Petroleum Hydrocarbons in Terrebonne Bay, Louisiana after the BP-Deep Horizon Spill: Sampling Using New Adsorbent Technology

by

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Abstract

The BP-Deep Horizon oil spill of April 2010 in the Gulf of Mexico was one of the worst in the world and was the worst in the USA. Contamination of inshore and offshore waters, beaches, salt marshes, bays, etc. has been widely reported, along with ill effects on estuarine and marine fauna. Reports of petroleum hydrocarbon and dispersant concentrations in the water have been variable. The purpose of this study was to determine the presence or absence of petroleum hydrocarbons in inshore Louisiana waters (Terrebonne Bay) using a new, state-of-the-art adsorbent material – Dyna-Aqua Oil Sorb from Dynamic Technologies, Inc. Samples were taken on Timbalier Island, LA and in the northern portion of Terrebonne Bay. Submerged and surface samples were taken on Aug. 20, 2010. The composition of petroleum hydrocarbons was determined along with their concentrations in the cloth and estimates of their concentrations in the seawater. A 4.12 m^2 piece of the material was towed behind a boat for 30-45 mins. Water was collected from the material, stored in amber collection jars at 4^oC. The water samples and the cloth were each processed by gas chromatography (GC) and gas chromatography – mass spectrometry (GCMS). The cloth was easily stripped of its water and associated compounds through wringing because of the light bonds occurring between the target compounds and the adsorbent. The water samples yielded 39 compounds, 23 of which were clearly identifiable. Many were components of crude oil, and one, 2-butoxy-ethanol, was a known toxic component of Corexit$^{(R)}$, the dispersant used by BP during the spill. Caffeine, a compound found commonly in inshore waters, was also found. The cloth collected high concentrations of these compounds ranging from 14-233 mg l^{-1}. When standardized by the estimated volume of seawater sampled, the range of concentrations fell to 0.002-0.033 $\mu g\ l^{-1}$. Considering the circumstances, this was not logical. NOAA's concentrations were reported from in an offshore environment to the east of the spill in May 2010. I would expect those concentrations to be much higher – since they were sampling down-current of the spill while it was still active. We were sampling up-current and 5 wks after the well had been capped. In addition, concentrations here may be considered conservative. Water was not being forced through the material, but only impacted it laterally. Because of this material's high sensitivity to petroleum hydrocarbons, it appears to be well suited for a variety of purposes, including surface oil adsorption, fill for adsorbent booms – replacing dated absorbent ones, adsorption of sunken oil concentrated at depth, environmental monitoring, industrial clean-up, and estuarine filters.

I. Introduction

The BP-Deep Horizon Oil spill, which began on April 20, 2010, is one of the largest recorded oil spills in the world and is the single largest oil spill to have occurred within the United States and its territorial waters (Crone and Tolstoy, 2010). Its occurrence has brought to the fore the need for implementation of new and effective ways to deal with disasters of this type, and spills in general. The spill has affected > 4,900 sq. km. surface waters (Anon. d, 2010), the water column (Univ. So. FL, 2010), the benthos (Cleveland, 2010), shorelines (Leinwand, 2010), beaches and salt marshes (Merrill, 2010), and bays in the northeastern Gulf of Mexico, and these effects are expected to continue for some time to come (Achenbach and Brown, 2010).

There has also been some controversy regarding water quality in the northeastern Gulf of Mexico with respect to contaminants derived from the crude oil spill (Gale, 2010; Schneider, 2010). Diminished water quality in this region can represent a threat to human health and seafood safety, both of which impact key industries for states of the Gulf coast.

Dynamic Technologies, Inc. has produced an advanced state-of-the-art adsorbent material, called Dyna-Aqua Oil Sorb (Dynamic Technology, Inc.; Anon. b, 2010; Dynamic Adsorbents, 2010; Rodie, 2010). It is composed of highly absorbent cotton, non-woven, which has been impregnated with a specialized alumina. This material is capable of adsorbing toxic volatile organic compounds (VOCs) and dispersants which have been used extensively in the recent BP-Deep Horizon Gulf of Mexico oil spill. According to corporate laboratory tests, it has the capability to absorb 30-40 times its own weight in oil (data available from Dynamic Technology, Inc.). Descriptions of the structural and chemical characteristics of this adsorbent may be found on Dynamic's website (www.dynamicadsorbents.com), in Rodie (2010), and in DAI's MSDS sheets. The material can be wrung out, affording the potential for the oil and associated produced waters to be re-captured.

Objectives

The purpose of this study is to –

. preliminarily sample the inshore waters of Terrebonne Bay, Louisiana for crude oil and associated compounds using this new material, in two field settings:

  - sub-surface, in an inshore environment, associated with a barrier island, and;
  - surface only, in an inshore bay environment, surrounded by salt marshes.

. determine the composition of the petroleum hydrocarbons in the water associated with the material
. examine the samples for evidence of oil dispersant in the water associated with the sample, and
. determine the concentrations of these compounds, and
. compare our results with a sample of data collected by NOAA during the spill.

It is emphasized that this is a preliminary study only and is not designed to be an exhaustive study of either the material, or crude oil or dispersant concentrations in the study area. Nonetheless, the data produced here will, I believe, provide a reasonable indication of both.

II. Materials and Methods

Field Deployment

Two sites were chosen for the field tests. The vessel used for the exercise was LUMCON's R/V Whiskey Pass, a 9 m, single-hull, open-construction boat, powered by two high-powered outboard motors.

Site 1 – Timbalier Island

Trial 1.

The first site was Timbalier Island, south of Cocodrie, LA at (29°05'N, -90°32'W). We performed the deployment on the NW tip of the island, because of a suspected meso-scale eddy in this region. This was due to known prevailing longshore currents from the east, and the crescent shape of the island, being bowed to the south. It was likely that submerged or surface oil would be present here.

At this site, we used two submerged sampling units, in sequence. Each unit consisted of a 0.9 x 4.5 m piece of the sheet-like, adsorbent material, secured to two pieces of steel re-bar – one at each end. The material was wrapped around the re-bar and secured with cable-ties. The material was towed from a pole extending to the port side of the boat, attached to the bow. The material was not permitted to extend beyond the stern of the boat, in order to avoid potential contamination by petroleum hydrocarbons released by the boat's engines.

The first trial was initiated at 11:08 hrs on Aug. 20, 2010. The material was pulled by the boat, mostly submerged, at 0.5-0.7 knots through the water for 30 mins. We repeatedly sampled the front. Not all of the adsorbent material was submerged, because of its buoyancy in seawater. 75% of it was completely submerged; the remainder was intermittently submerged. The entire bottom face of the material, however, was in contact with the water at all times.

When the material was retrieved, it was wrung of its liquid. The liquid was captured in EPA standard prep. amber jars. All sample jars were labelled, returned to the laboratory, and stored at 4^{o}C. The used adsorbent material was placed in black, heavy-duty, opaque plastic bags, labelled, returned to the lab, and stored at -20^{o}C.

Trial 2.

A second trial was performed in the same region. Before trying a second trawl with the material, we added weights to the bottom bar. We also placed 2-4 lbs on the front re-bar support. We placed three extra pieces of re-bar at regular intervals along the material, weighted with one

diving 1-lb weight on each. Four pounds of lead weights were also added to the tail re-bar to insure that it would sink. This configuration was designed to hold the material in a concave manner, at an average angle of 45^{o} to the surface. This allowed the material to sit completely submerged, with all sides in contact with the oncoming water.

We deployed the second submerged unit at 1312 hrs and trailed it for 45 mins. It remained completely submerged for that time. The speed of trawling was 1.0 knots. In this instance, after retrieving the material, we used a clothes hand-wringing technique to collect liquid from the material.

Below we will focus on the results from Trial 1.

Site 2 – Rock Island

We performed a similar trial at Rock Island near Cocodrie, LA ($29^{o}14'54"$N, $-90^{o}39'4"$W), at the north end of Terrebonne Bay, where the salt marshes were reported to have been oiled by the spill. In this deployment, the purpose was to test the material at the water's surface and attempt to capture any petroleum hydrocarbons floating on the surface. Upon arriving there, we observed booms on the island positioned for retrieval, indicating that the area may have been oiled in the recent past.

The head and tail pieces of this sampling unit were constructed of 2.5 cm diameter wooden dowel rods. This insured that the material would stay afloat and spread-out. This second sampling unit was also 0.91 x 4.54 m in size (4.12 m^2) and was deployed from the port side of the boat. It was pulled for 45 mins, beginning at 1505 hrs, at 0.6-0.8 knots.

Laboratory Analyses

Within one week, all samples and used materials were couriered to the Sherry Laboratories, Lafayette, LA for chemical analysis. Initial analysis was by gas chromatography (GC) to detect the classes of petroleum hydrocarbons potentially present, utilizing primarily number of carbons as an indicator. Once the classes were determined to be consistent with those known to occur in crude oil, a decision was taken to follow through with analysis by gas chromatography – mass spectrometry (GCMS), in order to identify specific compounds present, their relative abundances, and their concentrations.

III. Results

Field Observations

With respect to Site 1, a front with some accumulated flotsam was observed, suggesting eddy-type formations. The boat's generally circular drift while sampling also suggested the presence of a small meso-scale eddy in this region.

When the first piece of material was retrieved, it was clearly discolored, with a blackish tint. We retrieved the unit and wrang it as much as possible (first attempt) into 950 ml EPA standard prep amber jars, pre-labeled. We did not obtain much material from this run – perhaps 1-2 jars of liquid plus dissolved and suspended materials.

When the second submerged sampling unit was retrieved, almost all of the sampling material was very dark – dark grey to black. It was also apparent from the bottom of the material that we had touched bottom sediment with it. Using a more efficient hand-wringing process with the second submerged unit, we increased the amount of liquid collected by ~7-fold.

The third surface-oriented sampling unit proved to be very buoyant. While pulling it, it became evident that the upper side was remaining generally dry. Water was not washing over the top of the unit. Water did appear to bead up on the top after several minutes, however, and continued to accumulate there. What was most interesting was that these beads of water were quite clear – not in the least discolored, while the bay water was a highly discolored greenish/brown. When we retrieved the material, it appeared to have absorbed hardly any liquid. It was very light in weight and color. What was striking was that the top side of the material had its usual rough cotton texture, but the underside had a "slimey" feel to it – smooth and silky, as if it had adsorbed something on its surface. We wrang some liquid from the material, but were only able to obtain a small amount – perhaps 10-20 ml. The liquid sample and material was labeled and stored as described above.

Laboratory Analyses

Analyses of all samples by GC revealed the presence of petroleum hydrocarbons in all cases – in the liquid samples and in the material (Appendices 1 & 3). The two most prominent groups fell into the ranges of "diesel" and "oil". The estimated concentrations of these classes in the water samples drawn from the material are listed in Table 1. The pads exhibited the same class peaks, although lower in abundance.

The surface trial yielded a sufficient amount of liquid for preliminary GC analysis, but not for GCMS. In fact, the report of compounds "$\leq$ 2.0 mg l^{-1}" shown in Table 1 are only indicative of compounds present in amounts below the detection limits of the instrument.

The compounds identified by GCMS in the water samples derived from Submerged Trial #1 are listed in Table 2; (original data and chromatograms may be found in Appendices 2 & 4, respectively). Their abundances, ranked by concentration, are shown in Fig. 1. The compounds fell into the categories of petroleum hydrocarbons, alcohols, some of which are known to be toxic components of dispersants used in the BP-Deep Horizon spill, and other miscellaneous compounds, including caffeine.

Extraction of the material itself produced only four identifiable compounds, and in small amounts. None of these compounds appeared in the water samples derived from the material. 16 additional compounds were also extracted from the material, but were unidentifiable, based upon the reference library of the laboratory used.

Original reports and charts received from the processing laboratory are attached as Appendices 1-5.

The concentrations of these compounds in the water sampled were calculated by estimating volume of water impinging on the material surface over the sampling time. The following variables were used for calculation:

.	Material width:	0.91 m
.	Material length:	4.54 m
.	Surface area of material	4.12 m^2
.	Depth of water presumed interacting with material	3 mm
.	Boat speed	0.6 knot = 30.86 cm sec^{-1}
.	Tow time	30 mins = 1.8 x 10^3 secs
.	Est. volume of water interacting with material	7,004 litres

The concentrations of compounds collected by the material are presented in Tables 1 and 2.

IV. Discussion

Submerged Samples

A number of the petroleum hydrocarbon compounds identified in the submerged samples are known to occur in crude oil (El Nemr, 2006), such as that released in the BP-Deep Horizon Spill. With respect to the alcohols, the compound 2-butoxy-ethanol was confirmed to be present. This is a component of the primary oil dispersant used by BP and the US Coast Guard in their remediation exercises (Corexit^R, Nalco, Inc.) and is known to be toxic (George et al., 2001; New Jersey Govt., 2008; Anon. a, 2010; Florida Oil Spill Law, 2010b; Schmidt, 2010). Caffeine was also found to be present in small amounts. This is commonly found in high resolution chemical analyses such as these conducted in inshore coastal waters (Weigel et al., 2001; Azua and Gardinali, 2003).

Concentrations of compounds in the water samples derived from the submerged water samples were very high when compared to concentrations found by NOAA on one of their cruises on May 30, 2010 (NOAA, 2010). In fact, the concentrations derived directly from the material were 1-4 orders of magnitude higher than those reported by NOAA. When these concentrations were standardized to estimated volume of bay water contacted by the material, however, the range of concentrations fell within that reported for the NOAA cruise (see Table 2).

At first, this would appear to be logical. The situation surrounding the sampling periods, however, were not equivalent, raising expectations of differences between the two data sets. In the first case, NOAA was sampling east of the spill site and down-current, considering prevailing currents at that time. In addition, on May 30, the well had been releasing oil for five weeks and was still actively doing so. The well was capped by BP on July 15 (Anon., 2010g). We sampled on Aug. 20, 5 wks after the well had been capped. In addition, Terrebonne Bay is well west of the spill site and did not receive the severe levels of oiling that shorelines and open ocean to the

east of the site received. Thus, one would expect concentrations of petroleum hydrocarbons in the latter regions to be much lower – particularly after the region had been re-opened for fishing (Anon., 2010f). It is likely that the concentrations measured here were conservative also because the contaminated bay water was not forced through the adsorbent material. Rather, it the water impacted the sides of the material. For these reasons, the concentrations reported here may be underestimating actual concentrations in the environment by 3-5 fold. It is recommended that future sampling be performed in such a manner as to force water through the fabric, while accurately monitoring flow-volume for the duration of sampling.

Despite these points, concentrations of petroleum hydrocarbons and components of dispersant reported here are equally high to those observed some 10 wks earlier, during the peak of the spill. The concentration of 2-butoxy-ethanol within the water derived from the sampler was 69.156 $\mu g\ l^{-1}$. The concentrations of this compound recently found to cause severe medical problems was 50 ppm (Florida Oil Spill Law, 2010a). (In our case, one of our crew members experienced skin irritation/a burning sensation on his hands from handling the material upon retrieval without protection.)

The variation between the compounds extracted from water derived from the adsorbent material and the material itself is indicative of the manner in which the adsorbent works. The alumina adsorbent provides a surface attraction through loose hydrogen bonding. This may be the reason that so many of the organic compounds collected were able to be separated from the adsorbent material via the removal of the water through simple mechanical means. The compounds that were later extracted from the material itself were most likely those which did not easily detach from it. The fact that none of this latter set of compounds was found in the water samples suggests that both the water from the adsorbent and the cloth itself should be extracted in the future to obtain samples of the full suite of compounds present.

Irrespective of the actual concentrations of oil and dispersant found here, the mere identification and confirmation of these compounds in this region is inconsistent with recent reports that the oil and dispersant are no longer present in the region (Anon. e, 2010; Zaberenko, 2010). The presence of these compounds is a potential threat to the highly productive fisheries of the region and the marketability of these fishery products, even if only as affected by public perception of seafood safety and taste (Anon. c, 2010; Property Wire, 2010; Shapira, 2010).

Surface Sampling

Petroleum hydrocarbons may have been present in the aqueous surface sample. Analyses indicated, however, that the concentrations of compounds captured were below the Practical Quantitation Limit (PQL), or detection limits, of the spectrometer. Thus, it was difficult to confirm this. I do not believe that this surface trial of the buoyant surface unit can be considered a reliable test for the presence of these compounds. This is because the numbers reported were actually an artefact of sample size – only 10-20 ml *in toto*.

The adsorbent material is highly buoyant, as are the target compounds – low molecular weight petroleum hydrocarbons which comprise the "sheen" on the surface of the water. This sheen may or may not be visible to the naked eye and is only 1(-10) μm in thickness (Australian

Maritime Safety Authority, 2010). It is possible that forward motion of the unit's head-brace may have caused a bow-effect whereby the thin sheen and water's surface layer was parted and pushed laterally, causing only a small portion of it to be drawn under the material. On the other hand, if the sheen was drawn under the head-brace, micro-turbulence derived from the brace may have greatly diluted any contaminants present in the layer beneath the cloth – contaminants already present in low concentrations.

A future design for a surface sampler or collector should allow the head of the material to sit above the water, and the sides of the material to be weighted slightly, so as to form a slight concave surface, forcing surface water and any sheen present to contact the underside of the material.

Potential Applications

It is clear from the results here that the adsorbent material itself is extremely sensitive to the presence of petroleum hydrocarbons and dispersant. It is by using this new technology that we were actually able to detect the presence of these compounds, even in low concentrations. It is equivalent to a light "hydrocarbon flypaper". In my estimation, it has a number of applications for which it can used effectively, as follows:

1) *Surface oil adsorption.* It could be deployed as sheets over large areas of water, to be reeled in and possibly wrung, recovering the oil and produced waters, possibly to be re-used. In this case, the material should be made in such a way that it is only slightly negatively buoyant, so as to expose both sides of the material to surface oil.

2) *Industrial clean-up* for oil spills on land, in factories, refineries, tank farms, etc. If desired, oil could be recovered from such a collection as well.

3) *Adsorption of sunken oil concentrated at depth*. It is now known that some oil, either in combination with dispersant, or simply weathered, having lost its LMW compounds, can sink and, because of its near-neutral buoyancy or because of the application of dispersants at depth, remain in deep water (Texas A&M Univ., 2010; Valentine et al., 2010), accumulate on a deep picnocline, or sink to the bottom. This has been shown to be the case 17 km from the BP-Deep Horizon spill site, where an accumulation of oil has been sighted at a depth of 3,600-4,000 ft. (Hazen et al., 2010; Univ. Oklahoma, 2010). In this case, the adsorbent material should be weighted or to make it negatively buoyant or mechanically compressed to rid it of trapped air.

4) *Fill for adsorbent booms, replacing absorbent booms.* The adsorbent material utilized here may be more effective at adsorbing oil (30-40X its own weight) than the absorbent booms currently being used, whether they consist of natural or manufactured material (Adebajo et al., 2003; see Graham, 2010 for overview). It is recommended that a comparative study be performed to confirm the efficacy of Dynamic Technology materials *vs.* absorbent booms currently in use.

5) *Environmental Monitors.* At present, water samples are taken to determine the presence and concentrations of pollutants, including petroleum hydrocarbons, in waters from which our seafood and, in the case of freshwater, drinking water is drawn. Concentrations may be too low to detect. More importantly, some environmental insults are short in duration and/or intermittent, making it difficult to detect if the temporal scale of the sampling is not in alignment with a punctuated or randomly occurring pollution event. The material could be used as a sampler which is cumulative through time and space, covering a given period of time, say one week, and being exposed to a given volume of water. It could be deployed by federal, state, or municipal agencies interested in monitoring certain commercially (*e.g.* oyster beds) or socio-economically (*e.g.*, beaches) valuable areas. In addition, because the pollutant would be captured by the material, it could be identified to specific compound and the source possibly traced.

   As an environmental monitor, in order to obtain accurate information on contaminant concentration, I would recommend that the sampling unit containing the material have a pump associated with it that would gently force water through the filter unit. A gauge would need to be incorporated into unit to measure the amount of water passing through the unit in order to accurately calculate concentrations of the contaminant in standard units, such as mg l^{-1} or $\mu g\ l^{-1}$.

6) *Estuarine Filters.* If used in sufficient quantities, this material could be used to help decontaminate small semi-enclosed embayments. The highly sensitive character of this material makes it possible to use it as an open-water petroleum hydrocarbon filter in special situations, such as at the entrance of small embayments in estuaries with low tidal flux. This may be effective even where low concentrations of toxic petroleum hydrocarbons or dispersant are dissolved, suspended, or emulsified in the water. It may be possible to secure the material in a vertical position and stagger the sheets across the entrance to an embayment. In that way, water entering or leaving there impinges upon them with each tidal change. Petroleum hydrocarbon concentrations could therefore be reduced in contaminated waters, since that material would be acting to accumulate contaminants through time. The material would have to be changed or wrung out at regular intervals, say weekly, during a spill event. Deployment of the material could help to protect valuable fisheries of the region, such as shrimp, oysters, crabs, and fish.

In conclusion, the Dynamic Adsorbent appears to be a remarkable material, capable of adsorbing both petroleum hydrocarbons and toxic components of dispersants. It also is highly sensitive and has multiple potential applications, particularly in the areas of oil spill remediation, mitigation, environmental protection, and environmental monitoring.

