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Issued: November 03, 2010

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These are unapproved minutes of the 11.02.2010 Sequence VI Surveillance Panel conference call.

The meeting was called to order at 10:00 AM by Chairman Charlie Leverett.

Agenda

1.) **Roll Call**, any proxies or membership changes?
- **a.) Bob Campbell for Dave Glaenzer**
- **b.) Jason Bowden for Dwight Bowden.**
- **c.) See Attachment 1.**

2.) **Approval of minutes** from August 8th conference call.
- **a.) Motion to accept minutes by Rich Grundza, Jason Bowden second.**
- **b.) Minutes received unanimous approval.**

3.) **Action Items**:

3.1 Form a task force to develop a recommendation to the surveillance panel for adopting LTMS 2nd Edition to the Sequence VID. Task force to report to surveillance panel within six weeks of May 13th meeting.
The Task Force has supplied their recommendation as Appendix F modified for the VID test. See Attachment 2. There will be a face to face SP meeting scheduled in 01.2010 to discuss this issue.

3.2 Refine the procedure for the system time response measurement, add MAP, and repeat at the laboratories, comments in 5/13/10 minutes:

* There was discussion on load cell power supplies and temperature variations.
* Data for the labs was supplied.
* That data is not meaningful.

See old business below.

3.3 OHT to report VID engine usage and expected depletion date at all surveillance panel meetings.

a) **See Attachment 3, 4 and 5 for a review of the engine use.**
b) **D engine life would end in 2012 or 2013 at current usage rates.**
c) **It is expected orders will drop off in 2011, and extend to 2015.**
d) **The panel would need input from GM for expected life of engines, storage methods for retired engines, and critical parts should the engines be rebuilt.**
e) **OHT recommends an Engine Build Task Force be created. Dan Worcester has volunteered to Chair this group. Labs and OHT will be included in this Task Force at a minimum.**

ACTION: CREATE AN ENGINE BUILD TASK FORCE.

3.6 Sid Clark to inquire with GM if information they may release GM's opinions on oil consumption and if this may be shared with the surveillance panel.

a) **One engine was returned to GM from SwRI for tear down and review. OHT now has this engine.**
b) **The initial review showed flowering [high and low points in the cylinder bores], but later more detailed measurements indicated the bores were round with minimal distortion.**
c) **Exhaust seats showed peening, and #4 had burned.**
d) **Second ring lands had heavy carbon build up.**

4.) **New Business**:

4.1 Introduction of new reference oil, what are our options?

- Approve this oil for use in the Sequence VID using the current data to set the initial targets
- Determine target update intervals
- Determine if we want to drop one of the existing reference oils
- Determine the usage rate of RO-1010

a) **The TMC data sheet for 1010 is included as Attachment 6.**

MOTION: [Andy Richie, Bob Campbell second] ACCEPT 1010 FOR USE IN THE VID USING CURRENT POOLED STANDARD DEVIATI0N.
9 for, 0 against, 1 waive.

b) **Targets will be updated at 10 and 20 and fixed at 30, and this was accepted. However, LTMS 2 will define not changing the reference oil means, so this will be part of the LTMS discussion in January.**

MOTION: [Andy Richie, Robert Stockwell second] DROP RO-542 [5W-30, OIL X] AND REPLACE WITH RO-1010.
1 for, 1 against, 8 waive.

c) **There was discussion on which oil to drop, if any. The current procedure says to use all 3 reference oils for a new engine being brought into the system. There is also a usage rate defined below. This decision for usage rates and new reference oil assignment will be tabled for a conference call on 11.16.2010. A plan would be good.**

Current usage rates

Once a stand/engine has been accepted into the system, the TMC will assign reference oils for continuing calibration according to the following reference oil mix:

* 40% of the scheduled calibration tests should be conducted on reference oil 540 or subsequent approved re-blends.

* 20% of the scheduled calibration tests should be conducted on reference oil 541 or subsequent approved re-blends.

* 40% of the scheduled calibration tests should be conducted on reference oil 542 or subsequent approved re-blends.

