Committee D-2 ON PETROLEUM PRODUCTS AND LUBRICANTS

Chairman: N. DAVID SMITH, North Carolina Dept. of Agric., 2 West Edenton St., P.O. Box 27647, Raleigh, NC 27611 (919-733-3313) FAX: 919-715-0524
First Vice-Chairman: SUSAN E. LITKA, UOP Research Center, 50 East Algonquin Rd., P.O. Box 5016, Des Plaines, IL 60017-5016 (708-391-3390)
Second Vice-Chairman: KURT H. STRAUSS, 69 Brookside Rd., Portland, ME 04103 (207-773-4380) FAX: 207-775-6214
Secretary: KENNETH O. HENDERSON, Castrol North America, Automotive Div., 240 Centennial Ave., Piscataway, NJ 08854 (908-980-3630) FAX: 908-980-9519
Assistant Secretary: W. JAMES BOVER, Exxon Biomedical Sciences, Inc., Mettlers Rd., CN2350, East Millstone, NJ 08875-2350 (908-873-6318) FAX: 908-873-6009
Staff Manager: EARL R. SULLIVAN (215-299-5514)

Reply to: Michael S. Griggs
The Lubrizol Corporation
29400 Lakeland Boulevard
Wickliffe, OH 44092-2298

February 24, 2003

To: Members of the Single Cylinder Oil Test Engine (SCOTE) Surveillance Panel and guest attending the November 7, 2002 meeting.

Enclosed are the minutes of the SCOTE Surveillance panel meeting held in San Antonio, Texas. Please forward any corrections or additions to my attention.

Michael S. Griggs
Secretary, SCOTE Surveillance Panel

MEETING MINUTES

SINGLE CYLINDER DIESEL SURVEILLANCE PANEL

HELD NOVEMBER 7, 2002
SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS

ACTION ITEMS

1. TMC has agreed to propose a rater calibration process- Scott Parke/Frank Farber

2. Test labs are encouraged to provide any test data which would support a change to the proposed 1R QI calculation constants- 1R labs

3. Implement the proposed 1R QI calculation constants for ant test starting on or after January 1, 2003- 1R labs

4. Cat 1R calibration oil assignments by the TMC will be 75% and 25% for oils 820-2 (PC-9A) and 1005-1, respectively- Scott Parke

5. Labs not having a 6 month supply of 1K/1N liners should contact Jim McCord due to a delay in the new liner introduction- 1K/1N test labs

6. Issue a message regarding holding a rebuild workshop. Solicit a workshop host- Jim McCord

7. On page 27 of the 1R procedure, change “manual 18” to “manual 20”- Ben Weber

8. Missing data criteria now states that any test having a total (not necessarily consecutive) of 4 or more hours of missing data for ant controlled parameter is invalid- Test labs

9. The 1M-PC procedure needs to state the location on the engine where oil bearing pressure is to be measured- 1M-PC labs

1.0 CALL TO ORDER AND MEMBERSHIP CHANGES

1.1 Chairman Jim McCord opened the meeting at 9:00 am. The agenda is attachment 1.

1.2 There were no membership changes, however, it was noted that Roger Riviere (Caterpillar contact for engine part warranty issues) will be retiring. The attendance rooster is attachment 2.

2.0 MEETING MINUTES

2.1 The meeting minutes for the January 23, 2002 meeting were previously approved in an earlier teleconference.

2.2 Secretary's note- Meeting meetings are published on the ASTM TMC website in Adobe pdf format. Individuals desiring hardcopy minutes by mail should contact the secretary.

3.0 CAT 1R PROCEDURE REVIEW

3.1 Prior to this meeting, Ben Weber requested that labs respond to him via e-mail with corrections to the 1R draft procedure.

3.2 Ricarrdo Conti pointed out that page 27 of the 1R draft procedure should refer to CRC manual 20 rather than manual 18.

3.3 Bob Campbell questioned the need to measure air flow in the 1R test. Scott Parke reminded the panel that the air flow measurement was adopted so that AFR calculations could be made without doing exhaust gas analyses. Bob suggested doing away with air flow measurements. Mike Griggs added that flow meter calibrations by the manufacturer were about $500 and that the meters often need frequent calibration. The panel agreed to defer further discussion on this topic because Dwayne Tharp was not present at the meeting.

4.0 ANNUAL RATING WORKSHOP REQUIREMENTS

4.1 Jim McCord asked for clarification on the rating workshop requirements. Scott Parke replied that raters only need to attend one workshop per year. Jim asked if pistons could be made available for rater calibrations outside of the regular workshop. He suggested that a system is needed to calibrated raters

who cannot attend the annual workshop. This topic was added as an agenda item.

4.2 Scott Parke presented attachment 3 which is the ASTM Rater Calibration Task Force recommendations for the rater calibration process. He commented that the full week workshop allows staggering of raters from labs with several raters. The week long workshop also allows for more parts availability. Workshops serve to meet CRC and ASTM needs. Scott commented that for ASTM purposes, raters only need to rate parts and not participate in the majority of the workshop. If the rater mis-rates, then the remedy would be to have the rater participate in the calibration process.

4.3 Frank Faber commented that the CRC focus is not on specific tests. He suggested documenting specific guidelines for workshop participation. Jim McCord added that raters need to look at all parts of the piston. This would help explain rating disparities.

4.4 Bob Campbell suggested that a mechanism be put in place to accommodate raters unable to attend regularly scheduled workshops. Scott Parke briefly discussed the shipment of parts so that raters could be calibrated outside of the regular workshops. He pointed out that the parts need to be stored and shipped carefully and that target ratings need to be adjusted based on deposit loss over time.

4.5 Several important points surfaced as discussions proceeded. The SCOTE panel requirement, as currently stated, is that workshop attendance and piston rating is mandatory. Workshop results are posted on the TMC website and the numbers generated by CRC are after the rater has been calibrated. Jim McCord presented an example of CRC data (attachment 4) which shows results of a light duty workshop.

4.6 Frank Faber suggested that the panel task TMC to propose a rater calibration process. Bob Campbell asked if that had been discussed with the raters. Scott Parke replied that it had been only in broad terms. Scott pointed out that, in general, there is a big misconception on what happens at workshops. The panel agreed with Frank Farber's suggestion to have TMC propose a rater qualification process.

5.0 CAT 1R QI LIMIT EVALUATION

5.1 Scott Parke began his presentation by reminding the panel that he e-mailed a point paper (Why QI.pdf) to each member as pre-reading material for this meeting. He then proceeded with his QI presentation (attachment 5). The presentation concluded with the recommended action in cases where the end of test QI is less than 0 (page 6, attachment 5) and a multi-part motion for QI's (page 7, attachment 5).

5.2 Tom Franklin commented that the system "presumes guilt", that is, a presumption of invalidity automatically. Scott Parke explained that the default position for a test producing a negative QI is that it is invalid unless a proactive review is made by the engineer.

5.3 Rick Oliver commented that RSI has difficulty with reports showing up with negative QI's but with the declaration showing validity. Scott Parke explained that when a negative QI is produced and the test is not considered operationally invalid, then the lab must note the circumstances and justification on the comments form in the test report and attach all supporting documentation. Rick Oliver commented that RSI could live with the wording in the test procedure and Scott's motion.

5.4 Several panel members expressed concern with the wording in the motion that requires consultation with the customer in cases where test produce an end-of-test QI<0. Scott Parke agreed to delete the wording referring to consultation with the customer and requested a vote on the amended motion (page 7, attachment 5). The motion failed by a vote of 3 yes / 5 no.

5.5 Scott Parke then narrowed his motion further. He asked the panel to vote on the following: **Any test having a total of 4 or more hours of missing data for any controlled parameter is invalid.** The motion was unanimously accepted.

5.6 Scott Parke opened discussions on the QI constants by presenting attachment 6. He commented that the values in the table were the same as previously used and that the delta spec was the difference between beta and alpha. Scott reminded the panel that delta is not a min/max spec and that it encompasses much more. There followed quite a bit of discussion regarding what is to be considered an acceptable test. Scott Parke commented that 0 QI is associated with the bottom test of those tests deemed acceptable. Frank Farber added that an e-mail ballot could change the delta value if new data would support the change. Scott Parke commented that the numbers on the overhead are a starting point based on current data and are subject to change based on new data. Both Frank and Scott emphasized that the TMC and Surveillance panel were more than open to look at new data and that if subsequent data shows that process capability is actually less than current data shows, it can be promptly addressed.

5.7 Chris Mazuca expressed a concern that some candidate tests had QI's go from positive to negative when the 1P delta values were replaced with those from the 1R test. He mentioned that special causes such as lower oil viscosity grades may cause a test to have unacceptable QI's under the 1R QI constants. Several panel members did not consider the tests in question to have viscosity related QI problems. Frank Farber addressed Chris Mazuca's concern by

offering an interim solution whereby those parameters that had negative QI's would retain the 1P constants and the remaining parameters would adopt the 1R constants. This suggestion was not pursued.

5.8 Scott Parke presented the 1R candidate QI data (attachment 7) which labs provided for their candidate runs and reiterative his receptiveness to recalculating deltas if labs would send in data. Chris Mazuca commented that he thought acceptance of the 1R constants was premature. Scott asked Chris how long do we wait. Bob Campbell gave the background on why we track candidate QI. Following some other brief discussions, Scott Parke took the opportunity to move that the panel **accept the numbers as shown (attachment 7), effective for tests starting on or after January 1, 2003.** Bob Campbell seconded the motion which was accepted by a vote of 7 yes / 1 no.

6.0 CAT 1R SEVERITY AND PRECISION REVIEW

6.1 Scott Parke presented attachment 8 which is the 1R industry operationally valid data summary charts. Jim McCord asked Scott if there a weighted demerits trend. Scott replied that there was not and added that there were 8 tests since last October and that he was not seeing any differences.

6.2 Scott Parke asked the panel about establishing preferred reference oil. Jim McCord commented that the advantage of using oil PC-9A (TMC 820) is that it is a newer technology. Bob Campbell suggested that reference oil usage be 75% oil 820 and 25% oil 1005. Since the panel supported Bob's suggestion, Scott Parke agreed to implement this and said that a panel vote was not necessary.

7.0 CAT 1R RESEARCH REPORT STATUS

This agenda item was deferred to a future meeting since Dwayne Tharp was not present.

8.0 CAT 1K INDUSTRY SEVERITY VERSUS REFERENCE OIL DATA

8.1 Rick Oliver, Registration Systems Inc, began his presentation with background information on the RSI ACC website. He commented that the site URL was www.registration-systems.com and could be accessed with the user name "acc and password "rsi999".

