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Unapproved Minutes of the May 13, 2010  
Sequence V Surveillance Panel Meeting  
held in San Antonio, TX

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A copy of the Agenda is included as Attachment 1

The signed attendance sheet is included as Attachment 2.

Minutes from November 19, 2009 Surveillance panel meeting were approved with no changes.

Action Item Review

### Motions and Action Items As Recorded at the Meeting by Bill Buscher

1. Action Item O&H task force to perform a thorough Sequence VG test procedure review, and to investigate poor precision that was observed during the fuel prove-out matrix.

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Incomplete, discussions have taken place, but no task force has been formed

2. Action Item Haltermann to distribute monthly status reports for the current fuel batch to the SP members.

Not completed, to be discussed this meeting

3. Action Item SP to request a fuel batch approval plan from the TGC test fuel task force.

To be discussed this meeting

4. Action Item Schedule a SP conference call in March 2010 to review status of current fuel batch, review the approval process for a new fuel batch and plan for blending a new batch.

Conference call was held, complete

5. Action Item FCS to contact labs with details on shipping and handling costs for the replacement pistons.

Pistons being shipped, Complete

6. Action Item Labs to submit purchase orders to FCS for the replacements pistons within one week of receiving the information mentioned in the action item above.

Completed with item above

7. Action Item To see if we have a potential GF-4 or GF-5 reference oil for the VG, TMC to query suppliers of 5 primary VID reference oils (A, B, C, D and X) to see if data exists for these oils on the other GF-5 engine tests, or if they would be willing to generate data on the other GF-5 engine tests.

Two oils being brought forward, to be discussed this meeting, complete

8. Action Item Plan for an LTMS review at the May 2010 Surveillance Panel meeting, or preferably sooner, once the LTMS task force and TGC has met.

Open forum Meeting held 5/11/10, to be discussed this meeting.

### **Test Sponsor Report**

Ron Romano gave a verbal report. The major issue being dealt with was the replacement pistons, which are due to be received here late this week. The remainder of the pistons will be shipped later, as there have been some issues with scrappage. There are currently no plans for continuing the VG beyond 2015.

### **TMC Report**

There was no report given. A copy of the TMC report can be accessed via the following link.

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencev/semiannualreports/vg-04-2010.pdf>

### **ACC Report.**

A copy of the report is available via the following link. There were no questions on the report.

[https://acc-ma.org/docs/pcmo/iva/SemiAnnualReports/2010APR\\_IVA.pdf](https://acc-ma.org/docs/pcmo/iva/SemiAnnualReports/2010APR_IVA.pdf)

### **Fuel Suppliers Report.**

Mark Overaker gave a report on the status of the current blend of SVGMII fuel. Haltermann currently has 114000 gallons on hand and usage is following their projections. After considerable discussions, the panel agreed that a pilot blend, with subsequent tests, would not be necessary. Haltermann agreed to gather components and make a large blend, whose speciation would be made available to the lab, along with the speciation of the previous batch, for verification purposes. A teleconference would be conducted to review the speciation data. Al Lopez suggested Haltermann may wish to learn what adjustments could be made to the fuel to return off target performance to acceptable levels. Mark Overaker responded favorably to these remarks. Testing protocol for the new blend was discussed, and the panel decided to have the Statistics Group and the TMC representative(s) develop a matrix for testing the batch. Dan Worcester suggested that the previous matrices may have been too heavily skewed to reference oil 925-3. The

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Statistics group agreed to look at the appropriateness of the reference oils. A copy of the fuel suppliers report is included as attachment 3. A copy of Mark's report is included as attachment 4.

### **LTMS Version 2**

Doyle Boese presented the LTMS Task Forces recommendations for changes to the Sequence V LTMS. There were many concerns expressed about reducing the number of critical parameters to two. The panel decided to form a small group to review the LTMS changes and make recommendations to the panel, the group will report back to the panel by July 13, 2010. A copy of the presentation is included as attachment 5.

### **New Business**

The panel was presented with a potential motion to address aborted/invalid non reference oil tests as they relate to the test counter for runs between references Al Lopez had encountered a test which had to be aborted at the start and lost a potential non reference oil test. However, after considerable discussion, no agreement on rewording Section 11.1.1 of the test method could not be reached. The Test Labs and TMC will conduct a conference call to resolve this and submit to the panel for potential ballot when complete. Additional hardware items were discussed. Southwest Research indicated they may run out of blocks by 2013. Southwest also indicated that cylinder heads may be lasting longer than they originally planned. Several labs expressed some discomfort with the quality of the reworked heads that are being received from AER. Also, Southwest had tried to use a block obtained from Bishop, but the cylinders would not clean up and many of the blocks need modifications to accept the timing chain cover used by this group.

### **Scope and Objectives**

Andy Ritchie's report to Subcommittee B, as well as scope and objectives were reviewed and updated and are included as attachment 6.

### **GF-5 Category Oils**

The panel reviewed testing data for potential candidate oils. The panel agreed that either oil would be suitable for Sequence V testing. Copies of results summaries are included as attachments 7 and 8.

A listing of the action items from this meeting are included as attachment 9.

The meeting was adjourned at 11:40 pm.

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Attachment 1

Sequence VG Surveillance Panel  
San Antonio, TX  
Southwest Research Institute  
May 13, 2010  
9:00 a.m. - 12:00 p.m.

**A G E N D A**

- 1. Chairman comments.**
- 2. Attendance sign-in distribution.**
- 3. Membership changes.**
- 4. Motion and Action recorders.**
- 5. Approval of minutes for November 19<sup>th</sup> 2009. All**
- 6. Review action items from last meeting. Andy Ritchie**
- 7. Test Sponsor report. Ron Romano**
- 8. TMC Report. Questions on semi-annual report. Rich Grundza**
- 9. ACC Report. Questions on semi-annual report. Jeff Clark**
- 10. Fuel Supply Report. James Carter**
- 11. Plans for new fuel batch. All**
- 12. LTMS V2 review. Doyle Boese for Phil Scinto**
- 13. Review Scope and Objectives. All**
- 14. Old business All**
- 15. New business All**
- 16. Adjourn**

PRODUCT  
INFORMATION

**Haltermann**  
PRODUCTS

Attachment 3

T (281) 457-2768

F (281) 457-1469

PRODUCT: **SVGM2**  
**Seq. VG**

Batch No.: XC2721NX10  
MTS

PRODUCT CODE: **HF295**

Tank No.: 62  
Analysis Date: 3/31/2009

TEST	METHOD	UNITS	SPECIFICATIONS			RESULTS
			MIN	TARGET	MAX	
Distillation - IBP	ASTM D86	°C	23.9		35.0	28.9
5%		°C				44.1
10%		°C	48.9		57.2	51.3
20%		°C				64.6
30%		°C				80.7
40%		°C				98.6
50%		°C	98.9		115.6	108.3
60%		°C				114.4
70%		°C				123.4
80%		°C				145.3
90%		°C	162.8		176.6	175.4
95%		°C				192.8
Distillation - EP			°C	196.1		212.8
Recovery		vol %		Report		98.0
Residue		vol %			2.0	1.1
Loss		vol %		Report		0.9
Gravity	ASTM D4052	°API		Report		57.6
Specific Gravity	ASTM D4052	kg/m <sup>3</sup>		Report		0.7474
Reid Vapor Pressure	ASTM D5191	kPa	60.6		63.4	62.7
Carbon	ASTM E191	wt fraction	0.8580		0.8690	0.8632
Carbon	ASTM D3343	wt fraction		Report		0.8664
Oxygen	ASTM D4815	wt %			0.05	<0.01
Sulfur	ASTM D4294	mg/kg			200	<17.0
Lead	ASTM D3237	mg/l			2.6	<2.5
Phosphorous	ASTM D3231	mg/l			1.3	<0.2
Composition, aromatics	ASTM D1319	vol %			35.0	30.4
Composition, olefins	ASTM D1319	vol %	5.0		10.0	5.9
Composition, saturates	ASTM D1319	vol %		Report		63.8
Oxidation Stability	ASTM D525	minutes	1440			>1440
Copper Corrosion	ASTM D130				1	1a
Existent gum, washed	ASTM D381	mg/100mls			3.0	<0.5
Research Octane Number	ASTM D2699		96.0		98.0	98.0
Motor Octane Number	ASTM D2700			Report		89.2
R+M/2	D2699/2700			Report		93.6
Sensitivity	D2699/2700		7.5			9.2
Net Heat of Combustion	ASTM D240	Btu/lb		Report		18395
Additive, Ethyl antioxidant	calculated	ptb		Report		3.5

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Sequence VG Surveillance Panel  
May 13, 2010  
9:00AM – 12:00PM  
Southwest Research Institute  
San Antonio, TX

Motions and Action Items

As Recorded at the Meeting by Raham Kirkwood and Dan Worcester

1. Action Item – Conference call will be held to determine the next fuel prove-out matrix. Statistics sub-group will develop recommendations and report back to the Surveillance Panel.
2. Action Item – Form a task force to develop a recommendation to the surveillance panel for adopting LTMS 2<sup>nd</sup> Edition to the Sequence VG. Task force to report to surveillance panel before Tuesday July 13th at 2PM EST.
3. Motion – Based on successful results from the chemical analysis of the lab blend the Surveillance Panel instructs Haltermann to create a full tank of VG fuel.

Ed Altman / Mark Sutherland / Passed 12-0-1

4. Motion – To have Seq. VG procedures Section 11.1.1 wording changed to “15 operationally valid” tests.

Al lopez / Ed Altman / Tabled for E-Ballot with improved wording

5. Motion – Accept both potential reference oils as GF-5 category reference oils. Consider using either oil for the Sequence VG and replacing one of the outdated reference oils currently in use. Conduct a follow-up surveillance panel conference call to develop a plan for adopting one or both of these potential reference oils.

Rich Grundza / Mark Sutherland / Passed 12-0-1

May 13, 2010 V Minutes  
San Antonio, TX

Attachment 1

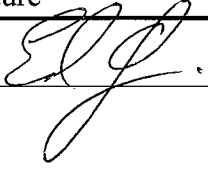
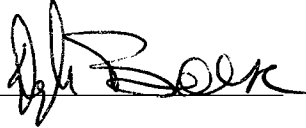


Sequence VG Surveillance Panel  
San Antonio, TX  
Southwest Research Institute  
May 13, 2010  
9:00 a.m. - 12:00 p.m.

**A G E N D A**

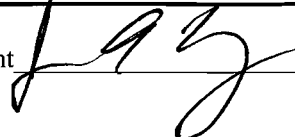
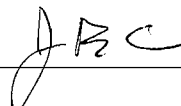



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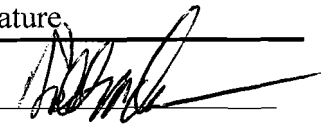
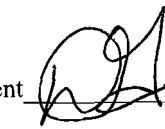

May 13, 2010



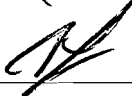


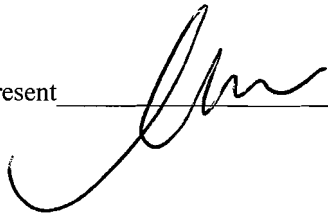
## ASTM Sequence V Surveillance Panel

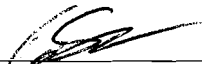
Name/Address	Phone/Fax/Email		Signature
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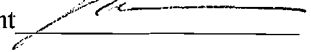
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 210-862-7935

Name/Address	Phone/Fax/Email		Signature
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Matt J. Snider GM Powertrain General Motors Corporation MC - 483-730-322 823 Joclyn Rd. Pontiac, MI 48090-9055 USA	248-672-3563 248-857-4441 <a href="mailto:mathew.j.snider@gm.com">mathew.j.snider@gm.com</a>	Non-Voting Member	Present _____
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Thomas Smith Valvoline P.O. Box 14000 Lexington, KY 40512-1400 USA	859-357-2766 859-357-7084 <a href="mailto:trsmith@ashland.com">trsmith@ashland.com</a> PCEOCP Chair	Voting Member	Present _____
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Mark Sutherland Chevron Oronite Company LLC 4502 Centerview Drive Suite 210 San Antonio, TX 78228 USA	210-731-5621 210-731-5699 <a href="mailto:msut@chevrontexaco.com">msut@chevrontexaco.com</a>	Voting Member	Present 
--	--	---------------	---

Ben O. Weber Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-5911 210-684-7530 <a href="mailto:bweber@swri.edu">bweber@swri.edu</a> <b>Sub-Committee D02.B01 Chair</b>	Non-Voting Member	Present _____
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Joe Vujica The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2058 440-347-4096 <a href="mailto:jsvu@lubrizol.com">jsvu@lubrizol.com</a>	Non-Voting Member	Present _____
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Jerry Wang Chevron Oronite Company LLC 7080 Colchester Lane Ypsilanti, MI 48197	734-48- 3806 none <a href="mailto:jwdy@chevron.com">jwdy@chevron.com</a>	Non-Voting Member	Present _____
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**DAN WORCESTER**
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 Haltermann Products  
 15635 Jacinto port  
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PRODUCT  
INFORMATION

**Haltermann**  
PRODUCTS

Attachment 3

T (281) 457-2768

F (281) 457-1469

PRODUCT: **SVGM2**  
**Seq. VG**

Batch No.: XC2721NX10  
MTS

PRODUCT CODE: **HF295**

Tank No.: 62  
Analysis Date: 3/31/2009

TEST	METHOD	UNITS	SPECIFICATIONS			RESULTS
			MIN	TARGET	MAX	
Distillation - IBP	ASTM D86	°C	23.9		35.0	28.9
5%		°C				44.1
10%		°C	48.9		57.2	51.3
20%		°C				64.6
30%		°C				80.7
40%		°C				98.6
50%		°C	98.9		115.6	108.3
60%		°C				114.4
70%		°C				123.4
80%		°C				145.3
90%		°C	162.8		176.6	175.4
95%		°C				192.8
Distillation - EP			°C	196.1		212.8
Recovery		vol %		Report		98.0
Residue		vol %			2.0	1.1
Loss		vol %		Report		0.9
Gravity	ASTM D4052	°API		Report		57.6
Specific Gravity	ASTM D4052	kg/m <sup>3</sup>		Report		0.7474
Reid Vapor Pressure	ASTM D5191	kPa	60.6		63.4	62.7
Carbon	ASTM E191	wt fraction	0.8580		0.8690	0.8632
Carbon	ASTM D3343	wt fraction		Report		0.8664
Oxygen	ASTM D4815	wt %			0.05	<0.01
Sulfur	ASTM D4294	mg/kg			200	<17.0
Lead	ASTM D3237	mg/l			2.6	<2.5
Phosphorous	ASTM D3231	mg/l			1.3	<0.2
Composition, aromatics	ASTM D1319	vol %			35.0	30.4
Composition, olefins	ASTM D1319	vol %	5.0		10.0	5.9
Composition, saturates	ASTM D1319	vol %		Report		63.8
Oxidation Stability	ASTM D525	minutes	1440			>1440
Copper Corrosion	ASTM D130				1	1a
Existent gum, washed	ASTM D381	mg/100mls			3.0	<0.5
Research Octane Number	ASTM D2699		96.0		98.0	98.0
Motor Octane Number	ASTM D2700			Report		89.2
R+M/2	D2699/2700			Report		93.6
Sensitivity	D2699/2700		7.5			9.2
Net Heat of Combustion	ASTM D240	Btu/lb		Report		18395
Additive, Ethyl antioxidant	calculated	ptb		Report		3.5

THIS INFORMATION IS OFFERED FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. IT SHOULD NOT BE CONTRUED AS A WARRANTY, GUARANTY NOR AS APERMISSION OR RECOMMENDATION TO PRACTICE ANY PATENTED INVENTION WITHOUT A LICENSE.



Attachment 4

# SVGMII Fuel Report

Mark Overaker  
Director of Manufacturing and Supply Chain  
Haltermann Products

May 13, 2010

*Test and Reference Fuels*



# Agenda

- Fuel adjustments – Tank History
  - Summary slide
- Fuel – Tank Survey
  - Excel File submitted
  - Summary slide
- Current inventory
- Consumption rate
- Timeframe to next batch
- Proposed plan to re-build next batch
  - Customer input required
    - Average Industry Free-Capacity
    - Time to empty once fully replenished

***Test and Reference Fuels***





# Fuel Adjustments – Tank History

Date: 7-10-09; 1258 gal of isobutane; 0.4% of 315,477 gal; 62.8 kPa from 61.0

Date: 8-25-09; 1062 gal of isobutane; 0.4% of 278,077 gal; 62.3 kPa from 60.9

No adjustments in 2010 through 5-7-10.