4.2 Limits for the VID to license GF-4 oils, request from PCEOCP:

*API will continue to license GF-4 until **September 30, 2011** and there are currently no plans to obsolete API SM / Energy Conserving so we are still very much interested in Sequence VID equivalent limits for these specifications.*

a) **There was no motion for VID limits for GF-4.**
b) **This will be dropped as an Action Item.**

5.) Old Business:

5.1Lubrizol engine failure:

We recently pulled a VID engine from service at 3700 hrs due to what was later determined to be failed rod bearings. It's a bit puzzling, and I thought I'd share the details with you in case there have been similar failures.

- Noticed both Oberg oil filters had significant amount of aluminum debris after last test
- BL fuel consumption shifted up by about 1% for all phases (BLB1 and 2, and BLA); the implication is the issue occurred BETWEEN the last test and previous test
- No discernable change in oil pressure
- ALL (6) rod bearings were damaged with a groove worn in the center
- Main bearings and cam bearings were perfect; crankshaft not damaged; oil pump was fine as well
- We cannot determine any operational anomaly that would be responsible for it (no shutdowns or faults out of the ordinary)
- The engine is 5C, which is a hand built version

a) No additional failures have been reported.

b) Labs should continue to report failures.

5.2 Time Constants – Below is the latest update (10/25/10) from Rich

This is what I got with the one lab reporting revised temp measurements. They were still on the low end

Revised	min	max
Speed	0.1	1.3
Torque	0.2	1.1
Oil Gallery Temperature	0.3	4.5
Coolant Inlet Temperature	1.3	4.3
Exhaust Back Pressure	0.3	2.5
Intake Air Temperature	1.3	4.4
Fuel to Fuel Rail Temperature	1.3	4.7

a) There was a question on limits. The consensus was a maximum would be desirable, but not a minimum.

b) This will be discussed further at the 11.16.2010 conference call.

c) Only SwRI has supplied MAP data for break in traces. Rich will request data for all engines broken in after 02.2010.

d) Lubrizol had data from a motoring dyno.

6.) Next Meeting

November 16, 2010 and January 2011 to discuss LTMS v2 at the call of the Chairman

7.) Adjournment The meeting adjourned at 10:55 AM.

ASTM SEQUENCE VI SURVEILLANCE PANEL

Approve R0101D — Remove 5/12

Name	Address	Phone/Fax/Email	Attendance
Jason ~~Bowden~~, Dwight ✓ Voting Member	OH Technologies, Inc. P.O. Box 5039 Mentor, OH 44061-5039	Phone: 440-354-7007 Fax: 440-354-7080 dhbowden@ohtech.com	W W
Bruce Matthews Voting Member	GM Powertrain Engine Oil Group Mail Code: 483-730-472 823 Joslyn Rd	Pontiac, MI 48340: 248-830-9197 bruce.matthews@gm.com	
Andy Ritchie ✓ Voting Member	Infineum 1900 East Linden Ave. Linden, NJ 07036-0735	Phone: 908-474- Fax: 908-474-3637	A W
Ron Romano Voting Member	Ford Motor Company 21500 Oakwood Blvd POEE Bldg Rm DR 167 MD 44 Dearborn, MI 48121-2053	Phone: 313-845-4068 rromano@ford.com	
Leverett, Charlie ✓ Voting Member	Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238	Phone: 210-647-9422 Fax: 210-523-4607 charlie.leverett@intertek.com	A ~~A~~ retract W
Grundza, Rich ✓ Voting Member	ASTM TMC 6555 Penn Ave. Pittsburgh, PA 15206-4489	Phone: 412-365-1034 Fax: 412-365-1047 Dml@tmc.astm.cmri.cmu.edu	A W
Miranda, Timothy Voting Member	BP Castrol Lubricants USA 1500 Valley Road Wayne, NJ 07470	Phone: 973-305-3334 Timothy.Miranda@bp.com	
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Szappanos, George ✓ Voting Member	Lubrizol 29400 Lakeland Blvd. Wickliffe, OH 44092	Phone: 440-347- Fax: 440-347-4096 George.Szappanos@lubrizol.com	A A
Glaenzer, David ✓ Voting Member	Afton Research Center 500 Spring Street Richmond, VA 23218	Phone: 804-788-5214 Fax: 804-788-6358 Dave_Glaenzer@ethyl.com	Bob Campbell has the proxy A No
Sutherland, Mark Voting Member	Chevron Oronite Company LLC 4502 Centerview Ste. 210 San Antonio, TX 78228	Phone: 731-5605 Fax: 731-5621 msut@chevrontexaco.com	
Robert Stockwell ✓ Voting Member	ConocoPhillips Lubricants R&D Passenger Car Engine Oil	office 580-767-6894 Robert.T.Stockwell@conocophillips.com	A W

