Sequence V Surveillance Panel Meeting
January 25th, 2021 10 AM EST

Roll Call:

Afton:	B. Maddock, B. Campbell
BP:	J. Agudelo
Ford:	M. Deegan
Gage Products:	J. Carter
General Motors:	B. Cosgrove, M. Hopp
Haltermann:	P. Tumati, Q. Dunford
HCS Group:	I. Gabrel, T. King
Infineum:	D. Boese, C. Laufer, A. Ritchie (Chair)
Intertek:	A. Lopez
Lubrizol:	J. Brys
OHT:	J. Bowden
Oronite:	J. Martinez, R. Stockwell
PSL Services	C. Taylor
Shell:	J. Hsu
SwRI:	A. Chaudhry, D. Engstrom, T. Kostan, M, Lochte
TEI:	D. Lanctot
TMC:	R. Grundza
Valvoline:	A. Savant
Willis Advanced Consulting:	A. Willis

Meeting Summary:
The Surveillance Panel reconvened to discuss the mild shift and reviewed the plots prepared by TMC. Some plots showed evidence of the fuel batch as a strong contributing factor, but some plots did not. The panel concluded that a more rigorous approach needs to be employed by the statisticians. As of week of Jan 18th, the fuel inventory was reported to be 260,000 gal (including the heel). A question regarding unscheduled downtime was raised. The 6th data point for 931 will complete soon, which will allow the group to calculate targets.

Actions:

1. **Statisticians** to analyze the database for potential causes of the mild shift.
2. Open action from June 24th meeting: **Haltermann** to look at fuel data from Sec 8.2.6 requirement and report back to panel.

Next meeting: Monday, February 15th, 2021 @ 10 AM EST

Meeting was adjourned at 11:19 AM EST

Meeting Details:

Before Rich Grundza (TMC) went through each of the plots (appended), Doyle Boese (Infineum) shared that a partition analysis showed the day of the fuel batch change aligned with the greatest difference in mild shift. The quick study indicated that the fuel batch change or something else that happened that day appears to have caused the mild shift.

Plot 1 shows the upward trend of the CUSUM values, starting at the date (vertical line) of the fuel batch change. Rich Grundza (TMC) stated that the results of a general linear model concurred with the observation that average engine sludge is significantly different between the batches of fuel. Chair Ritchie commented that the dips around test 70 and test 90 are from tests with 940, which was designed to be the high sludge reference oil. If one were to take the tests with 940 out of the CUSUM plot, the dips in the data would disappear (not shown). So it would appear that the new fuel batch is a strong contributing factor for the shift.

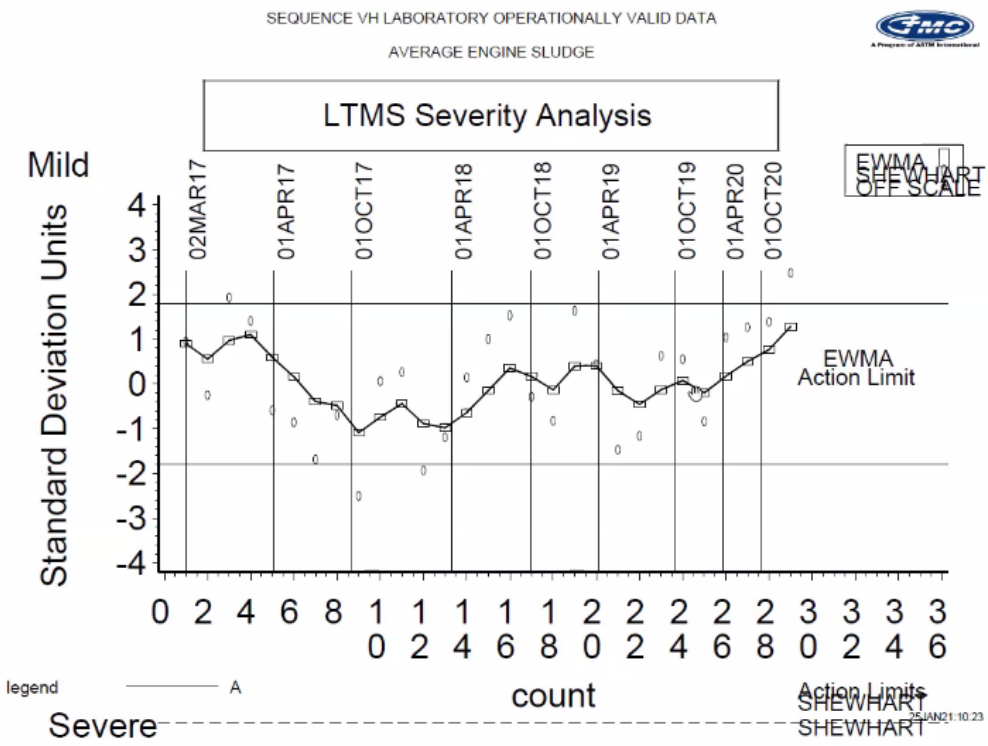
Balancing the above observation, Rich noted that the shift in rocker cover sludge starts before the batch change and that therefore, plot 2 is not as compelling as the previous plot. In addition, the varnish parameter does not seem to have reacted in the same way (plot 3). Plot 4 shows the summation values which are somewhat more mild but not dramatically.

