

**NOTICE OF INTENT  
FOR  
DANISH FLATS PRODUCED  
WATER EVAPORATION PONDS**

Prepared for



Danish Flats Environmental Services, Inc.

July 2010

Prepared by

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Project No. 3067-508-34-02-00

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## **1.0 INTRODUCTION**

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### **1.1 Site Location**

Danish Flats Environmental Services, Inc. (DFES) is the owner and operator of the Danish Flats Produced Water Evaporation Ponds (Danish Flats) facility located in Grand County, Utah in Section 8, Township 20 South, Range 24 East. The site is located approximately 3.0 miles north of Interstate 70 at Exit 212 and approximately 18 miles west of the Utah-Colorado state line.

### **1.2 Site Description**

The permitted facility (under The State of Utah Department of Natural Resources Division of Environmental Quality (UDEQ) Permit to Construct #08-121) consists of eight evaporation ponds with a capacity of approximately 275,000 barrels each, five evaporation ponds with a capacity of approximately 625,000 barrels each and one settlement pond with a capacity of approximately 67,000 barrels. An additional seven ponds have been permitted; however, at this time there are no plans to construct the seven additional ponds. The facility operates 24 hours per day, 7 days per week.

The current maximum throughput of the facility is 2,675,500 barrels (bbl) annually, based on the total surface area of all 13 ponds and the maximum evaporation rate of 60 inches annually, as well as gas scrubber water evaporation of 250 bbl per day. In the truck off-loading area, produced water is pumped from the truck into a receiving tank where initial oil/water phase separation occurs, and then flows to a series of concrete vaults where secondary phase separation occurs. The produced water then flows to the settlement pond for tertiary phase separation, and then to one of the thirteen evaporation ponds. Emissions from the receiving tanks, vaults and condensate storage tanks are collected and controlled in a thermal oxidizer and gas scrubber unit. The facility process is described in greater detail in section 2.0 of this report.

### **1.3 Report Content**

This report describes the process configuration of the site and identifies sources of emissions regulated in the Utah Air Quality Board (UAQB) Rule R307. Emissions at each source are quantified to determine the total site emissions. Equipment deployed on-site is identified, as well as capacities, pertinent dimensions, evaporation rate, and total facility throughput. Please see Appendix A for completed UAQB permit application forms.

## **2.0 SITE PROCESS, EQUIPMENT & CONFIGURATION**

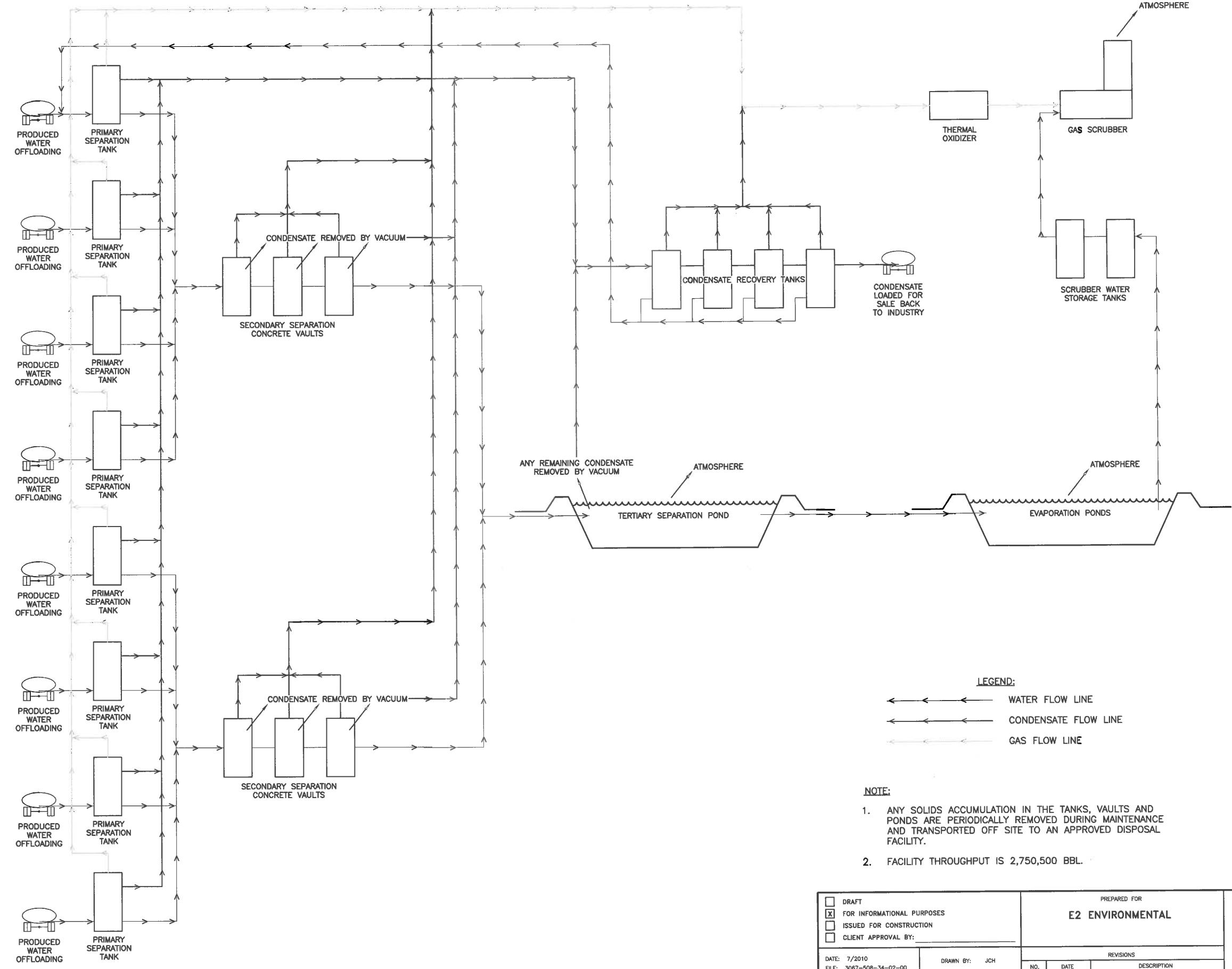
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### **2.1 Site Process Description**

The site accepts produced water generated by the oil & gas industry in the region. Produced water has trace hydrocarbons suspended in the water and the less soluble hydrocarbons can be removed through phase separation. These recovered hydrocarbons are known as condensate and the overall goal of the facilities process train is condensate recovery. The general process, from off-loading to evaporation pond, is described below. Pumping is integral to the transport vehicle, after which the produced water moves through either gravity flow or pumping.

1. Eight 500-barrel tanks will be installed in the receiving area to receive produced water off-loaded from the trucks. These tanks will provide initial oil/water phase separation of the produced water and will also act as surge tanks to provide a more uniform flow to downstream process equipment. Separated water from the tanks will flow to the concrete secondary phase separation vaults (see item 2), while condensate will flow to the condensate recovery tanks (see item 5), and off-gases will be collected and cleansed of pollutants in the thermal oxidizer and gas scrubber units (see item 6). Currently one 500-bbl receiving tank is in place, with four more to be installed before the end of 2010, and three more before the end of 2011.
2. From the primary separation tanks, the produced water flows into a series of three concrete secondary phase separation vaults where further phase separation occurs. The three concrete vaults are operated in parallel with two sets, making a total of six concrete vaults. Condensate that accumulates in the vaults is periodically vacuumed off the surface and transferred to the condensate recovery tanks. Separated water from the vaults flows to the tertiary separation pond, also known as the settlement pond (see item 3), and off gases are collected and cleansed of pollutants in the thermal oxidizer and gas scrubber units (see item 6).

3. Downstream of the concrete secondary separation vaults the produced water flows into a tertiary separation pond, also known as the settlement pond, where further phase separation occurs. Condensate that accumulates on the surface of the settlement pond is periodically skimmed off and transferred to the condensate recovery tanks (see item 5). It is anticipated that condensate will rarely accumulate on the surface of the settlement pond once the new receiving system is fully operational. Separated water from the settlement pond flows to evaporation pond 3, where the water can be transferred to one of the 13 evaporation ponds for storage and evaporation.
4. The evaporation ponds will receive all water treated through the primary separation tanks, concrete vaults and settlement pond. When the ponds are filled to freeboard elevation, they will have a maximum evaporation capacity of 2,598,850 bbl annually (see evaporative capacity calculation, Appendix B).
5. Four 500-barrel tanks will be installed adjacent to the receiving tanks to recover condensate collected in the various process stages before sale back to industry. These tanks will receive oil/condensate from the primary phase separation tanks, secondary phase separation vaults and settlement pond. Recovered condensate will be periodically off-loaded onto trucks and transported off-site for sale. Off-gases will be collected and cleansed of pollutants in the thermal oxidizer and gas scrubber units (see item 6).
6. A thermal oxidizer and gas scrubber will receive off-gases from the receiving tanks, concrete vaults, and condensate recovery tanks. The thermal oxidizer will achieve a minimum percent removal rate of Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs) of 98%, with the actual removal rate expected to be upwards of 99.5%. The gas scrubber uses water to scrub the exhaust gases from the thermal oxidizer. The water used is obtained on-site from the evaporation ponds, and stored in one of two scrubber water storage tanks for use in the gas scrubber. Scrubber water is evaporated in the scrubber unit with a maximum throughput of 210 bbl per day, and any sediment accumulations are periodically collected and disposed of off-site.



<input type="checkbox"/> DRAFT <input checked="" type="checkbox"/> FOR INFORMATIONAL PURPOSES <input type="checkbox"/> ISSUED FOR CONSTRUCTION <input type="checkbox"/> CLIENT APPROVAL BY: _____		PREPARED FOR <b>E2 ENVIRONMENTAL</b>		<b>DANISH FLATS PRODUCED WATER PONDS PROCESS DIAGRAM</b> GRAND COUNTY, UTAH	
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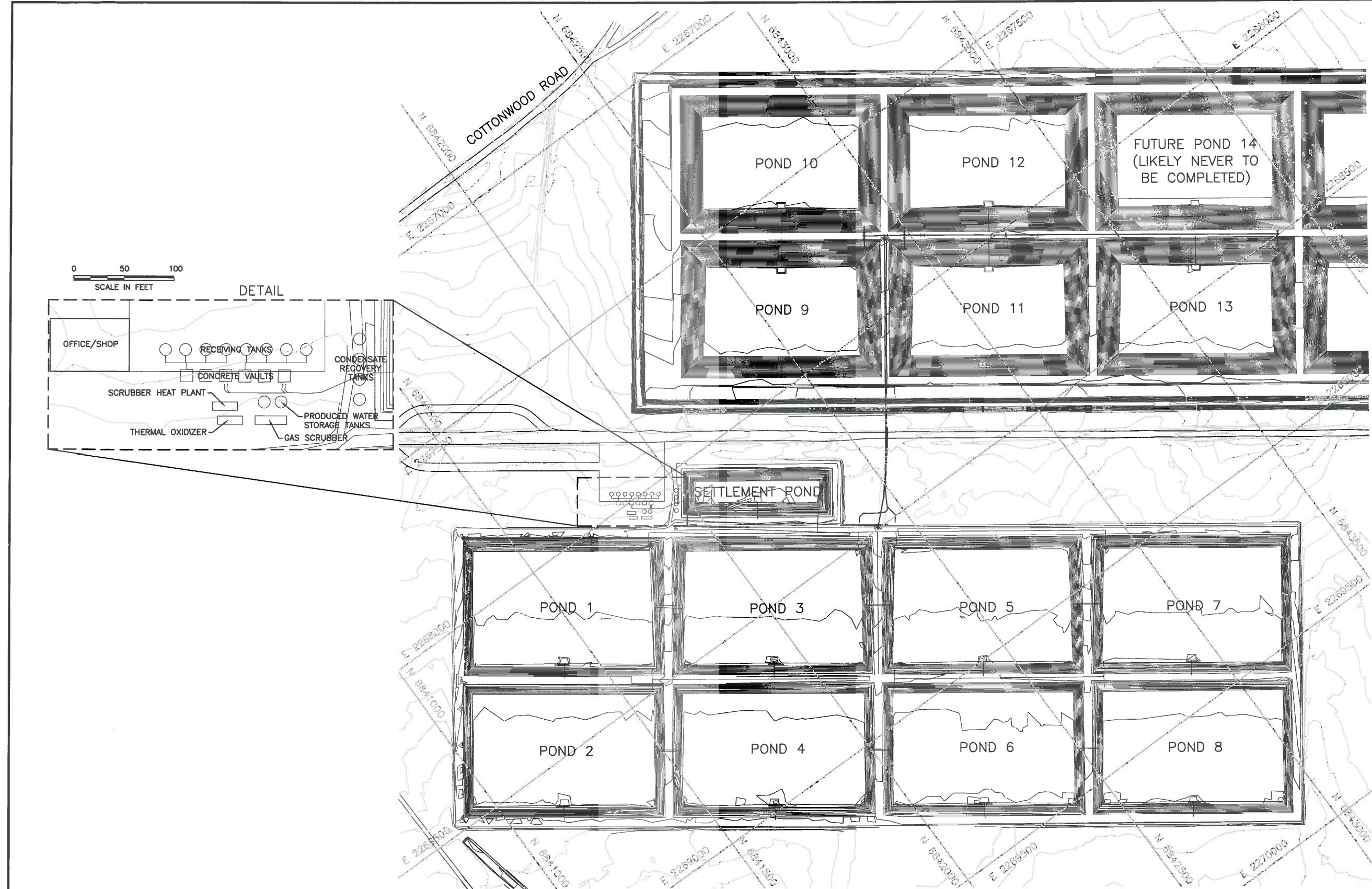
## **2.3 Site Equipment**

The following equipment will be in use on-site:

- Eight (8) 500 bbl Receiving Tanks
- Six (6) 410 bbl Concrete Vaults
- Four (4) 500 bbl Condensate Storage Tanks
- Two (2) 500 bbl Scrubber Water Storage Tanks
- One (1) Thermal Oxidizer manufactured by Purestream Technologies, this is a fully operational prototype unit.
- One (1) Gas Scrubber manufactured by Purestream Technologies, this is a fully operational prototype unit.
- One (1) MQ DCA-25SSIU2 Power Generator w/36 hp Isuzu AA-4LE2 diesel engine
- One (1) MQ DCA-125USJ Power Generator w/165 hp John Deere 6068TF275 diesel engine
- One (1) Bobcat S250 Skidsteer Loader w/ 75 hp Kubota V3300 diesel engine
- One (1) Terex AL4000 Light Tower w/13.6 hp Kubota 5KBXL01.3BCC diesel engine
- Two (2) Global Pump 4GSTAP Pumps w/ 36 hp diesel engine
- One (1) Godwin CD150M Pump w/ 97.2 hp diesel engine

DFES may use enhanced evaporation at some time in the future. If enhanced evaporation equipment is used on-site, then DFES will revise the applicable portions of the air permit, and will proceed with installation per interim approval of the revised permit. Enhanced evaporation will only affect facility emissions if it allows for an increased throughput beyond the current maximum of 2,675,500 bbl.

DFES will operate natural gas fired process heaters on 14 of the sites tanks. The gas fired heaters are NATCO model SB16-18 with a heat rating of 500,000 BTU/hr. These heaters are thermostatically controlled to maintain tank temperatures of 120° F in the four condensate recovery tanks and prevent freezing in any of the site's other 10 tanks.



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DANISH FLATS  
PRODUCED WATER PONDS  
SITE PLAN  
GRAND COUNTY, UTAH

Weaver Boos Consultants  
CHICAGO, IL DENVER, CO SOUTH BEND, IN  
NAPERVILLE, IL FORT WORTH, TX COLUMBUS, OH  
SPRINGFIELD, IL GRIFFITH, IN ST. LOUIS, MO

## 3.0 EMISSION ESTIMATIONS

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Site emissions were estimated by evaluating emissions from the following sources:

- primary separation tanks
- concrete vaults
- storage tanks
- settlement pond
- evaporation ponds
- condensate truck load-out
- fugitives from the process train
- particulates due to vehicle traffic
- natural gas combustion
- diesel combustion

Emissions from the thermal oxidizer and gas scrubber units are included in the natural gas combustion and evaporation pond emissions, since the thermal oxidizer burns natural gas, and any emissions due to pond water evaporated in the scrubber have been accounted for in the pond mass balance emissions calculations. Emissions from the primary separation tanks, concrete vaults, storage tanks, condensate truck load-out, fugitives from the process train, particulates due to vehicle traffic, natural gas combustion and diesel combustion were all estimated using methods prescribed by the Environmental Protection Agency (EPA).

### Settlement Pond & Evaporation Pond Emissions Estimates

Settlement pond and evaporation pond emissions were estimated using a mass balance approach with assumption that certain compounds present in the waste stream would volatize to the atmosphere after discharge into the settlement pond. The volatility of various compounds was considered in order to determine the likelihood of these compounds volatizing before being collected and contained. Volatility of carbon compounds generally decreases as the carbon chain gets longer, since longer carbon

chains become enmeshed in each other and more energy is needed to separate them versus short chain molecules, which have weaker forces of attraction for each other. Vapor pressure, boiling point, and volatility are all directly related as a rough measure of the amount of energy necessary to separate a liquid molecule from its nearest neighbor to form a gas molecule, therefore the following table of hydrocarbon alkanes provides a generalization for hydrocarbon volatility; however, boiling points will be different for various isomers, presence of a hydroxyl group, etc.

Table 3-1: Hydrocarbon Alkanes Boiling Point			
Name	Molecular Formula	Boiling Point (°C)	State @ 25°C
Methane	CH <sub>4</sub>	-164	Gas
Ethane	C <sub>2</sub> H <sub>6</sub>	-89	Gas
Propane	C <sub>3</sub> H <sub>8</sub>	-42	Gas
Butane	C <sub>4</sub> H <sub>10</sub>	-0.5	Gas
Pentane	C <sub>5</sub> H <sub>12</sub>	36	Liquid
Hexane	C <sub>6</sub> H <sub>14</sub>	69	Liquid
Heptane	C <sub>7</sub> H <sub>16</sub>	98	Liquid
Octane	C <sub>8</sub> H <sub>18</sub>	125	Liquid
Nonane	C <sub>9</sub> H <sub>20</sub>	151	Liquid
Decane	C <sub>10</sub> H <sub>22</sub>	174	Liquid
Undecane	C <sub>11</sub> H <sub>24</sub>	196	Liquid
Dodecane	C <sub>12</sub> H <sub>26</sub>	216	Liquid
Eicosane	C <sub>20</sub> H <sub>42</sub>	343	Solid
Triacontane	C <sub>30</sub> H <sub>62</sub>	450	Solid

In the evaporation ponds, any carbon chain C28 and shorter is assumed to volatize, thereby only hydrocarbon solids (paraffin wax) remain in the pond after hydrocarbon volatization. Therefore all gasoline and diesel range organics present in the evaporation ponds are included in the evaporation pond emissions.

In the settlement pond, it was assumed that any carbon chains of C10 and shorter would have sufficient vapor pressure to readily volatize at any time, thereby 100% of carbon chains C10 and shorter present in the waste stream are emitted to the atmosphere. Carbon chains of C10 and longer present in the water are assumed to be collected and contained

(skimmed off to the condensate recovery tanks) before volatizing, or discharged to the evaporation impoundments; therefore, they are not included in the settlement pond emissions. All gasoline range organics present in the settlement pond are included in the settlement pond emissions, while diesel range organics and heavy oils and solids will collect on the pond surface and be skimmed off before volatilization. It is assumed that all HAPs in the settlement pond will volatize, which is a conservative estimate given that HAPs make up over 8% by weight of the condensate recovered at the settlement pond, therefore proving that many HAPs are collected before they volatize. Also the VOC emissions estimate will be a conservative value since gasoline range organics make up over 50% of the condensate recovered at the settlement pond, again proving that many gasoline range organics are collected before they volatize.

### Methanol

Methanol emissions were estimated by averaging the concentration of methanol found in the settlement pond and evaporation pond #3. Methanol is added at various stages in the production of oil and gas to prevent freezing during the winter months. Methanol is not added during the summer months, when there is no risk of freezing. Since the water sampling was conducted in early May, when a high concentration of methanol still exists from winter operations, it is likely that the concentration of methanol found in the settlement pond was at or near its seasonal high, and the annual average will be less. By averaging the concentrations in the settlement pond and evaporation pond #3, the estimated emissions should more accurately reflect the annual average, since the evaporation pond concentration has been better diluted over the seasons to reflect the annual average.

Methanol is an alcohol with a short carbon chain; therefore, the hydroxyl group dictates the polarity of the molecule, causing a dipole moment very similar in strength to that of water. Given that water and methanol are both polar molecules, hydrogen bonds readily form between the two. Because of this hydrogen bonding, methanol will mix in water in all proportions, forming a homogenous solution, and will not phase separate.

Methanol is produced naturally in the anaerobic metabolism of many varieties of bacteria, and as a result, there is a small fraction of methanol vapor in the atmosphere naturally. Over the course of several days, atmospheric methanol is oxidized with the help of sunlight to form carbon dioxide and water.

### Site Throughput Values

For emissions estimates from produced water, it was assumed the water is 0.25% condensate by volume. This is a conservative estimate given that actual condensate recovery for the facility was 0.19% in 2009. Emissions for tanks and vaults were calculated using the volume of the condensate only, since emissions from the water component are negligible (compounds dissolved in the water cannot volatize due to the layer of condensate on the water surface). Since the total site throughput is 2,675,500 bbl, then the volume of condensate throughput is 6,690 bbl (280,980 gal).

### **3.1 Primary Separation Tanks (Receiving Area)**

All produced water accepted at the facility will pass through one of the eight 500 bbl receiving tanks, therefore the annual condensate throughput for each tank is  $6,690 \text{ bbl} / 8 = 836.25 \text{ bbl}$  (35,123 gal). Emissions from the tanks were estimated using EPA TANKS version 4.0.9d, using condensate data from actual samples taken from the facilities condensate holding tank. The following is a summary of the estimated emissions, with full program output presented in Appendix B. This is a controlled emission, since the primary separation tanks will be closed loop tied to the thermal oxidizer/gas scrubber unit, where VOC and HAP emissions will be destroyed.

COMPONENT	RESULTS lbs (tons)
Volatile Organic Compounds (VOCs)	101.80 (0.05)
Benzene	1.61 (0.00)
Toluene	0.01 (0.00)
Ethyl benzene	0.06 (0.00)
Xylenes	0.99 (0.00)
Hexane	37.42 (0.02)
Total Hazardous Air Pollutants (HAPs)	40.09 (0.02)
Total VOC Emissions for all 8 Tanks	814.40 (0.41)
Total HAP Emission for all 8 Tanks	320.72 (0.16)

### **3.2 Concrete Vaults**

Produced water leaving the primary separation (receiving) tanks will undergo secondary phase separation in one of six 410 bbl concrete vaults. Since the produced water entering

the concrete vaults has already undergone phase separation at the receiving tanks, the assumed condensate concentration is reduced by 50%, from 0.25% condensate by volume to 0.125% condensate by volume. This is a conservative estimate, as condensate removal efficiency for the receiving tanks is anticipated to be greater than 50%. Given the reduction, the annual condensate throughput for the concrete vaults is  $6,690 \text{ bbl} \times 0.5 = 3,345 \text{ bbl}$  (140,490 gal). The vaults are operated in dual series; therefore, three vaults operate in series, providing secondary phase separation for half of the site's total throughput, which is  $3,345 \text{ bbl} / 2 = 1,673 \text{ bbl}$  (70,266 gal).

Emissions from the vaults were estimated using EPA TANKS version 4.0.9d, using condensate data from actual samples taken from the facilities condensate holding tank. The vaults were modeled as a 410 bbl fixed roof tank with a free water surface area equal to that of the concrete vaults. The following is a summary of the estimated emissions, with full program output presented in Appendix B. This is a controlled emission, since the concrete vaults are closed loop tied to the thermal oxidizer/gas scrubber unit, where VOC and HAP emissions will be destroyed.

COMPONENT	RESULTS lbs (tons)
Volatile Organic Compounds (VOCs)	228.53 (0.11)
Benzene	3.60 (0.00)
Toluene	0.03 (0.00)
Ethyl benzene	0.13 (0.00)
Xylenes	2.18 (0.00)
Hexane	83.95 (0.04)
Total Hazardous Air Pollutants (HAPs)	89.89 (0.04)
Total VOC Emissions for all 6 Vaults	1,371.18 (0.69)
Total HAP Emission for all 6 Vaults	539.34 (0.27)

### 3.3 Storage Tanks

All condensate recovered in the primary phase separation tanks, secondary phase separation vaults, and settlement pond will be stored in one of the four 500 bbl condensate storage tanks. The tanks are operated in series, and condensate recovered is transported off-site for sale back to the industry. Since the tanks are operated in series, the total condensate throughput of each tank is equal to volume of condensate recovered

at the facility, which is 6,690 bbl (280,980 gal). Emissions from the tanks were estimated using EPA TANKS version 4.0.9d, using condensate data from actual samples taken from the facilities condensate holding tank. The following is a summary of the estimated emissions, with full program output presented in Appendix B. This is a controlled emission, since the storage tanks will be closed loop tied to the thermal oxidizer/gas scrubber unit, where VOC and HAP emissions will be destroyed.

COMPONENT	RESULTS lbs (tons)
Volatile Organic Compounds (VOCs)	551.23 (0.28)
Benzene	8.72 (0.00)
Toluene	0.06 (0.00)
Ethyl benzene	0.32 (0.00)
Xylenes	5.34 (0.00)
Hexane	202.63 (0.10)
Total Hazardous Air Pollutants (HAPs)	217.07 (0.11)
Total VOC Emissions for all 4 Tanks	2204.92 (1.10)
Total HAP Emission for all 4 Tanks	868.28 (0.43)

### 3.4 Settlement Pond

Produced water leaving the concrete vaults will undergo tertiary phase separation at the settlement pond. Water samples were collected near the settlement pond inlet to determine settlement pond emissions, however, the facility has not completed upgrading the process train to include all eight 500 bbl receiving tanks, therefore concentrations are greater than the values once the upgrade is complete. Emissions were estimated using the difference between concentrations at the settlement pond inlet and settlement pond discharge and the site throughput. Carbon chains longer than C10 were excluded from the emissions estimate with the assumption that they will be collected and contained or discharged to the evaporation ponds before volatizing, due to their low vapor pressure. This is a conservative estimate since the site currently collects a little over 50% of their gasoline range organics (C10 carbon chains and shorter) at the settlement pond. The table on the following page is a summary of the estimated emissions, with full calculations presented in Appendix B.

COMPONENT	RESULTS tons
Volatile Organic Compounds (VOCs)	25.73
Benzene	2.29
Toluene	4.49
Ethyl benzene	0.13
Xylenes	1.96
Hexane	0.11
Naphthalene	0.14
Total Hazardous Air Pollutants (HAPs)	9.12

### 3.5 Pond Emissions

Pond emissions are estimated using current data from samples collected at the discharge to the facilities existing ponds and the site throughput. Water samples were collected near the settlement pond discharge to determine evaporation pond emissions, however, the facility has not completed upgrading the process train to include all eight 500 bbl receiving tanks; therefore, concentrations are greater than the values once the upgrade is complete. The emissions were estimated using a mass-balance calculation, excluding carbon chains of C28 and longer since they are solids at room temperature, and even when detained in the evaporation ponds for many years, it is extremely unlikely these long carbon chains will volatize. Methanol concentration is an average of the settlement pond and evaporation pond #3 concentrations to better account for the seasonal variation of methanol. Although all methanol emissions are assumed to occur at the evaporation ponds, it is possible that some methanol volatizes at the settlement pond, though these emissions are accounted for since the settlement pond concentration was included in the methanol average. The table on the following page is a summary of the pond emissions, with calculations presented in Appendix B.