APPENDIX F
TEMPLATES FOR VERSION 2 LABORATORY AND STAND BASED LTMS

1. Sequence VID LTMS Requirements (A Stand-Engine Based Severity Adjustment System)

TEST METHOD PORTION

The following are the specific Sequence VID calibration test requirements.

A. Reference Oils and Parameters

The prediction error monitoring parameters are Fuel Economy Improvement at 16 hours (FEI1) and Fuel Economy Improvement at 100 hours (FEI2). The reference oils required for test stand-engine are reference oils accepted by the ASTM Sequence VID Surveillance Panel. The targets for the current reference oils for each parameter are presented below.

FUEL ECONOMY IMPROVEMENT AT 16 HOURS
Unit of Measure: Percent
PREDICTION ERROR MONITORING PARAMETER

Reference Oil	Target
540	1.32
541	0.87
542	1.49

FUEL ECONOMY IMPROVEMENT AT 100 HOURS
Unit of Measure: Percent
PREDICTION ERROR MONITORING PARAMETER

Reference Oil	Target
540	1.04
541	0.71
542	0.80

B. Acceptance Criteria

1. New stand-engine combination. A new stand-engine combination is defined as a stand-engine combination that has never previously achieved calibrated status.

a. A minimum of three (3) operationally valid reference and/or matrix tests with no level three e_i alarms (uninterrupted by nonreference oil tests) must be run on each new stand-engine combination.

- Note that industry matrix runs may be included, as well as reference runs, at the discretion of the surveillance panel.

b. Following the necessary tests, check the status of the control charts and follow the prescribed actions.

c. The first (3) tests must be conducted on reference oils 540 (GF5A), 541 (GF5D) and 542 (GF5X). These oils will be assigned in random order by the TMC.

2. Existing Stand-Engine in a Lab

a. For an existing stand-engine run one test

b. Following an operationally valid reference oil calibration test, check the status of the control charts and follow the prescribed actions.

3. Reference Oil Assignment

Once a test stand has been accepted into the system, the TMC will assign reference oils for continuing calibration according to the following reference oil mix:

- oils for continuing calibration according to the following reference oil mix:
  40% of the scheduled calibration tests should be conducted on reference oil 540 (GF5A), or subsequent approved reblends.
  20% of the scheduled calibration tests should be conducted on reference oil 541 (GF5D), or subsequent approved reblends.
  40% of the scheduled calibration tests should be conducted on reference oil 542 (GF5X), or subsequent approved reblends.

4. Chart Status

The following are the steps that must be taken in the case of exceeding chart limits. The steps are listed in order of priority, although charts should be studied simultaneously to determine the cause(s) of a problem. In the case of multiple alarms, contact the TMC for guidance. The laboratory always has the option of removing any stand or engine from the system.

a. Shewhart Chart of Prediction Error (e_i) for **prediction error monitoring parameters only**

- Level 3

  - Immediately conduct one additional reference test in the stand-engine that triggered the alarm. Do not update the control charts until the follow up reference test is completed and the Excessive Influence (ExI) analysis, per Section 4.c (below), has been performed.