As discussed in the prior meeting, Rich looked at the data by reference oil (plots 5, 6, 7). There's limited 1009 data, with one mild result. Plots 6 and 7, representing reference oils 1011 and 940 respectively and the majority of the oils tested, do show the mild shift.

Quinntine Dunford (Haltermann) asked if we've eliminated any other changes. He would like to understand how we got to this point so that Haltermann can go back and alleviate any issues going forward. Chair Ritchie agreed with the importance of this question and asked the labs to comment.

Al Lopez (Intertek) recalled the initial dataset from the fuel matrix and asked if perhaps this group needs to look at that analysis again and see if we still concur there was no fuel correction needed. Doyle Boese (Infineum) replied that the fuel adjustment was not statistically significant based on the data we used (about 15 tests). He looked at this data during the prior meeting and none of our conclusions have changed. Al asked if inclusion of the latest data would justify a correction. Doyle confirmed that it would justify a correction because the effect of the batch is now statistically significant. He added that since the severity adjustments are well established and are probably correcting things, an option could be to just monitor this, but if there's a concern, another option is applying correction factors going forward.

Ben Maddock (Afton) added that it would wise to have the statisticians look at the data by lab and by stand. We could then answer the question if this is a fuel issue or an industry issue or and issue with the lab or stand. Angela Willis (Willis Advanced Consulting) reminded the group we discussed this in the prior meeting and agreed that we need to understand if there's a heavy influence from a lab. Rich Grundza (TMC) generated the plots by lab during the meeting. Following 3 plots are for lab A, B, and D respectively:


SEQUENCE VH LABORATORY OPERATIONALLY VALID DATA
AVERAGE ENGINE SLUDGE
LTMS Severity Analysis
Mild
Standard Deviation Units
02MAR17
01APR17
01OCT17
01APR18
01OCT18
01APR19
01OCT19
01APR20
01OCT20
EWMA SHEWHART OFF SCALE
EWMA Action Limit
4 3 2 1 0 -1 -2 -3 -4
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
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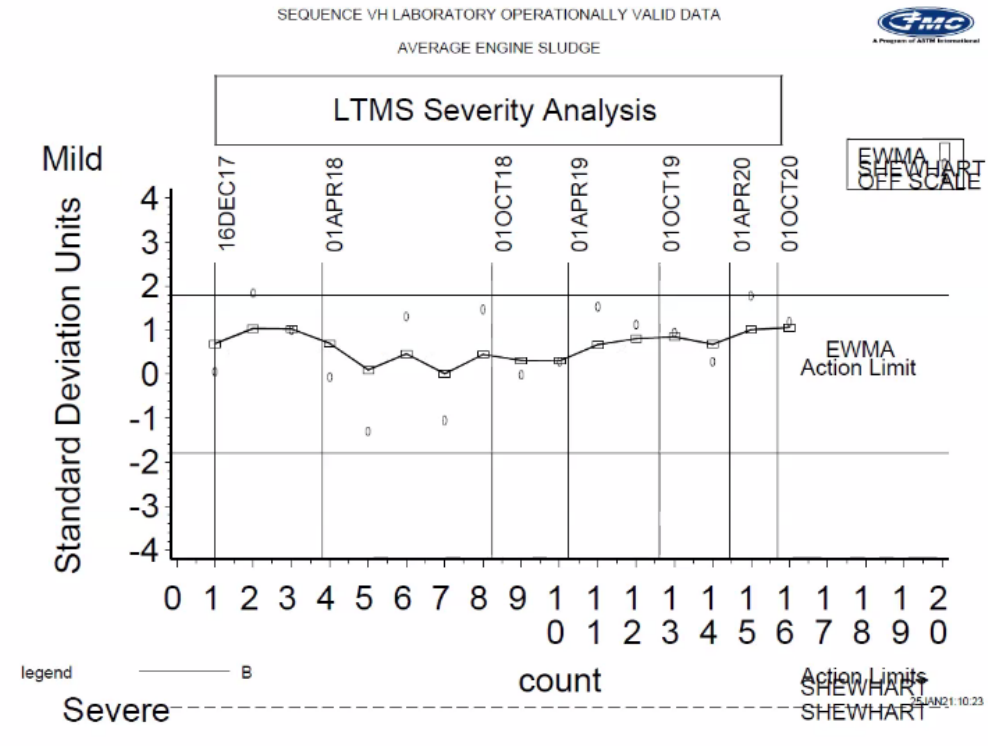
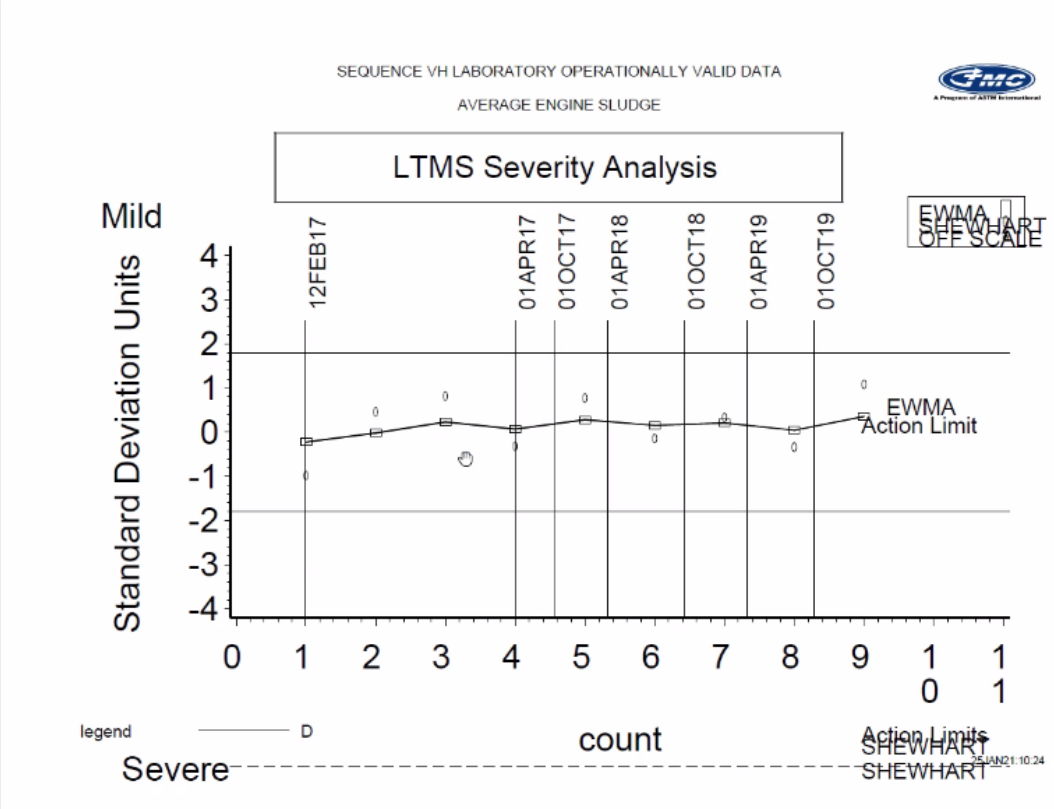
count
Action Limits SHEWHART
Severe
SHEWHART
25JAN21:10:23


