Natural Resources Canada   Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 7949

Rock-Eval Pyrolysis Results for Cuttings Samples from the Natsek E-56 Well, Beaufort-Mackenzie Basin, Canada

L.A. Neville, D.H. McNeil, S.E. Grasby, J.M. Galloway, H. Sanei, K. Dewing

2015

Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 7949

Rock-Eval Pyrolysis Results for Cuttings Samples from the Natsek E-56 Well, Beaufort-Mackenzie Basin, Canada

L.A. Neville, D.H. McNeil, S.E. Grasby, J.M. Galloway, H. Sanei, K. Dewing

Geological Survey of Canada, Calgary, Alberta

2015

©Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources Canada, 2015

doi:10.4095/297341

This publication is available for free download through GEOSCAN (http://geoscan.nrcan.gc.ca/).

Recommended citation
Neville, L.A., McNeil, D.H., Grasby, S.E., Galloway, J.M., Sanei, H., and Dewing, K., 2015. Rock-Eval Pyrolysis Results for Cuttings Samples from the Natsek E-56 Well, Beaufort-Mackenzie Basin, Canada; Geological Survey of Canada, Open File 7949, 76 p. doi:10.4095/297341

Publications in this series have not been edited; they are released as submitted by the author.

Acknowledgements

We thank many people at the Geological Survey of Canada (Calgary) including Krista Boyce and Richard Fontaine for organizing sample preparation and curation, Ross Stewart for Rock-Eval 6 analysis, Christine Deblonde for her assistance producing a location map, Doug Lemay for his assistance preparing the report for publication, and Dr. Omid Haeri Ardakani for his expertise on the topic. This study was funded by Natural Resources Canada through the Earth Sciences Sector GEM Program, Western Arctic Project. Dr. Larry Lane acted as scientific reviewer.

Abstract

A total of 195 cuttings samples were collected from between 229 – 2226 m from the Natsek E-56 well of Beaufort-Mackenzie Basin for Rock-Eval Pyrolysis. The Natsek E-56 well is being investigated as part of a multi-disciplinary study of petroleum systems in the Beaufort-Mackenzie Basin, carried out by the Geological Survey of Canada (Calgary) under the Geo-Mapping for Energy and Minerals (GEM) Program, Western Arctic Project. Organic matter characterization in conjunction with other on-going analyses of rock preserved in Natsek E-56 cuttings will be used to interpret the paleoenvironment, paleotemperature and paleosalinity during the Early to Middle Eocene to inform hydrocarbon source rock characterization, with broader implications extended to understanding Arctic Ocean paleoceanography and paleoclimate.

Rock-Eval pyrolysis parameters suggest that the samples from the Taglu and Aklak sequences, preserved in Natsek E-56, contain a mixture of poor to fair petroleum source rocks with immature to early mature Type III/IV kerogen. The Tmax values however, indicate that the cuttings from Natsek E-56 remain outside the window for petroleum generation.

Below about 2030 m there is a dramatic increase in the TOC content of several samples, suggesting that the Aklak sequence, a sandstone dominated succession, contains carbonaceous mudstone or coaly mudstone beds.

Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

1.1 Background

A multi-disciplinary study of petroleum systems in the Beaufort-Mackenzie Basin is being carried out by the Geological Survey of Canada (Calgary) under the Geo-Mapping for Energy and Minerals (GEM) Program, Western Arctic Project. Cuttings from the Natsek E-56 exploration well from the Beaufort-Mackenzie Basin (Figure 1) were selected for detailed paleoenvironmental, paleotemperature and paleosalinity analysis, which will aid in hydrocarbon source rock characterization. The Natsek E-56 study will contribute to a more refined interpretation of the age, depositional history, and hydrocarbon source potential of the continental margin strata in Northern Canada. Eocene strata are a significant source of hydrocarbons in the Beaufort-Mackenzie area, but the strata are complex stratigraphically and structurally. Refinement of the geological history of Cenozoic strata in the Beaufort Mackenzie area will contribute significantly to petroleum assessment and reduction of economic risk for future hydrocarbon exploration. Broader implications extend to understanding Arctic Ocean paleoceanographic and paleoclimatic events. The science of the Eocene Arctic Ocean is still in its infancy, with only one significant core drilled so far (ACEX on Lomonosov Ridge). The results from this research will contribute to a circum-Arctic understanding of Early to Middle Eocene history.

Details on the cuttings from the Natsek E-56 well and a summary of previous analysis can be found in the Dietrich et al.(1989) report. The original descriptions of the lithology, microfossil content, geochemical characteristic, and reflection seismic expressions of the stratigraphic units are presented there. Interpretations of the ages, depositional environments and regional stratigraphic correlations of the various units are also discussed. In addition, a brief description of the structural setting of the Natsek area is included. Main outcomes from the report included the recognition and stratigraphic identification of major unconformities of Early and Middle Eocene age, the introduction of the Taglu and Aklak sequence names as revisions to previous descriptions of the Beaufort-Mackenzie Basin sequence stratigraphy, descriptions of the nature of the sedimentary fill, and identification of submarine fan deposits in Eocene strata.

The work currently being conducted on cuttings from the Natsek E-56 well as part of GEM and outlined in this report targets the section of the well covering major Eocene paleoceanographic (e.g., *Azolla* blooms and freshening of Arctic water) and paleoclimatic (e.g., Paleocene – Eocene Thermal Maximum) events. It is expected that results from this targeted study will refine the original descriptions by Dietrich et al. (1989).

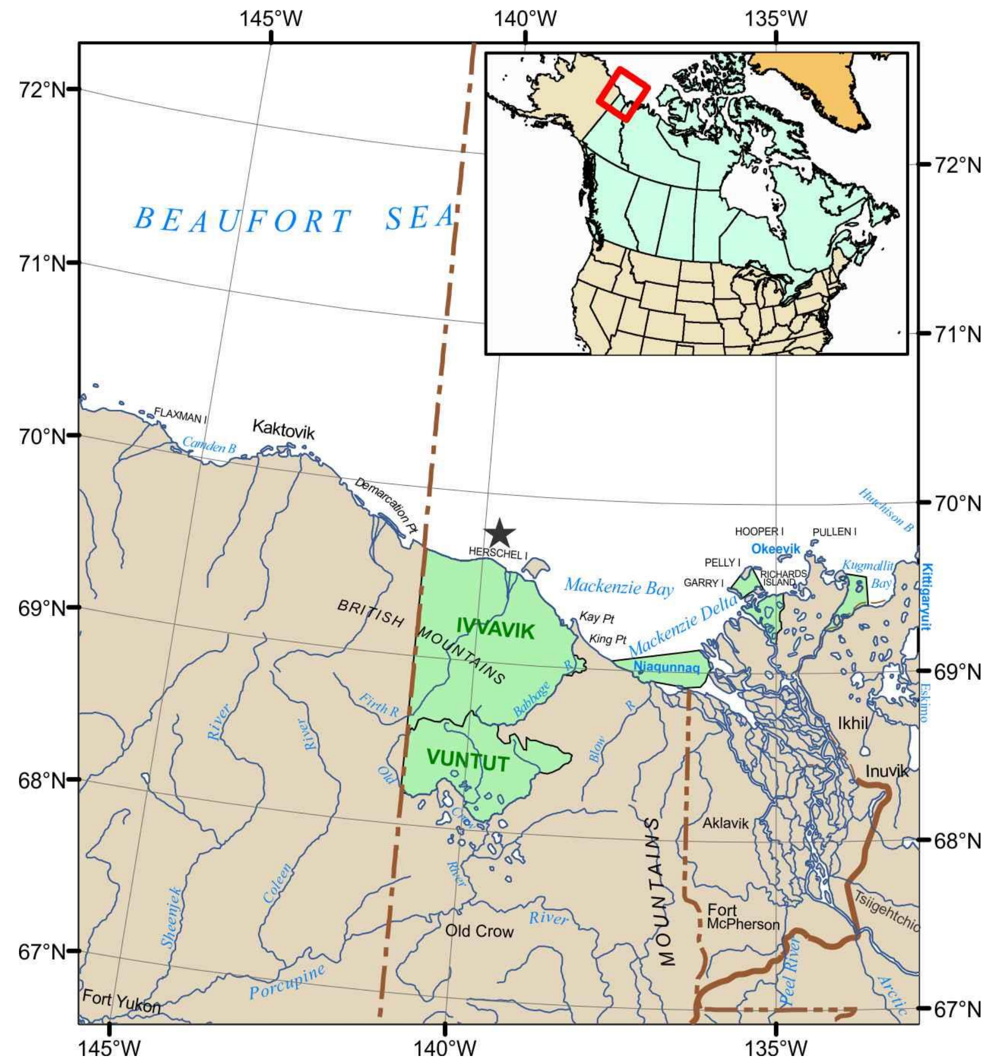


Figure 1: Location of the Natsek E-56 well (indicated by the star) in the Beaufort-Mackenzie Basin, Northwest Territory. Topographic base source: Government of Canada; Natural Resources Canada; Earth Sciences Sector; Canada Center for Mapping and Earth Observations.

1.2 Natsek E-56

The Dome Pacific et al. PEX Natsek E-56 well is located in the southwestern part of the Canadian Beaufort-Mackenzie Basin (Lat. 69° 45´ 21.46" N, Long. 139° 44´ 34.58" W; UWI 300E566950139300, Northwest Territories, Delta), 25 km Northwest of Herschel Island (Figure 1). Natsek E-56 was spudded July 10, 1978, reaching a depth of 2,687 m before suspension on November 14, 1978. The well was re-entered September 1, 1979 and drilled to the final depth of 3,529 m below kelly bushing (KB) before final suspension on September 26, 1979. Water depth at this location was 33.8 m. The well penetrated thick sections of Tertiary sedimentary strata. Of particular interest are the Taglu and Aklak sequences, both of which were deposited during the Eocene (Dietrich et al., 1989). This project focuses on important geologic events in the Arctic Ocean such as the climatic optimum of the Early to Middle Eocene and the freshening of the basin during the Upper Middle Eocene. The well section of interest appears to record the

"Eocene Thermal Maximum" and "Arctic *Azolla* Event", the former in a terrestrial setting, the latter in a relatively shallow water setting with potentially low salinity in the basin.

Rock-Eval pyrolysis was previously conducted on cuttings from the Natsek E-56 well at varying levels throughout the well with an average resolution of approximately 30 m. For this targeted study, however a higher resolution was required to allow for the data's utilization as a standard for geochemical results. New Rock-Eval 6 pyrolysis was conducted on cuttings samples for the current study. These results are presented here. The database reference for the original lower resolution study can be found at: Rock-Eval data for Canadian borehole cuttings, core and outcrop samples geoscience data repository, Earth Sciences Sector, Natural Resources Canada (http://open.canada.ca/data/en/dataset/1947bc46-c801-5360-8256-ca1dfd58586d).

1.2.1 Summary of Core Description from Dietrich et al. (1989)

The geology, geochemistry and biostratigraphy of the well section of interest for this study (Figure 2) are summarized here. Dietrich et al. (1989) investigated cuttings for lithology and microfossil content (foraminifers and palynomorphs). Thermal maturation observations were also made.

The Taglu sequence appears through 215 – 1951 m and consists entirely of weakly consolidated, silty to pebbly mudstone. Traces of carbonaceous debris and pyrite occur in the mudstones along with some thin beds of ironstone concretions. The upper 400 m of the sequence contains abundant chert pebbles. The upper part of the sequence (251 – 1250 m) is barren of foraminifers but contains a rich and diverse assemblage of pollen and dinoflagellates (Figure 2). The assemblages indicate a nearshore shallow marine environment of Early to Middle Eocene age. The 1250 – 1555 m interval contains abundant agglutinated foraminifers, this assemblage also suggests an Early Eocene age and the depositional environment was likely that of an inner shelf with less than normal marine salinity. The foraminiferal assemblage becomes less diverse below 1555 m. In general the Taglu sequence also contains other microfossils, including *Azolla* megaspores, algal cysts and fish bones. Seismically, the Taglu sequence is characterized by variable reflection amplitudes and geometry. In the vicinity of the well the sequence appears as an interval of low amplitude, subhorizontal reflections. Dietrich et al. (1989) concluded that the Lower to Middle Eocene sequence in the Natsek area is equivalent to the upper part of the Reindeer Formation or sequence of the Mackenzie Delta area.

The base of the Taglu sequence is marked by what is described as a prominent unconformity, which also marks the top of the Aklak sequence (Dietrich et al., 1989; Dixon et al., 1992). The seismic character change across the Taglu-Aklak contact produces one of the most prominent seismic sequence boundaries in the region. The base-Taglu unconformity is also a major erosional surface with substantial thickness of strata truncated below the unconformity. The Aklak sequence extends from 1951 – 2644 m and consists of a thick succession of interbedded sandstones, conglomerates, shales and coals. The section of Aklak sequence of interest for this project was barren of foraminifera with the exception of sparse *Reticulophragmium boreale* (2012 – 2042 m and 2195 – 2225 m) but contains abundant palynomorphs. Dietrich et al. (1989) concluded that the depositional setting for the Aklak strata was a non-marine, upper delta plain environment with common stacked fluvial channel deposits and coarsening-upward, crevasse-splay deposits capped by coal seams. The shaly intervals within the Aklak sequence are thought to be floodplain or levee deposits. Dietrich et al. (1989) suggests that the limited microfossil assemblages indicate an Early Eocene age. The sequence appears to be equivalent to the lower Reindeer sequence or Aklak Member of the Reindeer Formation of the Mackenzie Delta area.

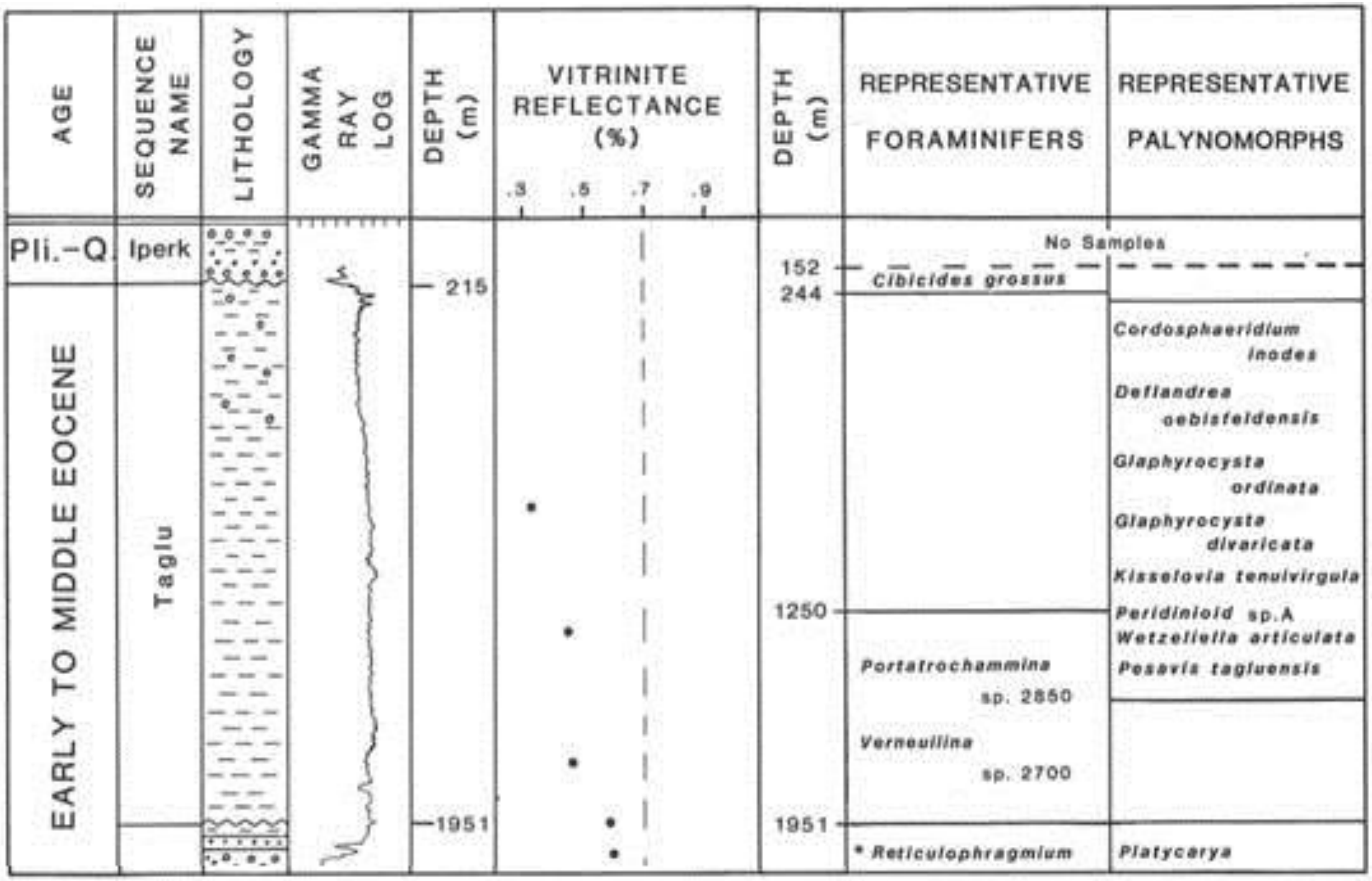


Figure 2: Modified summary of geology, geochemistry and biostratigraphy presented in Dietrich et al. (1989).

1.3 Procedure for Rock-Eval Pyrolysis

Rock-Eval pyrolysis provides fast and reliable characterization of the quantity and quality of sedimentary organic matter, as well as its thermal maturity. This type of analysis has been used extensively for the assessment of hydrocarbon potential in sedimentary basins by characterizing the organic richness, type of organic matter (OM) and thermal maturity of sedimentary rocks. It is a thermal desorption and pyrolysis technique developed to measure the amount of hydrocarbons, CO and CO_2 released from a powdered rock sample upon heating treatment under inert gas flow. Two useful measurements related to quantity of OM are the total organic carbon (TOC) and the fraction of TOC that is generated by hydrocarbons and other compounds during pyrolysis. The most familiar method of classifying OM type is the van Krevelen or atomic H/C vs. O/C diagram (Tissot et al., 1974). In this diagram different types of kerogens are shown as Type I (very oil prone), Type II (oil prone), and Type III (gas prone). Type IV (inert) kerogens contain very little hydrogen and plot near the bottom of the diagram (Peters, 1986).

At the GSC-Calgary, typical Rock-Eval analysis of well core and cuttings is performed on a Rock-Eval 6 Turbo device. Drill cuttings samples, usually collected over certain depth intervals (e.g., every 3, 10 or 30 feet or meters) by grabbing an aliquot from the composite cuttings bags/containers prepared at well site, are washed with tap water to remove any residual drilling mud that can contaminate the sample.

Initially samples are heated at 300°C for 3 minutes to volatilize any free hydrocarbons (HC) and these are represented by the Rock-Eval S1 peaks. Ideally, the area under the S1 pyrolysis curve (mg HC/g of initial rock) represents hydrocarbons generated *in situ* over geologic time, but sample impregnation by migrated hydrocarbons, expulsion and loss of hydrocarbons or organic drilling contaminants (e.g. oil-based drilling mud) can also affect the S1 results.

Following this isothermal heating step, samples are heated linearly from 300°C to 650°C at a rate of 25°C/minute, yielding an S2 peak that represents thermal decomposition products from sedimentary organic matter (kerogen). Under ideal conditions, the area under the S2 curve (mg HC/g of initial rock) represents the remaining hydrocarbon potential of the rock sample at increased thermal maturity; however, the results can also be affected by the presence of heavy bitumen or oil impregnation. The temperature at the maximum of S2 peak (TpS2) varies with the thermal maturity of the sedimentary organic matter, and is converted to Tmax (°C), the thermal maturity parameter originally established on the older Rock-Eval 2 model and well accepted by petroleum geologists and geochemists.

The S3 curve corresponds to the amount of CO_2 (mg CO_2/g of initial rock) generated from organic matter during the initial isothermal heating step and the programmed heating phase up to 400°C. CO_2 generated between 400°C and 650°C is from the thermal decomposition of carbonate minerals. The Rock-Eval 6 instrument also records the amount of CO generated during pyrolysis and associates various proportions to organic carbon and mineral sources, depending on sample temperature (Behar *et al*., 2001 for details). The amount of pyrolyzable or productive organic carbon (PC) is determined by combining the S1, S2, S3, CO_2 and CO contributions according to a specific formula (Behar *et al*., 2001). Pyrolysis mineral carbon is determined from the high temperature portions of the CO and CO_2 pyrolysis curves. Following pyrolysis, samples are transferred to an oxidation furnace in the Rock-Eval 6 instrument where they are linearly heated from 300°C to 850°C under air flow to determine the amount of residual organic carbon (RC) and oxidation mineral carbon from CO and CO_2 generated during oxidation. The total organic carbon (TOC**,** wt %) is the sum of the productive and residual organic carbon. Similarly, mineral carbon (MINC) is the sum of the pyrolysis and oxidation mineral carbon.

Other key Rock-Eval parameters included in this report are production index (PI = S1/(S1 + S2)), hydrogen index (HI = (S2x100)/TOC in mg HC/g TOC) and oxygen index (OI = (S3x100)/TOC in mg CO_2/g TOC). PI is often used as a thermal maturity indicator because S1, and thus PI, should increase with increasing maturation due to hydrocarbon generation. However, petroleum expulsion from a source rock at high maturation will result in lowered S1 and PI. In addition, a high PI may also indicate a pay zone due to oil accumulation. S1 and PI can be affected by drilling mud contamination. Plots of HI versus OI (Espitalié *et al*., 1977) are also useful to determine organic matter type and thermal maturity. Heavy bitumen impregnation, sample weathering and extremely low TOC content can affect HI and OI values; therefore, these results must be interpreted carefully. HI versus Tmax plots (Espitalié *et al*., 1980) can also be used to examine organic maturation pathways in situations where OI values are anomalously high due to contributions from mineral carbon or other factors (Peters, 1986).

Peters (1986) discusses various factors that influence Rock-Eval parameters and presents guidelines for interpreting Rock-Eval data. For immature rocks, sample contamination (natural or drilling related) is indicated by multi-modal S2 peaks and PI values > 0.2. For TOC values < 0.5 wt%, pyrolysate adsorption on the mineral matrix can affect S1, S2 and Tmax values, an effect most significant for argillaceous rocks. Peters (1986) suggests that Tmax values are unreliable when S2 values are less than 0.2 mg HC/g rock, although this criterion likely varies depending on the type of organic matter and rock matrix. For example, Obermajer *et al*. (2007) suggested a minimum S2 value of 0.35 mg HC/g rock for correctly interpreting Tmax values based on data from the Arctic Islands, and Riediger *et al*. (2004) used a value of 0.5 mg HC/g rock in their study of Triassic rocks from north eastern British Columbia.

The following list contains the standard measured Rock-Eval parameters (Espitalié et al., 1977, 1980) as well as several derived parameters:
TOC = total organic carbon reported as percent by weight of the whole rock (%);
Tmax = temperature (°C) at the top of the S2 peak;
S1 = hydrocarbons evolved (distilled or thermovaporised) at 300°C (mg hydrocarbon per g rock);
S2 = hydrocarbons evolved during heating at 25°C/min between 300°C and 600°C (mg hydrocarbon per g rock);
S3 = organic carbon dioxide evolved at 300°C and up to 390°C (mg CO2/g rock);
PI = Production Index = S1/(S1+S2);
HI = Hydrogen Index = 100 x S2/TOC, expressed as mg HC/g TOC
OI = Oxygen Index = 100 x S3/TOC, expressed as mg O_2/g TOC

2. Methods

2.1 Sampling and Preparation

In this study, 195 drill cuttings samples and 5 duplicate samples were collected from the Natsek E-56 well between 229 – 2226 m. Sampling intervals varied as shown in Table 1. The handpicked cuttings samples were washed lightly with tap water to remove drilling mud. Since the penetrated sediments at Natsek E-56 are not yet fully consolidated, care had been taken not to leave the cuttings soaked in water for too long. The cuttings samples were then oven dried at 35°C for 24 hours before being powdered. Aliquots of approximately 70 mg of each powdered cuttings sample were subjected to Rock-Eval 6 analysis.

Table 1: Depths and sampling intervals for the Natsek E-56 well.

Depth Interval (m)	Resolution (m)
229 - 351	30
384 -1235	9
1244 - 2226	12

2.2 Analysis

Rock-Eval 6 pyrolysis was conducted at the Geological Survey of Canada (Calgary) on a Rock-Eval 6 Turbo device following the *Basic Method* as described by Lafrague *et al* (1998) and

Behar *et al*. (2001). Standard Rock-Eval procedures were followed, details can be found above in section 1.3 Procedure for Rock-Eval Analysis.

3. Results

Appendix 1 lists the Rock-Eval/TOC results for the cuttings samples from the Natsek E-56 well. Data are presented in the familiar Rock-Eval 2 format. These Rock-Eval parameters have also been plotted against depth in Figure 3. A summary of the Rock-Eval pyrolysis results can be found in Table 2 and a summary of the quality assurance and control data can be found in Table 3.

Table 2: A summary of the Rock-Eval pyrolysis results for the Natsek E-56 well.

	S1 mg HC/g	**S2** mg HC/g	**PI** (S1/ (S1+S2))	**S3** mg CO_2/g	**Tmax** °C	**S3CO** mg CO/g	**PC** %	**TOC** wt.%	**RC** %	**HI** mg HC/g TOC	**OICO**	**OI** mg CO_2/g TOC	**MINC** wt%
Mean	0.2	3.1	0.1	3.0	420.2	0.7	0.4	3.0	2.6	69.5	31.3	144.6	0.5
Median	0.2	0.9	0.2	2.1	422.0	0.5	0.2	1.4	1.2	65.0	23.5	148.5	0.3
Stdev	0.2	7.4	0.1	2.1	10.5	0.9	0.7	4.9	4.2	32.6	19.1	51.7	0.4
Min	0.02	0.13	0.02	0.55	395.00	0.02	0.04	0.38	0.34	27.00	5.00	37.00	0.18
Max	1.13	51.64	0.28	14.24	439.00	6.62	5.16	34.02	28.86	189.00	80.00	280.00	4.24

Table 3: A summary of the quality assurance and control data (precision, accuracy, MOE (margin of error)) used during the analysis of the Natsek E-56 well. Standard reference material 9107 shale, internal to the GSC was utilized.

	S1 mg HC/g	**S2** mg HC/g	**PI** (S1/ (S1+S2))	**S3** mg CO_2/g	**Tmax** °C	**S3CO** mg CO/g	**PC** %	**TOC** wt.%	**RC** %	**HI** mg HC/g TOC	**OICO**	**OI** mg CO_2/g TOC	**MINC** wt%
Precision	3%	2%	8%	3%	0%	58%	2%	0%	1%	2%	59%	4%	6%
Accuracy	5%	3%	43%	14%	0%	7%	2%	1%	2%	3%	8%	5%	4%
MOE	0.01	0.18	0.00	0.01	0.57	0.07	0.01	0.01	0.01	3.59	1.44	0.30	0.16

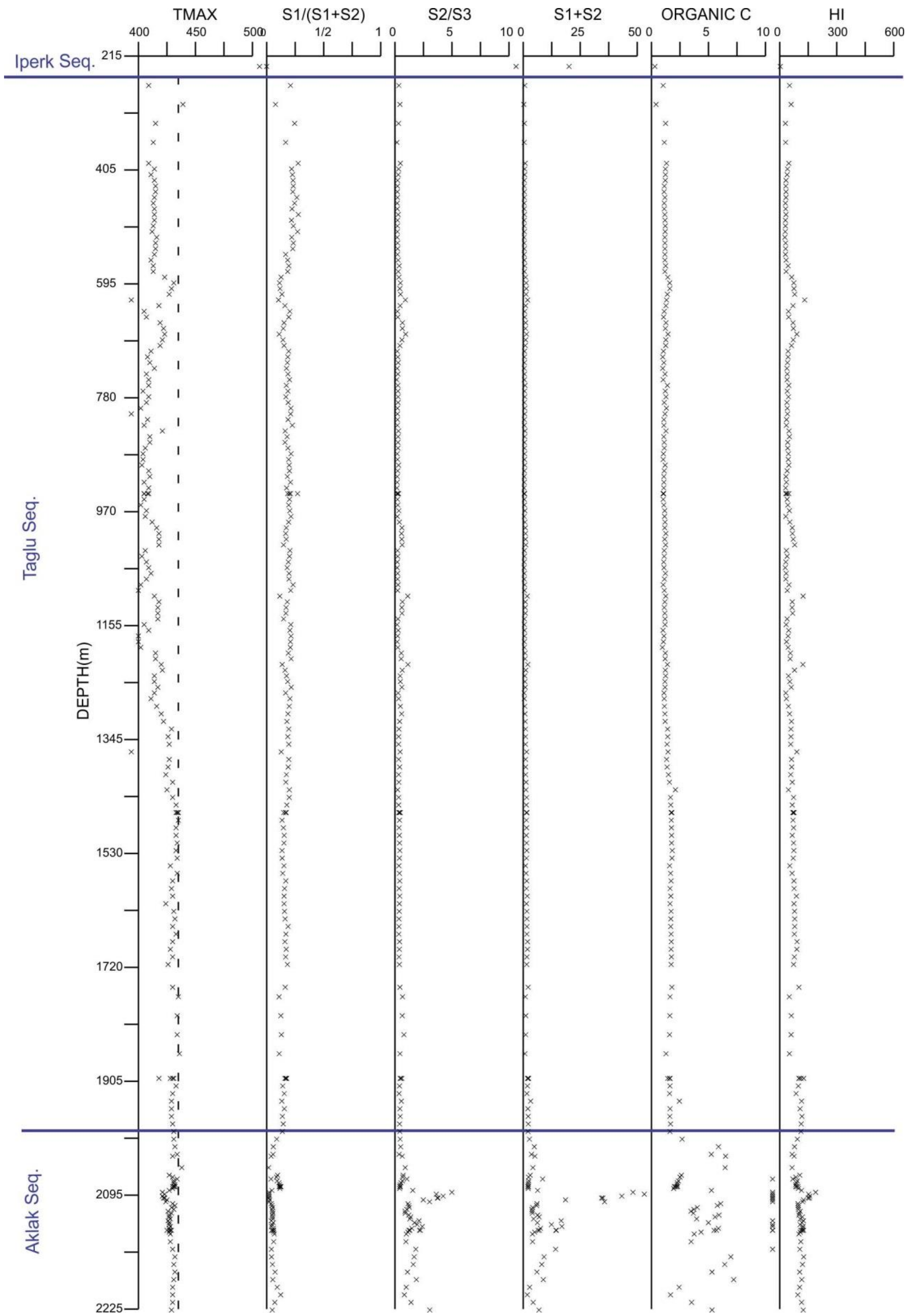


Figure 3: Selected Rock-Eval 6 pyrolysis parameters with depth for 195 washed oil and gas well cuttings samples from Natsek E-56.

3.1 Total Organic Carbon (TOC), free (S1) and residual (S2) hydrocarbons

The 195 samples have minimum and maximum TOC values of 0.38% and 34.02% respectively, with a median of 1.4%; minimum and maximum S1 values of 0.02 and 1.13 mg HC/g rock, with a median of 0.2 mg HC/g rock; and minimum and maximum S2 values of 0.13 mg HC/g and 51.64 mg HC/g rock, with a median of 0.9 mg HC/g rock (for standard deviation and average see Table 2; Figure 3; Appendix 1). The highest TOC, S1 and S2 values are found below ~2030 m in the Aklak sequence. The values observed indicate that the samples collected from the Natsek E-56 well could potentially qualify as either poor or fair for petroleum source rock based on the criteria of Peters (1986) and Peters and Cassa (1994) (Table 4).

Table 4: Generative potential (quantity) of immature source rock from Peters (1986).

Potential (quantity)	TOC (wt.%)	S1 (mg/g rock)	S2 (mg/g rock)
Poor	<0.5	<0.5	<2.5
Fair	0.5-1	0.5-1	2.5-5
Good	1-2	1-2	5-10
Very Good	2-4	2-4	10-20
Excellent	>4	>4	>20

3.2 Temperature at S2 peak (T_{max}) and Production Index (PI)

Temperature at S2 peak (Tmax) and Production Index (PI) petroleum generation requires Tmax values of at least 435°C and up to 445°C, depending upon the kerogen type (Peters, 1986; Peters and Cassa, 1994). Samples with an S2<0.2 mg HC/g rock are considered to produce unreliable Tmax values. However, in the study of Dewing and Sanei (2009), the Tmax of samples with S2< 0.35 were excluded from consideration as valid thermal maturity points. Using both as guidelines, 194 out of 195 samples contain S2>0.2 mg HC/g rock (samples with S2<0.2 mg HC/g rock are highlighted in grey in Appendix 1) and 186 out of 195 samples contain S2≥0.35 mg HC/g rock (samples with S2<0.35 mg HC/g rock are highlighted in blue in Appendix 1) (Figure 3); therefore, based on these criteria the Tmax values from the majority of samples are reliable and can be used in evaluating thermal maturity.

The Tmax values of the 194 out of 195 samples, with S2>0.2 mg HC/g rock, range from 395°C to 439°C, with a median of 422.0°C; the Tmax values of the 186 out of 195 samples, with S2≥0.35 mg HC/g rock, also range from 395°C to 438°C, with a median of 422.0°C, among which three samples contain values of 435°C (samples 1439 and 1723) and 438°C (1814), which are within the petroleum generation window according to Peters (1986) (Figure 3; Appendix 1).

From the pyrograms of the 195 samples (Appendix 2), all samples except for 26 (Natsek-850, 1050, 1260 through 1860, 2040, 3420, 3480, 6200) have relatively sharp and clean S2 peaks as noted by Peters (1986) multi-modal peaks may be caused by contamination (natural or drilling related). Among the 170 “valid” samples, the Tmax ranges and median remained the same as was produced using the entire data set (Table 2). Therefore, the majority of Natsek E-56 samples (except for samples 1439, 1723 and 1814 which have Tmax values above 435°C) (Figure 3; Appendix 1) remain outside the window for petroleum generation (between 435°C to 445°C is required for early generation; Peters, 1986). However, this is slightly inconsistent with the PI values (Figure 4), another parameter indicating the amount of in-situ hydrocarbon generation and describing level of thermal maturation. A PI value range of 0.1-0.15 is considered to be the minimum value to indicate early oil generation and a range of 0.25-0.40 for peak generation (Table 4) (Peters, 1986; Peters and Cassa, 1994). The PI values for the 195 samples range from a minimum of 0.02 to a maximum of 0.28 (Figure 4; Appendix 2), with an average of 0.1 and median of 0.2. Even after using S2 shape for individual sample pyrograms as an indicator of contamination and filtering of data, the PI values among the 170 "valid" samples remained the same as was produced using the entire data set (Table 2). If based on the PI values alone, the majority of samples would be considered within the window for petroleum generation; however, based on the low Tmax values these PI values are likely related to contamination (Figure 2; Table 2; Appendix 2)(see discussion below).

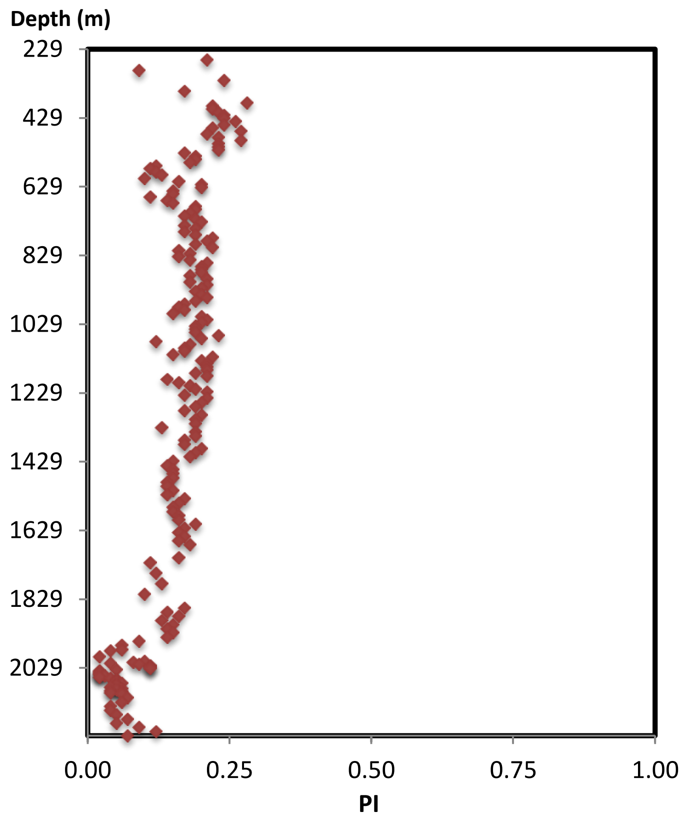


Figure 4: Graph of the production index vs. depth for the Natsek E-56 well.

3.3 Hydrogen Index (HI), ratio of S2 to S3 (S2/S3) and kerogen type

HI and S2/S3 are used to determine the organic matter type. HI > 600 and S2/S3 >15 are assigned to Type I kerogen; HI = 300–600 and S2/S3 = 10–15 to Type II kerogen; HI = 200–300 and S2/S3 = 5–10 to Type II/III kerogen; and HI = 50–200 and S2/S3 = 1–5 to Type III kerogen (Peters, 1986; Peters and Cassa, 1994). The HI values of the 195 samples range between a minimum of 27 and a maximum of 189, with a median of 65.0, and the S2/S3 values range from a minimum of 0.16 to a maximum of 4.99, with a median of 0.4. Based on this, and the van Krevelen diagram (Figure 5), the samples contain Type III kerogen (see discussion below).

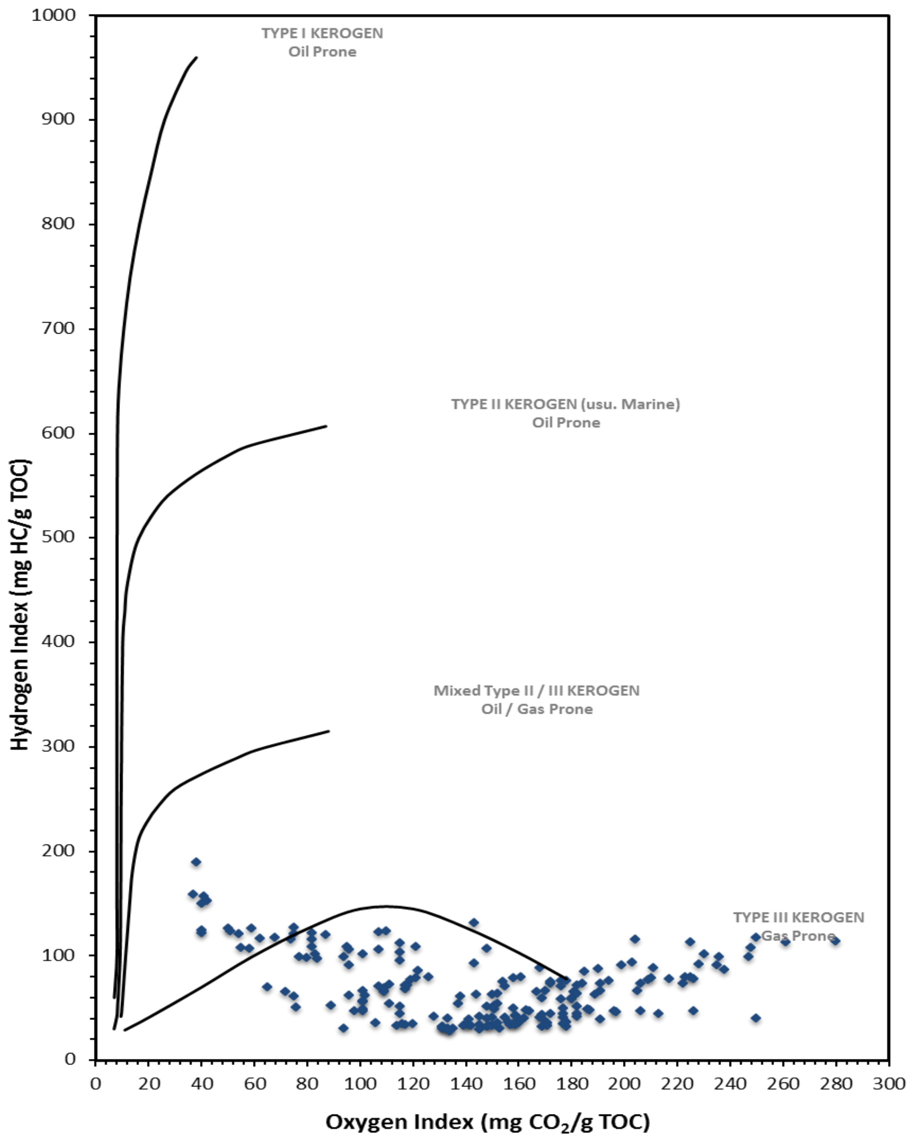


Figure 5: van Krevelen diagram showing relationships between Hydrogen and Oxygen indices of all 195 samples from the Natsek E-56 well.

3.4 Oxygen Index (OI)

The Oxygen Index (Figure 6) contains a wide range of values, from 37 to 280, with a median of 148.5. The lowest Oxygen Index values are observed at depth in the Natsek E-56 well (between ~ 1951-2225 m) where TOC is the highest (Figure 3 & 6).

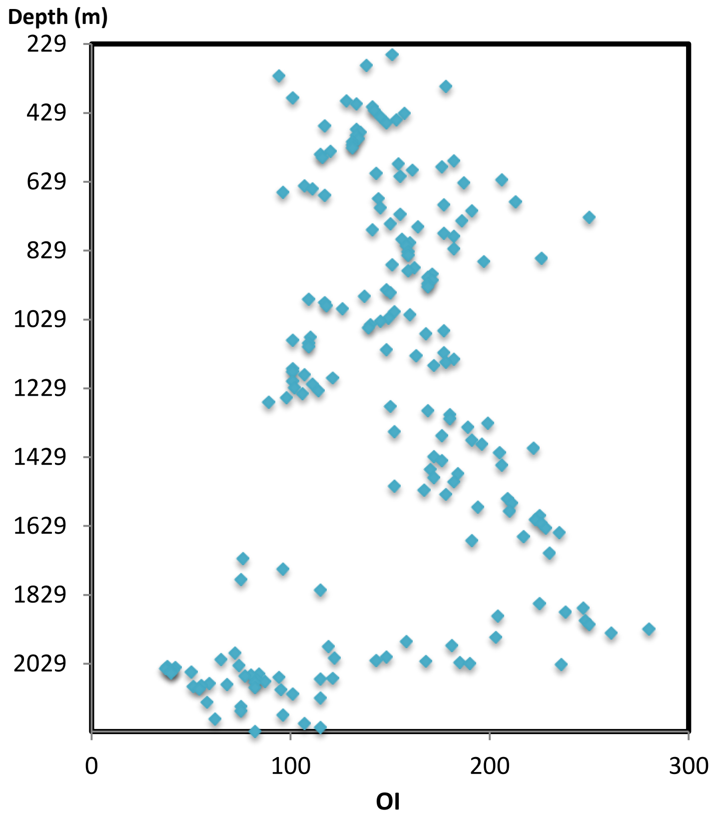


Figure 6: Graph of the Oxygen Index vs. depth for the Natsek E-56 well.