- Level 2

  - Reduce the number of tests allowed in the calibration period in the stand that triggered the alarm to eight (8) full length tests or 1400 engine hours during the first three calibration intervals and six (6) full length tests or 1050 engine hours for subsequent calibration intervals.

- Level 1

  – The level 1 limit applies in situations that have been pre-determined by the surveillance panel to have a potential impact on test results. These situations may include the introduction of new critical parts, fuel batches, reference oil reblends, or other test components. When these conditions have been met and a level 1 alarm is triggered, immediately conduct one additional reference test in the stand that triggered the alarm.

  – The level 1 limit also applies to a previously calibrated stand-engine that has not run an acceptable reference in the past two years. The stand-engine can calibrate with one test if the level 1 limits are not exceeded. Otherwise, immediately conduct another reference test in the stand-engine.

  – Level 1 limits are used to judge only the first valid reference in situations where it is determined to apply. All subsequent references are judged against Level 2 and Level 3 limits unless otherwise indicated by the surveillance panel.

b. Reference entity EWMA of Standardized Test Result (Z_i) for **all parameters**

- Level 2

  – Immediately conduct one additional reference test in the stand-engine that triggered the alarm

- Level 1

  – The level 1 limit applies to all reference tests that are control charted, even when other alarms have been triggered. Level 1 uses Z_i to determine the laboratory severity adjustment (SA). Calculate the laboratory SA for each parameter as follows and confirm the calculation with the TMC:

    $SA = -Z_i \times s_{SA}$

    where s_{SA} = industry approved severity adjustment standard deviation

c. Excessive influence (ExI) Analysis for **prediction error monitoring parameters only**

- The ExI analysis is performed anytime that a lab e_i level 3 alarm is triggered. As prescribed in Section 4.a, Level 3, a follow up reference test is run. The following comparisons then determine whether the value of Y_i is modified to limit its influence on LTMS. Y_{i+1} is the next completed reference in the laboratory after the level 3 alarm

  i) If $|Y_i - Y_{i+1}| \leq e_i$ level 3 limit, then Y_i is equal to the value originally determined.
  ii) If $Y_i > Z_{i-1}$ and $Y_i - Y_{i+1} > e_i$ level 3 limit, then let
  $Y_i = e_i$ level 3 limit + Z_{i-1}.
  iii) If $Y_i \leq Z_{i-1}$ and $Y_i - Y_{i+1} < -e_i$ level 3 limit, then let
  $Y_i = -e_i$ level 3 limit + Z_{i-1}.
  iv) If none of i), ii), or iii) is true, then Y_i is equal to the value originally determined.

  Where: i = test that originally triggered level 3 alarm,
  i-1 = test prior to alarm trigger, and
  i+1 = test immediately following alarm trigger.

  Once the proper Y_i value has been determined, update the charts. Confirm calculations with the TMC. The laboratory and the TMC maintain a record of the modification.

d. Industry EWMA of Standardized Test Result (Z_i) for **all parameters**

- Level 2
  - TMC informs the surveillance panel that the limit has been exceeded. The surveillance panel then investigates and pursues resolution of the alarm.
- Level 1
  - The TMC investigates whether severity adjustments are adequately addressing the trend, investigates the possible causes, and communicates as appropriate with industry.

TMC COMPENDIUM PORTION

The following are the specific Sequence VID calibration test requirements.

A. Reference Oils and Parameters

The prediction error monitoring parameters are Fuel Economy Improvement at 16 hours (FEI1) and Fuel Economy Improvement at 100 hours (FEI2). The reference oils required for test stand and test laboratory calibration are reference oils accepted by the ASTM Sequence VID Surveillance Panel. The standard deviations for the current reference oils for each parameter are presented below.

