- ROBO industry statistics
  - The current semester, 2021APR (10/01/20 – 3/31/21), is in progress. As of January 4 (approx. half way through the reporting semester), there were 55 results reported. Since last period, the bias has improved (Yi= -0.26); however the precision is worse than target (pooled s= 0.3568).
- TMC reference oils
  - At our August 2020 SP we agreed to explore TMC 436 as a potential replacement for TMC 438-2 or as a new reference oil. Initial data from the donated runs indicates that TMC 436 is a "good, passing" oil with limits comparable to the original TMC 438. The SP agreed that it can replace TMC 438-2 assuming more data is generated to set limits. There are a number of pending donated runs (labs have samples but have not run them yet). Tom Schofield to contact these labs. Expect to have "pending" runs by next SP meeting so we can set limits for TMC 436 and begin using as a reference oil. Below is the statistics on TMC 436:

n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
11	10.3015	29,777	0.131	23,033	38,496	10.0447	10.5583

  - At the October 2019 SP meeting we voted on interim limits for 434-3 with 13 data points. To date (January 4, 2021), there are 22 valid results available for 434-3 providing us with enough datapoints to set final limits. New limits were calculated with and without a bias correction. After some discussion, the SP agreed that we should apply the bias correction in order to remain consistent with precious limit setting. A motion to accept Option #2 (shown below) by was made by Gabriel Walkup and seconded by Tom Schofield:

TMC 434-3	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
Option #2	**22**	**10.8172**	**49,871**	**0.1389**	**37,987**	**65,473**	**10.5450**	**11.0894**

    - After a vote, the motion carried and new limits for TMC 434-3 will be as reflected above. Effective date for new limits will be February 1, 2021.
- Dilute Nitrogen Dioxide
  - Procedure for dilute NO2 continues to be drafted; however, there were several topics which needed to be discussed within the SP before additional progress could be made:
    - Concentration for NO2 – Recommended we confirm tolerances with two suppliers (Airgas and Electronic Fluorocarbons) to ensure we don't over specify limits and tolerances can be met.
    - Dilute NO2 flow rate – Recommended to be 185ml/min +/-5% for dilute NO2 as well as dry air.
    - Feed duration – Recommended to be 12 hours +/- 15 minutes to allow ample time if manual changeover from dilute NO2 to dry air is required.
- No additional topics
- Next meeting tentatively scheduled on April 15, 2021. Date may be postponed if necessary
- Meeting adjourned.

-End report-

Actions from January 7th meeting

- ☒ 1) Tom Schofield to follow up with labs that have pending TMC 436 runs to donate. (Ideally labs can complete their donate TMC 436 runs prior to next meeting, so we can set limits)
- ☒ 2) Tom Schofield to update limits in LTMS for TMC 434-3 with an effective date of February 1 ,2021.
- ☐ 3) Justin Mills, Matt Schlaff, Tom Schofield, Alan Flamberg to continue to work on dilute NO2 procedure/method.
- ☒ 4) Justin Mills to tentatively schedule the next ROBO SP meeting for April 15, 2021.

