Sequence IIIH Task Force Meeting June 2, 2015
Meeting location: SwRI, San Antonio TX.
Time 09:13 CDT

Task Force Leader: Karin Haumann
Secretary: Sid Clark

Attendees are captured in the Sequence III Surveillance Panel Sign in List attached and are accurate with the addition of Mr. Mike McMillan, Infineum, and Dave Passmore IMTS participating via conference line.

Agenda Item: Approval of Matrix Test Stand Inspections
Karin started the meeting with a review of the items pending approval before starting the precision matrix including the prove-out data and lab inspection reports. Karin reviewed some of the items discussed during lab inspections and indicated a list would be available on the TMC website. Also attached to this set of minutes are the two documents reviewed during the meeting showing the lab inspection discrepancies and the prove-out data.

Karin made a motion to approve the lab stand inspections and Jason Bowden seconded the motion.
Discussion: There was no discussion.

Vote: Unanimous, no waves

Agenda Item: U & L QI Limits
Rich Grundza provided a presentation showing the process used to calculate Quality Index thresholds for Upper and Lower Control Set Points for Sequence Test Parameters. Rich used his laptop to show select parameters indicating the results to QI values running 1°C and 2°C off from set point.

Karin and Rich commented the IIIH Precision Matrix will use current IIIG Upper and Lower limits for QI calculations on similar parameters and the statistical group will review the post-matrix data for applicability of QI values that may need to be applied to additional parameters.

Rich discussed some of the parameters and showed some of the plots generated from the prove-out testing data.

Bob Campbell, Karin, and Rich discussed the Coolant Pressure Parameter as an example with Bob Campbell commenting on how they established a range rather than a set point on the Heavy Duty Tests. The group discussed how the IIIH actually controls coolant pressure by adjusting the head pressure in the reservoir.

Rich commented that for the most part the prove-out data all met his engineering judgement on targets. Rich indicated there are some parameters where set points could vary by plus or

minus a couple units and still generate an acceptable QI so the group will need to review the post-test data to determine individual parameter validity.

Karin commented that discussions with the test sponsor disclosed the minimum pressure on the coolant system should not fall below 140 kPa and we run at 200 kPa so there should not be any problems with subtle deviations from the 200 kPa set point. The labs went on discussing which labs used closed loop control on the coolant pressure parameter.

Ed and Karin discussed the fact that the setting was above that required by the test sponsor so setting a QI on the coolant pressure may not be the best approach. Rich commented that the TMC will review the Matrix Data and discuss each parameter and what changes may be required based on laboratory control capability.

The group discussed moving the coolant pressure to the uncontrolled parameter list with suggestions to leave it as a controlled parameter but block out the QI requirement. Other suggestions included setting the coolant pressure as a Range Parameter with a target set point without a QI. Range example would be 190 kPa to 210 kPa.

Comments also included treating the Air-to-Fuel Ratio the same as the coolant pressure as it's also a non-controlled parameter. Rich reviewed some of the AFR data indicating the range some of the prove-out tests experienced.

Karin and Rich discussed changing the Table in the Procedure and the Report Forms to reflect the changes discussed with Rich suggesting the group entertain a motion to approve the discussions.

Motion: Rich Grundza / Karin Haumann

Add upper and lower Quality Index values for Intake Air Temperature @ 0.35 and Fuel Temperature @ 0.7 and revised Coolant Pressure QI values to Not Applicable with a range of 200 kPa ± 10 kPa.

There was some discussion about another parameter; however, the secretary did not catch the comments before the question was called.

Motion carried with unanimous consent.

Agenda Item: Procedure Update

Karin provided an update on the work with the Facilitator on the IIIH Procedure. Karin indicated the work is nearly completed and she would try to have a copy available for Rich to post on the TMC website by the end of the week with intent to finalize work with the Facilitator over the next month. Karin suggested sending the latest copy to the labs rather than posting it to the TMC. The group agreed to Karin sending the Procedure to the lab engineers for review.

Agenda Item: Assembly Manual Update
Sid read through his Assembly Manual Index verbally outlining Sections 0 through Section 12 and the group agreed to allow the lab engineers to review the document prior to putting it on the TMC website.