SEQUENCE VH LABORATORY OPERATIONALLY VALID DATA
AVERAGE ENGINE SLUDGE
LTMS Severity Analysis
Mild
Standard Deviation Units
16DEC17
01APR18
01OCT18
01APR19
01OCT19
01APR20
01OCT20
EWMA SHEWHART OFF SCALE
EWMA Action Limit
4 3 2 1 0 -1 -2 -3 -4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
legend B
count
Action Limits SHEWHART
Severe
SHEWHART
25JAN21:10:23



Rich clarified that 2 fuel batches are represented in these EWMA plots above: DJ batch from 2017 to 2018 and GI batch that was introduced toward the end of 2018 / early 2019. Angela advised that it would be good to lay out fuel batch in these plots to check our hypothesis. Rich said that if this is helpful, he could write the code to put the lines in to indicate the fuel batch change. Mike Deegan (Ford) asked to have a look at the fuel date and this is probably different for each lab. Angela suggested to put all the data on one graph but assign different colors for the labs; asked if it's possible that we could be overreacting since one lab ran significantly more tests and therefore influencing the trends. Bob Campbell (Afton) recommended that we take a scientific approach and involve the statisticians.

Chair Ritchie, recalling Doyle's insight from the beginning of the call, explained that this activity could be a significant draw on resource. If the group would like to do a deep dive led by Doyle and his peers, we can do this. Gathering input from the group:

- Al Lopez (Intertek) agreed that it's the right thing to but acknowledged diminishing returns because we're about to get a new batch of fuel. He suggested that we could do nothing but keep watching it.
- Jerry Brys (Lubrizol) said we have 2 options: 1) do nothing and let the system handle it, or 2) put in a correction factor for the rest of this batch. A correction factor is not desirable (due to the significant amount of work required by a lot of people) but that's ok. If we do nothing, that's ok too.
    - Doyle Boese (Infineum) highlighted that one concern about changing the adjustment factor now and not changing the historical data is that it will take time for the severity adjustments to shift back on target. So those severity adjustments will be somewhat misleading in the meantime due to lab, unless we go back and change the historical data.

- Travis Kostan (SwRI) added that even if we do nothing, fuel would always be something we wonder about. He suggested that it might be worthwhile to pursue a deep dive so we have variables to look at in the future. As an example, there could be 10 different variables that changed slightly and these could be helpful in the future when we got through this again.
- Ben Maddock (Afton) agreed that a deep dive for the reasons stated by Travis could be worthwhile.

Chair Ritchie summarized that there is general agreement to conduct a deep dive analysis and asked Doyle to take the lead in this assignment. Doyle agreed to put together an analysis and will engage with the other statisticians.