4. Discussion

Rock-Eval results indicate that the samples from the Taglu and Aklak sequences, at the Natsek E-56 location, contain a mixture of poor to fair petroleum source rocks with immature to, at best, early mature Type III/IV kerogen (Figure 5), which has a potential to generate gas. The poor quality of the organic matter is indicated by the low Hydrogen Index (HI) values, which are < 200 mgHc/g TOC (Appendix 1) for all of the samples analyzed (Figure 3).

Tmax values are widely scattered, ranging from 395-431°C between 229 m to approximately 1366 m depth. No trend of increasing Tmax values with increasing depth is apparent (Figure 3; Appendix 1). The FID pyrograms for samples from this well interval exhibit relatively large S1 peaks and most of the associated S2 peaks have a slight to prominent low temperature shoulder (Appendix 2), indicative of heavy or residual bitumen. The PI data which ranges from a minimum of 0.02 to a maximum of 0.28 (Figure 4; Appendix 1), with a median of 0.2, also suggests heavy or residual bitumen in the samples. As the samples contain immature Type III/IV kerogen (Figure 7), there should be no indigenous hydrocarbons present in the samples (Figure 8). There are two possible causes for what appear to be anomalous S1 and S2 values. Either the samples are stained by migrated hydrocarbons, or what is considered to be more likely in this case, they are contaminated by organic drilling mud additives (Figure 7). Peter (1986) indicated that oil-based mud contamination or migrated oil is likely where PI or S_1/TOC is greater than 0.2 or 0.3.

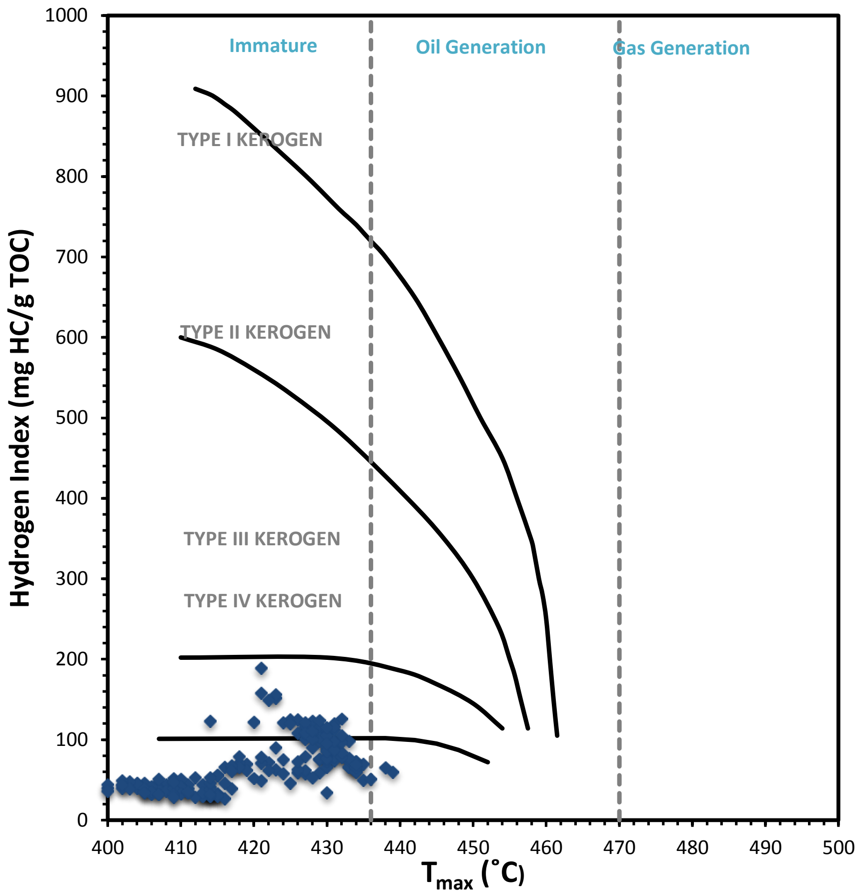


Figure 7: Graph showing kerogen type and maturity in the Natsek E-56 well.

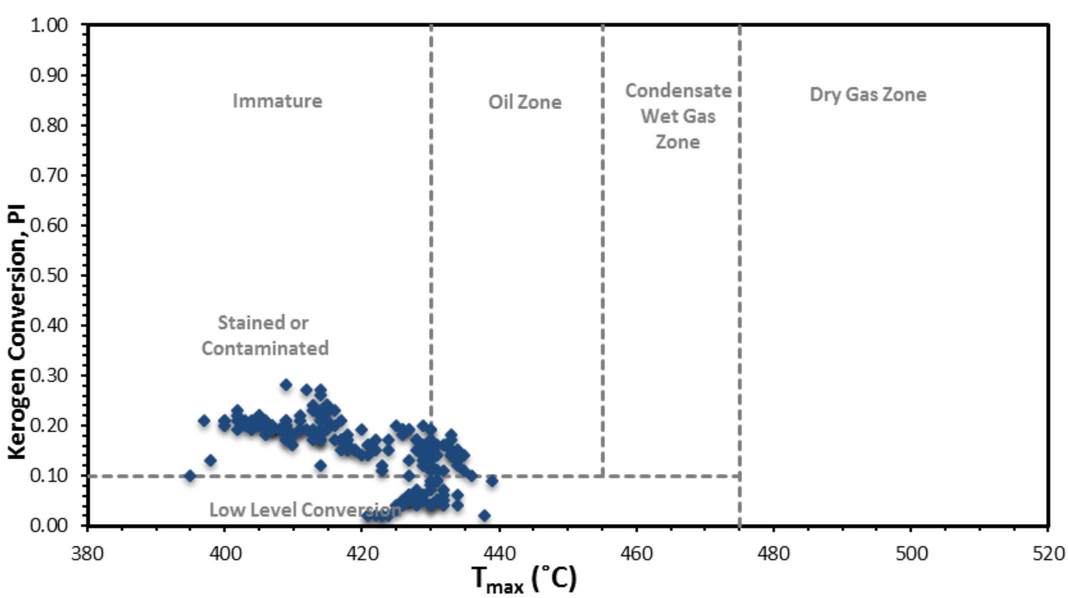


Figure 8: Graph showing kerogen conservation and maturity in the Natsek E-56 well.

Below approximately 1378 m in the Natsek E-56 well the Tmax values are more consistant (Figure 3; Appendix 1), ranging from 421-436°C, with most of the samples having Tmax values in the 425-435°C range, producing an average of 429°C. Although TOC, S1 and S2 values suggest poor to fair petroleum source rocks, based on the range of Tmax values the level of thermal maturity is estimated to correspond to between 0.49-0.67 % Ro equiv which indicates the majority of samples in the Natsek E-56 well are thermally immature for hydrocarbon production (Figure 9).

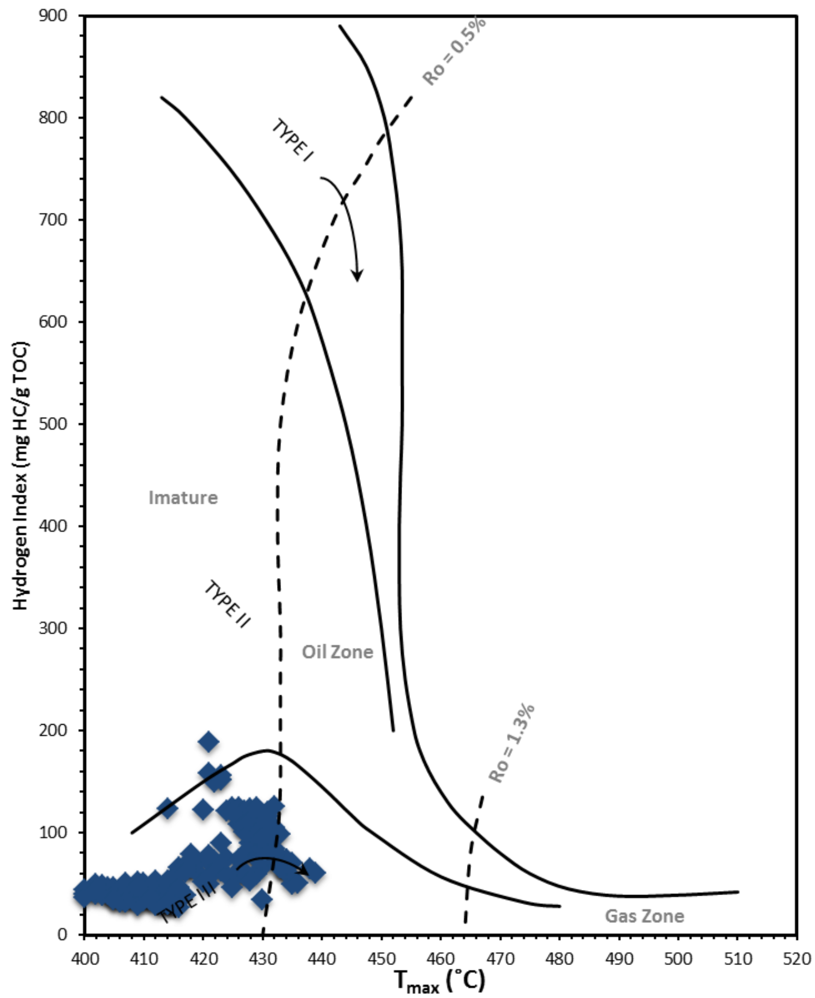


Figure 9: Graph of kerogen type, maturity and % Ro in the Natsek E-56 well.

Below about 2030 m, in the Aklak sequence of the Natsek E-56 well there is a dramatic increase in the TOC content of several samples (Figure 3; Appendix 1). This suggests that the Aklak sequence contains some carbonaceous mudrock. The TOC increase corresponds to decreases in OI values indicating increased productivity during this interval. This sequence was deposited during the Paleocene – Eocene Thermal Maximum and may represent shallow marine to terrestrial environmental conditions.

Some of the high TOC content samples (eg. 2037-2101 m) also have anomalously high S2 values ranging from 11.83-51.64 mgHc/g rock. Selected organic-rich (potentially coaly) samples will be examined by Reflected UV Light Microscopy to determine the type of organic material responsible for generating the high S2 values. Although samples from the 2037-2101 m depth interval in Natsek E-56 have high TOC and S2 values, they still have low Hydrogen Index (HI) values of < 200 mgHc/g TOC (Appendix 1), indicating no significant oil-generating potential.

5. Conclusions

A multi-disciplinary study of petroleum systems of the Beaufort-Mackenzie Basin is being carried out by the Geological Survey of Canada (Calgary) under the Geo-Mapping for Energy and Minerals (GEM) Program, Western Arctic Project. As part of that project the Natsek E-56 well from the Beaufort-Mackenzie Basin was selected for detailed paleoenvironmental, paleotemperature and paleosalinity interpretations. High total organic carbon, S1 and S2 values were observed in the lower part for the core (below ~2030 m), the values observed technically qualify as either poor or fair for petroleum source rock and suggest that the Aklak Sequence contains some carbonaceous mudrock. However, overall, Rock-Eval 6 pyrolysis results indicate that the samples from the Taglu and Aklak sequences, at the Natsek E-56 location, contain a mixture of immature to at best, early mature Type III/IV kerogen but the low Tmax values therefore suggest no hydrocarbon potential for the sedimentary sequences. A detailed organic geochemical investigation is to be pursued on the cuttings samples for oil-source correlation purpose.

6. References

Behar, F., Beaumont, V., De B. Penteado, H.L. 2001. Rock-Eval 6 technology: performances and developments. Oil and Gas Science and technology – Rev. IFP, v. 56, no. 2, p. 111–134.

Dewing, K., and Sanei, H. 2009. Analysis of large thermal maturity datasets: Examples for the Canadian Arctic Islands. International Journal of Coal Geology, 77: 436-448.

Dietrich, J., Dixon, J., McNeil, D.H., McIntyre, D.J., Snowdon, L.R., Cameron, A.R. 1989. The geology, biostratigraphy and organic geochemistry of the Natsek E-56 and Edlok N-56 wells, western Beaufort Sea. Geological Survey of Canada, 89-1G, p. 133-157.

Dixon, J., Dietrich, J.R., McNeil, D.H. 1992. Upper Cretaceous to Pleistocene sequence stratigraphy of the Beaufort-MacKenzie and Banks Island areas, Northwest Canada. Geological Survey of Canada, Bulletin 407.

Espitalié, J., Madec, M., Tissot, B., Mennig, J.J., Leplat, P. 1977. Source rock characterization method for petroleum exploration. Proceedings of the 9th Annual Offshore Technology Conference, v. 3, p. 439-448.

Espitalié, J., Madec, M., Tissot, B. 1980. Role of mineral matrix in kerogen pyrolysis: influence on petroleum generation and migration. American Association of Petroleum Geologists Bulletin, v. 64, no. 1, p. 59-66.

Lafargue, E., Marquis, F., Pillot, D. 1998. Rock-Eval 6 Applications in Hydrocarbon Exploration, Production and Soil Contamination Studies. Oil & Gas Science and Technology – Revue de l'Institut Français du Pétrole, v. 53, no. 4, p. 421-437.

Obermajer, M., Stewart, K. R., Dewing, K. 2007. Geological and Geochemical Data from the Canadian Arctic Islands, Part II: Rock-Eval/TOC Data. Geological Survey of Canada, Open File 5459, 27 (+ fig.) p. (CD-ROM).

Peters, K.E. 1986. Guidelines for evaluating petroleum source rock using programmed pyrolysis. American Association of Petroleum Geologists Bulletin, v. 70, no. 3, p. 318-329.

Peters, K.E., and Cassa, M.R. 1994. Applied source rock geochemistry. In: The petroleum system – from source to trap. L.B. Magoon and W.G. Dow (eds.). American Association of Petroleum Geologists, Memoir 60, p. 93–120.

Riediger, C., Carrelli, G.G., Zonneveld, J.-P. 2004. Hydrocarbon source rock characterization and thermal maturity of the Upper Triassic Baldonnel and Pardonet sequences, northeastern British Columbia, Canada. Bulletin of Canadian Petroleum Geology, v. 52, no. 4, p. 277-301.

Tissot, B.P., Durand, J., Espitalie, J., Combaz, A. 1974. Influence of nature and diagenesis of organic matter in formation of petroleum. AAPG Bulletin, 58, p. 499-506.

7. Appendices

Appendix 1: Rock-Eval/TOC results for the cuttings from the Natsek E-56 well, Beaufort-Mackenzie Basin. Samples with S2<0.2 mg HC/g rock is highlighted in grey and samples with S2<0.35 mg HC/g rock are highlighted in blue.

Depth m	Depth ft	S1	S2	PI	S3	Tmax	S3CO	PC(%)	TOC	RC%	HI	OICO	OI	MINC%
229	750	0.02	0.13	0.13	0.60	430	0.06	0.04	0.38	0.34	34	16	158	1.1
259	850	0.14	0.53	0.21	1.54	409	0.81	0.15	1.02	0.87	52	79	151	0.2
290	950	0.02	0.24	0.09	0.55	439	0.02	0.04	0.40	0.36	60	5	138	4.2
320	1050	0.12	0.37	0.24	1.17	415	0.30	0.11	1.24	1.13	30	24	94	0.2
351	1150	0.07	0.35	0.17	2.01	413	0.60	0.13	1.13	1.00	31	53	178	0.4
384	1260	0.24	0.63	0.28	1.33	409	0.75	0.16	1.32	1.16	48	57	101	0.2
393	1290	0.14	0.50	0.22	1.56	414	0.66	0.14	1.22	1.08	41	54	128	0.2
402	1320	0.14	0.48	0.22	1.64	411	0.71	0.15	1.23	1.08	39	58	133	0.2
412	1350	0.12	0.40	0.23	1.71	414	0.29	0.12	1.21	1.09	33	24	141	0.2
421	1380	0.11	0.36	0.24	1.61	415	0.27	0.11	1.13	1.02	32	24	142	0.3
430	1410	0.11	0.37	0.24	1.74	415	0.62	0.13	1.11	0.98	33	56	157	0.2
439	1440	0.14	0.39	0.26	1.71	414	0.65	0.13	1.18	1.05	33	55	145	0.2
448	1470	0.11	0.34	0.24	1.71	413	0.64	0.12	1.12	1.00	30	57	153	0.2
457	1500	0.10	0.35	0.22	1.66	414	0.65	0.13	1.12	0.99	31	58	148	0.2
466	1530	0.15	0.39	0.27	1.37	414	0.69	0.13	1.17	1.04	33	59	117	0.2
476	1560	0.10	0.36	0.21	1.58	414	0.29	0.12	1.19	1.07	30	24	133	0.3
485	1590	0.11	0.36	0.23	1.63	413	0.30	0.12	1.21	1.09	30	25	135	0.3
494	1620	0.13	0.35	0.27	1.60	412	0.31	0.12	1.20	1.08	29	26	133	0.3
503	1650	0.09	0.32	0.23	1.57	416	0.66	0.12	1.17	1.05	27	56	134	0.2
512	1680	0.11	0.36	0.23	1.54	415	0.67	0.12	1.18	1.06	31	57	131	0.2
521	1710	0.11	0.37	0.23	1.55	415	0.31	0.12	1.18	1.06	31	26	131	0.3
530	1740	0.07	0.35	0.17	1.54	414	0.68	0.12	1.18	1.06	30	58	131	0.3
540	1770	0.09	0.40	0.19	1.42	411	0.71	0.13	1.18	1.05	34	60	120	0.3
549	1800	0.13	0.54	0.19	1.43	413	0.72	0.14	1.24	1.10	44	58	115	0.3
558	1830	0.09	0.40	0.18	1.37	413	0.68	0.12	1.18	1.06	34	58	116	0.3
567	1860	0.13	0.90	0.12	2.60	423	0.24	0.19	1.43	1.24	63	17	182	0.7
576	1890	0.15	1.18	0.11	2.46	431	0.29	0.21	1.60	1.39	74	18	154	0.7
585	1920	0.16	1.21	0.12	2.84	429	0.37	0.23	1.61	1.38	75	23	176	0.7
595	1950	0.17	1.10	0.13	2.26	427	0.26	0.20	1.40	1.20	79	19	161	0.5
604	1980	0.20	1.73	0.10	1.89	395	0.29	0.25	1.32	1.07	131	22	143	0.4
613	2010	0.17	0.89	0.16	1.97	418	0.26	0.18	1.27	1.09	70	20	155	0.4
622	2040	0.13	0.51	0.20	2.31	405	0.36	0.17	1.12	0.95	46	32	206	0.3
631	2070	0.12	0.50	0.20	1.98	407	0.81	0.17	1.06	0.89	47	76	187	0.3
640	2100	0.16	0.89	0.15	1.36	419	0.21	0.16	1.27	1.11	70	17	107	0.3
649	2130	0.15	0.88	0.15	1.35	422	0.21	0.15	1.22	1.07	72	17	111	0.3
659	2160	0.16	1.30	0.11	1.39	423	0.52	0.20	1.45	1.25	90	36	96	0.2
668	2190	0.15	0.90	0.14	1.47	421	0.24	0.16	1.26	1.10	71	19	117	0.3
677	2220	0.14	0.78	0.15	1.80	419	0.19	0.16	1.25	1.09	62	15	144	0.4
686	2250	0.11	0.46	0.19	2.24	411	0.27	0.15	1.05	0.90	44	26	213	0.4
695	2280	0.10	0.44	0.19	1.75	408	0.23	0.14	0.99	0.85	44	23	177	0.4
704	2310	0.10	0.45	0.18	1.58	410	0.23	0.13	1.09	0.96	41	21	145	0.3

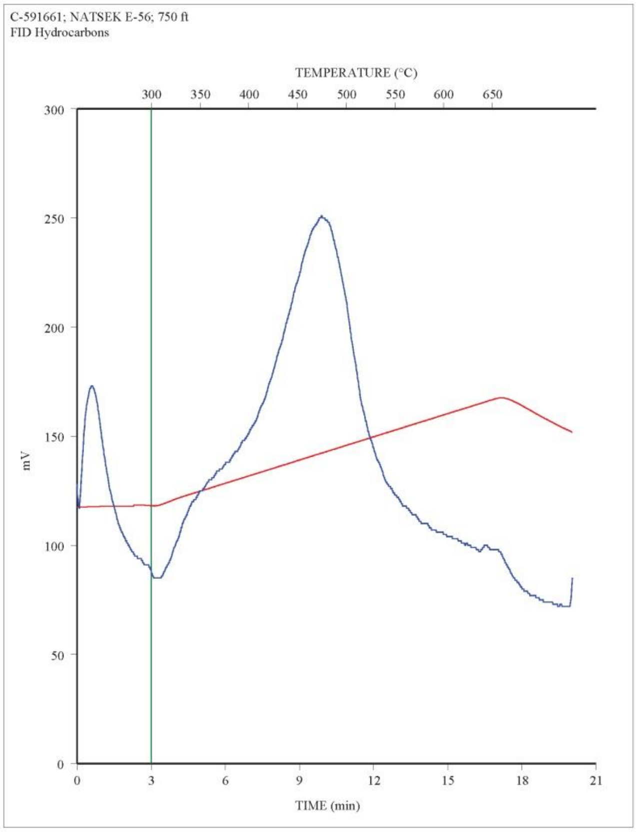
713	2340	0.08	0.38	0.17	1.89	414	0.24	0.13	0.99	0.86	38	24	191	0.5
723	2370	0.11	0.48	0.19	1.84	407	0.79	0.15	1.19	1.04	40	66	155	0.3
732	2400	0.10	0.40	0.20	2.58	409	0.65	0.16	1.03	0.87	39	63	250	0.4
741	2430	0.14	0.67	0.17	2.60	409	0.88	0.20	1.40	1.20	48	63	186	0.3
750	2460	0.11	0.48	0.19	1.82	404	0.70	0.15	1.21	1.06	40	58	150	0.2
759	2490	0.12	0.59	0.17	2.10	409	0.65	0.16	1.28	1.12	46	51	164	0.3
768	2520	0.10	0.43	0.19	1.58	407	0.27	0.13	1.12	0.99	38	24	141	0.3
777	2550	0.14	0.52	0.22	2.32	402	0.37	0.17	1.31	1.14	40	28	177	0.3
787	2580	0.13	0.49	0.21	2.17	397	0.38	0.15	1.19	1.04	41	32	182	0.3
796	2610	0.09	0.39	0.19	1.70	408	0.70	0.14	1.09	0.95	36	64	156	0.3
805	2640	0.11	0.38	0.22	1.74	405	0.69	0.14	1.09	0.95	35	63	160	0.3
814	2670	0.12	0.62	0.16	2.01	421	0.52	0.16	1.27	1.11	49	41	158	0.5
823	2700	0.12	0.55	0.18	1.97	410	0.80	0.17	1.08	0.91	51	74	182	0.4
832	2730	0.09	0.47	0.16	1.78	410	0.26	0.14	1.12	0.98	42	23	159	0.4
841	2760	0.11	0.48	0.18	1.80	406	0.81	0.16	1.13	0.97	42	72	159	0.3
851	2790	0.13	0.48	0.21	2.37	404	0.84	0.18	1.05	0.87	46	80	226	0.4
860	2820	0.11	0.46	0.20	2.03	404	0.82	0.17	1.03	0.86	45	80	197	0.3
869	2850	0.14	0.57	0.20	1.81	403	0.73	0.16	1.20	1.04	48	61	151	0.3
878	2880	0.11	0.44	0.20	1.81	409	0.78	0.15	1.12	0.97	39	70	162	0.3
887	2910	0.08	0.36	0.18	1.73	410	0.26	0.12	1.09	0.97	33	24	159	0.3
896	2940	0.10	0.38	0.21	1.86	405	0.30	0.13	1.09	0.96	35	28	171	0.3
905	2970	0.07	0.33	0.18	1.82	409	0.60	0.13	1.08	0.95	31	56	169	0.3
915	3000	0.09	0.34	0.21	1.81	409	0.56	0.12	1.06	0.94	32	53	171	0.4
924	3030	0.10	0.40	0.20	1.74	405	0.70	0.14	1.03	0.89	39	68	169	0.3
933	3060	0.11	0.46	0.19	1.82	402	0.28	0.14	1.08	0.94	43	26	169	0.4
942	3090	0.15	0.59	0.20	1.72	407	0.57	0.15	1.16	1.01	51	49	148	0.5
951	3120	0.10	0.37	0.21	1.73	406	0.62	0.13	1.15	1.02	32	54	150	0.3
960	3150	0.15	0.63	0.19	1.63	412	0.51	0.15	1.19	1.04	53	43	137	0.4
970	3180	0.16	0.77	0.17	1.26	416	0.23	0.14	1.16	1.02	66	20	109	0.3
979	3210	0.17	0.85	0.16	1.48	418	0.57	0.17	1.26	1.09	67	45	117	0.4
988	3240	0.17	0.82	0.17	1.37	418	0.22	0.15	1.16	1.01	71	19	118	0.5
997	3270	0.17	0.98	0.15	1.56	418	0.28	0.17	1.24	1.07	79	23	126	0.4
1006	3300	0.10	0.39	0.20	1.70	406	0.28	0.13	1.12	0.99	35	25	152	0.3
1015	3330	0.11	0.44	0.21	1.79	403	0.72	0.15	1.12	0.97	39	64	160	0.2
1024	3360	0.08	0.34	0.20	1.59	407	0.60	0.12	1.07	0.95	32	56	149	0.3
1034	3390	0.07	0.32	0.19	1.60	409	0.27	0.11	1.10	0.99	29	25	145	0.3
1043	3420	0.10	0.41	0.19	1.71	411	0.64	0.13	1.22	1.09	34	52	140	0.3
1052	3450	0.09	0.37	0.19	1.59	407	0.65	0.12	1.14	1.02	32	57	139	0.2
1061	3480	0.15	0.50	0.23	1.82	402	0.68	0.15	1.03	0.88	49	66	177	0.3
1070	3510	0.12	0.45	0.20	1.90	400	0.75	0.15	1.13	0.98	40	66	168	0.2
1079	3540	0.20	1.54	0.12	1.37	414	0.27	0.22	1.25	1.03	123	22	110	0.3
1088	3570	0.17	0.77	0.18	1.18	418	0.22	0.14	1.17	1.03	66	19	101	0.2
1098	3600	0.15	0.73	0.17	1.22	417	0.50	0.14	1.12	0.98	65	45	109	0.3
1107	3630	0.16	0.79	0.17	1.28	417	0.53	0.15	1.17	1.02	68	45	109	0.3
1116	3660	0.08	0.46	0.15	1.76	417	0.19	0.11	1.19	1.08	39	16	148	1.2
1125	3690	0.11	0.41	0.22	2.11	405	0.61	0.14	1.19	1.05	34	51	177	0.4
1134	3720	0.12	0.47	0.20	1.65	409	0.54	0.14	1.01	0.87	47	53	163	0.5
1143	3750	0.13	0.48	0.21	2.00	400	0.30	0.14	1.10	0.96	44	27	182	0.3
1152	3780	0.10	0.38	0.21	1.87	400	0.65	0.14	1.05	0.91	36	62	178	0.3

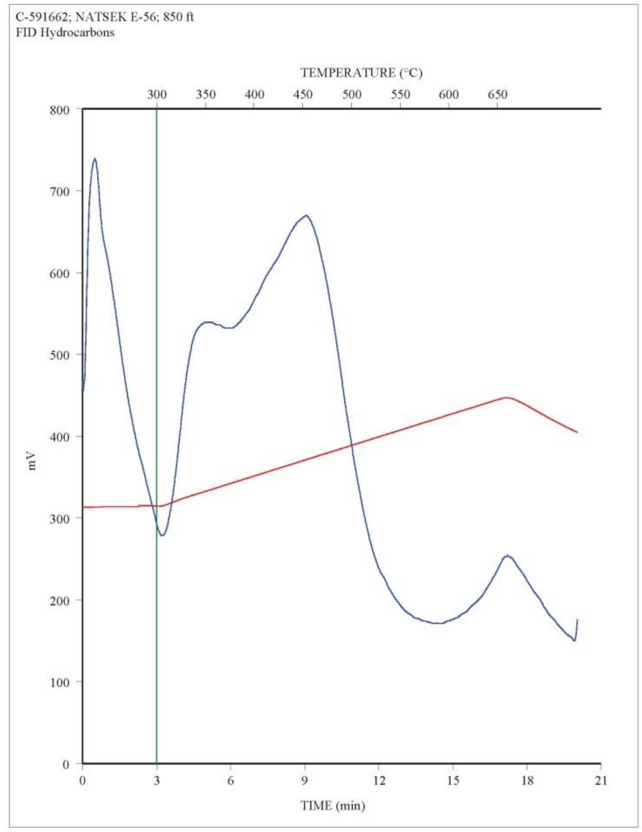
1162	3810	0.11	0.42	0.21	1.65	402	0.63	0.14	0.96	0.82	44	66	172	0.3
1171	3840	0.16	0.68	0.19	1.22	415	0.22	0.13	1.21	1.08	56	18	101	0.2
1180	3870	0.18	0.66	0.21	1.21	415	0.46	0.13	1.20	1.07	55	38	101	0.3
1189	3900	0.27	1.71	0.14	1.50	420	0.32	0.24	1.40	1.16	122	23	107	0.3
1198	3930	0.18	0.94	0.16	1.47	421	0.25	0.17	1.21	1.04	78	21	121	0.3
1207	3960	0.12	0.57	0.18	1.25	414	0.56	0.13	1.24	1.11	46	45	101	0.3
1216	3990	0.14	0.62	0.19	1.31	414	0.26	0.13	1.18	1.05	53	22	111	0.3
1226	4020	0.20	0.73	0.21	1.21	417	0.53	0.15	1.19	1.04	61	45	102	0.2
1235	4050	0.07	0.35	0.17	1.25	414	0.49	0.10	1.10	1.00	32	45	114	0.4
1244	4080	0.10	0.39	0.21	1.19	411	0.48	0.10	1.12	1.02	35	43	106	0.4
1256	4120	0.13	0.53	0.20	1.12	416	0.19	0.11	1.14	1.03	46	17	98	0.4
1268	4160	0.14	0.61	0.19	1.05	420	0.15	0.11	1.18	1.07	52	13	89	0.2
1280	4200	0.16	0.74	0.17	1.80	422	0.39	0.15	1.20	1.05	62	32	150	0.2
1293	4240	0.20	0.83	0.20	2.38	429	0.77	0.20	1.41	1.21	59	55	169	0.3
1305	4280	0.19	0.84	0.19	2.56	426	0.18	0.18	1.42	1.24	59	13	180	0.2
1317	4320	0.19	0.79	0.19	2.46	427	0.42	0.18	1.37	1.19	58	31	180	0.3
1329	4360	0.19	1.30	0.13	2.88	398	0.44	0.23	1.45	1.22	90	30	199	0.3
1341	4400	0.20	0.83	0.19	2.51	427	0.23	0.18	1.33	1.15	62	17	189	0.4
1354	4440	0.20	0.86	0.19	2.08	426	0.19	0.17	1.37	1.20	63	14	152	0.2
1366	4480	0.18	0.86	0.17	2.62	424	0.24	0.19	1.49	1.30	58	16	176	0.3
1378	4520	0.21	1.04	0.17	3.02	430	0.24	0.22	1.58	1.36	66	15	191	0.3
1390	4560	0.24	0.97	0.20	4.12	425	0.32	0.25	2.10	1.85	46	15	196	0.5
1402	4600	0.30	1.22	0.19	3.71	430	0.24	0.25	1.67	1.42	73	14	222	0.2
1415	4640	0.24	1.12	0.18	3.46	433	0.22	0.23	1.69	1.46	66	13	205	0.3
1427	4680	0.23	1.31	0.15	3.08	434	0.27	0.24	1.79	1.55	73	15	172	0.3
1439	4720	0.19	1.22	0.14	3.06	435	0.19	0.22	1.74	1.52	70	11	176	0.3
1451	4760	0.22	1.28	0.15	3.60	433	0.19	0.24	1.75	1.51	73	11	206	0.3
1463	4800	0.21	1.16	0.15	2.99	433	0.40	0.22	1.76	1.54	66	23	170	0.3
1476	4840	0.23	1.29	0.15	3.23	434	0.36	0.24	1.76	1.52	73	20	184	0.3
1488	4880	0.21	1.35	0.14	3.13	433	0.22	0.24	1.82	1.58	74	12	172	0.3
1500	4920	0.20	1.27	0.14	3.27	434	0.21	0.23	1.80	1.57	71	12	182	0.3
1512	4960	0.15	0.84	0.15	2.42	428	0.21	0.17	1.59	1.42	53	13	152	0.4
1524	5000	0.18	1.10	0.14	2.80	434	0.37	0.21	1.68	1.47	65	22	167	0.3
1537	5040	0.26	1.29	0.17	3.06	430	0.26	0.24	1.72	1.48	75	15	178	0.4
1549	5080	0.23	1.24	0.16	3.41	429	0.31	0.25	1.63	1.38	76	19	209	0.3
1561	5120	0.27	1.50	0.15	3.59	430	0.40	0.28	1.70	1.42	88	24	211	0.3
1573	5160	0.22	1.22	0.15	3.16	424	0.26	0.23	1.63	1.40	75	16	194	0.3
1585	5200	0.25	1.35	0.16	3.61	431	0.36	0.27	1.72	1.45	78	21	210	0.3
1598	5240	0.26	1.35	0.16	3.83	432	0.36	0.27	1.70	1.43	79	21	225	0.3
1610	5280	0.31	1.34	0.19	3.77	430	0.30	0.27	1.69	1.42	79	18	223	0.3
1622	5320	0.27	1.33	0.17	3.88	433	0.32	0.26	1.72	1.46	77	19	226	0.3
1634	5360	0.30	1.58	0.16	3.97	430	0.47	0.30	1.74	1.44	91	27	228	0.3
1646	5400	0.32	1.55	0.17	4.04	428	0.52	0.31	1.72	1.41	90	30	235	0.3
1659	5440	0.27	1.35	0.16	3.79	430	0.34	0.27	1.75	1.48	77	19	217	0.3
1671	5480	0.28	1.26	0.18	3.30	426	0.57	0.26	1.73	1.47	73	33	191	0.2
1707	5600	0.35	1.80	0.16	4.12	430	0.42	0.32	1.79	1.47	101	23	230	0.4
1723	5650	0.10	0.82	0.11	1.24	435	0.32	0.13	1.63	1.50	50	20	76	0.2
1753	5750	0.14	0.99	0.12	1.55	434	0.19	0.16	1.61	1.45	61	12	96	0.4
1784	5850	0.14	0.95	0.13	1.20	434	0.16	0.14	1.59	1.45	60	10	75	0.3

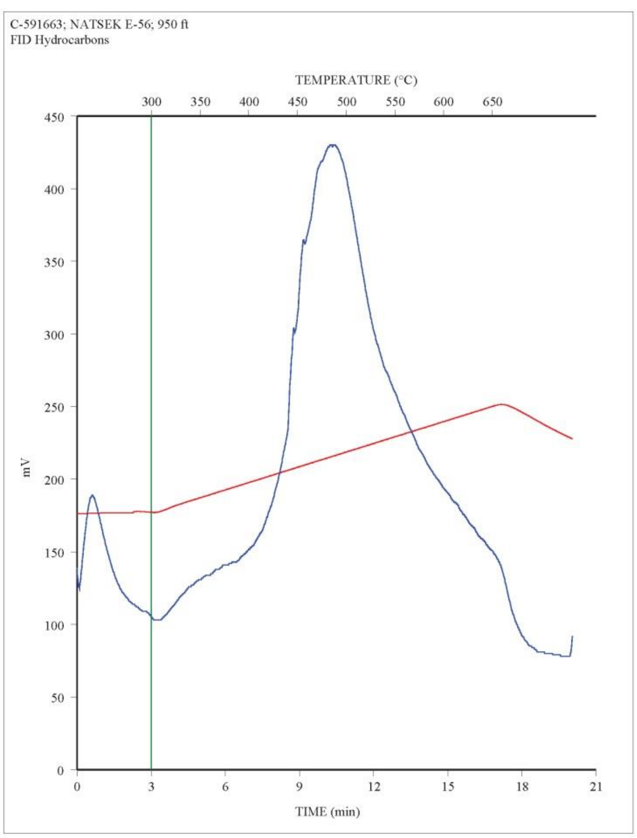
1814	5950	0.08	0.65	0.10	1.47	436	0.16	0.12	1.28	1.16	51	12	115	0.4
1854	6080	0.32	1.59	0.17	3.20	428	0.33	0.28	1.42	1.14	112	23	225	0.5
1866	6120	0.26	1.59	0.14	4.00	433	0.29	0.29	1.62	1.33	98	18	247	0.7
1878	6160	0.25	1.37	0.16	3.79	430	0.21	0.26	1.59	1.33	86	13	238	0.5
1890	6200	0.43	2.81	0.13	5.00	429	1.16	0.47	2.45	1.98	115	47	204	0.4
1902	6240	0.32	1.75	0.15	4.04	429	0.28	0.31	1.63	1.32	107	17	248	0.4
1915	6280	0.30	1.88	0.14	4.03	429	0.39	0.32	1.61	1.29	117	24	250	0.6
1927	6320	0.32	1.89	0.15	4.68	430	0.29	0.34	1.67	1.33	113	17	280	0.8
1939	6360	0.29	1.82	0.14	4.23	431	0.30	0.32	1.62	1.30	112	19	261	0.7
1951	6400	0.24	2.49	0.09	5.45	431	0.75	0.42	2.69	2.27	93	28	203	0.9
1963	6440	0.28	4.59	0.06	9.29	432	1.93	0.77	5.88	5.11	78	33	158	1.3
1976	6480	0.20	3.41	0.06	9.48	434	2.76	0.69	5.25	4.56	65	53	181	1.7
1979	6490	0.20	4.95	0.04	7.71	430	4.57	0.85	6.50	5.65	76	70	119	1.7
1997	6550	0.07	4.17	0.02	4.63	438	3.22	0.63	6.46	5.83	65	50	72	1.2
2009	6590	0.29	2.78	0.10	3.88	427	0.84	0.41	2.62	2.21	106	32	148	0.7
2012	6600	0.20	2.13	0.08	3.06	430	0.92	0.33	2.50	2.17	85	37	122	0.8
2015	6610	0.32	8.19	0.04	7.78	434	3.31	1.12	11.88	10.76	69	28	65	0.7
2018	6620	0.22	2.18	0.09	3.38	431	0.48	0.33	2.36	2.03	92	20	143	0.7
2021	6630	0.24	1.99	0.11	3.80	431	0.44	0.32	2.26	1.94	88	19	168	0.6
2024	6640	0.24	1.90	0.11	4.17	432	0.59	0.33	2.25	1.92	84	26	185	0.6
2027	6650	0.24	1.94	0.11	4.21	431	0.62	0.34	2.22	1.88	87	28	190	0.6
2030	6660	0.25	1.91	0.11	4.61	430	0.54	0.34	1.95	1.61	98	28	236	0.8
2034	6670	0.29	6.04	0.05	3.87	427	0.71	0.70	5.26	4.56	115	13	74	0.4
2037	6680	0.98	47.16	0.02	9.45	421	4.05	4.55	24.96	20.41	189	16	38	0.7
2040	6690	1.13	51.64	0.02	14.24	423	4.54	5.16	34.02	28.86	152	13	42	0.9
2043	6700	0.92	42.31	0.02	10.01	421	6.62	4.25	26.77	22.52	158	25	37	0.9
2046	6710	0.69	34.24	0.02	9.20	422	3.10	3.42	23.00	19.58	149	13	40	1.0
2049	6720	0.48	18.09	0.03	7.27	425	2.14	1.91	14.49	12.58	125	15	50	1.1
2052	6730	0.76	34.93	0.02	11.51	424	4.21	3.63	28.83	25.20	121	15	40	0.8
2055	6740	0.24	5.82	0.04	5.09	430	0.64	0.71	6.07	5.36	96	11	84	0.8
2058	6750	0.27	5.61	0.05	4.60	432	0.86	0.68	5.78	5.10	97	15	80	0.8
2061	6760	0.22	3.93	0.05	3.10	429	0.93	0.49	4.02	3.53	98	23	77	0.6
2064	6770	0.18	3.65	0.05	3.51	431	0.70	0.47	3.72	3.25	98	19	94	0.8
2067	6780	0.20	3.73	0.05	4.20	426	0.44	0.49	3.46	2.97	108	13	121	1.0
2070	6790	0.22	3.80	0.06	4.22	429	0.64	0.50	3.68	3.18	103	17	115	0.9
2073	6800	0.31	5.99	0.05	4.94	427	0.92	0.74	5.92	5.18	101	16	83	0.9
2076	6810	0.36	6.62	0.05	4.83	427	0.83	0.78	5.58	4.80	119	15	87	0.7
2079	6820	0.24	4.29	0.05	3.26	428	0.50	0.52	3.96	3.44	108	13	82	0.5
2082	6830	0.67	15.98	0.04	7.57	426	2.03	1.75	12.82	11.07	125	16	59	0.8
2085	6840	0.36	5.86	0.06	3.42	427	0.72	0.67	5.00	4.33	117	14	68	0.7
2088	6850	0.57	11.83	0.05	6.08	427	1.46	1.32	11.04	9.72	107	13	55	0.8
2091	6860	0.72	16.24	0.04	6.78	428	1.69	1.74	13.23	11.49	123	13	51	0.9
2095	6870	0.45	7.14	0.06	4.81	427	1.33	0.84	5.88	5.04	121	23	82	0.9
2098	6880	0.65	13.89	0.04	6.22	425	1.61	1.51	11.61	10.10	120	14	54	0.8
2101	6890	0.31	4.71	0.06	4.12	427	0.54	0.58	4.35	3.77	108	12	95	0.8
2104	6900	0.27	3.77	0.07	3.79	428	0.52	0.49	3.75	3.26	101	14	101	0.7
2116	6940	0.25	3.85	0.06	4.01	428	0.48	0.50	3.48	2.98	111	14	115	0.8
2128	6980	0.59	13.63	0.04	7.44	430	2.07	1.54	12.91	11.37	106	16	58	0.7
2140	7020	0.39	8.77	0.04	5.21	432	1.34	0.99	6.96	5.97	126	19	75	0.6

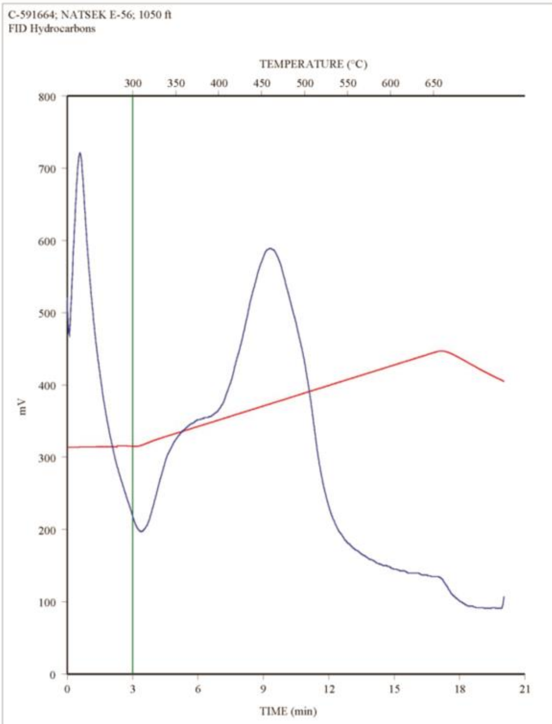
2152	7060	0.41	7.71	0.05	4.81	431	0.93	0.88	6.42	5.54	120	14	75	0.8
2165	7100	0.44	5.58	0.07	5.08	432	0.72	0.70	5.31	4.61	105	14	96	0.9
2177	7140	0.47	8.35	0.05	4.44	431	0.80	0.93	7.21	6.28	116	11	62	0.7
2189	7180	0.26	2.56	0.09	2.59	430	0.34	0.34	2.43	2.09	105	14	107	0.7
2201	7220	0.22	1.58	0.12	1.92	430	0.49	0.24	1.67	1.43	95	29	115	0.5
2213	7260	0.31	4.05	0.07	2.87	430	0.38	0.48	3.52	3.04	115	11	82	0.9
2226	7300	0.34	6.57	0.05	2.15	429	0.63	0.70	5.31	4.61	124	12	40	0.4

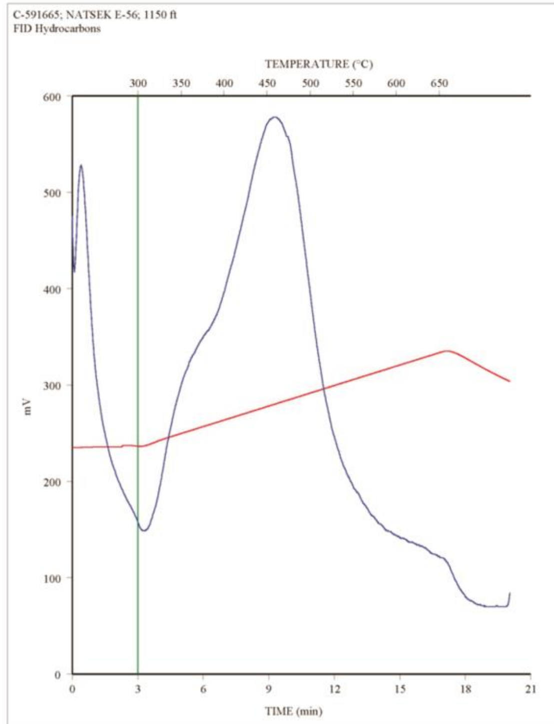
Appendix 2: Rock-Eval FID-pyrograms of S1 and S2 hydrocarbon peaks for cuttings samples from the Natsek E-56 well. Sample depths are indicated in feet, refer to Appendix 2 for corresponding depth in meters.