Action Item: Karin and Sid will forward the latest copies of the Procedure and Assembly Manual documents to the lab engineers for review.

OHT Update:
Jason Bowden provided an update on the status of materials for the precision matrix.

1) Pistons and rings are in-stock

Ed Altman asked about availability with Jason commenting; BC1 (Prove-Out materials) have been allocated to the labs with Chrysler holding some materials for future use while BC-2 (Precision Matrix materials) have been allocated along with two additional sets / lab based on Chrysler's request.

Jason was asked about the size of the BC-2 materials to which he replied there was a minimum six month supply based on Sequence IIIG test volume.

2) Oil Pan Gaskets are in process of looking at fastener torque recommendations from the supplier for the lower oil pan gasket.

IMTS Update:
Dave Passmore provided an update on the cylinder heads indicating labs have received their Seed Materials and all Cores have been machined. Dave also outlined plans to contact the labs each month to solicit cores each month so each lab can gain a feel on turnaround time and IMTS scheduling. Dave indicated core materials are the property of each lab and will be kept separate during processing. IMTS will inventory core materials by lab and ship as ordered. Dave also reminded everyone that IMTS was in possesion of a small quantity of emergency seed materials to help get through this learning process.

Discussion revolved around turnaround times and batch processing so that IMTS can set up and run for the industry, hopefully running 60 to 90 pieces each time. Discussion about FIFO indicated IMTS will process them on a FIFO basis keeping heads segregated between the labs. Another question came up about shipping and packaging concerns. Dave indicated IMTS worked with Chrysler's Packaging Facility to manufacture special containers to protect the cylinder heads.

Discussion continued about cylinder heads and shipping concerns with the understanding this will be a process that continues for the life of the test.

Additional Discussion Items:
Karin discussed prove-out data analyses and variables within the test results regarding some lab data, i.e., Ashland WPD and Intertek PVIS for their test that used lab cut piston rings. Karin informed the group that Ashland was sending their pistons to SwRI for a referee rating.

Bob Campbell commented the goal is not to go into the matrix with lab variables. The intent is to understand the bias and if it cannot be fixed then the lab does not run in the matrix. Bob indicated the prove-out is outside the MOA and Matrix Planning. Amol commented his understanding of the matrix was that if a lab showed a bias in the matrix they would not have a qualified stand coming out of the matrix.

Discussion continued with additional questions directed to Chrysler about engine build out timing and delays in the Precision Matrix. Haiying Tang confirmed Chrysler's concerns about starting the Precision Matrix ASAP.

Action Item: Haiying Tang and Jeff Betz will review their timing requirements for running the build-out engines through Trenton Engine.

Karin suggested the IIIH Task Force hold weekly meetings to review the Precision Matrix data as it is reported to help expedite the analytical process with the industry statisticians. Rich indicated the data would be reported in the same format as used for the Data Dictionary and reporting of the Raw Data. Charlie Leverett asked if cylinder Surface Finish data would be reported and Karin commented that the new version of the Data Dictionary includes surface finish information.

Action Item: The group agreed labs should conduct some sort of Round Robin Surface Finish data collection. Karin will work with Jo Martinez to put together a template for data collection.

The group discussed concerns that the BC2 Top Ring may be on the small end of the gap specification. Jason Bowden commented that materials returned for inspection are within the supplier tolerance for the parts. Discussion about ring gaps continued with concerns about running the first two reference periods with a lower gap than specified. A question was asked about possibly moving the mean of the gap tolerance to assure BC-3 ring gaps would be the same as BC-2. Jason indicated a batch uses the total tolerance during production.

The meeting adjourned at 11:57 CDT.

Action Items:

1) Karin and Sid will forward the latest copies of the Procedure and Assembly Manual documents to the lab engineers for review.

2) Haiying Tang and Jeff Betz will review their timing requirements for running the build-out engines through Trenton Engine.

3) The group agreed labs should conduct some sort of Round Robin Surface Finish data review. Karin will work with Jo Martinez to put together a template for data collection.