FUEL ECONOMY IMPROVEMENT AT 16 HOURS
Unit of Measure: Percent
PREDICTION ERROR MONITORING PARAMETER

Reference Oil	Standard Deviation
540	0.12
541	0.12
542	0.12

FUEL ECONOMY IMPROVEMENT AT 100 HOURS
Unit of Measure: Percent
PREDICTION ERROR MONITORING PARAMETER

Reference Oil	Standard Deviation
540	0.14
541	0.14
542	0.14

B. Acceptance Criteria

Adjustment (Z_i) and Monitoring (e_i) Charts

The constants used for the construction of the control charts for the Sequence VID, and the adjustment and monitoring chart limits, are shown below.

Stand-Engine Shewhart Limits for Prediction Error Monitoring Parameters

FUEL ECONOMY IMPROVEMENT AT 16 HOURS	
Shewhart Chart of Prediction Error $e_i = Y_i - Z_{i-1}$	
Limit Type	Limit
Level 3	2.126
Level 2	1.784
Level 1	1.390

FUEL ECONOMY IMPROVEMENT AT 100 HOURS	
Shewhart Chart of Prediction Error $e_i = Y_i - Z_{i-1}$	
Limit Type	Limit
Level 3	2.126
Level 2	1.784
Level 1	1.390

Stand-Engine EWMA Limits for Each Severity Adjustment Parameter

FUEL ECONOMY IMPROVEMENT AT 16 HOURS		
EWMA of Standardized Test Result $Z_i = \lambda(Y_i) + (1 - \lambda)Z_{i-1}$		
Limit Type	λ	Limit
Level 2 Upper Limit	0.3	2.5
Level 2 Lower Limit	0.3	-2.5
Level 1	0.3	0

FUEL ECONOMY IMPROVEMENT AT 100 HOURS		
EWMA of Standardized Test Result $Z_i = \lambda(Y_i) + (1 - \lambda)Z_{i-1}$		
Limit Type	λ	Limit
Level 2 Upper Limit	0.3	2.5
Level 2 Lower Limit	0.3	-2.5
Level 1	0.3	0

Stand-Engine Severity Adjustment Standard Deviation for Each Severity Adjustment Parameter

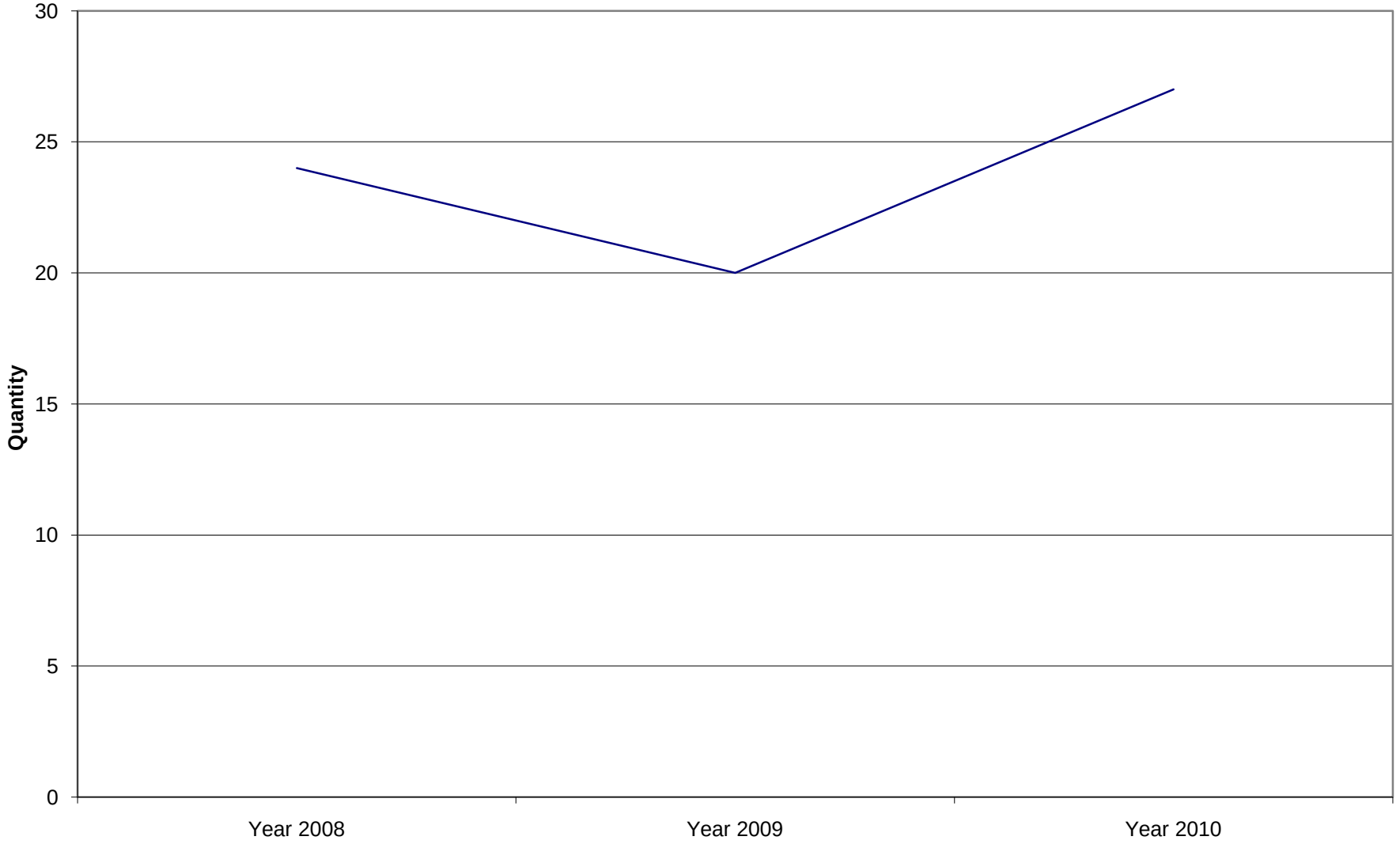
PARAMETER	s_{SA}
FUEL ECONOMY IMPROVEMENT AT 16 HOURS	0.12
FUEL ECONOMY IMPROVEMENT AT 100 HOURS	0.14