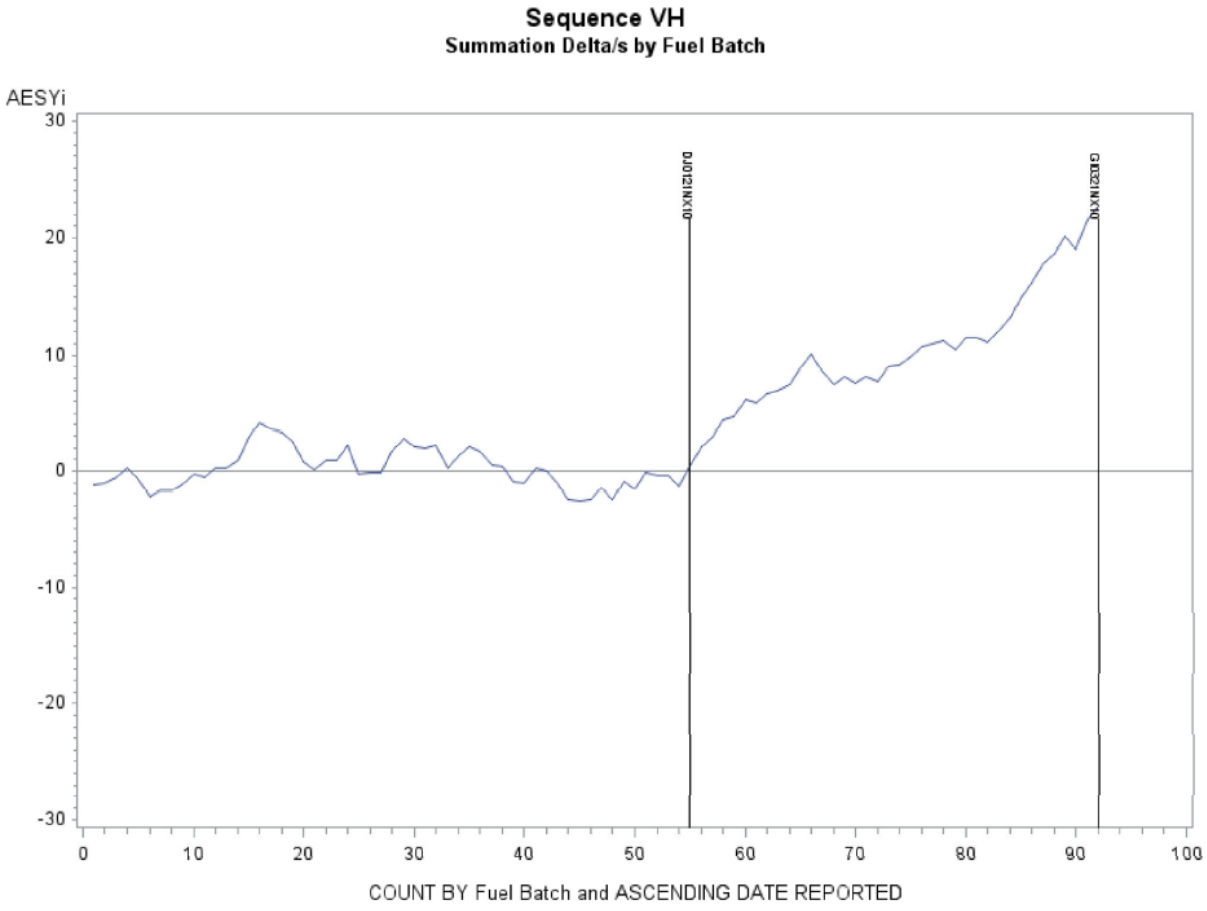
Re: 931 testing, Dan Engstrom (SwRI) updated the group that it would complete soon and will have a data point week of Feb 1st. Rich Grundza (TMC) said the results will be circulated when completed and we can have a call to calculate the targets. Al Lopez (Intertek) asked how to address the current investigation of fuel when looking at the 931 data. Doyle Boese (Infineum) answered that we would look at the severity adjusted data so we take into account the severity shift.

As a separate topic, Angela Willis (Willis Advanced Consulting) asked how the procedure handles unscheduled downtime as she would like to better understand what is considered acceptable, what is not. Al Lopez (Intertek) explained that in the procedure, there are no limits to downtime or shutdowns. From experience, he stated that he's seen good test results with several shutdowns and some bad results with no shutdowns. If the downtime is very long, the lab can make a judgement call on whether or not to proceed. Chair Ritchie added that the rings could be re-gapped; Al furthered that this can be done within 48 hours if the blowby is too high or too low. Jerry Brys (Lubrizol) commented that if an oil passes after many shutdowns, it tells you that the oil is good. But because the opposite can occur, the lab can make a judgement call. Chair Ritchie ask if there was a database, to which Rich Grundza (TMC) said that TMC has looked at this from time to time and it has shown no strong correlation one way or another. Rich recollected that previous versions of the procedure have had downtime limits but because users of the test showed it didn't make a difference, it was removed from the current version of the procedure.

Prasad Tumati (Haltermann) provided an update that we have 260,000 gal as of week of Jan 18th. This is 18,000 gal less than the previous update. Chair Ritchie stated that for the next meeting on Feb 15th, we would have another update on fuel inventory, an update on where we are with upcoming fuel submissions on technology demonstration, and remarks from the statisticians re: their analysis of the severity shift.

Meeting adjourned at 11:19 AM EST.