Motions:

1) Motion: Karin Haumann / Jason Bowden
   Motion to approve the IIIH Test Lab Stand Inspections.
   Vote: Unanimous, no waves

2) Motion: Rich Grundza / Karin Haumann
   Motion to add upper and lower Quality Index values for Intake Air Temperature @ 0.35 and Fuel Temperature @ 0.7 and revised Coolant Pressure QI values to Not Applicable with a range of 200 kPa ± 10 kPa.

   There was some discussion about another parameter; however, the secretary did not catch the comments before the question was called.
   Motion carried with unanimous consent.

This is a compilation from notes recorded during the call, with comments from member participants during the Draft Review. Certain subjects may not necessarily be in exact order; however, they are believed to represent an accurate account of the call. If anyone feels changes or additional content may be necessary, please contact Sid Clark @ 586-873-1255 or Sidney.Clark@swri.org

Thanks, Sid

IIIH Matrix Test Stand Inspection Discrepancies and Resolutions

Southwest Research 10/1/14

OHT oil pan and plug missing – Not available at the time of inspection, and has since been included.

OHT modified water pump – Was sent back to OHT for additional modification, and has since been received.

Air resonator modification within procedure specification – Procedure was since modified to allow a tolerance of ±1 cm which brings location into conformance.

3 kΩ resistor used for ECU coolant temperature – 500 Ω resistor in parallel to increase ECU coolant temperature on test has been removed.

Intertek 10/1/14

OHT oil pan and plug missing – Not available at the time of inspection, and has since been included.

Air resonator modification within procedure specification – Procedure was since modified to allow a tolerance of ±1 cm which brings location into conformance.

3 kΩ resistor used for ECU coolant temperature – 500 Ω resistor in parallel to increase ECU coolant temperature on test has been removed.

Lubrizol 11/5/14

Minimum 48 in of Tygon tube vertically into the Aerecology system – Length has been extended.

Ultrasonic parts cleaner and detergents not on hand – They have since been received.

3-way coolant temperature valve substitution has been found to be equivalent.

Type J thermocouples in use – Procedure has been amended to allow for either type E or J thermocouples.

Micro-motion model has found to be equivalent.

Missing throttle pedal – Procedure has been modified to allow the use of drive-by-wire as an appropriate substitution.

Afton 11/6/14

OHT crossover missing – Slave engine installed incorporated factory crossover, and has since been replaced.

Alternate coolant heat exchanger installed – Procedure has since been modified to allow for a tube and shell heat exchanger as an acceptable alternative.

Ashland 3/10/15

Minimum 48 in of Tygon tube vertically into the Aerecology system – Length has been extended.

Intake air pressure transducer ranges – Procedure has since been modified to allow for a wider selection of pressure ranges.

Type J thermocouples in use – Procedure has been amended to allow for either type E or J thermocouples.

Location of 2-way coolant control valve on wrong side of engine – Valve was re-plumbed per the coolant schematic in the procedure.

Prove out Matrix										
	SwRI		IAR		Lubrizol		Afton		Ashland	
	pVis, %	WPD	pVis, %	WPD	pVis, %	WPD	pVis, %	WPD	pVis, %	WPD
REO2	78.5	4.76	121.6	3.63	71.1	4.52	45.9	4.38	**79.4**	**3.88**
REO2	54.8	4.72	46.4	5.15	44.6	4.82	21.83	4.66	**65.8**	**3.95**
REO2	49.1	4.98	51.4	5.07						
434-1	143.7	4.27	90.5	4.76	754.7	3.8	264.3	4.46	**956**	**3.76**
434-1	146.8	4.61			412	3.84				
REO3	21.2	6.8			26.4	7.4				
438-1	155.1	3.43	34.0	3.56						
438-1	32.4	3.91								

Sequence IIIH Engine Assembly Manual Update

- Section Content:

0) Contact Information and Document Index
1) Engine Specifications and Fastener Torque
2) Precautionary Statements & Cylinder Head Core Preparation
3) New Engine Disassembly
4) Main Oil Gallery Modifications and Honing
5) Post Honing and Special Parts Cleaning
6) Cylinder Head Pre-Build Cleaning and Assembly
7) Short Block Assembly and General Information
8) Long Block Assembly
9) Final Dress
10) OHT Hardware (Still under construction)
11) Reagents and Equipment
12) Document Update Timeline

ASTM Sequence III Surveillance Panel (22 Voting members) date: 06/02/2015

Name/Address	Phone/Fax/Email 14 Voting Present		Signature
Ed Altman Afton Chemical Corporation 500 Spring Street Richmond, VA 23219 USA	804-788-5279 804-788-6358 ed.altman@aftonchemical.com	Voting Member	Present
Jeff Betz Chrysler Mopar Parts USA	jeff.betz@fcagroup.com	Voting Member	Present
Jason Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 jhbowden@ohtech.com	Voting Member	Present
Timothy L. Caudill Ashland Oil Inc. 22nd & Front Streets Ashland, KY 41101 USA	606-329-1960 x5708 606-329-2044 tlcaudill@ashland.com	Voting Member → Represented by Amal Savant for Voting Purposes.	Present
Richard Grundza ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1031 412-365-1047 reg@astmtmc.cmu.edu	Voting Member	Present
Jeff Hsu, PE Shell Technology Center 3333 Hwy. 6 South, Mail Drop L107C Houston, TX 77082	j.hsu@shell.com	Voting Member	Present
Tracey King Haltermann Solutions MI USA.	947-517-4107 tking@Jhaltermann.com	Voting Member	Present
Teri Kowalski Toyota Motor North America, Inc. 1555 Woodridge Ann Arbor, MI 48105 USA	734-995-4032 734-995-9049 teri.kowalski@tema.toyota.com	Voting Member	Present
Patrick Lang	210-522-2820	Voting Member	Present

3/10/15

ASTM Sequence III Surveillance Panel (22 Voting members) date:

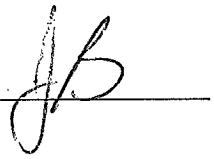
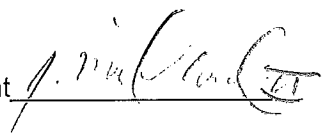
Name/Address	Phone/Fax/Email		Signature
Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-684-7523 plang@swri.edu		
Charlie Leverett Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-647-9422 210-523-4607 charlie.leverett@intertek.com	Voting Member	Present
Bruce Matthews GM Powertrain Mail Code 483-730-472 823 Jocyln Avenue Pontiac, MI 48340 USA	248-830-9197 248-857-4441 bruce.matthews@gm.com **Test Sponsor Representative**	Voting Member	Present
David Tsui BP Castrol Lubricants USA 1500 Valley Road Wayne, NJ 07470 USA	973-305-2337 David.Tsui@bp.com	Voting Member	Present
Mark Mosher ExxonMobil Technology Co. Billingsport Road Paulsboro, NJ 08066 USA	856-224-2132 856-224-3628 mark.r.mosher@exxonmobil.com	Voting Member	Present
Andrew Ritchie Infineum 1900 East Linden Avenue P.O. Box 735 Linden, NJ 07036 USA	908-474-2097 908-474-3637 Andrew.Ritchie@Infineum.com	Voting Member	Present
Ron Romano Ford Motor Company Diagnostic Service Center II Room 410. 1800 Fairlane Drive	313-845-4068 313-32-38042 rromano@ford.com	Voting Member	Present

ASTM Sequence III Surveillance Panel (22 Voting members) date:

Name/Address	Phone/Fax/Email		Signature
Allen Park, MI 48101 USA			
Greg Shank Volvo	301-790-5817 greg.shank@volvo.com	Voting Member	Present
Kaustav Sinha, Ph.D. Chevron Oronite Co., LLC 4800 Fournace Place Bellaire, TX 77401 USA	713-432-6642 713-432-3330 LFNQ@chevron.com	Voting Member	Present KS
Thomas Smith Valvoline P.O. Box 14000 Lexington, KY 40512-1400 USA	859-357-2766 859-357-7084 trsmith@ashland.com **PCEOCP Chair**	Voting Member	Present
Scott Stap Chevrolet Performance	scott.stap@tgidirect.com	Voting Member	Present
Mark Sutherland Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-867-8357 mrsutherland@tei-net.com	Voting Member	Present
George Szappanos The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2352 440-347-4096 greg.seman@lubrizol.com	Voting Member	Present
Haiying Tang Chrysler LLC	248-512-0593 ht146@chrysler.com	Voting Member	Present ON Phone