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Figure Legends

Figure 1. Concentration of compounds extracted from water captured by the adsorbent material, ranked by concentration in descending order. Concentrations shown in mg l^{-1}. See Table 2 for names of compounds. Aqueous sample derived from a tow of a 4.12 sq m piece of adsorbent cloth. Location – NW side of Timbalier Island, Louisiana, USA. Date – Aug. 20, 2010. Duration of tow – 30 mins. Speed = 1 knot. Material submerged.

Table Legends

Table 1. Results of Gas Chromatography (GC) analyses of an aqueous sample derived from a tow of a 4.12 sq m piece of adsorbent cloth. Location – NW side of Timbalier Island, Louisiana, USA. Date – Aug. 20, 2010. Duration of tow – 45 mins. Speed = 1 knot. Material submerged. Classes of compounds identified shown along with their concentrations. Mean, standard deviation, and sample size also shown where calculable.

Table 2. Results of Gas Chromatography - Mass Spectrometry (GCMS) analyses of an aqueous sample derived from a tow of a 4.12 sq m piece of adsorbent cloth. Tentatively identified compounds (TIC) listed. Location – NW side of Timbalier Island, Louisiana, USA. Date – Aug. 20, 2010. Duration of tow – 30 mins. Speed = 1 knot. Material submerged. Specific compounds adsorbed by the material shown in order of concentration, along with their concentrations in mg l^{-1}. Many of the compounds are known components of crude oil. [1]At least one alcohol is a known toxic component of the dispersant used to treat the BP-Deep Horizon Spill – Corexit$^{(R)}$ (Nalco, Inc.). ***, probability of match to reference compound = $\geq$ 85%; ** = $\geq$ 50%, but < 85%; * = < 50%. Confirmed components of crude oil: [1]Pirnik et al., 1974; [2]Chang et al., 2009; [3]Kira et al., 1994; [5]George et al., 2001; [6]New Jersey Govt., 2008; [7]Anon. a, 2010; [8]Florida Oil Spill Law, 2010b; [9]Schmidt, 2010; [10]microbial breakdown product of petroleum hydrocarbons, Vila and Grifoll, 2009; [11]Atlas and Bartha, 1973; [12]Janes, 2005; [13]Paris et al., 2010; [14]Panson and Winek, 1980; [15]Ozcan and Ozcan, 2000; [16]Kostichka et al., 2001; [17]Smith et al., 2002; [18]Ventura et al., 2008; [19]US Environmental Protection Agency, 2010.

Appendix Legends

Appendix I. Original report of Gas Chromatography (GC) analyses performed by the Sherry Laboratories, Lafayette, Louisiana, USA on the Submerged-1, Submerged-2, and Surface-1 aqueous samples. Data shown for two classes of petroleum hydrocarbons – diesel range and oil range. Concentrations given in mg l^{-1}. Reference sample: 4-terphenyl-d14 for all analyses.

Appendix II. Original report of Gas Chromatograph Mass Spectrometry (GCMS) analyses performed by the Sherry Laboratories, Lafayette, Louisiana, USA on the Submerged-1-1 aqueous sample. Individual compounds collected by the adsorbent material are shown along with their estimated concentrations. 18 specific compounds identified, falling into four general classes - petroleum hydrocarbons, alcohols, caffeine, and unknown. Some petroleum hydrocarbons are known components of crude oil. Some of the alcohols are known toxic components of the dispersant used to treat the BP-Deep Horizon Spill – Corexit$^{(R)}$ (Nalco, Inc.; marked with an asterisk).

Appendix III. Original gas chromatographs produced from laboratory analyses performed by the Sherry Laboratories, Lafayette, Louisiana, USA on the Submerged-1, Submerged-2, and Surface-1 aqueous samples.

Appendix IV. Original gas chromatographs produced from laboratory analyses performed by the Sherry Laboratories, Lafayette, Louisiana, USA on the adsorbent material used to sample during the Submerged-1, Submerged-2, and Surface-1 trials. The material was thawed from -20^{o}C to room temperature and its organic compounds extracted using dichloromethane (DCM) as a solvent.

Appendix V. Original chromatograms comparing compounds isolated from the aqueous samples of the Submerged-1-1 trial, with library reference data for known compounds. Details of match probability also shown.

Figure 1.

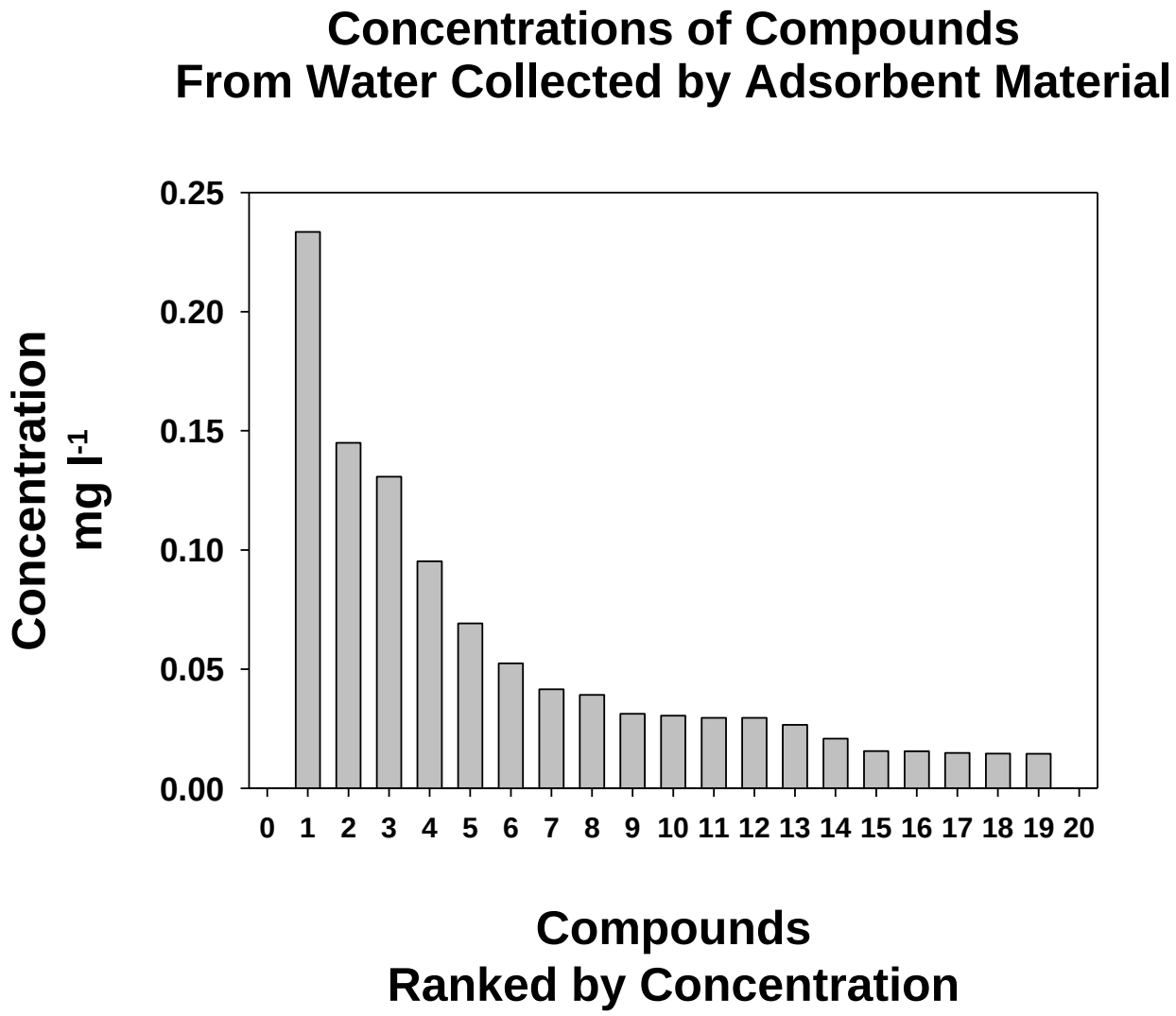
Concentrations of Compounds
From Water Collected by Adsorbent Material
Concentration
mg l-1
0.25
0.20
0.15
0.10
0.05
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Compounds
Ranked by Concentration

Table 1. Gas Chromatography (GC) Analyses - Classes of Compounds and Concentrations Found in Adsorbent Samples

Sample Type	Trial	Class - Total Petroleum Hydrocarbons (TPH)	Sub-Sample 1	2	3	4	5	6	7	Mean	s.d.	n
Submerged	**1**	TPH - Diesel Range (mg l^{-1})	0.176	0.351						0.26		2
		TPH - Oil Range (mg l^{-1})	0.162	0.324						0.24		2
	2	TPH - Diesel Range (mg l^{-1})	0.148	0.153	0.143	0.156	0.178	0.140	0.260	0.17	0.042	7
		TPH - Oil Range (mg l^{-1})	0.137	0.142	0.137	0.144	0.164	0.130	0.240	0.16	0.038	7
Surface	**1**	TPH - Diesel Range (mg l^{-1})*	2.170									
		TPH - Oil Range (mg l^{-1})*	2.000									
		Surr: 4-terphenyl-d14 (% Rec.) for all samples	46.8-133.0									

* Below threshold of detectable levels for instrument

Table 2. Gas Chromatography - Mass Spectrometry (GCMS) Results - Concentrations of individual compounds identified, ranked

Sample Type	Trial	Sub-Sample	Rank	Compound	Concentration in µg l^{-1} in water derived from adsorbent material	Concentration in µg l^{-1} standardized to est. total volume sampled	Probability of Match to Reference
Water Sample Drawn from Submerged Trial	1	1	1	1,2-benzene-dicarboxylic acid, butyl 2-ethylhexyl ester[1]	233.460	0.033333	**
			2	9-methyl-Z-10-tetradecen-1-ol acetate	144.970	0.020699	**
			3	cyclic octa-atomic sulfur[2]	130.780	0.018673	***
			4	n-hexadecanoic acid[3]	95.275	0.013603	**
			5	2-butoxy-ethanol[4,5-9]	69.156	0.009874	***
			6	(Z)-9-hexadecenoic acid, methyl ester[10]	52.375	0.007478	***
			7	2-[2-(2-butoxyethoxy)ethoxy]-ethanol	41.528	0.005929	**
			8	Octadecanoic acid[11]	39.186	0.005595	***
			9	4-methyl phenol[12]	31.280	0.004466	***
			10	Z-9-octadecenamide[13]	30.446	0.004347	**
			11	2-methylthio-ethanol	29.556	0.004220	***
			12	Z-9-tetradecenoic acid	29.506	0.004213	**
			13	3-pentanone[14]	26.593	0.003797	**
			14	oxybenzone	20.805	0.002971	***
			15	1-eicosanol[15]	15.615	0.002230	***
			16	caffeine	15.537	0.002218	***
			17	Unknown	14.836	0.002118	*
			18	ethyl cyclodo-decane[16]	14.509	0.002072	**
			19	Unknown	14.488	0.002069	*
Extraction from adsorbent material, post-wringing			1	2 (1H) naphthalenone, 3,5,6,7,8,8a-hexahydro-4,8a-dimethyl-6-(1-ethyl-ethenyl)	17.600	0.002513	***
			2	1-dotriacontanol[17]	11.000	0.001570	***
			3	hexadecahydro-pyrene[18]	10.300	0.001470	***

	4	Phthalic acid, diisooctyl ester[19]	7.000	0.000999	***
	5-20	Unknown (16 additional compounds)	a	a	
Range of Concentrations Found by NOAA in Water Sampling 5/5/2010	max.	nC-17 heptadecane	n/a	1.235000	b
	min.	C-2 naphthalenes	n/a	0.000449	b

[1-3,5-18]Component of crude oil, references

[4]Known component of Corexit dispersant

***, probability of match to reference compound = $\geq$ 85%;
** = probability of match to reference > 50%, but < 85%;
* = probability of match to reference < 50%.

a = low concentrations
b = unknown

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CLIENT: Dynamic Adsorbents, Inc.
Lab Order: L10081126
Project: Estuary Samples

Date Received: 8/26/10 15:15
Date Reported: 9/02/10 15:56

Lab ID: L10081126-01 **Collection Date: 8/20/10 11:41** **Sample ID: Sub 1-1**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	1.68	0.176		mg/L	8/28/10 17:01	
TPH (Oil Range)	1.83	0.162		mg/L	8/28/10 17:01	
Surr: 4-Terphenyl-d14	77.4	46.8-133		%REC	8/28/10 17:01	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc.
Lab Order: L10081126
Project: Estuary Samples

Date Received: 8/26/10 15:15
Date Reported: 9/02/10 15:56

Lab ID: L10081126-02 **Collection Date: 8/20/10 11:41** **Sample ID: Sub 1-2**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	1.04	0.351		mg/L	8/28/10 22:22	
TPH (Oil Range)	1.72	0.324		mg/L	8/28/10 22:22	
Surr: 4-Terphenyl-d14	107	46.8-133		%REC	8/28/10 22:22	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
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CLIENT: Dynamic Adsorbents, Inc. **Date Received:** 8/26/10 15:15
Lab Order: L10081126 **Date Reported:** 9/02/10 15:56
Project: Estuary Samples

Lab ID: L10081126-03 **Collection Date: 8/20/10 13:12** **Sample ID: Sub 2**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	0.727	0.148		mg/L	8/28/10 22:40	
TPH (Oil Range)	0.801	0.137		mg/L	8/28/10 22:40	
Surr: 4-Terphenyl-d14	103	46.8-133		%REC	8/28/10 22:40	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc. **Date Received:** 8/26/10 15:15
Lab Order: L10081126 **Date Reported:** 9/02/10 15:56
Project: Estuary Samples

Lab ID: L10081126-04 **Collection Date: 8/20/10 13:12** **Sample ID: Sub2-2**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	0.543	0.153		mg/L	8/28/10 22:58	
TPH (Oil Range)	0.723	0.142		mg/L	8/28/10 22:58	
Surr: 4-Terphenyl-d14	84.6	46.8-133		%REC	8/28/10 22:58	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc. **Date Received:** 8/26/10 15:15
Lab Order: L10081126 **Date Reported:** 9/02/10 15:56
Project: Estuary Samples

Lab ID: L10081126-05 Collection Date: 8/20/10 13:12 Sample ID: Sub 2-3
Matrix: AQUEOUS Tag Number:

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	0.685	0.148		mg/L	8/28/10 23:16	
TPH (Oil Range)	0.752	0.137		mg/L	8/28/10 23:16	
Surr: 4-Terphenyl-d14	97.7	46.8-133		%REC	8/28/10 23:16	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc.
Lab Order: L10081126
Project: Estuary Samples

Date Received: 8/26/10 15:15
Date Reported: 9/02/10 15:56

Lab ID: L10081126-06 **Collection Date: 8/20/10 13:12** **Sample ID: Sub 2-4**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	0.384	0.156		mg/L	8/28/10 17:37	
TPH (Oil Range)	0.492	0.144		mg/L	8/28/10 17:37	
Surr: 4-Terphenyl-d14	77.0	46.8-133		%REC	8/28/10 17:37	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc. **Date Received:** 8/26/10 15:15
Lab Order: L10081126 **Date Reported:** 9/02/10 15:56
Project: Estuary Samples

Lab ID: L10081126-07 Collection Date: 8/20/10 13:12 Sample ID: Sub 2-5
Matrix: AQUEOUS Tag Number:

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	0.482	0.178		mg/L	8/28/10 17:55	
TPH (Oil Range)	0.620	0.164		mg/L	8/28/10 17:55	
Surr: 4-Terphenyl-d14	84.7	46.8-133		%REC	8/28/10 17:55	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc.
Lab Order: L10081126
Project: Estuary Samples

Date Received: 8/26/10 15:15
Date Reported: 9/02/10 15:56

Lab ID: L10081126-08 **Collection Date: 8/20/10 13:12** **Sample ID: Sub 2-6**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	0.592	0.140		mg/L	8/28/10 18:13	
TPH (Oil Range)	0.630	0.130		mg/L	8/28/10 18:13	
Surr: 4-Terphenyl-d14	81.4	46.8-133		%REC	8/28/10 18:13	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

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CLIENT: Dynamic Adsorbents, Inc. **Date Received:** 8/26/10 15:15
Lab Order: L10081126 **Date Reported:** 9/02/10 15:56
Project: Estuary Samples

Lab ID: L10081126-09 Collection Date: 8/20/10 13:12 Sample ID: Sub 2-7
Matrix: AQUEOUS Tag Number:

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	1.04	0.260		mg/L	8/28/10 18:30	
TPH (Oil Range)	0.781	0.240		mg/L	8/28/10 18:30	
Surr: 4-Terphenyl-d14	79.2	46.8-133		%REC	8/28/10 18:30	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
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CLIENT: Dynamic Adsorbents, Inc. **Date Received:** 8/26/10 15:15
Lab Order: L10081126 **Date Reported:** 9/02/10 15:56
Project: Estuary Samples

Lab ID: L10081126-10 **Collection Date: 8/20/10 15:05** **Sample ID: Float 3-1**
Matrix: AQUEOUS **Tag Number:**

Analyses	Result	PQL	Qual	Units	Date Analyzed	Analyst
TPH BY GC/FID	**SW8015B**					**CR**
TPH (Diesel Range)	< 2.17	2.17		mg/L	8/28/10 17:19	
TPH (Oil Range)	< 2.00	2.00		mg/L	8/28/10 17:19	
Surr: 4-Terphenyl-d14	98.1	46.8-133		%REC	8/28/10 17:19	

Qualifiers:

B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
E - Estimated value
+DO - Diluted out due to dilution
MI+ - Matrix Interference
H - Exceeds Holding Time
R - RPD outside accepted recovery limits
PQL - Practical Quantitation Limit
* - Value exceeds MCL or Permit Limitation
< - Not Detected at the Reporting Limit

Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D
Report Date: 07-Sep-2010 16:36

Sherry Laboratories-LA

TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: Dynamic Adsorbents
Lab Smp Id: SAMP L10081126-01A
Operator : KTK
Sample Location:
Sample Matrix: WATER
Analysis Type: SV
Inj Date: 04-SEP-2010 04:59

Client Smp ID: Sub 1-1
Sample Date: 8/20/10
Sample Point:
Date Received: 8/26/10
Level: LOW

Number TICs found: 19

CONCENTRATION UNITS:
(mg/L or mg/KG) mg/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	5271-38-5	Ethanol, 2-(methylthio)-	3.453	0.029556	NJ
2.	111-76-2	Ethanol, 2-butoxy-	4.193	0.069156	PJ
3.	96-22-0	3-Pentanone	5.659	0.026593	PJ
4.	106-44-5	Phenol, 4-methyl-	5.899	0.031280	NJ
5.	143-22-6	Ethanol, 2-[2-(2-butoxyetho	7.147	0.041528	PJ
6.	58-08-2	Caffeine	15.228	0.015537	NJ
7.	1000130-84-	Z-9-Tetradecenoic acid	16.370	0.029506	PJ
8.	57-10-3	n-Hexadecanoic acid	16.639	0.095275	NJ
9.	131-57-7	Oxybenzone	17.289	0.020805	NJ
10.	10544-50-0	Cyclic octaatomic sulfur	17.593	0.13078	NJ
11.	1120-25-8	9-Hexadecenoic acid, methyl	18.448	0.052375	NJ
12.	57-11-4	Octadecanoic acid	18.657	0.039186	NJ
13.		Unknown	19.294	0.014836	J
14.	85-69-8	1,2-Benzenedicarboxylic aci	21.753	0.23346	PJ
15.	301-02-0	9-Octadecenamide, (Z)-	23.459	0.030446	PJ
16.	629-96-9	1-Eicosanol	25.490	0.015615	NJ
17.	28981-49-9	Cyclododecane, ethyl-	25.836	0.014509	PJ
18.		Unknown	26.704	0.014488	J
19.	1000130-99-	9-Methyl-Z-10-tetradecen-1-	26.871	0.14997	PJ

J: Estimated value.

N: Presumptive evidence of compound, identification is based on mass spectral library search at 85% or better match probability.

P: Possible evidence of compound, identification is based on mass spectral library search match probability > 50% but < 85%

Unknown: Peak meets 10% height criteria compared to nearest Internal Standard, but library search result is < 50% match probability.