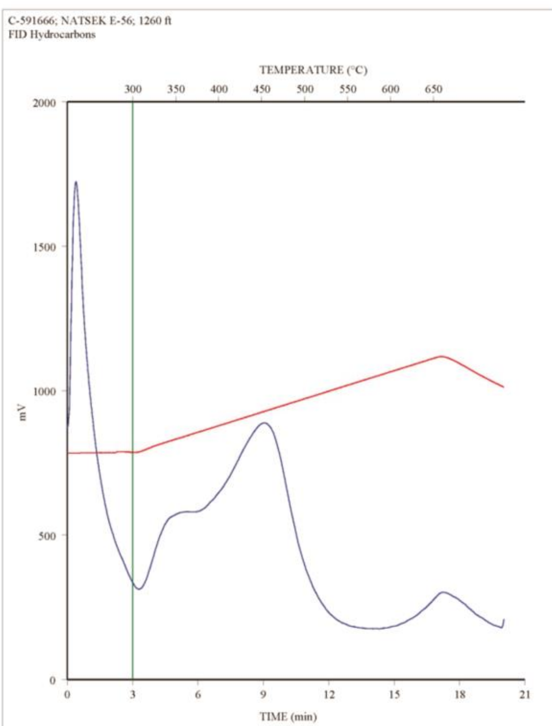


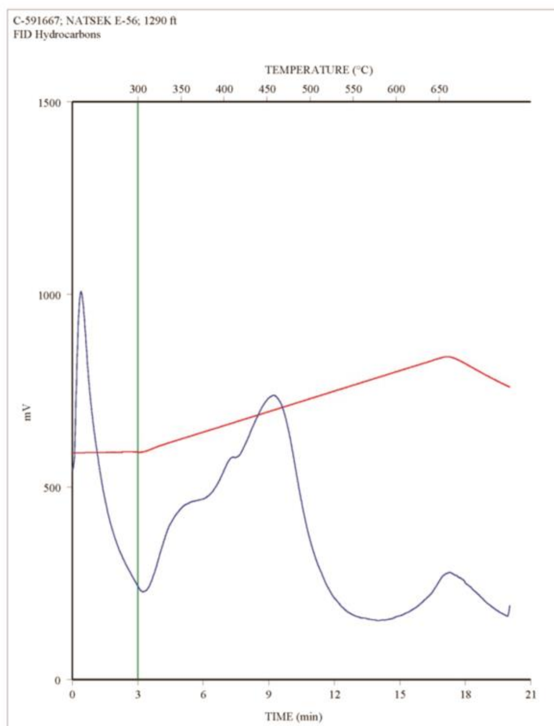


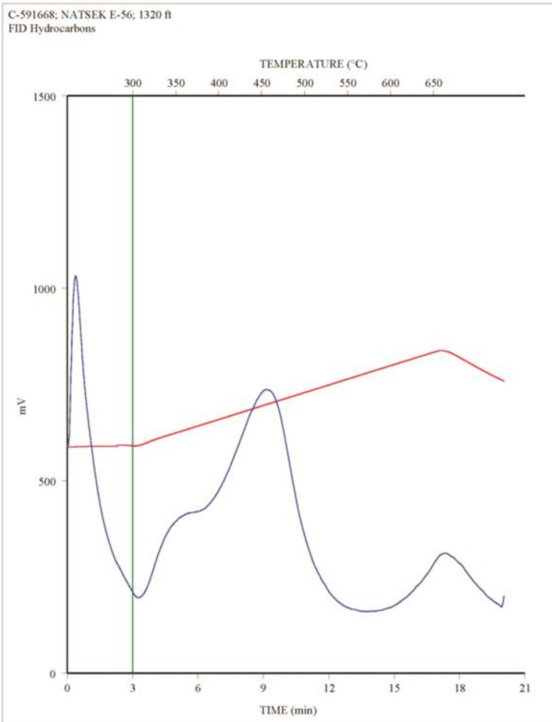


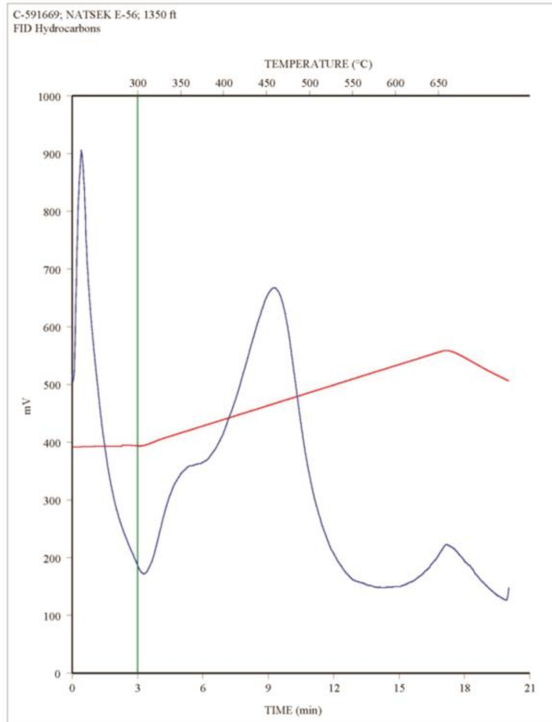

C-591664; NATSEK E-56; 1050 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 100 200 300 400 500 600 700 800
0 3 6 9 12 15 18 21
TIME (min)

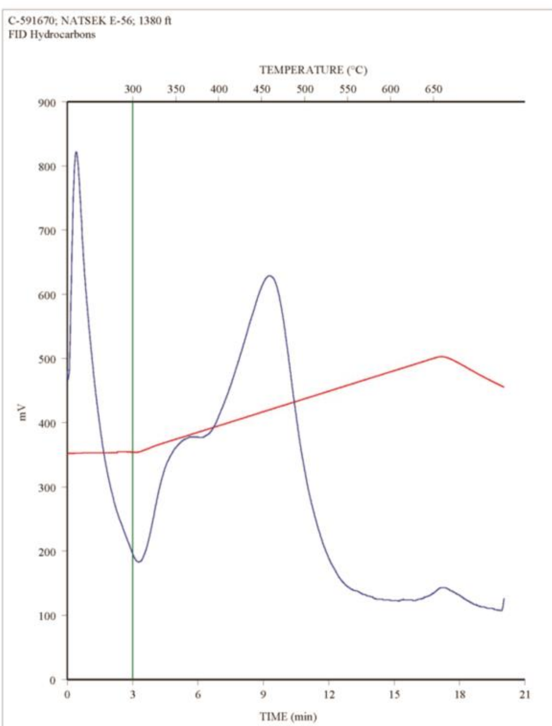

C-591665; NATSEK E-56; 1150 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 100 200 300 400 500 600
0 3 6 9 12 15 18 21
TIME (min)

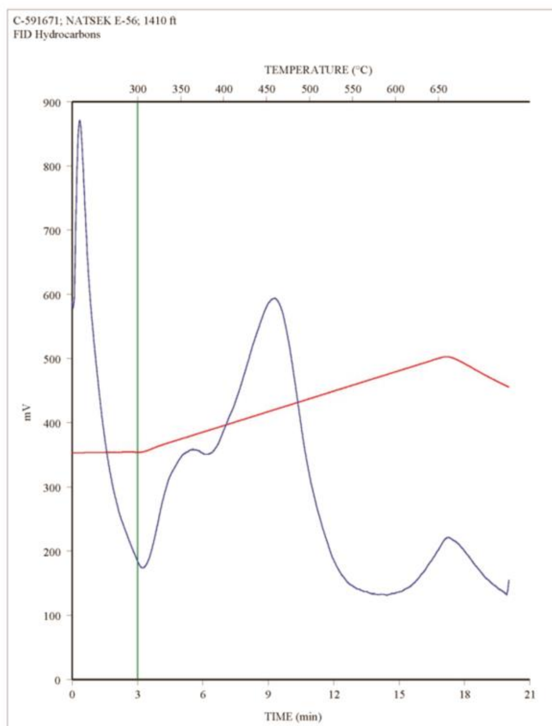

C-591666; NATSEK E-56; 1260 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000
0 3 6 9 12 15 18 21
TIME (min)

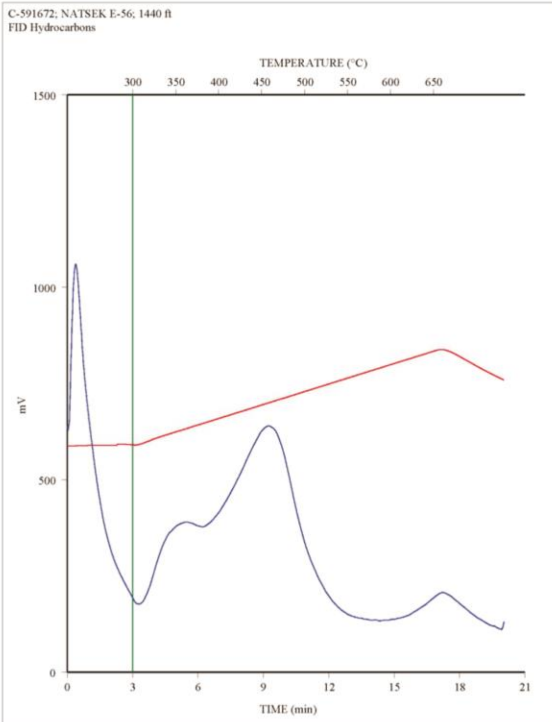

C-591667; NATSEK E-56; 1290 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500
0 3 6 9 12 15 18 21
TIME (min)

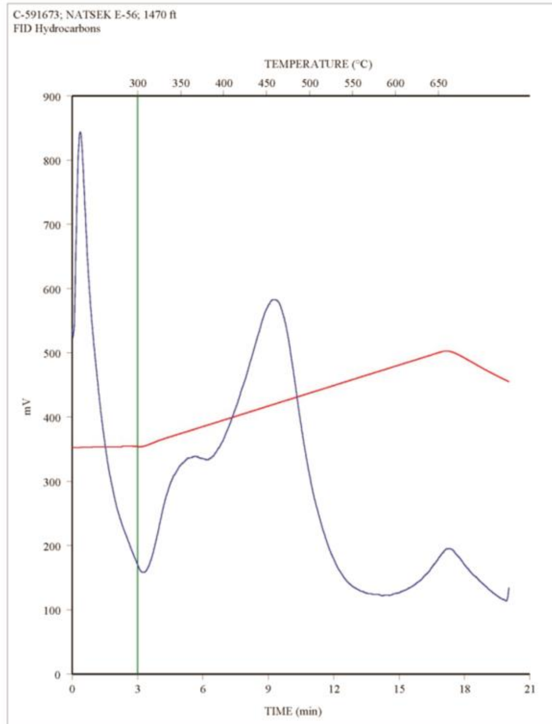

C-591668; NATSEK E-56; 1320 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

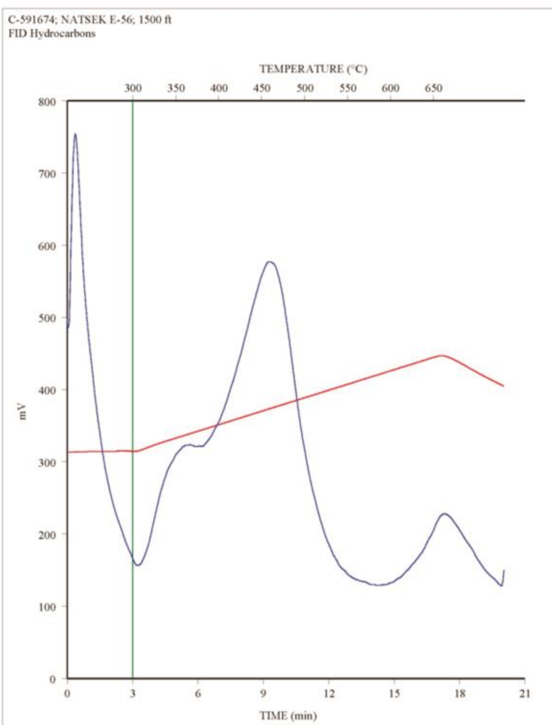

C-591669; NATSEK E-56; 1350 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

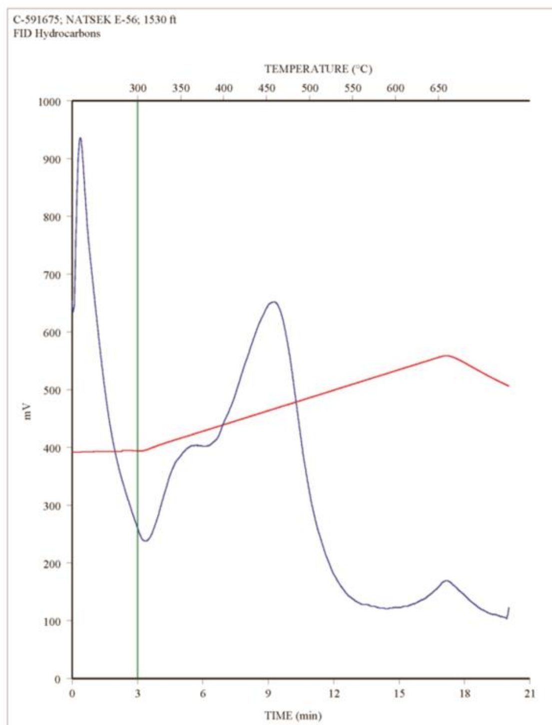

C-591670; NATSEK E-56; 1380 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

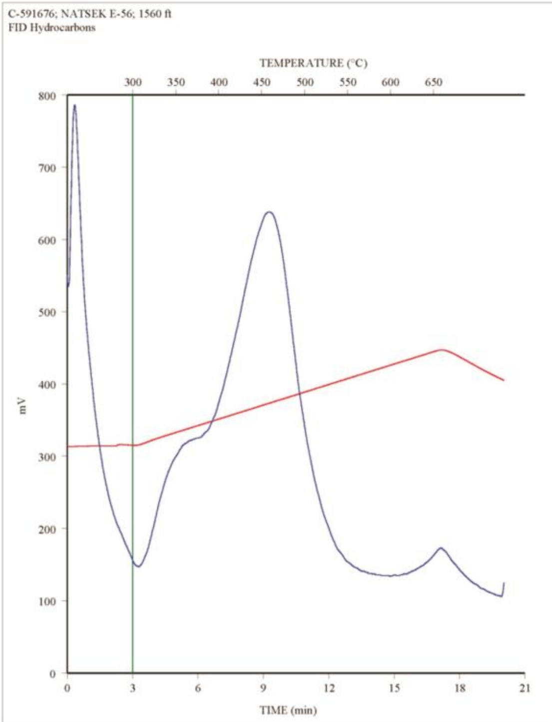

C-591671; NATSEK E-56; 1410 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

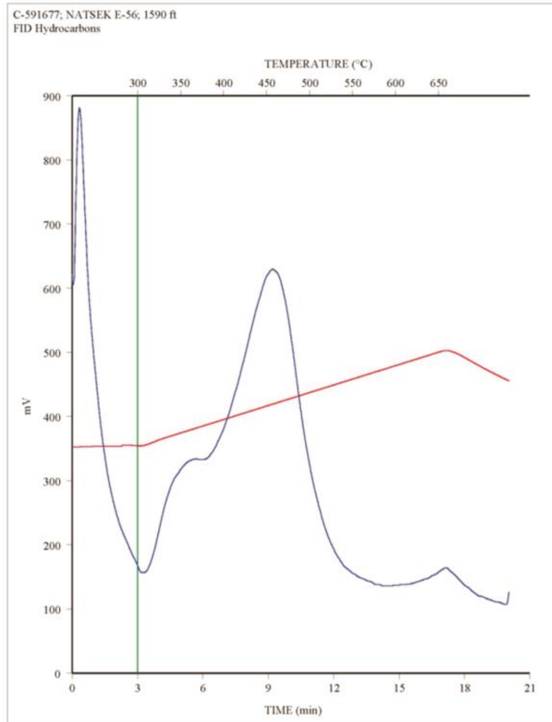

C-591672; NATSEK E-56; 1440 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

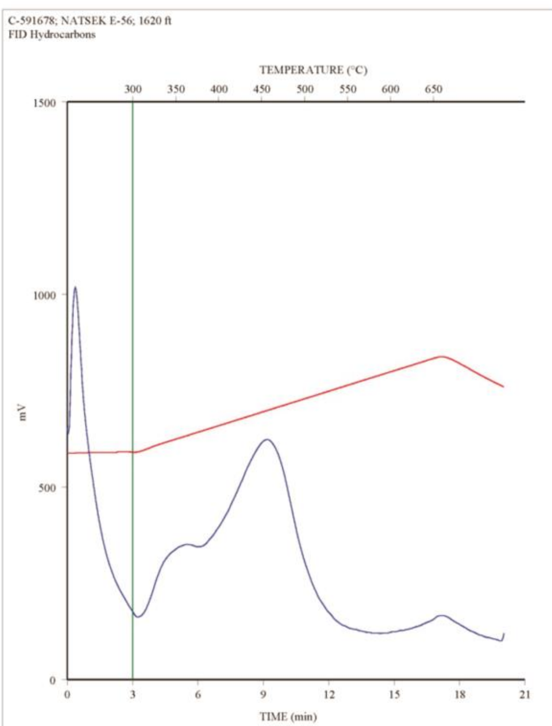

C-591673; NATSEK E-56; 1470 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
900
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

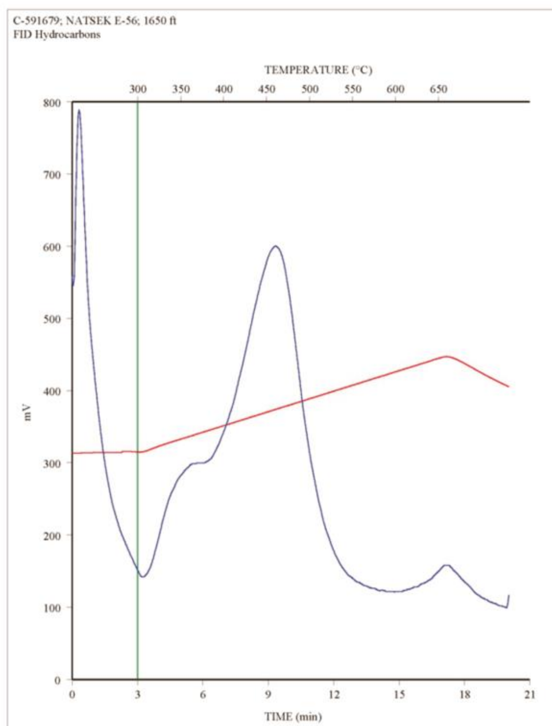

C-591674; NATSEK E-56; 1500 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

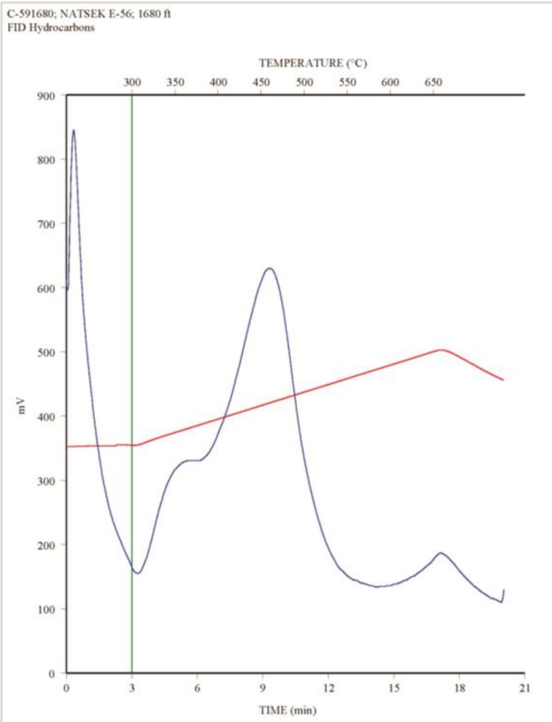

C-591675; NATSEK E-56; 1530 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1000
900
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

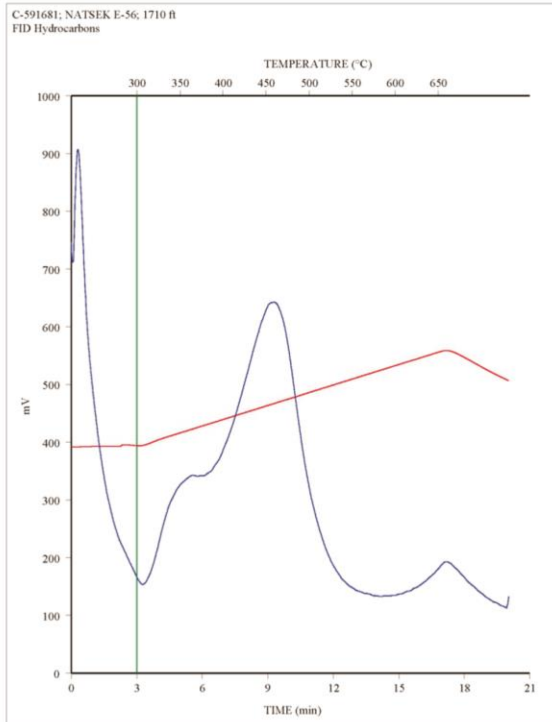

C-591676; NATSEK E-56; 1560 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

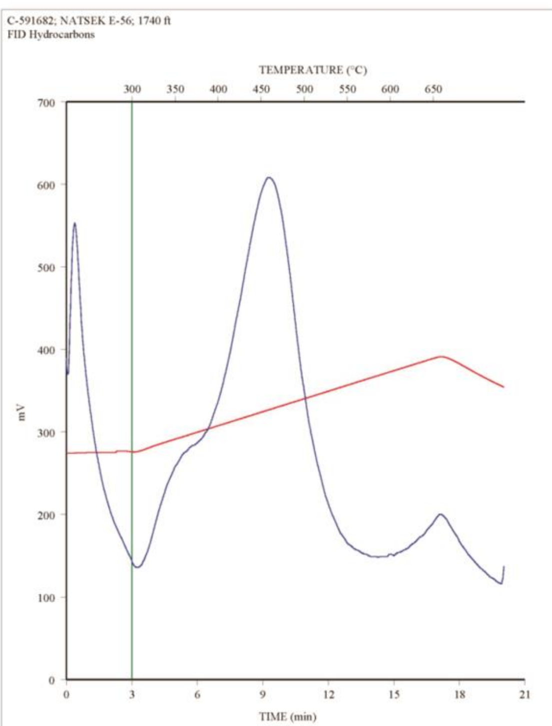

C-591677; NATSEK E-56; 1590 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

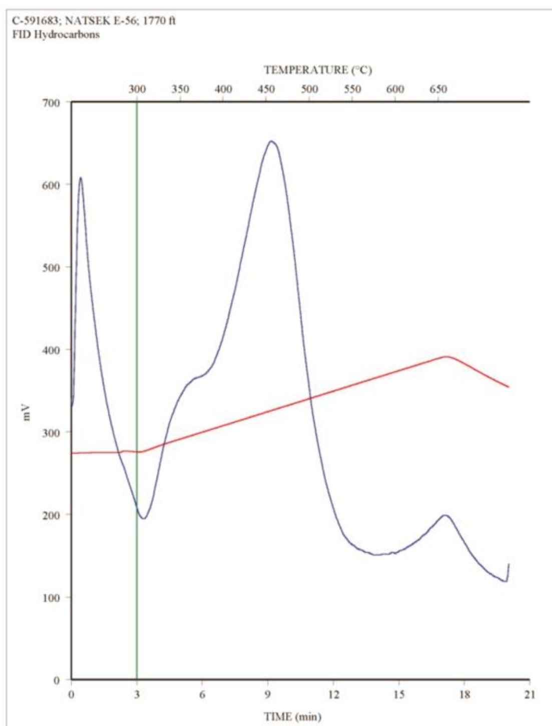

C-591678; NATSEK E-56; 1620 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

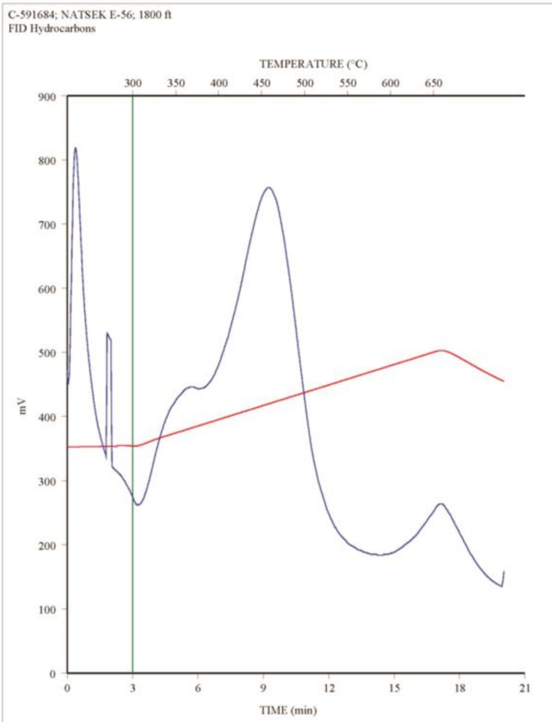

C-591679; NATSEK E-56; 1650 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

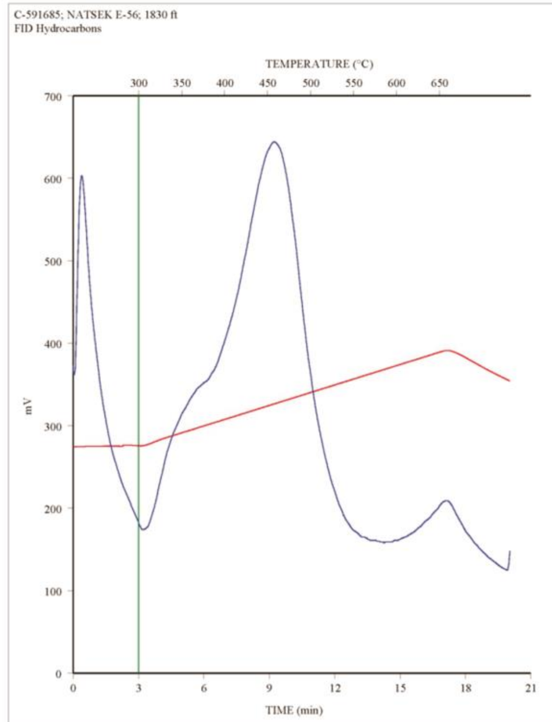

C-591680; NATSEK E-56; 1680 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

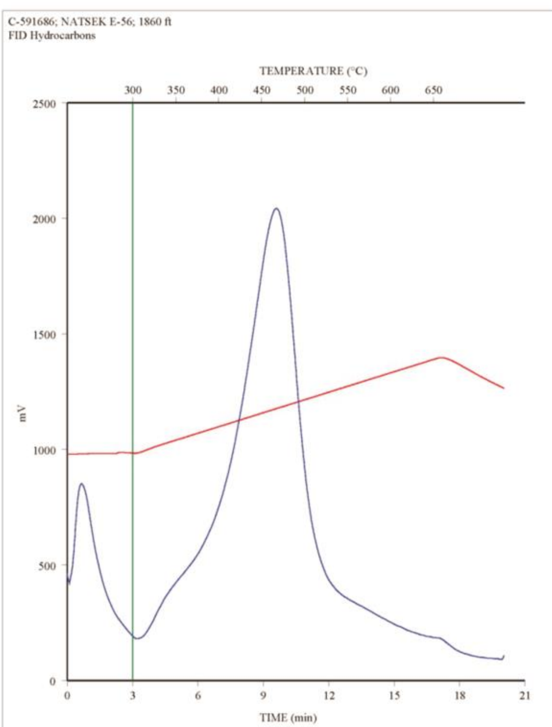

C-591681; NATSEK E-56; 1710 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

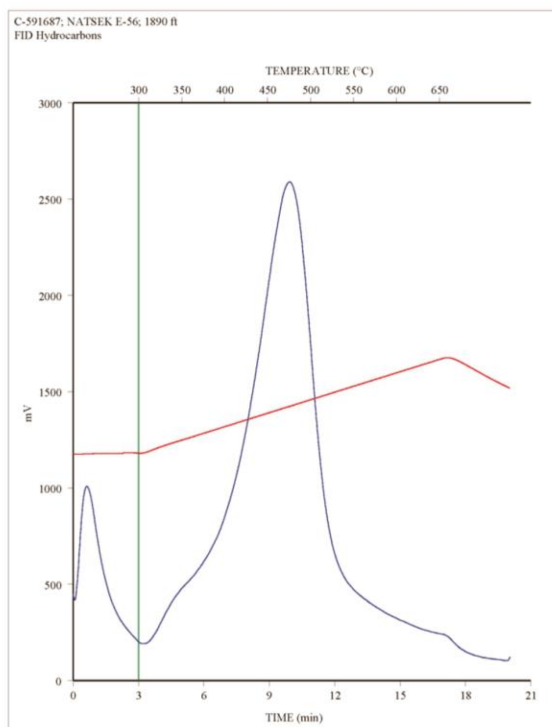

C-591682; NATSEK E-56; 1740 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

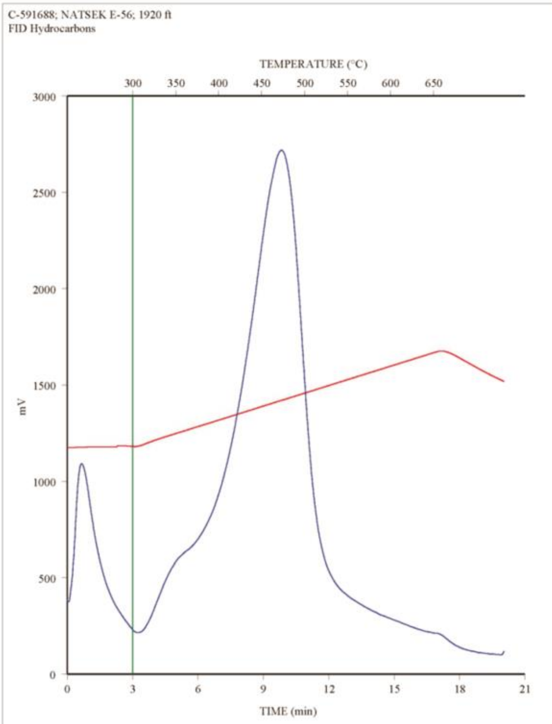

C-591683; NATSEK E-56; 1770 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

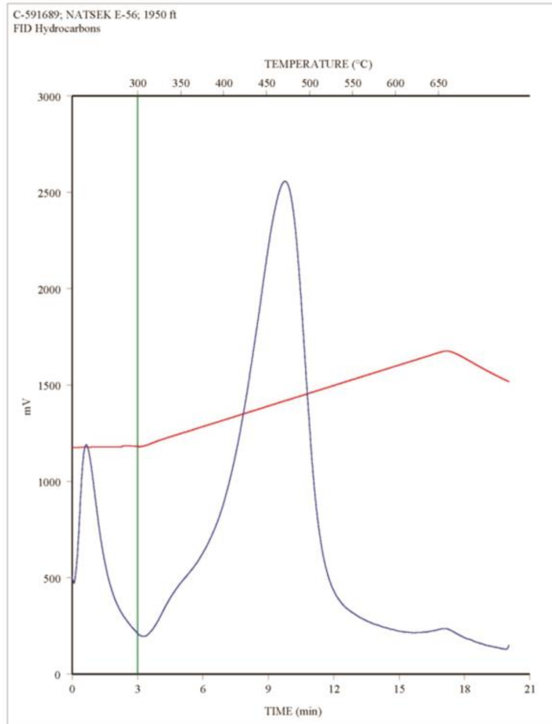

C-591684; NATSEK E-56; 1800 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

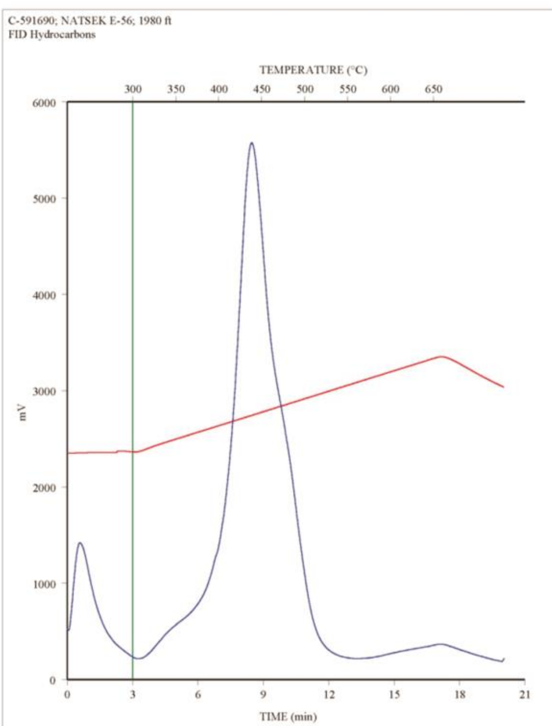

C-591685; NATSEK E-56; 1830 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

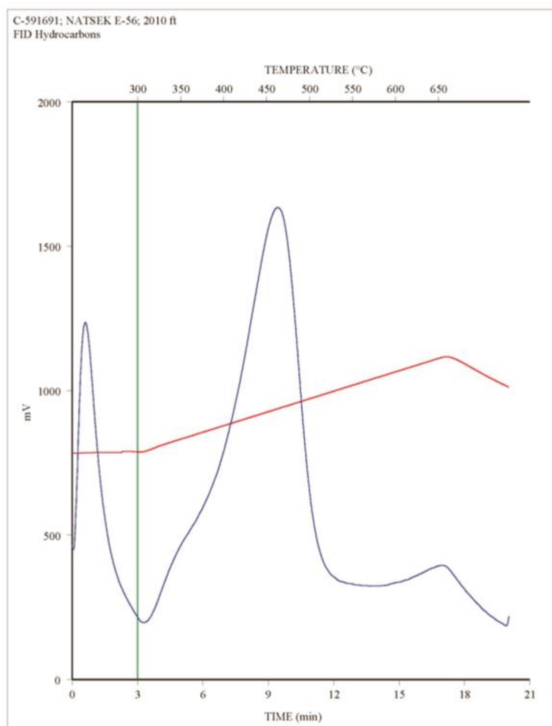

C-591686; NATSEK E-56; 1860 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

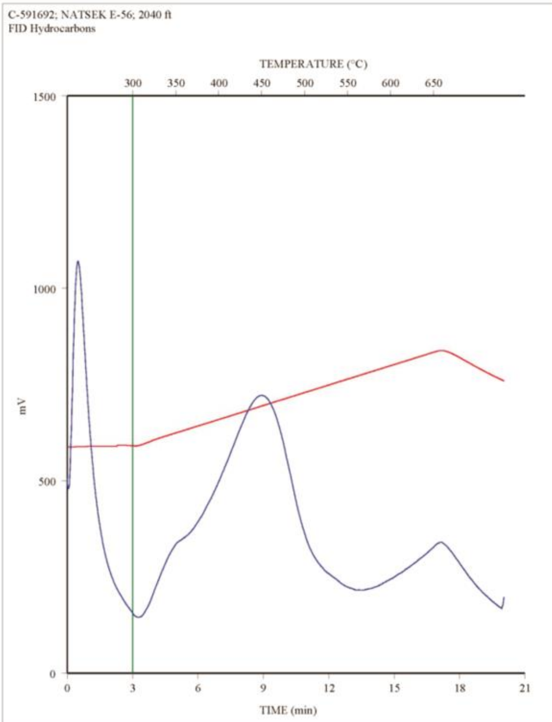

C-591687; NATSEK E-56; 1890 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

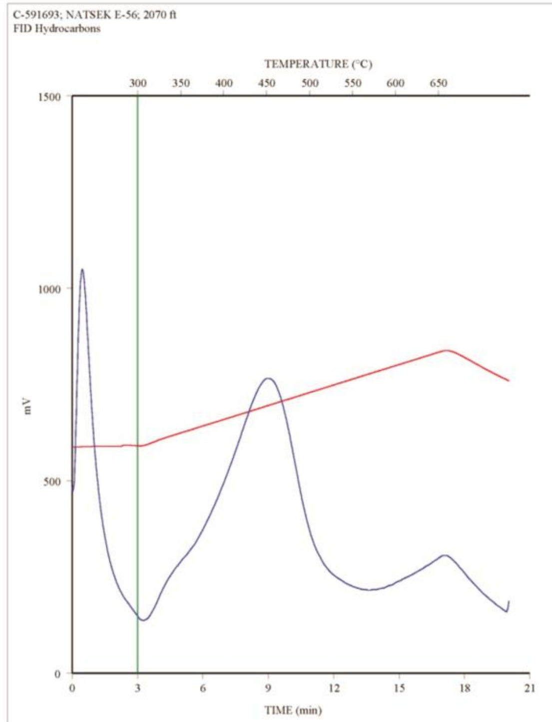

C-591688; NATSEK E-56; 1920 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000
0 3 6 9 12 15 18 21
TIME (min)

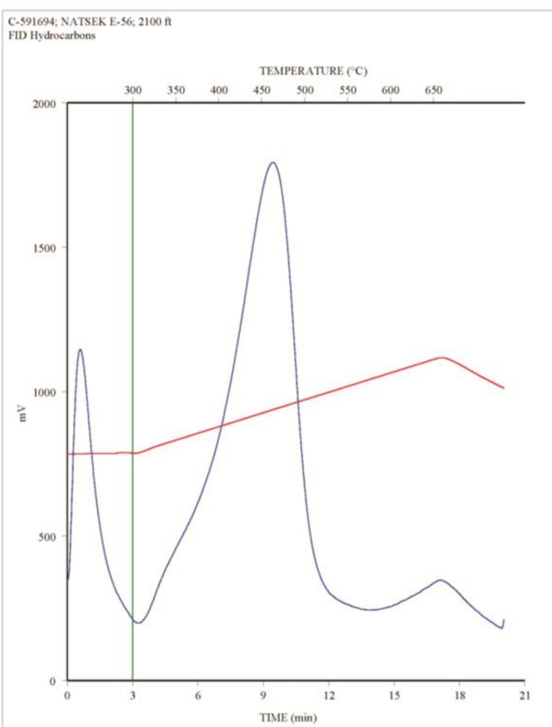

C-591689; NATSEK E-56; 1950 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000
0 3 6 9 12 15 18 21
TIME (min)

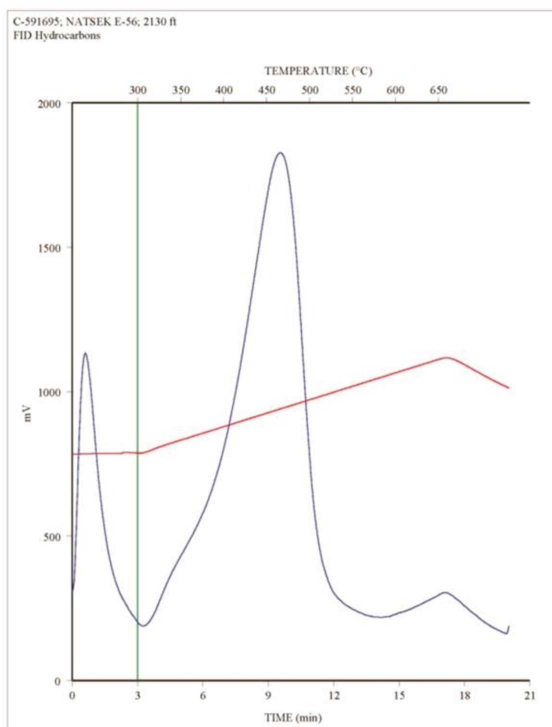

C-591690; NATSEK E-56; 1980 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 1000 2000 3000 4000 5000 6000
0 3 6 9 12 15 18 21
TIME (min)