Name/Address	Phone/Fax/Email		Signature
Ricardo Affinito Chevron Oronite Co. LLC	affinito@chevron.com	Non-Voting Member	Present
Art Andrews ExxonMobil Products Research 600 Billingsport Rd. Paulsboro, NJ 08066 USA	856-224-3013 arthur.t.andrews@exxonmobil.com	Non-Voting Member	Present
Zack Bishop Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-877-0223 210-690-1959 zbishop@tei-net.com	Non-Voting Member	Present
Doyle Boese Infineum 1900 E. Linden Avenue Linden, NJ 07036 USA	908-474-3176 908-474-3637 doyle.boese@infineum.com	Non-Voting Member	Present
Adam Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 adbowden@ohtech.com	Non-Voting Member	Present
Dwight H. Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 dhbowden@ohtech.com	Non-Voting Member	Present
Matt Bowden OH Technologies, Inc. 9300 Progress Parkway	440-354-7007 440-354-7080 mjbowden@ohtech.com	Non-Voting Member	Present On Phone

ASTM Sequence III Surveillance Panel (22 Voting members) date:

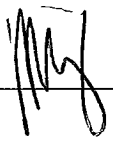
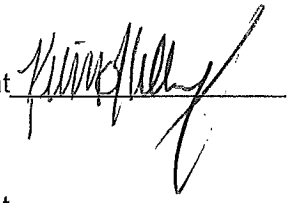
Name/Address	Phone/Fax/Email		Signature
P.O. Box 5039 Mentor, OH 44061-5039 USA			
Jerome A. Brys Lubrizol Corp. 29400 Lakeland Blvd. Wickliffe, Ohio 44092 USA	440 347-2631 jerome.brys@lubrizol.com	Non-Voting Member	Present 
Bill Buscher III Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-6802 210-684-7523 william.buscher@swri.org	Non-Voting Member	Present
Bob Campbell Afton Chemical Corporation 500 Spring Street Richmond, VA 23219 USA	804-788-5340 804-788-6358 bob.campbell@aftonchemical.com	Non-Voting Member	Present 
Chris Castanien	Chris.Castanien@gmail.com	Non-Voting Member	Present
Martin Chadwick Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-706-1543 210-684-6074 martin.chadwick@intertek.com	Non-Voting Member	Present
Jeff Clark ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1032 412-365-1047 jac@atc-erc.org **Sequence III Secretary**	Non-Voting Member	Present
Sid Clark Southwest Research 50481 Peggy Lane Chesterfield, MI 48047 USA	586-873-1255 sidney.l.clark@swri.org	Non-Voting Member	Present ON Phone
J. Michael Conrad, II The Lubrizol Corporation	440-347-4594 440-347-4096	Non-Voting Member	Present 

3/10/15

ASTM Sequence III Surveillance Panel (22 Voting members) date:

Name/Address	Phone/Fax/Email		Signature
29400 Lakeland Boulevard Wickliffe, OH 44902-2298 USA	Michael.conrad@lubrizol.com		
Todd Dvorak Afton Chemical Corporation P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788- 6367 804-788- 6388 todd.dvorak@aftonchemical.com	Non-Voting Member	Present
Frank Farber ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1030 412-365-1047 fmf@astmtmc.cmu.edu	Non-Voting Member	Present
Gordon R. Farnsworth Infineum RR # 5 Box 211 Montrose, PA 18801 USA	570-934-2776 570-934-0141 gordon.farnsworth@infineum.com	Non-Voting Member	Present
Joe Franklin Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-523-4671 210-523-4607 joe.franklin@intertek.com	Non-Voting Member	Present
David L. Glaenzer Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5214 804-788-6358 dave.glaenzer@aftonchemical.com **Surveillance Panel Chairman**	Non-Voting Member	Present
Karin E. Haumann Southwest Research Institute Fuels & Lubricants Res. Div.	210-522-6351 210-522-6858 karin.haumann@swri.org	Non-Voting Member	Present
Walter Lerche GM M/C 482-A30-C71 100 Renaissance Center Detroit, MI 48265 USA	313-667-1918 313-667-4095 walt.lerche@gm.com	Non-Voting Member	Present