RVP Spec: 60.6 to 63.4 kPa

***Test and Reference Fuels***



# Fuel – Tank Survey

Dated: 3/5/10

1/13/10

Date received: 4/10/2010 3/18/2010 3/18/2010 3/9/2010 3/1/2010 2/11/2010 2/11/2010 2/8/2010 1/14/2010

Analysis date: 4/14/2010 3/19/2010 3/19/2010 3/10/2010 3/4/2010 2/17/2010 2/17/2010 2/17/2010 1/29/2010

TEST	METHOD	UNITS	SPECIFICATIONS			RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS
			MIN	TARGET	MAX									
Distillation - IBP	ASTM D86	°C	23.9		35.0	30.8	30.0	29.3	31.7	29.8	28.9	29.2	28.8	
5%		°C				42.4	42.0	43.8	42.8	44.0	41.3	44.1	41.0	
10%		°C	48.9		57.2	50.3	50.1	51.9	50.3	51.7	48.8	51.5	49.4	
20%		°C				63.5	63.6	64.4	63.4	65.1	62.2	64.5	62.8	
30%		°C				79.2	79.9	79.7	78.5	80.9	78.0	80.0	78.4	
40%		°C				97.3	97.9	97.0	96.5	98.4	95.8	97.5	96.9	
50%		°C	98.9		115.6	108.1	108.6	198.3	108.0	108.8	107.8	108.3	108.2	
60%		°C				114.2	114.8	114.7	114.5	114.9	114.5	114.4	114.6	
70%		°C				121.8	122.3	122.1	121.8	122.6	122.0	122.2	121.8	
80%		°C				140.2	140.6	139.8	139.3	140.7	140.1	140.1	139.2	
90%		°C	162.8		176.7	171.5	172.5	172.1	172.1	172.5	172.1	171.9	172.3	
95%		°C				183.7	184.6	184.3	184.3	184.4	184.7	183.6	183.9	
Distillation - EP		°C	196.1		212.8	206.6	213.1	211.4	212.6	211.7	212.4	211.1	210.5	
Recovery		vol %		Report		97.2	97.2	97.2	96.8	97.8	97.8	97.4	97.3	
Residue		vol %			2.0	1.1	1.1	1.1	1.1	1.1	1.1	1.5	1.1	
Loss		vol %		Report		1.7	1.7	1.7	2.1	1.1	1.1	1.6	1.6	
Gravity	ASTM D4052	°API		Report		57.5	57.5	57.5	57.6	57.4	57.7	57.4	57.5	
Specific Gravity	ASTM D4052	-		Report		0.7488	0.7488	0.7587	0.7484	0.7481	0.7481	0.7491	0.7486	
Reid Vapor Pressure	ASTM D5191	kPa				60.6	61.9	62.2	60.8	59.7	66.8	61.8	61.8	
Existent gum, unwashed	ASTM D381	mg/100mls		Report		<0.5	1.0	2.0	<0.5	1.0	<0.5	<0.5	<0.5	73.0
Existent gum, washed	ASTM D381	mg/100mls			3.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Verified

ANALYS: JAM JAM JAM JAM JAM JAM JAM JAM JAM JAM JAM

**Test and Reference Fuels**



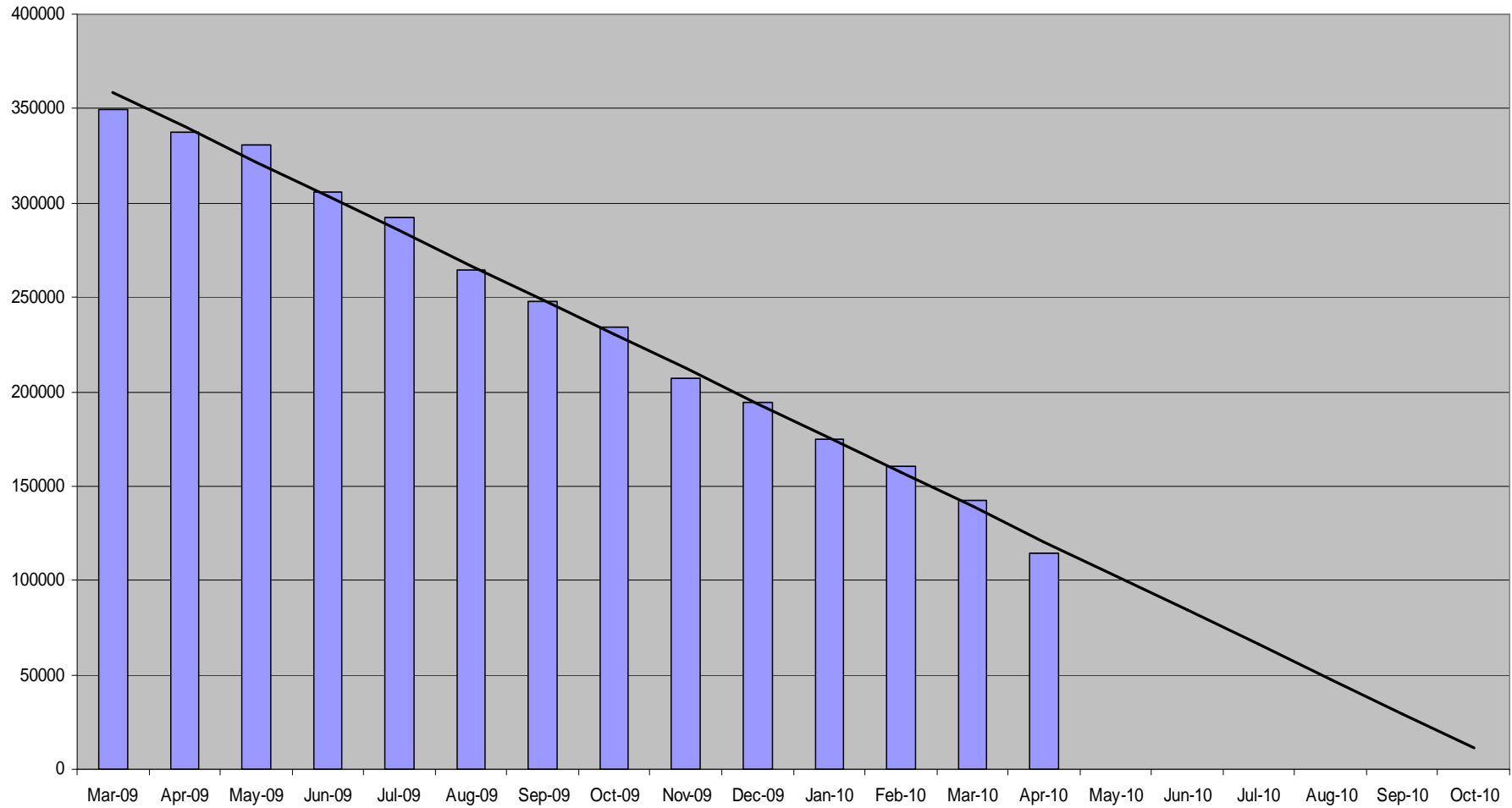
# Current Inventory

- 356,000 gallons starting inventory after testing was completed and fuel was qualified in 5/09
- 244,217 gallons total consumption to date
  - 12,061 gallons used in engine tests
  - 232,156 gallons sold after approval
- RVP Adjustment
  - 2,320 gal “light” stream added
- Inventory as of 5/1/2009
  - 114,103 gallons

*Test and Reference Fuels*



# Consumption Rate & Re-Build Point



***Test and Reference Fuels***



# Proposed plan-next re-build

- Current VG demand
  - Two loads scheduled in May
- Current VG maintenance
  - Make final “bump” to current VG fuel
  - Mix and sample
  - Maintain fuel and fill orders until Action Point
    - Estimated July 2010.

*Test and Reference Fuels*



# Proposed plan-next re-build

- Deplete inventory to specified level
  - Determine average volume necessary to fill customer inventory to full capacity at any point in time.
  - Add heel and safety margin volume to determine level that will trigger re-build plans. Heel volume dependent on final industry needs.
  - IFR jacks at 6'6" (approx. 75K gal) – Air permit drives action at that point!
  - Action proposed when inventory reaches 75K gallons
    - Estimate July 2010 to reach "Action Point."
    - At action point, will "top off the industry inventory", load remainder on 6 ISO's (approx. 36K gal), then move to re-build VG fuel on top of remaining heel

***Test and Reference Fuels***



# Proposed plan-next re-build

- Plan Timing
  - Estimate 2 months to re-build
  - 1 month to fill / evaluate and adjust (if necessary)
  - 1 month for engine testing
    - Timing contingent on level of testing needed as determined by the panel
  - Must determine if customers can operate during this period without contingencies
    - 6 ISO's of VG in storage to cover “re-build” efforts
      - » Could be sold or added back to new batch

***Test and Reference Fuels***



# Next Batch

- Formulation target identical to last batch
  - CoA and speciation analysis will be conducted
- All components are currently commercially available and are projected to remain so
- Next batch volume must be determined by panel
- Assuming same volume for next batch as last batch, price estimate based on last batch's raw material pricing is \$9.19/gal (actual will be calculated at time of fill). Next batch price drivers
  - 23% reduction from current price
  - Assumes reduction in number of tests by ½
  - Elimination of up-front tank preparation costs

***Test and Reference Fuels***





# Decision Point

- Hand-Blend – Tote – Testing – Big Batch
- Or ??????

*Test and Reference Fuels*

# The Second Addition of LTMS

(Theoretical Sneak Peak for the VG)

VG SP: May 2010



# Basic Idea for LTMS 2<sup>nd</sup> Edition

- A Simpler, More Robust System
- Improve Candidate Test Accuracy
- Remove Unnecessary Tests and Punishments for Being “Off-Target”
- Remove Opportunities for Games and Poor Choice Changes
- Standardize Across Test Types as Much as Possible

# New LTMS Versus Old LTMS

- The Showdown



# DO NOT BE AFRAID

- Proposed Changes to LTMS are Slight and are not Expected to Have Major Ramifications



# Summary of Proposed Changes

- No more Consequences for Yi
  - Eliminate Punishment for Being Different
- No more Ri or Qi
  - Less Games and Invalid Tests
- Default Limit of 15(18) Non-Reference Tests or 12(18) Months for an Existing Test Stand
- Primary and Secondary Parameters
- Two Suggested Approaches for Introduction of New Hardware, Parts, Fuel, etc.
- Suggestion to Fix Targets, but Update Standard Deviations when Appropriate

# Summary of Proposed Changes

- New Control Charts
  - EWMA of  $Y_i$  ( $Z_i$ )
    - Continuous Severity Adjustments
      - SP Sets Limits for  $Z_i$
  - Shewhart of Residuals:  $e_i = (Y_i - Z_{i-1})$ 
    - Are you Where you Think you Are
    - Apply to Primary Parameters Only
      - Level 3, Level 2, Level 1
      - Can Reduce AND Extend Reference Intervals
      - Undue Influence Analysis

# Summary of Proposed Changes

- Suggested Default  $\lambda$ 
  - 0.2, but 0.3 a Good One Too
- Fast Start to EWMA
  - $Z_0 = \text{Average of First 3 Tests}$
- Initial Calibration
  - 3 Tests for First Stand in a New Lab
    - Lab Based Severity Adjustment System
  - 3 Tests for each and every Stand/Engine
    - Stand Based Severity Adjustment System



# Take a Breathe

- Any Clarification Questions?



# Back to the Basics

- Do we Wish to Review the Basics of LTMS and Control Charts?

# Take a Breathe

- Do we Understand the Control Charts and their Function?



# Take a Breathe

- Any Questions on the Continuous SA?



# Flowchart of the New Process

- Can Review if Desired

# New LTMS for the VG

- Specific System Suggestions for VG
- Examples are Crude
  - Things Would Likely have Played Out Differently Under the New System
  - Some Calculations Pretend that References are Candidates

# New LTMS for the VG

- Lab Based Severity Adjustment System
- Primary Parameters
  - Average Engine Sludge
  - Average Piston Varnish
- Secondary Parameters
  - Rocker Cover Sludge
  - Average Engine Varnish
  - Oil Screen Sludge
- Limit of 15 Non-Reference Tests or X Months for an Existing Test Stand
  - Set X Equal to 6, 9 or 12
- Start System with “Next” Reference Test after Surveillance Panel Approval

# New LTMS for the VG

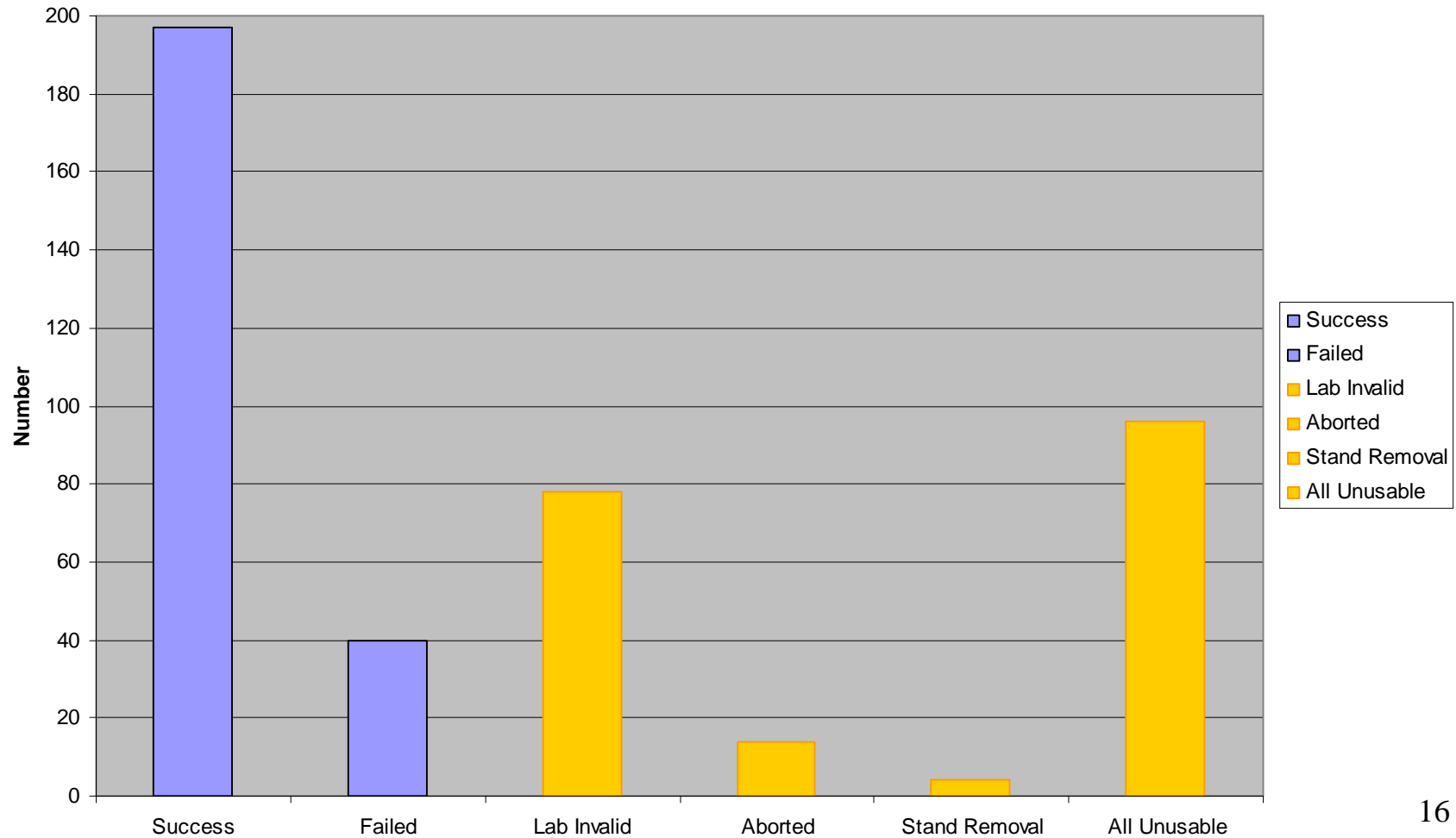
EWMA of Standardized Test Result: $Z_i$			
Parameter	Limit Type	Lambda	Limit
AES	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	2.0
	Level 1	0.2	0.0
APV	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	2.0
	Level 1	0.2	0.0
RCS	Level 2 Lower	0.2	-3.0
	Level 2 Upper	0.2	1.5
	Level 1	0.2	0.0
AEV	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	2.0
	Level 1	0.2	0.0
OSCR	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	1.6
	Level 1	0.2	0.0

Shewhart Chart of Prediction Error	
$e_i = Y_i - Z_{i-1}$	
Limit Type	Limit
Level 3	2.066
Level 2	1.734
Level 1	1.351
Undue Influence Follow Up	2.066