COMPONENT	RESULTS tons
Volatile Organic Compounds (VOCs)	19.23
Benzene	0.70
Toluene	2.06
Ethyl benzene	0.10
Xylenes	1.59
Hexane	0.12
Naphthalene	0.00
Total Hazardous Air Pollutants (HAPs)	4.57
Methanol	177.76

### 3.6 Condensate Truck Load-out Emissions

Emissions released while loading the recovered condensate from the storage tanks into trucks to be transported off-site were calculated according to methods prescribed by the EPA in Section 2, Chapter 5 of the AP-42 Compilation of Air Pollutant Emission Factors. The total VOCs released during the loading of trucks was calculated to be 396.18 lbs (0.20 tons) annually. Full calculations are presented in Appendix B.

### 3.7 Fugitive Emissions

Fugitive emissions are considered negligible since the produced water stream has a water content greater than 99%. This assumption is per the US EPA Bulletin Board (Leaks\_OG.WP5; 8/19/1995).

### 3.8 Particulate Emissions due to Vehicle Traffic

The site's roads are unpaved; therefore, a small amount of particulates are released from vehicle traffic. The site practices best management practices to control particulates from vehicle traffic by conditioning the road with magnesium chloride, which hardens the road surface and drastically reduces particulate emissions. Particulate emissions due to vehicle traffic were estimated using equations prescribed by the EPA in Section 2, Chapter 13 of the AP-42 Compilation of Air Pollutant Emission Factors. The total particulates released

due to vehicle traffic on the site were calculated to be 0.31 tons annually. Full calculations are presented in Appendix B.

### 3.9 Natural Gas Combustion Emissions

The site burns natural gas to produce heat in the thermal oxidizer/gas scrubber and tank heaters. The thermal oxidizer and gas scrubber together burn approximately 7,500 SCF of gas in one hour, and these units will operate continuously. The tank heaters operate intermittently to maintain tank temperatures above freezing for water tanks, and above 120° F for condensate tanks. The peak natural gas consumption for a water tank occurs in January, where the average minimum temperature is 13° F and each tank burns approximately 38 SCF of gas in one hour, while the condensate tanks (operating at higher temperatures) burn approximately 73 SCF per hour. In July, when the average maximum temperature is 99° F, water tank freezing is not a concern, and gas consumption in the condensate tanks is approximately 8 SCF per hour. Conservatively averaged over the entire year, the total gas consumption for the 10 water tanks and four condensate tanks is 3,083,520 SCF. Added to the gas consumption of the thermal oxidizer/gas scrubber units, the total annual gas consumption is 68,783,520 SCF. Using emissions factors prescribed by the EPA in Section 4, Chapter 1 of the AP-42 Compilation of Air Pollutant Emission Factors, the natural gas consumption at Danish Flats yields the emissions shown in the chart below. Full calculations are presented in Appendix B.

COMPONENT	RESULTS lbs (tons)
CO <sub>2</sub>	8,254,022 (4127.01)
NO <sub>x</sub>	6,878.35 (3.44)
CO	5,777.82 (2.89)
Particulate Matter (Total)	522.75 (0.26)
Volatile Organic Compounds (VOCs)	378.31 (0.19)

Although exhaust gas from the thermal oxidizer passes through gas scrubber, no NO<sub>x</sub> or particulate matter removal is assumed since the scrubber is a prototype unit, and although fully operational, the unit is still in development. Specifically, the varying pH levels encountered with using produced water in the scrubber affects the efficiency of the unit, and the facility cannot provide consistent operational data at this time.

### **3.10 Diesel Fuel Combustion Emissions**

The site burns diesel fuel in several pieces of equipment, including generators, pumps and a light tower. These pieces of equipment are operated periodically or continuously, depending on the equipment and its use on the site. The following specifies the equipment type and its average daily use:

1. One (1) MQ DCA-25SSIU2 Power Generator w/36 hp Isuzu AA-4LE2 diesel engine used continuously for shop power generation.
2. One (1) MQ DCA-125USJ Power Generator w/165 hp John Deere 6068TF275 diesel engine used intermittently for back up power for thermal oxidizer / gas scrubber control unit. Its intermittent use means emissions are negligible compared to other diesel emissions and overall site emissions; therefore, diesel emissions were multiplied by a 10% factor of safety to account for negligible diesel emissions.
3. One (1) Bobcat S250 Skidsteer Loader w/ 75 hp Kubota V3300 diesel engine used intermittently. Its intermittent use means emissions are negligible compared to other diesel emissions and overall site emissions; therefore, diesel emissions were multiplied by a 10% factor of safety to account for negligible diesel emissions.
4. One (1) Terex AL4000 Light Tower w/13.6 hp Kubota 5KBXL01.3BCC diesel engine used to light the off-loading area during nighttime hours. Average daily use estimated to be 12 hours per day.
5. Two (2) Global Pump 4GSTAP Pumps w/ 36 hp diesel engine used intermittently for pumping operations. Their intermittent use means emissions are negligible compared to other diesel emissions and overall site emissions; therefore, diesel emissions were multiplied by a 10% factor of safety to account for negligible diesel emissions.
6. One (1) Godwin CD150M Pump w/ 97.2 hp diesel engine used frequently to pump water from the settlement pond to evaporation pond 3. Average daily use estimated to be 8 hours per day.

Using emissions factors prescribed by the EPA in Section 3, Chapter 3 of the AP-42 Compilation of Air Pollutant Emission Factors and the estimated average daily use from above, the diesel fuel consumption at Danish Flats yields the emissions shown in the chart below. Full calculations are presented in Appendix B.

COMPONENT	RESULTS lbs (tons)
CO <sub>2</sub>	833,322 (416.66)
NO <sub>x</sub>	22,463.44 (11.23)
CO	4,840.51 (2.42)
SO <sub>x</sub>	1485.49 (0.74)
Particulate Matter (Total)	522.46 (0.26)

## 4.0 SUMMARY OF TOTAL EMMISIONS

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### 4.1 Summary of Emissions from Produced Water (Uncontrolled by Thermal Oxidizer & Gas Scrubber)

PROCESS STAGE	VOCs lbs (tons)	HAPs lbs (tons)
Primary Separation Tanks	0.41	0.16
Concrete Vaults	0.69	0.27
Storage Tanks	1.10	0.43
Settlement Pond	25.73	9.12
Ponds	19.23	4.57
<b>TOTAL</b>	<b>47.16</b>	<b>14.55</b>

### 4.2 Summary of Emissions from Produced Water (Controlled by Thermal Oxidizer & Gas Scrubber)

PROCESS STAGE	VOCs lbs (tons)	HAPs lbs (tons)
Primary Separation Tanks	0.01	0.00
Concrete Vaults	0.01	0.01
Storage Tanks	0.02	0.01
Settlement Pond	25.73	9.12
Ponds	19.23	4.57
<b>TOTAL</b>	<b>45.00</b>	<b>13.71</b>

### 4.3 Summary of Total Site Emissions (Controlled)

POLLUTANT	AMOUNT tons
VOCs	45.00
HAPs	13.71
Methanol	177.76
CO <sub>2</sub>	4,543.67
NO <sub>x</sub>	14.67
SO <sub>x</sub>	0.74
CO	5.31
PM	0.83

## **5.0 BACT ANALYSIS**

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DFES performed the following Best Available Control Technology (BACT) analysis to document that the existing and proposed pollution control technologies will effectively control facility emissions compared to other technologies. Separation technology is the cornerstone of effective emissions control for produced water treatment. By removing hydrocarbons before the water is evaporated, emissions are reduced. Two effective separation technologies exist, as follows:

1. Phase separation by settlement, since hydrocarbons are less dense than water.
2. Dissolved Gas Flotation/Induced Gas Flotation (DGF/IGF), where tiny gas bubbles are introduced to a water column, and oil droplets attach to the bubbles and float to the top.

To demonstrate how the facilities current removal of hydrocarbons from the produced water stream drastically reduces the facility emissions, a mass balance approach was used to estimate emissions due to the condensate, which consist almost entirely of hydrocarbon compounds recovered by the facility. Applying the actual condensate recovery of 0.19% in 2009 to the estimated maximum throughput of 2,675,500 bbl, an estimated 5,083 bbl of condensate is recovered. Using data from a sample obtained at the facilities condensate holding tank and assuming that only C7 and shorter carbon chains have sufficient vapor pressure to readily volatize, the estimated emissions from 5,083 bbl of condensate is 139.66 tons VOC and 101.36 tons HAPs.

Therefore, through the recovery of condensate in the current process train, which only consist of the concrete vaults and settlement pond, facility VOC and HAP emissions are reduced by 139.66 tons and 101.36 tons, respectively. Once the new receiving tanks are fully operational, it is anticipated the rate of condensate recovery will be improved, further reducing site emissions.

Additionally, 2.16 tons VOC and 0.84 tons HAPs are controlled by the thermal oxidizer. Although over \$1 million has been invested in the thermal oxidizer and gas scrubber units, their purpose on-site is for pollution control as well as research and development

and marketing. Since a \$30,000 VOC destruction flare could provide the same pollution control as thermal oxidizer, a flare is used in the BACT analysis. The cost for this emissions reduction is as follows:

PROCESS STAGE	Purchase/ Installation Cost	Annual Operating Cost *
Primary Separation Tanks	\$400,000	\$20,800
Concrete Vaults	\$300,000	\$15,600
Storage Tanks	\$200,000	\$10,400
Settlement Pond	\$150,000	\$17,950
Flare	\$30,000	\$6,500
<b>TOTAL</b>	<b>\$1,080,000</b>	<b>\$71,250</b>

\* Maintenance cost assumes 1 hour per week per component maintenance at \$50/hour, settlement pond maintenance estimated at 1 hour per day, flare maintenance estimated at 2.5 hours per week.

The value of the recovered condensate is approximately \$50/bbl, however this is dependant upon market conditions and transportation cost, which can vary significantly over time. With a 5,083 bbl recovery rate, the total annual value of the recovered product is \$254,150. The assumed component life for the various process train equipment is 20 years, and the assumed interest rate for Danish Flats Environmental Services, Inc. is 7%.

#### Cost Calculation for Current Control Equipment:

$$\text{Annualized Cost (\$/ton of pollutant removed)} = (B+C)/D$$

where: C = Annual Operating Cost (less value of recovered product)

D = Emissions Reduction (tons/yr)

$$B = PV(i / (1 - (1 + i)^{-n}))$$

where: PV = Present value of equipment

i = interest rate (7 %)

n = equipment life (20 years)

$$B = PV \left( \frac{i}{1 - (1 + i)^{-n}} \right) = \$1,080,000 \left( \frac{0.07}{1 - (1 + 0.07)^{-20}} \right) = \$101,944$$

$$\text{Annualized Cost (\$/ton VOC)} = \frac{\$101,944 + \$71,250 - \$254,150}{139.66 \text{ tons}} = -\$580 / \text{ton}$$

$$\text{Annualized Cost} (\$/\text{ton HAP}) = \frac{\$101,944 + \$71,250 - \$254,150}{101.36 \text{ tons}} = -\$798.80 / \text{ton}$$

The facility has a net capital gain by recovering condensate from the waste stream.

Weaver Boos Consultants surveyed other produced water disposal facilities in the region and found that the only other technology that has been effectively and reliably deployed to reduce the concentration of hydrocarbons in the water is a DGF or IGF unit. Danish Flats has concluded that the additional cost of treating the water with a DGF or IGF is not economically feasible, especially considering the limited additional gain in hydrocarbon removal. For the purpose of this analysis, the cost and hydrocarbon removal information for a DGF were evaluated, though this technology is very similar in performance and cost to an IGF.

#### Estimated Emission Reduction With Addition of DGF to Process Train

Deploying a DGF at the site would not effectively reduce the hydrocarbon concentration at the settlement pond discharge, because a DGF would have a hydrocarbon removal efficiency similar to that of the settlement pond. As gas bubbles percolate through the water in a DGF, they serve to accelerate the phase separation by attaching to oil droplets and floating them to the surface more quickly. Since Danish Flats features a settlement pond with a very long water detention time, oil droplets are able to float to the surface naturally before being discharged into the evaporation ponds. Discharge concentrations after treatment in a DGF could even be higher than after treatment in the settlement pond.

For the purpose of this BACT analysis, it is assumed that a DGF could remove condensate with a similar efficiency to the settlement pond, though this isn't necessarily the case.

If a DGF replaced the settlement pond, then settlement pond emissions could be controlled, since the DGF can be closed loop tied to the thermal oxidizer/gas scrubber. Therefore, estimated VOC emissions reduction attributable to the installation of a DGF would be roughly equal to the estimated VOC emissions of the settlement pond.

Not all HAP emissions that currently occur at the settlement pond could be controlled by a DGF. Since HAPs tend to be fairly soluble, there would be a significant flow through, deferring emissions to the evaporation ponds. Removal efficiency all HAPs, except for Xylene, would be less than 25%, and Xylene reduction would be less than 50%;

therefore, the estimated HAP reduction would be 2.77 tons. The cost table on the following page shows the planned annual cost per ton to obtain the VOC emissions reduction of 25.73 tons and HAP reduction of 2.7 tons with the installation of a DGF:

ITEM DESCRIPTION	Quantity	Unit Cost	Total Cost
Coagulant Tank	1	\$7,500	\$7,500
Coagulant & Polymer Feeding Pump	6	\$1,500	\$9,000
Polyblend Unit	1	\$20,000	\$20,000
Transfer Pump	3	\$7,500	\$22,500
Sludge Holding Tank	2	\$35,000	\$70,000
Bottom Solids Press	1	\$250,000	\$250,000
Air operated pump	2	\$1,500	\$1,500
Air Compressor	2	\$5,000	\$10,000
Dissolved Air Flotation Unit	2	\$250,000	\$500,000
Installation Cost (30%)	1	\$267,000	\$267,000
		<b>Total</b>	<b>\$1,157,500</b>

\*Lifetime Maintenance Cost assumes 20 year component life. Therefore lifetime maintenance cost is annual maintenance multiplied by 20 years. Maintenance cost assumed to be 2 hrs per day for DGF and related equipment at \$50/hour.

The estimated annual operating cost of the DGF and related equipment is \$74,750, assuming maintenance activities by one technician of 3 hours per day at \$50/hr and an annual parts allowance of \$20,000.

#### Cost Calculation for DGF Control Equipment:

$$B = PV \left( \frac{i}{1 - (1 + i)^{-n}} \right) = \$1,157,500 \left( \frac{0.07}{1 - (1 + 0.07)^{-20}} \right) = \$109,260$$

$$\text{Annualized Cost} (\$/ton VOC) = \frac{\$109,260 + \$74,750}{25.00 \text{ tons}} = \$7,360 / \text{ton}$$

$$\text{Annualized Cost} (\$/ton HAP) = \frac{\$109,260 + \$74,750}{2.7 \text{ tons}} = \$68,152 / \text{ton}$$

## **6.0 IMPLEMENTATION SCHEDULE**

The process configuration depicted in this Notice of Intent presents the site in its planned future configuration; however, the facility is currently in the process of installing all of the proposed equipment. The remaining equipment yet to be installed is as follows:

1. Seven receiving tanks have yet to be installed and all eight receiving tanks have yet to be tied to the thermal oxidizer to control tank emissions. Estimated completion date for this activity is:
    - a. The first four will be installed by December 31, 2010; and
    - b. The remaining three will be installed by December 31, 2011.
  2. Four condensate recovery tanks have yet to be tied to the thermal oxidizer to control tank emissions. The estimated completion date for this activity is on or about July 2011.

Since the emissions estimates featured in this report do not reflect the concentration reductions anticipated with the installation of all eight receiving tanks, future site emissions will be lower.

**Appendix A**  
**Completed Division Forms**



# Utah Division of Air Quality

## New Source Review Section

Date: 7/22/2010

### Form 1

#### General Information

Application for:

Initial Approval Order

Approval Order Modification

AN APPROVAL ORDER MUST BE ISSUED BEFORE ANY CONSTRUCTION OR INSTALLATION CAN BEGIN. This is not a stand alone document. Please refer to the Permit Application Instructions for specific details required to complete the application. Please print or type all information requested. All information requested must be completed and submitted before an engineering review can be initiated. If you have any questions, contact the Division of Air Quality at (801) 536-4000 and ask to speak with a New Source Review Engineer. Written inquiries may be addressed to: Division of Air Quality, New Source Review Section, P.O. Box 144820, Salt Lake City, Utah 84114-4820.

Applicable base fee for engineering review and filing fee must be submitted with the application.

#### General Owner and Facility Information

1. Company name and address: Danish Flats Environmental Services, Inc. 616 West Monument St Colorado Springs, CO 80905 Phone No.: ( 719 ) 598-9735 Fax No.: ( 719 ) 260-7720	2. Company contact for environmental matters: Cindy L. Nicoll Compliance Officer  Phone No.: ( 719 ) 494-9711 Fax No.: ( 719 ) 260-7720
3. Facility name and address (if different from above): Danish Flats Produced Water Evaporation Ponds 3 Miles North of Interstate 70 at Exit 212 Cisco, UT 84540 Phone no.: ( N/A ) Fax no.: ( N/A )	4. Owners name and address: Danish Flats Environmental Services, Inc. 616 West Monument St Colorado Springs, CO 80905 Phone No.: ( 719 ) 598-9735 Fax No.: ( 719 ) 260-7720
5. County where the facility is located in: Grand County	6. Latitude & longitude, and/or UTM coordinates of plant: 39° 04' 36.1524", -109° 17' 29.0076"
7. Directions to plant or Installation (street address and/or directions to site) (include U.S. Coast and Geodetic Survey map if necessary): East on Interstate 70 to Exit 212 3 Miles North on Cottonwood Rd Facility is to the Right	
8. Identify any current Approval Order(s): N/A AO# _____ Date _____ AO# _____ Date _____ AO# _____ Date _____	AO# _____ Date _____ AO# _____ Date _____ AO# _____ Date _____
9. If request for modification, permit # to be modified: DAQE #EN0141850001-08 DATED: 12/17/2008	
10. Type of business at this facility: Produced Water Disposal	
11. Total company employees greater than 100?  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	12. Standard Industrial Classification Code 1 3 8 9

Approval Order Application  
Form 1 (Continued)

**13. Application for:**

- |   |   |
|---|---|
| <input type="checkbox"/> New construction<br><input type="checkbox"/> Existing equipment operating without permit<br><input checked="" type="checkbox"/> Change of permit condition | <input type="checkbox"/> Modification<br><input type="checkbox"/> Permanent site for Portable Approval Order<br><input type="checkbox"/> Change of location |
|---|---|

**14. For new construction or modification, enter estimated start date:** \_\_\_\_\_ **Estimated completion date:** \_\_\_\_\_

**15. For change of permittee, location or condition, enter date of occurrence:** N/A

**16. For existing equipment in operation without prior permit, enter initial operation date:** \_\_\_\_\_

**17. Has facility been modified or the capacity increased since November 29, 1969:**  Yes  No

**Process Information**

**18. Site plan of facility:** See attached Report, Section 2.4

**19. Flow diagram of entire process to include flow rates and other applicable information:** See attached Report, Section 2.2

**20. Detailed written process and equipment description.** See attached Report, Section 2.0

Description must include:

Process/Equip specific form(s) identified in the instructions

Fuels and their use      Equipment used in process

Raw materials used      Operation schedules

Production rates      (including daily/seasonal variances)

Description of product(s)

Description of changes to process (if applicable)

**21. Does this application contain justifiable confidential data?**  Yes  No

**Emissions Information**

**22. Complete and attach Form 1d, Emissions Information**

Include Material Safety Data Sheets for all chemicals or compounds that may be emitted to the atmosphere.

**23. Identify on the site plan (see #18 above) all emissions points, building dimensions, stack parameters, etc.**

**Air Pollution Control Equipment Information**

**24. List all air pollution control equipment and include equipment specific forms identified in the instructions.**

*See attached report. Facility controls consist of phase separation equipment routed to thermal oxidizer. Gas scrubber is a basic wet scrubber still in R&D phase, and since natural gas combustion is fairly clean, the positive effects of the scrubber are assumed to be negligible.*

**25. List and describe all compliance monitoring devices and/or activities (such as CEM, pressure gages). Compliance monitoring shall consist of quarterly water sampling.**

**26. Submit modeling for the project if required. See attached instructions. N/A**

**27. Attach your proposal of what air pollution control devices, if any, or operating practices represents Best Available Control Technology. Discuss and evaluate all air pollution control technologies relevant to your situation or process. See attached report.**

**28. I hereby certify that the information and data submitted in and with this application is completely true, accurate and complete, based on reasonable inquiry made by me and to the best of my knowledge and belief.**

Signature:

Title: Compliance Officer

29. Cindy L. Nicoll

30. Telephone Number:  
( 719 ) 494-9711

30. Date: 7/22/2010

Name (Type or print)



## Utah Division of Air Quality New Source Review Section

### Form 1d Emissions Information

Company: Danish Flats Environmental Services, Inc.  
Site/Source: Danish Flats Produced Water Evap. Ponds  
Date: 7/22/2010

Please print neatly or type all information requested. All information must be truthful, accurate and complete before we can process your application. If you have any questions, call (801) 536-4000 and ask to speak with a New Source Review engineer. Written inquiries may be addressed to: Division of Air Quality, NSR Section, P.O. Box 144820, Salt Lake City, Utah 84114-4820.

**Table 1. Proposed Emissions**

Pollutant	Permitted Emissions (tons/year)	Emissions Increases (tons/year)	Proposed Emissions (tons/year)
PM <sub>TOTAL</sub> (PM <sub>2.5</sub> + PM <sub>10</sub> )			0.83
SO <sub>2</sub>			0.74
NO <sub>x</sub>			14.67
CO			5.31
VOC			45.00
Hazardous Air Pollutants (total)			13.71
Hazardous Air Pollutants (list individually) (attach additional sheet if needed)			
Benzene			3.00
Toluene			6.55
Ethyl benzene			0.23
Xylenes			3.55
Hexane			0.24
Naphthalene			0.14
other pollutants (list) (attach additional sheet if needed)			
Methanol			177.76
CO <sub>2</sub>			4,543.67

**Utah Division of Air Quality  
Approval Order Application  
Form 1d  
Emissions Information**

**Table 2. Controlled and Uncontrolled Emissions**

**Utah Division of Air Quality  
Approval Order Application  
Form 1d  
Emissions Information**

**Table 3. Hourly HAP Emissions**

Hazardous Air Pollutants (list individually)	Maximum emission rate (lbs/hour)
Benzene	2.08
Toluene	4.55
Ethyl benzene	0.16
Xylenes	2.47
Hexane	0.17
Naphthalene	0.10

\* Maximum Hourly Emissions Rate assumes annual HAP emissions are released over a 4 month period (i.e. the summer evaporation season).

**Utah Division of Air Quality  
Approval Order Application  
Form 1d  
Emissions Information**

**Instructions**

- Table 1.** Fill out the table. Attach additional sheets if necessary. Provide potential emissions from your entire facility in units of tons per year, expressed to at least two decimal places. Emissions of individual Hazardous Air Pollutants may require more precision; contact a New Source Review Engineer. If you do not now have an Approval Order and you are applying for your first Approval Order, the emissions in "Existing Emissions" column will be zero and the "Emissions Increases" will be equal to the "Proposed "Emissions. If you do have an Approval Order, the emissions in the "Existing Emissions" column will be the emissions listed in your Approval Order. All emissions should be those emissions occurring **after** any air pollution control devices. Provide emissions that would result if you operated 24 hours per day, 8760 hours per year, **unless** you are also proposing operating hour limits. If you are proposing operating hour limits, state what these limits are and provide emissions based on these limits. Provide emissions that would result from your potential production or potential raw material consumption, **unless** you are also proposing production or raw material consumption limits. If you are proposing production or raw material consumption limits, state what these limits are and provide emissions based on these limits. **Attach additional sheets with detailed calculations or stack testing information showing how all of the above emission numbers were determined.**
- Table 2.** Fill out the table. Attach additional sheets if necessary. Provide potential emissions from your entire facility in units of tons per year, expressed to at least two decimal places. Emissions of individual Hazardous Air Pollutants may require more precision; contact a New Source Review Engineer. The Hazardous Air Pollutants should be the same Hazardous Air Pollutants listed in Table 1. The emissions in the "Controlled Emissions" column shoud be those emissions occurring **after** any air pollution control devices. The emissions in the "Uncontrolled Emissions" should be those emissions occurring **before** any air pollution control devices (in other words, emissions that would result if you did not have any air pollution control devices at all). Provide emissions that would result if you operated 24 hours per day, 8760 hours per year, **unless** you are also proposing operating hour limits. If you are proposing operating hour limits, state what these limits are and provide emissions based on these limits. Provide emissions that would result from your potential production or potential raw material consumption, **unless** you are also proposing production or raw material consumption limits. If you are proposing production or raw material consumption limits, state what these limits are and provide emissions based on these limits. **Attach additional sheets with detailed calculations or stack testing information showing how all of the above emission numbers were determined.**
- Table 3.** List all Hazardous Air Pollutants emitted by your facility. They should be the same Hazardous Air Pollutants listed in tables 1 and 2. For each HAP provide its maximum emission rate in units of pounds per hour. The emission rates should be those rates occurring **after** any air pollution control devices. **Attach additional sheets with detailed calculations or stack testing information showing how all of the above emission numbers were determined.**

**Depending on other conditions unique to each facility, additional emissions information may be required.**

**Appendix B**  
**Calculations & Computer Models**

**TANKS 4.0.9d****Emissions Report - Detail Format****Tank Identification and Physical Characteristics****Identification**

User Identification: Danish Flats Receiving Tanks  
City: Cisco  
State: Utah  
Company: Danish Flats Environmental Services, LLC  
Type of Tank: Vertical Fixed Roof Tank  
Description: 500 bbl Steel Receiving Tank

**Tank Dimensions**

Shell Height (ft): 25.00  
Diameter (ft): 12.00  
Liquid Height (ft): 24.00  
Avg. Liquid Height (ft): 24.00  
Volume (gallons): 20,304.71  
Turnovers: 1.68  
Net Throughput(gal/yr): 35,123.00  
Is Tank Heated (y/n): N

**Paint Characteristics**  
Shell Color/Shade: Red/Primer  
Shell Condition: Good  
Roof Color/Shade: Red/Primer  
Roof Condition: Good

**Roof Characteristics**

Type: Dome  
Height (ft) 0.01  
Radius (ft) (Dome Roof) 12.00

**Breather Vent Settings**

Vacuum Settings (psig): -1.00  
Pressure Settings (psig) 0.00

Meteorological Data used in Emissions Calculations: Grand Junction, Colorado (Avg Atmospheric Pressure = 12.37 psia)

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Liquid Contents of Storage Tank**

**Danish Flats Receiving Tanks - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Mixture/Component	Month	Avg.	Daily Liquid Temp., Surf. Min.	Daily Liquid Temp., Bulk Max. (deg F)	Vapor Pressure (psia) Avg.	Vapor Pressure (psia) Min.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Danish Flats Condensate	All	66.46	52.01	80.91	57.27	0.8753	0.6089	1.2318	84.4626	0.0943	111.30
2,2,4-Trimethylpentane (isooctane)						0.7156	0.4712	1.0579	114.2300	0.0040	114.23
Benzene						1.3833	0.3819	2.0296	78.1100	0.0075	0.0158
Butane						28.3769	22.4493	37.7083	58.1200	0.0018	0.0814
Decane (-n)						0.0387	0.0278	0.0537	142.2800	0.2072	0.0121
Ethylbenzene						0.1354	0.0817	0.2170	106.1700	0.0029	0.0006
Heptane (-n)						0.7403	0.4797	1.1164	100.2000	0.1934	0.2156
Hexane (-n)						2.2581	1.5484	3.2147	86.1700	0.1081	0.3676
Isopentane						11.6364	8.3152	15.6096	72.1500	0.0054	0.1123
Nonane (-n)						0.0768	0.0541	0.1084	128.2600	0.1216	0.0141
Octane (-n)						0.1731	0.1190	0.2501	114.2300	0.2821	0.0735
Pentane (-n)						7.8759	5.7094	10.6791	72.1500	0.0078	0.0929
Toluene						0.4025	0.2562	0.6140	92.1300	0.0002	0.0001
Xylenes (mixed isomers)						0.1130	0.0679	0.1820	106.1700	0.0569	0.0097
										106.17	

