INTERIM ACTION WORK PLAN
CENTRAL WATERFRONT SITE, CHEVRON SUBAREA

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Description
ASB	Aerated Stabilization Basin
BMP	best management practice
BMC	Bellingham Municipal Code
City	City of Bellingham
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management System
HPA	Hydraulic Project Approval
IA	interim action
JARPA	Joint Aquatic Resources Permit Application
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MTCA	Model Toxics Control Act (Chapter 173-340 WAC)
NAPL	non-aqueous phase liquid
NPDES	National Pollutant Discharge Elimination System
Port	Port of Bellingham
RCW	Revised Code of Washington
RI/FS	remedial investigation/feasibility study
SEPA	State Environmental Policy Act
Site	Central Waterfront Site
SMA	Shoreline Management Act
TPH	total petroleum hydrocarbons
TPH-Dx	TPH-diesel extended
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
Work Plan	Interim Action Work Plan

1 INTRODUCTION

The Port of Bellingham (Port) intends to perform an interim action (IA) at the Central Waterfront Site (Site) in Bellingham, Washington (Figure 1), to excavate and remove non-aqueous phase liquid (NAPL) petroleum and petroleum-impacted soil and sediments from the Chevron subarea beach to prevent petroleum sheen on Whatcom Waterway.

The IA will be conducted under Agreed Order No. DE 3441 as amended (AO) (Ecology 2006, 2012) between the Port, the City of Bellingham (City), and the Washington State Department of Ecology (Ecology). This Interim Action Work Plan (Work Plan) has been prepared in accordance with the Scope of Work (Exhibit D of the AO amendment) and, once approved by Ecology, will become an integral and enforceable part of the AO.

1.1 Site Description and Background

The Site, located in Bellingham, Washington, encompasses 55 acres and includes both upland property (bounded by the Whatcom and I & J Waterways, Roeder Avenue, and the former Aerated Stabilization Basin (ASB) facility) and in-water nearshore surface sediments in the Whatcom and I & J Waterways. The Central Waterfront Site is comprised of four contaminated sites that were formerly managed separately under the Model Toxics Control Act (MTCA): the Roeder Avenue Landfill site, the Olivine Corp. Hilton site (Olivine Uplands), the Chevron Bellingham Port site (Chevron Terminal), and the Colony Wharf site (Figure 2). In 2003, due to the presence of comingled groundwater contamination, Ecology consolidated these four sites (herein referred to as subareas) into a single area-wide site now known as the Central Waterfront Site. In 2006, the Port and City entered into the AO with Ecology to perform a remedial investigation/feasibility study (RI/FS) for the Site, which is currently in progress.

The Chevron subarea was operated as a bulk fuel terminal from approximately 1913 until the late 1980s. The former terminal included two tank farms (north and south yards), a rail loading dock with associated piping, three tanker truck loading racks (one in north yard and two in south yard), a rail loading rack (south yard), product storage warehouse and office (south yard), and facility piping and stormwater management features. Former terminal

features, including above ground storage tanks and loading racks, have been demolished at the property.

This property was acquired by the Port in 2004 and is currently leased by the Port to The Landings at Colony Wharf, who in turn sublets portions of their leasehold to a gravel-hauling company and other tenants. The company offloads gravel from barges using the Colony Wharf barge loading facility. The gravel is either stockpiled on Site or is delivered directly to construction projects in Whatcom County.

Petroleum hydrocarbons and associated constituents have been identified in soil and groundwater within the Chevron subarea. Numerous independent investigations and interim cleanup actions have been performed by Chevron at the former Chevron property.

The first amendment to the AO (AO Amendment 2012) allows the Port to undertake IAs before completing the RI/FS, with public review and Ecology approval, in accordance with Washington Administrative Code (WAC) 173-340-430 and WAC 173-340-600(16). The IA outlined in this Work Plan will reduce the potential threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at the Site. The IA will be implemented in advance of selecting the final cleanup action for the Site and will not preclude reasonable alternatives for the final cleanup action (WAC 173-340-430(3)(b)).

1.1.1 Site Physical Conditions

The Chevron subarea beach which is the subject of this IA (Figure 3) was originally defined by a beveled tieback timber bulkhead. The bulkhead consisted of vertical cantilever timber piles spaced about 15 feet on-center and held in place with steel rods tied back to an unknown buried "deadman" anchor. The top of the piles and bulkhead were at approximate elevation +15 feet mean lower low water (MLLW). Ground surface behind the bulkhead appears to have been at approximate elevation +14 feet MLLW.

The bulkhead is now in a severe state of deterioration. While portions of the bulkhead are still standing vertical and full height, the top 6 feet of the bulkhead wall that comprises the central 70 feet have been lost through deterioration. The cantilever timber piles in this

section are gone. In addition, the shortened timber bulkhead planks have rotated toward the waterway about 60 degrees. As a consequence of the central bulkhead deterioration and rotation, much of the soil originally behind the bulkhead has been washed away and a sloping gravelly-sand beach is now present.

Groundwater flow at the Site occurs in a shallow, unconfined groundwater unit. In the area of the Chevron subarea beach, the Site Groundwater Unit consists of the Soil Fill Unit and the native Sand Unit. The native Glacial Marine Drift Unit is the bottom confining layer for the groundwater unit. Water table elevation varies across the Site and from the dry to the wet season. The average groundwater elevation measured in all active monitoring wells during the dry (i.e., September) and wet seasons (i.e., March) are 8 feet above MLLW.

The stratigraphic units at the Site with relevance to the IA, from ground surface down, are described below:

- **Soil Fill Unit:** A shallow, unconfined water-bearing unit that contains the impacted soil/sediment to be removed during the IA. The Soil Fill Unit is generally between 10 and 15 feet thick, but can be nearly 20 feet thick in localized areas. Where bulkheads are absent along the shoreline (such as on the beach), the Soil Fill Unit grades laterally with marine sediments. Most of the Soil Fill Unit is composed of loose to poorly compacted sand, silty sand, and silt derived mainly from the initial dredging of the I & J and Whatcom Waterways. Occasional shell fragments, gravel layers, and organic material such as reeds and other plant matter are also present. Other debris such as wood and concrete may locally be present.
- **Sand Unit:** This is a saturated unit that underlies the Soil Fill Unit in the Chevron subarea of the Site. The thickness of the Sand Unit varies from 0 to 35 feet. In undisturbed areas, the minimum thickness of sand is about 10 feet. The Sand Unit is mostly fine-grained sand with varying percentages of silt and occasional interbeds of silt and silty sand. Medium- and coarse-grained sand and gravels occur in localized areas. Shell fragments are common but comprise less than 10 percent of the unit.
- **Glacial Marine Drift:** This is a regional geologic unit deposited during the most recent glaciation of the Puget Sound region. This fine-grained unit forms the bottom confining layer for the Site groundwater unit. The Glacial Marine Drift is about 90 feet thick and is mainly composed of clay with varying percentages of silt.

Discontinuous silt interbeds and fine-grained sand partings and interbeds are also present.

1.1.2 Contaminant Source Area

This IA will address observed NAPL occurrence and the highest concentrations of gasoline and diesel/motor oil range total petroleum hydrocarbons (TPH) detected in beach sediments. Oily sheens have been observed on groundwater seeps coming from the Chevron subarea beach. Test borings in this area indicate that the petroleum impacts are associated with the top of the groundwater table fluctuation zone (smear zone) intersecting the beach. It appears that the seep moves up and down the beach between elevations +1 and +7 feet MLLW due to the groundwater table's response to tidal variation.

In May 2012, a supplemental investigation was performed in the Chevron subarea beach and adjacent upland to evaluate the source of petroleum sheens to Whatcom Waterway (results of the investigation are included in Appendix A). A series of test pits were dug by hand on the beach, and soil borings were performed using a direct-push Geoprobe rig in the uplands. Within the IA area, gasoline-range TPH concentrations range from non-detect to 1,200 milligrams per kilogram (mg/kg) and diesel/motor oil-range TPH (TPH-diesel extended or TPH-Dx) concentrations range from 13.4 to 9,200 mg/kg (Figures 4 and 5, respectively). Figure 6 shows the IA excavation area as well as the location of cross-sections; cross-sections shown in Figures 7 and 8 shows that the highest TPH concentrations observed in beach sediments are very shallow and coincide with the water table fluctuation zone.

Although petroleum impacts extend upland, beyond the interim action area, they are not directly contributing mobile NAPL to the observed petroleum seeps. Rather, it appears that the source of the observed sheens are beach sediments impacted with NAPL and/or TPH-Dx concentrations in the 8,000-9,000 mg/kg range that are subject to erosion from tidal action. However, the upland petroleum impacts may serve as an ongoing source of contamination to the beach area. Therefore, this IA includes temporary source control measures to protect the clean backfill pending completion of the RI/FS and implementation of a final cleanup action for the Site.

1.1.3 Coordination with Whatcom Waterway Cleanup

The Port, with Ecology oversight, is performing a separate cleanup of contaminated sediments located within Whatcom Waterway, which bounds the Central Waterfront Site to the south. This work is being completed pursuant to a final Consent Decree and Cleanup Action Plan that was issued in 2007. The Engineering Design Report and permitting for the first phase of this cleanup are currently in progress. Whatcom Waterway cleanup along the Central Waterfront shoreline will consist of sediment removal, capping, and shoreline stabilization. This IA will be coordinated with Whatcom Waterway cleanup plans.

1.2 Work Plan Organization

Following this introductory section, the remaining sections of this Work Plan are as follows:

- Section 2 – Overview of Interim Action to be Performed
- Section 3 –Interim Action Components
- Section 4 – Permitting and Substantive Requirements
- Section 5 – Reporting
- Section 6 – Schedule
- Section 7 – Integration with Final Cleanup Action and Whatcom Waterway Cleanup
- Section 8 – References

Appendices to this document include other plans necessary for implementation of the IA, including:

- Appendix A – May 2012 Investigation Report (AECOM)
- Appendix B – Best Management Practices
- Appendix C – Health and Safety Plan
- Appendix D –July 13, 2012 Substantive Comments from WDFW
- Appendix E – Critical Area Report

2 OVERVIEW OF INTERIM ACTION TO BE PERFORMED

The IA is being implemented to prevent the spread of petroleum contamination to the waters of Bellingham Bay by removing the impacted sediments in the area where sheens have been observed, installing a temporary liner to prevent recontamination by upland impacts pending completion of the RI/FS, and backfilling with clean cap material to prevent further erosion of the shoreline. Project activities include the excavation and removal of contaminated material, backfill with clean cap material, and removal of approximately 12 creosote-treated pilings within the intertidal shoreline of the Chevron subarea.

2.1 Goal of Interim Action

As outlined in Sections 1.1.1 and 1.1.2, the Site RI activities and supplemental investigations conducted to date have identified nearshore occurrences of contaminated soil/sediment that have concentrations of total petroleum hydrocarbons that represent an ongoing source of contamination to Site groundwater and the adjacent water of Whatcom Waterway. Based on the collective investigation information, the goal of the IA presented in this Work Plan is to achieve permanent control of localized petroleum product sources to sediment, groundwater, and surface water through isolation and removal of contaminated soil for off-Site disposal. In addition, the beach will be backfilled with imported clean sand and gravel and armored to minimize beach erosion until the Whatcom Waterway cleanup action and Central Waterfront RI/FS are completed.

2.2 Soil Remediation Levels

The Site is currently within the RI/FS process, so Ecology has not yet established final cleanup levels for the Site. Therefore, the IA area is defined based on soils/sediments containing visible NAPL and/or capable of producing a sheen in the tidal fluctuation zone rather than a TPH concentration. This visual "remediation level" may be less stringent than final cleanup levels, in accordance with WAC 173-340-355.

The vertical extent of excavation is expected to be about 2 feet above MLLW, but no lower than 0 feet above MLLW due to practical limitations of excavation during low tides and because that depth is sufficient to seat the final Whatcom Waterway cap that is planned for the area. Based on the May 2012 investigation, this vertical extent of excavation is

anticipated to achieve soil/sediment cleanup levels for the Site and will be evaluated against cleanup levels ultimately selected for the Site as part of the MTCA RI/FS and Cleanup Action Plan process.

3 INTERIM ACTION COMPONENTS

The IA includes excavation and off-Site disposal of contaminated sediments and soils.

3.1 Waste Profiling

In accordance with Washington State Dangerous Waste regulations (WAC 173-303) and landfill requirements, waste profiling for excavation spoils will rely on data from samples representative of the materials to be disposed of. Based on the extensive Site characterization work completed to date, it is expected that soils and sediments will meet the requirements for disposal at a Subtitle D facility.

3.2 Soil Excavation and Construction Approach

The IA involves conventional excavation of contaminated soils, likely with ancillary uncontaminated soils, to anticipated depths to 10 feet or more below existing grade within the inferred IA soil excavation area shown on Figure 6. An estimated 800 cubic yards of petroleum-contaminated soils and sediments will be excavated between the standing sections of parallel and perpendicular bulkhead and between elevations 0 to +14 feet MLLW. Excavation may be limited in the area immediately adjacent to the existing dock so as not to disturb the exposed tie backs currently supporting the vertical portion of the bulkhead (Figure 6). Based on the May 2012 test borings, the excavation is expected to extend to a depth of +2 feet MLLW, but no deeper than elevation 0 MLLW. Figure 9 shows a typical cross-section of the likely excavation extent and Figure 10 shows a typical cross-section of the maximum excavation extent. The area defined on Figures 9 and 10 is the anticipated extent of contaminated soil containing visible petroleum product or relatively high TPH concentrations resulting in seeps observed at the shoreline and, as such, would be the excavation bottom.

The excavation sidewalls will be sloped or otherwise stabilized as needed to facilitate excavation to the required depths. The IA excavations will not extend deeper than MLLW.

Petroleum-contaminated soils and sediments will be excavated by either track-mounted excavators equipped with buckets or rubber-tired backhoes. Front-loading construction equipment may also be used in conjunction with the excavators. Excavation and backfill

with clean cap material will occur "in the dry" during low-tide stages. During each low-tide stage, a silt curtain will be placed between the two existing timber bulkheads to separate the work site from the Whatcom Waterway. Sandbags will be placed by hand to secure the silt curtain during construction. The sandbags and silt curtain will be removed daily after construction has concluded. In addition, an oil containment boom will be used to contain the spread of any oil sheens into Whatcom Waterway.

Excavated material will either be stockpiled on Site in the upland area for subsequent disposal or loaded directly onto plastic-lined dump trucks for immediate disposal in an approved upland disposal facility. If the material is stockpiled on Site, it will be managed as described in Section 3.4, using best management practices (BMPs) to minimize the potential for erosion from the stockpile. BMPs for the project are detailed in Appendix B.

During excavation, creosote-treated piling, cross-ties, and deadmen within the project footprint will be removed using heavy equipment. Piling will be removed by either cutting them off at the bottom elevation of the excavated area or by pulling them out with an excavator. All piling, cross-ties, or deadmen removed will be disposed of in an approved upland disposal facility.

3.3 Dewatering and Water Management

Dewatering may be required due to groundwater flow from the uplands into the IA area and is described below.

Construction dewatering will be conducted during IA soil excavation to meet three goals:

1. Dewater the saturated contaminated soil in place to facilitate effective soil removal/handling and to prevent the excavation from sloughing and undermining the excavation equipment; and
2. Prevent NAPL and petroleum-impacted groundwater from recontaminating clean backfill or from flowing into Whatcom Waterway.

Removal of beach sands below the groundwater table may create upward seepage and loss of soil strength in the sandy material, creating potential for liquefaction of the excavation

bottom. Soil excavation and dewatering will be conducted so that the physical integrity of the excavation will not be compromised.

Means and methods for dewatering the beach sands to facilitate soil excavation will be determined by the construction contractor and may include temporary sumps within the open excavation, well points outside the excavation, or groundwater cutoff technologies. Sumps are an effective means of dewatering excavations within lower permeability material where groundwater heads need only be depressed several feet. If sumps are inadequate for dewatering the excavation, closely-spaced vacuum well points may be used outside the excavation footprint. Methods such as temporary shoring or trench boxes can also be employed to reduce water inflow or to stabilize the beach excavation.

The water level (head) in the sand will be reduced to approximately the bottom of the excavation so as to minimize the hydraulic gradient across the excavation face and limit the potential for breach of the excavation bottom.

Groundwater pumped during dewatering will be pre-treated to reduce settleable solids and remove potential separate-phase petroleum and then discharged to the ASB in accordance with the Port's National Pollutant Discharge Elimination System (NPDES) permit for the facility.

3.4 Stockpile Management

The Port will encourage direct loading of excavated materials into trucks for off-site disposal to minimize stockpiling. In the event that temporary stockpiling of excavated soil is required, the stockpiled soil will be placed in bermed (e.g., concrete block), lined stockpile areas. The liner will consist of 15-20 mil geotextile and the stockpiles will be covered with Visqueen when not in use. Drainage water from the stockpiles will be managed with the dewatering water, including pre-treatment to reduce settleable solids and remove potential separate-phase petroleum and then discharged to the ASB.

3.5 Off-Site Disposal

Soils and sediments excavated from the IA area will be disposed of at a permitted off-Site facility in accordance with applicable state and federal requirements.

3.6 Compliance Monitoring

In accordance with WAC 173-340-410, compliance monitoring for a cleanup action includes the following elements:

- **Protection monitoring** confirms that human health and the environment are adequately protected during the cleanup action
- **Performance monitoring** confirms that the cleanup action has attained cleanup levels and met other performance standards, such as permit requirements
- **Confirmation monitoring** confirms the long-term effectiveness of the cleanup action once cleanup levels and other performance standards have been reached.

For this IA, protection and performance monitoring will be conducted. Confirmation monitoring will be conducted as part of the Site final cleanup action. The protection and performance monitoring programs for the IA are outlined below.

3.6.1 Protection Monitoring

Protection monitoring will be conducted during the IA by requiring that on-Site cleanup workers are appropriately trained in hazardous waste operations and follow the site-specific health and safety plan (Appendix C) prepared specifically for the IA project.

3.6.2 Performance Monitoring

Performance monitoring during the IA will consist of soil sampling to document soil TPH concentrations at the base and sidewalls of the excavation. The IA excavation prism has been pre-defined based on correlation to seep observations, practical limitations (physical constraints such as bulkheads and tie-backs), and the fact that the excavation will be lined with an isolation barrier and backfilled with a sediment cap compatible with the Whatcom Waterway cleanup. Therefore, the extent of the excavation will be based on visual observation of product or sheen and depth needed to seat the Whatcom Waterway cap,

rather than on soil confirmation sampling. However, soil samples will be collected at the base and sidewalls to document soil and sediment concentrations remaining in place after completion of the IA.

When soils have been removed from the pre-defined extent of the IA excavation prism, bottom and sidewall soil samples will be collected for laboratory analysis. Bottom samples will be collected (using the excavator bucket) on a systematic 15-foot grid (one sample per 15-foot by 15-foot square) to document soil concentrations remaining at the base of the excavation. Sidewall sampling will be conducted to document soil concentrations along the lateral extent of the excavation. Sidewall samples will be collected at a horizontal spacing of approximately 15 feet and at 3-foot depth intervals (e.g., 0 to 3 feet, 3 to 6 feet, or 6 to 9 feet) across the full depth of excavation. The sample grid is shown overlying the excavation footprint in Figure 11.

Soil samples from the IA area will be analyzed for gasoline- and diesel extended-range TPH and benzene. Sampling and chemical analyses will be conducted in accordance with the Sampling and Analysis Plan and Quality Assurance Project Plan included in the Site RI/FS Work Plan (RETEC 2007). Samples will be submitted to Analytical Resources Inc. in Seattle for laboratory analysis.

3.7 Excavation Backfill

Approximately ten feet of the base and landward slope of the excavation will be covered with an impermeable liner (15 to 20 mil geotextile), as shown in Figure 12, as a temporary measure to prevent recontamination of clean backfill materials from upland sources pending completion of the RI/FS. Any seams in the liner will overlap 3 feet. The liner will be covered with 2 to 2.5 feet of sand cap material, 1 to 1.5 feet of filter/gravel material, and 2 to 2.5 feet of armor rock. A final layer of "fish mix" will be placed on top of the armor stone as shown in Figure 12. The fish mix is comprised of 3-inch minus rock material. All backfill materials will be clean imported materials, and the backfill sequence/design is consistent with the overall Whatcom Waterway cap design. Depending on the condition of the excavation bottom prior to backfill, quarry spalls may be required as a base for the granular backfill materials. The granular backfill materials will be placed in lifts and compacted as called for in the construction specifications.

The fish mix will be placed to allow it to fill the interstitial areas of the cap material and provide habitat for juvenile salmonids and other species. The fish mix is being placed at the request of the Washington State Department of Fish and Wildlife (WDFW) as an opportunity to understand the practicality of its application for future projects along the Central Waterfront and Whatcom Waterway. The fish mix will be placed as a one-time application and no maintenance or performance standards regarding the ultimate fate of the fish mix will be employed. The WDFW will observe and document movement or erosion over a 1-year period and will use this information to inform the viability of such actions on future projects.

The position of the existing +10-foot MLLW elevation contour will be maintained after excavation and backfill. It is anticipated that the excavation and backfill will proceed in small sections perpendicular to the water during low tides within the construction window, which may require night-time work and will proceed from the landward side and in the dry.

Clean cap material will be placed in the excavation areas using the excavation equipment noted in Section 3.2. Clean cap material will either be stockpiled on Site prior to construction or brought in by truck and immediately placed.

3.8 Interface with Whatcom Waterway Cleanup

The IA area includes removal of soils with elevated TPH concentrations that represent a potential source of oily sheens on Whatcom Waterway. Specific considerations for removal of contaminated soil and sediment in this area are outlined below.

During excavation, visual and olfactory field screening will be used to determine the final depth of the excavation, which will be between the "likely excavation extent" and the "maximum excavation extent" shown in Figures 7 and 8, respectively. Excavation is not anticipated below the "maximum extent of excavation" or elevation 0 feet MLLW because the design depths are sufficient to seat the Whatcom Waterway cap, which is approximately 6 feet thick. Whatcom Waterway cleanup is scheduled to begin during summer 2013 and will require excavation of a small portion of the IA cap in order to complete construction of

the Whatcom Waterway cap in this area. Figure 13 shows the interface of the IA excavation and cap with the future Whatcom Waterway cap.

3.9 Debris Removal and Physical Constraints

Wood pilings and other wood debris are expected within the excavation based on wood pilings and debris currently visible at the surface of the IA beach area. If large debris (e.g., timber or concrete) is encountered during excavation, it will be segregated from the excavated soils. Debris with petroleum staining or odor will be disposed of off-Site with the contaminated soil.

It may be necessary to limit the lateral extent of the excavation sidewall in areas where additional excavation would compromise existing structures (timber bulkheads). For example, at either end of the excavation area, extensive excavation of sidewall soils near the timber bulkheads could expose the pile foundations, which would potentially destabilize or damage the bulkheads. Likewise, excavating in close proximity to the shoreline bulkhead could compromise its integrity. In these cases, excavation would be completed to the maximum extent practicable as dictated by structural considerations. Sidewall samples would be collected as described above in Section 3.6.2, and remaining TPH impacts will be evaluated in the FS and addressed as necessary as a component of the final cleanup action.

Based on the available data, the bottom of the beach IA excavation is anticipated to be approximately 100 feet by 60 feet and will extend to an average depth of 8 feet. For the purposes of this Work Plan, it is estimated that up to 800 cubic yards of soil and debris will be removed from the IA area. This estimate may be refined during remedial design.

4 PERMITTING AND SUBSTANTIVE REQUIREMENTS

This IA will be conducted under Agreed Order No. DE 3441, as amended, with Ecology. The amended AO requires identification of the permits or specific federal, state, or local requirements that Ecology has determined are applicable and that are known at the time of entry of the Order. In performing the IA, the Port and the City are exempt from the procedural requirements of Chapters 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 Revised Code of Washington (RCW) and of any laws requiring or authorizing local government permits or approvals, but must still comply with the substantive requirements of such permits or approvals. The amended AO also requires that the exempt permits or approvals and the applicable substantive requirements of those permits or approvals, as they are known at the time of entry of the Order, be identified.

4.1 Applicable Permits and Requirements

The interim action to be performed at the Site requires the following permit and environmental review process:

4.1.1 U.S. Army Corps of Engineers (USACE) Nationwide Permit 38

Section 404 of the Clean Water Act, 33 U.S.C. § 1344, requires a permit prior to discharging dredged or fill material into the waters of the United States, including special aquatic sites such as wetlands. The Port will obtain and comply with the conditions of a Nationwide Permit 38, which covers the Cleanup of Hazardous and Toxic Wastes that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority.

The Port completed and submitted a Joint Aquatic Resources Permit Application (JARPA) to the USACE on July 11, 2012.

4.1.2 State Environmental Policy Act Integrated Compliance (RCW 43.21C.036 and WAC 197-11)

Compliance with the State Environmental Policy Act (SEPA), Chapter 43.21C RCW, will be achieved by conducting SEPA review in accordance with applicable regulatory requirements, including WAC 197-11-268, and Ecology guidance as presented in Ecology Policy 130A.

SEPA review was conducted concurrent with public review of AO Amendment and the interim action scope of work. The Port, acting as the SEPA lead agency issued a Mitigated Determination of Non-Significance dated July 12, 2012.

4.1.3 National Pollutant Discharge Elimination System Waste Discharge Permit

The Port currently operates the ASB under an individual NPDES Waste Discharge Permit (Permit No. WA-000109-1). Management of Site stormwater and construction-related dewatering water will be routed to the ASB for treatment. The Port will comply with all requirements of the NPDES Waste Discharge permit and any subsequent modifications.

4.2 Permit Exemptions and Substantive Requirements

The following state and local requirements have been identified as applicable but are procedurally exempt to this IA:

- Hydraulics Project Approval (HPA), WDFW
- Shoreline Management Act (SMA), RCW 90.58; City of Bellingham Shoreline Permit
- Major Grading Permit; City of Bellingham Grading Ordinance, Bellingham Municipal Code (BMC) 16.70
- City of Bellingham Stormwater Requirements, BMC 15.42
- Critical Areas Permit; City of Bellingham Critical Areas Ordinance, BMC 16.55

The applicable substantive requirements of these permits or approvals, as they are known at the time of the preparation of this Work Plan, are identified below. The manner in which the IA will meet these substantive requirements for these laws and regulations is addressed in the following sections. Substantive requirements may be further identified in subsequent deliverables, and their approval shall reflect Ecology's determination on what substantive requirements apply.

4.2.1 Washington Department of Fish and Wildlife Hydraulic Project Approval

Chapter 220-110 WAC (Hydraulic Code Rules) and Chapter 77.55 RCW (Construction Projects in State Waters) regulate work that uses, diverts, obstructs, or changes the natural flow or bed of any of the salt or fresh waters of the state and includes bed reconfiguration, all construction, or other work waterward, under, and over the ordinary high water line, including dry channels, and may include projects landward of the ordinary high water line (e.g., activities outside the ordinary high water line that will directly impact fish life and habitat, falling trees into streams or lakes, bridge maintenance, or dike construction). Typically the WDFW oversees the implementation of these laws and issues an HPA with appropriate conditions to protect these resources. , The Port provided a copy of the JARPA to WDFW as part of Nationwide Permit 38 process. In lieu of an HPA, the WDFW provided substantive comments on July 13, 2012 (Appendix D) that the Port will comply with during implementation of the IA.

4.2.2 City of Bellingham Shoreline Substantial Development Permit (Bellingham Municipal Code Title 22)

Pursuant to the City of Bellingham Shoreline Master Program (BMC Title 22), the IA must meet the requirements of a City Shoreline Substantial Development Permit for projects that involve more than 50 cubic yards of grading within the shoreline zone. The interim action will occur within the regulated shoreline area designated by BMC Title 22 as Urban Maritime. The substantive requirements include meeting the general conditions for SMP, requirements and conditions of the Urban Maritime shoreline designation, and applicable use activity policies, procedures, and regulations. Consultation with the City indicates that the IA work to be performed is consistent with normal maintenance or repair of an established condition and is exempt from the requirements for a substantial development permit under WAC 173-27-040-2b.

4.2.3 City of Bellingham Fill and Grade Permit (Bellingham Municipal Code Title 16.70.070)

Pursuant to the City of Bellingham Grading Ordinance (BMC 16.70), a Major Grading permit is required from the City for grading projects that involve more than 500 cubic yards of

grading. The City's Grading Ordinance identifies a number of standards and requirements for obtaining a grading permit. The City standards and requirements will be integrated into the construction plans and specification for the IA to ensure that it complies with the substantive requirements of the City's Grading Ordinance. Those substantive requirements include: staking and flagging property corners and lines when near adjacent property, location and protection of potential underground hazards, proper vehicle access point to prevent transport of soil off site, erosion control, work hours and methods compatible with weather conditions and surrounding property uses, prevention of damage or nuisance, maintaining a safe and stable work site, compliance with noise ordinances and zoning provisions, development of a traffic plan when utilizing city streets, and written permission for grading from legal property owner.

4.2.4 City of Bellingham Construction Stormwater Permit (Bellingham Municipal Code Title 15.42)

Pursuant to the City of Bellingham Stormwater Management Ordinance (BMC 15.42), the interim action must meet the requirements of a City Stormwater Permit. The substantive requirements include preparation of a stormwater site plan, preparation of a construction stormwater pollution prevention plan, source control of pollution, preservation of natural drainage systems and outfalls, on-site stormwater management, run-off treatment, flow control, and system operations and maintenance.

4.2.5 City of Bellingham Critical Area Ordinance (Bellingham Municipal Code Title 16.55.420)

Critical area substantive requirements are applied to land development activities in the City of Bellingham. The interim action will occur on land designated as "erosion" and "landslide" hazard areas by BMC 16.55.420 Critical Areas. The substantive requirements include an assessment or characterization of the hazard areas, a hazard analysis, and a geotechnical engineering report by a licensed professional. A Critical Area report has been prepared to meet these requirements and is included in Appendix E.

5 REPORTING

Upon completion of the IA work, a final Interim Action Report, describing the methods and outcome of the IA, will be prepared and submitted to Ecology for review and comment. Following final Ecology approval of the Interim Action Report, the methods and results of the IA will also be incorporated into the Site-wide draft RI/FS. The data collected during the IA will be uploaded to Ecology's Environmental Information Management System (EIM) database along with the other RI/FS data, in accordance with the AO.

6 SCHEDULE

The Port will conduct the IA in a single construction phase, taking approximately 2 weeks to complete. It is anticipated that the construction activities will be conducted in January 2013.

The current schedule for the IA is as follows:

1. In accordance with the AO, as amended, within 30 days of the effective date of the first amendment to the AO, the Port will submit the Work Plan to Ecology for review and approval.
2. The Port will complete the remedial design in September and October 2012 and submit construction plans and specifications detailing the cleanup construction for the IA area to Ecology for review.
3. The Port bidding process will be performed in November and December 2012.
4. IA construction in the IA area is to be initiated by late December 2012, with an approximately 2-week construction period anticipated; construction shall be complete by the end of January 2013.
5. The Port shall prepare, for Ecology review and approval, a final Interim Action Completion Report within 90 days following the completion of the IA construction.

The Port will subsequently integrate the IA information into the RI/FS report being revised under the AO.

7 INTEGRATION WITH FINAL CLEANUP ACTION AND WHATCOM WATERWAY CLEANUP

The permanent source removal achieved through the IA is designed to be consistent with, and not preclude, alternatives for the Site final cleanup action as required under WAC 173-340-430(3)(b). Source control is the first and most important step for controlling potential migration of contaminants, and preventing contaminant migration to on-Site and off-Site receptors will be a key requirement for the final cleanup action. The IA will be assessed for integration into the final Site cleanup action, which will be completed following finalization of the RI/FS and Ecology's issuance of a Cleanup Action Plan. The IA will also be designed to be compatible with the final cleanup action for Whatcom Waterway.

By permanently removing contaminated soil and building materials from the Site, the IA will also support, not preclude, the Port's planned future Site redevelopment. The IA area will be restored to its current condition, with no change in Site use as a component of the IA.

8 REFERENCES

AECOM, 2009. *Remedial Investigation/Feasibility Study for Central Waterfront Site, Bellingham, Washington*. Prepared for Port of Bellingham by AECOM, Inc. May 2009.

Ecology, 2006. *In the Matter of Remedial Action by the Port of Bellingham and the City of Bellingham*. Agreed Order No. DE 3441 issued by Washington State Department of Ecology. September 2006.

Ecology, 2012. *In the Matter of Remedial Action by the Port of Bellingham and the City of Bellingham*. First Amendment to Agreed Order No. DE 3441 issued by Washington State Department of Ecology. 2012.

RETEC, 2007. *Draft Central Waterfront RI/FS Sampling and Analysis Plan and Quality Assurance Project Plan*. Prepared for the Port of Bellingham by The RETEC Group, Inc. and S.S. Papadopulos & Associates. March 2007.

FIGURES

Q:\Jobs\120007-01.01_Central_Waterfront_RIFSMaps\2012_09\Vicinity_Map.mxd nkochie 9/6/2012 11:25:43 AM

ANCHOR QEA

Feet
0 3,000 6,000

Project North

True North

Figure 1
Vicinity Map
Central Waterfront Site

Q:\Jobs\120007-01.01_Central_Waterfront_RIFSMaps\2012_09\Sub_Areas.mxd nkochie 9/6/2012 10:59:33 AM

ANCHOR QEA

Figure 2
Subareas
Central Waterfront Site

Q:\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\2012_09\Chevron Interim Action Site Plan_8pt5x11.mxd nkochie 9/6/2012 2:21:23 PM

ANCHOR QEA

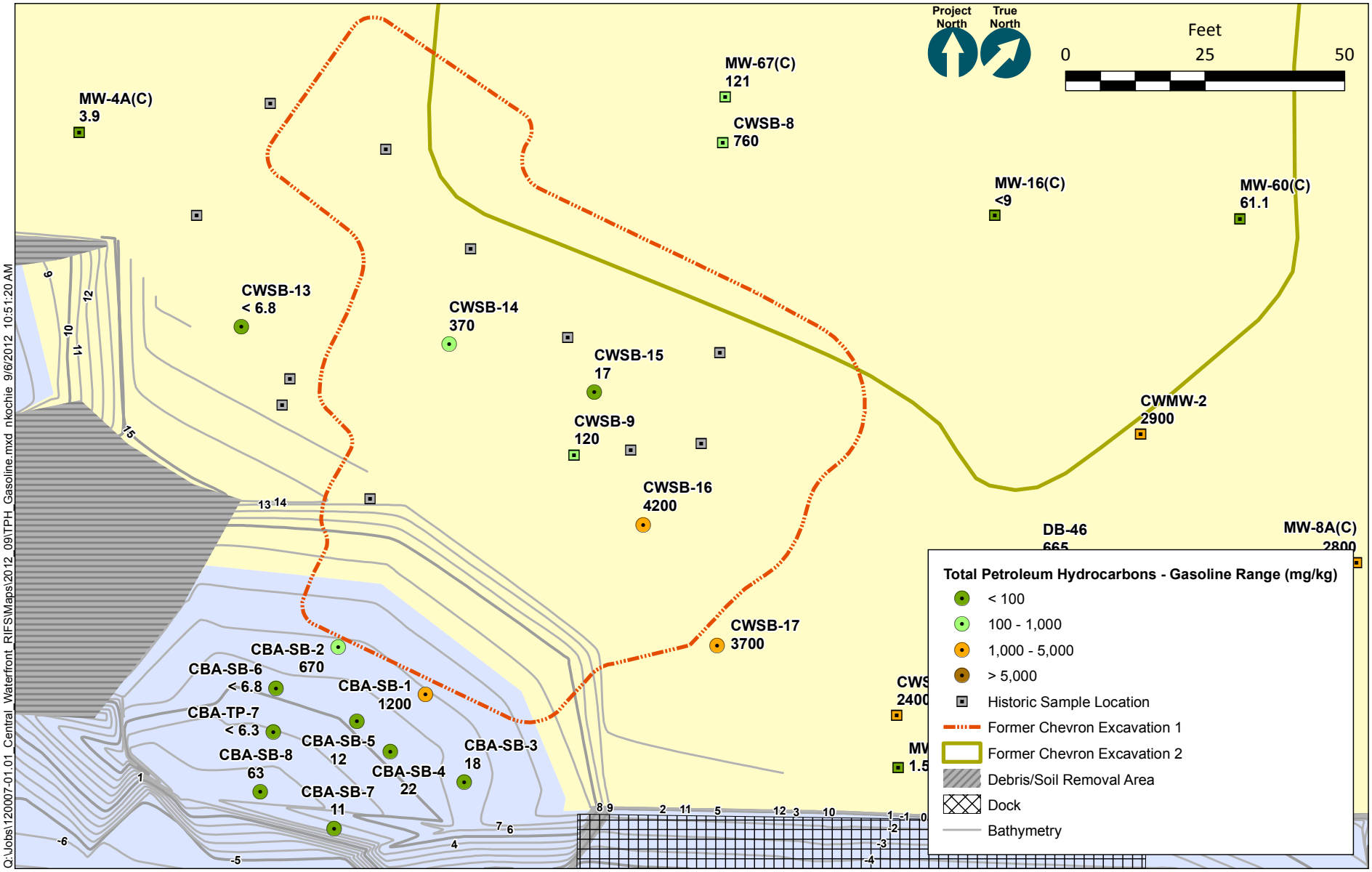
Feet
0 100 200

Project North

True North

NOTES:
1. Horizontal Datum: WA State Plane North Zone, NAD83, Feet.
2. Aerial image acquired from Bing Maps.
3. Property lines provided by Port of Bellingham.
4. Subareas provided by ENSR|AECOM.

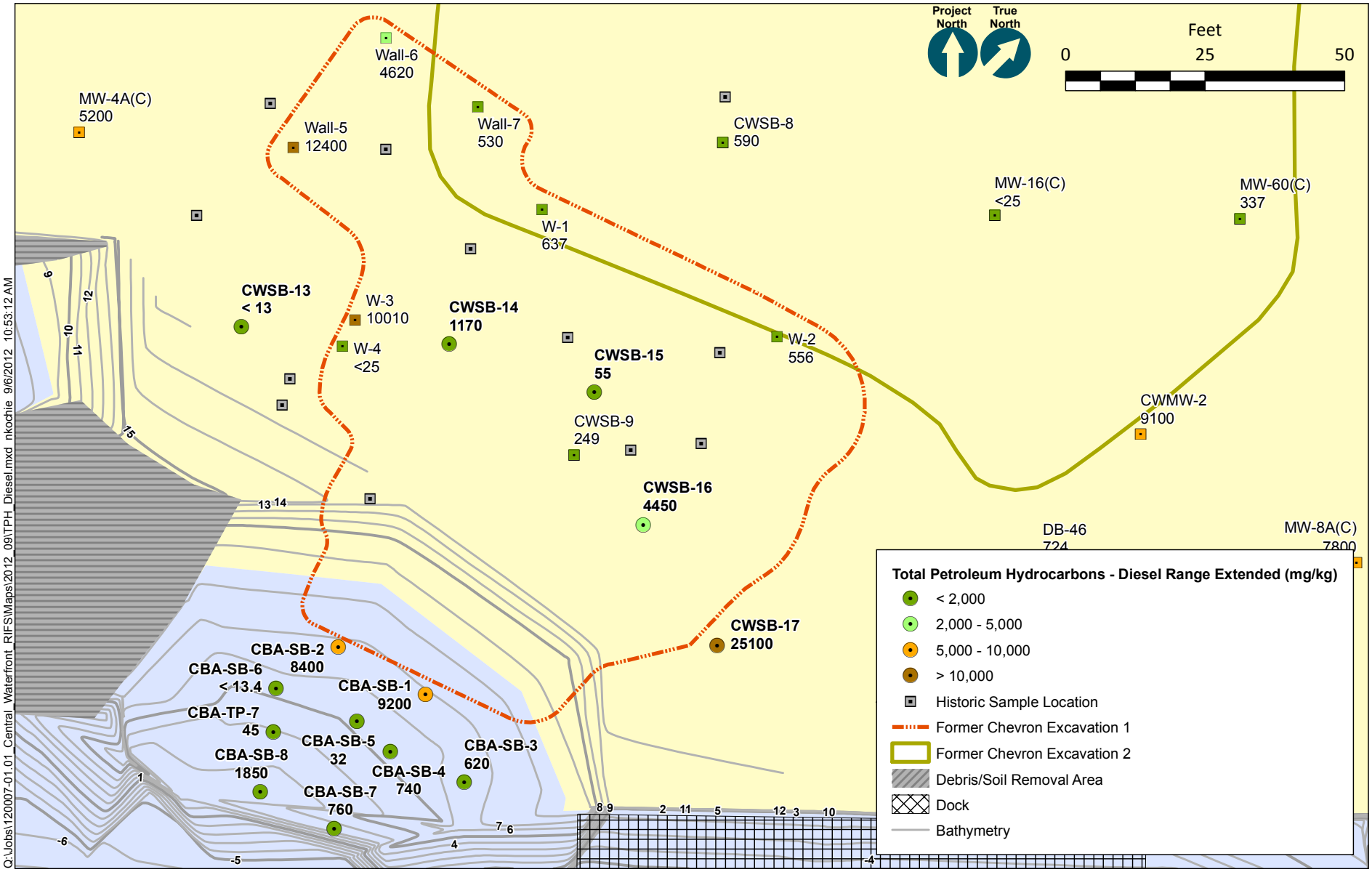
Figure 3
Site Plan
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham



NOTES:
1. The highest concentration at each sample location was used when samples were collected at multiple depth intervals.
2. For non-detect values the reporting limit is displayed, and ½ the reporting limit is used for contouring.
3. Former Chevron Excavation 1 location approximate; digitized from "not to scale" pre-existing figure.

ANCHOR QEA

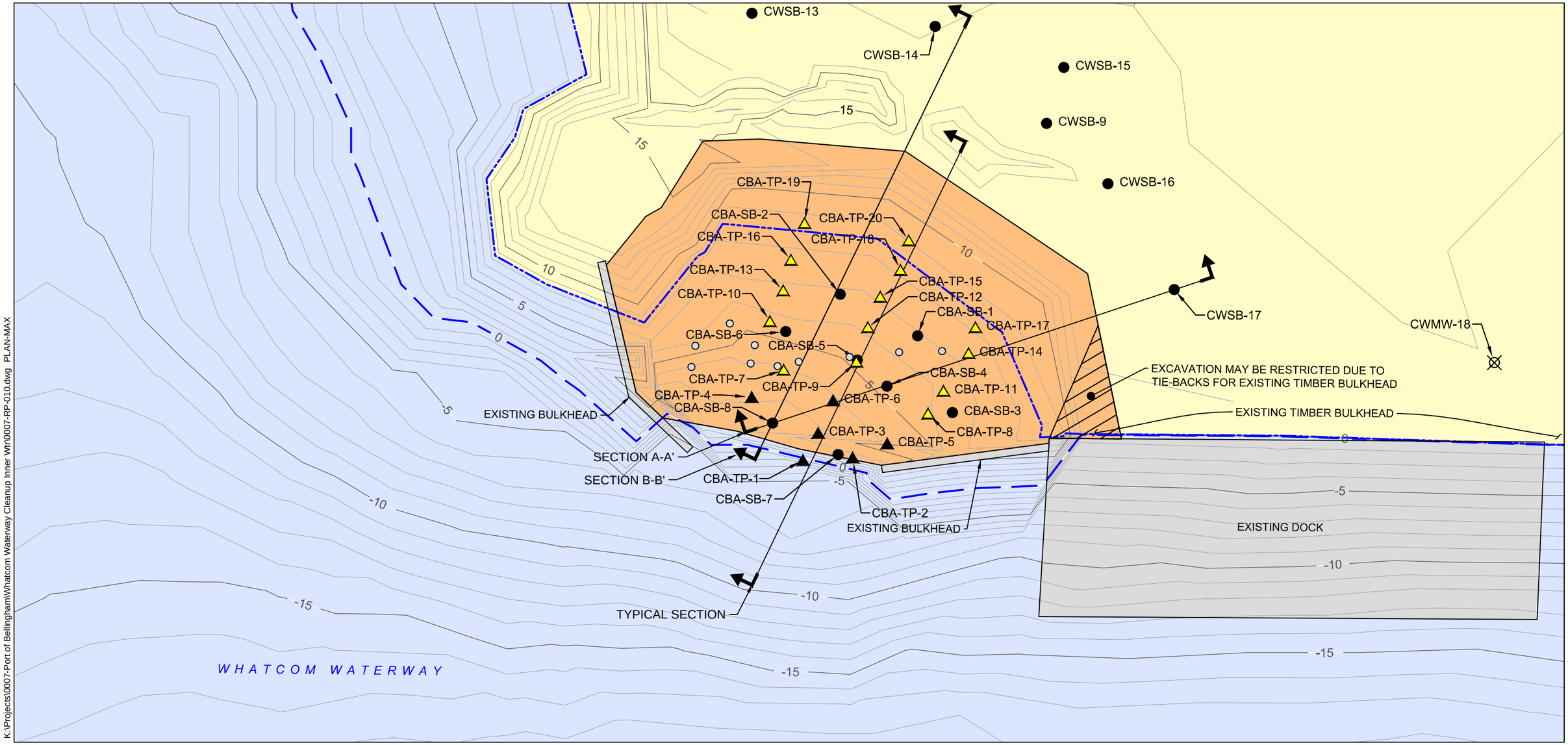
Figure 4
Total Petroleum Hydrocarbons - Gasoline Range
May 2012 Chevron Subarea Shoreline



NOTES:
1. The highest concentration at each sample location was used when samples were collected at multiple depth intervals.
2. For non-detect values the reporting limit is displayed, and ½ the reporting limit is used for contouring.
3. Former Chevron Excavation 1 location approximate; digitized from "not to scale" pre-existing figure.

ANCHOR QEA

Figure 5
Total Petroleum Hydrocarbons - Diesel Range Extended
May 2012 Chevron Subarea Shoreline



K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg PLAN-MAX

Sep 05, 2012 2:40pm epipkin

HORIZONTAL DATUM: Washington State Plane North, NAD83, Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:
1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.
2. Existing docks and pilings digitized from aerial photo.

LEGEND:

- Mean Lower Low Water (MLLW)
- Mean Higher High Water (MHHW)
- Existing Major Contour (5' Interval)
- Existing Minor Contour (1' Interval)
- Area of Excavation
- Existing Structure
- Piling
- Beach Test Pit Location
- Beach Test Pit Location with Visible Product
- Soil Boring Location
- Monitoring Well Location

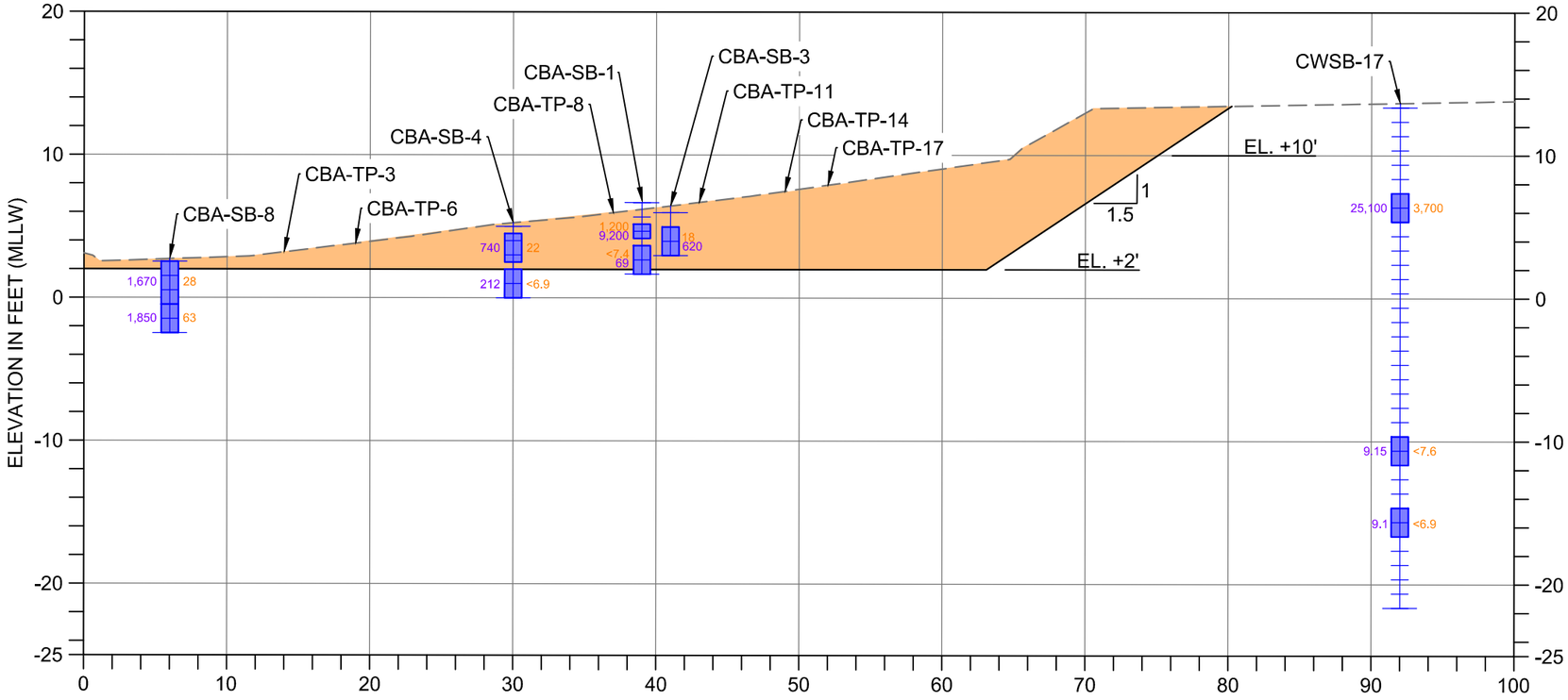
Project North / True North

0 20

Scale in Feet

ANCHOR QEA

Figure 6
Plan View - Extent of Excavation
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham



ANALYTICAL RESULT NOTES:

1. Shaded intervals represent depth ranges with analytical results.
2. Tick marks are 1-ft intervals.
3. All units are milligrams per kilogram (mg/kg).
4. At locations with field duplicate results the highest concentration is presented.

VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:

1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.
2. Not all samples fall on the section line, some have been projected horizontally for presentation.

LEGEND:

- Existing Ground
- Excavation Neatline
- Area of Excavation

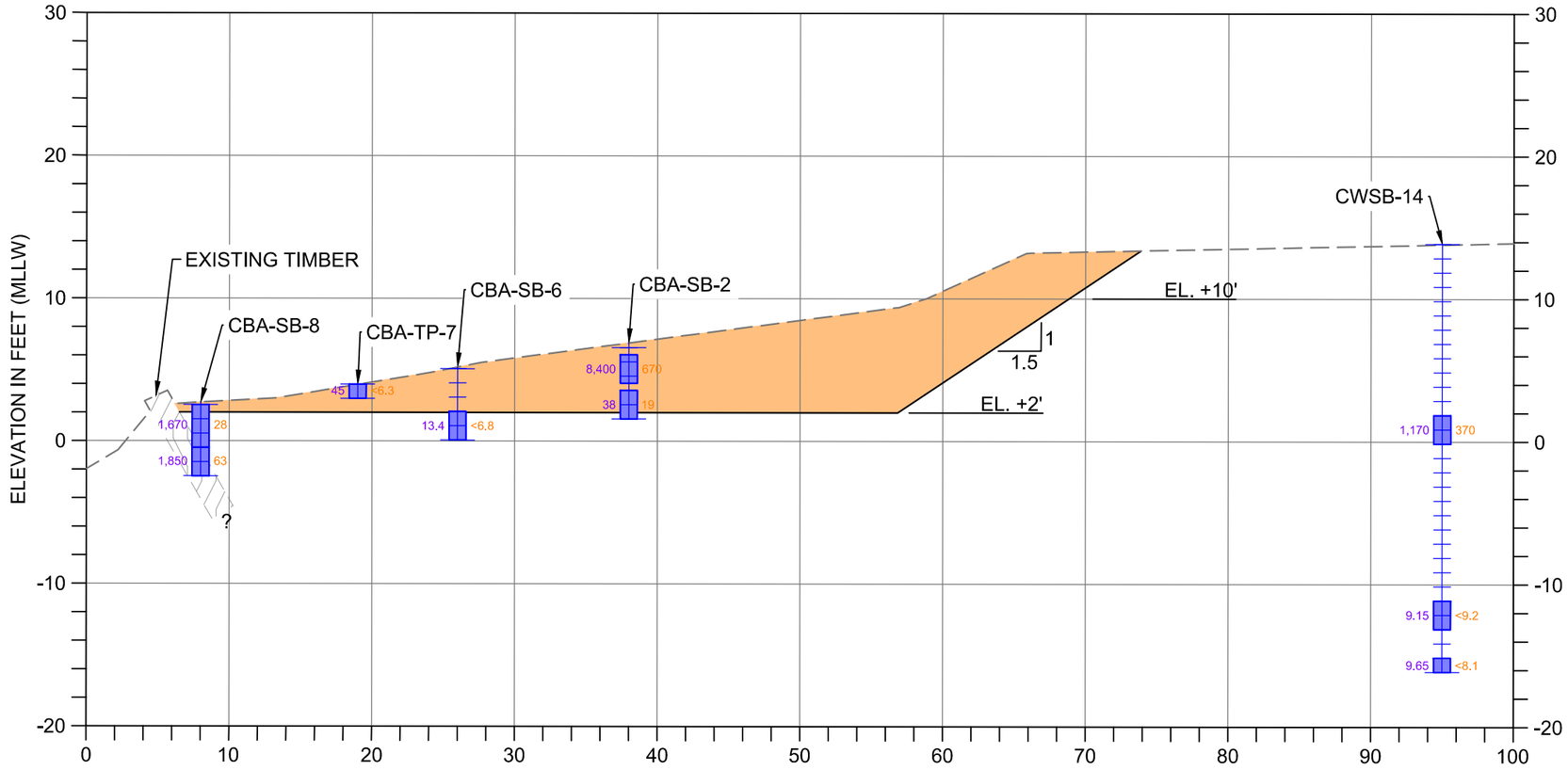
0 10
Scale in Feet

K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg AA' LIKELY EXCAVATION

Sep 05, 2012 2:40pm epipkin

Figure 7
Section A-A' - Likely Extent of Excavation and Existing Sample Locations
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham

ANCHOR QEA



Ground Surface at Cross-Section Projected Location

Ground Surface at Actual Location

TPH - Diesel Range Extended (mg/kg) — 740 — 22 — TPH - Gasoline Range (mg/kg)

212 — <6.9

ANALYTICAL RESULT NOTES:

1. Shaded intervals represent depth ranges with analytical results.
2. Tick marks are 1-ft intervals.
3. All units are milligrams per kilogram (mg/kg).
4. At locations with field duplicate results the highest concentration is presented.

VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:

1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.
2. Not all samples fall on the section line, some have been projected horizontally for presentation.

LEGEND:

— — — Existing Ground

——— Excavation Neatline

Area of Excavation

0 10

Scale in Feet

K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg BB' LIKELY EXCAVATION

Sep 05, 2012 2:41pm epipkin

Figure 8

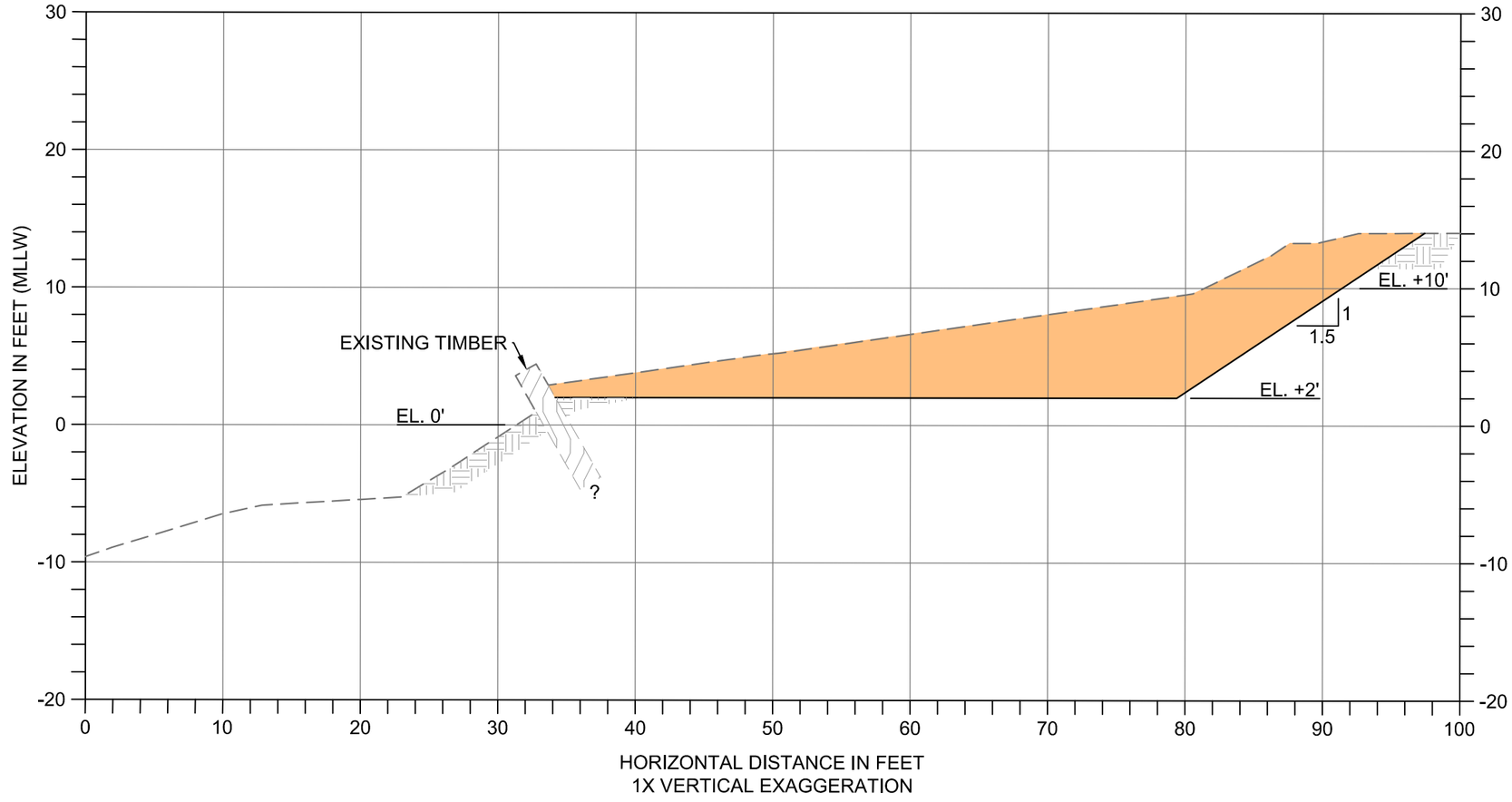
Section B-B' - Likely Extent of Excavation and Existing Sample Locations

Chevron Subarea Interim Action

Central Waterfront Site

Port of Bellingham

ANCHOR QEA



K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg LIKELY EXCAVATION

Sep 05, 2012 2:42pm epipkin

VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:

1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.

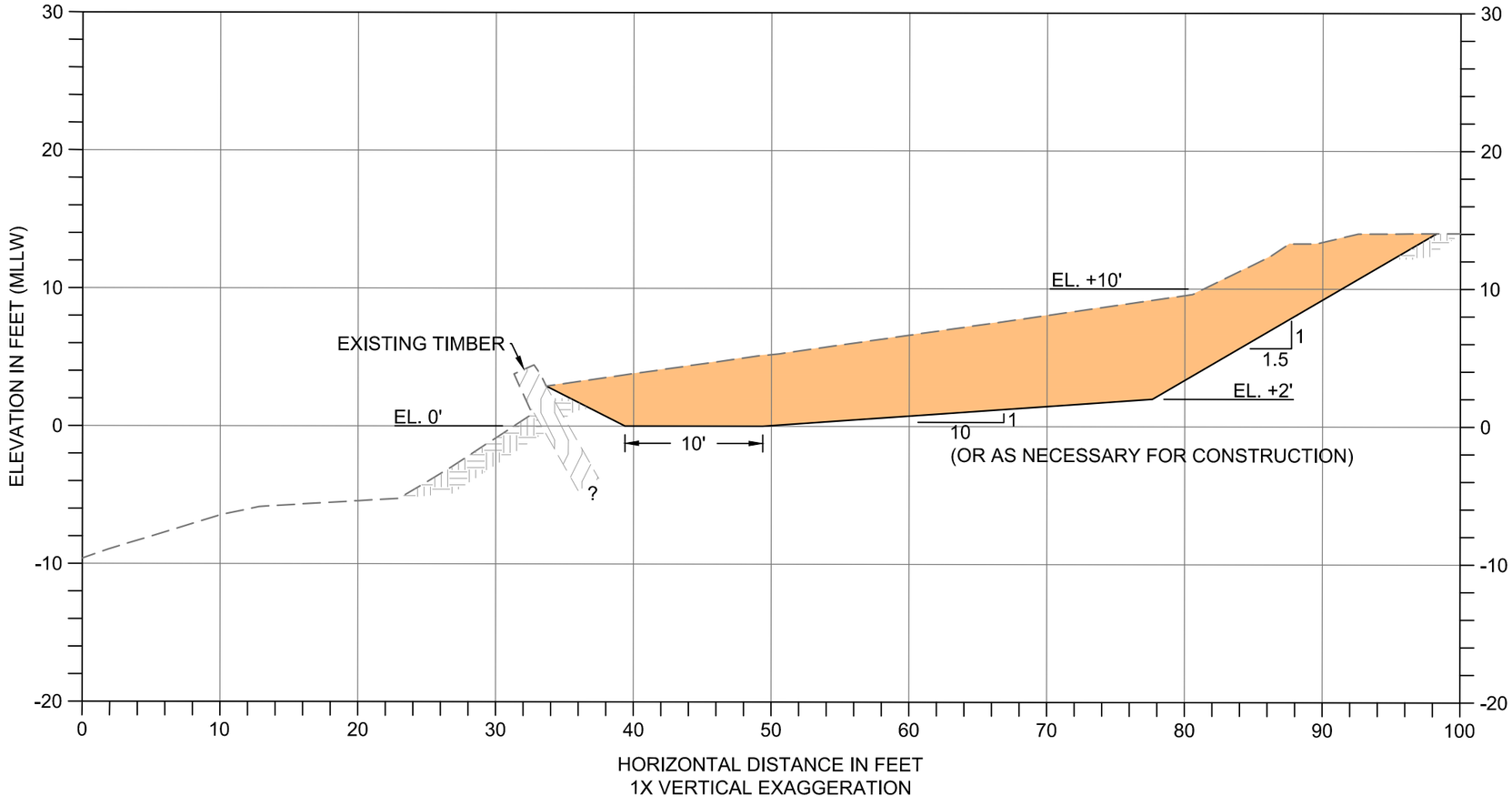
LEGEND:

- Existing Ground
- Excavation Neatline
- Area of Excavation

0 10
Scale in Feet

ANCHOR QEA

Figure 9
Typical Section - Likely Extent of Excavation
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham



VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:

1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.

LEGEND:

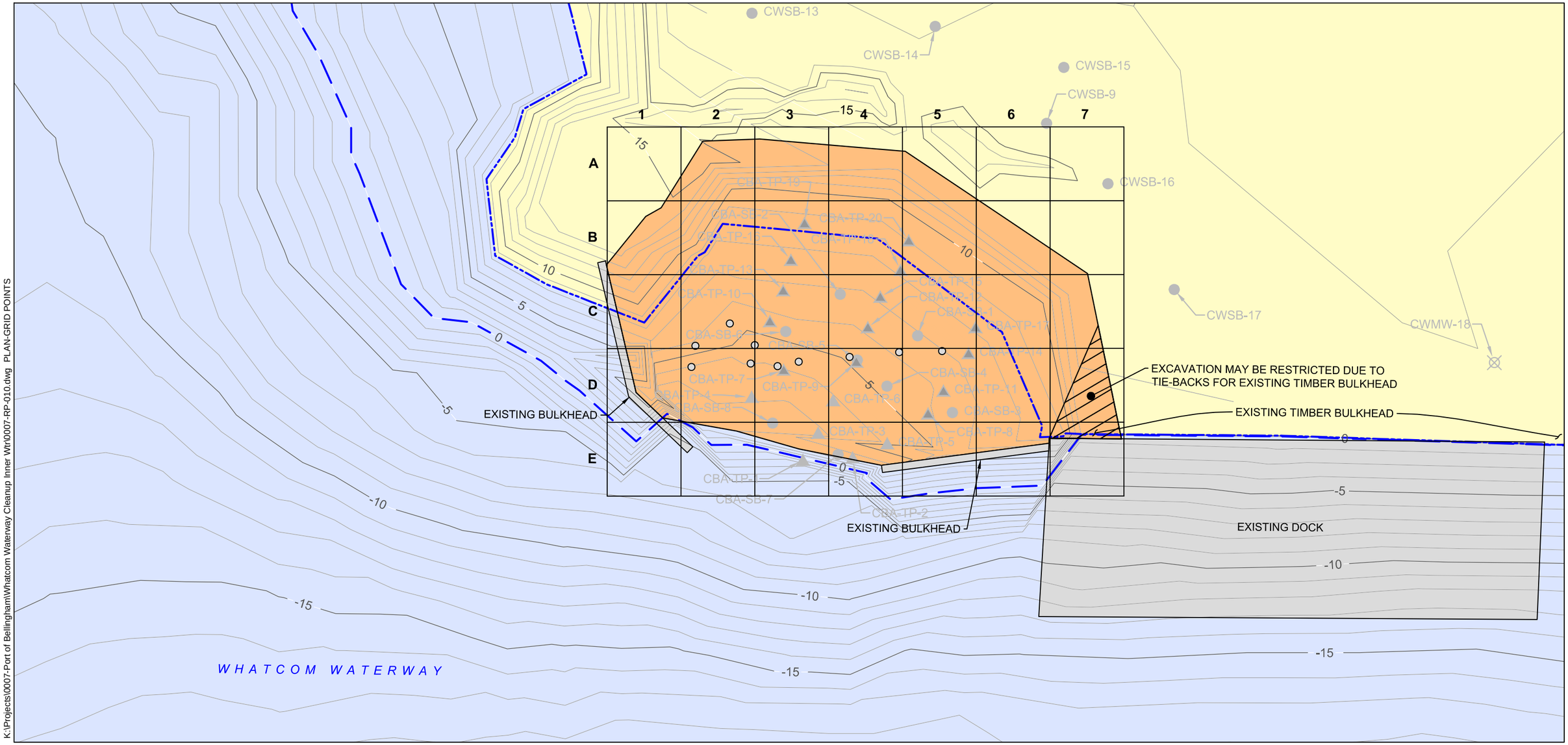
- Existing Ground
- Excavation Neatline
- Area of Excavation

0 10
Scale in Feet

K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg MAXIMUM EXCAVATION
Sep 05, 2012 2:42pm epipkin

ANCHOR QEA

Figure 10
Typical Section - Maximum Extent of Excavation
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham



K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg PLAN-GRID POINTS

Sep 26, 2012 9:05am epipkin

HORIZONTAL DATUM: Washington State Plane North, NAD83, Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:
1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.
2. Existing docks and pilings digitized from aerial photo.

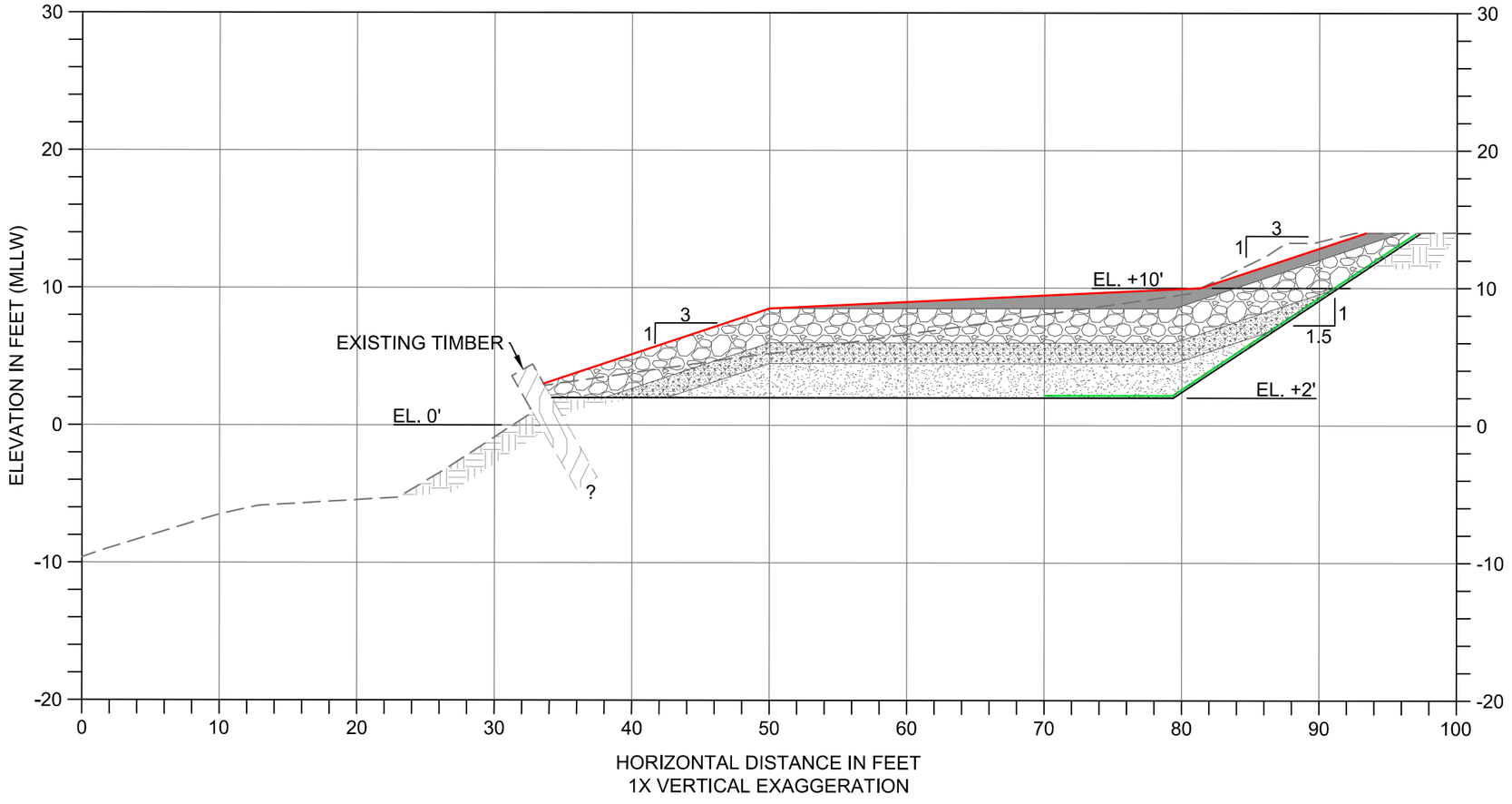
LEGEND:

- Mean Lower Low Water (MLLW)
- Mean Higher High Water (MHHW)
- Existing Major Contour (5' Interval)
- Existing Minor Contour (1' Interval)
- Area of Excavation
- Existing Structure
- Piling
- Beach Test Pit Location
- Beach Test Pit Location with Visible Product
- Soil Boring Location
- Monitoring Well Location

Project North
True North
0
20
Scale in Feet

ANCHOR QEA

Figure 11
Soil Sampling Grid
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham



VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:
1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.
2. Whatcom Waterway cap to be placed in Interim Action Area during Whatcom Waterway construction. See Figure 5 for cap and transition.

LEGEND:

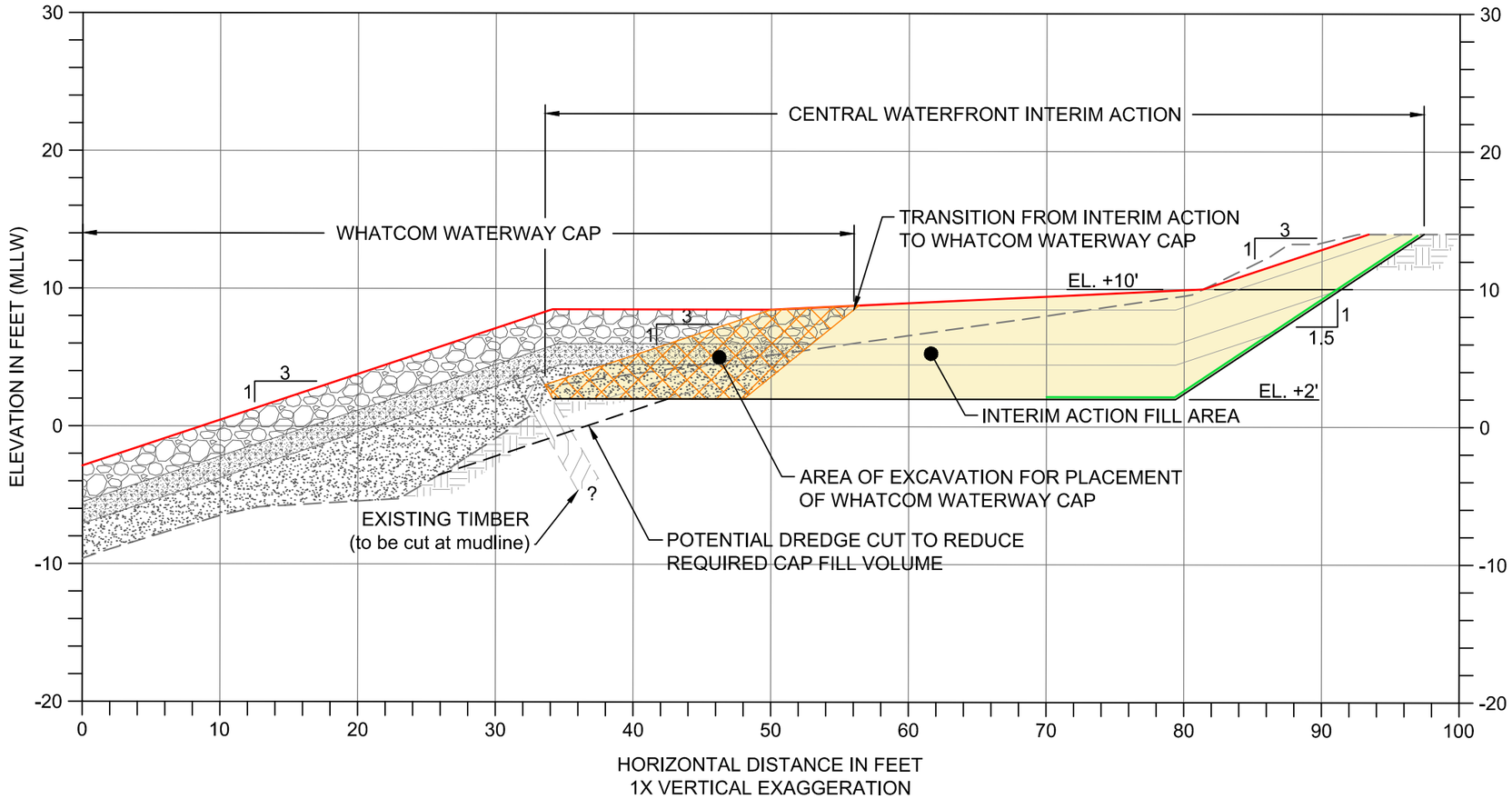
- Existing Ground
- Proposed Ground
- Excavation Neatline
- Impermeable Liner
- Beach Material
- Armor (2.0 - 2.5 ft Thickness)
- Filter/Gravel (1.0 - 1.5 ft Thickness)
- Sand Cap (2.0 - 2.5 ft Thickness)

0 10
Scale in Feet

K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg LIKELY FILL
Sep 05, 2012 2:48pm epipkin

ANCHOR QEA

Figure 12
Typical Section - Likely Extent of Fill
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham



VERTICAL DATUM: Mean Lower Low Water (MLLW), Feet, 1983-2001 Tidal Epoch.

NOTES:

1. Drawing prepared from surveys provided by Wilson Surveying and Engineering.

LEGEND:

- Existing Ground
- Proposed Ground
- Excavation Neatline
- Impermeable Liner
- Interim Action Fill Area (See Figure 4)
- Armor (2.0 - 2.5 ft Thickness)
- Filter/Gravel (1.0 - 1.5 ft Thickness)
- Sand Cap (2.0 - 2.5 ft Thickness)
- Area of Excavation for Whatcom Waterway Cap Placement

0 10
Scale in Feet

K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-010.dwg WHATCOM CAP
Sep 05, 2012 4:13pm epipkin

Figure 13
Typical Section - Whatcom Waterway Cap / Interface
Chevron Subarea Interim Action
Central Waterfront Site
Port of Bellingham

ANCHOR QEA

APPENDIX A
MAY 2012 INVESTIGATIVE REPORT (AECOM)

APPENDIX B
BEST MANAGEMENT PRACTICES

APPENDIX C
HEALTH AND SAFETY PLAN

APPENDIX D
JULY 13, 2012 SUBSTANTIVE COMMENTS FROM WDFW

APPENDIX E
CRITICAL AREA REPORT

APPENDIX A
MAY 2012 INVESTIGATIVE REPORT (AECOM)

AECOM
710 Second Avenue, Suite 1000
Seattle, WA 98104

206.624.9349 tel
206.623.3793 fax

Memorandum

To	Brian Gouran, Port of Bellingham	Page 1
CC		
Subject	Technical Memorandum for Central Waterfront RI/FS Work Plan Addendum 2 - Port of Bellingham, Washington	
From	Jason Palmer and Halah Voges (Anchor QEA)	
Date	August 30, 2012	

AECOM is submitting this technical memorandum to summarize the field activities performed and analytical data collected during the Chevron Subarea investigation conducted on May 7-8, 2012 at the Central Waterfront Site in Bellingham, Washington. The investigation was conducted under Agreed Order DE3441 and in accordance with the Central Waterfront RI/FS Work Plan Addendum 2 (AECOM 2012), approved by the Washington State Department of Ecology (Ecology) on April 11, 2012. The intent of the investigation was to augment existing data from previous investigations and provide additional information to allow for the development of potential interim remedial action(s) along the Chevron Subarea shoreline.

Field Preparation Activities

Field preparation activities were conducted on May 4, 2012. Wilson Engineering and Survey marked the locations of the predetermined upland boring locations and surveyed ground surface elevations. In addition, they installed two rows of survey stakes perpendicular to the water in the beach area for elevation reference during beach test pit excavation and comparison to the upland boring elevations. Several of the upland borings were adjusted landward due to debris along the shoreline that prevented access to the geoprobe rig. Private (APS) and public utility locators were also on site May 4th to identify any underground utilities in the work area.

Sampling Techniques and Locations

Surface and subsurface soils were characterized within the Chevron Subarea at the locations shown on Figure 1. Upland subsurface soil sampling was completed at five pre-determined locations using a direct push geoprobe rig to a maximum depth of 35 feet below ground surface [bgs]. Cascade Drilling provided geoprobe equipment, operation, and assistance with sampling. Two to three soil samples were collected at each location from 1-2 foot intervals exhibiting the strongest observed evidence of contamination (i.e. olfactory, PID, visual, sheen and/or “paper towel” test). A “clean” sample was also collected at each location at a depth where the soils appeared to be free of contaminants to delineate the vertical extent of contamination. Subsurface soil samples collected in the uplands are designated in the Sample ID as CWSB-# (Central Waterfront Soil Boring).

A 1-inch monitoring well (CWMW-18) was installed adjacent to the bulkhead that runs along the southeast portion of the site (also known as the “Chevron dock”). The monitoring well location was selected in consultation with Ecology for use in potential future sampling events at the site. Soil sampling was conducted using the same methodology as described above. Groundwater sampling was not performed as it was not included in the scope of the work plan addendum.

Beach soil samples were collected at eight locations using a hand driven corer barrel to a maximum depth of five feet, the locations of which are shown on Figure 1. One to two soil samples were collected at each location from 1-2 foot intervals exhibiting the strongest observed evidence of contamination (i.e. olfactory, PID, visual, sheen and/or “paper towel” test). Beach soil samples are designated in the Sample ID as CBASB-# (Chevron Beach Area Soil Boring). Prior to collecting the beach soil samples, 20 shallow test pits were dug along transects extending outward from the shoreline to determine the appropriate locations for the core samples. Visual observations were noted on field logs, and are presented in Table 1. Only one analytical sample was collected from the test pits at location CBATP-7. The beach area test pits are designated in the Sample ID as CBATP-# (Chevron Beach Area Test Pit).

Table 2 lists all samples collected during the investigation, including coordinates, elevations, and laboratory analyses. Boring logs for the upland and beach area soil borings are included as Attachment A.

Sample Results and Summary

In accordance with the Work Plan, all samples were submitted for laboratory analysis of Total Petroleum Hydrocarbon gasoline range (NWTPH-G), and Total Petroleum Hydrocarbon diesel range extended (NWTPH-Dx). Several samples were also submitted for Total Organic Carbon (TOC), and one beach sample was submitted for benzene, toluene, ethylbenzene and xylenes (BTEX), semi-volatile organic compounds (SVOCs), and extractable petroleum hydrocarbons/volatile petroleum hydrocarbons (EPH/VPH). Table 2 lists all samples collected during the investigation, including coordinates, elevations, and laboratory analyses.

Tables 3 and 4 show the analytical results (NWTPH-Dx, NWTPH-G and TOC) for the upland and beach area samples collected during the May 2012 investigation, respectively. Table 5 shows the BTEX, SVOCs, EPH and VPH analytical results for soil sample CBA-SB-8. Figures 2 and 3 summarize the highest concentrations for NWTPH-G and NWTPH-Dx results for these locations, respectively. Attachment B includes copies of the laboratory reports and data validation results for this event.

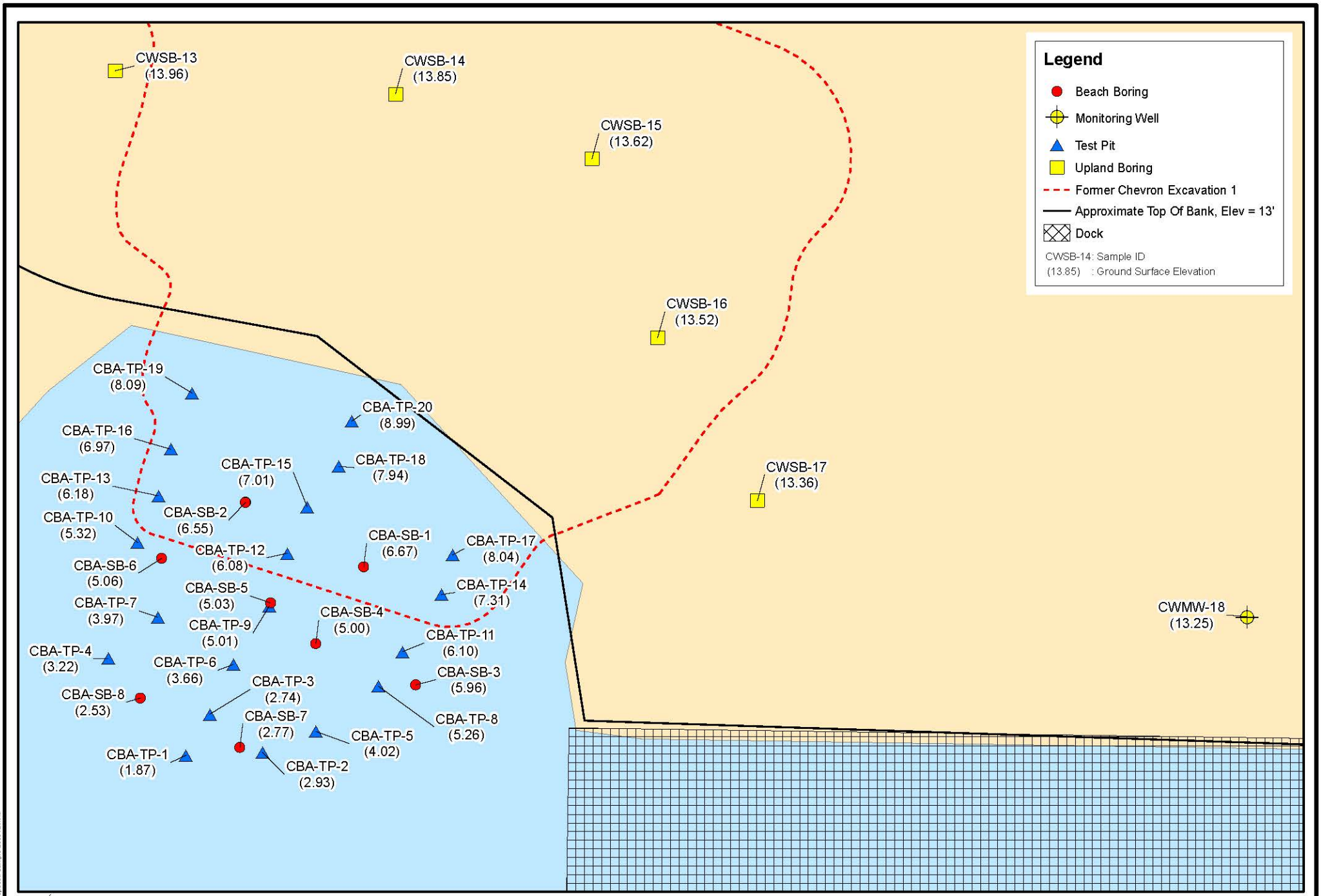
Gasoline range TPH concentrations were detected above the MTCA Method A cleanup level of 100 milligrams per kilogram (mg/kg) in 4 of the 6 upland boring locations and 2 of the 9 beach locations. The highest concentration in the upland was 4,200 mg/kg at CWSB-16 at 8 to 10 feet bgs or at a corresponding elevation of 5.52 to 3.52 feet MLLW. The highest detected concentration in the beach area was 1,200 mg/kg at CBA-SB-1 at 1.5 to 2.5 feet bgs or at a corresponding elevation of 5.17 to 4.17 feet MLLW. Gasoline range TPH did not exceed MTCA Method A cleanup level below -0.15 feet MLLW in the upland area and 4.05 feet MLLW in the beach area. However, gasoline range TPH was detected below Method A cleanup level down to -2.48 feet MLLW.

Diesel and motor oil range TPH concentrations were detected above the MTCA Method A cleanup level of 2,000 mg/kg in 2 of the 6 upland boring locations and 2 of the 9 beach locations. The diesel and motor oil range TPH concentrations were summed for comparison with applicable screening levels. One-half the reporting limit was used in the summation if one of the TPH ranges (diesel or

motor oil) was not detected. The highest detected concentration in the upland was 25,100 mg/kg at CWSB-17 at 6 to 8 feet bgs or 7.36 to 5.36 feet MLLW. The highest detected concentration in the beach area was 9,200 mg/kg at CBA-SB-1 at 1.5 to 2.5 feet bgs or 5.17 to 4.17 feet MLLW. Diesel and motor oil range TPH did not exceed the Method A cleanup level below 3.52 feet MLLW in the upland area and 4.05 feet MLLW in the beach area. However, along the beach concentrations of diesel and motor oil range TPH were detected to a depth of -2.48 feet MLLW.

Attachments:
Figures
Tables
Attachment A: Boring Logs
Attachment B: Data Verification Report and Analytical Laboratory Report

Figures

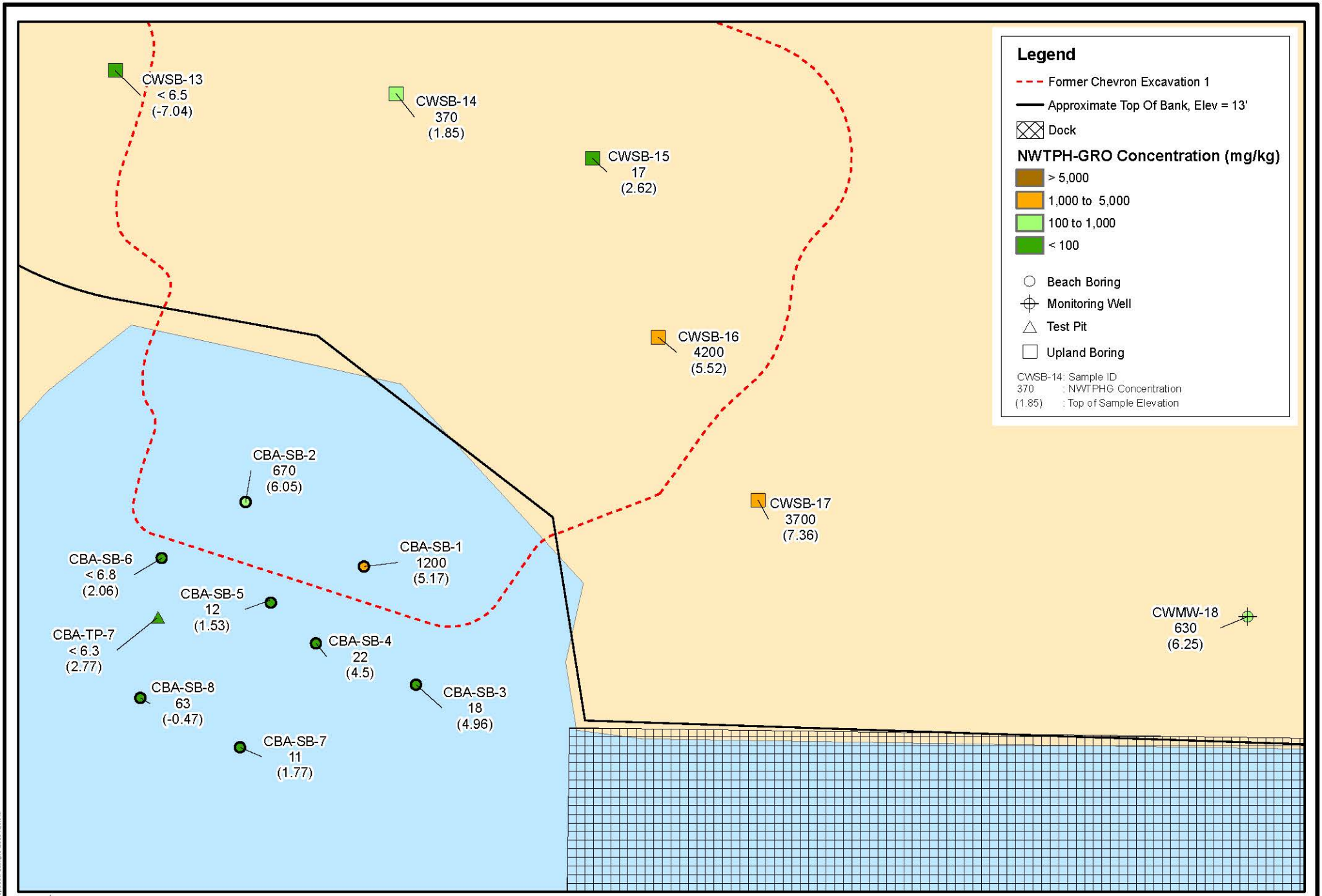


L:\Port of Bellingham\MXD\PProposed Sample Locs V2.mxd

AECOM

Notes:
1. Former Chevron Excavation 1 location approximate; digitized from "not to scale" pre-existing figure.
2. CBA-Chevron Beach Area.
3. Ground surface elevation in feet above Mean Lower Low Water.

Port of Bellingham Central Waterfront (60139509)			May 2012 Chevron Subarea Shoreline Investigation Locations
DATE: 07/25/12	DWRN: mv/SEA	Revision: 0	FIGURE 1



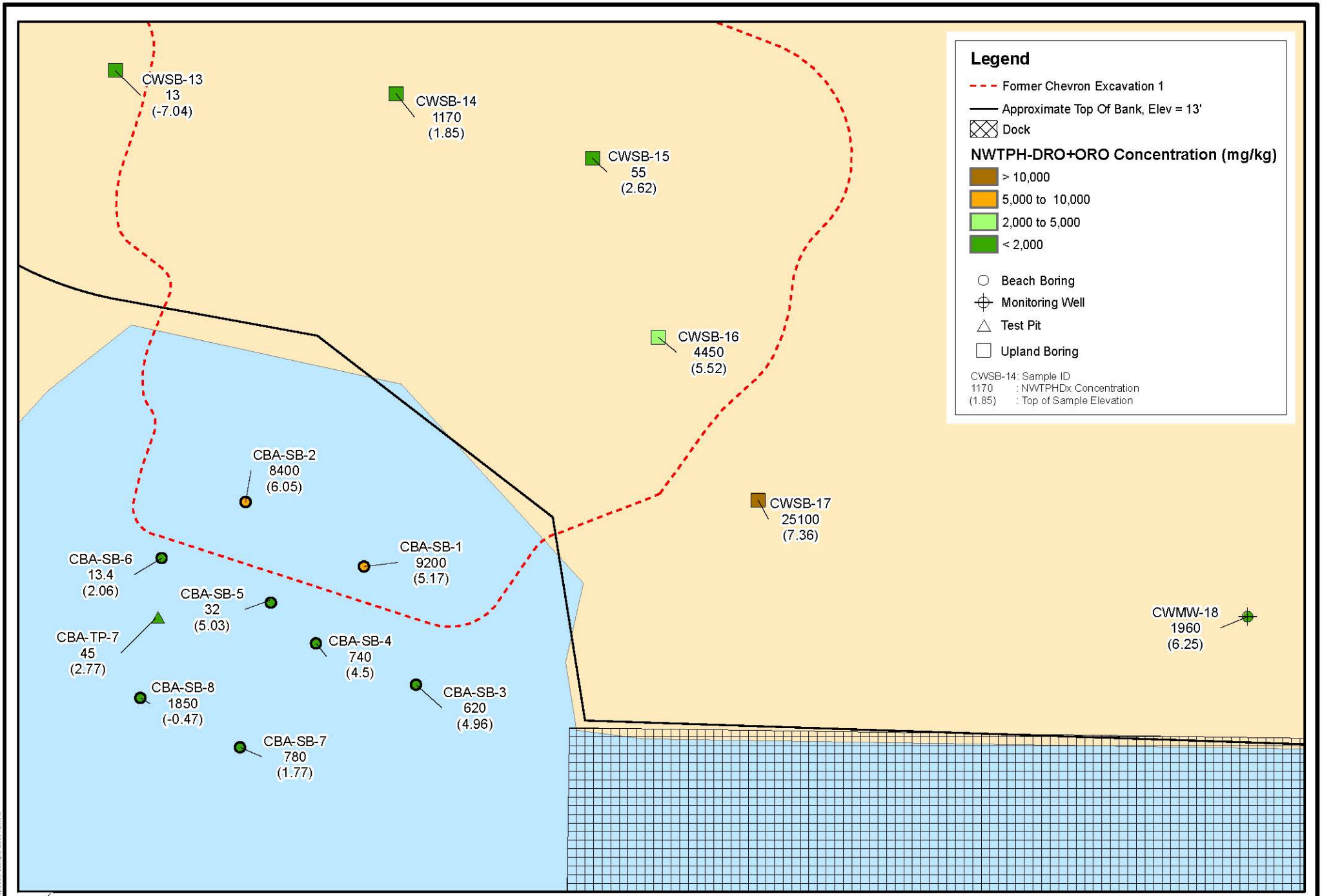
0 5 10 20 Feet

AECOM

Notes:
1. The highest concentration at each sample location was used when samples were collected at multiple depth intervals.
2. For non-detect values the reporting limit is displayed.
3. Former Chevron Excavation 1 location approximate; digitized from "not to scale" pre-existing figure.
4. CBA-Chevron Beach Area.
5. Ground surface elevation in feet above Mean Lower Low Water.

Port of Bellingham Central Waterfront (60139509)			May 2012 Chevron Subarea Shoreline NWTPH-GRO Concentrations
DATE: 07/18/12	DWRN:mvl/SEA	Revision: 0	FIGURE 2

L:\Port of Bellingham\MXD\Proposed Sample Locs\V2.mxd


CWSB-13
13
(-7.04)
CWSB-14
1170
(1.85)
CWSB-15
55
(2.62)
CWSB-16
4450
(5.52)
CWSB-17
25100
(7.36)
CWMW-18
1960
(6.25)
CBA-SB-2
8400
(6.05)
CBA-SB-1
9200
(5.17)
CBA-SB-6
13.4
(2.06)
CBA-SB-5
32
(5.03)
CBA-TP-7
45
(2.77)
CBA-SB-4
740
(4.5)
CBA-SB-8
1850
(-0.47)
CBA-SB-3
620
(4.96)
CBA-SB-7
780
(1.77)
Legend
Former Chevron Excavation 1
Approximate Top Of Bank, Elev = 13'
Dock
NWTPH-DRO+ORO Concentration (mg/kg)
> 10,000
5,000 to 10,000
2,000 to 5,000
< 2,000
Beach Boring
Monitoring Well
Test Pit
Upland Boring
CWSB-14: Sample ID
1170 : NWTPHDx Concentration
(1.85) : Top of Sample Elevation
0 5 10 20
Feet
AECOM
Notes:
1. The highest concentration at each sample location was used when samples were collected at multiple depth intervals.
2. For non-detect values the reporting limit is displayed.
3. Former Chevron Excavation 1 location approximate; digitized from "not to scale" pre-existing figure.
4. CBA-Chevron Beach Area.
5. Ground surface elevation in feet above Mean Lower Low Water.
Port of Bellingham
Central Waterfront
(60139509)
MAy 2012 Chevron Subarea Shoreline
NWTPH-DRO+ORO Concentrations
DATE: 07/26/12
DWRN:mv/SEA
Revision: 0
FIGURE 3
L:\Port of Bellingham\MXD\Proposed Sample Locs\V2.mxd

Tables

Table 1 Central Waterfront – Beach Test Pit Observations

Sample ID	Type	Elev	X_NAD27	Y_NAD27	Observations
CBA-TP-1	Test Pit	1.87	1600884.795	642866.875	Slight white, block sheen after hole sits a while (biological)
CBA-TP-2	Test Pit	2.93	1600891.660	642874.296	White, blocky sheen (appears biological)
CBA-TP-3	Test Pit	2.74	1600883.157	642872.959	White, blocky sheen (appears biological)
CBA-TP-4	Test Pit	3.22	1600868.408	642868.717	Very slight rainbow sheen when first disturbed, then no sheen. White, blocky sheen develops in hole with time.
CBA-TP-5	Test Pit	4.02	1600894.689	642881.247	White, blocky sheen (appears biological)
CBA-TP-6	Test Pit	3.66	1600880.701	642879.811	White, blocky sheen (appears biological)
CBA-TP-7	Test Pit	3.97	1600869.184	642877.203	Silver and rainbow, swirling sheen observed, occational product bubbles up and turns a heavy sheen on water surface. Sample collected.
CBA-TP-8	Test Pit	5.26	1600896.347	642891.394	Silver sheen and trace product. Staining at ~6", foam with trace product
CBA-TP-9	Test Pit	5.01	1600878.591	642888.735	Silver, swirling, heavy sheen, slight rainbow sheen
CBA-TP-10	Test Pit	5.32	1600860.280	642882.312	Rainbow sheen with small black blebs of product
CBA-TP-11	Test Pit	6.10	1600895.369	642896.889	Sheen; silver, swirling, trace brown product, staining below 6". Foam with trace product
CBA-TP-12	Test Pit	6.08	1600875.340	642895.357	Product, brown product seeping from edge of hole. Staining below ~2".
CBA-TP-13	Test Pit	6.18	1600857.820	642888.663	Product, brown product seeping from edge of hole. Staining below ~2".
CBA-TP-14	Test Pit	7.31	1600893.652	642905.911	Product, brown product, staining below ~6"
CBA-TP-15	Test Pit	7.01	1600872.817	642901.557	Product below 1'. Staining below 1'.
CBA-TP-16	Test Pit	6.97	1600854.597	642894.183	Heavy sheen (silver) observed below 1.5'
CBA-TP-17	Test Pit	8.04	1600890.965	642910.658	Light product and staining below 1.5'
CBA-TP-18	Test Pit	7.94	1600871.941	642908.314	Light product and staining below 1.5'
CBA-TP-19	Test Pit	8.09	1600851.356	642901.472	Light product, heavy sheen only slight odor all below 2'
CBA-TP-20	Test Pit	8.99	1600868.930	642913.761	Some staining below ~1.5'. Product below 2'. Strong odor.

Notes:

X_NAD27 and Y_NAD27	Horizontal datum
Elev	Ground surface elevation in feet above Mean Lower Low Water
ID	Identification
' = feet	
" = inches	

Table 2 Central Waterfront Sample Location and Laboratory Analytical Details

Location ID	X_NAD27	Y_NAD27	Ground Surface Elevation	Sample ID	Depth Interval (ft)	NWTPH-G	NWTPH-Dx	TOC	EPH, VPH, SVOC, BTEX
CWSB-13	1600813.8490	642924.4730	13.96	CWSB-13-14.0-14.5-0512	14 - 14.5	x	x	x	—
				CWSB-13-21-22-0512	21 - 22	x	x	AC	—
				CWSB-13-25-27-0512	25 - 27	x	x	AC	—
				CWSB-13-28-30-0512	28 - 30	AC	AC	AC	—
CWSB-14	1600842.3210	642948.6150	13.85	CWSB-14-12-14-0512	12 - 14	x	x	x	AC
				CWSB-14-25-27-0512	25 - 27	x	x	x	—
				CWSB-14-29-30-0512	29 - 30	x	x	x	—
CWSB-15	1600866.8100	642960.9530	13.62	CWSB-15-11-13-0512	11 - 13	x	x	AC	—
				CWSB-15-18-20-0512	18 - 20	x	x	x	—
				CWSB-15-23-25-0512	23 - 25	x	x	AC	—
				CWSB-15-29-30-0512	29 - 30	AC	AC	AC	—
CWSB-16	1600889.7630	642950.3410	13.52	CWSB-16-8-10-0512	8 - 10	x	x	x	—
				CWSB-16-13-15-0512	13 - 15	x	x	x	—
				CWSB-16-18-20-0512	18 - 20	x	x	AC	—
				CWSB-16-23-25-0512	23 - 25	AC	AC	AC	—
CWSB-17	1600914.4170	642944.4060	13.36	CWSB-17-6-8-0512	6 - 8	x	x	x	AC
				CWSB-17-23-25-0512	23 - 25	x	x	x	—
				CWSB-170-23-25-0512	23 - 25	x	x	x	—
				CWSB-17-28-30-0512	28 - 30	x	x	x	—
CWMW-18	1600971.2670	642979.3300	13.25	CWMW-18-7-9-0512	7 - 9	x	x	x	—
				CWMW-18-13-15-0512	13 - 15	x	x	x	—
CBA-TP-7	1600869.1840	642877.2030	3.97	CBA-TP-7-0-1-0512	0 - 1	x	x	x	—
CBA-SB-1	1600883.7570	642901.2180	6.67	CBA-SB-1-1.5-2.5-0512	1.5 - 2.5	x	x	x	—
				CBA-SB-1-3-5-0512	3 - 5	x	x	x	—
CBA-SB-2	1600866.6160	642896.2160	6.55	CBA-SB-2-0.5-2.5-0512	0.5 - 2.5	x	x	AC	—
				CBA-SB-20-0.5-2.5-0512	0.5 - 2.5	x	x	AC	—
				CBA-SB-2-3-5-0512	3 - 5	x	x	AC	—
CBA-SB-3	1600899.7260	642895.0140	5.96	CBA-SB-3-1-3-0512	1 - 3	x	x	x	—
CBA-SB-4	1600886.4650	642889.5200	5.00	CBA-SB-4-0.5-2.5-0512	0.5 - 2.5	x	x	x	—
				CBA-SB-4-3-5-0512	3 - 5	x	x	x	—
CBA-SB-5	1600878.4430	642889.1060	5.03	CBA-SB-5-0-2-0512	0 - 2	x	x	AC	—
				CBA-SB-50-3-5-0512	3 - 5	x	x	AC	—
				CBA-SB-5-3-5-0512	3 - 5	x	x	AC	—
CBA-SB-6	1600864.0080	642883.0640	5.06	CBA-SB-6-3-5-0512	3 - 5	x	x	x	—
CBA-SB-7	1600889.1040	642872.6550	2.77	CBA-SB-7-1-3-0512	1 - 3	x	x	x	—
				CBA-SB-7-3-5-0512	3 - 5	AC	—	—	—
CBA-SB-8	1600875.1350	642867.9330	2.53	CBA-SB-8-1-3-0512	1 - 3	x	x	x	x
				CBA-SB-80-3-5-0512	3 - 5	x	x	x	—
				CBA-SB-8-3-5-0512	3 - 5	x	x	x	—

Notes:

X_NAD27 and Y_NAD27	Horizontal datum
Ground Surface Elevation	Datum in feet above Mean Lower Low Water
ID	Identification
NWTPH-G	Northwest Total Petroleum Hydrocarbons – Gasoline Range
NWTPH-Dx	Northwest Total Petroleum Hydrocarbons – Diesel Extended Range
TOC	Total Organic Carbon
EPH	Extractable Petroleum Hydrocarbons
VPH	Volatile Petroleum Hydrocarbons
SVOC	Semi-volatile Organic Compounds
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
x	Analyzed
AC	Archived Sample
—	Not Sampled

CWSB-170-23-25-0512 is a duplicate sample of CWSB-17-23-25-0512
CBA-SB-20-0.5-2.5-0512 is a duplicate sample of CBA-SB-2-0.5-2.5-0512
CBA-SB-50-3-5-0512 is a duplicate sample of CBA-SB-5-3-5-0512
CBA-SB-80-3-5-0512 is a duplicate sample of CBA-SB-8-3-5-0512

Table 3 Central Waterfront Upland Analytical Results

				Chemical Name	Total Organic Carbon	Total Solids	Gasoline Range Hydrocarbons	Diesel Range Hydrocarbons	Motor Oil	TPH-Dx (calc)
				Unit	%	%	mg/kg	mg/kg	mg/kg	mg/kg
Location	Sample	Sample Date	Depth Range (ft bgs)	Elevation Depth Range (MLLW)						
CWMW-18	CWMW-18-7-9-0512	05/08/2012	7 – 9	6.25 - 4.25	**1.71**	**75.10**	**630**	**1300**	**660**	**1960**
	CWMW-18-13-15-0512	05/08/2012	13 – 15	0.25 – -1.75	**0.584**	**79.90**	< 7.1	**7.4**	< 12	13.4
CWSB-13	CWSB-13-14.0-14.5-0512	05/07/2012	14 – 14.5	-0.04 – -0.54	**0.500**	**82.30**	< 6.2	< 5.9	< 12	8.95
	CWSB-13-21-22-0512	05/07/2012	21 – 22	-7.04 – -8.04	NA	NA	< 6.5	**6.5**	< 13	13
	CWSB-13-25-27-0512	05/07/2012	25 – 27	11.04 – -13.04	NA	NA	< 6.8	< 6.3	< 13	9.65
CWSB-14	CWSB-14-12-14-0512	05/07/2012	12 – 14	1.85 – -0.15	**0.532**	**81.90**	**370**	**850**	**320**	**1170**
	CWSB-14-25-27-0512	05/07/2012	25 – 27	11.15 – -13.15	**0.489**	**75.50**	< 9.2	< 6.3	< 12	9.15
	CWSB-14-29-30-0512	05/07/2012	29 – 30	-15.15 – -16.15	**0.383**	**78.10**	< 8.1	< 6.3	< 13	9.65
CWSB-15	CWSB-15-11-13-0512	05/07/2012	11 – 13	2.62 - 0.62	NA	NA	**17**	**40**	**15**	**55**
	CWSB-15-18-20-0512	05/07/2012	18 – 20	-4.38 – -6.38	**0.801**	**78.60**	< 6.4	**6.4**	< 12	12.4
	CWSB-15-23-25-0512	05/07/2012	23 – 25	-9.38 – -11.38	NA	NA	< 7.1	< 6.4	< 13	9.7
CWSB-16	CWSB-16-8-10-0512	05/07/2012	8 – 10	5.52 - 3.52	**0.794**	**87.00**	**4200**	**3800**	**650**	**4450**
	CWSB-16-13-15-0512	05/07/2012	13 – 15	0.52 – -1.48	**0.405**	**74.70**	< 7.6	**22**	< 13	28.5
	CWSB-16-18-20-0512	05/07/2012	18 – 20	-4.48 – -6.48	NA	NA	< 7.0	**9.1**	< 12	15.1
CWSB-17	CWSB-17-6-8-0512	05/08/2012	6 – 8	7.36 - 5.36	**3.49**	**86.80**	**3700**	**21000**	**4100**	**25100**
	CWSB-17-23-25-0512	05/08/2012	23 – 25	-9.64 – -11.64	**0.549**	**77.90**	< 7.6	< 6.2	< 12	9.1
	CWSB-170-23-25-0512	05/08/2012	23 – 25	-9.64 – -11.64	**0.393**	**78.50**	< 7.1	< 6.3	< 12	9.15
	CWSB-17-28-30-0512	05/08/2012	28 – 30	-14.64 – -16.64	**0.265**	**79.00**	< 6.9	< 6.2	< 12	9.1

Notes:
Bold result indicates detected analyte.
NWTPH-G Northwest Total Petroleum Hydrocarbons – Gasoline Range
NWTPH-Dx Northwest Total Petroleum Hydrocarbons – Diesel Extended Range
bgs below ground surface
% percentage
mg/kg milligrams per kilogram
TPH-Dx (calc) Sum of the motor oil range and diesel range hydrocarbons by Method NWTPH-Dx. One-half (1/2) the reporting limit was used for all non-detect results.
Elevation in feet above MLLW
MLLW Mean Lower Low Water
NA Not Analyzed
< Below the reporting limit
CWSB-170-23-25-0512 is a duplicate sample of CWSB-17-23-25-0512

Table 4 Central Waterfront Beach Area Analytical Results

Location	Sample	Sample Date	Depth Range (ft bgs)	Elevation Depth Range (MLLW)	Total Organic Carbon	Total Solids	Gasoline Range Hydrocarbons	Diesel Range Hydrocarbons	Motor Oil	TPH-Dx (calc)
				Unit	%	%	mg/kg	mg/kg	mg/kg	mg/kg
CBA-SB-1	CBA-SB-1-1.5-2.5-0512	05/08/2012	1.5 - 2.5	5.17 - 4.17	**1.29**	**85.40**	**1200**	**7400**	**1800 NJ**	**9200**
	CBA-SB-1-3-5-0512	05/08/2012	3 - 5	3.67 - 1.67	**1.06**	**76.50**	< 7.4	**48**	**21 NJ**	**69**
CBA-SB-2	CBA-SB-2-0.5-2.5-0512	05/08/2012	0.5 - 2.5	6.05 - 4.05	NA	NA	**670 J**	**6600**	**1800 NJ**	**8400**
	CBA-SB-20-0.5-2.5-0512	05/08/2012	0.5 - 2.5	6.05 - 4.05	NA	NA	**540 J**	**5500**	**1400 NJ**	**6900**
	CBA-SB-2-3-5-0512	05/08/2012	3 - 5	3.55 - 1.55	NA	NA	**19**	**26**	**12 NJ**	**38**
CBA-SB-3	CBA-SB-3-1-3-0512	05/08/2012	1 - 3	4.96 - 2.96	**2.05**	**82.80**	**18**	**200**	**420**	**620**
CBA-SB-4	CBA-SB-4-0.5-2.5-0512	05/08/2012	0.5 - 2.5	4.5 - 2.5	**1.35**	**81.70**	**22**	**220**	**520**	**740**
	CBA-SB-4-3-5-0512	05/08/2012	3 - 5	2 - 0	**0.523**	**85.50**	< 6.9	**82**	**130**	**212**
CBA-SB-5	CBA-SB-5-0-2-0512	05/08/2012	0 - 2	5.03 - 3.03	NA	NA	< 6.4	**16**	**16**	**32**
	CBA-SB-50-3-5-0512	05/08/2012	3 - 5	2.03 - 0.03	NA	NA	< 6.2	**9.8**	< 12	15.8
	CBA-SB-5-3-5-0512	05/08/2012	3 - 5	2.03 - 0.03	NA	NA	**12**	**10**	< 12	16
CBA-SB-6	CBA-SB-6-3-5-0512	05/08/2012	3 - 5	2.06 - 0.06	**0.449**	**79.60**	< 6.8	**7.4**	< 12	13.4
CBA-SB-7	CBA-SB-7-1-3-0512	05/08/2012	1 - 3	1.77 - -0.23	**2.21**	**83.60**	**11**	**260**	**500**	**760**
CBA-SB-8	CBA-SB-8-1-3-0512	5/8/2012	1 - 3	1.53 - -0.47	**1.28**	**77.50**	**28**	**570**	**1100**	**1670**
	CBA-SB-80-3-5-0512	05/08/2012	3 - 5	-0.47 - -2.47	**2.44**	**72.30**	**43**	**560**	**960**	**1520**
	CBA-SB-8-3-5-0512	05/08/2012	3 - 5	-0.47 - -2.48	**2.55**	**68.40**	**63**	**650**	**1200**	**1850**
CBA-TP-7	CBA-TP-7-0-1-0512	05/07/2012	0 - 1	2.77 - 1.77	**0.283**	**82.50**	< 6.3	**18**	**27**	**45**

Notes:

Bold result indicates detected analyte.

NWTPH-G Northwest Total Petroleum Hydrocarbons – Gasoline Range

NWTPH-Dx Northwest Total Petroleum Hydrocarbons – Diesel Extended Range

bgs below ground surface

% percentage

mg/kg milligrams per kilogram

TPH-Dx (calc) Sum of the motor oil range and diesel range hydrocarbons by Method NWTPH-Dx. One-half (1/2) the reporting limit was used for all non-detect results.

Elevation in feet above MLLW

MLLW Mean Lower Low Water

NJ The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.

J The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NA Not Analyzed

< Below the reporting limit

CBA-SB-20-0.5-2.5-0512 is a duplicate sample of CBA-SB-2-0.5-2.5-0512

CBA-SB-50-3-5-0512 is a duplicate sample of CBA-SB-5-3-5-0512

CBA-SB-80-3-5-0512 is a duplicate sample of CBA-SB-8-3-5-0512

Table 5 Central Waterfront BTEX, SVOC, EPH and VPH Analytical Results

Location		CBA-SB-8
Sample		CBA-SB-8-1-3-0512
Sample Date		05/08/2012
Depth Range (feet bgs)		1 - 3
Elevation Depth Range (MLLW)		1.53 - -0.47
Chemical Name	**Unit**	
SW8260C-SIM		
Benzene	µg/kg	**22**
Ethylbenzene	µg/kg	**21**
m,p-Xylene	µg/kg	**60**
o-Xylene	µg/kg	**25**
Toluene	µg/kg	**68**
SW8270D		
1,2,4-Trichlorobenzene	µg/kg	< 60
1,2-Dichlorobenzene	µg/kg	< 60
1,3-Dichlorobenzene	µg/kg	< 60
1,4-Dichlorobenzene	µg/kg	< 60
1-Methylnaphthalene	µg/kg	**160**
2,2'-Oxybis(1-Chloropropane)	µg/kg	< 60
2,4,5-Trichlorophenol	µg/kg	< 300
2,4,6-Trichlorophenol	µg/kg	< 300
2,4-Dichlorophenol	µg/kg	< 300
2,4-Dimethylphenol	µg/kg	< 60
2,4-Dinitrophenol	µg/kg	< 600
2,4-Dinitrotoluene	µg/kg	< 300
2,6-Dinitrotoluene	µg/kg	< 300
2-Chloronaphthalene	µg/kg	< 60
2-Chlorophenol	µg/kg	< 60
2-Methylnaphthalene	µg/kg	**250**
2-Methylphenol	µg/kg	< 60
2-Nitroaniline	µg/kg	< 300
2-Nitrophenol	µg/kg	< 60
3,3'-Dichlorobenzidine	µg/kg	< 300
3-Nitroaniline	µg/kg	< 300
4,6-Dinitro-2-Methylphenol	µg/kg	< 600
4-Bromophenyl-phenylether	µg/kg	< 60
4-Chloro-3-methylphenol	µg/kg	< 300
4-Chloroaniline	µg/kg	< 300
4-Chlorophenyl-phenylether	µg/kg	< 60
4-Methylphenol	µg/kg	< 60
4-Nitroaniline	µg/kg	< 300
4-Nitrophenol	µg/kg	< 300
Acenaphthene	µg/kg	< 60
Acenaphthylene	µg/kg	< 60
Anthracene	µg/kg	< 60
Benzo(a)anthracene	µg/kg	**70**
Benzo(a)pyrene	µg/kg	**65**
Benzo(g,h,i)perylene	µg/kg	< 60
Benzoic Acid	µg/kg	< 600
Benzyl Alcohol	µg/kg	< 300

Table 5 Central Waterfront BTEX, SVOC, EPH and VPH Analytical Results

Location		CBA-SB-8
Sample		CBA-SB-8-1-3-0512
Sample Date		05/08/2012
Depth Range (feet bgs)		1 - 3
Elevation Depth Range (MLLW)		1.53 - -0.47
Chemical Name	**Unit**	
bis(2-Chloroethoxy) Methane	µg/kg	< 60
Bis-(2-Chloroethyl) Ether	µg/kg	< 60
bis(2-Ethylhexyl)phthalate	µg/kg	< 60
Butylbenzylphthalate	µg/kg	< 60
Carbazole	µg/kg	< 60
Chrysene	µg/kg	**110**
Dibenz(a,h)anthracene	µg/kg	< 60
Dibenzofuran	µg/kg	**79**
Diethylphthalate	µg/kg	< 60
Dimethylphthalate	µg/kg	< 60
Di-n-Butylphthalate	µg/kg	< 60
Di-n-Octyl phthalate	µg/kg	< 60
Fluoranthene	µg/kg	**660**
Fluorene	µg/kg	**68**
Hexachlorobenzene	µg/kg	< 60
Hexachlorobutadiene	µg/kg	< 60
Hexachlorocyclopentadiene	µg/kg	< 300
Hexachloroethane	µg/kg	< 60
Indeno(1,2,3-cd)pyrene	µg/kg	< 60
Isophorone	µg/kg	< 60
Naphthalene	µg/kg	**280**
Nitrobenzene	µg/kg	< 60
N-Nitroso-Di-N-Propylamine	µg/kg	< 60
N-Nitrosodiphenylamine	µg/kg	< 60
Pentachlorophenol	µg/kg	< 300
Phenanthrene	µg/kg	**250**
Phenol	µg/kg	< 60
Pyrene	µg/kg	**380**
Total Benzofluoranthenes	µg/kg	**110**
EPH		
C10-C12 Aliphatics	µg/kg	**4600**
C10-C12 Aromatics	µg/kg	< 2400
C12-C16 Aliphatics	µg/kg	**28000**
C12-C16 Aromatics	µg/kg	**5700**
C16-C21 Aliphatics	µg/kg	**45000**
C16-C21 Aromatics	µg/kg	**30000**
C21-C34 Aliphatics	µg/kg	**130000**
C21-C34 Aromatics	µg/kg	**71000**
C8-C10 Aliphatics	µg/kg	6000 U
C8-C10 Aromatics	µg/kg	< 2400
VPH		
Benzene	µg/kg	< 1600
C10-C12 Aliphatics	µg/kg	< 16000
C10-C12 Aromatics	µg/kg	< 16000

Table 5 Central Waterfront BTEX, SVOC, EPH and VPH Analytical Results

Location		CBA-SB-8
Sample		CBA-SB-8-1-3-0512
Sample Date		05/08/2012
Depth Range (feet bgs)		1 - 3
Elevation Depth Range (MLLW)		1.53 - -0.47
Chemical Name	**Unit**	
C12-C13 Aromatics	µg/kg	< 16000
C5-C6 Aliphatics	µg/kg	< 16000
C6-C8 Aliphatics	µg/kg	< 16000
C8-C10 Aliphatics	µg/kg	< 16000
C8-C10 Aromatics	µg/kg	< 16000
Ethylbenzene	µg/kg	< 1600
m,p-Xylene	µg/kg	< 3100
Methyl tert-Butyl Ether	µg/kg	< 1600
n-Decane	µg/kg	< 1600
n-Dodecane	µg/kg	< 1600
n-Hexane	µg/kg	< 1600
n-Octane	µg/kg	< 1600
n-Pentane	µg/kg	< 1600
o-Xylene	µg/kg	< 1600
Toluene	µg/kg	< 1600

Notes:

Bold result indicates detected analyte.

bgs below ground surface

µg/kg micrograms per kilogram

MLLW Mean Lower Low Water

U The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

< Below the reporting limit

Attachment A

BORING NUMBER CBA-SB-1

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 6.7 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0.5 feet
NOTES AC = archived. Datum NAD27 X= 1600883.8, Y= 642901.2
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		80				(0.0-1.75) SP: POORLY GRADED SAND, wet @ 0.5', very dark grayish brown (10YR 3/2) grading to very dark gray (10YR 3/1), fine, trace to 10% medium to coarse sand from 0-0.5'. Moderate hydrocarbon odor at 0.5', staining and product observed at 0.5'. ▽	
1					1.8		5.0
2	CBA-SB-1-1.5-2.5-0512		36.2		3.0	(1.75-3.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, 25% medium to coarse sand, trace fine gravel, trace shells. Slight to moderate hydrocarbon odor, silver and rainbow sheen observed.	3.7
3						(3.0-5.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine. No to very slight hydrocarbon odor, no sheen or staining observed.	
4	CBA-SB-1-3-5-0512		30.1			@ 3.5' trace shell fragments @ 4' - 1" silty sand layer	
5					5.0	@ 4.75' - 0.5" wood layer	1.7

Bottom of borehole at 5.0 feet.

BORING NUMBER CBA-SB-2

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 6.6 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0.5 feet
NOTES AC = archived. Datum NAD27 X= 1600866.6, Y= 642896.2
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		78				(0.0-5.0) SP: POORLY GRADED SAND, wet @ 0.5', very dark grayish brown (10YR 3/2) grading to very dark gray (10YR 3/1), fine, trace fine, rounded gravel at surface, trace silt. Moderate to slight hydrocarbon odor, staining and product @ 0.5-1.5'.	
1	CBA-SB-2-0.5-2.5-0512 (TOC-AC)					▽	
2			50.2				
3	CBA-SB-2-3-5-0512 (TOC-AC)						
4			29.6				
5					5.0		1.6

Bottom of borehole at 5.0 feet.

BORING NUMBER CBA-SB-3

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 6.0 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0.5 feet
NOTES AC = archived. Datum NAD27 X= 1600899.7, Y= 642895.0
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		83				(0.0-3.0) SP: POORLY GRADED SAND, wet @ 0.5', very dark gray (10YR 3/1), fine. Slight hydrocarbon odor, droplets of silver and rainbow sheen observed.	
						▽ @ 0.5-0.8' - 10% silt	
1			7.5			@ 1-1.7' - 15% medium sand	
2	CBA-SB-3-1-3-0512						
3			12.5		3.0	@ 2.8-3' wood pieces	3.0
						Bottom of borehole at 3.0 feet.	

BORING NUMBER CBA-SB-4

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 5.0 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0 feet
NOTES AC = archived. Datum NAD27 X= 1600886.5, Y= 642889.5
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		60				(0.0-5.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, scattered wood throughout. Slight hydrocarbon odor to 4' and slight sliver and rainbow sheen observed @ 0-3.5'.	
						@ 0-0.5' - 20% medium to coarse sand and trace fine gravel	
1	CBA-SB-4-0.5-2.5-0512						
2			71.8			@ 1.75' - 2" layer of wood and silt, trace medium sand	
3							
4	CBA-SB-4-3-5-0512		15.1				
5					5.0		0.0

Bottom of borehole at 5.0 feet.

GEOPROBE - GINT STD US.GDT - 7/18/12 14:50 - F:\PROJECT\PORT OF BELLINGHAM\CENTRAL WATERFRONT\SOIL LOGS\CW BORING LOGS\CENTRAL WATERFRONT DP.GPJ

BORING NUMBER CBA-SB-5

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 5.0 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0 feet
NOTES AC = archived. Datum NAD27 X= 1600878.4, Y= 642889.1
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		76			0.8	(0.0-0.75) SW: WELL GRADED SAND, wet, very dark grayish brown (10YR 3/2), fine to coarse, subrounded to rounded, equant, 20-30% medium to coarse sand, 10% fine gravel. No odor, sheen or staining observed.	4.3
1	CBA-SB-5 -0-2-0512 (TOC-AC)					(0.75-3.75) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine. Slight hydrocarbon odor and no sheen or staining observed.	
2			29.1			@ 2-3' - 10% medium to coarse sand	
3					3.8		1.3
4	CBA-SB-5- 3-5-0512 (TOC-AC)		19.1		4.5	(3.75-4.5) SM: SILTY SAND, wet, very dark grayish brown (10YR 3/2), fine, 20% silt. Slight hydrocarbon odor and no sheen or staining observed.	0.5
5					5.0	(4.5-5.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1) fine. Slight hydrocarbon odor and no sheen or staining observed.	0.0

Bottom of borehole at 5.0 feet.

BORING NUMBER CBA-SB-6

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 5.1 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0 feet
NOTES AC = archived. Datum NAD27 X= 1600864.0, Y= 642883.1
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		62				(0.0-4.5) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, 15% medium sand, trace fine, subrounded, equant gravel. No to very slight hydrocarbon odor and no sheen or staining observed.	
1							
2			13.4				
3						@ 2.75' - 1" layer of 20% silt	
4	CBA-SB-6-3-5-0512		25.7		4.5		0.6
5					5.0	(4.5-5.0) SM: SILTY SAND, wet, very dark gray (10YR 3/1), fine, 20% silt, little wood fibers. Very slight hydrocarbon odor and no sheen or staining observed.	0.1

Bottom of borehole at 5.0 feet.

BORING NUMBER CBA-SB-7

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 2.8 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0 feet
NOTES AC = archived. Datum NAD27 X= 1600889.1, Y= 642872.7
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		50				(0.0-5.0) SP-SM: POORLY GRADED SAND WITH SILT, wet, very dark gray (10YR 3/1), fine, 10% silt, trace fine to coarse gravel. Slight hydrocarbon odor and trace droplets of rainbow sheen observed.	
1							
2	CBA-SB-7-1-3-0512		5.3				
3						@ 2.5' wood	
4			50.3				
5					5.0		-2.2

Bottom of borehole at 5.0 feet.

BORING NUMBER CBA-SB-8

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 2.5 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD Hand Hammer Macrocore
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 0 feet
NOTES AC = archived. Datum NAD27 X= 1600875.1, Y= 642867.9
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		65				(0.0-3.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, trace silt, trace shells, scattered wood pieces. Slight to moderate hydrocarbon odor and 1/8" silver sheen blobs observed.	
1							
2	CBA-SB-8-1-3-0512 (plus EPH, VPH, BTEX, SVOCs analyzed)		130				
3					3.0		-0.5
						(3.0-4.5) ML: SILT WITH SAND, wet, very dark gray (10YR 3/1), soft, 30% fine sand, trace to little wood. Slight to moderate hydrocarbon odor and trace sheen blobs.	
4	CBA-SB-8-3-5-0512		313		4.5		-2.0
						@ 4.5-4.75' wood chunk (4.5-5.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, trace wood fibers. Slight hydrocarbon odor and no sheen or staining observed.	
5					5.0		-2.5

Bottom of borehole at 5.0 feet.

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/7/12 **COMPLETED** 5/7/12
GROUND ELEVATION 14.0 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD GeoProbe Direct Push
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 11.5 feet
NOTES AC = archived. Datum NAD27 X= 1600813.8, Y= 642924.5
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0.0		80	0			(0.0-1.5) SP-SM: POORLY GRADED SAND WITH SILT AND GRAVEL, damp, very dark gray (10YR 3/1), fine to medium, subangular to subrounded, equant, 20% fine subangular to subrounded, equant gravel, 10% silt. No odor, sheen or staining observed.	
			1.5		1.5		12.5
					1.8	(1.5-1.75) SP-SM: POORLY GRADED SAND WITH SILT AND GRAVEL, damp, black (10YR 2/1), fine, 30% silt, 15% fine gravel. No odor, sheen or staining observed.	12.3
2.5			0			(1.75-7.5) SP: POORLY GRADED SAND, damp, brown (10YR 4/3), fine, 10-15% medium sand, trace fine gravel and coarse sand, trace gray mottles. Slight to moderate hydrocarbon odor and no sheen or staining observed.	
5.0		76	0.7				
7.5			0		7.5	@ 7.5' reddish brown zone next to contact (7.5-15.0) SP: POORLY GRADED SAND, wet @ 11.5', dark gray (10YR 4/1), fine, 10% silt, trace roots and shells. Slight hydrocarbon odor at 14-14.5' and no sheen or staining observed.	6.5
10.0		100	2.7				
12.5	CWSB-13-14.0-14.5-0512		4.3			@ 11.2-11.6' layers of silt @ 11.7' organic wood layer @ 11.8-12.2' layer of coarse sand and fine gravel @ 12.5-13.2' layers of silt	
15.0			5.4		15.0		-1.0

(Continued Next Page)

AECOM

Boring Log

CLIENT Port of Bellingham **PROJECT NAME** Central Waterfront

PROJECT NUMBER 60139509 **PROJECT LOCATION** Chevron Substation

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
15.0		80	9.9		17.5	(15.0-17.5) SM: SILTY SAND, wet, very dark grayish brown (10YR 3/2), fine, no to low plasticity silt, trace shells. Slight H2S odor and no sheen or staining observed.	-3.5
17.5			5.4			@ 17.5' layer of shells (17.5-24.75) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, little shell fragments. Moderate H2S, slight hydrocarbon odor @ 22' and no sheen or staining observed.	
20.0		100	10.3				
22.5	CWSB-13-21-22-0512 (TOC-AC)		8.3			@ 20.5-20.8' 20% fine gravel @ 21-22.5' 15% silt	
25.0			9.1		24.8	@ 23-24' 15% medium to coarse sand	-10.8
		90	8.3			(24.75-30.0) SM: SILTY SAND, wet, dark gray (10YR 4/1), fine, 20-25% no to low plasticity silt, trace shells, trace pockets of fine sand. Moderate H2S odor and no sheen or staining observed.	
27.5	CWSB-13-25-27-0512 (TOC-AC)		9.1				
			9				
30.0			10.3		30.0		-16.0

Bottom of borehole at 30.0 feet.

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/7/12 **COMPLETED** 5/7/12
GROUND ELEVATION 13.9 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD GeoProbe Direct Push
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 7.5 feet
NOTES AC = archived. Datum NAD27 X= 1600842.3, Y= 642948.6
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0.0		64	4.6		0.5	(0.0-0.5) SW-SM: WELL GRADED SAND WITH SILT AND GRAVEL, damp, very dark gray (10YR 3/1), fine to medium, 20% fine, subangular to subrounded gravel, 10-15% silt, gravel fill at surface. No odor, sheen, or staining observed.	13.4
2.5			7.1			(0.5-8.5) SP: POORLY GRADED SAND, wet @ 7.5', very dark brown (10YR 3/2), fine , loose, 10% fine to coarse gravel, trace silt. No odor, sheen or staining observed.	
			7.2				
5.0		70					
			7.2				
7.5						▽	
			9.3		8.5		5.4
			9.1			(8.5-10.0) GW: WELL GRADED GRAVEL WITH SAND, wet, dark gray (10YR 4/1), fine to coarse, angular, flat, 20% fine to coarse sand, trace silt. No odor, sheen or staining observed.	
10.0		88			10.0		3.9
			26.4		11.0	(10.0-11.0) SM: SILTY SAND, wet, very dark brown (10YR 2/2), fine, 10% fine to coarse gravel, trace medium to coarse sand, trace organics, 60% water. Hydrocarbon odor, silver sheen observed.	2.9
			63.2			(11.0-15.0) SP: POORLY GRADED SAND, wet, black (10YR 2/1), fine, trace fine to coarse gravel, trace to little organics, trace shells. Strong hydrocarbon (diesel) odor, silver and rainbow sheen observed.	
12.5	CWSB-14-12-14-0512						
			10.1				
15.0					15.0	@ 14.75 - 1" layer of medium plasticity clay	-1.1

(Continued Next Page)

AECOM

Boring Log

CLIENT Port of Bellingham **PROJECT NAME** Central Waterfront

PROJECT NUMBER 60139509 **PROJECT LOCATION** Chevron Substation

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
15.0		90	7.6			(15.0-19.0) SM: SILTY SAND, wet, dark grayish brown (10YR 4/2), fine, 20% silt, trace to 10% fine gravel, trace coarse gravel, trace shells. Moderate hydrocarbon (diesel) odor, no odor at 19', slight silver and rainbow sheen observed.	
17.5			14.6				
					19.0		-5.1
20.0		90	20.5			(19.0-30.0) SM: SILTY SAND, wet, dark gray (10YR 4/1), fine, 20% silt, trace to little organics and shells. Slight H2S odor, no sheen or staining observed.	
22.5			17.8				
25.0			21.7				
		100	8.4				
27.5	CWSB-14-25-27-0512 CWSB-14-29-30-0512		11.4				
30.0			7.1		30.0		-16.1

Bottom of borehole at 30.0 feet.

BORING NUMBER CWSB-15

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/7/12 **COMPLETED** 5/7/12
GROUND ELEVATION 13.6 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD GeoProbe Direct Push
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 7.5 feet
NOTES AC = archived. Datum NAD27 X= 1600866.8, Y= 642961.0
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0.0		72	5.3		1.3	(0.0-1.25) SP-SM: POORLY GRADED SAND WITH SILT AND GRAVEL, damp, dark gray (10YR 4/1), fine to medium, 20-25% fine to coarse subangular to subrounded, equant, flat gravel, 10% silt, trace coarse sand. No odor, sheen, or staining observed, (fill).	12.4
2.5			16.6			(1.25-8.5) SP: POORLY GRADED SAND, wet @ 7.5', very dark grayish brown (10YR 3/2), fine, 10% fine to coarse gravel, trace medium to coarse sand and silt. No odor, sheen, or staining observed.	
5.0		56	29.9				
7.5			10		8.5		5.1
						(8.5-10.25) GW-GM: WELL GRADED GRAVEL WITH SILT AND SAND, wet, very dark gray (10YR 3/1), fine to coarse, angular to subrounded, flat, 25% fine to coarse sand, 10% silt. Slight hydrocarbon odor, slight silver sheen observed.	
10.0		100			10.3		3.4
			50.4			(10.25-13.25) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, 15% medium sand, trace coarse sand to fine gravel, trace to little shells. Slight hydrocarbon odor and slight silver sheen observed.	
12.5	CWSB-15-11-13-0512 (TOC-AC)		42.1		13.3		0.4
						(13.25-15.0) SP-SM: POORLY GRADED SAND WITH SILT, wet, dark gray (10YR 4/1), fine, 10-15% silt, trace roots and rootlets. Slight H2S odor and no sheen or staining observed.	
15.0					15.0		-1.4

(Continued Next Page)

AECOM

Boring Log

CLIENT Port of Bellingham **PROJECT NAME** Central Waterfront

PROJECT NUMBER 60139509 **PROJECT LOCATION** Chevron Substation

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
15.0		65	33.1			@ 14.9' lense of organics (15.0-20.3) SM: SILTY SAND, wet, dark grayish brown (10YR 4/2), fine, 20% no to low plasticity silt, 10-15% medium to coarse sand, little roots, wood, and shells. No to slight H2S odor and no sheen or staining observed.	
17.5			24.6				
20.0		100	11.8		20.3		-6.7
22.5	CWSB-15-18-20-0512		18.9			(20.3-30.0) SM: SILTY SAND, wet, dark grayish brown (10YR 4/2), fine, 25-30% low plasticity silt, trace shells. Strong H2S odor and no sheen or staining observed.	
25.0		70	13.5				
27.5	CWSB-15-23-25-0512 (TOC-AC)		10.7				
30.0			13.6		30.0		-16.4
			7.6			Bottom of borehole at 30.0 feet.	

BORING NUMBER CWSB-16

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/7/12 **COMPLETED** 5/7/12
GROUND ELEVATION 13.5 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD GeoProbe Direct Push
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 8 feet
NOTES AC = archived. Datum NAD27 X= 1600889.8, Y= 642950.3
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0.0		44	4.9		1.5	(0.0-1.5) SP-SM: POORLY GRADED SAND WITH SILT AND GRAVEL, damp, dark gray (10YR 4/1), fine to medium, 20-25% fine to coarse, subangular to subrounded, flat, equant gravel, 10% silt. No odor, sheen or staining observed.	12.0
2.5			12.6			(1.5-6.5) SP: POORLY GRADED SAND, damp, very dark grayish brown (10YR 3/2), fine, 10-15% fine to coarse gravel, trace medium sand and silt. No odor, sheen or staining observed.	
5.0		90	6.3		6.5		7.0
7.5			143			(6.5-13.0) SP: POORLY GRADED SAND, wet @ 8', very dark gray (10YR 3/1), fine, 10% medium to coarse sand and fine gravel, trace to little shells. Moderate hydrocarbon odor and stain on gloves @ 8-9'. ▽	
10.0		100	198				
12.5	CWSB-16-8-10-0512 CWSB-16-13-15-0512		25.4 7.4		13.0	@ 12.5-13' 30% coarse gravel	0.5
15.0			6.9		14.5	(13.0-14.0) SP-SM: POORLY GRADED SAND WITH SILT, wet, dark gray (10YR 4/1), fine, 10% silt, trace brown mottles. Very slight hydrocarbon odor, no sheen or staining observed.	-1.0

(Continued Next Page)

AECOM

Boring Log

CLIENT Port of Bellingham **PROJECT NAME** Central Waterfront

PROJECT NUMBER 60139509 **PROJECT LOCATION** Chevron Substation

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
15.0		100	5.7			(14.5-16.0) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, trace to 10% medium to coarse sand, trace silt and fine gravel, trace shells. Very slight hydrocarbon-like odor, no sheen or staining observed. *(continued)*	
					16.0		-2.5
						(16.0-19.5) SM: SILTY SAND, wet, dark grayish brown (10YR 4/2) fine, 20% silt, 10% medium sand, trace fine gravel, little shells. Slight H2S odor, no sheen or staining observed.	
17.5	CWSB-16-18-20-0512 (TOC-AC)		5.8				
			10.9		19.5		-6.0
20.0		96	5.8			(19.5-25.0) SP-SM: POORLY GRADED SAND WITH SILT, wet, dark gray (10YR 4/1) fine, less than 10% silt, trace shells and organic roots. Slight H2S odor, no sheen or staining observed.	
22.5			6.9				
			6.8				
25.0					25.0		-11.5

Bottom of borehole at 25.0 feet.

BORING NUMBER CWSB-17

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 13.4 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD GeoProbe Direct Push
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 7.5 feet
NOTES AC = archived. Datum NAD27 X= 1600914.4, Y= 642944.4
Sampler Macrocore

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
0		80	14.2			(0.0-1.75) SP-SM: POORLY GRADED SAND WITH SILT AND GRAVEL, damp, very dark grayish brown (10YR 3/2), fine to medium, 15-20% fine, subangular to subrounded, equant gravel, 10% silt, trace coarse gravel. No odor, sheen or staining observed.	
					1.8	@ 1.5-1.7' broken concrete	11.7
						(1.75-5.75) SP: POORLY GRADED SAND, damp, dark grayish brown (10YR 4/2), fine, trace fine, subrounded gravel and silt. No odor, sheen or staining observed.	
5		80	45.4				
					5.8		7.7
	CWSB-17-6-8-0512		313			(5.75-12.75) SP: POORLY GRADED SAND, wet @ 7.5', black (10YR 2/1), fine, 10-20% medium to coarse sand, trace fine gravel. Strong hydrocarbon odor.	
			148			@ 7.5' LNAPL covered grains	
10		84	262			@ 8.5' color grades to very dark gray (10 YR 3/1)	
					12.8		0.7
			32			@ 12.75-12.9' wood layer	
						(12.75-15.5) SW: WELL GRADED SAND, wet, very dark gray (10YR 3/1), fine to coarse, angular to subrounded, equant, flat. Strong hydrocarbon odor and silver sheen observed. Trace LNAPL.	
15		90	107			@ 12.9-13.2' pea gravel layer	
					15.5		-2.1
			112			(15.5-19.5) SM: SILTY SAND, wet, very dark grayish brown (10YR 3/2), fine, 25% silt, trace coarse sand, trace shell fragments. Slight hydrocarbon and H2S odor, no sheen or staining observed. @ 19.5' wood	
					19.5		-6.1
20							

(Continued Next Page)

AECOM

Boring Log

CLIENT Port of Bellingham **PROJECT NAME** Central Waterfront

PROJECT NUMBER 60139509 **PROJECT LOCATION** Chevron Substation

DEPTH (ft)	SAMPLE ID Depth Range	DRIVE RECOVERY %	PID (ppm)	GRAPHIC LOG	DEPTH BELOW GROUND SURFACE (FT)	MATERIAL DESCRIPTION	ELEVATION (NAVD88)
20		95	60.2			(19.5-30.5) SP: POORLY GRADED SAND, wet, very dark gray (10YR 3/1), fine, trace to 10% silt in layers, less silt down section. Slight to moderate H2S, no sheen or staining observed. *(continued)* @ 20' - 1" thick wood @ 22' - 1" thick wood	
	CWSB-17-23-25-0512		106				
25		75	7.9				
	CWSB-17-28-30-0512		9.1				
30		78			30.5		-17.1
			71.2			(30.5-35.0) CH: FAT CLAY, wet, dark gray (10YR 4/1), slow dilatancy, high plasticity, 20-30% silt, trace 2" pockets of fine sand. No odor, sheen or staining observed.	
35			8.5		35.0		-21.6

Bottom of borehole at 35.0 feet.

WELL NUMBER CWMW-18

AECOM

Boring Log

CLIENT Port of Bellingham
PROJECT NAME Central Waterfront
PROJECT NUMBER 60139509
PROJECT LOCATION Chevron Substation
DATE STARTED 5/8/12 **COMPLETED** 5/8/12
GROUND ELEVATION 13.3 ft MLLW **BORE SIZE** 2"
DRILLING CONTRACTOR Cascade Drilling L.P.
NOTES:
DRILLING METHOD GeoProbe Direct Push
Analytical NWTPH-Dx, NWTPH-G, TOC=unless noted below
LOGGED BY R. Knecht **CHECKED BY** J. Palmer
Groundwater 6.5 feet
NOTES DP=Direct push Datum NAD27 X= 1600971.3, Y= 642979.3
Sampler Macrocore

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N Value)	GRAPHIC LOG	MATERIAL DESCRIPTION	Environmental Data	WELL DIAGRAM
0.0							
					(0.0-1.25) GW: WELL GRADED GRAVEL WITH SAND, damp, gray (10YR 5/1), fine to coarse, subangular to angular, 40% fine to coarse sand, trace silt (fill). No odor, sheen or staining observed.	PID = 118	Flush mount well box
1.3						12.1	
					(1.25-4.25) SP: POORLY GRADED SAND, damp, very dark grayish brown (10YR 3/2) grading to dark grayish brown (10YR 4/2), fine, 10% fine gravel, trace silt. No odor, sheen or staining observed. @ 3.5-4' fine sand.		0-3' concrete seal
2.5						PID = 187	
	DP	72	0				3-4' Bentonite Seal
4.3						9.1	
					(4.25-5.0) CL: LEAN CLAY, damp, dark grayish brown (10YR 4/2), low plasticity, 15-20% silt. No odor, sheen or staining observed.		
5.0						8.3	
					(5.0-6.0) SP: POORLY GRADED SAND WITH GRAVEL, damp, dark grayish brown (10YR 4/2), fine, 20% fine to coarse gravel, trace clay. No odor, sheen or staining observed.	PID = 110	
6.0						7.3	
					▽(6.0-8.0) ML: SILT WITH SAND, wet @ 6.5', very dark grayish brown (10YR 3/2), no to low plasticity, 15% fine sand, trace clay, little wood chunks coated with product, trace roots. Strong hydrocarbon odor @ 6.5', moderate silver and rainbow sheen observed. Pockets of sand with product.		
7.5	DP CWMW-18-7-9-0512	70	0				
8.0						5.3	
					(8.0-15.0) SP-SM: POORLY GRADED SAND WITH SILT, wet, dark gray (10YR 4/1), fine, 10% silt, trace wood chunks. Moderate hydrocarbon odor, trace sheen observed to 9'.	PID = 83	
10.0					@ 10-11' - 10% medium sand and trace fine gravel	PID = 36.2	3-16' 10/20 Silica sand
	DP	100	0				6-16' schedule 40 PVC, 1" prepacked screen
12.5						PID = 10.2	
	DP CWMW-18-13-15-0512				@ 14-14.25' wood		
					@ 14.5-15' - 15% fine, rounded gravel		
15.0						-1.7	
					(15.0-16.0) Lithology description ends at 15 feet. Well installation information total depth is 16 feet.		
16.0						-2.7	

Bottom of borehole at 16.0 feet.

Attachment B - Refer to CD

AECOM Environment

Submitted to:
Port of Bellingham
Soil Samples

Submitted by:
AECOM
Pittsburgh PA
60139509-560
June 5, 2012

Organic and Inorganic Data Verification Report

Port of Bellingham Central Waterfront Soil and Aqueous QC Samples Analytical Resources, Inc. Data May 2012 Sampling Event

Prepared By Gregory A. Malzone
Project Chemist

Overview

The samples analyzed for the Port of Bellingham Central Waterfront sampling event from May 7-8, 2012 are listed in the Table of Samples Analyzed (page 4). Data verification was performed on a total of forty distinct soil samples, and one soil QC trip blank sample.

Samples were analyzed by Analytical Resources, Inc. (ARI) of Tukwila, WA. The verified analyses were Volatile Organic Compounds (VOCs) by SW-846 method 8260B; Semivolatile Organic Compounds (SVOCs) by SW-846 method 8270D; Benzene, Toluene, Ethylbenzene, m,p-Xylene, and o-Xylene (BTEX) by SW-846 method 8260B SIM (Selected Ion Monitoring); Gasoline Range Hydrocarbons (GRH) by WDOE method NWTPH-G; Diesel Range Hydrocarbons (DRH) as Diesel and Motor Oil by WDOE method NWTPH-Dx; Extractable Petroleum Hydrocarbons (EPH) by WDOE method EPH; Volatile Petroleum Hydrocarbons (VPH) by WDOE method VPH; Total Organic Carbon (TOC) by methods 415.1/Plumb 1981; and Total Solids for dry weight determination by method SM2540B.

The AECOM Analytical Data Verification Checklist is presented as pages 6-11. Data were evaluated based on validation criteria set forth in the *USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic/Inorganic Data Review*, document numbers EPA540/R-99/008 and EPA540/R-04/004 of October 1999 (Organic) and October 2004 (Inorganic), and the *USEPA CLP National Functional Guidelines for Superfund Organic Methods Data Review*, document number USEPA-540-R-07-003, July 2007, as they applied to the reported methodology. Washington State Department of Ecology (WDOE) methods were reviewed as per *WDOE Analytical Methods for Petroleum Hydrocarbons*, ECY 97-602 of June 1997. Field duplicate RPD control limits were taken from the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, December 1996.

The following data components were reviewed during the data validation procedure:

Submitted Deliverables
Chain-of-Custody form(s) and sample integrity
Assigned laboratory flags and definitions
Sample results including reporting limits and dilution factors
Holding time
Method blank results
LCS, LCSD (blank spike) results
MS, MSD (matrix spike/matrix spike duplicate) results
Surrogate recoveries
Trip blank results
Organic sample chromatograms (for select project samples and select fuel methods only)

Data Validation Qualifiers Assigned During this Review

U: The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J: The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NJ: The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.

Other Qualifiers Assigned During this Review

DNR: Do not report, another acceptable result from a secondary dilution is reportable.
ECR: The reported concentration exceeded the instrument calibration range.

Assigned qualifiers are detailed in the Analytical Limited Data Validation Checklist and are summarized in the Table of Qualified Analytical Results (page 5).

Overall Data Assessment

All data received from the laboratory are suitable for their intended use with the qualifications and clarifications noted. Completeness of the total data set is calculated to be 100% and is acceptable.

Table of Samples Analyzed
Port of Bellingham – Central Waterfront
Soil Samples and Aqueous QC Samples
Analytical Resources, Inc. (ARI) Laboratory Reports (as listed)
May 2012 Sampling Events

Matrix	Sample Name	Parent Sample ID	Sample Date and Time		Lab SDG	Lab Sample ID
Soil	CWSB-13-14.0-14.5-0512		5/7/2012	10:10	UT77	UT77A
Soil	CWSB-13-21-22-0512		5/7/2012	10:55	UT77	UT77B
Soil	CWSB-13-25-27-0512		5/7/2012	11:10	UT77	UT77C
Soil	CWSB-13-28-30-0512		5/7/2012	11:30	UT77	UT77D
Soil	CWSB-14-12-14-0512		5/7/2012	12:10	UT77	UT77E
Soil	CWSB-14-25-27-0512		5/7/2012	13:30	UT77	UT77F
Soil	CWSB-14-29-30-0512		5/7/2012	13:35	UT77	UT77G
Soil	CWSB-15-11-13-0512		5/7/2012	14:30	UT77	UT77H
Soil	CWSB-15-23-25-0512		5/7/2012	15:30	UT77	UT77I
Soil	CWSB-15-18-20-0520		5/7/2012	14:45	UT77	UT77J
Soil	CWSB-15-29-30-0512		5/7/2012	15:40	UT77	UT77K
Soil	CWSB-16-8-10-0512		5/7/2012	16:20	UT77	UT77L
Soil	CWSB-16-13-15-0512		5/7/2012	17:00	UT77	UT77M
Soil	CWSB-16-18-20-0512		5/7/2012	17:20	UT77	UT77N
Soil	CWSB-16-23-25-0512		5/7/2012	17:41	UT77	UT77O
Soil	CWSB-17-6-8-0512		5/8/2012	8:30	UT77	UT77P
Soil	CWSB-17-23-25-0512		5/8/2012	9:45	UT77	UT77Q
Soil	CWSB-17-28-30-0512		5/8/2012	10:10	UT77	UT77R
Soil (QC)	CWSB-170-23-25-0512	CWSB-17-23-25-0512	5/8/2012	8:45	UT77	UT77S
Aqueous (QC)	TB-050712 (trip blank)		5/7/2012	0:00	UT77	UT77T
Soil	CBA-SB-1-1.5-2.5-0512		5/8/2012	11:15	UT78	UT78A
Soil	CBA-SB-1-3-5-0512		5/8/2012	11:30	UT78	UT78B
Soil	CBA-SB-2-0.5-2.5-0512		5/8/2012	11:45	UT78	UT78C
Soil	CBA-SB-3-1-3-0512		5/8/2012	12:30	UT78	UT78D
Soil	CBA-SB-4-0.5-2.5-0512		5/8/2012	13:40	UT78	UT78E
Soil	CBA-SB-4-3-5-0512		5/8/2012	13:48	UT78	UT78F
Soil	CBA-SB-5-3.5-0512		5/8/2012	14:15	UT78	UT78G
Soil	CBA-SB-5-0-2-0512		5/8/2012	14:25	UT78	UT78H
Soil	CBA-SB-20-0.5-2.5-0512	CBA-SB-2-0.5-2.5-0512	5/8/2012	10:45	UT78	UT78I
Soil	CBA-SB-50-3-5-0512	CBA-SB-5-3.5-0512	5/8/2012	13:15	UT78	UT78J
Soil	CBA-SB-6-3-5-0512		5/8/2012	14:55	UT78	UT78K
Soil	CBA-SB-7-1-3-0512		5/8/2012	15:25	UT78	UT78L
Soil	CBA-SB-8-3-5-0512		5/8/2012	16:00	UT78	UT78M
Soil	CBA-SB-8-1-3-0512		5/8/2012	16:00	UT78	UT78N
Soil	CWMW-18-7-9-0512		5/8/2012	17:00	UT78	UT78O
Soil	CWMW-18-13-15-0512		5/8/2012	17:30	UT78	UT78P
Soil	CBA-SB-80-3-5-0512	CBA-SB-8-3-5-0512	5/8/2012	15:00	UT78	UT78Q
Soil	CBA-TP-7-0-1-0512		5/8/2012	15:05	UT78	UT78R
Soil	CBA-SB-2-3-5-0512		5/8/2012	12:00	UT78	UT78S
Soil	CBA-SB-7-3-5-0512		5/8/2012	15:15	UT78	UT78T
Soil	CBA-SB-8-1-3-0512		5/8/2012	16:15	UT78	UT78U

Table of Qualified Analytical Results
Port of Bellingham – Central Waterfront
Soil Samples and Aqueous QC Samples
Analytical Resources, Inc. (ARI) Laboratory Reports (as listed)
May 2012 Sampling Events

Qualified Reportable Results

Lab ID	Sample ID	Analysis	DF	Method	Analyte	Concentration		Qualifier[1]	Reason Code[2]
UT78A	CBA-SB-1-1.5-2.5-0512	Initial	50	NWTPHD	Motor Oil	1800	mg/kg	NJ	CHRO
UT78B	CBA-SB-1-3-5-0512	Initial	1	NWTPHD	Motor Oil	21	mg/kg	NJ	CHRO
UT78C	CBA-SB-2-0.5-2.5-0512	Initial	1	NWTPHG	Gasoline	670	mg/kg	J	SUR
UT78C	CBA-SB-2-0.5-2.5-0512	Initial	1	NWTPHD	Motor Oil	1800	mg/kg	NJ	CHRO
UT78I	CBA-SB-20-0.5-2.5-0512	Initial	1	NWTPHG	Gasoline	540	mg/kg	J	SUR
UT78I	CBA-SB-20-0.5-2.5-0512	Initial	50	NWTPHD	Motor Oil	1400	mg/kg	NJ	CHRO
UT78S	CBA-SB-2-3-5-0512	Initial	1	NWTPHD	Motor Oil	12	mg/kg	NJ	CHRO
UT78U	CBA-SB-8-1-3-0512	Initial	1	EPH	C8-C10 Aliphatics	6000 B	µg/kg	U	MB

(1): Data Validation Qualifiers:

U: The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J: The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NJ: The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.

(2): Reason Codes:

CHRO – Detected response of total peaks in range, but the chromatographic pattern does not match the calibration standard or additional hydrocarbons in the range are not identifiable.

MB – Contamination detected in the associated method blank.

SUR – Surrogate recovery was outside the quality control limits.

Non-Reportable Results

Field ID	Lab ID	Method	Analyte	Concentration			Reason Code[1]	Comment
CWSB-16-8-10-0512	UT77L	NWTPHG	Gasoline	2200	E	mg/kg	DNR, ECR	Use DL result
CBA-SB-1-1.5-2.5-0512	UT78A	NWTPHG	Gasoline	630	E	mg/kg	DNR, ECR	Use DL result

(1): Reason Codes:

DNR – Do not report. An acceptable result from a secondary dilution is available..

ECR – The concentration exceeded the calibration range.

Project Name: Port of Bellingham (POB) – Central Waterfront	Laboratory: Analytical Resources, Inc. (ARI) of Tukwila, WA.
Project Reference: Central Waterfront	Sample Matrix: Soil and Aqueous QC Samples
ENSR Project: 60139509-560	Sample Start Date: 05/07/2012
Verified By/Date Verified: Greg Malzone 06/05/12 (completed)	Sample End Date: 05/08/2012

Samples Analyzed: see Table of Samples Analyzed, Port of Bellingham – Central Waterfront, Soil and Aqueous QC Samples (page 4).

Parameters Verified: Volatile Organic Compounds (VOCs) by SW-846 method 8260B; Semivolatile Organic Compounds (SVOCs) by SW-846 method 8270D; Benzene, Toluene, Ethylbenzene, m,p-Xylene, and o-Xylene (BTEX) by SW-846 method 8260B SIM (Selected Ion Monitoring); Gasoline Range Hydrocarbons (GRH) by WDOE method NWTPH-G; Diesel Range Hydrocarbons (DRH) as Diesel and Motor Oil by WDOE method NWTPH-Dx; Extractable Petroleum Hydrocarbons (EPH) by WDOE method EPH; Volatile Petroleum Hydrocarbons (VPH) by WDOE method VPH; Total Organic Carbon (TOC) by methods 415.1/Plumb 1981; and Total Solids for dry weight determination by method SM2540B.

Not all samples were analyzed for every parameter/method. Refer to Chain of Custody records for the exact analyses requested.

Laboratory Project IDs (SDGs): UT77 and UT78

PRECISION, ACCURACY, METHOD COMPLIANCE, and COMPLETENESS ASSESSMENT

Precision:	**X**	Acceptable		Unacceptable	GAM	Initials

Comments: Precision is the measure of variability of individual sample measurements. Laboratory precision was determined by examination of laboratory duplicate results. Evaluation laboratory duplicates for precision was done using the Relative Percent Difference (RPD). The RPD is defined as the difference between two duplicate samples divided by the mean and expressed as a percent. Laboratory RPD limits referenced EPA published QC limits. No data required qualification based on precision data; overall laboratory precision was acceptable. Precision measurements are reviewed in items 17, 20, and 21.

Accuracy:	**X**	Acceptable		Unacceptable	GAM	Initials

Comments: Laboratory accuracy is a measure of the system bias, and was measured by evaluating laboratory control sample/laboratory control sample duplicate (LCS/LCSD), matrix spike/matrix spike duplicate (MS/MSD), and organic system monitoring compounds (surrogate) percent recoveries (%Rs). LCS/LCSD %Rs, which demonstrated the overall performance of the analysis, were compared to EPA published QC limits. MS/MSD %Rs, which provided information on sample matrix interferences, were compared to EPA published QC limits or laboratory control charted limits. System monitoring compound or surrogate recoveries, which measured system performance and efficiency during organic analysis, were compared to EPA published QC limits or laboratory control charted limits. Although several data points required qualification based on a nonconforming surrogate recovery (see item 14); overall laboratory accuracy was acceptable. Accuracy measurements are reviewed in items 12, 14, 15 and 16.

Method Compliance:	**X**	Acceptable		Unacceptable	GAM	Initials

Comments: Method compliance was determined by evaluating sample integrity, holding time, and laboratory blanks, against method specified requirements, while applying EPA data validation guidelines. Additionally, laboratory notations regarding instrument calibration outliers were considered and utilized in qualifying the associated data in this report. Although some data required qualification based pattern match discrepancies (see item 22) and method blank contamination (see item 11), overall method compliance was acceptable based on the supplied data.

Completeness:	X	Acceptable		Unacceptable	GAM	Initials

Comments: Completeness is the overall ratio of the number of samples planned versus the number of samples with validated analyses. Completeness goals are set at 90-100%. Determination of completeness included a review of chain of custody records, laboratory analytical methods and detection limits, laboratory case narratives, and project requirements. Completeness also included 100% review of the laboratory sample data results, QC summary reports, and electronic data deliverables (EDDs). All data received from the laboratory are useable with some qualification. Completeness of the total data set is calculated to be 100% and is acceptable.

VALIDATION CRITERIA CHECK

Data validation qualifiers used in this review:

U: The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J: The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NJ: The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.

DNR: Do not report, a second acceptable result from a secondary dilution is reportable.
ECR: The reported concentration exceeded the instrument calibration range.

The following comments requiring qualification are in bold type. The other comments are of interest, but qualification of the samples was not necessary.

Refer to the Table of Qualified Analytical Results (page 5) for a listing of the samples, analytes, and concentrations qualified.

1. Did the laboratory identify any non-conformances related to the analytical results?	X	Yes		No	GAM	Initials

Explanation by laboratory: General notes were provided in the laboratory case narratives. Notations regarding outliers observed in non-project samples prepared as QC batch MS/MSD, or laboratory duplicate samples were not evaluated because matrix similarity to project samples could not be guaranteed. In some cases, laboratory QC batches did not include MS/MSD samples because of insufficient sample volume. The following laboratory notes specially refer to project samples.

Method NWTPHG (SDG UT77): The percent recoveries for the surrogate, bromobenzene, were high following the initial NWTPH-G analyses of samples CWSB-16-8-10-0512 and CWSB-17-6-8-0512. This was due to co-elution with interference. Both samples were diluted and re-analyzed. The percent recoveries for all surrogates were within established QC limits for the dilutions. The results for both analyses have been submitted for these samples.
Method NWTPHG (SDG UT78): The percent recoveries for the surrogate, bromobenzene, were high following the initial NWTPHG analyses of samples CBA-SB-1 -1 .5-2.5-051 2, CBA-SB -2-0.5-2.5-051 2 and CBAS8-20-0.5-2.5-0512. This was due to co-elution with an interference. Sample CBA-SB-1-1.5-2.5-0512 was diluted and re-analyzed. The percent recoveries for all surrogates were within established QC limits for the dilution. The results for both analyses have been submitted for this sample.
Method VPH (SDG UT78): The method blank was re-analyzed for VPH due to suspected carryover from a previous sample. The results for the re-analysis only have been submitted.

Data qualification, if any, related to the laboratory observations are discussed in the following sections.

2. Were sample Chain-of-Custody forms complete?	X	Yes		No	GAM	Initials

Comments: COC records from field to laboratory were complete and accurately reflect the sampling information with the exceptions noted below. Custody was maintained as evidenced by field and laboratory personnel signatures, dates, and times of receipt.

3. Were all the analyses requested for the samples on the COCs completed by the laboratory?	X	Yes		No	GAM	Initials

Comments: All requested analyses as documented on original COC records were completed by the laboratory.

4. Were samples received in good condition and at the appropriate temperature?	**X**	Yes		No	GAM	Initials
Comments: All samples were received intact and in good condition as stated in the report cover letters submitted with each SDG. All samples were received intact and in good condition as stated in the Cooler Receipt Forms submitted with each SDG. All samples were received at acceptable cooler temperatures of 0.9° C to 3.8° C as noted on the Cooler Receipt Forms provided. Samples received at less than 2° C were determined to be in acceptable condition because sample containers were intact and samples themselves were not frozen. No action is required other than to note this observation.						
5. Were the requested analytical methods in compliance with WP/QAPP, permit, or COC?	**X**	Yes		No	GAM	Initials
Comments: Reported methods and target analyte lists were in compliance with COC records.						
6. Were detection limits in accordance with WP/QAPP, permit, or method?	**X**	Yes		No	GAM	Initials
Comments: Reported detection limits are achievable by the quoted methods. Detection limits for soil results reported on a dry weight basis were increased to reflect the percent moisture content.						
7. Do the laboratory reports include only those constituents requested to be reported for a specific analytical method?	**X**	Yes		No	GAM	Initials
Comments: Reported target analytes were consistent with COC requests.						
8. Were sample holding times met?	**X**	Yes		No	GAM	Initials
Comments: Extraction and analytical holding times were met for all samples and analyses.						
9. Were correct concentration units reported?	**X**	Yes		No	GAM	Initials
Comments: Correct concentration units were reported. The soil NWTPHG and NWTPHD results are reported in mg/kg (ppm) on a dry weight basis. The BTEX, VPH, and EPH results are reported in µg/kg on a dry weight basis. The TOC and total solids results were reported in percent (%). The TOC results were reported on a dry weight basis.						
10. Were the reporting requirements for flagged data met?	**X**	Yes		No	GAM	Initials
Comments: Data validation qualifiers override assigned laboratory flags.						
11. Were laboratory blank samples free of target analyte contamination?		Yes	**X**	No	GAM	Initials
Comments: All laboratory blanks were free of target compound contamination at the detection limits with the following exception. Method GC-EPH (SDG UY78): C8-C10 Aliphatics were detected in the method blank associated with sample CBA-SB-8-1-3-0512, extracted on 05/15/12, at a concentration greater than the reporting limit. **The positive C8-C10 Aliphatics result for sample CBA-SB-8-1-3-0512 was less than five times the method blank level and was qualified "U," as undetected, because of laboratory contamination.** Refer to the Table of Qualified Analytical Results (page 5) for a listing of the samples, analytes, and concentrations qualified.						
12. Were trip blank, field blank, and/or equipment rinse blank samples free of target analyte contamination?	**X**	Yes		No	GAM	Initials
Comments: The trip blank samples were free of target analyte contamination or were associated with undetected sample results. Field blank and equipment rinse blank samples were not submitted for analysis.						

13. Were instrument calibrations within method control limits?	NA	Yes	NA	No	GAM	Initials
Comments: Not applicable for this level of data validation – Instrument calibration data were not supplied in analytical laboratory reports and were therefore not included in this data review.						
14. Were surrogate recoveries within control limits?		Yes	**X**	No	GAM	Initials
Comments: Surrogate %Rs for organic analyses were within data verification and/or laboratory control-charted QC limits all samples and associated QC samples, or met the following requirements, except as noted. High surrogate %Rs associated with undetected target analyte results did not initiate data qualification since the indicated high bias was not realized. Non-volatile surrogate recoveries affected by required sample dilution did not require qualification, because extraction/analytical efficiency was demonstrated in associated blank or LCS spike surrogate %Rs. Nonconforming surrogate %Rs in laboratory QC samples did not initiate qualification of project samples as long as surrogate %Rs in project samples were acceptable. Method MWTPHG (SDG UT78): The bromobenzene surrogate recoveries for samples CBA-SB-2-0.5-2.5-0512 and CBA-SB-20-0.5-2.5-0512 were greater than the upper quality control limit. **The positive gasoline (GRO) results for samples CBA-SB-2-0.5-2.5-0512 and CBA-SB-20-0.5-2.5-0512 were qualified "J," as estimated concentrations, because of high bias attributable to matrix effects.** Refer to the Table of Qualified Analytical Results (page 5) for a listing of the samples, analytes, and concentrations qualified.						
15. Were laboratory control sample recoveries within control limits?	**X**	Yes		No	GAM	Initials
Comments: LCS and LCSD (blank spike) recoveries were within data validation or laboratory control-charted QC limits for all target analytes.						
16. Were matrix spike recoveries within control limits?	**X**	Yes		No	GAM	Initials
Comments: Project specific MS and MSD recoveries for target analytes were within data verification QC limits (75-125% for metals; 50-150% for general chemistry) or were within laboratory control charted QC limits (all other methods), or else spike %Rs were not applicable due to native sample concentrations that exceeded four times the spiked amount, except as noted. Note in that in some instances, MS/MSD data was not reported, however, LCS and/or LCSD data were reported instead to demonstrate analytical accuracy and/or precision. No action is required for this level of review other than to note this observation.						
17. Were RPDs within control limits?	**X**	Yes		No	GAM	Initials
Comments: Laboratory RPDs for target analytes in LCS/LCSD and project-specific MS/MSD samples were within data validation control limits						
18. Were organic system performance criteria met?	NA	Yes	NA	No	GAM	Initials
Comments: Not applicable for this level of data validation – Organic system performance data were not supplied in the analytical laboratory reports and were therefore not included in this data review.						
19. Were internal standards within method criteria for GC/MS sample analyses?	NA	Yes	NA	No	GAM	Initials
Comments: Not applicable for this level of data validation – GC/MS internal standard data were not supplied in the analytical laboratory reports and were therefore not included in this data review.						
20. Were inorganic system performance criteria met?	NA	Yes	NA	No	GAM	Initials
Comments: Not applicable for this level of data validation – Inorganic system performance data were not supplied in the analytical laboratory reports and were therefore not included in this data review.						

21. Were blind field duplicates collected? If so, discuss the precision (RPD) of the results.	X	Yes		No	GAM	Initials

Duplicate Sample No.	CWSB-170-23-25-0512	Primary Sample No.	CWSB-17-23-25-0512
Duplicate Sample No.	CBA-SB-20-0.5-2.5-0512	Primary Sample No.	CBA-SB-2-0.5-2.5-0512
Duplicate Sample No.	CBA-SB-50-3-5-0512	Primary Sample No.	CBA-SB-5-3-5-0512
Duplicate Sample No.	CBA-SB-80-3-5-0512	Primary Sample No.	CBA-SB-8-3-5-0512

Comments: The RPDs for the duplicates were within the 0-50% data validation QC limits for soil samples, or RPDs were not applicable due to results that were ± twice the reporting limit or were undetected in both samples. Details are provided in the tables below.

Laboratory/field sampling precision and sample homogeneity were acceptable. No data qualifications were required.