8.2 Rick Oliver explained that interpretation of the EWMA values plotted in the Proactive Monitoring Control Charts primarily involves looking at whether the EWMA line has exceeded either the three sigma or four sigma control limits in a positive or negative direction. When a result falls outside of the four sigma control limit, there is only a 0.003% chance that a shift in test severity has <u>not</u> occurred. Rick also presented material available in the Test

Activity charts and the Status & Precision Reports. Jim McCord commented that he found the RSI information useful.

8.3 Jim McCord pointed out that 1K reference data for WTD shows a mild trend while candidate data is 4 sigma severe which could possibly be due to candidate oil change over time. Frank Farber also question whether this could be a result of formulation optimization. Bob Campbell suggested that maybe newer formulations no longer work as well in the 1K tests.

8.4 Scott Parke presented attachment 9 which shows the 1K LTMS charts. He noted that the targets were set in 1994. He also showed the panel attachment 10 which shows the LTMS targets calculated from all 598 tests as well as the recomputed 1K targets. The consensus of the panel was that it is not necessary to revise targets, particularly since new liners will be introduced.

9.0 ACC DECLARATIONS

9.1 Rick Oliver commented that the ACC Laboratory Conformance statement previously required that declaration #2 be check "no" for all tests with any QI's less than 0, but now this block may be checked "yes" if engineering judgment shows that the test should be declared valid. Declaration #3 is test specific. It is checked "no" in the case of SCOTE testing.

9.2 Riccardo Conti asked for a recommendation on how to declare tests with very high oil consumption that run for the full test duration. Following a lot of discussion, Bob Campbell concluded that the test would be valid. This seemed to satisfy the panel.

9.3 Rick Oliver advised the panel that intermediate test data is not required to be sent to RSI.

10.0 OTHER SCOTE BUSINESS

10.1 Bob Campbell reiterated his desire to revisit the need for the air flow meter in the Cat 1P/1R test. The panel agreed to pursue this with Caterpillar.

10.2 Bob Campbell commented that he would like to be able to calibrate using reduced "k" criteria by reading across between the 1P and 1R test. His rationale was that the tests were virtually identical in hardware and operation. Frank Farber responded saying that it is not an issue about testing competency but more of a data flow issue to develop the proper severity adjustments.

10.3 Bob Campbell pointed out that the 1M-PC procedure has a 226 kPa spec on measuring bearing pressure but the location on the engine for measuring the pressure is missing. A standardized location will have to be agreed upon by the panel.

10.4 Bob Campbell asked the panel if there is any interest in a build workshop. Jim McCord commented that he would like to see one. Bob suggested that the workshop should include the engine startup as this is a critical aspect of the test. Jim McCord agreed to send out a message soliciting host for the workshop. He suggested that a lab other than SWRI or PE might be able to host the workshop. Scott Parke explained that past workshops with engineer participation were very productive. He encouraged engineer participation for the next workshop.

11.0 NEXT MEETING

The next meeting is expected to be via teleconference to discuss the introduction of the new Cat 1K/1N liners.

Att 1 1/1

Caterpillar SCOTE Surveillance Panel Meeting

Date/Time: November 7, 2002 (09:00 – 17:00)

Location: Southwest Research Institute
6220 Culebra Road
San Antonio, Texas 78238

AGENDA

Thursday, November (09:00 – 17:00)

1. Membership

2. Cat 1R Procedure: Review

3. Cat 1R QI Limit Evaluation

4. Cat 1R Calibration Oil 1005-1 & PC9A
   Severity and Precision Review

5. Cat 1R Research Report Status

6. Cat 1K Severity
   Evaluation of Industry Severity vs. Reference Oil Data

7. ACC Declarations

8. Other SCOTE Business

Att 2 1/3

SCOTE SURVEILLANCE PANEL

Attendance Rooster

Name:	Griggs, Mike
Company:	The Lubrizol Corporation
Address:	29400 Lakeland Blvd. Wickliffe, OH 44092-2298
Phone:	440-347-2905
Fax:	440-347-4096
e-mail:	msg@lubrizol.com

Name:	Franklin, Tom
Company:	PerkinElmer
Address:	5404 Bandera Road San Antonio, TX 78238
Phone:	210-647-9446
Fax:	210-523-4607
e-mail:	tom.franklin@perkinelmer.com

Name:	Oliver, Rick
Company:	Registration Systems, Inc.
Address:	4139 Gardendale, Suite 205 San Antonio, TX 78229
Phone:	210-341-2680
Fax:	210-341-4038
e-mail:	crickoliver@attbi.com

Name:	Conti, Riccardo
Company:	ExxonMobil R&E Products Research & Technology
Address:	600 Billingsport Road Paulsboro, NJ 08066-0480
Phone:	856-224-2681
Fax:	856-224-3904
e-mail:	riccardo.conti@exxonmobil.com

Name:	Gutzwiller, Jim
Company:	Infineum
Address:	4335 Piedras Dr., W. Suite 101 San Antonio, TX 78228
Phone:	210-732-8123 ext. 13
Fax:	210-341-8480
e-mail:	james.gutzwiller@infinium.com

Name:	Mazuca, Chris
Company:	Perkin Elmer
Address:	5404 Bandera Road San Antonio, TX 78238
Phone:	210-602-2120
Fax:	
e-mail:	chris.mazuca@perkinelmer.com

Att 2 2/3

SCOTE SURVEILLANCE PANEL

Attendance Rooster

Name:	Buck, Ron
Company:	Test Engineering, Inc.
Address:	12718 Cimarron Path
	San Antonio, TX 78249-3417
Phone:	210-690-1958
Fax:	210-690-1959
e-mail:	rbuck@tei-net.com

Name:	Parke, Scott
Company:	ASTM/TMC
Address:	6555 Penn Avenue
	Pittsburgh, PA 15206-4489
Phone:	412-365-1036
Fax:	412-365-1047
e-mail:	sdp@astmtmc.cmu.edu

Name:	Farber, Frank
Company:	ASTM/TMC
Address:	6555 Penn Avenue
	Pittsburgh, PA 15206-4489
Phone:	412-365-1030
Fax:	412-365-1047
e-mail:	fmf@astmtmc.cmu.edu

Name:	Campbell, Bob
Company:	Ethyl Corporation
Address:	500 Spring Street
	P.O. Box 2158
	Richmond, VA 23219
Phone:	804-788-5340
Fax:	804-788-6358
e-mail:	bob_campbell@ethyl.com

Name:	McCord, James
Company:	SWRI
Address:	6220 Culebra Rd.
	San Antonio, TX 78228-0510
Phone:	210-522-3439
Fax:	
e-mail:	jmccord@swri.edu

Name:	Cooper, Mark
Company:	Chevron Oronite Co.
Address:	4502 Centerview Dr., Suite 210
	San Antonio, TX 78228
Phone:	210-731-5606
Fax:	210-731-5699
e-mail:	mawc@chevron.com

Att 2 3/3

Mike GRIGGS. LUBRIZOL
Tom Franklin Perkin Elmer
RICK OLIVER - RSI email crickoliver@attbi.com
RICCARDO CONTI - EXXONMOBIL *
JIM GUTZWILLER - INFINEUM - FOR PAT FETTERMAN *
CHRIS MAZUCA - PERKIN ELMER *
RON BUCK - Test Engineering - rbuck@TEI-NET.com
SCOTT PARKE TMC
FRANK FARBER TMC
BOB Campbell Ethyl
JIM McCord SwRI
Mark Cooper

Att 3

ASTM Rater Calibration Task Force
Recommendations - Calibration Process

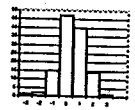
- Category I raters, to achieve calibration, must attend and contribute to a minimum of one (1) ASTM or CRC industry rating workshop or make-up session each year
  - Ratings must be in the deposit or distress area where calibration is sought.
  - Ratings must be used in the generated statistical data at that workshop

Light Duty Rating Workshop

PART ID = calibration - composite (screened)

RATED VALUES

	Groove 1	Groove 2	Groove 3	Groove 4	Land 1	Land 2	Land 3	Land 4	Under-crown	Oil Gallery	TGF	2GF	TLHC	TLFC	UWPD	WPD
poop	0.75	0.74	7.09			1.33	3.24	1.00	1.01			8.89			23.05	23.05
TSCHIRHART	0.75	0.60	7.56			1.00	3.40	1.00	0.75			9.51			23.57	23.57
RAMIREZ	0.75	0.75	7.58			1.35	2.72	1.00	1.09			9.63			23.87	23.87
CASTILLO	0.74	0.75	7.39			0.95	3.04	1.00	0.75			8.93			22.55	22.55
LOPEZ	0.75	0.75	7.70			1.21	2.52	1.00	0.75			8.91			22.59	22.59
GARRETT	0.74	0.59	7.97			1.28	2.97	1.00	0.93			8.88			23.36	23.36
RODRIGUEZ	0.75	0.71	7.22			1.30	2.90	1.00	0.73			9.37			22.98	22.98
HILLS	0.75	0.75	7.25			1.05	2.72	1.00	0.78			8.86			22.16	22.16
CUNNIFF	0.75	0.75	7.75			1.08	2.88	1.00	0.93			9.49			23.63	23.63
VIERA	0.75	0.75	8.10			1.63	2.88	1.00	1.16			9.30			24.57	24.57
GARCIA, P	0.75	0.68	7.25			1.28	2.97	1.00	0.86			9.10			22.89	22.89
GARCIA, O	0.72	0.70	7.94			1.34	3.38	1.00	1.16			8.91			24.15	24.15
ADAMS	0.75	0.70	7.22			1.16	2.88	1.00	1.16			9.32			23.19	23.19
WALKER	0.75	0.75	6.90			1.61	3.20	1.00	0.75			9.03			22.98	22.98
CAPRONI	0.75	0.75	7.13			1.63	3.94	1.00	1.16			9.40			24.76	24.76
MAXIMUM	0.75	0.75	8.10			1.63	3.94	1.00	1.16			9.63			24.76	24.76
MINIMUM	0.72	0.59	6.90			0.95	2.52	1.00	0.73			8.86			22.16	22.16
MEAN	0.75	0.71	7.47			1.28	3.04	1.00	0.93			9.17			23.35	23.35
STD	0.01	0.05	0.36			0.22	0.35	0.00	0.18			0.27			0.75	0.75
STD/MEAN, %	1.15%	7.57%	4.85%			17.01%	11.46%	0.00%	19.05%			2.97%			3.19%	3.19%



yi within 1	72.5%
yi within 2	96.7%
yi within 3	99.2%
yi >3	0.8%

PART ID = calibration - composite (screened)