Option 2: A=6.8118, B=1257.84, C=220.74  
 Option 2: A=6.905, B=1211.033, C=220.79  
 Option 1: VP60 = 26.027 VP70 = 31.212  
 Option 1: VP60 = .033211 VP70 = .041762  
 Option 2: A=6.975, B=1424.255, C=213.21  
 Option 3: A=37358, B=8.2555  
 Option 2: A=6.876, B=1171.17, C=24.41  
 Option 1: VP60 = 10.005 VP70 = 12.53  
 Option 1: VP60 = .065278 VP70 = .08309  
 Option 1: VP60 = .165444 VP70 = .188224  
 Option 3: A=27691, B=7.558  
 Option 2: A=6.954, B=1344.8, C=219.48  
 Option 2: A=7.009, B=1462.266, C=215.11

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Detail Calculations (AP-42)**

**Danish Flats Receiving Tanks - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Annual Emission Calculations	
Standing Losses (lb):	39.9797
Vapor Space Volume (cu ft):	113.6628
Vapor Density (lb/cu ft):	0.0131
Vapor Space Expansion Factor:	0.0770
Ventted Vapor Saturation Factor:	0.9555
Tank Vapor Space Volume:	113.6628
Vapor Space Volume (cu ft):	12.0000
Tank Diameter (ft):	1.0050
Vapor Space Outage (ft):	25.0000
Tank Shell Height (ft):	24.0000
Average Liquid Height (ft):	0.0050
Roof Outage (ft):	0.0050
Roof Outage (Dome Roof):	12.0000
Dome Radius (ft):	6.0000
Shell Radius (ft):	
Vapor Density:	0.0131
Vapor Density (lb/cu ft):	84.4526
Vapor Molecular Weight (lb/lb-mole):	
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.8753
Daily Avg. Liquid Surface Temp. (deg R):	526.1308
Daily Average Ambient Temp. (deg F):	52.9333
Ideal Gas Constant R:	
(psia/ft) / (lb-in-lb-deg R):	10.731
Liquid Bulk Temperature (deg R):	516.9433
Tank Paint Solar Absorptance (Shell):	0.8800
Tank Paint Solar Absorptance (Roof):	0.8800
Daily Total Solar Insulation Factor (Btu/sqft day):	1.578.3125
Vapor Space Expansion Factor:	
Daily Vapor Temperature Range (deg R):	0.0770
Daily Vapor Pressure Range (psia):	57.7875
Breather Vent Press. Setting Range (psia):	0.6229
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.0000
Surface Temperature (psia):	0.8753
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.6089
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	1.2318
Daily Avg. Liquid Surface Temp. (deg R):	526.1308
Daily Min. Liquid Surface Temp. (deg R):	511.6840
Daily Max. Liquid Surface Temp. (deg R):	540.5777
Daily Ambient Temp. Range (deg R):	25.6333
Ventted Vapor Saturation Factor:	0.9555
Ventted Vapor Saturation Factor:	0.9555
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.8753
Vapor Space Outage (ft):	1.0050

Working Losses (lb):	
Vapor Molecular Weight (lb/lb-mole):	61.8250
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	84.4626
Annual Net Throughput (gal/yr):	0.8763
Annual Turnovers:	35,123.0000
Turnover Factor:	1.6799
Maximum Liquid Volume (gal):	1.0000
Maximum Liquid Height (ft):	20,304.7110
Tank Diameter (ft):	24.0000
Working Loss Product Factor:	12.0000
Total Losses (lb):	101.8048

**TANKS 4.0.9d****Emissions Report - Detail Format**  
**Individual Tank Emission Totals****Emissions Report for: Annual****Danish Flats Receiving Tanks - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Components	Losses(lbs)		
	Working Loss	Breathing Loss	Total Emissions
Danish Flats Condensate	61.83	39.98	101.80
Butane	5.04	3.26	8.29
Isopentane	6.95	4.49	11.44
Pentane (-n)	5.74	3.71	9.46
Hexane (-n)	22.73	14.70	37.42
Heptane (-n)	13.33	8.62	21.95
Octane (-n)	4.54	2.94	7.48
Nonane (-n)	0.87	0.56	1.43
Benzene	0.98	0.63	1.61
Toluene	0.01	0.00	0.01
Ethylbenzene	0.04	0.02	0.06
Xylenes (mixed isomers)	0.60	0.39	0.99
2,2,4-Trimethylpentane (isooctane)	0.26	0.17	0.43
Decane (-n)	0.75	0.48	1.23



## TANKS 4.0.9d

### Emissions Report - Detail Format

#### Tank Identification and Physical Characteristics

##### Identification

User Identification: Danish Flats Concrete Vault  
City: Cisco  
State: Utah  
Company: Danish Flats Environmental Services, LLC  
Type of Tank: Vertical Fixed Roof Tank  
Description: 410 bbl Concrete Vault

##### Tank Dimensions

Shell Height (ft): 16.00  
Diameter (ft): 13.54  
Liquid Height (ft): 13.00  
Avg. Liquid Height (ft): 13.00  
Volume (gallons): 14,002.44  
Turnovers: 4.87  
Net Throughput(gal/yr): 70,266.00  
Is Tank Heated (y/n): N

##### Paint Characteristics

Shell Color/Shade: Red/Primer  
Shell Condition: Good  
Roof Color/Shade: Gray/Medium  
Roof Condition: Good

##### Roof Characteristics

Type: Dome  
Height (ft): 0.01  
Radius (ft) (Dome Roof): 13.54

##### Breather Vent Settings

Vacuum Settings (psig): -1.00  
Pressure Settings (psig): 0.00

Meteorological Data used in Emissions Calculations: Grand Junction, Colorado (Avg Atmospheric Pressure = 12.37 psia)

**TANKS 4.0.9d**  
**Emissions Report - Detal**  
**Liquid Contents of Stor**

## Danish Flats Concrete Vault - Vertical Fixed Roof Tank Cisco, Utah

Mixture/Component	Month	Daily Liquid Surf Temperature (deg F) Min.	Avg.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Vapor Pressure (psia) Min.	Vapor Mol. Weight.	Liquid Mol. Weight.	Vapor Mass Fract.	Mol. Weight.	Basis for Vapor Pressure Calculations
Danish Flats Condensate	All	64.80	51.51	78.09	56.64	0.8405	0.6009	1.1543	84.3890	0.0040	0.0042	111.30
2,2,4-Trimethylpentane (isooctane)					0.6830	0.4641	0.9821	114.2300	0.0075	0.0158	114.23	Option 2: A=6.8116, B=1237.84, C=220.74
Benzene					1.3321	0.9185	78.1100	0.0018	0.0824	78.11	Option 2: A=6.905, B=1211.033, C=220.79	
Butane					28.5152	22.2244	35.9736	58.1200	0.0018	0.0122	58.12	Option 1: VP60 = 26.027 VP70 = 31.212
Decane (-n)					0.0373	0.0274	0.0505	142.2900	0.2072	0.0121	142.29	Option 1: VP60 = .033211 VP70 = .041762
Ethylbenzene					0.1280	0.0803	0.1984	106.1700	0.0029	0.0006	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Heptane (-n)					0.7051	0.4723	1.0321	100.2000	0.1934	0.2140	100.20	Option 3: A=37.358, B=8.2855
Hexane (-n)					2.1649	1.5275	3.0057	86.1700	0.1081	0.3673	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Isopentane					11.2167	8.2089	14.7972	72.1500	0.0064	0.1229	72.15	Option 1: VP60 = 10.005 VP70 = 12.53
Nonane (-n)					0.3738	0.0534	0.1014	128.2600	0.1216	0.0141	128.26	Option 1: VP60 = .065278 VP70 = .08309
Octane (-n)					0.1660	0.1174	0.2330	114.2300	0.2821	0.0735	114.23	Option 1: VP60 = 1454.44 VP70 = 188224
Pentane (-n)					7.5966	5.6441	10.0754	72.1500	0.0078	0.034	72.15	Option 3: A=27691, B=7.558
Toluene					0.3827	0.2521	0.5666	92.1300	0.0002	0.0001	92.13	Option 2: A=6.954, B=1344.8 C=219.48
Xylenes (mixed isomers)					0.1068	0.0666	0.1662	106.1700	0.0569	0.0095	106.17	Option 2: A=7.009, B=1462.266, C=215.11

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Detail Calculations (AP-42)**

**Danish Flats Concrete Vault - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Annual Emission Calculations	
Standing Losses (lb):	109,8679
Vapor Space Volume (cu ft):	432,6848
Vapor Density (lb/cu ft):	0,0126
Vapor Space Expansion Factor:	0,0626
Vented Vapor Saturation Factor:	0,8819
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	432,6848
Tank Diameter (ft):	13,5400
Vapor Space Outage (ft):	3,0050
Tank Shell Height (ft):	16,0000
Average Liquid Height (ft):	13,0000
Roof Outage (ft):	0,0050
Roof Outage (Dome Roof)	
Roof Outage (ft):	0,0050
Dome Radius (ft):	13,5400
Shell Radius (ft):	6,7700
Vapor Density	
Vapor Density (lb/cu ft):	0,0126
Vapor Molecular Weight (lb/lb-mole):	84,3890
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	
Daily Avg. Liquid Surface Temp. (deg. R):	0,8405
Daily Avg. Liquid Surface Temp. (deg. F):	524,4688
Ideal Gas Constant R (psia cu ft / lb-mol-deg R):	52,8333
Liquid Bulk Temperature (deg. R):	10,731
Tank Paint Solar Absorptance (Shell):	516,3133
Tank Paint Solar Absorptance (Roof):	0,0590
Daily Total Solar Insulation Factor (Btu/sqft day):	0,6800
1,578,3125	
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0,0626
Daily Vapor Temperature Range (deg. R):	53,1473
Daily Vapor Pressure Range (psia):	0,5534
Breath Vent Press. Setting Range (psia):	1,0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	
Surface Temperature (psia):	0,8405
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0,6009
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	1,1543
Daily Avg. Liquid Surface Temp. (deg R):	524,4688
Daily Min. Liquid Surface Temp. (deg R):	511,1820
Daily Max. Liquid Surface Temp. (deg R):	537,7557
Daily Ambient Temp. Range (deg. R):	25,6333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0,8819
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	
Surface Temperature (psia):	0,8405
Vapor Space Outage (ft):	3,0050

Working Losses (lb):	
Vapor Molecular Weight (lb/lb-mole):	118.6613
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	84.3890
Annual Net Throughput (gal/yr):	0.8405
Turnover Factor:	70,266.0000
Maximum Liquid Volume (gal):	4.8712
Maximum Liquid Height (ft):	1.0000
Tank Diameter (ft):	14,002.4412
Working Loss Product Factor:	13.0000
Total Losses (lb):	13.5400
	1.0000
	228.5292

**TANKS 4.0.9d****Emissions Report - Detail Format**  
**Cisco, Utah**  
**Individual Tank Emission Totals****Emissions Report for: Annual****Danish Flats Concrete Vault - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Components	Losses(lbs)		
	Working Loss	Breathing Loss	Total Emissions
Isopentane	13.39	12.40	25.80
Pentane (-n)	11.08	10.26	21.35
Hexane (-n)	43.59	40.36	83.95
Heptane (-n)	25.40	23.52	48.91
Octane (-n)	8.72	8.07	16.79
Nonane (-n)	1.67	1.55	3.22
Benzene	1.87	1.73	3.60
Toluene	0.01	0.01	0.03
Ethylbenzene	0.07	0.06	0.13
Xylenes (mixed isomers)	1.13	1.05	2.18
Danish Flats Condensate	118.66	109.87	228.53
Butane	9.78	9.05	18.83
2,2,4-Trimethylpentane (isooctane)	0.50	0.47	0.97
Decane (-n)	1.44	1.33	2.77



**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Tank Identification and Physical Characteristics**

**Identification**

User Identification: Danish Flats Condensate Tank  
City: Cisco  
State: Utah  
Company: Danish Flats Environmental Services, LLC  
Type of Tank: Vertical Fixed Roof Tank  
Description: 500 bbl Steel Condensate Recovery Tank

**Tank Dimensions**

Shell Height (ft): 25.00  
Diameter (ft): 12.00  
Liquid Height (ft): 24.00  
Avg. Liquid Height (ft): 24.00  
Volume (gallons): 20,304.71  
Turnovers: 13.44  
Net Throughput(gal/yr): 280,980.00  
Is Tank Heated (y/n): Y

**Paint Characteristics**

Shell Color/Shade: Red/Primer  
Shell Condition: Good  
Roof Color/Shade: Red/Primer  
Roof Condition: Good

**Roof Characteristics**

Type: Dome  
Height (ft): 0.01  
Radius (ft) (Dome Roof): 12.00

**Breather Vent Settings**

Vacuum Settings (psig): 0.00  
Pressure Settings (psig): 0.00

Meteorological Data used in Emissions Calculations: Grand Junction, Colorado (Avg Atmospheric Pressure = 12.37 psia)

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Liquid Contents of Storage Tank**

**Danish Flats Condensate Tank - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Mixture/Component	Month	Daily Liquid Surf Temperatures (deg F)	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Vapor Mol. Weight. Min.	Vapor Mol. Weight. Max.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Danish Flats Condensate	All	66.46	52.01	80.91	57.27	8.8753	0.6089	1.2318	84.4626	Option 2: A=6.8118, B=1257.84, C=220.74
2,2,4-Trimethylpentane (isooctane)						0.7156	0.4712	1.0579	114.2300	Option 2: A=6.905, B=1211.033, C=220.79
Benzene						1.3933	0.9319	2.0296	78.1100	0.0075
Butane						29.3769	22.4493	37.7083	58.1200	0.0018
Decane (-n)						0.0387	0.0278	0.0537	142.2800	0.2072
Ethylbenzene						0.1354	0.0817	0.2170	106.1700	0.0029
Heptane (-n)						0.7403	0.4797	1.1164	100.2000	0.1934
Hexane (-n)						2.2581	1.5484	3.2147	86.1700	0.1081
Isopentane						11.6384	8.3152	15.6096	72.1500	0.0064
Nonane (-n)						0.0763	0.0541	0.1084	128.2600	0.1216
Octane (-n)						0.1731	0.1190	0.2501	114.2300	0.2921
Pentane (-n)						7.8759	5.7094	10.6791	72.1500	0.0078
Toluene						0.4026	0.2562	0.6140	92.1300	0.0002
Xylenes (mixed isomers)						0.1130	0.0679	0.1820	106.1700	0.0569
									0.0097	106.17

**TANKS 4.0.9d**  
**Emissions Report - Detail Format**  
**Detail Calculations (AP-42)**

**Danish Flats Condensate Tank - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Annual Emission Calculations	
Standing Losses (lb):	56.6363
Vapor Space Volume (cu ft):	113.6628
Vapor Density (lb/cu ft):	0.0131
Vapor Space Expansion Factor:	0.1091
Vented Vapor Saturation Factor:	0.9555
Tank Vapor Space Volume:	113.6628
Vapor Space Volume (cu ft):	12.0000
Tank Diameter (ft):	1.0050
Vapor Space Outage (ft):	25.0000
Tank Shell Height (ft):	24.0000
Average Liquid Height (ft):	0.0050
Roof Outage (Dome Roof)	0.0050
Roof Outage (ft):	12.0000
Dome Radius (ft):	6.0000
Shell Radius (ft):	
Vapor Density	0.0131
Vapor Density (lb/cu ft):	84.4626
Vapor Molecular Weight (lb/lb-mole):	
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.8753
Daily Avg. Liquid Surface Temp. (deg. R):	526.1308
Daily Average Ambient Temp. (deg. F):	52.8333
Ideal Gas Constant R:	
(psia-cuft.)/(lb-mol-deg R):	10.731
Liquid Bulk Temperature (deg. R):	516.9433
Tank Paint Solar Absorbance (Shell):	0.8900
Tank Paint Solar Absorbance (Roof):	0.8900
Daily Total Solar Insulation Factor (Btu/sqft day):	1.578.3125
Vapor Space Expansion Factor	0.1091
Vapor Space Expansion Factor:	0.89938
Daily Vapor Temperature Range (deg. R):	28.8938
Daily Vapor Pressure Range (psia):	0.6229
Breather Vent Press. Setting Range (psia):	0.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.8753
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.6089
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	1.2318
Daily Avg. Liquid Surface Temp. (deg R):	526.1308
Daily Min. Liquid Surface Temp. (deg R):	511.8840
Daily Max. Liquid Surface Temp. (deg R):	540.5777
Daily Ambient Temp. Range (deg. R):	25.6333
Vented Vapor Saturation Factor	0.9555
Vented Vapor Saturation Factor:	0.9555
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.8753
Vapor Space Outage (ft):	1.0050

Working Losses (lb):	
Vapor Molecular Weight (lb/lb-mole):	494.5933
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	84.4626
Annual Net Throughput (gal/yr.):	0.8753
Annual Turnovers:	280,980.0000
Turnover Factor:	13.4390
Maximum Liquid Volume (gal):	1.0000
Maximum Liquid Height (ft):	20,304.7110
Tank Diameter (ft):	24.0000
Working Loss Product Factor:	12.0000
Total Losses (lb):	1,0000
	551.2296

**TANKS 4.0.9d****Emissions Report - Detail Format**  
**Cisco, Utah**  
**Individual Tank Emission Totals****Emissions Report for: Annual****Danish Flats Condensate Tank - Vertical Fixed Roof Tank**  
**Cisco, Utah**

Components	Working Loss	Losses(lbs)	
		Breathing Loss	Total Emissions
Isopentane	55.57	6.36	61.93
Pentane (-n)	45.96	5.26	51.22
Hexane (-n)	181.81	20.82	202.63
Heptane (-n)	106.63	12.21	118.84
Octane (-n)	36.36	4.16	40.52
Nonane (-n)	6.95	0.80	7.75
Benzene	7.83	0.90	8.72
Toluene	0.06	0.01	0.06
Ethylbenzene	0.29	0.03	0.32
Xylenes (mixed isomers)	4.79	0.55	5.34
2,2,4-Trimethylpentane (isooctane)	2.11	0.24	2.35
Decane (-n)	5.98	0.68	6.66
Danish Flats Condensate	494.59	56.64	551.23
Butane	40.28	4.61	44.89



# Weaver Boos Consultants, LLC

Sheet 1 of 2  
File #: 3067-508-34  
Calculation #: 1

Made By: JCH

Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds

Checked By: NCN

Date: 7/22/2010

Settlement Pond Emissions Calculation

**Objective:** To determine the total Volatile Organic Compound (VOC) and Hazardous Air Pollutant (HAP) emissions from the Danish Flats facility settlement pond, using the settlement pond inlet and discharge water sampling results.

**Method:** To estimate emissions, apply a mass balance relationship with the assumption that VOC and HAP compounds present in the waste stream will be emitted to the ambient air as a result of evaporation/volatilization. Assume only carbon chains of C10 and shorter (Gasoline Range Organics) have a sufficiently high vapor pressure to volatize prior to being skimmed off the pond surface. Use the difference in inlet and discharge concentrations to account for hydrocarbon flow through.

**Given:** The concentration of VOCs in the water, based on laboratory data (See Appendix D), is as follows:  
 $82 \text{ mg/L} - 27 \text{ mg/L} = 55 \text{ mg/L}$  Volatile Hydrocarbons

The concentration of HAPs in the water, based on the attached laboratory data, is as follows:

$$\begin{aligned} 6,400 \mu\text{g/L} - 1,500 \mu\text{g/L} &= 4,900 \mu\text{g/L} = 4.9 \text{ mg/L Benzene} \\ 14,000 \mu\text{g/L} - 4,400 \mu\text{g/L} &= 9,600 \mu\text{g/L} = 9.6 \text{ mg/L Toluene} \\ 500 \mu\text{g/L} - 220 \mu\text{g/L} &= 280 \mu\text{g/L} = 0.28 \text{ mg/L Ethylbenzene} \\ 7,600 \mu\text{g/L} - 3,400 \mu\text{g/L} &= 4,200 \mu\text{g/L} = 4.2 \text{ mg/L Xylenes} \\ 480 \mu\text{g/L} - 250 \mu\text{g/L} &= 230 \mu\text{g/L} = .25 \text{ mg/L Hexane} \\ 290 \mu\text{g/L} - 0 \mu\text{g/L} &= 290 \mu\text{g/L} = .29 \text{ mg/L Naphthalene} \end{aligned}$$

The estimated maximum annual throughput of produced water is 2,675,500 barrels.

**Calculations:** Emission calculations:

Annual VOC emission calculation:

$$\frac{55 \text{ mg VOC}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{25.73 \text{ tons VOC}}{\text{year}}$$

Annual Benzene emission calculation:

$$\frac{4.9 \text{ mg Benzene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{2.29 \text{ tons Benzene}}{\text{year}}$$

Annual Toluene emission calculation:

$$\frac{9.6 \text{ mg Toluene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{4.49 \text{ tons Toluene}}{\text{year}}$$

# Weaver Boos Consultants, LLC

Sheet 2 of 2  
File #: 3067-508-34  
Calculation #: 1

Made By: JCH

Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
Settlement Pond Emissions Calculation

Checked By: NCN

Date: 7/22/2010

Annual Ethylbenzene emission calculation:

$$\frac{0.28 \text{ mg Ethylbenzene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.13 \text{ tons Ethylbenzene}}{\text{year}}$$

Annual Xylenes emission calculation:

$$\frac{4.2 \text{ mg Xylenes}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{1.96 \text{ tons Xylenes}}{\text{year}}$$

Annual Hexane emission calculation:

$$\frac{.23 \text{ mg Hexane}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.11 \text{ tons Hexane}}{\text{year}}$$

Annual Naphthalene emission calculation:

$$\frac{.29 \text{ mg Naphthalene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.14 \text{ tons Naphthalene}}{\text{year}}$$

## Solution

Total VOC emissions: 25.73 TPY

Total HAP emissions: 9.12 TPY

# Weaver Boos Consultants, LLC

Sheet 1 of 2  
File #: 3067-508-34  
Calculation #: 2

Made By: JCH  
Checked By: NCN

Date: 7/22/2010  
Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
Pond Emissions Calculation

**Objective:** To determine the total Volatile Organic Compound (VOC) and Hazardous Air Pollutant (HAP) emissions from the Danish Flats facility ponds using the settlement pond discharge water sampling results.

**Method:** To estimate emissions, apply a mass balance relationship with the assumption that VOC and HAP compounds present in the waste stream will be emitted to the ambient air as a result of evaporation/volatilization. Assume only carbon chains of C28 and shorter (Diesel & Gasoline Range Organics) have a sufficiently high vapor pressure to volatize. Use the average settlement pond and evaporation pond #3 methanol concentrations to account for seasonal variation.

**Given:** The concentration of VOCs in the water, based on laboratory data (See Appendix D), is as follows:  
**41.1 mg/L Volatile Hydrocarbons**

The concentration of methanol in the water, based on laboratory data (See Appendix D), is as follows:  
**520 mg/L + 240 mg/L = 760 mg/L / 2 = 380 mg/L Methanol**

The concentration of HAPs in the water, based on the attached laboratory data, is as follows:

**1,500 µg/L = 1.5 mg/L Benzene**  
**4,400 µg /L = 4.4 mg/L Toluene**  
**220 µg /L = 0.22 mg/L Ethylbenzene**  
**3,400 µg /L = 3.4 mg/L Xylenes**  
**250 µg /L = .25 mg/L Hexane**  
**0 µg /L = 0 mg/L Naphthalene**

The estimated maximum annual throughput of produced water is 2,675,500 barrels.

**Calculations:** Emission calculations:

Annual VOC emission calculation:

$$\frac{41.1 \text{ mg VOC}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{19.23 \text{ tons VOC}}{\text{year}}$$

Annual Benzene emission calculation:

$$\frac{1.5 \text{ mg Benzene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.70 \text{ tons Benzene}}{\text{year}}$$

Annual Toluene emission calculation:

$$\frac{4.4 \text{ mg Toluene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{2.06 \text{ tons Toluene}}{\text{year}}$$

# Weaver Boos Consultants, LLC

Sheet 2 of 2  
File #: 3067-508-34  
Calculation #: 2

Made By: JCH

Checked By: NCN

Date: 7/22/2010

Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
Pond Emissions Calculation

Annual Ethylbenzene emission calculation:

$$\frac{0.22 \text{ mg Ethylbenzene}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.10 \text{ tons Ethylbenzene}}{\text{year}}$$

Annual Xylenes emission calculation:

$$\frac{3.4 \text{ mg Xylenes}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{1.59 \text{ tons Xylenes}}{\text{year}}$$

Annual Hexane emission calculation:

$$\frac{2.5 \text{ mg Hexane}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.12 \text{ tons Hexane}}{\text{year}}$$

Annual Methanol emission calculation:

$$\frac{380 \text{ mg Methanol}}{\text{Liter}} \times \frac{3.78 \text{ Liter}}{\text{gal}} \times \frac{42 \text{ gal}}{\text{bbl}} \times \frac{2,675,500 \text{ bbl}}{\text{Year}} \times \frac{\text{g}}{1000 \text{ mg}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{177.76 \text{ tons Methanol}}{\text{year}}$$

## Solution

Total VOC emissions: 19.23 TPY

Total HAP emissions: 4.57 TPY

Total Methanol emissions: 177.76 TPY

# Weaver Boos Consultants, LLC

Sheet 1 of 1  
File #: 3067-508-34  
Calculation #: 3

Made By: JCH  
Checked By: NCN

Date: 7/22/2010  
Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
Estimated Truck Loadout Emissions

---

**Given:** VOC emissions from loading condensate into tank trucks is estimated using the following equation:

$$L_L = 12.46 \times S \times P \times M/T$$

Where:  $L_L$  = loading loss per 1,000 gallons of liquid loaded,  $S$  = saturation factor (from table 5.2-1, AP-42),  $P$  = true vapor pressure of liquid loaded (psia),  $M$  = molecular weight of tank vapors (lb/lb – mol), and  $T$  = temperature of bulk liquid loaded ( $^{\circ}$ R).

From data calculated by EPA TANKS 4.0.9d for the Danish Flats condensate and regional climate factors, the following are the input values for the above equation:

$P = .8753$  psia  
 $M = 111.30$  lb/lb – mol  
 $T = 517$   $^{\circ}$ R

From table 5.2-1,  $S = .6$

The facility handles 280,980 gallons of condensate annually

**Calculations:**

$$L_L = 12.46 \times S \times P \times M/T$$

$$L_L = 12.46 \times .6 \times .8753 \times 111.30/517$$

$$L_L = 1.41 \text{ lbs/1000 gal}$$

**Solution**

Total VOC emissions from loading the condensate onto a trucks is:  
 $1.41 \text{ lbs/1000 gal} \times 280,980 \text{ gallons} = 396.18 \text{ lbs}$

# ANNUAL UNPAVED ROADS PM<sub>2.5</sub> EMISSION CALCULATIONS

## DANISH FLATS PRODUCED WATER PONDS - GRAND COUNTY, UTAH

### **Required:**

Determine the annual PM<sub>2.5</sub> emissions generated from vehicles traveling on unpaved roads at the site.