Method	Analyte	CWSB-17-23-25-0512	CWSB-170-23-25-0512	RPD	Qualifier	Samp RL	Dup RL	Units
Plumb	Total Organic Carbon	0.549	0.393	33		0.020	0.020	%
2540B	Total Solids	77.90	78.50	0.8		0.01	0.01	%

Method	Analyte	CBA-SB-2-0.5-2.5-0512	CBA-SB-20-0.5-2.5-0512	RPD	Qualifier	Samp RL	Dup RL	Units
NWTPHG	Gasoline	670	540	21		7.2	6.9	mg/kg
NWTPHD	Diesel Range	6600	5500	18		300	300	mg/kg
NWTPHD	Motor Oil Range	1800	1400	25		600	600	mg/kg
2540B	Total Solids	82.90	84.60	2		0.01	0.01	%

Method	Analyte	CBA-SB-5-3-5-0512	CBA-SB-50-3-5-0512	RPD	Qualifier	Samp RL	Dup RL	Units
NWTPHG	Gasoline	12	6.2 U	NC	±2RL	7.3	6.2	mg/kg
NWTPHD	Diesel Range	10	9.8	2		6.2	5.8	mg/kg
2540B	Total Solids	80.50	84.00	4		0.01	0.01	%

Method	Analyte	CBA-SB-8-3-5-0512	CBA-SB-80-3-5-0512	RPD	Qualifier	Samp RL	Dup RL	Units
NWTPHG	Gasoline	63	43	38		11	11	mg/kg
NWTPHD	Diesel Range	650	560	15		35	36	mg/kg
NWTPHD	Motor Oil Range	1200	960	22		71	71	mg/kg
Plumb	Total Organic Carbon	2.55	2.44	4		0.020	0.020	%
2540B	Total Solids	68.40	72.30	6		0.01	0.01	%

22. Were qualitative criteria for organic target analyte identification met?	X	Yes		No	GAM	Initials

Comments: GC/MS and GC quantitation reports and chromatograms were reviewed by trained laboratory personnel in accordance with the laboratory's internal QA/QC program. There were no identification flags assigned by the laboratory other than those noted below.

Method NWTPHG (All SDGs): The laboratory noted that several gasoline results reported in soil samples represented positive results that did not match the chromatographic gasoline pattern. Some sample chromatograms were provided by the laboratory, but no standard chromatograms were submitted so comparisons of sample to standard patterns could not be conducted. Although the analyte is listed as "gasoline" in the laboratory report pages, the submitted EDD query correctly lists the analyte name as "Gasoline Range Hydrocarbons" to correctly encompass not only gasoline, but other co-eluting/interfering compounds found within the target carbon range. No action is required other than to note this observation since the database contains the correct information.

Method NWTPHD (All SDGs): The laboratory noted that the diesel and/or motor oil results reported for some samples were affected by unidentifiable organics and/or hydrocarbons within the specified range. Although supporting documentation to fully evaluate the laboratory comments cannot be made with this level of report deliverable, professional judgment determines to uphold the laboratory assessment.

Diesel is listed as "diesel" in the laboratory report pages, but the submitted EDD query correctly lists the analyte name as "Diesel Range Hydrocarbons" to correctly encompass not only diesel, but other co-eluting/interfering compounds found within the target range of C_{10}-C_{25}. No action is required for the diesel data other than to note this observation because the database contains the correct target analyte determination.

The EDD however does list the motor oil result as "motor oil" in both the laboratory report and in the database. **Positive motor oil results in samples CBA-SB-1-1.5-2.5-0512, CBA-1-3-5-0512, CBA-2-0.5-2.5-0512, CBA-SB-20-0.5-2.5-0512, and CBA-SB-2-3-5-0512 require "NJ" qualifiers to indicate tentative identification and estimated quantitation due to pattern match discrepancies and possible interference from non-target analytes within the designated range of C_{24}-C_{38}.**

Refer to the Table of Qualified Analytical Results (page 5) for a listing of the samples, analytes, and concentrations qualified.

23. Were 100% of the EDD concentrations and reporting limits compared to the hardcopy data reports?	X	Yes		No	GAM	Initials

Comments: The EDD entries were resolved with the hardcopy data results and corrected as necessary. According to validation protocol, the hardcopy data report was accepted as the correct reference. Qualifiers and Reason Codes were added to the EDD files. The EDD files were formatted for EQuIS upload and uploaded to the database by the database administrator.

24. General Comments: Data were evaluated based on validation criteria set forth in the *USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic/Inorganic Data Review*, document numbers EPA540/R-99/008 and EPA540/R-04/004 of October 1999 (Organic) and October 2004 (Inorganic), and the *USEPA CLP National Functional Guidelines for Superfund Organic Methods Data Review*, document number USEPA-540-R-07-003, July 2007, as they applied to the reported methodology. Washington State Department of Ecology (WDOE) methods were reviewed as per *WDOE Analytical Methods for Petroleum Hydrocarbons*, ECY 97-602 of June 1997. Field duplicate RPD control limits were taken from the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, December 1996.

Refer to the Table of Qualified Analytical Results (page 5) for a listing of the samples, analytes, and concentrations qualified.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

18 May 2012

Jason Palmer
AECOM, Inc.
710 2nd Avenue
Suite 1000
Seattle, WA 98104

RE: Client Project: Central Waterfront
ARI Job No.: UT77

Dear Jason:

Please find enclosed the original chain of custody records and the final results for samples from the project referenced above. Analytical Resources, Inc accepted nineteen soil samples and one trip blank on May 9, 20112. The samples were analyzed for NWTPH-G, NWTPH-Dx and TOC as requested.

The percent recoveries for the surrogate, bromobenzene, were high following the initial NWTPH-G analyses of samples CWSB-16-8-10-0512 and CWSB-17-6-8-0512. This was due to co-elution with an interference. Both samples were diluted and re-analyzed. The percent recoveries for all surrogates were within established QC limits for the dilutions. The results for both analyses have been submitted for these samples.

The remaining analyses proceeded without incident of note.

A copy of these reports and all raw data will be kept on file at ARI. Should you have any questions regarding these results, please feel free to call me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Mark D. Harris
Project Manager
206/695-6210
<markh@arilabs.com>

Enclosures

cc: file UT77

MDH/mdh

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: UT77	Turn-around Requested: Standard	Page: 1 of 4	
ARI Client Company: AECOM	Phone: 206 624 9349	Date: 5/7/12	Ice Present? Y
Client Contact: Jason Palmer		No. of Coolers: 4	Cooler Temps: 3.8, 0.9, 1.6, 1.2
Client Project Name: Central Waterfront			
Client Project #:	Samplers: Renee Knecht/Aaron Timbrook/Eric Martelli		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: NWTPH-Dx	NWTPH-G	% TOC	EPH	VPH	SIM-BTEX	SVOCs		Notes/Comments
CWSB-13-14.0-14.5-0512	5/7/12	10:10	SO	5	X	X	X						
CWSB-13-21-22-0512		1055	SO	5	X	X	X						Do Not analyze TOC - Archive
CWSB-13-25-27-0512		1110	SO	5	X	X	X						Archive TOC
CWSB-13-28-30-0512		1130	SO	5	X	X	X						Archive
CWSB-14-12-14-0512		1210	SO	12	X	X	X	X	X	X	X		DO NOT RUN EPH/VPH/BTEX/SVOCs
CWSB-14-25-27-0512		1330	SO	5	X	X	X						
CWSB-14-29-30-0512		1335	SO	5	X	X	X						
CWSB-15-11-13-0512		1430	SO	5	X	X	X						Archive TOC
CWSB-15-23-25-0512		1530	SO	5	X	X	X						Archive TOC
CWSB-15-18-20-0512		1445	SO	5	X	X	X						

Comments/Special Instructions	Relinquished by (Signature)	Received by (Signature)	Relinquished by (Signature)	Received by (Signature)
	Printed Name: Renee Knecht	Printed Name: Jennifer Millsap	Printed Name:	Printed Name:
	Company: AECOM	Company: ARI	Company:	Company
	Date & Time: 5/9/12 1015	Date & Time: 5/9/12 1015	Date & Time	Date & Time.

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: UT77	Turn-around Requested: Standard
ARI Client Company: AECOM	Phone: 206.624.9349
Client Contact: Jason Palmer	
Client Project Name: Central Water Front	
Client Project #:	Samplers:
Page: 2 of 4	
Date: 5/7/12	Ice Present? Y
No. of Coolers: 4	Cooler Temps: 3.8, 0.9, 1.6, 1.2

Sample ID	Date	Time	Matrix	No. Containers	NWTPH-Dx	NWTPH-G	TOC	EPH	VPH	SIM-BTEX	SVOCs		Notes/Comments
CWSB-15-29-30-0512	5/7/12	1540	SO	5	x	x	x						Archive
CWSB-16-8-10 0512	↓	1620	SO	5	x	x	X						
CWSB-16-13-15-0512	↓	1700	SO	5	x	x	X						
CWSB-16-18-20-0512	↓	1720	SO	5	x	x	x						Archive TOC
CWSB-16-23-25-0512	↓	1741	SO	5	x	x	x						Archive
CWSB-17-6-8-0512	5/8/12	0830	SO	12	x	x	x	x	x	x	x		Do NOT analysis EPH/VPH/BTEX/SVOCs
CWSB-17-23-25-0512	↓	0945	SO	5	x	x	X						
CWSB-17-28-30-0512	↓	1010	SO	5	x	X	X						
TB-050712	5/2/12	–	W	1									
CWSB-170-23-25-0512	5/8/12	0845	SO	5	x	x	X						

Comments/Special Instructions:

	Relinquished by	Received by	Relinquished by	Received by
(Signature)	[signature]	[signature]		
Printed Name	Renee Knecht	Jennifer Milsap		
Company	AECOM	ARI		
Date & Time	5/9/12 1015	5/9/12 1015		

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: AECOM Project Name: Central Waterfront

COC No(s): _____ (NA) Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: _____

Assigned ARI Job No: UTT7 Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES (NO)

Were custody papers included with the cooler? (YES) NO

Were custody papers properly filled out (ink, signed, etc) (YES) NO

Temperature of Cooler(s) (°C) (recommended 2.0-6 0 °C for chemistry): 3.8 0.9 1.6 1.2

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID#: 90877952

Cooler Accepted by: JM Date: 5/9/12 Time: 1015

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES (NO)

What kind of packing material was used? (Bubble Wrap) (Wet Ice) Gel Packs (Baggies) Foam Block Paper Other: _____

Was sufficient ice used (if appropriate)? NA (YES) NO

Were all bottles sealed in individual plastic bags? YES (NO)

Did all bottles arrive in good condition (unbroken)? (YES) NO

Were all bottle labels complete and legible? (YES) NO

Did the number of containers listed on COC match with the number of containers received? YES (NO)

Did all bottle labels and tags agree with custody papers? (YES) NO

Were all bottles used correct for the requested analyses? (YES) NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) (NA) YES NO

Were all VOC vials free of air bubbles? NA YES (NO)

Was sufficient amount of sample sent in each bottle? (YES) NO

Date VOC Trip Blank was made at ARI: (NA) _____

Was Sample Split by ARI: (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by: JM Date: 5/9/12 Time: _____

*** Notify Project Manager of discrepancies or concerns ***

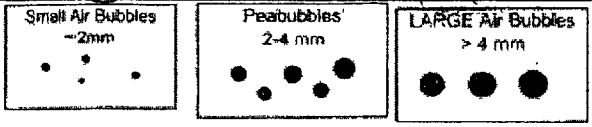
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

CWSB-17-6-8-0512 has 11 containers not 12.

TB-050712 = sm in 6 of 6

By: JM Date: 5/9/12



Small → "sm"	
Peabubbles → "pb"	
Large → "lg"	
Headspace → "hs"	

UTT7 : 00004

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UT77
Client: AECOM
Project Event: N/A
Project Name: Central Waterfront

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	CWSB-13-14.0-14.5-0512	UT77A	12-8459	Soil	05/07/12 10:10	05/09/12 10:15
2.	CWSB-13-21-22-0512	UT77B	12-8460	Soil	05/07/12 10:55	05/09/12 10:15
3.	CWSB-13-25-27-0512	UT77C	12-8461	Soil	05/07/12 11:10	05/09/12 10:15
4.	CWSB-13-28-30-0512	UT77D	12-8462	Soil	05/07/12 11:30	05/09/12 10:15
5.	CWSB-14-12-14-0512	UT77E	12-8463	Soil	05/07/12 12:10	05/09/12 10:15
6.	CWSB-14-25-27-0512	UT77F	12-8464	Soil	05/07/12 13:30	05/09/12 10:15
7.	CWSB-14-29-30-0512	UT77G	12-8465	Soil	05/07/12 13:35	05/09/12 10:15
8.	CWSB-15-11-13-0512	UT77H	12-8466	Soil	05/07/12 14:30	05/09/12 10:15
9.	CWSB-15-23-25-0512	UT77I	12-8467	Soil	05/07/12 15:30	05/09/12 10:15
10.	CWSB-15-18-20-0512	UT77J	12-8468	Soil	05/07/12 14:45	05/09/12 10:15
11.	CWSB-15-29-30-0512	UT77K	12-8469	Soil	05/07/12 15:40	05/09/12 10:15
12.	CWSB-16-8-10-0512	UT77L	12-8470	Soil	05/07/12 16:20	05/09/12 10:15
13.	CWSB-16-13-15-0512	UT77M	12-8471	Soil	05/07/12 17:00	05/09/12 10:15
14.	CWSB-16-18-20-0512	UT77N	12-8472	Soil	05/07/12 17:20	05/09/12 10:15
15.	CWSB-16-23-25-0512	UT77O	12-8473	Soil	05/07/12 17:41	05/09/12 10:15
16.	CWSB-17-6-8-0512	UT77P	12-8474	Soil	05/08/12 08:30	05/09/12 10:15
17.	CWSB-17-23-25-0512	UT77Q	12-8475	Soil	05/08/12 09:45	05/09/12 10:15
18.	CWSB-17-28-30-0512	UT77R	12-8476	Soil	05/08/12 10:10	05/09/12 10:15
19.	CWSB-170-23-25-0512	UT77S	12-8477	Soil	05/08/12 08:45	05/09/12 10:15
20.	TB-050712	UT77T	12-8478	Water	05/07/12	05/09/12 10:15

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.

F Samples were frozen prior to particle size determination

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	Basis	Range	Result
MB-051012	Method Blank	05/10/12	Dry	Gasoline	< 5.0 U
12-8459		PID2		HC ID	---
				Trifluorotoluene	99.9%
				Bromobenzene	99.2%
UT77A	CWSB-13-14.0-14.5-0512	05/10/12	Dry	Gasoline	< 6.2 U
12-8459		PID2		HC ID	---
				Trifluorotoluene	94.3%
				Bromobenzene	92.3%
UT77B	CWSB-13-21-22-0512	05/10/12	Dry	Gasoline	< 6.5 U
12-8460		PID2		HC ID	---
				Trifluorotoluene	101%
				Bromobenzene	98.5%
UT77C	CWSB-13-25-27-0512	05/10/12	Dry	Gasoline	< 6.8 U
12-8461		PID2		HC ID	---
				Trifluorotoluene	102%
				Bromobenzene	101%
UT77E	CWSB-14-12-14-0512	05/10/12	Dry	**Gasoline**	**370**
12-8463		PID2		HC ID	GRO
				Trifluorotoluene	100%
				Bromobenzene	122%
UT77F	CWSB-14-25-27-0512	05/10/12	Dry	Gasoline	< 9.2 U
12-8464		PID2		HC ID	---
				Trifluorotoluene	95.3%
				Bromobenzene	95.4%
UT77G	CWSB-14-29-30-0512	05/10/12	Dry	Gasoline	< 8.1 U
12-8465		PID2		HC ID	---
				Trifluorotoluene	94.8%
				Bromobenzene	95.8%
UT77H	CWSB-15-11-13-0512	05/10/12	Dry	**Gasoline**	**17**
12-8466		PID2		HC ID	GRO
				Trifluorotoluene	98.6%
				Bromobenzene	99.6%
UT77I	CWSB-15-23-25-0512	05/10/12	Dry	Gasoline	< 7.1 U
12-8467		PID2		HC ID	---
				Trifluorotoluene	101%
				Bromobenzene	101%
UT77J	CWSB-15-18-20-0512	05/10/12	Dry	Gasoline	< 6.4 U
12-8468		PID2		HC ID	---
				Trifluorotoluene	94.8%
				Bromobenzene	95.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	Basis	Range	Result
MB-051112	Method Blank	05/11/12	Dry	Gasoline	< 5.0 U
12-8470		PID2		HC ID	---
				Trifluorotoluene	101%
				Bromobenzene	102%
UT77L	CWSB-16-8-10-0512	05/10/12	Dry	**Gasoline**	**2200 E**
12-8470		PID2		HC ID	GAS/GRO
				Trifluorotoluene	99.4%
				Bromobenzene	146%
UT77L DL	CWSB-16-8-10-0512	05/11/12	Dry	**Gasoline**	**4200**
12-8470		PID2		HC ID	GAS/GRO
				Trifluorotoluene	103%
				Bromobenzene	121%
UT77M	CWSB-16-13-15-0512	05/10/12	Dry	Gasoline	< 7.6 U
12-8471		PID2		HC ID	---
				Trifluorotoluene	94.5%
				Bromobenzene	96.5%
UT77N	CWSB-16-18-20-0512	05/10/12	Dry	Gasoline	< 7.0 U
12-8472		PID2		HC ID	---
				Trifluorotoluene	98.8%
				Bromobenzene	101%
UT77P	CWSB-17-6-8-0512	05/11/12	Dry	**Gasoline**	**2200 E**
12-8474		PID2		HC ID	GAS/GRO
				Trifluorotoluene	102%
				Bromobenzene	170%
UT77P DL	CWSB-17-6-8-0512	05/11/12	Dry	**Gasoline**	**3700**
12-8474		PID2		HC ID	GAS/GRO
				Trifluorotoluene	103%
				Bromobenzene	123%
UT77Q	CWSB-17-23-25-0512	05/10/12	Dry	Gasoline	< 7.6 U
12-8475		PID2		HC ID	---
				Trifluorotoluene	91.2%
				Bromobenzene	93.5%
UT77R	CWSB-17-28-30-0512	05/10/12	Dry	Gasoline	< 6.9 U
12-8476		PID2		HC ID	---
				Trifluorotoluene	97.4%
				Bromobenzene	100%
UT77S	CWSB-170-23-25-0512	05/10/12	Dry	Gasoline	< 7.1 U
12-8477		PID2		HC ID	---
				Trifluorotoluene	98.2%
				Bromobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	Basis	Range	Result

Gasoline values reported in mg/kg (ppm)

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: CWSB-13-14.0-14.5-0512
MATRIX SPIKE

Lab Sample ID: UT77A
LIMS ID: 12-8459
Matrix: Soil
Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Date Analyzed MS: 05/10/12 22:58
MSD: 05/10/12 23:26
Instrument/Analyst MS: PID2/JLW
MSD: PID2/JLW

Purge Volume: 5.0 mL

Sample Amount MS: 80.9 mg-dry-wt
MSD: 80.9 mg-dry-wt

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Gasoline Range Hydrocarbons	< 6.18 U	69.2	51.8	134%	67.0	51.8	129%	3.2%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	MS	MSD
Trifluorotoluene	101%	100%
Bromobenzene	101%	99.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG

Sample ID: LCS-051012
LAB CONTROL SAMPLE

Lab Sample ID: LCS-051012
LIMS ID: 12-8459
Matrix: Soil
Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/10/12 13:13
LCSD: 05/10/12 13:41
Instrument/Analyst LCS: PID2/JLW
LCSD: PID2/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	47.3	50.0	94.6%	51.8	50.0	104%	9.1%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	98.8%	91.6%
Bromobenzene	96.6%	93.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-051112
LAB CONTROL SAMPLE

Lab Sample ID: LCS-051112
LIMS ID: 12-8470
Matrix: Soil
Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/11/12 11:23
LCSD: 05/11/12 11:51
Instrument/Analyst LCS: PID2/JLW
LCSD: PID2/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	57.2	50.0	114%	52.0	50.0	104%	9.5%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	93.0%	104%
Bromobenzene	90.8%	102%

ANALYTICAL RESOURCES INCORPORATED

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: UT77
Matrix: Soil

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-051012	NA	99.9%	99.2%	0
LCS-051012	NA	98.8%	96.6%	0
LCSD-051012	NA	91.6%	93.9%	0
CWSB-13-14.0-14.5-0512	NA	94.3%	92.3%	0
CWSB-13-14.0-14.5-0512 MS	NA	101%	101%	0
CWSB-13-14.0-14.5-0512 MSD	NA	100%	99.2%	0
CWSB-13-21-22-0512	NA	101%	98.5%	0
CWSB-13-25-27-0512	NA	102%	101%	0
CWSB-14-12-14-0512	NA	100%	122%	0
CWSB-14-25-27-0512	NA	95.3%	95.4%	0
CWSB-14-29-30-0512	NA	94.8%	95.8%	0
CWSB-15-11-13-0512	NA	98.6%	99.6%	0
CWSB-15-23-25-0512	NA	101%	101%	0
CWSB-15-18-20-0512	NA	94.8%	95.1%	0
MB-051112	NA	101%	102%	0
LCS-051112	NA	93.0%	90.8%	0
LCSD-051112	NA	104%	102%	0
CWSB-16-8-10-0512	NA	99.4%	146%*	1
CWSB-16-8-10-0512 DL	NA	103%	121%	0
CWSB-16-13-15-0512	NA	94.5%	96.5%	0
CWSB-16-18-20-0512	NA	98.8%	101%	0
CWSB-17-6-8-0512	NA	102%	170%*	1
CWSB-17-6-8-0512 DL	NA	103%	123%	0
CWSB-17-23-25-0512	NA	91.2%	93.5%	0
CWSB-17-28-30-0512	NA	97.4%	100%	0
CWSB-170-23-25-0512	NA	98.2%	102%	0

	LCS/MB LIMITS	QC LIMITS
(BFB) = Bromofluorobenzene	(70-130)	(70-130)
(TFT) = Trifluorotoluene	(80-120)	(66-123)
(BBZ) = Bromobenzene	(80-120)	(62-130)

Log Number Range: 12-8459 to 12-8477

FORM II TPHG

Data File: /chem3/pid2.i/051112-1.b/0511a006.d

Date : 11-MAY-2012 12:19

Client ID:

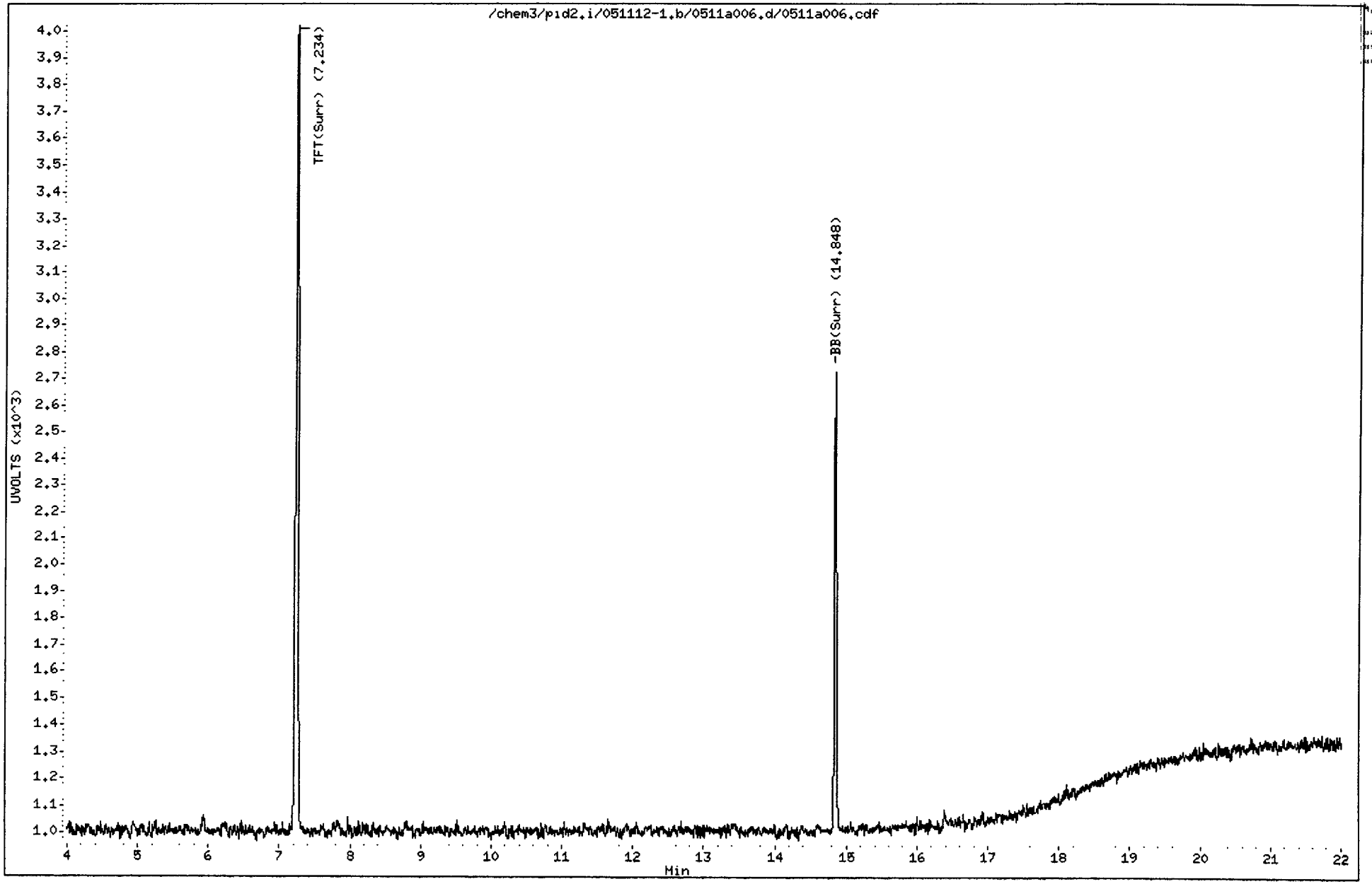
Sample Info: MB0511

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

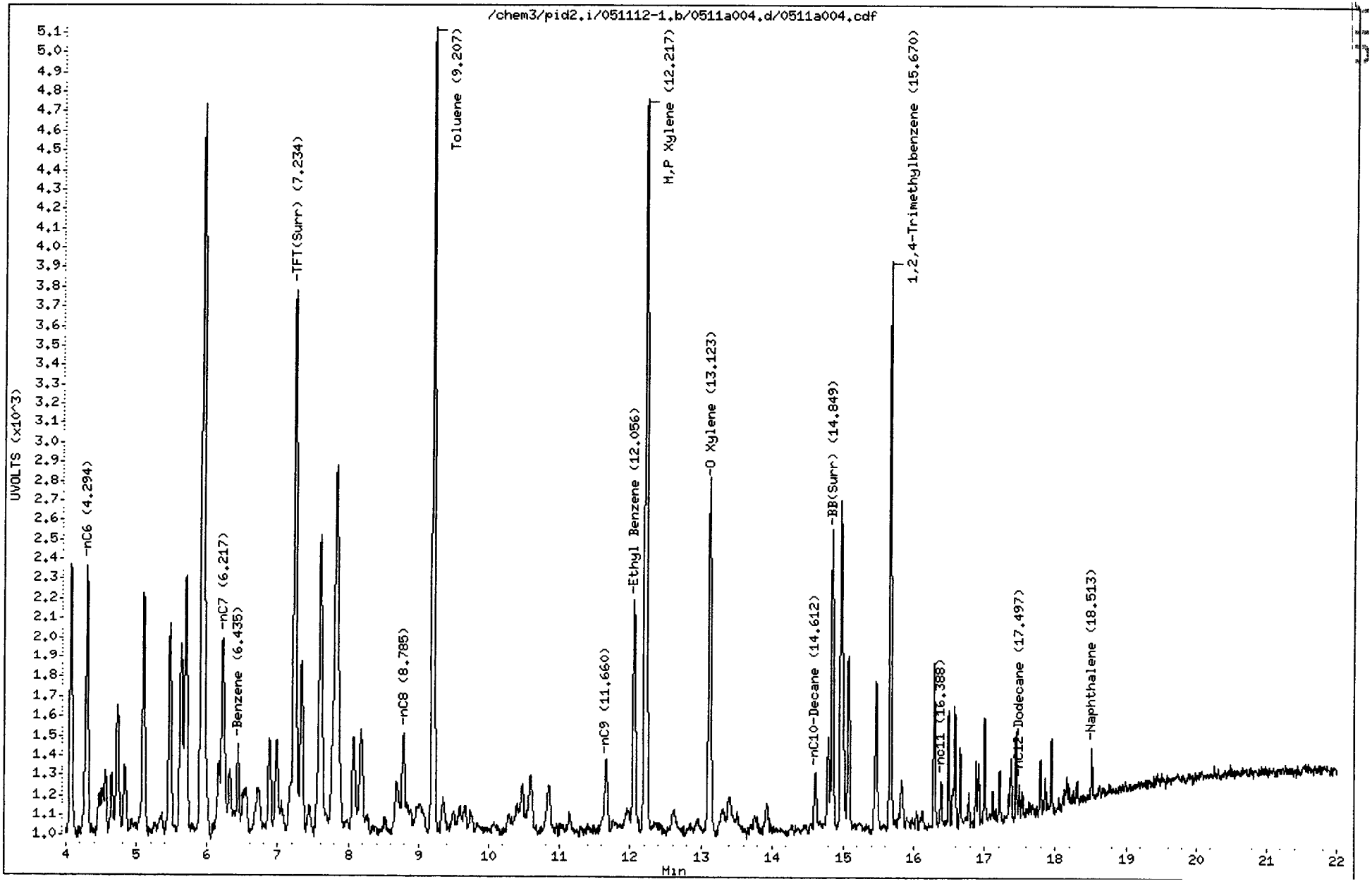
Column diameter: 0.18

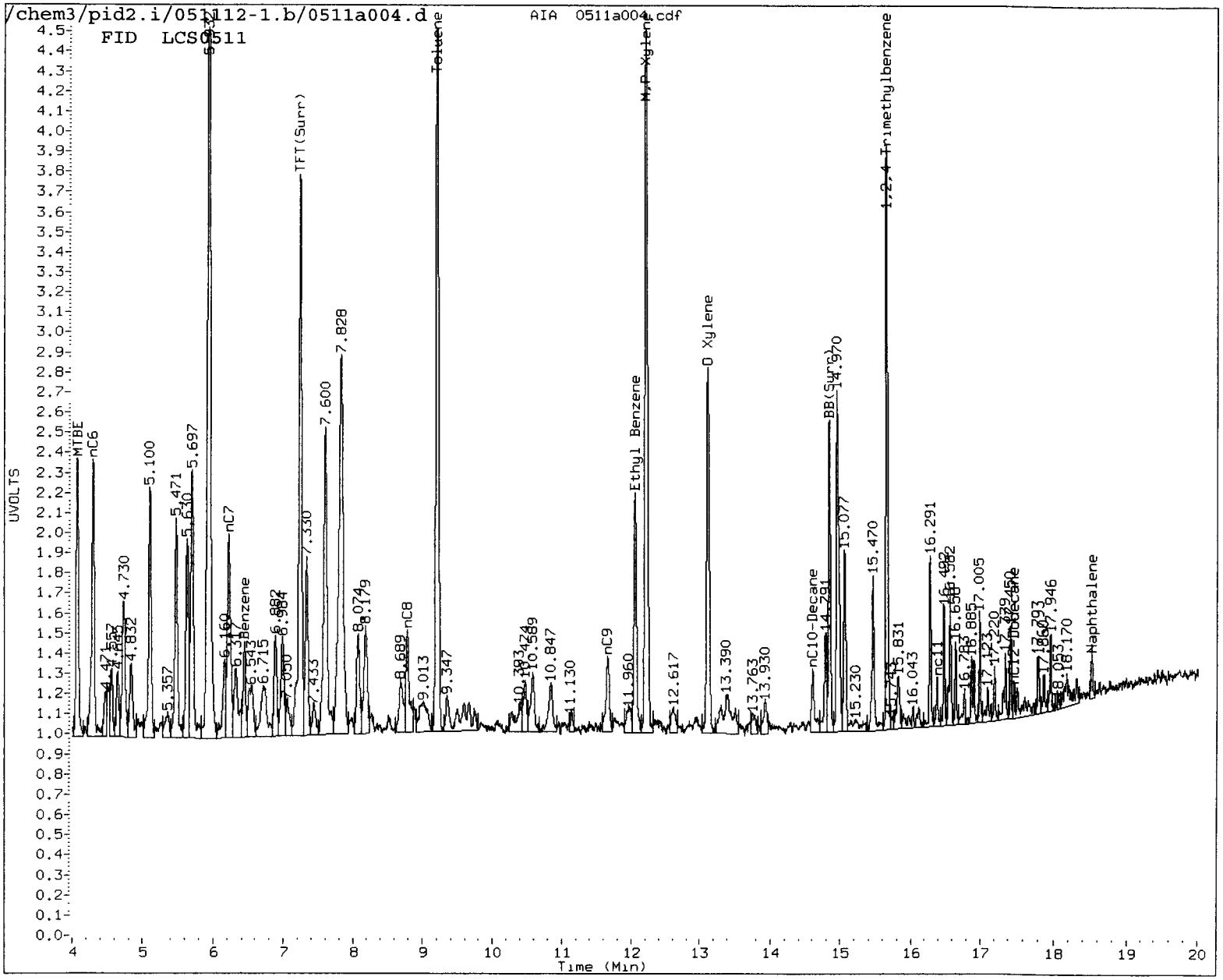


Data File: /chem3/pid2.i/051112-1.b/0511a004.d
Date : 11-MAY-2012 11:23
Client ID:
Sample Info: LCS0511

Instrument: pid2.i

Operator: JW
Column phase: RTX 502-2 FID
Column diameter: 0.18





MANUAL INTEGRATION

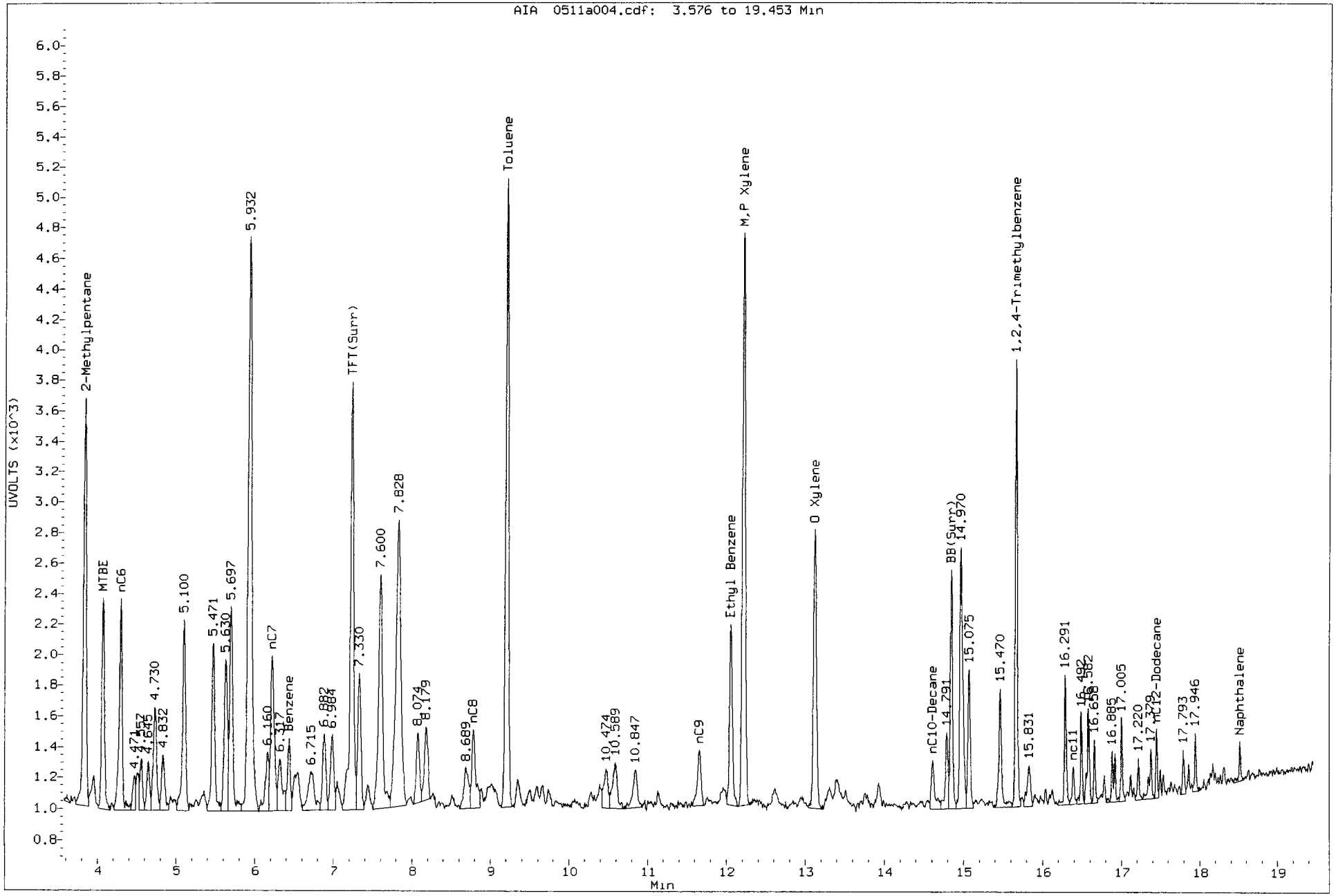
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/14/12

Data File: /chem3/pid2.i/051112-1.b/0511a004.d/0511a004.cdf
Injection Date: 11-MAY-2012 11:23
Instrument: pid2.i
Client Sample ID:

Before
5/14/12



Data File: /chem3/pid2.i/051112-1.b/0511a005.d

Date : 11-MAY-2012 11:51

Client ID:

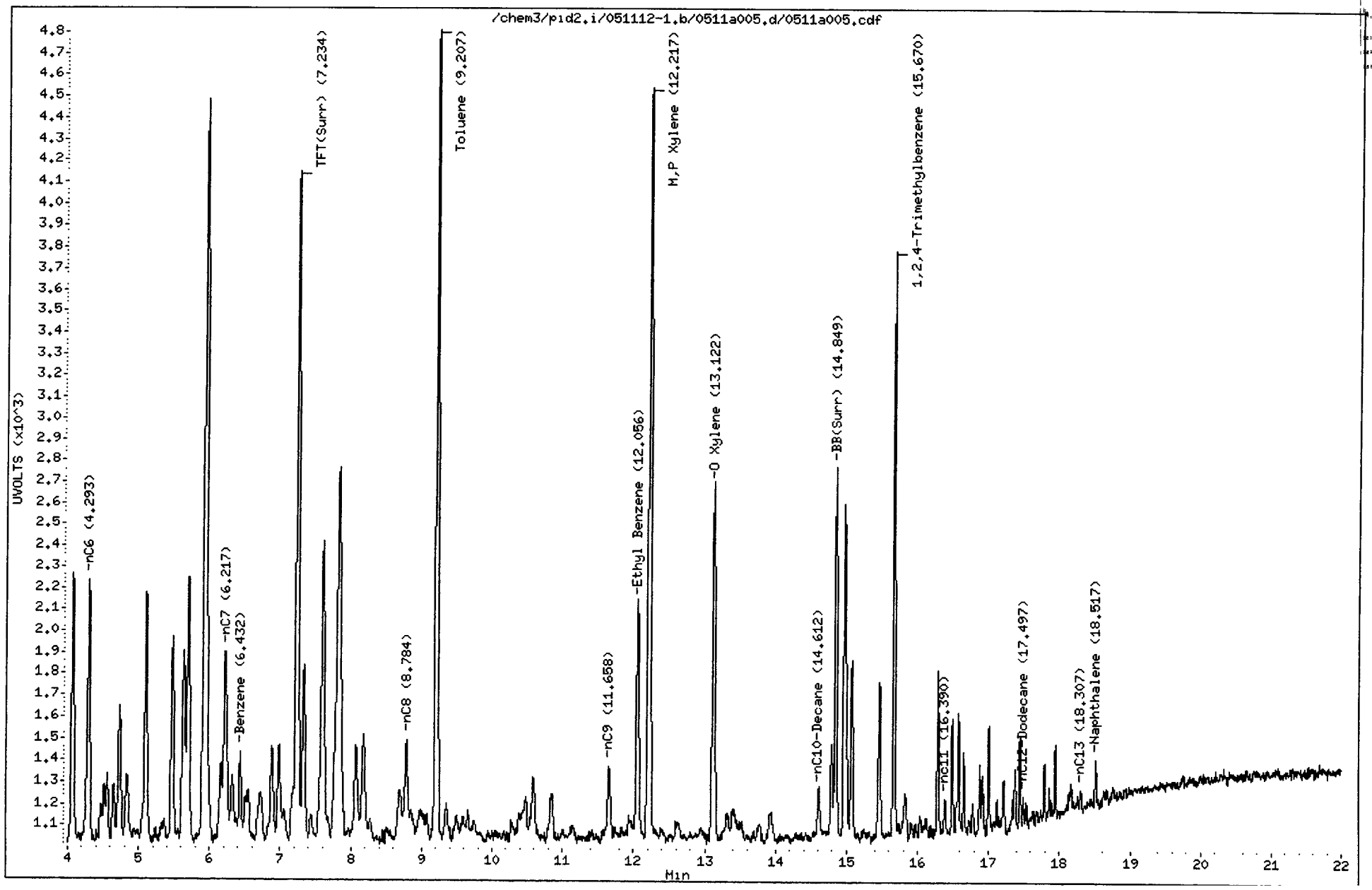
Sample Info: LCSD0511

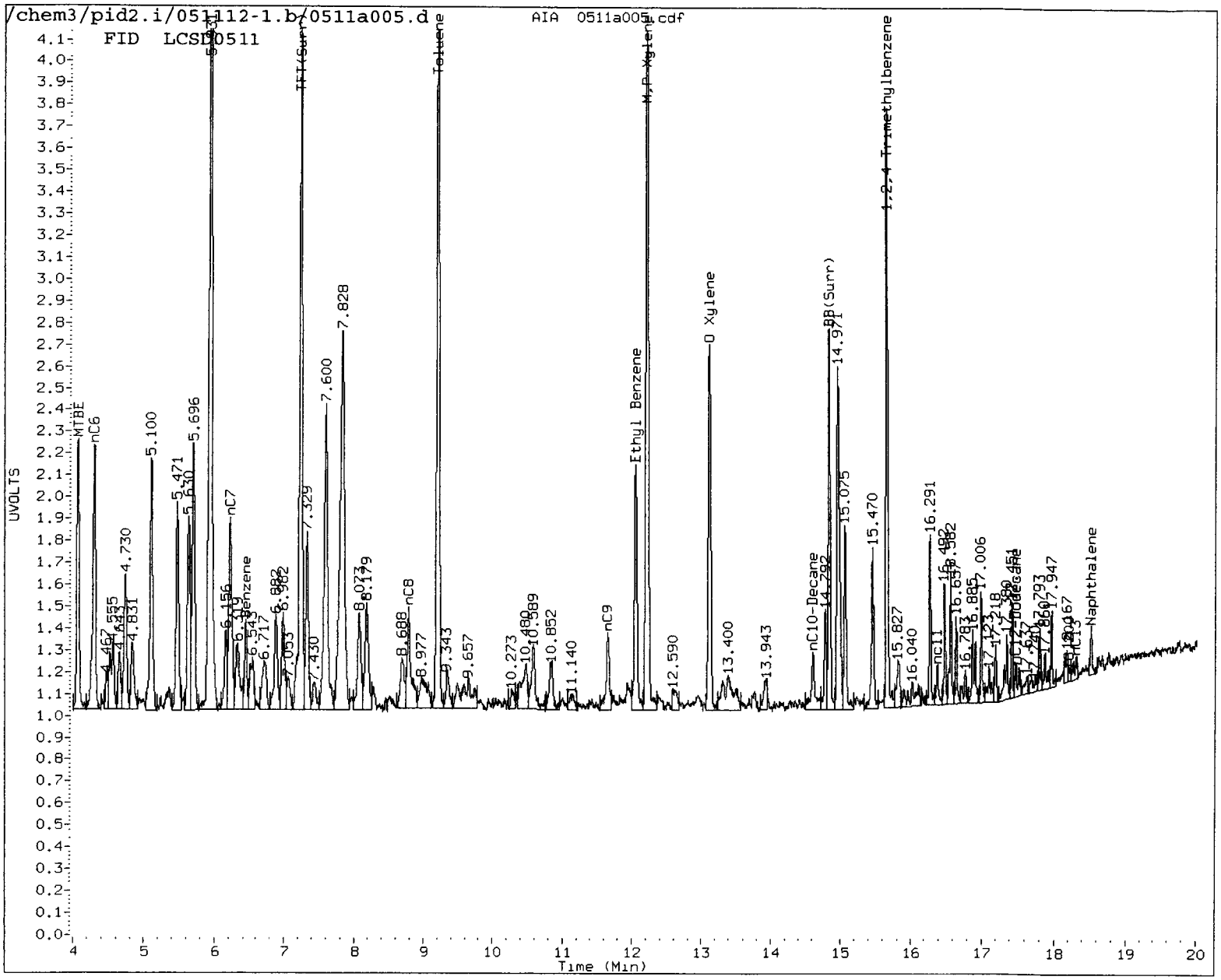
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

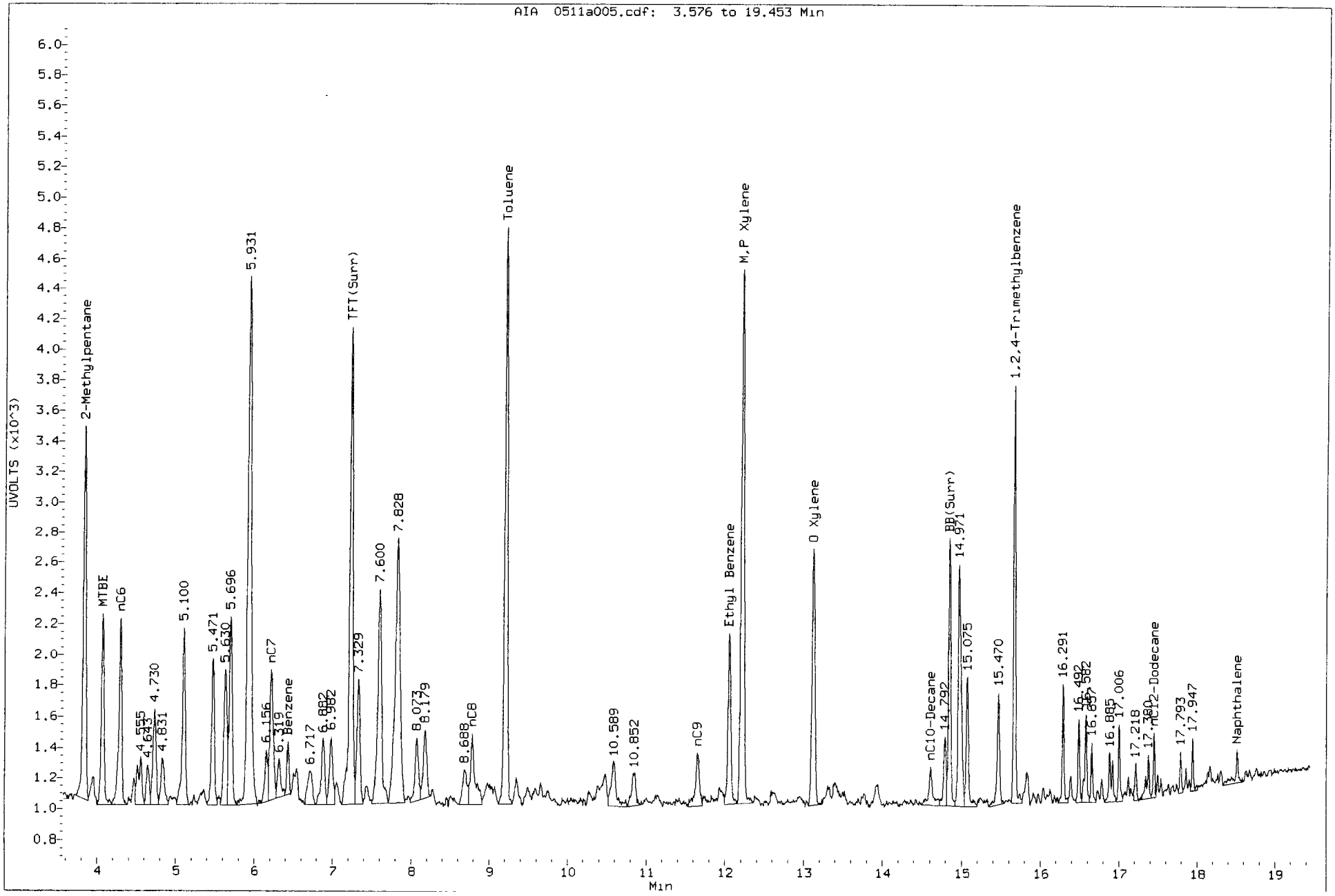
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/14/12

Before
JW
5/14/12

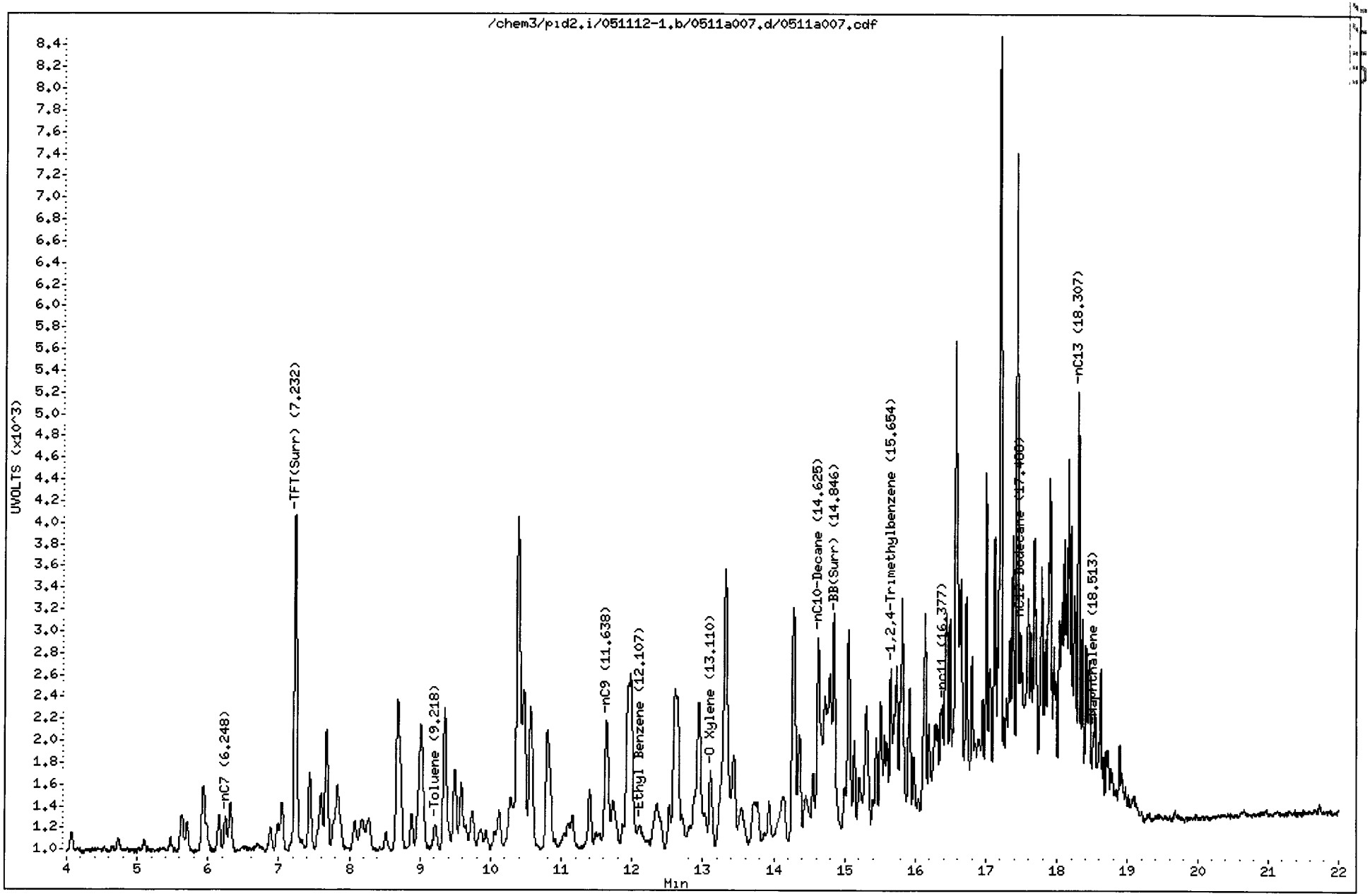
Data File: /chem3/pid2.i/051112-1.b/0511a005.d/0511a005.cdf
Injection Date: 11-MAY-2012 11:51
Instrument: pid2.i
Client Sample ID:

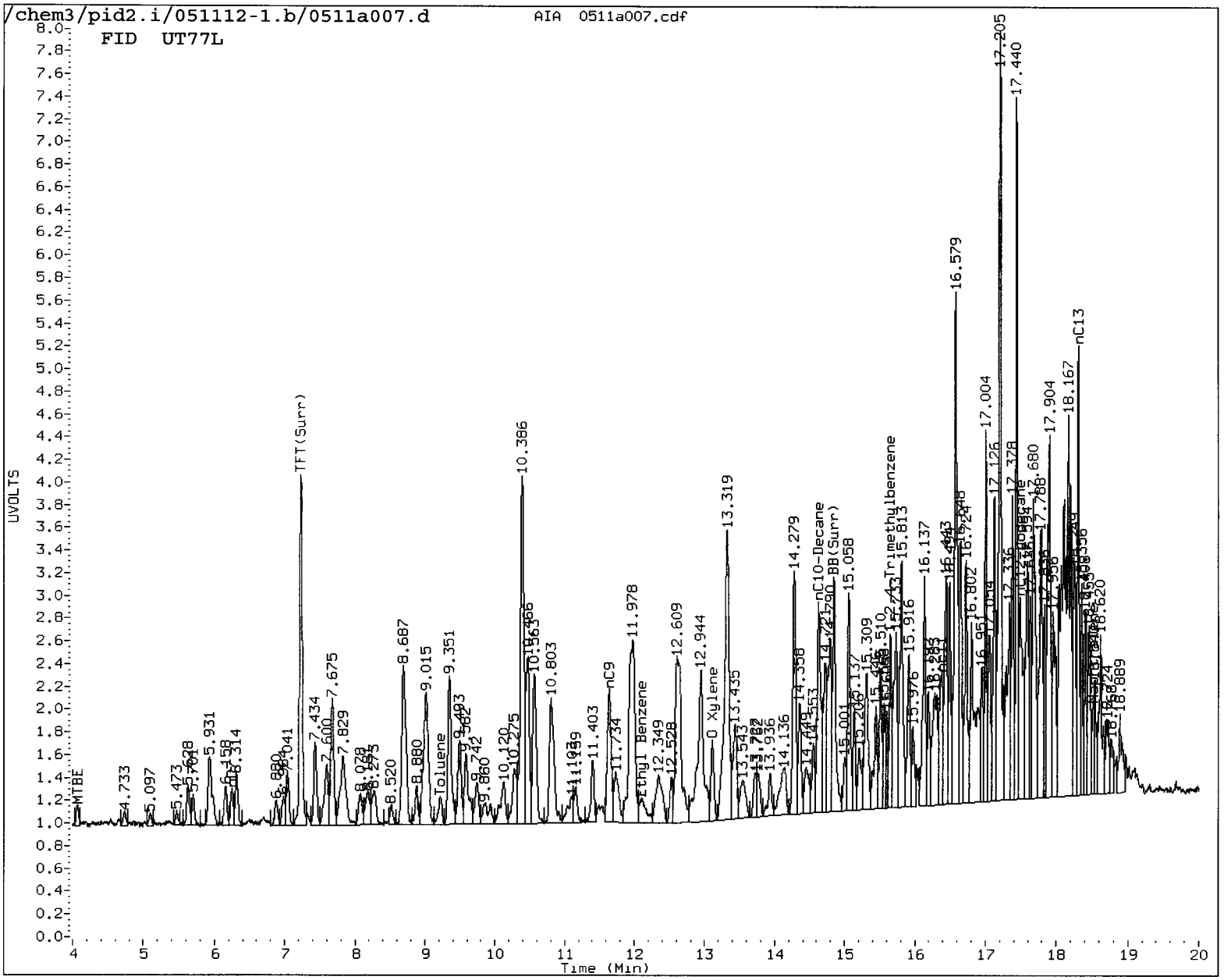


Data File: /chem3/pid2.i/051112-1.b/0511a007.d
Date : 11-MAY-2012 13:02
Client ID: CWSB-16-8-10-0512
Sample Info: UT77L

Instrument: pid2.i
Operator: JW
Column diameter: 0.18

Column phase: RTX 502-2 FID





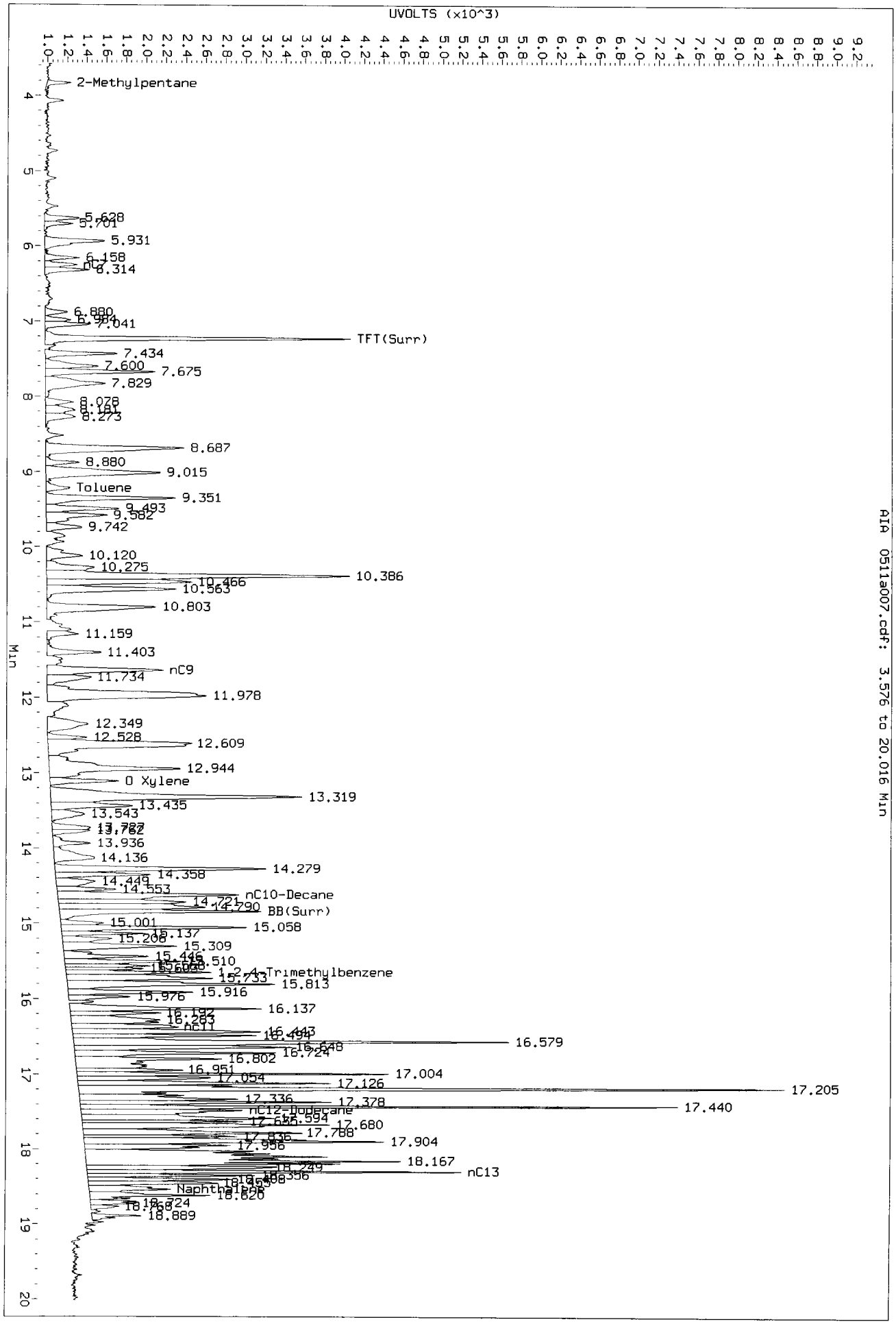
MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: TW Date: 5/15/12

UT77-060214

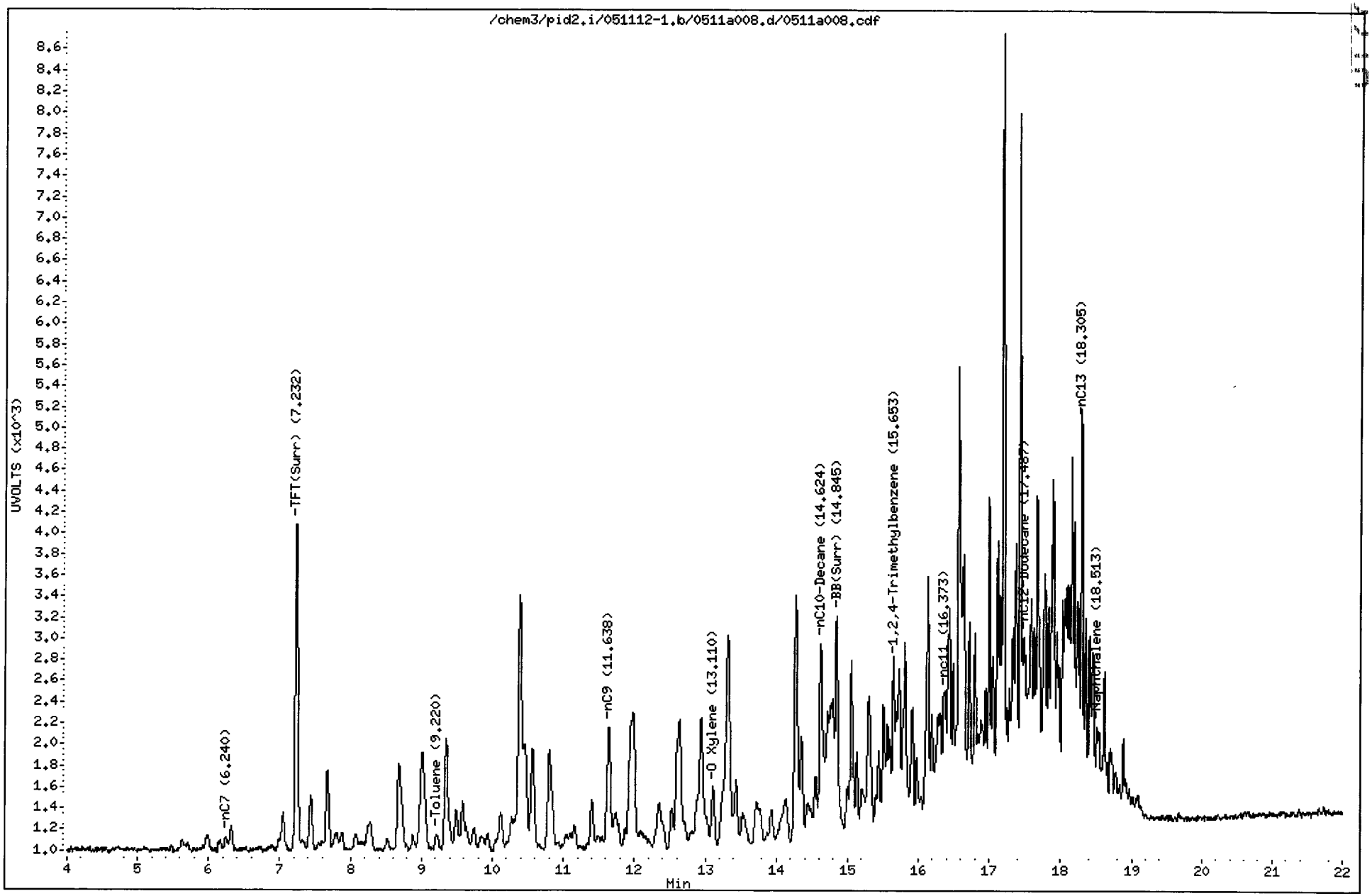


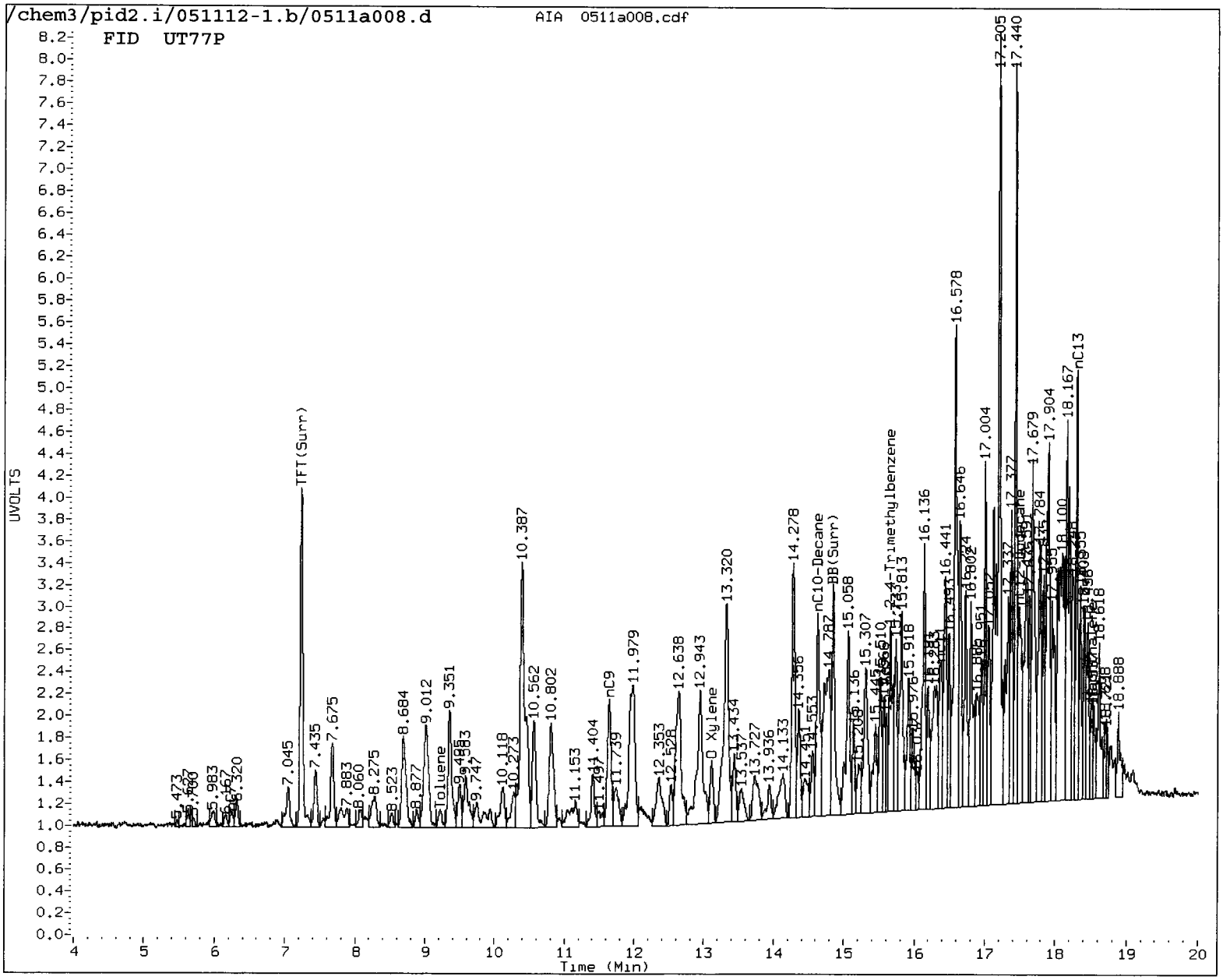
Benzene
TW
5/15/12

Data File: /chem3/pid2.i/051112-1.b/0511a008.d
Date : 11-MAY-2012 13:30
Client ID: CWSB-17-6-8-0512
Sample Info: UT77P

Instrument: pid2.i
Operator: JW
Column diameter: 0.18

Column phase: RTX 502-2 FID





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

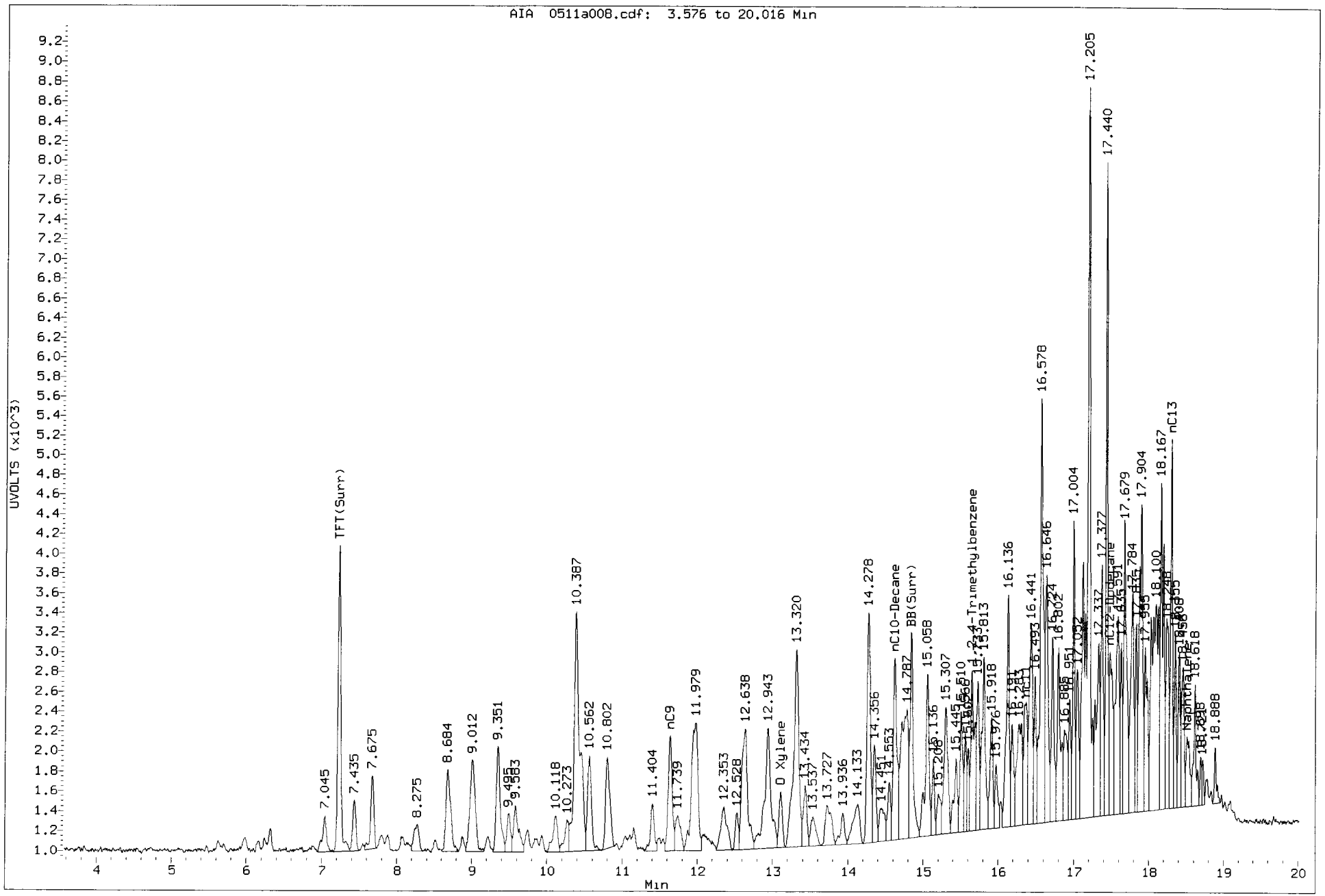
5. Other _____

Analyst: JW Date: 5/15/12

UT77:066627

Before 5/15/12

Data File: /chem3/pid2.i/051112-1.b/0511a008.d/0511a008.cdf
Injection Date: 11-MAY-2012 13:30
Instrument: pid2.i
Client Sample ID: CWSB-17-6-8-0512



Data File: /chem3/pid2.i/051012-1.b/0510a006.d

Date : 10-MAY-2012 14:09

Client ID:

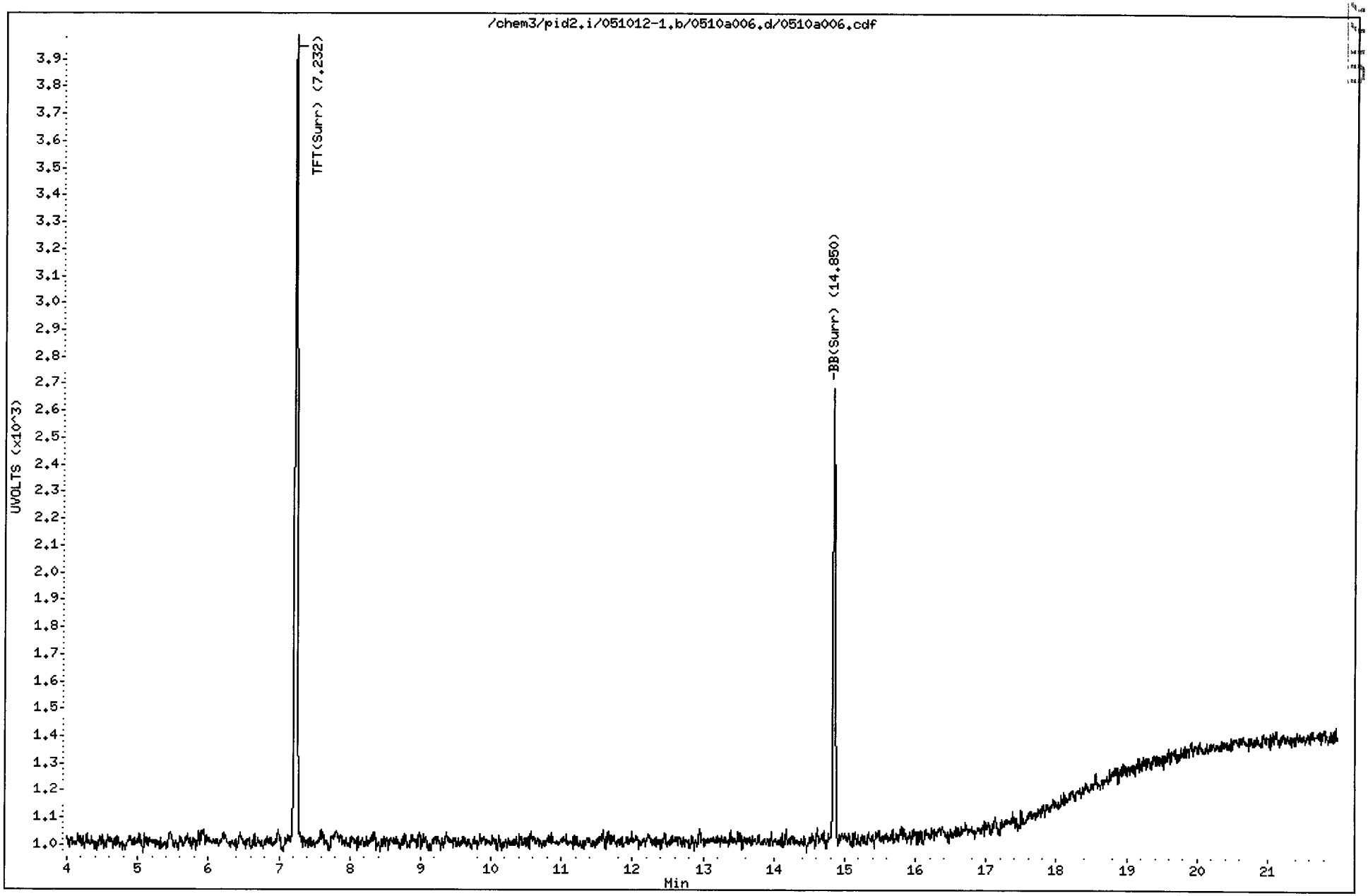
Sample Info: MB0510

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



Data File: /chem3/pid2.i/051012-1.b/0510a004.d

Date : 10-MAY-2012 13:13

Client ID:

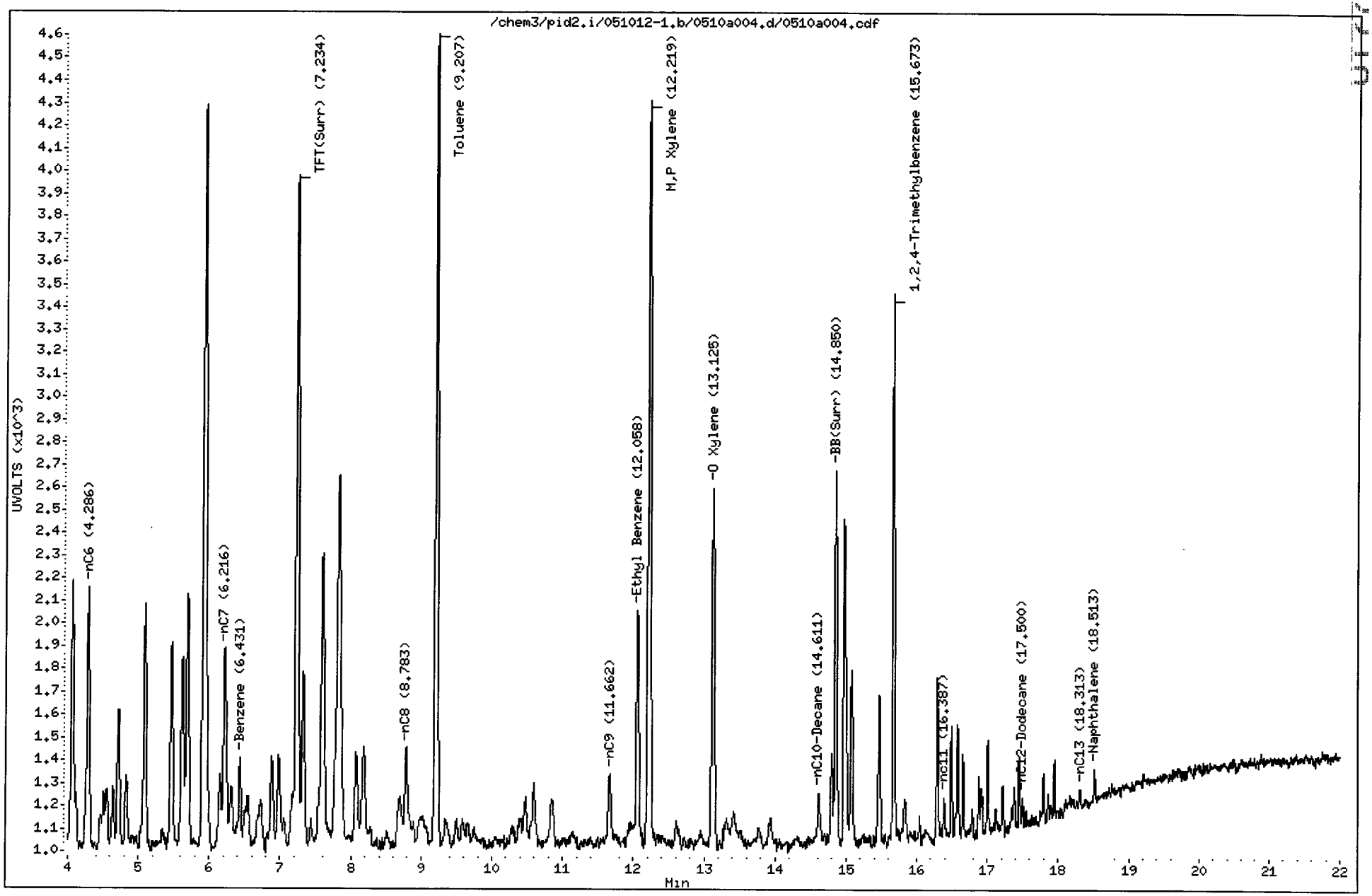
Sample Info: LCS0510

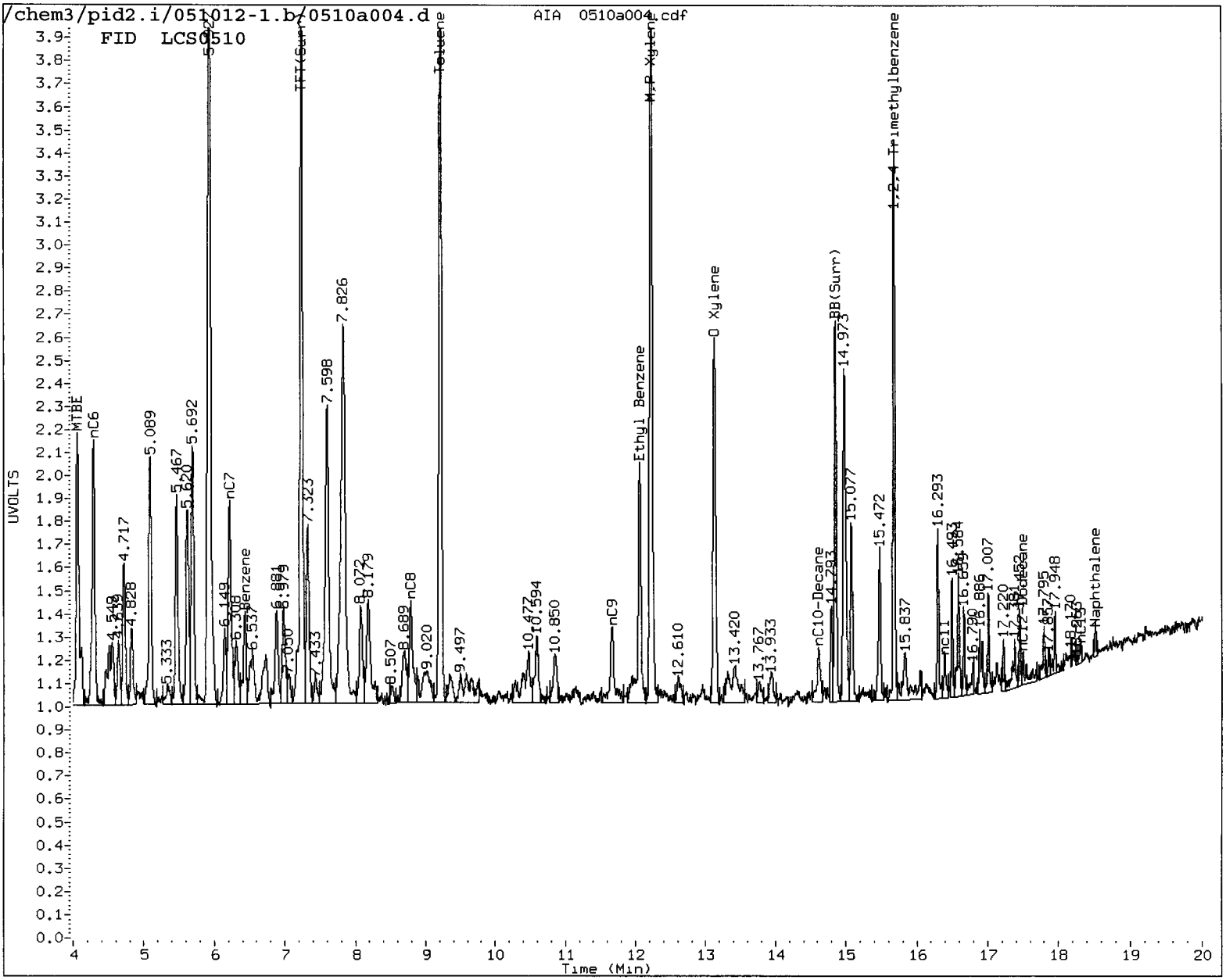
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



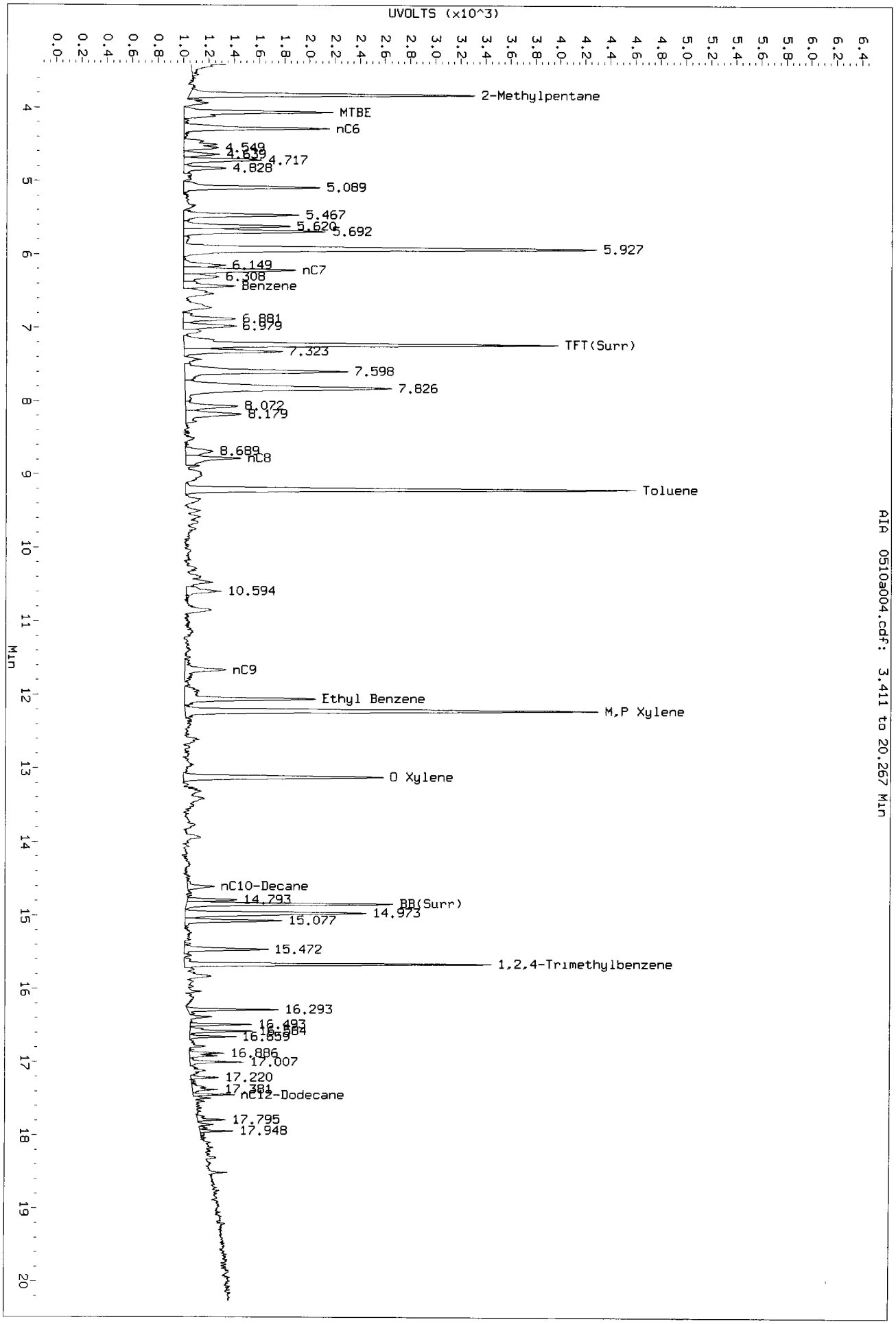


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JU Date: 5/15/12


Data File: /chem3/pid2.i/051012-1.b/0510a004.d/0510a004.cdf
Injection Date: 10-MAY-2012 13:13
Instrument: pid2.i
Client Sample ID:
UVOLTS (x10^3)
AIA 0510a004.cdf: 3.411 to 20.267 Min
Min
2-Methylpentane
MTBE
nC6
4.549
4.717
4.828
5.089
5.467
5.620
5.692
5.927
6.149
nC7
6.308
Benzene
6.881
6.979
TFT(Surr)
7.323
7.598
7.826
8.072
8.179
8.689
nC8
Toluene
10.594
nC9
Ethyl Benzene
M,P Xylene
O Xylene
nC10-Decane
14.793
BB(Surr)
14.973
15.077
15.472
1,2,4-Trimethylbenzene
16.293
16.659
16.886
17.007
17.220
nC12-Dodecane
17.795
17.948

Data File: /chem3/pid2.i/051012-1.b/0510a005.d

Date : 10-MAY-2012 13:41

Client ID:

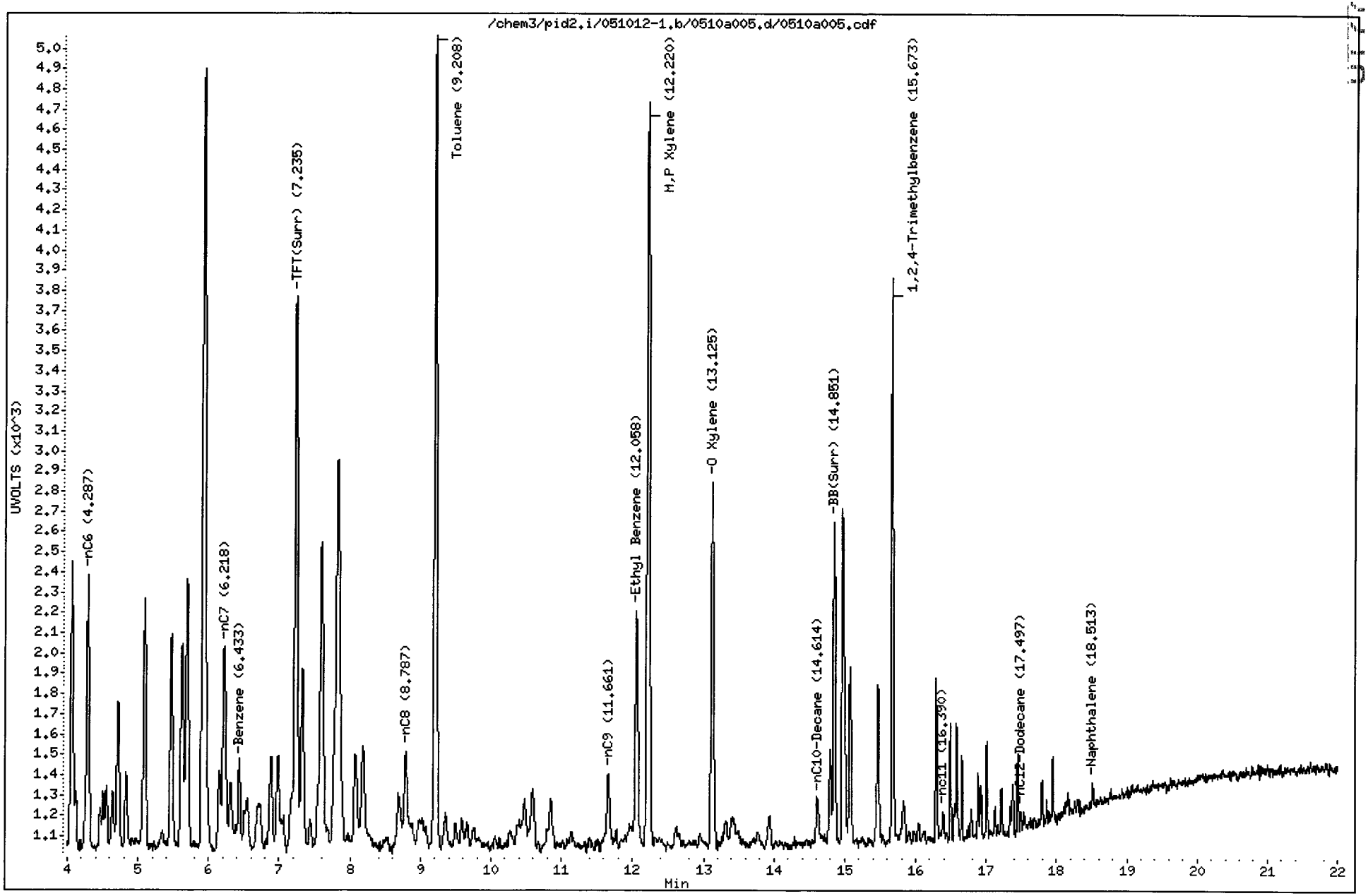
Sample Info: LCSD0510

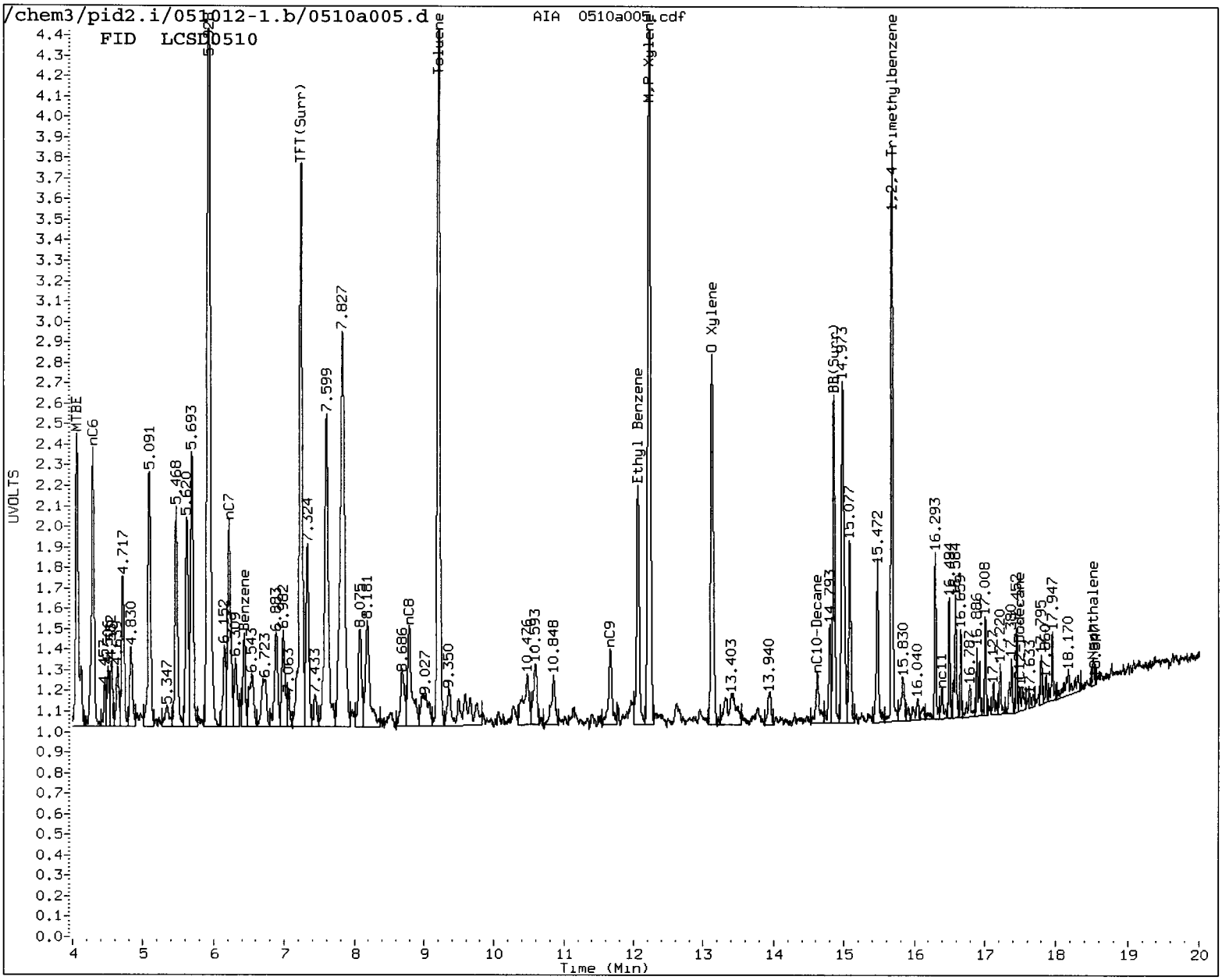
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

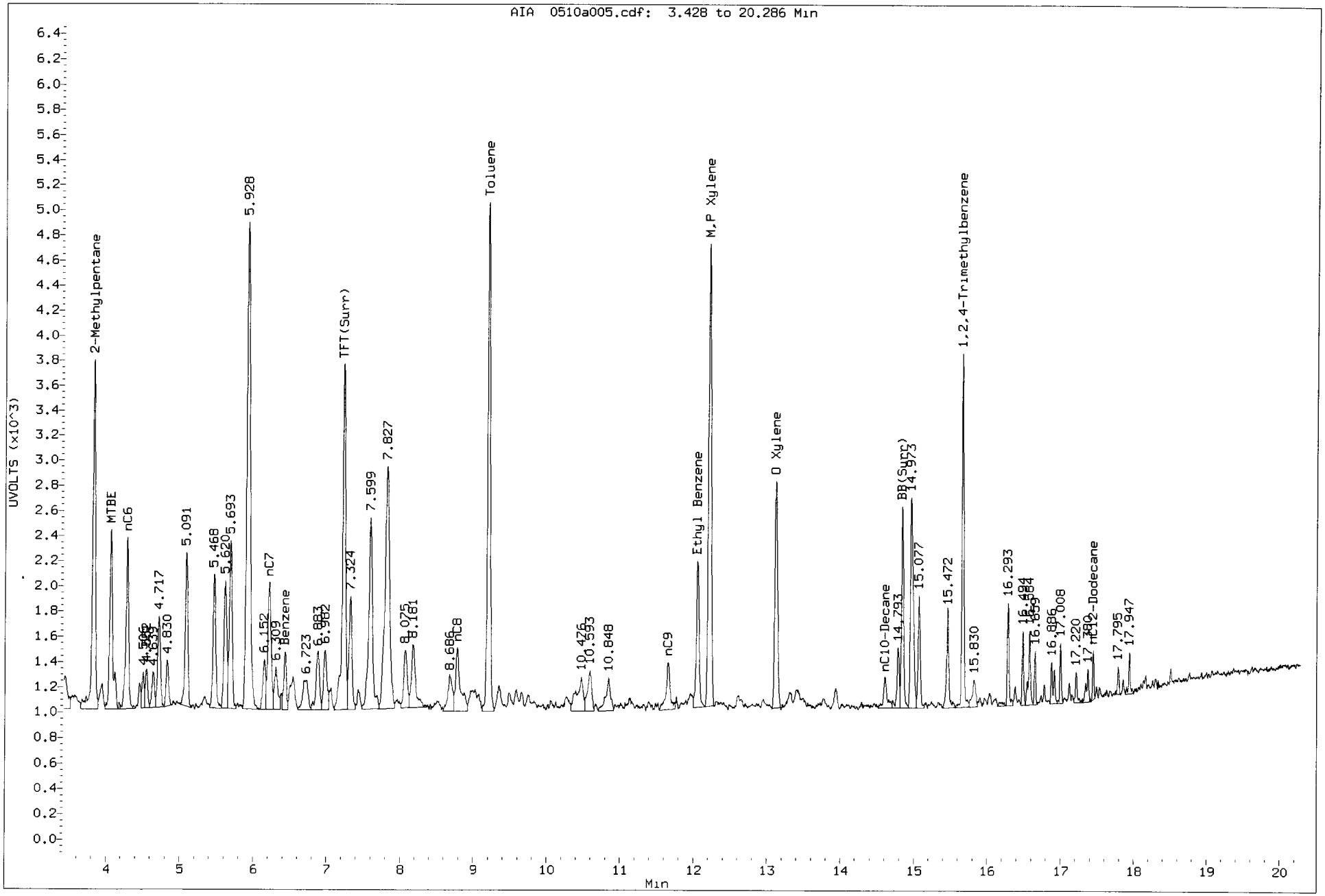
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/15/12

Before
JW 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a005.d/0510a005.cdf
Injection Date: 10-MAY-2012 13:41
Instrument: pid2.i
Client Sample ID:



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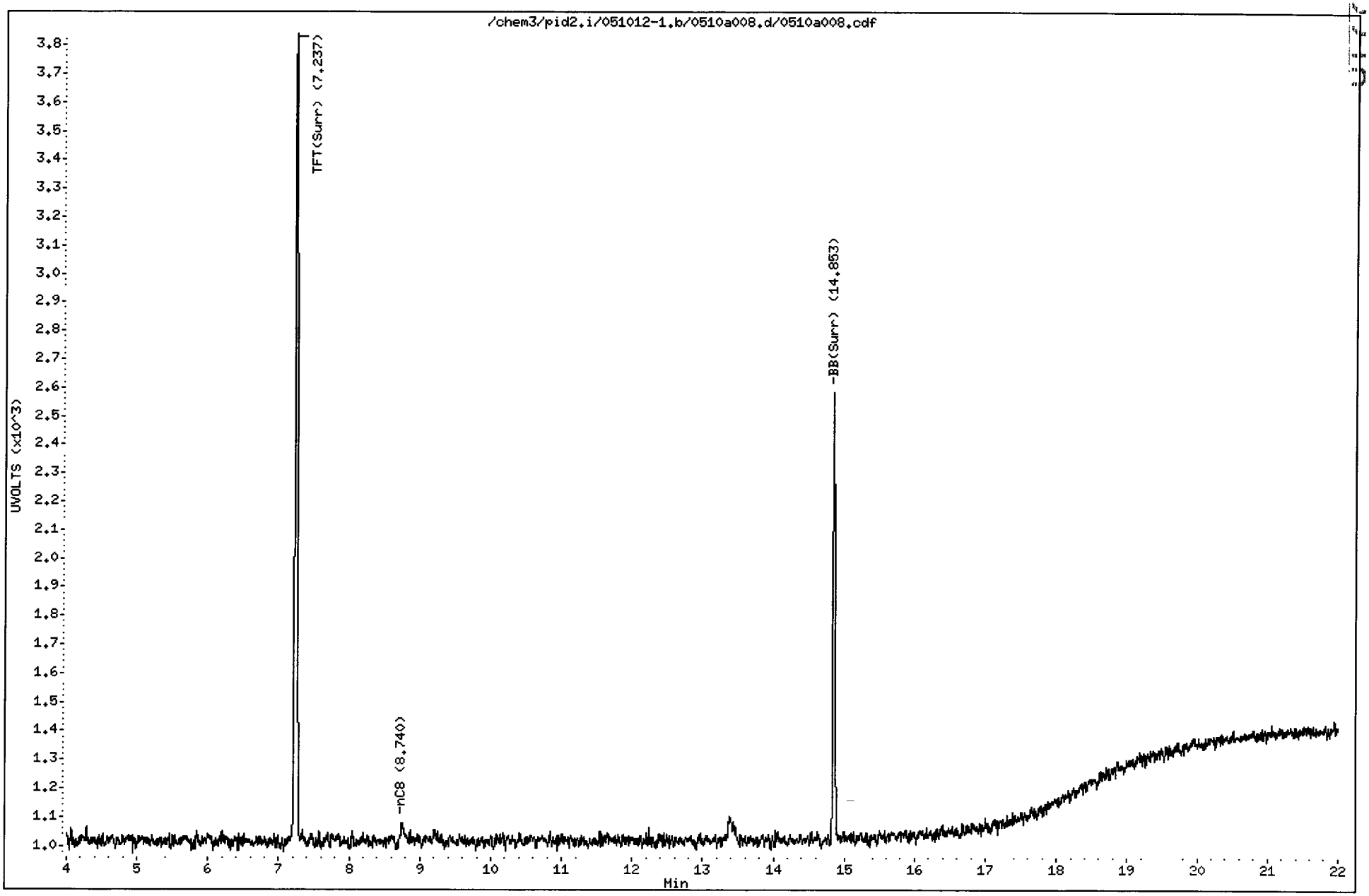
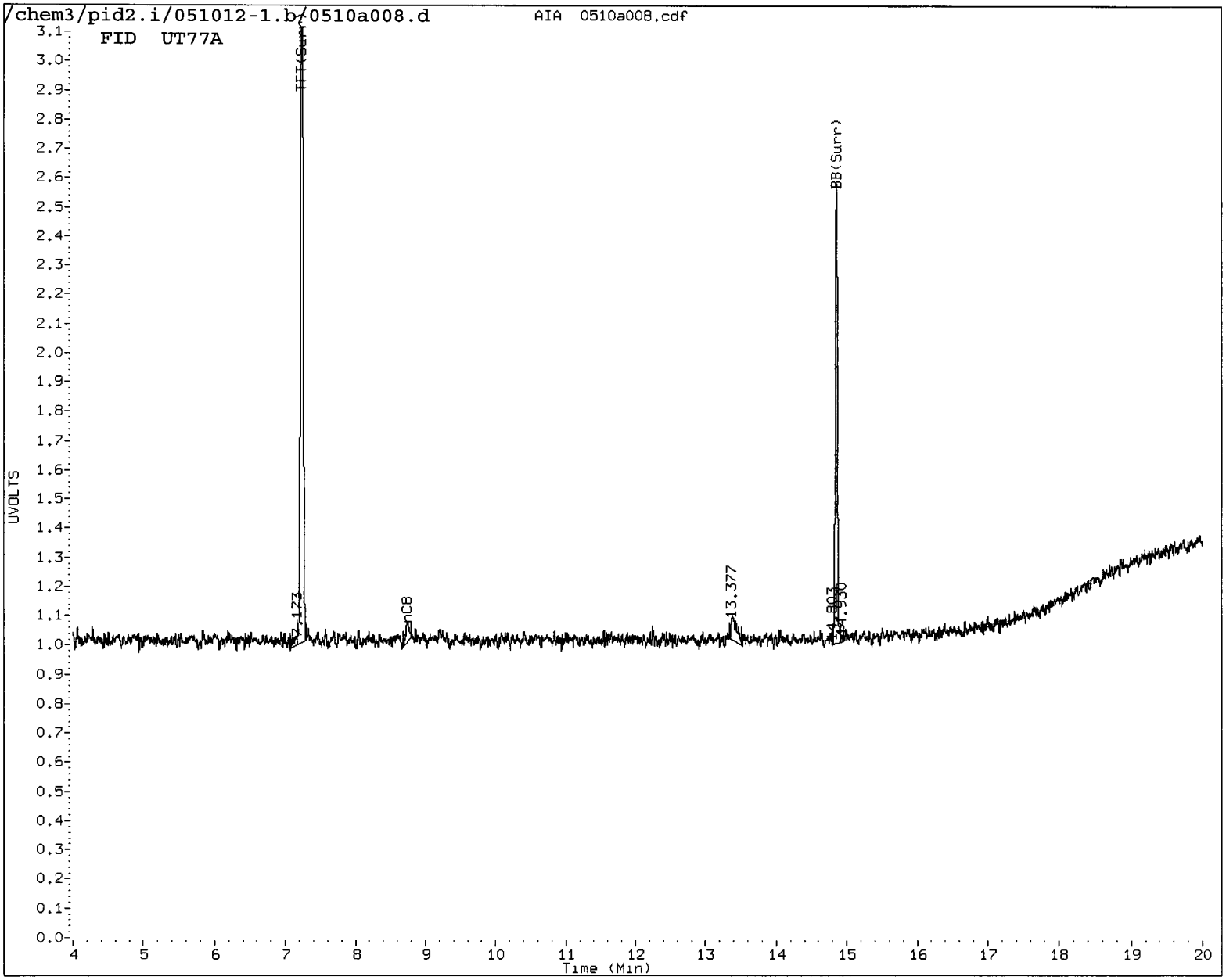
Date : 10-MAY-2012 15:29
Client ID: CWSB-13-14.0-14.5-0
Sample Info: UT77A

Instrument: pid2.i
Operator: JW
Column phase: RTX 502-2 FID
Column diameter: 0.18





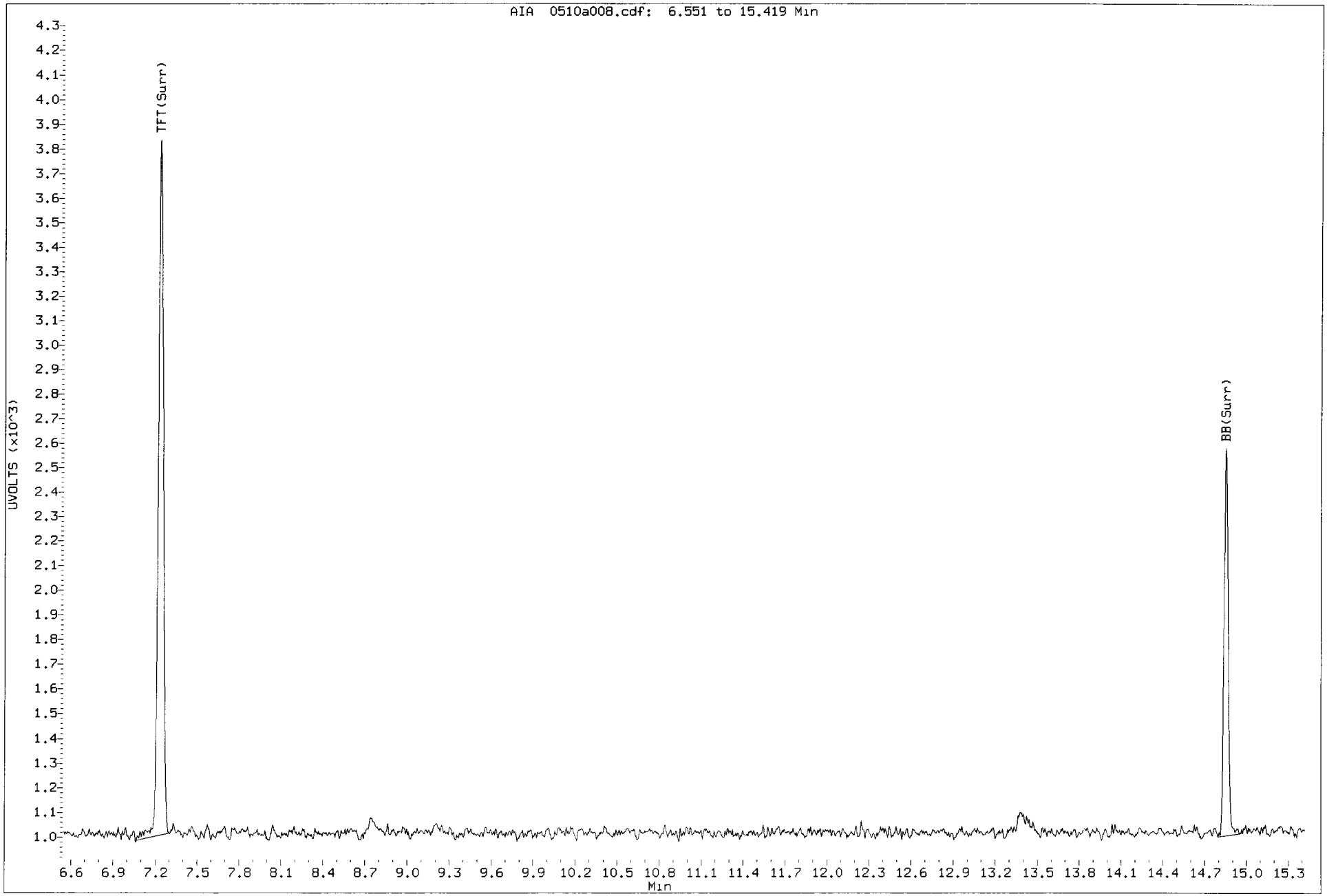
MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PS

Analyst: JW Date: 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a008.d/0510a008.cdf
Injection Date: 10-MAY-2012 15:29
Instrument: pid2.i
Client Sample ID: CWSB-13-14.0-14.5-0

Before GW 5/15/12



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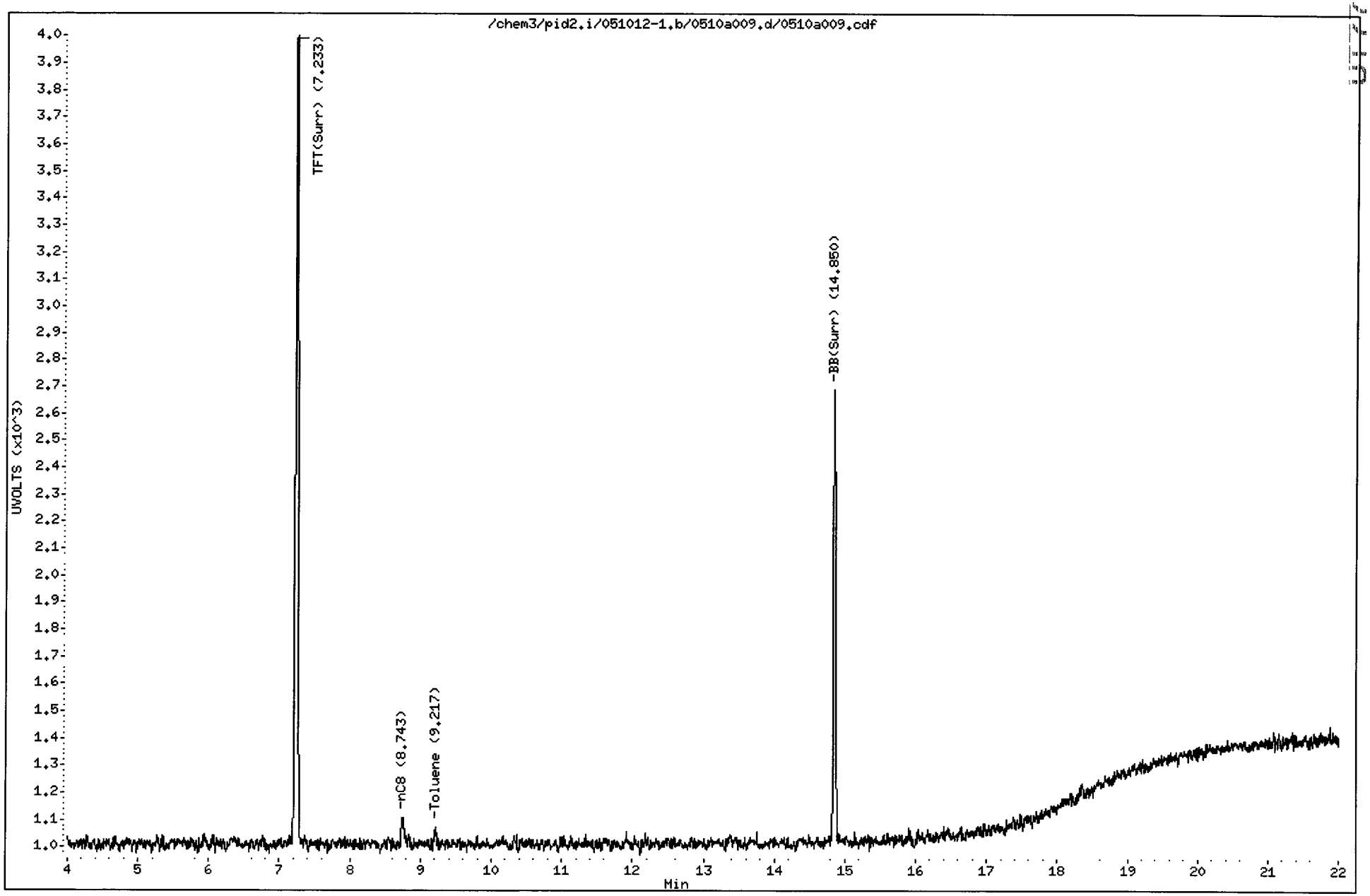
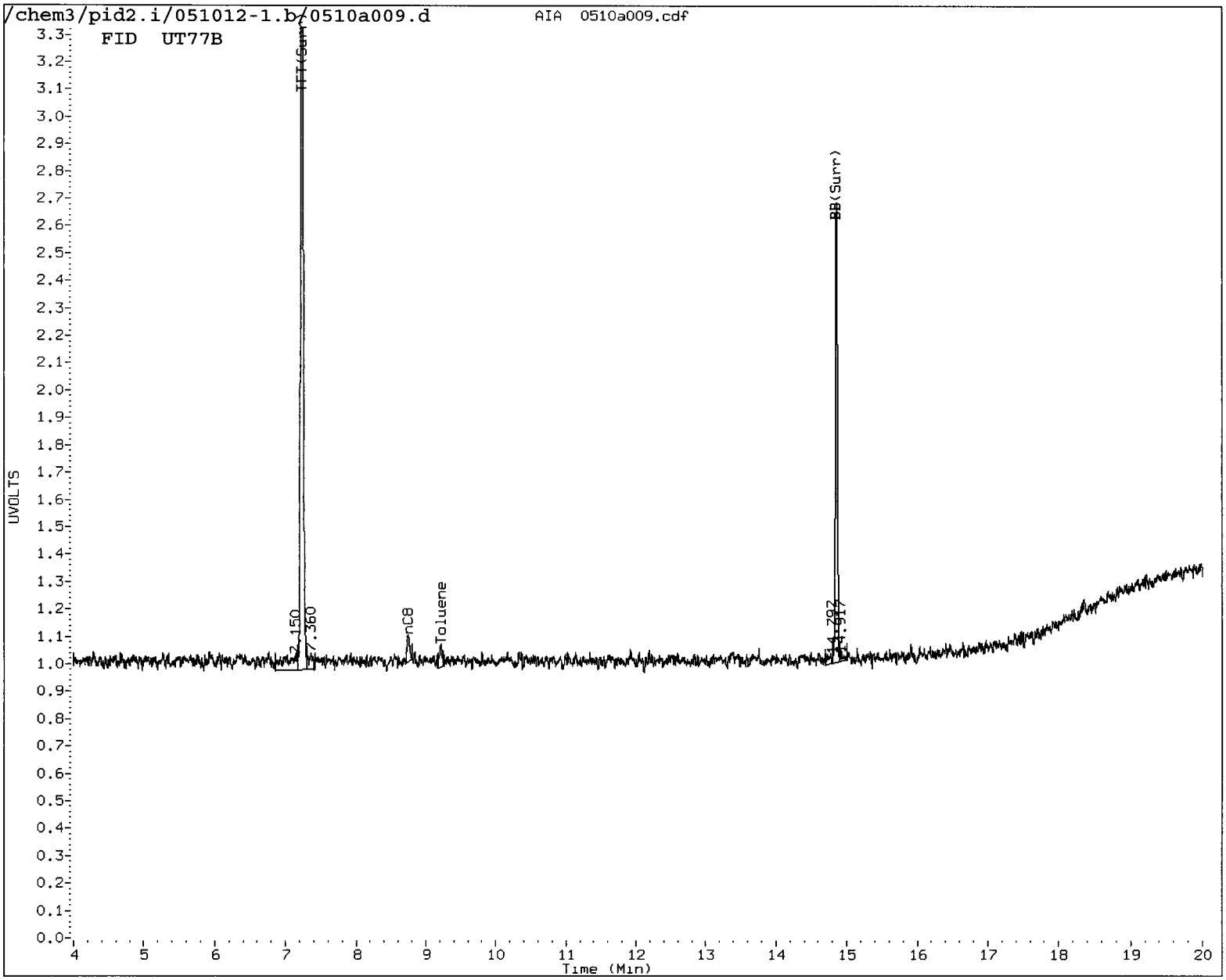
Date : 10-MAY-2012 15:57
Client ID: CWSB-13-21-22-0512
Sample Info: UT77B

Instrument: pid2.i
Operator: JW
Column diameter: 0.18

Column phase: RTX 502-2 FID





MANUAL INTEGRATION

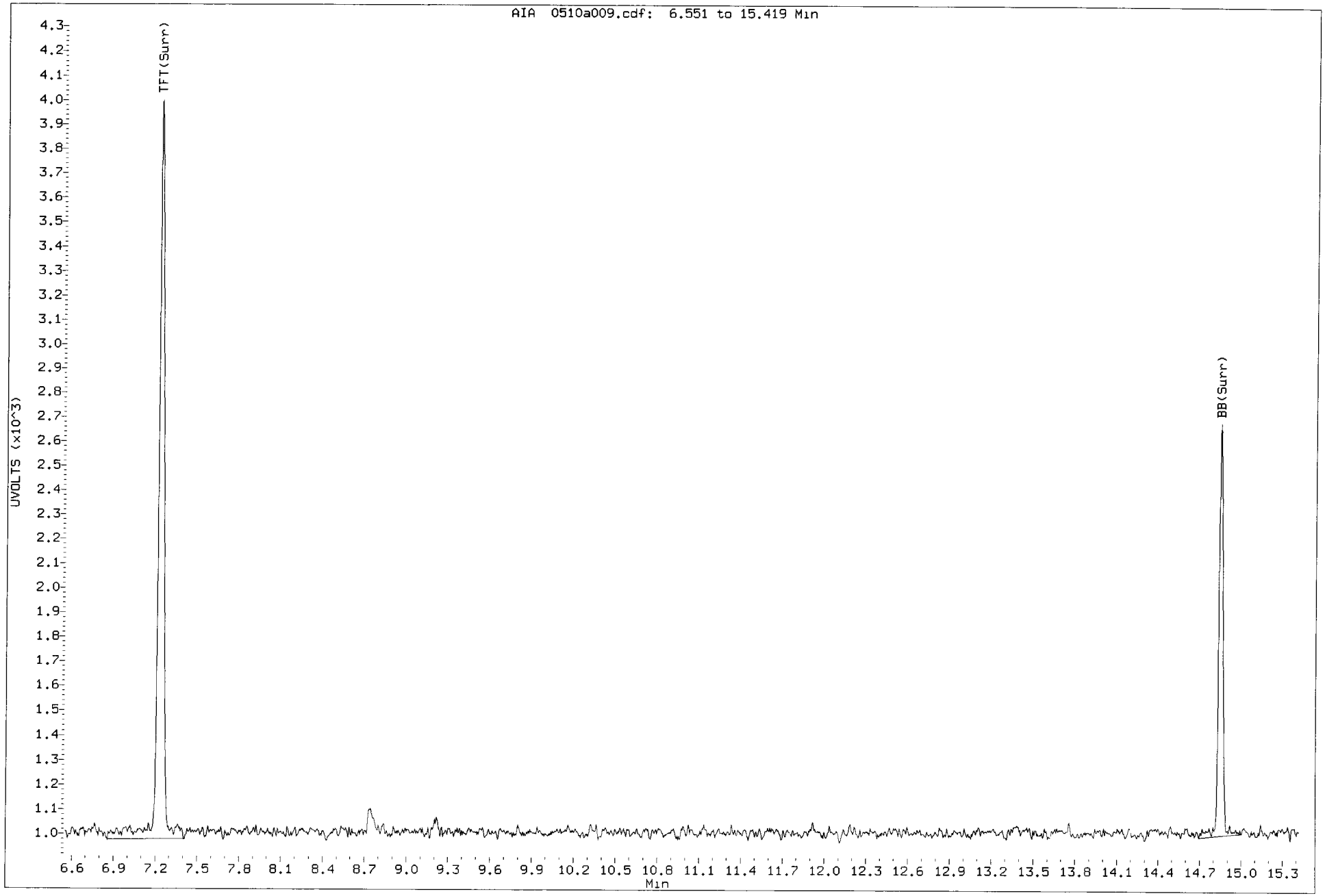
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PS

Analyst: JW Date: 5/15/12

UT77:0509

Data File: /chem3/pid2.i/051012-1.b/0510a009.d/0510a009.cdf
Injection Date: 10-MAY-2012 15:57
Instrument: pid2.i
Client Sample ID: CWSB-13-21-22-0512

Before JW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a010.d

Page 1

Date : 10-MAY-2012 16:25

Client ID: CWSB-13-25-27-0512

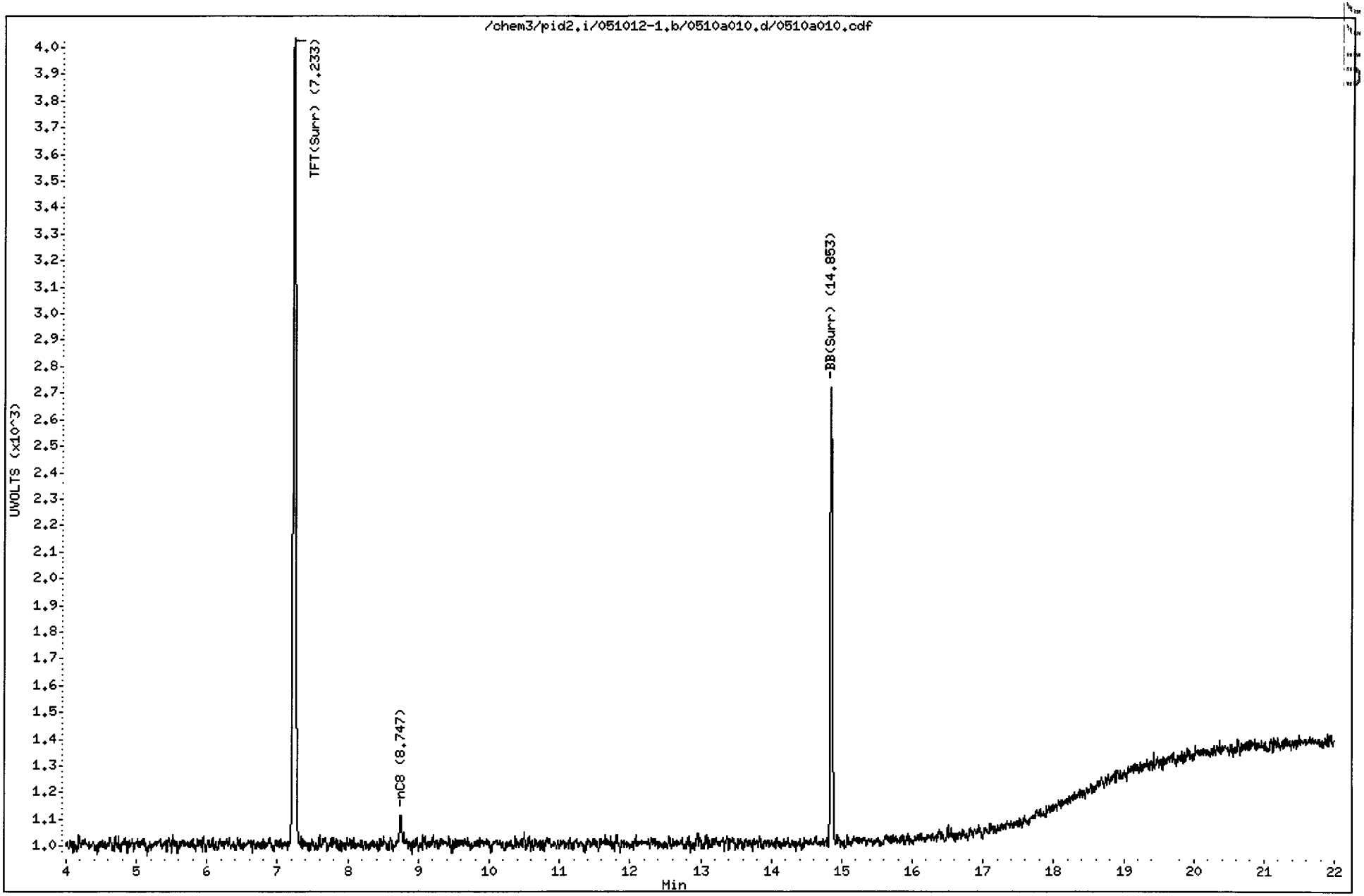
Instrument: pid2.i

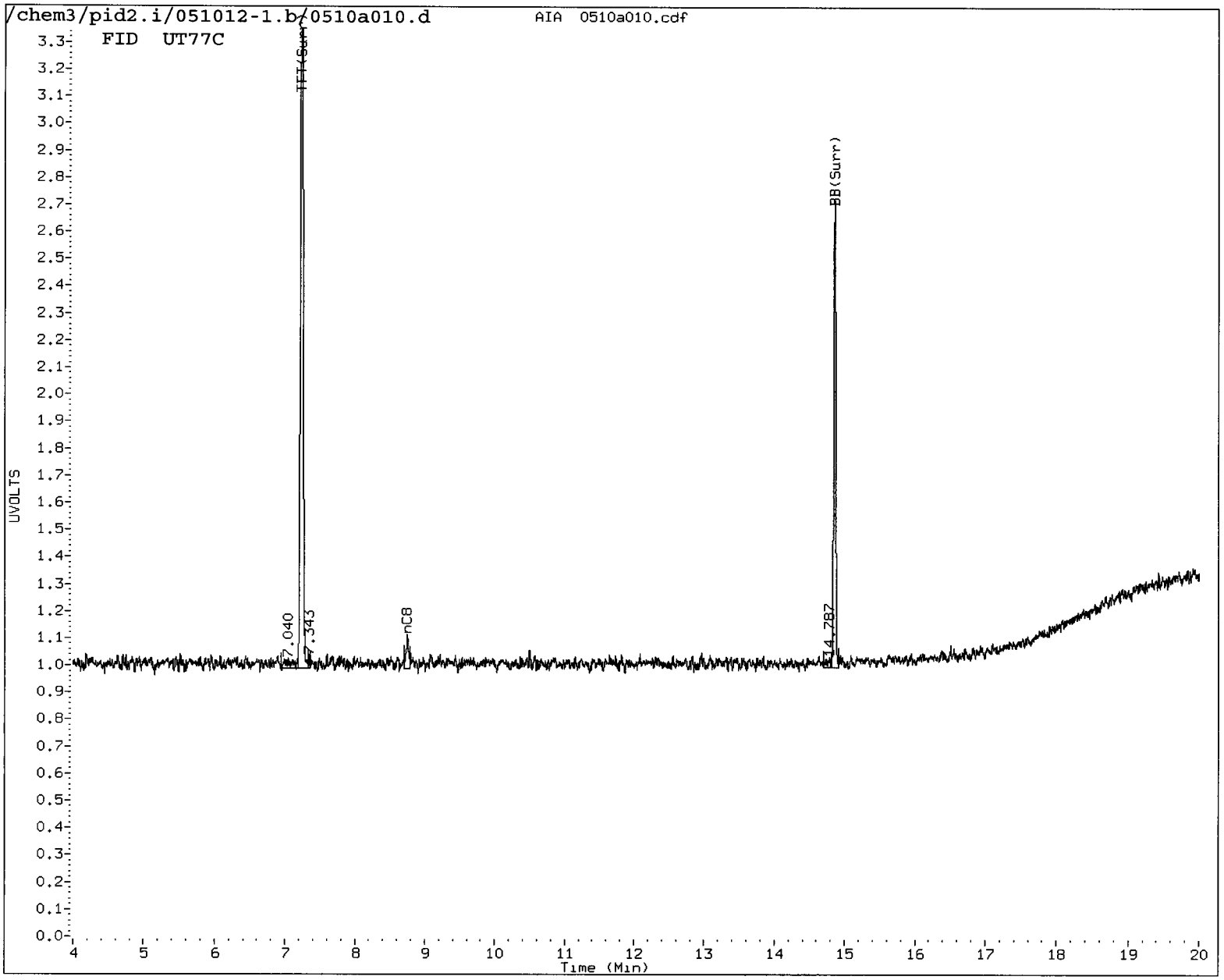
Sample Info: UT77C

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18





MANUAL INTEGRATION

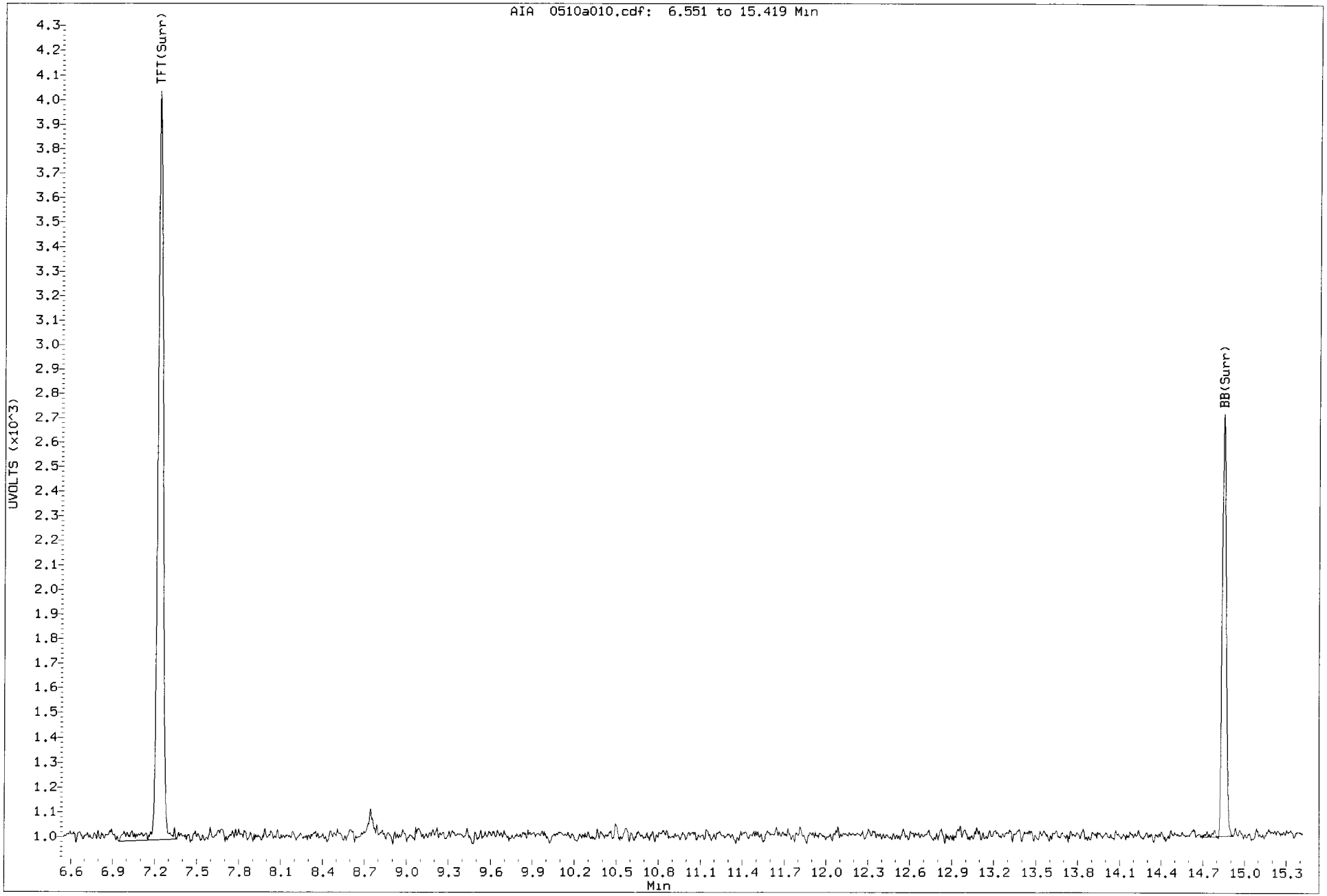
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PS

Analyst: JU Date: 5/15/12

UT77:66645

Data File: /chem3/pid2.i/051012-1.b/0510a010.d/0510a010.cdf
Injection Date: 10-MAY-2012 16:25
Instrument: pid2.i
Client Sample ID: CWSB-13-25-27-0512

Before JW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a011.d

Date : 10-MAY-2012 16:53

Client ID: CWSB-14-12-14-0512

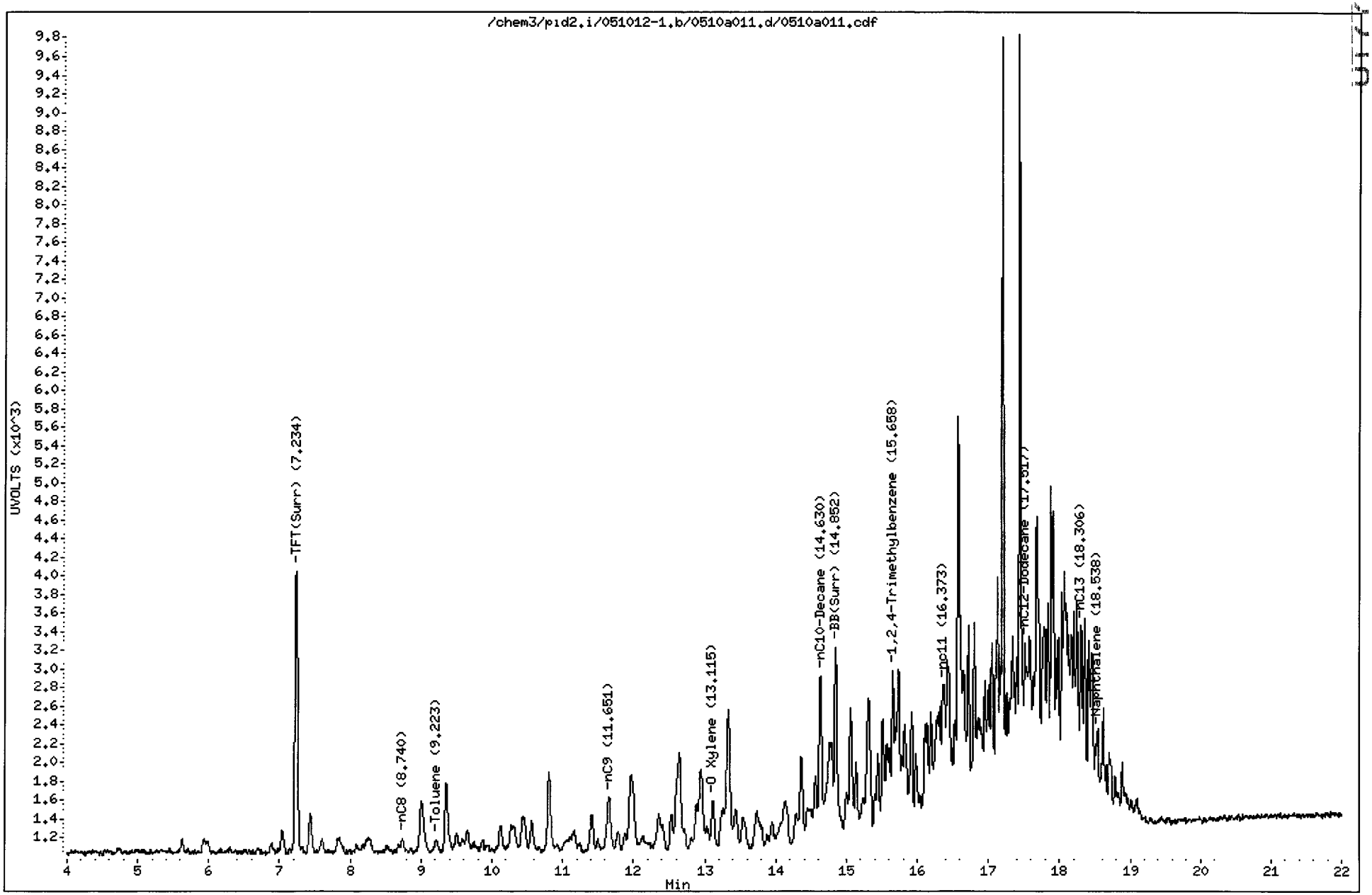
Sample Info: UT77E

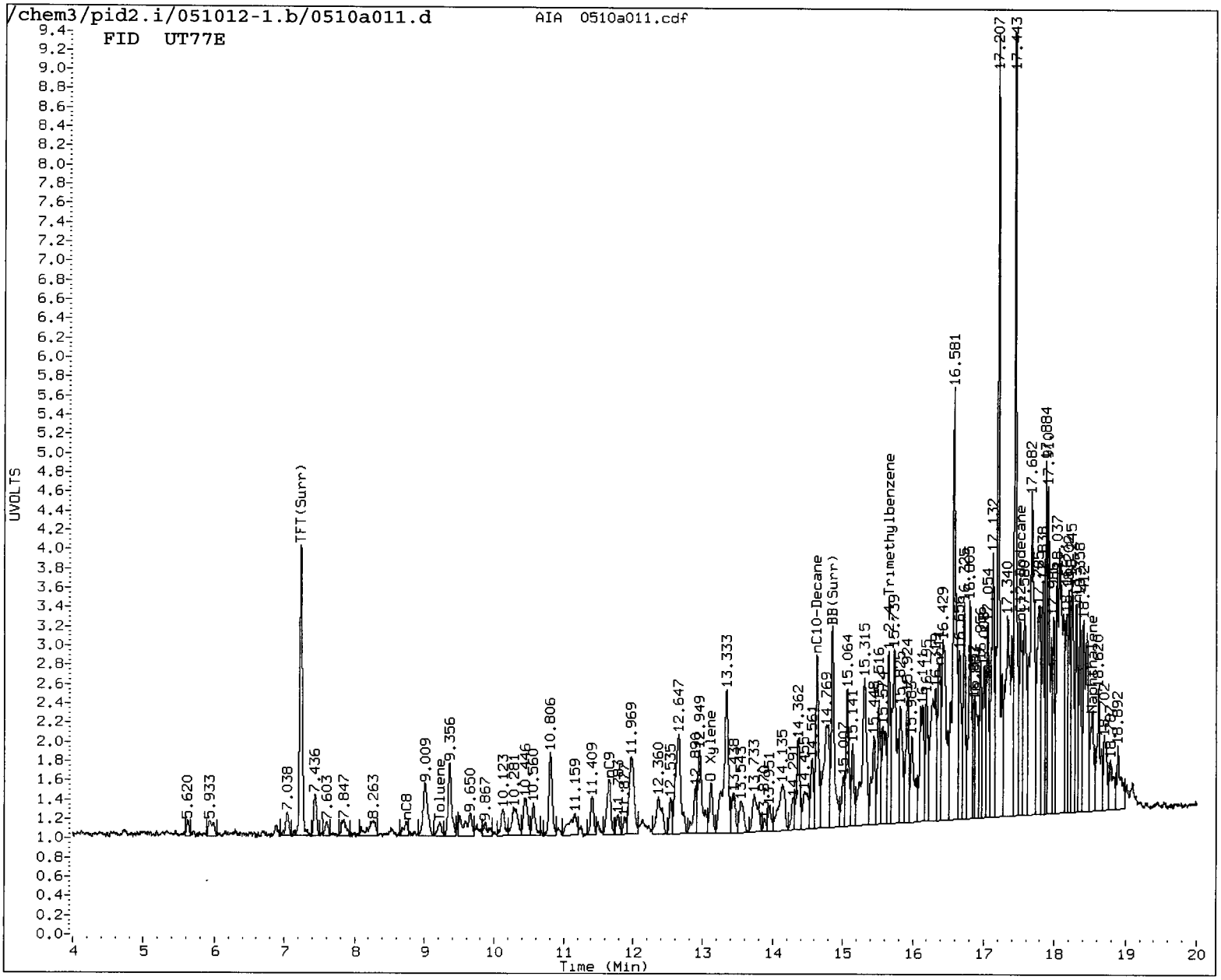
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

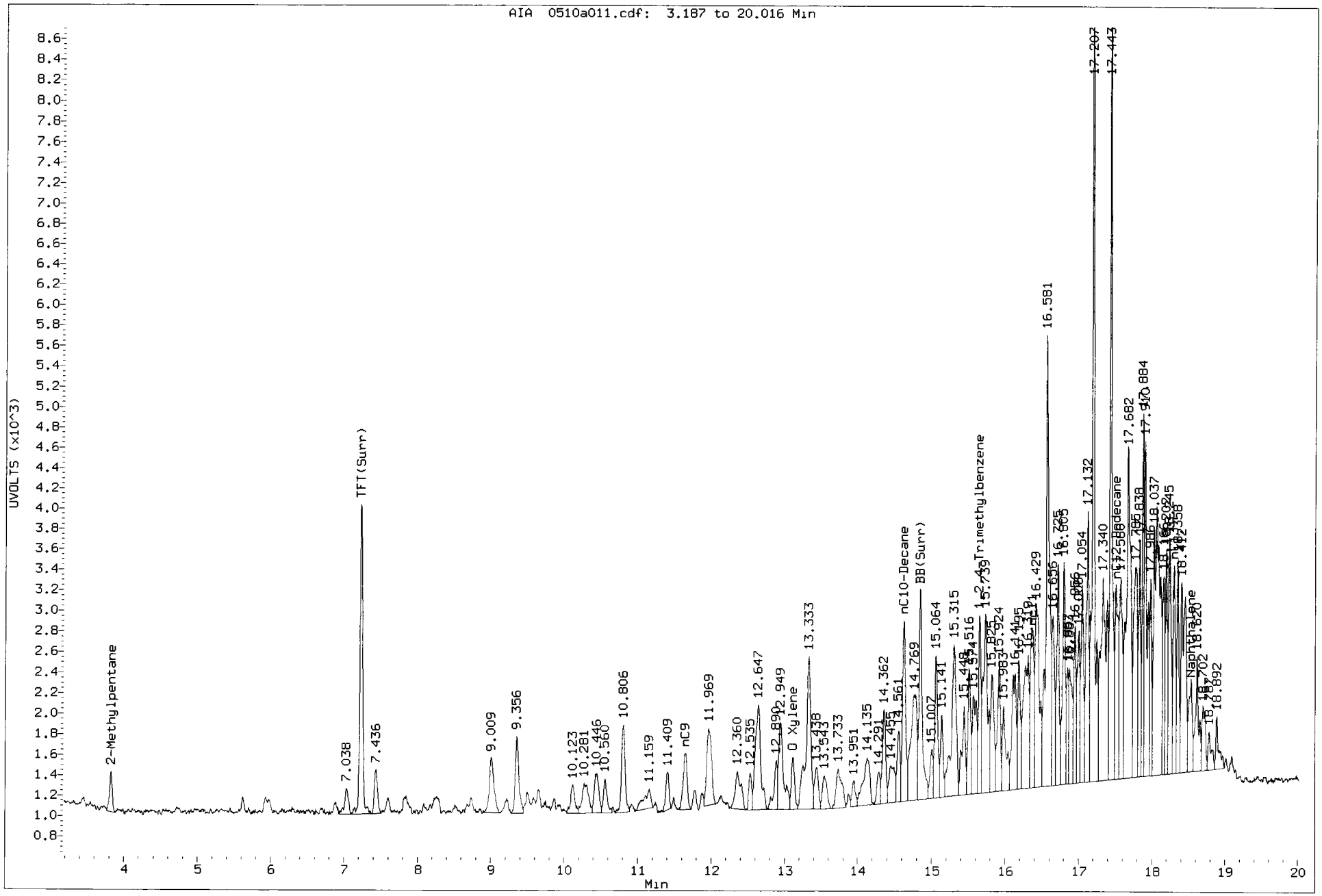
5. Other _____

Analyst: JW Date: 5/15/12

UT77-0604C

Data File: /chem3/pid2.i/051012-1.b/0510a011.d/0510a011.cdf
Injection Date: 10-MAY-2012 16:53
Instrument: pid2.i
Client Sample ID: CWSB-14-12-14-0512

Before
JW
5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a013.d

Date : 10-MAY-2012 17:49

Client ID: CWSB-14-25-27-0512

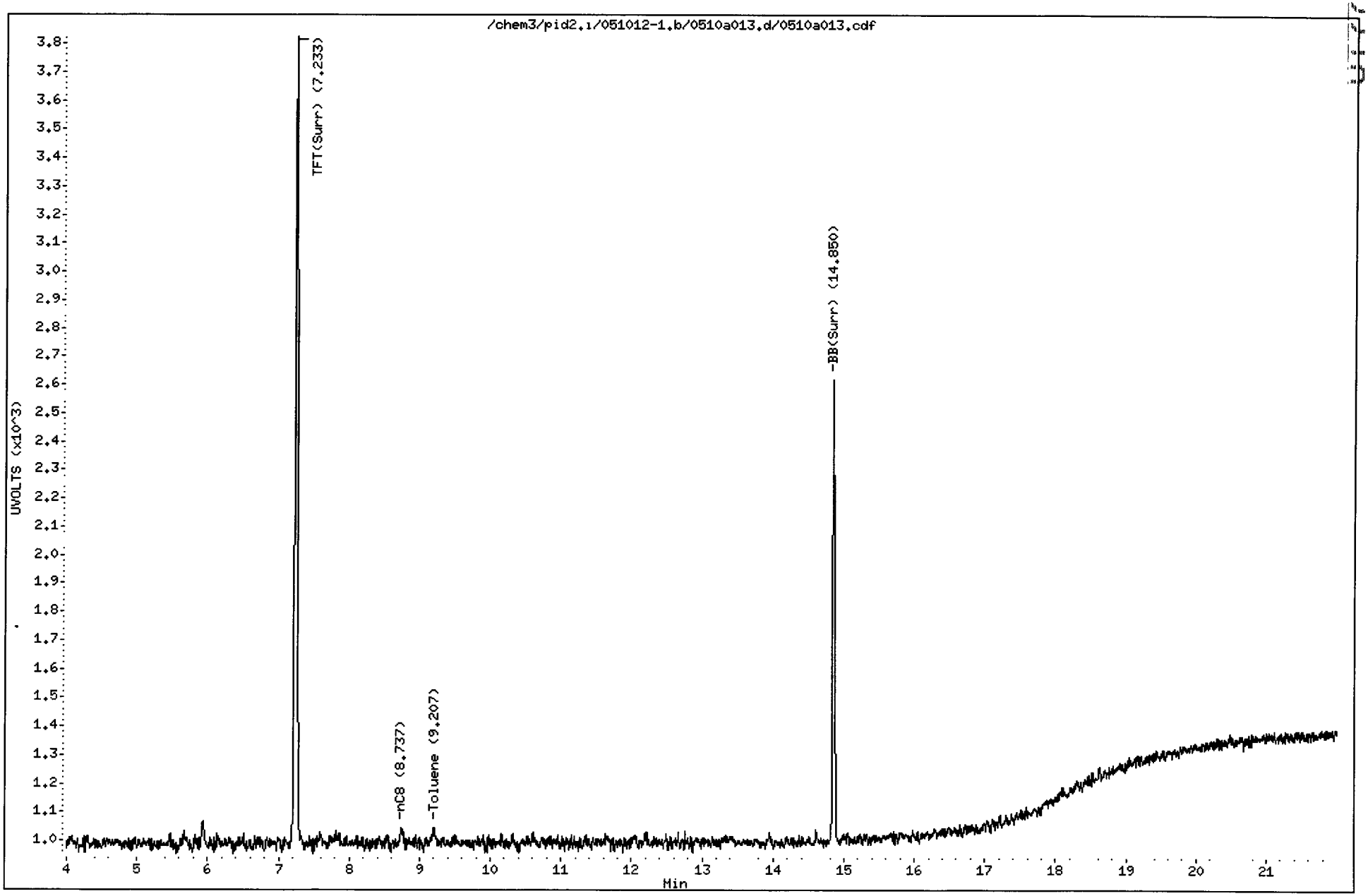
Sample Info: UT77F

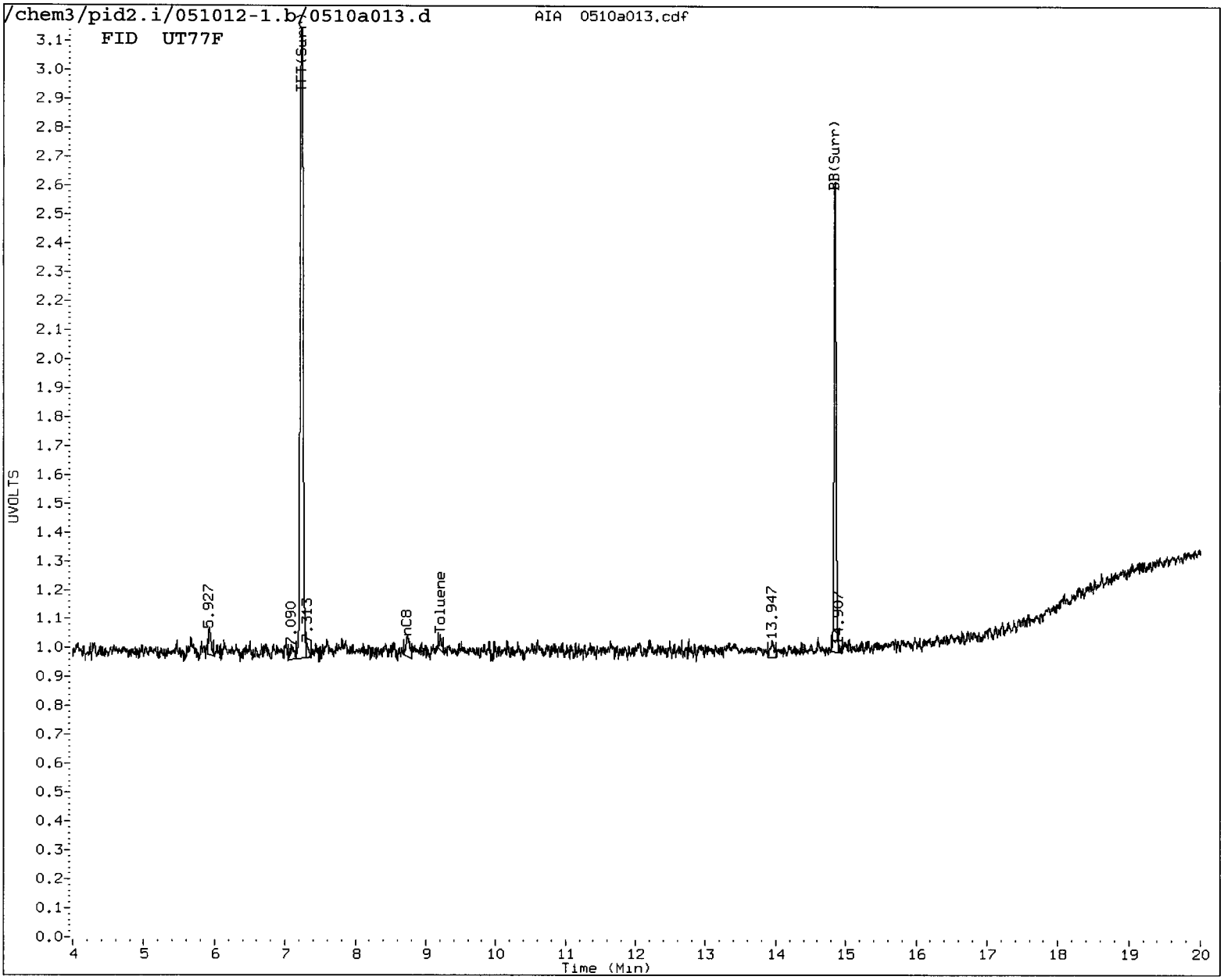
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

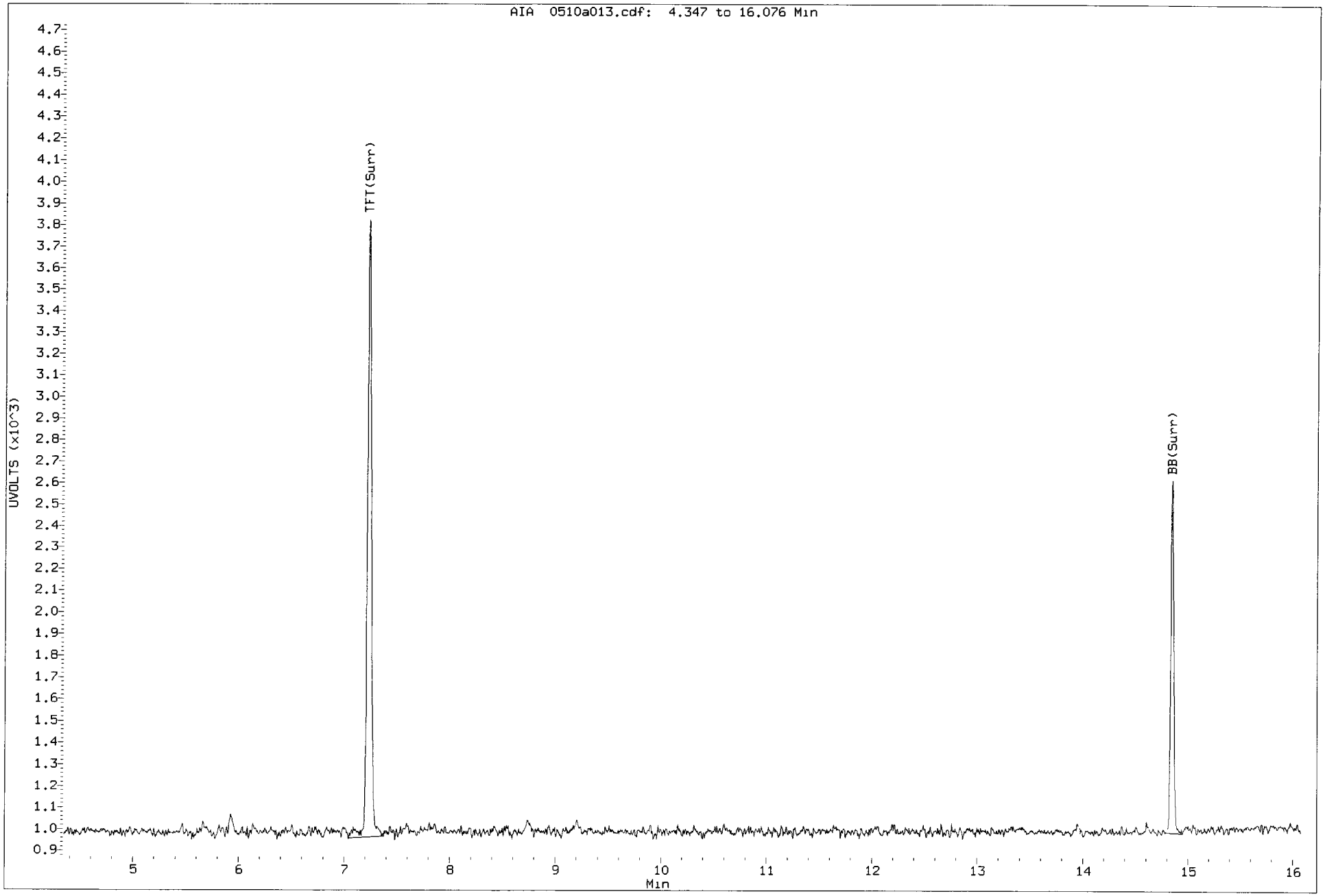
5. Other PS

Analyst: JW Date: 5/6/12

UT77:000416

Data File: /chem3/pid2.i/051012-1.b/0510a013.d/0510a013.cdf
Injection Date: 10-MAY-2012 17:49
Instrument: pid2.i
Client Sample ID: CWSB-14-25-27-0512

Before SW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a014.d

Date : 10-MAY-2012 18:17

Client ID: CWSB-14-29-30-0512

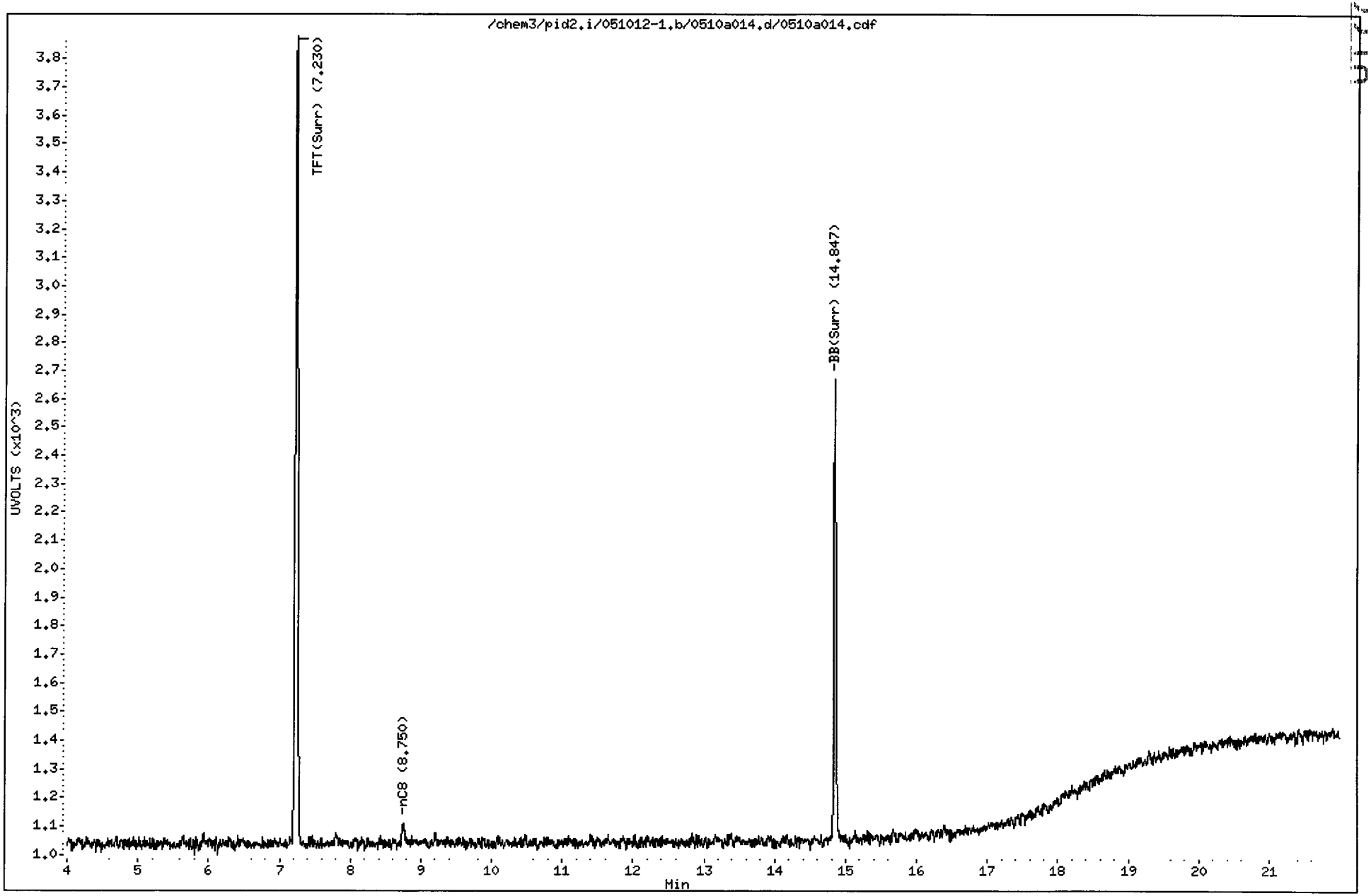
Sample Info: UT77G

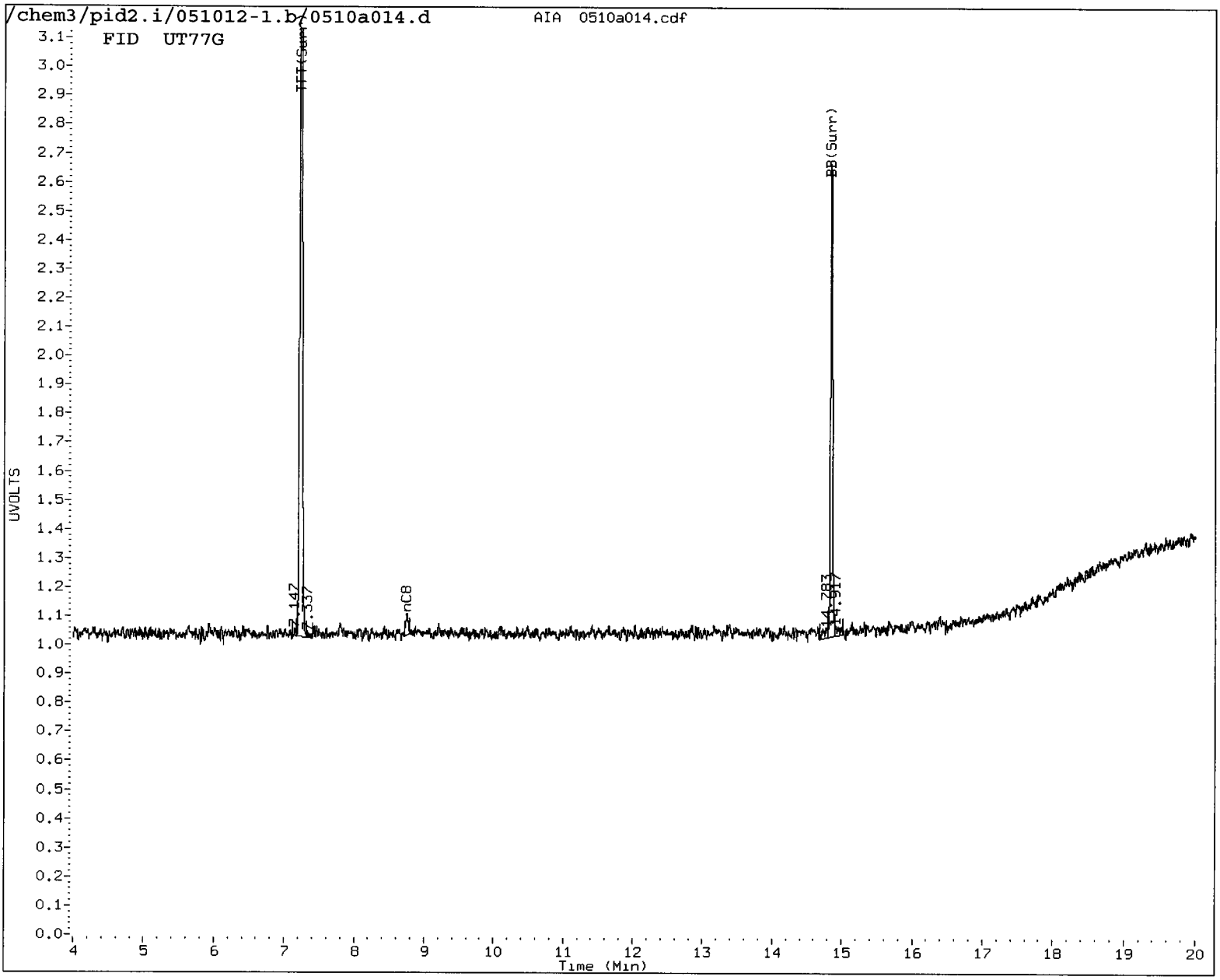
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

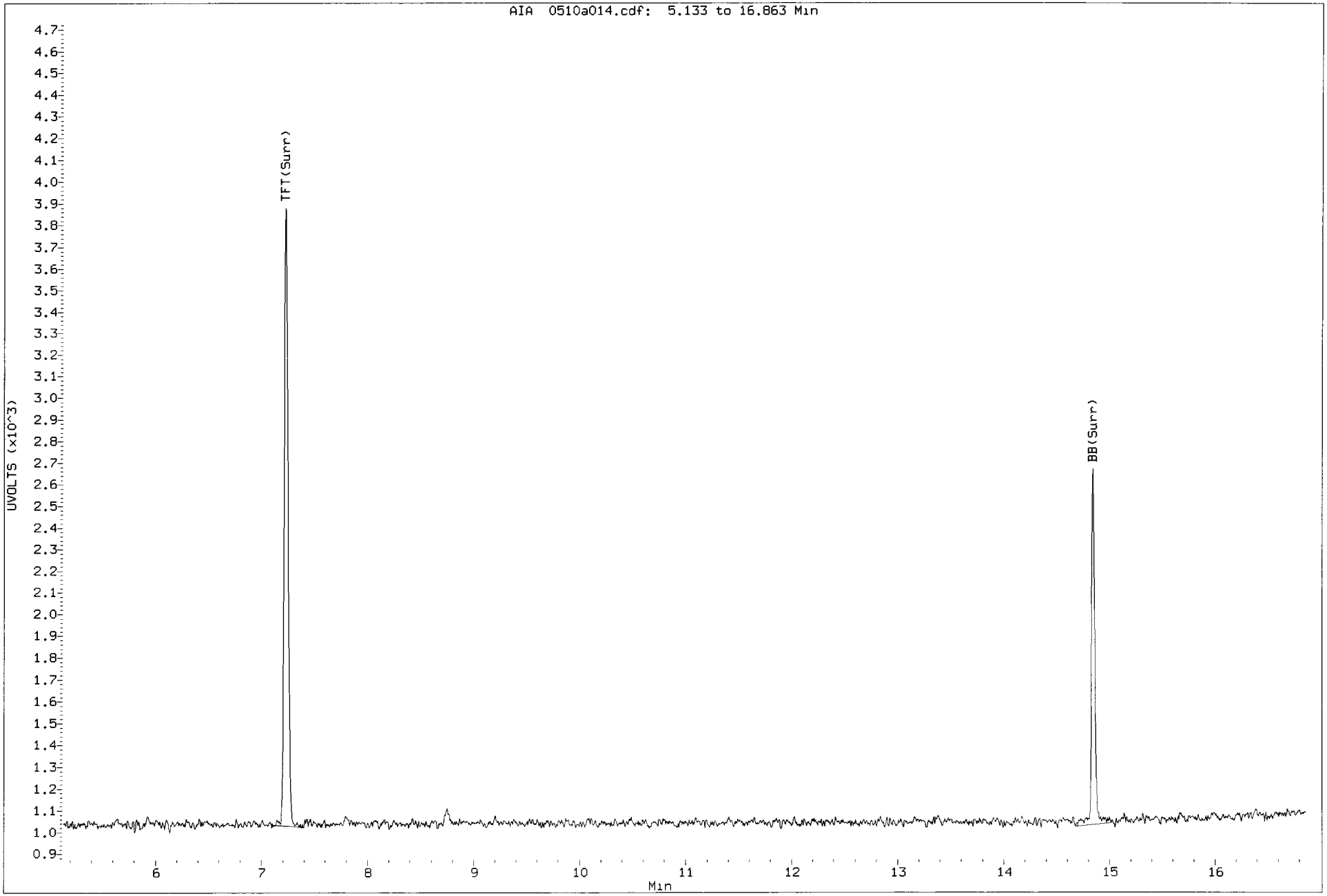
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PB