YI VALUES

	Groove 1	Groove 2	Groove 3	Groove 4	Land 1	Land 2	Land 3	Land 4	Under-crown	Oil Gallery	TGF	2GF	TLHC	TLFC	UWPD	WPD	MEAN	STD
poop	0.43	0.47	-1.05			0.23	0.57	0.00	0.44			-1.02			-0.40	-0.40	-0.07	0.61
TSCHIRHART	0.43	-2.12	0.25			-1.29	1.02	0.00	-1.02			1.26			0.29	0.29	-0.09	1.06
RAMIREZ	0.43	0.65	0.30			0.32	-0.93	0.00	0.89			1.69			0.69	0.69	0.47	0.67
CASTILLO	-1.33	0.65	-0.22			-1.52	-0.01	0.00	-1.02			-0.87			-1.08	-1.08	-0.65	0.71
LOPEZ	0.43	0.65	0.64			-0.32	-1.50	0.00	-1.02			-0.96			-1.03	-1.03	-0.41	0.80
GARRETT	-0.74	-2.30	1.38			0.00	-0.21	0.00	-0.01			-1.07			0.01	0.01	-0.29	0.95
RODRIGUEZ	0.43	-0.09	-0.69			0.09	-0.41	0.00	-1.13			0.73			-0.50	-0.50	-0.21	0.55
HILLS	0.43	0.65	-0.61			-1.06	-0.93	0.00	-0.85			-1.14			-1.60	-1.60	-0.67	0.79
CUNNIFF	0.43	0.65	0.77			-0.92	-0.47	0.00	-0.01			1.17			0.37	0.37	0.24	0.61
VIERA	0.43	0.65	1.74			1.61	-0.47	0.00	1.29			0.49			1.64	1.64	0.90	0.79
GARCIA, P	0.43	-0.64	-0.61			0.00	-0.21	0.00	-0.40			-0.26			-0.63	-0.63	-0.29	0.36
GARCIA, O	-3.08	-0.27	1.30			0.28	0.97	0.00	1.29			-0.94			1.07	1.07	0.17	1.37
ADAMS	0.43	-0.27	-0.69			-0.55	-0.47	0.00	1.29			0.56			-0.22	-0.22	-0.01	0.61
WALKER	0.43	0.65	-1.59			1.51	0.45	0.00	-1.02			-0.50			-0.49	-0.49	-0.11	0.90
CAPRONI	0.43	0.65	-0.94			1.61	2.57	0.00	1.29			0.86			1.89	1.89	1.03	1.04
Yi MAXIMUM	-3.08	-2.30	1.74			1.61	2.57	0.00	1.29			1.69			1.89	1.89	1.03	1.37
Yi MINIMUM	0.43	-0.09	-0.22			0.00	-0.01	0.00	-0.01			-0.26			0.01	0.01	-0.01	0.36
Yi MEAN	0.00	0.00	0.00			0.00	0.00	0.00	0.00			0.00			0.00	0.00		
Yi STD	1.00	1.00	1.00			1.00	1.00	0.00	1.00			1.00			1.00	1.00		
Ratings MEAN	0.75	0.71	7.47			1.28	3.04	1.00	0.93			9.17			23.35	23.35		
Ratings STD	0.01	0.05	0.36			0.22	0.35	0.00	0.18			0.27			0.75	0.75		

Maintaining Test Precision

Assumptions:

1. Maintaining test precision at current levels is a good thing
2. Operational control is one of the variables in test repeatability
3. If operational control does not change, test precision will not change (assuming no changes to the other variables)
4. Operational control and precision are positively correlated
5. If operational control does not degrade, test precision will not degrade

Att 5 ½

Determining When Operational Control Degrades

What is the current "state of affairs"

Tell me when something worse than that happens

Att 5 2/7

What tools are available to help detect a change?

Data plot – best tool.
    also unwieldy, subjective, requires other plots as basis for comparison

Average? Standard Deviation? %Offset? %Outliers?
    well known problems with each

Quality Index – second best tool
    has proven to be a suitable stand-in for data plots

Att 5 3/7

How are Calculation Constants for QI Chosen?

1. Gather collection of representative data (matrix)
2. Determine which are acceptable and which are not
3. Determine the worst of the acceptable group
4. Ensure that anything worse than that gets attention

Ensure that anything worse than that gets attention

Derive QI constants such that "anything worse than that" will have end-of-test QI ≤ 0

Att 5 5/7

Recommended action in cases where end-of-test QI ≤ 0

Test is operationally invalid...

...unless engineering review and consultation with the customer (or TMC in the case of references) determines that the calculated QI value does not accurately assess the true operating conditions of the test as displayed in the plotted data.

Att 5 6/7

Motion:

Set the QI calculation constants as shown on the following slide

Tests producing end-of-test QI ≤ 0 are operationally invalid unless engineering review and consultation with the customer (or TMC in the case of references) determines that the calculated QI value does not accurately assess the true operating conditions of the test as displayed in the plotted data.

In cases where tests producing end-of-test QI values ≤ 0 are not considered operationally invalid, note the circumstances and justification on the comments form in the test report and attach all supporting documentation. In the case of reference tests, this documentation will be in the form of a QI deviation letter.

Any test having a total of 4 or more hours of missing data for any controlled parameter is invalid.

Att 5 2/7

Parameter	Target	Round to	Spec Min	Spec Max	α	β	Δ	Floor	Ceiling
Coolant Flow	75	0.1	70	80	73.32	76.68	3.36	-44.33	194.33
Coolant Out Temp	105	0.1	102	108	104.76	105.24	0.48	88.06	121.94
Exhaust Pressure	252	0.1	251	253	251.23	252.77	1.54	197.44	306.56
Fuel Flow	240	0.1	239	241	239.05	240.95	1.91	172.36	307.64
Fuel Temp	42	0.1	39	45	40.98	43.02	2.04	-30.56	114.56
Fuel Pressure	275	1	255	295	272.17	277.83	5.66	74.24	475.76
Humidity	17.8	0.1	16.1	19.5	17.12	18.48	1.37	-30.70	66.30
Intake Air Pressure	292	0.1	291	293	291.43	292.57	1.13	251.85	332.15
Intake Air Temp	60	0.1	57	63	59.45	60.55	1.09	21.28	98.72
Oil Man Pressure	415	1	395	435	407.95	422.05	14.10	-85.64	915.64
Oil Man Temp	120	0.1	117	123	119.53	120.47	0.95	86.31	153.69
Speed	1800	1	1797	1803	1798.71	1801.29	2.58	1708.40	1891.60

1R Candidate QI Data

Lab	Test Identifier	EOT Date	Coolant Flow	Coolant Out Temp	Exhaust Pressure	Fuel Flow	Fuel Temp	Fuel Pressure	Humidity	Intake Air Pressure	Intake Air Temp	Oil Man Pressure	Oil Man Temp	Speed
A	2	20020105	0.783	0.915	-0.011	0.595	0.941	0.830	-0.174	0.301	0.894	0.922	-0.373	0.638
D	48	20020225	0.684	0.759	0.967	0.901	0.980	0.915	0.755	0.744	0.949	0.629	0.918	0.981
B	3500	20020227	0.972	0.755	0.917	0.525	0.920	0.881	0.907	0.966	0.986	0.730	0.325	0.834
A	1	20020306	0.795	0.884	0.280	0.728	0.858	0.094	-1.190	0.080	0.766	0.989	0.867	0.470
G	E	20020316	0.904	-0.394	0.786	0.883	0.977	0.765	0.490	0.421	0.526	0.826	0.772	0.788
G	P	20020316	0.961	0.827	0.658	0.468	0.978	0.809	0.492	0.368	0.870	0.896	0.729	0.712
G	R	20020323	0.832	0.013	0.672	0.908	0.894	0.751	0.560	0.261	0.331	0.953	0.979	0.850
B	3600	20020328	0.963	0.797	0.955	0.911	0.896	0.912	0.842	0.972	0.987	0.815	0.582	0.834
A	3	20020401	0.564	0.970	0.772	0.921	-0.070	0.554	-1.204	0.710	-0.073	0.947	-0.057	0.598
G	K	20020404	0.454	0.625	0.764	0.868	0.937	0.498	0.646	0.705	0.765	0.909	0.976	0.708
B	3700	20020427	0.951	0.750	0.956	0.936	0.929	0.831	0.414	0.978	0.985	0.812	0.463	0.824
B	3800	20020529	0.948	0.918	0.967	0.979	0.948	0.944	0.920	0.976	0.987	0.777	0.511	0.886
F	807-5		0.616	-14.93	0.956	0.862	0.920	0.262	0.919	0.978	0.977	0.914	0.166	0.502
F	807-7	20020618	0.546	0.342	0.900	0.932	0.941	0.191	0.744	0.581	0.982	-3.621	0.141	0.902
F	807-8	20020830	0.372	0.690	0.931	0.362	0.957	0.447	0.801	0.972	0.977	0.934	0.983	0.935
B	3900	20020701	0.944	0.841	0.955	0.987	0.977	0.937	0.827	0.974	0.986	0.796	0.408	0.901
B	4000	20020804	0.965	0.906	0.972	0.982	0.980	0.913	0.832	0.979	0.988	0.805	0.467	0.902
B	4100	20020830	0.951	0.812	0.973	0.980	0.979	0.930	0.770	0.979	0.987	0.823	0.437	0.893
B	4200	20020925	0.955	0.911	0.960	0.988	0.959	0.967	0.878	0.951	0.987	0.672	0.416	0.700
B	4300	20021021	0.961	0.906	0.967	0.995	0.984	0.905	0.908	0.933	0.985	0.835	0.646	0.888
F	807-9	20021029	0.802	0.677	0.941	0.509	0.954	0.716	0.976	0.970	0.967	0.912	0.967	0.964