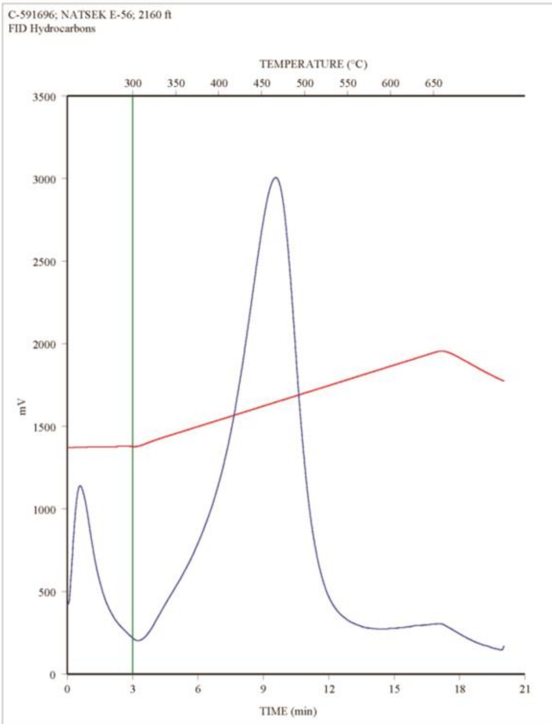

C-591691; NATSEK E-56; 2010 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000
0 3 6 9 12 15 18 21
TIME (min)

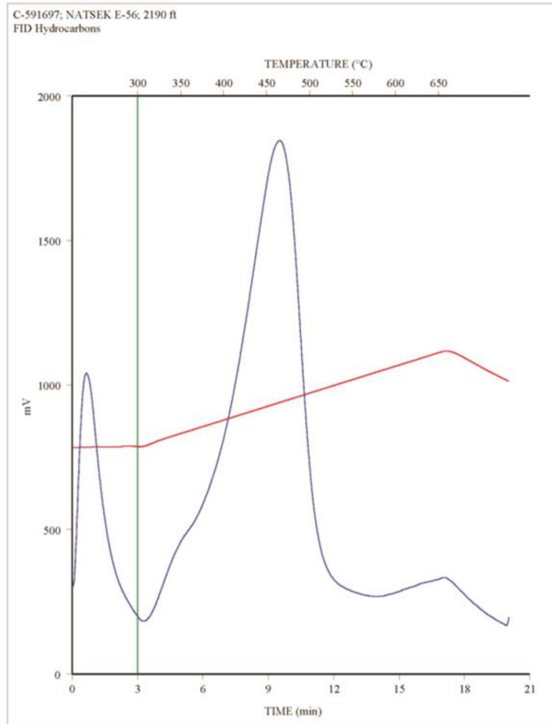

C-591692; NATSEK E-56; 2040 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

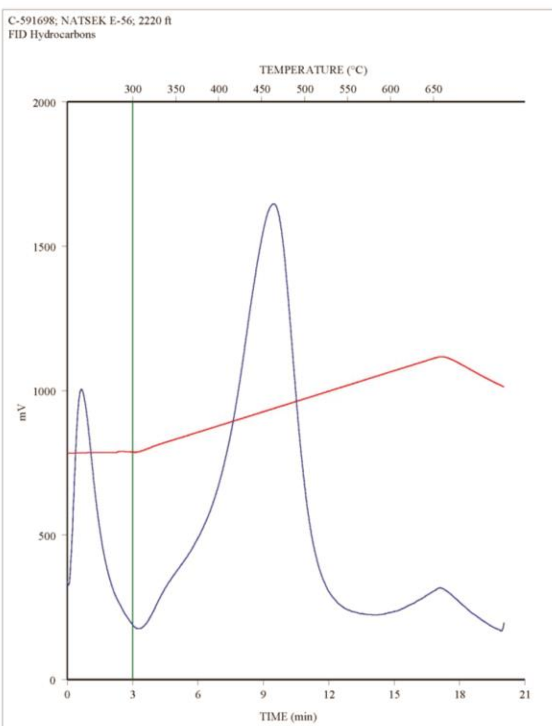

C-591693; NATSEK E-56; 2070 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

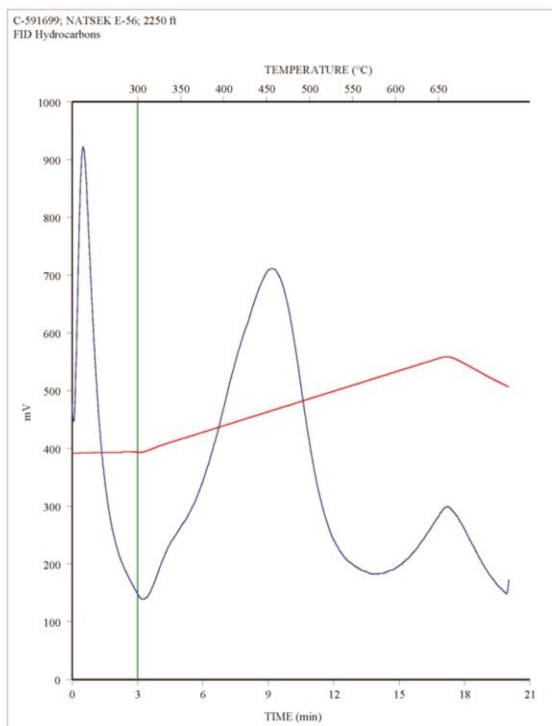

C-591694; NATSEK E-56; 2100 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

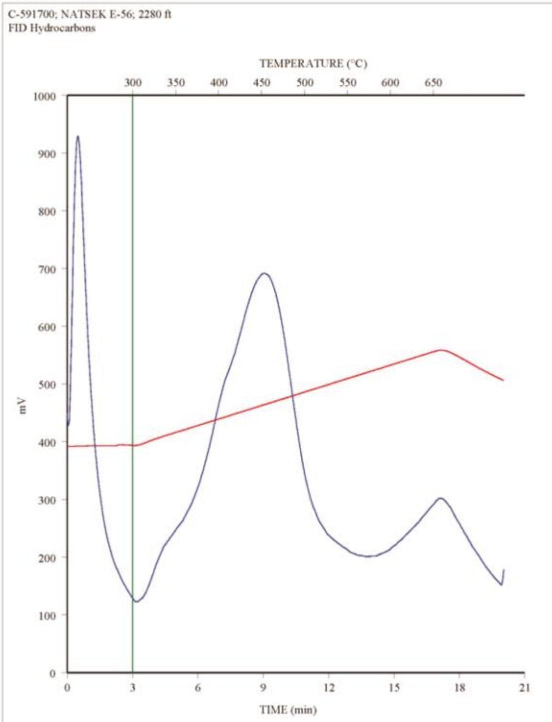

C-591695; NATSEK E-56; 2130 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

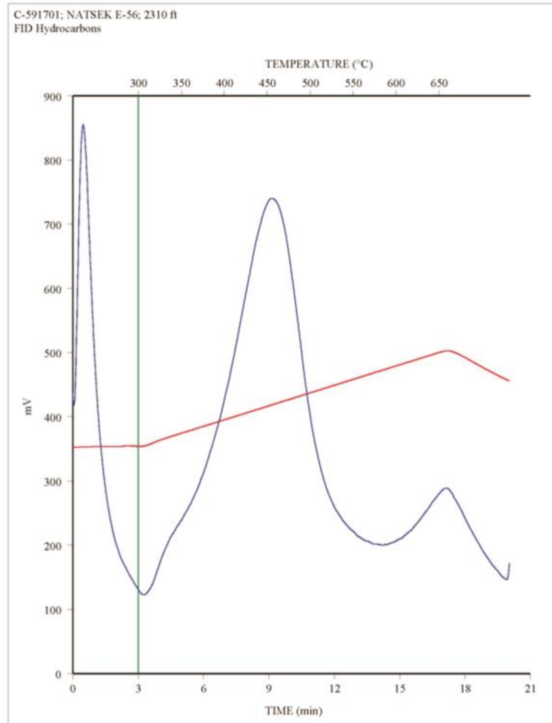

C-591696; NATSEK E-56; 2160 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

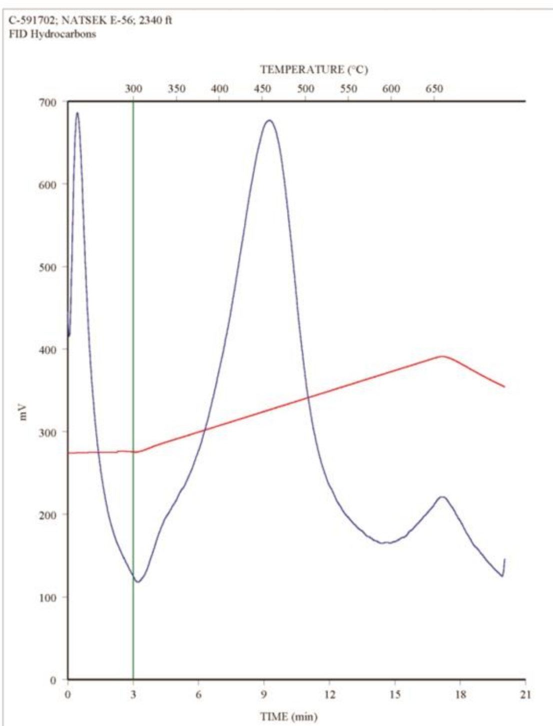

C-591697; NATSEK E-56; 2190 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

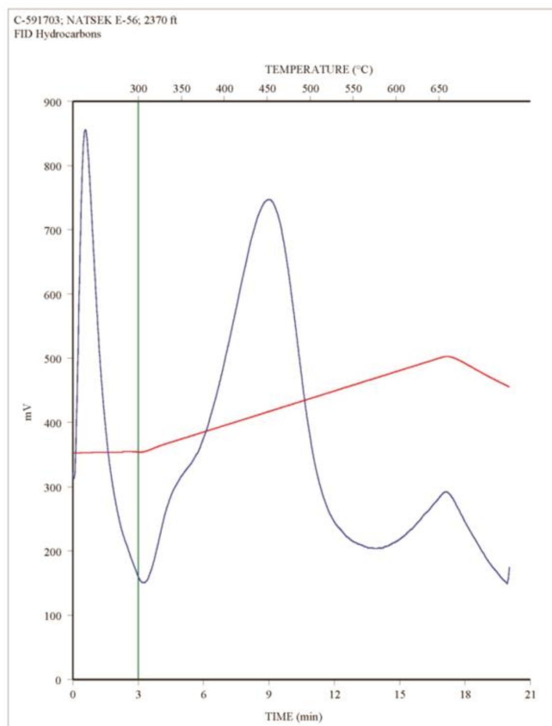

C-591698; NATSEK E-56; 2220 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

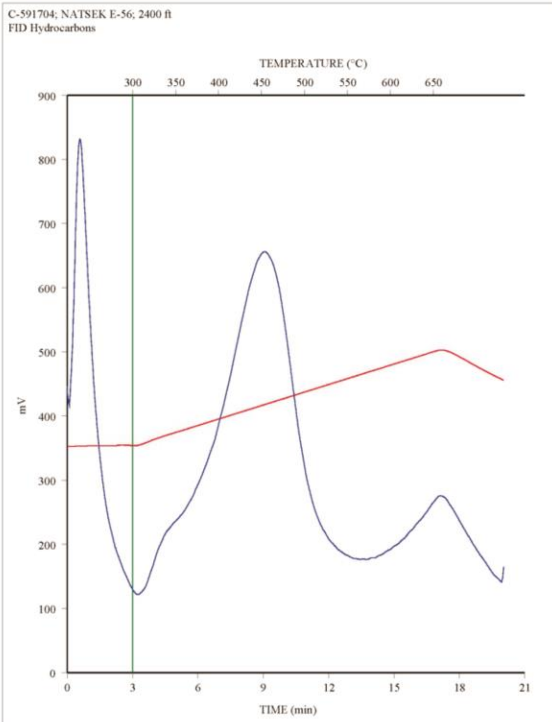

C-591699; NATSEK E-56; 2250 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

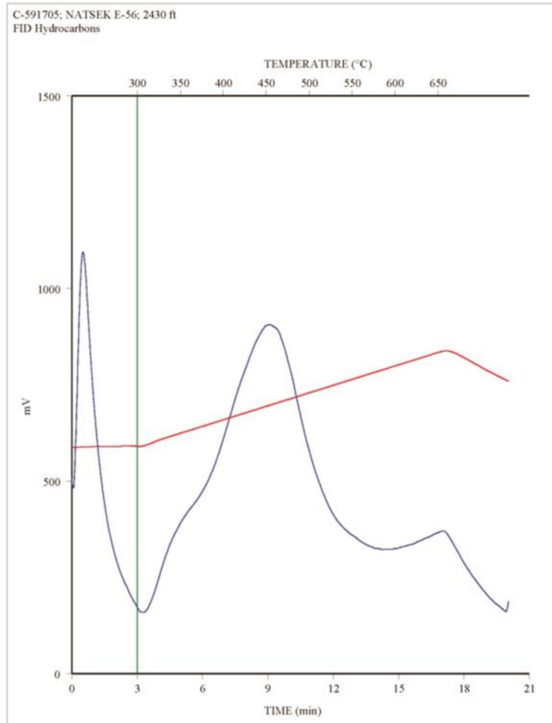

C-591700; NATSEK E-56; 2280 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

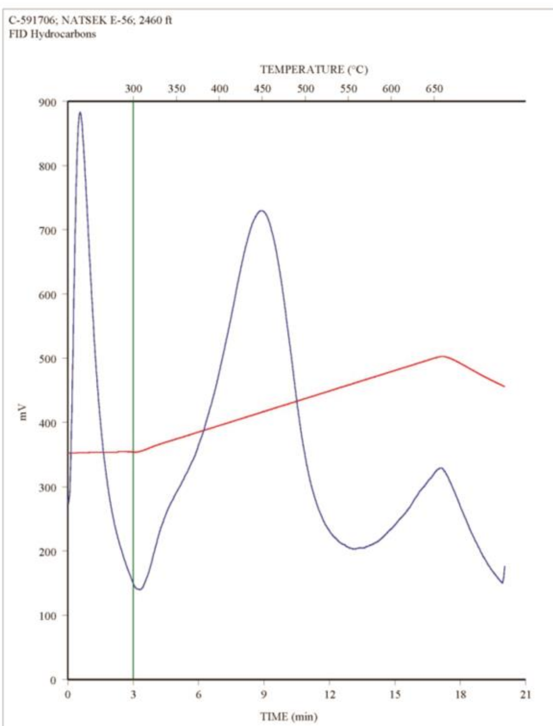

C-591701; NATSEK E-56; 2310 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

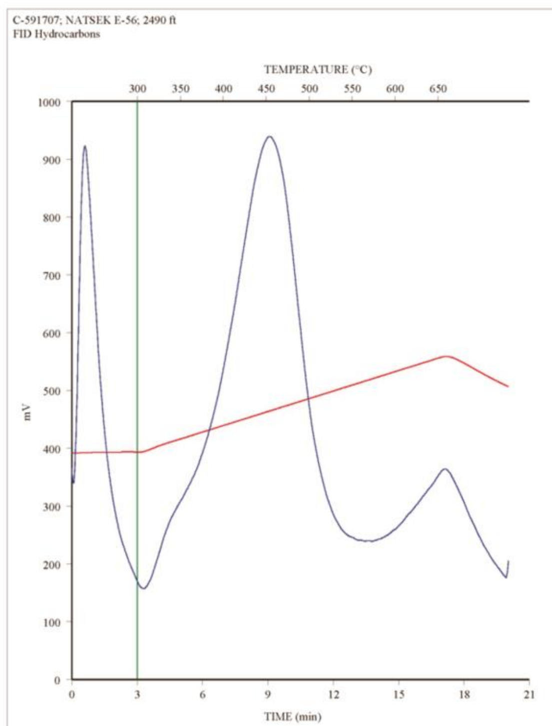

C-591702; NATSEK E-56; 2340 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

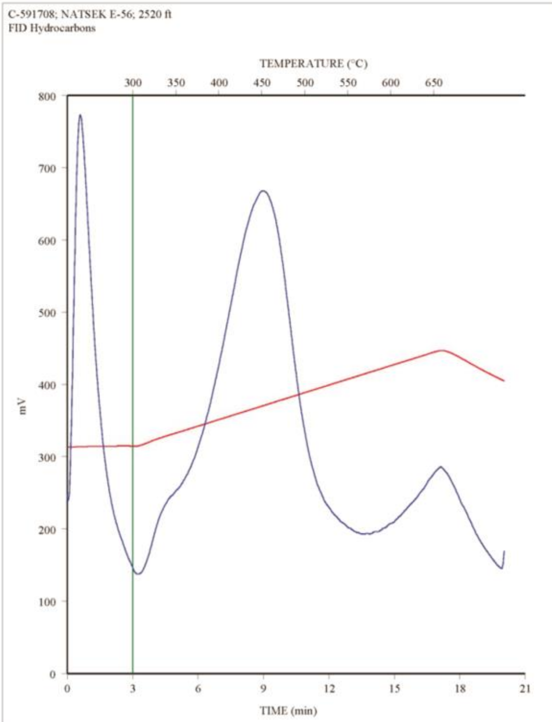

C-591703; NATSEK E-56; 2370 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

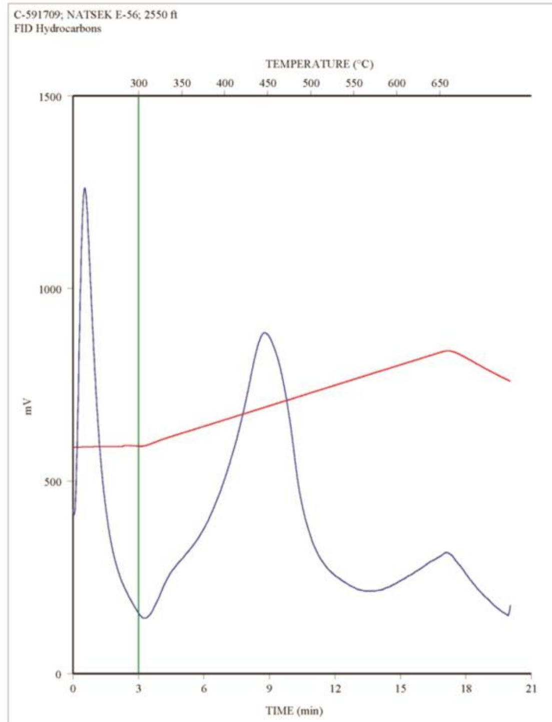

C-591704; NATSEK E-56; 2400 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

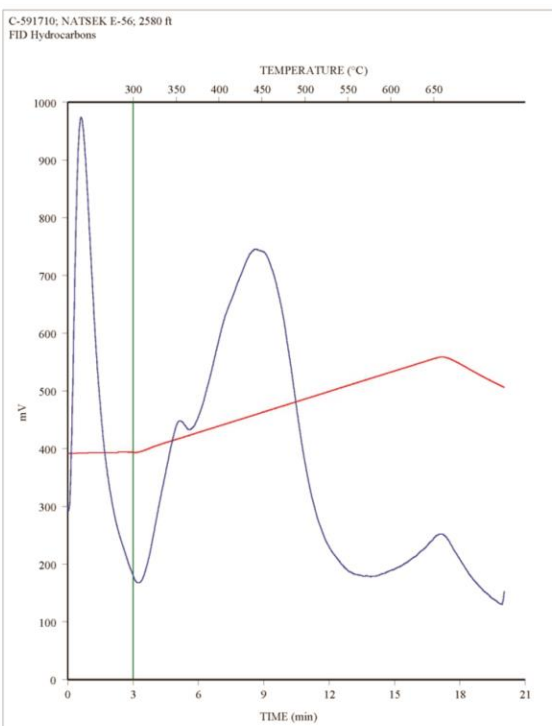

C-591705; NATSEK E-56; 2430 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

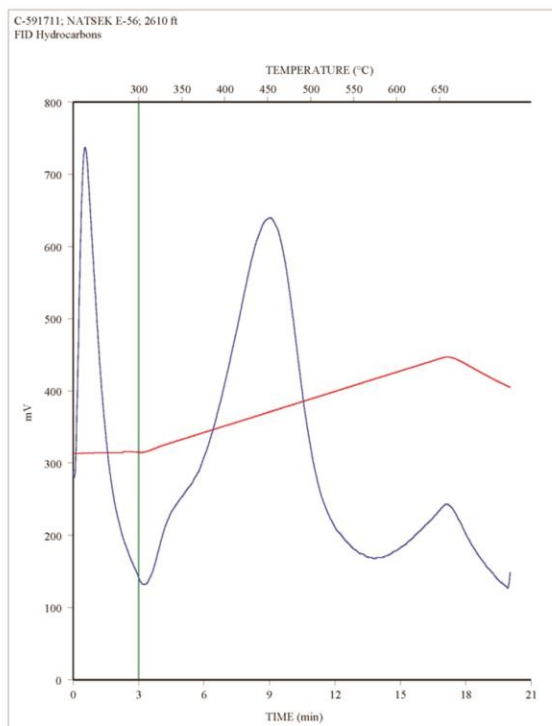

C-591706; NATSEK E-56; 2460 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

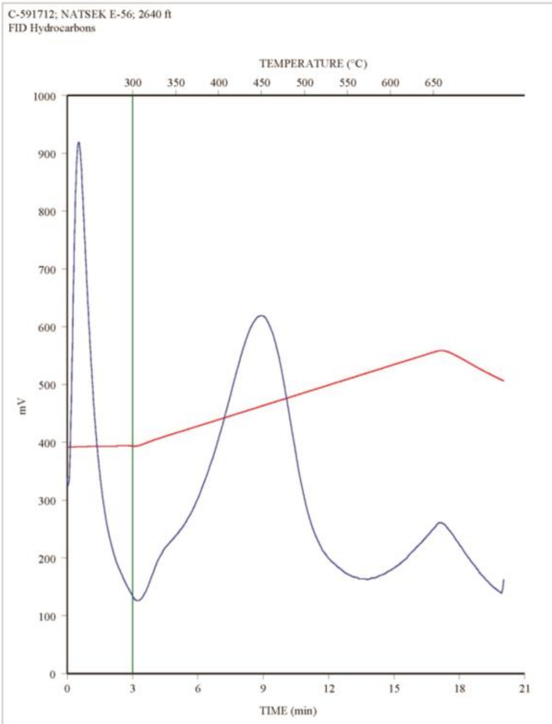

C-591707; NATSEK E-56; 2490 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

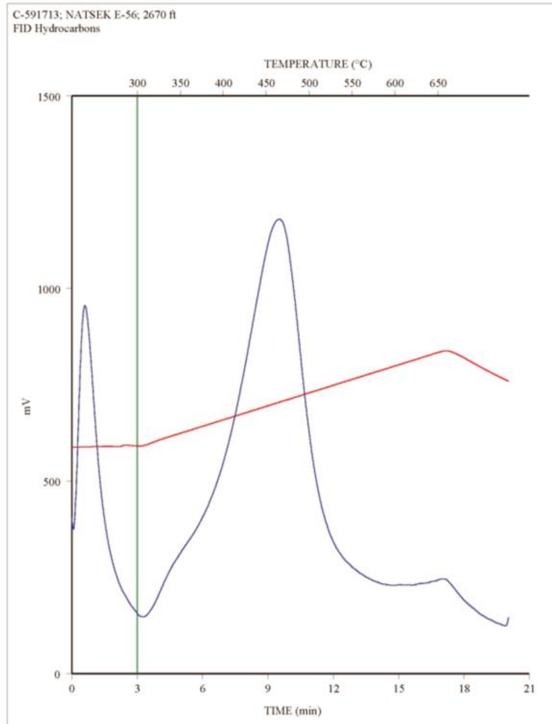

C-591708; NATSEK E-56; 2520 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

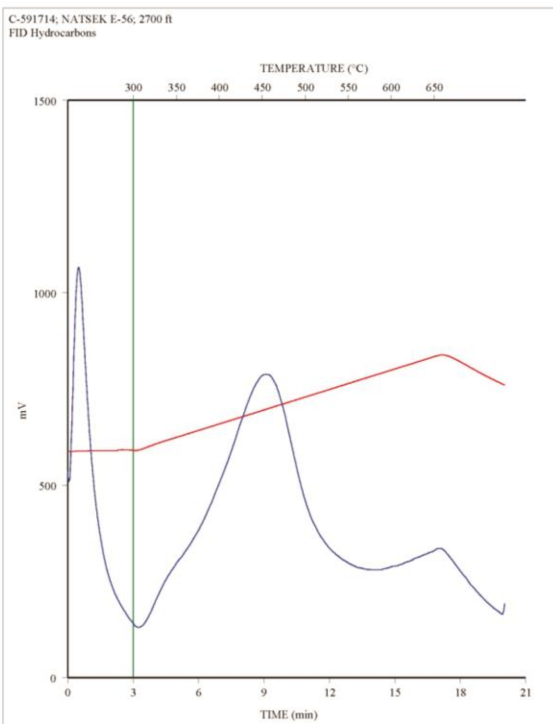

C-591709; NATSEK E-56; 2550 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

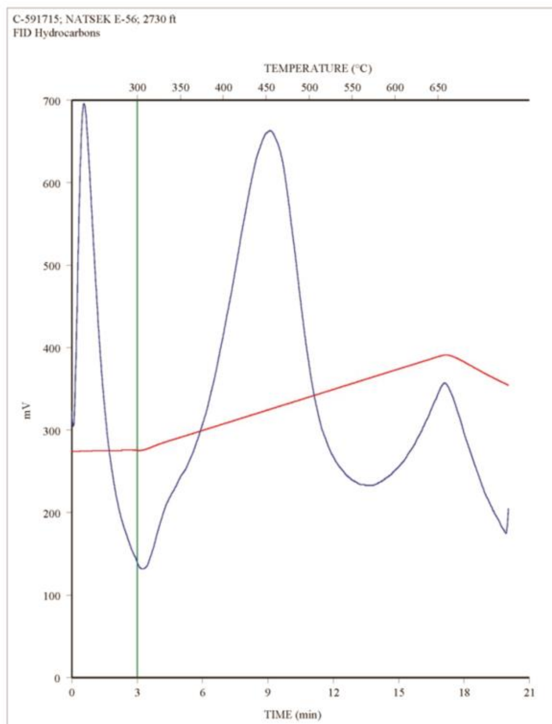

C-591710; NATSEK E-56; 2580 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

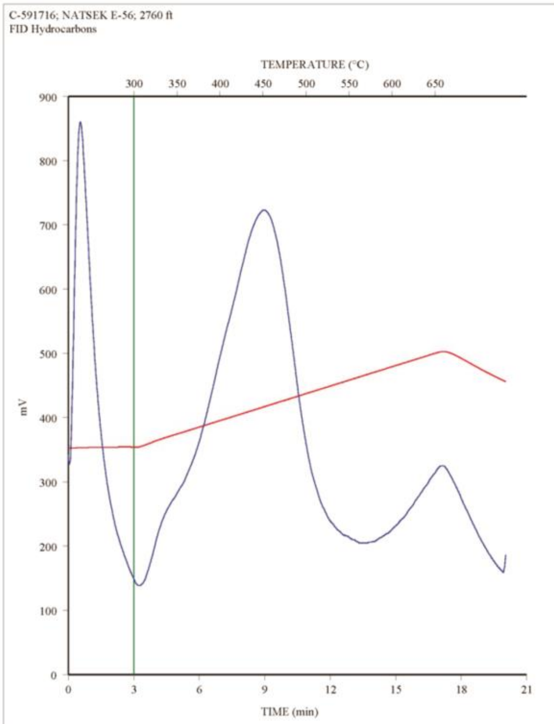

C-591711; NATSEK E-56; 2610 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

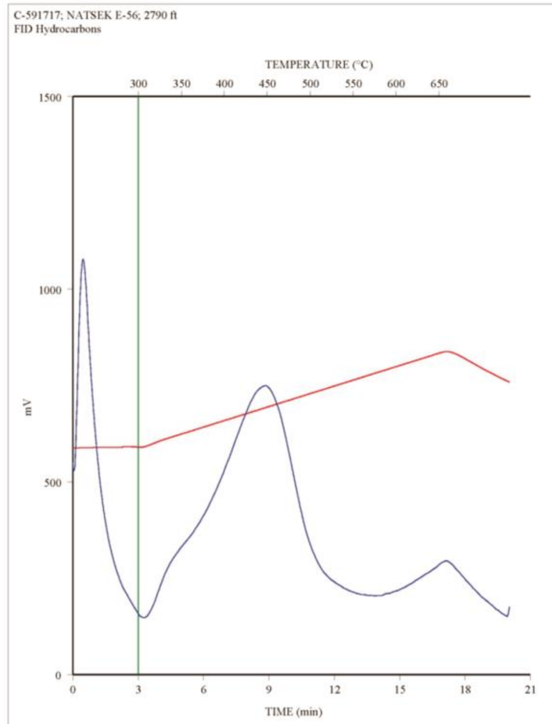

C-591712; NATSEK E-56; 2640 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

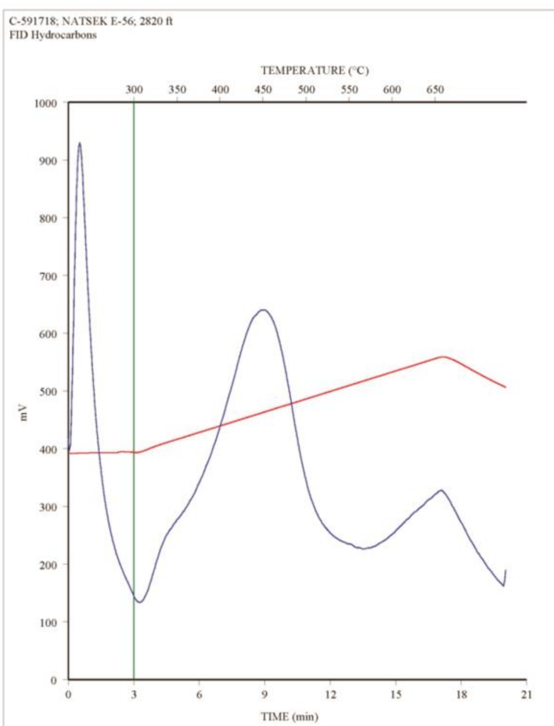

C-591713; NATSEK E-56; 2670 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

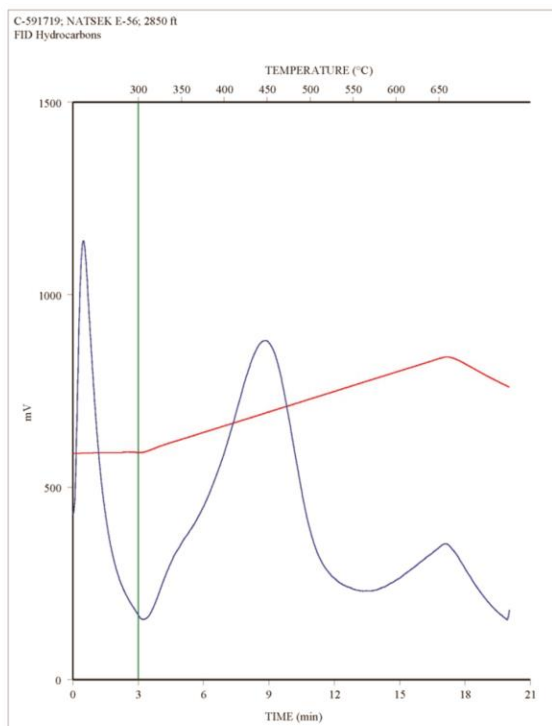

C-591714; NATSEK E-56; 2700 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

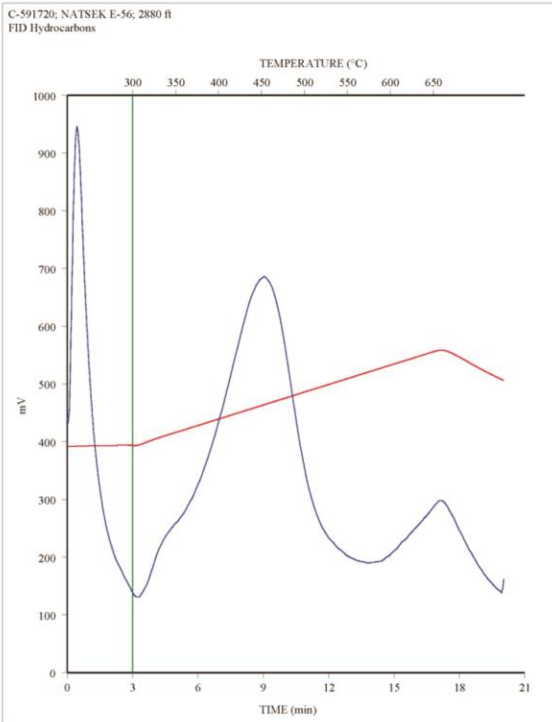

C-591715; NATSEK E-56; 2730 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

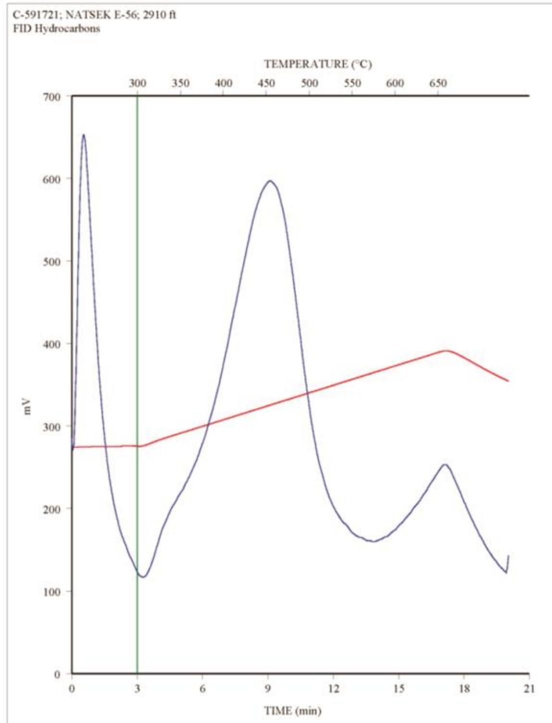

C-591716; NATSEK E-56; 2760 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
TIME (min)

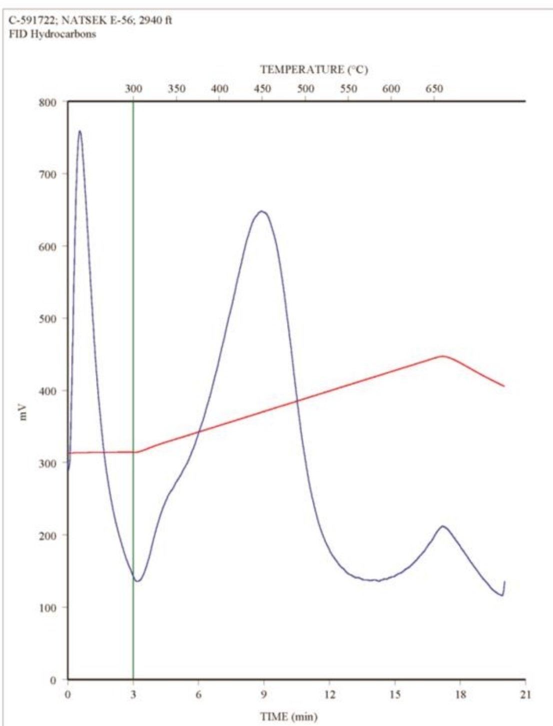

C-591717; NATSEK E-56; 2790 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
TIME (min)

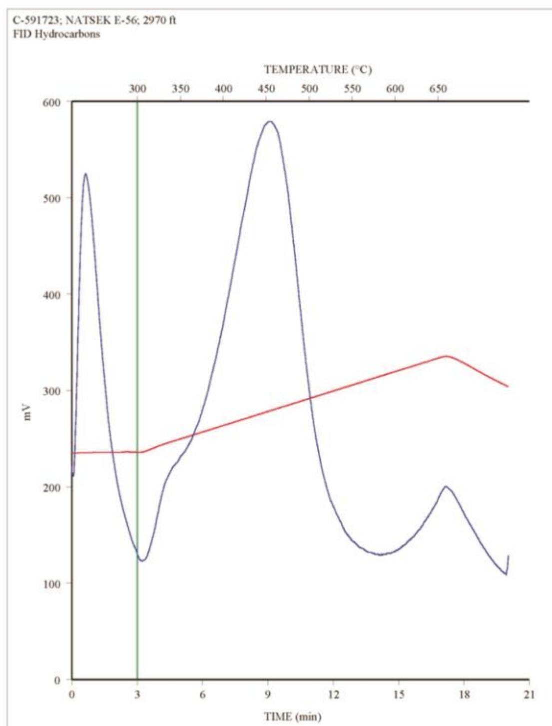

C-591718; NATSEK E-56; 2820 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
TIME (min)

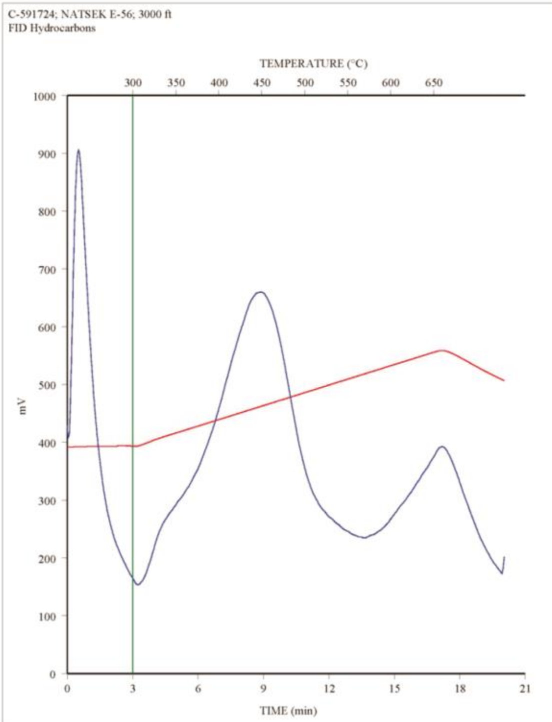

C-591719; NATSEK E-56; 2850 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
TIME (min)

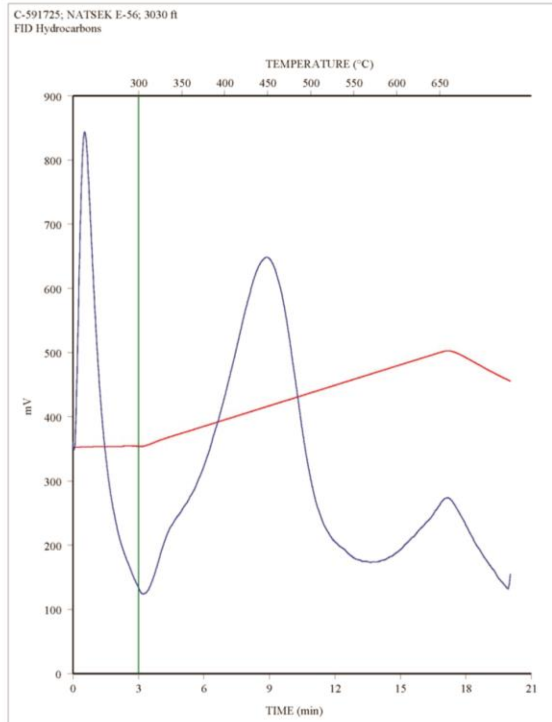

C-591720; NATSEK E-56; 2880 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 100 200 300 400 500 600 700 800 900 1000
TIME (min)
0 3 6 9 12 15 18 21

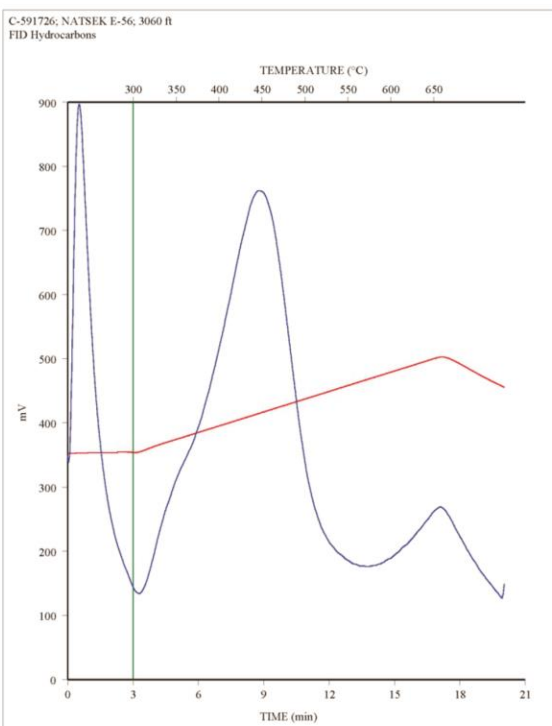

C-591721; NATSEK E-56; 2910 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 100 200 300 400 500 600 700
TIME (min)
0 3 6 9 12 15 18 21

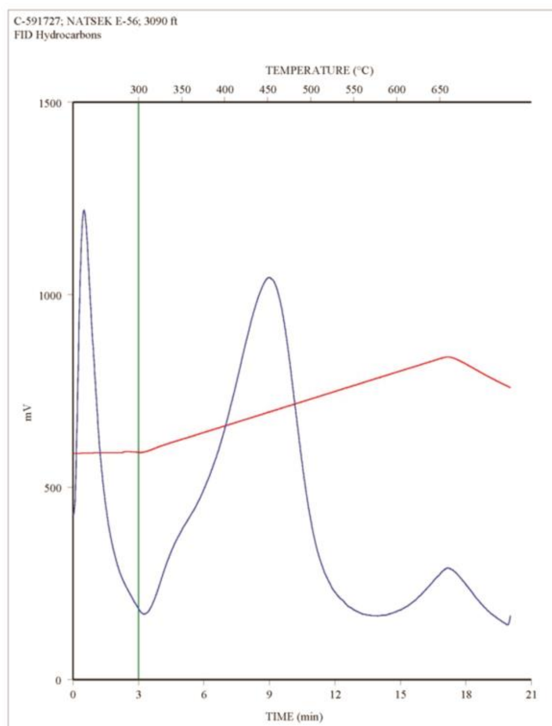

C-591722; NATSEK E-56; 2940 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 100 200 300 400 500 600 700 800
TIME (min)
0 3 6 9 12 15 18 21