Analyst: JW Date: 5/15/12

UT77:66652

Data File: /chem3/pid2.i/051012-1.b/0510a014.d/0510a014.cdf
Injection Date: 10-MAY-2012 18:17
Instrument: pid2.i
Client Sample ID: CWSB-14-29-30-0512

Before JW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a015.d

Date : 10-MAY-2012 18:45

Client ID: CWSB-15-11-13-0512

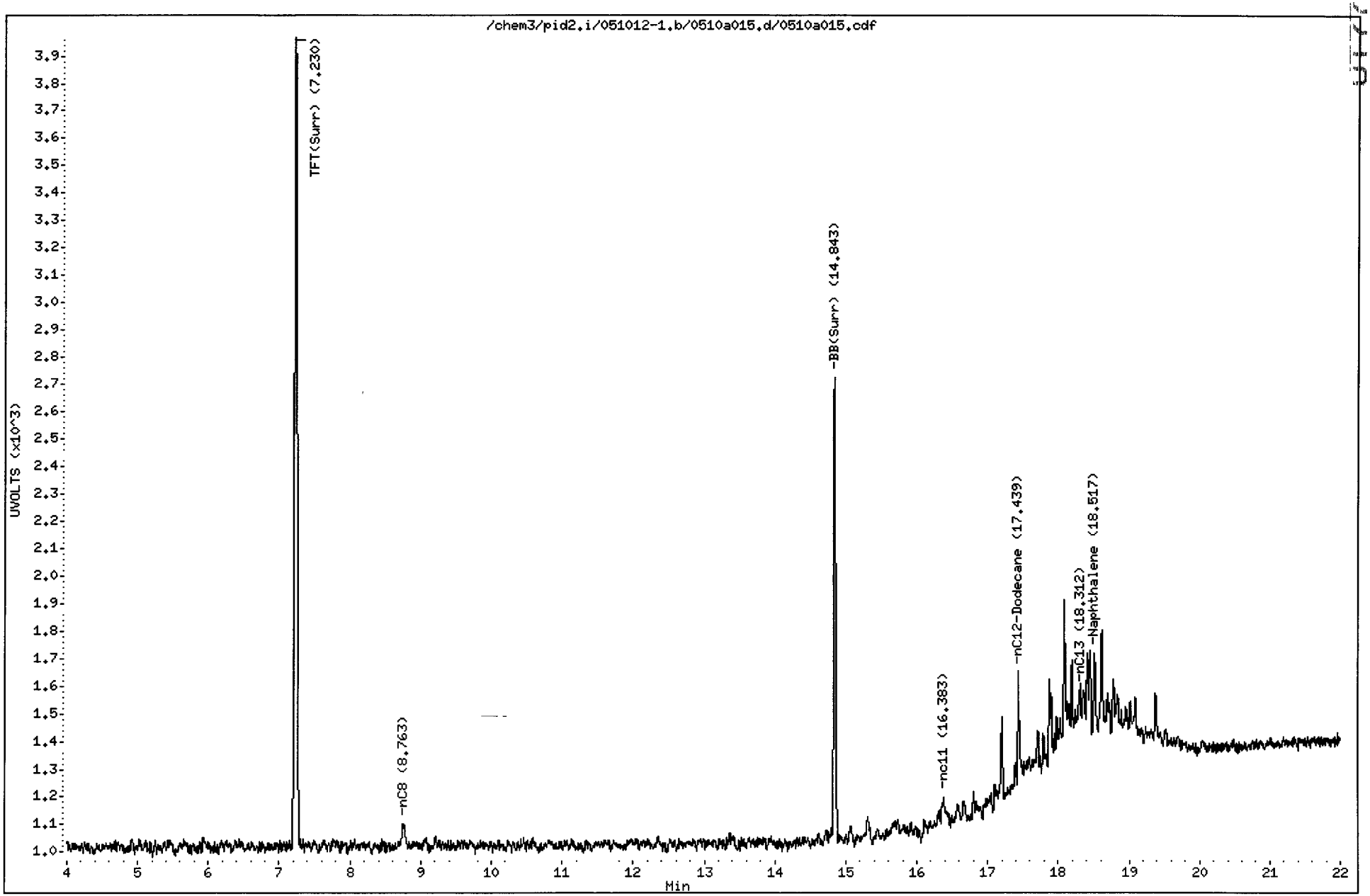
Sample Info: UT77H

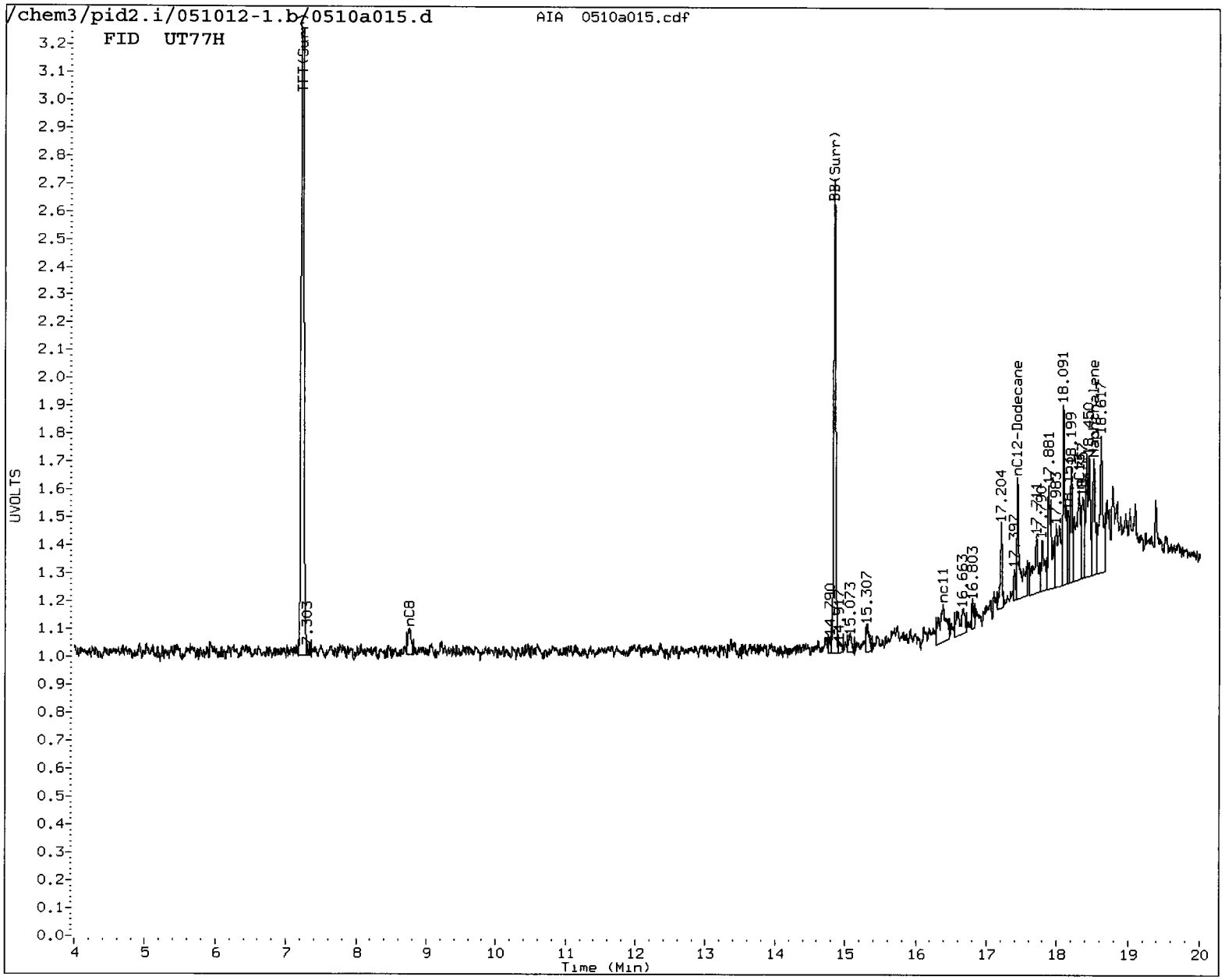
Instrument: pid2.i

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18





MANUAL INTEGRATION

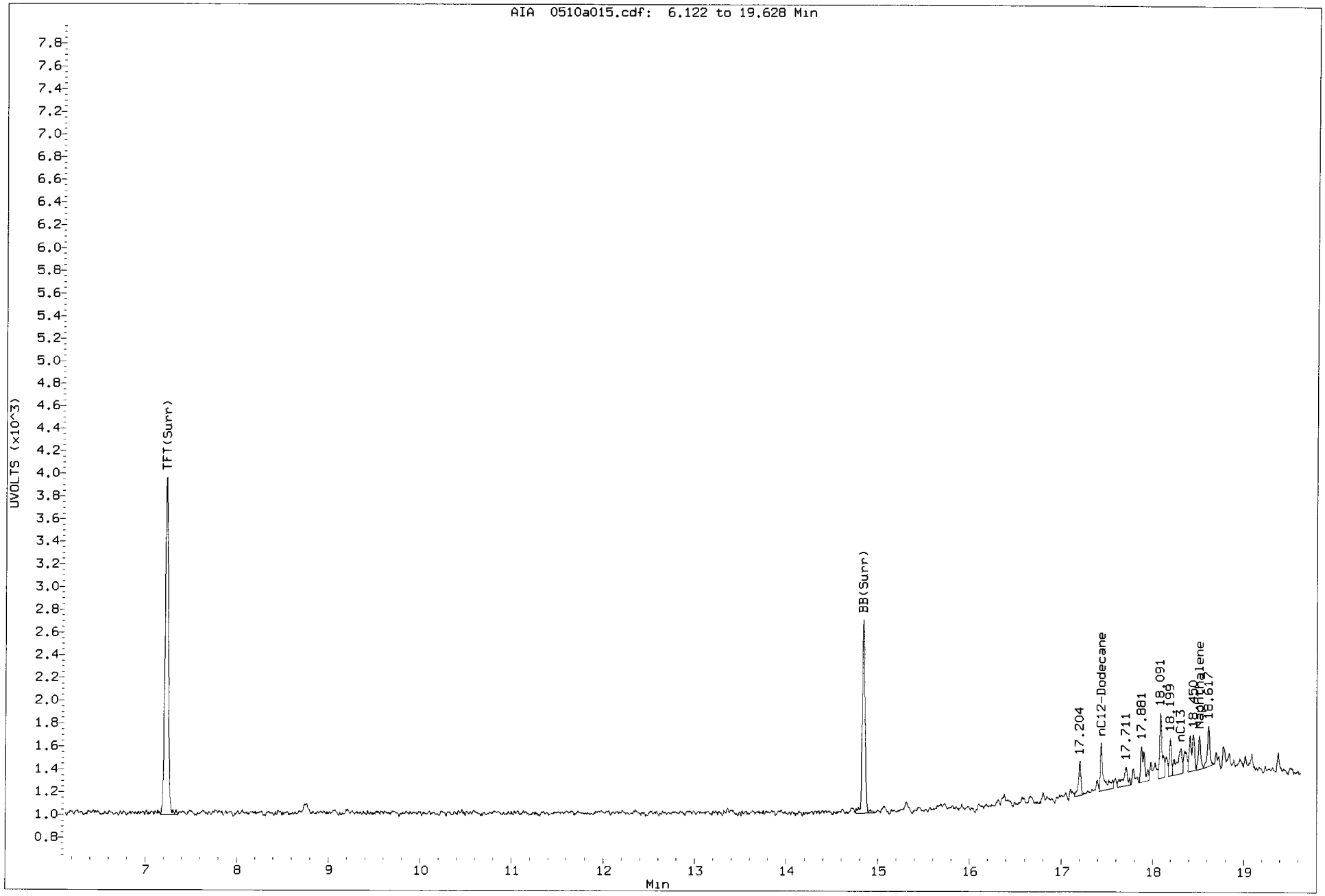
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PS

Analyst: JW Date: 5/15/12

UT77-0808

Data File: /chem3/pid2.i/051012-1.b/0510a015.d/0510a015.cdf
Injection Date: 10-MAY-2012 18:45
Instrument: pid2.i
Client Sample ID: CWSB-15-11-13-0512

Before JW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a016.d

Date : 10-MAY-2012 19:13

Client ID: CWSB-15-23-25-0512

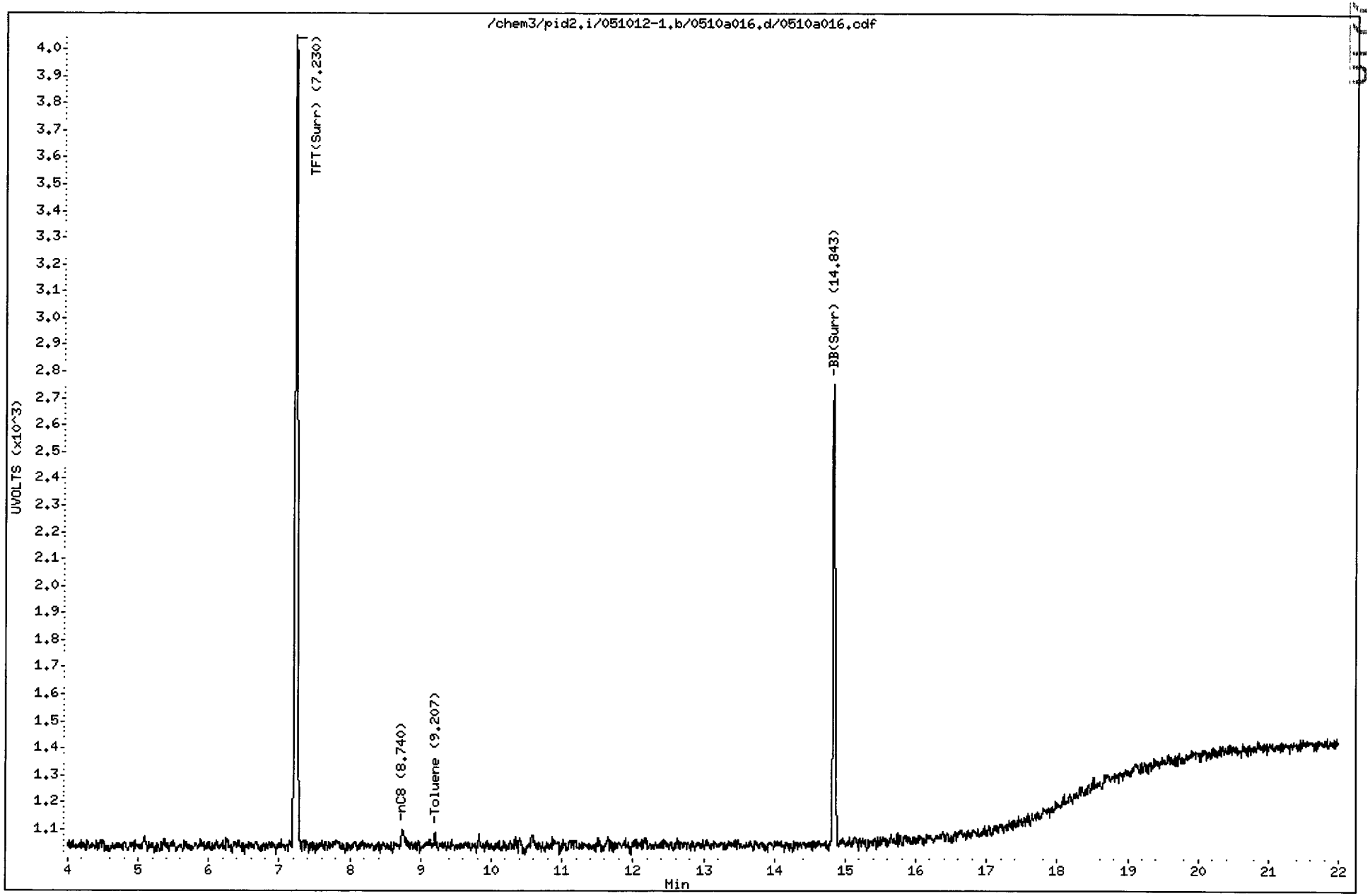
Sample Info: UT77I

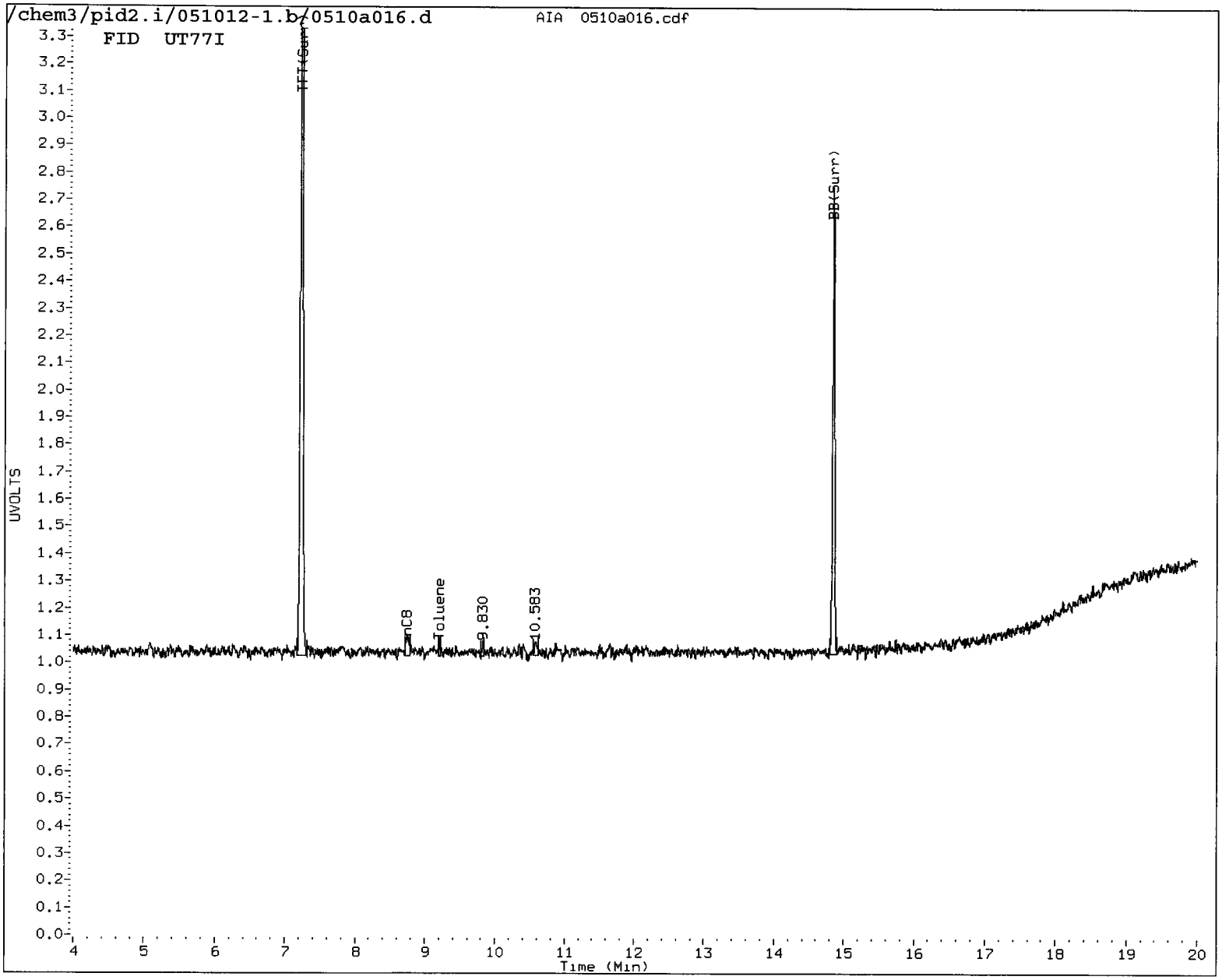
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a016.d/0510a016.cdf
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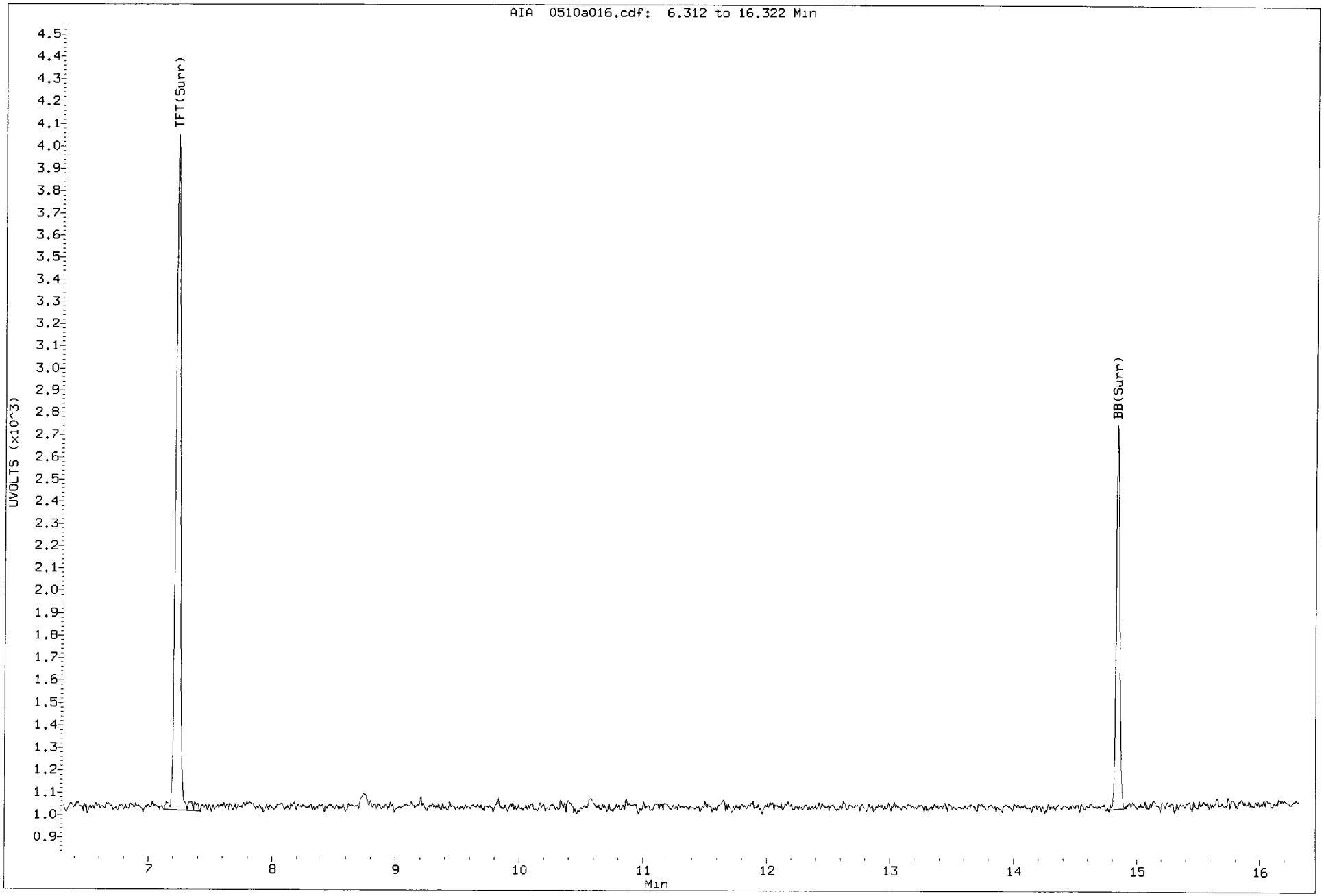
Instrument: pid2.i
Client Sample ID: CWSB-15-23-25-0512

Before JW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a017.d

Date : 10-MAY-2012 19:41

Client ID: CWSB-15-18-20-0512

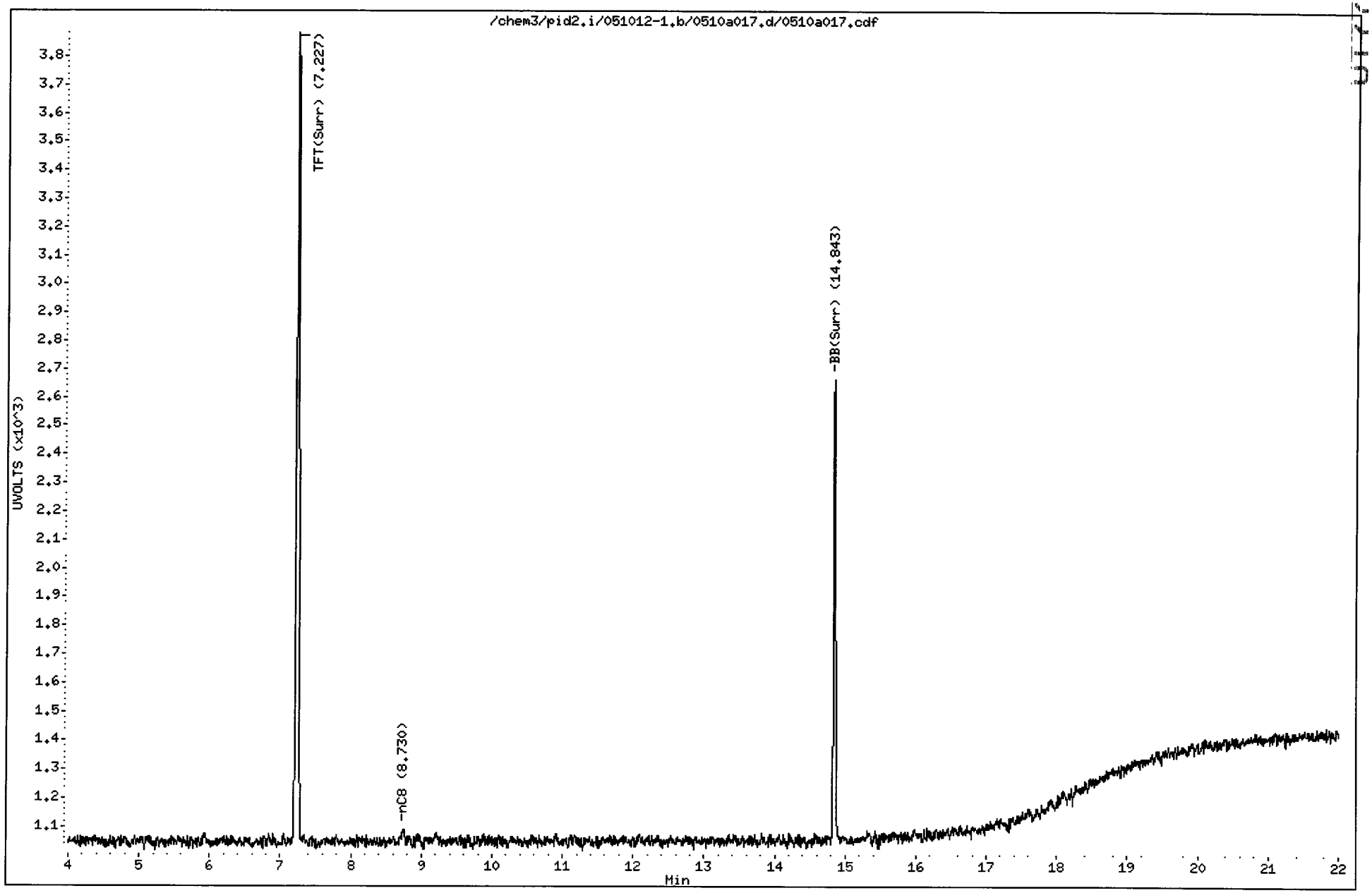
Sample Info: UT77J

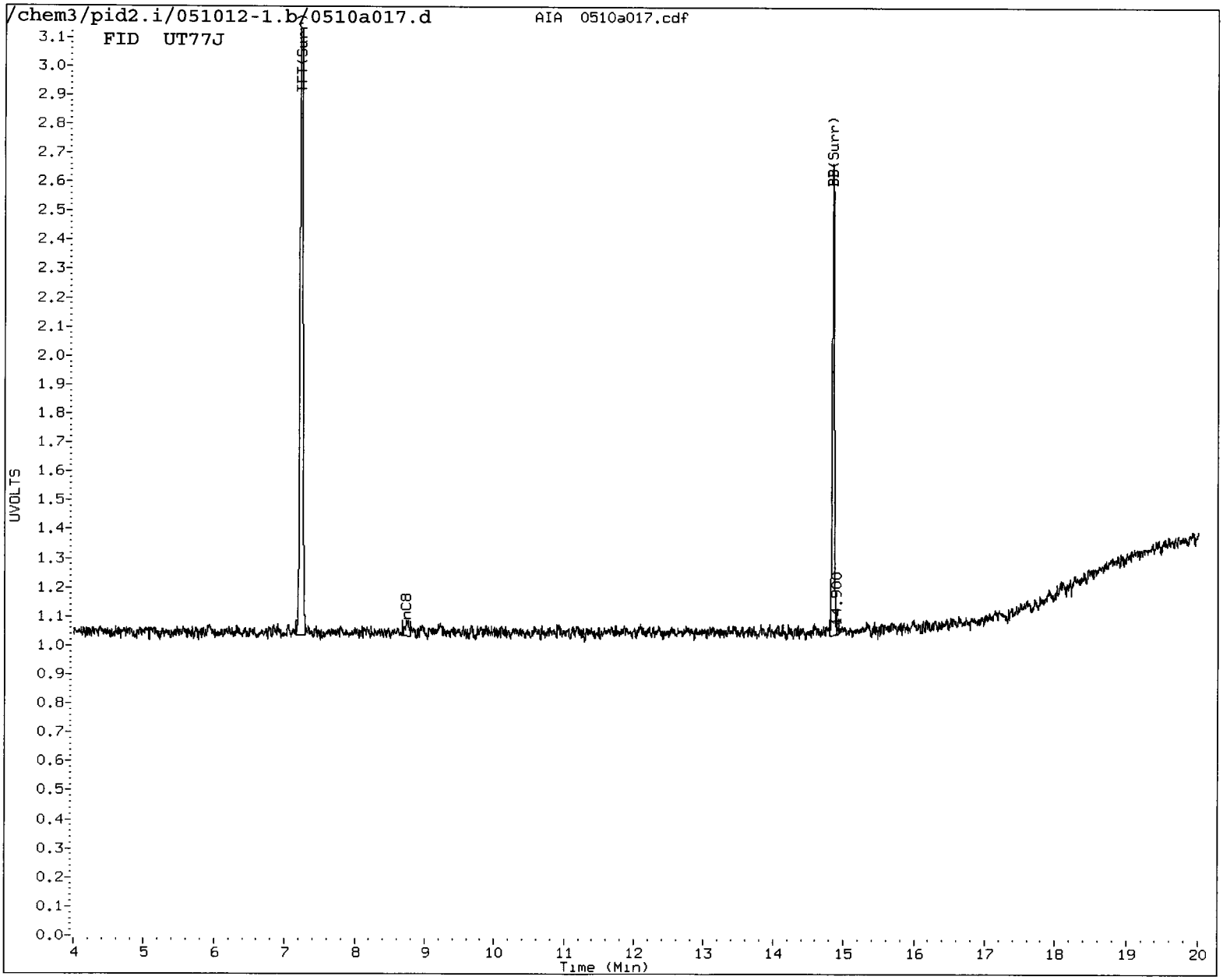
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5 Other PS

Analyst: JW Date: 5/15/12

Before JW 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a017.d/0510a017.cdf
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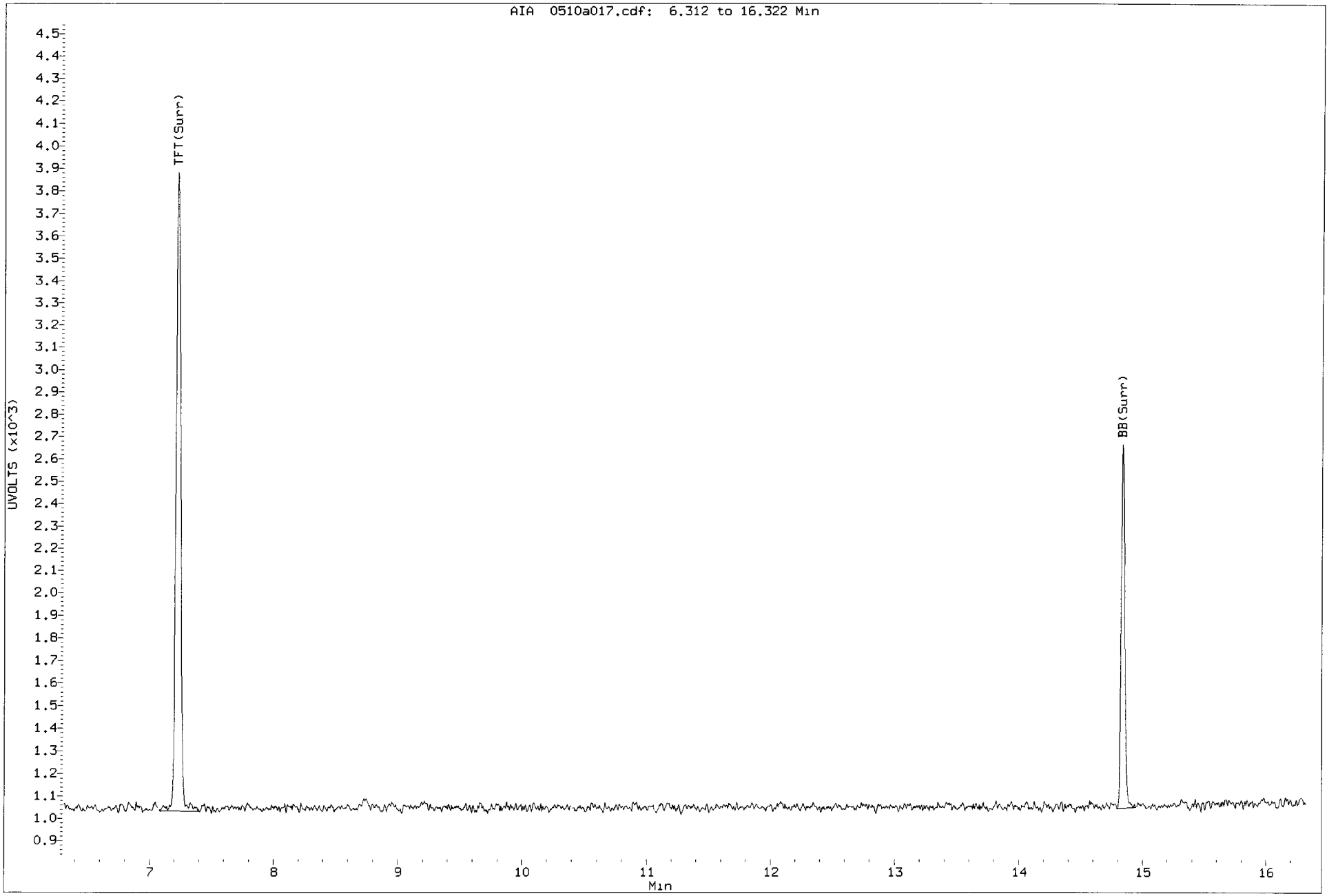
Instrument: pid2.i
Client Sample ID: CWSB-15-18-20-0512



Data File: /chem3/pid2.i/051012-1.b/0510a026.d

Date : 10-MAY-2012 23:54

Client ID: CWSB-16-8-10-0512

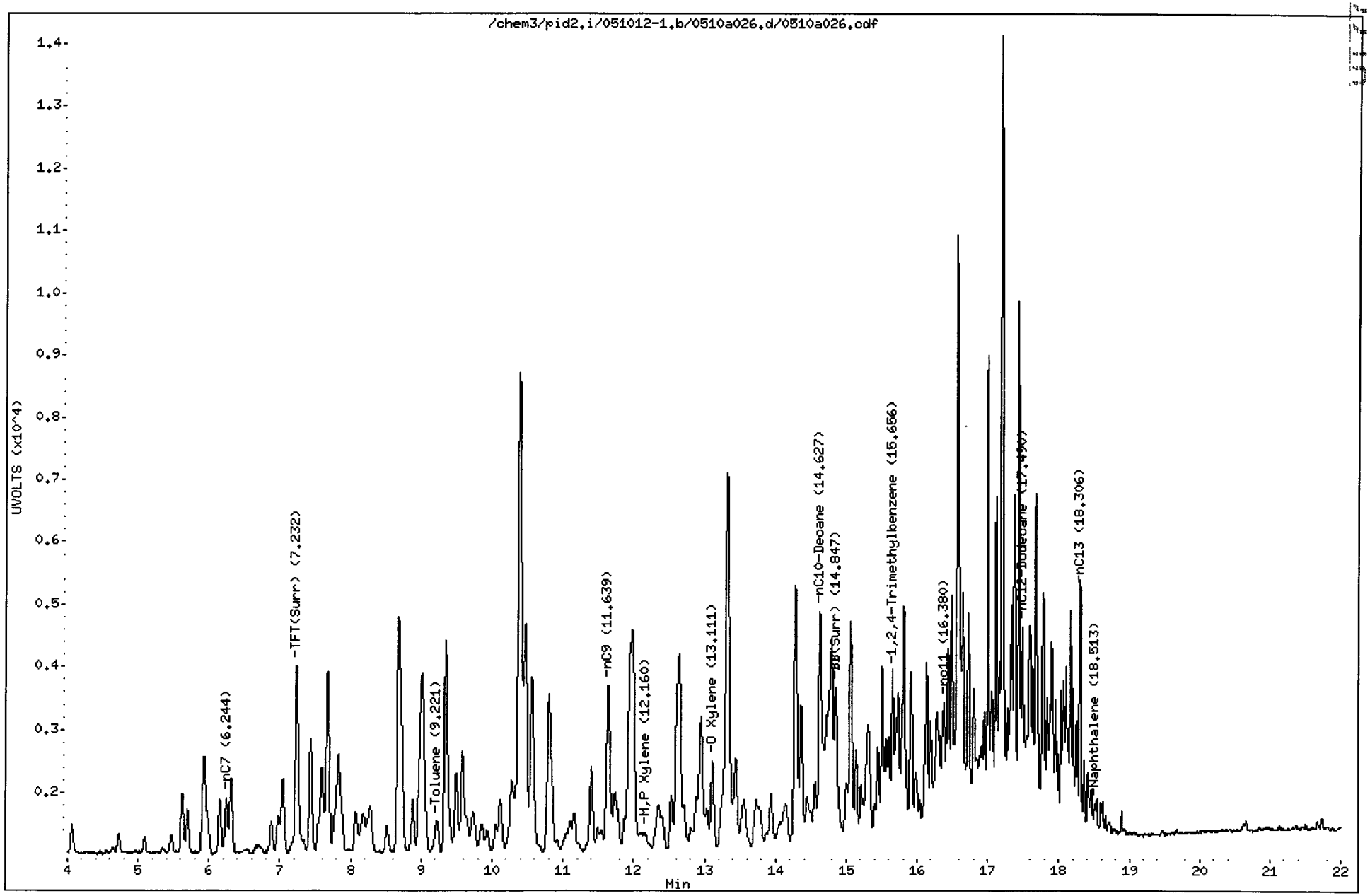
Sample Info: UT77L

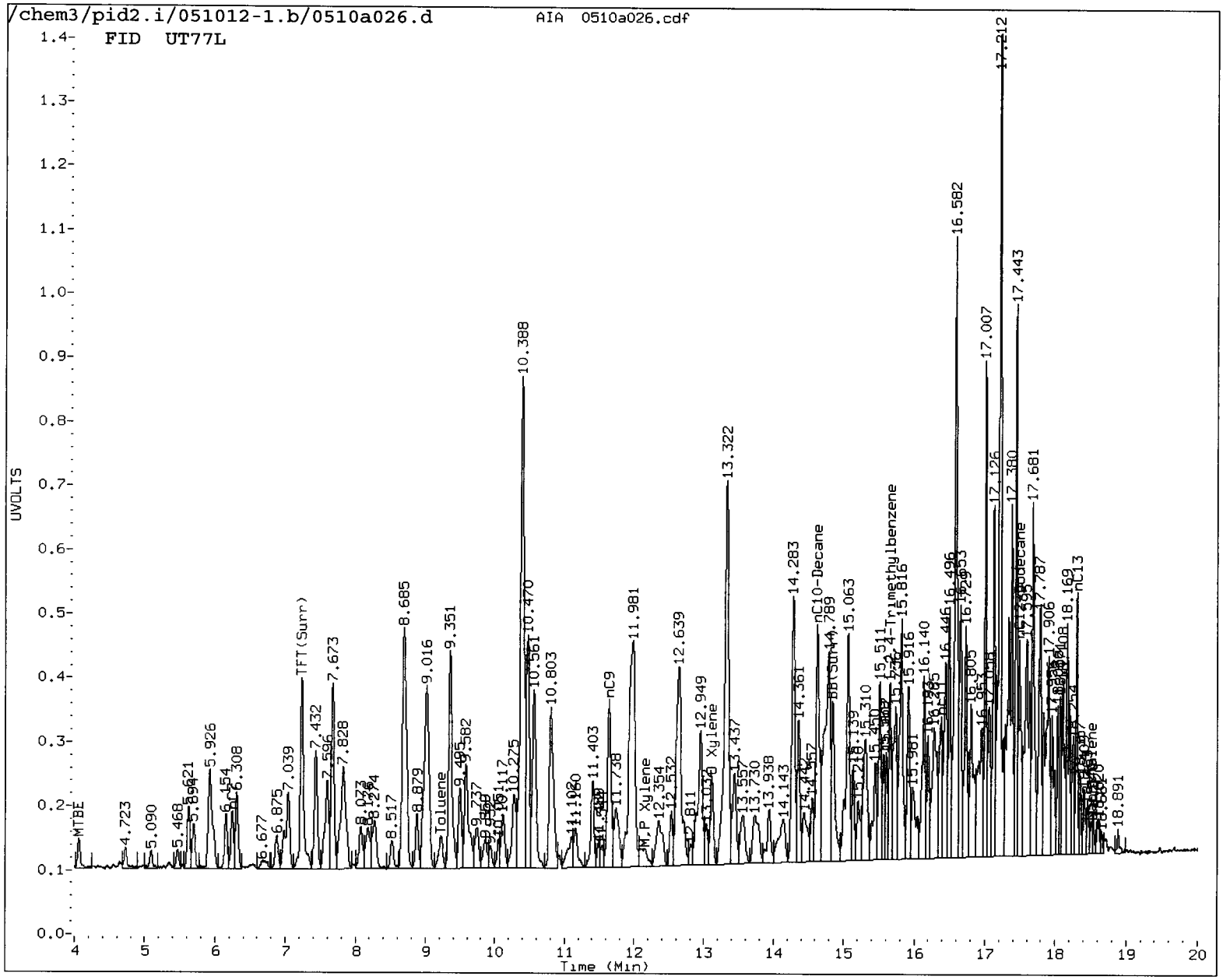
Instrument: pid2.i

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

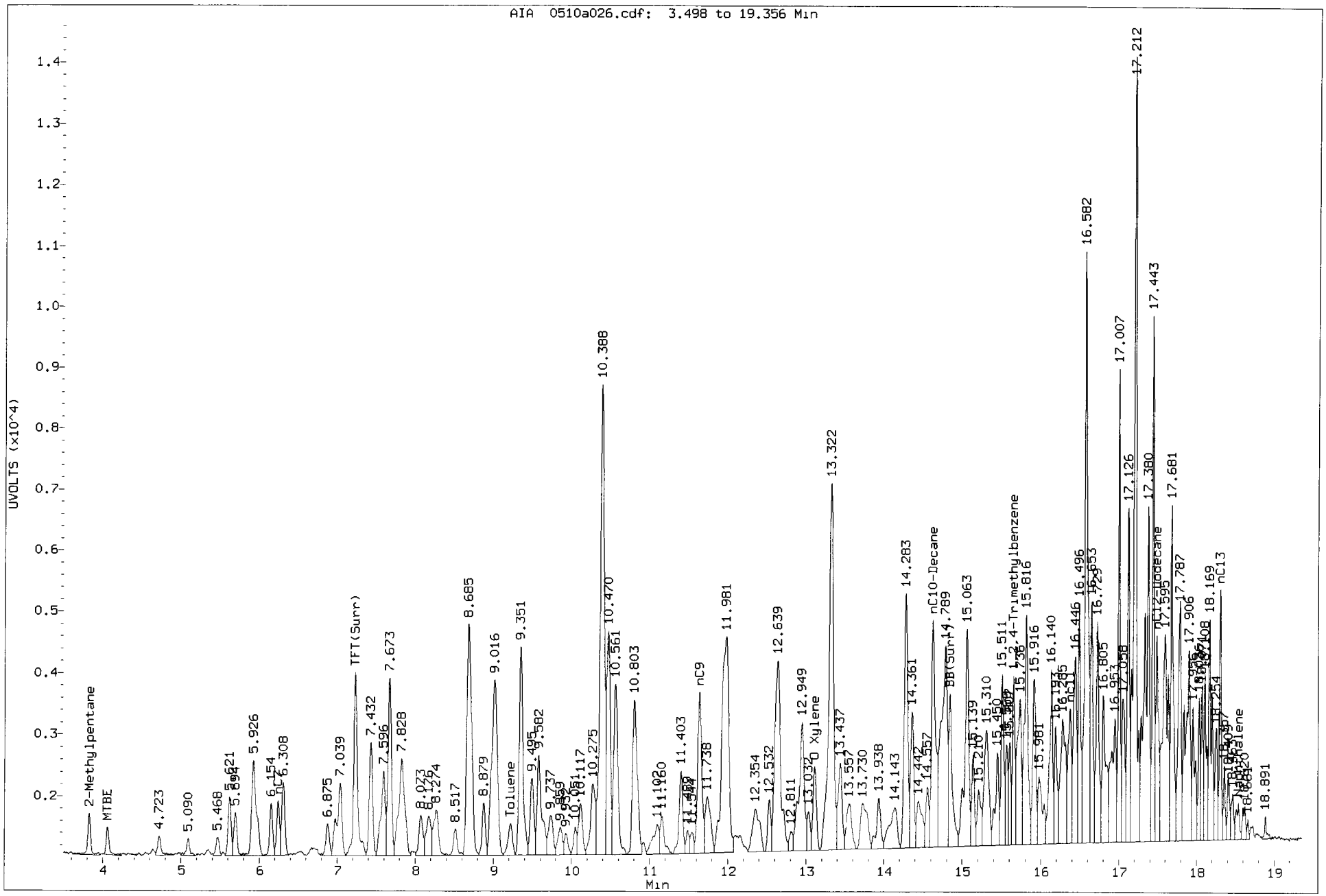
5. Other _____

Analyst: JW Date: 5/15/12

UT-6805

Data File: /chem3/pid2.i/051012-1.b/0510a026.d/0510a026.cdf
Injection Date: 10-MAY-2012 23:54
Instrument: pid2.i
Client Sample ID: CWSB-16-8-10-0512

Before
JW
5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a018.d

Date : 10-MAY-2012 20:09

Client ID: CWSB-16-13-15-0512

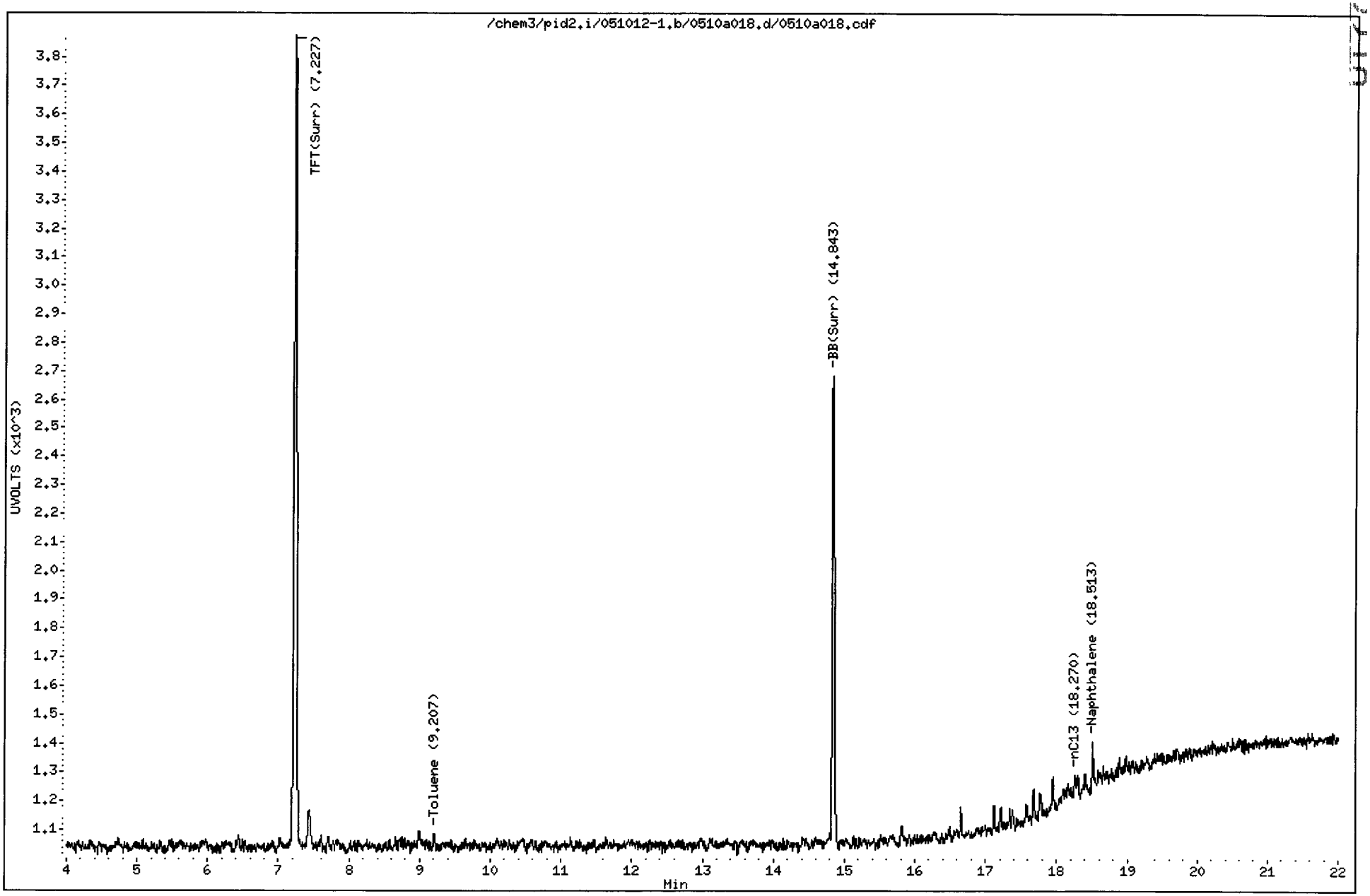
Sample Info: UT77M

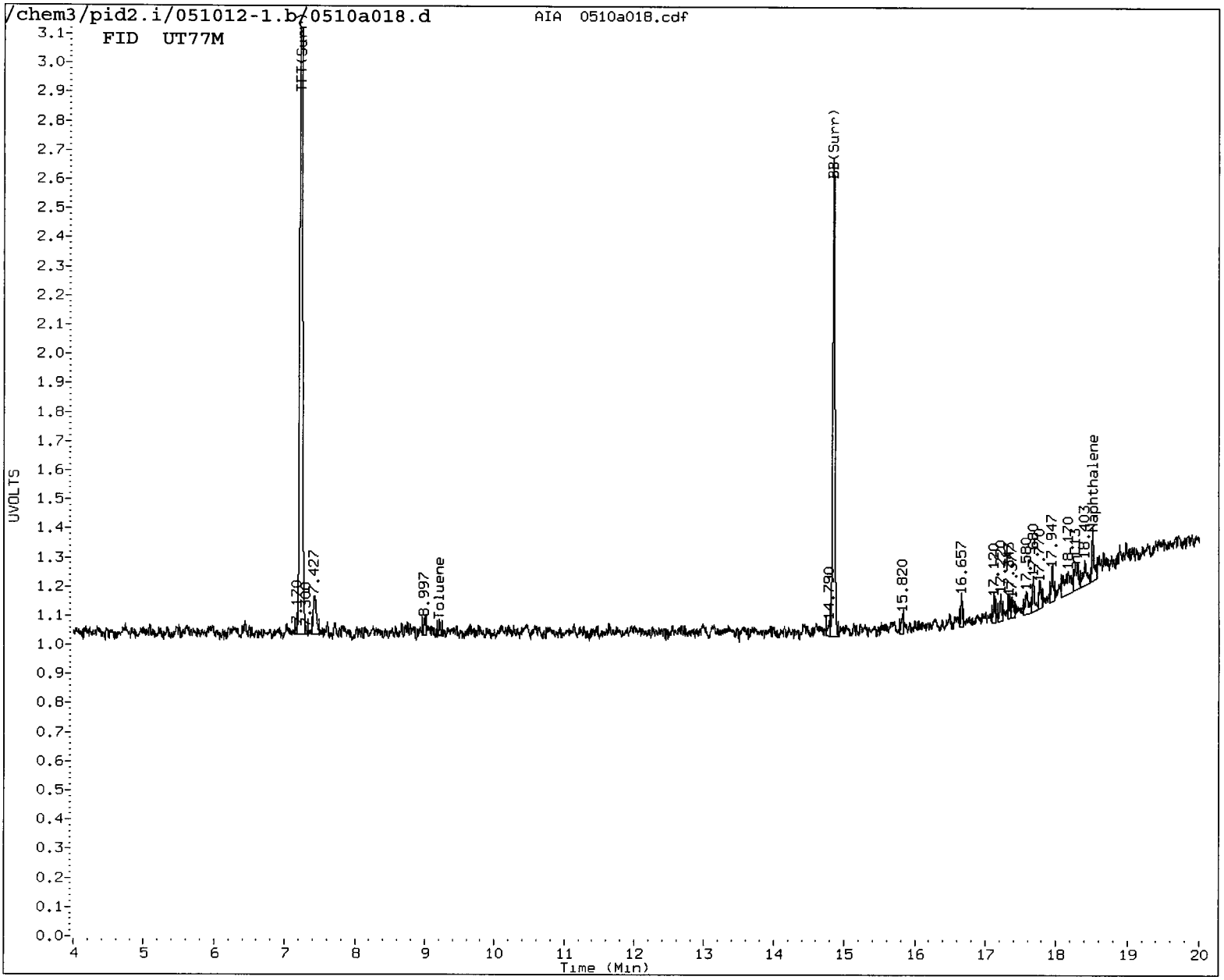
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

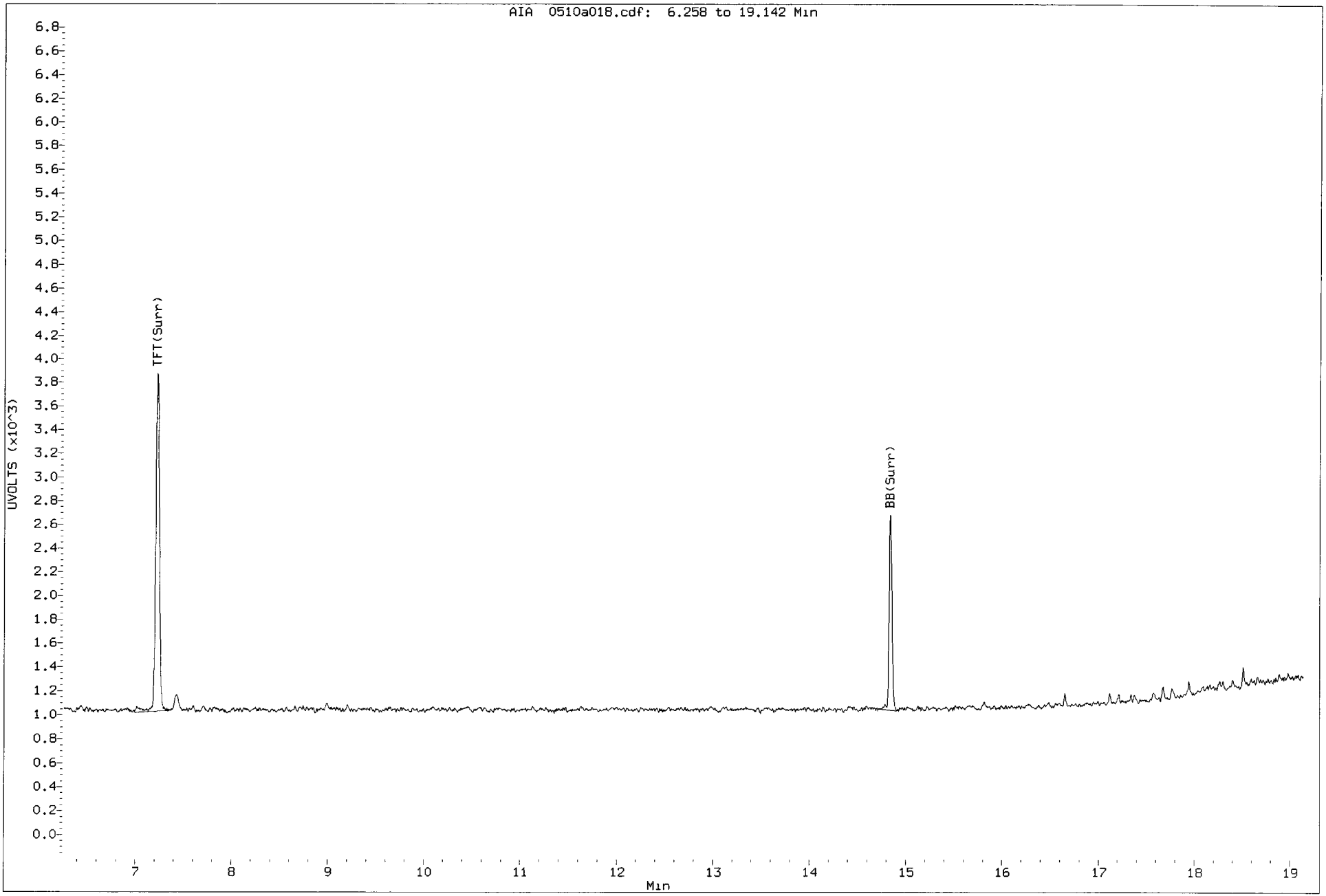
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PS

Analyst: SW Date: 5/15/12

UT77:66657

Before JW 5/16/12

Data File: /chem3/pid2.i/051012-1.b/0510a018.d/0510a018.cdf
Injection Date: 10-MAY-2012 20:09
Instrument: pid2.i
Client Sample ID: CWSB-16-13-15-0512



Data File: /chem3/pid2.i/051012-1.b/0510a019.d

Date : 10-MAY-2012 20:38

Client ID: CWSB-16-18-20-0512

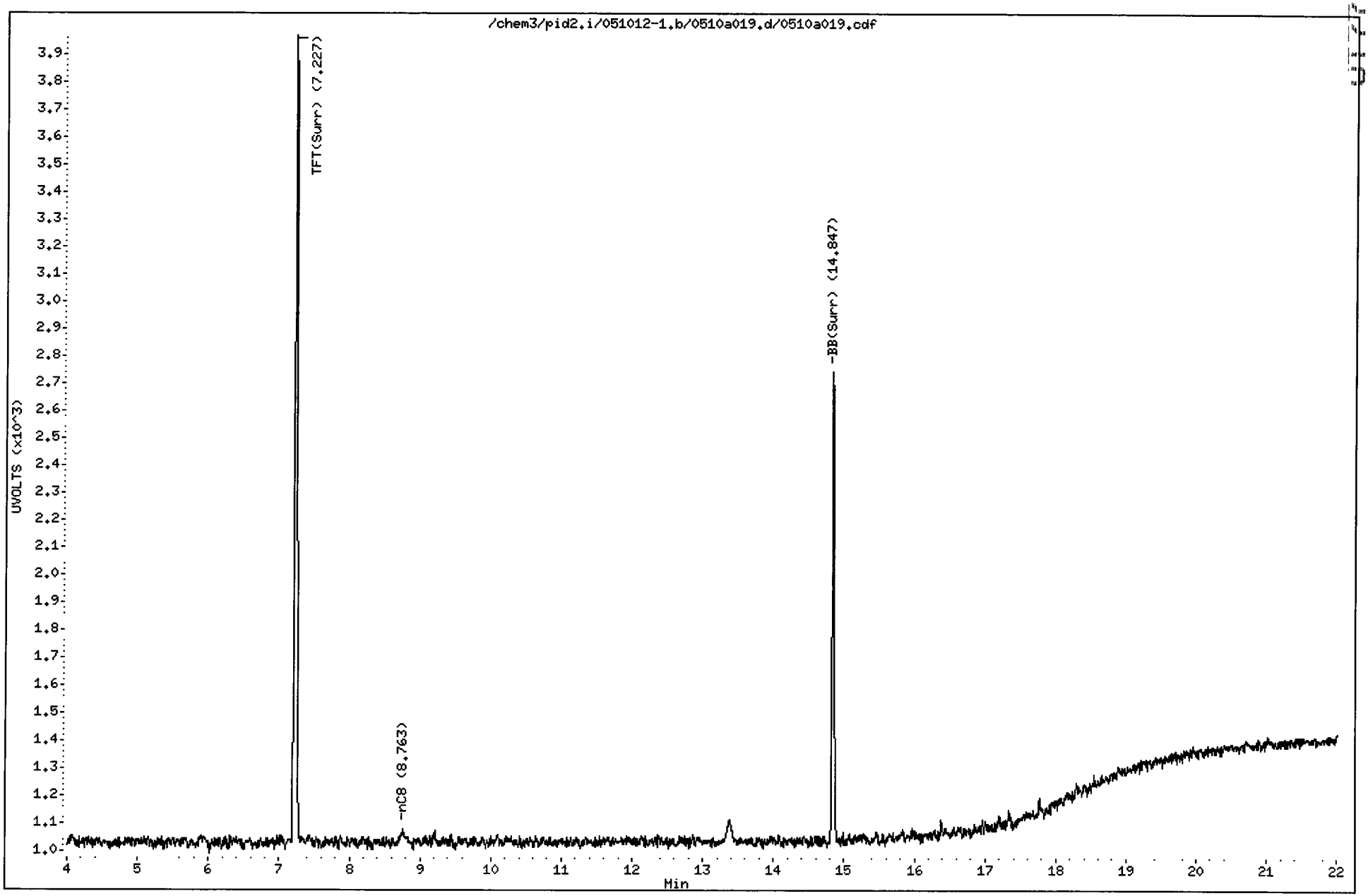
Sample Info: UT77N

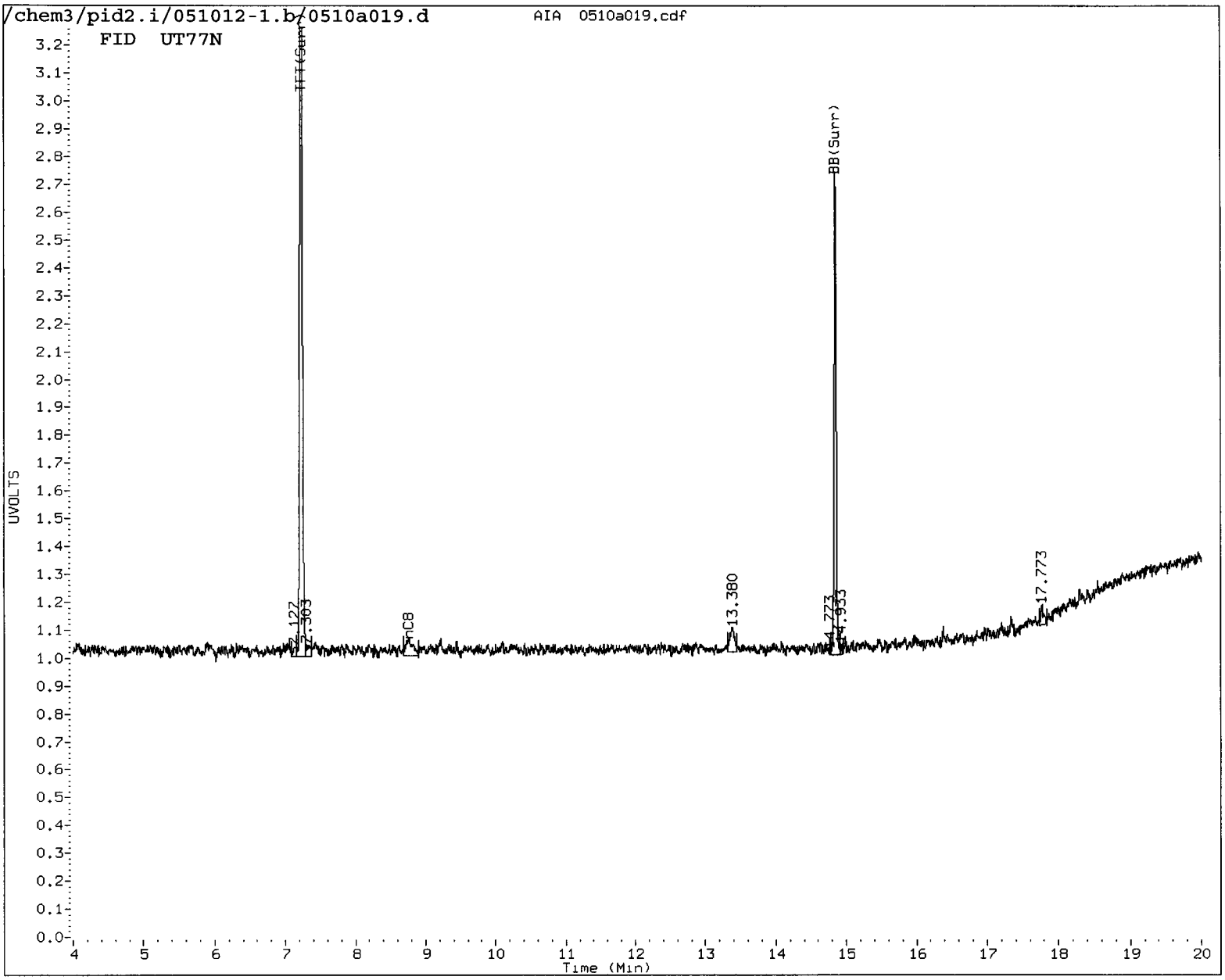
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





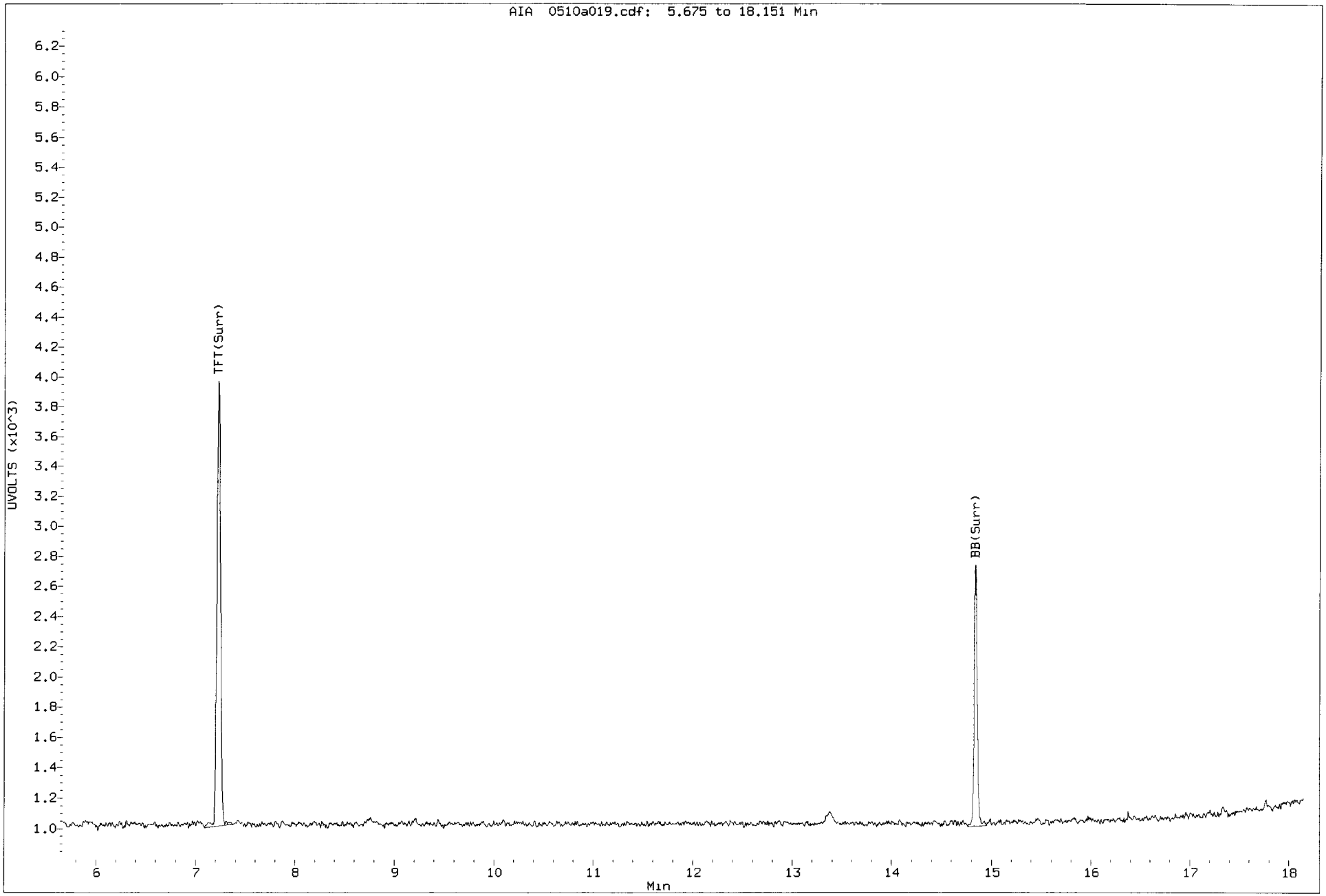
MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PB

Analyst: JW Date: 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a019.d/0510a019.cdf
Injection Date: 10-MAY-2012 20:38
Instrument: pid2.i
Client Sample ID: CWSB-16-18-20-0512

Benzene JW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a027.d

Date : 11-MAY-2012 00:22

Client ID: CWSB-17-6-8-0512

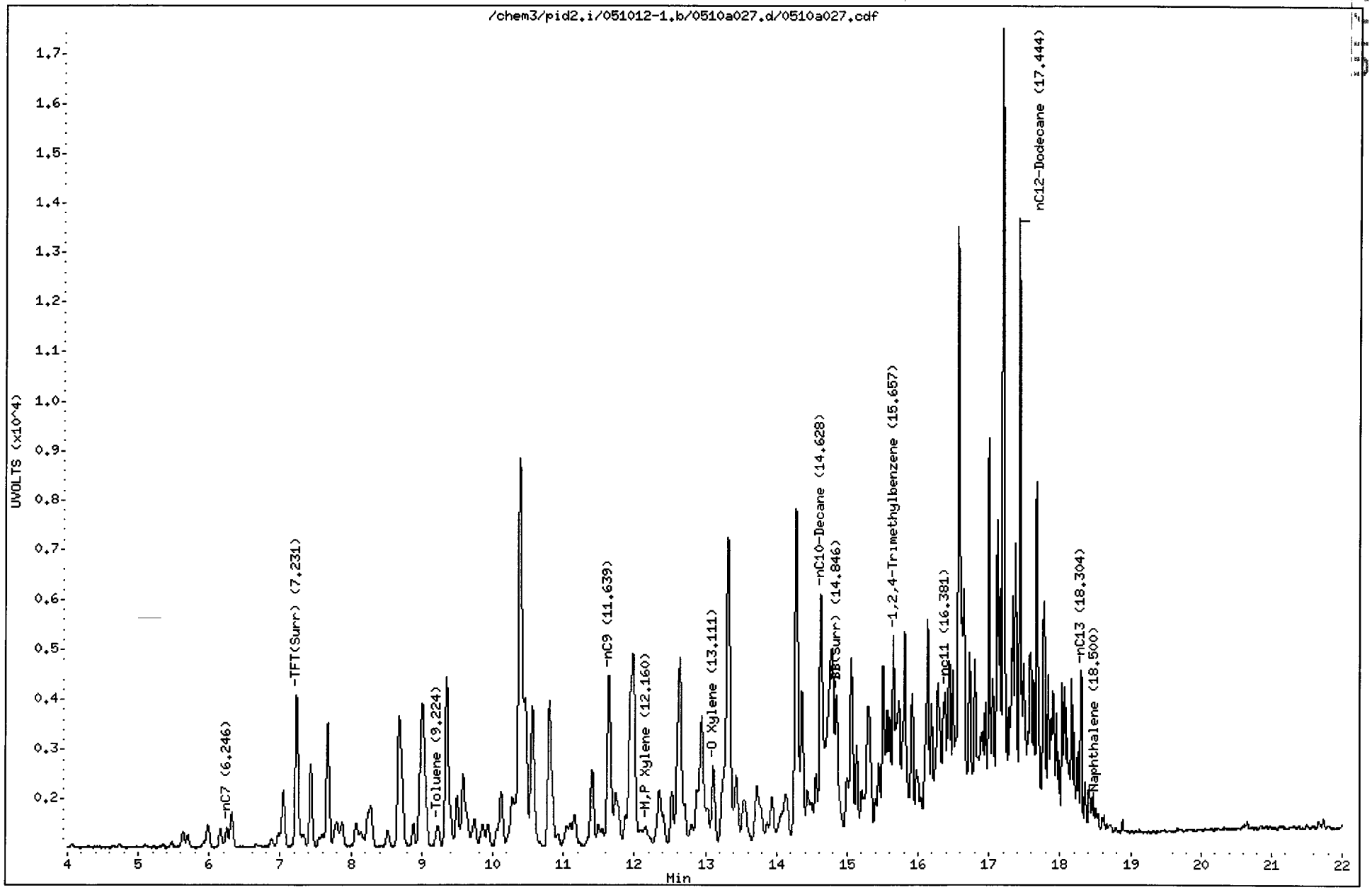
Sample Info: UT77P

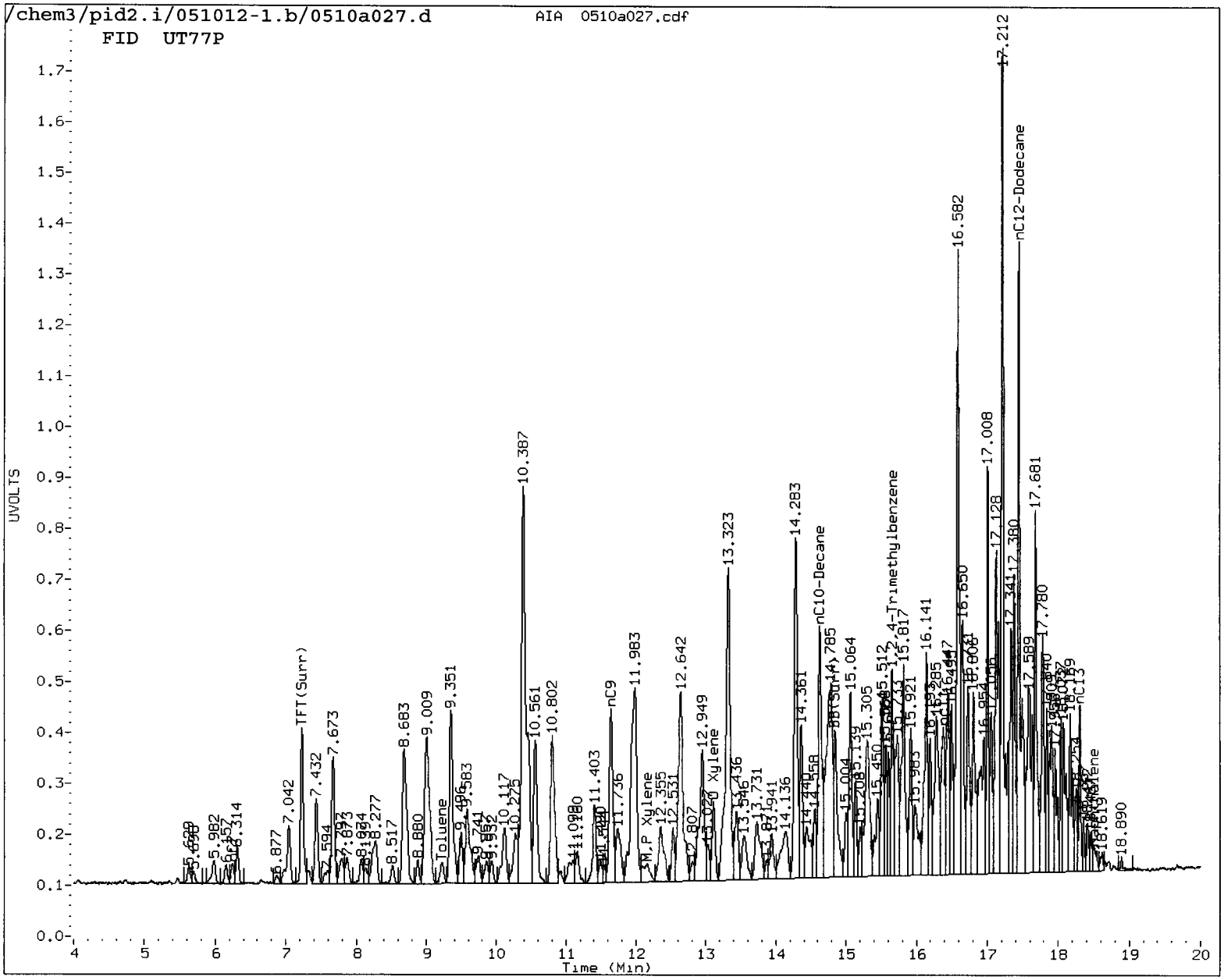
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



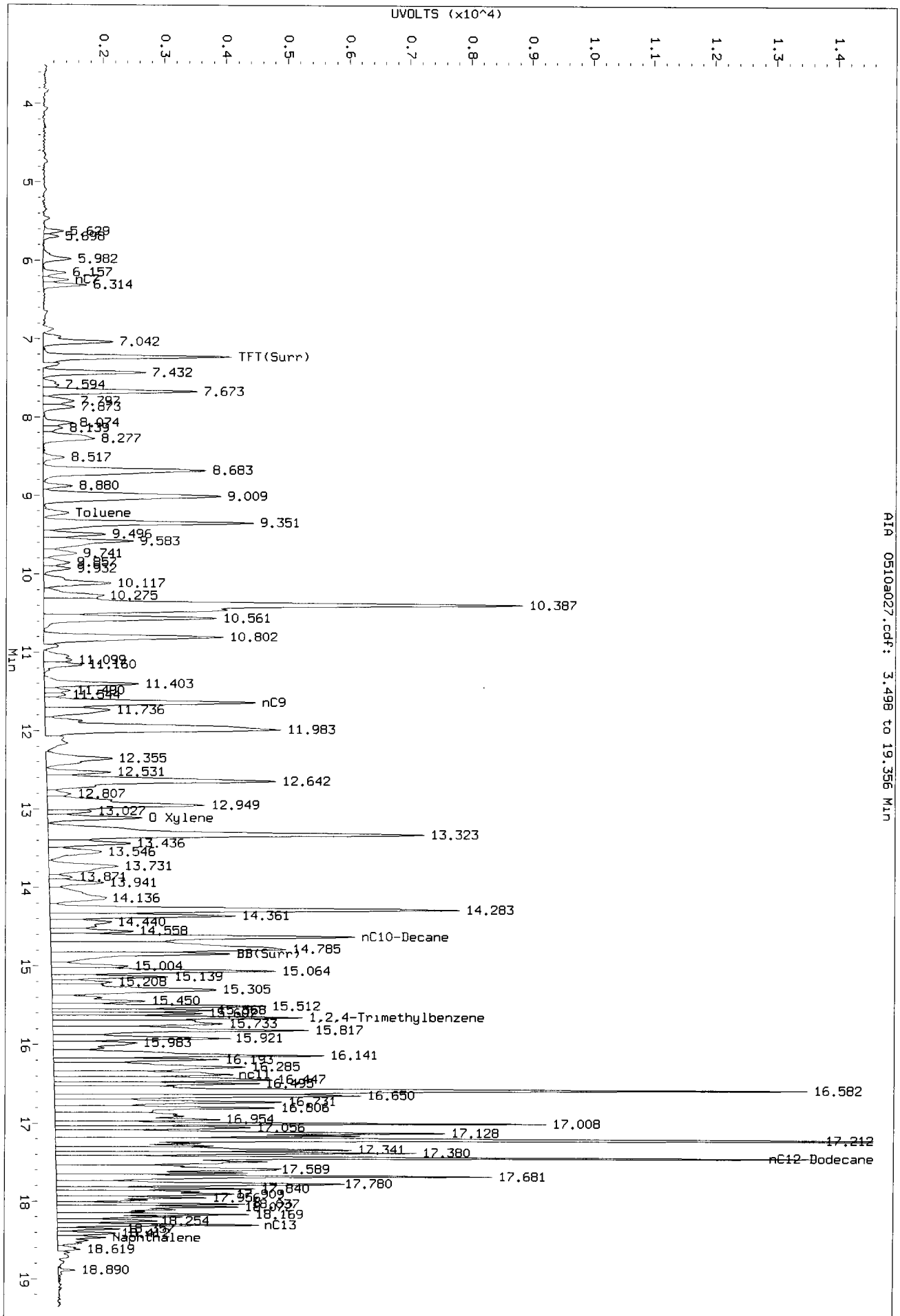


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: _____ Date: _____



Before TM 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a020.d

Date : 10-MAY-2012 21:06

Client ID: CWSB-17-23-25-0512

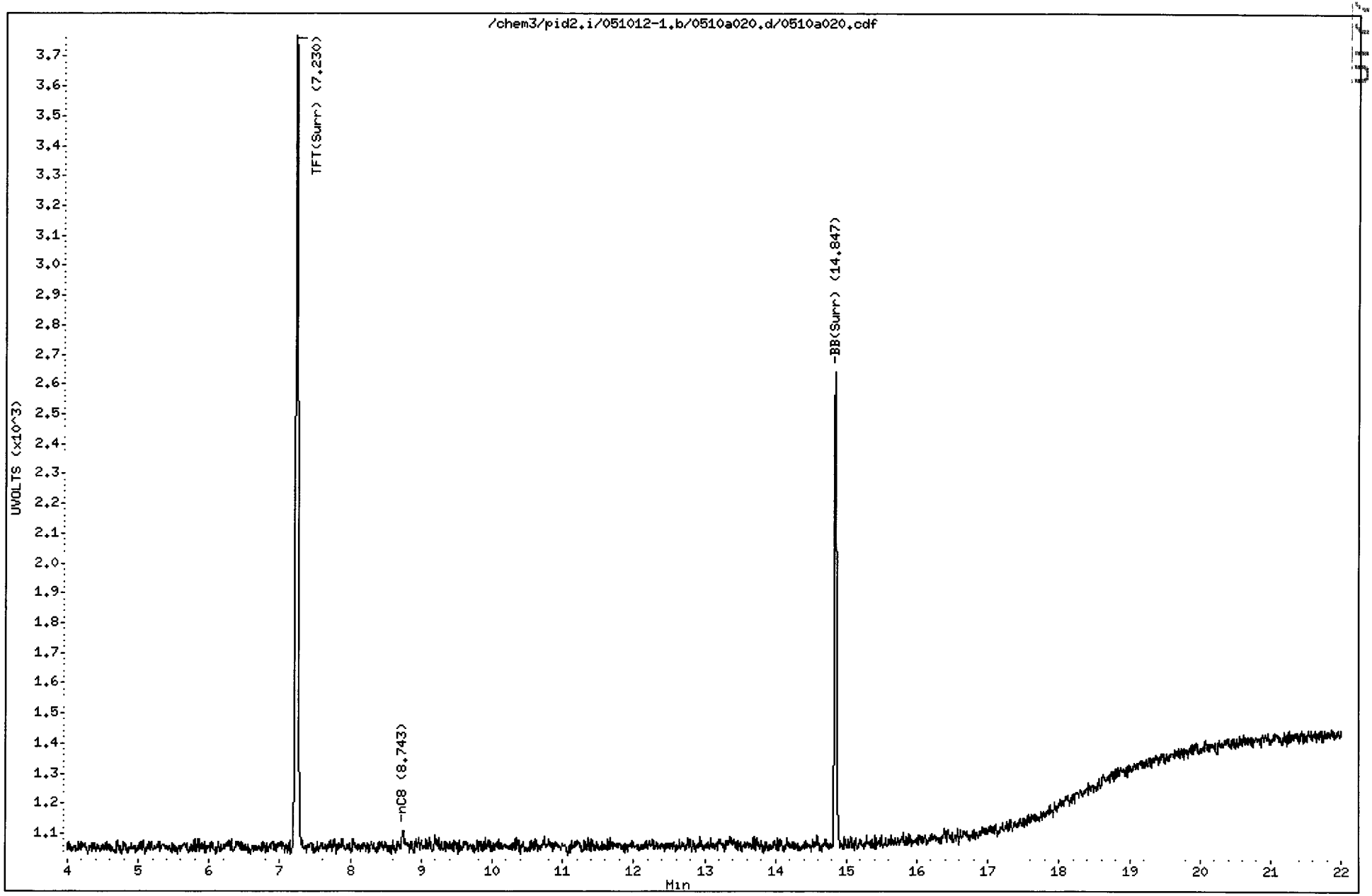
Sample Info: UT77Q

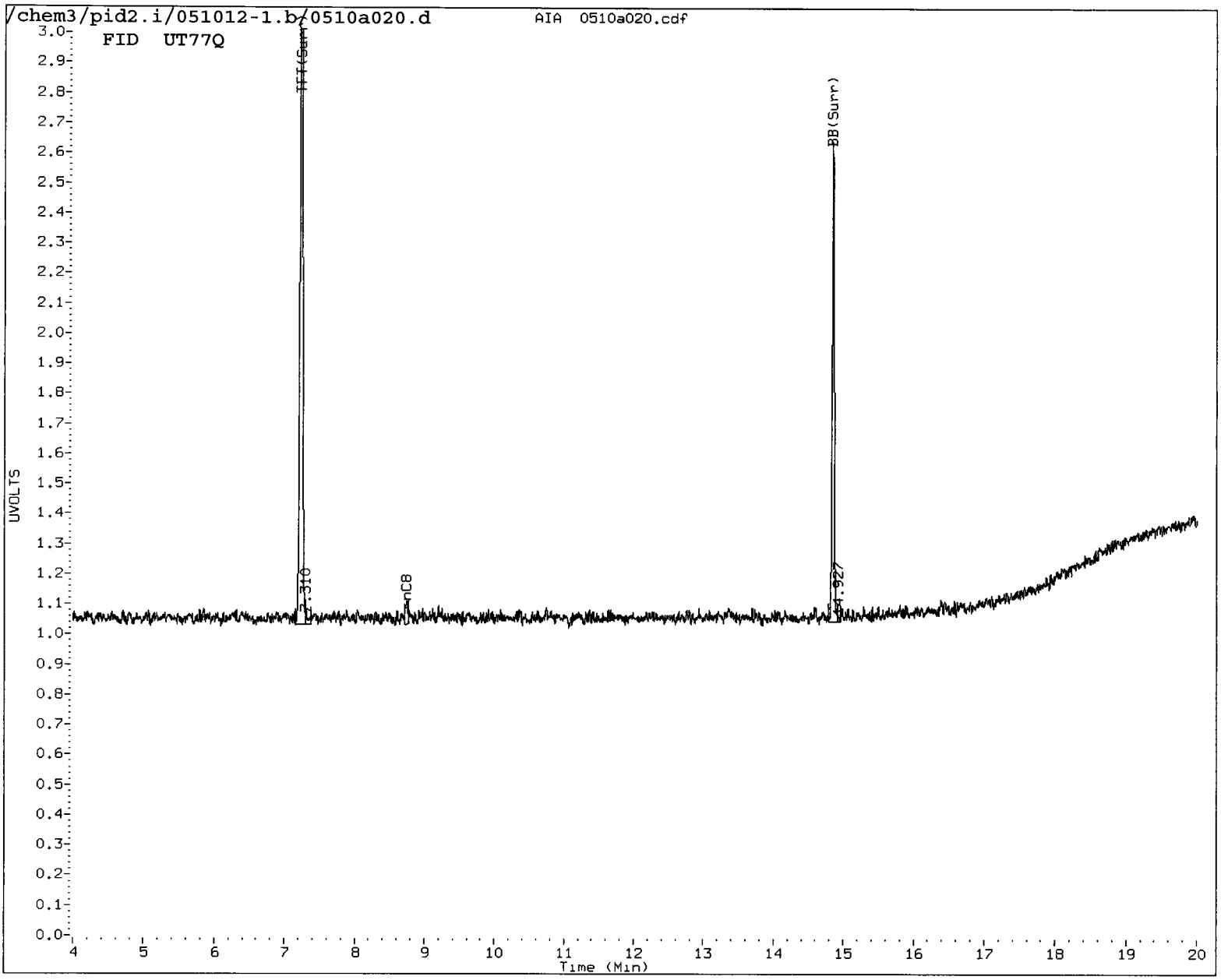
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

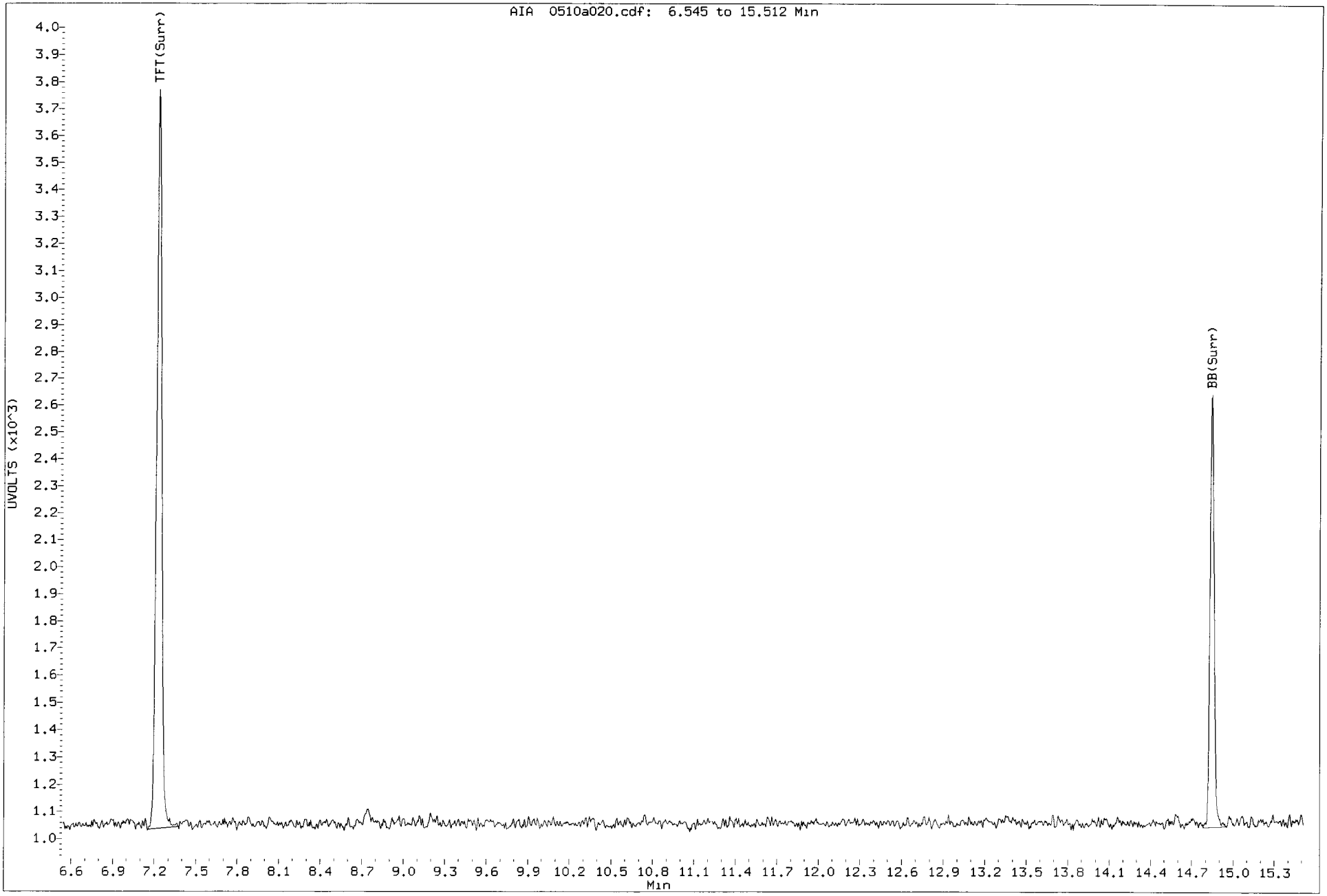
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other PS

Analyst: JW Date: 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a020.d/0510a020.cdf
Injection Date: 10-MAY-2012 21:06
Instrument: pid2.i
Client Sample ID: CWSB-17-23-25-0512

Before TW 5/15/12



Data File: /chem3/pid2.i/051012-1.b/0510a022.d

Date : 10-MAY-2012 22:02

Client ID: CWSB-17-28-30-0512

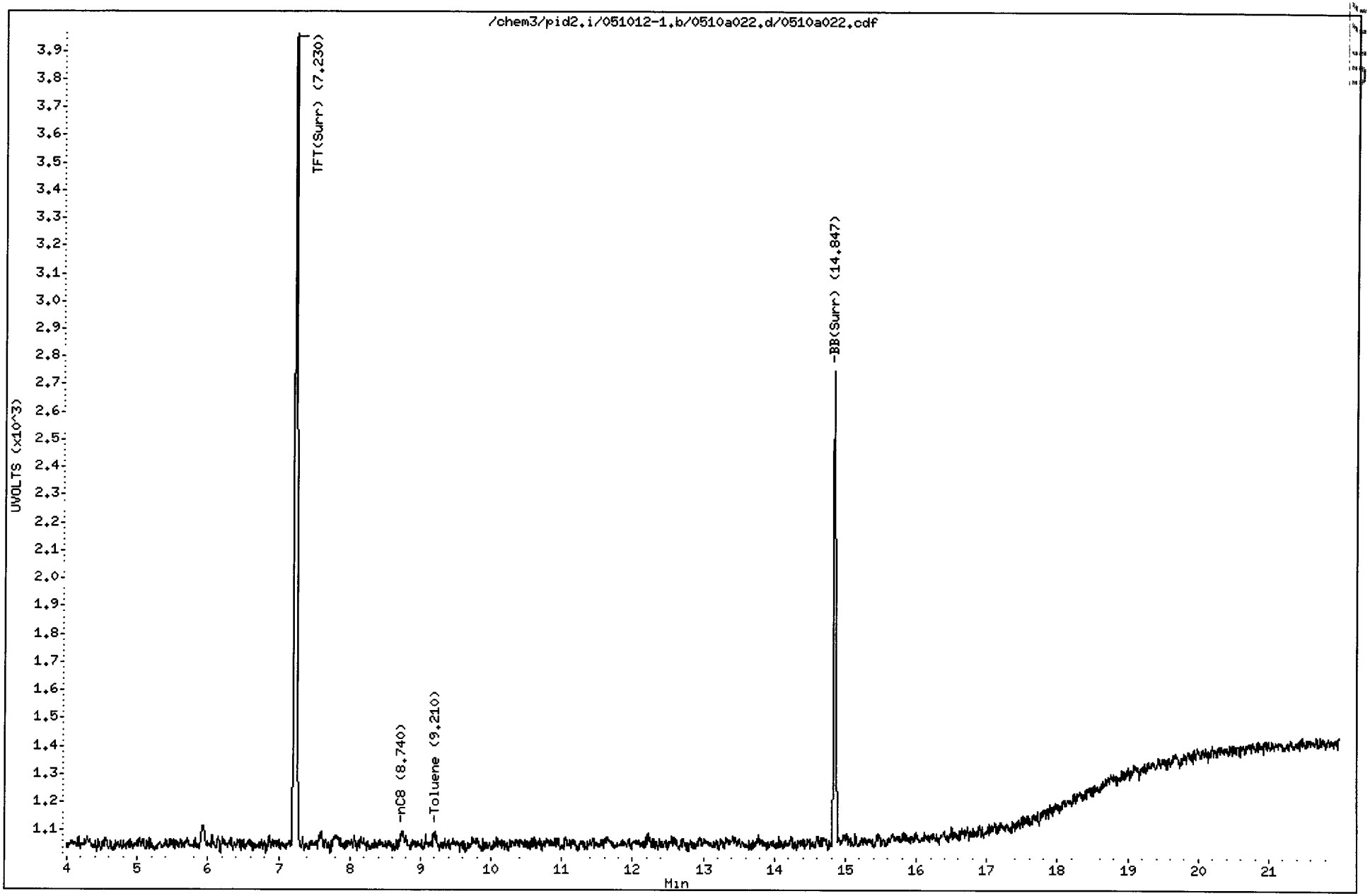
Sample Info: UT77R

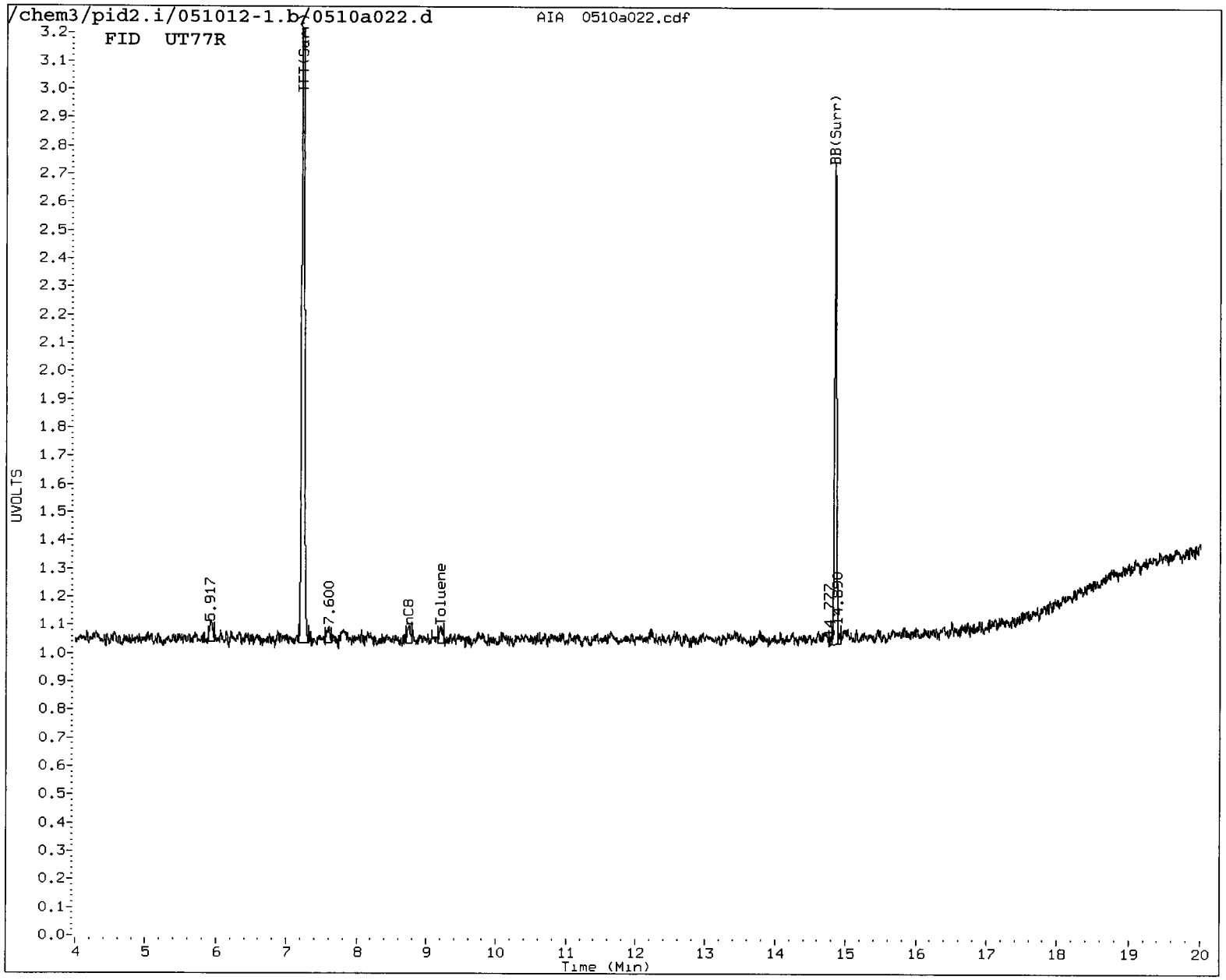
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

(1). Baseline correction
2. Poor chromatography
(3). Peak not found
4. Totals calculation

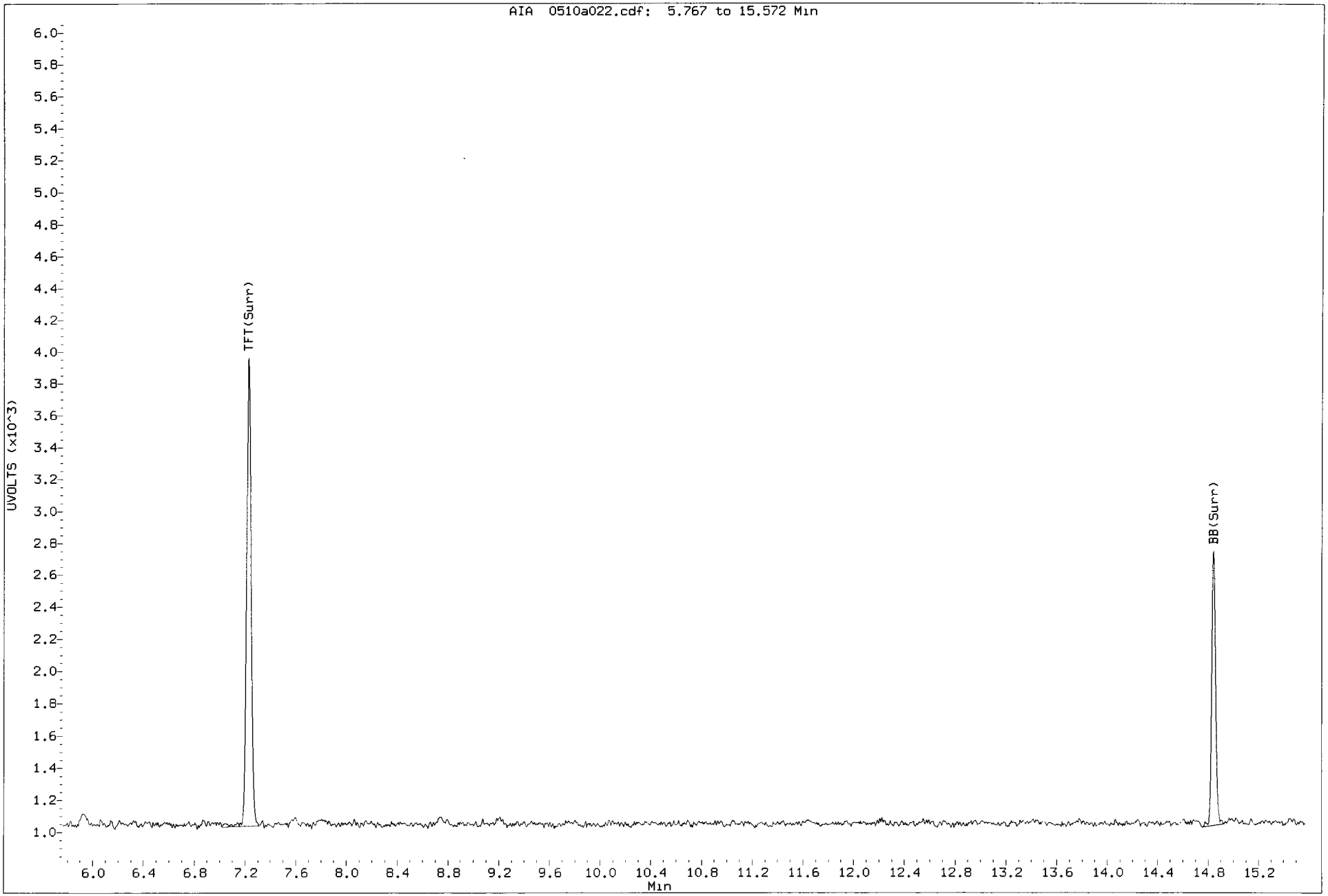
(5.) Other RS

Analyst: SW Date: 5/15/12

UT77:0510

Before JW 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a022.d/0510a022.cdf
Injection Date: 10-MAY-2012 22:02
Instrument: pid2.i
Client Sample ID: CWSB-17-28-30-0512



Data File: /chem3/pid2.i/051012-1.b/0510a023.d

Date : 10-MAY-2012 22:30

Client ID: CWSB-170-23-25-0512

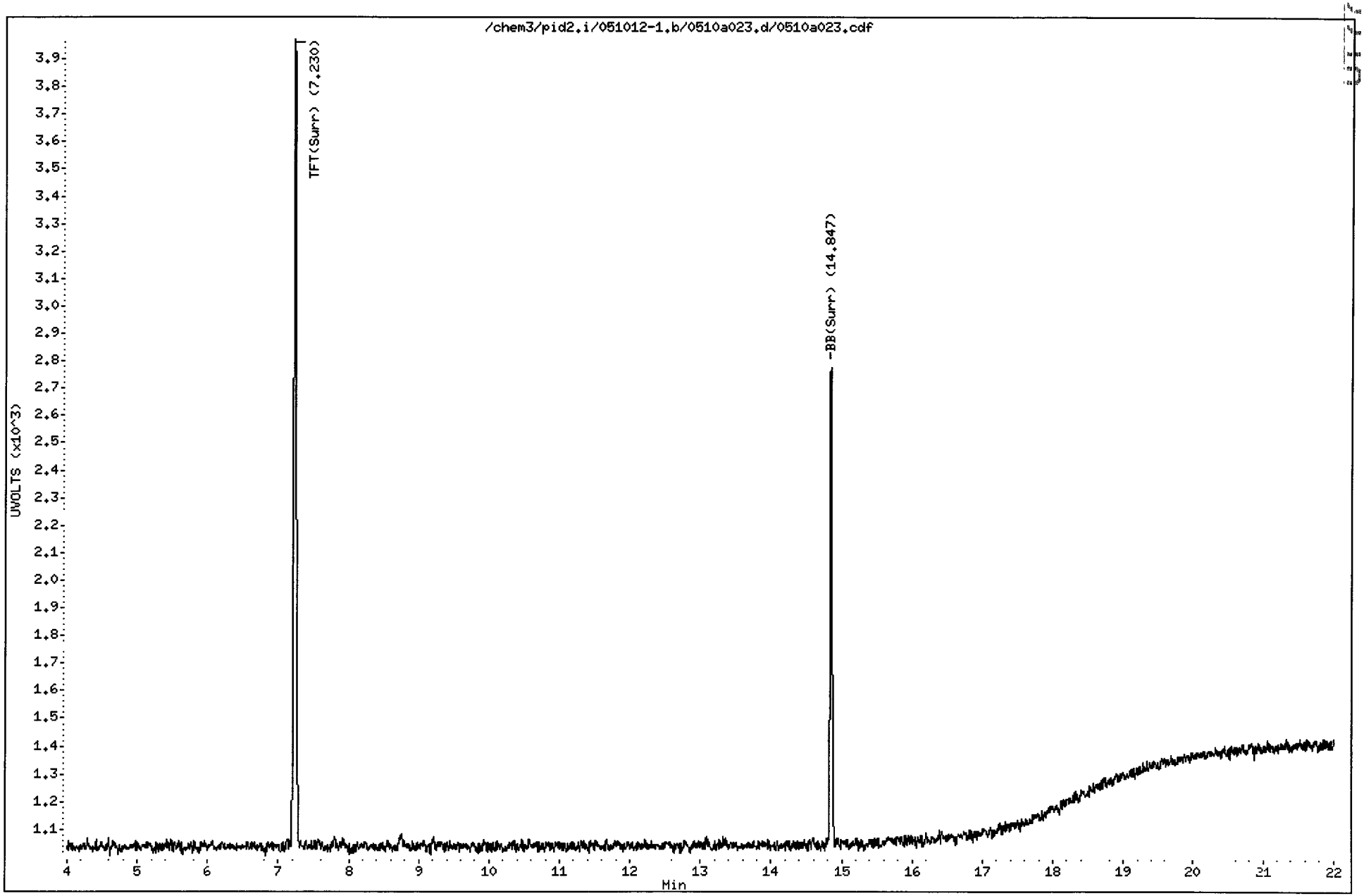
Sample Info: UT77S

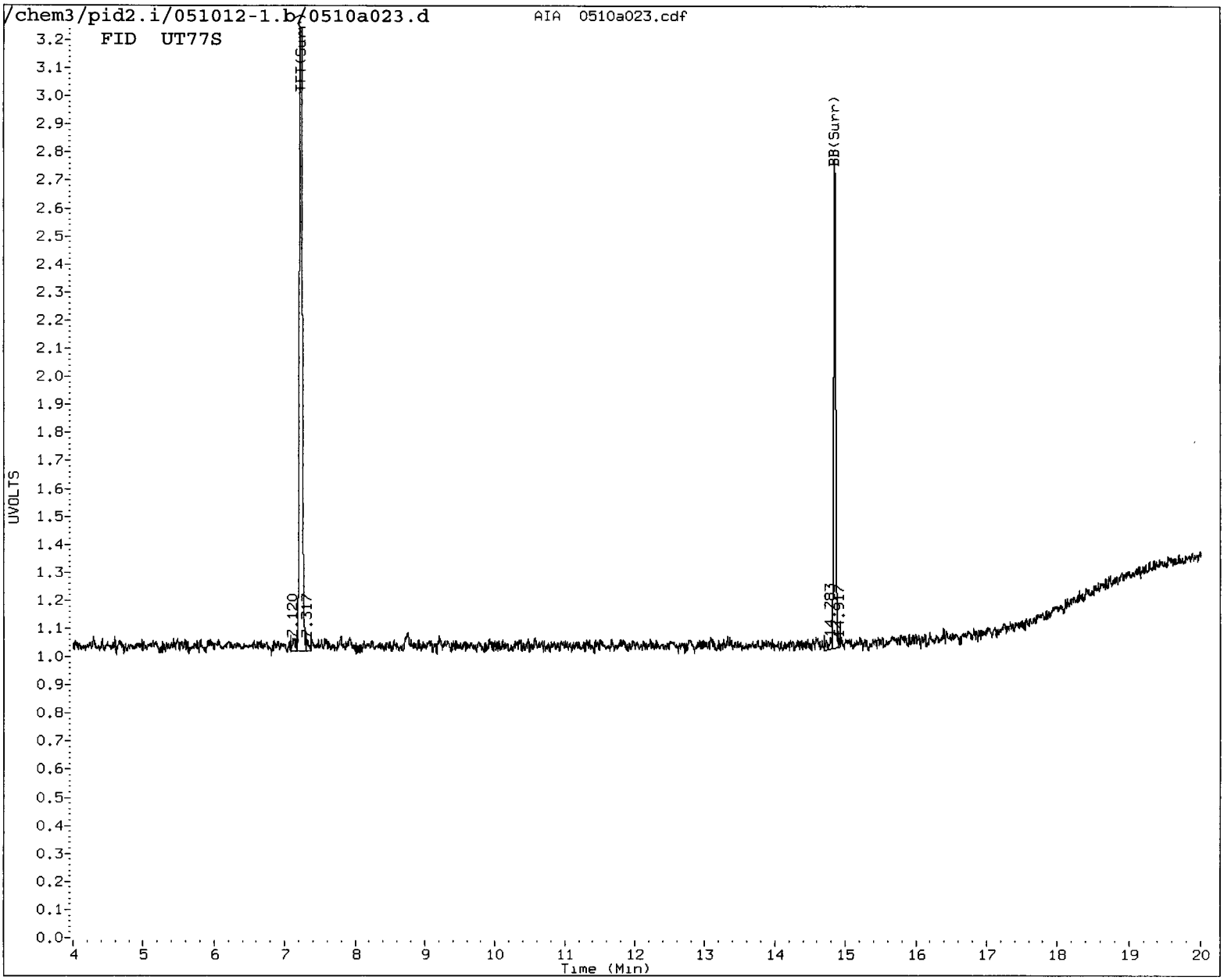
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

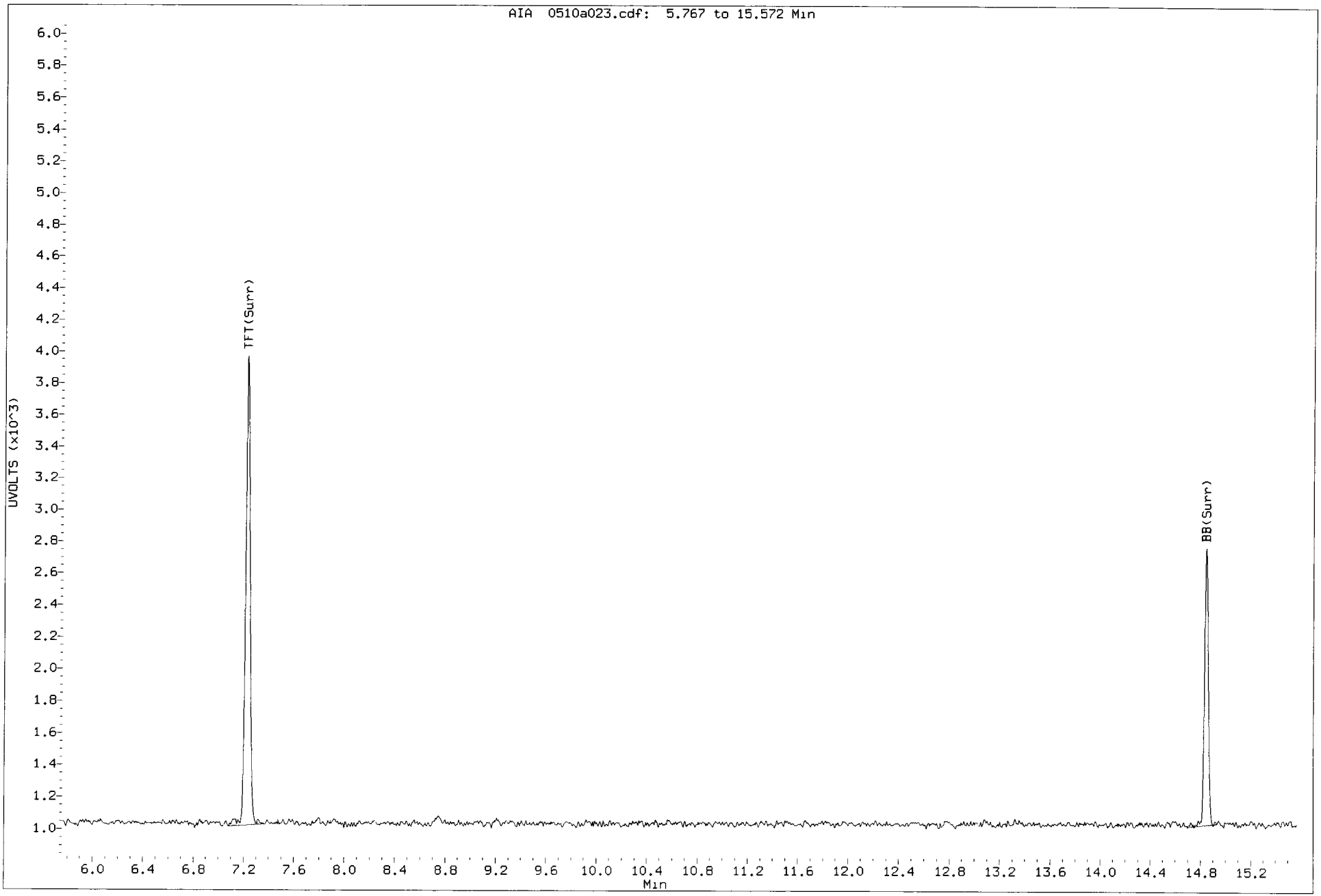
(1.) Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

(5.) Other PS

Analyst: SW Date: 5/15/12

Before
SW
5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a023.d/0510a023.cdf
Injection Date: 10-MAY-2012 22:30
Instrument: pid2.i
Client Sample ID: CWSB-170-23-25-0512



Data File: /chem3/pid2.i/051012-1.b/0510a024.d

Date : 10-MAY-2012 22:58

Client ID: CWSB-13-14.0-15.5-0

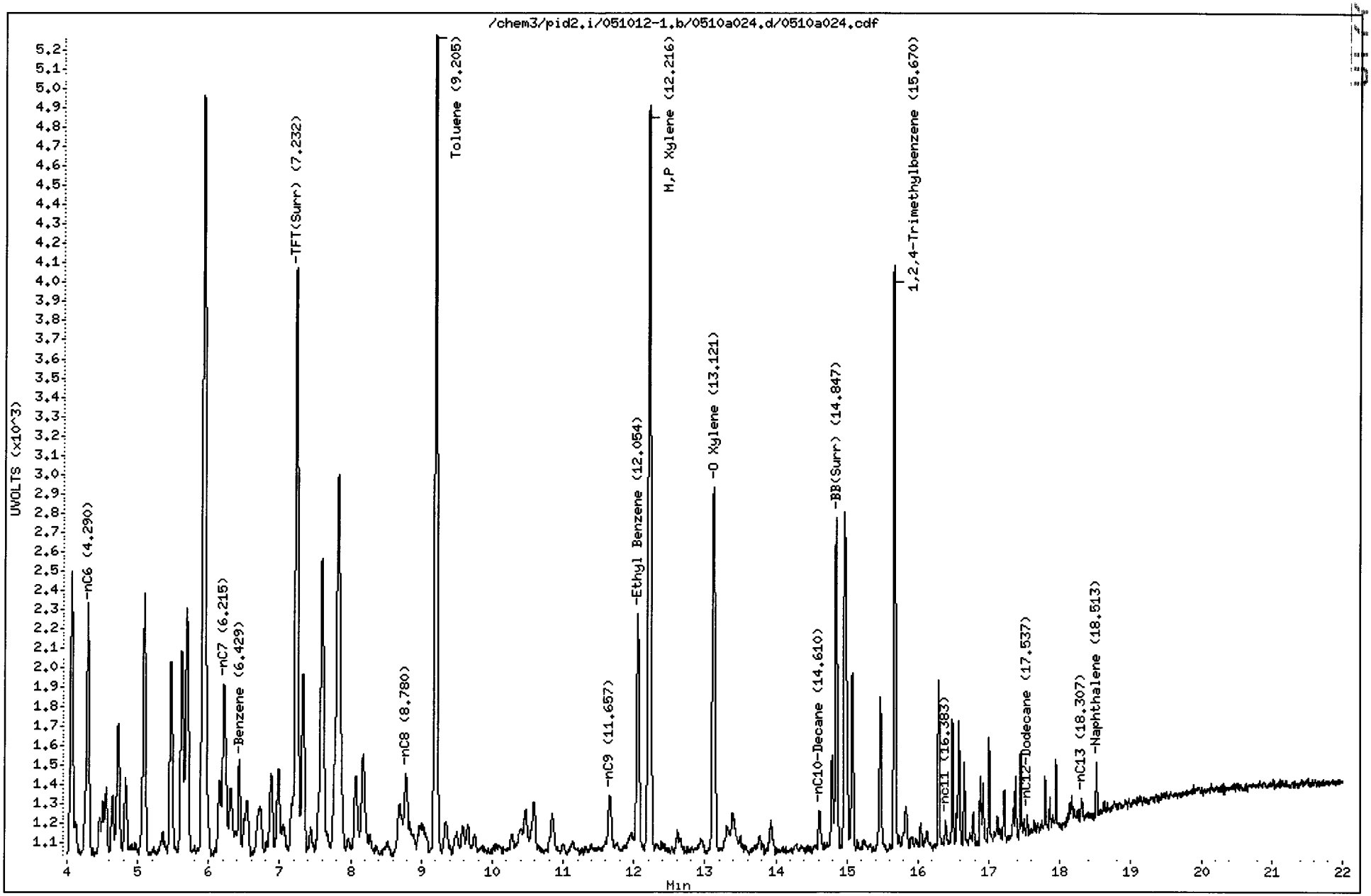
Sample Info: UT77AMS

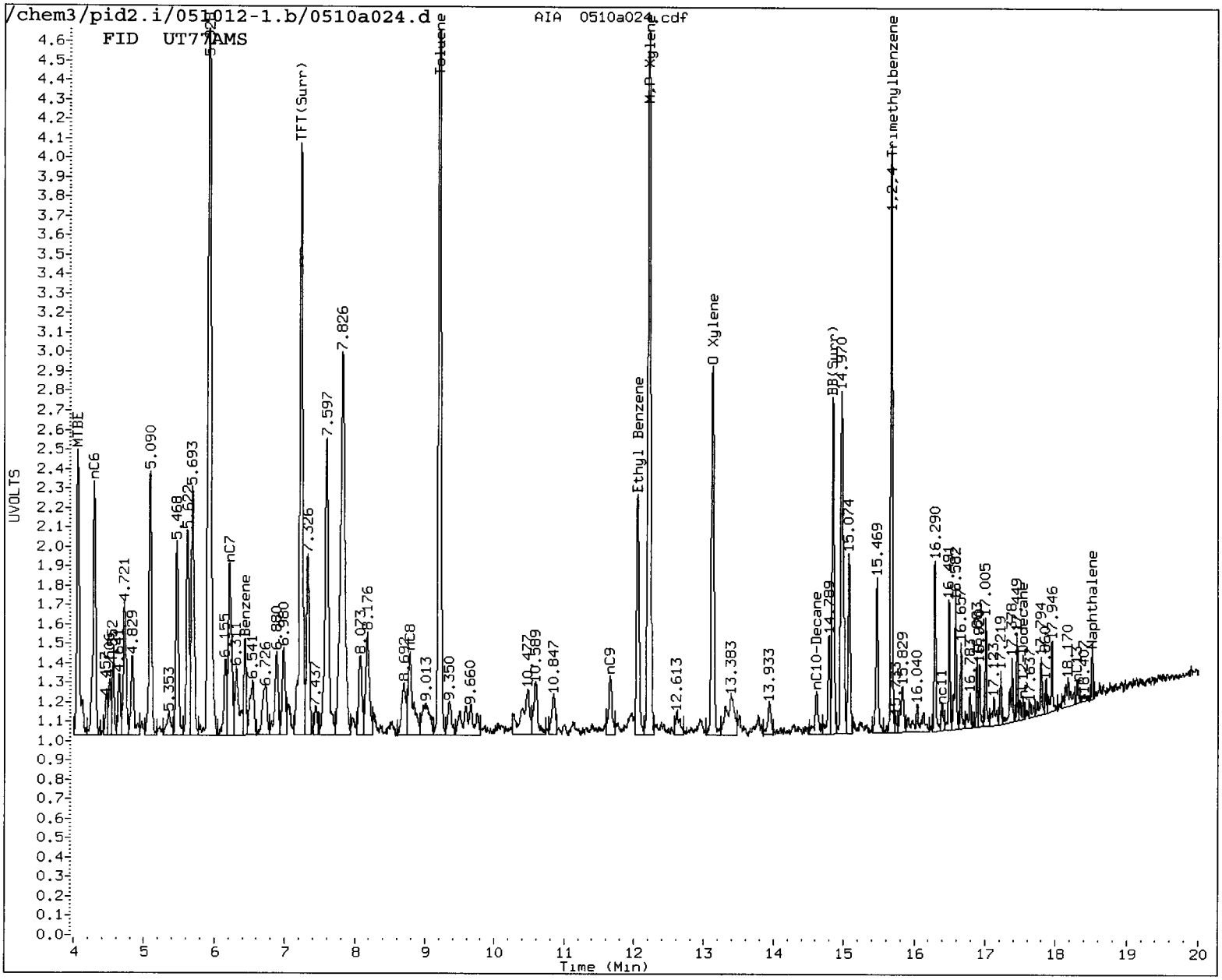
Instrument: pid2.i

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18





MANUAL INTEGRATION

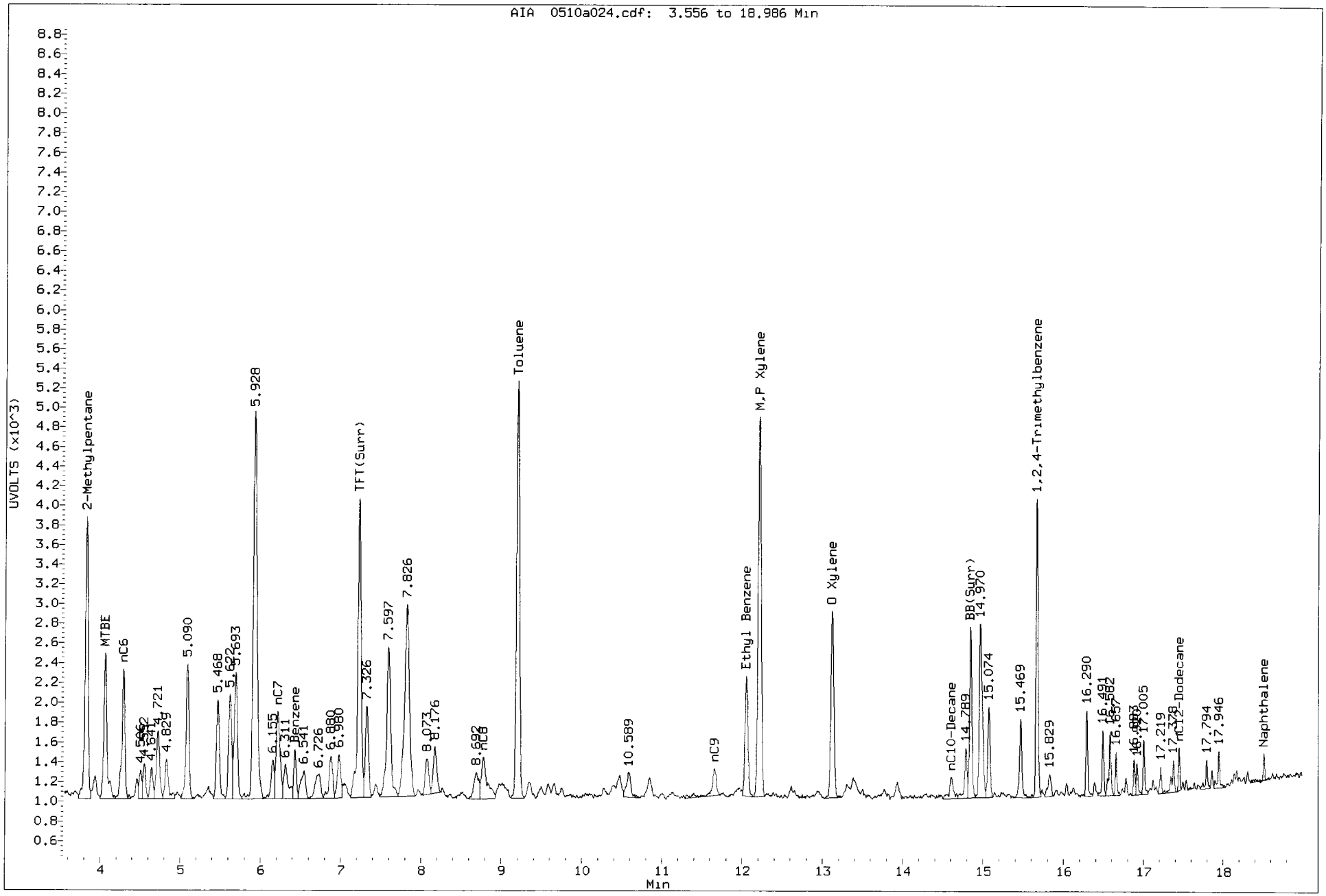
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: SW Date: 5/15/12

Before
5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a024.d/0510a024.cdf
Injection Date: 10-MAY-2012 22:58
Instrument: pid2.i
Client Sample ID: CWSB-13-14.0-15.5-0



Data File: /chem3/pid2.i/051012-1.b/0510a025.d

Date : 10-MAY-2012 23:26

Client ID: CWSB-13-14.0-15.5-0

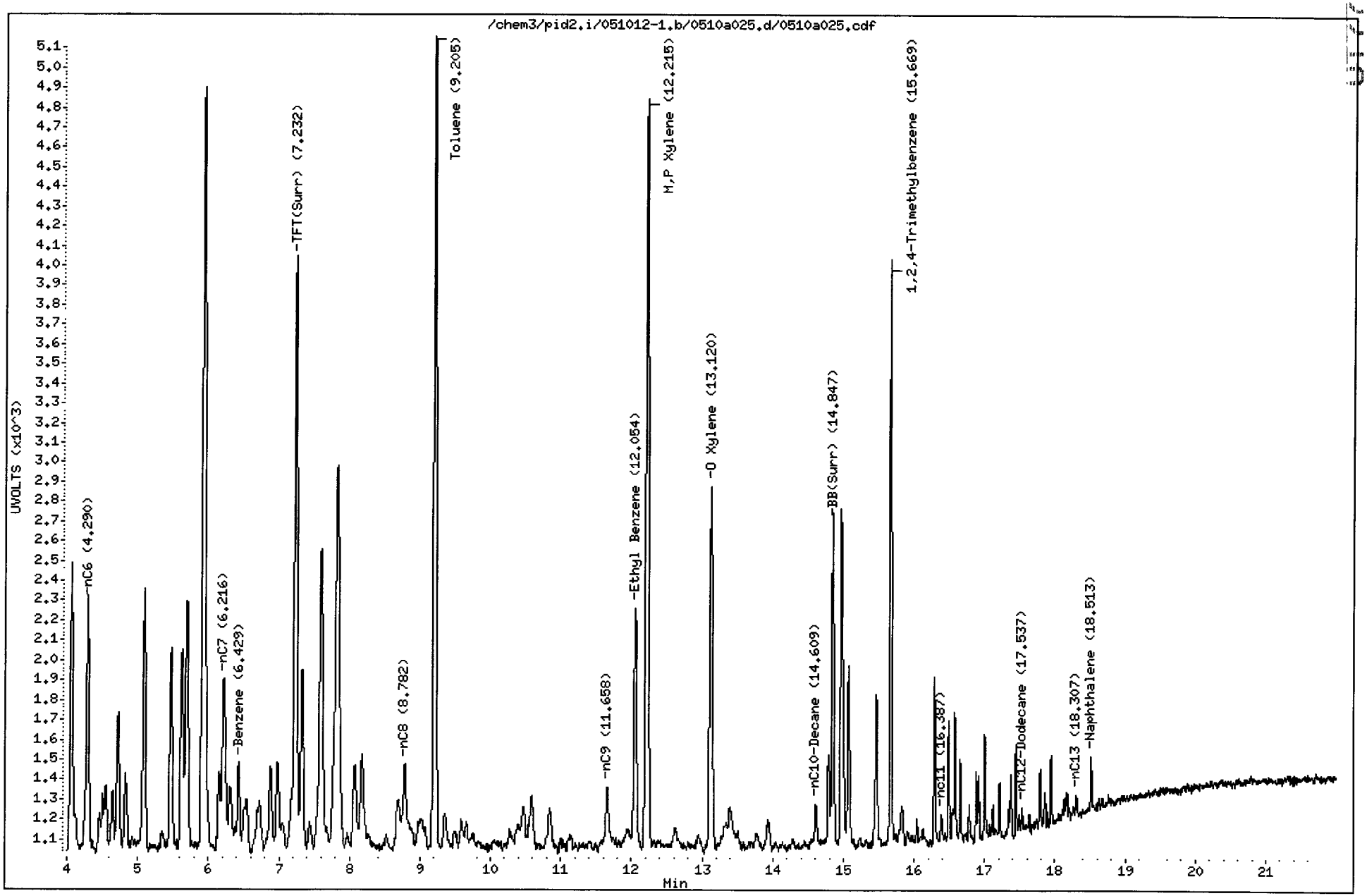
Sample Info: UT77AMSD

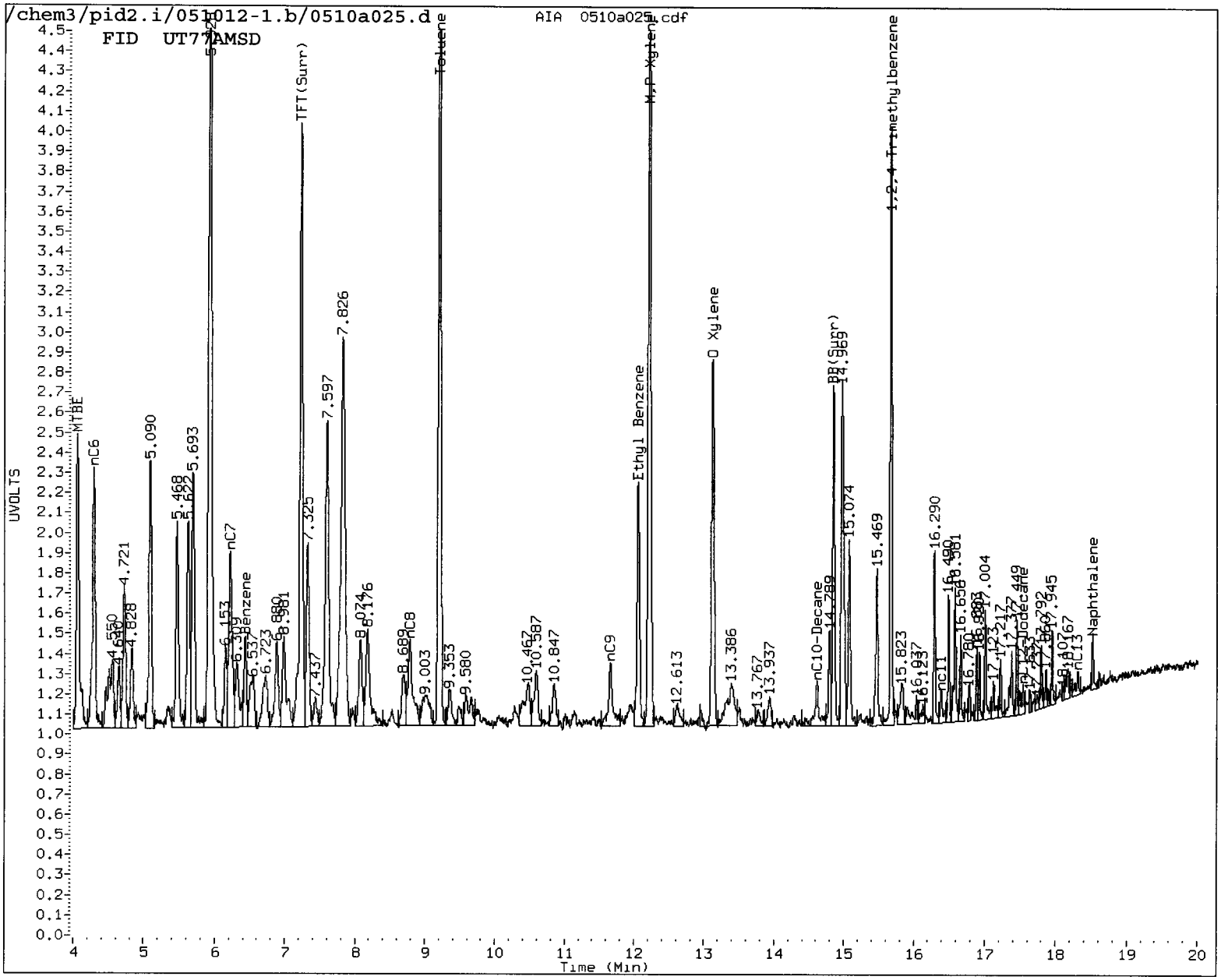
Instrument: pid2.i

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18





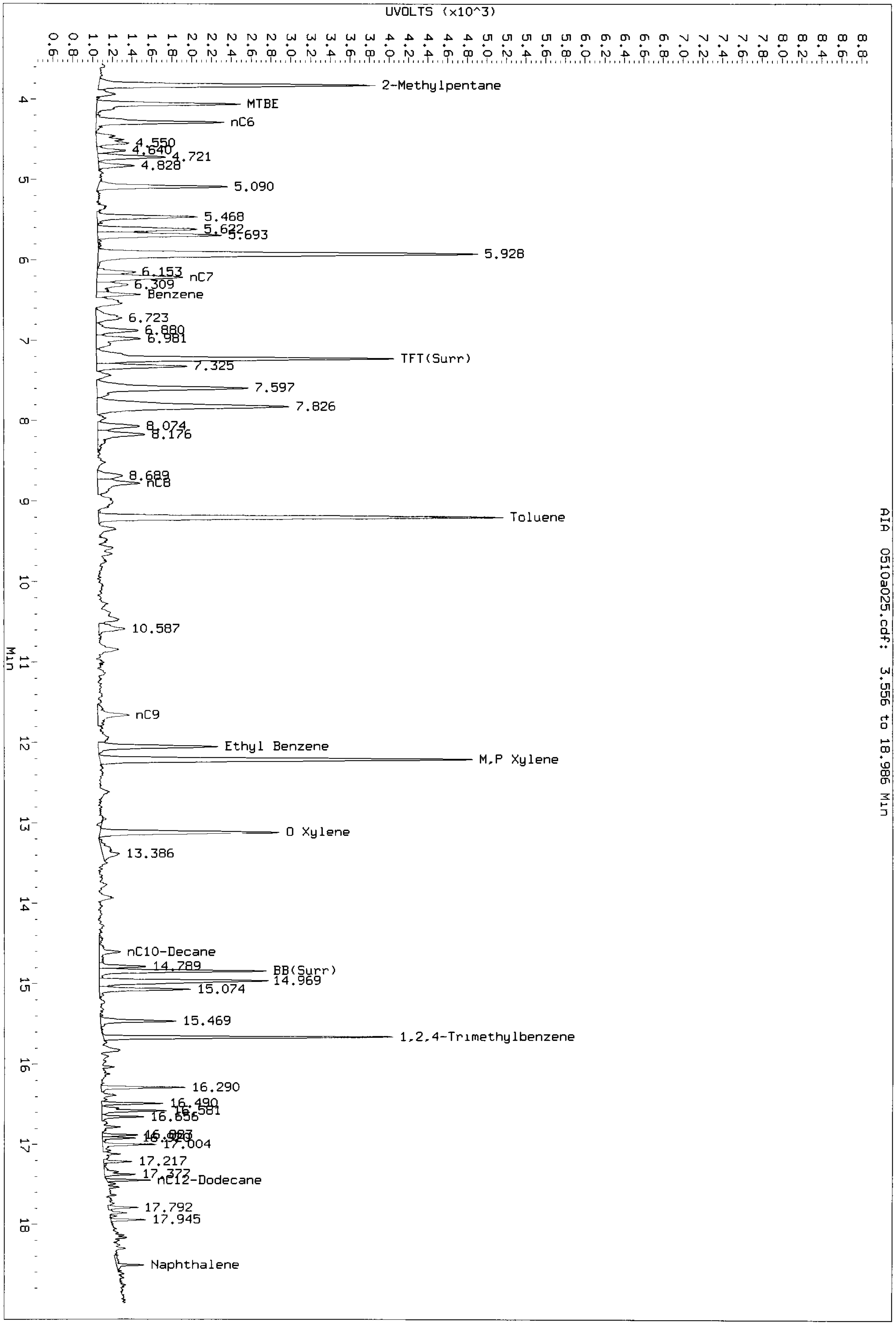
MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a025.d/0510a025.cdf
Injection Date: 10-MAY-2012 23:26
Instrument: pid2.i
Client Sample ID: CWSB-13-14.0-15.5-0



AIA 0510a025.cdf: 3.556 to 18.986 Min

Before
SW
5/15/12

UT77:00089

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Water

Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	DL	Range	Result
MB-051012	Method Blank	05/10/12	1.0	Gasoline	< 0.25 U
12-8478		PID2		HC ID	---
				Trifluorotoluene	99.9%
				Bromobenzene	99.2%
UT77T	TB-050712	05/10/12	1.0	Gasoline	< 0.25 U
12-8478		PID2		HC ID	---
				Trifluorotoluene	103%
				Bromobenzene	97.0%

Gasoline values reported in mg/L (ppm)

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-051012
LAB CONTROL SAMPLE

Lab Sample ID: LCS-051012
LIMS ID: 12-8478
Matrix: Water
Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/10/12 13:13
LCSD: 05/10/12 13:41
Instrument/Analyst LCS: PID2/JLW
LCSD: PID2/JLW

Purge Volume: 5.0 mL

Dilution Factor LCS: 1.0
LCSD: 1.0

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	0.95	1.00	95.0%	1.04	1.00	104%	9.0%

Reported in mg/L (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	98.8%	91.6%
Bromobenzene	96.6%	93.9%

ANALYTICAL RESOURCES INCORPORATED

TPHG WATER SURROGATE RECOVERY SUMMARY

ARI Job: UT77
Matrix: Water

QC Report No: UT77-AECOM
Project: Central Waterfront
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-051012	99.9%	99.2%	0
LCS-051012	98.8%	96.6%	0
LCSD-051012	91.6%	93.9%	0
TB-050712	103%	97.0%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(80-120)
(BBZ) = Bromobenzene	(80-120)	(80-120)

Log Number Range: 12-8478 to 12-8478

UT77:000892

Data File: /chem3/pid2.i/051012-1.b/0510a006.d

Date : 10-MAY-2012 14:09

Client ID:

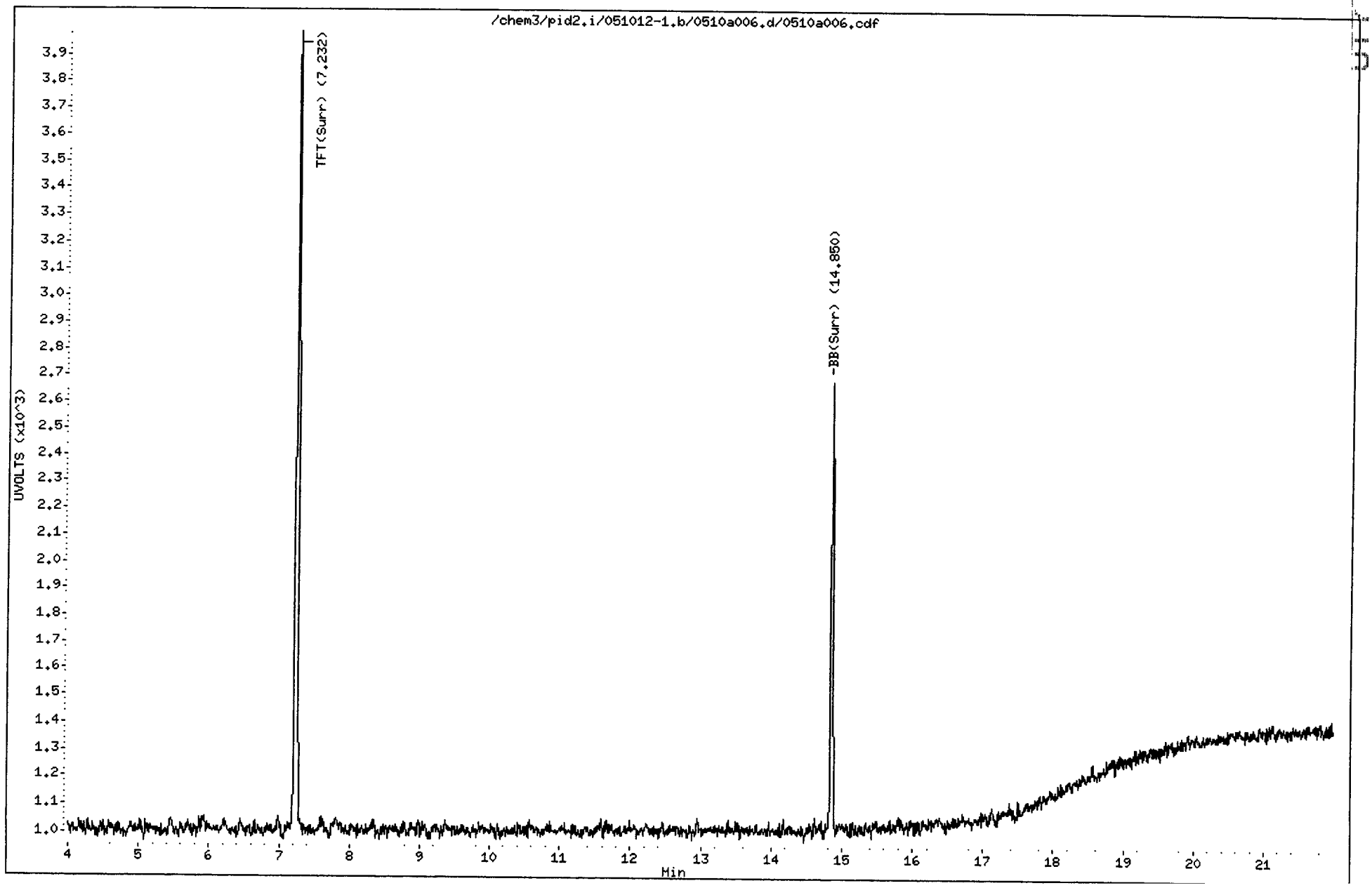
Sample Info: MB0510

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



Data File: /chem3/pid2.i/051012-1.b/0510a004.d

Date : 10-MAY-2012 13:13

Client ID:

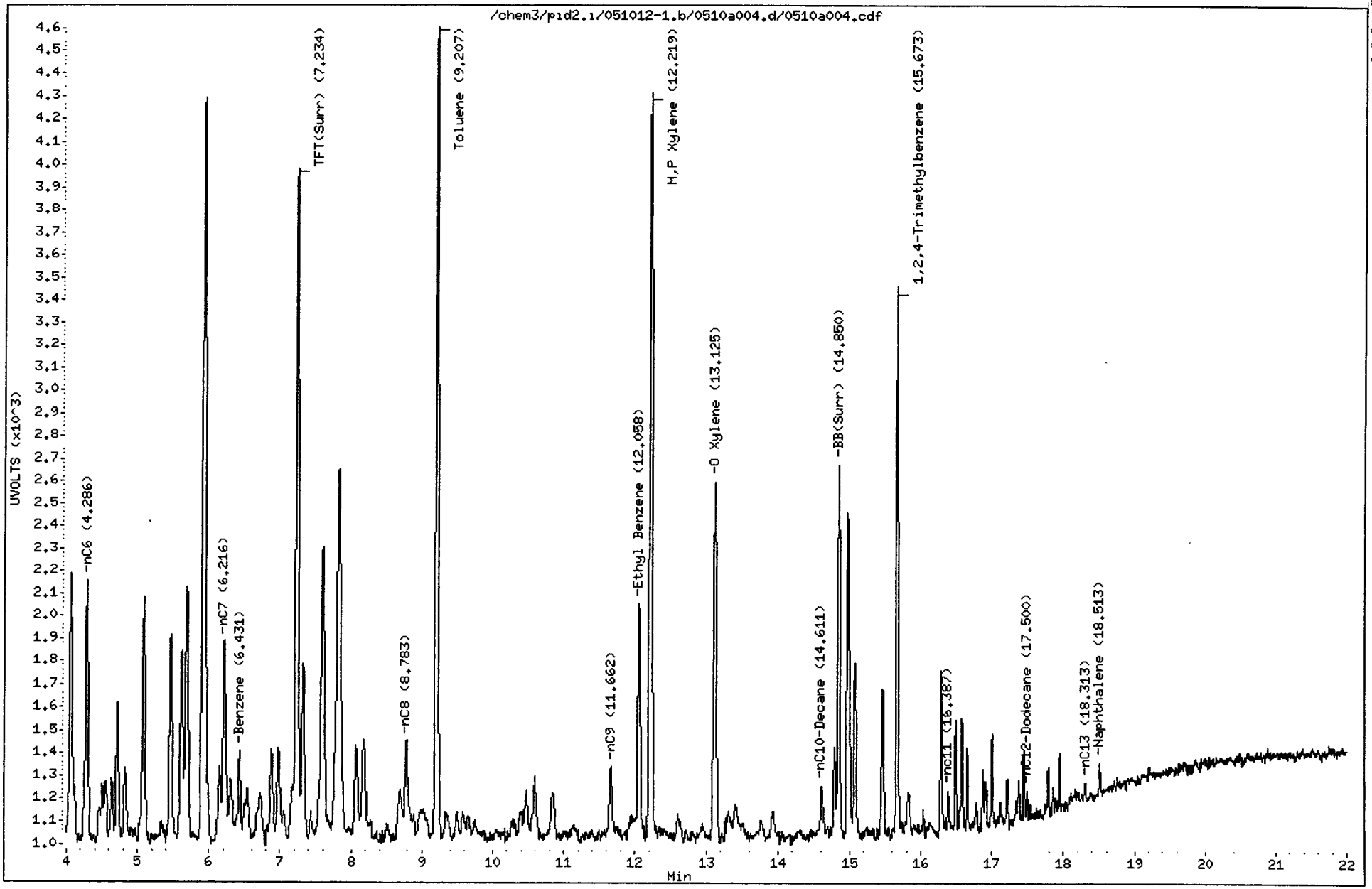
Sample Info: LCS0510

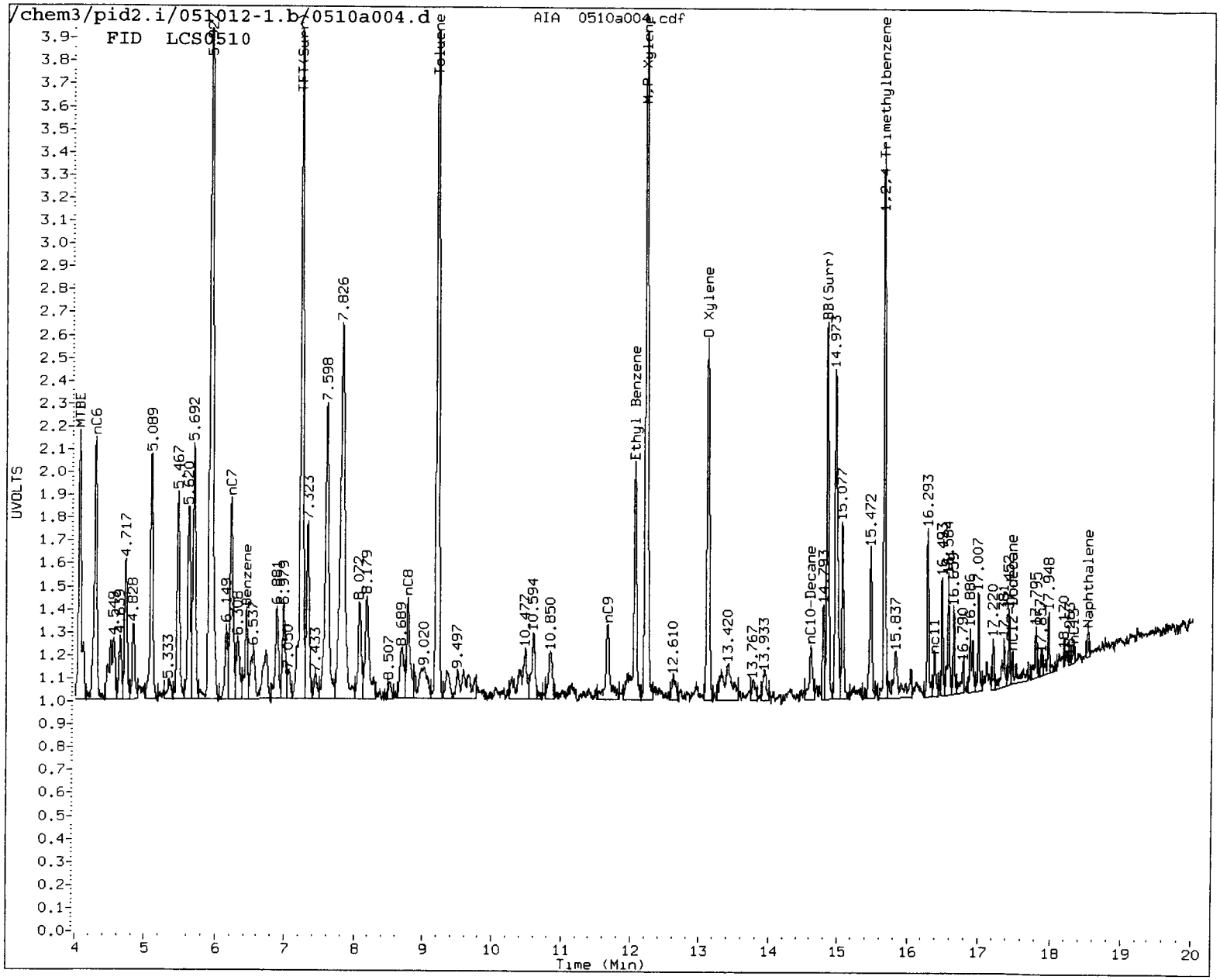
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

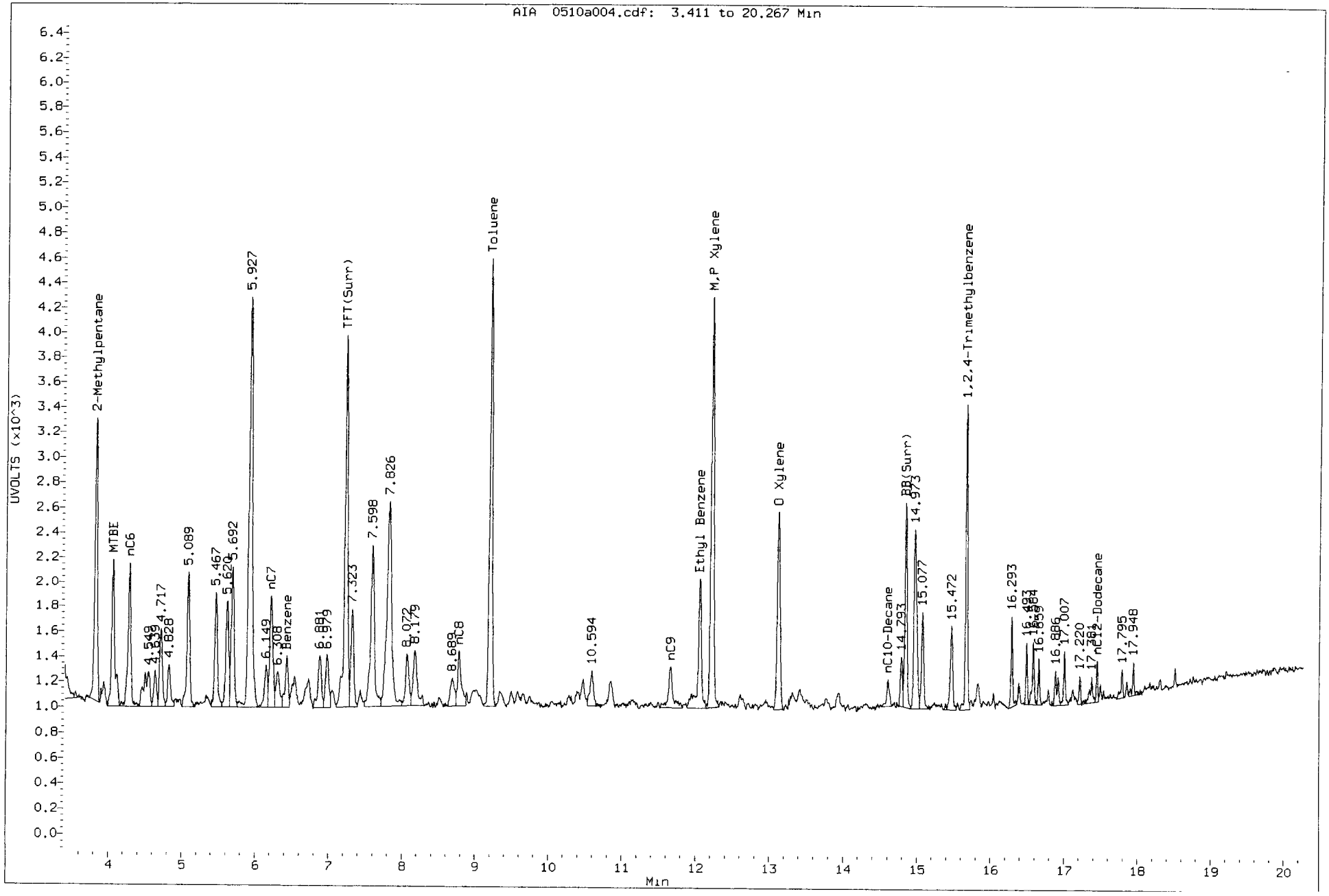
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JU Date: 5/15/12

Before
SCD
5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a004.d/0510a004.cdf
Injection Date: 10-MAY-2012 13:13
Instrument: pid2.i
Client Sample ID:

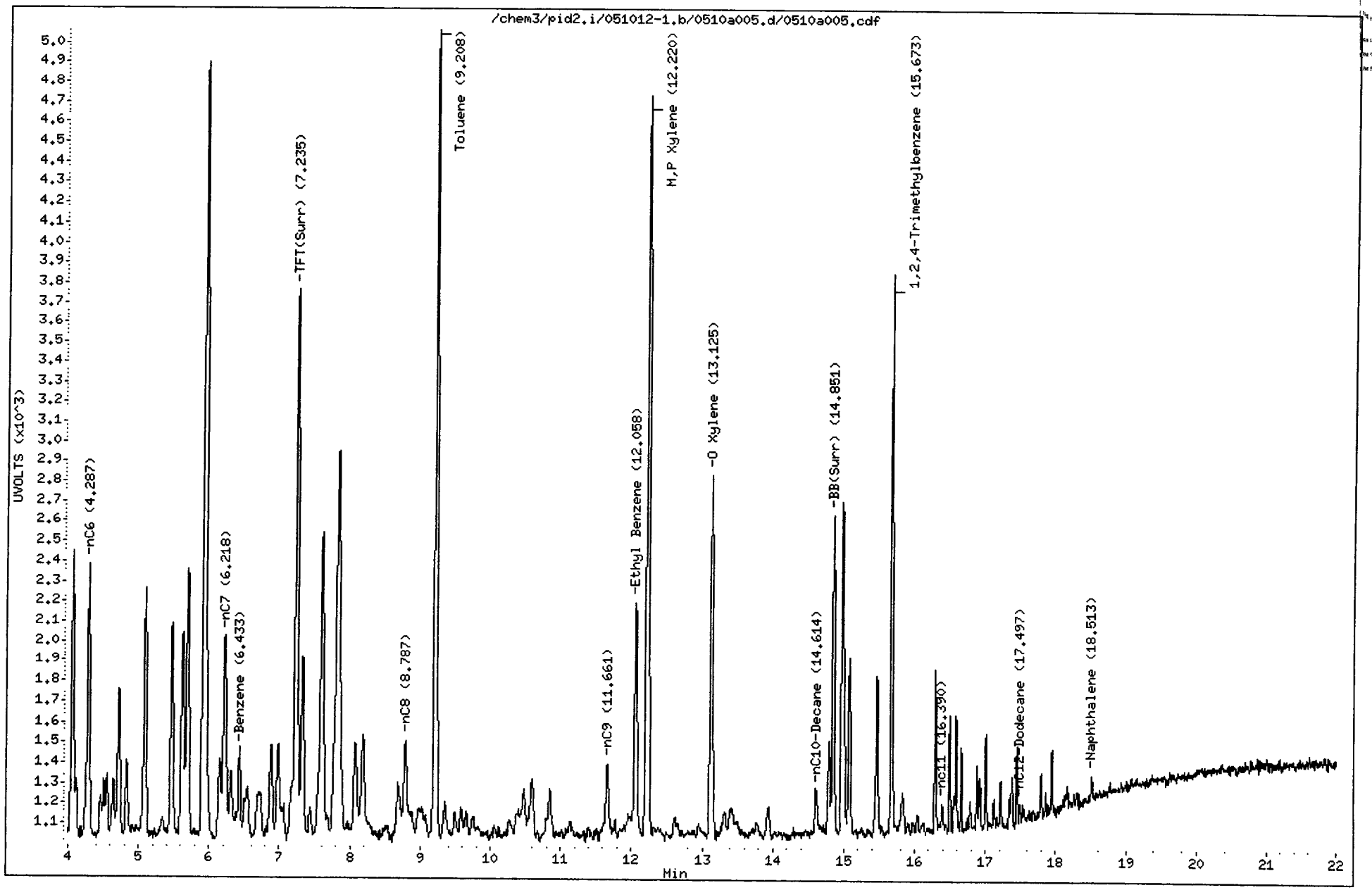


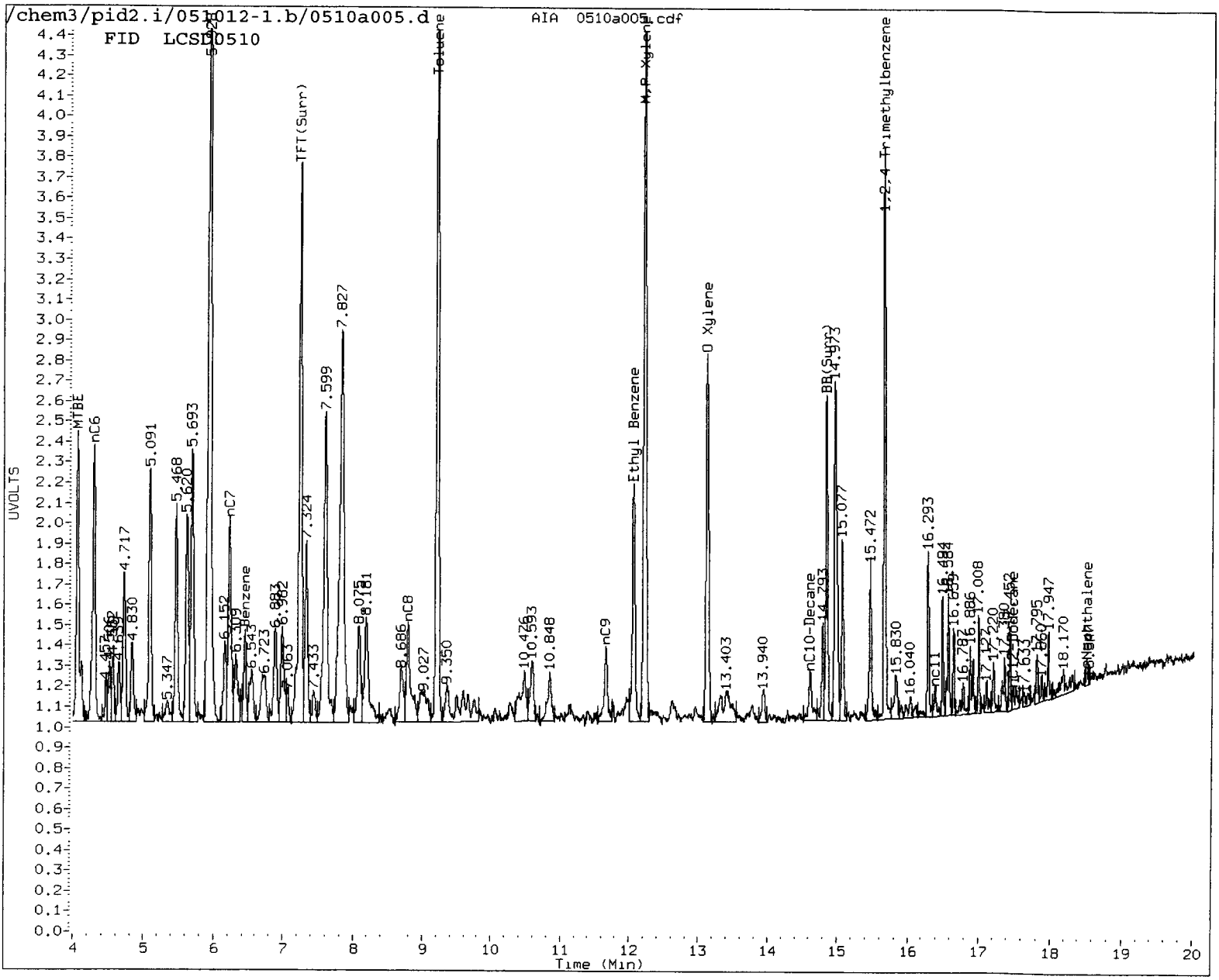
Data File: /chem3/pid2.i/051012-1.b/0510a005.d
Date : 10-MAY-2012 13:41
Client ID:
Sample Info: LCSD0510