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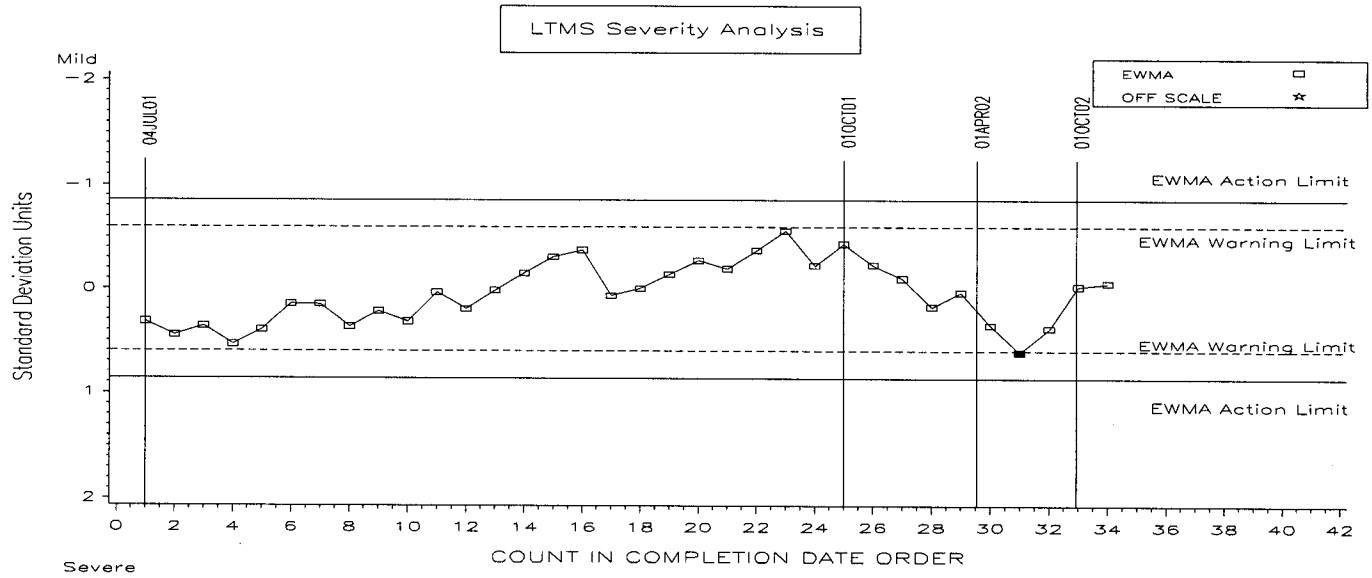
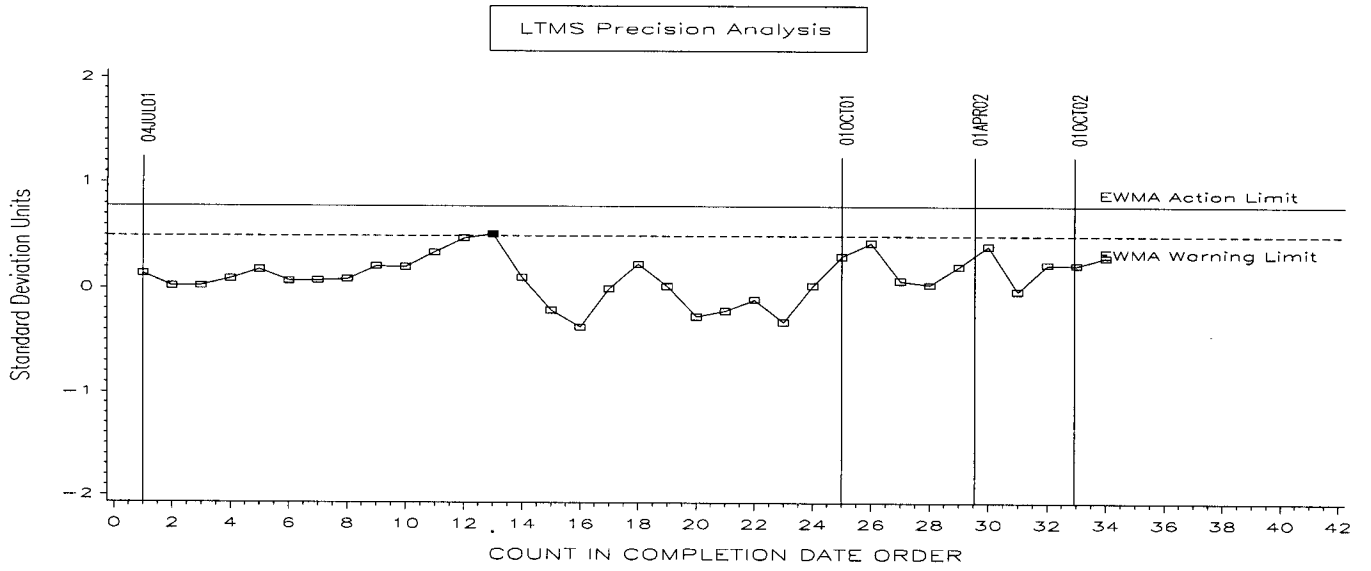
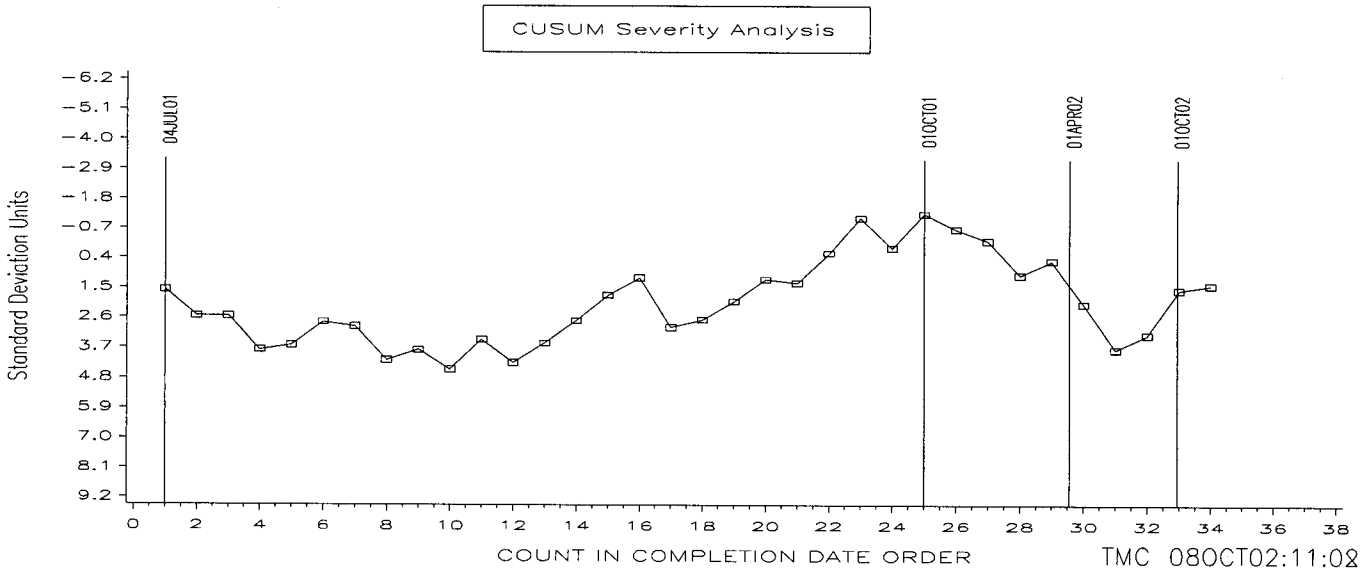
Att 8 1/5

1R INDUSTRY OPERATIONALLY VALID DATA

FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)







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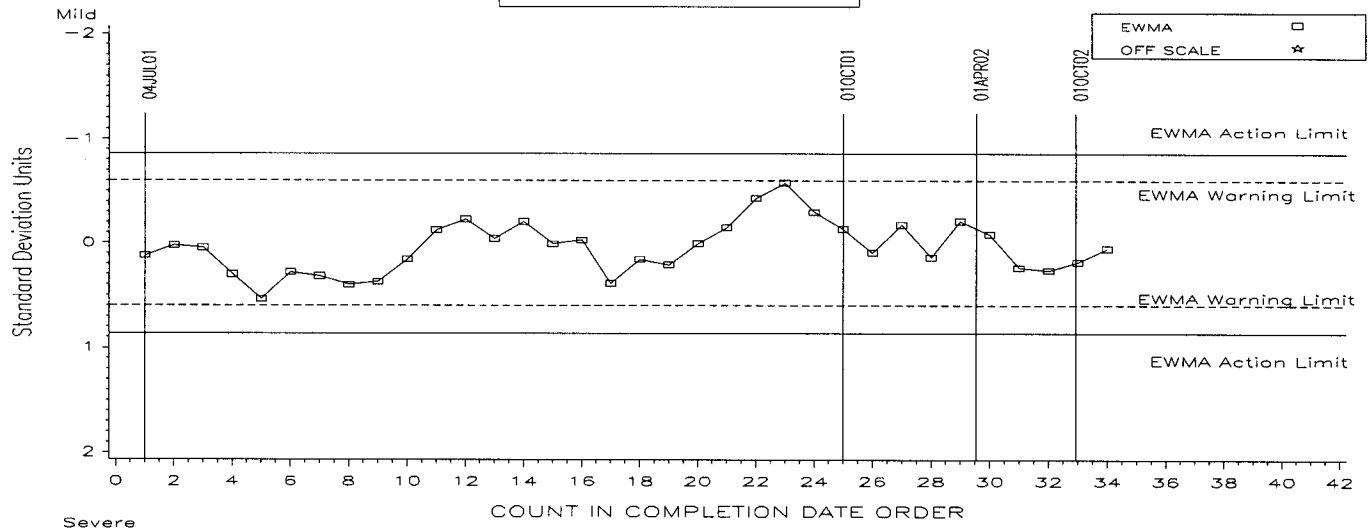
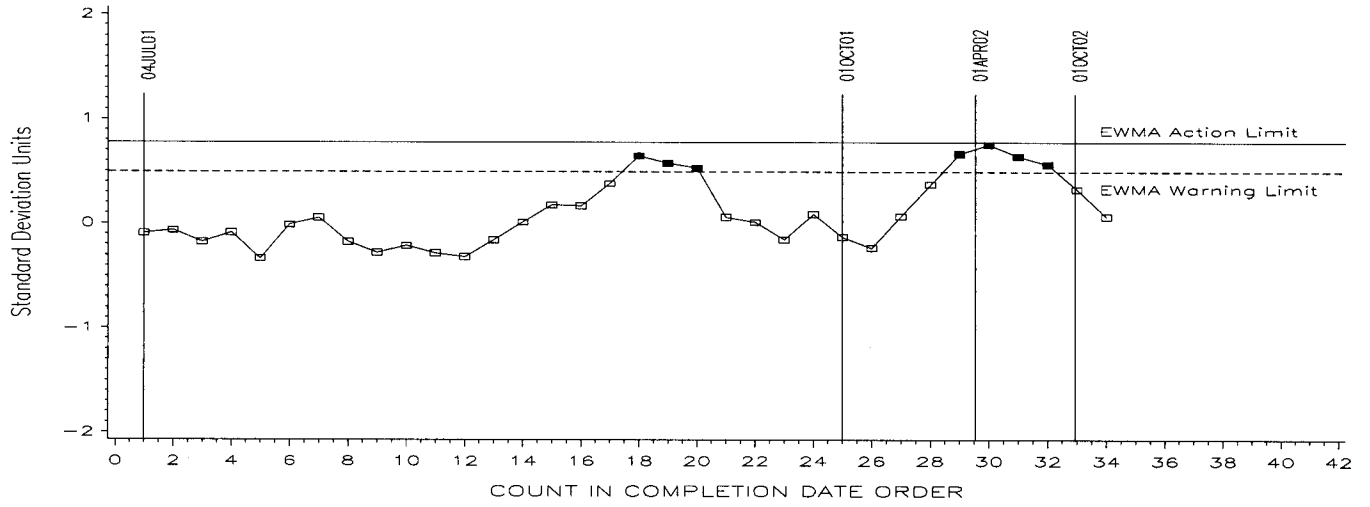
1R INDUSTRY OPERATIONALLY VALID DATA