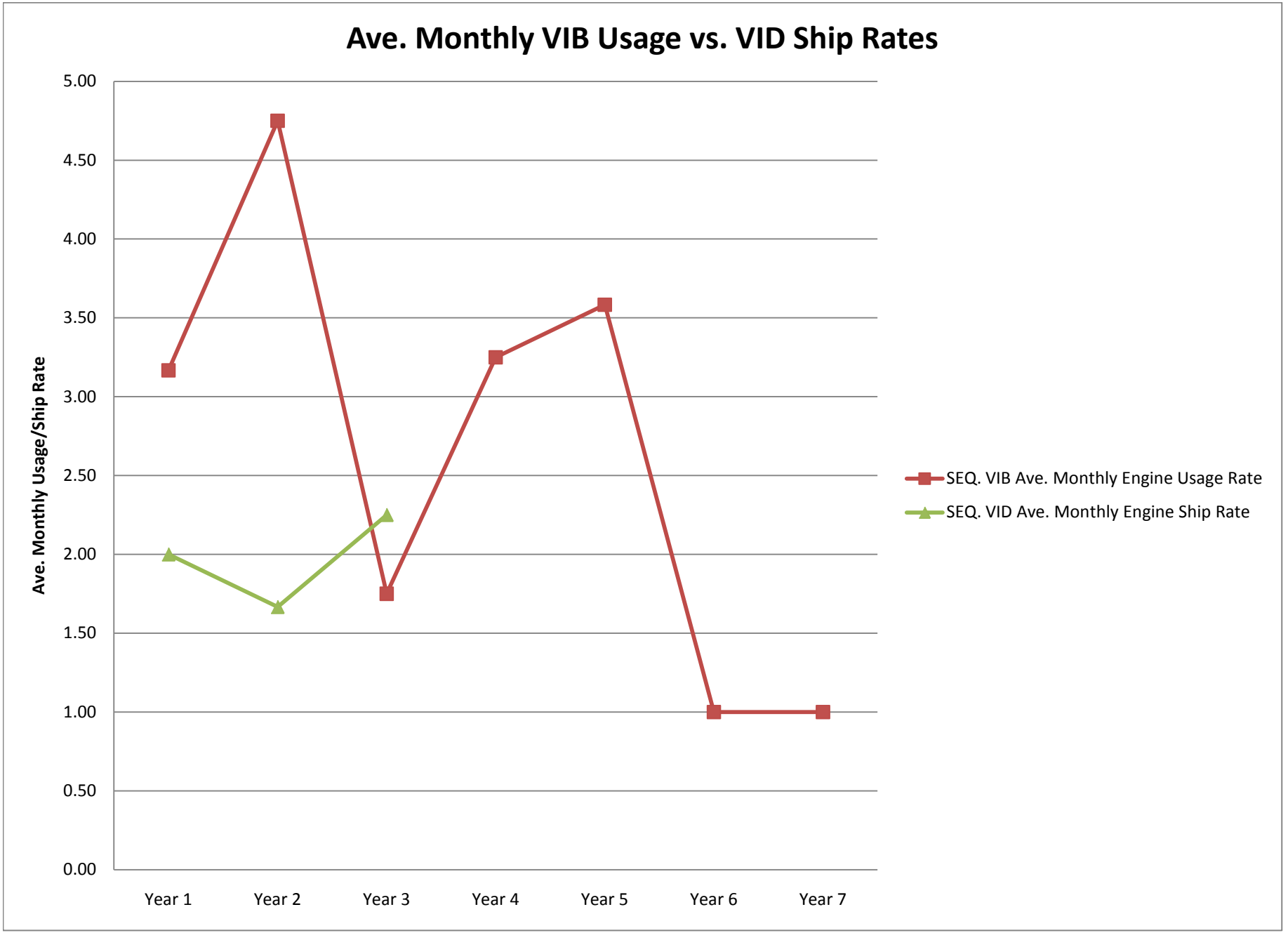
Industry EWMA Limits for Each Severity Adjustment Parameter