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW
Column diameter: 0.18



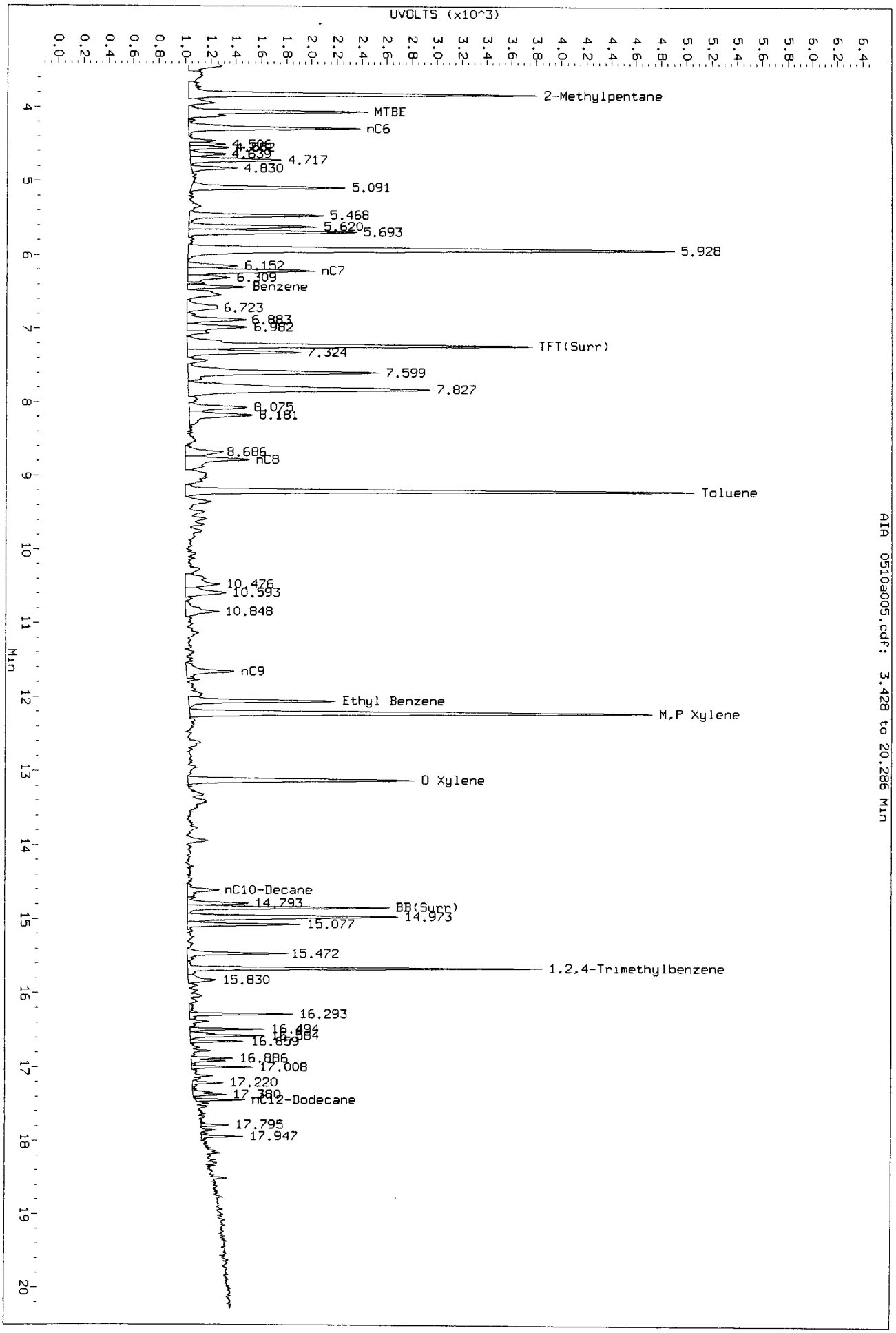


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: DW Date: 5/15/12



Before
5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a007.d

Page 1

Date : 10-MAY-2012 15:01

Client ID: TB-050712

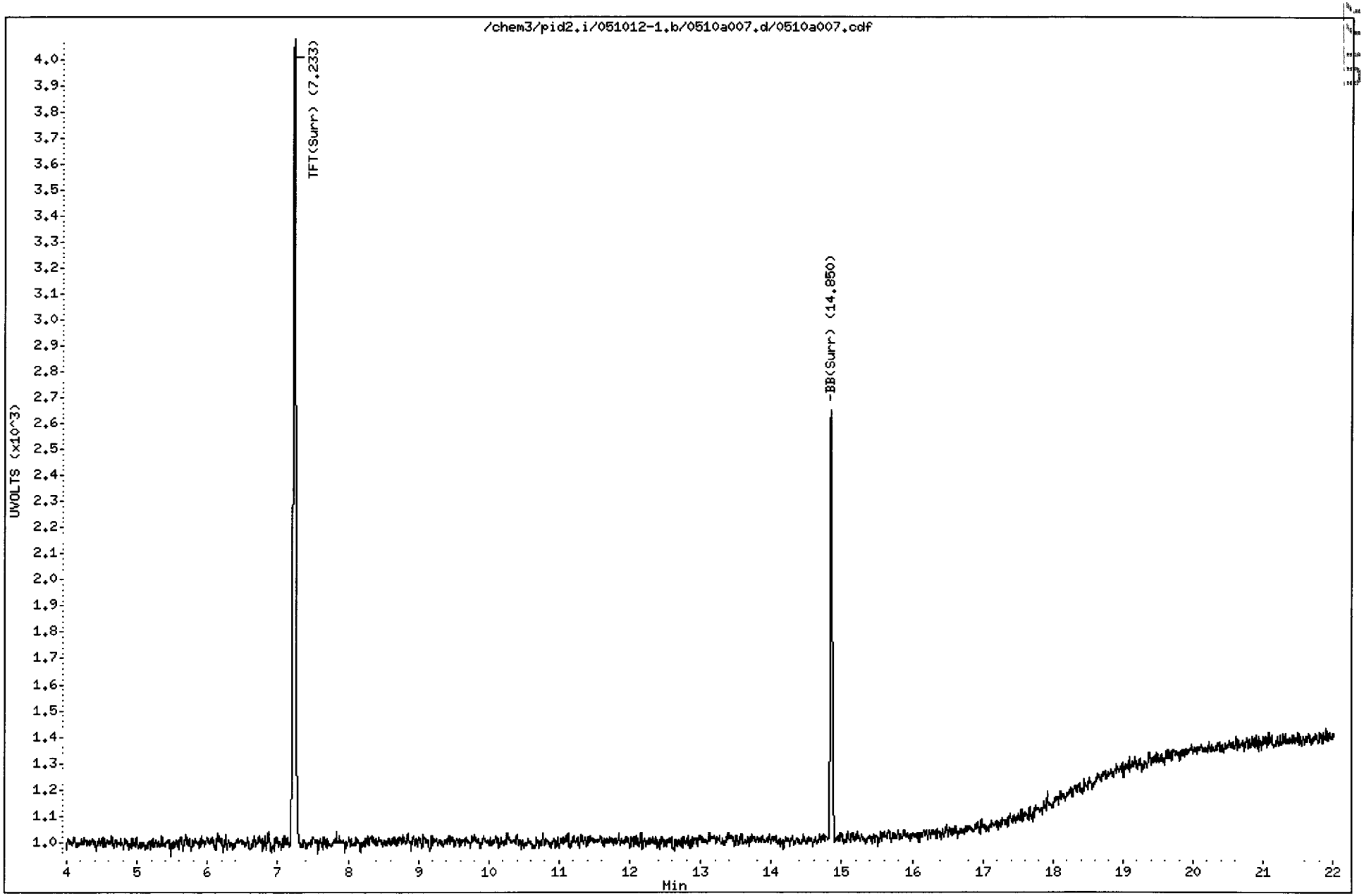
Instrument: pid2.i

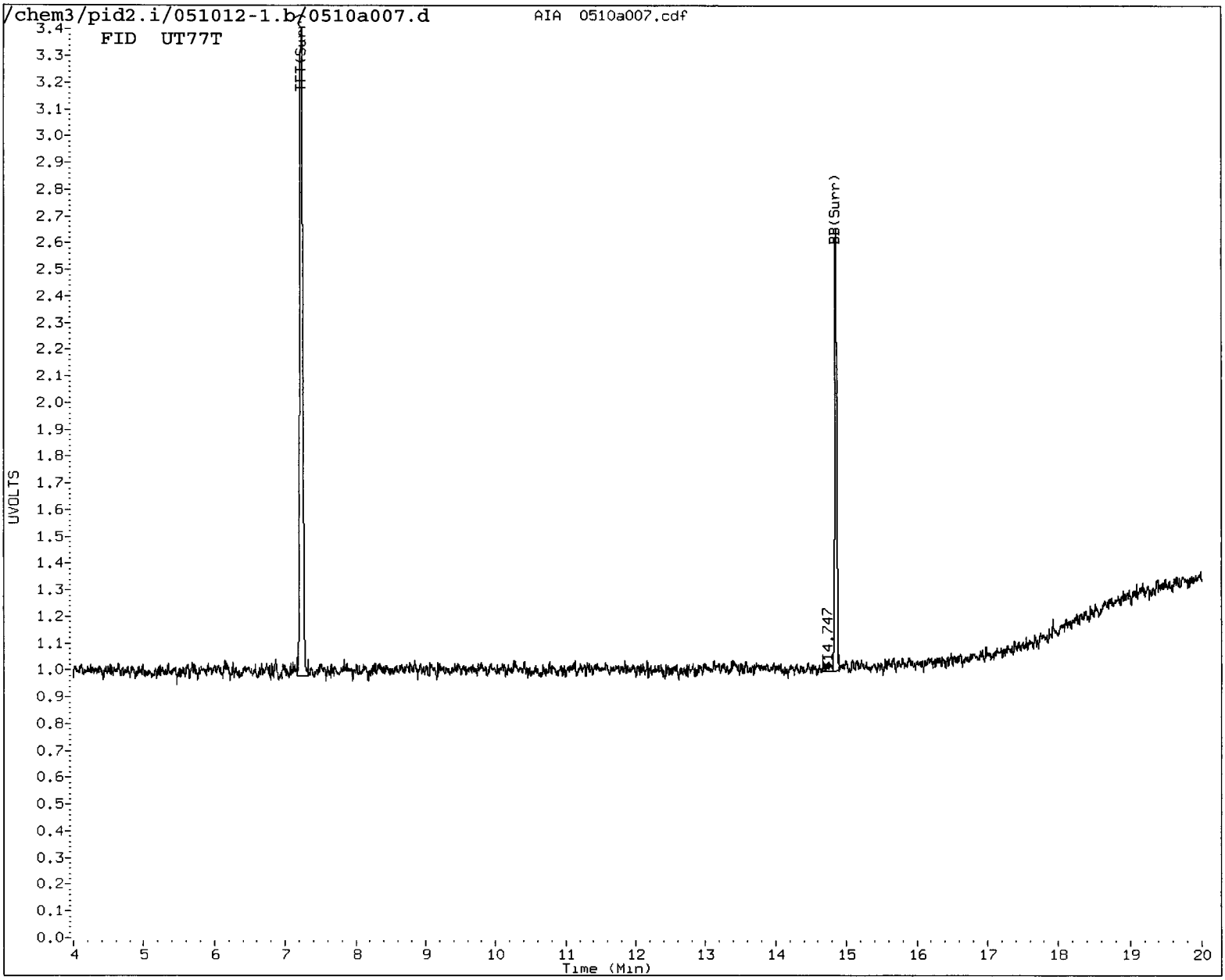
Sample Info: UT77T

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18





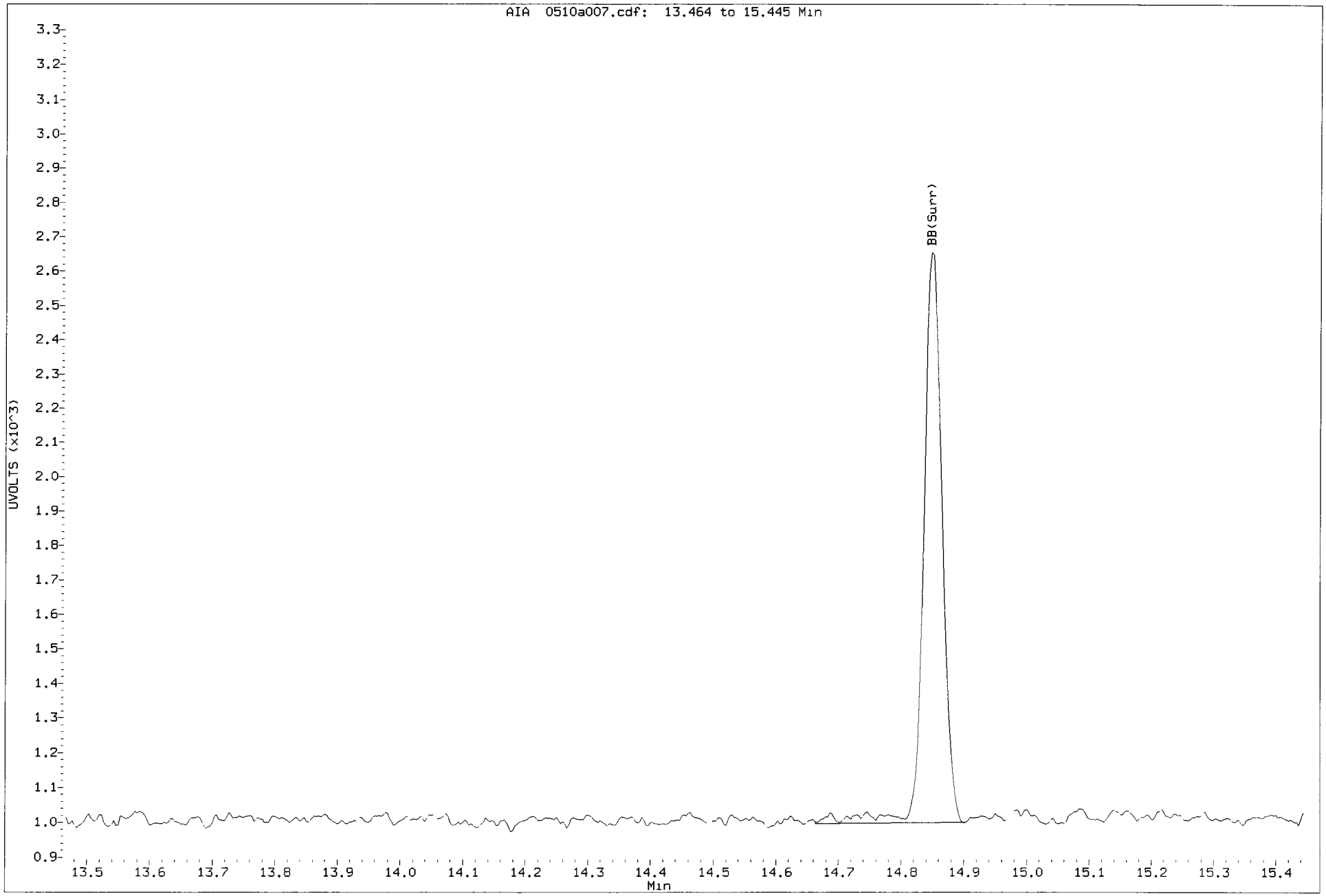
MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation
5. Other PS

Analyst: JW Date: 5/15/12

Data File: /chem3/pid2.i/051012-1.b/0510a007.d/0510a007.cdf
Injection Date: 10-MAY-2012 15:01
Instrument: pid2.i
Client Sample ID: TB-050712

Before
JW
5/15/12



ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 1 of 2
Matrix: Soil

QC Report No: UT77-AECOM
Project: Central Waterfront

Date Received: 05/09/12

Data Release Authorized:
Reported: 05/15/12

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
UT77A	CWSB-13-14.0-14.5-05105/11/12		05/13/12	1.00	Diesel Range	5.9	< 5.9 U
12-8459	HC ID: ---		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		86.5%
UT77B	CWSB-13-21-22-0512	05/11/12	05/13/12	1.00	**Diesel Range**	**6.3**	**6.5**
12-8460	HC ID: **DRO**		FID4A	1.0	Motor Oil Range	13	< 13 U
					o-Terphenyl		98.2%
UT77C	CWSB-13-25-27-0512	05/11/12	05/13/12	1.00	Diesel Range	6.3	< 6.3 U
12-8461	HC ID: ---		FID4A	1.0	Motor Oil Range	13	< 13 U
					o-Terphenyl		88.4%
MB-051112	Method Blank	05/11/12	05/13/12	1.00	Diesel Range	5.0	< 5.0 U
12-8463	HC ID: ---		FID4A	1.0	Motor Oil Range	10	< 10 U
					o-Terphenyl		87.1%
UT77E	CWSB-14-12-14-0512	05/11/12	05/14/12	1.00	**Diesel Range**	**59**	**850**
12-8463	HC ID: **DIESEL/MOTOR OIL**		FID4A	10	**Motor Oil Range**	**120**	**320**
					o-Terphenyl		73.6%
UT77F	CWSB-14-25-27-0512	05/11/12	05/13/12	1.00	Diesel Range	6.3	< 6.3 U
12-8464	HC ID: ---		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		91.3%
UT77G	CWSB-14-29-30-0512	05/11/12	05/13/12	1.00	Diesel Range	6.3	< 6.3 U
12-8465	HC ID: ---		FID4A	1.0	Motor Oil Range	13	< 13 U
					o-Terphenyl		89.8%
UT77H	CWSB-15-11-13-0512	05/11/12	05/13/12	1.00	**Diesel Range**	**6.0**	**40**
12-8466	HC ID: **DRO/MOTOR OIL**		FID4A	1.0	**Motor Oil Range**	**12**	**15**
					o-Terphenyl		90.0%
UT77I	CWSB-15-23-25-0512	05/11/12	05/13/12	1.00	Diesel Range	6.4	< 6.4 U
12-8467	HC ID: ---		FID4A	1.0	Motor Oil Range	13	< 13 U
					o-Terphenyl		91.3%
UT77J	CWSB-15-18-20-0512	05/11/12	05/13/12	1.00	**Diesel Range**	**6.1**	**6.4**
12-8468	HC ID: **DRO**		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		89.6%
UT77L	CWSB-16-8-10-0512	05/11/12	05/14/12	1.00	**Diesel Range**	**110**	**3,800**
12-8470	HC ID: **DIESEL/MOTOR OIL**		FID4A	20	**Motor Oil Range**	**230**	**650**
					o-Terphenyl		D
UT77M	CWSB-16-13-15-0512	05/11/12	05/13/12	1.00	**Diesel Range**	**6.4**	**22**
12-8471	HC ID: **DRO**		FID4A	1.0	Motor Oil Range	13	< 13 U
					o-Terphenyl		87.4%
UT77N	CWSB-16-18-20-0512	05/11/12	05/13/12	1.00	**Diesel Range**	**5.9**	**9.1**
12-8472	HC ID: **DRO**		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		90.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 2 of 2
Matrix: Soil

QC Report No: UT77-AECOM
Project: Central Waterfront

Date Received: 05/09/12

Data Release Authorized:
Reported: 05/15/12

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
UT77P	CWSB-17-6-8-0512	05/11/12	05/14/12	1.00	**Diesel Range**	**550**	**21,000**
12-8474	HC ID: **DIESEL/MOTOR OIL**		FID4A	100	**Motor Oil Range**	**1,100**	**4,100**
					o-Terphenyl		D
UT77Q	CWSB-17-23-25-0512	05/11/12	05/13/12	1.00	Diesel Range	6.2	< 6.2 U
12-8475	HC ID: ---		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		82.1%
UT77R	CWSB-17-28-30-0512	05/11/12	05/13/12	1.00	Diesel Range	6.2	< 6.2 U
12-8476	HC ID: ---		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		86.1%
UT77S	CWSB-170-23-25-0512	05/11/12	05/13/12	1.00	Diesel Range	6.3	< 6.3 U
12-8477	HC ID: ---		FID4A	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		88.0%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicates results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: CWSB-14-12-14-0512
MS/MSD

Lab Sample ID: UT77E
LIMS ID: 12-8463
Matrix: Soil
Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront

Date Sampled: 05/07/12
Date Received: 05/09/12

Date Extracted MS/MSD: 05/11/12

Date Analyzed MS: 05/14/12 17:04
MSD: 05/14/12 17:28
Instrument/Analyst MS: FID4A/MH
MSD: FID4A/MH

Sample Amount MS: 8.53 g-dry-wt
MSD: 8.47 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 10.0
MSD: 10.0
Percent Moisture: 16.5%

Range	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Diesel	847	1,050	176	NA	1,010	177	NA	3.9%

TPHD Surrogate Recovery

	MS	MSD
o-Terphenyl	71.6%	74.7%

Results reported in mg/kg
NA-No recovery due to high concentration of analyte in original sample and/or calculated negative recovery.
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: LCS-051112
LAB CONTROL

Lab Sample ID: LCS-051112
LIMS ID: 12-8463
Matrix: Soil
Data Release Authorized:
Reported: 05/15/12

QC Report No: UT77-AECOM
Project: Central Waterfront

Date Sampled: NA
Date Received: NA

Date Extracted: 05/11/12
Date Analyzed: 05/13/12 08:33
Instrument/Analyst: FID4A/MH

Sample Amount: 10.0 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
Diesel	120	150	80.0%

TPHD Surrogate Recovery

o-Terphenyl	86.9%

Results reported in mg/kg

FORM III

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: UT77
Matrix: Soil Project: Central Waterfront
Date Received: 05/09/12

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
12-8459-UT77A	CWSB-13-14.0-14.5-0	8.42 g	1.00 mL	D	05/11/12
12-8460-UT77B	CWSB-13-21-22-0512	7.96 g	1.00 mL	D	05/11/12
12-8461-UT77C	CWSB-13-25-27-0512	7.94 g	1.00 mL	D	05/11/12
12-8463-051112MB1	Method Blank	10.0 g	1.00 mL	-	05/11/12
12-8463-051112LCS1	Lab Control	10.0 g	1.00 mL	-	05/11/12
12-8463-UT77E	CWSB-14-12-14-0512	8.50 g	1.00 mL	D	05/11/12
12-8463-UT77EMS	CWSB-14-12-14-0512	8.53 g	1.00 mL	D	05/11/12
12-8463-UT77EMSD	CWSB-14-12-14-0512	8.47 g	1.00 mL	D	05/11/12
12-8464-UT77F	CWSB-14-25-27-0512	7.98 g	1.00 mL	D	05/11/12
12-8465-UT77G	CWSB-14-29-30-0512	7.94 g	1.00 mL	D	05/11/12
12-8466-UT77H	CWSB-15-11-13-0512	8.28 g	1.00 mL	D	05/11/12
12-8467-UT77I	CWSB-15-23-25-0512	7.87 g	1.00 mL	D	05/11/12
12-8468-UT77J	CWSB-15-18-20-0512	8.24 g	1.00 mL	D	05/11/12
12-8470-UT77L	CWSB-16-8-10-0512	8.86 g	1.00 mL	D	05/11/12
12-8471-UT77M	CWSB-16-13-15-0512	7.79 g	1.00 mL	D	05/11/12
12-8472-UT77N	CWSB-16-18-20-0512	8.48 g	1.00 mL	D	05/11/12
12-8474-UT77P	CWSB-17-6-8-0512	9.06 g	1.00 mL	D	05/11/12
12-8475-UT77Q	CWSB-17-23-25-0512	8.06 g	1.00 mL	D	05/11/12
12-8476-UT77R	CWSB-17-28-30-0512	8.07 g	1.00 mL	D	05/11/12
12-8477-UT77S	CWSB-170-23-25-0512	7.99 g	1.00 mL	D	05/11/12

Basis: D=Dry Weight W=As Received

Diesel Extraction Report

ANALYTICAL RESOURCES INCORPORATED

TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT77-AECOM
Project: Central Waterfront

Client ID	OTER	TOT OUT
CWSB-13-14.0-14.5-0512	86.5%	0
CWSB-13-21-22-0512	98.2%	0
CWSB-13-25-27-0512	88.4%	0
051112MBS	87.1%	0
051112LCS	86.9%	0
CWSB-14-12-14-0512	73.6%	0
CWSB-14-12-14-0512 MS	71.6%	0
CWSB-14-12-14-0512 MSD	74.7%	0
CWSB-14-25-27-0512	91.3%	0
CWSB-14-29-30-0512	89.8%	0
CWSB-15-11-13-0512	90.0%	0
CWSB-15-23-25-0512	91.3%	0
CWSB-15-18-20-0512	89.6%	0
CWSB-16-8-10-0512	D	0
CWSB-16-13-15-0512	87.4%	0
CWSB-16-18-20-0512	90.7%	0
CWSB-17-6-8-0512	D	0
CWSB-17-23-25-0512	82.1%	0
CWSB-17-28-30-0512	86.1%	0
CWSB-170-23-25-0512	88.0%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3546
Log Number Range: 12-8459 to 12-8477

FORM-II TPHD

Data File: /chem3/fid4a.i/20120512a.b/0512a064.d

Date : 13-MAY-2012 08:09

Client ID: UT57MBS1

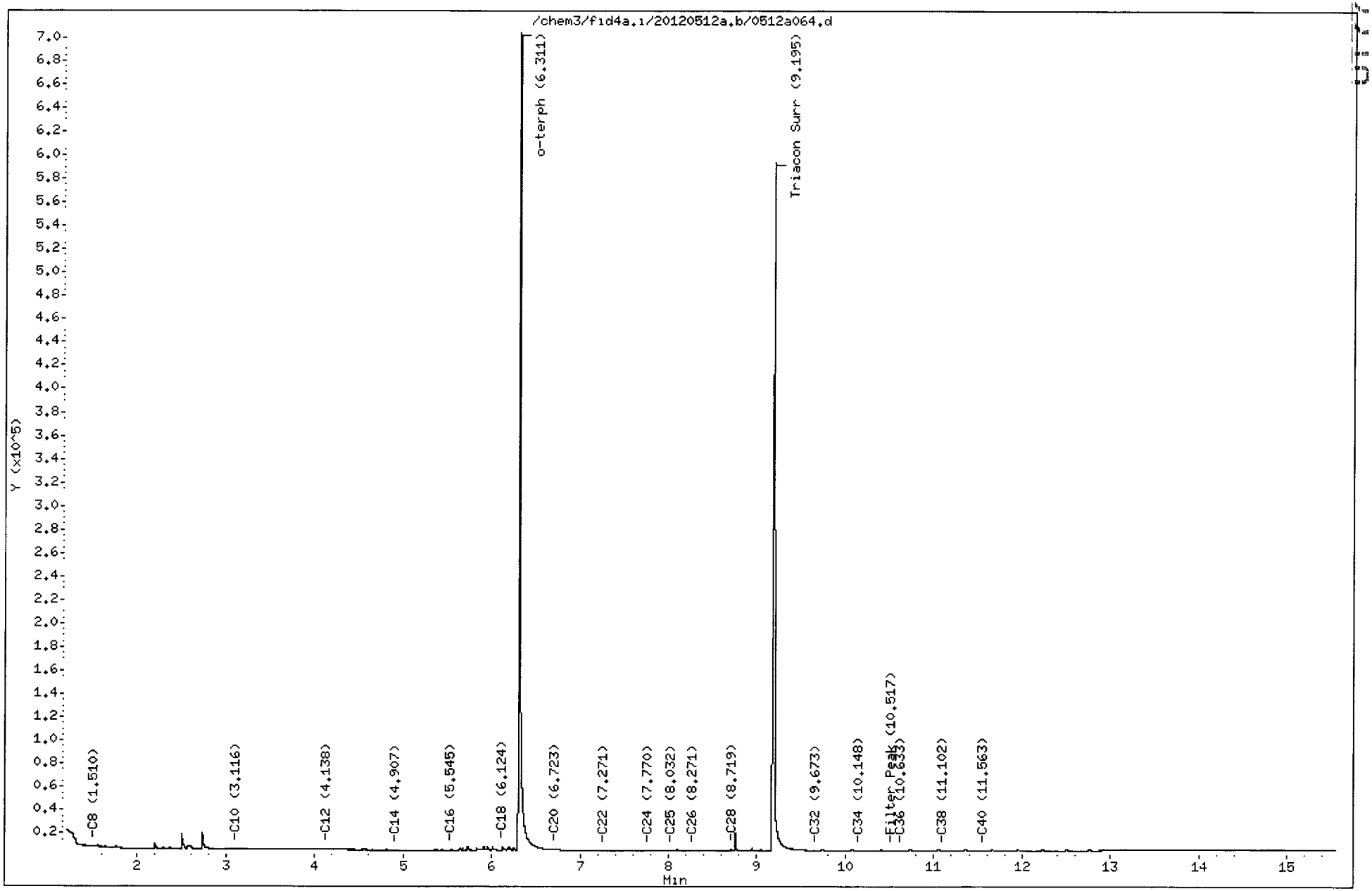
Sample Info: UT57MBS1

Instrument: fid4a.i

Operator: MH

Column phase: RTX-1

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a065.d

Date : 13-MAY-2012 08:33

Client ID: UT57LCSS1

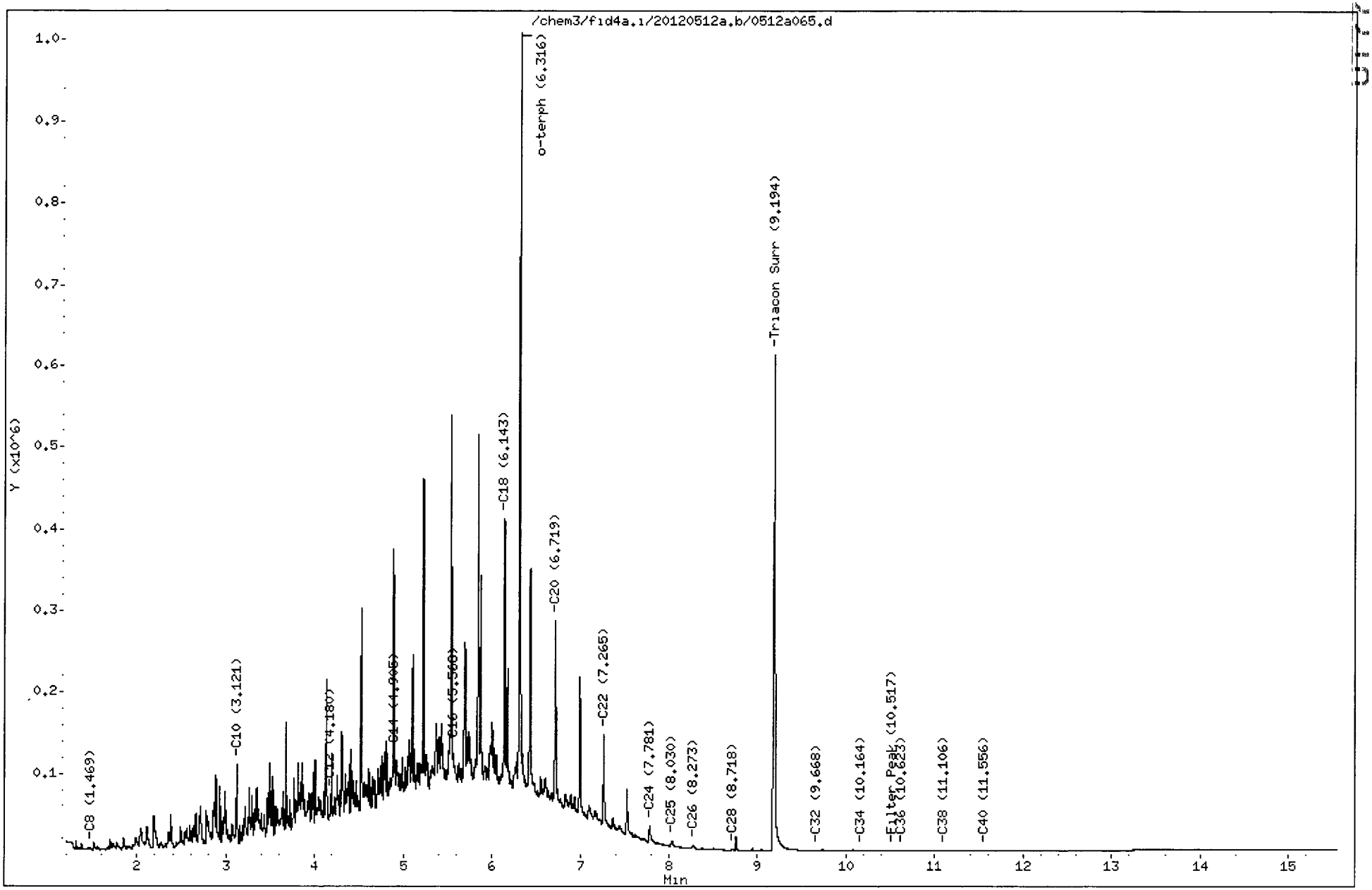
Sample Info: UT57LCSS1

Column phase: RTX-1

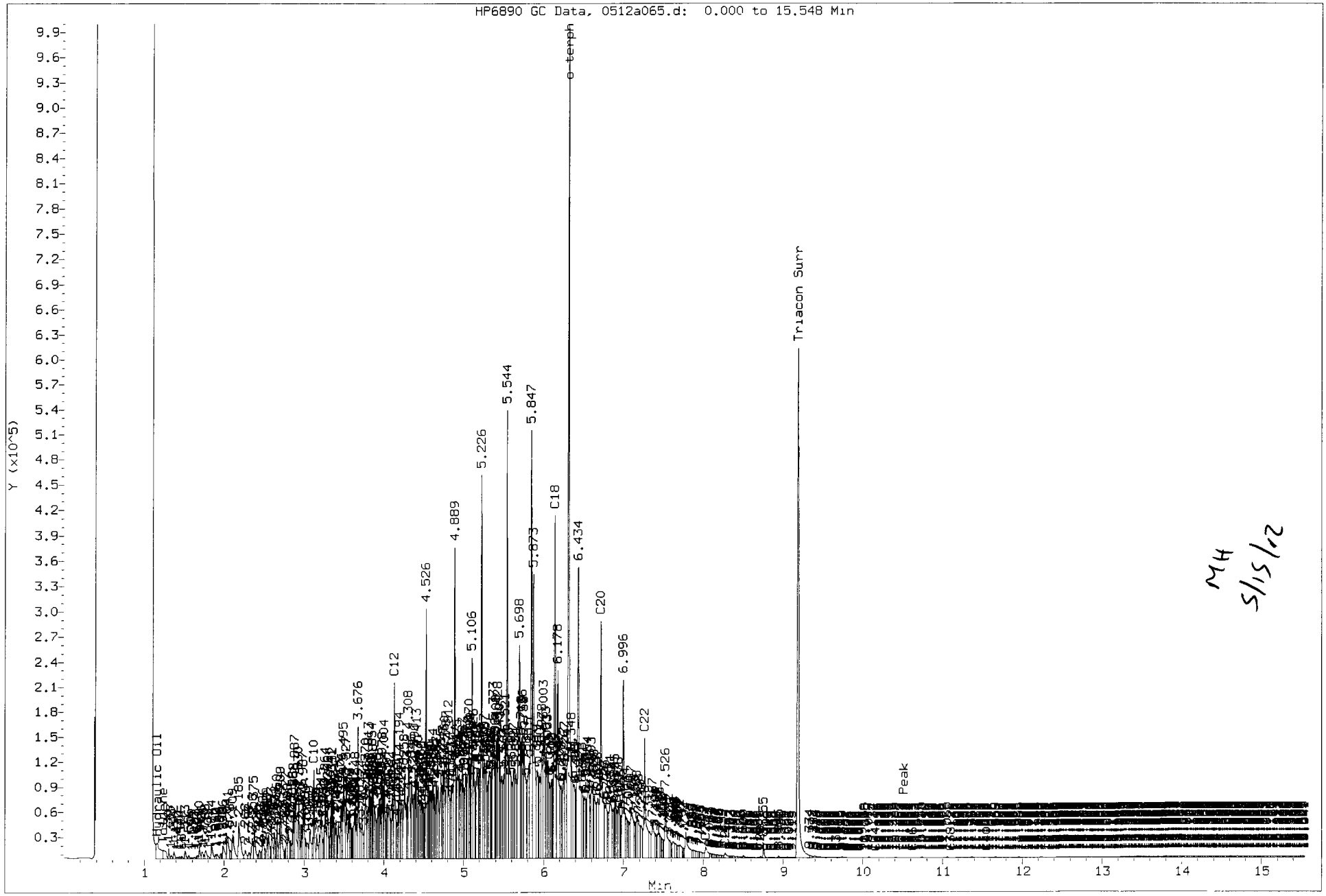
Instrument: fid4a.i

Operator: MH

Column diameter: 0.25

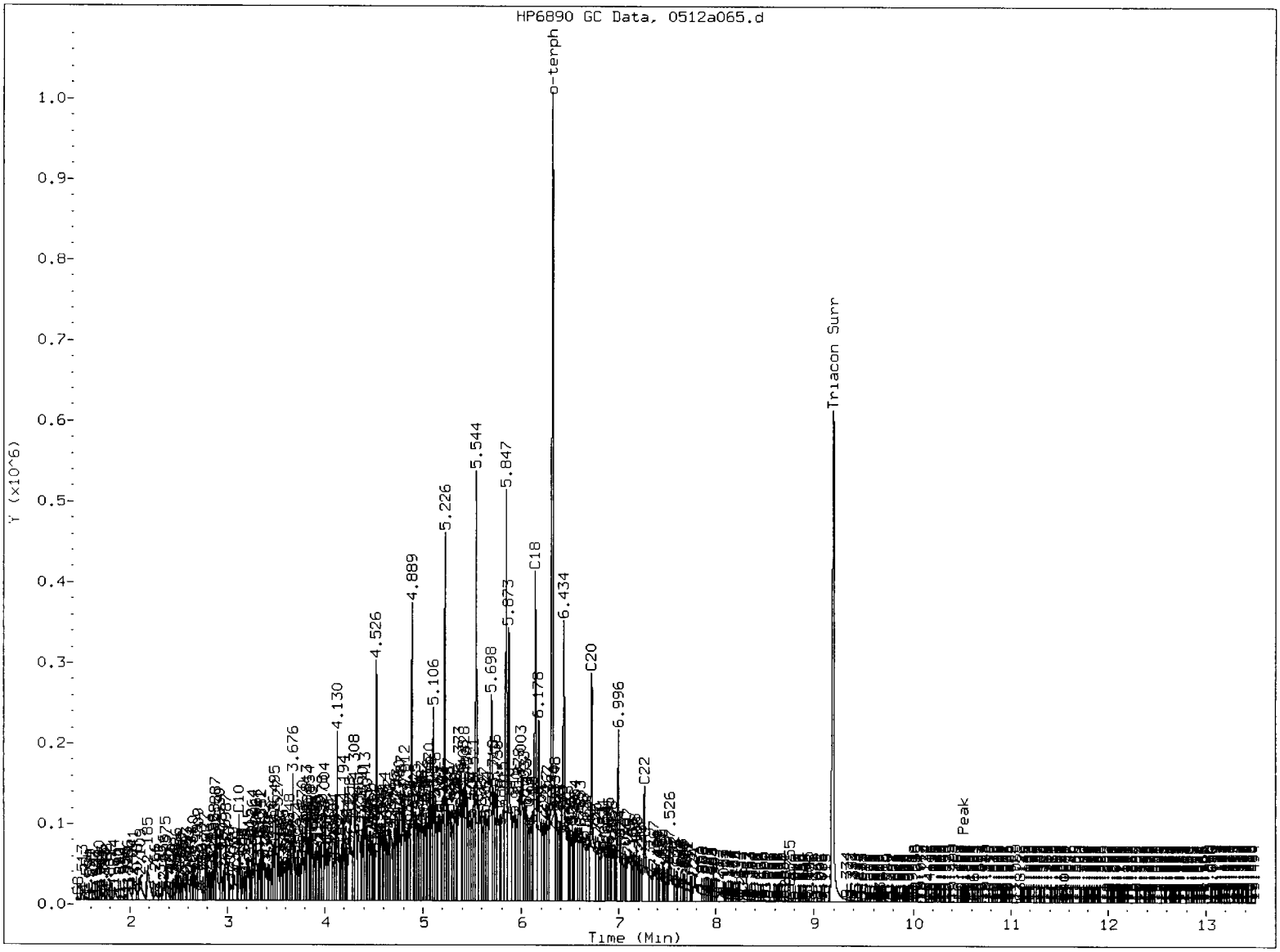


Data File: /chem3/fid4a.i/20120512a.b/0512a065.d
Injection Date: 13-MAY-2012 08:33
Instrument: fid4a.i
Client Sample ID: UT57LCSS1



MH
5/15/12

FID:4A-2C/RTX-1 UT57LCSS1 FID:4A SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/15/12

Data File: /chem3/fid4a.i/20120512a.b/0512a067.d

Date : 13-MAY-2012 09:21

Client ID: CWSB-13-14.0-14.5-0

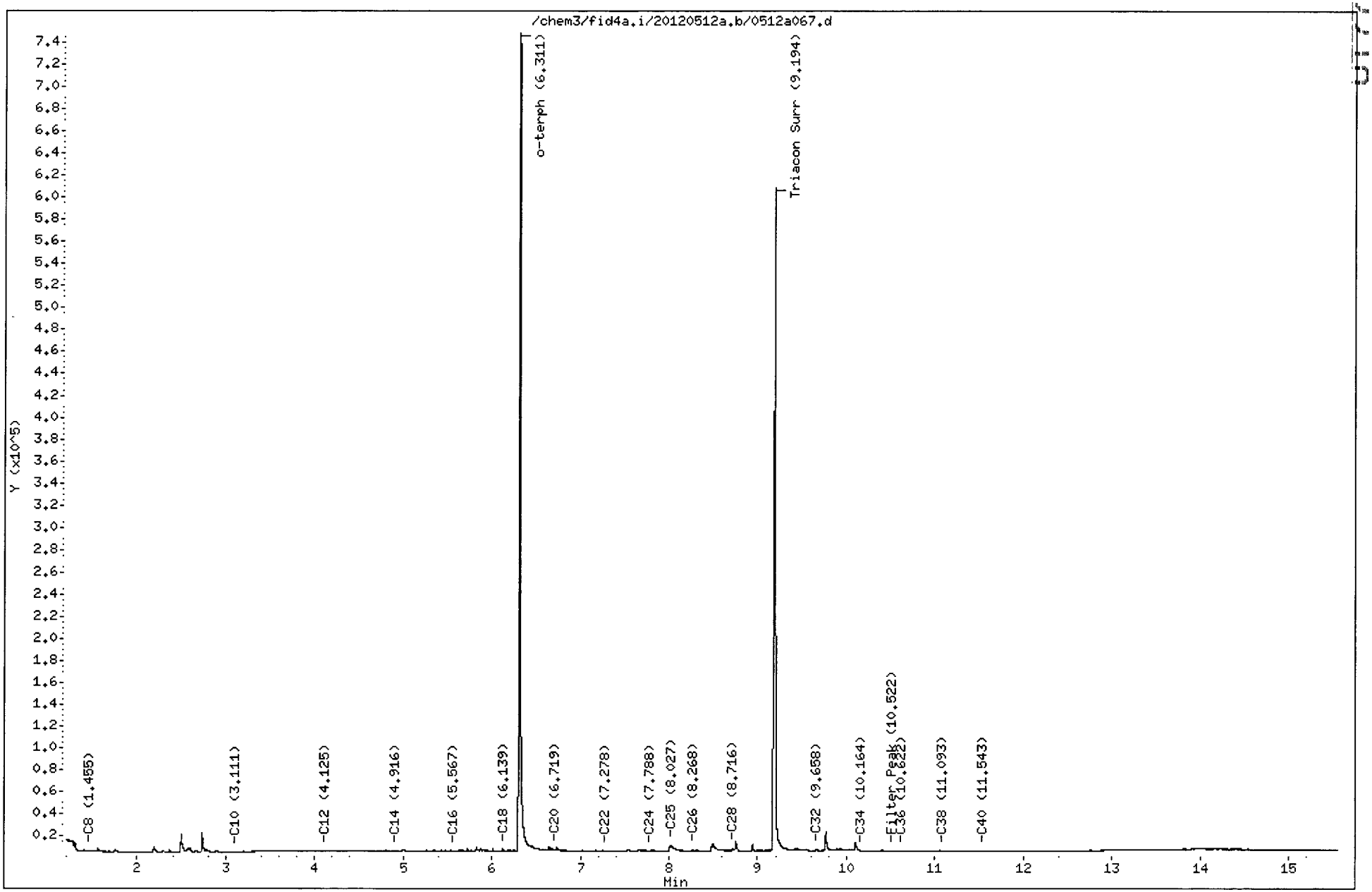
Sample Info: UT77A

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a068.d

Date : 13-MAY-2012 09:46

Client ID: CWSB-13-21-22-0512

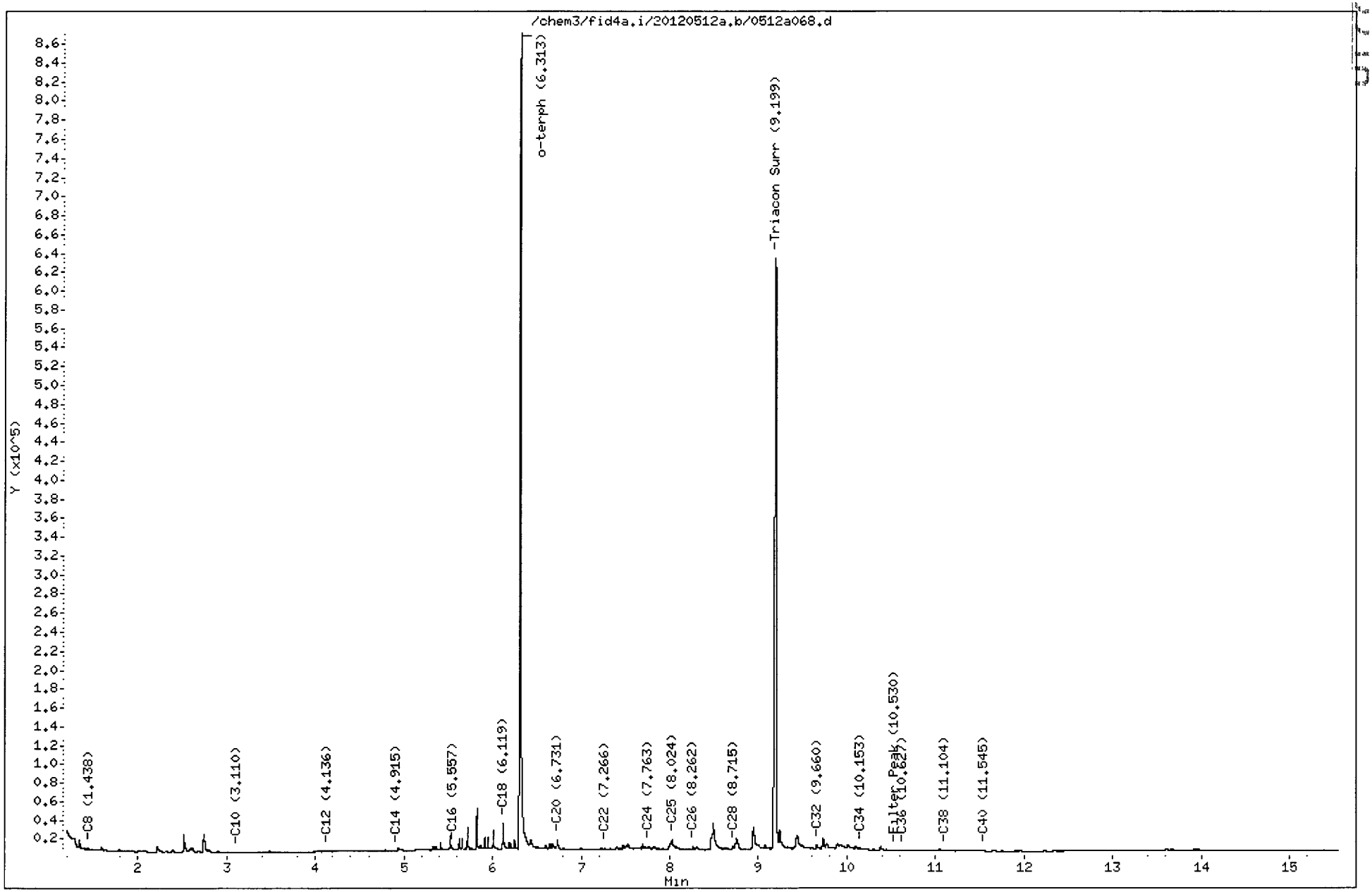
Sample Info: UT77B

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a069.d

Date : 13-MAY-2012 10:10

Client ID: CWSB-13-25-27-0512

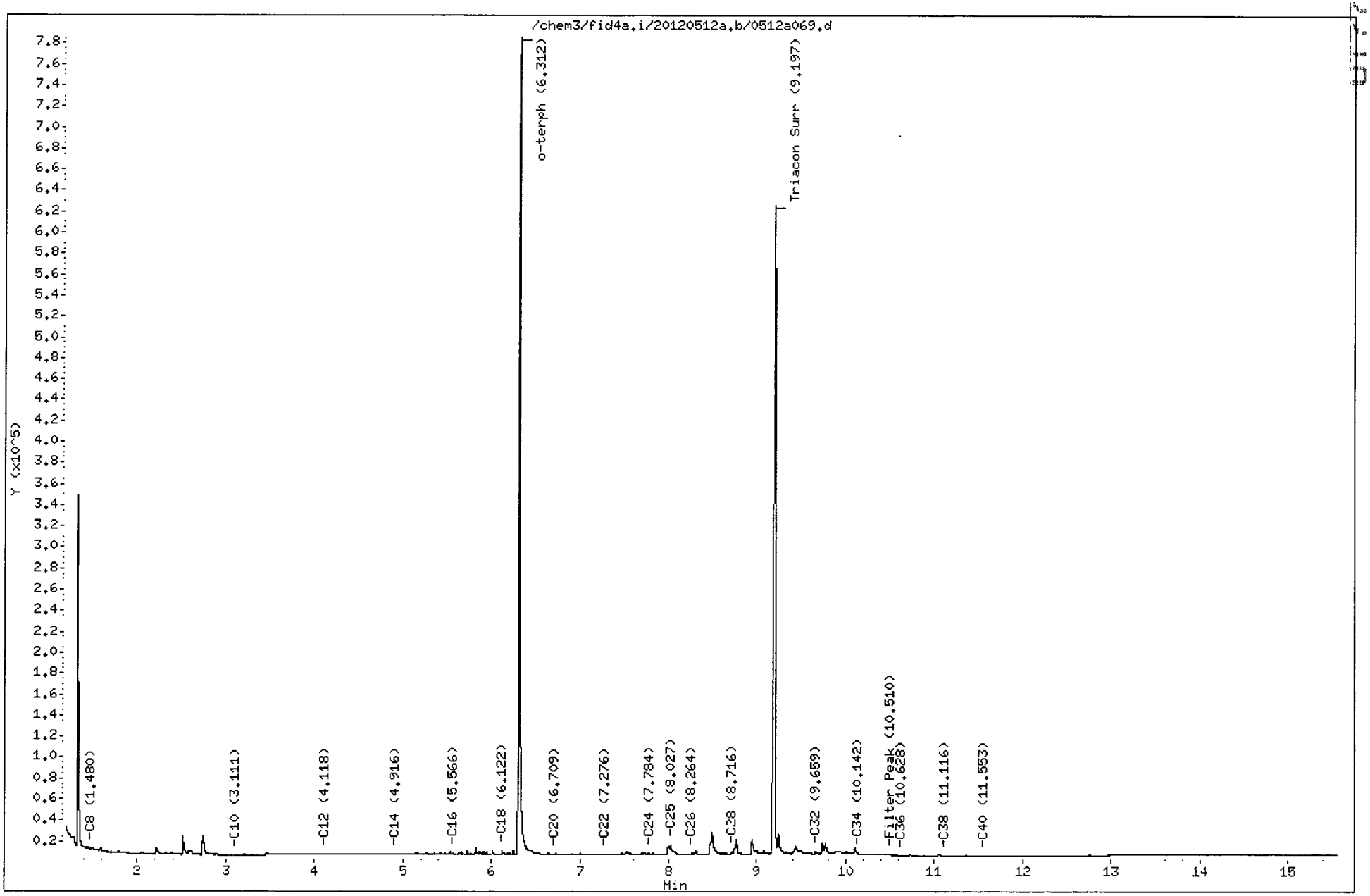
Sample Info: UT77C

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a073.d

Date : 13-MAY-2012 11:48

Client ID: CWSB-14-25-27-0512

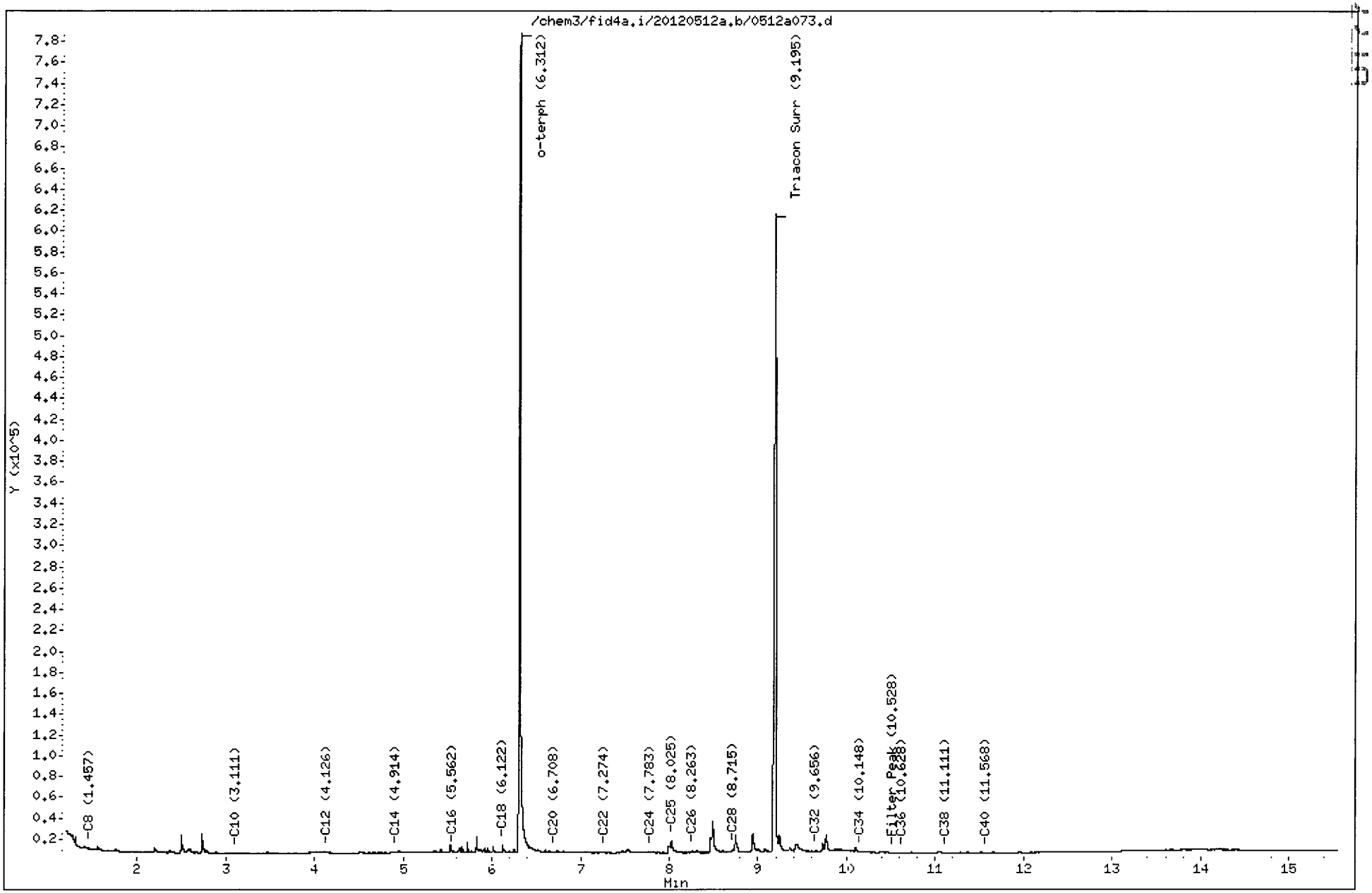
Sample Info: UT77F

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a076.d

Date : 13-MAY-2012 13:01

Client ID: CWSB-14-29-30-0512

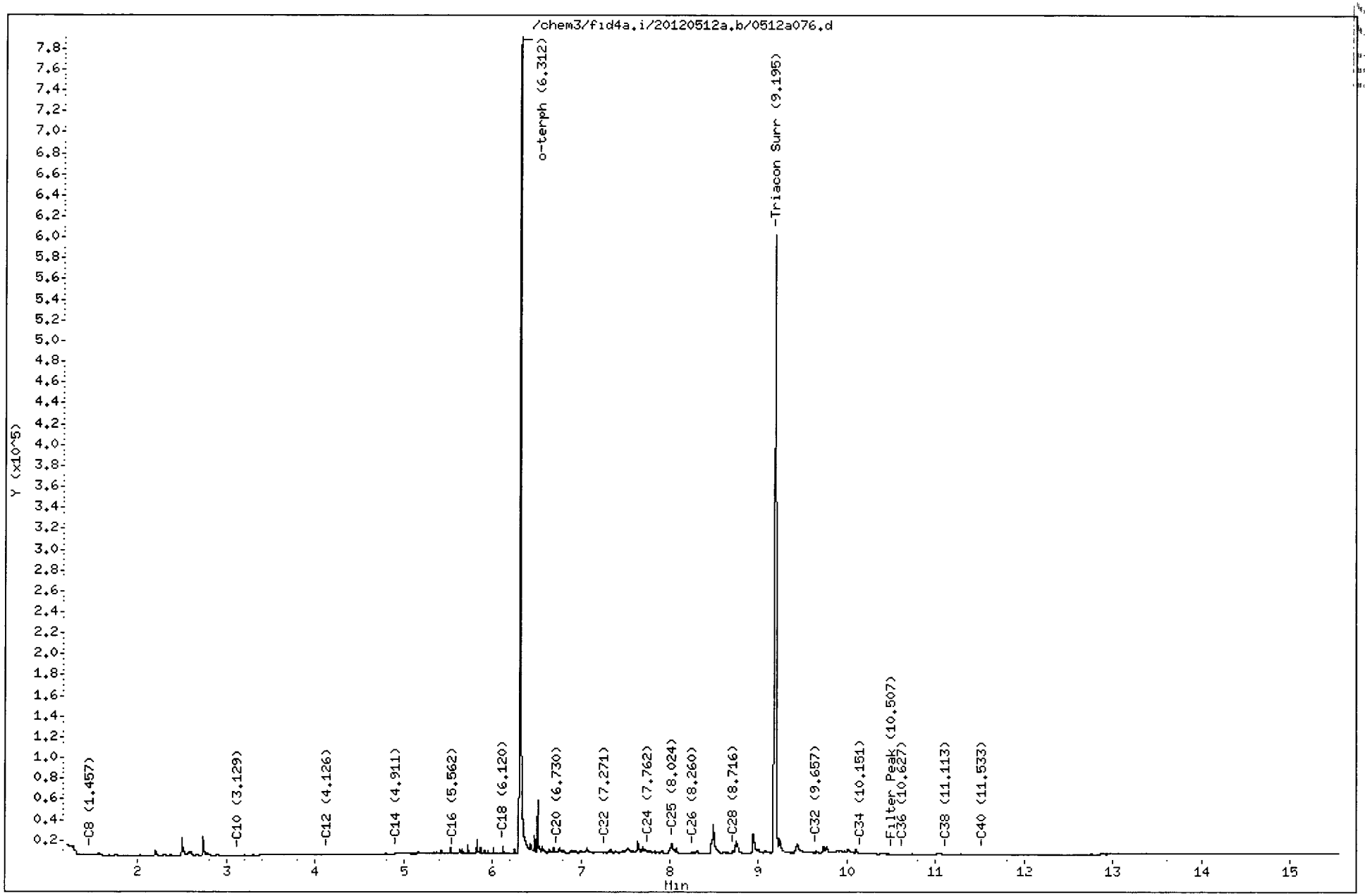
Sample Info: UT77G

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25

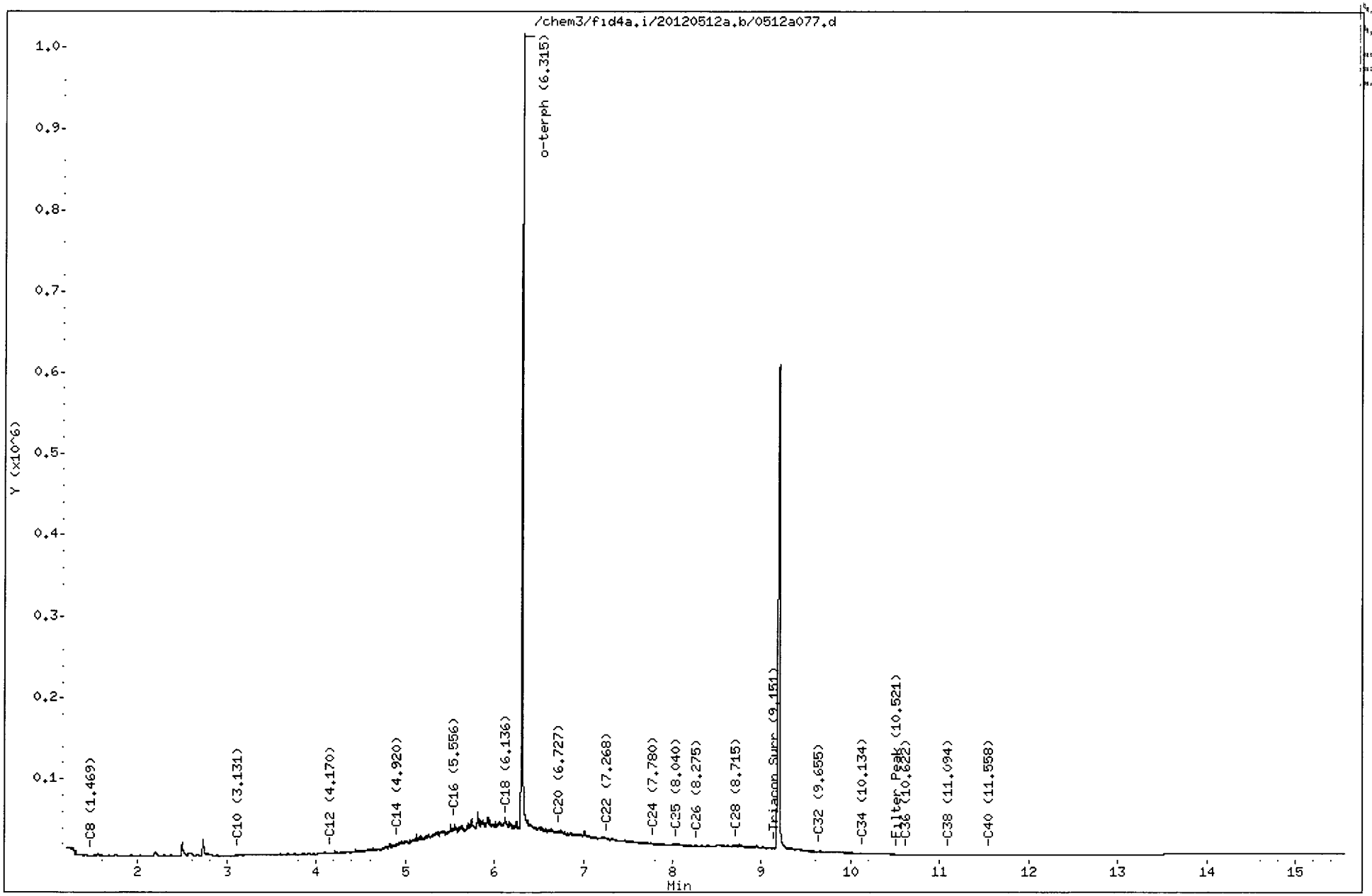


Data File: /chem3/fid4a.i/20120512a.b/0512a077.d
Date : 13-MAY-2012 13:25
Client ID: CWSB-15-11-13-0512
Sample Info: UT77H

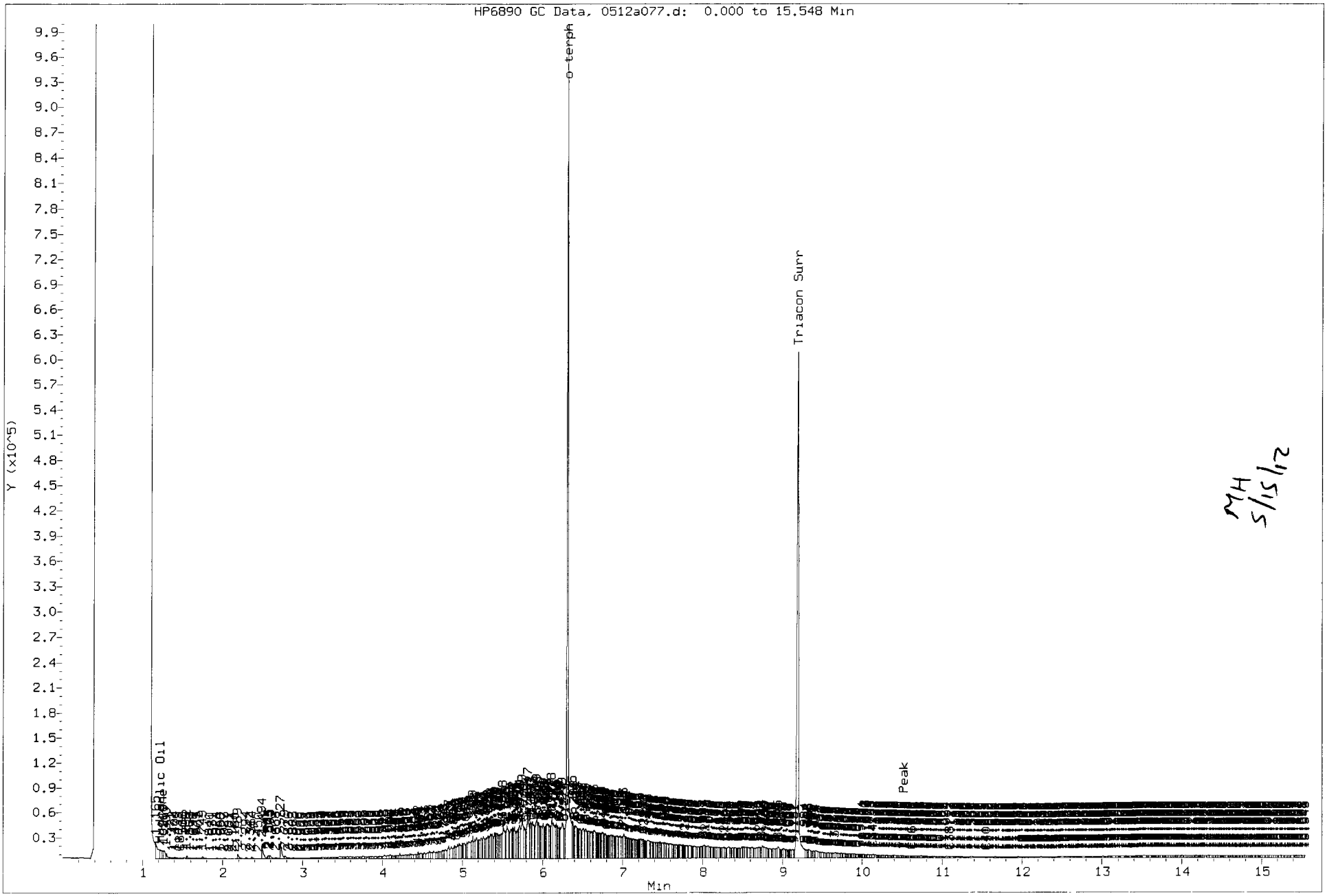
Instrument: fid4a.i

Operator: MH
Column diameter: 0.25

Column phase: RTX-1



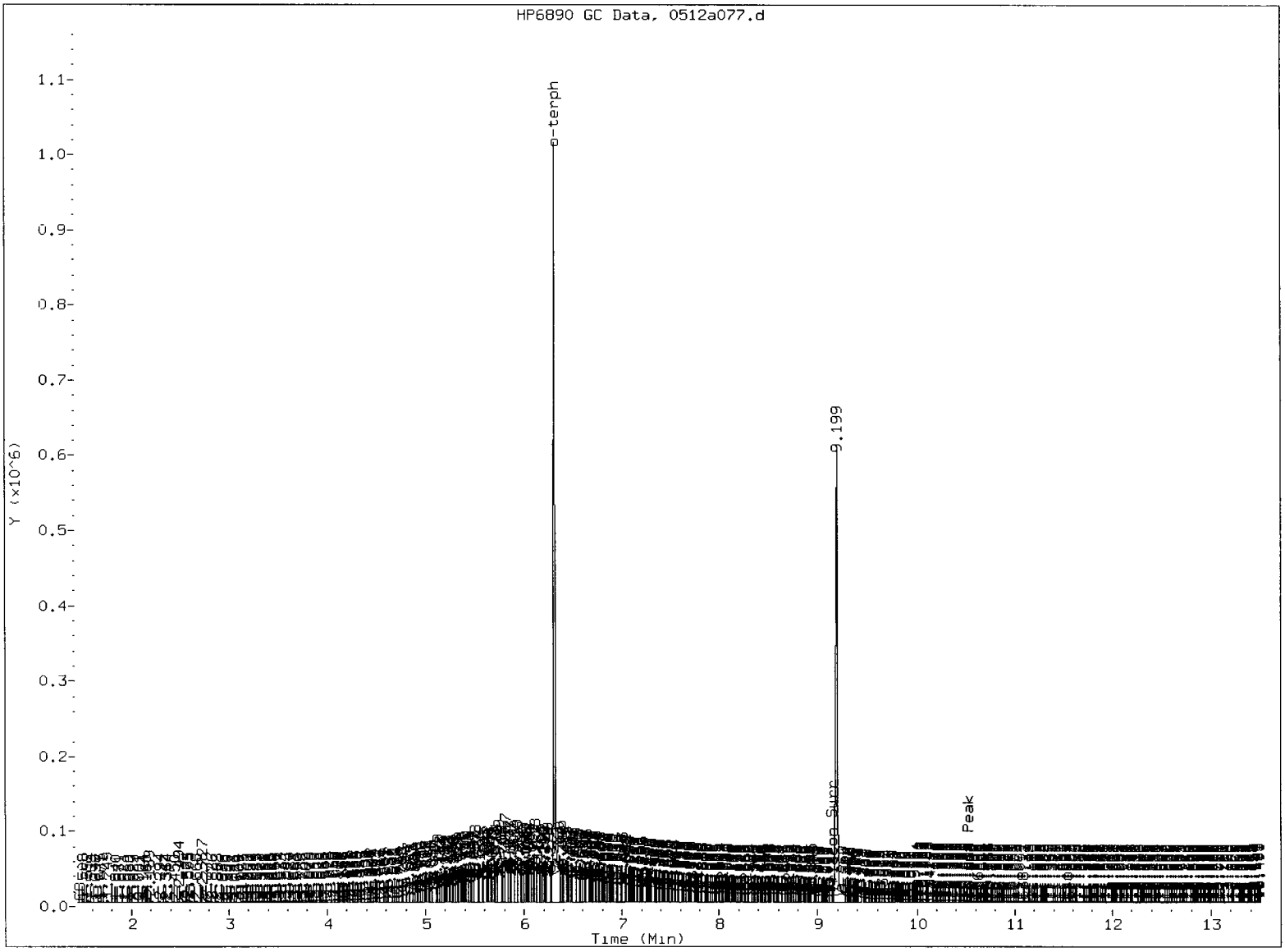
Data File: /chem3/fid4a.i/20120512a.b/0512a077.d
Injection Date: 13-MAY-2012 13:25
Instrument: fid4a.i
Client Sample ID: CWSB-15-11-13-0512



5/15/12

FID:4A-2C/RTX-1 UT77H

FID:4A SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/15/12

UT77:66129

Data File: /chem3/fid4a.i/20120512a.b/0512a078.d

Date : 13-MAY-2012 13:49

Client ID: CWSB-15-23-25-0512

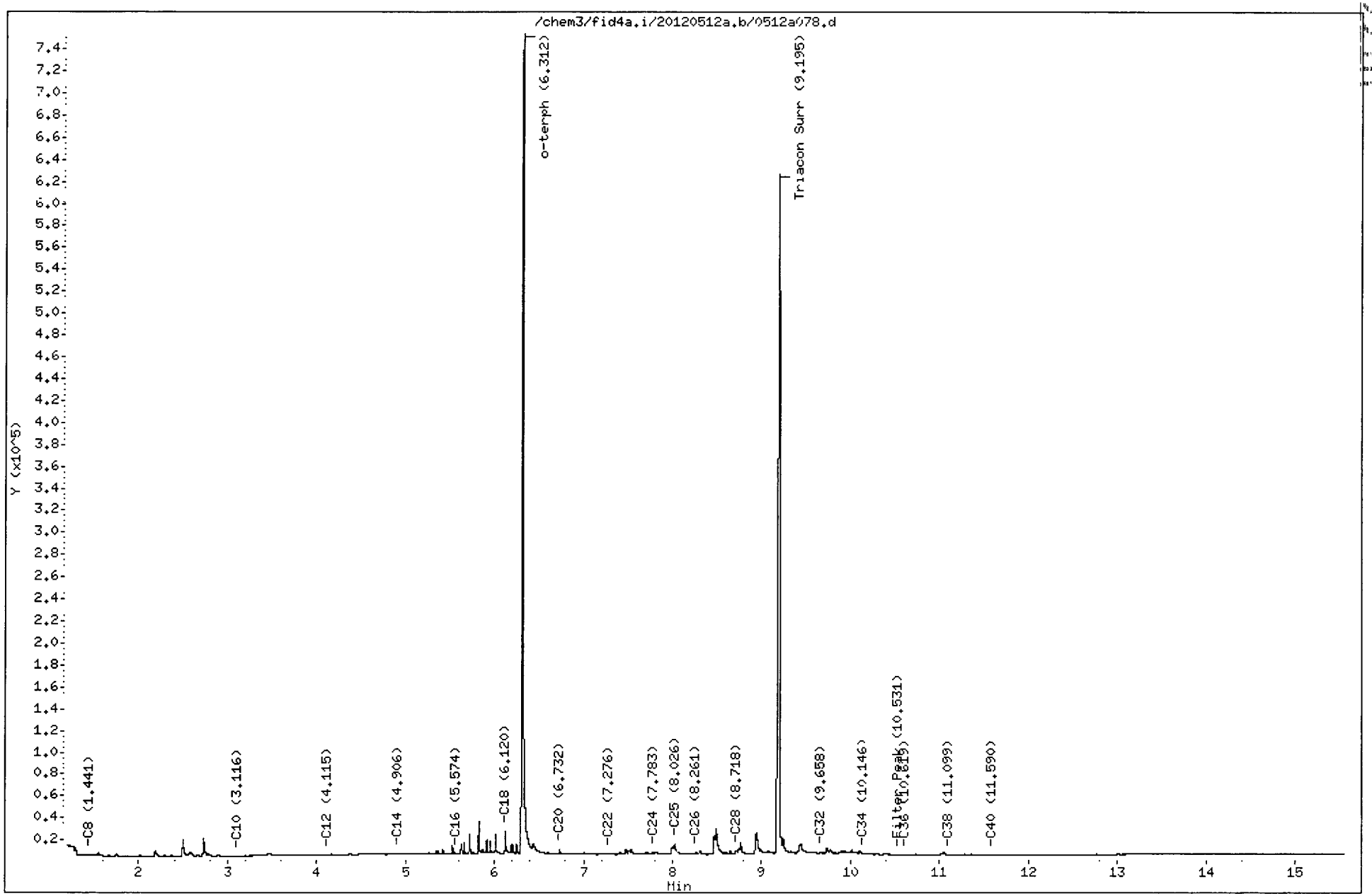
Sample Info: UT77I

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a079.d

Date : 13-MAY-2012 14:13

Client ID: CWSB-15-18-20-0512

Sample Info: UT77J

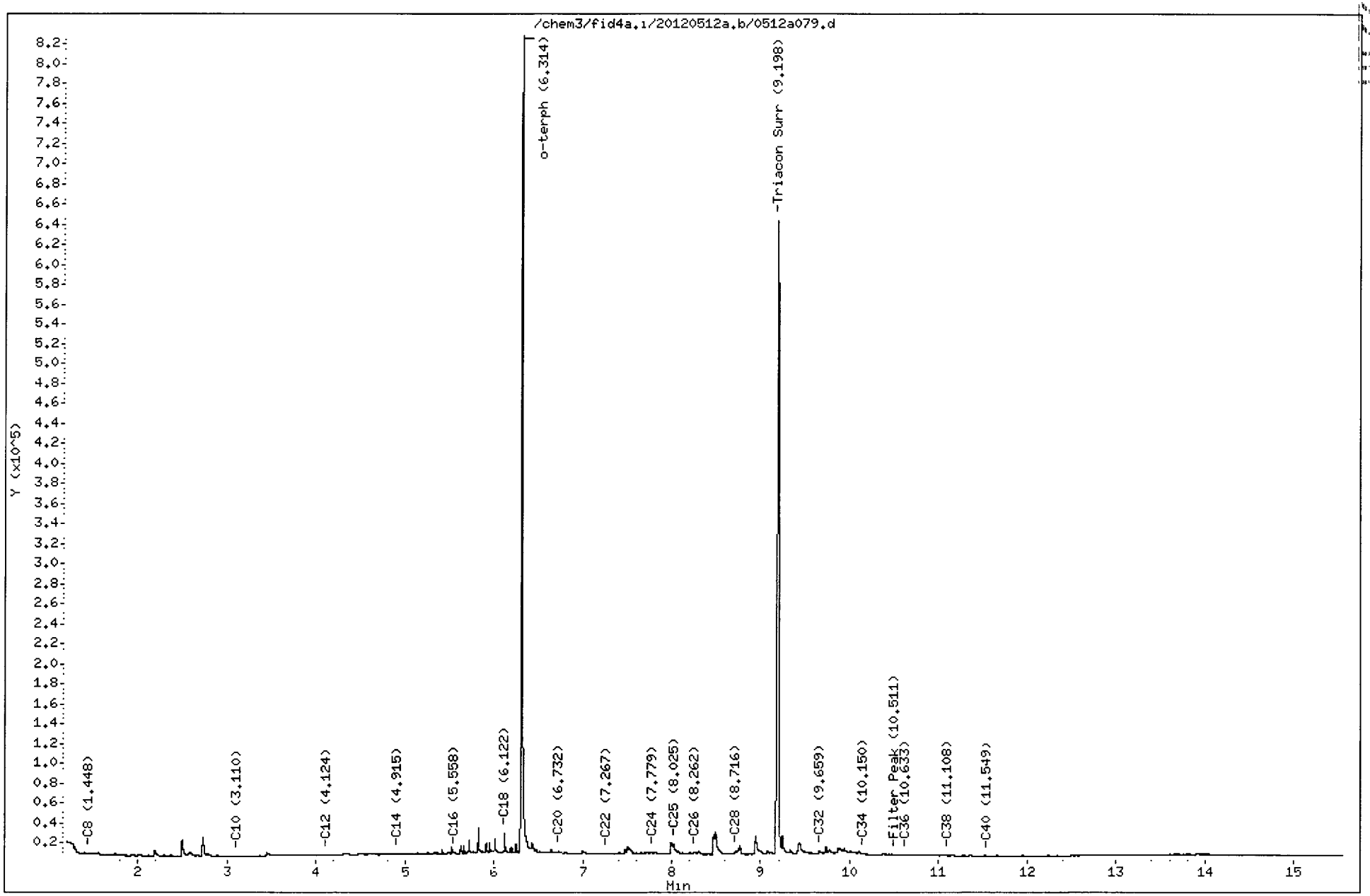
Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25

UT77J 05.12.12



Data File: /chem3/fid4a.i/20120512a.b/0512a081.d

Date : 13-MAY-2012 15:02

Client ID: CWSB-16-13-15-0512

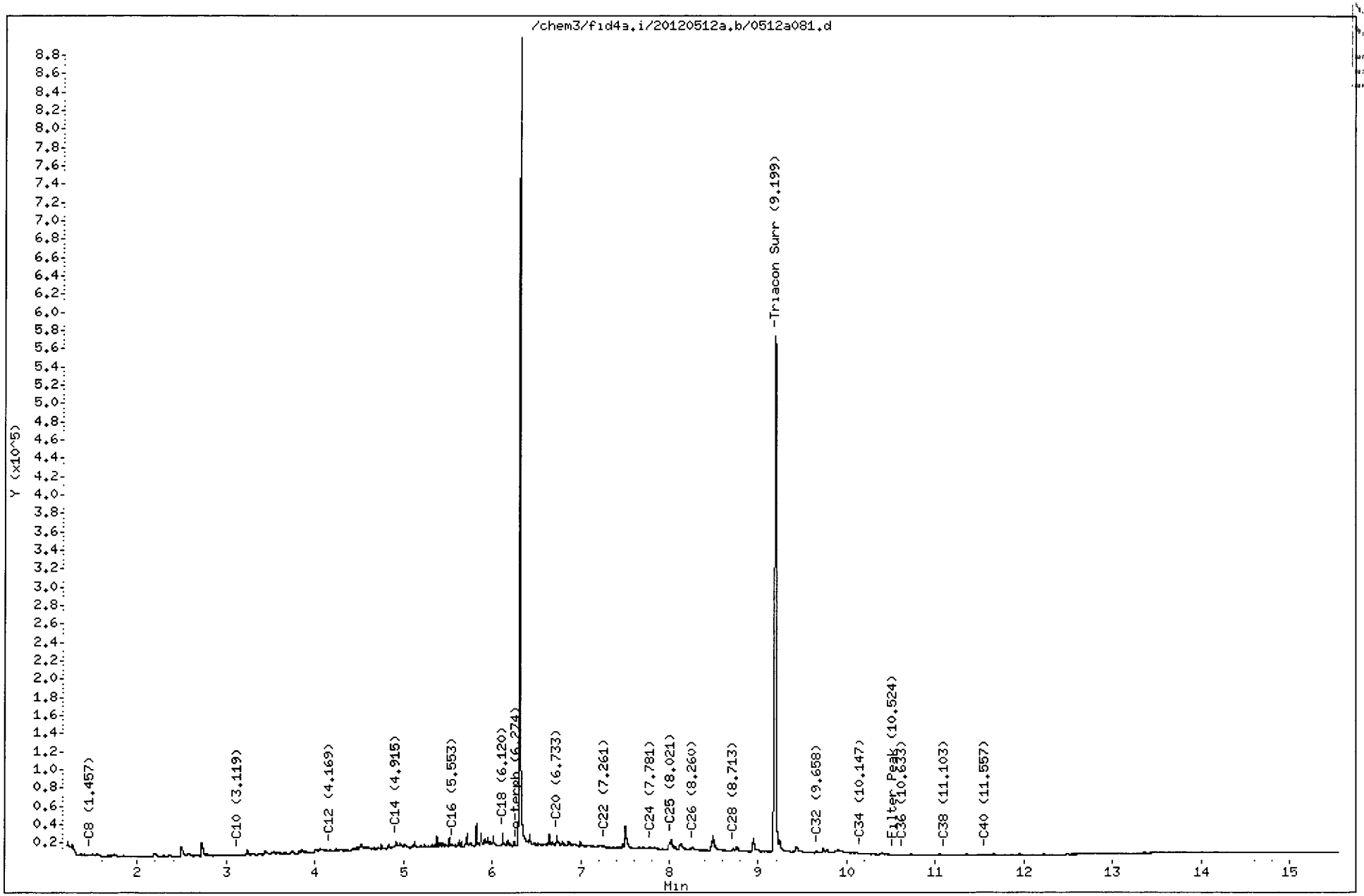
Sample Info: UT77M

Column phase: RTX-1

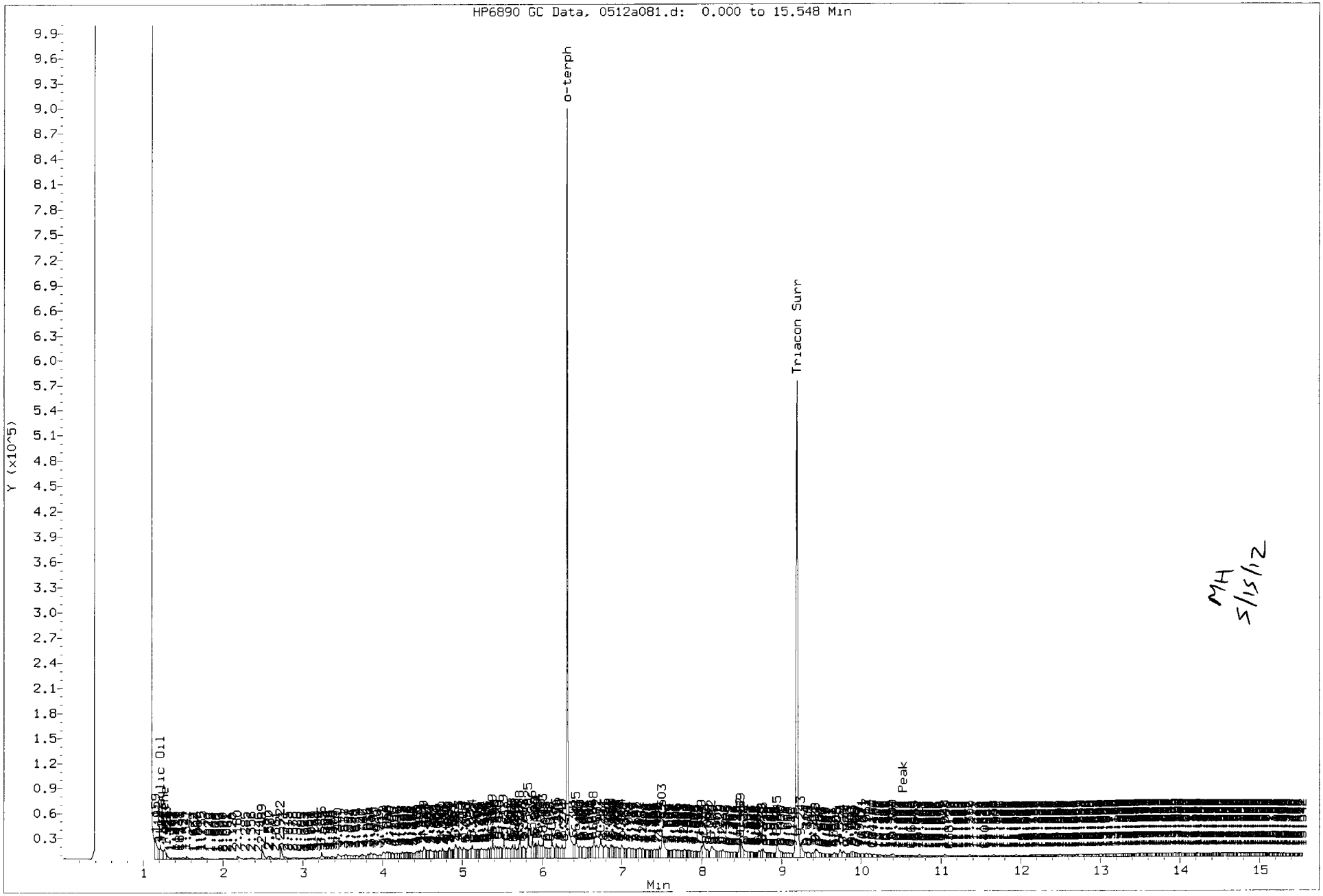
Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



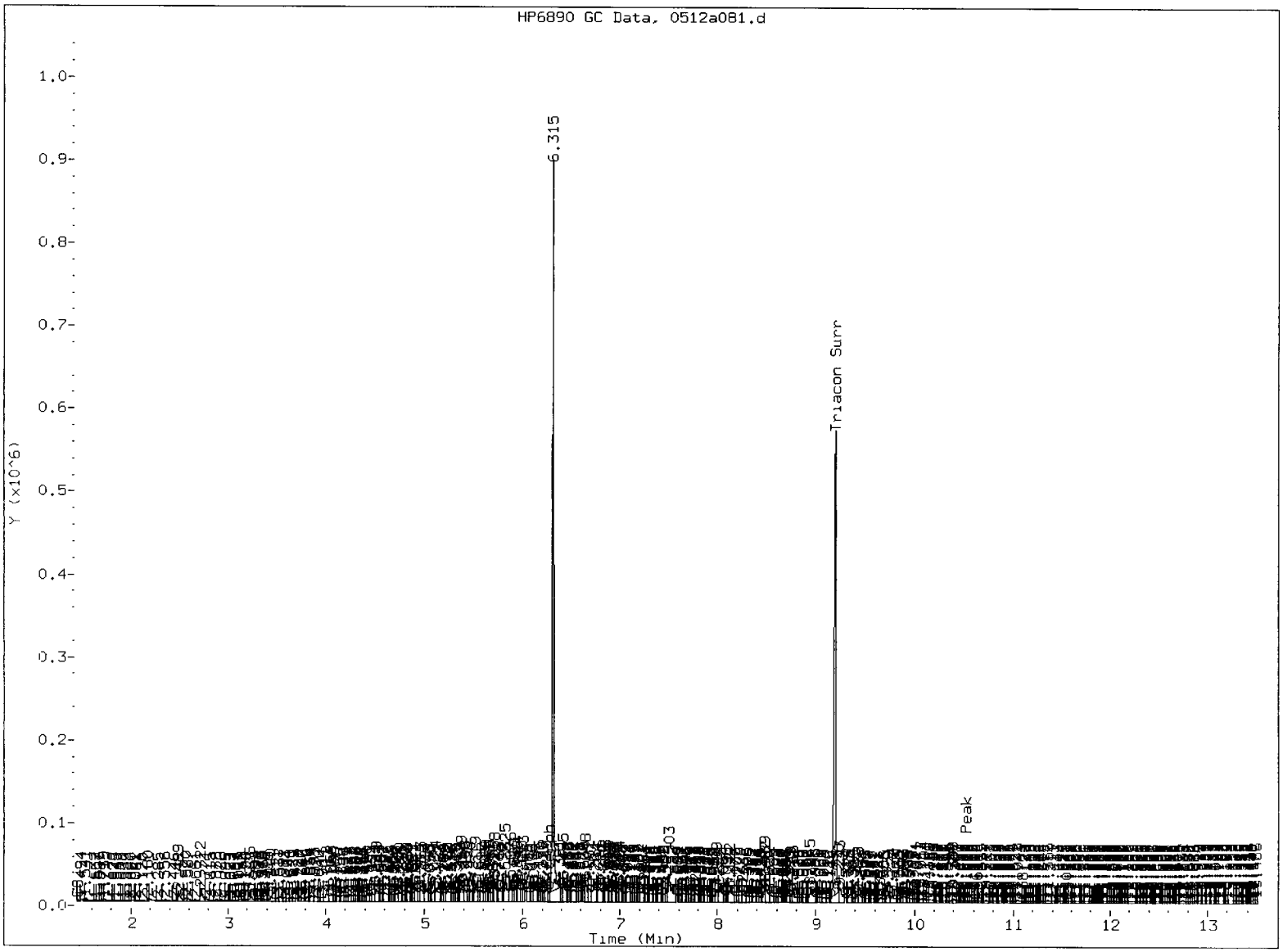
Data File: /chem3/fid4a.i/20120512a.b/0512a081.d
Injection Date: 13-MAY-2012 15:02
Instrument: fid4a.i
Client Sample ID: CWSB-16-13-15-0512



MH
5/15/12

FID:4A-2C/RTX-1 UT77M

FID:4A SIGNAL



MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/15/12

UT77-061225

Data File: /chem3/fid4a.i/20120512a.b/0512a082.d

Date : 13-MAY-2012 15:26

Client ID: CWSB-16-18-20-0512

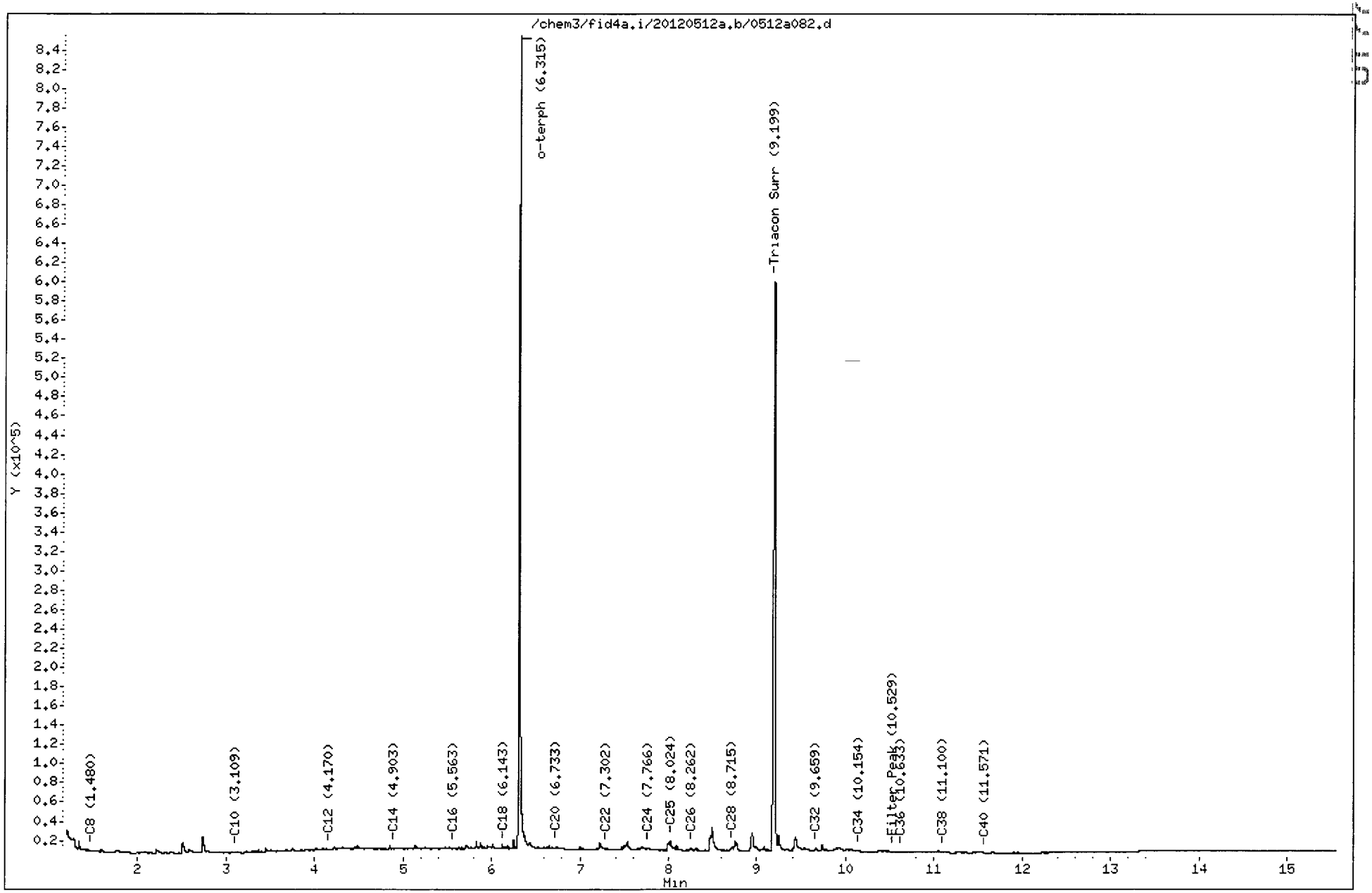
Sample Info: UT77N

Column phase: RTX-1

Instrument: fid4a.i

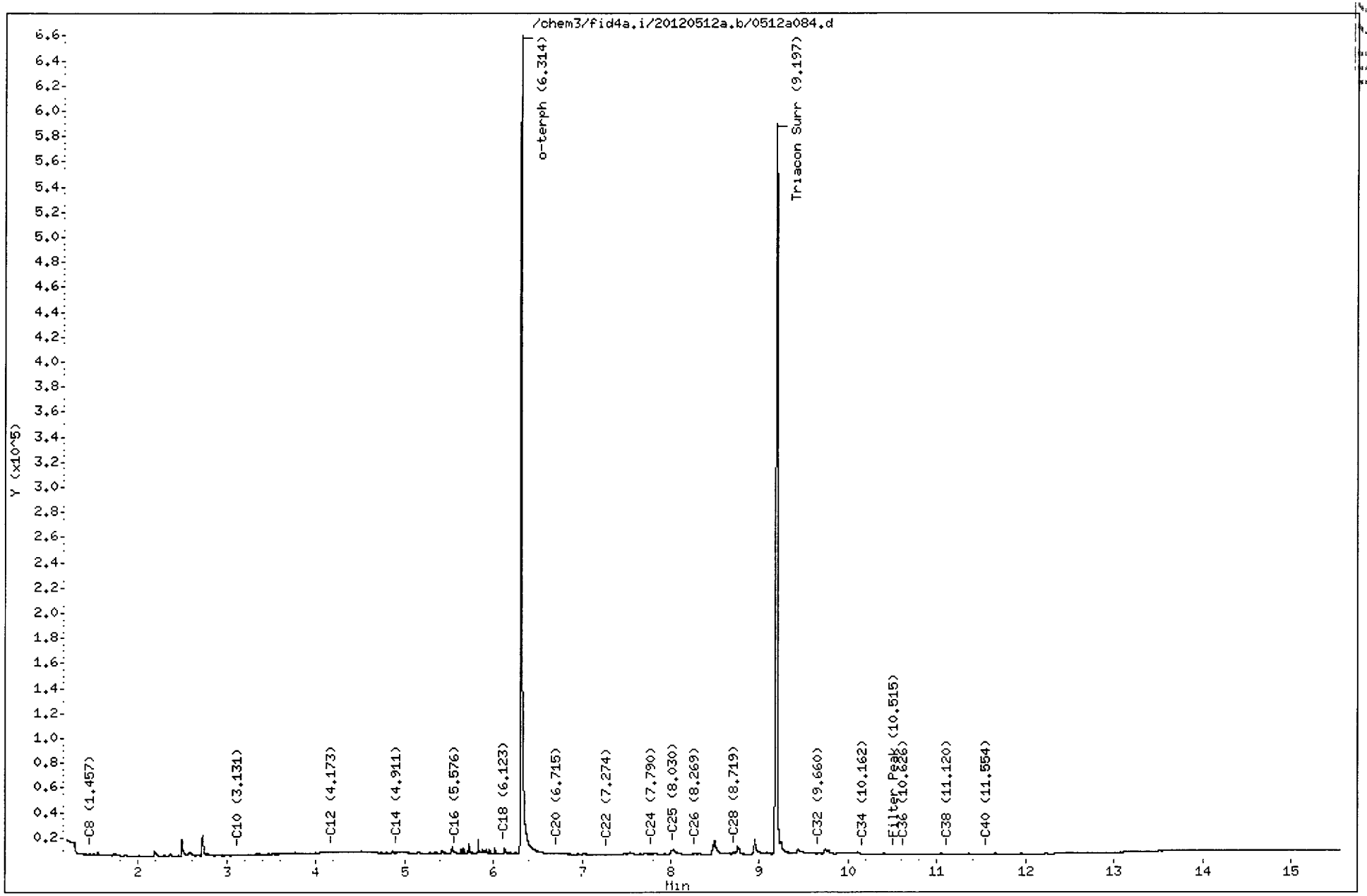
Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a084.d
Date : 13-MAY-2012 16:15
Client ID: CWSB-17-23-25-0512
Sample Info: UT77Q

Instrument: fid4a.i
Operator: MH
Column phase: RTX-1
Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a085.d

Date : 13-MAY-2012 16:39

Client ID: CWSB-17-28-30-0512

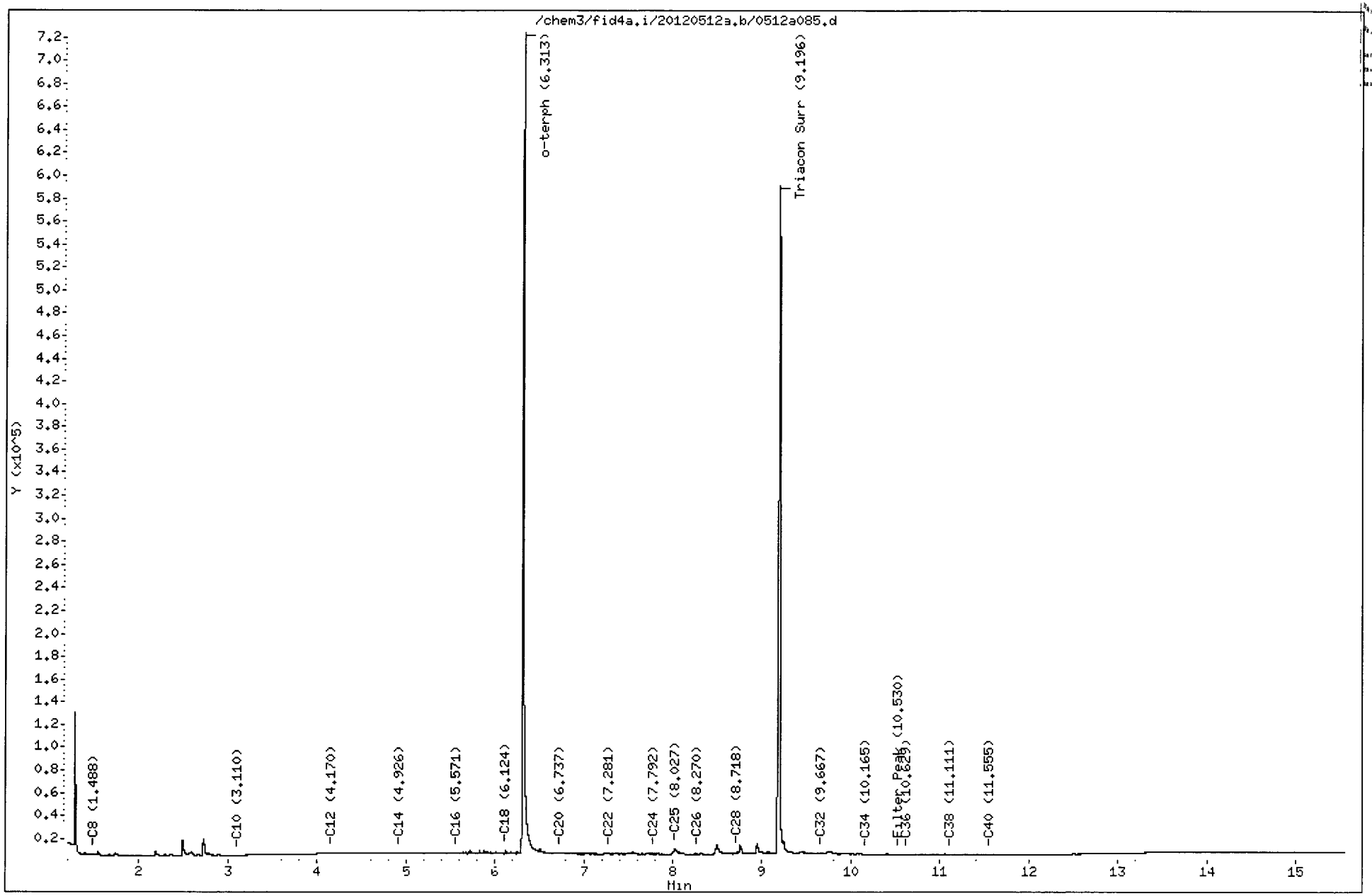
Sample Info: UT77R

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120512a.b/0512a086.d

Date : 13-MAY-2012 17:03

Client ID: CWSB-170-23-25-0512

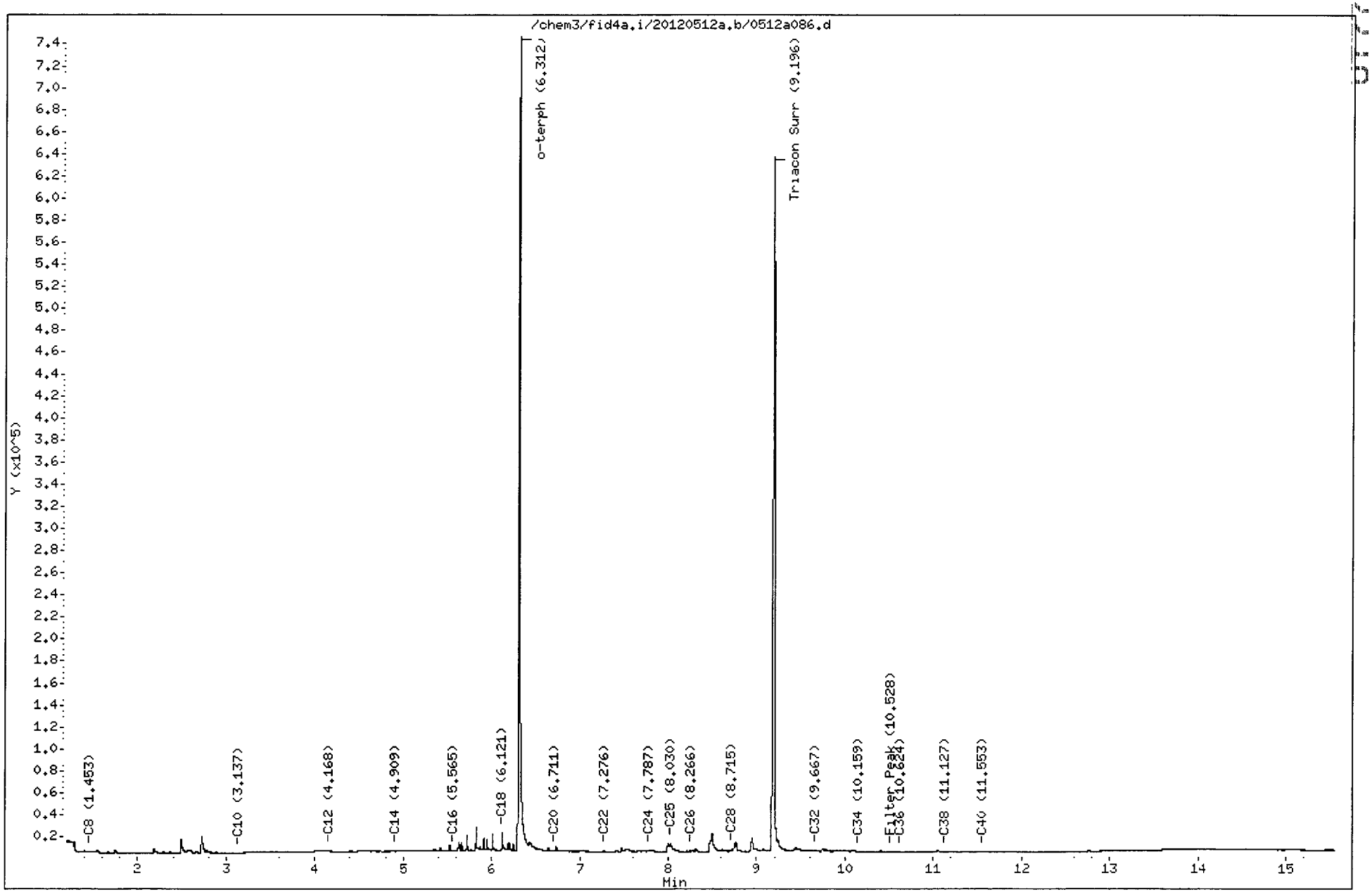
Sample Info: UT77S

Instrument: fid4a.i

Operator: MH

Column phase: PTX-1

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120514.b/0514a027.d

Date : 14-MAY-2012 16:39

Client ID: CWSB-14-12-14-0512

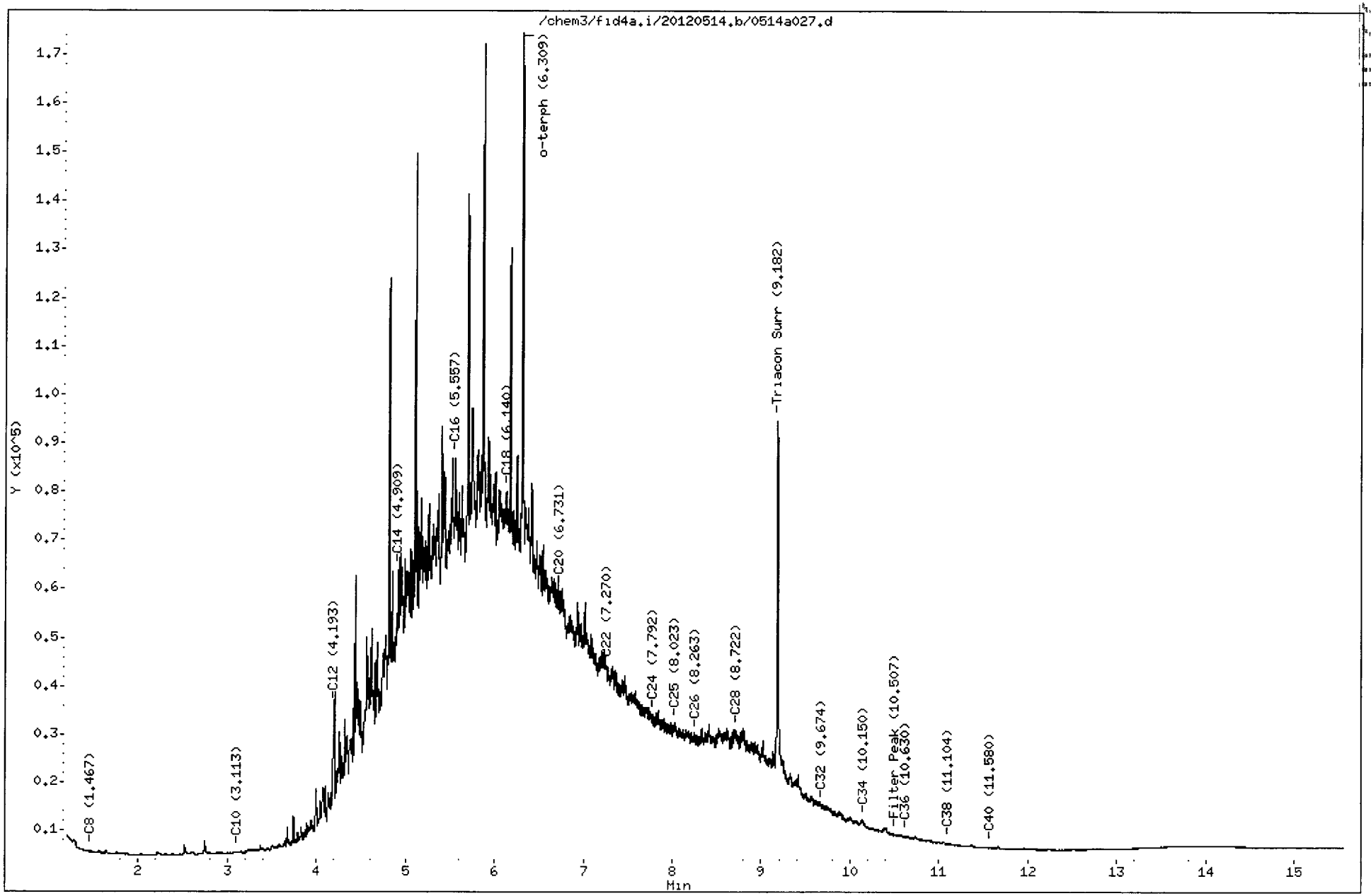
Sample Info: UT77E,10

Column phase: RTX-1

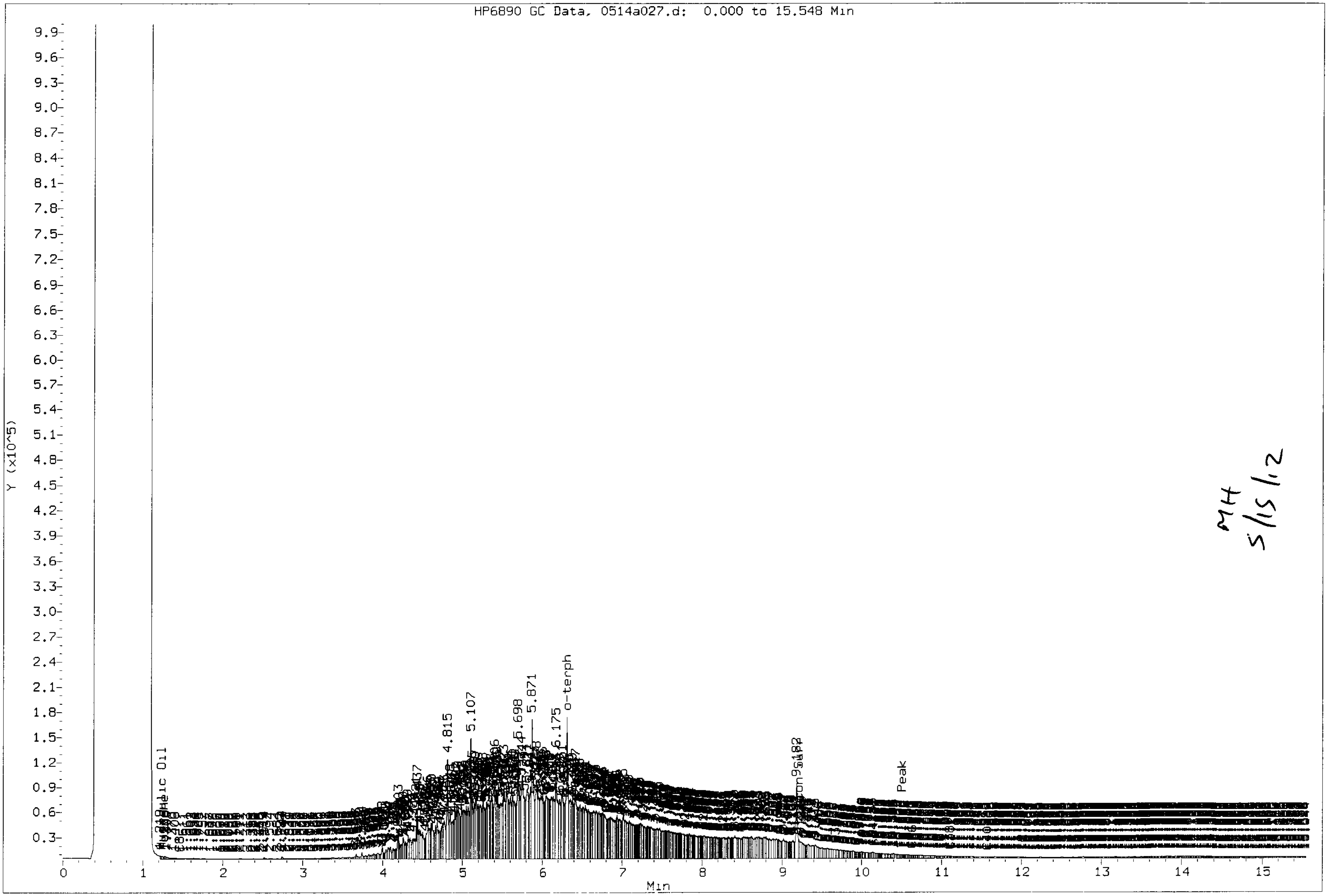
Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



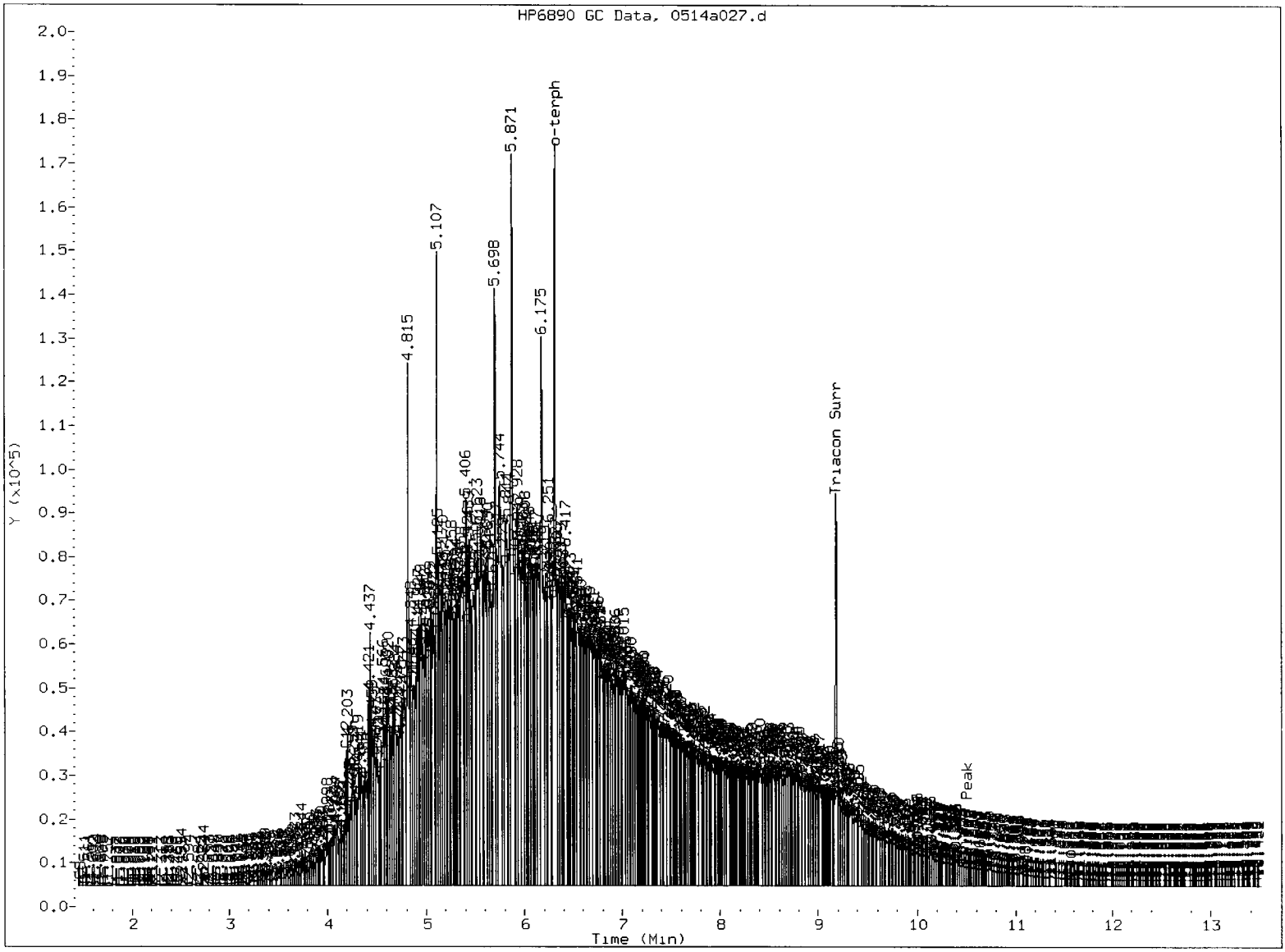
Data File: /chem3/fid4a.i/20120514.b/0514a027.d
Injection Date: 14-MAY-2012 16:39
Instrument: fid4a.i
Client Sample ID: CWSB-14-12-14-0512



MH
5/15/12

UTT7 : 00131

FID:4A-2C/RTX-1 UT77E FID:4A SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/15/12

UT77:001132

Data File: /chem3/fid4a.i/20120514.b/0514a030.d

Date : 14-MAY-2012 17:52

Client ID: CWSB-16-8-10-0512

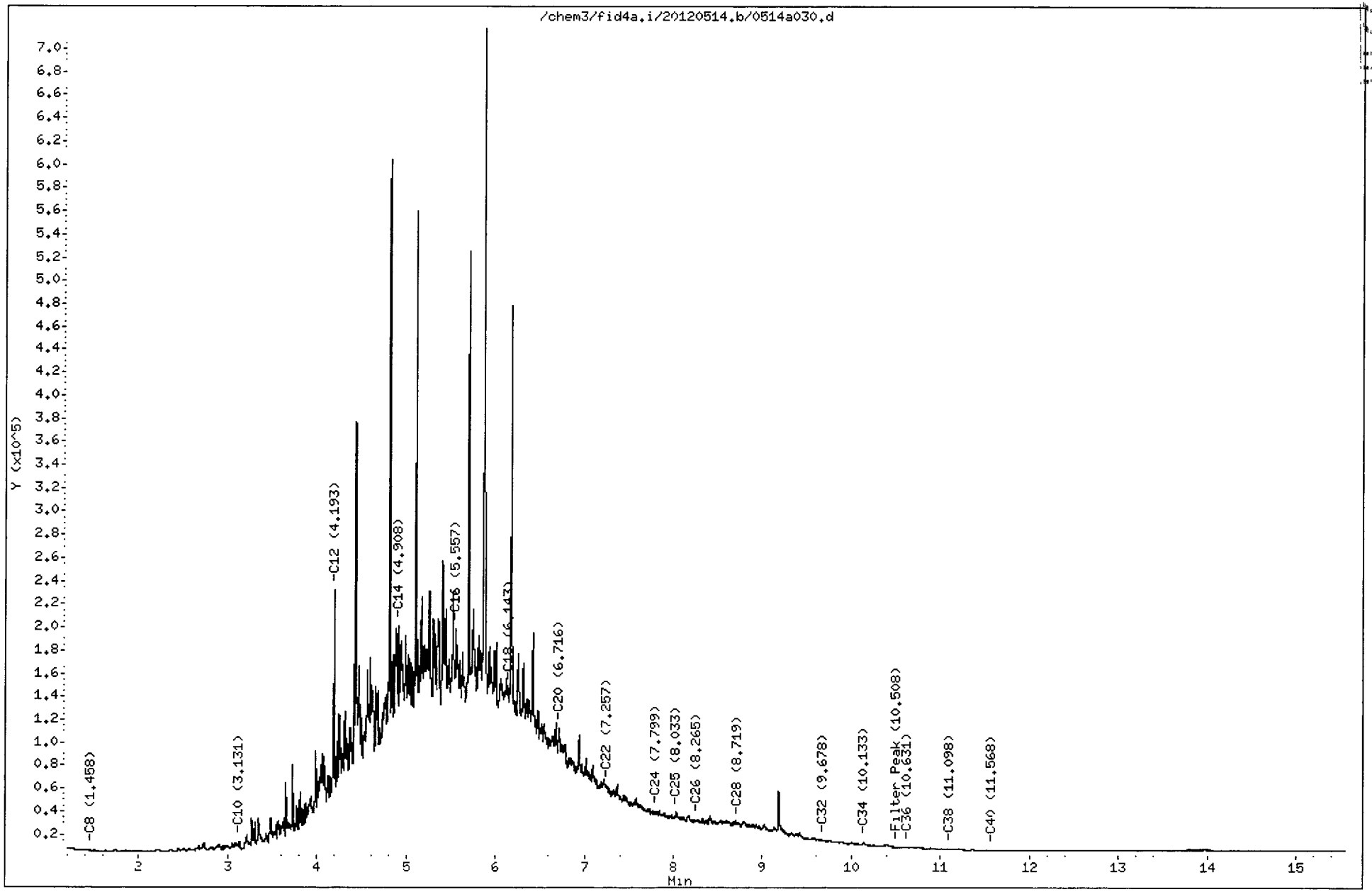
Sample Info: UT77L,20

Instrument: fid4a.i

Operator: MH

Column phase: RTX-1

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120514.b/0514a031.d

Date : 14-MAY-2012 18:16

Client ID: CWSB-17-6-8-0512

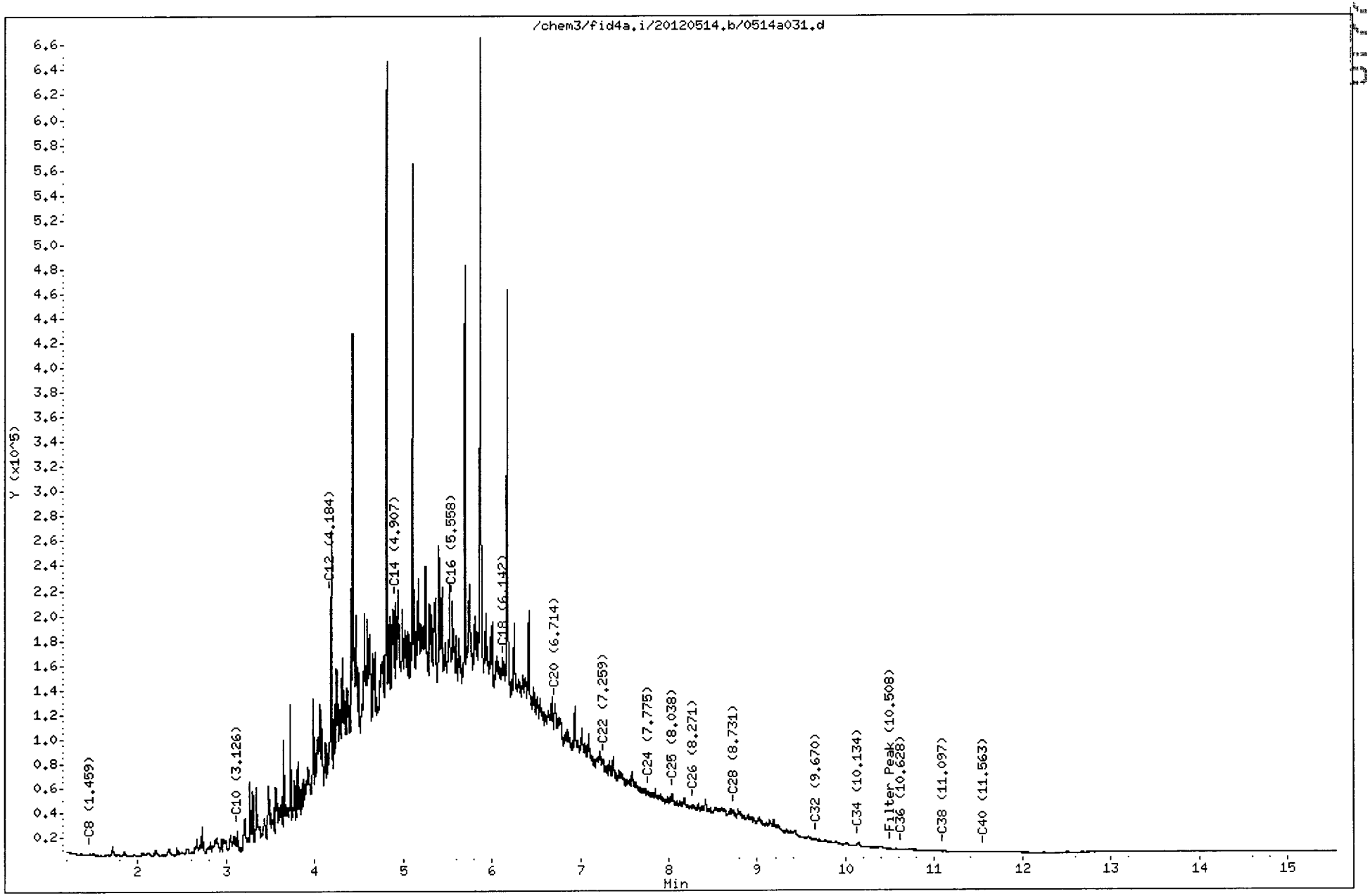
Sample Info: UT77P,100

Column phase: RTX-1

Instrument: fid4a.i

Operator: MH

Column diameter: 0.25



Data File: /chem3/fid4a.i/20120514.b/0514a028.d

Date : 14-MAY-2012 17:04

Client ID:

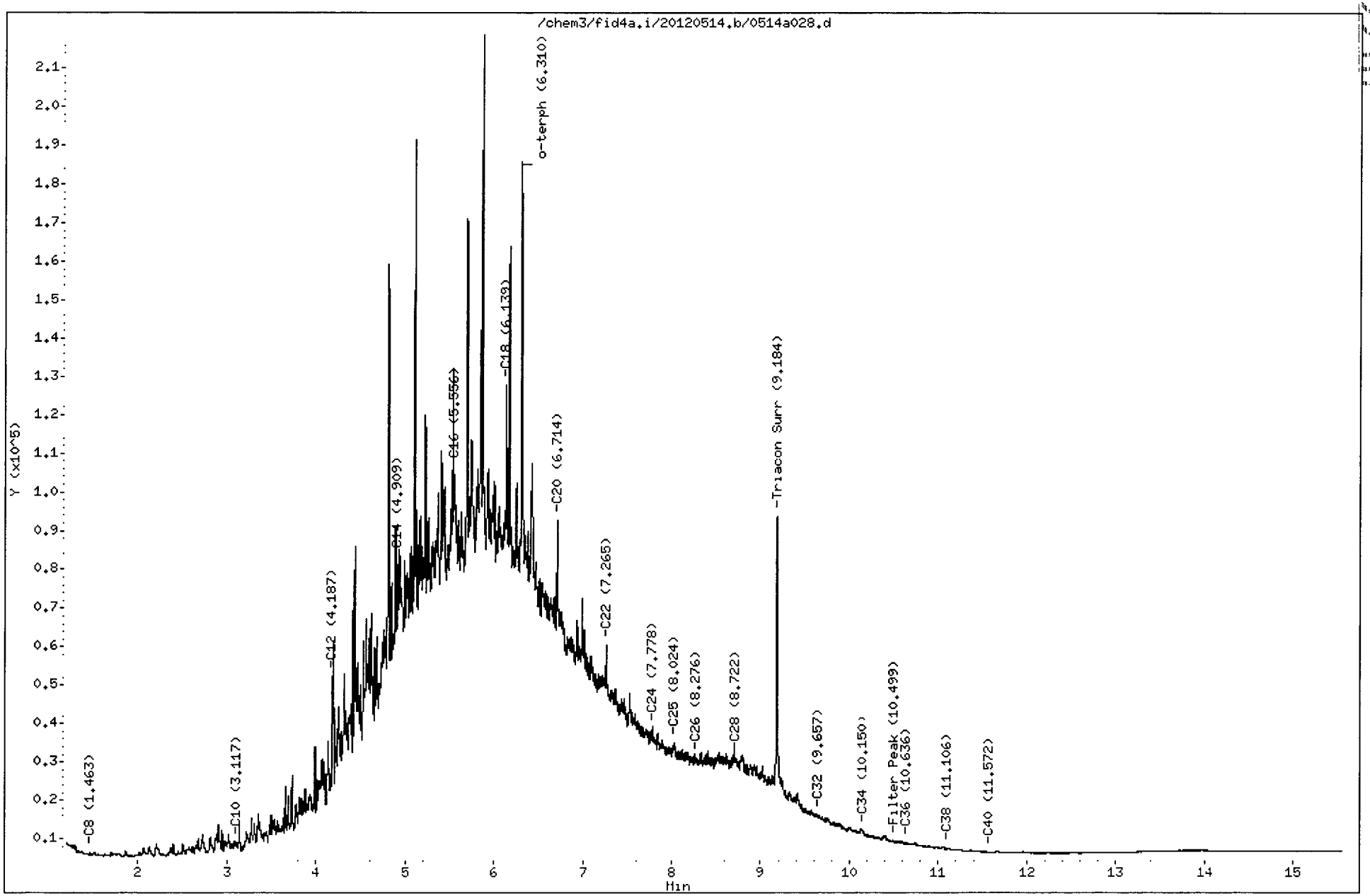
Sample Info: UT77EMD,10

Column phase: RTX-1

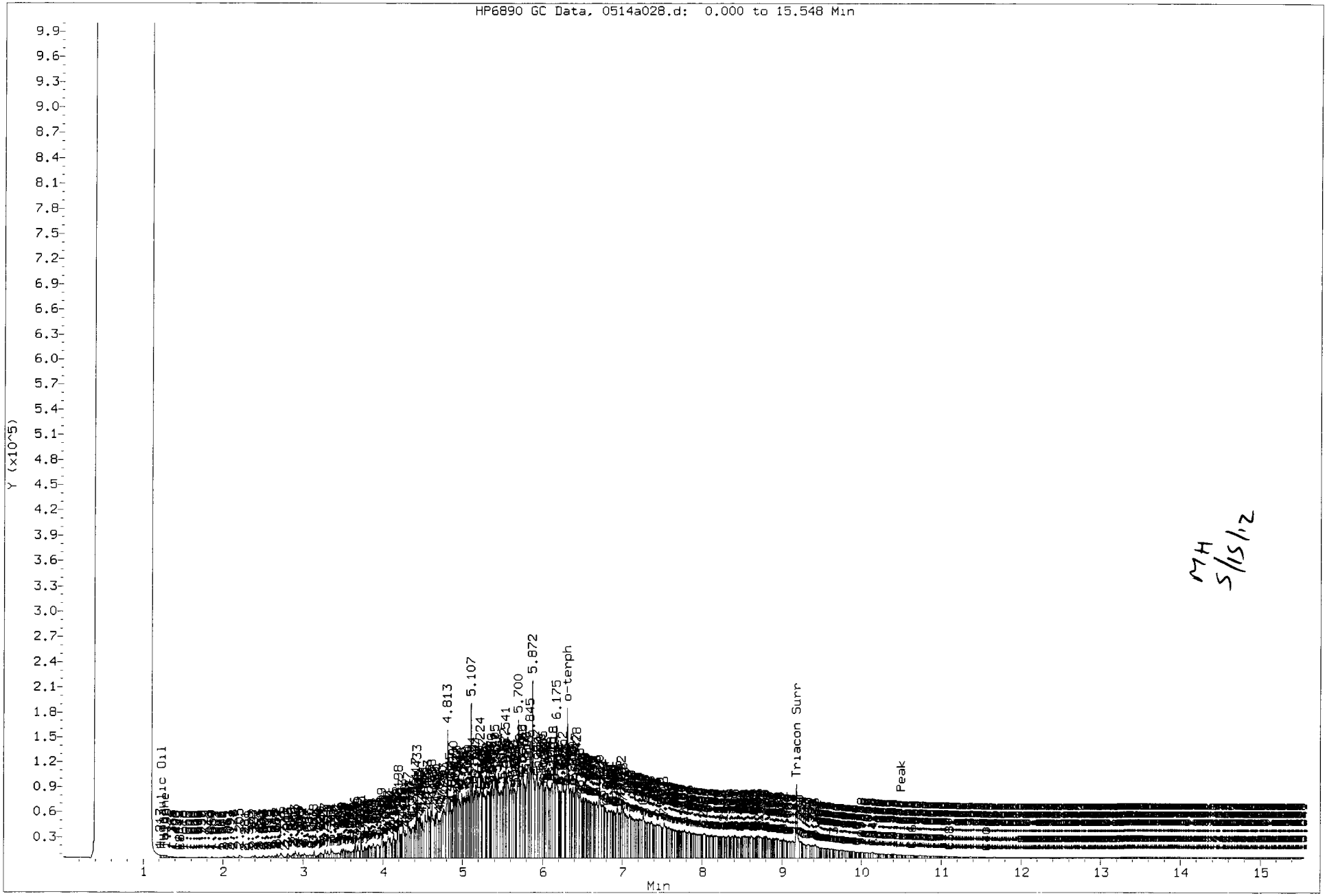
Instrument: fid4a.i

Operator: MH

Column diameter: 0.25

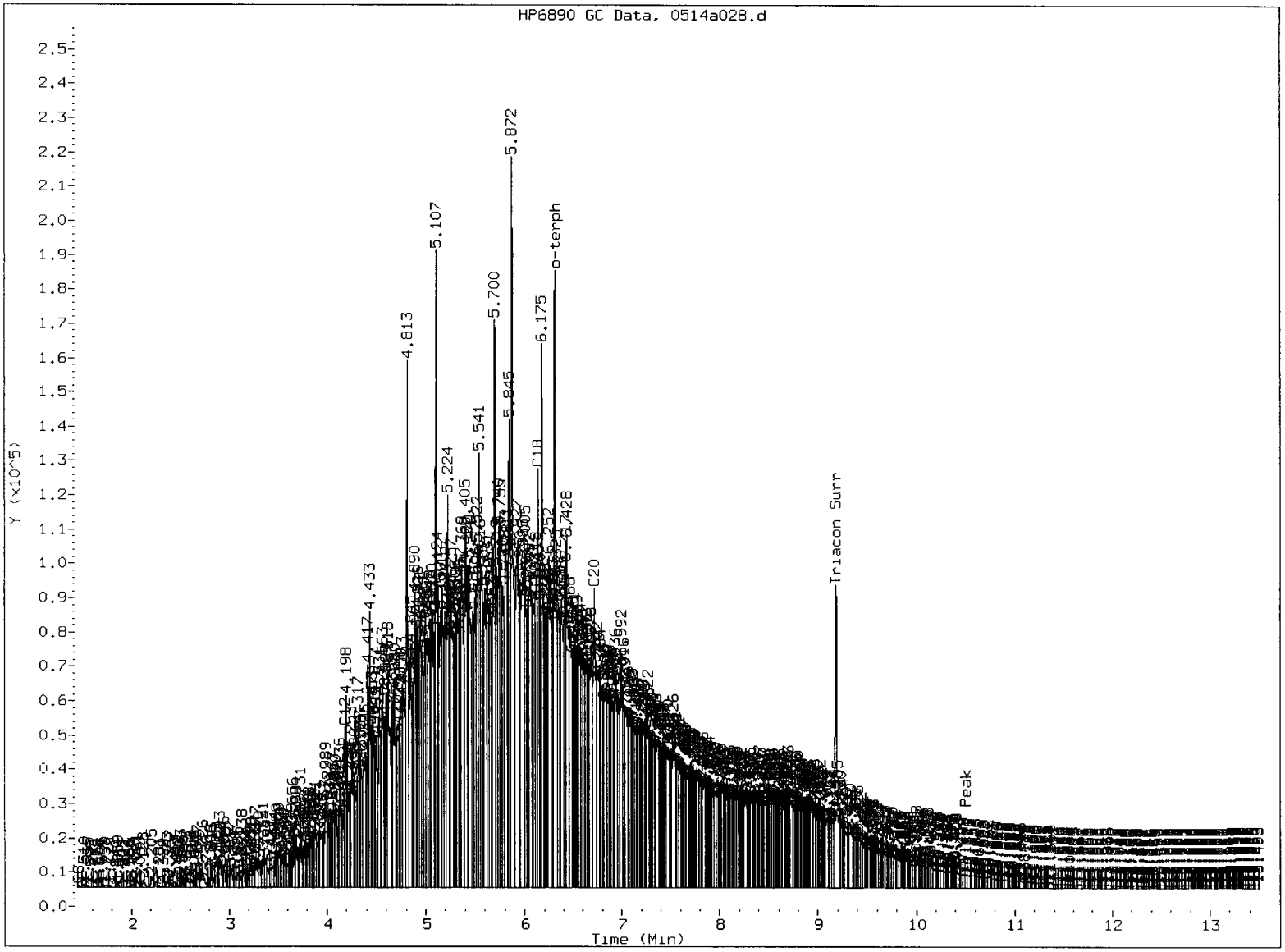


Data File: /chem3/fid4a.i/20120514.b/0514a028.d
Injection Date: 14-MAY-2012 17:04
Instrument: fid4a.i
Client Sample ID:



MH 5/15/12

FID:4A-2C/RTX-1 UT77EMD FID:4A SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/15/12

UT77:00107

Data File: /chem3/fid4a.i/20120514.b/0514a029.d

Date : 14-MAY-2012 17:28

Client ID: CWSB-14-12-14-0 MSD

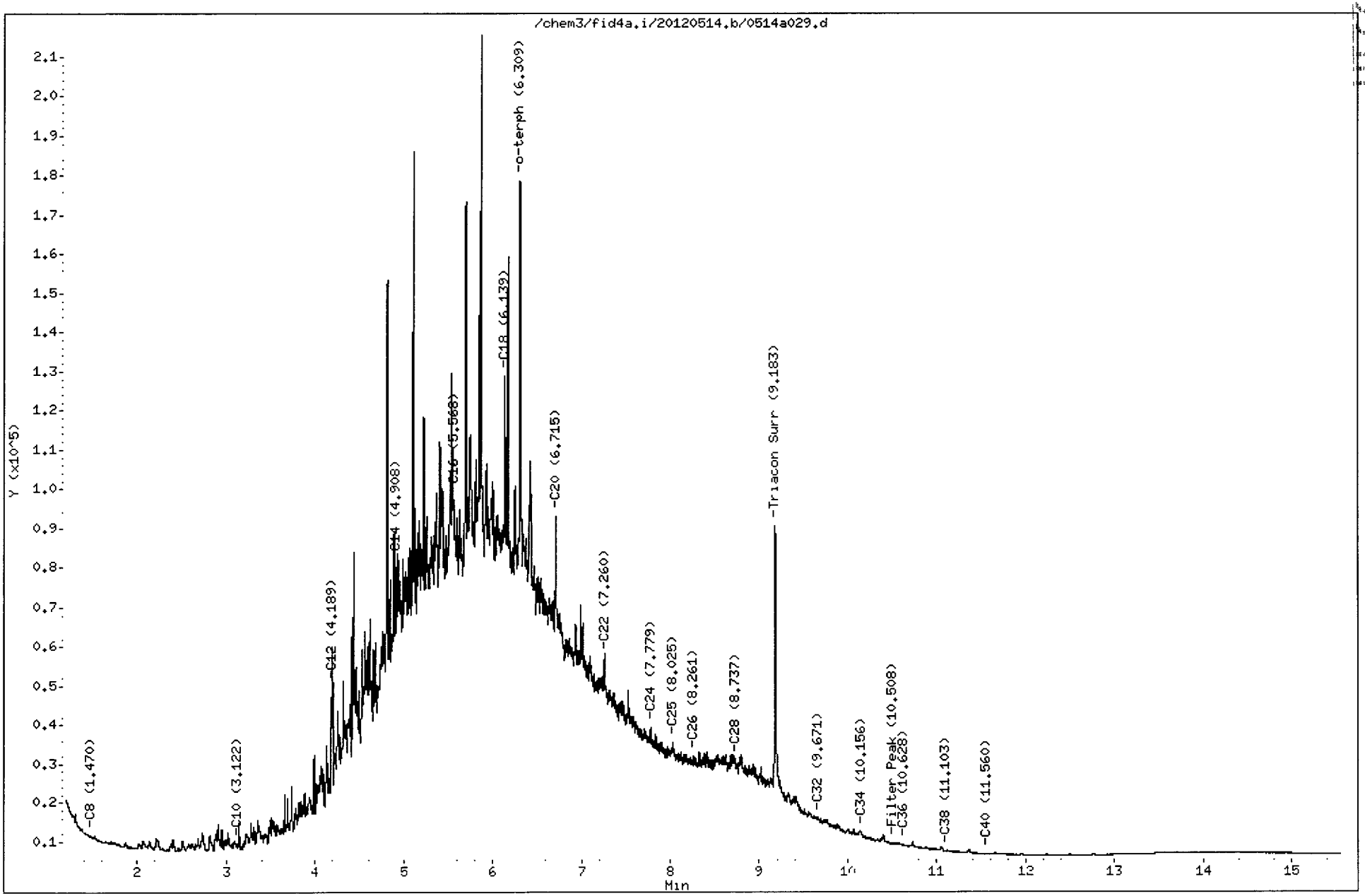
Sample Info: UT77EMSD,10

Column phase: RTX-1

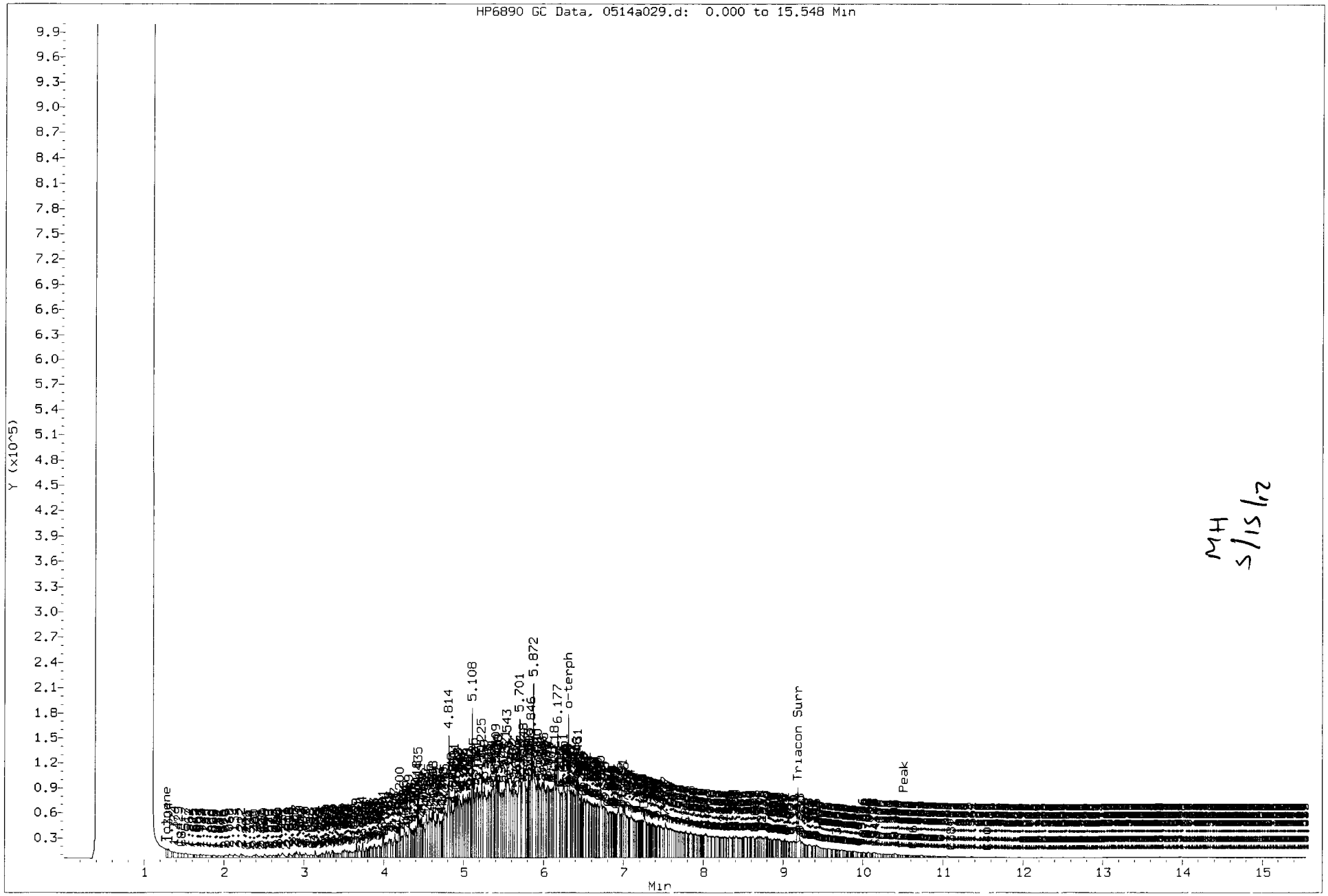
Instrument: fid4a.i

Operator: MH

Column diameter: 0.25

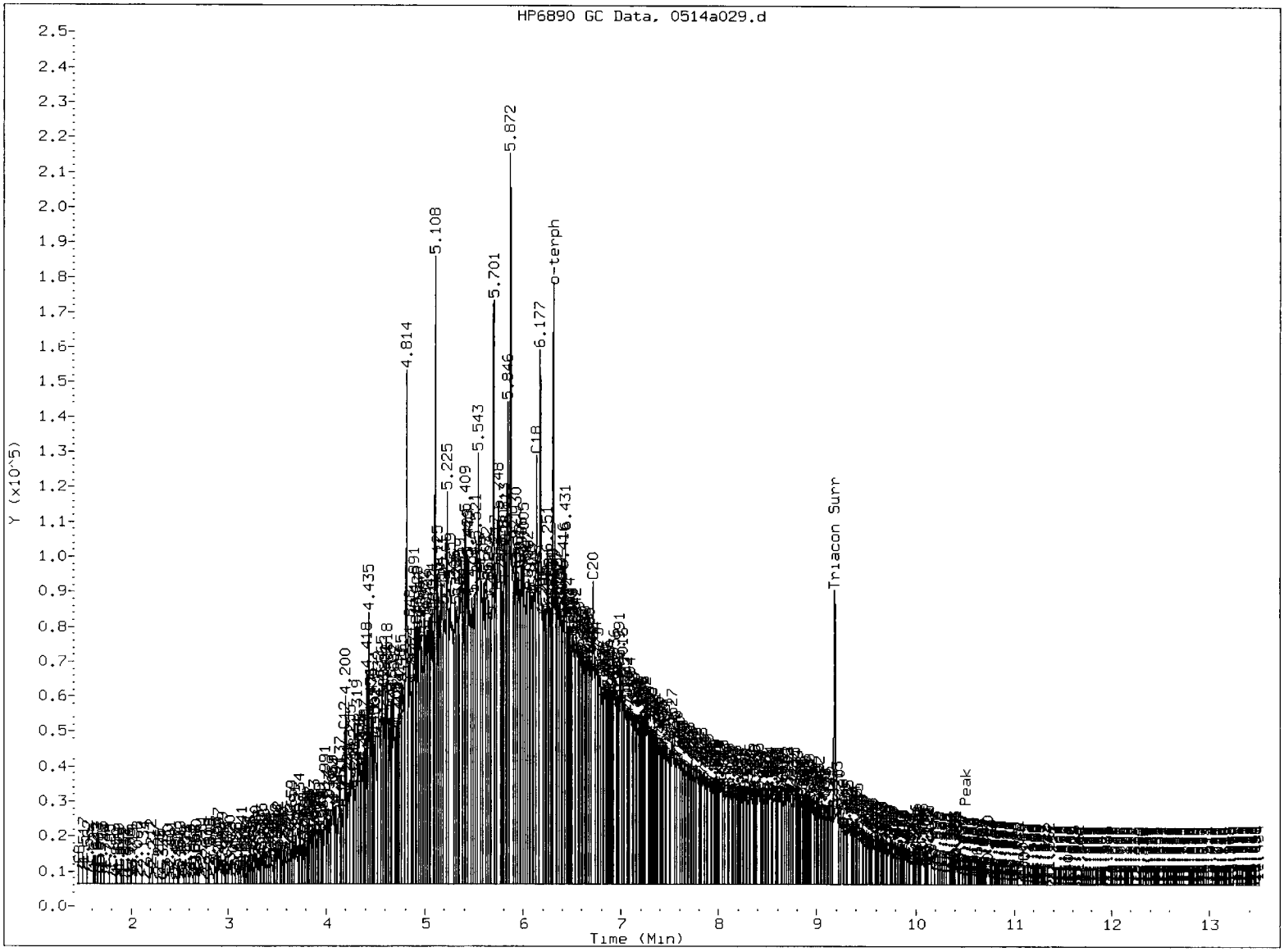


Data File: /chem3/fid4a.i/20120514.b/0514a029.d
Injection Date: 14-MAY-2012 17:28
Instrument: fid4a.i
Client Sample ID: CWSB-14-12-14-0 MSD



MH 5/15/12

FID:4A-2C/RTX-1 UT77EMSD FID:4A SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/15/12

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-13-14.0-14.5-0512
ARI ID: 12-8459 UT77A

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	82.30
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.500

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-14-12-14-0512
ARI ID: 12-8463 UT77E

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	81.90
Total Organic Carbon	05/15/12 051512#1	Plumb,1981	Percent	0.020	0.532

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-14-25-27-0512
ARI ID: 12-8464 UT77F

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	75.50
Total Organic Carbon	05/15/12 051512#1	Plumb,1981	Percent	0.020	0.489

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-14-29-30-0512
ARI ID: 12-8465 UT77G

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	78.10
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.383

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-15-18-20-0512
ARI ID: 12-8468 UT77J

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	78.60
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.801

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-16-8-10-0512
ARI ID: 12-8470 UT77L

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	87.00
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.794

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CWSB-16-13-15-0512
ARI ID: 12-8471 UT77M

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	74.70
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.405

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CWSB-17-6-8-0512
ARI ID: 12-8474 UT77P

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	86.80
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	3.49

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CWSB-17-23-25-0512
ARI ID: 12-8475 UT77Q

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	77.90
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.549

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CWSB-17-28-30-0512
ARI ID: 12-8476 UT77R

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	79.00
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.265

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CWSB-170-23-25-0512
ARI ID: 12-8477 UT77S

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	78.50
Total Organic Carbon	05/16/12 051612#1	Plumb,1981	Percent	0.020	0.393

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	05/09/12	Percent	< 0.01 U
Total Organic Carbon	05/15/12	Percent	< 0.020 U
	05/16/12		< 0.020 U

LAB CONTROL RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/Method	QC ID	Date	Units	LCS	Spike Added	Recovery
Total Organic Carbon	ICVL	05/15/12	Percent	0.098	0.100	98.0%
Plumb,1981	ICVL	05/16/12		0.099	0.100	99.0%

STANDARD REFERENCE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
Total Organic Carbon	05/15/12	Percent	2.63	2.99	88.0%
NIST 1941B	05/16/12		2.80	2.99	93.6%

REPLICATE RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: UT77A Client ID: CWSB-13-14.0-14.5-0512					
Total Solids	05/09/12	Percent	82.30	80.90 81.90	0.9%
Total Organic Carbon	05/16/12	Percent	0.500	0.468 0.423	8.3%

UT77:80155

MS/MSD RESULTS-CONVENTIONALS
UT77-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Analyte	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: UT77A Client ID: CWSB-13-14.0-14.5-0512						
Total Organic Carbon	05/16/12	Percent	0.500	1.32	0.745	110.0%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

22 May 2012

Jason Palmer
AECOM, Inc.
710 2nd Avenue
Suite 1000
Seattle, WA 98104

RE: Client Project: Central Waterfront
ARI Job No.: UT78

Dear Jason:

Please find enclosed the original chain of custody records and the final results for samples from the project referenced above. Analytical Resources, Inc accepted twenty soil samples on May 9, 20112. One sample was placed on hold as instructed. The remaining samples were analyzed for BETX, NWTPH-G, VPH, SVOAs, NWTPH-Dx, EPH and TOC as requested.

The percent recoveries for the surrogate, bromobenzene, were high following the initial NWTPH-G analyses of samples CBA-SB-1-1.5-2.5-0512, CBA-SB-2-0.5-2.5-0512 and CBA-SB-20-0.5-2.5-0512. This was due to co-elution with an interference. Sample CBA-SB-1-1.5-2.5-0512 was diluted and re-analyzed. The percent recoveries for all surrogates were within established QC limits for the dilution. The results for both analyses have been submitted for this sample.

Several samples were re-analyzed for NWTPH-G due to suspected carryover from previous samples. The results for the re-analyses only have been submitted.

The method blank was re-analyzed for VPH due to suspected carryover from a previous sample. The results for the re-analysis only have been submitted.

The remaining analyses proceeded without incident of note.

A copy of these reports and all raw data will be kept on file at ARI. Should you have any questions regarding these results, please feel free to call me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Mark D. Harris
Project Manager
206/695-6210
<markh@arilabs.com>

Enclosures
cc: file UT78
MDH/mdh

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: UT78	Turn-around Requested: Standard TAT	Page: 3 of 4	
ARI Client Company: AECOM	Phone: 206 624 9349	Date: 5/8/12	Ice Present? Y
Client Contact: Jason Palmer		No. of Coolers: 4	Cooler Temps: 3.6, 0.9, 1.6, 1.2
Client Project Name: Central Waterfront			
Client Project #:	Samplers:		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: NWTPH-Dx	NWTPH-G	TOC						Notes/Comments
CBA-SB-1-1.5-2.5-0512	5/8/12	1115	SO	5	X	X	X						
CBA-SB1-3-5-0512		1130	SO	5	X	X	X						
CBA-SB-2-0.5-2.5		1145	SO	5	X	X	X						Archive TOC
CBA-SB-3-~~13~~-0512		1200	SO	5	X	X	X						
CBA-SB-4-0.5-2.5-0512		1340	SO	5	X	X	X						
CBA-SB-4-3-5-0512		1348	SO	5	X	X	X						
CBA-SB-5-3-5-0512		1415	SO	5	X	X	X						Archive TOC
CBA-SB-5-0-2-0512		1425	SO	5	X	X	X						Archive TOC
CBA-SB-20-0.5-2.5-0512		1045	SO	5	X	X	X						Archive TOC
CBA-SB-50-3-5-0512		1315	SO	5	X	X	X						Archive TOC

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Renee Knecht	Printed Name: Jennifer Milsap	Printed Name:	Printed Name:
	Company: AECOM	Company: ARI	Company:	Company:
	Date & Time: 5/9/12 1015	Date & Time: 5/9/12 1015	Date & Time:	Date & Time:

UT78 : 5552

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: UT78	Turn-around Requested: Standard	Page: 4 of 4	
ARI Client Company: AECOM	Phone: 206.624.9349	Date: 5/8/12	Ice Present? Y
Client Contact: Jason Palmer		No. of Coolers: 4	Cooler Temps: 3.8, 0.9, 1.4, 1.2
Client Project Name: Central Waterfront			
Client Project #:	Samplers:		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: NWTPH-Dx	NWTPH-G	TOC	8270 PAH	VPH	Sim BTEX	SVOCs		Notes/Comments
CBA-SB-6-3-5-0512	5/8/12	1455	SO	5	X	X	X						
CBA-SB-7-3-5-0512		1515	SO	2		X							DO NOT analyse
CBA-SB-7-1-3-0512		1525	SO	5	X	X	X						
CBA-SB-8-3-5-0512		1600	SO	5	X	X	X						
CBA-SB-8-1-3-0512		1615	SO	12	X	X	X	X	X	X	X		
CWMW-18-7-9-0512		1700	SO	5	X	X	X						Bottles labeled (7-8) Changed to (7-9)
CWMW-18-13-15-0512		1730	SO	5	X	X	X						
CBA-SB-80-3-5-0512		1500	SO	5	X	X	X						

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Renee Knecht	Printed Name: Jennifer Millsap	Printed Name:	Printed Name:
	Company: AECOM	Company: ARI	Company:	Company:
	Date & Time: 5/4/12 1015	Date & Time: 5/9/12 1015	Date & Time:	Date & Time:

UT78:00003

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: AECOM

Project Name: Central Waterfront

COC No(s): _____ (NA)

Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: _____

Assigned ARI Job No: UT78

Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc.)	(YES)	NO
Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)	3.8 0.9 1.0 1.2	

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 90877952

Cooler Accepted by: JM Date: 5/9/12 Time: 1015

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?	YES	(NO)
What kind of packing material was used? (Bubble Wrap) (Wet Ice) Gel Packs (Baggies) Foam Block Paper Other:		
Was sufficient ice used (if appropriate)?	NA	(YES) NO
Were all bottles sealed in individual plastic bags?	YES	(NO)
Did all bottles arrive in good condition (unbroken)?	(YES)	NO
Were all bottle labels complete and legible?	(YES)	NO
Did the number of containers listed on COC match with the number of containers received?	(YES)	NO
Did all bottle labels and tags agree with custody papers?	(YES) JM	NO
Were all bottles used correct for the requested analyses?	(YES)	(NO)
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	(YES)	NO
Were all VOC vials free of air bubbles?	(NA) YES	NO
Was sufficient amount of sample sent in each bottle?	(NA) YES	NO
Date VOC Trip Blank was made at ARI	(YES)	NO
Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____	(NA)	Split by: _____

Samples Logged by: JM Date: 5/9/12 Time: 1330

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC
CBA-SB-2-0.5-2.5 0512	CBA-SB-2-0.5-2.5		

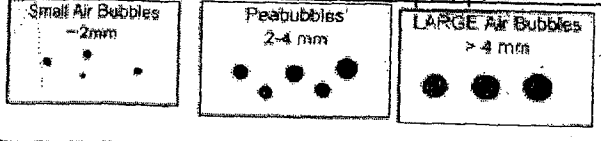
Additional Notes, Discrepancies, & Resolutions:

2 samples were received that were not on COC - CBASB-23-5-0512 5/8/12 @1200.

Trip Blanks logged with UT77

CBA-TP-7-0-1-0512 5/8/12 @ 1505

By: JM Date: 5/9/12



Small → "sm"

Peabubbles → "pb"

Large → "lg"

Headspace → "hs"

On all samples ~~No~~ there was no dash between CBASB like on the COC, logged IDs from ~~bottle~~ COC.

Sample Containers for CBA-SB-3-1-3-0512 have a collection time of 1230, COC say 1200.

Subject: RE: Central Waterfront
From: "Knecht, Renee" <Renee.Knecht@aecom.com>
Date: 5/9/2012 1:57 PM
To: Mark Harris <markh@arilabs.com>, "Palmer, Jason" <Jason.Palmer@aecom.com>

Apologies Mark-

CBA-SB-2-3-5-0512 - analyze for NWTPH-Dx, NWTPH-G and archive TOC
CBA-TP-7-0-1-0512 - date 5/7/12 - at 1505 - analyze for NWTPH-Dx, NW-TPH-G and TOC
CBA-SB-3-1-3-0512 use the time on the bottles.

Please let me know if you have any other questions or concerns.

-----Original Message-----
From: Mark Harris [mailto:markh@arilabs.com]
Sent: Wednesday, May 09, 2012 1:39 PM
To: Palmer, Jason; Knecht, Renee
Subject: Central Waterfront

Jason/Renee:

Just a couple of inconsistencies to clear up:

1) Pleas read the Cooler Receipt. Sets of jars were received for two samples not listed on any COC. Should they be logged or archived? If logged, for what tests?

2) For the fourth sample on page 3 of 4, there is a discrepancy in the time of collection. See the note on the bottom of the page.

Mark H.