FINAL TOP LAND CARBON (DEMERITS)

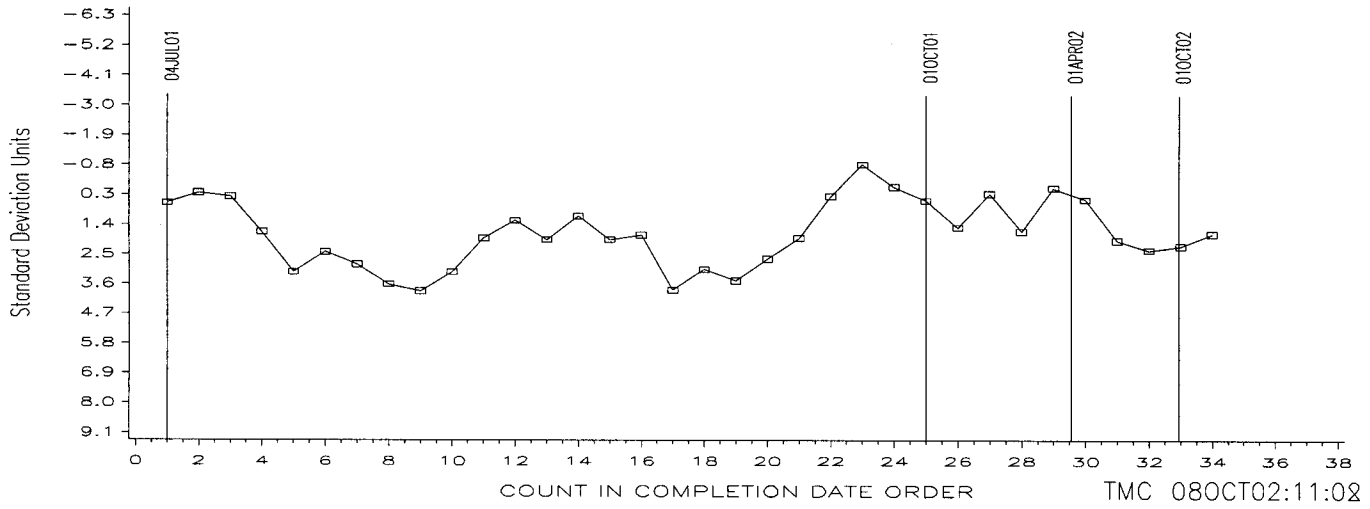
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



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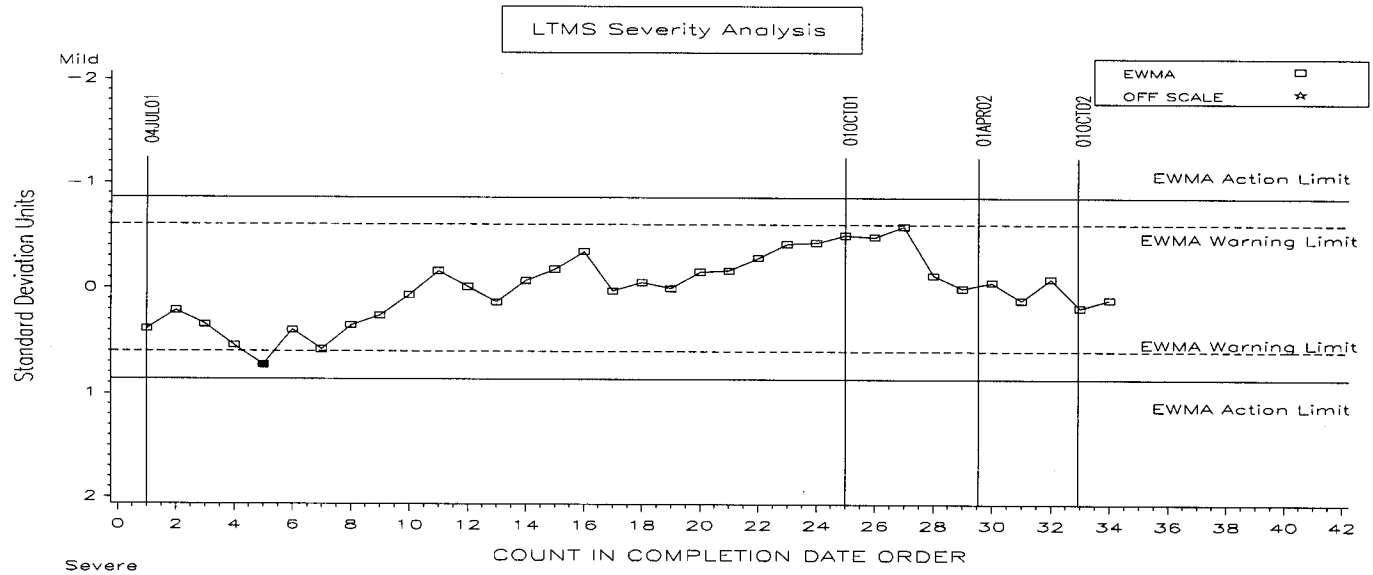
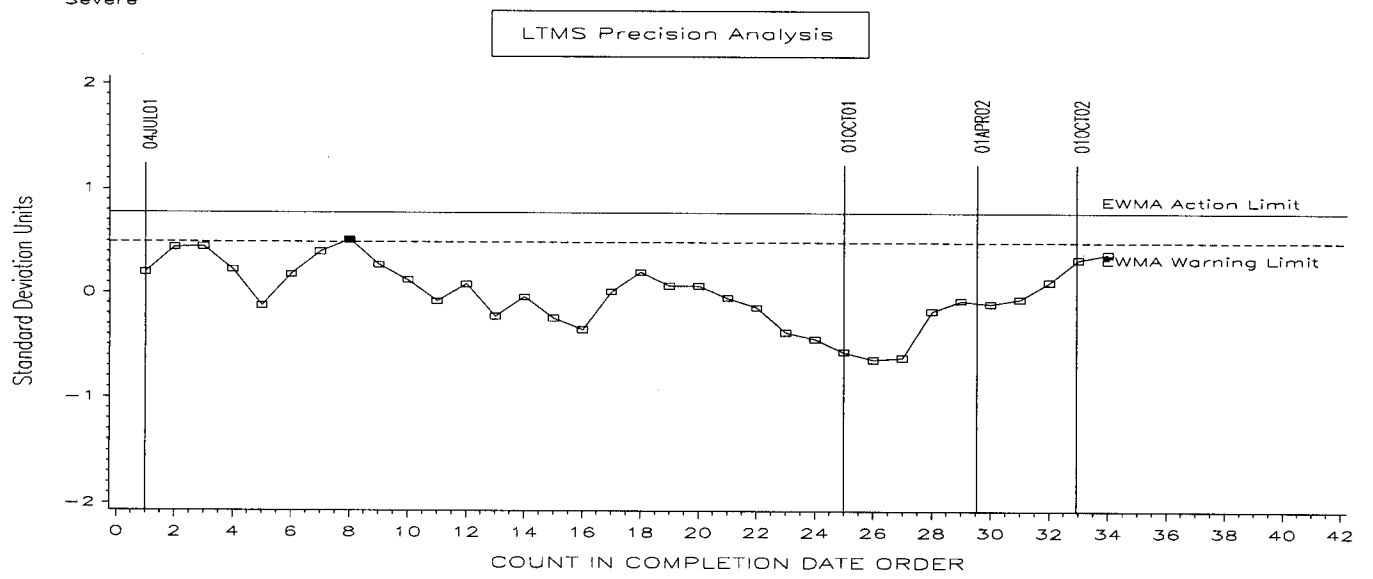
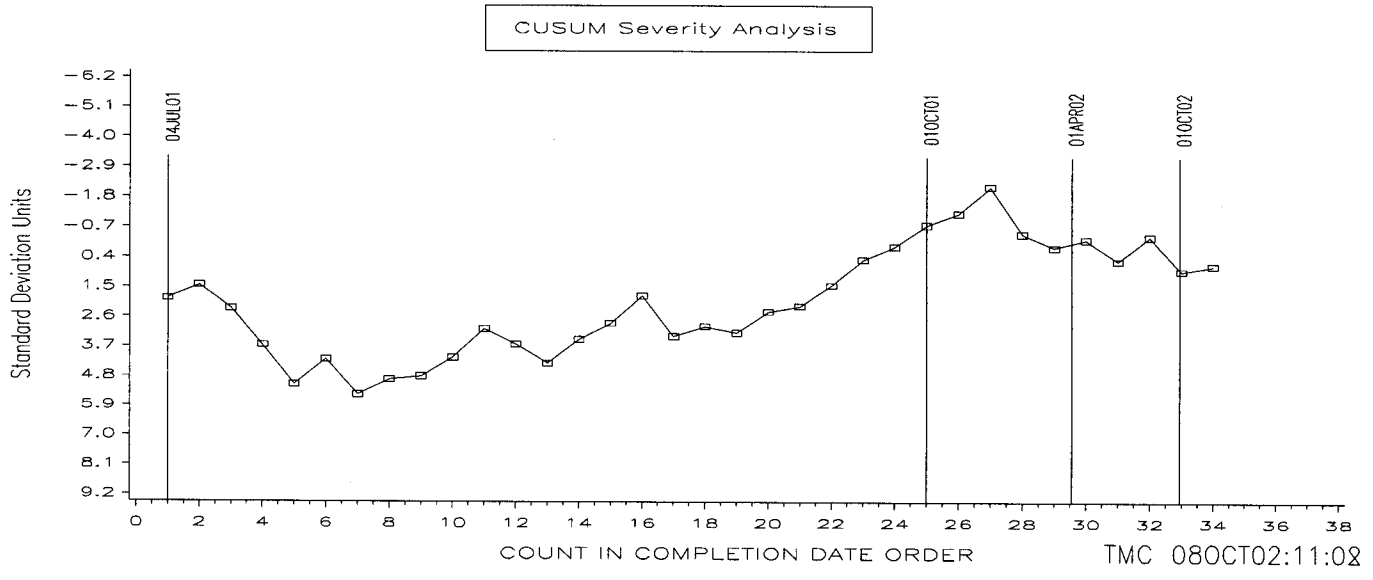
Att 8 3/5