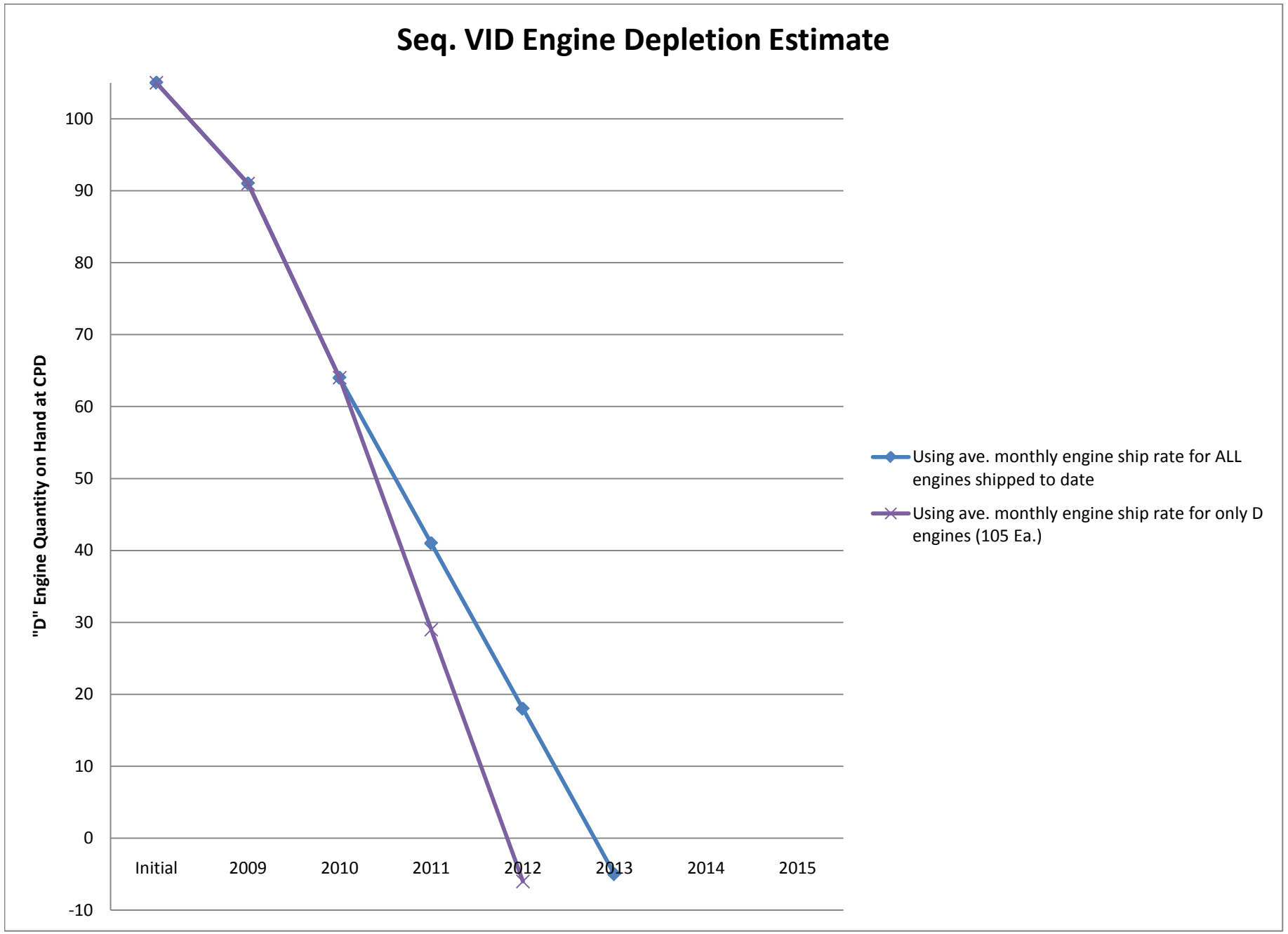
FUEL ECONOMY IMPROVEMENT AT 16 HOURS		
EWMA of Standardized Test Result $Z_i = \lambda(Y_i) + (1 - \lambda)Z_{i-1}$		
Limit Type	λ	Limit
Level 2 Upper Limit	0.2	TBD by SP Input
Level 2 Lower Limit	0.2	TBD by SP Input
Level 1	0.2	TBD