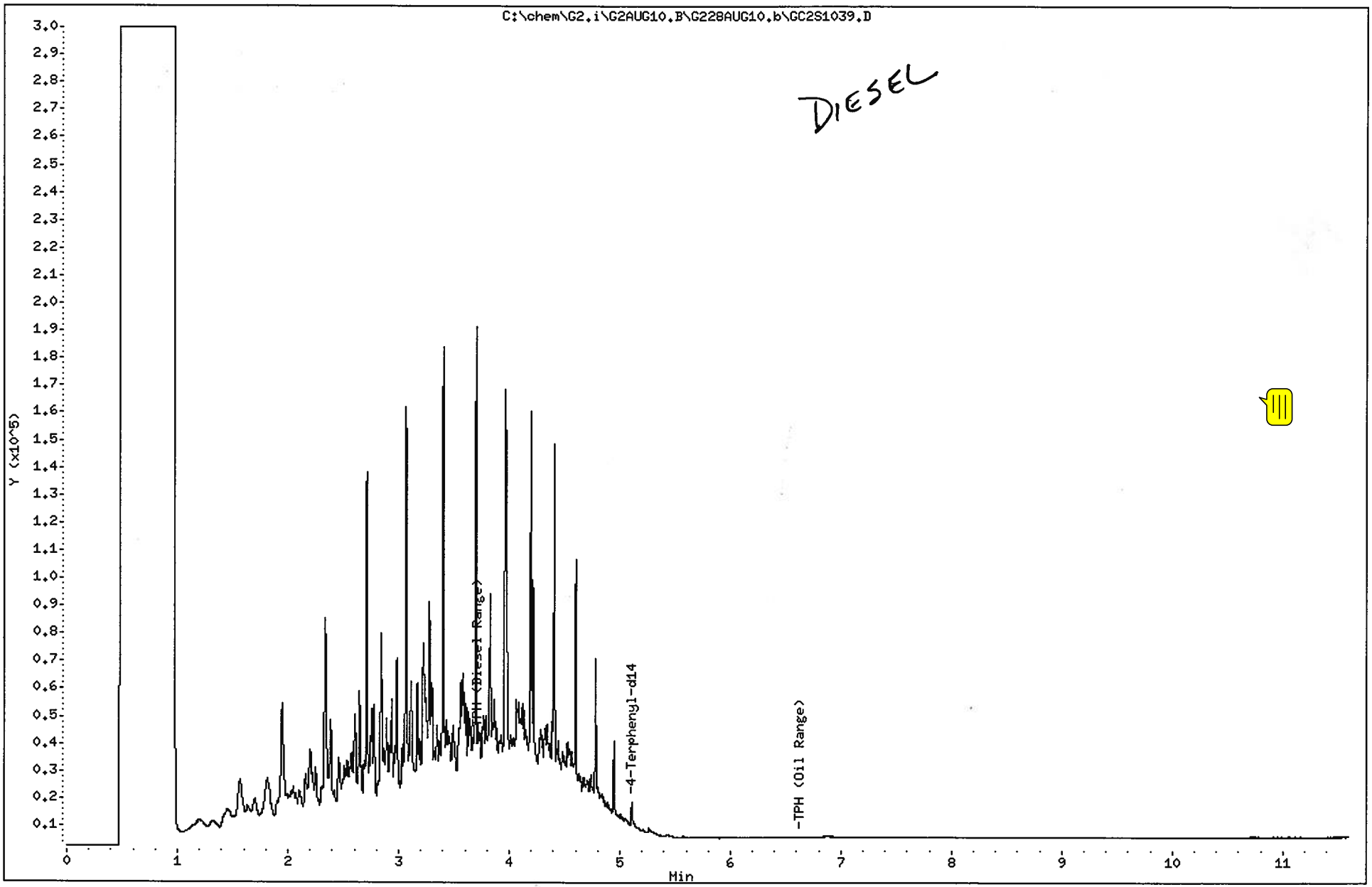
Analyzed by: KTK
Review Date: 09/07/10

Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1039.D
Date : 28-AUG-2010 23:51
Client ID: Diesel CCV
Sample Info: 3000 DIESEL STD

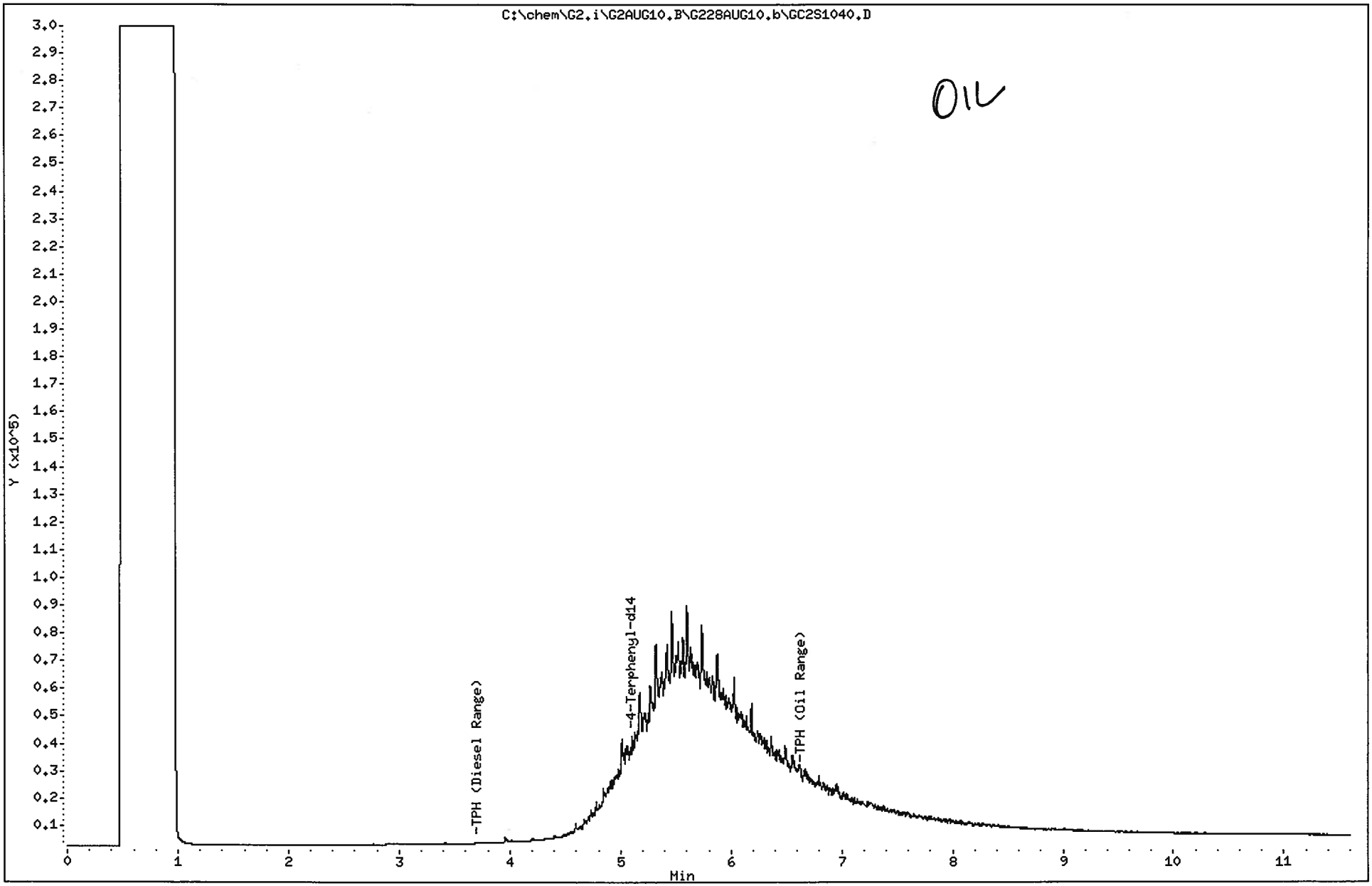
Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:



Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1040.D
Date : 29-AUG-2010 00:09
Client ID: MOIL CCV
Instrument: G2.i
Sample Info: 3000 MOIL STD
Operator: CER
Column phase:
Column diameter: 2.00

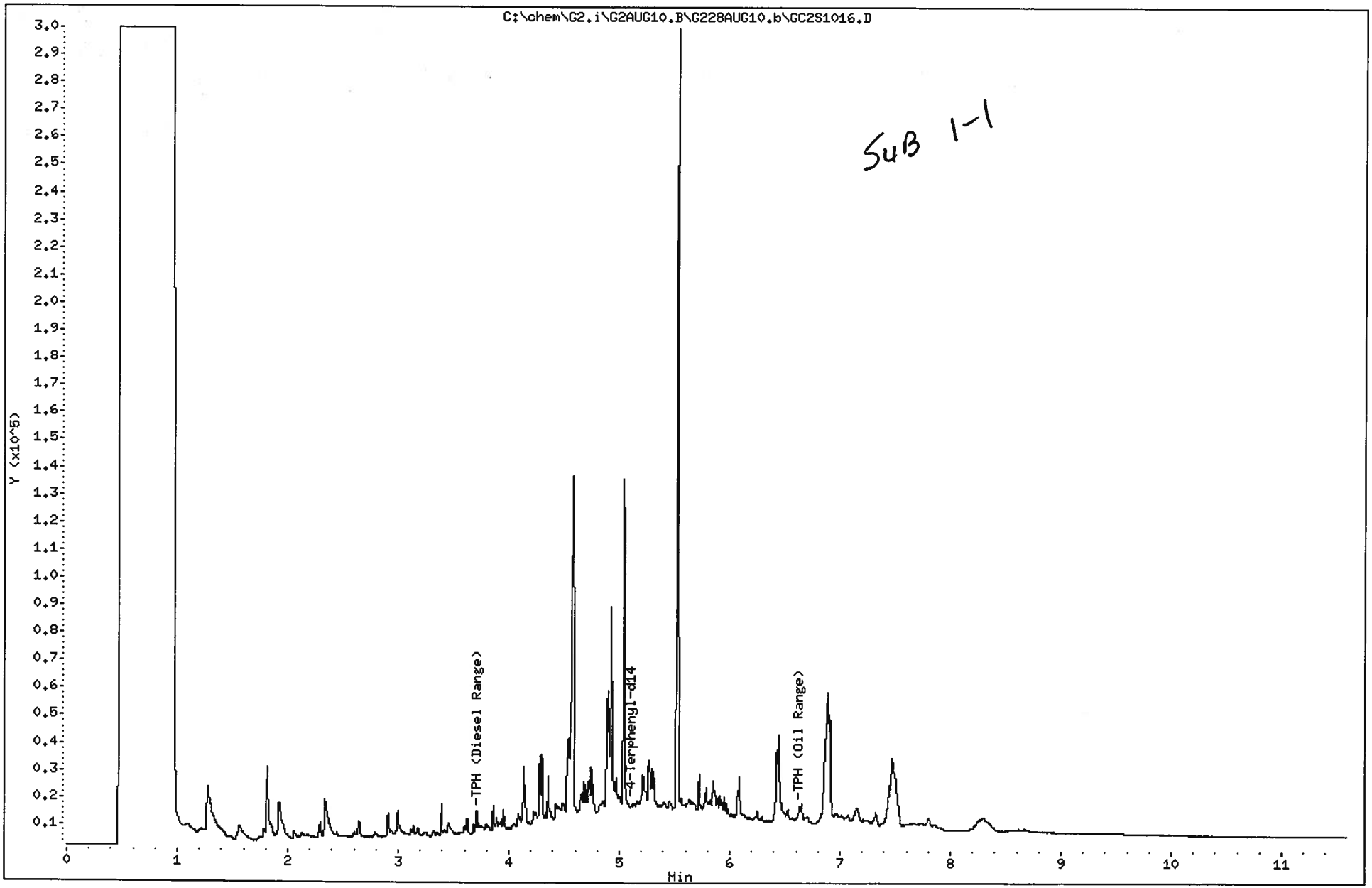


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1016.D
Date : 28-AUG-2010 17:01
Client ID: Sub 1-1
Sample Info: L10081126-01A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

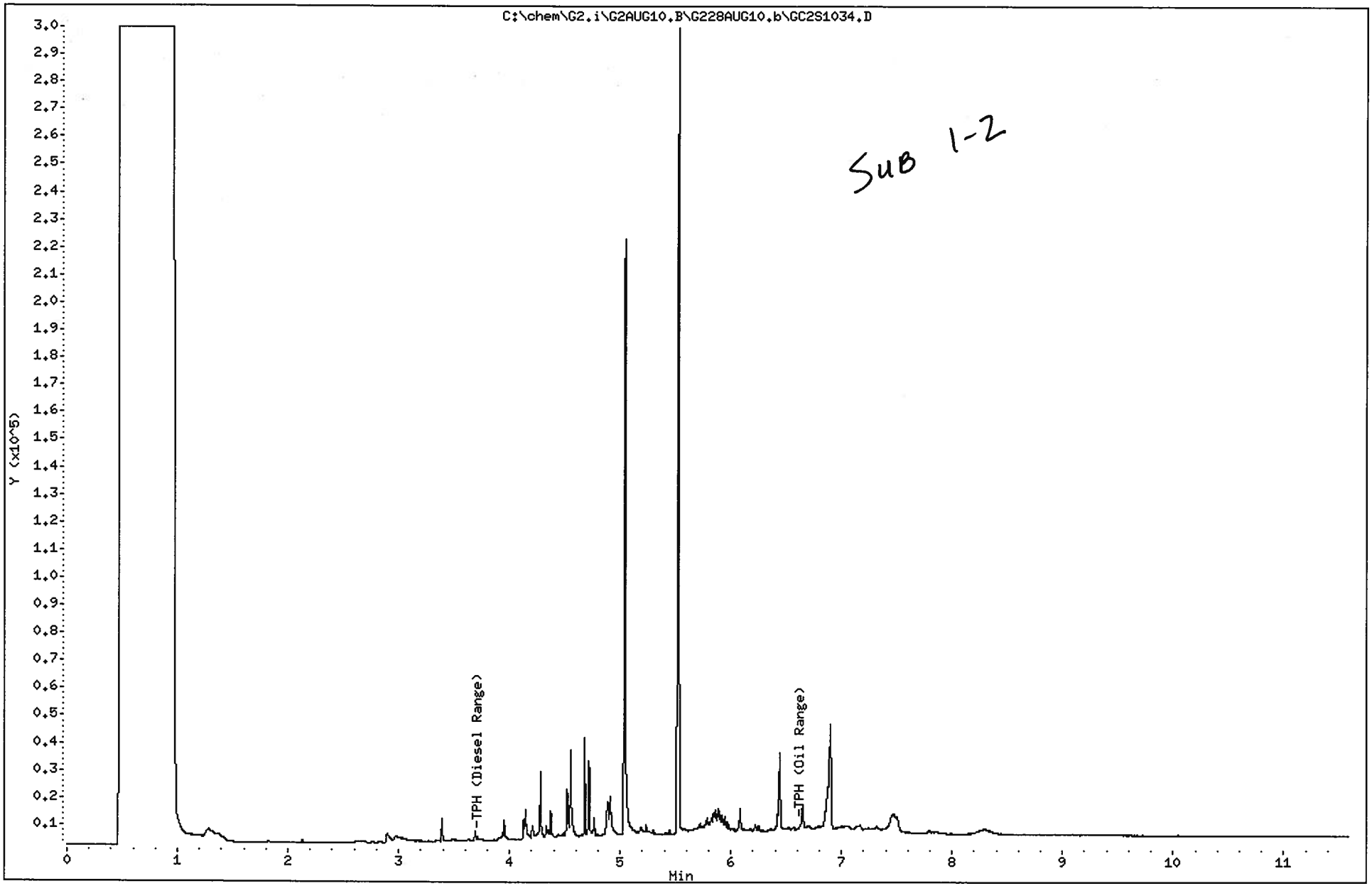


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1034.D
Date : 28-AUG-2010 22:22
Client ID: Sub 1-2
Sample Info: L10081126-02A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

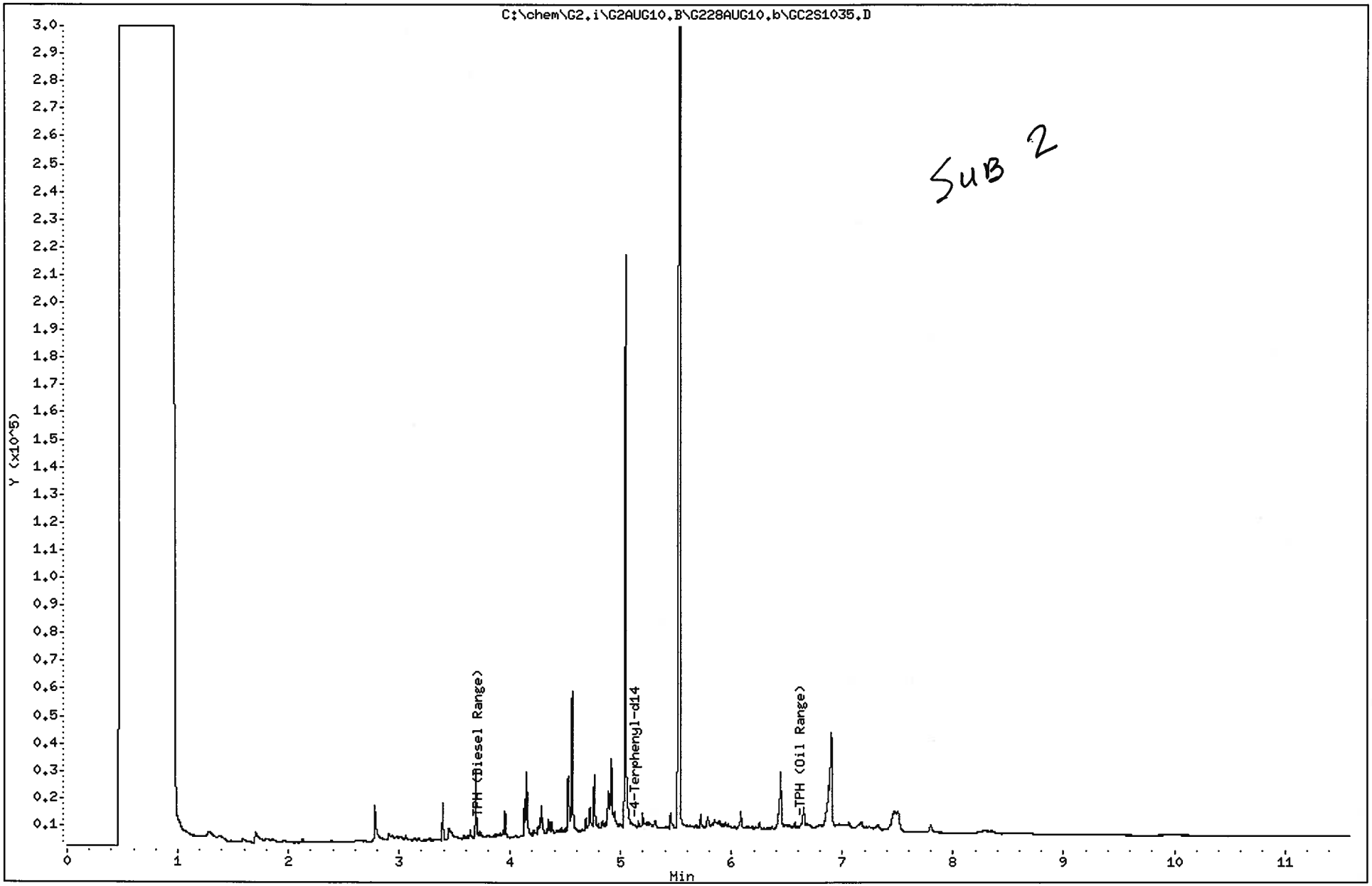


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1035.D
Date : 28-AUG-2010 22:40
Client ID: Sub 2
Sample Info: L10081126-03A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

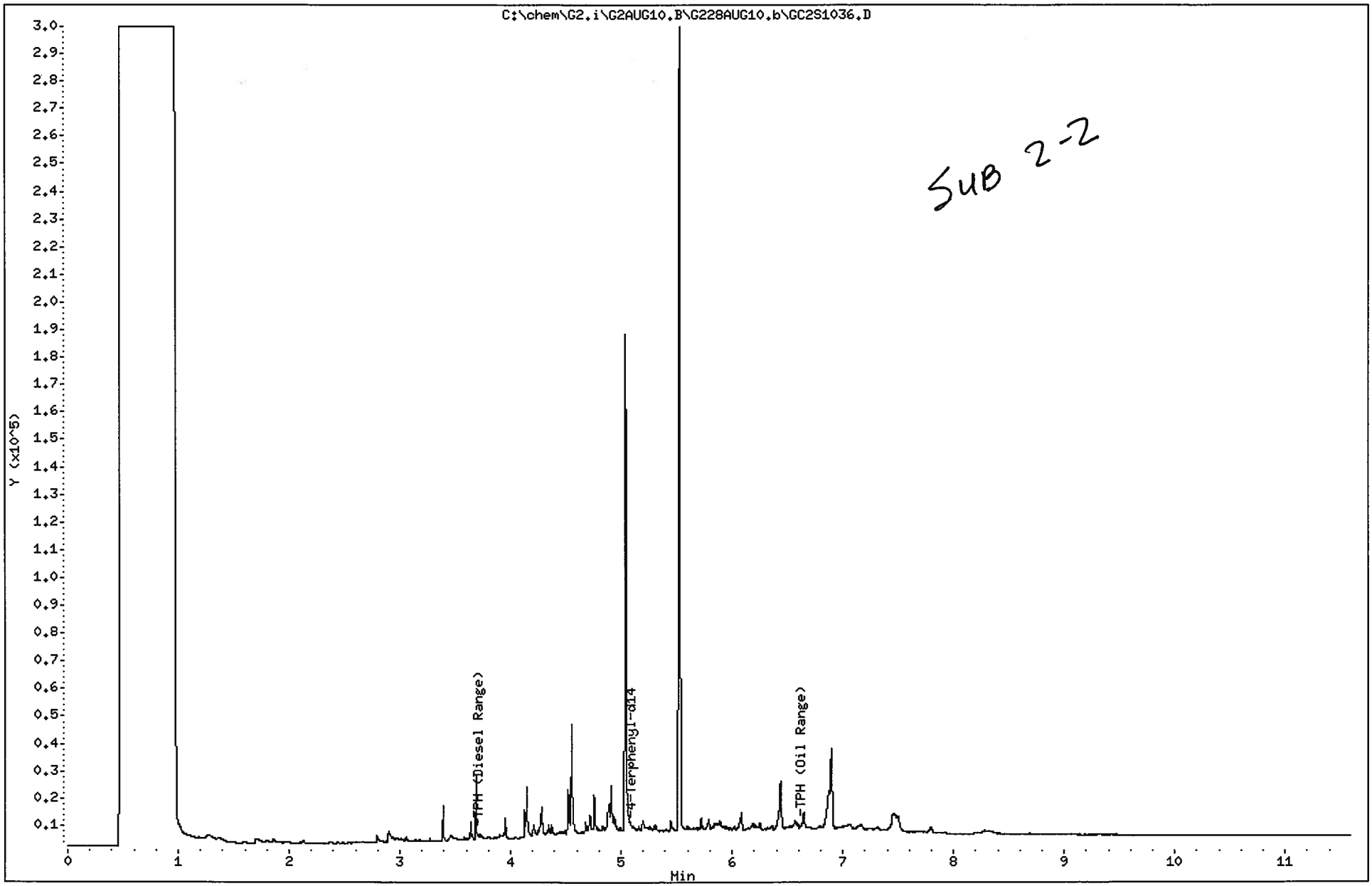


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1036.D
Date : 28-AUG-2010 22:58
Client ID: Sub 2-2
Sample Info: L10081126-04A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