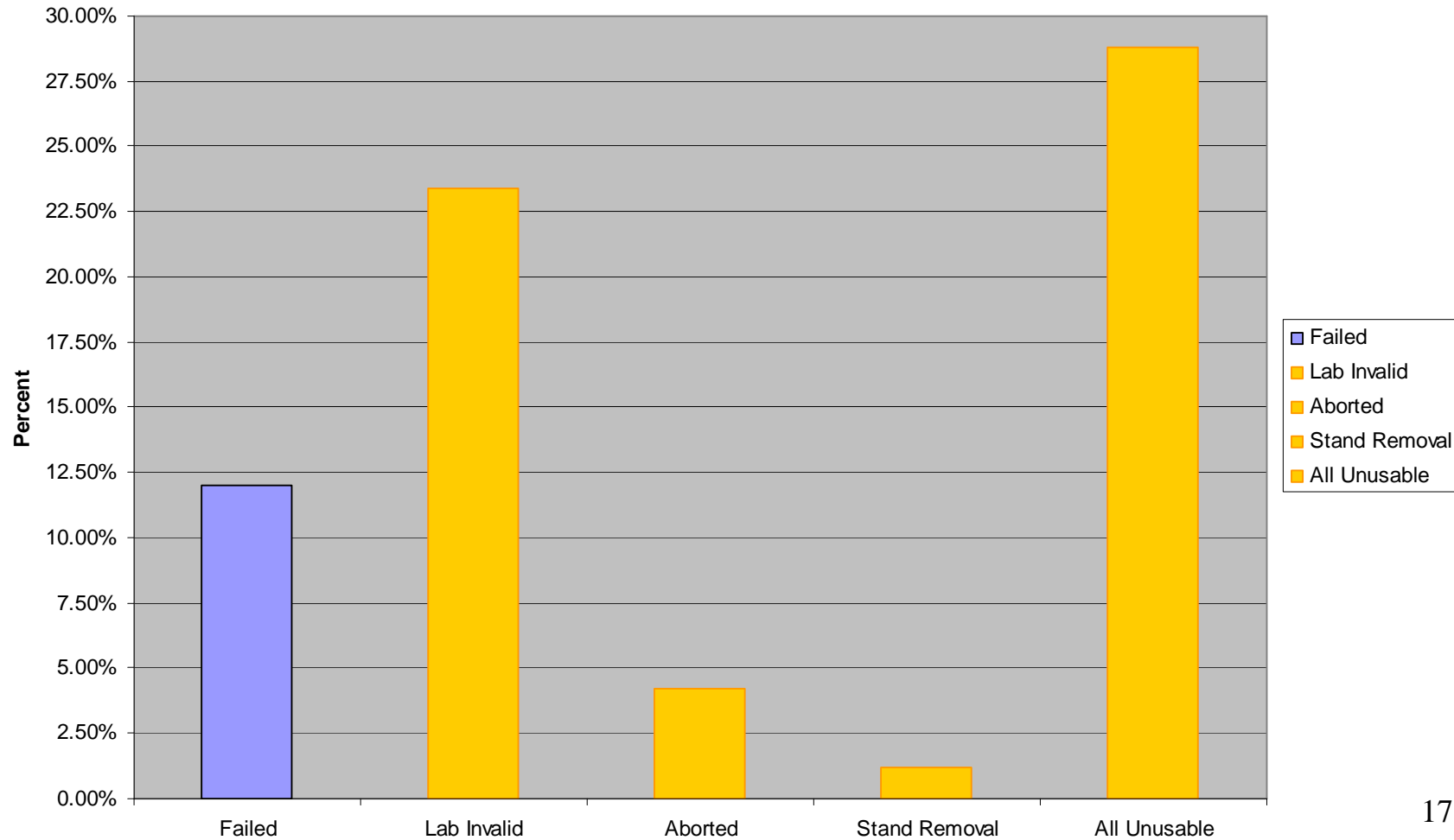
# New LTMS for the VG

Fate of VG Calibration Attempts  
According to TMC Semi-Annual Reports



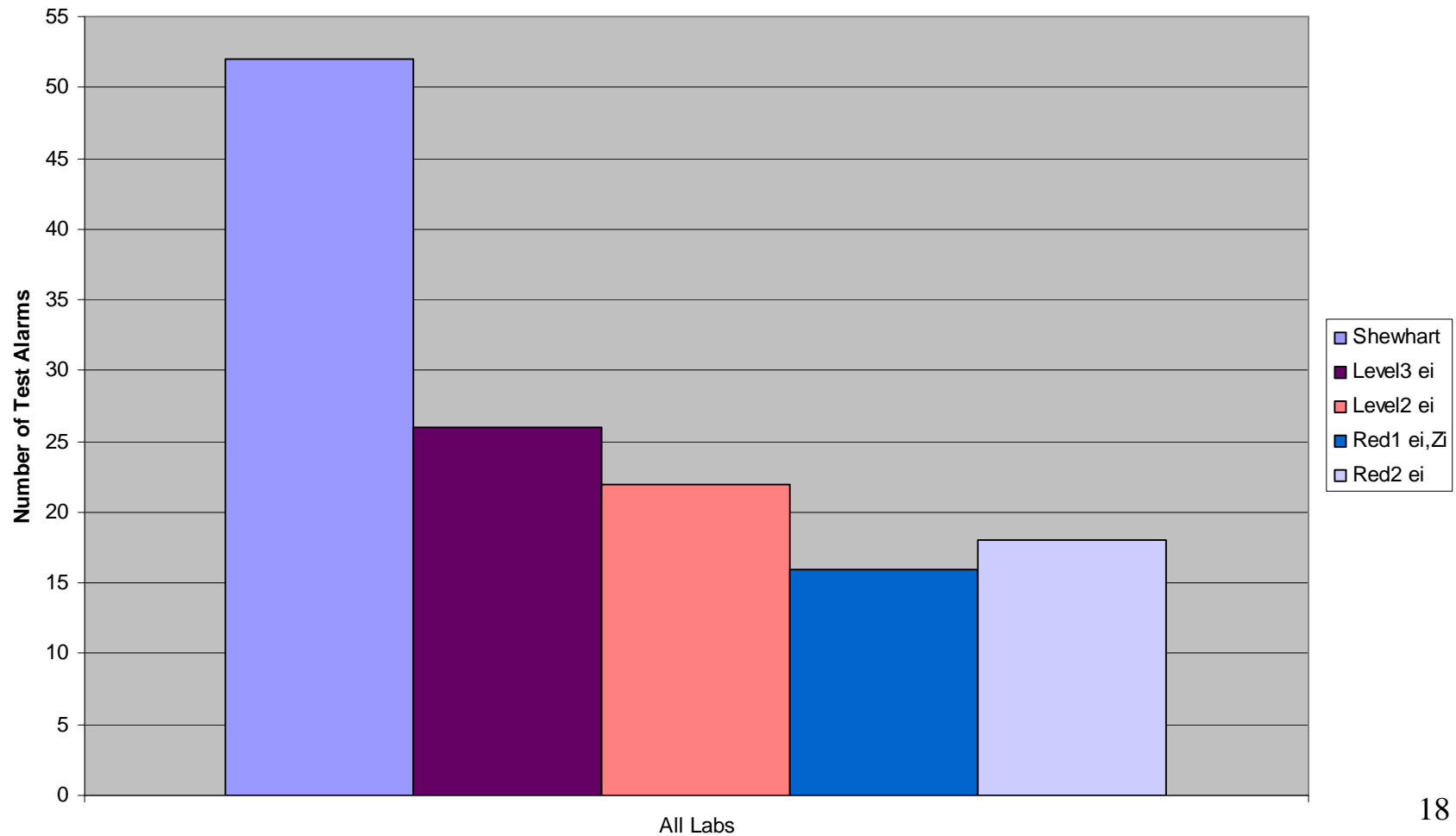
# New LTMS for the VG

Fate of VG Calibration Attempts  
According to TMC Semi-Annual Reports



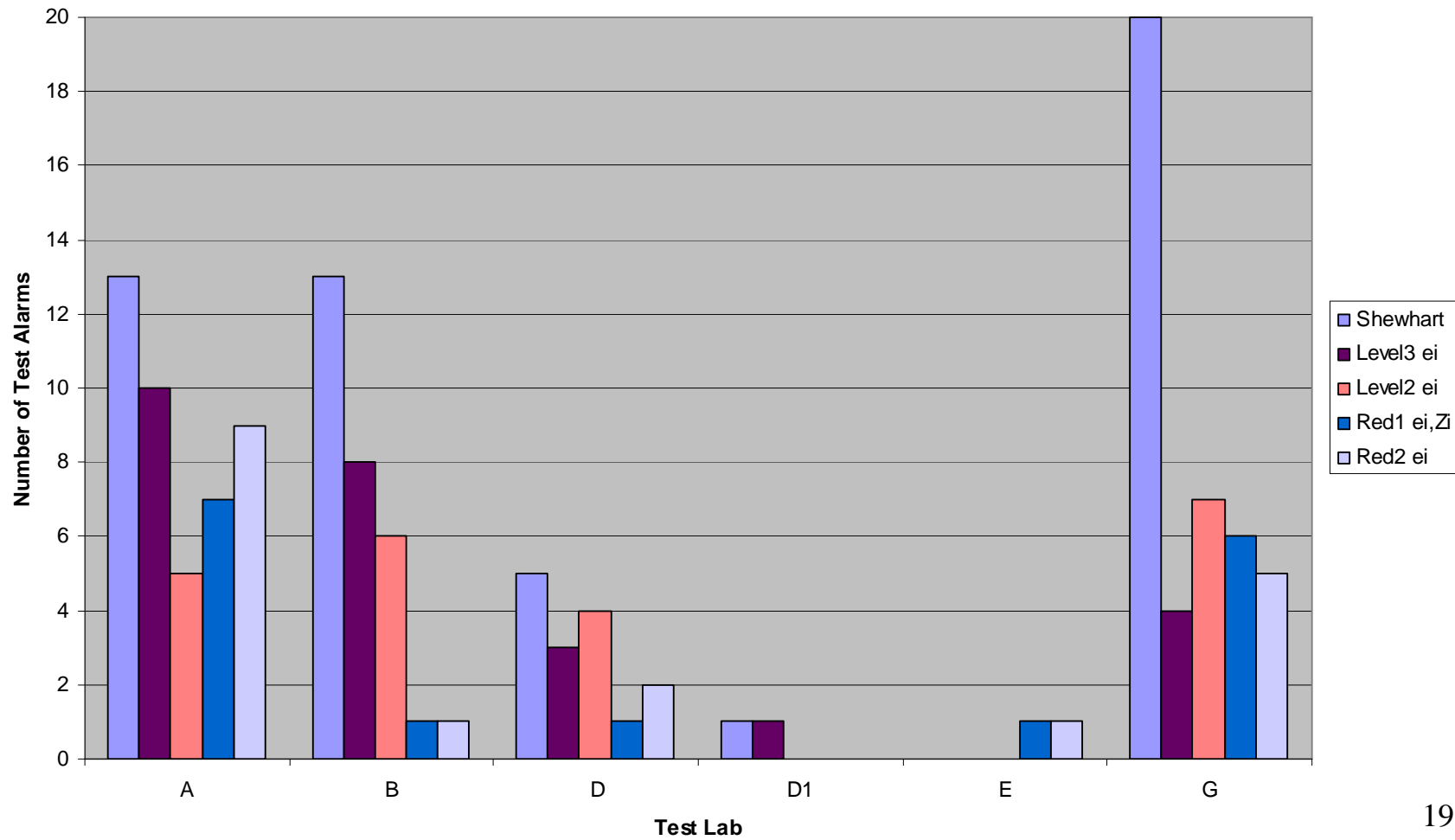
# New LTMS for the VG

LTMS Alarms in the Sequence VG Test Based on Chartable Tests Only  
(AES and APV Primary)



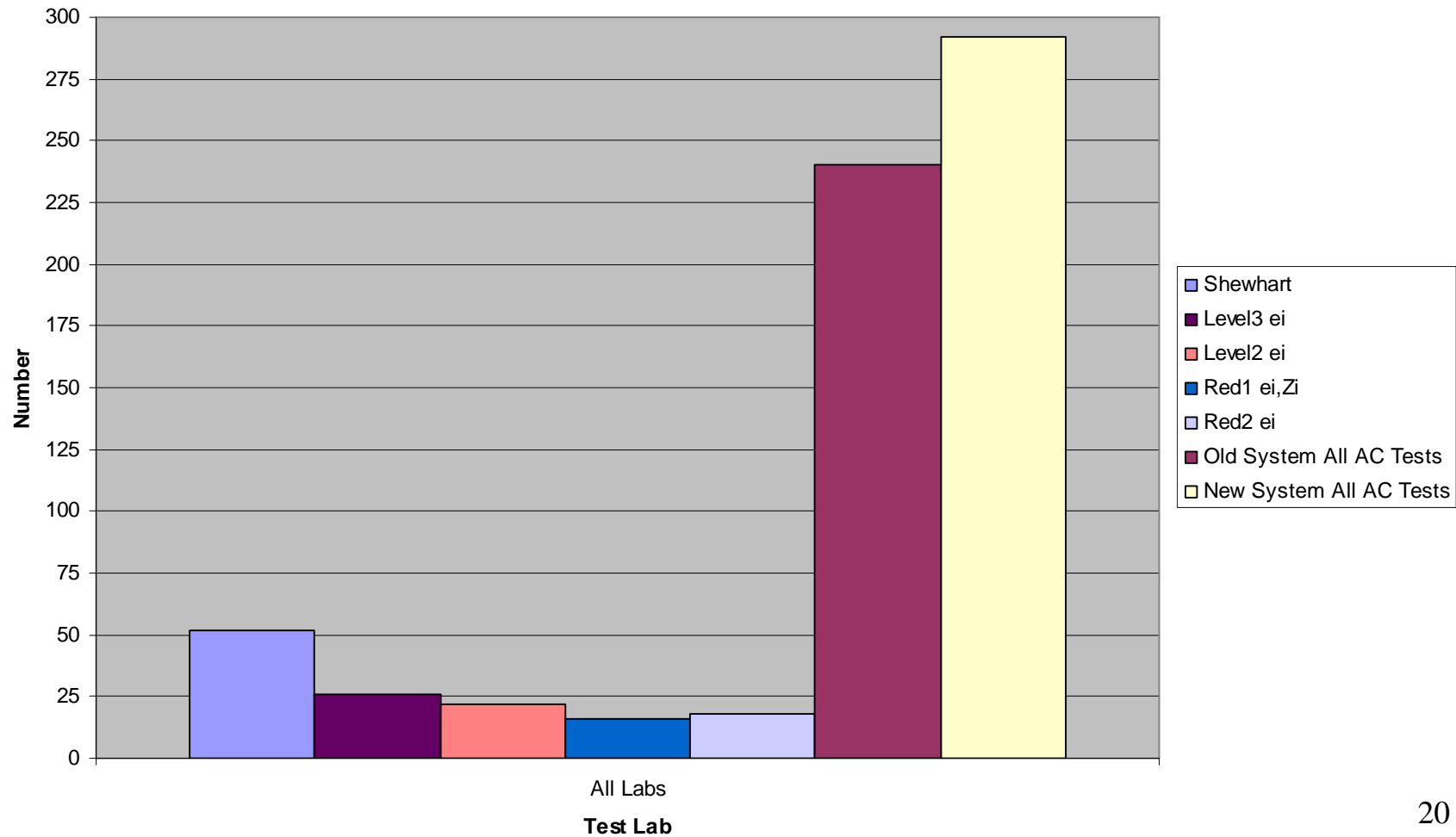
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LTMS Alarms in the Sequence VG Test Based on Chartable Tests Only  
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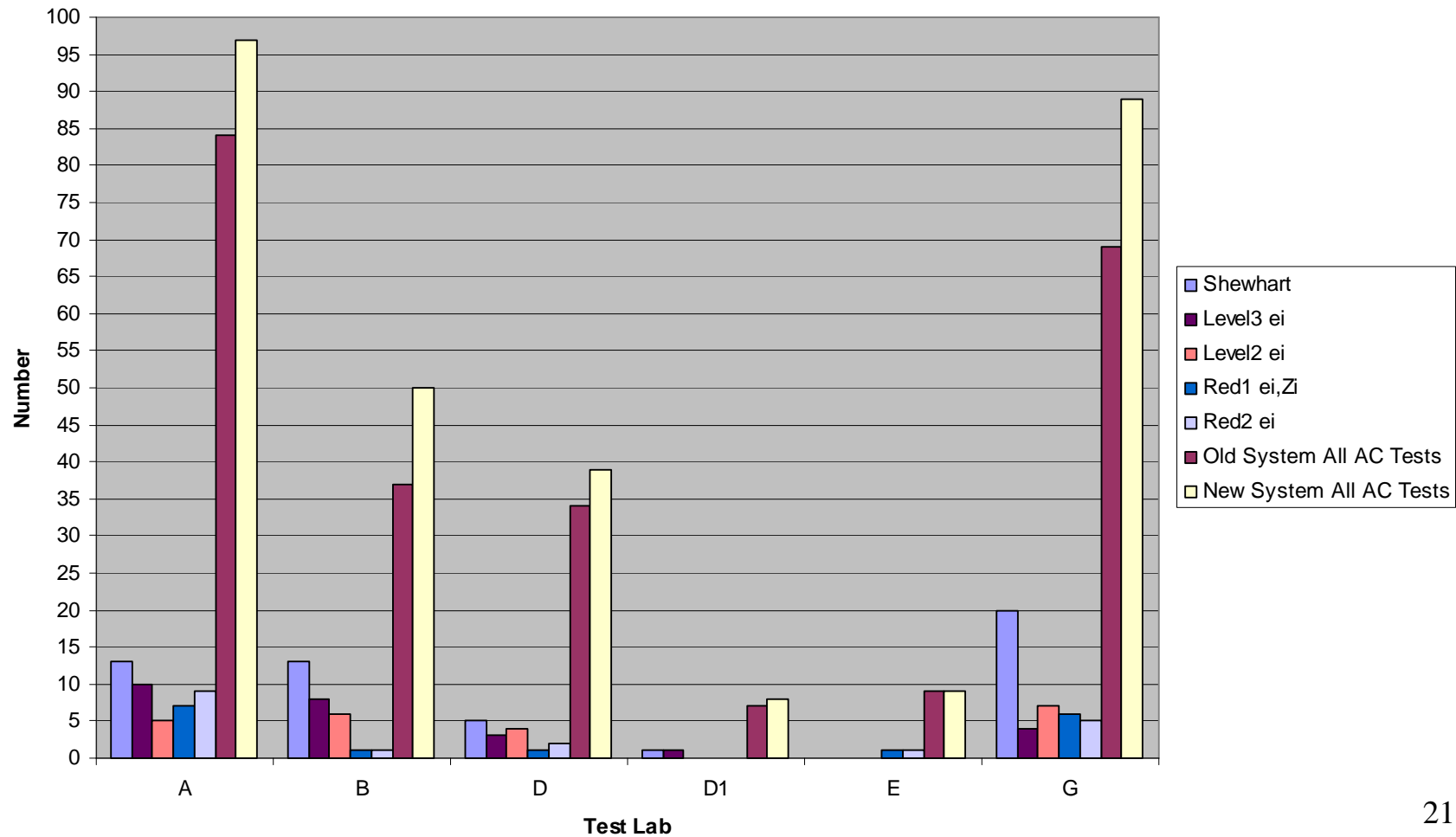
# New LTMS for the VG