### **Reference:**

1. US EPA's *Compilation of Air Pollutant Emission Factors* (AP-42), Section 13.2.2, Unpaved Roads (10/01).

### **Solution:**

1. Determine a weighted average for the weight of the vehicles that annually travel on the unpaved roads at the facility.

Vehicle Type	Weight (tons) <sup>(1)</sup>	Average No. of Vehicles/yr <sup>(2)</sup>
Semi-Trucks	28.32	23,204
Other (P/U)	2.90	2,920
<b>Total</b>		<b>26,124</b>
<b>Weighted Avg.</b>		<b>25.48</b>

<sup>(1)</sup> based on an average of the loaded and unloaded weights of the vehicles

<sup>(2)</sup> based on site data

2. Determine the emission factor from unpaved roads.

$$E_r = k (s / 12)^a (W / 3)^b (365 - P) / 365$$

Where:

- |                |   |
|----------------|---|
| E <sub>r</sub> | = Annual size-specific emission factor, lb/VMT - vehicle miles traveled   |
| k              | = Empirical constant (AP-42, Table 13.2.2-2, PM-2.5, Equation 1a)   |
| s              | = Surface material silt content of road surface, % (AP-42, Table 13.2.2-1, MSW Landfills, Disposal routes)                              |
| a              | = Empirical constant (AP-42, Table 13.2.2-2, PM-2.5, Equation 1a)   |
| W              | = Mean vehicle weight, tons   |
| b              | = Empirical constant (AP-42, Table 13.2.2-2, PM-2.5, Equation 1a)   |
| P              | = Mean number of days with at least 0.254 mm (0.01 in) of precipitation per year, days (AP-42, Figure 13.2.2-1, for Grand County, Utah) |

# ANNUAL UNPAVED ROADS PM<sub>2.5</sub> EMISSION CALCULATIONS

## DANISH FLATS PRODUCED WATER PONDS - GRAND COUNTY, UTAH

k	=	0.15	lb/VMT
s	=	6.4	%
a	=	0.9	
W	=	25.48	tons
b	=	0.45	
P	=	81	days

E <sub>r</sub>	=	0.17	lb/VMT
----------------	---	------	--------

3. Determine the miles traveled on the unpaved roads per year.

$$VMT = (V)(M)$$

Where: VMT = Vehicle miles traveled per year, miles/yr  
 V = Number of vehicles per day, vehicles/day  
 M = Number of miles traveled per vehicle (conservative estimate)

$$\begin{aligned} V &= 26,124 && \text{vehicles/day} \\ M &= 1.36 && \text{miles/vehicle} \end{aligned}$$

VMT	=	35,633	miles/yr
-----	---	--------	----------

4. Determine the annual PM<sub>2.5</sub> emissions from the unpaved roads.

$$PM_{2.5, road} = (E_r)(VMT)(1 / 2000)((100 - CA) / 100)$$

Where: PM<sub>2.5, road</sub> = PM<sub>2.5</sub> emissions from the unpaved roads, tons/year  
 E<sub>r</sub> = Calculated emission factor, lb/VMT  
 VMT = Vehicle miles traveled per year, miles/yr  
 2000 = Conversion factor from pounds to tons, lbs/ton  
 CA = Control activity - unpaved roads are watered to control dust emissions, % (AP-42, Appendix B, Table B-2.3)

$$\begin{aligned} E_r &= 0.17 && \text{lb/VMT} \\ CA &= 90 && \% \text{ control efficiency} \end{aligned}$$

PM <sub>2.5, road</sub>	=	0.31	tons/year
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Made By: JCH  
Checked By: NCN

Date: 7/22/2010  
Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
Natural Gas & Diesel Emissions

---

**Given:** The facility's annual natural gas consumption is estimated at:  
**68,783,530 SCF**

The facility's annual diesel use is:

$$\begin{aligned}36 \text{ hp} * 24 \text{ hrs/day} * 365 \text{ days} &= 315,360 \text{ hp-hr} \\13.6 \text{ hp} * 12 \text{ hrs/day} * 365 \text{ days} &= 59,568 \text{ hp-hr} \\97.2 \text{ hp} * 8 \text{ hrs/day} * 365 \text{ days} &= 283,824 \text{ hp-hr}\end{aligned}$$

**Total = 658,752 hp-hr**

Emissions Factors from AP-42 are as follows:

**120,000 lb CO<sub>2</sub> / 1,000,000 SCF Natural Gas**  
**100 lb NO<sub>x</sub> / 1,000,000 SCF Natural Gas**  
**84 lb CO / 1,000,000 SCF Natural Gas**  
**7.6 lb PM / 1,000,000 SCF Natural Gas**  
**5.5 lb VOC / 1,000,000 SCF Natural Gas**

**1.15 lb CO<sub>2</sub> / hp-hr Diesel Fuel**  
**0.031 lb NO<sub>x</sub> / hp-hr Diesel Fuel**  
**0.00668 lb CO / hp-hr Diesel Fuel**  
**0.00205 lb SO<sub>x</sub> / hp-hr Diesel Fuel**  
**0.000721 lb PM / hp-hr Diesel Fuel**

**Calculations:**

Natural Gas Emissions:

$$120,000 \text{ lb CO}_2 / 1,000,000 \text{ SCF Natural Gas} * 68,783,530 \text{ SCF} = \mathbf{8,254,022 \text{ lbs CO}_2}$$

$$100 \text{ lb NO}_x / 1,000,000 \text{ SCF Natural Gas} * 68,783,530 \text{ SCF} = \mathbf{6,878.35 \text{ lbs NO}_x}$$

$$84 \text{ lb CO / 1,000,000 SCF Natural Gas} * 68,783,530 \text{ SCF} = \mathbf{5,777.82 \text{ lbs CO}}$$

$$7.6 \text{ lb PM / 1,000,000 SCF Natural Gas} * 68,783,530 \text{ SCF} = \mathbf{522.75 \text{ lbs PM}}$$

$$5.5 \text{ lb VOC / 1,000,000 SCF Natural Gas} * 68,783,530 \text{ SCF} = \mathbf{378.31 \text{ lbs VOC}}$$

# Weaver Boos Consultants, LLC

Sheet 2 of 2  
File #: 3067-508-34  
Calculation #: 5

Made By: JCH

Checked By: NCN

Date: 7/22/2010

Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
Natural Gas & Diesel Emissions

## Diesel Fuel Emissions:

1.15 lb CO<sub>2</sub> / hp-hr Diesel Fuel \* 658,752 hp-hr =  
757,565 lbs CO<sub>2</sub> \* 1.10 (Factor of Safety) = **833,322 lbs CO<sub>2</sub>**

0.031 lb NO<sub>x</sub> / hp-hr Diesel Fuel \* 658,752 hp-hr =  
20,421.31 lbs NO<sub>x</sub> \* 1.10 (Factor of Safety) = **22,463.44 lbs NO<sub>x</sub>**

0.00668 lb CO / hp-hr Diesel Fuel \* 658,752 hp-hr =  
4,400.46 lbs CO \* 1.10 (Factor of Safety) = **4,840.51 lbs CO**

0.00205 lb SO<sub>x</sub> / hp-hr Diesel Fuel \* 658,752 hp-hr =  
1,350.44 lbs SO<sub>x</sub> \* 1.10 (Factor of Safety) = **1,485.49 lbs SO<sub>x</sub>**

0.000721 lb PM / hp-hr Diesel Fuel \* 658,752 hp-hr =  
474.96 lbs PM \* 1.10 (Factor of Safety) = **522.46 lbs PM**

Made By: JJW  
Checked By: NCN

Date: 7/7/2010  
Date: 7/7/2010

Subject: Danish Flats Produced Water Ponds  
Estimated Pond Evaporative Capacity

---

**Given:** The design dimensions, as calculated in AutoCAD Civil 3D 2009, of Ponds 1 through 13 at the maximum water level (maintaining 2' free board) are:  
Pond 1: 223,863 ft<sup>2</sup>  
Pond 2: 221,162 ft<sup>2</sup>  
Pond 3: 223,863 ft<sup>2</sup>  
Pond 4: 221,162 ft<sup>2</sup>  
Pond 5: 223,863 ft<sup>2</sup>  
Pond 6: 221,162 ft<sup>2</sup>  
Pond 7: 223,863 ft<sup>2</sup>  
Pond 8: 221,162 ft<sup>2</sup>  
Pond 9: 224,196 ft<sup>2</sup>  
Pond 10: 232,886 ft<sup>2</sup>  
Pond 11: 224,196 ft<sup>2</sup>  
Pond 12: 232,886 ft<sup>2</sup>  
Pond 13: 224,196 ft<sup>2</sup>

The Annual Pond Evaporation rate is 6 inches per year (5 ft).

$$1 \text{ ft}^2 = 7.48 \text{ gallons}$$
$$1 \text{ bbl} = 42 \text{ gallons}$$

**Calculations:** Total pond surface area at maximum volume (2' free board): 2,918,460 ft<sup>2</sup>

$$\text{Evaporative Volume (Surface Area x Rate): } 2,918,460 \text{ ft}^2 \times 5 \text{ ft} = 14,592,299 \text{ ft}^3$$

$$14,592,299 \text{ ft}^2 * 7.48 \text{ gallons/ft}^2 = 109,150,397 \text{ Gallons}$$

$$\text{Total Evaporation Volume: } 109,150,397 \text{ Gallons} / 42 \text{ Gallons/bbl} = 2,598,819 \text{ bbl/yr}$$

### Solution

**Annual Evaporative Capacity for all Ponds: 2,598,850 bbl**

\*Note that these evaporation rates assume that the pond water level is always maintained at the maximum height (2' freeboard).

Made By: JCH  
Checked By: NCN

Date: 7/22/2010  
Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds  
BACT- Condensate Emissions Calculation

**Objective:** To determine the total Volatile Organic Compound (VOC) and Hazardous Air Pollutant (HAP) emissions controlled by the facility through the recovery of condensate.

**Method:** To estimate emissions, apply a mass balance relationship with the assumption that VOC and HAP compounds present in the condensate will be emitted to the ambient air as a result of volatilization. Assume that only carbon chains of 7 carbon atoms and shorter have a sufficiently high vapor pressure to volatize. Assume that all benzene, toluene, ethylbenzene and xylenes will volatize to atmosphere.

**Given:** The condensate recovery in 2009 was .19% of the total site throughput, therefore the estimated condensate recovery given a throughput of 2,675,500 bbl produced water is 5,083 bbl.

Percent weight of each carbon chain is as follows, as determined through a detailed hydrocarbon analysis of a condensate sample collected at the facility's condensate recovery tanks:

C1	0.0000
C2	0.0000
C3	0.0167
IC4	0.0627
NC4	0.1840
IC5	0.6408
NC5	0.7830
Heptanes	19.3279
<b>Total % Weight</b>	<b>21.0151</b>
Benzene	0.7537
Toluene	0.0188
Ethylbenzene	0.2875
Xylenes	5.6864
Hexane	8.5064

Density of condensate determined by detailed hydrocarbon analysis: 746,700 g/m<sup>3</sup>

**Calculations:** Emission calculations:

Annual VOC emission calculation:

$$21.0151\% \text{ VOCs} \times \frac{746,700 \text{ g}}{\text{m}^3} = \frac{156,920 \text{ g VOC}}{\text{m}^3}$$

$$\frac{156,920 \text{ g VOC}}{\text{m}^3} \times \frac{1 \text{ m}^3}{6.29 \text{ bbl}} \times \frac{5,083 \text{ bbl}}{\text{Year}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{139.66 \text{ tons VOC}}{\text{year}}$$

Annual Benzene emission calculation:

$$0.7537\% \text{ Benzene} \times \frac{746,700 \text{ g}}{\text{m}^3} = \frac{5,628 \text{ g Benzene}}{\text{m}^3}$$

$$\frac{5,628 \text{ g Benzene}}{\text{m}^3} \times \frac{1 \text{ m}^3}{6.29 \text{ bbl}} \times \frac{5,083 \text{ bbl}}{\text{Year}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{5.01 \text{ tons Benzene}}{\text{year}}$$

# Weaver Boos Consultants, LLC

Sheet 2 of 2  
File #: 3067-508-34  
Calculation #: 7

Made By: JCH

Date: 7/22/2010

Subject: Danish Flats Produced Water Ponds

Checked By: NCN

Date: 7/22/2010

BACT- Condensate Emissions Calculation

---

Annual Toluene emission calculation:

$$0.0188\% \text{ Toluene} \times \frac{746,700 \text{ g}}{\text{m}^3} = \frac{140.4 \text{ g Toluene}}{\text{m}^3}$$

$$\frac{140.4 \text{ g Toluene}}{\text{m}^3} \times \frac{1 \text{ m}^3}{6.29 \text{ bbl}} \times \frac{5,083 \text{ bbl}}{\text{Year}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{0.12 \text{ tons Toluene}}{\text{year}}$$

Annual Ethylbenzene emission calculation:

$$0.2875\% \text{ Ethylbenzene} \times \frac{746,700 \text{ g}}{\text{m}^3} = \frac{2,147 \text{ g Ethylbenzene}}{\text{m}^3}$$

$$\frac{2,147 \text{ g Ethylbenzene}}{\text{m}^3} \times \frac{1 \text{ m}^3}{6.29 \text{ bbl}} \times \frac{5,083 \text{ bbl}}{\text{Year}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{1.91 \text{ tons Ethylbenzene}}{\text{year}}$$

Annual Xylenes emission calculation:

$$5.6864\% \text{ Xylenes} \times \frac{746,700 \text{ g}}{\text{m}^3} = \frac{42,460 \text{ g Xylenes}}{\text{m}^3}$$

$$\frac{42,460 \text{ g Xylenes}}{\text{m}^3} \times \frac{1 \text{ m}^3}{6.29 \text{ bbl}} \times \frac{5,083 \text{ bbl}}{\text{Year}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{37.79 \text{ tons Xylenes}}{\text{year}}$$

Annual Hexane emission calculation:

$$8.5064\% \text{ Hexane} \times \frac{746,700 \text{ g}}{\text{m}^3} = \frac{63,517 \text{ g Hexane}}{\text{m}^3}$$

$$\frac{63,517 \text{ g Hexane}}{\text{m}^3} \times \frac{1 \text{ m}^3}{6.29 \text{ bbl}} \times \frac{5,083 \text{ bbl}}{\text{Year}} \times \frac{\text{lb}}{454 \text{ g}} \times \frac{\text{ton}}{2,000 \text{ lb}} = \frac{56.53 \text{ tons Hexane}}{\text{year}}$$

## Solution

Total VOC emissions reduction: 139.66 TPY

Total HAP emissions reduction: 101.36 TPY

**Appendix C**  
**Danish Flats Condensate Analysis Results**

**TECHNOLOGY LABORATORY, INC.**

1012 Centre Avenue, Suite 101  
Fort Collins, Colorado 80526  
Phone: 970-490-1414  
Fax: 970-472-5488  
[info@techlabusa.com](mailto:info@techlabusa.com)

May 12, 2010

Danish Flats Environmental  
Ms. Cindy Nicoll  
616 West Monument Street  
Colorado Springs, CO 80905

Re: Work Order A1597

Dear Cindy Nicoll:

The following sample was received in good condition for a Detailed Hydrocarbon Analysis. The sample conditions were as follows:

Company: Danish Flats Environmental

Location: N/A

Project #: Danish Flats

Sample Name: Condensate

psig: atmospheric

Temperature: N/A

Cylinder #: N/A

Date Sampled: 05/04/10

Sampled By: John Hockman

Sincerely yours,

*Lei Bellas*

TECHNOLOGY LABORATORY, INC.

# TECHNOLOGY LABORATORY, INC.

## CENTRE PROFESSIONAL OFFICE PARK

1012 CENTRE AVENUE  
Fort Collins, Colorado 80526  
(970) 490-1414

## CERTIFICATE OF ANALYSIS

Danish Flats Environmental  
616 West Monument Street  
Colorado Springs, CO 80905

Date Sampled: 05/04/10  
Date Received: 05/06/10  
Date Analyzed: 05/13/10  
Project No.: Danish Flats  
Lab ID: A1597  
Sample ID: Danish Flats  
Condensate

	Mol %	Weight %	LV %
C1	0.0000	0.0000	0.0000
C2	0.0000	0.0000	0.0000
C3	0.0416	0.0167	0.0240
IC4	0.1189	0.0627	0.0835
NC4	0.3499	0.1840	0.2360
IC5	0.9853	0.6408	0.7717
NC5	1.2024	0.7830	0.9325
Hexanes	11.1381	8.5064	8.9098
Heptanes	21.6175	19.3279	19.8188
Octanes	27.8827	28.1884	27.9919
Nonanes	10.5955	12.1485	12.1721
Benzene	1.0695	0.7537	0.6391
Toluene	0.0227	0.0188	0.0167
Ethylbenzene	0.3003	0.2875	0.2474
Xylene	5.9356	5.6864	4.9123
NC6	2.9549	2.2979	2.5992
2,2,4 Trimethyl Pentane	0.3836	0.3951	0.4114
C10+	15.4015	20.7022	20.2336
Total	100.0000	100.0000	100.0000

*Six Bettens*  
TECHNOLOGY LABORATORY, INC.



**Detailed Hydrocarbon Analysis Summary Report -**

Report Date: 5/13/2010 11:19:18 AM

RawFile: C:\Chem32\11\DATA\TLNDHA-050610 2010-05-08 10-44-19\001F0201.D\001F0201.CDF	Acquired: 05/06/10 11:52:04
Sample: 1597-01b	Analyzed: 5/13/2010 11:16:31 AM
Processed 451 Peaks	
Reference File: C:\Program Files\DHA Application Software\References\REF-9888-01-WHT_02182010.DHA	
Comments:	Normalized to 100.0000%

**SUMMARY REPORT**

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	23.7662	25.1578	23.7514
I-Paraffins:	30.5120	31.9827	30.6522
Olefins:	0.0000	0.0000	0.0000
Naphthenes:	22.0748	21.4558	25.3005
Aromatics:	10.6261	9.0729	11.0154
Total C14+:	7.0167	6.8682	4.1341
Total Unknowns:	6.0042	5.4626	5.1464

**Oxygenates:**

Total: 0.0000(Mass%) 0.0000(Vol%)

Total Oxygen Content: 0.0000(Mass%)

Multisubstituted Aromatics: 8.7737(Mass%) 7.5353(Vol%)

Average Molecular Weight: 116.8861

Relative Density: 0.7467

Vapor Pressure: 1.2763

Calculated Octane Number: 68.8646

	IBP	T10	T50	T90	FBP
Boiling Point (Deg F)	82.11	177.30	269.65	421.34	488.66

Percent Carbon: 85.5603 Percent Hydrogen: 14.4397

Bromine Number (Calc): 0.0000

**Appendix D**  
**Danish Flats Pond Water Analysis Results**

**Key Laboratories, Inc.**  
**2479A Riverside Parkway**  
**Grand Junction, Colorado 81505-1319**  
**Phone (970) 243-5311 Fax (970) 243-6010**

**Final Results**  
**Report Date:** **06/30/10**

### Hexane Results

Key Lab#	Key COC#	Client Sample Name	Client Sample Location	Instrument Result	Units
10-0633	0505100633	V3-50510	DF-Vault #3	<b>460</b>	ug/L
10-0634	0505100633	V6-50510	DF-Vault #6	<b>260</b>	ug/L
10-0635	0505100633	P3-50510	DF-Pond #3	<b>250</b>	ug/L
10-0636	0505100633	9-50510	DF-Pond #9	<b>1.80</b>	ug/L
10-0637	0505100633	2-50510	DF-Pond #2	<b>1.10</b>	ug/L
10-0638	0505100633	SP-50510	DF-Sludge Pond	<b>480</b>	ug/L

### Methanol Results

Key Lab#	Key COC#	Client Sample Name	Client Sample Location	Instrument Result	Units
10-0633	0505100633	V3-50510	DF-Vault #3	<b>320</b>	mg/L
10-0634	0505100633	V6-50510	DF-Vault #6	<b>340</b>	mg/L
10-0635	0505100633	P3-50510	DF-Pond #3	<b>240</b>	mg/L
10-0636	0505100633	9-50510	DF-Pond #9	<50	mg/L
10-0637	0505100633	2-50510	DF-Pond #2	<50	mg/L
10-0638	0505100633	SP-50510	DF-Sludge Pond	<b>520</b>	mg/L

### Oil & Grease Results

Key Lab#	Key COC#	Client Sample Name	Client Sample Location	Instrument Result	Units
10-0633	0505100633	V3-50510	DF-Vault #3	<b>88.8</b>	mg/L
10-0634	0505100633	V6-50510	DF-Vault #6	<b>143</b>	mg/L
10-0635	0505100633	P3-50510	DF-Pond #3	<b>60.4</b>	mg/L
10-0636	0505100633	9-50510	DF-Pond #9	<b>62.4</b>	mg/L
10-0637	0505100633	2-50510	DF-Pond #2	<b>4.6</b>	mg/L
10-0638	0505100633	SP-50510	DF-Sludge Pond	<b>197</b>	mg/L

Diesel Range Organics TEH

TEH(DRO) calculation sheet

## TEH(DRO) RESULTS

Run Date	Matrix	Key Lab #	Hexane Volume [mL]	TEH Run Blank [ppm]	Moisture Multiplier	Aliquot [g, mL]	Instrument DF Multiplier	Multipled Raw T.E.H. [ppm]	Key COC#	Key Lab#	Sample#	Final TEH Results	Units
05/11/20-1:10		10-0001	4	1	1	4.00	1.000	994.9	0101100001	10-0001	Continuing Calibration Check	995.0	mg /
05/11/20-1:11		10-0002	4	1	1	500.00	1.000		0101100002	10-0002	Method Blank	< (0.8)	mg /
05/11/20-1:32	Water	10-0633	4	1	1	500.00	1.000	13149.8	0505100633	10-0633	V3-50510	105.0	mg / Liter
05/11/20-1:32	Water	10-0634	4	1	1	500.00	1.000	1622.4	0505100633	10-0634	V6-50510	13.0	mg / Liter
05/11/20-1:21	Water	10-0635	4	1	1	500.00	1.000	1765.6	0505100633	10-0635	P3-50510	14.1	mg / Liter
05/11/20-1:22	Water	10-0636	4	1	1	500.00	1.000	286.4	0505100633	10-0636	9-50510	2.3	mg / Liter
05/11/20-1:22	Water	10-0637	4	1	1	500.00	1.000	235.8	0505100633	10-0637	2-50510	1.9	mg / Liter
05/11/20-1:23	Water	10-0638	4	1	1	500.00	1.000	14332.3	0505100633	10-0638	SP-50510	115.0	mg / Liter

## Quantitation Report (QT Reviewed)

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0301003.D Vial: 3  
Acq On : 11 May 2011 10:01:51 Operator: KEY  
Sample : 10-0633, V3-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplr: 1.00  
IntFile : TERPHEN.E  
Quant Time: May 14 10:01 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Initial Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL

Signal Phase : HP-5 = 50m x 0.2mm x 0.33um

Signal Info :

Compound	R.T.	Response	Conc	Units
<hr/>				
System Monitoring Compounds				
2) S o-Terphenyl	14.04f	3686794	49.857	ppm m
Spiked Amount	48.600	Range	50 - 150	Recovery = 102.59%
<hr/>				
Target Compounds				
1) H TERPH [DRO]	13.00	769503053	13149.753	ppm

Quantitation Report

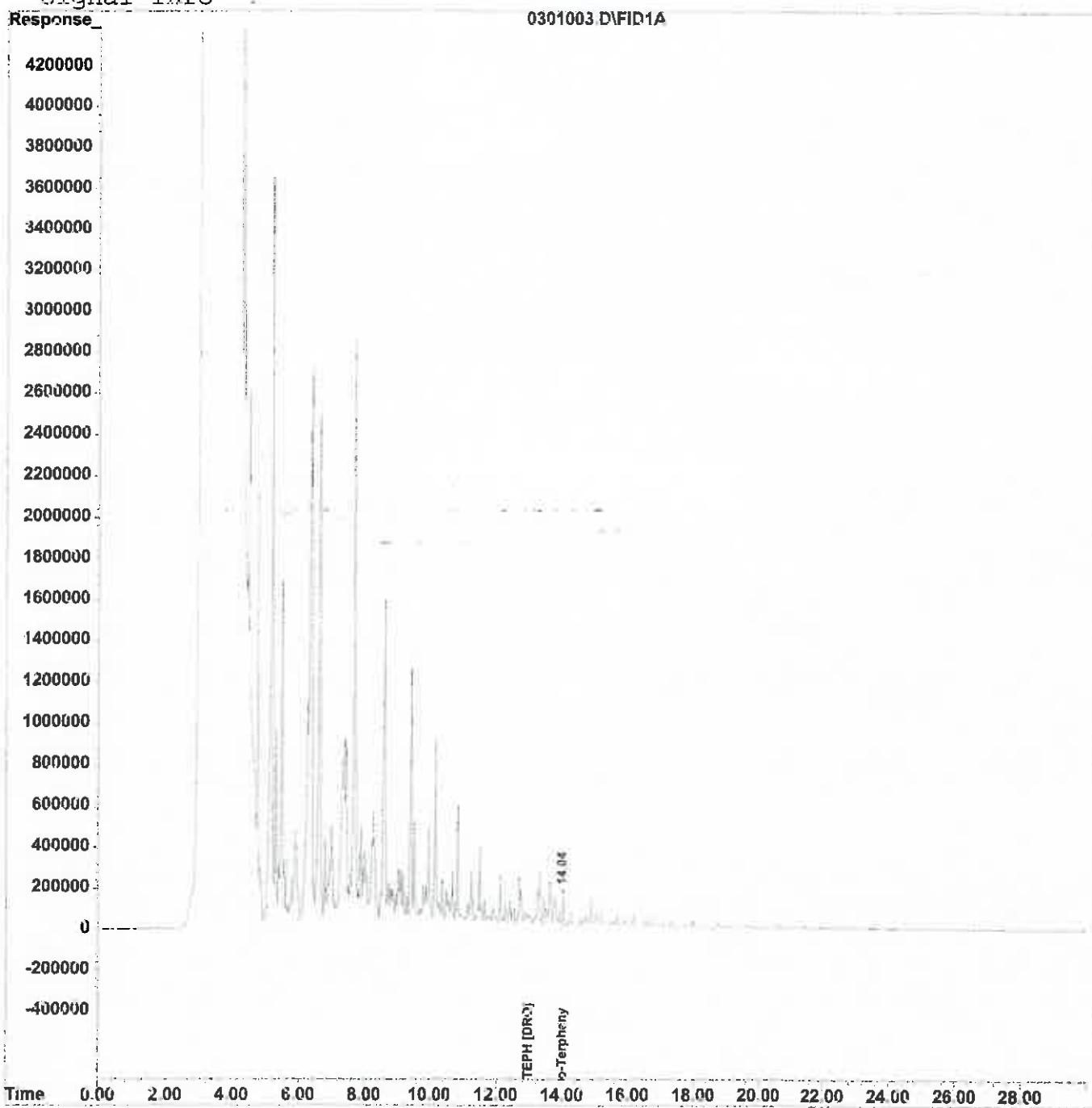
Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0301003.D Vial: 3  
Acq On : 11 May 2011 13:1 Operator: KEY  
Sample : 10-0633, V3-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multipllr: 1.00  
IntFile : TEH\_HP5.E  
Quant Time: May 14 10:01 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Multiple Level Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL

Signal Phase : HP-5 = 50m x 0.2mm x 0.33um

Signal Info :



## Quantitation Report (QT Reviewed)

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0401004.D Vial: 4  
Acq On : 11 May 2011 132:4 Operator: KEY  
Sample : 10-0634, V6-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplr: 1.00  
IntFile : TERPHEN.E  
Quant Time: May 14 10:02 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HPS  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Initial Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :

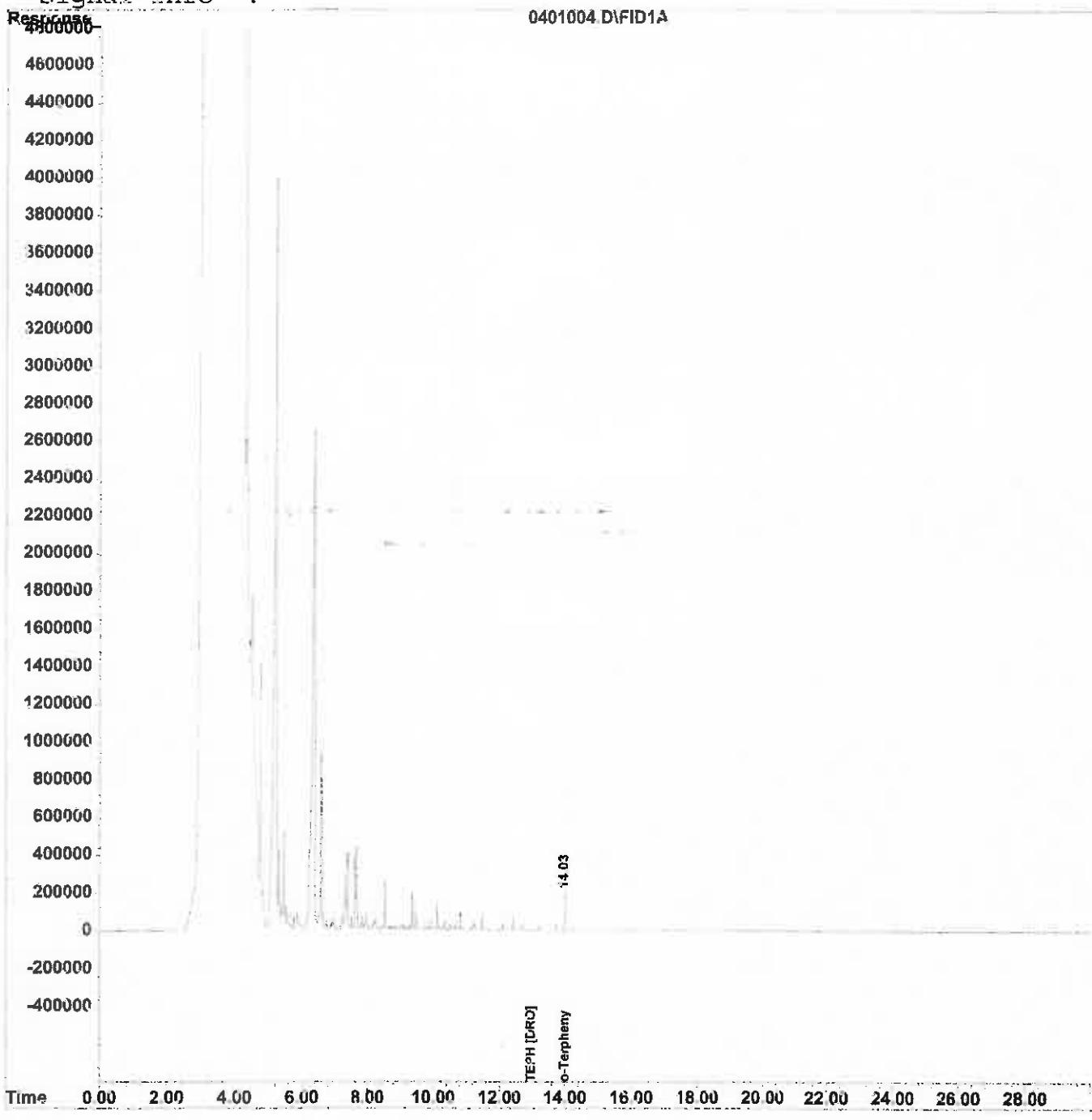
Compound	R.T.	Response	Conc Units
<hr/>			
System Monitoring Compounds			
2) S o-Terphenyl	14.03f	3808162	51.498 ppm m
Spiked Amount 48.600	Range 50 - 150	Recovery =	105.96%
<hr/>			
Target Compounds			
1) H TEPH [DRO]	13.00	94937716	1622.356 ppm

Quantitation Report

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0401004.D Vial: 4  
Acq On : 11 May 2011 132:4 Operator: KEY  
Sample : 10-0634, V6-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplr: 1.00  
IntFile : TEH\_HP5.E  
Quant Time: May 14 10:02 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Multiple Level Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :



## Quantitation Report (QT Reviewed)

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0501005.D Vial: 5  
 Acq On : 11 May 2011 12:2 Operator: KEY  
 Sample : 10-0635, P3-50510, 0505100633, Inst : TEH 5890/  
 Misc : Water, 500ml, Danish Flats Multipllr: 1.00  
 IntFile : TERPHEN.E  
 Quant Time: May 14 10:02 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chromstation Integrator)  
 Title : TEH\_HP5  
 Last Update : Tue Apr 14 10:56:54 2009  
 Response via : Initial Calibration  
 DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL

Signal Phase : HP-5 = 50m x 0.2mm x 0.33um

Signal Info :

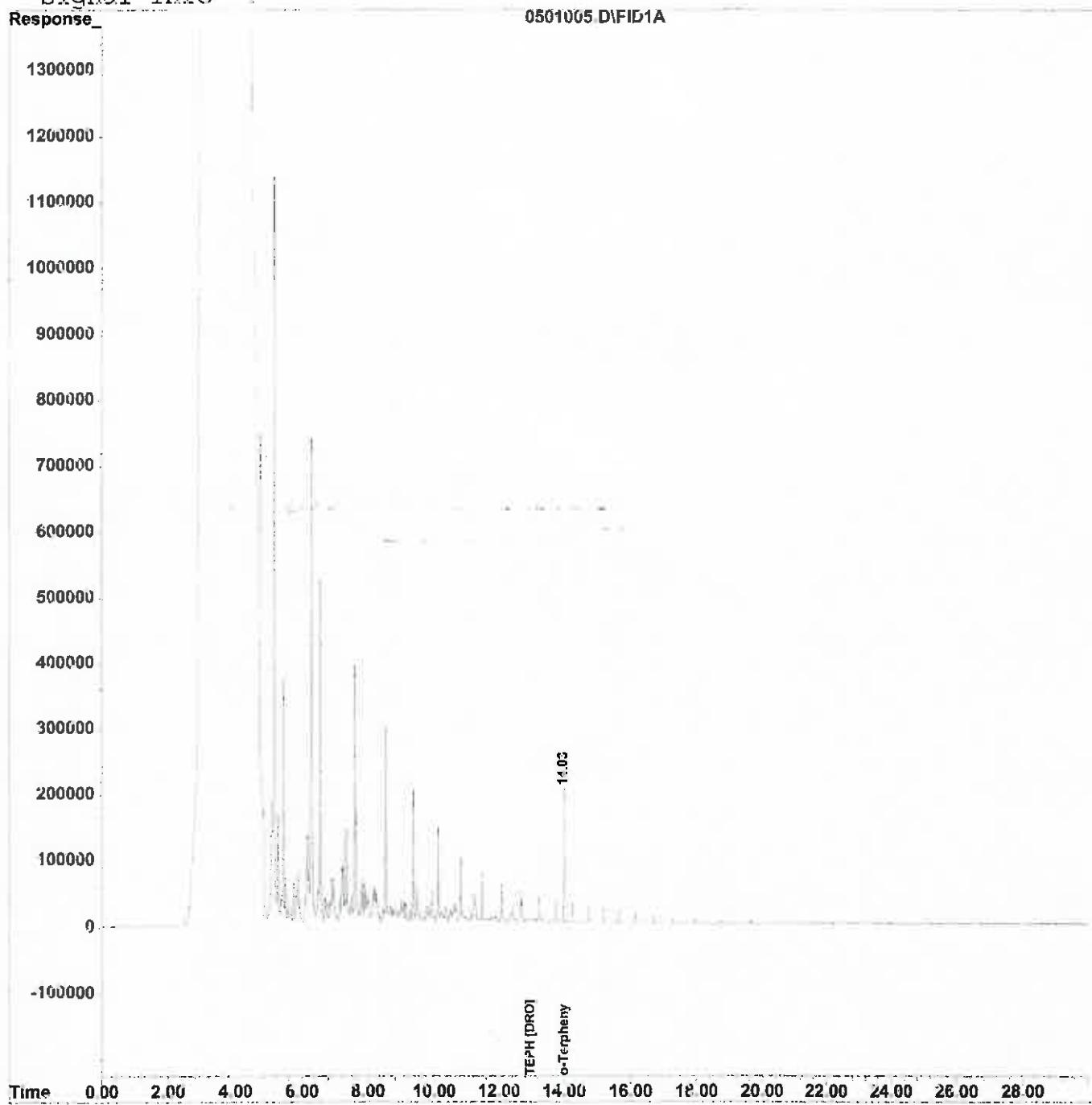
Compound	R.T.	Response	Conc	Units
<hr/>				
System Monitoring Compounds				
2) S o-Terphenyl	14.03f	3574879	48.343	ppm m
Spiked Amount 48.600	Range 50 - 150	Recovery =	99.47%	
<hr/>				
Target Compounds				
1) H TEPH [DRO]	13.00	103321670	1765.626	ppm

# Quantitation Report

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0501005.D Vial: 5  
Acq On : 11 May 2011 12:1:2 Operator: KEY  
Sample : 10-0635, P3-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multipllr: 1.00  
IntFile : TEH\_HP5.E  
Quant Time: May 14 10:02 19110 Quant Results File: TEH\_HPS.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HPS  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Multiple Level Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :



## Quantitation Report (QT Reviewed)

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0601006.D Vial: 6  
Acq On : 11 May 2011 122:0 Operator: KEY  
Sample : 10-0636, 9-50510, 0505100533, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplr: 1.00  
IntFile : TERPHEN.E  
Quant Time: May 14 10:03 12110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Initial Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :

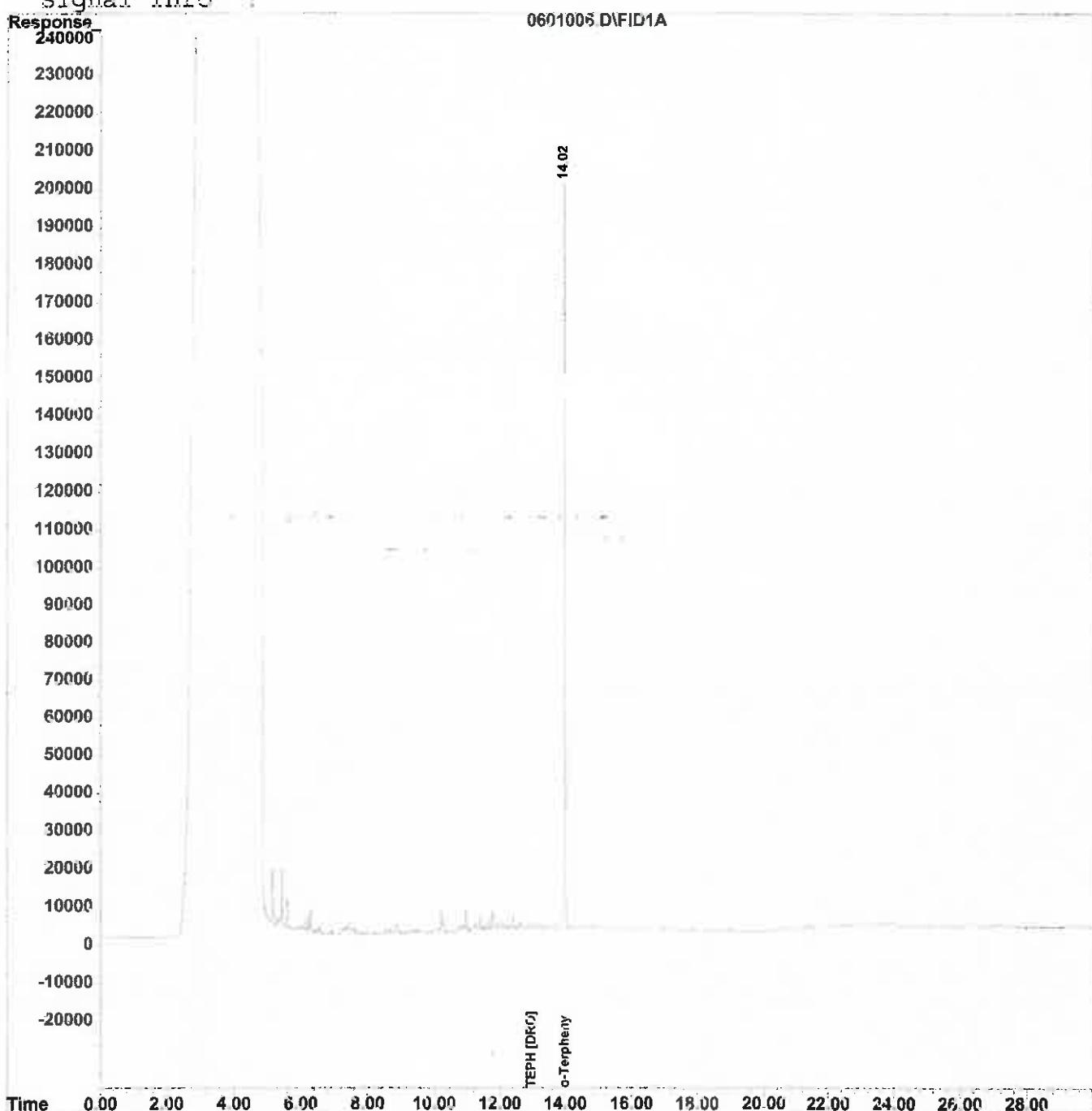
Compound	R.T.	Response	Conc	Units
System Monitoring Compounds				
2) S o-Terphenyl	14.02f	3403765	46.029	ppm m
Spiked Amount 48.600 Range 50 - 150 Recovery = 94.71%				
Target Compounds				
1) H TEPH [DRO]	13.00	16759566	286.392	ppm

# Quantitation Report

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0601006.D Vial: 6  
Acq On : 11 May 2011 10:03:13 Operator: KEY  
Sample : 10-0636, 9-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplr: 1.00  
IntFile : TEH\_HP5.E  
Quant Time: May 14 10:03 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Multiple Level Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :



## Quantitation Report (QT Reviewed)

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0701007.D Vial: 7  
Acq On : 11 May 2011 122:4 Operator: KEY  
Sample : 10-0637, 2-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multipllr: 1.00  
IntFile : TERPHEN.E  
Quant Time: May 14 10:03 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HPS  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Initial Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :

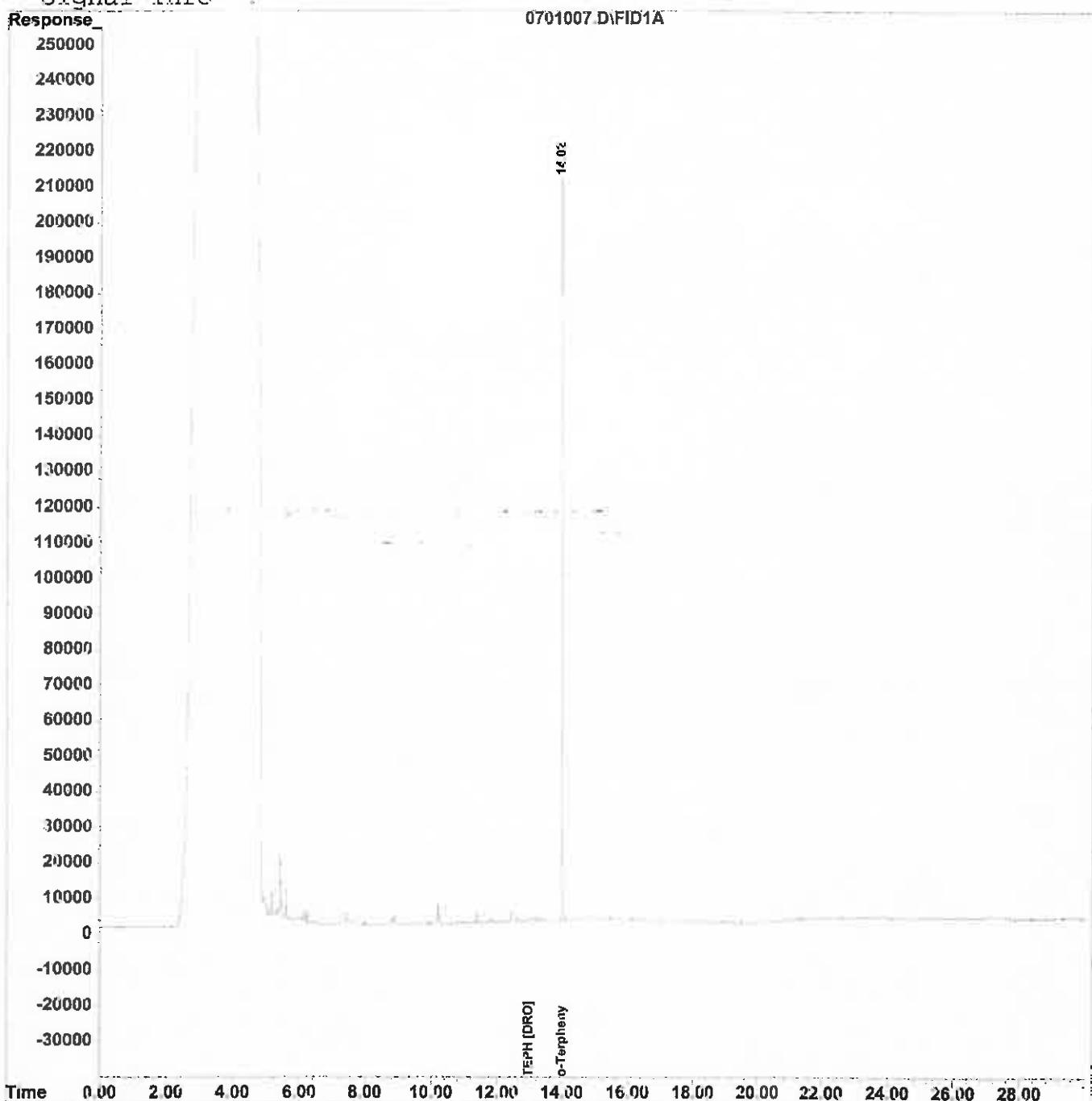
Compound	R.T.	Response	Conc Units
<hr/>			
System Monitoring Compounds			
2) S o-Terphenyl	14.02f	3677083	49.725 ppm
Spiked Amount 48.600	Range 50 - 150	Recovery =	102.31%
<hr/>			
Target Compounds			
1) H TEPH [DRO]	13.00	13800837	235.837 ppm

Quantitation Report

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0701007.D Vial: 7  
Acq On : 11 May 2011 122:4 Operator: KEY  
Sample : 10-0637, 2-50510, 0505100633, Inst : TEH 5820/  
Misc : Water, 500ml, Danish Flats Multiplr: 1.00  
IntFile : TEH\_HP5.E  
Quant Time: May 14 10:03 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Multiple Level Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :



## Quantitation Report (QT Reviewed)

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0801008.D Vial: 8  
Acq On : 11 May 2011 10:04:30 Operator: KEY  
Sample : 10-0638, SP-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplkr: 1.00  
IntFile : TERPHEN.E  
Quant Time: May 14 10:04 19110 Quant Results File: TEH\_HPS.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HPS.M (Chemstation Integrator)  
Title : TEH\_HPS  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Initial Calibration  
DataAcq Meth : TEH\_HPS.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :

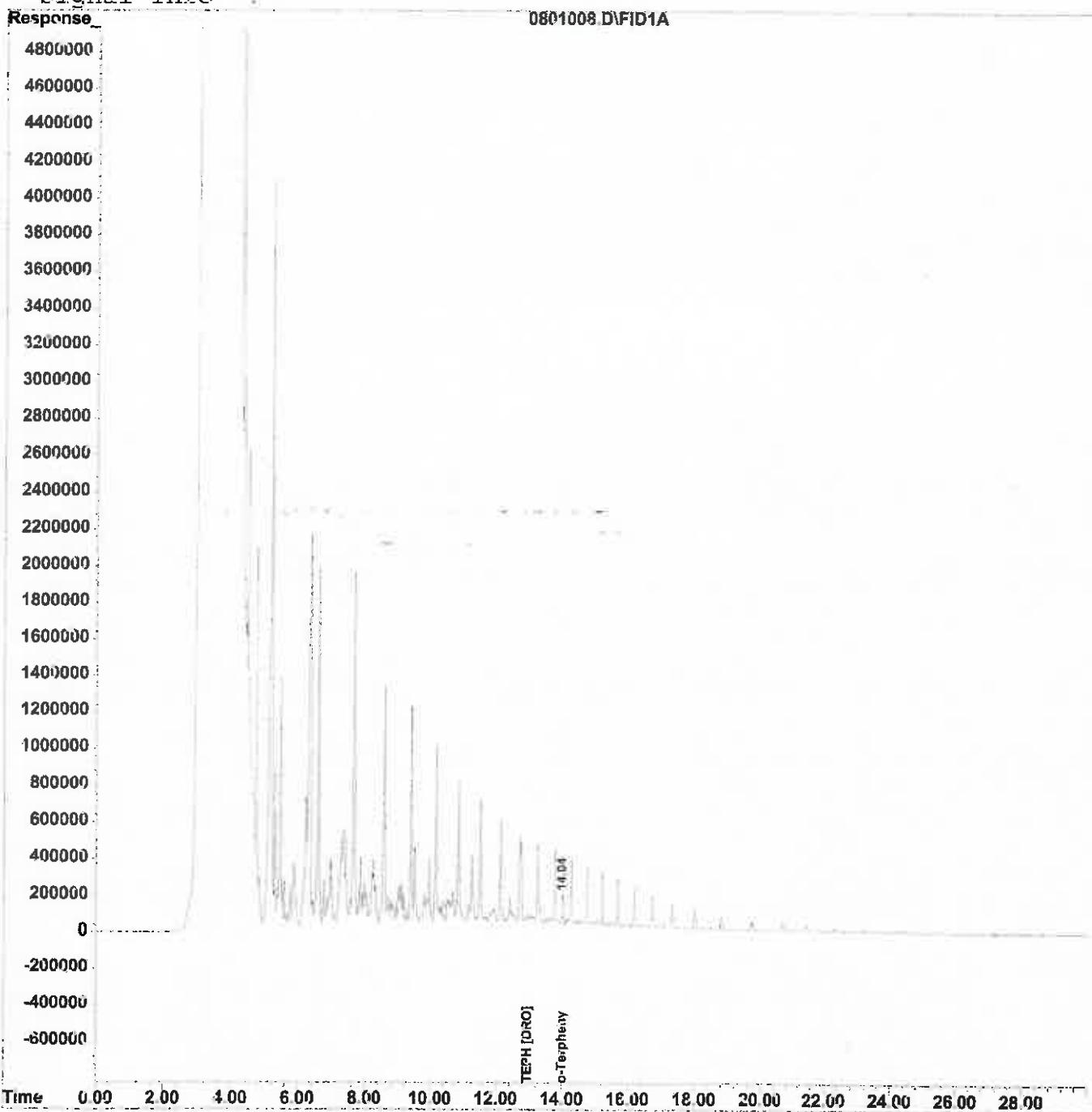
Compound	R.T.	Response	Conc Units
<hr/>			
System Monitoring Compounds			
<hr/>			
2) S o-Terphenyl	14.04f	3778763	51.100 ppm m
Spiked Amount	48.600	Range	50 - 150 Recovery = 105.14%
<hr/>			
Target Compounds			
1) H TEPH [DRO]	13.00	838704374	14332.309 ppm

# Quantitation Report

Data File : C:\HPCHEM\1\TEH\_DATA\10MAY11\0801008.D Vial: 8  
Acq On : 11 May 2011 123:1 Operator: KEY  
Sample : 10-0638, SP-50510, 0505100633, Inst : TEH 5890/  
Misc : Water, 500ml, Danish Flats Multiplrx: 1.00  
IntFile : TEH\_HP5.E  
Quant Time: May 14 10:04 19110 Quant Results File: TEH\_HP5.RES

Quant Method : C:\HPCHEM\1\METHODS\TEH\_HP5.M (Chemstation Integrator)  
Title : TEH\_HP5  
Last Update : Tue Apr 14 10:56:54 2009  
Response via : Multiple Level Calibration  
DataAcq Meth : TEH\_HP5.M

Volume Inj. : 2 uL  
Signal Phase : HP-5 = 50m x 0.2mm x 0.33um  
Signal Info :



# BTEX Analytical Report

## KEY LABORATORIES, INC.

2479A Riverside Parkway  
Grand Junction, CO 81505-1319  
(970) 243-5311 FAX (970) 243-6010

Client: Danish Flats  
Client Project Name: Danish Flats  
Client Project Number:  
Client Sample ID: P3-50510  
Client Sample Location: DF-Pond #3  
Sampling Date: 5/5/2010  
Sampling Time: 11:00  
Sample Matrix: Water  
Sampler: Curt  
Project Name:

QC Type:  
Key Lab #: 10-0635  
Work Order #: 0505100633  
Date Received: 05/05/10  
Method: EPA SW846 5030/5035/8260  
Technician: KEY  
Data File Name: 1500015.D  
Date Analyzed: 11 May 2010 22:23  
Data File Path: C:\MSDCHEM\DATA\\_1005MAY11\  
Lab Sample Information: water, 100Xdil, Danish Flats  
Lab Sample Number: P3\_10-0635\_100X\_0505100633

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =  
Dilution/Extraction volume [mL] =  
Reported=>> x

Sample vol/wt = 5  
DF = 100

Case	Type	Target Compounds	Audit	R.T.	Resp.	Amt.	MDL (ug)	DF	Final Conc.	RDL	Qual	MQL	Spk	%Rec
1634-04-4	H1	TVH [GRO] [C6-C10]	x	1.9	23820723	270.39	150 ug	100	27 mg/L	15	J		4000	
M1		MTBE					0.25 ug							
71-43-2	M1	Benzene	x	3.984	1049372	15.26	0.33 ug	100	1500 ug/L	33			48000	
108-88-3	MC1	Toluene	x	7.034	1976409	43.75	1.33 ug	100	4400 ug/L	135			48000	
100-41-4	MC2	Ethylbenzene	x	9.932	200844	2.20	0.27 ug	100	220 ug/L	27			48000	
		XYLEMES (Total)	x		2532101	33.8	0.47 ug	100	3400 ug/L	47			14400000	
91-20-3	M3	Naphthalene	x	15.57	72890	1.41	2 ug	100	<	200			48000	
TVH GRO (C6-C10) Subtraction Blank =														
Catalyst														
95-47-6	M2	MLT Xylene	x	10.34	2127741	28.44	1.1 ug	100	2800 ug/L	110			96000	
95-47-6	M2	O-Xylene	x	11.06	404360	5.33	0.47 ug	100	530 ug/L	47			48000	
108-67-8	M2	1,3,5-Trimethylbenzene	x	13.18	253603	3.21	0.65 ug	100	320 ug/L	65			48000	
95-63-6	M2	1,2,4-Trimethylbenzene	x	13.61	370017	4.56	1.18 ug	100	460 ug/L	118	J		48000	

Case	Type	System Monitoring Compounds	R.T.	Resp.	Amt.	Area%	Data	Qual	Final Conc.	RDL	Qual	MQL	Spk	%Rec
1868-53-7	S1	Dibromofluoromethane	x	2.933	2709090	68.98	111 ug	2441318	81 - 120	73 - 127	J	70	98.5	
17060-07-0	S1	1,2-Dichloroethane-d4	x	3.365	709594	69.83	118 ug	602333	82 - 118	83 - 117	J	70	99.8	
2037-26-5	S1	Toluene-d8	x	6.925	3067102	70.91	112 ug	2726578	89 - 111	86 - 114	J	70	101.3	
460-00-4	S2	4-Bromofluorobenzene	x	11.77	2856524	64.88	107 ug	2662516	81 - 119	72 - 128	J	70	92.7	