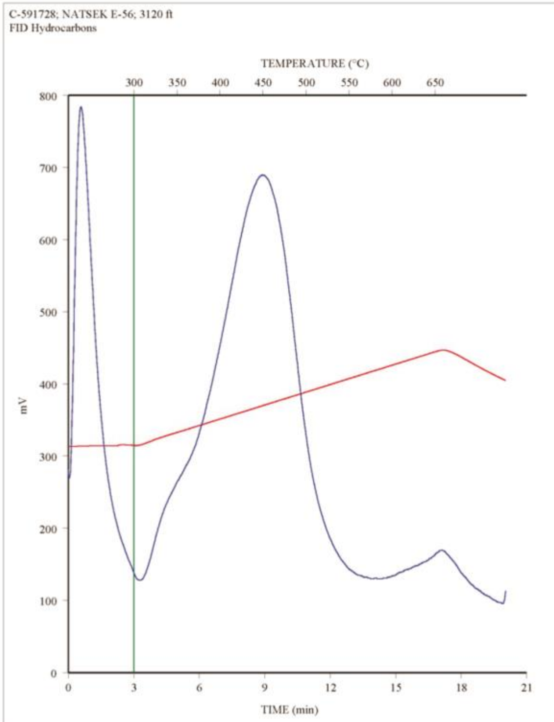

C-591723; NATSEK E-56; 2970 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 100 200 300 400 500 600
TIME (min)
0 3 6 9 12 15 18 21

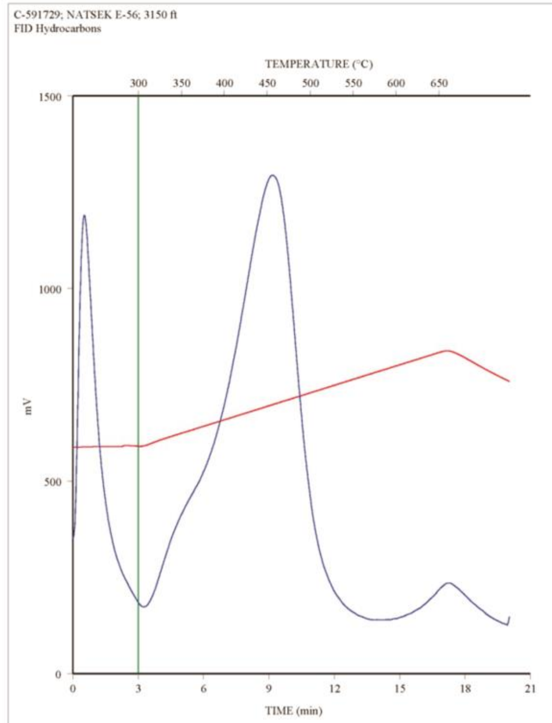

C-591724; NATSEK E-56; 3000 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
1000 900 800 700 600 500 400 300 200 100 0
0 3 6 9 12 15 18 21
TIME (min)

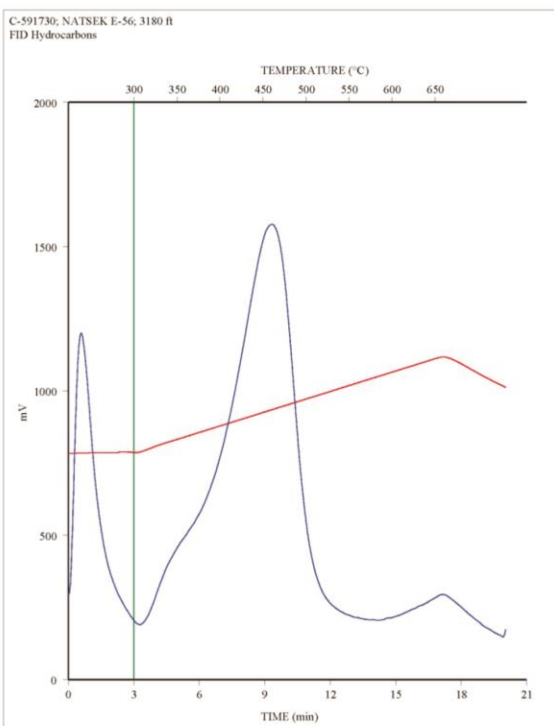

C-591725; NATSEK E-56; 3030 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
900 800 700 600 500 400 300 200 100 0
0 3 6 9 12 15 18 21
TIME (min)

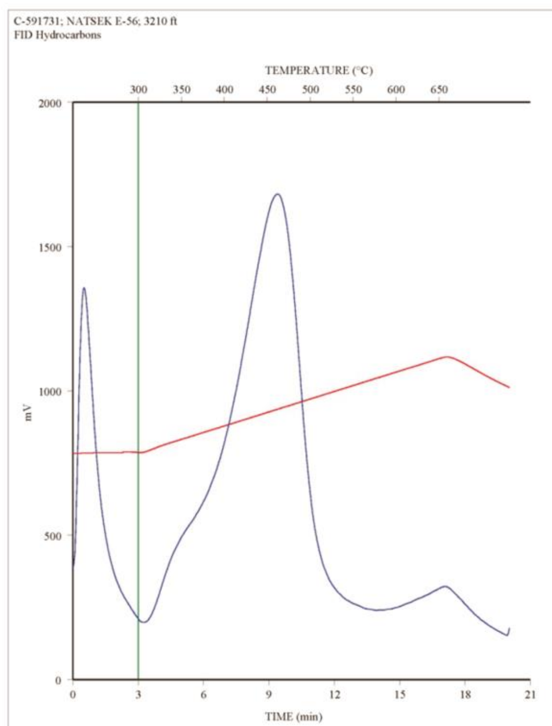

C-591726; NATSEK E-56; 3060 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
900 800 700 600 500 400 300 200 100 0
0 3 6 9 12 15 18 21
TIME (min)

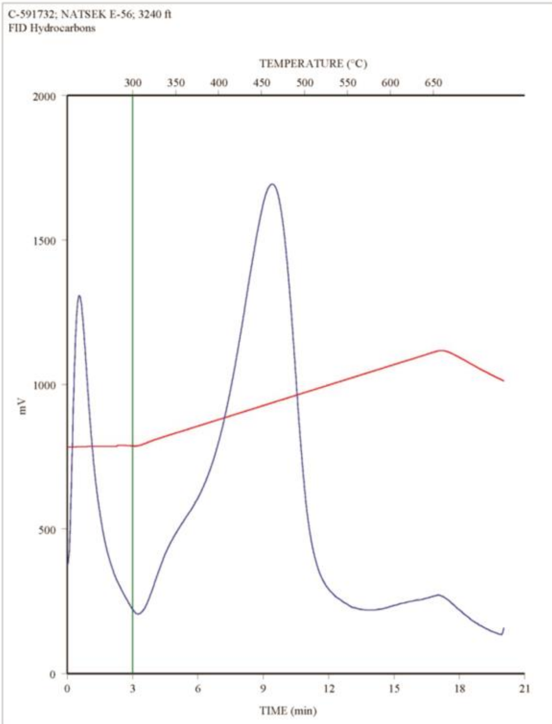

C-591727; NATSEK E-56; 3090 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

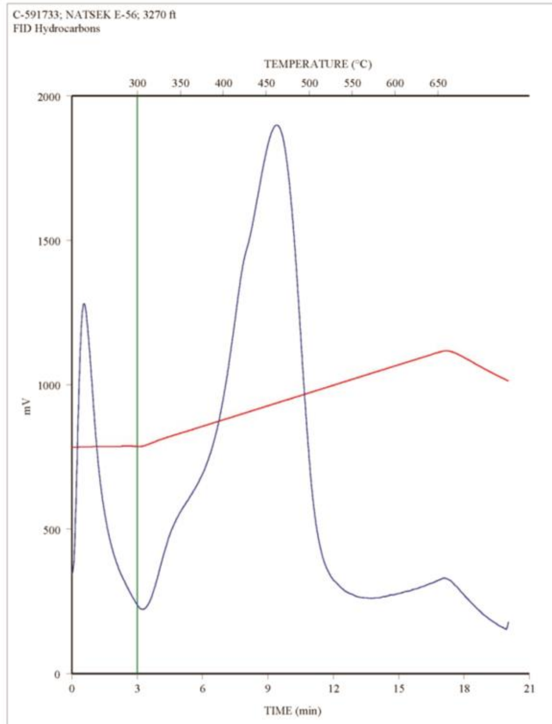

C-591728; NATSEK E-56; 3120 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

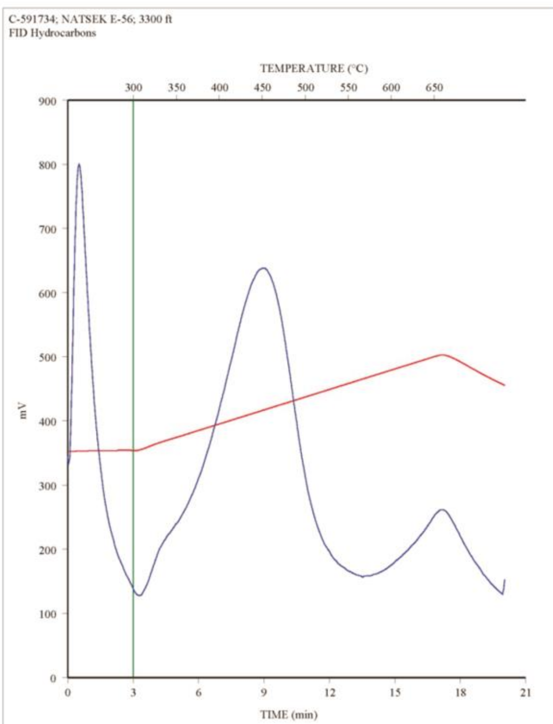

C-591729; NATSEK E-56; 3150 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

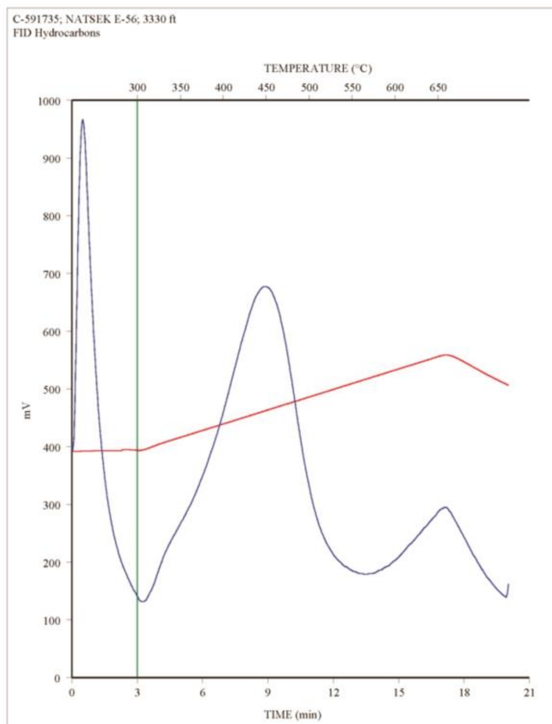

C-591730; NATSEK E-56; 3180 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

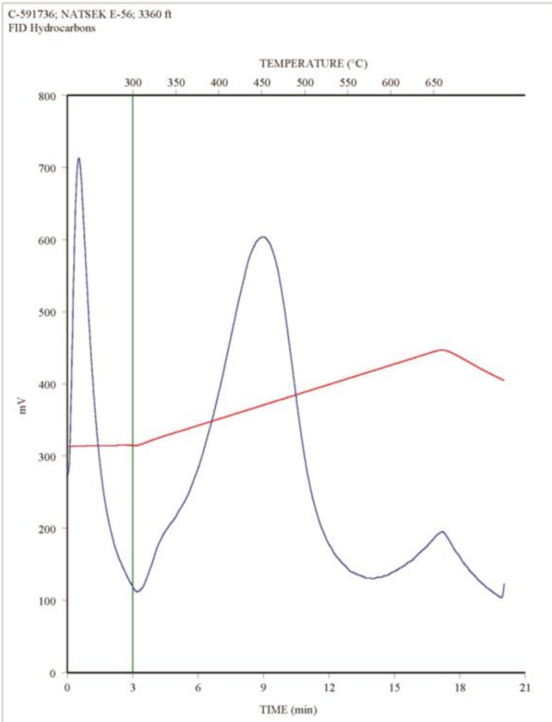

C-591731; NATSEK E-56; 3210 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

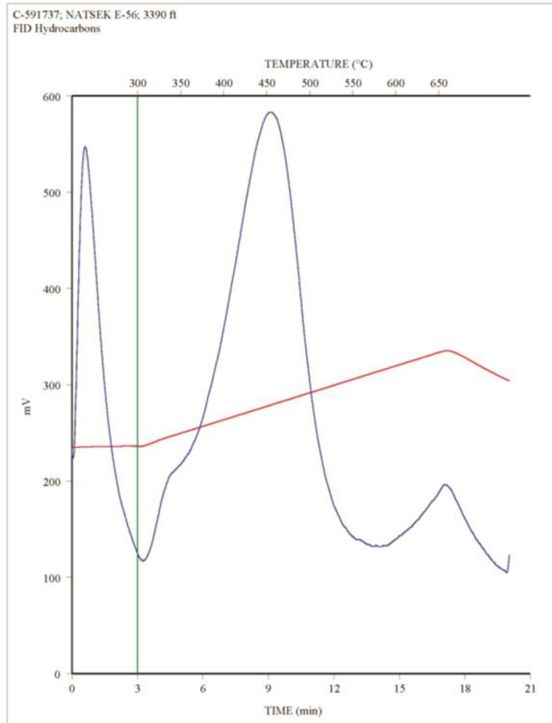

C-591732; NATSEK E-56; 3240 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

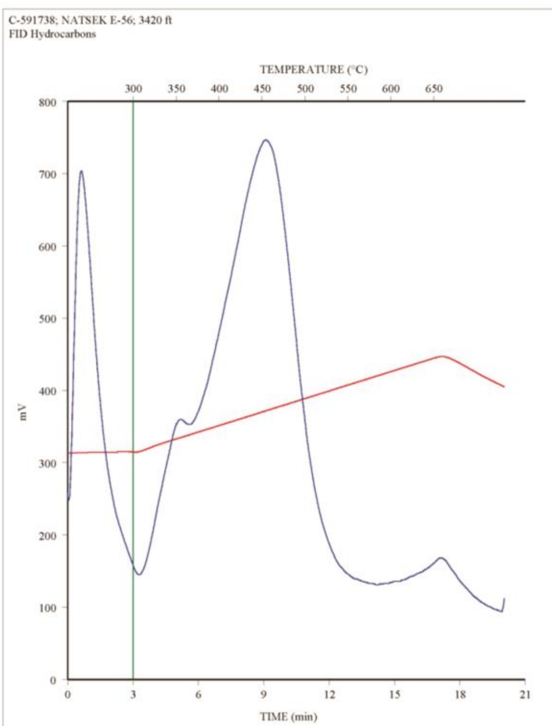

C-591733; NATSEK E-56; 3270 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

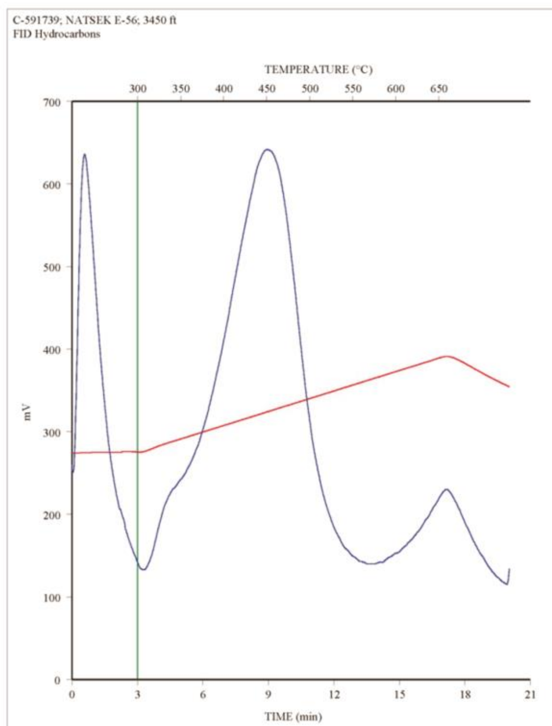

C-591734; NATSEK E-56; 3300 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

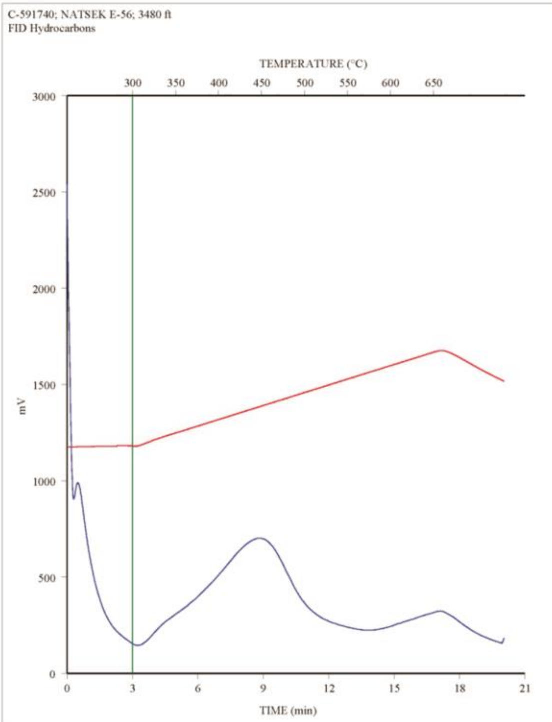

C-591735; NATSEK E-56; 3330 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

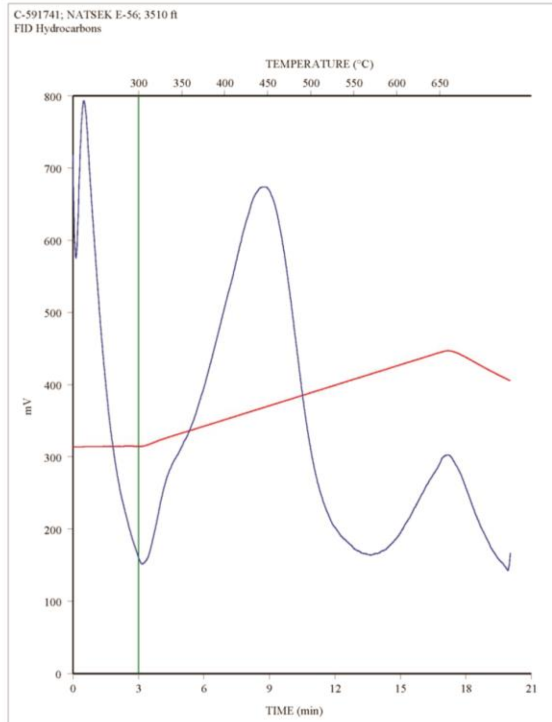

C-591736; NATSEK E-56; 3360 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

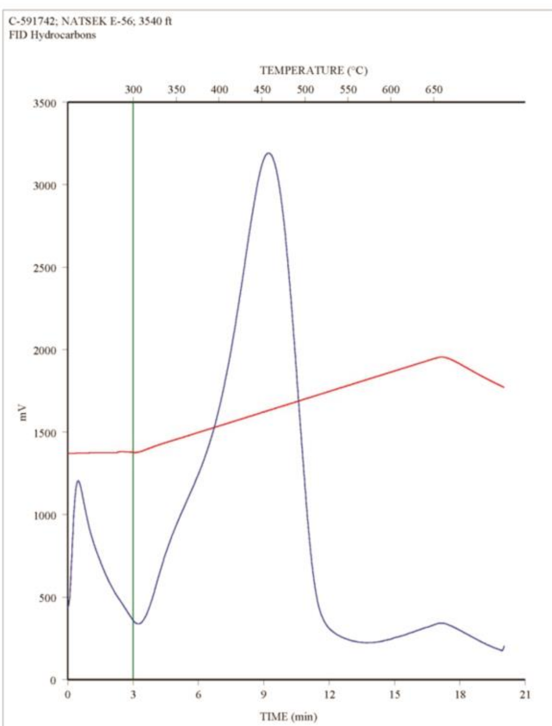

C-591737; NATSEK E-56; 3390 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

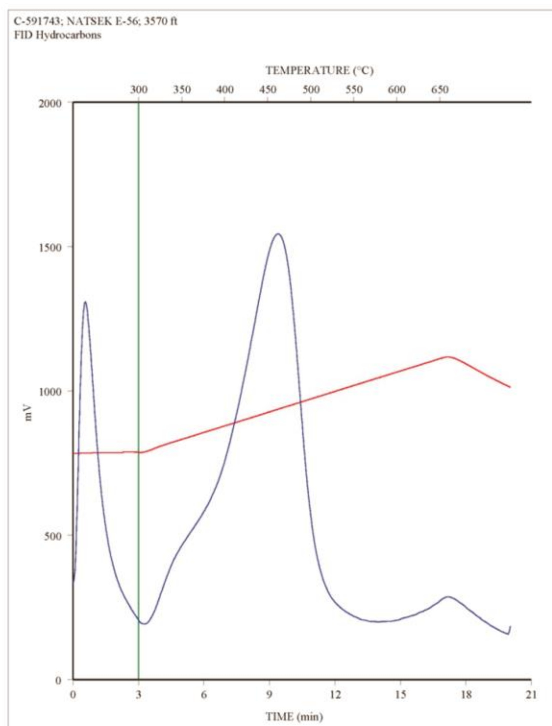

C-591738; NATSEK E-56; 3420 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

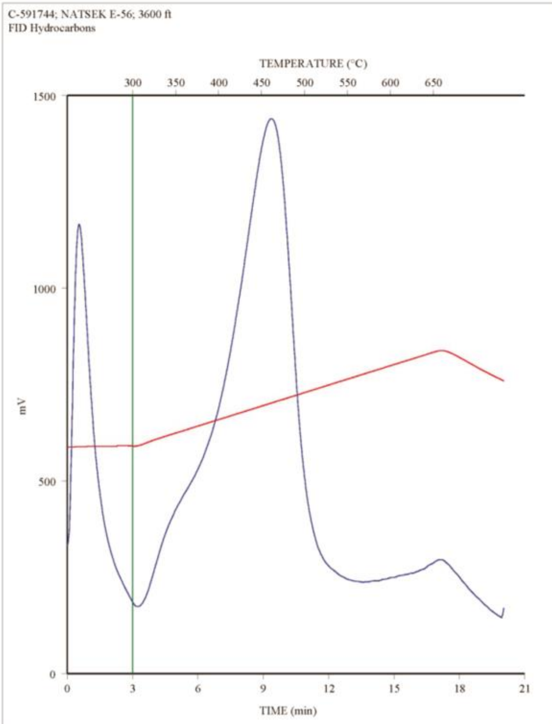

C-591739; NATSEK E-56; 3450 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

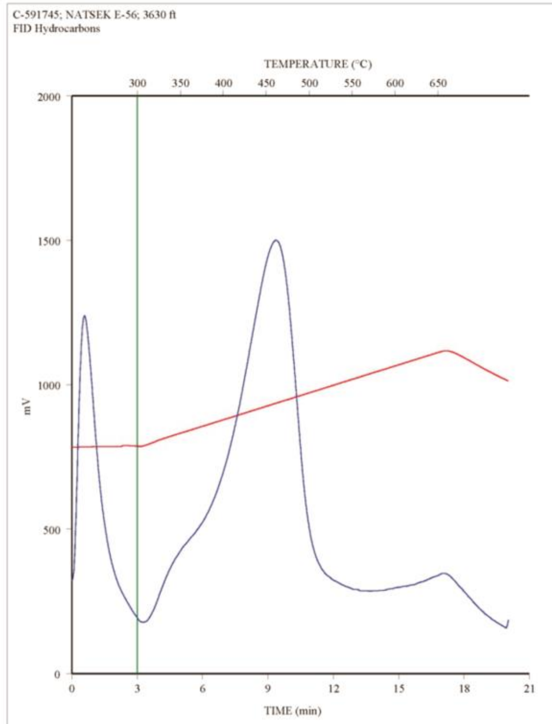

C-591740; NATSEK E-56; 3480 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

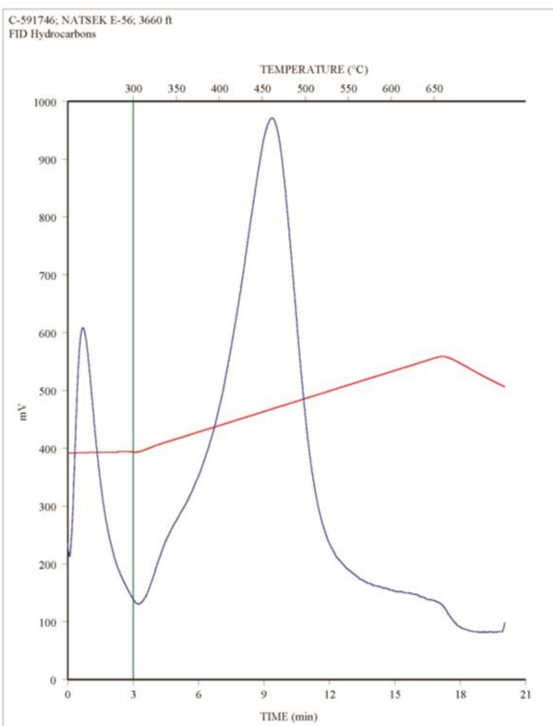

C-591741; NATSEK E-56; 3510 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

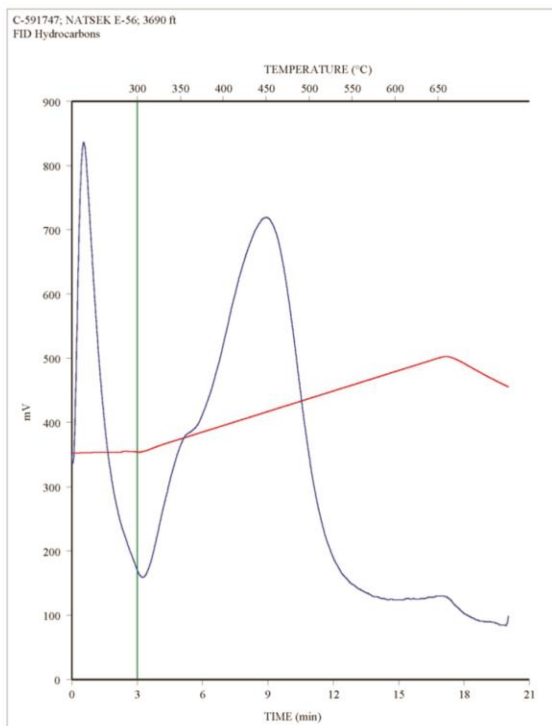

C-591742; NATSEK E-56; 3540 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
3500
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

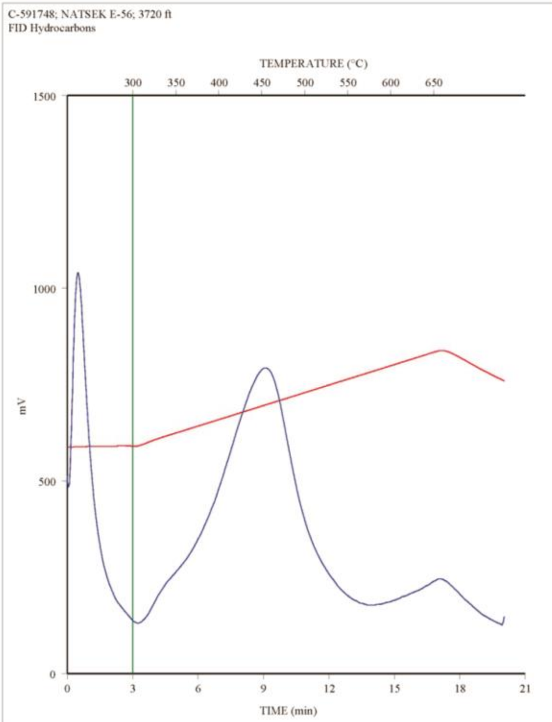

C-591743; NATSEK E-56; 3570 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)


C-591744; NATSEK E-56; 3600 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

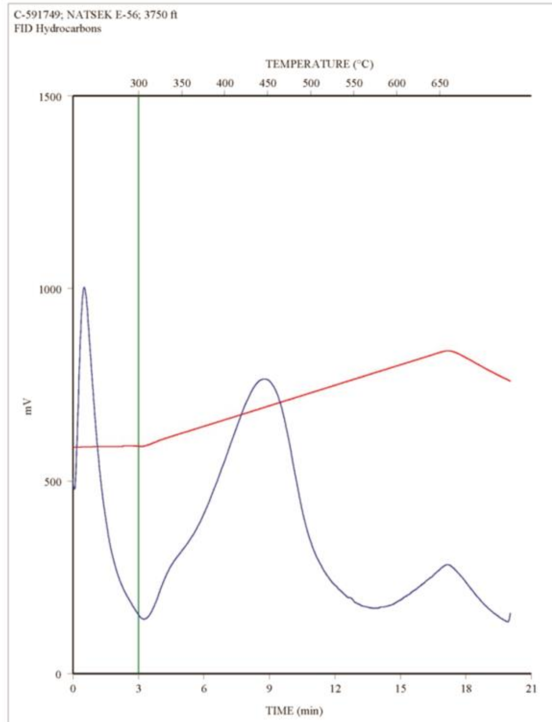

C-591745; NATSEK E-56; 3630 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)


C-591746; NATSEK E-56; 3660 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

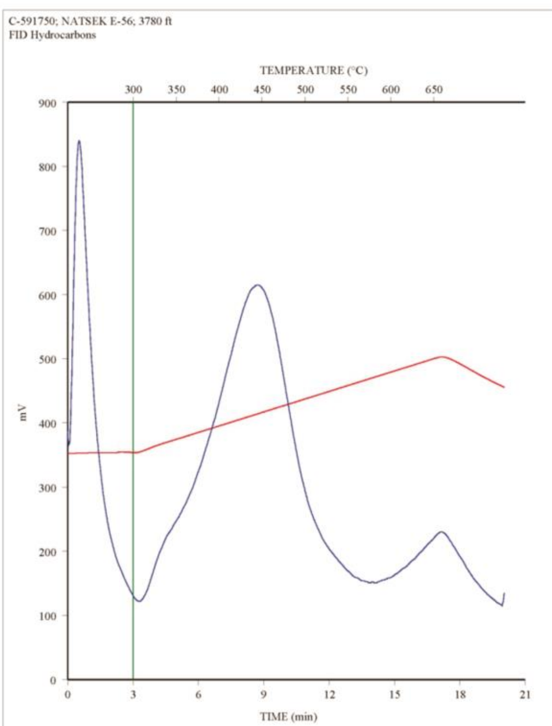

C-591747; NATSEK E-56; 3690 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)



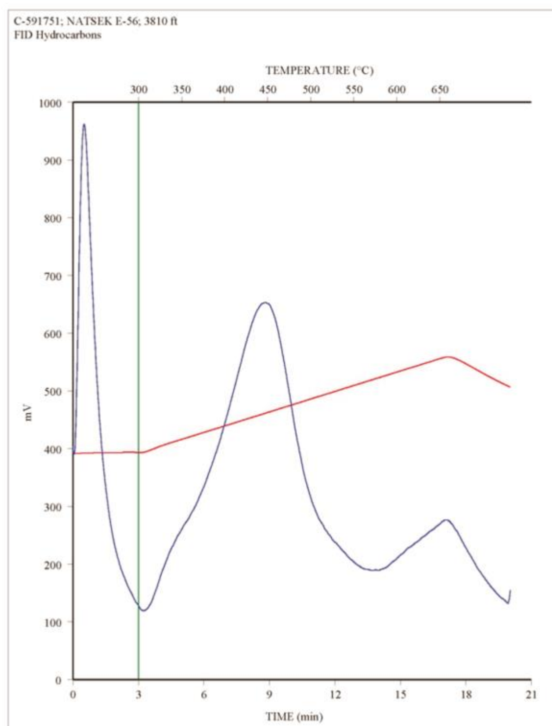
C-591748; NATSEK E-56; 3720 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)



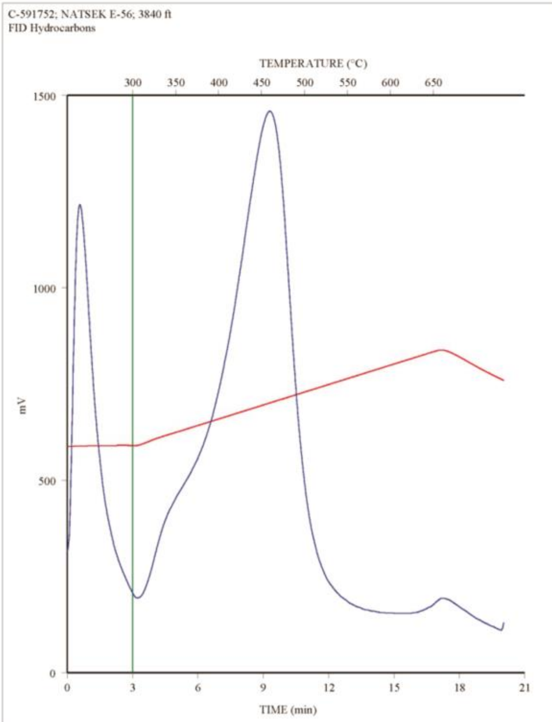
C-591749; NATSEK E-56; 3750 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

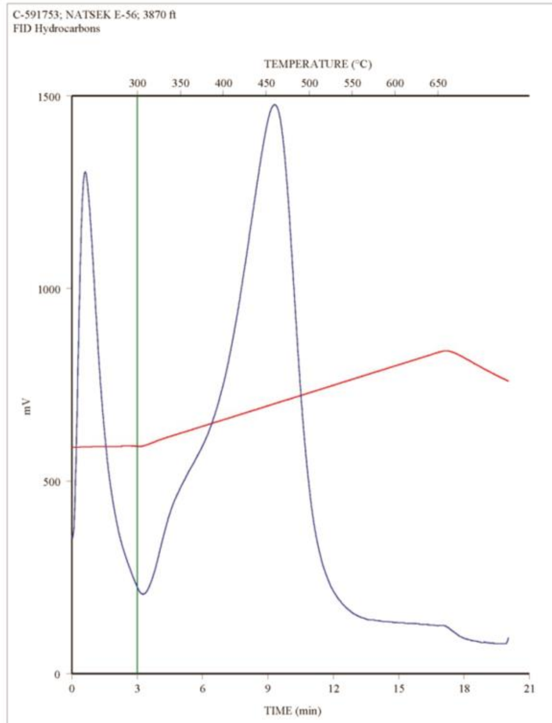


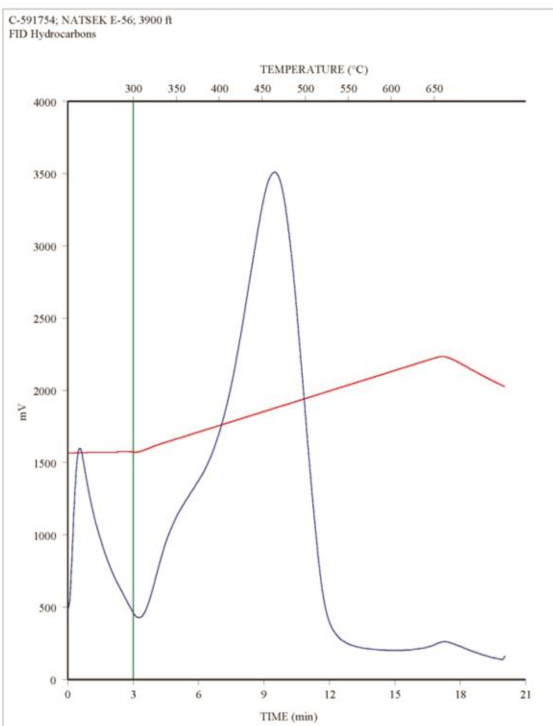
C-591750; NATSEK E-56; 3780 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
900
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

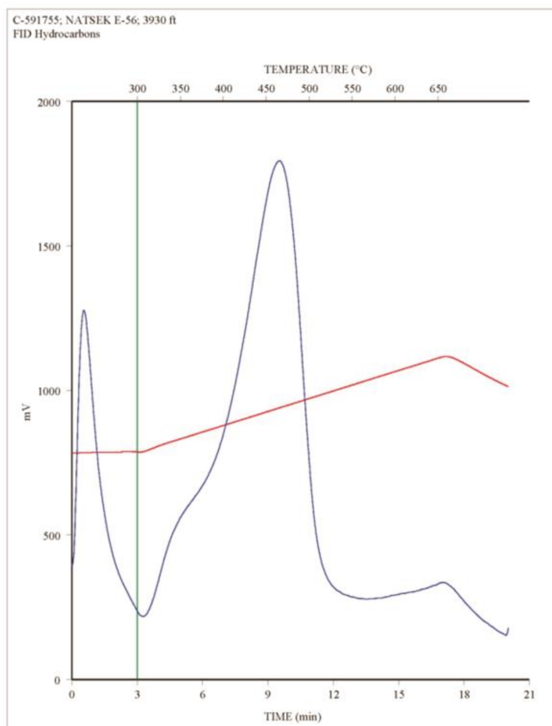


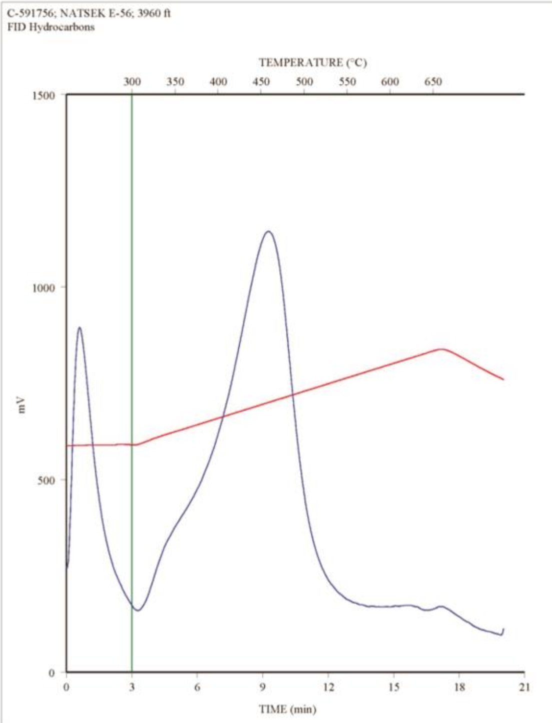
C-591751; NATSEK E-56; 3810 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1000
900
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

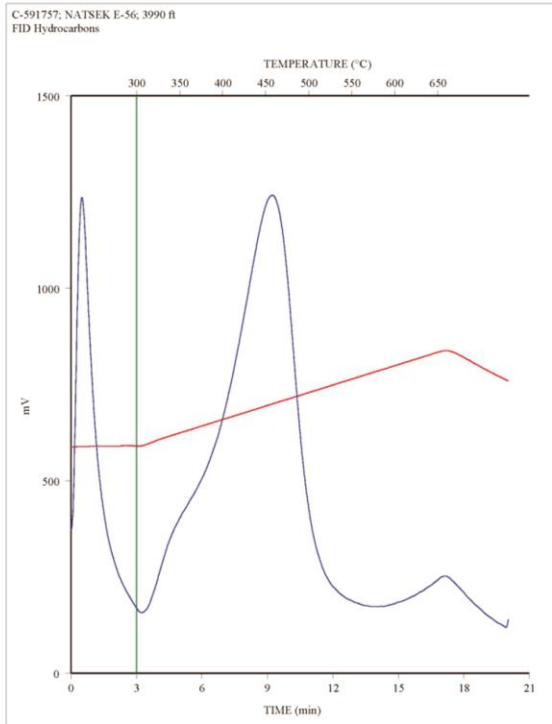

C-591752; NATSEK E-56; 3840 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500
0 3 6 9 12 15 18 21
TIME (min)

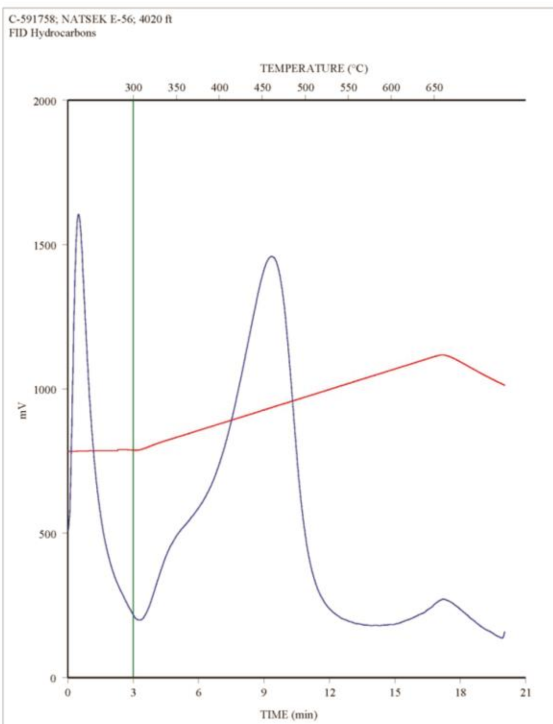

C-591753; NATSEK E-56; 3870 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500
0 3 6 9 12 15 18 21
TIME (min)

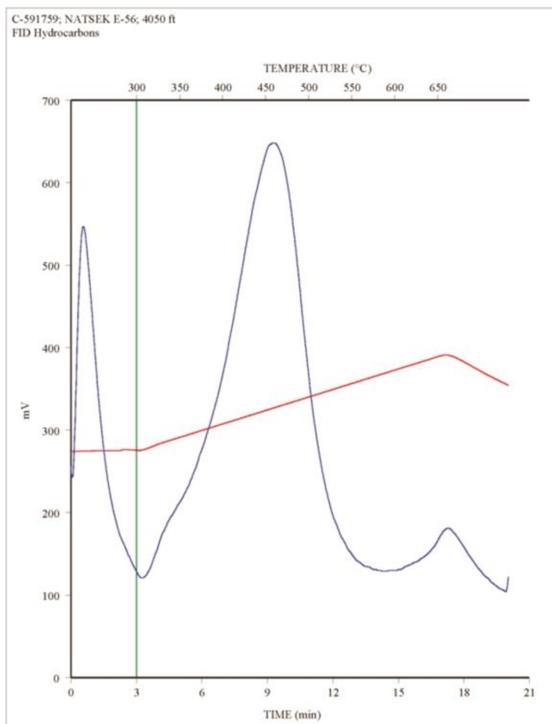

C-591754; NATSEK E-56; 3900 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000 3500 4000
0 3 6 9 12 15 18 21
TIME (min)