LTMS Alarms in the Sequence VG Test Based on Chartable Tests Only  
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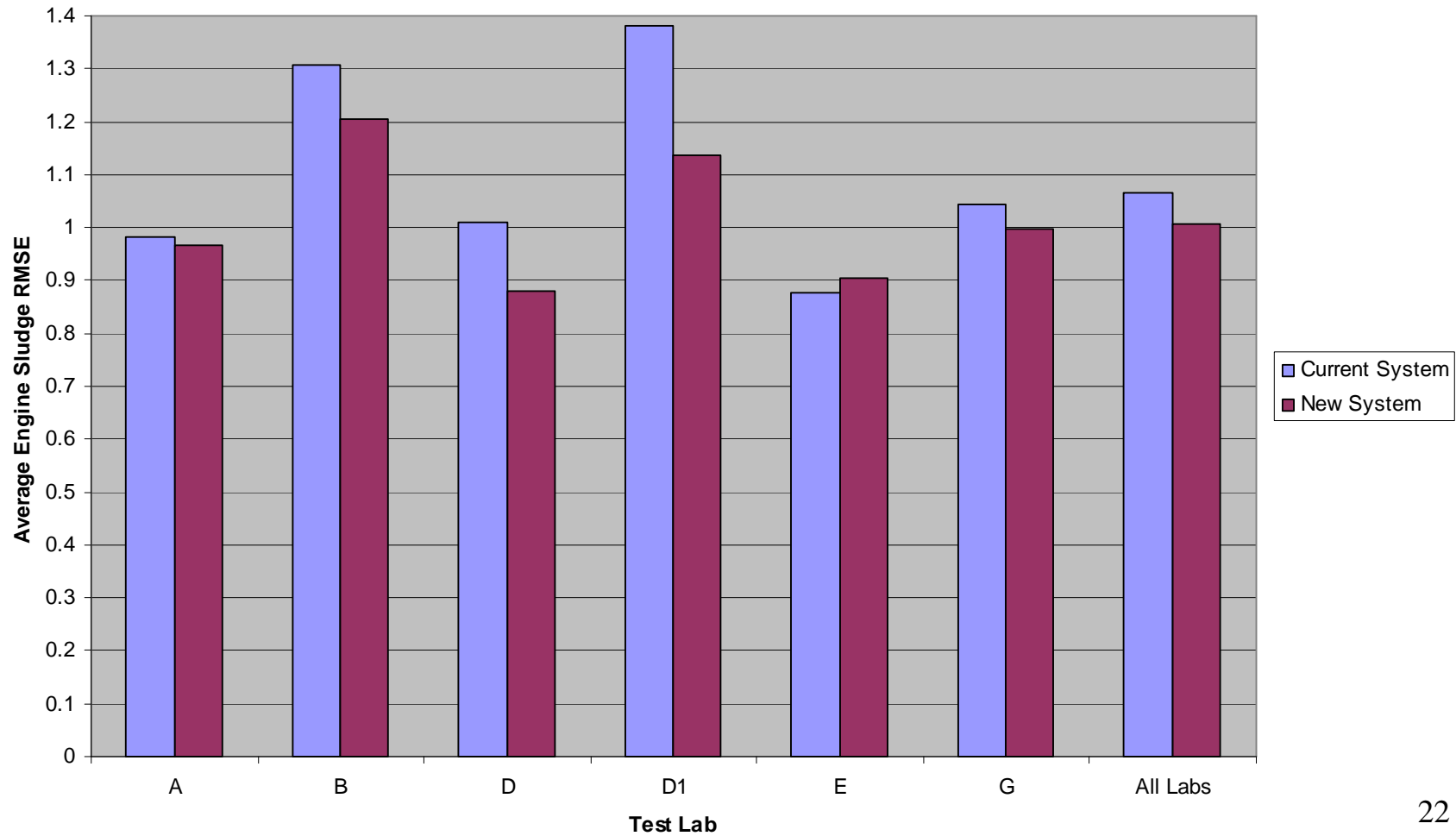
# New LTMS for the VG

LTMS Alarms in the Sequence VG Test Based on Chartable Tests Only  
(AES and APV Primary)



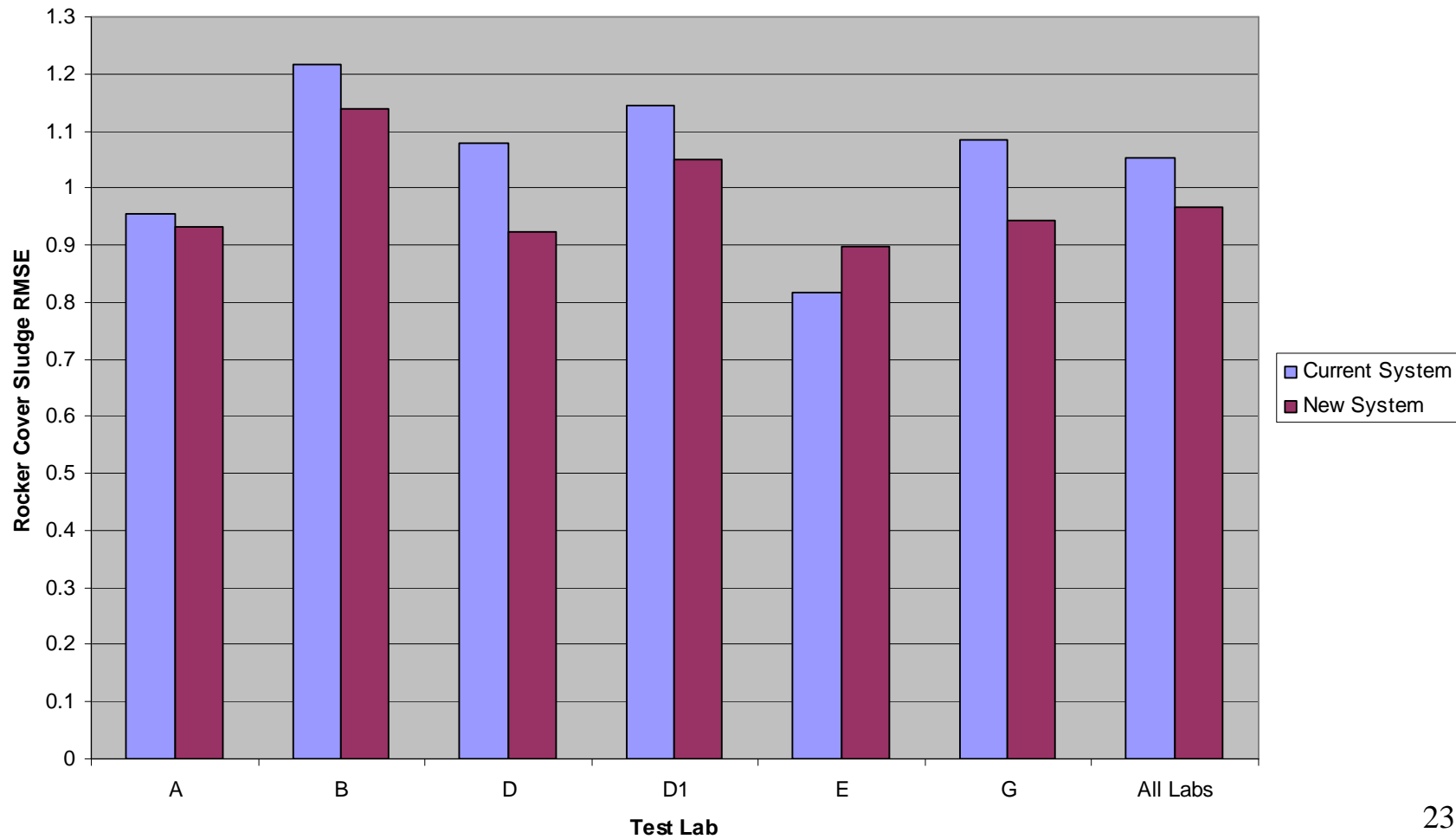
# New LTMS for the VG

Candidate Oil Test Result Target Variability in the Sequence VG  
Based on All Chartable Tests



# New LTMS for the VG

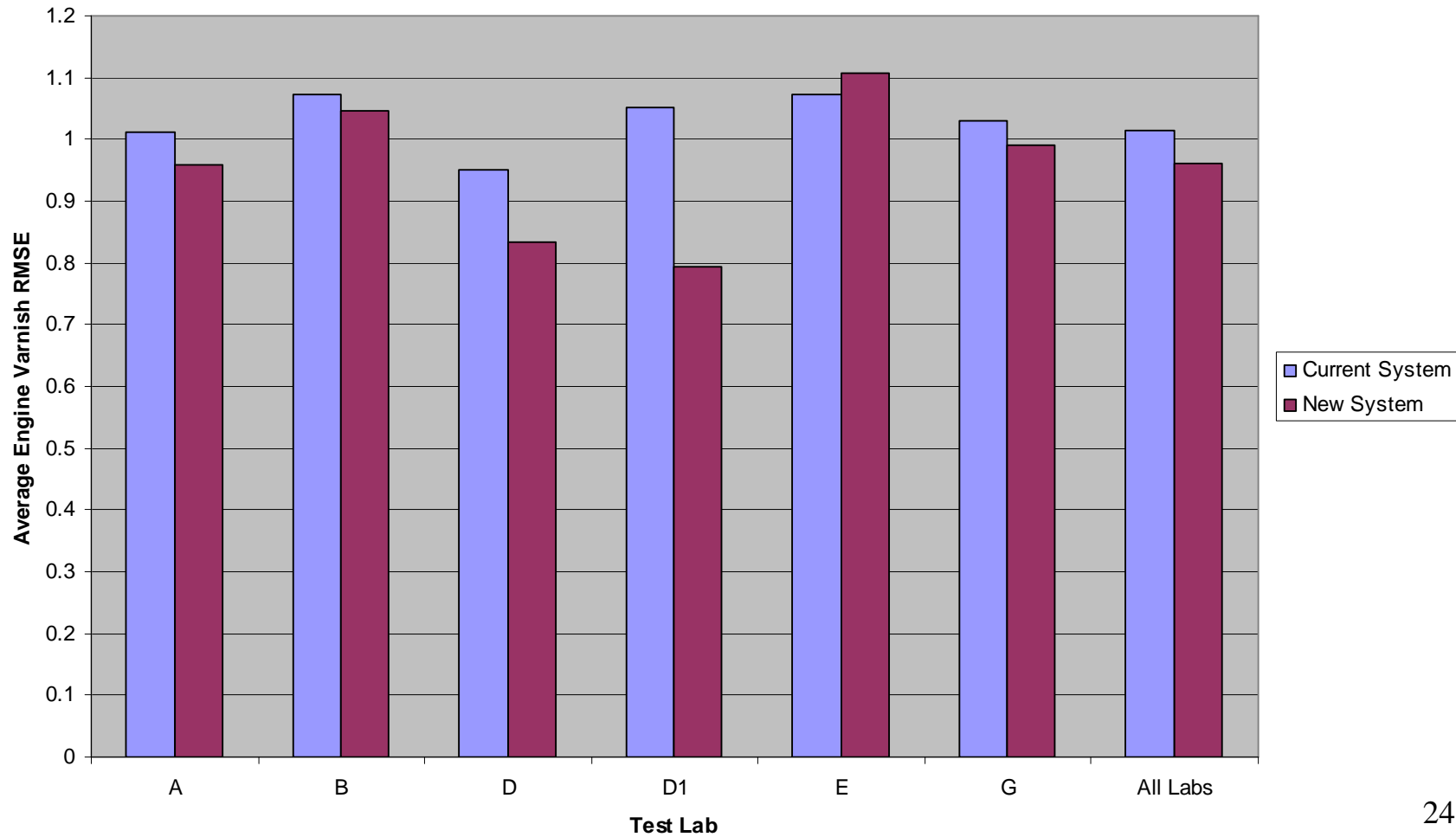
Candidate Oil Test Result Target Variability in the Sequence VG  
Based on All Chartable Tests





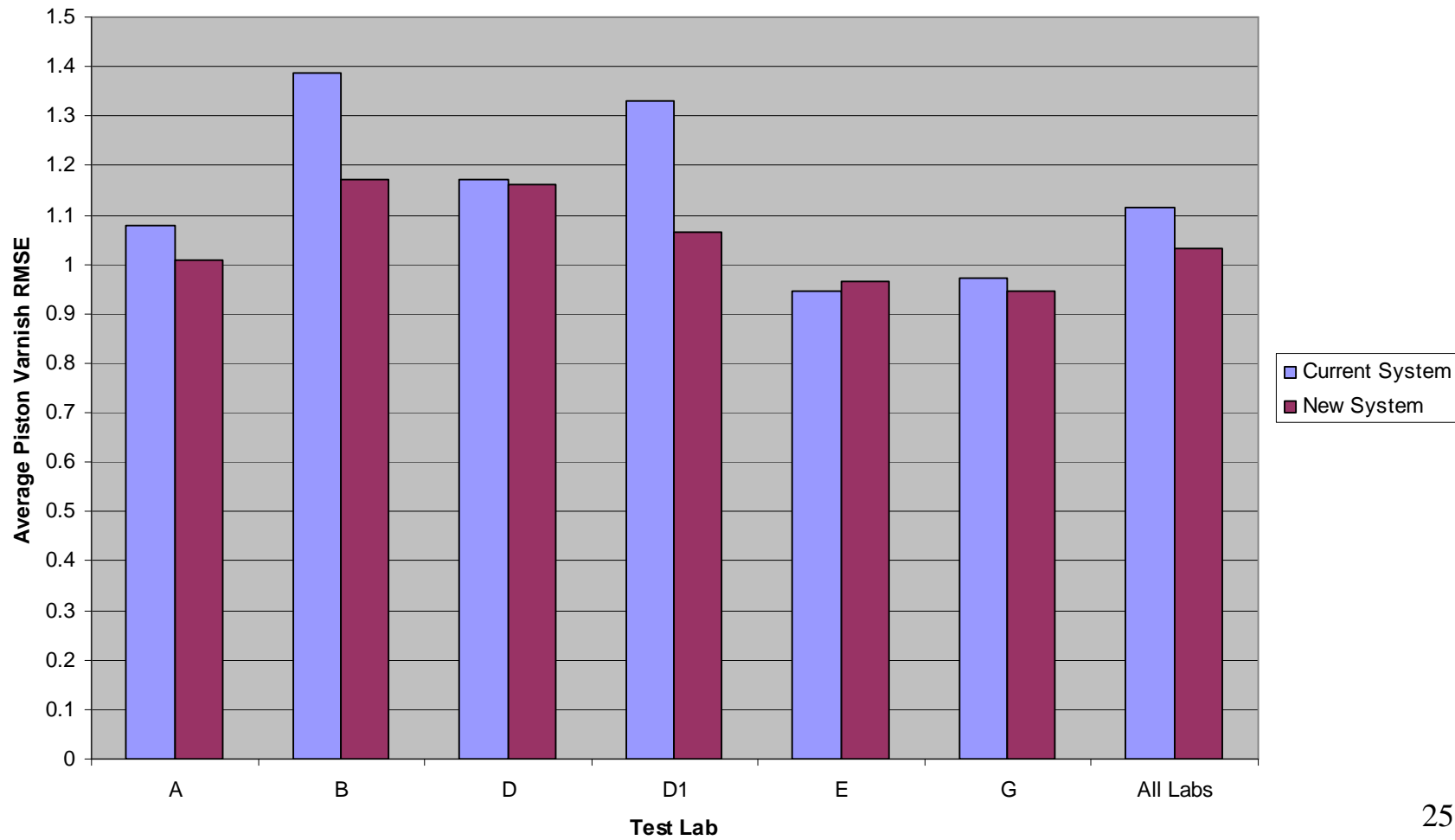
# New LTMS for the VG

Candidate Oil Test Result Target Variability in the Sequence VG  
Based on All Chartable Tests



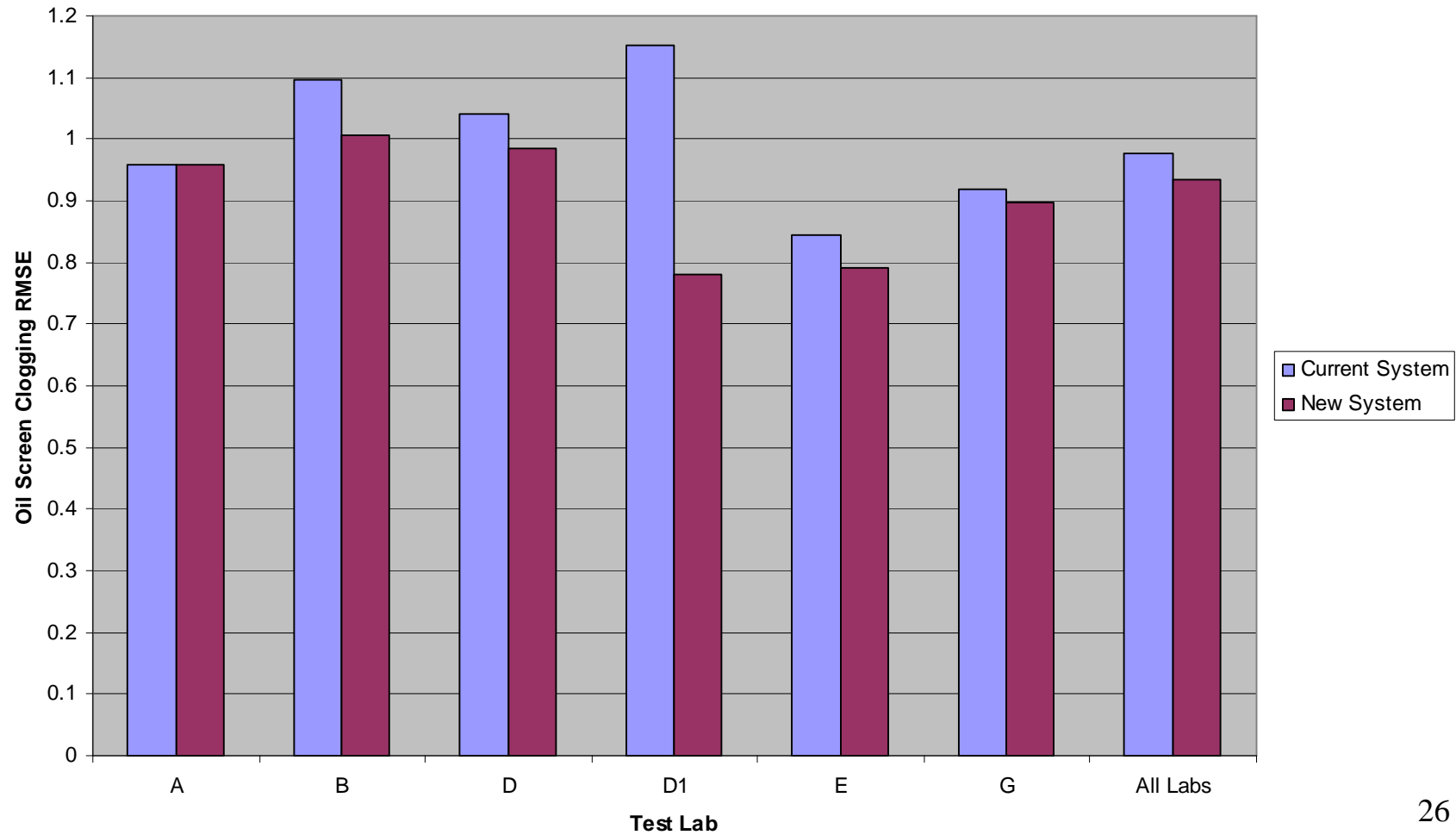
# New LTMS for the VG

Candidate Oil Test Result Target Variability in the Sequence VG  
Based on All Chartable Tests