TMC charts appended: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Summation Delta/s by Fuel Batch
AESYi
30
20
10
0
-10
-20
-30
0
10
20
30
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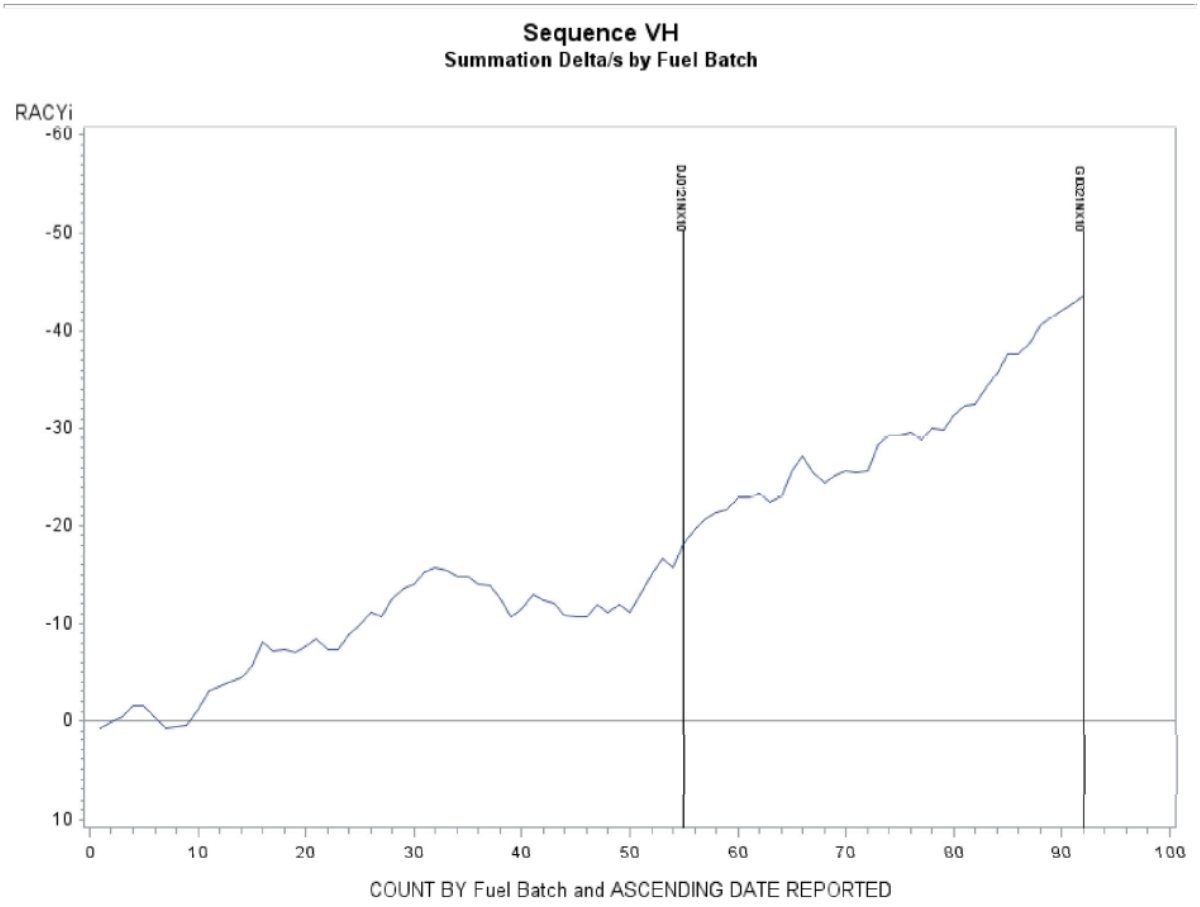
60
70
80
90
100
COUNT BY Fuel Batch and ASCENDING DATE REPORTED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Summation Delta/s by Fuel Batch