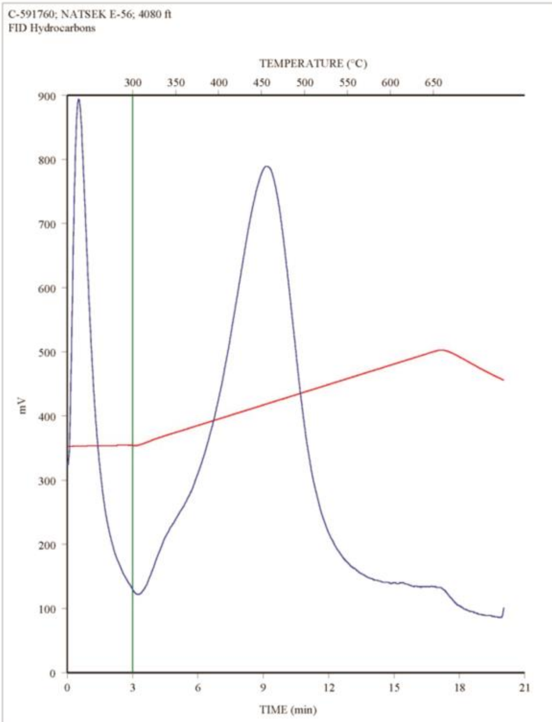

C-591755; NATSEK E-56; 3930 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000
0 3 6 9 12 15 18 21
TIME (min)

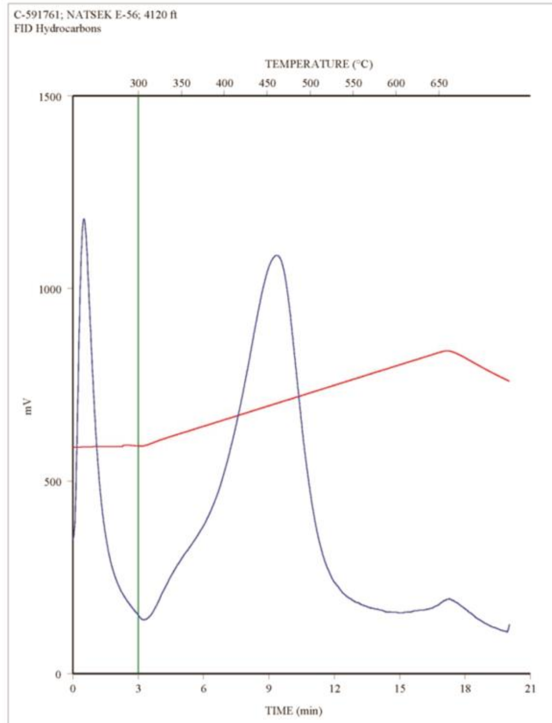

C-591756; NATSEK E-56; 3960 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

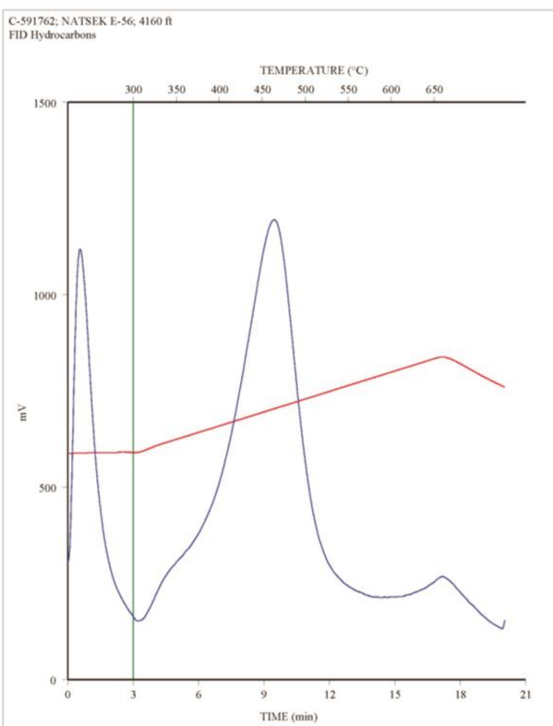

C-591757; NATSEK E-56; 3990 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

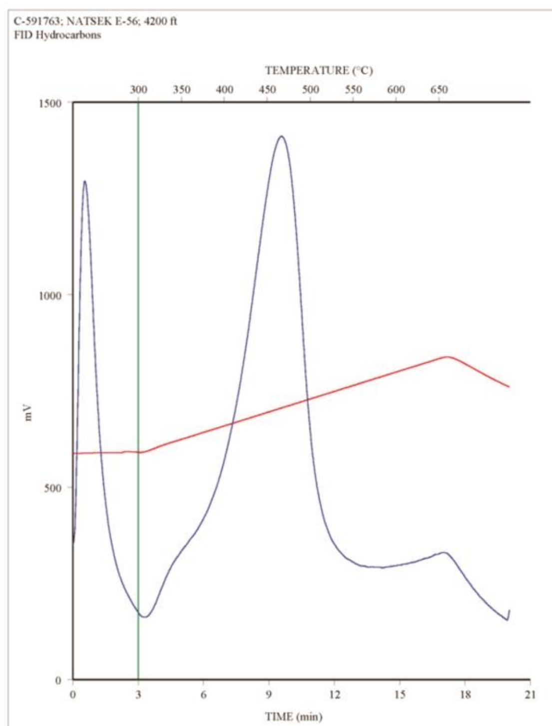

C-591758; NATSEK E-56; 4020 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

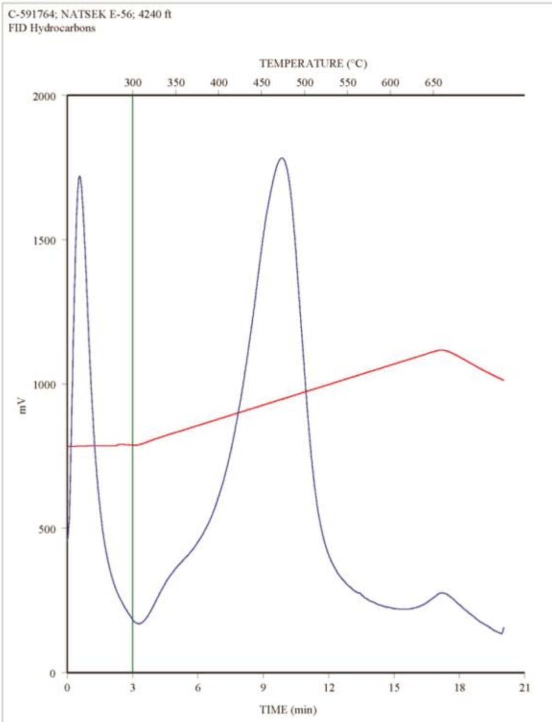

C-591759; NATSEK E-56; 4050 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

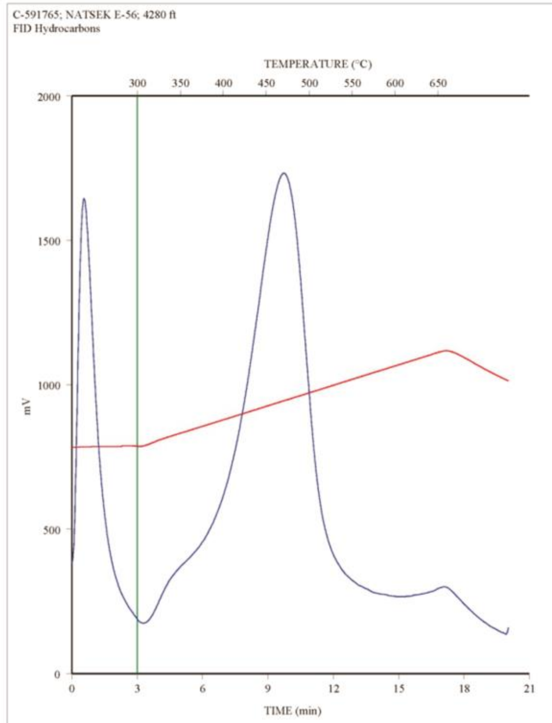

C-591760; NATSEK E-56; 4080 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
900
800
700
600
500
400
300
200
100
0
mV
0 3 6 9 12 15 18 21
TIME (min)

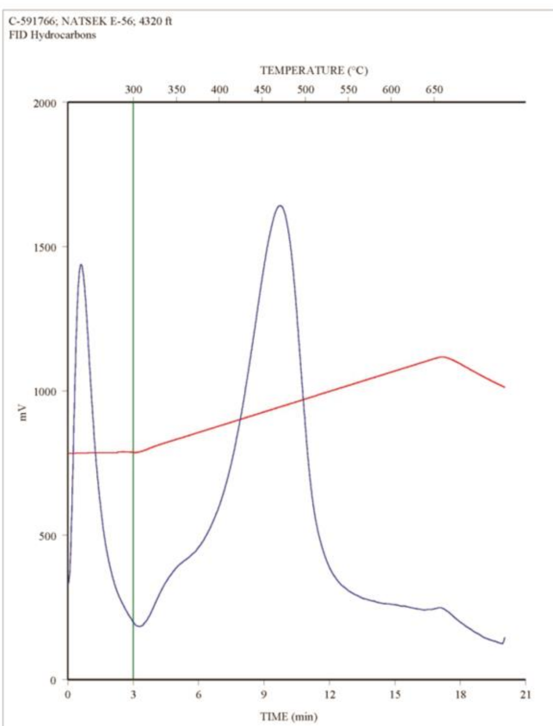

C-591761; NATSEK E-56; 4120 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

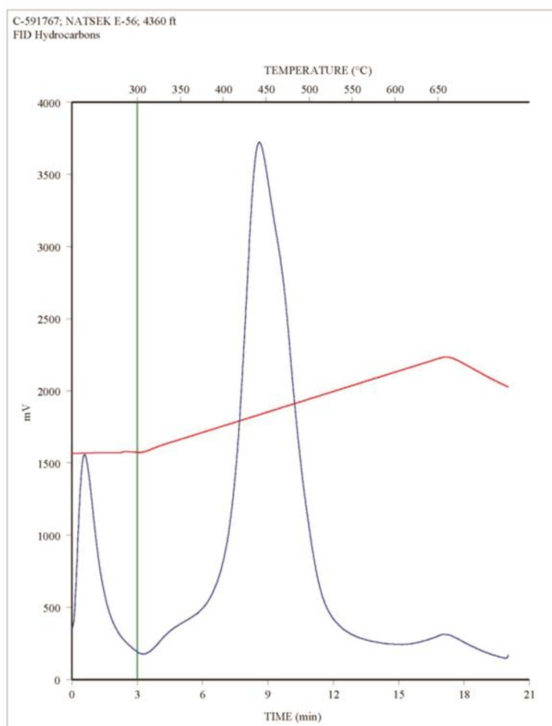

C-591762; NATSEK E-56; 4160 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

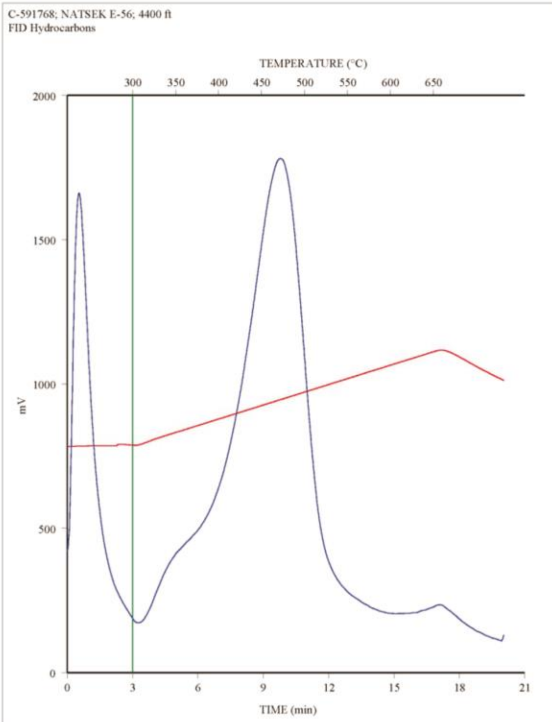

C-591763; NATSEK E-56; 4200 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

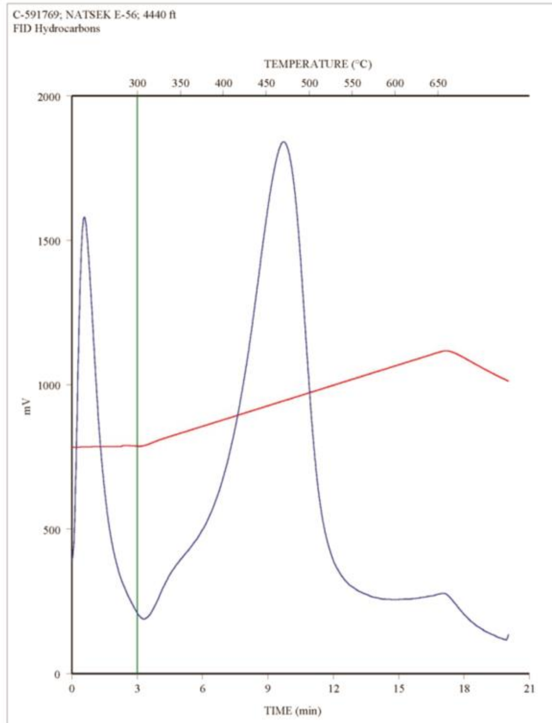

C-591764; NATSEK E-56; 4240 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

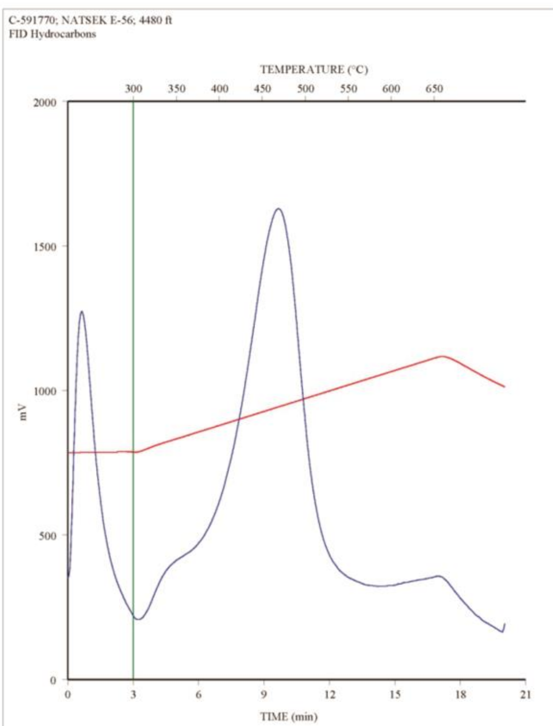

C-591765; NATSEK E-56; 4280 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

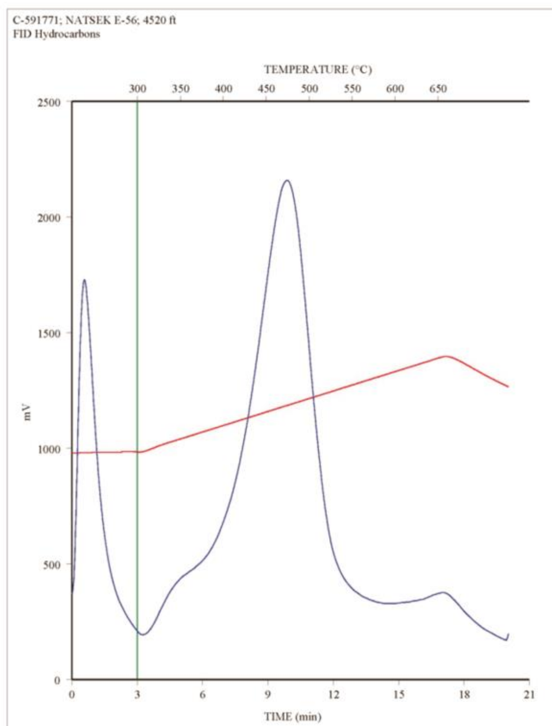

C-591766; NATSEK E-56; 4320 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

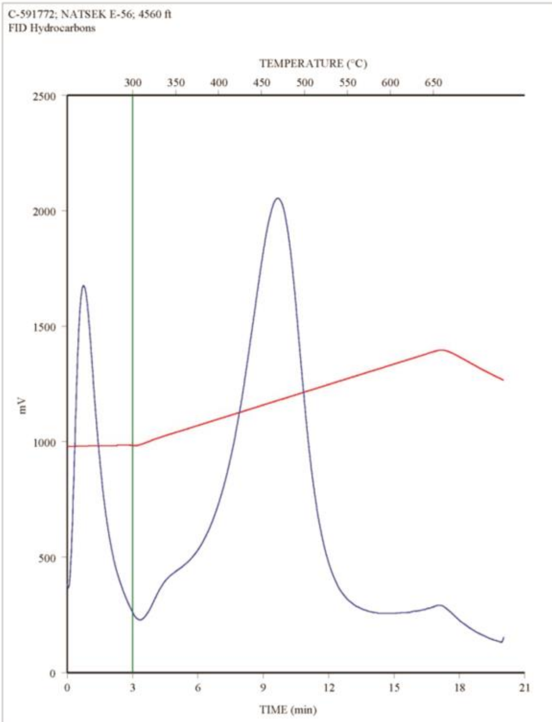

C-591767; NATSEK E-56; 4360 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4000 3500 3000 2500 2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

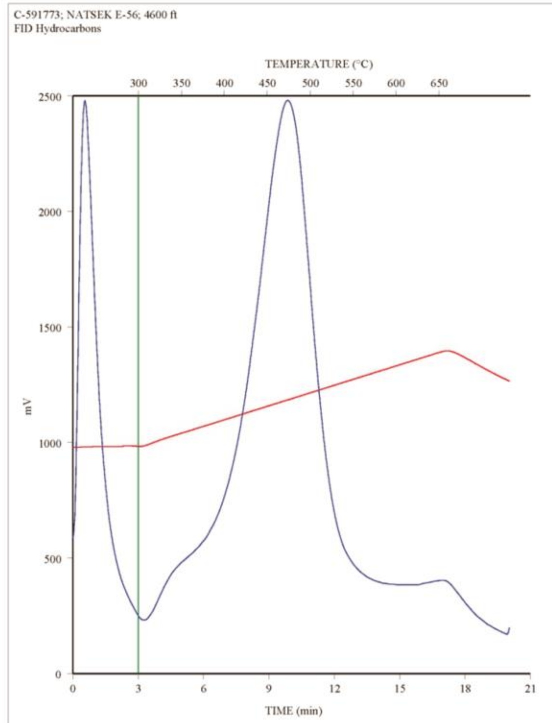

C-591768; NATSEK E-56; 4400 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

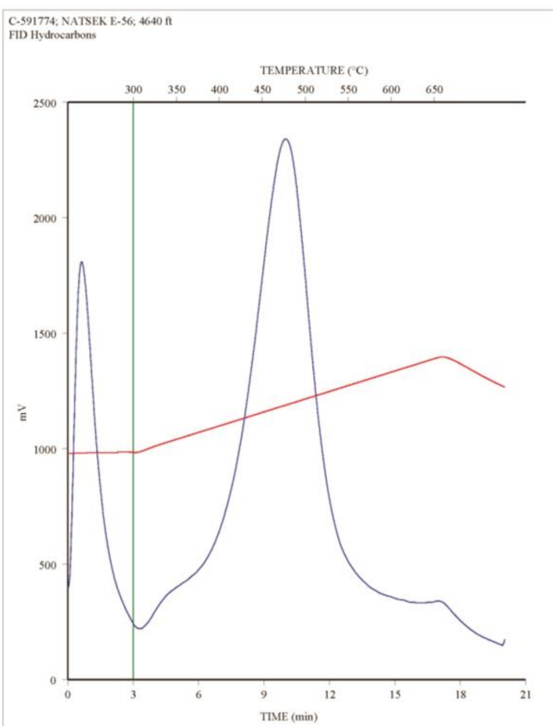

C-591769; NATSEK E-56; 4440 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

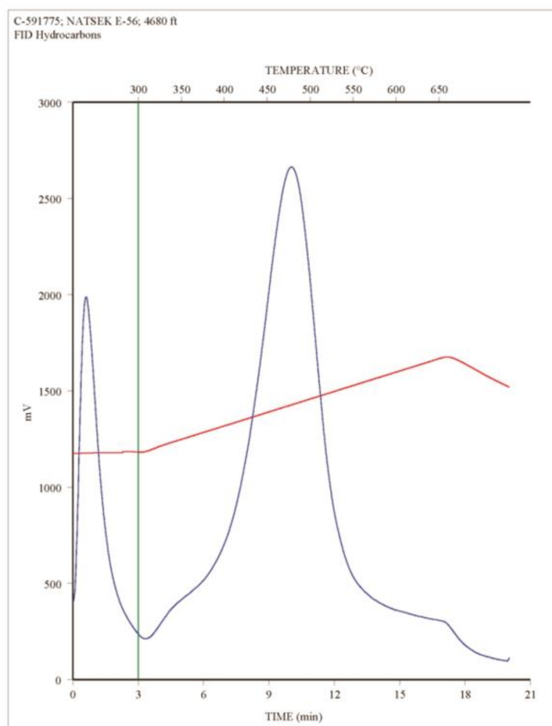

C-591770; NATSEK E-56; 4480 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

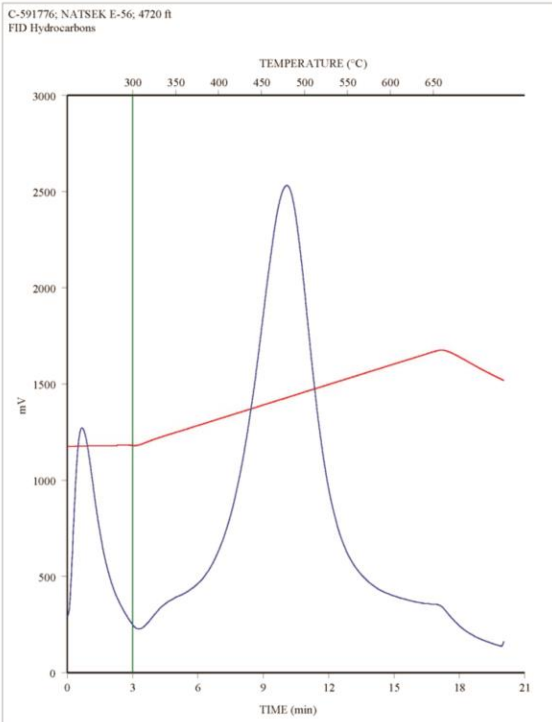

C-591771; NATSEK E-56; 4520 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

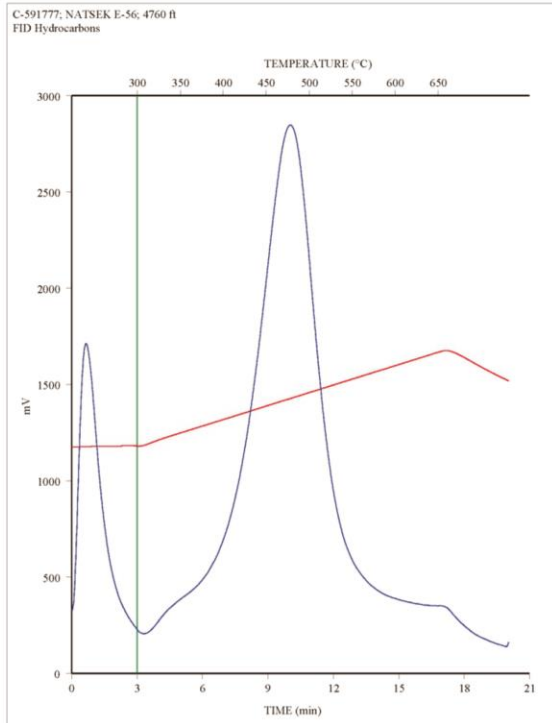

C-591772; NATSEK E-56; 4560 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

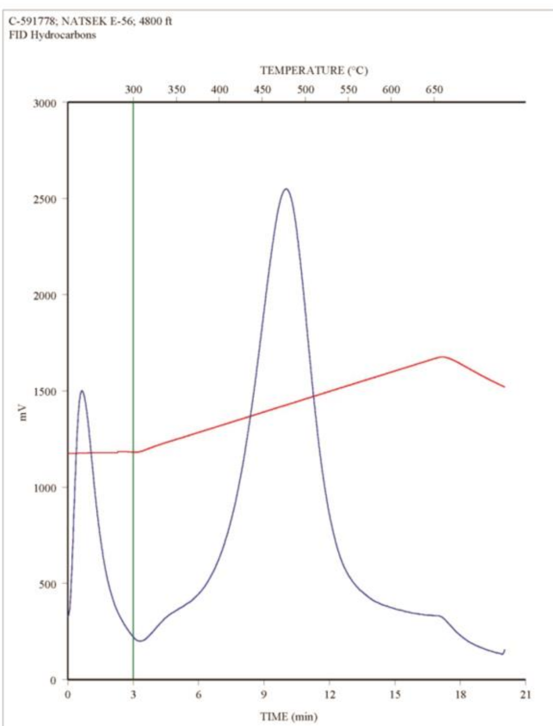

C-591773; NATSEK E-56; 4600 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

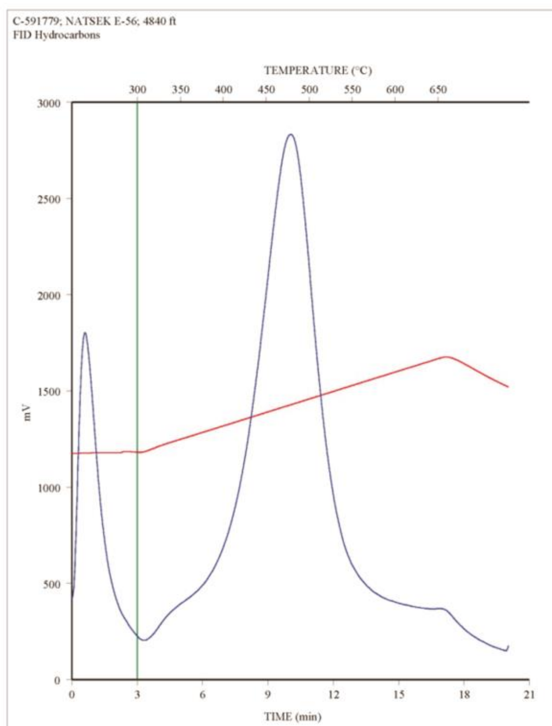

C-591774; NATSEK E-56; 4640 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

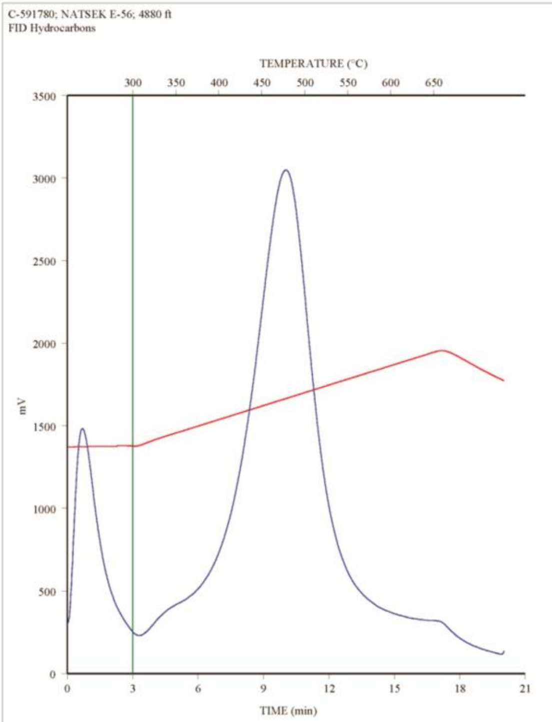

C-591775; NATSEK E-56; 4680 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

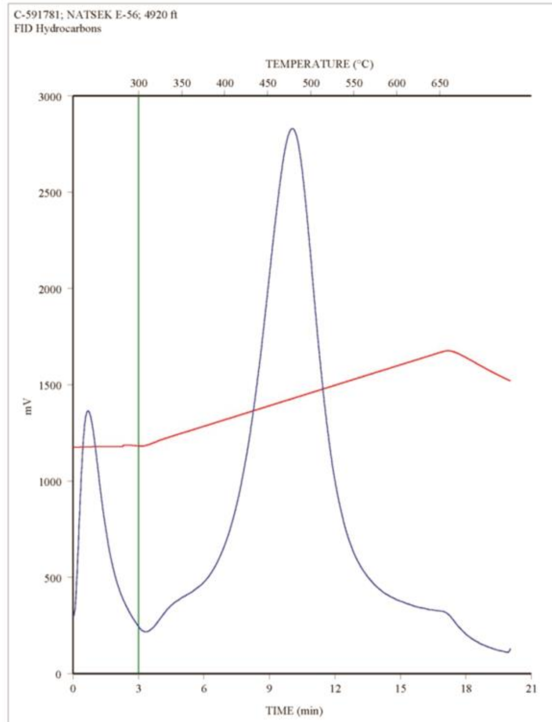

C-591776; NATSEK E-56; 4720 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

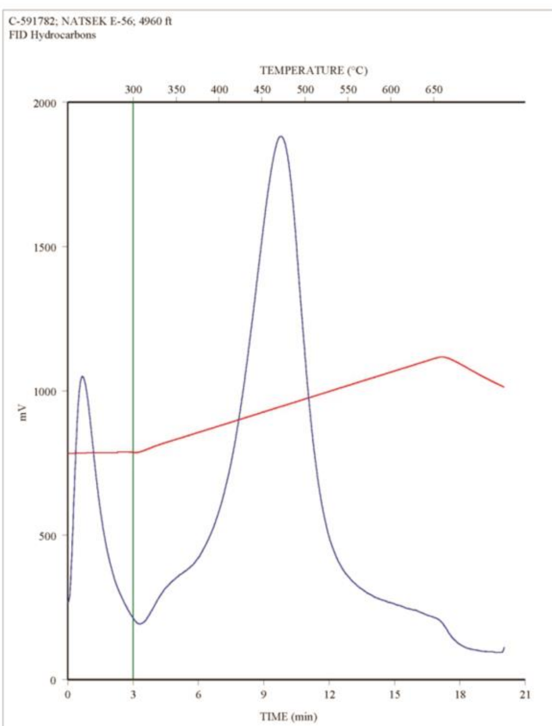

C-591777; NATSEK E-56; 4760 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

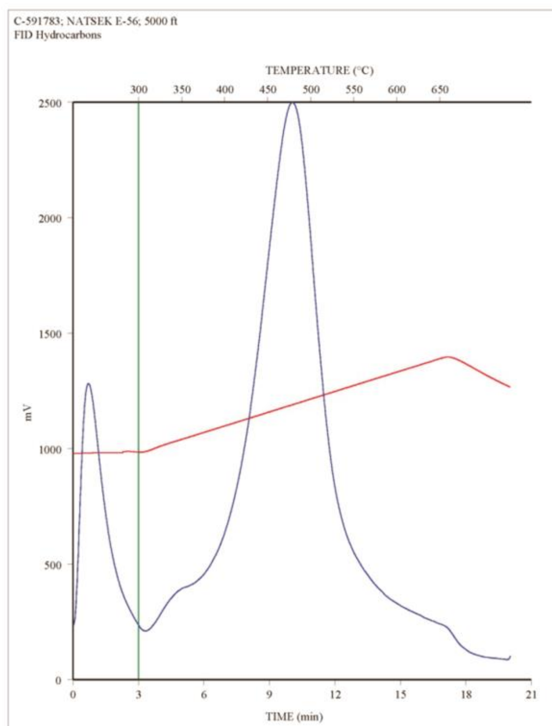

C-591778; NATSEK E-56; 4800 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

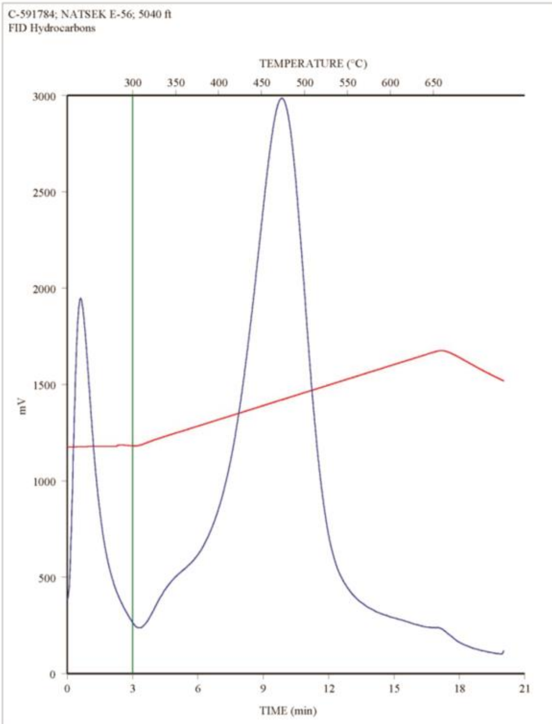

C-591779; NATSEK E-56; 4840 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

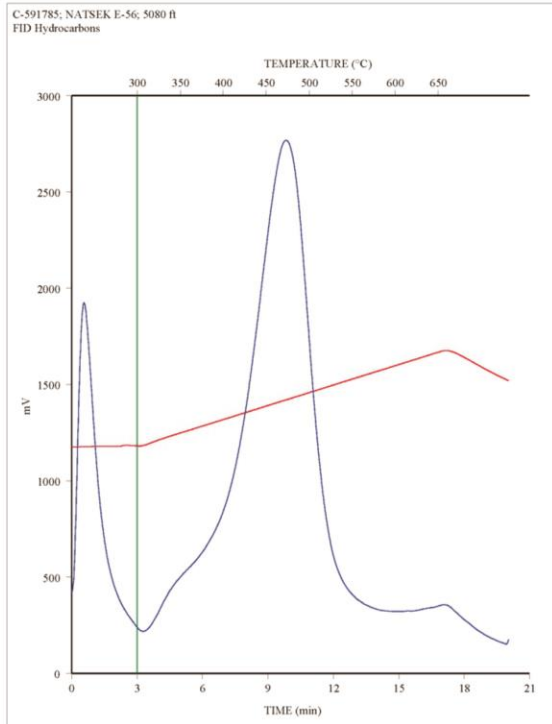

C-591780; NATSEK E-56; 4880 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000 3500
0 3 6 9 12 15 18 21
TIME (min)

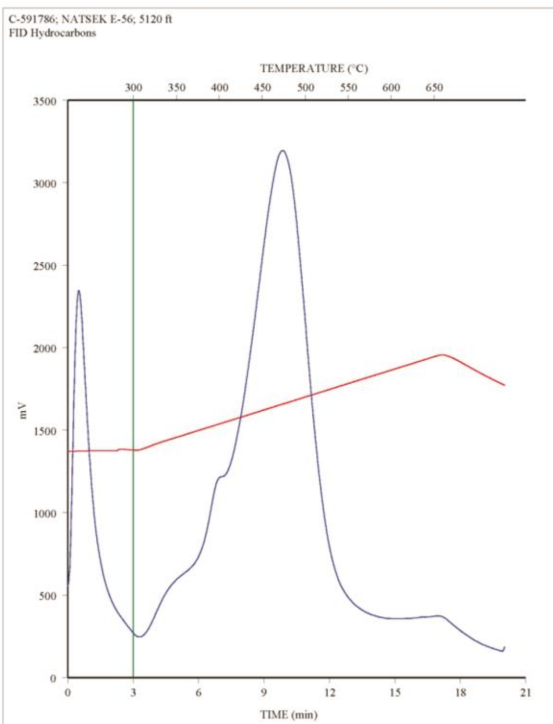

C-591781; NATSEK E-56; 4920 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000
0 3 6 9 12 15 18 21
TIME (min)

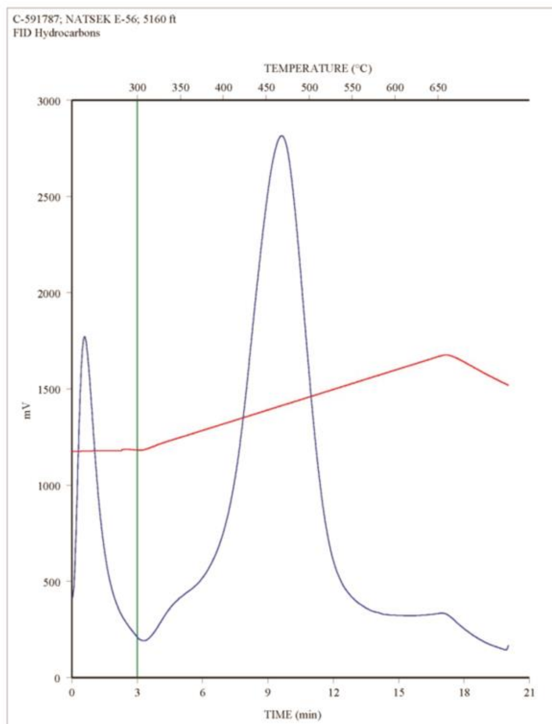

C-591782; NATSEK E-56; 4960 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000
0 3 6 9 12 15 18 21
TIME (min)

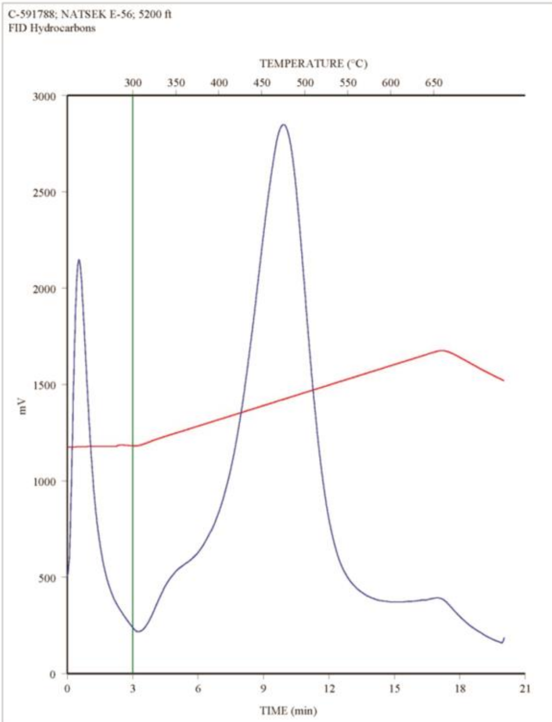

C-591783; NATSEK E-56; 5000 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500
0 3 6 9 12 15 18 21
TIME (min)

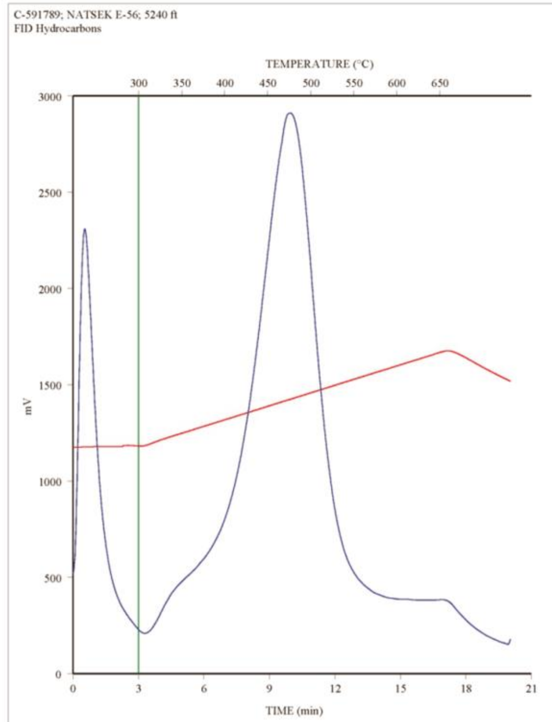

C-591784; NATSEK E-56; 5040 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

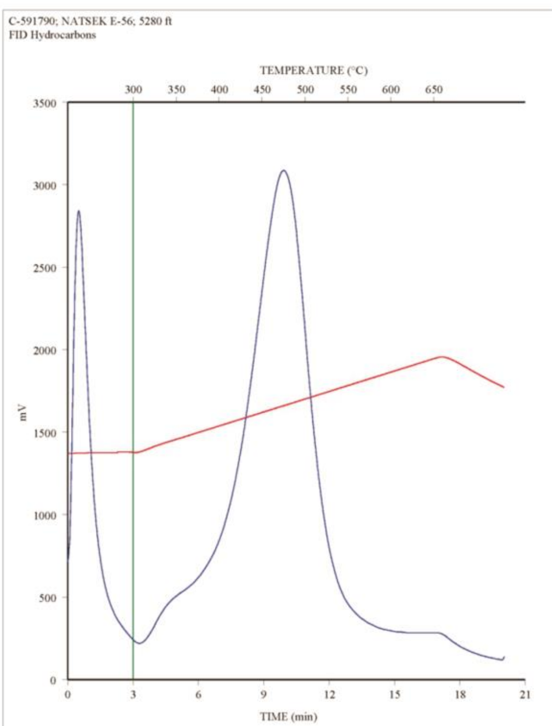

C-591785; NATSEK E-56; 5080 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

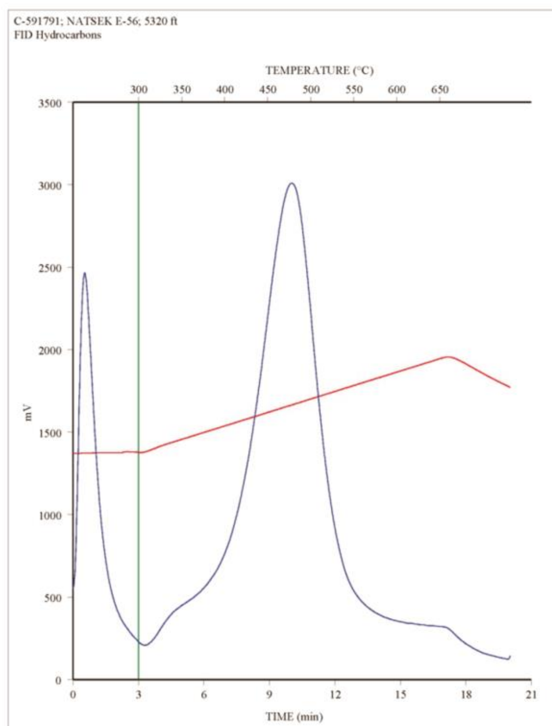

C-591786; NATSEK E-56; 5120 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3500 3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