ASTM Sequence III Surveillance Panel (22 Voting members) date:

Name/Address	Phone/Fax/Email		Signature
Josephine G. Martinez Chevron Oronite Company LLC 100 Chevron Way Richmond, CA 94802 USA	510-242-5563 510-242-3173 jogm@chevrontexaco.com	Non-Voting Member	Present 
Mike McMillan	mmcmillan123@comcast.net	Non-Voting Member	Present On Phone
Bob Olree 5388 Hill 23 Drive Flint, MI 48507 USA	248-689-3078 olree@netzero.net	Non-Voting Member	Present
Kevin O'Malley Lubrizol Corp.	kevin.omalley@lubrizol.com	Non-Voting Member	Present 
Christian Porter Afton Chemical Corp. 500 Spring Street Richmond, VA 23219 USA	804-788-5837 804-788-6358 christian.porter@aftonchemical.com	Non-Voting Member	Present
Phil Rabbat BASF Corporation 500 White Plains Road Tarrytown, NY 10591-9005 USA	914-785-2217 914-785-3681 phil.rabbat@basf.com	Non-Voting Member	Present
Allison Rajakumar The Lubrizol Corporation Drop 152A 29400 Lakeland Blvd. Wickliffe, OH 44092 USA	440-347-4679 440-347-2014 Allison.Rajakumar@Lubrizol.com	Non-Voting Member	Present
Scott Rajala Idemitsu Lubricants America Corp.	srajala@ilacorp.com	Non-Voting Member	Present
Jim Rutherford Chevron Oronite Company LLC 100 Chevron Way	510-242-3410 510-242-3173 jaru@chevrontexaco.com	Non-Voting Member	Present

Name/Address	Phone/Fax/Email		
Richmond, CA 94802 USA			
Amol Savant Ashland Engine Lab 121 22nd St. Ashland, KY 41101 USA	606-320-1960 x5604 acsavant@ashland.com	Voting Member Carrying Proxy for Tim Caudill	Present
Addison Schweitzer Intertek AR		Non-Voting Member	Present
Philip R. Scinto The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2161 440-347-9031 prs@lubrizol.com	Non-Voting Member	Present
Don Smolenski GM?	248-255-7892 donald.j.smolenski@gm.com	Non-Voting Member	Present
Ben O. Weber Consultant 9902 Cominsky Park San Antonio, TX 78250 USA	210-241-5313 bweber1@satx.rr.com **Sub-Committee D02.B01 Chair**	Non-Voting Member	Present
Tom Wingfield Chevron Phillips Chemical Co. USA	wingftm@cpchem.com	Non-Voting Member	Present
ROBERT. STECKWELL@CHEVRON.COM		RTS	
CLIFF SALVESEN EXXONMOBIL	clifford.r.salvesen@exxonmobil.com		
Nathan Nies LZ	NAML@lubrizol.com	NN	
JOE GLEASON	Jog1@lubrizol.com		
TIM CUSHING	timothy.cushing@gm.com	TC	

Mike Raney michael.p.raney@gm.com MR

Scott Stap Scott.Stap@Tgidirect.com SS

Jim Linden LINDENJIM@JLINDENCONSULTING.COM

Martin J. Heimrich, SwRI mheimrich@swri.org MJ

CHRIS TAYLOR VP RACING FUELS CHRIS.TAYLOR@VPRACINGFUELS.COM CT

Dan Lanctot dlanctot@tei-net.com TEI

MARK SUTHERLAND msutherland@tei-net.com

ON Phone – DAVE PASSMORE IMTS