--

Mark Harris
Project Manager
Analytical Resources, Inc.
206/695-6210
markh@arilabs.com

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UT78
Client: AECOM
Project Event: N/A
Project Name: Central Waterfront

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	CBA-SB-1-1.5-2.5-0512	UT78A	12-8487	Soil	05/08/12 11:15	05/09/12 10:15
2.	CBA-SB-1-3-5-0512	UT78B	12-8488	Soil	05/08/12 11:30	05/09/12 10:15
3.	CBA-SB-2-0.5-2.5-0512	UT78C	12-8489	Soil	05/08/12 11:45	05/09/12 10:15
4.	CBA-SB-3-1-3-0512	UT78D	12-8490	Soil	05/08/12 12:30	05/09/12 10:15
5.	CBA-SB-4-0.5-2.5-0512	UT78E	12-8491	Soil	05/08/12 13:40	05/09/12 10:15
6.	CBA-SB-4-3-5-0512	UT78F	12-8492	Soil	05/08/12 13:48	05/09/12 10:15
7.	CBA-SB-5-3.5-0512	UT78G	12-8493	Soil	05/08/12 14:15	05/09/12 10:15
8.	CBA-SB-5-0-2-0512	UT78H	12-8494	Soil	05/08/12 14:25	05/09/12 10:15
9.	CBA-SB-20-0.5-2.5-0512	UT78I	12-8495	Soil	05/08/12 10:45	05/09/12 10:15
10.	CBA-SB-50-3-5-0512	UT78J	12-8496	Soil	05/08/12 13:15	05/09/12 10:15
11.	CBA-SB-6-3-5-0512	UT78K	12-8501	Soil	05/08/12 14:55	05/09/12 10:15
12.	CBA-SB-7-1-3-0512	UT78L	12-8502	Soil	05/08/12 15:25	05/09/12 10:15
13.	CBA-SB-8-3-5-0512	UT78M	12-8503	Soil	05/08/12 16:00	05/09/12 10:15
14.	CBA-SB-8-1-3-0512	UT78N	12-8504	Soil	05/08/12 16:00	05/09/12 10:15
15.	CWMW-18-7-9-0512	UT78O	12-8505	Soil	05/08/12 17:00	05/09/12 10:15
16.	CWMW-18-13-15-0512	UT78P	12-8506	Soil	05/08/12 17:30	05/09/12 10:15
17.	CBA-SB-80-3-5-0512	UT78Q	12-8507	Soil	05/08/12 15:00	05/09/12 10:15
18.	CBA-TP-7-0-1-0512	UT78R	12-8508	Soil	05/07/12 15:05	05/09/12 10:15
19.	CBA-SB-2-3-5-0512	UT78S	12-8509	Soil	05/08/12 12:00	05/09/12 10:15
20.	CBA-SB-7-3-5-0512	UT78T	12-8510	Soil	05/08/12 15:15	05/09/12 10:15
21.	CBA-SB-8-1-3-0512	UT78U	12-8511	Soil	05/08/12 16:15	05/09/12 10:15

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: CBA-SB-8-1-3-0512**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UT78N
LIMS ID: 12-8504
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: 05/08/12
Date Received: 05/09/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 05/21/12 14:26

Sample Amount: 114 mg-dry-wt
Purge Volume: 10.0 mL
Moisture: 20.5%

CAS Number	Analyte	RL	Result	Q
71-43-2	**Benzene**	**1.8**	**22**	
108-88-3	**Toluene**	**1.8**	**68**	
100-41-4	**Ethylbenzene**	**1.8**	**21**	
179601-23-1	**m,p-Xylene**	**3.5**	**60**	
95-47-6	**o-Xylene**	**1.8**	**25**	

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	97.7%
d8-Toluene	103%
Bromofluorobenzene	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM Sample ID: MB-052112
 METHOD BLANK

Lab Sample ID: MB-052112
LIMS ID: 12-8504
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Date Sampled: NA
Date Received: NA

Instrument/Analyst: NT7/PKC
Date Analyzed: 05/21/12 13:50

Sample Amount: 200 mg-dry-wt
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
71-43-2	Benzene	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
179601-23-1	m,p-Xylene	2.0	< 2.0	U
95-47-6	o-Xylene	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	105%
d8-Toluene	99.6%
Bromofluorobenzene	92.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM Sample ID: LCS-052112
Page 1 of 1 **LAB CONTROL SAMPLE**

Lab Sample ID: LCS-052112 QC Report No: UT78-AECOM
LIMS ID: 12-8504 Project: Central Waterfront
Matrix: Soil
Data Release Authorized: Date Sampled: NA
Reported: 05/21/12 Date Received: NA

Instrument/Analyst LCS: NT7/PKC Sample Amount LCS: 200 mg-dry-wt
LCSD: NT7/PKC LCSD: 200 mg-dry-wt
Date Analyzed LCS: 05/21/12 12:57 Purge Volume LCS: 10.0 mL
LCSD: 05/21/12 13:23 LCSD: 10.0 mL

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	48.4	50.0	96.8%	48.6	50.0	97.2%	0.4%
Toluene	48.9	50.0	97.8%	49.3	50.0	98.6%	0.8%
Ethylbenzene	54.4	50.0	109%	54.3	50.0	109%	0.2%
m,p-Xylene	107	100	107%	108	100	108%	0.9%
o-Xylene	53.6	50.0	107%	53.8	50.0	108%	0.4%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

SW8260-SIM SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Client ID	DCE	TOL	BFB	TOT OUT
MB-052112	105%	99.6%	92.0%	0
LCS-052112	99.4%	104%	108%	0
LCSD-052112	101%	104%	106%	0
CBA-SB-8-1-3-0512	97.7%	103%	102%	0

	LCS/MB LIMITS	QC LIMITS
(DCE) = d4-1,2-Dichloroethane	(75-125)	(75-125)
(TOL) = d8-Toluene	(75-125)	(75-125)
(BFB) = Bromofluorobenzene	(30-160)	(30-160)

Prep Method: SW5030
Log Number Range: 12-8504 to 12-8504

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized: MW
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	Basis	Range	Result
MB-051512	Method Blank	05/15/12	Dry	Gasoline	< 5.0 U
12-8487		PID2		HC ID	---
				Trifluorotoluene	95.7%
				Bromobenzene	91.4%
UT78A	CBA-SB-1-1.5-2.5-0512	05/15/12	Dry	**Gasoline**	**630 E**
12-8487		PID2		HC ID	GRO
				Trifluorotoluene	94.8%
				Bromobenzene	163%
UT78A DL	CBA-SB-1-1.5-2.5-0512	05/16/12	Dry	**Gasoline**	**1200**
12-8487		PID2		HC ID	GRO
				Trifluorotoluene	102%
				Bromobenzene	114%
MB-051612	Method Blank	05/16/12	Dry	Gasoline	< 5.0 U
12-8488		PID2		HC ID	---
				Trifluorotoluene	88.7%
				Bromobenzene	97.4%
UT78B	CBA-SB-1-3-5-0512	05/16/12	Dry	Gasoline	< 7.4 U
12-8488		PID2		HC ID	---
				Trifluorotoluene	101%
				Bromobenzene	95.9%
UT78C	CBA-SB-2-0.5-2.5-0512	05/15/12	Dry	**Gasoline**	**670**
12-8489		PID2		HC ID	GRO
				Trifluorotoluene	95.2%
				Bromobenzene	141%
UT78D	CBA-SB-3-1-3-0512	05/16/12	Dry	**Gasoline**	**18**
12-8490		PID2		HC ID	GRO
				Trifluorotoluene	103%
				Bromobenzene	99.9%
UT78E	CBA-SB-4-0.5-2.5-0512	05/16/12	Dry	**Gasoline**	**22**
12-8491		PID2		HC ID	GRO
				Trifluorotoluene	105%
				Bromobenzene	103%
UT78F	CBA-SB-4-3-5-0512	05/15/12	Dry	Gasoline	< 6.9 U
12-8492		PID2		HC ID	---
				Trifluorotoluene	99.0%
				Bromobenzene	94.5%
UT78G	CBA-SB-5-3.5-0512	05/15/12	Dry	**Gasoline**	**12**
12-8493		PID2		HC ID	GRO
				Trifluorotoluene	93.0%
				Bromobenzene	96.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	Basis	Range	Result
UT78H 12-8494	CBA-SB-5-0-2-0512	05/15/12 PID2	Dry	Gasoline HC ID Trifluorotoluene Bromobenzene	< 6.4 U --- 89.7% 92.1%
UT78I 12-8495	CBA-SB-20-0.5-2.5-0512	05/15/12 PID2	Dry	**Gasoline** HC ID Trifluorotoluene Bromobenzene	**540** GRO 95.1% 134%
UT78J 12-8496	CBA-SB-50-3-5-0512	05/16/12 PID2	Dry	Gasoline HC ID Trifluorotoluene Bromobenzene	< 6.2 U --- 104% 103%
UT78K 12-8501	CBA-SB-6-3-5-0512	05/15/12 PID2	Dry	Gasoline HC ID Trifluorotoluene Bromobenzene	< 6.8 U --- 88.5% 91.2%
UT78L 12-8502	CBA-SB-7-1-3-0512	05/15/12 PID2	Dry	**Gasoline** HC ID Trifluorotoluene Bromobenzene	**11** GRO 92.1% 94.2%
UT78M 12-8503	CBA-SB-8-3-5-0512	05/15/12 PID2	Dry	**Gasoline** HC ID Trifluorotoluene Bromobenzene	**63** GRO 88.1% 92.6%
UT78N 12-8504	CBA-SB-8-1-3-0512	05/16/12 PID2	Dry	**Gasoline** HC ID Trifluorotoluene Bromobenzene	**28** GRO 89.6% 94.4%
UT78O 12-8505	CWMW-18-7-9-0512	05/16/12 PID2	Dry	**Gasoline** HC ID Trifluorotoluene Bromobenzene	**630** GRO 92.1% 109%
UT78P 12-8506	CWMW-18-13-15-0512	05/16/12 PID2	Dry	Gasoline HC ID Trifluorotoluene Bromobenzene	< 7.1 U --- 103% 102%
UT78Q 12-8507	CBA-SB-80-3-5-0512	05/16/12 PID2	Dry	**Gasoline** HC ID Trifluorotoluene Bromobenzene	**43** GRO 92.7% 99.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

ARI ID	Client ID	Analysis Date	Basis	Range	Result
UT78R 12-8508	CBA-TP-7-0-1-0512	05/16/12 PID2	Dry	Gasoline	< 6.3 U
				HC ID	---
				Trifluorotoluene	89.6%
				Bromobenzene	95.9%
UT78S 12-8509	CBA-SB-2-3-5-0512	05/16/12 PID2	Dry	**Gasoline**	**19**
				HC ID	GRO
				Trifluorotoluene	89.5%
				Bromobenzene	98.0%

Gasoline values reported in mg/kg (ppm)

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-051512
LAB CONTROL SAMPLE

Lab Sample ID: LCS-051512
LIMS ID: 12-8487
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/15/12 16:10
LCSD: 05/15/12 16:38
Instrument/Analyst LCS: PID2/JLW
LCSD: PID2/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	49.8	50.0	99.6%	56.7	50.0	113%	13.0%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	83.0%	87.8%
Bromobenzene	81.3%	88.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-051612
LAB CONTROL SAMPLE

Lab Sample ID: LCS-051612
LIMS ID: 12-8488
Matrix: Soil
Data Release Authorized: hmw
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/16/12 11:17
LCSD: 05/16/12 11:45
Instrument/Analyst LCS: PID2/JLW
LCSD: PID2/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	49.1	50.0	98.2%	54.7	50.0	109%	10.8%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	87.2%	90.5%
Bromobenzene	89.4%	94.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: CBA-SB-2-3-5-0512
MATRIX SPIKE

Lab Sample ID: UT78S
LIMS ID: 12-8509
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Date Analyzed MS: 05/16/12 03:26
MSD: 05/16/12 03:55
Instrument/Analyst MS: PID2/JLW
MSD: PID2/JLW

Purge Volume: 5.0 mL

Sample Amount MS: 78.8 mg-dry-wt
MSD: 78.8 mg-dry-wt

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Gasoline Range Hydrocarbons	19.3	88.8	54.6	127%	87.6	54.6	125%	1.4%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	MS	MSD
Trifluorotoluene	88.3%	94.8%
Bromobenzene	93.6%	93.6%

ANALYTICAL RESOURCES INCORPORATED

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: UT78
Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-051512	NA	95.7%	91.4%	0
LCS-051512	NA	83.0%	81.3%	0
LCSD-051512	NA	87.8%	88.3%	0
CBA-SB-1-1.5-2.5-0512	NA	94.8%	163%*	1
CBA-SB-1-1.5-2.5-0512 DL	NA	102%	114%	0
MB-051612	NA	88.7%	97.4%	0
LCS-051612	NA	87.2%	89.4%	0
LCSD-051612	NA	90.5%	94.9%	0
CBA-SB-1-3-5-0512	NA	101%	95.9%	0
CBA-SB-2-0.5-2.5-0512	NA	95.2%	141%*	1
CBA-SB-3-1-3-0512	NA	103%	99.9%	0
CBA-SB-4-0.5-2.5-0512	NA	105%	103%	0
CBA-SB-4-3-5-0512	NA	99.0%	94.5%	0
CBA-SB-5-3.5-0512	NA	93.0%	96.5%	0
CBA-SB-5-0-2-0512	NA	89.7%	92.1%	0
CBA-SB-20-0.5-2.5-0512	NA	95.1%	134%*	1
CBA-SB-50-3-5-0512	NA	104%	103%	0
CBA-SB-6-3-5-0512	NA	88.5%	91.2%	0
CBA-SB-7-1-3-0512	NA	92.1%	94.2%	0
CBA-SB-8-3-5-0512	NA	88.1%	92.6%	0
CBA-SB-8-1-3-0512	NA	89.6%	94.4%	0
CWMW-18-7-9-0512	NA	92.1%	109%	0
CWMW-18-13-15-0512	NA	103%	102%	0
CBA-SB-80-3-5-0512	NA	92.7%	99.3%	0
CBA-TP-7-0-1-0512	NA	89.6%	95.9%	0
CBA-SB-2-3-5-0512	NA	89.5%	98.0%	0
CBA-SB-2-3-5-0512 MS	NA	88.3%	93.6%	0
CBA-SB-2-3-5-0512 MSD	NA	94.8%	93.6%	0

	LCS/MB LIMITS	QC LIMITS
(BFB) = Bromofluorobenzene	(70-130)	(70-130)
(TFT) = Trifluorotoluene	(80-120)	(66-123)
(BBZ) = Bromobenzene	(80-120)	(62-130)

Log Number Range: 12-8487 to 12-8509

FORM II TPHG

Data File: /chem3/pid2.i/051512a-1.b/0515a012.d

Date : 15-MAY-2012 17:06

Client ID:

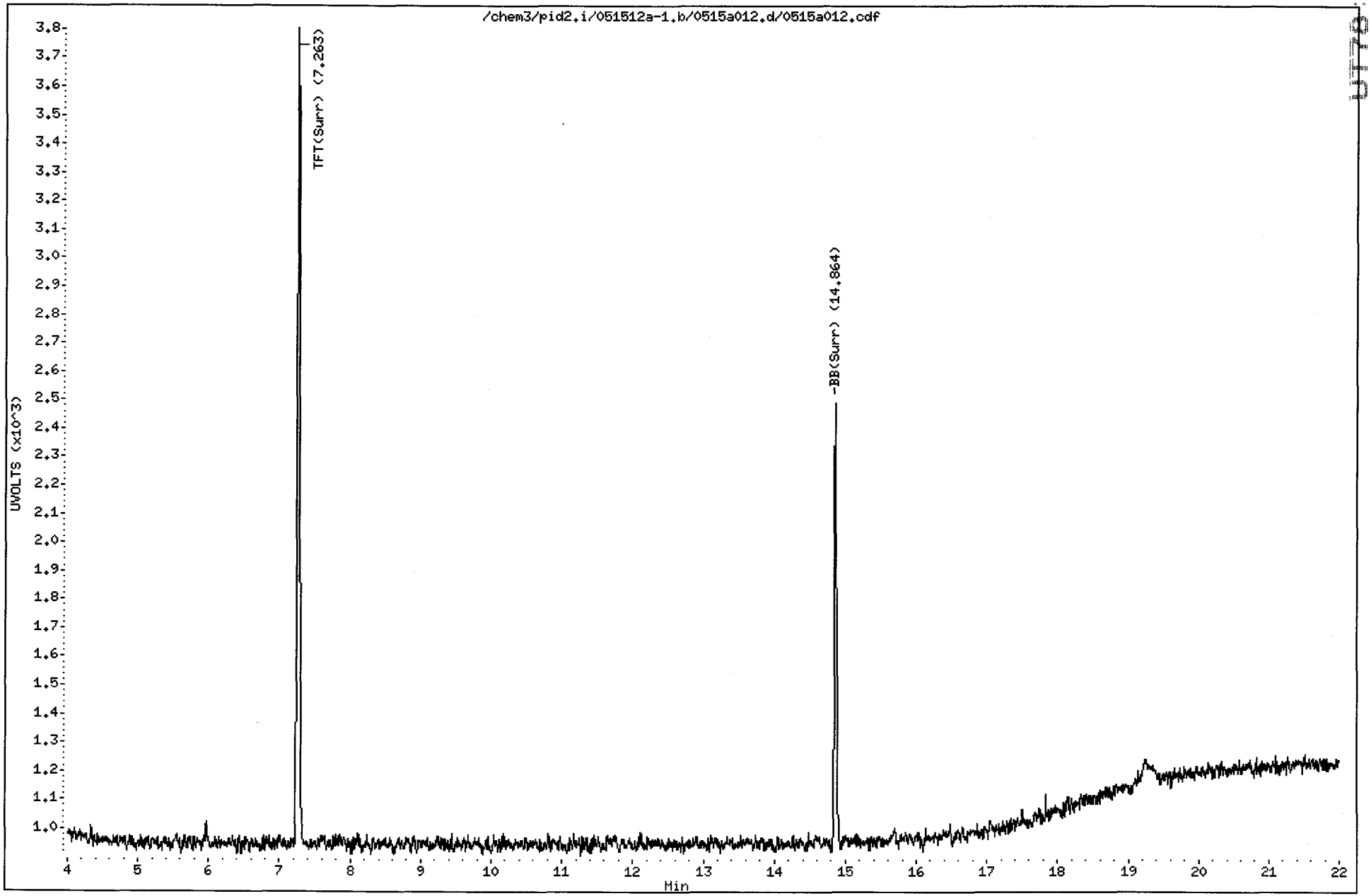
Sample Info: MB0515

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



Data File: /chem3/pid2.i/051512a-1.b/0515a010.d

Page 1

Date : 15-MAY-2012 16:10

Client ID:

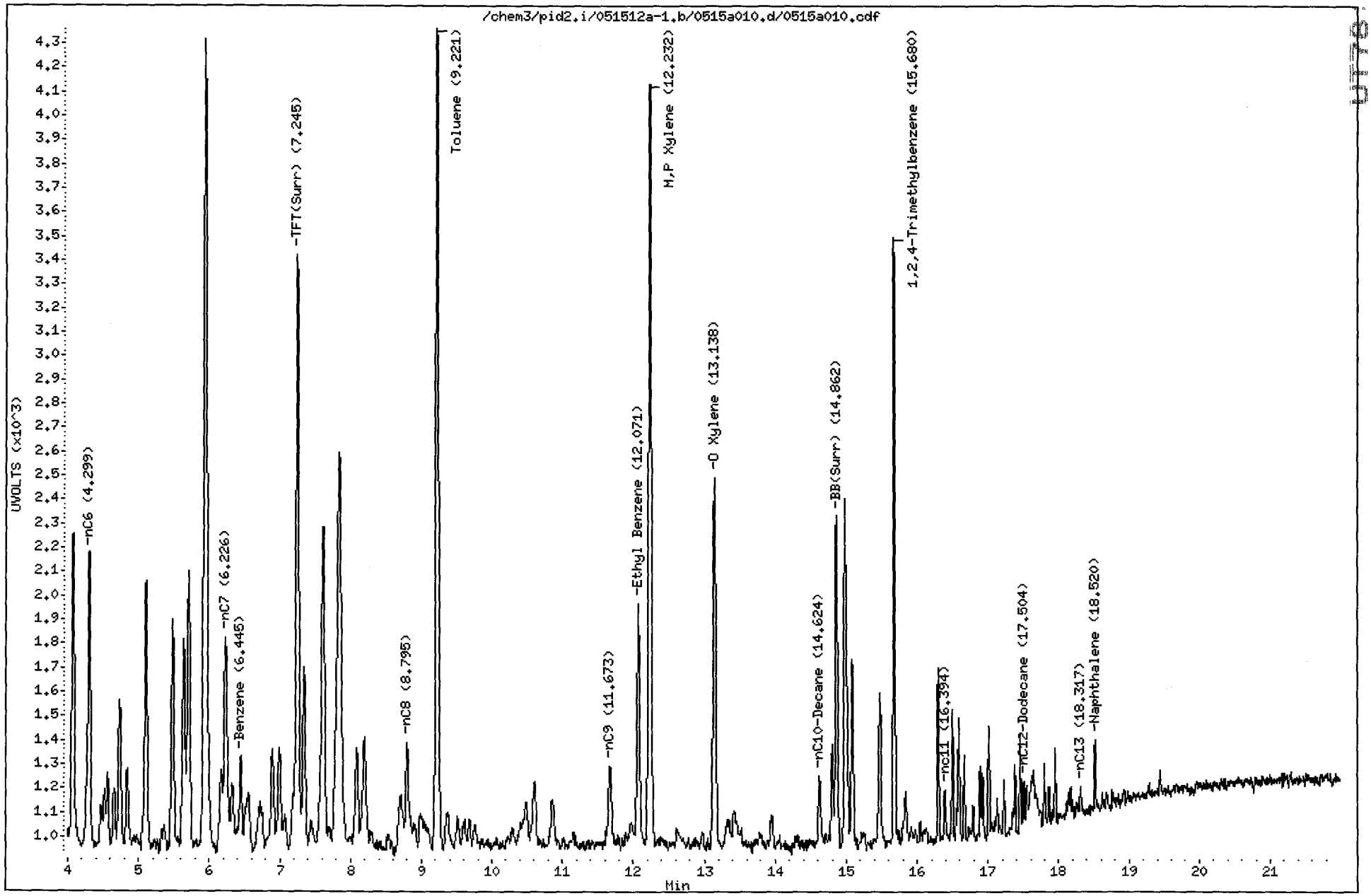
Instrument: pid2.i

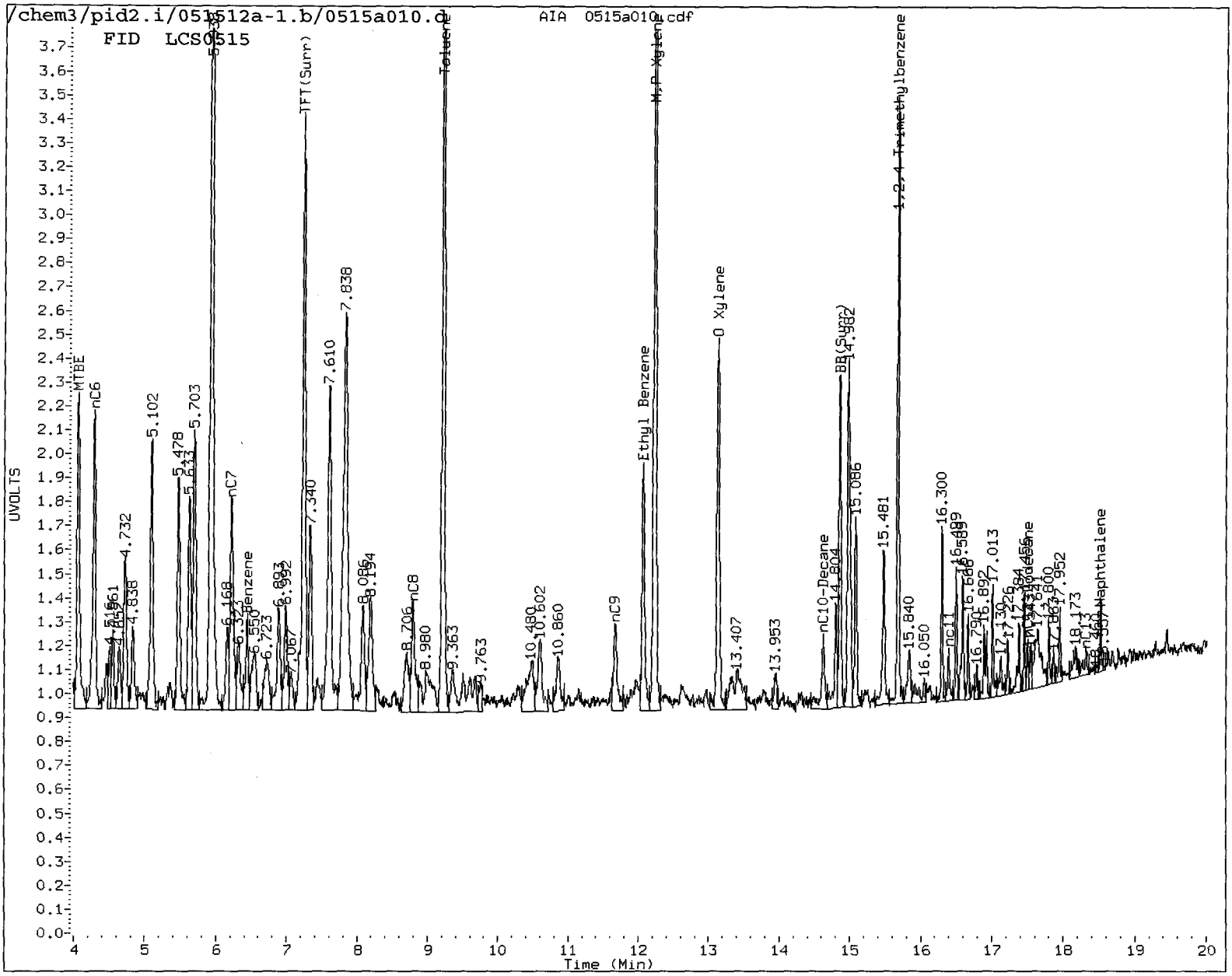
Sample Info: LCS0515

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18



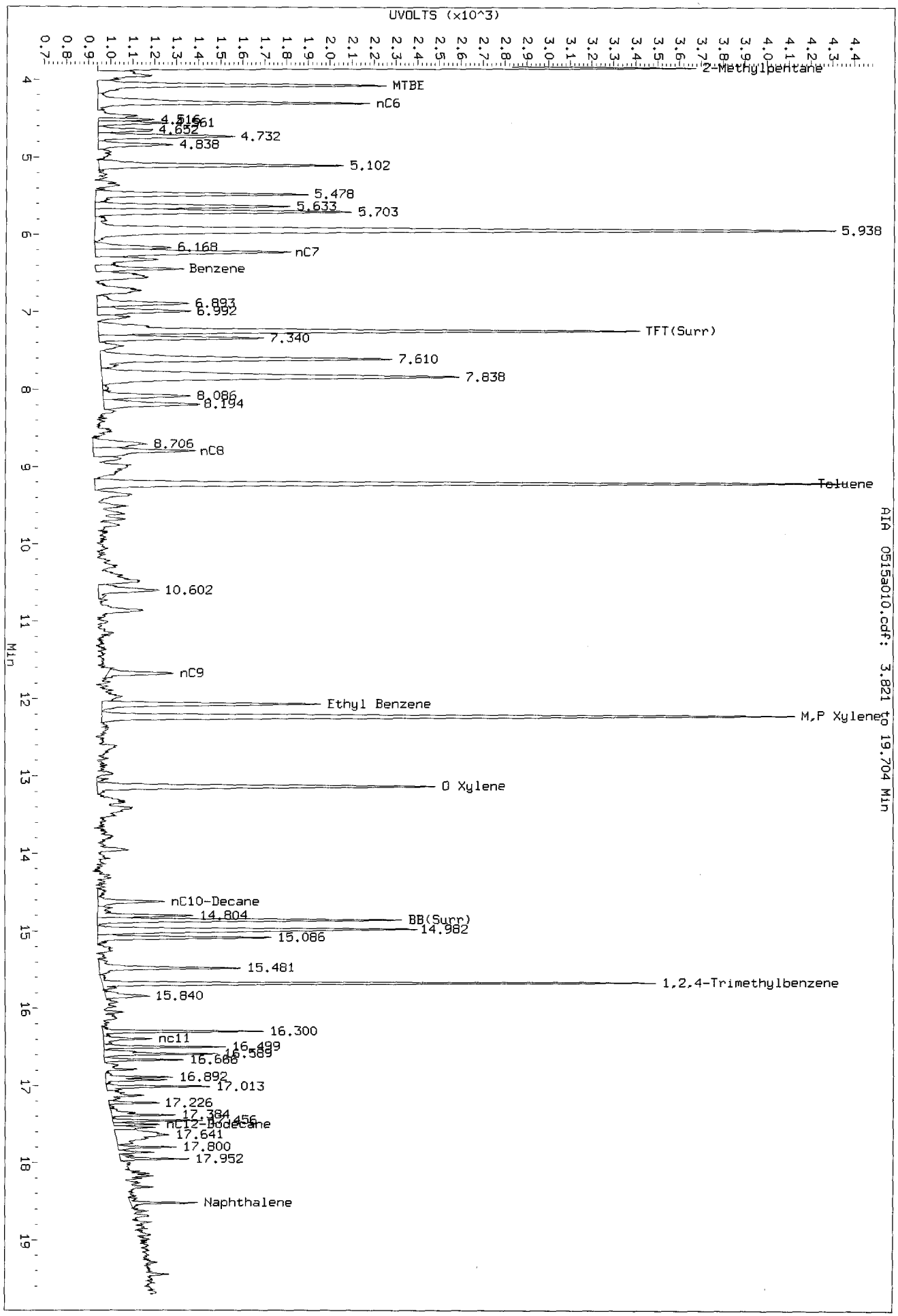


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/17



Data file: /chem3/pid2.i/051512a-1.b/0515a010.d/0515a010.cdf
Injection Date: 15-MAY-2012 16:10
Instrument: pid2.i
Client Sample ID:

AIA 0515a010.cdf: 3.821 to 19.704 Min

Before TB Stdn

Data File: /chem3/pid2.i/051512a-1.b/0515a011.d

Date : 15-MAY-2012 16:38

Client ID:

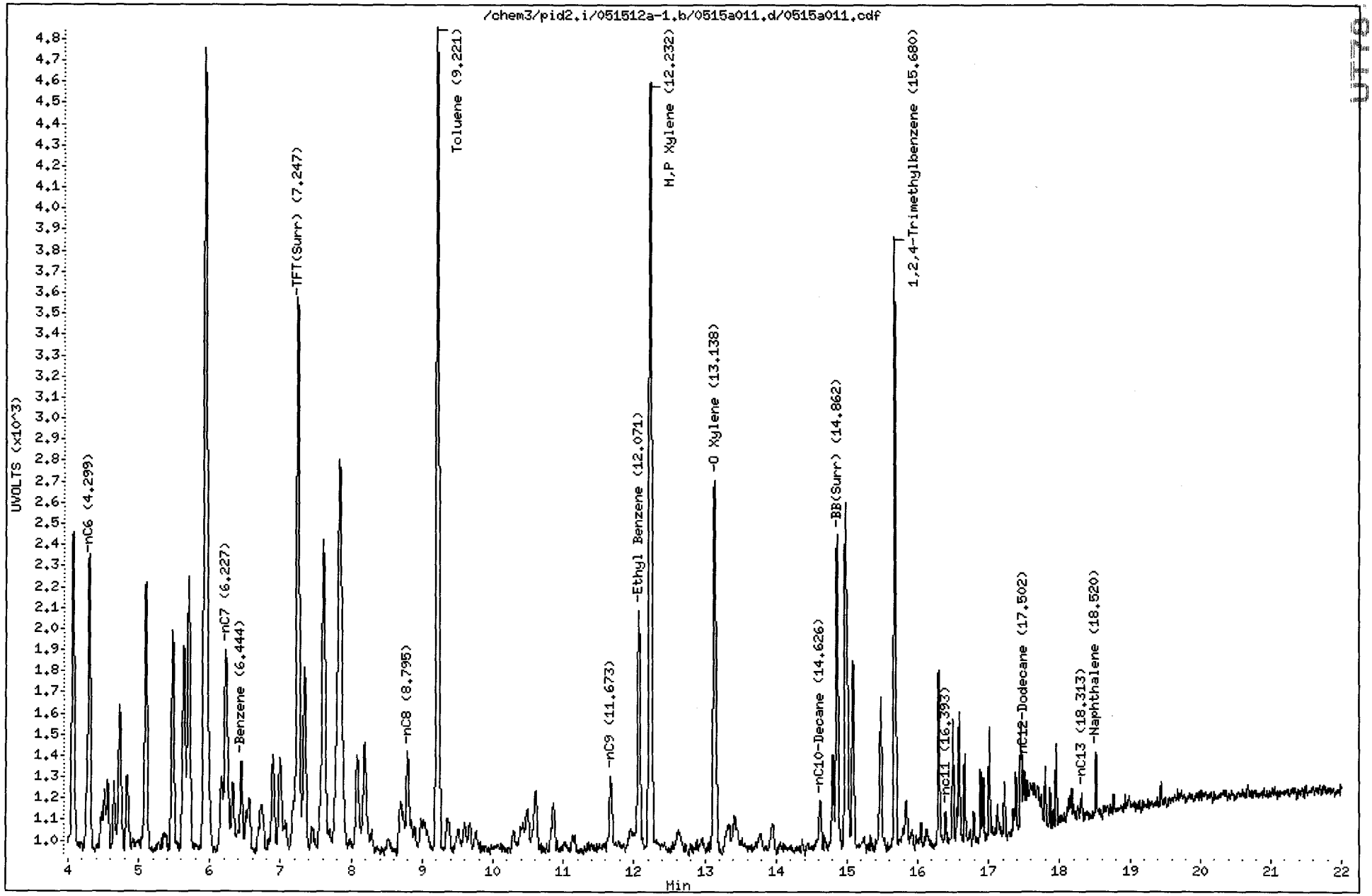
Sample Info: LCSD0515

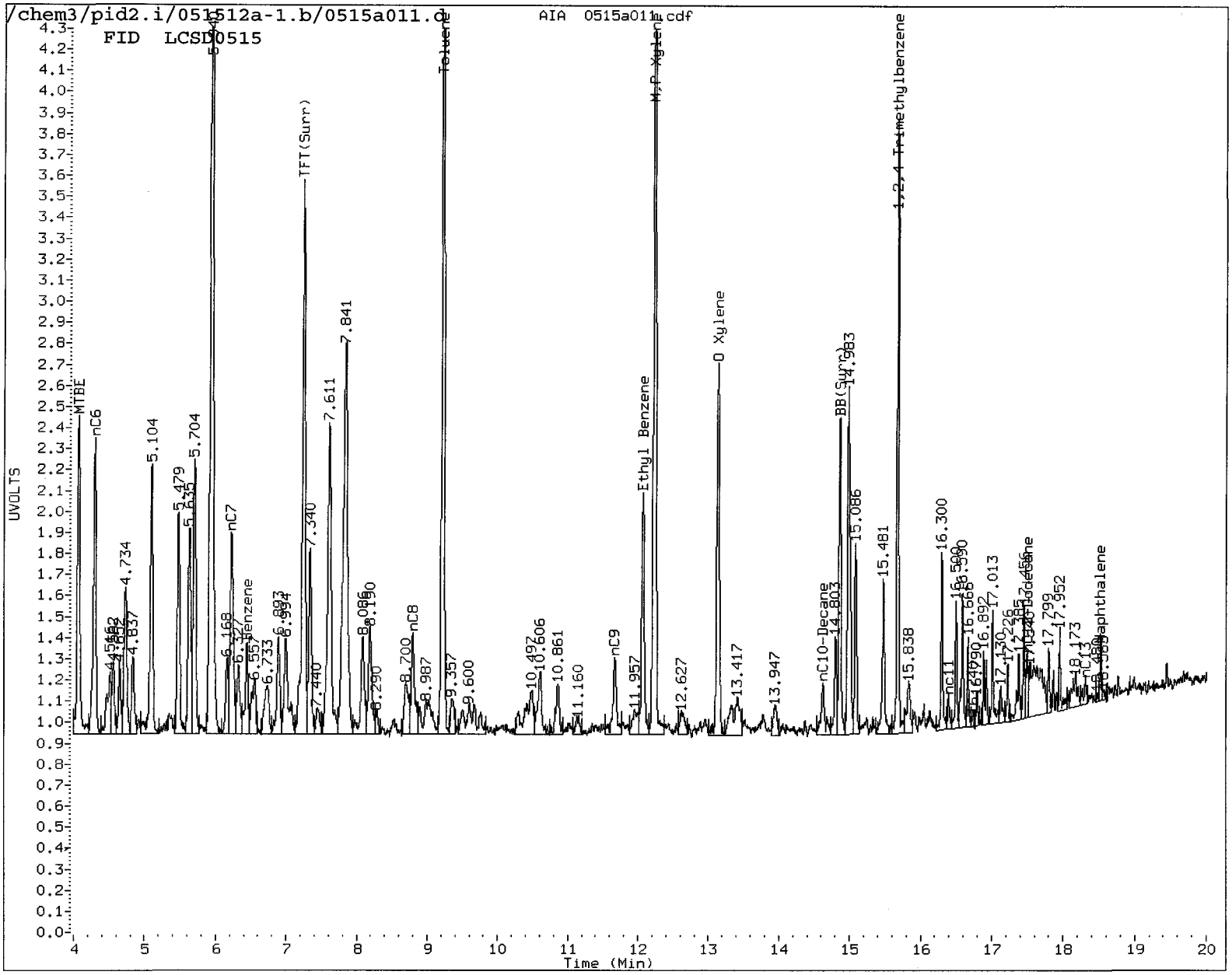
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



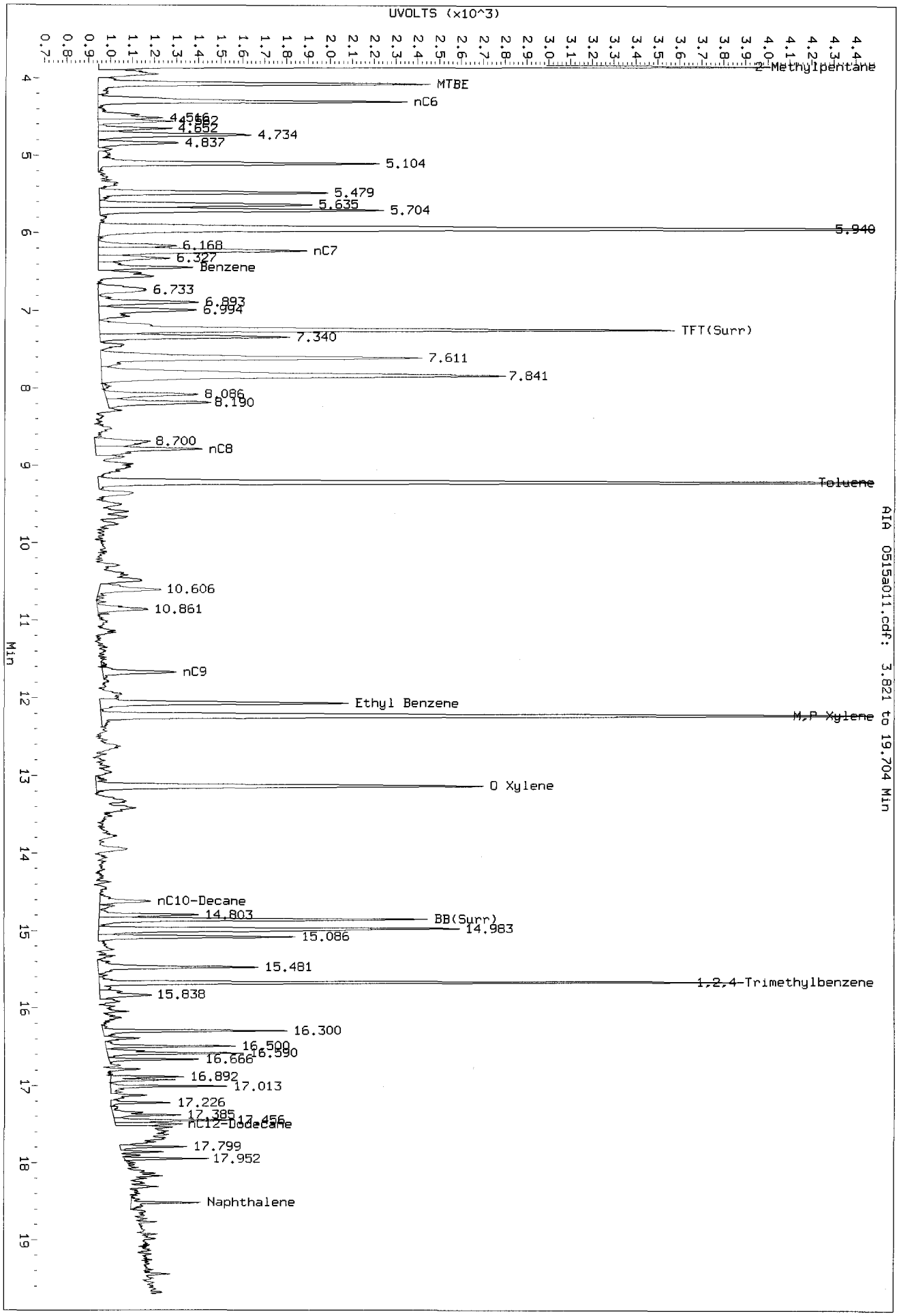


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/16/12



Before RW 5/16/12

Data File: /chem3/pid2.i/051512a-1.b/0515a013.d

Date : 15-MAY-2012 17:35

Client ID: CBA-SB-1-1.5-2.5-05

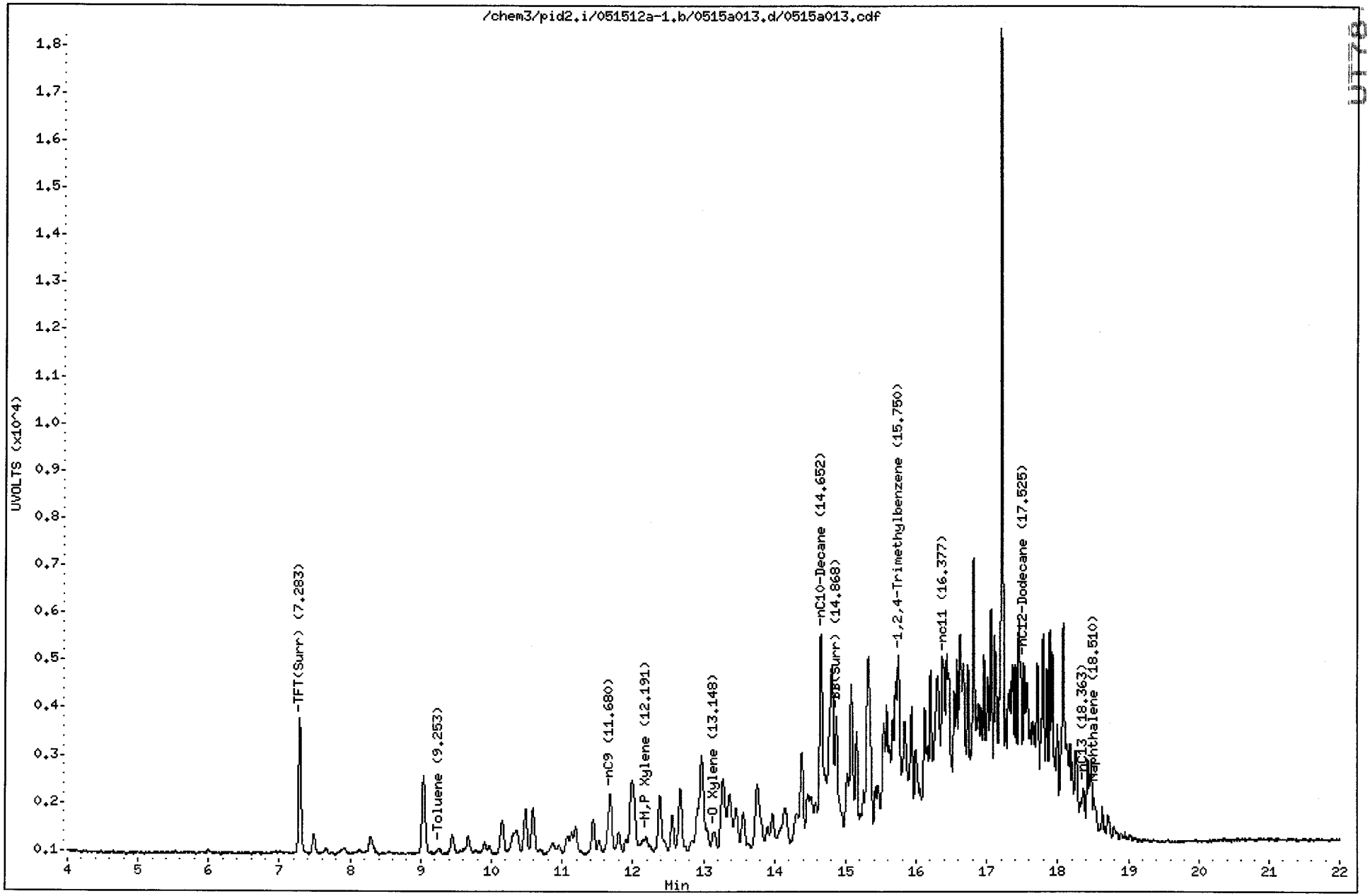
Sample Info: UT78A

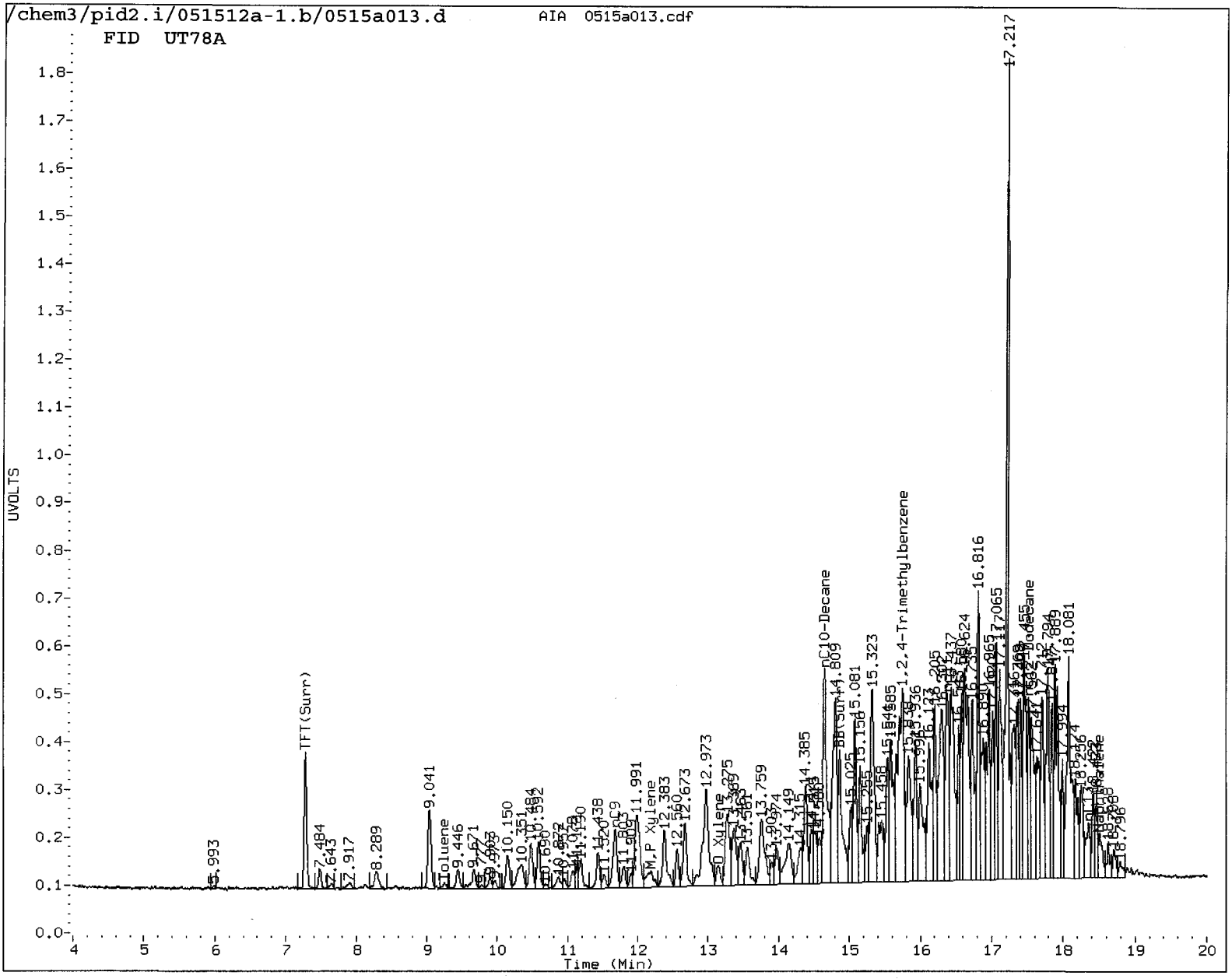
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



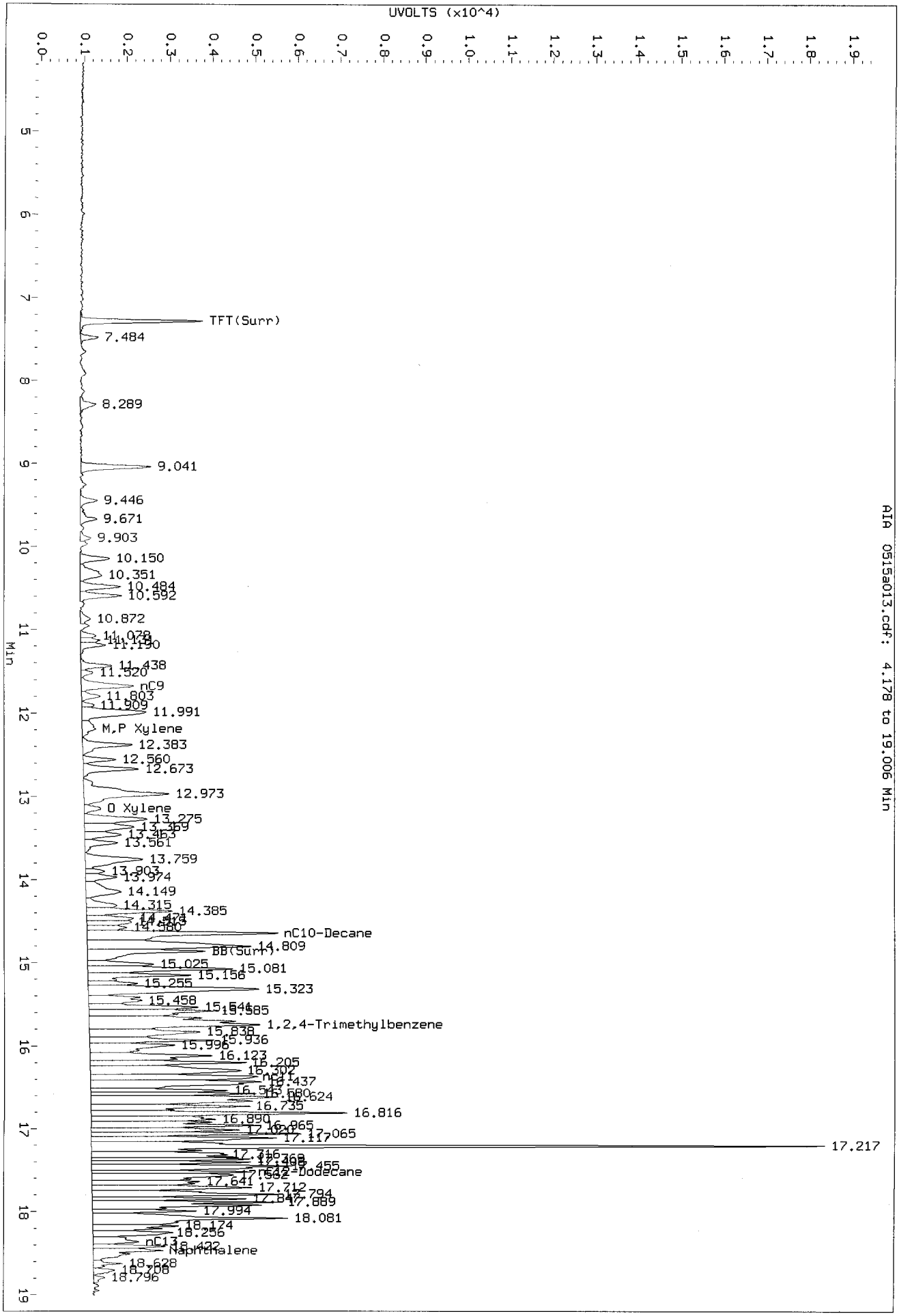


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12



Before
AW
5/16/12

Data File: /chem3/pid2.i/051512a-1.b/0515a015.d

Date : 15-MAY-2012 18:31

Client ID: CBA-SB-2-0.5-2.5-05

Sample Info: UT78C

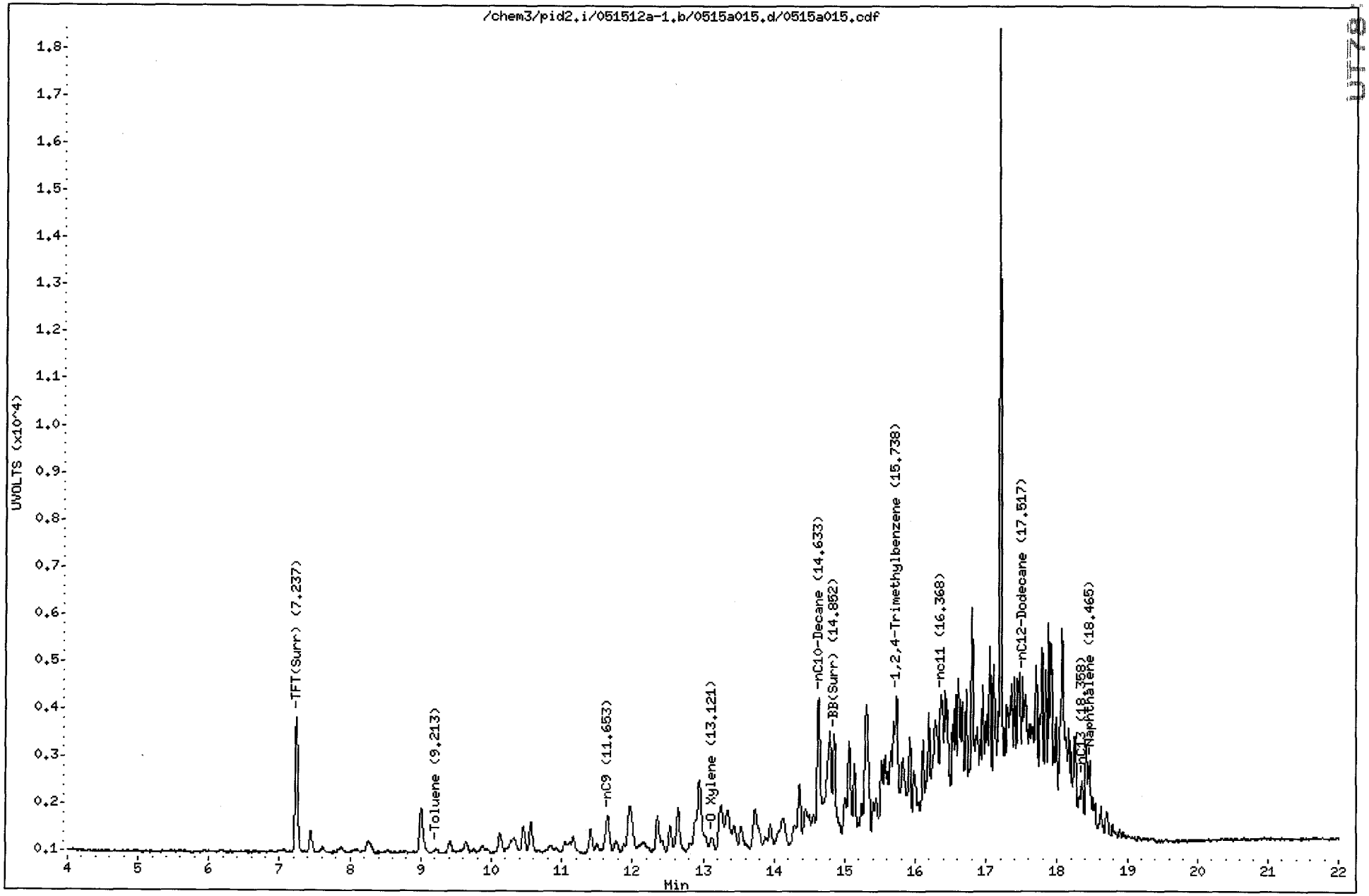
Column phase: RTX 502-2 FID

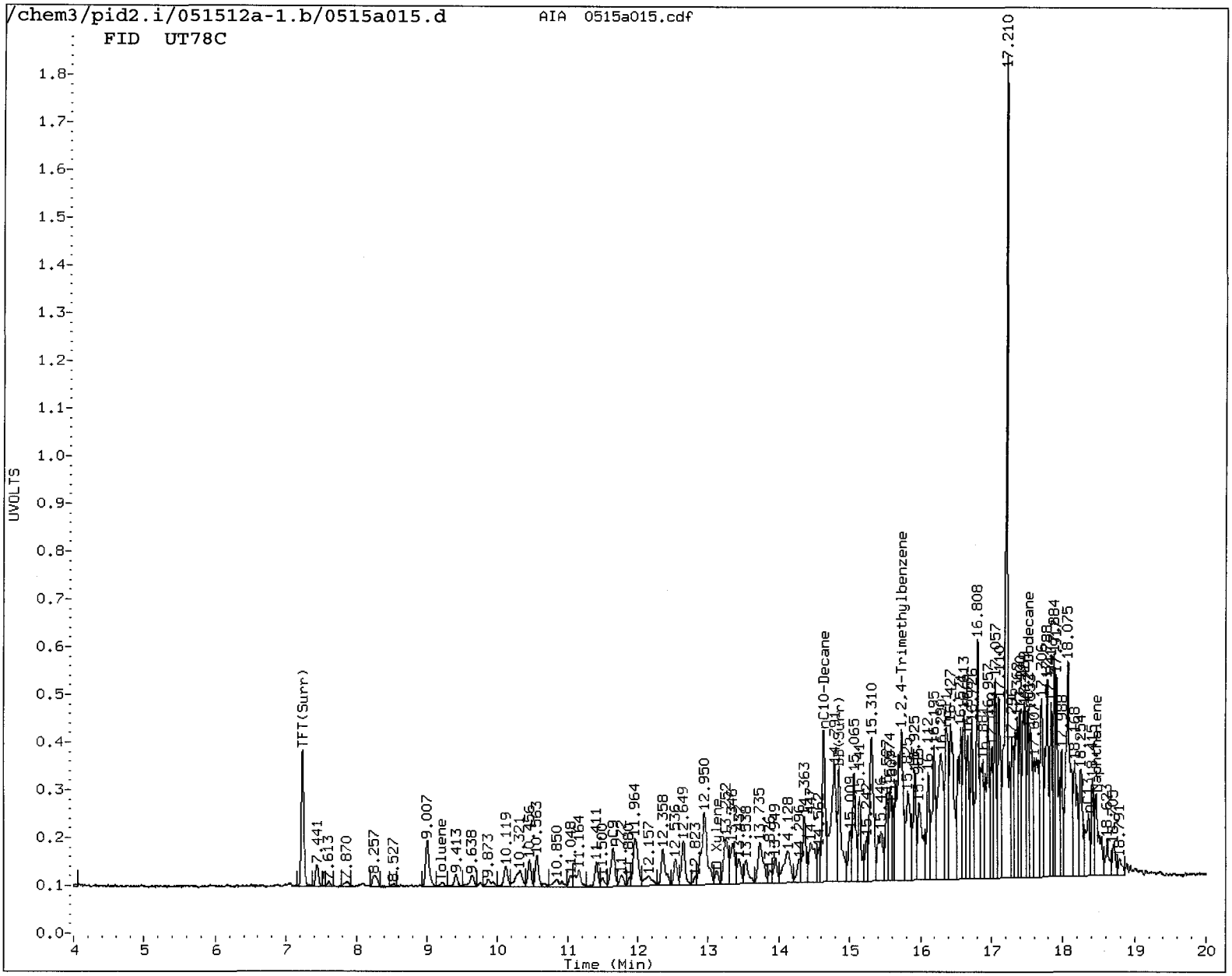
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00031





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Before PCS 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a018.d

Date : 15-MAY-2012 19:55

Client ID: CBA-SB-4-3-5-0512

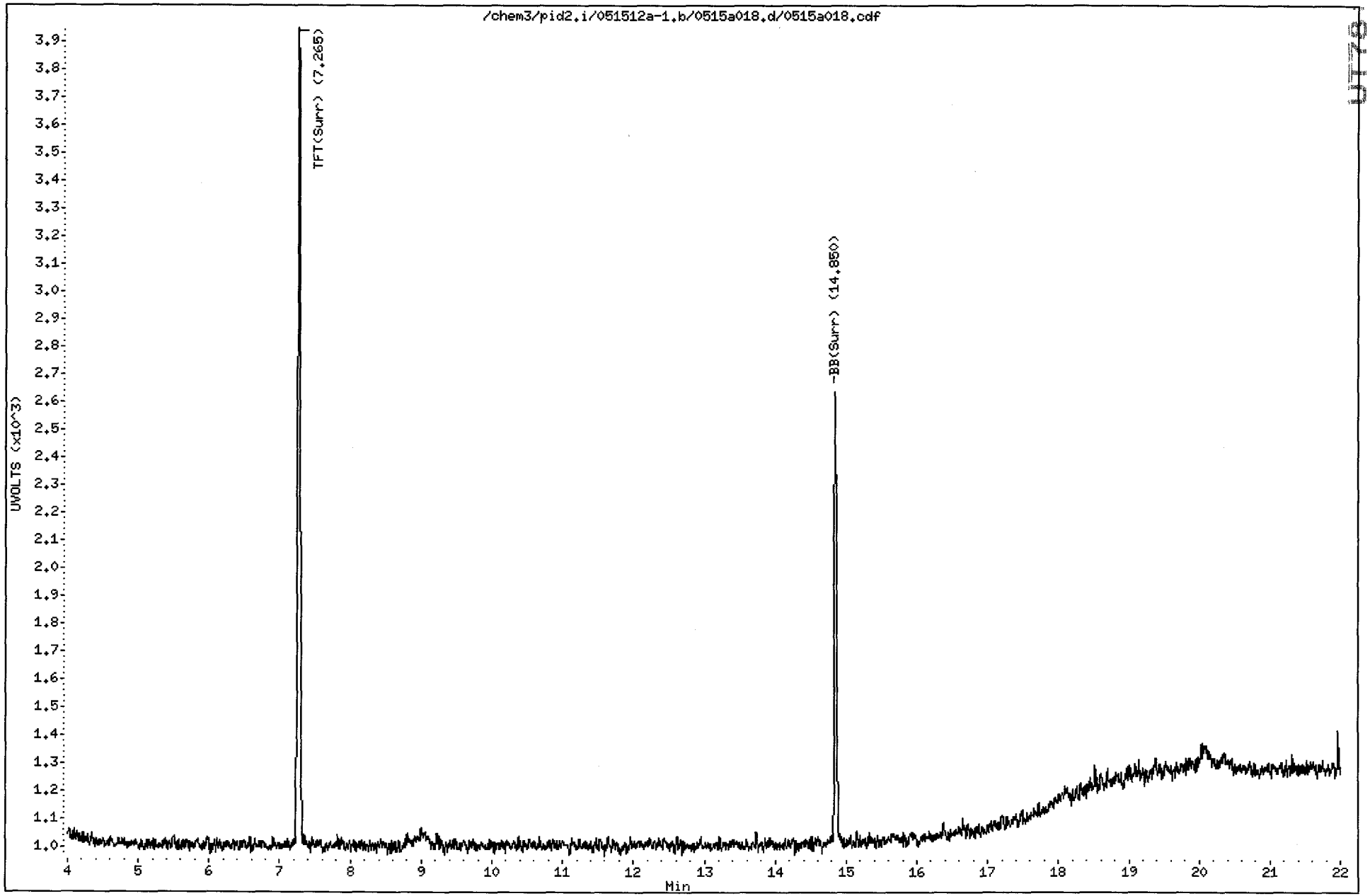
Sample Info: UT78F

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



Data File: /chem3/pid2.i/051512a-1.b/0515a020.d

Page 1

Date : 15-MAY-2012 20:52

Client ID: CBA-SB-5-3.5-0512

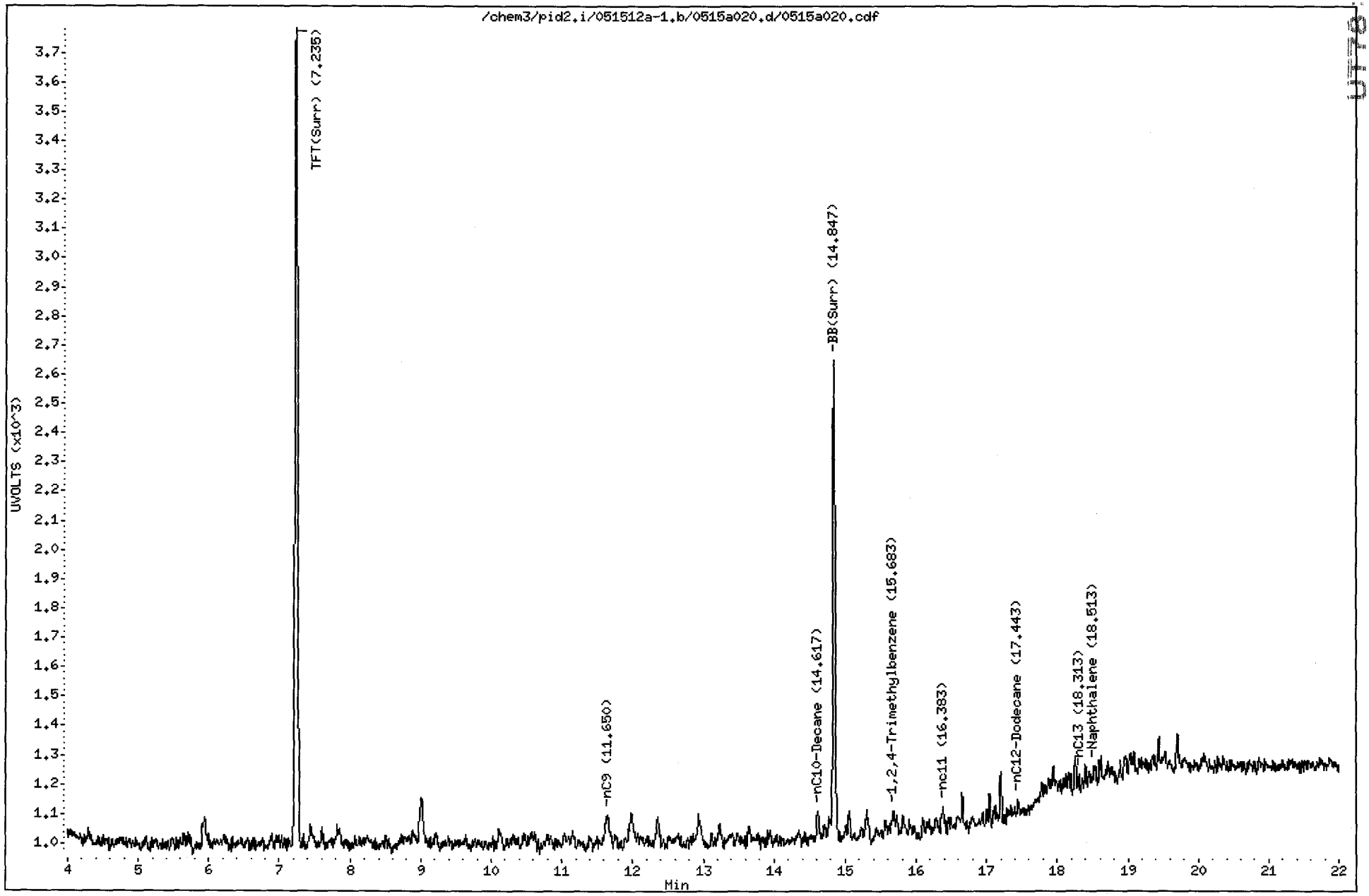
Instrument: pid2.i

Sample Info: UT78G

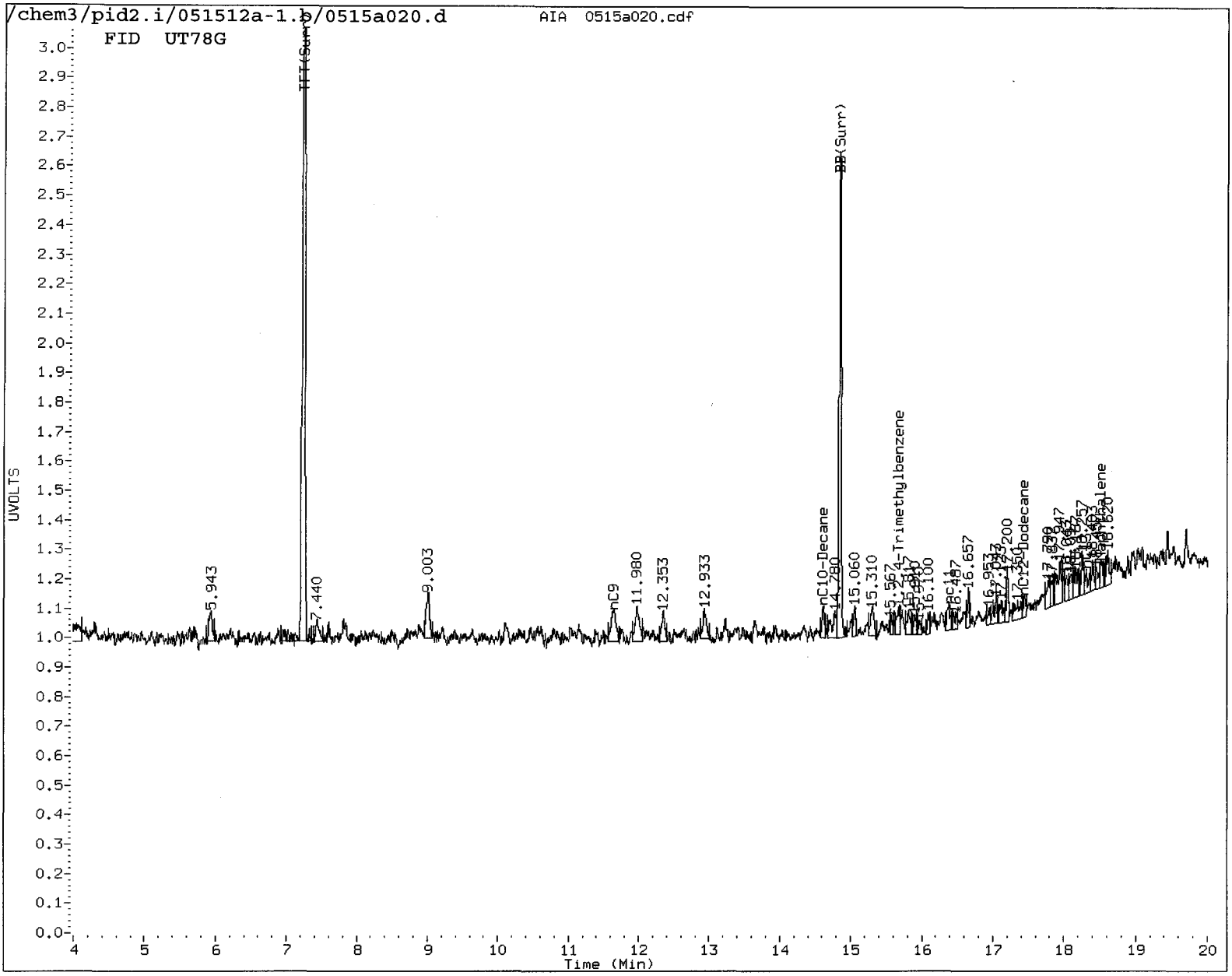
Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18



UT78 0035



MANUAL INTEGRATION

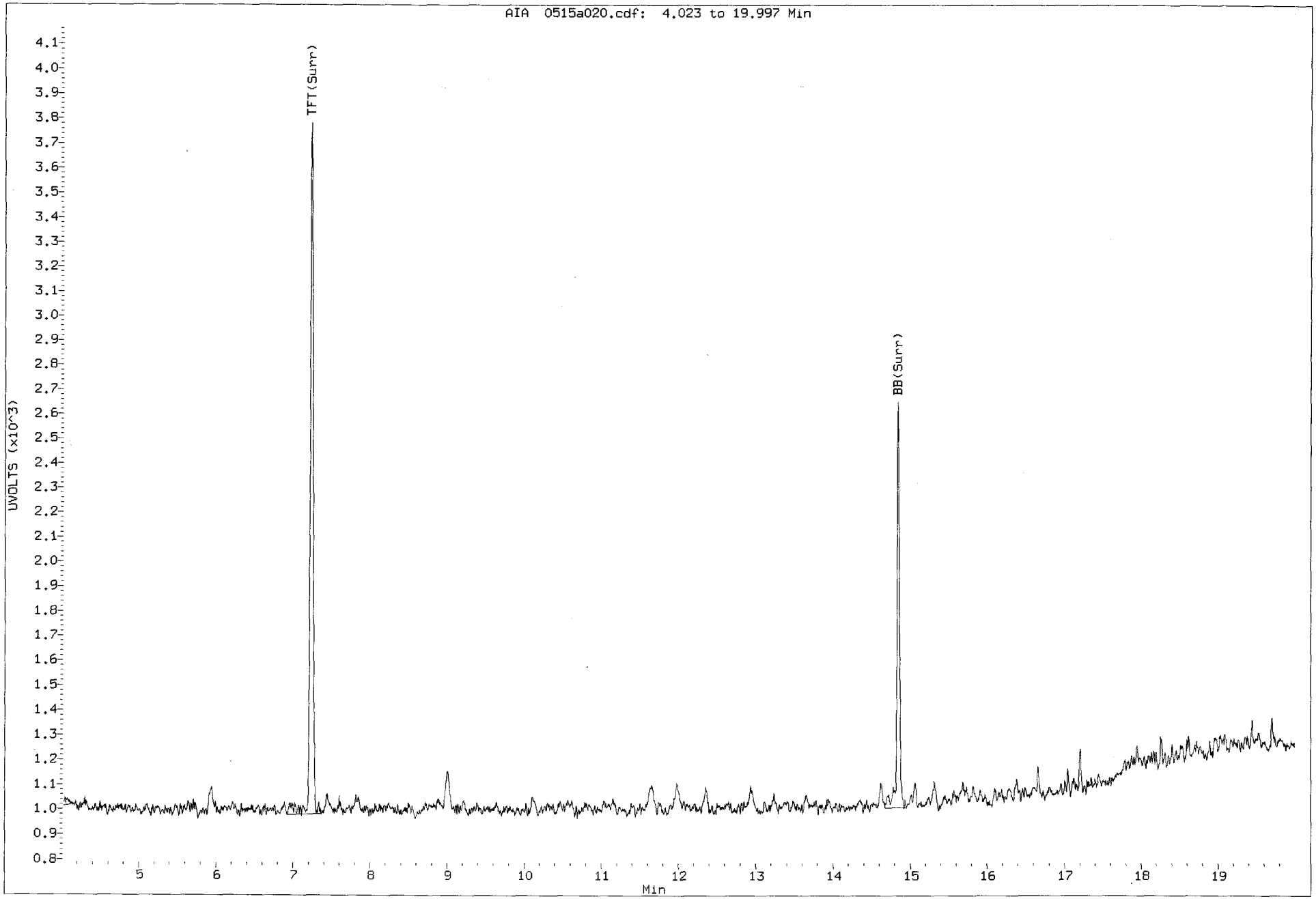
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a020.d/0515a020.cdf
Injection Date: 15-MAY-2012 20:52
Instrument: pid2.i
Client Sample ID: CBA-SB-5-3.5-0512

Before SW 5/18/12



L1569857

Data File: /chem3/pid2.i/051512a-1.b/0515a021.d

Date : 15-MAY-2012 21:20

Client ID: CBA-SB-5-0-2-0512

Sample Info: UT78H

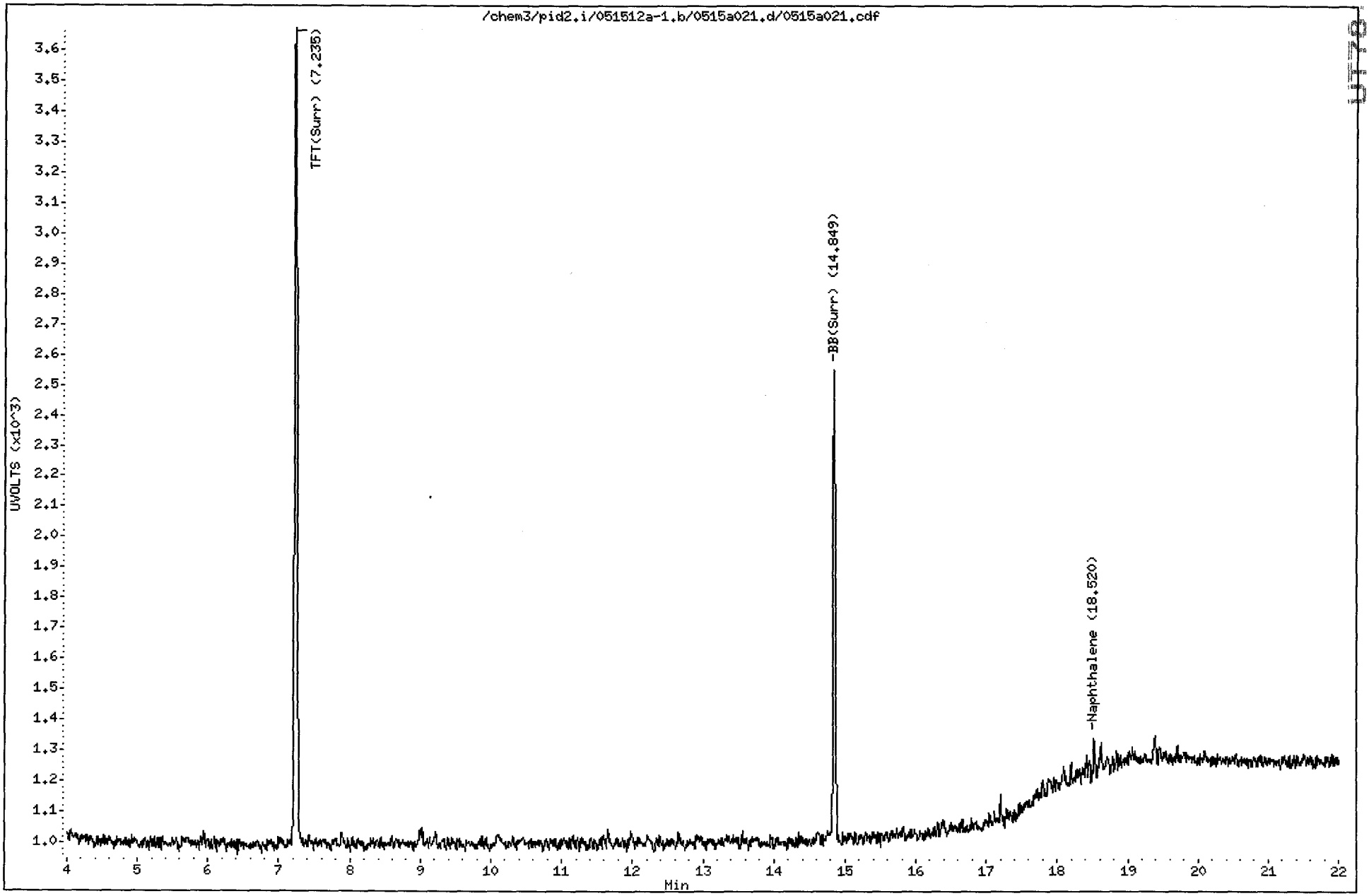
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 050538



Data File: /chem3/pid2.i/051512a-1.b/0515a022.d

Date : 15-MAY-2012 21:48

Client ID: CBA-SB-20-0.5-2.5-0

Sample Info: UT78I

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00039

/chem3/pid2.i/051512a-1.b/0515a022.d/0515a022.cdf

UVOLTS (x10^4)

-TFT(Surr) (7.309)

-Toluene (9.260)

-nC9 (11.674)

-M,P Xylene (12.187)

-O Xylene (13.136)

-nC10-Decane (14.640)

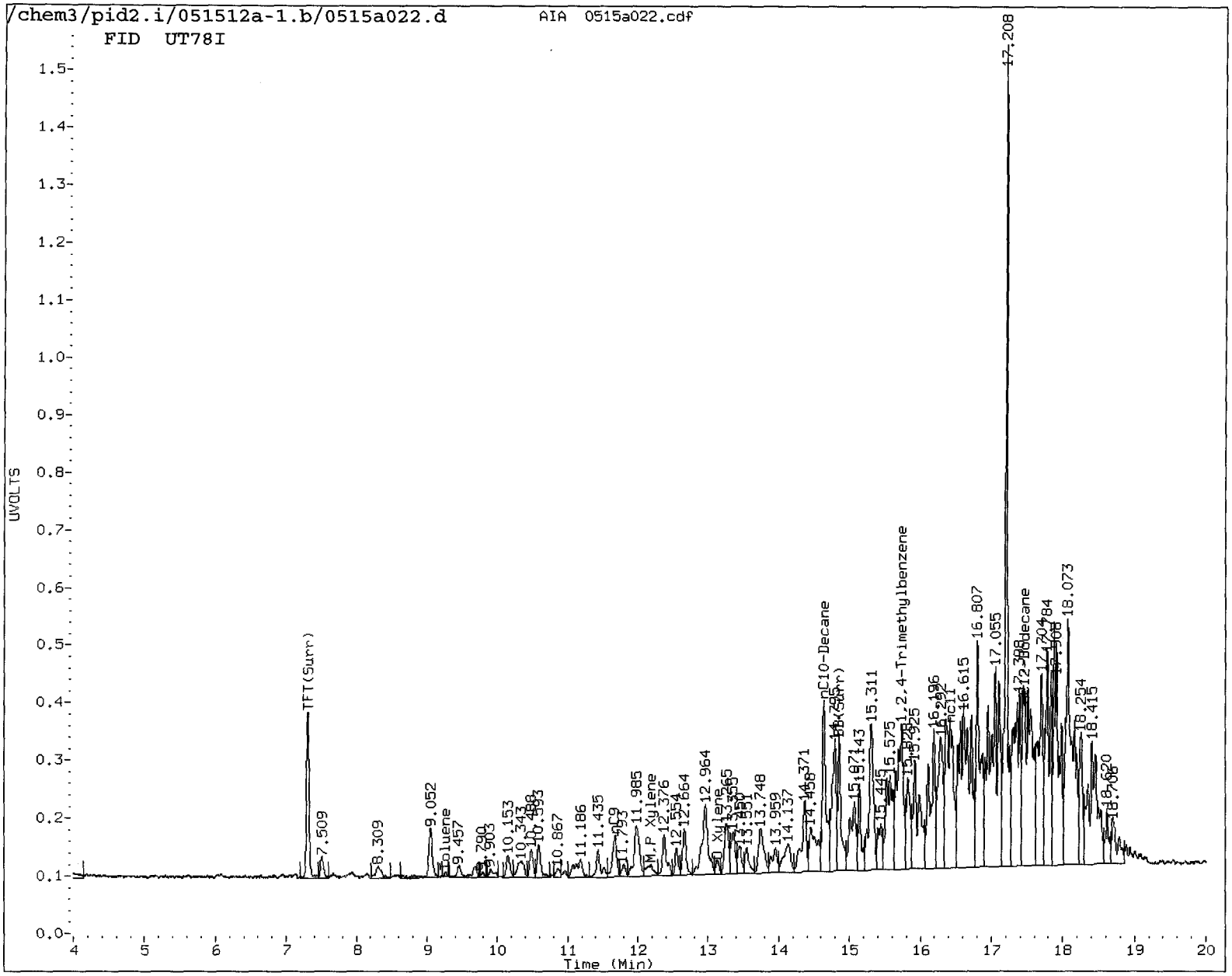
-BB(Surr) (14.857)

-1,2,4-Trimethylbenzene (15.736)

-nc11 (16.430)

-nC12-Dodecane (17.458)

Min



MANUAL INTEGRATION

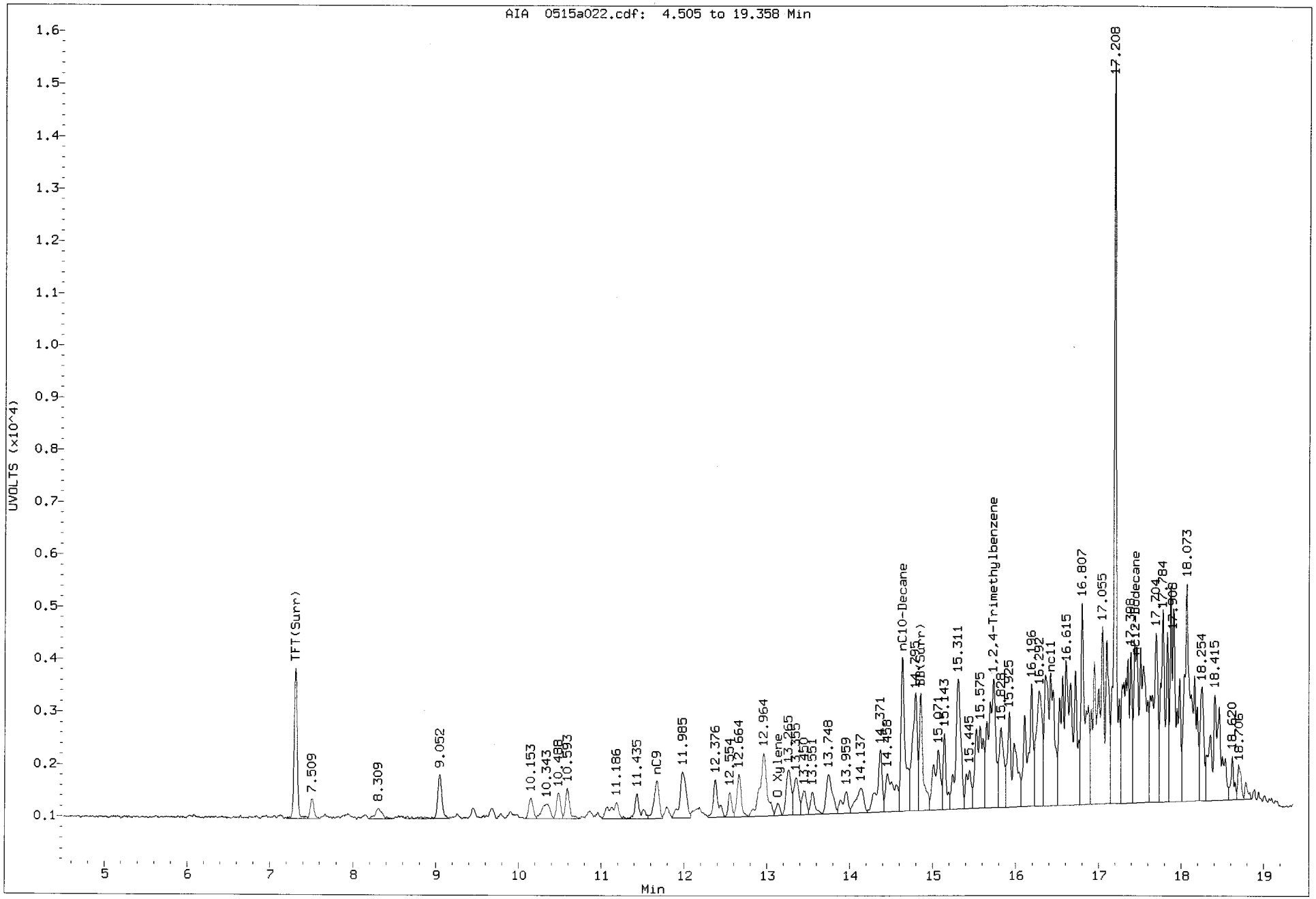
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a022.d/0515a022.cdf
Injection Date: 15-MAY-2012 21:48
Instrument: pid2.i
Client Sample ID: CBA-SB-20-0.5-2.5-0

Before
TW
5/16/12



Data File: /chem3/pid2.i/051512a-1.b/0515a024.d

Date : 15-MAY-2012 22:45

Client ID: CBA-SB-6-3-5-0512

Sample Info: UT78K

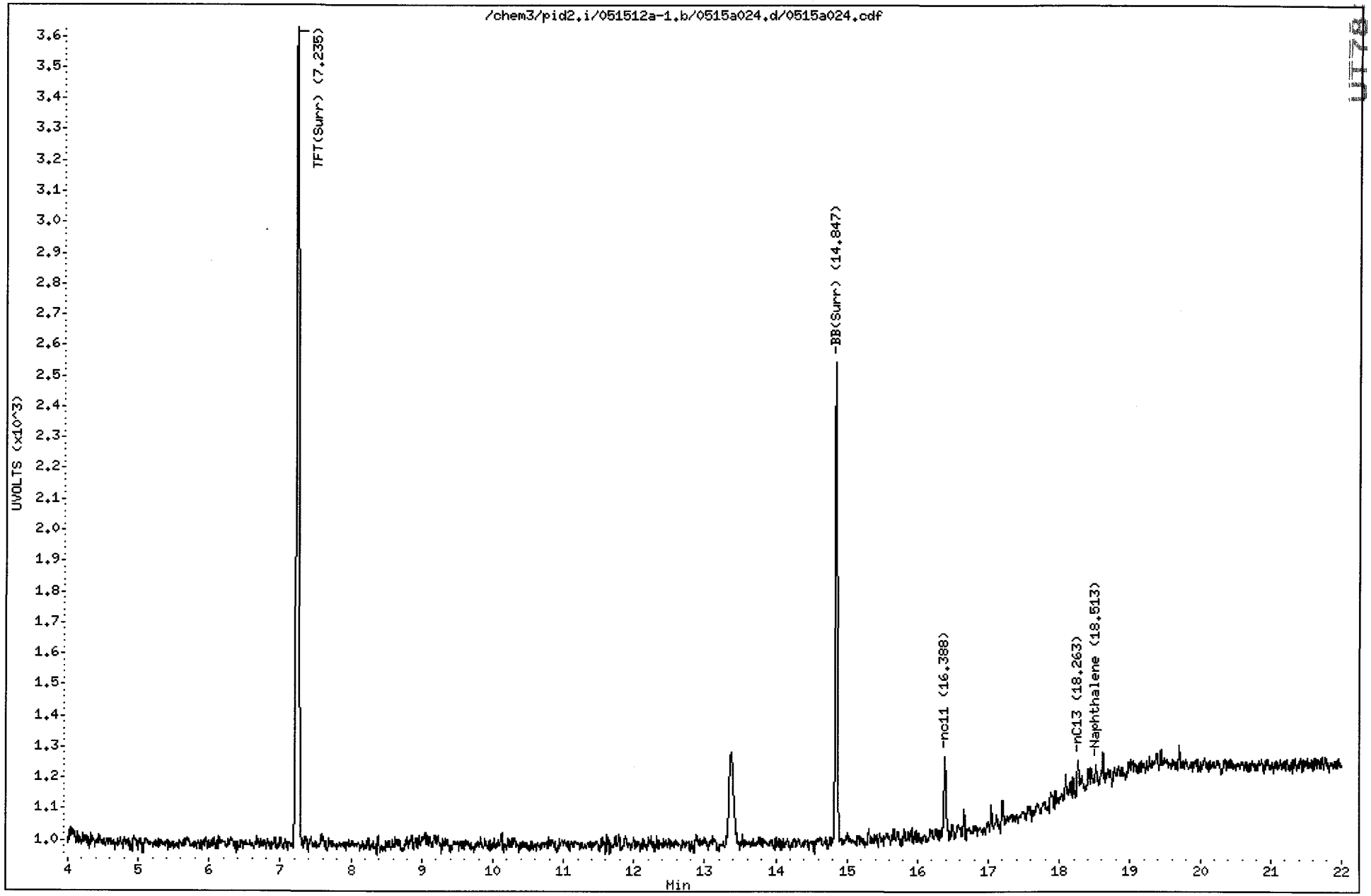
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 060112



Data File: /chem3/pid2.i/051512a-1.b/0515a025.d

Date : 15-MAY-2012 23:13

Client ID: CBA-SB-7-1-3-0512

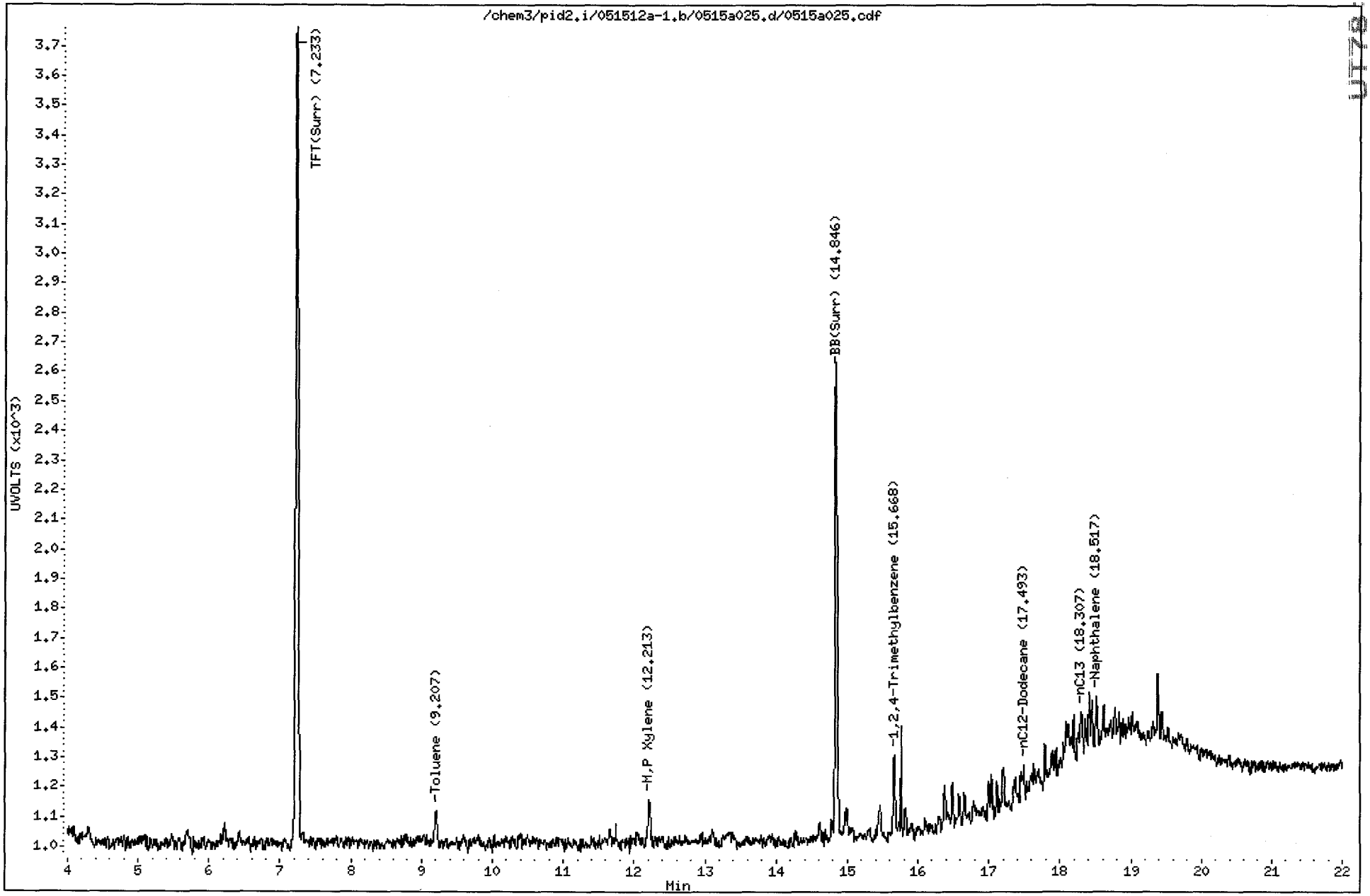
Sample Info: UT78L

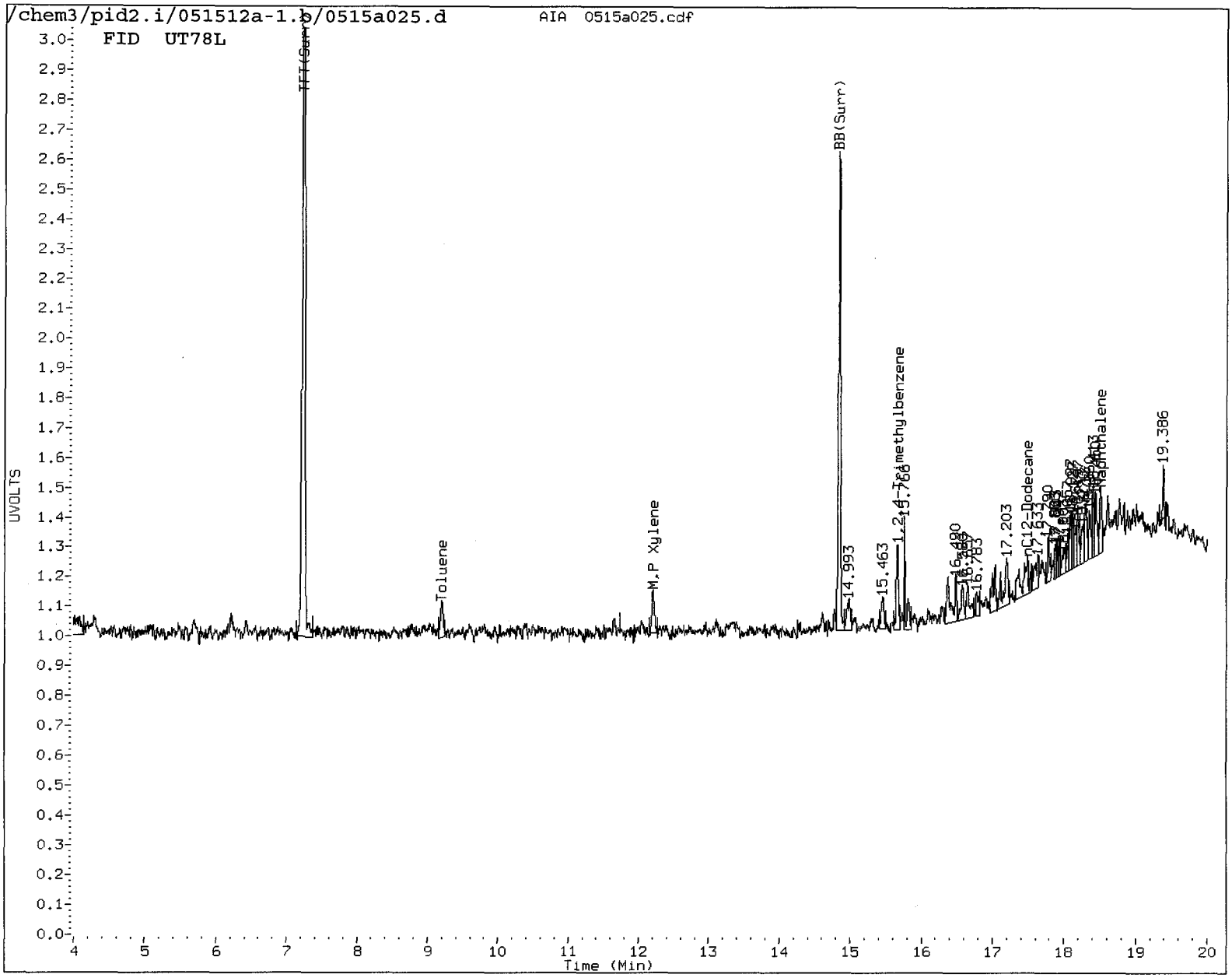
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

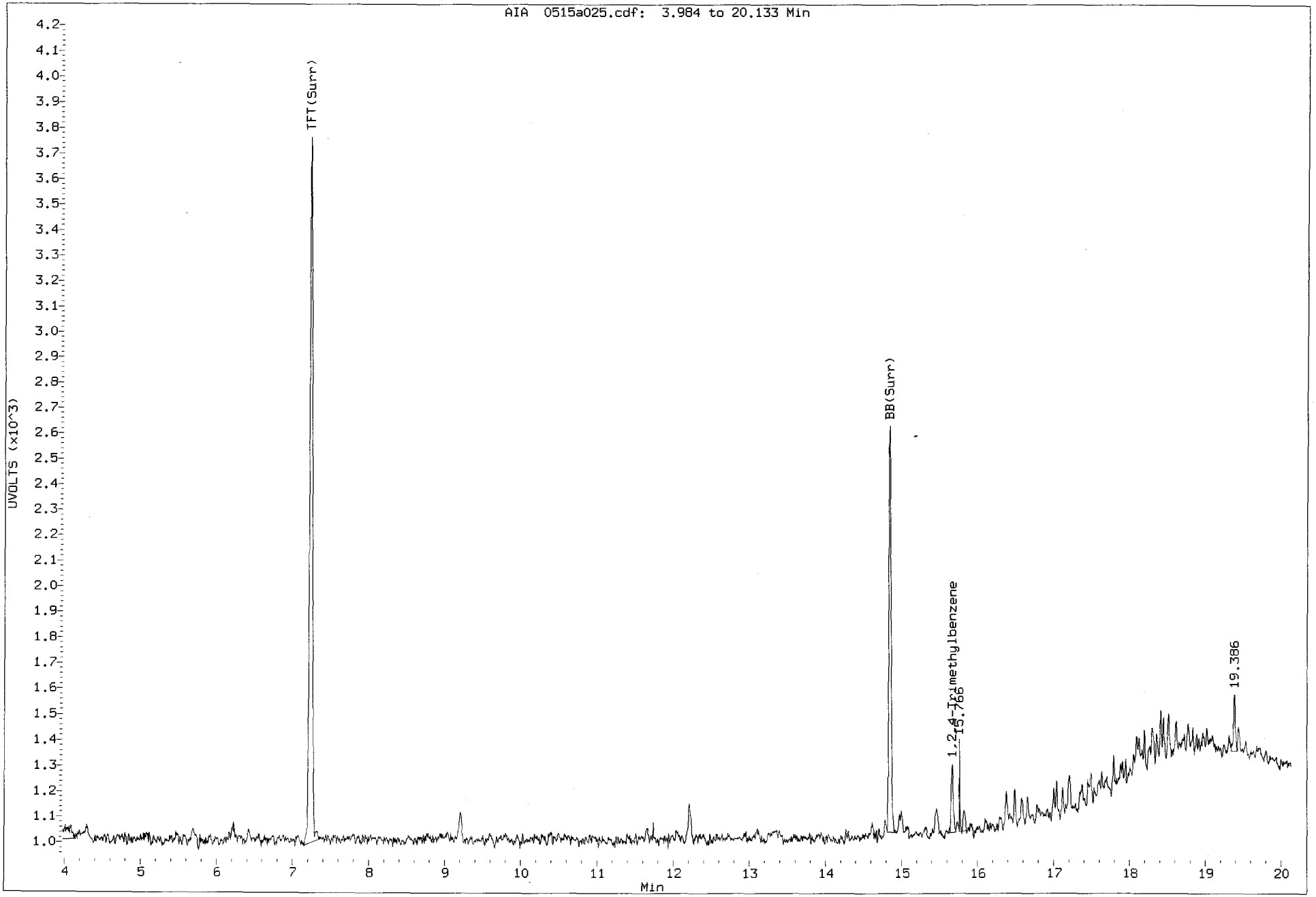
5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a025.d/0515a025.cdf
Injection Date: 15-MAY-2012 23:13
Instrument: pid2.i
Client Sample ID: CBA-SB-7-1-3-0512

Before JW 5/18/12

UT79 00015



Data File: /chem3/pid2.i/051512a-1.b/0515a026.d

Date : 15-MAY-2012 23:41

Client ID: CBA-SB-8-3-5-0512

Sample Info: UT78M

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 051512

/chem3/pid2.i/051512a-1.b/0515a026.d/0515a026.cdf

UVOLTS (x10^3)

TFT(Surr) (7.233)

-Toluene (9.207)

-nC9 (11.640)

-BB(Surr) (14.847)

-1,2,4-Trimethylbenzene (15.680)

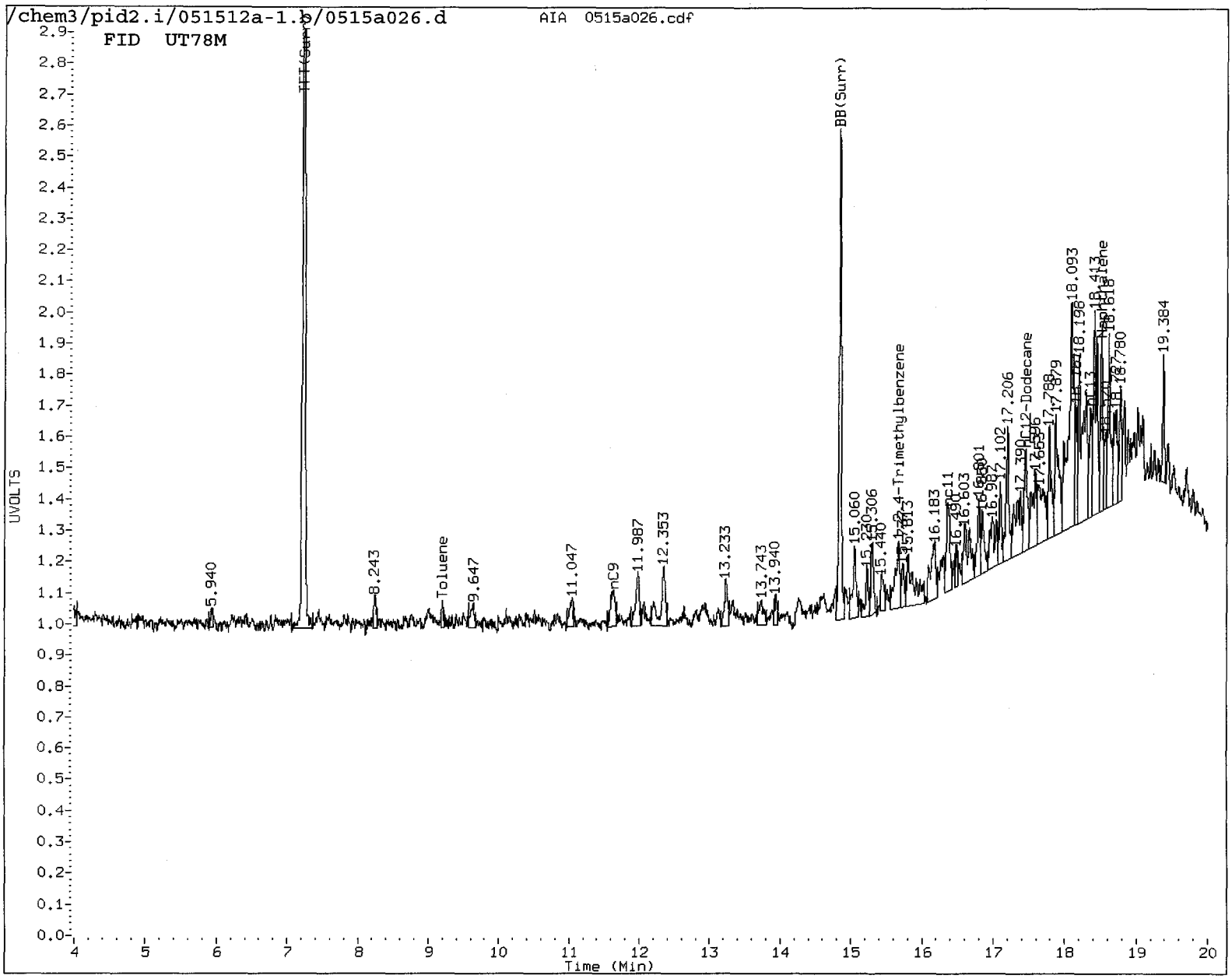
-nC11 (16.368)

-nC12-Dodecane (17.461)

-nC13 (18.364)

-Naphthalene (18.513)

Min



MANUAL INTEGRATION

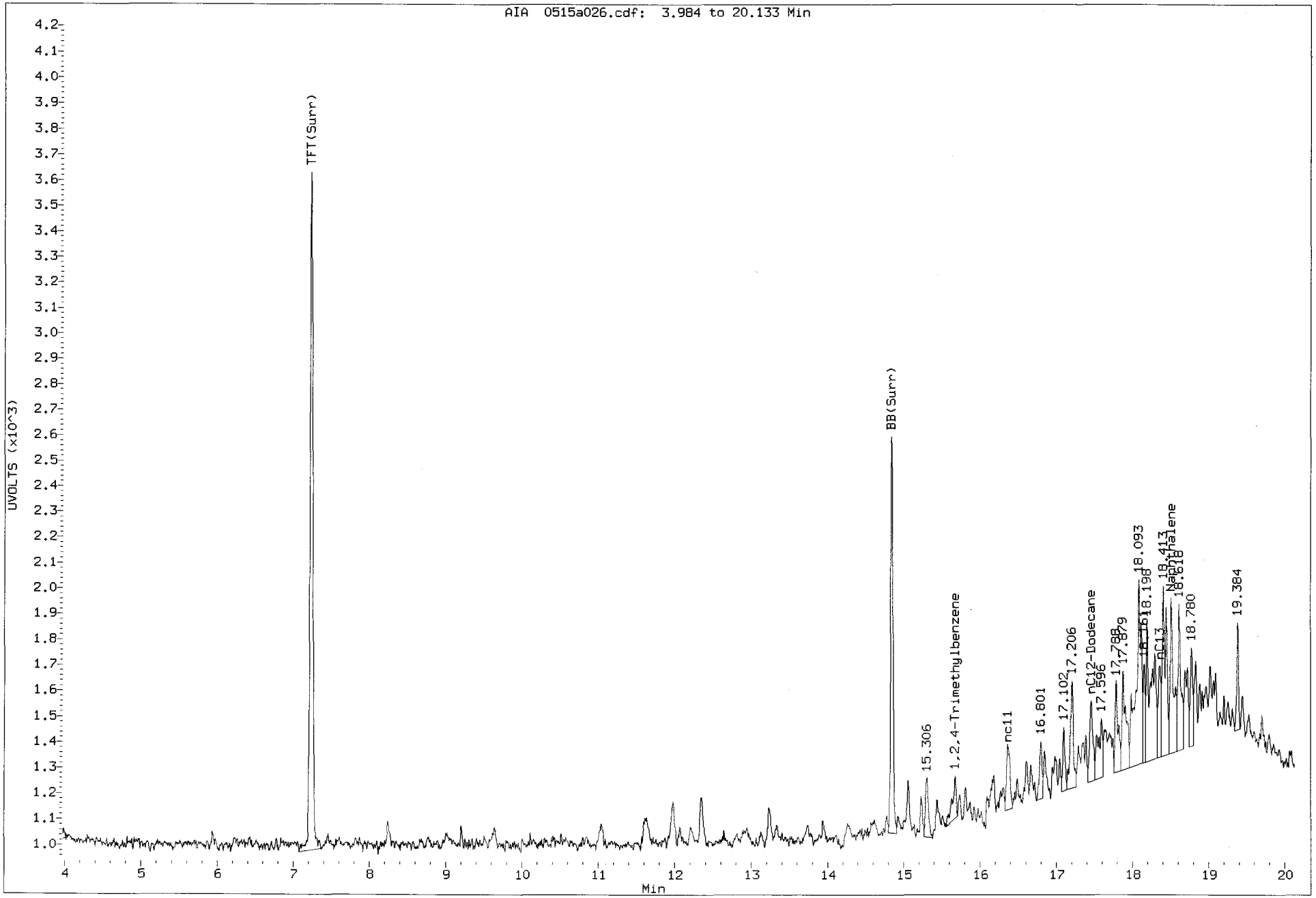
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a026.d/0515a026.cdf
Injection Date: 15-MAY-2012 23:41
Instrument: pid2.i
Client Sample ID: CBA-SB-8-3-5-0512

Before JW 5/16/12



Data File: /chem3/pid2.i/051512a-1.b/0515a027.d

Date : 16-MAY-2012 00:09

Client ID: CBA-SB-8-1-3-0512

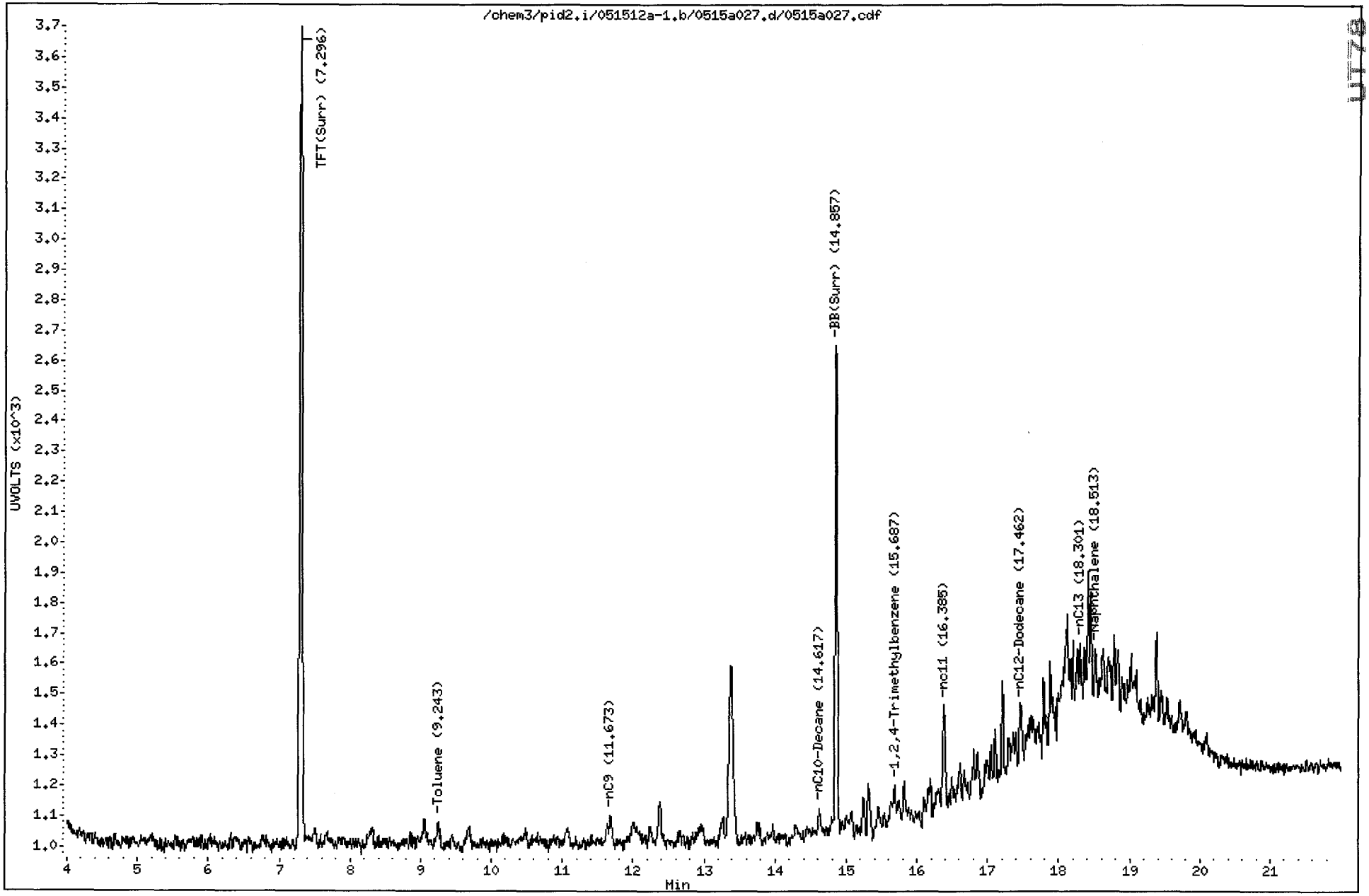
Sample Info: UT78N

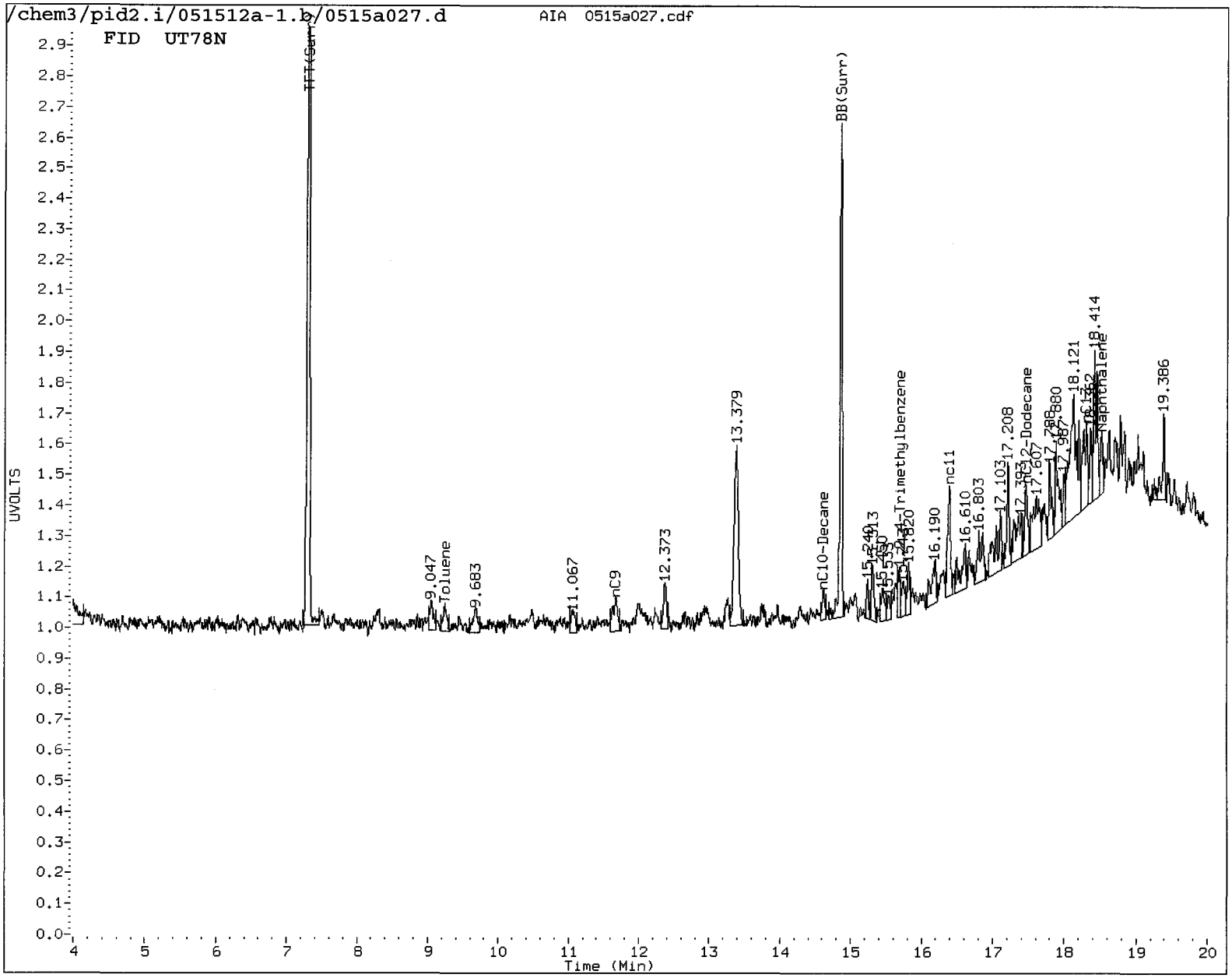
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

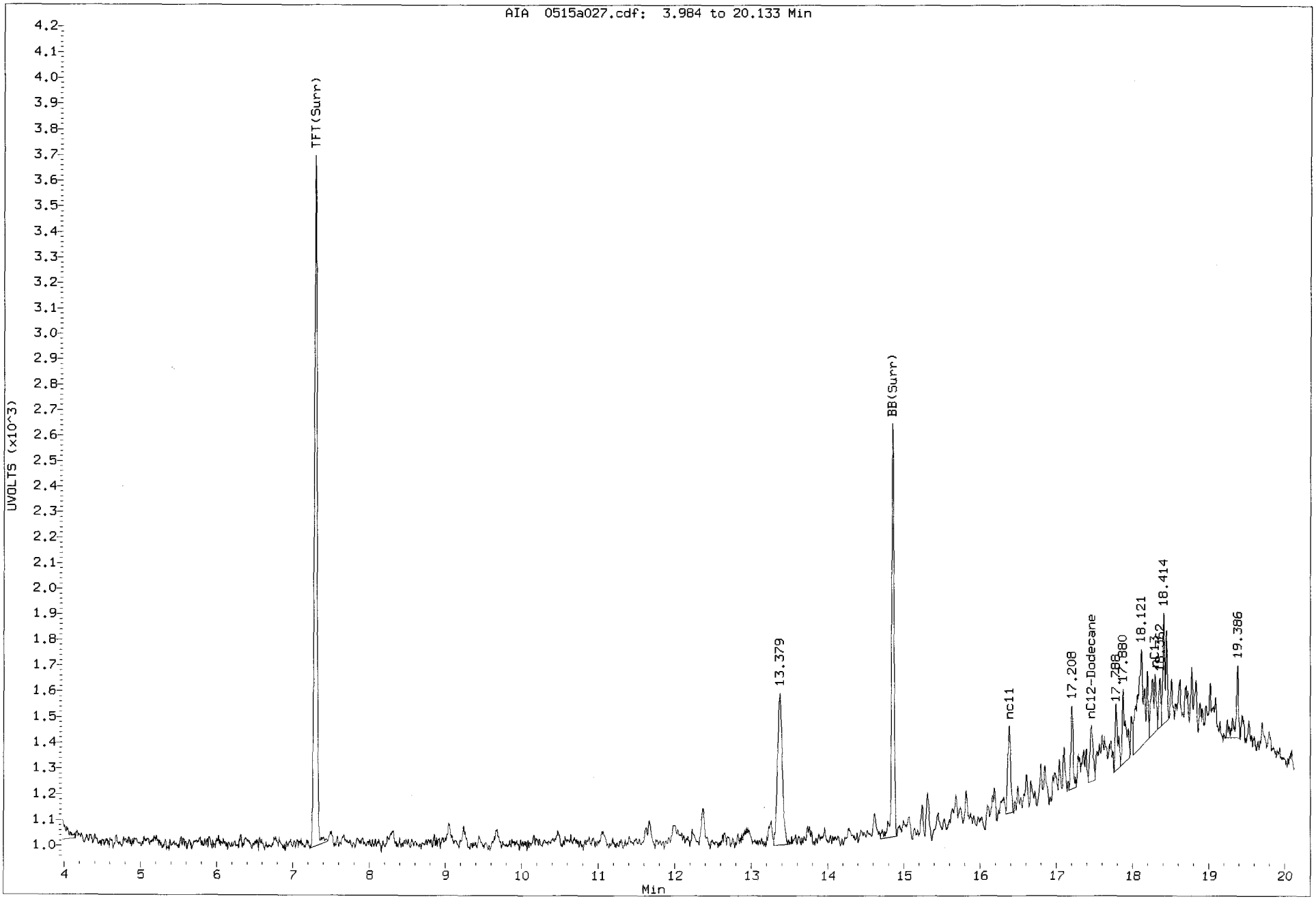
5. Other _____

Analyst: JL Date: 5/16/12

Data File: /chem3/pid2.i/051512a-1.b/0515a027.d/0515a027.cdf
Injection Date: 16-MAY-2012 00:09
Instrument: pid2.i
Client Sample ID: CBA-SB-8-1-3-0512

Before
JW
5/18/12

LIT73 : 60051



Data File: /chem3/pid2.i/051512a-1.b/0515a029.d

Date : 16-MAY-2012 01:06

Client ID: CWMW-18-7-9-0512

Sample Info: UT780

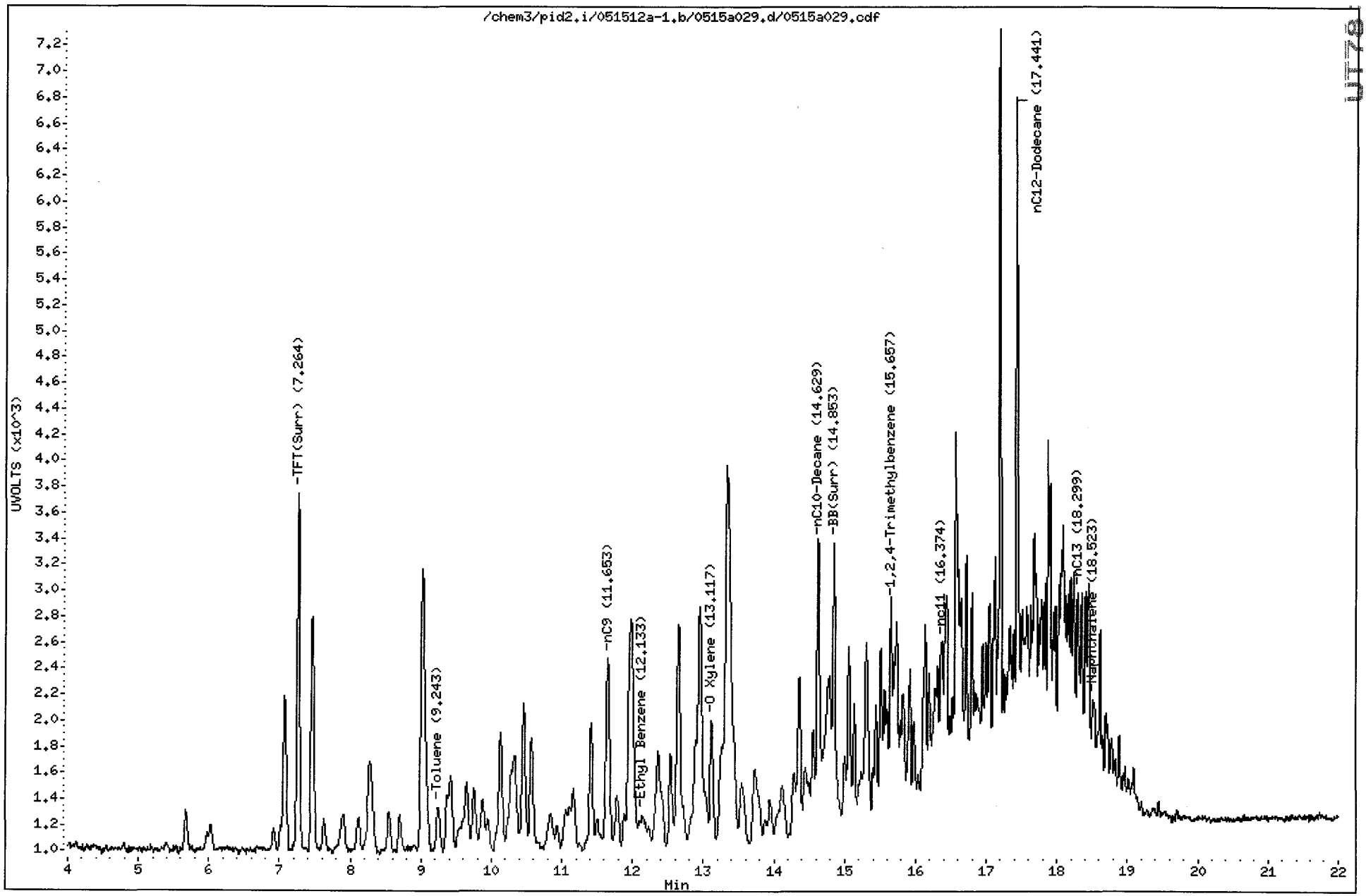
Column phase: RTX 502-2 FID

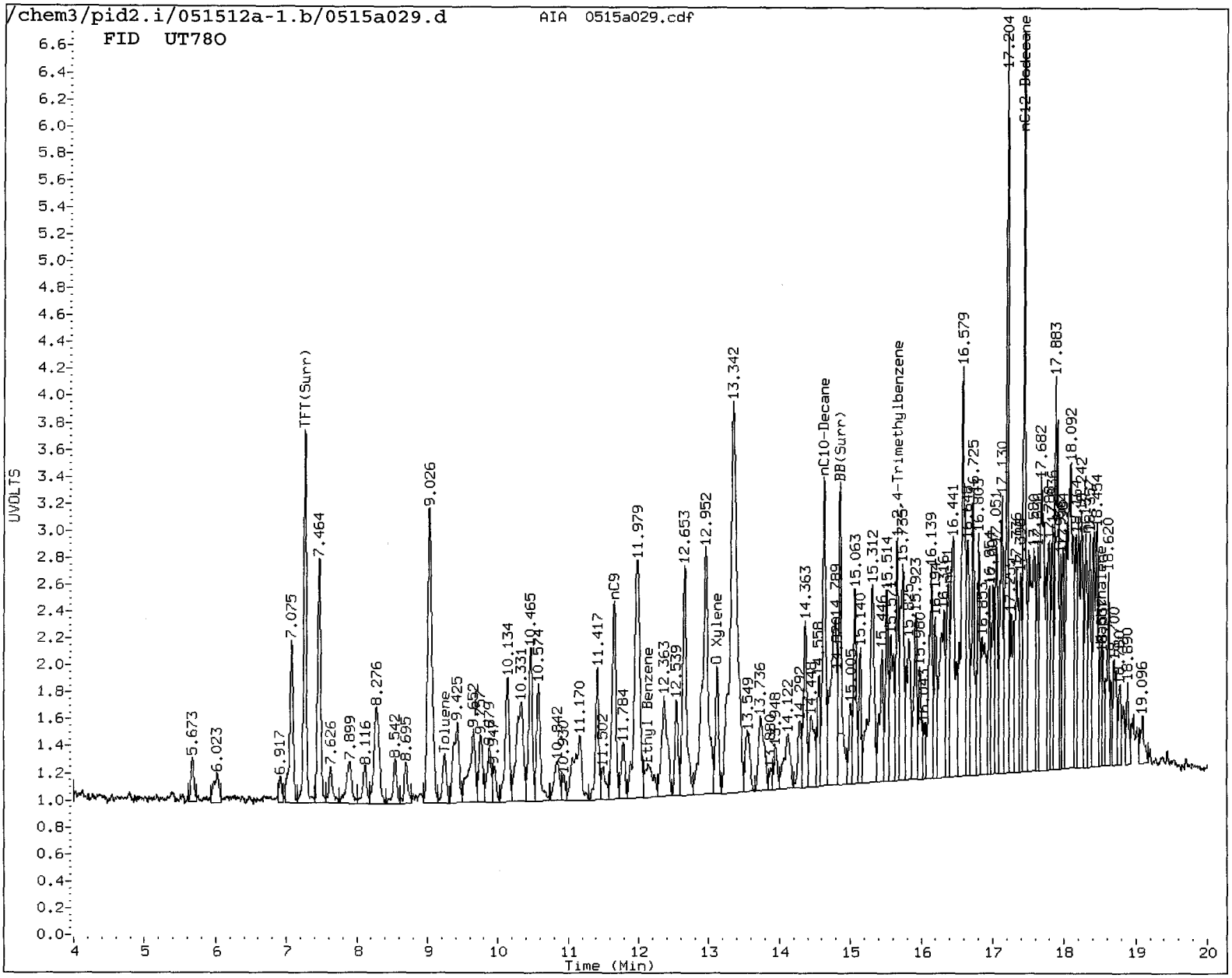
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT780052



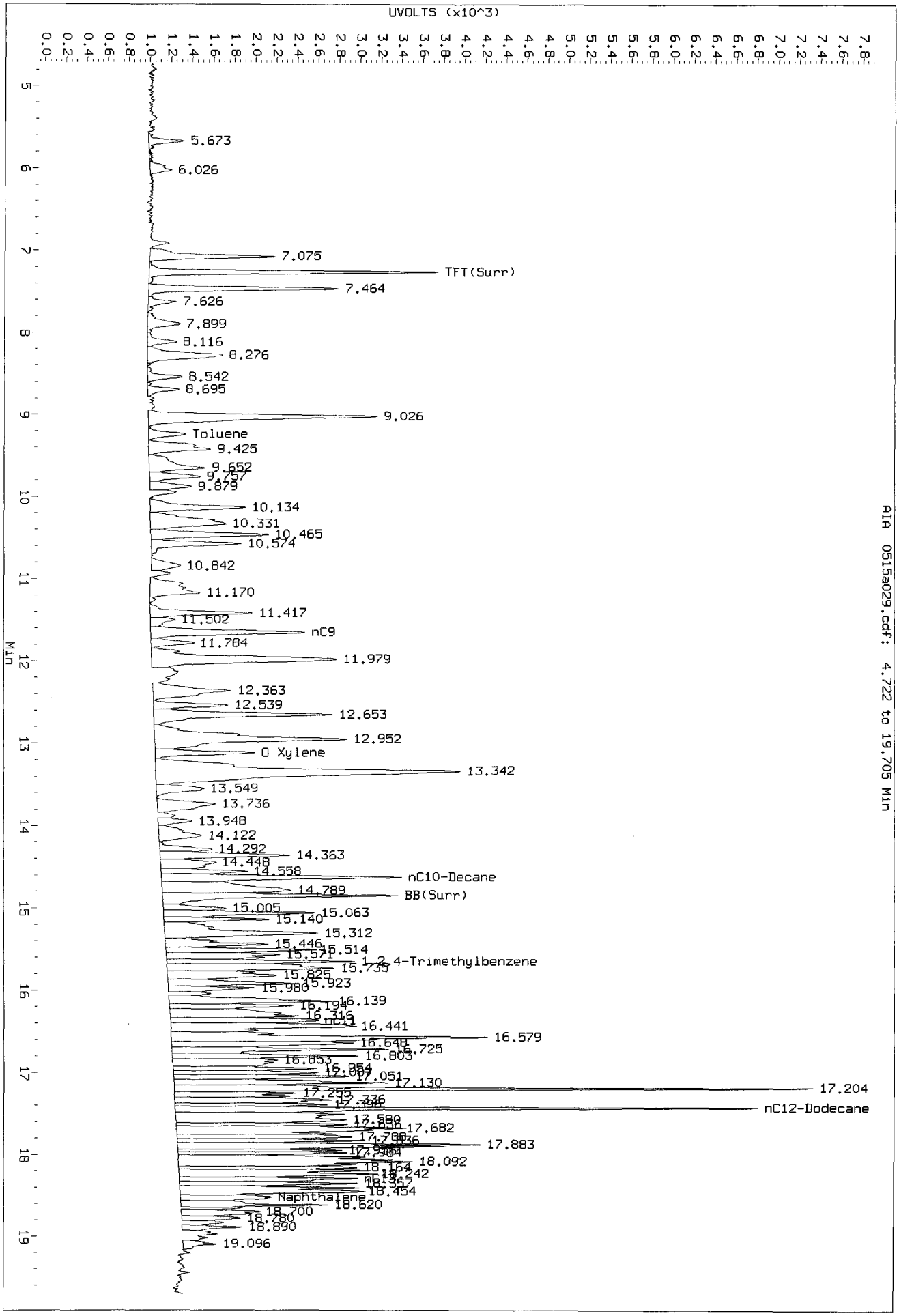


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: _____ Date: 5/16/12



Before
SW
5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a031.d

Date : 16-MAY-2012 02:02

Client ID: CBA-SB-80-3-5-0512

Sample Info: UT78Q

Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00055

/chem3/pid2.i/051512a-1.b/0515a031.d/0515a031.cdf

UVOLTS (x10^3)

-Benzene (6.440)

TFT(Surr) (7.236)

-Toluene (9.217)

-nC9 (11.640)

-M,P Xylene (12.210)

-BB(Surr) (14.847)

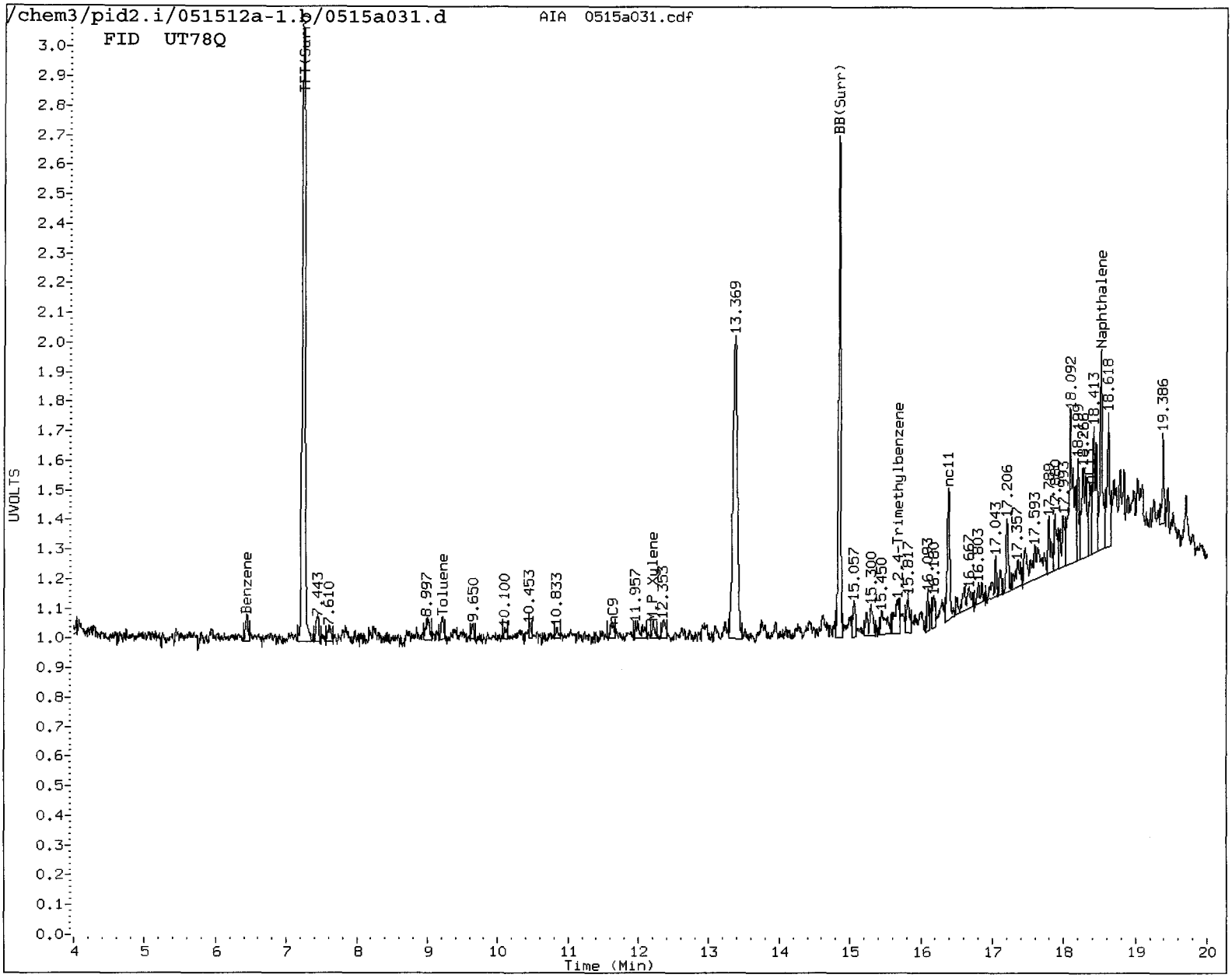
-1,2,4-Trimethylbenzene (15.683)

-nc11 (16.386)

-nC13 (18.363)

-Naphthalene (18.515)

Min



MANUAL INTEGRATION

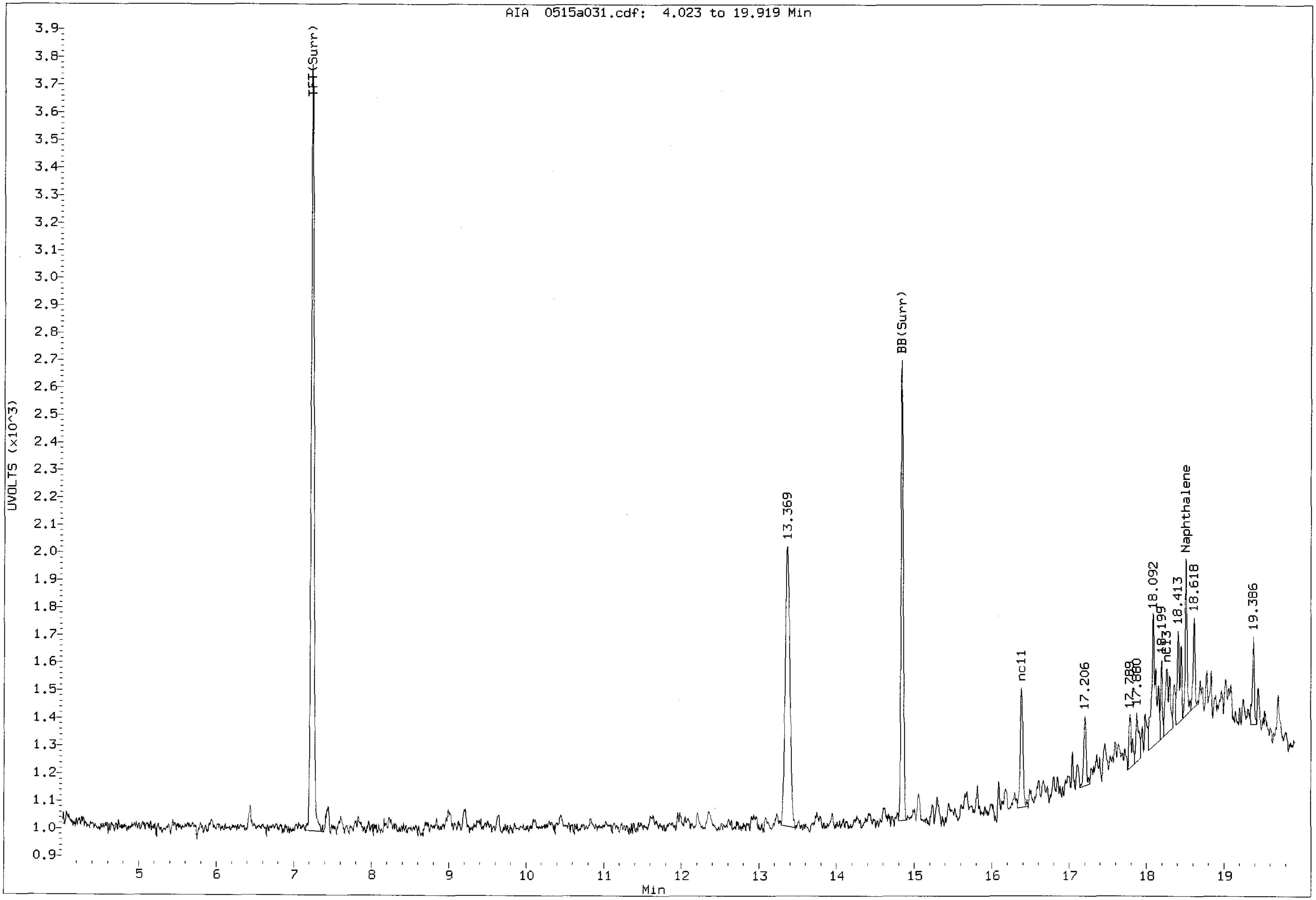
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a031.d/0515a031.cdf
Injection Date: 16-MAY-2012 02:02
Instrument: pid2.i
Client Sample ID: CBA-SB-80-3-5-0512

Before
JW
5/18/12



Data File: /chem3/pid2.i/051512a-1.b/0515a032.d

Date : 16-MAY-2012 02:30

Client ID: CBA-TP-7-0-1-0512

Sample Info: UT78R

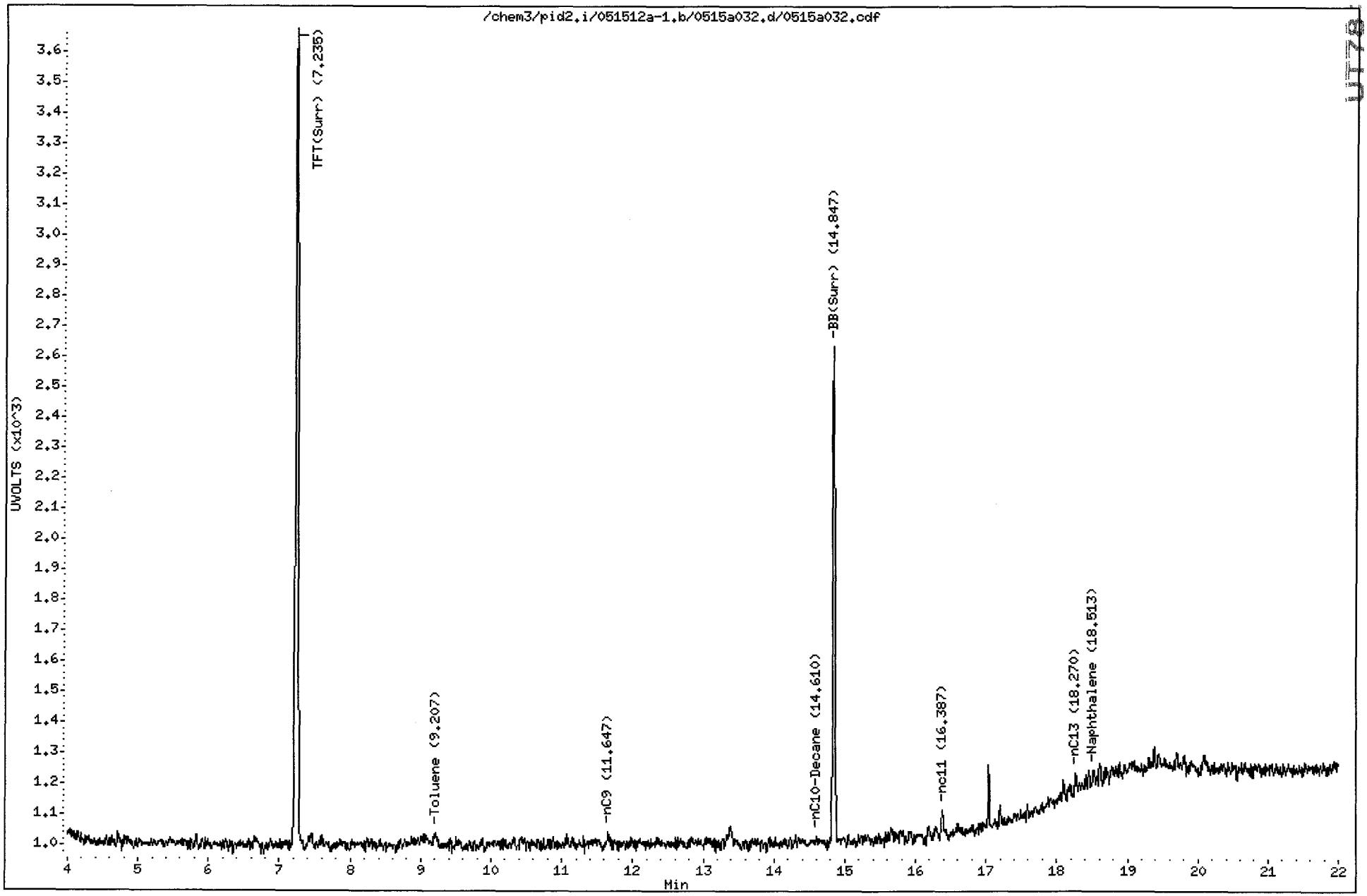
Column phase: RTX 502-2 FID

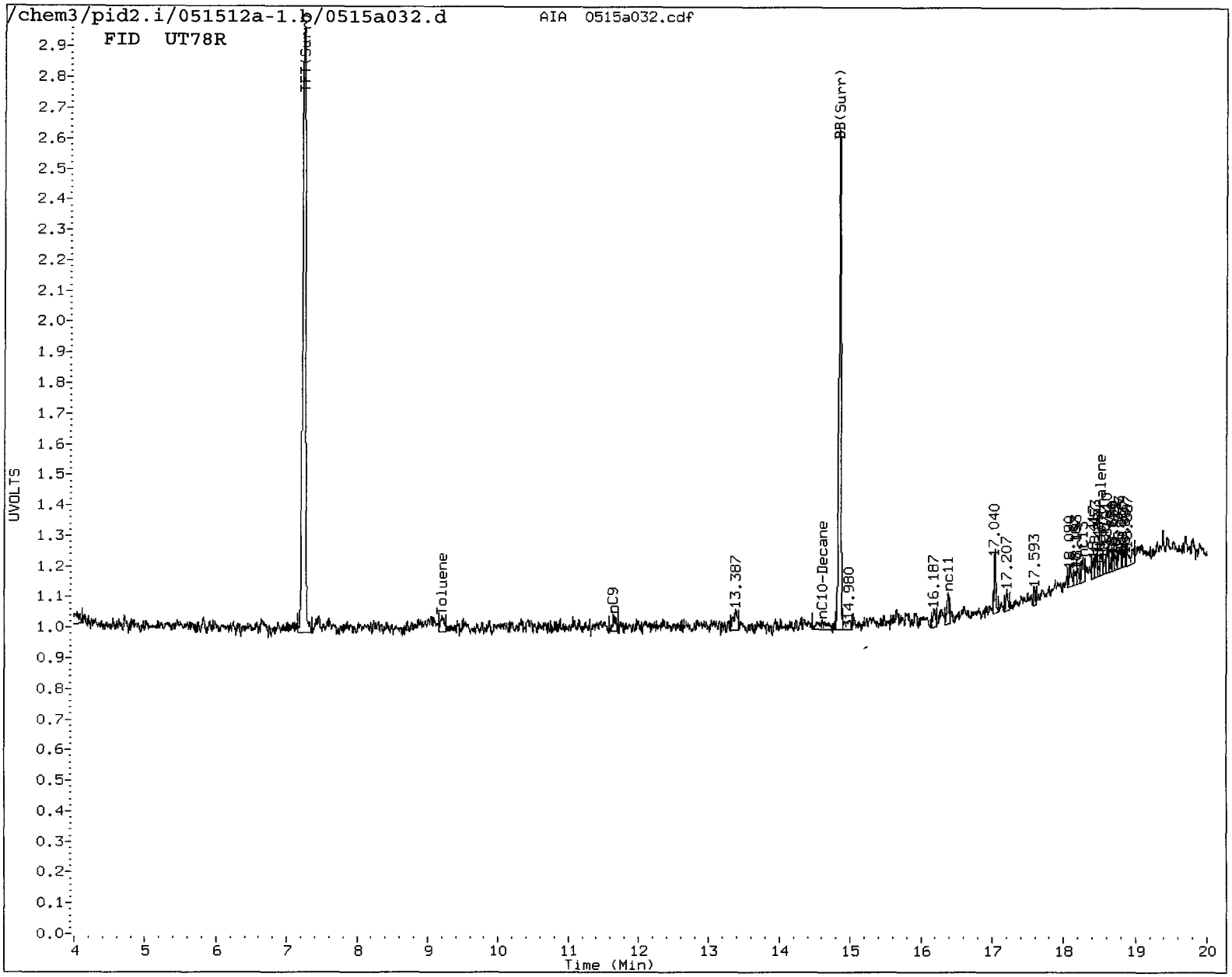
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 60058





MANUAL INTEGRATION

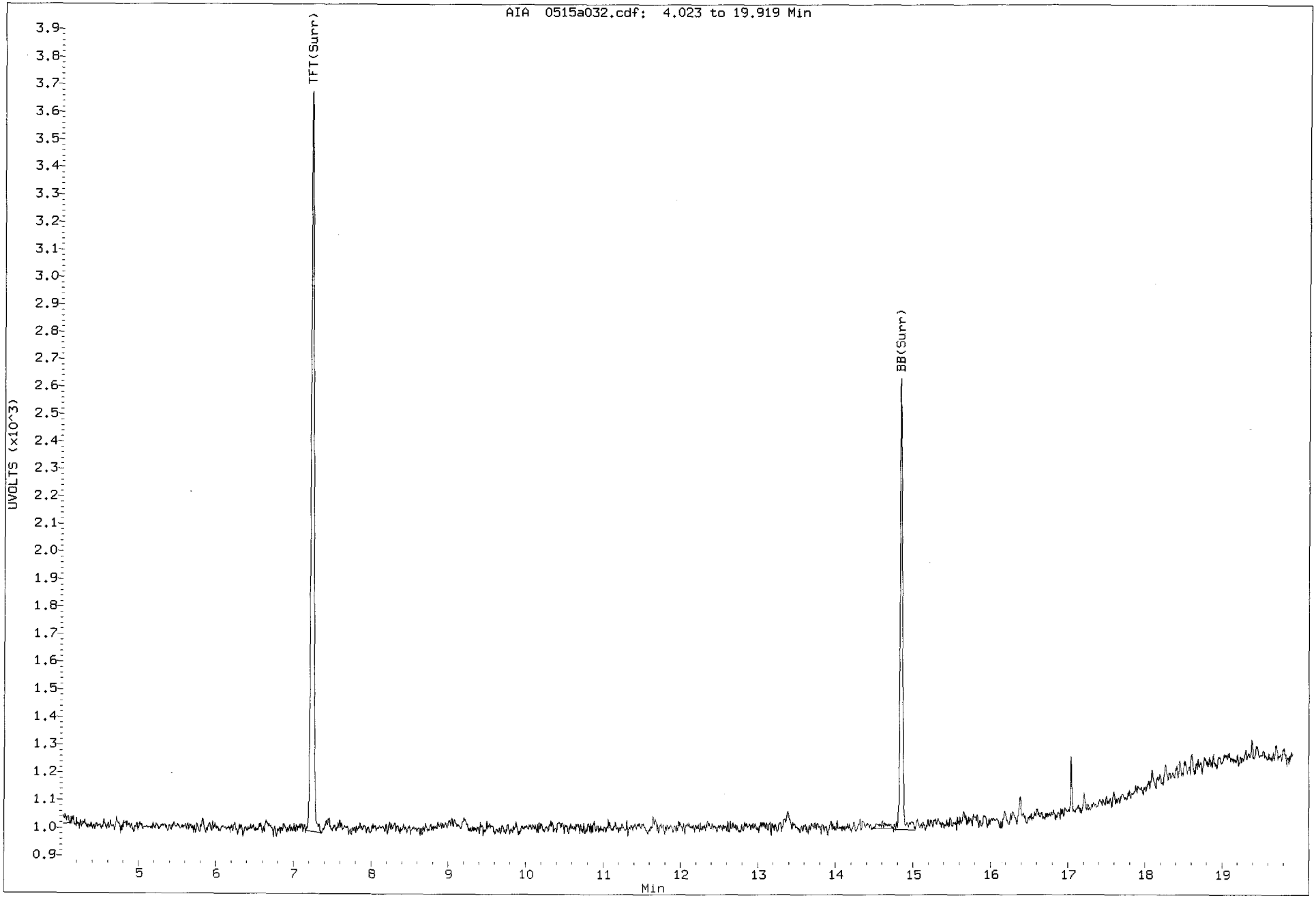
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051512a-1.b/0515a032.d/0515a032.cdf
Injection Date: 16-MAY-2012 02:30
Instrument: pid2.i
Client Sample ID: CBA-TP-7-0-1-0512

Before JW 5/16/12



Data File: /chem3/pid2.i/051512a-1.b/0515a033.d

Date : 16-MAY-2012 02:58

Client ID: CBA-SB-2-3-5-0512

Sample Info: UT78S

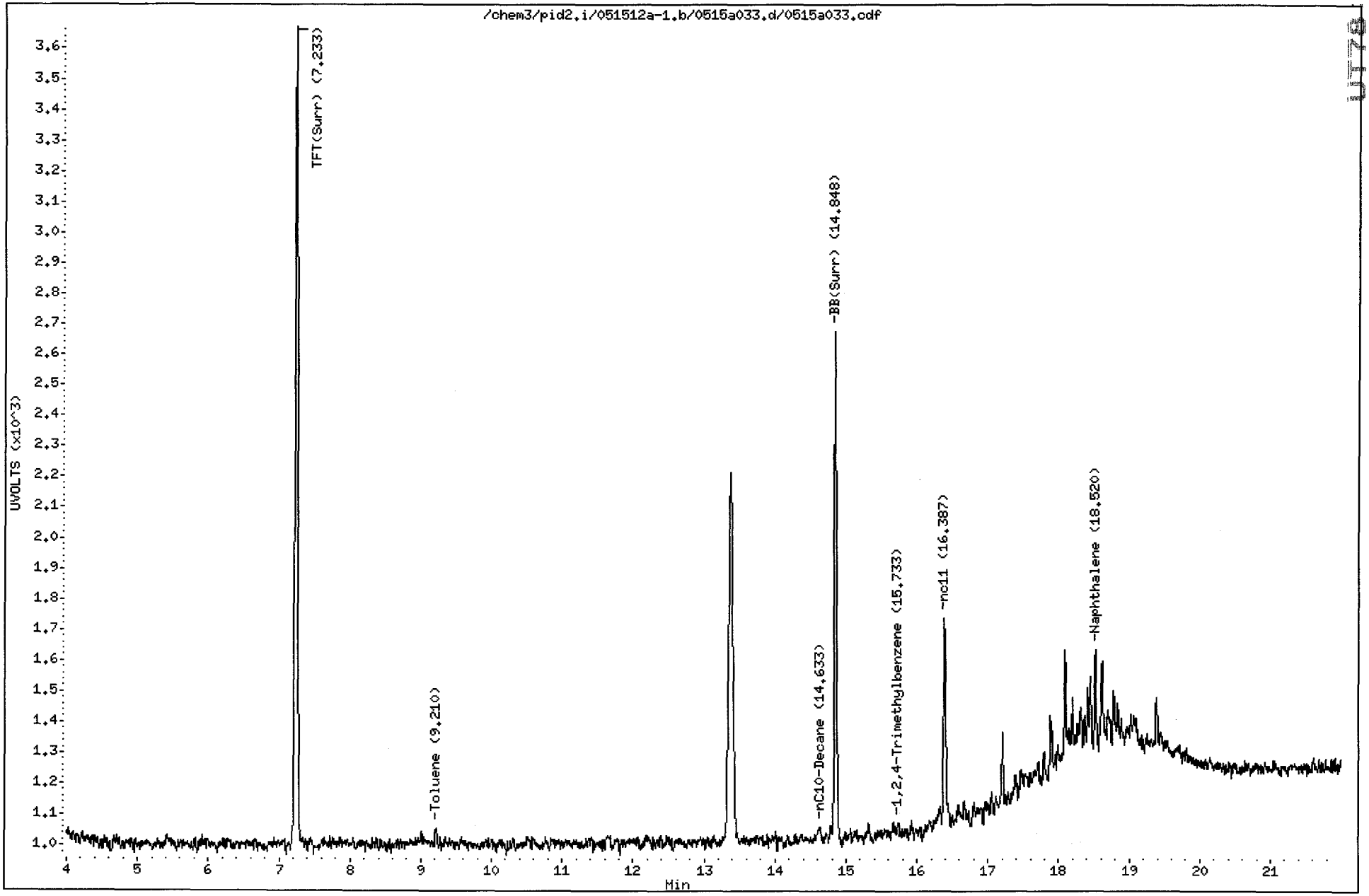
Column phase: RTX 502-2 FID

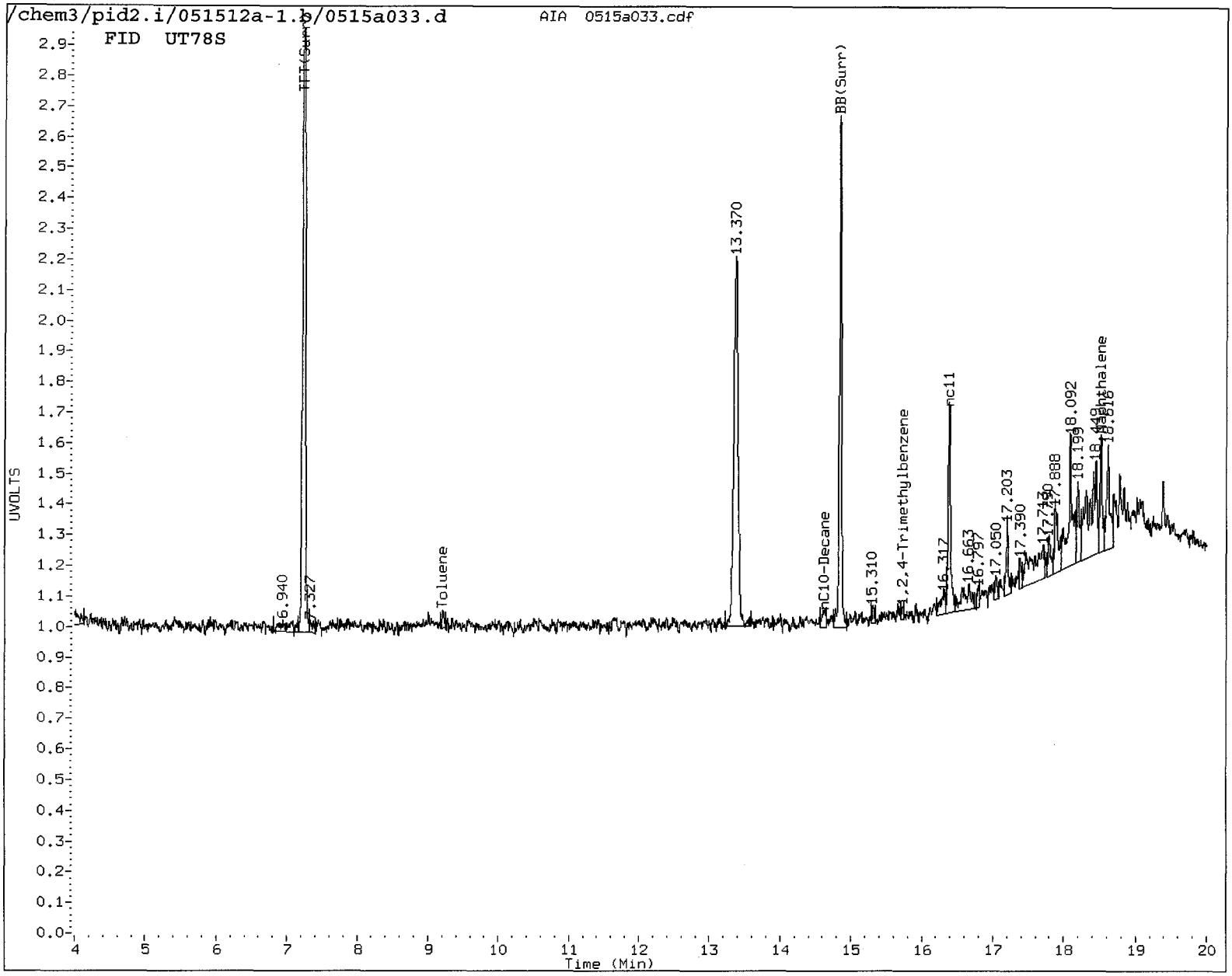
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00051





MANUAL INTEGRATION

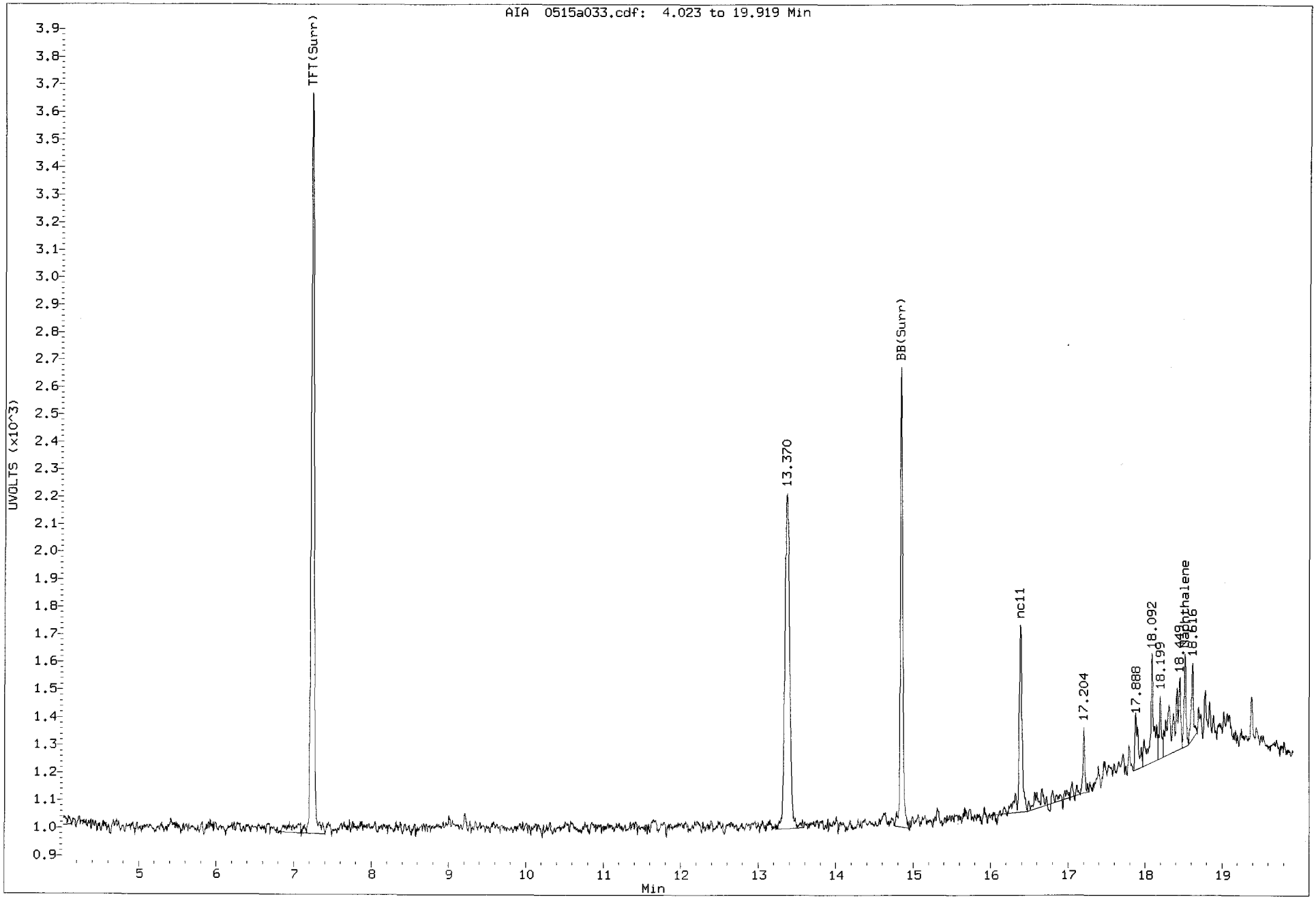
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/16/12

Before
JW
5/15/12

Data File: /chem3/pid2.i/051512a-1.b/0515a033.d/0515a033.cdf
Injection Date: 16-MAY-2012 02:58
Instrument: pid2.i
Client Sample ID: CBA-SB-2-3-5-0512



Data File: /chem3/pid2.i/051512a-1.b/0515a034.d

Date : 16-MAY-2012 03:26

Client ID: CBA-SB-2-3-5-0512

Sample Info: UT78SMS

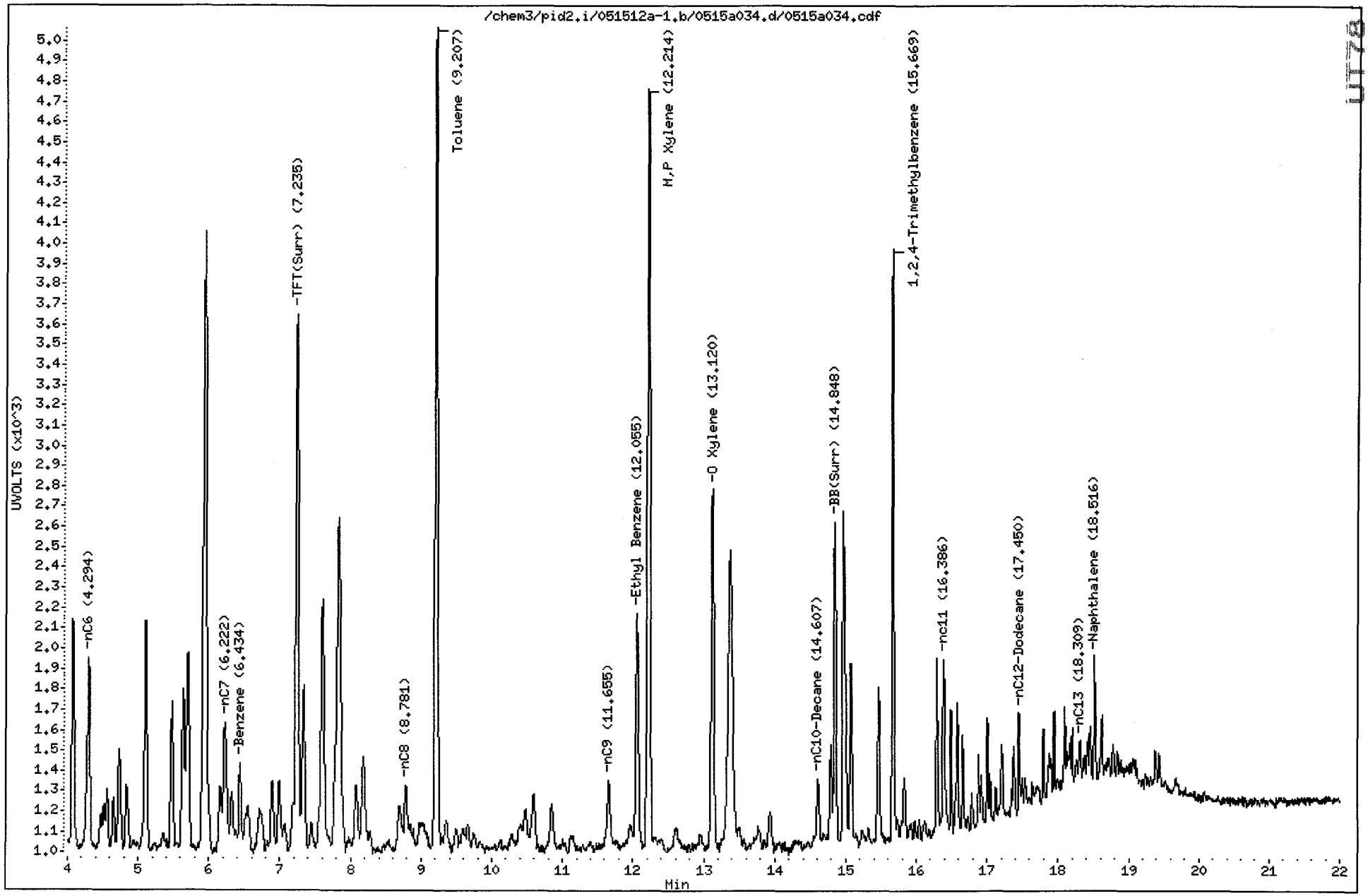
Column phase: RTX 502-2 FID

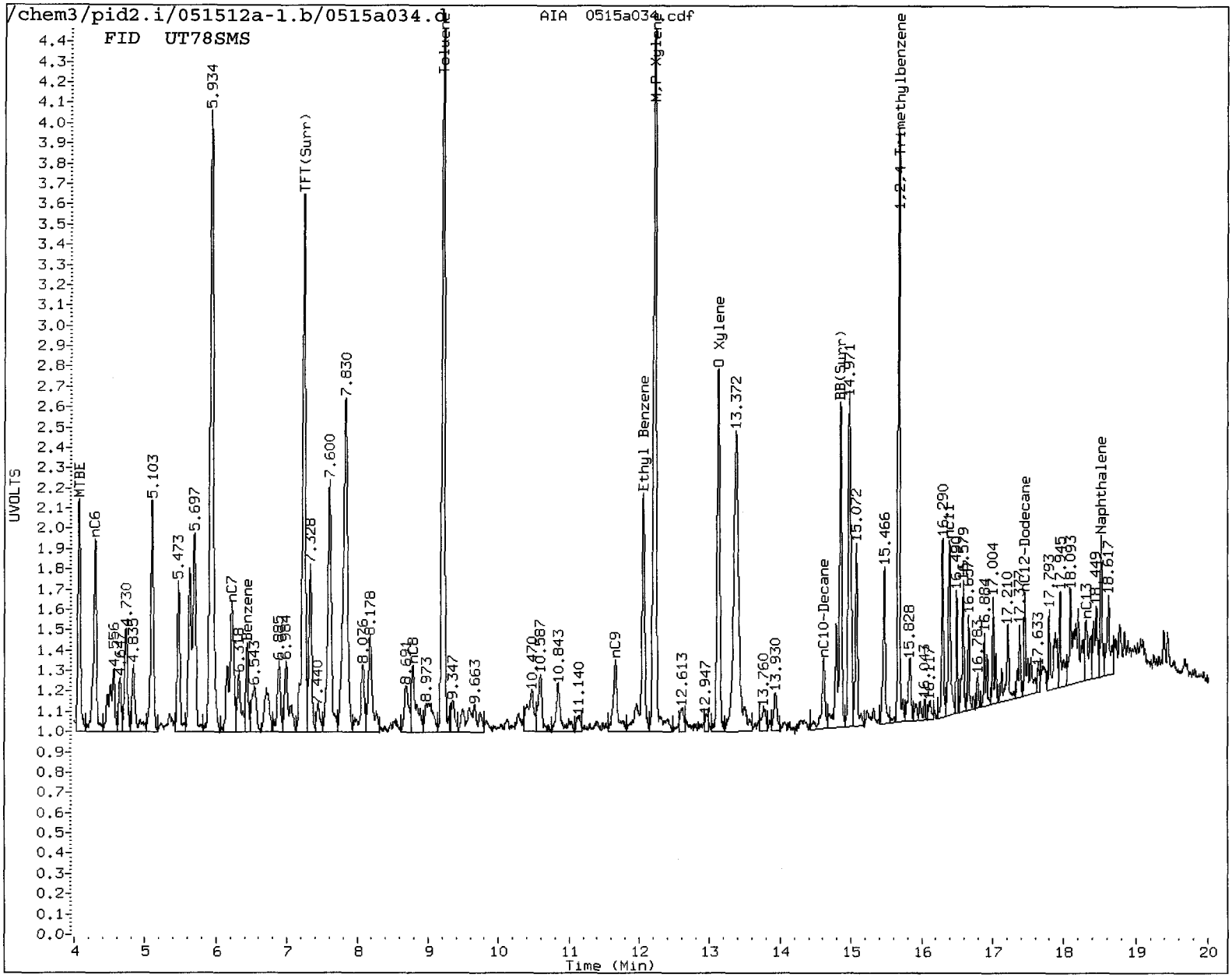
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00061



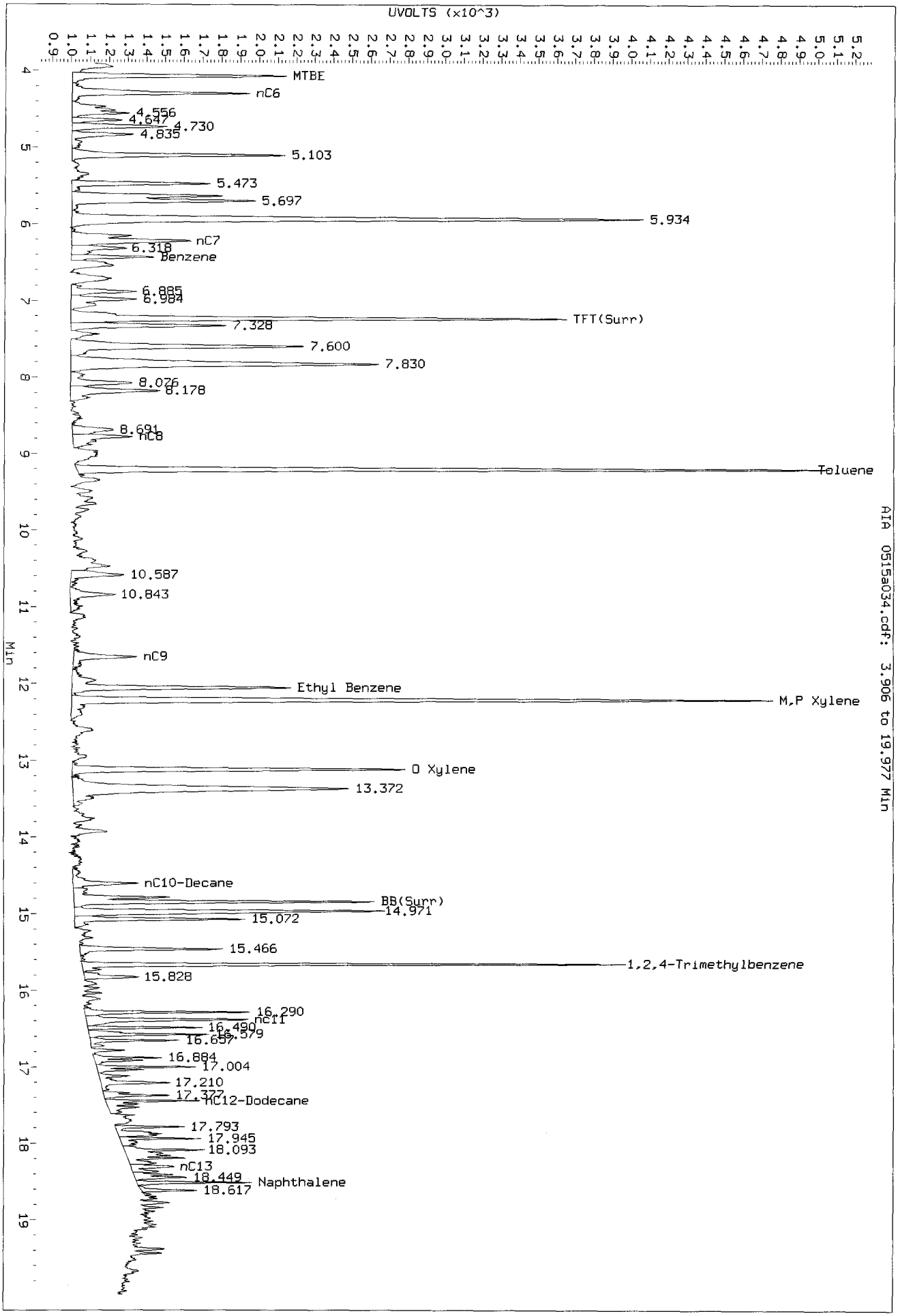


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12



Data File: /chem3/pid2.i/051512a-1.b/0515a034.d/0515a034.cdf
Injection Date: 16-MAY-2012 03:26
Instrument: pid2.i
Client Sample ID: CBA-SB-2-3-5-0512

