

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

**Meeting:** ROBO SP Meeting

**Date:** October 25, 2018

**Location:** Skype meeting

**Minutes by:** Justin Mills

### Actions:

1. Matt Schlaff or Justin Mills to contact ASTM's ILS group and determine appropriate course of action for approving dilute nitrogen dioxide as an alternative to concentrated nitrogen dioxide in the ASTM D7528 method.
2. Justin Mills to provide link to TMC LTMS document that contains ROBO calibration requirements.
  - a. <http://www.astmtmc.cmu.edu/ftp/docs/ltms/>
3. Justin Mills to include "calibration requirements for new units" as a topic in the next SP meeting.
4. Justin Mills and Tom Schofield to develop wording for footnote regarding 434-2 bias correction in the TMC Calibration Requirement. Justin Mills to include this as a topic in next SP meeting.
5. Justin Mills to schedule next SP meeting for Thursday, November 29<sup>th</sup>.

### Membership and Attendance:

Ace Glass	Dave Lawrence
Afton	*Shelia Thompson, Jeff Yang, Todd Dvorak
ASTM TMC	*Tom Schofield
BASF	Mary Dery, Bridgett Rakestraw
Chevron Oronite	Man Hon Tsang, Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	Joe Franklin, *Matt Schlaff
Lubrizol	*Mike Faile, *Aimee Shinhearl, Rick Hartman
PetroChina	Li Shaohui , Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	*Justin Mills, *Bruce Zweitzig, *Joan Souchik, *John Maxwell
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 Miiller, Ted Selby
General Interest	*Alan Flamberg
Guests	

\* Denotes attendance

### Summary:

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

- Meeting convened at 10:03EST on October 25, 2018
- Agenda accepted by SP without any modifications
- ASTM Antitrust and Recording Policy reviewed
- Membership review and update
  - Elizabeth Wagoner of Evonik was removed from the membership list, because she is no longer with Evonik.
- Meeting minutes from June SP meeting were accepted
  - Motion made by Matt Schlaff and seconded by Shelia Thompson
- Actions from the July 19<sup>th</sup> meeting were reviewed - all actions from July 19<sup>th</sup> meeting have been completed (see attached slides for further details)
  - Leen Poot of Kuwait Petroleum was removed from ROBO SP membership list due to inactivity (likely retired from Kuwait Petroleum).
  - Justin Mills emailed API to provide an update on ROBO test queues at independent labs so that API may assess whether or not provisional licensing is still necessary. Justin reported that API decided to maintain provisional licensing despite the relatively low test queues.
  - The current queue at SWRI is about 1 week and at Intertek the queue is about 2.5 weeks
  - Tom Schofield has updated the TMC Calibration Requirements to reflect the new TMC 434-2 limits and specify yield stress as a pass/fail criteria for all current reference oils.
  - Tom reported that all calibration documents for TMC monitored tests will now be housed in a single LTMS document that can be accessed through the TMC website <http://www.astmtmc.cmu.edu/ftp/docs/lrms/>

The Test Monitoring Center (TMC) offers reference oil distribution and data handling services to laboratories involved in lubricant testing. We provide a reference oil based system for the calibration of ASTM Test Methods.

Other services include laboratory inspections, rater calibration workshops and industry related registration services. Please contact us at 412-365-1030 for any calibration or registration needs.

Website Links

- Online Store
- Surveillance Panel List
- Current TMC Price Schedule
- Control Chart Guidelines (LTMS)
- ASTM Reference Oil Book
- Subcommittee B Glossary
- ASTM Test Method 'D' Numbers
- TMC Single Source Data Policy
- Best Practices
- Test Hardware Control
- Rater Workshop Registration
- Data Analyst List
- ASTM Tech. Committee Regs. & Orientation
- Safety Data Sheets (SDS)

Industry Links

- ASTM International
- ACC Monitoring Agency
- ATC-European Registration Centre
- CEC - Coordinating European Council

- Evonik has resumed work on the dilute nitrogen dioxide study/comparison.
- Stats Group update
  - Justin Mills and Tom Schofield provided the ASTM Stats Group with a ROBO timeline containing dates for critical ROBO events (see attached slides for timeline)
  - The Stats Group is currently very busy with supporting Sequence engine tests for GF-6
    - Justin Mills has expressed to the Stats Group that investigating severity factors or some alternative form of a correction factor has been on our SP's to-do list for a while but we consider it to be low priority.
- Dilute nitrogen dioxide
  - Adding dilute nitrogen dioxide (1.13% NO<sub>2</sub> in air) at 185 ml/min over first 12 hours is equivalent to mixing 2ml of concentrated NO<sub>2</sub> with 185ml of dry air over 12 hours.