1R INDUSTRY OPERATIONALLY VALID DATA

FINAL TOP GROOVE CARBON (DEMERITS)







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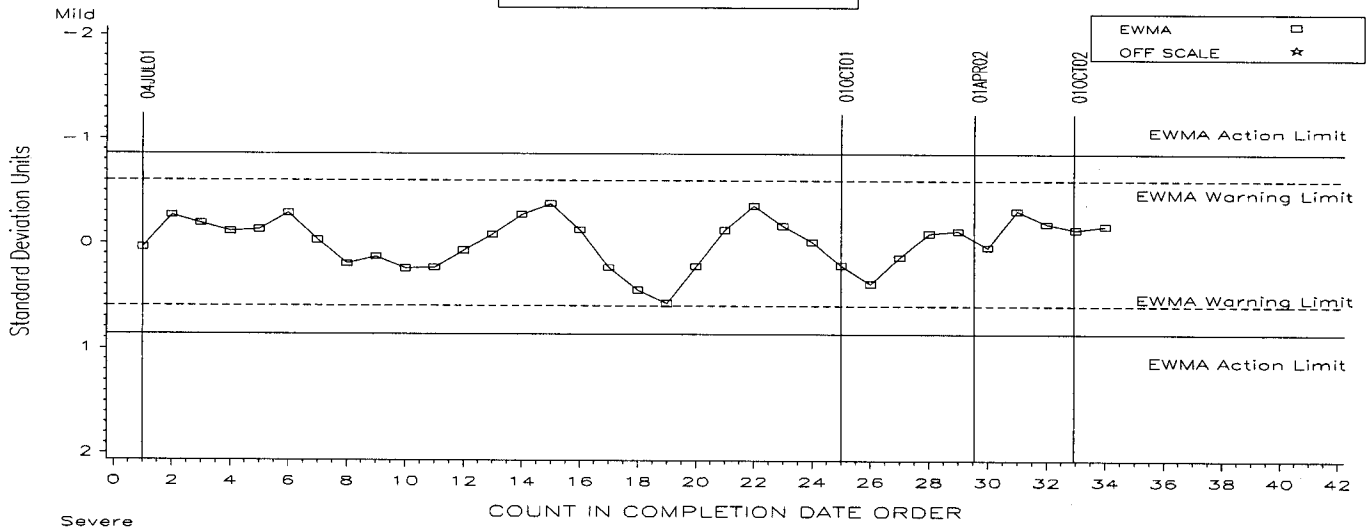
Att 8 4/5

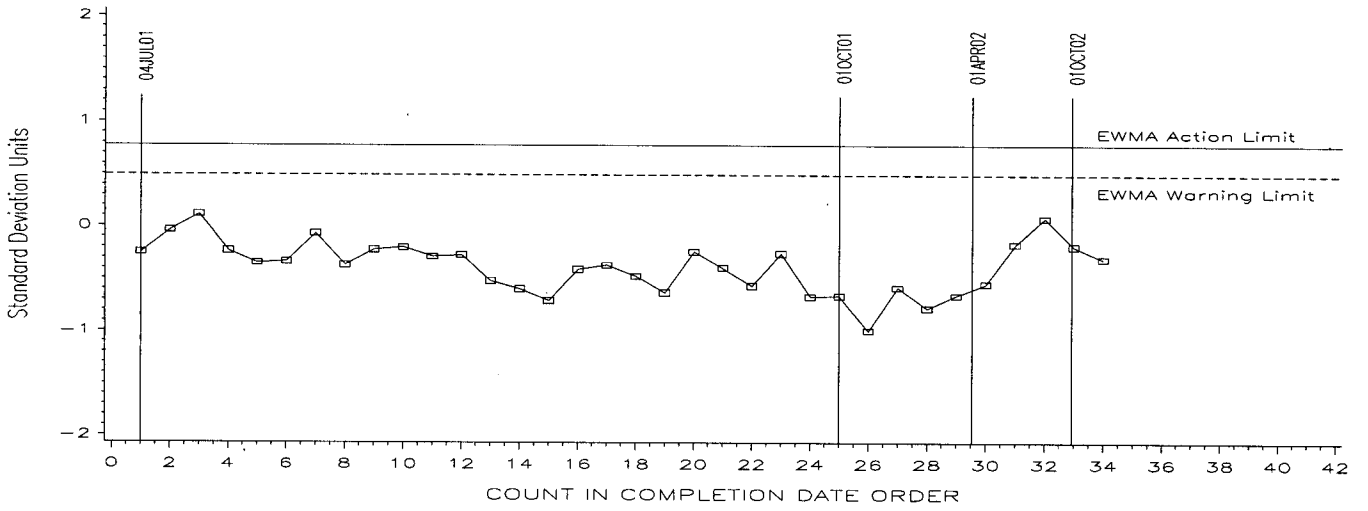
1R INDUSTRY OPERATIONALLY VALID DATA

FINAL EOTOC (g/h)

LTMS Severity Analysis



LTMS Precision Analysis



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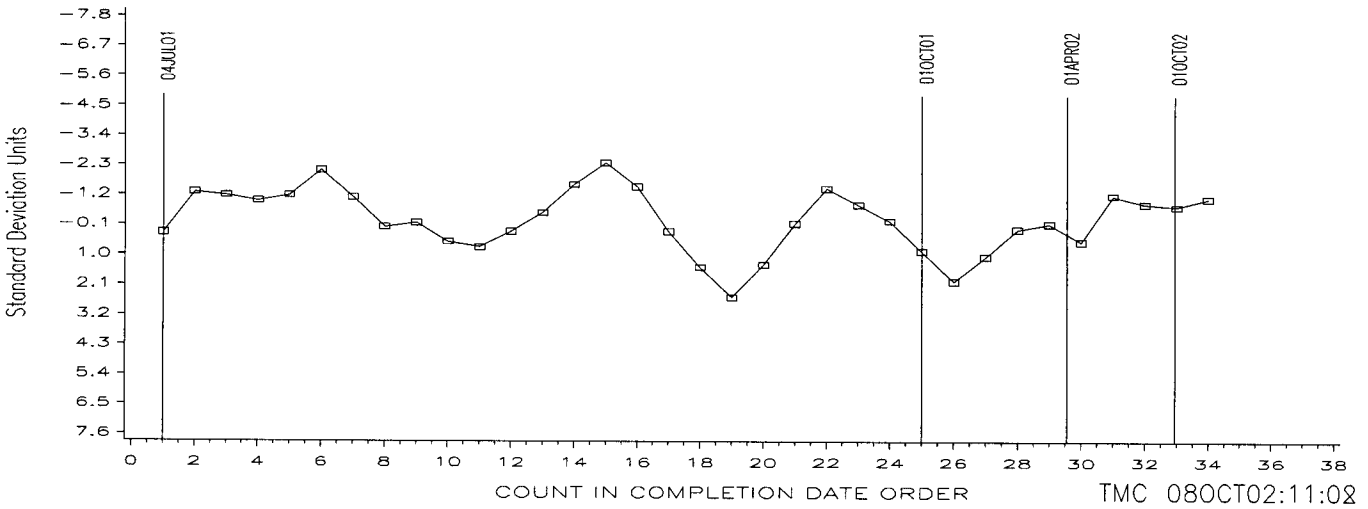

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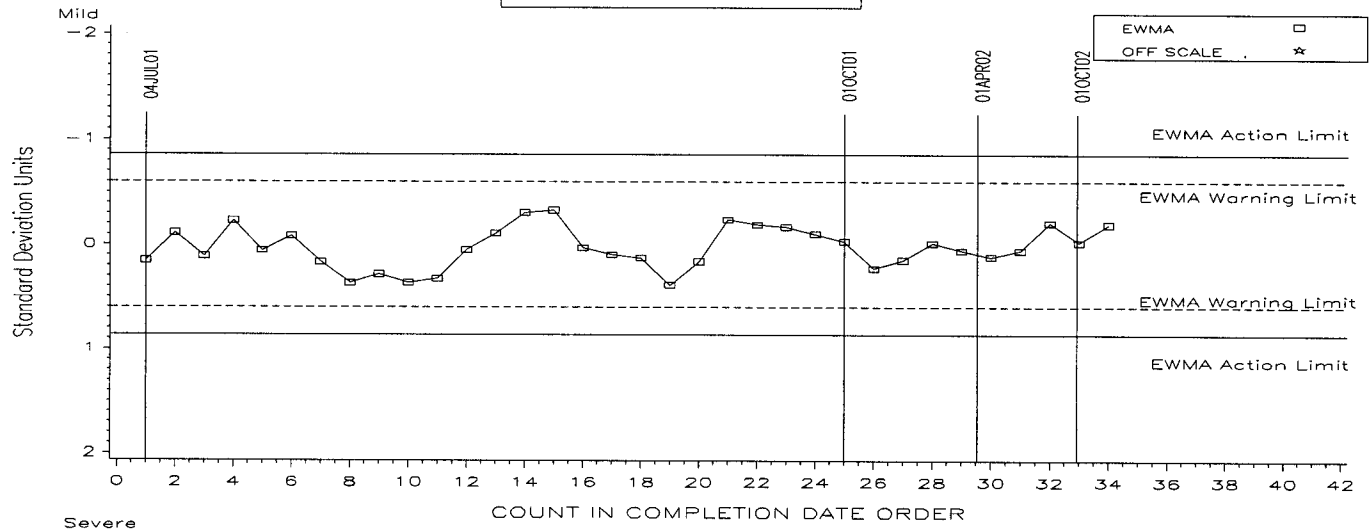
Att 8 5/5