Case	Type	Internal Standard Compounds	R.T.	Resp.	Amt.	Area%	Data	Qual	Final Conc.	RDL	Qual	MQL	Spk	%Rec
462-06-6	I1	fluorobenzene	x	4.281	4962009	70.00	112 ug	4443128	50 - 200	50 - 200	J	70	70.0	
3114-55-4	I2	Chlorobenzene-d5	x	9.356	758393	70.00	115 ug	660291	50 - 200	50 - 200	J	70	70.0	
3855-82-1	I3	1,4-Dichlorobenzene-d4	x	13.72	2173094	70.00	106 ug	2057567	50 - 200	50 - 200	J	70	70.0	

MDL = Method Detection Limit

PQL = Practical Quantitation Limit = 4 x MDL

RDL = Reporting Detection Limit = MDL x Dilution Factor

MQL = Maximum Quantitation Limit = 110% x DF x Highest Calibration Standard

Reporting basis is Kg for solids and L for liquids

J qualifier = MDL < Result < PQL

E qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

Data Path : C:\MSDCHEM\1\DATA\\_1005may11\  
 Data File : 1500015.D  
 Acq On : 11 May 2010 22:23  
 Operator : KEY  
 Sample : P3, 10-0635, 100X, 0505100635,  
 Misc : water, 100Xdil, Danish Flats  
 ALS Vial : 15 Sample Multiplier: 1

Quant Time: May 12 10:59:30 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX 8260/BTEX  
 Quant Update : Tue May 11 14:09:01 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	Qion	Response	Cone	Units	Dev(Min)
--------------------	------	------	----------	------	-------	----------

1) Fluorbenzene	4.29	96	4962009	70.00	ug	0.00
9) Chlorobenzene-d5	9.36	54	758393	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	2173094+	70.00	ug	0.00

## System Monitoring Compounds

4) Bromofluoromethane	2.93	113	27090994	68.98	ug	0.00
Spiked Amount	70.000	Range	81 - 120	Recovery	= 98.54%	
5) 1,2-Dichloroethane-d4	3.37	67	709594	69.83	ug	0.00
Spiked Amount	70.000	Range	82 - 118	Recovery	= 99.76%	
7) Toluene-d8	6.93	100	3067102	70.91	ug	0.00
Spiked Amount	70.000	Range	89 - 111	Recovery	= 101.30%	
13) 4-Bromofluorobenzene	11.77	174	2856524+	64.88	ug	0.00
Spiked Amount	70.000	Range	81 - 119	Recovery	= 92.69%	

## Target Compounds

					Qvalue	
2) TVB [C6-C10]	1.90	TIC	23820723m	270.39	ug	
3) MTBE	0.00	73	0	N.D.		
6) Benzene	3.98	78	1049372	15.26	ug	# 97
8) Toluene	7.03	92	1976409	43.75	ug	99
10) Ethylbenzene	9.93	91	200844	2.20	ug	96
11) M/P Xylene	10.34	91	2127741	28.44	ug	100
12) o-Xylene	11.06	91	404360	5.33	ug	98
14) 1,3,5-Trimethylbenzene	13.18	105	253603	3.21	ug	99
15) 1,2,4-Trimethylbenzenes	13.61	105	370017	4.56	ug	99
17) Napthylene	15.57	128	72890	1.41	ug	# 93

(#) = qualifier out of range (m) = manual integration (+) = signals summed

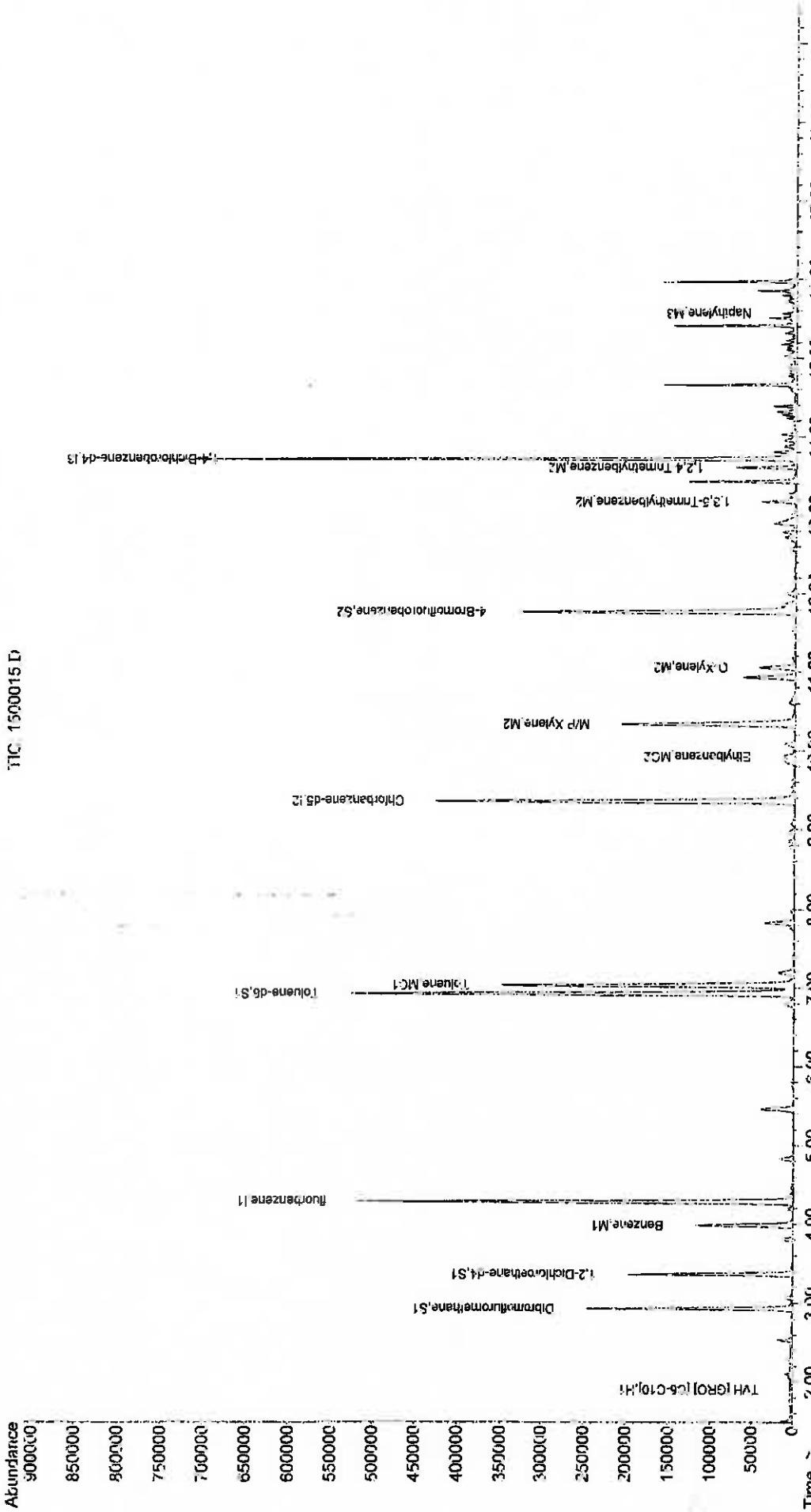
## Instrumentation Report

Date Generated:

Data Path : C:\MSDCHEM\DATA\005May11\  
Data File : 1500015.D  
Acq On : 11 May 2010 22:23  
Operator : KEY  
Sample : PS, 10-0635, 1.00X, 0505100633,  
Misc : water, 100XnH<sub>2</sub>O, Banish Flats  
AIS Vial : 15 Sample Multiplier: 1

Quant Time: May 12 10:59:30 2010  
Quant Method : C:\MSDCHEM\1\5\973N\4VERTEX.M  
Quant Title : 4PPNBTEX 8260/BTEZ  
Last Update : Tue May 11 14:09:01 2010  
Response via : Initial Calibration

TIC 1500015.D



# BTEX Analytical Report

## KEY LABORATORIES, INC.

2479A Riverside Parkway  
Grand Junction, CO 81505-1319  
(970) 243-5311 FAX (970) 243-6010

Client: **Danish Flats**  
Client Project Name: **Danish Flats**  
Client Project Number:  
Client Sample ID: **SP-50510**  
Client Sample Location: **DF-Sludge Pond**  
Sampling Date: **5/5/2010**  
Sampling Time: **11:00**  
Sample Matrix: **Water**  
Sampler: **Curt**  
Project Name:

QC Type:   
Key Lab #: **10-0638**  
Work Order #: **0505100633**  
Date Received: **05/05/10**  
Method: **EPA SW846 5030/5035/8260**  
Technician: **KEY**  
Data File Name: **2100021.D**  
Date Analyzed: **12 May 2010 00:59**  
Data File Path: **C:\MSDCHEM1\DATA\1005MAY1\water, 190Xdil, Danish Flats**  
Lab Sample Information: **Lab Sample Number: SP-10-0638\_100X\_0505100633.**

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported= **<20** **x**

Sample vol/wt = **5**  
DF = **100**

CASE#	Type	Target Compound	Audit	R.T.	Resp.	Amt.	MDL	Units	DF	Final Conc.	RDL	Qual	MQL	Spots	%RPLC
1634-04-4	H1	TVH [GRO] [C6-C10]	x	1.9	70342618	823.46	150	ug	100	82 mg/L	15			4000	
1634-04-4 M1		MTBE					0.25	ug							
71-43-2 M1		Benzene	x	3.983	4258529	63.87	0.33	ug	100	6400 ug/L	33			48000	
108-88-3 MC1		Toluene	x	7.034	6085582	138.92	1.35	ug	100	14000 ug/L	135			48000	
100-41-4 MC2		Ethylbenzene	x	9.929	435065	4.97	0.27	ug	100	500 ug/L	27			48000	
		XYLENES (Total)	x		5479671	76.3	0.47	ug	100	7600 ug/L	47			14400000	
91-20-3 M3		Naphthalene	x	15.57	146930	2.92	2	ug	100	290 ug/L	200	J		48000	

CASE#	Type	Target Compound	Audit	R.T.	Resp.	Amt.	MDL	Units	DF	Final Conc.	RDL	Qual	MQL		
	M2	M/P Xylene	x	10.34	4567205	63.70	1.1	ug	100	6400 ug/L	110			96000	
95-47-6 M2		O-Xylene	x	11.06	912466	12.56	0.47	ug	100	1300 ug/L	47			48000	
108-67-8 M2		1,3,5-Trimethylbenzene	x	13.18	490216	6.47	0.65	ug	100	650 ug/L	65			48000	
95-63-6 M2		1,2,4-Trimethylbenzene	x	13.61	670935	8.62	1.18	ug	100	860 ug/L	118			48000	

TVH GRO (C6-C10) Subtraction Blank =

CASE#	Type	System Monitoring Compound	R.T.	Resp.	Amt.	Area%	Units	Mult.	RDL	Water Limits	Soil Limits	Spots	%RPLC
1868-53-7 S1		Dibromofluoromethane	x	2.933	2668738	70.08	109	ug	2441318	81 - 120	73 - 127	70	100.1
17060-07-0 S1		1,2-Dichloroethane-d4	x	3.365	693880	70.43	115	ug	602333	82 - 118	83 - 117	70	100.6
2037-26-5 S1		Toluene-d8	x	6.926	2926625	69.78	107	ug	2726578	89 - 111	86 - 114	70	99.7
460-00-4 S2		4-Bromofluorobenzene	x	11.77	2885447	68.38	108	ug	2662516	81 - 119	72 - 128	70	97.7

CASE#	Type	Internal Standard Compound	R.T.	Resp.	Amt.	Area%	Units	Mult.	RDL	Water Limits	Soil Limits	Spots	%RPLC
463-06-6 I1		fluorobenzene	x	4.281	4811326	70.00	108	ug	4443128	50 - 200	50 - 200	70	70.0
3114-55-4 I2		Chlorobenzene-d5	x	9.356	726839	70.00	110	ug	660291	50 - 200	50 - 200	70	70.0
3855-82-1 I3		1,4-Dichlorobenzene-d4	x	13.72	2112315	70.00	103	ug	2057567	50 - 200	50 - 200	70	70.0

MDL = Method Detection Limit

PQL = Practical Quantitation Limit = 4 x MDL

DL = Reporting Detection Limit = MDL x Dilution Factor

MQL = Maximum Quantitation Limit = 110% x DF x Highest Calibration Standard

Reporting basis is Kg for solids and L for liquids

I qualifier = MDL < Result < PQL

E qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

Data Path : C:\MSDCHEM\1\DATA\1005may11\  
 Data File : 2100021.D  
 Acq On : 12 May 2010 00:59  
 Operator : KEY  
 Sample : SP, 10-0638, 100X, 0505100638,  
 Misc : water, 100Xdil, Danish Flats  
 ALS Vial : 21 Sample Multiplier: 1

Quant Time: May 12 10:59:36 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX 8260/BTEX  
 QLast Update : Tue May 11 14:09:01 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	QIon	Response	Conc	Units	Dew (Min)
1) fluorbenzene	4.28	96	4811326	70.00	ug	0.00
9) Chlorobenzene-d5	9.36	54	726859	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	2112315+	70.00	ug	0.00

## System Monitoring Compounds

4) Dibromofluoromethane	2.93	113	2660738+	70.08	ug	0.00
Spiked Amount	70.000	Range	81 - 120	Recovery	=	100.11%
5) 1,2-Dichloroethane-d4	3.37	67	693680	70.43	ug	0.00
Spiked Amount	70.000	Range	82 - 118	Recovery	=	100.61%
7) Toluene-d8	6.93	100	2926625	69.78	ug	0.00
Spiked Amount	70.000	Range	89 - 111	Recovery	=	99.69%
13) 4-Bromofluorobenzene	11.77	174	2885447+	68.38	ug	0.00
Spiked Amount	70.000	Range	81 - 119	Recovery	=	97.69%

## Target Compounds

					QValue
2) TVN [GRO] [C6-C10]	1.90	TIC	70342613m	823.46	ug
3) MTBE	0.00	73	0	N.D.	
6) Benzene	3.98	78	4256529	63.87	ug
8) Toluene	7.03	92	6085582	138.92	ug
10) Ethylbenzene	9.93	91	435065	4.37	ug
11) M/E Xylene	10.34	91	4567205	63.70	ug
12) O-Xylene	11.06	91	912456	12.56	ug
14) 1,3,5-Trimethylbenzene	13.18	105	490216	6.47	ug
15) 1,2,4-Trimethylbenzene	13.61	105	670935	8.62	ug
17) Naphtylene	15.57	128	146930	2.92	ug

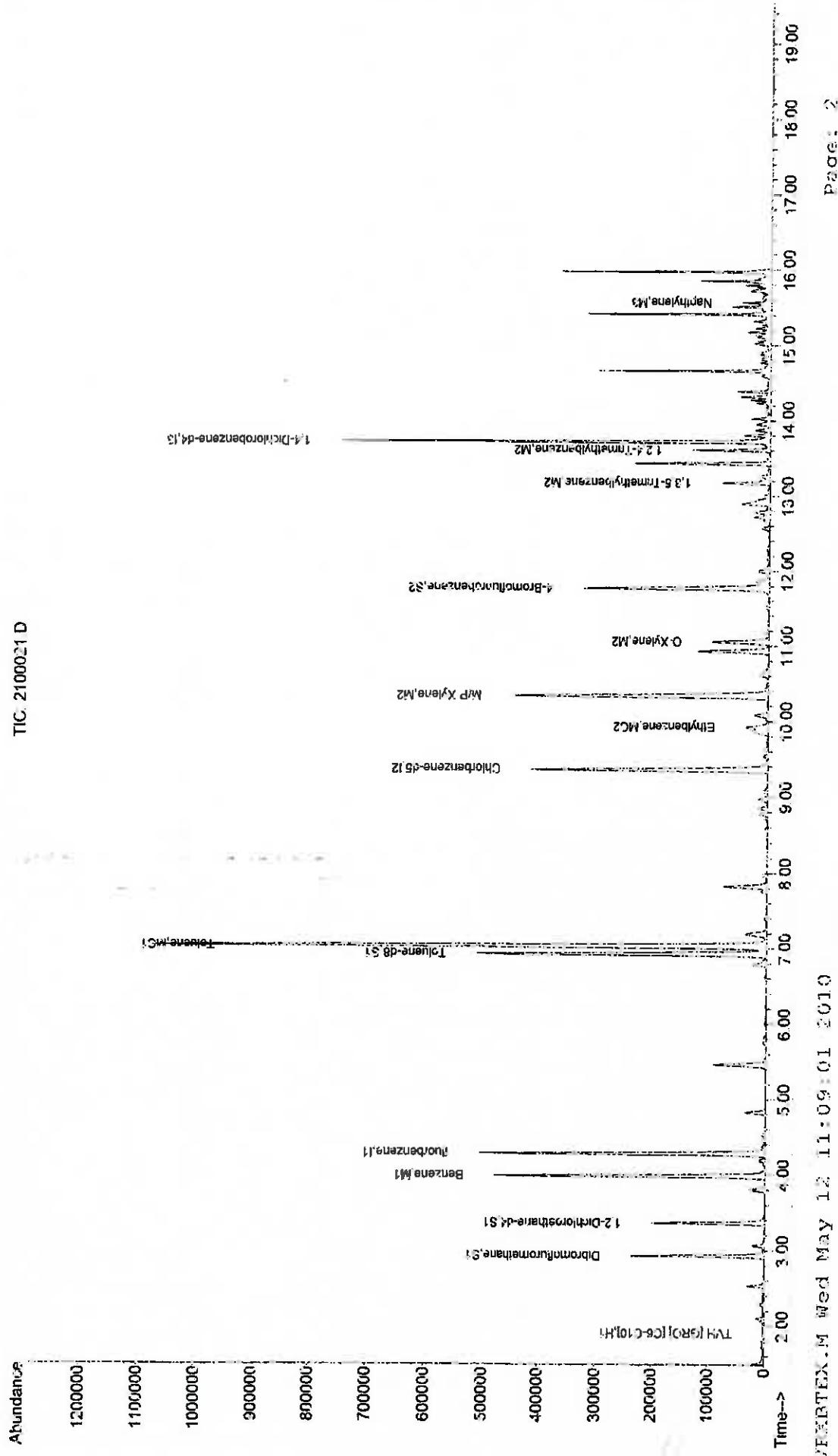
(#) = qualifier out of range (m) = manual integration (+) = signals summed

## Quantitation Report (QTR) Reviewed

Data Path : C:\MSDCHEM\NORTA\1003May11\  
 Data File : 2100021.D  
 Acq On : 12 May 2010 00:55  
 Operator : KEY  
 Sample : SP, 10-0638, 100X, 0505100633,  
 Misc : water, 100ml, Danish Flats  
 A/S Vial : 21, Sample Multiplier: 1

Quant Time: May 12 10:59:36 2010  
 Quant Method: C:\MSDCHEM\1\5973N\4VREKETMX.M  
 Quant Title: 4VREKETMX 826G/BTEX  
 Quant Update: Tue May 11 14:09:01 2010  
 Response via: Initial Calibration

TIC: 2100021.D



# BTEX Analytical Report

## KEY LABORATORIES, INC.

2479A Riverside Parkway  
Grand Junction, CO 81505-1319  
(970) 243-5311 FAX (970) 243-6010

Client: Key Laboratories, Inc.  
Client Project Name: DF Quality Control Sample  
Client Project Number:  
Client Sample ID: Method Blank  
Client Sample Location: Key Labs  
Sampling Date: 5/5/2010  
Sampling Time:  
Sample Matrix:  
Sampler: KEY  
Project Name: DF

QC Type: Blank DF  
Key Lab #: 10-0002  
Work Order #: 0101100002  
Date Received: 05/05/10  
Method: EPA SW846 5030/5035/8260  
Technician: KEY  
Data File Name: 0200002.D  
Date Analyzed: 7 May 2010 17:27  
Data File Path: C:\MSP\CHEM1\DATA\1005MAY07\  
Lab Sample Information: SuL #417

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported=>>

Lab Sample Number: Blank\_10-0002\_0101100002

Sample vol/wt = 5  
DF = 1

CAS#	Type	Target Compounds	Audit	R.T.	Resp.	Amt.	MDL (ppb)	DF	Final Conc.	RDL	Qual	MQL	Sample %Rec
1634-04-4	H1	Gasoline [TVH] [C6-C10]	x	1.9	-2147484	.81 .31	150 ug	1	< .15	.15		40	
71-43-2	M1	MTBE	x				0.25 ug	1	< .25	.25		480	
108-88-3	M1	Benzene	x	3.983	7484	0.11	0.33 ug	1	< .33	.33		480	
100-41-4	MC1	Toluene	x				0.57 ug	1	< .57	.57		480	
91-20-3	MC2	Ethylbenzene	x				0.27 ug	1	< .27	.27		480	
		XYLENES (Total)	x		3473	.1	0.47 ug	1	< .47	.47		1440	
91-20-3	M3	Naphthalene	x	15.57	19644	0.40	2 ug	1	< .2	.2		480	

CAS#	Type	Target Compounds	Audit	R.T.	Resp.	Amt.	MDL (ppb)	DF	Final Conc.	RDL	Qual	MQL	
	M2	M/P Xylene	x	10.38	3473	0.06	1.1 ug	1	< 1.1	1.1		960	
95-47-6	M2	O-Xylene	x				0.47 ug	1	< .47	.47		480	
108-67-8	M2	1,3,5-Trimethylbenzene	x				0.65 ug	1	< .65	.65		480	
95-63-6	M2	1,2,4-Trimethylbenzene	x	13.61	5660	0.09	1.18 ug	1	< 1.18	1.18		480	
		TVH GRO (C6-C10) Subtraction Blank =											

CAS#	Type	System Monitoring Compounds	R.T.	Resp.	Amt.	Amt/Vol	Units	Init.Resp.	Water Limits	Solid Limits	Liquid Limits	%Rec
1868-53-7	S1	Dibromofluoromethane	x	2.929	2429371	71.13	75	ug	3227858	81 - 120	73 - 127	70 101.6
17060-07-0	S1	1,2-Dichloroethane-d4	x	3.362	617516	65.08	74	ug	830726	82 - 118	83 - 117	70 93.
2037-26-5	S1	Toluene-d8	x	6.927	2573732	71.84	82	ug	3149367	89 - 111	86 - 114	70 102.6
460-00-4	S2	4-Bromofluorobenzene	x	11.78	2291173	71.69	72	ug	3196959	81 - 119	72 - 128	70 102.4

CAS#	Type	Internal Standard Compounds	R.T.	Resp.	Amt.	Amt/Vol	Units	Init.Resp.	Water Limits	Solid Limits	Liquid Limits	%Rec
462-06-6	I1	fluorobenzene	x	4.279	4305247	70.00	80	ug	5369781	50 - 200	50 - 200	70.0
3114-55-4	I2	Chlorobenzene-d5	x	9.359	611784	70.00	70	ug	876674	50 - 200	50 - 200	70.0
3855-62-1	I3	1,4-Dichlorobenzene-d4	x	13.72	1753130	70.00	71	ug	2474228	50 - 200	50 - 200	70.0

MDL = Method Detection Limit

PQL = Practical Quantitation Limit = 4 x MDL

RDL = Reporting Detection Limit = MDL x Dilution Factor

MQL = Maximum Quantitation Limit = 110% x DF x Highest Calibration Standard

Reporting basis is Kg for solids and L for liquids

i qualifier = MDL < Result < PQL

E qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

Data Path : C:\MSDCHEM\1\DATA\\_1005may07\  
 Data File : 0200002.D  
 Acq On : 7 May 2010 17:27  
 Operator : KEY  
 Sample : Blank, 10-0002, 0101100000,  
 Misc : Sub #417  
 ALS Vial : 2 Sample Multiplier: 1

Quant Time: May 07 17:47:24 2010  
 Quant Method: C:\MSDCHEM\1\S973N\4VRXBTEX.M  
 Quant Title: 4VRXBTEX Q260/BTEX  
 QLast Update: Mon Jan 18 12:11:04 2010  
 Response via: Initial Calibration

Internal Standards	R.T.	Qion	Response	Conc	Units	Dev(Min)
1) fluorbenzene	4.28	96	4305247	70.00	ug	0.00
9) Chlorobenzene-d5	9.36	54	611784	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	1753130+	70.00	ug	0.00

## System Monitoring Compounds

4) Dibromoefluoromethane	2.93	113	2429371+	71.13	ug	0.00
Spiked Amount	70.000	Range	81 - 120	Recovery	= 101.61%	
5) 1,2-Dichloroethane-d4	3.36	67	617516	65.08	ug	0.00
Spiked Amount	70.000	Range	82 - 116	Recovery	= 92.97%	
7) Toluene-d8	6.93	100	2573732	71.84	ug	0.00
Spiked Amount	70.000	Range	89 - 111	Recovery	= 102.63%	
13) 4-Bromofluorobenzene	11.78	174	2291175+	71.69	ug	0.00
Spiked Amount	70.000	Range	81 - 119	Recovery	= 102.41%	

## Target Compounds

				Qvalue
2) Gasoline (TVH) [C6-C10]	1.90	TIC	-6314878m	Below Cal
3) MTBE	0.00	73	0	N.D.
6) Benzene	3.98	78	7484	0.11 ug # 83
8) Toluene	0.00	92	0	N.D.
10) Ethylbenzene	0.00	91	0	N.D.
11) M/P Xylene	10.38	91	3473	0.06 ug # 42
12) O-Xylene	0.00	91	0	N.D.
14) 1,3,5-Trimethylbenzene	0.00	105	0	N.D.
15) 1,2,4-Trimethylbenzene	13.61	106	5660	0.09 ug # 46
17) Naphtylene	15.57	128	19644	0.40 ug # 69