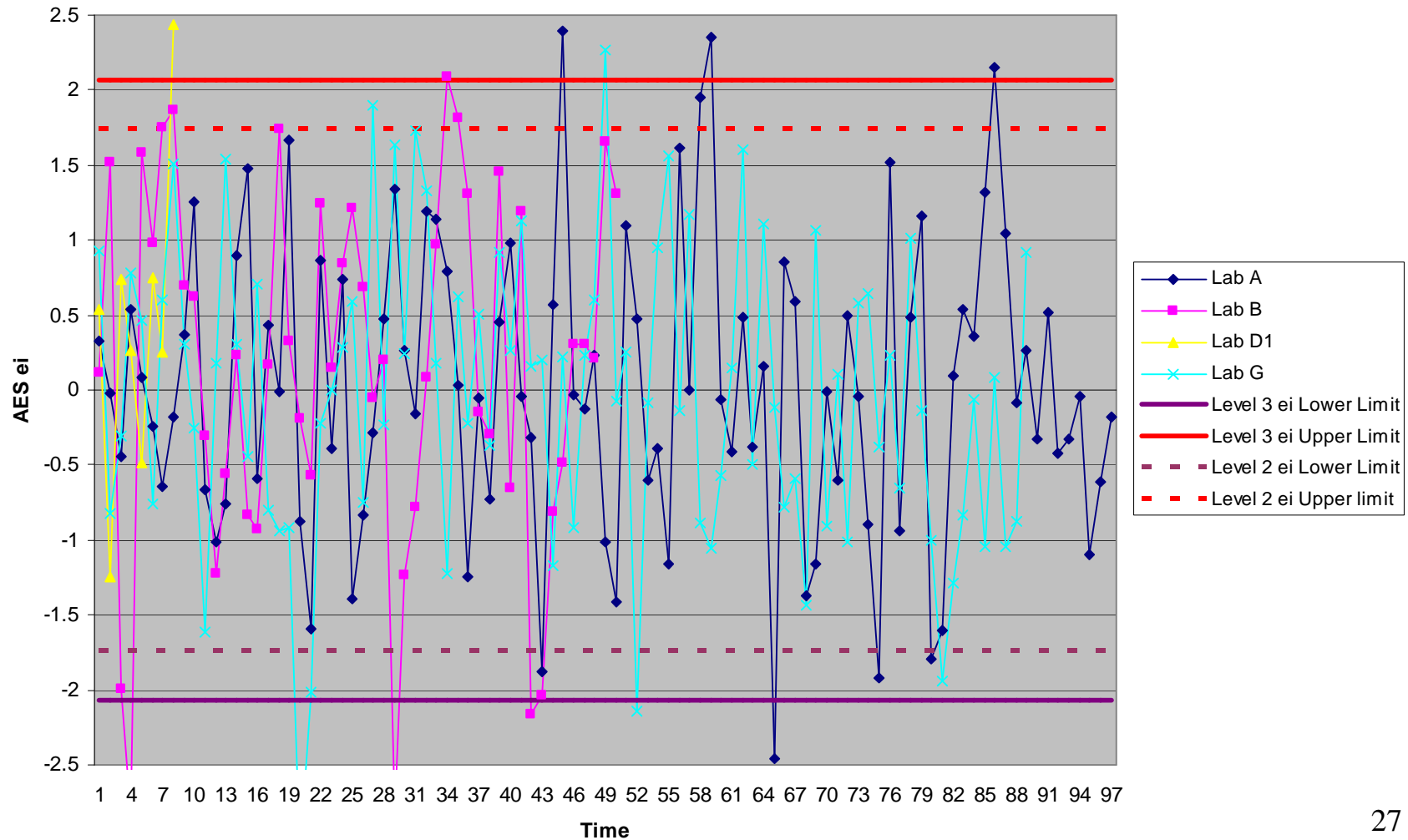
# New LTMS for the VG

Candidate Oil Test Result Target Variability in the Sequence VG  
Based on All Chartable Tests



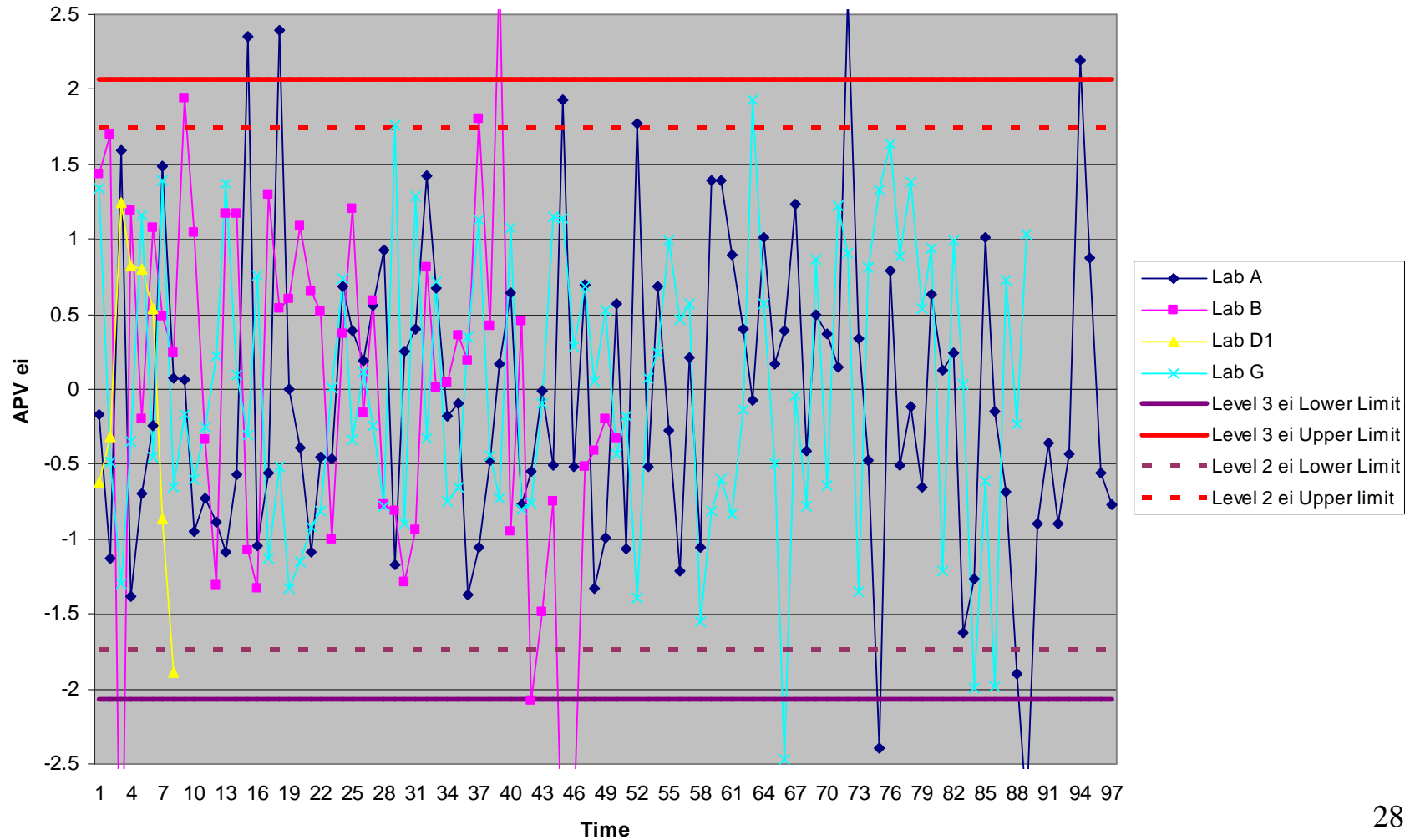
# New LTMS for the VG

AES ei Alarms by Lab



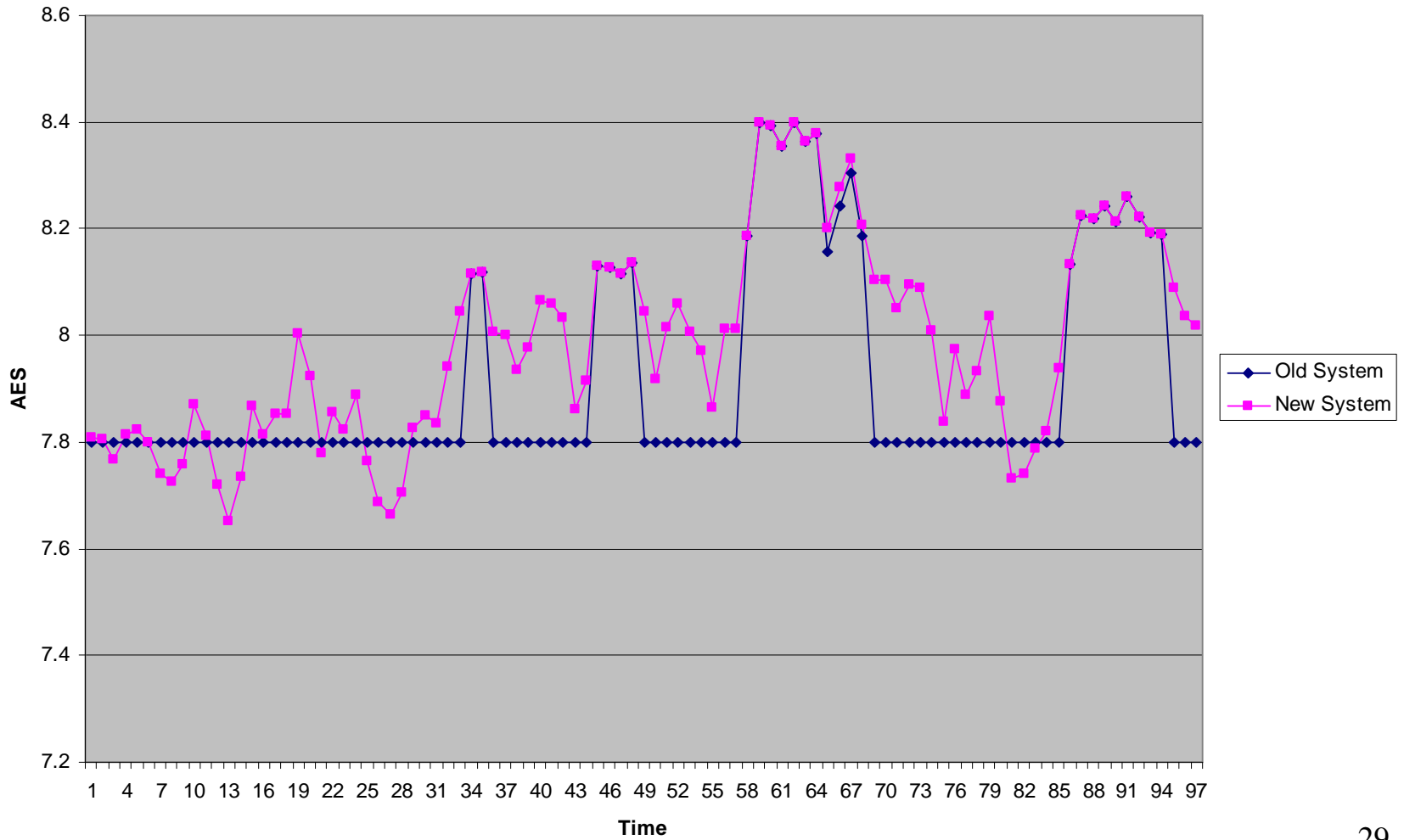
# New LTMS for the VG

APV ei Alarms by Lab



# New LTMS for the VG

Effective Pass Limit Given Severity Adjustment for Lab A



# **New LTMS for the VG**

- Wow! There are A lot of Slide
- For More we Can View the Spreadsheet

# Take a Breathe

- Any Questions



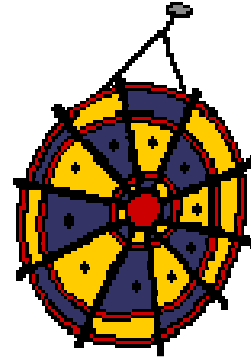


# Next Steps

- Review, Absorb, Cry
- Set Final
  - Zi and ei limits
  - Reference Interval Requirements
- Schedule an Implementation Meeting?
- Implement ... ?
- Official Calculations Would be Done by the TMC and Start with “Next” Reference after Adoption

# Additional Slides

# LTMS Introduction



- What is LTMS?
  - Control Charting System that Monitors Both Bias and Precision for Both Abrupt Changes and Consistent Trends
  - Accuracy = Function(Bias, Precision)
- Why LTMS?
  - Maintain Calibration → Protect Quality
  - X Special Causes → Reduce Time/Cost
  - LTMS is a major prerequisite to fair, unbiased, cost effective candidate testing

# LTMS Introduction

- Important Notes
  - LTMS does not solve problems
    - It is a tool to help solve problems
    - It is a tool to facilitate ‘fair’ testing
  - LTMS is at the mercy of bad practices
    - LTMS more effective under sound practices
  - LTMS should serve its purpose and should not be altered to accommodate poorly developed and administered tests
  - LTMS is not for all tests
    - Some tests have extremely poor standardization practices

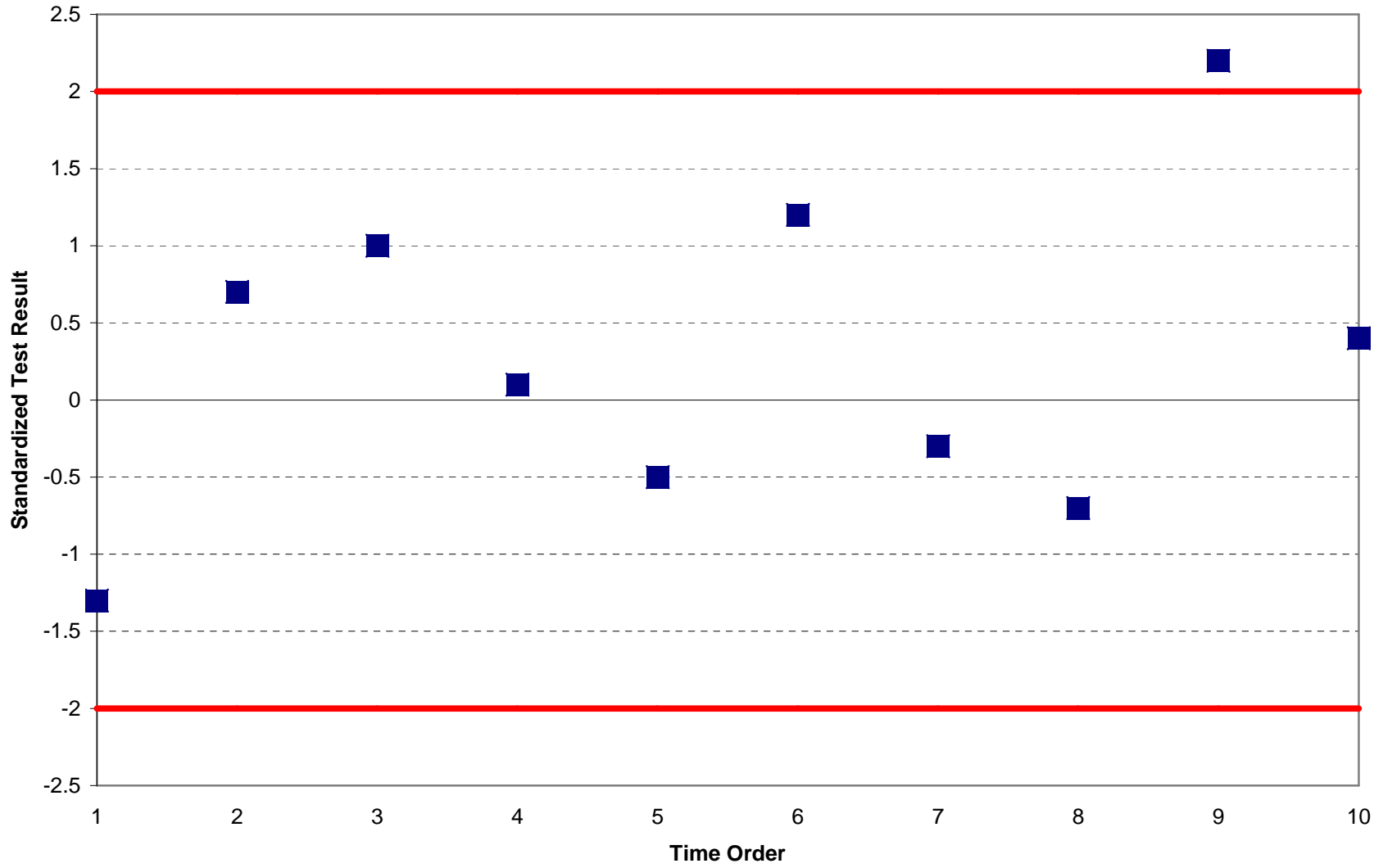
# LTMS Introduction

- Elements of LTMS
  - Increase value of reference tests
    - Test to generate necessary data, NOT as punishment
  - Use of ALL operationally valid data
  - Actions = Function (Control Chart)
  - Use of fixed reference oil targets
  - Use of reference oils that mimic candidates
  - Standardized control charts
  - Near real time severity adjustments
  - Monitoring of different levels of severity (Engine, Stand, Lab, Industry)