Current status of ROBO

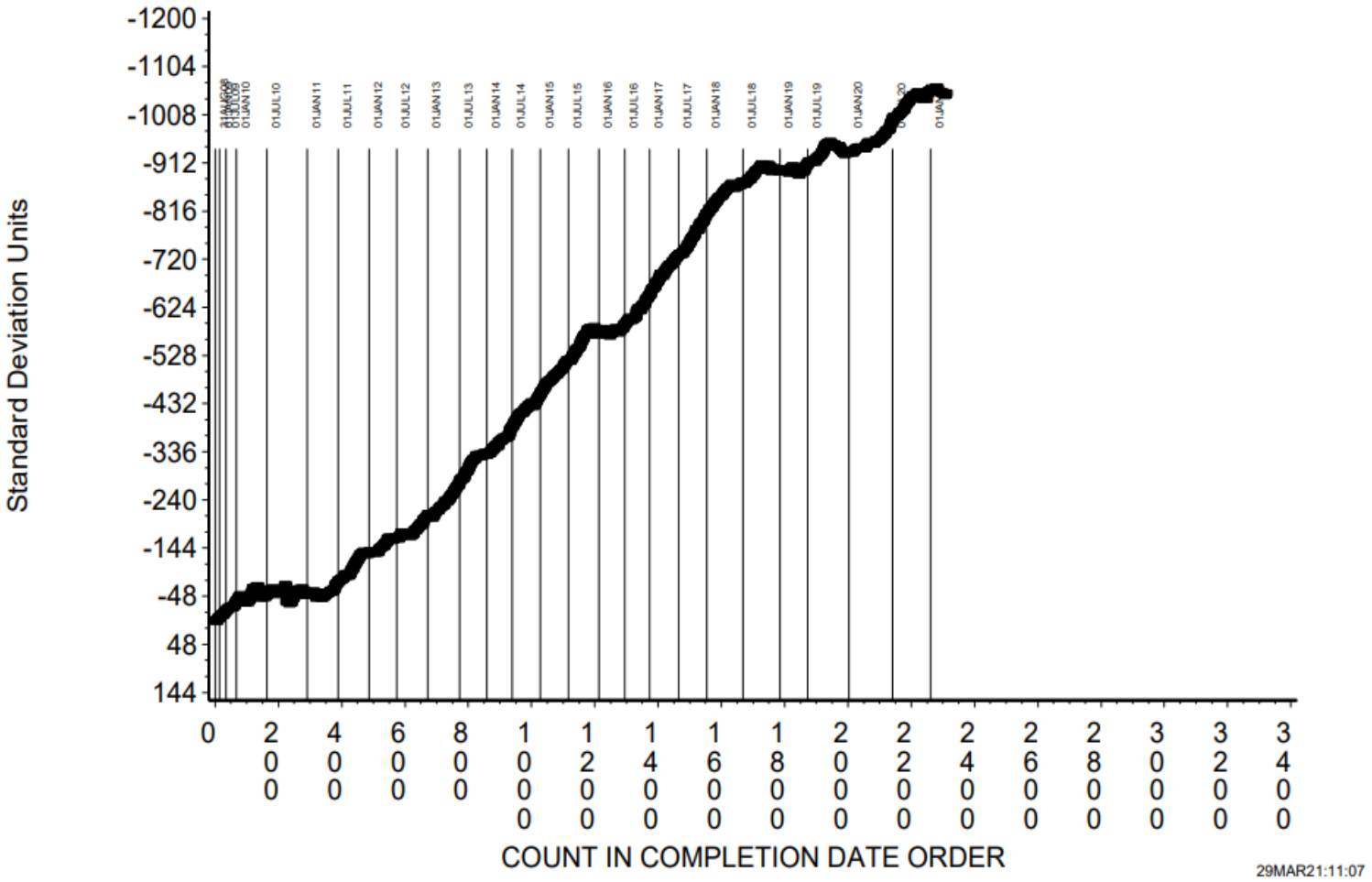
ROBO Industry Statistics

Period	N-size	Degrees of Freedom	Pooled s	Mean Δ/s
Current Targets	49	46	0.1945	------
4/1/17 through 9/30/17	99	95	0.2220	-0.76
10/1/17 through 3/31/18	91	87	0.2367	-0.91
4/1/18 through 9/30/18	126	122	0.2184	-0.49
10/1/18 through 3/31/19	100	96	0.2738	0.04
4/1/19 through 9/30/19	95	91	0.2492	-0.32
10/1/19 through 3/31/20	158	153	0.2723	-0.10
4/1/20 through 9/30/20	119	113	0.2264	-0.76
10/1/20 through 3/31/21	112	107	0.3190	-0.10

- Versus previous period (2020OCT), the test is running less mild, but is also less precise.

Source: http://www.astmtmc.cmu.edu/ftp/refdata/bench/robo/data/statistics.txt (Apr07-2021)

CUSUM severity analysis



Source: http://www.astmtmc.cmu.edu/ftp/refdata/bench/robo/plots/mrv%20INDUSTRY.pdf (Mar29-2021)

Reference oils

TMC reference oils
Current limits

D7528 (ROBO) Aged Oil MRV Acceptance Bands, mPa·s and ln(mPa·s)

Oil	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa·s Min[1]	95% band in mPa·s Max[1]	95% Bands Min (ln)	95% Bands Max (ln)
434-1	13	10.6599	42,612	0.1672	30,706	59,136	10.3322	10.9876
434-2	36	[2]10.9284	[2]55,737	0.1551	[2]41,126	[2]76,008	[2]10.6244	[2]11.2386
434-3	22	[2]10.8172	[2]49,871	0.1389	[2]37,987	[2]65,473	[2]10.5450	[2]11.0894
435	15	11.4895	97,685	0.2932	[3]60,000	173,546	[3]11.0021	12.0642
435-1	22	11.0416	62,420	0.20295	[4]44570	92910	[4]10.7048	11.4394
438	14	10.2676	28,785	0.2037	19,308	42,912	9.8683	10.6669
438-2	19	[2]10.5404	[2]37813	0.2596	[2]22,734	[2]62,894	[2]10.0316	[2]11.0492

[1] 95% bands in mPa·s are listed for information purposes only, the transformed values will be used to judge acceptance in all cases.
[2] A bias adjustment has been applied to the mean of reference oils 434-2, 434-3 and 438-2 to account for biases observed in the TMC reference data during the periods that each oil target dataset was generated. The 95% confidence range reflects the inclusion of the bias adjustments.
[3] The minimum value for Reference oil 435 is fixed at 60,000 (11.0021 in transformed units) and not a true 95% minimum as calculated from the statistics.
[4] The minimum value for reference oil 435-1 is based on -1.66 standard deviations from the target mean (to match the range previously approved for oil 435 min), so is not actually a 95% confidence range. A 95% confidence range would use 1.96 standard deviations from target mean.

- At the January 7th meeting, SP voted to finalize limits for 434-3 which became effective in February (see above).
- At the January 7th meeting, SP agreed 436 could replace 438-2 assuming more data was generated to set limits.