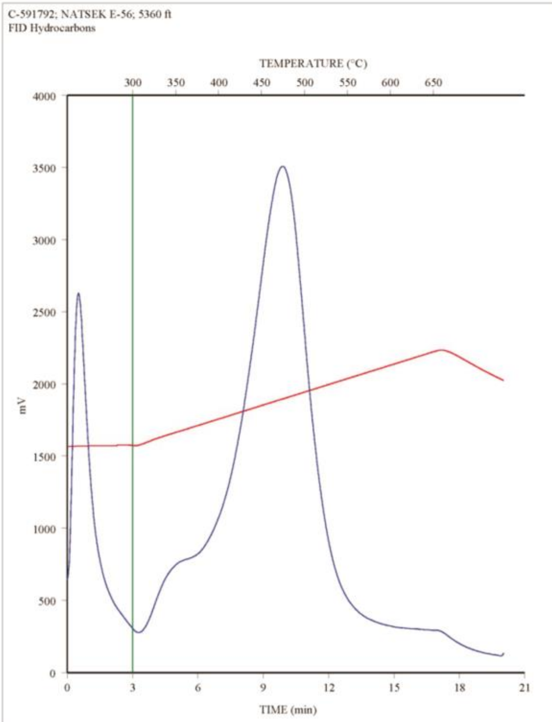

C-591787; NATSEK E-56; 5160 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
3000 2500 2000 1500 1000 500 0
0 3 6 9 12 15 18 21
TIME (min)

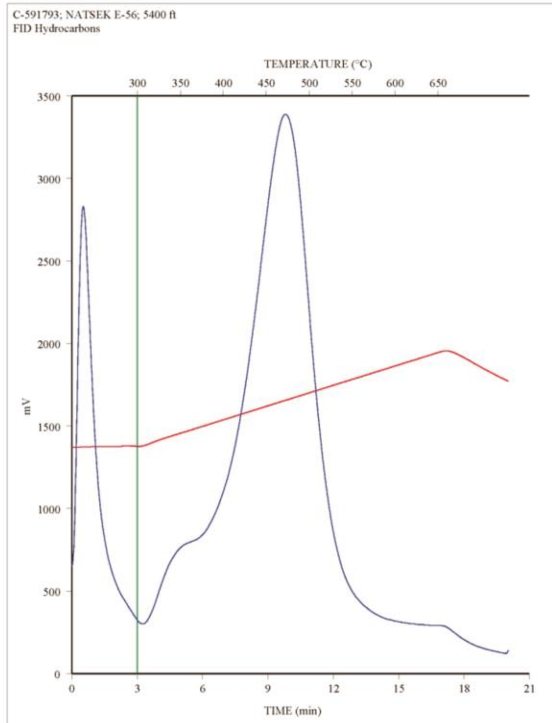

C-591788; NATSEK E-56; 5200 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000
TIME (min)
0 3 6 9 12 15 18 21

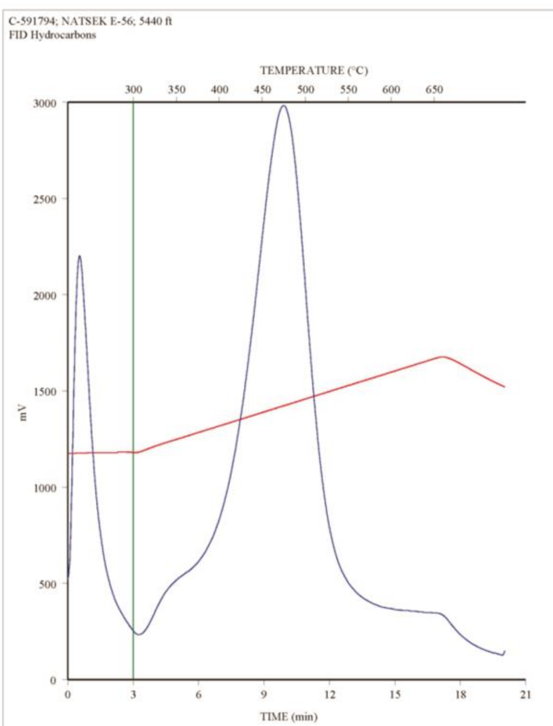

C-591789; NATSEK E-56; 5240 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000
TIME (min)
0 3 6 9 12 15 18 21

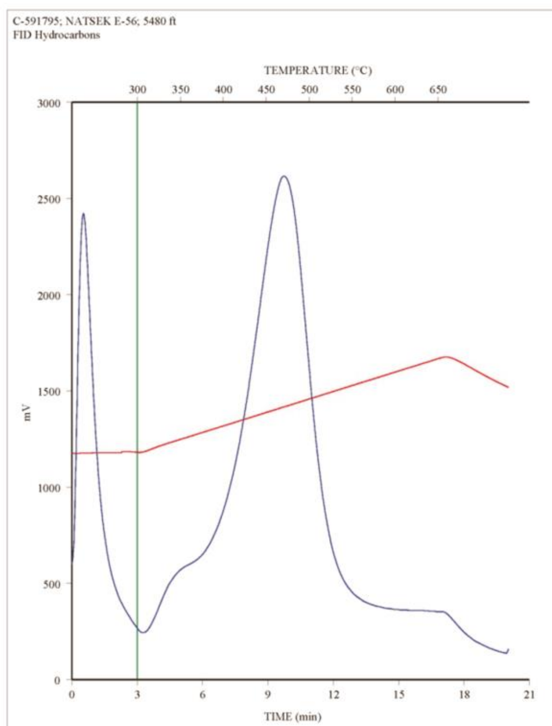

C-591790; NATSEK E-56; 5280 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000 3500
TIME (min)
0 3 6 9 12 15 18 21

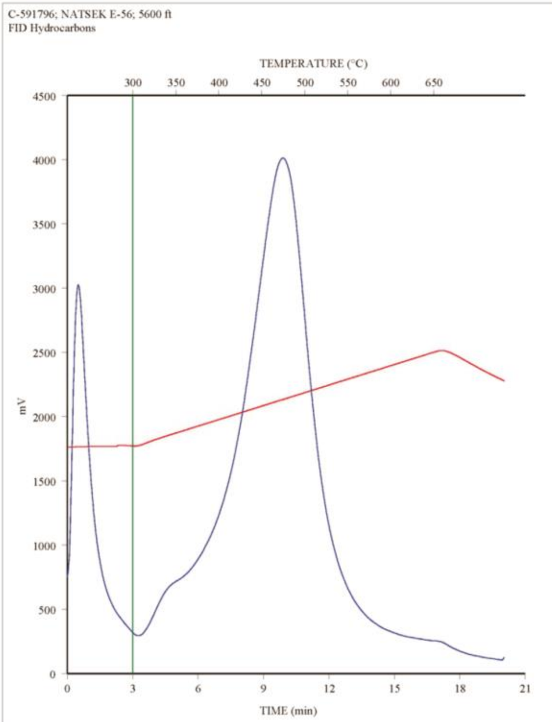

C-591791; NATSEK E-56; 5320 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000 3500
TIME (min)
0 3 6 9 12 15 18 21

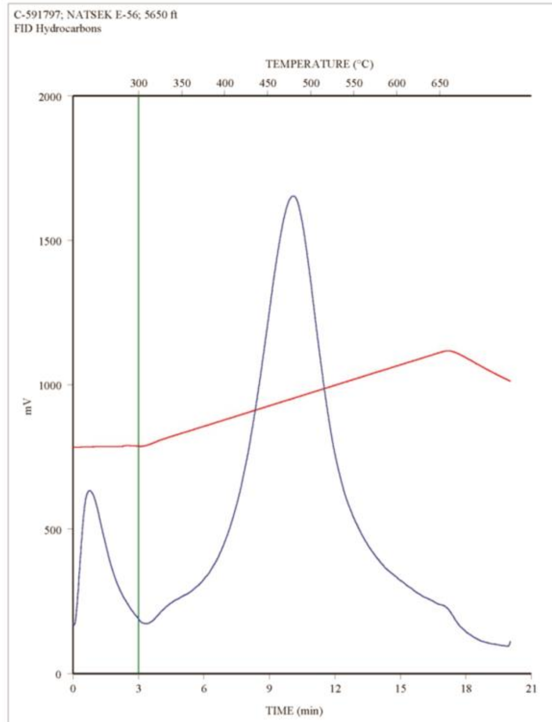

C-591792; NATSEK E-56; 5360 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

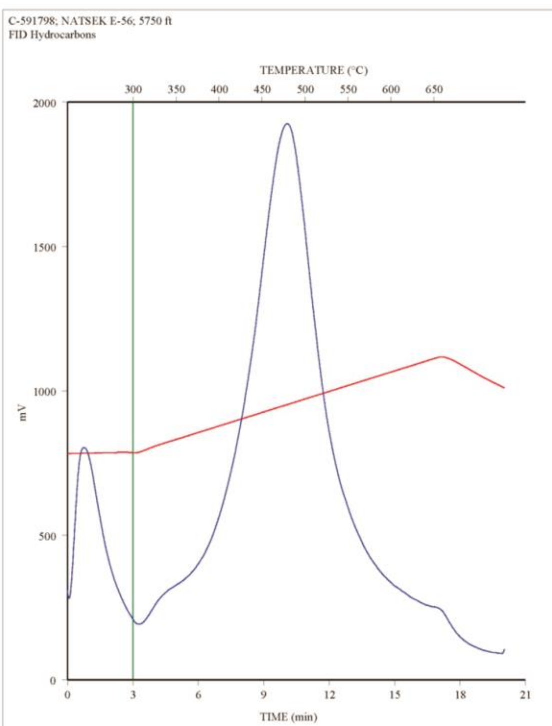

C-591793; NATSEK E-56; 5400 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

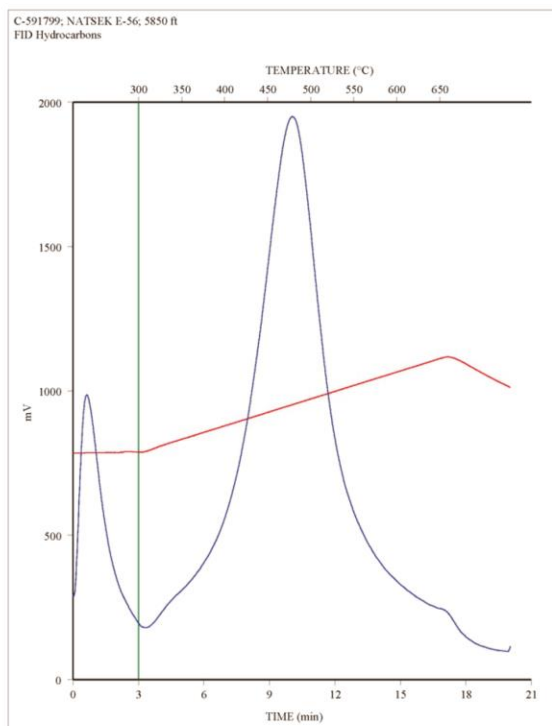

C-591794; NATSEK E-56; 5440 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

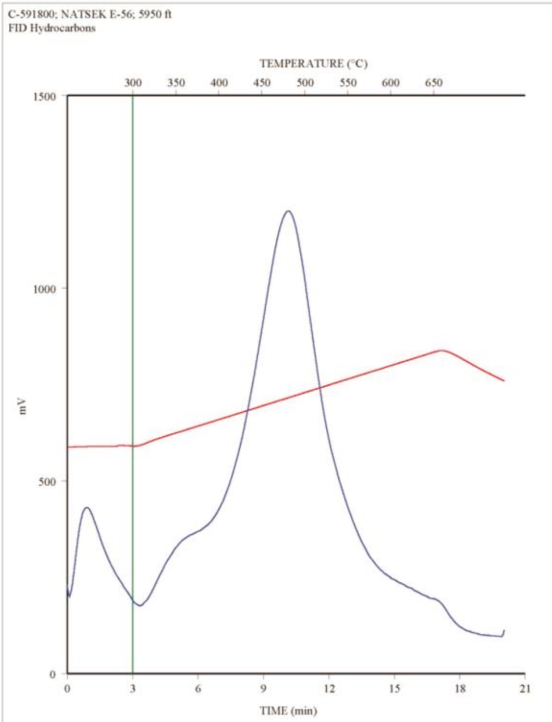

C-591795; NATSEK E-56; 5480 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

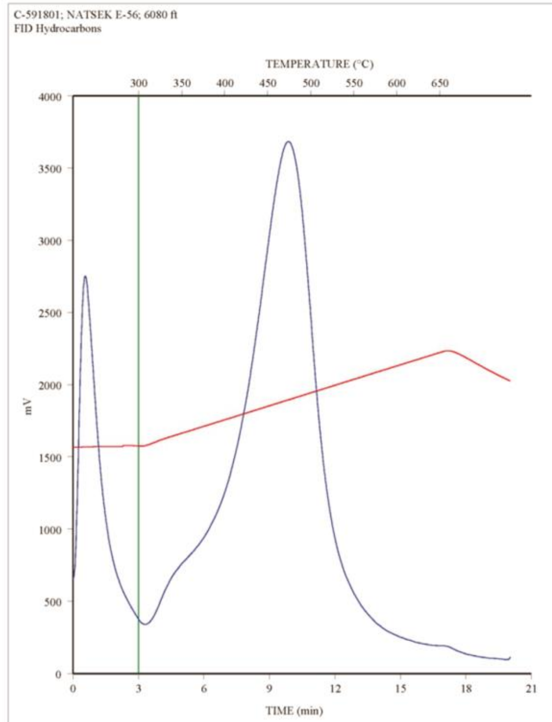

C-591796; NATSEK E-56; 5600 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

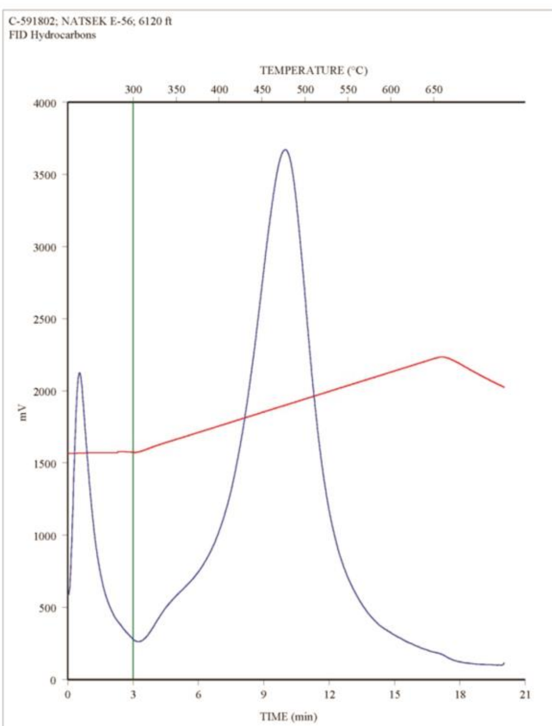

C-591797; NATSEK E-56; 5650 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

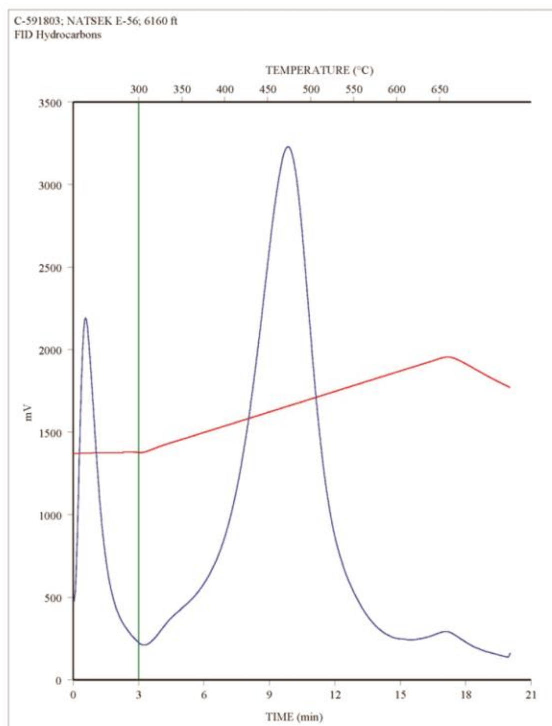

C-591798; NATSEK E-56; 5750 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

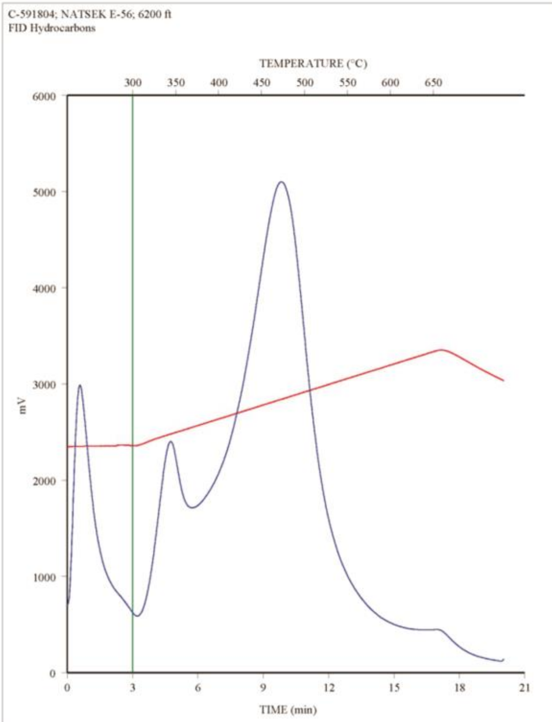

C-591799; NATSEK E-56; 5850 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

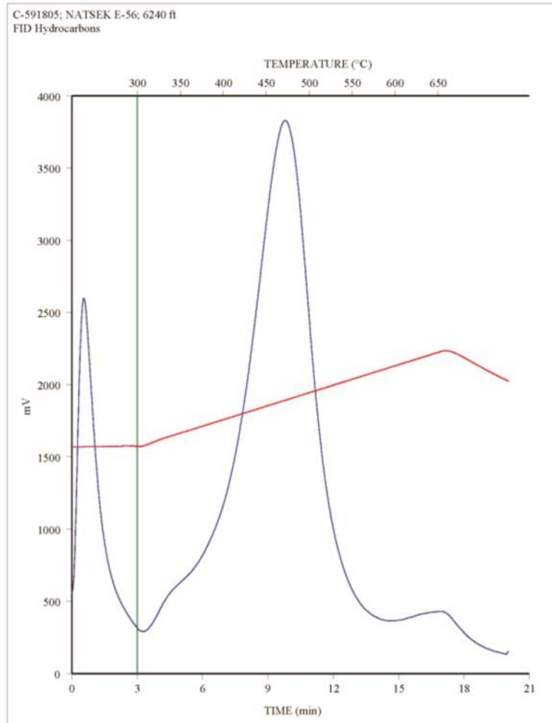

C-591800; NATSEK E-56; 5950 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

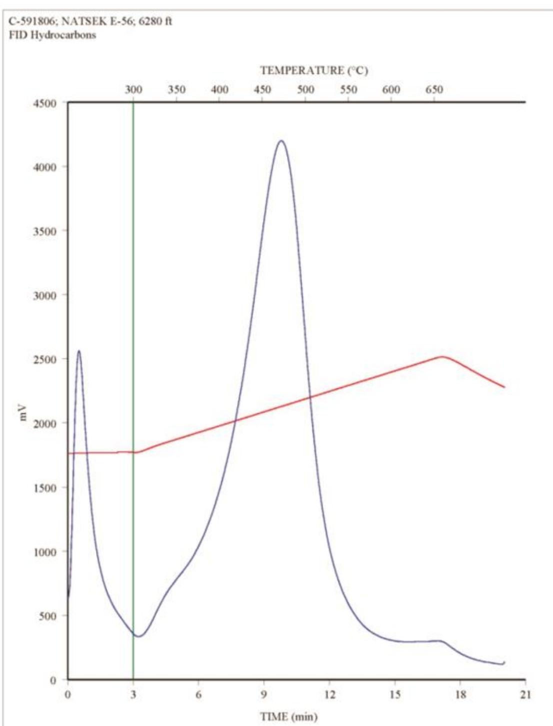

C-591801; NATSEK E-56; 6080 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4000
3500
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

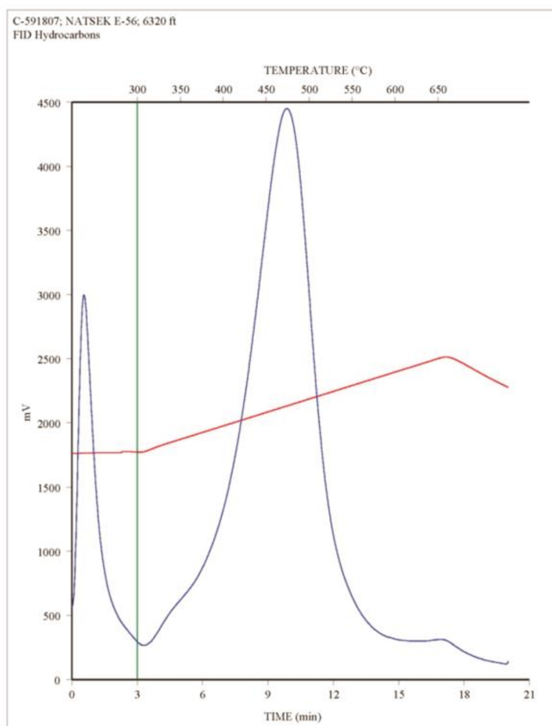

C-591802; NATSEK E-56; 6120 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4000
3500
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

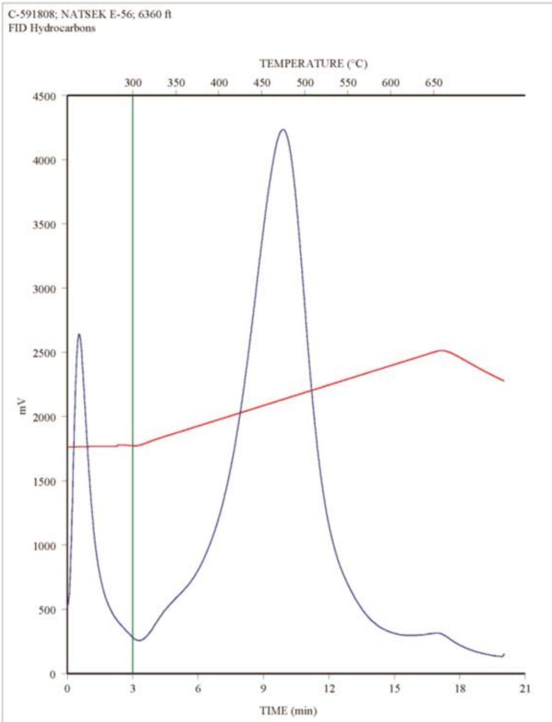

C-591803; NATSEK E-56; 6160 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
3500
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

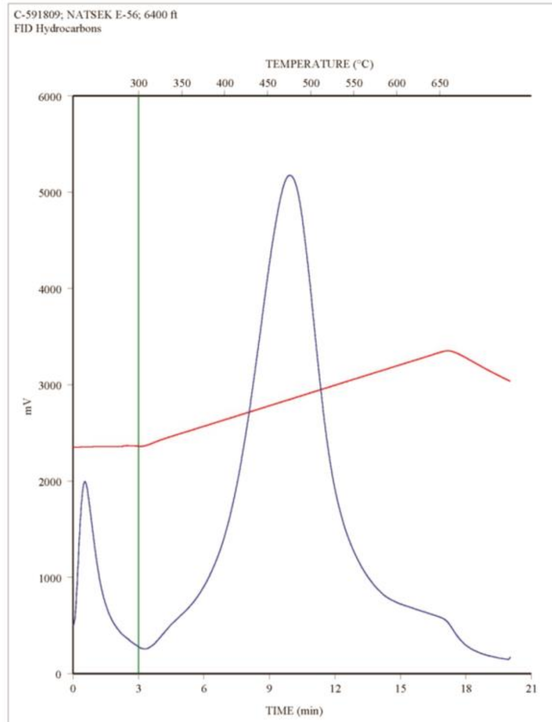

C-591804; NATSEK E-56; 6200 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
6000 5000 4000 3000 2000 1000 0
mV
0 3 6 9 12 15 18 21
TIME (min)

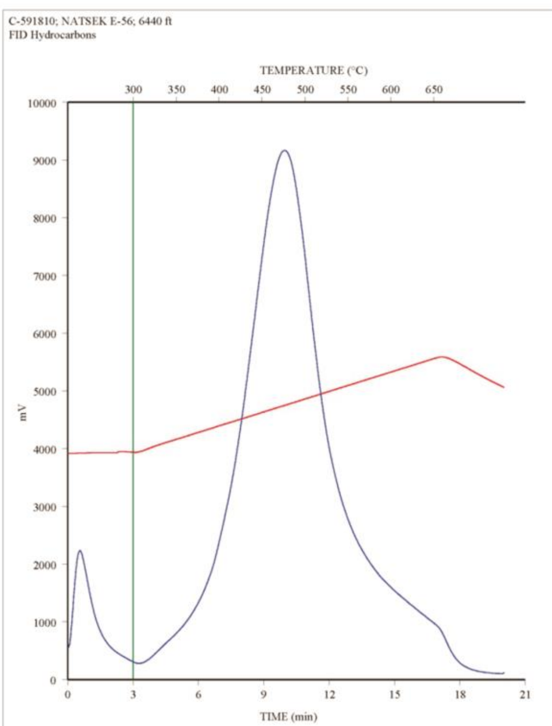

C-591805; NATSEK E-56; 6240 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4000 3500 3000 2500 2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

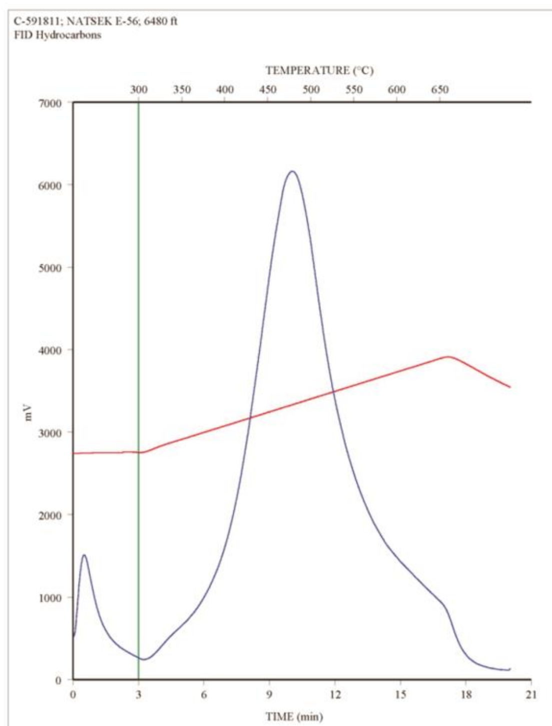

C-591806; NATSEK E-56; 6280 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4500 4000 3500 3000 2500 2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

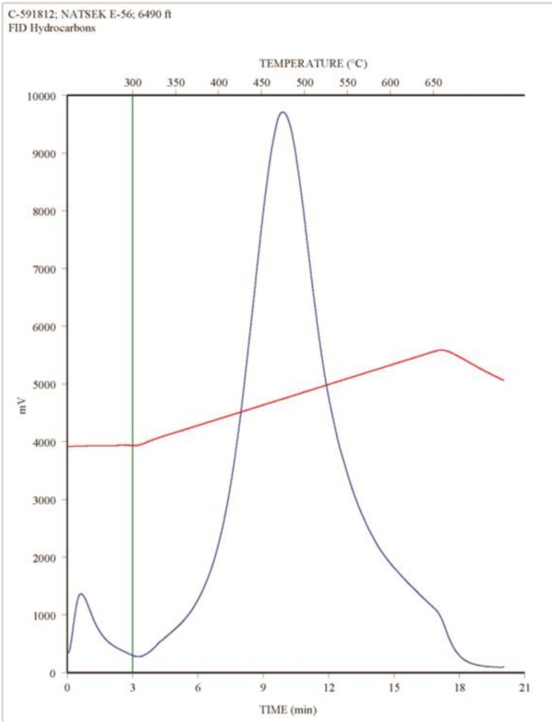

C-591807; NATSEK E-56; 6320 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4500 4000 3500 3000 2500 2000 1500 1000 500 0
mV
0 3 6 9 12 15 18 21
TIME (min)

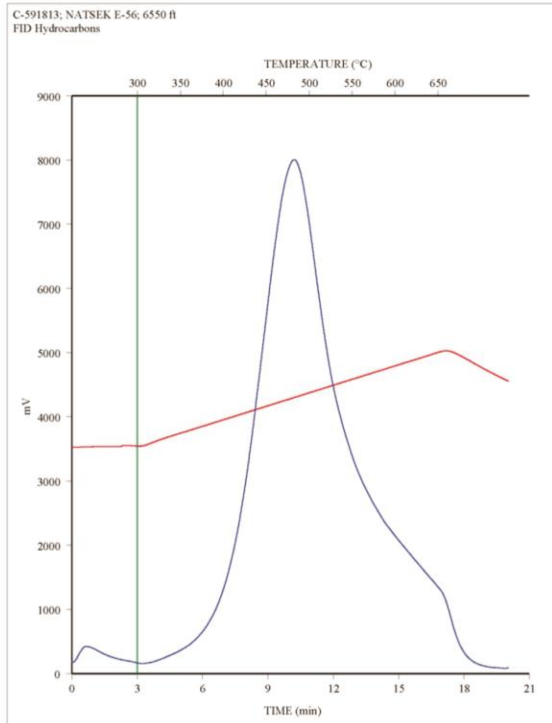

C-591808; NATSEK E-56; 6360 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
4500
4000
3500
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)

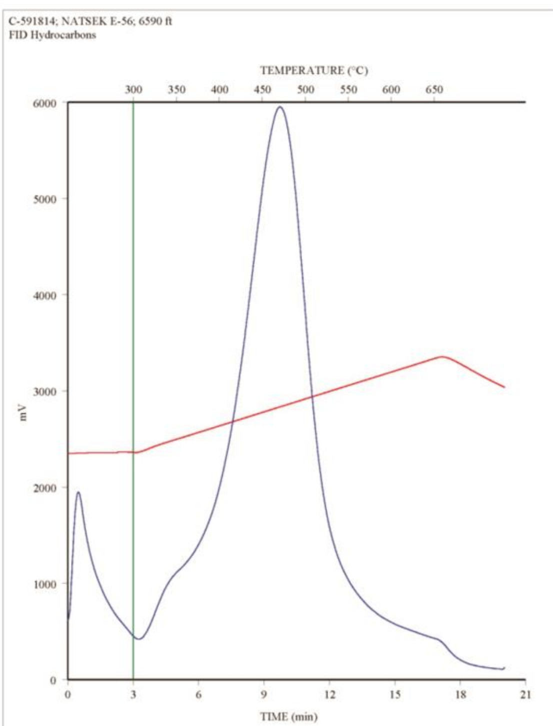

C-591809; NATSEK E-56; 6400 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

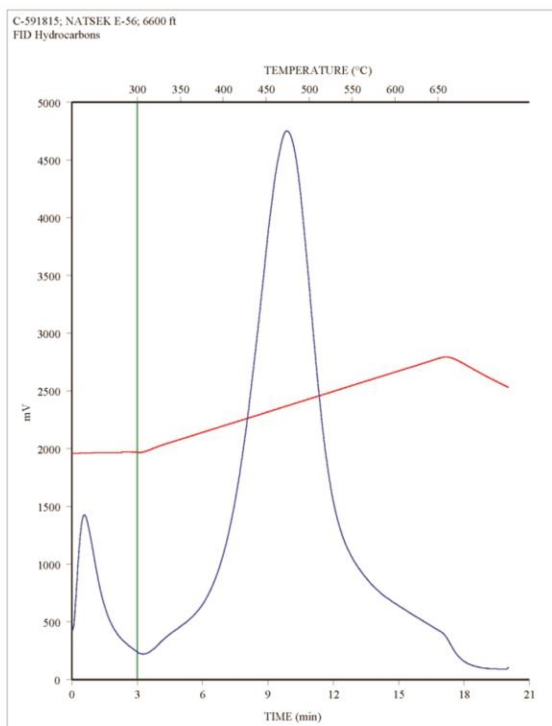

C-591810; NATSEK E-56; 6440 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

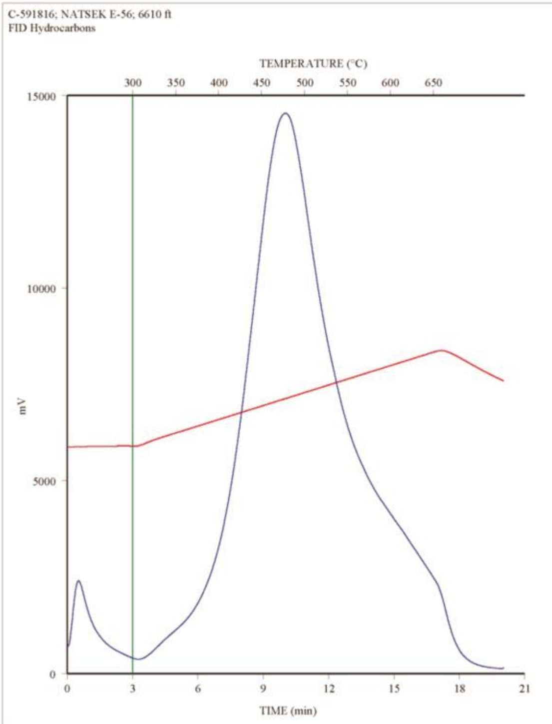

C-591811; NATSEK E-56; 6480 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

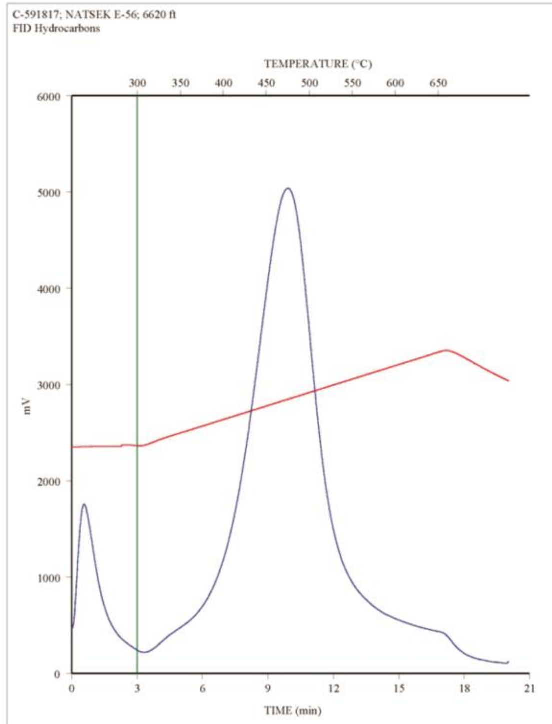

C-591812; NATSEK E-56; 6490 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

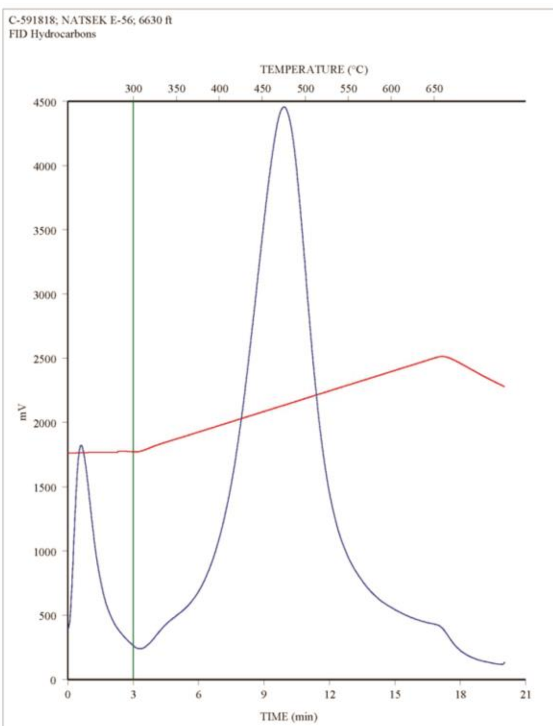

C-591813; NATSEK E-56; 6550 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

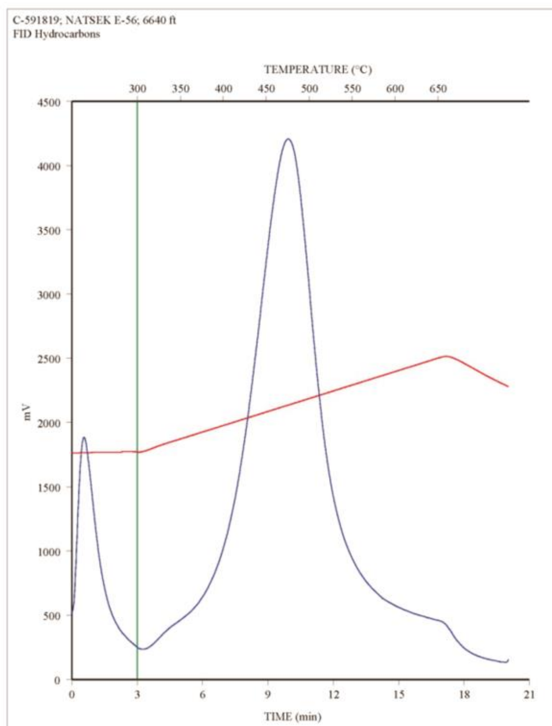

C-591814; NATSEK E-56; 6590 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

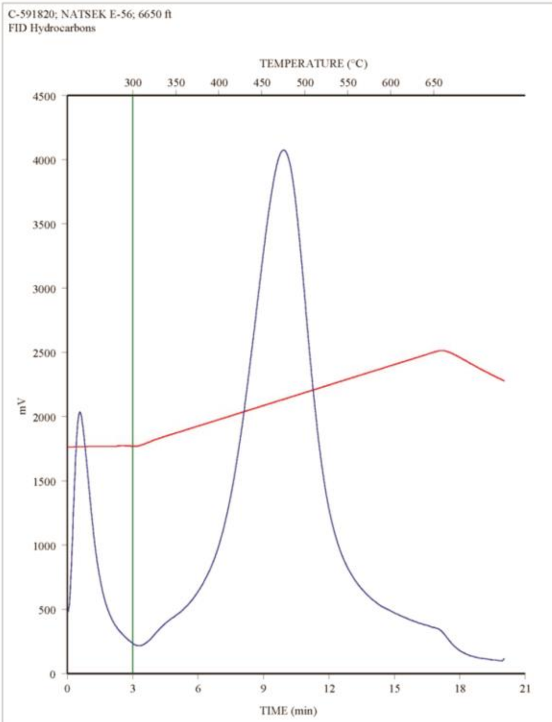

C-591815; NATSEK E-56; 6600 ft
FID Hydrocarbons
TEMPERATURE (°C)
TIME (min)
mV

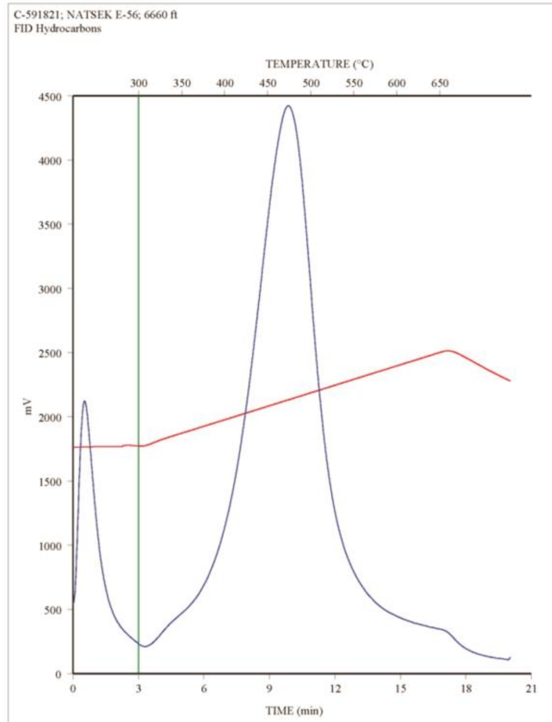

C-591816; NATSEK E-56; 6610 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 5000 10000 15000
TIME (min)
0 3 6 9 12 15 18 21

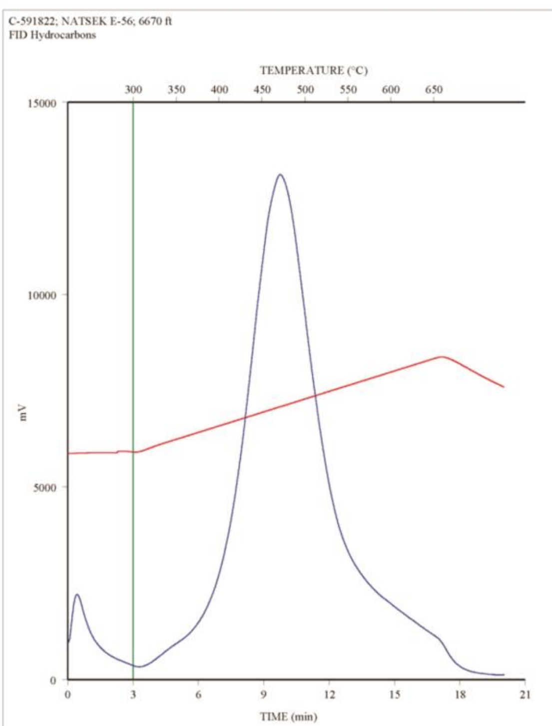

C-591817; NATSEK E-56; 6620 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 1000 2000 3000 4000 5000 6000
TIME (min)
0 3 6 9 12 15 18 21

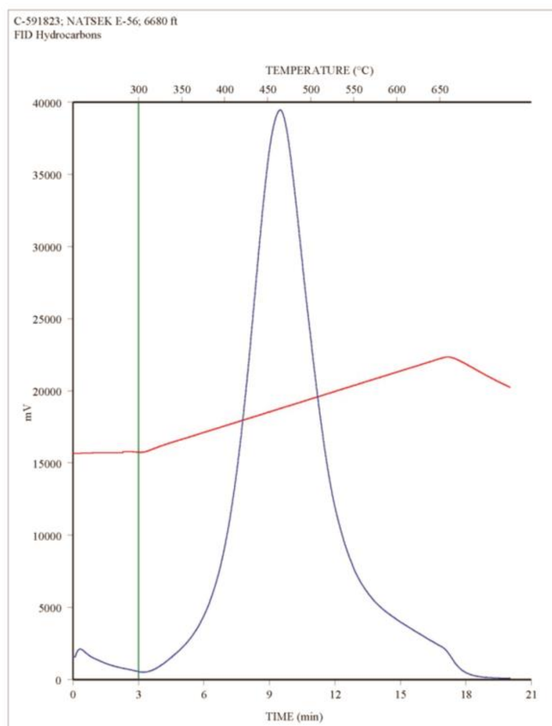

C-591818; NATSEK E-56; 6630 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000 3500 4000 4500
TIME (min)
0 3 6 9 12 15 18 21