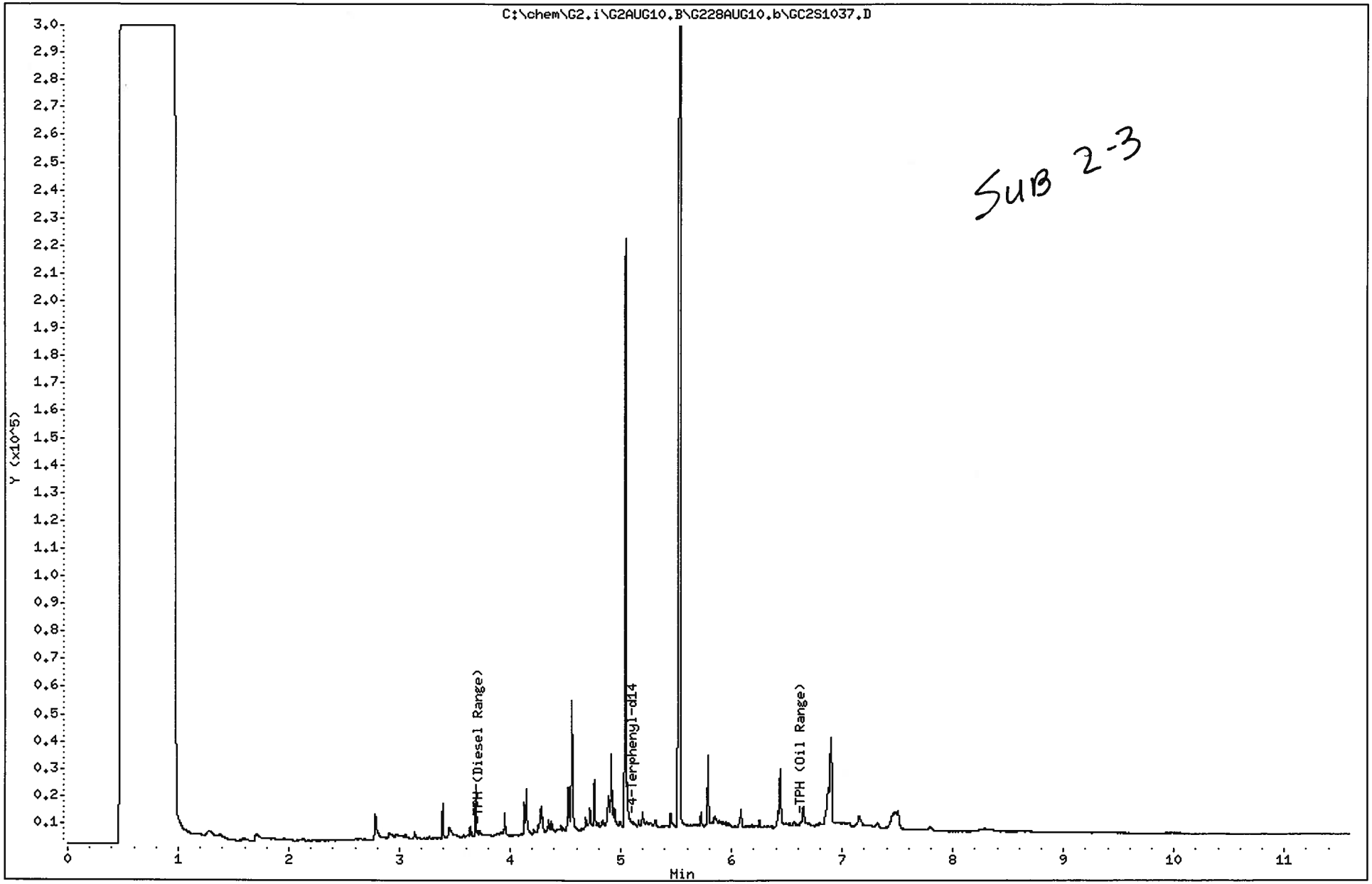


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1037.D
Date : 28-AUG-2010 23:16
Client ID: Sub 2-3
Sample Info: L10081126-05A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

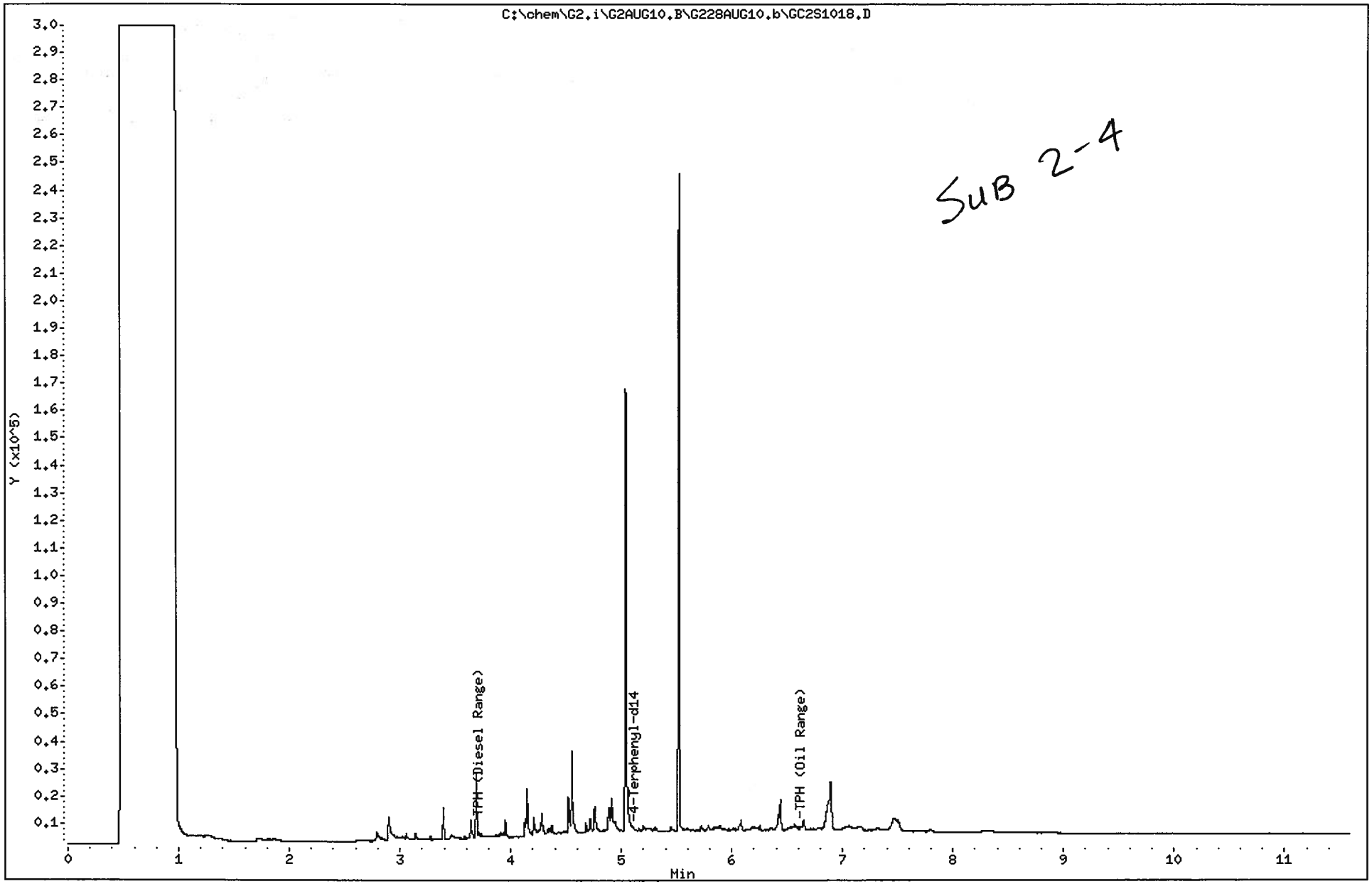
Column phase:



Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1018.D
Date : 28-AUG-2010 17:37
Client ID: Sub 2-4
Sample Info: L10081126-06A

Instrument: G2.i

Operator: CER
Column phase:
Column diameter: 2.00

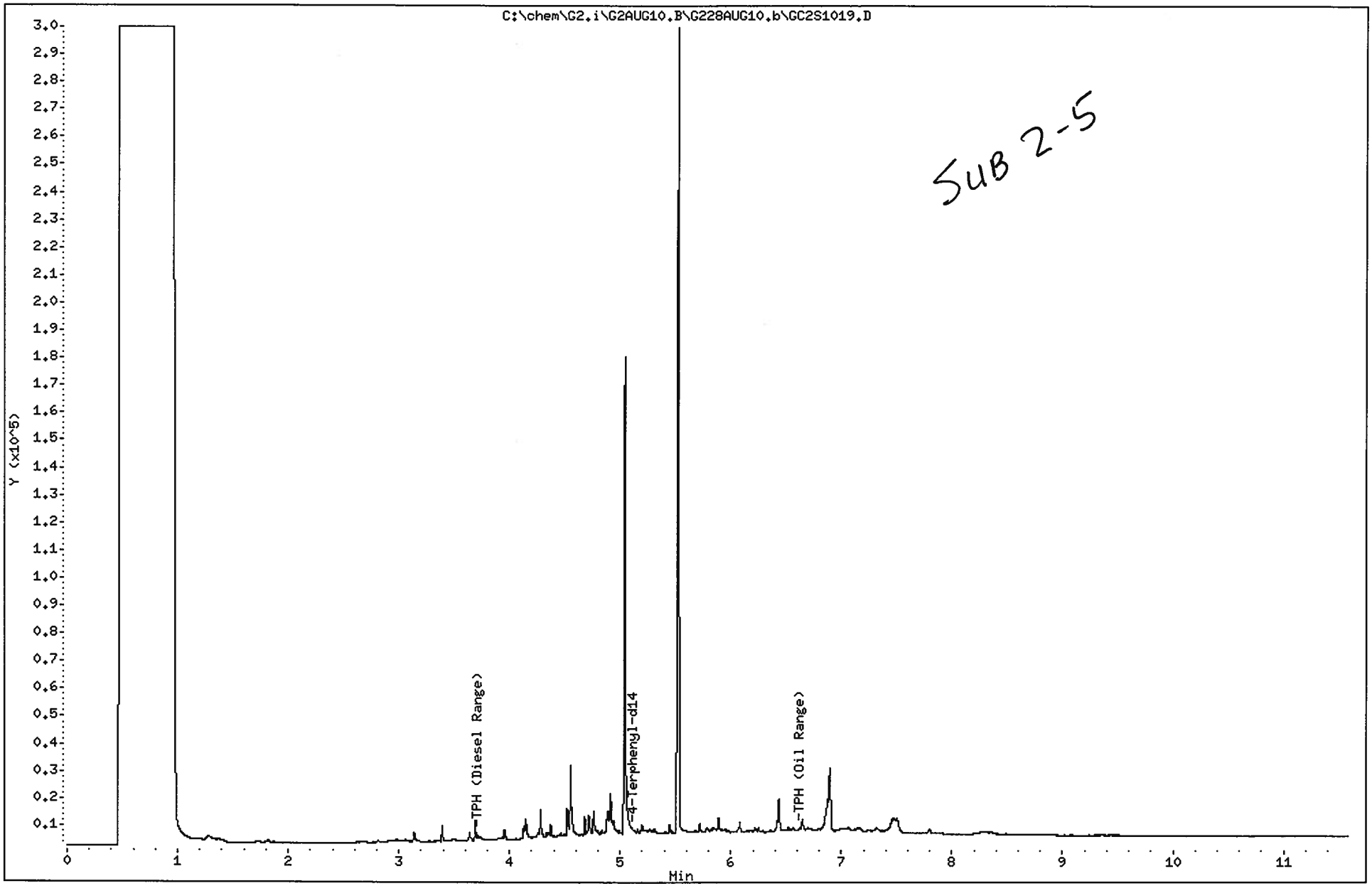


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1019.D
Date : 28-AUG-2010 17:55
Client ID: Sub 2-5
Sample Info: L10081126-07A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

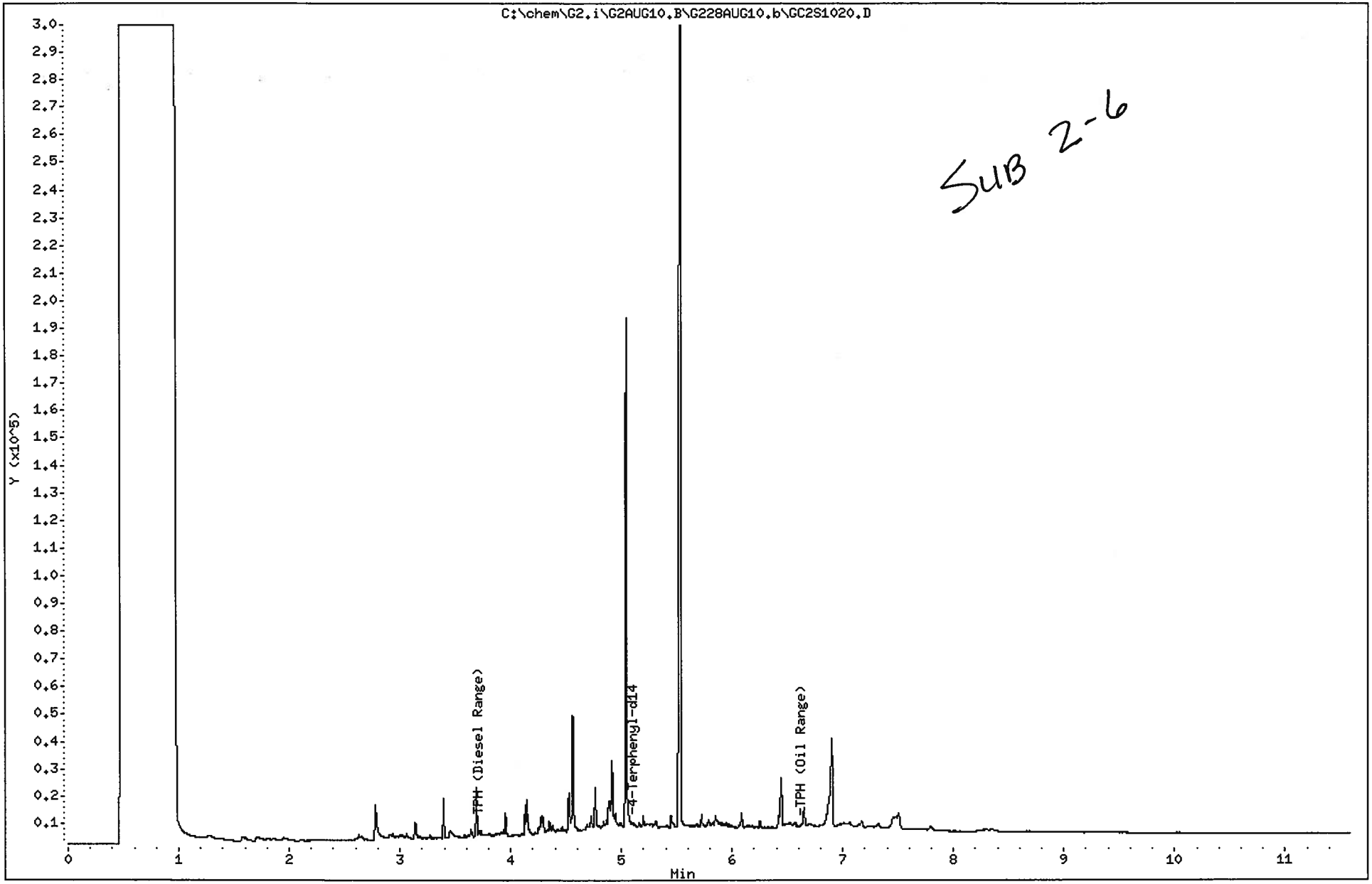


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1020.D
Date : 28-AUG-2010 18:13
Client ID: Sub 2-6
Sample Info: L10081126-08A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

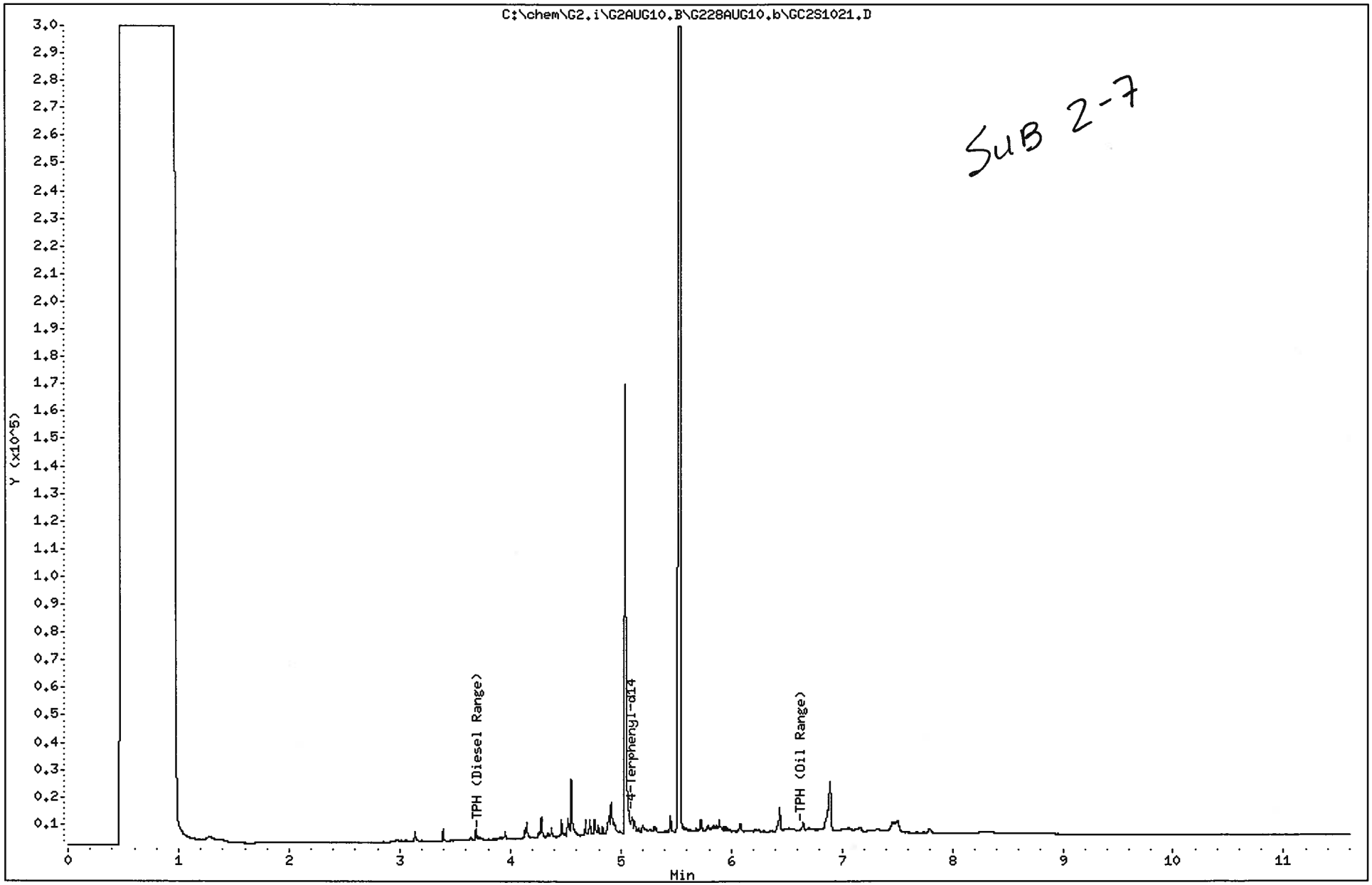


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1021.D
Date : 28-AUG-2010 18:30
Client ID: Sub 2-7
Sample Info: L10081126-09A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