## MEETING MINUTES: ROBO SURVEILLANCE PANEL

- Evonik has resumed work on the dilute nitrogen dioxide study/comparison
  - Evonik's configuration was shared (see attached slides)
  - Evonik compared results for standard NO<sub>2</sub> and dilute NO<sub>2</sub> ROBO runs on their internal 5W-20 QC oil, and observed comparable values for oxidation, pVis, and MRV.
  - Evonik plans to run the three TMC reference oils back-to-back using the dilute NO<sub>2</sub> to confirm equivalency.
    - At the request of the SP, Evonik will run two back-to-back sets of TMC reference oils. If two back-to-back sets are completed with passing results, Mike Faile of Lubrizol said he would feel confident to begin his comparison study.
- To implement dilute nitrogen dioxide as an alternative to pure nitrogen dioxide, an ILS may be necessary. Matt Schlaff believes there may be less rigorous alternative for equivalency studies. Matt to contact ILS group or provide Justin with appropriate contact.
  - If implemented, labs will likely need to conduct a 2-test reference when switching from standard/concentrated nitrogen dioxide to dilute nitrogen dioxide
- Intertek plans to participate in the dilute nitrogen dioxide study, but their current backlog of samples is preventing them from converting an existing, calibrated ROBO unit to a dilute NO<sub>2</sub> configuration.
- Additional topics
  - Unresolved/unclear whether or not all new ROBO units must complete 3 back-to-back runs with TMC reference oils followed by 2 back-to-back blind reference runs. Justin Mills and Tom Schofield believe that existing labs with multiple ROBO units should only be required to complete the standard 2 back-to-back blind reference runs. Agreed to address this topic at next SP meeting
  - Matt Schlaff suggested we add a footnote on the TMC Calibration Requirements for 434-2 limits to describe the bias correction. Justin Mills to work with Tom Schofield on wording for footnote. Agreed to address this topic and possibly vote on its inclusion into calibration requirements at the next meeting.
- Next meeting to be scheduled for November 29, 2018.
- Meeting adjourned

# ROBO Surveillance Panel Meeting

October 25, 2018

Justin Mills

## Agenda

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- Welcome, ASTM statement
- Review membership of SP
- Review and approve minutes from previous meetings (see attachment)
- Review actions from July 19<sup>th</sup> meeting
- Update on recent activity with ASTM Stats Group
- Dilute nitrogen dioxide discussion – review available data
- Additional topics?
- Set next meeting

## ASTM Antitrust and Recording Policy

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ASTM International is a not-for-profit organization and developer of voluntary consensus standards. ASTM's leadership in international standards development is driven by the contributions of its members: more than 30,000 technical experts and business professionals representing 135 countries.

The purpose of antitrust laws is to preserve economic competition in the marketplace by prohibiting, among other things, unreasonable restraints of trade. In ASTM activities, it is important to recognize that participants often represent competitive interests. Antitrust laws require that all competition be open and unrestricted.

It is ASTM's policy, and the policy of each of its committees and subcommittees, to conduct all business and activity in full compliance with international, federal and state antitrust and competition laws. The ASTM Board of Directors has adopted an antitrust policy which is found in Section 19 of ASTM Regulations Governing Technical Committees. All members need to be aware of and compliant with this policy. The Regulations are accessible on the ASTM website (<http://www.astm.org/COMMIT/Regs.pdf>).

Electronic recording of ASTM meetings is prohibited.