# LTMS Introduction

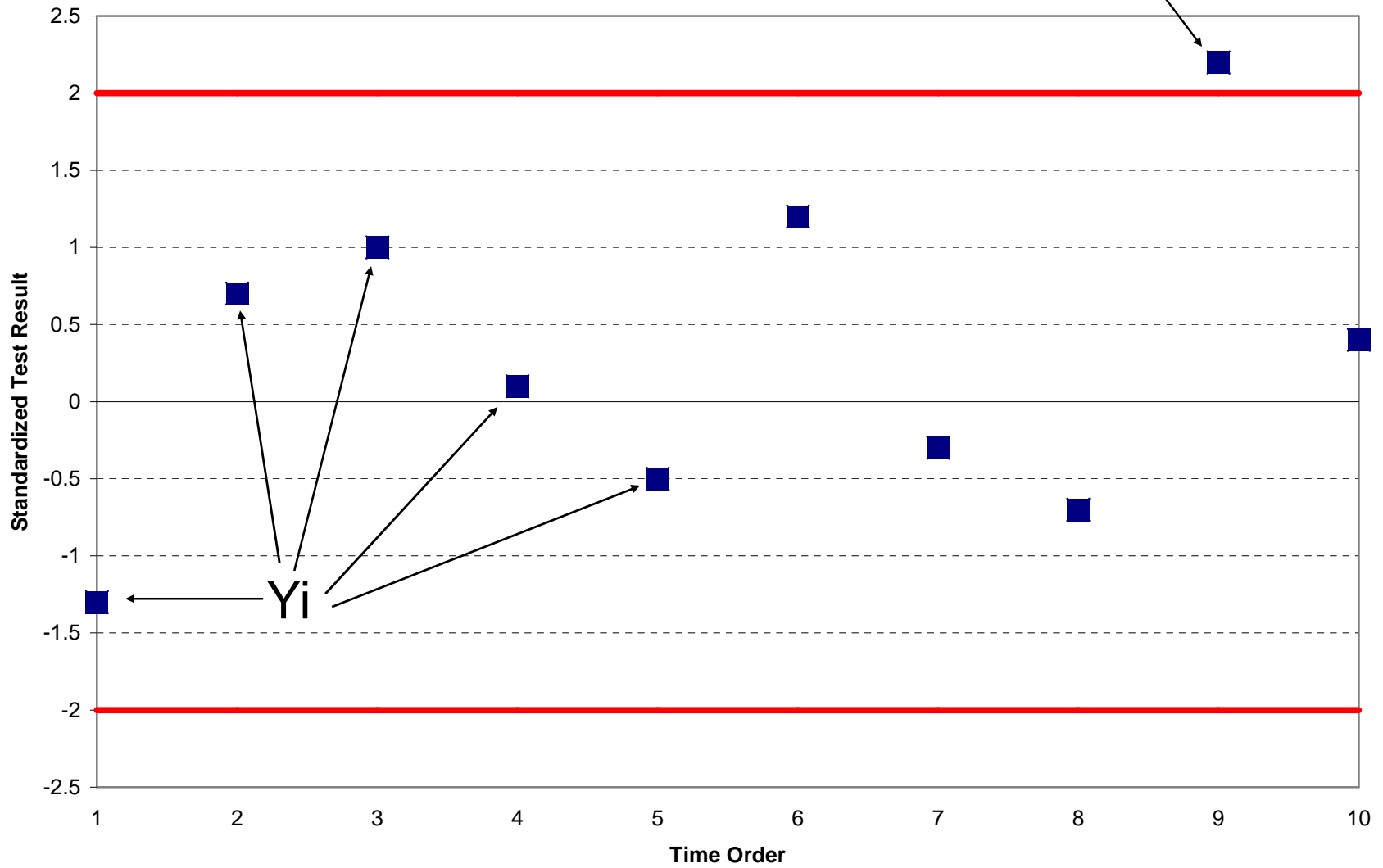
- What is a Control Chart?
  - Critical tool in LTMS process

### Shewhart Control Chart Example



### Shewhart Control Chart Example

Yi alarm





# LTMS Introduction

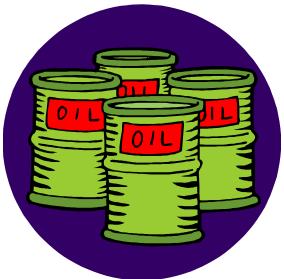
- LTMS Prerequisites
  - Consistent, managed parts supply
  - Consistent, managed fuel supply
  - Consistent test operation and hardware
  - Consistent, managed supply of reference oils that mimic the performance of candidate oils
  - Approximate data normality (transformations)
  - Sufficient reference testing per lab
  - Baseline matrix or round robin or data history

# LTMS Introduction

- Perspective

- Why Do all This?

- An Investment
    - Cost Effective Testing
    - Poor Oils Must Fail and Good Oils Must Pass



# LTMS Methodology

- Notation

- $k$  = Standard Deviation Multiplier for Control Chart Limit
- $X_i$  = Test Result at Test/Time  $i$
- $T_i$  = Transformed Test Result at Test/Time  $i$ 
  - Example:  $T_i = \text{LN}(Y_i)$
- $Y_i$  = Standardized Test Result at Time/Test  $i$ 
  - $Y_i = \frac{(T_i - \text{Reference Oil Mean})}{\text{Reference Oil Standard Deviation}}$
- $e_i$  = Prediction Error at Time/Test  $i$ 
  - $e_i = Y_i - Z_{i-1}$

# LTMS Methodology

- Notation

- $Z_i$  = Exponentially Weighted Moving Average of  $Y_i$

- $Z_i = (\lambda) Y_i + (1 - \lambda) Z_{i-1}$

- Lambda =  $\lambda$  = Tuning parameter for EWMA

# LTMS Methodology

- The Exponentially Weighted Moving Average (EWMA)

$$Z_i = (\lambda) Y_i + (1 - \lambda) Z_{i-1}$$

where:  $0 \leq \lambda \leq 1$  ,  $Z_0 = \text{Start}$

$Z_i$  has a Memory, it Captures Process History

$Z_i$  is the One-Step-Ahead Predictor of the Process

$$\text{VAR}(Z_i) = (\lambda / (2 - \lambda)) \times \text{VAR}(Y_i)$$

# LTMS Methodology

- EWMA Example (Set  $\lambda = 0.3$ )

$$Z_i = (\lambda) Y_i + (1 - \lambda) Z_{i-1}$$

$$Y_1 = 0.5$$

$$Z_1 = (0.3)(0.5) + (0.7)(0) = 0.15$$

$$Y_2 = 1.0$$

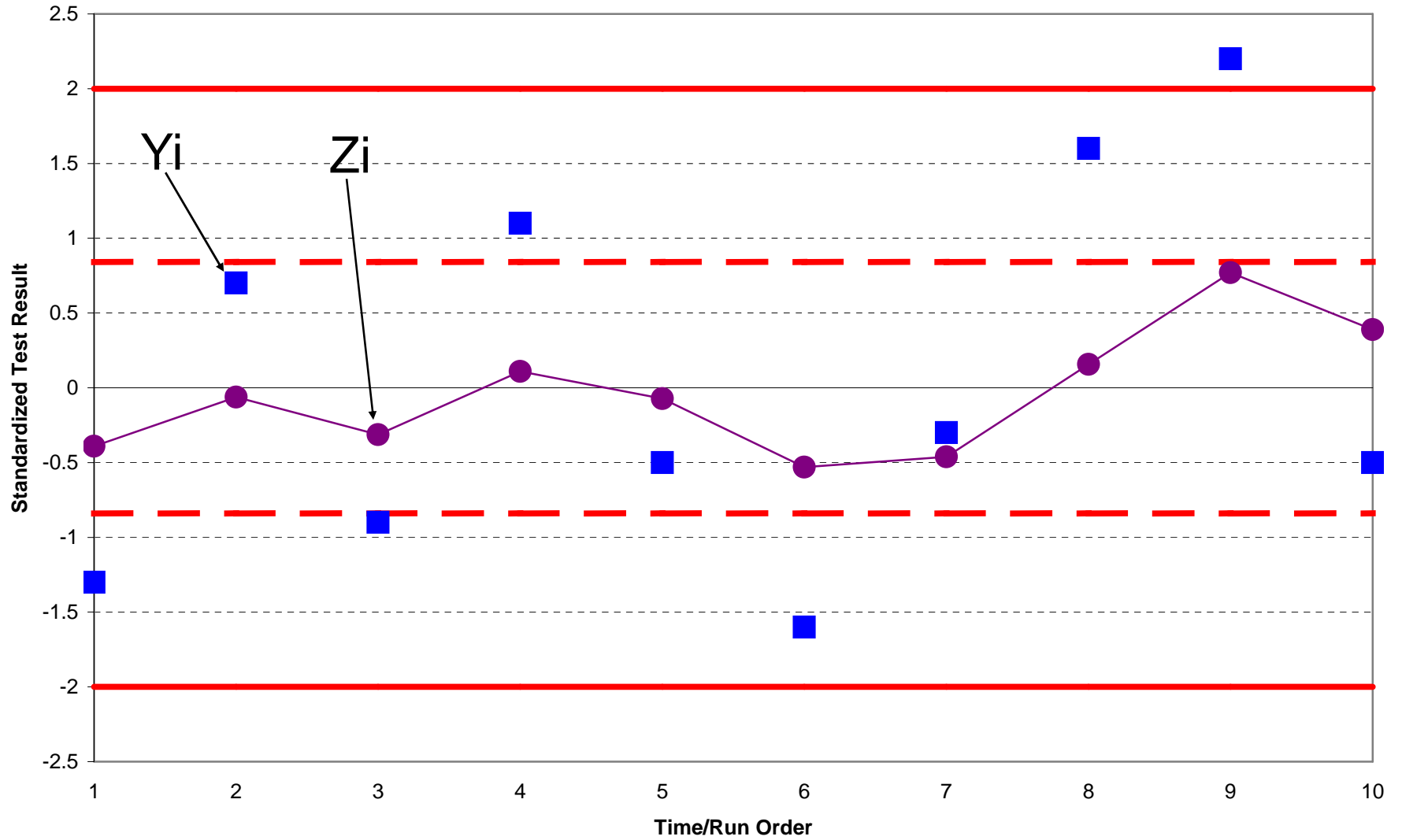
$$Z_2 = (0.3)(1.0) + (0.7)(0.15) = 0.405$$

$$Y_3 = 0.75$$

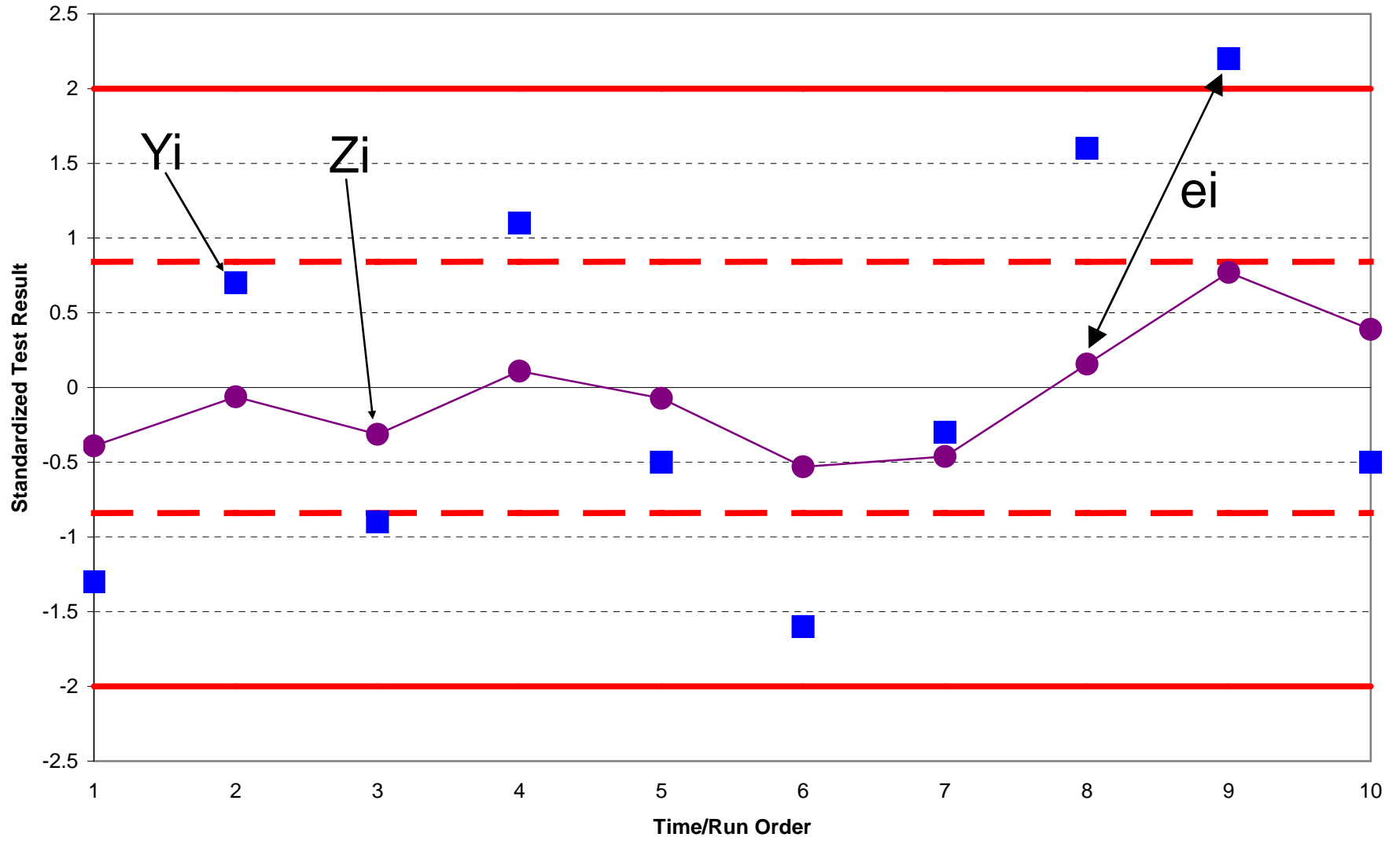
$$Z_3 = (0.3)(0.75) + (0.7)((0.405) = 0.5085$$

$$Z_3 = (0.3)(Y_3) + (0.3)(0.7)Y_2 + (0.3)(0.7)(0.7)(Y_1) + (0.7)(0.7)(0.7)(Z_0)$$

Shewhart/EWMA LTMS Control Chart

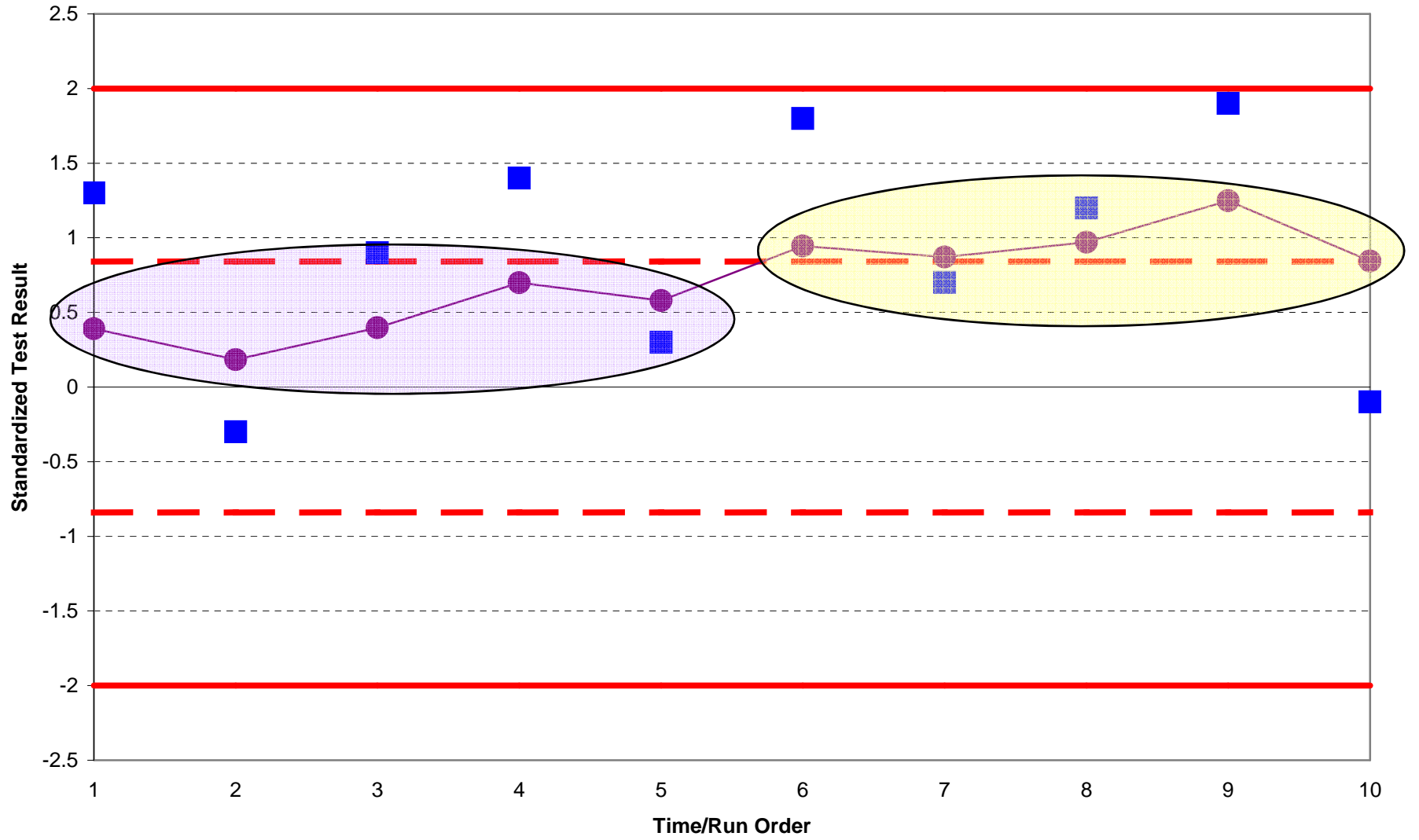


Shewhart/EWMA LTMS Control Chart





Shewhart/EWMA LTMS Control Chart



# LTMS Methodology

- $e_i$  Example

$$e_i = Y_i - Z_{i-1}$$

$$Z_{10} = 2.5$$

$$Y_{11} = 2.5$$

$$e_{11} = 2.5 - 2.5 = 0.0$$

No Problem

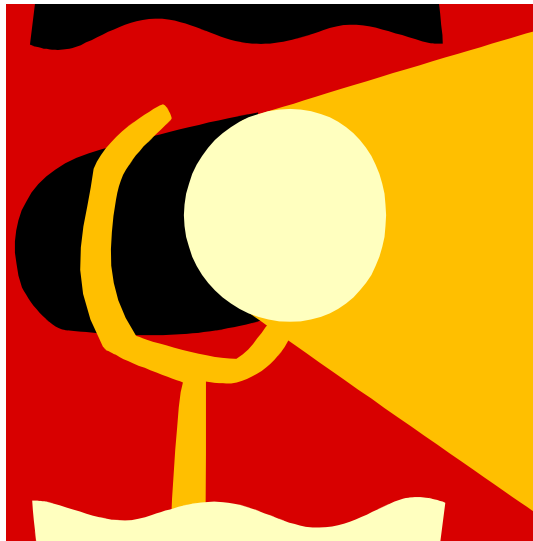
$$Y_{12} = 0.0$$

$$e_{12} = 0.0 - 2.5 = -2.5$$

Problem

# Continuous SA

- Why the SPOTLIGHT on Continuous SA?
  - Because Why the Continuous SA?
    - Because Best Overall 'GOODNESS'
    - Do we Wish to Review?