1R INDUSTRY OPERATIONALLY VALID DATA

FINAL BOTOC

LTMS Severity Analysis



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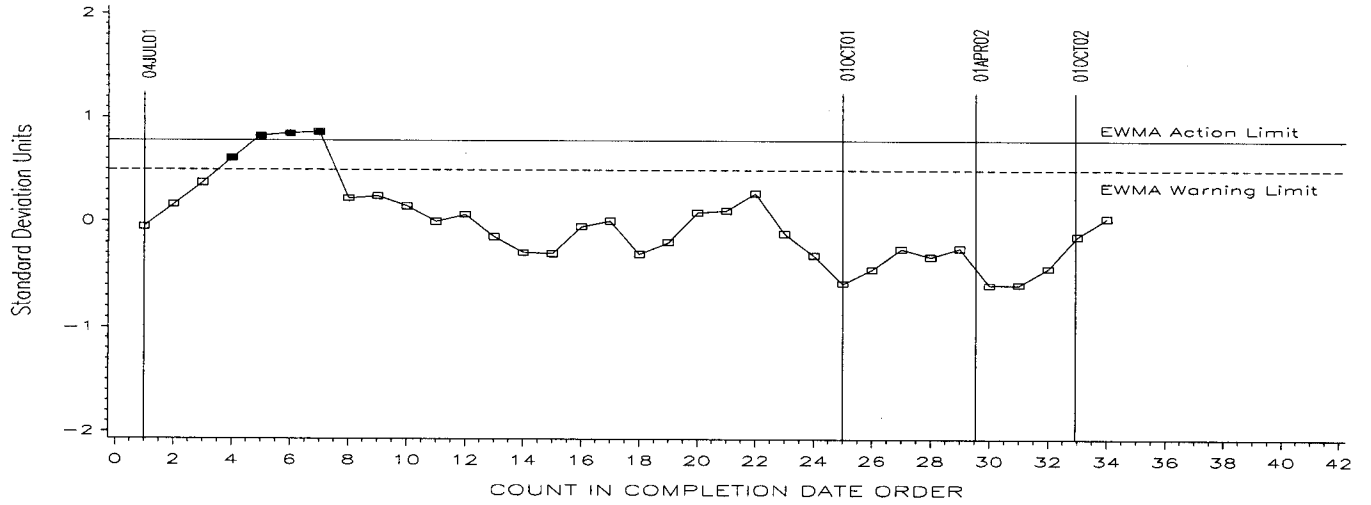

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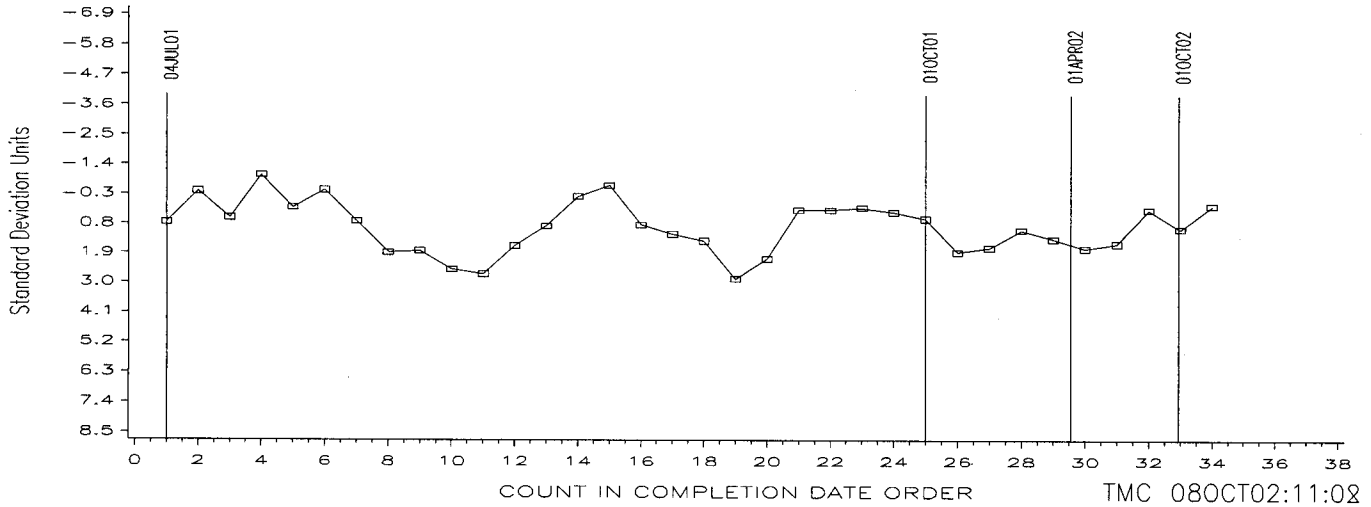

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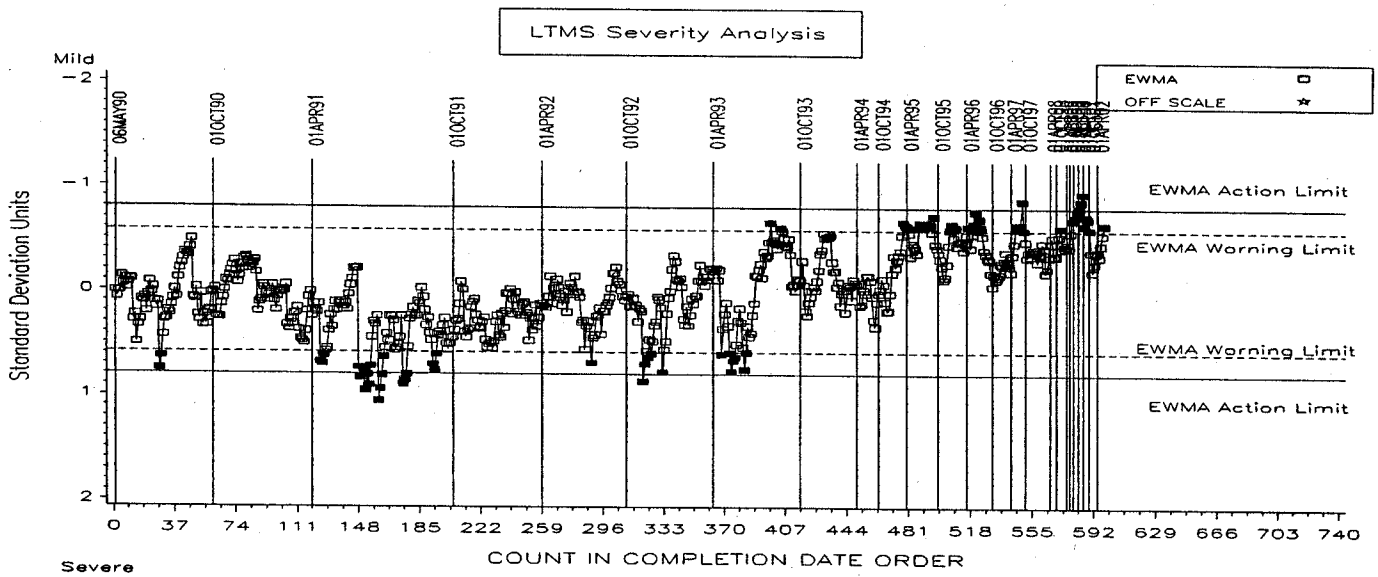
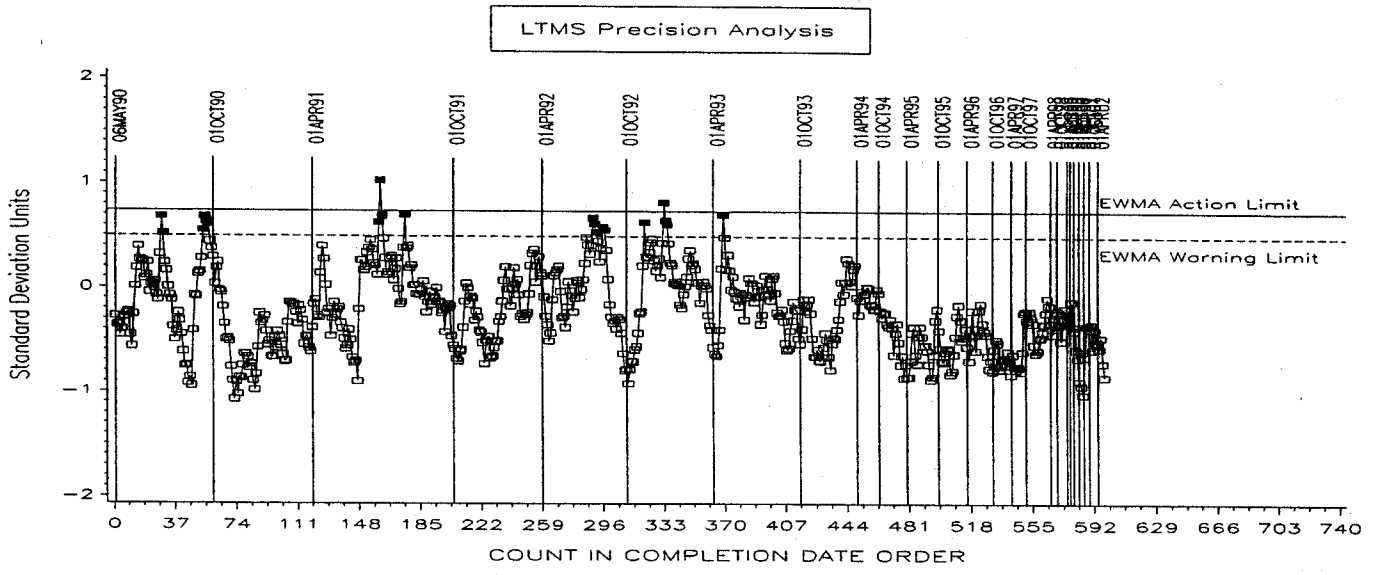
Att 9 1/2