## Membership – Updated 7/24/18

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Ace Glass	Dave Lawrence
Afton	Shelia Thompson, Jeff Yang, Todd Dvorak
ASTM TMC	Tom Schofield
BASF	Mary Dery, Bridgett Rakestraw
Chevron Oronite	Man Hon Tsang, Robert Stockwell
ExxonMobil	Dennis Gaal
Infineum	Andy Richie, Sapna Eticala
Intertek	Joe Franklin, Matt Schlaff
Lubrizol	Mike Faile, Aimee Shinheart, Rick Hartman
PetroChina	Li Shaohui, Sun Ruihua, Peng Wang, Xiaogang Li, Xu Li
Evonik Oil Additives	Justin Mills, Bruce Zweitzig, Joan Souchik, John Maxwell, Elizabeth Wagoner
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

### Summary of changes:

- Todd Dvorak added to Afton's membership list
- Alan Flamberg added to General Interest
- Leen Poot of Kuwait Petroleum removed due to inactivity

## Motion to accept July 19, 2018 meeting minutes

**MEETING MINUTES: ROBO SURVEILLANCE PANEL**

Meeting: ROBO SP Meeting  
Date: July 19, 2018  
Location: Spine meeting  
Minutes by: Justin Mills

**Agenda:**

- Justin Mills to email Leen Poot of Kuwait Petroleum to see if he still wishes to be a ROBO SP member. If no response is received within a week, he will be removed from membership list.
- Justin Mills to email API (Kevin Ferrick) with an update on test queue at independent labs.
- Tom Schofield to update the TMC Calibration Requirements to reflect the new TMC 434-2 limits.
- Evonik to resume work on dilute nitrogen dioxide project and present initial finding at next SP meeting.
- Tom Schofield to update TMC Calibration Requirements to include pass/fail requirements for MRV yield stress.
- Current TMC reference oils (434-2, 435-1, 438) to have <35 Pa yield stress.
- Justin Mills to schedule next SP meeting for late September.

**Members and Attendance:**

Alan Oates	Steve Lawrence
Alan	Yuhua Thompson, Jeff Yang, *Tad Dornak
ASTM TMC:	*Tom Schofield
BAEP:	Mary Dery, Bridget Rukonova
Chromatix:	Mike Van Tassig, *Robert Blockstad
ExxonMobil:	Derrick Gao
Intertek:	Amy Rhome, Sapna Elstia
Intertek:	Joe Franklin, *Matt Schuff
Kuwait Petroleum:	Leen Poot
Lambert:	Mike Lane, Anne Dornak, Rob Hoffman
Perstorp:	Li Sheng, Zou Rufan, Peng Yihan, Hongping Li, Ru Li
Evonik Oil Additives:	*Justin Mills, *Vince Zwarg, *John Bouche, *John Maxwell, *Elizabeth Wagner
Verabrid Chemicals:	Al Filas, Ron Hiza
Battl:	*Nicky Gifford, Joe De La Cruz, *Mike Bika, *Yong-Li Mafarlan
Verabrid:	Antar Jhaari, Kevin Eggert, Steve Lazzaro
Kocher Instruments:	Raj Shah, Vincent Colapinto
Tamarcobalt:	Greg Miller, Ted Selby
General Interest:	*Alan Flannery
Guests:	*Mike Santos (Intertek)

ASTM 0708 ROBO SP Meeting July 19, 2018

**MEETING MINUTES: ROBO NOVEL LABS PANEL**

**Agenda:**

- Meeting commenced at 10:00 AM on July 19, 2018.
- Approved by SP members: Resolutions
- ASTM calibration and monitoring project - POCY reviewed
- Membership review and update:
  - Leen Poot was asked to submit membership list
  - Alan Flannery was added to General Interest
  - Leen Poot of Kuwait Petroleum has not submitted a membership list. It is likely that he has not yet received an email from our membership list. Justin Mills will send an email to Leen. If no response is received within a week, he will be removed from membership list.
- ASTM procedural licensing for ROBO:
  - Meeting minutes from June SP meeting were accepted
  - In March 2018 ASTM granted provisional licensing for ROBO to API 5th Plus due to long test queue. At that point, Independent Labs had capacity in excess of 3 months for ROBO. The demand for ROBO has since subsided and the backlog at IDRI is approximately one week and at Intertek is approximately one month. Now that the test queue for ROBO is a manageable amount of time, the SP needs to update API.
  - Setting permanent limits for TMC 434-2
    - A full battery of these test will temporary limits for TMC 434-2 July 2017 were reviewed.
    - The need for a bias correction factor was reviewed. The methodology for calculating the factor was also reviewed.