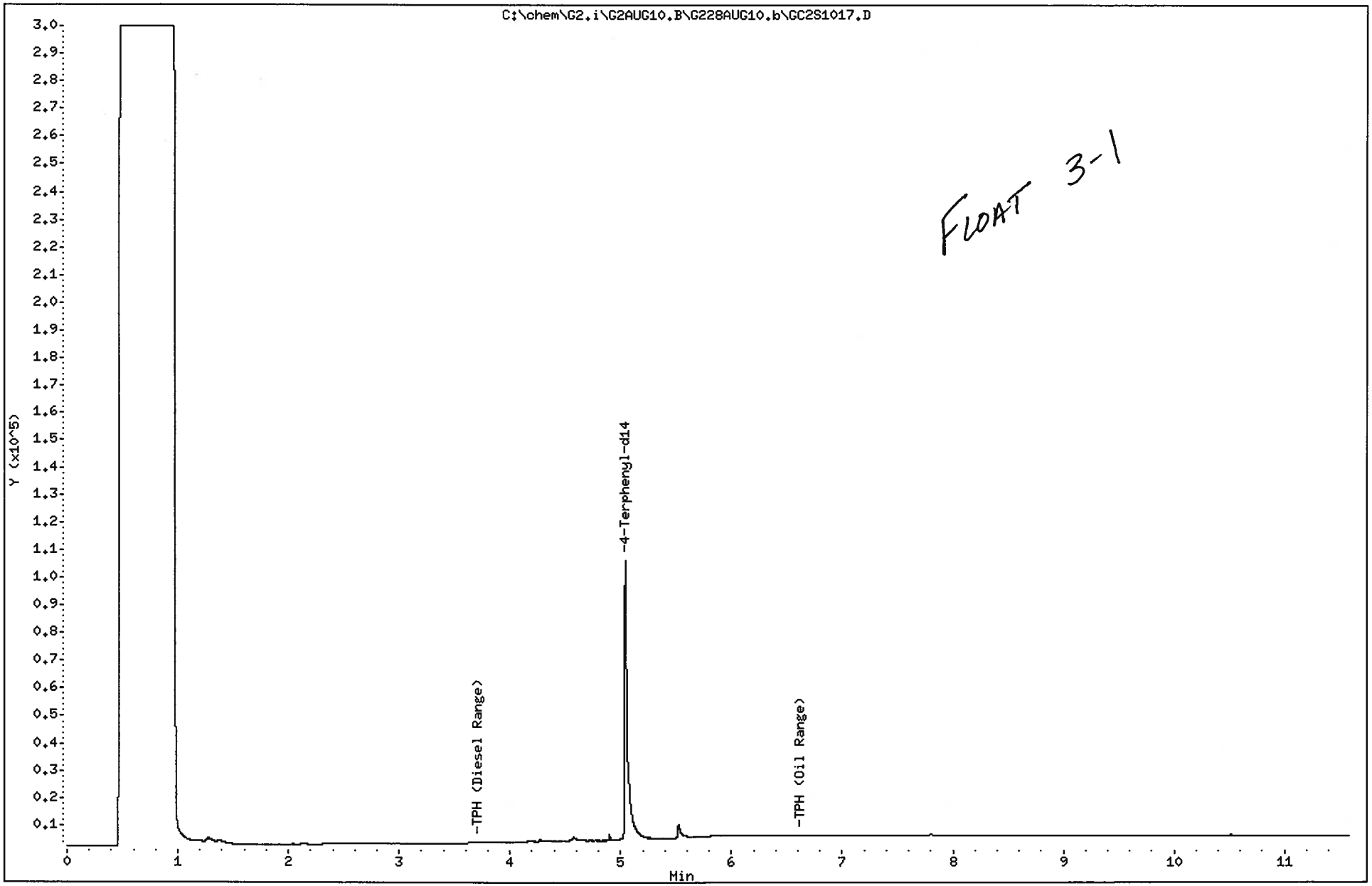


Data File: C:\chem\G2.i\G2AUG10.B\G228AUG10.b\GC2S1017.D
Date : 28-AUG-2010 17:19
Client ID: Float 3-1
Sample Info: L10081126-10A

Column phase:

Instrument: G2.i

Operator: CER
Column diameter: 2.00



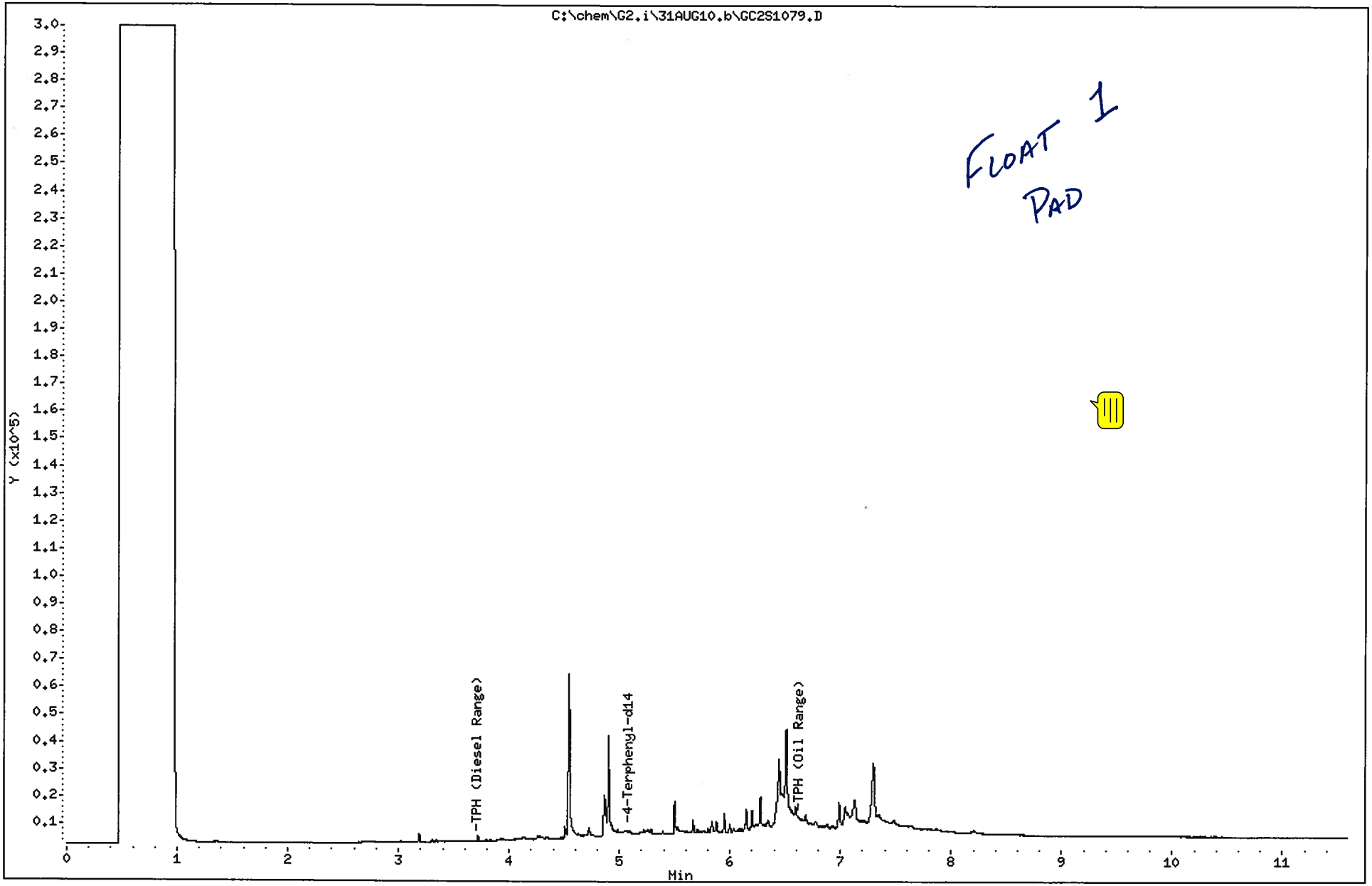
FLOAT 3-1

Data File: C:\chem\G2.i\31AUG10.b\GC2S1079.D
Date : 01-SEP-2010 08:07
Client ID: FLOAT 1
Sample Info: L10081126-11A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

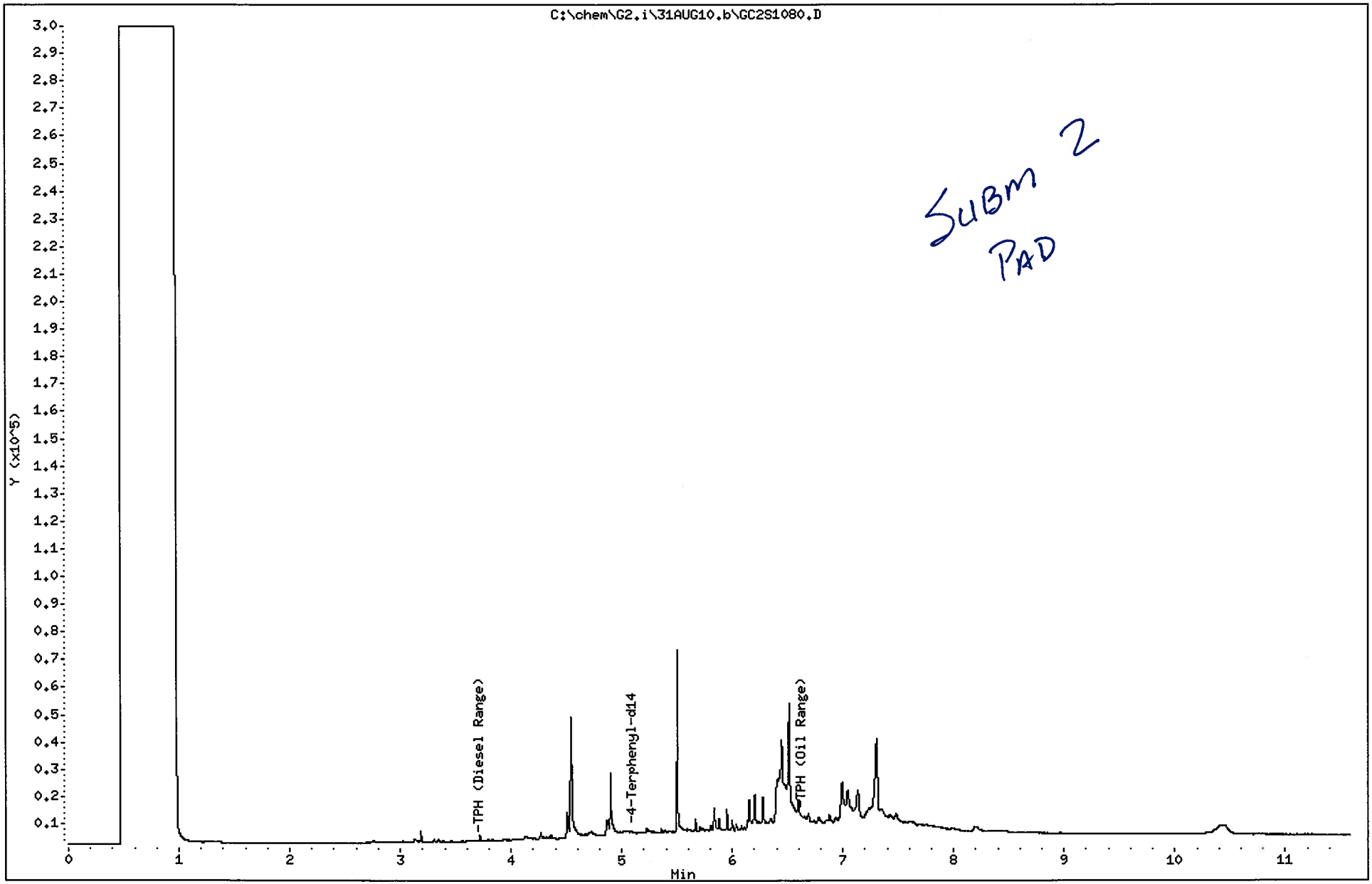


Data File: C:\chem\G2.i\31AUG10.b\GC2S1080.D
Date : 01-SEP-2010 08:24
Client ID: SUBM 2
Sample Info: L10081126-12A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:

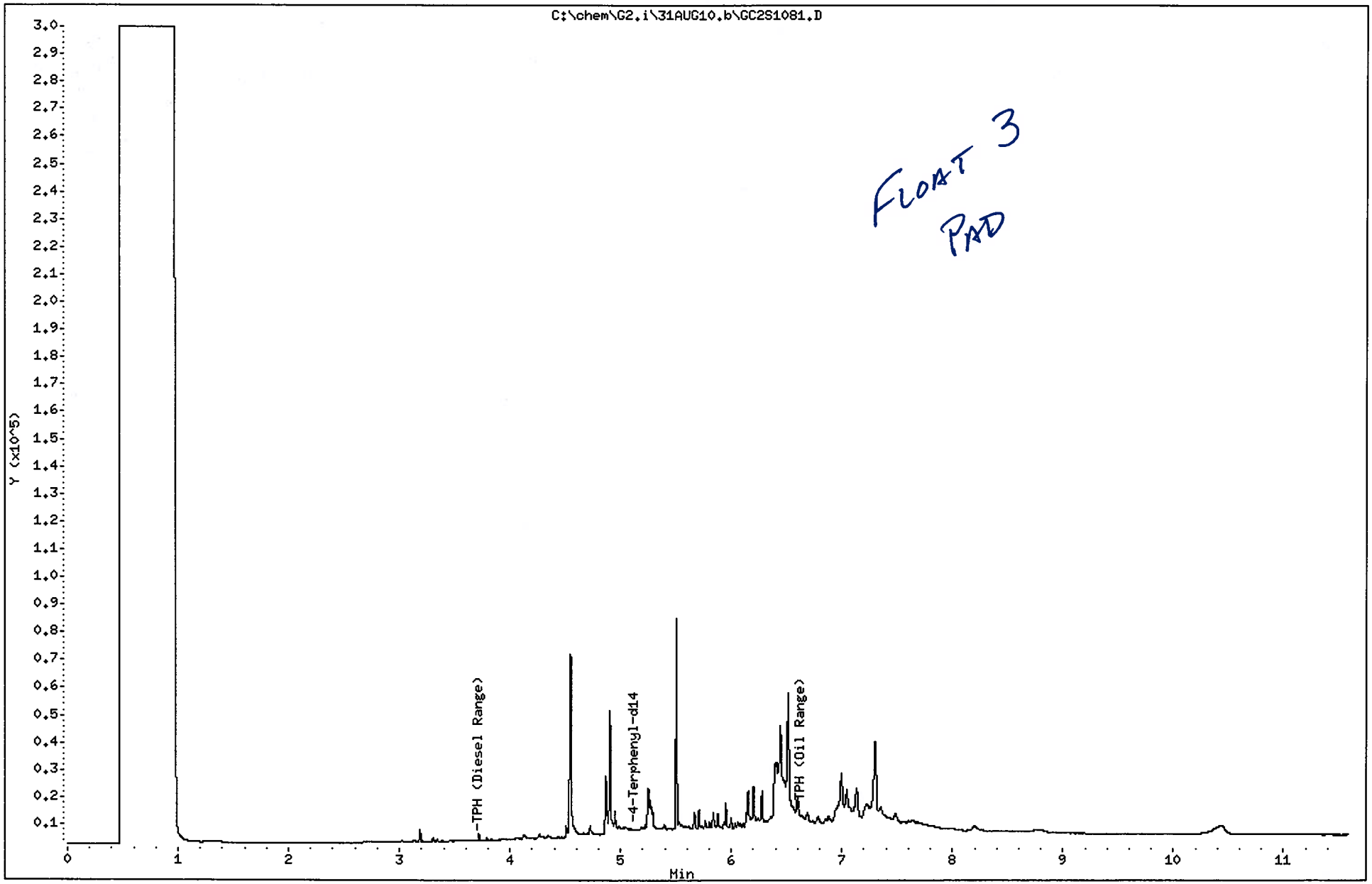


Data File: C:\chem\G2.i\31AUG10.b\GC2S1081.D
Date : 01-SEP-2010 08:42
Client ID: FLOAT 3
Sample Info: L10081126-13A

Instrument: G2.i

Operator: CER
Column diameter: 2.00

Column phase:



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

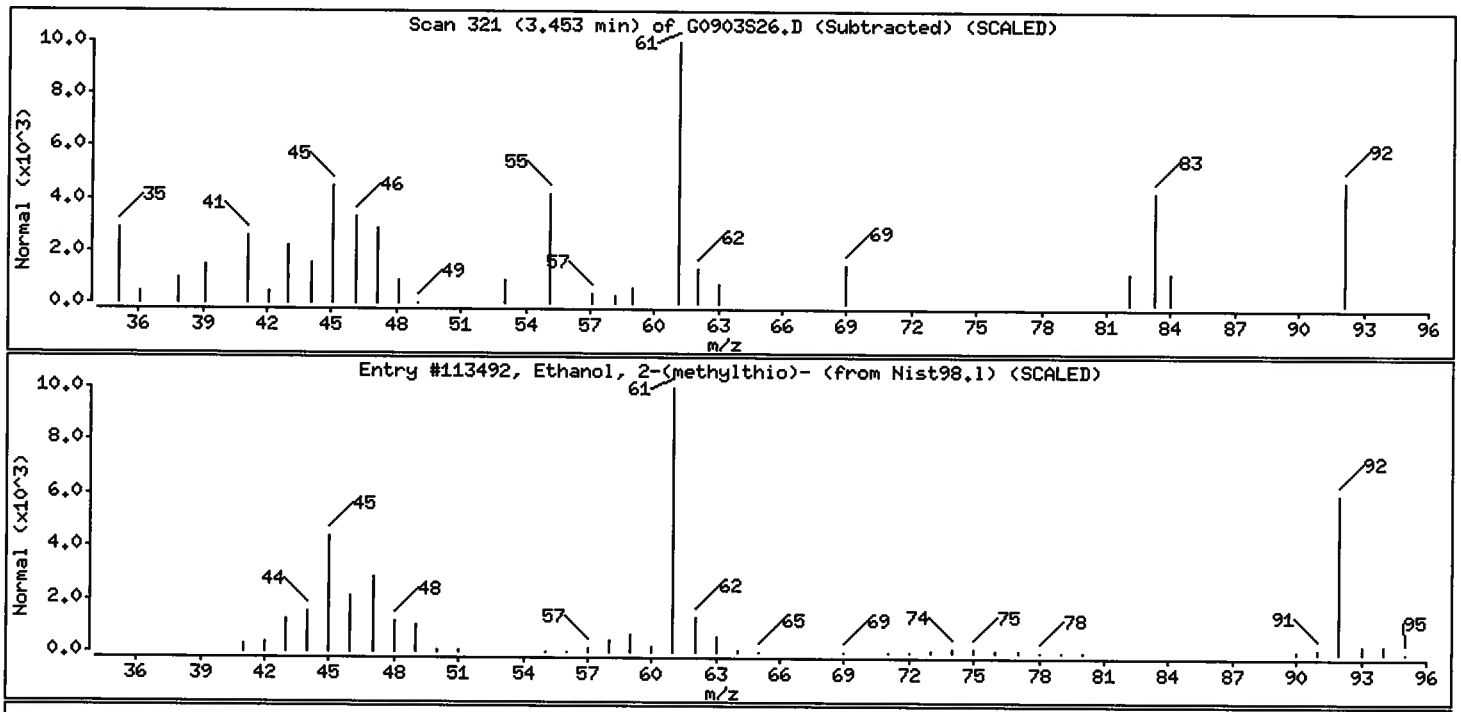
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Ethanol, 2-(methylthio)-	5271-38-5	Nist98.l	113492	93	C3H8OS	92