FUEL ECONOMY IMPROVEMENT AT 100 HOURS		
EWMA of Standardized Test Result $Z_i = \lambda(Y_i) + (1 - \lambda)Z_{i-1}$		
Limit Type	λ	Limit
Level 2 Upper Limit	0.2	TBD by SP Input
Level 2 Lower Limit	0.2	TBD by SP Input
Level 1	0.2	TBD

VID Engine Shipments by Year




Ave. Monthly VIB Usage vs. VID Ship Rates
Ave. Monthly Usage/Ship Rate
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
SEQ. VIB Ave. Monthly Engine Usage Rate
SEQ. VID Ave. Monthly Engine Ship Rate


Seq. VID Engine Depletion Estimate
"D" Engine Quantity on Hand at CPD
100
90
80
70
60
50
40
30
20
10
0
-10
Initial
2009
2010
2011
2012
2013
2014
2015
Using ave. monthly engine ship rate for ALL engines shipped to date
Using ave. monthly engine ship rate for only D engines (105 Ea.)

	FEI1 (Adj)	FEI1 (Rep.)	FEI2 (Adj)	FEI2 (REP)	FEISum (Adj)	FEISUM (REP)
Supplier	1.38	1.31	1.41	1.19	2.79	2.5
Lab A	1.42	1.41	1.3	1.26	2.72	2.67
Lab B	1.22	1.2	1.03	0.95	2.25	2.15
Lab D	1.25	1.14	1.24	1.06	2.49	2.2
Lab G	1.31	1.32	1.21	1.15	2.52	2.47
	1.32		1.24		2.55	2.40