Item	Item	Item	Item	Item	Item
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Item 13	Item 14	Item 15	Item 16	Item 17	Item 18
Item 19	Item 20	Item 21	Item 22	Item 23	Item 24
Item 25	Item 26	Item 27	Item 28	Item 29	Item 30
Item 31	Item 32	Item 33	Item 34	Item 35	Item 36
Item 37	Item 38	Item 39	Item 40	Item 41	Item 42
Item 43	Item 44	Item 45	Item 46	Item 47	Item 48
Item 49	Item 50	Item 51	Item 52	Item 53	Item 54
Item 55	Item 56	Item 57	Item 58	Item 59	Item 60
Item 61	Item 62	Item 63	Item 64	Item 65	Item 66
Item 67	Item 68	Item 69	Item 70	Item 71	Item 72
Item 73	Item 74	Item 75	Item 76	Item 77	Item 78
Item 79	Item 80	Item 81	Item 82	Item 83	Item 84
Item 85	Item 86	Item 87	Item 88	Item 89	Item 90
Item 91	Item 92	Item 93	Item 94	Item 95	Item 96
Item 97	Item 98	Item 99	Item 100	Item 101	Item 102
Item 103	Item 104	Item 105	Item 106	Item 107	Item 108
Item 109	Item 110	Item 111	Item 112	Item 113	Item 114
Item 115	Item 116	Item 117	Item 118	Item 119	Item 120
Item 121	Item 122	Item 123	Item 124	Item 125	Item 126
Item 127	Item 128	Item 129	Item 130	Item 131	Item 132
Item 133	Item 134	Item 135	Item 136	Item 137	Item 138
Item 139	Item 140	Item 141	Item 142	Item 143	Item 144
Item 145	Item 146	Item 147	Item 148	Item 149	Item 150
Item 151	Item 152	Item 153	Item 154	Item 155	Item 156
Item 157	Item 158	Item 159	Item 160	Item 161	Item 162
Item 163	Item 164	Item 165	Item 166	Item 167	Item 168
Item 169	Item 170	Item 171	Item 172	Item 173	Item 174
Item 175	Item 176	Item 177	Item 178	Item 179	Item 180
Item 181	Item 182	Item 183	Item 184	Item 185	Item 186
Item 187	Item 188	Item 189	Item 190	Item 191	Item 192
Item 193	Item 194	Item 195	Item 196	Item 197	Item 198
Item 199	Item 200	Item 201	Item 202	Item 203	Item 204
Item 205	Item 206	Item 207	Item 208	Item 209	Item 210
Item 211	Item 212	Item 213	Item 214	Item 215	Item 216
Item 217	Item 218	Item 219	Item 220	Item 221	Item 222
Item 223	Item 224	Item 225	Item 226	Item 227	Item 228
Item 229	Item 230	Item 231	Item 232	Item 233	Item 234
Item 235	Item 236	Item 237	Item 238	Item 239	Item 240
Item 241	Item 242	Item 243	Item 244	Item 245	Item 246
Item 247	Item 248	Item 249	Item 250	Item 251	Item 252
Item 253	Item 254	Item 255	Item 256	Item 257	Item 258
Item 259	Item 260	Item 261	Item 262	Item 263	Item 264
Item 265	Item 266	Item 267	Item 268	Item 269	Item 270
Item 271	Item 272	Item 273	Item 274	Item 275	Item 276
Item 277	Item 278	Item 279	Item 280	Item 281	Item 282
Item 283	Item 284	Item 285	Item 286	Item 287	Item 288
Item 289	Item 290	Item 291	Item 292	Item 293	Item 294
Item 295	Item 296	Item 297	Item 298	Item 299	Item 300

ASTM 0708 ROBO SP Meeting July 19, 2018

**MEETING MINUTES: ROBO NOVEL LABS PANEL**

nitrogen dioxide. Evonik has agreed to resume their work on dilute nitrogen dioxide. IDRI and Intertek have 3 on their "to do" list and will likely resume their work in the coming months.