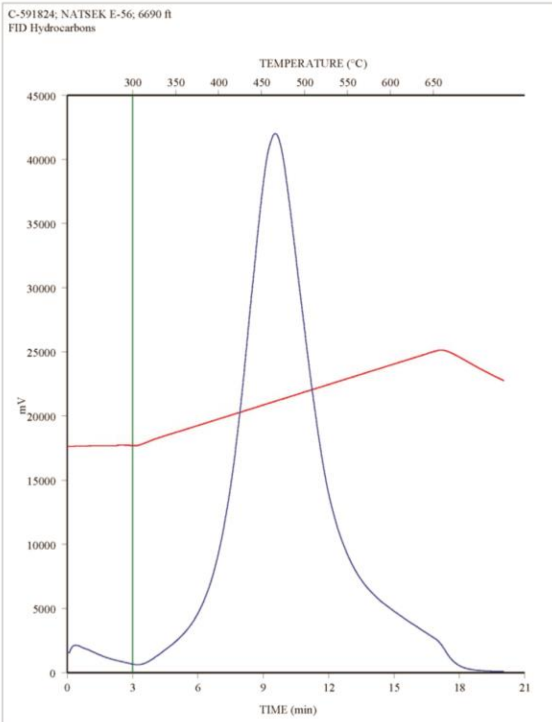

C-591819; NATSEK E-56; 6640 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
mV
0 500 1000 1500 2000 2500 3000 3500 4000 4500
TIME (min)
0 3 6 9 12 15 18 21

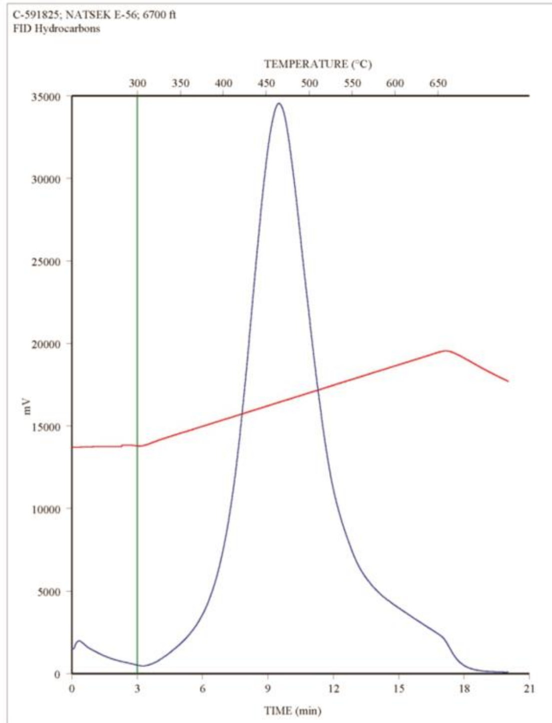

C-591820; NATSEK E-56; 6650 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

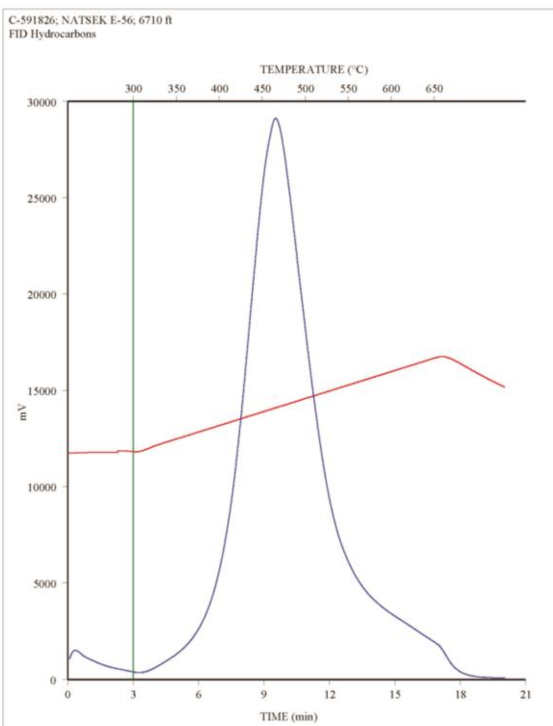

C-591821; NATSEK E-56; 6660 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

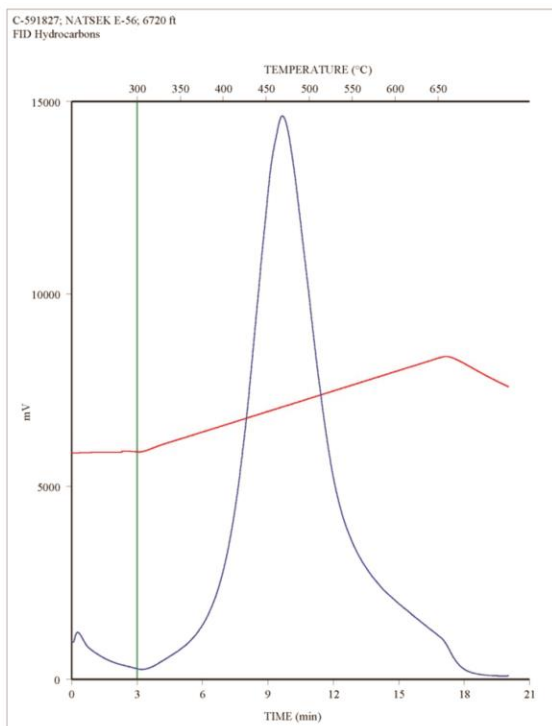

C-591822; NATSEK E-56; 6670 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

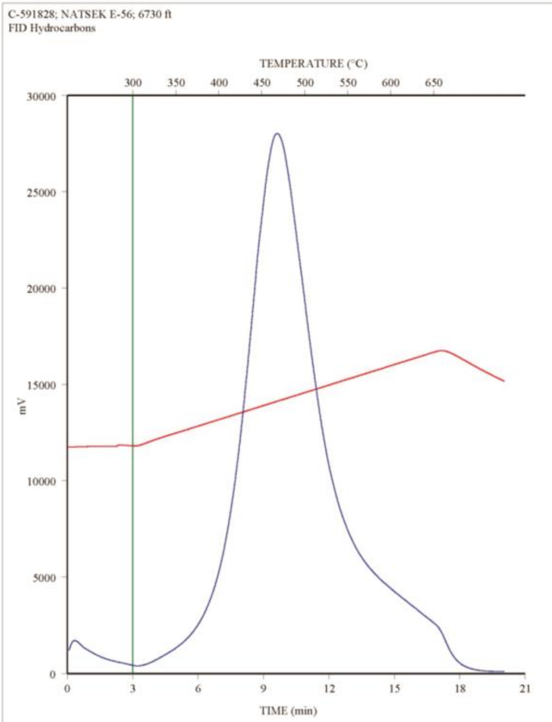

C-591823; NATSEK E-56; 6680 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

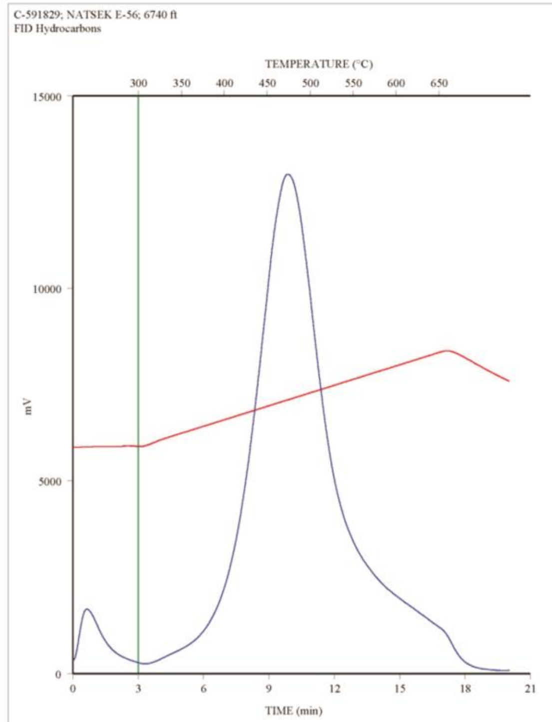

C-591824; NATSEK E-56; 6690 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

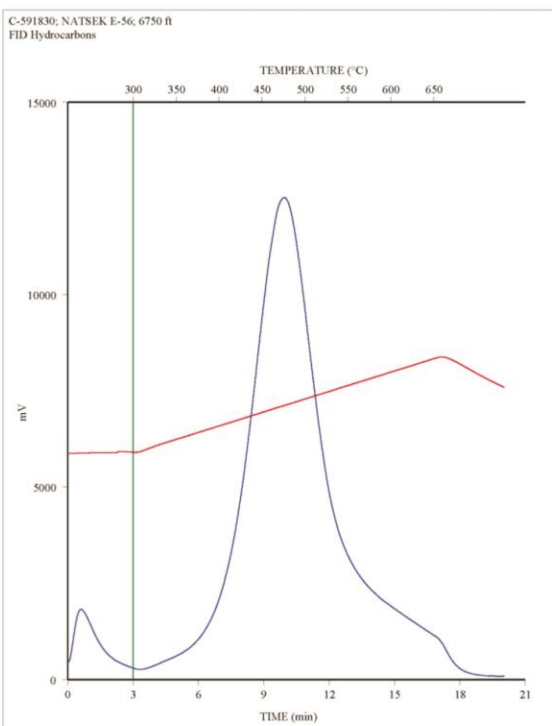

C-591825; NATSEK E-56; 6700 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

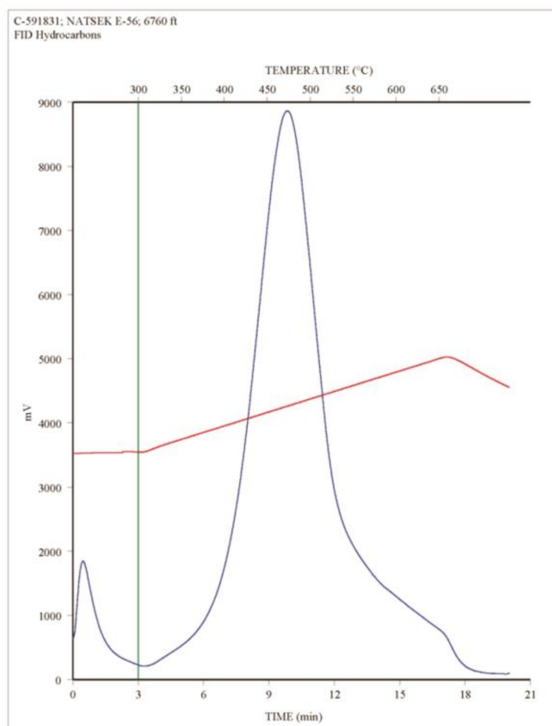

C-591826; NATSEK E-56; 6710 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

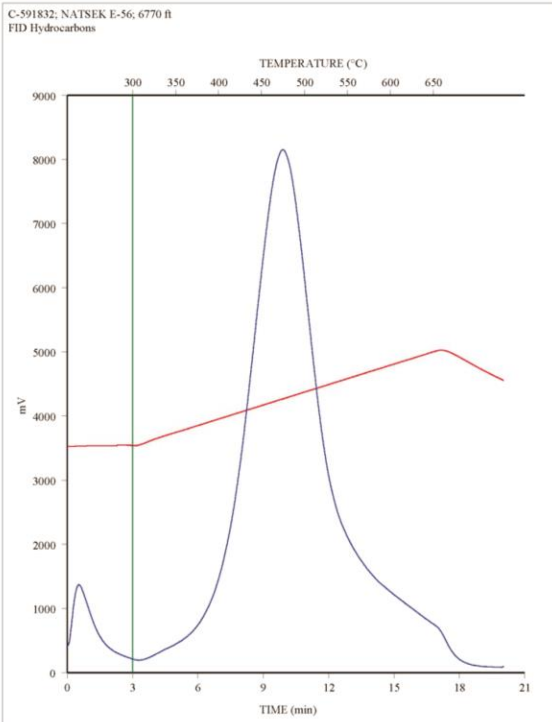

C-591827; NATSEK E-56; 6720 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

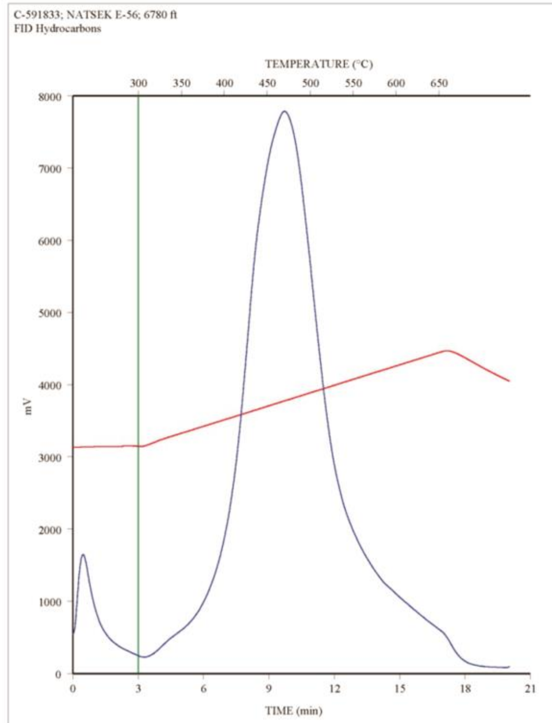

C-591828; NATSEK E-56; 6730 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
30000
25000
20000
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

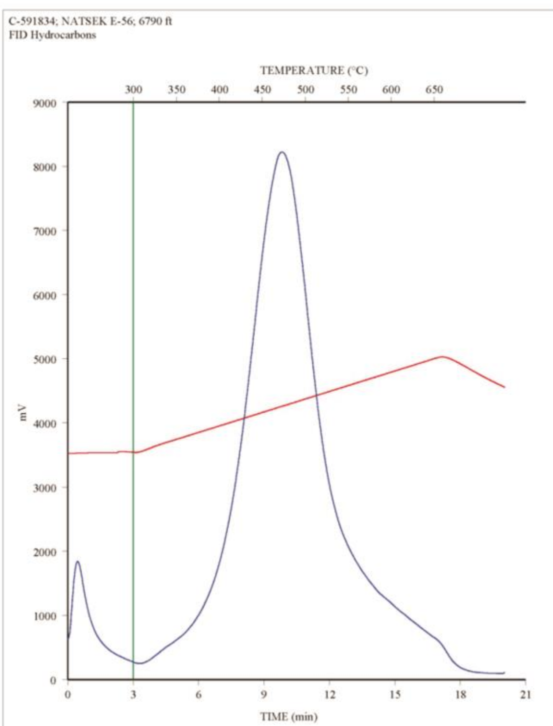

C-591829; NATSEK E-56; 6740 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

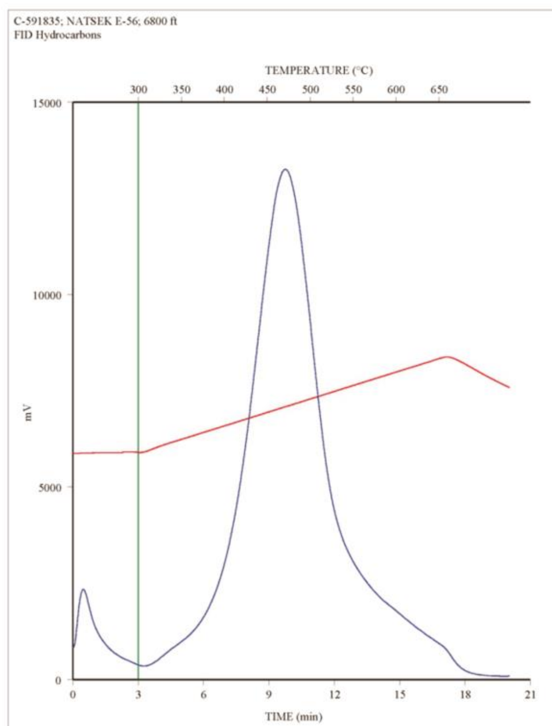

C-591830; NATSEK E-56; 6750 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

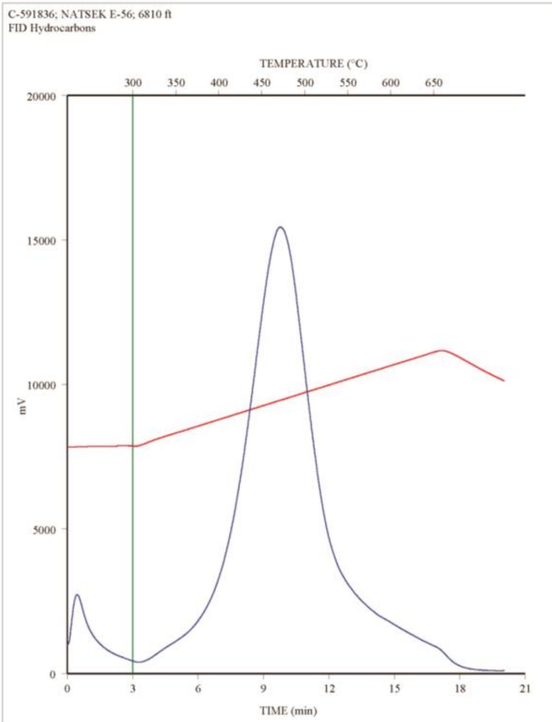

C-591831; NATSEK E-56; 6760 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

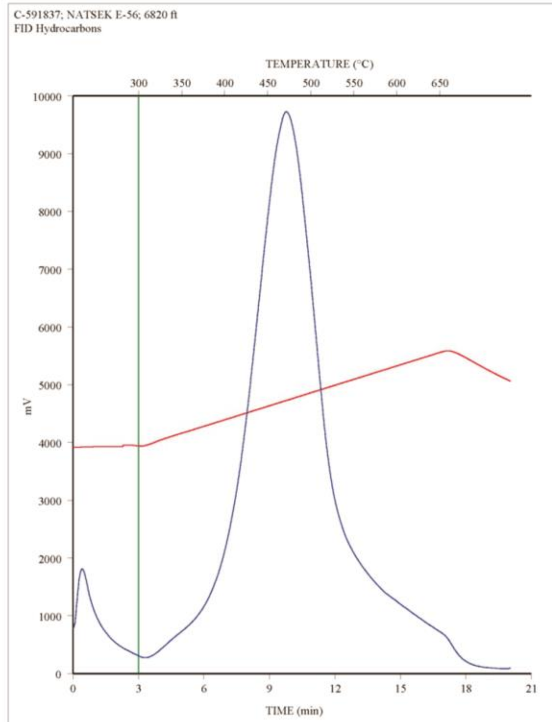

C-591832; NATSEK E-56; 6770 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

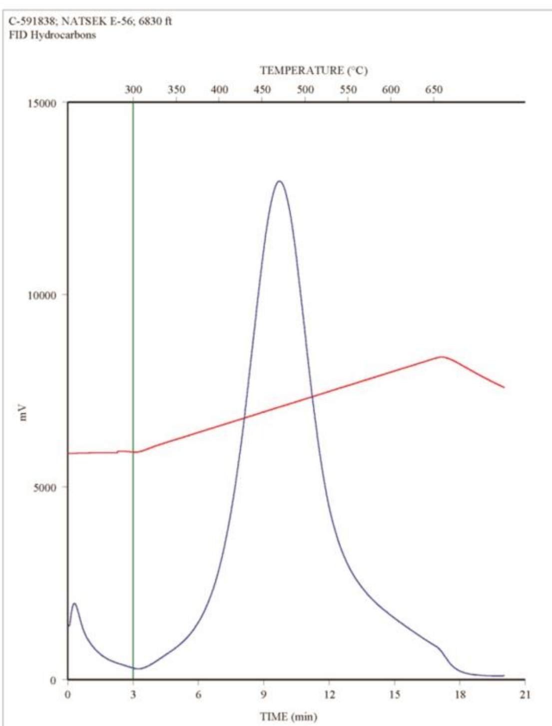

C-591833; NATSEK E-56; 6780 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

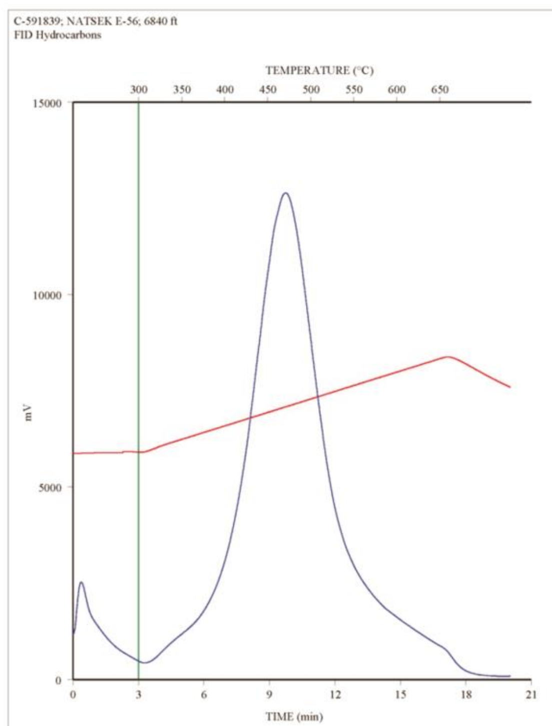

C-591834; NATSEK E-56; 6790 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

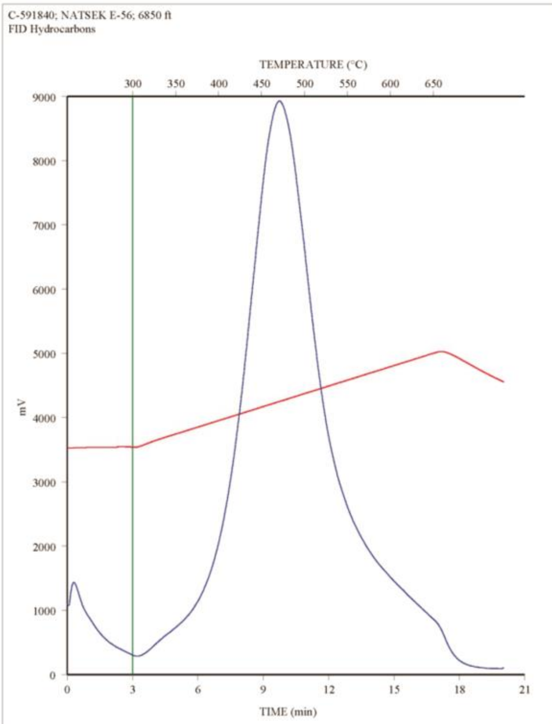

C-591835; NATSEK E-56; 6800 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

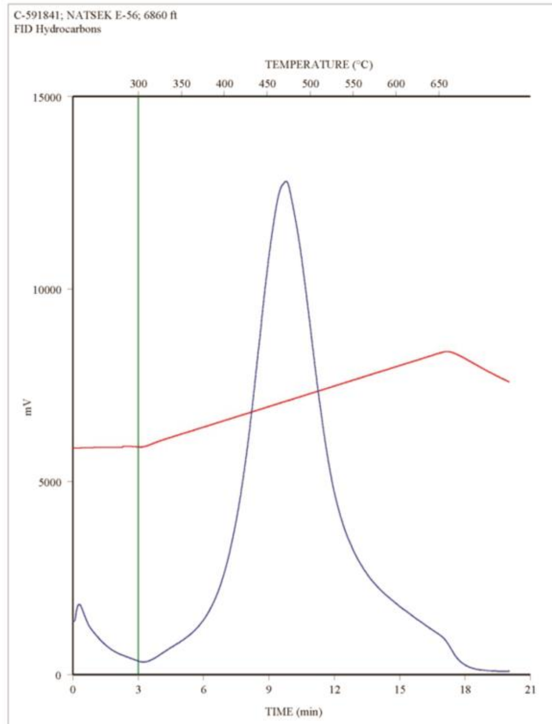

C-591836; NATSEK E-56; 6810 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
20000
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

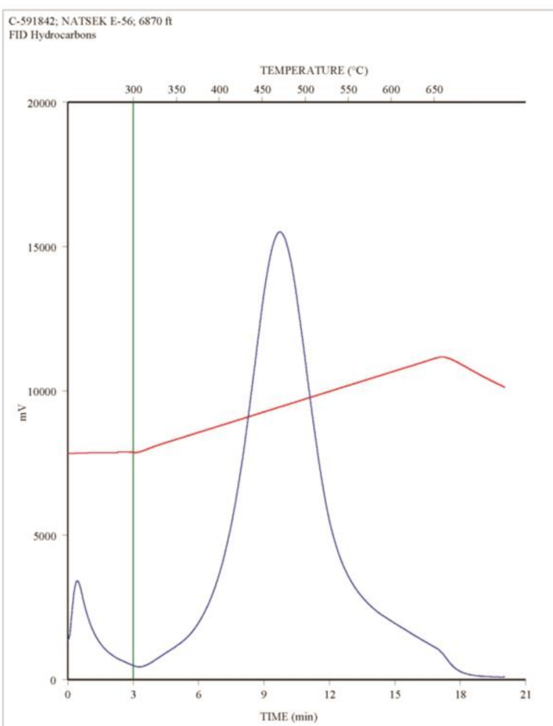

C-591837; NATSEK E-56; 6820 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

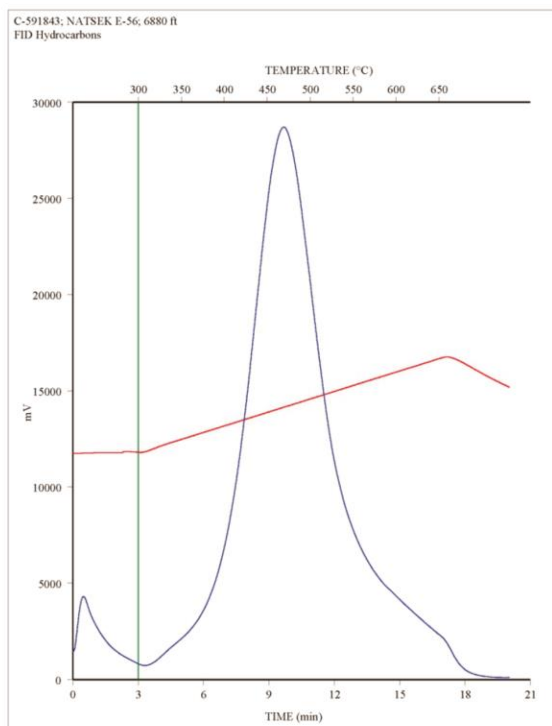

C-591838; NATSEK E-56; 6830 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

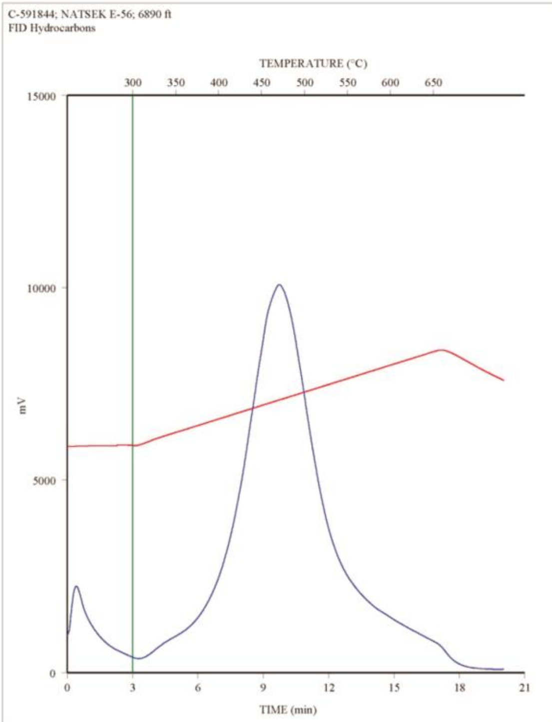

C-591839; NATSEK E-56; 6840 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

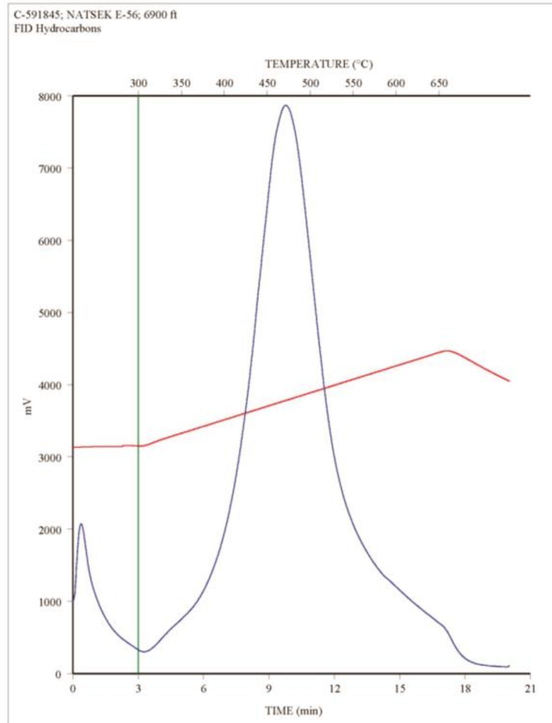

C-591840; NATSEK E-56; 6850 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

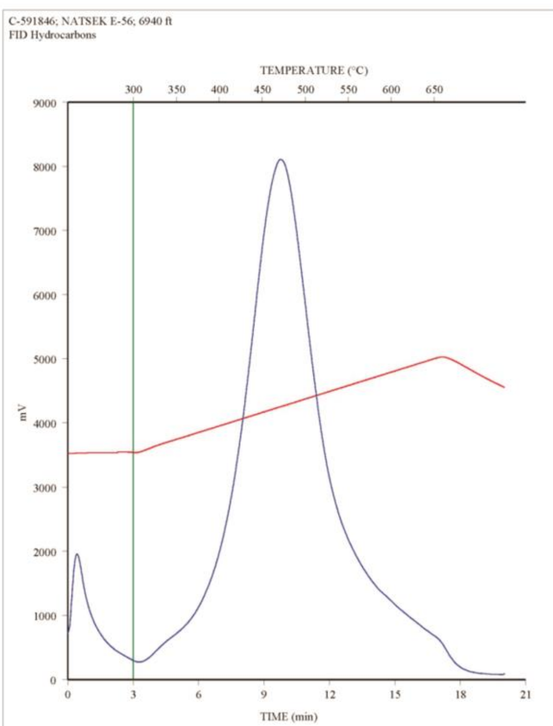

C-591841; NATSEK E-56; 6860 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

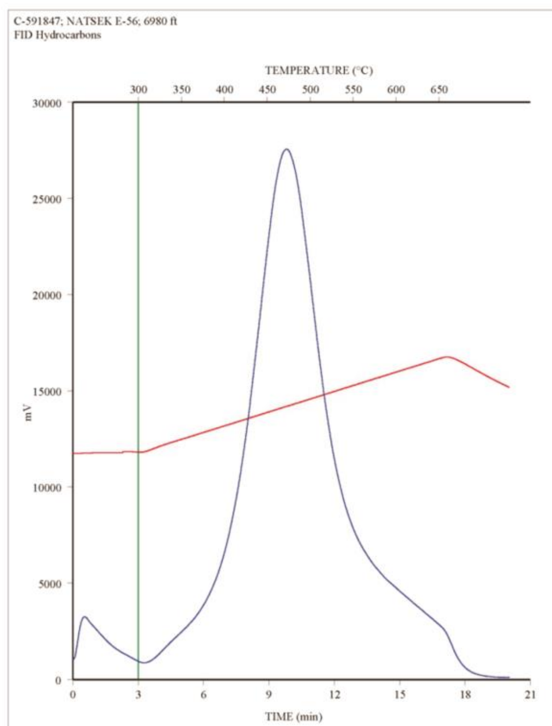

C-591842; NATSEK E-56; 6870 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

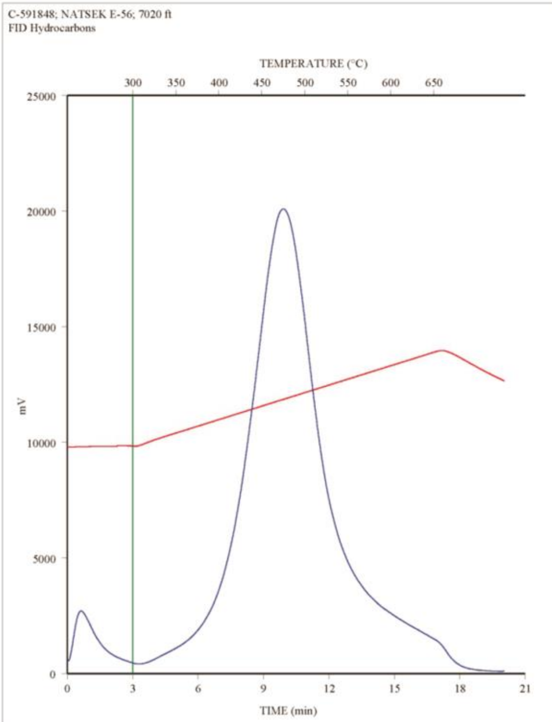

C-591843; NATSEK E-56; 6880 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

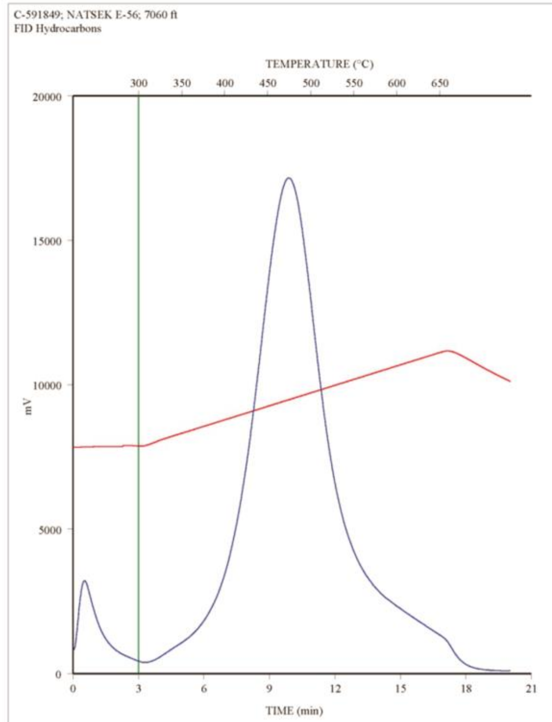

C-591844; NATSEK E-56; 6890 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

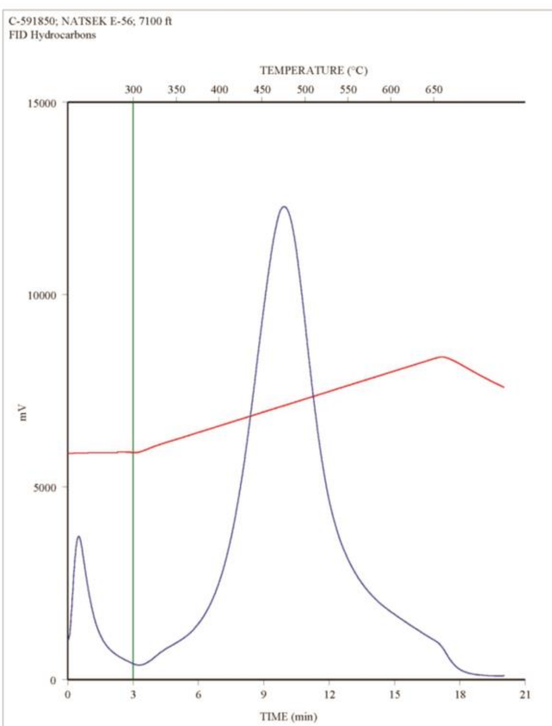

C-591845; NATSEK E-56; 6900 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
8000
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

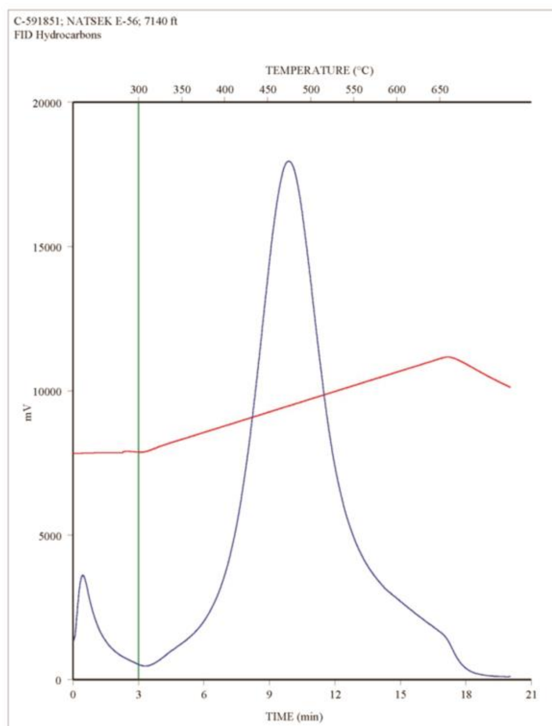

C-591846; NATSEK E-56; 6940 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

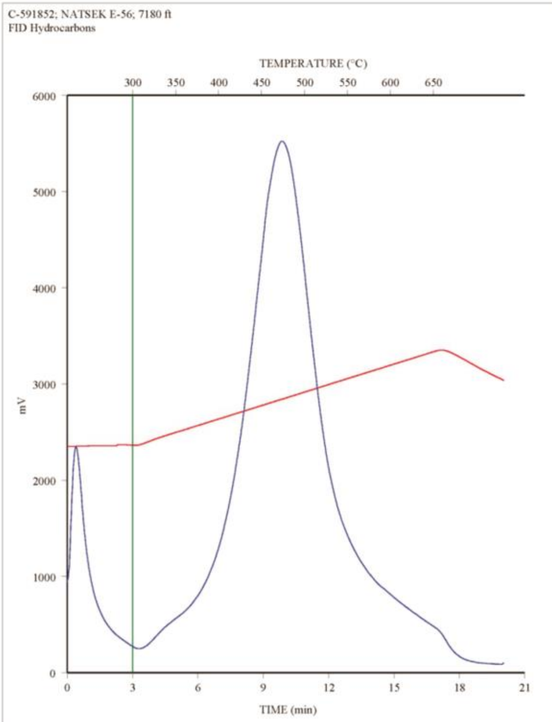

C-591847; NATSEK E-56; 6980 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
30000
25000
20000
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)

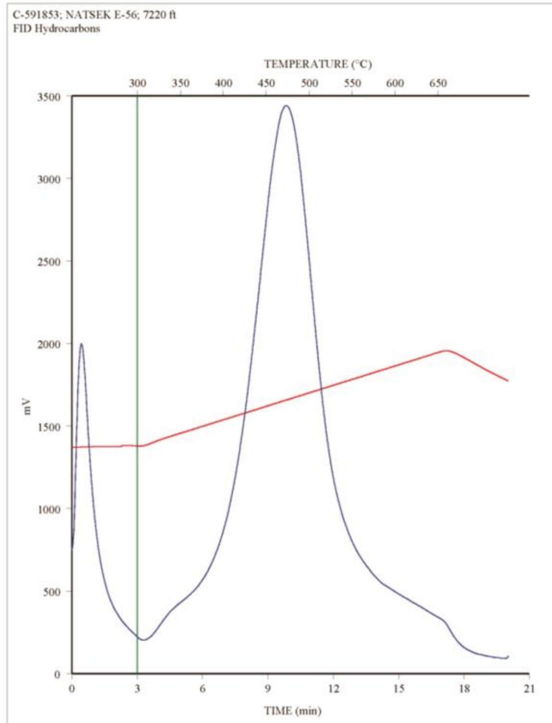

C-591848; NATSEK E-56; 7020 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

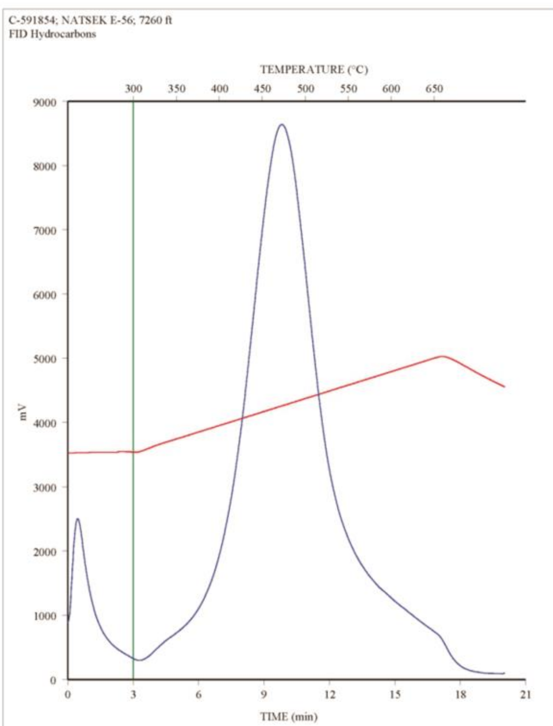

C-591849; NATSEK E-56; 7060 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)

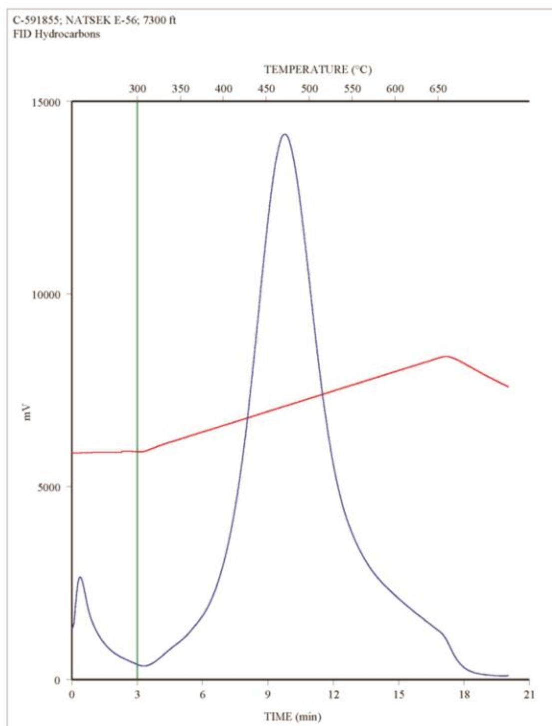

C-591850; NATSEK E-56; 7100 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)


C-591851; NATSEK E-56; 7140 ft
FID Hydrocarbons
TEMPERATURE (°C)
mV
TIME (min)


C-591852; NATSEK E-56; 7180 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)


C-591853; NATSEK E-56; 7220 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
3500
3000
2500
2000
1500
1000
500
0
mV
0 3 6 9 12 15 18 21
TIME (min)


C-591854; NATSEK E-56; 7260 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mV
0 3 6 9 12 15 18 21
TIME (min)


C-591855; NATSEK E-56; 7300 ft
FID Hydrocarbons
TEMPERATURE (°C)
300 350 400 450 500 550 600 650
15000
10000
5000
0
mV
0 3 6 9 12 15 18 21
TIME (min)