Source: http://www.astmtmc.cmu.edu/ftp/docs/ltms/ltms.pdf 02-2021 version

TMC 436
Limit setting

METHOD	IND	TESTKEY	DTCOMP	APPARATS	MRVTEMP	MRVYSEOT	MRV	MRVti	VAL	VOLEOT	PVIS	
ROBO	436	158276-ROBO	20200918	AM2	-30	<35	26000	10.1659	AG	48	72.7	
ROBO	436	158277-ROBO	20200925	AM2	-30	<35	28500	10.2577	AG	49	80.4	
ROBO	436	158156-ROBO	20201001	A4	-30	<35	27900	10.2364	AG	46	75.9	
ROBO	436	158157-ROBO	20201001	A6	-30	<35	36900	10.516	AG	51	92.8	
ROBO	436	158158-ROBO	20201003	A1	-30	<35	37800	10.5401	AG	54	116.3	
ROBO	436	158333-ROBO	20201014	B2	-30	<35	31000	10.3417	AG	47	86.5	
ROBO	436	158334-ROBO	20201016	B2	-30	<35	31600	10.3609	AG	47	84.4	
ROBO	436	158335-ROBO	20201023	B2	-30	<35	30200	10.3156	AG	46	80.5	
ROBO	436	158152-ROBO	20210113	BC1	-30	<35	29000	10.2751	AG	44	70.5	
ROBO	436	158153-ROBO	20210115	BC1	-30	<35	26200	10.1735	AG	41	63.1	
ROBO	436	158154-ROBO	20210117	BC1	-30	<35	30000	10.309	AG	46	82.6	
ROBO	436	158278-ROBO	20210122	AM5	-30	<35	34100	10.4371	AG	53	104.4	
ROBO	436	158970-ROBO	20210125	AQ2	-30	<35	32700	10.3951	AG	49	84.3	
ROBO	436	158279-ROBO	20210129	AM5	-30	<35	30000	10.309	AG	53	105	
ROBO	436	158155-ROBO	20210314	BC1	-30	<35	30100	10.3123	AG	44	76.4	
~~ROBO~~	~~436~~	~~158323-ROBO~~	~~20210328~~	~~G3~~	~~-30~~	~~<35~~	~~20900~~	~~9.9475~~	~~AG~~	~~45~~	~~120.8~~	~~Outlier~~
~~ROBO~~	~~436~~	~~158324-ROBO~~	~~20210328~~	~~G6~~	~~-30~~	~~<35~~	~~42100~~	~~10.6478~~	~~AG~~	~~48~~	~~99.5~~	~~Outlier~~

TMC 436

Statistics with and without correction factor applied to account for bias

TMC 436		n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa*s, min	95% band in mPa*s, max	95% band (ln), min	95% band (ln), max
Option #1	No bias correction. Outliers removed.	15	10.3297	30,629	0.1087	24,750	37,904	10.1166	10.5428
Option #2	Average Yi from TMC statistics (Yi = -0.1000). Outliers removed.		10.3475	31,179		25,195	38,584	10.1344	10.5606
Option #3	Average Yi from TMC statistics (Yi = -0.1000). Outliers included	17	10.3437	31,061	0.1605	22,677	42,544	10.0291	10.6583
438		14	10.2676	28,785	0.2037	19,308	42,912	9.8683	10.6669
438-2		19	10.5404	37,813	0.2596	22,734	62,894	10.0316	11.0492

- The ROBO test ran slightly mild last semester when data was collected: Yi = -0.1000
- Applying correction factor has minor impact to overall range; nevertheless, we should apply it if we wish to remain consistent with previous reference oil limit setting.

➢ Recommend we approve Option #2.

Comparison of limits

Oil	n	Natural Log Transformed Mean (ln)	Mean in Original Units	s.d. (ln)	95% band in mPa·s Min[1]	95% band in mPa·s Max[1]	95% Bands Min (ln)	95% Bands Max (ln)
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435	15	11.4895	97,685	0.2932	60,000	173,546	11.0021	12.0642
435-1	22	11.0416	62,420	0.20295	44570	92910	10.7048	11.4394
436	15	10.3475	31,179	0.1087	25195	38584	10.1344	10.5606
438	14	10.2676	28,785	0.2037	19,308	42,912	9.8683	10.6669
438-2	19	10.5404	37813	0.2596	22,734	62,894	10.0316	11.0492

Dilute NO_2

Dilute nitrogen dioxide
Next steps

Microsoft Word Document

Path forward to implement dilute NO2 as an alternative to pure NO2 is the following:

- ☒ **1) Demonstrate equivalence to the SP** → Based on the available data, SP feels confident that dilute NO2 and concentrated NO2 yield comparable results.
- ☒ 2) Develop a procedure for dilute NO2 → Draft completed, but now need input/review from SP.
- ☐ 3) Approve by SP → Seek approval after procedure is written.
- ☐ 4) Issue information letter allowing use of dilute NO2 as an alternative
- ☐ 5) Ballot the recommended changes at ASTM

Any Additional Topics?

Next Meeting

- Suggestions for next SP meeting? Need to allow time for SP to review alternative procedure for dilute NO2
  - **May 13?**