- Additional topics - housekeeping
  - MRV yield stress is required by TMC for reference oils, but there is currently no successful criteria. As such, yield stress is not included in the assessment. The three current TMC reference oils (434-2, 435-1, and 438) should not include yield stress. A motion was made by Tom Schofield to include MRV yield stress in the TMC calibration requirements. It was accepted by Mike Bika. The motion to include yield stress in the TMC calibration requirements was accepted by the SP.
  - The SP was reminded to adhere to ASTM guidelines for reporting test results.
- Next meeting to be scheduled for late September 2018.
- Meeting adjourned

ASTM 0708 ROBO SP Meeting July 19, 2018

## Actions from July 19<sup>th</sup> meeting

- Justin Mills to email Leen Poot of Kuwait Petroleum to see if he still wishes to be a ROBO SP member. If no response is received within a week, he will be removed from membership list.
  - Complete. Email sent to Leen, but no response was received. Leen has been removed from SP membership.
- Justin Mills to email API (Kevin Ferrick) with an update on test queue at independent labs.
  - Complete. API chose not remove ROBO from provisional licensing.
- Tom Schofield to update the TMC Calibration Requirements to reflect the new TMC 434-2 limits.
  - Complete. TMC Calibration Requirements updated with version 20180720.
- Evonik to resume work on dilute nitrogen dioxide project and present initial finding at next SP meeting.
  - Complete. Will discuss in later slides
- Tom Schofield to update TMC Calibration Requirements to include pass/fail requirements for MRV yield stress. Current TMC reference oils (434-2, 435-1, 438) to have <35 Pa yield stress.
  - Complete. TMC Calibration Requirements updated with version 20180720.
- Justin Mills to schedule next SP meeting for late September.
  - Complete. Meeting was scheduled for September but postponed to October 25<sup>th</sup> due to lack of updates.

## TMC Calibration Requirements update

Table 1  
MRV VISCOSITY  
Unit of Measure: LN(MRV)

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 <sup>2</sup>	95% band in mPa s Max <sup>2</sup>	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	10.9284	55,737	0.1551	41,126	76,008	10.6244	11.2386	
435	15	11.4895	97,685	0.2932	160,000	173,546	11.0021	12.0642	
435-1	22	11.0416	62,420	0.20295	344570	92910	10.7048	11.4394	
438	14	10.2676	28,785	0.2037	19,308	42,912	9.8683	10.6669	

4. EOT yield stress (MRVYSEOT) for the reference oils, in a properly run test, should always be <35 Pa. Tests with EOT yield stress measured or reported at anything other than <35 will be declared operationally invalid.

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## Email sent to API regarding provisional licensing

**From:** Mills, Justin  
**Sent:** Monday, July 23, 2018 1:33 PM  
**To:** 'Dennis Bachelder'; 'Ferrick@API.Org'; 'doug\_anderson@americanchemistry.com'; 'JRFrederick@Valvoline.com'  
**Subject:** RE: API SN Plus and ROBO Queue at Independent Labs

All,

I am writing this email to you as the ROBO Surveillance Panel Chair. On March 12<sup>th</sup> I sent an email (see below) informing you of the long test queue for the ROBO test at the independent test labs. As a result, provisional licensing was granted for the ROBO test. Since this time the long test queues have subsided. This is likely due to two reasons: demand for API SN Plus testing is winding down and some labs have added additional ROBO test capacity. At our ROBO Surveillance Panel meeting on July 19<sup>th</sup>, I was informed that one independent lab has a test queue of approximately one week and the other independent lab has a test queue of approximately one month.

Please use this information as you see fit. My intention is only to inform you of the test queue.

Best Regards,  
 Justin Mills - Chair of ROBO SP

**API chose to maintain provisional licensing for ROBO.**

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# Statistics

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## **ASTM Stats Group Support Update**