(#) = qualifier out of range (m) = manual integration (+) = signals summed

Quantitation Method: TIC

File: TIC.M1

Data Path: C:\MSDCHEM\DATA\1005May07\

Data File: 0200002.D

Acq On: 7 May 2010 17:27

Operator: KEY

Sample: Blank, 10-0002, 01010000,

Miss: 500, #417

ALS Vial: 2 Sample Multiplier: 1

Quant Time: May 07 17:47:24 2010

Quant Method: C:\MSDCHEM\1\5973N\4VRAUTEX.M

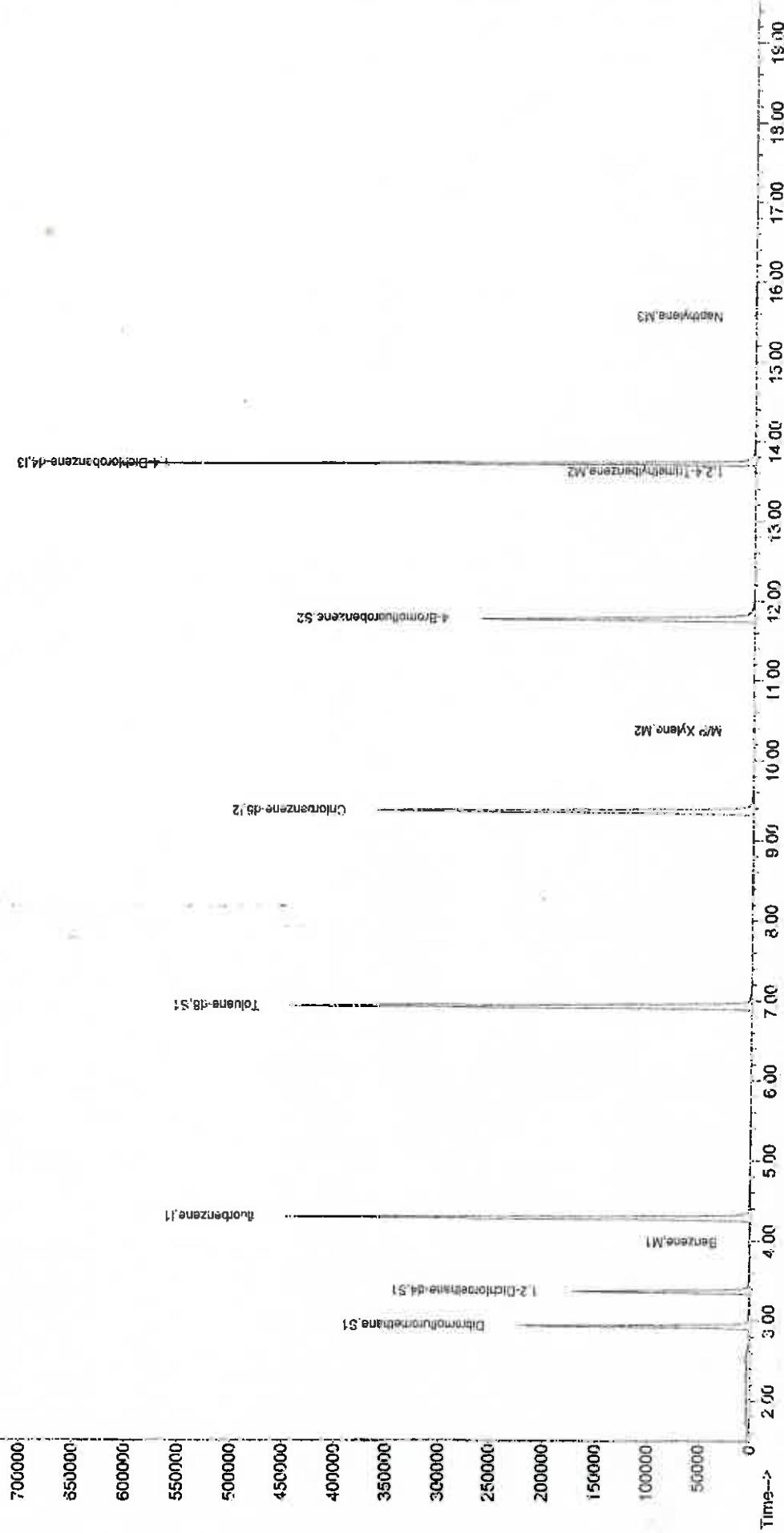
Quant Title: 4VRAUTEX 8260/8TEX

QLast Update: Mon Jan 18 12:11:04 2010

Response via: Initial Calibration

TIC 0200002.D

Abundance



# BTEX Analytical Report

Client: Key Laboratories, Inc.  
 Client Project Name: DF Quality Control Sample  
 Client Project Number:  
 Client Sample ID: Continuing Calibration Check  
 Client Sample Location: Key Labs  
 Sampling Date: 5/5/2010  
 Sampling Time:  
 Sample Matrix:  
 Sampler: KEY  
 Project Name: DF

**KEY LABORATORIES, INC.**  
 2479A Riverside Parkway  
 Grand Junction, CO 81505-1319  
 (970) 243-5311 FAX (970) 243-6010

QC Type: CCV DF  
 Key Lab #: 10-0001  
 Work Order #: 0101100001  
 Date Received: 05/05/10  
 Method: EPA SW846 5030/5035/8260  
 Technician: KEY  
 Data File Name: 0100001.D  
 Date Analyzed: 7 May 2010 16:27  
 Date File Path: C:\MSDCHEM\DATA\\_1005MAY07\  
 Lab Sample Information: 1uL #420 + 5uL #417  
 Lab Sample Number: CC BTEX 40ppb, 10-0001, 0101100000,

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported--> x

Sample vol/wt = 5  
DF = 1

CASE#	Type	Target Compound	Audit	R.T.	Resp.	Amt.	MDL	Units	DF	Final Conc.	R.D.L.	Qual.	M.Q.L.	Spike	%Rec.
1634-04-4	H1	Gasoline [TVH] (C6-C10)	x	1.9	505053.19	657.30	150	ug	1	0.66 mg/L	.15		40		
71-43-2	M1	MTBE	x	2.156	1221793	35.15	0.25	ug	1	35 ug/L	.25		480	40	87.9
108-88-3	M1	Benzene	x	3.982	2528456	39.03	0.33	ug	1	39 ug/L	.33		480	40	97.6
100-41-4	MC1	Toluene	x	7.035	1652407	40.19	0.57	ug	1	40 ug/L	.57		480	40	100.5
91-20-3	MC2	Ethylbenzene	x	9.925	3188009	45.16	0.27	ug	1	45 ug/L	.27		480	40	112.9
		XYLEMES (Total)	x		7994823	138.8	0.47	ug	1	140 ug/L	.47		1440	120	115.7
	M3	Naphthalene	x	15.57	2022596	36.48	2	ug	1	36 ug/L	.2		480	40	91.2
		TVH GRO (C6-C10) Subtraction Blank =													

CASE#	Type	Target Compound	Audit	R.T.	Resp.	Amt.	MDL	Units	DF	Final Conc.	R.D.L.	Qual.	M.Q.L.	Spike	%Rec.
95-47-6	M2	M/P Xylene	x	10.35	5378246	93.47	1.1	ug	1	93 ug/L	.11		960	80	116.8
108-67-8	M2	O-Xylene	x	11.06	2616577	45.35	0.47	ug	1	45 ug/L	.47		480	40	113.4
95-63-6	M2	1,3,5-Trimethylbenzene	x	13.18	2682120	44.87	0.65	ug	1	45 ug/L	.65		480	40	112.2
	M2	1,2,4-Trimethylbenzene	x	13.61	2879429	46.77	1.18	ug	1	47 ug/L	1.18		480	40	116.9

CASE#	Type	System Monitoring Compounds	R.T.	Resp.	Amt.	Area %	Units	Init Resp.		Water Limits		Soil Limits		Spike	%Rec.
1868-53-7	S1	Dibromofluoromethane	x	2.929	2370234	69.97	73	ug	3227858	81 - 120	73 - 127	70	100.		
17060-07-0	S1	1,2-Dichloroethane-d4	x	3.362	598286	63.57	72	ug	830726	82 - 118	83 - 117	70	90.8		
2037-26-5	S1	Toluene-d8	x	6.927	2573231	72.42	82	ug	3149367	89 - 111	86 - 114	70	103.5		
460-00-4	S2	4-Bromofluorobenzene	x	11.77	2457373	77.82	77	ug	3196959	81 - 119	72 - 128	70	111.2		

CASE#	Type	Internal Standard Compound	R.T.	Resp.	Amt.	Area %	Units	Init Resp.		Water Limits		Soil Limits		DIG Conc
462-06-6	I1	fluorobenzene	x	4.28	4269967	70.00	80	ug	5369781	50 - 200	50 - 200	70	70.0	
3114-55-4	I2	Chlorobenzene-d5	x	9.359	604485	70.00	69	ug	876674	50 - 200	50 - 200	70	70.0	
3855-82-1	I3	1,4-Dichlorobenzene-d4	x	13.72	1967629	70.00	80	ug	2474228	50 - 200	50 - 200	70	70.0	

MDL = Method Detection Limit

PQL = Practical Quantitation Limit = 4 x MDL

RDL = Reporting Detection Limit = MDL x Dilution Factor

MQL = Maximum Quantitation Limit = 110% x DF x Highest Calibration Standard

Reporting basis is Kg for solids and L for liquids

J qualifier = MDL < Result < PQL

F qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

## Evaluate Continuing Calibration Report

Data Path : C:\MSDCHEM\1\DATA\\_1005may07\  
 Data File : 0100001.D  
 Acq On : 7 May 2010 16:27  
 Operator : KEY  
 Sample : GC BTEX 40ppb, 10-0001, 0101100000,  
 Misc : 1uL #420 + 5uL #417  
 ALS Vial : 1 Sample Multiplier: 1

Quant Time: May 07 16:46:56 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX 8260/BTEX  
 QLast Update : Mon Jan 18 12:11:04 2010  
 Response via : Initial Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min  
 Max. RRF Dev : 25% Max. Rel. Area : 150%

	Compound	AvgRRF	CCRF	%Dev	Area#	Dev(min)
1 I1	fluorobenzene	1.000	1.000	0.0	80	0.00
2 H1	Gasoline [TVH] [C6-C10]	1.260	1.380	-9.5	87	0.00
3 M1	MTBE	0.570	0.501	12.1	71	0.00
4 S1	Dibromofluoromethane	0.555	0.555	0.0	73	0.00
5 S1	1,2-Dichloroethane-d4	0.154	0.140	9.1	72	0.00
6 M1	Benzene	1.062	1.036	2.4	72	0.00
7 S1	Toluene-d8	0.582	0.603	-3.6	82	0.00
8 MC1	Toluene	0.674	0.677	-0.4	73	0.00
9 I2	Chlorobenzene-d5	1.000	1.000	0.0	69	0.00
10 MC2	Ethylbenzene	8.174	9.229	-12.9	75	0.00
11 M2	M/F Xylene	6.663	7.785	-16.8	74	0.00
12 M2	O-Xylene	6.681	7.575	-13.4	74	0.00
13 S2	4-Bromofluorobenzene	3.657	4.065	-11.2	77	0.00
14 M2	1,3,5-Trimethylbenzene	6.923	7.765	-12.2	77	0.00
15 M2	1,2,4-Trimethylbenzene	7.129	8.336	-16.9	76	0.00
16 I3	1,4-Dichlorobenzene-d4	1.000	1.000	0.0	80	0.00
17 M3	Naphthalene	1.972	1.799	8.8	77	0.00

(#) = Out of Range

SPCC's out = 0 CCC's out = 0

## Quantitation Report (Q1 Reviewed)

Data Path : C:\MSDCHEM\1\DATA\\_1005may07\  
 Data File : 0100001.D  
 Acq On : 7 May 2010 16:27  
 Operator : KEY  
 Sample : GC BTEX 40ppb, 10-0001, 0101100000,  
 Mass : 1uL #420 + 5uL #417  
 ALS Vial : 1 Sample Multiplier: 1

Quant Time: May 07 16:46:36 2010  
 Quant Method: C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX 0260/BTEX  
 QLast Update : Mon Jan 18 12:11:04 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	Q1on	Response	Conc	Units	Dev(Min)
1) Fluorbenzene	4.28	96	4269967	70.00	ug	0.00
9) Chlorbenzene-d5	9.36	54	604485	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	1967629+	70.00	ug	0.00
<b>System Monitoring Compounds</b>						
4) Dibromofluoromethane	2.93	113	2370234+	69.97	ug	0.00
Spiked Amount 70.000	Range 81 - 120		Recovery =	99.96%		
5) 1,2-Dichloroethane-d4	3.36	67	598286	63.57	ug	0.00
Spiked Amount 70.000	Range 82 - 118		Recovery =	90.81%		
7) Toluene-d8	6.93	100	2573330	72.42	ug	0.00
Spiked Amount 70.000	Range 89 - 111		Recovery =	103.46%		
13) 4-Bromofluorobenzene	11.77	174	2457373+	77.82	ug	0.00
Spiked Amount 70.000	Range 81 - 119		Recovery =	111.17%		
<b>Target Compounds</b>						
2) Gasoline (TVR) (C6-C10)	1.90	TIC	50505319m	657.30	ug	Qvalue
3) MTBE	2.16	73	1221793	35.15	ug	99
6) Benzene	3.98	78	2528456	39.03	ug	# 100
8) Toluene	7.04	92	1652407	40.19	ug	98
10) Ethylbenzene	9.92	91	3188009	45.16	ug	100
11) M/P Xylene	10.35	91	5378246	93.47	ug	99
12) O-Xylene	11.06	91	2616577	45.35	ug	100
14) 1,3,5-Trimethylbenzene	13.18	105	2682120	44.87	ug	99
15) 1,2,4-Trimethylbenzene	13.61	105	2879429	46.77	ug	99
17) Naphtylene	15.57	128	2022596	36.48	ug	# 100

(\*) = qualifier out of range (m) = manual integration (+) = signals summed

# BTEX Analytical Report

Client: Key Laboratories, Inc.  
 Client Project Name: DF Quality Control Sample  
 Client Project Number:  
 Client Sample ID: TVH Calibration Check  
 Client Sample Location: Key Labs  
 Sampling Date: 5/5/2010  
 Sampling Time:  
 Sample Matrix:  
 Sampler: KEY  
 Project Name: DF

QC Type: TVH DF  
 Key Lab #: 10-0003  
 Work Order #: 0101100003  
 Date Received: 05/05/10  
 Method: EPA SW846 5030/5035,3260  
 Technician: KEY  
 Data File Name: 0300003.D  
 Date Analyzed: 7 May 2010 17:53  
 Data File Path: C:\MSDCHEM\1\DATA\1005MAY07\  
 Lab Sample Information: 5uL #417 + #397  
 Lab Sample Number: TVH 5K\_10-0003\_0101100003

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported=> x

Sample vol/wt = 5  
DF = 1

CAS#	Type	Target Compound	Audit	R.T.	Repp.	Amt.	MDL	Units	DF	Final Conc.	RDL	Qual.	MQL	Spk	%Rec	
1634-04-4	H1	Gasoline [TVH] [C6-C10]	x	1.9	3e9623698	4938.79	150	ug	1	4.9 mg/L	15			40	5	98.8
71-43-2	M1	MTBE		2.104			0.25	ug								
108-88-3	M1	Benzene		3.982			0.33	ug								
100-41-4	MC1	Toluene		7.036			0.57	ug								
91-20-3	MC2	Ethylbenzene		9.922			0.27	ug								
		XYLEMES (Total)					0.47	ug								
91-20-3	M3	Naphthalene		15.57			2	ug								
		TVH GRO (C6-C10) Subtraction Blank =														
CAS#	Type	System Monitoring Compound	Audit	R.T.	Repp.	Amt.	MDL	Units	DF	Final Conc.	RDL	Qual.	MQL	Spk	%Rec	
95-47-6	M2	M/P Xylene		10.34			1.1	ug								
108-67-8	M2	O-Xylene		11.05			0.47	ug								
95-63-6	M2	1,3,5-Trimethylbenzene		13.18			0.65	ug								
		1,2,4-Trimethylbenzene		13.61			1.18	ug								
		TVH GRO (C6-C10) Subtraction Blank =														
CAS#	Type	Internal standard Compound	Audit	R.T.	Repp.	Amt.	Area%	Units	DF	Final Conc.	RDL	Qual.	MQL	Spk	%Rec	
1868-53-7	S1	Dibromofluoromethane	x	2.929	2312716	70.10	72	ug	3227858	81 - 120	73 - 127		70	100.1		
17060-07-0	S1	1,2-Dichloroethane-d4	x	3.262	595959	65.01	72	ug	830726	82 - 118	83 - 117		70	92.9		
2037-26-5	S1	Toluene-d8	x	6.926	2632239	76.06	84	ug	3149367	89 - 111	86 - 114		70	108.7		
460-00-4	S2	4-Bromofluorobenzene	x	11.77	2459063	76.57	77	ug	3196959	81 - 119	72 - 128		70	109.4		
CAS#	Type	Internal standard Compound	Audit	R.T.	Repp.	Amt.	Area%	Units	DF	Final Conc.	RDL	Qual.	MQL	Spk	%Rec	
462-06-6	I1	fluorobenzene	x	4.279	4159012	70.00	77	ug	5369781	50 - 200	50 - 200		70	70.0		
3114-55-4	I2	Chlorobenzene-d5	x	9.257	614820	70.00	70	ug	876674	50 - 200	50 - 200		70	70.0		
3855-82-1	I3	1,4-Dichlorobenzene-d4	x	13.72	1883503	70.00	76	ug	2474228	50 - 200	50 - 200		70	70.0		

MDL = Method Detection Limit

PQL = Practical Quantitation Limit =  $4 \times \text{MDL}$

RDL = Reporting Detection Limit =  $\text{MDL} \times \text{Dilution Factor}$

MQL = Maximum Quantitation Limit =  $110\% \times \text{DF} \times \text{Highest Calibration Standard}$

Reporting basis is Kg for solids and L for liquids

J qualifier =  $\text{MDL} < \text{Result} < \text{PQL}$

E qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

## Quantitation Report (QT Reviewed)

Data Path : C:\MSDCHEM\1\DATA\1005may07\  
 Data File : 0300003.D  
 Acq On : 7 May 2010 17:53  
 Operator : KEY  
 Sample : TVH 5K, 10-0003, 0101100000,  
 Misc : SuL #417 + #397  
 ABL Vial : 3 Sample Multiplier: 1

Quant Time: May 07 18:13:15 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEx.M  
 Quant Title : 4VRXBTEx S260/BTEK  
 QLast Update : Mon Jan 18 12:11:04 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	QIon	Response	Conc	Units	Dev (Min)
1) fluorobenzene	4.28	96	4159012	70.00	ug	0.00
9) Chlorbenzene-d5	9.36	54	614820	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	1883503+	70.00	ug	0.00
<hr/>						
System Monitoring Compounds						
4) Dibromofluoromethane	2.93	113	2312716+	70.10	ug	0.00
Spiked Amount	70.000	Range	81 - 120	Recovery	=	100.14%
5) 1,2-Dichloroethane-d4	3.36	67	595959	65.01	ug	0.00
Spiked Amount	70.000	Range	82 - 118	Recovery	=	92.87%
7) Toluene-d8	6.93	100	2632239	76.06	ug	0.00
Spiked Amount	70.000	Range	89 - 111	Recovery	=	109.66%
13) 4-Bromofluorobenzene	11.77	174	2459063+	76.57	ug	0.00
Spiked Amount	70.000	Range	81 - 119	Recovery	=	109.39%
<hr/>						
Target Compounds						
2) Gasoline (TVH) [C8-C10]	1.90	TIC	369625696m	4938.79	ug	Qvalue
3) MTBE	2.10	73	1528	0.05	ug	# 1
6) Benzene	3.93	78	6749877	106.97	ug	# 100
8) Toluene	7.04	92	20834249	520.25	ug	99
10) Ethylbenzene	9.92	91	7710750	107.40	ug	99
11) M/P Xylene	10.34	91	23747955	405.77	ug	99
12) o-Xylene	11.05	91	9553622	162.81	ug	99
14) 1,3,5-Trimethylbenzene	13.18	105	2818389	46.35	ug	99
15) 1,2,4-Trimethylbenzene	13.61	105	10960664	175.06	ug	98
17) Naphthylene	15.57	123	345378	6.51	ug	# 99

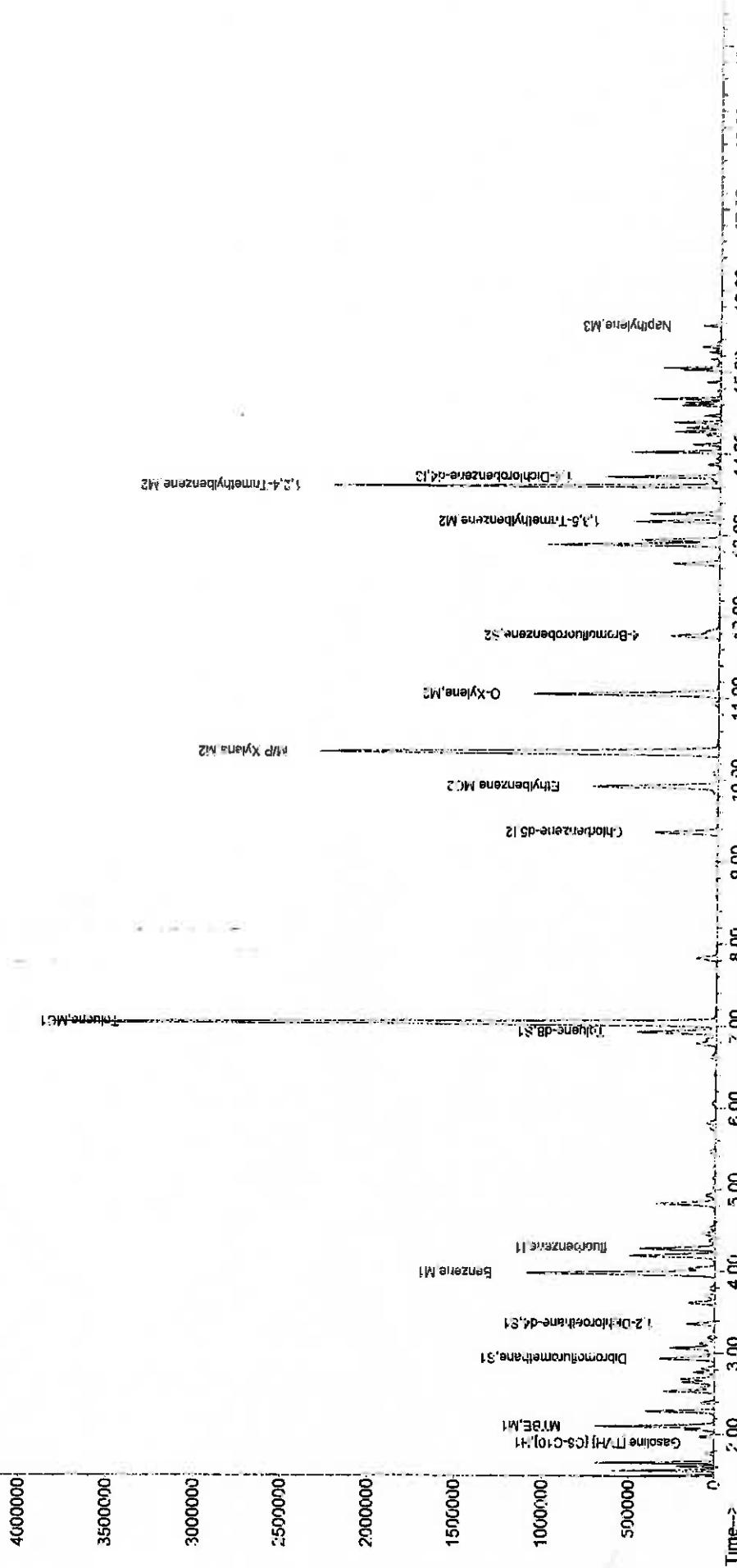
(#) = qualifier out of range (m) = manual integration (+) = signals summed

## Quantitation report (U1 Reviewer)

Quant Time: May 07 16:13:15 2010  
 Quant Method: C:\MSDCHEM\1\S973N\4\VRXTEX.M  
 Quant Title: 4VRXTEX 8260/3TEX  
 QLast Update: Mon Jan 16 12:11:04 2010  
 Response vls: Initial Calibration

TIC 0300003 D

Abundance



# BTEX Analytical Report

## KEY LABORATORIES, INC.

2479A Riverside Parkway  
Grand Junction, CO 81505-1319  
(970) 243-5311 FAX (970) 243-6010

Client: Key Laboratories, Inc.  
Client Project Name: DF Quality Control Sample  
Client Project Number:  
Client Sample ID: Method Blank  
Client Sample Location: Key Labs  
Sampling Date: 5/5/2010  
Sampling Time:  
Sample Matrix:  
Sampler: KEY  
Project Name: DF

QC Type: Blank DF  
Key Lab #: 10-0002  
Work Order #: 0101100002  
Date Received: 05/05/10  
Method: EPA SW846 5030/5035/8260  
Technician: KEY  
Data File Name: 0200002.D  
Date Analyzed: 11 May 2010 15:55  
Data File Path: C:\MSDCHEM\DATA\1005MAY11  
Lab Sample Information: SuL #417

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported<--> x

Sample vol/wt = 5  
DF = 1

Lab Sample Number: Blank\_10-0002, 0101100000.