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

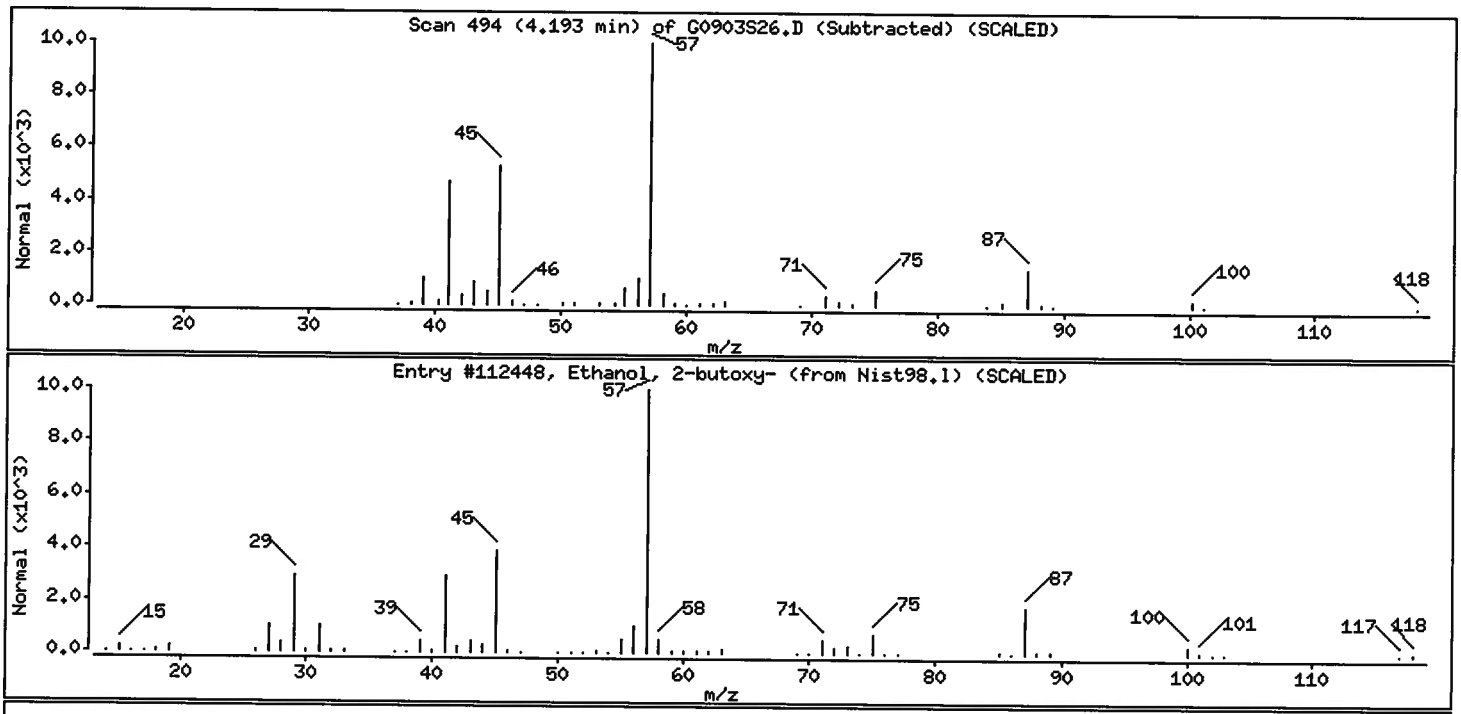
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Ethanol, 2-butoxy-	111-76-2	Nist98.l	112448	58	C6H14O2	118



Data File: C:\chem\C5.b\C5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: C5.i

Sample Info: SAMP L10081126-01A

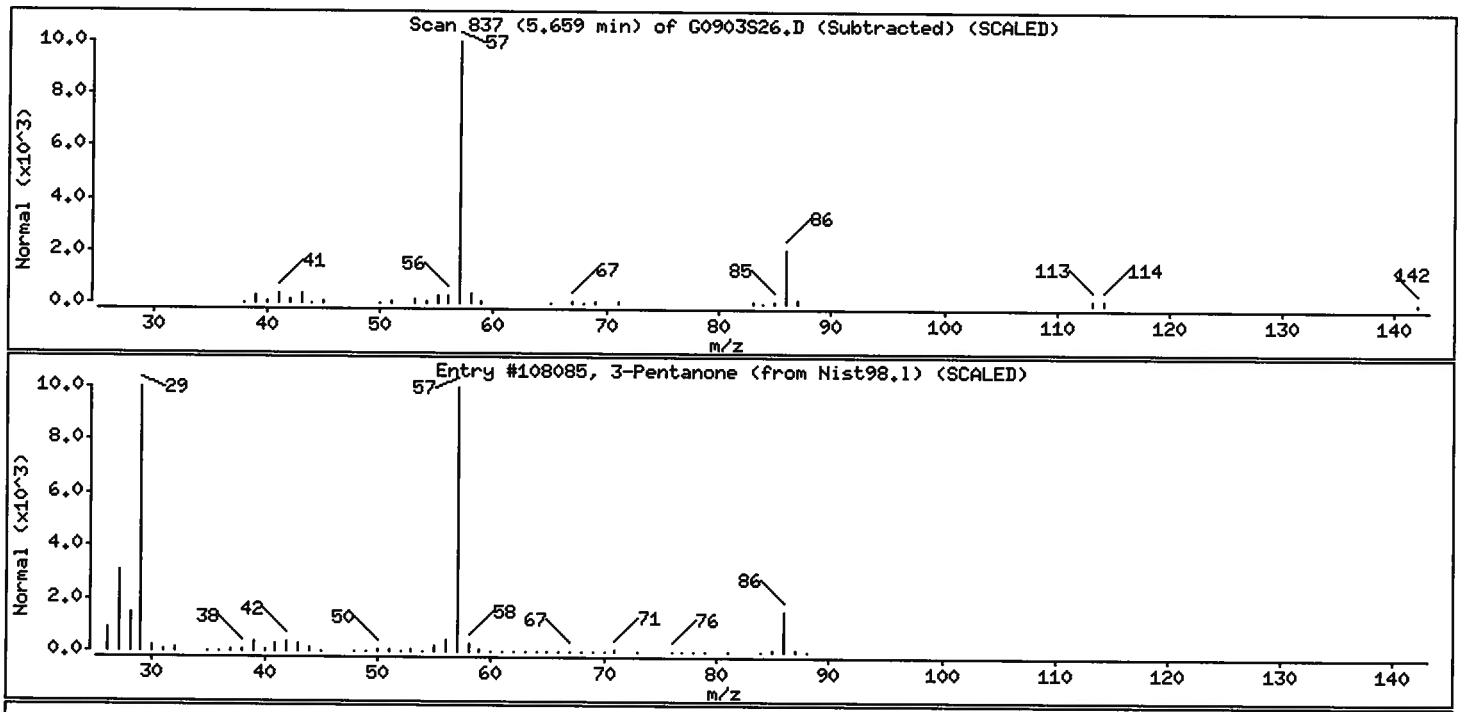
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
3-Pentanone	96-22-0	Nist98.l	108085	72	C5H10O	86



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

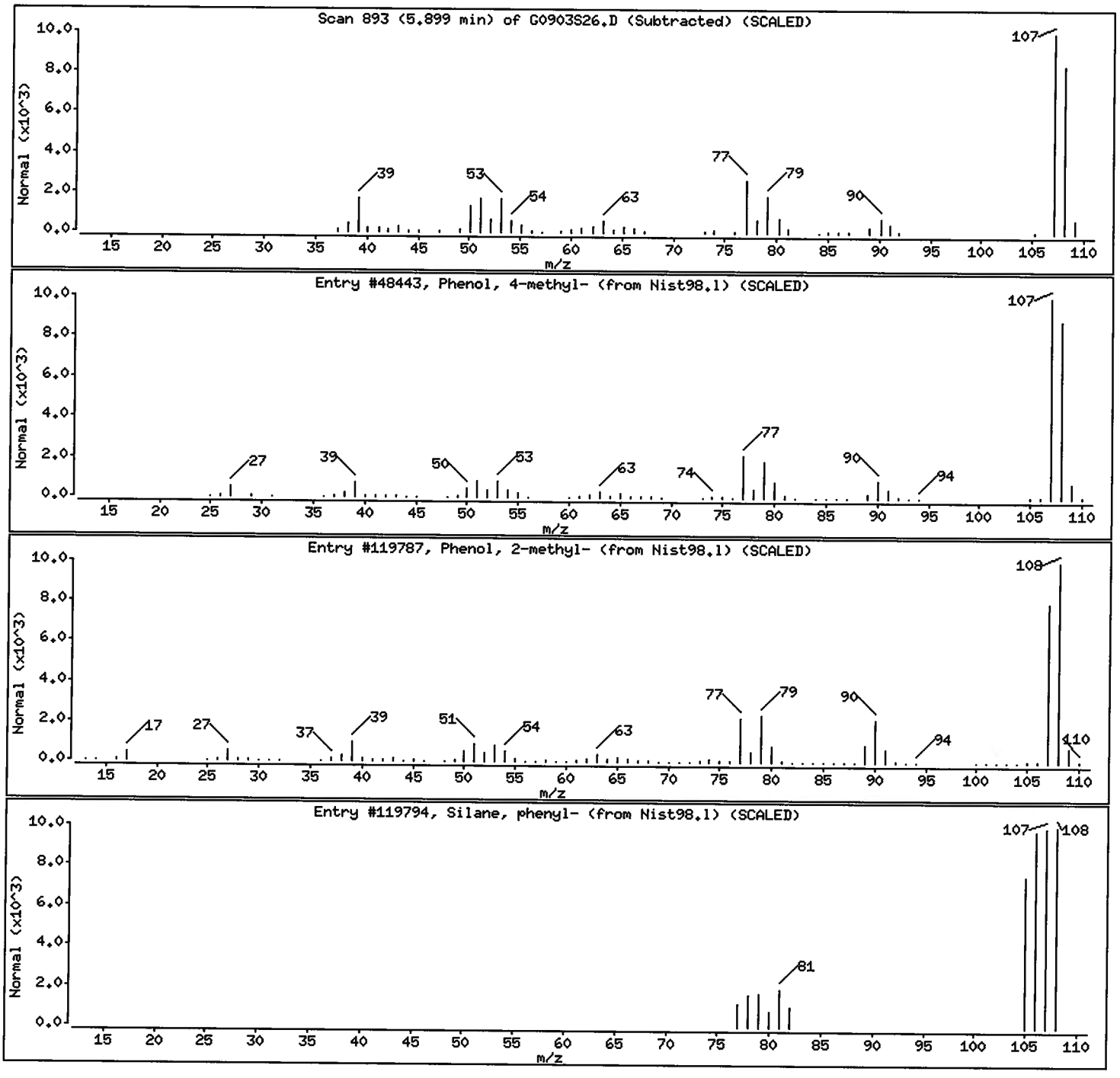
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Phenol, 4-methyl-	106-44-5	Nist98.l	48443	95	C7H8O	108
Phenol, 2-methyl-	95-48-7	Nist98.l	119787	81	C7H8O	108
Silane, phenyl-	694-53-1	Nist98.l	119794	78	C6H8Si	108



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

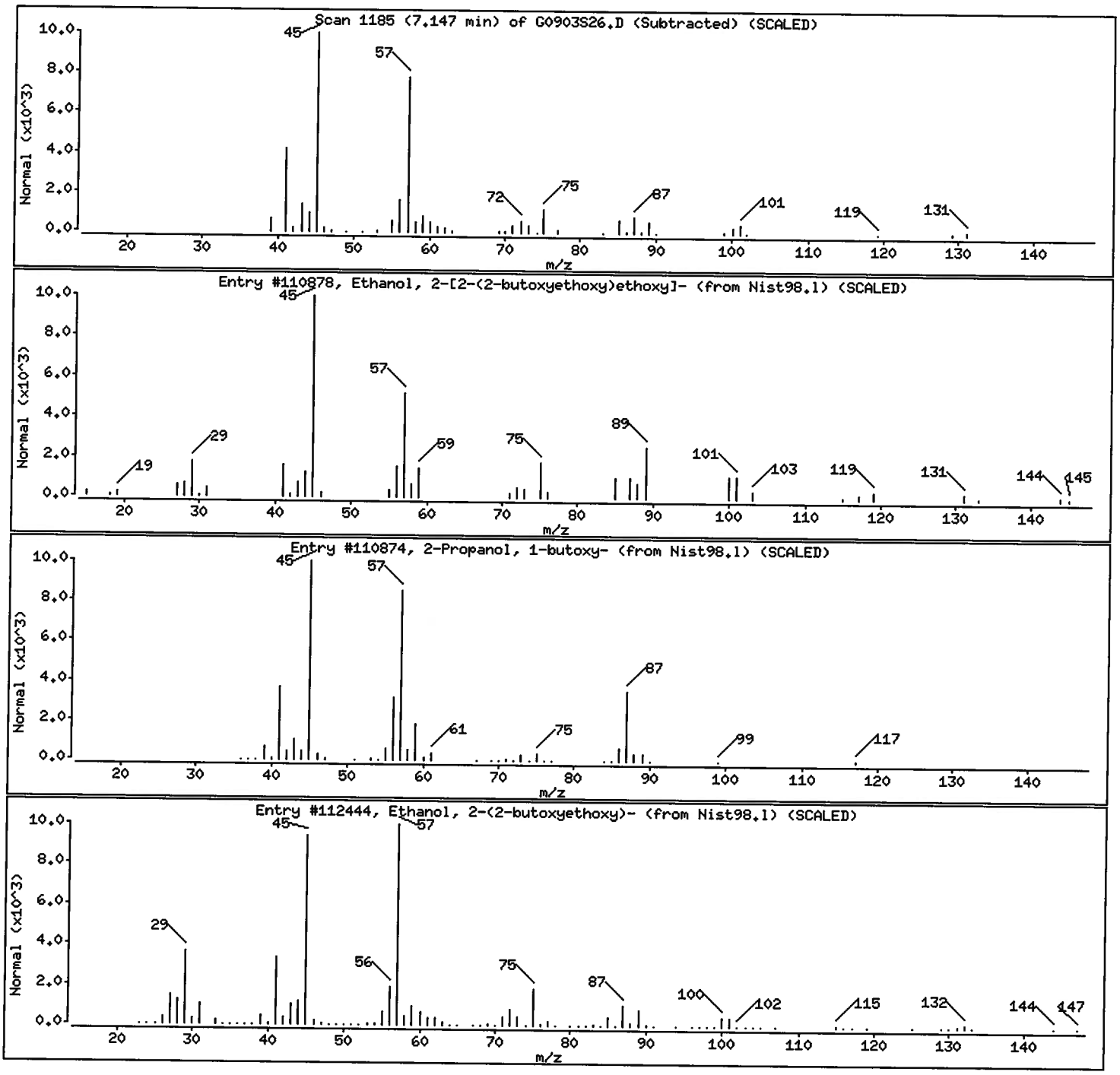
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Ethanol, 2-[2-(2-butoxyethoxy)ethoxy]-	143-22-6	Nist98.l	110878	50	C10H2204	206
2-Propanol, 1-butoxy-	5131-66-8	Nist98.l	110874	50	C7H1602	132
Ethanol, 2-(2-butoxyethoxy)-	112-34-5	Nist98.l	112444	50	C8H1803	162



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

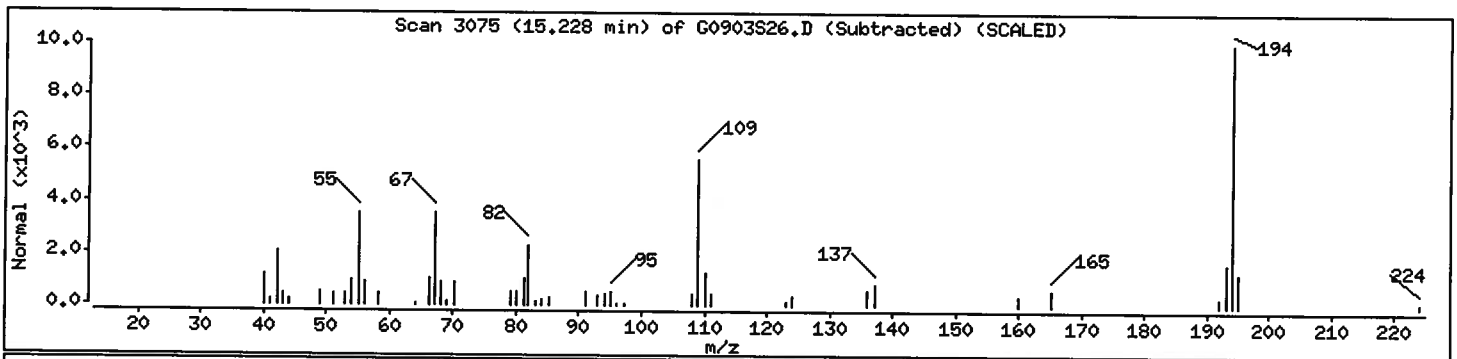
Volume Injected (uL): 1.0

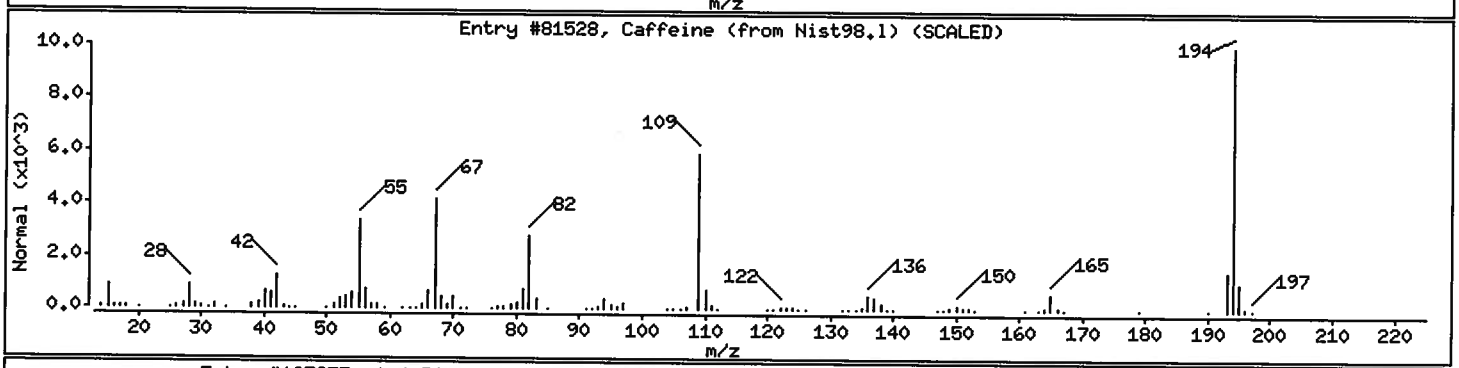
Operator: LMK/KTK

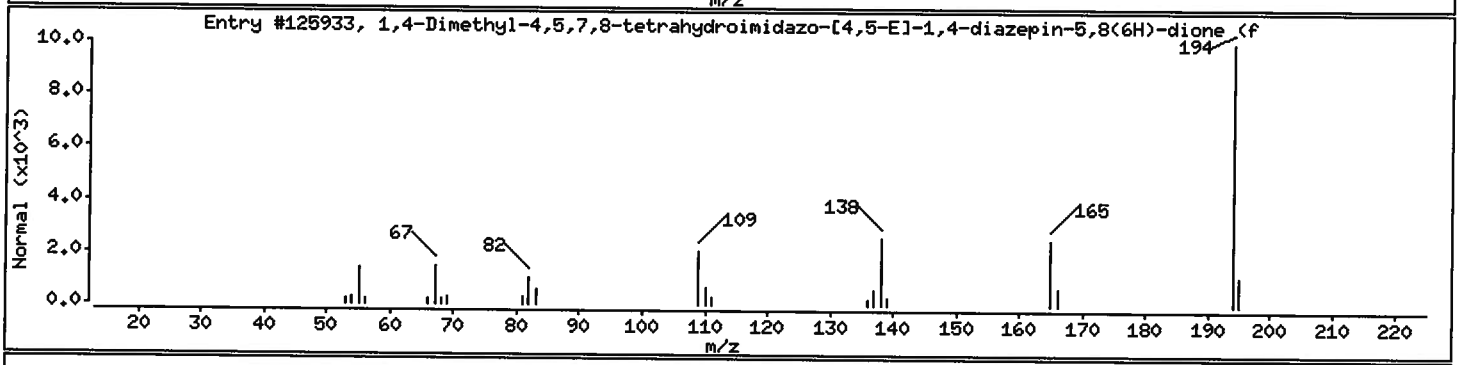
Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Caffeine	58-08-2	Nist98.l	81528	95	C8H10N4O2	194
1,4-Dimethyl-4,5,7,8-tetrahydroimidazo-[	130063-15-9	Nist98.l	125933	53	C8H10N4O2	194







Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

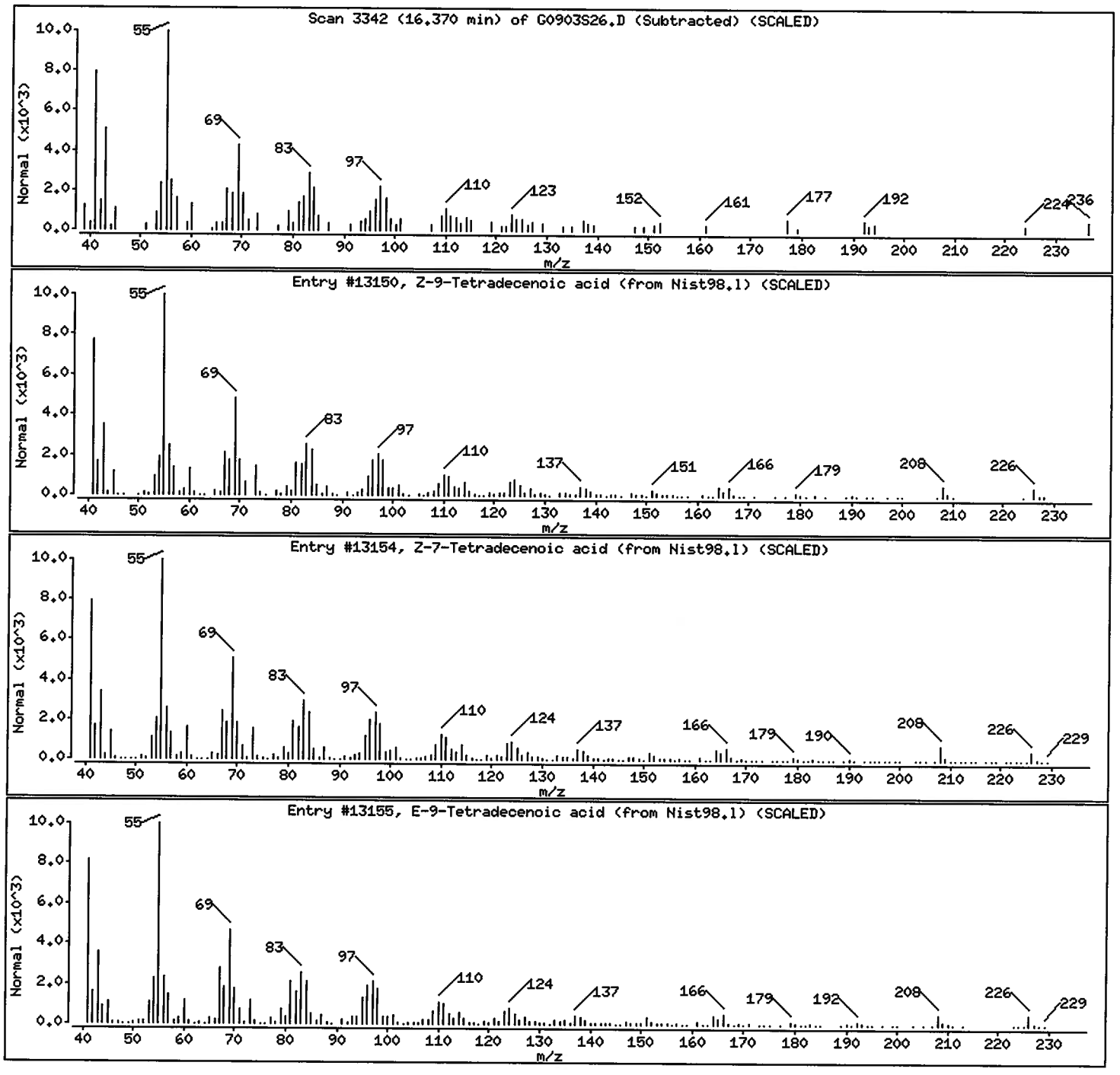
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Z-9-Tetradecenoic acid	1000130-84-4	Nist98.l	13150	83	C14H2602	226
Z-7-Tetradecenoic acid	1000130-98-4	Nist98.l	13154	80	C14H2602	226
E-9-Tetradecenoic acid	1000131-35-8	Nist98.l	13155	64	C14H2602	226



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

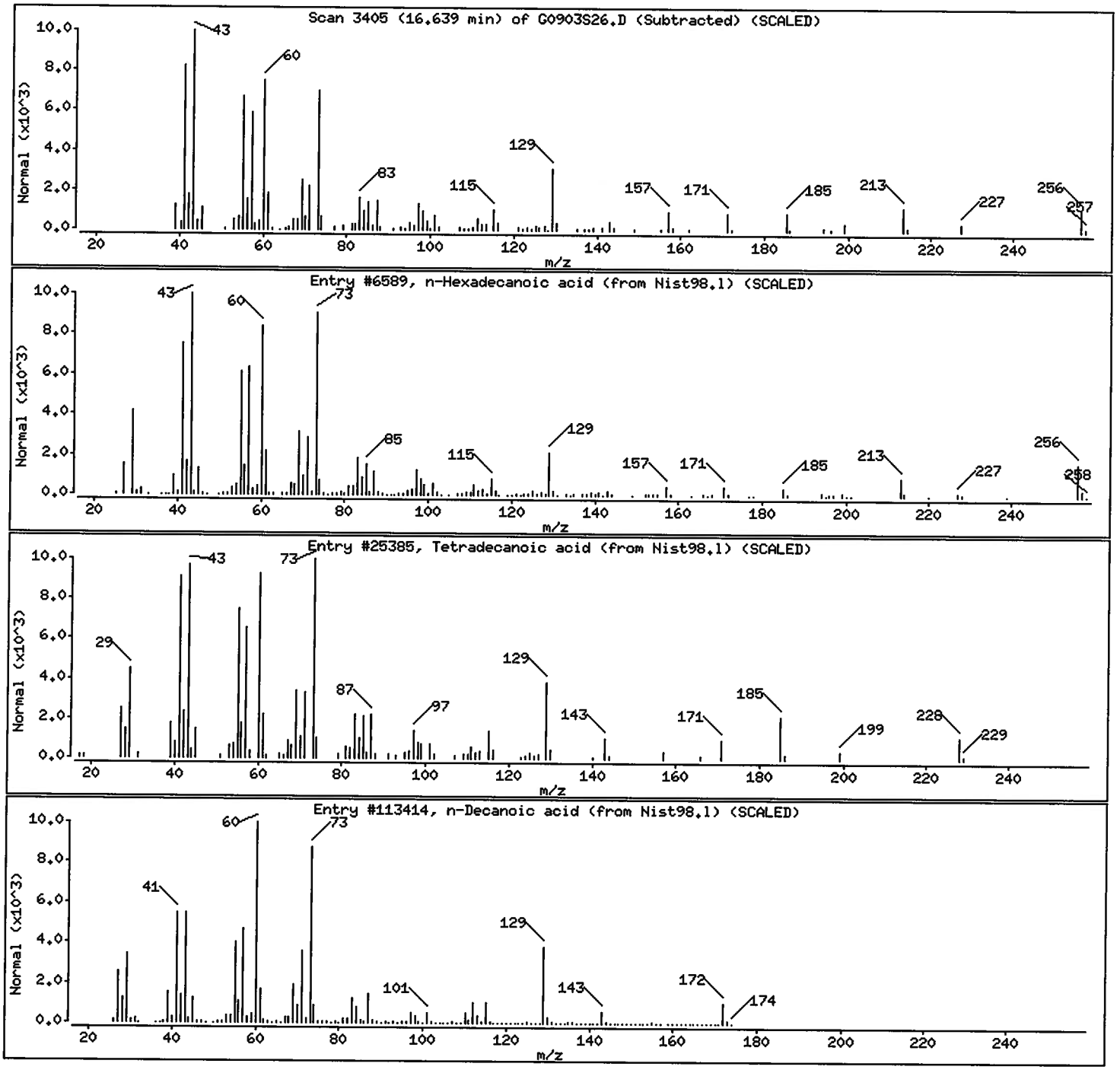
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
n-Hexadecanoic acid	57-10-3	Nist98.l	6589	98	C16H3202	256
Tetradecanoic acid	544-63-8	Nist98.l	25385	64	C14H2802	228
n-Decanoic acid	334-48-5	Nist98.l	113414	58	C10H2002	172



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

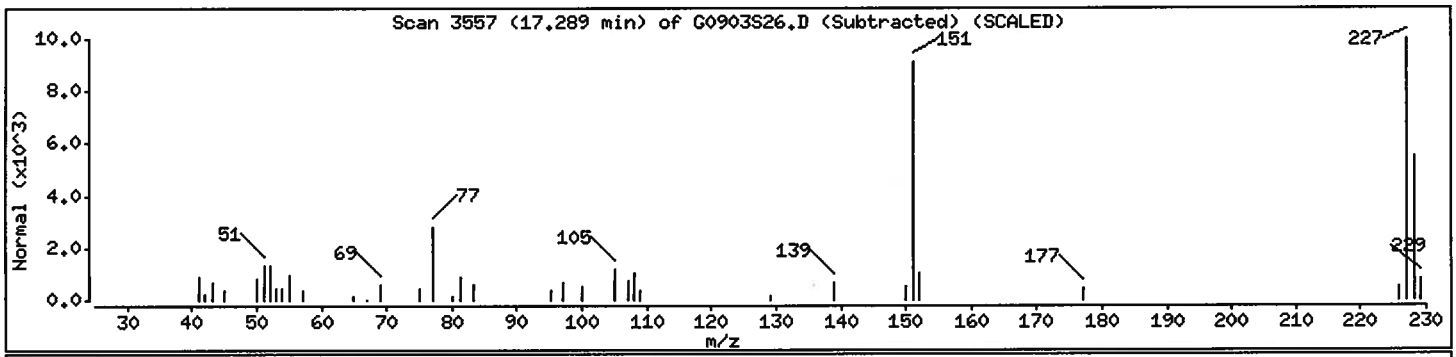
Volume Injected (uL): 1.0

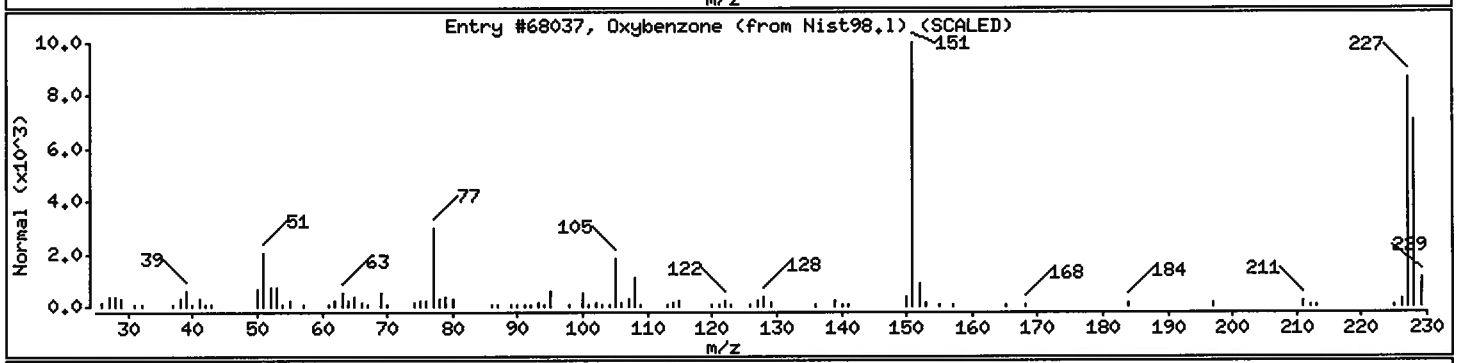
Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Oxybenzone	131-57-7	Nist98.l	68037	93	C14H1203	228





Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

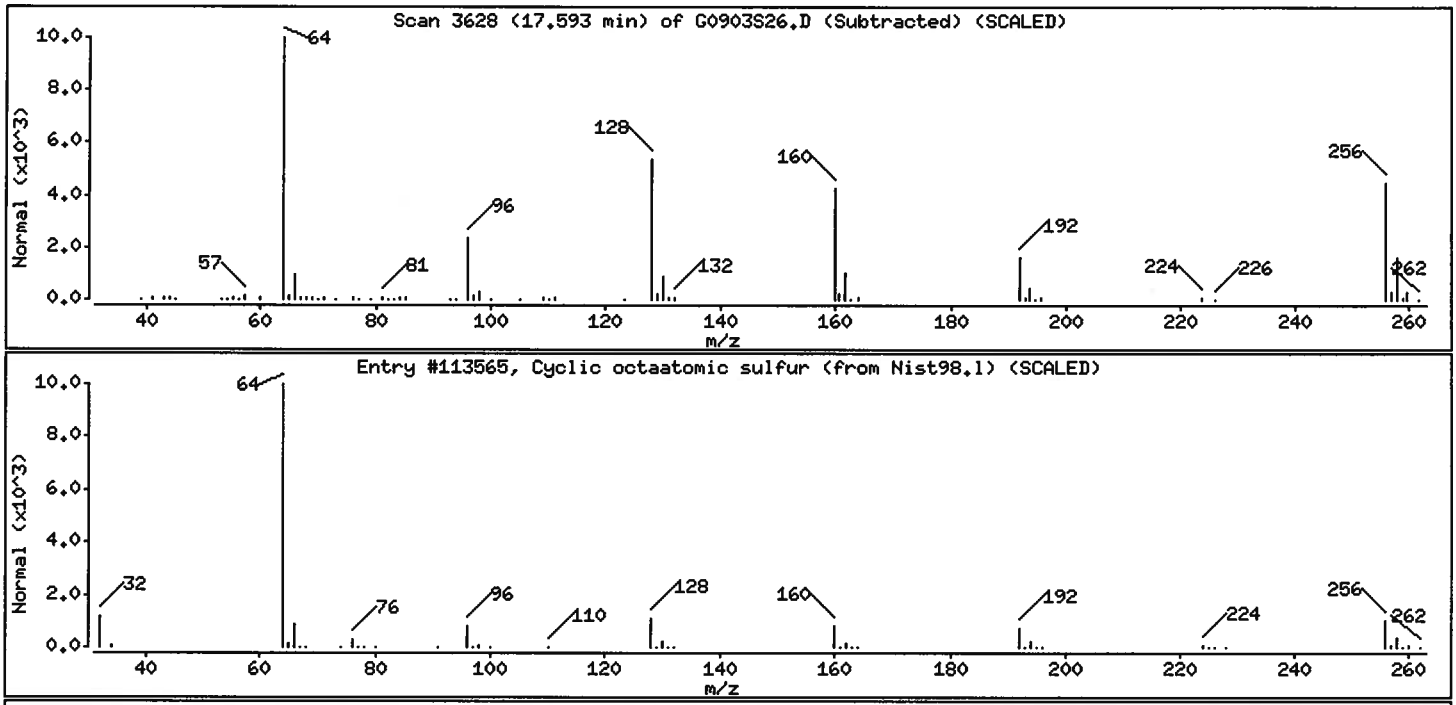
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Cyclic octaatomic sulfur	10544-50-0	Nist98.l	113565	91	S8	256



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

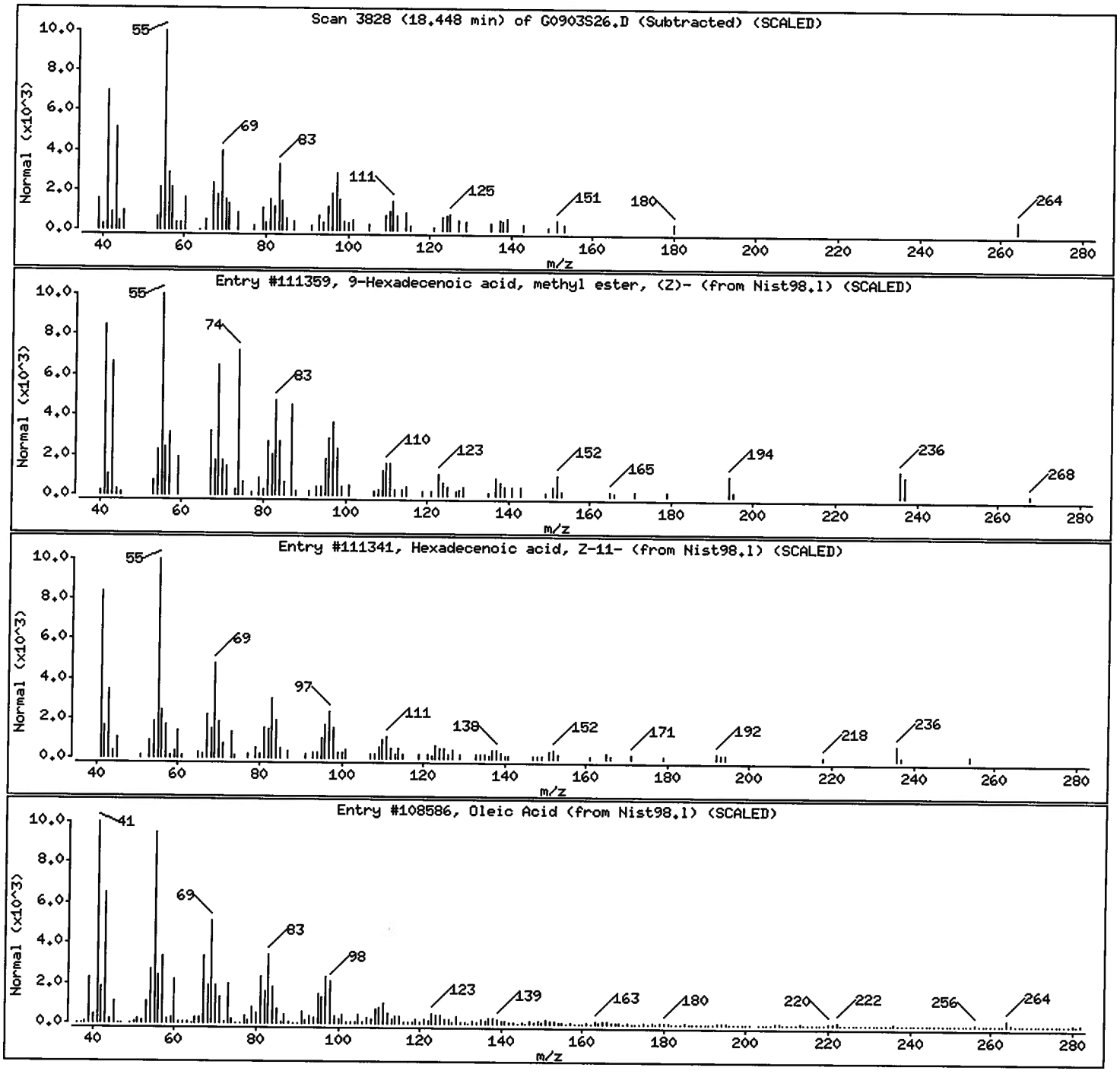
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
9-Hexadecenoic acid, methyl ester, (Z)-	1120-25-8	Nist98.l	111359	86	C17H3202	268
Hexadecenoic acid, Z-11-	2416-20-8	Nist98.l	111341	80	C16H3002	254
Oleic Acid	112-80-1	Nist98.l	108586	64	C18H3402	282



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

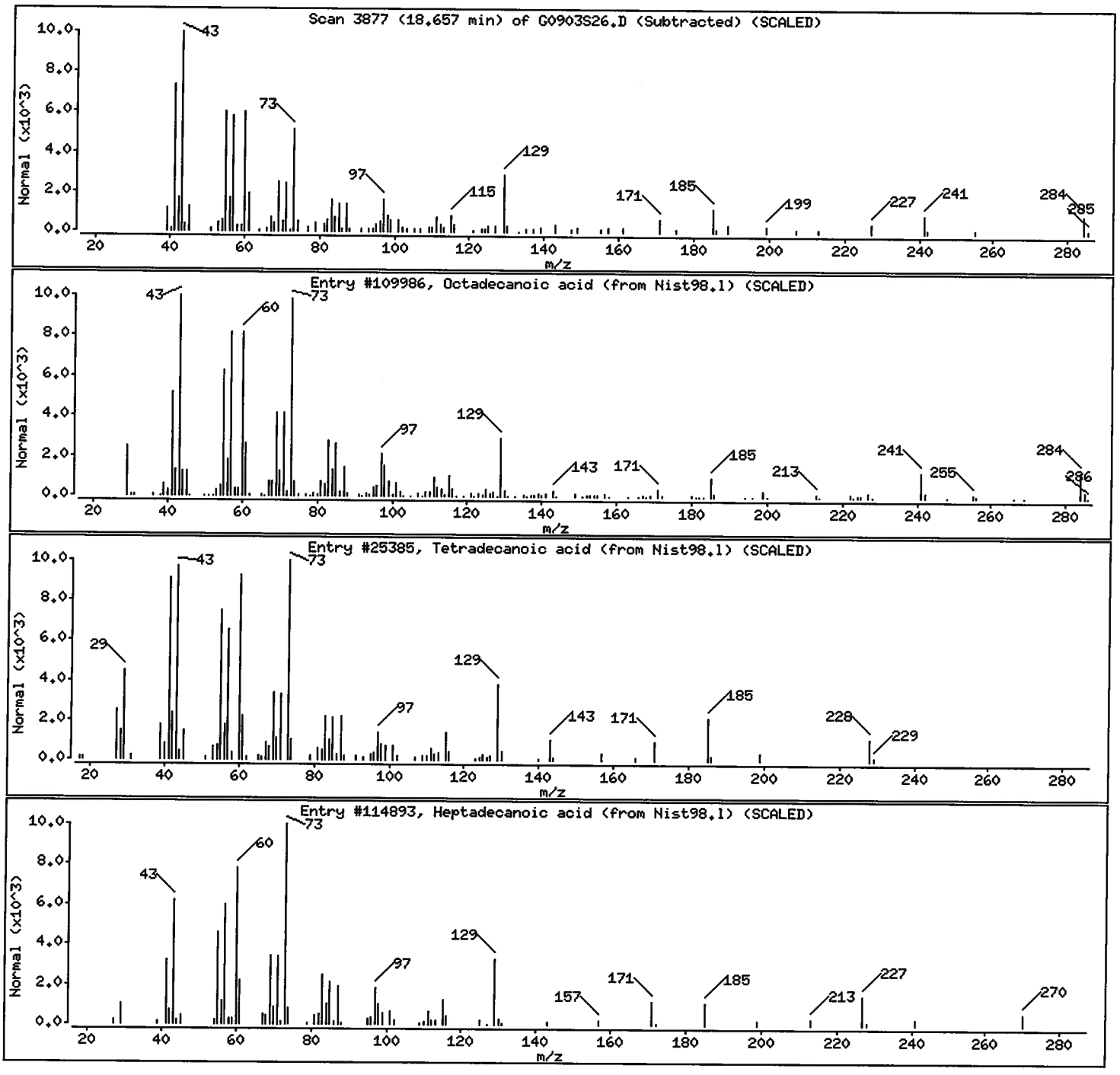
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Octadecanoic acid	57-11-4	Nist98.l	109986	98	C18H3602	284
Tetradecanoic acid	544-63-8	Nist98.l	25385	83	C14H2802	228
Heptadecanoic acid	506-12-7	Nist98.l	114893	74	C17H3402	270