Before SW 5/16/12

Data File: /chem3/pid2.i/051512a-1.b/0515a035.d

Date : 16-MAY-2012 03:55

Client ID: CBA-SB-2-3-5-0512

Sample Info: UT78SMSD

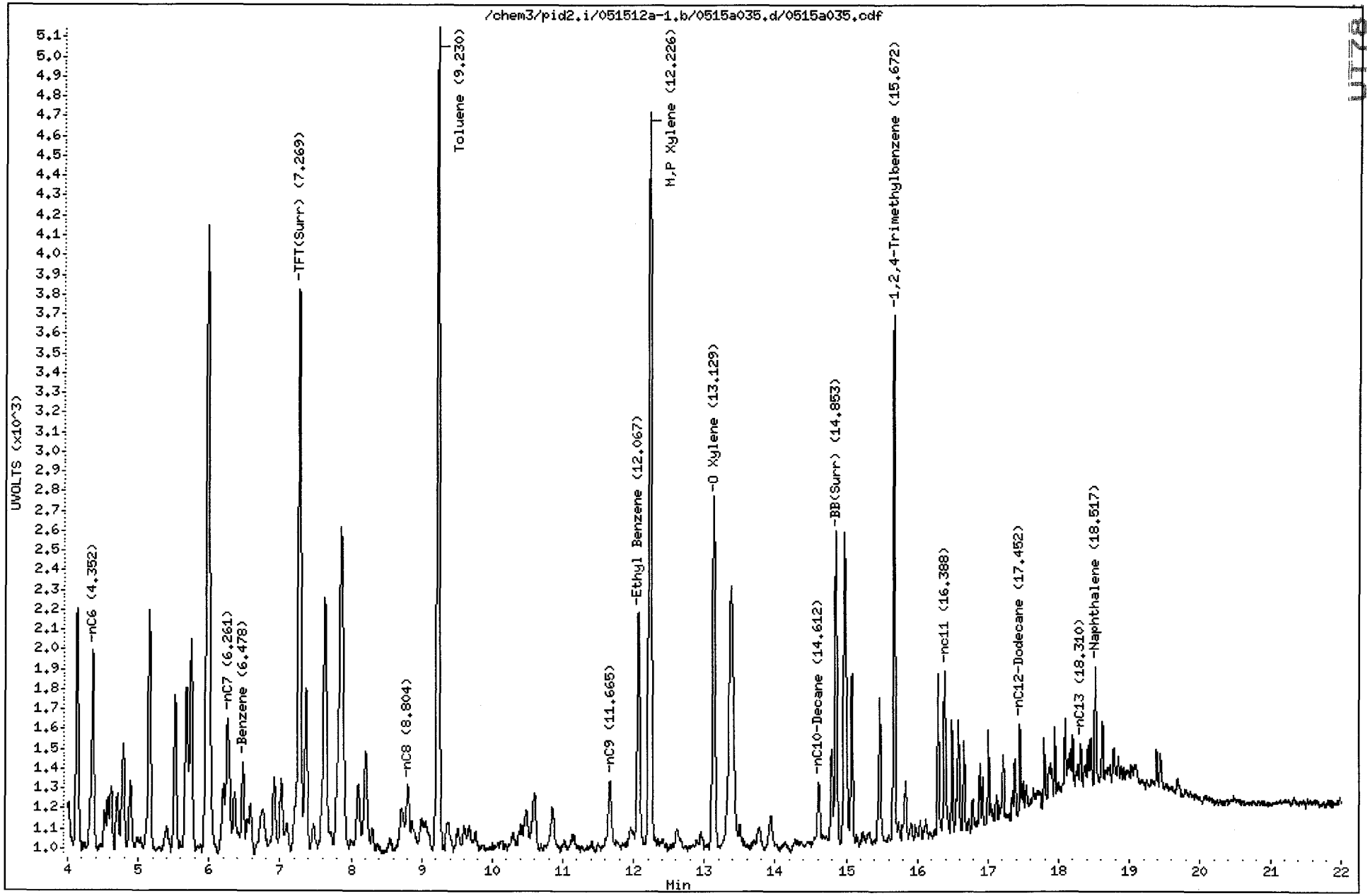
Column phase: RTX 502-2 FID

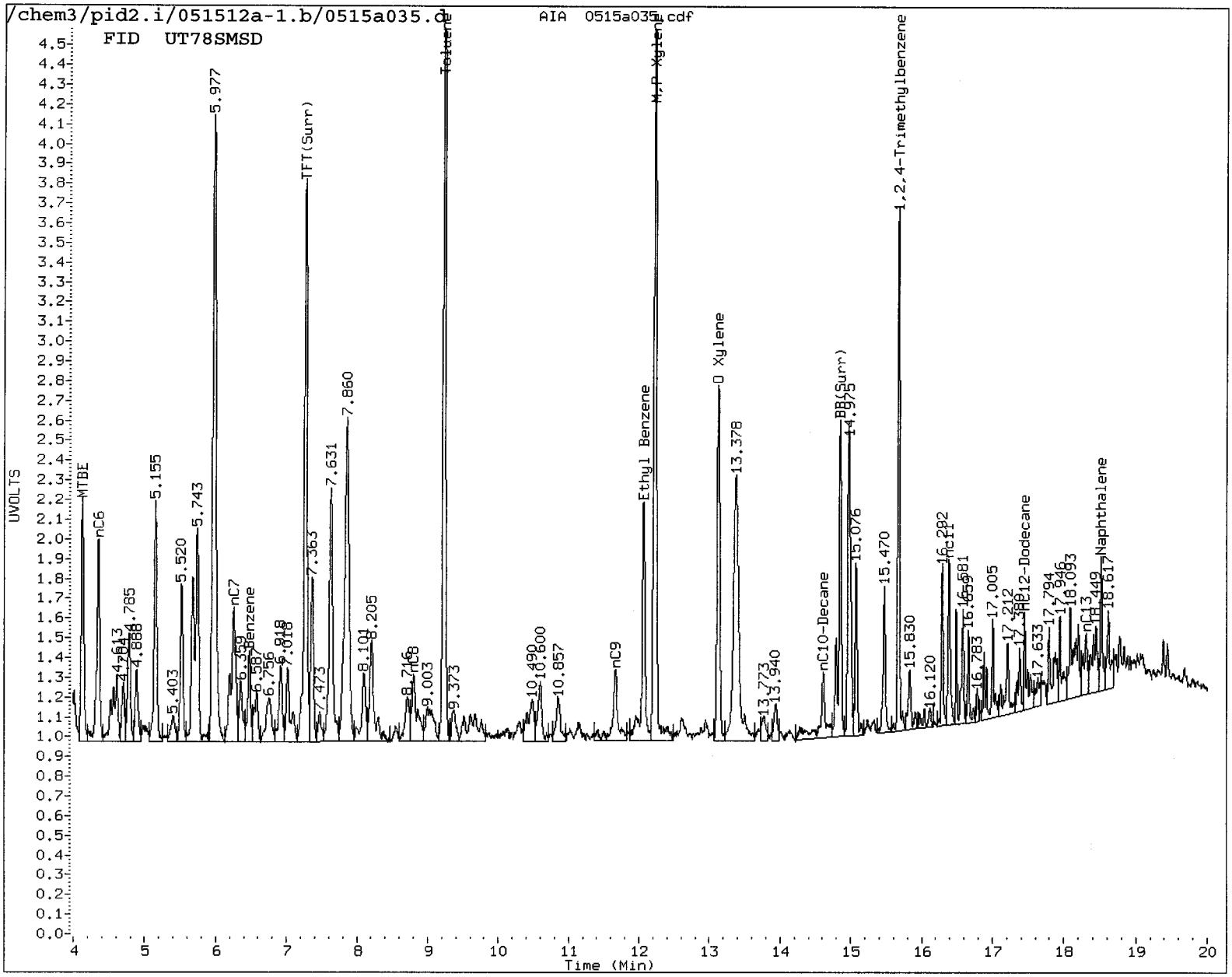
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00057



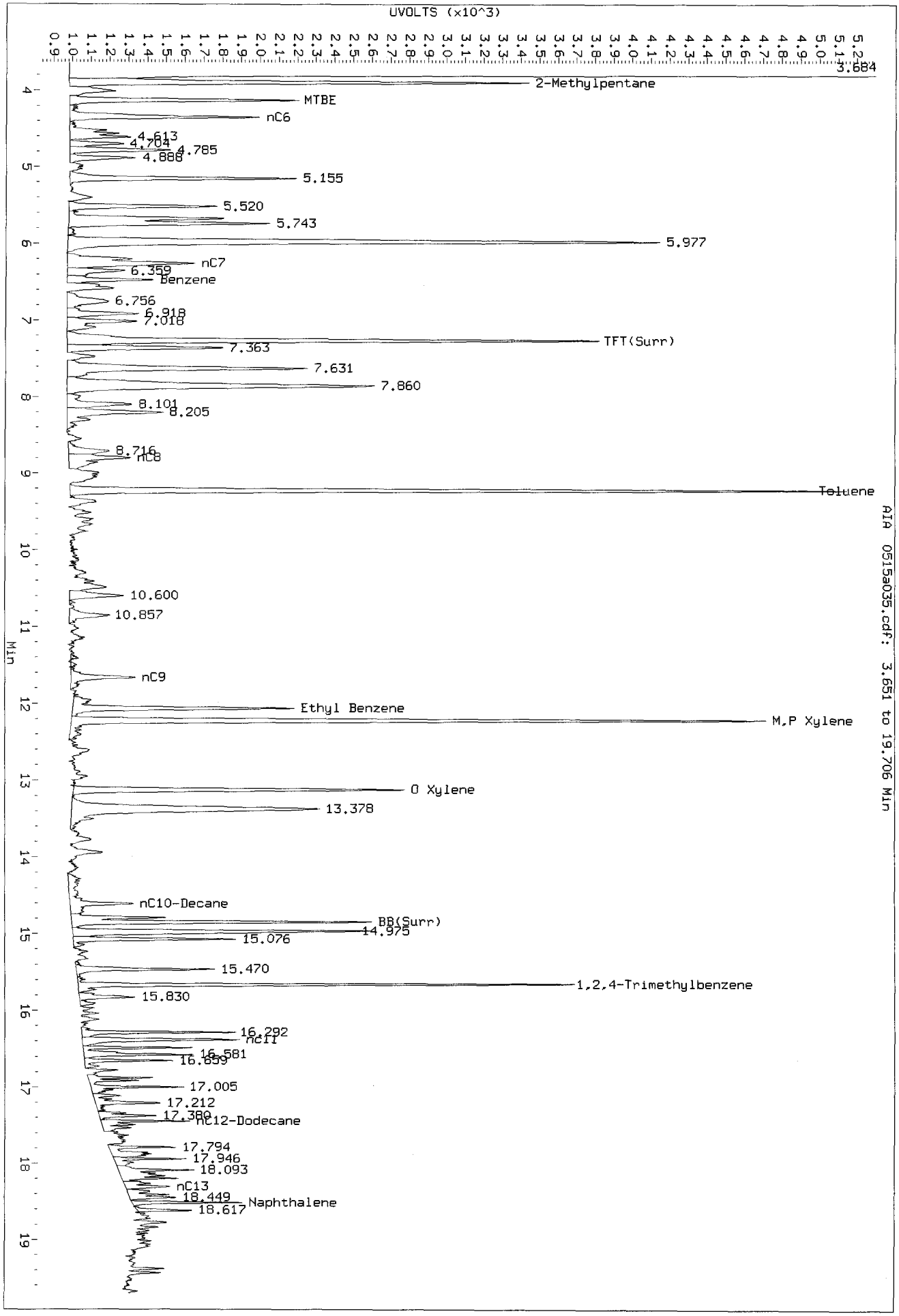


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/16/12



Data File: /chem3/pid2.i/051512a-1.b/0515a035.d/0515a035.cdf
Injection Date: 16-MAY-2012 03:55
Instrument: pid2.i
Client Sample ID: CBA-SB-2-3-5-0512

Before
JW
5/16/12

Data File: /chem3/pid2.i/051612-1.b/0516a006.d

Page 1

Date : 16-MAY-2012 12:13

Client ID:

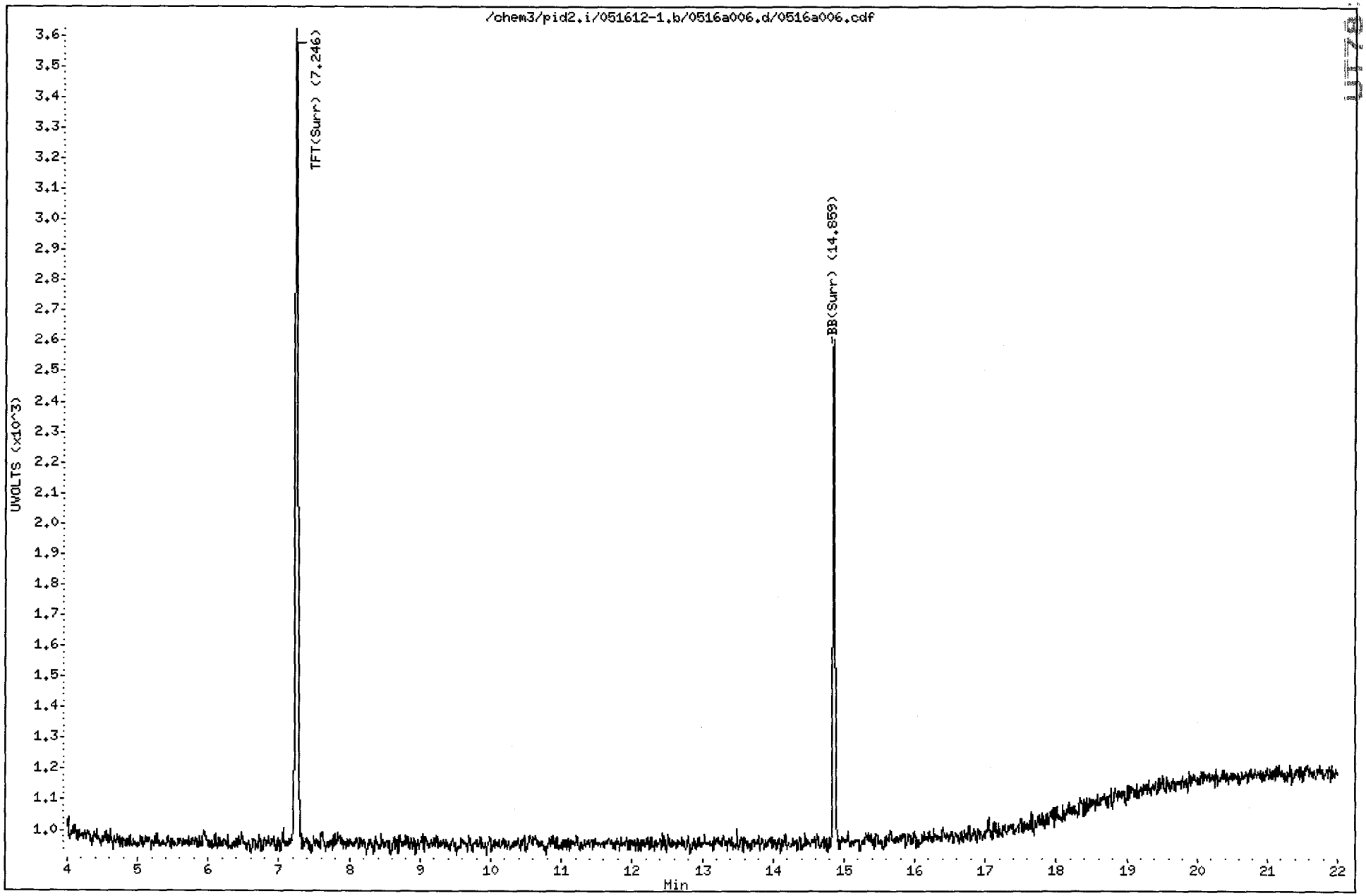
Instrument: pid2.i

Sample Info: MB0516

Operator: JW

Column phase: RTX 502-2 FID

Column diameter: 0.18



Data File: /chem3/pid2.i/051612-1.b/0516a004.d

Date : 16-MAY-2012 11:17

Client ID:

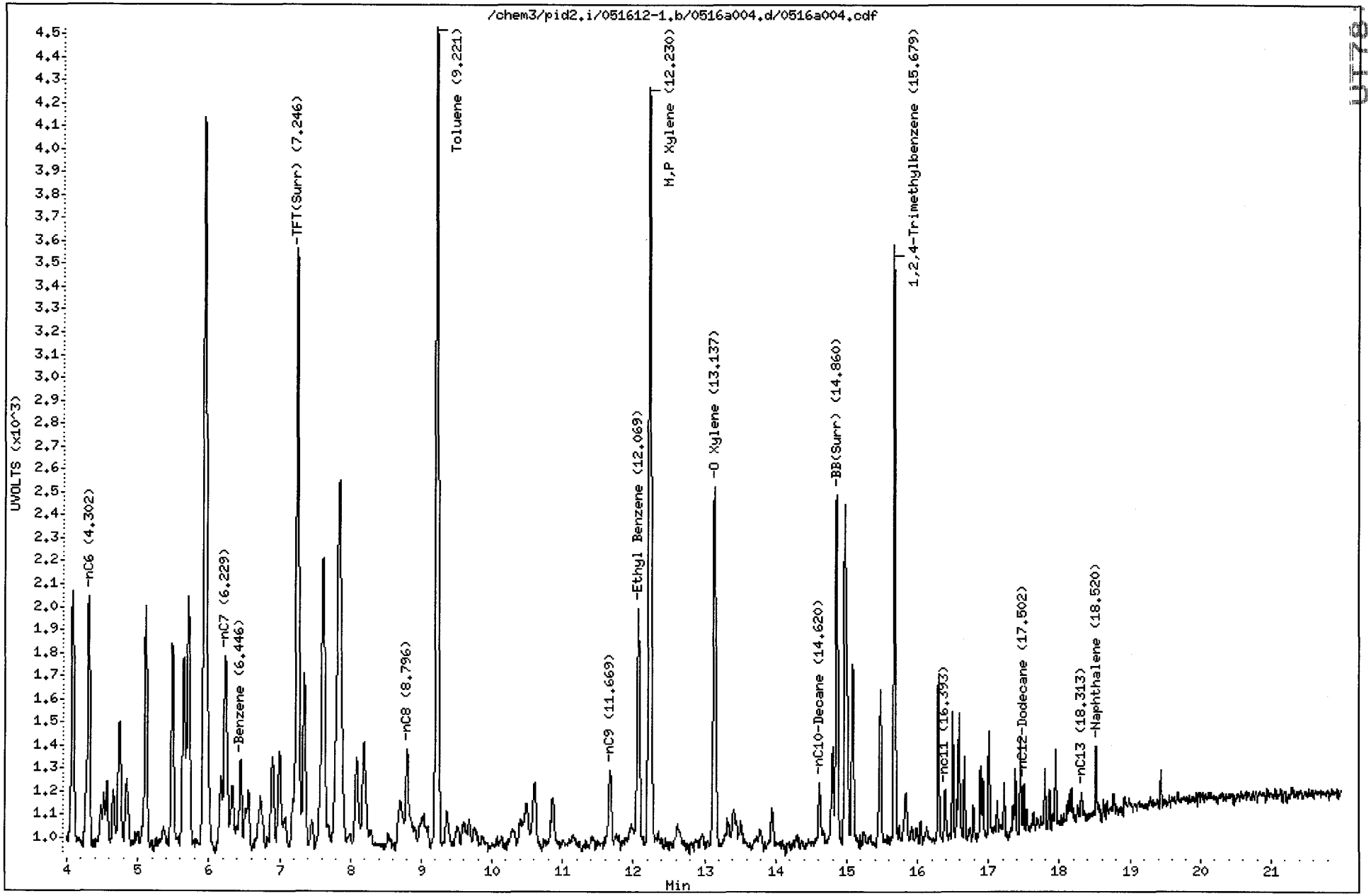
Sample Info: LCS0516

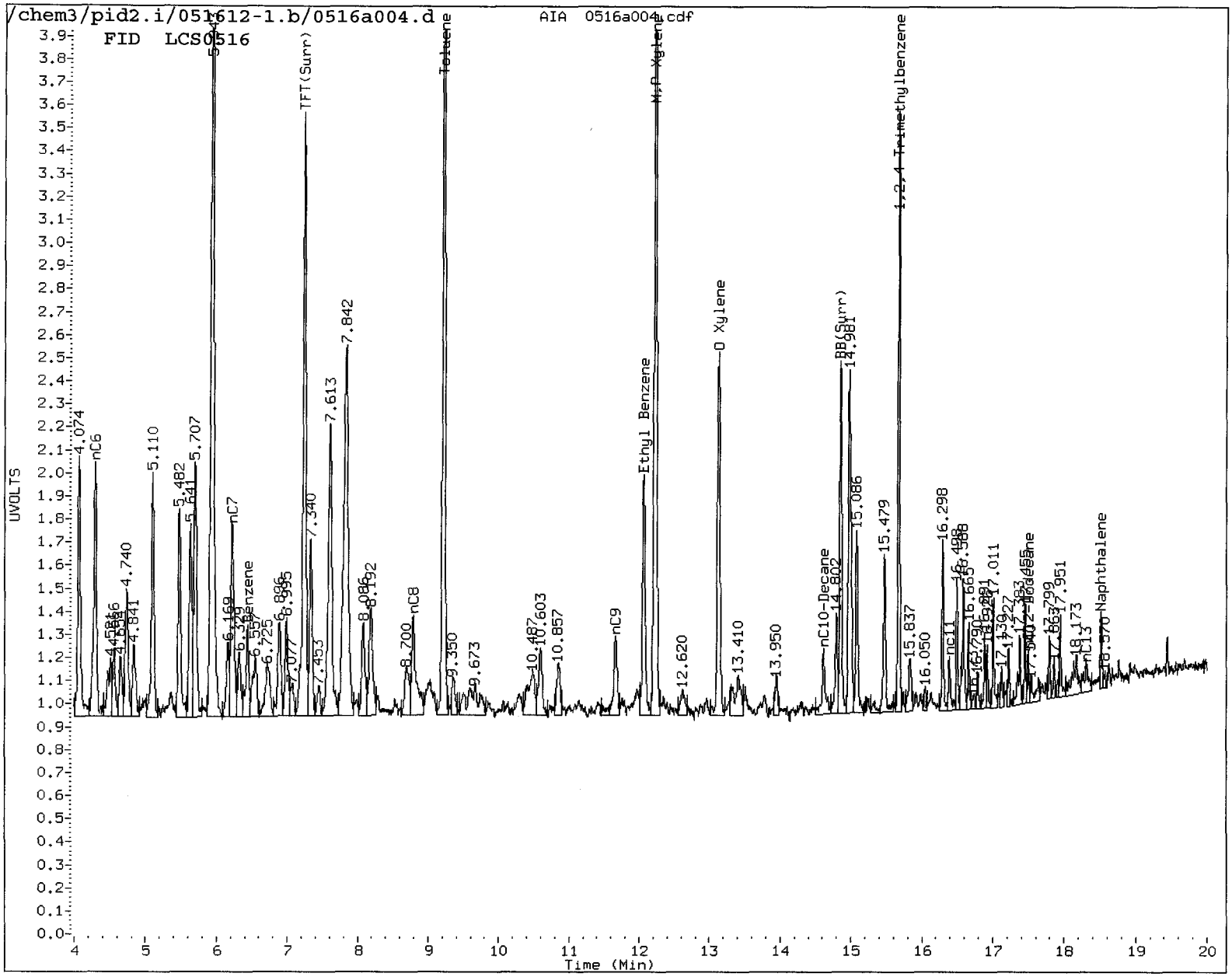
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



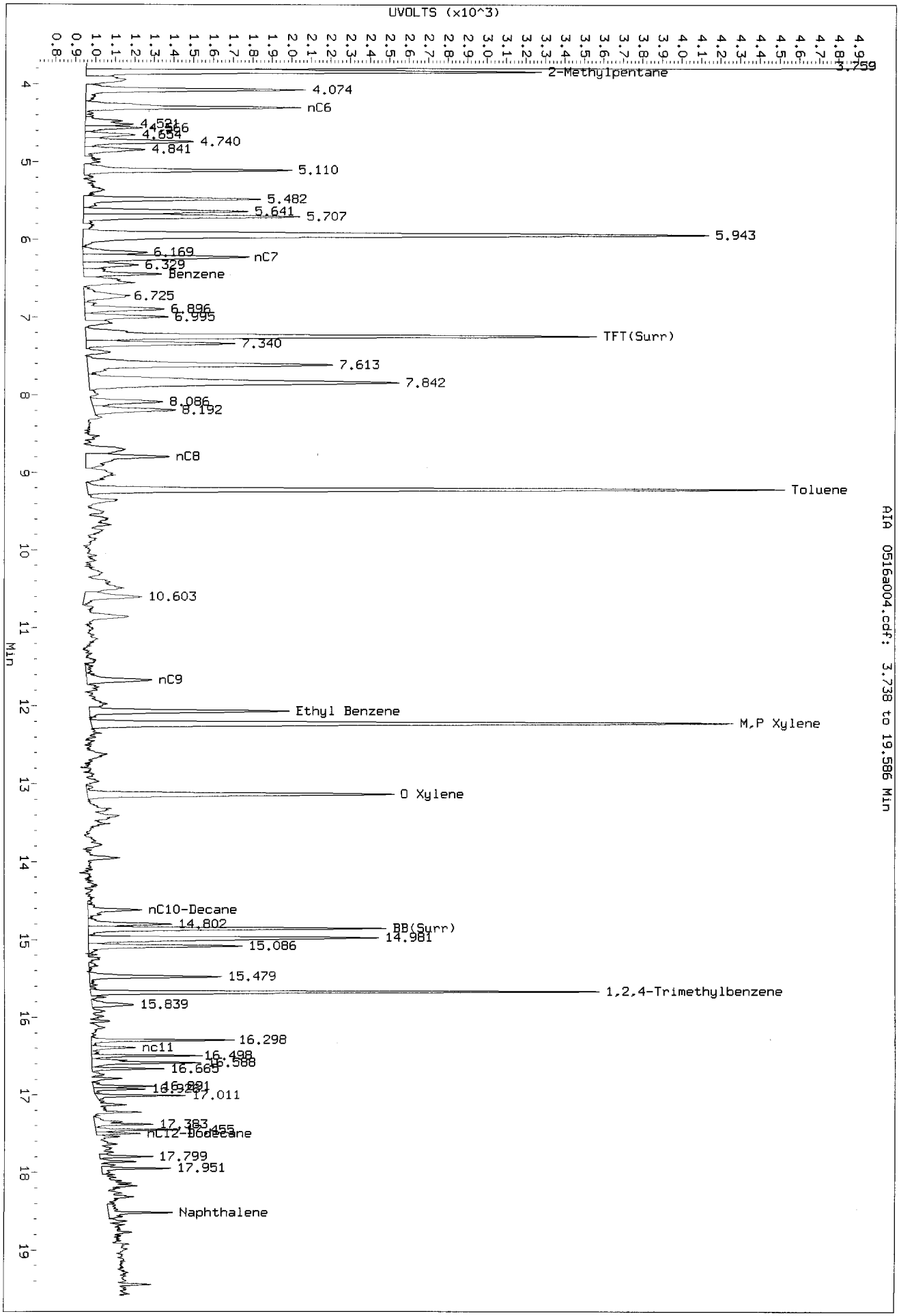


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12



Data File: /chem3/pid2.i/051612-1.b/0516a004.d/0516a004.cdf
Injection Date: 16-MAY-2012 11:17
Instrument: pid2.i
Client Sample ID:

AIA 0516a004.cdf: 3.738 to 19.586 Min

Before 30 Gallon

UT78:00073

Data File: /chem3/pid2.i/051612-1.b/0516a005.d

Date : 16-MAY-2012 11:45

Client ID:

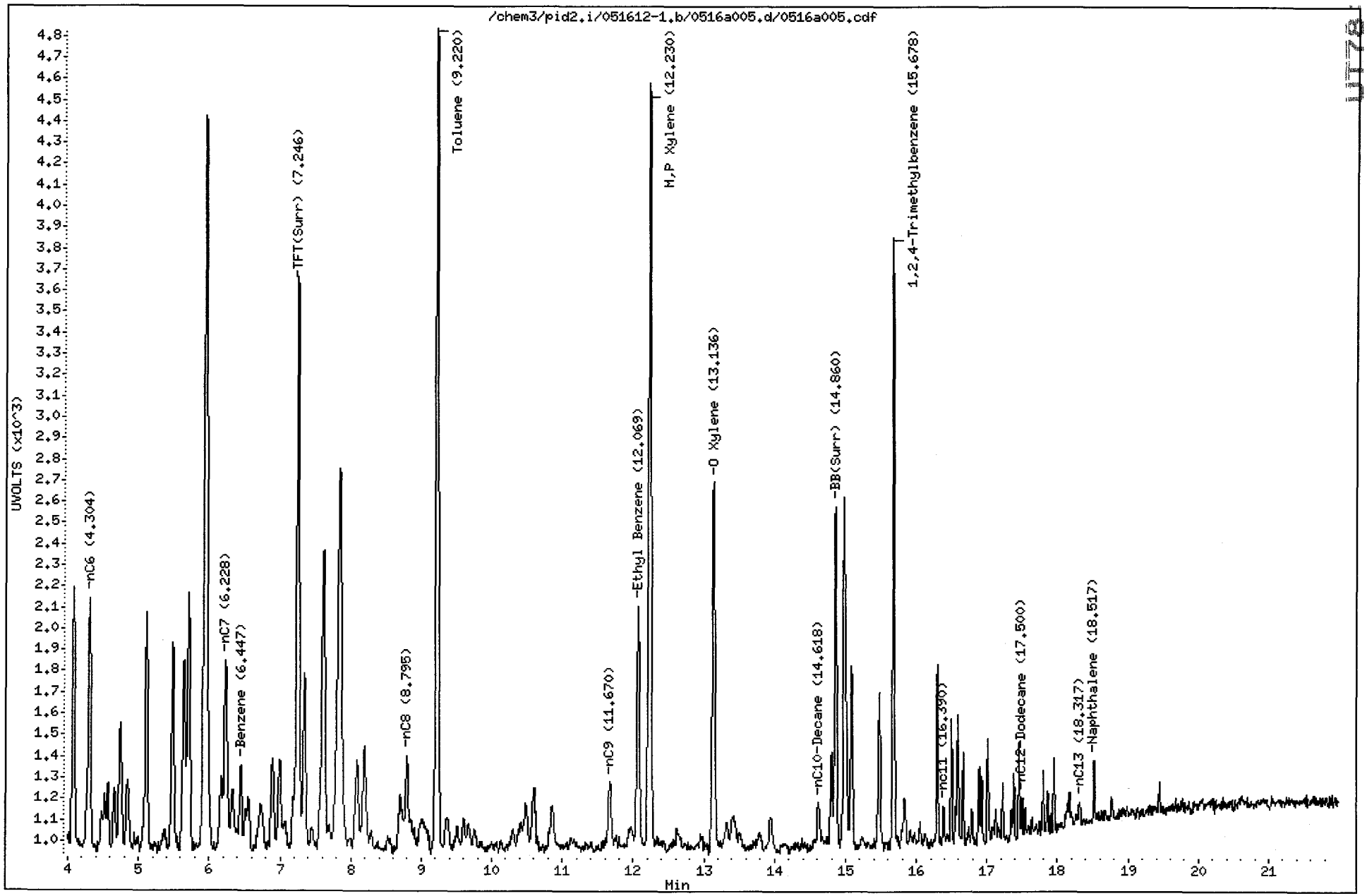
Sample Info: LCSD0516

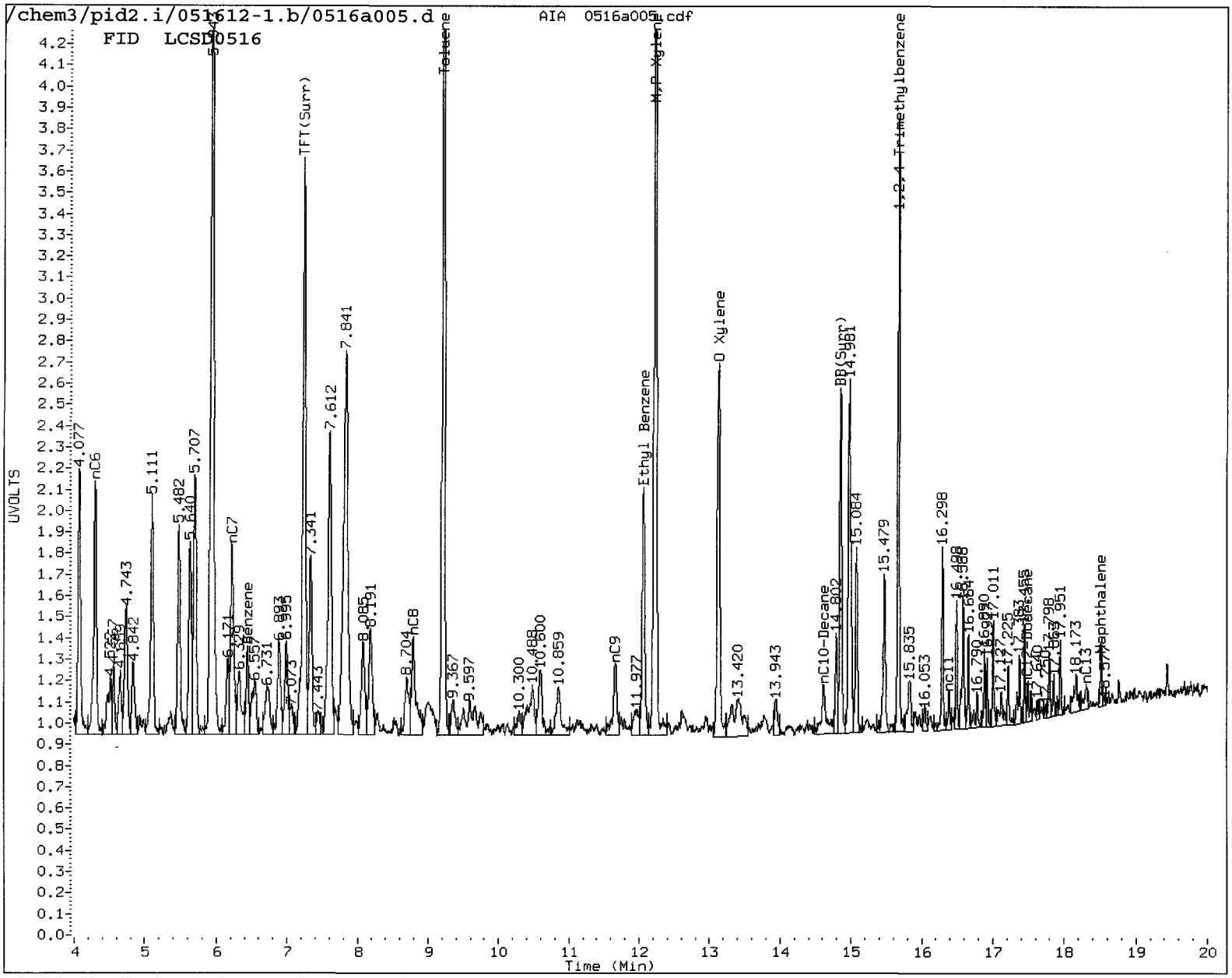
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18



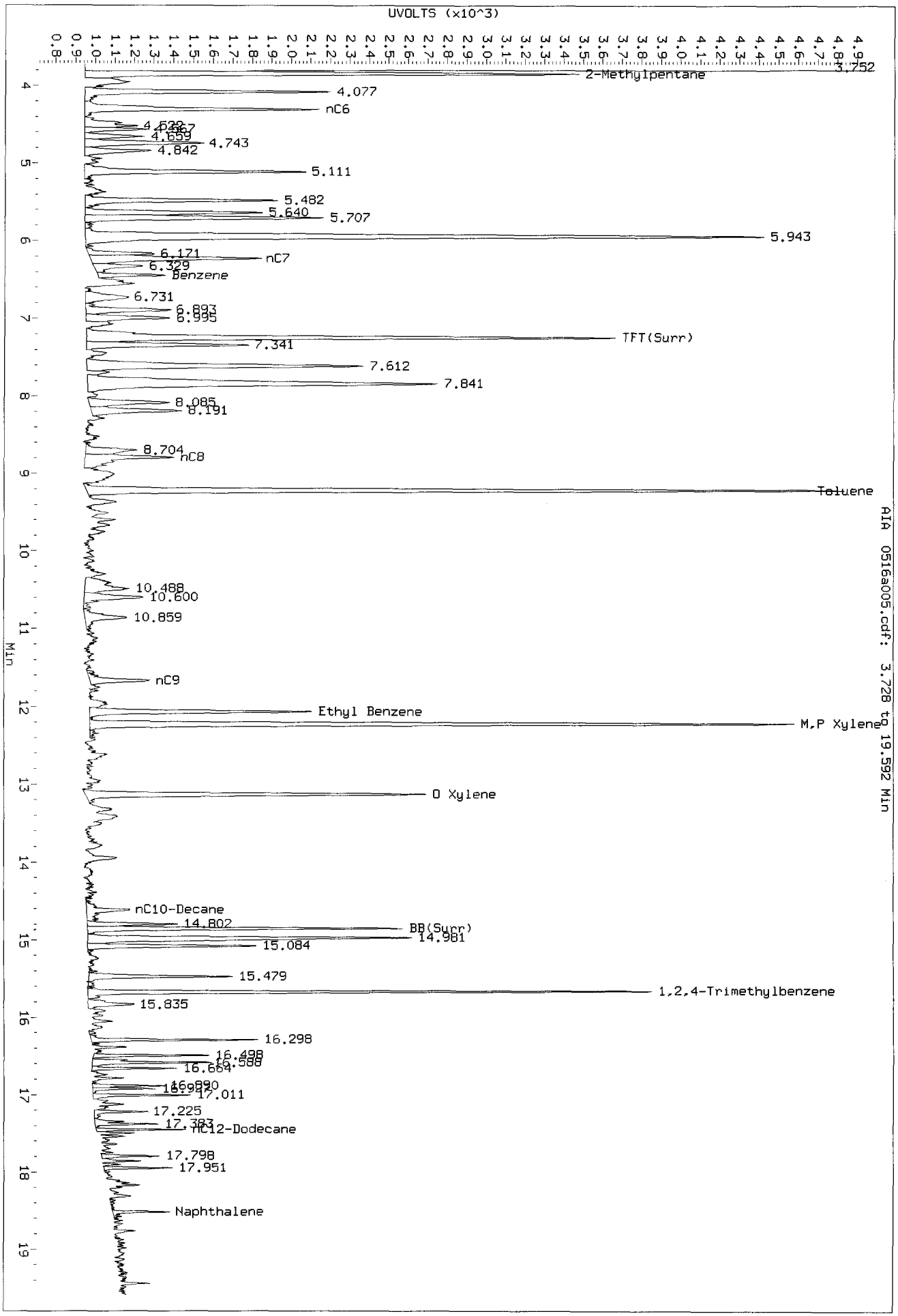


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12


UVOLTS (x10^3)
Min
2-Methylpentane
4.077
nC6
4.659
4.743
4.842
5.111
5.482
5.640
5.707
5.943
6.171
nC7
6.329
Benzene
6.731
6.995
TFT(Surr)
7.341
7.612
7.841
8.085
8.191
8.704
nC8
Toluene
10.488
10.600
10.859
nC9
Ethyl Benzene
M,P Xylene
O Xylene
nC10-Decane
14.802
BB(Surr)
14.981
15.084
15.479
1,2,4-Trimethylbenzene
15.835
16.298
16.664
17.011
17.225
nC12-Dodecane
17.798
17.951
Naphthalene
Data File: /chem3/pid2.i/051612-1.b/0516a005.d/0516a005.cdf
Injection Date: 16-MAY-2012 11:45
Instrument: pid2.i
Client Sample ID:
AIA 0516a005.cdf: 3.728 to 19.592 Min

UT78 : 00076

Data File: /chem3/pid2.i/051612-1.b/0516a007.d

Date : 16-MAY-2012 13:05

Client ID: CBA-SB-1-3-5-0512

Sample Info: UT78B

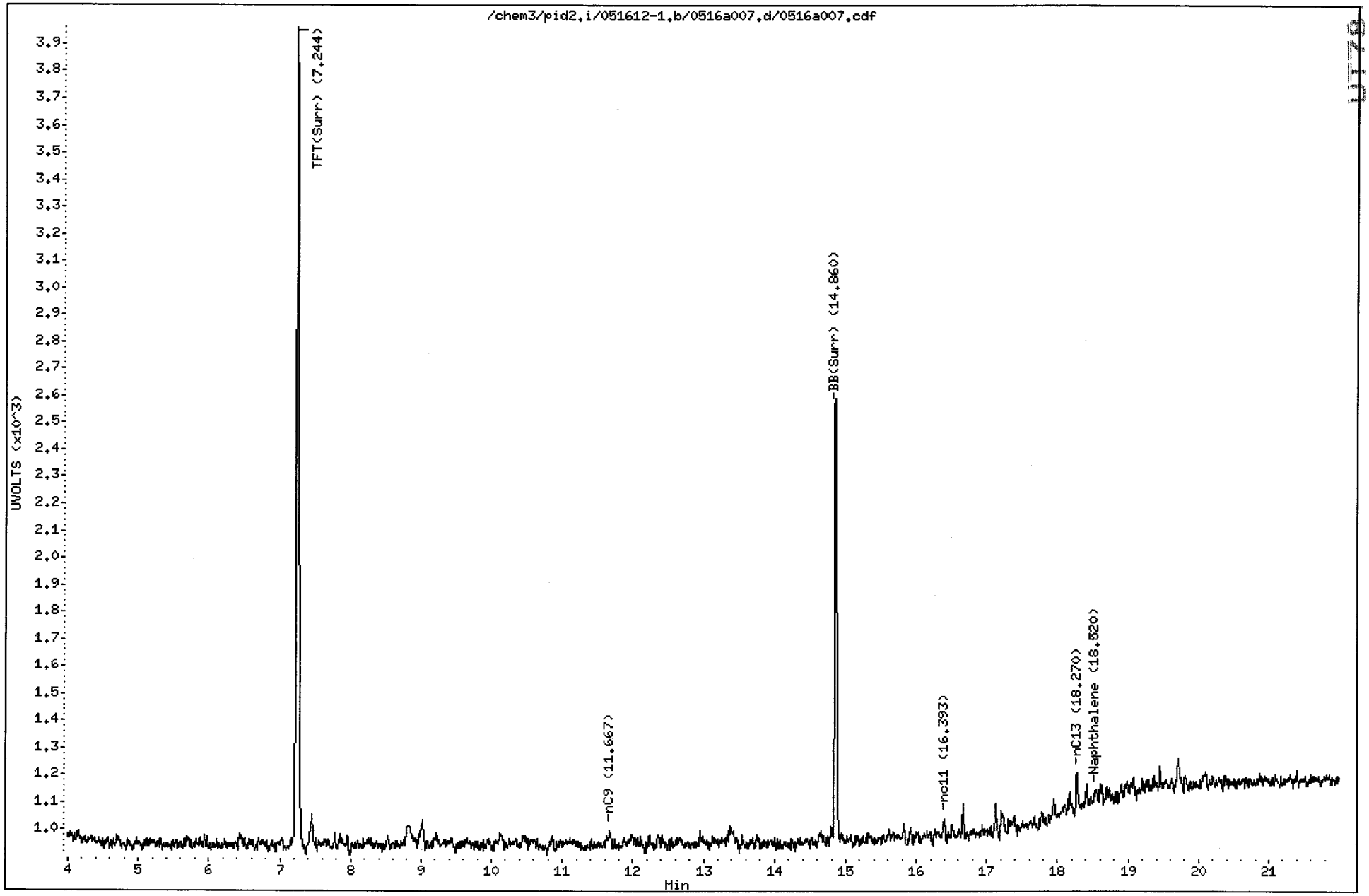
Column phase: RTX 502-2 FID

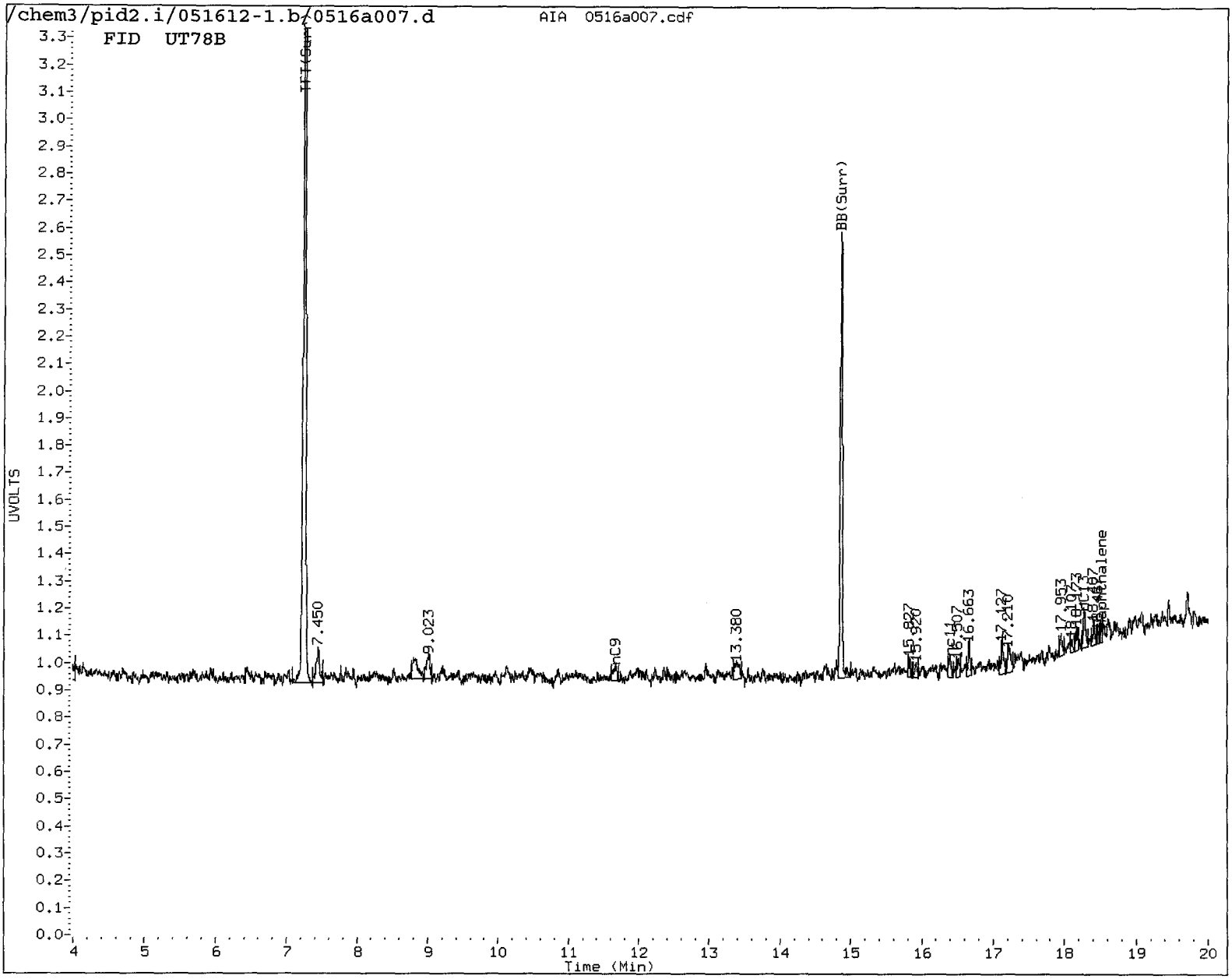
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00077





MANUAL INTEGRATION

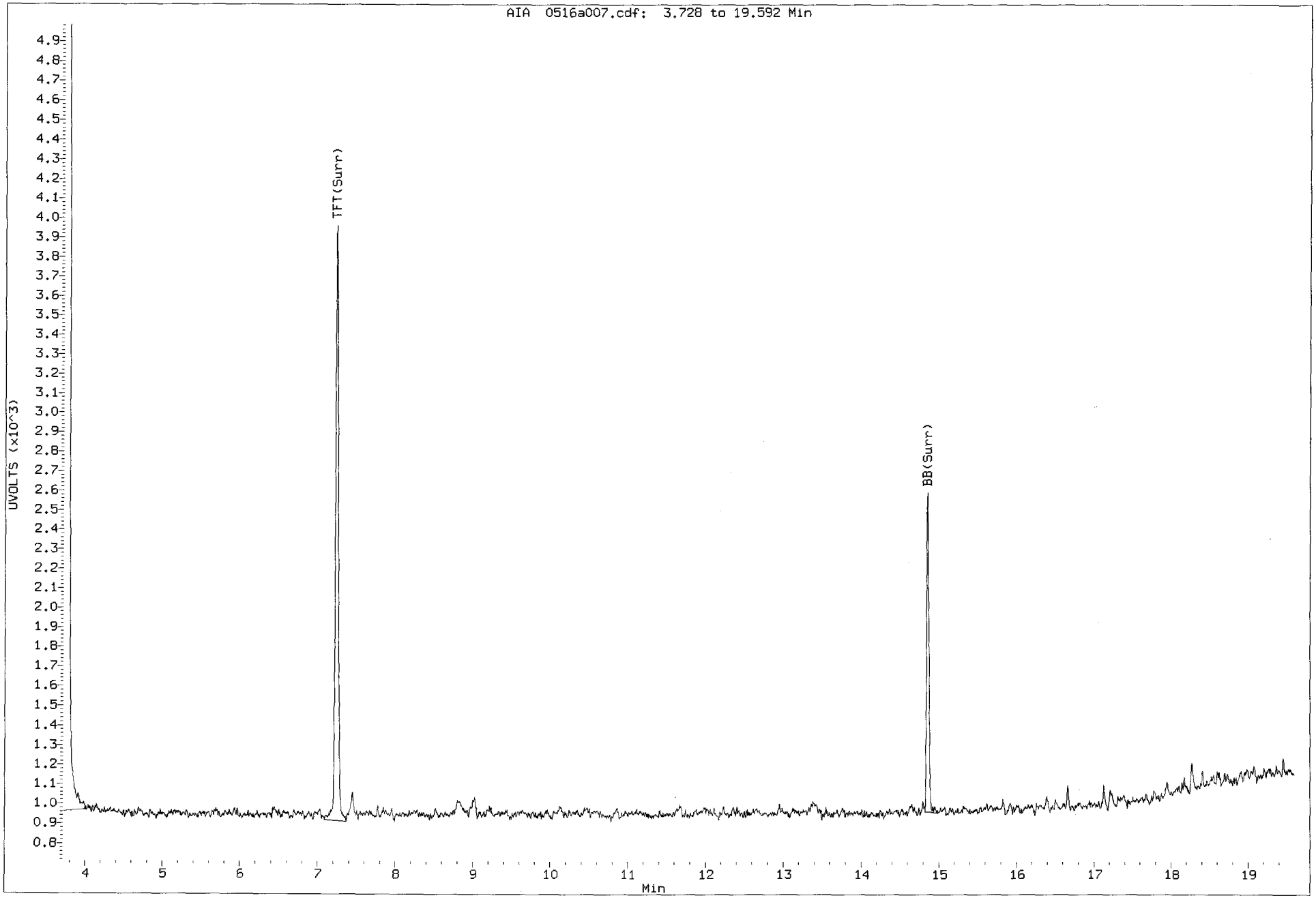
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/16/12

Before IC 5/16/12

Data File: /chem3/pid2.i/051612-1.b/0516a007.d/0516a007.cdf
Injection Date: 16-MAY-2012 13:05
Instrument: pid2.i
Client Sample ID: CBA-SB-1-3-5-0512



Data File: /chem3/pid2.i/051612-1.b/0516a008.d

Date : 16-MAY-2012 13:33

Client ID: CBA-SB-3-1-3-0512

Sample Info: UT78D

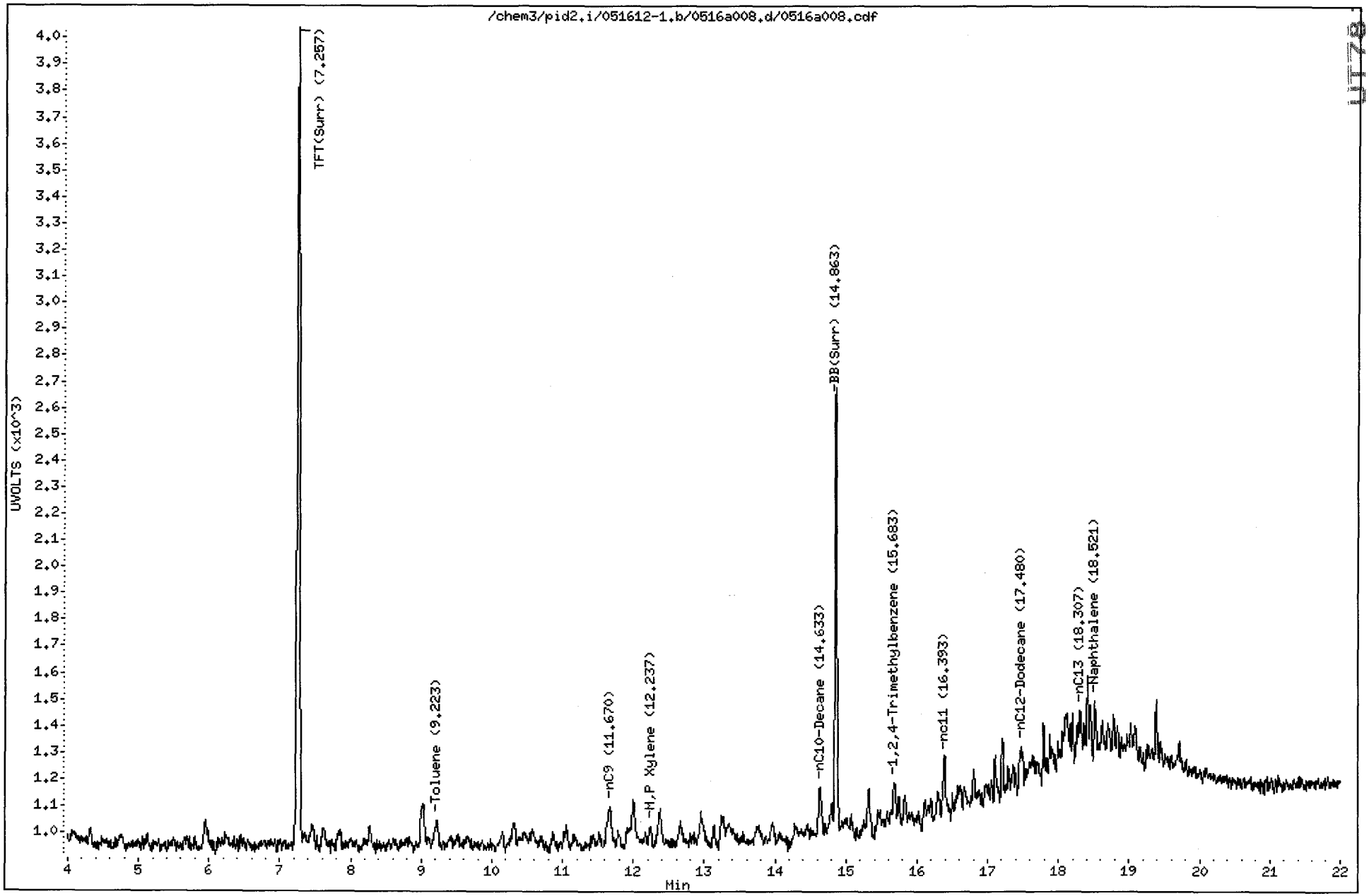
Column phase: RTX 502-2 FID

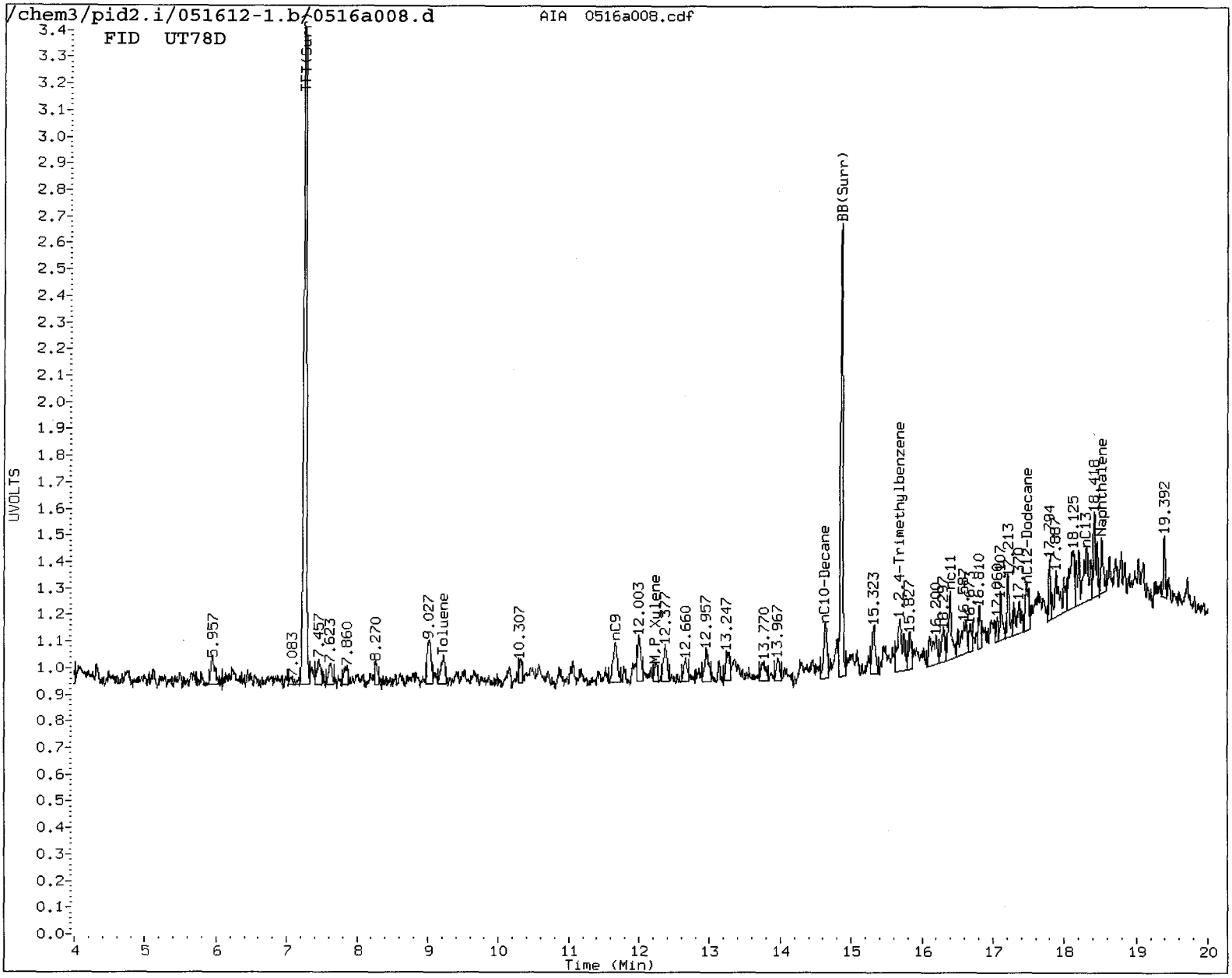
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 60030





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

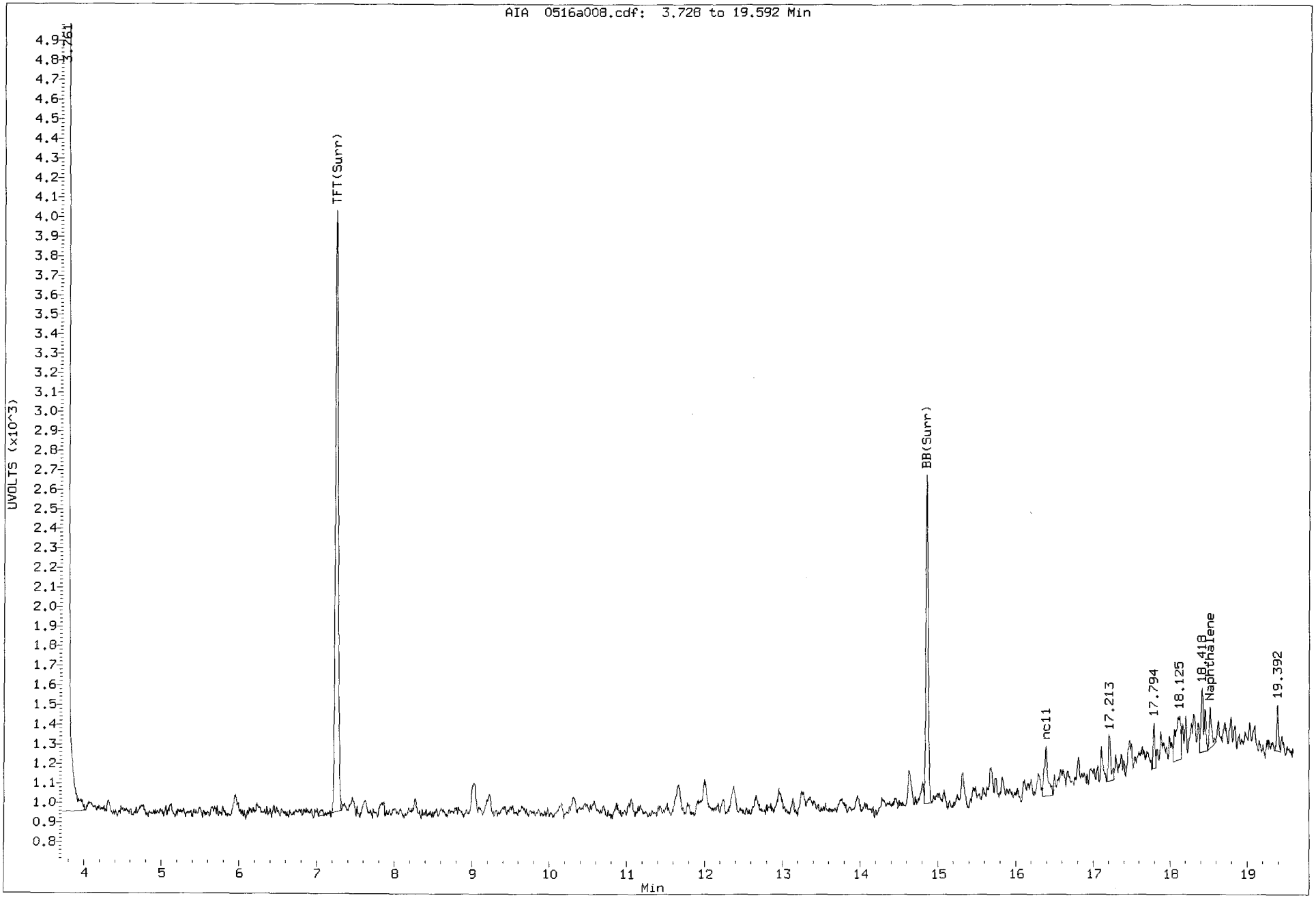
5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051612-1.b/0516a008.d/0516a008.cdf
Injection Date: 16-MAY-2012 13:33
Instrument: pid2.i
Client Sample ID: CBA-SB-3-1-3-0512

Before JD 5/16/12

UT73:00032



Data File: /chem3/pid2.i/051612-1.b/0516a009.d

Date : 16-MAY-2012 14:01

Client ID: CBA-SB-4-0.5-2.5-05

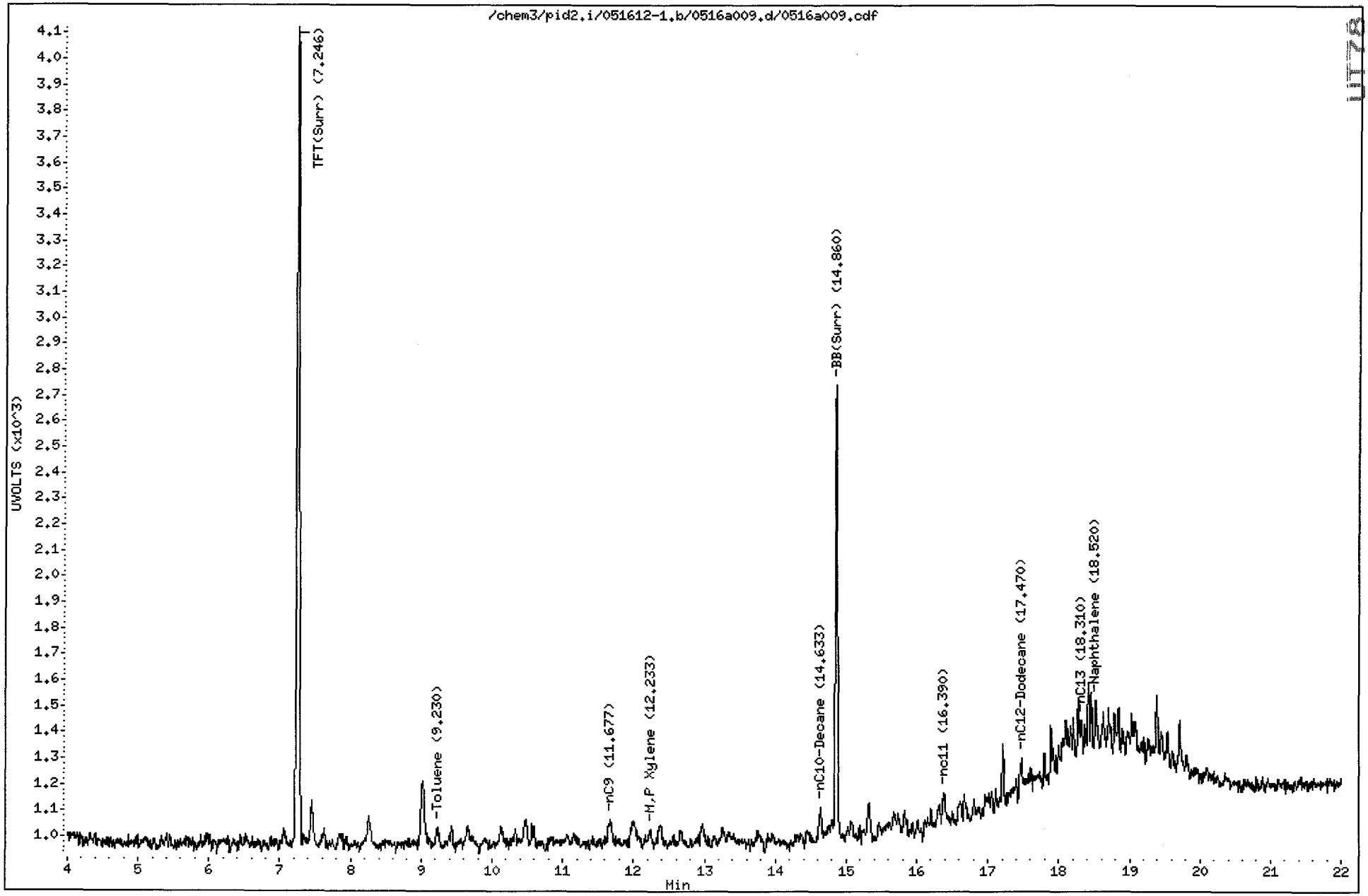
Sample Info: UT78E

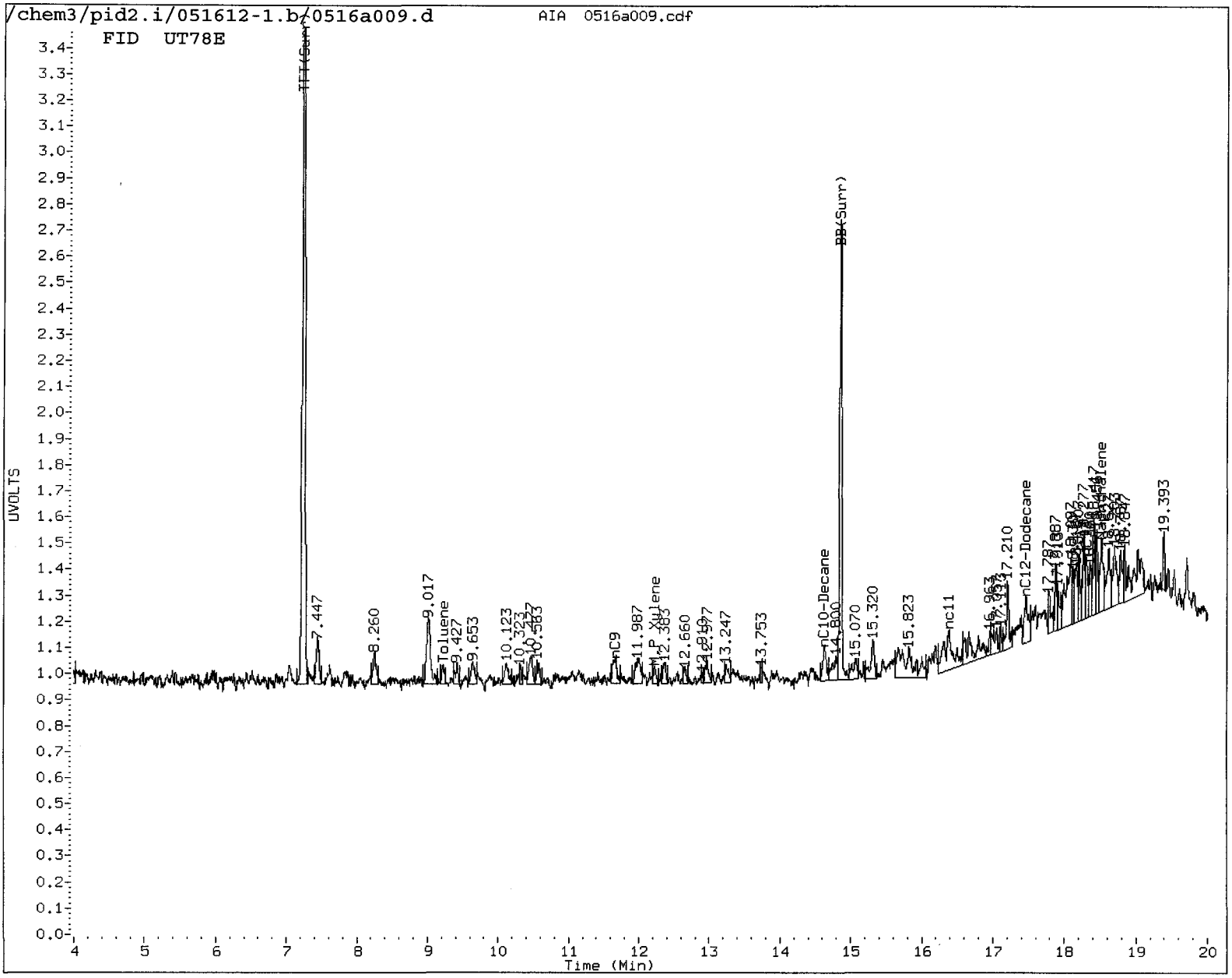
Column phase: RTX 502-2 FID

Instrument: pid2.i

Operator: JW

Column diameter: 0.18





MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

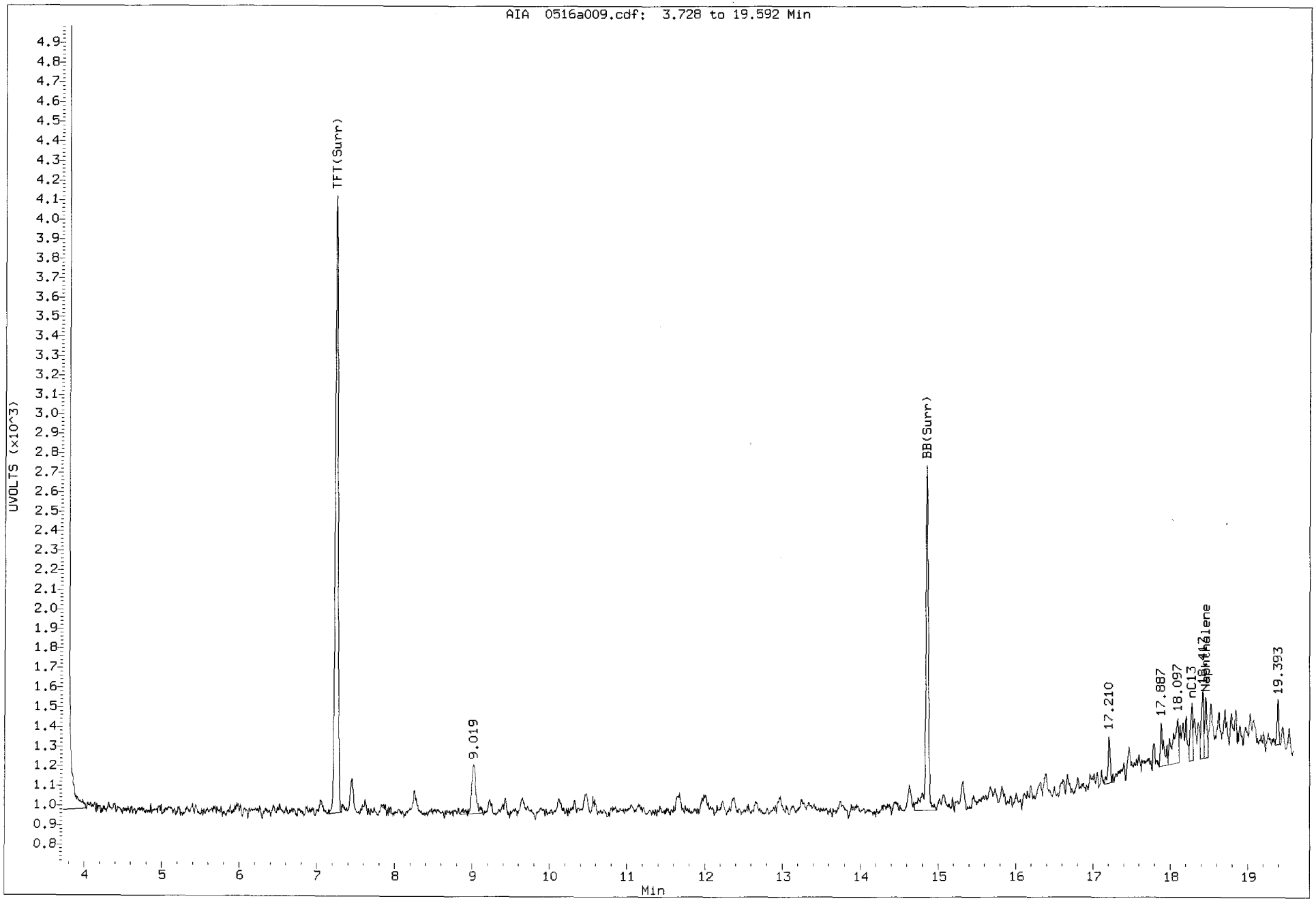
5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051612-1.b/0516a009.d/0516a009.cdf
Injection Date: 16-MAY-2012 14:01
Instrument: pid2.i
Client Sample ID: CBA-SB-4-0.5-2.5-05

Before JLJ 5/18/12

UTP 000035



Data File: /chem3/pid2.i/051612-1.b/0516a010.d

Date : 16-MAY-2012 14:28

Client ID: CBA-SB-50-3-5-0512

Sample Info: UT78J

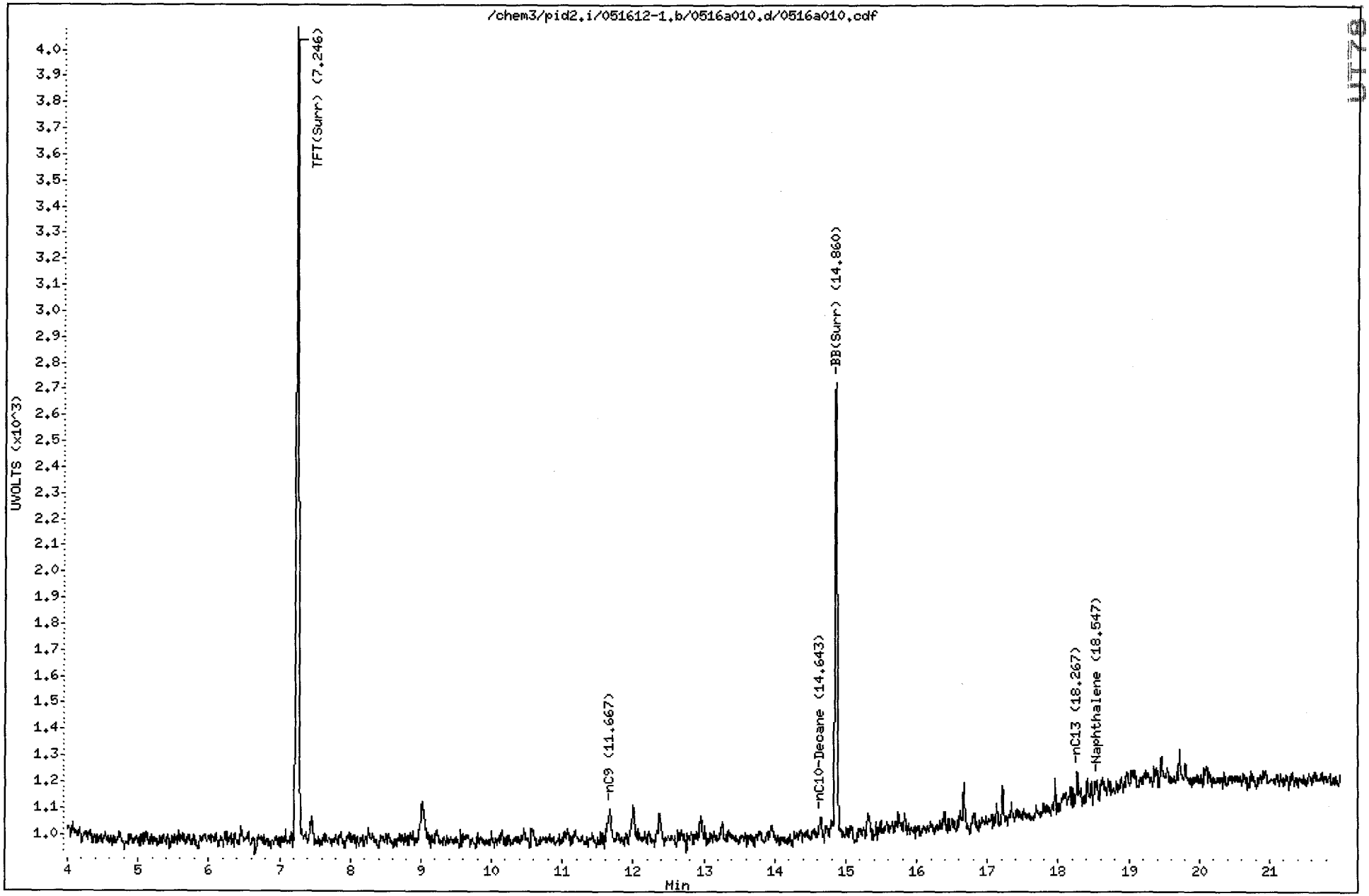
Column phase: RTX 502-2 FID

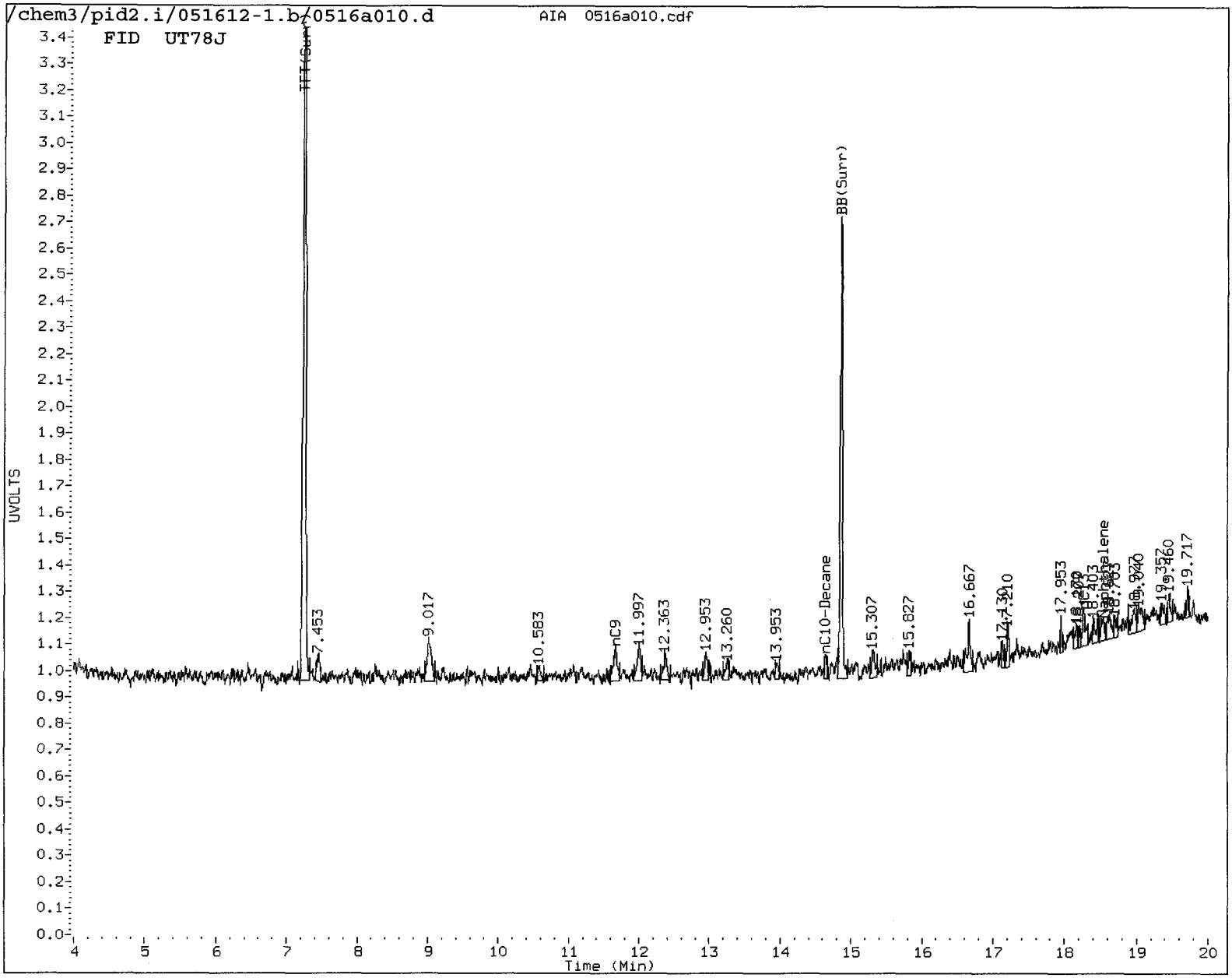
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00045





MANUAL INTEGRATION

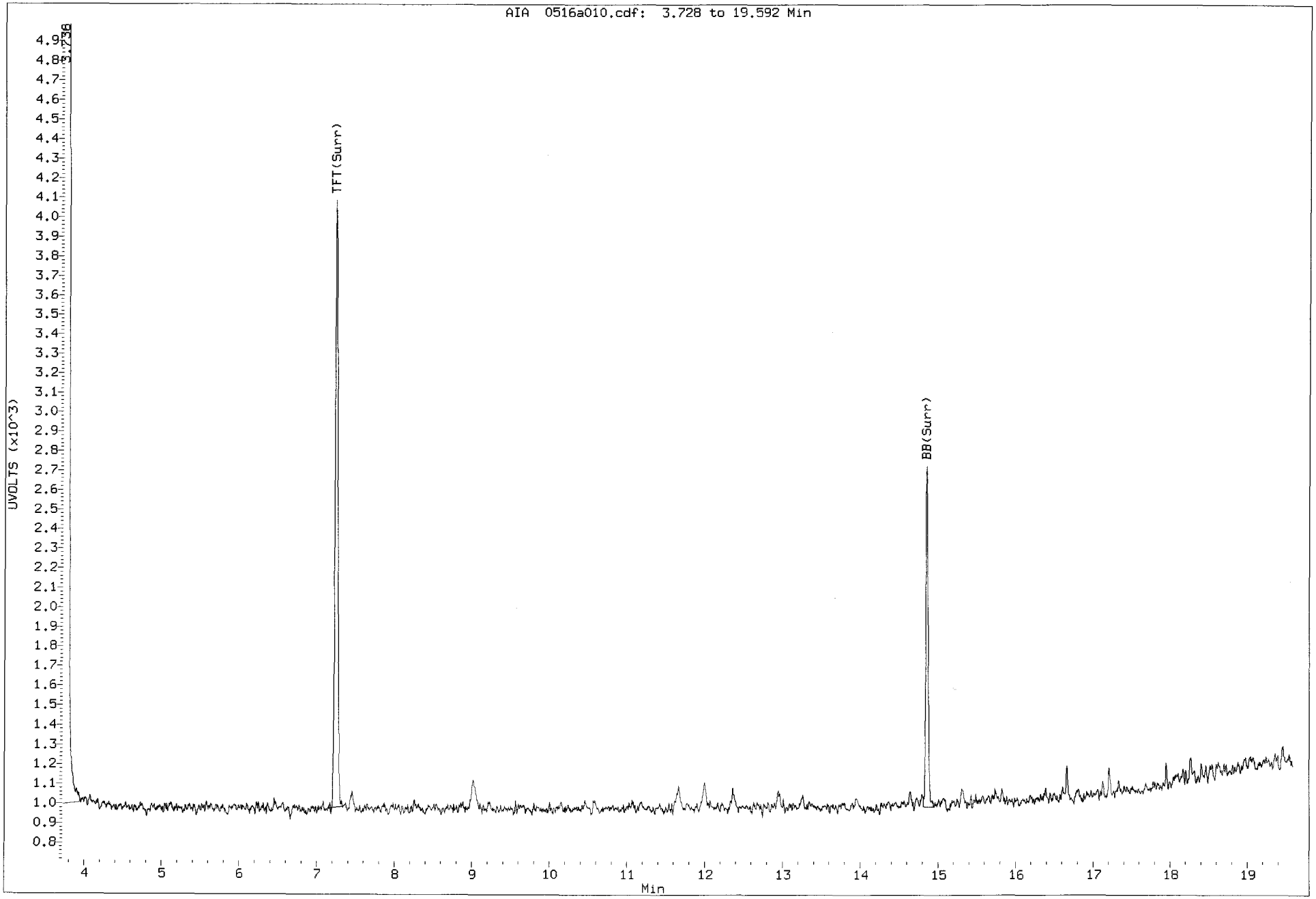
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: DW Date: 5/14/12

Before JW 5/16/12

Data File: /chem3/pid2.i/051612-1.b/0516a010.d/0516a010.cdf
Injection Date: 16-MAY-2012 14:28
Instrument: pid2.i
Client Sample ID: CBA-SB-50-3-5-0512



Data File: /chem3/pid2.i/051612-1.b/0516a011.d

Date : 16-MAY-2012 14:56

Client ID: CWMW-18-13-15-0512

Sample Info: UT78P

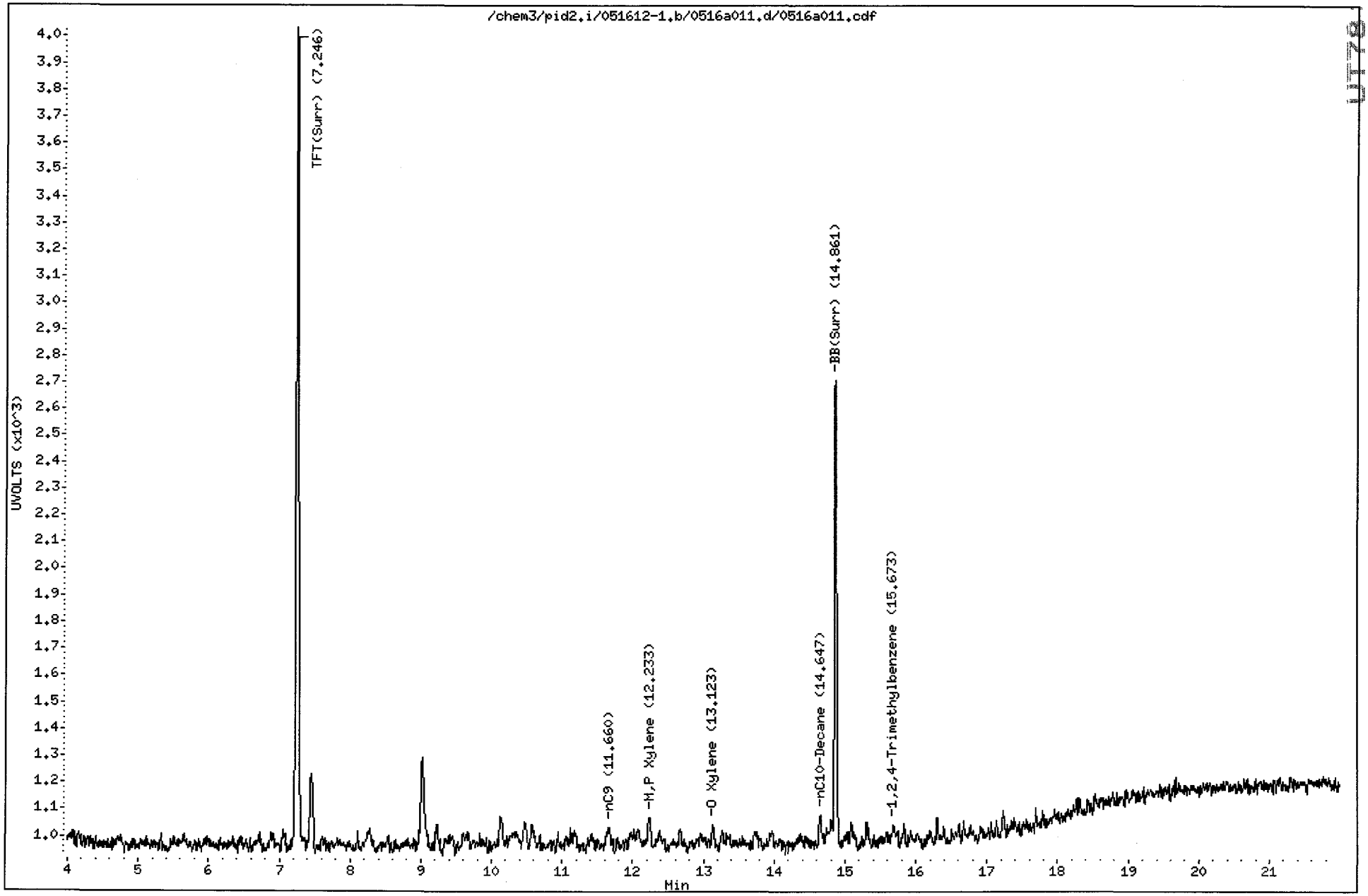
Column phase: RTX 502-2 FID

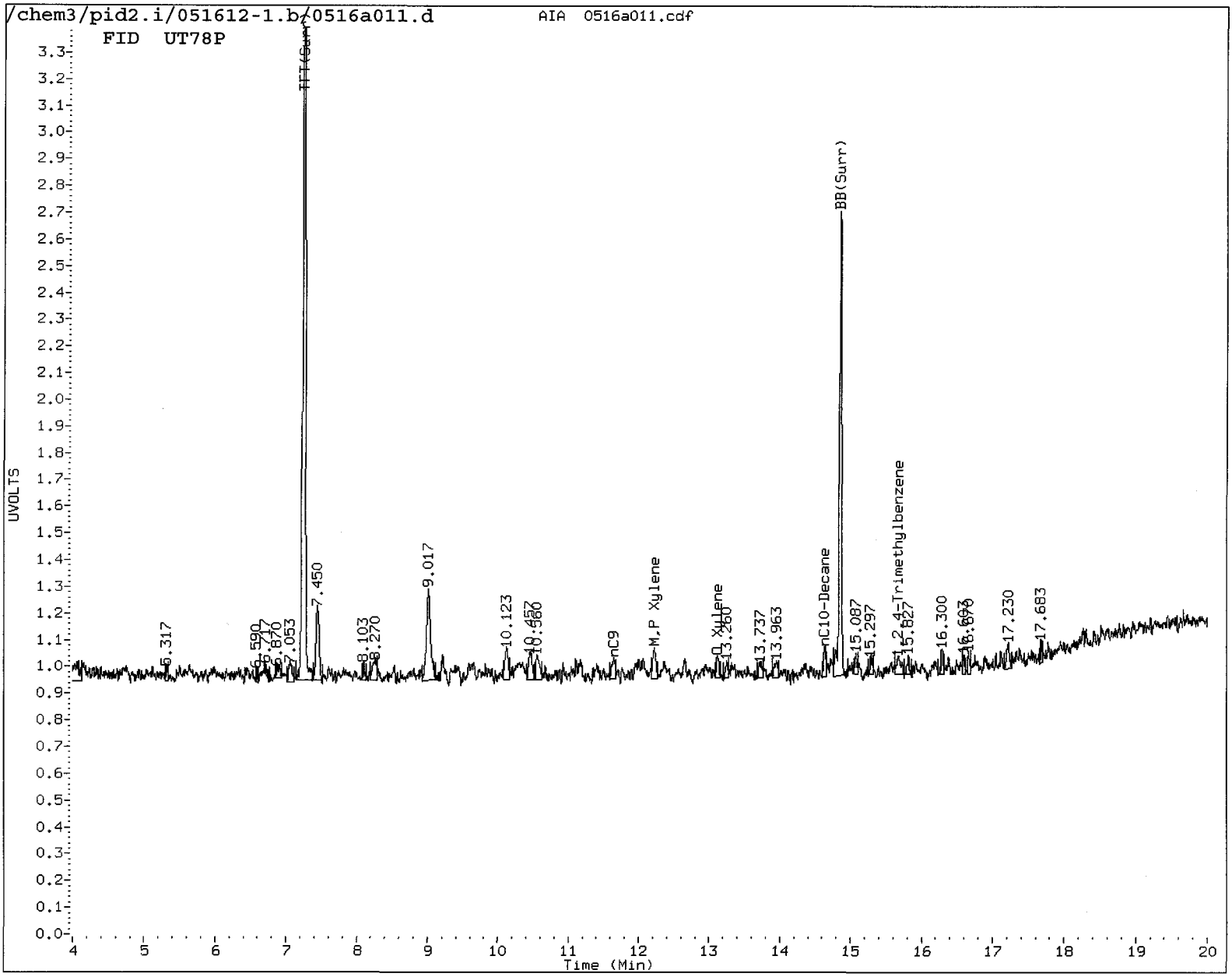
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 000035





MANUAL INTEGRATION

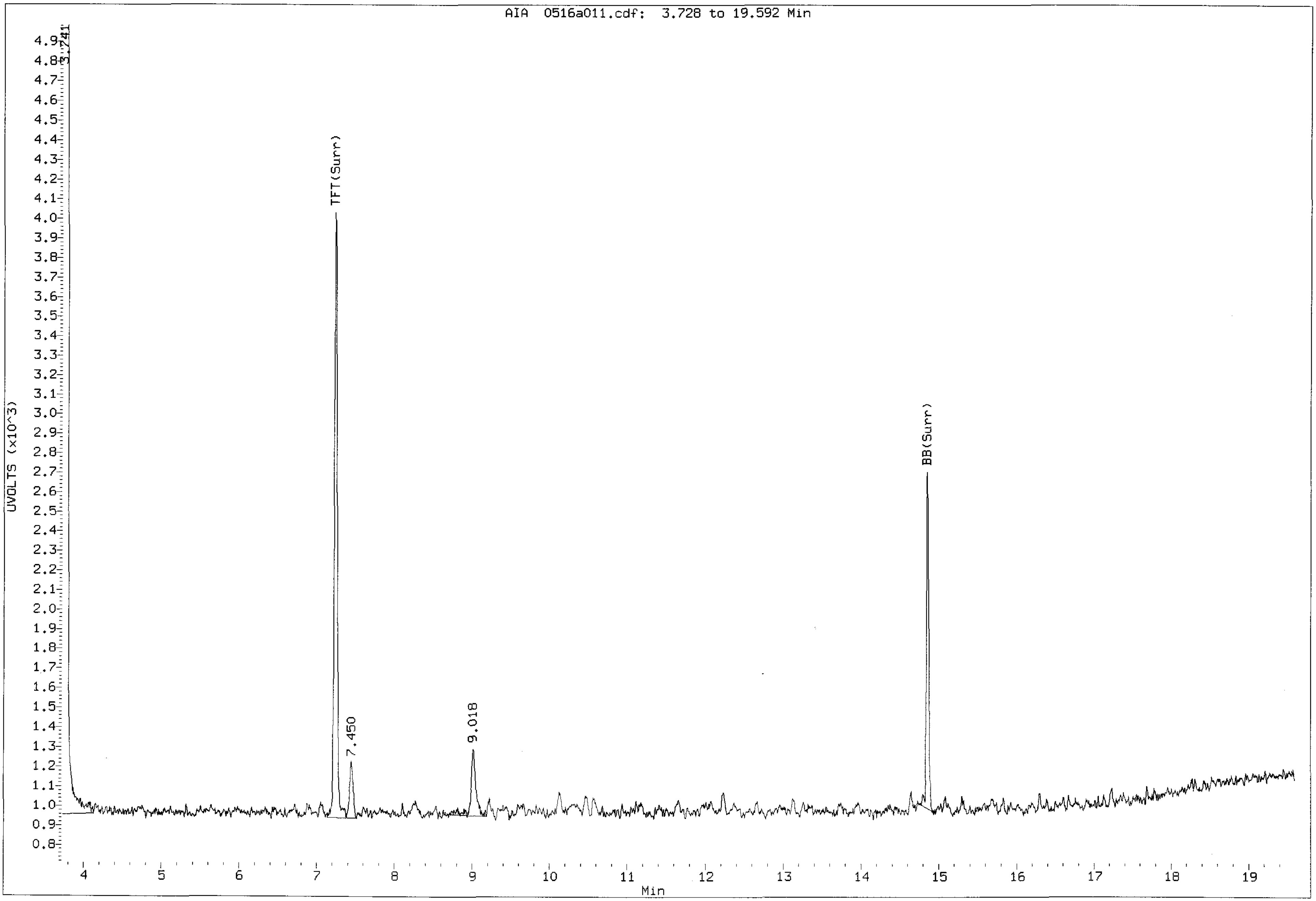
1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12

Data File: /chem3/pid2.i/051612-1.b/0516a011.d/0516a011.cdf
Injection Date: 16-MAY-2012 14:56
Instrument: pid2.i
Client Sample ID: CWMW-18-13-15-0512

Before
[initials] 5/18/12



Data File: /chem3/pid2.i/051612-1.b/0516a012.d

Date : 16-MAY-2012 15:24

Client ID: CBA-SB-1-1.5-2.5-05

Sample Info: UT78A

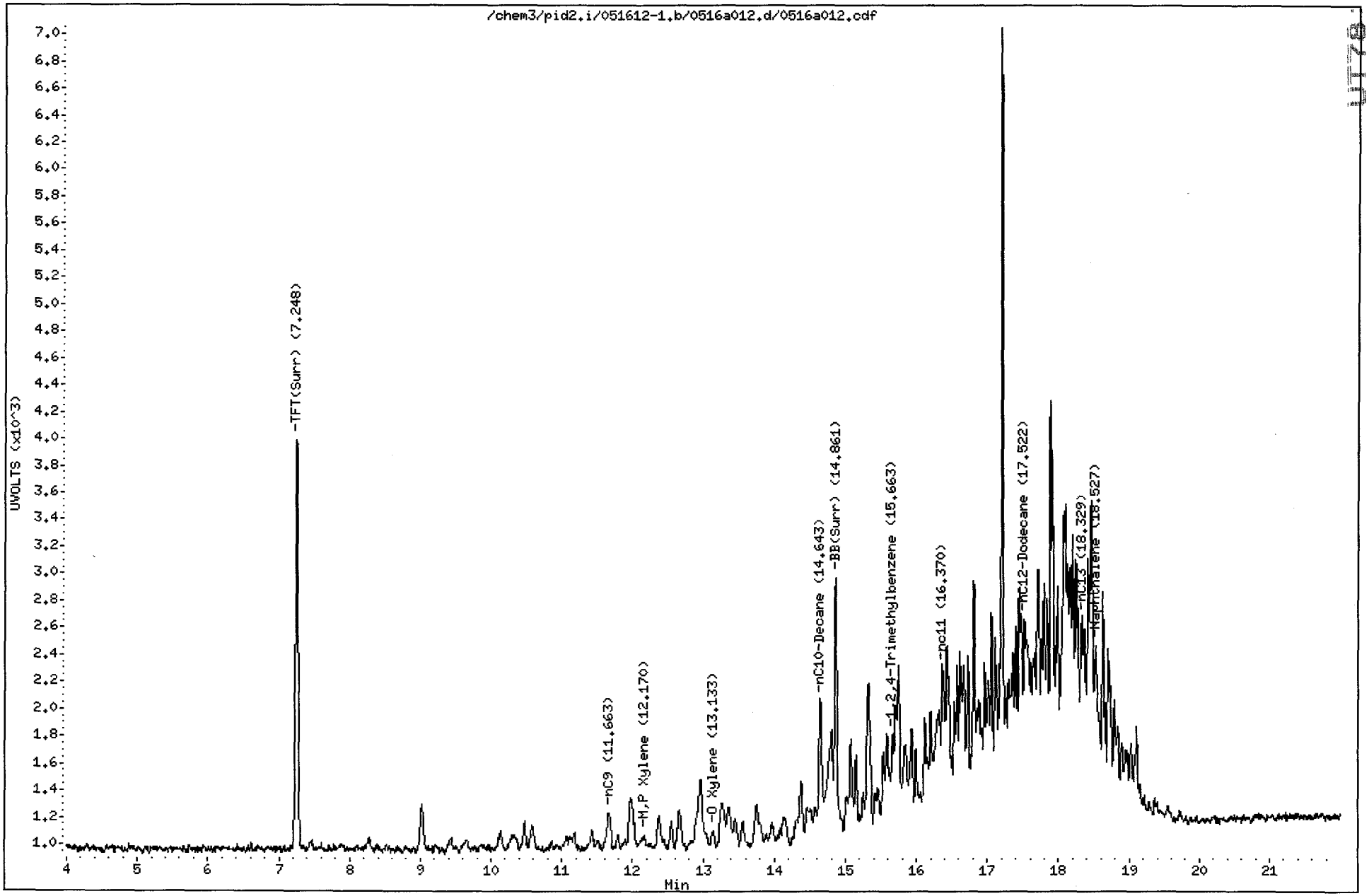
Column phase: RTX 502-2 FID

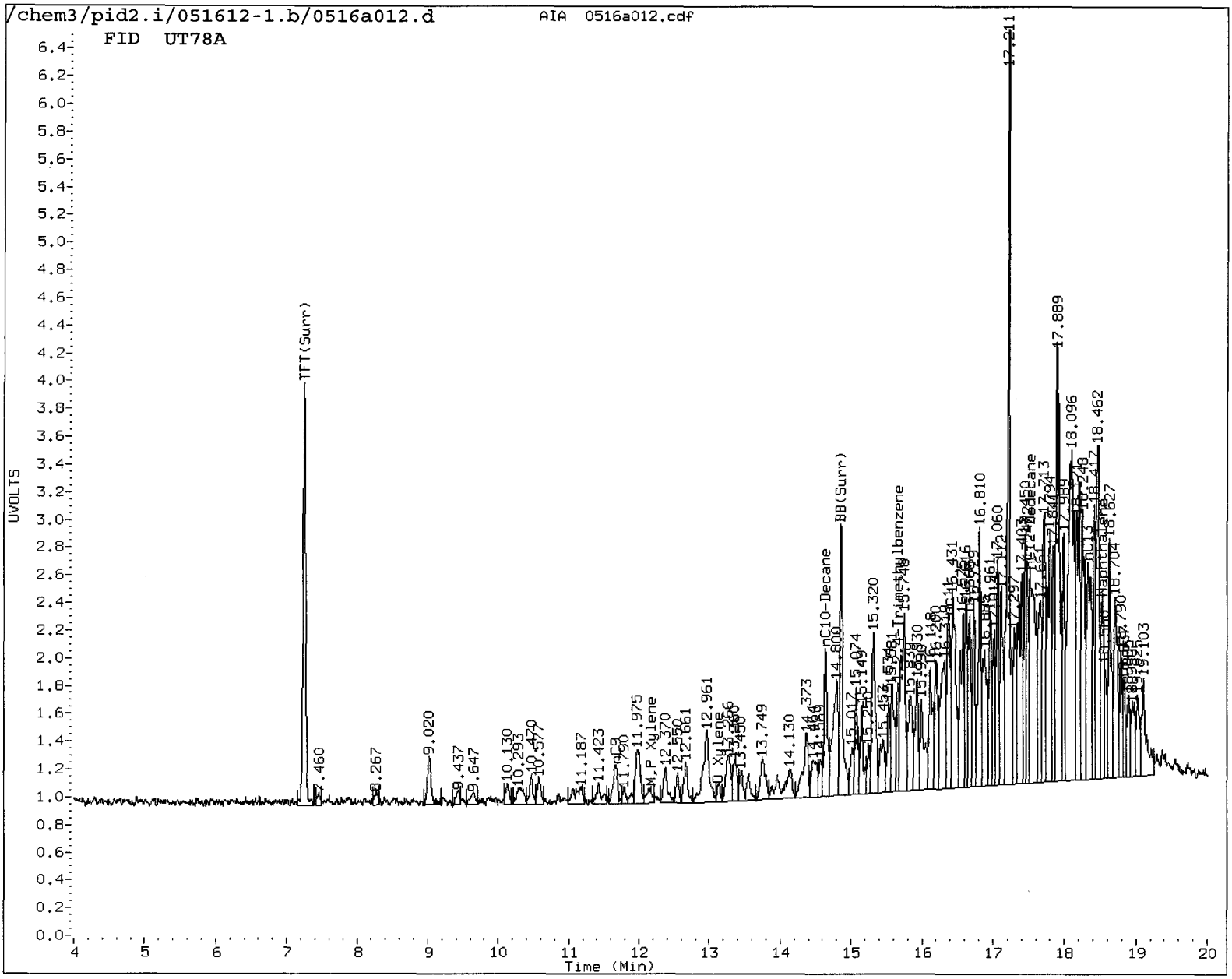
Instrument: pid2.i

Operator: JW

Column diameter: 0.18

UT78 00052



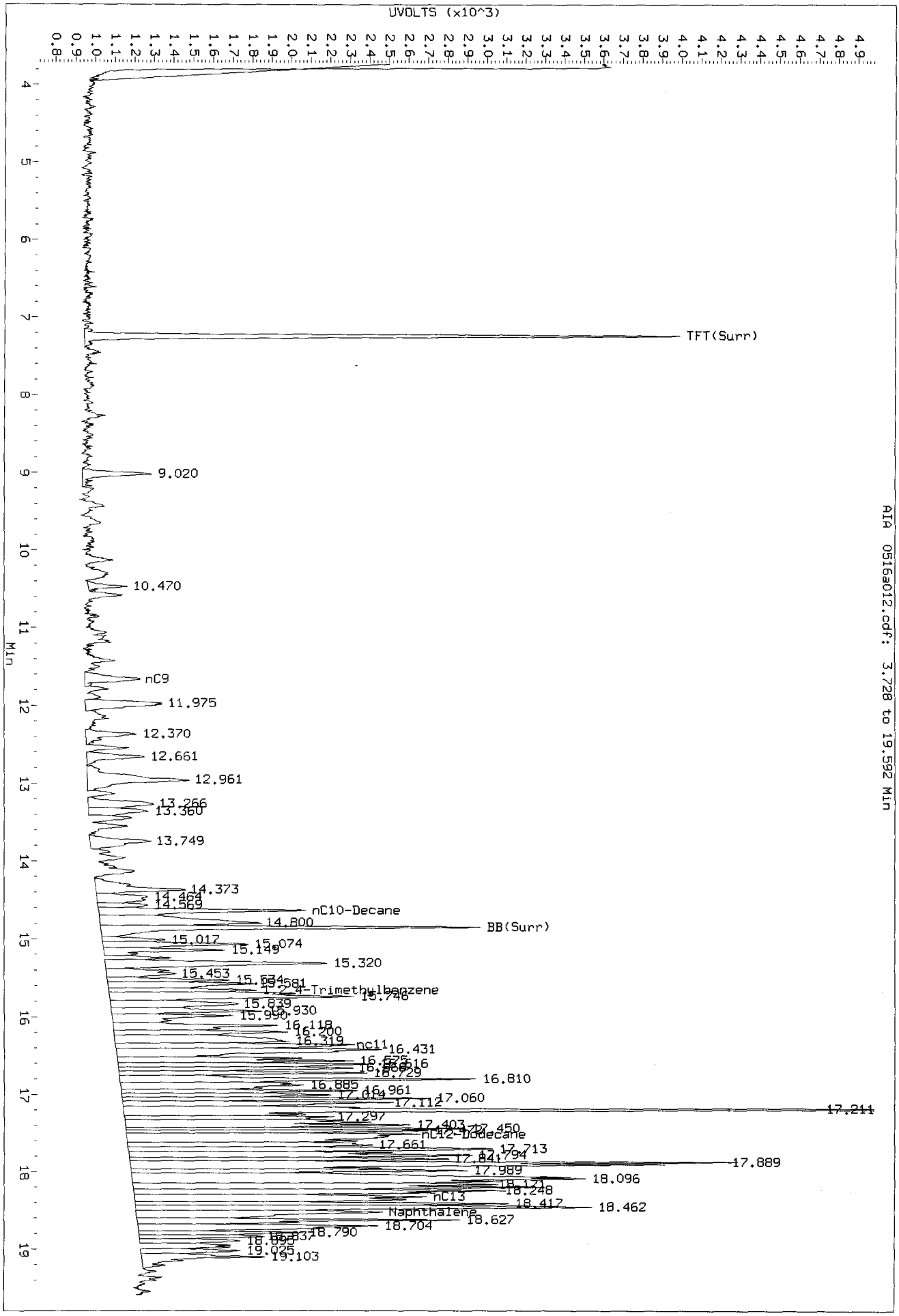


MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: JW Date: 5/18/12



Benzene
5/18/12

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: MB-051212
METHOD BLANK

Lab Sample ID: MB-051212
LIMS ID: 12-8511
Matrix: Soil
Data Release Authorized: MW
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Date Sampled: NA
Date Received: NA

Date Analyzed: 05/12/12 12:18
Instrument/Analyst: PID1/JLW

Purge Volume: 10 mL
Sample Amount: 111 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	450	< 450 U
108-88-3	Toluene	450	< 450 U
100-41-4	Ethylbenzene	450	< 450 U
179601-23-1	m,p-Xylene	900	< 900 U
95-47-6	o-Xylene	450	< 450 U
1634-04-4	Methyl tert-Butyl Ether	450	< 450 U
109-66-0	n-Pentane	450	< 450 U
110-54-3	n-Hexane	450	< 450 U
111-65-9	n-Octane	450	< 450 U
124-18-5	n-Decane	450	< 450 U
112-40-3	n-Dodecane	450	< 450 U

Range	RL	Result
C8-C10 Aromatics	4,500	< 4,500 U
C10-C12 Aromatics	4,500	< 4,500 U
C12-C13 Aromatics	4,500	< 4,500 U
C5-C6 Aliphatics	4,500	< 4,500 U
C6-C8 Aliphatics	4,500	< 4,500 U
C8-C10 Aliphatics	4,500	< 4,500 U
C10-C12 Aliphatics	4,500	< 4,500 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	110%
FID: 2,5-Dibromotoluene	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: CBA-SB-8-1-3-0512
SAMPLE

Lab Sample ID: UT78U
LIMS ID: 12-8511
Matrix: Soil
Data Release Authorized: MW
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: 05/08/12
Date Received: 05/09/12

Date Analyzed: 05/12/12 18:49
Instrument/Analyst: PID1/JLW

Purge Volume: 10 mL
Sample Amount: 31.9 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	1600	< 1,600 U
108-88-3	Toluene	1600	< 1,600 U
100-41-4	Ethylbenzene	1600	< 1,600 U
179601-23-1	m,p-Xylene	3100	< 3,100 U
95-47-6	o-Xylene	1600	< 1,600 U
1634-04-4	Methyl tert-Butyl Ether	1600	< 1,600 U
109-66-0	n-Pentane	1600	< 1,600 U
110-54-3	n-Hexane	1600	< 1,600 U
111-65-9	n-Octane	1600	< 1,600 U
124-18-5	n-Decane	1600	< 1,600 U
112-40-3	n-Dodecane	1600	< 1,600 U

Range	RL	Result
C8-C10 Aromatics	16,000	< 16,000 U
C10-C12 Aromatics	16,000	< 16,000 U
C12-C13 Aromatics	16,000	< 16,000 U
C5-C6 Aliphatics	16,000	< 16,000 U
C6-C8 Aliphatics	16,000	< 16,000 U
C8-C10 Aliphatics	16,000	< 16,000 U
C10-C12 Aliphatics	16,000	< 16,000 U

Values reported in µg/kg (ppb)

VPH Surrogate Recovery

PID: 2,5-Dibromotoluene	117%
FID: 2,5-Dibromotoluene	115%

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

VPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Client ID	PDBT	FDBT	TOT OUT
MB-051212	110%	101%	0
LCS-051212	102%	101%	0
LCSD-051212	103%	101%	0
CBA-SB-8-1-3-0512	117%	115%	0

	LCS/MB LIMITS	QC LIMITS
(PDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)
(FDBT) = 2,5-Dibromotoluene	(60-140)	(60-140)

Prep Method: METHOD
Log Number Range: 12-8511 to 12-8511

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
VPH by Method WA VPH

Sample ID: LCS-051212
LCS/LCSD

Lab Sample ID: LCS-051212
LIMS ID: 12-8511
Matrix: Soil
Data Release Authorized: MW
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 05/12/12 10:28
Date Analyzed LCSD: 05/12/12 11:14
Instrument/Analyst: PID1/JLW

Purge Volume: 10 mL
Sample Amount: 111 mg-dry-wt

Analyte/Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	4760	4500	106%	4690	4500	104%	1.5%
Toluene	4720	4500	105%	4670	4500	104%	1.1%
Ethylbenzene	4800	4500	107%	4740	4500	105%	1.3%
m,p-Xylene	9450	9010	105%	9360	9010	104%	1.0%
o-Xylene	4700	4500	104%	4670	4500	104%	0.6%
Methyl tert-Butyl Ether	4490	4500	99.8%	4540	4500	101%	1.1%
Naphthalene	4600	4500	102%	4650	4500	103%	1.1%
1,2,3-Trimethylbenzene	4720	4500	105%	4700	4500	104%	0.4%
1-Methylnaphthalene	5160	4500	115%	5350	4500	119%	3.6%
n-Pentane	5760	4500	128%	5730	4500	127%	0.5%
n-Hexane	4990	4500	111%	5000	4500	111%	0.2%
n-Octane	4700	4500	104%	4720	4500	105%	0.4%
n-Decane	5170	4500	115%	4820	4500	107%	7.0%
n-Dodecane	5250	4500	117%	5510	4500	122%	4.8%

Values reported in µg/kg (ppb)
RPD calculated using sample concentrations per SW846.

VPH Surrogate Recovery

	LCS	LCSD
PID: 2,5-Dibromotoluene	102%	103%
FID: 2,5-Dibromotoluene	101%	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: CBA-SB-8-1-3-0512
SAMPLE

Lab Sample ID: UT78N
LIMS ID: 12-8504
Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

QC Report No: UT78-AECOM
Project: Central Waterfront
NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Date Extracted: 05/10/12
Date Analyzed: 05/16/12 22:38
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 8.38 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 20.5%

CAS Number	Analyte	RL	Result
108-95-2	Phenol	60	< 60 U
111-44-4	Bis-(2-Chloroethyl) Ether	60	< 60 U
95-57-8	2-Chlorophenol	60	< 60 U
541-73-1	1,3-Dichlorobenzene	60	< 60 U
106-46-7	1,4-Dichlorobenzene	60	< 60 U
100-51-6	Benzyl Alcohol	300	< 300 U
95-50-1	1,2-Dichlorobenzene	60	< 60 U
95-48-7	2-Methylphenol	60	< 60 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	60	< 60 U
106-44-5	4-Methylphenol	60	< 60 U
621-64-7	N-Nitroso-Di-N-Propylamine	60	< 60 U
67-72-1	Hexachloroethane	60	< 60 U
98-95-3	Nitrobenzene	60	< 60 U
78-59-1	Isophorone	60	< 60 U
88-75-5	2-Nitrophenol	60	< 60 U
105-67-9	2,4-Dimethylphenol	60	< 60 U
65-85-0	Benzoic Acid	600	< 600 U
111-91-1	bis(2-Chloroethoxy) Methane	60	< 60 U
120-83-2	2,4-Dichlorophenol	300	< 300 U
120-82-1	1,2,4-Trichlorobenzene	60	< 60 U
91-20-3	**Naphthalene**	**60**	**280**
106-47-8	4-Chloroaniline	300	< 300 U
87-68-3	Hexachlorobutadiene	60	< 60 U
59-50-7	4-Chloro-3-methylphenol	300	< 300 U
91-57-6	**2-Methylnaphthalene**	**60**	**250**
77-47-4	Hexachlorocyclopentadiene	300	< 300 U
88-06-2	2,4,6-Trichlorophenol	300	< 300 U
95-95-4	2,4,5-Trichlorophenol	300	< 300 U
91-58-7	2-Chloronaphthalene	60	< 60 U
88-74-4	2-Nitroaniline	300	< 300 U
131-11-3	Dimethylphthalate	60	< 60 U
208-96-8	Acenaphthylene	60	< 60 U
99-09-2	3-Nitroaniline	300	< 300 U
83-32-9	Acenaphthene	60	< 60 U
51-28-5	2,4-Dinitrophenol	600	< 600 U
100-02-7	4-Nitrophenol	300	< 300 U
132-64-9	**Dibenzofuran**	**60**	**79**
606-20-2	2,6-Dinitrotoluene	300	< 300 U
121-14-2	2,4-Dinitrotoluene	300	< 300 U
84-66-2	Diethylphthalate	60	< 60 U
7005-72-3	4-Chlorophenyl-phenylether	60	< 60 U
86-73-7	**Fluorene**	**60**	**68**
100-01-6	4-Nitroaniline	300	< 300 U
534-52-1	4,6-Dinitro-2-Methylphenol	600	< 600 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: CBA-SB-8-1-3-0512
SAMPLE

Lab Sample ID: UT78N
LIMS ID: 12-8504
Matrix: Soil
Date Analyzed: 05/16/12 22:38

QC Report No: UT78-AECOM
Project: Central Waterfront
NA

CAS Number	Analyte	RL	Result
86-30-6	N-Nitrosodiphenylamine	60	< 60 U
101-55-3	4-Bromophenyl-phenylether	60	< 60 U
118-74-1	Hexachlorobenzene	60	< 60 U
87-86-5	Pentachlorophenol	300	< 300 U
85-01-8	**Phenanthrene**	**60**	**250**
86-74-8	Carbazole	60	< 60 U
120-12-7	Anthracene	60	< 60 U
84-74-2	Di-n-Butylphthalate	60	< 60 U
206-44-0	**Fluoranthene**	**60**	**660**
129-00-0	**Pyrene**	**60**	**380**
85-68-7	Butylbenzylphthalate	60	< 60 U
91-94-1	3,3'-Dichlorobenzidine	300	< 300 U
56-55-3	**Benzo(a)anthracene**	**60**	**70**
117-81-7	bis(2-Ethylhexyl)phthalate	60	< 60 U
218-01-9	**Chrysene**	**60**	**110**
117-84-0	Di-n-Octyl phthalate	60	< 60 U
50-32-8	**Benzo(a)pyrene**	**60**	**65**
193-39-5	Indeno(1,2,3-cd)pyrene	60	< 60 U
53-70-3	Dibenz(a,h)anthracene	60	< 60 U
191-24-2	Benzo(g,h,i)perylene	60	< 60 U
90-12-0	**1-Methylnaphthalene**	**60**	**160**
TOTBFA	**Total Benzofluoranthenes**	**60**	**110**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	54.0%	2-Fluorobiphenyl	59.6%
d14-p-Terphenyl	57.6%	d4-1,2-Dichlorobenzene	52.0%
d5-Phenol	57.6%	2-Fluorophenol	56.5%
2,4,6-Tribromophenol	73.1%	d4-2-Chlorophenol	57.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS
Page 1 of 2

Sample ID: MB-051012
METHOD BLANK

Lab Sample ID: MB-051012
LIMS ID: 12-8504
Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

QC Report No: UT78-AECOM
Project: Central Waterfront
NA
Date Sampled: NA
Date Received: NA

Date Extracted: 05/10/12
Date Analyzed: 05/16/12 18:14
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.50 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
108-95-2	Phenol	67	< 67 U
111-44-4	Bis-(2-Chloroethyl) Ether	67	< 67 U
95-57-8	2-Chlorophenol	67	< 67 U
541-73-1	1,3-Dichlorobenzene	67	< 67 U
106-46-7	1,4-Dichlorobenzene	67	< 67 U
100-51-6	Benzyl Alcohol	330	< 330 U
95-50-1	1,2-Dichlorobenzene	67	< 67 U
95-48-7	2-Methylphenol	67	< 67 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	67	< 67 U
106-44-5	4-Methylphenol	67	< 67 U
621-64-7	N-Nitroso-Di-N-Propylamine	67	< 67 U
67-72-1	Hexachloroethane	67	< 67 U
98-95-3	Nitrobenzene	67	< 67 U
78-59-1	Isophorone	67	< 67 U
88-75-5	2-Nitrophenol	67	< 67 U
105-67-9	2,4-Dimethylphenol	67	< 67 U
65-85-0	Benzoic Acid	670	< 670 U
111-91-1	bis(2-Chloroethoxy) Methane	67	< 67 U
120-83-2	2,4-Dichlorophenol	330	< 330 U
120-82-1	1,2,4-Trichlorobenzene	67	< 67 U
91-20-3	Naphthalene	67	< 67 U
106-47-8	4-Chloroaniline	330	< 330 U
87-68-3	Hexachlorobutadiene	67	< 67 U
59-50-7	4-Chloro-3-methylphenol	330	< 330 U
91-57-6	2-Methylnaphthalene	67	< 67 U
77-47-4	Hexachlorocyclopentadiene	330	< 330 U
88-06-2	2,4,6-Trichlorophenol	330	< 330 U
95-95-4	2,4,5-Trichlorophenol	330	< 330 U
91-58-7	2-Chloronaphthalene	67	< 67 U
88-74-4	2-Nitroaniline	330	< 330 U
131-11-3	Dimethylphthalate	67	< 67 U
208-96-8	Acenaphthylene	67	< 67 U
99-09-2	3-Nitroaniline	330	< 330 U
83-32-9	Acenaphthene	67	< 67 U
51-28-5	2,4-Dinitrophenol	670	< 670 U
100-02-7	4-Nitrophenol	330	< 330 U
132-64-9	Dibenzofuran	67	< 67 U
606-20-2	2,6-Dinitrotoluene	330	< 330 U
121-14-2	2,4-Dinitrotoluene	330	< 330 U
84-66-2	Diethylphthalate	67	< 67 U
7005-72-3	4-Chlorophenyl-phenylether	67	< 67 U
86-73-7	Fluorene	67	< 67 U
100-01-6	4-Nitroaniline	330	< 330 U
534-52-1	4,6-Dinitro-2-Methylphenol	670	< 670 U

Lab Sample ID: MB-051012 QC Report No: UT78-AECOM
LIMS ID: 12-8504 Project: Central Waterfront
Matrix: Soil NA
Date Analyzed: 05/16/12 18:14

CAS Number	Analyte	RL	Result
86-30-6	N-Nitrosodiphenylamine	67	< 67 U
101-55-3	4-Bromophenyl-phenylether	67	< 67 U
118-74-1	Hexachlorobenzene	67	< 67 U
87-86-5	Pentachlorophenol	330	< 330 U
85-01-8	Phenanthrene	67	< 67 U
86-74-8	Carbazole	67	< 67 U
120-12-7	Anthracene	67	< 67 U
84-74-2	Di-n-Butylphthalate	67	< 67 U
206-44-0	Fluoranthene	67	< 67 U
129-00-0	Pyrene	67	< 67 U
85-68-7	Butylbenzylphthalate	67	< 67 U
91-94-1	3,3'-Dichlorobenzidine	330	< 330 U
56-55-3	Benzo(a)anthracene	67	< 67 U
117-81-7	bis(2-Ethylhexyl)phthalate	67	< 67 U
218-01-9	Chrysene	67	< 67 U
117-84-0	Di-n-Octyl phthalate	67	< 67 U
50-32-8	Benzo(a)pyrene	67	< 67 U
193-39-5	Indeno(1,2,3-cd)pyrene	67	< 67 U
53-70-3	Dibenz(a,h)anthracene	67	< 67 U
191-24-2	Benzo(g,h,i)perylene	67	< 67 U
90-12-0	1-Methylnaphthalene	67	< 67 U
TOTBFA	Total Benzofluoranthenes	67	< 67 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	58.0%	2-Fluorobiphenyl	59.2%
d14-p-Terphenyl	72.8%	d4-1,2-Dichlorobenzene	56.4%
d5-Phenol	58.9%	2-Fluorophenol	60.3%
2,4,6-Tribromophenol	66.9%	d4-2-Chlorophenol	58.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: LCS-051012
LAB CONTROL

Lab Sample ID: LCS-051012
LIMS ID: 12-8504
Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: 05/08/12
Date Received: 05/09/12

Date Extracted: 05/10/12
Date Analyzed: 05/16/12 18:47
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes

Sample Amount: 7.50 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

Analyte	Lab Control	Spike Added	Recovery
Phenol	1050	1670	62.9%
Bis-(2-Chloroethyl) Ether	1080	1670	64.7%
2-Chlorophenol	990	1670	59.3%
1,3-Dichlorobenzene	955	1670	57.2%
1,4-Dichlorobenzene	978	1670	58.6%
Benzyl Alcohol	917	1670	54.9%
1,2-Dichlorobenzene	993	1670	59.5%
2-Methylphenol	945	1670	56.6%
2,2'-Oxybis(1-Chloropropane)	1060	1670	63.5%
4-Methylphenol	2000	3330	60.1%
N-Nitroso-Di-N-Propylamine	1060	1670	63.5%
Hexachloroethane	981	1670	58.7%
Nitrobenzene	986	1670	59.0%
Isophorone	1190	1670	71.3%
2-Nitrophenol	1000	1670	59.9%
2,4-Dimethylphenol	2080	5000	41.6%
Benzoic Acid	6230	9170	67.9%
bis(2-Chloroethoxy) Methane	1040	1670	62.3%
2,4-Dichlorophenol	3000	5000	60.0%
1,2,4-Trichlorobenzene	996	1670	59.6%
Naphthalene	959	1670	57.4%
4-Chloroaniline	2310	5000	46.2%
Hexachlorobutadiene	980	1670	58.7%
4-Chloro-3-methylphenol	3420	5000	68.4%
2-Methylnaphthalene	943	1670	56.5%
Hexachlorocyclopentadiene	2620	5000	52.4%
2,4,6-Trichlorophenol	3260	5000	65.2%
2,4,5-Trichlorophenol	3250	5000	65.0%
2-Chloronaphthalene	1050	1670	62.9%
2-Nitroaniline	3330	5000	66.6%
Dimethylphthalate	1350	1670	80.8%
Acenaphthylene	1070	1670	64.1%
3-Nitroaniline	3120	5000	62.4%
Acenaphthene	1030	1670	61.7%
2,4-Dinitrophenol	6170	9170	67.3%
4-Nitrophenol	3840	5000	76.8%
Dibenzofuran	1030	1670	61.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by SW8270D GC/MS

Sample ID: LCS-051012
LAB CONTROL

Lab Sample ID: LCS-051012
LIMS ID: 12-8504
Matrix: Soil
Date Analyzed: 05/16/12 18:47

QC Report No: UT78-AECOM
Project: Central Waterfront

Analyte	Lab Control	Spike Added	Recovery
2,6-Dinitrotoluene	3890	5000	77.8%
2,4-Dinitrotoluene	4200	5000	84.0%
Diethylphthalate	1410	1670	84.4%
4-Chlorophenyl-phenylether	1180	1670	70.7%
Fluorene	1110	1670	66.5%
4-Nitroaniline	3380	5000	67.6%
4,6-Dinitro-2-Methylphenol	7180	9170	78.3%
N-Nitrosodiphenylamine	1170	1670	70.1%
4-Bromophenyl-phenylether	1150	1670	68.9%
Hexachlorobenzene	1190	1670	71.3%
Pentachlorophenol	3550	5000	71.0%
Phenanthrene	1180	1670	70.7%
Carbazole	1310	1670	78.4%
Anthracene	1070	1670	64.1%
Di-n-Butylphthalate	1470	1670	88.0%
Fluoranthene	1330	1670	79.6%
Pyrene	1090	1670	65.3%
Butylbenzylphthalate	1340	1670	80.2%
3,3'-Dichlorobenzidine	2730	5000	54.6%
Benzo(a)anthracene	1190	1670	71.3%
bis(2-Ethylhexyl)phthalate	1330	1670	79.6%
Chrysene	1190	1670	71.3%
Di-n-Octyl phthalate	1320	1670	79.0%
Benzo(a)pyrene	1130	1670	67.7%
Indeno(1,2,3-cd)pyrene	1120	1670	67.1%
Dibenz(a,h)anthracene	1220	1670	73.1%
Benzo(g,h,i)perylene	1100	1670	65.9%
1-Methylnaphthalene	1280	1670	76.6%
Total Benzofluoranthenes	2490	3330	74.8%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	58.0%
2-Fluorobiphenyl	60.4%
d14-p-Terphenyl	70.8%
d4-1,2-Dichlorobenzene	55.2%
d5-Phenol	62.7%
2-Fluorophenol	62.9%
2,4,6-Tribromophenol	77.6%
d4-2-Chlorophenol	60.5%

Reported in µg/kg (ppb)

ANALYTICAL RESOURCES INCORPORATED

SW8270 SEMIVOLATILES SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-051012	58.0%	59.2%	72.8%	56.4%	58.9%	60.3%	66.9%	58.4%	0
LCS-051012	58.0%	60.4%	70.8%	55.2%	62.7%	62.9%	77.6%	60.5%	0
CBA-SB-8-1-3-0512	54.0%	59.6%	57.6%	52.0%	57.6%	56.5%	73.1%	57.9%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(46-102)	(32-106)
(FBP) = 2-Fluorobiphenyl	(51-105)	(39-107)
(TPH) = d14-p-Terphenyl	(55-124)	(31-130)
(DCB) = d4-1,2-Dichlorobenzene	(48-104)	(38-102)
(PHL) = d5-Phenol	(44-110)	(27-112)
(2FP) = 2-Fluorophenol	(38-112)	(22-108)
(TBP) = 2,4,6-Tribromophenol	(54-120)	(31-131)
(2CP) = d4-2-Chlorophenol	(50-103)	(36-104)

Prep Method: SW3546
Log Number Range: 12-8504 to 12-8504

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Page 1 of 2
Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Received: 05/09/12

Data Release Authorized:
Reported: 05/17/12

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
UT78A	CBA-SB-1-1.5-2.5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**280**	**7,400**
12-8487	HC ID: **DIESEL/RRO**		FID3B	50	**Motor Oil Range**	**570**	**1,800**
					o-Terphenyl		D
UT78B	CBA-SB-1-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**6.1**	**48**
12-8488	HC ID: **DIESEL/RRO**		FID3B	1.0	**Motor Oil Range**	**12**	**21**
					o-Terphenyl		86.8%
UT78C	CBA-SB-2-0.5-2.5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**300**	**6,600**
12-8489	HC ID: **DIESEL/RRO**		FID3B	50	**Motor Oil Range**	**600**	**1,800**
					o-Terphenyl		D
UT78D	CBA-SB-3-1-3-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**30**	**200**
12-8490	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**59**	**420**
					o-Terphenyl		84.4%
UT78E	CBA-SB-4-0.5-2.5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**30**	**220**
12-8491	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**60**	**520**
					o-Terphenyl		83.3%
UT78F	CBA-SB-4-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**6.2**	**82**
12-8492	HC ID: **DIESEL/MOTOR OIL**		FID3B	1.0	**Motor Oil Range**	**12**	**130**
					o-Terphenyl		91.8%
UT78G	CBA-SB-5-3.5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**6.2**	**10**
12-8493	HC ID: **DRO**		FID3B	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		96.8%
UT78H	CBA-SB-5-0-2-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**5.7**	**16**
12-8494	HC ID: **DIESEL/MOTOR OIL**		FID3B	1.0	**Motor Oil Range**	**12**	**16**
					o-Terphenyl		97.8%
UT78I	CBA-SB-20-0.5-2.5-0510	05/15/12	05/16/12	1.00	**Diesel Range**	**290**	**5,500**
12-8495	HC ID: **DIESEL/RRO**		FID3B	50	**Motor Oil Range**	**580**	**1,400**
					o-Terphenyl		D
UT78J	CBA-SB-50-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**5.8**	**9.8**
12-8496	HC ID: **DRO**		FID3B	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		97.4%
UT78K	CBA-SB-6-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**6.1**	**7.4**
12-8501	HC ID: **DRO**		FID3B	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		95.8%
UT78L	CBA-SB-7-1-3-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**30**	**260**
12-8502	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**59**	**500**
					o-Terphenyl		91.7%
UT78M	CBA-SB-8-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**35**	**650**
12-8503	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**71**	**1,200**
					o-Terphenyl		100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Received: 05/09/12

Data Release Authorized:
Reported: 05/17/12

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
UT78N	CBA-SB-8-1-3-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**31**	**570**
12-8504	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**62**	**1,100**
					o-Terphenyl		95.4%
UT78O	CWMW-18-7-9-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**33**	**1,300**
12-8505	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**66**	**660**
					o-Terphenyl		96.6%
UT78P	CWMW-18-13-15-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**6.2**	**7.4**
12-8506	HC ID: **DRO**		FID3B	1.0	Motor Oil Range	12	< 12 U
					o-Terphenyl		97.4%
UT78Q	CBA-SB-80-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**36**	**560**
12-8507	HC ID: **DIESEL/MOTOR OIL**		FID3B	5.0	**Motor Oil Range**	**71**	**960**
					o-Terphenyl		92.9%
UT78R	CBA-TP-7-0-1-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**5.9**	**18**
12-8508	HC ID: **DRO/MOTOR OIL**		FID3B	1.0	**Motor Oil Range**	**12**	**27**
					o-Terphenyl		98.4%
MB-051512	Method Blank	05/15/12	05/16/12	1.00	Diesel Range	5.0	< 5.0 U
12-8509	HC ID: ---		FID3B	1.0	Motor Oil Range	10	< 10 U
					o-Terphenyl		90.8%
UT78S	CBA-SB-2-3-5-0512	05/15/12	05/16/12	1.00	**Diesel Range**	**5.7**	**26**
12-8509	HC ID: **DIESEL/RRO**		FID3B	1.0	**Motor Oil Range**	**11**	**12**
					o-Terphenyl		94.6%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicates results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: CBA-SB-2-3-5-0512
MS/MSD

Lab Sample ID: UT78S
LIMS ID: 12-8509
Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: 05/08/12
Date Received: 05/09/12

Date Extracted MS/MSD: 05/15/12

Date Analyzed MS: 05/16/12 16:44
MSD: 05/16/12 17:03
Instrument/Analyst MS: FID3B/MH
MSD: FID3B/MH

Sample Amount MS: 8.73 g-dry-wt
MSD: 8.71 g-dry-wt
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 15.1%

Range	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Diesel	25.6	174	172	86.3%	181	172	90.3%	3.9%

TPHD Surrogate Recovery

	MS	MSD
o-Terphenyl	95.0%	99.6%

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID
Page 1 of 1

Sample ID: LCS-051512
LAB CONTROL

Lab Sample ID: LCS-051512
LIMS ID: 12-8509
Matrix: Soil
Data Release Authorized:
Reported: 05/17/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Date Sampled: NA
Date Received: NA

Date Extracted: 05/15/12
Date Analyzed: 05/16/12 09:09
Instrument/Analyst: FID3B/MH

Sample Amount: 10.0 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
Diesel	133	150	88.7%

TPHD Surrogate Recovery

o-Terphenyl	92.9%

Results reported in mg/kg

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: UT78
Matrix: Soil Project: Central Waterfront
Date Received: 05/09/12

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
12-8487-UT78A	CBA-SB-1-1.5-2.5-05	8.81 g	1.00 mL	D	05/15/12
12-8488-UT78B	CBA-SB-1-3-5-0512	8.18 g	1.00 mL	D	05/15/12
12-8489-UT78C	CBA-SB-2-0.5-2.5-05	8.37 g	1.00 mL	D	05/15/12
12-8490-UT78D	CBA-SB-3-1-3-0512	8.42 g	1.00 mL	D	05/15/12
12-8491-UT78E	CBA-SB-4-0.5-2.5-05	8.29 g	1.00 mL	D	05/15/12
12-8492-UT78F	CBA-SB-4-3-5-0512	8.10 g	1.00 mL	D	05/15/12
12-8493-UT78G	CBA-SB-5-3.5-0512	8.10 g	1.00 mL	D	05/15/12
12-8494-UT78H	CBA-SB-5-0-2-0512	8.73 g	1.00 mL	D	05/15/12
12-8495-UT78I	CBA-SB-20-0.5-2.5-0	8.60 g	1.00 mL	D	05/15/12
12-8496-UT78J	CBA-SB-50-3-5-0512	8.54 g	1.00 mL	D	05/15/12
12-8501-UT78K	CBA-SB-6-3-5-0512	8.21 g	1.00 mL	D	05/15/12
12-8502-UT78L	CBA-SB-7-1-3-0512	8.46 g	1.00 mL	D	05/15/12
12-8503-UT78M	CBA-SB-8-3-5-0512	7.07 g	1.00 mL	D	05/15/12
12-8504-UT78N	CBA-SB-8-1-3-0512	8.03 g	1.00 mL	D	05/15/12
12-8505-UT78O	CWMW-18-7-9-0512	7.62 g	1.00 mL	D	05/15/12
12-8506-UT78P	CWMW-18-13-15-0512	8.00 g	1.00 mL	D	05/15/12
12-8507-UT78Q	CBA-SB-80-3-5-0512	7.04 g	1.00 mL	D	05/15/12
12-8508-UT78R	CBA-TP-7-0-1-0512	8.51 g	1.00 mL	D	05/15/12
12-8509-051512MB1	Method Blank	10.0 g	1.00 mL	-	05/15/12
12-8509-051512LCS1	Lab Control	10.0 g	1.00 mL	-	05/15/12
12-8509-UT78S	CBA-SB-2-3-5-0512	8.74 g	1.00 mL	D	05/15/12
12-8509-UT78SMS	CBA-SB-2-3-5-0512	8.73 g	1.00 mL	D	05/15/12
12-8509-UT78SMSD	CBA-SB-2-3-5-0512	8.71 g	1.00 mL	D	05/15/12

Basis: D=Dry Weight W=As Received

ANALYTICAL RESOURCES INCORPORATED

TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Client ID	OTER	TOT OUT
CBA-SB-1-1.5-2.5-0512	D	0
CBA-SB-1-3-5-0512	86.8%	0
CBA-SB-2-0.5-2.5-0512	D	0
CBA-SB-3-1-3-0512	84.4%	0
CBA-SB-4-0.5-2.5-0512	83.3%	0
CBA-SB-4-3-5-0512	91.8%	0
CBA-SB-5-3.5-0512	96.8%	0
CBA-SB-5-0-2-0512	97.8%	0
CBA-SB-20-0.5-2.5-0512	D	0
CBA-SB-50-3-5-0512	97.4%	0
CBA-SB-6-3-5-0512	95.8%	0
CBA-SB-7-1-3-0512	91.7%	0
CBA-SB-8-3-5-0512	100%	0
CBA-SB-8-1-3-0512	95.4%	0
CWMW-18-7-9-0512	96.6%	0
CWMW-18-13-15-0512	97.4%	0
CBA-SB-80-3-5-0512	92.9%	0
CBA-TP-7-0-1-0512	98.4%	0
051512MBS	90.8%	0
051512LCS	92.9%	0
CBA-SB-2-3-5-0512	94.6%	0
CBA-SB-2-3-5-0512 MS	95.0%	0
CBA-SB-2-3-5-0512 MSD	99.6%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3546
Log Number Range: 12-8487 to 12-8509

Data File: /chem3/fid3b.i/20120516.b/0516b006.d

Date : 16-MAY-2012 08:50

Client ID: UT78MBS1

Sample Info: UT78MBS1

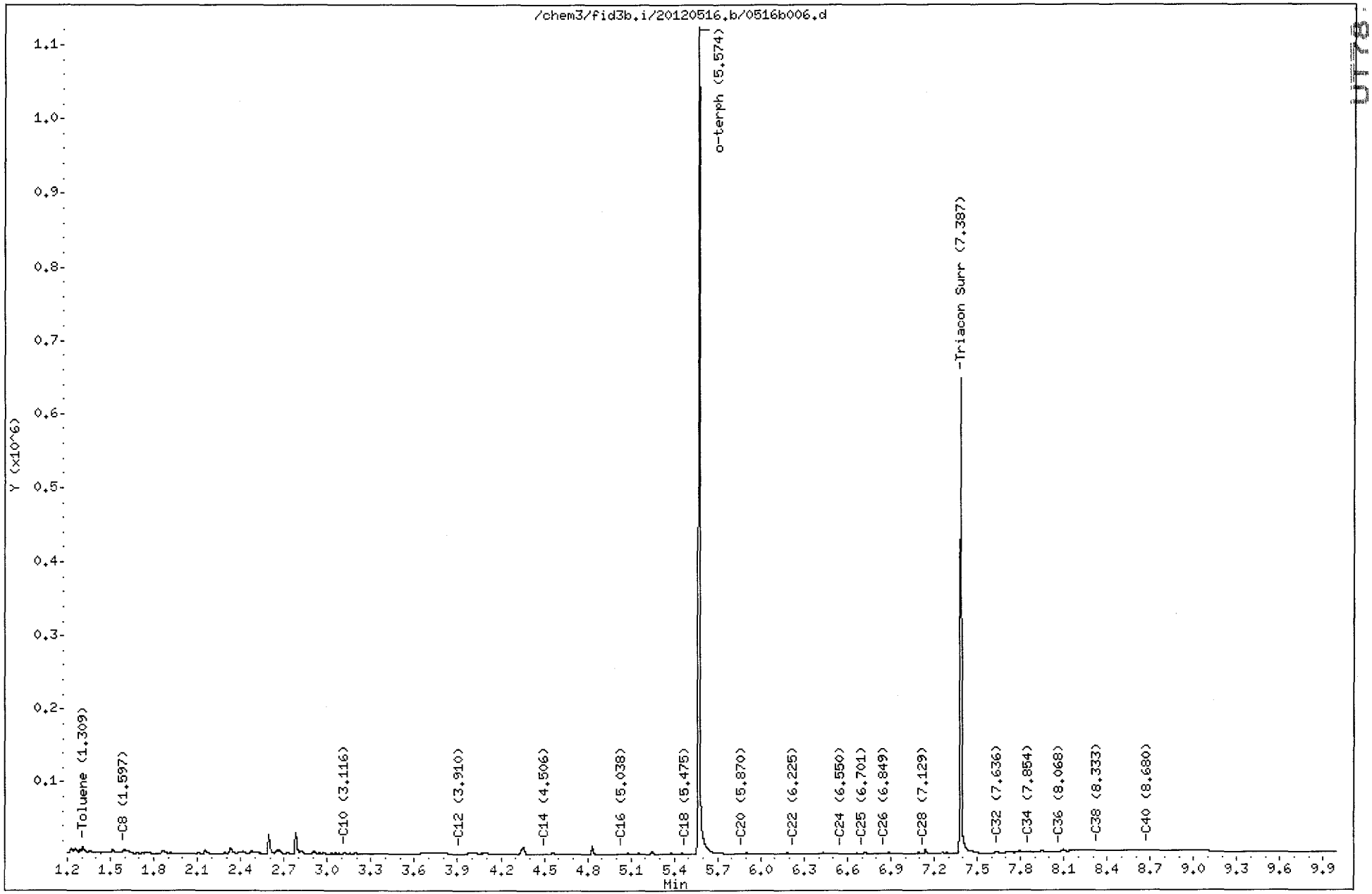
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78-050112



Data File: /chem3/fid3b.i/20120516.b/0516b007.d

Date : 16-MAY-2012 09:09

Client ID: UT78LCSS1

Sample Info: UT78LCSS1

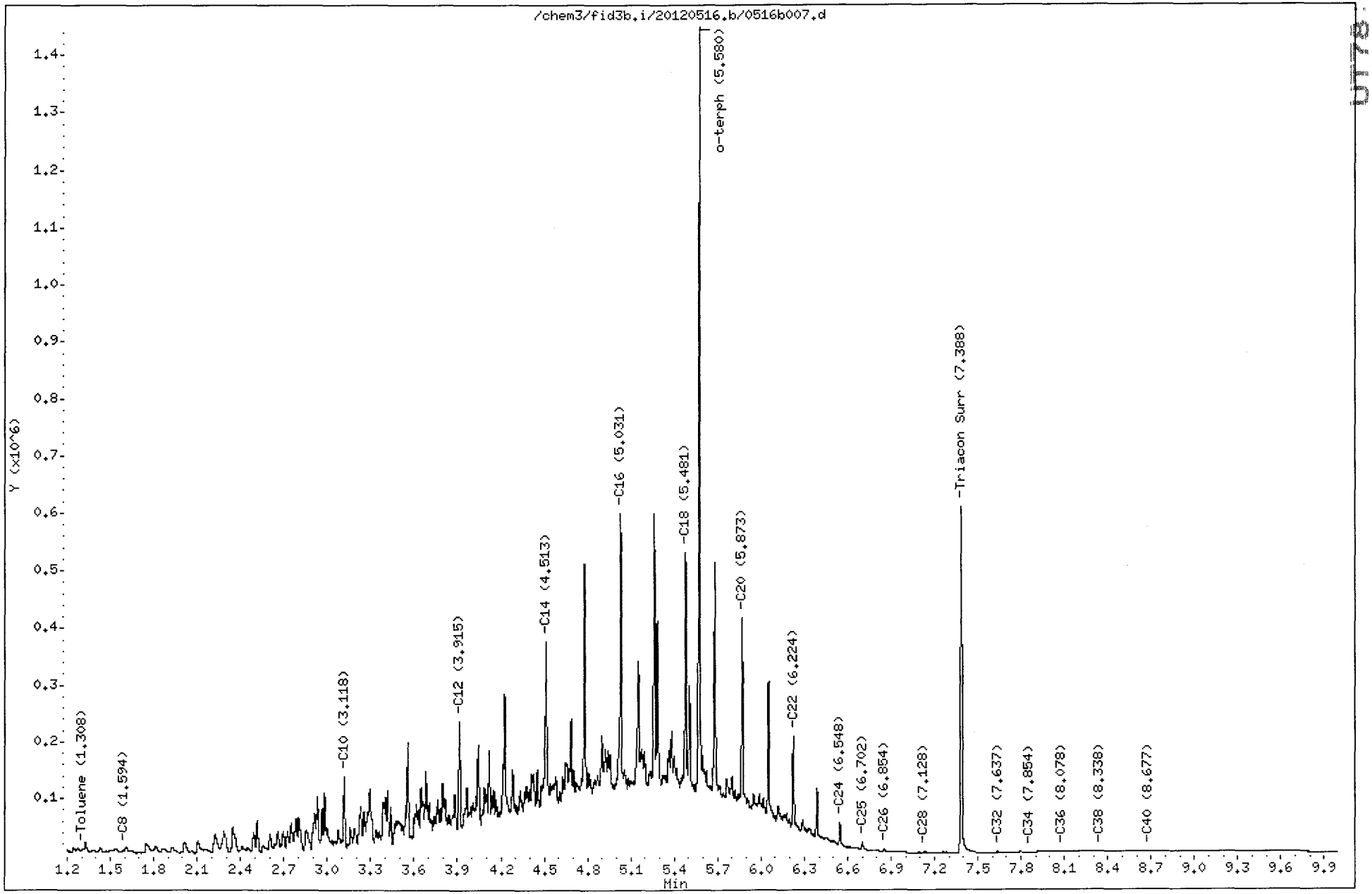
Column phase: RTX-1

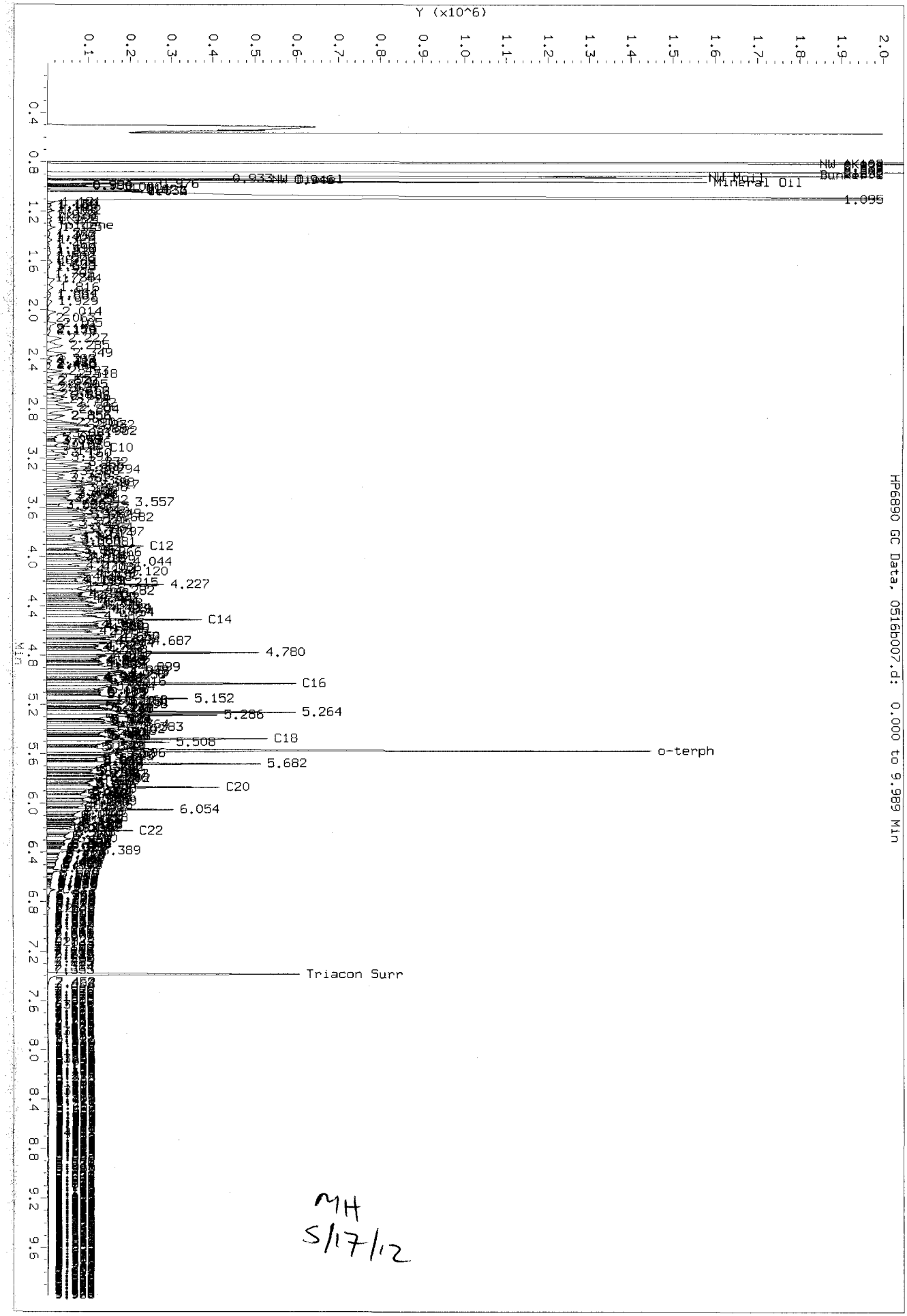
Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

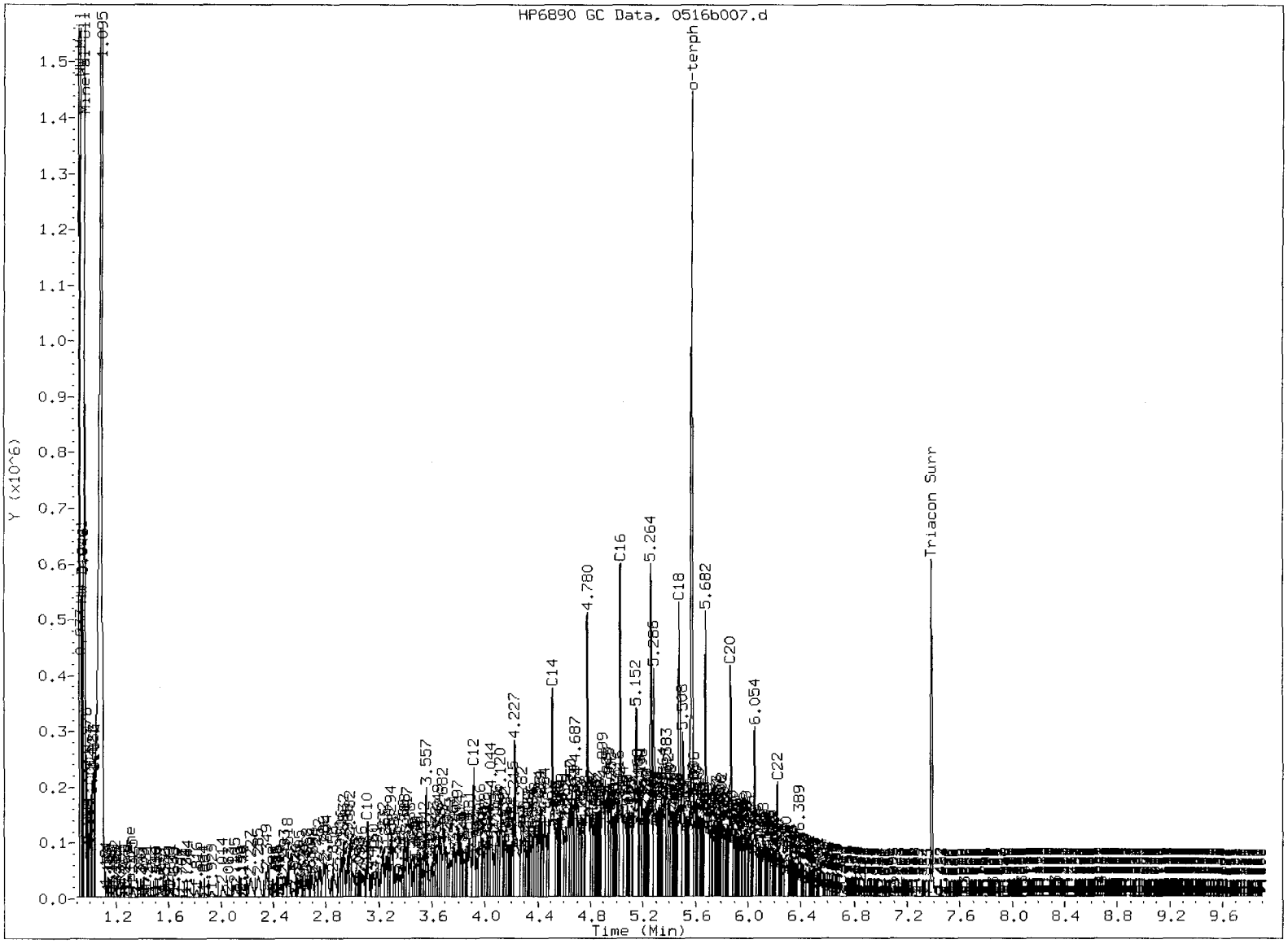
UT78.001.13




Y (x10^6)
Data File: /chem3/fid3b.i/20120516.b/0516b007.d
Injection Date: 16-MAY-2012 09:09
Instrument: fid3b.i
Client Sample ID: UT78LCSS1
HP6890 GC Data, 0516b007.d: 0.000 to 9.989 Min
Min
Mineral Oil
C10
C12
C14
C16
C18
C20
C22
o-terph
Triacon Surr
4.227
4.780
5.152
5.264
5.508
5.682
6.054
3.557

MH
5/17/12

FID:3B-2C/RTX-1 UT78LCSS1 FID:3B SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b008.d

Date : 16-MAY-2012 09:28

Client ID: CBA-SB-1-1.5-2.5-05

Sample Info: UT78A,50

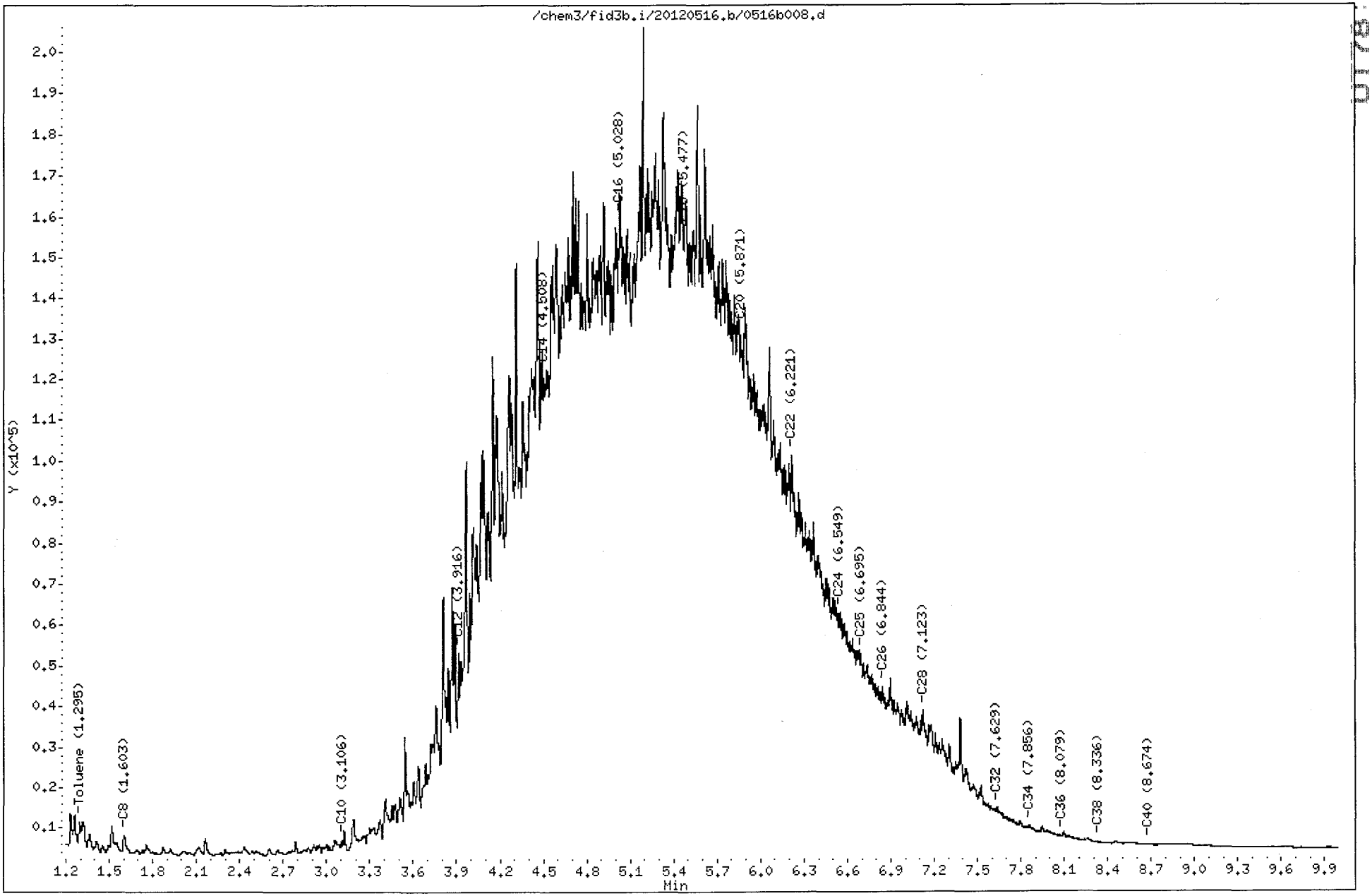
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78A 20120516



Data File: /chem3/fid3b.i/20120516.b/0516b009.d

Page 1

Date : 16-MAY-2012 09:47

Client ID: CBA-SB-1-3-5-0512

Instrument: fid3b.i

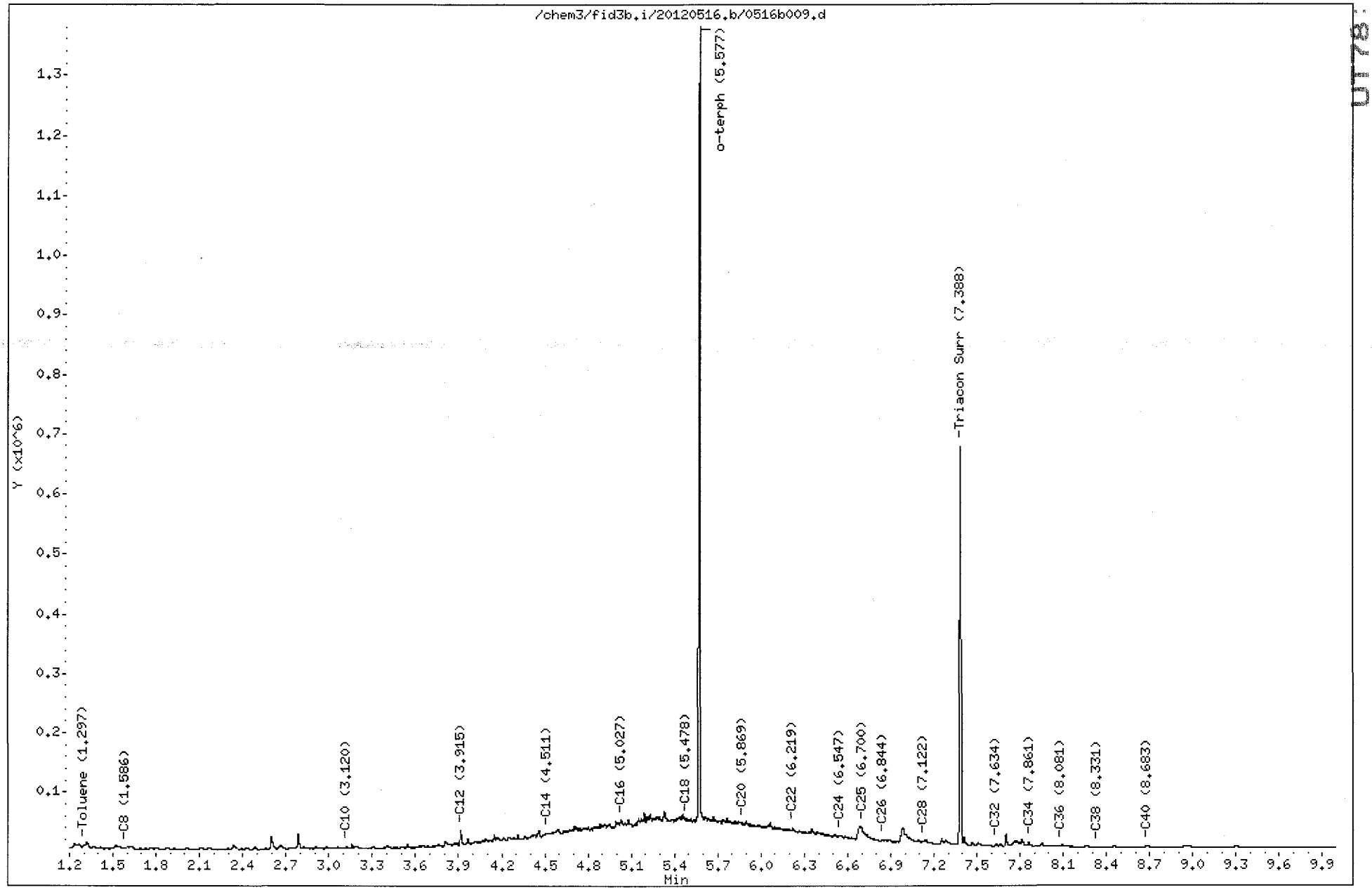
Sample Info: UT78B

Operator: MH

Column phase: RTX-1

Column diameter: 0.25

UT78 5017



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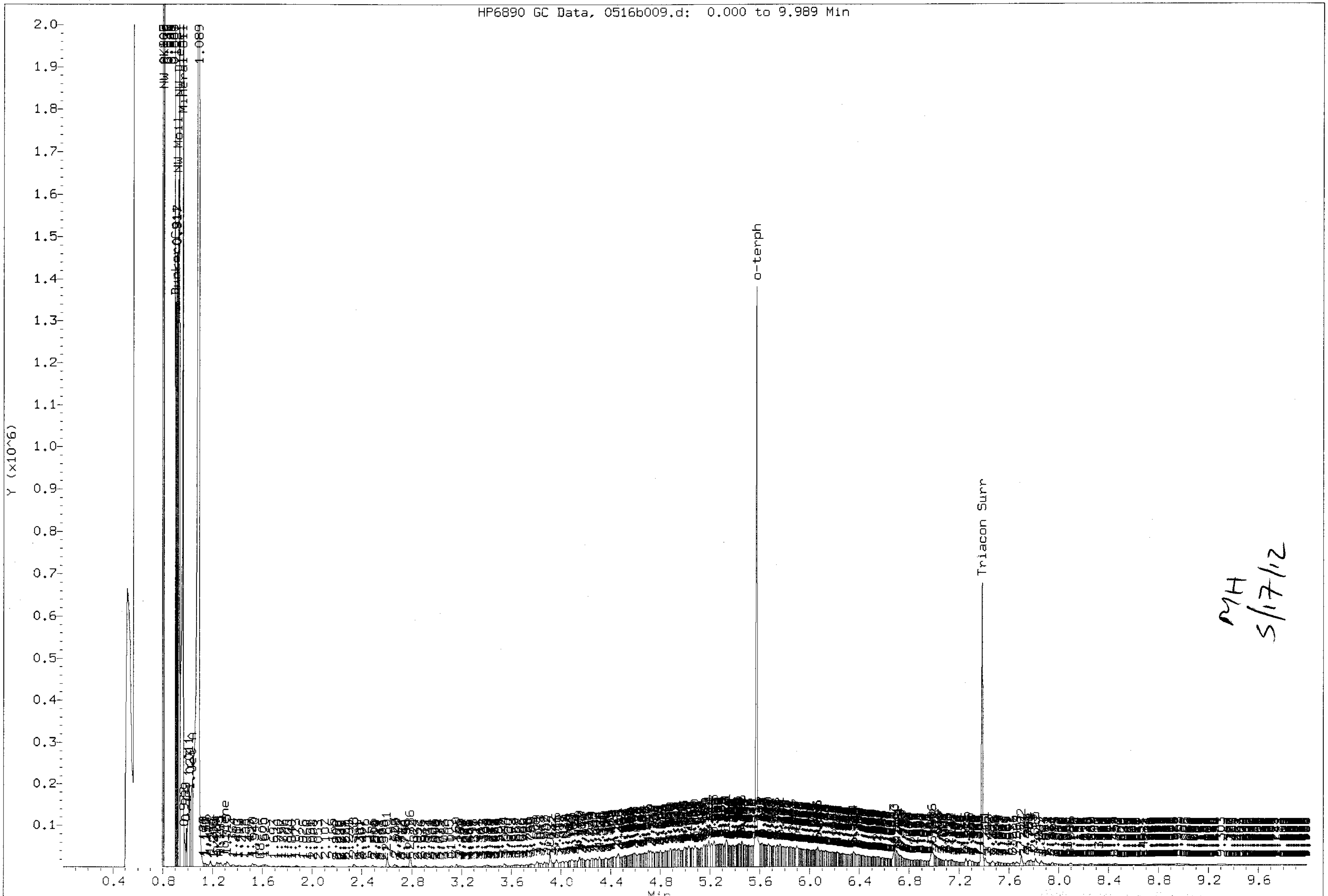
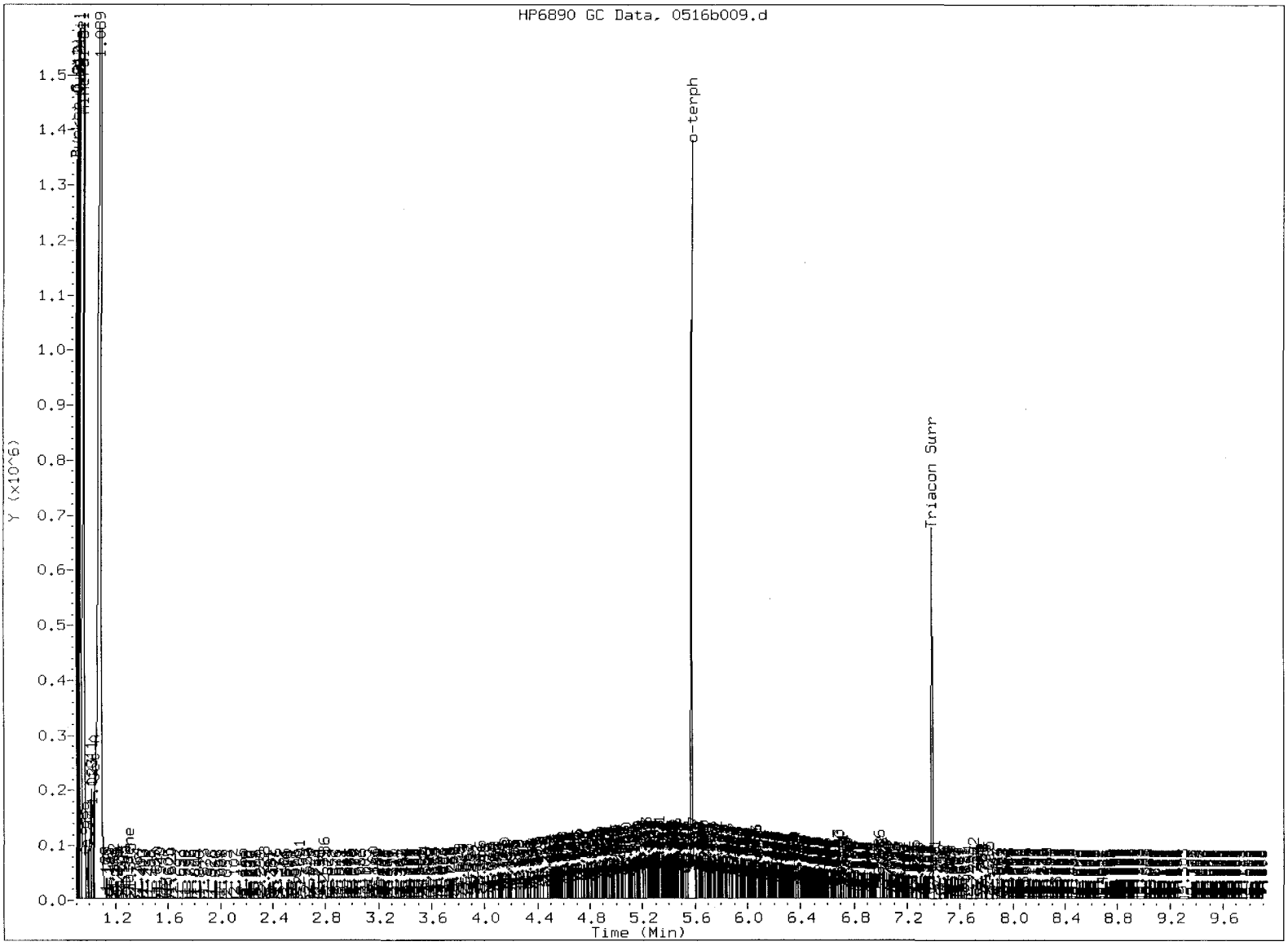
Injection Date: 16-MAY-2012 09:47
Instrument: fid3b.i
Client Sample ID: CBA-SB-1-3-5-0512