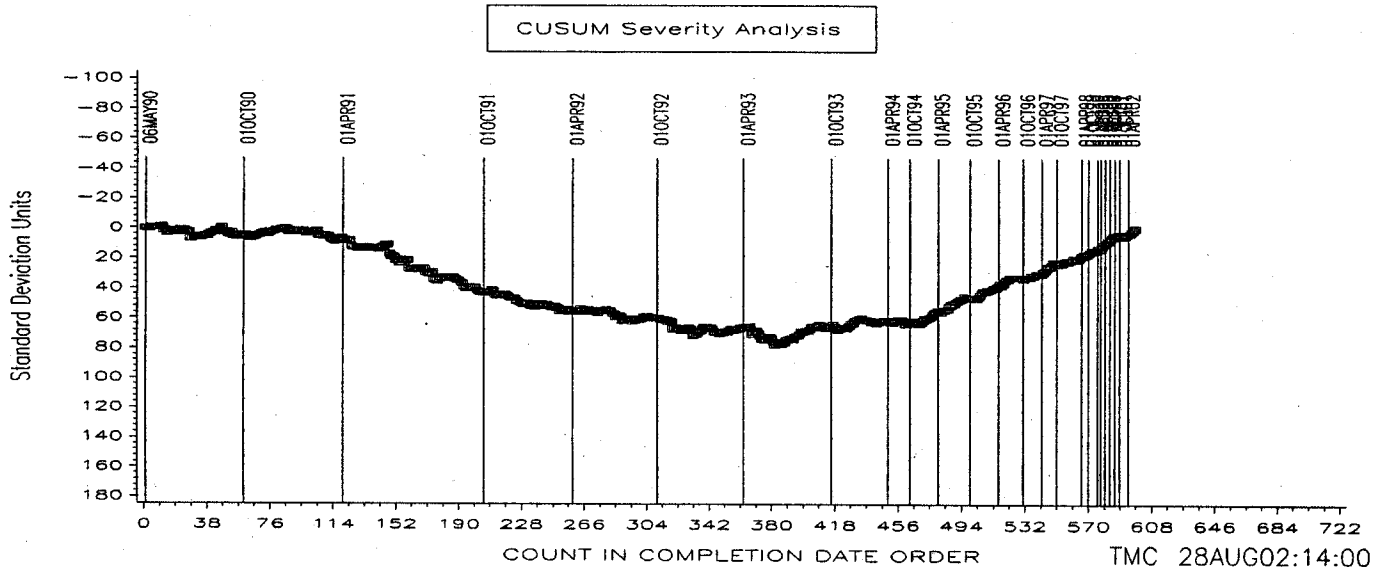
1K INDUSTRY OPERATIONALLY VALID DATA

Using non-LTMS targets generated from all 598 tests

Weighted Total Demerits







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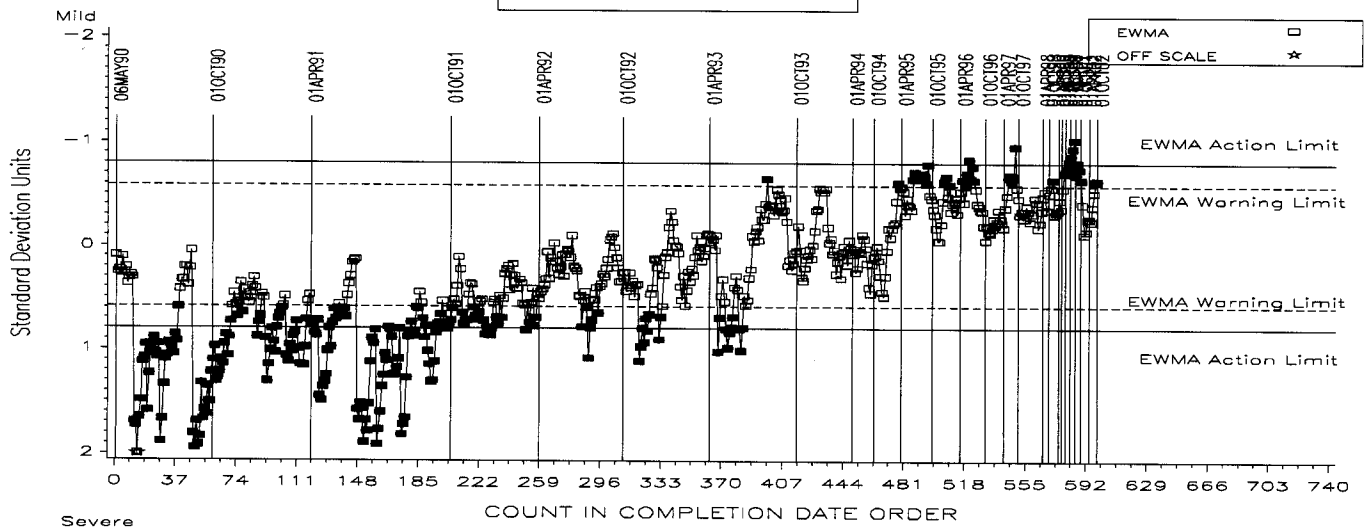
Att 9 3/2

1K INDUSTRY OPERATIONALLY VALID DATA

Weighted Total Demerits

LTMS Severity Analysis



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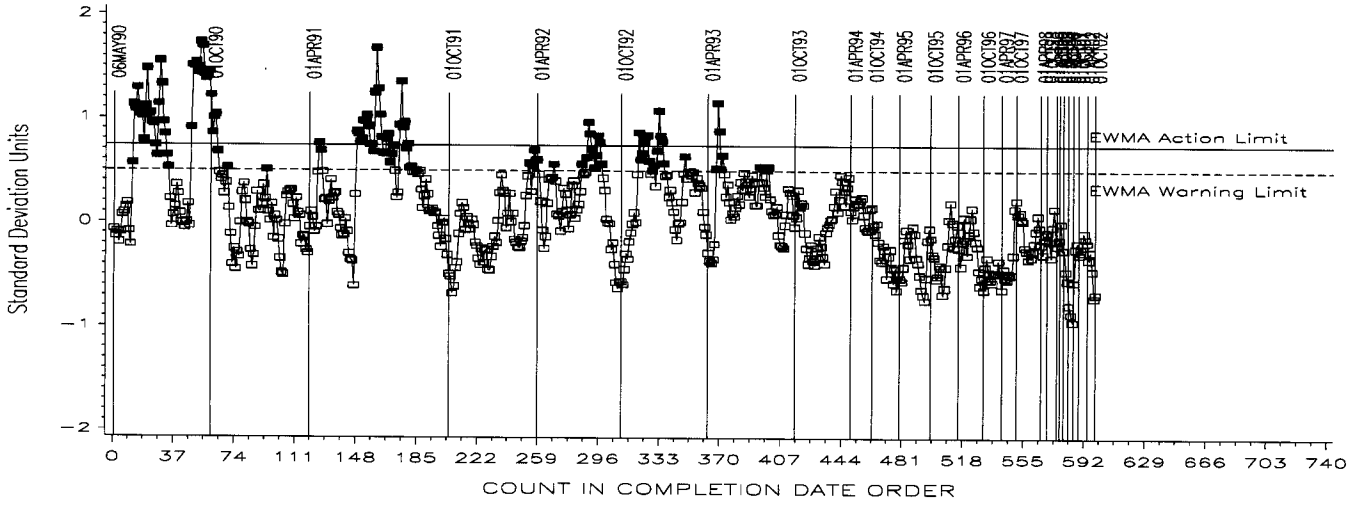
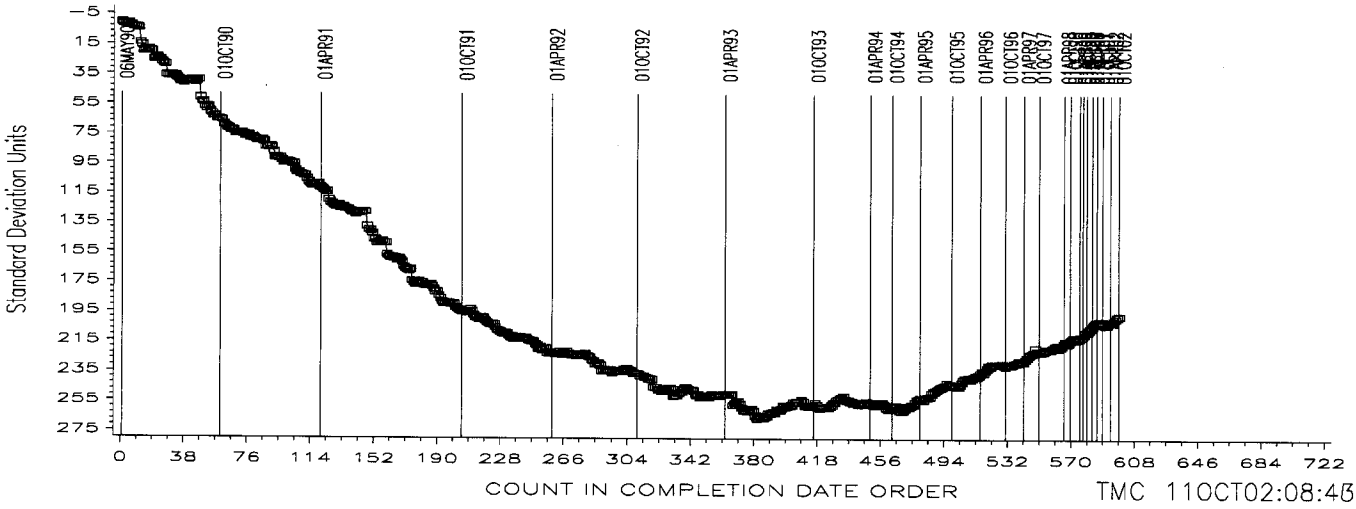


CUSUM Severity Analysis



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Current 1K Targets

OIL	809		809-1		811-1		810-2	
NSIZE	30		30		30		8	
	mean	std	mean	std	mean	std	mean	std
TGF	12.3	6.3	17.5	15.7	27.3	16.6	55.3	20.2
WDK	219.2	41.9	216.4	35.6	327.7	55.9	261.3	38.8
TLHC	0.398	0.900	0.605	1.100	0.868	1.000	1.935	1.700
BSOC	0.272	0.117	0.268	0.145	0.267	0.097	0.375	0.331
ETOC	0.272	0.310	0.284	0.332	0.248	0.236	0.503	0.556

Recomputed 1K Targets*

OIL	809-1		811-1	
NSIZE	226		186	
	mean	std	mean	std
TGF	14.6	10.7	23.7	15.7
WDK	215.2	40.6	347.2	76.6
TLHC	0.540	0.935	0.890	0.897
BSOC	0.240	0.087	0.241	0.073
ETOC	0.249	0.189	0.253	0.146

*data includes all operationally valid tests