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
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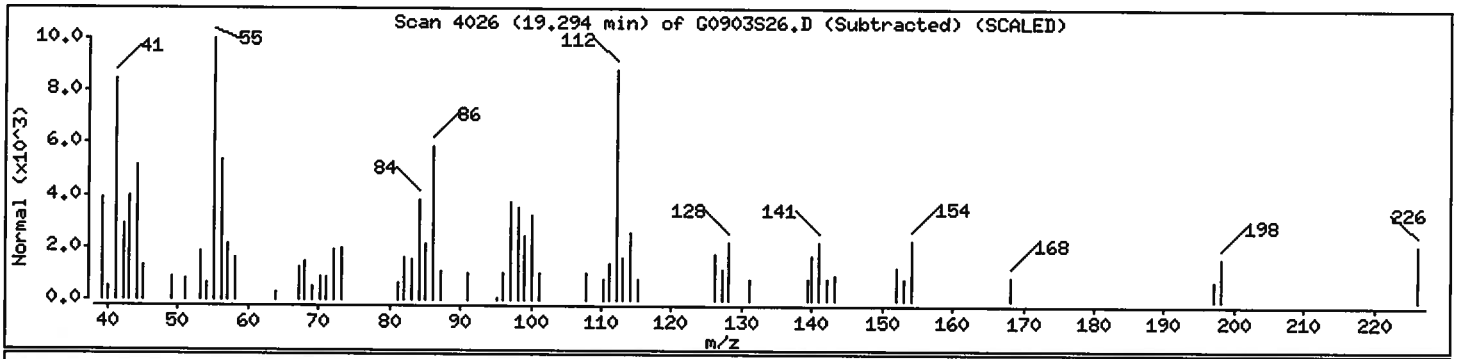


Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

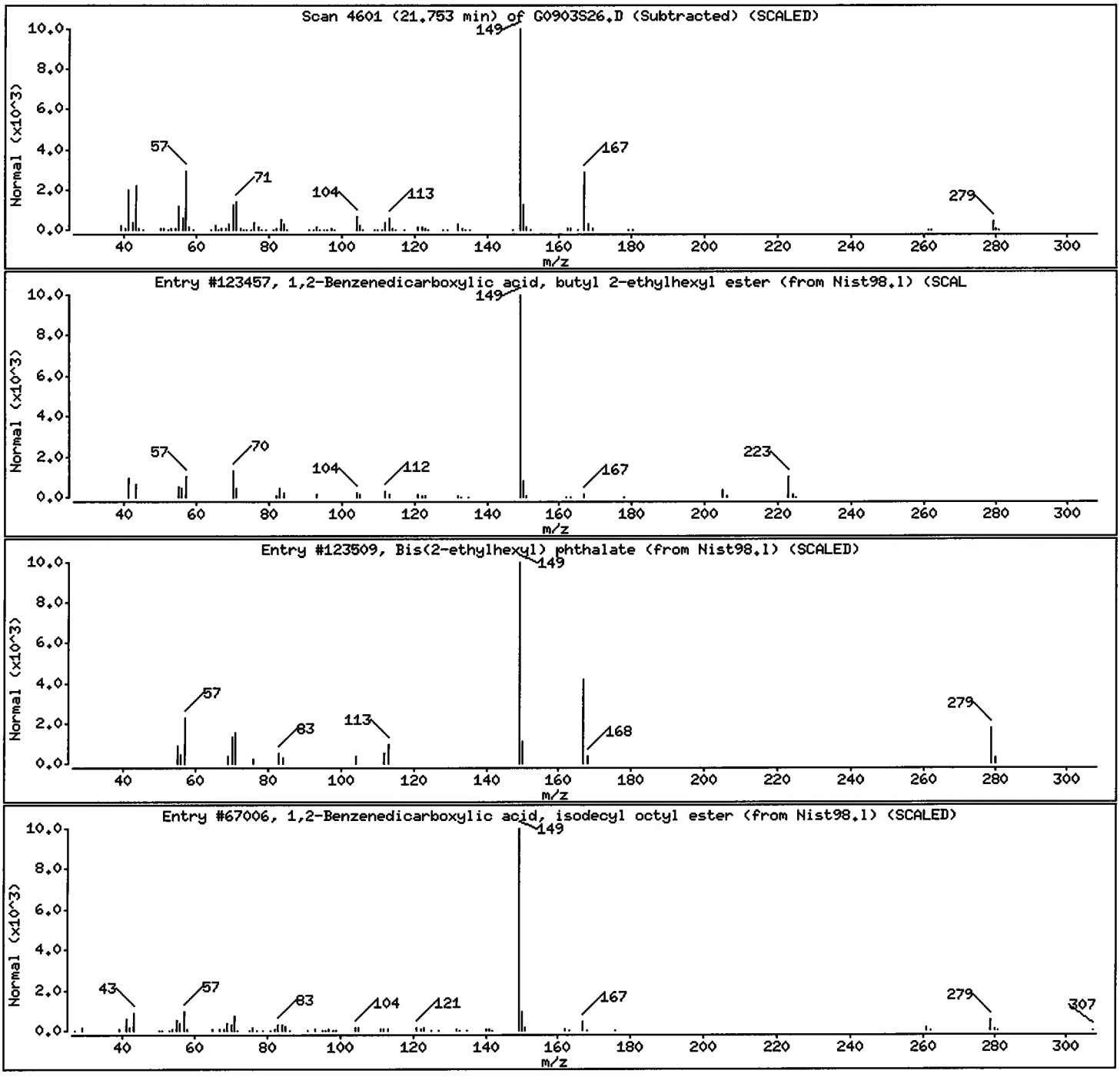
Client ID: Sub 1-1 Instrument: G5.i

Sample Info: SAMP L10081126-01A

Volume Injected (uL): 1.0 Operator: LMK/KTK

Column phase: RTX-5MSil Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
1,2-Benzenedicarboxylic acid, butyl 2-et	85-69-8	Nist98.l	123457	59	C20H3004	334
Bis(2-ethylhexyl) phthalate	117-81-7	Nist98.l	123509	58	C24H3804	390
1,2-Benzenedicarboxylic acid, isodecyl o	1330-96-7	Nist98.l	67006	53	C26H4204	418



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Date : 04-SEP-2010 04:59

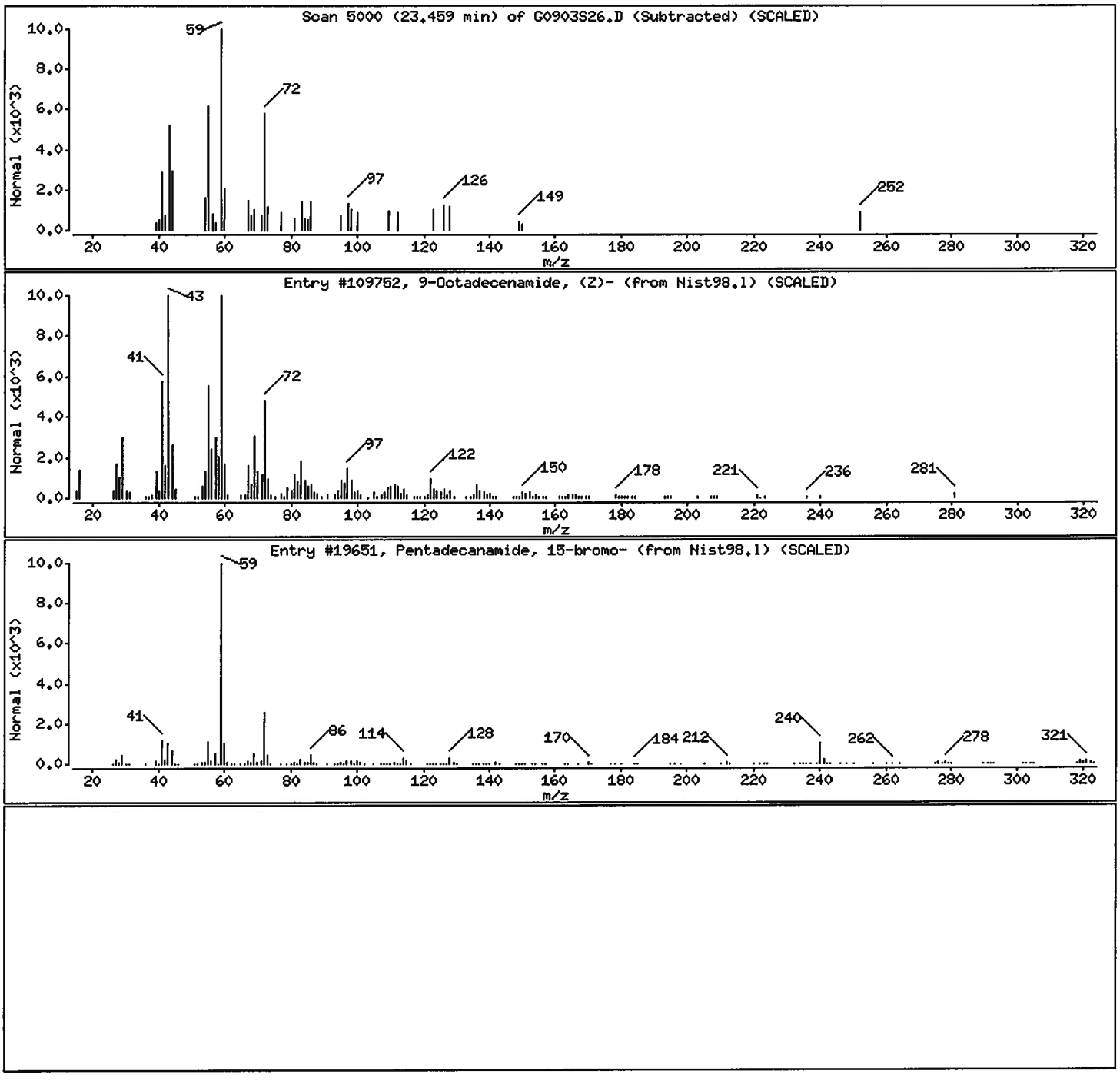
Client ID: Sub 1-1 Instrument: C5.i

Sample Info: SAMP L10081126-01A

Volume Injected (uL): 1.0 Operator: LMK/KTK

Column phase: RTX-5MSil Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
9-Octadecenamide, (Z)-	301-02-0	Nist98.l	109752	59	C18H35NO	281
Pentadecanamide, 15-bromo-	1000163-86-1	Nist98.l	19651	53	C15H30BrNO	319



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Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

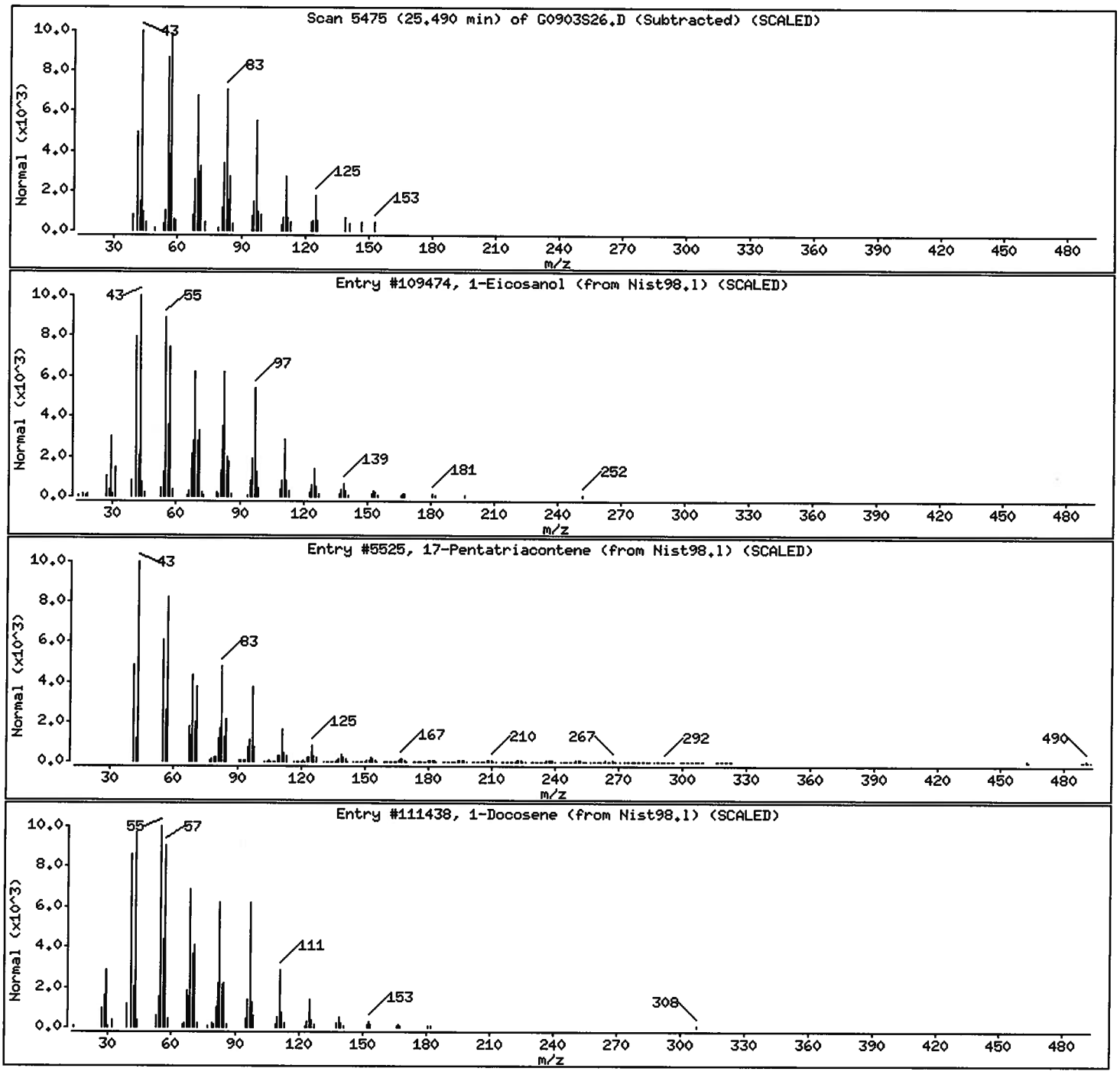
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
1-Eicosanol	629-96-9	Nist98.l	109474	91	C20H420	298
17-Pentatriacontene	6971-40-0	Nist98.l	5525	91	C35H70	491
1-Docosene	1599-67-3	Nist98.l	111438	87	C22H44	308



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Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

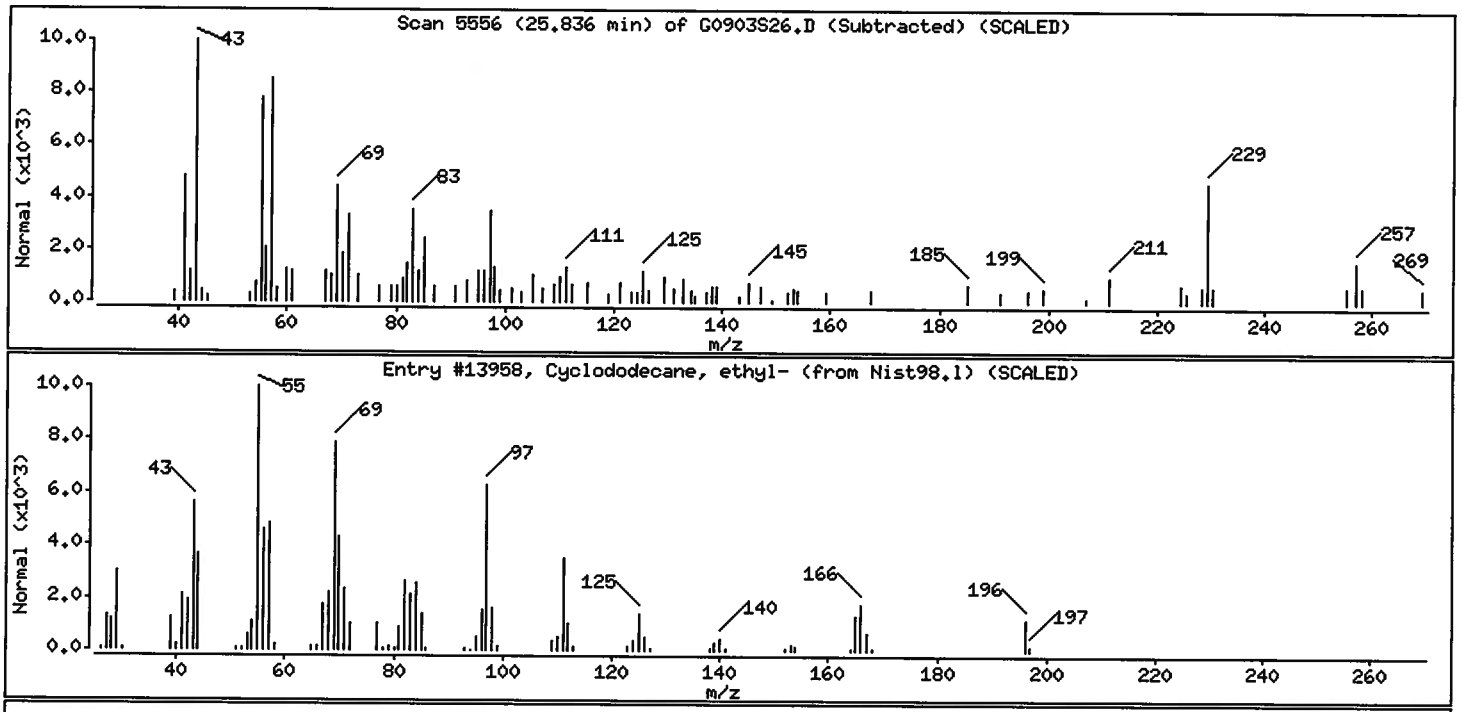
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Cyclododecane, ethyl-	28981-49-9	Nist98.l	13958	53	C14H28	196



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Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

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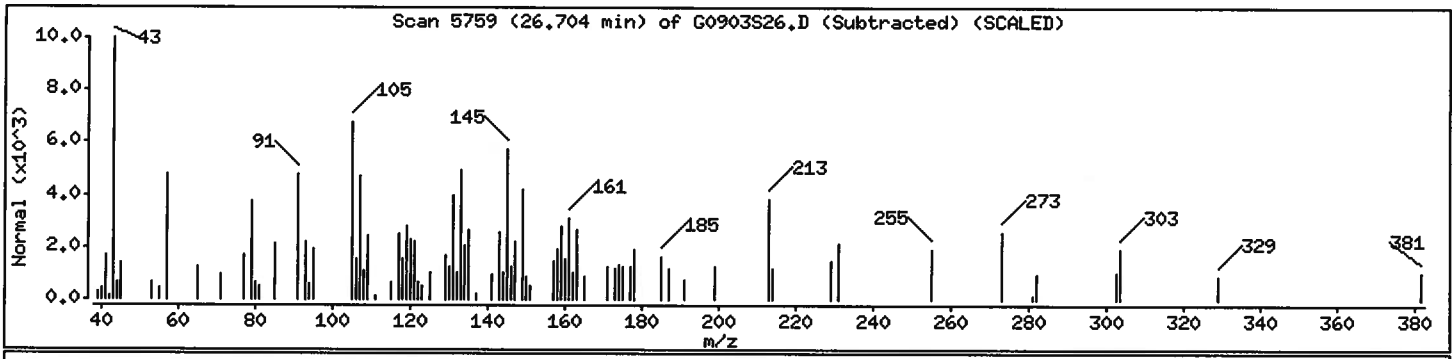
Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
Unknown			0	0		0



Data File: C:\chem\G5.b\G5100903b.B\G0903S26.D

Date : 04-SEP-2010 04:59

Client ID: Sub 1-1

Instrument: G5.i

Sample Info: SAMP L10081126-01A

Volume Injected (uL): 1.0

Operator: LMK/KTK

Column phase: RTX-5MSil

Column diameter: 0.25

Library Search Compound Match	CAS Number	Library	Entry	Quality	Formula	Weight
9-Methyl-Z-10-tetradecen-1-ol acetate	1000130-99-4	Nist98.l	5243	60	C17H3202	268
Cyclopentadecanone, 2-hydroxy-	4727-18-8	Nist98.l	13224	58	C15H2802	240
8-Cyclohexadecen-1-one	3100-36-5	Nist98.l	2051	55	C16H280	236