RACYi
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-40
-30
-20
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0
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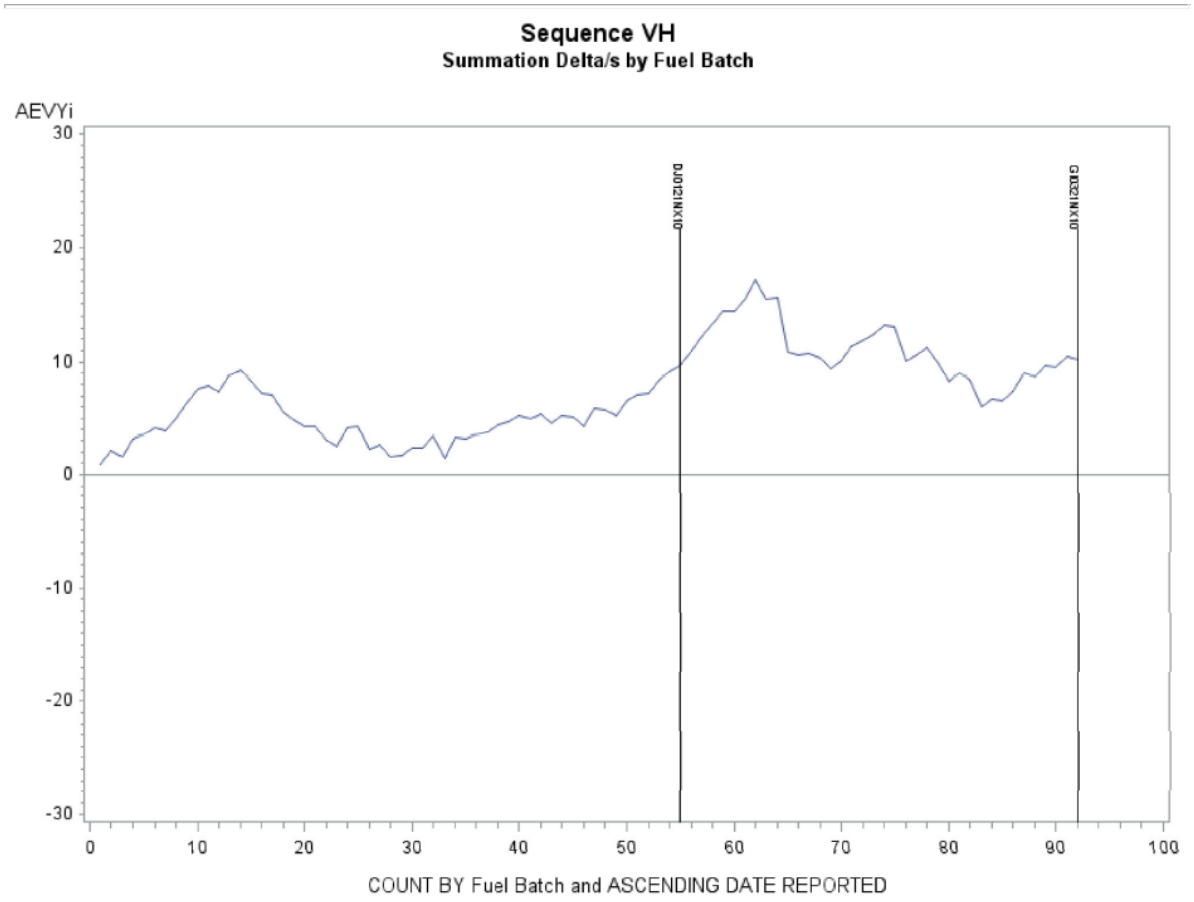
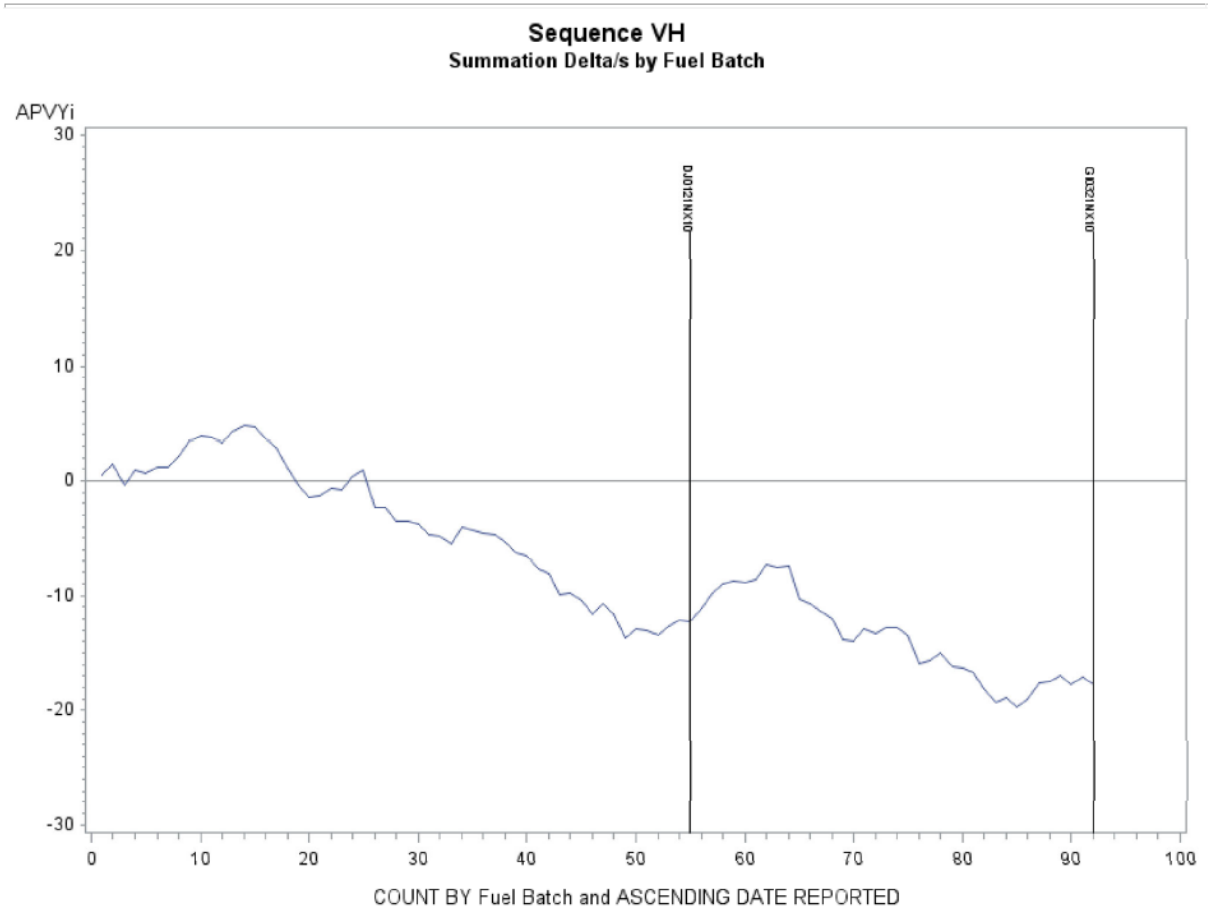
20
30
40
50
60
70
80
90
100
COUNT BY Fuel Batch and ASCENDING DATE REPORTED