MH
5/17/12

UT78:00118

FID:3B-2C/RTX-1 UT78B FID:3B SIGNAL



MANUAL INTEGRATION

~~X~~. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b010.d

Date : 16-MAY-2012 10:06

Client ID: CBA-SB-2-0.5-2.5-05

Sample Info: UT78C,50

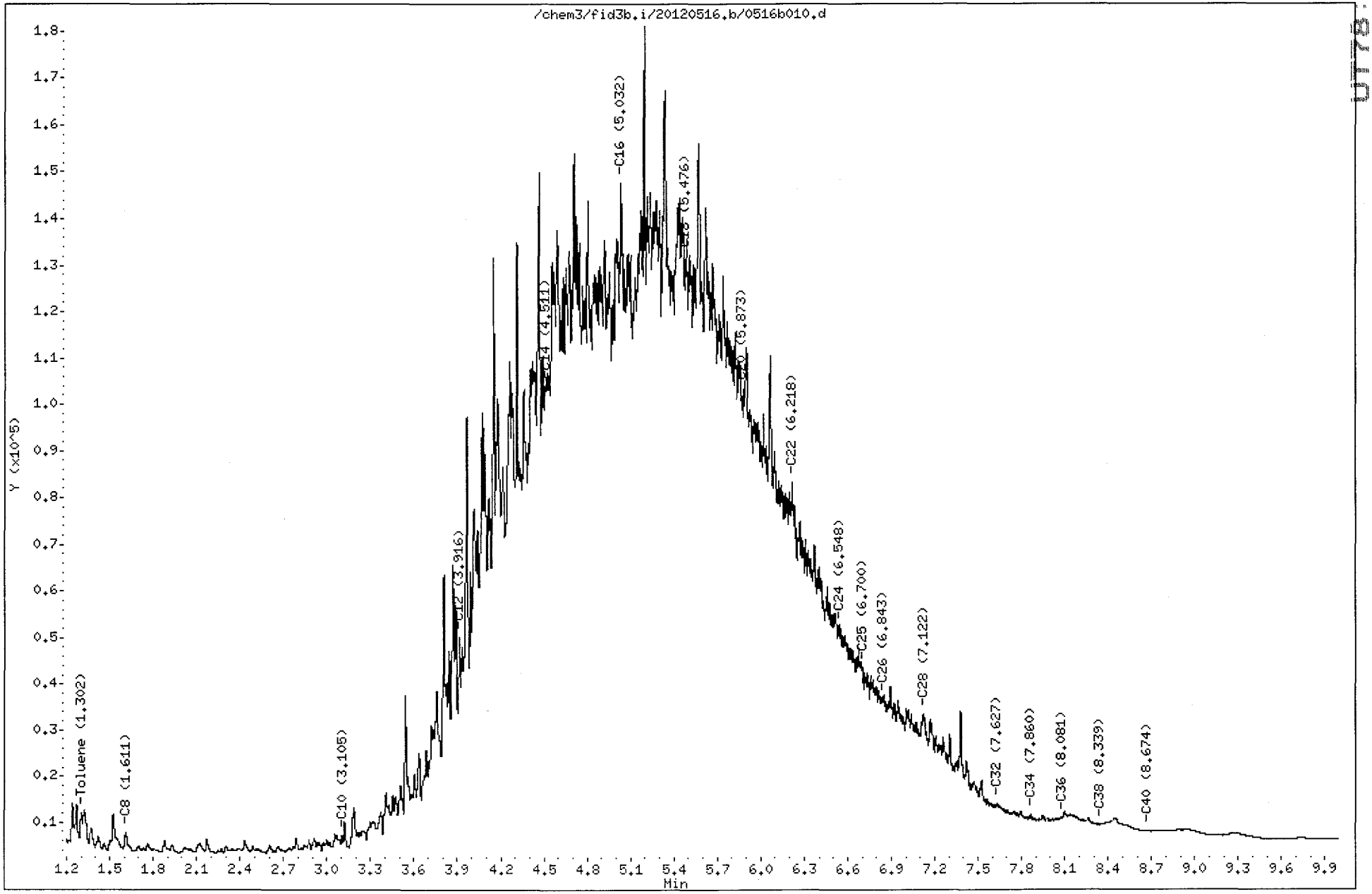
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78-00120



Data File: /chem3/fid3b.i/20120516.b/0516b011.d

Date : 16-MAY-2012 10:25

Client ID: CBA-SB-3-1-3-0512

Sample Info: UT78D,5

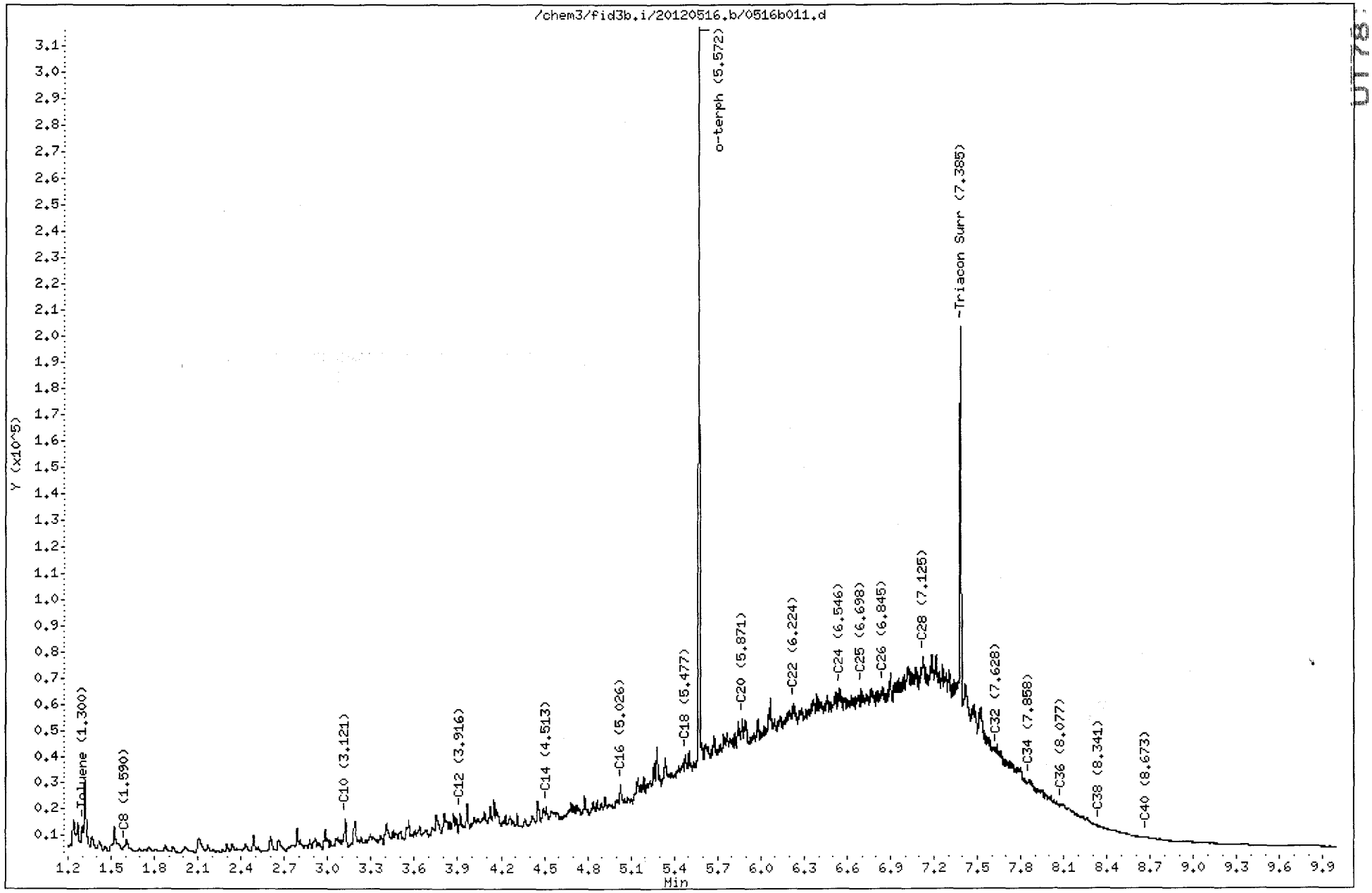
Instrument: fid3b.i

Operator: MH

Column phase: RTX-1

Column diameter: 0.25

UT78D 60121



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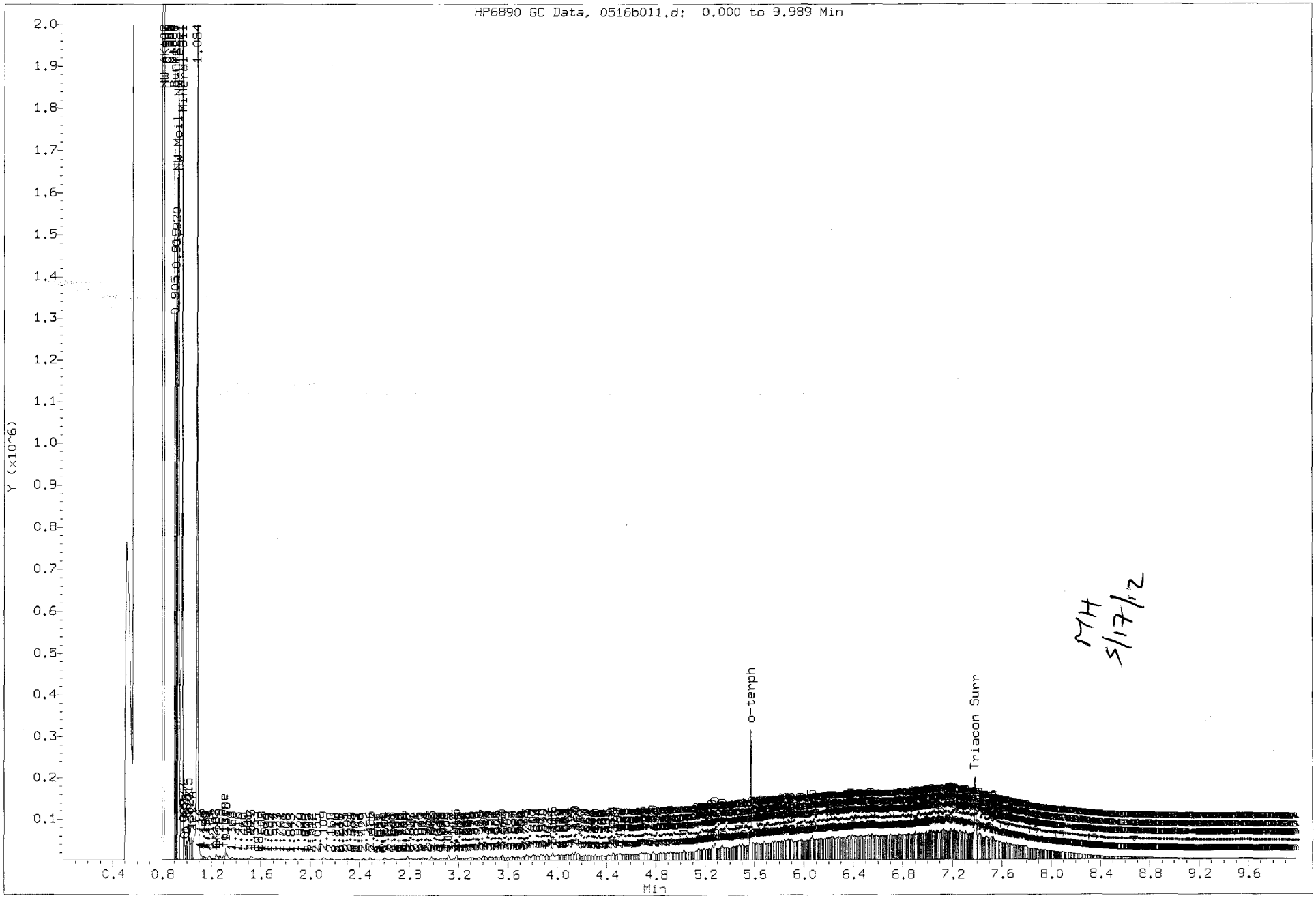
Injection Date: 16-MAY-2012 10:25
Instrument: fid3b.i
Client Sample ID: CBA-SB-3-1-3-0512

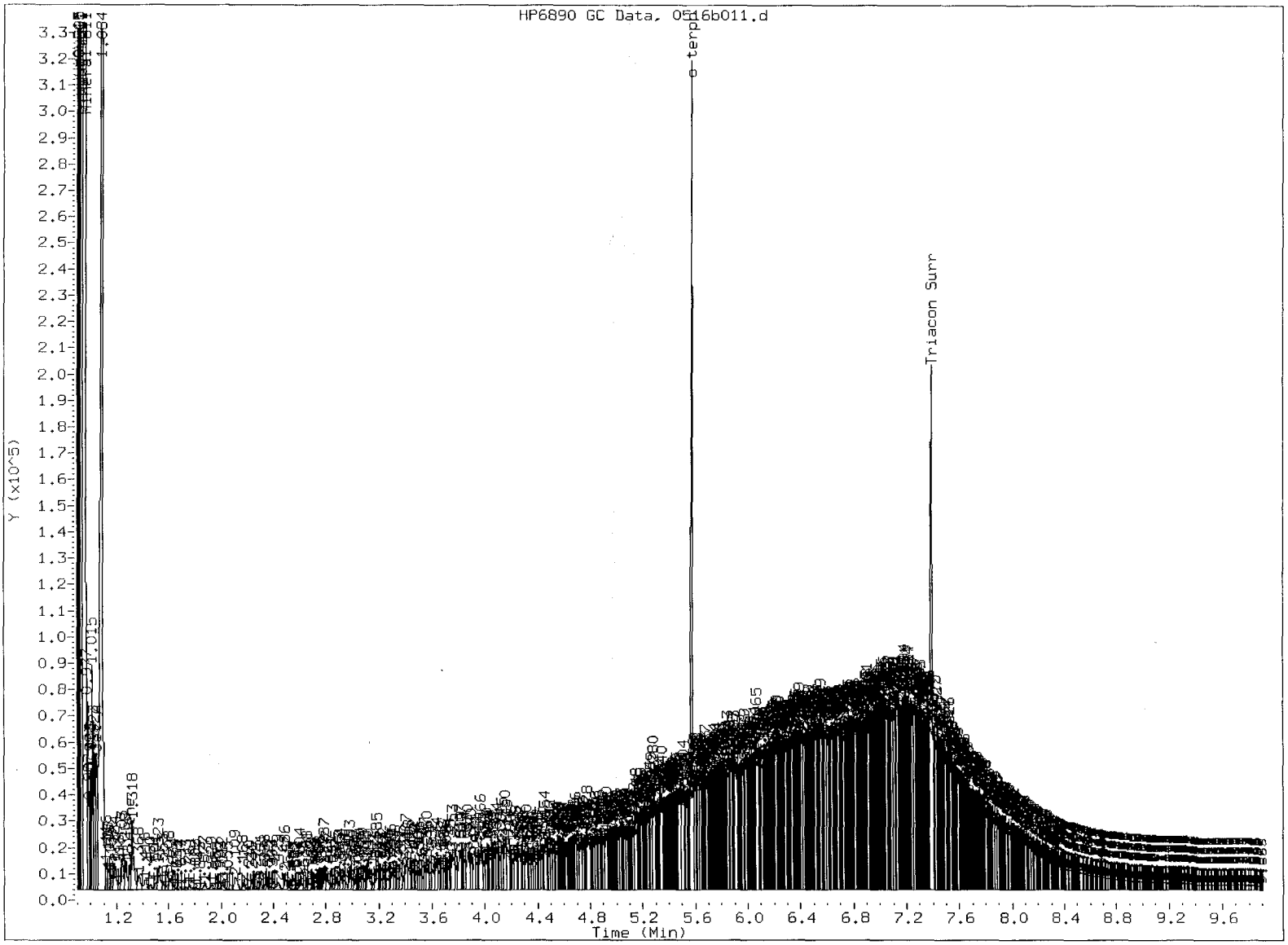


5/17/12 MH

5/17/12

FID:3B-2C/RTX-1 UT78D

FID:3B SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b012.d

Date : 16-MAY-2012 10:44

Client ID: CBA-SB-4-0.5-2.5-05

Sample Info: UT78E,5

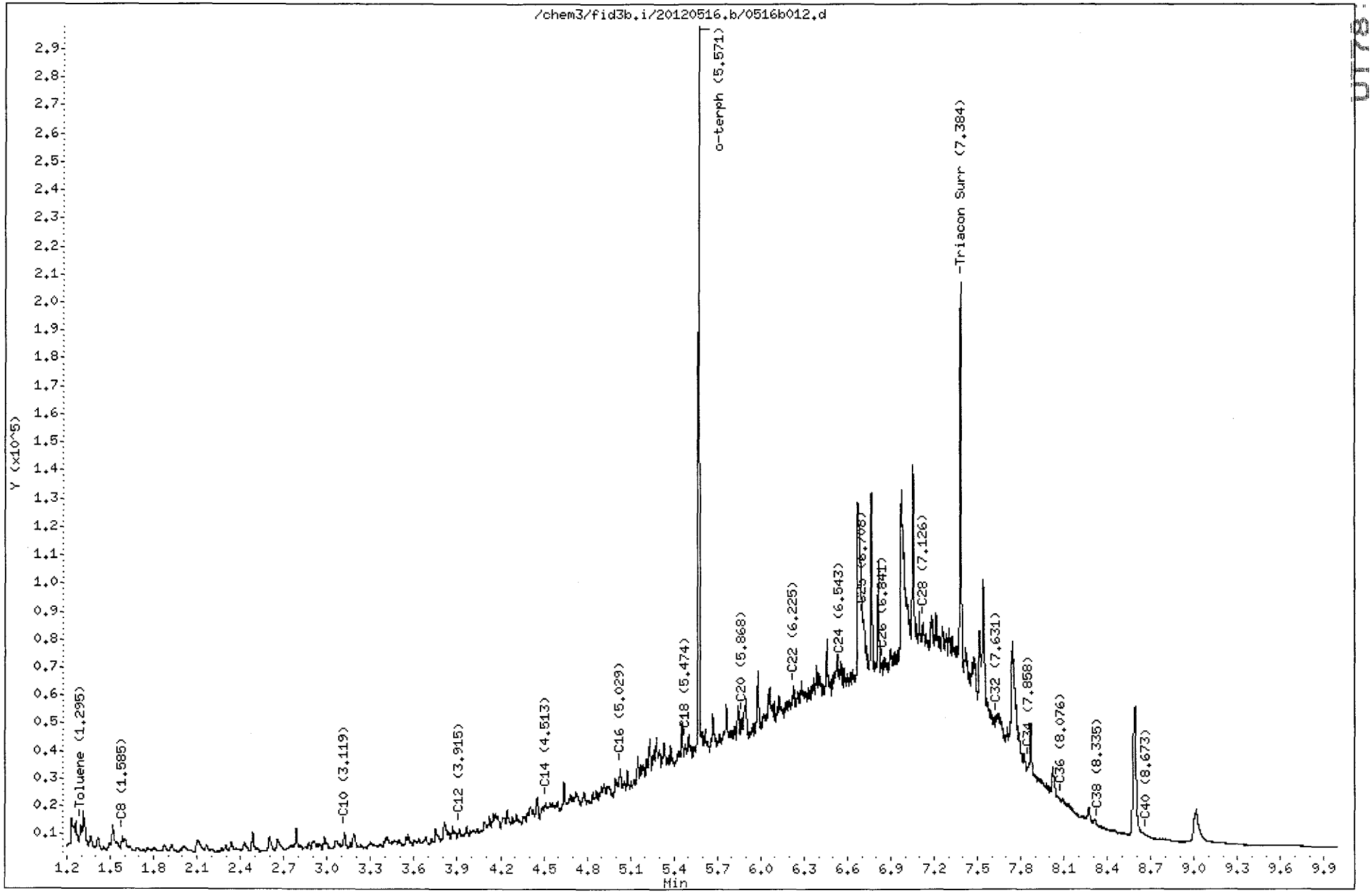
Column phase: RTX-1

Instrument: fid3b.i

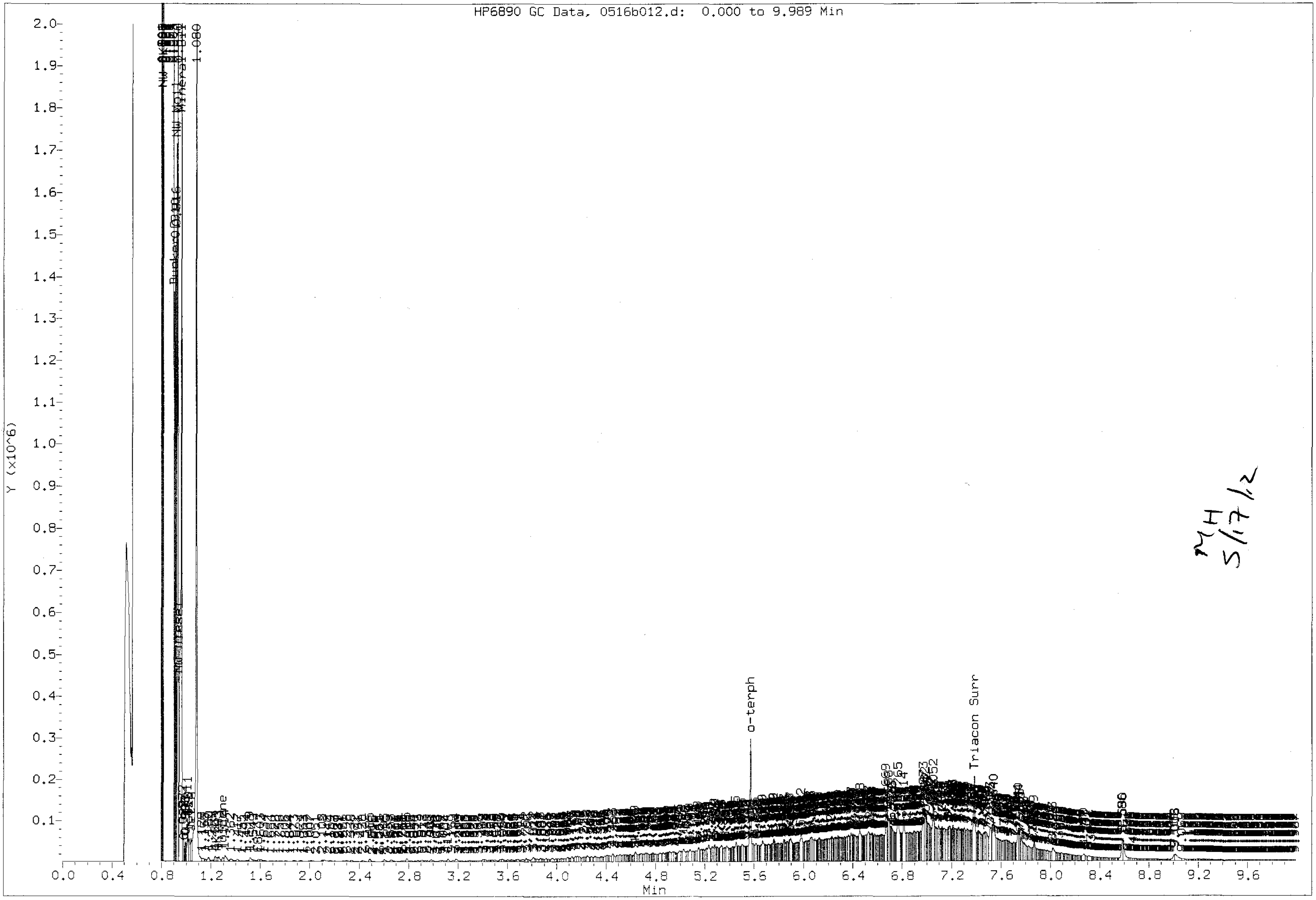
Operator: MH

Column diameter: 0.25

UT78E 00121

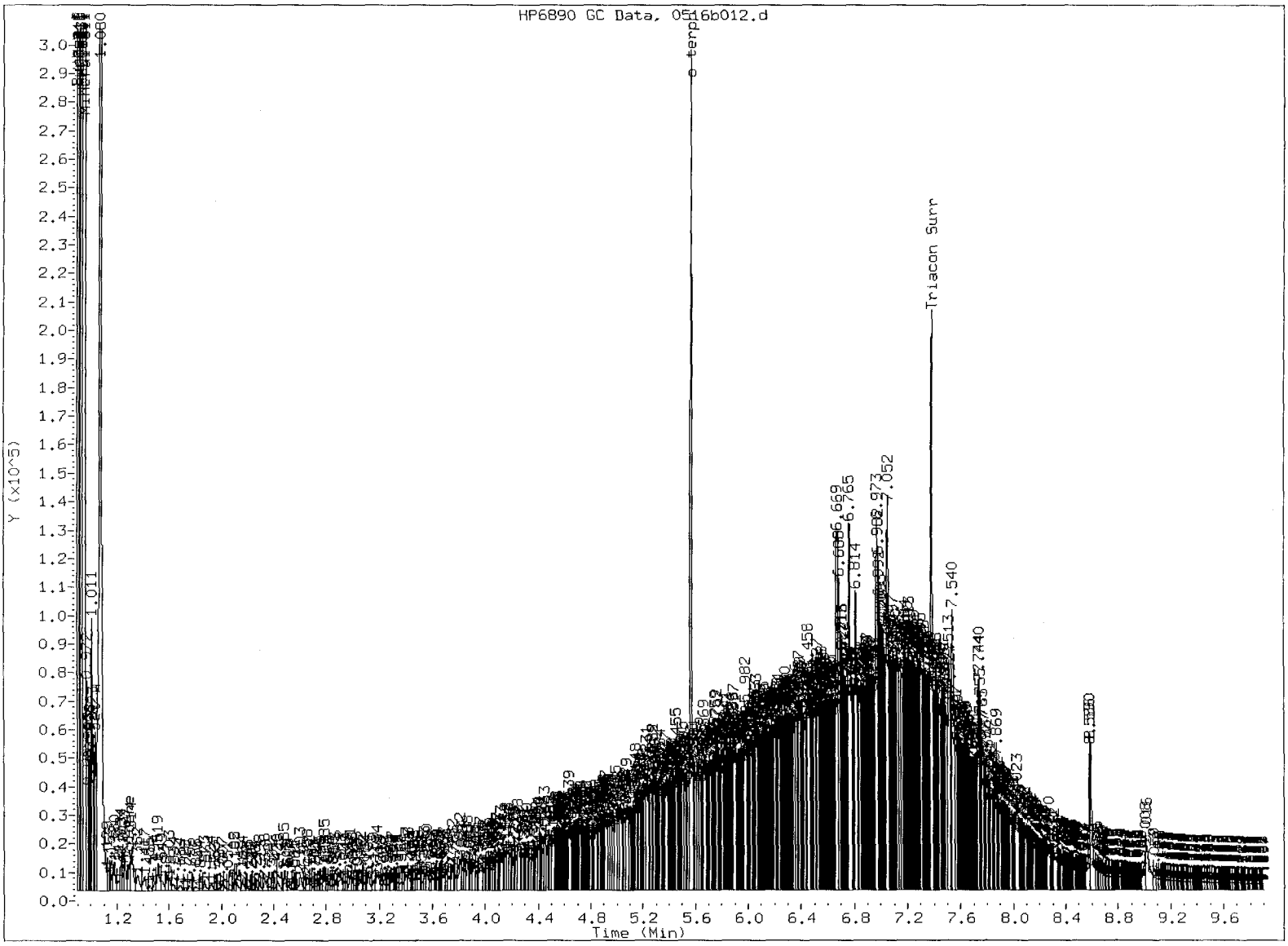


Data File: /chem3/fid3b.i/20120516.b/0516b012.d
Injection Date: 16-MAY-2012 10:44
Instrument: fid3b.i
Client Sample ID: CBA-SB-4-0.5-2.5-05



MH
5/17/12

FID:3B-2C/RTX-1 UT78E FID:3B SIGNAL



MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b013.d

Page 1

Date : 16-MAY-2012 11:03

Client ID: CBA-SB-4-3-5-0512

Instrument: fid3b.i

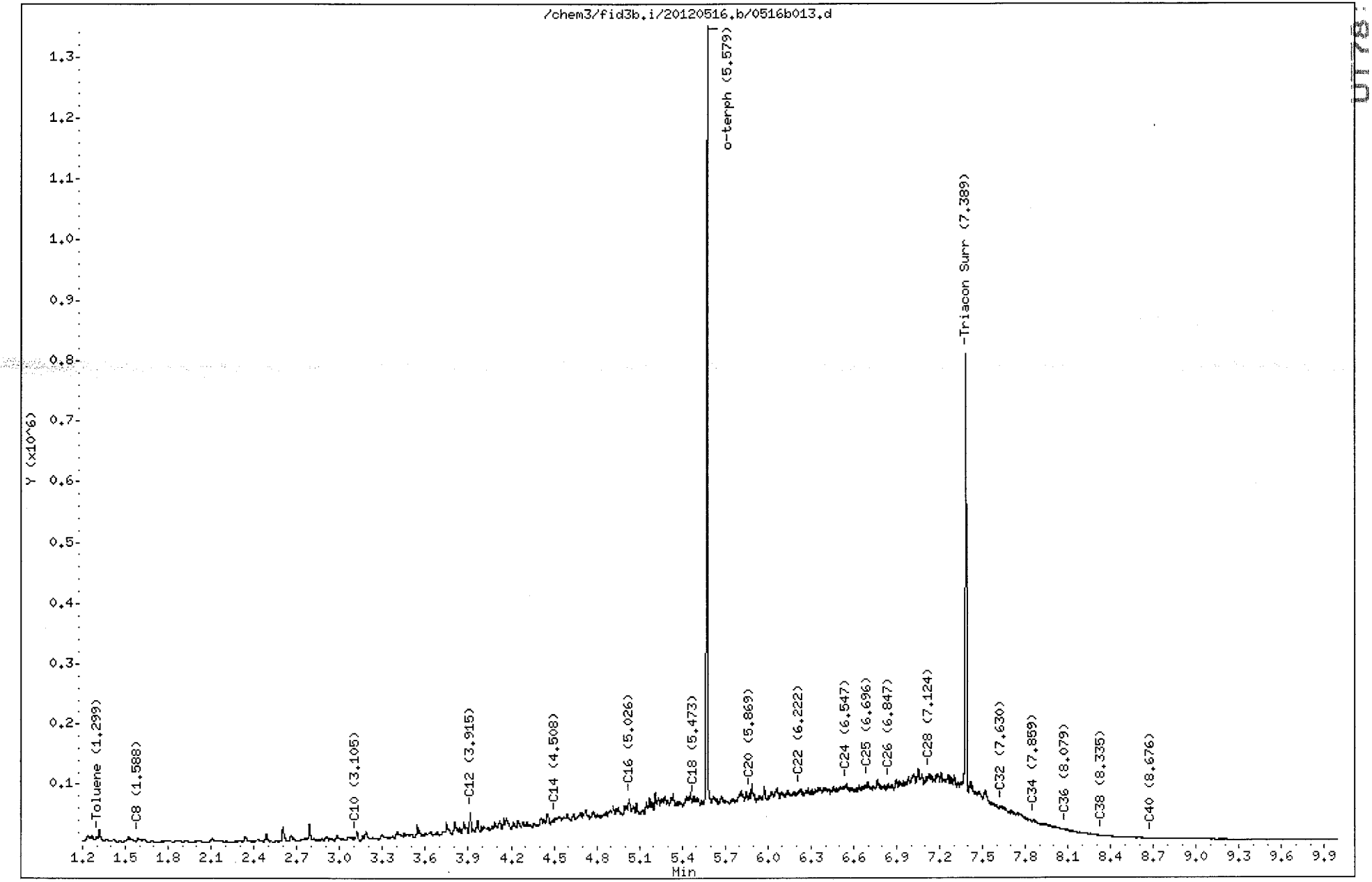
Sample Info: UT78F

Operator: MH

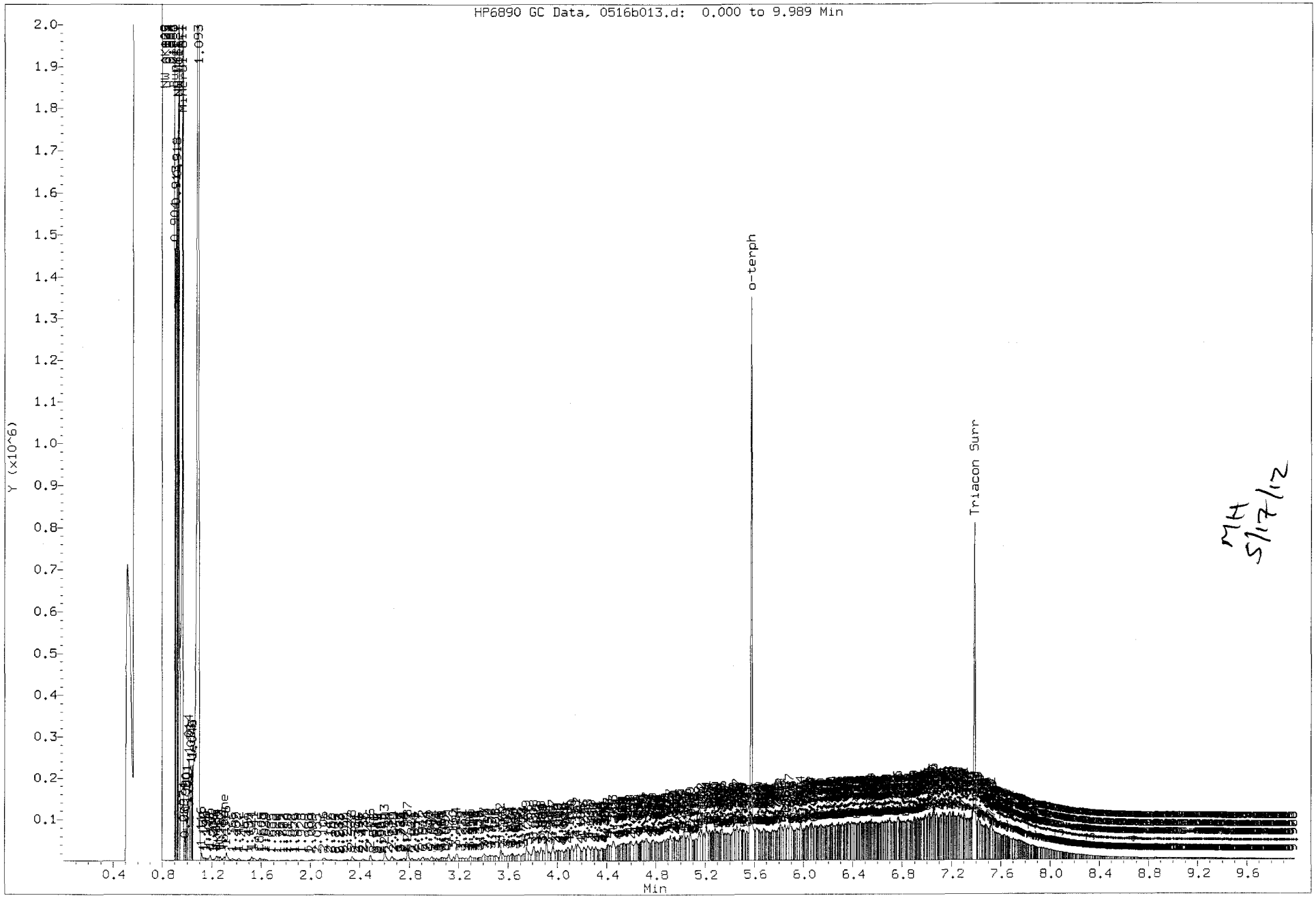
Column phase: RTX-1

Column diameter: 0.25

UT78.00127



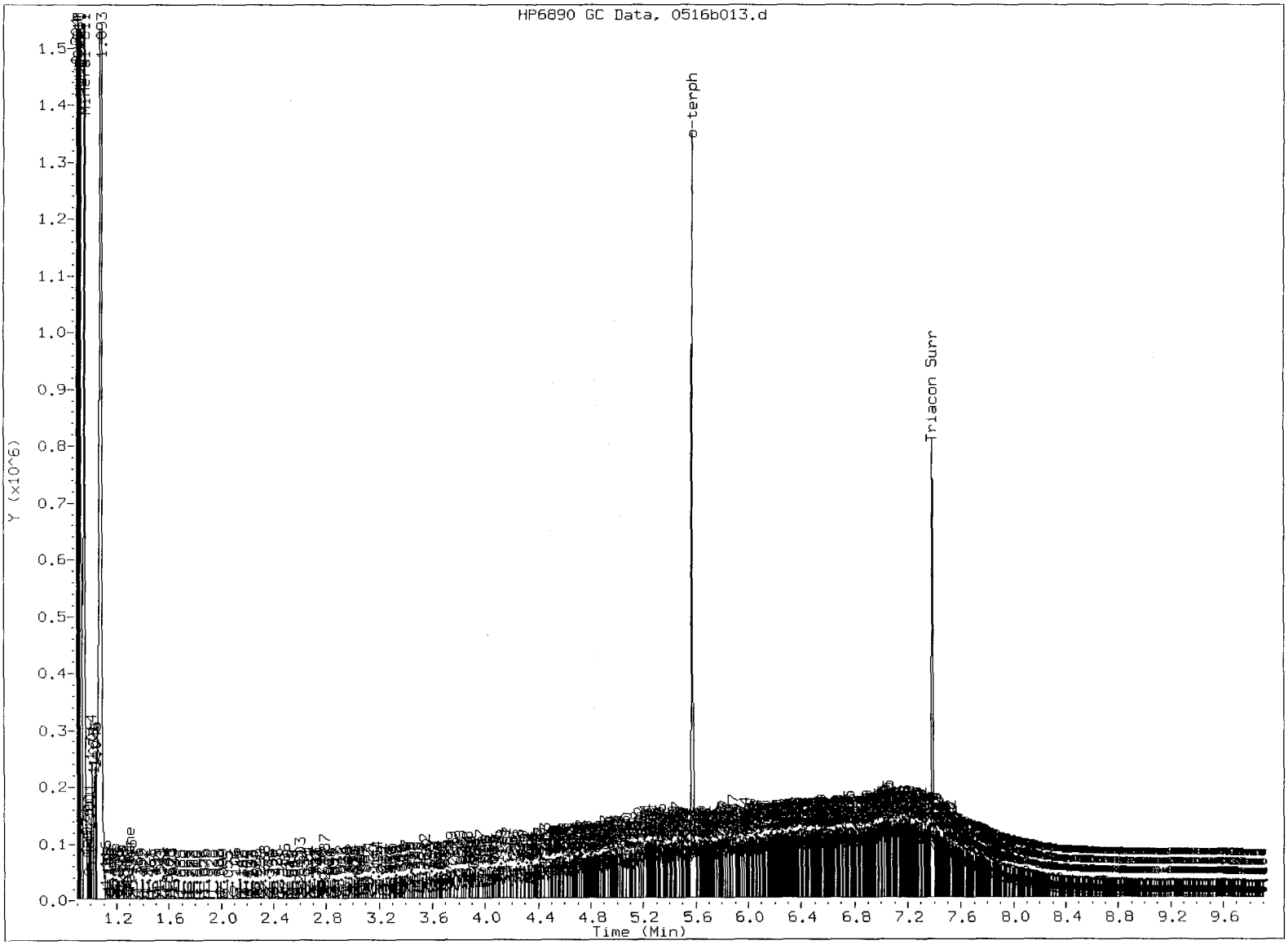
Data File: /chem3/fid3b.i/20120516.b/0516b013.d
Injection Date: 16-MAY-2012 11:03
Instrument: fid3b.i
Client Sample ID: CBA-SB-4-3-5-0512



MH 5/17/12

UTT3:00128

FID:3B-2C/RTX-1 UT78F FID:3B SIGNAL



MANUAL INTEGRATION

~~1~~. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b014.d

Date : 16-MAY-2012 11:22

Client ID: CBA-SB-5-3.5-0512

Sample Info: UT78G

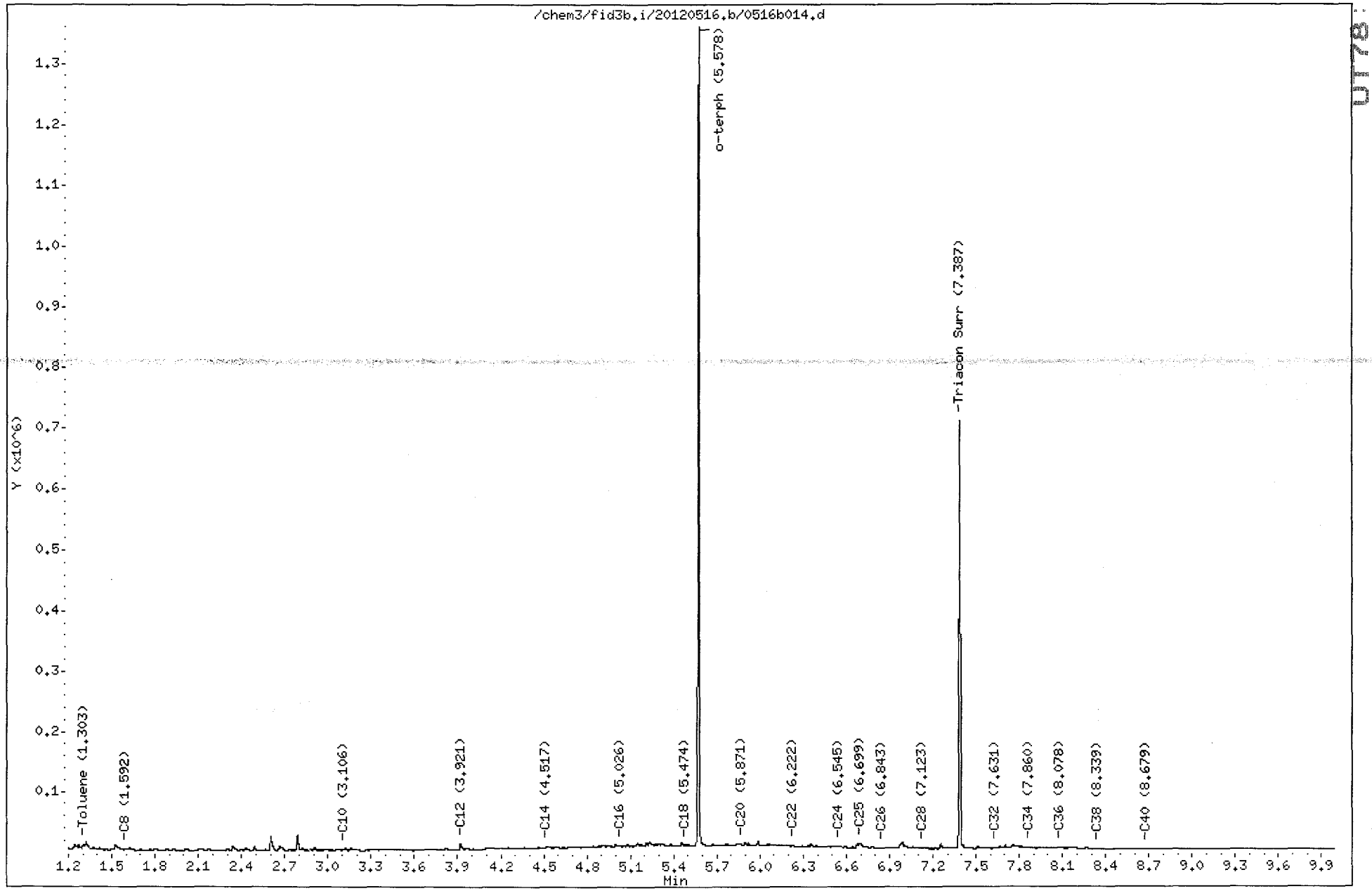
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78:001-30



Data File: /chem3/fid3b.i/20120516.b/0516b015.d

Date : 16-MAY-2012 11:41

Client ID: CBA-SB-5-0-2-0512

Sample Info: UT78H

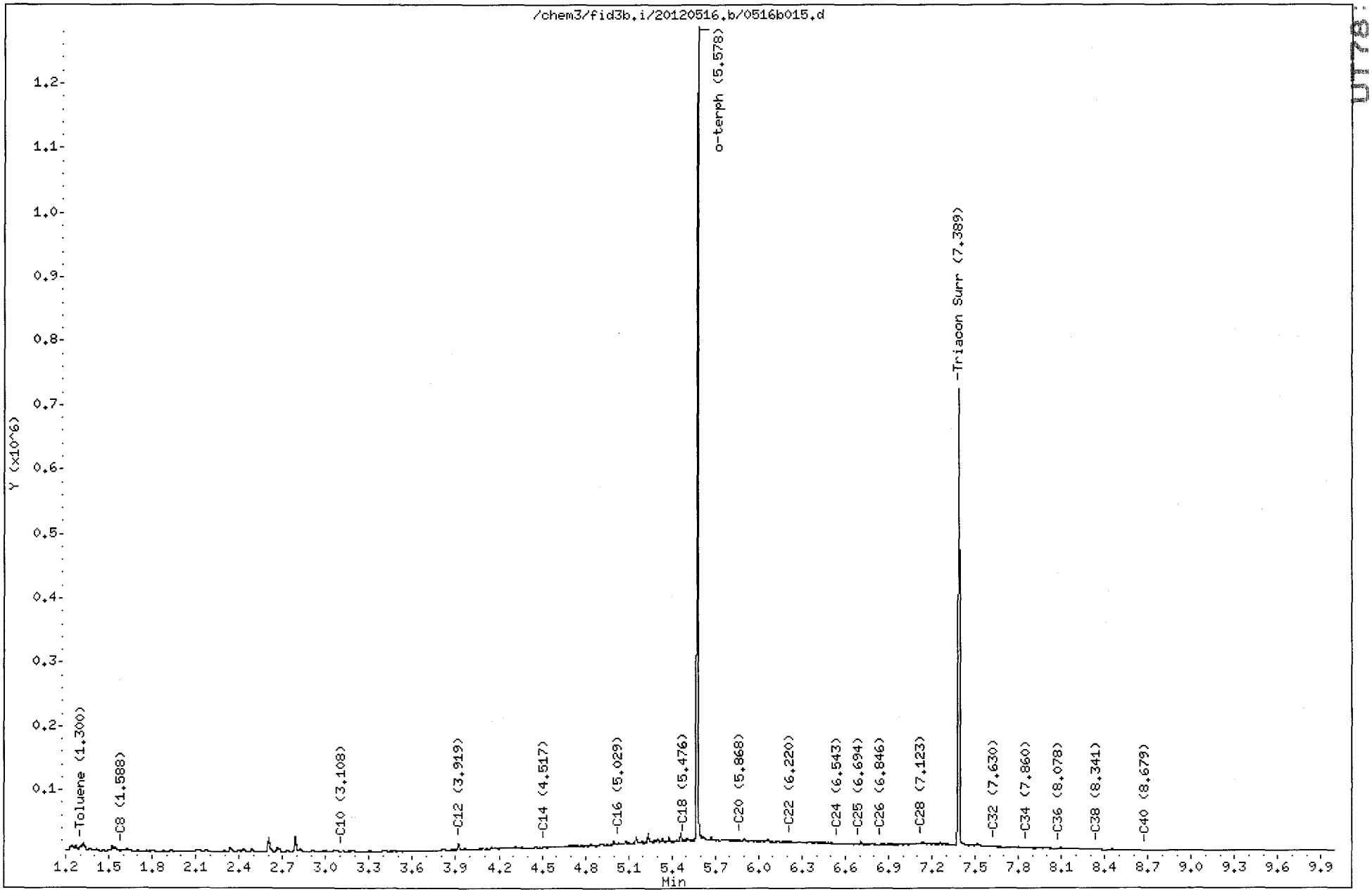
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78 0015



Data File: /chem3/fid3b.i/20120516.b/0516b018.d

Date : 16-MAY-2012 12:38

Client ID: CBA-SB-20-0.5-2.5-0

Sample Info: UT78I,50

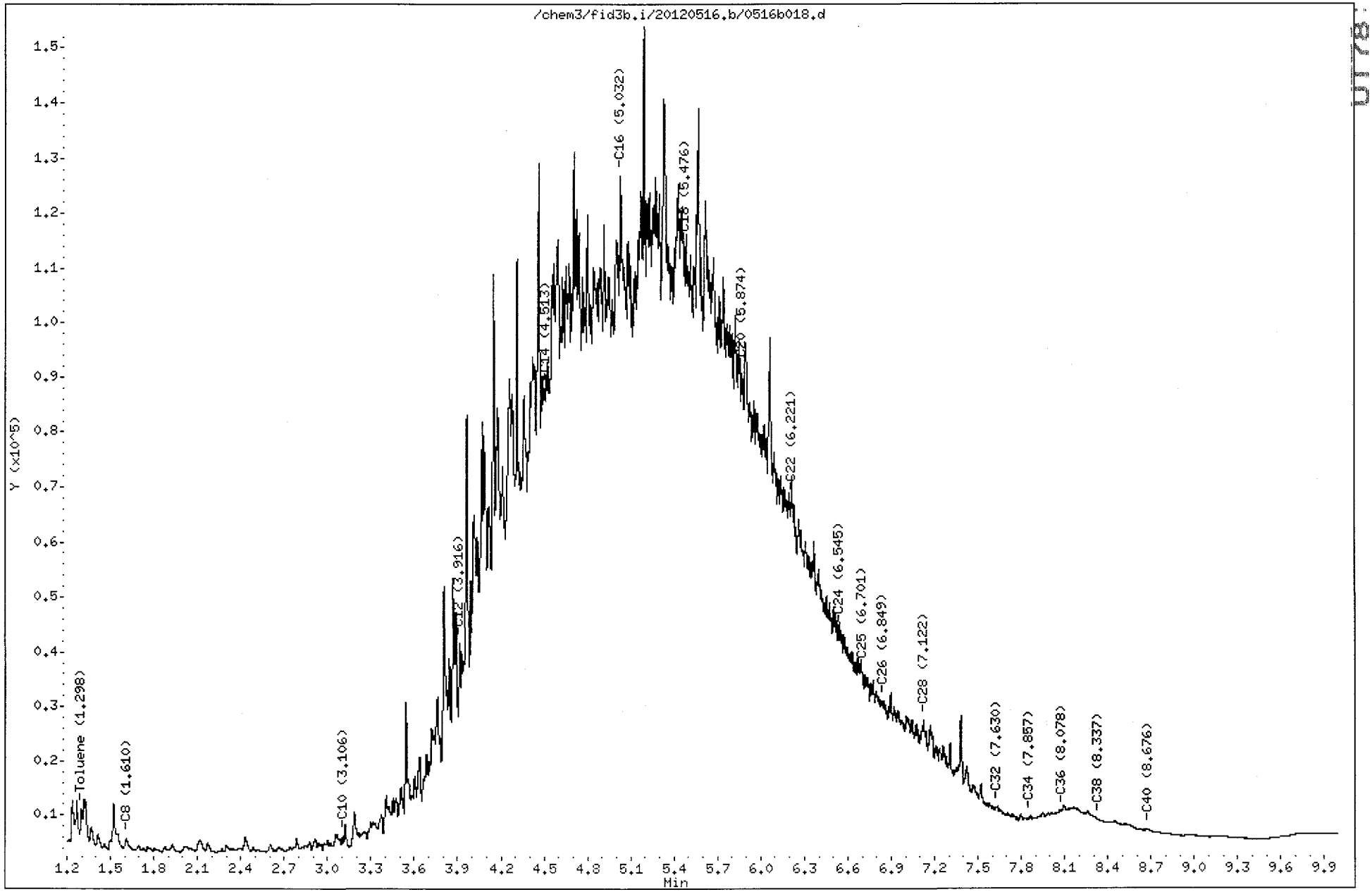
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78I:00132



Data File: /chem3/fid3b.i/20120516.b/0516b019.d

Date : 16-MAY-2012 12:57

Client ID: CBA-SB-50-3-5-0512

Sample Info: UT78J

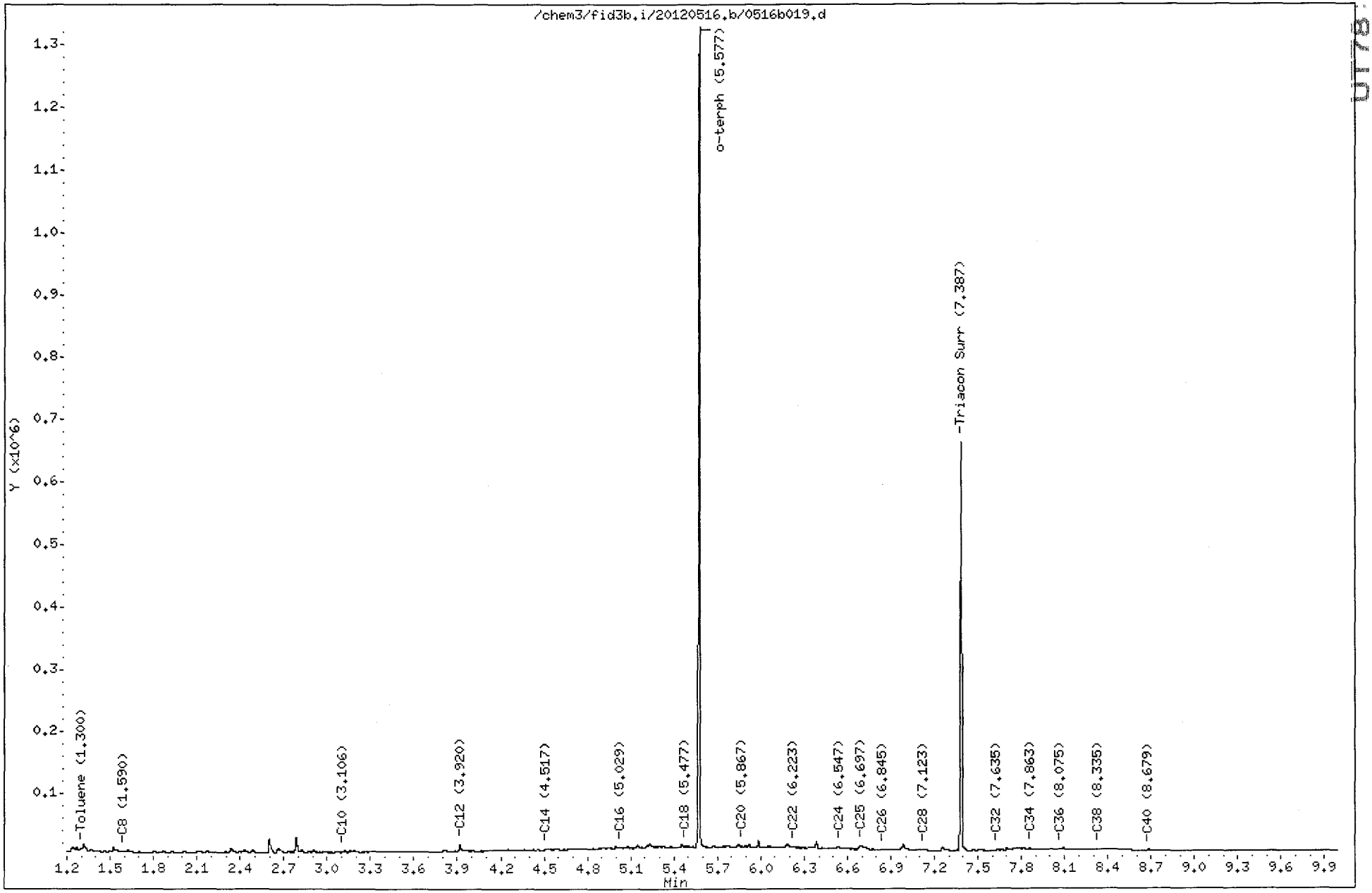
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78.00133



Data File: /chem3/fid3b.i/20120516.b/0516b020.d

Page 1

Date : 16-MAY-2012 13:16

Client ID: CBA-SB-6-3-5-0512

Instrument: fid3b.i

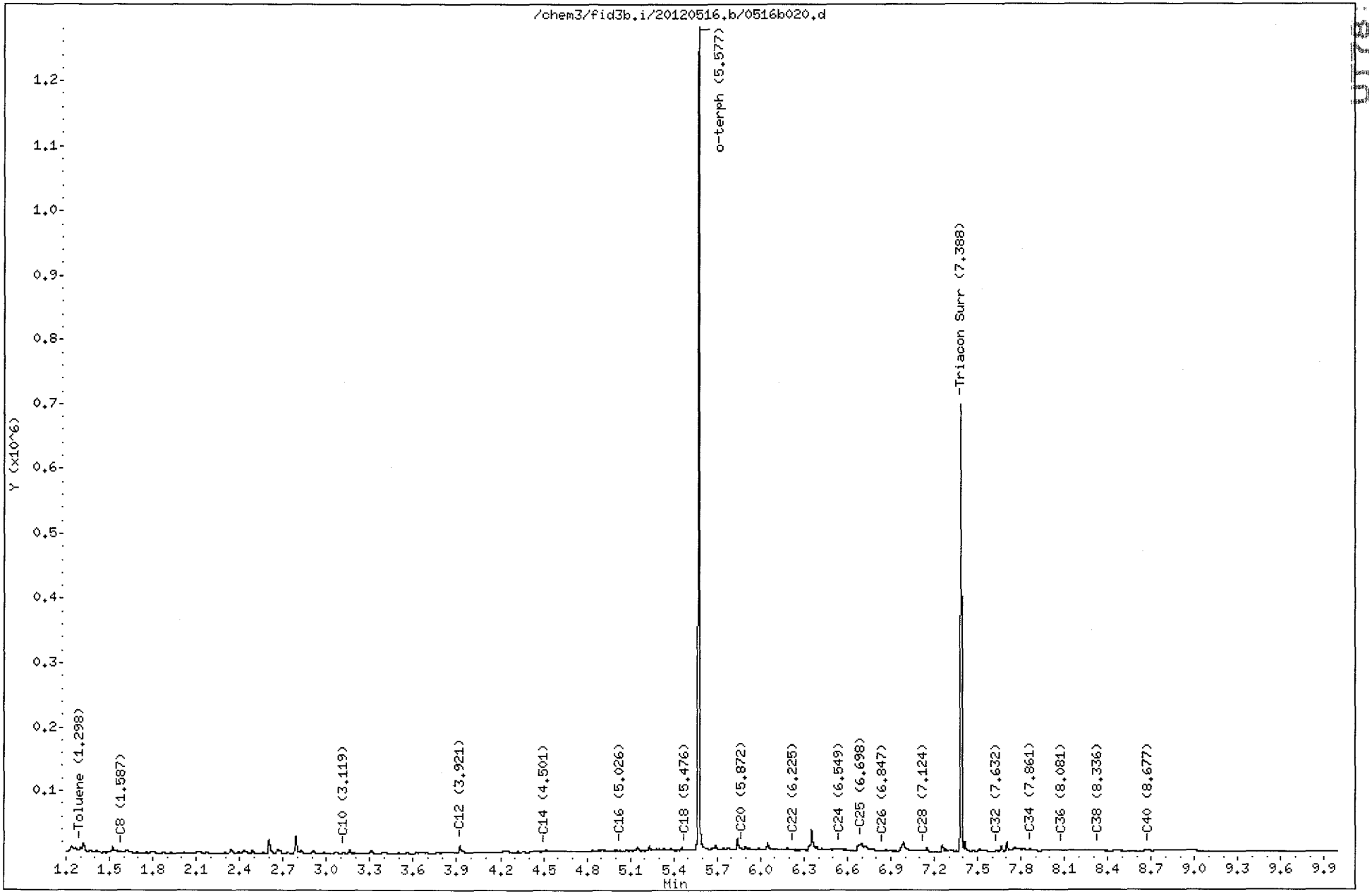
Sample Info: UT78K

Operator: MH

Column phase: RTX-1

Column diameter: 0.25

UT78 0513



Data File: /chem3/fid3b.i/20120516.b/0516b021.d

Date : 16-MAY-2012 13:35

Client ID: CBA-SB-7-1-3-0512

Sample Info: UT78L,5

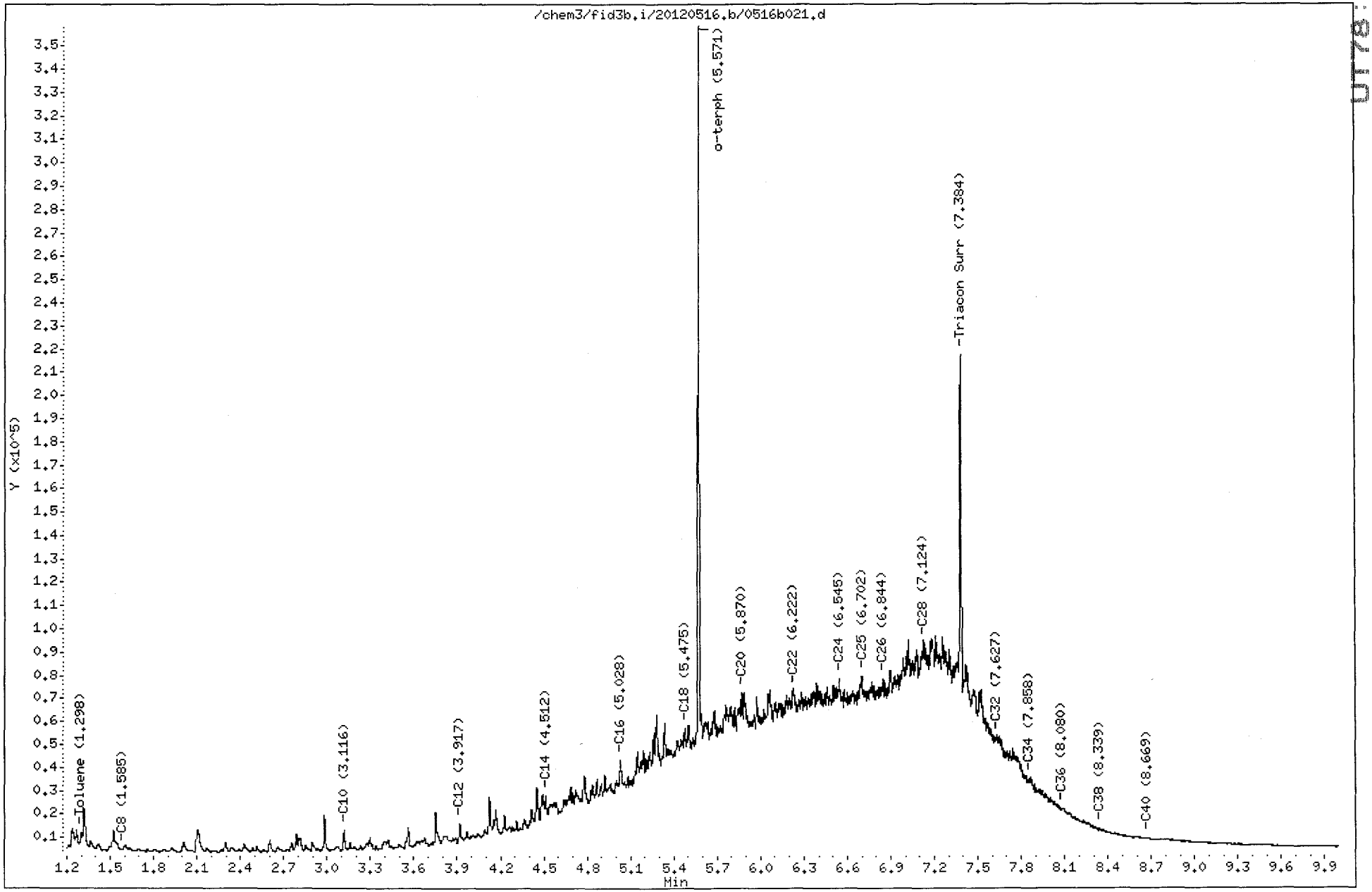
Column phase: RTX-1

Instrument: fid3b.i

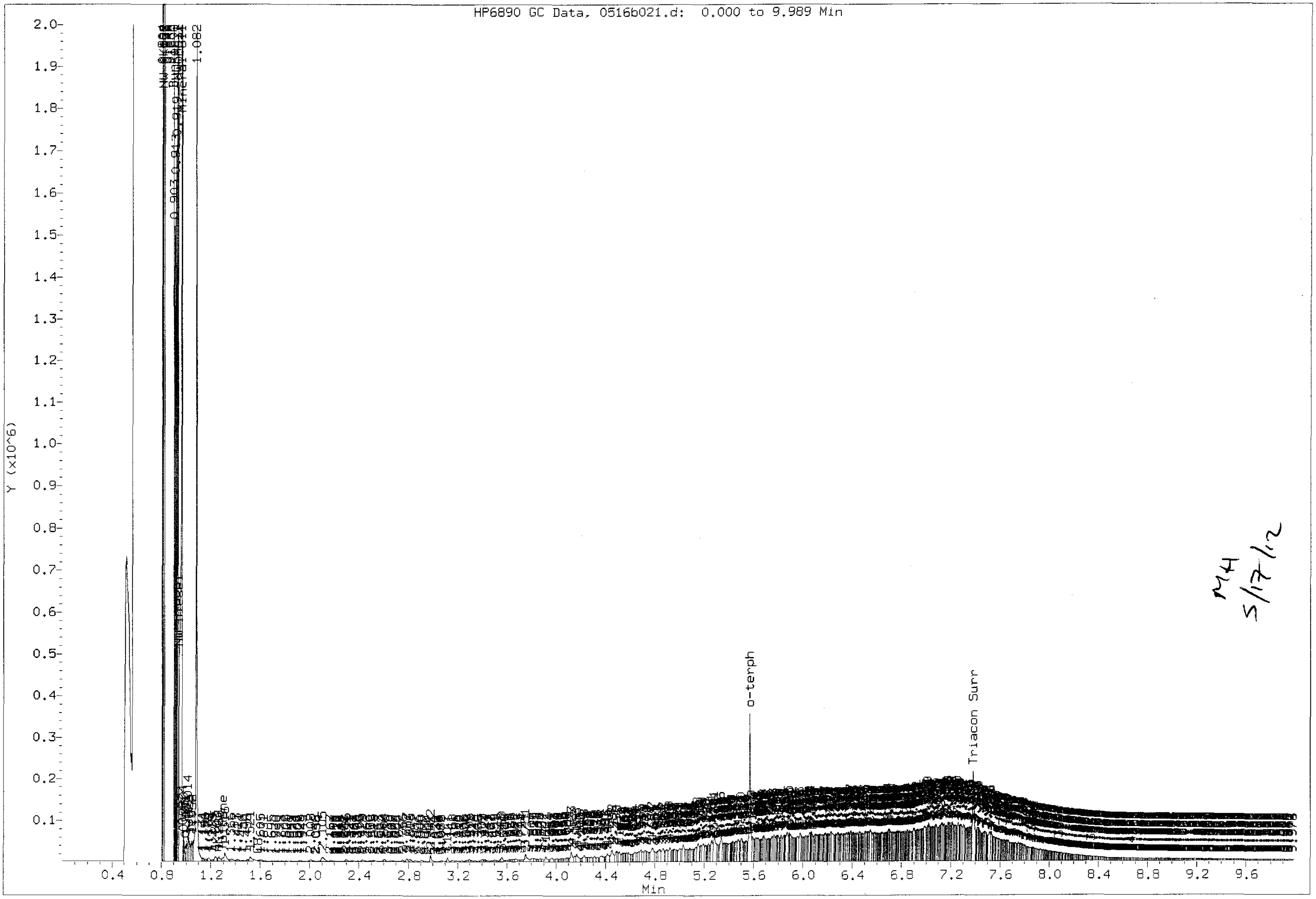
Operator: MH

Column diameter: 0.25

UT78L-001135

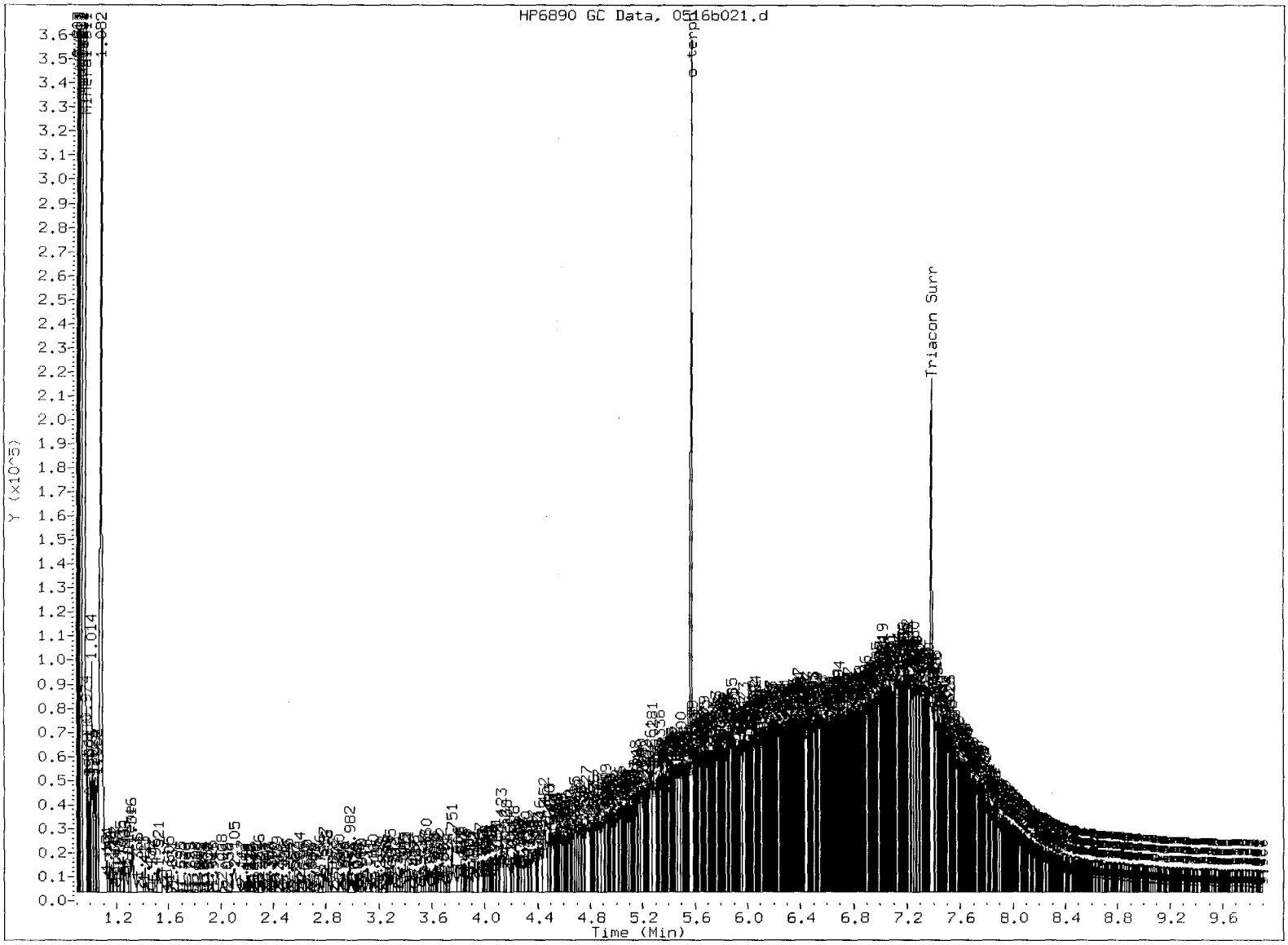


Data File: /chem3/fid3b.i/20120516.b/0516b021.d
Injection Date: 16-MAY-2012 13:35
Instrument: fid3b.i
Client Sample ID: CBA-SB-7-1-3-0512



MH
5/17/12

FID:3B-2C/RTX-1 UT78L FID:3B SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b022.d

Date : 16-MAY-2012 13:54

Client ID: CBA-SB-8-3-5-0512

Sample Info: UT78M,5

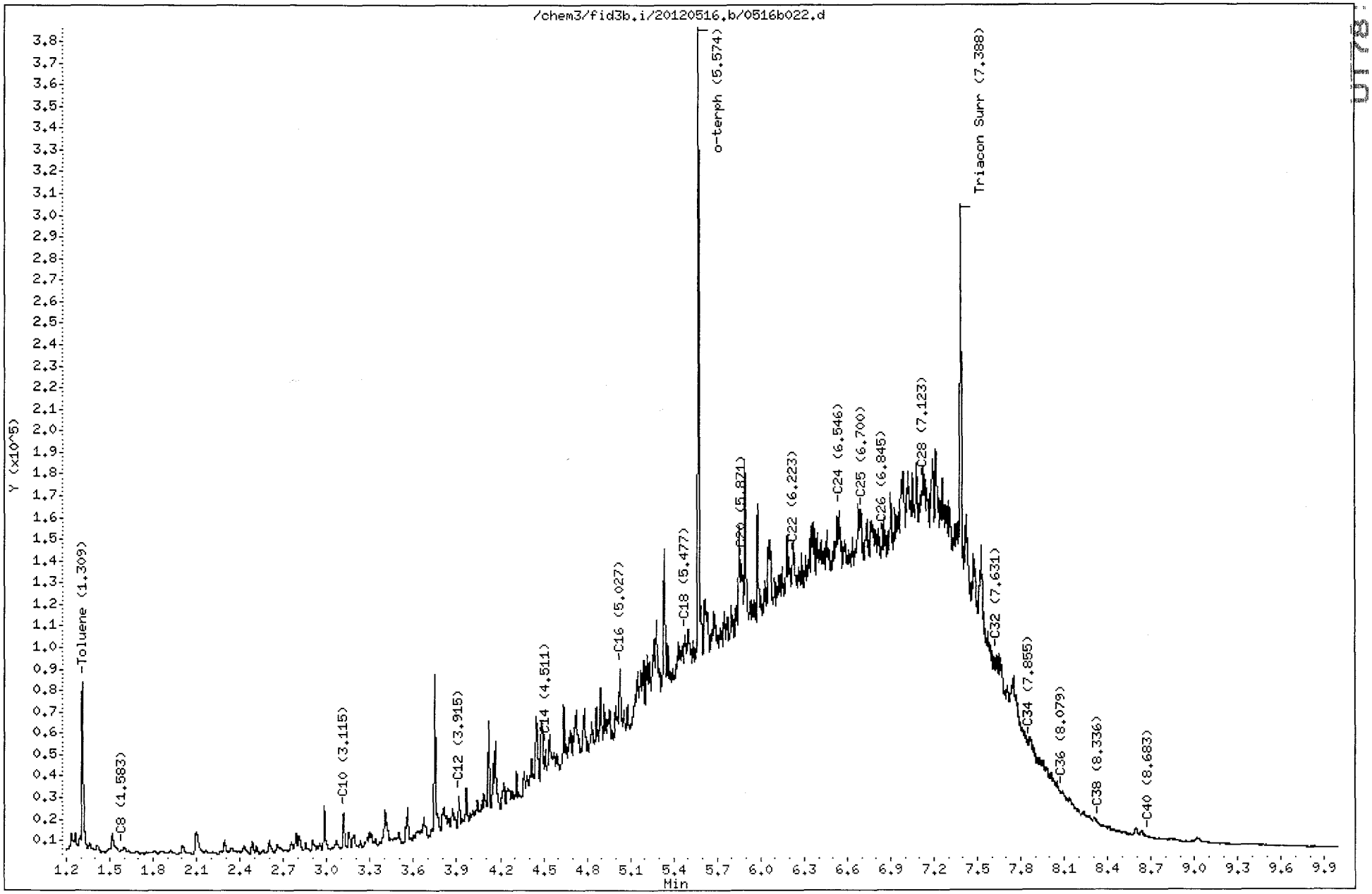
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78 00138



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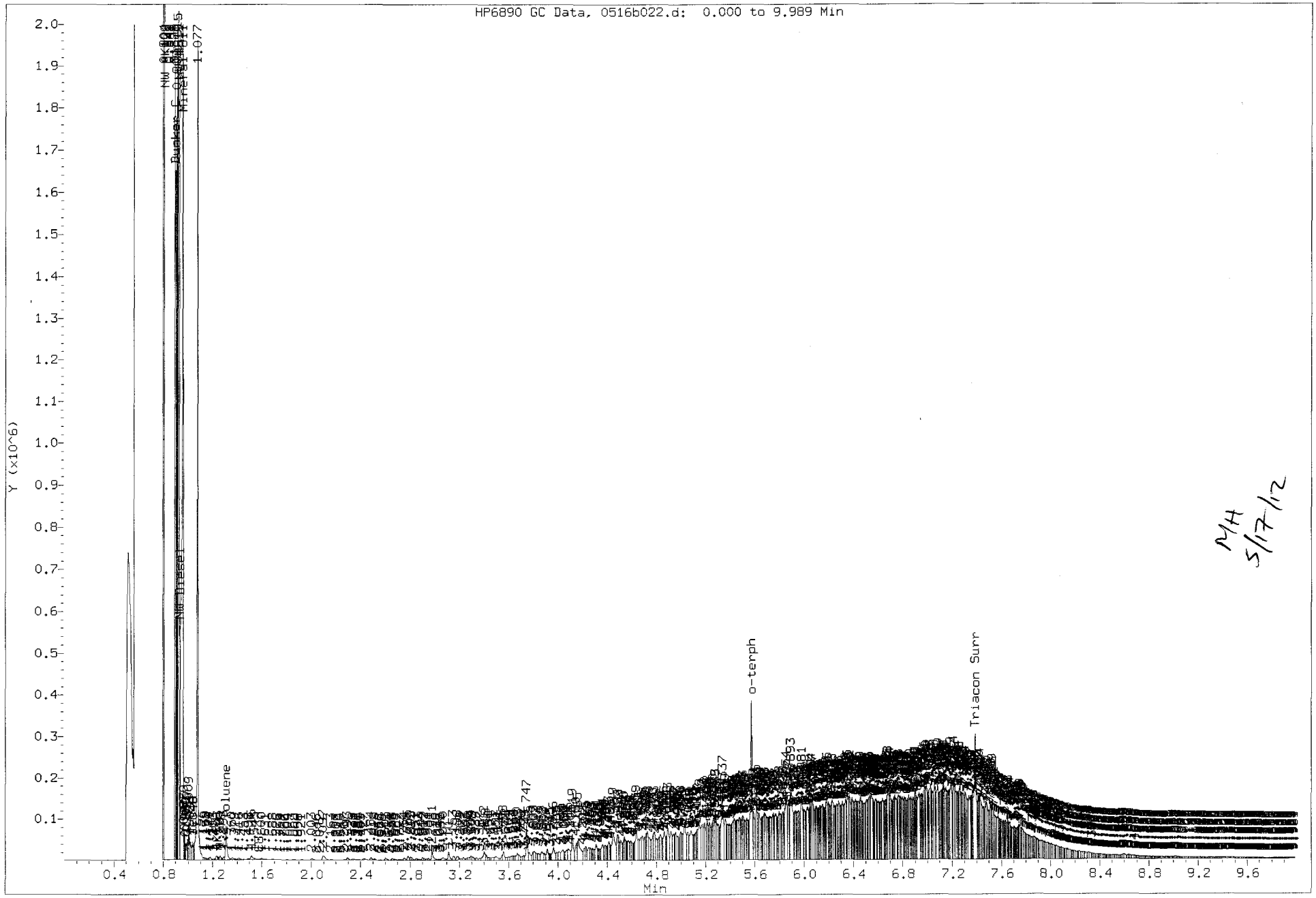
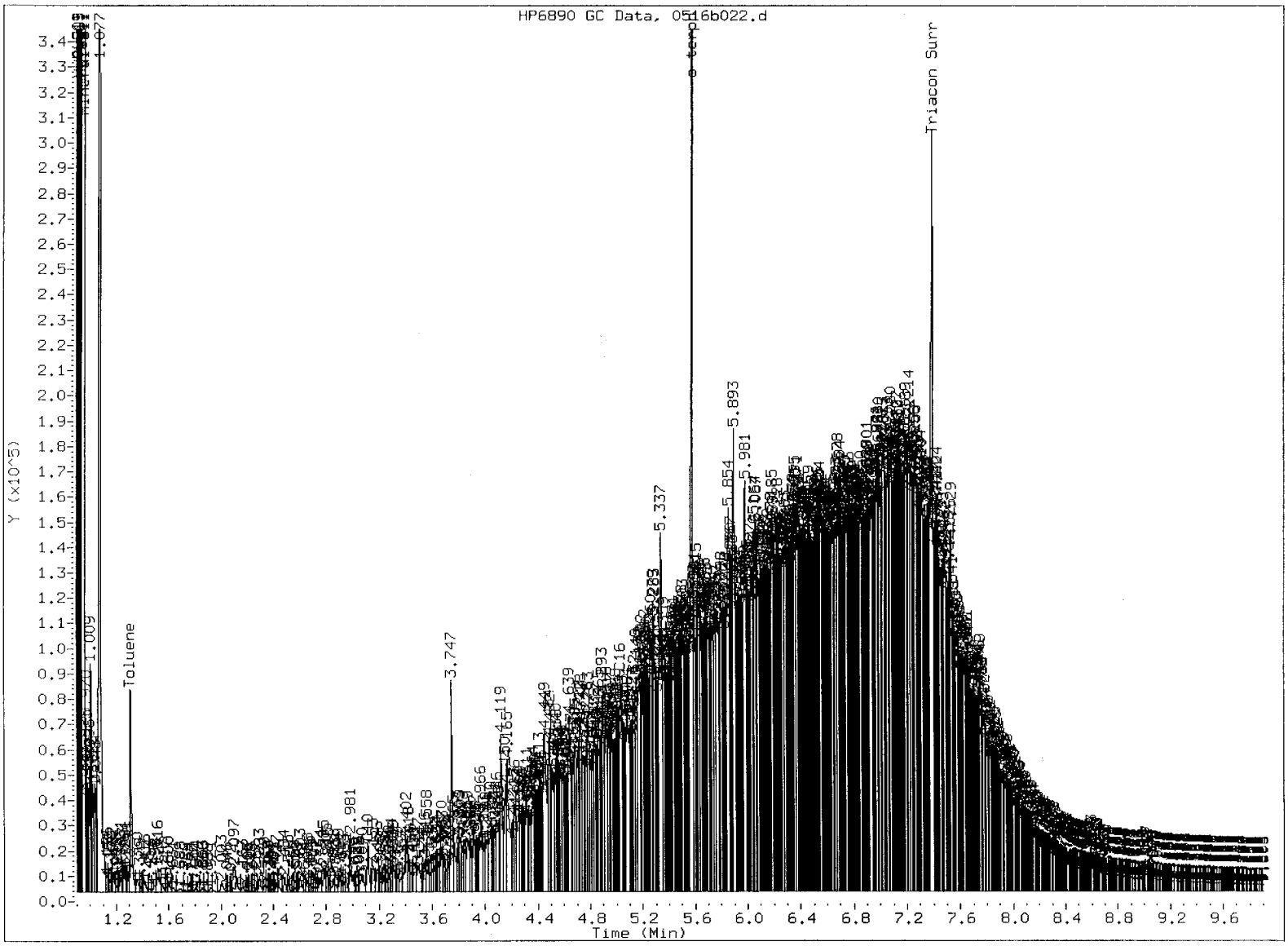
Injection Date: 16-MAY-2012 13:54
Instrument: fid3b.i
Client Sample ID: CBA-SB-8-3-5-0512



MH 5/17/12

FID:3B-2C/RTX-1 UT78M FID:3B SIGNAL



MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b023.d

Date : 16-MAY-2012 14:13

Client ID: CBA-SB-8-1-3-0512

Sample Info: UT78N,5

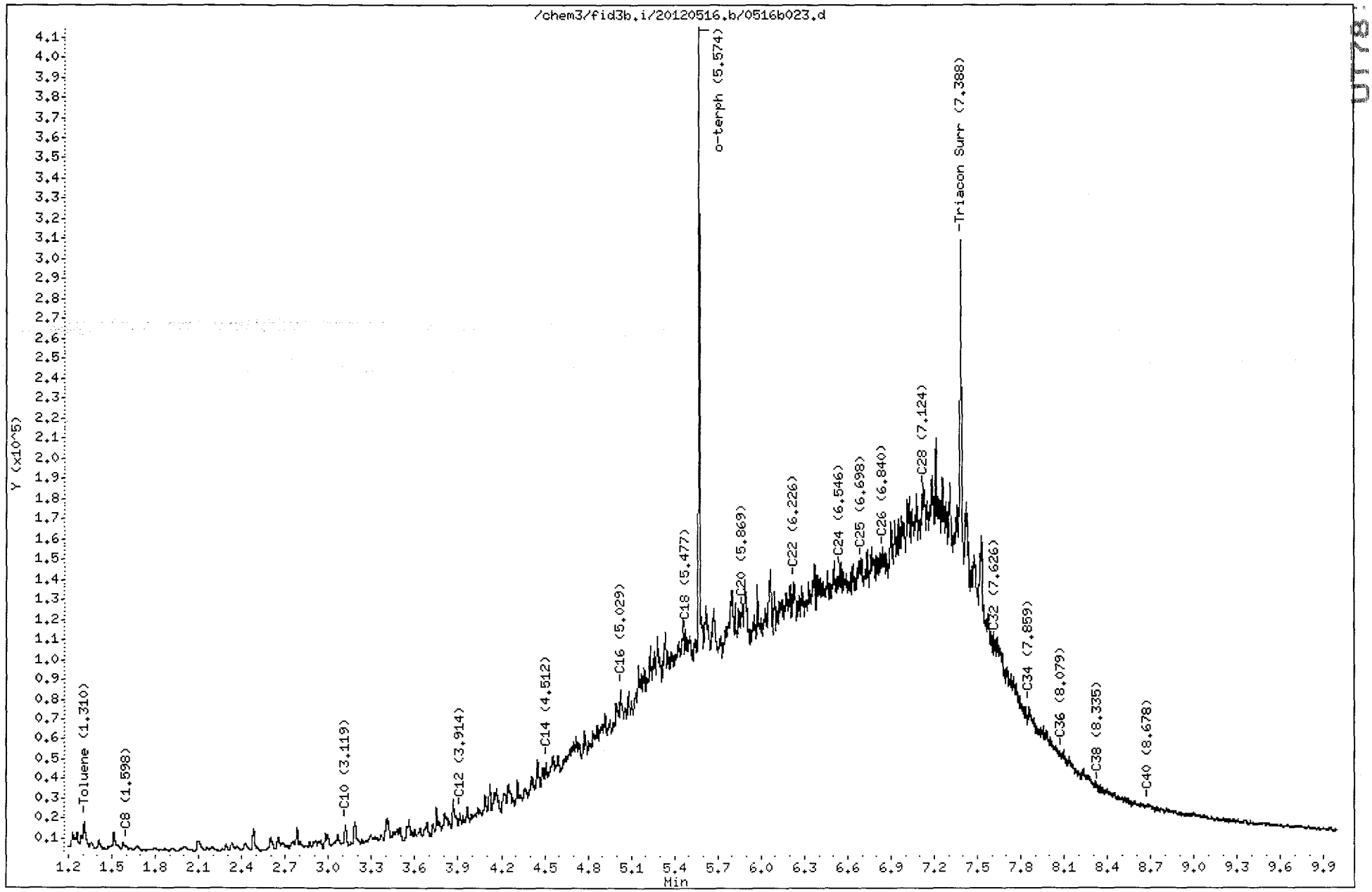
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78 00114



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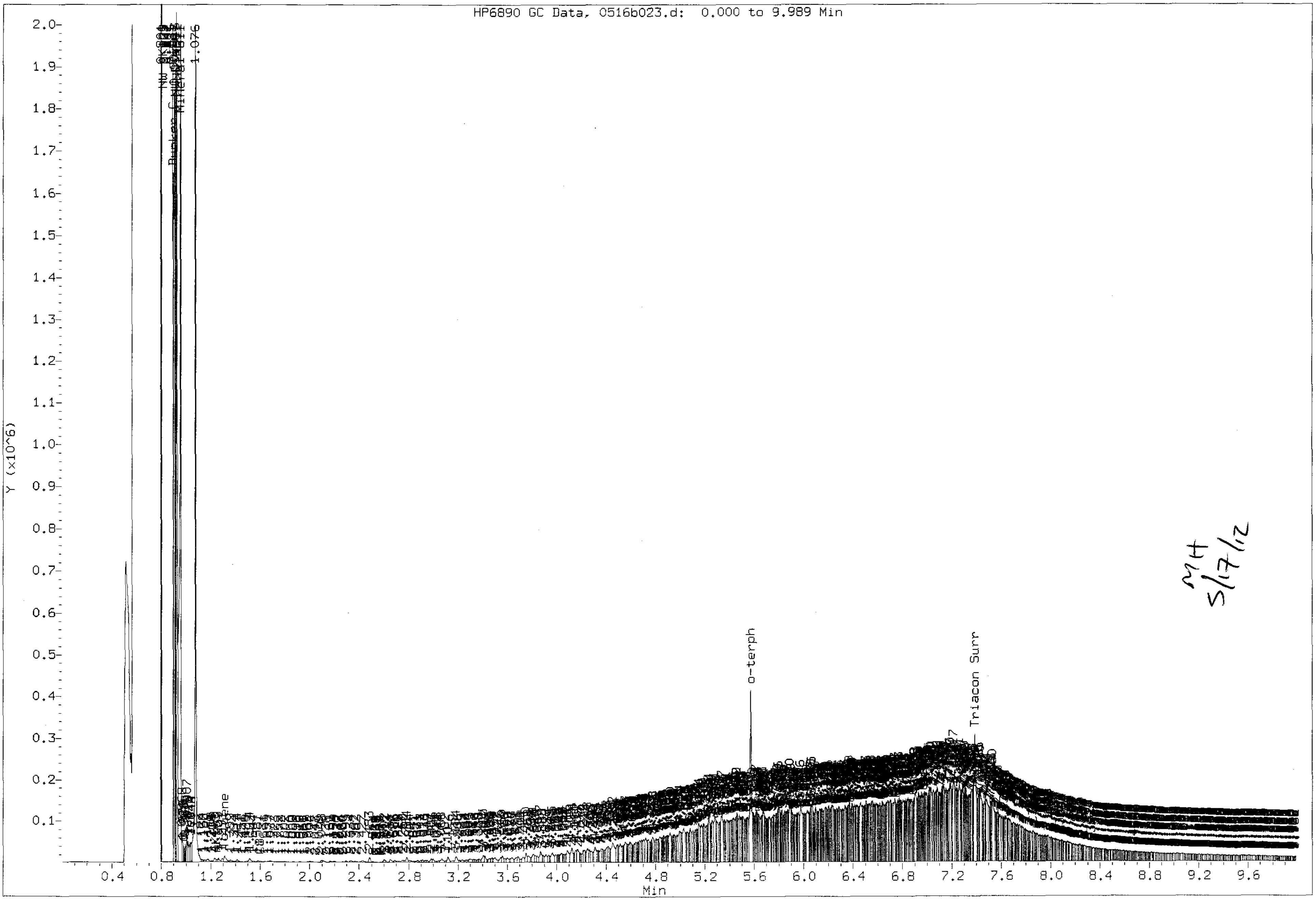
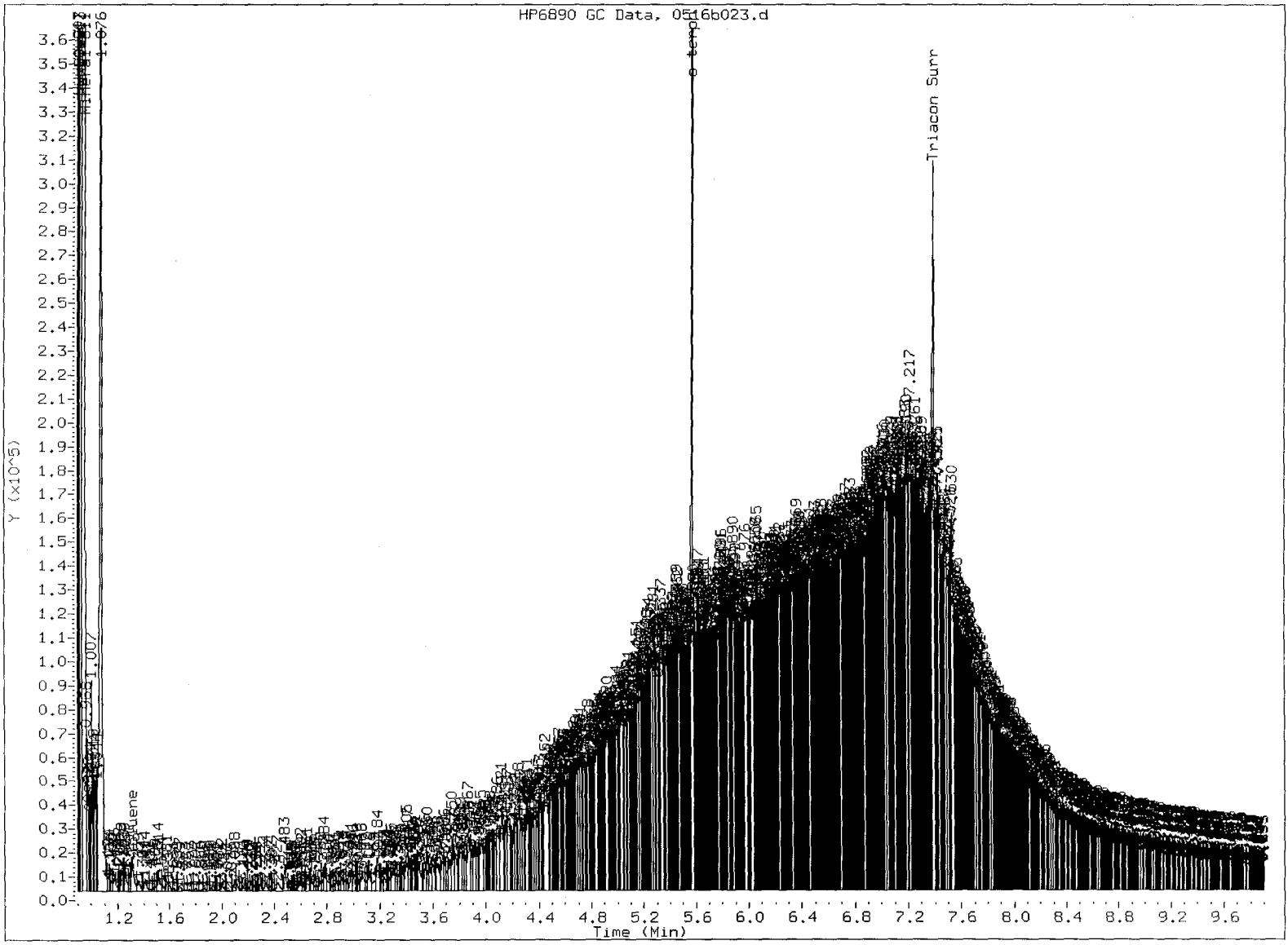
Injection Date: 16-MAY-2012 14:13
Instrument: fid3b.i
Client Sample ID: CBA-SB-8-1-3-0512



MH 5/17/12

FID:3B-2C/RTX-1 UT78N FID:3B SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b024.d

Date : 16-MAY-2012 14:32

Client ID: CWMW-18-7-9-0512

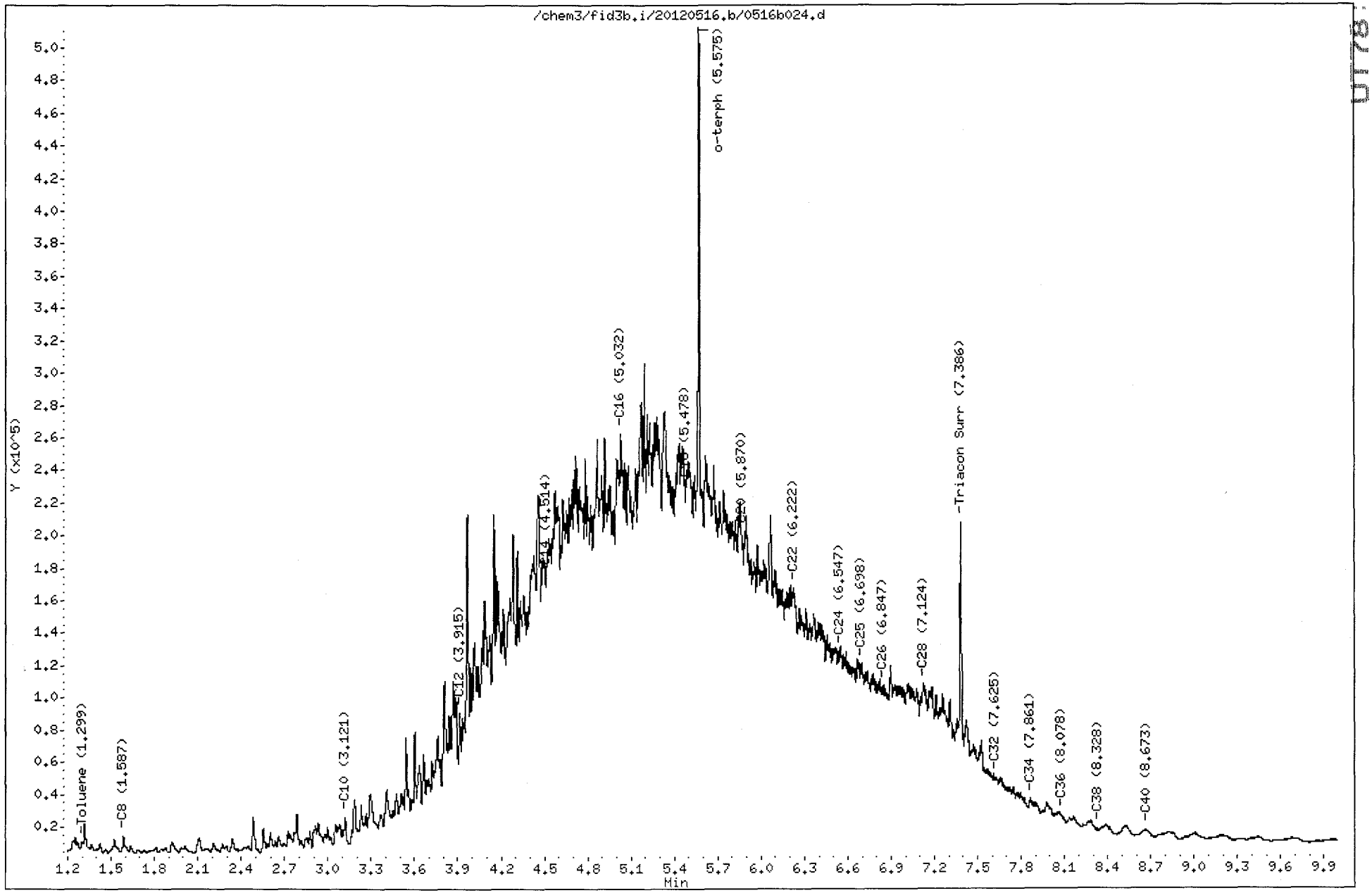
Sample Info: UT780,5

Column phase: RTX-1

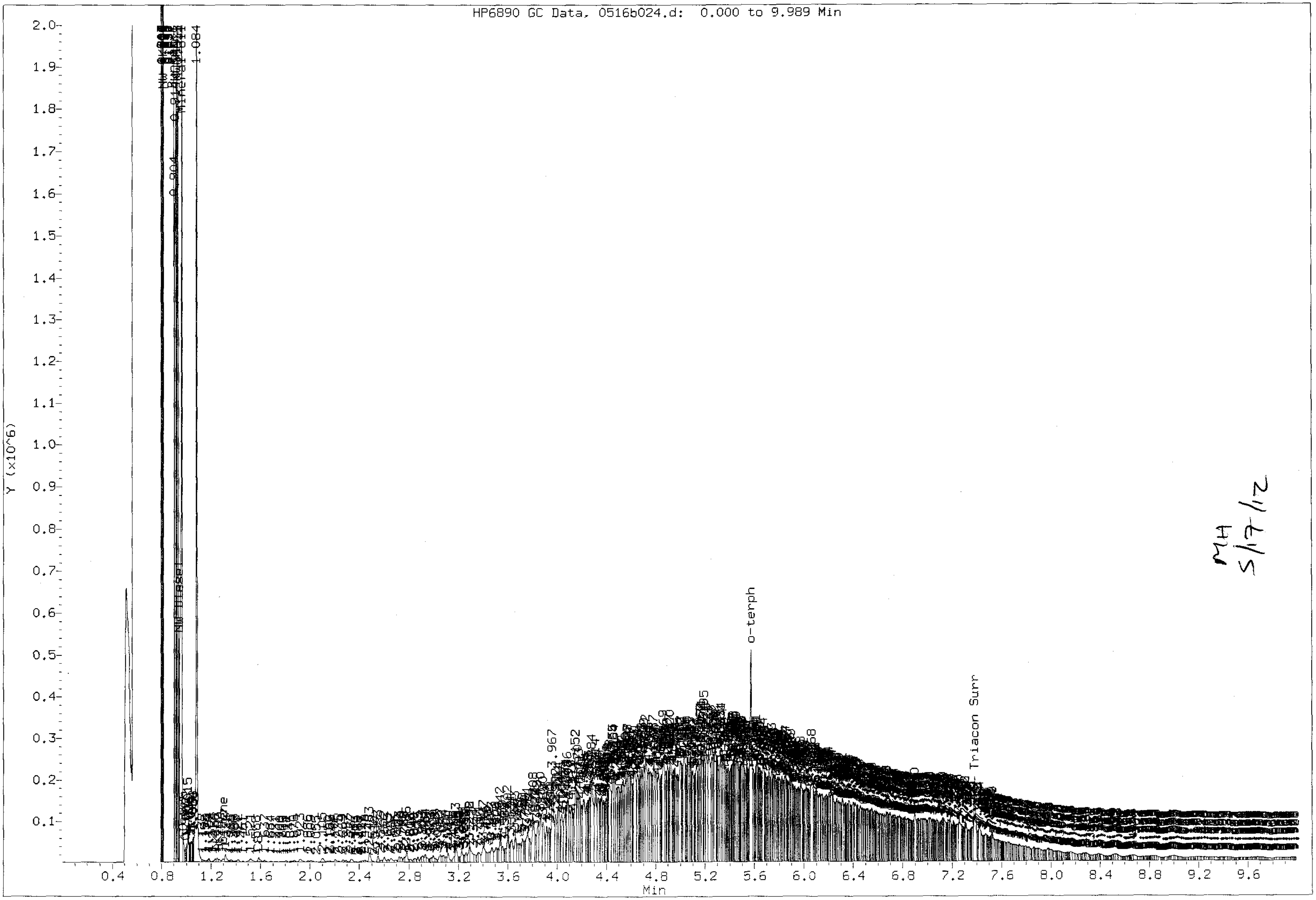
Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

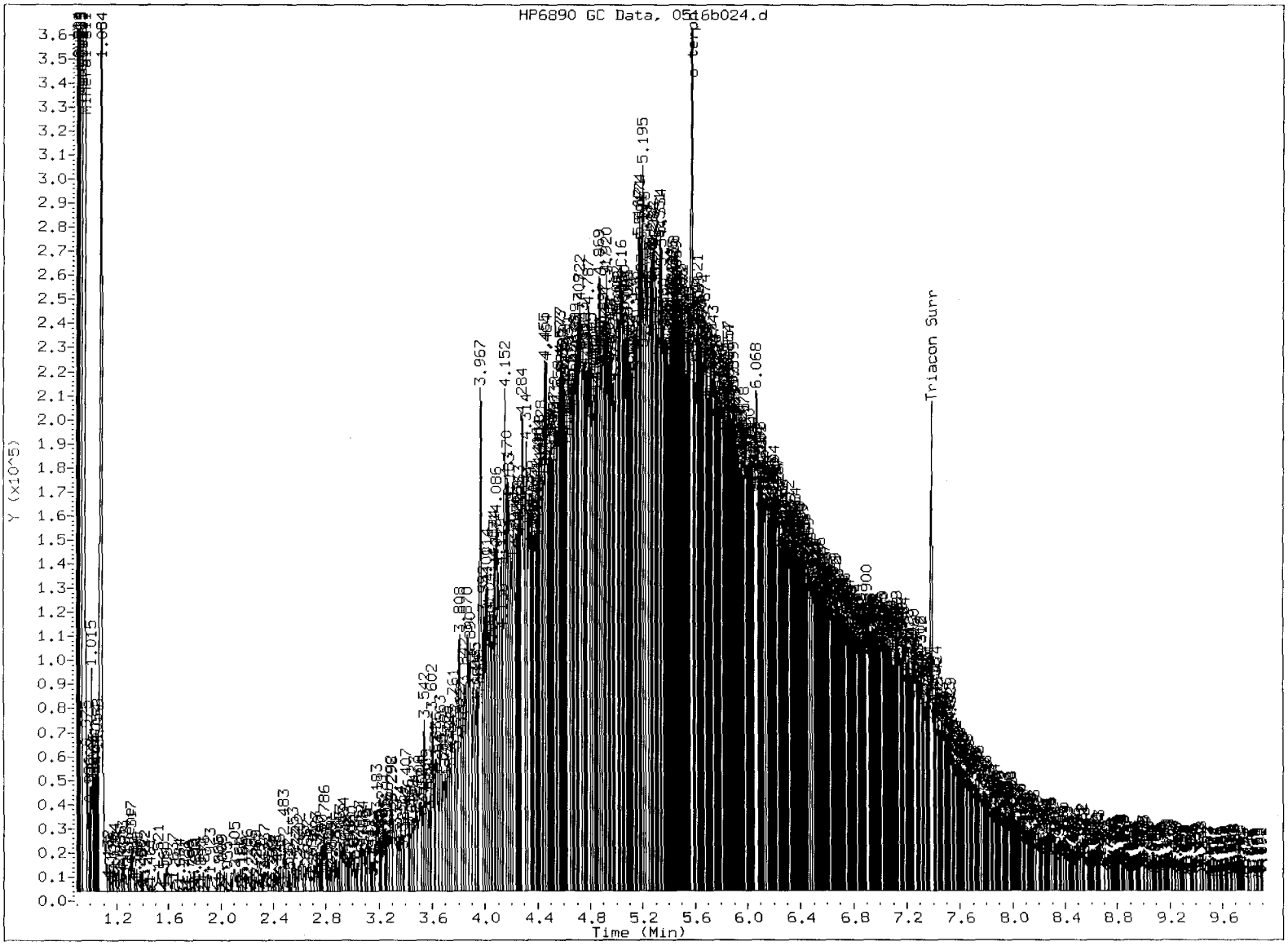


Data File: /chem3/fid3b.i/20120516.b/0516b024.d
Injection Date: 16-MAY-2012 14:32
Instrument: fid3b.i
Client Sample ID: CWMW-18-7-9-0512



MH
5/17/12

FID:3B-2C/RTX-1 UT780 FID:3B SIGNAL



MANUAL INTEGRATION

X) Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b025.d

Date : 16-MAY-2012 14:51

Client ID: CWMW-18-13-15-0512

Sample Info: UT78P

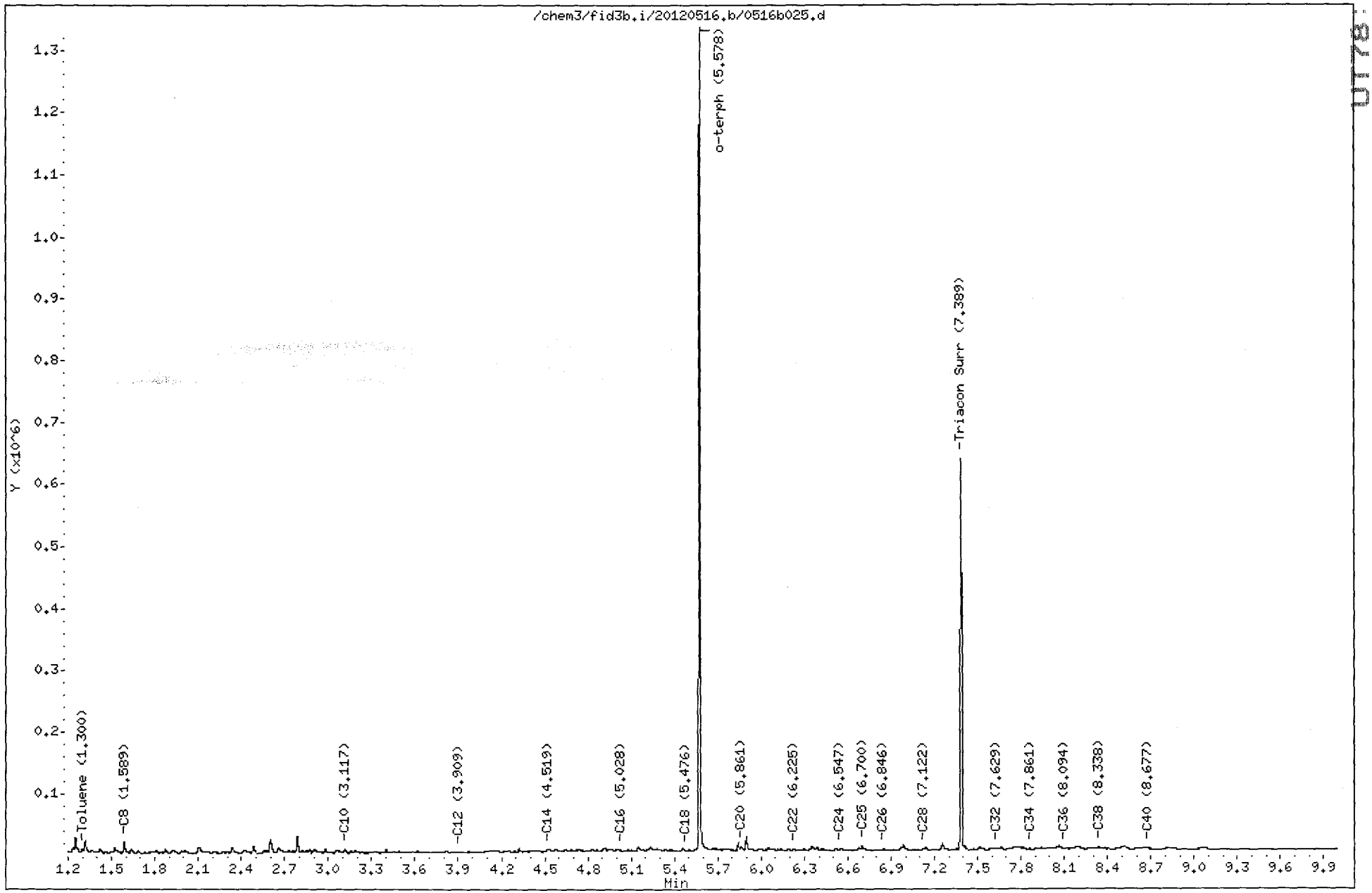
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78 09117



Data File: /chem3/fid3b.i/20120516.b/0516b026.d

Date : 16-MAY-2012 15:10

Client ID: CBA-SB-80-3-5-0512

Sample Info: UT78Q,5

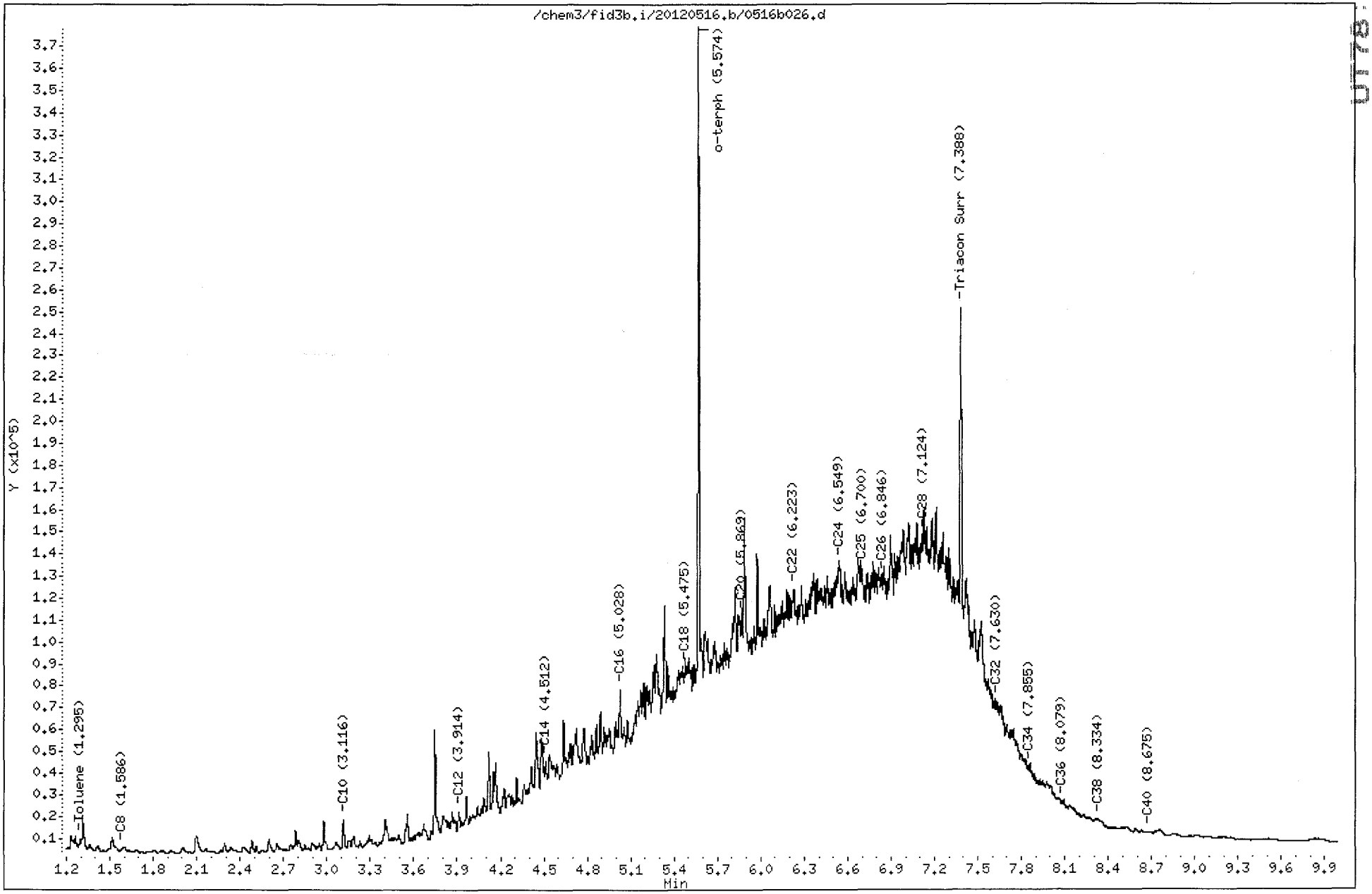
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH

Column diameter: 0.25

UT78 091118



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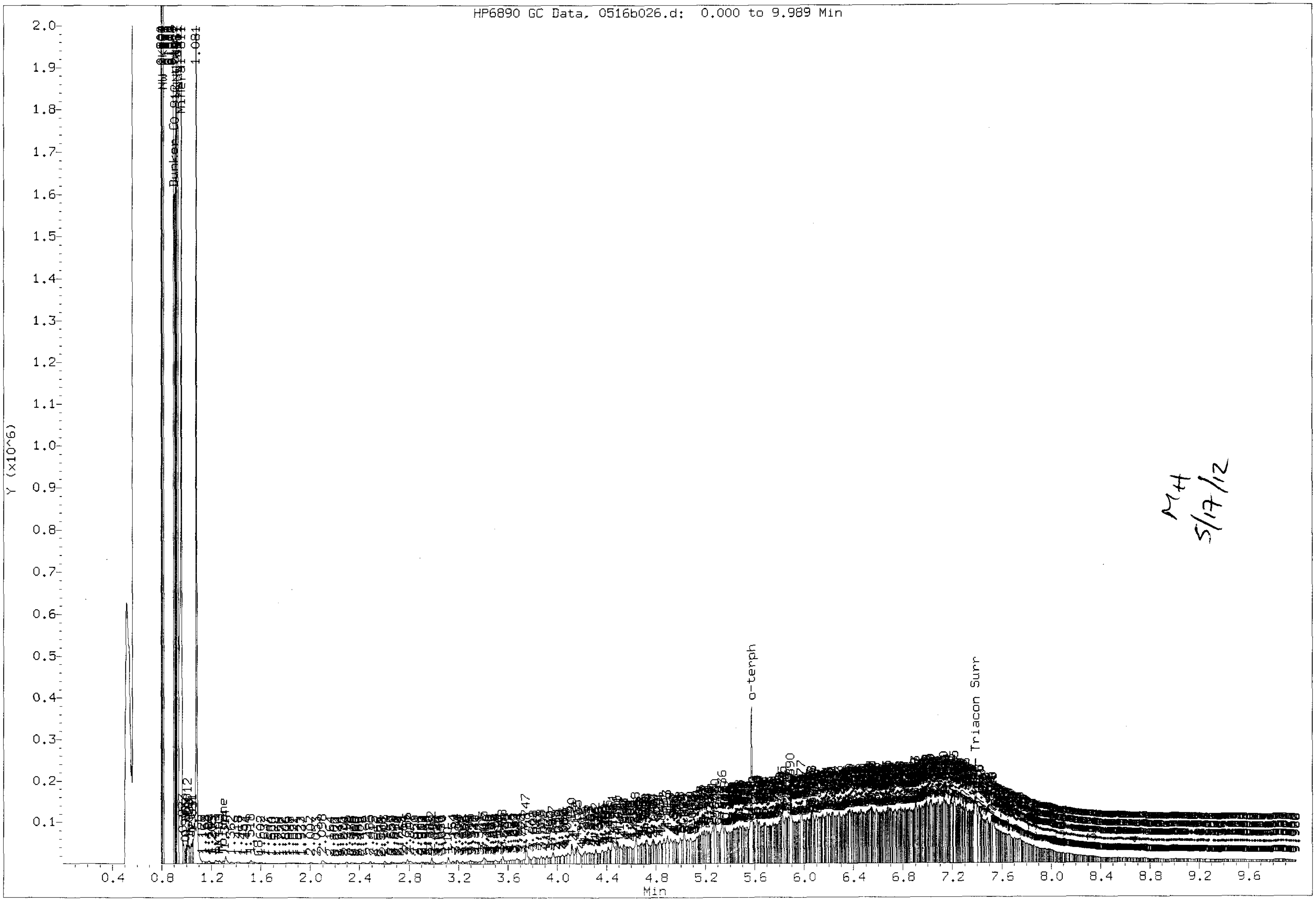
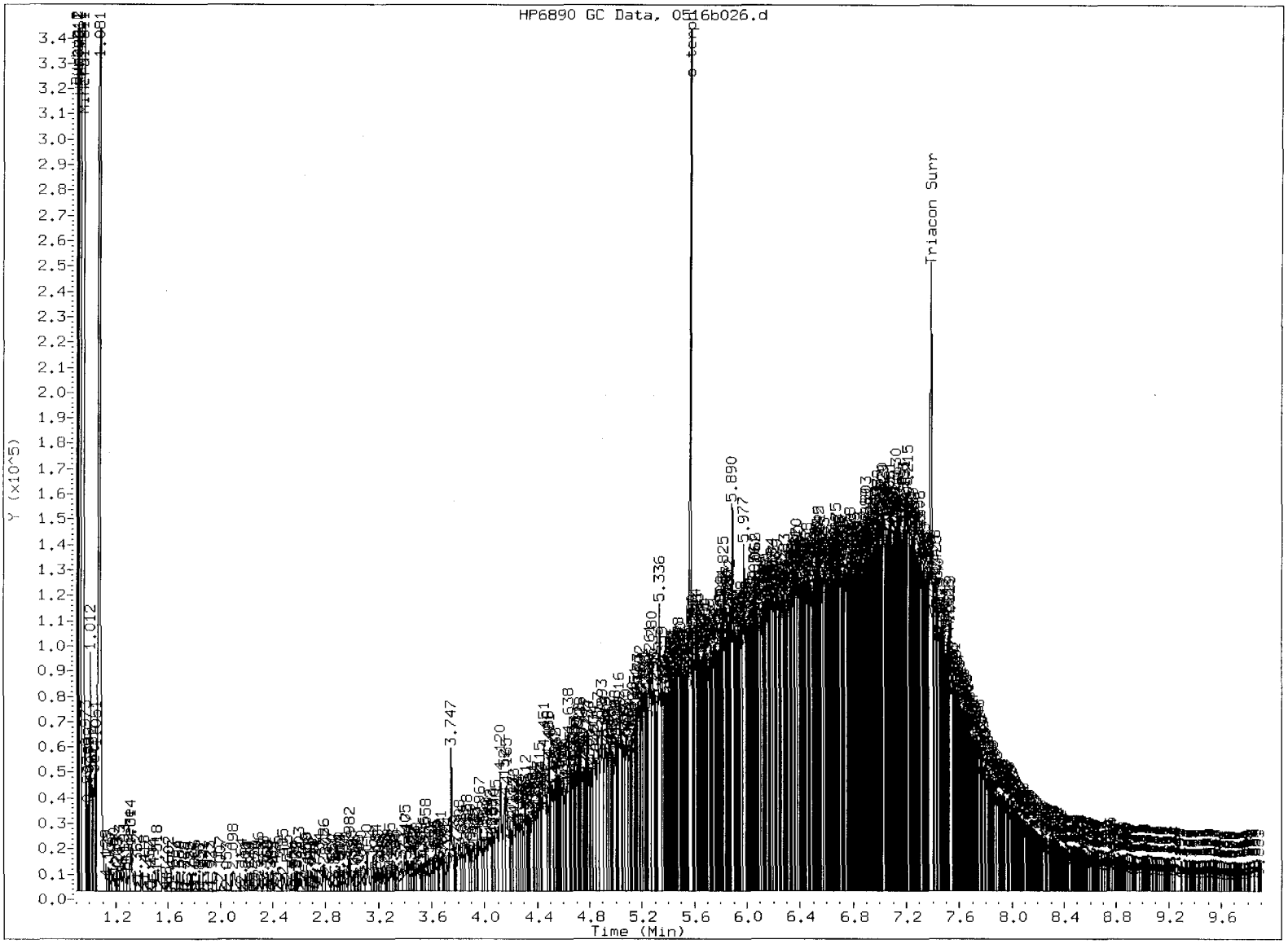
Injection Date: 16-MAY-2012 15:10
Instrument: fid3b.i
Client Sample ID: CBA-SB-80-3-5-0512



MH
5/17/12

FID:3B-2C/RTX-1 UT78Q

FID:3B SIGNAL



MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b029.d

Date : 16-MAY-2012 16:07

Client ID: CBA-TP-7-0-1-0512

Sample Info: UT78R

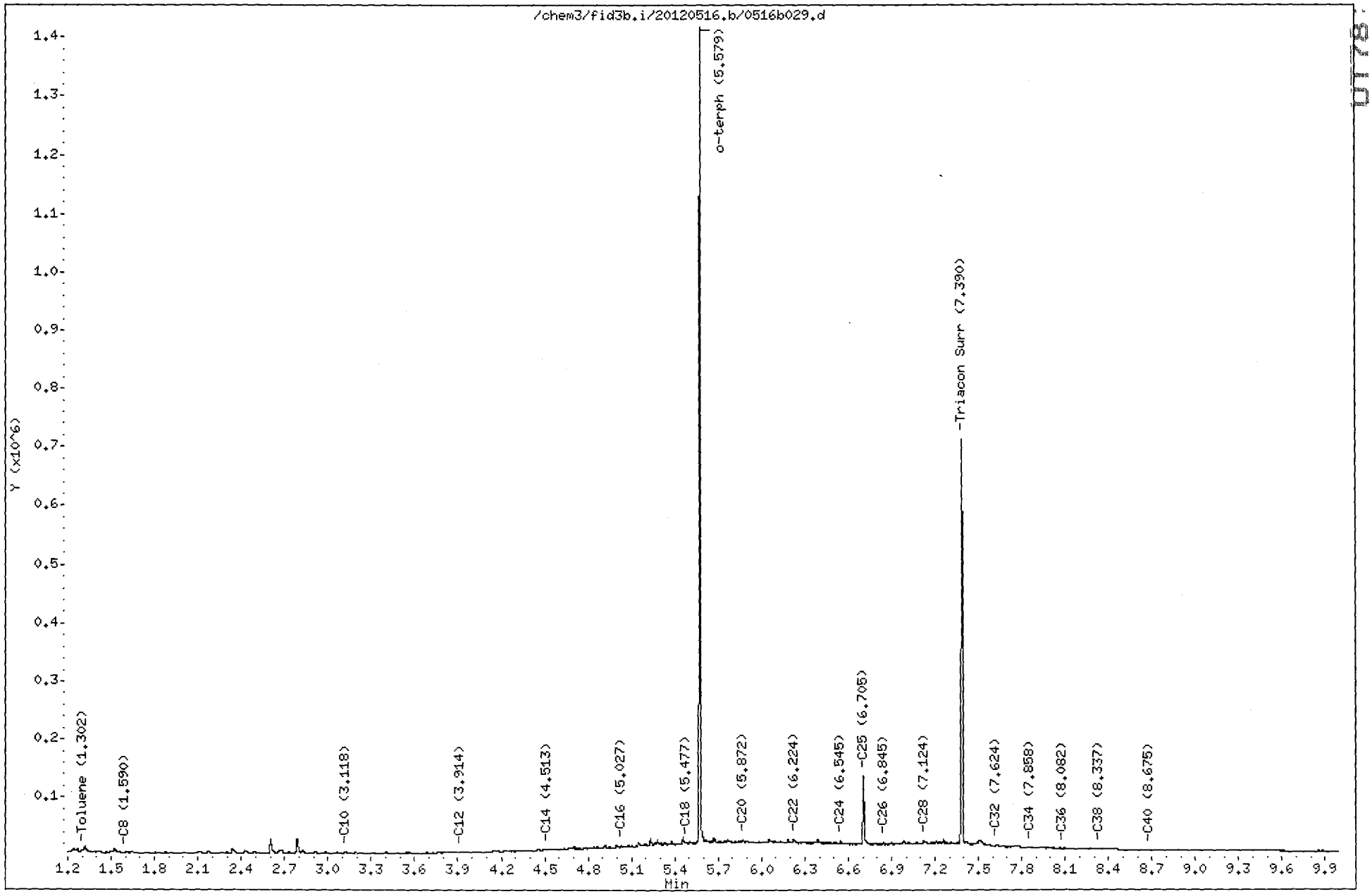
Column phase: RTX-1

Instrument: fid3b.i

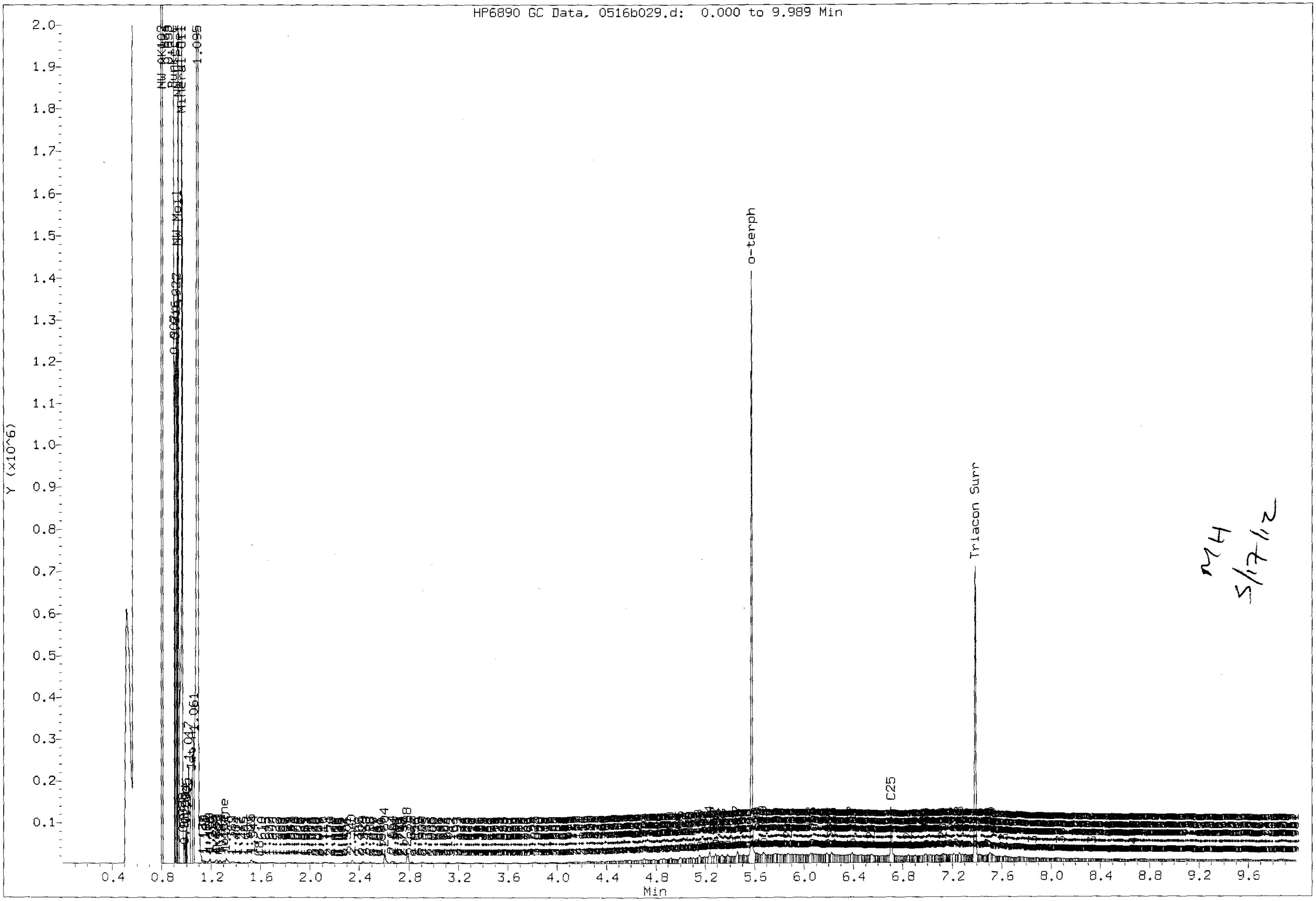
Operator: MH

Column diameter: 0.25

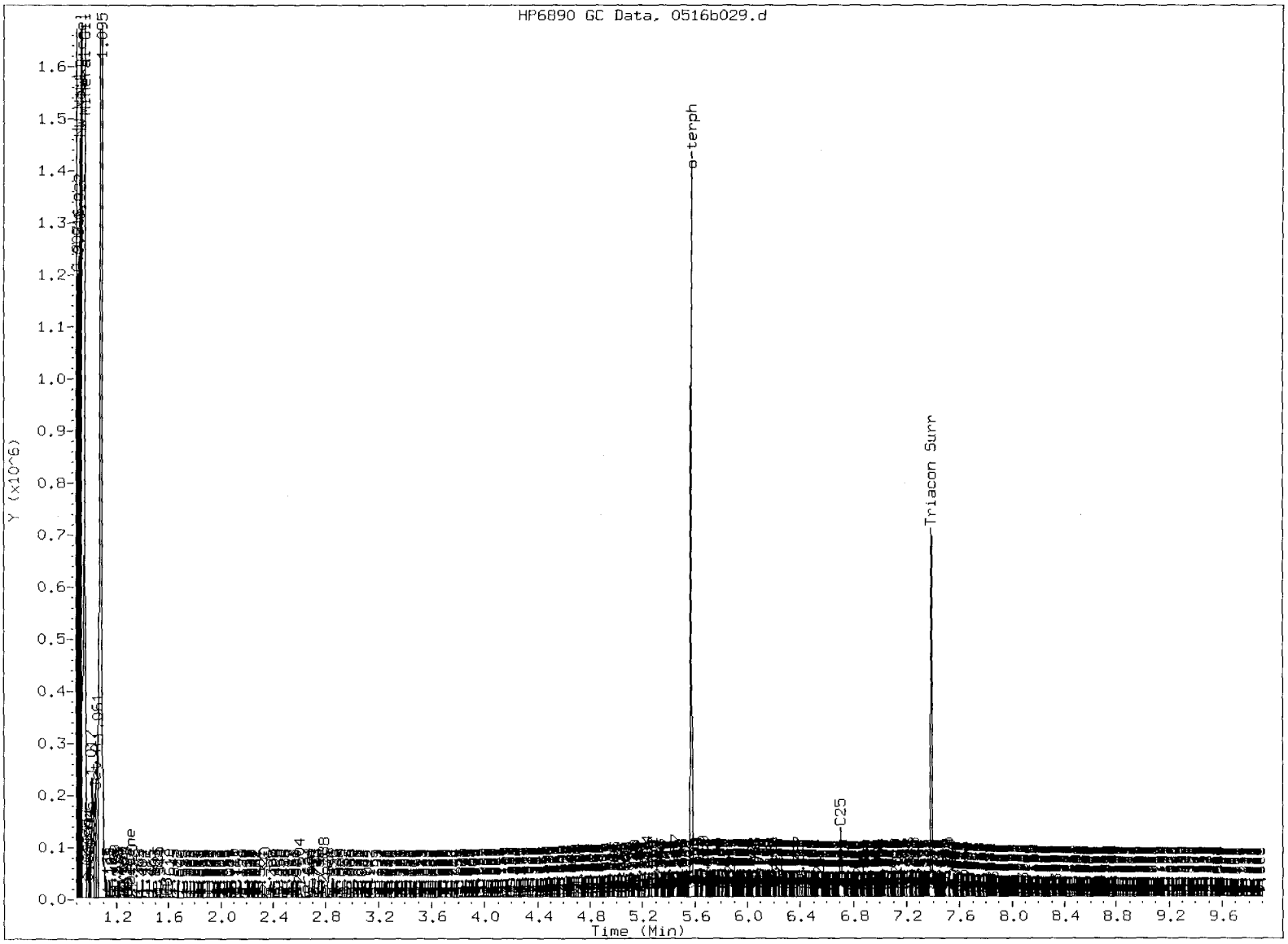
UT78.00151



Data File: /chem3/fid3b.i/20120516.b/0516b029.d
Injection Date: 16-MAY-2012 16:07
Instrument: fid3b.i
Client Sample ID: CBA-TP-7-0-1-0512



FID:3B-2C/RTX-1 UT78R FID:3B SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

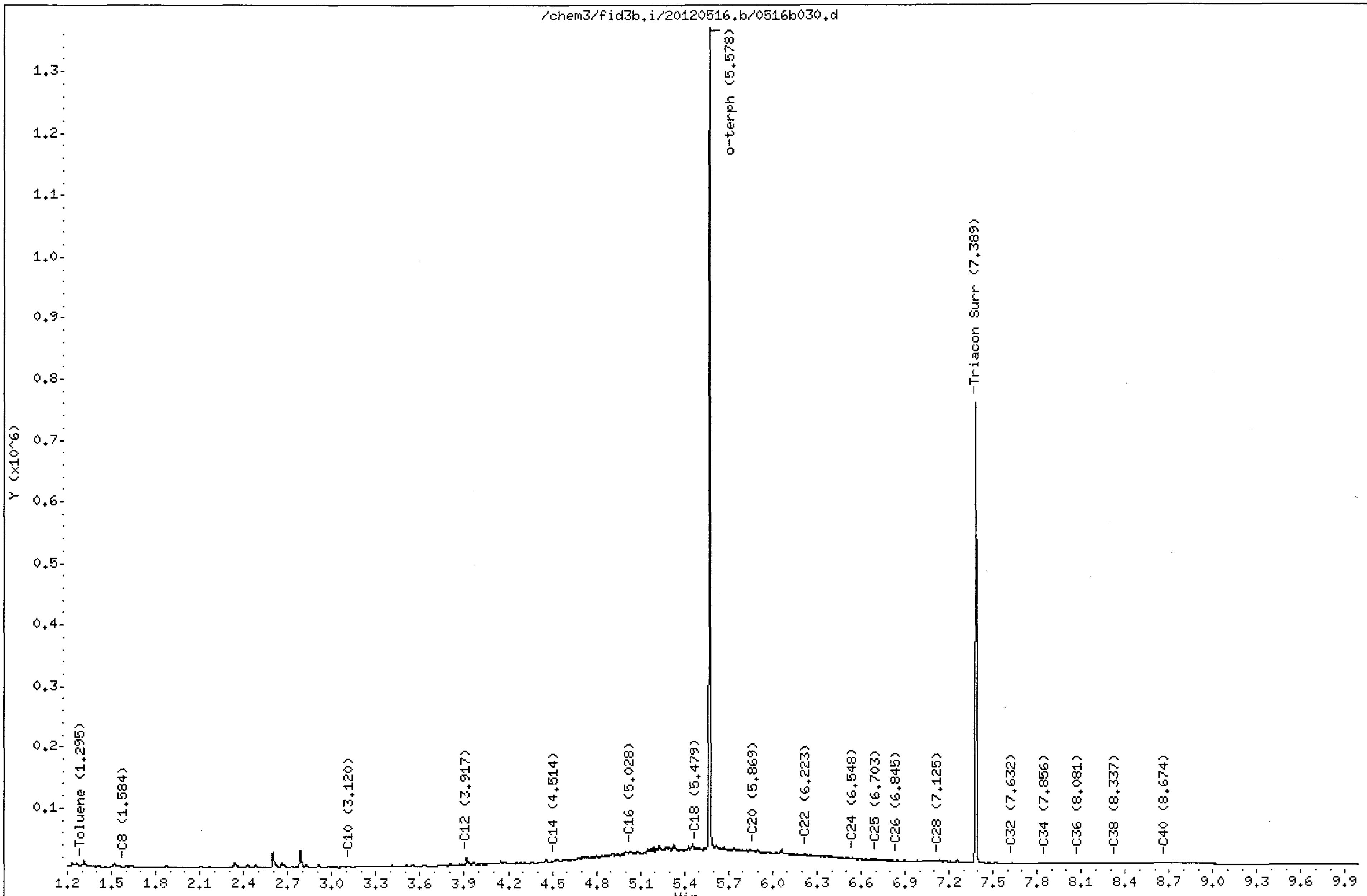
Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b030.d
Date : 16-MAY-2012 16:25
Client ID: CBA-SB-2-3-5-0512
Sample Info: UT78S

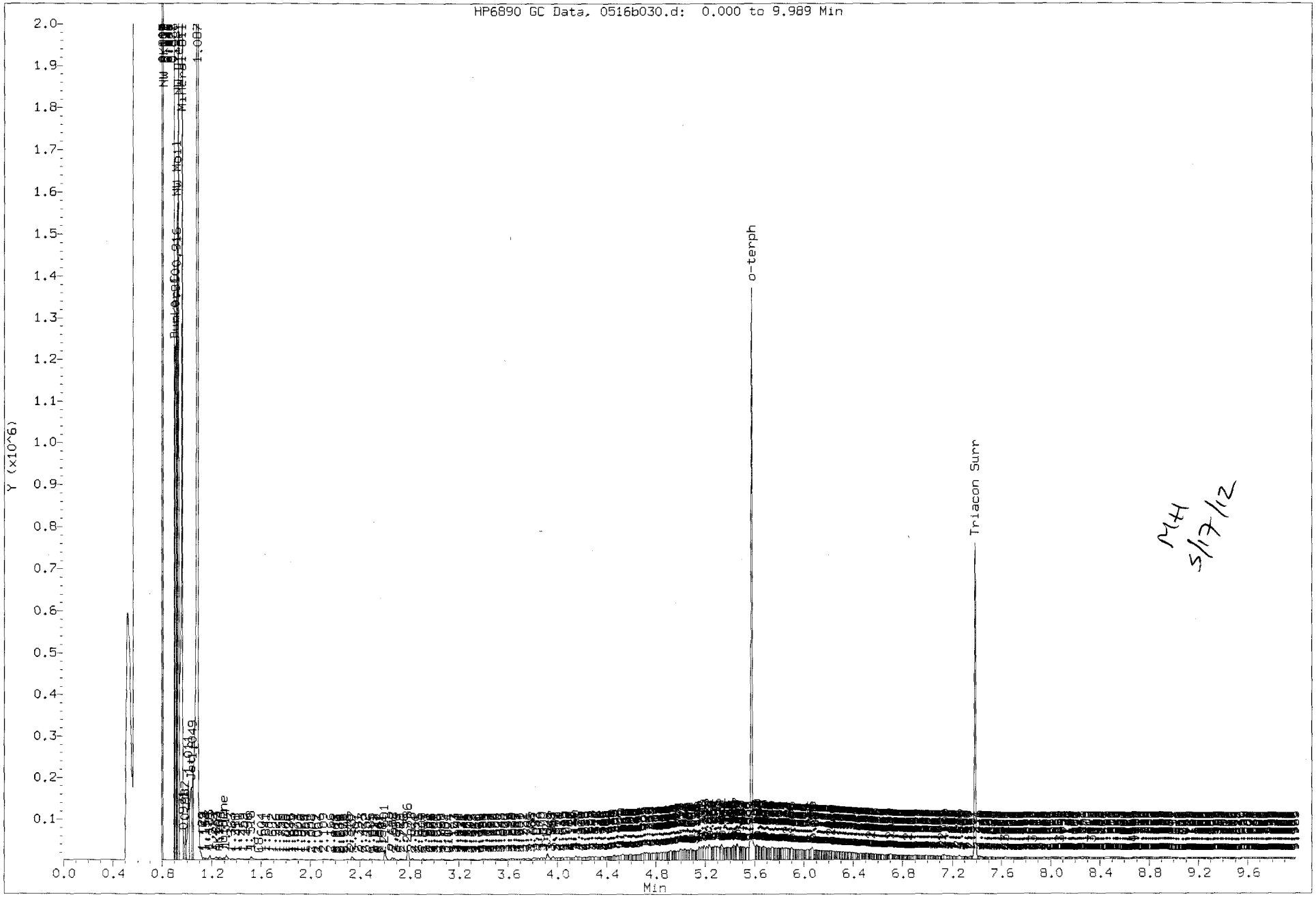
Column phase: RTX-1

Instrument: fid3b.i

Operator: MH
Column diameter: 0.25

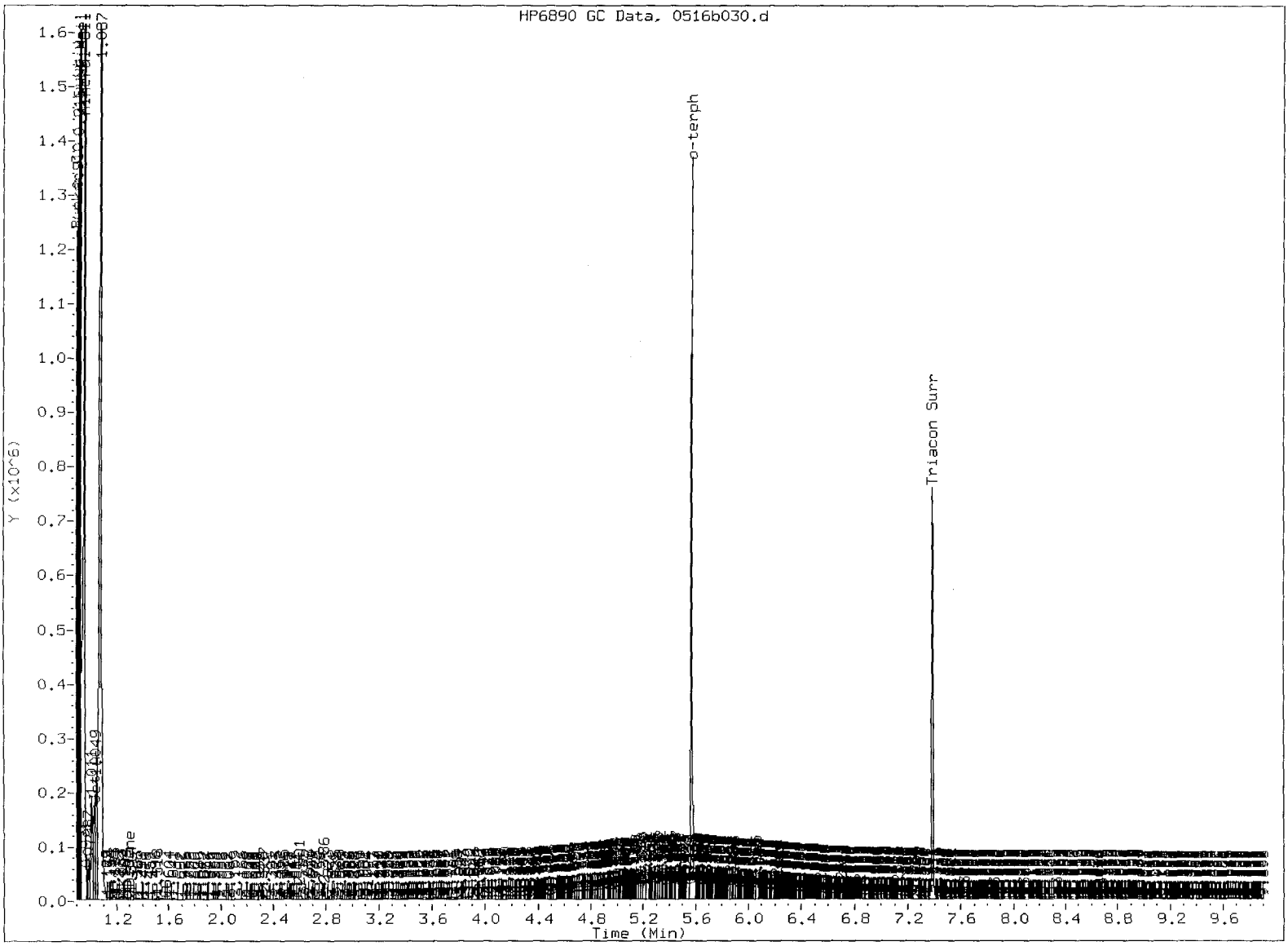


Data File: /chem3/fid3b.i/20120516.b/0516b030.d
Injection Date: 16-MAY-2012 16:25
Instrument: fid3b.i
Client Sample ID: CBA-SB-2-3-5-0512



MH
5/17/12

FID:3B-2C/RTX-1 UT78S FID:3B SIGNAL



MANUAL INTEGRATION

X 1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b031.d

Page 1

Date : 16-MAY-2012 16:44

Client ID: CBA-SB-2-3-5-05 MS

Instrument: fid3b.i

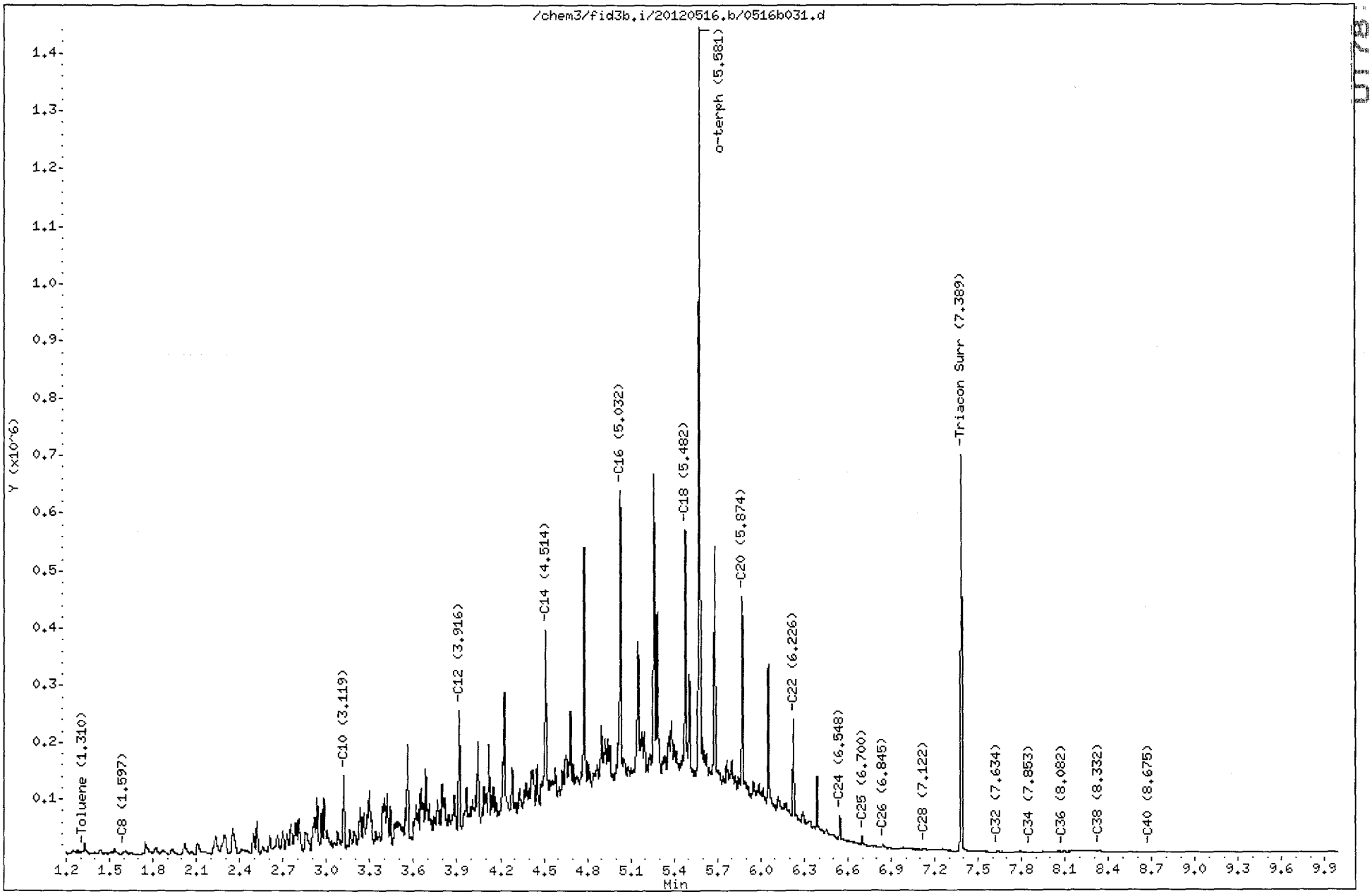
Sample Info: UT78SMS

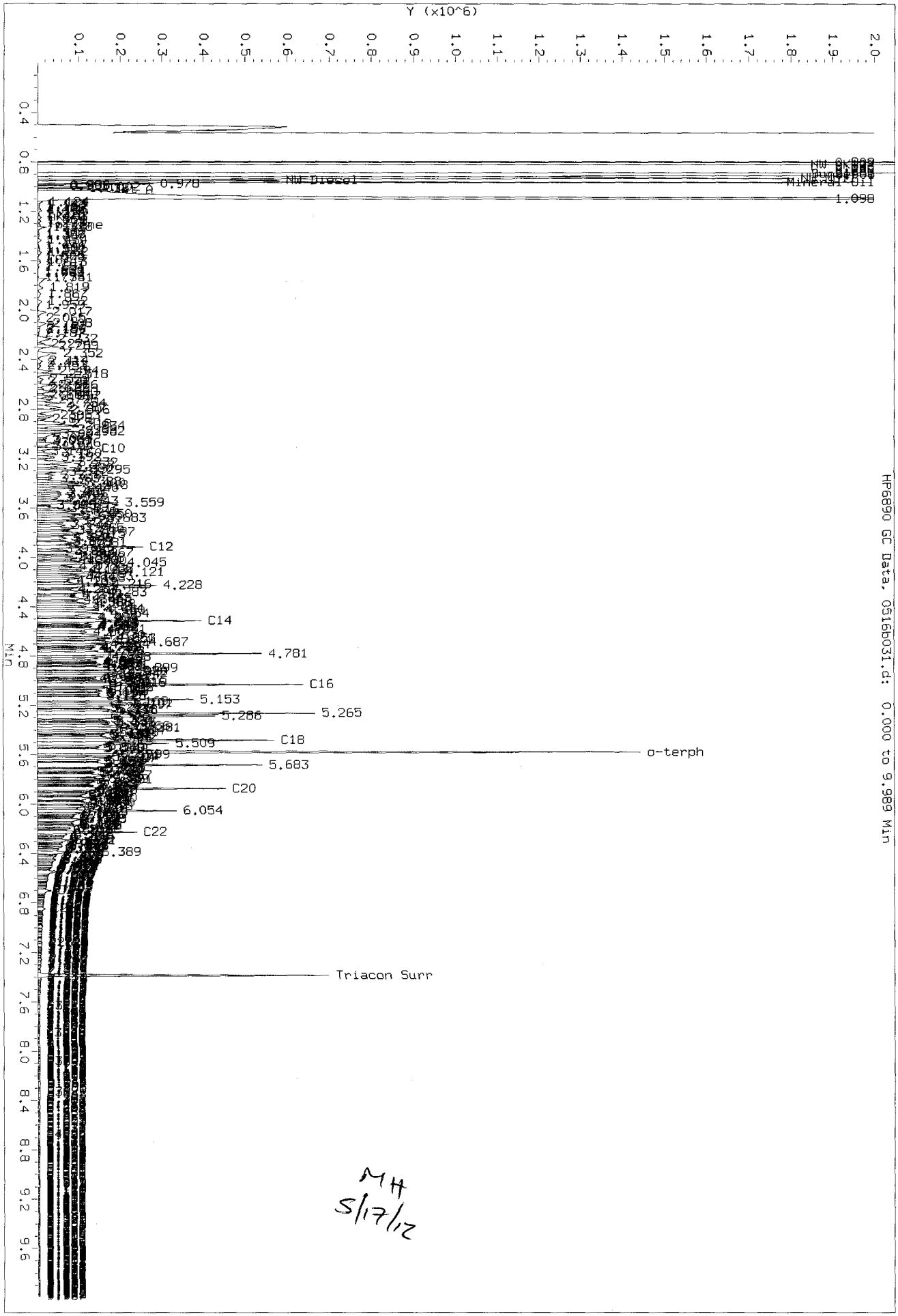
Operator: MH

Column phase: RTX-1

Column diameter: 0.25

UT78-00157

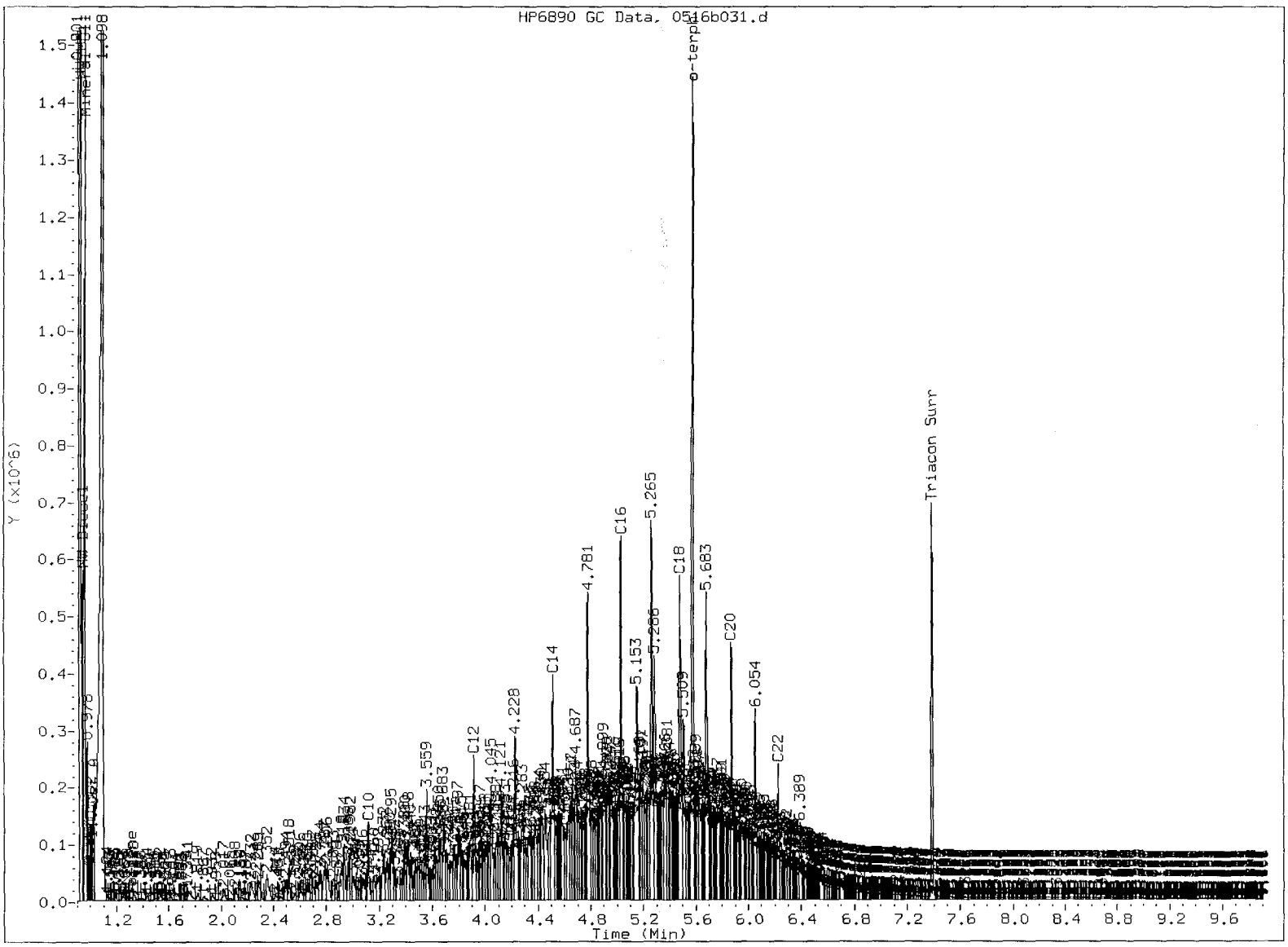




Data File: /chem3/fid3b.i/20120516.b/0516b031.d
Injection Date: 16-MAY-2012 16:44
Instrument: fid3b.i
Client Sample ID: CBA-SB-2-3-5-05 MS

MH
5/17/12

FID:3B-2C/RTX-1 UT78SMS FID:3B SIGNAL



MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

Data File: /chem3/fid3b.i/20120516.b/0516b032.d

Page 1

Date : 16-MAY-2012 17:03

Client ID:

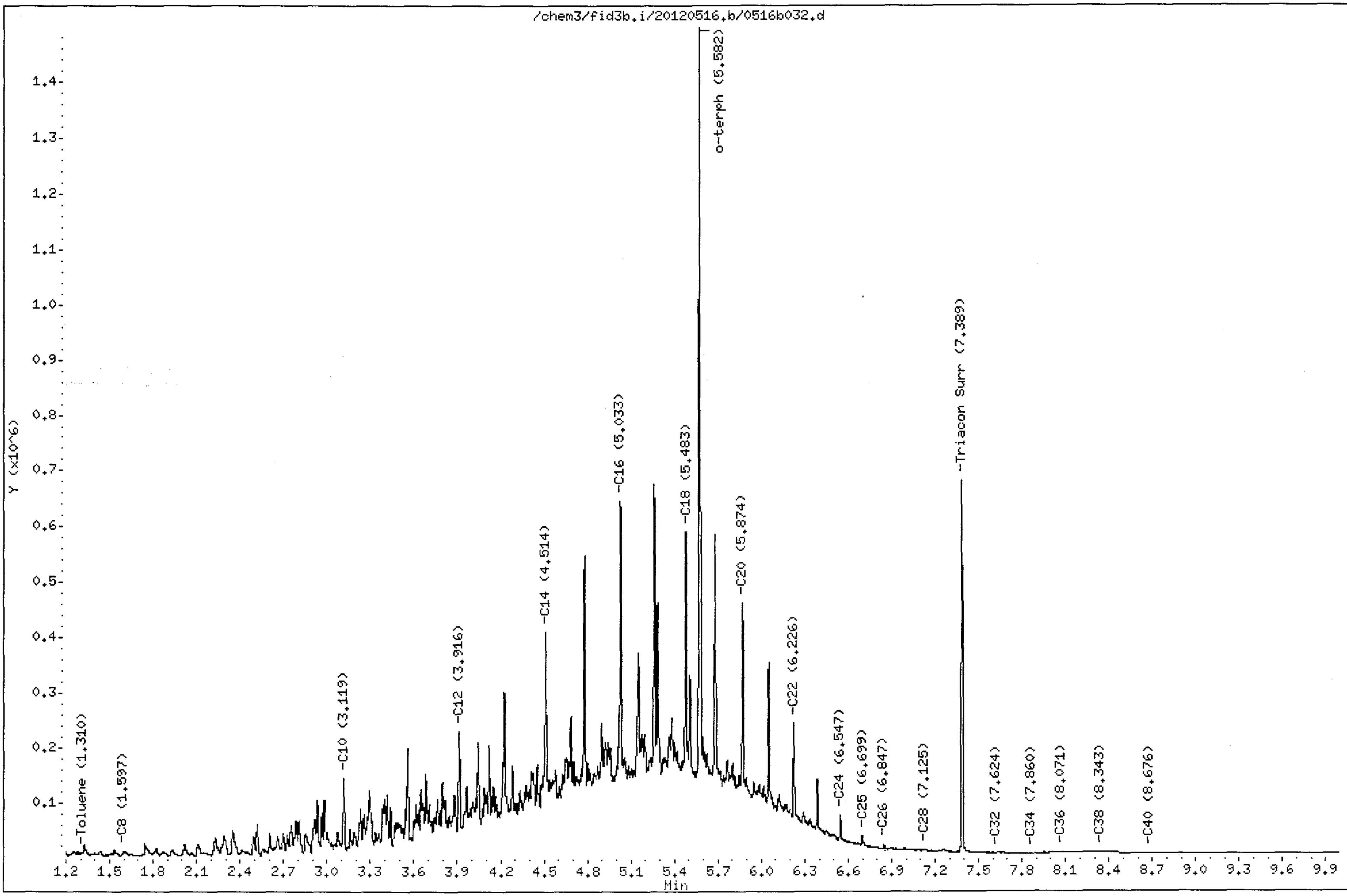
Instrument: fid3b.i

Sample Info: UT78MSD

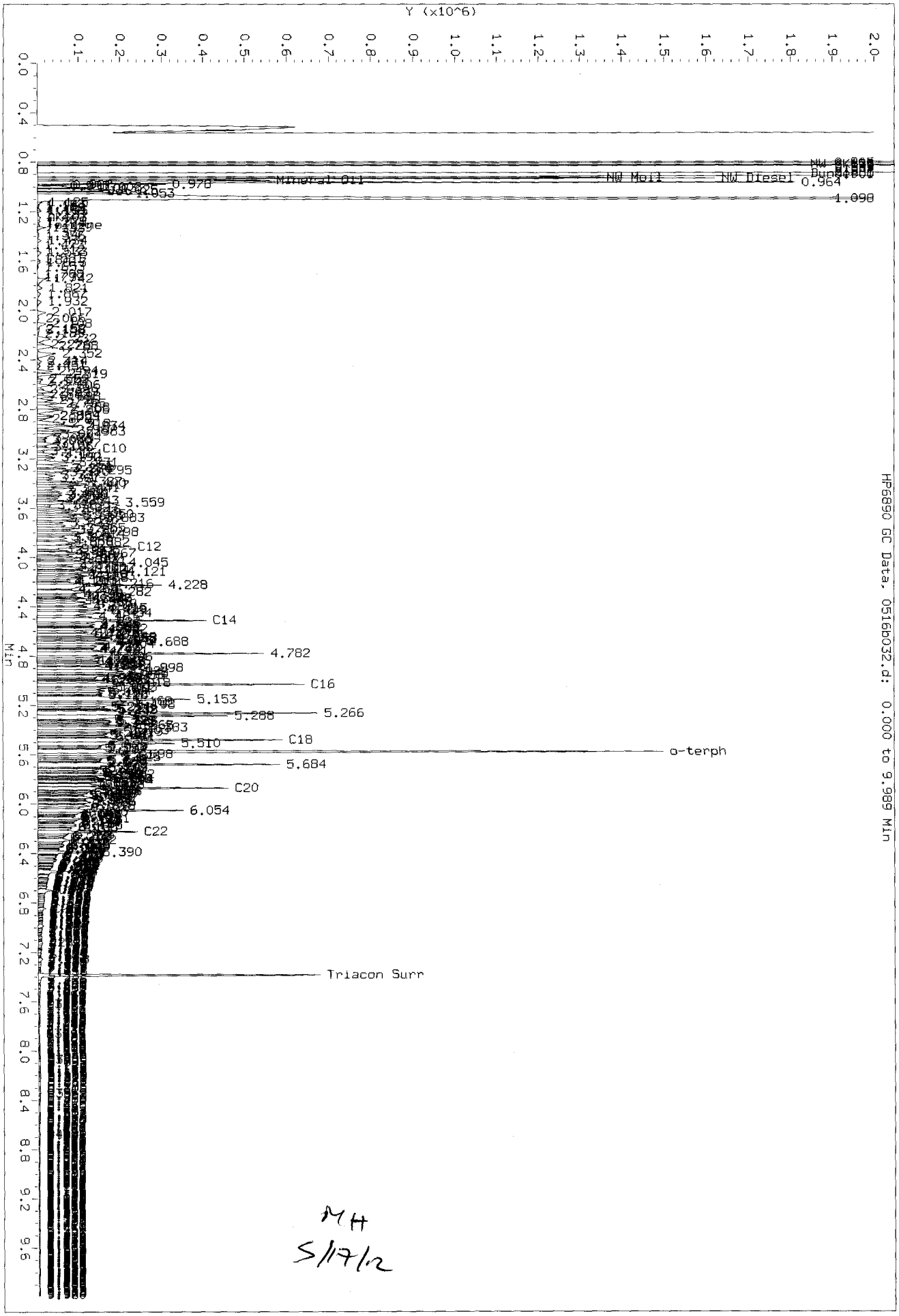
Operator: MH

Column phase: RTX-1

Column diameter: 0.25

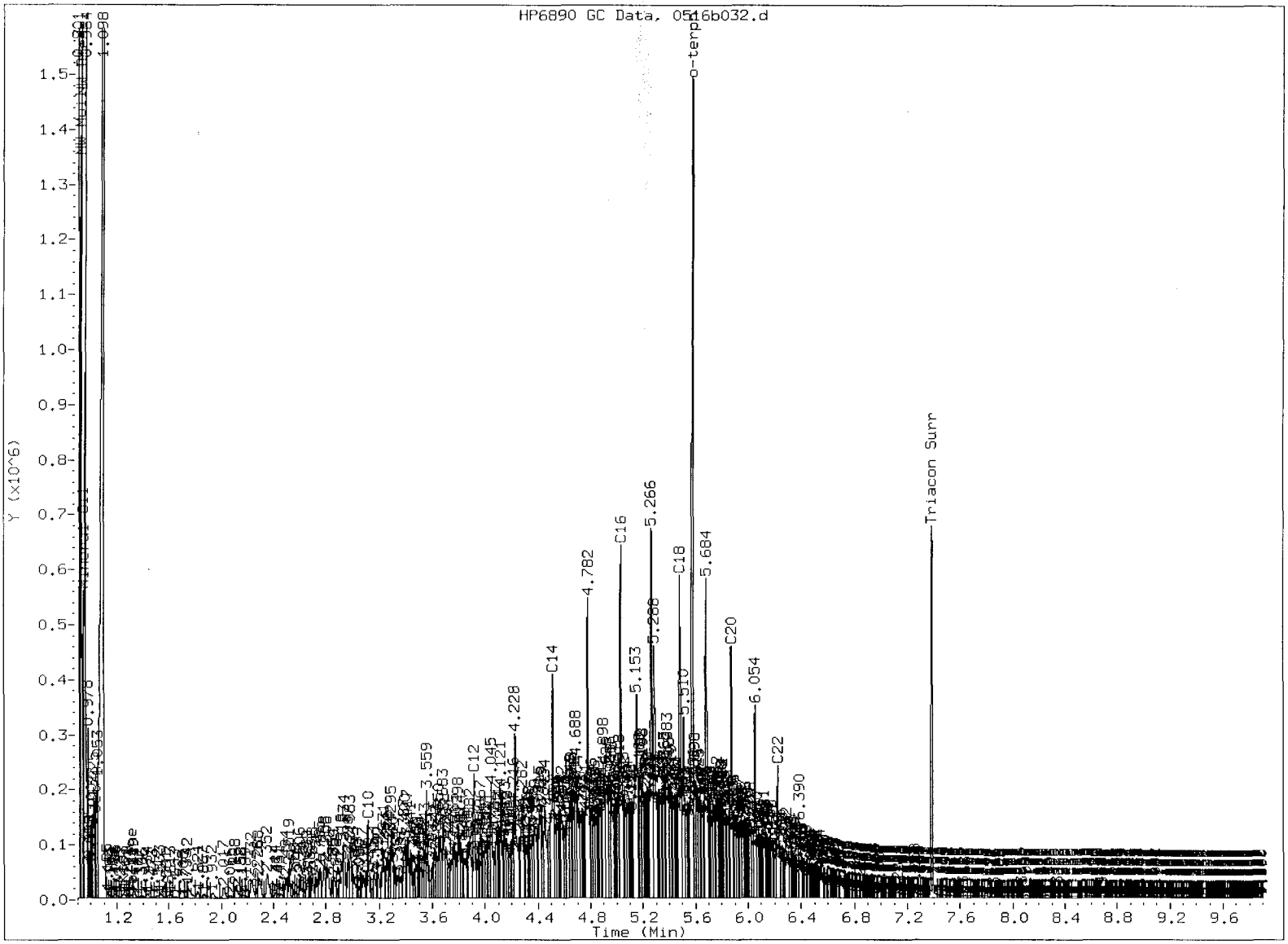


UT78:00160


Y (x10^6)
Min
Mineral Oil
NW Motl
NW Diesel
0.964
1.090
0.978
C10
3.559
C12
4.045
4.228
C14
4.688
4.782
C16
5.153
5.266
C18
5.510
o-terph
5.684
C20
6.054
C22
Triacon Surr
Data File: /chem3/fid3b.i/20120516.b/0516b032.d
Injection Date: 16-MAY-2012 17:03
Instrument: fid3b.i
Client Sample ID:
HP6890 GC Data, 0516b032.d: 0.000 to 9.989 Min

MH
5/17/12

FID:3B-2C/RTX-1 UT78MSD FID:3B SIGNAL



MANUAL INTEGRATION

1. Baseline correction
2. Poor chromatography
3. Peak not found
4. Totals calculation

5. Other _____

Analyst: MH Date: 5/17/12

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: CBA-SB-8-1-3-0512
SAMPLE

Lab Sample ID: UT78U
LIMS ID: 12-8511
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: 05/08/12
Date Received: 05/09/12

Date Extracted: 05/15/12
Percent Moisture: 19.4%

Sample Amount: 8.22 g-dry-wt
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 05/18/12 16:15
Instrument/Analyst: FID8/MH

Dilution Factor: 1.00

Aromatic
Date Analyzed: 05/19/12 01:20
Instrument/Analyst: FID8/MH

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	**2,400**	**6,000 B**
C10-C12 Aliphatics	**2,400**	**4,600**
C12-C16 Aliphatics	**2,400**	**28,000**
C16-C21 Aliphatics	**2,400**	**45,000**
C21-C34 Aliphatics	**2,400**	**130,000**
C8-C10 Aromatics	2,400	< 2,400 U
C10-C12 Aromatics	2,400	< 2,400 U
C12-C16 Aromatics	**2,400**	**5,700**
C16-C21 Aromatics	**2,400**	**30,000**
C21-C34 Aromatics	**2,400**	**71,000**

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	77.4%
Aromatic	o-Terphenyl	110%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: MB-051512
METHOD BLANK

Lab Sample ID: MB-051512
LIMS ID: 12-8511
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront
Date Sampled: NA
Date Received: NA

Date Extracted: 05/15/12
Percent Moisture: NA

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 05/18/12 14:36
Instrument/Analyst: FID8/MH

Dilution Factor: 1.00

Aromatic
Date Analyzed: 05/18/12 23:42
Instrument/Analyst: FID8/MH

Dilution Factor: 1.00

Range	RL	Result
C8-C10 Aliphatics	**2,000**	**2,000**
C10-C12 Aliphatics	2,000	< 2,000 U
C12-C16 Aliphatics	2,000	< 2,000 U
C16-C21 Aliphatics	2,000	< 2,000 U
C21-C34 Aliphatics	2,000	< 2,000 U
C8-C10 Aromatics	2,000	< 2,000 U
C10-C12 Aromatics	2,000	< 2,000 U
C12-C16 Aromatics	2,000	< 2,000 U
C16-C21 Aromatics	2,000	< 2,000 U
C21-C34 Aromatics	2,000	< 2,000 U

Reported in µg/kg (ppb)

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	90.9%
Aromatic	o-Terphenyl	90.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Aliphatic/Aromatic GC-EPH
Page 1 of 1

Sample ID: LCS-051512
LAB CONTROL

Lab Sample ID: LCS-051512
LIMS ID: 12-8511
Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

QC Report No: UT78-AECOM
Project: Central Waterfront

Date Sampled: NA
Date Received: NA

Date Extracted: 05/15/12

Sample Amount: 10.0 g-as-rec
Final Extract Volume: 1.0 mL

Aliphatic
Date Analyzed: 05/18/12 15:01
Instrument/Analyst: FID8/MH

Dilution Factor: 1.00

Aromatic
Date Analyzed: 05/19/12 00:07
Instrument/Analyst: FID8/MH

Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
C8-C10 Aliphatics	12000 B	15000	80.0%
C10-C12 Aliphatics	12000	15000	80.0%
C12-C16 Aliphatics	16000	15000	107%
C16-C21 Aliphatics	15000	15000	100%
C10-C12 Aromatics	12200	15000	81.3%
C12-C16 Aromatics	12900	15000	86.0%
C16-C21 Aromatics	27300	30000	91.0%
C21-C34 Aromatics	29700	30000	99.0%

Results reported in µg/kg

EPH Surrogate Recovery

Aliphatic	1-Chlorooctadecane	92.6%
Aromatic	o-Terphenyl	95.3%

ANALYTICAL RESOURCES INCORPORATED

ALEPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Client ID	COD	TOT OUT
MB-051512	90.9%	0
LCS-051512	92.6%	0
CBA-SB-8-1-3-0512	77.4%	0

	LCS/MB LIMITS	QC LIMITS
(COD) = 1-Chlorooctadecane	(27-128)	(39-131)

Prep Method: SW3580A
Log Number Range: 12-8511 to 12-8511

ANALYTICAL RESOURCES INCORPORATED

AREPH SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UT78-AECOM
Project: Central Waterfront

Client ID	OTER	TOT OUT
MB-051512	90.3%	0
LCS-051512	95.3%	0
CBA-SB-8-1-3-0512	110%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(34-133)	(10-143)

Prep Method: SW3580A
Log Number Range: 12-8511 to 12-8511

FORM-II AREPH

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-1-1.5-2.5-0512
ARI ID: 12-8487 UT78A

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	85.40
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	1.29

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-1-3-5-0512
ARI ID: 12-8488 UT78B

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	76.50
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	1.06

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-3-1-3-0512
ARI ID: 12-8490 UT78D

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	82.80
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	2.05

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-4-0.5-2.5-0512
ARI ID: 12-8491 UT78E

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	81.70
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	1.35

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-4-3-5-0512
ARI ID: 12-8492 UT78F

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	85.50
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	0.523

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-6-3-5-0512
ARI ID: 12-8501 UT78K

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	79.60
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	0.449

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-7-1-3-0512
ARI ID: 12-8502 UT78L

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	83.60
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	2.21

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-8-3-5-0512
ARI ID: 12-8503 UT78M

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	68.40
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	2.55

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-8-1-3-0512
ARI ID: 12-8504 UT78N

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	77.50
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	1.28

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CWMW-18-7-9-0512
ARI ID: 12-8505 UT780

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	75.10
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	1.71

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CWMW-18-13-15-0512
ARI ID: 12-8506 UT78P

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	79.90
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	0.584

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Client ID: CBA-SB-80-3-5-0512
ARI ID: 12-8507 UT78Q

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	72.30
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	2.44

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/07/12
Date Received: 05/09/12

Client ID: CBA-TP-7-0-1-0512
ARI ID: 12-8508 UT78R

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/09/12 050912#1	SM2540B	Percent	0.01	82.50
Total Organic Carbon	05/17/12 051712#1	Plumb,1981	Percent	0.020	0.283

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	05/09/12	Percent	< 0.01 U
Total Organic Carbon	05/17/12	Percent	< 0.020 U

LAB CONTROL RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/Method	QC ID	Date	Units	LCS	Spike Added	Recovery
Total Organic Carbon Plumb,1981	ICVL	05/17/12	Percent	0.101	0.100	101.0%

STANDARD REFERENCE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
Total Organic Carbon NIST 1941B	05/17/12	Percent	2.95	2.99	98.7%

REPLICATE RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: UT78A Client ID: CBA-SB-1-1.5-2.5-0512					
Total Solids	05/09/12	Percent	85.40	85.60 84.80	0.5%
Total Organic Carbon	05/17/12	Percent	1.29	1.30 1.19	4.8%

MS/MSD RESULTS-CONVENTIONALS
UT78-AECOM

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/21/12

Project: Central Waterfront
Event: NA
Date Sampled: 05/08/12
Date Received: 05/09/12

Analyte	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: UT78A Client ID: CBA-SB-1-1.5-2.5-0512						
Total Organic Carbon	05/17/12	Percent	1.29	2.83	1.46	105.8%

APPENDIX B
BEST MANAGEMENT PRACTICES

BEST MANAGEMENT PRACTICES

- All applicable permits for the project will be obtained prior to construction activities. All work will be performed according to the requirements and conditions of these permits.
- Construction of the proposed project will comply with water quality requirements imposed by Washington Administrative Code Chapter 173-201A, which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Washington State Department of Ecology's standards is intended to ensure that fish and aquatic life are protected to the extent feasible and practical.
- The contractor will be responsible for the preparation and implementation of a Spill Prevention, Control, and Countermeasures (SPCC) plan to be used for the duration of the project. The plan will be submitted to the project engineer prior to the commencement of any construction activities. A copy of the plan with any updates will be maintained at the work site by the contractor.
  - The SPCC plan will identify construction planning elements and recognize potential spill sources at the site. The plan will outline responsive actions in the event of a spill or release, and will identify notification and reporting procedures. The plan will also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
  - The SPCC plan will outline which measures the contractor will take to prevent the release or spread of hazardous materials, either found on site or encountered during construction but not identified in contract documents, or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to, gasoline, oils, and chemicals. Hazardous materials are defined in Revised Code of Washington 70.105.010 under "hazardous substance."
  - The contractor will maintain at the job site the applicable equipment and materials designated in the SPCC plan.
- Excess or waste materials will not be disposed of or abandoned waterward of

mean higher high water or allowed to enter waters of the state.