CASE	Type	Target Compounds	Audit	R.T.	Resp.	Amnt.	MDL	Units	DF	Final Conc.	RDL	Qual	MDL Spots	%REC
1634-04-4	M1	TVH [GRO] [C6-C10]	x	1.9	-2147484	-107.14	150	ug	1	<	15		40	
		MTBE					0.25	ug						
71-43-2	M1	Benzene	x	3.986		13069	0.20	0.33	ug	1	<	.33		480
106-88-3	MC1	Toluene	x	7.042		56657	1.31	1.35	ug	1	<	1.35		480
100-41-4	MC2	Ethylbenzene	x	9.956		4211	0.05	0.27	ug	1	<	.27		480
		XYLENES (Total)	x			30859	.4	0.47	ug	1	<	.47		1440
91-20-3	M3	Naphthalene	x	15.58		26046	0.54	2	ug	1	<	2		480

CASE	Type	Target Compounds	Audit	R.T.	Resp.	Amnt.	MDL	Units	DF	Final Conc.	RDL	Qual	MDL	%REC
	M2	M/P Xylene	x	10.36		25692	0.37	1.1	ug	1	<	1.1		960
95-47-6	M2	O-Xylene	x	11.08		5168	0.07	0.47	ug	1	<	.47		480
108-67-8	M2	1,3,5-Trimethylbenzene	x	13.18		4043	0.05	0.65	ug	1	<	.65		480
95-63-6	M2	1,2,4-Trimethylbenzene	x	13.61		14041	0.18	1.18	ug	1	<	1.18		480
		TVH GRO (C6-C10) Subtraction Blank =												

CASE	Type	System Monitoring Compounds	Audit	R.T.	Resp.	Amnt.	Area %	Units	Inf Recd.	Water Limits	Soil Limits	Spots	%Rec	
1868-53-7	S1	Dibromofluoromethane	x	2.934		2608644	69.28	107	ug	2441318	81 - 120	73 - 127	70	99
17060-07-0	S1	1,2-Dichloroethane-d4	x	3.366		690052	70.83	115	ug	602333	52 - 118	83 - 117	70	101.2
2037-26-5	S1	Toluene-d8	x	6.927		2863234	69.04	105	ug	2726578	89 - 111	86 - 114	70	98.6
460-00-4	S2	4-Bromofluorobenzene	x	11.77		2667595	64.42	100	ug	2662516	81 - 119	72 - 128	70	92

CASE	Type	Internal Standard Compounds	Audit	R.T.	Resp.	Amnt.	Area %	Units	Inf Recd.	Water Limits	Soil Limits	Spots	ISS Conc	
462-06-6	I1	fluorobenzene	x	4.282		4757713	70.00	107	ug	4443128	50 - 200	50 - 200	70	0
3114-55-4	I2	Chlorobenzene-d5	x	9.357		713377	70.00	108	ug	660291	50 - 200	50 - 200	70	0
3855-82-1	I3	1,4-Dichlorobenzene-d4	x	13.72		2034965	70.00	99	ug	2057567	50 - 200	50 - 200	70	0

MDL = Method Detection Limit

PQL = Practical Quantitation Limit = 4 x MDL

RDL = Reporting Detection Limit = MDL x Dilution Factor

MQL = Maximum Quantitation Limit = 110% x DF x Highest Calibration Standard

Reporting basis is Kg for solids and L for liquids

I qualifier = MDL < Result < PQL

E qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

## Quantitation Report (Q1 Reviewed)

Data Path : C:\MSDCHEM\1\DATA\\_1005may11\  
 Data File : 0200002.D  
 Acq On : 11 May 2010 15:55  
 Operator : KEY  
 Sample : Blank, 10-0002, 0101100000,  
 Misc : SUL #417  
 ALC Vial : 2 Sample Multiplier: 1

Quant Time: May 11 17:04:32 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEK.M  
 Quant Title : 4VRXBTEK 8260/BTEX  
 Last Update : Tue May 11 14:03:01 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	Qion	Response	Cone	Units	Dev(Min)
1) fluorbenzene	4.28	96	4757713	70.00	ug	0.00
9) Chlorbenzene-d5	9.36	54	713377	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	2034965+	70.00	ug	0.00
<b>System Monitoring Compounds</b>						
4) DibromoFluoromethane	2.93	113	2608644+	69.28	ug	0.00
Spiked Amount 70.000	Range 81 - 120		Recovery =	98.97%		
5) 1,2-Dichloroethane-d4	3.37	67	690052	70.83	ug	0.00
Spiked Amount 70.000	Range 82 - 118		Recovery =	101.19%		
7) Toluene-d8	6.93	100	2863234	69.04	ug	0.00
Spiked Amount 70.000	Range 89 - 111		Recovery =	98.63%		
13) 4-Bromofluorobenzene	11.77	174	2667595+	64.42	ug	0.00
Spiked Amount 70.000	Range 81 - 119		Recovery =	92.03%		
<b>Target Compounds</b>						
2) TVB (GRO) [C6-C10]	1.90	TIC	-9050145m	Below Cal		Qvalue
3) MTBE	0.00	73	0	N.U.		
6) Benzene	3.93	78	13069	0.20	ug	# 52
8) Toluene	7.04	92	56657	1.31	ug	# 94
10) Ethylbenzene	9.96	91	4211	0.05	ug	# 55
11) m/p Xylene	10.36	91	25692	0.37	ug	# 76
12) o-Xylene	11.08	91	5168	0.07	ug	# 65
14) 1,3,5-Trimethylbenzene	13.18	105	4043	0.05	ug	# 43
15) 1,2,4-Trimethylbenzene	13.61	105	14041	0.18	ug	# 75
17) Naphthylene	15.50	128	26046	0.54	ug	# 92

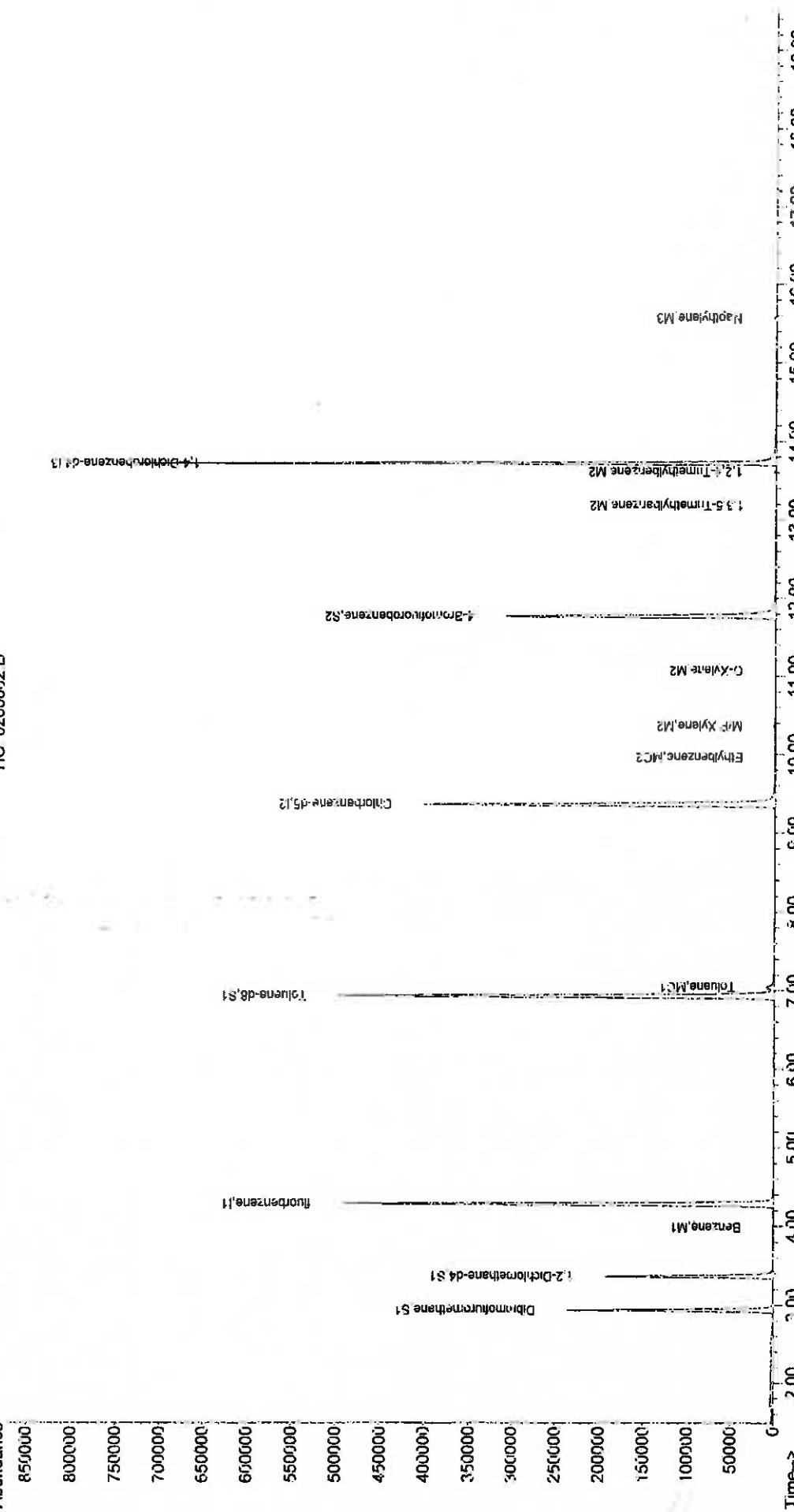
(#) = qualifier out of range (m) = manual integration (+) = signals summed

## QUANTIFICATION REPORT (Q2) NOV 2010

Data Path : C:\MSDCHEM\1\DATA\100\may11  
 Data File : 0262002.D  
 Acq On : 11 May 2010 15:55  
 Operator : EEW  
 Sample : Blank, 10-0002, 010110000,  
 Misc : Sub, #427  
 A/Ls Vial : 2 Sample Multiplier: 1

Quant Time: May 11 17:04:32 2010  
 Quant Method : C:\MSDCHEM\1\5975N\4VRXTEX.M  
 Quant Title : 4VRXTEX 3260/ETEX  
 QLast Update : Tue May 11 14:09:01 2010  
 Response via : Initial Calibration

Abundance



# BTEX Analytical Report

## KEY LABORATORIES, INC.

2479A Riverside Parkway  
Grand Junction, CO 81505-1319  
(970) 243-5311 FAX (970) 243-6010

Client: Key Laboratories, Inc.  
Client Project Name: DF Quality Control Sample  
Client Project Number:  
Client Sample ID: Continuing Calibration Check  
Client Sample Location: Key Labs  
Sampling Date: 5/5/2010  
Sampling Time:  
Sample Matrix:  
Sampler: KEY  
Project Name: DF

QC Type: CCV DF  
Key Lab #: 10-0001  
Work Order #: 0101100001  
Date Received: 05/05/10  
Method: EPA SW846 5030/5035/8260  
Technician: KEY  
Data File Name: 0100001.D  
Date Analyzed: 11 May 2010 15:29  
Data File Path: C:\MSDCHEM1\DATA\\_1005MAY11\  
Lab Sample Information: 1uL #420 + 1uL #428 + 5uL #417

Lab Sample Number: CC\_NHEx BTEX 40ppb\_10-0001\_0101100001

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported=> x

Sample vol/wt = 5  
DF = 1

CASE#	Type	Target Compounds	Amt	R.T.	Resp.	Amt	MDL	Calcd	DF	Final Conc	R.D.L.	Qual	MOL Spike	%Rec
H1	TVH [GRO] [C6-C10]	x	1.9	68044295	813.26	150 ug	1	0.81 mg/L	15				40	
1634-04-4 M1	MTBE		2.161			0.25 ug							40	
71-43-2 M1	Benzene	x	2.986	2678313	41.01	0.33 ug	1	41 ug/L	33				480	40
108-88-3 MC1	Toluene	x	7.037	1812295	42.24	1.35 ug	1	42 ug/L	135				480	40
100-41-4 MC2	Ethylbenzene	x	9.927	3443253	42.49	0.27 ug	1	42 ug/L	27				480	40
	XYLENES (Total)	x		8712762	130.6	0.47 ug	1	130 ug/L	47				1440	120
91-20-3 M3	Naphthalene	x	15.57	1960790	39.71	2 ug	1	40 ug/L	2				480	40
TVH GRO (C6-C10) Subtraction Blank =														

CASE#	Type	Target Compounds	Amt	R.T.	Resp.	Amt	MDL	Calcd	DF	Final Conc	R.D.L.	Qual	MOL Spike	%Rec
M2	M/P Xylene	x	10.35	5828807	87.77	1.1 ug	1	88 ug/L	1.1				960	80
95-47-6 M2	O-Xylene	x	11.06	2883955	42.86	0.47 ug	1	43 ug/L	47				480	40
108-67-8 M2	1,3,5-Trimethylbenzene	x	13.18	2822286	40.20	0.65 ug	1	40 ug/L	65				480	40
95-63-6 M2	1,2,4-Trimethylbenzene	x	13.61	3157999	43.81	1.13 ug	1	44 ug/L	1.18				480	40
TVH GRO (C6-C10) Subtraction Blank =														

CASE#	Type	System Monitoring Compounds	R.T.	Resp.	Amt	Area %	Unde Init	Init Resp.		Water Limit		Soil Limit	Spike	%Rec
1868-53-7 S1	Dibromofluoromethane	x	2.934	2620944	79.27	107	ug	2441318		81 - 120		73 - 127	70	100.4
17060-07-0 S1	1,2-Dichloroethane-d4	x	3.367	653359	67.71	108	ug	602333		82 - 118		83 - 117	70	96.7
2037-26-5 S1	Toluene-d8	x	6.929	2786441	67.83	102	ug	2726578		89 - 111		86 - 114	70	96.9
460-00-4 S2	4-Bromofluorobenzene	x	11.78	2746794	70.28	103	ug	2662516		81 - 119		72 - 126	70	100.4
Internal Standard Compounds														

ADL = Method Detection Limit

PQL = Practical Quantitation Limit = 4 x MDL

DL = Reporting Detection Limit = MDL x Dilution Factor

SQL = Maximum Quantitation Limit = 110% x DF x Highest Calibration Standard

Reporting basis is Kg for solids and L for liquids

I qualifier = MDL < Result < PQL

E qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

## Evaluate Continuing Calibration Report

Data Path : C:\MSDCHEM\1\DATA\\_1005MAY11\  
 Data File : 0100001.D  
 Acq On : 11 May 2010 15:29  
 Operator : KEY  
 Sample : CC NHEX BTEX 40ppb, 10-0001, 0101100000,  
 Misc : 1uL #420 + 1uL #428 + 5uL #417  
 ALS Vial : 1 Sample Multiplier: 1

Quant Time: May 12 13:17:18 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX 8260/BTEX  
 QLast Update : Tue May 11 14:09:01 2010  
 Response via : Initial Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min  
 Max. RRF Dev : 25% Max. Rel. Area : 150%

	Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
1	11 Fluorbenzene	1.000	1.000	0.0	106	0.00
2	H1 TVH [GRO] [C6-C10]	1.243	1.263	-1.6	97	0.00
3	M3 MTBE	0.447	0.442	1.1	104	0.00
4	S1 Dibromofluoromethane	0.554	0.556	-0.4	107	0.00
5	S1 1,2-Dichloroethane-d4	0.143	0.139	2.8	108	0.00
6	M1 Benzene	0.970	0.993	-2.6	102	0.00
7	S1 Toluene-d8	0.610	0.591	3.1	102	0.00
8	MCl Toluene	0.637	0.673	-5.7	104	0.00
9	I2 Chlorobenzene-d5	1.000	1.000	0.0	102	0.00
10	M2 Ethylbenzene	8.426	8.950	-6.2	103	0.00
11	M2 M/P Xylene	6.905	7.576	-9.7	103	0.00
12	M2 o-Xylene	6.997	7.496	-7.1	102	0.00
13	S2 4-Bromofluorobenzene	4.064	4.080	-0.4	103	0.00
14	M2 1,3,5-Trimethylbenzene	7.299	7.336	-0.5	100	0.00
15	M2 1,2,4-Trimethylbenzene	7.495	8.209	-9.5	104	0.00
16	I3 1,4-Dichlorobenzene-d4	1.000	1.000	0.0	101	0.00
17	M3 Napthylene	1.670	1.658	0.7	111	0.00

(\*) = Out of Range

SPCC's out = 0 CCC's out = 0

## Quantitation Report (Q1 Reviewed)

Data Path : C:\MSDCHEM\1\DATA\\_1005MAY11\  
 Data File : 0100001.D  
 Acq On : 11 May 2010 15:29  
 Operator : KEY  
 Sample : CC NHEX BTEX .40ppb, 10-0001, 0101100000,  
 Misc : 1uL #420 + 1uL #428 + 5uL #417  
 ALS Vial : 1 Sample Multiplier: 1

Quant Time: May 12 13:17:18 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX S260/BTEX  
 Quant Update : Tue May 11 14:09:01 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	QIon	Response	Cone	Units	Dev(Min)
1) fluorbenzene	4.28	96	4712473	70.00	ug	0.00
2) Chlorbenzene-d5	9.36	54	673245	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	20700694+	70.00	ug	0.00
<b>System Monitoring Compounds</b>						
4) Dibromoformmethane	2.93	113	2620944+	70.27	ug	0.00
Spiked Amount 70.000	Range 81 - 120		Recovery	=	100.39%	
5) 1,2-Dichloroethane-d4	3.37	67	653359	67.71	ug	0.00
Spiked Amount 70.000	Range 82 - 118		Recovery	=	96.73%	
7) Toluene-d8	6.93	100	2786941	67.83	ug	0.00
Spiked Amount 70.000	Range 89 - 111		Recovery	=	96.90%	
13) 4-Bromofluorobenzene	11.78	174	2746794+	70.28	ug	0.00
Spiked Amount 70.000	Range 81 - 119		Recovery	=	100.40%	
<b>Target Compounds</b>						
2) TVH [GRO] [C6-C10]	1.90	TIC	68044295m	813.26	ug	Qvalue
3) MTBE	2.16	73	1190433	39.57	ug	99
6) Benzene	3.99	73	2678313	41.01	ug	# 99
8) Toluene	7.04	92	1812295	42.24	ug	98
10) Ethylbenzene	9.93	91	3443253	42.43	ug	98
11) M/P Xylene	10.35	91	5828607	87.77	ug	99
12) o-Xylene	11.06	91	2883955	42.86	ug	100
14) 1,3,5-Trimethylbenzene	13.18	105	2822286	40.20	ug	100
15) 1,2,4-Trimethylbenzene	13.61	105	3157999	43.81	ug	98
17) Naphtylene	15.57	128	1960790	39.71	ug	# 98

(\*) = qualifier out of range (m) = manual integration (+) = signals summed

# BTEX Analytical Report

Client: Key Laboratories, Inc.  
 Client Project Name: DF Quality Control Sample  
 Client Project Number:

Client Sample ID: TVH Calibration Check  
 Client Sample Location: Key Labs  
 Sampling Date: 5/5/2010  
 Sampling Time:  
 Sample Matrix:  
 Sampler: KEY  
 Project Name: DF

QC Type: TVH DF  
 Key Lab #: 10-0003  
 Work Order #: 0101100003  
 Date Received: 05/05/10  
 Method: EPA SW846 5030/5035/8260  
 Technician: KEY  
 Data File Name: 0300003.D  
 Date Analyzed: 11 May 2010 16:20  
 Data File Path: C:\MSDCHEM\DATA\\_1005may11\  
 Lab Sample Information: SuL #417 + #397  
 Lab Sample Number: TVH 5K\_10-0003\_0101100003

Loss On Heating multiplier =

MeOH Extract/Dilution Aliquot [uL] =

Dilution/Extraction volume [mL] =

Reported=> x

Sample vol/wt = 5  
 DF = 1

CAS#	Type	Target Compounds	Audit	R.T.	Rep.	Amt.	MDL	Units	DF	Final Conc.	RDL	Qual	MQL	SPKE	PERC	
1634-04-4	H1	TVH [GRO] [C6-C10]	x	1.9	419711373	5081.94	150	ug	1	5.1 mg/L	15			40	5	101.6
71-43-2	M1	MTBE					0.25	ug								
108-88-3	M1	Benzene		3.985			0.33	ug								
100-41-4	M2	Toluene		7.037			1.35	ug								
91-20-3	M2	Ethylbenzene		9.922			0.27	ug								
		XYLEMES (Total)					0.47	ug								
	M3	Naphthalene		15.57				2	ug							
		TVH GRO (C6-C10) Subtraction Blank =														
CAS#	Type	Target Compounds	Audit	R.T.	Rep.	Amt.	MDL	Units	DF	Final Conc.	RDL	Qual	MQL	SPKE	PERC	
95-47-6	M2	M/P Xylene		10.34			1.1	ug								
108-67-8	M2	O-Xylene		11.05			0.47	ug								
95-63-6	M2	1,3,5-Trimethylbenzene		13.18			0.65	ug								
		1,2,4-Trimethylbenzene		13.61			1.18	ug								
		TVH GRO (C6-C10) Subtraction Blank =														

CAS#	Type	System Monitoring Compounds	R.T.	Rep.	Amt.	Area %	Units	Init. Rep.	Water Limits	Soil Limits	Spke	%Rec	
1868-53-7	S1	Dibromofluoromethane	x	2.935	2544389	69.11	104	ug	2441318	81 - 120	73 - 127	70	98.7
17060-07-0	S1	1,2-Dichloroethane-d4	x	3.367	678428	71.22	113	ug	602332	82 - 118	83 - 117	70	101.7
2037-26-5	S1	Toluene-d8	x	6.927	2864314	70.64	105	ug	2726578	89 - 111	86 - 114	70	100.9
460-00-4	S2	4-Bromofluorobenzene	x	11.77	2810713	67.09	106	ug	2662516	81 - 119	72 - 128	70	95.8

CAS#	Type	Internal Standard Compounds	R.T.	Rep.	Amt.	Area %	Units	Init. Rep.	Water Limits	Soil Limits	Spke	%Rec
462-06-11	I1	Fluorobenzene	x	4.282	4651666	70.00	105	ug	4443128	50 - 200	50 - 200	70.0
3114-55-4	I2	Chlorobenzene-d5	x	9.357	721680	70.00	109	ug	660291	50 - 200	50 - 200	70.0
3835-82-1	I3	1,4-Dichlorobenzene-d4	x	13.72	2184335	70.00	106	ug	2037567	50 - 200	50 - 200	70.0

MDL = Method Detection Limit

Reporting basis is Kg for solids and L for liquids

PQL = Practical Quantitation Limit = 4 x MDL

J qualifier = MDL < Result < PQL

RDL = Reporting Detection Limit = MDL x Dilution Factor

F qualifier = Estimated Result > Highest Calibration Standard

Analyst

Approved

Data Path : C:\MSDCHEM\1\DATA\1005may11\  
 Data File : 0300003.D  
 Acq On : 11 May 2010 16:20  
 Operator : KEY  
 Sample : TVH 5K, 10-0003, 0101100000,  
 Misc : Sol #417 + #397  
 ALS Vial : 3 Sample Multiplier: 1

Quant Time: May 11 17:04:33 2010  
 Quant Method : C:\MSDCHEM\1\5973N\4VRXBTEX.M  
 Quant Title : 4VRXBTEX 8260/BTEX  
 Last Update : Tue May 11 14:09:01 2010  
 Response via : Initial Calibration

Internal Standards	R.T.	Qion	Response	Conc	Units	Dev(Min)
1) Fluorobenzene	4.28	96	4651666	70.00	ug	0.00
2) Chlorobenzene-d5	9.36	54	721680	70.00	ug	0.00
16) 1,4-Dichlorobenzene-d4	13.72	154	2184335+	70.00	ug	0.00
<b>System Monitoring Compounds</b>						
4) Dibromoformmethane	2.93	113	2544389+	69.11	ug	0.00
Spiked Amount	70.000	Range	81 - 120	Recovery	=	98.73%
5) 1,Z-Dichloroethane-d4	3.37	67	678428	71.22	ug	0.00
Spiked Amount	70.000	Range	82 - 118	Recovery	=	101.74%
7) Toluene-d8	6.93	100	2864314	70.64	ug	0.00
Spiked Amount	70.000	Range	89 - 111	Recovery	=	100.91%
13) 4-Bromofluorobenzene	11.77	174	2810713+	67.09	ug	0.00
Spiked Amount	70.000	Range	81 - 119	Recovery	=	95.84%
<b>Target Compounds</b>						
2) TVH [GRO] (C6-C10)	1.90	TIC	419711373m	5081.94	ug	Qvalue
3) MTBE	0.00	73	0	N.D.		
6) Benzene	3.99	78	7627801	118.32	ug	# 100
8) Toluene	7.04	92	23825605	562.54	ug	99
10) Ethylbenzene	9.92	91	8915255	102.62	ug	99
11) M/P Xylene	10.34	91	27441589	385.50	ug	100
12) O-Xylene	11.05	91	11045407	153.12	ug	100
14) 1,3,5-Trimethylbenzene	13.18	105	3269657	43.45	ug	100
15) 1,2,4-Trimethylbenzene	13.61	105	12908995	167.07	ug	99
37) Naphthalene	15.57	128	437044	8.39	ug	# 97

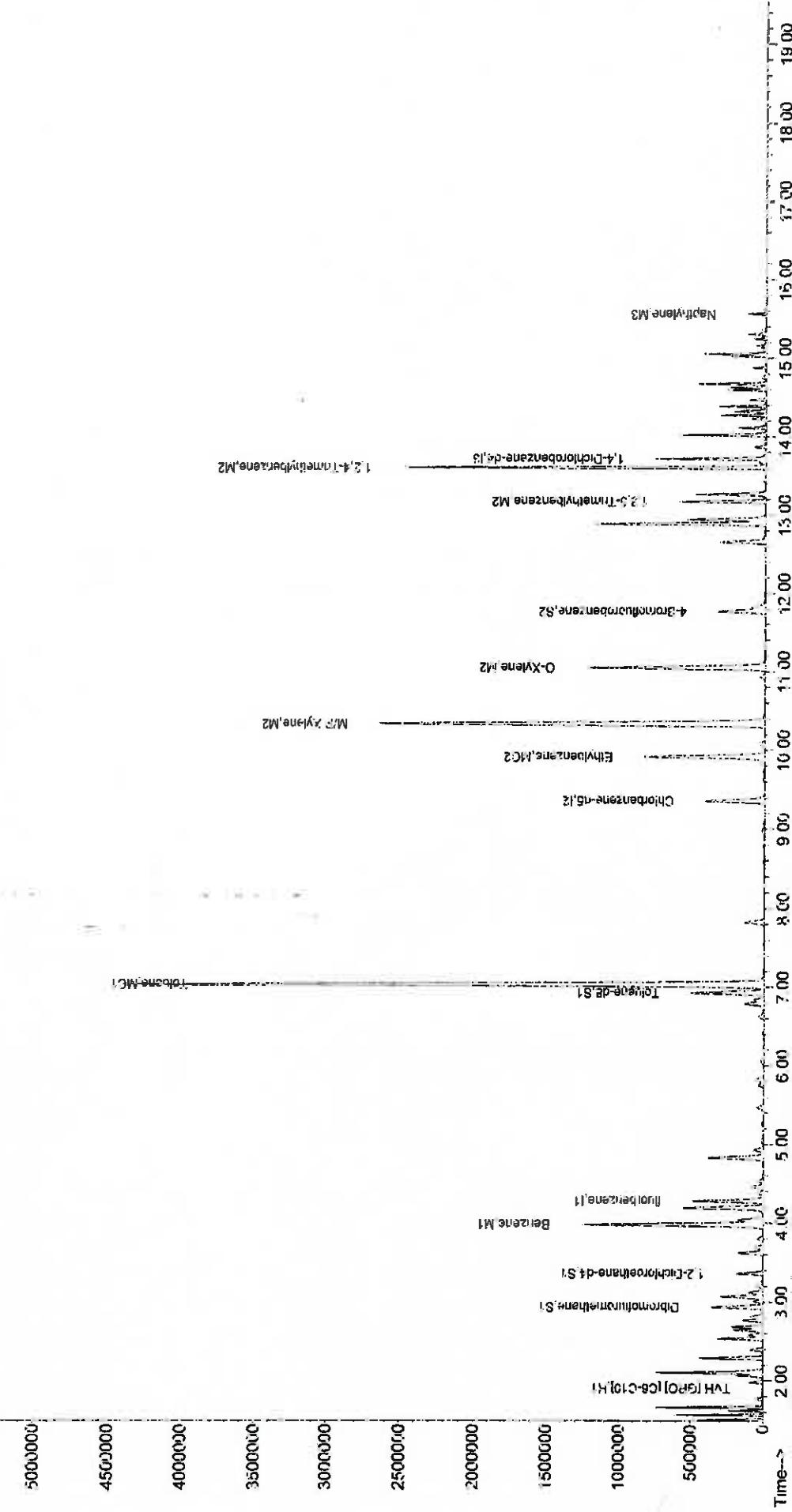
(#) = qualifier out of range (m) = manual integration (+) = signals summed

## Quantitation report (QTP FID/OneD)

Date Path : C:\MSDCHEM\1\DATA\1005May11\  
Data File : C30000.S.D  
Acq On : 11 May 2010 16:20  
Operator : KES  
Sample : TVH 5K, 10-0003, 010110000,  
Misc : 59L #417 + #397  
ALS Vial : 3 Sample Multiplier: 1

Quant Time: May 11 17:04:33 2010  
Quant Method : C:\MSDCHEM\1\5972N\VRKBTEx.M  
Quant Title : VRKBTEx 8250/BTEX  
QLast Update : Tue May 11 14:09:01 2010  
Response vial : Initial calibration

Abundance



**Appendix E**  
**Prior Correspondence**



State of Utah

JON M. HUNTSMAN, JR.  
*Governor*

GARY HERBERT  
*Lieutenant Governor*

Department of  
Environmental Quality

William J. Sinclair  
*Acting Executive Director*

DIVISION OF AIR QUALITY  
Cheryl Heying  
*Director*

## Small Source Registration

DAQE-EN0141850001-08

December 17, 2008

Cindy Nicoll  
Danish Flats Environmental Services  
616 West Monument Street  
Colorado Springs, CO 80905

Dear Ms. Nicoll:

Re: Request for Evaluation of Compliance with Rule R307-401-9, UAC: Exemptions and Special Provisions - Small Source Exemptions - De Minimis Emissions: Cisco Oil and Gas Exploration and Production Water Evaporation Pond Farm, located at: Remote Location North of Cisco, Cisco, Grand County  
Project Fee Code: N014185-0001

The Utah Department of Environmental Quality, Division of Air Quality (DAQ) has reviewed your letter, submitted September 29, 2008, requesting a small source exemption for one separation pond, one settling pond, two 12,000 gallon storage tanks, and eight evaporation ponds and determined that the small source exemption applies as long as the above-referenced equipment and associated processes are operated as specified in the Registration Request.

The small source exemption does not exempt a source from complying with other applicable Federal, State, and local regulations and the current Utah Administrative Code. If you change your operation such that there is an increase in the emissions submitted to DAQ, it is recommended that you notify us as an approval order may be required.

The fee for issuing the small source/de minimis designation is the cost, as authorized by the Utah Legislature of the actual time spent by the Review Engineer and all other staff on the project, and a one time filing fee. Payment should be sent to the DAQ upon receipt of the invoice.

Thank you for informing the DAQ of this process. If you have any additional questions, please contact Tim Dejulis at (801) 536-4012.

Sincerely,

M. Cheryl Heying, Executive Secretary  
Utah Air Quality Board



John. T. Blanchard, Manager  
Minor New Source Review Section

MCH:JTB:TDJ:kw

Attachments: Small Source Exemption Registration Request and attached forms