Sequence VH
Summation Delta/s by Fuel Batch
AEVYi
30
20
10
0
-10
-20
-30
0
10
20
30
40
50
60
70
80
90
100
COUNT BY Fuel Batch and ASCENDING DATE REPORTED


Sequence VH
Summation Delta/s by Fuel Batch
APVYi
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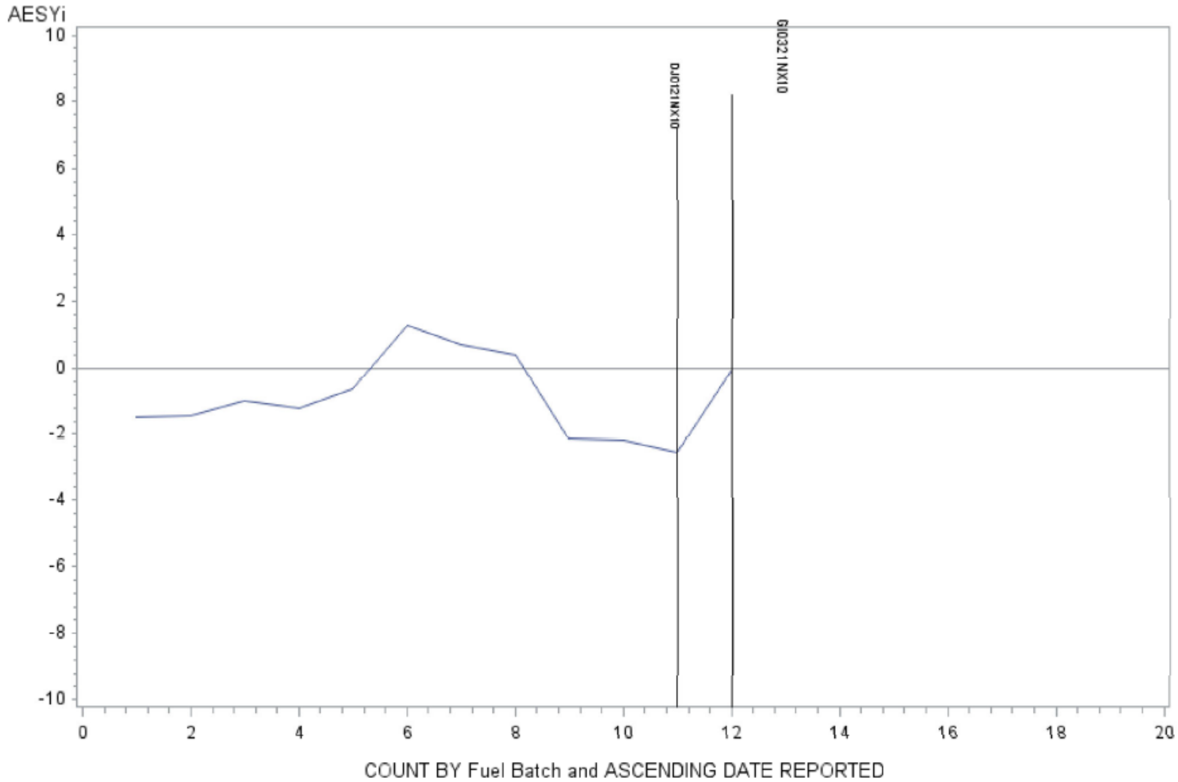
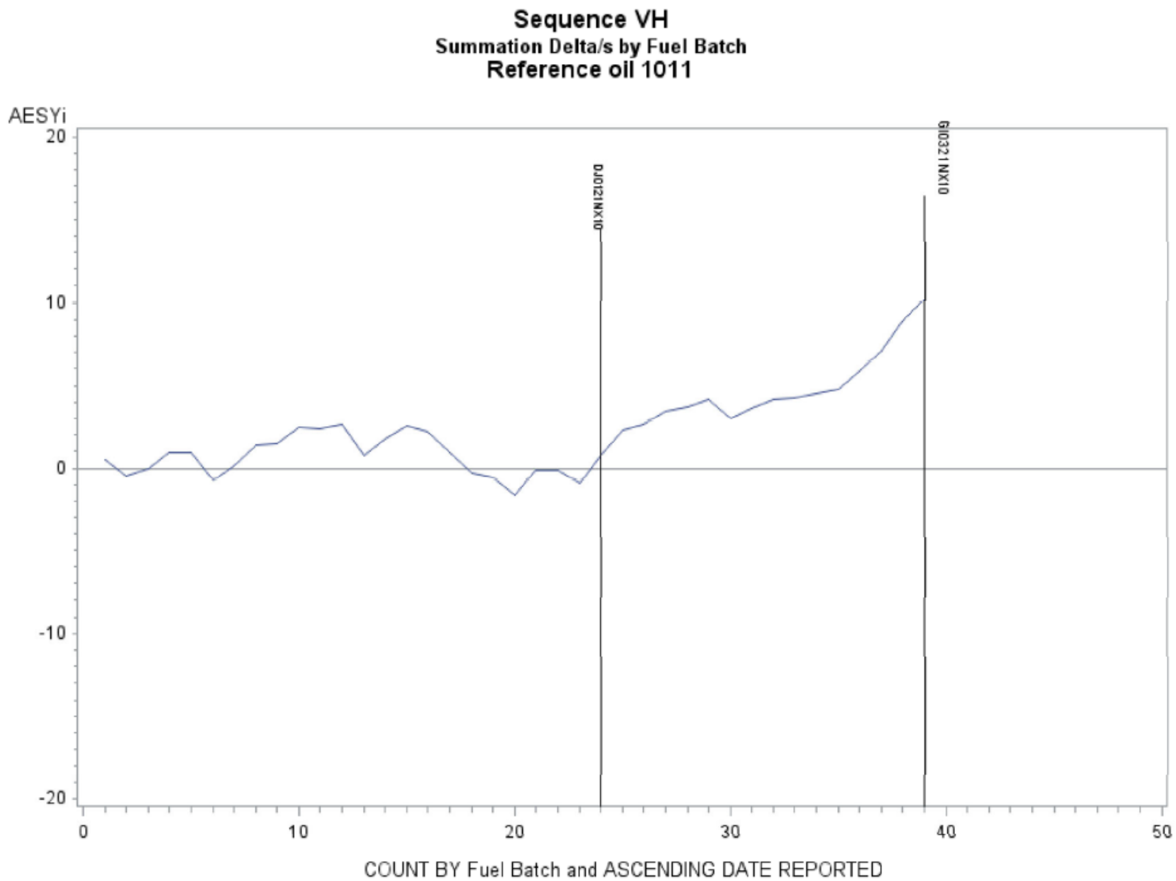
10
0
-10
-20
-30
0
10
20
30
40
50
60
70
80
90
100
DJ0121NX10
GX0321NX10
COUNT BY Fuel Batch and ASCENDING DATE REPORTED