# Measure of Goodness

- Spread of Data Around Expected Result
  - Accuracy
- Mean-Squared Error (MSE)
  - $MSE = E\{(Actual - Expected)^2\}$ 
    - $MSE = E\{(Actual - Predicted)^2\}$
  - $MSE = Variance + (Bias)^2$ 
    - $MSE = Variance + (Uncorrected Process Bias)^2$
- What Should We Expect?
  - We Expect Test Results, Corrected or Uncorrected, to be on Target with Minimal Variance Around the Target
  - We Expect a Small MSE

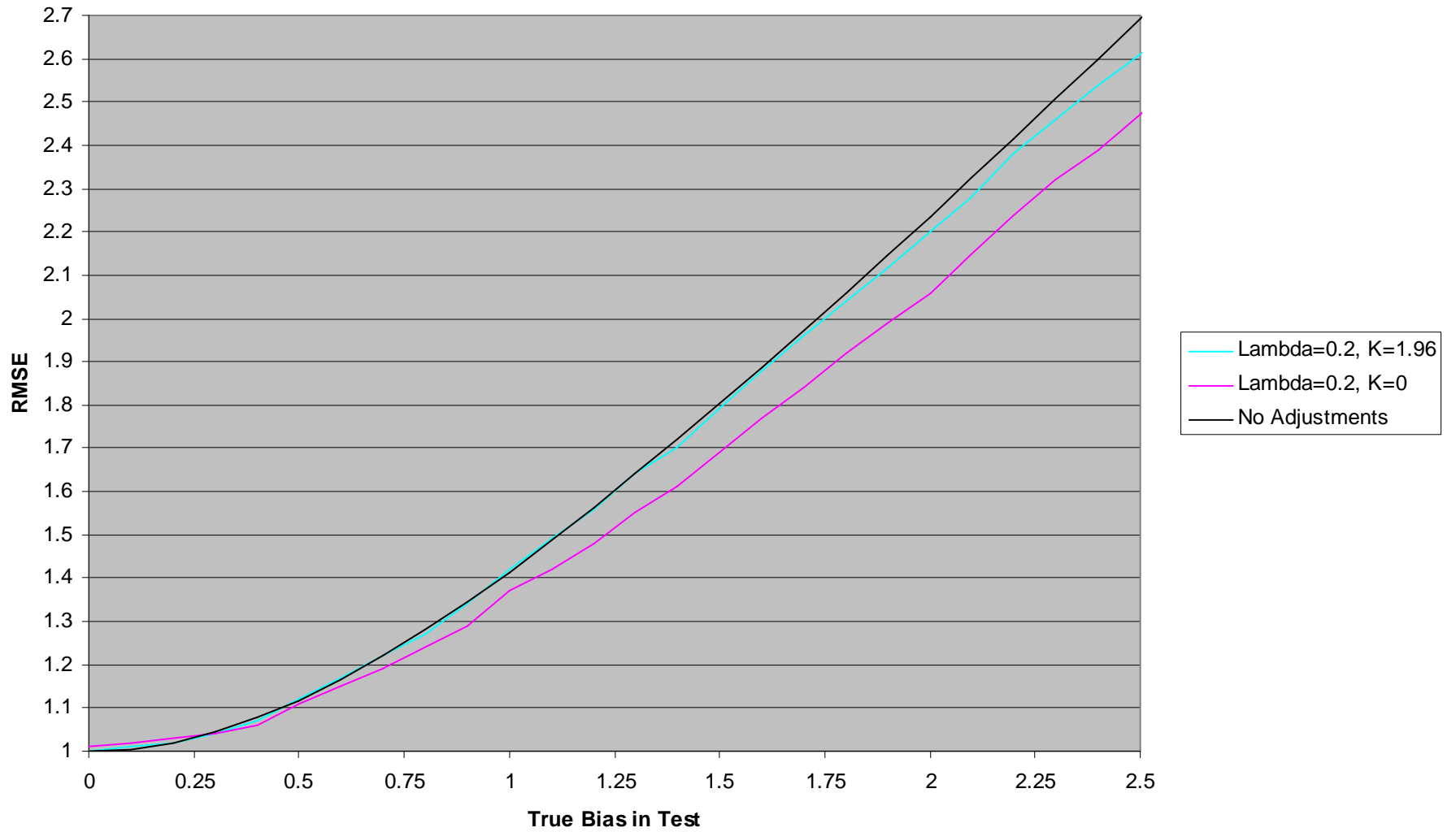
# Calculation Method

- Compare MSE of Different Adjustment Methods Over Different Bias (Test Shift) Scenarios
  - Theoretical Calculation for Situation of No Bias
  - 10,000 Simulations in Cases of Bias (Test Shift)
- Mean Target is Zero (0) and True Standard Deviation is One (1)
- Comparisons are Made at 2, 4, and 10 Tests
  - What is the average variability of my test results after correcting after 2, 4 and 10 tests after a shift
  - It is Very Unlikely that No Shifts Occur Within 10 Reference Tests

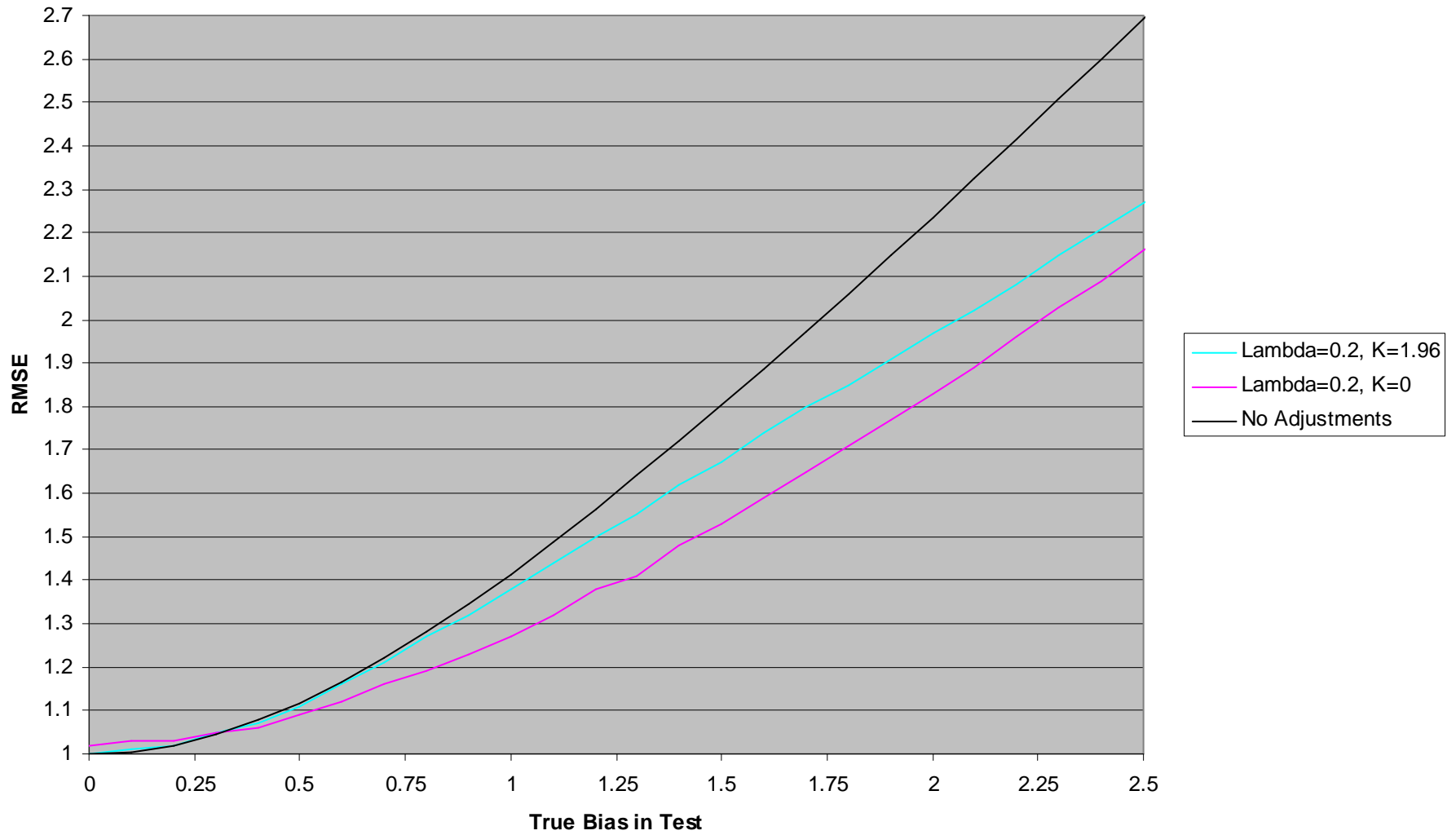
# EWMA Continuous Adjustment

- IFF No Bias, No Adjustment Best for RMSE
  - BUT
    - Differences in RMSE are Very, Very Small
    - Better RMSE for EWMA from 0.2 to 0.4 Bias Depending on n and Lambda
    - Given Historical Data, Probability of Test Shifts and Lab Bias is High
- Best Lambda Depends on Size of Shift/Bias
  - Bias Less than 0.5
    - Small,  $\lambda = 0.1$  or  $\lambda = 0.2$ , Better
  - Bias Greater than 0.75
    - Larger,  $\lambda = 0.3$  or  $\lambda = 0.4$  Better
  - Selection of  $\lambda = 0.2$  Appears to be a Good Compromise

Root Mean Squared Error of Adjusted Test Results  
where True  $s=1.0$  and  $n=2$

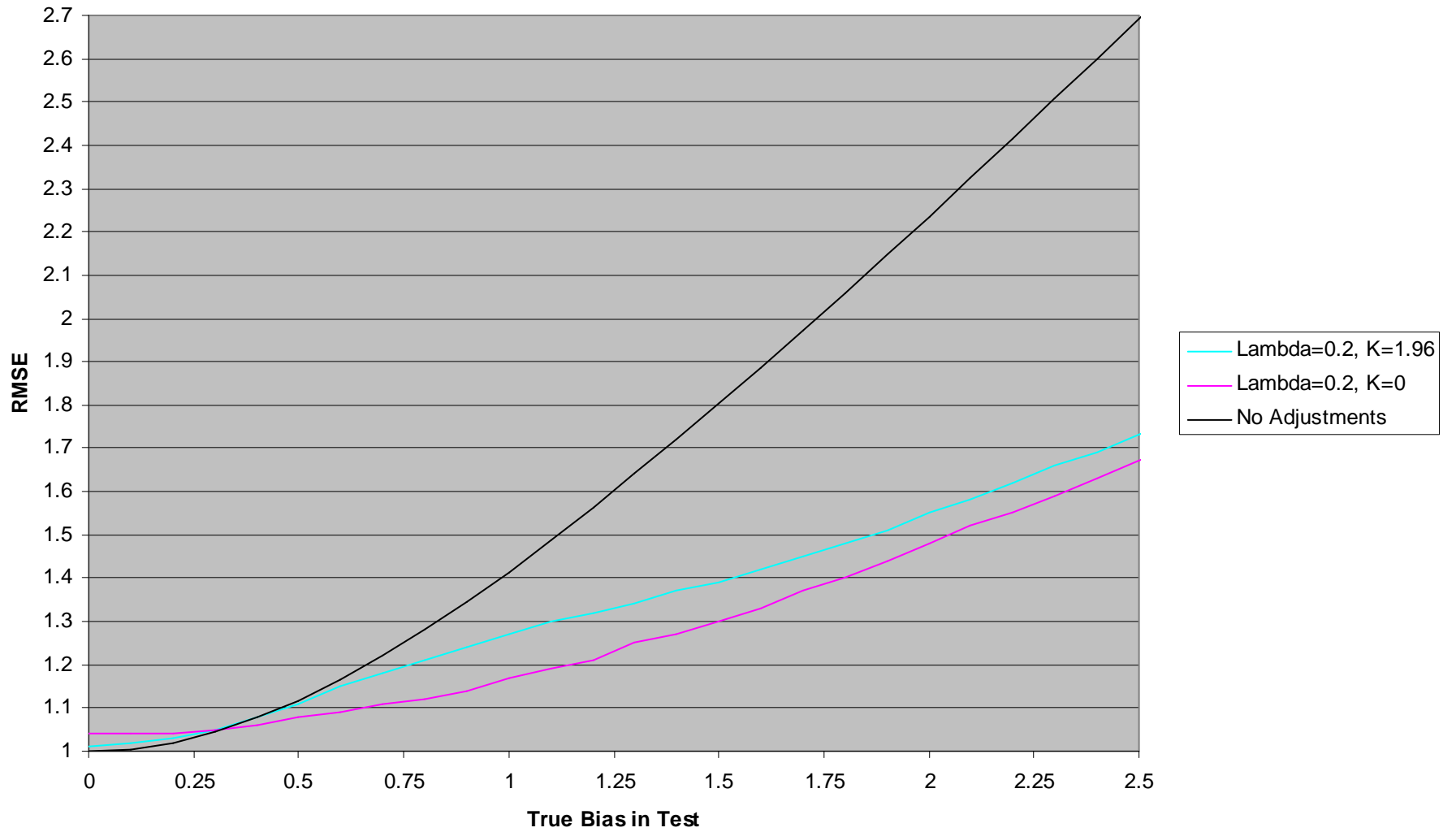


Root Mean Squared Error of Adjusted Test Results  
where True  $s=1.0$  and  $n=4$





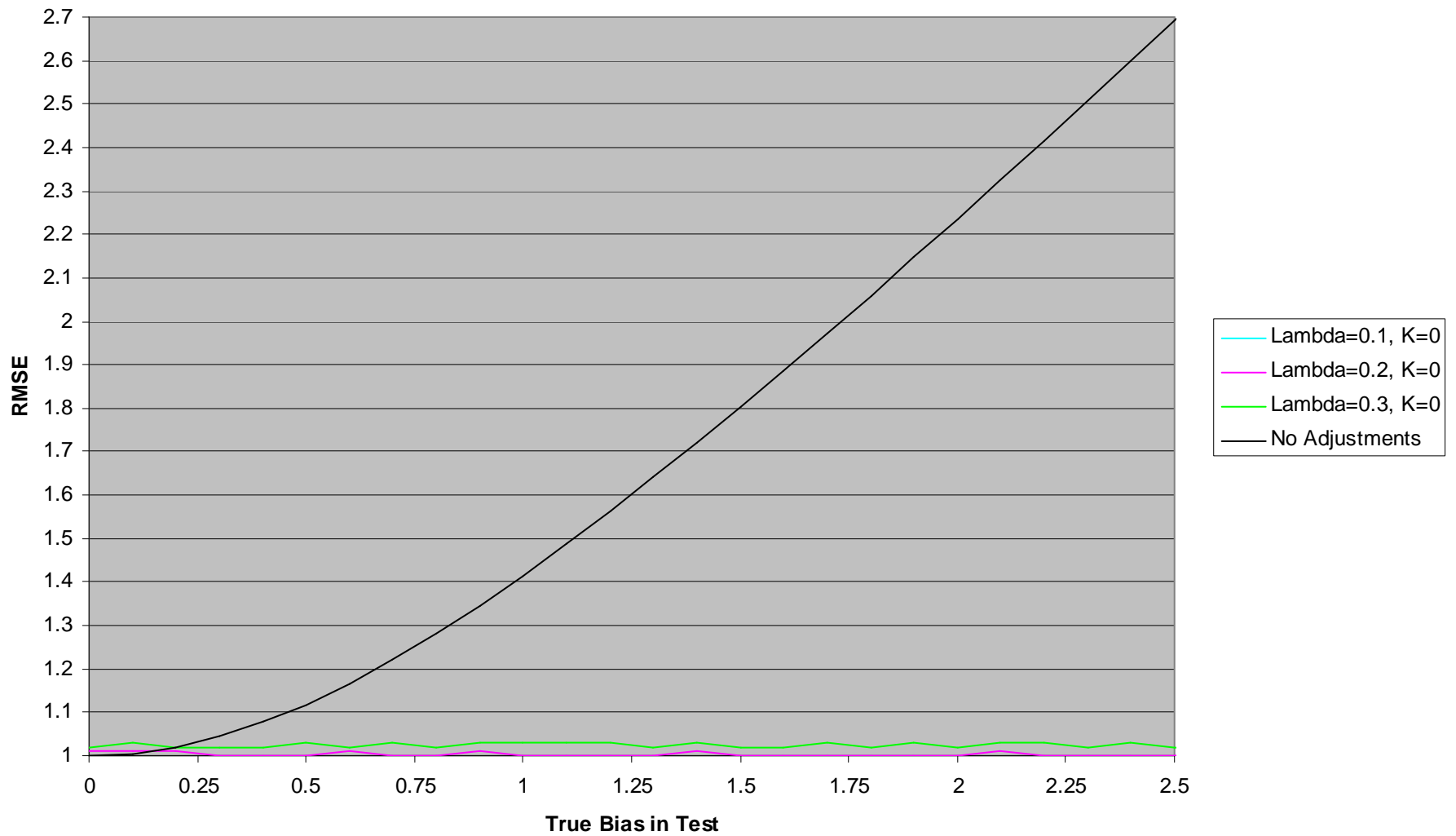
Root Mean Squared Error of Adjusted Test Results  
where True  $s=1.0$  and  $n=10$



# Fast Start to the EWMA

- Set  $Z_0$  to the Average of the First 3 Reference Tests
- Results in an Overall Reduction of the RMSE

**Root Mean Squared Error of Adjusted Test Results**  
where True  $s=1.0$ ,  $n=5$  AND  $Z_0$  Set from Average of First 3 Test Results