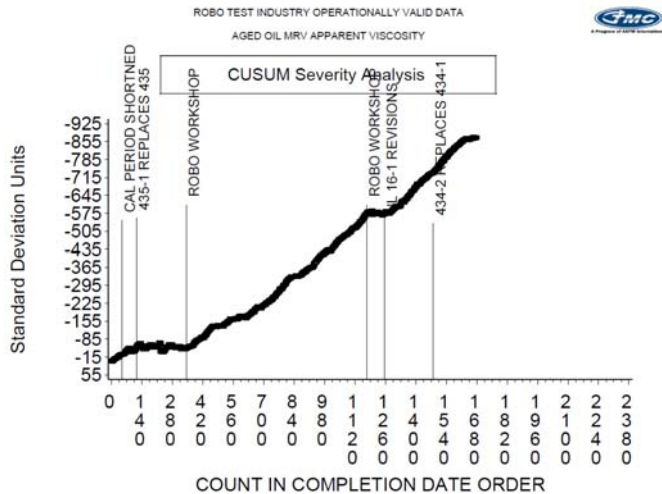
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- ASTM Stats Group has been provided with ROBO timeline
- Stats Group is very busy with Sequence tests for GF-6
  - I expressed that investigating severity factors or some alternative form of a correction factor has been on our SP's to-do list for a while but we consider it to be low priority.
- No additional updates to report

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## MRV timeline



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## Critical dates for ROBO timeline

### Slide 1 of 2

- 2008 First RR to set preliminary targets, participating rigs retroactively given calibrated status. Not all RR data is included in TMC data base! Data was collected outside of TMC database system, only retroactive tests that calibrate rig were added to TMC database.
- 20081113 First calibration requirements issued, includes oil targets and acceptance bands (based on natural log transformed results, Ti), oils 434-1, 435 & 438.
- 20081220 DTCOMP of first non-RR calibration test (1 of 2 test calibration)
- 20081113 First calibration requirements document issued (approximate date)
- 20090115 TMC sent notice we are open for ROBO business, report packet issued (some test reported retroactively).
- 20090122 Labs informed of critical update to MRV test method (D4684), making update to new MRV method mandatory.
- 20090708 Test method update from 'Draft 5' to D7528-09
- 20091012 Calibration period shortened from '25 tests or 100 days' to '15 tests or 50 days'. Retroactively implemented, but labs ready to expire were given a 'three-test lead' to recalibrate.
- 20100408 Replaced 435 w/ 435-1 (some overlap as labs use up 435)
- 20110423 Calibration requirements update effective (v 20110420), includes new two-test requirement following two successive OC fails, and VOLEOT > = 60 % fails a test operationally. 20110816 Report packet update (fields added to track changes to vacuum pumps, reactor vessels, heater voltage, all now considered 'significant changes' that would trigger a required two-test calibration).
- 20110406 ROBO Workshop

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## Critical dates for ROBO timeline

### Slide 2 of 2

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- 20130814 Update test method from -09 to -13
- 20151014 ROBO Workshop
- 20160311 IL 16-1 Test Method Revisions implemented, many clarifications, TMC monitoring required.
- 20170606 Update test method from -13 to -17 (includes all IL items except TMC monitoring participation, unintended omission)
- 20170728 Updated calibration requirements, replace 434-1 w/ 434-2 (overlap as labs use up 434-1). Preliminary targets based on only 5 tests!
- 20171101 Updated test method from -17 to -17a to include making TMC monitoring mandatory (already effective through IL)
- 20180525 Updated report packet effective to expand CCSVEOT to allow for '>' symbol.
- 20180720 Updated calibration requirements to reflect new limits for 434-2 (permanent limits replaced temporary limits)

## Dilute Nitrogen Dioxide

## Dilute Nitrogen Dioxide

### Slide from July 19<sup>th</sup> meeting

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#### ▪ Past Activity

- Dilute NO<sub>2</sub> workgroup met in September 2017
  - Agreed that an equivalent concentration would be **1.13% NO<sub>2</sub> in air fed at 185ml/min for 12hours.**
- Lab AM completed 4 runs with dilute NO<sub>2</sub> – no change in severity with dilute NO<sub>2</sub> was observed
- Work at all labs halted because of high ROBO demand at all labs to support API SN Plus.

#### ▪ Now that demand from API SN Plus has subsided, it is time to start resuming work on the dilute NO<sub>2</sub> alternative.

- Evonik is in process of re-converting a unit to use dilute NO<sub>2</sub>
- Do any other labs have plans to resume their work on dilute NO<sub>2</sub> alternative? If so, when?