- The contractor will be required to retrieve any floating debris generated during construction using a skiff and a net. Debris will be disposed of at an appropriate upland facility.
- Erosion control measures will be addressed in a Temporary Erosion and Sediment Control Plan prepared by the contractor and adhered to during construction activities.
- Demolition and construction materials will not be stored where high tides, wave action, or upland runoff can cause materials to enter surface waters.
- Work will occur when tides are low enough to prevent incidental contact of material with marine waters during construction activities.
- Existing large woody debris (LWD) will be collected and stored on site prior to construction. The LWD will be placed back within the intertidal area upon completion of the project.
- An oil containment boom will be placed in the water throughout the duration of construction.

APPENDIX C
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
CENTRAL WATERFRONT SITE RI
WHATCOM WATERWAY SITE CLEANUP

Prepared for

Port of Bellingham
1801 Roeder Ave.
Bellingham, WA 98225

Prepared by

Anchor QEA, LLC
1605 Cornwall Ave.
Bellingham, WA 98225

Revised August 2012

CERTIFICATION PAGE

Halah Voges
Project Manager
Anchor QEA, LLC

Date: September 11, 2012

Bruce McDonald
Field Lead
Anchor QEA, LLC

Date: September 11, 2012

The information in this Health and Safety Plan has been designed for the Central Waterfront Site RI presently contemplated by Anchor QEA, LLC (Anchor QEA). Therefore, this document may not be appropriate if the work is not performed by or using the methods presently contemplated by Anchor QEA. In addition, as the work is performed, conditions different from those anticipated may be encountered and this document may have to be modified. Therefore, Anchor QEA only intends this plan to address currently anticipated activities and conditions and makes no representations or warranties as to the adequacy of the Health and Safety Plan for all conditions encountered.

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

Project Number: 120007-01 Project Name: Central Waterfront Site RI

My signature below certifies that I have read and understand the policies and procedures specified in this Health and Safety Plan (HASP). For non-Anchor QEA employees, this HASP may include company-specific appendices to this plan developed by entities other than Anchor QEA.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

SITE EMERGENCY PROCEDURES

Emergency Contact Information

Table A

Site Emergency Form and Emergency Phone Numbers*

Category	Information	
Possible Chemicals of Concern	BTEX, Petroleum	
Minimum Level of Protection	Modified Level D	
Site(s) Location Address	Central Waterfront, Whatcom Waterway, Bellingham, WA	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	1-800-222-1212	
Client Contact	Brian Gouran	Office: (360) 676-2500
Project Manager (PM)	Halah Voges	Office: (206) 903-3303 Cell: (206) 462-9572
Field Lead (FL)	Bruce McDonald	Office: (253) 858-5552 Cell: (253) 514-1875
Corporate Health and Safety Manager (CHSM)	David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
National Response Center	1-800-424-8802	
Department of Ecology	1-360-956-3262	
EPA Environmental Response Team	1-201-321-6600	

* In the event of any emergency contact the PM and FL.

Table B

Hospital Information

Category	Information
Hospital Name	St. Joseph's Hospital
Address	2901 Squalicum Parkway
City, State	Bellingham, WA
Phone	(360) 734-5400
Emergency Phone	911

Hospital Route Map and Driving Directions

START: A C St & Roeder Ave, Bellingham, Washington 98225

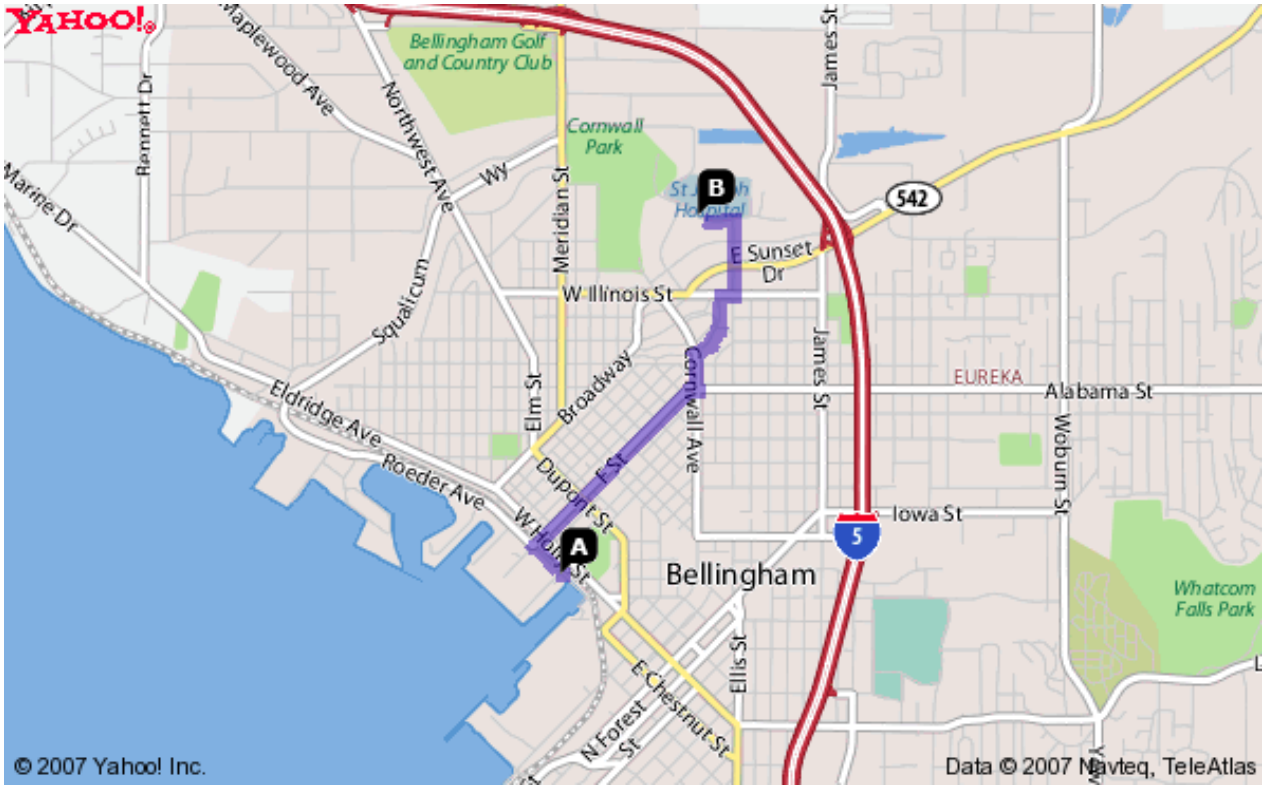
FINISH: B **St. Joseph Hospital**, 2901 Squalicum Pkwy, Bellingham, Washington 98225

Total Distance: 1.9 miles, Total Time: 9 minutes (approx.)

1.	Start at **C Street & Roeder Avenue, Bellingham** going toward **C ST**	go **0.1** miles
2.	Turn **RIGHT** on **F Street**	go **0.8** miles
3.	Bear **RIGHT** on **Alabama Street**	go **< 0.1** miles
4.	Turn **LEFT** on **Cornwall Avenue**	go **0.1** miles
5.	Turn **RIGHT** on **South Park Drive**	go **0.1** miles
6.	Continue on **Lyle Street**	go **0.1** miles
7.	Turn **RIGHT** on **East Illinois Street**	go **< 0.1** miles
8.	Turn **LEFT** on **Ellis Street**	go **0.3** miles
9.	Turn **LEFT** on **Squalicum Parkway**	go **0.1** miles
10.	Arrive at **St. Joseph Hospital** at **2901 Squalicum Parkway, Bellingham,** on the **RIGHT**	

Figure A

Hospital Route Map



Key Safety Personnel

The following people share responsibility for health and safety at the site. See Section 4 of this HASP for a description of the role and responsibility of each.

Client Contact: Brian Gouran	Office: (360) 676-2500
Project Manager (PM): Halah Voges	Office: (206) 903-3303 Cell: (206) 462-9572
Field Lead (FL): Bruce McDonald	Office: (253) 858-5552 Cell: (253) 514-1875
Corporate Health and Safety Manager (CHSM): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279

Emergency Response Procedures

In the event of an emergency, immediate action must be taken by the first person to recognize the event. Use the following steps as a guideline:

- Survey the situation to ensure that it is safe for you and the victim. Do not endanger your own life. Do not enter an area to rescue someone who has been overcome unless properly equipped and trained. Ensure that all protocols are followed. If applicable, review Material Safety Data Sheets (MSDS) to evaluate response actions for chemical exposures.
- Call the appropriate emergency number (911; if available) or direct someone else to do this immediately (see Table A). Explain the physical injury, chemical exposure, fire, or release and location of the incident.
- Have someone retrieve the nearest first aid kit and Automatic External Defibrillator (AED), if available. Note: Only use an AED if you have been properly trained and are currently certified to do so.
- Decontaminate the victim without delaying life-saving procedures (see Section 8).
- Administer first aid and cardiopulmonary resuscitation (CPR), if properly trained, until emergency responders arrive.
- Notify the Project Manager (PM), Field Lead (FL), and owner.
- Complete the appropriate incident investigation reports.

First Aid and CPR Guidelines

Personnel qualified and current in basic first aid and/or CPR procedures may perform those procedures as necessary. Personnel qualified and current in basic first aid and/or CPR are protected under Good Samaritan policies as long as they only perform the basic tasks that they were taught. Do not perform first aid and/or CPR tasks if you have not been trained in first aid and/or CPR.

Injury Management/Incident Notification

Observe the following injury management/incident notification procedures and practices:

Injury Management

- Once a personal injury incident is discovered, the first action will be to ensure that the injured party receives appropriate medical attention.
- If it is safe to do so, the nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident.
- Render first aid and call 911 or the appropriate emergency number as soon as possible.
- Escort the injured person to the occupational clinic or hospital or arrange for an ambulance.
- Proceed immediately to Notification Requirements, below.

Notification Requirements

- Directly after caring for an injured person, the work crew supervisor will be summoned. The work crew supervisor will immediately make contact with the PM or other designated individual to alert them of the medical emergency. The work crew supervisor will advise them of the following:
  - Location of the victim at the work site
  - Nature of the emergency
  - Whether the victim is conscious
  - Specific conditions contributing to the injury, if known

- Contact the PM, FL, and owner immediately.
- The PM will contact upper line management, including the Corporate Health and Safety Manager (CHSM).
- The CSHM will facilitate the incident investigation.

All client requirements will also be adhered to pertinent to personal injury incident reporting.

Incident Other Than Personal Injury

All incidents including, but not limited to, fire, explosion, property damage, or environmental release will be responded to in accordance with the site-specific Health and Safety Plan. In general, this includes securing the site appropriate to the incident, turning control over to the emergency responders, or securing the site and summoning appropriate remedial personnel or equipment. Anchor QEA will immediately notify the client of any major incident, fire, equipment or property damage, or environmental incident with a preliminary report. A full report will be provided within 72 hours.

Near-Miss Reporting

All near-miss incidents (those that could have reasonably lead to an injury, environmental release, or other incident) must also be reported to the FL and/or PM immediately so they can take action to ensure that such conditions that lead to the near-miss incident can be readily corrected in order to prevent future occurrences.

Spills and Releases of Hazardous Materials

When required, notify the National Response Center and local state agencies. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of facility
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility

The emergency telephone number for the National Response Center is 1-800-424-8802. If hazardous waste has been released or produced through control of the incident, ensure that:

- Waste is collected and contained
- Containers of waste are removed or isolated from the immediate site of the emergency
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided
- No waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed

Ensure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

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LIST OF ACRONYMS AND ABBREVIATIONS

° C	degrees Celsius
° F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AED	Automated External Defibrillator
Anchor QEA	Anchor QEA, LLC
ANSI	American National Standards Institute
APR	Air-Purifying Respirator
CDC	Centers for Disease Control
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
COC	chemical of concern
CPR	Cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dbA	A-weighted decibel
dB	decibel
DOT	U.S. Department of Transportation
DPT	Direct Push Technology
EPA	U.S. Environmental Protection Agency
eV	electron volts
EZ	Exclusion Zone/Hot Zone
FID	Flame Ionization Detector
FL	Field Lead
GFCI	Ground Fault Circuit Interrupter
H:V	horizontal to vertical
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
HMIS	Hazardous Material Information System
IDLH	Immediately Dangerous to Life or Health

IP	Ionization Potential
JSA	Job Safety Analysis
kPa	kilopascal
kV	kilovolts
LEL	Lower Explosive Limit
LO/TO	Lockout/Tagout
mg/m^3	Milligrams per cubic meter
MHR	Maximum Heart Rate
MSDS	Material Safety Data Sheets
MUTCD	Manual of Uniform Traffic Control Devices
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priority List
NRR	Noise Reduction Rating
O_2	Oxygen
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Act or Administration
OV	Organic Vapor
OVM	Organic Vapor Monitor
PAHs	Polycyclic Aromatic Hydrocarbon
P.E.	Professional Engineer
PEL	Permissible Exposure Limit
PFD	personal flotation device
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	parts per million
PRCS	Permit-Required Confined Spaces
PVC	Polyvinyl Chloride
QLFT	Qualitative Fit Test
REL	Recommended Exposure Limits
RCRA	Resource Conservation and Recovery Act

STEL	Short Term Exposure Limit
SZ	Support Zone/Clean Zone
TLV	Threshold Limit Values
TSD	Treatment, Storage, and Disposal Facility
tsf	ton per square foot
TWA	Time Weighted Average
UL	Underwriters Laboratories Inc.
USCG	U.S. Coast Guard
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Temperature

1 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared on behalf of the Port of Bellingham and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC (Anchor QEA) personnel and at a minimum by its subcontractors during work activities at Central Waterfront (the site). This HASP has been developed in accordance with Title 29 of the Code of Federal Regulations (CFR), Part 1910.120 (b), and will be used in conjunction with Anchor QEA's Corporate Health and Safety Program. See Section 1.1 for HASP modification procedures.

The provisions of this HASP are mandatory for all Anchor QEA personnel assigned to the project. Anchor QEA subcontractors are also expected to follow the provisions of this HASP unless they have their own HASP that covers their specific activities related to this project. Any subcontractor HASPs must include the requirements set forth in this HASP, at a minimum. All visitors to the work site must also abide by the requirements of this HASP and will attend a pre-work briefing where the contents of this HASP will be presented and discussed.

Personnel assigned to work at the project site will be required to read this plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of the HASP.

Subcontractors are ultimately responsible for the health and safety of their employees. Subcontractors may mandate health and safety protection measures for their employees beyond the minimum requirements specified in this HASP.

The objectives of this HASP are to identify potential physical, chemical, and biological hazards associated with field activities; establish safe working conditions and protective measures to control those hazards; define emergency procedures; and describe the responsibilities, training requirements, and medical monitoring requirements for site personnel.

This HASP prescribes the procedures that must be followed during specific site activities. Significant operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Corporate Health and Safety Manager (CHSM).

Issuance of this approved plan documents that the workplace has been evaluated for hazards. A hazard assessment has been performed and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d) - Personal Protective Equipment, General Requirements (general industry), 1910.134 – Respiratory Protection, 1926.28 – Personal Protective Equipment (construction industry), and 1926.55 – Gases, vapors, fumes, dusts and mist, and is duly noted by the signature(s) and date appearing on the certification page of this document.

1.1 Health and Safety Plan Modifications

This HASP will be modified by amendment, if necessary, to address changing field conditions or additional work tasks not already described in this document. Modifications will be proposed by the Field Lead (FL) using the "Modification to Health and Safety Plan" form included in Appendix A. Modifications will be reviewed by the CHSM or authorized representative and approved by the PM.

2 SITE DESCRIPTION/BACKGROUND INFORMATION

2.1 Site Description

The Central Waterfront Site is located along the northwest shoreline of Whatcom Waterway in Bellingham, Washington. Field activities will be performed within the intertidal zone and extending approximately 100 feet away from the shoreline. The Site includes mostly bulkheaded shoreline and a shallowly sloping beach area that extends into the Waterway. The Site is used by Colony Wharf and typically accommodates barge traffic.

2.2 Site Background Information

Anchor QEA, LLC, is currently conducting remedial design and permitting activities in support of the Whatcom Waterway Site Cleanup project. This work is being performed in accordance with the First Amendment to Consent Decree No. 07-2-02257-7. The design and permitting work is being performed on behalf of the Port of Bellingham and other signatories to the Consent Decree. In addition, ongoing Remedial Investigation and Feasibility Study (RI/FS) activities are being performed at the Central Waterfront site in accordance with Agreed Order No. DE 3441. Recent petroleum sheens observed on the southern shoreline triggered Ecology to issue an amendment (First Amendment) to the Agreed Order authorizing an interim action to address the observed sheens.

During development of the Whatcom Waterway Engineering Design Report and review of existing Central Waterfront RI/FS documents, Ecology identified information needs relating to shoreline soil and groundwater quality in certain areas along the northern shoreline of the Whatcom Waterway site. This shoreline area is located within both the Whatcom Waterway site (due to the presence of mercury in impacted subsurface sediments), and the Central Waterfront site (due to the presence of petroleum impacted soils and groundwater, as well as sediments contaminated with boatyard-associated contaminants). Ecology specifically identified the need for supplemental data to document current groundwater and porewater quality in portions of this shoreline area, and to evaluate soil quality in an area where capping/stabilization of the shoreline may include limited areas of shoreline cut-back.

The Supplemental Work Plan identifies the methods to be used to collect the information requested by Ecology to address the above-described data gaps. The work described in this

document will inform the ongoing Whatcom Waterway design effort, and the results will be incorporated into the Phase 1 Engineering Design Report. Additionally, this work will inform the anticipated revisions to the Central Waterfront RI/FS, which is currently undergoing Ecology review.

3 SCOPE OF WORK

3.1 Project Scope of Work

This plan addresses health and safety issues involved with an investigation of petroleum contaminated soils. The following tasks will be performed as part of this investigation:

- Shoreline reconnaissance
- Test pit excavation and soil sampling
- Porewater sampling
- Seep water sampling
- Groundwater sampling

This plan also addresses the health and safety issues involved with the construction management of the following tasks that will be performed by the contractor (TBD):

- Limited excavation in the nearshore environment to remove petroleum-impacted soils.

4 AUTHORITY AND RESPONSIBILITIES OF KEY PERSONNEL

This section describes the authority and responsibilities of key Anchor QEA project personnel. The names and contact information for the following key safety personnel are listed in the Emergency Site Procedures section at the beginning of this HASP. Should key site personnel change during the course of the project, a new list will be established and posted immediately at the site. The emergency phone number for the site is **911**, and should be used for all medical, fire, and police emergencies.

4.1 Project Manager

The PM provides overall direction for the project. The PM is responsible for ensuring that the project meets the client's objectives in a safe and timely manner. The PM is responsible for providing qualified staff for the project and adequate resources and budget for the health and safety staff to carry out their responsibilities during the field work. The PM will be in regular contact with the FL and CHSM to ensure that appropriate health and safety procedures are implemented into each project task.

The PM has authority to direct response operations; the PM assumes total control over project activities but may assign responsibility for aspects of the project to others. In addition, the PM:

- Oversees the preparation and organization of background review of the project, the work plan, and the field team.
- Ensures that the team obtains permission for site access and coordinates activities with appropriate officials.
- Briefs the FL and field personnel on specific assignments.
- Together with the FL, sees that health and safety requirements are met.
- Consults with the CHSM regarding unsafe conditions, incidents, or changes in site conditions or the Scope of Work.

4.2 Field Lead

The FL reports to the PM, has authority to direct response operations, and assumes control over on-site activities. The FL will direct field activities, coordinate the technical and health

and safety components of the field program, and is responsible in general for enforcing this site-specific HASP and Corporate HASP requirements. The FL will be the primary point of contact for all field personnel and visitors and has direct responsibility for implementation and administration of this HASP. The FL and any other member of the field crew have the authority to stop or suspend work in the event of an emergency, if conditions arise that pose an unacceptable health and safety risk to the field crew or environment, or if conditions arise that warrant revision or amendment of this HASP. The following include, but are not necessarily limited to, the functions of the FL related to this HASP:

- Conduct and document daily safety meetings, or designate an alternate FL in his or her absence.
- Execute the work plan and schedule.
- Conduct periodic field health and safety inspections to ensure compliance with this HASP.
- Oversee implementation of safety procedures.
- Implement worker protection levels.
- Enforce site control measures to ensure that only authorized personnel are allowed on site.
- Notify, when necessary, local public emergency officials (all personnel on site may conduct this task as needed).
- Follow-up on incident reports to the PM.
- Periodically inspect protective clothing and equipment for adequacy and safety compliance.
- Ensure that protective clothing and equipment are properly stored and maintained.
- Perform or oversee air monitoring in accordance with this HASP.
- Maintain and oversee operation of monitoring equipment and interpretation of data from the monitoring equipment.
- Monitor workers for signs of stress, including heat stress, cold exposure, and fatigue.
- Require participants to use the "buddy" system.
- Provide (via implementation of this HASP) emergency procedures, evacuation routes, and telephone numbers of the local hospital, poison control center, fire department, and police department.
- Communicate incidents promptly to the PM.
- Maintain communication with the CHSM on site activities.

- If applicable, ensure that decontamination and disposal procedures are followed.
- Maintain the availability of required safety equipment.
- Advise appropriate health services and medical personnel of potential exposures.
- Notify emergency response personnel in the event of an emergency and coordinate emergency medical care.

The FL will record health-and-safety-related details of the project in the field logbook. At a minimum, each day's entries must include the following information:

- Project name or location
- Names of all on-site personnel
- Level of PPE worn and any other specifics regarding PPE
- Weather conditions
- Type of field work being performed

The FL will have completed the required Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and annual updates, the 8-hour Supervisor training, medical monitoring clearance, and current first aid and cardiopulmonary resuscitation (CPR) training. Other certifications or training may be stipulated based on client or site requirements.

4.3 Corporate Health and Safety Manager

Anchor QEA's CHSM will be responsible for managing on-site health and safety activities and will provide support to the PM and FL on health and safety issues. The specific duties of the CHSM are to:

- Provide technical input into the design and implementation of this HASP.
- Advise on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards.
- Ensure that a hazard assessment has been performed and that the adequacy of the PPE selected was evaluated as required by 29 CFR 1910.132(d), 1910.134, 1926.25, and 1926.55, and is duly noted by the signatures and date appearing on the Certification Page of this document.

- Consult with the FL on matters relating to suspending site activities in the event of an emergency.
- Verify that all on-site Anchor QEA personnel and subcontractors have read and signed the HASP Acknowledgement Form.
- Verify that corrective actions resulting from deficiencies identified by audit and observations are implemented and effective.

The CHSM will have completed the required OSHA 40-hour HAZWOPER training and annual updates, the 8-hour Supervisor training, and have medical monitoring clearance. In addition, the CHSM will have current training in first aid and CPR.

4.4 Project Field Team

All project field team members will attend a project-specific meeting conducted by the FL concerning safety issues and project work task review before beginning work. All field crew, including subcontractors, must be familiar with and comply with this HASP. The field crew has the responsibility to immediately report any potentially unsafe or hazardous conditions to the FL, and all members of the field crew have the authority to stop or suspend work if conditions arise that pose an unacceptable health and safety risk to the field crew or environment, or if conditions arise that warrant revision or amendment of this HASP. The field team reports to the FL for on-site activities and is responsible for:

- Reviewing and maintaining a working knowledge of this HASP
- Safe completion of on-site tasks required to fulfill the work plan
- Compliance with the HASP
- Attendance and participation in daily safety meetings
- Notification to the FL of existing or potential safety conditions at the site
- Reporting all incidents to the FL
- Demonstrating safety and health conscious conduct

Per OSHA 1910.120(e)(3)(i)[1], newly assigned HAZWOPER 40-hour trained field team members must have at least 3 days of field work supervised by an experienced FL (preferably

1 "General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous

an individual with HAZWOPER Supervisor training). It is the responsibility of the PM to identify such "short service" personnel and ensure that their supervised field experience occurs (or has occurred) and is documented in the project field notes and on the Daily Safety Briefing form (Appendix A).

substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained experienced supervisor."

5 PROJECT-SPECIFIC REQUIREMENTS

This section provides activity-specific levels of protection and air monitoring requirements to be used on this site based on the Scope of Work and the chemicals of concern (COCs).

5.1 Activity-Specific Level of Protection Requirements

Refer to Section 10 of this plan for general requirements for PPE. Level D is the minimum acceptable level for most sites. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can come in contact with the skin or work uniform. An upgrade to Level C occurs when there is a potential for exposure to airborne COCs; i.e., if the results of air monitoring reveal that action levels have been exceeded. Hearing protection must be worn when there are high noise levels. Workers must maintain proficiency in the use and care of PPE that is to be worn.

Table 5-1, Project Job Tasks and Required PPE, describes the specific means of protection needed for each identified work activity.

5.2 Project Air Monitoring Requirements

Refer to Section 11 of this plan for general requirements for air monitoring at the project site, including information on air monitoring equipment. Upgrade from Level D and/or Modified Level D to Level C when the results of air monitoring reveals that action levels have been exceeded.

Table 5-2, Project Air Monitoring Requirements, describes the specific air monitoring required for each identified work activity.

Table 5-1

Project Job Tasks and Required PPE

Job Tasks		PPE Requirements
• Construction oversight • Decontamination of equipment • Lifting and moving of Zodiac and Sample Coolers • Operation of sampling equipment but with no anticipated direct contact with sediments, soil, groundwater or decontamination chemicals	☒	Standard work uniform/coveralls
	☒	Work boots with safety toe
	☒	Traffic Safety Vest
	☒	Chemical-resistant clothing check appropriate garments: ☐ One-piece coverall ☐ Hooded one- or two-piece chemical splash suit ☒ Disposable chemical coveralls ☐ Chemical-resistant hood and apron ☐ Bib-style overalls and jacket with hood **Fabric Type:** Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with polycyclic aromatic hydrocarbons (PAHs) or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	☒	Disposable inner gloves (surgical)
	☒	Disposable chemical-resistant outer gloves **Material Type:** Nitrile
	☒	Chemical-resistant boots with safety toe and steel shank or disposable boot covers for safety toe/work boots **Material Type:** Rubber or leather
	☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	☐	Splash-proof safety goggles
	☒	Safety glasses
	☒	Hard hat
	☐	Hard hat with face shield
	☒	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]).
	☐	Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)
	☐	Long cotton underwear
	☒	U.S. Coast Guard (USCG)-approved personal flotation device (PFD)

Job Tasks		PPE Requirements
• Soil and Groundwater sample collection • Porewater and Seep Water collection	☐	USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if water temperatures are below 50° F
	☐	Half-face Air-Purifying Respirator (APR) (OSHA/NIOSH-approved)
	☐	Full-face APR (OSHA/NIOSH-approved)
	☐	**Type of Cartridges to be Used:** ☐ **OV or** ☐ **OV/HEPA (if samples are dry)**

Table 5-2

Project Air Monitoring Requirements

Instrument*	Job Tasks / Functions	Measurement	Monitoring Schedule[3]	Actions[1]
FID and/or PID (10.6*eV lamp) - Measures Total Organic Vapors	Conduct air monitoring for volatile organic compounds (VOCs) during activities where contaminated media are present. Make sure that a background reading is taken before the start of activities and periodically thereafter.	0 to 5 ppm above background in breathing zone	Periodically (every 15 to 30 minutes)	Acceptable, continue work.
		> 5 to 25ppm above background	Periodically (every 15 minutes)	Upgrade to Level C[4] protection. Monitor for vinyl chloride, hydrogen cyanide, and benzene using colorimetric detector tubes.
		> 25 ppm above background in breathing zone		Stop work required[2]. Leave work area and contact Project Manager (PM) and Corporate Health and Safety Manager (CHSM) for

Instrument*	Job Tasks / Functions	Measurement	Monitoring Schedule[3]	Actions[1]
				guidance.

*Note: Instruments must be calibrated according to manufacturer's recommendations.
1 For VOCs, a sustained reading for greater than 2 minutes in excess of the action level will trigger a protective measure.
2 Contact with the CHSM and PM must be made prior to continuance of work. A hazard review must be conducted before proceeding with work. Corrective actions may include temporary work stoppage to allow vapors to dissipate, and then returning to work if air monitoring data permits.
3 Monitoring frequency is from the beginning of each task and at specified intervals thereafter, or when detectable soil contamination is encountered (as indicated by strong, sustained odor, visual evidence of product, or petroleum-discolored soils).
4 Contact the CHSM for respiratory protection fit testing and air purifying cartridge change-out requirements.
ppm – parts per million
mg/m^3 – milligrams per cubic meter

6 RISK ANALYSIS AND CONTROL

The following sections discuss the potential worker health and safety hazards associated with the field tasks described in the Supplemental Work Plan. Controls of these hazards are addressed through the mechanical and physical control measures, use of PPE, monitoring, training, decontamination, emergency response, and safety procedures.

Significant changes in the Supplemental Work Plan covered by this HASP must be communicated to the PM and CHSM, and an amendment to this HASP must be created as needed (see Section 1.1). Any task conducted beyond those identified in the Supplemental Work Plan and this HASP must be evaluated using the Job Safety Analysis (JSA) process prior to conducting the work.

6.1 Job Safety Analysis

Anchor QEA work tasks have been evaluated for their hazards, and JSA documents have been developed that detail the chemical, physical, and biological hazards associated with these tasks, along with the control measures (e.g., engineering controls, administrative controls, and/or PPE) that will be used to ensure that these tasks are conducted in a safe manner.

The PM and FL are responsible for identifying work tasks and project site conditions that are beyond the previously developed JSA documents and for communicating such information to the CHSM. The CHSM will provide support, as needed, to the PM and/or the FL, who will have primary responsibility to develop project-specific JSAs.

The contents of the JSA documents shall be communicated to project personnel during the site orientation meeting and during daily safety meetings when conducting work where the specific JSAs are applicable.

JSA documents applicable to this project are located in Appendix B of this HASP and include the following field tasks:

- Shoreline reconnaissance
- Field Activities

- Porewater and Seep Sampling
- Groundwater Sampling
- Personnel Decontamination
- Tool & Equipment Decontamination
- Test Pit and Confirmation Soil Sampling
- Heavy Equipment Operation

6.1.1 Augmented JSA Process

If significant work tasks are identified during the course of the project that were not previously addressed in the JSA documentation supplied in Appendix B of this HASP, then a task-specific JSA document must be developed at the project site prior to conducting the work. The PM and/or FL shall develop this document(s) with input from the CHSM, as needed, and this HASP will be amended to include the document (see Section 1.1 for HASP modification procedures). Project personnel shall be trained on the contents of the developed task-specific JSA prior to its implementation. A copy of the task-specific JSA form used in this process is supplied in Appendix B of this HASP.

6.2 Exposure Routes

Possible routes of exposure to the chemicals potentially encountered on this project include inhalation, dermal contact, and ingestion of dust, mist, gas, vapor, or liquid. Exposure will be minimized by using safe work practices and by wearing the appropriate PPE. A further discussion of PPE requirements is presented in Section 10.

6.2.1 Inhalation

Inhalation of particulates, dust, mist, gas, or vapor during field activities is possible. Whenever possible, work activities will be oriented so that personnel are upwind of the sampling location. An organic vapor monitor (OVM) may be used to monitor ambient air and the breathing zone within the work area for organic compounds. Section 5.2 describes potential OVM action levels and response procedures.

6.2.2 Dermal Contact

Dermal contact with potentially contaminated soil, sediment, or groundwater during field activities is possible. Direct contact will be minimized through the use of appropriate PPE and decontamination procedures.

6.2.3 Ingestion

Direct ingestion of contaminants can occur by inhaling airborne dust, mist, or vapors, or by swallowing contaminants trapped in the upper respiratory tract. Indirect ingestion can occur by introducing the contaminants into the mouth by way of food, tobacco, fingers, or other carriers. Although ingestion of contaminants can occur, proper hygiene, decontamination, and contamination reduction procedures should reduce the probability of this route of exposure.

6.3 Chemicals of Concern Profile

The following table provides a summary profile for the COCs for this project. As available, this profile is based on recent site history and site characterization information. For more detailed and specific information, always refer to the Material Safety Data Sheet (MSDS) or equivalent information for the chemical (see Appendix C).

Table 6-1
Chemicals of Concern Profile

Chemical	Route of Entry	OEL (STEL)	Odor Threshold	TLV	IP (eV)
Benzene	Skin Absorption Hazard, Volatile	5	34-119	0.1	9.25
Toluene	Skin Absorption Hazard, Volatile	150	0.16-37	50	8.82
Ethylbenzene	Skin Absorption Hazard, Volatile	125	0.092-0.6	100	8.72
Xylenes	Skin Absorption Hazard, Volatile	100	20	100	8.5

eV – electron volts
IP – Ionization Potential
TLV – Threshold Limit Value
OEL – Occupational Exposure Limit (identifies the most restrictive exposure limit, e.g., federal or state OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV), and/or National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for the chemicals of concern.
STEL – Short-term exposure limit

7 SITE CONTROL AND COMMUNICATIONS

The primary purposes for site controls are to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas, and to prevent unauthorized access or exposure to hazardous materials by site personnel and the public. Site control is especially important in emergency situations.

7.1 General Site Control Safety Procedures

The following are standard safe work practices that apply to all Anchor QEA site personnel and subcontractors and shall be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited on site except in designated areas.
- Hands and faces must be washed upon leaving the work area and before eating, drinking, chewing gum or tobacco, and smoking.
- A buddy system will be used. Radio or hand signals will be established to maintain communication.
- During site operations, each worker will consider him/herself as a safety backup to his/her partner.
- Visual contact will be maintained between buddies on-site when performing hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established in this HASP, will be subject to corrective action, potentially including, but not limited to, reprimanded and immediate dismissal.
- Proper decontamination procedures must be followed before leaving a contaminated work area.

7.2 Work Area Access Control

If work is performed in public areas, the following precautions shall be taken to protect both the workers and the public. Access control to the work area will be accomplished by the use of a combination of the following devices and/or methods:

- Fences and/or barricades
- Traffic control devices and/or use of flaggers
- Caution tape
- Other methods to keep the site secure and provide a visual barrier to help keep unauthorized personnel from entering the site and active work areas

7.3 Hazardous Waste Site Work Control Procedures

To prevent contamination from migrating from personnel and equipment, work areas will be clearly specified as an Exclusion Zone/Hot Zone (EZ), Contaminant Reduction Zone (CRZ), or Support Zone/Clean Zone (SZ) prior to beginning operations. Each work area will be clearly identified using signs or physical barriers. At the end of each workday, the site should be secured and/or guarded to prevent unauthorized entry.

Site work zones will include:

- **Exclusion Zone/Hot Zone (EZ).** The EZ will be the "hot zone" or contaminated area inside the site perimeter (or sample collection area of boat). The EZ is the defined area where potential respiratory and/or health hazards exist. All personnel entering the EZ must use the required PPE, as set forth in this HASP, and meet the appropriate training and medical clearance. Entry to and exit from this zone will be made through a designated point. Appropriate warning signs to identify the EZ should be posted (e.g., DANGER, AUTHORIZED PERSONNEL ONLY, PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT). Personnel and equipment decontamination must be performed upon exiting the EZ.
- **Contaminant Reduction Zone (CRZ).** The CRZ, also known as the "warm zone," is a transitional zone between the EZ and the SZ (also known as the "cold zone" or "clean zone"). The CRZ provides a location for removal and decontamination of PPE and tools leaving the EZ. A separate decontamination area will be established for heavy

equipment. All personnel and equipment must exit via the CRZ. If, at anytime, the CRZ is compromised, a new CRZ will be established.

- **Support Zone/Clean Zone (SZ).** This uncontaminated zone will be the area outside the EZ and CRZ and within the geographic perimeters of the site (including boat and processing areas). The SZ is used for support personnel; staging materials; parking vehicles; office, laboratory, and sanitation facilities; and receiving deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, and others who will not necessarily be permitted in the EZ or CRZ.

A log of all personnel visiting, entering, or working on the site shall be maintained by the FL. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e), (f) (and 29 CFR 1926.1101(k)(9), (m) if appropriate). Visitors will attend a site orientation given by the FL and sign the HASP.

7.4 Site-Specific Work Zone Requirements

This section contains guidelines for maintaining safe conditions when working from a boat, in a roadway, or at an excavation site.

7.4.1 Working at Excavation/Trenching Sites

Observe the following site control practices and procedures when working around excavation and trenching sites:

- A "competent person" is required per Occupational Safety and Health Act (OSHA), 29 CFR 1926 Subpart P.
- Safeguard open excavations by restricting unauthorized access.
- Highlight the work area using prominent warning signs (e.g., cones, sawhorses, or other barricades, and signage) placed a minimum of 10 feet back from the excavation opening.
- Maintain zone definition along the perimeter with a continuous string of yellow or orange caution tape.

7.5 Field Communications

Communications between all Anchor QEA employees and subcontractors at the work site can be verbal and/or non-verbal. Verbal communication can be affected by the on-site background noise and various PPE. See Table 7-1 for a list of the types of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to ensure proper operation. All project personnel must be initially briefed on the communication methods prior to starting work; communication methods should be reviewed in daily safety meetings.

Table 7-1
Field Communication Methods

Type of Communication	Communication Device	Signal
Emergency notification	On-site Telephone or Cellular Telephone	Initiate phone call using applicable emergency numbers
Emergency notification among site personnel	Two-way Radio	Initiate radio communication with Code Red message
Hailing site personnel for non-emergency	Compressed Air Horn	One long blast, one short blast
Hailing site personnel for emergency evacuation	Compressed Air Horn	Three long, continuous blasts
Hailing site personnel for distress, need help	Visual	Arms waved in circle overhead
Hailing site personnel for emergency evacuation	Visual	Arms waved in criss-cross over head
Contaminated air/strong odor	Visual	Hands clutching throat
Break, lunch, end of day	Visual	Two hands together, break apart

8 DECONTAMINATION PROCEDURES AND PRACTICES

8.1 Minimization of Contamination

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

Personnel

- Do not walk through spilled materials
- Do not handle, touch, or smell sample media directly
- Make sure PPE has no cuts or tears prior to use
- Protect and cover any skin injuries
- Stay upwind of airborne dusts and vapors
- Do not eat, drink, chew tobacco, or smoke in the work zones

Sampling Equipment and Vehicles/Vessels

- Use care to avoid getting sampled media on the outside of sample containers
- If necessary, bag sample containers before filling with sampled media
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media
- Keep contaminated equipment and tools separate from clean equipment and tools
- Fill sample containers over a plastic tub to contain spillage
- Clean up spilled material immediately to avoid tracking around the vehicle/vessel

8.2 Decontamination Equipment

All vehicles, vessels, and equipment that have entered potentially contaminated areas will be visually inspected and, if necessary, decontaminated prior to leaving the area. If the level of vehicle contamination is low, decontamination may be limited to rinsing tires and wheel wells with an appropriate detergent and water. If the vehicle is significantly contaminated, steam cleaning or pressure washing may be required. Tools will be cleaned in the same manner. Rinsate from all decontamination activities will be collected for proper disposal. Decontamination of equipment and tools will take place within the CRZ.

The following supplies will be available to perform decontamination activities:

- Wash and rinse buckets
- Tap water and phosphate-free detergent
- Scrub brushes
- Distilled/deionized water
- Deck pump with pressurized freshwater hose (aboard the vessel)
- Pressure washer/steam cleaner, if appropriate
- Paper towels and plastic garbage bags

8.3 Personnel Decontamination

The FL will ensure that all site personnel are familiar with personnel decontamination procedures as listed below. All personnel wearing PPE in a work area (EZ) must undergo decontamination prior to entering the SZ. Personnel will perform the following decontamination procedures:

- Wash and rinse outer gloves and boots in portable buckets to remove gross contamination.
- If suit is heavily soiled, rinse it off.
- Remove outer gloves; inspect and discard if damaged. Leave inner gloves on. Personnel will remove their outer garment and gloves, dispose of them, and properly label container or drum. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items then will be hand-carried to the next station. Remove inner gloves.
- Thoroughly wash hands and face before leaving CRZ.
- Sanitize respirators and place in a clean plastic bag.

8.4 Sampling and Processing Equipment Decontamination

To prevent sample cross-contamination, sampling and processing equipment in contact with soil, sediment, or water samples will undergo the following decontamination procedures when work is completed in the CRZ and prior to additional use:

1. Rinse with potable water and wash with scrub brush.
2. Wash with phosphate-free detergent (Alconox®).

3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox® is insufficient to remove visually observable tar-related contamination on equipment, the equipment will be scrubbed and rinsed using hexane (or similar type solution) until all visual signs of contamination are absent.
4. Rinse external sampling equipment with potable water three times prior to use. Rinse homogenizing equipment once with potable water and three times with distilled water prior to and between sample processing.

8.5 Handling of Investigation-Derived Waste

All remaining soil or sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

8.5.1 Disposable PPE

Disposable PPE may include Tyvek suits, inner latex gloves, and respirator cartridges. Dispose of PPE according to the requirements of the client and state and federal agencies.

8.5.2 Non-disposable PPE

Non-disposable PPE may include respirators and boots and gloves. When decontaminating respirators, observe the following practices and procedures:

- Wipe out the respirator with a disinfecting pad prior to donning.
- Decontaminate the respirator on site at the close of each day with an approved sanitizing solution.

When decontaminating boots and gloves, observe the following practices and procedures:

- Decontaminate the boots or gloves outside with a solution of detergent and water; rinse with water prior to leaving the site.
- Protect the boots or gloves from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

8.6 Sanitizing of Personal Protective Equipment

Respirators, reusable protective clothing, and other personal articles must not only be decontaminated before being reused, but also sanitized. The insides of masks and clothing become soiled due to exhalation, body oils, and perspiration. Manufacturer's instructions should be used to sanitize respirator masks. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

8.7 Emergency Personnel Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

8.8 Containment of Decontamination Fluids

As necessary, spill control measures will be used to contain contaminated runoff that may enter into clean areas. Use plastic sheeting, hay bales, or install a spill control system to prevent spills and contain contaminated water.

8.9 Pressure Washing

The following procedure is required when using high-pressure washing equipment for decontamination purposes:

- Wear modified Level D protection, including a face shield and safety goggles.
- Ensure that other personnel are out of the area prior to decontamination.
- Secure the area around the decontamination pad with cones, caution tape, or barricades.
- Ensure that safe work practices and precautions are taken to minimize the potential for physical injury from high-pressure water spray. Follow the manufacturer's operating instructions.

- The pressure washer wand must be equipped with a safety release handle.
- Ensure that the area is clean after equipment is decontaminated. Barricades, cones, or caution tape must be left in place and secured at all times.

9 HEALTH AND SAFETY TRAINING AND INFORMATIONAL PROGRAMS

This section describes the health and safety training and informational programs that Anchor QEA project site personnel must comply with.

9.1 Initial Project Site Orientation

Work on all Anchor QEA project sites will require participation in an initial health and safety orientation presented by the PM or FL that will consist of, at a minimum, the following topics:

- A review of the contents of this HASP, including the Supplemental Work Plan and associated site hazards and control methods and procedures.
- Provisions of this plan are mandatory for all Anchor QEA personnel assigned to the project.
- Anchor QEA subcontractors are also expected to follow the provisions of this plan unless they have their own HASP that covers their specific activities related to this project and includes the minimum requirements of this HASP.
- All visitors to the work site will also be required to abide by the requirements of this plan.
- Personnel assigned to perform work at the project site, working under the provisions of this HASP, will be required to read the plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this plan.

9.2 Daily Safety Meetings

Daily safety meetings ("tailgate meetings") make accident prevention a top priority for everyone and reinforce awareness of important accident-prevention techniques. The following daily safety meeting procedures and practices are required:

- Daily safety meetings will be held each morning prior to conducting site activities.
- The Daily Safety Briefing form in Appendix A will be used to document each meeting.
- Copies of the completed Daily Safety Briefing forms will be maintained on-site during the course of the project.

9.3 Hazardous Waste Operations Training

Personnel working on project sites that present a potential exposure to hazardous wastes or other hazardous substances shall be trained in accordance with the requirements of the 29 CFR 1910.120 (HAZWOPER) regulation. Training requirements will consist of the following:

- Field personnel must complete a minimum of 40 hours of hazardous waste activity instruction.
- Field personnel must complete a minimum of 3 days of supervised field instruction.
- Field personnel assigned to the site will also have received 8 hours of refresher training if time lapsed since their previous training has exceeded 1 year.
- On-site managers and supervisors directly responsible for employees engaged in hazardous waste operations will receive an additional 8 hours of supervisory training.
- Field personnel shall be current in first aid/CPR and bloodborne pathogen training.
- Other training may be required depending on the task to be performed (e.g., confined space, excavation/trenching, underground storage tank removal, fall protection, respiratory protection, and hazard communication).

9.4 Hazard Communication Program

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at the field project site are communicated to all Anchor QEA personnel and subcontractors according to 29 CFR 1926.59.

Every container of hazardous materials must be labeled by the manufacturer, who must also provide a MSDS upon initial order of the product and upon request thereafter. The actual format may differ from company to company (e.g., National Fire Protection Association [NFPA], Hazardous Material Information System [HMIS], or other), but the labels must contain similar types of information. Maintain manufacturer labels if at all possible. The label may use words or symbols to communicate the following:

- The name of the chemical
- The name, address, and emergency telephone number of the company that made or imported the chemical
- The physical hazards (Will it explode or catch fire? Is it reactive? Is it radioactive?)

- Any important storage or handling instruction
- The health hazards (Is it toxic? Could it cause cancer? Is it an irritant? What is the target organ?)
- The basic protective clothing, equipment, and procedures that are recommended when working with the chemical

MSDS for all chemicals brought onto the site or anticipated to be encountered on site shall be provided in Appendix C of this HASP. These MSDS shall be readily available for reference by site personnel and emergency response personnel.

Hazardous materials received without proper labels shall be set aside and not distributed for use until properly labeled.

If a hazardous chemical is transferred into a portable container (approved safety can), even if it is for immediate use only, the contents of the portable container (for example, acetone, gasoline, etc.) must be identified.

10 GENERAL PPE REQUIREMENTS

The minimum level of PPE should be selected according to the hazards that may be encountered during site activities in accordance with established U.S. Environmental Protection Agency (EPA) levels of protection (D and C). Only PPE that meets American National Standards Institute (ANSI) standards shall be worn. Workers must maintain proficiency in the use and care of PPE.

Refer to Section 5 of this plan for site-specific job task and level-of-protection requirements.

10.1 Minimum Requirements – Level D Protection

The minimum level of protection on project sites will be Level D protection, which consists of the following equipment:

- Standard work uniform/coveralls
- Work boots with safety toe (meets ANSI Z41 – 1991 requirements for foot protection)
- Approved safety glasses or goggles (meets ANSI Z87.1 – 1989 requirements for eye protection)
- Hard hat (meets ANSI Z89.1 – 1986 requirements for head protection)
- Traffic safety vest
- Hearing protection when there are high noise levels

Level D protection will be used only when:

- The atmosphere contains no known hazards
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the Permissible Exposure Limit (PEL) and/or Threshold Limit Value (TLV)

10.1.1 Modified Level D Protection Requirements

Depending on the Supplemental Work Plan and the potential hazards to be encountered, Level D protection shall be modified to include additional protective equipment such as USCG-approved PFDs, face shields/goggles, chemical-resistant clothing, and disposable

gloves of varying materials depending on the chemical substances involved. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can contact the skin or work uniform.

11 GENERAL AIR MONITORING REQUIREMENTS

11.1 General Requirements

In general, air monitoring shall be conducted when the possibility of hazardous atmospheres, chemical volatilization, or contaminated airborne dust exists (e.g., from intrusive activities involving contaminated soils and/or groundwater, developing new monitoring wells, wells containing known COCs, confined space entry, or others).

Air movers or other engineering controls shall be used to exhaust or dilute solvent vapors emanating from monitoring wells or hazardous atmospheres in confined spaces prior to the use of respiratory protection devices.

Site-specific air monitoring action levels are provided in Section 5.2 of this HASP.

11.2 Real-Time Air Monitoring Equipment

As applicable, organic vapor concentrations shall be monitored in the field with either a photoionization detector (PID) or flame ionization detector (FID). Flammable vapors and/or gasses are monitored with an oxygen/lower-explosive level (O_2/LEL) real-time instrument. Organic vapor measurements are usually taken in the breathing zone of the worker while O_2/LEL measurements are taken at the point of operation (e.g., monitoring well head or auger point).

As applicable, airborne dust/particulate concentrations shall be measured using a real-time aerosol monitor (using a scattered light photometric sensing cell) when there are visible signs of potentially contaminated airborne dust. Both area and personal air monitoring readings are to be taken to characterize site activities.

As applicable, colorimetric detector tubes shall be used to monitor specific COCs such as benzene or vinyl chloride if there is a possibility that they may be present in elevated concentrations based upon the background of the project site, the Supplemental Work Plan, and conditions discovered at the site.

As applicable, other real-time air monitoring equipment, such as hydrogen cyanide meters, may be utilized depending upon the Supplemental Work Plan and COCs.

Air monitoring results shall be documented on the Daily Air Monitoring Record form (see Appendix A) or in the field logbook.

11.3 Time-Integrated Air Monitoring Equipment

Some Anchor QEA projects may require the use of time-integrated air monitoring equipment to determine employee exposures to COCs. Time-integrated air monitoring would be required if there is the possibility that employees would be exposed to concentrations of a COC that approach or exceed an established exposure limit.

Typical time-integrated sampling methods will usually involve the use of personal sampling pumps and associated filter and/or charcoal sampling media, or the use of diffusion-based sampling media. Exposed sampling media is normally sent to an accredited laboratory for analysis.

Contact the CHSM for consultation and assistance with the performance of time-integrated air monitoring activities.

11.4 Equipment Calibration and Maintenance

Calibration and maintenance of air monitoring equipment shall follow manufacturer specifications and must be documented. Recalibration and adjustment of air monitoring equipment shall be completed as site conditions and equipment operation warrant. Record all air monitoring equipment calibration and adjustment information on the Daily Air Monitoring Record form (see Appendix A) and in the field logbook.

11.5 Air Monitoring Action Levels

Air monitoring action levels have been developed that stipulate the chemical concentrations in the breathing zone that require an upgrade in level of PPE.

Air monitoring action levels are typically set at one-half of the OSHA PEL, NIOSH Recommended Exposure Limit (REL), or the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs. The rationale for establishing action levels is based on the available data that characterize COCs in site media.

Air monitoring measurements shall generally be taken in the breathing zone of the worker most likely to have the highest exposure. Transient peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a 5-minute period. Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities.

11.6 Air Monitoring Frequency Guidelines

In general, conduct periodic air monitoring when:

- It is possible that an immediately dangerous to life or health (IDLH) condition or a flammable atmosphere has developed (e.g., confined space entry or intrusive activities)
- There is an indication that exposures may have risen over established action levels, PELs, or published exposure levels since the last monitoring. Look for a possible rise in exposures associated with the following situations:
  - *Change in site area* – Work begins on a different section of the site.
  - *Change in on-site activity* – One operation ends and another begins.
  - *Change in contaminants* – Handling contaminants other than those first identified.
  - Visible signs of particulate exposure from intrusive activities such as drilling, boring, or excavation.
  - Perceptible chemical odors or symptoms of exposure.
  - Handling leaking drums or containers.
  - Working with obvious liquid contamination (e.g., a spill or lagoon).
  - Conduct air monitoring when the possibility of volatilization exists (such as with a new monitoring well or a well containing known COCs).

12 HEALTH AND SAFETY PROCEDURES AND PRACTICES

In addition to the task-specific JSAs listed in Section 6.1 and presented in Appendix B of this HASP, this section lists the health and safety procedures and practices applicable to this project. For additional information, consult with the PM.

12.1 Physical Hazards and Controls

12.1.1 General Site Activities

Observe the following general procedures and practices to prevent physical hazards:

- Legible and understandable precautionary labels shall be affixed prominently to containers of potentially contaminated soil, sediment, water, and clothing.
- No food or beverages shall be present or consumed in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- No tobacco products or cosmetics shall be present or used in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- An emergency eyewash unit shall be located immediately adjacent to employees who handle hazardous or corrosive materials, including decontamination fluids. All operations involving the potential for eye injury or splash must have approved eyewash units locally available capable of delivering at least 0.4 gallons per minute for at least 15 minutes.
- On a project-specific basis, personnel working on or near bodies of water shall wear USCG-approved PFDs.
- Certain project sites may have newly finished work (e.g., concrete, paving, framing, habitat reconstruction, or sediment caps) that may be damaged by unnecessary contact, or that could cause dangerous conditions for personnel (e.g., slipping, sinking, or tripping). Personnel working in or around these areas shall communicate with the PM, FL, and property owner as needed to prevent damaging new work or entering dangerous conditions.
- Generally, all on-site activities will be conducted during daylight hours. If work after dusk is planned or becomes necessary due to an emergency, adequate lighting must be provided.

- Hazardous work, such as handling hazardous materials and heavy loads and equipment operation, should not be conducted during severe storms.
- All temporary electrical power must have a ground fault circuit interrupter (GFCI) as part of its circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.

12.1.2 Slip/Trip/Fall

Observe the following procedures and practices to prevent slips, trips, and falls:

- Inspect each work area for slip/trip/fall potential prior to each work task.
- Slip/trip/fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided.
- All personnel must be aware of their surroundings and maintain constant communication with each other at all times.

12.1.3 Underground/Overhead Utility Line Contact Prevention

Observe the following underground/overhead utility line contact prevention procedures and practices:

- Prior to conducting work, the PM or FL shall ensure that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods. Documentation of utility mark-out shall be completed using the Utility Contact Prevention Checklist form (see Appendix A). No excavation work is to be performed until all utility mark-outs are verified.
- The PM or FL shall conduct a site survey to search for signs of other buried or overhead utilities. The results of such surveys shall be documented on the Utility Mark-out documentation form.
- The property owner or facility operator shall be consulted on the issue of underground utilities. As-built drawings shall be reviewed, when available, to verify that underground utility locations are consistent with the utility location mark-outs. All knowledge of past and present utilities must be evaluated prior to conducting work.

- If on-site subsurface utility locations are in question, a private locating service shall be contacted to verify locations. If the investigation calls for boreholes in an area not covered by the municipal One-Call system, then a private utility locate firm shall be contacted to determine the location of other underground utilities.
- The PM shall have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of any fiber optic cables.
- **Only hand digging is permitted within 3 feet of underground high voltage, product, or gas lines.** Once the line is exposed, heavy equipment can be used, but must remain at least 3 feet from the exposed line.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, and cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. Distance from utility lines may be adjusted by the FL depending on actual voltage of the lines.
- Overhead utility locations shall be marked with warning tape or flags where equipment has the potential for contacting overhead utilities.

Table 12-1 shows the minimum clearances required for energized overhead electrical lines.

Table 12-1
Overhead Utility Clearance Requirements

Minimum Clearance from Energized Overhead Electric Lines	
Nominal System Voltage	**Minimum Required Clearance**
0 to 50 kV	10 feet
51 to 100 kV	12 feet
101 to 200 kV	15 feet
201 to 300 kV	20 feet
301 to 500 kV	25 feet
501 to 750 kV	35 feet
751 to 1000 kV	45 feet

Notes:
kV – kilovolts
Whenever equipment operations must be performed closer than 20 feet from overhead power lines, the Field Leader (FL) must be notified. When clearance to proceed is received from the FL, the electric utility company must be contacted to turn the power off or physically insulate (protect) the lines if the operation must be performed closer to the power line than is allowed in this table. For voltages not listed on this table, add 0.4 inches per kV to obtain the safe distance between equipment and power lines.

12.1.4 Electric Safety

Observe the following procedures and practices to prevent electric shock:

- General
  - Use only appropriately trained and certified electricians to perform tasks related to electrical equipment. A good rule of thumb is to defer any task that would not normally and reasonably be completed by the average public consumer.
  - Ensure that all equipment is grounded with either an appropriate plug (i.e., "three-pronged") or by using a GFCI.
  - Test all GFCIs prior to use.
  - Use only extension cords that are in good condition—if in doubt, throw it out.
  - Use only 16-gauge, heavy duty, three-wire, Underwriters Laboratories Inc. (UL)-approved three-pronged extension cords
  - Be sure to locate extension cords out of traffic areas or, if this is unavoidable, flag cords and protect workers from tripping over them (i.e., use barricades, tape the cord down, etc.)
  - Do not stage extension cords or powered equipment in wet areas, to the degree possible. Elevate cords and equipment out of puddles.
- Specific
  - If unsure if a task requires specific electrical training, err on the side of caution and contact the PM and FL prior to proceeding.
  - If subsurface work is to be performed, follow the guidelines in Section 12.1.5 and conduct utility locating prior to work and in accordance with local ordinances.
  - If lock out/tag out (LO/TO) procedures are required (i.e., de-energizing machinery or equipment so work may be performed), the equipment owner must provide LO/TO procedures and training. By default, the equipment owner should perform any LO/TO. If it becomes necessary for Anchor QEA personnel to perform LO/TO tasks, contact the PM and FL prior to doing so.
  - Maintain appropriate distance from overhead utilities (see Table 12-1).
  - If unexpected electrical equipment is encountered (i.e., buried wire) assume it is live, stop work, and contact the PM and FL immediately.

12.1.5 Heavy Equipment Operations

Observe the following heavy equipment operations procedures and practices:

- Wear leather gloves while attaching support members to protect against pinching injuries.
- While working from elevated levels greater than 6 feet, ensure that all employees have fall protection that meets OSHA and ANSI Z3591 standards.
- Do not stand under loads that are being raised or lowered with cranes or aerial lifts.
- The subcontractor or Anchor QEA equipment operator must conduct pre-operational inspections of all equipment. In addition, daily inspections will be conducted on the equipment prior to site activities.
- Maintain the appropriate distance from overhead utilities (see Table 12-1):
- Always stay out of the swing radius of all heavy equipment. Always use a spotter during movement of equipment. The spotter and others, as appropriate, shall maintain constant communication with the operator.
- All operators must have adequate training and be qualified to operate the particular heavy equipment unit.
- Conduct a site evaluation to determine proper positioning for the unit. Make sure the surface is level. Cordon off holes, drop-offs, bumps, or weak ground surfaces.
- When using a crane, do not use hands when the load is being lifted or lowered. Use non-conductive tag line to help direct and position the load.
- Never climb a raised platform or stand on the mid-rail or top-rail.
- Tools should always be hung or put into a belt whenever possible

12.1.6 Motor Vehicle Operation

All drivers are required to have a valid driver's license, and all vehicles must have appropriate state vehicle registration and inspection stickers. The use of hand-held wireless devices is prohibited by Anchor QEA while driving any vehicle for business use at any time, for personal use during business hours, and as defined by law. Additionally, site-specific motor vehicle requirements must be followed, if any.

When driving to, from, and within the job site, be aware of potential hazards including:

- Vehicle accidents

- Distractions
- Fatigue
- Weather and road conditions

To mitigate these hazards, observe the following procedures and practices regarding motor vehicle operation:

- Wear a seat belt at all times and make sure that clothing will not interfere with driving.
- Inspect fluid levels and air pressure in tires, adjust mirrors and seat positions appropriately, watch the fuel level, and fill up when the fuel level is low.
- Plan your travel route and check maps for directions or discuss with colleagues.
- Clean windows and mirrors as needed throughout the trip.
- Wear sunglasses as needed.
- Follow a vehicle maintenance schedule to reduce the possibility of a breakdown while driving.
- Stop driving the vehicle, regardless of the speed (i.e., even 5 mph) or location (i.e., a private road), when the potential of being distracted by conversation exists.
- Drivers are prohibited from using hand-held communication devices (e.g., cell phones) while operating any motor vehicle.
- Get adequate rest prior to driving.
- Periodically change your seat position, stretch, open the window, or turn on the radio to stay alert.
- Pull over and rest if you are experiencing drowsiness.
- Check road and weather conditions prior to driving.
- Be prepared to adjust your driving plans if conditions change.
- Travel in daylight hours, if possible.
- Give yourself plenty of time to allow for slowdowns due to construction, accidents, or other unforeseen circumstances.
- Use lights at night and lights and wipers during inclement weather.

12.1.7 Boating Operations

The following precautions shall be followed when conducting boating trailer and launch activities:

- Follow the trailer and boat manufacturers' instructions for securing the boat to the trailer.
- Follow the trailer manufacturer's instructions for securing the trailer to the towing vehicle.
- Prohibit workers from moving into trailer/vehicle pinch points without advising the vehicle operator.
- Use experienced operators when backing trailers on boat ramps.
- Wear proper work gloves when the possibility of pinching or other injury may be caused by moving or handling large or heavy objects.
- Maintain all equipment in a safe condition.
- Launch boats one at a time to avoid collisions.
- Use a spotter for vehicles backing boats to the launch area.
- Understand and review hand signals.
- Wear boots with non-slip soles when launching boats.
- Wear USCG-approved PFDs when working on or near the water.
- Keep ropes and lines coiled and stowed to eliminate trip hazards.
- Maintain three-point contact on dock/pier or boat ladders.
- Ensure that drain plugs are in place, as present.

The following precautions shall be followed when conducting boating operations:

- Maintain a current boater's license(s) as required.
- Wear USCG-approved PFDs for work activities on or near the water.
- Obtain and review information regarding dams that may be present in work areas, particularly with regard to "no boating" zones and safety buoys, cables, and warning signage.
- Maintain boat anchorage devices commensurate with anticipate currents, distance to shore, and water depths.
- Provide a floating ring buoy with at least 90 feet of line in the immediate boat launch/landing areas.

- Step into the center of the boat.
- Keep your weight low when moving on the boat.
- Move slowly and deliberately.
- Steer directly across other boat wakes at a 90-degree angle to avoid capsizing.
- Steer the boat facing forward.
- Watch for floating objects in the water.
- Right-of-way is yielded to vessels on your boat's right, or starboard, and vessels with limited ability to maneuver such as any wind-propelled vessel.

The following precautions shall be followed when working on a boat:

- Observe proper lifting techniques.
- Obey lifting limits (see Section 12.1.19)
- Use mechanical lifting equipment (i.e., pulleys or winches) to move large or awkward loads.
- Wear USCG-approved PFDs for work activities on or near the water.

The safety-related items listed in Table 12-2 shall be available when conducting boating operations:

Table 12-2

Safety Equipment Specific to In-water Work

Additional Safety Equipment for Sampling Vessel per U.S. Coast Guard (USCG) Requirements:	
• Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number) • USCG-approved personal flotation devices (PFDs; or life jackets) for every person on the sampling vessel (Type II PFD required, Type I PFD preferred as it will turn most unconscious wearers face up in the water) • Appropriate, non-expired, visual distress devices for day and night use from the following: - Three hand-held red flares (day and night), or - One hand-held red flare and two parachute flares (day and night), or - One hand-held orange smoke signal, two floating orange smoke signals (day), and one electric distress light (night only) • Alternate means of propulsion (oars or paddles) • Dewatering device (pump or bailer) • Properly maintained and inspected USCG-approved fire extinguishers (no fixed system = (2) B-1 or (1) B-2 type extinguishers; fixed system = (1) B-1 type extinguisher) • Proper ventilation of gasoline-powered vessels • Sound-producing device (whistle, bell, or horn) • VHF 2-way radio • Proper navigational light display • Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD)	
Additional USCG Recommended Equipment Includes:	
• Extra visual distress signals • Primary and spare anchor • Heaving line • Fenders • First aid kit • Flashlight • Mirror • Searchlight • Sunburn lotion • Tool kit • Spare fuel	• Boat hook • Spare propeller • Mooring line • Food and water • Binoculars • Spare batteries • Sunglasses • Marine hardware • Extra clothing • Spare parts • Pertinent navigational chart(s) and compass

12.1.8 Working Over or Near Water

12.1.8.1 Personal Flotation Devices

PFDs are not required where employees are continuously protected from the hazard of drowning by railings, nets, safety belts, or other applicable provisions.

Type III, Type V, or better USCG-approved International Orange PFD shall be provided and properly worn by all personnel in the following circumstances:

1. On floating pipelines, pontoons, rafts, or stages.
2. On structures extending over or next to the water, except where guard rails or safety nets are provided for employees.
3. Working alone at night where there are drowning hazards, regardless of other safeguards provided.
4. In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit.
5. Whenever there is a drowning hazard.

The following precautions shall be followed when using PFDs:

- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
- All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
- Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
- PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. On shore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

12.1.8.2 Cold Water Work

When the water temperature is below 50° F, field personnel working on or near water shall wear either a float coat and bib-overalls (e.g., a full two-piece "Mustang" survival suit or similar), or a one-piece survival suit. Suits or float coats shall be USCG approved. If extremely cold or severe weather conditions are forecast, work activities should be postponed. Work activities will be continually reviewed and adjustments made if wearing a survival suit during work activities potentially poses a hazard due to warm air temperatures,

or limited mobility or agility. In addition, proximity of water work to shore and scope/duration/timing of work activities will be considered when stipulating the above requirement. Overall, if water craft will be used during work, or work will be conducted near water, it is imperative that site specific conditions are considered and evaluated so that proper safeguards and procedures are in place prior to beginning work.

In addition to considering the use of apparel appropriate for anticipated air, weather, and water conditions, field teams shall identify any procedures necessary for cold-water "man-overboard" scenarios. These procedures should be identified in the site-specific HASP, described in the JSA used for boating activities and, if prudent, practiced before work.

12.1.9 Excavation and Trenching Activities

Observe the following practices and procedures when performing excavation and trenching work:

The purpose of this procedure is to describe the company requirements for excavation and trenching safety. These requirements are based on the federal OSHA excavation standard found in 29 CFR 1926, Subpart P. Local regulations should also be consulted for the state in which the work is being performed.

With very few exceptions, protective systems must be designed and installed to protect employees who enter excavations of 5 feet or more in depth. Accepted protective systems include sloping, shoring, and shielding.

The protective system must be designed by a registered Professional Engineer (P.E., civil), and plans must be available for inspections on site, under prescribed conditions.

12.1.9.1 Definitions

Angle of Repose – The greatest angle above the horizontal plane at which a material will lie without sliding.

Benching – A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near-vertical surfaces between levels.

Competent Person – An employee who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them.

Excavation – Any man-made cut, cavity, trench, or depression in an earth surface, including its sides, walls, or faces, formed by earth removal.

Registered Professional Engineer – An individual currently registered as a P.E. (preferably civil) in the state where work is to be performed.

Sheeting – Members of a shoring system that retain the earth in position, and in turn are supported by other members of the shoring system.

Shield – A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields may be pre-manufactured or job-built in accordance with CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring – Structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and that is designed to prevent cave-ins.

Sloping – A method of protecting employees from cave-ins by excavating to form sides of a trench that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Support System – A structure such as underpinning, bracing, or shoring, that provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench – A narrow (in relation to its length) excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

Type A Soil – Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) (144 kilopascal [kPa]) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam, and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, soil is NOT Type A if:

- The soil is fissured
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects
- The soil has been previously disturbed
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of 4H:1V or greater
- The material is subjected to other factors that would require it to be classified as a less stable material

Type B Soil – This classification refers to:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa), but less than 1.5 tsf (144 kPa)
- Granular, cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and, in some cases, silty clay loam and sandy clay loam
- Previously disturbed soils except those that would otherwise be classified as Type C soil
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration
- Dry rock that is not stable

- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4H:1V, but only if the material would otherwise be classified as Type B

Type C Soil – This classification refers to:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less
- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation or a slope of 4H:1V or steeper

12.1.9.2 Pre-Excavation Requirements

Underground Installations – Prior to opening an excavation, the estimated locations of underground utilities such as sewer, telephone, fuel, electric, water, or any other underground installations that may reasonably be expected to be encountered during the excavation work shall be determined.

The property owner and/or utility location service shall be contacted within the established pre-notification time, advised of the proposed work, and asked to delineate the location of all underground utilities. Employees should be careful to protect and preserve the utility markings until they are no longer required for safe excavation. At least 3 feet of clearance between any underground utility and the cutting edge or point of powered excavation equipment will be maintained until the precise location of the utility is determined. Initial excavation within this 3-foot area will be conducted manually.

Surface Encumbrances – All surface encumbrances (e.g., trees, poles, or boulders) that may create a hazard to employees shall be removed or supported.

Vehicular Traffic – Employees exposed to vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. Traffic control devices (e.g., barricades, signs, cones, or flagpersons)

shall be specified and used in accordance with regulations applicable to the roadway or area in which excavation activities are occurring.

12.1.9.3 Training

Those who supervise the entry of personnel into an excavation, a "Competent Person," must have completed a training course that included instruction in:

- Types of hazards associated with excavation operations
- Safe work practices and techniques
- A review of applicable federal, state, and local regulations
- A review of this procedure

Employees who enter excavations are required to complete a site-specific training session to enable them to recognize unsafe conditions in and around the excavation. This training can be conducted during a tailgate safety meeting that emphasizes the specific excavation hazards that may be encountered.

Training documentation shall be maintained in the project files. As part of the standard employee supervision process, training shall be complemented with on-the-job instruction and reinforcement of accepted practices to the extent necessary to ensure compliance with this procedure and all other applicable regulations.

12.1.9.4 Excavation Work Practices

General – Each employee working within an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926 Subpart P, except when the excavation is made entirely in stable rock or when the excavation is less than 5 feet deep and examination of the ground by a competent person provides no indication of a potential cave-in. A competent person shall ensure that protective systems, when required, are installed and maintained per the design specifications. No employees shall be permitted to enter an excavation unless it is absolutely essential to do so and all requirements of this procedure are met.

Supervision – Work in an excavation shall be supervised at all times by a competent person. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments aboveground that may warn of impending earth movement.

Soil Classification – Based on their training, the competent person will classify each soil or rock deposit as stable rock, Type A, Type B, or Type C. When layers of soil or rock exist, the weakest layer will be classified; however, each layer may be classified individually when a more stable layer lies under a less stable layer. If the properties or conditions of a soil or rock deposit change in any way, re-evaluation will be required.

Access and Egress – Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 or more feet in depth so as to require no more than 25 feet of lateral travel for employees.

Protective Systems – Protective systems shall be designed in accordance with 29 CFR 1926.652(b) or (c) and shall have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Exposure to Falling Loads – No employees shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

Warning System for Mobile Equipment – When mobile equipment is operated adjacent to an excavation, and the operator does not have a clear and direct view of the edge of the

excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.

Hazardous Atmospheres (see related information in Tables 5-1, 5-2, and 7-1) – Where an oxygen-deficient (less that 19.5% O_2) or hazardous atmosphere exists, or could reasonably be expected to exist, the excavation shall be tested before employees enter. Testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. Some excavations may be considered confined spaces that require compliance with appropriate procedures (see Section 12.1.17). Adequate precautions shall be taken to prevent employee exposure to oxygen-deficient or hazardous atmospheres. As appropriate, ventilation and/or respiratory protective devices shall be used (see Table 7-1).

Water Accumulation Hazards – Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. If water is controlled or prevented from accumulating by the use of water removal equipment, the process shall be monitored by a competent person to ensure proper operation.

If the excavation work interrupts the natural drainage of surface water (e.g., streams or run-off channels), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains shall be regularly inspected by a competent person.

Stability of Adjacent Structures – Structures adjoining an excavation shall be evaluated to assess their stability. Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall only be permitted when:

- A support system (underpinning) is provided to ensure the safety of employees and the stability of the structure
- The excavation is in stable rock

- A registered P.E. has determined that the structure will be unaffected by the excavation
- A registered P.E. has determined that such excavation will not pose a hazard to employees

Sidewalks, pavements, and other surface structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

Protection from Loose Rock or Soil – Employees shall be protected from loose rock or soil that could fall or roll from the excavation face or edge. Such protection could consist of scaling to remove loose materials, or the installation of protective barriers. All spoil shall be placed at least 2 feet from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more feet from the excavation edge so as not to cover surface indicators of subsidence (such as fissures or cracks).

Inspections – A competent person shall make daily inspections of excavations, adjacent areas, and protective systems for evidence of conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be made prior to start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard-increasing event, and will be documented. Where the inspection finds evidence of any hazardous condition, exposed employees shall immediately be removed from the hazardous area until necessary precautions have been taken.

Fall Protection – Where employees or equipment are permitted to cross over excavations, walkways or bridges shall be provided. Standard guard rails shall be provided where walkways are 6 feet or more above lower levels. Adequate barriers or other types of physical protection shall be provided at all remotely located excavations. All wells, pits, or shafts, shall be barricaded or covered, and shall be backfilled as soon as possible.

12.1.10 Noise

Excessive noise is hazardous not only because of its potential to damage hearing, but also because of its potential to disrupt communications and instructions. The following procedures and practices shall be followed to prevent noise-related hazards:

- All employees will have access to disposal ear plugs with a Noise Reduction Rating of not less than 30.
- Ear plugs must be worn in any environment where workers must raise their voices to be heard while standing at a distance of 3 feet or less.
- Ear plugs must be worn by any personnel operating concrete cutting or sawing equipment.

Hearing protection is required for workers operating or working near noisy equipment or operations, where the noise level is greater than 85 A-weighted decibels (dbA) (Time Weighted Average [TWA]), as well as personnel working around heavy equipment. The FL will determine the need and appropriate testing procedures, (i.e., sound level meter and/or dosimeter) for noise measurement.

When needed, a sound level meter will be used to measure noise levels at selected locations in the work area and on the site perimeter. When used, noise monitoring equipment must be calibrated before and after each shift.

If continuous noise levels are found to exceed 85 dbA at any location within the work area, warning signs will be posted. Workers and visitors will be notified that hearing protection is required. Appropriate hearing protection (i.e., ear plugs or ear muffs) will be worn whenever personnel or visitors are working in that location. A supply of ear plugs will be maintained on site.

Action levels in Table 12-3 will trigger the use of appropriate hearing protection (plugs or muffs). Hearing protection must be able to attenuate noise below 90 dbA (8-hour TWA). Each hearing protection or device has a Noise Reduction Rating (NRR) assigned by EPA. The calculation for a hearing protection device's effectiveness is:

$$\text{Noise reading dbA} - (\text{NRR} - 7\text{dB}) < 90 \text{ dbA}$$

Table 12-3
Noise Exposure Action Levels

Instrument	Measurement	Action
Type I or Type II Sound Level Meter or Dosimeter	> 80 dbA to 85 dbA	Hearing protection recommended. Limit work duration to 8-hour shifts.
	> 85 dbA to 90 dbA	Hearing protection required. Limit work duration to 8-hour shifts.
	> 90 dbA to 115 dbA	Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.
	> 115 dbA	Stop work. Consult CHSM.

12.1.11 Lifting and Material Handling

Observe the following procedures and practices for lifting and material handling:

- Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (e.g., wood, piping, drums, etc.).
- The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weighs over 60 pounds. Multiple employees or mechanical lifting devices are required for objects over the 60-pound limit.
- Plan a lift before doing it. Bend at the knees and lift with the legs; keep the natural curves of the back; do not use back muscles.
- Check the planned route for clearance.
- Use the buddy system when lifting heavy or awkward objects.
- Do not twist your body while lifting.
- Know the capacity of any handling device (e.g., crane, forklift, chain fall, or come-along) that you intend to use.
- Use tag lines to control loads.
- Ensure that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.
- Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released.

- Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
- Tie down all light, large-surface-area material that might be moved by the wind.
- When working at heights, secure tools, equipment, and wrenches against falling.
- Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations.
- Fuel-powered tools used inside buildings or enclosures shall be vented and checked for excessive noise.

12.1.12 Cleaning Equipment

Observe the following procedures and practices when cleaning equipment:

- Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, Alconox®, or other cleaning materials.
- Stand upwind to minimize any potential inhalation exposure.
- Dispose of spent cleaning solutions and rinses accordingly.

12.1.13 Hand and Power Tools

Observe the following procedures and practices when working with hand and power tools:

- Keep hand tools sharp, clean, oiled, dressed, and not abused.
- Worn tools are dangerous. For example, the "teeth" in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if the jaws are sprung, and hammerheads can fly off loose handles.
- Tools subject to impact (e.g., chisels, star drills, and caulking irons) tend to "mushroom." Keep them dressed to avoid flying spalls. Use tool holders.
- Do not force tools beyond their capacity.
- Flying objects can result from operating almost any power tool, so always warn people in the vicinity and use proper eye protection.
- Each power tool should be examined before use for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Also inspect for adequate lighting, proper lubrication, and abandoned tools or material that could "vibrate into trouble."

- Compressed air must be shut off or the electric cord unplugged before making tool adjustments. Air must be "bled down" before replacement or disconnection.
- Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.
- Replace all guards before start-up. Remove cranks, keys, or wrenches used in service work.

12.1.14 Fire Control

Observe the following fire control procedures and practices:

- Smoke only in designated areas.
- Keep flammable liquids in closed containers.
- Keep the worksite clean; avoid accumulating combustible debris such as paper.
- Obtain and follow property owner hot work safety procedures when welding or performing other activities requiring an open flame.
- Isolate flammable and combustible materials from ignition sources.
- Ensure fire safety integrity of equipment installations according to NEC specifications.

12.2 Environmental Hazards and Controls

12.2.1 Heat Stress

Observe the following general procedures and practices regarding heat stress:

- Increase the number of rest breaks and/or rotate workers in shorter work shifts.
- Watch for signs and symptoms of heat stress and fatigue (see Section 12.2.1.1).
- During hot months, plan work for early morning or evening.
- Use ice vests when necessary.
- Rest in cool, dry areas.

12.2.1.1 Signs, Symptoms, and Treatment

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident

probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn since they prevent evaporative body cooling. Wearing PPE places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

Heat Rash. Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing. The condition is characterized by a localized red skin rash and reduced sweating. Heat rash reduces the ability to tolerate heat. To treat, keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

Heat Cramps. Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood, which can cause painful muscle spasms and pain in the extremities and abdomen. To treat, remove the employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or heat stroke.

Heat Exhaustion. Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within 1 hour. Symptoms include a weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and fatigue. To treat, remove the employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continuously to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.

Heat Stroke. Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. ***This is a medical emergency!*** Symptoms include red, hot, dry skin; a body temperature of 105° F or higher; no perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. Since heat stroke is a true medical emergency, transport the patient to a medical facility immediately. Prior to transport,

remove as much clothing as possible and wrap the patient in a sheet soaked with water. Fan the patient vigorously while transporting to help reduce body temperature. If available, apply cold packs under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing the patient in a cool-water bath (however, be careful not to over-chill the patient once body temperature is reduced below 102° F). If this is not possible, keep the patient wrapped in a sheet and continuously douse with water and fan.

12.2.1.2 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1% saltwater solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid temperature should be kept cool, 50° F to 60° F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

All workers are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet, including the harmful effects of excessive alcohol and caffeine consumption.

12.2.1.3 Monitoring

Heat stress monitoring should be performed when employees are working in environments exceeding 90° F ambient air temperature. If employees are wearing impermeable clothing,

this monitoring should begin at 77° F. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT), and physiological. The Heat Stress Monitoring Record form (see Appendix A) will be used to record the results of heat stress monitoring.

Note that some states such as Washington and California have specific regulatory standards for protection of employees from heat stress-related injuries.

Wet Bulb Globe Temperature (WBGT). The WBGT index is the simplest and most suitable technique to measure the environmental factors that most nearly correlate with core body temperature and other physiological responses to heat. When WBGT exceeds 25° C (77° F), the work regiment in Table 12-4 should be followed.

Table 12-4
Permissible Heat Exposure Threshold Limit Values

Work/Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86° F (30.0° C)	80° F (26.7° C)	77° F (25.0° C)
75% work, 25% rest each hour	87° F (30.6° C)	82° F (28.0° C)	78° F (25.9° C)
50% work, 50% rest, each hour	89° F (31.4° C)	85° F (29.4° C)	82° F (27.9° C)
25% work, 75% rest, each hour	90° F (32.2° C)	88° F (31.1° C)	86° F (30.0° C)
These TLVs are based on the assumption that nearly all acclimated, fully-clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 100.4° F (38° C).			

(From OSHA Technical Manual, Section III: Chapter 4 - Heat Stress)

The TLVs denoted in Table 12-4 apply to physically fit and acclimatized individuals wearing light, summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLVs should be adjusted based on the WBGT Correction Factors in Table 12-5.

Table 12-5
WBGT Correction Factors

Clothing Type	WBGT Correction
Summer lightweight working clothing	32° F (0° C)
Cotton coveralls	28° F (-2° C)
Winter work clothing	25° F (-4° C)
Water barrier, permeable	86° F (-6° C)
Fully encapsulating	14° F (-10° C)

Physiological. Physiological monitoring can be used in lieu of, or in addition to, WBGT. This monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Since individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The two parameters that are to be monitored at the beginning of each rest period are:

- **Heart Rate** – The maximum heart rate (MHR) is the amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Each individual will count his/her radial (wrist) pulse for 1 minute as early as possible during each rest period. If the heart rate of any individual exceeds 75% of their calculated MHR (MHR = 200 - age) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75% of their calculated MHR.
- **Temperature** – Each individual will measure his/her temperature with a thermometer for 1 minute as early as possible in the first rest period. If the temperature exceeds 99.6° F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work if his/her temperature exceeds 100.4° F

12.2.1.4 Training

Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

12.2.2 Cold Stress

Observe the following procedures and practices regarding cold stress:

- Take breaks in heated shelters when working in extremely cold temperatures.
- Upon entering the shelter, remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration.
- Drink warm liquids to reduce the susceptibility to cold stress.
- Be aware of cold stress symptoms, including shivering, numbness in the extremities, and sluggishness.
- Provide adequate insulating dry clothing to maintain warmth if work is performed in air temperature below 40° F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32° F or less, hands should be protected.
- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Implement a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.

12.2.2.1 Signs, Symptoms, and Treatment

Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below. The appropriate guidelines should be followed if any personnel exhibit these symptoms:

Frostbite. Frostbite is characterized by pain in the extremities and loss of manual dexterity. "Frostnip," or reddening of the tissue, is accompanied by a tingling or loss of sensation in the extremities and continuous shivering.

Hypothermia. Hypothermia is characterized by pain in the extremities and loss of manual dexterity, with severe, uncontrollable shivering, and an inability to maintain the level of activity. Symptoms include excessive fatigue, drowsiness, irritability, or euphoria. Severe hypothermia includes clouded consciousness, low blood pressure, pupil dilation, cessation of shivering, unconsciousness, and possible death.

Remove the patient to a warm, dry place. If the patient's clothing is wet, remove it and replace it with dry clothing. Keep the patient warm. Re-warming of the patient should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the patient is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the patient warm and calm and remove them to a medical facility as soon as possible.

12.2.3 Inclement Weather

Observe the following procedures and practices regarding inclement weather:

- Stop outdoor work during electrical storms (lightning strikes), hailstorms, high winds, and other extreme weather conditions such as extreme heat or cold
- Take cover indoors or in a vehicle
- Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods

12.2.4 Insects/Spiders

Observe the following general procedures and practices regarding insects/spiders:

- Tuck pants into socks
- Wear long sleeves
- Use insect repellent
- Avoid contact by always looking ahead to where you will be walking, standing, sitting, leaning, grabbing, lifting, or reaching
- Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms

The most dangerous spiders to humans in North America are black widows and brown spiders (also known as brown recluse or fiddleback spiders). A guide to identifying these spiders is presented in Table 12-6.

Table 12-6
North American Hazardous Spider Identification Guide

Hazardous Spider Identification Guide	
Black Widow Spider • Abdomen usually shows hourglass marking. • Female is 3 to 4 centimeters in diameter. • Have been found in well casings and flush-mount covers. • Not aggressive, but more likely to bite if guarding eggs. • Light, local swelling and reddening are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea. • If bitten, see a physician as soon as possible.	
Brown Spiders (aka Brown Recluse or Fiddleback) • Found in the central and southern United States, although in some other areas, as well. • 1/4-to-1/2-inch-long body, and size of a silver dollar. • Hide in baseboards, ceiling cracks, and undisturbed piles of material. • Bite may either go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of the affected tissue, and very slow healing. • If bitten, see a physician as soon as possible.	

12.2.5 Bees and Wasps

Many encounters with bees and wasps occur when nests built in well casings or excavation areas are disturbed. Before opening a well casing, take a few moments to observe whether or not insects are entering or exiting. If they are flying to and from the casing, avoid it if possible. If you must be in an area where disturbing a nest is likely, be sure to wear long pants and a long-sleeved shirt. Stinging insects fly around the top of their target, so if you get into trouble, pull a portion of your shirt over your head and run away.

If you get stung, look for a stinger, and, if present, remove it as soon as possible. Several over-the-counter products or a simple cold compress can be used to alleviate the pain of the sting. If the sting is followed by severe symptoms, or if it occurs in the neck or the mouth, seek medical attention immediately because swelling could cause suffocation.

If you need to destroy a nest, consult with the PM and project FL first. Commercially available stinging insect control aerosols are very effective, but could potentially contaminate the well. Once the nest is destroyed, fine mesh may be applied over the exit and entry points of a well casing to prevent re-infestation.

12.2.6 Mosquitoes

Mosquitoes in the United States have been known to carry West Nile Virus, St. Louis encephalitis, and Dengue Fever. To avoid mosquito bites:

- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when outdoors. DEET is very effective, but could potentially contaminate samples.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent to further reduce your risk, or stay indoors during peak mosquito feeding hours (dusk until dawn).
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around the work area.
- If you need to destroy a nest, consult with the PM and project FL first.
- Check to see if there is an organized mosquito control program near the project site. If no program exists, work with the local government officials to establish a program.

13 MEDICAL SURVEILLANCE PROGRAM

This section describes the medical surveillance program that Anchor QEA field personnel must comply with when working on sites where there is a potential for exposure to hazardous wastes or other hazardous substances.

13.1 General Requirements

Anchor QEA employees shall be enrolled in a medical surveillance program in compliance with OSHA standards (29 CFR 1910.120(f)) under the following circumstances:

If they are involved with any of the following operations:

- *Cleanup operations* required by a governmental body, whether federal, state, local, or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority List [NPL] sites, state priority list sites, sites recommended for the EPA NPL, and initial investigation of government-identified sites that are conducted before the presence or absence of hazardous substances has been ascertained).
- *Corrective actions* involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 et seq)
- *Voluntary cleanup operations* at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites.
- *Operations involving hazardous wastes* that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA or by agencies under agreement with the EPA to implement RCRA regulations.
- *Emergency response operations* for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

And, if the employee(s) meets the following criteria:

- Are or may be exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more per year.

In addition, employees are required to be enrolled in the medical surveillance program if they meet any of the following conditions:

- Wear a respirator for 30 days or more per year
- Are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations
- Are members of a Hazardous Materials (HAZMAT) team

Anchor QEA employees required to be enrolled in a medical surveillance program under 29 CFR 1910.120(f) shall have medical examinations and consultations made available to them by Anchor QEA on the following schedule:

- Prior to assignment
- At least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- As soon as possible upon notification that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary

The content of medical examinations or consultations made available to employees shall be determined by the attending physician but shall include, at a minimum, a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

The attending physician shall provide Anchor QEA with a written opinion for each examined employee that contains the following information:

- Whether the employee has any detected medical conditions that would place the employee at an increased risk of impairment of the employee's health from hazardous waste operations work, emergency response, or respirator use
- Any recommended limitations on the employee's assigned work
- A statement that the employee has been informed of the results of the medical examination and any medical conditions that require further examination or treatment

The written opinion obtained by Anchor QEA shall not reveal specific findings or diagnoses unrelated to occupational exposures. Medical surveillance and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.

13.2 Crew Self Monitoring

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion
- Symptoms of hypothermia

If any of these conditions develop, the affected person will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital

will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

APPENDIX A
HEALTH AND SAFETY LOGS AND FORMS

ANCHOR QEA

DATE: _____

PROJECT NAME: _____

PROJECT NO: _____

DAILY SAFETY BRIEFING

PERSON CONDUCTING MEETING: _____ **HEALTH & SAFETY OFFICER:** _____ **PROJECT MANAGER:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/MSDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Other:
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking

WEATHER CONDITIONS: _____

DAILY WORK SCOPE: _____

SITE-SPECIFIC HAZARDS: _____

SAFETY COMMENTS: _____

ATTENDEES

PRINTED NAME	SIGNATURE

FIELD SAFETY EQUIPMENT CHECKLIST

The following is a list of safety-related gear that may be appropriate depending on the type of work being conducted. The purpose of this checklist is twofold: 1) ensure that all field crew members think about appropriate safety gear needs before heading to the worksite; and 2) provide an extensive list of gear to consider in order to serve as a reminder of potential safety gear needs during a field effort.

☐ **Safety Briefing Log or Notebook**

Personal Protective Gear
- ☐ Rain pants and jacket
- ☐ Hard hats
- ☐ Boots (steel-toed, if appropriate)
- ☐ Safety glasses
- ☐ Ear protection
- ☐ Nitrile gloves (inner and outer pair)
- ☐ Tyvek overalls
- ☐ H_2S sensor
- ☐ Flashlight
- ☐ EpiPen (inquire if any field staff use one)
- ☐ Other:

Warm Weather Safety Gear
- ☐ Sunscreen
- ☐ Water
- ☐ Hat
- ☐ Light clothes

Cold Weather Safety Gear
- ☐ Warm clothes (preferably synthetics)
- ☐ Hat
- ☐ Gloves
- ☐ Boot warmers
- ☐ Thermos of warm drink/soup

Communications
- ☐ Notify office staff of day's field plan
- ☐ Walkie Talkies
- ☐ Cell phones
- ☐ Satellite phone (if appropriate)
- ☐ Contact numbers (other field crew members, PM, others to notify that you are accessing site)

General Gear for Work Near Water
- ☐ Life jacket
- ☐ Boots or waders (hip or chest)
- ☐ Throwline

Boat Safety Gear

U.S. Coast Guard Required Gear:
- ☐ 1. Personal flotation device (PFD), preferably life jacket, for each occupant
- ☐ 2. Fire extinguisher (filled to operable range)
- ☐ 3. Flares (unexpired)
- ☐ 4. Horn
- ☐ 5. Navigation lights

- ☐ First aid kit
- ☐ Bowline and stern line
- ☐ Anchor and anchor line
- ☐ Paddle
- ☐ Spare propeller and linchpin
- ☐ Appropriate personal protective gear (boots or waders) to step onto shore if necessary
- ☐ Drain plug (and spare)
- ☐ Boat fuel and oil
- ☐ Weather radio (if appropriate)
- ☐ Weather, tides, and currents forecasts
- ☐ Warm clothes/blanket in dry bag

ANCHOR QEA

DATE: _____

PROJECT NAME: _____

PROJECT NO: _____

MODIFICATION TO HEALTH AND SAFETY PLAN

MODIFICATION: _____

_____

_____

_____

_____

REASON FOR MODIFICATION: _____

_____

_____

_____

_____

_____

_____

SITE PERSONNEL BRIEFED

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

NAME: _____ **DATE:** _____

APPROVALS

FIELD LEAD: _____ _____ _____

Printed Name | Signature | Date

PROJECT MANAGER: _____ _____ _____

Printed Name | Signature | Date

ANCHOR QEA

DATE: ______________________

PROJECT NAME: ______________________

PROJECT NUMBER: ______________________

LOCATION: ______________________

HEAT STRESS MONITORING RECORD

	Monitoring Results												
	Initial Reading Time:	First Work Period Time:		Second Work Period Time:		Third Work Period Time:		Fourth Work Period Time:		Fifth Work Period Time:		Sixth Work Period Time:	
	WBGT (°F):	WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):	
Employee Name	Air Temp (°F):	Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):	
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
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	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
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	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:

Notes:

Completed by:

Printed Name ______________ Signature ______________ Date ______________

EMPLOYEE EXPOSURE/INJURY INCIDENT/SPILL/NEAR MISS REPORT

EMPLOYEE NAME: _____ **DATE:** _____

PROJECT NAME/NO: _____ **TIME:** _____

TYPE OF OCCURRENCE: ☐ employee exposure ☐ injury incident ☐ spill ☐ near miss

SITE NAME AND LOCATION: _____

SITE WEATHER (clear, rain, snow, etc.): _____

NATURE OF ILLNESS/INJURY: _____

SYMPTOMS: _____

ACTION TAKEN: ☐ rest ☐ first aid ☐ medical

TRANSPORTED BY: _____

WITNESSED BY: _____

HOSPITAL NAME: _____ **TREATMENT:** _____

DESCRIBE IN DETAIL HOW THIS EXPOSURE/INJURY INCIDENT/SPILL/NEAR MISS OCCURRED (if a spill, list the name of the compounds, quantities, and method of clean-up/containment): _____

WHAT WAS THE PERSON DOING AT THE TIME OF THE ACCIDENT/INCIDENT?: _____

LIST PERSONAL PROTECTIVE EQUIPMENT WORN: _____

WHAT IMMEDIATE ACTION WAS TAKEN TO PREVENT RECURRENCE?: _____

Employee:

Printed Name	Signature	Date

Supervisor:

Printed Name	Signature	Date

Site Safety Representative:

Printed Name	Signature	Date

NOTE: Use additional page(s) if necessary.

DAILY AIR MONITORING RECORD

PROJECT NAME: _____ **DATE:** _____

PROJECT NUMBER: _____ **LOCATION:** _____

TEMPERATURE: _____

CONDITIONS: _____

_____

_____

_____

COC	Instrument	S/N	Calibration Date	Calibration Gas/Method	Calibration by
Organic vapors					
Particulates					
O_2					
Other:					
Other:					
Other:	Draeger				

Time	Location/Description	Organic Vapor (ppm)	O_2%	CG %LEL	Other	Other

Notes:

Completed by:

_____ _____ _____

Printed Name Signature Date

APPENDIX B
JOB SAFETY ANALYSIS (JSA) DOCUMENTS

Shoreline Reconnaissance

Project Name: Central Waterfront Site RI – Whatcom Waterway Site Cleanup	**Project Number:** 120007-01 (080007-01)	**JSA Number:** 001	**Issue Date:** June 5, 2012
Location: Bellingham, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Julia Labadie	**Analysis Date:** June 5, 2012
Work Operation: Shoreline Reconnaissance	**Superintendent/Competent Person:** TBD	**Revised by:** Julia Labadie	**Revised Date:** June 5, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, and Coast Guard-approved personal floatation device (PFD).		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 5, 2012
		Approved by: Mark Larsen	**Approved Date:** June 5, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Boat activities	Marine Operation Hazards	• Follow the Marine Safety Standard Operating Procedures when working near or on the water.	• Inspect PFD daily.

Shoreline Reconnaissance

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Loading/unloading onto vessel	General	• Secure boat. • Use rails or assistance from someone on the dock. • Be cautious when entering or exiting the vessel. With one hand on the boat, quickly lower straight down into the center of the craft. Never jump into or off of a vessel. • If others are boarding, have them step along the fore and aft centerline of the boat while the boat is held in place along the pier. • Avoid directly carrying anything on or off the vessel. Load the items off the pier or have someone hand them to you one by one. • Never overload the vessel. • Keep weight toward center of the boat and center of gravity as low as possible. • Distribute equipment evenly on vessel.	
Shoreline reconnaissance	Slips, Trips, Falls	• Be aware of potentially unstable and slippery surfaces (logs, rip rap, debris) and tripping hazards on shoreline. • Wear footwear that has sufficient traction to reduce risk of slipping (wear steel-toed rubber boots). • Proceed carefully on floating docks and ramps. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Notify the Field Lead of any unsafe conditions.	
	Slips, Trips, Falls Off Boat/ Drowning Hazards	• Wear U.S. Coast Guard-approved personal flotation device (PFD). • Be aware of any obstacles on boat deck.	• PFDs should be inspected daily prior to use.

Shoreline Reconnaissance

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Shoreline reconnaissance	Hydrocarbon exposure (e.g., Benzene inhalation)	• Perform regular air monitoring of breathing zone (within 1 foot of mouth)using a PID if sheen is observed or HC odors are present. • If PID reading is over 5 ppm above background, move at least 10 feet away to an area with fresh air, preferably upwind of area. • Continue to monitor breathing zone with PID, and only return to area if an upwind option is available, or if breathing zone conditions become safe. • If field personnel become faint or light-headed, stop work and move to an area with fresh air.	• Ensure PID is calibrated and functioning properly.
	Rain	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working near water.	• Inspect PPE for rip/tears before heading into field.

Shoreline Reconnaissance

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Operating Around Machinery	Barge Ramp Lockout/Tagout Procedures	• When working around or under barge ramp, use lockout/tagout procedures to ensure safety, as specified in Section 2.2.18 and 29 CFR 1910.147. • Ensure that machinery/equipment is shut down and locked out prior to entering area. • Familiarize staff with shut-down procedure: metal girder with pins locks start/stop button, sledge hammer needed to activiate. • De-activate the energy isolating device (remove from energy source) so that machine is isolated from energy source. • Lock out the energy-isolating device with a lock. • Stored residual energy must be dissipated or restrained by methods such as grounding, repositioning, bleeding down, etc. • Talk to Port tenants – tag ramp and ensure that tenants are not using ramp during reconnaissance work.	

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Field Activities

Project Name: Central Waterfront Site RI – Whatcom Waterway Site Cleanup	**Project Number:** 120007-01	**JSA Number:** 002	**Issue Date:** June 26, 2012
Location: Bellingham, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Julia Labadie	**Analysis Date:** June 25, 2012
Work Operation: Field Activities	**Superintendent/Competent Person:** TBD	**Revised by:** Julia Labadie	**Revised Date:** June 26, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, Coast Guard-approved personal floatation device (PFD), and waders.		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 26, 2012
		Approved by: Mark Larsen	**Approved Date:** June 26, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, Physical Activity	Slips, Trips, Falls	• Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the Field Lead of any unsafe conditions.	

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, Physical Activity (cont.)	Heat Stress	• Adjust work schedules, as necessary. • Perform work during cooler hours of the day, if possible, or at night, if possible and if adequate lighting can be provided. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold Stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Rain	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working near water.	• PPE should be inspected daily prior to use.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have water available for dehydration.	
	Lightning	• Do not begin or continue work until lightning subsides for 20 minutes. • Immediately head for shore if on the water and lightning is observed. • If you are not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, Physical Activity (cont.)	High Winds, Dust Storm	• Wear goggles if dust/debris is visible.	
	Pollen	• Take medication (i.e., antihistamine) to minimize allergic reaction to pollen. • Wear dust mask, if necessary.	• PPE should be inspected daily prior to use.
	Biological Hazards (flora [poison ivy, poison oak, etc.] and fauna [ticks, bees, mosquitoes, snakes, etc.])	• Personnel will be aware of potential exposure to biological hazards. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, Tyvek coveralls, as appropriate), and insect repellant. • Personnel will wear thick gloves when clearing plants or debris from work area.	

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Porewater and Seep Sampling

Project Name: Central Waterfront Site RI – Whatcom Waterway Site Cleanup	**Project Number:** 120007-01	**JSA Number:** 003	**Issue Date:** June 26, 2012
Location: Bellingham, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Julia Labadie	**Analysis Date:** June 25, 2012
Work Operation: Porewater and Seep Sampling	**Superintendent/Competent Person:** TBD	**Revised by:** Julia Labadie	**Revised Date:** June 26, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, Coast Guard-approved personal floatation device (PFD), and waders.		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 26, 2012
		Approved by: Mark Larsen	**Approved Date:** June 26, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Boat activities	Marine Operation Hazards	• Follow the Marine Safety Standard Operating Procedures when working near or on the water.	• Inspect PFD daily.

Porewater and Seep Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Loading/unloading onto vessel	General	• Secure boat (Zodiac) before loading/unloading personnel or equipment. • Use rails or assistance from someone on the dock. • Be cautious when entering or exiting the vessel. With one hand on the boat, quickly lower straight down into the center of the craft. Never jump into or off of a vessel. • If others are boarding, have them step along the fore and aft centerline of the boat while the boat is held in place along the pier. • Avoid directly carrying anything on or off the vessel. Load the items off the pier or have someone hand them to you one by one. • Never overload the vessel. • Keep weight toward center of the boat and center of gravity as low as possible. • Distribute equipment evenly on vessel.	
Seep and Porewater Sampling along Shoreline	Slips, Trips, Falls	• Be aware of potentially unstable and slippery surfaces (logs, rip rap, debris) and tripping hazards on shoreline. • Wear footwear that has sufficient traction to reduce risk of slipping (wear steel-toed rubber boots or waders). • Keep all sampling areas clean and free of debris to deter any unnecessary trips and falls. • Notify the Field Lead of any unsafe conditions.	
	Slips, Trips, Falls Off Boat/ Drowning Hazards	• Wear U.S. Coast Guard-approved personal flotation device (PFD). • Be aware of any obstacles on boat deck and along shoreline.	• PFDs should be inspected daily prior to use.

Porewater and Seep Sampling

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Groundwater Sampling

Project Name: Central Waterfront Site RI – Whatcom Waterway Site Cleanup	**Project Number:** 120007-01	**JSA Number:** 004	**Issue Date:** June 26, 2012
Location: Bellingham, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Julia Labadie	**Analysis Date:** June 25, 2012
Work Operation: Groundwater Sampling	**Superintendent/Competent Person:** TBD	**Revised by:** Julia Labadie	**Revised Date:** June 26, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, Coast Guard-approved personal floatation device (PFD), and waders.		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 26, 2012
		Approved by: Mark Larsen	**Approved Date:** June 26, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Groundwater Gauging and Sampling	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use	
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	

Groundwater Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Groundwater Gauging and Sampling (cont.)	Slips, Trips, Falls	• Clear work areas of equipment, tools, vegetation, excavated material, and debris • Mark, identify, or barricade other obstructions	
	Inhalation and Skin Contact with Hazardous Substances	• Provide workers proper skin, eye, and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Monitor breathing zone air to determine levels of contaminants • Follow proper procedures for handling/preserving/packaging/labeling analytical samples; chemicals/preserving agents • Follow proper decontamination procedures to prevent ingestion of contaminants	
	Battery Handling/ Electrical Shock	• Inspect pump and battery for bare/exposed wiring or loose connections • Verify DC current leads are correctly connected to battery • Do not perform battery connections with wet hands or gloves	
	Caught between/ Pinch Points	• Inspect moving parts and guards on pump before operations begin • Make sure guards are in place before operating pump	
	High/Low Ambient Temperature	• Monitor for Heat/Cold stress • Provide fluids to prevent worker dehydration • Follow work/rest schedule	

Groundwater Sampling

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Personnel Decontamination

Project Name: Central Waterfront Site RI – Whatcom Waterway Site Cleanup	**Project Number:** 120007-01	**JSA Number:** 005	**Issue Date:** June 26, 2012
Location: Bellingham, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Julia Labadie	**Analysis Date:** June 25, 2012
Work Operation: Personnel Decontamination	**Superintendent/Competent Person:** TBD	**Revised by:** Julia Labadie	**Revised Date:** June 26, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, Coast Guard-approved personal floatation device (PFD), and waders.		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 26, 2012
		Approved by: Mark Larsen	**Approved Date:** June 26, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontaminate personnel exiting the Exclusion Zone	General	• Personnel should use appropriate PPE to reduce exposure. • Collect rinse water and dispose of per appropriate standard operating procedures. • Follow decontamination procedures.	• PPE should be inspected daily prior to use.
	Site Hazardous Material Exposure	• Training and safety awareness of potential exposure to chemicals of concern at the site and decontamination procedure. • Review chemicals of concern. • Appropriate PPE will be worn.	• PPE should be inspected daily prior to use.

Personnel Decontamination

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontaminate personnel exiting the Exclusion Zone (cont.)	Slips, Trips, Falls	• Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the Field Lead of any unsafe conditions.	
	Heat Stress	• Adjust work schedules, as necessary. • Perform work during cooler hours of the day, if possible, or at night, if possible and if adequate lighting can be provided. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold Stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Personnel Decontamination

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Tool and Equipment Decontamination

Project Name: Central Waterfront Site RI – Whatcom Waterway Site Cleanup	**Project Number:** 120007-01	**JSA Number:** 006	**Issue Date:** June 26, 2012
Location: Bellingham, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Julia Labadie	**Analysis Date:** June 25, 2012
Work Operation: Tool and Equipment Decontamination	**Superintendent/Competent Person:** TBD	**Revised by:** Julia Labadie	**Revised Date:** June 26, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: long sleeves if handling potentially contaminated media, safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, Coast Guard-approved PFD.		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 26, 2012
		Approved by: Mark Larsen	**Approved Date:** June 26, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Process items through decontamination	Site Hazardous Material Exposure	• Training and safety awareness of potential exposure to chemicals of concern at the site and decontamination procedure. • Review chemicals of concern. • Appropriate PPE will be worn. • Personnel will follow appropriate decontamination procedures.	• PPE should be inspected daily prior to use.

Tool and Equipment Decontamination

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Process items through decontamination (cont.)	Slips, Trips, Falls	• Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the Field Lead of any unsafe conditions.	
	Heat Stress	• Adjust work schedules, as necessary. • Perform work during cooler hours of the day, if possible, or at night, if possible and if adequate lighting can be provided. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold Stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Tool and Equipment Decontamination

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Test Pit Excavation and Soil Sampling

Project Name:	Project Number:	JSA Number:	Issue Date:
Central Waterfront Site RI – Whatcom Waterway Site Cleanup	120007-01	007	June 26, 2012
Location:	**Contractor:**	**Analysis by:**	**Analysis Date:**
Bellingham, Washington	Anchor QEA, LLC	Julia Labadie	June 25, 2012
Work Operation:	**Superintendent/Competent Person:**	**Revised by:**	**Revised Date:**
Test Pit Excavation and Soil Sampling	TBD	Julia Labadie	June 26, 2012
Required Personal Protective Equipment (PPE): Modified Level D – • Long pants, steel-toed boots, hard hat, reflective vest, rain gear (optional). • Depending on activity, the following PPE may also be required: long sleeves if handling potentially contaminated media, safety glasses/ splash goggles, nitrile or PVC gloves, Tyvek coveralls, Coast Guard-approved PFD.		**Reviewed by:** Mark Larsen	**Reviewed Date:** June 26, 2012
		Approved by: Mark Larsen	**Approved Date:** June 26, 2012

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Test Pit Soil Sampling	Inhalation of Contaminated Dust, Inhalation of Volatile Contaminants, Ingestion of Contaminants, Skin/Eye Contact with Contaminated Materials	• Wear appropriate PPE. • Contact 911 as necessary. • If a person breathes in a large amount of organic vapor, move the exposed person to fresh air, rinse mouth. Have a trained person perform CPR if breathing stops. • If exposure to contaminated materials occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Keep the affected person warm and at rest.	PPE should be inspected daily prior to use.

Test Pit Excavation and Soil Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Test Pit Soil Sampling	Slips, Trips, Falls	• Be aware of potentially slippery surfaces and tripping hazards. • Wear footwear that has sufficient traction to reduce risk of slipping. • Wear steel-toed rubber boots versus over-the-shoe rubber boots. • Work slowly during transit. Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to deter any unnecessary trips and falls. • Clean up all spills immediately. • Notify the Field Lead of any unsafe conditions.	
	Noise Exposure	• Hearing protection will be worn in high noise areas by all field personnel (including Archaeological Monitor) or when working around heavy machinery or equipment (action level of 85 decibels [dBA] averaged over an 8-hour day).	PPE should be inspected daily prior to use.
	Pinch Points	• Maintain awareness of procedures underway and be attentive of sampling operations. • Maintain distance when backhoe is in operation.	Maintain eye contact with backhoe operator before approaching bucket.
	Overhead Hazards	• Backhoe and backhoe bucket.	Maintain eye contact with backhoe operator before approaching bucket.
	Muscle Strain/Injuries from Improper Lifting	• Personnel will utilize proper lifting techniques or ask for assistance with moving/lifting objects.	

Test Pit Excavation and Soil Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Test Pit Soil Sampling	Heat Stress	• Adjust work schedules, as necessary. • Perform work during cooler hours of the day, if possible, or at night, if possible and if adequate lighting can be provided. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	Monitor workers' physical conditions. Monitor outside temperature versus worker activity.
	Cold Stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	Monitor workers' physical conditions. Monitor outside temperature versus worker activity.
	Rain	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working near water.	PPE should be inspected daily prior to use.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have water available for dehydration.	
	Lightning	• Do not begin or continue work until lightning subsides for 20 minutes.	

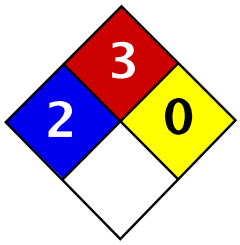
Test Pit Excavation and Soil Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Test Pit Soil Sampling	Biological Hazards (flora [poison ivy, poison oak, etc.] and fauna [ticks, bees, mosquitoes, snakes, etc.])	• Personnel will be aware of potential exposure to biological hazards. • Wear appropriate clothing (hat, long-sleeve shirt, long pants, leather gloves, boots, Tyvek coveralls, as appropriate), and insect repellant. • Personnel will wear thick gloves when clearing plants or debris from work area.	•

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 CFR 1910.120(e), including, but not limited to, initial 40-hour, 8-hour supervisor, and annual 8-hour refresher training. All boat operators must have successfully completed an appropriate state boating safety course as required.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

APPENDIX C
MATERIAL SAFETY DATA SHEETS (MSDS)



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
The substance is toxic to blood, bone marrow, central nervous system (CNS).
The substance may be toxic to liver, Urinary System.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Slightly flammable to flammable in presence of oxidizing materials.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire.
Reacts on contact with iodine heptafluoride gas.

Dioxygenyl tetrafluoroborate is as very powferful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition.
Contact with sodium peroxide with benzene causes ignition.
Benzene ignites in contact with powdered chromic anhydride.
Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States]
TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.1 STEL: 1 from NIOSH
TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States]
TWA: 10 (ppm) from OSHA (PEL) [United States]
TWA: 3 (ppm) [United Kingdom (UK)]
TWA: 1.6 (mg/m3) [United Kingdom (UK)]
TWA: 1 (ppm) [Canada]
TWA: 3.2 (mg/m3) [Canada]
TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant.
(Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone.
Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 930 mg/kg [Rat].
Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
Causes damage to the following organs: blood, bone marrow, central nervous system (CNS).
May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:
Very hazardous in case of inhalation.
Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects.
May affect genetic material (mutagenic).
May cause cancer (tumorigenic, leukemia))
Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system.
Eyes: Causes eye irritation.
Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and

other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system.
Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene
California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene
Connecticut carcinogen reporting list.: Benzene
Connecticut hazardous material survey.: Benzene
Illinois toxic substances disclosure to employee act: Benzene
Illinois chemical safety act: Benzene
New York release reporting list: Benzene
Rhode Island RTK hazardous substances: Benzene
Pennsylvania RTK: Benzene
Minnesota: Benzene
Michigan critical material: Benzene
Massachusetts RTK: Benzene
Massachusetts spill list: Benzene
New Jersey: Benzene
New Jersey spill list: Benzene
Louisiana spill reporting: Benzene
California Director's list of Hazardous Substances: Benzene

TSCA 8(b) inventory: Benzene
SARA 313 toxic chemical notification and release reporting: Benzene
CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R22- Harmful if swallowed.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R45- May cause cancer.
R62- Possible risk of impaired fertility.
S2- Keep out of the reach of children.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S39- Wear eye/face protection.
S46- If swallowed, seek medical advice immediately and show this container or label.
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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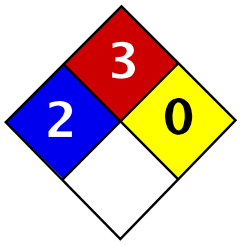

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C8H10

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD50): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (irritant, sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:
CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001)
CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001)
CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States]
TWA: 435 STEL: 545 from OSHA (PEL) [United States]
TWA: 435 STEL: 545 (mg/m3) from NIOSH [United States]
TWA: 100 STEL: 125 (ppm) from NIOSH [United States]
TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States]
TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)]
TWA: 100 STEL: 125 (ppm) [Belgium]
TWA: 100 STEL: 125 (ppm) [Finland]
TWA: 50 (ppm) [Norway]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in diethyl ether.
Very slightly soluble in cold water or practically insoluble in water.
Soluble in all proportions in Ethyl alcohol.
Soluble in Carbon tetrachloride, Benzene.
Insoluble in Ammonia.
Slightly soluble in Chloroform.
Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials.
Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:
Lethal Dose/Conc 50% Kill:
LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg
Lowest Published Lethal Dose/Conc:
LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data.
May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate.
May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Can cause mild skin irritation. It can be absorbed through intact skin.
Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm , it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS)
Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and conciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987).
Ingestion: Do not drink, pipet or siphon by mouth. May cause gastroinestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through)]. 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Ethylbenzene
Illinois toxic substances disclosure to employee act: Ethylbenzene
Illinois chemical safety act: Ethylbenzene
New York release reporting list: Ethylbenzene
Rhode Island RTK hazardous substances: Ethylbenzene
Pennsylvania RTK: Ethylbenzene
Minnesota: Ethylbenzene
Massachusetts RTK: Ethylbenzene
Massachusetts spill list: Ethylbenzene
New Jersey: Ethylbenzene
New Jersey spill list: Ethylbenzene
Louisiana spill reporting: Ethylbenzene
California Director's List of Hazardous Substances: Ethylbenzene
TSCA 8(b) inventory: Ethylbenzene
TSCA 4(a) proposed test rules: Ethylbenzene
TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97
SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S24/25- Avoid contact with skin and eyes.
S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Manufacturer's Material Safety Data Sheet.
-Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA)
-Registry of Toxic Effects of Chemical Substances (RTECS)
-Chemical Hazard Response Information System (CHRIS)
-Hazardous Substance Data Bank (HSDB)
-New Jersey Hazardous Substance Fact Sheet
-Ariel Global View
-Reprotext System

Other Special Considerations: Not available.

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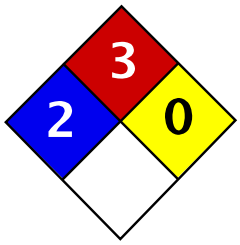


Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide;

concentrated nitric acid, sulfuric acid + nitric acid; N_2O_4; $AgClO_4$; BrF_3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States]
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 100 STEL: 150 from NIOSH [United States]
TWA: 375 STEL: 560 (mg/m^3) from NIOSH [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Practically insoluble in cold water.
Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide.
Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride.
Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C.
Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 636 mg/kg [Rat].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin.
Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days.
Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite.
Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation.
Chronic Potential Health Effects:
Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis.
Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may

arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene
California prop. 65 (no significant risk level): Toluene: 7 mg/day (value)
California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene
Connecticut hazardous material survey.: Toluene
Illinois toxic substances disclosure to employee act: Toluene
Illinois chemical safety act: Toluene
New York release reporting list: Toluene
Rhode Island RTK hazardous substances: Toluene
Pennsylvania RTK: Toluene
Florida: Toluene
Minnesota: Toluene
Michigan critical material: Toluene
Massachusetts RTK: Toluene
Massachusetts spill list: Toluene
New Jersey: Toluene
New Jersey spill list: Toluene
Louisiana spill reporting: Toluene
California Director's List of Hazardous Substances.: Toluene
TSCA 8(b) inventory: Toluene
TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92
SARA 313 toxic chemical notification and release reporting: Toluene
CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S25- Avoid contact with eyes.
S29- Do not empty into drains.
S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

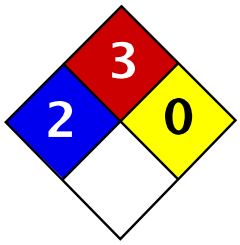
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:30 PM

Last Updated: 11/06/2008 12:00 PM



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

Chemical Name: Xylenes (o-, m-, p- isomers)

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Xylenes	1330-20-7	100

Toxicological Data on Ingredients: Xylenes: ORAL (LD50): Acute: 4300 mg/kg [Rat]. 2119 mg/kg [Mouse]. DERMAL (LD50): Acute: >1700 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 24°C (75.2°F). (Tagliabue.) OPEN CUP: 37.8°C (100°F).

Flammable Limits: LOWER: 1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Slightly explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Vapors may travel to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Vapors may form explosive mixtures with air.
Containers may explode when heated.

May polymerize explosively when heated.
An attempt to chlorinate xylene with 1,3-Dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin) caused a violent explosion

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 (ppm) [Canada]
TWA: 435 (mg/m3) [Canada]
TWA: 434 STEL: 651 (mg/m3) from ACGIH (TLV) [United States]
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Miscible with absolute alcohol, ether, and many other organic liquids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Store away from acetic acid, nitric acid, chlorine, bromine, and fluorine.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2119 mg/kg [Mouse].

Acute dermal toxicity (LD50): >1700 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 5000 4 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal.
May cause adverse reproductive effects (male and femael fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation. Can be absorbed through skin.
Eyes: Causes eye irritation.
Inhalation: Vapor causes respiratory tract and mucous membrane irritation. May affect central nervous system and behavior (General anesthetic/CNS depressant with effects including headache, weakness, memory loss, irritability, dizziness, giddiness, loss of coordination and judgement, respiratory depression/arrest or difficulty breathing, loss of appetite, nausea, vomiting, shivering, and possible coma and death). May also affects blood, sense organs, liver, and peripheral nerves.
Ingestion: May cause gastrointestinal irritation including abdominal pain, vomiting, and nausea. May also affect liver and urinary system/kidneys. May cause effects similar to those of acute inhalation.
Chronic Potential Health Effects:
Chronic inhalation may affect the urinary system (kidneys) blood (anemia), bone marrow (hyperplasia of bone marrow) brain/behavior/Central Nervous system. Chronic inhalation may alsocause mucosal bleeding.
Chronic ingestion may affect the liver and metabolism (loss of appetite) and may affect urinary system (kidney damage)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Xylenes
Illinois chemical safety act: Xylenes
New York acutely hazardous substances: Xylenes
Rhode Island RTK hazardous substances: Xylenes
Pennsylvania RTK: Xylenes
Minnesota: Xylenes
Michigan critical material: Xylenes
Massachusetts RTK: Xylenes
Massachusetts spill list: Xylenes
New Jersey: Xylenes
New Jersey spill list: Xylenes
Louisiana spill reporting: Xylenes
California Director's List of Hazardous Substances: Xylenes
TSCA 8(b) inventory: Xylenes
SARA 302/304/311/312 hazardous chemicals: Xylenes
SARA 313 toxic chemical notification and release reporting: Xylenes
CERCLA: Hazardous substances.: Xylenes: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R10- Flammable.
R21- Harmful in contact with skin.
R36/38- Irritating to eyes and skin.
S2- Keep out of the reach of children.
S36/37- Wear suitable protective clothing and gloves.
S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:54 PM

Last Updated: 11/06/2008 12:00 PM

APPENDIX D
JULY 13, 2012 SUBSTANTIVE COMMENTS FROM WDFW

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
Region 4 Office: 16018 Mill Creek Boulevard - Mill Creek, Washington 98012 - (425) 775-1311

July 13, 2012

Port of Bellingham
Attention: Brian Gouran
1801 Roeder Avenue
Bellingham, WA. 98227

SUBJECT: MTCA SUBSTANTIVE COMMENTS – Central Waterfront Site - Chevron Subarea Interim Action, Bellingham Bay, Whatcom County, WRIA 01.9000

Dear Mr. Gouran,

The Washington Department of Fish and Wildlife (WDFW) has reviewed your plans for the Central Waterfront Site - Chevron Subarea Interim Action and offer the following MTCA Substantive Comments.

1. TIMING LIMITATIONS: The project shall begin immediately and shall be completed by December 31, 2013.

A. Work below the ordinary high water line shall not occur from March 15 through July 15 of any year for the protection of migrating juvenile salmonids.

B. Work below the ordinary high water line from July 16 through July 31 of any year shall only occur in the dry for the protection of migrating juvenile salmonids.

2. NOTIFICATION REQUIREMENT: The Area Habitat Biologist (AHB) listed below shall be notified of the project start date. Notification shall be received by the AHB prior to the start of construction activities.

3. The project shall be constructed as in described in your application and illustrated by your project plans dated June 2012.

4. All work below the +10.0 tide elevation (MLLW = 0.00) shall be conducted in the dry during low tide cycles.

5. Contaminated soils and sediments excavated from the intertidal beach and shoreline areas identified in your project plans shall be disposed at an approved upland disposal facility.

6. If excavated contaminated soils and sediments are temporarily stockpiled at an onsite upland area prior to removal to an approved upland disposal facility, the best management practices (BMPs) detailed in Attachment 3 shall be employed.

7. The creosote treated piling within the project footprint shall be extracted where possible. If the creosote treated piling cannot be extracted, they shall be cut off a minimum of 18 inches below the bed.

8. The creosote treated piling, cross ties, and deadman within the project footprint shall be removed from the beach and disposed at an approved upland disposal facility.

9. The silt curtain between the two existing timber bulkheads will be placed in the dry during low tide cycles. The proposed silt curtain is a potential fish trap if allowed to over top during high tide cycles. The silt curtain shall be carefully managed during project construction to minimize overtopping and shall be removed at the end of each work day.

10. The project footprint shall be backfilled as described in your application and illustrated in sheet 4 of your project plans.

11. Only round rock and gravel materials shall be used to backfill the project footprint. Under no circumstances shall crushed rock materials be used.

12. If a fish kill occurs or fish are observed in distress, the project activity shall immediately cease and WDFW Habitat Program shall be notified immediately.

13. All debris material resulting from construction shall be removed from the beach area and bed and prevented from entering waters of the state.

14. No petroleum products or other deleterious materials shall enter surface waters.

If you have any questions, please contact me at (360) 466-4345, extension 250.

Sincerely,

Brian Williams

Brian Williams
Area Habitat Biologist

APPENDIX E
CRITICAL AREA REPORT

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

MEMORANDUM

To:	Brian Gouran, Port of Bellingham	**Date:**	September 11, 2012
From:	John Laplante, P.E. and Wes MacDonald, Anchor QEA	**Project:**	120007-01.01
Cc:	Halah Voges, Anchor QEA		
Re:	Critical Areas Report Geologic Hazard Areas – Bellingham Central Waterfront		

The Port of Bellingham (Port) intends to perform an interim action (IA) at the Central Waterfront Site in Bellingham, Washington, to excavate and remove non-aqueous phase liquid (NAPL) petroleum and petroleum-impacted soil and sediments from the Chevron subarea beach (Site) to prevent petroleum sheen on Whatcom Waterway.

The IA will be conducted under Agreed Order No. DE 3441 as amended (AO) (Ecology 2006, 2012) between the Port, the City of Bellingham (City), and the Washington State Department of Ecology (Ecology). The IA will address observed NAPL occurrence and the highest concentrations of gasoline and diesel/motor oil range total petroleum hydrocarbons (TPH) detected in beach sediments. Oily sheens have been observed on groundwater seeps emanating from the Chevron subarea beach. Test borings in this area indicate that the petroleum impacts are associated with the top of the groundwater table fluctuation zone (smear zone) intersecting the beach. It appears that the seep moves up and down the beach between elevations +1 and +7 feet mean lower low water (MLLW) due to the groundwater table's response to tidal variation.

This geotechnical engineering evaluation has been prepared as an attachment to the Interim Action Work Plan (Work Plan) to evaluate the potential for Critical Areas at the Chevron subarea and to document the overall affect the work will have on any Critical Areas that may be present at the Site.

Geologic Hazard Areas (BMC 16.55.410)

Geologic Hazard Areas, as defined by Section 16.55.410 (Attachment A) of the Bellingham Municipal Code (BMC), were evaluated for the site based on mapped conditions. Geologically hazardous areas include areas susceptible to erosion, landslide, seismic, or mine hazards.

Erosion Hazard Areas

Erosion Hazard Areas are specifically defined in Section 16.55.420.A of the BMC as:

- Areas identified in soil unit maps and *Table 11—Building Site Development* of the U.S. Department of Agriculture Soil Conservation Service Soil Survey of Whatcom County Area (Attachment B)
- Uplands immediately adjacent to Lake Whatcom, Lake Padden, and Bellingham and Chuckanut bays
- Any area where the soil type is predominantly (greater than 50%) comprised of sand, clay, silt, and/or organic matter and slope is greater than 30%

The Site is defined as an Erosion Hazard Area due to its location immediately adjacent to Bellingham Bay, and soil fill unit slopes of greater than 30% near the high water mark.

Landslide Hazard Areas

Section 16.55.420.B of the BMC describes Landslide Hazard Areas that can result in risk of injury or damage to the public and environment, specifically including:

- Areas identified in soil unit maps and *Table 11—Building Site Development* of the U.S. Department of Agriculture Soil Conservation Service Soil Survey of Whatcom County Area (Attachment B)
- Slopes with an incline that is equal to or greater than 40% grade (22 degrees) within a vertical elevation change of at least 10 feet
- Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials
- Current and historic marine bluffs along present and historical shorelines, including Bellingham and Chuckanut bays

- Areas depicted as having *High Landslide Potential* within the *Landslide Hazard Areas* section of the Geologic Hazard Areas Map Folio, Bellingham, Washington, 1991 (Attachment C)

Based on review of the Geologic Hazard Areas Map and existing topographic survey data, the Site is not considered to contain a Landslide Hazard Area.

Buffers

A buffer of 50 feet is required around the edges of landslide hazard areas by the BMC. However, the entire area of excavation is considered an erosion and seismic hazard area, and no buffers are considered necessary.

Seismic Hazard Areas

Seismic Hazard Areas have the potential to be damaged by the direct effects of an earthquake. Seismic Hazard Areas are defined in Section 16.55.420.C of the BMC as areas of very high response to seismic shaking, including:

- All landfills placed waterward of the historic 1850 natural coastline of Bellingham and Chuckanut bays
- All alluvial deposits near the mouth (delta) of Chuckanut Creek, Padden Creek, Whatcom Creek, Squalicum Creek, and Little Squalicum Creek
- All marine and stream course bluffs greater than 10 feet in vertical relief and steeper than 100% (45 degrees)
- All rock outcrops greater than 10 feet in vertical relief and lands lying adjacent, or in close proximity, and within the fall-line of potential falling, rolling, or sliding rock and debris flows

The site is located in Bellingham Bay and was most likely constructed with fill materials placed since 1850. Soils at the site, as reported in the Work Plan, are loose and sandy in nature and are potentially liquefiable. Therefore, the Site is considered a Seismic Hazard Area.

Mine Hazard Areas

Mine Hazards Areas are underlain by mine-related workings and have the potential for sink holes, gas releases, or subsidence. Section 16.55.420D of the BMC specifies areas of known

and suspected historical mining and hazards as areas depicted as Coal Mine Hazard Areas within the Geologic Hazard Areas Map Folio, Bellingham, Washington, 1991 (Attachment C). The site does not contain any Mine Hazard Areas.

Hazards Analysis

The IA will be performed in areas defined by BMC 16.55.410 as Erosion and Seismic Hazard areas. A site plan and cross-sections showing the extent of excavation and fill at the Site are provided in the Work Plan in Figures 8 and 12, respectively. The IA consists of removal of existing contaminated soils and replacement with specified sand, gravel, and armor materials, which will be properly placed and graded. Excavations are expected to be less than 10 feet in depth. Final slopes will be 3H:1V (Horizontal:Vertical) at the steepest, the same slope as existing conditions.

The work proposed under the IA is expected to reduce the risk associated with the geological hazards identified for this Site:

- The erosion hazard will be reduced by installation of an armored shoreline to protect against wave erosion
- The seismic hazard will be mitigated to a level less than the pre-development conditions by the placement of armor and gravel material, which is much less susceptible to liquefaction than the existing *in situ* soils

The work proposed under the IA is a requirement of the Ecology AO. Removal of bank soils is unavoidable, and there is no other alternative that would accomplish the requirements of the AO and avoid working within these Critical Areas. However, the design of the IA, which includes construction of a new engineered armor bank, will minimize potential impacts within the Critical Area and is expected to result in a Site that has less risk for both Erosion and Seismic Hazards.

Attachments:

Attachment A	Whatcom Critical Area Ordinance – Geologically Hazardous Areas
Attachment B	Excerpts from Soil Survey of Whatcom County Area, Washington
Attachment C	City of Bellingham Geologic Hazard Areas Map Folio

ATTACHMENT A
WHATCOM CRITICAL AREA ORDINANCE—GEOLOGICALLY HAZARDOUS AREAS

City of Bellingham Municipal Code

Title 16 ENVIRONMENT
Chapter 55 CRITICAL AREAS

16.55.410 - DESIGNATION OF GEOLOGICALLY HAZARDOUS AREAS

Geologically hazardous areas include areas susceptible to erosion, landslide, rock fall, subsidence, earthquake, or other geological events. They pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard. Such incompatible development may not only place itself at risk, but also may increase the hazard to surrounding development and use. Areas susceptible to one or more of the following types of hazards shall be designated as a geologically hazardous area:

A. Erosion hazard;

B. Landslide hazard;

C. Seismic hazard; or

D. Mine hazard.

16.55.420 - DESIGNATION OF SPECIFIC HAZARD AREAS

A. Erosion Hazard Areas. Erosion hazard areas are prone to soil erosion. Specifically these areas include:

1. Areas identified in soil unit maps and *Table 11—Building Site Development* of the U.S. Department of Agriculture Soil Conservation Service Soil Survey of Whatcom County Area. They are rated as "Severe:" due to "slope, wetness, ponding, flooding, cutbanks cave" or any combination thereof.

2. Erosion hazard areas also include those uplands immediately adjacent to Lake Whatcom, Lake Padden, Bellingham and Chuckanut bays, ponds under 20 acres in size and all streams.

3. Erosion hazard areas may also include any area where the soil type is predominantly (> 50%) comprised of sand, clay, silt, and/or organic matter and slope is greater than 30%.

B. Landslide Hazard Areas. Landslide hazard areas may be prone to landslides and/or subsidence that could include slow to rapid movement of soil, fill materials, rock and

other geologic strata resulting in risk of injury or damage to the public and environment. Landslides could result from any combination of soil, slope, topography, underlying geologic structure, hydrology, freeze-thaw, earthquake and other geologic influences. Specific landslide hazard areas include:

1. Those areas identified in soil unit maps and *Table 11—Building Site Development* of the U.S. Department of Agriculture Soil Conservation Service Soil Survey of Whatcom County Area. They are rated "Severe:" due to "slope" and/or "subsides".

2. Slopes with an incline that is equal to or greater than 40% grade (22 degrees) within a vertical elevation change of at least 10 feet. Slope shall be calculated by identifying slopes that have at least 10 feet of vertical elevation change within a horizontal distance of 25 feet or less.

Slope shall not include those lands that have 10 feet of vertical change by virtue of a legally established retaining wall(s), foundation wall, stairways or similar vertical structure or those land areas where public infrastructure and its supporting elements have been developed.

3. Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials.

4. Current and historic marine bluffs along present and historical shorelines including Bellingham and Chuckanut bays.

5. Areas depicted as having *High Landslide Potential* within the *Landslide Hazard Areas* section of the GEOLOGIC HAZARD AREAS Map Folio, Bellingham, Washington, 1991.

C. Seismic Hazard Areas. Seismic hazard areas are areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, lateral spreading, or surface faulting. Specific areas of very high response to seismic shaking include:

1. All landfills placed waterward of the historic 1850 natural coastline of Bellingham and Chuckanut bays.

2. All alluvial deposits near the mouth (delta) of Chuckanut Creek, Padden Creek, Whatcom Creek, Squalicum Creek and Little Squalicum Creek.

3. All marine and stream course bluffs greater than 10' in vertical relief and steeper than 100% (45 degrees).

4. All rock outcrops greater than 10' in vertical relief and lands lying adjacent, or in close proximity, and within the fall-line of potential falling, rolling or sliding rock and debris flows.

D. Mine Hazard Areas. Mine hazard areas are those areas underlain by or affected by mine workings such as adits, gangways, tunnels, drifts, or airshafts, and those areas of probable sink holes, gas releases, or subsidence due to mine workings. Specific areas of known and suspected historical mining activity and hazards include:

1. Areas depicted as *Coal Mine Hazard Areas* within the GEOLOGIC HAZARD AREAS Map Folio, Bellingham, Washington, 1991.

ATTACHMENT B
EXCERPTS FROM SOIL SURVEY OF WHATCOM COUNTY AREA, WASHINGTON

Soil Survey of
Whatcom County Area, Washington

By Alan Goldin, Ph.D., Soil Conservation Service

Fieldwork by Alan Goldin, Barry Strickler, Sanderson Page, and Dennis Robinson, Soil Conservation Service; and David Hammer, Ralph Minden, Robert M. Freimark, George Carnine, Roger Stark, Andrew Card, and Reed Young, Washington State Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service, in cooperation with
Washington State Department of Natural Resources and Washington State University, Agriculture Research Center

The survey area is in the northwest corner of Washington (fig. 1). It has an area of about 809 square miles, or 518,135 acres. The population of the county in 1980 was 106,701. Bellingham, the county seat, had a population of 45,794. It is in the southwestern part of the survey area.

The survey area is bounded on the west by the Strait of Georgia, on the south by Skagit County, on the east by the Mount Baker-Snoqualmie National Forest, and on the north by Canada. A few privately owned areas are interspersed in the national forest near Baker Lake. The survey area ranges from 18 to 34 miles from east to west and is about 25 miles from north to south. Point Roberts is located on a peninsula 10 miles west of the main part of the survey area. It is connected to the rest of the survey area by roads that run through Canada.

The northwestern half of the survey area is nearly level to rolling. It includes flood plains, outwash terraces, and glaciomarine drift plains at elevations of sea level to 300 feet above sea level. The southeastern part is dominantly steep and mountainous, except for the flood plains along the three forks of the Nooksack River. Dairy farming, hay and pasture, and forestry are the main economic enterprises in the survey area.

Soil scientists have identified about 100 different kinds of soil in the survey area. The soils have a wide range of texture, natural drainage, and other characteristics. The soils along the major drainageways

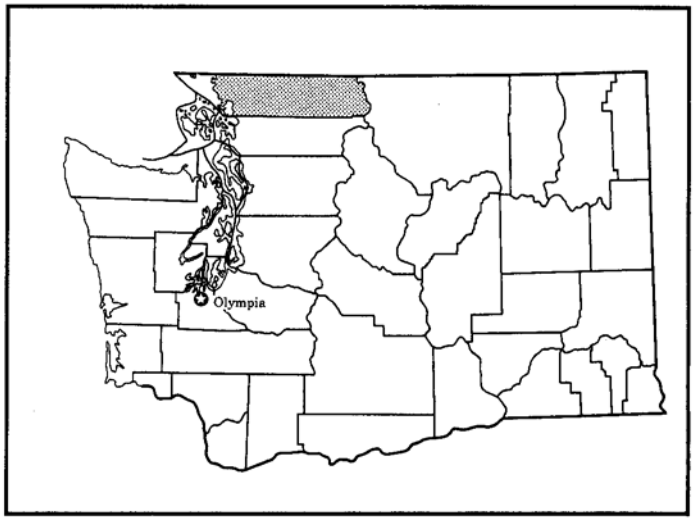


Figure 1.-Location of Whatcom County In Washington.

are suited to cropland, hay, and pasture. Wetness and the hazard of flooding are the main management concerns. The soils on outwash terraces are suited to cropland, hay and pasture, and woodland. A moderate available water capacity and a high water table are the main limitations. Extensive tile drainage has made the soils on the outwash terraces and flood plains well

available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the dense glacial till and bedrock in some areas, trees are occasionally subject to windthrow when the soils are wet and winds are strong.

The Typic Cryorthods are in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

170-Typic Psammaquents, tidal, 0 to 1 percent slopes. These very deep, poorly drained soils are on tidal flats. They formed in alluvium. The average annual precipitation is about 35 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 170 days. Elevation is sea level.

No single profile is representative of these soils. In one of the more commonly observed ones, however, the soil to a depth of 60 inches is gray and olive gray loamy sand and sand. The sand content ranges from 80 to 95 percent. The content of clay ranges from 0 to 2 percent. In some areas the soil has strata of sandy loam.

Included in this unit are small areas of water and Hydraquents. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the Typic Psammaquents. Available water capacity is low. The effective rooting depth is limited by a seasonal high water table, which is at or above the surface during periods of high tide. These soils are subject to frequent, long periods of flooding during high tides throughout the year.

This unit is used as wildlife habitat or for recreation.

This map unit is in capability subclass VIIIw.

171-Urban land. This map unit is on terraces. Slopes are 0 to 3 percent. Elevation is near sea level to 220 feet above sea level. The average annual precipitation is about 35 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 170 days.

The Urban land consists of areas covered by streets, buildings, parking lots, and other structures that so obscure the soils that identification of the soil series is not feasible.

Included in this unit are small areas of Labounty, Whatcom, Whitehorn, Birchbay, Everett, and Squalicum soils and small areas of Urban land that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

This unit is used for urban development. This map unit is in capability subclass VIIIs.

172-Urban land-Whatcom-Labounty complex, 0 to 8 percent slopes. This map unit is on glaciomarine drift plains. The Whatcom soil is on 0 to 8 percent slopes, and the Labounty soil is on 0 to 2 percent slopes. The native vegetation is mainly trees and shrubs. Elevation is near sea level to 200 feet above sea level. The average annual precipitation is about 35 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 170 days.

This unit is 40 percent Urban land, 30 percent Whatcom silt loam, and 20 percent Labounty silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale of mapping.

Included in this unit are small areas of Squalicum, Bellingham, Everett, Birchbay, Chuckanut, and Kickerville soils and small areas of Whatcom soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

The Urban land consists of areas covered by streets, buildings, parking lots, and other structures that so obscure the soils that identification of the soil series is not feasible.

The Whatcom soil is very deep and moderately well drained. It formed in a mixture of loess and volcanic ash over glaciomarine deposits. Typically, the surface layer is dark brown silt loam 9 inches thick. The upper 7 inches of the subsoil is dark brown silt loam. The lower 10 inches is light olive brown, mottled loam. The upper 9 inches of the substratum is olive gray, mottled loam. The lower part to a depth of 60 inches is dark gray loam. In some areas the surface layer is loam or gravelly silt loam. In other areas the substratum has lenses of sandy material, is 10 to 18 percent clay, or is 5 to 10 percent cobbles, stones, or boulders.

Permeability is moderate in the upper part of the Whatcom soil and slow in the lower part. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 1.5 to 3.0 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

The Labounty soil is very deep and poorly drained. It formed in an admixture of loess, volcanic ash, and glaciomarine deposits. Typically, the surface layer is very dark grayish brown silt loam 10 inches thick. The upper 6 inches of the subsoil is grayish brown and light brownish gray, mottled loam. The lower 19 inches is grayish brown, olive gray, and light olive gray, mottled loam. The substratum to a depth of 60 inches is gray loam. In some areas the surface layer is loam. In other areas the substratum has lenses of sandy material, is 10 to 18 percent clay, or is 5 to 10 percent cobbles, stones, or boulders.

Permeability is moderately slow in the Labounty soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 1 to 3 feet from November through May. Runoff usually is very slow, but the soil may be ponded during the winter. There is no hazard of erosion.

The Whatcom and Labounty soils in this unit are used for lawns, gardens, parks, or vacant lots.

The main limitation affecting homesite development is the high water table. Tile drains and open drains can be used to lower the water table if a suitable outlet is available. The wetness can be reduced by building the house on a pad and by installing drainage tile around footings if a suitable outlet is available. The restricted permeability and the high water table increase the likelihood that the absorption field will fail. Installing absorption lines that are longer than normal helps to overcome these limitations.

The Urban land is in capability subclass VIIIs. The Whatcom soil is in capability subclass IIe. The Labounty soil is in capability subclass IIw.

173-Vanzandt very gravelly loam, 5 to 15 percent slopes. This moderately deep, moderately well drained soil is on foothill toe slopes and in valleys. It formed in volcanic ash, loess, and slope alluvium over glacial till derived dominantly from phyllite. The native vegetation is mainly conifers and shrubs. Elevation is 250 to 1,500 feet. The average annual precipitation is about 60 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 7 inches, the surface layer is dark brown very gravelly loam. The subsoil is dark yellowish brown and dark brown very gravelly loam 16 inches thick. The substratum is light yellowish brown, mottled very gravelly loam about 8 inches thick. Dense glacial till that crushes to very gravelly loam is at a depth of 31 inches. The depth to dense glacial till ranges from 20 to 40 inches. The dense glacial till is similar to a cemented pan. In some areas the surface layer is gravelly loam or very gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and the upper part of the substratum or is 40 to 60 inches deep to dense glacial till.

Included in this unit are small areas of Squires, Heisler, and Barneston soils; Bellingham and Shalcar soils in depressions; soils that have a substratum of very gravelly sand; and Vanzandt soils that have slopes of more than 15 percent or less than 5 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Vanzandt soil and very slow in the dense glacial till. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. Water is perched above the dense glacial till from December through April.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, western redcedar, and bigleaf maple. The common understory plants are Oregongrape, western swordfern, western brackenfern, vine maple, salal, red huckleberry, and salmonberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 159. On the basis of a 50-year site curve, it is 125. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 169 cubic feet per acre per year, occurring at age 65.

The kind of equipment that can be used and the time of the year when it can be used normally are not restricted on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the dense glacial till, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This map unit is in capability subclass IVe.

174-Vanzandt very gravelly loam, 15 to 30 percent slopes. This moderately deep, moderately well drained soil is on foothill back slopes and toe slopes. It formed in volcanic ash, loess, and slope alluvium over glacial till derived dominantly from phyllite. The native vegetation is mainly conifers and shrubs. Elevation is 250 to 1,500 feet. The average annual precipitation is about 60 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark brown very gravelly loam. The subsoil is strong brown very gravelly loam 11 inches thick. The substratum is light

Search

Map Unit Legend

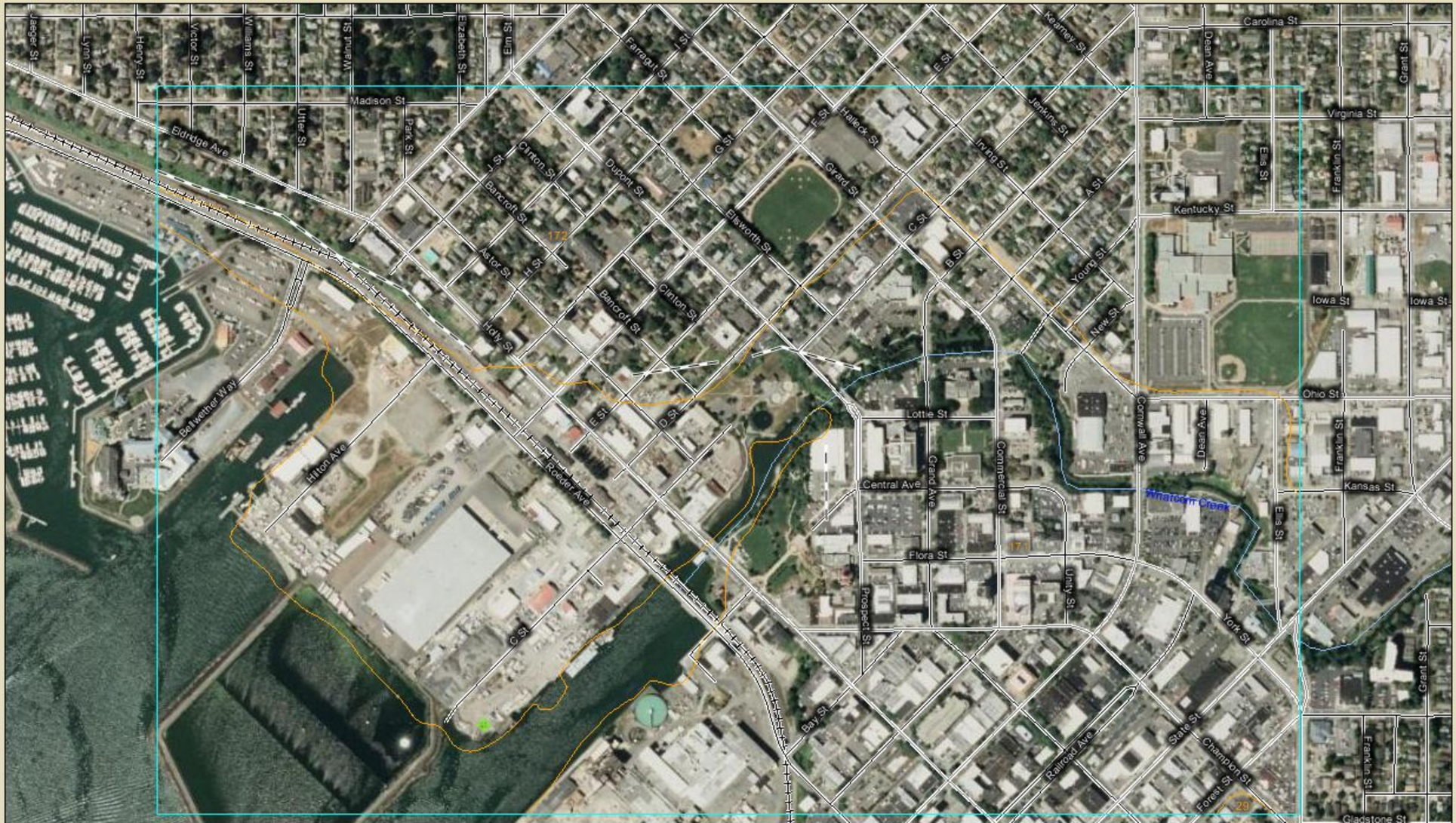
Whatcom County Area, Washington (WA673)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
29	Chuckanut-Urban land complex, 5 to 20 percent slopes	0.4	0.1%
82	Kickerville-Urban land complex, 0 to 3 percent slopes	0.0	0.0%
171	Urban land	269.0	53.2%
172	Urban land-Whatcom-Labounty complex, 0 to 8 percent slopes	160.7	31.8%
Subtotals for Soil Survey Area		**430.2**	**85.1%**
Totals for Area of Interest		**505.6**	**100.0%**

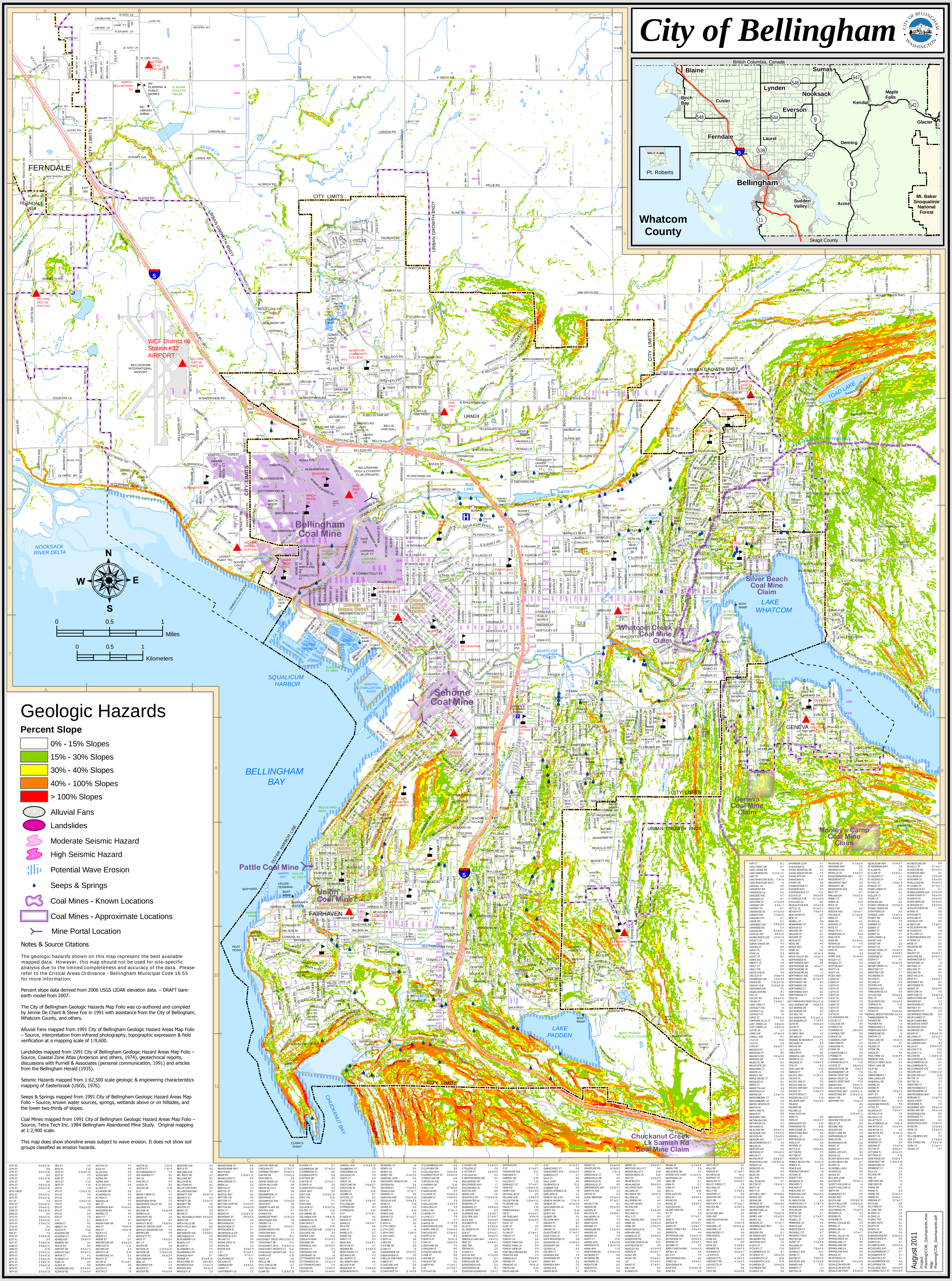
Soil Map

Legend

Scale (not to scale)



ATTACHMENT C
CITY OF BELLINGHAM GEOLOGIC HAZARD AREAS MAP FOLIO


City of Bellingham
Washington
Whatcom County
British Columbia, Canada
Skagit County
Geologic Hazards
Percent Slope
0% - 15% Slopes
15% - 30% Slopes
30% - 40% Slopes
40% - 100% Slopes
> 100% Slopes
Alluvial Fans
Landslides
Moderate Seismic Hazard
High Seismic Hazard
Potential Wave Erosion
Seeps & Springs
Coal Mines - Known Locations
Coal Mines - Approximate Locations
Mine Portal Location
Notes & Source Citations
The geologic hazards shown on this map represent the best available mapped data. However, this map should not be used for site-specific analysis due to the limited completeness and accuracy of the data. Please refer to the Critical Areas Ordinance - Bellingham Municipal Code 16.55 for more information.
Percent slope data derived from 2006 USGS LIDAR elevation data. – DRAFT bare-earth model from 2007.
The City of Bellingham Geologic Hazards Map Folio was co-authored and compiled by Jennie De Chant & Steve Fox in 1991 with assistance from the City of Bellingham, Whatcom County, and others.
Alluvial Fans mapped from 1991 City of Bellingham Geologic Hazard Areas Map Folio – Source, interpretation from infrared photography, topographic expression & field verification at a mapping scale of 1:9,600.
Landslides mapped from 1991 City of Bellingham Geologic Hazard Areas Map Folio – Source, Coastal Zone Atlas (Anderson and others, 1974), geotechnical reports, discussions with Purnell & Associates (personal communication, 1991) and articles from the Bellingham Herald (1935).
Seismic Hazards mapped from 1:62,500 scale geologic & engineering characteristics mapping of Easterbrook (USGS, 1976).
Seeps & Springs mapped from 1991 City of Bellingham Geologic Hazard Areas Map Folio – Source, known water sources, springs, wetlands above or on hillsides, and the lower two-thirds of slopes.
Coal Mines mapped from 1991 City of Bellingham Geologic Hazard Areas Map Folio – Source, Tetra Tech Inc. 1984 Bellingham Abandoned Mine Study. Original mapping at 1:2,400 scale.
This map does show shoreline areas subject to wave erosion. It does not show soil groups classified as erosion hazards.
0 0.5 1 Miles
0 0.5 1 Kilometers
Bellingham Coal Mine
Sehome Coal Mine
Pattle Coal Mine
Union Coal Mine?
Silver Beach Coal Mine Claim
Whatcom Creek Coal Mine Claim
Geneva Coal Mine Claim
Manley's Camp Coal Mine Claim
Chuckanut Creek Lk Samish Rd Coal Mine Claim
BELLINGHAM BAY
LAKE WHATCOM
LAKE PADDEN
TOAD LAKE
SQUALICUM HARBOR
NOOKSACK RIVER DELTA
CHUCKANUT BAY
FERNDALE
FAIRHAVEN
GENEVA
CITY LIMITS
URBAN GROWTH BNDY
August 2011
Project: Planning\COB_Geohazards.mxd
Map: Planning\COB_Geohazards.pdf