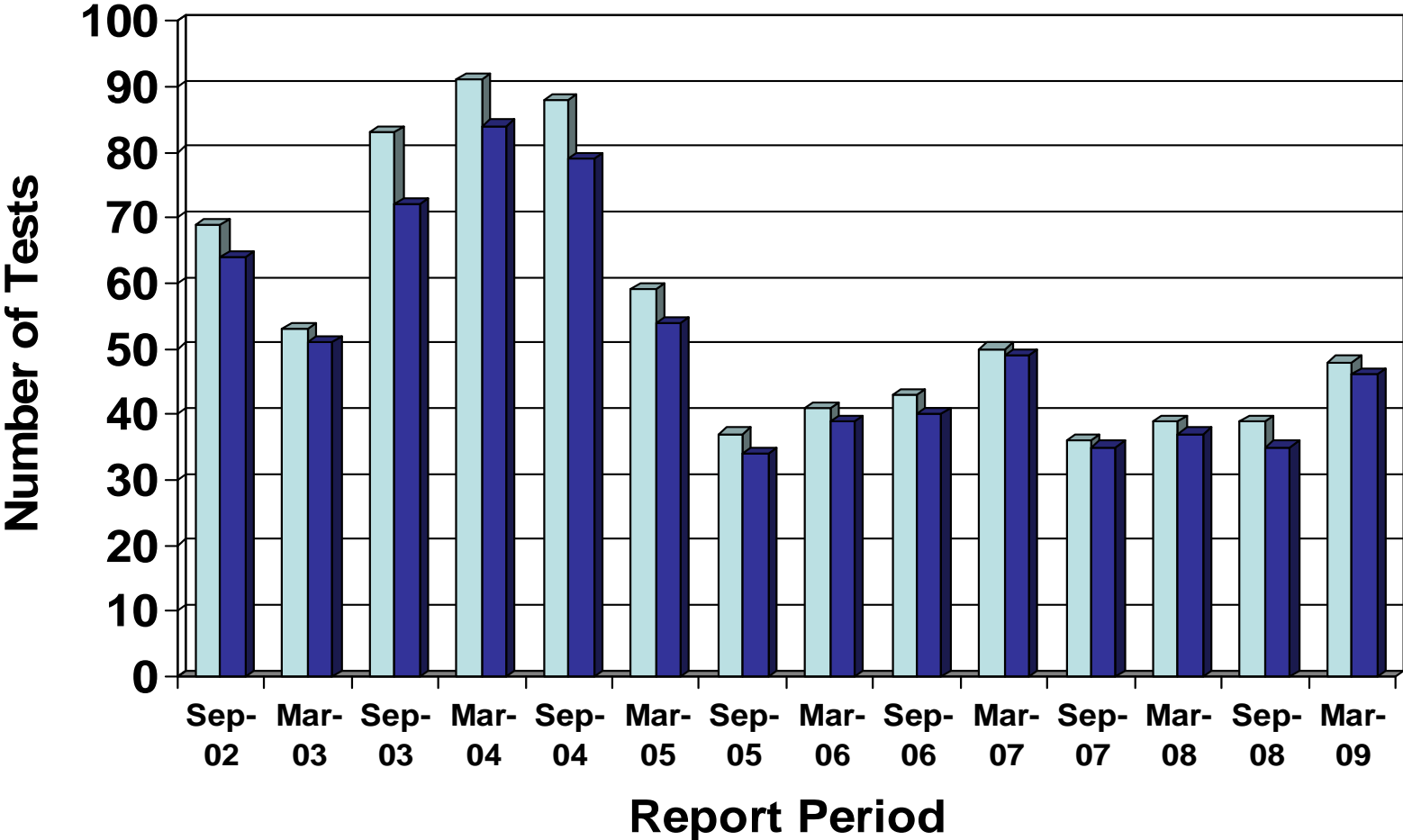
**Sequence VG S.P.  
Presentation to Subcommittee  
D02.B  
DRAFT**

Prepared By: Andrew Ritchie, S.P. Chairman

May 13<sup>th</sup> 2010

# Sequence VG S.P. Report

## Candidate Test Activity



■ Total Reported Tests ■ Operationally Valid

# Sequence VG S.P. Report

## Reference Oil Update

- **There is ample supply (3 years or more) of all active VG reference oils:**
  - **925-3**     *SAE 5W30 failing reference oil*
  - **1006-2**   *SAE 5W30 passing reference oil*
  - **1007**     *SAE 5W30 passing reference oil*
  - **1009**     *SAE 5W30 borderline passing reference oil*

# **Sequence VG S.P. Report**

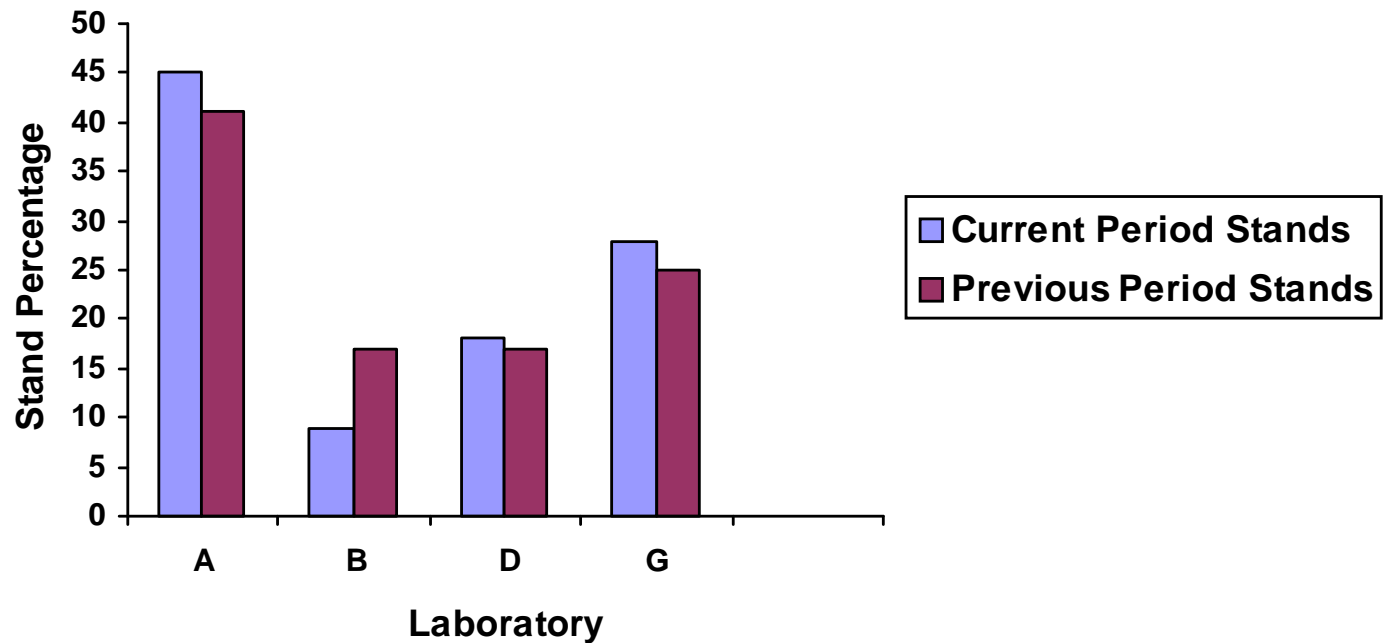
## **Panel Activity**

- **The VG Surveillance panel met May 13<sup>th</sup> 2010.**
  - **Surveillance panel will meet next 2H 2010.**
  - **Panel is working on the approval of a new fuel batch.**

# Sequence VG S.P. Report

## LTMS Laboratory/Stand Distribution

Laboratory/Stand Distribution





# Sequence VG S.P. Report

## Industry Reference Severity Summary

6 month time frame

Variable	Pooled s All Oils	Mean Delta/s	Based on	Delta in Reported Units
RAC	0.23	-0.09	8.0	-0.02
AES	0.55	0.00	7.8	0.00
APV	0.28	-0.29	7.5	-0.08
AEV	0.13	0.08	8.9	0.01
OSCR	0.51	-0.71	20	-6.8

# **Sequence VG S.P. Report**

## **Sequence VG S.P. Scope**

The Sequence V Surveillance Panel is responsible for the surveillance and continued improvement of the Sequence VG test documented in ASTM Standard D6593 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 rating technique, test operation, test monitoring and test validation will be accomplished through continual communication with the Test Sponsor, ASTM Test Monitoring Center, ASTM B0.01, Passenger Car Engine Oil Classification Panel, ASTM Light Duty Rating Task Force, ASTM Committee B0.01, ACC Monitoring Agency and CRC Motor Rating Methods Group. Actions to improve the process will be recommended when deemed appropriate based on input from the preceding. Industry transition to new engine hardware batches will be monitored and redistribution of existing hardware facilitated to accomplish uniform industry implementation. Development and correlation of updated test procedures with previous test procedures will be reviewed by the panel. This process will provide the best possible test procedure for evaluating automotive lubricant performance with respect to the lubricant's ability to prevent engine sludge, engine varnish, oil screen plugging, oil ring clogging and ring sticking.

# Sequence VG S.P. Report

## Sequence VG S.P. Objectives

<u>Objectives</u>	<u>Target Date</u>
1. Prepare and evaluate a new batch of SVG M2 fuel.	Complete by YE 2010

# Sequence VG S.P. Report

Information Item for Subcommittee B/B01

- ***Efforts are underway to secure a new fuel batch for the Sequence VG.***



**Ford Motor Company  
Ford Customer Service Division  
Service Engineering Office**

**Diagnostic Service Center II  
1800 Fairlane Drive  
Allen Park, mi. 48101**

May 6, 2010

Thom Smith  
PCEOCP Chairman  
The Valvoline Company  
P.O. Box 14000 VL-2  
Lexington, Ky. 40512-4001

Dear Thom,

At the last PCEOCP meeting the group requested the submission of a candidate for a GF-5 reference oil that met at least the Sequence VID and Sequence IIIG ILSAC GF-5 limits. I'd like to submit the attached data from a candidate oil for consideration. This is an SAE 5W-20 oil that passes both the Sequence IIIG and VID and most of the other GF-5 tests. This oil doesn't meet the emulsion retention requirements of ILSAC GF-5. The test data provided are single tests, but we're confident in the data as we've run a number of tests on this DI chemistry with passing results on the Sequence VID, IIIG, VG, IVA, etc. The additional data is proprietary and can not be shared.

Please circulate this information to the PCEOCP members and Surveillance Panel chairs for consideration and discussion at the next meeting.

If you have any question please contact me.

Sincerely

A handwritten signature in black ink, appearing to read "Ron Romano".

Ron Romano  
Service Lubricants Technical Expert

### SAE 5W-20 GF-5 Reference Oil Candidate

<u>Performance Requirements</u>	<u>Specification</u>	<u>Test Results</u>
<b>ASTM Ball Rust (ASTM D6557)</b>		
Average Gray Value	100 min	124
<b>Sequence IIIG</b>		
Viscosity Increase at 40 °C	150% max	81
Weighted Piston Deposits	4.0 min	4.0
Hot Stuck Piston Rings	0	0
Cam Plus Lifter Wear, Average	60 µm max	12
<b>Sequence IIIGA</b>		
Aged oil CCS Viscosity at -30°C	Report	7200
MRV TP-1, cP	1 grade up max	11400@ -30°C
Yield Stress, Pa	<35 max	<35
Sequence IIIB		
Phosphorus Retention, %	79 min	85
<b>Sequence IVA (ASTM D6891)</b>		
Average Cam Wear (7 position average)	90 µm, max	18
<b>Sequence VG (ASTM D6593)</b>		
Average Engine Sludge	8.0 min	9.5
Rocker Arm Cover Sludge	8.3 min	9.6
Average Engine Varnish	8.9 min	9.1
Piston Skirt Varnish	7.5 min	8.1
Oil Screen Clogging	15% max	1
Hot Stuck Compression Rings	0	0
Cold Stuck Rings	Report	0
<b>Sequence VID (ASTM D7589)</b>		
<u>SAE 5W-20</u>		
FEI SUM *	2.6% min	2.79
FEI 2 at 100 Hours	1.2% min	1.41
* FEI SUM = FEI at 16 hours + FEI at 100 hours		
<b>Sequence VIII (ASTM D6709)</b>		
Bearing Weight Loss	26 mg, max	1
<b>TEOST MHT-4 (ASTM D7097)</b>		
Deposit Weight	35 mg, max	35
<b>TEOST 33C (ASTM D6335)</b>		
Deposit Weight	30 mg, max	15

**SAE 5W-20 GF-5 Reference Oil Candidate**

<b><u>Physical/Chemical Property Requirements</u></b>	<b><u>Specification</u></b>	<b><u>Results</u></b>
Viscosity at 100 °C (ASTM D445), mm <sup>2</sup> /s, 5W-20	5.6 - <9.3	8.3
Viscosity at -30 °C (ASTM D5293), mPa.s	6600 max	3500
Low Temp. Pumping Viscosity at -35°C, mPa.s	60,000 max	10,000
Volatility		
Evap. Loss, 1 hr at 250 °C (ASTM D5800), %	15.0 max	14
Dist. by GC at 371 °C (ASTM D6417), %	10.0 max	5
Gelation Index (ASTM D5133)	12.0 max	5
HTHS Viscosity, mPa-sec at 150 °C & 10 <sup>6</sup> 1/sec (ASTM D4741 or ASTM D4683)	2.6 min	2.6
Filterability with short heating (ASTM D6795), %	50 max	-26
Filterability with long heating (ASTM D6794), %	50 max	-10
Foaming (ASTM D892) (after 1 minute settling time for all foaming sequences)		
Sequence I, mL*	10/0 max	0/0
Sequence II, mL*	50/0 max	0/0
Sequence III, mL*	10/0 max	0/0
High Temperature Foaming (ASTM D6082), mL*	100/0 max	50/0
Phosphorus, (ASTM D4951), % mass	0.06 - 0.08	0.077
Sulfur, (ASTM D4951 or D5453), % mass	0.50 max	0.3
Emulsion Retention,(ASTM D7563)		
0°C, 24 hours	No water separation	Water separation
25°C, 24 hours	No water separation	Water separation
Homogeneity and Miscibility (ASTM D6922)	No Separation	No Separation
Elastomer Compatibility (ASTM D7216 ANNEX A2)		
a. Polyacrylate Rubber (ACM-1)		
Volume (ASTM D471), %Δ	-5, 9	0.51
Hardness (ASTM D2240), pts.	-10, 10	-2
Tensile Strength (D412), %Δ	-40, 40	-12.5
b. Hydrogenated Nitrile Rubber (HNBR-1)		
Volume (ASTM D471), %Δ	-5, 10	-1.79
Hardness (ASTM D2240), pts.	-10, 5	0
Tensile Strength (D412), %Δ	-20,15	10.1
c. Silicone Rubber (VMQ-1)		
Volume (ASTM D471), %Δ	-5, 40	22.98
Hardness (ASTM D2240), pts.	-30,10	-20
Tensile Strength (D412), %Δ	-50, 5	-45.5
d. Fluorocarbon Rubber (FKM-1)		
Volume (ASTM D471), %Δ	-2, 3	-0.52
Hardness (ASTM D2240), pts.	-6, 6	-1
Tensile Strength (D412), %Δ	-65, 10	-12.9
e. Ethylene Acrylic Rubber (AEM-1)		
Volume (ASTM D471), %Δ	-5, 30	14.47
Hardness (ASTM D2240), pts.	-20,10	-7
Tensile Strength (D412), %Δ	-30, 30	-4.4

### Potential GF-5 Reference Oil Test Data

Test Method	Parameter	Unit	Limit			Test Result	
						5W-20	5W-30
Sequence VIII - D6709	10 h Stripped Viscosity	cSt	stay in grade			VGRA	9.7
	Total Bearing Weight Loss	mg	26 max.				20
Sequence IIIGB - D7320	Phosphorus Retention	%	79			VGRA	88
Sequence IVA - D6891	Average Cam Wear	µm	90 max.			VGRA	6
Sequence VID - D7589			XW20	XW30	10W30		
	FEI Sum	%	2.6	1.9	1.5 min	2.7	N/A
	FEI2	%	1.2	0.9	0.6 min	1.3	N/A
Sequence IIIG - D7320	Kinematic Viscosity Increase @40 °C	%	150 max.			VGRA	66
	Average Piston Skirt Varnish	merits	report				9.5
	Weighted Piston Deposits	merits	4.0 min				4.4
	Avg. Cam and Lifter Wear	µm	60 max.				24
	Hot Stuck Rings		None				none
	Oil Consumption	Liters	Report				3.5
Sequence VG - D6593	Average Engine Sludge	merits	8.0 min.			VGRA	9.1
	Rocker Cover Sludge	merits	8.3 min.				9.4
	Average Piston Skirt Varnish	merits	7.5 min.				8.1
	Average Engine Varnish	merits	8.9 min.				9.0
	Oil Screen Sludge	%	15 max.				2
	Hot Stuck Compression Rings		none				none
	Cold Stuck Rings		report				1
	Oil Screen Debris	%	report				20
	Oil Ring Clogging	%	report				0
	Average Follower Pin Wear	µm	30 max. (Ford spec)				3.9
	Average Ring Gap Increase	µm	225 max. (Ford spec)				76
Ball Rust Test - D6557	Average Gray Value		100 min.				VGRA



Sequence VG Surveillance Panel  
May 13, 2010  
9:00AM – 12:00PM  
Southwest Research Institute  
San Antonio, TX

Motions and Action Items

As Recorded at the Meeting by Raham Kirkwood and Dan Worcester

1. Action Item – Conference call will be held to determine the next fuel prove-out matrix. Statistics sub-group will develop recommendations and report back to the Surveillance Panel.
2. Action Item – Form a task force to develop a recommendation to the surveillance panel for adopting LTMS 2<sup>nd</sup> Edition to the Sequence VG. Task force to report to surveillance panel before Tuesday July 13th at 2PM EST.
3. Motion – Based on successful results from the chemical analysis of the lab blend the Surveillance Panel instructs Haltermann to create a full tank of VG fuel.

Ed Altman / Mark Sutherland / Passed 12-0-1

4. Motion – To have Seq. VG procedures Section 11.1.1 wording changed to “15 operationally valid” tests.

Al lopez / Ed Altman / Tabled for E-Ballot with improved wording

5. Motion – Accept both potential reference oils as GF-5 category reference oils. Consider using either oil for the Sequence VG and replacing one of the outdated reference oils currently in use. Conduct a follow-up surveillance panel conference call to develop a plan for adopting one or both of these potential reference oils.

Rich Grundza / Mark Sutherland / Passed 12-0-1