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## Current setting vs proposed alternative

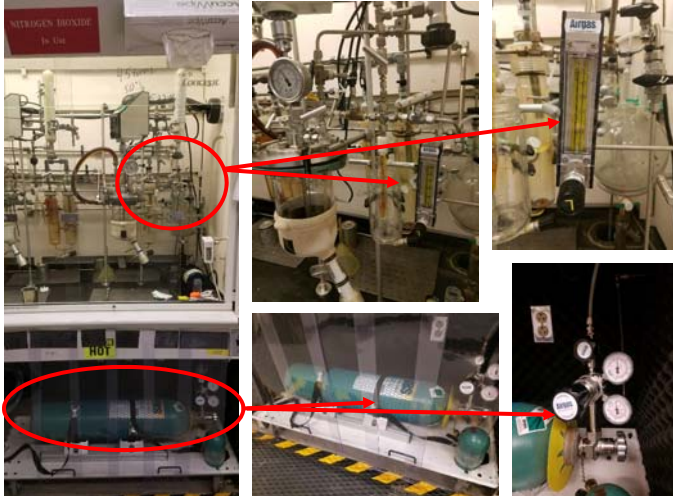
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Ingredient	ROBO Setting	Proposed dilute NO2 setting
Test fluid	200 grams	200 grams
Iron ferrocene	15 PPM	15 PPM
Nitrogen dioxide	2 ml "pure" NO <sub>2</sub> fed over first 12 hours	1.13% NO <sub>2</sub> in air fed at 185 ml/min over first 12 hours
Dry air	185 ml / minute (entire test)	185 ml / minute (12 hours – EOT)
Agitation	200 RPM	200 RPM
Vacuum	0.61 Bar 56.6 L/min	0.61 Bar 56.6 L/min
Temperature	170°C	170°C
Time	40 Hours	40 Hours

**Only difference is nitrogen dioxide and dry air.**

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### Evonik's setup

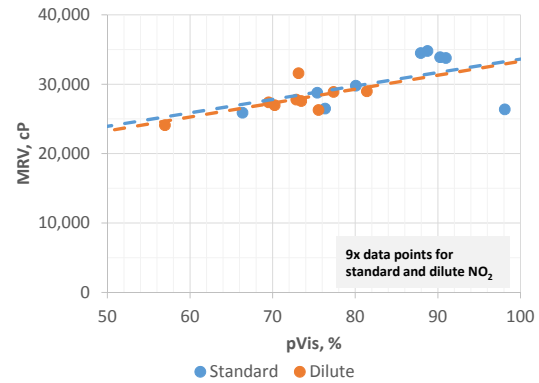
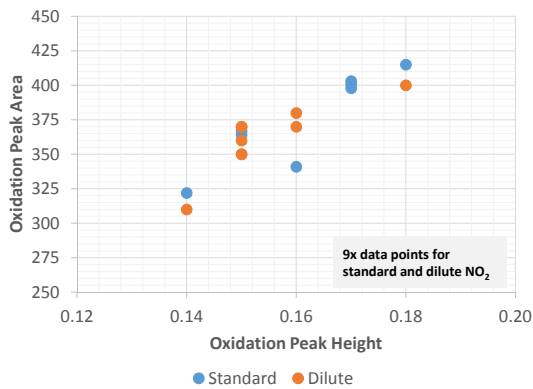


Air cylinder	Air Gas
Regulator	Air Gas
Flow meter	Air Gas

- Temporary configuration
- Permanent configurations will likely include:
  - Permanent cabinet for storing larger, upright NO<sub>2</sub> bottles
  - Digital flow meter/controller
  - On/Off solenoid or switch to convert from dilute NO<sub>2</sub> to dry air

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### Evonik's data on internal reference oil SAE 5W-20, API SN



**Comparable levels of oxidation achieved. Similar pVis and MRV.**

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## Next steps

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- Evonik will run TMC calibration oils
  - Run all three test back-to-back to ensure calibration is possible
  - Compare results with historic values
  
- What other data is necessary to approve dilute NO<sub>2</sub> as an alternative to concentrated NO<sub>2</sub>?
  
- When can other labs begin testing?

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**Any Additional Topics?**

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## Next Meeting

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- Suggestions for next SP meeting?
  - Suggest we have meeting before December ASTM
  - November 29?, December 6?