Sequence VH
Summation Delta/s by Fuel Batch
Reference oil 1009




Sequence VH
Summation Delta/s by Fuel Batch
Reference oil 1011
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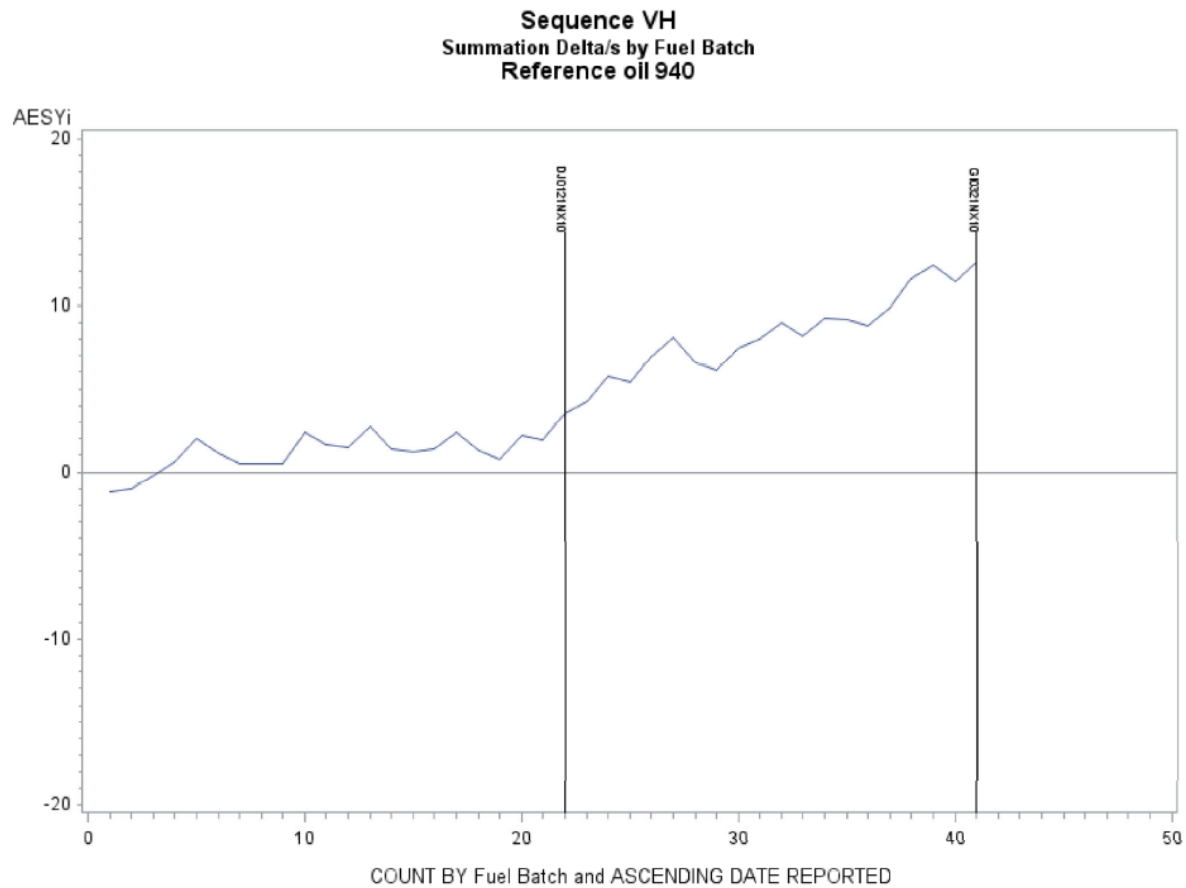
10
0
-10
-20
DJ0121NX10
GI0321NX10
0
10
20
30
40
50
COUNT BY Fuel Batch and ASCENDING DATE REPORTED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Summation Delta/s by Fuel Batch
Reference oil 940
AESYi
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10
0
-10
-20
DJ0121NX10
0
10
20
30
40
50
COUNT BY Fuel Batch and ASCENDING DATE REPORTED